go2signals

Manual

Decoder Datasheets

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Contents

1. Standard Decoders HF

Note: For every decoder any operation limitations should be listed. If any submode of a decoder is not mentioned explicitly then it is not supported.

1.1. Alcatel 801H

General Information

Alcatel 801H is an 8 tone MFSK ARQ teleprinter system.

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	8
	Tone length (ms)	10
	Tone spacing (Hz)	100
Demodulator Settings	Demodulator	Coquelet
	Tone duration (ms)	10
	TD tolerance (ms)	0
	No. of tones	8
	Tone distance (Hz)	100
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 1: Alcatel 801H

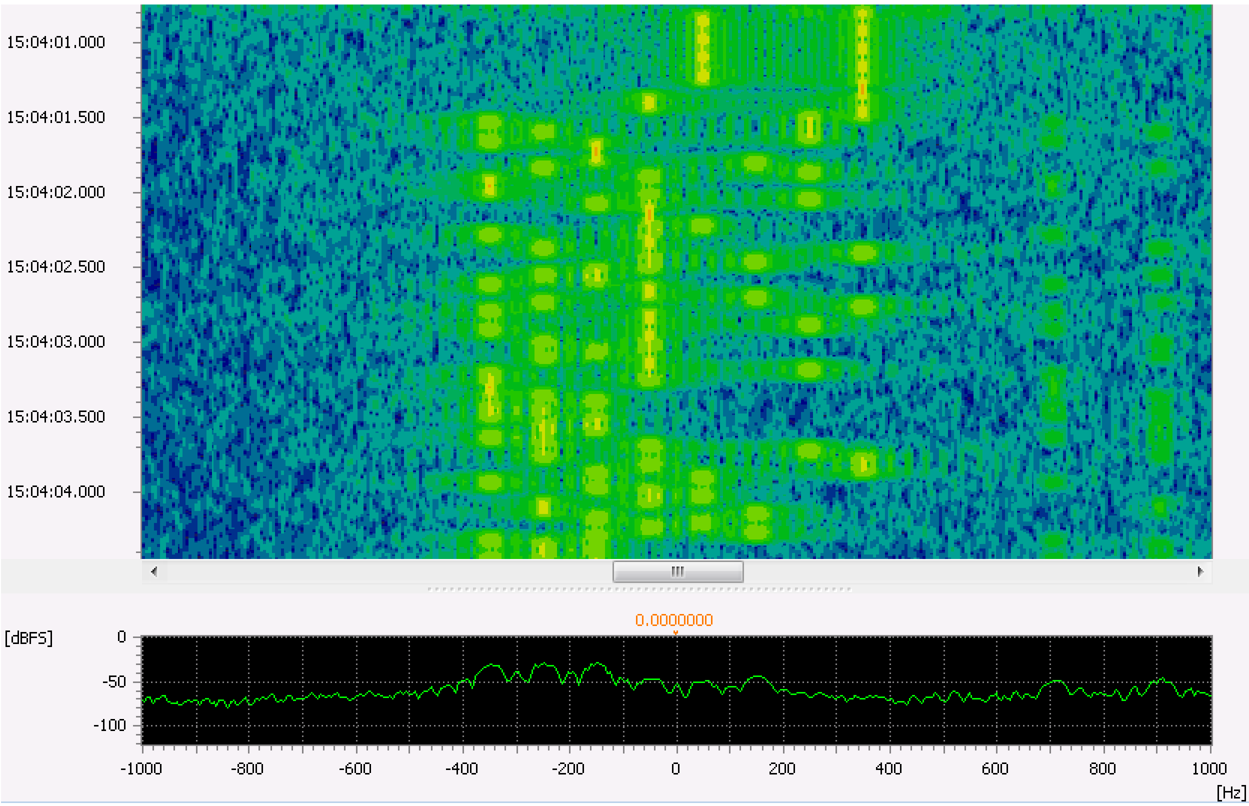


Figure 1: Alcatel 801H Spectrogram

1.2. ALE-2G

General Information

Automatic Link Establishment (ALE) second generation is based on the standard MIL-STD 188-141A. This system is used to detect and assign the HF-channel which is considered most reliable for data-communication at the given time.

Usage

- Detection of the HF-channel best suited for data-transfer between two stations

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'ALE2G'

Mode Details

	Item	Value
Standard	Modulation	FSK
	Tones	8
	Tone distance (Hz)	250
	Bandwidth	2000
	Symbol rate (Bd)	125
	Data rate (bit/s)	375
	Alphabet	ITA5
Demodulator Settings	Demodulator	Multitone (MFSK)
	Number of tones	8
	(ms)	8
	TD Tone duration tolerance (ms)	0.050
	Tone position type	Equidistant frequencies
	Tone distance (Hz)	250
Extras	Offset nominal frq. (Hz)	750
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 2: ALE-2G

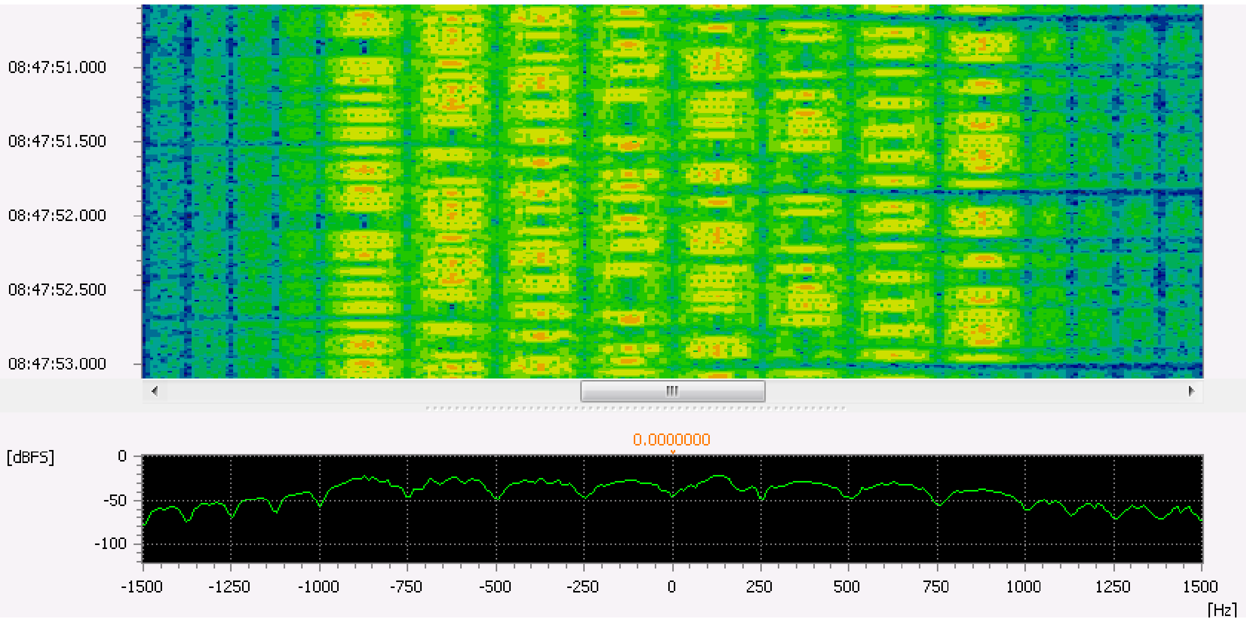


Figure 2: ALE-2G Spectrogram

1.3. ALE-400

General Information

ALE-400 is an Automatic Link Establishment system used by amateur radio. It is a version of ALE-2G adapted to the demands of amateur radio emergency traffic handling.

Usage

- Detection of the HF-channel best suited for data-transfer between two stations

Mode Details

	Item	Value
Standard	Modulation	FSK
	Tones	8
	Tone distance (Hz)	50
	Bandwidth	400
	Symbol rate (Bd)	50
	Data rate (bit/s)	150
	Alphabet	ITA5
Demodulator Settings	Demodulator	Multitone (MFSK)
	Number of tones	8
	Tone duration (ms)	20
	TD tolerance (ms)	2
	Tone position type	Equidistant frequencies
	Tone distance (Hz)	50
Extras	Offset nominal frq. (Hz)	1450
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 3: ALE-400

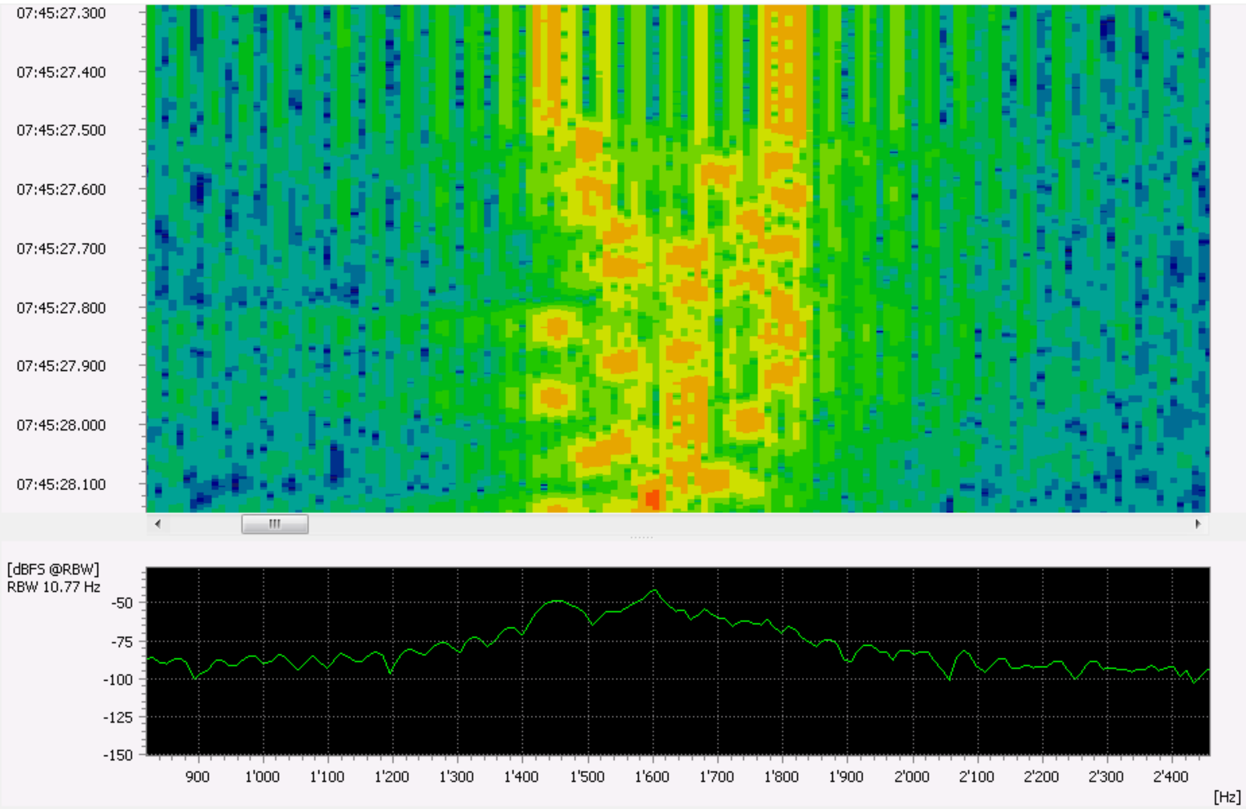


Figure 3: ALE-400 Spectrogram

1.4. ALIS

General Information

ALIS is a simplex ARQ teleprinter system developed by Rhode & Schwarz.

Usage

- Transfer of textual information over HF with automatic Link setup

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'ALIS'

Mode Details

	Item	Value
Standard	Number of tones	2
	Shift (Hz)	170
	Symbol rate (Bd)	228.7
	Error correction	CRC-16
	Alphabet	ITA-2
Demodulator Settings	Demodulator	FSK 2,3,4 discr.
	Symbol rate (Bd)	228.67
	SR tolerance (Bd)	1.000
	Modulation order	2
	Shift (Hz)	170
	Shift tolerance (Hz)	10
	Modem type	Synchronous
	Min. burst length (s)	0.210
Features	Max. burst length (s)	0.260
	Min. pause length (s)	0.010
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 4: ALIS

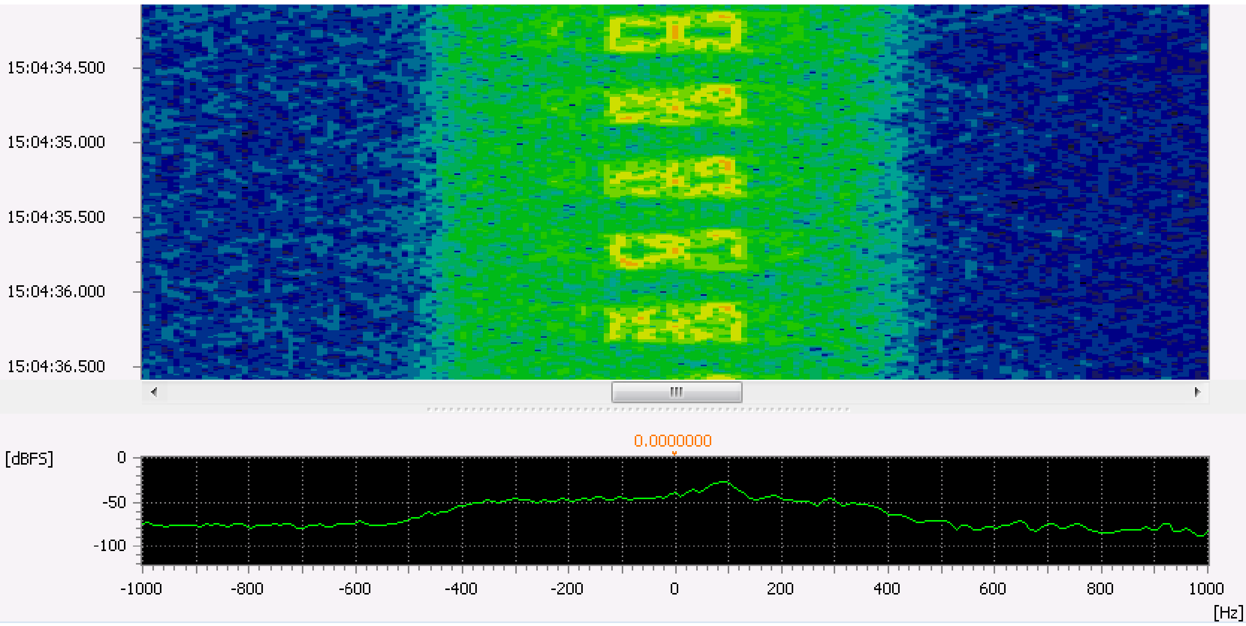


Figure 4: ALIS Spectrogram

1.5. ALIS-2

General Information

ALIS-2 is simplex ARQ teleprinter system developed by Rhode & Schwarz.
ALIS-2 is a further development of ALIS.

Usage

- Transfer of textual information and binary data over HF with automatic Link setup

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	8
	Tone spacing (Hz)	240
	Symbol rate (Bd)	240.82
	Error correction	CRC-16
	Alphabet	ITA-5
Demodulator Settings	Demodulator	Multitone (FSKn)
	Tone duration (ms)	4.153
	TD tolerance (ms)	0.100
	No. of tones	8
	Tone position type	Equidistant frequencies
	Tone distance (Hz)	240.816
	Min. burst length (s)	0.040
Features	Max. burst length (s)	0.350
	Min. pause length (s)	0.070
	Demodulation	yes
	Recognition	yes
	Decoding	no
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 5: ALIS-2

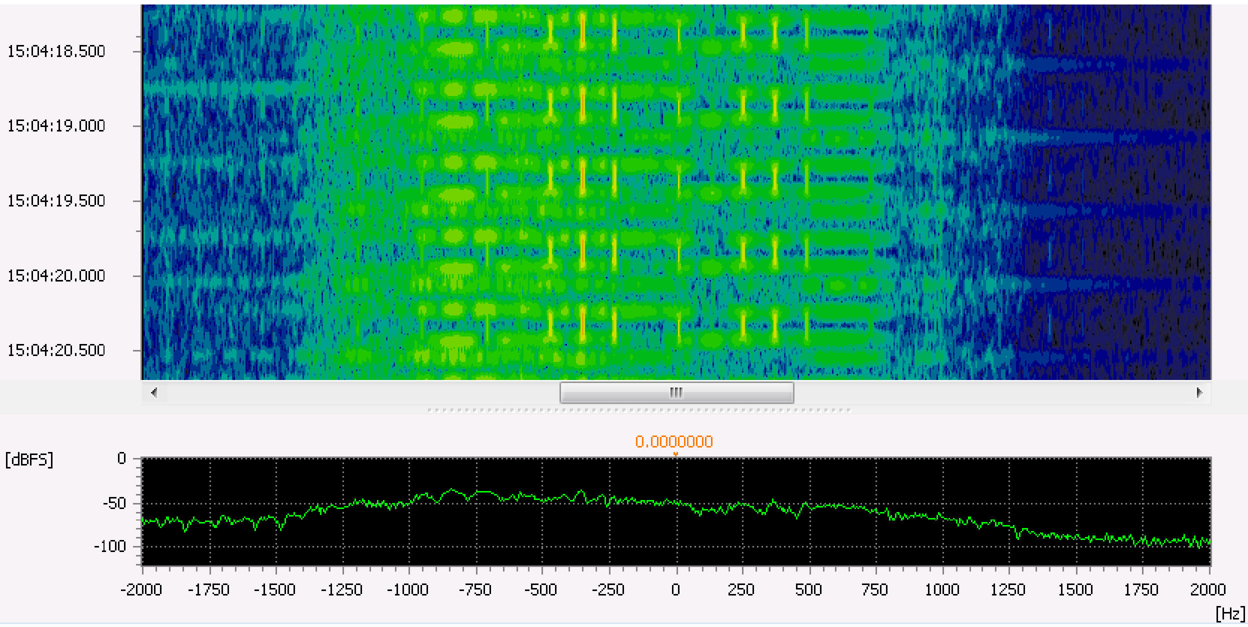


Figure 5: ALIS-2 Spectrogram

1.6. ARQ-6-90

General Information

ARQ-6-90 is an ARQ mode similar to SITOR for the exchange of teletype-data over a radio channel in a robust way.

Usage

- Basic data communication over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	400
	Bandwidth (Hz)	600
	Symbol rate (Bd)	200
	Error correction	ARQ
	Alphabet	CCIR-476
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	200
	SR tolerance (Bd)	5
	Shift (Hz)	400
	Shift tolerance (Hz)	20
	Modem type	Synchronous
	Min. burst length (s)	0.065
	Max. burst length (s)	0.260
	Min. pause length (s)	0.200
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 6: ARQ-6-90

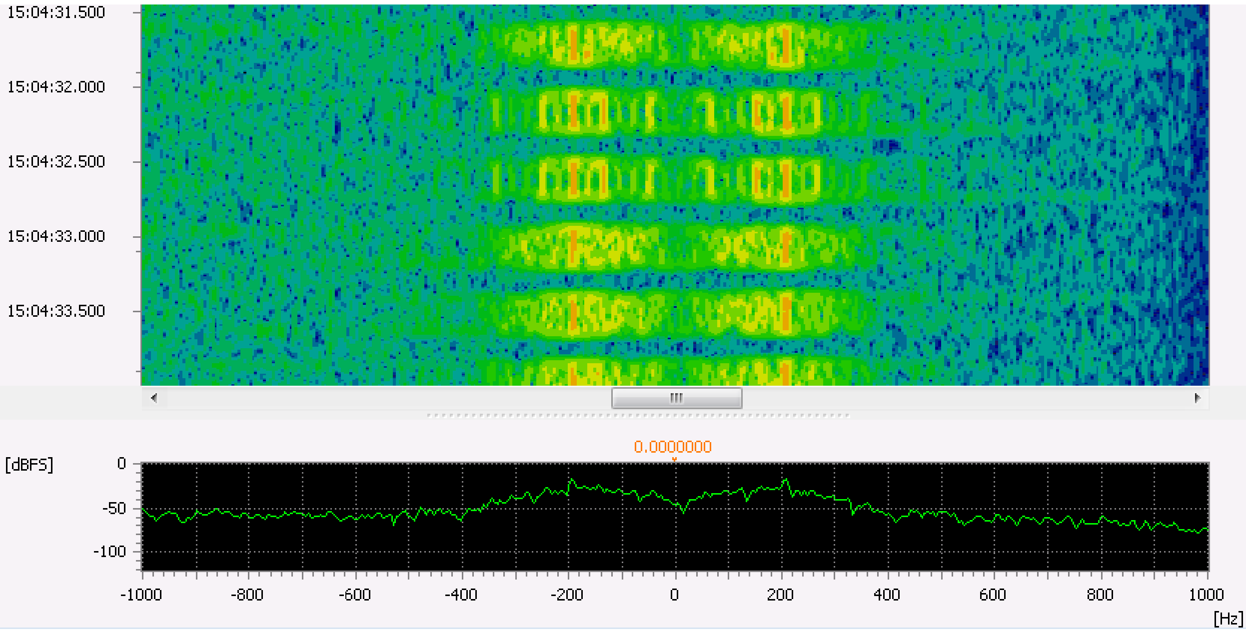


Figure 6: ARQ-6-90 Spectrogram

1.7. ARQ-6-98

General Information

ARQ-6-98 is an ARQ mode similar to SITOR for the exchange of teletype-data over a radio channel in a robust way.

Usage

- Basic data communication over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	200
	Bandwidth (Hz)	400
	Symbol rate (Bd)	200
	Error correction	ARQ
	Alphabet	CCIR-476
Demodulator Settings	Demodulator	FSK 2,3,4 discr.
	Symbol rate (Bd)	200
	SR tolerance (Bd)	5
	Modulation order	2
	Shift (Hz)	170
	Shift tolerance (Hz)	20
	Modem type	Synchronous
	Min. burst length (s)	0.065
	Max. burst length (s)	0.260
	Min. pause length (s)	0.150
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 7: ARQ-6-98

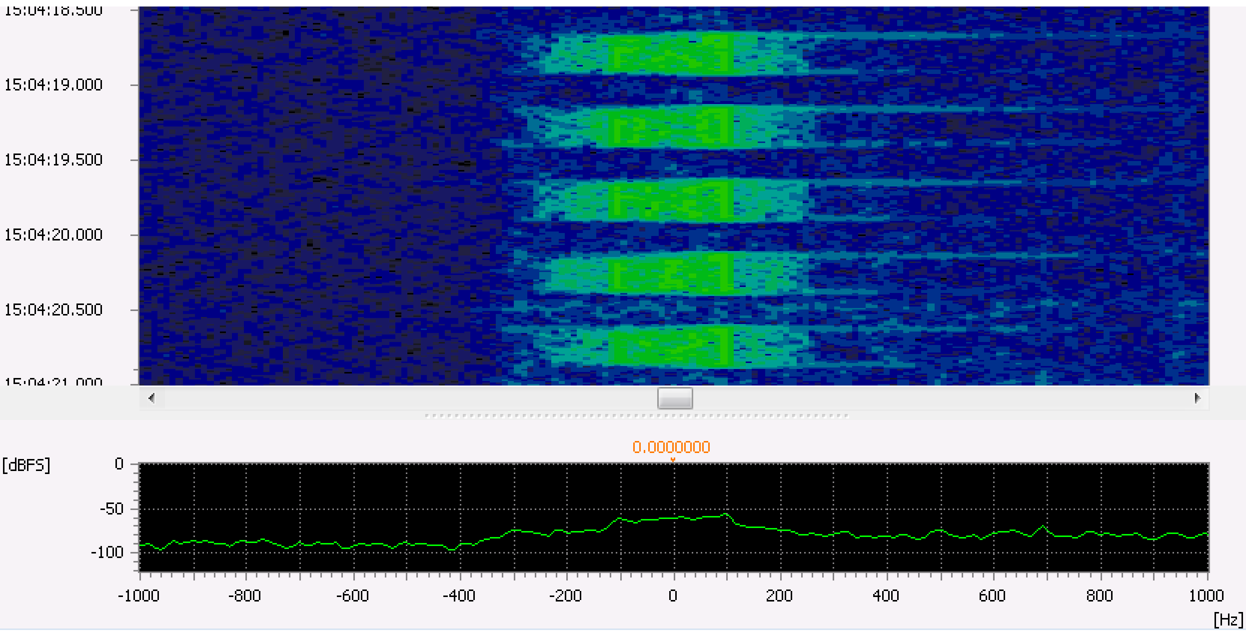


Figure 7: ARQ-6-98 Spectrogram

1.8. ARQ-E

General Information

ARQ-E is a synchronous dual channel ARQ mode for the exchange of teletype-data over a radio channel in a robust way.

Usage

- Military or diplomatic data communication over HF

Mode Details

	Item	Value	
Standard	Modulation	FSK	
	Number of tones	2	
	Shift (Hz)	170	370
	Bandwidth (Hz)	300	600
	Symbol rate (Bd)	30 ... 650	
	Error correction	ARQ	
	Alphabet	ITA-2 extended	
Demodulator Settings	Demodulator	FSK 2 matched	
	Symbol rate (Bd)	85.7	185
	SR tolerance (Bd)	4	5
	Shift (Hz)	170	370
	Shift tolerance (Hz)	20	
	Modem type	Synchronous	
Features	Demodulation	yes	
	Recognition	yes	
	Decoding	yes	
	Automatic Polarity Adjustment	yes	
	Combination with other modems (modem list)	yes	

Table 8: ARQ-E

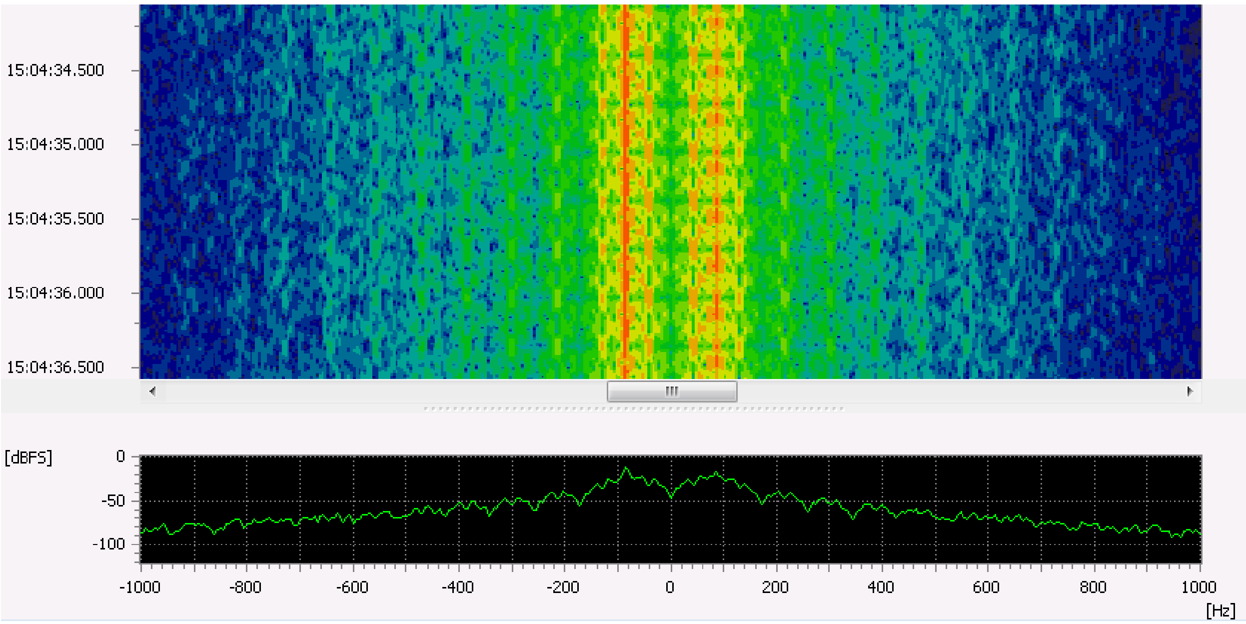


Figure 8: ARQ-E cyc4 Spectrogram

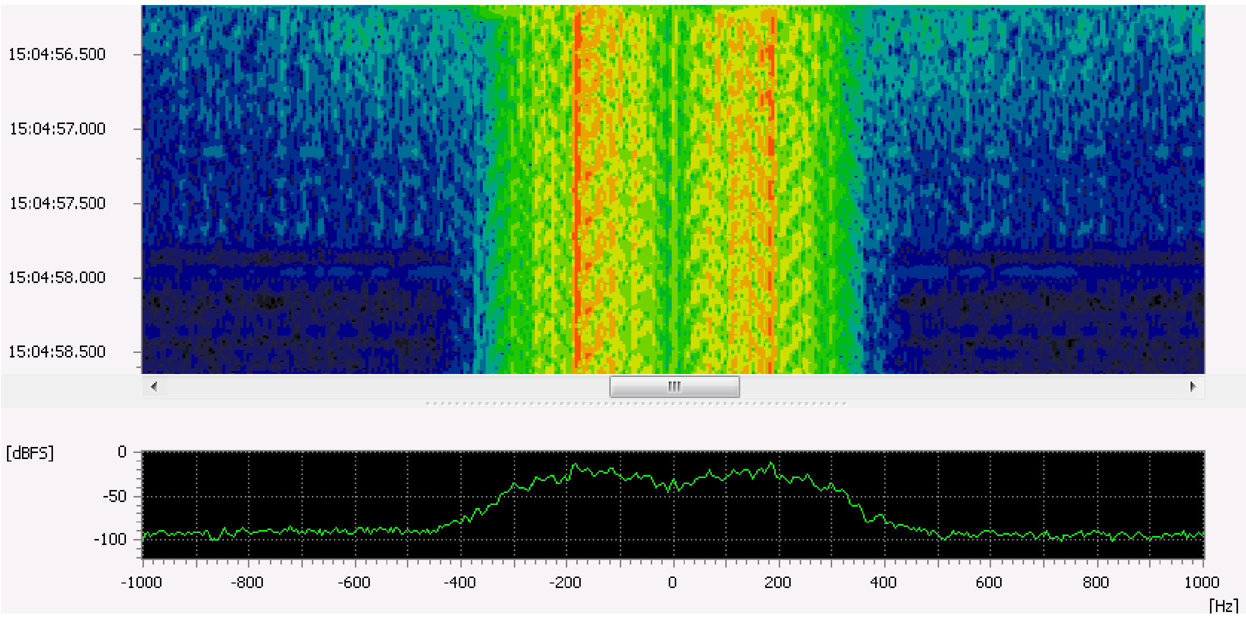


Figure 9: ARQ-E cyc8 Spectrogram

1.9. ARQ-E3

General Information

ARQ-E3 is a synchronous dual channel ARQ mode for the exchange of teletype-data over a radio channel in a robust way.

Usage

- Military or diplomatic data communication over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	400
	Bandwidth (Hz)	600
	Symbol rate (Bd)	30 ... 650
	Error correction	ARQ
	Alphabet	ITA-3
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	500
	SR tolerance (Bd)	5
	Shift (Hz)	400
	Shift tolerance (Hz)	30
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 9: ARQ-E3

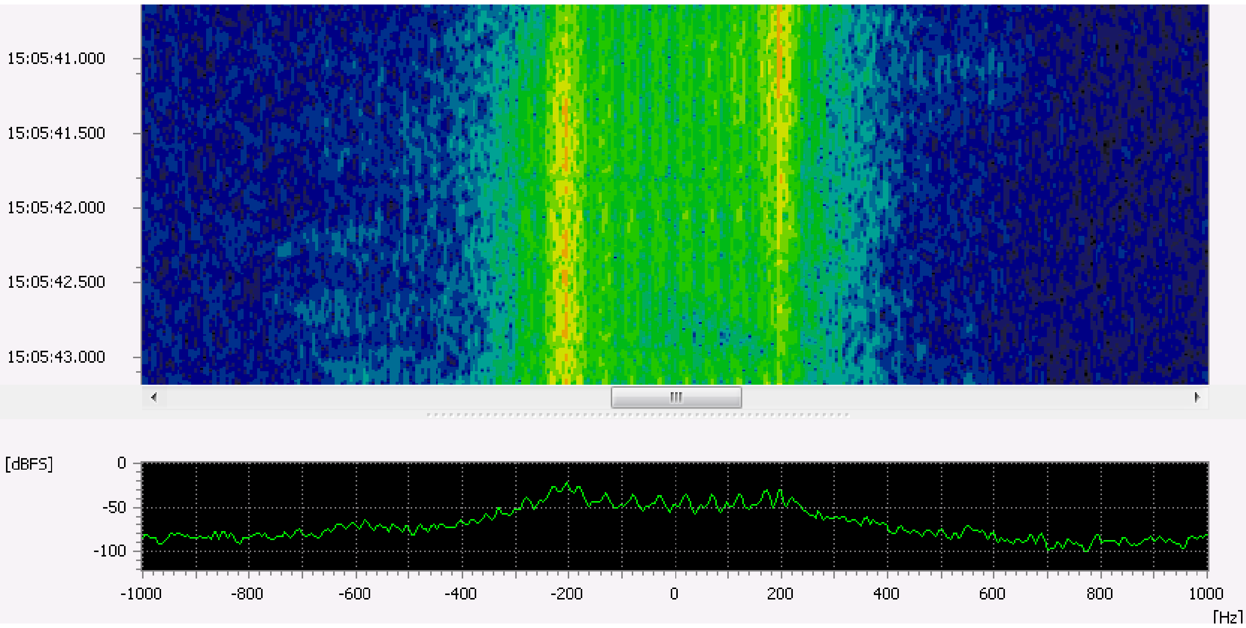


Figure 10: ARQ-E3 spectrogram

1.10. ARQ-M2-242

General Information

ARQ-M2-242 is a synchronous full duplex time-division multiplex system designed for low error-rate exchange of textual data between two stations of governmental authorities.

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	430
	Bandwidth (Hz)	600 / 800
	Symbol rate (Bd)	96 / 200
	Alphabet	ITA-3
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	96
	SR tolerance (Bd)	5
	Shift (Hz)	430
	Shift tolerance (Hz)	30
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 10: ARQ-M2-242

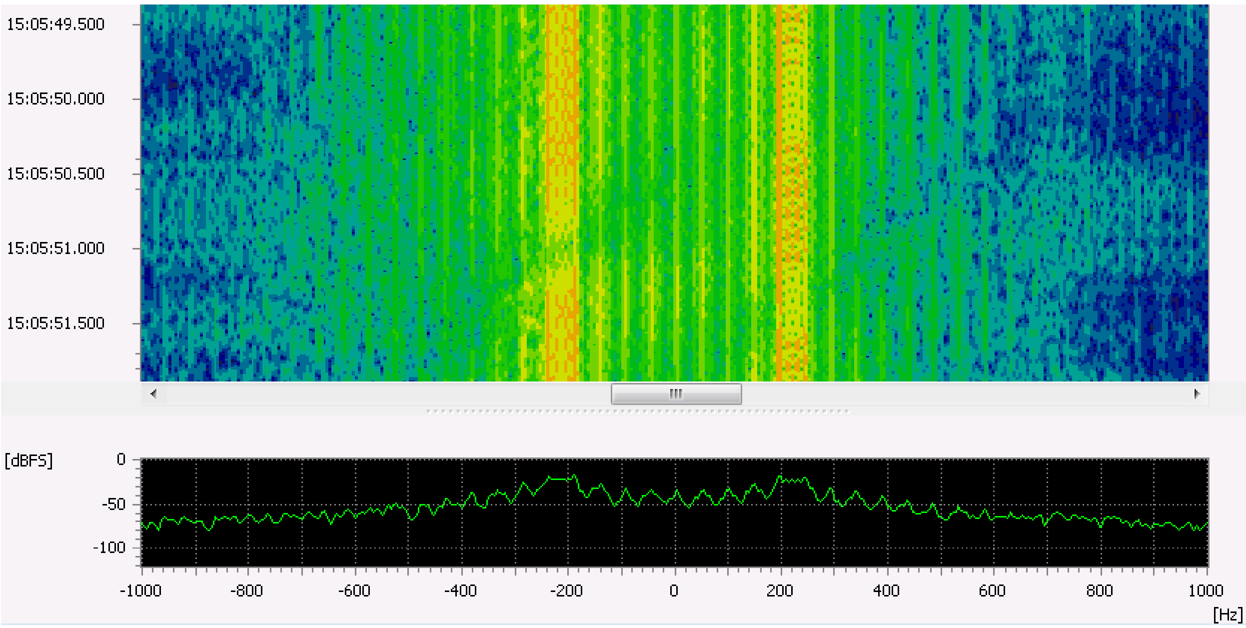


Figure 11: ARQ-M2-242 Spectrogram

1.11. ARQ-M2-342

General Information

ARQ-M2-342 is a synchronous full duplex time-division multiplex system designed for low error-rate exchange of textual data between two stations of governmental authorities.

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	400
	Bandwidth (Hz)	600 / 800
	Symbol rate (Bd)	96 / 200
	Alphabet	ITA-3
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	96
	SR tolerance (Bd)	5
	Shift (Hz)	400
	Shift tolerance (Hz)	30
	Modem type	Synchronous
Features	Demodulator	FSK 2 matched
	Symbol rate (Bd)	96
	SR tolerance (Bd)	5
	Shift (Hz)	400
	Shift tolerance (Hz)	30
	Modem type	Synchronous

Table 11: ARQ-M2-342

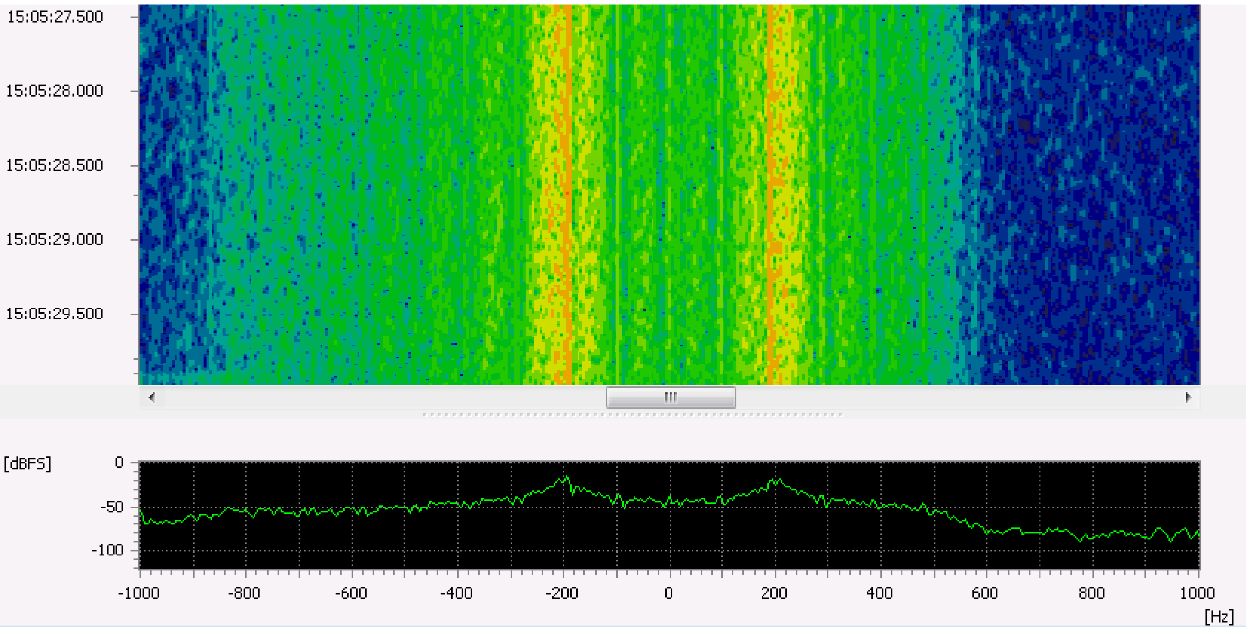


Figure 12: ARQ-M2-342 Spectrogram

1.12. ARQ-M4-242

General Information

ARQ-M4-242 is a synchronous full duplex time-division multiplex system designed for low error-rate exchange of textual data between two stations of governmental authorities.

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	170
	Bandwidth (Hz)	400
	Symbol rate (Bd)	172 / 192
	Alphabet	ITA-3
Demodulator Settings	Demodulator	FSK 2,3,4 discr.
	Symbol rate (Bd)	192
	SR tolerance (Bd)	2
	Modulation order	2
	Shift (Hz)	173
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 12: ARQ-M4-242

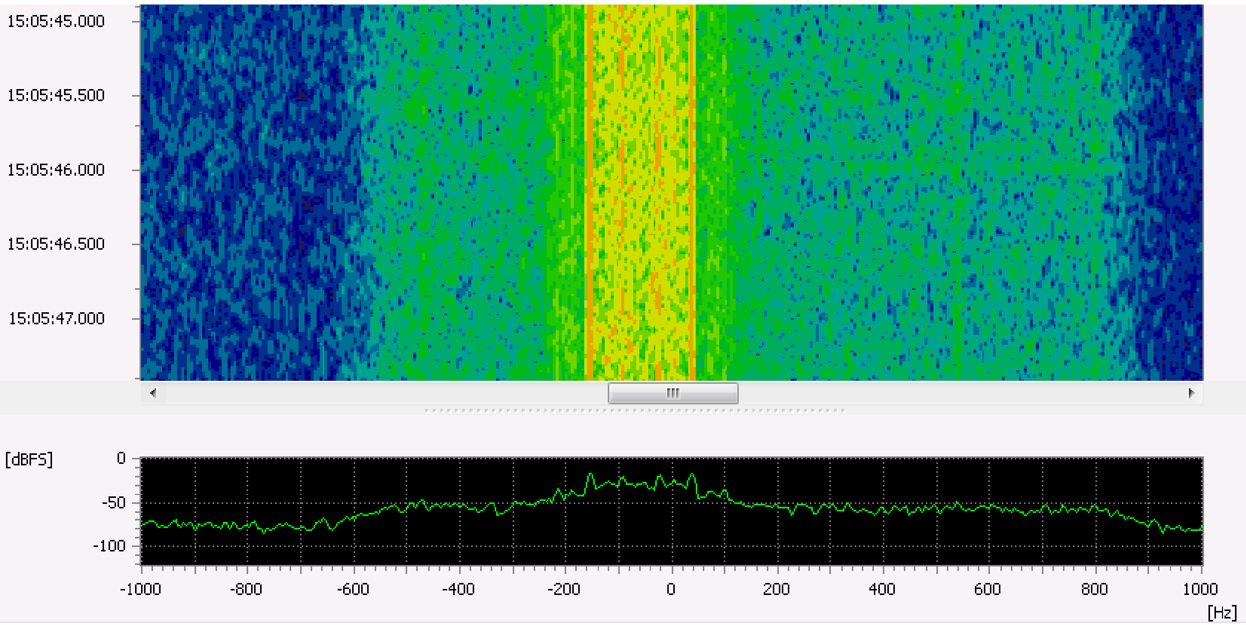


Figure 13: ARQ-M4-242 Spectrogram

1.13. ARQ-M4-342

General Information

ARQ-M4-342 is a synchronous full duplex time-division multiplex system designed for low error-rate exchange of textual data between two stations of governmental authorities.

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	400
	Bandwidth (Hz)	800
	Symbol rate (Bd)	172 / 192
	Alphabet	ITA-3
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	192
	SR tolerance (Bd)	5
	Shift (Hz)	400
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 13: ARQ-M4-342

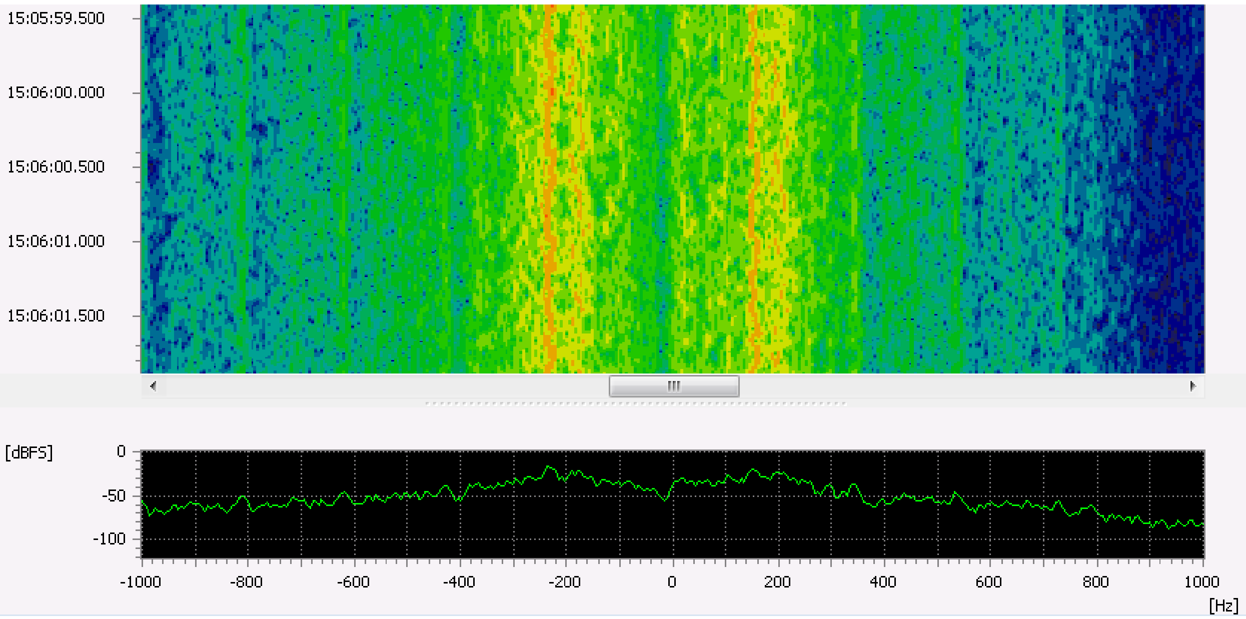


Figure 14: ARQ-M4-342 Spectrogram

1.14. ARQ-N

General Information

ARQ-N is a synchronous dual channel ARQ mode. This system was used by Italian diplomatic services.

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	850
	Symbol rate (Bd)	96
	Error correction	ARQ
	Repetition cycles (char)	4,5,8
	Alphabet	ITA-2P
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	96
	SR tolerance (Bd)	5
	Shift (Hz)	850
	Shift tolerance (Hz)	20
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 14: ARQ-N

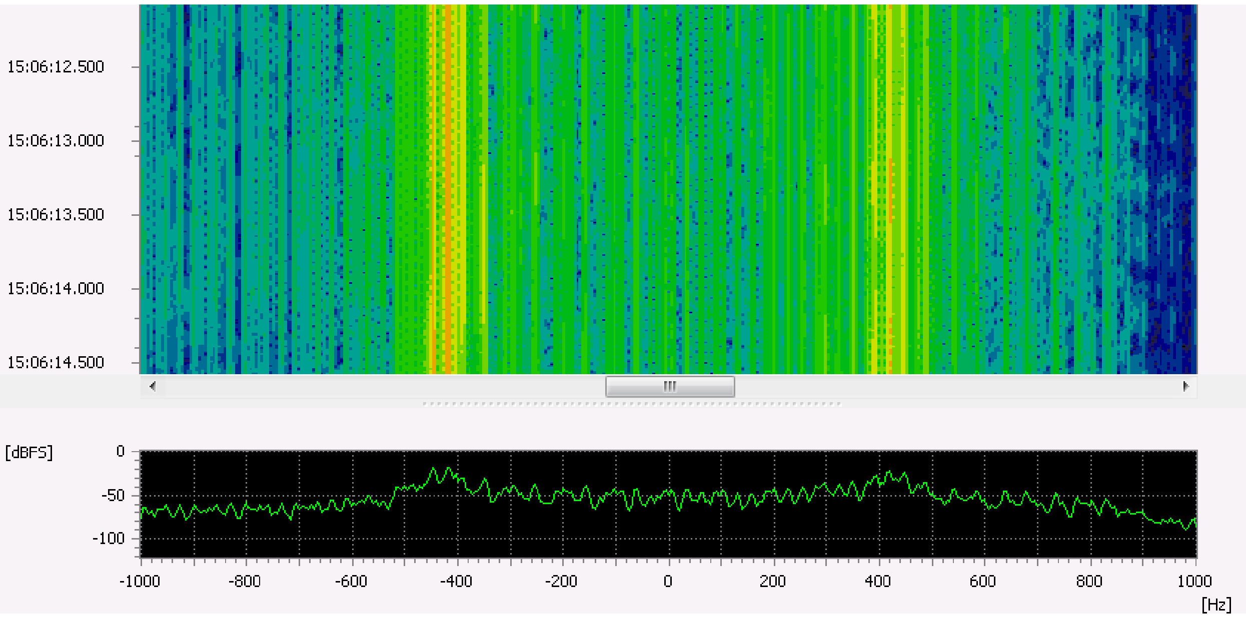


Figure 15: ARQ-N Spectrogram

1.15. ASCII 7 Bit

General Information

The American Standard Code for Information Interchange (ASCII) is a set of binary values to represent printable characters in electronic communication.
In the first version of the standard the character-length was 7 bit.

Usage

- Transfer of textual information over HF
- Processing, transfer and storage of textual information

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'ASCII7'

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	173 (other values possible)
	Bandwidth (Hz)	300 (depends on shift/SR)
	Symbol rate (Bd)	100 (other values possible)
	Character	1 Start-, 7 Data-, 1 Stop-Bit
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	100
	SR tolerance (Bd)	5
	Shift (Hz)	173
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 15: ASCII 7 Bit

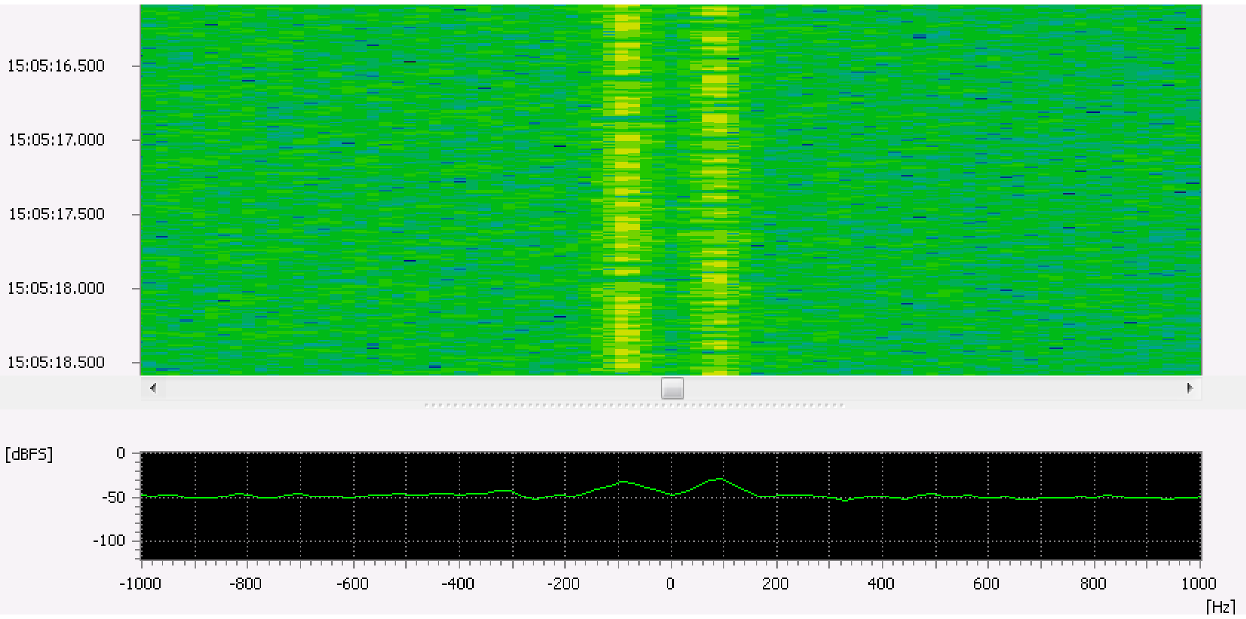


Figure 16: ASCII 7 Bit Spectrogram

1.16. ASCII 8 Bit

General Information

The American Standard Code for Information Interchange (ASCII) is a set of binary values to represent printable characters in electronic communication.
In a later version of the standard the character-length was extended to 8 bit.

Usage

- Processing, transfer and storage of textual information

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'ASCII8'

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	500 (other values possible)
	Bandwidth (Hz)	700 (depends on shift/SR)
	Symbol rate (Bd)	180 (other values possible)
	Character	1 Start-, 8 Data-, 2 Stop-Bit
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	180
	SR tolerance (Bd)	5
	Shift (Hz)	500
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 16: ASCII 8 Bit

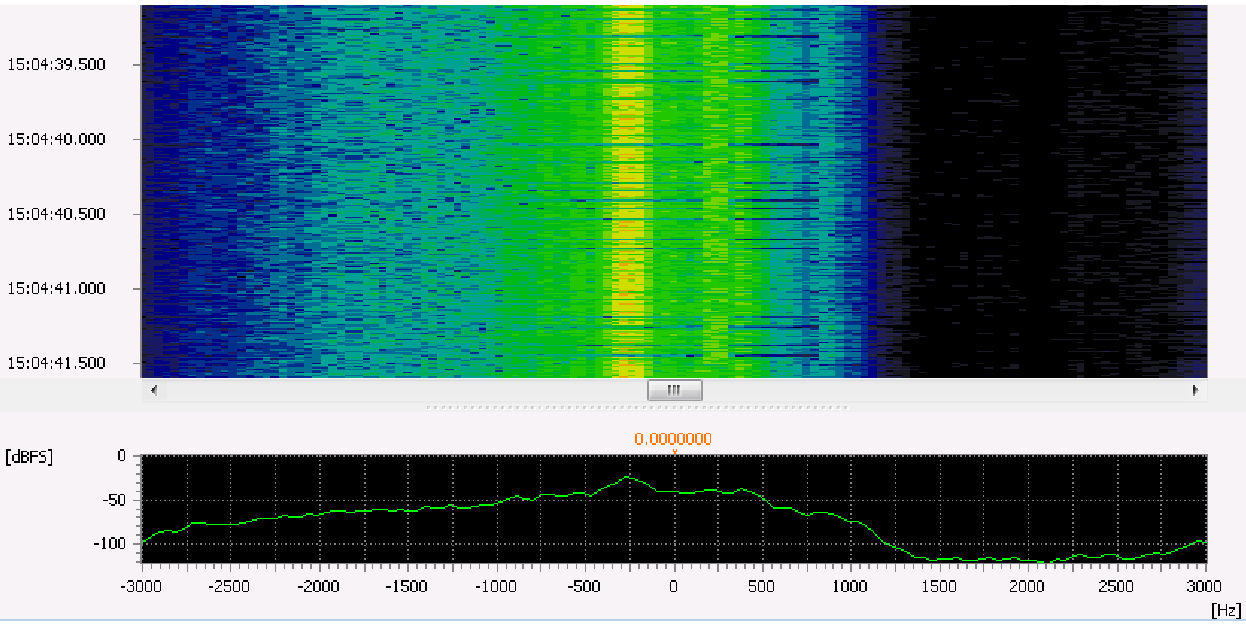


Figure 17: ASCII 8 Bit Spectrogram

1.17. AUTOSPEC

General Information

Autospec is a synchronous FEC system. This system was used by British coastal station for communication to oil rigs.

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	270
	Symbol rate (Bd)	68.5
	Alphabet	ITA-2
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	68.5
	SR tolerance (Bd)	1
	Shift (Hz)	270
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 17: AUTOSPEC

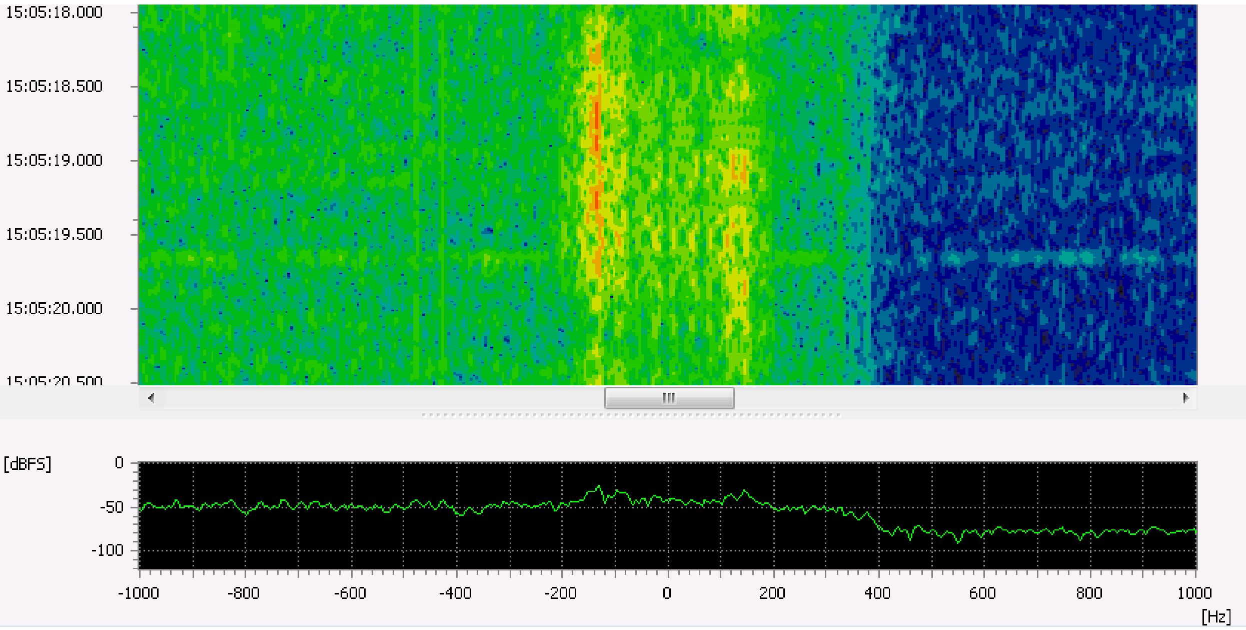


Figure 18: AUTOSPEC Spectrogram

1.18. Baudot Async

General Information

The asynchronous Baudot mode is a means to transfer printable characters over a communication channel. Synchronization in this case is achieved by the use of a Start-Bit, which has the polarity reverse to the Stop-Bit and the Idle-State.

Usage

- Transfer of textual information over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Baudot'

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	450 / 850
	Bandwidth (Hz)	800 / 1500
	Symbol rate (Bd)	50 / 75 / 100
	Character	1 Start-, 5 Data-, 1/1.5/2 Stop-Bit
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	50
	SR tolerance (Bd)	5
	Shift (Hz)	450
	Shift tolerance (Hz)	10
	Modem type	Asynchronous
Decoder settings	Alphabet	Latin, Arabic, Cyrillic, Hebrew
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 18: Baudot Async

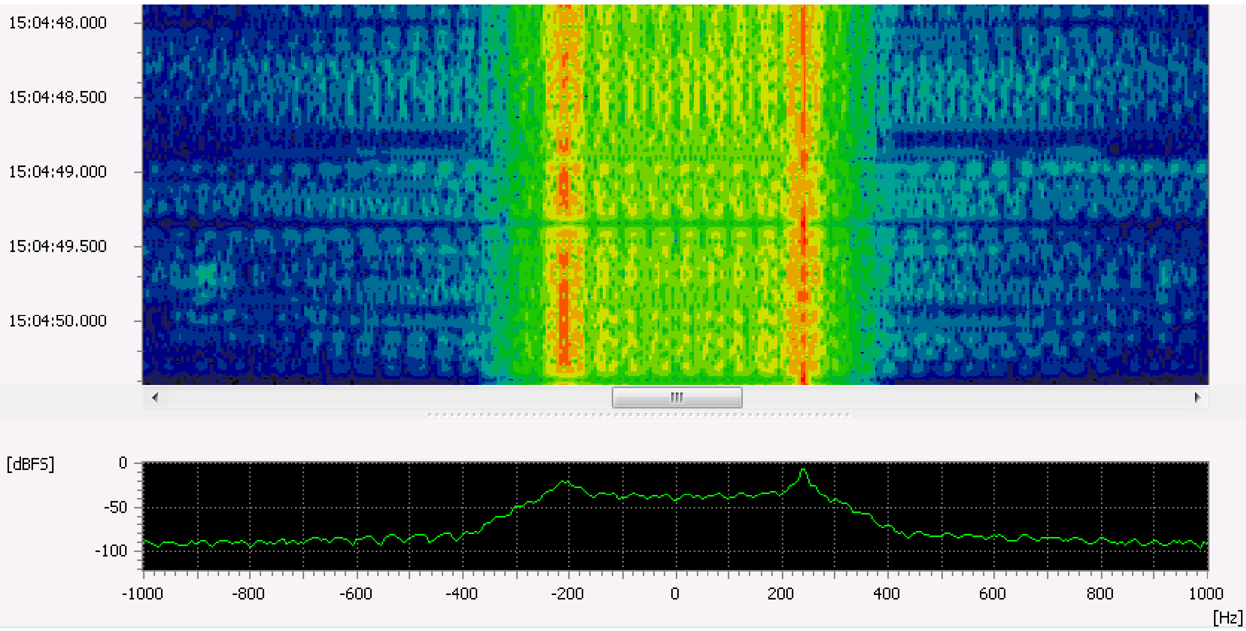


Figure 19: Baudot Async Spectrogram

1.19. Baudot Sync

General Information

The synchronous Baudot mode is a means to transfer printable characters over a communication channel. Synchronization in this case is achieved by using a fixed character-length and a combination of Start- and Stop-Bit of reverse polarity.

There are two decoder variants shipped:

- baudot11: 1 start-bit and 1 stop-bit
- baudot_universal: 1 start-bit, any number of stop-bits

Usage

- Transfer of textual information

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Baudot'

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	450 / 850
	Bandwidth (Hz)	800 / 1500
	Symbol rate (Bd)	200
	Character	1 Start-, 5 Data-, 1 Stop-Bit
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	200
	SR tolerance (Bd)	5
	Shift (Hz)	850
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Decoder settings (only universal variant)	Alphabet	Latin, Arabic, Cyrillic, Hebrew
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 19: Baudot Sync

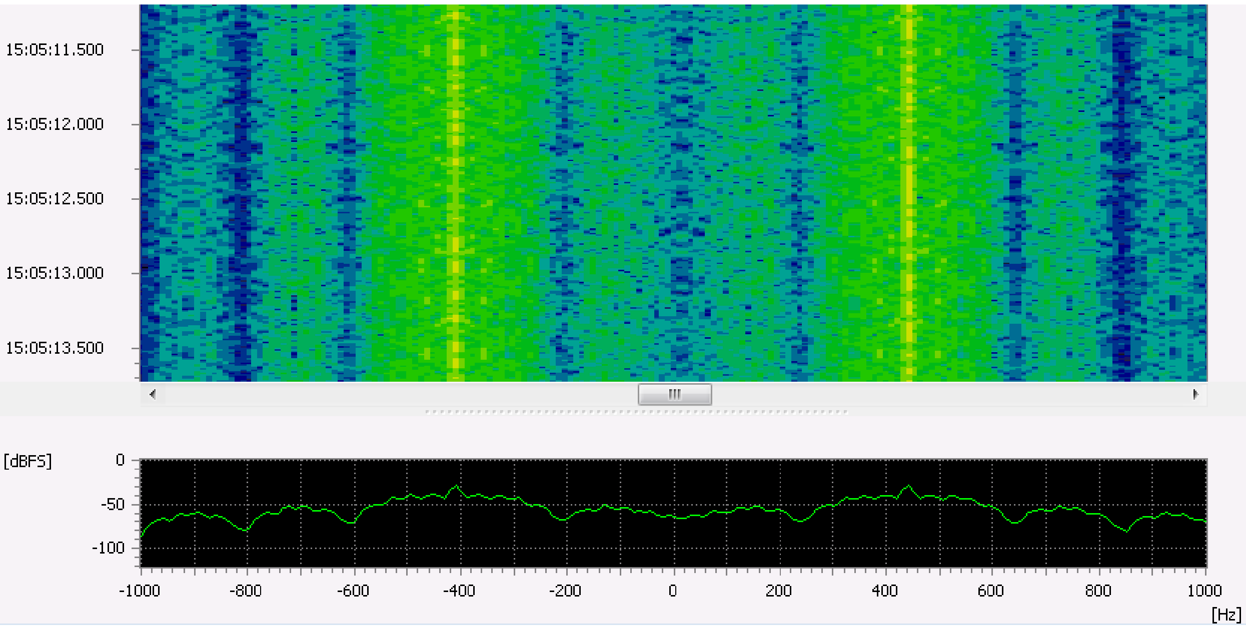


Figure 20: Baudot Sync Spectrogram

1.20. BULG-ASCII

General Information

BULG-ASCII is a modem used by the Bulgarian Ministry of Foreign Affairs.

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	500
	Bandwidth (Hz)	600
	Symbol rate (Bd)	120
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	75
	SR tolerance (Bd)	10
	Shift (Hz)	510
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 20: BULG-ASCII

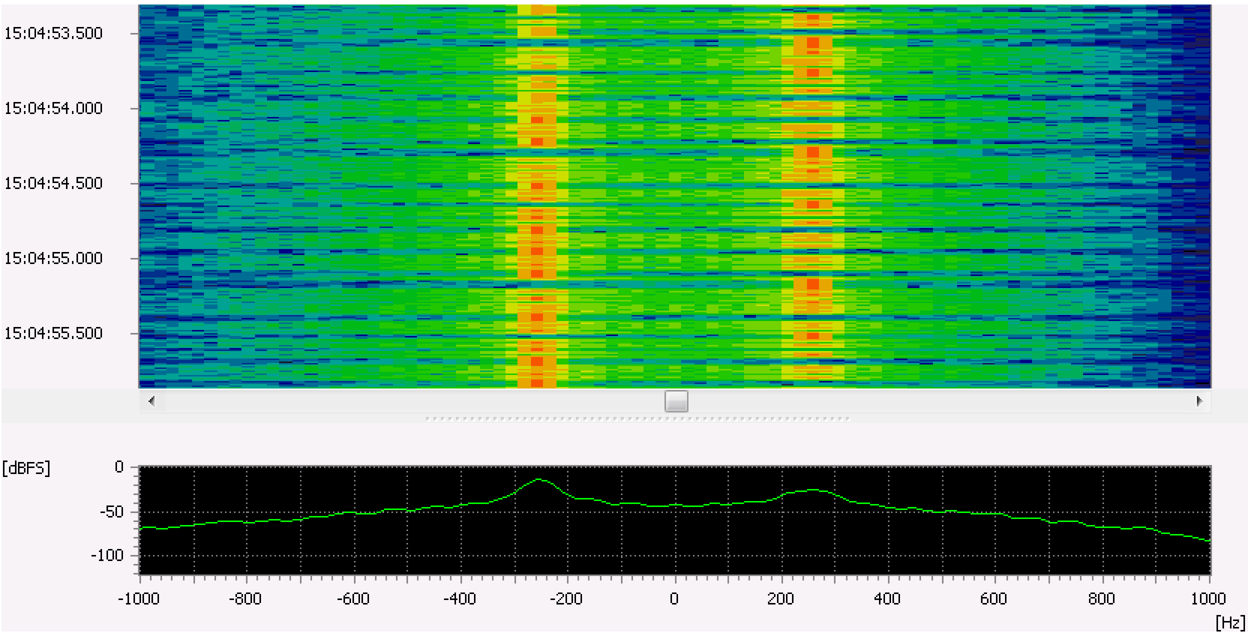


Figure 21: BULG-ASCII Spectrogram

1.21. CHN MIL 4FSK 400/500

General Information

CHN MIL 4FSK 400/500 is a Chinese multi-tone modem with either 400 or 500 Hz tone distance.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	MFSK
	Number of tones	4
	Tone spacing (Hz)	400 / 500
	Bandwidth (Hz)	500 / 600
	Symbol rate (Bd)	100
Demodulator Settings	Demodulator	Multitone (MFSK)
	Tone duration (ms)	10
	TD tolerance (ms)	0.5
	No. of tones	4
	Tone position type	Equidistant frequencies
	Tone distance (Hz)	500
	Min. burst length (s)	2.500
	Max. burst length (s)	3.200
	Min. pause length (s)	1.000
Extras	Offset nominal frq. (Hz)	1500 / 1250
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 21: CHN MIL 4FSK 400/500

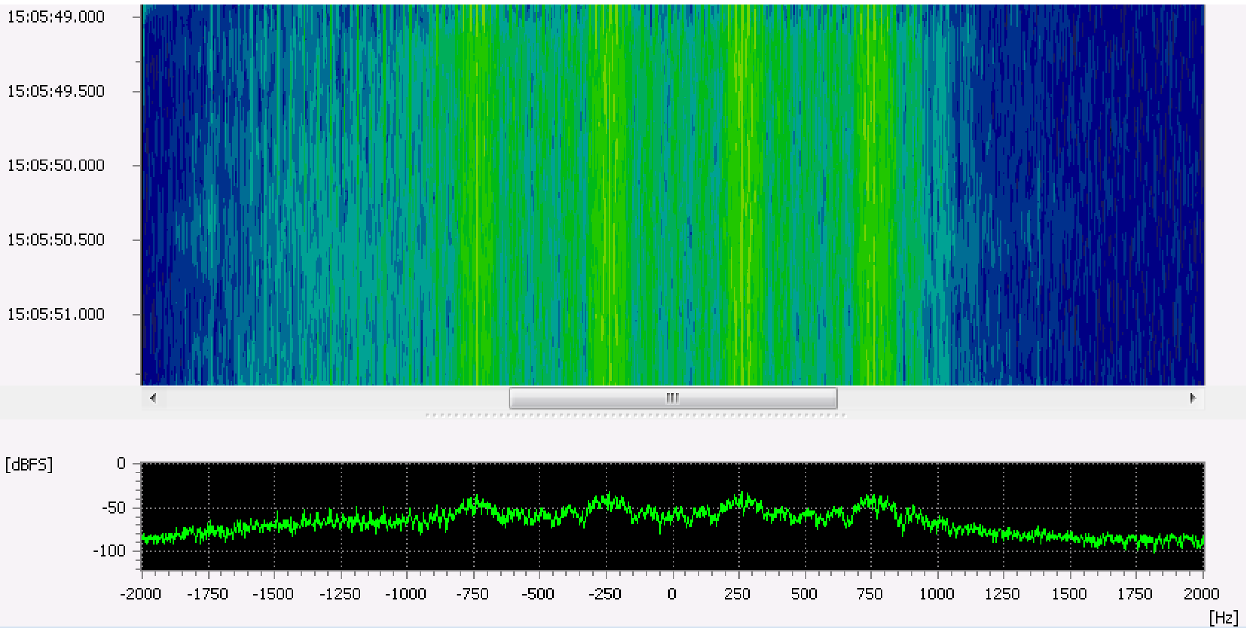


Figure 22: CHN MIL 4FSK 500Hz Spectrogram

1.22. CHU

General Information

CHU is a radio station in Canada that continuously broadcasts time of day information. It is operated by the National Research Council of Canada.

Usage

- Time information broadcasts

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	200
	Bandwidth (Hz)	500
	Symbol rate (Bd)	500
	Coding	BCD
Demodulator Settings	Demodulator	FSK 2,3,4 discr.
	Symbol rate (Bd)	300
	SR tolerance (Bd)	5
	Modulation order	2
	Shift (Hz)	200
	Shift tolerance (Hz)	5
	Modem type	Synchronous
	Min. burst length (s)	0.200
	Max. burst length (s)	0.700
	Min. pause length (s)	0.150
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 22: CHU

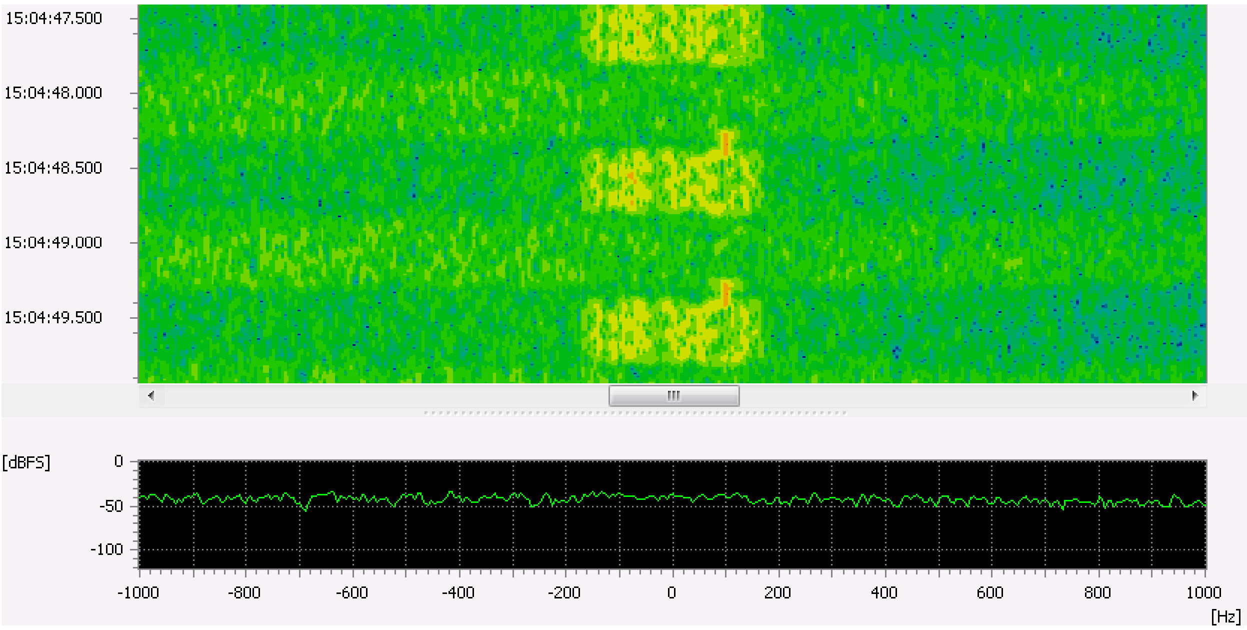


Figure 23: CHU Spectrogram

1.23. CHX-200

General Information

CHX-200 is an old ARQ modem developed by Siemens AG. It is sometimes named CHP-200 referring the associated communication processor, which is also responsible for encryption and frequency control.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	170
	Symbol rate (Bd)	250
Demodulator Settings	Demodulator	FSK 2 discr.
	Symbol rate (Bd)	250
	SR tolerance (Bd)	2
	Shift (Hz)	170
	Shift tolerance (Hz)	10
	Modem type	Synchronous
	Min. burst length (s)	0.100
	Max. burst length (s)	0.200
	Min. pause length (s)	0.010
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	no
Tuning	The tuning frequency is the center of the signal	

Table 23: CHX-200

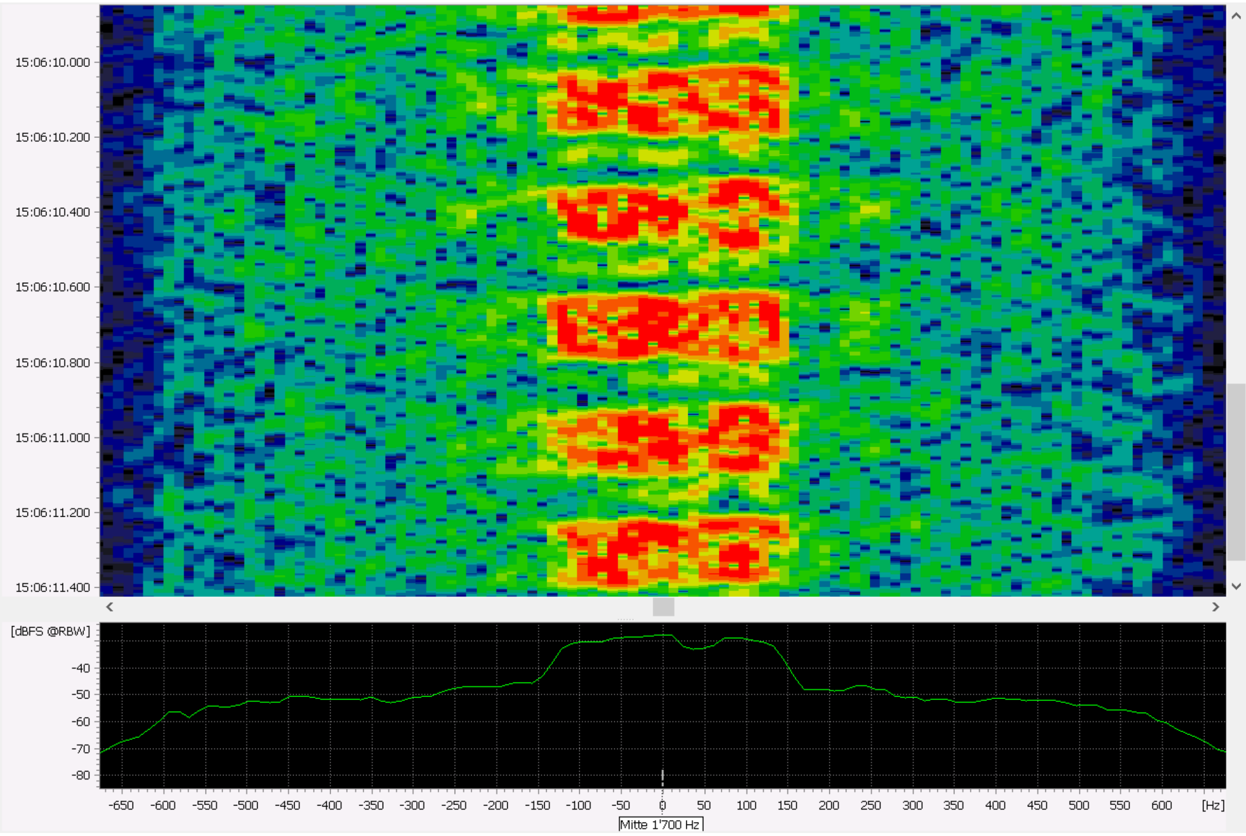


Figure 24: CHX-200 Spectrogram

1.24. CIS-11

General Information

CIS-11 is a full duplex teleprinter system used in former CIS (Commonwealth of Independent States).

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	500
	Symbol rate (Bd)	100
	Error correction	Parity
	Alphabet	ITA-2
Demodulator Settings	Demodulator	FSK 2,3,4 discr.
	Symbol rate (Bd)	100
	SR tolerance (Bd)	5
	Modulation order	2
	Shift (Hz)	500
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 24: CIS-11

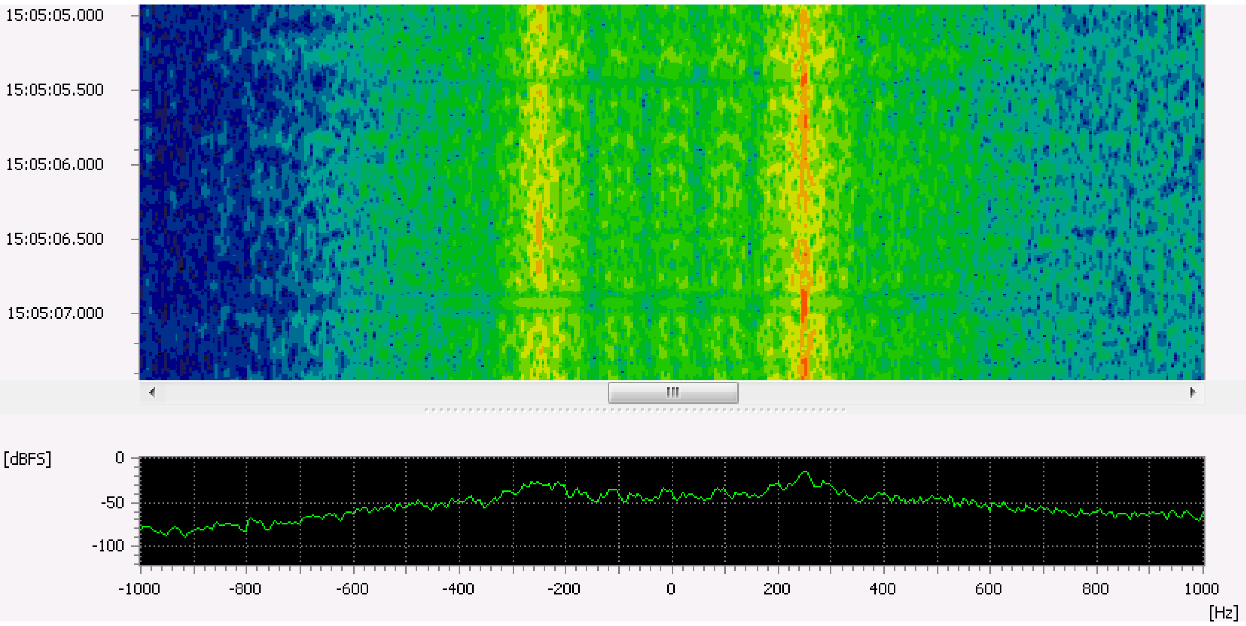


Figure 25: CIS-11 Spectrogram

1.25. CIS-12

General Information

CIS-12 is a Russian military multi-channel modem. It features scrambled voice- or data-communication at a maximum data rate of 4800 bits/sec. The signal appears in 12-channel PSK 2A, PSK4A and PSK4B. This modem system is also known as MS5 and FIRE.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	Multi-channel PSK2 / PSK4
	Channel spacing (Hz)	200
	Symbol rate (Baud)	120
	Coding	Vocoder (not included)
	Pilot tone (Hz)	3300
Demodulator Settings	Demodulator	MDPSK 2,4,8,16 A/B
	Symbol rate (Bd)	120
	SR tolerance (Bd)	5
	Modulation order	2, 4
	Version	A, A/B
	No. of channels	12
	Channel position type	Channel distance
	Channel distance (Hz)	200
Extras	Offset nominal frq. (Hz)	700
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 25: CIS-12

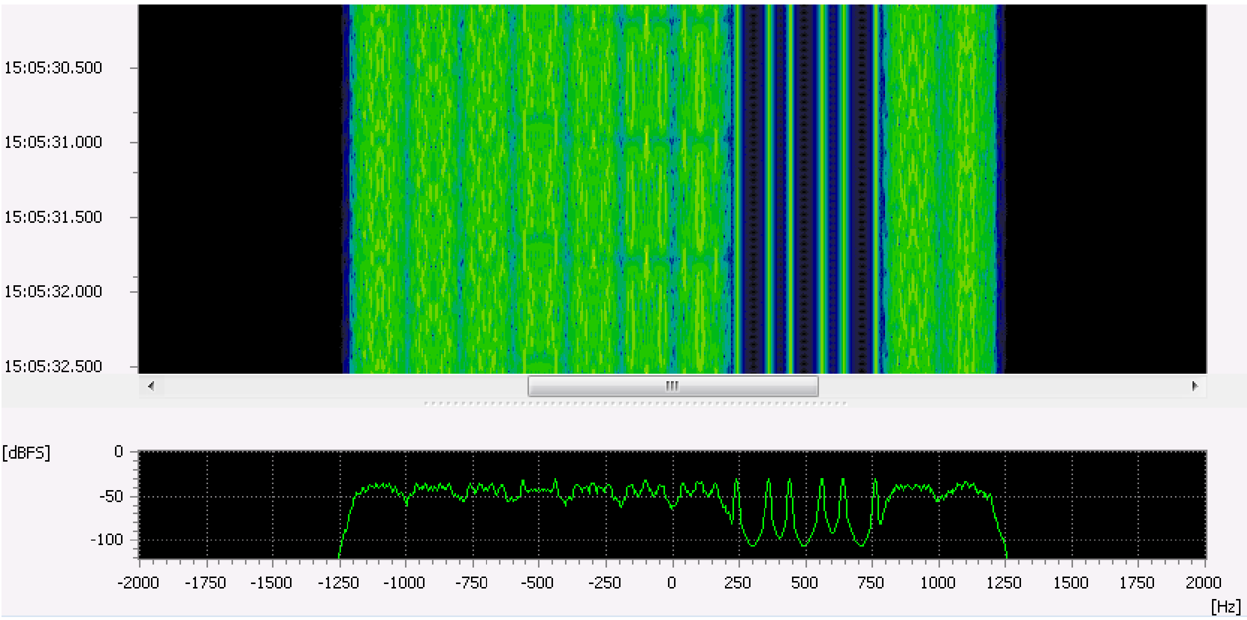


Figure 26: CIS-12 Spectrogram

1.26. CIS-14

General Information

CIS-14 is a synchronous duplex teleprinter system with ARQ.
This modem system is also known as AMOR and AMOR96.

Usage

- Data communication over HF
- Point-to-point communication between stations in CIS-region (Commonwealth of Independent States)

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of channels	2
	Shift (Hz)	500
	Bandwidth (Hz)	700
	Symbol rate (Baud)	96
	Error correction	Parity check
	Alphabet	M2 Cyrillic
Demodulator Settings	Symbol rate (Bd)	96
	SR tolerance (Bd)	5
	Shift (Hz)	500
	Shift tolerance (Hz)	20
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 26: CIS-14

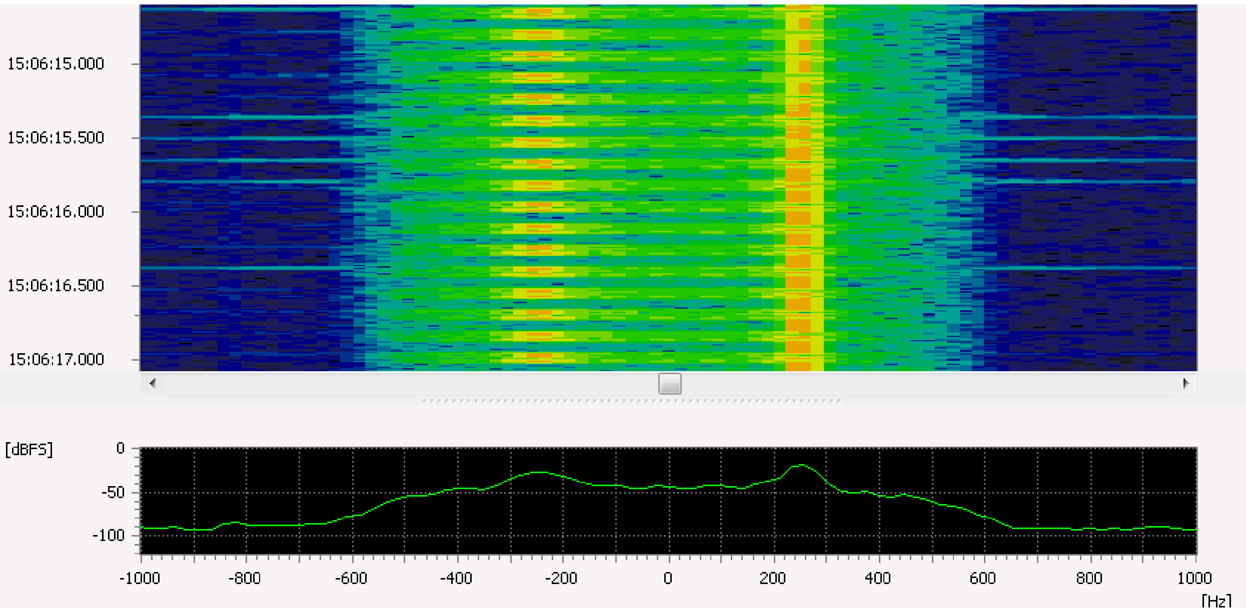


Figure 27: CIS-14 Spectrogram

1.27. CIS-36

General Information

CIS-36 is a modem used by the Russian military and diplomatic services.

This modem system is also known as CROWD 36.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	MFSK
	Number of tones	36
	Tone spacing (Hz)	40
	Bandwidth (Hz)	2000
	Symbol rate (Baud)	40
Demodulator Settings	Demodulator	Multitone (MFSK)
	Tone duration (ms)	25
	TD tolerance (ms)	2.5
	No. of tones	36
	Tone position type	Equidistant frequencies
	Tone distance (Hz)	40
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 27: CIS-36

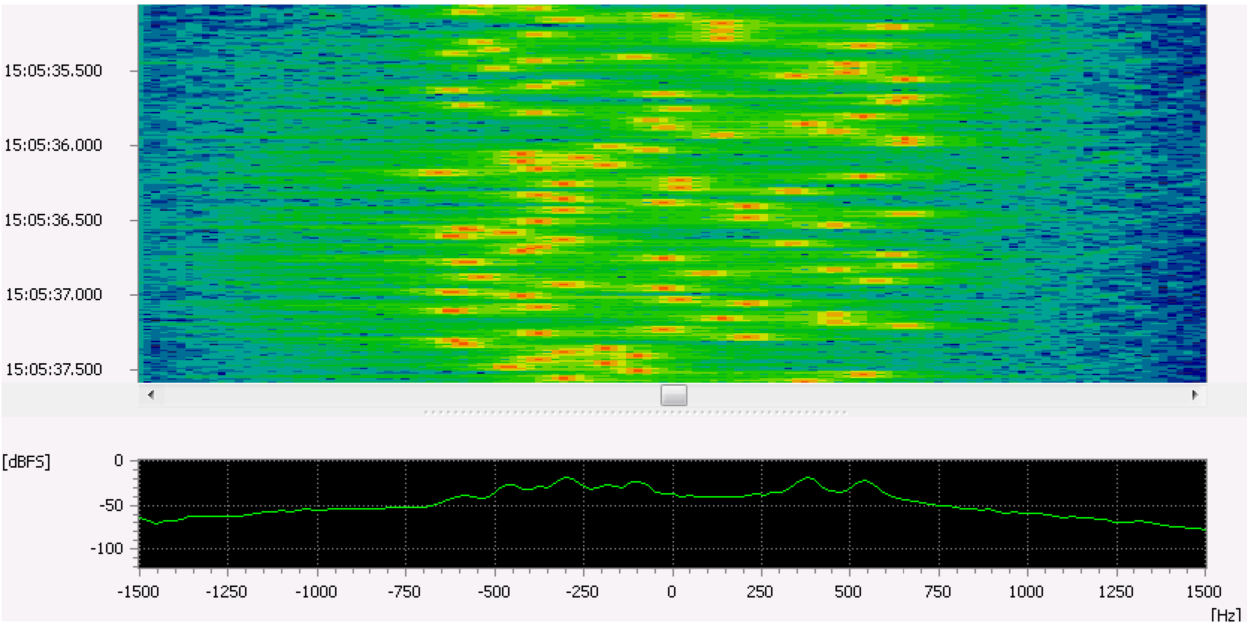


Figure 28: CIS-36 Spectrogram

1.28. CIS-36-50 / CIS-50-50

General Information

CIS-36-50 / CIS-50-50 is a modem used by the Russian navy.
This modem system is also known as BEE or T600.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	200 / 250 / 500
	Bandwidth (Hz)	300 ... 550
	Symbol rate (Baud)	50
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	50
	SR tolerance (Bd)	5
	Shift (Hz)	250
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding (raw output)	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 28: CIS-36-50 / CIS-50-50

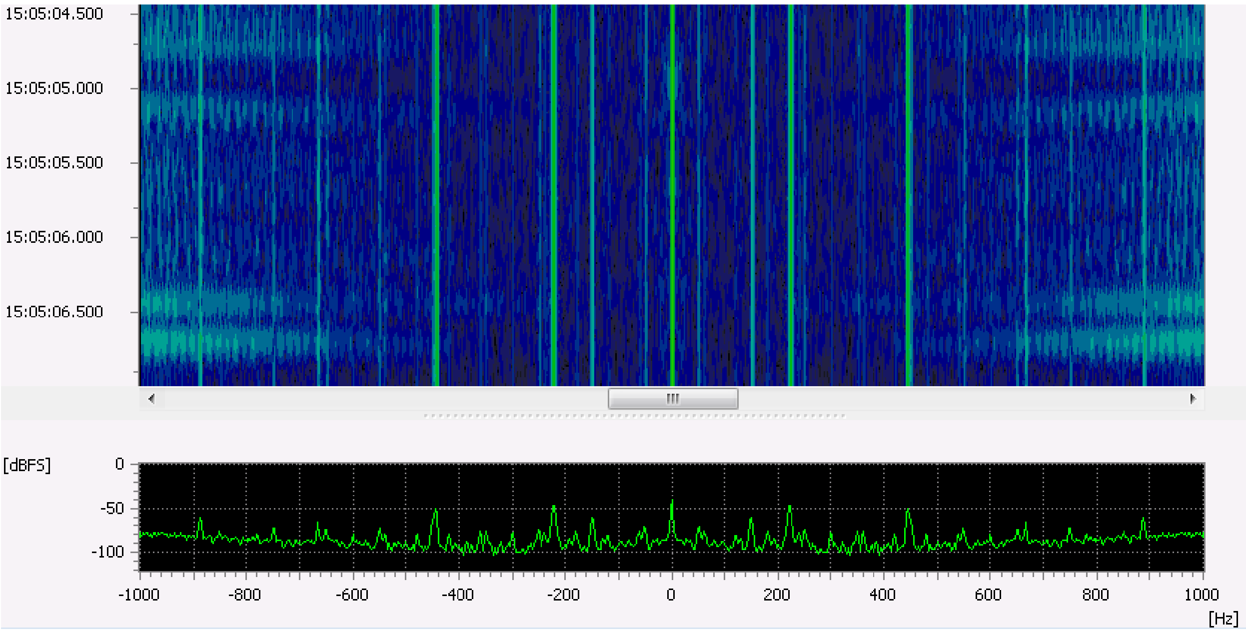


Figure 29: CIS-36-50 / CIS-50-50 Spectrogram

1.29. CIS-45

General Information

CIS-45 is a modem believed to be used by the Russian military and diplomatic services. There are two versions with slightly different symbol rates.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	OFDM
	Number of tones	45 + 1
	Bandwidth (Hz)	3000
	Symbol rate (Bd)	33.33 / 40
Demodulator Settings	Demodulator	OFDM
	Symbol rate (Bd)	33.33 / 40
	Channel distance (Hz)	62.5
	Constellation	DPSK2A
	No. of channels	47
Extras	Offset nominal frq. (Hz)	300
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Combination with other modems (modem list)	yes

Table 29: CIS-45

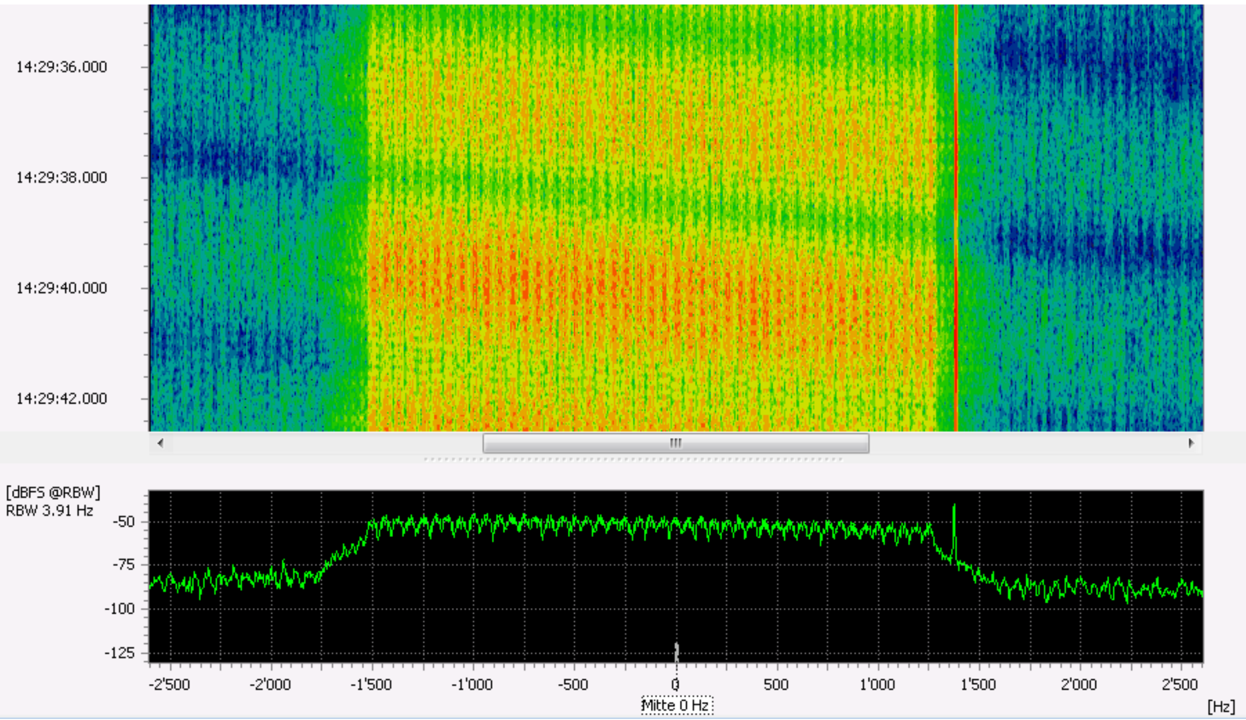


Figure 30: CIS-45 Spectrogram

1.30. CIS-112

General Information

CIS-112 is a modem believed to be used by the Russian military and diplomatic services. There are a data stream mode and a burst mode. The bursts are probably a kind of wake-up sequence or an ALE system.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	OFDM
	Number of tones	112 + 1
	Bandwidth (Hz)	3000
	Symbol rate (Bd)	22.22
Demodulator Settings	Demodulator	OFDM
	Symbol rate (Bd)	22.22
	Channel distance (Hz)	25.62
	Constellation	DPSK2A / DPSK4A
	No. of channels	112
	Min. burst length (s), burst mode only	3.3
	Max. burst length (s), burst mode only	3.6
	Min. pause length (s), burst mode only	0.110
Extras	Offset nominal frq. (Hz)	350
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Combination with other modems (modem list)	yes

Table 30: CIS-112

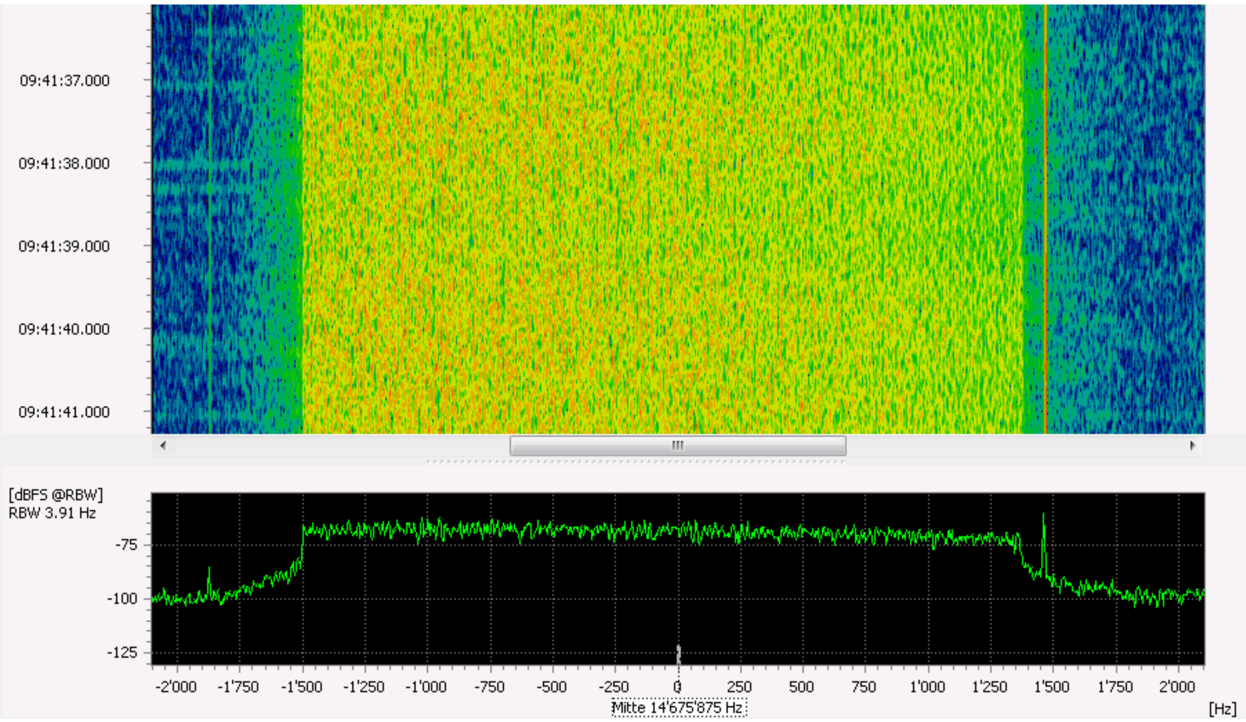


Figure 31: CIS-112 Data Stream Spectrogram

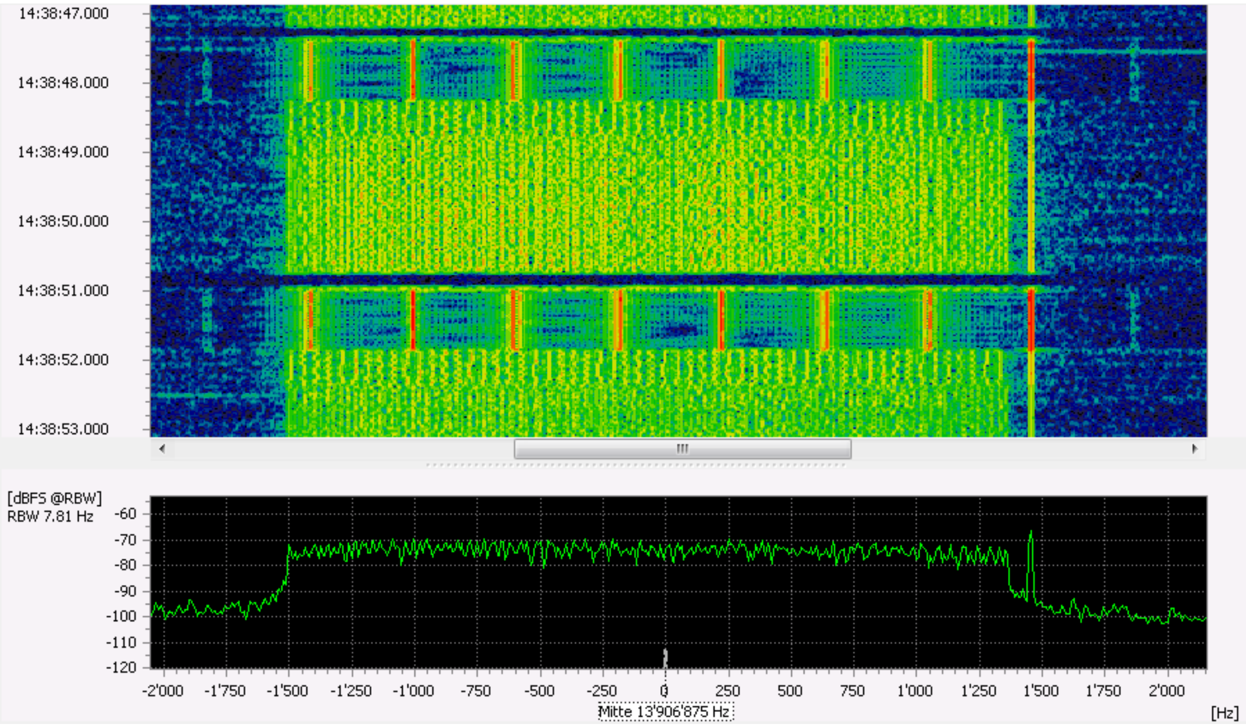


Figure 32: CIS-112 Burst Spectrogram

1.31. CIS-128

General Information

CIS-128 is a modem used by the Russian military and diplomatic services. There are 2 versions with 3 kHz and 6 kHz bandwidth.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	OFDM
	Number of tones	128
	Bandwidth (Hz)	3000 / 6000
	Symbol rate (Bd)	20.98 / 41.96
Demodulator Settings	Demodulator	OFDM
	Symbol rate (Bd)	20.98 / 41.96
	Channel distance (Hz)	23.44 / 46.88
	Constellation	PSK-8A
	No. of channels	129
Extras	Offset nominal frq. (Hz)	-1500 / -3000
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Combination with other modems (modem list)	yes

Table 31: CIS-128

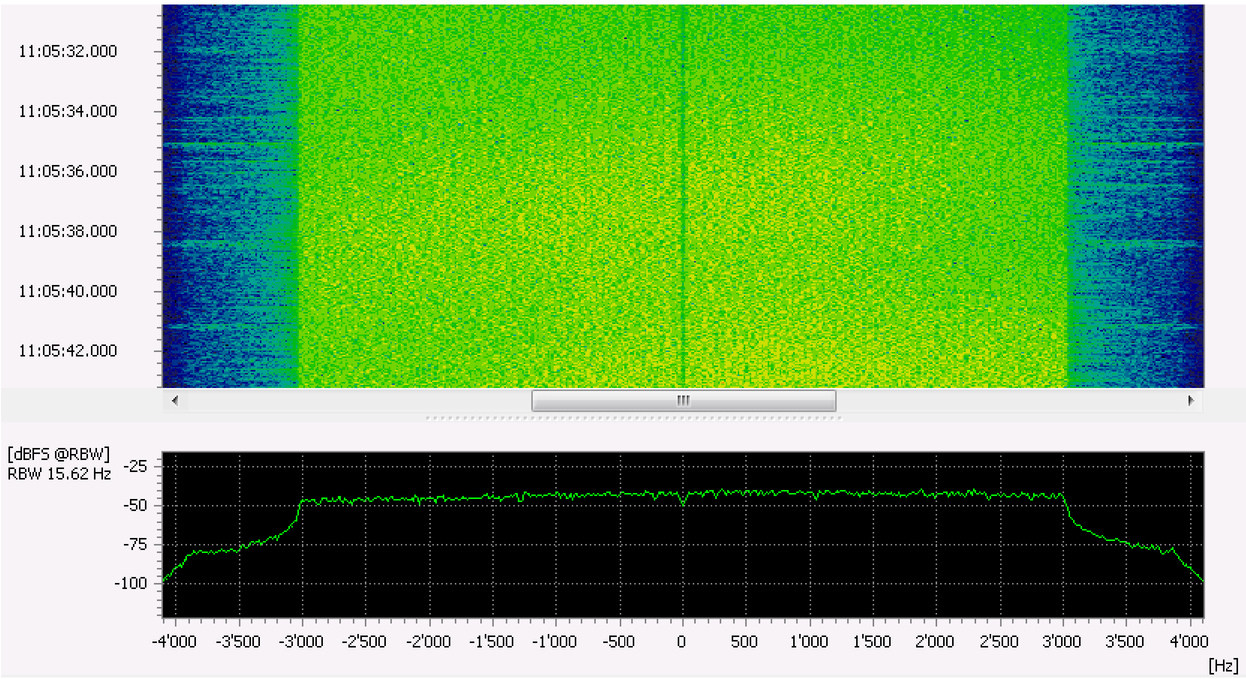


Figure 33: CIS-128 Spectrogram

1.32. CIS 405-3915

General Information

CIS 405-3915 is a synchronous teleprinter system in a CIS-8181 variant, but uses the half baud rate. This system is used by the Russian military and railways authorities for point to point connections. Despite its simplicity this modem is still in operation today. Traffic is always encrypted. Sometimes operator chat or station id in Morse telegraphy can be copied.

Usage

- Transfer of textual information over HF
- Point-to-point communication between stations in CIS-region (Commonwealth of Independent States)

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	500
	Symbol rate (Baud)	40.5
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	40.5
	SR tolerance (Bd)	5
	Shift (Hz)	500
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 32: CIS 405-3915

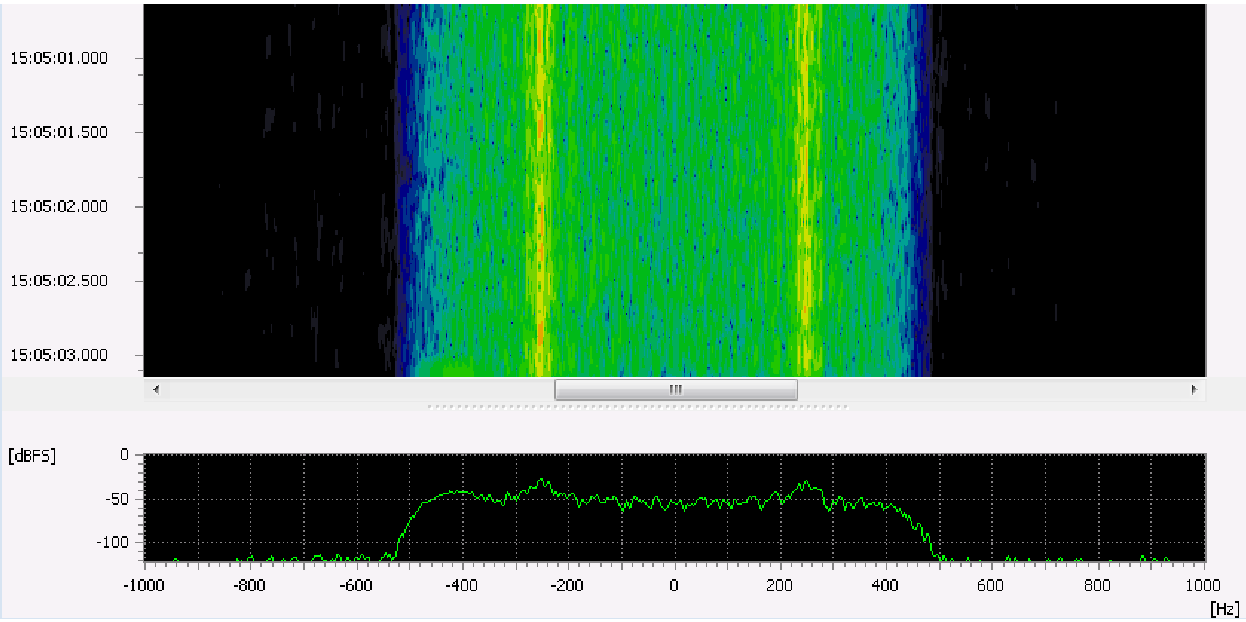


Figure 34: CIS 405-3915 Spectrogram

1.33. CIS-3000

General Information

CIS-3000 is a modem using PSK 8 / 3000 bd is a modem used by the Russian military and diplomatic services. It quite often used as an ALE-like prefix with other modulation types like MFSK-68. The signal may appear in continuous mode as well as chained bursts. Burst pauses however are quite short (<150 ms) in relation to a variable but typically much longer burst length.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	PSK 8
	Bandwidth (Hz)	3600
	Symbol rate (Bd)	3000
Demodulator Settings	Demodulator	DPSK
	Symbol rate (Bd)	3000
	SR tolerance (Bd)	5
	Modulation order	8
	Version	A
	Burst mode	off
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes
Tuning	The tuning frequency is the center of the signal	

Table 33: CIS-3000

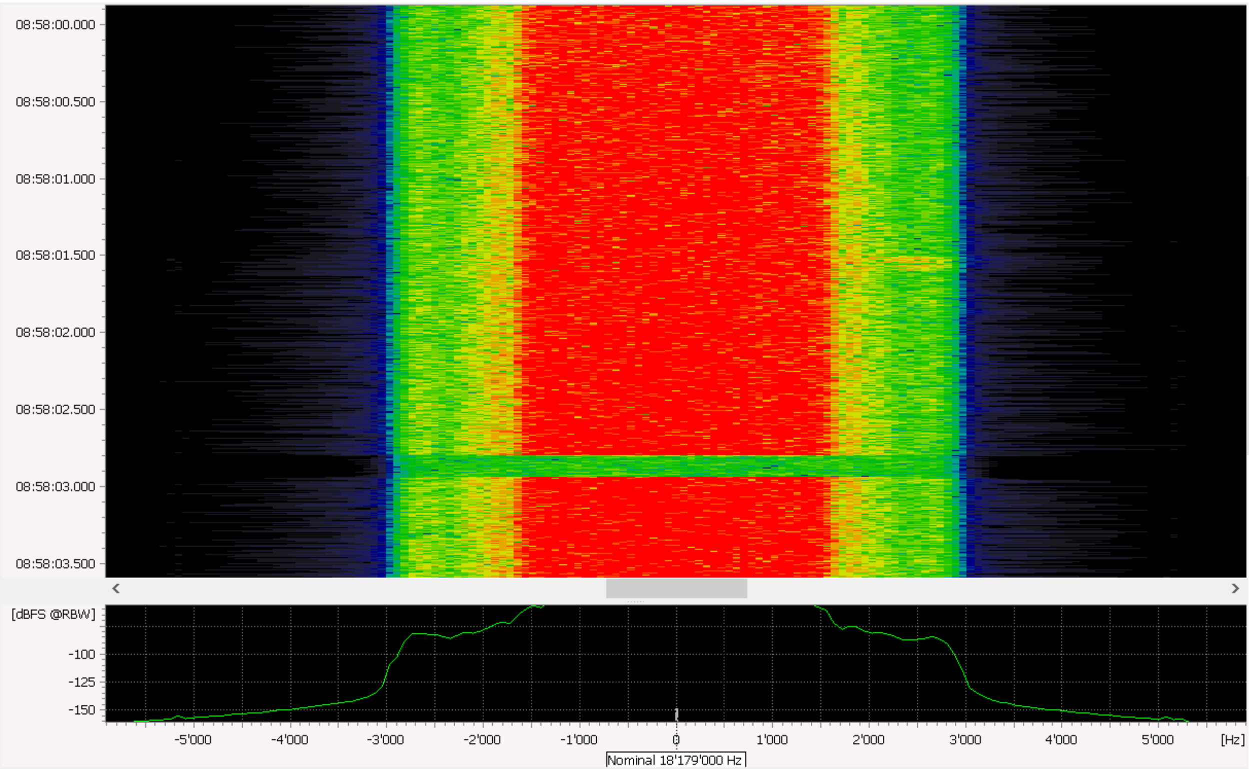


Figure 35: CIS-3000 Spectrogram

1.34. CIS-8181

General Information

CIS-8181 is a modem used by the Russian navy.

There is also a variant called CIS 8129.

Usage

- Data communication over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'CIS-81-81'

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	500
	Bandwidth (Hz)	600
	Symbol rate (Baud)	81
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	81
	SR tolerance (Bd)	5
	Shift (Hz)	500
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding (raw output)	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 34: CIS-8181

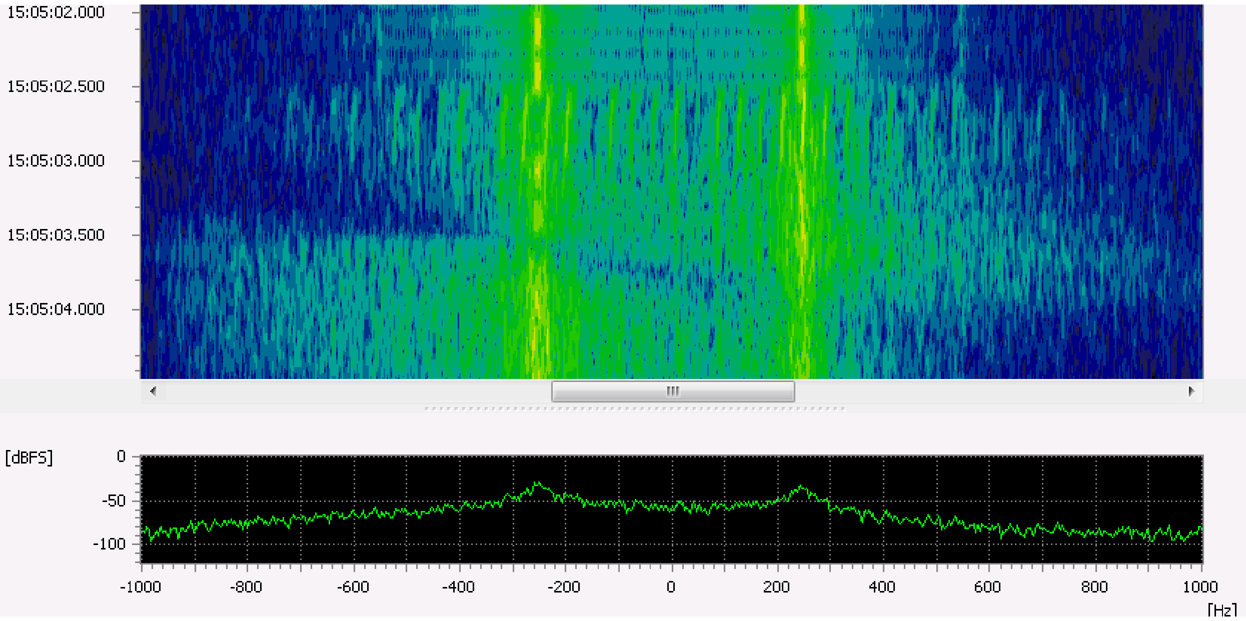


Figure 36: CIS-8181 Spectrogram

1.35. CIS Akula 500Bd/1000Hz

General Information

CIS Akula is a FSK burst waveform, most likely used by Russian/CIS Navy submarine links. Alternate names are "CIS 500" or "Shark".

Usage

- Data communication over HF
- Point-to-point communication between stations in CIS-region (Commonwealth of Independent States)

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'CIS Akula'

Mode Details

	Item	Value
Standard	Modulation	FSK
	Shift (Hz)	1000
	Bandwidth (Hz)	1500
	Symbol rate (Baud)	500
Demodulator Settings	Symbol rate (Bd)	500
	SR tolerance (Bd)	5
	Shift (Hz)	1000
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	raw
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 35: CIS Akula 500Bd/1000Hz

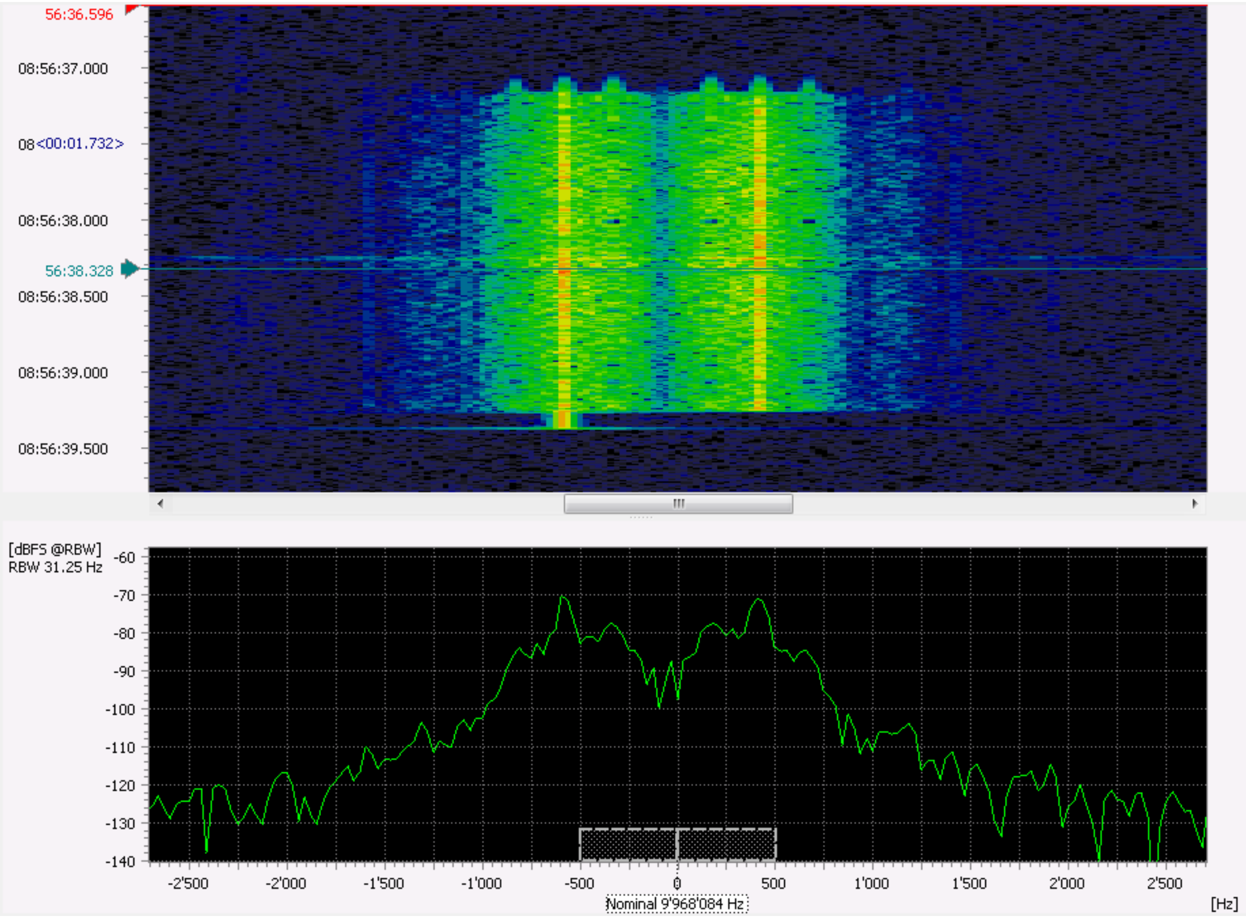


Figure 37: CIS Akula 500Bd/1000Hz Spectrogram

1.36. CIS FSK 200/500

General Information

CIS FSK 200/500 is believed to be used by one of the Russian intelligence services. It transmits data using FSK (Frequency Shift Keying) modulation with the ITA-2 alphabet (with 1.5 stop bits).

This modem is also known as F01.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of channels	2
	Shift (Hz)	500
	Bandwidth (Hz)	700
	Symbol rate (Baud)	200
	Alphabet	ITA-2
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	200
	SR tolerance (Bd)	6
	Shift (Hz)	500
	Shift tolerance (Hz)	10
	Modem type	Asynchronous Baudot
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 36: CIS FSK 200/500

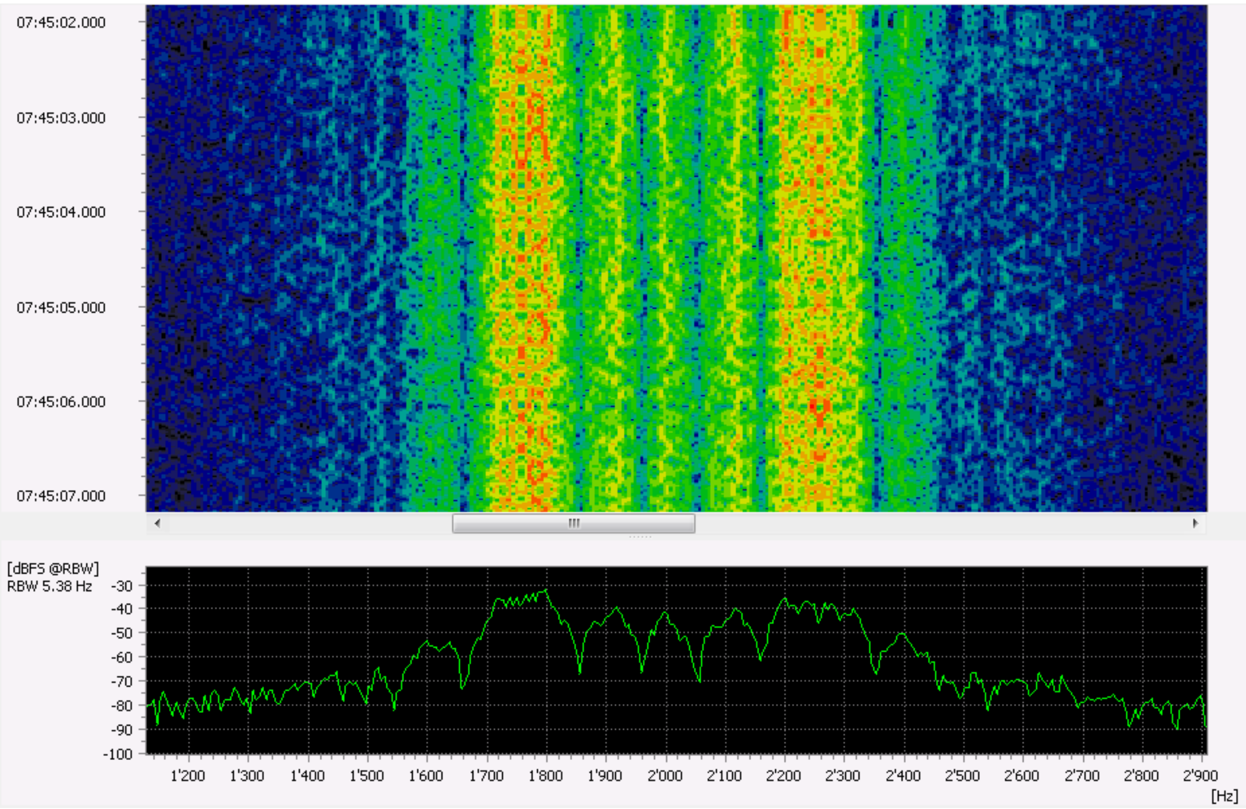


Figure 38: CIS FSK 200/500 Spectrogram

1.37. CIS FSK 200/1000

General Information

CIS FSK 200/1000 is believed to be used by one of the Russian intelligence services. It transmits data messages using FSK (Frequency Shift Keying). Each message is separated unnumbered 88 bit blocks. The first two frames (blocks) of a message contain information about the message size, identification parameters etc. Further coding is unknown, so raw hexadecimal code is used for output.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of channels	2
	Shift (Hz)	1000
	Bandwidth (Hz)	1200
	Symbol rate (Baud)	200
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	200
	SR tolerance (Bd)	5
	Shift (Hz)	1000
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 37: CIS FSK 200/1000

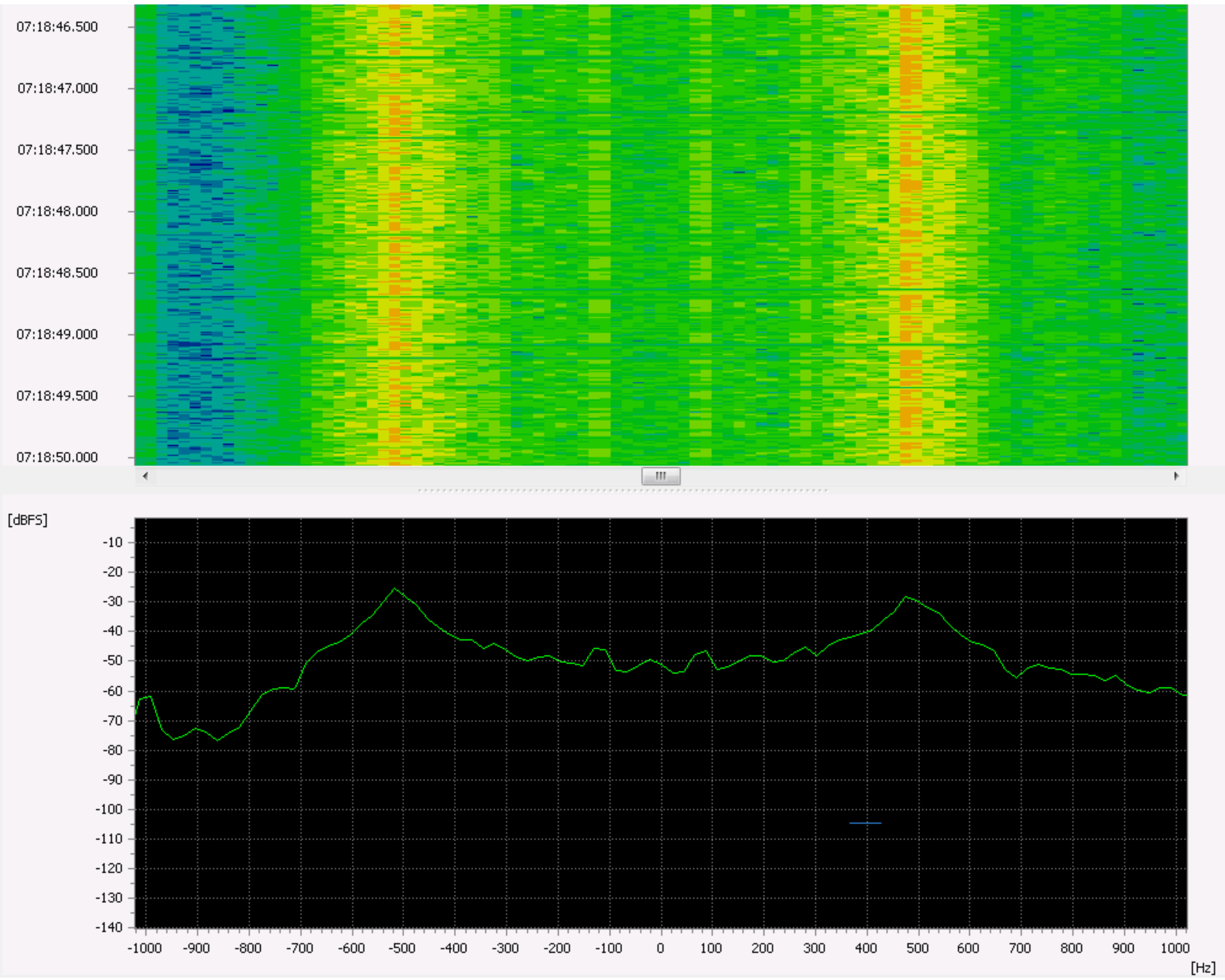


Figure 39: CIS FSK 200/1000 Spectrogram

1.38. CIS Hybrid MFSK-68 PSK-9000

General Information

CIS Hybrid MFSK-68 PSK-9000 is a modem presumably to be used by the Russian military and diplomatic services. It uses a MFSK with 68 tones interleaved with PSK sync bursts at 9000 Bd. The number of simultaneous tones is either 3 or 5, which the decoder determines heuristically. Further coding is unknown, so the decimal tone number is used for output.

Usage

- Data communication over HF

Restrictions

- This modem is not suitable for automatic search. Only usable in production mode

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'CIS Hybrid MFSK-68 PSK-9000'

Mode Details

	Item	Value
Standard	Modulation	MFSK-68 / PSK
	Number of tones	68
	Tone distance (Hz)	46.9
	Bandwidth (Hz)	9000
	Tone duration (s)	0.021322
Demodulator Settings	Demodulator	Multitone (MFSK)
	Tone duration (s)	0.021322
	Tone duration tolerance (s)	0
	No. of tones	67
	Simultaneous tones	5
	Tone distance (Hz)	46.9
	Burst Mode	Off
Features	Demodulation	yes
	Recognition	no
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	no

Table 38: CIS Hybrid MFSK-68 PSK-9000

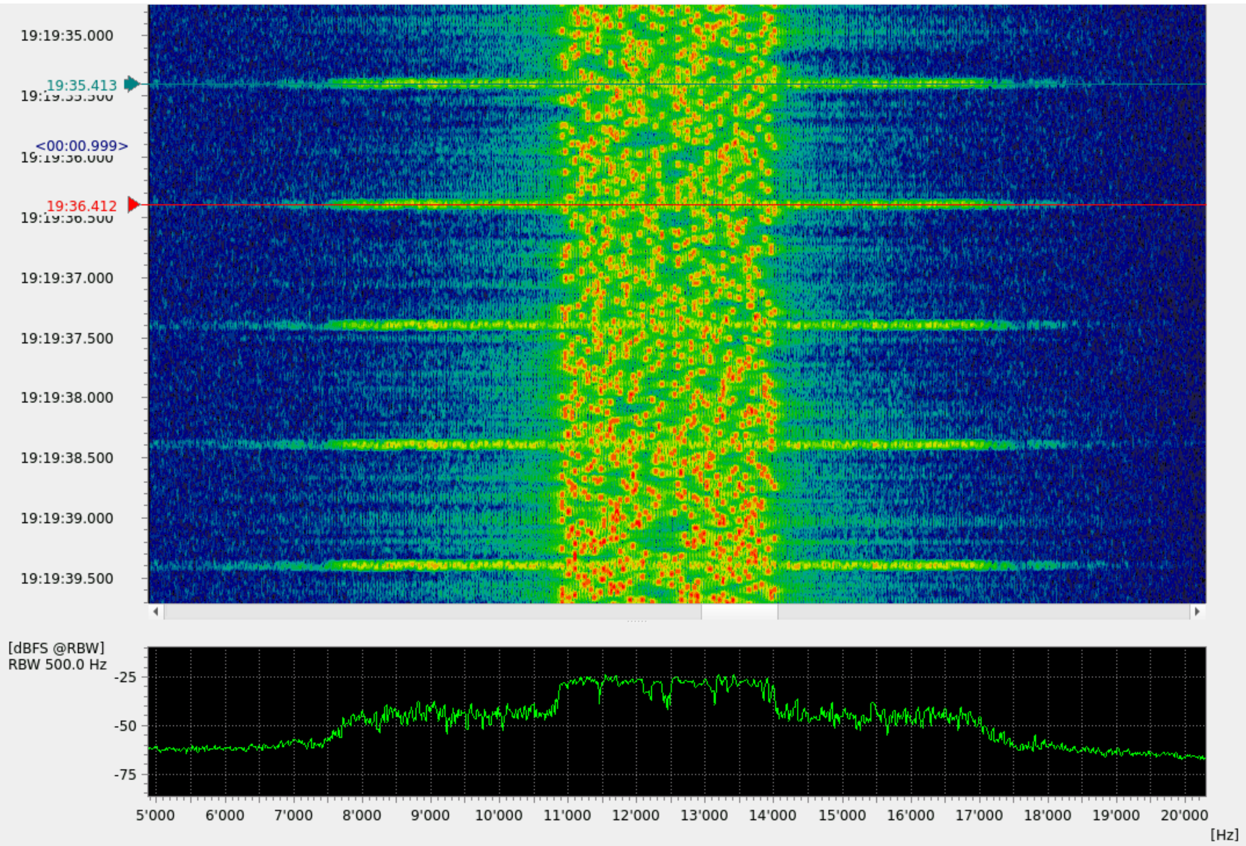


Figure 40: CIS Hybrid MFSK-68 PSK-9000 Spectrogram

1.39. CIS Hybrid MFSK-80 PSK-250

General Information

CIS Hybrid MFSK-80 PSK-250 is a modem presumably to be used by the Russian military and diplomatic services. It uses a MFSK with 80 tones interleaved with BPSK sync bursts at alternating frequencies. Further coding is unknown, so the decimal tone number is used for output.

Usage

- Data communication over HF

Restrictions

- This modem is not suitable for automatic search. Only usable in production mode

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'CIS Hybrid MFSK-80 PSK-250'

Mode Details

	Item	Value
Standard	Modulation	MFSK-80 / BPSK
	Number of tones	80
	Tone distance (Hz)	20
	Bandwidth (Hz)	1600
	Tone duration (s)	0.1
Demodulator Settings	Demodulator	Multitone (MFSK)
	Tone duration (s)	0.1
	Tone duration tolerance (s)	0.002
	No. of tones	80
	Simultaneous tones	5
	Tone distance (Hz)	20
	Burst Mode	Off
Features	Demodulation	yes
	Recognition	no
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	no

Table 39: CIS Hybrid MFSK-80 PSK-250

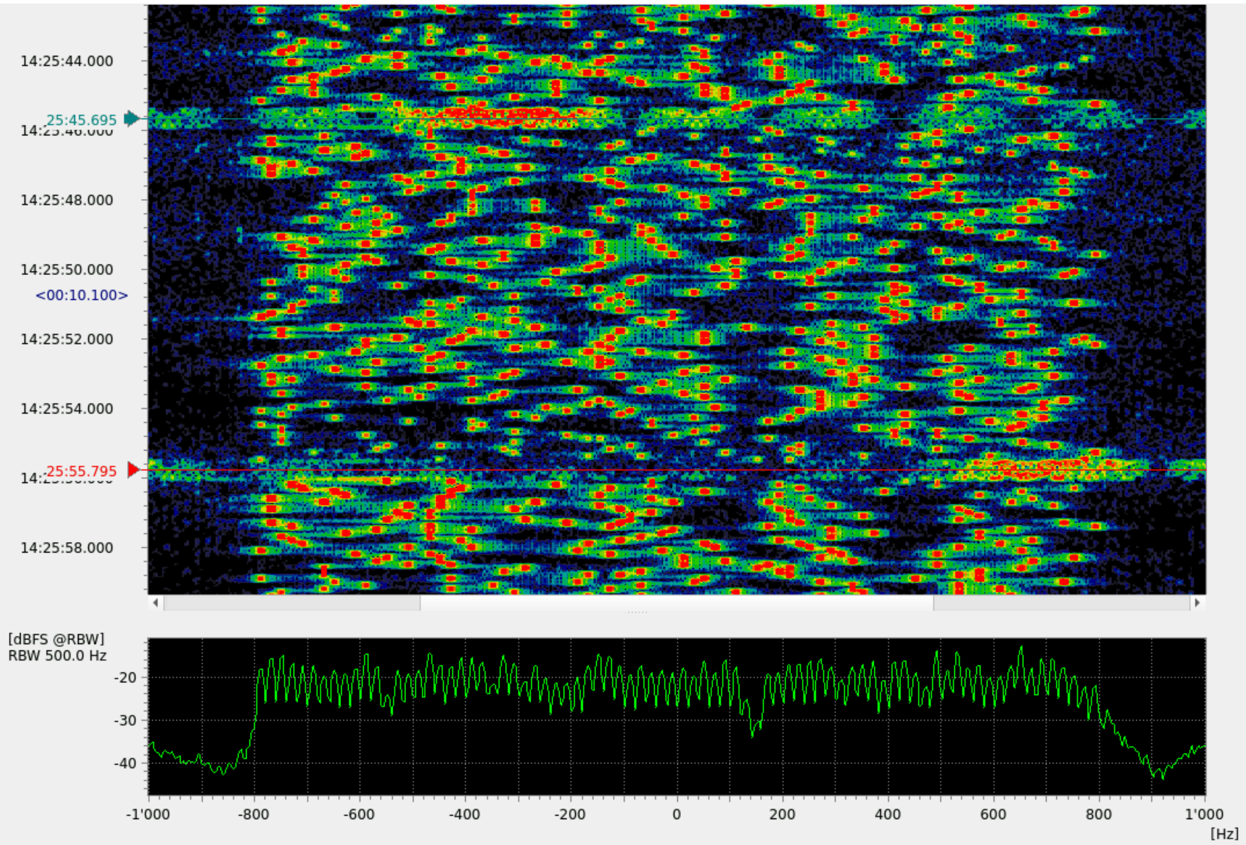


Figure 41: CIS Hybrid MFSK-80 PSK-250 Spectrogram

1.40. Clansman

General Information

This FSK modem is part of the Clansman Radio System formally used by the UK forces. The modem seems to be still in use by radio amateurs. A message burst starts with reversals followed by a unique 64-bit preamble. Prior the message two 64 bit codes are repeated four times each.

Usage

- Radio amateurs

Mode Details

	Item	Value
Standard	Modulation	FSK 2
	Bandwidth (Hz)	1350Hz (300bd)
	Symbol rate (Bd)	300 (formerly also 150, 75)
Demodulator Settings	Demodulator	FSK matched
	Symbol rate (Bd)	300
	SR tolerance (Bd)	5
	Shift(Hz)	850
	Shift tolerance(Hz)	10
	Modem type	synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 40: Clansman

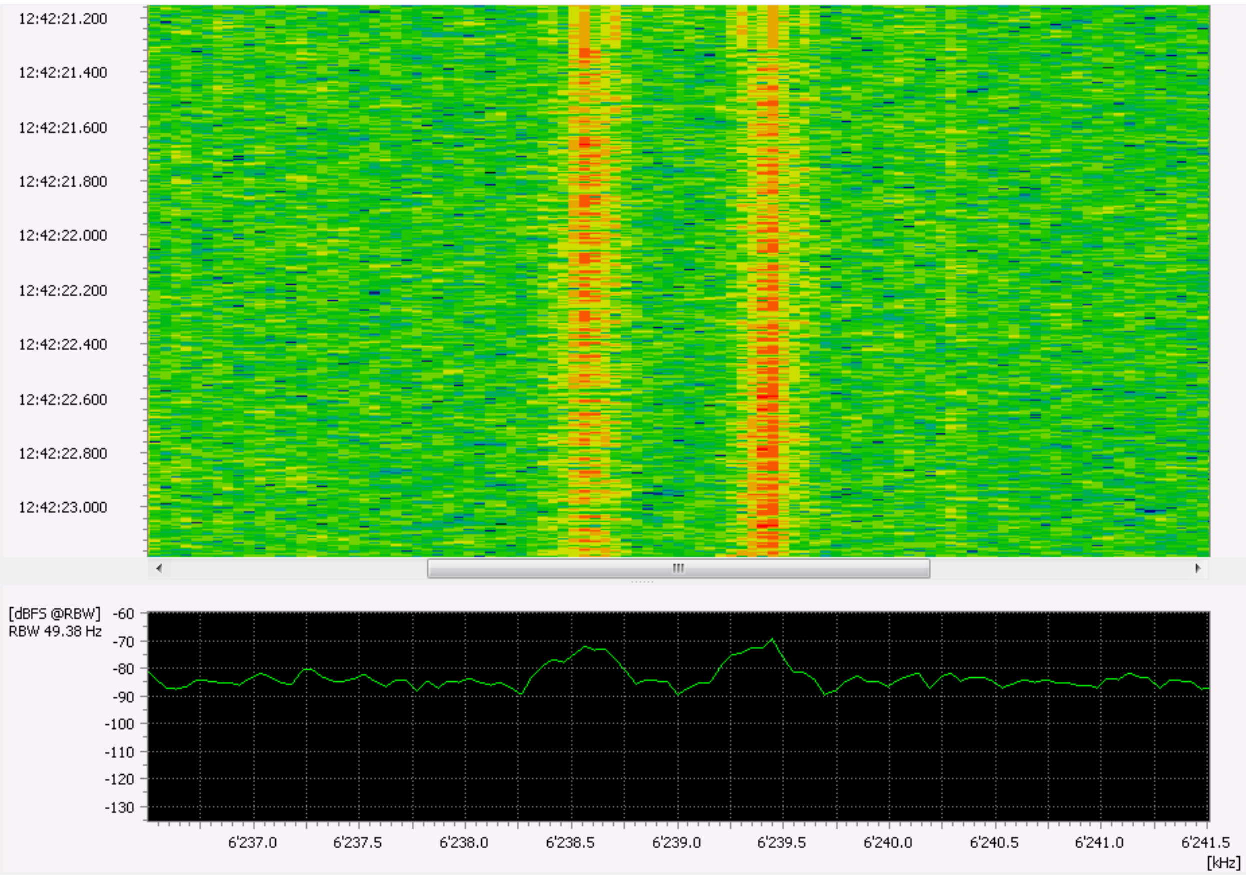


Figure 42: Clansman Spectrogram at burst start

1.41. Clover-II

General Information

Clover-II mode is a proprietary standard developed by HAL Communications Corp., USA.

Usage

- ARQ and broadcast data communication over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Clover II'

Mode Details

	Item	Value
Standard	Modulation	DBPSK / DQPSK / 8-DPSK / 8P2A / 16P4A
	Number of channels	4
	Channel spacing (Hz)	125
	Bandwidth (Hz)	500
	Symbol rate (Baud)	31.25
	Error correction	Reed-Solomon
Demodulator Settings	Demodulator	Clover II
	Modulation order	4
	Min. burst length (s)	0.540
	Max. burst length (s)	17.824
	Min. pause length (s)	0.064
	Min. burst SNR (dB)	0
Extras	Offset nominal frq. (Hz)	2062.5 (channel nr. 4)
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 41: Clover-II

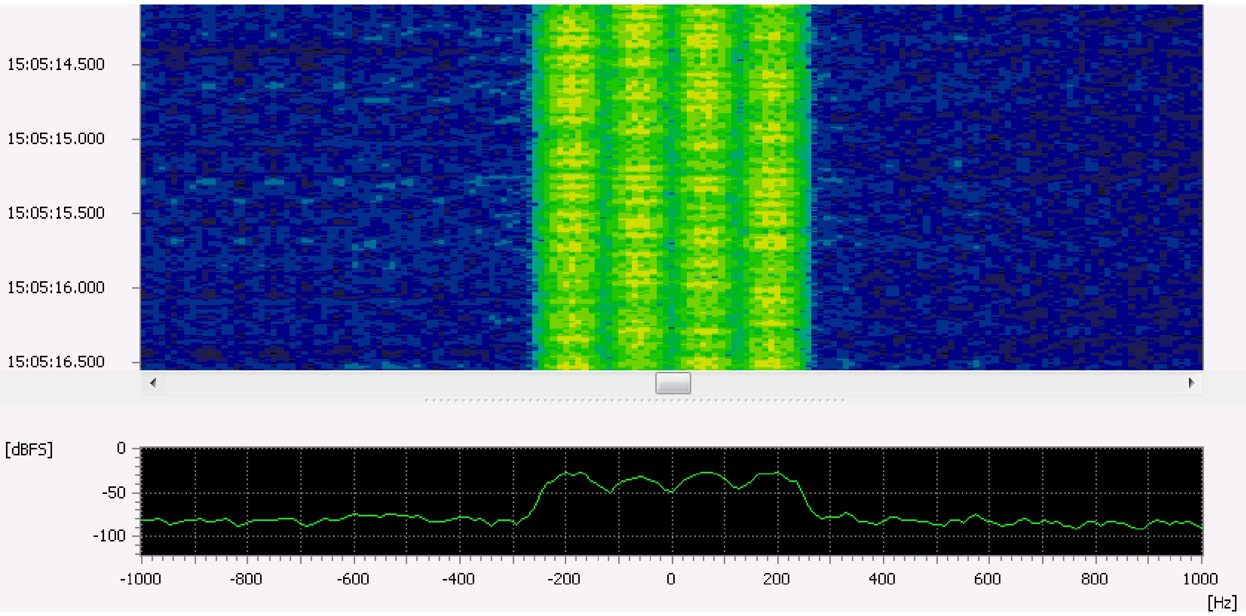


Figure 43: Clover-II Spectrogram

1.42. Clover 2000/2500

General Information

Clover 2000 mode is a standard developed by HAL Communications Corp., USA.
Clover 2500 is a version with identical modulation types and coding but increased bandwidth (2500 Hz) and symbol-rate.

Usage

- ARQ and broadcast data communication over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Clover 2000/2500'

Mode Details

	Item	Value	
Standard	Modulation	DBPSK / DQPSK / 8-DPSK / 8P2A / 16P4A	
	Number of channels	8	
	Channel spacing (Hz)	250	312.5
	Bandwidth (Hz)	2000	2500
	Symbol rate (Baud)	62.5	78.125
	Error correction	Reed-Solomon	
Demodulator Settings	Demodulator	Clover 2000 / Clover 2500	
	Modulation order	64	
	Min. burst length (s)	0.270	
	Max. burst length (s)	4.400	
	Min. pause length (s)	0.040	
	Min. burst SNR (dB)	0	
Extras	Offset nominal frq. (Hz)	625	468
Features	Demodulation	yes	
	Recognition	yes	
	Decoding	yes	
	Automatic Polarity Adjustment	no	
	Combination with other modems (modem list)	yes	

Table 42: Clover 2000/2500

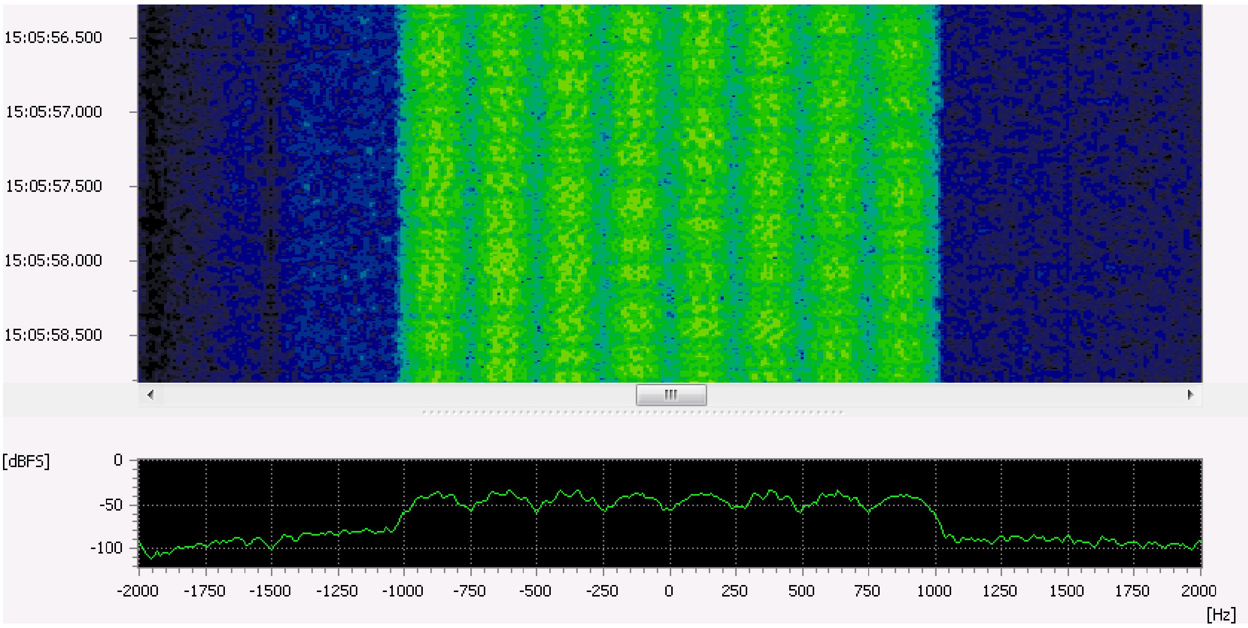


Figure 44: Clover 2000/2500 Spectrogram

1.43. Codan 3012/3212 16 Channel

General Information

Codan 3012 mode is a proprietary standard developed by CODAN PTY Australia. Codan 3212 is similar to the Codan 3012 mode with same modulation parameters but slightly different encoding parameters. The Codan 3212 modem also supports decoding of the Codan 3012 mode.

Usage

- ARQ and broadcast data communication over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'CODAN 3212 16 Channel PSK'

Mode Details

	Item	Value
Standard	TX modus	selective, broadcast, group call
	Modulation	DPSK
	Number of tones	4
	Number of channels	16
	Channel spacing (Hz)	112.5
	Bandwidth (Hz)	1800
	Symbol rate (Bd)	1200
	Data rate (bit/s)	up to 6000
	Alphabet	CCIR-476
Demodulator Settings	Demodulator	MDPSK 2,4,8,16 A/B
	Symbol rate (Bd)	75
	SR tolerance (Bd)	2
	Modulation order	4
	Version	A
	No. of channels	16
	Channel position type	Channel distance
	Channel distance (Hz)	112.5
	Min. burst length (s)	0.700
	Max. burst length (s)	12.000
	Min. pause length (s)	0.070
	Min. burst SNR (dB)	9
Extras	Offset nominal frq. (Hz)	656.25

	Item	Value
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 43: Codan 3012/3212 16 channel

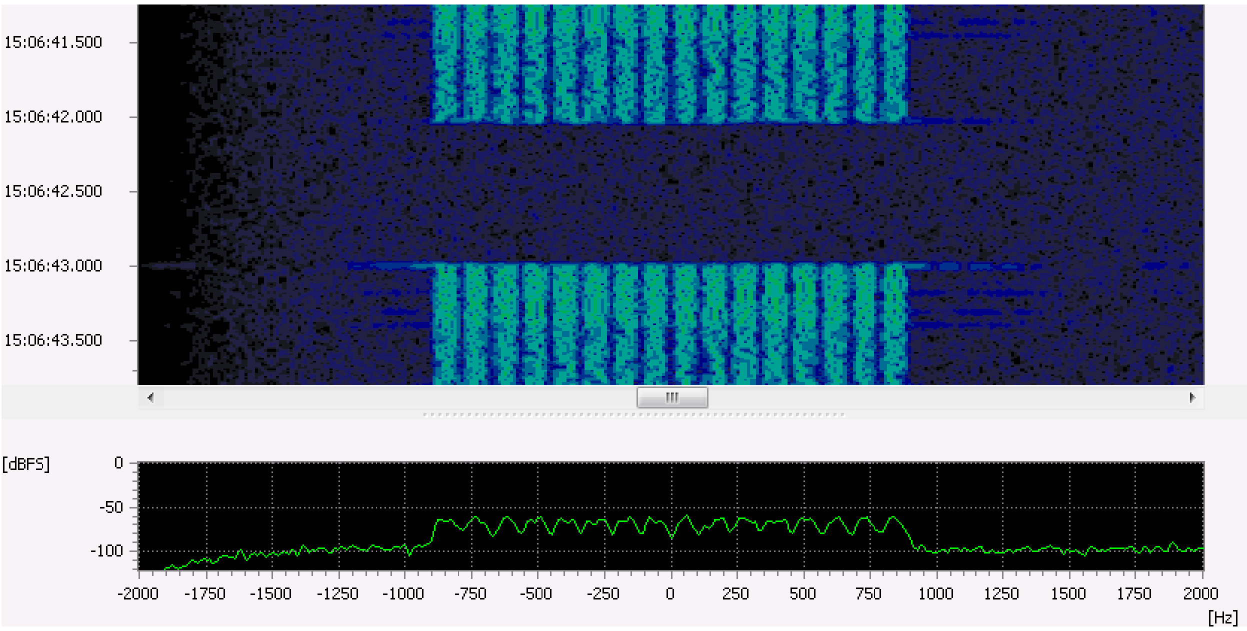


Figure 45: Codan 3012 16 channel Data Spectrogram

1.44. Codan 3212 1 Channel

General Information

The 3212 HF Data Modem uses waveforms derived from Military Standard (MIL-STD) Waveforms, which are based on STANAG 4539 and modified to provide optimal performance over commercial 2.4 kHz HF channels.

Usage

- ARQ and broadcast data communication over HF
- ALE

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table

- 'CODAN 3212 1 Channel'
- 'CODAN 3212 1 Channel HDR'
- 'CODAN 3212 1 Channel 75bps'

Mode Details

	Item	Value
Standard	Modulation	PSK8, 16QAM, 32QAM or 64 QAM
	Bandwidth (Hz)	2400
	Symbol rate (Bd)	1800
	Data rate (bit/s)	75 / 150 / 300 / 600 / 1200 / 2400 / 3600 / 4800 / 6000 / 7200
	Error correction	FEC, Convolutional Code
	Short interleaver (s)	0.12
	Long interleaver (s)	8.64
Demodulator Settings	Demodulator	PSK data aided
	Symbol rate (Bd)	1800
	Modulation order	8

	Item	Value
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Supported alphabet in each submode	ASCII 8 bit, without start & stop bits
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes
	Channel 16: Binary hex output	yes
	STANAG-5066 post-processing	yes (only when MIL option)

Table 44: Codan 3212 1 Channel

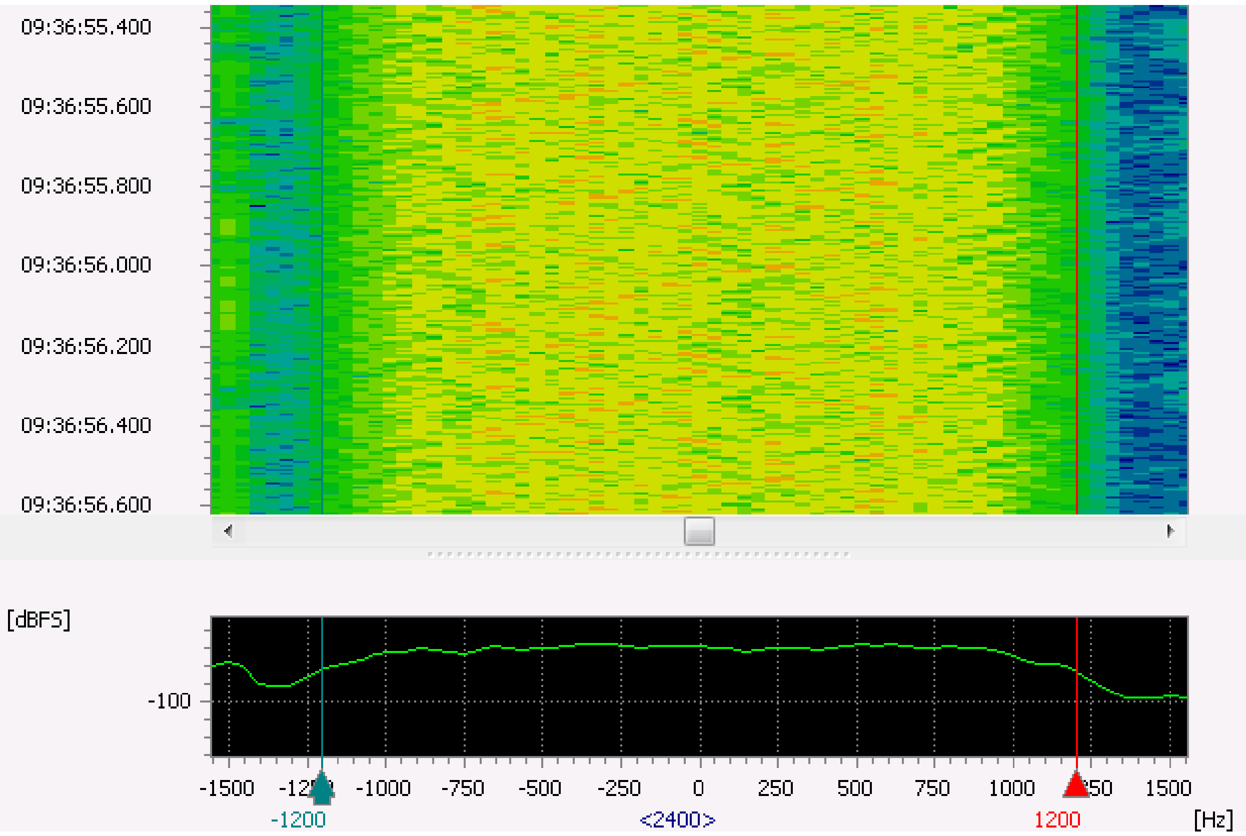


Figure 46: Codan 3212 Data 1 Channel Spectrogram

Supported submode

Signal	Status		
CODAN 3212 (STANAG-4539 mode) Bitrates (bps): short & long	Demodulation	Recognition	Decoding
75	yes	yes	yes
150	yes	yes	yes
300	yes	yes	yes
600	yes	yes	yes
1200	yes	yes	yes
2400	yes	yes	yes
3600	Yes	Yes	yes
4800	Yes	Yes	yes
6000	Yes	Yes	yes
7200	Yes	Yes	yes

Table 45: Codan 3212 1 Channel Submode Availability

1.45. Codan Chirp

General Information

Codan Chirp is the ALE (automatic link establishment) system for Codan 3012/3212 data transmission modes.

Usage

- ALE

Mode Details

	Item	Value
Standard	Modulation	PSK (Chirp)
	Number of channels	32
	Channel spacing (Hz)	80
	Bandwidth (Hz)	2600
	Symbol rate (Bd)	80
	Error correction	Golay code
Demodulator Settings	Demodulator	CHIRP
	Symbol rate (Bd)	80
	SR tolerance (Bd)	0.1
	Modulation order	2
	Chirp Mode	Linear UP-CHIRP
	Shift (Hz)	3000
Extras	Offset nominal frq. (Hz)	656.25
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 46: Codan Chirp

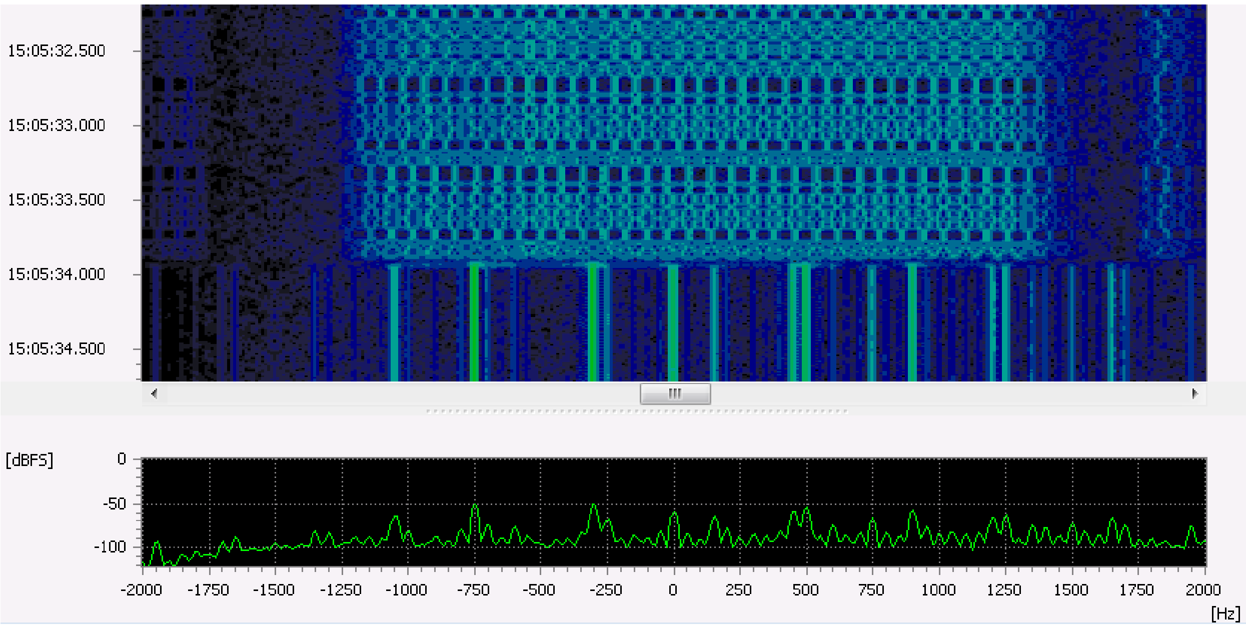


Figure 47: Codan Chirp Spectrogram

1.46. Codan SelCal

General Information

Codan SelCal FSK is a radio standard developed by CODAN PTY Australia and is also known as CCIR 493-4 Selcall or Australian Selcall. This type of selcal is also implemented by other modem manufacturers like Barrett, QMAC, Micom, Icom, Vertex, R&S and Jenal modems.

Support for 4-digit and 6-digit selcall addresses is implemented.

Usage

- SelCal and status message transfer over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Codan Selcal'

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	170
	Bandwidth (Hz)	400
	Symbol rate (Bd)	100
		Parity checksum
Demodulator Settings	Demodulator	FSK 2,3,4 discr.
	Symbol rate (Bd)	100
	SR tolerance (Bd)	5
	Modulation order	2
	Shift (Hz)	170
	Shift tolerance (Hz)	20
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 47: Codan SelCal

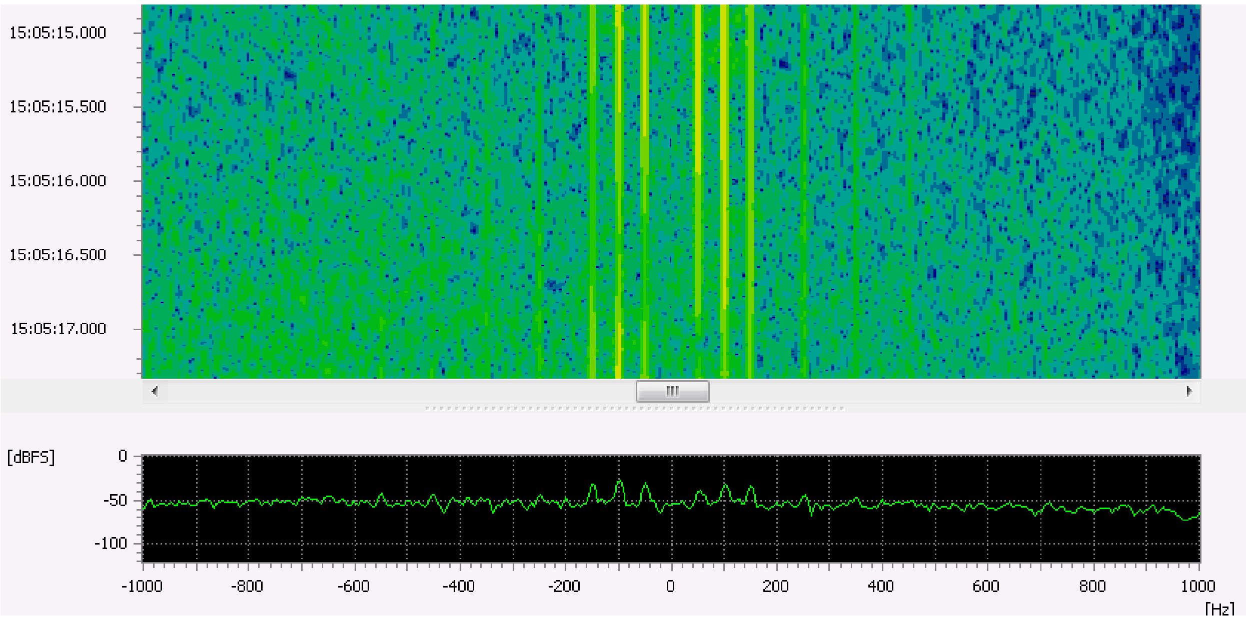


Figure 48: Codan SelCal Spectrogram

1.47. Contestia

General Information

Contestia is a radio teletype modem developed by radio amateur Nick Fedoseev.

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	MFSK
	Number of tones	4/8/16/32
	Shift (Hz)	200
	Symbol rate (Bd)	31.25(62.5/125)
	Error correction	Walsh
	Alphabet	6 bits characters
Demodulator Settings	Demodulator	Multitone (MFSK)
	Tone duration (ms)	32
	TD tolerance (ms)	4
	No. of tones	32
	Tone position type	Equidistant frequencies
	Tone distance (Hz)	31.25(62.5)
Extras	Offset nominal frq. (Hz)	500
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 48: Contestia

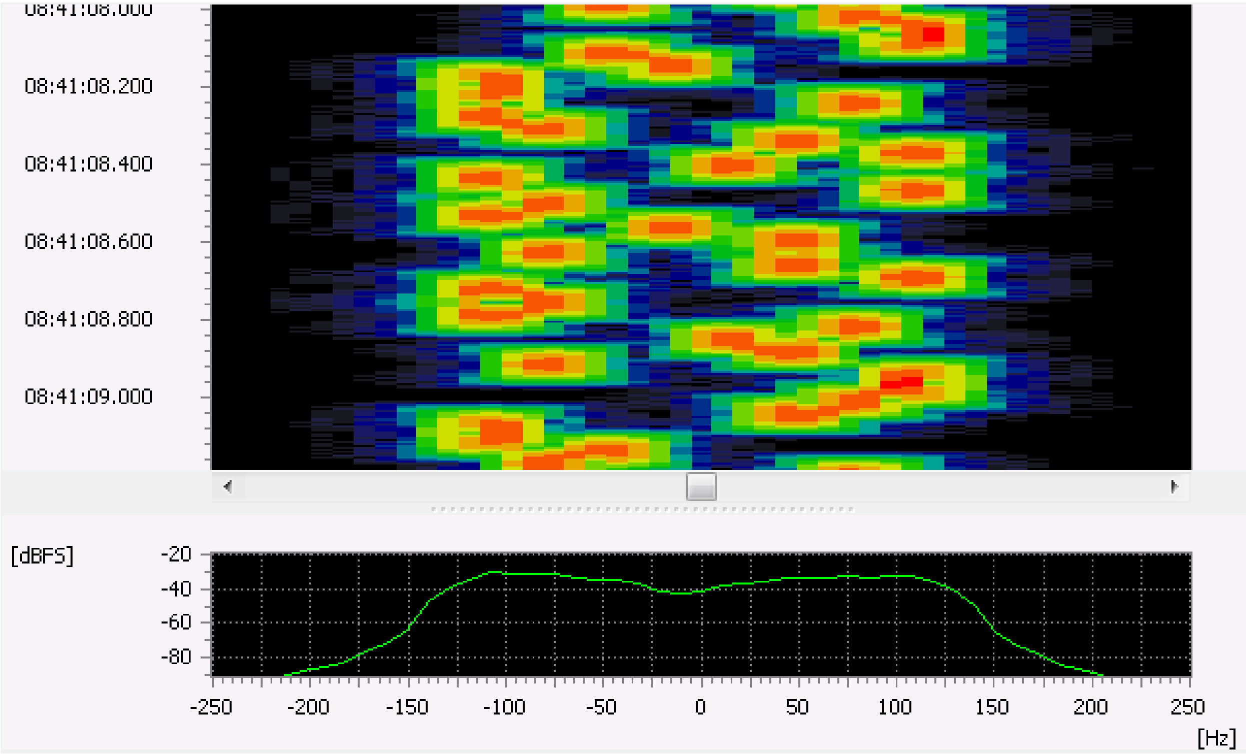


Figure 49: Contestia Spectrogram

1.48. Coquelet-8

General Information

The Coquelet modes were designed for the communications of French customs and police authorities. They are similar to the British Piccolo modes.

Usage

- Transfer of textual information (mostly encrypted) over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	8
	Shift (Hz)	26.67
	Bandwidth (Hz)	300
	Symbol rate (Baud)	13.3 / 26.7
	Alphabet	ITA-2 / ATU-80
Demodulator Settings	Demodulator	Coquelet
	Tone duration (ms)	37.5
	TD tolerance (ms)	2
	No. of tones	8
	Tone distance (Hz)	26.67
Extras	Offset nominal frq. (Hz)	773
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 49: Coquelet-8

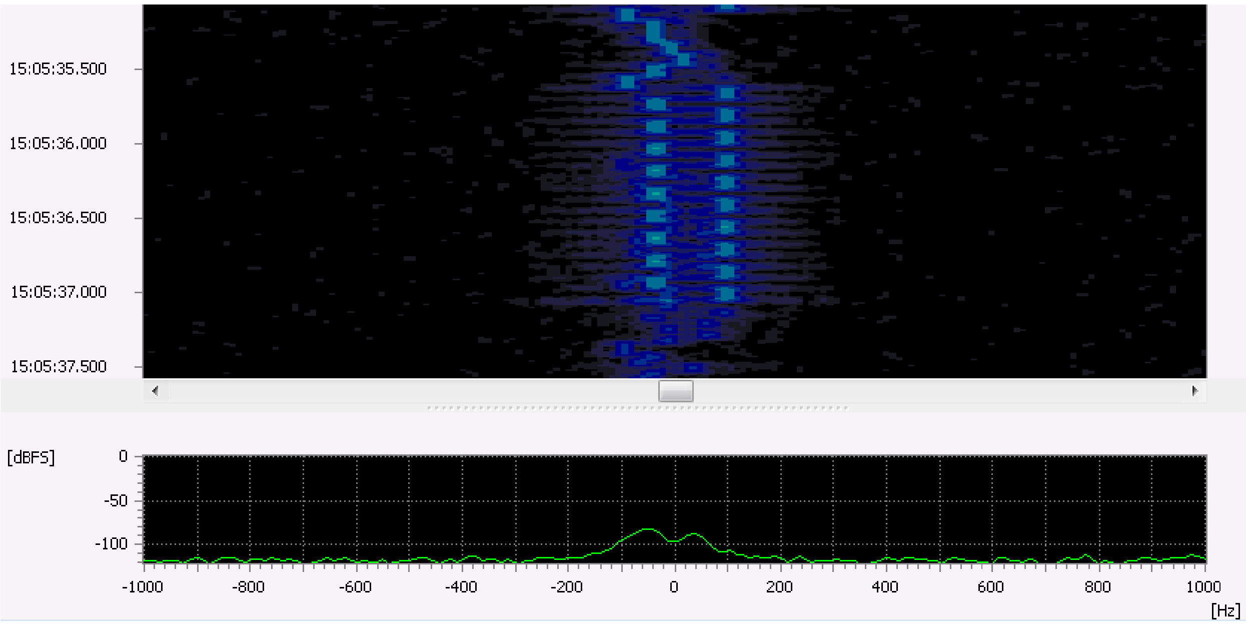


Figure 50: Coquelet-8 Spectrogram

1.49. Coquelet-13

General Information

The Coquelet modes were designed for the communications of French customs and police authorities. They are similar to the British Piccolo modes.

Usage

- Transfer of textual information (mostly encrypted) over HF

Mode Details

	Item	Value
Standard	Modulation	MFSK
	Number of tones	13
	Shift (Hz)	30
	Bandwidth (Hz)	500
	Symbol rate (Baud)	13.3 / 20.0
	Alphabet	ITA-2 / ATU-80
Demodulator Settings	Demodulator	Multitone (MFSK)
	Tone duration (ms)	75
	TD tolerance (ms)	1
	No. of tones	13
	Tone position type	Equidistant frequencies
	Tone distance (Hz)	30
Extras	Offset nominal frq. (Hz)	812
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 50: Coquelet-13

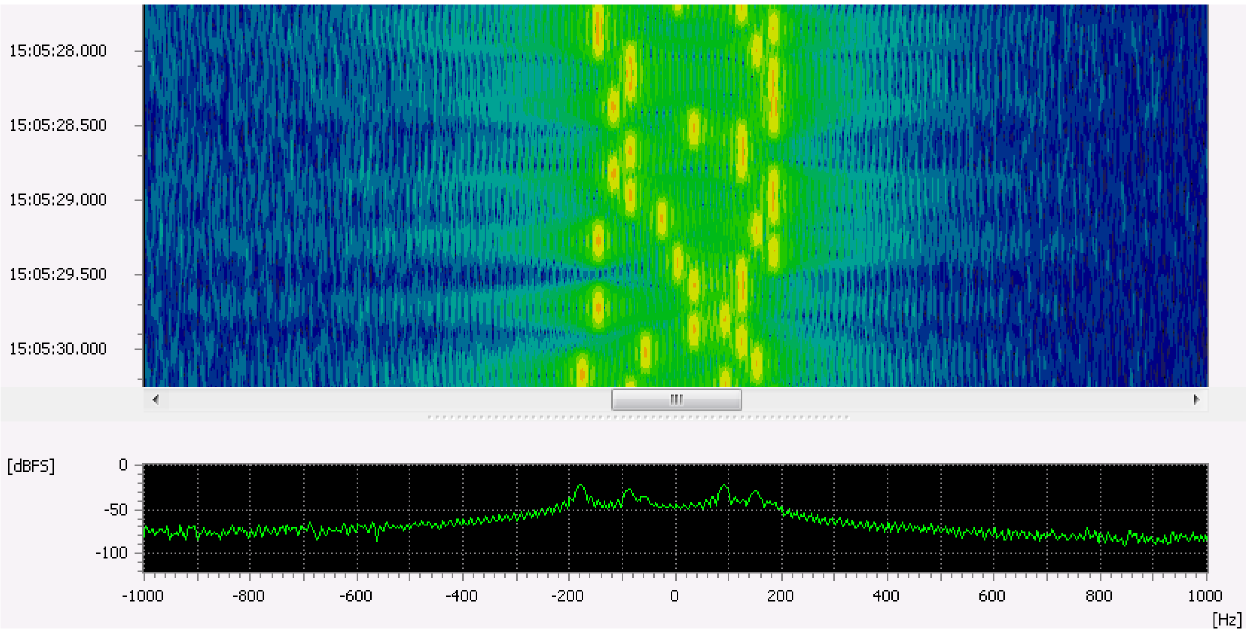


Figure 51: Coquelet-13 Spectrogram

1.50. Coquelet-80

General Information

The Coquelet modes were designed for the communications of French customs and police authorities. They are similar to the British Piccolo modes.
Coquelet-80 is the extension of Coquelet-8 by FEC.

Usage

- Transfer of textual information (mostly encrypted) over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	8
	Shift (Hz)	26.67
	Bandwidth (Hz)	300
	Symbol rate (Baud)	13.3 / 26.7
	Alphabet	ITA-2 / ATU-80
Demodulator Settings	Demodulator	Coquelet
	Tone duration (ms)	37.5
	TD tolerance (ms)	2
	No. of tones	8
	Tone spacing (Hz)	26.67
Extras	Offset nominal frq. (Hz)	773
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 51: Coquelet-80

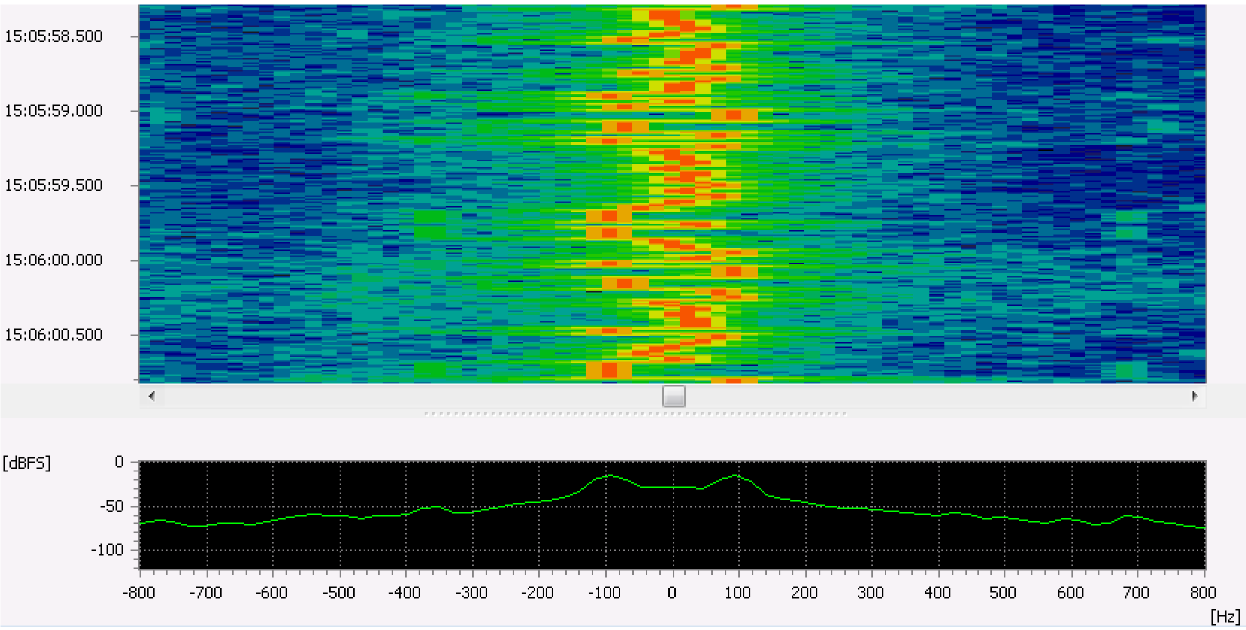


Figure 52: Coquelet-80 Spectrogram

1.51. Datawell Buoy 2FSK HF Link

General Information

HF Links transmitted by Datawell Marine measurement buoys, measuring ocean conditions, temperature, and wave current. The Waverider MkI, MkII, MkIII buoys use the HXV transmission format. Emissions are present in the frequency range of 25 - 36 MHz.

Usage

- GPS for buoy monitoring and tracking through HF link

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	140
	Symbol rate (Bd)	81.9
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	81.90
	SR tolerance (Bd)	1.0
	Shift (Hz)	140
	Shift tolerance (Hz)	40
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes
Tuning	The tuning frequency is the center of the signal	

Table 52: Datawell Buoy 2FSK HF Link

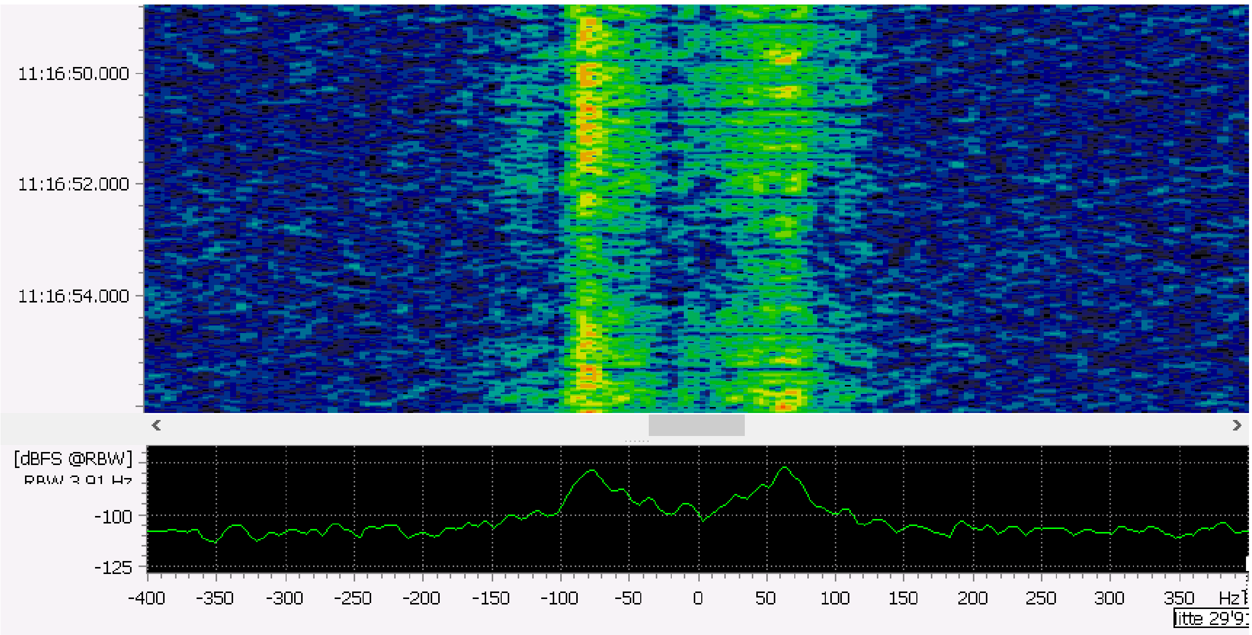


Figure 53: Datawell Buoy 2FSK HF Link Spectrogram

1.52. DGPS

General Information

DGPS is a radio standard for transmission of corrections to the satellite ranging measurements (GPS and GLONASS). This radio standard is based on the recommendations of the RTCM Special Committee 104 (SC-104).

Usage

- Transmission of differential correction signals

Mode Details

	Item	Value
Standard	Modulation	MSK / QPSK
	Symbol rate (Baud)	100 / 300
	Error correction	Parity checksum, CRC
Demodulator Settings	Demodulator	(G)MSK
	Type	MSK
	Symbol rate (Bd)	200
	SR tolerance (Bd)	10
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes
Frequencies	283–315 kHz 435–495 kHz 505–526 kHz 1625–1635 kHz 1800–1810 kHz 1850–2000 kHz 2000–2025 kHz 2160–2170 kHz 2625–2650 kHz 2650–2850 kHz 3155–3200 kHz 3200–3230 kHz 3500–3800 kHz	

Table 53: DGPS

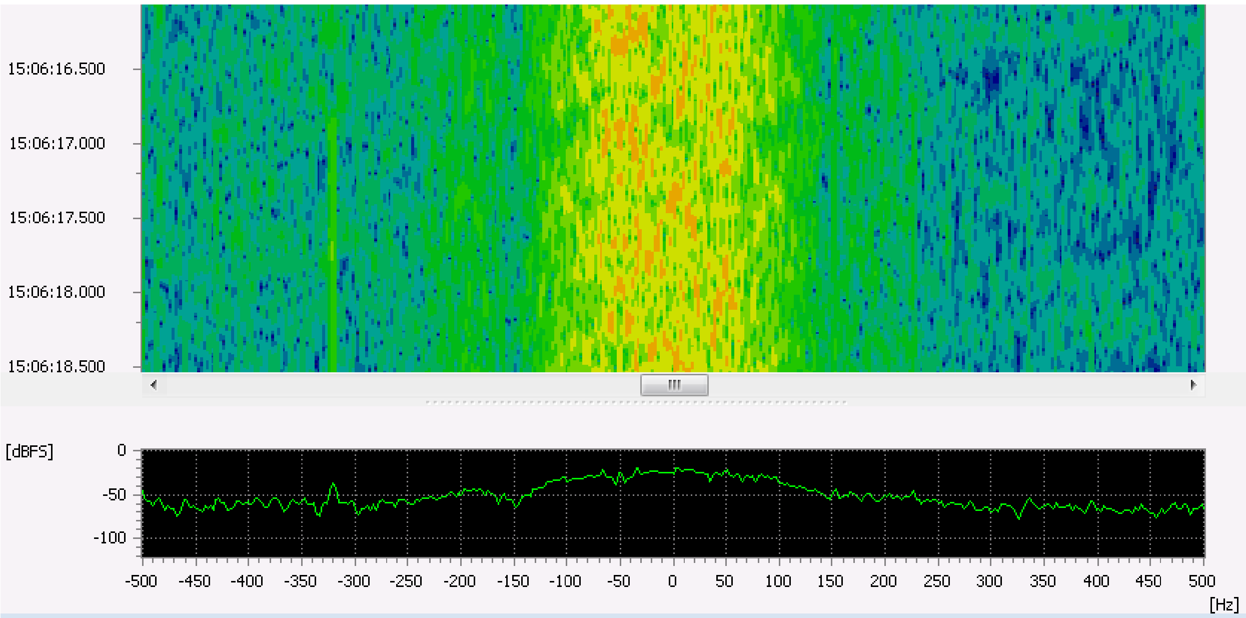


Figure 54: DGPS Spectrogram

1.53. DominoEX

General Information

DominoEX is a robust modem type developed by radio amateurs. It makes use of so called Incremental Frequency Keying (IFK) based on an MFSK 18.

Usage

- Transfer of textual information over HF in two separated channels

Restrictions:

- The modem should not be used for general search

Mode Details

	Item	Value
Standard	Modulation	MFSK18 or more frequencies
	Bandwidth (Hz)	173, 244, 346, 262, 355, 524
	Symbol rate (Bd)	3.906, 5.383, 7.812, 10.766, 15.625, 21.533
	Error correction	None
Demodulator Settings	Demodulator	Multitone(MFSK)
	Tone duration (ms)	256.0, 185.760, 128.0, 93.747, 64.0, 46.440
	Tone duration tolerance (ms)	5, 4, 3, 2, 1, 1
	Total no. of tones	20
	Simultaneous tones	1
Features	Tone position type	Equidistant
	Tone distance (Hz)	7.813, 10.767, 15.625, 10.767, 15.625, 21.533
	Burst mode	off
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	no

Table 54: DominoEx

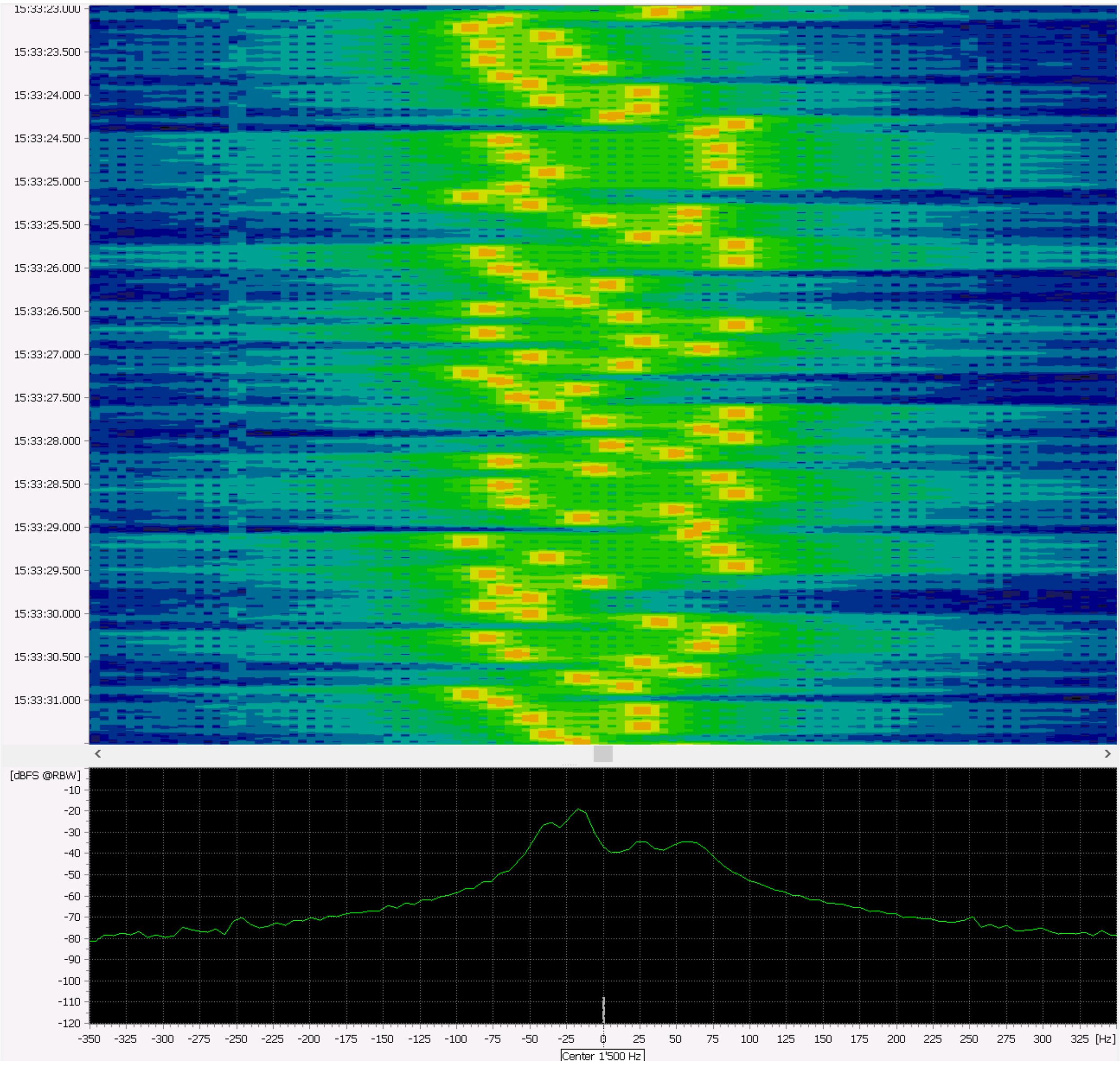


Figure 55: DominoEX Spectrogram

1.54. DPRK PSK 150/300/600/1200

General Information

This group of signals is supposed to be used by the Democratic People Republic of Korea. The signals appear as continuous PSK2 signal with different baud rates and a common characteristic period within the preamble. This preamble can be detected for all modes.

Usage

- Broadcast data communication over HF

Mode Details

	Item	Value
Standard	Modulation	(D)PSK 2
	Symbol rate (Baud)	150/300/600/1200
Demodulator Settings	Demodulator	DPSK 2A
	Symbol rate (Bd)	150/300/600/1200
	SR tolerance (Bd)	5/5/5/10
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 55: DPRK PSK 150 - 1200 Bd

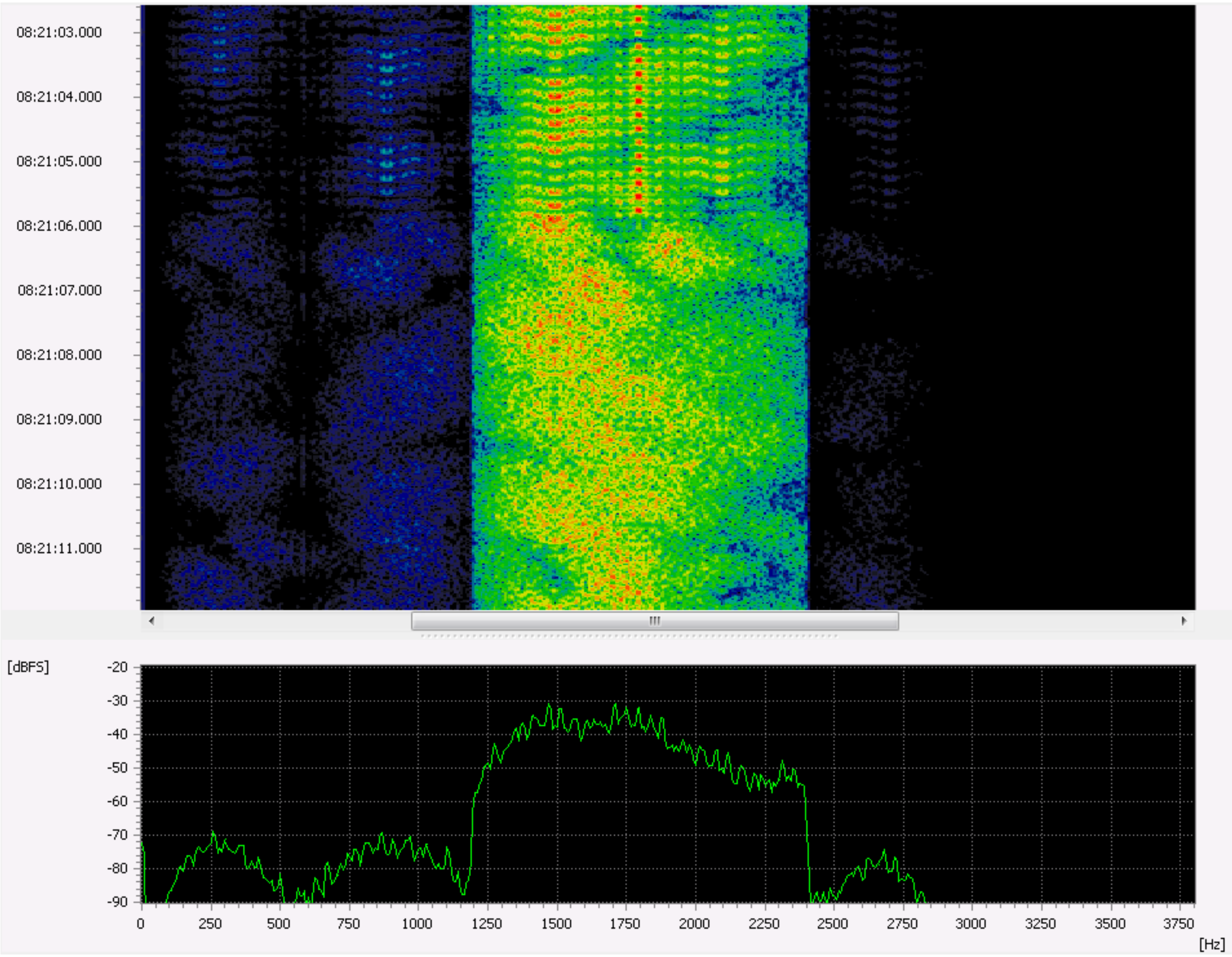


Figure 56: DPRK PSK 600Bd Spectrogram

1.55. DSC-HF

General Information

Digital Selective Calling (DSC) is part of the Global Maritime Distress and Safety System (GMDSS). It provides automatically formatted distress alerts, urgency, safety and routine radio-telephone calls.

Usage

- Data communication over HF
- Initiation of radiotelephone and MF/HF radio telex calls

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'DSC-SELCAL'

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	170, 500
	Bandwidth (Hz)	500
	Symbol rate (Baud)	100
	Error correction	Checksum
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	100
	SR tolerance (Bd)	10
	Shift (Hz)	170, 500
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment HF	no
	Combination with other modems (modem list)	yes
Frequencies	2187.5 kHz 4207.5 kHz 6312.0 kHz 8414.5 kHz 12577.0 kHz 16804.5 kHz	

Table 56: DSC-HF

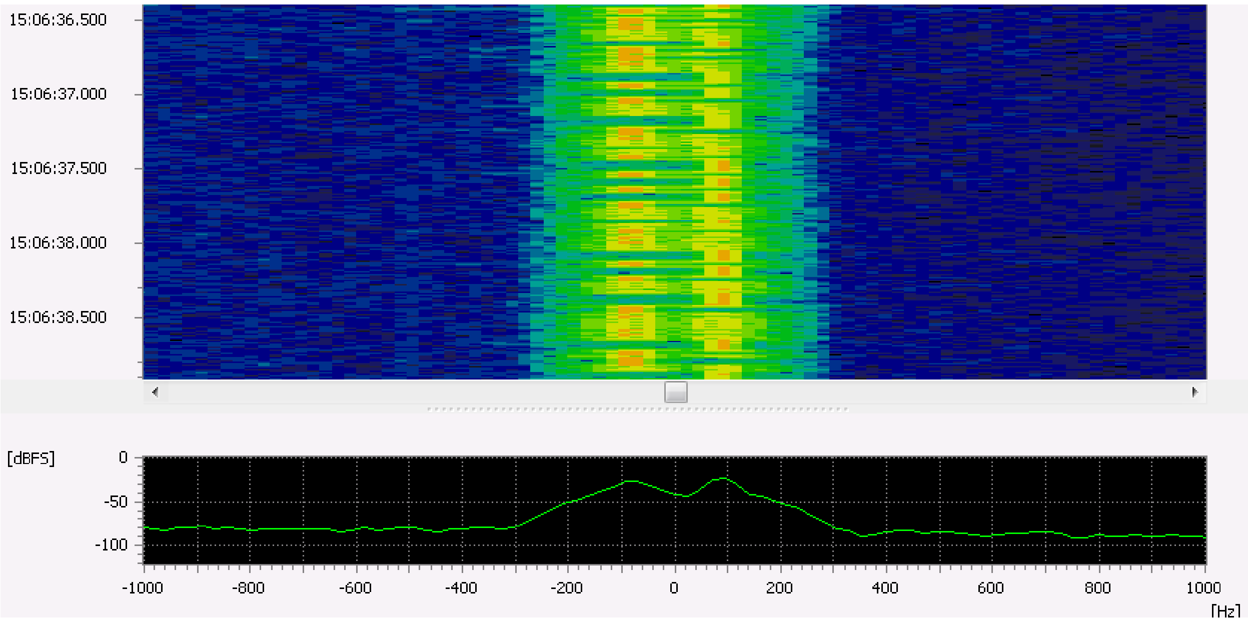


Figure 57: DSC-HF 170 Hz Spectrogram

1.56. DUP-ARQ

General Information

DUP-ARQ is a synchronous duplex teleprinter system with ARQ. This modem was used by the Ministry of Foreign Affairs in Hungary. Two Modes are used with different symbol rates and shifts. The mode with 250 Bd is also called DUP-ARQ-2.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	170 / 850
	Symbol rate (Baud)	125 / 250
	Error correction	Hamming /parity
	Alphabet	ITA-2
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	125 / 250
	SR tolerance (Bd)	0.1 / 1.0
	Shift (Hz)	170 / 850
	Shift tolerance (Hz)	10
	Modem type	Synchronous
	Min. burst length (s)	0.245
	Max. burst length (s)	0.280
	Min. pause length (s)	0.260
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 57: DUP-ARQ

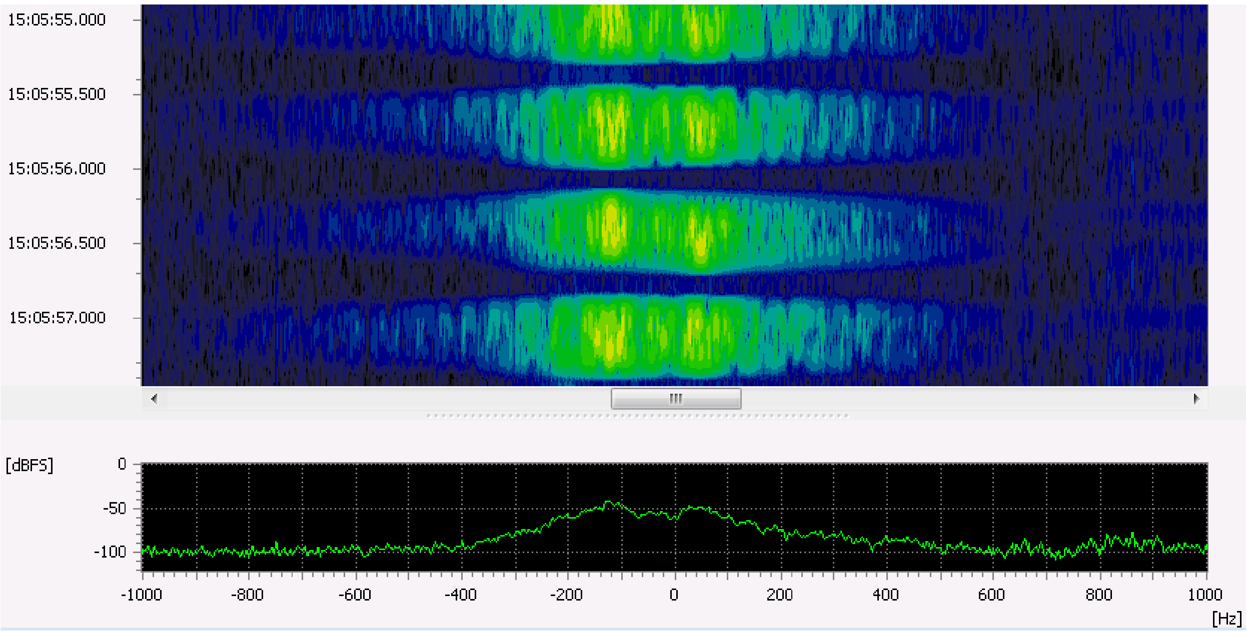


Figure 58: DUP-ARQ Spectrogram

1.57. DUP-FEC-2

General Information

DUP-FEC-2 is a further development based on DUP-ARQ(2) and runs at two different baud rates. It is used as a full duplex system working on different frequencies for each direction. The modem was used e.g. by Norwegian army and embassies.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	850
	Symbol rate (Baud)	125 / 250
	Coding	Hamming + parity
	Alphabet	ASCII
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	125 / 250
	SR tolerance (Bd)	2
	Shift (Hz)	850
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes
Tuning	The tuning frequency is the center of the signal	

Table 58: DUP-FEC-2

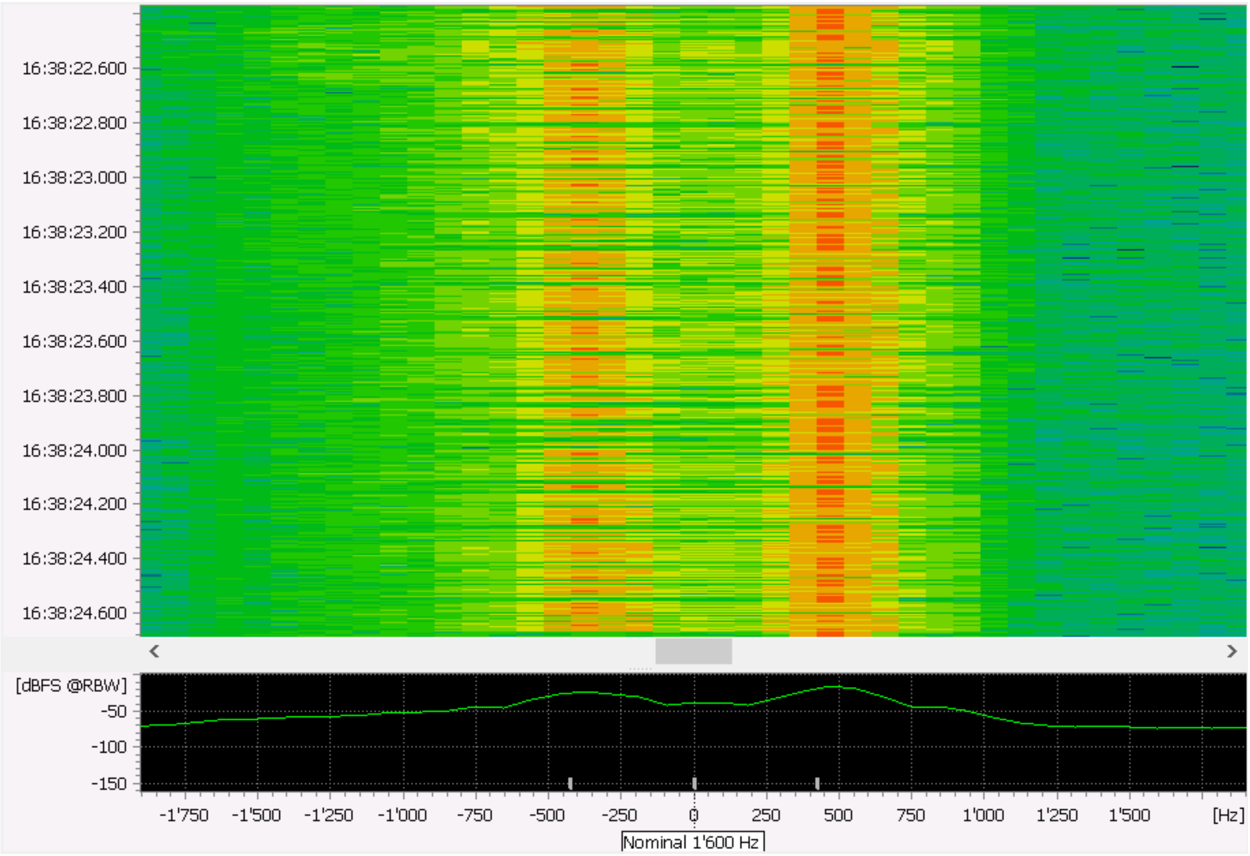


Figure 59: DUP-FEC-2 Spectrogram

1.58. Enagal Buoy HF Link

General Information

HF Links transmitted by ELECTRO NAVAL GALICIA (ENAGAL) longline fishing buoys. Emissions are present in the frequency range of 27 - 29 MHz.

Usage

- GPS for buoy monitoring and tracking through HF link

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	290
	Symbol rate (Bd)	51
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	51.0
	SR tolerance (Bd)	1
	Shift (Hz)	290
	Shift tolerance (Hz)	10
	Modem type	Synchronous
	Min. burst length (ms)	2000
	Max. burst length (ms)	4000
	Min. pause length (ms)	100
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes
Tuning	The tuning frequency is the center of the signal	

Table 59: Enagal Buoy HF Link

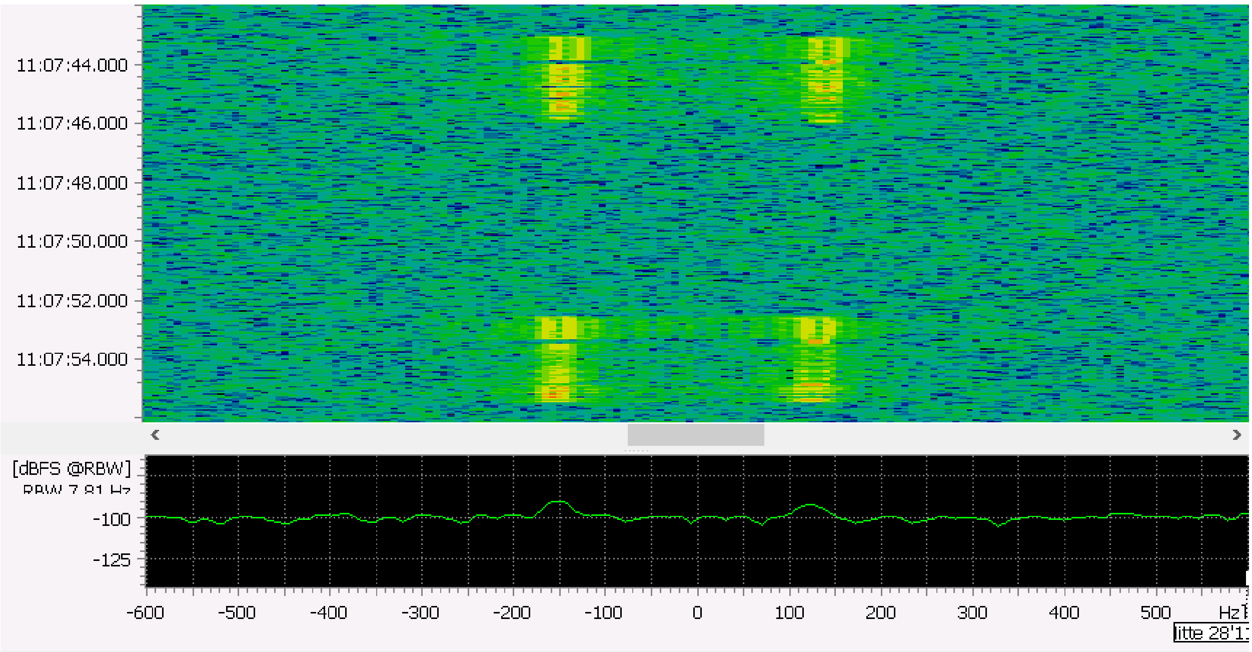


Figure 60: Enagal Buoy HF Link Spectrogram

1.59. F7W Morse / Baudot

General Information

F7W Morse / Baudot is a 2 channel frequency domain multiplex system for data communication. This mode uses two independent asynchronous channels, one for Morse and one for FSK (Baudot coding).

Usage

- transfer of textual information.

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table

- 'Morse'
- 'Baudot'

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	4
	Alphabet	ITA-2
Demodulator Settings	Demodulator	F7B/F7W
	Mode	Morse/Data
	Symbol rate channel A(BpM)	200
	SR tolerance (BpM)	66.7
	Symbol rate (Bd)	100
	SR tolerance (Bd)	5
	Distance F1 <-> F2 (Hz)	1000
	Distance F2 <-> F3 (Hz)	1000
	Distance F3 <-> F4 (Hz	1000
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 60: F7W Morse / Baudot

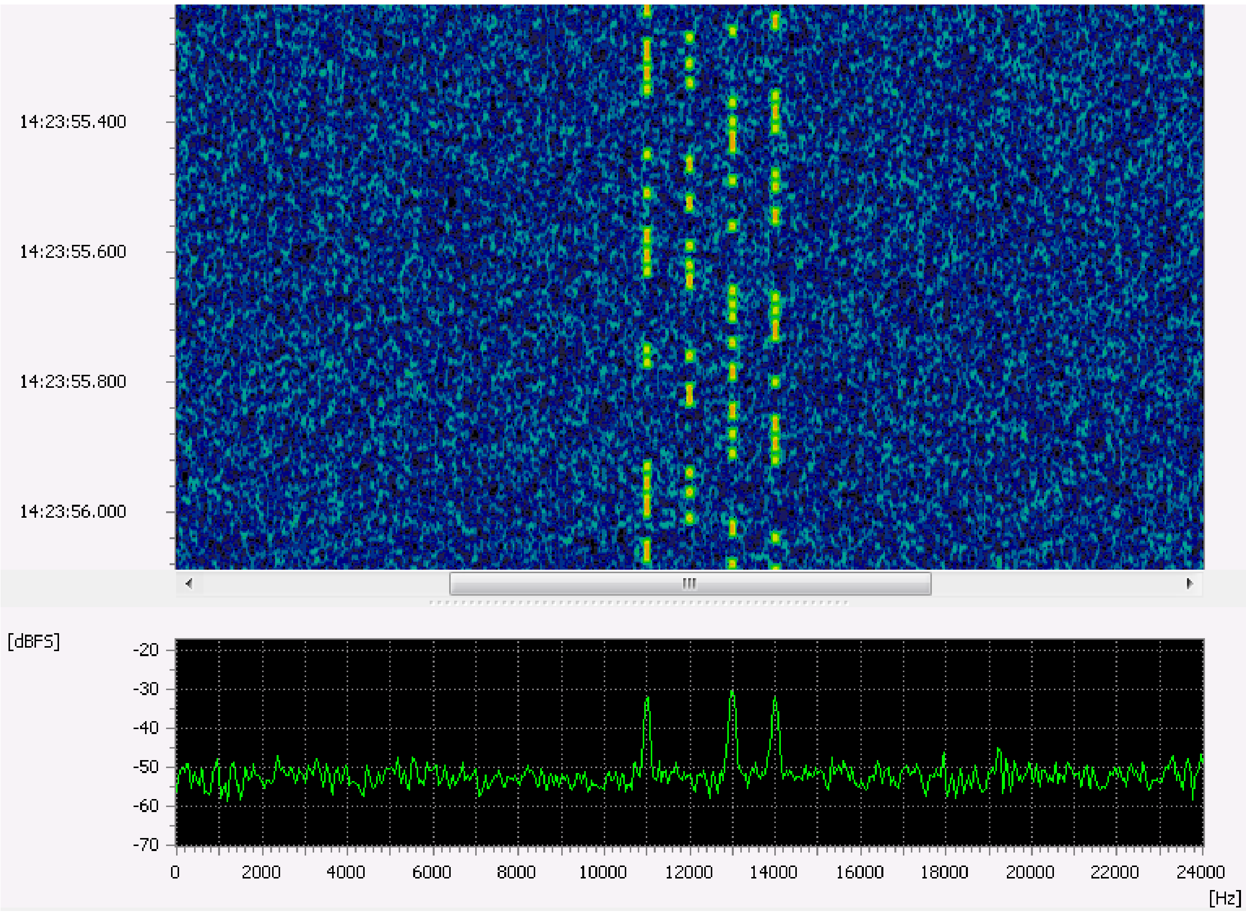


Figure 61: F7W Morse / Baudot Spectrogram

1.60. Fax Group 3

General Information

Fax Group 3 is a digital standard developed for transmitting and receiving faxes over the public switched telephone network (PSTN). It uses a combination of advanced compression techniques and error correction techniques to reduce the size of fax images and improve their transmission reliability. It also includes features such as automatic error correction and page compression. For transmission of meta information the modulation described in ITU-Standard V.21 is used. The actual transmission of the fax images is performed using the modulations from V.27ter (PSK), V.29 (ASK/PSK) and V.17 (QAM).

Usage

- Transfer of fax images information over HF, SAT and standard telephone lines

Mode Details

	Item	V.21	V.17	V.27ter	V.29
Standard	Modulation	FSK	QAM	PSK	ASKPSK
	Number of tones	2	-	-	-
	Shift (Hz)	200	-	-	-
	Symbol rate (Baud)	300	2400	1200 / 1600	2400
	Bandwidth (Hz)	400	3000	1500 / 2000	3000
	Carrier to Center (Hz)	1750	1800	1800	1700
	Error correction	ARQ if ECM is on			
Demodulator Settings	Demodulator	Fax, external Modem 15007			
Features	Demodulation	yes			
	Recognition	yes			
	Decoding	yes, black and white coding only			
	Automatic Polarity Adjustment	no			
	Combination with other modems (modem list)	yes			

Table 61: Fax Group 3

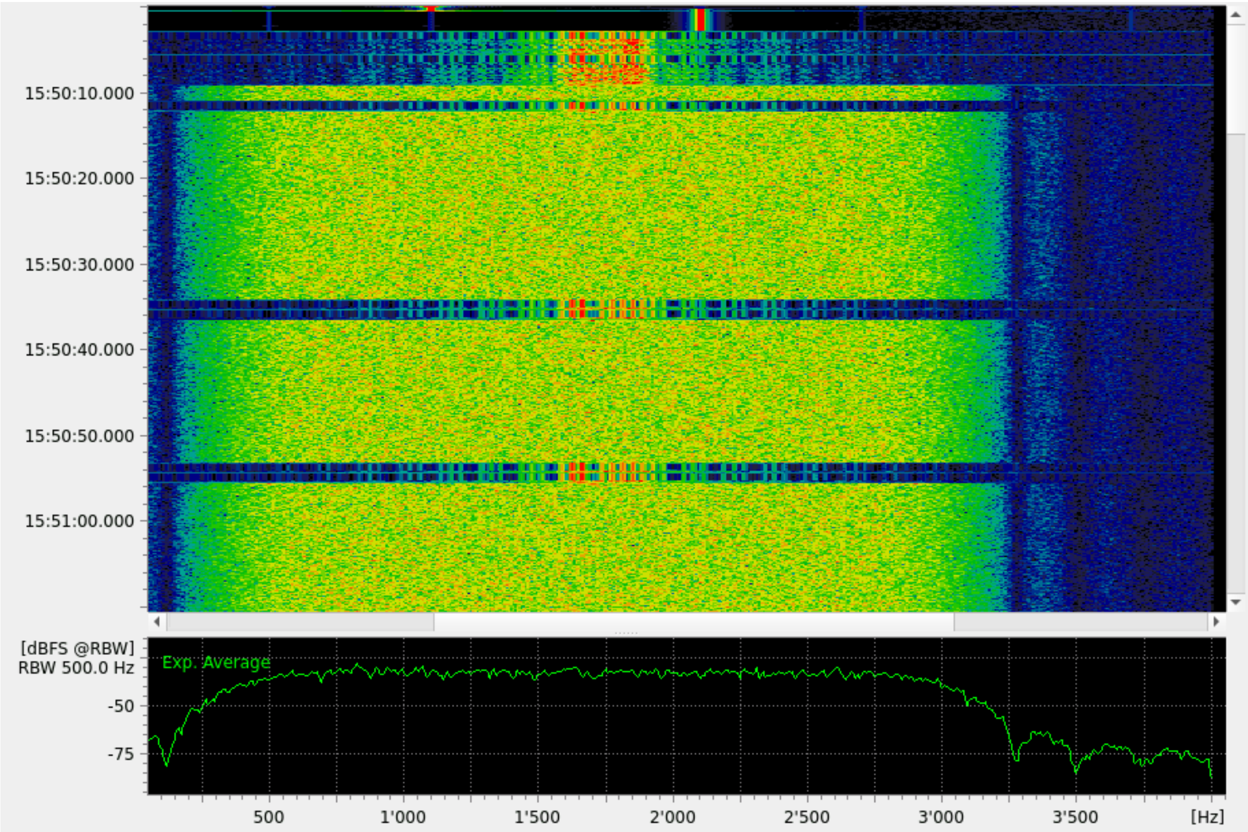


Figure 62: Fax Group 3 Spectrogram

1.61. FEC-A

General Information

FEC-A is a synchronous FEC system. This system was mainly used for military and diplomatic services as well as for news agencies. This modem system is also known as FEC-100(A).

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	850
	Bandwidth (Hz)	1200
	Symbol rate (Baud)	144
	Error correction	Convolutional coding
	Alphabet	ITA-2
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	145
	SR tolerance (Bd)	5
	Shift (Hz)	850
	Shift tolerance (Hz)	50
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 62: FEC-A

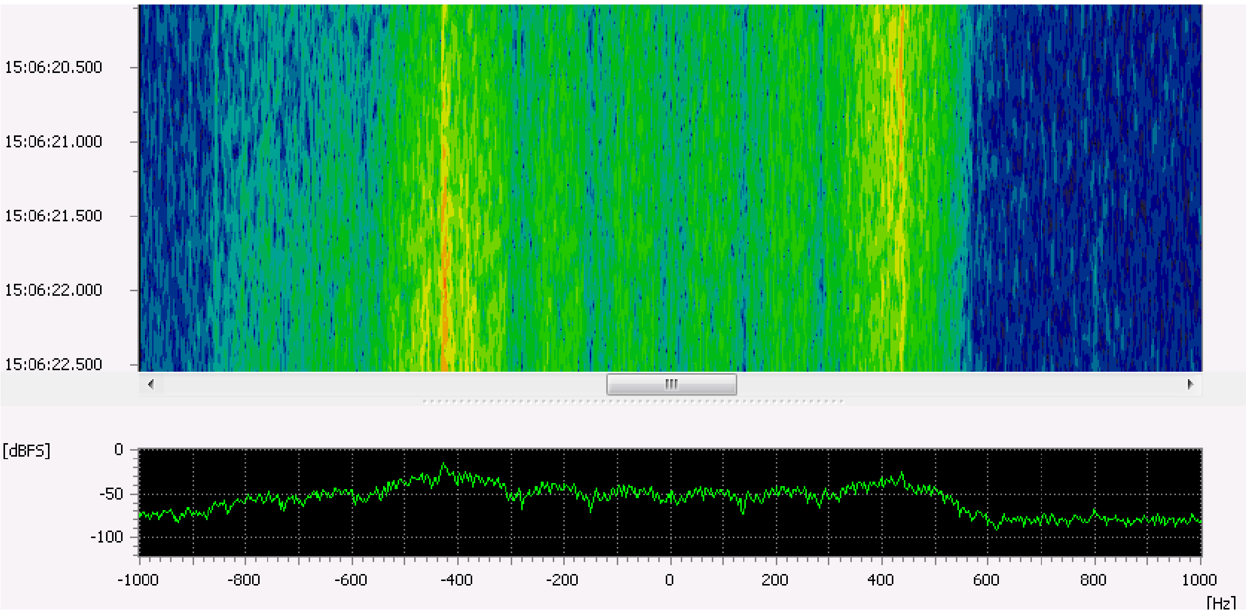


Figure 63: FEC-A Spectrogram

1.62. FreeDV

General Information

FreeDV is an open source software defined radio. It is used by amateur radio operators to transmit voice. The voice codecs used are codec2 and LPCNet. Several transmission modes are defined.

One of the modes (800XA) is designed to be used in VHF range.

Usage

- Transmission of digital voice
- Transfer of textual information

Supported modes

- 1600 (HF)
- 700C (HF)
- 700D (HF)
- 700E (HF)
- 2020 (HF)
- 2020B (HF)
- 800XA (VHF)

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'FreeDV'

Mode Details

	Item	Value
Standard	Modulation	MCPSK / OFDM / 4FSK
Demodulator Settings	Demodulator	FreeDV external Modem 15008 / FSK discr.
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes (including voice)
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 63: FreeDV

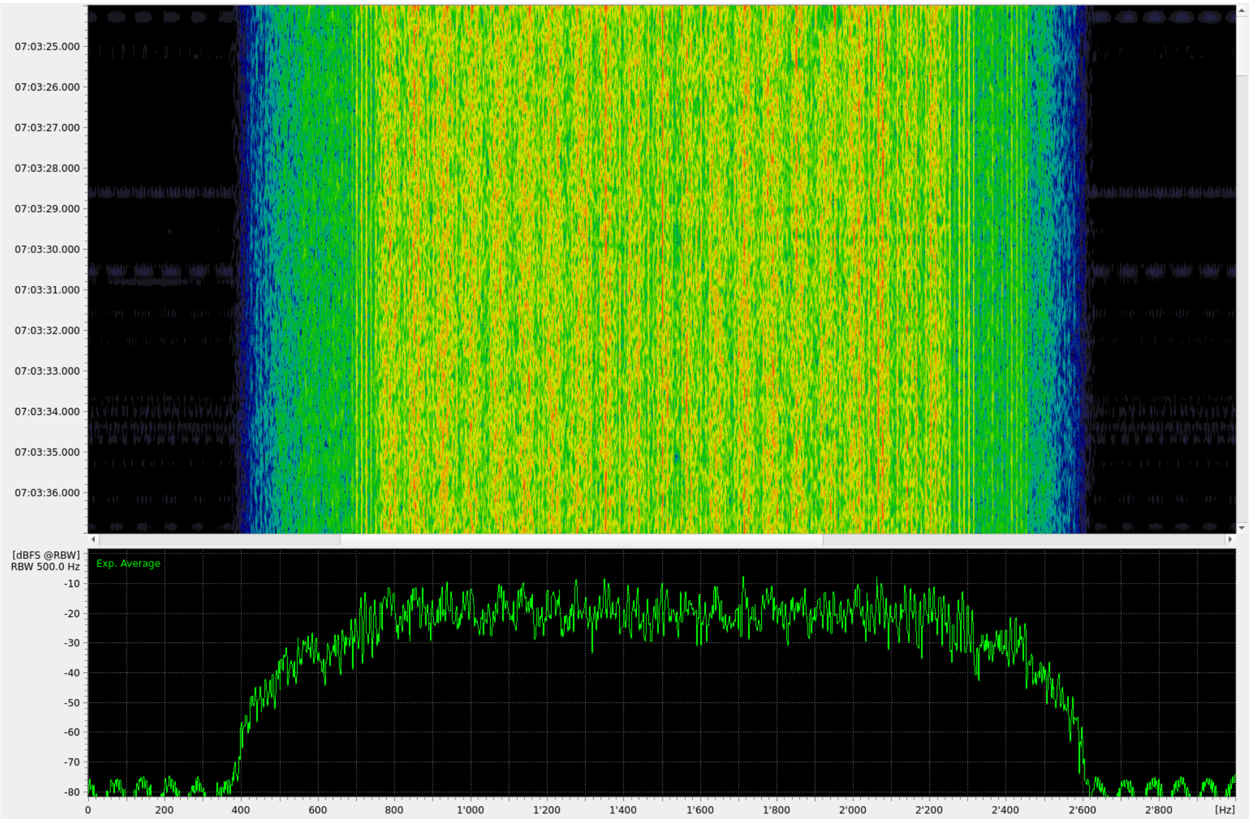


Figure 64: FreeDV Mode 700E Spectrogram

1.63. FT-8 / FT-4

General Information

FT-8 and FT-4 are digital modes used in amateur radio for wireless communication. It is used by radio amateurs especially on short waves. Data is processed within a time frame of 15 seconds for FT-8 and 7.5 seconds for FT-4 with a low required SNR.

Usage

- Transfer of textual information over HF

Restrictions

- These modems are not suitable for frequency range search and have to be used with a fixed nominal frequency

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'FT-X'

Mode Details

	Item	FT-8	FT-4
Standard	Modulation	MFSK	MFSK
	Number of tones	8	4
	Tone distance (Hz)	6.25	20.833
	Symbol rate (Baud)	6.25	20.833
	Error correction	LDPC (174,87)	LDPC (174,87)
Demodulator Settings	Demodulator	Multitone	Multitone
	Tone duration (s)	0.16	0.048
	Tone duration tolerance (s)	0	0
	No. of tones	8	4
	Simultaneous tones	1	1
	Tone distance (Hz)	6.25	20.833
	Burst Mode	Off	Off
Features	Demodulation	yes	yes
	Recognition	yes	yes
	Decoding	yes	yes
	Automatic Polarity Adjustment	no	no
	Combination with other modems (modem list)	yes	yes

Table 64: FT-8 / FT-4

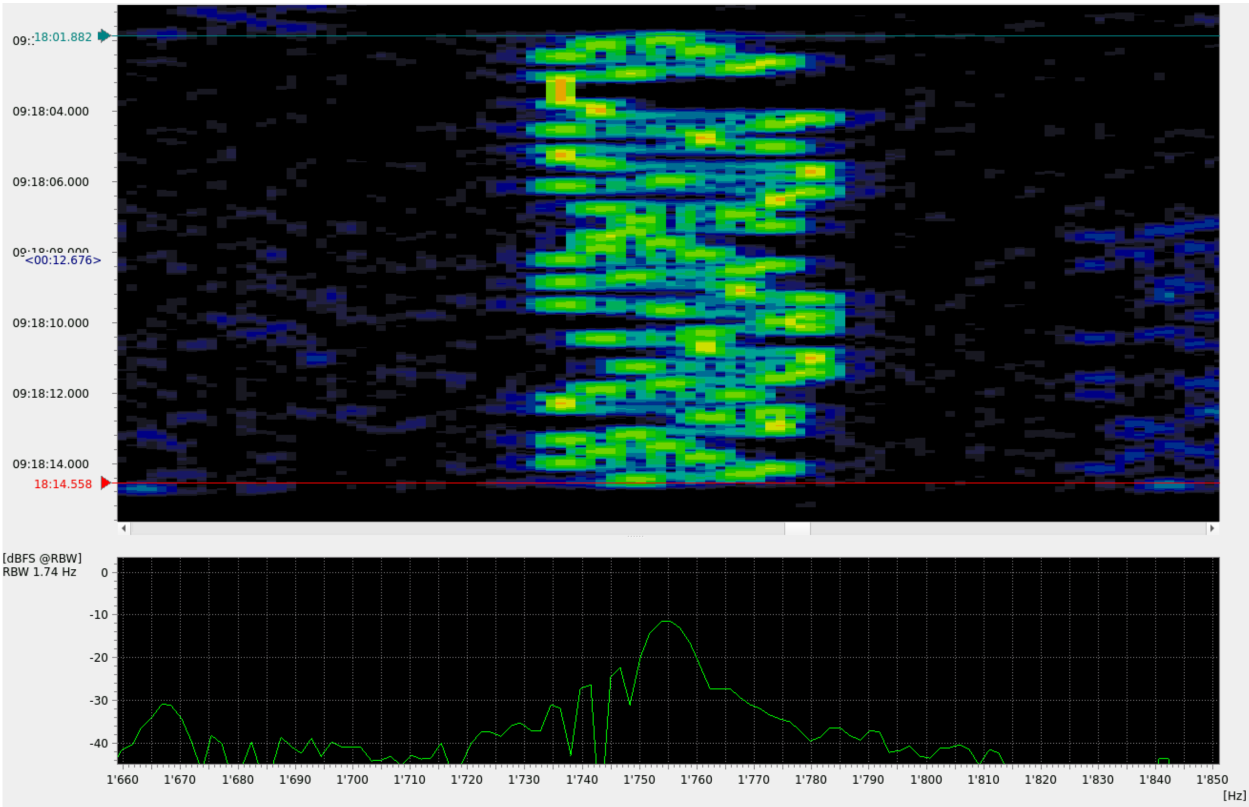


Figure 65: FT-8 Spectrogram

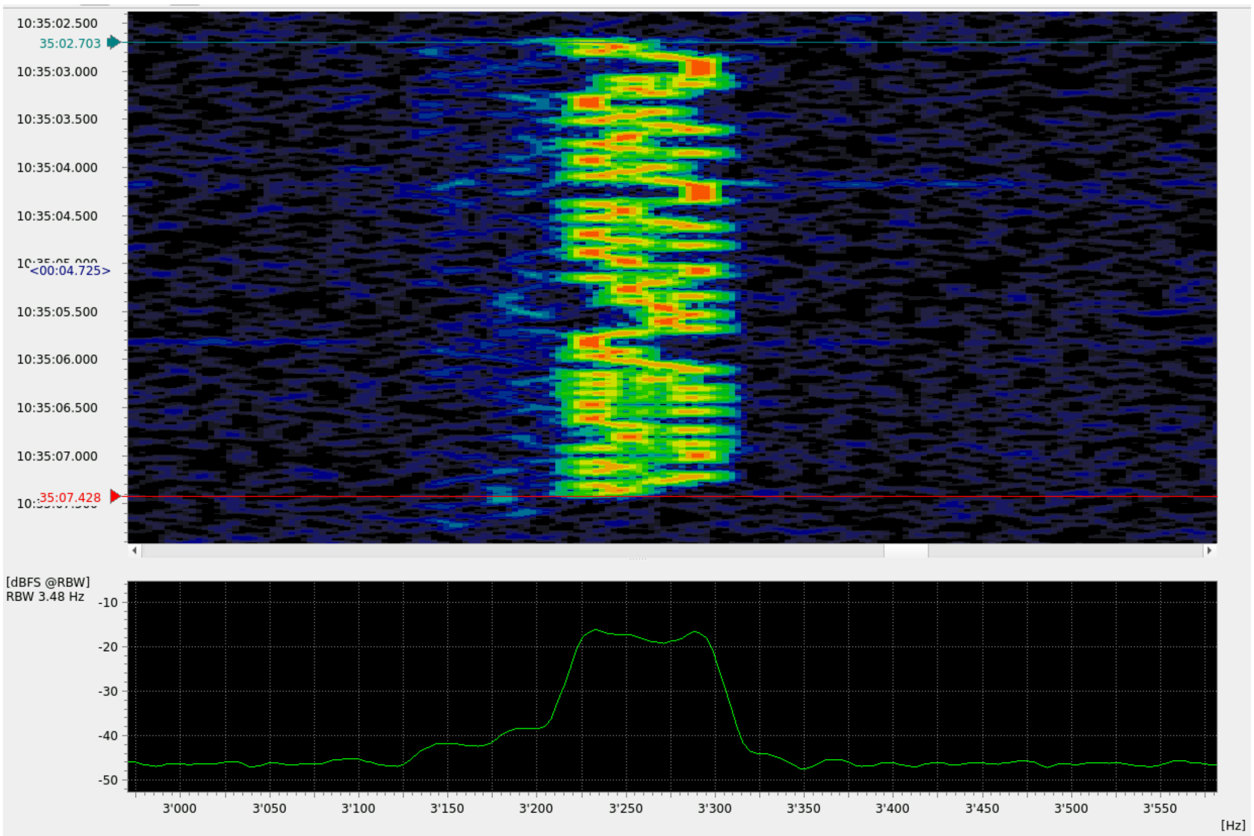


Figure 66: FT-4 Spectrogram

1.64. Globe Wireless FSK

General Information

Globe Wireless FSK is one of several radio modems used by the Globe Wireless Company in the HF- frequency band.

Usage

- Transfer of SelCal and status messages over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	200
	Bandwidth (Hz)	300
	Symbol rate (Bd)	100
	Error correction	Parity checksum
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	100
	SR tolerance (Bd)	10
	Shift (Hz)	200
	Shift tolerance (Hz)	10
	Modem type	Synchronous
	Min. burst length (s)	0.700
	Max. burst length (s)	1.700
	Min. pause length (s)	0.120
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 65: Globe Wireless FSK

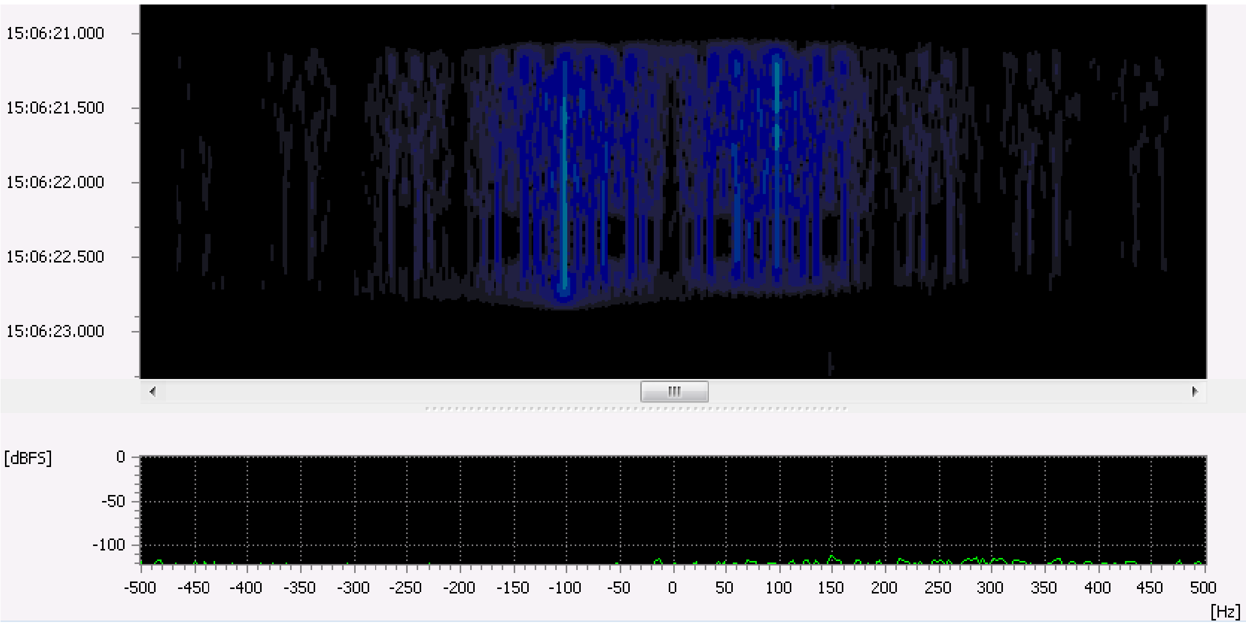


Figure 67: Globe Wireless FSK Spectrogram

1.65. Globe Wireless PSK

General Information

Globe Wireless PSK is one of several radio modems used by the Globe Wireless Company in the HF-frequency band.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	DQPSK
	Bandwidth (Hz)	400
	Symbol rate (Bd)	200
Demodulator Settings	Demodulator	DPSK 2,4,8,16 A/B
	Symbol rate (Bd)	200
	SR tolerance (Bd)	5
	Modulation order	4
	Version	A
	Min. burst length (s)	0.400
	Max. burst length (s)	1.000
	Min. pause length (s)	0.100
	Min. burst SNR (dB)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 66: Globe Wireless PSK

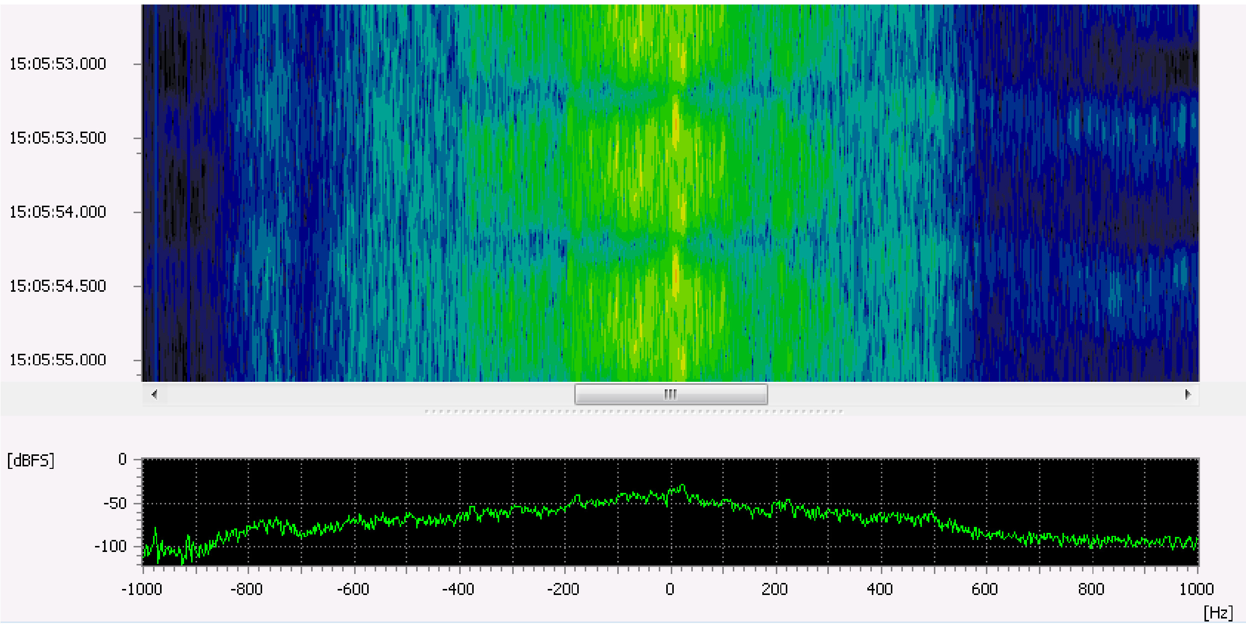


Figure 68: Globe Wireless PSK Spectrogram

1.66. Globe Wireless OFDM

General Information

Globe Wireless OFDM is one of several radio modems used by the Globe Wireless Company in the HF-frequency band. It is no longer active. We only provide a detector.

1.67. G-TOR

General Information

G-TOR mode is a proprietary standard developed by Kantronics Inc. and is used by radio amateurs, military (Irish Air Corps/Navy, Mexican army) and governmental agencies (ICRC).

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	170
	Symbol rate (Bd)	100 / 200 / 300
	Error correction	Golay code, Interleaving, CRC
	Alphabet	ITA-5
Demodulator Settings	Demodulator	FSK discr.
	Symbol rate (Bd)	300
	SR tolerance (Bd)	5
	Modulation order	2
	Shift (Hz)	180
	Shift tolerance (Hz)	20
	Modem type	Synchronous
	Min. burst length (s)	0.080
	Max. burst length (s)	2.000
	Min. pause length (s)	0.080
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 67: G-TOR

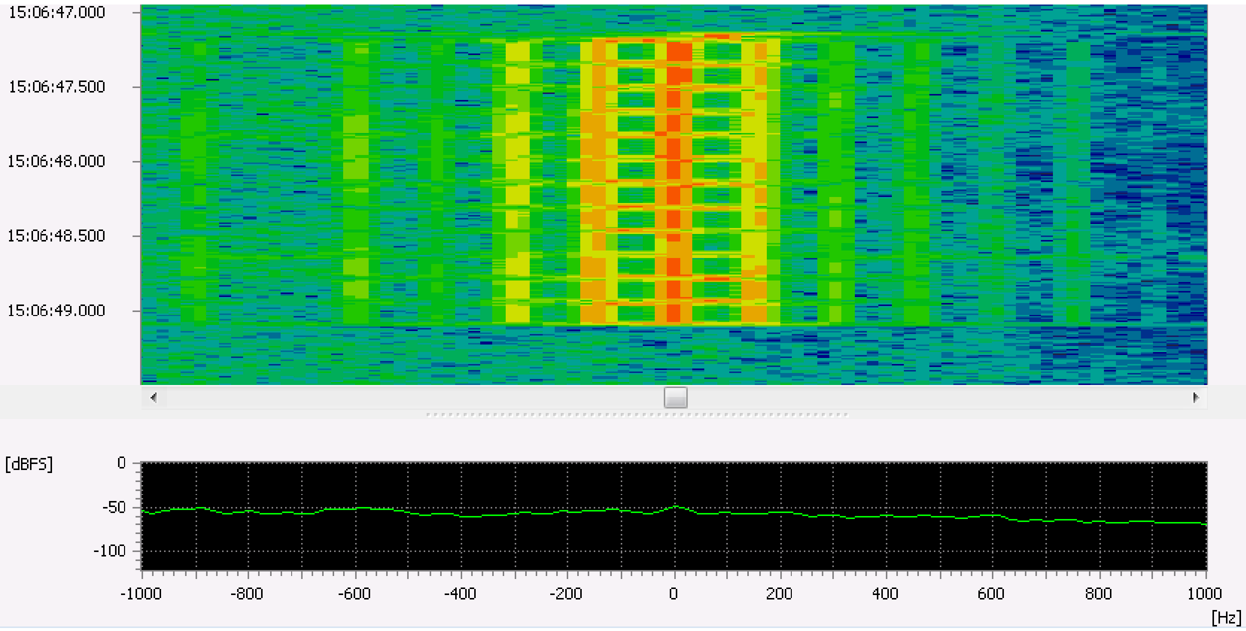


Figure 69: G-TOR Spectrogram

1.68. HF-FAX

General Information

HF-FAX is mainly used to transfer weather charts over HF.

Usage

- Transfer of weather charts over HF

Restrictions

- This modem is not suitable for frequency range search and has to be used with a fixed nominal frequency
- Basic parameters such as lines per minute (LPM) and index of cooperation (IOC) must be known in advance.

Mode Details

	Item	Value
Standard	Modulation	FM analog
	Shift (Hz)	800
Demodulator Settings	Demodulator	FSK 2,3,4 discr.
	Symbol rate (Bd)	4000
	SR tolerance (Bd)	0
	Modulation order	2
	Shift (Hz)	1000
	Shift tolerance (Hz)	0
	Modem type	Analog
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
Tuning	The tuning frequency is the center of the signal.	
	Right peak in spectrum should be around 420 Hz	

Table 68: HF-FAX

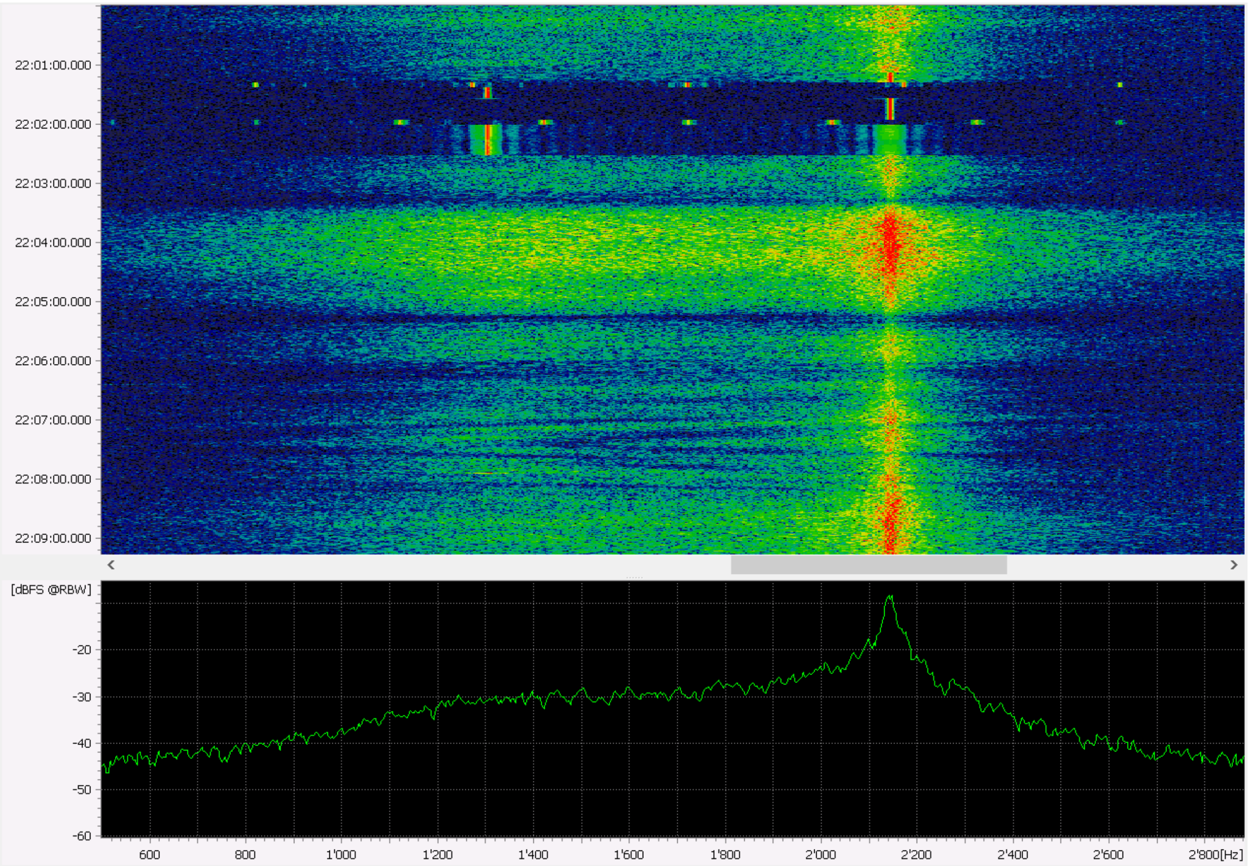


Figure 70: HF-FAX Spectrogram

1.69. HFDL

General Information

The **H**igh **F**requency **D**ata **L**ink (HFDL) (ARINC Report 635-3) is used in civil long distance aircraft communications between aircrafts and a cluster of ground stations.

Usage

- Aeronautical information exchange over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'HFDL'

Mode Details

	Item	Value
Standard	Modulation	PSK2/PSK4
	Bandwidth (Hz)	1800
	Symbol rate (Bd)	1800
	Error correction	ARQ
	Data rate (bps)	300 / 600 / 1200 /1800
Demodulator Settings	Demodulator	PSK data aided
	Symbol rate (Bd)	1800
	SR tolerance (Bd)	9
	Modulation order	2
	Shift (Hz)	170
	Min. burst length (s)	2.100
	Max. burst length (s)	5.000
	Min. pause length (s)	0.010
Extras	Offset nominal frq. (Hz)	1440
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes
Protocols	CPDLC, ADS-C, Media Advisory, MIAM	

Table 69: HFDL

	Item
Frequencies (kHz)	HFDL System Table Version 51
	SAN FRANCISCO - CALIFORNIA 21934 17919 13276 11327 10081 8927 6559 5508
	MOLOKAI - HAWAII 21937 17919 13324 13312 13276 11348 11312 10027 8936 8912 6565 5514
	REYKJAVIK - ICELAND 17985 15025 11184 8977 6712 5720 3900
	RIVERHEAD - NEW YORK 21931 17919 13276 11387 8912 6661 5652
	AUCKLAND - NZ 17916 13351 10084 8921 6535 5583
	HAT YAI - THAILAND 21949 17928 13270 10066 8825 6535 5655
	SHANNON - IRELAND 11384 10081 8942 8843 6532 5547 3455 2998
	JOHANNESBURG - SOUTH AFRICA 21949 17922 13321 11321 8834 5529 4681 3016
	BARROW - ALASKA 21937 21928 17934 17919 11354 10093 10027 8936 8927 6646 5544 5538 5529 4687 4654 3497 3007 2992 2944
	MUAN - SOUTH KOREA 21931 17958 13342 10060 8939 6619 5502 2941
	ALBROOK - PANAMA 17901 13264 10063 8894 6589 5589
	SANTA CRUZ - BOLIVIA 21997 17916 13315 11318 8957 6628 4660
	KRASNOYARSK - RUSSIA 21990 17912 13321 10087 8886 6596 5622
	AL MUHARRAQ - BAHRAIN 21982 17967 13354 10075 8885 5544
	AGANA - GUAM 21928 17919 13312 11306 8927 6652 5451
	CANARIAS - SPAIN 21955 17928 13303 11348 8948 6529

Table 70: HFDL Frequencies

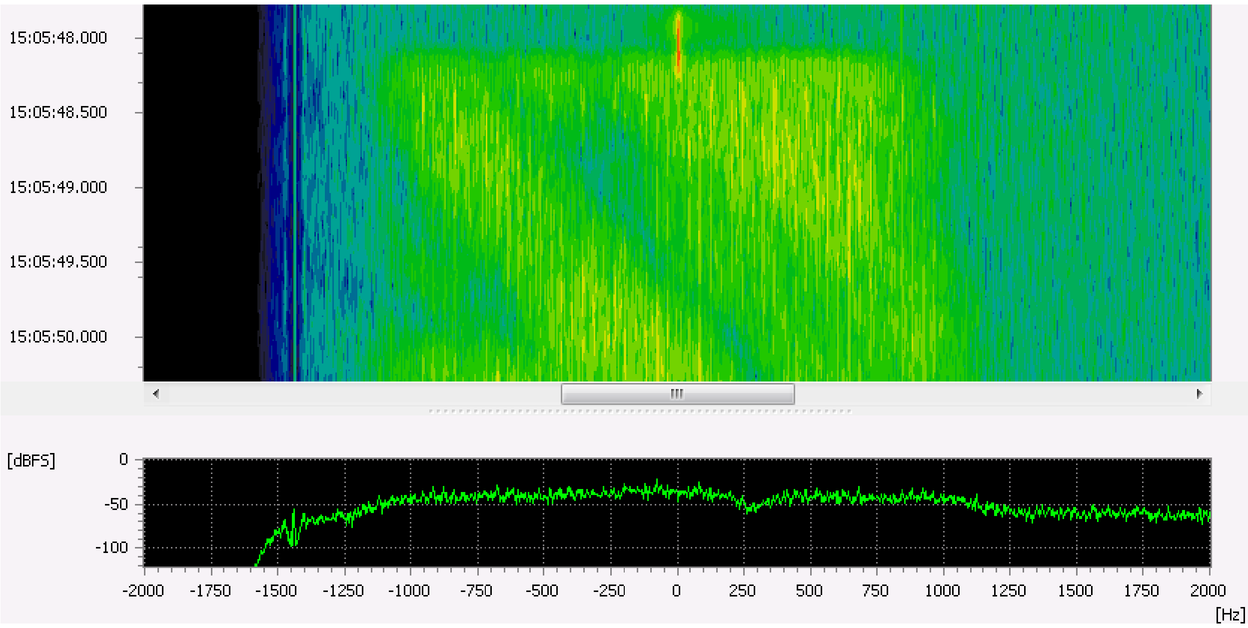


Figure 71: HFDL Spectrogram

1.70. HNG-FEC

General Information

HNG-FEC is a full duplex system used by the Ministry of Foreign Affairs in Hungary.
This modem is not used any more.

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	500
	Symbol rate (Bd)	100.5
	Error correction	Interleaving, Parity bits
	Alphabet	ITA-2
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	100
	SR tolerance (Bd)	5
	Shift (Hz)	420
	Shift tolerance (Hz)	20
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 71: HNG-FEC

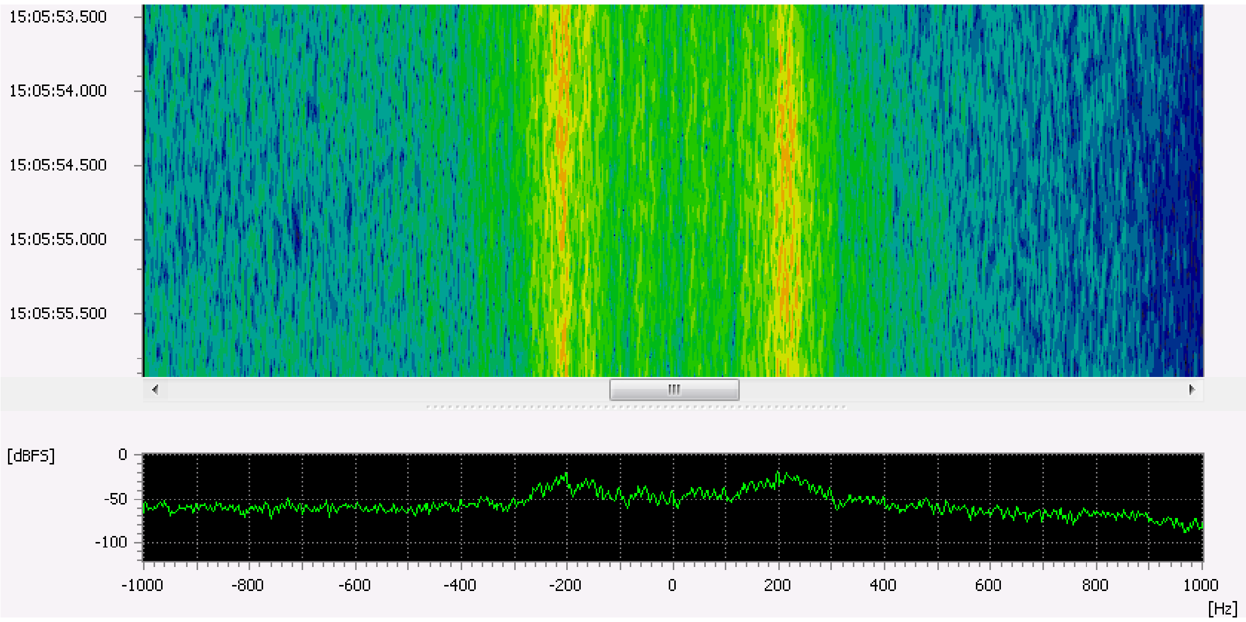


Figure 72: HNG-FEC Spectrogram

1.71. Japanese Slot Machine

General Information

Japanese Slot Machine is a modem used by the Japanese navy. The idle sequence, transmitted most of time, sounds like a slot machine, therefore the name.

Idle and traffic mode will be detected.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	QPSK
	Bandwidth (Hz)	2000
	Symbol rate (Bd)	1500
Demodulator Settings	Demodulator	DPSK 2,4,8,16 A/B
	Symbol rate (Bd)	1500
	SR tolerance (Bd)	1.0
	Modulation order	4
	Version	A
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 72: Japanese Slot Machine

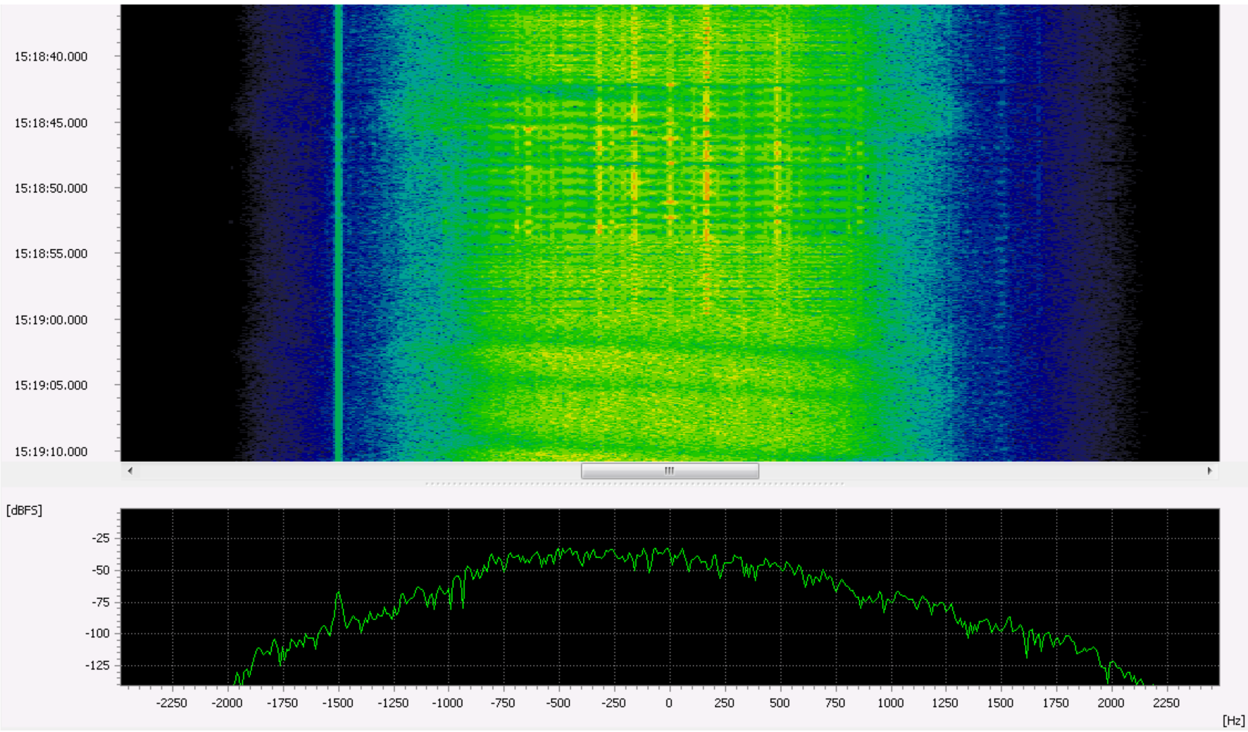


Figure 73: Japanese Slot Machine Spectrogram

1.72. KG-STV

General Information

KG-STV is an amateur mode for transmitting compressed images or text.

Usage

- Image and text transmission over HF and SAT

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'KG-STV'

Mode Details

	Item	Value
Standard	Modulation	MSK/4-FSK
	Bandwidth (Hz)	1800
	Symbol rate (Bd)	1200
Demodulator Settings	Demodulator	FSK 2, 3, 4 discr.
	Symbol rate (Bd)	1200
	SR tolerance (Bd)	1
	Modulation order	4
	Shift (Hz)	200
	Shift tolerance (Hz)	1
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 73: KG-STV

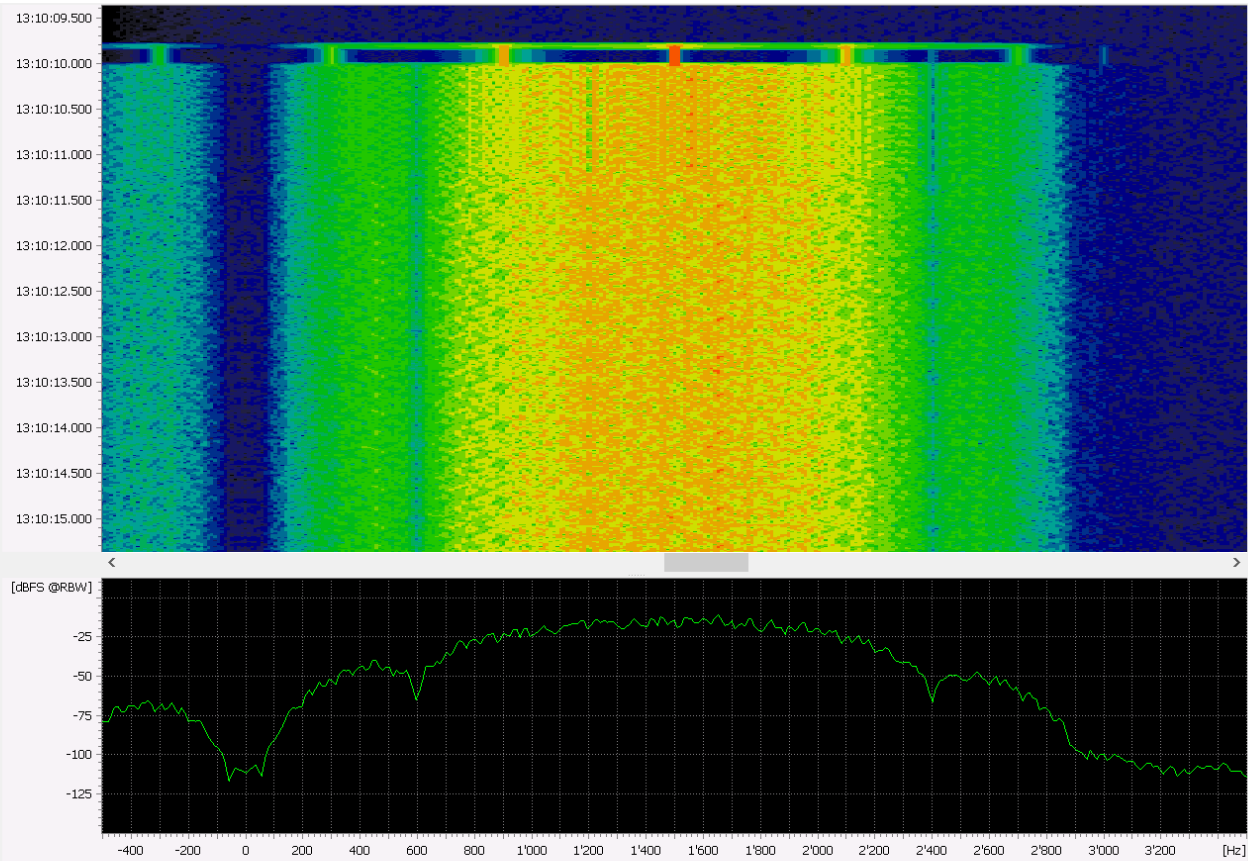


Figure 74: KG-STV Spectrogram

1.73. Maritime Mesh Network Traffic Management

General Information

Maritime Mesh Network is a surface technology which uses a Cognitive Networked High Frequency (CNHF) radio system to create a complete infrastructure independent network.

The original developer of the Maritime Mesh Network is KNL Networks company located in Finland, who were recently acquired by Telenor Maritime.

The system works adaptive to the amount of data which shall be transferred. The traffic management bursts – which are recognized here - are sent on a frequency 3 kHz below the actual data bursts.

Usage

- Maritime-Military-grade communications and Data Security

Mode Details

	Item	Value
Standard	Modulation	DQPSK
	Bandwidth (Hz)	2000
	Symbol rate (Bd)	1500
	Error correction	FEC
Demodulator Settings	Demodulator	DPSK
	Symbol rate (Bd)	1500
	Constellation	PSK 4A
	Min. burst length (s)	0.100
	Max. burst length (s)	0.320
	Min. pause length (s)	0.100
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 74: Maritime Mesh Network Traffic Management

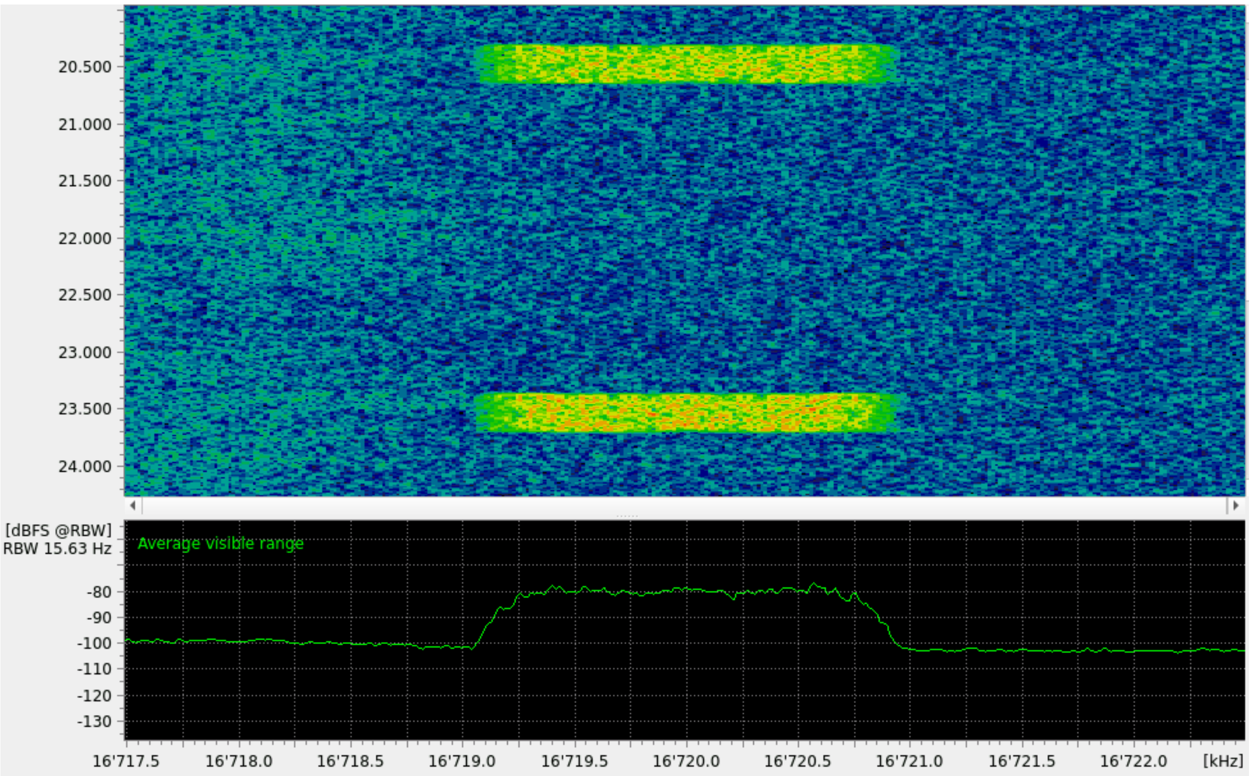


Figure 75: Maritime Mesh Network Traffic Management Spectrogram

1.74. MEROD

General Information

MEROD is a **M**essage **E**ntry and **R**ead-**O**ut **D**evice for exchange of encrypted tactical messages over a radio channel in burst mode.

Usage

- Exchange of tactical information over HF with emissions of minimum length

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	800
	Bandwidth (Hz)	950 / 1100
	Symbol rate (Bd)	150 / 267
	Error correction	BCH(127,78)
	Alphabet	MEROD specific 6 bit
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	150
	SR tolerance (Bd)	5
	Shift (Hz)	800
	Shift tolerance (Hz)	20
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 75: MEROD

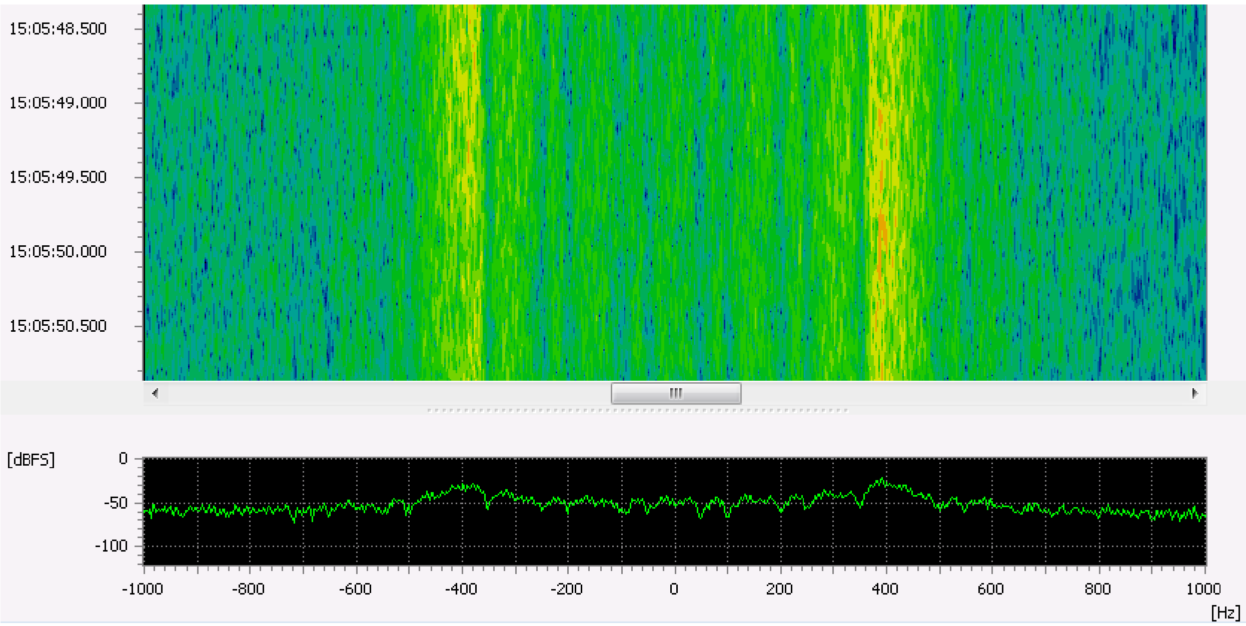


Figure 76: MEROD Spectrogram

1.75. MFSK-8/16/32

General Information

MFSK8/16/32 are modes for digital data communication in the amateur radio domain.

Usage

- Transfer of textual information by radio amateurs over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	32 / 16 / 16
	Tone spacing (Hz)	7.8125 / 15.625 / 31.25
	Bandwidth (Hz)	330 / 330 / 580
	Symbol rate (Bd)	7.8125 / 15.625 / 31.25
	Error correction	FEC
Demodulator Settings	Demodulator	Multitone (MFSK)
	Tone duration (ms)	128 / 64 / 32
	TD tolerance (ms)	0 / 0.3 / 1.375
	No. of tones	32 / 16 / 16
	Tone position type	Equidistant frequencies
	Tone distance (Hz)	7.813 / 15.625 / 31.25
Extras	Offset nominal frq. (Hz)	500
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 76: MFSK-8/16/32

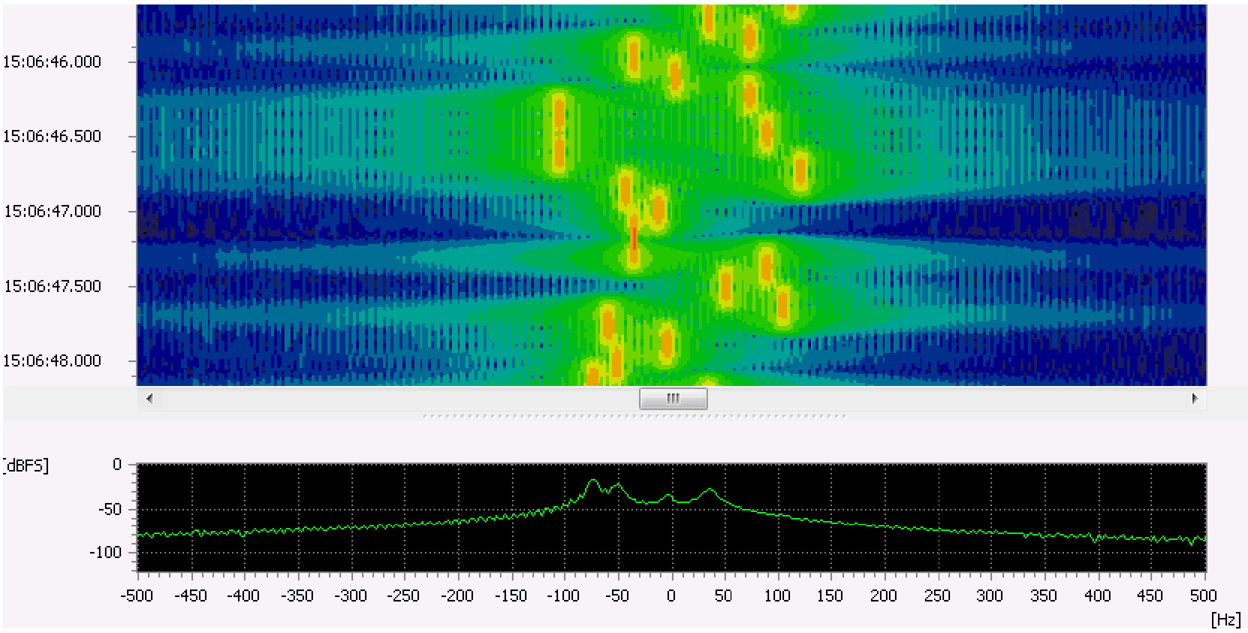


Figure 77: MFSK-8 Spectrogram

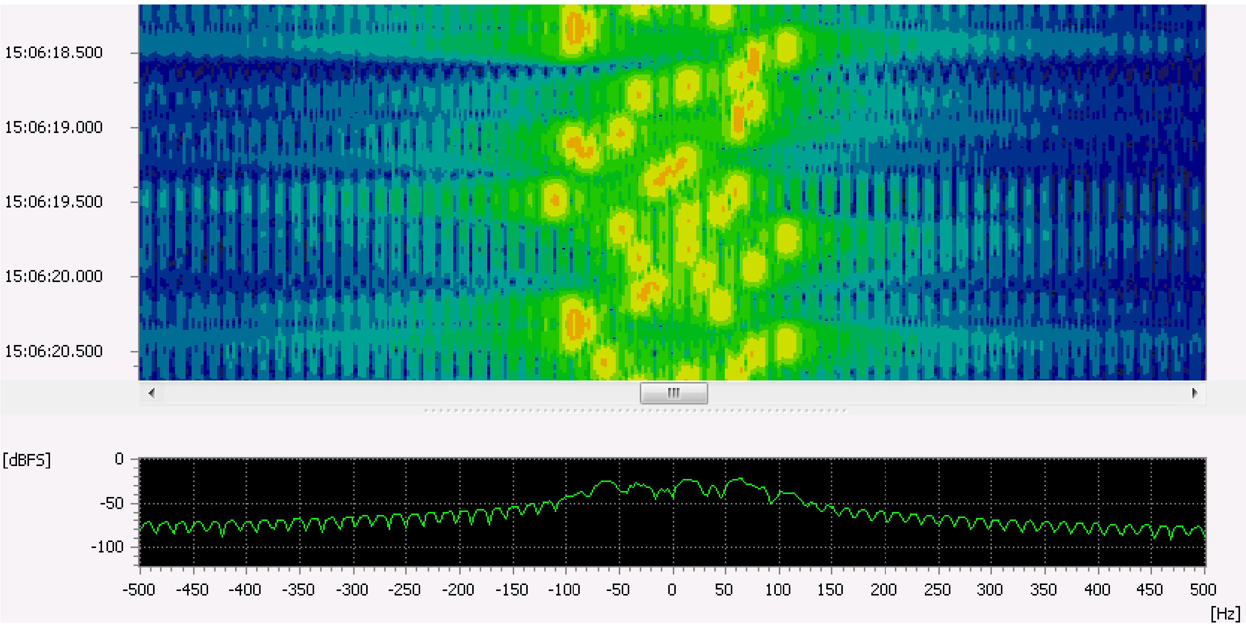


Figure 78: MFSK-16 Spectrogram

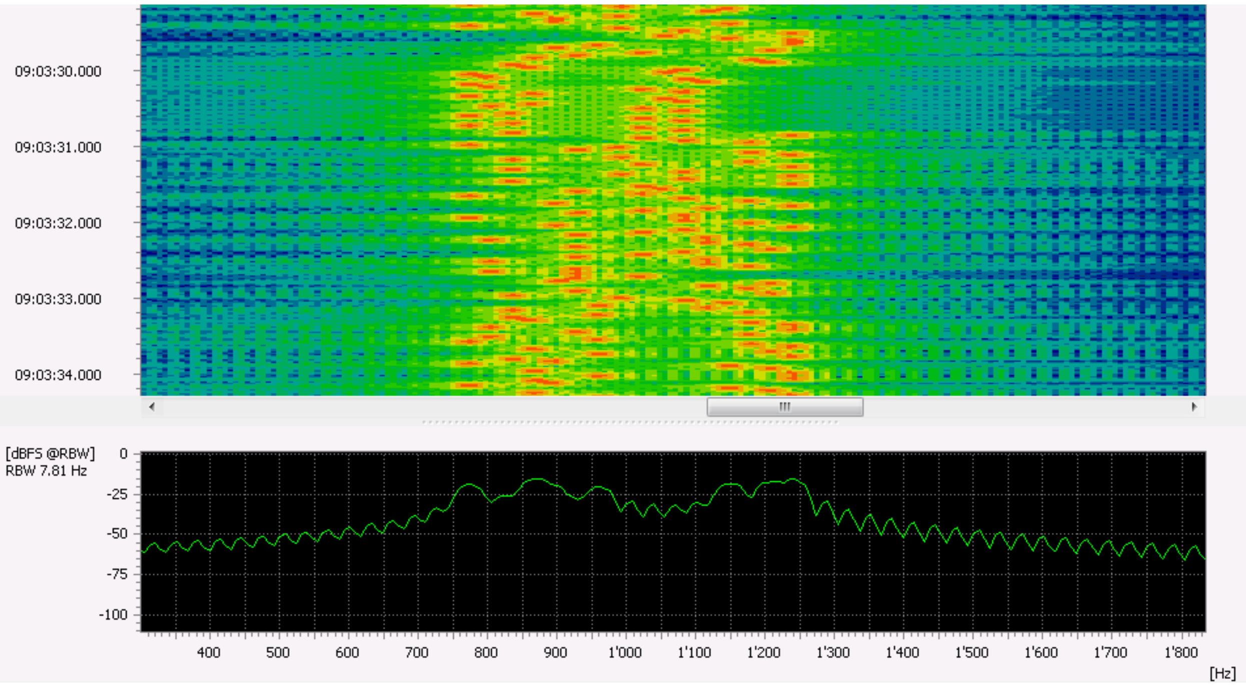


Figure 79: MFSK-32 Spectrogram

1.76. Morse

General Information

Morse code was the first method for data transfer over radio. By now it has been mostly replaced by digital modes.

Usage

- Transfer of textual information over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Morse'

Mode Details

	Item	Value
Standard	Modulation	Carrier keyed on/off
	Bandwidth (Hz)	400
	Symbol rate (Bd)	Depending on data-rate
	Data rate (cpm)	30 ... 300
Demodulator Settings	Demodulator	Morse
	Keying rate (cpm)	92.5
	Tolerance (cpm)	60.0
	Sensitivity	Auto
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 77: Morse

Sensitivity

The Morse detector can be parameterized with the sensitivity setting "High" or "Low". If "High" is selected, very short Morse signal are detected, but this increases the false positive detection probability. If "Auto" is selected, one of the two settings is automatically selected. If the APC is running in production mode (manual mode) or in modem recognition mode (automatic mode) with a fixed nominal frequency, the sensitivity is set to "High". When searching within a frequency range, the sensitivity is set to "Low".

Post-Processing

The decoder can recognize call sequences and various codes in the input signal. Faulty passages are corrected within limits. Missing or incorrect spaces are added or removed when specified sequences are detected. This post-processing can be configured by the user via parameters.

Both the raw text and the post-processed text are output in different channels.

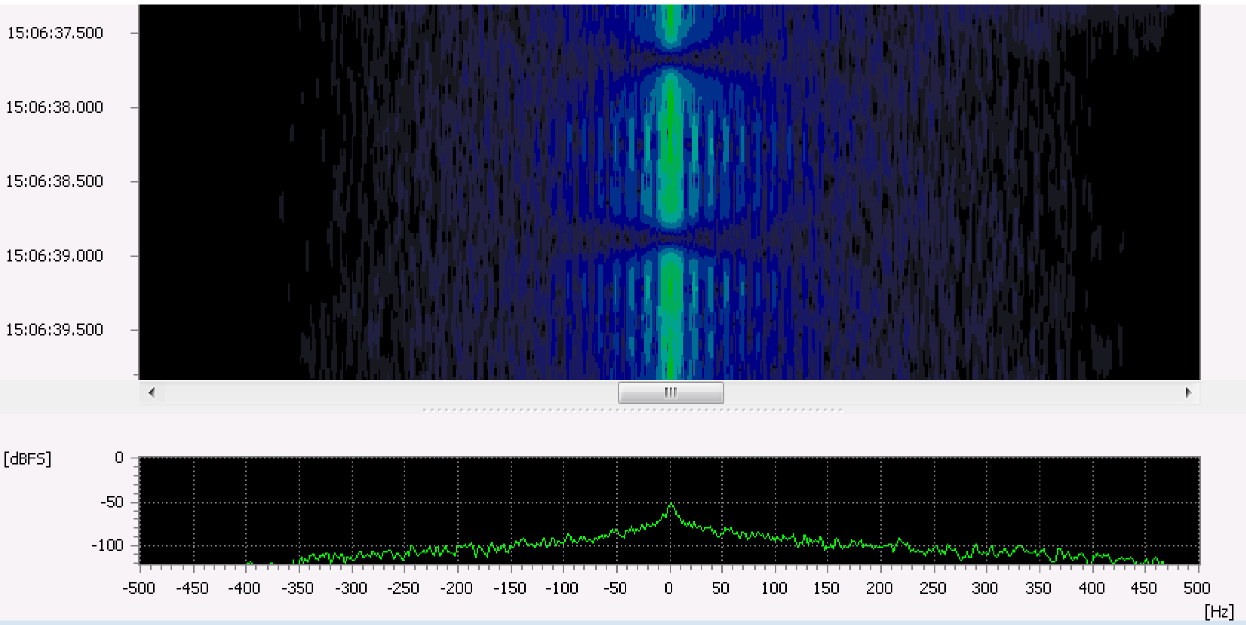


Figure 80: Morse Spectrogram

1.77. Morse A2A

General Information

Morse A2A is an AM modulated Morse signal with an active carrier.

Usage

- Transfer of textual information over HF or VUHF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Morse'

Mode Details

	Item	Value
Standard	Modulation primary	AM with carrier
	Modulation secondary	keyed on/off
	Data rate (cpm)	30 ... 300
Demodulator Settings	Demodulator	Morse
	Keying rate (cpm)	92.5
	Tolerance (cpm)	60.0
	Sensitivity	Auto
Extras	Primary demodulator	AM
	Offset nominal frq. (Hz)	800
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 78: Morse

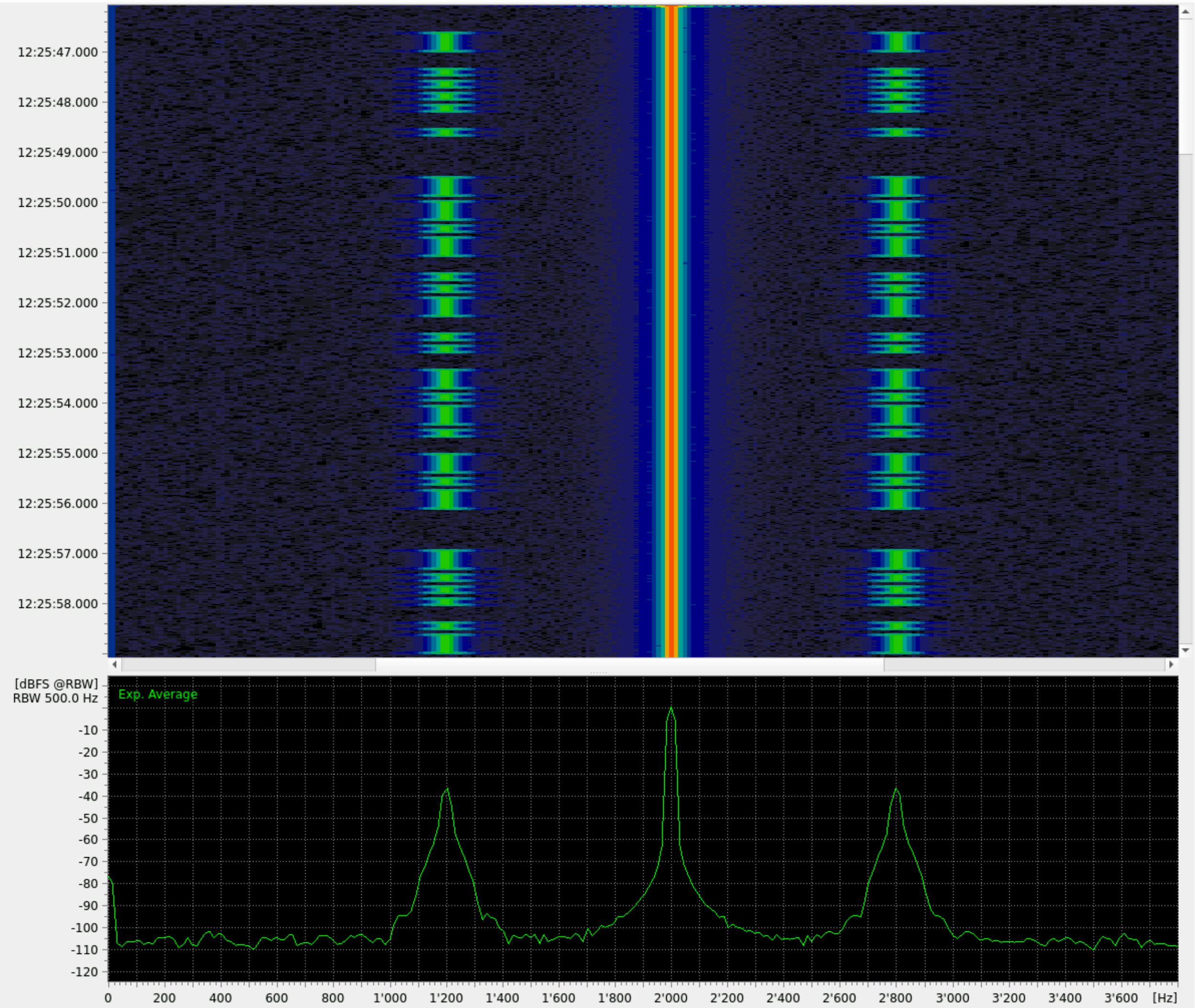


Figure 81: Morse A2A Spectrogram

1.78. Morse F1A

General Information

Morse F1A is a Morse signal transmitted over two tone frequency shift keying (FSK2) with one tone (usually upper frequency) containing straight Morse encoded pulses and the other tone (usually lower frequency) being reversed version of the first tone.

Usage

- Transfer of textual information over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Morse'

Mode Details

	Item	Value
Standard	Modulation	FSK
	Data rate (cpm)	30 ... 300
Demodulator Settings	Demodulator	F1A
	Keying rate (cpm)	85.6
	Tolerance (cpm)	20.0
	Shift (Hz)	200
	Shift tolerance (Hz)	5
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes*

Table 79: Morse

* If used in combination with plain Morse modem then that one might be recognized (depends on keying rate tolerance).

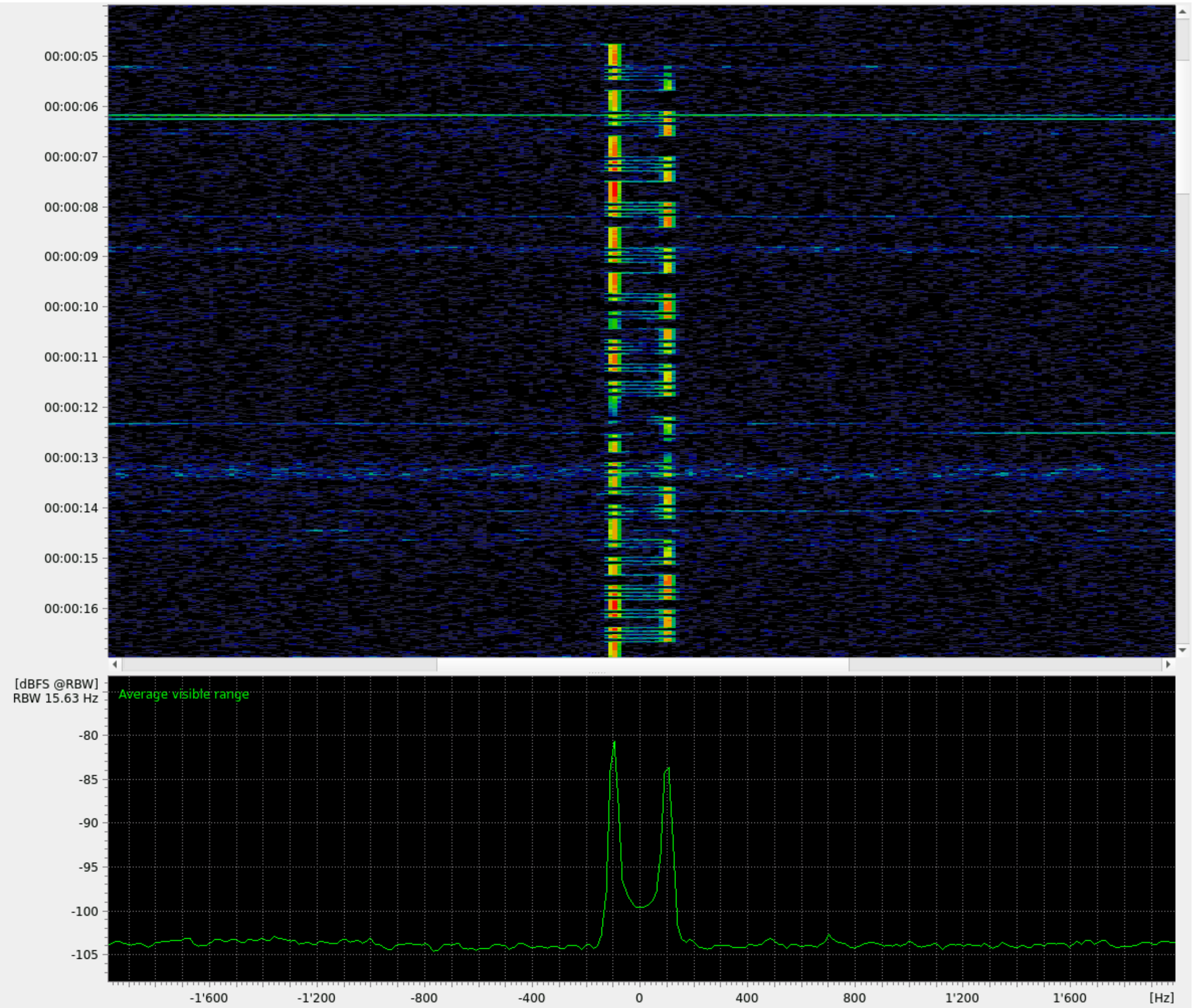


Figure 82: Morse F1A Spectrogram

1.79. Morse F2A

General Information

Morse F2A is an FM modulated Morse signal with an active carrier.

Usage

- Transfer of textual information over HF or VUHF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Morse'

Mode Details

	Item	Value
Standard	Modulation primary	FM with carrier
	Modulation secondary	keyed on/off
	Data rate (cpm)	30 ... 300
Demodulator Settings	Demodulator	Morse
	Keying rate (cpm)	92.5
	Tolerance (cpm)	60.0
	Sensitivity	Auto
Extras	Primary demodulator	FM
	FM bandwidth (Hz)	2500
	Offset nominal frq. (Hz)	800
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 80: Morse

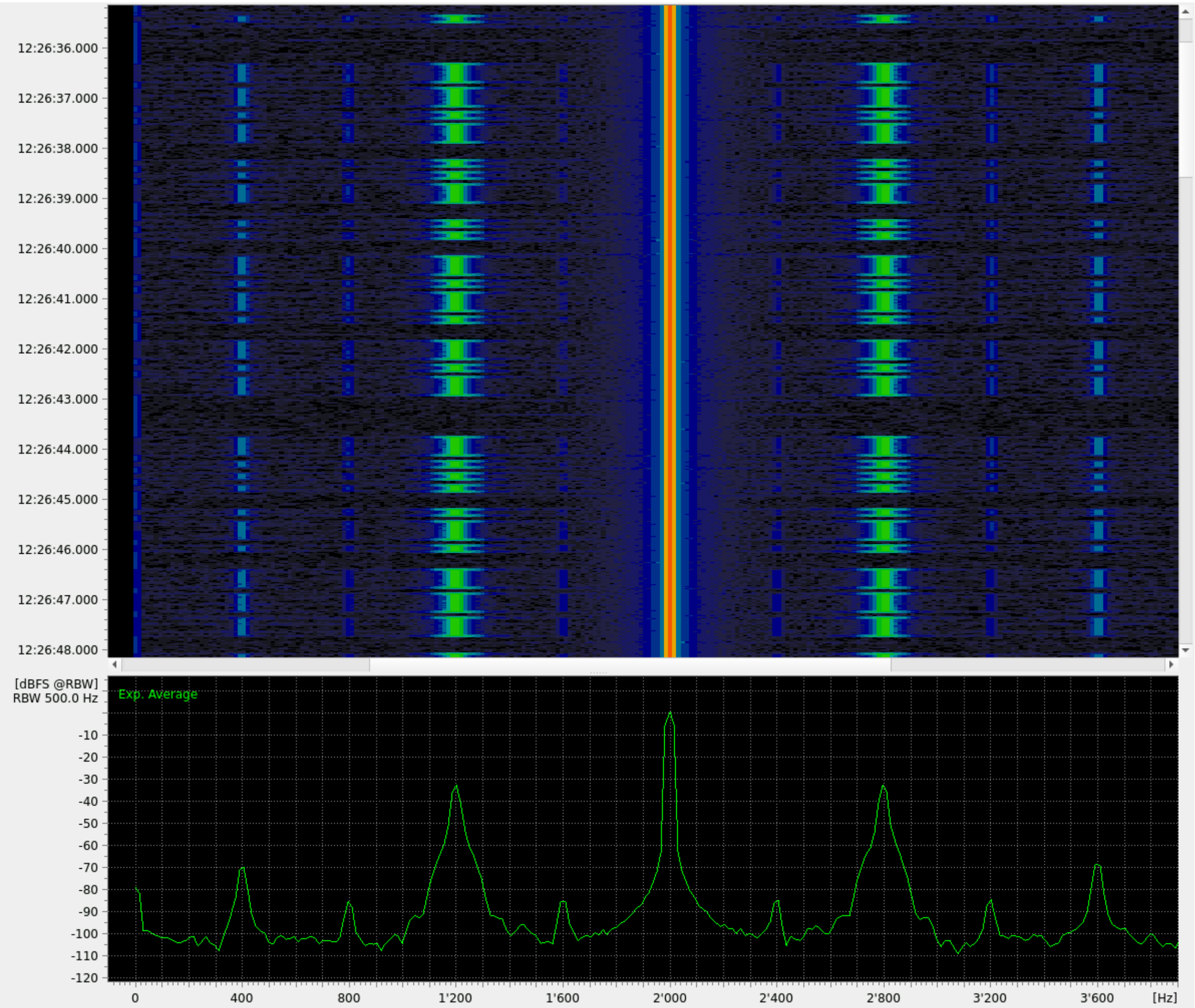


Figure 83: Morse F2A Spectrogram

1.80. MT63

General Information

MT63 is a digital radio protocol for amateur communications. The MT63 modem transits 64 tones, all 64 tones are differential bipolar phase shift keyed at 5 Bd, 10 Bd or 20 Bd.

The MT63 signal is spread both in the time domain and the frequency domain, in a short interleaving mode each encoded character is spread over 32 sequential symbols. In a long interleaving mode, the spreading is over 64 symbols.

Usage

- HF Amateur radio communications

Restrictions

- The mode with 5 Bd (MT63-500) is not suitable for a general search. At least 26 seconds of signal are needed for a recognition. This will slow down the overall recognition performance.

Mode Details

	Item	Value
Standard	Modulation	Multi-channel
	Number of channels	64
	channel spacing (Hz)	15.625
	Symbol rate (Bd)	5, 10 or 20
	Error correction	Walsh coding
Demodulator Settings	Demodulator	MT63
	Symbol rate (Bd)	5, 10 or 20
Extras	Offset nominal frq. (Hz)	500
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 81: MT63

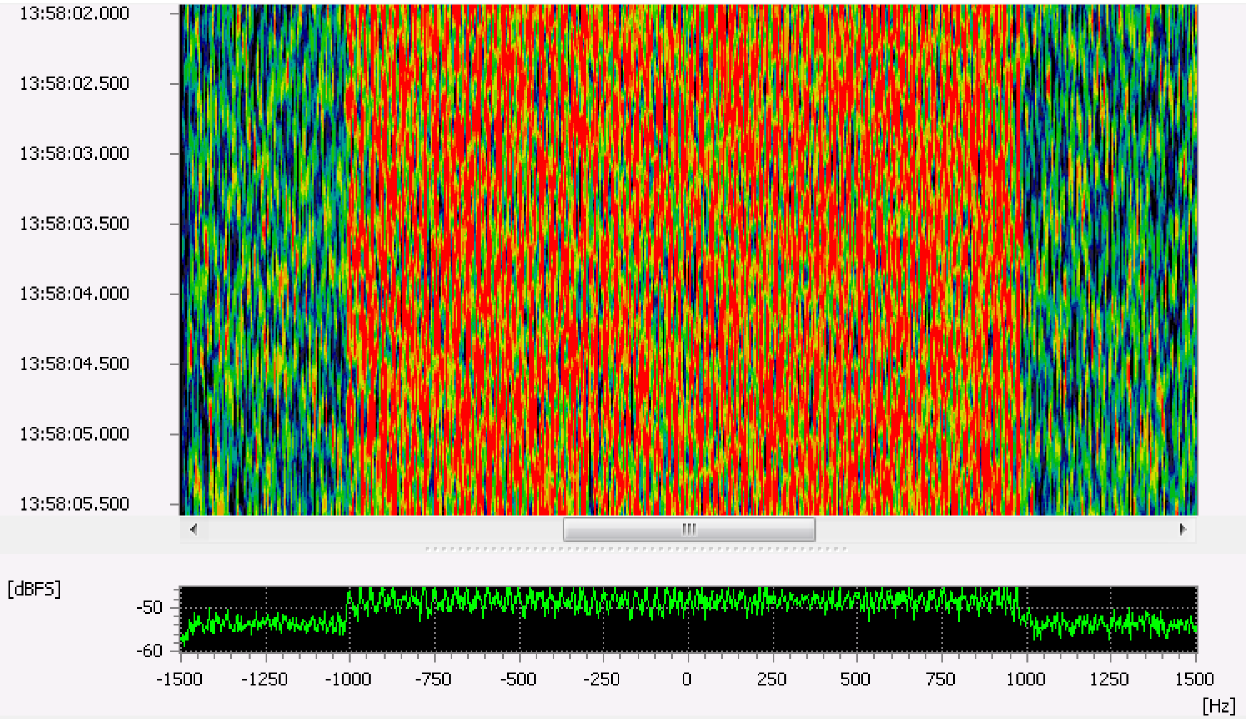


Figure 84: MT63 Spectrogram

1.81. Olivia

General Information

Olivia is a radio teletype modem developed by radio amateur Pawel Jalocha.

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	MFSK
	Number of tones	4/8/16/32/64
	Shift (Hz)	200
	Symbol rate (Bd)	31.25
	Error correction	Walsh
	Alphabet	ITA-5
Demodulator Settings	Demodulator	Multitone (MFSK)
	Tone duration (ms)	32
	TD tolerance (ms)	4
	No. of tones	32
	Tone position type	Equidistant frequencies
	Tone distance (Hz)	31.25
Extras	Offset nominal frq. (Hz)	500
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 82: Olivia

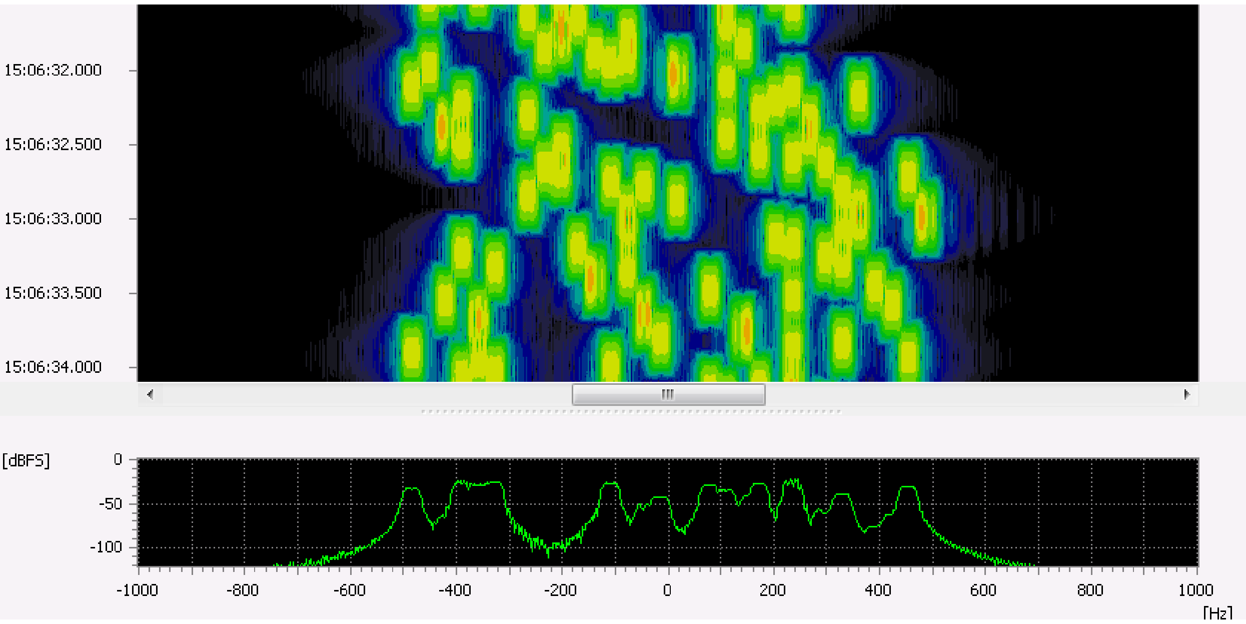


Figure 85: Olivia Spectrogram

1.82. Packet 300

General Information

Packet radio is a complex data transmission system used by radio amateurs. Packet radio networks use the AX.25 data link layer protocol, derived from the X.25 protocol suite and designed for amateur radio use.

Usage

- Data communication over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Packet'

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	200
	Bandwidth (Hz)	500
	Symbol rate (Bd)	300
	Coding	NRZ
Demodulator Settings	Demodulator	FSK 2,3,4 discr.
	Symbol rate (Bd)	300
	SR tolerance (Bd)	5
	Modulation order	2
	Shift (Hz)	200
	Shift tolerance (Hz)	10
	Modem type	Synchronous
	Min. burst length (s)	0.500
	Max. burst length (s)	10.000
	Min. pause length (s)	0.180
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 83: Packet 300

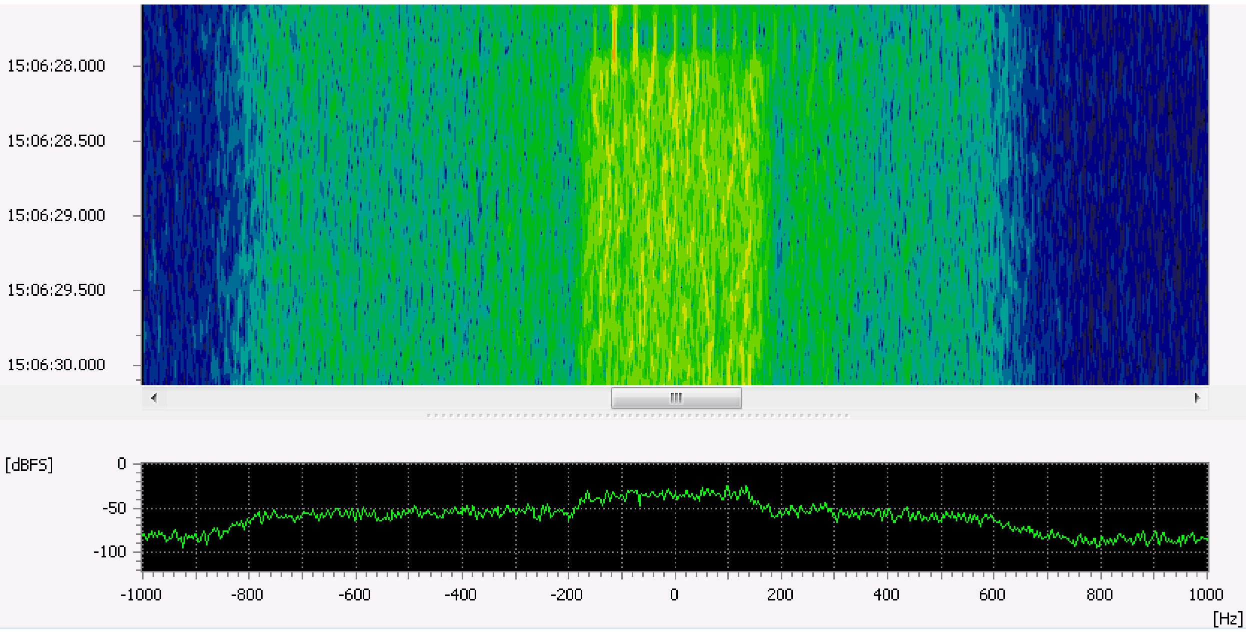


Figure 86: Packet 300 Spectrogram

1.83. PACTOR I/II/III

Combination of PACTOR I, PACTOR II and PACTOR III. It will automatically detect and switch between the different modes. This MultiModem is not suitable for manual analysis mode. In this case use one of the single modems.

1.84. PACTOR I

General Information

PACTOR I mode is a proprietary standard developed by SCS GmbH & Co. KG, Hanau, Germany.

Usage

- Data communication over HF
- In successive standards PACTOR II and PACTOR III the mode PACTOR I is used during the call set-up

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	200
	Bandwidth (Hz)	300
	Symbol rate (Bd)	100 / 200
	Coding	Huffman code
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	200
	SR tolerance (Bd)	5
	Shift (Hz)	200
	Shift tolerance (Hz)	10
	Modem type	Multiple SR
	Min. burst length (s)	0.120
	Max. burst length (s)	1.000
	Min. pause length (s)	0.170
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 84: PACTOR I

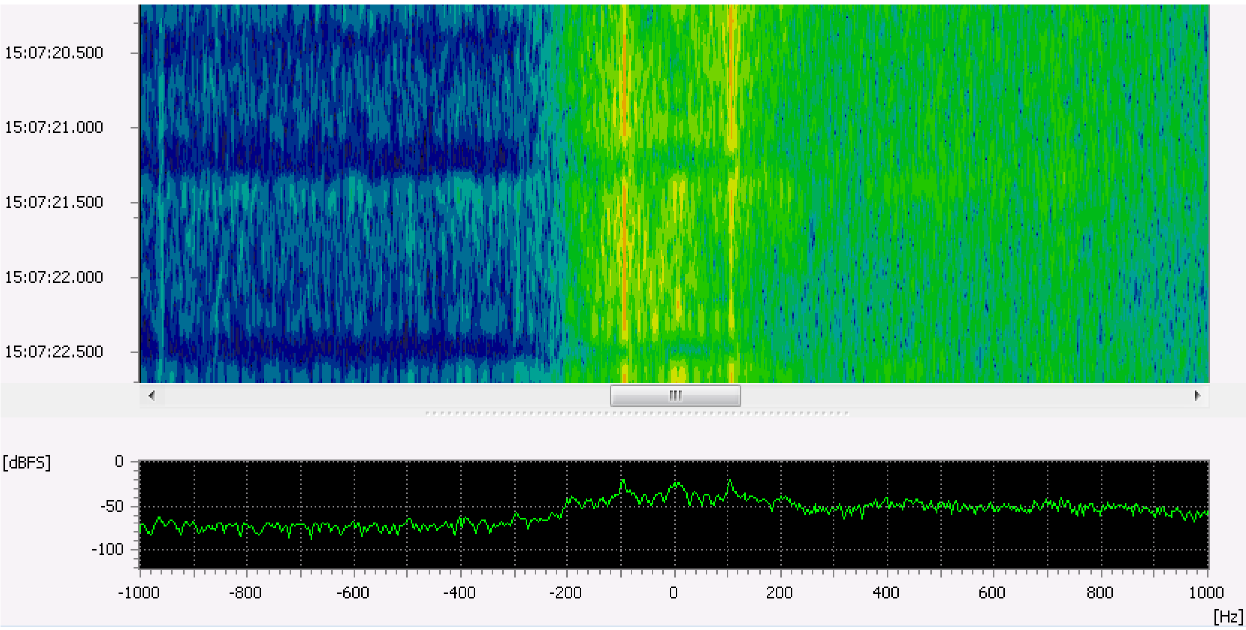


Figure 87: PACTOR I Spectrogram

1.85. PACTOR I FEC

General Information

PACTOR I mode is a proprietary standard developed by SCS GmbH & Co. KG, Hanau, Germany.
The FEC/Unproto variant is used for broadcast transmissions.

Usage

- Broadcast data transmissions over HF
- During call set-up Pactor-I-FEC mode is used

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'PACTOR I/II/III'

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	200
	Symbol rate (Bd)	100 / 200
	Error correction	Huffman code, CRC
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	200
	SR tolerance (Bd)	1
	Shift (Hz)	200
	Shift tolerance (Hz)	20
	Modem type	Multiple SR
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 85: PACTOR I FEC

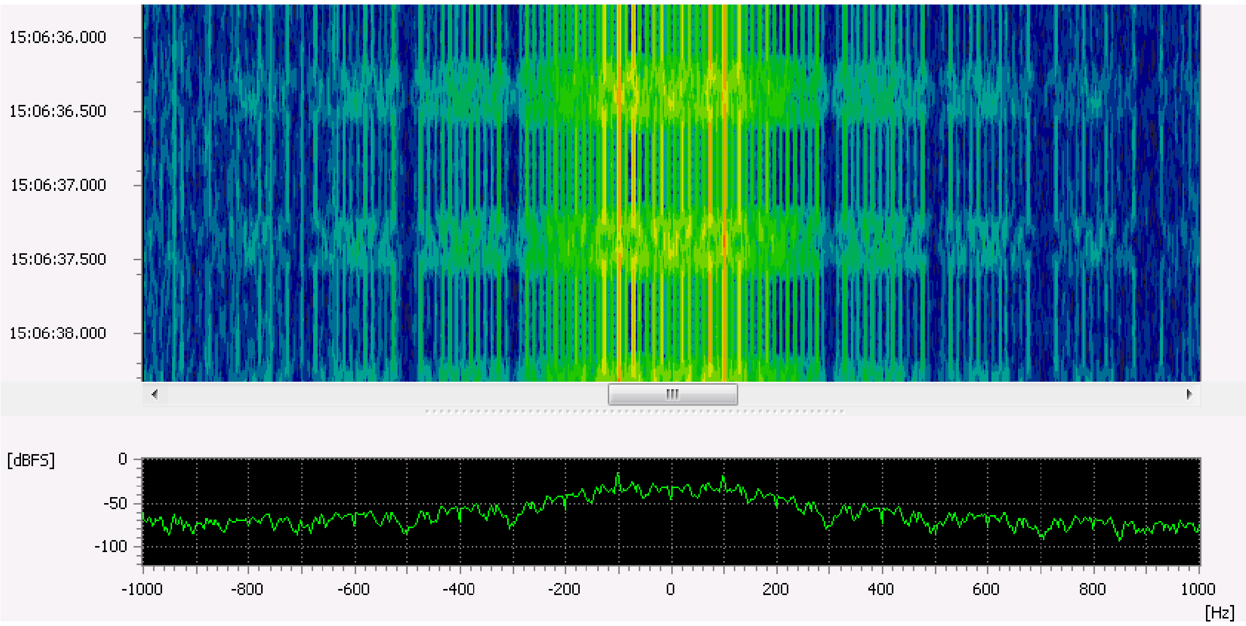


Figure 88: PACTOR I FEC Spectrogram

1.86. PACTOR II

General Information

PACTOR II mode is a proprietary standard developed by SCS GmbH & Co. KG, Hanau, Germany.
It is an advancement of the PACTOR I mode.

Usage

- ARQ and data communication over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'PACTOR I/II/III'

Mode Details

	Item	Value
Standard	Modulation	DBPSK / DQPSK / 8-DPSK / 16-DPSK
	Number of channels	2
	Channel spacing (Hz)	200
	Bandwidth (Hz)	450
	Symbol rate (Bd)	200
	Error correction	Convolutional FEC
Demodulator Settings	Demodulator	Pactor II
	Min. burst length (s)	0.300
	Max. burst length (s)	3.400
	Min. pause length (s)	0.035
	Min. burst SNR (dB)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 86: PACTOR II

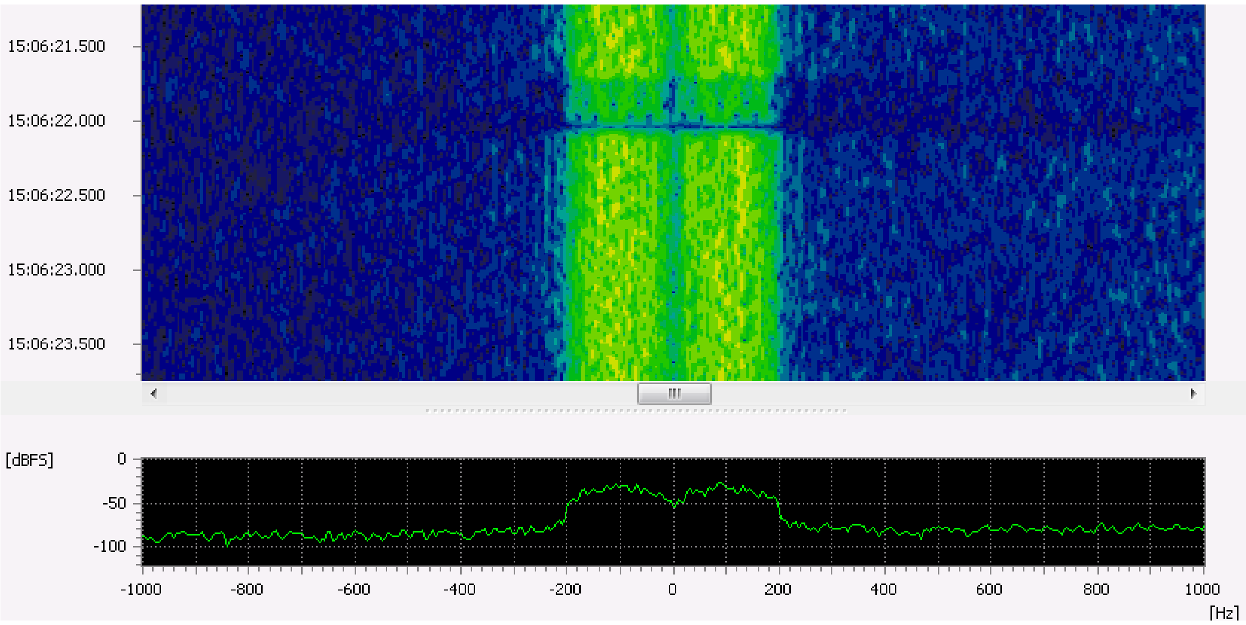


Figure 89: PACTOR II Spectrogram

1.87. PACTOR II FEC

General Information

PACTOR II FEC mode is a proprietary standard developed by SCS GmbH & Co. KG, Hanau, Germany.
It is an advancement of the PACTOR I FEC mode.

Usage

- Broadcast data transmissions (plain-text and encrypted) over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'PACTOR I/II/III'

Mode Details

	Item	Value
Standard	Modulation	DQPSK
	Number of channels	2
	Channel spacing (Hz)	200
	Bandwidth (Hz)	450
	Symbol rate (Bd)	200
	Error correction	Convolutional FEC code, Viterbi code
Demodulator Settings	Demodulator	Pactor II
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 87: PACTOR II FEC

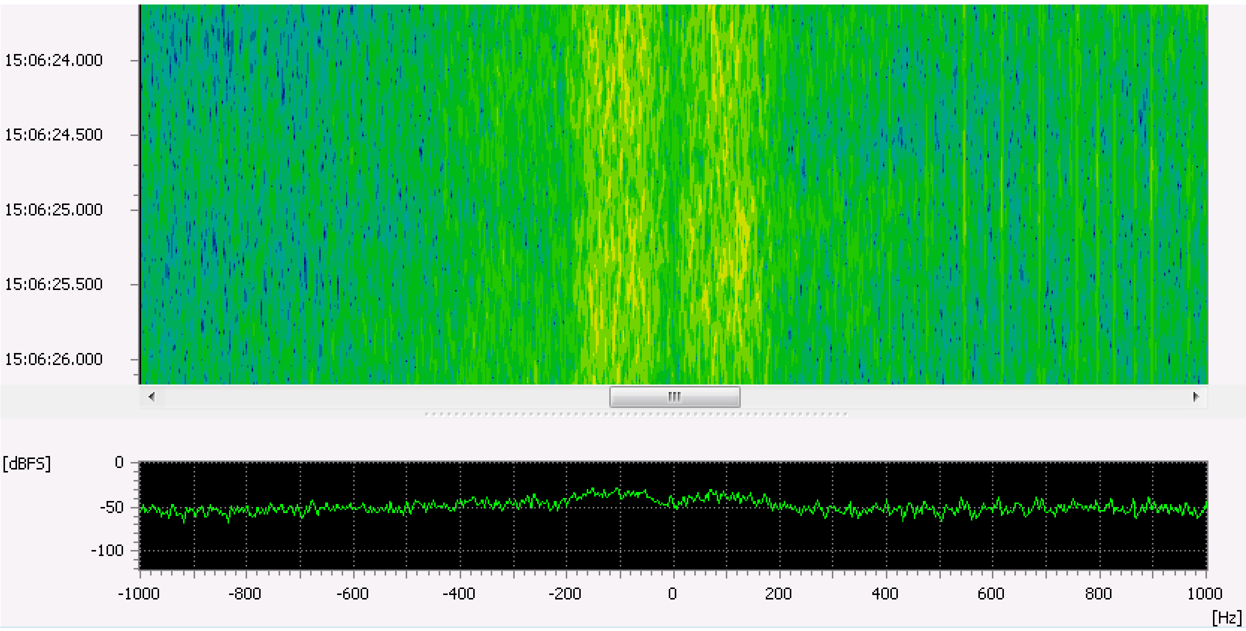


Figure 90: PACTOR II FEC Spectrogram

1.88. PACTOR III

General Information

PACTOR III mode is a proprietary standard developed by SCS GmbH & Co. KG, Hanau, Germany.
It is an advancement of the PACTOR I and PACTOR II modes.

Usage

- ARQ and broadcast data communication over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'PACTOR I/II/III'

Mode Details

	Item	Value
Standard	Modulation	DBPSK / DQPSK
	Number of channels	2 / 6 /14 /16 / 18
	Channel spacing (Hz)	120
	Bandwidth (Hz)	max 2200
	Symbol rate (Bd)	100 per channel
	Error correction	Convolutional FEC
Demodulator Settings	Demodulator	Pactor III
	Min. burst length (s)	0.300
	Max. burst length (s)	3.400
	Min. pause length (s)	0.035
	Min. burst SNR (dB)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 88: PACTOR III

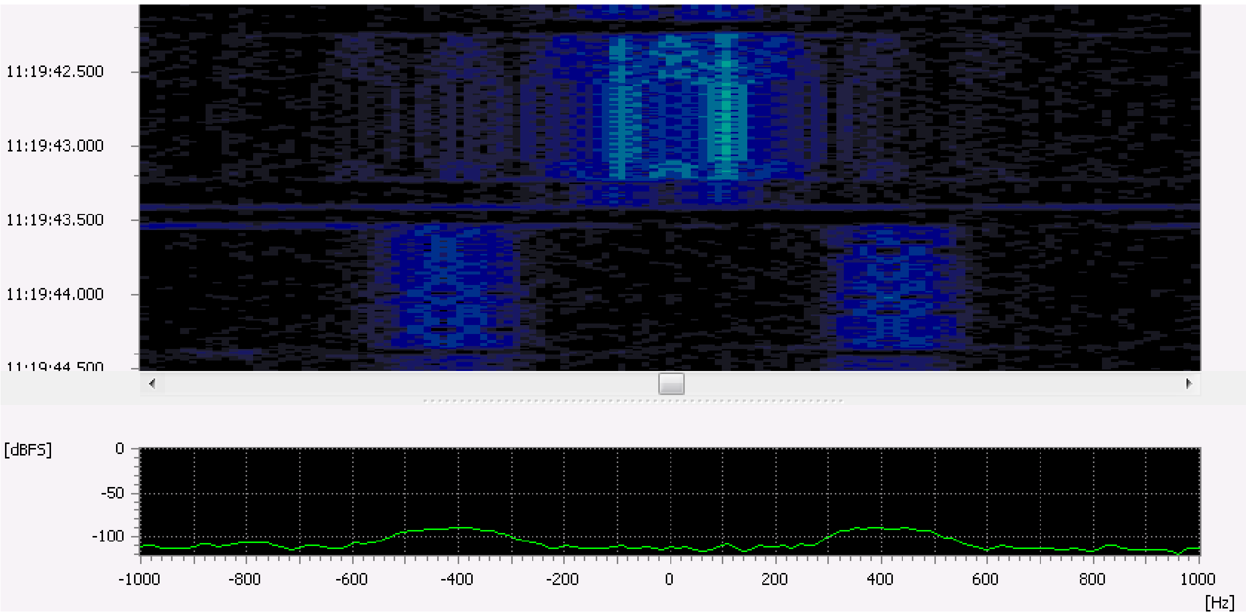


Figure 91: PACTOR III Spectrogram

1.89. PACTOR-4

General Information

PACTOR-4 mode is a standard developed by SCS GmbH & Co. KG, Hanau, Germany. It provides higher throughput and robustness than Pactor –I, -II and III. The modem uses 10 different modes ("speed levels") in order to adapt to different transmission conditions. Short and long bursts may occur alternating. The burst cycle is fixed to either short or long path values

Usage

- ARQ and broadcast data communication over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'PACTOR-4'

Mode Details

	Item	Value		
Speed Levels	Mode	Channels	Symbol Rate (/Spread Factor)	Data Rate
	1: 2 chirped channel DPSK 4	2 (chirped)	112,5 Bd	1/2
	2: Spread Spectrum DPSK 4	1	1800 / 16 Bd	1/2
	3: Spread Spectrum DPSK 4	1	1800 / 16 Bd	5/6
	4: Spread Spectrum DPSK 4	1	1800 / 8 Bd	5/6
	5: PSK 2	1	1800 Bd	1/3
	6: PSK 2	1	1800 Bd	5/6, 1/3
	7: PSK 4	1	1800 Bd	5/6, 1/3
	8: PSK 8	1	1800 Bd	5/6, 1/3
	9: QAM 16	1	1800 Bd	5/6, 1/3
	10: QAM 32	1	1800 Bd	5/6
Burst Length	Short: 800 ms Long : 3.294 ms ACK : 240 ms			
ARQ Cycle Time Short Path: Long Path:	short / long bursts: short / long bursts:	1250 / 3750 ms 1400 / 4200 ms		
Demodulator Settings	Demodulator	Pactor-4		

	Item	Value		
Features	Demodulation	yes		
	Recognition	yes		
	Decoding	yes		
	Automatic Sideband Adjustment	no		
	Combination with other modems (modem list)	yes		

Table 89: PACTOR-4

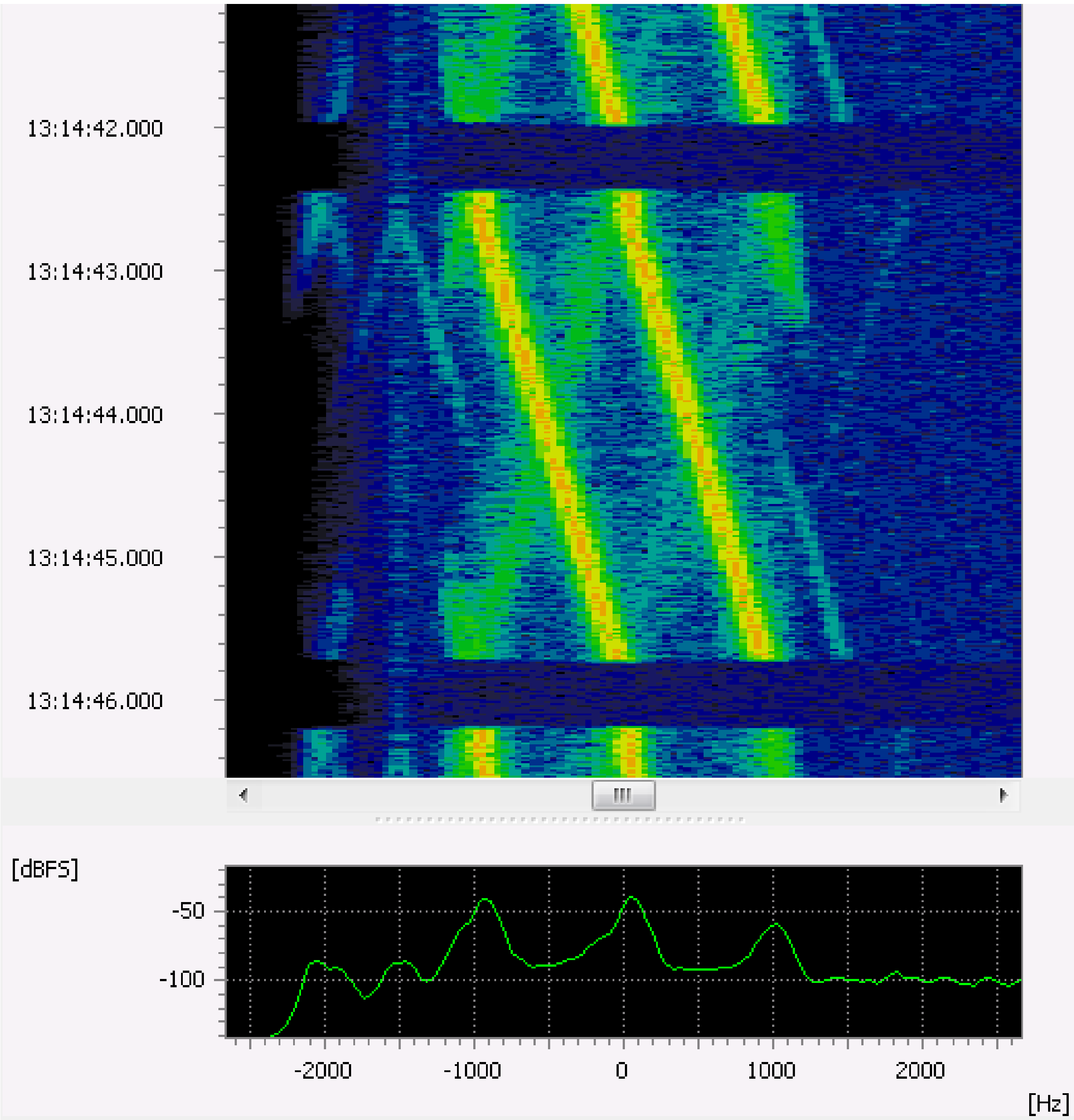


Figure 92: Pactor-4 Mode 1

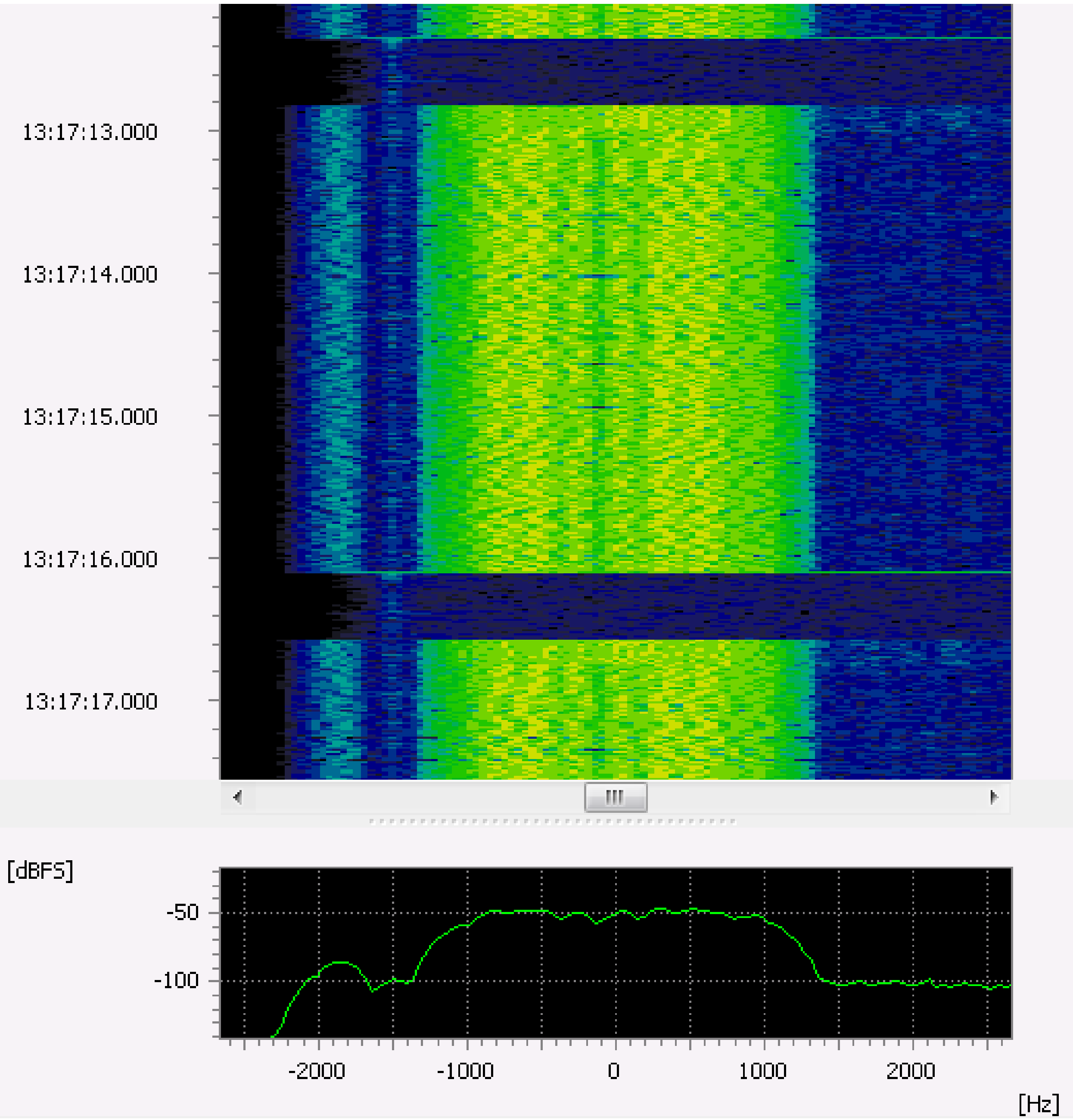


Figure 93: Pactor-4 Mode 4

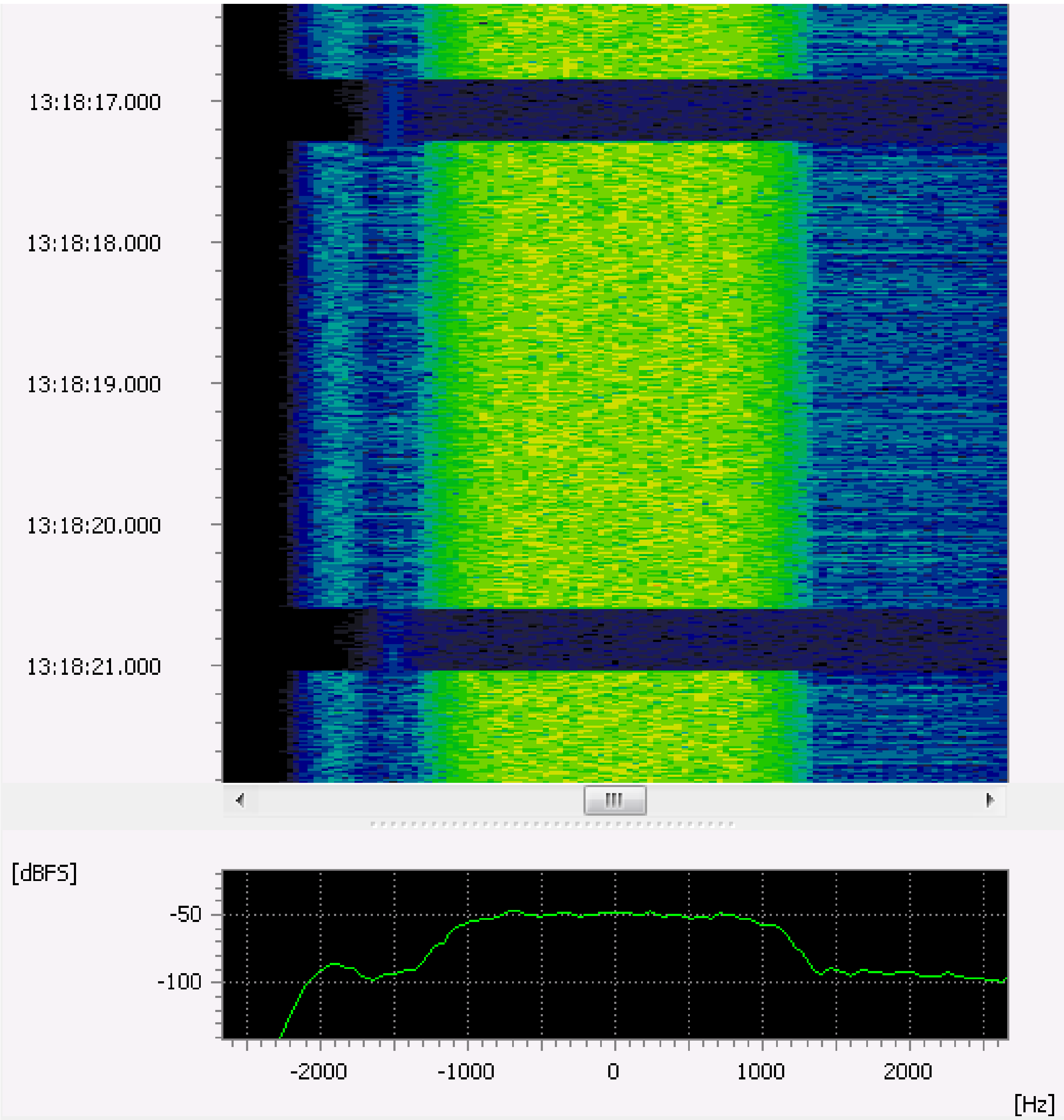


Figure 94: Pactor-4 Mode 8

Decoder Outputs

The decoder will produce outputs on decoder output channel 1 – 4.

Channel 1:

This output contains only CRC-proved and repetition-eliminated payload contents.

Example:

```
ls:7Ht4aM6n,em:h3z)
{SFI = 76 on 2017/02/01 12:02z}
Welcome to SailMail Europe, station R-12


MZON8 de OSY QTC 3 msg 7604 char>
FS Y
; MZON8 de OSY QTC: 3 7371 3986
FC EM MZON8 244 2728 1424 1
```

Channel 2:

This output contains the output of each processed burst containing correct or faulty checksums, repetitions, internal meta information etc.

Example:

```
12:01:15:687 CycLen:1250 ms
-R- SL:6 short RQ_Cnt:1 Errors:0 CRC:ffff_h Alpha:HUF TCntrl:0 Bytes:41 BurstLen:1440
Noise:19
Payload:
ls:7Ht4aM6n,em:h3z)
{SFI = 76 on 2017/02/

12:01:16:937 CycLen:1250 ms
-D- SL:6 short RQ_Cnt:2 Errors:0 CRC:ffff_h Alpha:PMC_E TCntrl:4 Bytes:53 BurstLen:1440
Noise:17
Payload:
01 12:02z}
Welcome to SailMail Europe, station R-1
```

Description:

- Line 1 is started with the bursts time stamp, followed by the distance to the last burst (CycLen)
- Line 2 reveals some internal meta informations:
  - Preamble type -R- for repetition or -D- for new data
  - The speed level SL 1 to SL 10 with short or long bursts
  - The modulo-4 repetition counter RQ_Cnt
  - The number of internally FEC-corrected bits of the payload
  - The received CRC (ffff (hexadecimal) is used by standard modems)
  - The detected alphabet for this burst (Huffman(HUF), Pseudo-Markov (PMC_E/ PMC_D) , ASCII
  - The 3 bit status word TCntrl containing ARQ-information
  - The number of payload bytes detected in this burst
  - The detected length of the burst in number of symbols
  - A calculated noise indicator for this burst (0..100)

- The data payload of this burst

Channel 3:

This optional output contains text evaluations of AirMail and SailMail Headers. It will also contain paths of produced output files.

Example:

```
<airmail-header-recipient.type.callsign>MZON8</airmail-header-
recipient.type.callsign>
<airmail-header-sender.type.callsign>OSY</airmail-header-sender.type.callsign>
<airmail-header-qtc>3</airmail-header-qtc>
<airmail-header-uncompressedSize>7371</airmail-header-uncompressedSize>
<airmail-header-compressedSize>3986</airmail-header-compressedSize>

<airmail-header-msgs-msg.id.1-messageId>MZON8_244</airmail-header-msgs-msg.id.1-
messageId>
<airmail-header-msgs-msg.id.1-uncompressedSize>2728</airmail-header-msgs-msg.id.1-
uncompressedSize>
<airmail-header-msgs-msg.id.1-compressedSize>1424</airmail-header-msgs-msg.id.1-
compressedSize>
<airmail-header-msgs-msg.id.1-compression>Bzip2</airmail-header-msgs-msg.id.1-
compression>
                                .
                                .
                                .

Resultfile created: C:\mem_prod/20030101/20030101-000016-937___D01_297.bz2
Resultfile created: C:\mem_prod/20030101/20030101-000016-937___D01_1765.bz2
Resultfile created: C:\mem_prod/20030101/20030101-000016-937___D01_3230.txt
```

Channel 4:

This channel contain error and warning messages related to AirMail/SailMail evaluations

Decoder Parameters

The following decoder options can be selected via checkboxes (see Figure 95):

- Binary file post processing:
  The payload of AirMail and SailMail messages shall be extracted. This is only possible, if the raw contents could be decoded for nearly 100%. The mail result will be stored as two different file types in the production memory:

1. Compressed files (extension .bz2). They can be decompressed with standard tools like 7Zip.The contents can be text and or other user applications formats.
2. Text files (extension .txt). These pure text messages have been already decompressed with internal tools.

Decoder output channel 3 is used to indicated produced result files.

- Air/Sailmail header parser:
  The text format header will also be evaluated, prepared for usage in database applications. These results shall be listed on decoder output channel 3.
- Force ASCII alphabet:
  This option forces the ASCII alphabet, when the frame checksum test failed. Pactor uses the various alphabets including also Huffman and Pseudo-Markov coding variations. So a wrong detected alphabet might happen in case of a partly faulty frame as well. ASCII however will be the alphabet most often used for non-text data.
- Xdat output:
  This option will produce a file containing raw received coded in xml-format. It will also reveal some meta-information like checksums and burst boundaries for individual post processing methods like diversity corrections methods etc.
- Binary file output:
  The corrected payload output of channel 1 will be transferred to a file with extension ".bin". This file now contains the complete information including non-printable characters on bit level.

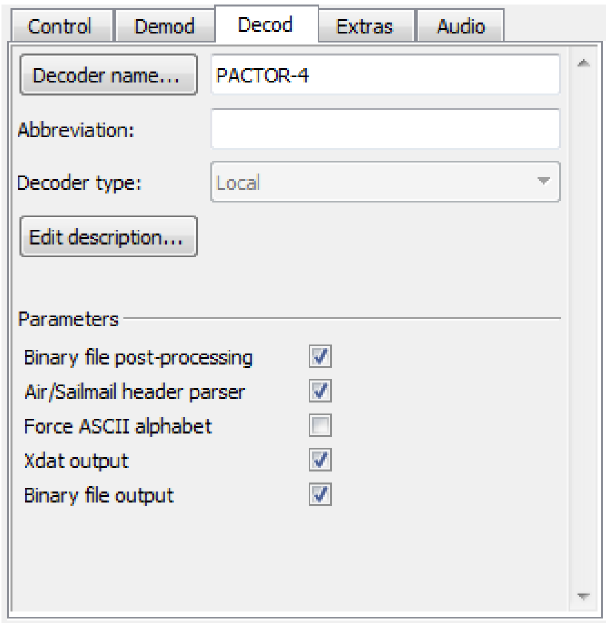


Figure 95: Decoder Parameter Checkboxes

1.90. Piccolo MK6

General Information

The Piccolo modes were developed in the UK for communications between Great Britain and its embassies and military stations all over the world.
They are similar to the French Coquelet modes.

Usage

- Transfer of textual information (mostly encrypted) over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	6
	Shift (Hz)	20
	Bandwidth (Hz)	180
	Symbol rate (Bd)	20
	Alphabet	ITA-2
Demodulator Settings	Demodulator	Multitone (MFSK)
	Tone duration (ms)	50
	TD tolerance (ms)	0.1
	No. of tones	6
	Tone position type	Equidistant frequencies
	Tone distance (Hz)	20
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 90: Piccolo MK6

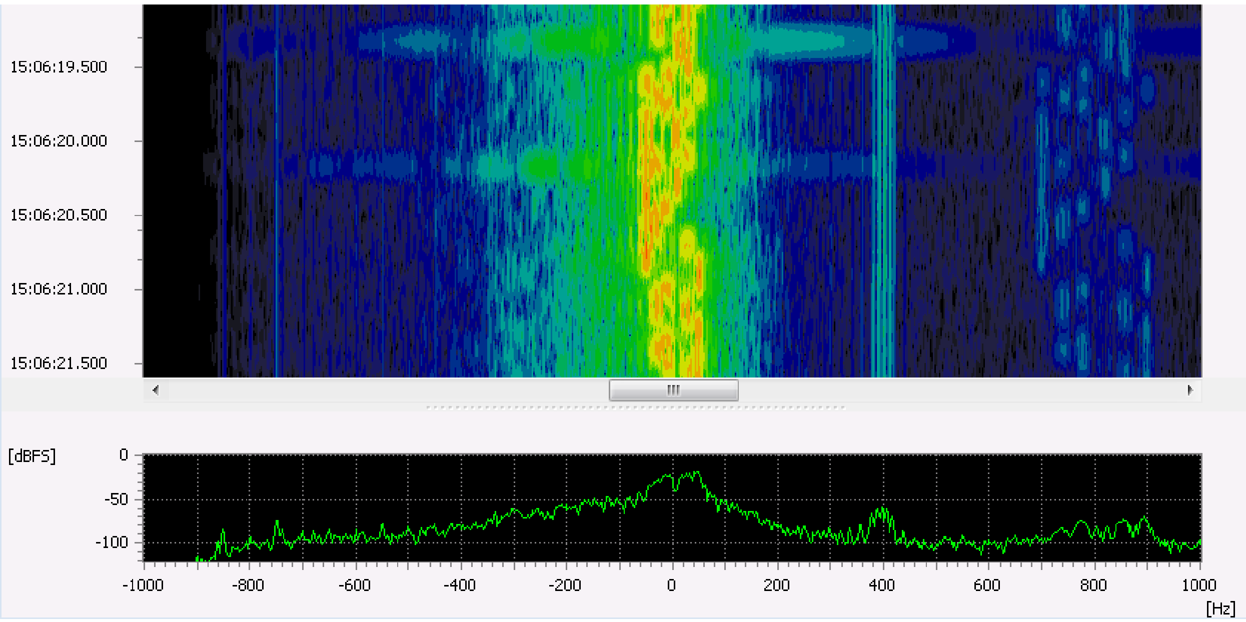


Figure 96: Piccolo MK6 Spectrogram

1.91. Piccolo MK12

General Information

The Piccolo modes were developed in the UK for communications between Great Britain and its embassies and military stations all over the world.
They are similar to the French Coquelet modes.

Usage

- Transfer of textual information (mostly encrypted) over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	12
	Shift (Hz)	20
	Bandwidth (Hz)	300
	Symbol rate (Bd)	20
	Alphabet	ITA-5
Demodulator Settings	Demodulator	Multitone (MFSK)
	Tone duration (ms)	50
	TD tolerance (ms)	2
	No. of tones	12
	Tone position type	Equidistant frequencies
	Tone distance (Hz)	20
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 91: Piccolo MK12

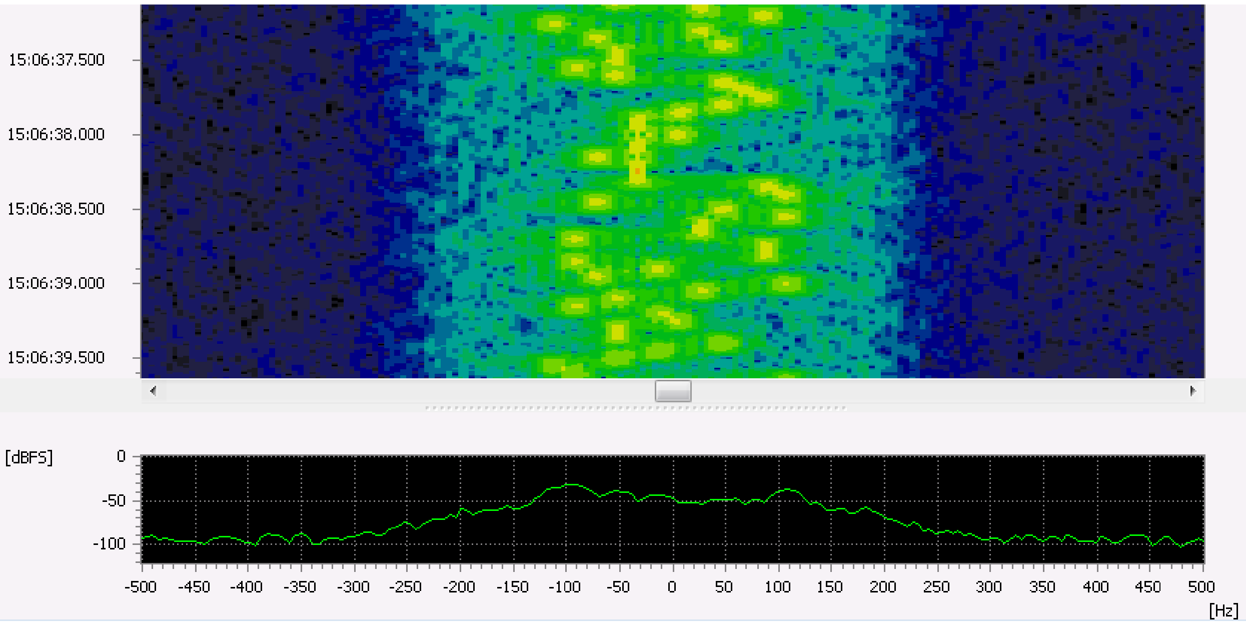


Figure 97: Piccolo MK12 Spectrogram

1.92. POL-ARQ

General Information

POL-ARQ is a synchronous duplex FARQ system. This system was used by the Ministry of Foreign Affairs of Poland.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	270
	Symbol rate (Bd)	100
	Alphabet	CCIR-476
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	100
	SR tolerance (Bd)	5
	Shift (Hz)	270
	Shift tolerance (Hz)	30
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 92: POL-ARQ

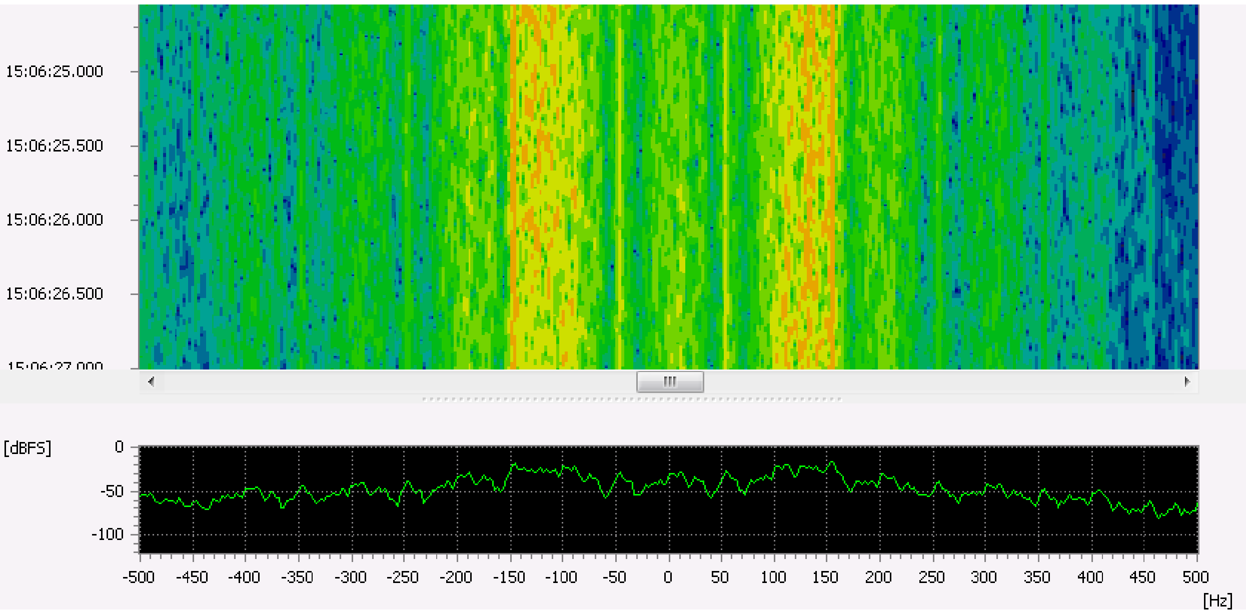


Figure 98: POL-ARQ Spectrogram

1.93. PSK10

General Information

PSK10 is a modem type developed by radio amateurs. PSK10 emissions are very narrow-band and robust against fading effects.

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	DBPSK
	Symbol rate (Bd)	10
	Coding	Huffman coding
Demodulator Settings	Demodulator	DPSK 2,4,8,16 A/B
	Symbol rate (Bd)	10
	SR tolerance (Bd)	0.5
	Modulation order	2
	Version	A
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 93: PSK10

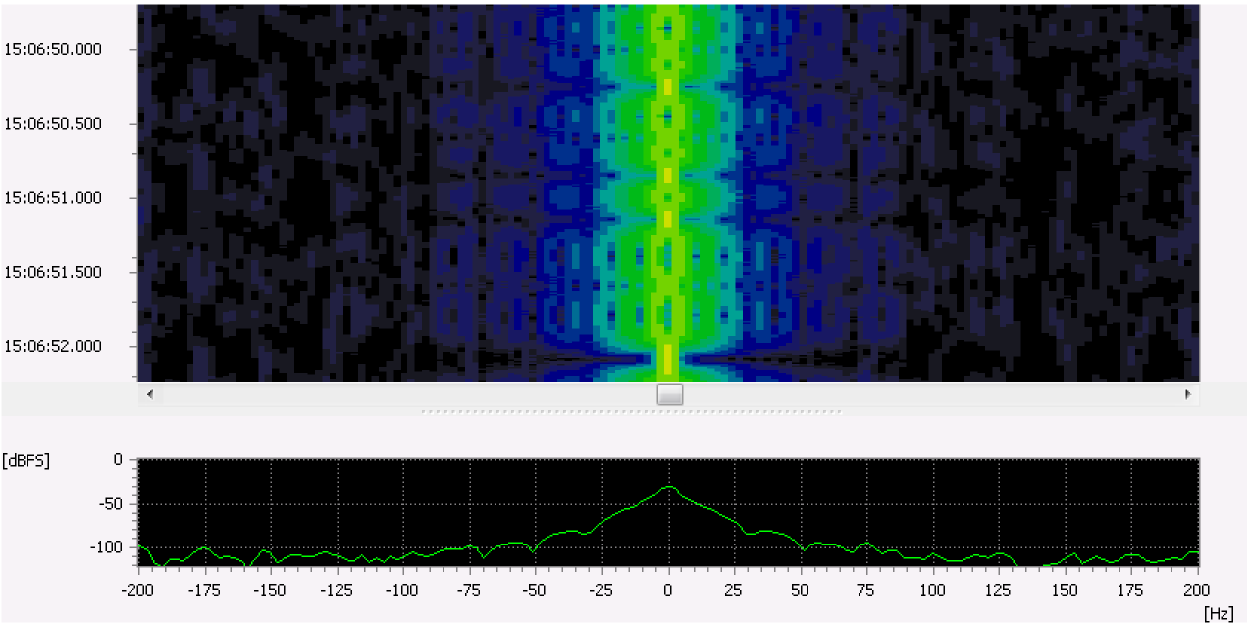


Figure 99: PSK10 Spectrogram

1.94. PSK-AM

General Information

PSK-AM is a modem type developed by radio amateurs. PSK-AM emissions are very narrow-band and robust against fading effects.

Usage

- Transfer of textual information over HF

Restrictions:

- Not reliable enough for general search

Mode Details

	Item	Value
Standard	Modulation	DBPSK
	Symbol rate (Bd)	10 / 31.25 / 50
	Coding	Repetition code
Demodulator Settings	Demodulator	DPSK 2,4,8,16 A/B
	Symbol rate (Bd)	10
	SR tolerance (Bd)	5
	Modulation order	2
	Version	A
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 94: PSK-AM

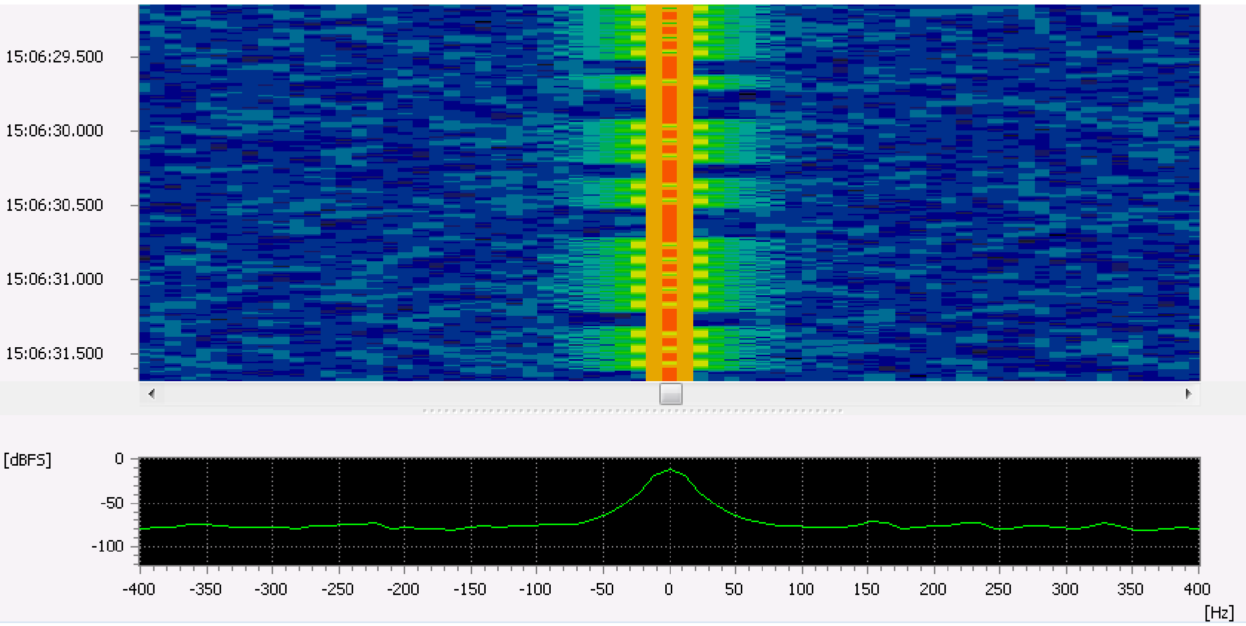


Figure 100: PSK-AM Spectrogram

1.95. PSK31

General Information

PSK31 is a modem type developed by radio amateurs. PSK31 emissions are very narrow-band and robust against fading effects.

Usage

- Transfer of textual information over HF

Restrictions:

- The non-FEC modes with a symbol rate of 125 and 250 Bd are not reliable enough for general search

Mode Details

	Item	Value
Standard	Modulation	DBPSK,QPSK
	Bandwidth (Hz)	50
	Symbol rate (Bd)	31.25 (62.5 / 125/ 250 / 500)
	Error correction	(FEC variants) Convolutional FEC
Demodulator Settings	Demodulator	DPSK 2,4,8,16 A/B
	Symbol rate (Bd)	31
	SR tolerance (Bd)	5
	Modulation order	2
	Version	A
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 95: PSK31

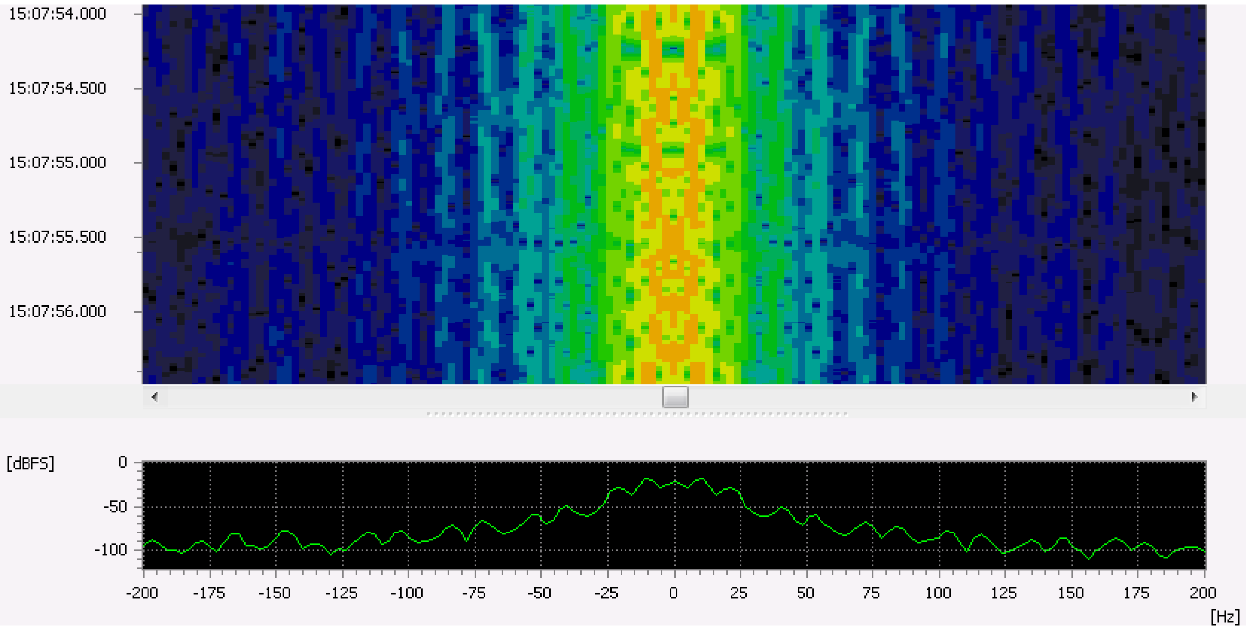


Figure 101: PSK31 Spectrogram

1.96. QPSK31

General Information

QPSK31 is a modem type developed by radio amateurs. QPSK31 emissions are very narrow-band and robust against fading effects.

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	DBPSK,QPSK
	Bandwidth (Hz)	63 – 1000Hz
	Symbol rate (Bd)	31.25 (62.5 / 125/ 250 / 500)
	Error correction	(FEC variants) Convolutional FEC
Demodulator Settings	Demodulator	DPSK 2,4,8,16 A/B
	Symbol rate (Bd)	31
	SR tolerance (Bd)	5
	Modulation order	4
	Version	A
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 96: QPSK31

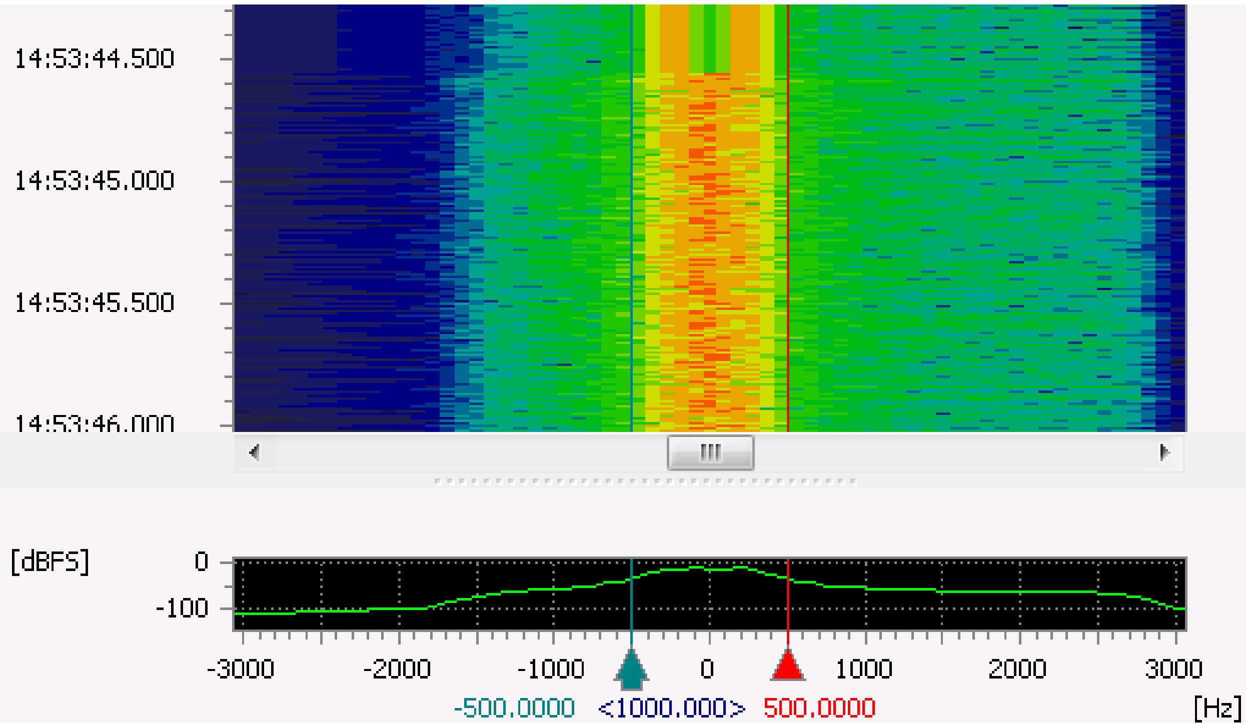


Figure 102: QPSK31 Spectrogram

1.97. Robust Packet Radio

General Information

Robust Packet Radio (RPR) is a more robust alternative to Packet Radio developed by SCS. It uses the same AX.25 protocol however with forward error correction capability and a more efficient 8-channel pulse shaped OFDM modulation. The channel modulation in ARQ mode is adaptive to the transmission conditions and may be DBPSK or DQPSK resulting in user data net rates of 200 bps or 600 bps.

Usage

- General data communication over HF
- HF-APRS (Position Tracking)

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Roubst Packet'

Mode Details

	Item	Value
Standard	Modulation	OFDM (PSK2 and DPSK4)
	Number of channels	8
	Channel Distance (Hz)	60
	Bandwidth (Hz)	500
	Symbol rate (Bd)	50
	Error correction	FEC
Demodulator Settings	Demodulator	Robust Packet
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 97: Robust Packet Radio

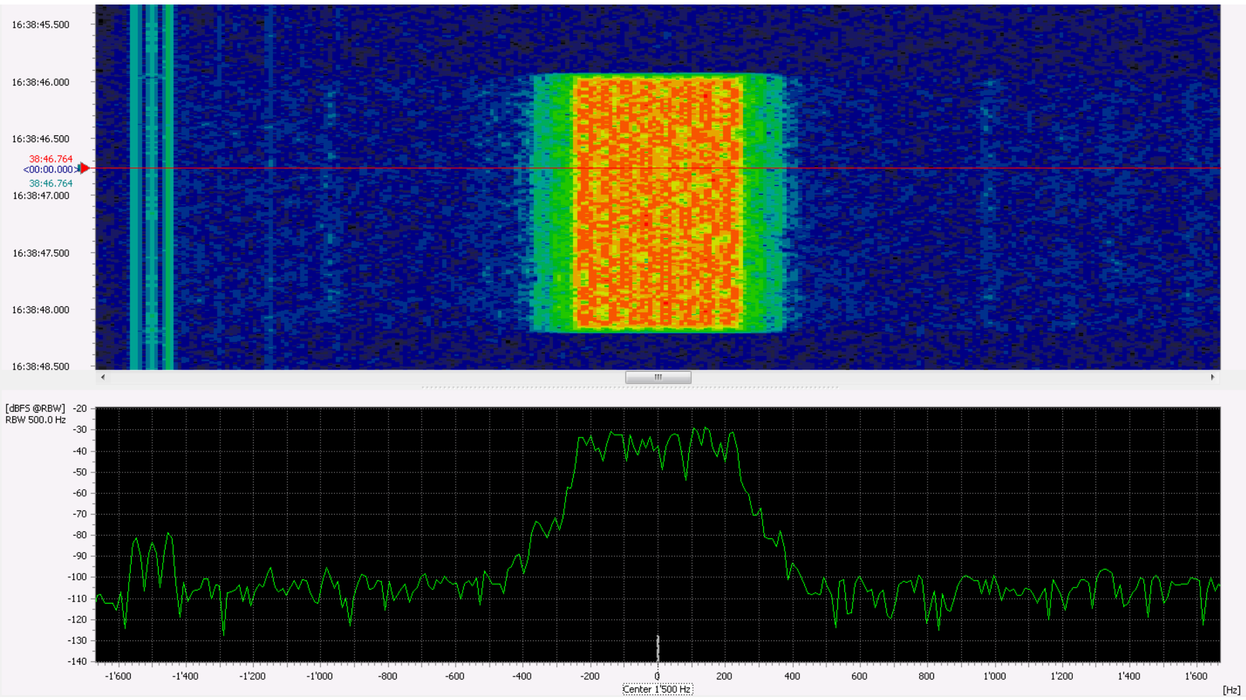


Figure 103: Robust Packet Radio Spectrogram

1.98. RUM-FEC

General Information

RUM-FEC is a duplex FEC system used by the Ministry of Foreign Affairs of Romania.

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	400
	Symbol rate (Bd)	164.5
	Error correction	Interleaving, FEC
	Alphabet	RUM-FEC
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	165
	SR tolerance (Bd)	5
	Shift (Hz)	400
	Shift tolerance (Hz)	20
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 98: RUM-FEC

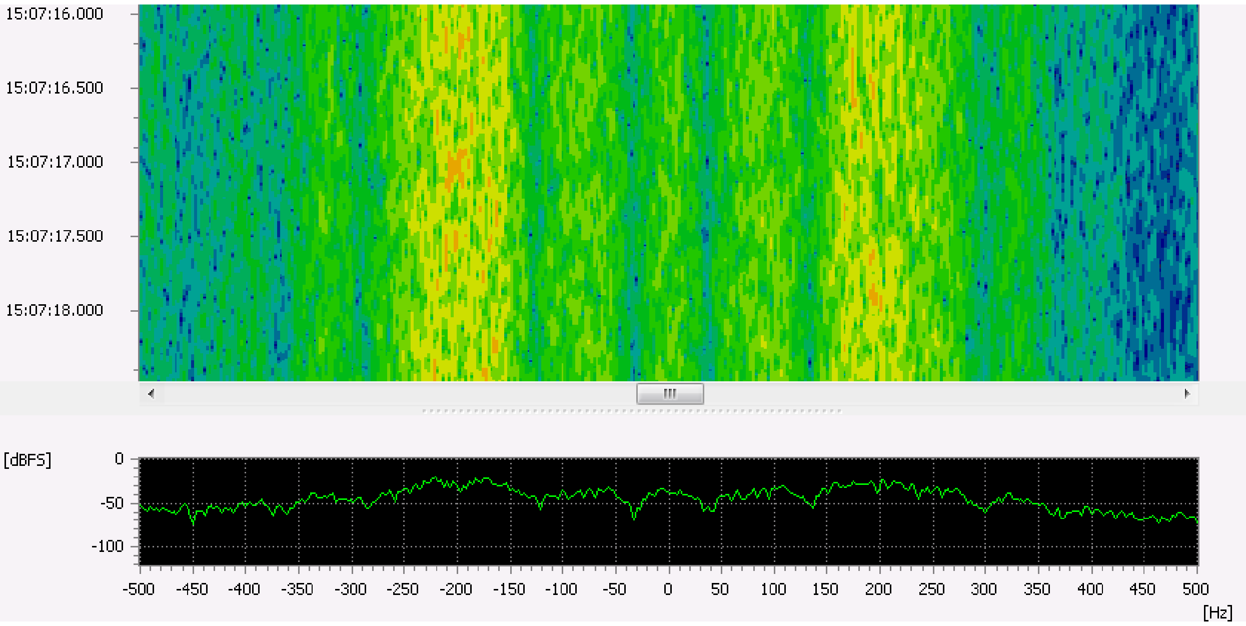


Figure 104: RUM-FEC Spectrogram

1.99. SI-ARQ

General Information

SI-ARQ is an ARQ mode similar to SITOR for the exchange of teletype-data over a radio channel in a robust way.

Usage

- Basic maritime data communication over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	170
	Bandwidth (Hz)	400 / 500
	Symbol rate (Bd)	96 / 192
	Error correction	ARQ
	Alphabet	ITA-2
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	96
	SR tolerance (Bd)	1
	Shift (Hz)	170
	Shift tolerance (Hz)	5
	Modem type	Synchronous
	Min. burst length (s)	0.217
	Max. burst length (s)	0.600
	Min. pause length (s)	0.061
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 99: SI-ARQ

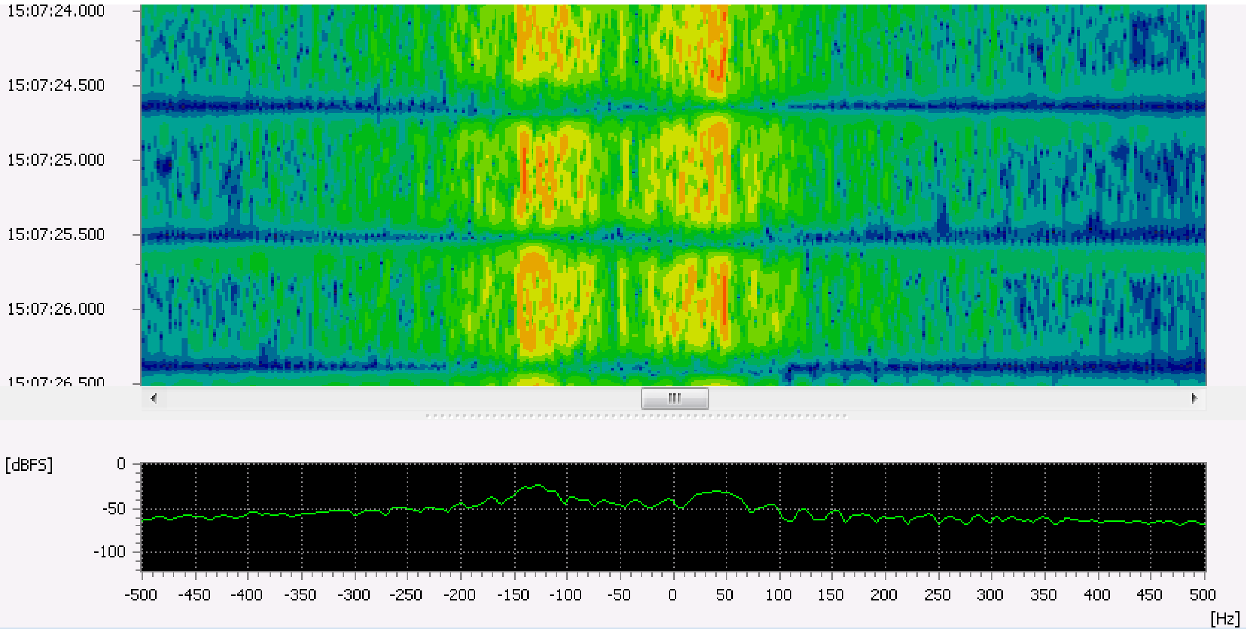


Figure 105: SI-ARQ Spectrogram

1.100. SI-FEC

General Information

SI-FEC is an FEC mode similar to SITOR for the exchange of teletype-data over a radio channel in a robust way.

Usage

- Basic maritime data communication over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	170
	Bandwidth (Hz)	400 / 500
	Symbol rate (Bd)	96 / 192
	Error correction	FEC
	Alphabet	ITA-2
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	96
	SR tolerance (Bd)	5
	Shift (Hz)	170
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 100: SI-FEC

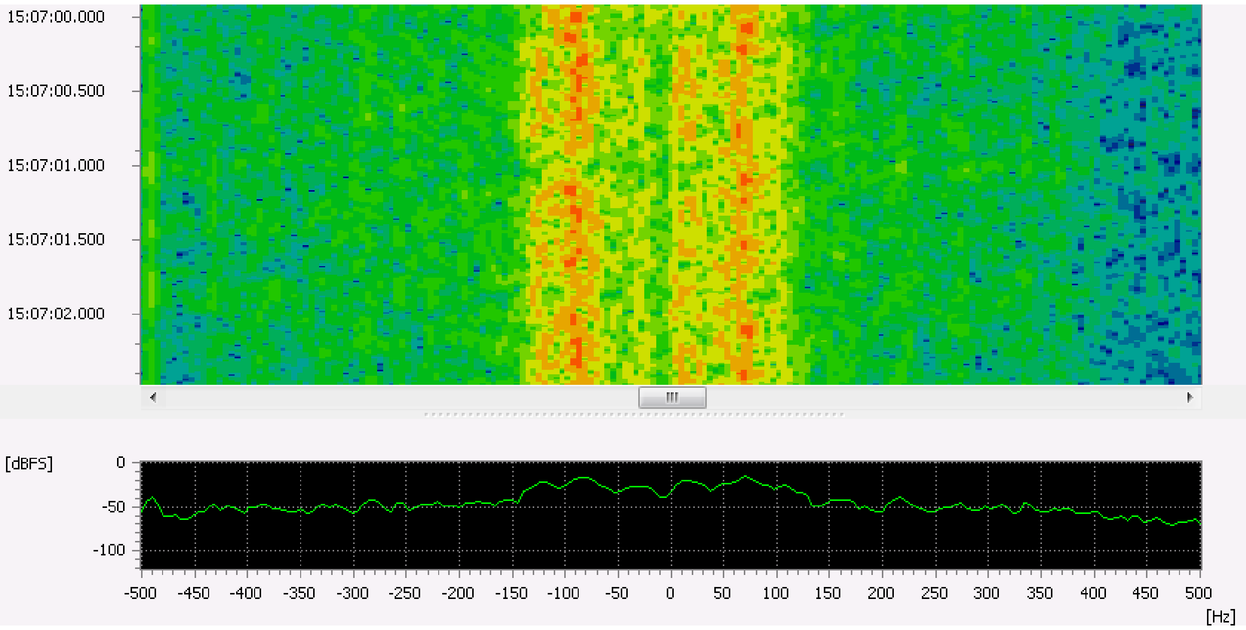


Figure 106: SI-FEC Spectrogram

1.101. SITOR-A

General Information

SIimplex **T**eletype **O**ver **R**adio (SITOR) is a mode for maritime communications to exchange teletype-data over a radio channel in a robust way.
SITOR-A is the ARQ variant.

Usage

- Basic maritime data communication over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	170
	Bandwidth (Hz)	350
	Symbol rate (Bd)	100
	Error correction	ARQ
	Alphabet	ITA-2
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	100
	SR tolerance (Bd)	5
	Shift (Hz)	170
	Shift tolerance (Hz)	10
	Modem type	Synchronous
	Min. burst length (s)	0.065
	Max. burst length (s)	0.290
	Min. pause length (s)	0.200
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 101: SITOR-A

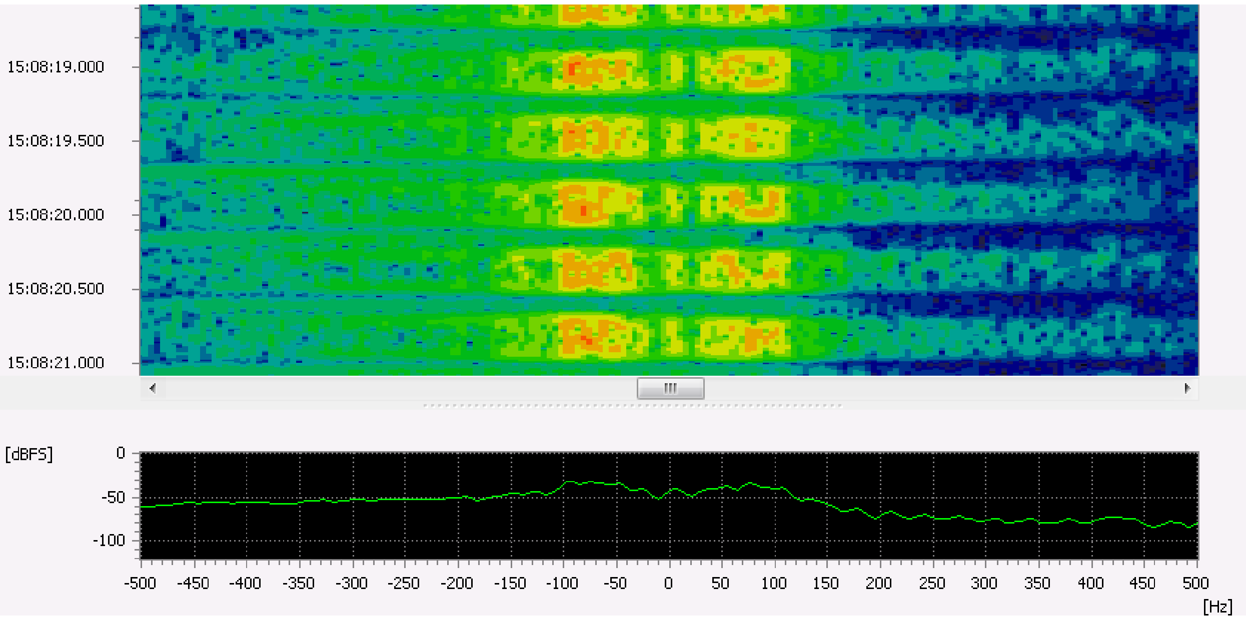


Figure 107: SITOR-A Spectrogram

1.102. SITOR-B

General Information

SImplex **T**eletype **O**ver **R**adio (SITOR) is a mode for maritime communications to exchange teletype-data over a radio channel in a robust way.
SITOR-B is the FEC variant.

Usage

- Basic maritime data communication over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	170 / 400
	Bandwidth (Hz)	350 / 800
	Symbol rate (Bd)	100
	Error correction	FEC
	Alphabet	ITA-2
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	100
	SR tolerance (Bd)	5
	Shift (Hz)	400
	Shift tolerance (Hz)	20
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 102: SITOR-B

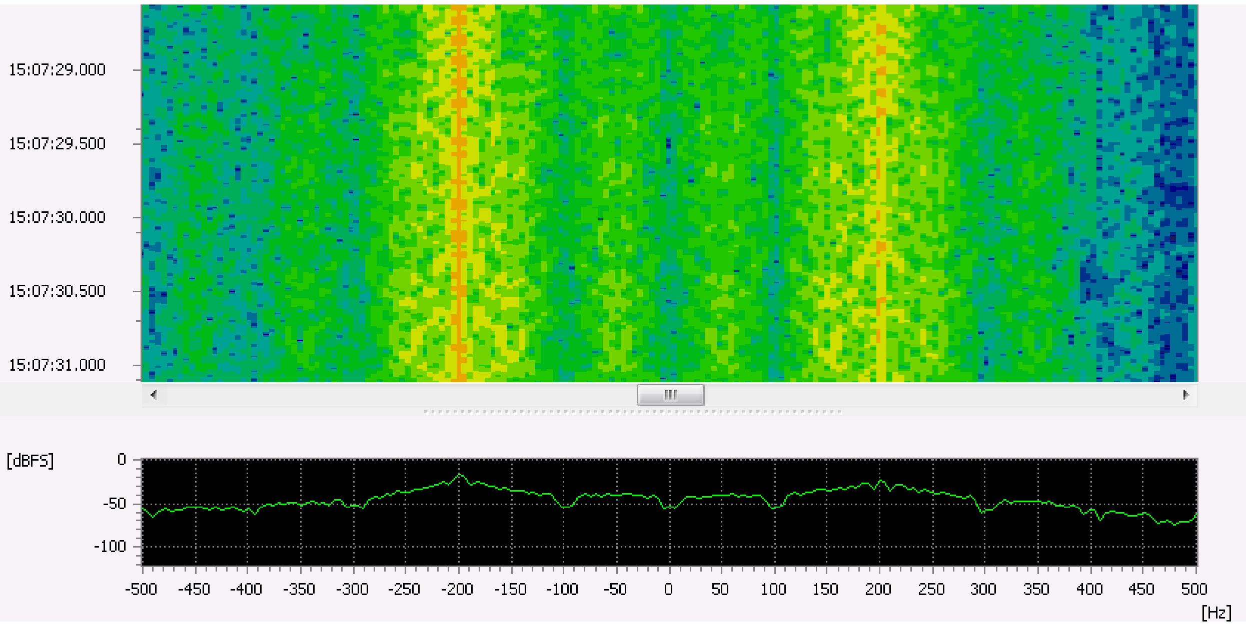


Figure 108: SITOR-B Spectrogram

1.103. SP14

General Information

This standard is a system with 14 tones where only 13 tones are used. The carrier is AM modulated with a secondary MFSK modulation for the data.
SP14 is equivalent to NUM-13.

Usage

- Transmission of numeric codes

Mode Details

	Item	Value
Standard	Modulation, primary, secondary	AM, MFSK
	Number of tones	14
	Tone length (ms)	133
	Tone spacing (Hz)	16
	Bandwidth (Hz)	210
	Symbol rate (Bd)	7.5
	Coding	Character coding
Demodulator Settings	Demodulator	Multitone (MFSK)
	Tone duration (ms)	133
	TD tolerance (ms)	5
	No. of tones	14
	Tone position type	Equidistant frequencies
	Tone distance (Hz)	16
Extras	Offset nominal frq. (Hz)	298
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 103: SP14

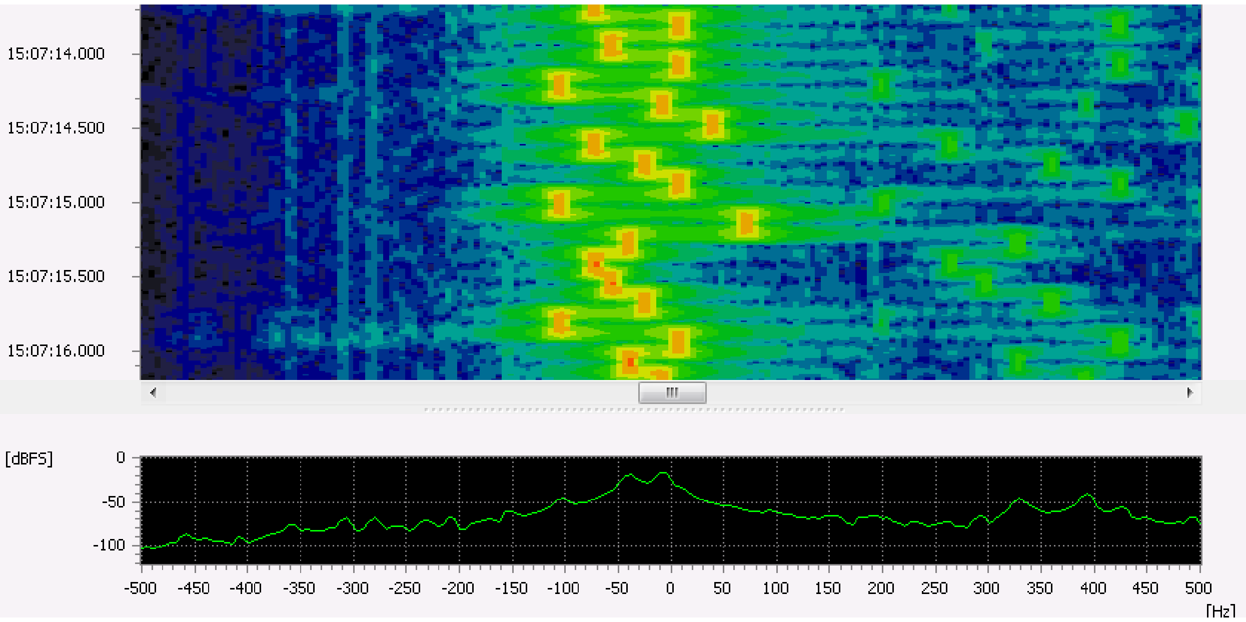


Figure 109: SP14 Spectrogram

1.104. SPREAD 51

General Information

SPREAD 51 is a synchronous FEC system which was used by the Ministry of Foreign Affairs in Romania.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	400
	Symbol rate (Bd)	102.7
	Error correction	10 Bit Bauer code, Interleaving
	Alphabet	ITA-2
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	102.7
	SR tolerance (Bd)	1
	Shift (Hz)	400
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 104: SPREAD 51

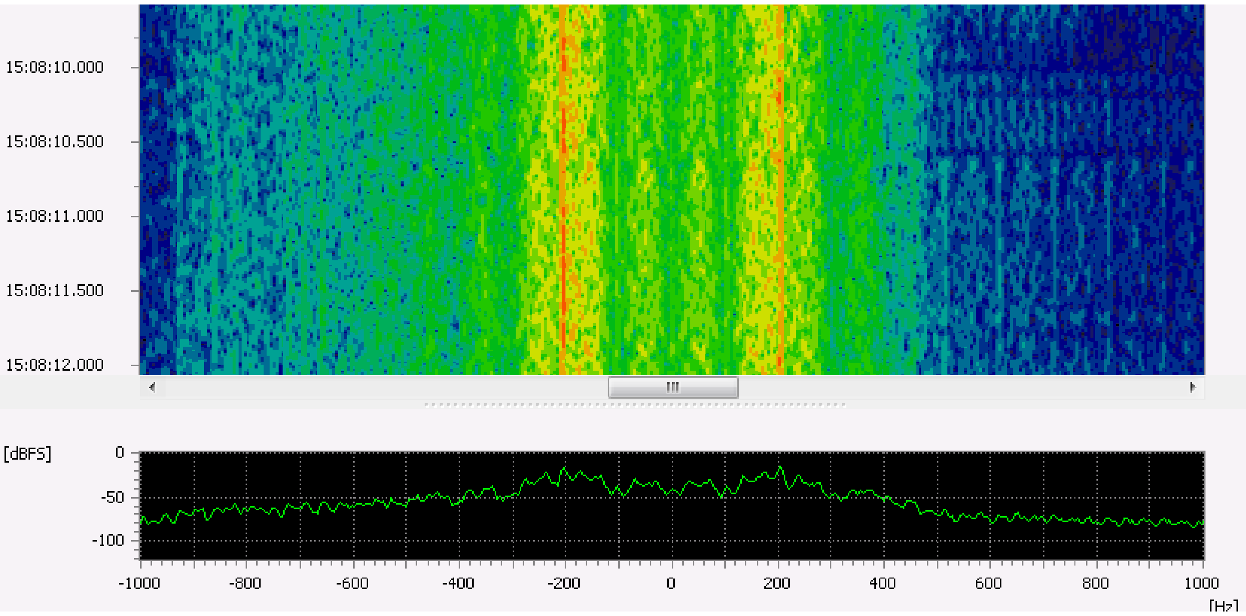


Figure 110: SPREAD 51 Spectrogram

1.105. SSTV

General Information

SSTV is an analog mode for transmitting small images over HF used by radio amateurs. There are several submodes with different scanline timings and color codings. These submodes are announced in a header called VIS (Vertical Interval Signaling).

Usage

- image transfer over HF

Mode Details

	Item	Value
Standard	Modulation	FM analog
	Shift (Hz)	800
Demodulator Settings	Demodulator	FSK 2,3,4 discr.
	Symbol rate (Bd)	8000
	SR tolerance (Bd)	0
	Modulation order	2
	Shift (Hz)	2000
	Shift tolerance (Hz)	0
	Modem type	Analog
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Autodetect VIS	yes
Tuning	The tuning frequency is the center of the signal.	

Table 105: SSTV

Supported submodes

- Martin M1-M4
- Scottie S1-S4/DX
- Robot 8/12 BW
- Robot 24/36/72 Color
- Wraase SC2 180

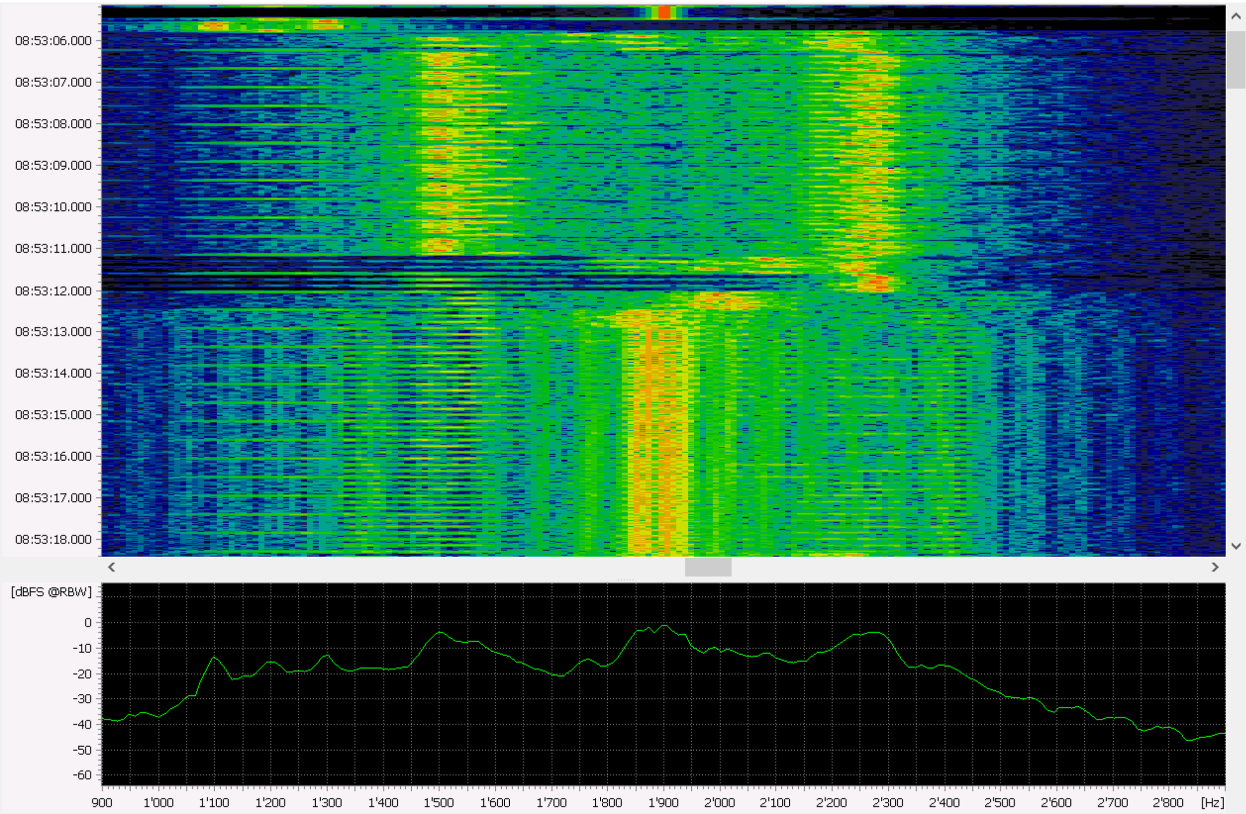


Figure 111: SSTV Spectrogram

1.106. SWED-ARQ

General Information

SWED-ARQ is an adaptive FSK system which was used for diplomatic communication with Swedish embassies. This system is no longer in operation.

Usage

- Transfer of textual information over HF

Restrictions

- This modem is not suitable for frequency range search and has to be used with a fixed nominal frequency

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	400
	Symbol rate (Bd)	100
	Alphabet	CCIR-476
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	100
	SR tolerance (Bd)	5
	Shift (Hz)	400
	Shift tolerance (Hz)	10
	Modem type	Synchronous
	Min. burst length (s)	0.065
	Max. burst length (s)	1.700
	Min. pause length (s)	0.200
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 106: SWED-ARQ

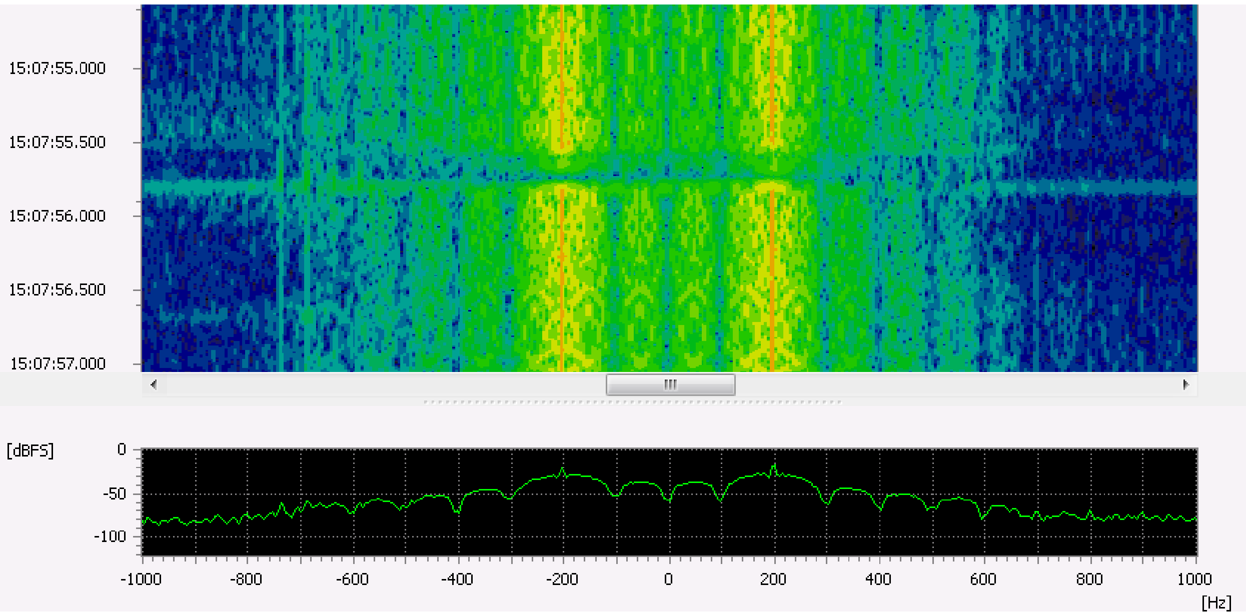


Figure 112: SWED-ARQ Spectrogram

1.107. THROB and THROBX

General Information

THROB is a digital radio protocol for amateur communications. The THROB and THROBX are multi-tone frequency shift keyed (MFSK) modes. For THROB, nine tones are used, spaced 8 or 16 Hz. For THROBX, 11 tones are used, spaced 7.8125 or 15.625 Hz. The THROB and THROBX was developed by Lionel G3PPT.

This modem is not suitable for the automatic detection in a large search list. False detection might occur due to the unspecific encoding.

Usage

- Amateur radio communications

Mode Details

	Item	Value
Standard	Modulation	Multitone (one or two tones simultaneously)
	Number of tones	9
	Tone spacing (Hz)	8 or 16
	Symbol rate (Bd)	1, 2 or 4
	Coding	THROB alphabet
Demodulator Settings	Demodulator	THROB/THROBX
	Throb Modus	THROB 1, 2, 4
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	no

Table 107: THROB

	Item	Value
Standard	Modulation	Multitone (two tones simultaneously)
	Number of tones	11
	Tone spacing (Hz)	8 or 16
	Symbol rate (Bd)	1, 2 or 4
	Coding	THROBX alphabet
Demodulator Settings	Demodulator	THROB/THROBX
	Throb Modus	THROBX 1, 2, 4
Features	Demodulation	yes
	Recognition	yes
	Decoding	Yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	no

Table 108: THROBX

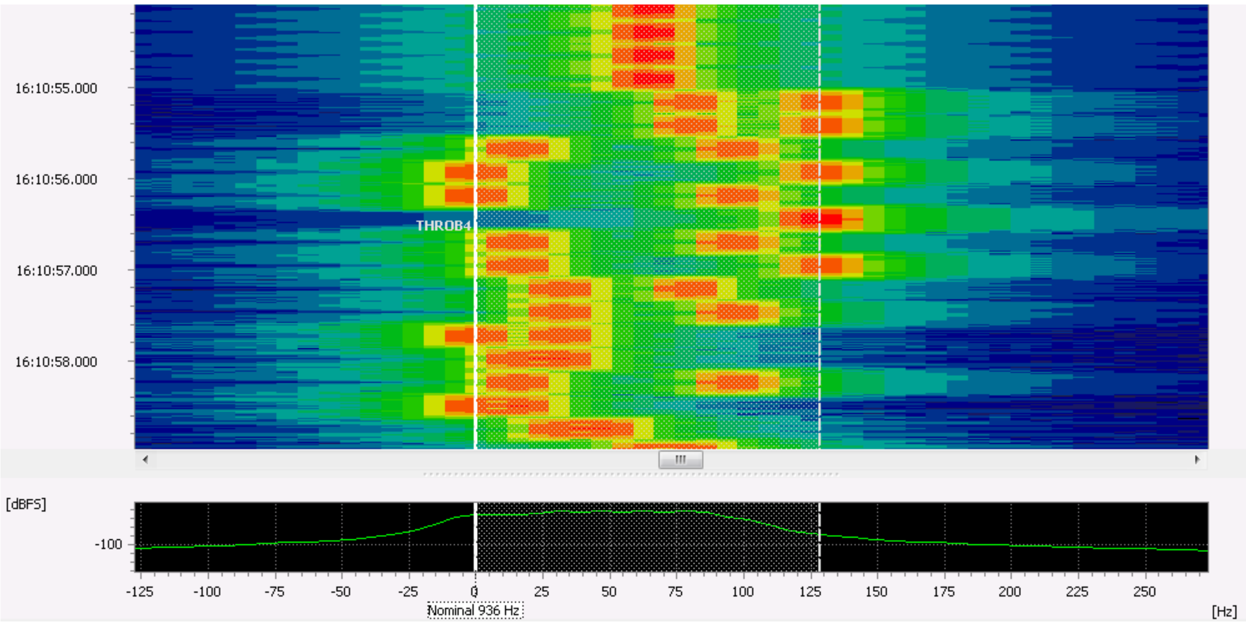


Figure 113: THROB Spectrogram

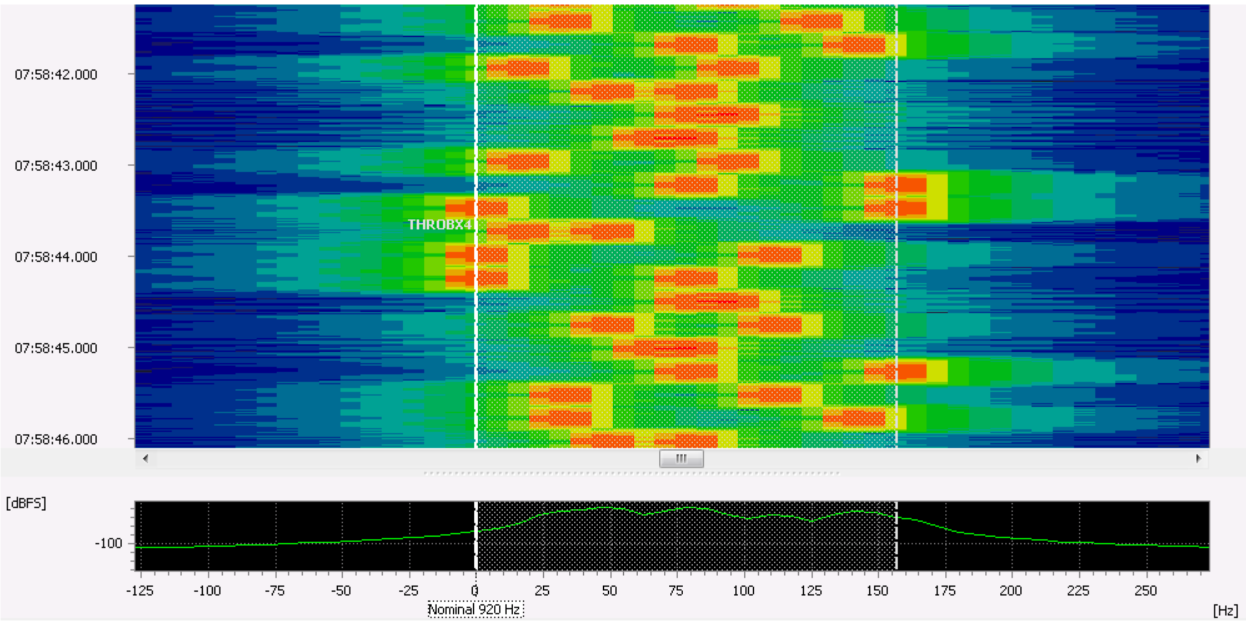


Figure 114: THROBX Spectrogram

1.108. TWINPLEX

General Information

TWINPLEX is a 2 channel frequency domain multiplex ARQ system for data communications.

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	4
	Symbol rate (Bd)	50
	Error correction	ARQ
	Alphabet	CCIR-476
Demodulator Settings	Demodulator	F7B/F7W
	Mode	Data (interleaved)
	Symbol rate (Bd)	100
	SR tolerance (Bd)	5
	Distance F1 <-> F2 (Hz)	115
	Distance F2 <-> F3 (Hz)	170
	Distance F3 <-> F4 (Hz)	515
	Shift tolerance (Hz)	20
	Min. burst length (s)	0.180
	Max. burst length (s)	0.250
	Min. pause length (s)	0.100
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 109: TWINPLEX

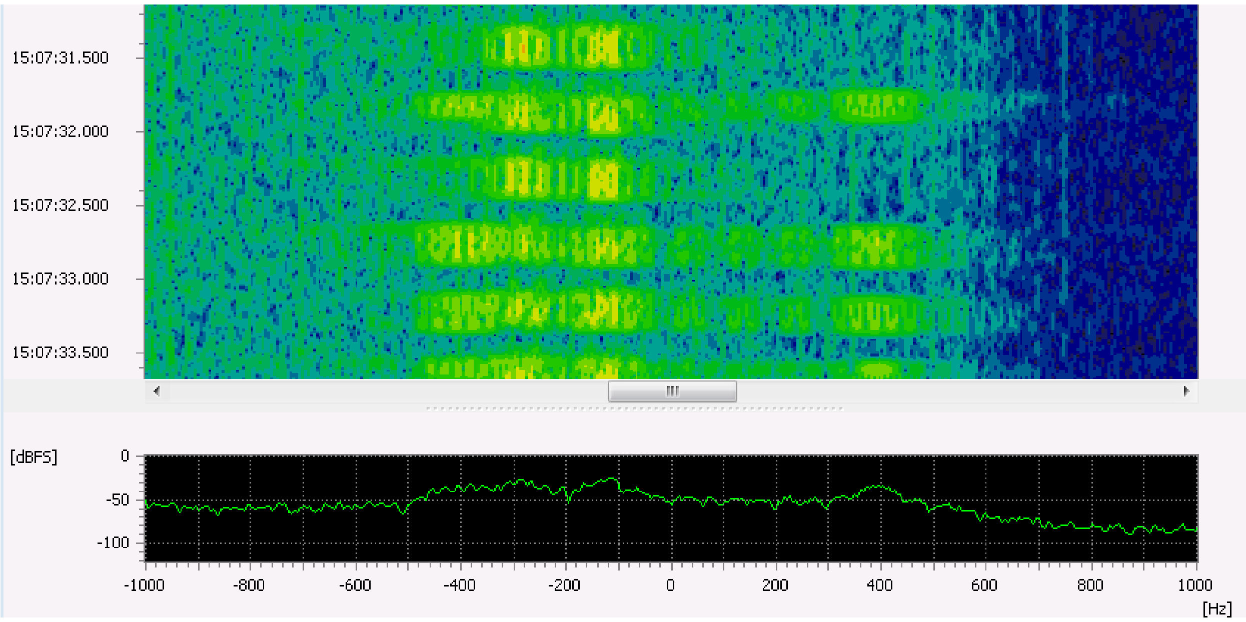


Figure 115: TWINPLEX Spectrogram

1.109. Visel

General Information

Visel is a synchronous teleprinter system used in former Yugoslavia.
It is unknown whether the system is still in use.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	300
	Symbol rate (Bd)	81.3 / 123.5 / 125
	Error correction	FEC
	Alphabet	ITA-2
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	120.9
	SR tolerance (Bd)	3
	Shift (Hz)	300
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 110: Visel

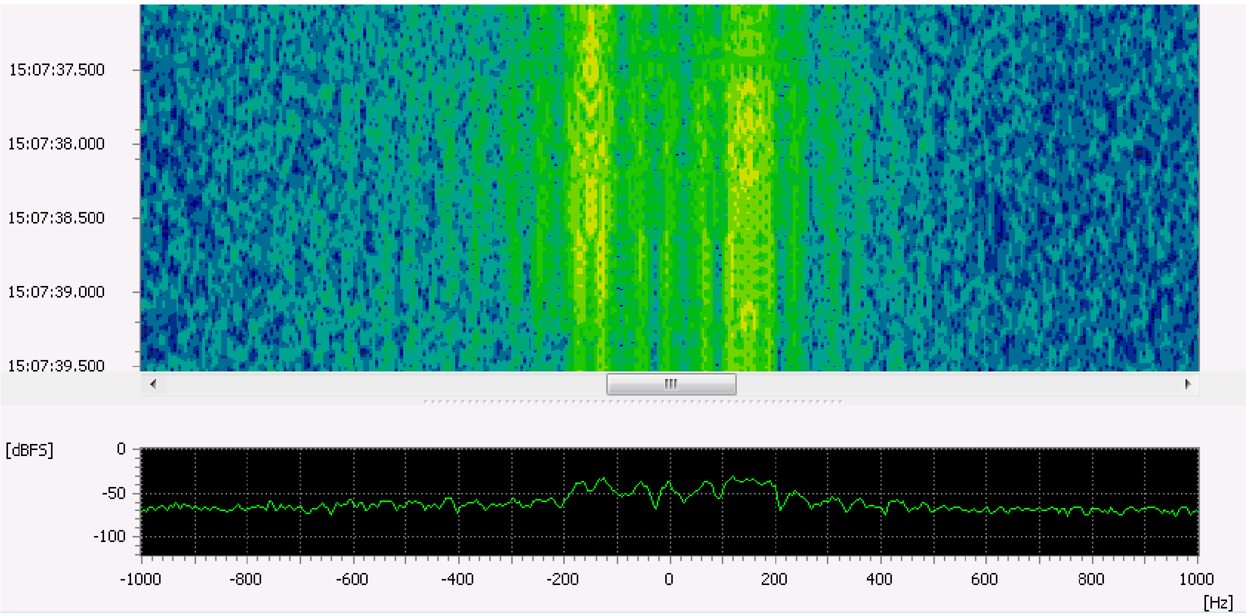


Figure 116: Visel Spectrogram

1.110. Voice J3E – SELCAL ICAO

General Information

International Civil Aviation Organization (ICAO) known as ANNEX10 is an aeronautical selective calling system was defined in 1985 consisting of 12 tones ("A" to "M", but without tone "I"). It was extended with additional tones for the characters "P", "Q", "R" and "S" in 1994 (ANNEX10) resulting in 16 tones.

The Aeronautical Radio, Inc. ARINC (ICAO Designator SelCal Registry) manages exclusively the allocation of selective call addresses. This modem will recognize and produce both Voice J3E USB and SELCAL ICAO.

Usage

- HF and V/UHF transmissions
- Civil aviation

Mode Details

	Item	Value
Standard	Modulation	Dual Tone / 2 of 16 tones simultaneously
	Number of tones	16
	Coding	Character coding
Demodulator Settings	Demodulator	Voice
	Voice Mode	J3E USB
	Audio in file	on
	SELCAL type	ICAO HF
	Sensitivity	middle
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 111: Voice J3E - SELCAL ICAO

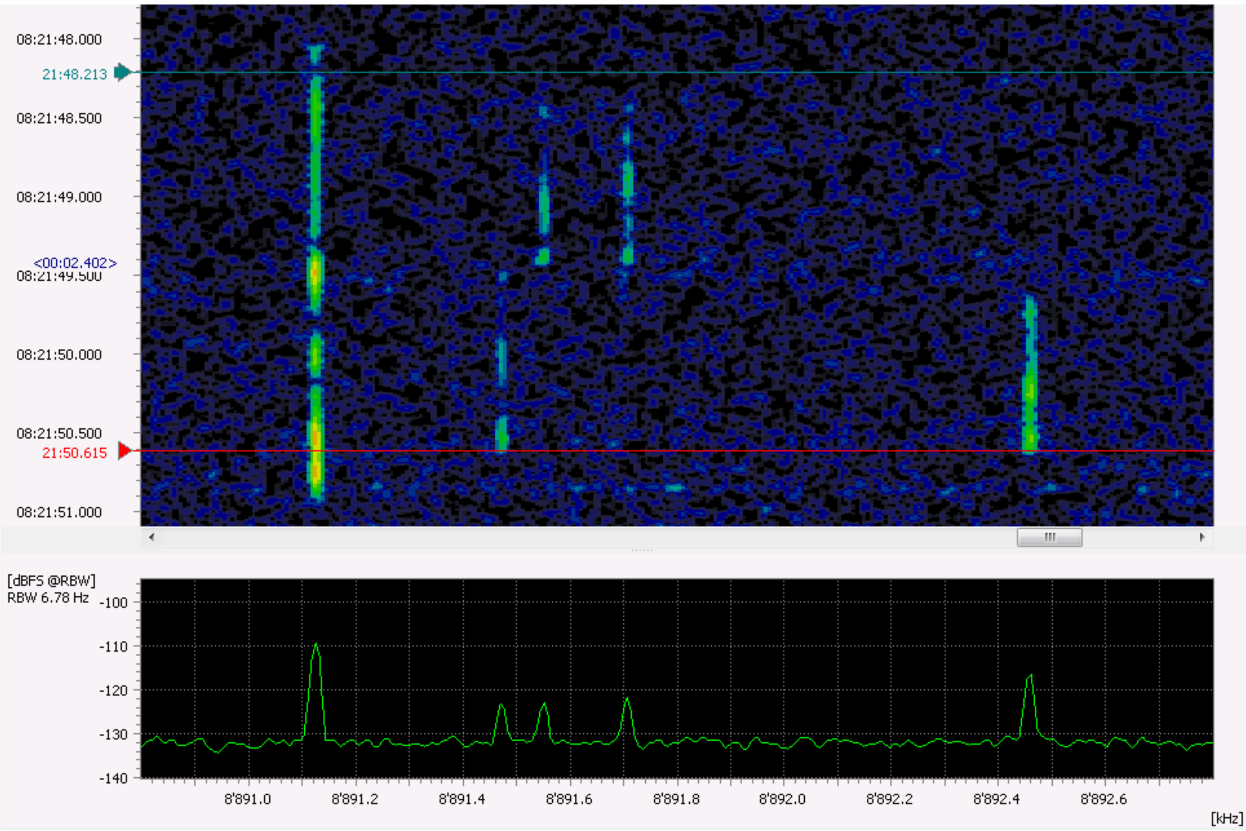


Figure 117: Voice J3E - SELCAL ICAO Spectrogram

1.111. X06 (Mazielka)

General Information

X06 is a selective call system, most oft followed by a CIS-36 signal. A group of 6 MFSK-6-tones will be repeated a couple of times. SelCal and message might be sent on different frequencies.

Usage

- Selective call / wake-up / alert signal used by Russian diplomatic services

Mode Details

	Item	Value
Standard	Modulation	MFSK
	Number of tones	6
	Tone spacing (Hz)	30 to 41 Hz
	Symbol rate (Bd)	3.0
	Burst length	6 tones = 2.0 s
	Burst Pause	1.3 s
Demodulator Settings	Demodulator	Multitone (MFSK)
	Tone duration (ms)	333
	TD tolerance (ms)	10
	No. of tones	6
	Tone position type	Frequency table
	Frequency table (Hz)	0
		30.04 Hz
		62.63 Hz
		97.74 Hz
		135.67 Hz
		176.98 Hz
	Min burst length	1.800 s
	Max burst length	2.400 s
	Min pause length	1.000 s
Extras	Offset nominal frq. (Hz)	840

	Item	Value
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 112: X06 (Mazielka)

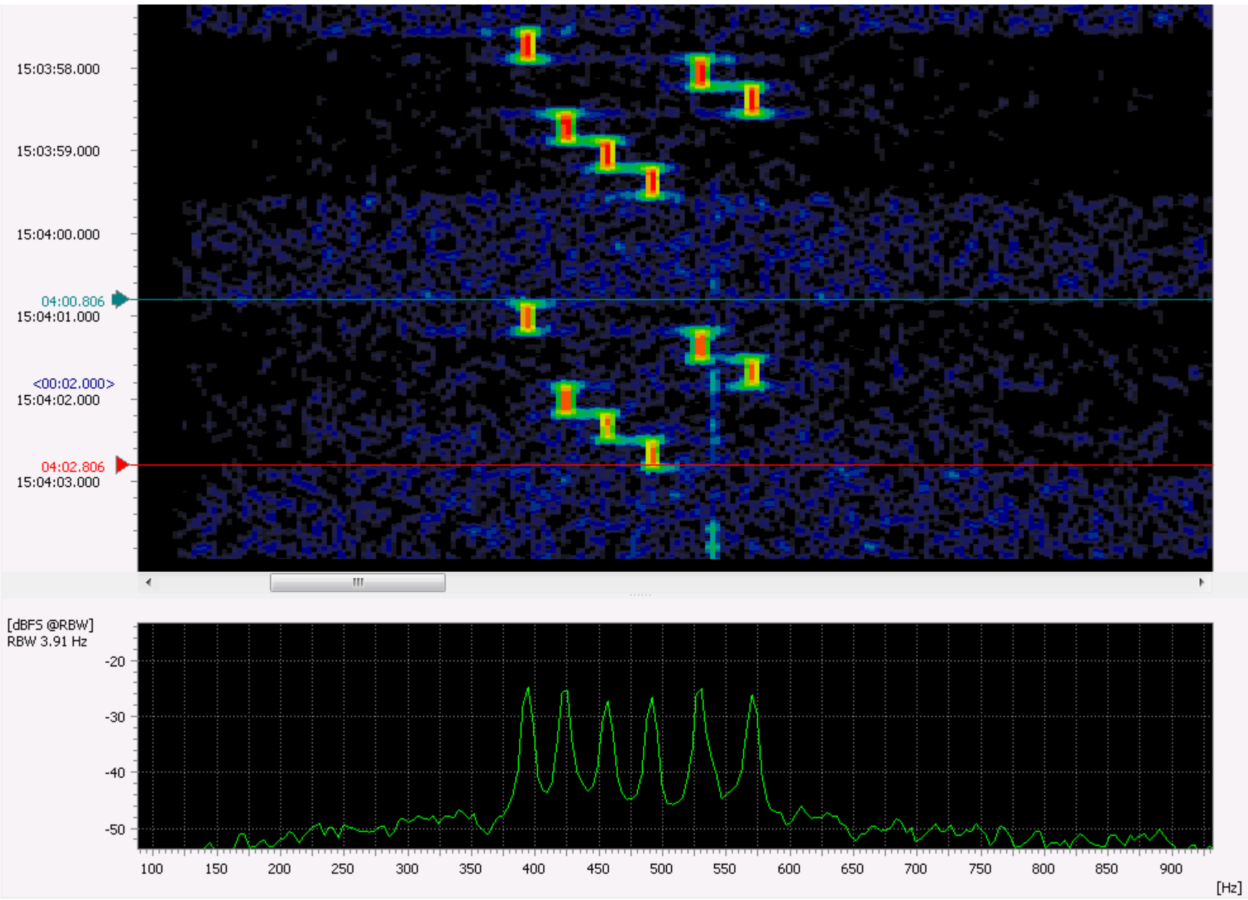


Figure 118: X06 (Mazielka) Spectrogram

1.112. XPA

General Information

XPA (aka CIS-MFSK-20/CIS-MFSK-17) is a 20 tone-MFSK signal. However, three tones are unused (2, 4 and 19). The signal can be put in the category of numbers station signals.

Every XPA signal begins with an idle sequence, followed by a changeable preamble and sync sequence depending on wether the signal contains information or a null message. Information is transmitted via 5-tone-groups, each separated by a lower "separation" tone. After 64 groups, there's an additional sync sequence in between traffic tones.

Usage

- XPA is believed to be used by Russian diplomatic services. Meaning of ciphers are unknown.

Restrictions

- This modem is not suitable for frequency range search and has to be used with a fixed nominal frequency

Mode Details

	Item	Value
Standard	Modulation	MFSK
	Number of tones	20
	Tone spacing (Hz)	40
	Symbol rate (Bd)	10
Demodulator Settings	Demodulator	Multitone (MFSK)
	Tone duration (ms)	100
	TD tolerance (ms)	0.5
	No. of tones	20
	Tone position type	Equidistant frequencies
	Tone distance (Hz)	40
Extras	Offset nominal frq. (Hz)	520
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 113: XPA

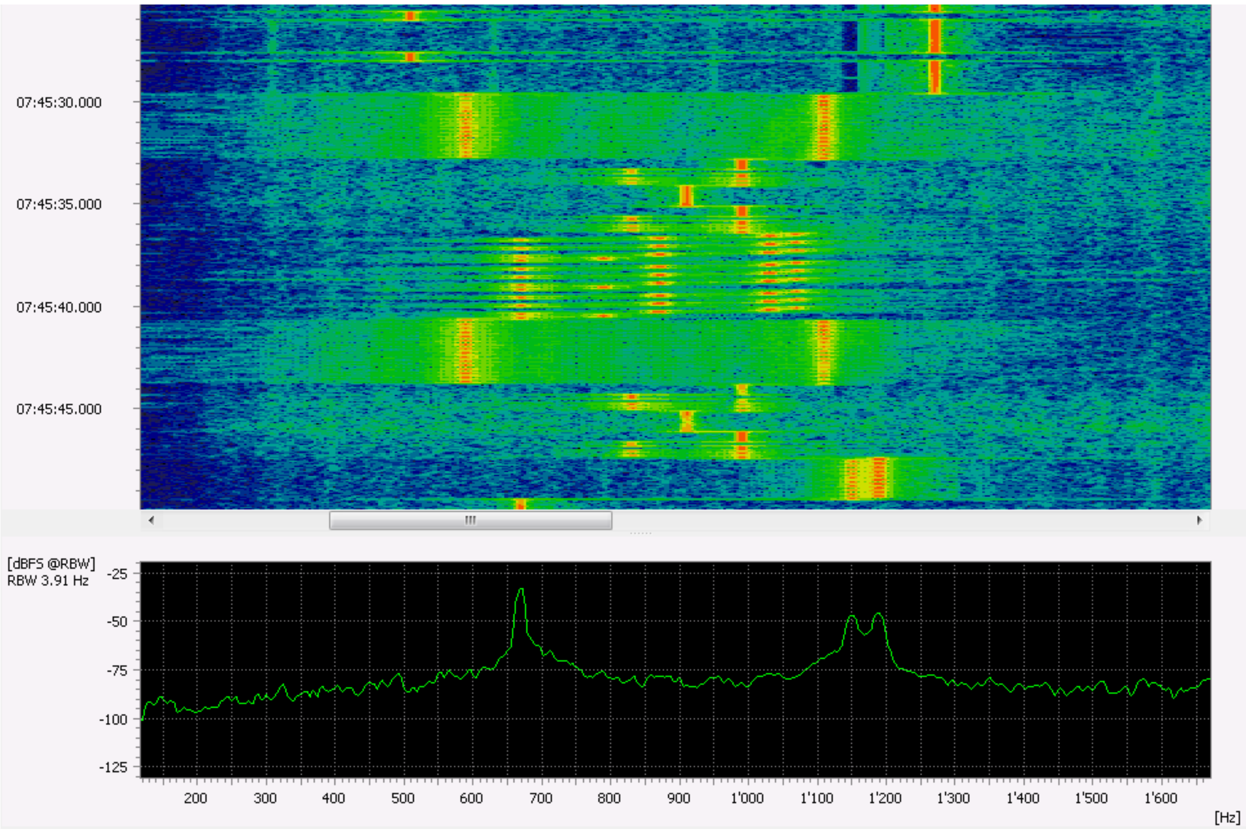


Figure 119: XPA spectrogram of preamble sequence

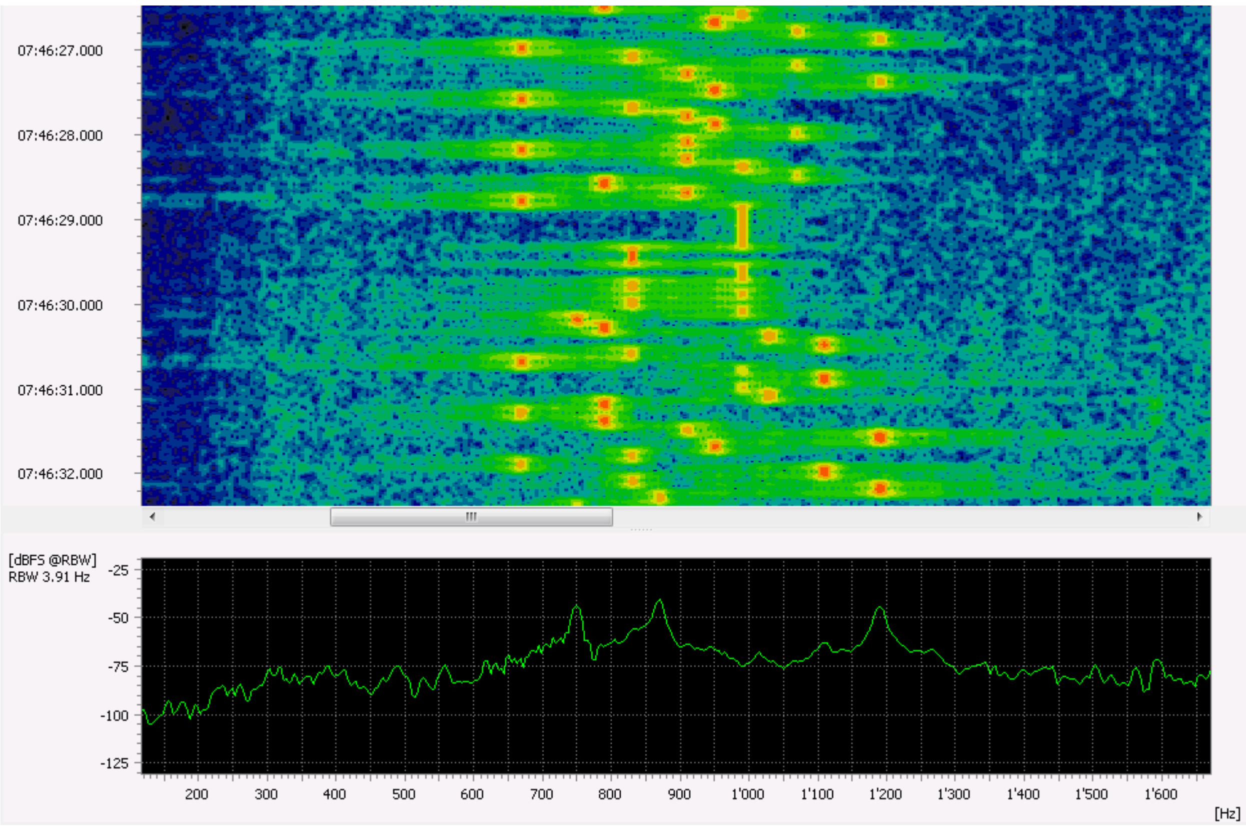


Figure 120: XPA spectrogram of traffic tones with intermediate sync sequence after 64 tones

1.113. XPA2

General Information

XPA2 (aka CIS-MFSK-16/CIS-MFSK-14) is a 16 tone-MFSK signal. However, two tones are unused (2 and 5). The signal can be put in the category of numbers station signals. Every XPA2 signal begins with an idle sequence of up to two minutes length, followed by an unchangeable sync sequence right before the traffic sequence. Data transmission always ends with an "end-of-message" sequence. Information is transmitted via 5-tone-groups, each separated by a lower "separation" tone. Every traffic tone (tones 7-16) represents a cipher ranging from 0-9 with an additional "repeat previous" tone located one tone-spacing frequency beneath the tone representing cipher zero.

Usage

- XPA2 is believed to be used by Russian diplomatic services. Meaning of ciphers are unknown.

Restrictions

- This modem is not suitable for frequency range search and has to be used with a fixed nominal frequency

Mode Details

	Item	Value
Standard	Modulation	MFSK
	Number of tones	16
	Tone spacing (Hz)	15.625
	Symbol rate (Bd)	7.8
Demodulator Settings	Demodulator	Multitone (MFSK)
	Tone duration (ms)	128
	TD tolerance (ms)	0.5
	No. of tones	16
	Tone position type	Equidistant frequencies
	Tone distance (Hz)	15.625
Extras	Offset nominal frq. (Hz)	1000
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 114: XPA2

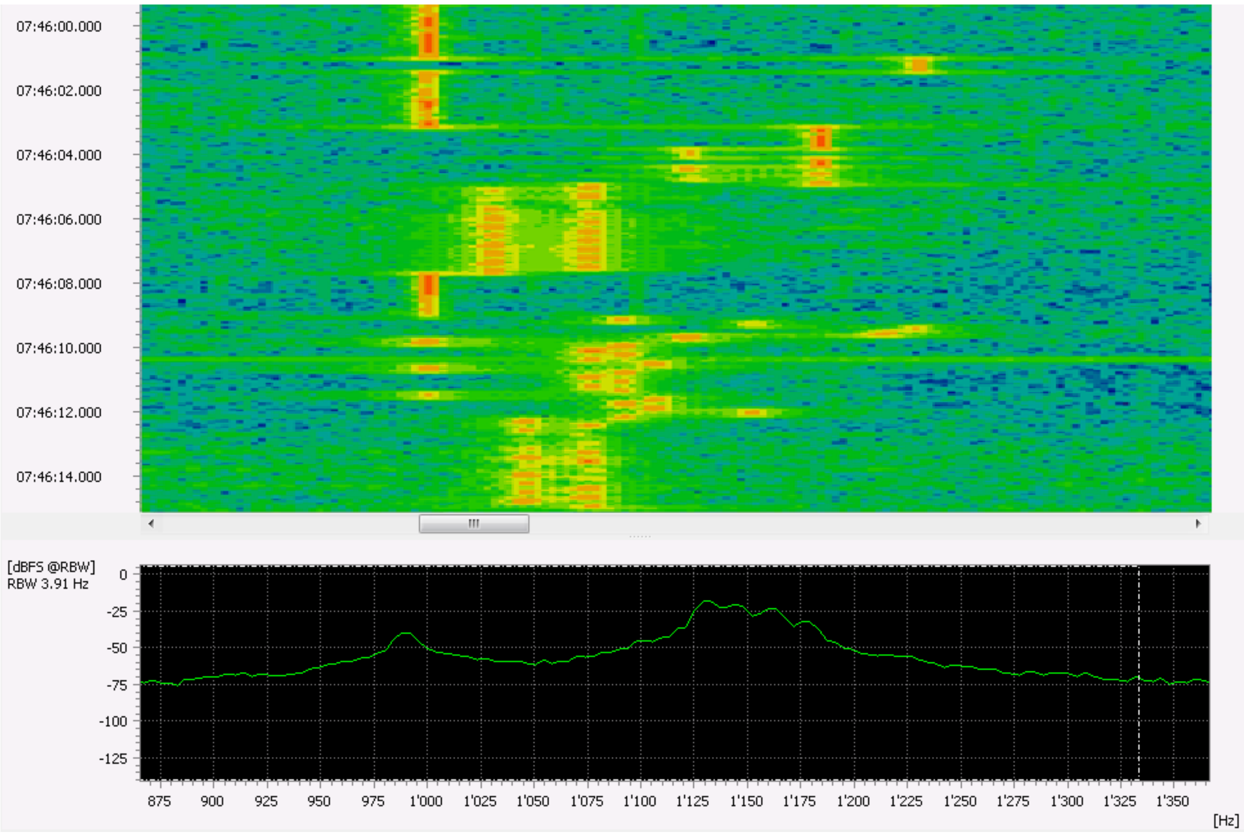


Figure 121: XPA2 Spectrogram with all sequences: idle, sync, traffic, end-of-message

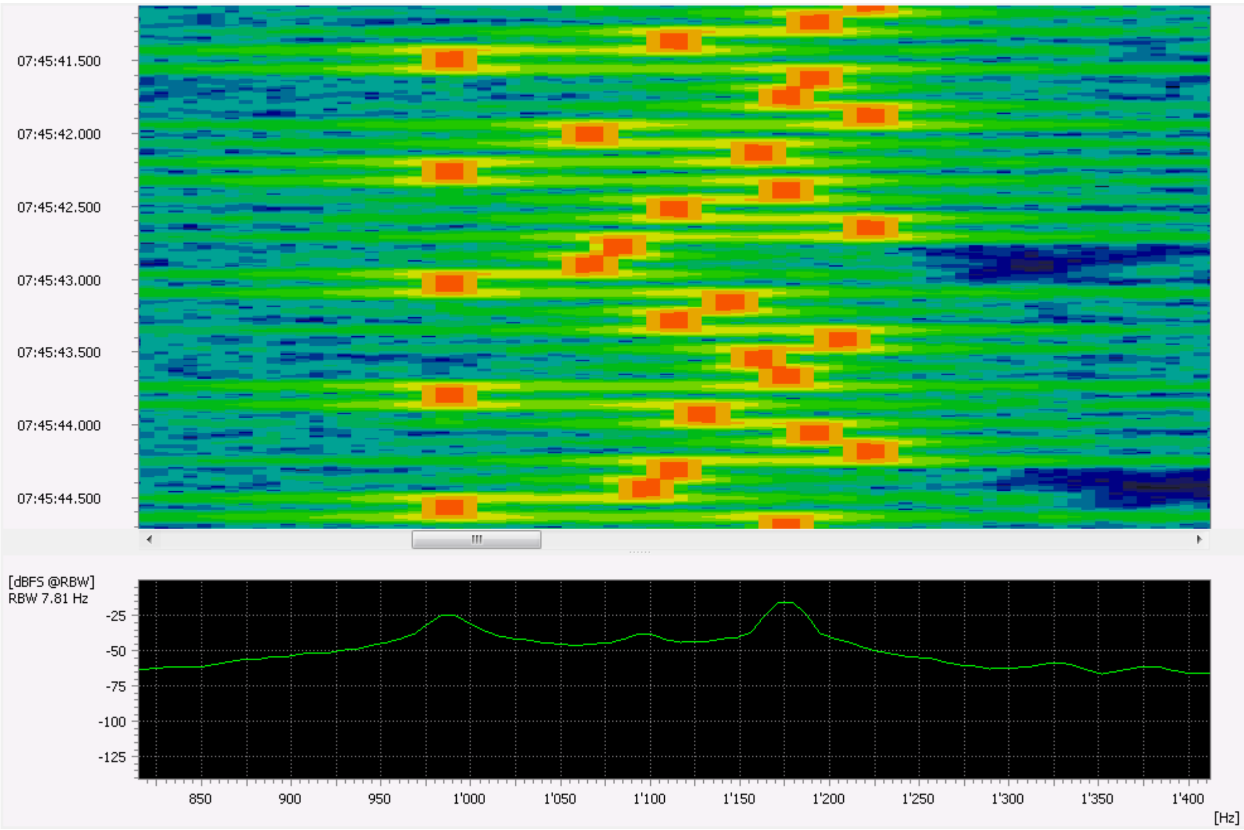


Figure 122: XPA2 Spectrogram of traffic tones only (with separation tone every 6th tone)

2. Standard Decoders VHF/UHF

Note: For every decoder any operation limitations should be listed. If any submode of a decoder is not mentioned explicitly then it is not supported.

2.1. General

Many decoders in the VHF/UHF frequency range make use of an AM or FM primary modulation. This is automatically taken into account. However, if your narrow band receiver has an audio or FSK discriminator output then you should use the modem files with the suffix "sub" (only supplied with go2DECODE). Primary demodulation is disabled there and these are suitable for baseband demodulation. Such signals will normally be used only in a signal analyst environment and cannot appear in a real-world system. For real-world signals use the modem versions without the suffix "sub".

2.2. ACARS VHF

General Information

Aircraft Communication Addressing and Reporting System (ACARS) is a digital data link system for exchange of small messages between aircraft and ground stations.

Usage

- Aeronautical communication over VHF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'ACARS'

Mode Details

	Item	Value
Standard	Modulation: primary secondary	DSB-AM MSK
	Shift (Hz)	1200
	Bandwidth (kHz)	25
	Symbol rate (Bd)	2400
	Error correction	CRC
Demodulator Settings	Demodulator	G (MSK)
	Type	MSK
	Symbol rate (Bd)	2400
	SR tolerance (Bd)	2.000
	BT	1.0
	Min. burst length (s)	0.050
	Max. burst length (s)	2.000
	Min. pause length (s)	0.010
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes
FANS Protocols	CPDLC, ADS-C	

	Item	Value
Frequencies (MHz)	129.125 USA & Canada 130.025 USA and Canada 130.425 USA 130.450 USA & Canada 131.125 USA 131.450 Primary channel for Japan 131.475 Air Canada company channel 131.525 Secondary Europe 131.550 Primary Channel worldwide 131.725 Primary channel in Europe 131.850 New Europa 136.700 Additional channel for USA 136.750 Additional channel for USA 136.750 New Europe 136.800 Additional channel for USA 136.850 SITA North American Frequency 136.900 Secondary Europe	

Table 115: ACARS VHF

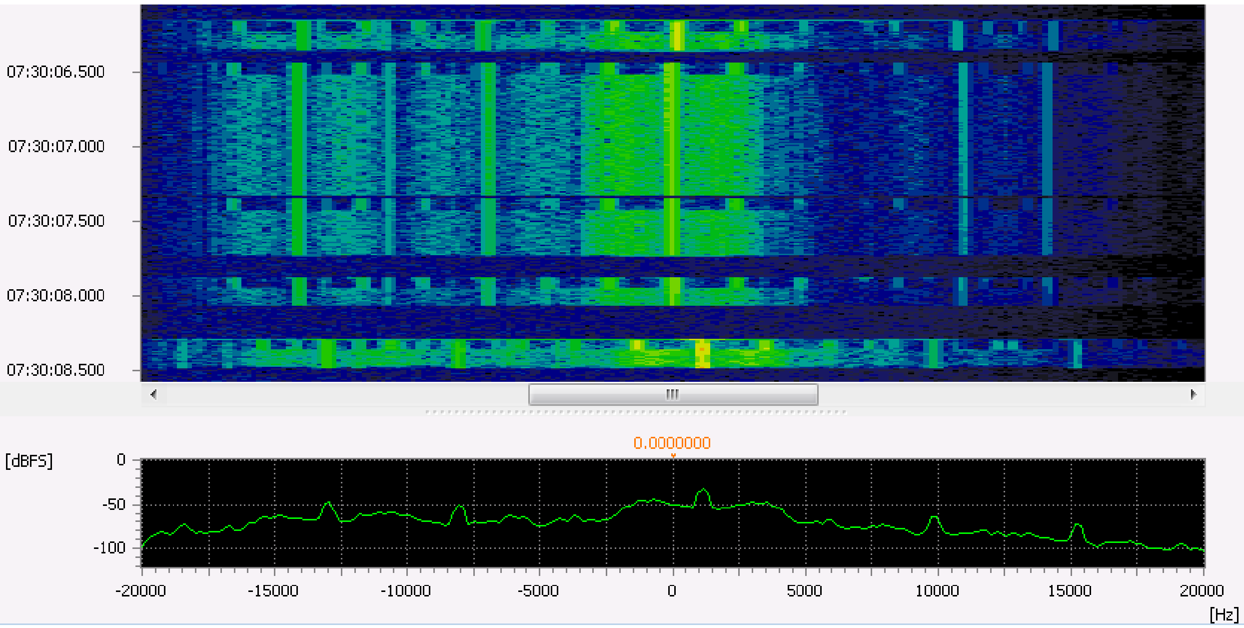


Figure 123: ACARS VHF Spectrogram

2.3. AIS

General Information

The universal ship borne Automatic Identification System (AIS) was created for efficient exchange of navigational data among ships and between ships and stations ashore to improve safety of navigation.

Usage

- Worldwide radio system for ship collision avoidance and navigational advice

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'AIS'

Mode Details

	Item	Value
Standard	Modulation: primary secondary	FM GMS
	BT product 12.5 kHz / 25 kHz	0.3 or 0.5 / max 0.5
	Symbol rate (Bd)	9600
	Error correction	NRZI and CRC
Demodulator Settings	Demodulator	G (MSK)
	Type	GMSK
	Symbol rate (Bd)	9600
	SR tolerance (Bd)	20.000
	BT	0.40
	Min. burst length (s)	0.040
	Max. burst length (s)	0.080
	Min. pause length (s)	0.440
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes
Frequencies	161.975 MHz 162.025 MHz	

Table 116: AIS

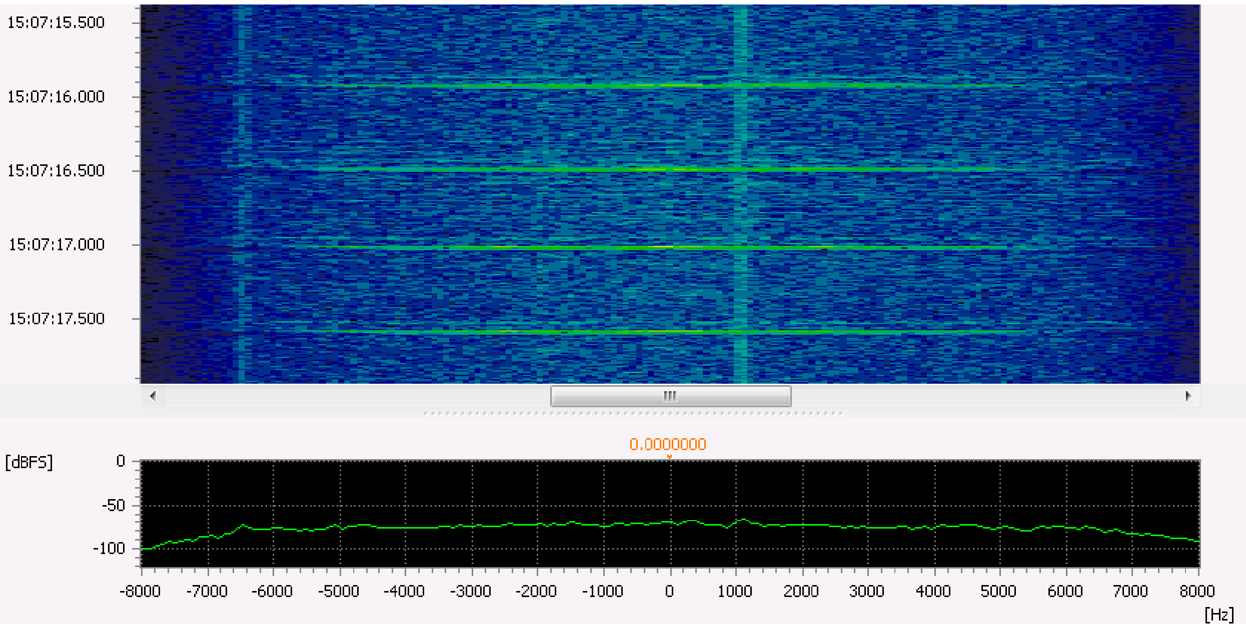


Figure 124: AIS Spectrogram

2.4. ATIS

General Information

Automatic Transmitter Identification System (ATIS) is used for identifying a ship or vessel that made a radio transmission. An identity tag is transmitted immediately after the actual transmission ends.

Usage

- Identification of radio transmitters

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'ATIS'

Mode Details

	Item	Value
Standard	Modulation: primary secondary	FM FSK
	Number of tones	2
	Shift (Hz)	800
	Symbol rate (Baud)	1200
Demodulator Settings	Demodulator	FSK 2,3,4 discr.
	Symbol rate (Bd)	1200
	SR tolerance (Bd)	10
	Modulation order	2
	Shift (Hz)	800
	Shift tolerance (Hz)	20
	Modem type	Synchronous
Features	Recognition	yes
	Demodulation	yes
	Decoding	yes
	Combination with other modems (modem list)	yes

Table 117: ATIS

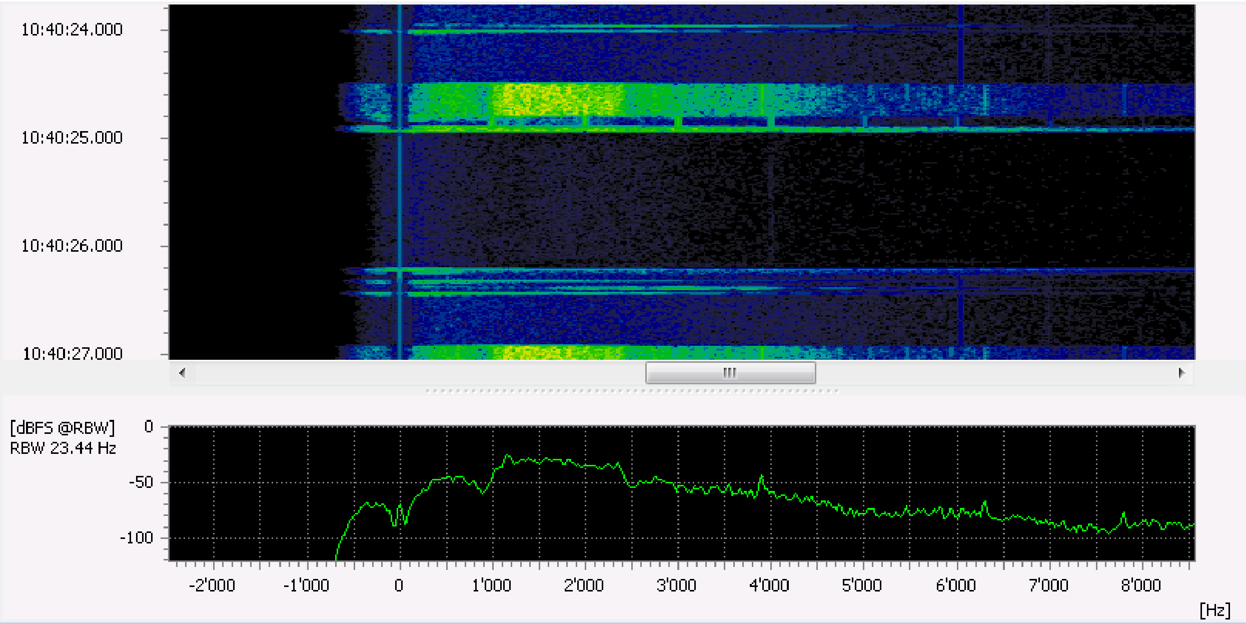


Figure 125: ATIS Spectrogram

2.5. Autocab

General Information

Autocab is Digital Dispatch System (DDS) for taxis. These use GMSK modulation with FM Primary modulation.

Usage

- VHF communications

Mode Details

	Item	Value
Standard	Demodulator	GMSK
	Symbol rate (Bd)	1200
	SR tolerance (Bd)	5
Demodulator Settings	Demodulator	GMSK
	Symbol rate (Bd)	1200
	SR tolerance (Bd)	5
	Min. burst length (s)	0.100
	Max. burst length (s)	99.000
	Min. pause length (s)	0.010
Extras	Primary demodulator	USB
	Offset nominal frq. (Hz)	1500
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	

Table 118: setting for Autocab baseband signal

	Item	Value
Standard	Demodulator	GMSK
	Symbol rate (Bd)	1200
	SR tolerance (Bd)	5

	Item	Value
Demodulator Settings	Demodulator	GMSK
	Symbol rate (Bd)	1200
	SR tolerance (Bd)	5
	Min. burst length (s)	0.100
	Max. burst length (s)	99.000
	Min. pause length (s)	0.010
Extras	Primary demodulator	FM
	FM bandwith (Hz)	12000
	Offset nominal frq. (Hz)	1500
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	

Table 119: setting for Autocab with FM Primary modulation

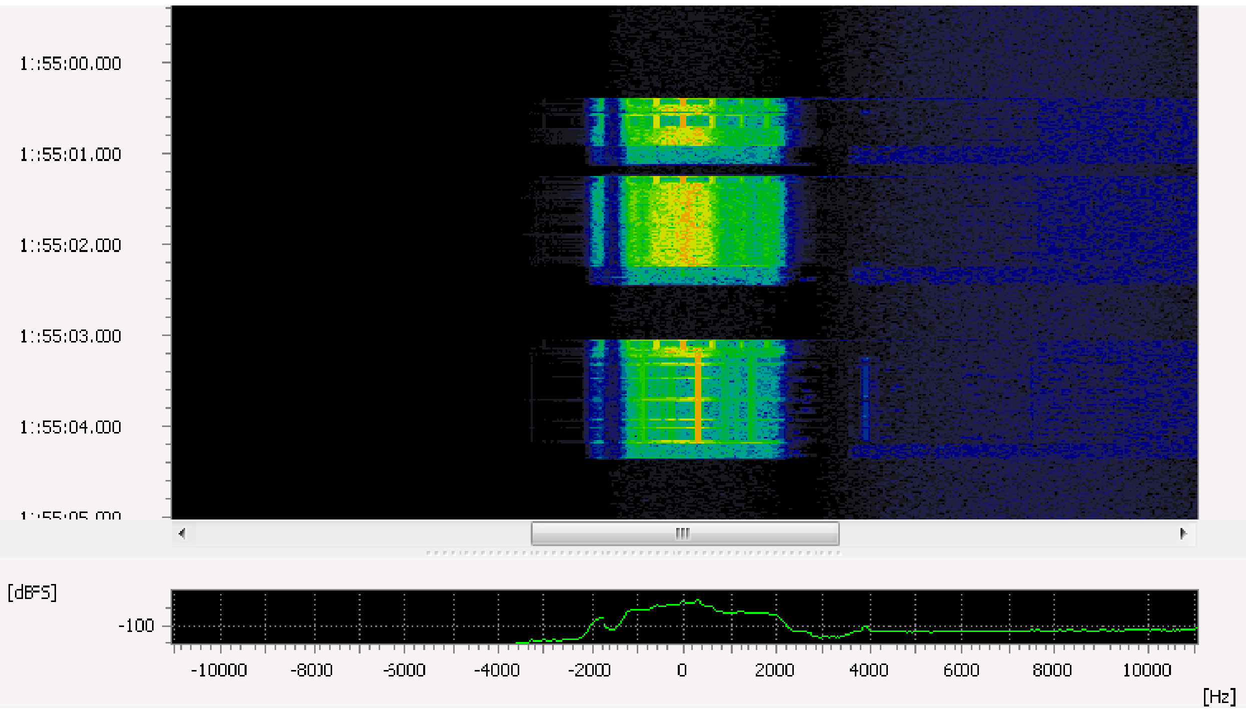


Figure 126: Autocab Spectrogram

2.6. BIIS

General Information

Binary **I**nterchange of **I**nformation and **S**ignalling (BIIS) provides digital signalling and data transmission, mainly to supplement private analog land mobile radio systems. The functionality comprises digital addressing and identification, short and long user messages, control and status messages to handle calls, networks, gateways etc. The standard is described by ETSI in ETS 300230.

Usage

- BIIS is typically used as a SelCall mode by mobile radios in VHF (136-174 MHz) and UHF (400-470 MHz)

Mode Details

	Item	Value
Standard	Modulation: primary secondary	FM MSK
	Symbol rate (Bd)	1200
	Error correction	64 bit codewords including 16 bit CRC
Demodulator Settings	Demodulator	(G)MSK
	Type	MSK
	Symbol rate (Bd)	1200
	SR tolerance (Bd)	5.000
	Min. burst length (s)	0.060
	Max. burst length (s)	1.000
	Min. pause length (s)	0.060
	Offset nominal frequency (Hz)	1500
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Sideband	yes (FM)
	Combination with other modems (modem list)	yes
Frequencies	136-174 MHz 400-470 MHz	

Table 120: BIIS

Evaluated message functions

Message function	Alphanumeric	Hexadecimal
Addressing (short)	X	
External addressing	X	
Telephone Call	X	
Short Data	X	
Al Others		X

Table 121: BIIS message functions

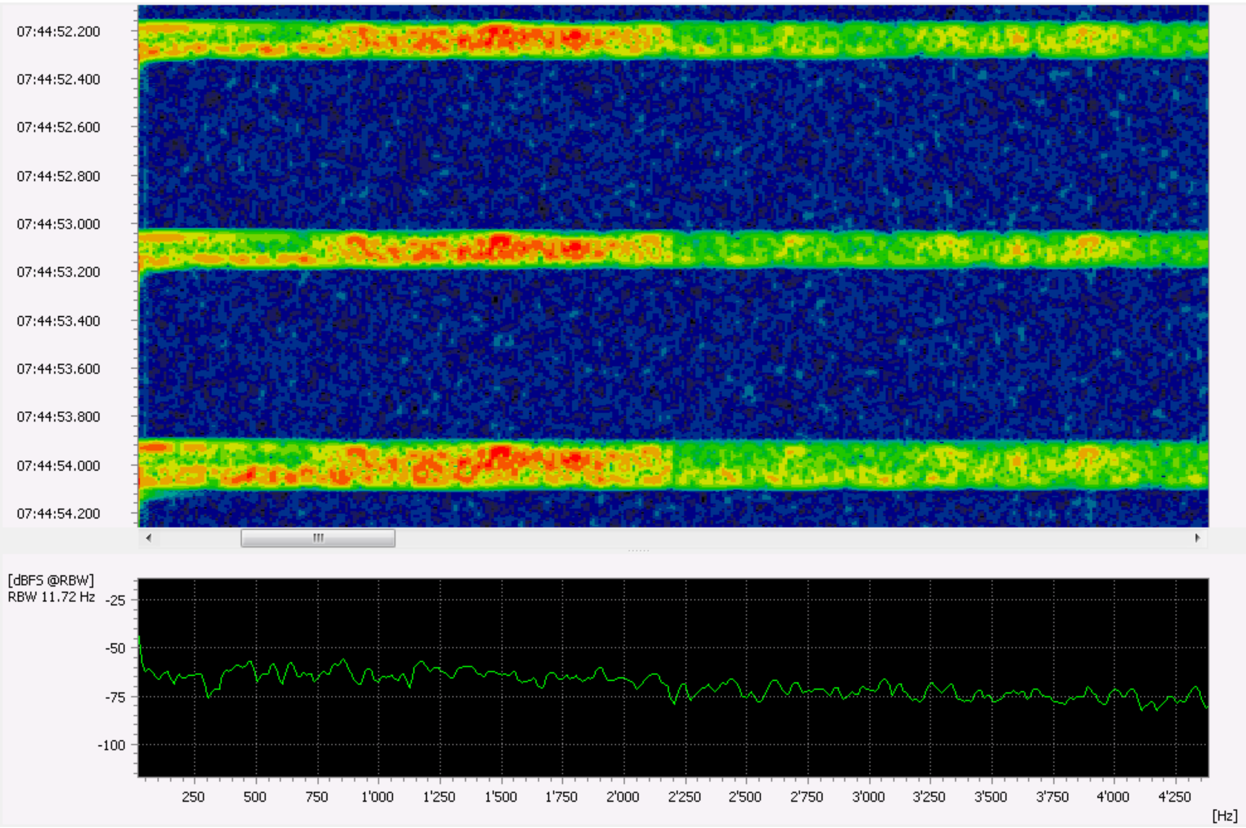


Figure 127: BIIS Spectrogram

2.7. CTCSS

General Information

The **C**ontinuous **T**one **C**oded **S**quelch **S**ystem (CTCSS) was developed for use with analog voice radios. Analog radios equipped with the CTCSS system transmit a tone simultaneously with the voice signal. CTCSS radios enable the selection of particular radio units by recognition of the CTCSS tones. CTCSS tones are standardized by the EIA/TIA, but some systems use non-standard tones

Usage

- Analog voice radio with station selection

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'VoiceInfo'

Mode Details

	Item	Value
Standard	Modulation	Multi-tone
	Number of tones	38
Demodulator Settings	Demodulator	Voice
	Voice mode	F3E
	SelCal type	CTCSS
	Sensitivity	Middle
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 122: CTCSS

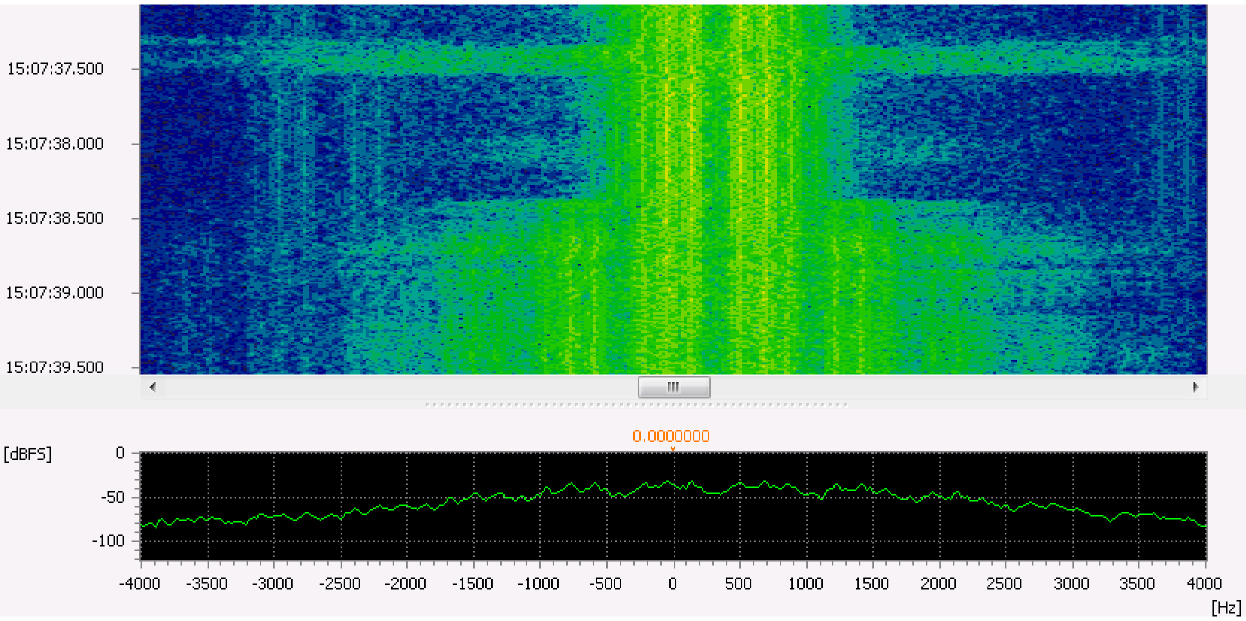


Figure 128: CTCSS Spectrogram

2.8. Distress Radiobeacons

General Information

Digital Distress Radiobeacons (EPIRB's, PLB's and ELT's) are emergency radio beacons used for search and rescue operations to locate a vessel, plane, or person in distress. Global operation is assured by Cospas/Sarsat satellites.

Depending on field of application, different beacon emitting quipment is used:

- Maritime : "EPIRB"
- Aviation : "ELT"
- Personal/Handheld : "LB"

Usage

- Data communication at 121.5MHz and 406MHz

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Distress Radiobeacons'

Mode Details

- This modulation is similar but not identical to PSK2A. IQ symbols are not shifted 180° but 126°.
- Manchester Coding leads to phase 0° (carrier like structure in signal center) at each symbol change from 0 to 1 or vice verca

	Item	Value
Standard	Modulation	PSK
	Bandwidth (KHz)	1
	Symbol rate (Baud)	800
Demodulator Settings	Demodulator	PSK 2,4,8,16 A/B
	Symbol rate (Bd)	800
	SR tolerance (Bd)	1.234
	Modulation order	2
	Version	A
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment VHF	yes
Frequencies	121.5MHz, 406MHz	

Table 123: Distress Radiobeacons

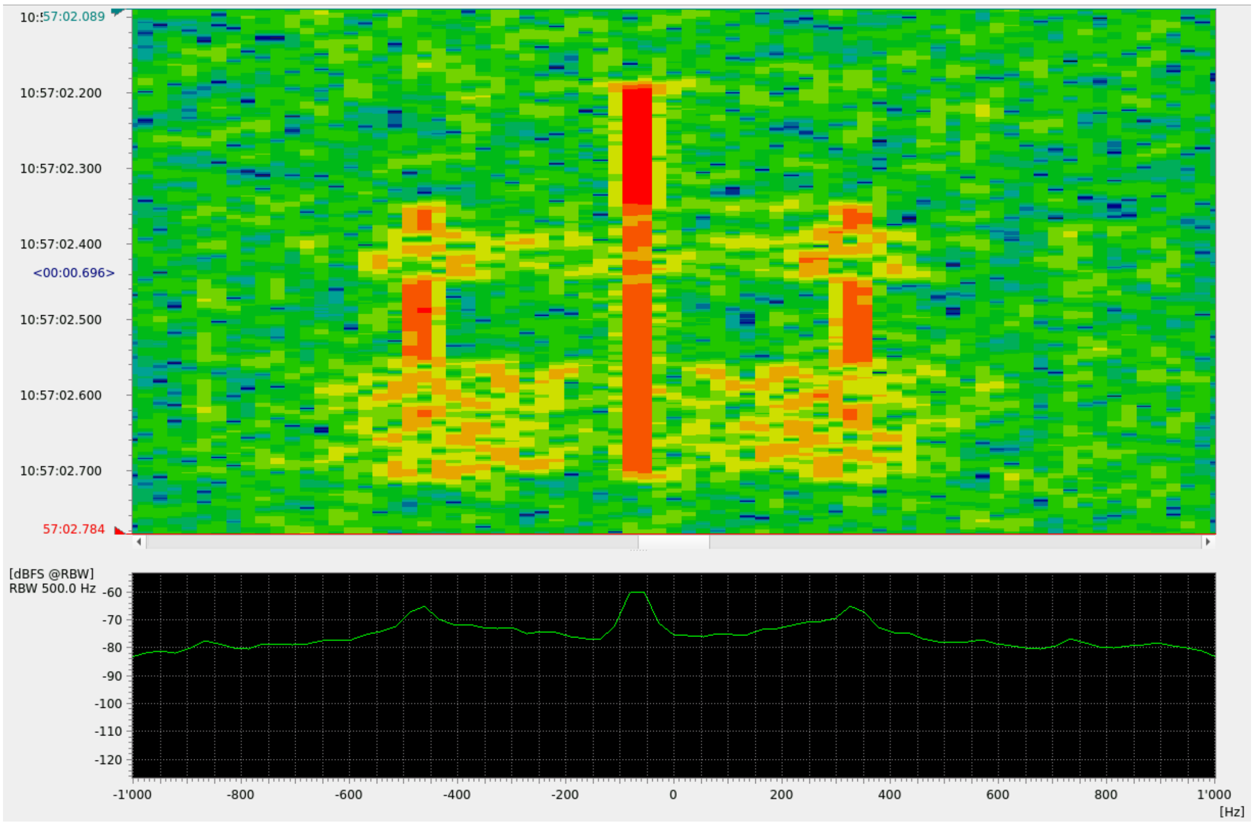


Figure 129: Distress Radiobeacons Spectrogram

2.9. DSC-VHF

General Information

Digital Selective Calling (DSC) is part of the GMDSS (Global Maritime Distress and Safety System). It provides automatically formatted distress alerts, urgency, safety and routine radio-telephone calls.

Usage

- Data communication over VHF

Mode Details

	Item	Value
Standard	Modulation: primary secondary	FM FSK
	Number of tones	2
	Shift (Hz)	800
	Bandwidth (KHz)	10
	Symbol rate (Baud)	1200
	Error correction	Checksum
Demodulator Settings	Demodulator	FSK 2,3,4 discr.
	Symbol rate (Bd)	1200
	SR tolerance (Bd)	5
	Modulation order	2
	Shift (Hz)	800
	Shift tolerance (Hz)	20
	Modem type	Synchronous
	Min. burst length (s)	0.300
	Max. burst length (s)	0.600
	Min. pause length (s)	0.100
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment VHF	yes
	Combination with other modems (modem list)	yes
Frequencies	156.525 MHz	

Table 124: DSC-VHF

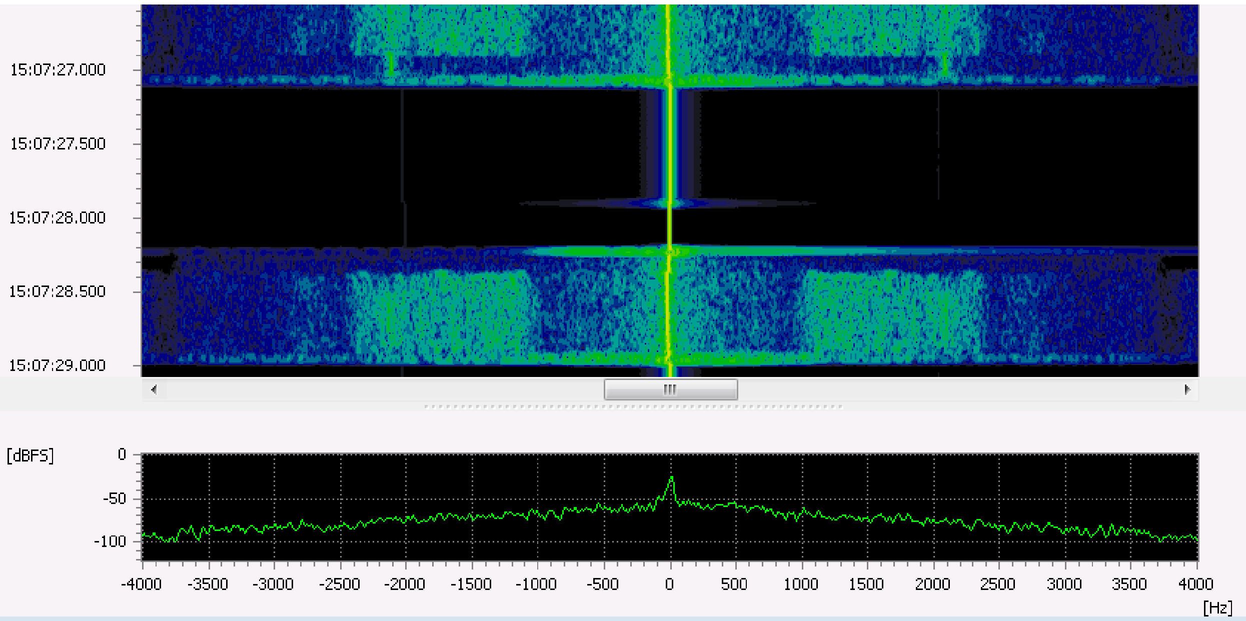


Figure 130: DSC-VHF Spectrogram

2.10. ERMES

General Information

European Radio Message Service (ERMES) is a European common standard pager protocol developed by European Telecommunications Standards Institute (ETSI). Ermes uses Frequency Shift keying (4-FSK) modulation and transmits the data at 6250 bit/s. ERMES is losing importance in Europe. Several networks have been closed down.

Usage

- Broadcast paging over VHF

Restrictions

- This modem is not suitable for frequency range search and has to be used with a fixed nominal frequency

Mode Details

	Item	Value
Standard	Modulation	FSK-4
	Symbol rate (Bd)	3125
	Data rate (bps)	6250
	Error correction	BCH(30,18)
	Alphabet	Numeric / alphanumeric Paging
Demodulator Settings	Demodulator	FSK 2,3,4 diskr.
	Symbol rate (Bd)	3125
	SR tolerance (Bd)	5
	Shift (Hz)	9375
	Shift tolerance (Hz)	500
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 125: ERMES

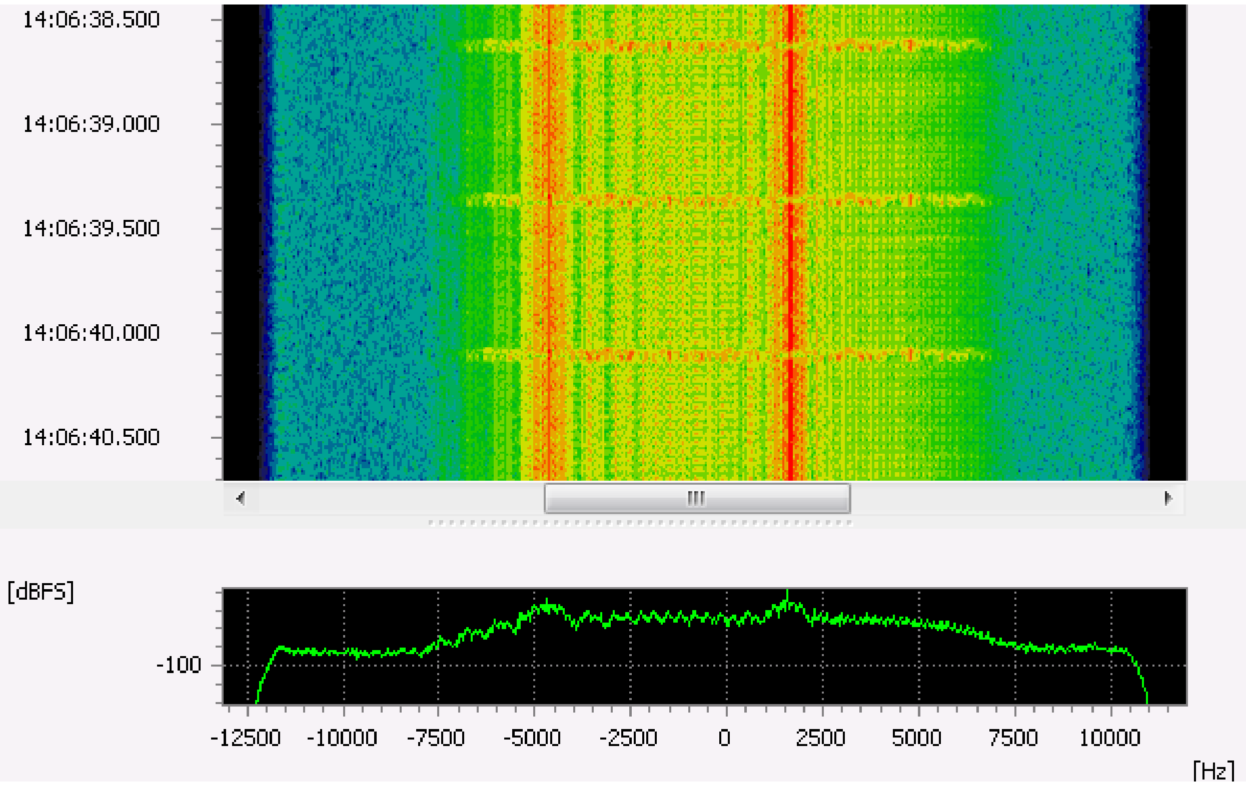


Figure 131: ERMES Spectrogram

2.11. FLARM

General Information

FLARM is a system for the collision avoidance between light aircrafts and UAVs.

The FLARM message is encrypted, Manchester-encoded, and modulated with frequency shift keying (FSK).

Usage

- Light aircraft and UAVs Anti-collision modem over UHF

Note:

The Decoder output is depending on following:

- The decryption requires accurate timestamp of live or recorded signal
- reference position of ground station location, please enter in the decoder parameter the following reference parameters:
  - Reference latitude
  - Reference longitude
  - Reference Altitude in meters

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'FLARM'

Mode Details

	Item	Value
Standard	Modulation	FSK diskr.
	Symbol rate (Bd)	100.000
	Coding	Manchester Coding
	Encryption	XXTEA
Demodulator Settings	Demodulator	FSK 2 diskr.
	Symbol rate (Bd)	100.000
	SR tolerance (Bd)	500
	Shift (Hz)	89420
	Shift tolerance (Hz)	10
	Modem type	Synchronous
	Min. burst length (ms)	3.5
	Max. burst length (ms)	20
	Min. pause length (ms)	800

	Item	Value
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Decryption	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes
Tuning	Center frequency	

Table 126: FLARM

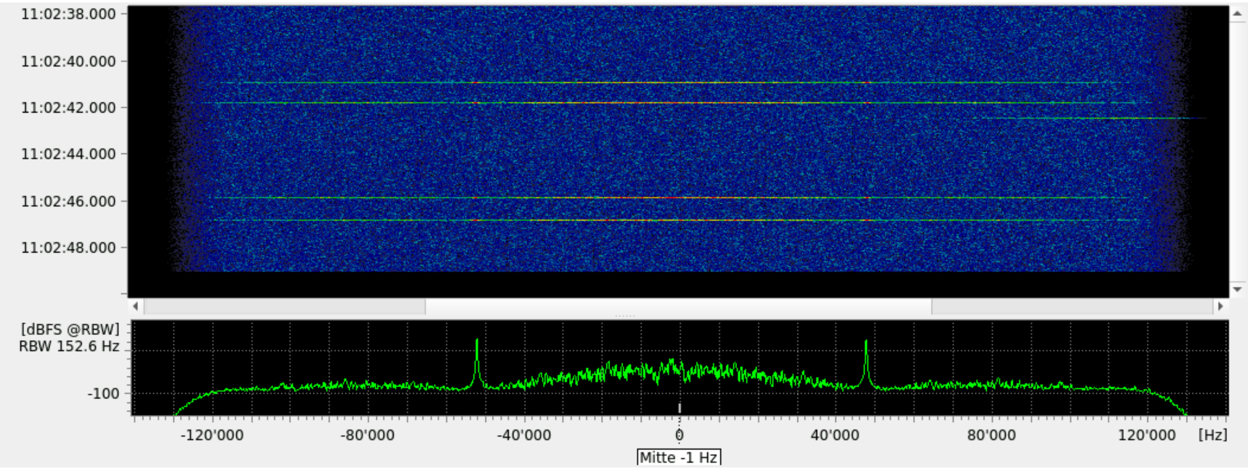


Figure 132: FLARM Spectrogram

2.12. FLEX

General Information

FLEX is a high speed pager protocol developed by Motorola. Two Messaging Systems are currently defined, the FLEX one-way data messaging protocol and the ReFLEX two-way data messaging protocol.

Usage

- Broadcast paging over VHF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'FLEX'

Mode Details

	Item	Value
Standard	Modulation	FFSK-2 / FFSK-4
	Symbol rate (Bd)	1600 / 3200
	Data rate (bps)	1600 / 3200 / 6400
	Error correction	BCH(31,21)
	Alphabet	ITA-5
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	1600
	SR tolerance (Bd)	5
	Shift (Hz)	9600
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding, FFSK-2 / FFSK-4	yes / no
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 127: FLEX

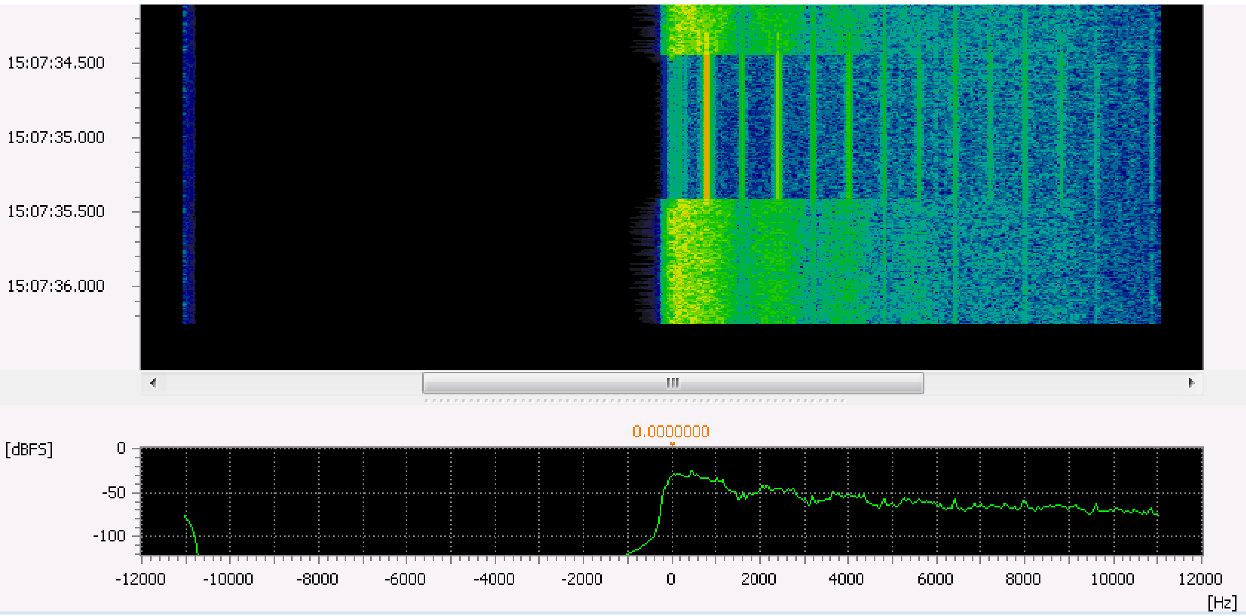


Figure 133: FLEX Spectrogram

2.13. FMS-BOS

General Information

The radio reporting system, German "**F**unk**M**elde**S**ystem" (FMS), for agencies and organizations with safety assignments, German "**B**ehörden und **O**rganisationen mit **S**icherheitsaufgaben" (**BOS**), is a radio communication system for security authorities and organizations.

Usage

- VHF security related communications

Mode Details

	Item	Value
Standard	Modulation, primary, secondary	FM, FSK
	Shift (Hz)	600
	Bandwidth (Hz)	1800
	Symbol rate (Bd)	1200
	Error correction	BCD and CRC
Demodulator Settings	Demodulator	FSK 2,3,4 discr.
	Symbol rate (Bd)	1200
	SR tolerance (Bd)	10
	Modulation order	2
	Shift (Hz)	600
	Shift tolerance (Hz)	10
	Modem type	Synchronous
	Min. burst length (s)	0.120
	Max. burst length (s)	1.200
	Min. pause length (s)	0.150
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 128: FMS-BOS

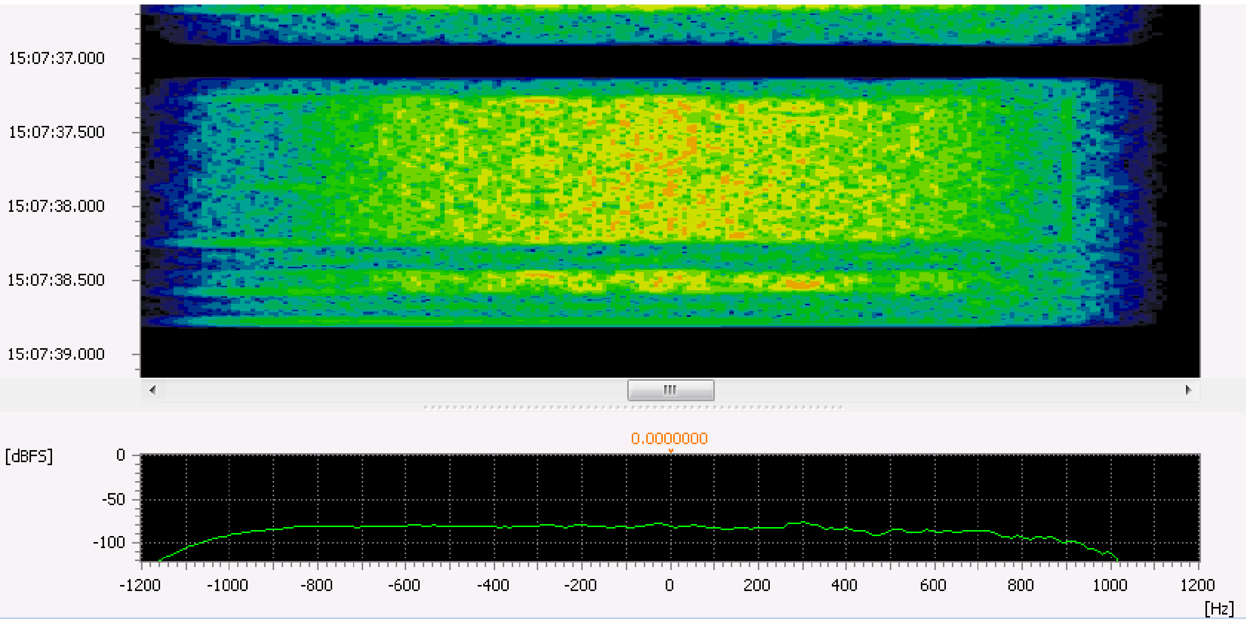


Figure 134: FMS-BOS Spectrogram

2.14. FreeDV VHF

FreeDV offers several modes for transmission of voice and text. It is mainly used in the HF range, but there is also a VHF mode (800XA)

See FreeDV - HF section.

2.15. Golay Pager

General Information

Golay Pager is a paging protocol developed by Motorola Inc. Another designation for this modem type is Golay Sequential Code (GSC).

Usage

- Alert and status messages, emergency services etc. on VHF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	2000
	Bandwidth (Hz)	2600
	Symbol rate (Bd)	300 / 600
	Error correction	Golay(23,12) and BCH(15,7)
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	600
	SR tolerance (Bd)	5
	Shift (Hz)	2000
	Shift tolerance (Hz)	10
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 129: Golay Pager

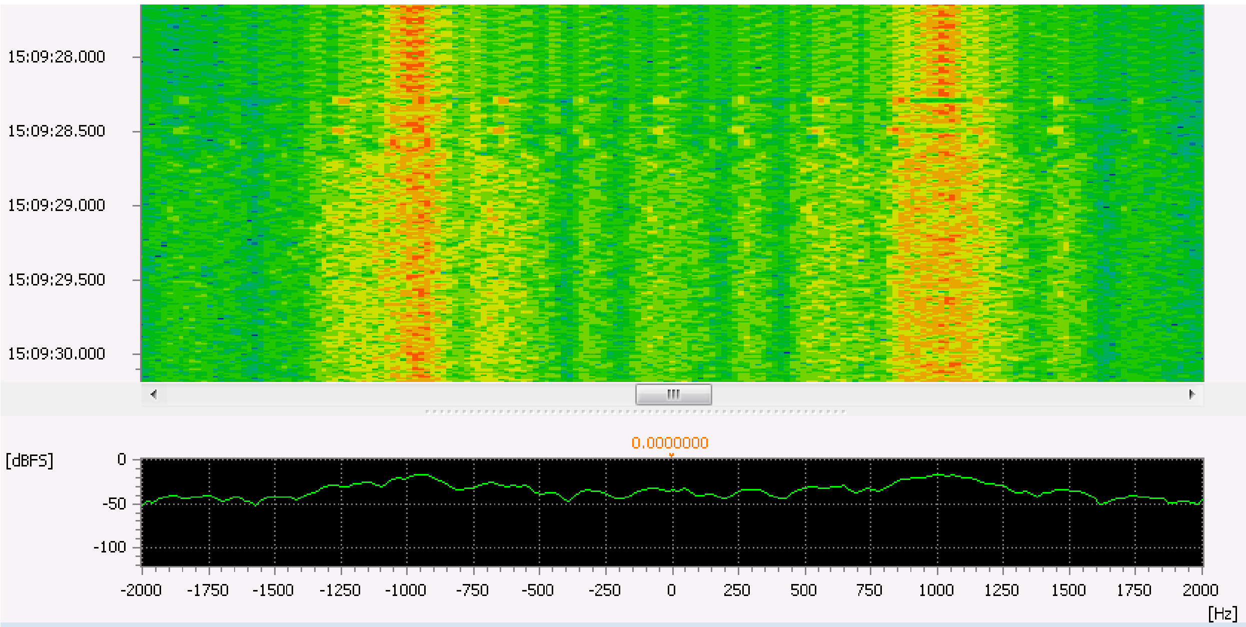


Figure 135: Golay Pager Spectrogram

2.16. MOBITEX-1200

General Information

Mobitex-1200 is a wireless packet switched data network found on 70 MHz in Sweden. MOBITEX-1200 was the first MOBITEX standard and is similar to MOBITEX-8000 above the ROSI link-layer. Sweden closes down the service since 2012 step by step. It is unknown whether the service is still active in some areas.

Usage

- Transfer of textual information over VHF (mostly Taxi, Ambulance)

Mode Details

	Item	Value
Standard	Modulation	FFSK
	Number of tones	2
	Bandwidth (Hz)	15000
	Symbol rate (Bd)	1200
	Error correction	ECC: Short Cyclic Block Code (69,48)
Demodulator Settings	Demodulator	FSK 2,3,4 discr.
	Symbol rate (Bd)	1200
	SR tolerance (Bd)	10
	Modulation order	2
	Shift (Hz)	600
	Shift Tolerance	150
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 130: MOBITEX-1200

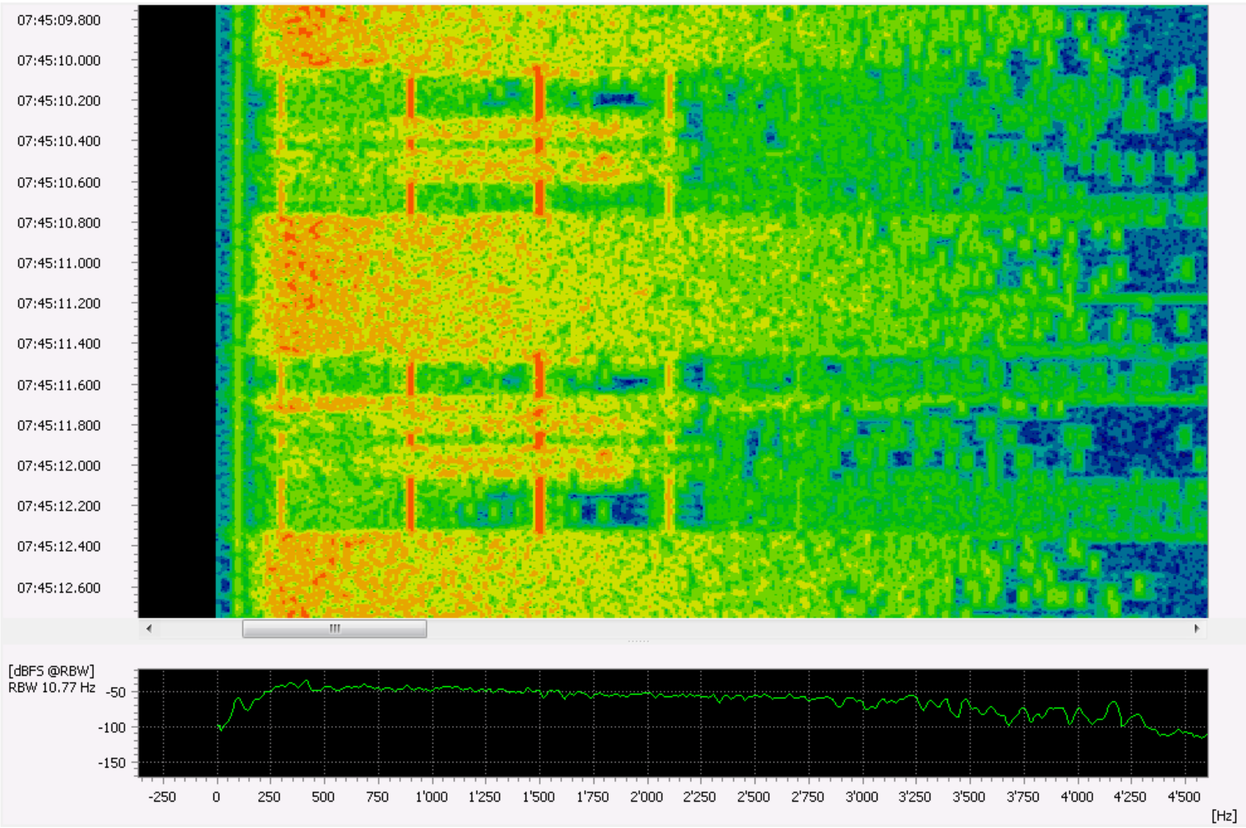


Figure 136: MOBITEX-1200 Spectrogram

2.17. MOBITEX-8000

General Information

Mobitex-8000 is a wireless packet switched data network found on 400/800 and 900 MHz around the world. The MOBITEX Operator Association (MOA) coordinates the specifications, the operator specific additions and further hard- and software development.

Usage

- Transfer of textual information over UHF

Mode Details

	Item	Value
Standard	Modulation	GMSK
	Number of tones	2
	Bandwidth (Hz)	15000
	Symbol rate (Bd)	8000
	Error correction	Hamming (12,8) CRC-16 (CCITT)
Demodulator Settings	Demodulator	FSK 2,3,4 discr.
	Symbol rate (Bd)	8000
	SR tolerance (Bd)	10
	Modulation order	2
	Shift (Hz)	4000
	Shift Tolerance	100
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 131: MOBITEX-8000

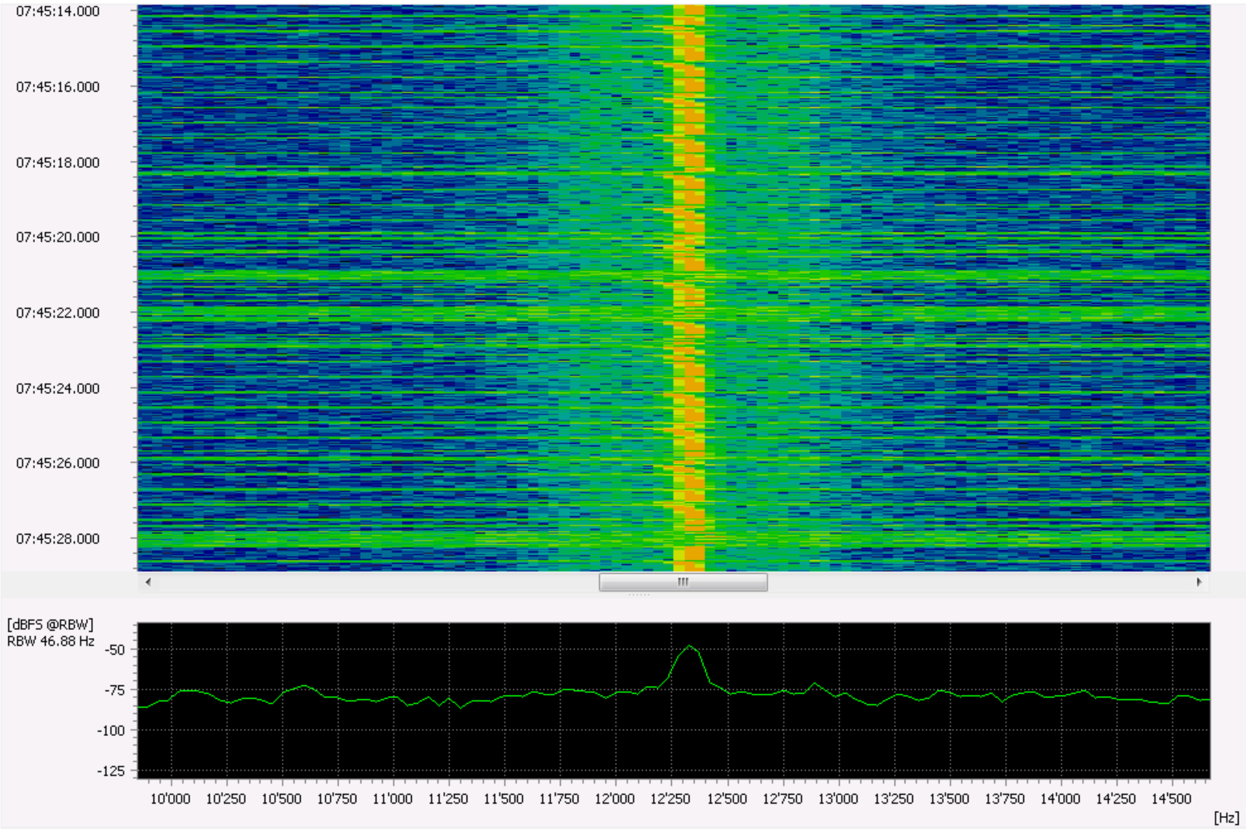


Figure 137: MOBITEX-8000 Spectrogram

2.18. Mode-S/ADS-B

General Information

Mode-S is a secondary surveillance radar process which allows selective interrogation of aircrafts. Mode-S is standardised by ICAO. The **A**utomatic **D**ependent **S**urveillance **B**roadcast (ADS-B), which includes navigational data is thereby part of Mode-S.

Usage

- Broadband aircraft interrogation system in the UHF frequency range. Data communication at 1.09GHz (Downlink) and 1.03GHz (Uplink).

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Mode-S'

Mode Details

	Item	Value
Standard	Modulation	PPM
	Coding	Manchester coding
Demodulator Settings	Demodulator	ASK-2
	Symbol rate (Bd)	2000000.0
	SR tolerance (Bd)	1.234
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 132: Mode-S/ADS-B

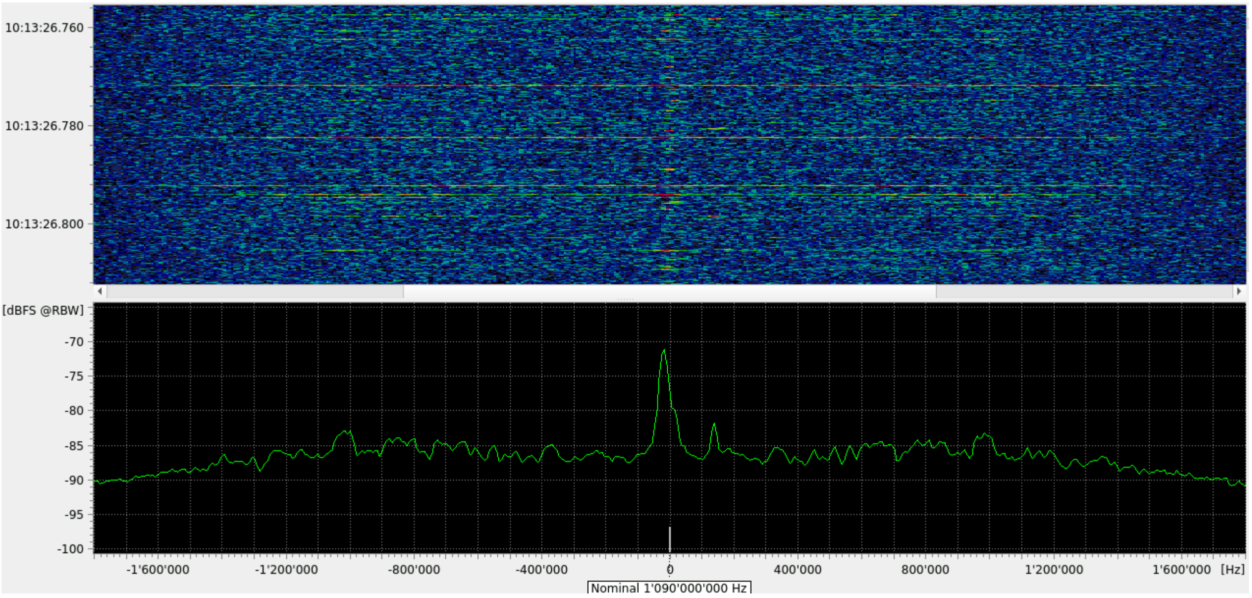


Figure 138: Mode-S/ADS-B Spectrogram

2.19. Morse A2A

See data sheet in HF section.

2.20. Morse F2A

See data sheet in HF section.

2.21. NATEL

General Information

The NATEL SelCal standard was defined by the Scandinavian **Na**tional **Tel**ephone.

Usage

- Narrowband FM SelCal system in the VHF/UHF frequency range

Mode Details

	Item	Value
Standard	Modulation	Multitone
	Number of tones	16
	Coding	Character coding
Demodulator Settings	Demodulator	Analogue SelCal
	Tone duration (ms)	70
	TD tolerance (ms)	15
	No. of tones	16
	SelCal type	NATEL
	Min. burst length (s)	0.280
	Max. burst length (s)	1.000
	Min. pause length (s)	0.070
	Min. burst SNR (dB)	3
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 133: NATEL

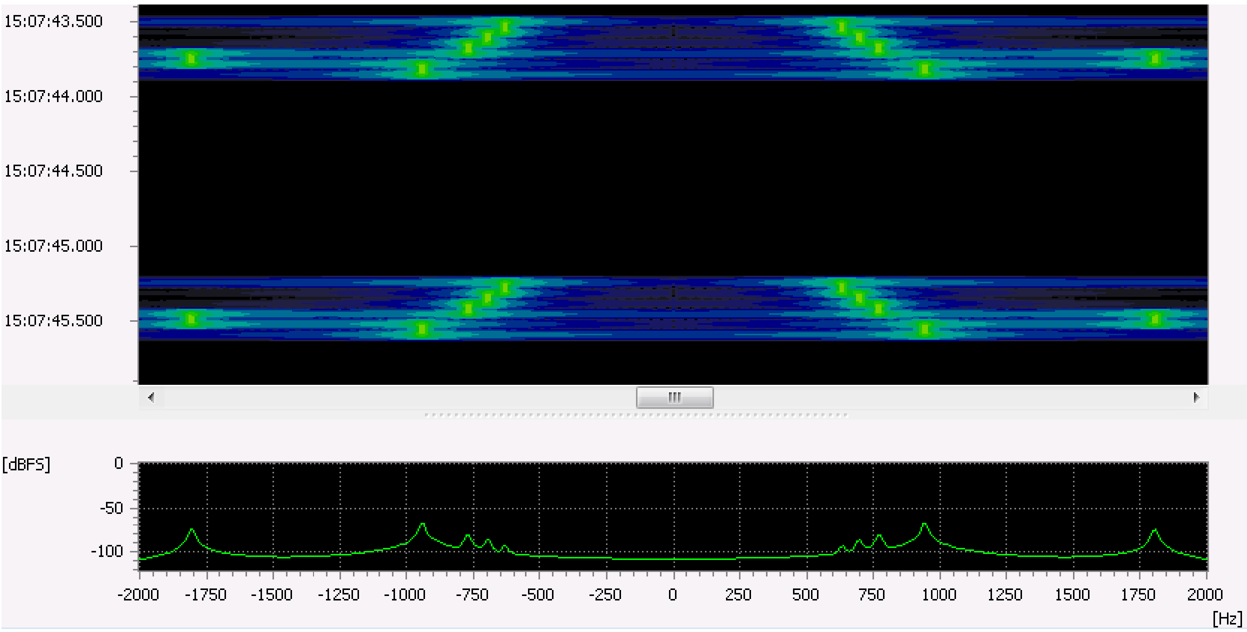


Figure 139: NATEL Spectrogram

2.22. NMT450

General Information

The **N**ordic **M**obile **T**elephone Standard NMT-450 is an analog mobile telephone system developed by Telecommunications Administrations of Denmark, Finland, Norway and Sweden.

Usage

- Public mobile phone network on UHF (450 MHz, 900 MHz with some restrictions)

Restrictions

- Not reliable enough for general search

Mode Details

	Item	Value
Standard	Modulation	FFSK
	Shift (Hz)	600
	Symbol rate (Bd)	1200
	Error correction	Convolutional FEC
Demodulator Settings	Demodulator	(G)MSK
	Type	MSK
	Symbol rate (Bd)	1200
	SR tolerance (Bd)	100
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 134: NMT450

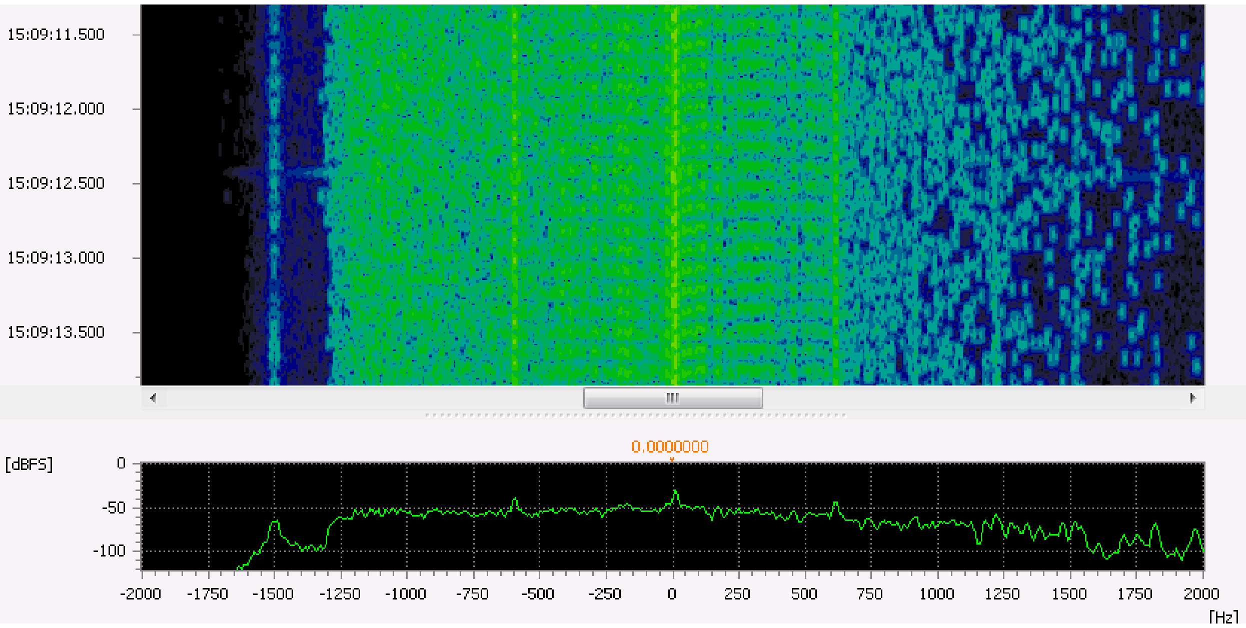


Figure 140: NMT450 Spectrogram

2.23. Packet 1200/2400/4800

General Information

Packet radio is a complex data transmission system used by radio amateurs. Packet radio networks use the AX.25 data link layer protocol, derived from the X.25 protocol suite and designed for amateur radio use.

Usage

- Data communication over VHF/UHF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Packet'

Mode Details

	Item	Value
Standard	Modulation: primary secondary	FM FSK
	Number of tones	2
	Shift (Hz)	1000/1200/2400
	Symbol rate (Bd)	1200/2400/4800
	Coding	NRZ
Demodulator Settings	Demodulator	FSK 2 matched/FSK disc.
	Symbol rate (Bd)	1200/2400/4800
	SR tolerance (Bd)	10
	Modulation order	2
	Shift (Hz)	1000/1200/2400
	Shift tolerance (Hz)	300
	Modem type	Synchronous
	Min. burst length (s)	0.500
	Max. burst length (s)	10.000
	Min. pause length (s)	0.300
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 135: Packet 1200/2400/4800

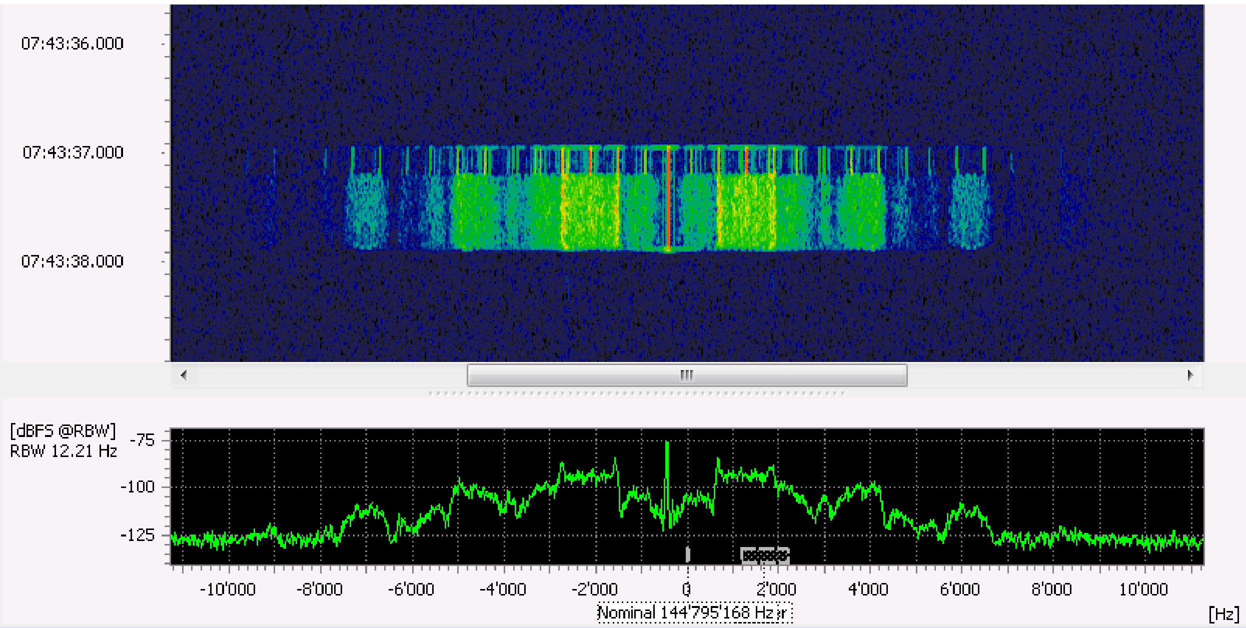


Figure 141: Packet 1200 Spectrogram

2.24. Packet 9600

General Information

Packet radio is a complex data transmission system used by radio amateurs. Packet radio networks use the AX.25 data link layer protocol, derived from the X.25 protocol suite and designed for amateur radio use.

Usage

- Data communication over VHF/UHF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Packet'

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Shift (Hz)	4200
	Symbol rate (Bd)	9600
	Coding	NRZ
Demodulator Settings	Demodulator	FSK 2,3,4 discr.
	Symbol rate (Bd)	9600
	SR tolerance (Bd)	10
	Modulation order	2
	Shift (Hz)	4200
	Shift tolerance (Hz)	1000
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 136: Packet 9600

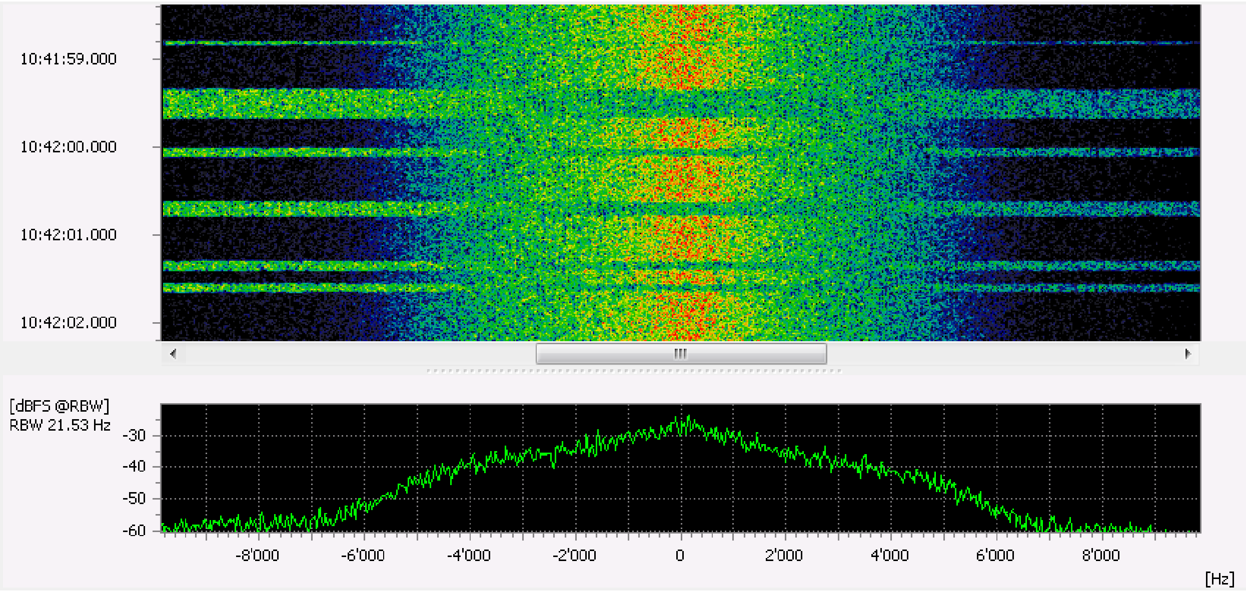


Figure 142: Packet 9600 Spectrogram

2.25. POCSAG

General Information

The Post Office Code Standard Advisory Group (POCSAG) pager defines the format used to encode messages and the standards for message transmission.

Usage

- Pager in the VHF/UHF frequency range used by PTT administrations

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'POCSAG'

Mode Details

	Item	Value
Standard	Modulation	FFSK
	Number of tones	2
	Symbol rate (Bd)	512 / 1200 / 2400
	Shift (Hz)	6000/8500
	Error correction	BCH(31,21)
	Alphabet	ITA-5
Demodulator Settings	Demodulator	FSK2 matched
	Symbol rate (Bd)	1200
	SR tolerance (Bd)	5
	Shift (Hz)	8500
	Shift tolerance (Hz)	500
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 137: POCSAG

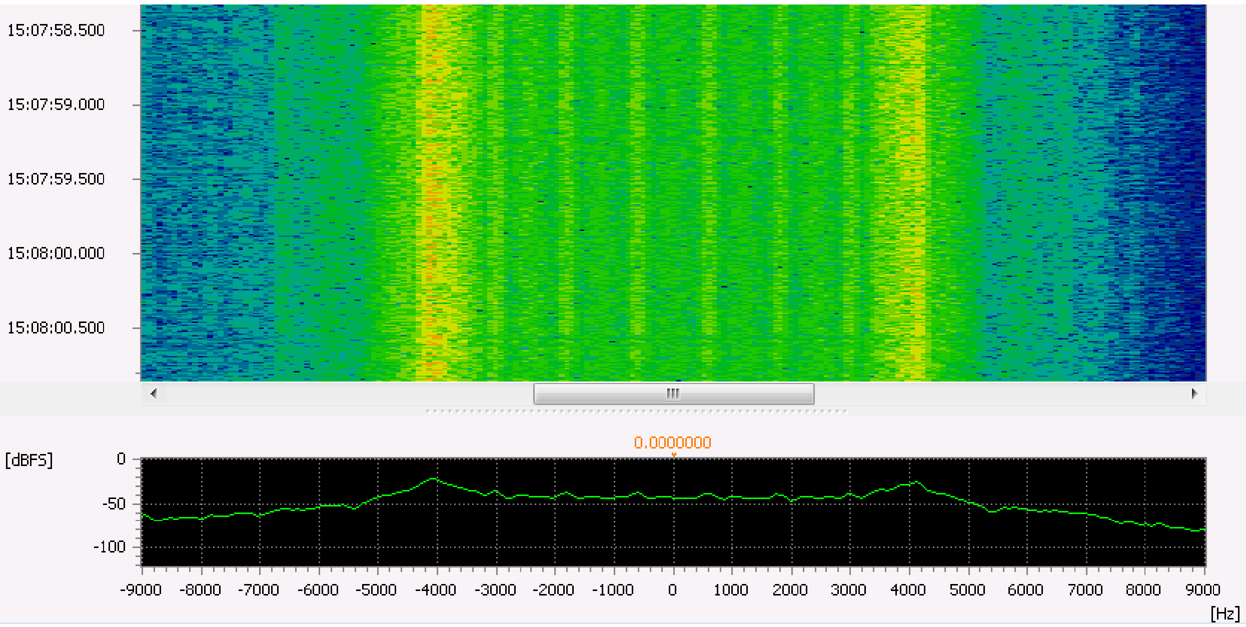


Figure 143: POCSAG Spectrogram

2.26. SelCal CCIR

General Information

These SelCal standards are based on the CCIR-Recommendations (now ITU) CCIR-1, CCIR-2(CCIR-7) and PCCIR. CCIR-1 and CCIR-2 vary in the nominal tone duration.

Usage

- Narrowband FM SelCal system in the VHF/UHF frequency range

Restrictions

- This modem is not suitable for frequency range search and has to be used with a fixed nominal frequency

Mode Details

	Item	Value
Standard	Modulation	Multitone
	Number of tones	16
	Coding	Character coding
Demodulator Settings	Demodulator	Analogue SelCal
	Tone duration (ms)	100
	TD tolerance (ms)	10
	No. of tones	17
	SelCal type	CCIR-1/PCCIR
	Min. burst length (s)	0.400
	Max. burst length (s)	1.000
	Min. pause length (s)	0.100
	Min. burst SNR (dB)	3
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 138: SelCal CCIR

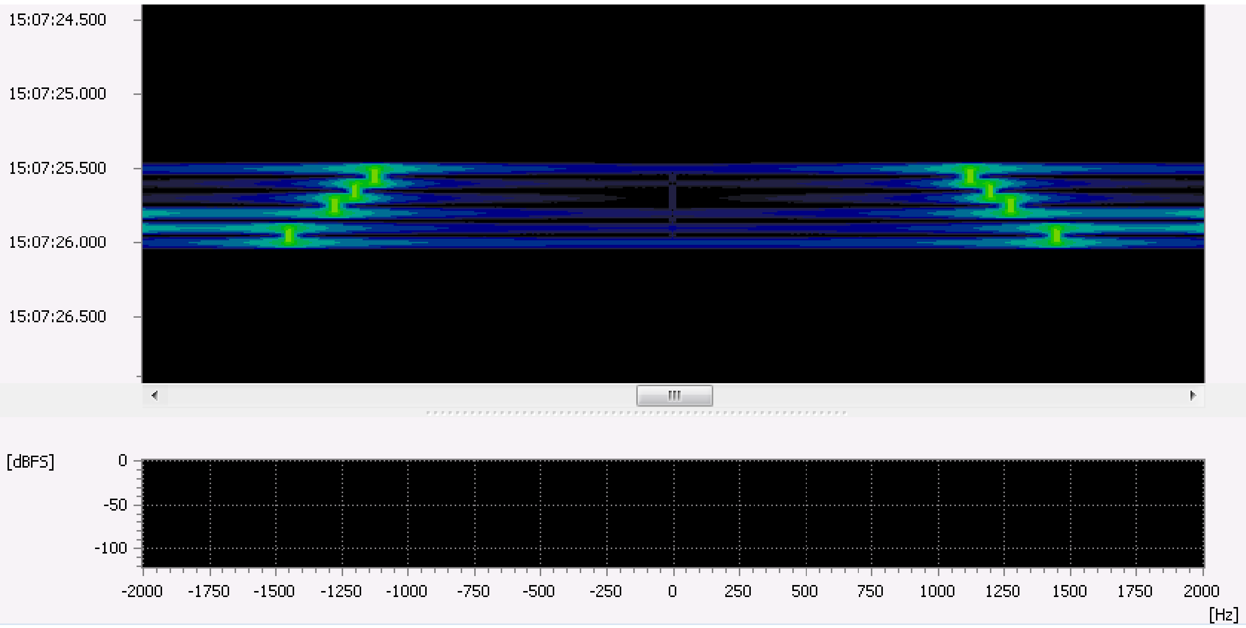


Figure 144: SelCal CCIR Spectrogram

2.27. SelCal CCITT

General Information

This SelCal standard is based on a CCITT-Recommendation (now ITU) for tone-based selective calling.

Usage

- Narrowband FM SelCal system in the VHF/UHF frequency range

Restrictions

- This modem is not suitable for frequency range search and has to be used with a fixed nominal frequency

Mode Details

	Item	Value
Standard	Modulation	Multitone
	Number of tones	15
	Coding	Character coding
Demodulator Settings	Demodulator	Analogue SelCal
	Tone duration (ms)	100
	TD tolerance (ms)	5
	No. of tones	11
	SelCal type	Euro
	Min. burst length (s)	0.400
	Max. burst length (s)	1.000
	Min. pause length (s)	0.100
	Min. burst SNR (dB)	3
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 139: SelCal CCITT

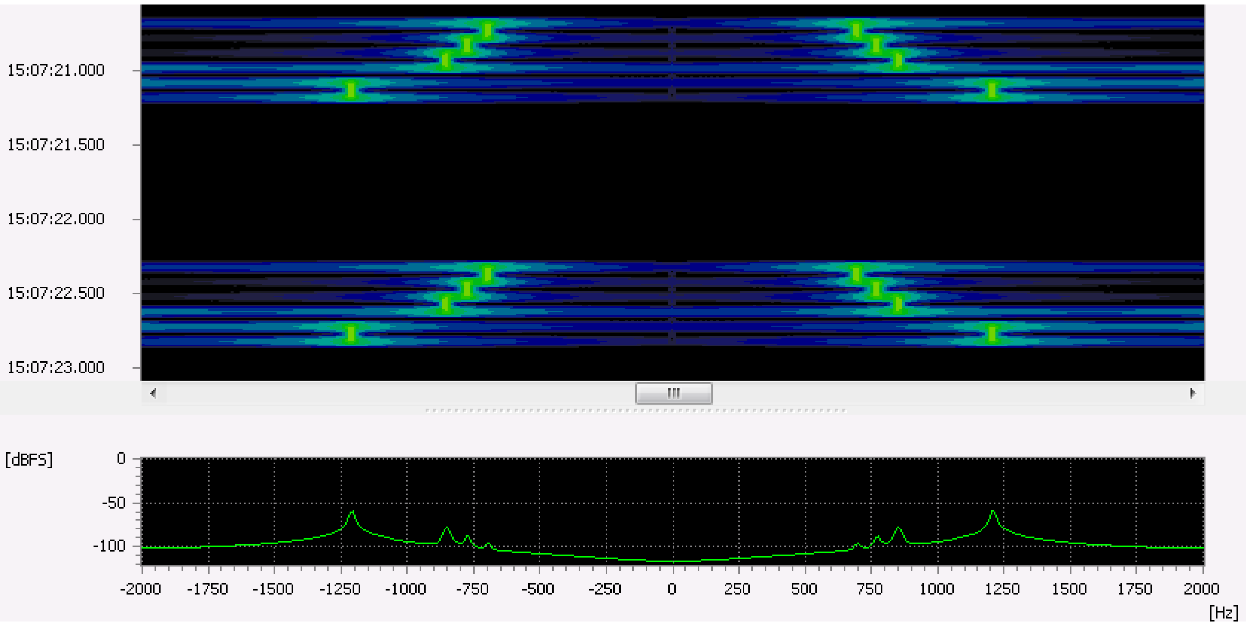


Figure 145: SelCal CCITT Spectrogram

2.28. SelCal DCS

General Information

The **D**igitally **C**oded **S**quelch (also known as DCSS, **D**igitally **C**oded **S**quelch **S**ignaling) was developed for use with analog voice radios. Analog radios equipped with the DCS system transmit a code simultaneously with the voice signal. DCS radios enable the selection f particular radio units by recognition of the DCS codes. DCS codes are standardized by the ETSI/MPT. Polarity can be normal or reverse.

Usage

- Analog voice radio with station selection

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'VoiceInfo'

Mode Details

	Item	Value
Standard	Modulation	FSK
	Modulation order	2
Demodulator Settings	Demodulator	Voice
	Voice mode	F3E
	SelCal type	DCS
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 140: SelCal DCS

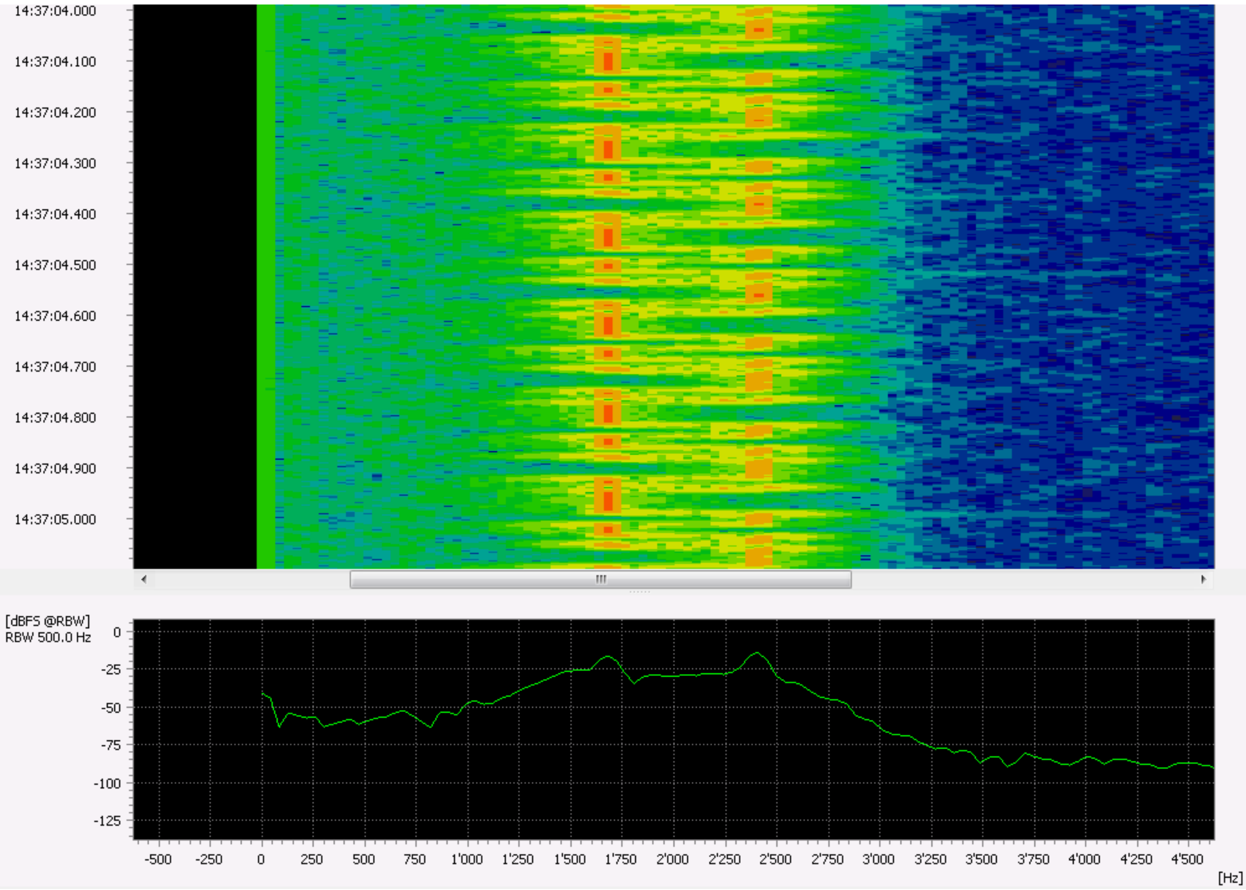


Figure 146: SelCal DCS Spectrogram

2.29. SelCal DTMF

General Information

The **D**ual **T**one **M**ulti-**F**requency (DTMF) was developed for use with POTS services and defined in ITU Recommendation Q.23 and F.902. Analog radios supporting DTMF transmit dual tones as specified in the user interface for circuit switched telephony terminals.

Usage

- Analog FM voice radio with standard POTS keypad dial tones

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'VoiceInfo'

Mode Details

	Item	Value
Standard	Modulation	Multitone
	Number of tones	8
Demodulator Settings	Demodulator	Voice
	Voice mode	F3E
	SelCal type	DTMF
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 141: SelCal DTMF

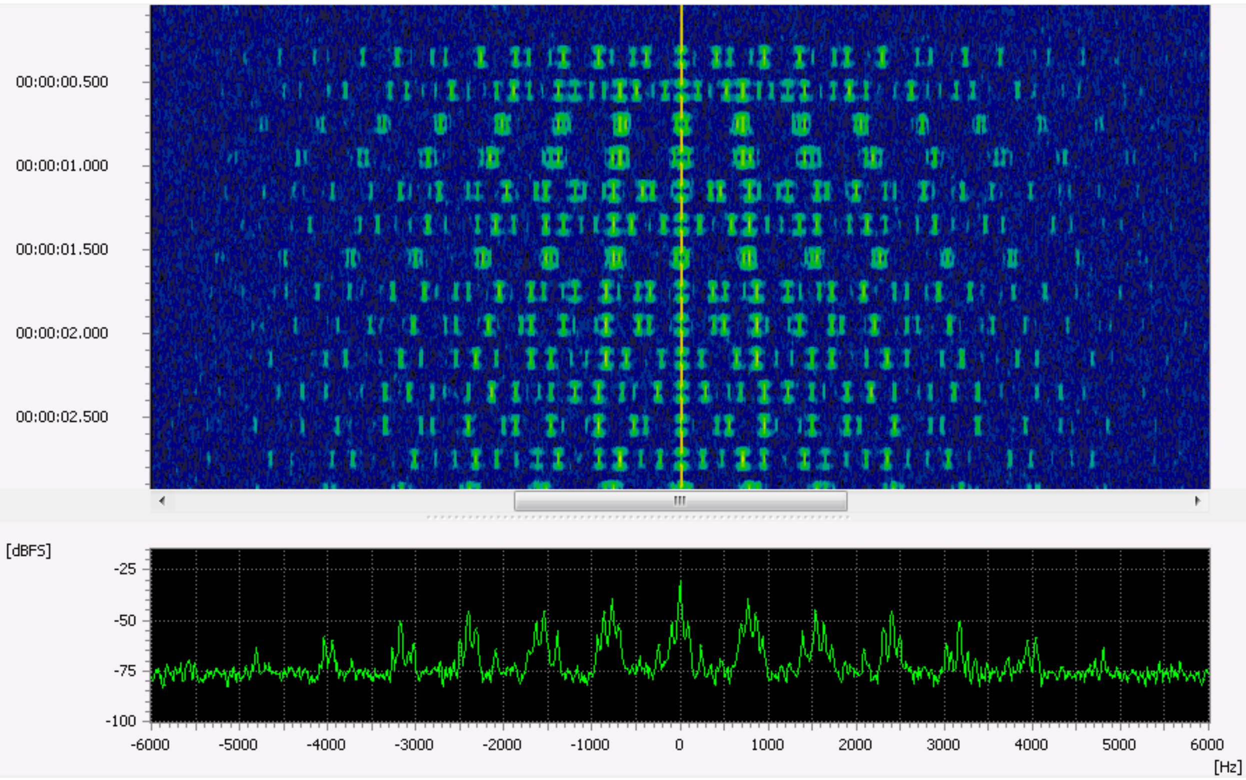


Figure 147: SelCal DTMF Spectrogram

2.30. SelCal EEA

General Information

The EEA SelCal standard was defined by the **E**lectronic **E**ngineering **A**ssociation, UK.

Usage

- Narrowband FM SelCal system in the VHF/UHF frequency range

Restrictions

- This modem is not suitable for frequency range search and has to be used with a fixed nominal frequency

Mode Details

	Item	Value
Standard	Modulation	Multitone
	Number of tones	16
	Coding	Character coding
Demodulator Settings	Demodulator	Analogue SelCal
	Tone duration (ms)	40
	TD tolerance (ms)	4
	No. of tones	16
	SelCal type	EEA
	Min. burst length (s)	0.160
	Max. burst length (s)	1.000
	Min. pause length (s)	0.040
	Min. burst SNR (dB)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 142: SelCal EEA

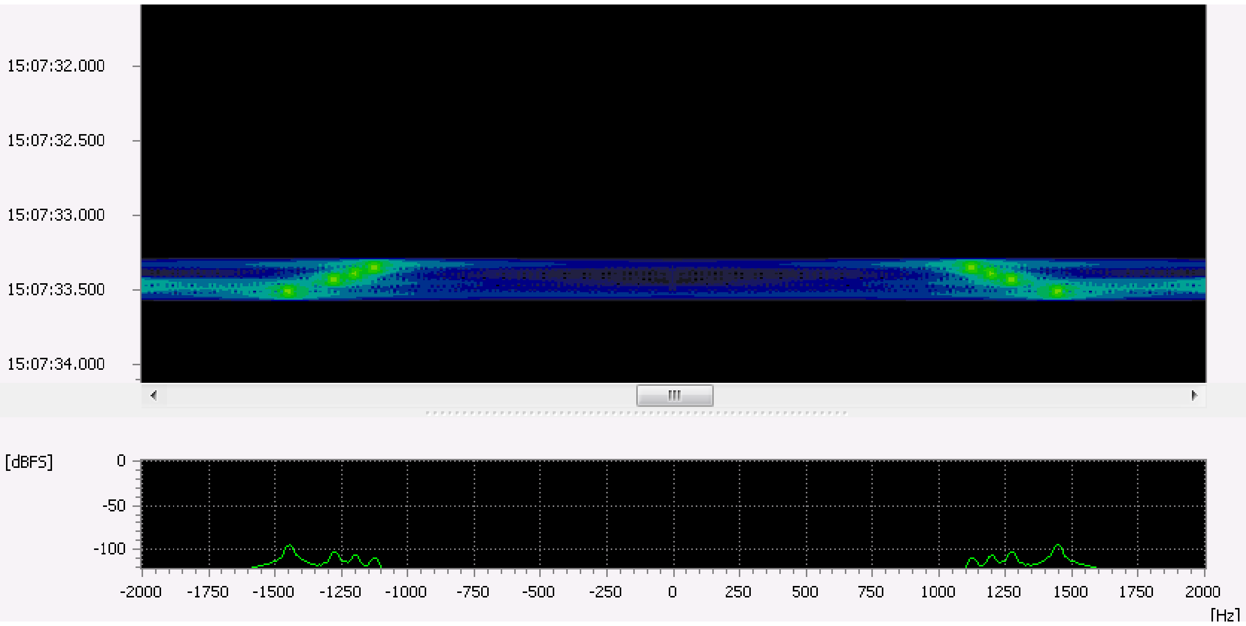


Figure 148: SelCal EEA Spectrogram

2.31. SelCal EIA

General Information

The EIA SelCal standard was defined by the Electronics Industries Association, USA.

Usage

- Narrowband FM SelCal system in the VHF/UHF frequency range

Restrictions

- This modem is not suitable for frequency range search and has to be used with a fixed nominal frequency

Mode Details

	Item	Value
Standard	Modulation	Multitone
	Number of tones	15
	Coding	Character coding
Demodulator Settings	Demodulator	Analogue SelCal
	Tone duration (ms)	33
	TD tolerance (ms)	4
	No. of tones	15
	SelCal type	EIA
	Min. burst length (s)	0.132
	Max. burst length (s)	1.000
	Min. pause length (s)	0.033
	Min. burst SNR (dB)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 143: SelCal EIA

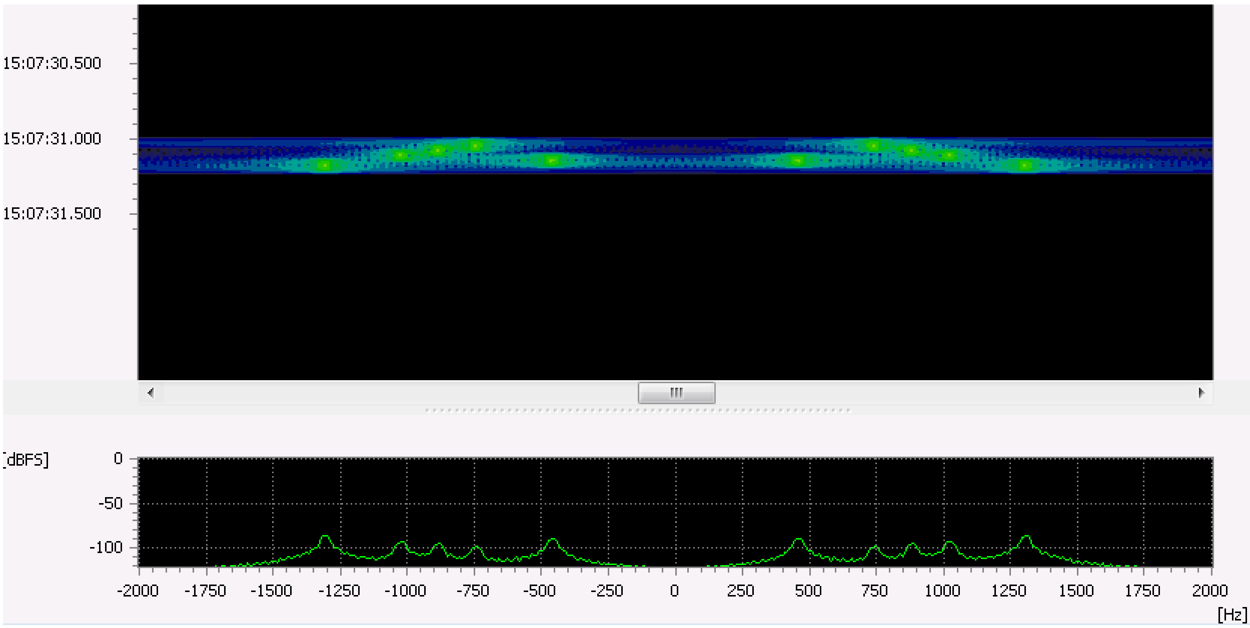


Figure 149: SelCal EIA Spectrogram

2.32. SelCal Euro

General Information

Euro is a SelCal supplement to the analog voice transmission capability which enables an operator to address his call to single subscribers or groups.

Usage

- Narrowband FM SelCal system in the VHF/UHF frequency range

Restrictions

- This modem is not suitable for frequency range search and has to be used with a fixed nominal frequency

Mode Details

	Item	Value
Standard	Modulation	Multitone
	Number of tones	16
	Coding	Character coding
Demodulator Settings	Demodulator	Analogue SelCal
	Tone duration (ms)	100
	TD tolerance (ms)	5
	No. of tones	11
	SelCal type	Euro
	Min. burst length (s)	0.400
	Max. burst length (s)	1.000
	Min. pause length (s)	0.100
	Min. burst SNR (dB)	3
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 144: SelCal Euro

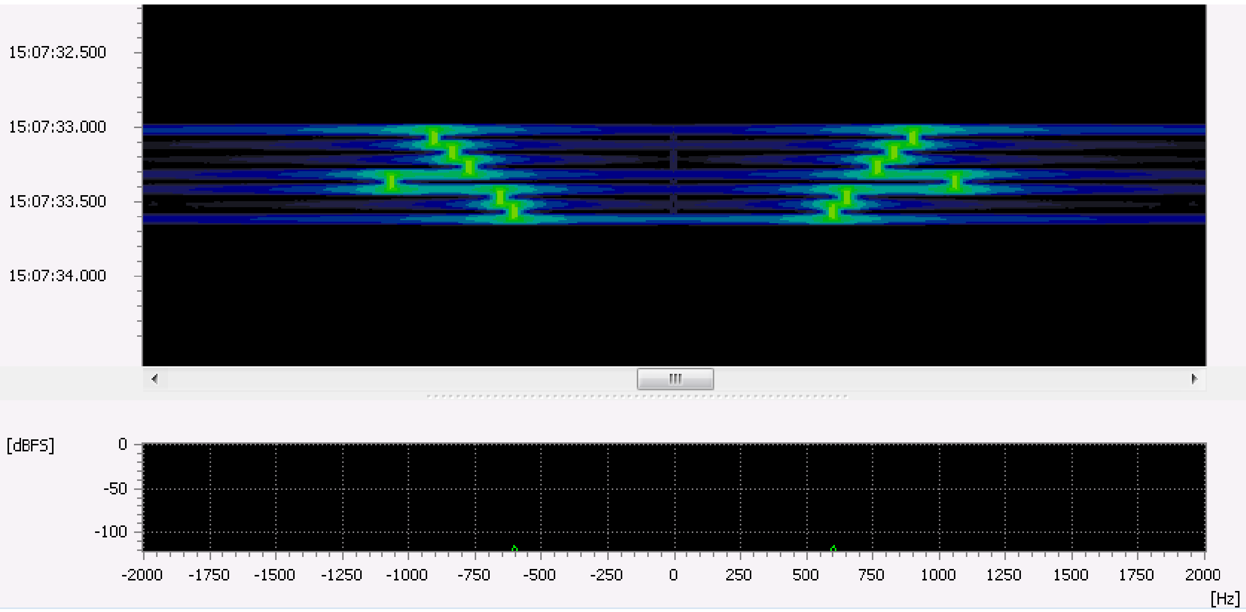


Figure 150: SelCal Euro Spectrogram

2.33. SelCal MODAT

General Information

The MODAT SelCal standard was defined by Motorola.

Usage

- SelCal system in the VHF/UHF frequency range

Restrictions

- This modem is not suitable for frequency range search and has to be used with a fixed nominal frequency

Mode Details

	Item	Value
Standard	Modulation	Multitone
	Number of tones	11
	Coding	Character coding
Demodulator Settings	Demodulator	Analogue SelCal
	Tone duration (ms)	40
	TD tolerance (ms)	4
	No. of tones	11
	SelCal type	MODAT
	Min. burst length (s)	0.400
	Max. burst length (s)	1.000
	Min. pause length (s)	0.100
	Min. burst SNR (dB)	3
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 145: SelCal MODAT

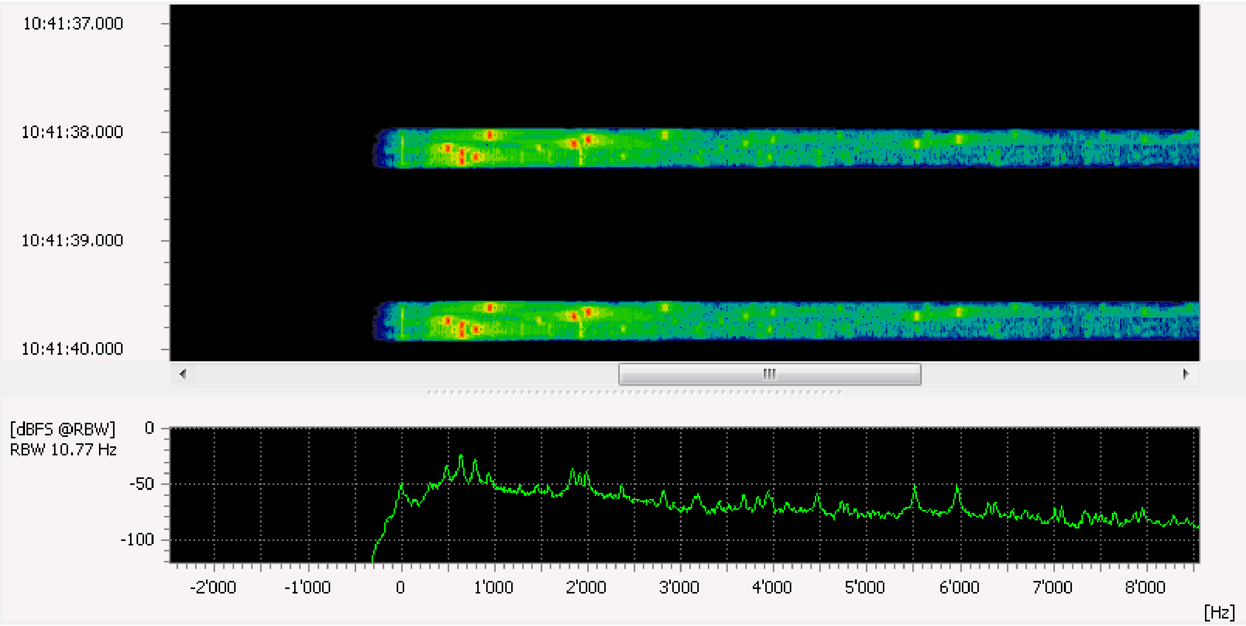


Figure 151: SelCal MODAT Spectrogram

2.34. SelCal NATEL

General Information

The NATEL SelCal standard was defined by the Scandinavian **Na**tional **Tel**ephone.

Usage

- Narrowband FM SelCal system in the VHF/UHF frequency range

Restrictions

- This modem is not suitable for frequency range search and has to be used with a fixed nominal frequency

Mode Details

	Item	Value
Standard	Modulation	Multitone
	Number of tones	16
	Coding	Character coding
Demodulator Settings	Demodulator	Analogue SelCal
	Tone duration (ms)	70
	TD tolerance (ms)	15
	No. of tones	16
	SelCal type	NATEL
	Min. burst length (s)	0.280
	Max. burst length (s)	1.000
	Min. pause length (s)	0.070
	Min. burst SNR (dB)	3
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 146: SelCal NATEL

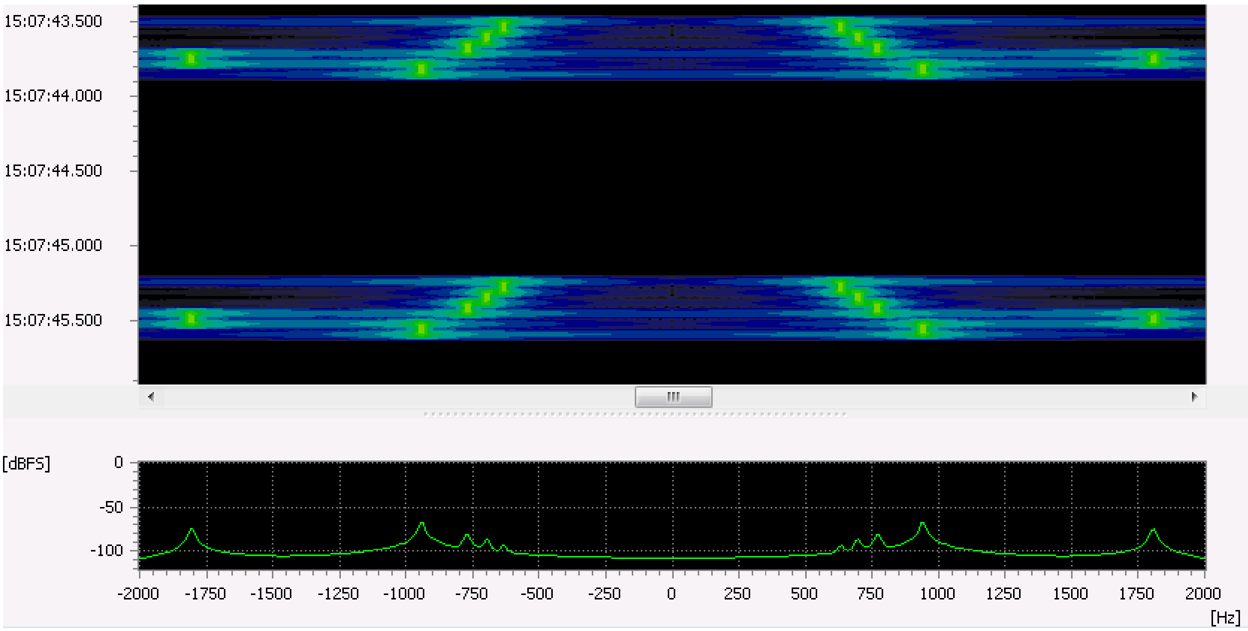


Figure 152: SelCal NATEL Spectrogram

2.35. SelCal VDEW

General Information

This SelCal system conforms to the VDEW (**V**ereinigung **D**eutscher **E**lektrizitaets**W**erke) recommendations (Germany). It is an analog SelCal system using a sequence of single tones.

Usage

- Narrowband FM SelCal system in the VHF/UHF frequency range

Restrictions

- This modem is not suitable for frequency range search and has to be used with a fixed nominal frequency

Mode Details

	Item	Value
Standard	Modulation	Multitone
	Number of tones	12
	Coding	Character coding
Demodulator Settings	Demodulator	Analogue SelCal
	Tone duration (ms)	100
	TD tolerance (ms)	10
	No. of tones	12
	SelCal type	VDEW
	Min. burst length (s)	0.300
	Max. burst length (s)	1.000
	Min. pause length (s)	0.100
	Min. burst SNR (dB)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 147: SelCal VDEW

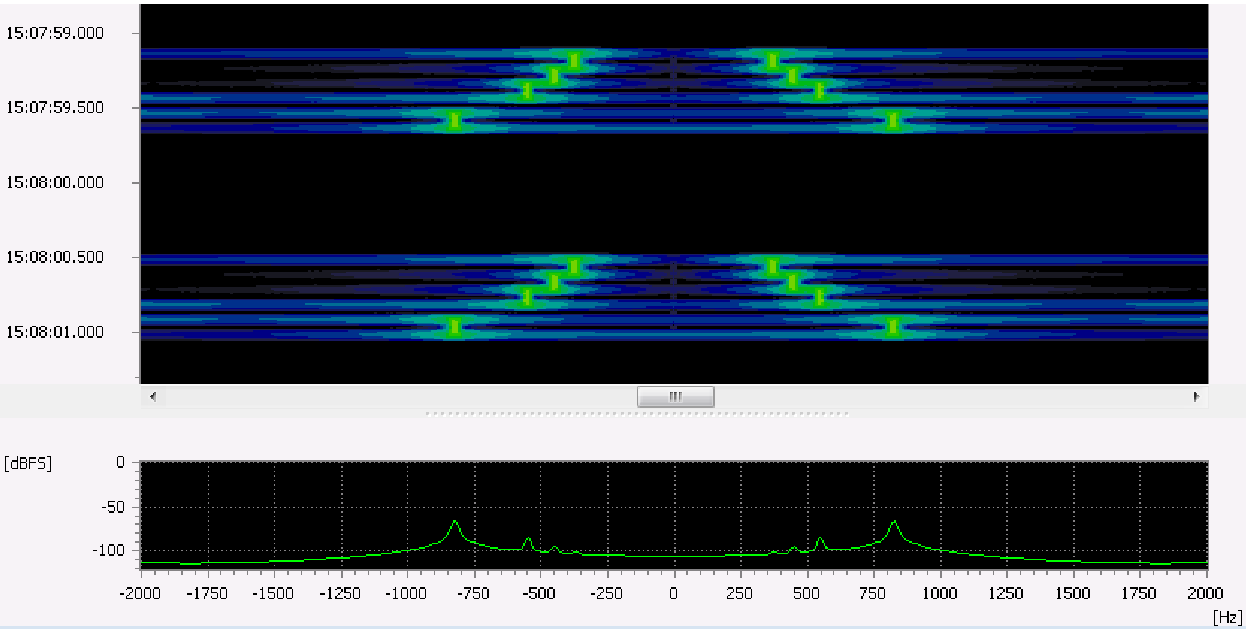


Figure 153: SelCal VDEW Spectrogram

2.36. Selcal ZVEI

General Information

This is a SelCal standard from the **Z**entral**V**erband der **E**lektrotechnischen **I**ndustrie, Germany. ZVEI I, ZVEI II, ZVEI III, **DZVEI, PDZVEI** and PZVEI vary only in the digit encoding.

Usage

- Narrowband FM SelCal system in the VHF/UHF frequency range

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'VoiceInfo'

Mode Details

	Item	Value
Standard	Modulation	Multitone
	Number of tones	16
	Coding	Character coding
Demodulator Settings	Demodulator	Analogue SelCal
	Tone duration (ms)	70
	TD tolerance (ms)	15
	No. of tones	19
	SelCal type	ZVEI
	Min. burst length (s)	0.280
	Max. burst length (s)	1.000
	Min. pause length (s)	0.070
	Min. burst SNR (dB)	0
Features	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 148: SelCal ZVEI

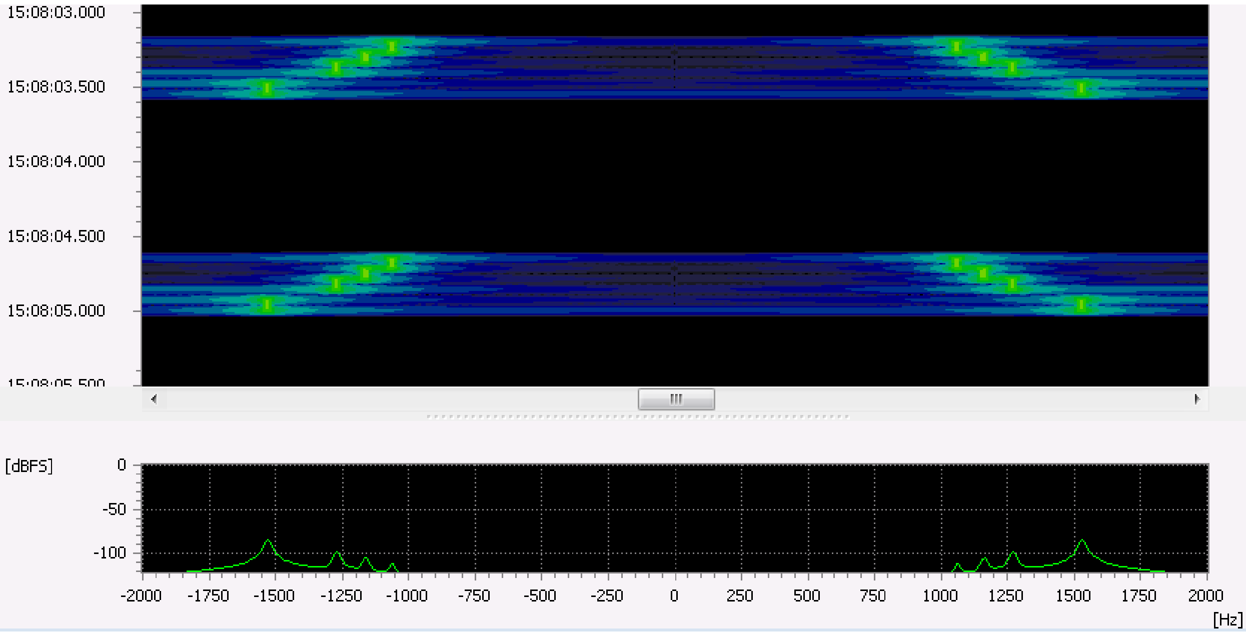


Figure 154: SelCal ZVEI Spectrogram

2.37. VDL 2

General Information

The **V**HF **D**igital **L**ink (VDL) Mode 2 is an ICAO standard developed by the Aeronautical Mobile Communications Panel (AMCP) providing data communication between aircraft and ground-based systems. Aeronautical VHF data links use the band 136 - 137 MHz assigned by the International Telecommunication Union.

- 136.650 USA (ARINC)
- 136.700 USA (ARINC)
- 136.800 USA (SITA)
- 136.725 Europe (ARINC)
- 136.775 Europe (SITA)
- 136.825 Europe (ARINC)
- 136.875 Europe (SITA)
- 136.975 Worldwide (SITA & ARINC)

Usage

- Data communication within the Aeronautical Telecommunication Network

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'VDL 2'

Mode Details

	Item	Value
Standard	Modulation	DPSK
	Modulation order	8
	Bandwidth (Hz)	25000
	Symbol rate (Bd)	10500
	Error correction	Reed Solomon
Demodulator Settings	Demodulator	DPSK 2,4,8 A/B
	Symbol rate (Bd)	10500
	SR tolerance (Bd)	10
	Modulation order	8
	Version	A
	Min. burst length (s)	0.003
	Max. burst length (s)	1.000
	Min. pause length (s)	0.001
	Min. burst SNR (dB)	6

	Item	Value
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes
Frequencies	136.900 MHz 136.975 MHz	

Table 149: VDL 2

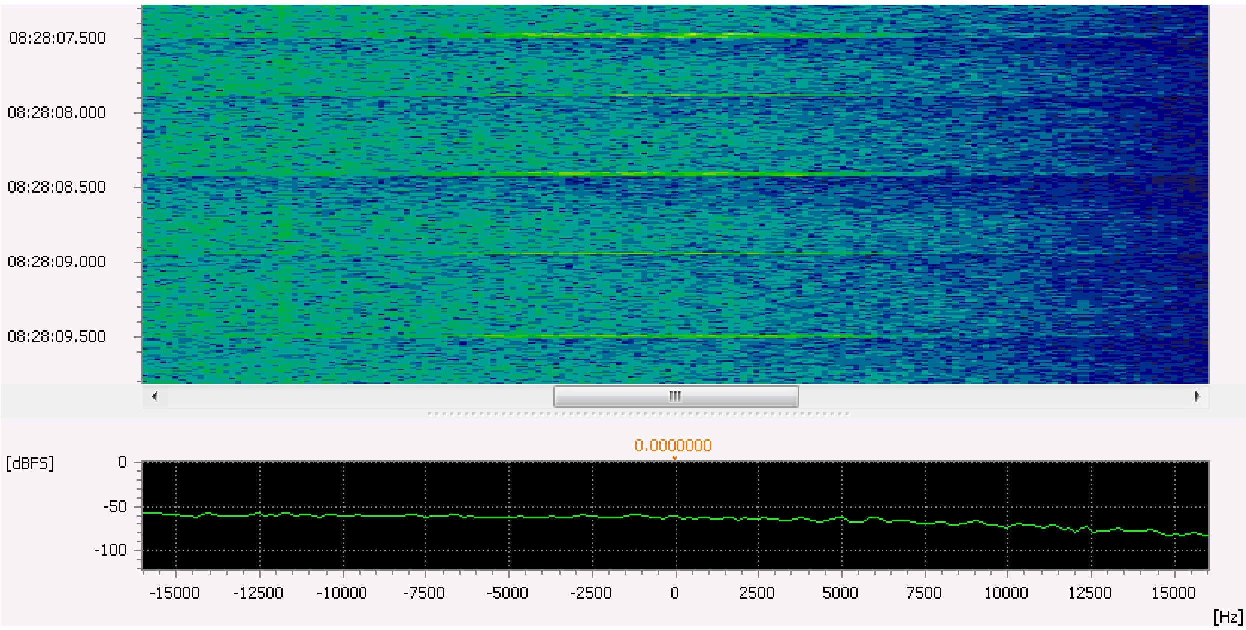


Figure 155: VDL 2 Spectrogram

2.38. VDL 3

General Information

The **V**HF **D**igital **L**ink (VDL) Mode 3 is an ICAO standard providing data and digitized voice communication between aircraft and ground-based systems. Ground stations assign Time Division Multiple Access (TDMA) slots for the exchange of information.

Usage

- Data and digitized voice communication within the Aeronautical Telecommunication Network

Mode Details

	Item	Value
Standard	Modulation	DPSK
	Modulation order	8
	Bandwidth (Hz)	25000
	Symbol rate (Bd)	10500
	Error correction	Reed Solomon
Demodulator Settings	Demodulator	DPSK 2,4,8 A/B
	Symbol rate (Bd)	10500
	SR tolerance (Bd)	10
	Modulation order	8
	Version	A
	Min. burst length (s)	0.010
	Max. burst length (s)	1.000
	Min. pause length (s)	0.010
	Min. burst SNR (dB)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 150: VDL 3

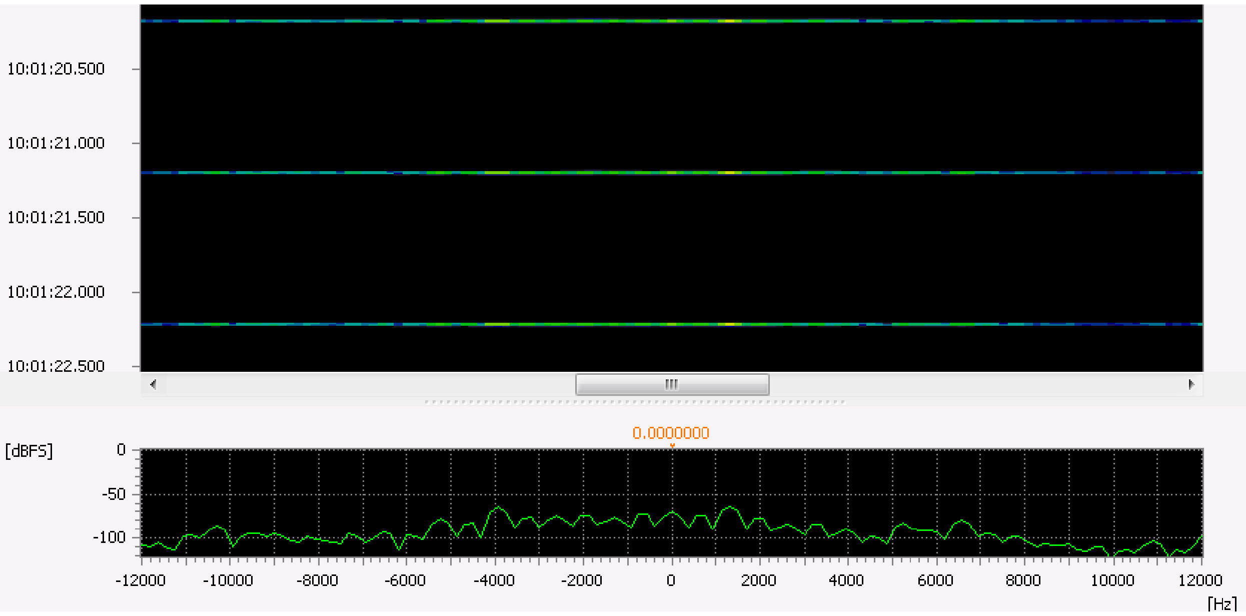


Figure 156: VDL 3 Spectrogram

2.39. Voice A3E Air Traffic

General Information

Air traffic control (ATC) is a service provided by ground-based controllers who direct aircraft on the ground and through controlled airspace, and can provide advisory services to aircraft in non-controlled airspace. The primary purpose of ATC worldwide is to prevent collisions, organize and expedite the flow of air traffic, and provide information and other support for pilots. In some countries, ATC plays a security or defensive role, or is operated by the military. Communication takes place on certain frequencies (airband). Aircraft communications radio operations worldwide use amplitude modulation, predominantly A3E double sideband with full carrier on VHF and UHF. A specialization of the general Voice A3E modem is used which will recognize very short emissions (less than two seconds).

Usage

- VHF/UHF
- Civic or military aviation: communication between aircraft and tower on preset frequencies

Restrictions

- It is not recommended to use this modem in a general search list due to its sensitivity

Mode Details

	Item	Value
Standard	Modulation	Voice, Analog double side band (A3E)
Demodulator Settings	Demodulator	Voice
	Voice Mode	A3E
	Audio in file	on
	Sensitivity	high
	Decoder	voiceAirTraffic
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes (see above for limitations)

Table 151: Voice A3E Air Traffic

2.40. Voice F3E - SELCALS

General Information

Analog FM modulated voice is transmitted together with various SELCALs. The SELCALs are used to transmit a digital code or number.

Usage

- Voice transmission in VHF/UHF

Included SELCALs

- DCS
- DTMF
- CTCSS
- ZVEI

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'VoiceInfo'

Mode Details

	Item	Value
Standard	Modulation	Voice, frequency modulated (F3E)
Demodulator Settings	Demodulator	Voice
	Voice Mode	F3E
	Audio in file	on
	SELCAL type	AUTO (see above for included types)
	Sensitivity	Middle
	Decoder	voiceInfo
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 152: Voice F3E - SELCALS

2.41. Voice Inversion (FM-LSB)

General Information

This voice mode is used as a simple encryption or to hide the voice transmission, since most radios do not support this mode. In this simplest form the voice frequency band is mirrored (LSB), then frequency shifted (see Offset nominal frq. parameter) and then frequency modulated (FM).

Usage

- Voice transmission in VHF/UHF

Mode Details

	Item	Value
Standard	Modulation	FM modulated, Inverted Voice (J3E LSB)
Demodulator Settings	Demodulator	Voice
	Voice Mode	J3E LSB
	Audio in file	on
	Sensitivity	middle
Extras	Primary demodulator	FM
	FM bandwidth (Hz)	7000
	Offset nominal frq. (Hz)	3400
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 153: Voice Inversion (FM-LSB)

2.42. ZVEI-VDEW

General Information

ZVEI and VDEW are digital selective calling systems.

The typical use of the system is selective call and data transmission in the non-public mobile land radio service. The VDEW and ZVEI systems are identical on the physical layer, with some more additional features for ZVEI system.

Usage

- VHF/UHF, selective call and Data transmission in the non-public mobile land radio service

Mode Details

	Item	Value
Standard	Modulation, primary, secondary	FM, (G)MSK
	Shift (Hz)	600
	Bandwidth (Hz)	1800
	Symbol rate (Bd)	1200
	Coding	BCD and CRC
Demodulator Settings	Demodulator	MSK
	Symbol rate (Bd)	1200
	SR tolerance (Bd)	5
	Shift (Hz)	600
	Shift tolerance (Hz)	10
	Modem type	Synchronous
	Min. burst length (s)	0.50
	Max. burst length (s)	0.400
	Min. pause length (s)	0.100
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 154: ZVEI-VDEW

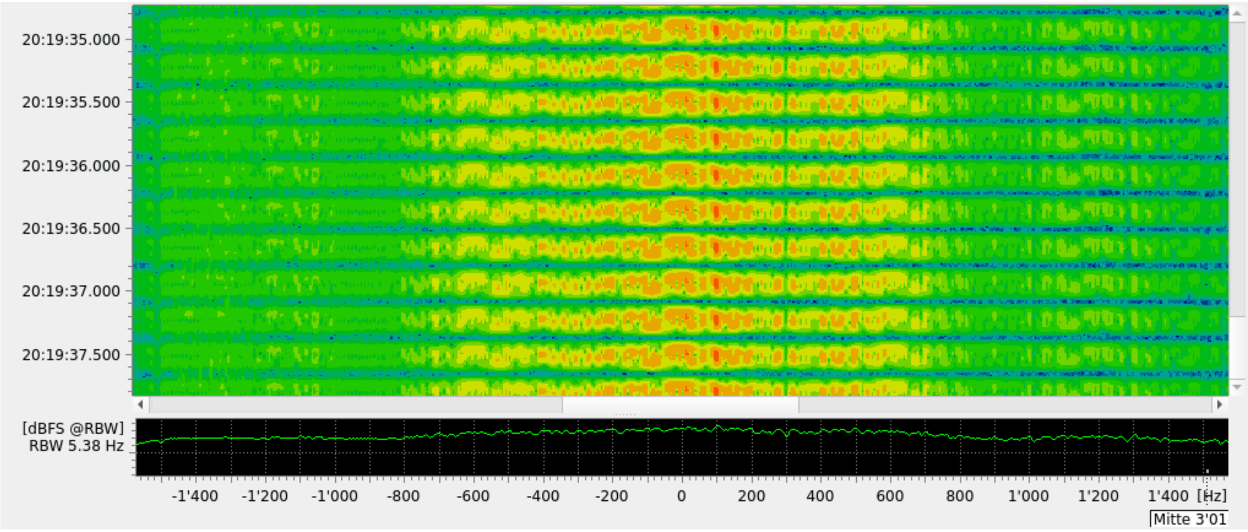


Figure 157: ZVEI-VDEW Spectrogram

3. SAT Decoders

Note: For every decoder any operation limitations should be listed. If any submode of a decoder is not mentioned explicitly then it is not supported.

3.1. INMARSAT AERO-C

General Information

AERO-C (C channel) is Circuit-mode single channel per carrier (SCPC) channel, used in both to-aircraft and from-aircraft directions. This channel is time division multiplexed to provide a primary channel for voice or data traffic and a sub-band channel for signalling, supervision and data messages. The use of the channel is controlled by assignment and release signalling at the start and end of each transaction.

Usage

- Aeronautical mobile satellite service

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'INMARSAT AERO-C'

Mode Details

- For bitrates: **8.4, 10.5, 21.0 kbit/s continuous(to-aircraft)**

	Item	Value
Standard	Modulation	OQPSK
	Bandwidth (kHz)	from 8.4 to 21.0
	Symbol rate (kBd)	4.2, 5.25 or 10.5
	Data rate (kbit/s)	8.4, 10.5 or 21.0
	Error correction	FEC rate $\frac{1}{2}$, $\frac{2}{3}$, k = 7
	Interleaver (s)	block and permutation
Demodulator Settings	Demodulator	OQPSK
	Symbol rate (Bd)	from 4200, 5250 or 10500
	SR tolerance (Bd)	5
Extras	Offset nominal frq. (Hz)	0

	Item	Value
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 155: AERO-C OQPSK Continuous Mode

- For bitrates: **8.4, 10.5, 21.0 kbit/s burst mode (from-aircraft)**

	Item	Value
Standard	Modulation	OQPSK
	Bandwidth (kHz)	from 8.4 to 21.0
	Symbol rate (kBd)	4.2, 5.25 or 10.5
	Data rate (kbit/s)	8.4, 10.5 or 21.0
	Error correction	FEC rate $\frac{1}{2}$, $\frac{2}{3}$, k = 7
	Interleaver (s)	block and permutation
Demodulator Settings	Demodulator	OQPSK
	Symbol rate (Bd)	from 4200, 5250 or 10500
	SR tolerance (Bd)	5
	Min. burst length (s)	0.10
	Max. burst length (s)	1.000
	Min. pause length (s)	0.10
	Min. burst SNR (dB)	0
Extras	Offset nominal frq. (Hz)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 156: AERO-C OQPSK burst mode

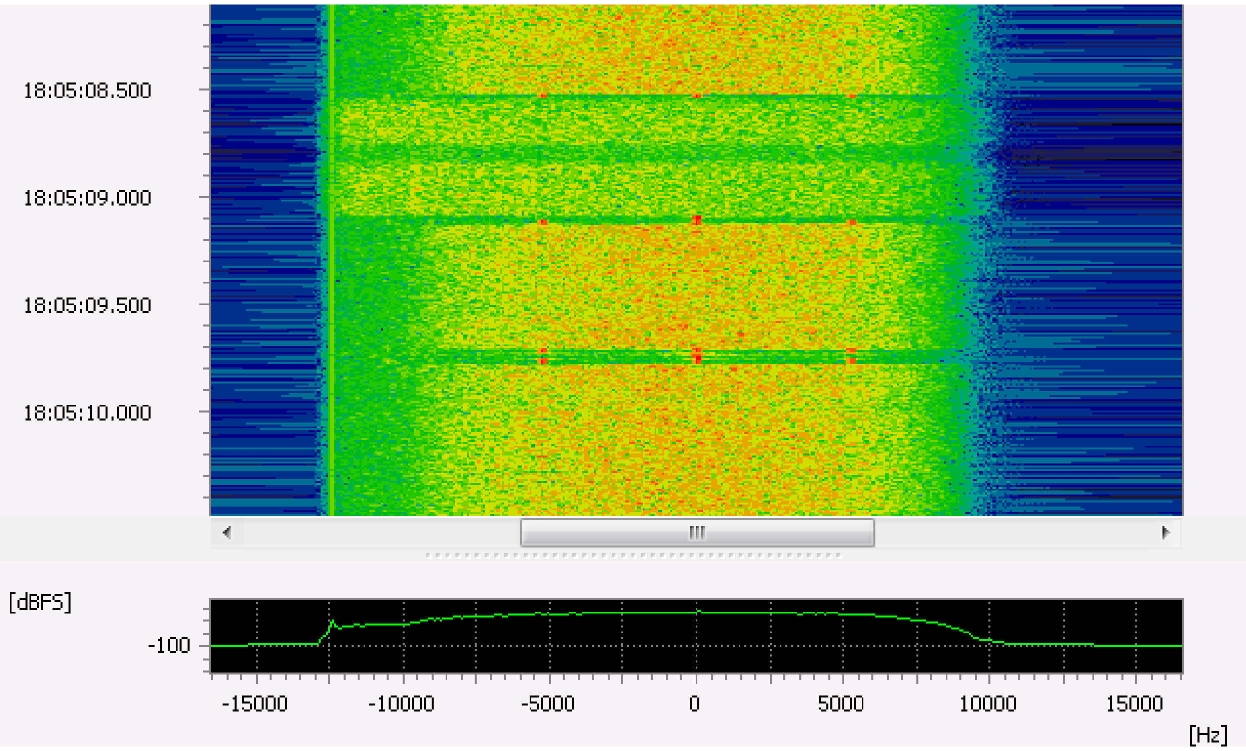


Figure 158: AERO-C 21.0kbps Spectrogram

3.2. INMARSAT AERO-P

General Information

AERO-P (P channel) is Packet mode time division multiplex (TDM) channel transmitted continuously from the aeronautical ground earth station (GES) in the to-aircraft direction to carry signalling and user data.

Usage

- Aeronautical mobile satellite service

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'INMARSAT AERO-P'

Mode Details

- For bitrates: **0.6, 1.2, 2.4 kbit/s**

	Item	Value
Standard	Modulation	MSK
	Bandwidth (Hz)	from 600 to 2400
	Symbol rate (kBd)	0.6, 1.2 or 2.4
	Data rate (kbit/s)	0.6, 1.2 or 2.4
	Error correction	FEC rate $\frac{1}{2}$, k = 7
	Interleaver (s)	block and permutation
Demodulator Settings	Demodulator	MSK
	Symbol rate (Bd)	from 600, 1200 or 2400
	SR tolerance (Bd)	3
Extras	Offset nominal frq. (Hz)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 157: AERO-P MSK

- For bitrates: **4.8 and 10.5 kbit/s**

	Item	Value
Standard	Modulation	OQPSK
	Bandwidth (Hz)	from 4800 to 10500
	Symbol rate (kBd)	2.4 or 5.25
	Data rate (kbit/s)	4.8 or 10.5
	Error correction	FEC rate $\frac{1}{2}$, k = 7
	Interleaver (s)	block and permutation
Demodulator Settings	Demodulator	OQPSK
	Symbol rate (Bd)	2400 or 5250
	SR tolerance (Bd)	5
Extras	Offset nominal frq. (Hz)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 158: AERO-P OQPSK

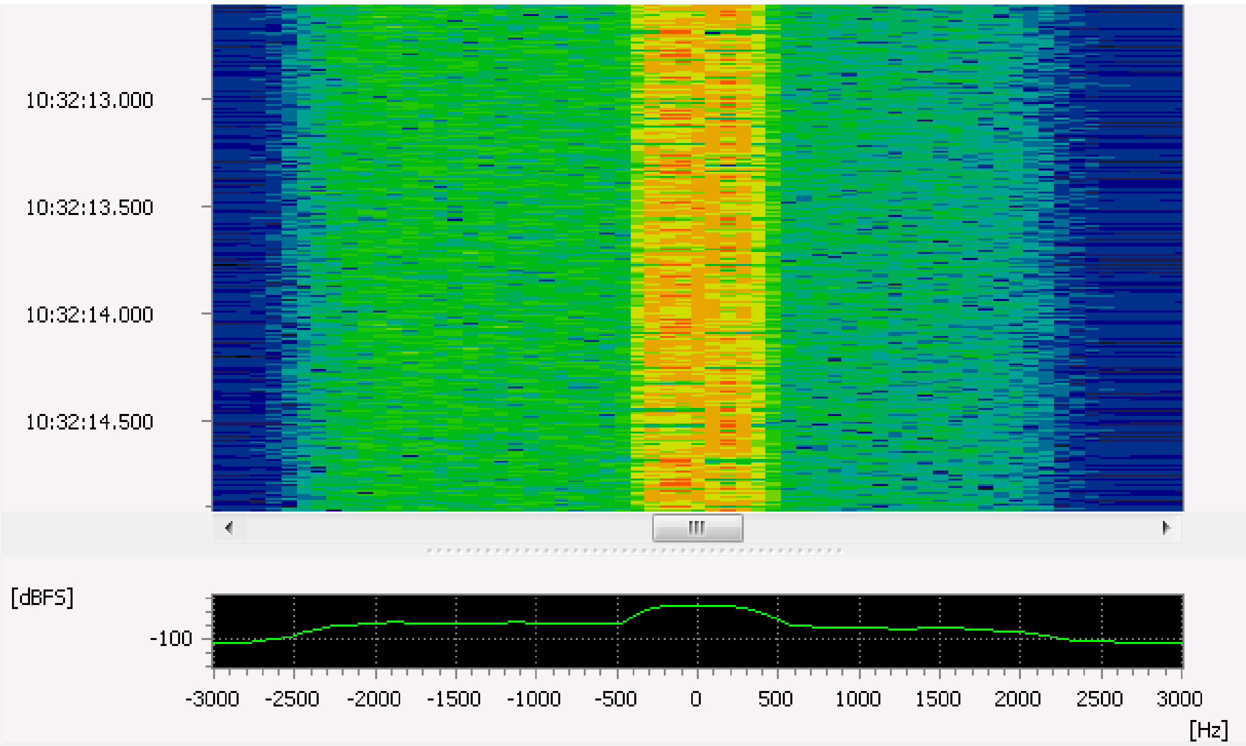


Figure 159: AERO-P 0.6kbps Spectrogram

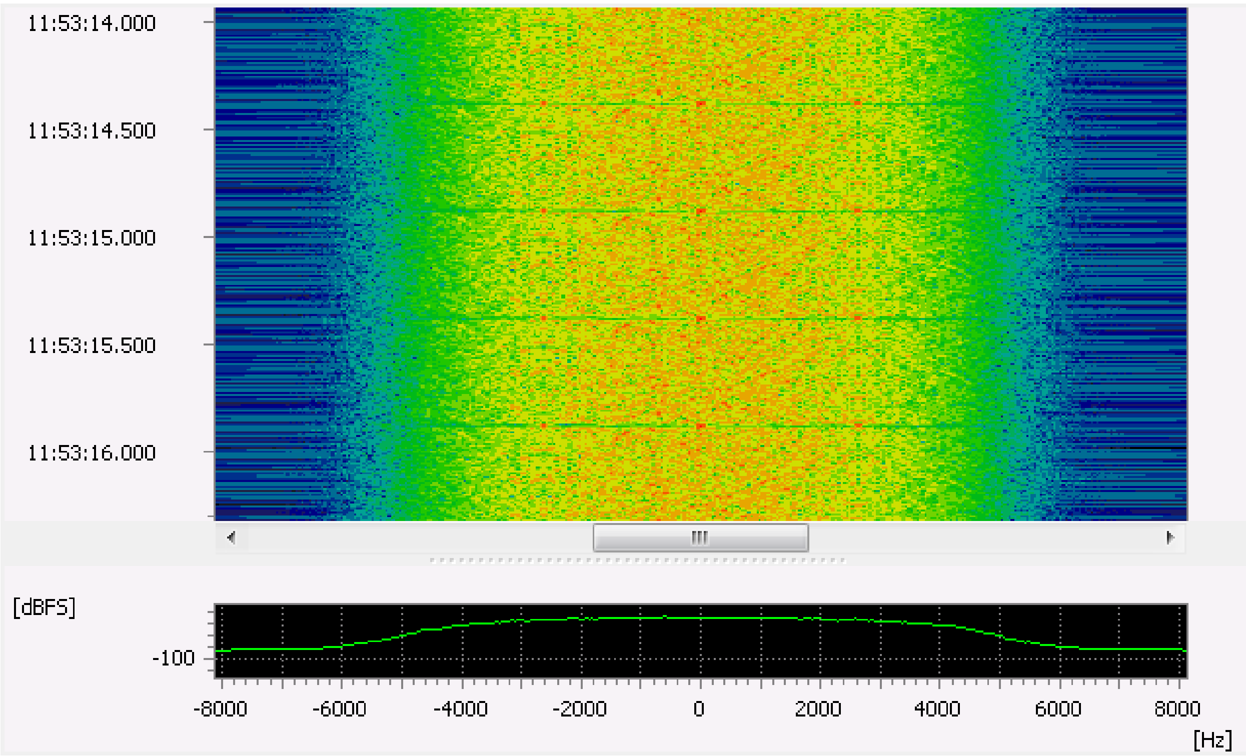


Figure 160: AERO-P 10.5kbps Spectrogram

3.3. INMARSAT AERO-R

General Information

AERO-R (R channel) is a random access (slotted Aloha) channel, used in the from-aircraft direction to carry signalling and user data.

Usage

- Aeronautical mobile satellite service

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'INMARSAT AERO-R'

Mode Details

- For bitrates: **0.6, 1.2, 2.4 kbit/s**

	Item	Value
Standard	Modulation	MSK
	Bandwidth (Hz)	from 600 to 2400
	Symbol rate (kBd)	0.6, 1.2 or 2.4
	Data rate (kbit/s)	0.6, 1.2 or 2.4
	Error correction	FEC rate $\frac{1}{2}$, k = 7
	Interleaver (s)	block and permutation
Demodulator Settings	Demodulator	MSK
	Symbol rate (Bd)	from 600, 1200 or 2400
	SR tolerance (Bd)	5
	Min. burst length (s)	0.050
	Max. burst length (s)	1.000
	Min. pause length (s)	0.010
	Min. burst SNR (dB)	0
Extras	Offset nominal frq. (Hz)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 159: AERO-R MSK

- For bitrate: **10.5 kbit/s**

	Item	Value
Standard	Modulation	OQPSK
	Bandwidth (Hz)	10500
	Symbol rate (kBd)	5.25
	Data rate (kbit/s)	10.5
	Error correction	FEC rate $\frac{1}{2}$, k = 7
	Interleaver (s)	block and permutation
Demodulator Settings	Demodulator	OQPSK
	Symbol rate (Bd)	5250
	SR tolerance (Bd)	5
	Min. burst length (s)	0.050
	Max. burst length (s)	1.000
	Min. pause length (s)	0.010
	Min. burst SNR (dB)	0
Extras	Offset nominal frq. (Hz)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 160: AERO-R OQPSK

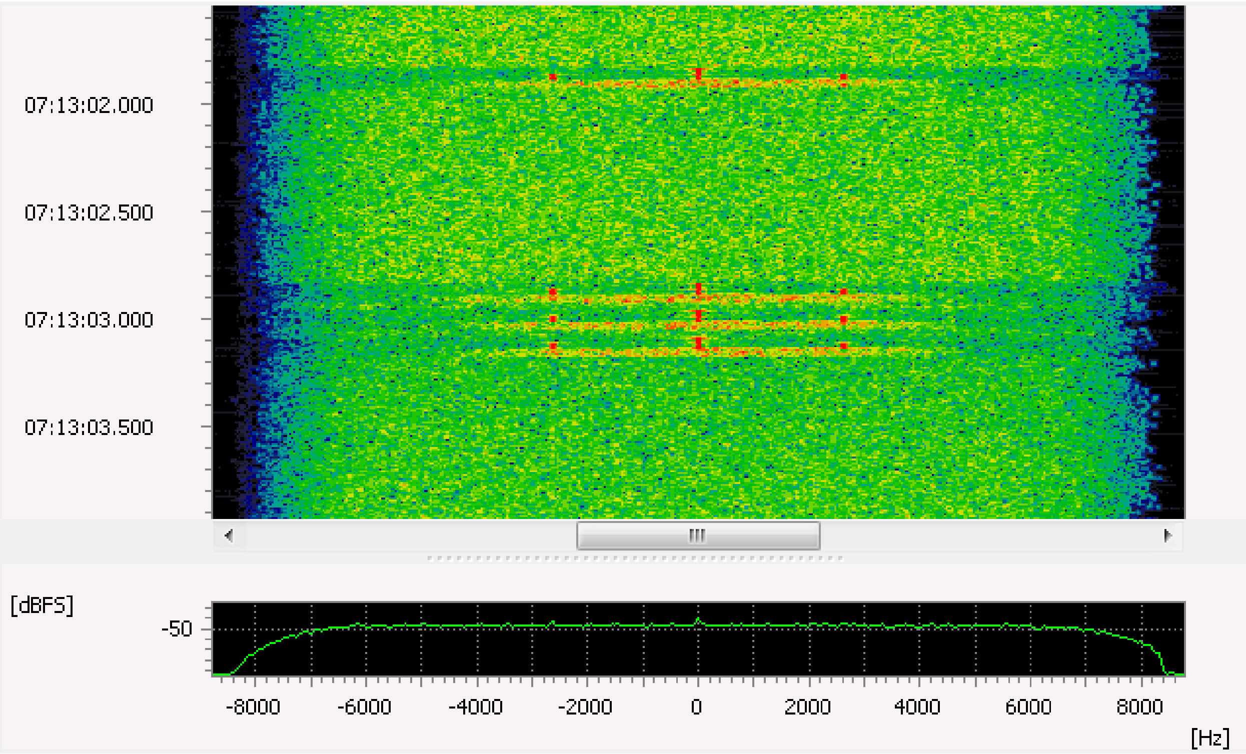


Figure 161: AERO-R 10.5kbps Spectrogram

3.4. INMARSAT AERO-T

General Information

AERO-T (T channel) is a reservation time division multiple access (TDMA) channel, used in the from-aircraft direction only. The receiving GES reserves time slots for transmissions requested by aircraft earth stations (AESs) according to message length. The sending AES transmits the message in the reserved time slots according to priority.

Usage

- Aeronautical mobile satellite service

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'INMARSAT AERO-T'

Mode Details

- For bitrates: **0.6, 1.2, 2.4 kbit/s**

	Item	Value
Standard	Modulation	MSK
	Bandwidth (Hz)	from 600 to 2400
	Symbol rate (kBd)	0.6, 1.2 or 2.4
	Data rate (kbit/s)	0.6, 1.2 or 2.4
	Error correction	FEC rate $\frac{1}{2}$, k = 7
	Interleaver (s)	block and permutation
Demodulator Settings	Demodulator	MSK
	Symbol rate (Bd)	from 600, 1200 or 2400
	SR tolerance (Bd)	3
	Min. burst length (s)	0.050
	Max. burst length (s)	1.000
	Min. pause length (s)	0.010
	Min. burst SNR (dB)	0
Extras	Offset nominal frq. (Hz)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 161: AERO-T MSK

- For bitrate: **10.5 kbit/s**

	Item	Value
Standard	Modulation	OQPSK
	Bandwidth (Hz)	10500
	Symbol rate (kBd)	5.25
	Data rate (kbit/s)	10.5
	Error correction	FEC rate $\frac{1}{2}$, k = 7
	Interleaver (s)	block and permutation
Demodulator Settings	Demodulator	OQPSK
	Symbol rate (Bd)	5250
	SR tolerance (Bd)	5
	Min. burst length (s)	0.050
	Max. burst length (s)	1.000
	Min. pause length (s)	0.010
	Min. burst SNR (dB)	0
Extras	Offset nominal frq. (Hz)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 162: AERO-T OQPSK

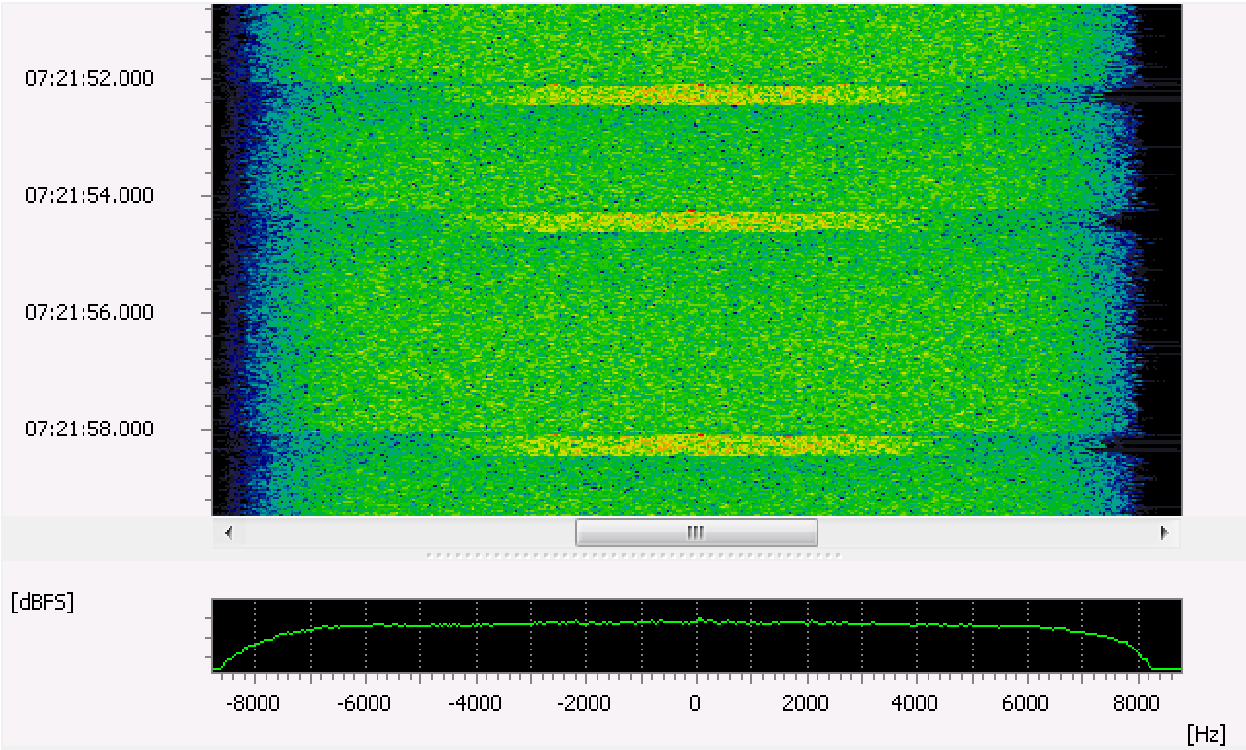


Figure 162: AERO-T 10.5kbps Spectrogram

3.5. INMARSAT-C TDM

General Information

Inmarsat-C is a satellite communications system which facilitates data transfer between mobile earth stations (MESs) and fixed Land Earth Stations (LESs) which are connected to terrestrial networks. Data can also be transferred from mobile to mobile via an LES. Mobile stations can be located on ships or on land based stations which can be mounted on vehicles or can be transportable.

The forward channels are continuous time division multiplex (TDM) channels. They are used for message transmission and signaling.

The return direction messages are transmitted by time division multiple access (TDMA) channels assigned by the network control station (NCS).

EGC (Enhanced Group Call) is a broadcast service mainly for maritime safety information (SafetyNET). It also contains a commercial service (FleetNET) for messages to many terminals simultaneously. A TDM channel originating from a NCS normally carries EGC packets (NCS common channel).

Messages directed to a single terminal are transmitted on TDM channels originating land earth stations (LES) and often contains unencrypted eMails.

Each frame (8.64 s) contains a bulletin board with a description and status information of the channel.

Usage

- Maritime, land based or aeronautical mobile satellite data communications

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'INMARSAT-C TDM'

Mode Details

- For INMARSAT-C TDM

	Item	Value
Standard	Modulation	BPSK
	Bandwidth (Hz)	1800
	Symbol rate (Bd)	1200
	Data rate (kbit/s)	1200
	Error correction	FEC rate $\frac{1}{2}$, k = 7
	Interleaver (s)	block and permutation
Demodulator Settings	Demodulator	BPSK
	Symbol rate (Bd)	1200
	SR tolerance (Bd)	5
Extras	Offset nominal frq. (Hz)	0

	Item	Value
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Decoding of EGC packets	yes
	Decoding of directed messages	yes
	Combination with other modems (modem list)	yes

Table 163: INMARSAT-C TDM

Output Description

- Output-Channel 1: All received and successfully decoded packets.
- Output-Channel 2: Merged directed messages. The data is interpreted as ASCII and Baudot, because both formats are used.
- Output-Channel 3: Merged EGC messages.

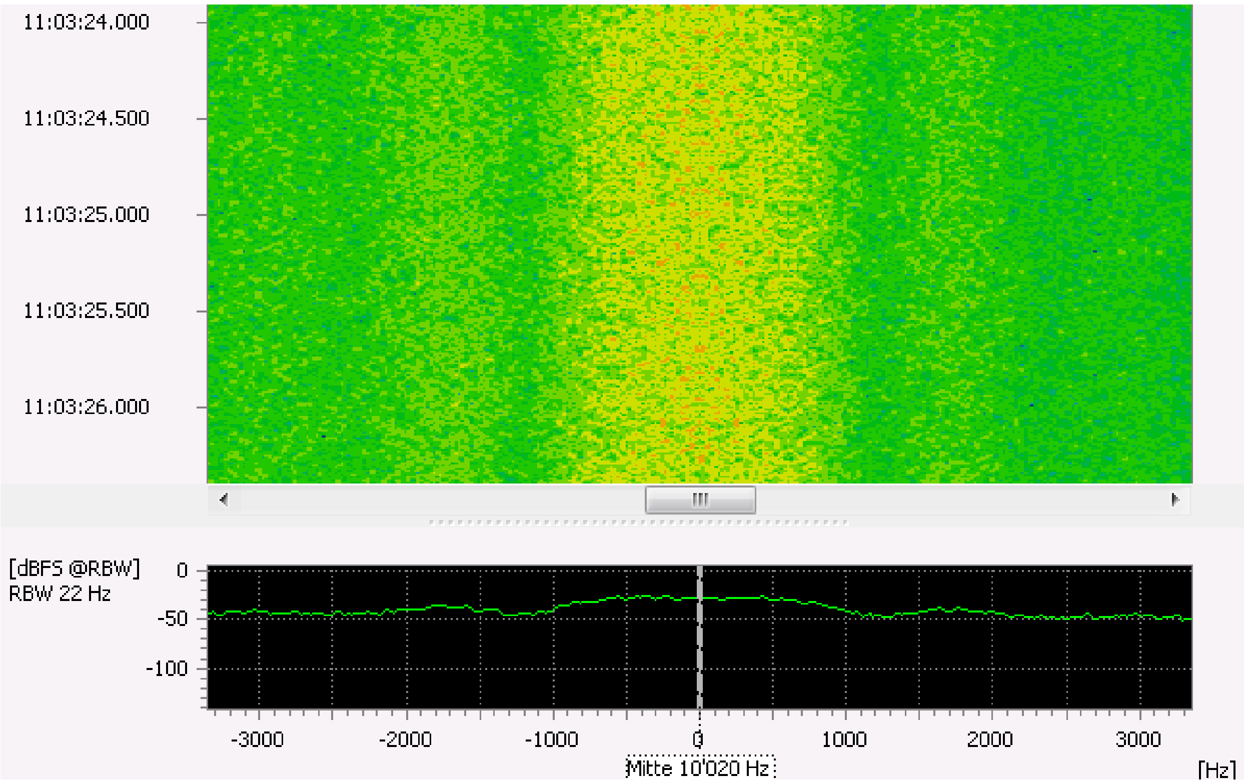


Figure 163: INMARSAT-C TDM Spectrogram

3.6. INMARSAT-C TDMA

General Information

Inmarsat-C is a satellite communications system which facilitates data transfer between mobile earth stations (MESs) and fixed Land Earth Stations (LESs) which are connected to terrestrial networks. Data can also be transferred from mobile to mobile via an LES. Mobile stations can be located on ships or on land based stations which can be mounted on vehicles or can be transportable.

The forward channels are continuous time division multiplex (TDM) channels. They are used for message transmission and signaling.

The return direction messages are transmitted by time division multiple access (TDMA) channels assigned by the network control station (NCS).

Usage

- Maritime, land based or aeronautical mobile satellite data communications

Mode Details

- For INMARSAT-C TDMA

	Item	Value
Standard	Modulation	MSK
	Bandwidth (Hz)	1800
	Symbol rate (Bd)	1200
	Data rate (kbit/s)	1200
	Error correction	FEC rate $\frac{1}{2}$, k = 7
	Interleaver (s)	block and permutation
Demodulator Settings	Demodulator	BPSK
	Symbol rate (Bd)	1200
	SR tolerance (Bd)	3
	Min. burst length (s)	0.100
	Max. burst length (s)	4.000
	Min. pause length (s)	0.100
	Min. burst SNR (dB)	0
Extras	Offset nominal frq. (Hz)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 164: INMARSAT-C TDMA

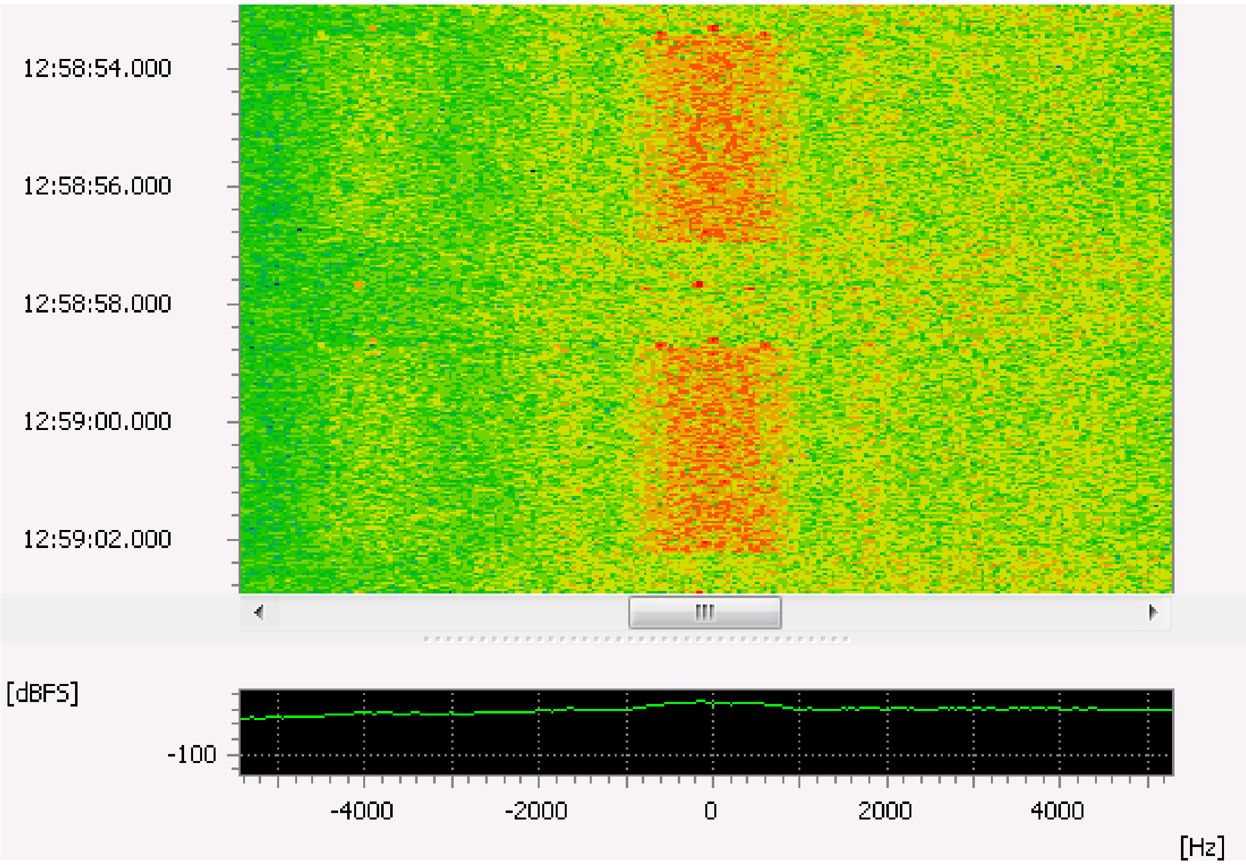


Figure 164: INMARSAT-C TDMA Spectrogram

3.7. INMARSAT IsatPhone Uplink

General Information

The IsatPhone family, e.g. IsatPhone 2, are mobile satellite telephones designed by Inmarsat for voice and data communication. Data capabilities, include SMS, short message emailing and GPS look-up-and-send, as well as supporting a data service of up to 20kbit/s. The link is provided by geostationary telecommunications satellites. The Standard is defined in GMR-2 documents ETSI TS 101 377-x-x.

Usage

- SAT telephony will be especially used in regions without cell phone infrastructure

Mode Details

	Item	Value
Standard	Modulation	GMSK, BT 0.3
	Bandwidth (Hz)	100 000
	Symbol rate (Bd)	67 708
	Traffic, Control Data, Channel Coding	encrypted
Demodulator Settings	Demodulator	(G)MSK
	Symbol rate (Bd)	67 708
	Type	GMSK linear
	SR tolerance (Bd)	10
	BT	0.3
	Min. burst length	1.5 ms
	Max. burst length	3.0 ms
	Min. pause length	10.0 ms
Extras	Offset nominal frq. (Hz)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 165: INMARSAT IsatPhone Uplink

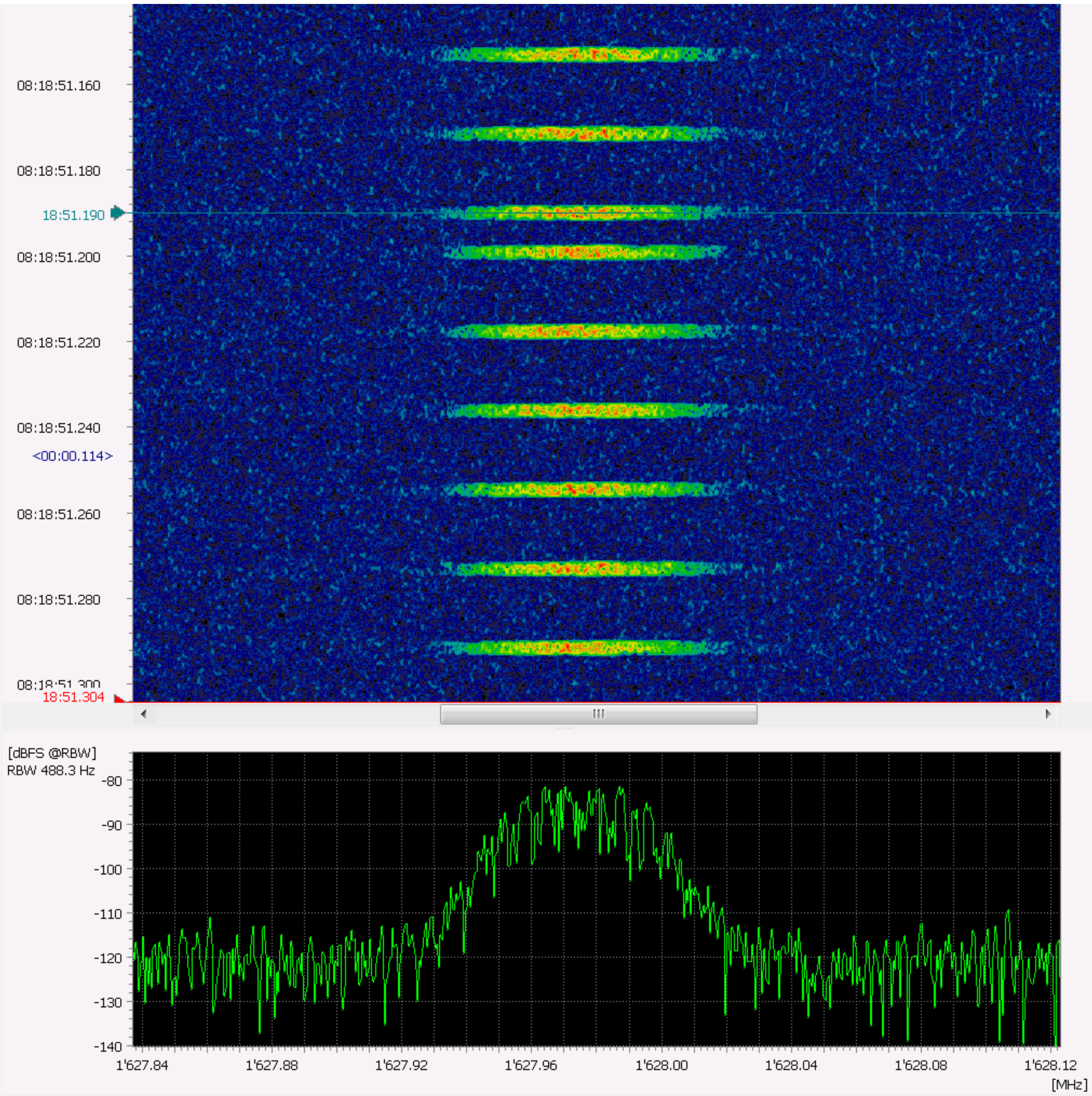


Figure 165: INMARSAT IsatPhone Uplink Spectrogram

Output Description

- As uplink channels are completely encrypted, only two burst types will be detected and indicated:
  - FTCB (Frequency and Time Correction Burst) indicated as "F"
  - NB (Normal Burst) containing traffic and control data, indicated as "*"

Output Example:

```
09:58:03:560 : IsatPhone Uplink detected

Beam Cluster Colour Code = 6
****FFFFFFFF**********************
```

3.8. Iridium Uplink

General Information

Iridium sat phone system is established by several low orbit satellites. This modem is able to detect e.g. the telephone product Iridium 9555. Modes are designed for voice connections as well as different kind of data applications. The System is defined by proprietary standards.

Usage

- Voice telephony, internet connection, M2M datagram, GMDSS (maritime polar regions), LRIT(maritime), FANS(avionics in isolated regions)

Mode Details

	Item	Value
Standard	Modulation	DPSK2, DPSK4
	Bandwidth (Hz)	31 250
	Symbol rate (Bd)	25 000
	Traffic, Control Data, Channel Coding	proprietary
Demodulator Settings	Demodulator	DPSK 4 A
	Symbol rate (Bd)	25 000
	SR tolerance (Bd)	5
	Min. burst length	7.0 ms
	Max. burst length	10.0 ms
	Min. pause length	5.0 ms
	Min. burst SNR	0 dB
Extras	Offset nominal frq. (Hz)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 166: Iridium Uplink

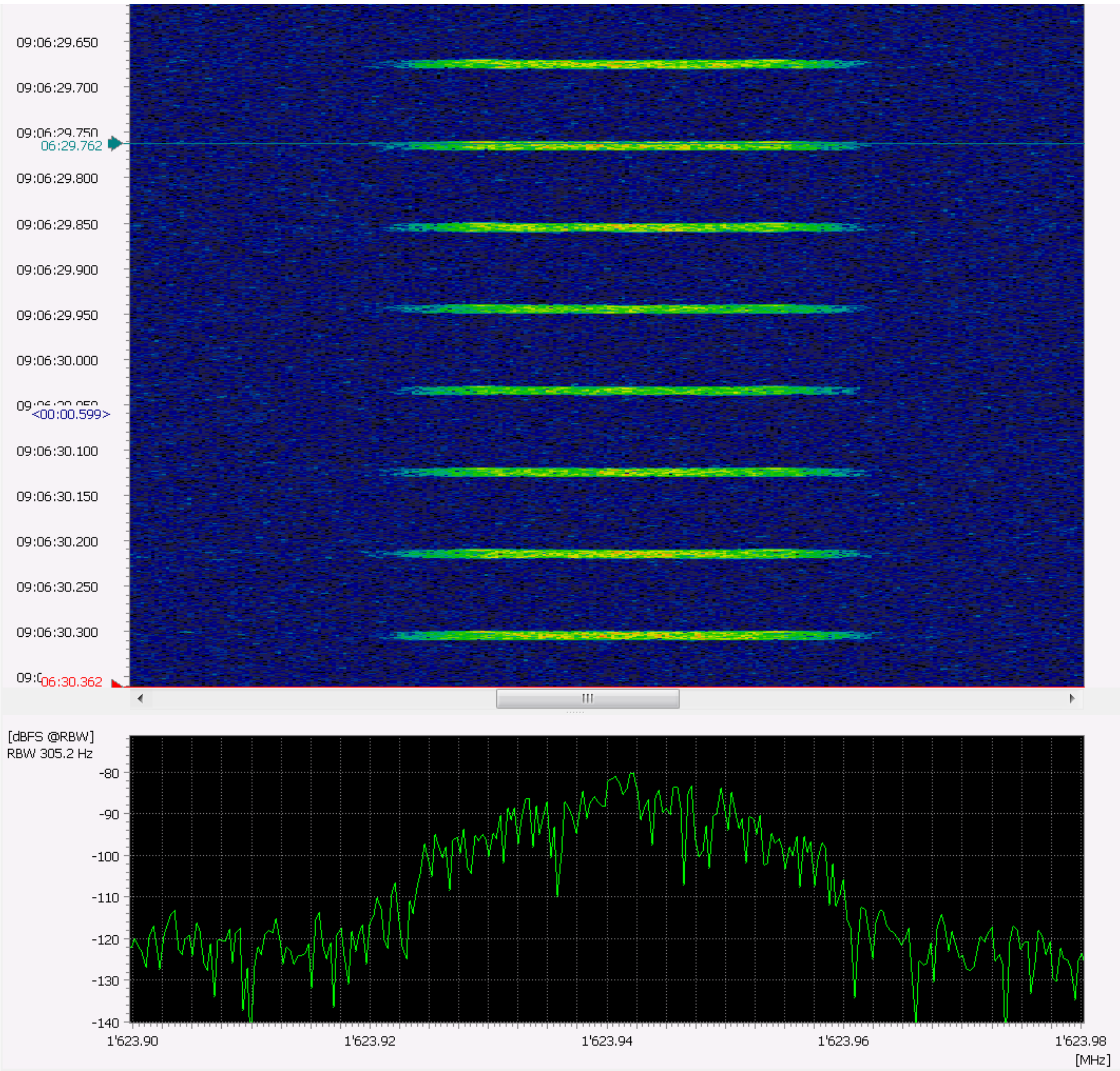


Figure 166: Iridium Uplink Spectrogram

Output Description

- A signal detection message with timestamp per detection of an emission

3.9. Thuraya Uplink

General Information

Thuraya is satellite communication network. As the network operates with only three geosynchronous satellites, it can only be accessed from limited world regions. The standard is defined in the ETSI GMR-1 Standards ETSI TS 101 376-x-x. This detector modem is e.g. able to detect the common satellite phone Thuraya XT-PRO.

In addition, RACH (random access channel) bursts are decoded, which contain the GPS coordinates of the transmitter unencrypted. In the case of a call setup by the RACH, the telephone number of the called party is also output.

Usage

- Speech communications, data communications up to 9600 bps

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Thuraya'

Mode Details

	Item	Value
Standard	Modulation	PSK 2B, PSK 4B, DPSK 4B
	Bandwidth (Hz)	31 250
	Symbol rate (Bd)	23 400
	Traffic, Control Data, Channel Coding	encrypted
Demodulator Settings	Demodulator	PSK 4B
	Symbol rate (Bd)	23 400
	SR tolerance (Bd)	5
	Min. burst length	1.0 ms
	Max. burst length	30.0 ms
	Min. pause length	10.0 ms
	Min. burst SNR	0 dB
Extras	Offset nominal frq. (Hz)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	RACH only
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 167: Thuraya Uplink

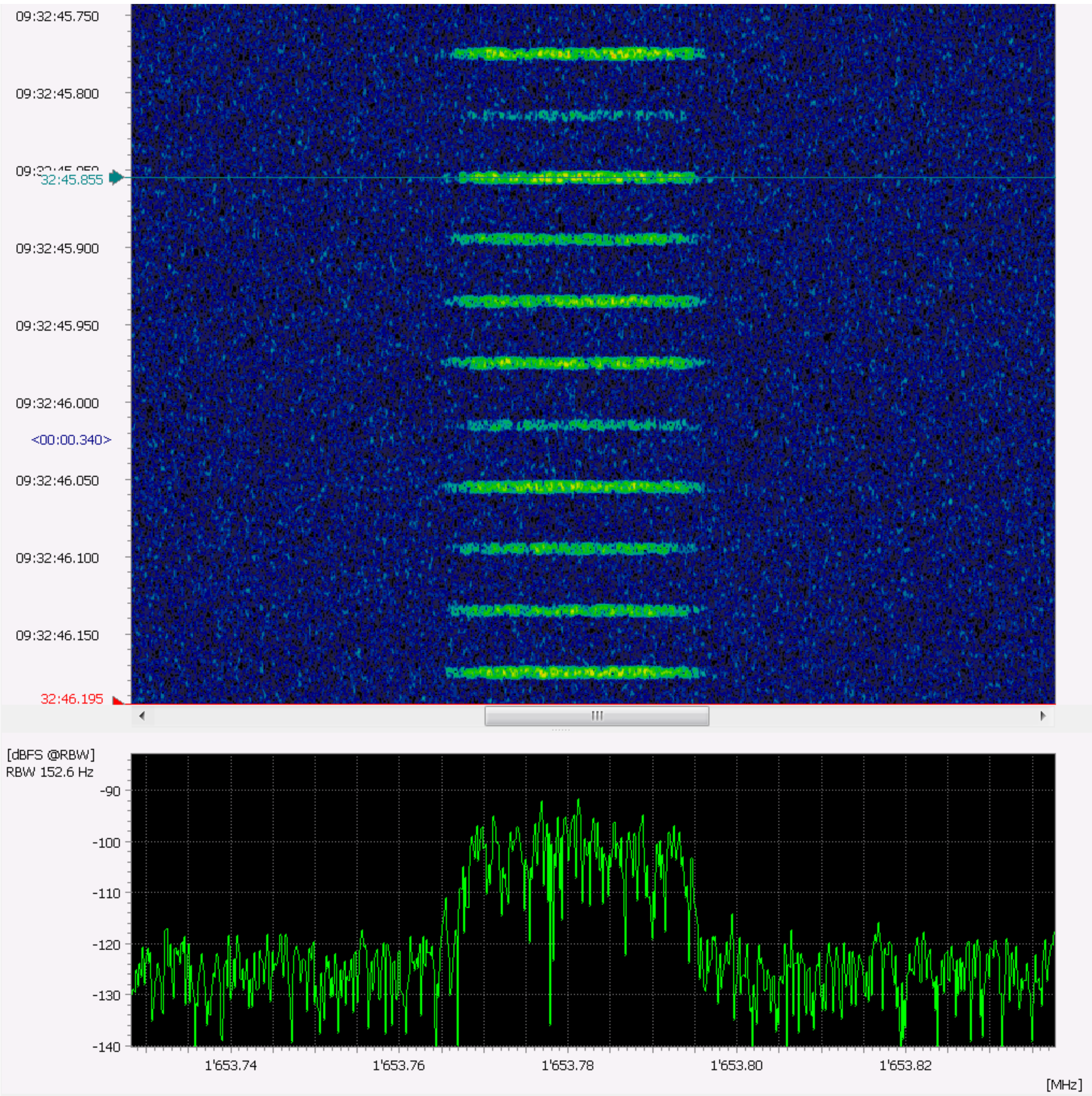


Figure 167: Thuraya Uplink Spectrogram

Output Description

- The output contains:
  - Burst types NT3 (three time slots), NT6 (six time slots)
  - Channel types TCH (traffic channels) , FACCH (fast associated control channel)
- A "*" indicates the same detected type of frame in sequence

Output Example:

```
09:32:47:372 BurstType: NT3 Channel:TCH3 **********
09:32:47:852 BurstType: NT3 Channel:TCH3 *****************
09:32:49:652 BurstType: NT3 Channel:FACCH3-1 **
09:32:51:092 BurstType: NT3 Channel:FACCH3-0 ***
09:32:51:252 BurstType: NT3 Channel:FACCH3-1 ***
```

3.10. Fax Group 3

See data sheet in HF section.

4. PMR Decoders

Note: For every decoder any operation limitations should be listed. If any submode of a decoder is not mentioned explicitly then it is not supported.

4.1. APCO-25

General Information

APCO-25 is a radio communication standard for Public Safety and Government organisation.

Usage

- VHF/UHF radio communication (136-174 MHz, 403-512 MHz, 746-806 MHz, 806-870 MHz)

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'APCO25'

Mode Details

	Item	Value
Standard	Duplex method	FDD or TDD
	Modulation	Continuous 4 Level FM (C4FM)
	Number of tones	4
	Tone spacing (Hz)	1200
	Symbol rate (Bd)	4800
Demodulator Settings	Demodulator	FSK 2, 3, 4 discr.
	Symbol rate (Bd)	4800
	SR tolerance (Bd)	4.8
	Modulation order	4
	Shift (Hz)	1167
	Shift tolerance (Hz)	33
Features	Demodulation	yes
	Recognition	yes
	Decoding, Binary Data / Voice Data	Yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

	Item	Value
Vocoder	IMBE	included

Table 168: APCO-25

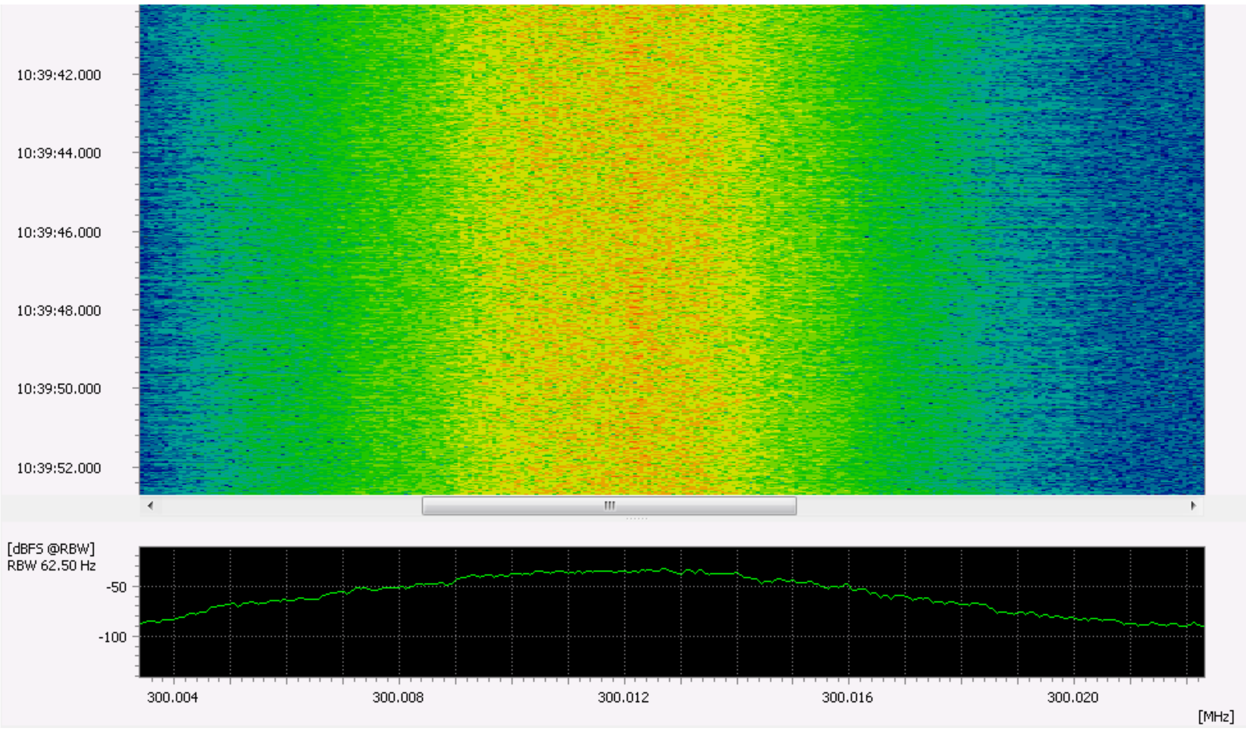


Figure 168: APCO-25 Spectrogram

4.2. APCO-25 Phase 2 TDMA Downlink

General Information

APCO-25 is a radio communication standard for Public Safety and Government organization. Phase2 is an extension based on TDMA to achieve a higher spectral efficiency. Two users can receive data from the base station on the same frequency.

All voice frames and most data frames within the signal are scrambled and cannot be decoded without initializing the descrambler with the correct seed. The seed consists of 3 parameters (WACN, System ID and Color Code). The decoder implements an automatic estimation of these parameters based on the scrambled data.

Usage

- VHF/UHF radio communication (136-174 MHz, 403-512 MHz, 746-806 MHz, 806-870 MHz)

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'APCO25 Phase2'

Mode Details

	Item	Value
Standard	Duplex method	TDMA
	Modulation	Pi/4-DQPSK
	Symbol rate (Bd)	6000
Demodulator Settings	Demodulator	DPSK
	Symbol rate (Bd)	6000
	SR tolerance (Bd)	3
	Modulation order	4
	Version	B
Features	Demodulation	yes
	Recognition	yes
	Decoding, Voice / MAC data packets	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes
	Automatic scrambling seed estimation	yes
Vocoder	AMBE+2™	included

Table 169: APCO-25 Phase 2 TDMA Downlink

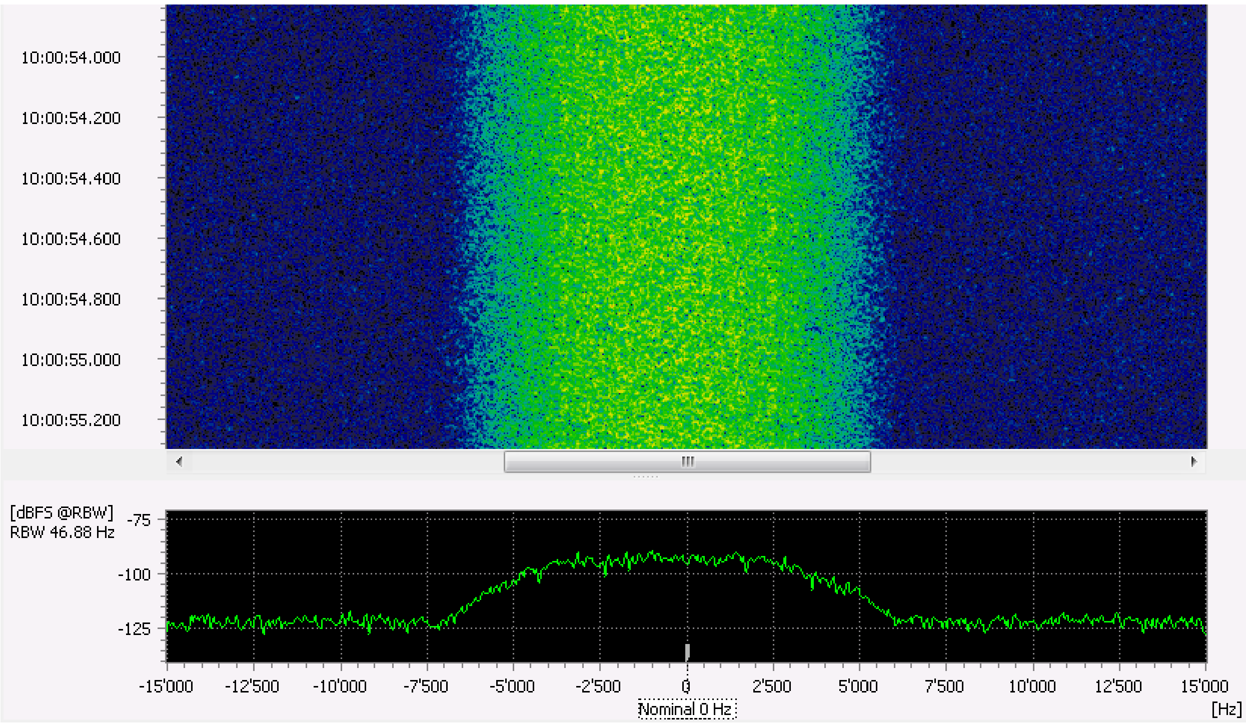


Figure 169: APCO-25 Phase 2 TDMA Downlink Spectrogram

4.3. DECT

General Information

DECT (Digital Enhanced Cordless Telecommunications) is a radio standard which is used particularly frequently for fixed network telephones. Often the systems set up in the home user area are unencrypted and allow the recording of conversations. The decoding of the signal is based on GAP (Generic Access Profile).

Usage

- Mainly use of cordless phones at home and in the office

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'DECT'

Mode Details

	Item	Value
Standard	Duplex method	TDMA / FDMA
	Modulation	GMSK
	Symbol rate (Bd)	1152000
Demodulator Settings	Demodulator	DECT, external Modem 15006
Features	Demodulation	yes
	Recognition	yes
	Decoding, Voice / Cs channel data (GAP)	yes, if unencrypted
	Combination with other modems (modem list)	yes
Vocoder	G.726 @ 32 kbit/s	included

Table 170: DECT - GAP

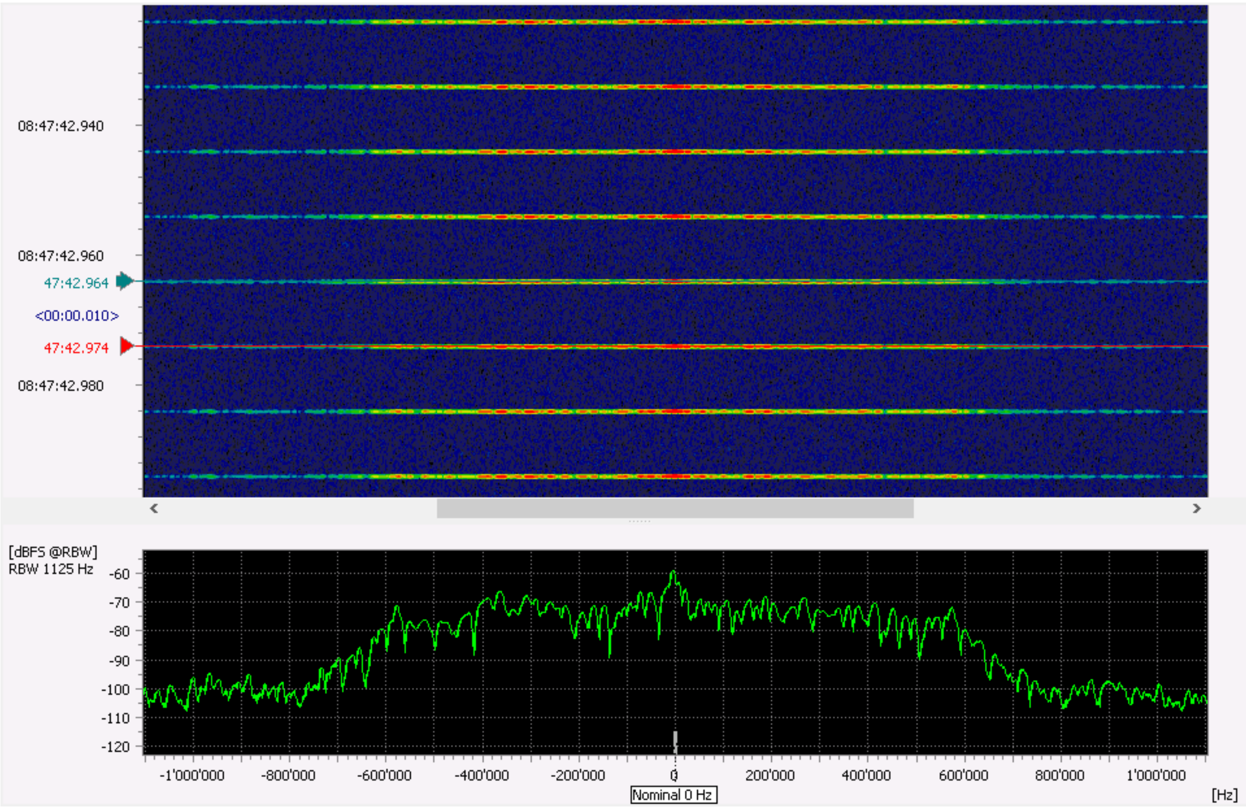


Figure 170: DECT dummy bearer Spectrogram

4.4. DMR

General Information

Digital Mobile Radio (*DMR*) is a digital modem with 12.5 kHz channel spacing and TDMA based protocol described in the ETSI technical standards.

TS 102 398: General Design

TS 102 361: Part 1: DMR Air Interface (AI) protocol

Part 2: DMR voice and generic services and facilities

Part 3: DMR Data protocol

Part 4: DMR trunking protocol

TS 102 362: Conformance Testing

Usage

- Category 1: Individuals and industries with low requirements, small-scale applications
- Category 2: Industries with high demands on business-critical large-scale communication

Decoding of Tier1, Tier 2 and Tier 3, however without trunking protocol, are supported. Embedded IP data is decoded and output as HEX and printable ASCII characters. In addition, it is saved as a pcap file.

Note: IP data can be fragmented by DMR protocol. The decoder does not combine these fragments.

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table

- 'DMR'
- 'DMR Continuous'

Mode Details

	Item	Value
Standard	Duplex method	FDD or TDD
	Modulation	FSK
	Number of tones	4
	Tone spacing (Hz)	1296
	Symbol rate (Bd)	4800

	Item	Value
Demodulator Settings	Demodulator	FSK 2, 3, 4 discr.
	Symbol rate (Bd)	4800
	SR tolerance (Bd)	10
	Modulation order	4
	Shift (Hz)	1296
	Shift tolerance (Hz)	0
	Modem type	Synchronous
	Min. burst length (s)	0.015
	Max. burst length (s)	0.045
	Min. pause length (s)	0.015
Features	Demodulation	yes
	Recognition	yes
	Decoding, Binary Data / Voice Data	Yes
	Manual Decryption with key	Motorola Basic Hytera Basic Alinco ARC4 DES AES
	Automatic Decryption	Motorola Basic Hytera Basic Alinco (key only at end of production)
	Automatic Side Band Adjustment	Yes
	Combination with other modems (modem list)	yes
Vocoder	AMBE+2™	included

Table 171: DMR multiple bursts transmission

	Item	Value
Standard	Duplex method	FDD or TDD
	Modulation	FSK
	Number of tones	4
	Tone spacing (Hz)	1296
	Symbol rate (Bd)	4800
Demodulator Settings	Demodulator	FSK 2, 3, 4 discr.
	Symbol rate (Bd)	4800
	SR tolerance (Bd)	10
	Modulation order	4
	Shift (Hz)	1296
	Shift tolerance (Hz)	0
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding, Binary Data / Voice Data	Yes
	Manual Decryption with key	Motorola Basic Alinco ARC4 DES AES
	Automatic Decryption	Motorola Basic Alinco
	Automatic Side Band Adjustment	--
	Combination with other modems (modem list)	yes
Vocoder	AMBE+2™	included

Table 172: DMR continuous transmission

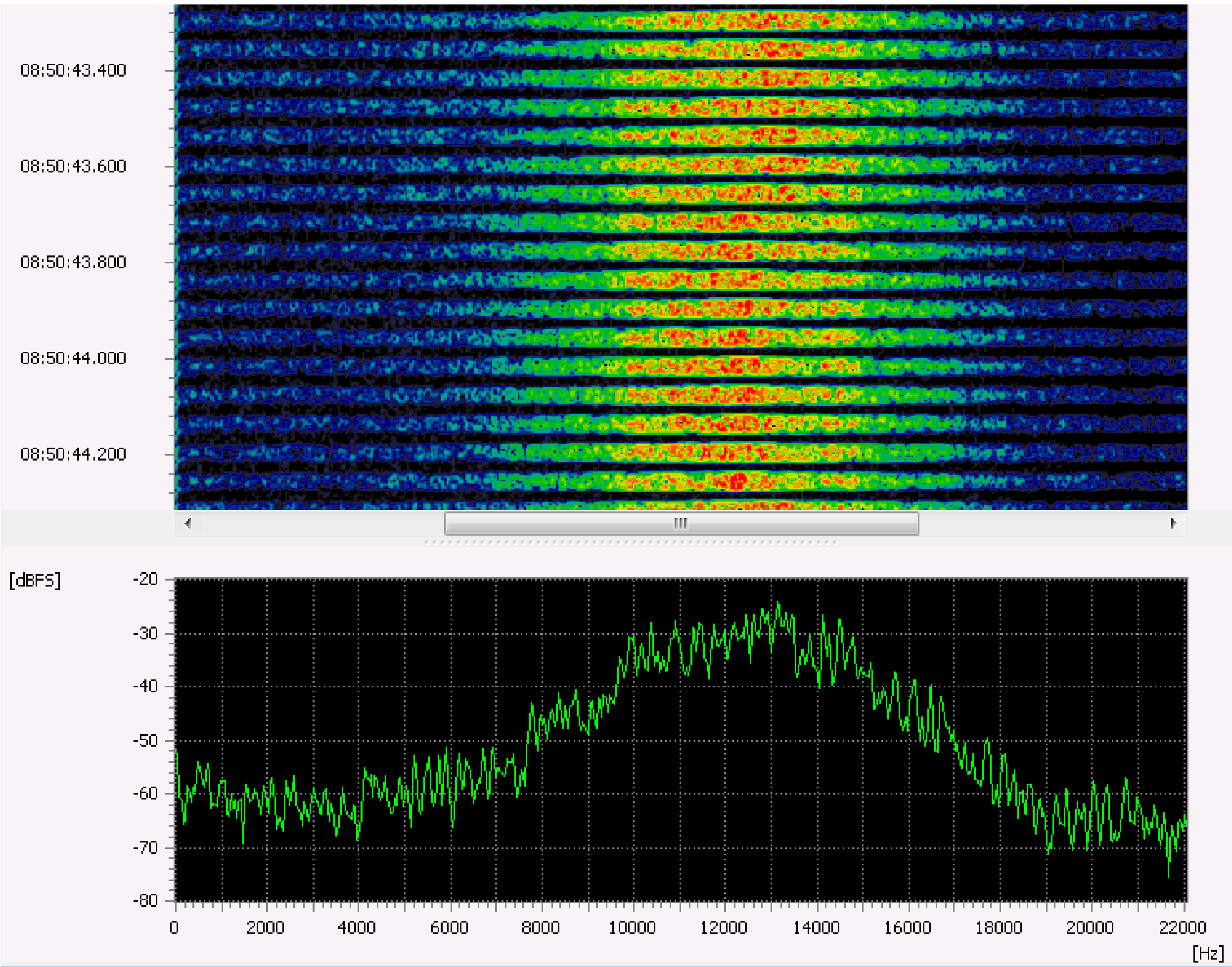


Figure 171: DMR multiple bursts transmission Spectrogram

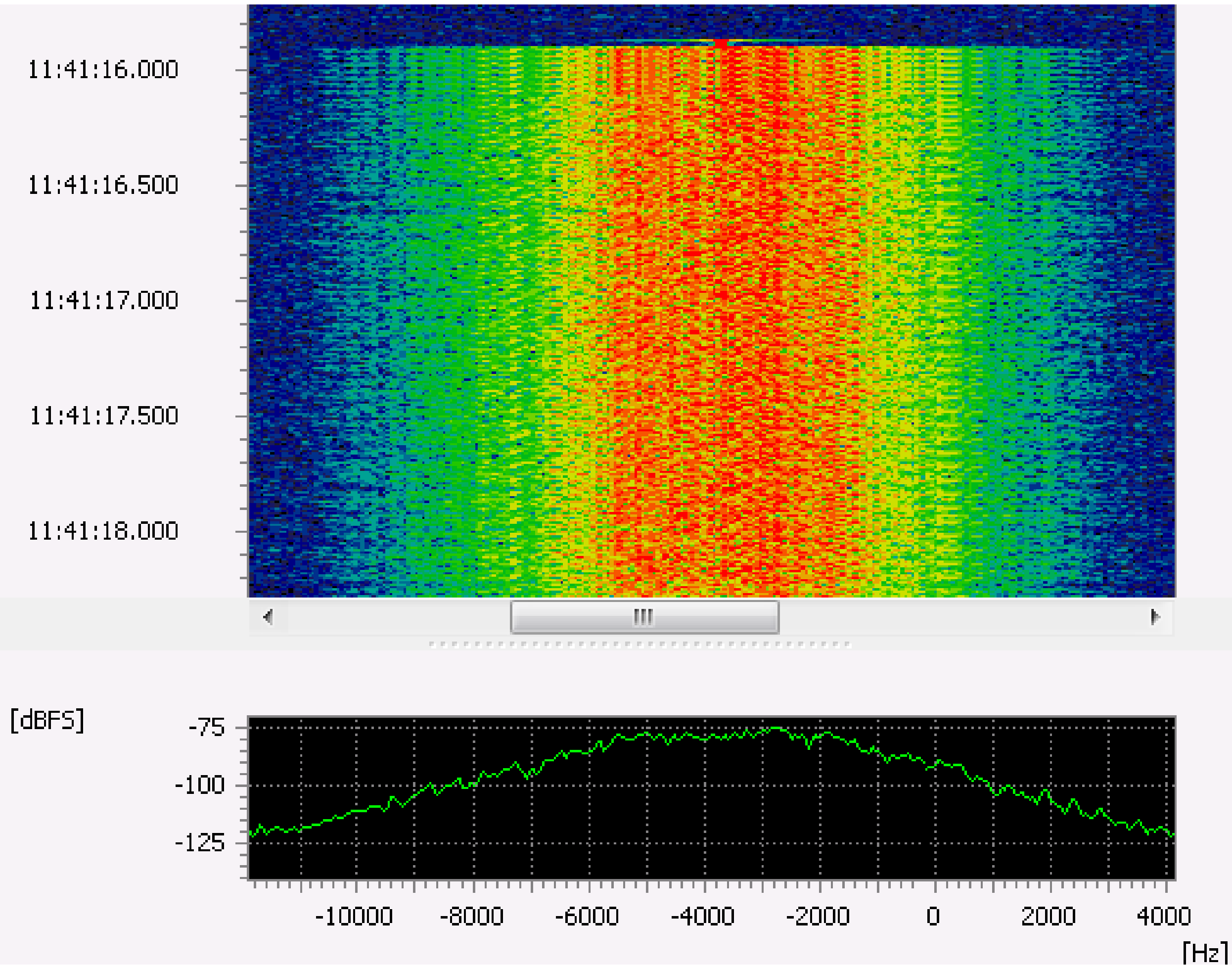


Figure 172: DMR continuous transmission Spectrogram

4.5. dPMR

General Information

digital Private Mobile Radio (dPMR) is a digital radio protocol for voice and data communications. dPMR is a narrowband (6.25 kHz channel spacing) FDMA based protocol described in the ETSI technical standards TS102 490 and TS102 658.

Usage

- Professional and private voice & data communications

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'dPMR'

Mode Details

	Item	Value
Standard	Modulation	Multi tone
	Number of tones	4
	Tone spacing (Hz)	700
	Symbol rate (Bd)	2400
	Error correction	FEC
Demodulator Settings	Demodulator	FSK 2, 3, 4 discr.
	Symbol rate (Bd)	2400
	SR tolerance (Bd)	1
	Modulation order	4
	Shift (Hz)	733
	Shift tolerance (Hz)	0
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding, Binary Data / Voice Data	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes
Vocoder	AMBE+2™	included

Table 173: dPMR

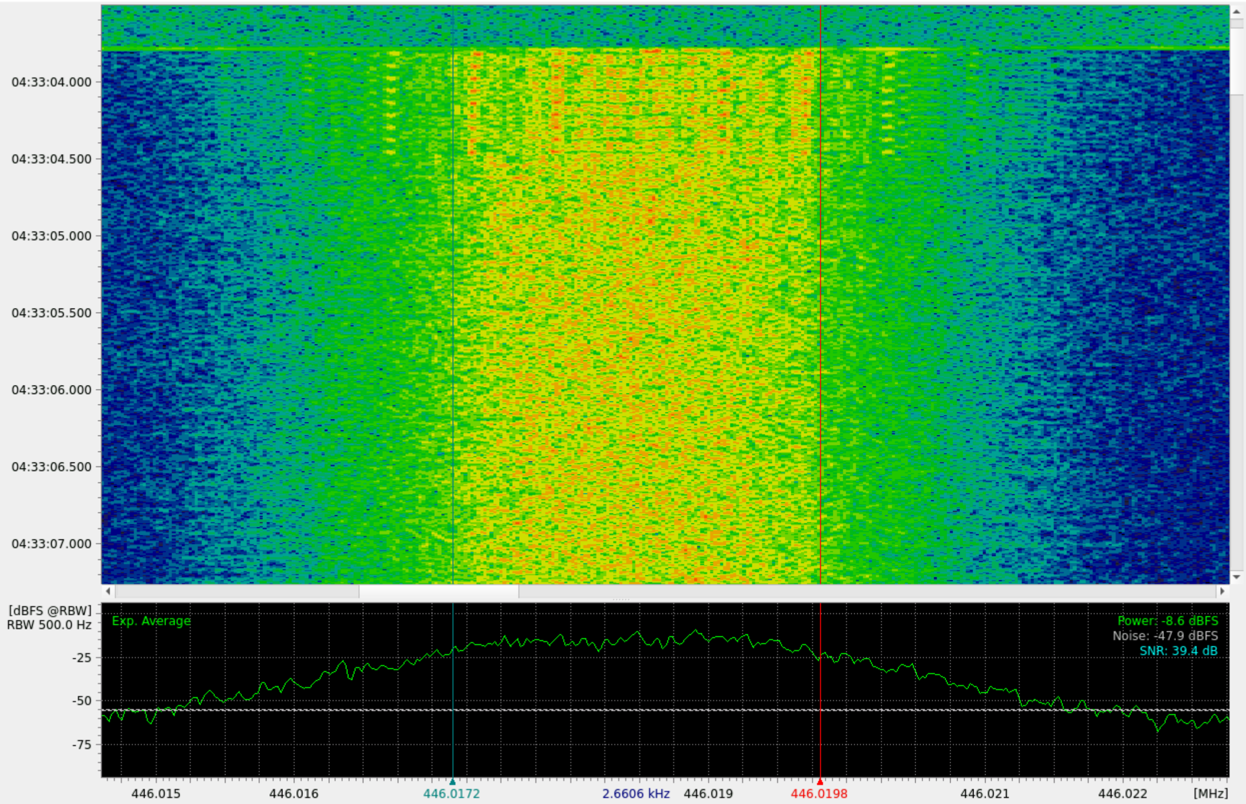


Figure 173: dPMR Spectrogram

4.6. D-STAR

General Information

D-STAR is an open digital protocol developed by the Japanese amateur radio league for digital voice and data transmission in amateur radio. ICOM as the only vendor on the market has a big range of radios based on this standard with extended capabilities.

The decoder supports metadata output (frame header) and voice data output.

Usage

- Digital voice and data for amateur radio communication on vhf bands and above

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'D-STAR'

Mode Details

	Item	Value
Standard	Modulation	GMSK
	Symbol rate (Bd)	4800
	Error correction	Convolutional Coding
Demodulator Settings	Demodulator	FSK 2 discr.
	Symbol rate (Bd)	4800
	SR tolerance (Bd)	5
	Modulation order	2
	Shift (Hz)	2000
	Shift tolerance (Hz)	100
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding, Binary Data / Voice Data	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes
Vocoder	AMBE	included

Table 174: D-Star

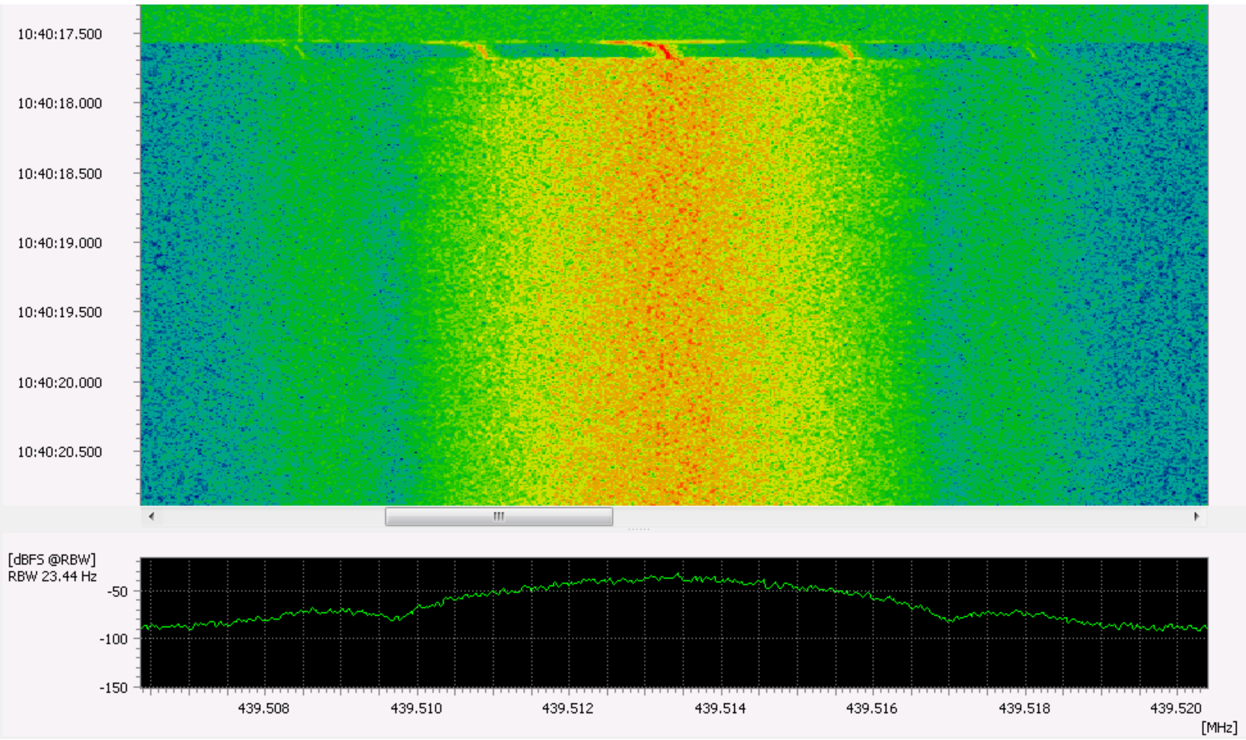


Figure 174: D-Star Spectrogram

4.7. GSM C0 Control Channel

General Information

The Global System for Mobile Communications (GSM) is a digitial cellular network used worldwide to provide voice and data services for the public.

Each GSM cell has exactly one control channel on a fixed frequency. This channel is used to transmit unencrypted signaling and metadata. The Broadcast Channel (BCH), Paging Channel (PCH), Access Grant Channel(AGCH) and some dedicated control channels are part of this.

Decoding of any traffic channels or any uplink signals from mobile to basestation is not supported.

Usage

- Voice and data services for the public

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'GSM'

Mode Details

	Item	Value
Standard	Duplex method	TDMA / FDMA
	Modulation	GMSK
	Symbol rate (Bd)	270833.33
Demodulator Settings	Demodulator	GSM, external Modem 15003
Features	Demodulation	yes
	Recognition	yes
	Decoding of Broadcast Channel	yes
	Decoding of Paging Channel	yes
	Decoding of Access Grant Channel	yes
	Combination with other modems (modem list)	yes
Restriction	Demodulation only for the C0 control channel frequency	
	Decoding of traffic channels (TCH) is not supported	
	Decoding of uplink is not supported	

Table 175: GSM C0 Control Channel

Output Description

Decoding of the Broadcast Channel (BCH) includes

- Mobile Country Code (MCC) and assigned country name
- Mobile Network Code (MNC) and assigned operator
- Location area code (LAC)
- Basic cell configuration values (CCCH-CONF)
- ARFCNs of traffic channels of the current cell and corresponding absolute radio frequency if calculation is possible for the currently used GSM band
- Counting of used slots

Decoding of the paging channel (PCH) includes

- TMSI or IMSI of paging request
- count and time of requests

Decoding of the Access Grant Channel (AGCH) includes

- data or dedicated
- assigend timeslot
- frequency hopping configuration

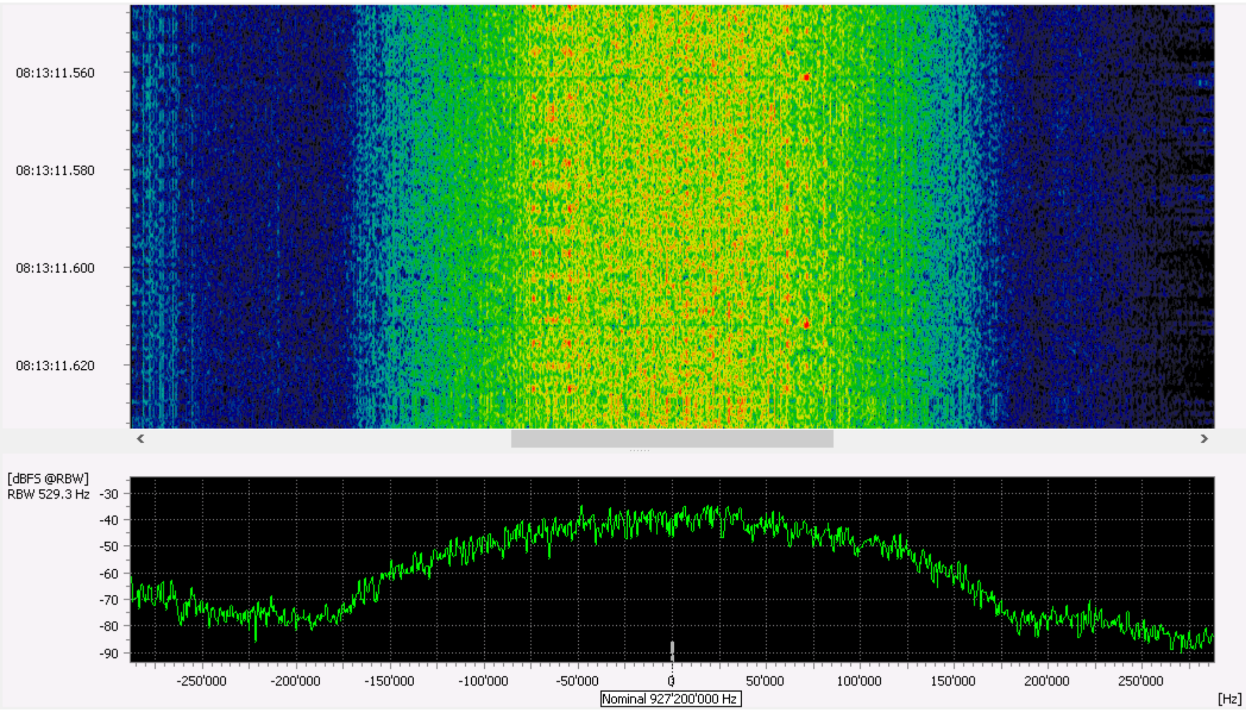


Figure 175: GSM C0 Control Channel Spectrogram

4.8. Motorola SmartNet

General Information

Motorola SmartNet is an early analog trunked radio system developed by Motorola. System control is conducted via a continuous digital (FSK) control channel. Two different bandwidths are known.

The actual voice channels are either analogue FM or digital P25 (ASTRO SmartNet).

Usage

- Mobile voice and data communication

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Smartnet'

Mode Details

	Item	Value
Standard	Modulation	FSK 2
	Bandwidth (Hz)	3000 / 6000
	Symbol rate (Bd)	3600
	Error correction	FEC, CRC
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	3600
	SR tolerance (Bd)	5
	Shift (Hz)	3000 or 5200
	Shift tolerance (Hz)	100
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 176: Motorola SmartNet

Output Description

The output on channel 1 will show the interpreted data of a Motorola proprietary protocol. Every output line represents one successfully decoded message. For clarity, repeated status messages are filtered.

The optional output on channel 2 will show the result of channel decoding, which is a stream of 3 data fields in hexadecimal annotation:

- A 12 bit command
- A single bit flag (G)roup call / (I)ndividual call)
- A 16 bit ID field

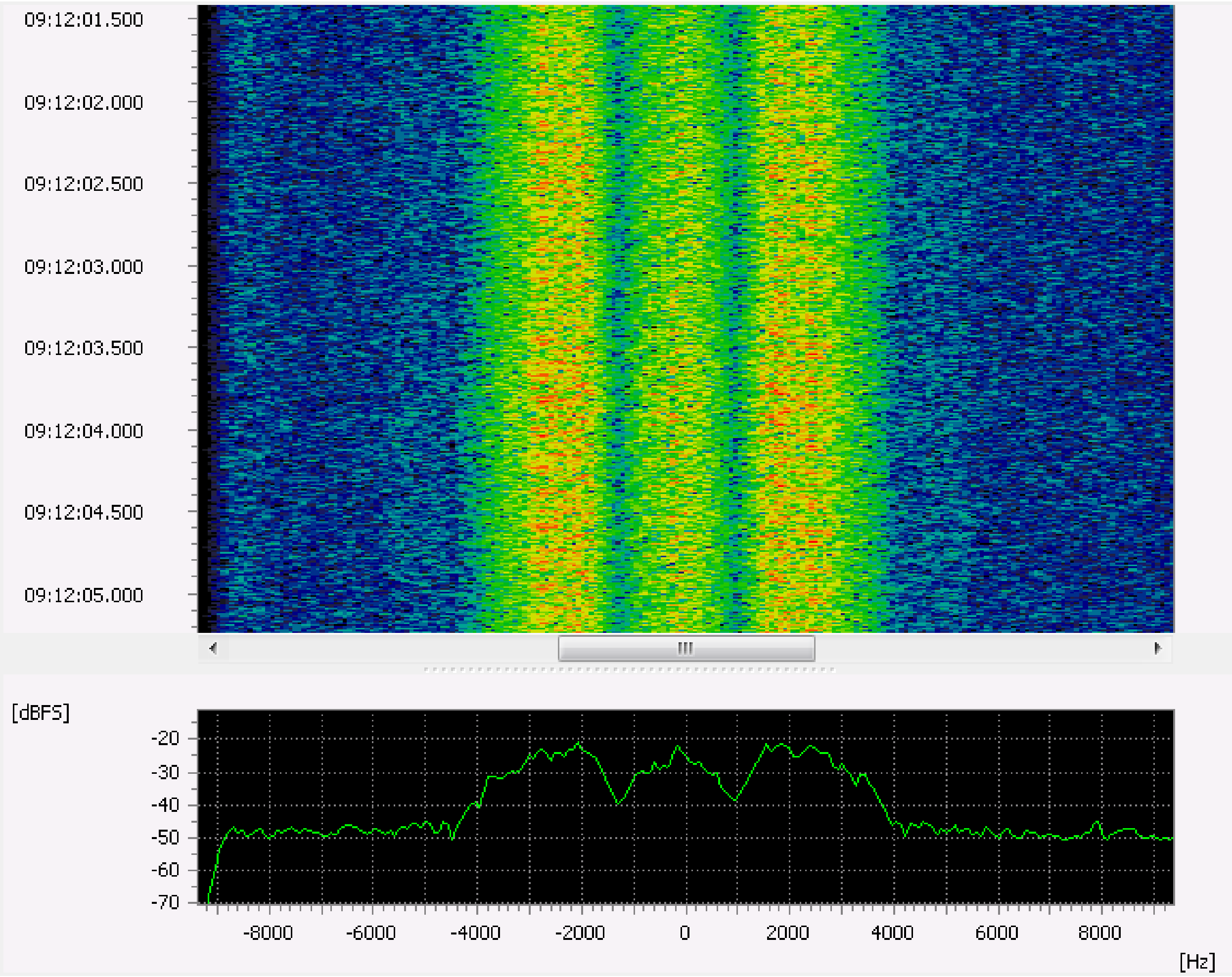


Figure 176: Motorola SmartNet Spectrogram

4.9. MPT1327

General Information

MPT1327 is a Signaling Standard for Trunked Private Land Line Mobile Radio Systems, issued by the British Radio communication Agency.

Usage

- Mobile voice and data communication

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'MPT1327'

Mode Details

	Item	Value
Standard	Modulation	FFSK
	Number of channels	1 + 1024
	Bandwidth (Hz)	12500
	Symbol rate (Bd)	1200
	Error correction	CRC
Demodulator Settings	Demodulator	(G)MSK
	Type	MSK
	Symbol rate (Bd)	1200
	SR tolerance (Bd)	5
	Min. burst length (s)	0.010
	Max. burst length (s)	60.000
	Min. pause length (s)	0.010
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes
Restriction	This decoder processes data on the TSC (*Trunking System Controller*) level only, not on the RU (*Radio Unit*) level.	

Table 177: MPT1327

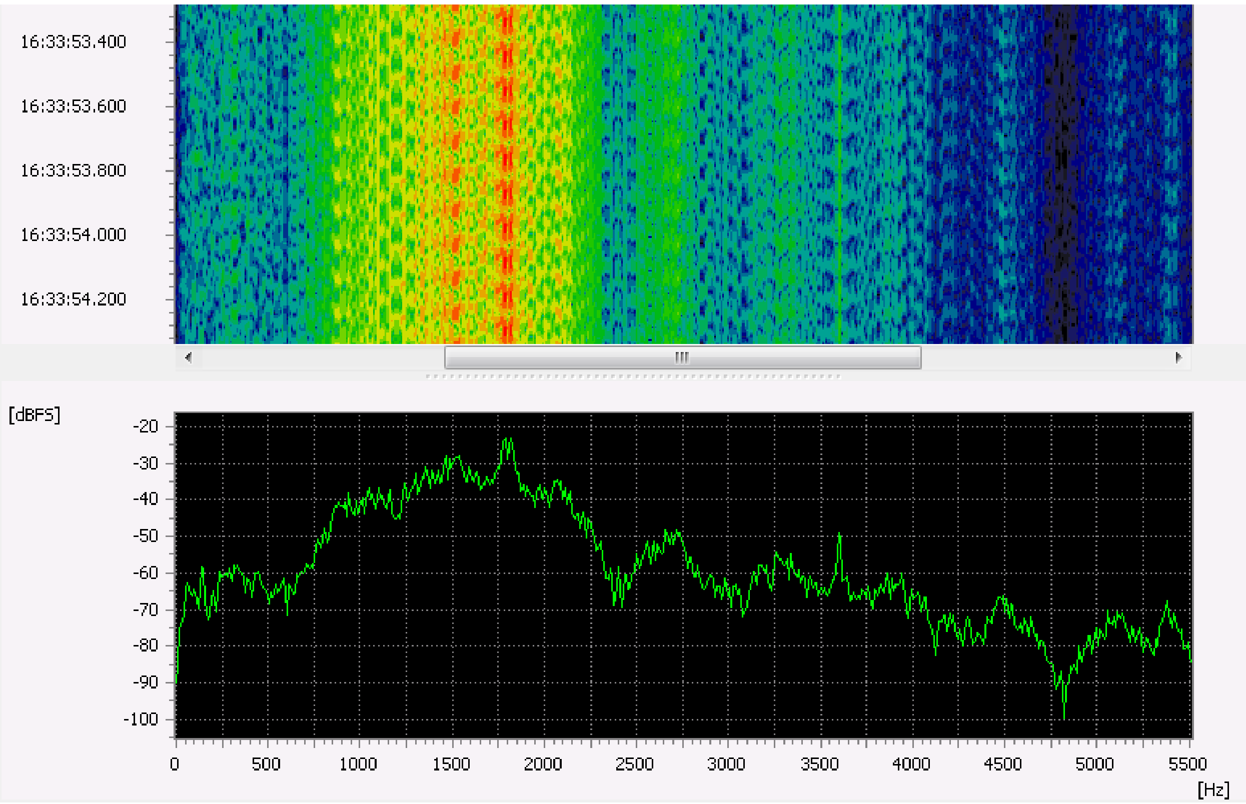


Figure 177: MPT1327 Spectrogram

4.10. NXDN

General Information

NXDN is a Land Mobile Radio System for Public Safety and Industry applications used under 512 MHz (mainly in the 150 MHz and 450 MHz bands).

Usage

- NXDN radio transmission (Digital voice and data)
- Conventional and trunking mode available

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'NXDN'

Mode Details

	Item	Value	
Standard	Modulation	FSK	
	Number of tones	4	
	Shift (Hz)	700	1600
	Bandwidth (Hz)	6250	12500
	Symbol rate (symbols/s)	2400	4800
	Vocoder	AMBE+2, 3600 bps, EHR future extension	
Demodulator Settings	Demodulator	FSK 2, 3, 4 discr.	
	Symbol rate (Bd)	2400	4800
	SR tolerance (Bd)	10	10
	Modulation order	4	4
	Shift (Hz)	733	1600
	Shift tolerance (Hz)	3	3
Features	Demodulation	yes	
	Recognition	yes	
	Decoding, Binary Data / Voice Data	yes	
	Manual Decryption with key	scrambler DES	
	Automatic Decryption	scrambler	
	Automatic Polarity Adjustment	yes	
	Combination with other modems (modem list)	yes	
Vocoder	AMBE+2™	included	

Table 178: NXDN

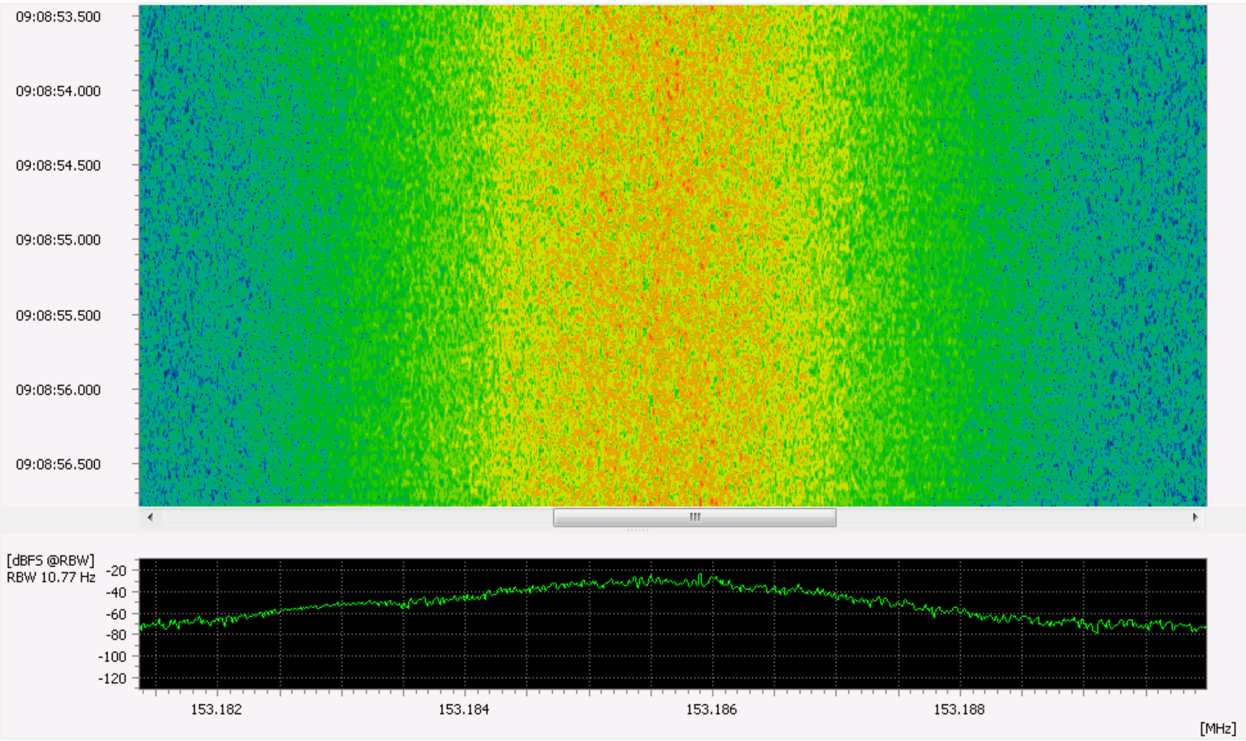


Figure 178: NXDN Spectrogram

4.11. TETRA DMO

General Information

TErrestrial TRunked rAdio (TETRA) Direct Mode Operation (DMO) is the mode for direct connections from Mobile Stations to Mobile Stations.

They look similar to uplink signals however additional control slots might appear.

Usage

- Communication in the VHF/UHF frequency range among closed user groups such as public safety, military, industry and transportation

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'TETRA DMO'

Mode Details

	Item	Value
Standard	Demodulator	DPSK 2,4,8,16 A/B
	Symbol rate (Bd)	18000
	SR tolerance (Bd)	10
Demodulator Settings	Demodulator	DPSK 2,4,8,16 A/B
	Symbol rate (Bd)	18000
	SR tolerance (Bd)	10
	Modulation order	4
	Version	B
	adaptive equalizer	off
	Min. burst length (s)	0.010
	Max. burst length (s)	0.500
	Min. pause length (s)	0.005
	Min. Burst SNR (dB)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding, Binary Data / Voice Data	yes
	Manual Decryption with key	TEA 1/3/4
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 179: TETRA DMO

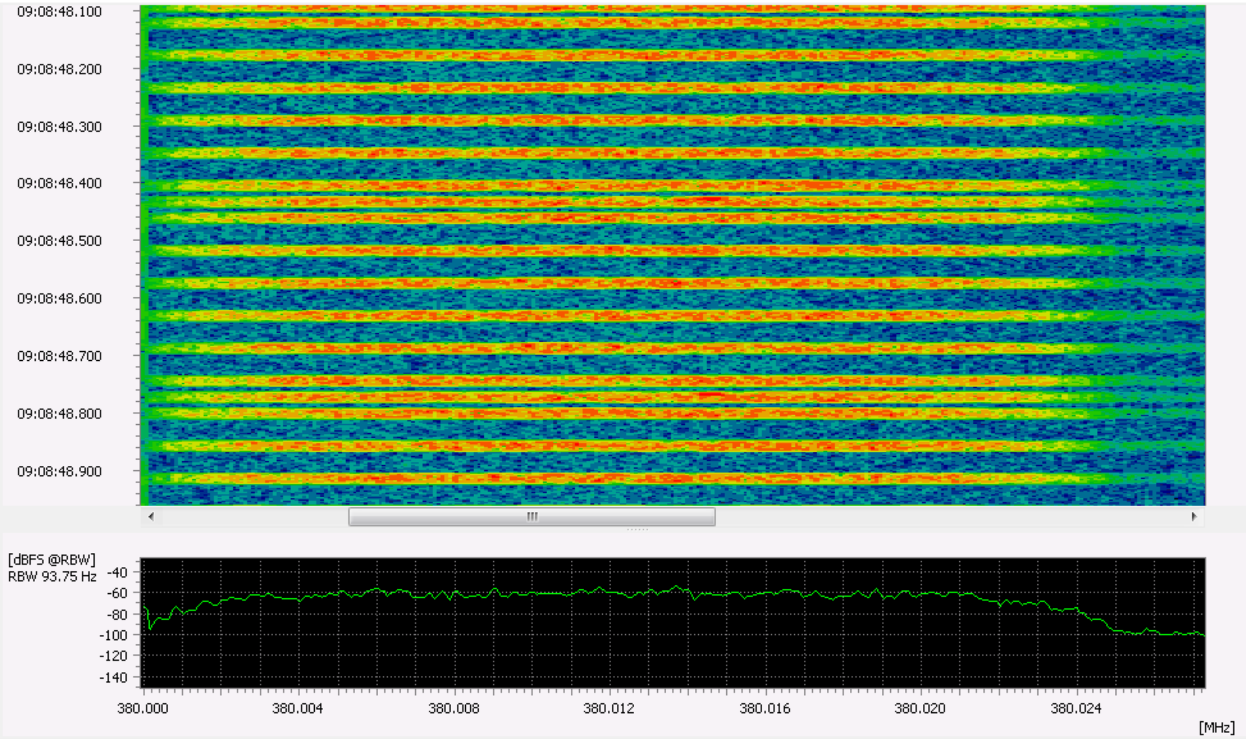


Figure 179: TETRA DMO Spectrogram

4.12. TETRA Downlink

General Information

TErrestrial TRunked rAdio (TETRA) is a standard for digital voice and data mobile communication over radio. The standard has been released by ETSI organization. More than 100 countries across Europe, Middle East, Africa, Asia Pacific, Caribbean and Latin America are using TETRA systems. The standard is being updated and extended continuously by ETSI.

Usage

- Communication in the VHF/UHF frequency range among closed user groups such as public safety, military, industry and transportation

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'TETRA'

Mode Details

	Item	Value
Standard	Demodulator	DPSK 2,4,8 A/B
	Symbol rate (Bd)	18000
	SR tolerance (Bd)	10
Demodulator Settings	Demodulator	DPSK 2,4,8 A/B
	Symbol rate (Bd)	18000
	SR tolerance (Bd)	10
	Modulation order	4
	Version	B
Features	Demodulation	yes
	Recognition	yes
	Decoding, Meta Data / Voice Data	yes
	Manual Decryption with key	TEA 1/3/4
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes
Vocoder	ACELP	included

Table 180: TETRA Downlink

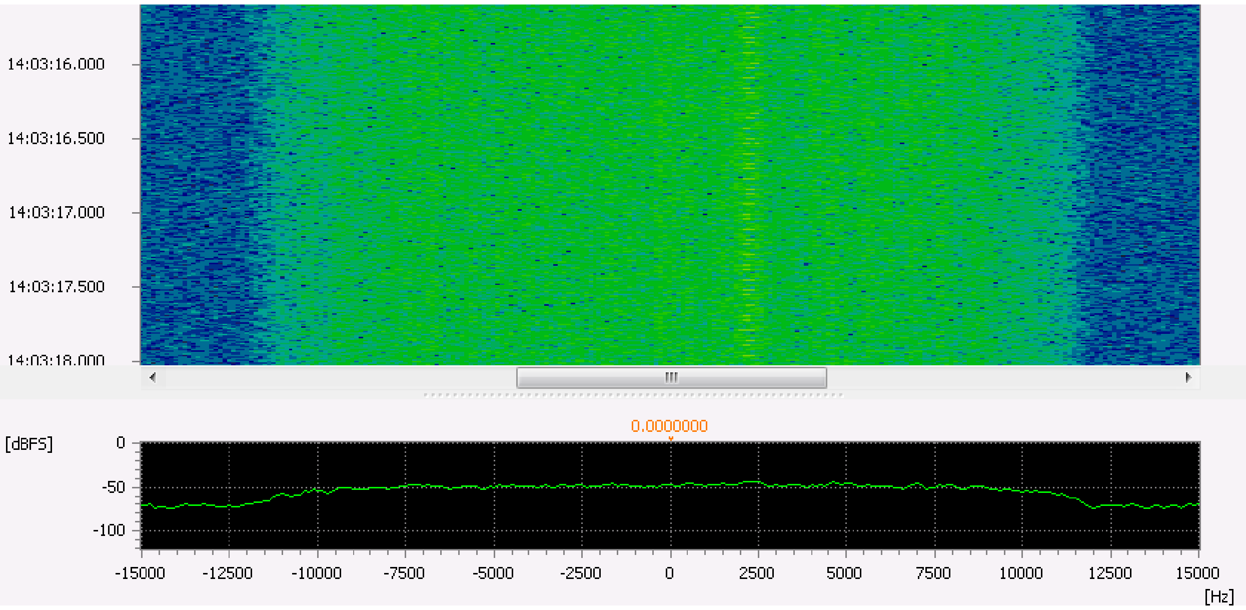


Figure 180: TETRA Downlink Spectrogram

4.13. TETRA Uplink

General Information

TErrestrial **TR**unked r**A**dio (TETRA) Uplink is the signal path from the TETRA mobile station to the base station. In contrast to TETRA Downlink the signal is bursted. The demodulator parameters are equivalent. However the decoder needs some additional individual parameters for each network. These parameters can be achieved from the decoder result of the downlink signal. The corresponding downlink signal can be normally found exactly 10 MHz above the uplink signal.

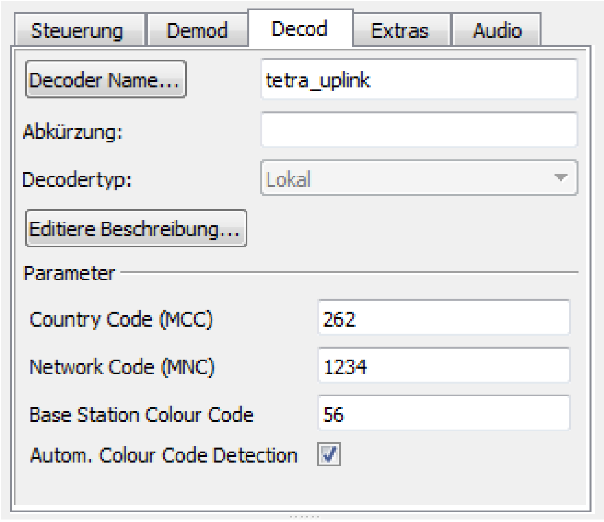


Figure 181: TETRA Uplink Parameter Settings

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'TETRA Uplink'

Decoder Parameters

Parameter	Description	Value
Country Code (MCC)	The Mobile Country Code of the network (e.g. 262 for Germany)	0 ... 1023
Network Code (MNC)	The Mobile Network Code, identifying the TETRA network	0 ... 16383
Base Sation Colour Code	A code identifying the receiving base station	0 ... 63
Autom. Colour Code Detection	If activated, the decoder will try all possible colour codes to find a valid result.	On / Off

Table 181: TETRA Uplink Decoder Parameters

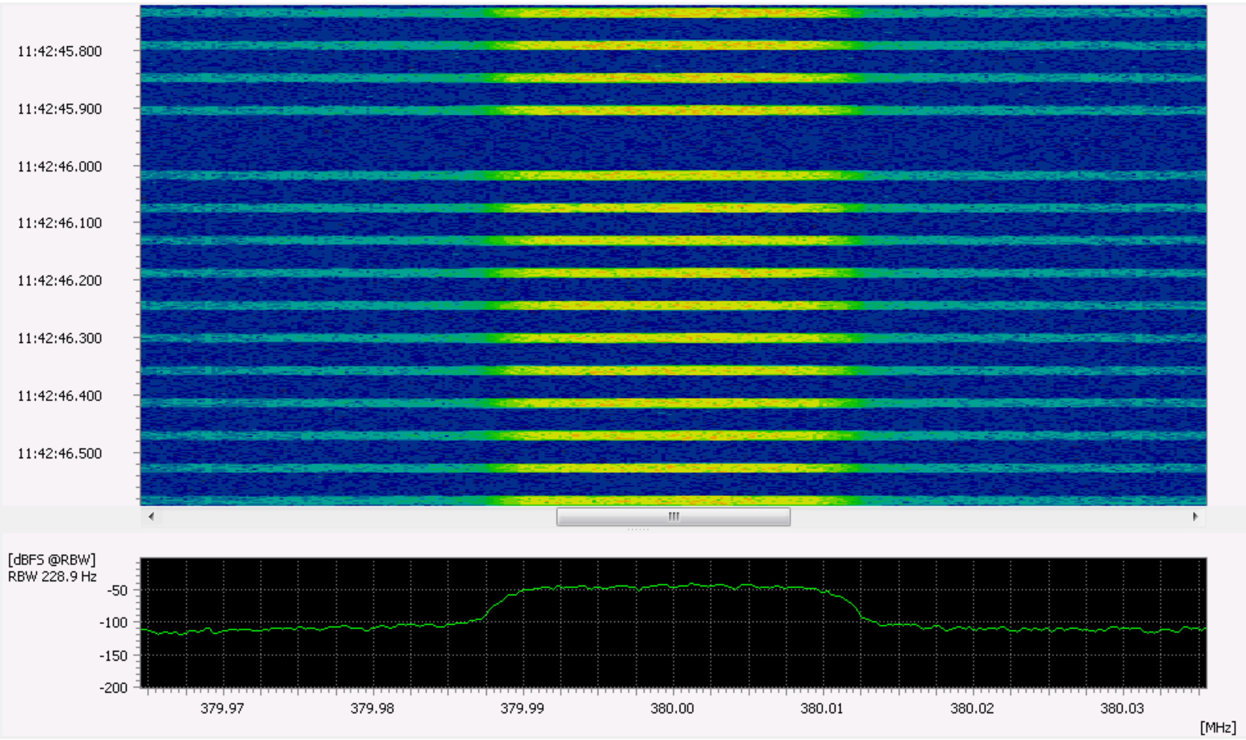


Figure 182: TETRA Uplink Spectrogram

4.14. Tetrapol

General Information

Tetrapol is a digital professional mobile radio (PMR) standard for digital voice and data communication. The standard is defined in a Publicly Available Specification (PAS) published by the TETRAPOL Forum.

Usage

- Communication in the VHF/UHF frequency range among closed user groups such as public safety, military, industry and transportation

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Tetrapol'

Mode Details

Tetrapol appears as separated uplink and downlink signals, typically with a duplex spacing of 10 MHz. Downlink signals are further separated into Control Channels (CCH) with metadata only and Traffic Channels (TCH) mainly conveying digital coded and encrypted voice.

This modem covers decoding of uplink and downlink metadata from CCH and TCH channels. The appearance of voice frames will be indicated ("VVV…").

	Item	Value
Standard	Modulation	GMSK
	BT	0.25
	Bandwidth (Hz)	12500
	Symbol rate (Bd)	8000
	Error correction	FEC, encryption
	Encryption	end-to-end
Demodulator Settings	Demodulator	(G)MSK
	Type	GMSK non linear
	Symbol rate (Bd)	8000
	SR tolerance (Bd)	10
	BT	0.25
Features	Demodulation	yes
	Recognition	yes
	Decoding, Binary Data	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes
Vocoder	RP-CELP	included

Table 182: Tetrapol

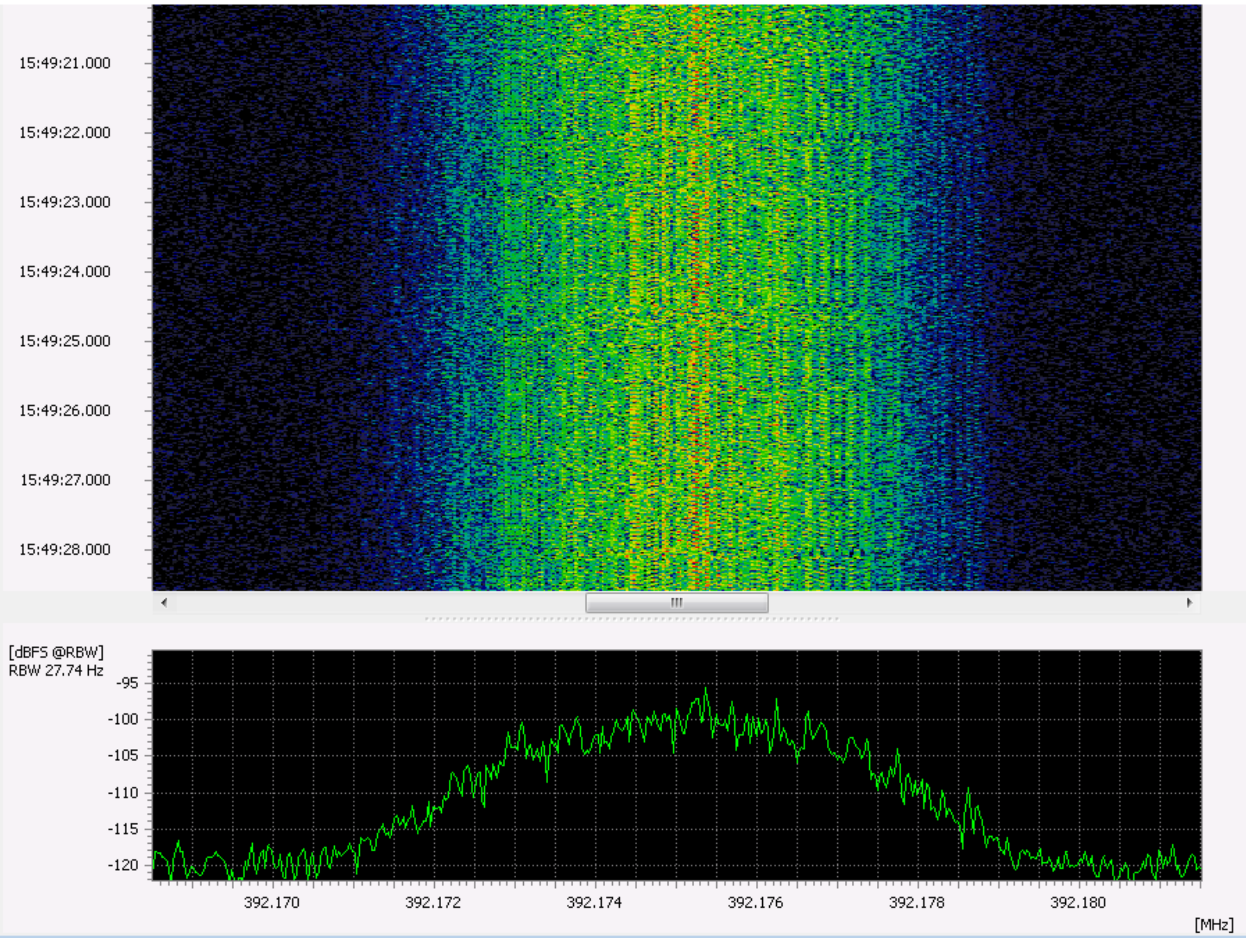


Figure 183: Tetrapol Spectrogram

Output Description

The output will be listed on two output channels. Channel 1 contains a chronological data stream list, while channel 2 shows evaluated data units. All displayed values use hexadecimal annotation.

The CCH Data Stream on output channel 1 (see Figure 14) contains:

- Time stamp
- Logical channels SDCH, BCH, PCH, RCH, RACH (PAS 0001-3-3/ 5.1)

For logical channels SDCH, BCH and PCH:

- Address Type TTI, CGI, COI, RTI or Broadcast = "All" (PAS 0001-3-3 / 7.4.1.4)
- The temporary address field (PAS 0001-3-3 / 7.4.1.4)
- Command value and names (PAS 0001-3-3 / 7.5.4.3)
- TPDU-Type (PAS 0001-3-3 / 8.3)
- TSDU-Type (PAS 0001-3-2 / 4.4)
- TSDU-Data
- Reference number assigning evaluations (if existing) in channel 2

For logical channel RCH:

- Terminal address acknowledgements (PAS 0001-3-3 /7.4.2)

Idle ("stuffing") frames will not be displayed.

```
15:42:41:840  SDCH TTI Addr(Z-Y-X): 1-3-6b3 Command:03 UI TPDU-Type: DU TSDU-Type: D_TTI_ASSIGNMENT TSDU-Data: 5344 Ref: e0b0
15:42:41:900  SDCH All Addr(Z-Y-X): 1-7-fff Command:03 UI TPDU-Type: DU TSDU-Type: D_GROUP_ACTIVATION TSDU-Data: 55117f4309c776693f Ref: 0197
15:42:42:000  SDCH All Addr(Z-Y-X): 1-7-fff Command:03 UI TPDU-Type: DU TSDU-Type: D_GROUP_ACTIVATION TSDU-Data: 55161619098677 6a3f Ref: a7c1
15:42:42:020  SDCH TTI Addr(Z-Y-X): 1-3-6b3 Command:03 UI TPDU-Type: DU TSDU-Type: D_TTI_ASSIGNMENT TSDU-Data: 5344 Ref: e0b0
15:42:42:080  SDCH All Addr(Z-Y-X): 1-7-fff Command:03 UI TPDU-Type: DU TSDU-Type: D_GROUP_ACTIVATION TSDU-Data: 55117f4309c776693f Ref: 0197
15:42:42:140  SDCH All Addr(Z-Y-X): 1-7-fff Command:03 UI TPDU-Type: DU TSDU-Type: D_GROUP_ACTIVATION TSDU-Data: 55161619098677 6a3f Ref: a7c1
15:42:42:200  SDCH All Addr(Z-Y-X): 1-7-fff Command:03 UI TPDU-Type: DU TSDU-Type: D_GROUP_ACTIVATION TSDU-Data: 55117f4309c776693f Ref: 0197
15:42:42:220  SDCH TTI Addr(Z-Y-X): 1-3-6b3 Command:03 UI TPDU-Type: DU TSDU-Type: D_TTI_ASSIGNMENT TSDU-Data: 5344 Ref: e0b0
15:42:42:280  SDCH All Addr(Z-Y-X): 1-7-fff Command:03 UI TPDU-Type: DU TSDU-Type: D_GROUP_ACTIVATION TSDU-Data: 55161619098677 6a3f Ref: a7c1
15:42:42:400  SDCH All Addr(Z-Y-X): 1-7-fff Command:03 UI TPDU-Type: DU TSDU-Type: D_GROUP_ACTIVATION TSDU-Data: 55117f4309c776693f Ref: 0197
15:42:42:460  SDCH All Addr(Z-Y-X): 1-7-fff Command:03 UI TPDU-Type: DU TSDU-Type: D_GROUP_ACTIVATION TSDU-Data: 55161619098677 6a3f Ref: a7c1
15:42:42:600   BCH All Addr(Z-Y-X): 1-7-fff Command:03 UI TPDU-Type: DU TSDU-Type: D_SYSTEM_INFO TSDU-Data: 90004209560015001161410083000000 00 Ref: 68c9
15:42:42:640  SDCH All Addr(Z-Y-X): 1-7-fff Command:03 UI TPDU-Type: DU TSDU-Type: D_GROUP_ACTIVATION TSDU-Data: 55117f4309c776693f Ref: 0197
15:42:42:920  SDCH All Addr(Z-Y-X): 1-7-fff Command:03 UI TPDU-Type: DU TSDU-Type: D_NEIGHBOURING_CELL TSDU-Data:
940c0008938308d683097e83091d8308a78308bd83091783098383091983193103293b032886030218051001100410042000200120022003200030051001100410040316 2165 Ref: 44b1
15:42:42:960  SDCH TTI Addr(Z-Y-X): 0-4-344 Command:30 I  TPDU-Type: CC TSDU-Type: Unknown TSDU-Data: 28030144000000000000 Ref: e0fa
15:42:43:020  SDCH All Addr(Z-Y-X): 1-7-fff Command:03 UI TPDU-Type: DU TSDU-Type: D_GROUP_ACTIVATION TSDU-Data: 55161619098677 6a3f Ref: a7c1
```

Figure 184: CCH Data Stream

The TCH Data Stream on output channel 1 (see) contains:

- Time stamp
- Address Type (PAS 0001-3-3 / 7.4.1.4)
- The temporary address field (PAS 0001-3-3 / 7.4.1.4)
- Command value and names (PAS 0001-3-3 / 7.5.4.3)
- LSDU-Type
- LSDU-Data

or

- TPDU-Type (PAS 0001-3-3 / 8.3)
- TSDU-Type (PAS 0001-3-2 / 4.4)
- TSDU-Data
- Reference number assigning evaluations (if existing) in channel 2

or

- LSDU Types
- LSDU Evaluations (PAS 0001-3-4 / 5. and 6.)

Idle ("stuffing") frames will not be displayed.

```
07:02:32:743   All Addr(Z-Y-X): 1-7-fff Command:a3 UI_CD LSDU-Type: TP_ADDRESS LSDU-Data: 01a01361550004ffffffff SIGNATURE : 0 MODIFIER_NUMBER : a RT_ADDRESS : 1361550004ffffff
07:02:32:763   All Addr(Z-Y-X): 1-7-fff Command:c3 UI_VCH LSDU-Type: D_FORCED_LISTENING LSDU-Data: 010000
07:02:32:783   All Addr(Z-Y-X): 1-7-fff Command:c3 UI_VCH LSDU-Type: D_CHANNEL_FREE LSDU-Data: 000000
07:02:33:543   All Addr(Z-Y-X): 1-7-fff Command:c3 UI_VCH LSDU-Type: D_START_SPEECH LSDU-Data: 03ff01 NUM_BLOCK: ff PRIORITY: 1
07:02:33:583   All Addr(Z-Y-X): 1-7-fff Command:a3 UI_CD LSDU-Type: TP_ADDRESS LSDU-Data: 01a01361443088ffffffff SIGNATURE : 0 MODIFIER_NUMBER : a RT_ADDRESS : 1361443088ffffff
07:02:33:623 Voice: VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV
07:02:35:103   All Addr(Z-Y-X): 1-7-fff Command:c3 UI_VCH LSDU-Type: D_VOICE_STUFFING LSDU-Data: 02ff01 NUM_BLOCK: ff PRIORITY: 1
07:02:35:143 Voice: VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV
07:02:36:403   All Addr(Z-Y-X): 1-7-fff Command:a3 UI_CD LSDU-Type: TP_ADDRESS LSDU-Data: 01a01361443088ffffffff SIGNATURE : 0 MODIFIER_NUMBER : a RT_ADDRESS : 1361443088ffffff
07:02:36:423   All Addr(Z-Y-X): 1-7-fff Command:c3 UI_VCH LSDU-Type: D_FORCED_LISTENING LSDU-Data: 010000
07:02:36:443   All Addr(Z-Y-X): 1-7-fff Command:c3 UI_VCH LSDU-Type: D_CHANNEL_FREE LSDU-Data: 000000
07:02:37:103   All Addr(Z-Y-X): 1-7-fff Command:c3 UI_VCH LSDU-Type: D_START_SPEECH LSDU-Data: 03ff0d NUM_BLOCK: ff PRIORITY: d
07:02:37:143   All Addr(Z-Y-X): 1-7-fff Command:a3 UI_CD LSDU-Type: TP_ADDRESS LSDU-Data: 01a01361550004ffffffff SIGNATURE : 0 MODIFIER_NUMBER : a RT_ADDRESS : 1361550004ffffff
07:02:37:183 Voice: VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV
07:02:40:763   All Addr(Z-Y-X): 1-7-fff Command:a3 UI_CD LSDU-Type: TP_ADDRESS LSDU-Data: 01a01361550004ffffffff SIGNATURE : 0 MODIFIER_NUMBER : a RT_ADDRESS : 1361550004ffffff
07:02:40:783   All Addr(Z-Y-X): 1-7-fff Command:c3 UI_VCH LSDU-Type: D_FORCED_LISTENING LSDU-Data: 010000
07:02:40:803   All Addr(Z-Y-X): 1-7-fff Command:c3 UI_VCH LSDU-Type: D_CHANNEL_FREE LSDU-Data: 000000
07:02:41:883   All Addr(Z-Y-X): 1-7-fff Command:c3 UI_VCH LSDU-Type: D_START_SPEECH LSDU-Data: 03ff01 NUM_BLOCK: ff PRIORITY: 1
07:02:41:923   All Addr(Z-Y-X): 1-7-fff Command:a3 UI_CD LSDU-Type: TP_ADDRESS LSDU-Data: 01a01361443088ffffffff SIGNATURE : 0 MODIFIER_NUMBER : a RT_ADDRESS : 1361443088ffffff
07:02:41:963 Voice: VVVVVVVVVVVVVVVVVVVVVVVVVVVVVV
07:02:42:563   All Addr(Z-Y-X): 1-7-fff Command:c3 UI_VCH LSDU-Type: D_FORCED_LISTENING LSDU-Data: 010000
07:02:42:583 Voice: VVVVVVVVVVVVVVVVVVVVVVVVVV
07:02:43:103   All Addr(Z-Y-X): 1-7-fff Command:c3 UI_VCH LSDU-Type: D_VOICE_STUFFING LSDU-Data: 02ff01 NUM_BLOCK: ff PRIORITY: 1
07:02:43:143 Voice: VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV
```

Figure 185: TCH Data Stream

The following TSDU units will be evaluated in output channel 2 (see):

- D_SYSTEM_INFO
- D_GROUP_ACTIVATION
- D_GROUP_LIST
- D_GROUP_PAGING
- D_NEIGHBOURING_CELL
- D_TTI_ASSIGNMENT

(All described in PAS 0001-3-2)

```
15:42:32:159  D_GROUP_ACTIVATION - Ref: 0197
HOOK: Automatic without tone TYPE: Internal group call
GROUP_ID = 17f
COVERAGE_ID: 43
CHANNEL_ID: 9c7
U_CH_SCRAMBLING: 76
D_CH_SCRAMBLING: 69
KEY_REFERENCE: 3f

15:42:32:600  D_SYSTEM_INFO - Ref: 68c9
CELL_STATE       : 00 [MODE: 0 BCH: 0 ROAM: 0 EXP: 0]
COUNTRY_CODE     : 09
SYSTEM_ID        : 56 [NETWORK: 5 VERSION: 6]
LOC_AREA_ID      : 00 [MODE: 0 LOC_ID: 00]
BN_ID            : 15
CELL_ID          : 001 [BS_ID: 00 RSW_ID: 01]
CELL_BN          : 161
U_CH_SCRAMBLING  : 41
CELL_RADIO_PARAM: 0083 [TX_MAX: 0 RADIO_LINK_TIMEOUT: 0 PWR_TX_ADJUST: 8 RXLEV_ACCESS: 3]
SYSTEM_TIME      : 00
CELL_ACCESS      : 00
SUPERFRAME_CPT   : a14

15:42:35:060  D_GROUP_LIST - Ref: fd65
REVISION: 3 INDEX_LIST: 80
TALK GROUP
COVERAGE_ID: 39 NEIGHBOURING_CELL bitmap: 3ff
COVERAGE_ID: 43 NEIGHBOURING_CELL bitmap: fff
COVERAGE_ID: 02 NEIGHBOURING_CELL bitmap: fff
COVERAGE_ID: fd NEIGHBOURING_CELL bitmap: 006
COVERAGE_ID: fb NEIGHBOURING_CELL bitmap: e60
COVERAGE_ID: 0a NEIGHBOURING_CELL bitmap: 0f8
COVERAGE_ID: 19 NEIGHBOURING_CELL bitmap: fff
COVERAGE_ID: 06 NEIGHBOURING_CELL bitmap: 3ff
COVERAGE_ID: fc NEIGHBOURING_CELL bitmap: fff
```

Figure 186: Data Unit Evaluations

4.15. Yaesu Fusion

General Information

"**System Fusion**" is a digital amateur radio implementation of the Japanese company **Yaesu**. It makes use of FSK4 (C4FM) to transmit digital voice and data over VHF/UHF Amateur radio bands. Digital Voice can be transmitted in high quality full rate (7200 bps) or half rate (3600bps), which allows to transmit digital data in parallel. An alternative data full rate data mode can be used at times when no voice is active.

Modulation frequency deviation can be 5400Hz (wide band) or 2700Hz (narrow band)

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Yaesu Fusion'

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	4
	Tone spacing (Hz)	1800
	Symbol rate (Bd)	4800
Demodulator Settings	Demodulator	FSK 2, 3, 4 discr.
	Symbol rate (Bd)	4800
	SR tolerance (Bd)	10
	Modulation order	4
	Shift (Hz)	1800 or 900
	Shift tolerance (Hz)	0
	Burst mode	off
Features	Demodulation	yes
	Recognition	yes
	Decoding, Binary Data / Voice Data	yes
	Automatic Side Band Detection	yes (detection only)
	Combination with other modems (modem list)	yes
Vocoder	IMBE/AMBE+2™	full / half rate

Table 183: Yaesu Fusion

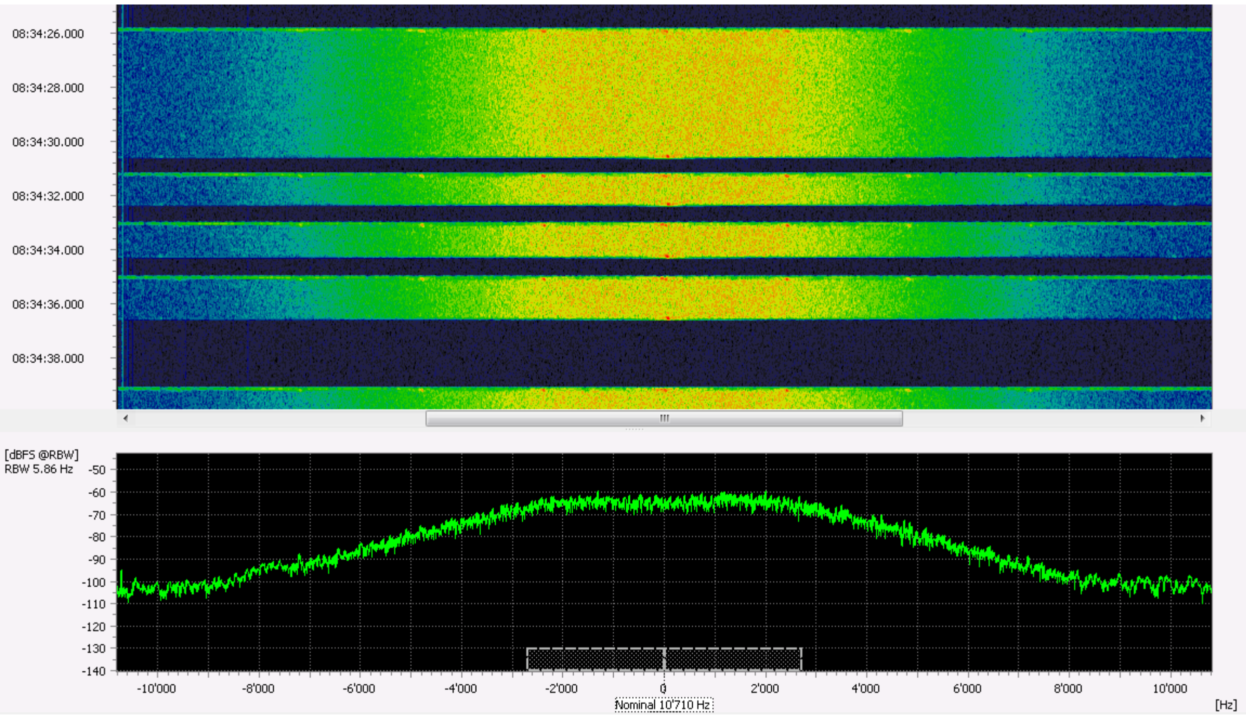


Figure 187: Yaesu Fusion Spectrogram, Shift 1800 Hz

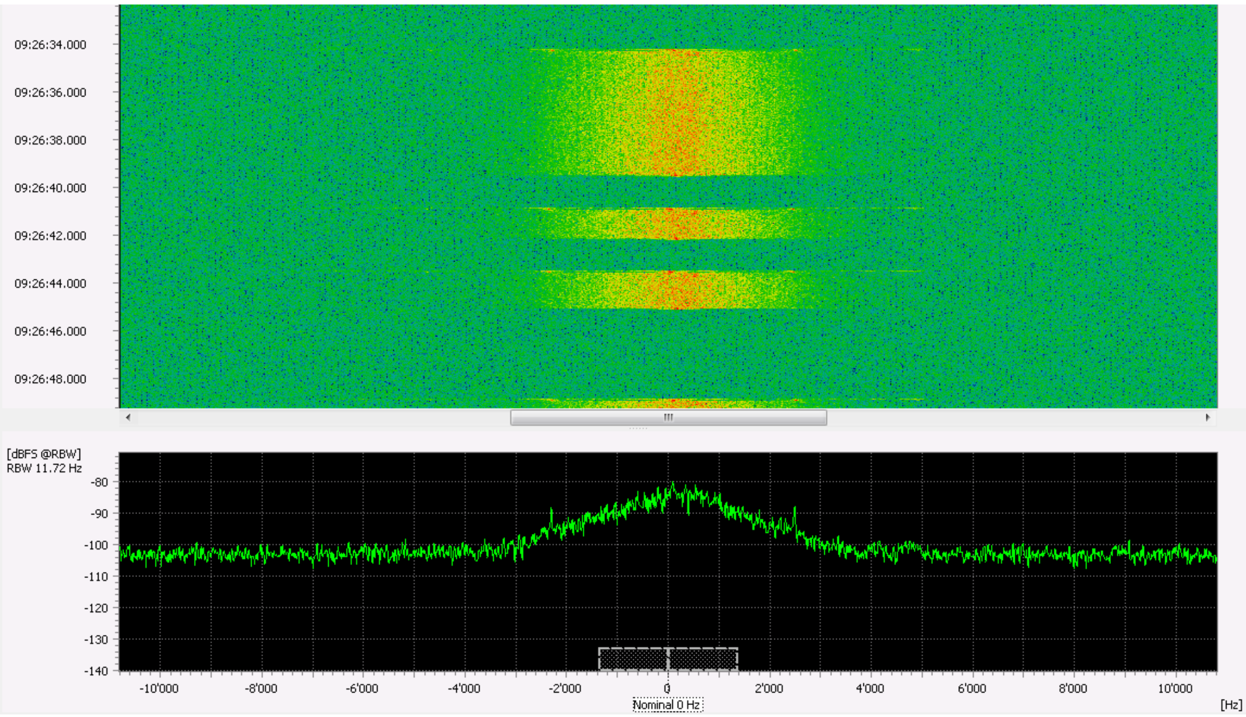


Figure 188: Yaesu Fusion Spectrogram, Shift 900 Hz

4.16. PMR decryption capabilities

Decoder/Encryption type	Detection	Decryption
TETRA Downlink		
TEA 1,3,4	X (type not recognizable)	key entered
TEA 2, end-to-end	X (type not recognizable)	
TETRA Uplink		
TEA 1,2,3,4	X	
end-to-end	X	
TETRA DMO		
TEA 1,3,4	X	key entered
TEA 2, end-to-end	X	
DMR / DMR Continuous		
Motorola Basic	X	automatic / key entered
Alinco	X	automatic / key entered
Hytera Basic	X	automatic / key entered (not DMR Continuous)
Kenwood Basic	X	
Enhanced/ARC4	X	key entered automatic key finding with go2key (optional)
Advanced encryptions (DES/AES)	X	key entered
APCO-25, APCO-25 P2		
ACCORDION 1.3	X	
BATON (Auto Even)	X	
FIREFLY Type 1	X	
MAYFLY Type 1	X	
SAVILLE	X	
BATON (Auto Odd)	X	
DES-OFB	X	
2-key triple DES	X	
3-key triple DES	X	
AES	X	
DES-XL	X	
ADP/RC4	X	
NXDN		

Decoder/Encryption type	Detection	Decryption
Basic Encryption (scrambled)	X	automatic / key entered
DES 56	X	key entered
AES 128	X	
DECT		
Encryption	X	
Tetrapol		
Encryption	X	

Table 184: PMR decryption

Note: The PMR decryption requires optional product feature PMR decoder package.
The performance of our software products depends on the hardware used. Technical parameters can differ under real operational conditions. The parameters specified are limit values that cannot be guaranteed in all combinations. Specifications subject to change.

5. Military Decoders

Note: For every decoder any operation limitations should be listed. If any submode of a decoder is not mentioned explicitly then it is not supported.

5.1. ALE-3G

General Information

Automatic Link Establishment third generation is based on the standard **STANAG 4538**. ALE-3G is an improved version of ALE-2G, it is tailored to the needs of modern tactical communications systems. This system is used to detect and assign the HF-channel which is considered most reliable for data-communication at the given time.

There are 8 burst waveforms (BW0-7) which are used for different purposes. The actual data transmission takes place via BW 2, 3, 7. The other BWs are for connection setup, acknowledgments and metadata.

- BW2 - HDL protocol. A PSK8 modulation is used.
- BW3 - LDL protocol. A spreading system is used in order to transmit reliably over heavily disturbed radio channels.
- BW7 - HDL+ protocol. Benign channels allow faster data transmission by using higher-order symbol constellations.

Usage

- Detection of the HF-channel best suited for data-transfer between two stations or broadcast transmissions
- Establishing a link between modems prior to the actual data transmission
- Reliable data transmission over HF

Remarks

- Supported burst waveforms including decoding: BW 0, 1, 2, 3, 5, 6, 7
- All supported burst waveforms include additional decoded PDU frames output. This is not possible for BW 0, 1, 5, 6 if linking protection (encryption) is activated.
- Burst waveform BW 4 (LDL Acknowledgement) is not detected/demodulated for several reasons
  - Walsh-symbols are scrambled/encrypted according to a seed or key
  - there is no unique preamble
- There are **incompatible** differences in the standard implementations (coding) of BW2 and BW3 depending on the modem manufacturer. The decoder is able to distinguish signals from RapidMobile and Harris modems.

- An Automatic repeat request (ARQ) protocol is used to avoid transmission errors. Since the data is initially transmitted via the HDL and LDL protocol without redundancy (FEC), individual bit errors in the decoder cannot be corrected. If a bit error is detected at the permitted receiver, it requests redundancy via an additional burst. Of course, a monitoring system cannot do this. If redundancy is transmitted because the permitted receiver has also detected errors, the decoder takes advantage of this. With broadcast transmissions, it is likely that error correction is always transmitted as well, since several receivers cannot request redundancy.

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'ALE-3G'

Mode Details

	Item	Value
Standard	Modulation	PSK2, PSK4, PSK8, QAM16, QAM64, Orthogonal Walsh-Symbols
	Bandwidth	3000
	Symbol rate / Chip rate (Bd)	2400
Demodulator Settings	Demodulator	ALE3G, external Modem 15001
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 185: ALE-3G

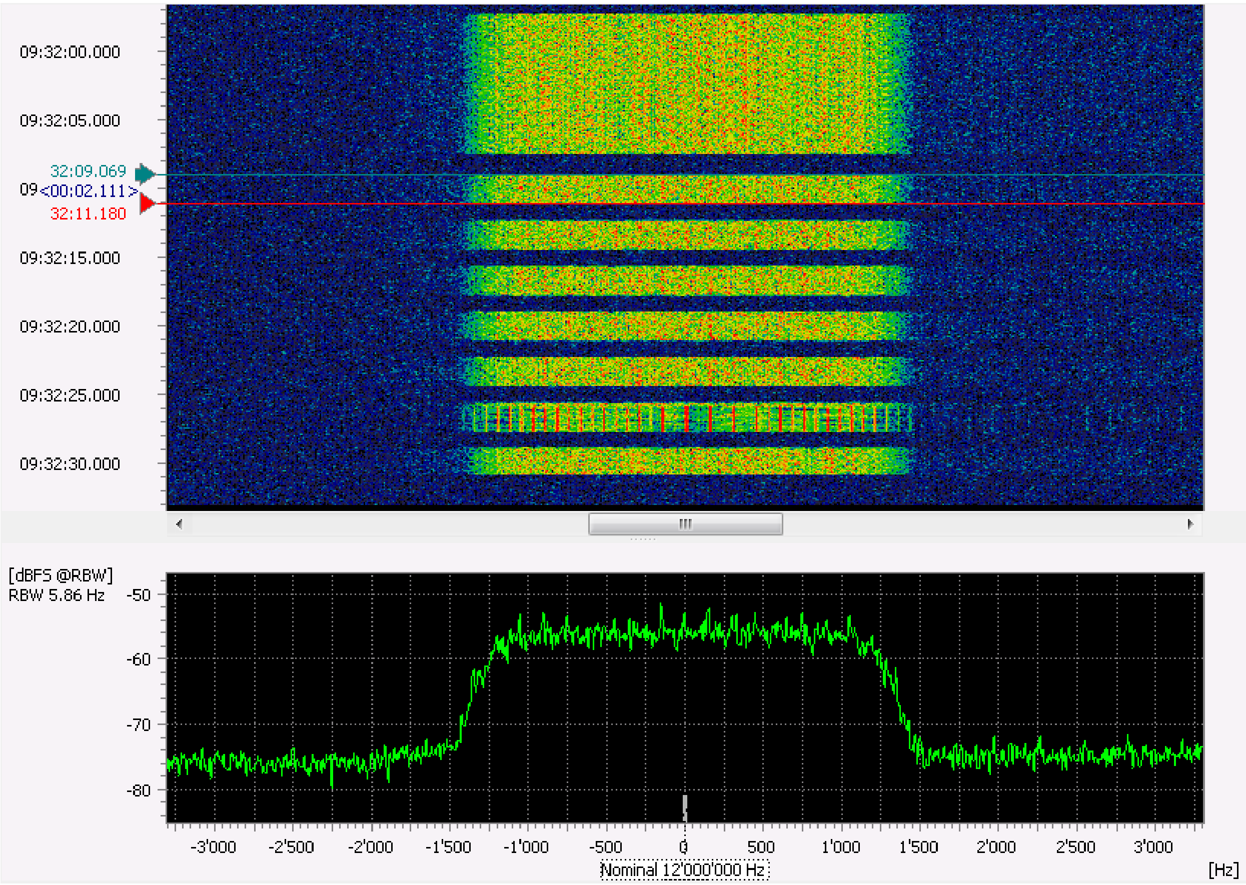


Figure 189: ALE-3G Spectrogram

5.2. ALE-4G

General Information

Automatic Link Establishment fourth generation is used to establish a link between two HF modems. It is a further improvement of ALE-3G and able to establish a link between wideband channels.

Usage

- Detection of the HF-channel best suited for data-transfer between two stations or broadcast transmissions
- Establishing a link between modems prior to the actual data transmission
- Reliable data transmission over HF

Restrictions

- Detection only.

Mode Details

	Item	Value
Standard	Demodulator	PSK 8
	Symbol rate (Bd)	2400
	Bandwidth	3000
Demodulator Settings	Demodulator	PSK 2,4,8,16 A/B
	Symbol rate (Bd)	2400
	SR tolerance (Bd)	5
	Modulation order	8
	Version	A
	adaptive equalizer	off
	Min. burst length (s)	0.08
	Max. burst length (s)	8.00
	Min. pause length (s)	0.1
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Automatic Polarity Adjustment	no

Table 186: ALE-4G

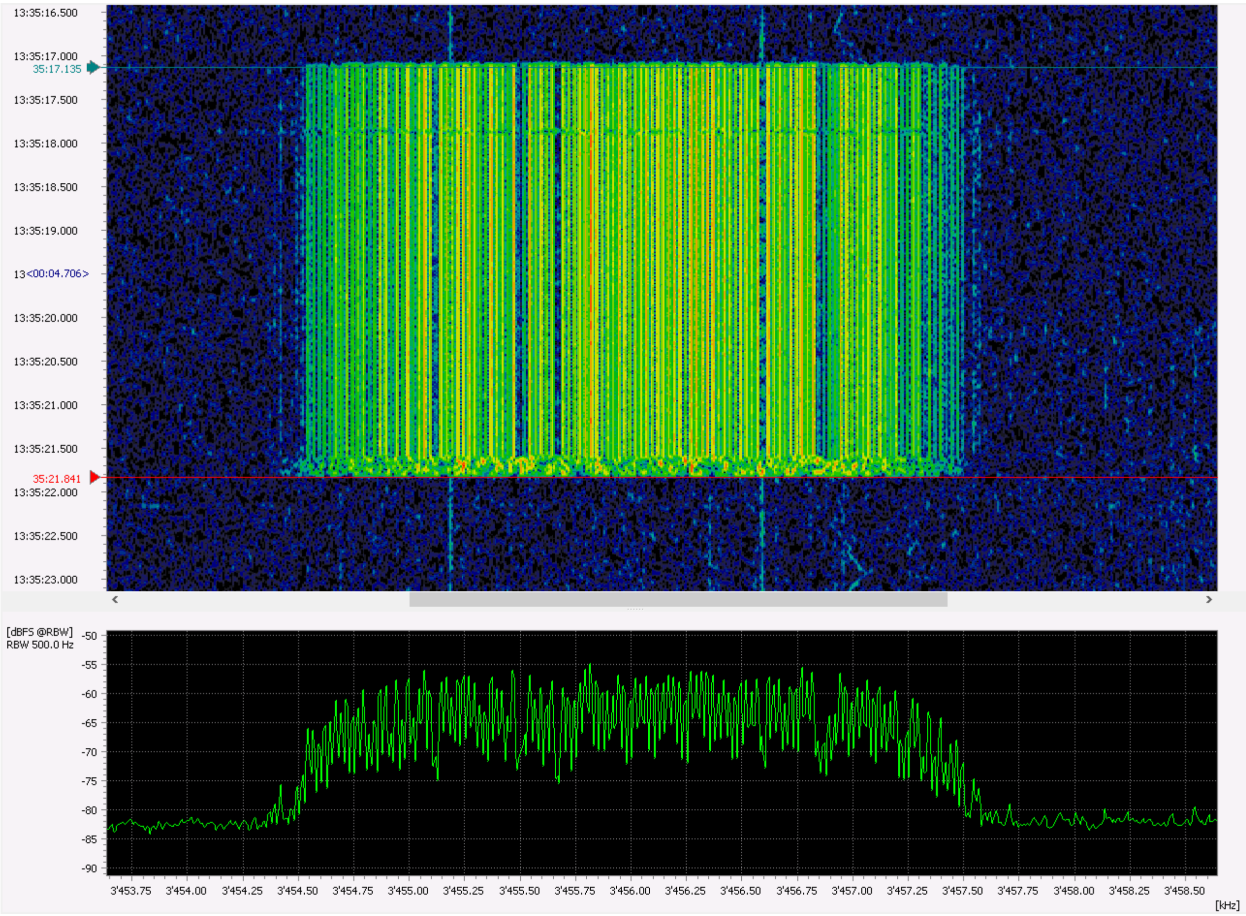


Figure 190: ALE-4G Spectrogram

5.3. CHN 4plus4

General Information

CHN 4+4 is a mode assumedly used by the Chinese military.
It is based on two groups, with a 450 Hz gap, of 4 tones with 300 Hz spacing.

Usage

- Transfer of textual information over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'CHN 4+4'

Mode Details

	Item	Value
Standard	Modulation	QPSK
	Tones	2 x 4
	Channel distance (Hz)	300 / 450
	Bandwidth	3000
	Symbol rate (Bd) (per channel)	75
	Data rate (bit/s)	1200
Demodulator Settings	Demodulator	MPSK 2,4,8 A/B
	Symbol rate (Bd)	75
	SR tolerance (Bd)	1
	Modulation order	4
	Version	B
	Number of channels	8
Extras	Offset nominal frq. (Hz)	615
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 187: CHN 4plus4

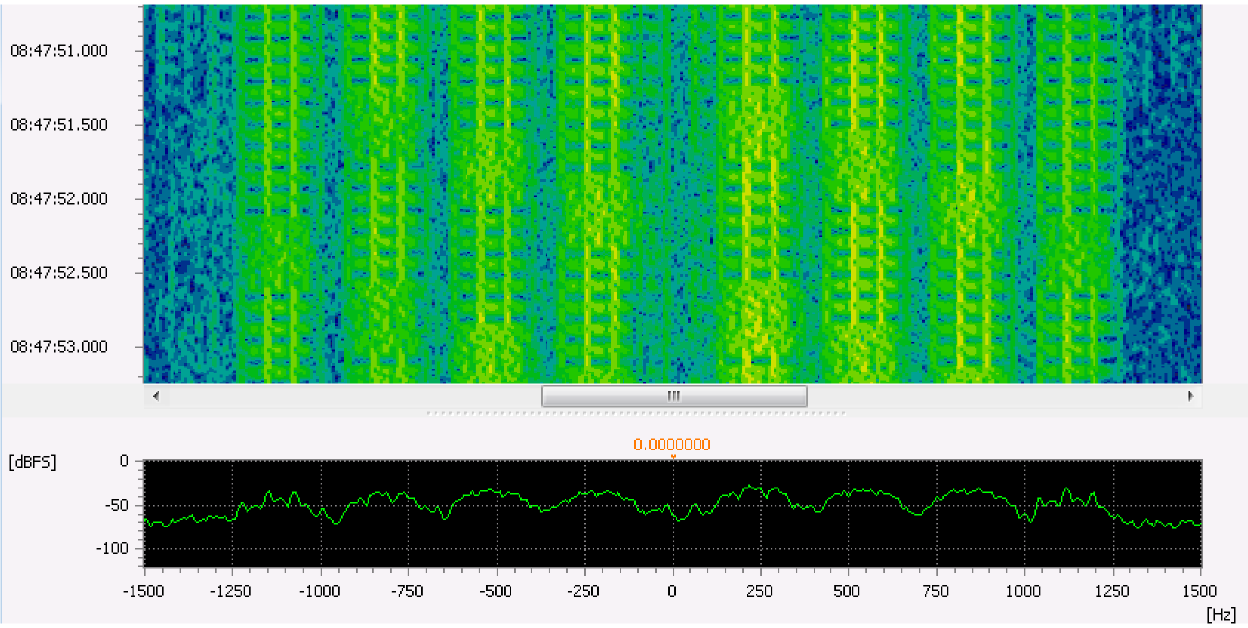


Figure 191: CHN 4plus4 Spectrogram

5.4. CHN BPSK 2400Bd

General Information

CHN BPSK 2400Bd is assumed to be used by the Chinese military. It is based on a Walsh –coded PSK-modulation organized in bursts of about one minute length. Bursts are starting with a repeated preamble of 128 bit.

Usage

- Transfer of textual information, most often as numerical cipher groups

Mode Details

	Item	Value
Standard	Modulation	PSK2
	Bandwidth (Hz)	2880
	Symbol rate (Bd)	2400
Demodulator Settings	Demodulator	PSK 2,4,8,16 A/B
	Symbol rate (Bd)	2400
	SR tolerance (Bd)	5
	Modulation order	2
	Version	A
	Min. burst length (ms)	10 000
	Max. burst length (ms)	99 000
	Min. pause length (ms)	200
	Min. burst SNR (dB)	0
Extras	Offest nominal frq. (HZ)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 188: CHN BPSK 2400Bd

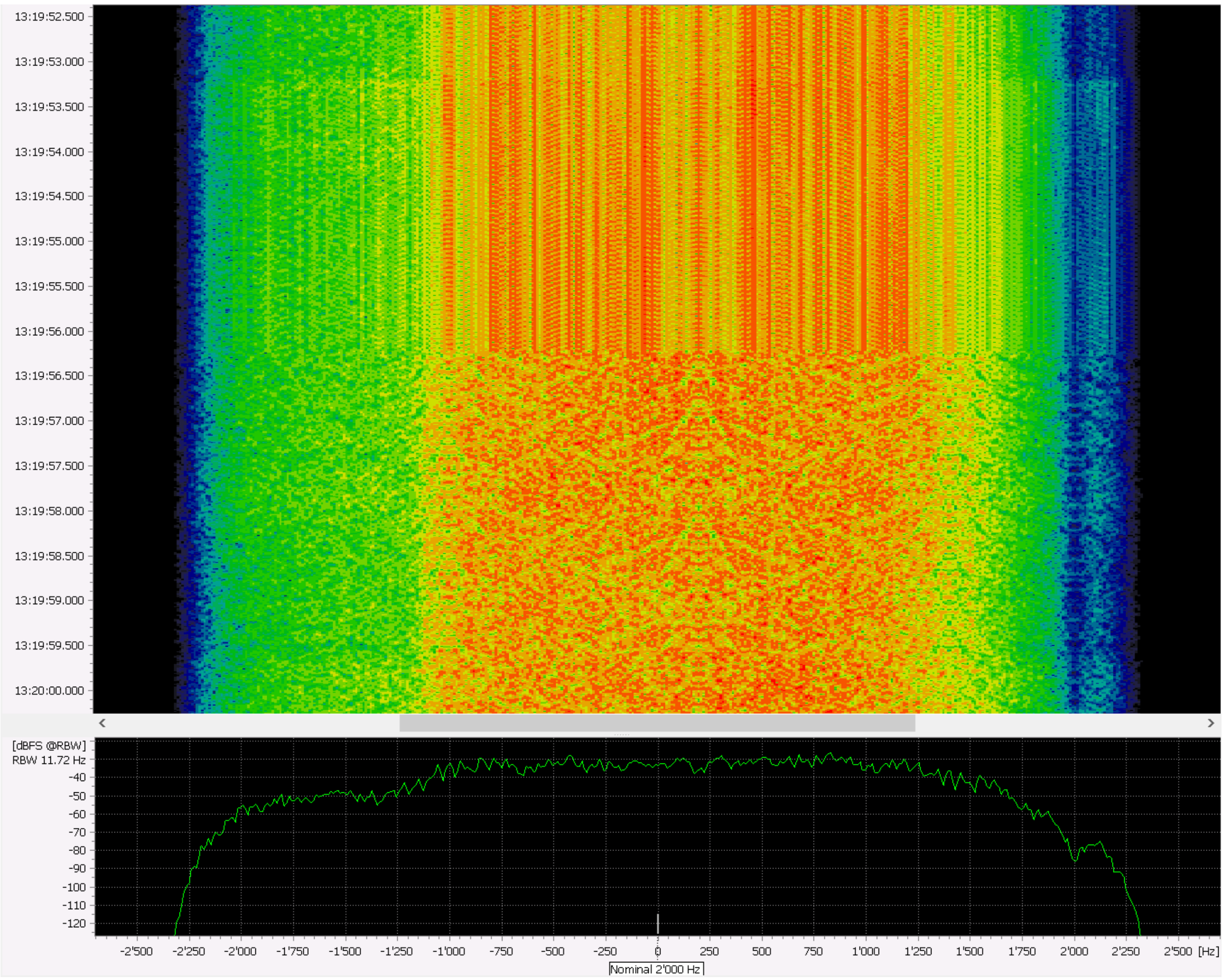


Figure 192: CHN BPSK 2400Bd Spectrogram

5.5. CHN MIL 64FSK

General Information

CHN MIL 64FSK is a mode assumedly used by the Chinese military.
It is based on 64 tone MFSK modulation with baud rate of 37.5 bd. Preamble is transferred with half baud rate (18.75 bd).

Usage

- Transfer of textual information, most often as numerical cipher groups

Mode Details

	Item	Value
Standard	Modulation	Multitone (MFSK)
	Symbol rate (Bd)	37.5 / 18.75
	Number of tones	64
	Tone distance (Hz)	37.5
	Bandwidth (Hz)	2400
Demodulator Settings	Demodulator	Multitone (MFSK)
	Tone duration (ms)	26.667
	Tone duration tolerance (ms)	1
	Total no. of tones	64
	Simultaneous tones	1
	Tone position type	Equidistant
	Tone distance	37.5
Extras	Offset nominal frq. (Hz)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes
Tuning	The tuning frequency is the center of the lowest frequency tone	

Table 189: CHN MIL 64FSK

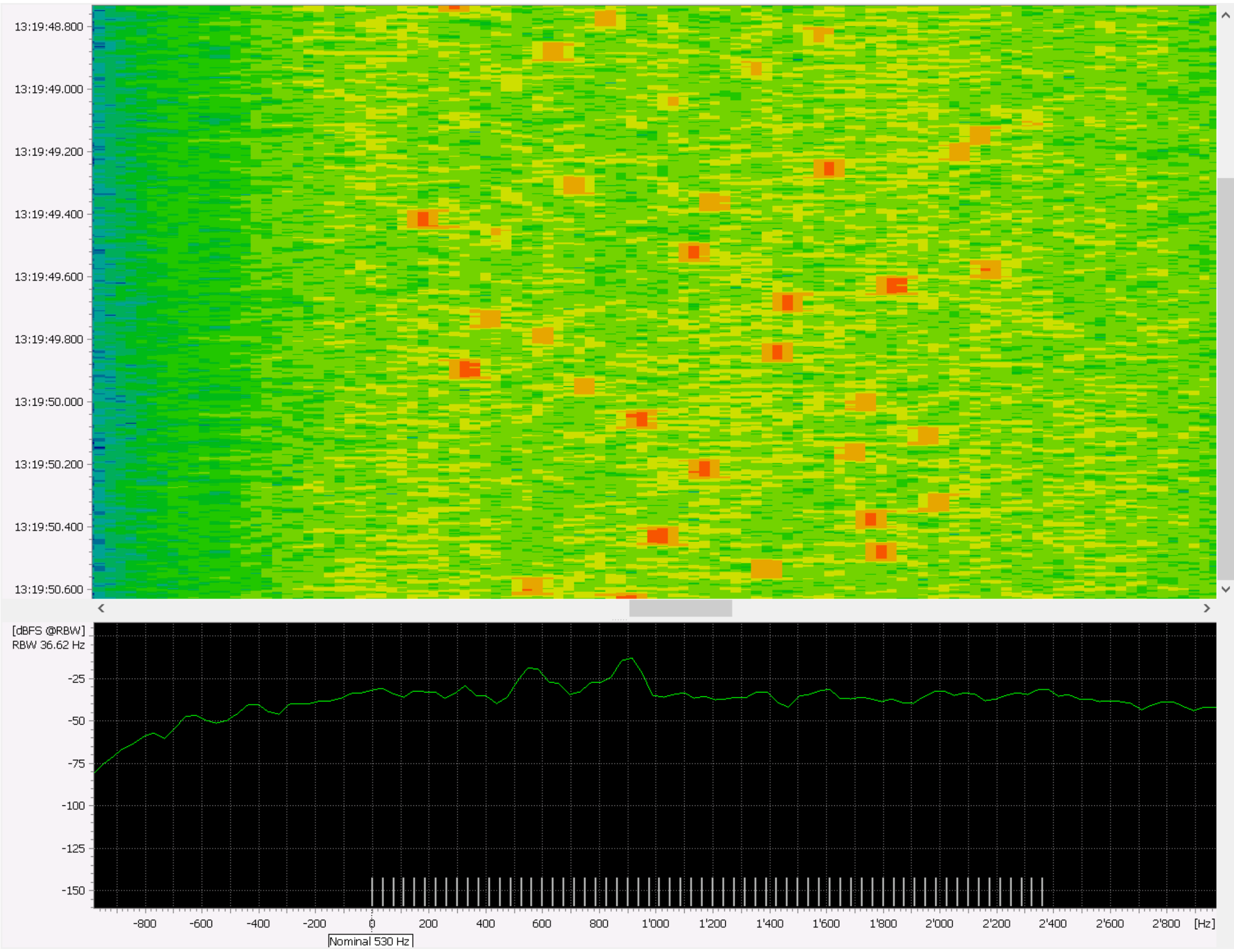


Figure 193: CHN MIL 64FSK Spectrogram

5.6. CHN MIL Datalink 30 Tone

General Information

This modem is starting with four QPSK modulated tones, spaced in 600 Hz. This preamble is followed by 30 channels BPSK plus a pilot tone. Channels are modulated with a symbol rate of 60 baud and 75 Hz channel distance. The signal is transmitted in burst mode.

Usage

- Military communication over HF

Mode Details

	Item	Value
Standard	Modulation	MDQPSK
Preamble	Tones	4
	Shift (Hz)	600
	Bandwidth (Hz)	1800
	Symbol rate (Bd)	60
Waveform	Tones	30
	Shift (Hz)	75
	Bandwidth (Hz)	2400
	Symbol rate (Bd)	60
	Error correction	unknown
Demodulator Settings	Demodulator	MDPSK
	Symbol rate (Bd)	60
	No. of channels	4
	Channel distance (Hz)	600
	Constellation	PSK 4A
	Min. burst length (s)	0.550
	Max. burst length (s)	5.000
	Min. pause length (s)	0.800
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 190: CHN MIL Datalink 30 Tone

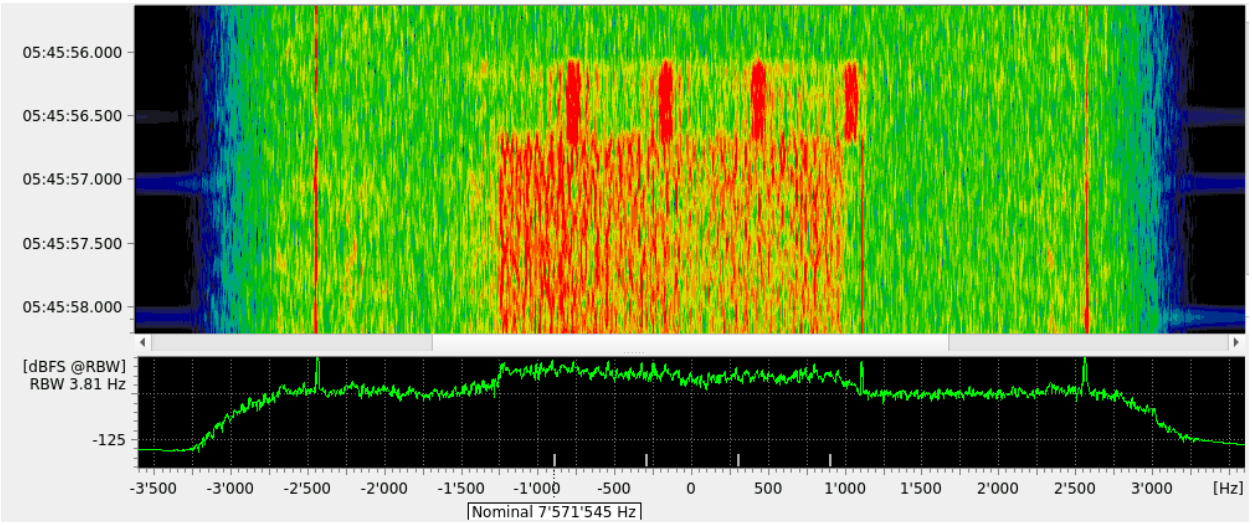


Figure 194: CHN MIL Datalink 30 Tone Spectrogram

5.7. CHN MIL Hybrid 8FSK-PSK

General Information

CHN MIL Hybrid 8FSK-PSK is a Chinese modem which is operated in ARQ mode with different burst types and modulations. It is presumably used by the Chinese Navy. There are multiple combinations with MFSK and PSK.

Usage

- Data communication over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'CHN MIL Hybrid 8FSK-PSK'

Mode Details

	Item	Value
Standard	Modulation	MFSK-8 / PSK-4
	Number of tones	8 / N.A.
	Tone spacing (Hz)	250 / N.A
	Bandwidth (Hz)	2400
	Symbol rate (Bd)	128 / 2400
Demodulator Settings	Demodulator	Hybrid
	Mode	Chinese Hybrid 8FSK-PSK
Extras	Offset nominal frq. (Hz)	1625
Features	Demodulation	yes
	Recognition	yes
	Decoding QPSK part	yes
	Decoding MFSK part	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 191: CHN MIL Hybrid 8FSK-PSK

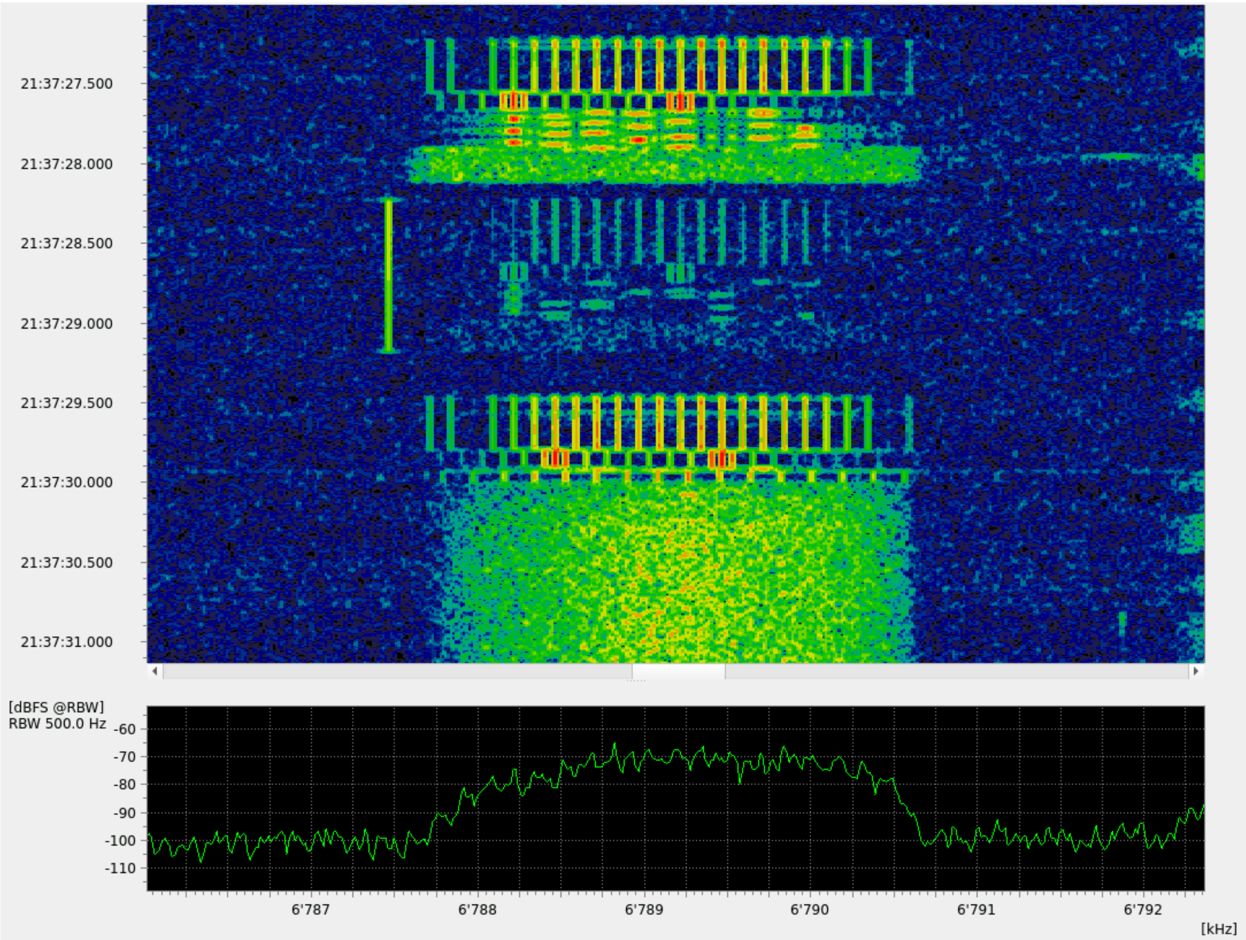


Figure 195: CHN MIL Hybrid 8FSK-PSK Spectrogram

5.8. CHN pi/2 BPSK 2400Bd

General Information

CHN pi/2 BPSK 2400Bd is a mode assumedly used by the Chinese military. There are at least 4 different coding modes, named A-D, with distinct frame lengths, interleaving and FEC.

Usage

- Transfer of digital information over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'CHN pi/2 BPSK 2400Bd'

Mode Details

	Item	Value
Standard	Modulation	Pi/2 BPSK
	Bandwidth (Hz)	ca. 2800
	Symbol rate (Bd)	2400
Demodulator Settings	Demodulator	PSK 2,4,8,16 A/B
	Symbol rate (Bd)	2400
	SR tolerance (Bd)	5
	Modulation order	2
	Version	B
	Adaptive equaliser	yes
	Min. burst length (s)	0.700
	Max. burst length (s)	3.000
	Min. pause length (s)	0.700
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes, with FEC
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 192: CHN pi/2 BPSK 2400Bd

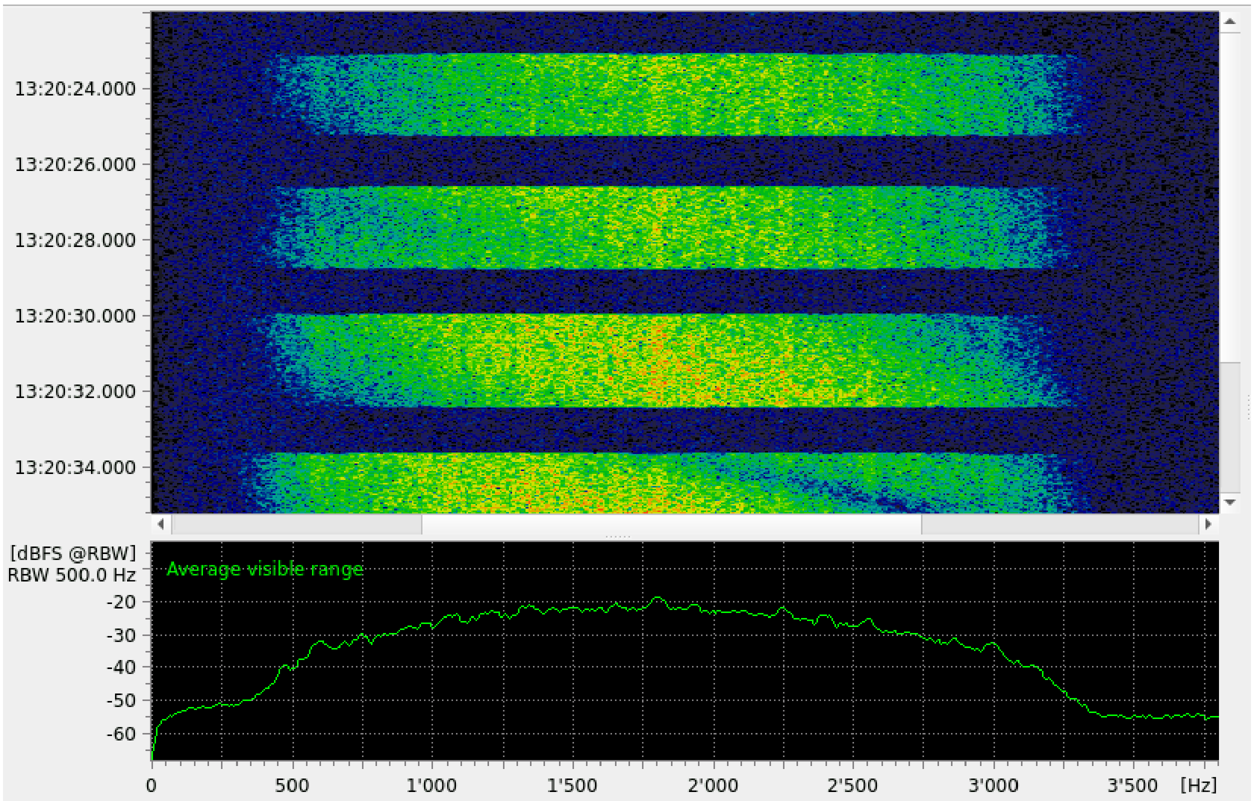


Figure 196: CHN pi/2 BPSK 2400Bd Spectrogram

5.9. CIS DataLink

General Information

CIS DataLink is a HF system to transfer air defense radar data.

Usage

- Transfer of radar target data
- Transfer of radar system control data

Mode Details

	Item	Value
Standard	Modulation	FSK
	Symbol rate (Bd)	1200
	Number of tones	2
	Tone distance (Hz)	800
	Bandwidth (Hz)	1400
Demodulator Settings	Demodulator	FSK discr.
	Symbol rate (Bd)	1200
	SR tolerance (Bd)	5
	Modulation order	2
	Shift (Hz)	800
	Shift tolerance(Hz)	20
	Modem type	Synchronous
Extras	Offset nominal frq. (Hz)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 193: CIS DataLink

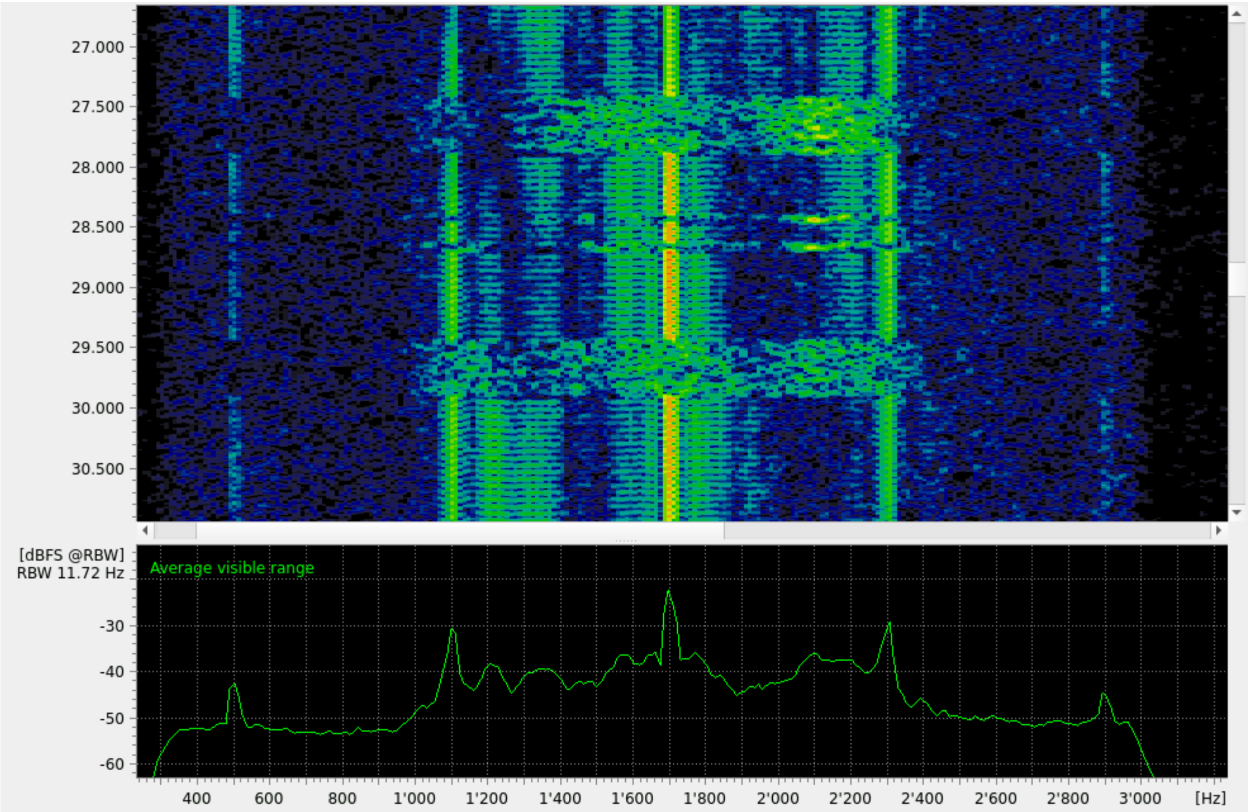


Figure 197: CIS DataLink Spectrogram

5.10. CV-786

General Information

CV-786 is a synchronous FSK mode built in MDM-2001 HF Modems. This modem is very similar to MD-674 and MIL-M-55529A.

Usage

- Data communication over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Number of tones	2
	Symbol rate (Bd)	50 / 75 / 100 / 110 / 150 Bit/s
	Error correction	ARQ
	Alphabet	ITA-2 / ITA-5
Demodulator Settings	Demodulator	FSK 2 matched
	Symbol rate (Bd)	100
	SR tolerance (Bd)	50
	Modulation order	2
	Shift (Hz)	850
	Shift tolerance (Hz)	8
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 194: CV-786

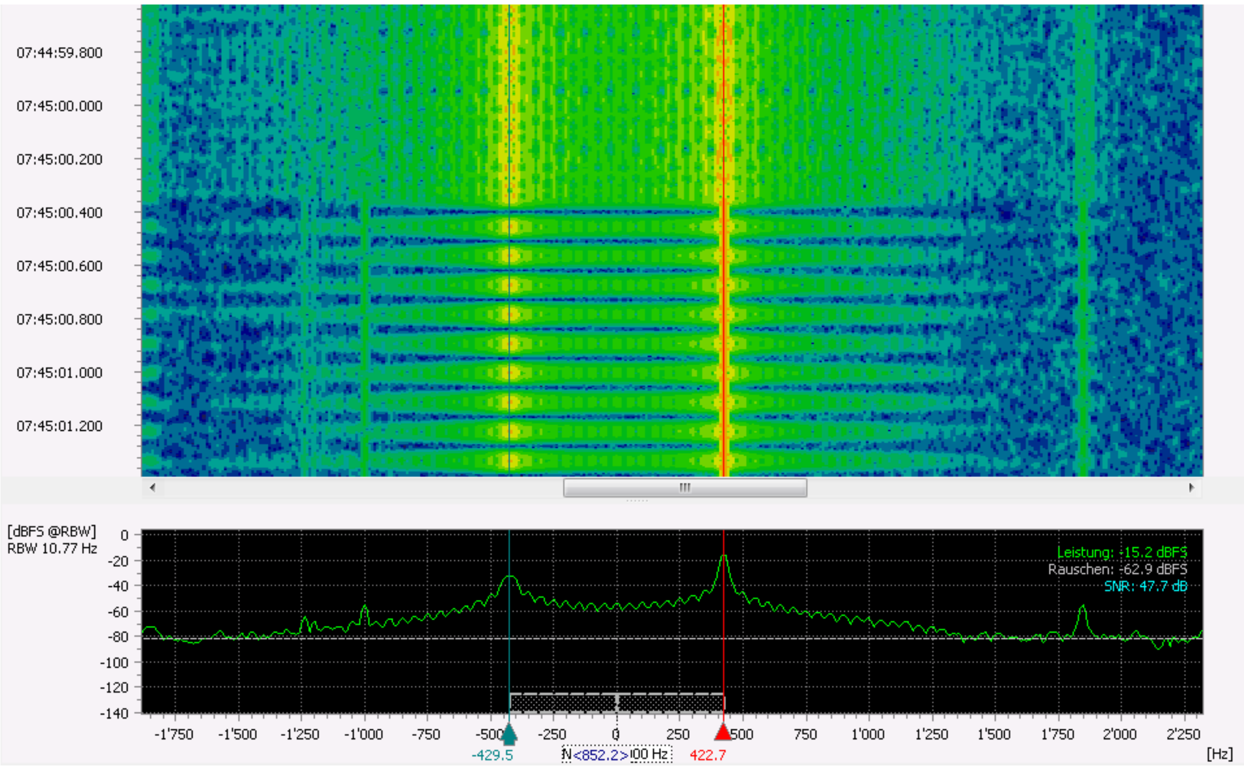


Figure 198: CV-786 Spectrogram

5.11. HARRIS RF-5800 SelCal

General Information

The Harris RF-5800 Selcal System mode is using a primary GMSK selection call, followed by an FSK 8 signal for fast automatic link establishment. The section call consists of 100 bits′ correlation period and every 100 bits multiple repeated up to 3 times.

Usage

- Automatic link establishment

Mode Details

	Item	Value
Standard	Modulation	GMSK
	Symbol rate (Bd)	2000
	Coding	unknown
Demodulator Settings	Demodulator	G (MSK)
	Type	GMSK linear
	Symbol rate (Bd)	2000
	SR tolerance (Bd)	1000
	BT	0.8
	Min. burst length (s)	0.500
	Max. burst length (s)	3.840
	Min. pause length (s)	0.500
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 195: HC-ARQ

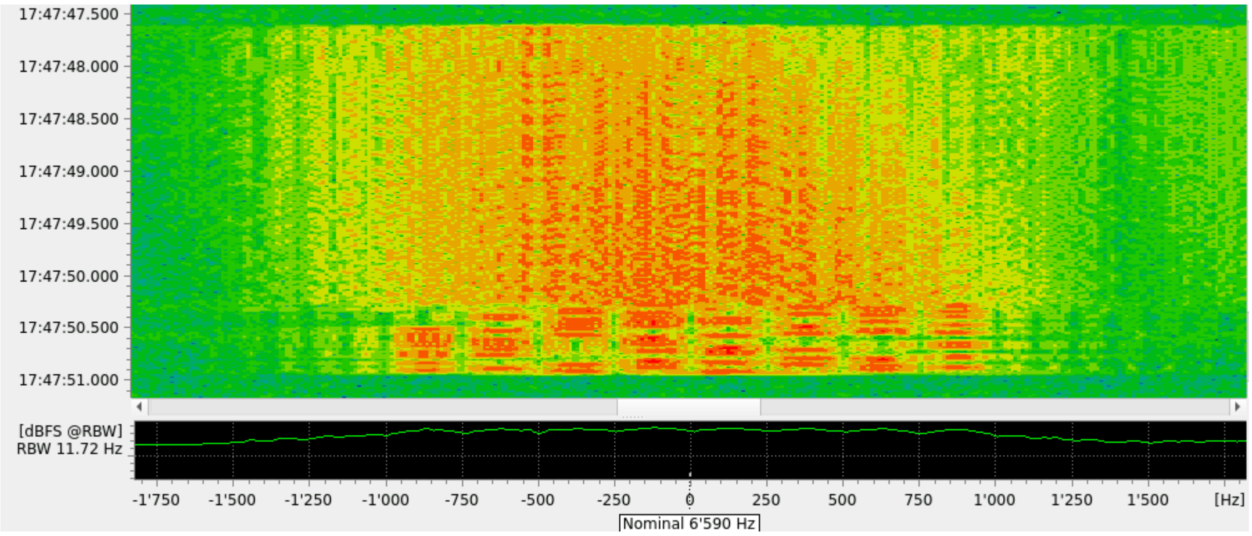


Figure 199: Harris RF-5800 SelCal Spectrogram

5.12. HC-ARQ

General Information

Haegelin Crypto ARQ is a synchronous simplex ARQ system (no longer) used by UN and IRC.

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value
Standard	Modulation	FSK
	Tones	2
	Shift (Hz)	200
	Bandwidth (Hz)	440
	Symbol rate (Bd)	240
	Alphabet	ITA-2
Demodulator Settings	Demodulator	FSK 2,3,4 discr.
	Symbol rate (Bd)	240
	SR tolerance (Bd)	0
	Modulation order	2
	Shift (Hz)	200
	Shift tolerance (Hz)	48
	Modem type	Synchronous
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 196: HC-ARQ

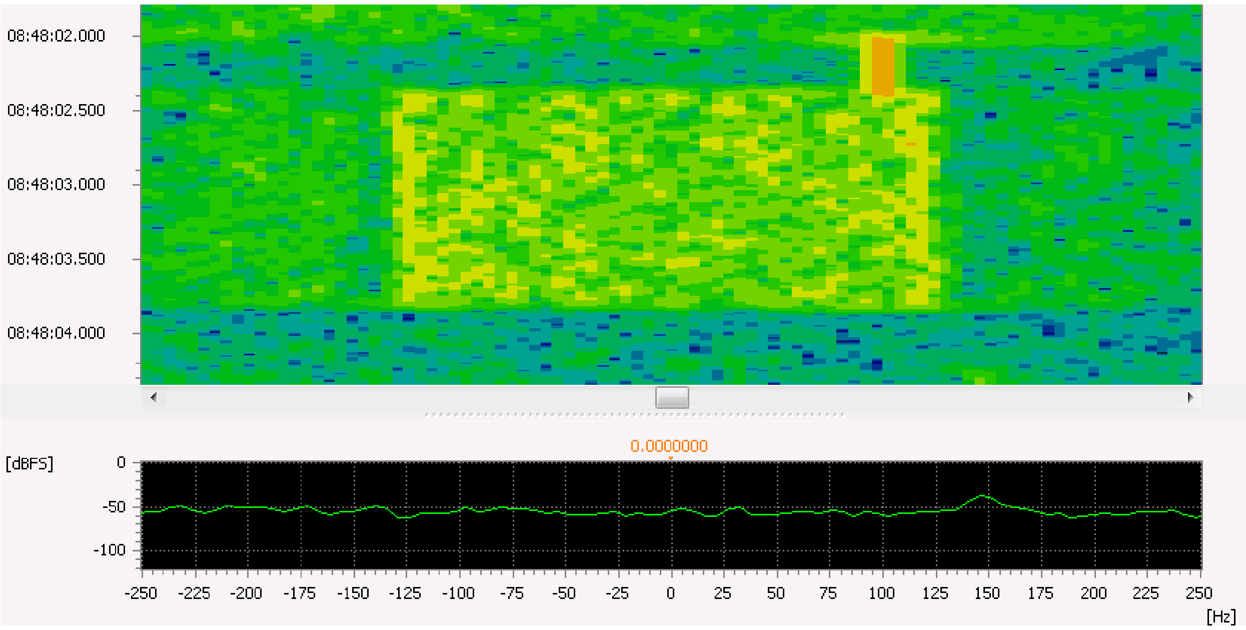


Figure 200: HC-ARQ Spectrogram

5.13. KG-84

General Information

KG-84 is a encryption mode used in several waveforms like STANAG-4285. Detection of this encryption mode is built into several decoders. If detected, the initialization vectors are also output.

5.14. KW-46

General Information

KW-46 is a encryption mode used in several waveforms like STANAG-4285. Detection of this encryption mode is built into several decoders.

5.15. Link 11 CLEW

General Information

STANAG5511 CLEW mode is a NATO Standard for tactical data exchange. The Conventional Link Eleven Waveform (CLEW) is one of the modes defined within the Link 11 NATO Standard. The UHF variant is additionally FM modulated.

Usage

- Transfer of tactical data over HF and VUHF

Mode Details

	Item	Value
Standard	Modulation	DQPSK
	Tones	16
	Bandwidth (Hz)	2500
	Data rate (bit/s)	1364 / 2250
Demodulator Settings	Demodulator	LINK-11 (external modem 15004)
Extras	Offset nominal frq. (Hz)	605
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 197: Link 11 CLEW

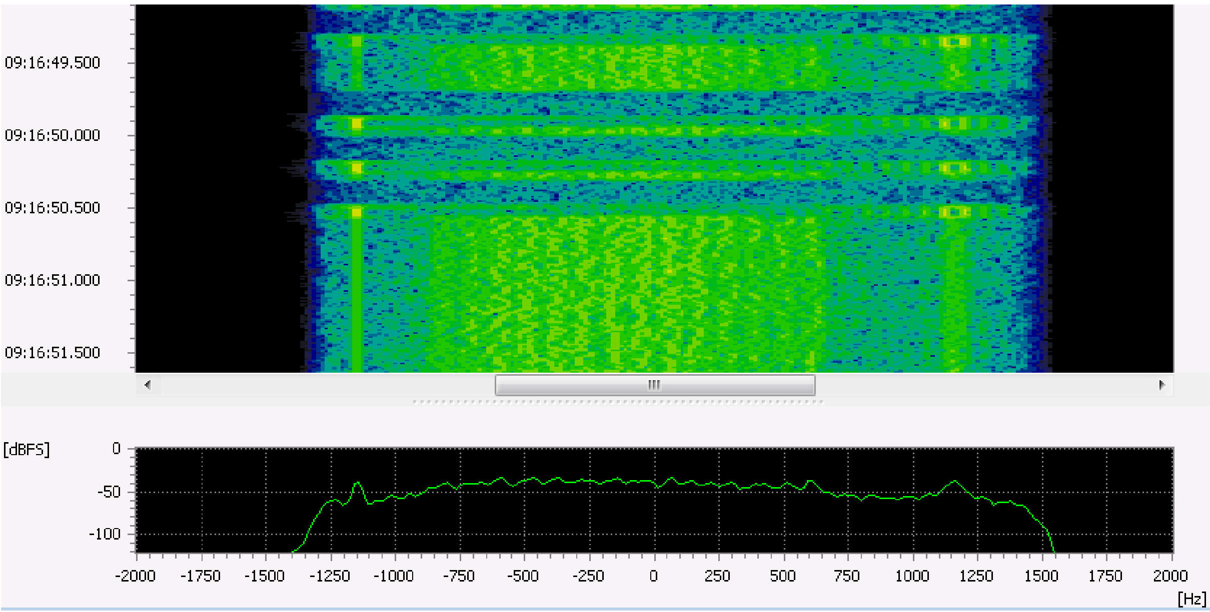


Figure 201: Link 11 CLEW Spectrogram

	Item	Value
Standard	Modulation	FM & DQPSK
	Bandwidth (Hz)	45 kHz
	Data rate (bit/s)	1364 / 2250
Demodulator Settings	Demodulator	LINK-11 (external modem 15004)
Extras	Primary demodulator	FM
	FM bandwidth	45000 Hz
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 198: Link 11 CLEW UHF

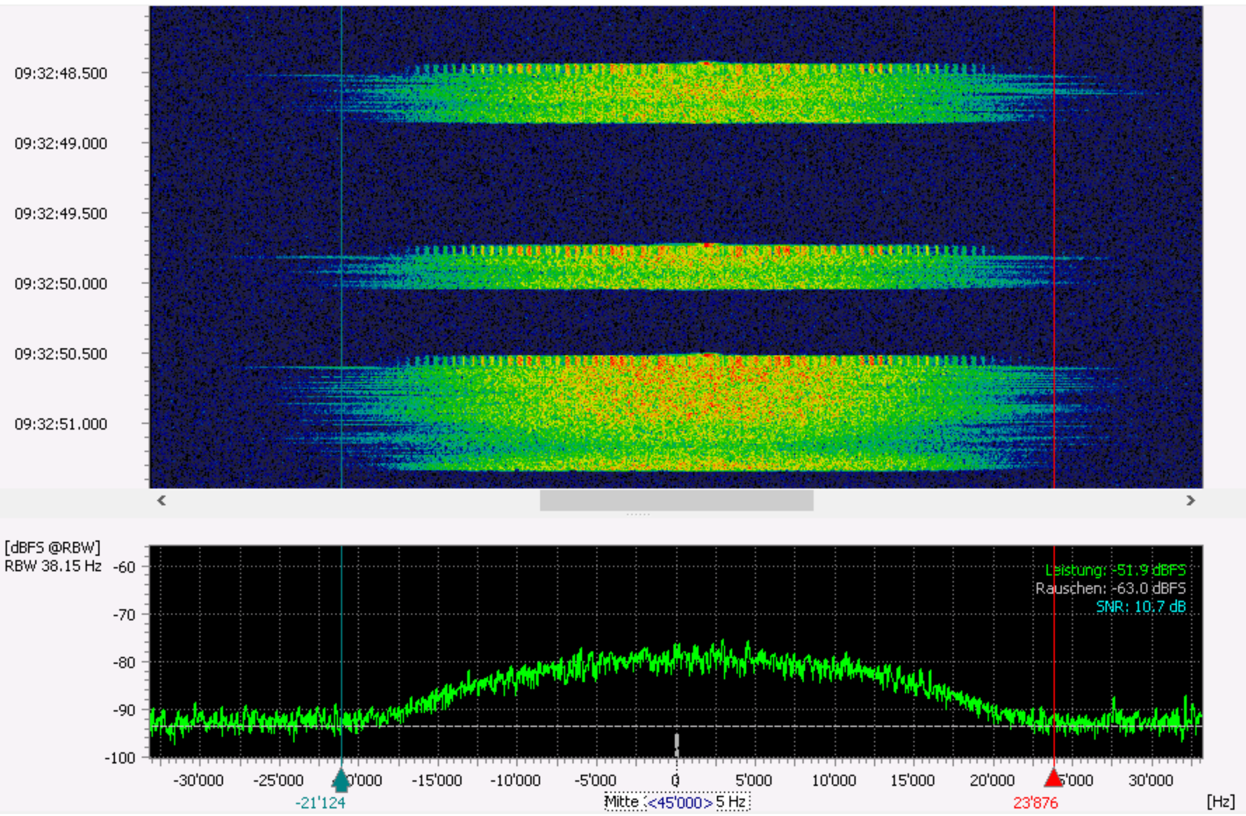


Figure 202: Link 11 CLEW UHF Spectrogram

5.16. Link 11 SLEW

General Information

STANAG5511 SLEW mode is a NATO Standard for tactical data exchange. The Single Tone Link Eleven Waveform (SLEW) is one of the modes defined within the Link 11 NATO standard.

Usage

- Transfer of tactical data over HF and VHF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'STANAG 5511 SLEW'

Mode Details

	Item	Value
Standard	Modulation	PSK
	Tones	8
	Bandwidth (Hz)	3000
	Symbol rate (Bd)	2400
	Error correction	Convolutional
Demodulator Settings	Demodulator	PSK data aided
	Symbol rate (Bd)	2400
	SR tolerance (Bd)	5
	Modulation order	8
	Min. burst length (s)	0.100
	Max. burst length (s)	2.000
	Min. pause length (s)	0.004
Extras	Offset nominal frq. (Hz)	1800
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 199: Link 11 SLEW

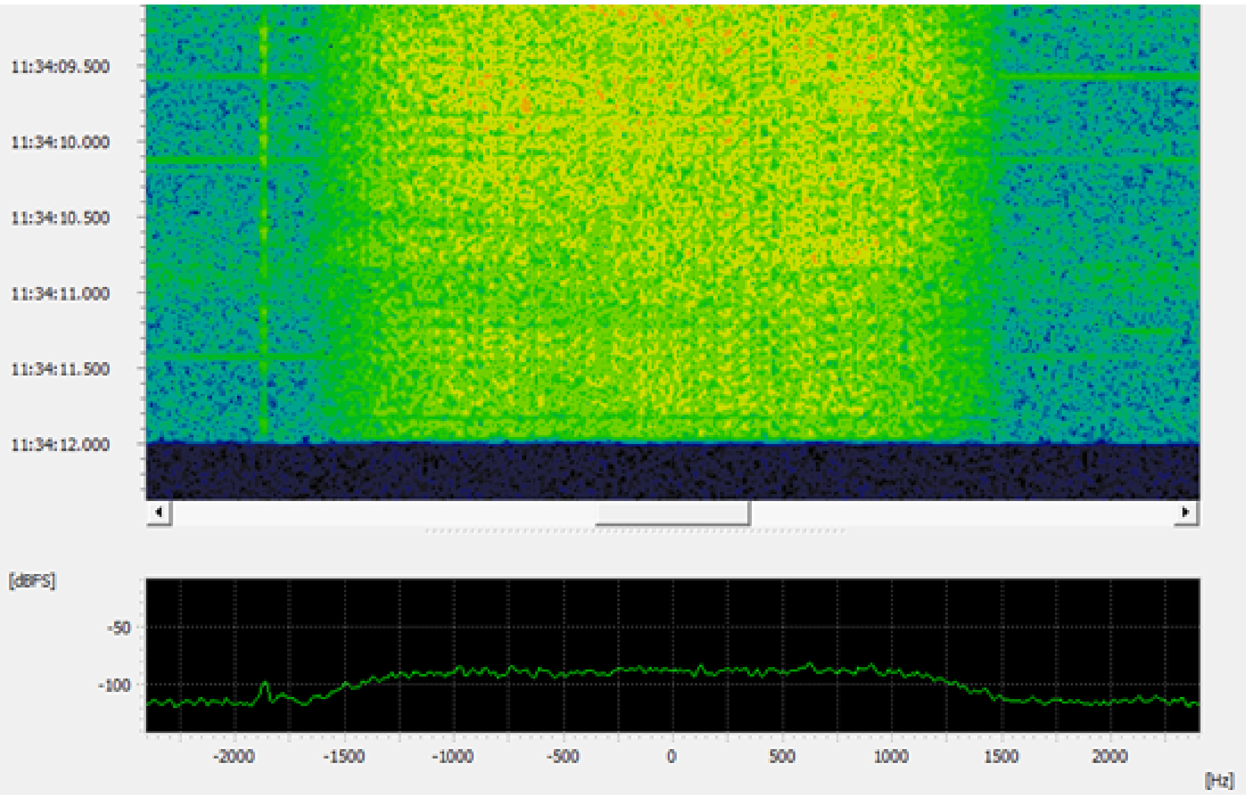


Figure 203: Link 11 SLEW Spectrogram

5.17. Link 22 (Stanag 4539 Appendix D)

General Information

Link 22 is a NATO tactical radio link network, originally introduced to replace Link 11. The network is differently implemented in HF and UHF bands, in fixed frequency and hopped modes. The HF fixed frequency implementation started with the modulation and coding described in Stanag 4539 Appendix D, later enhanced by additional modes described in Appendix E, F and G. These different modes may appear as mixed type of bursts in a TDMA scenario. The current implementation makes use of Appendix D only.

Usage

- Transfer of tactical data over HF and VHF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Link 22'

Mode Details

	Item	Value
Standard	Modulation	PSK4 / PSK8
	Tones	Single Tone
	Bandwidth (Hz)	3000
Demodulator Settings	Demodulator	PSK data aided
	Symbol rate (Bd)	2400
	Modulation order	4
	Burst mode	yes
	Min. burst length	1000 ms
	Max. burst length	5000 ms
	Min. pause length	20 ms
Features	Recognition	yes (WF1 – WF3)
	Decoding	yes (WF1 – WF3)
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 200: Link 22

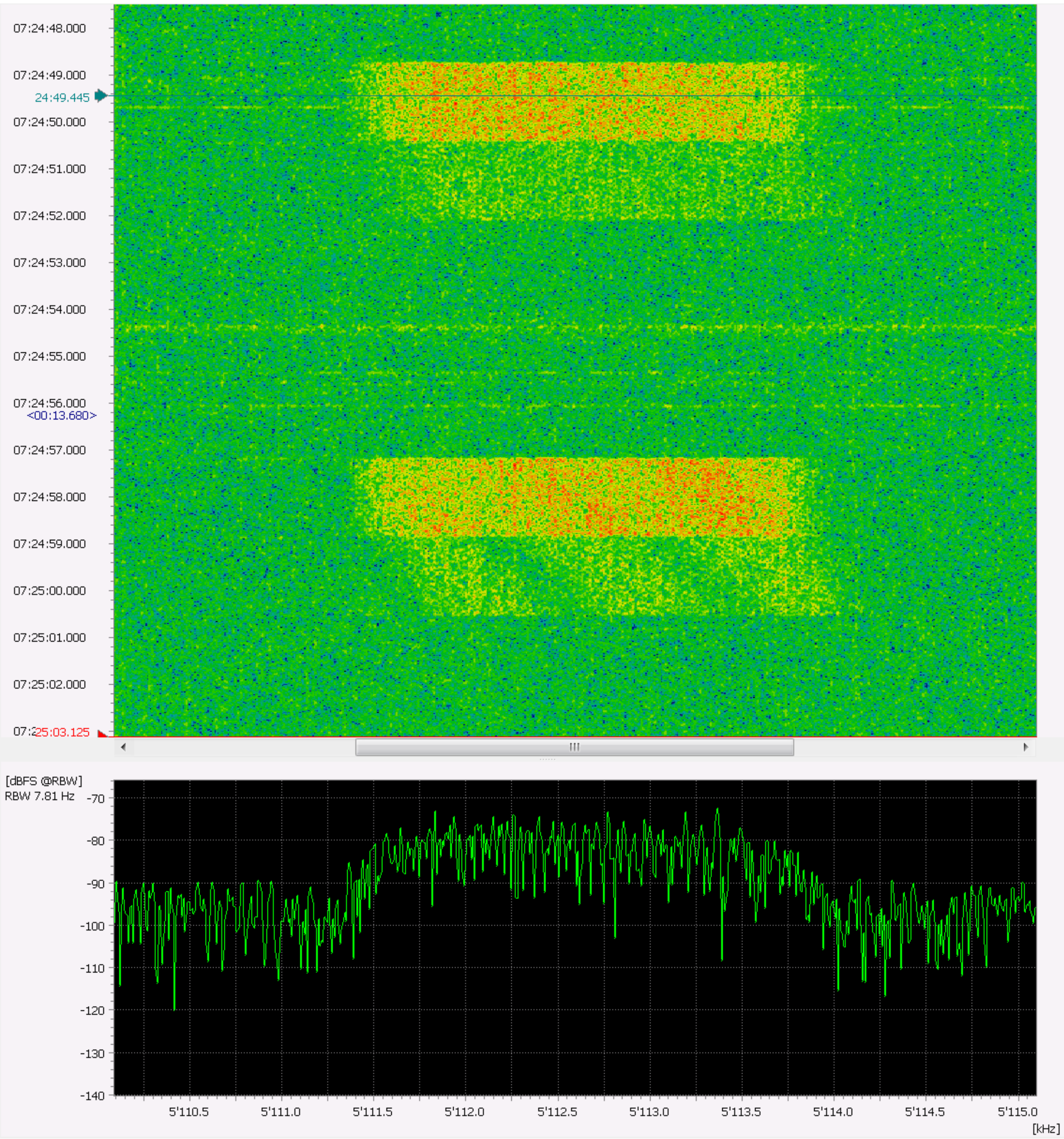


Figure 204: LINK 22 HF Spectrogram

5.18. MIL-M-55529A

General Information

MIL-M-55529A is a synchronous FSK mode built into GRC-MD522 teletypewriter sets.
This mode is also known as MD-522 (NB/WB).

Usage

- Transfer of textual information over HF

Mode Details

	Item	Value	
Standard	Modulation	FSK	
	Tones	2	
	Version	NB	WB
	Shift (Hz)	85	850
	Bandwidth (Hz)	200	1000
	Center Frequency (Hz)	2804	2000
	Symbol rate (Bd)	50, 75, 100, 110	
	Data rate (bit/s)	28 / 42 / 55 / 61	32 / 48 / 64 / 70
	Alphabet	ITA2, ITA5	
Demodulator Settings	Demodulator	FSK 2 matched	
	Symbol rate (Bd)	100	
	SR tolerance (Bd)	10	
	Shift (Hz)	85	850
	Modem type	Synchronous	
	Min. burst length (s)	0.100	
	Max. burst length (s)	1.000	
	Min. pause length (s)	0.100	
Features	Demodulation	yes	
	Recognition	yes	
	Decoding	yes	
	Automatic Polarity Adjustment	yes	
	Combination with other modems (modem list)	yes	

Table 201: MIL-M-55529A Spectrogram

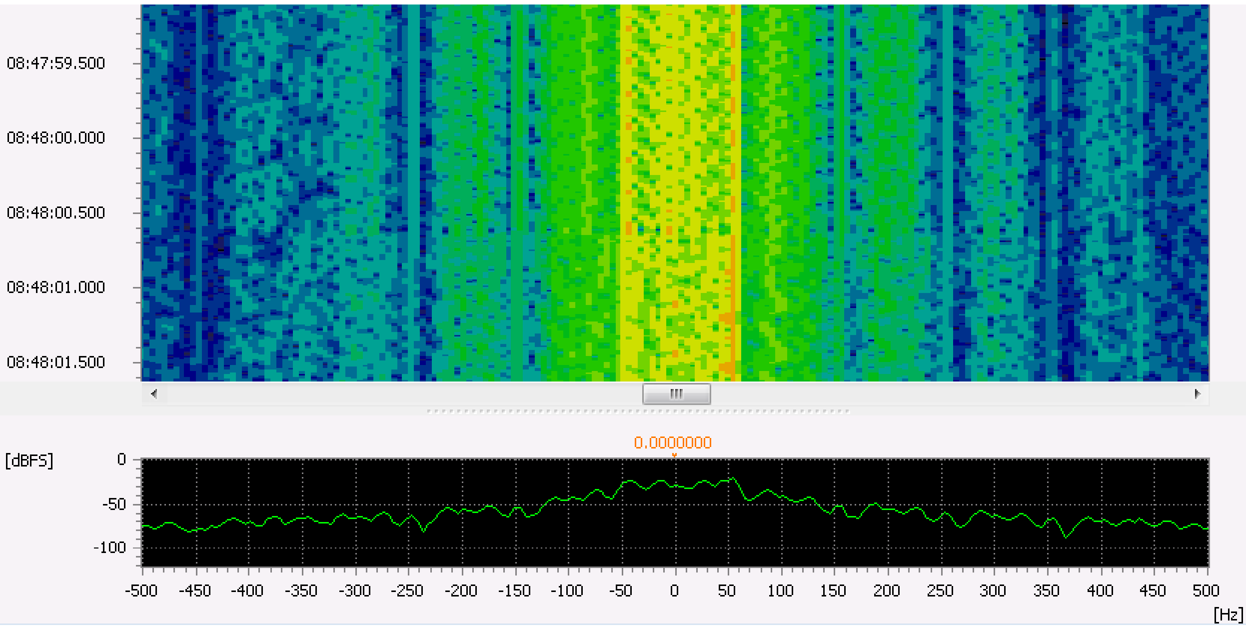


Figure 205: MIL-M-55529A Spectrogram

5.19. MIL-188-110 16 Tone

General Information

MIL-STD-188-110B 16Tone is a parallel mode which uses 16 subcarrier tones in the audio frequency band with differential phase shift keying (DPSK) modulation for bit synchronous data transmission. The modulation rate of the modulator output is constant for all data rates. The system supports data rates of 75 to 2400 bps. This modem is not suitable for the automatic detection.

Usage

- Data communication over HF between departments and agencies of the MOD

Restrictions

- This modem is not suitable for the automatic detection, because there is no channel coding

Mode Details

	Item	Value
Standard	Modulation	DPSK
	Number of tones	16
	Bandwidth (Hz)	2500
	Symbol rate (Bd)	75
	Data rate (bit/s)	75 … 2400
Demodulator Settings	Demodulator	MDPSK 2,4,8,16 A/B
	Symbol rate (Bd)	75
	SR tolerance (Bd)	1
	Modulation order	4
	Version	B
	No. of channels	16
	Channel position type	Channel distance
	Channel distance (Hz)	110
	Min. burst length (s)	0.100
	Max. burst length (s)	1.000
	Min. pause length (s)	0.100
	Min. burst SNR (dB)	0
Extras	Offset nominal frq. (Hz)	925
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	no

Table 202: MIL-188-110 16 Tone

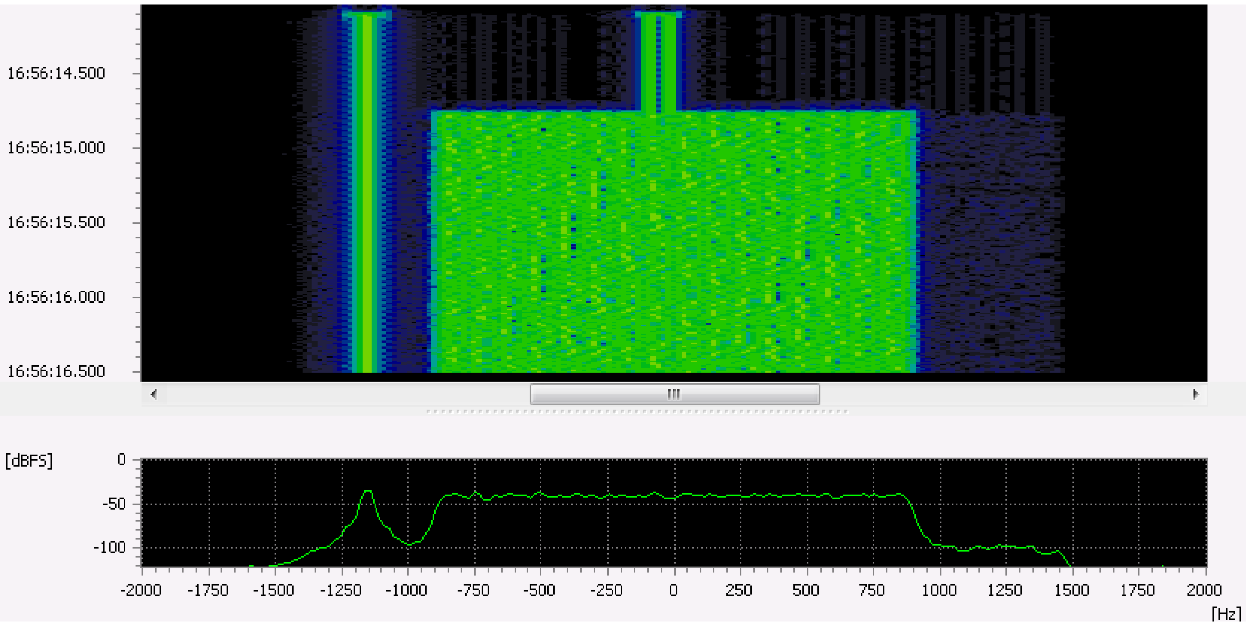


Figure 206: MIL-188-110 16 Tone Spectrogram

5.20. MIL-188-110 39 Tone

General Information

The modem is described in MIL-STD-188-110 Appendix B. It uses a parallel 39 tone OFDM modulation with quadrature differential phase shift keying (QDPSK). The modulation baud rate of the modulator output is constant for all data rates. The system supports bit rates of 75 to 2400 bps, various interleaving variants and different character codings.

Usage

- General simplex or full duplex HF data communications

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'MIL-188-110 39 Tone'

Mode Details

	Item	Value
Standard	Modulation	QDPSK
	Number of tones	1 + 39
	Bandwidth (Hz)	2500
	Symbol rate (Bd)	44.44
	Data rate (bit/s)	600/1200/2400
	Error correction	Reed Solomon / Trellis
Demodulator Settings	Demodulator	Special Plugin
Extras	Offset nominal frq. (Hz)	393.75
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 203: MIL-188-110 39 Tone

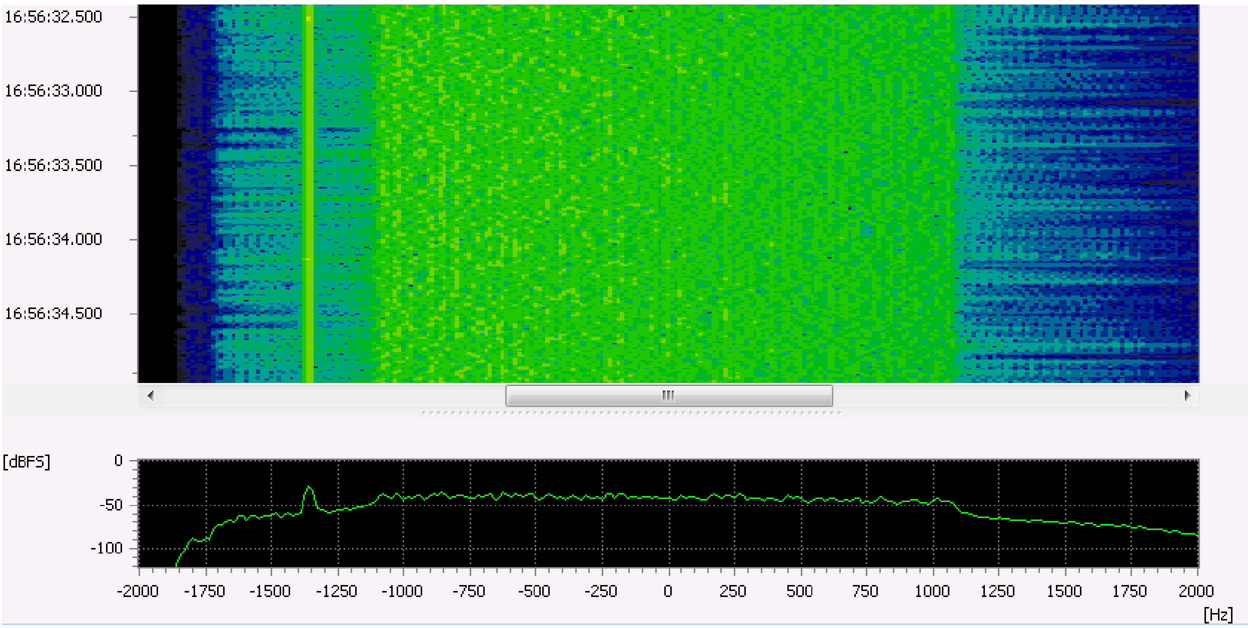


Figure 207: MIL-188-110 39 Tone Spectrogram

Supported bit rates and interleaving modes

Signal	Status			
MIL-188-110 39 Tone	Very short	Medium Short	Medium Long	Very Long
75	yes	yes	yes	yes
150	yes	yes	yes	yes
300	yes	yes	yes	yes
600	yes	yes	yes	yes
1200	yes	yes	yes	yes
2400 short interleaving modes	yes	yes	yes	yes
2400 long interleaving modes	yes	yes	yes	yes
Automatic bitrate detection and setting	yes			
Automatic interleaving d etection and setting	yes			

Table 204: MIL-188-110 39 Tone supported bit rates

Supported data formats

Data format	Sync	1 stop bit	2 stop bits	1 stop bit + parity	2 stop bits + parity
8 (Latin1/ASCII)	yes [1]	yes [1]	yes [1]	yes [1]	yes
7 (ASCII)		yes	yes	yes	yes
6 (Hex transparent)		yes	yes	yes	yes
5 (ITA2)		yes	yes	yes	yes

Table 205: MIL-188-110 39 Tone - supported data formats

[1] Full automatic detection possible for this modes. For other modes data format must be set manually.

Supported diversity modes

Diversity Mode	Available
Time & Frequency	yes
Frequency only	yes
Automatic diversity mode detection and setting	yes

Table 206: MIL-188-110 39 Tone - supported diversity modes

Preamble

Short and long preambles are accepted automatically. Due to fading or poor signal quality, there is a possibility that a preamble is incorrectly not detected. In such cases it is possible to deactivate preamble detection or burst processing in order to process the signal manually. The corresponding option can be found in the decoder parameters. The signal should start exactly after the preamble so that the OFDM demodulator works correctly.

5.21. MIL-188-110 App. D

General Information

MIL_STD-188-110 App. D describes a set of wideband single-tone waveforms. The bandwidths range from 3 kHz to 24 kHz. The waveforms can be used for different applications. There are both robust waveforms with low data rate and a lot of redundancy as well as more error-prone waveforms for faster data transmission.

Since no checksum is defined in the standard, it is not easy to make a statement about error-free reception. An indication is given by the error metric of the Viterbi algorithm.

The demodulator is able to equalize sky wave channels for waveforms 0 – 10. Waveforms 11 and 12 are actually designed for ground wave channels only, but sky wave channels are supported with limitations.

Table 208 gives an indication of the required SNR or error-free reception.

The preamble modulation is very robust and always the same for all waveforms of a bandwidth. Therefore, even waveforms that cannot be demodulated and decoded without a significant number of errors due to a low SNR can eventually be detected and tracked.

Usage

- Transfer of digital speech or data over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'MIL110APPD'

Mode Details

	Item	Value
Standard	Modulation	orthogonal Walsh sequences / BPSK / QPSK / 8PSK / 16QAM / 32QAM / 64QAM / 256QAM
	Bandwidth (Hz)	3000 – 24000 Hz
	Symbol rate (Bd)	2400 – 19200 Bd (see Table 208)
	Data rate (bit/s)	75 – 120000 (see Table 209)
	Error correction	Convolutional coding (see Table 210), constraint length 7 or 9
	Interleaving modes	Ultra Short, Short, Medium, Long
Demodulator Settings	Demodulator	MIL110_AppD, external Modem 15005
Extras	Nominal Frequencies	see Table 208

	Item	Value
Features	Demodulation	yes
	iterative Equalization	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes

Table 207: MIL-188-110 App. D Features

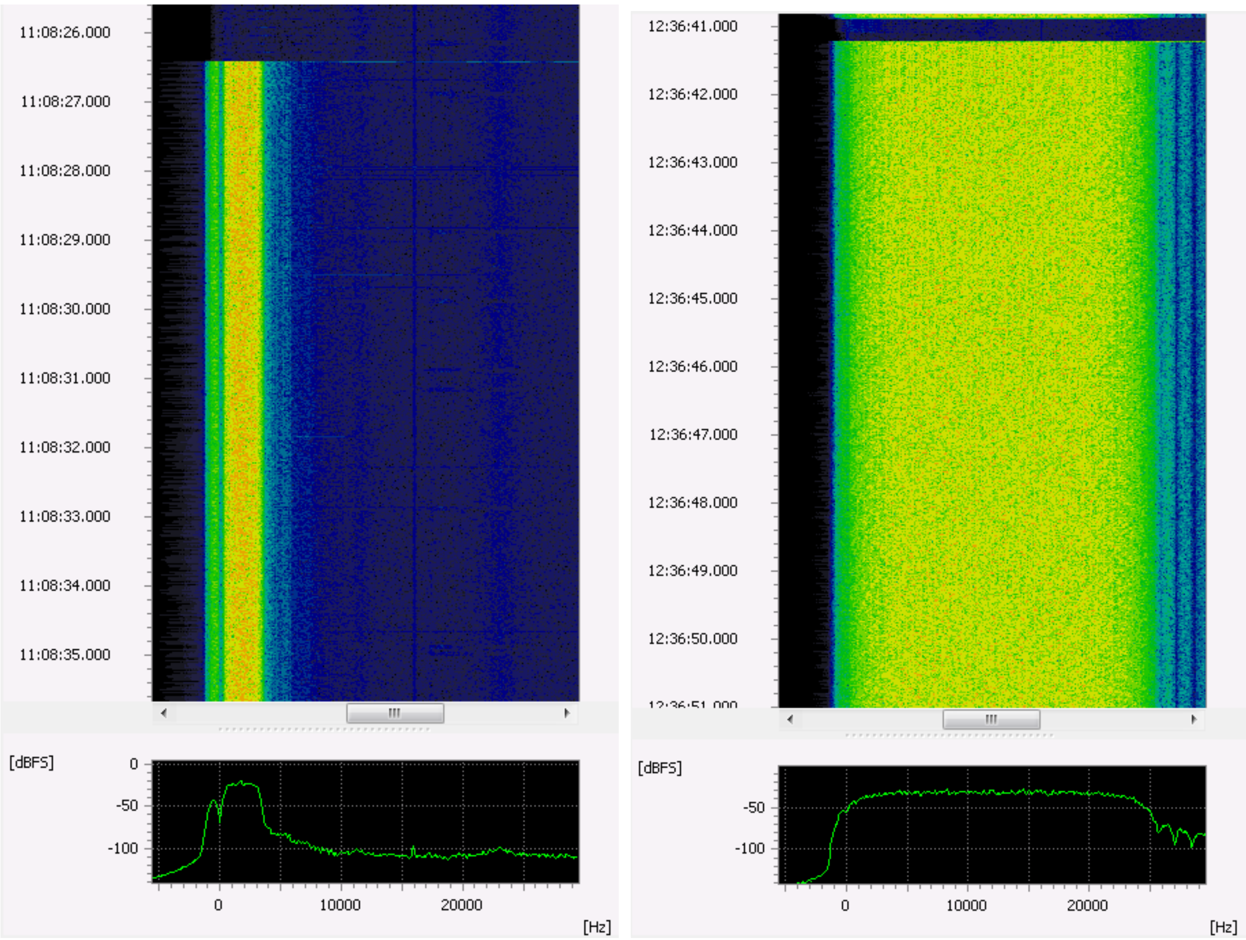


Figure 208: MIL-188-110 App. D 3kHz and 24kHz

Bandwidth (kHz)	Symbol Rate (Sym/sec)	Nominal Frequency
3	2400	1800
6	4800	3300
9	7200	4800
12	9600	6300

Bandwidth (kHz)	Symbol Rate (Sym/sec)	Nominal Frequency
15	12000	7800
18	14400	9300
21	16800	10800
24	19200	12300

Table 208: MIL-188-110 App. D Symbol Rates / Nominal Frequencies

Waveform Number	0 Walsh	1 BPSK	2 BPSK	3 BPSK	4 BPSK	5 BPSK	6 QPSK	7 8PSK	8 16QAM	9 32QAM	10 64QAM	11 64QAM	12 256QAM	13 QPSK
Bandwidth (kHz)														
3	75	150	300	600	1200	1600	3200	4800	6400	8000	9600	12000	16000	2400
6	150	300	600	1200	2400	3200	6400	9600	12800	16000	19200	24000	32000	
9	300	600	1200	2400	-	4800	9600	14400	19200	24000	28800	36000	48000	
12	300	600	1200	2400	4800	6400	12800	19200	25600	32000	38400	48000	64000	
15	300	600	1200	2400	4800	8000	16000	24000	32000	40000	48000	57600	76800	
18	600	1200	2400	4800	-	9600	19200	28800	38400	48000	57600	72000	90000	
21	300	600	1200	2400	4800	9600	19200	28800	38400	48000	57600	76800	115200	
24	600	1200	2400	4800	9600	12800	25600	38400	51200	64000	76800	96000	120000	

Table 209: MIL-188-110 App. D Bandwidths and Bit Rates

Waveform Number	0 Walsh	1 BPSK	2 BPSK	3 BPSK	4 BPSK	5 BPSK	6 QPSK	7 8PSK	8 16QAM	9 32QAM	10 64QAM	11 64QAM	12 256QAM	13 QPSK
Bandwidth (kHz)														
3	1/2	1/8	1/4	1/3	2/3	3/4	3/4	3/4	3/4	3/4	3/4	8/9	8/9	9/16
6	1/2	1/8	1/4	1/3	2/3	3/4	3/4	3/4	3/4	3/4	3/4	8/9	8/9	
9	2/3	1/8	1/4	1/2	-	3/4	3/4	3/4	3/4	3/4	3/4	8/9	8/9	
12	1/2	1/8	1/4	1/3	2/3	3/4	3/4	3/4	3/4	3/4	3/4	8/9	8/9	
15	2/5	1/12	1/6	1/3	2/3	3/4	3/4	3/4	3/4	3/4	3/4	8/9	8/9	
18	2/3	1/8	1/4	1/2	-	3/4	3/4	3/4	3/4	3/4	3/4	8/9	5/6	
21	2/7	1/16	1/8	1/4	1/2	2/3	2/3	2/3	2/3	2/3	2/3	4/5	9/10	
24	1/2	1/8	1/4	1/3	2/3	3/4	3/4	3/4	3/4	3/4	3/4	8/9	5/6	

Table 210: MIL-188-110 App. D Code Rates

Waveform Number	Average SNR (dB) for BER ≤ 1.0E-5	
	AWGN Channel	"Poor" Channel
0	-6	-1
1	-3	3
2	0	5
3	3	7
4	5	10
5	6	11
6	9	14
7	13	19
8	16	23
9	19	27
10	21	31
11	24	-
12	30	-
13	6	11

Table 211: MIL-188-110 App. D SNR requirements

5.22. PANTHER-H Sync

General Information

PANTHER-H is a tactical HF radio system developed by Racal (now Thales Group) which provides a Low Probability of Intercept (LPI) and anti-jamming protection whilst delivering reliable.

This intelligent frequency hopping transceiver has a signature 8-burst SOC (Start Of Conversation) sync procedure. After the SOC, the modem will begin sending data using frequency hopping. This decoder will only detect the SOC.

Usage

- HF radio communications

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Panther-H'

Mode Details

	Item	Value
Standard	Demodulator	DPSK 2,4,8,16 A/B
	Symbol rate (Bd)	2400
	SR tolerance (Bd)	5
Demodulator Settings	Demodulator	DPSK 2,4,8,16 A/B
	Symbol rate (Bd)	2400
	SR tolerance (Bd)	5
	Modulation order	4
	Version	A
	adaptive equalizer	off
	Min. burst length (s)	0.030
	Max. burst length (s)	0.150
	Min. pause length (s)	0.005
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	

Table 212: Panther-H

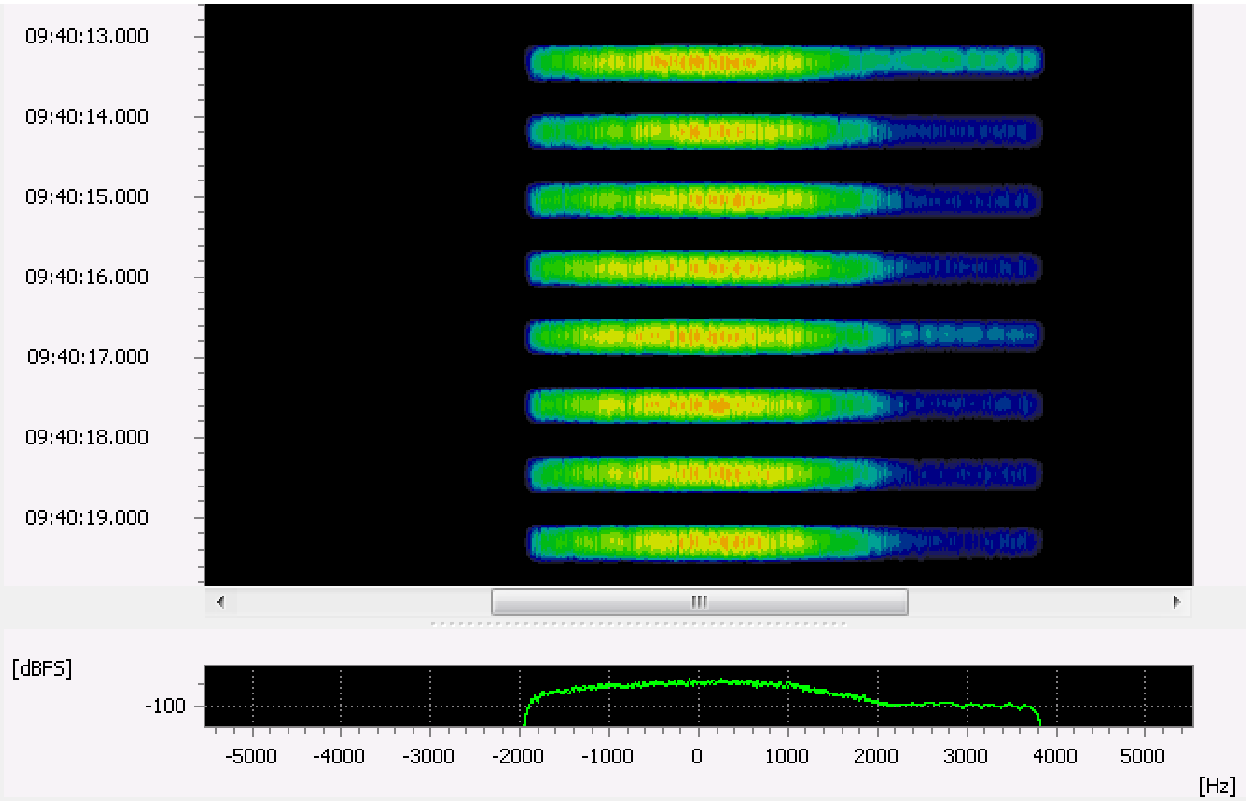


Figure 209: Panther-H signature burst spectrogram

5.23. STANAG-4197

General Information

STANAG 4197 is a mode for the exchange of voice-data, which are coded according to the LPC10 (Linear Predictive Coding) standard, over a radio channel in a robust way.

Usage

- Military voice communication over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'STANAG 4197'

Mode Details

	Item	Value
Standard	Modulation	QPSK
	Tones	39
	Shift (Hz)	56.25
	Bandwidth (Hz)	2300
	Symbol rate (Bd)	44.44
	Error correction	FEC
Demodulator Settings	Demodulator	OFDM
	Symbol rate (Bd)	44.444
	No. of channels	39
	Channel distance (Hz)	56.250
	Constellation	PSK 4A
	Min. burst length (s)	0.200
	Max. burst length (s)	0.000
	Min. pause length (s)	0.050
Extras	Offset nominal frq. (Hz)	675
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes
	Channel 16: Binary hex output	yes
Vocoder	LPC10	not included

Table 213: STANAG-4197

Note: It is recommended to use this modem only in nominal frequency mode.

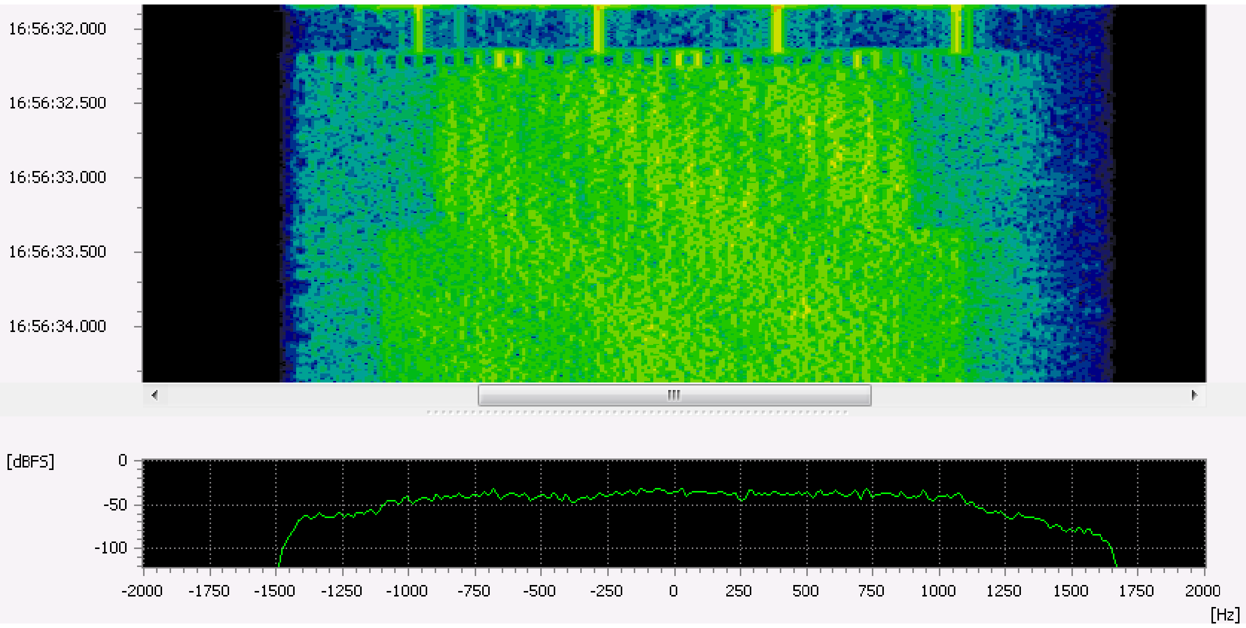


Figure 210: STANAG-4197 Spectrogram

5.24. STANAG-4285

General Information

STANAG-4285 is a NATO standard for digital data communication. **Transmissions using a KG-84 encryption device can be detected. Header and message data is shown using hexadecimal encoding.**

Usage

- Transfer of digital information over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'STANAG 4285/4529'

Mode Details

Parameter	Value							
Symbol rate (Bd)	2400							
Bandwidth (Hz)	3000							
Short interleaver (s)	0.852							
Long interleaver (s)	10.240							
Data rate (bit/s)	75	150	300	600	1200	2400		
Modulation	BPSK	BPSK	BPSK	BPSK	QPSK	8PSK		
Error correction	CR 1/16	CR 1/8	CR 1/4	CR 1/2	CR 1/2	CR 2/3		
Interleaving	Short/ Long	Short/ Long	Short/ Long	Short/ Long	Short/ Long	Short/ Long		

Table 214: STANAG-4285 Standard

	Item	Value
Demodulator Settings	Demodulator	PSK data aided
	Symbol rate (Bd)	2400
	Modulation order	8
	Version	A
Extras	Offset nominal frq. (Hz)	1800

	Item	Value
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes
	Channel 2: STANAG-5066 text output	yes
	Channel 16: Binary hex output	yes
	STANAG-5066 post-processing	yes
	Detection of KG-84	yes
	Detection of KW-46	yes

Table 215: STANAG-4285

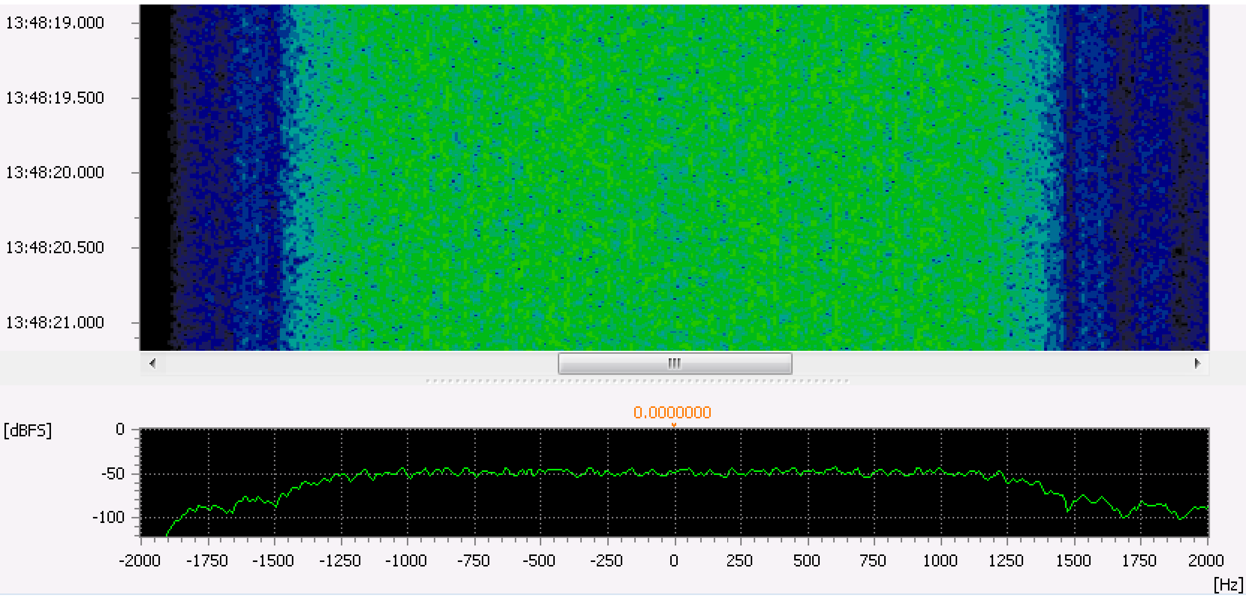


Figure 211: STANAG-4285 Spectrogram

Supported alphabet in each submode

Setting	5N1	5N2	7N1	7N2	8N1	8N2	7N0	8N0
automatic	x	x	x	x	x	x	-	-
manual	x	x	x	x	x	x	x	x

Table 216: STANAG-4285 alphabet availability

5.25. STANAG-4415

General Information

STANAG is a NATO standard for robust, non-hopping digital data communication.

It is equivalent to the 75 bps variant of MIL-STD-188-110 A/B single

Usage

- Transfer of digital information over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'STANAG 4415'

Mode Details

	Item	Value
Standard	Modulation	8PSK
	Bandwidth (Hz)	3000
	Symbol rate (Bd)	2400
	Data rate (bit/s)	75
	Error correction	FEC rate 1/2
	Interleaver (s)	0, 0.6, 4.8
Demodulator Settings	Demodulator	PSK 2,4,8 A/B
	Symbol rate (Bd)	2400
	SR tolerance (Bd)	20
	Modulation order	8
	Version	A
Extras	Offset nominal frq. (Hz)	1800
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Detection of KW-46	yes
	Combination with other modems (modem list)	yes

Table 217: STANAG-4415

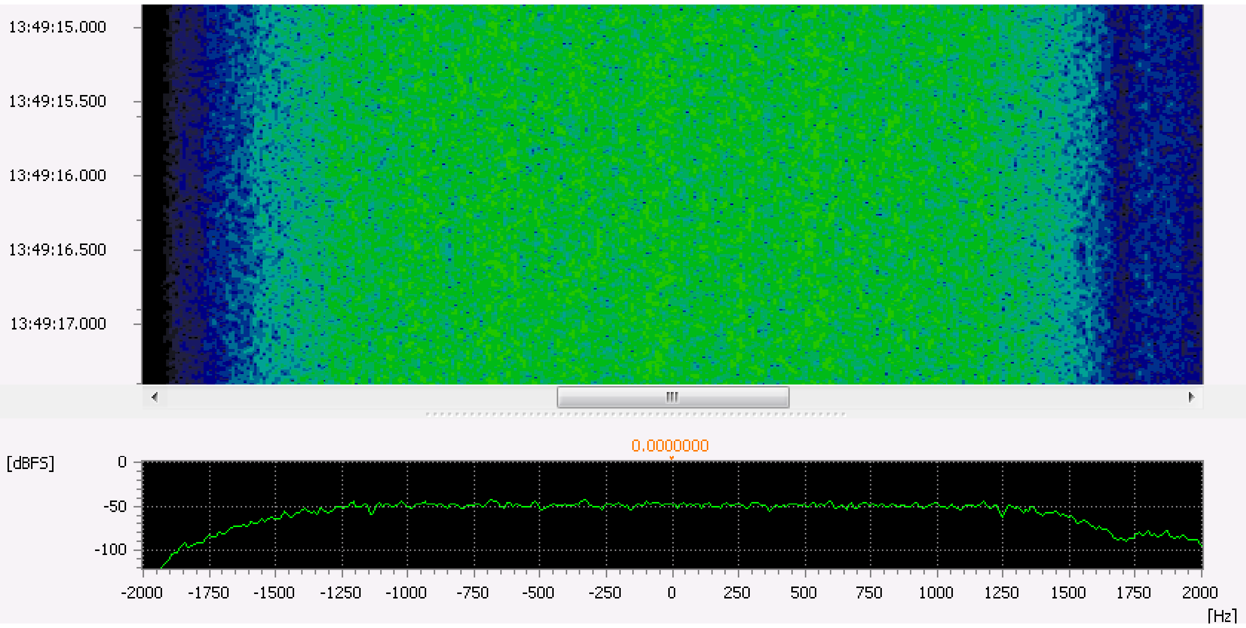


Figure 212: STANAG-4415 Spectrogram

Setting	5N1	5N2	7N1	7N2	8N1	8N2	7N0	8N0
automatic	x	x	x	x	x	x	-	-
manual	x	x	x	x	x	x	x	x

Table 218: STANAG-4415 alphabet availability

5.26. STANAG-4481

General Information

STANAG-4481 is a NATO standard for maritime shore-to-ship broadcast digital data communication. Data are sent by a single land-based transmitting station and received by many stations aboard ships.

There are two variants, one with a FSK modulated signal, the other with PSK modulation. The PSK version however is equivalent to a mode of STANAG-4285 (300 bit/s). So there is no separate modem provided for STANAG-4481 PSK. For the FSK version transmissions using a KG-84 encryption device can be detected. Header and message data is shown using hexadecimal encoding.

Usage

- Transfer of maritime related digital information over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'STANAG 4481 (FSK variant)'

Mode Details

	Item	Value	
Standard	Modulation	FSK	PSK
	Tones	2	-
	Shift (Hz)	850	-
	Bandwidth (Hz)	1500	3000
	Symbol rate (Bd)	75 / 100 / 150 / 300 / 600	2400
	Data rate (bit/s)	-	300
	Error correction	-	FEC rate 1/4
Demodulator Settings	Demodulator	FSK 2 matched	PSK data aided
	Symbol rate (Bd)	75	2400
	SR tolerance (Bd)	5	24
	Shift (Hz)	850	-
	Shift tolerance (Hz)	10	-
	Modulation order	-	8
	Version	-	A
Extras	Offset nominal frq. (Hz)	0	1800

	Item	Value	
Features	Demodulation	yes	
	Recognition	yes	
	Decoding	yes	
	Automatic Polarity Adjustment	no	
	Detection of KW-46	yes	
	Combination with other modems (modem list)	yes	

Table 219: STANAG-4481

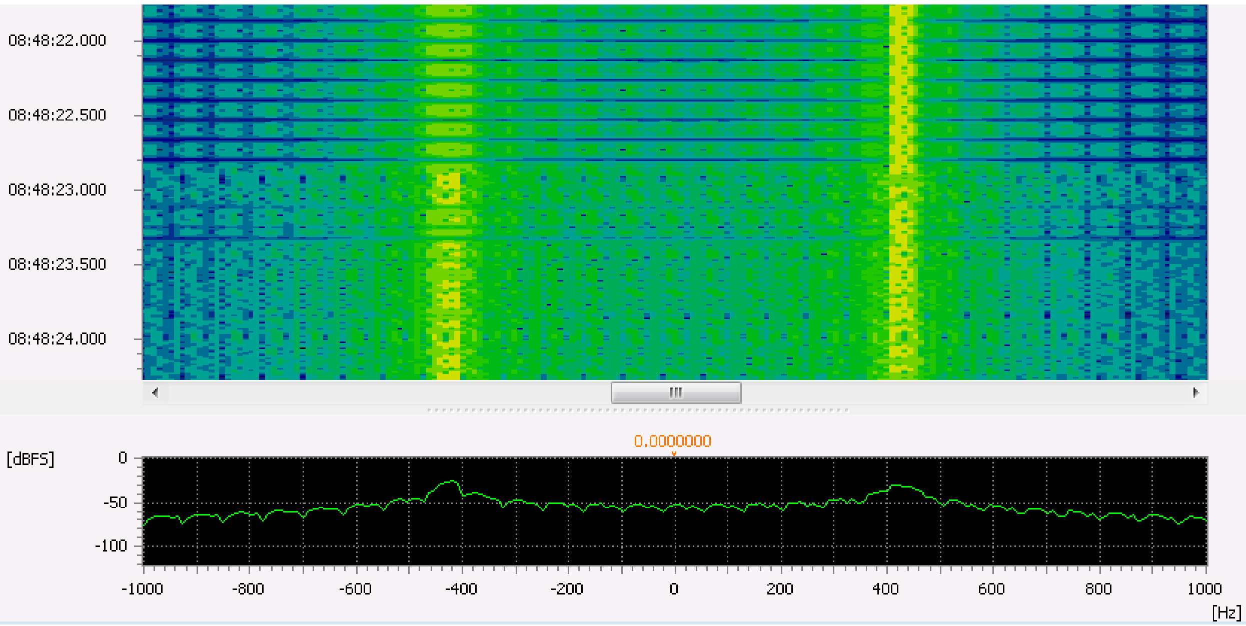


Figure 213: STANAG-4481 FSK Spectrogram

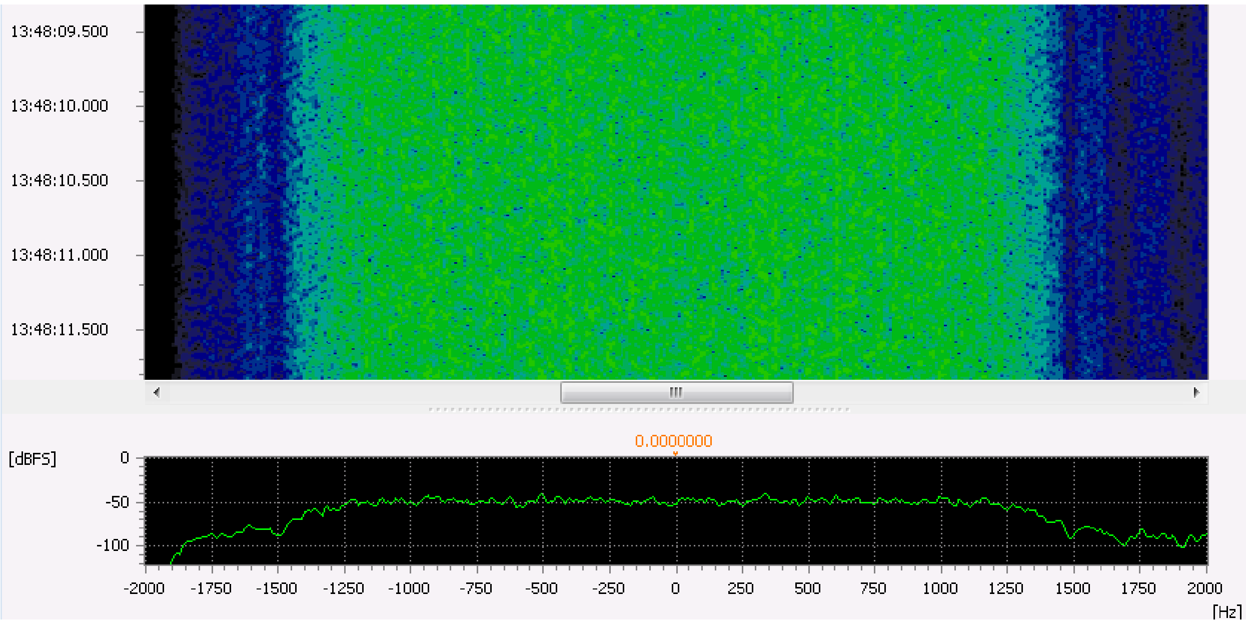


Figure 214: STANAG-4481 PSK Spectrogram

Supported alphabet in each submode

Setting	5N1	5N2	7N1	7N2	8N1	8N2	7N0	8N0
automatic	x	x	x	x	x	x	-	-
manual	-	-	-	-	-	-	-	-

Table 220: STANAG-4481 FSK alphabet availability

Setting	5N1	5N2	7N1	7N2	8N1	8N2	7N0	8N0
automatic	x	x	x	x	x	x	-	-
manual	x	x	x	x	x	x	x	x

Table 221: STANAG-4481 PSK alphabet availability

5.27. STANAG-4529

General Information

STANAG-4529 is a NATO standard for secure maritime digital data communication with data rates ranging from 75 to 1800 bit/s.

Usage

- Transfer of maritime related digital information over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'STANAG 4285/4529'

Mode Details

Parameter	Value							
Symbol rate (Bd)	1200							
Bandwidth (Hz)	1300							
Short interleaver (s)	1.706							
Long interleaver (s)	20.480							
Data rate (bit/s)	75	150	300	600	1200	600	1200	1800
Modulation	BPSK	BPSK	BPSK	BPSK	QPSK	8PSK	BPSK	8PSK
Error correction	CR 1/8	CR 1/4	CR 1/2	CR 1/2	CR 2/3	none	none	none
Interleaving	Short/ Long	Short/ Long	Short/ Long	Short/ Long	Short/ Long	none	none	none

Table 222: STANAG-4529 Standard

	Item	Value
Demodulator Settings	Demodulator	PSK data aided
	Symbol rate (Bd)	1200
	SR tolerance (Bd)	6
	Modulation order	8
	Version	A
Extras	Offset nominal frq. (Hz)	1800

	Item	Value
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes
	Channel 2 STANAG-5066 text output	yes
	STANAG-5066 post-processing	yes

Table 223: STANAG-4529

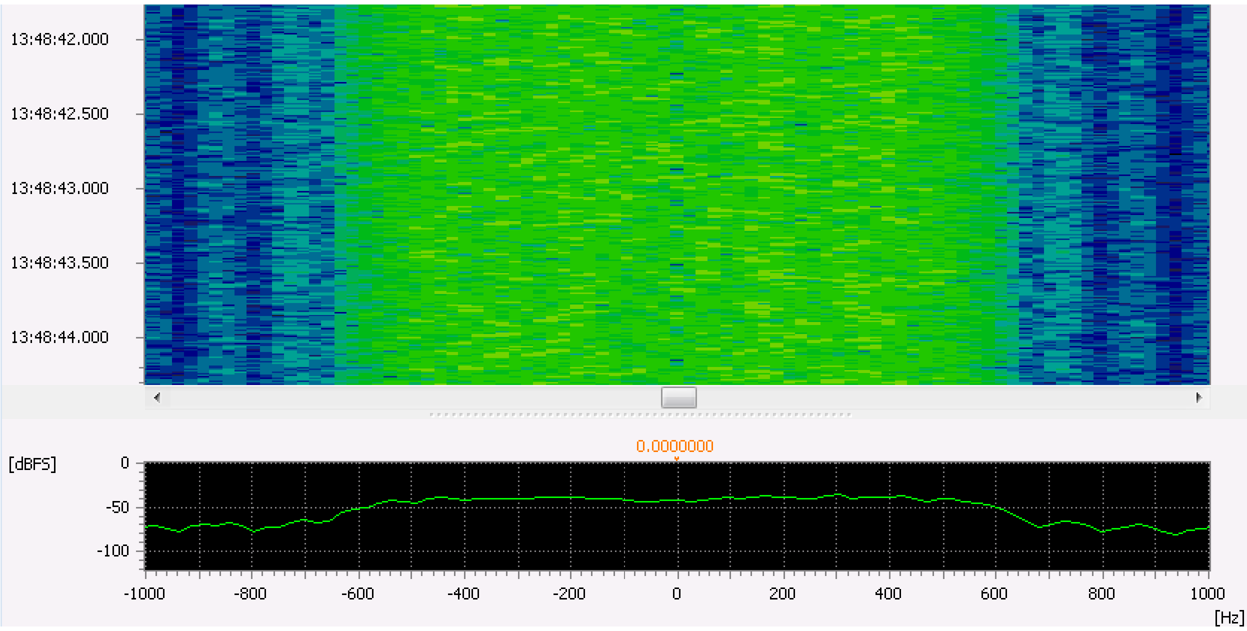


Figure 215: STANAG-4529 Spectrogram

Supported alphabet in each submode

Setting	5N1	5N2	7N1	7N2	8N1	8N2	7N0	8N0
automatic	x	x	x	x	x	x	-	-
manual	x	x	x	x	x	x	x	x

Table 224: STANAG-4529 alphabet availability

5.28. STANAG-4539

General Information

STANAG-4539 is a NATO standard for digital data communication.

It is equivalent to MIL-STD-188-110 A/B single mode.

Usage

- Transfer of digital information over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'STANAG 4539'

Mode Details

	Item	Value
Standard	Modulation	QPSK, 8PSK
	Bandwidth (Hz)	3000
	Symbol rate (Bd)	2400
	Data rate (bit/s)	150 / 300 / 600 /1200 / 2400 /4800 (uncoded)
	Error correction	FEC, code rate 3/4
	Short interleaver (s)	0.12
	Long interleaver (s)	8.64
Demodulator Settings	Demodulator	PSK data aided
	Symbol rate (Bd)	2400
	Modulation order	8
	Version	A
Extras	Offset nominal frq. (Hz)	1800
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes
	Channel 16: Binary hex output	yes
	STANAG-5066 post-processing	yes
	Detection of KW-46	yes

Table 225: STANAG-4539

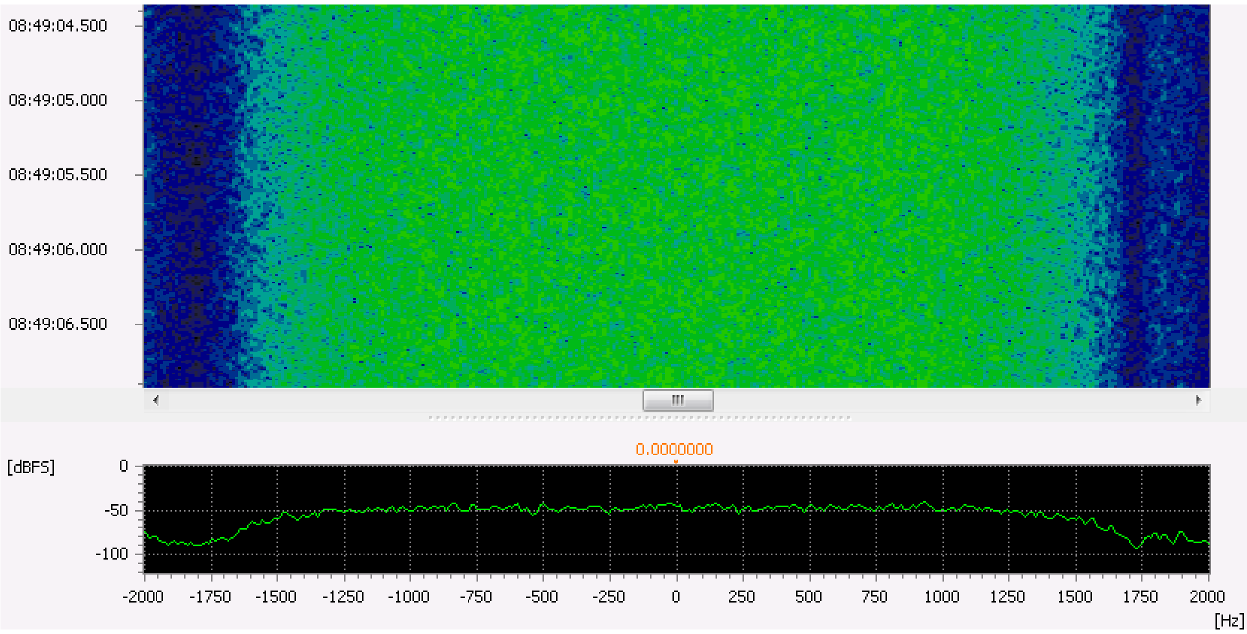


Figure 216: STANAG-4539 Spectrogram

Supported alphabet in each submode

Setting	5N1	5N2	7N1	7N2	8N1	8N2	7N0	8N0
automatic	x	x	x	x	x	x	-	-
manual	x	x	x	x	x	x	x	x

Table 226: STANAG-4539/HDR alphabet availability

5.29. STANAG-4539 HDR

General Information

STANAG-4539 is a NATO standard for digital data communication.

The HDR variant is equivalent to MIL-STD-188-110 Appendix C mode.

Usage

- Transfer of digital information over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'STANAG 4539 HDR'

Mode Details

	Item	Value
Standard	Modulation	QPSK, 8PSK, QAM 16/32/64
	Bandwidth (Hz)	3000
	Symbol rate (Bd)	2400
	Data rate (bit/s)	3200 / 4800 / 6400 / 800 / 9600 / 12800 (uncoded)
	Error correction	FEC, code rate 3/4
	Interleaving	"ultra short", "very short", "short", "medium", "long", "very long"
Demodulator Settings	Demodulator	PSK data aided
	Symbol rate (Bd)	2400
	SR tolerance (Bd)	10
	Modulation order	8
	Version	A
Extras	Offset nominal frq. (Hz)	1800
Features	Demodulation	yes
	Recognition	yes
	Decoding	yes
	Automatic Polarity Adjustment	no
	Combination with other modems (modem list)	yes
	Channel 16: Binary hex output	yes
Alphabets	see Stanag 4539	

Table 227: STANAG-4539 HDR

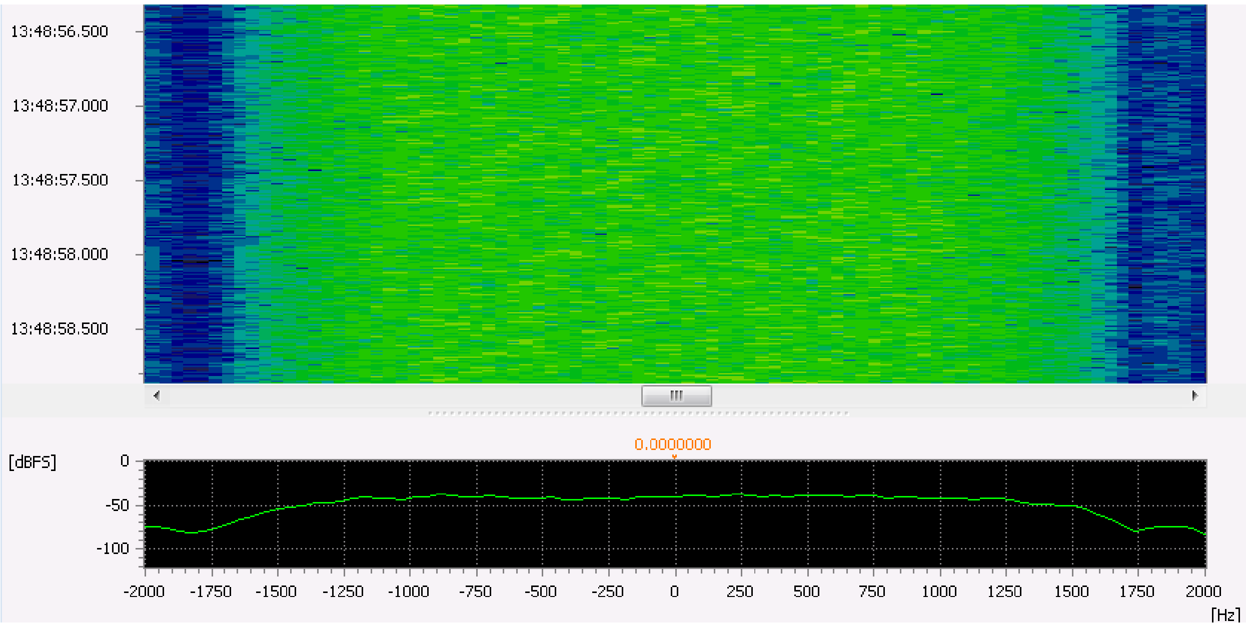


Figure 217: STANAG-4539 HDR Spectrogram

5.30. STANAG-5065

General Information

STANAG-5065 is a NATO standard for maritime digital data communication with low data rates on low frequencies.

Usage

- Transfer of maritime related textual information over HF

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'STANAG 5065 (FSK)'

Mode Details

	Item	80 Hz / 75Bd	850 Hz / 50Bd
emodulator Settings	Modulation	FSK discr.	FSK 2 matched.
	Tones	2	
	Shift (Hz)	85	850
	Shift tolerance (Hz)	10	20
	Symbol rate (Bd)	75	50
	Symbol rate tolerance(Bd)	1	1
	Alphabet	ITA2, ITA5	
Features	Demodulation	yes	
	Detection of KW-46	yes	

Table 228: D

5.31. STANAG-5066

General Information

STANAG-5066 is a NATO standard for reliable HF radio data communications. It defines a common air interface on top of other waveforms. In addition to a set of link layer protocols, the standard describes application layer protocols for email and file exchange.

Support for STANAG-5066 email communication is built into several decoders as part of the post-production processing. See the respective feature lists. Decoding includes ARQ and NRQ modes using HMTP and CFTP (MIL-STD-188-141B Appendix E.5.2). Successfully decoded emails are saved as separate files.

5.32. Thales System 3000 Skymaster SelCal

General Information

The Thales System 3000 Skymaster mode is using a primary GMSK selection call, followed by an FSK 8 signal for fast automatic link establishment. The section call consist of 96 multiple repeated bits.

Usage

- Automatic link establishment

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Thales System 3000 Skymaster SelCal'

Mode Details

	Item	Value
Standard	Modulation	GMSK
	Bandwidth (Hz)	2000
	Symbol rate (Bd)	2000
Demodulator Settings	Demodulator	GMSK
	Symbol rate (Bd)	2000
	SR tolerance (Bd)	1
	BT:	0.8
Features	Demodulation	yes
	Recognition	yes
	Decoding	no
	Automatic Polarity Adjustment	yes
	Combination with other modems (modem list)	yes

Table 229: Thales System 3000 Skymaster SelCal

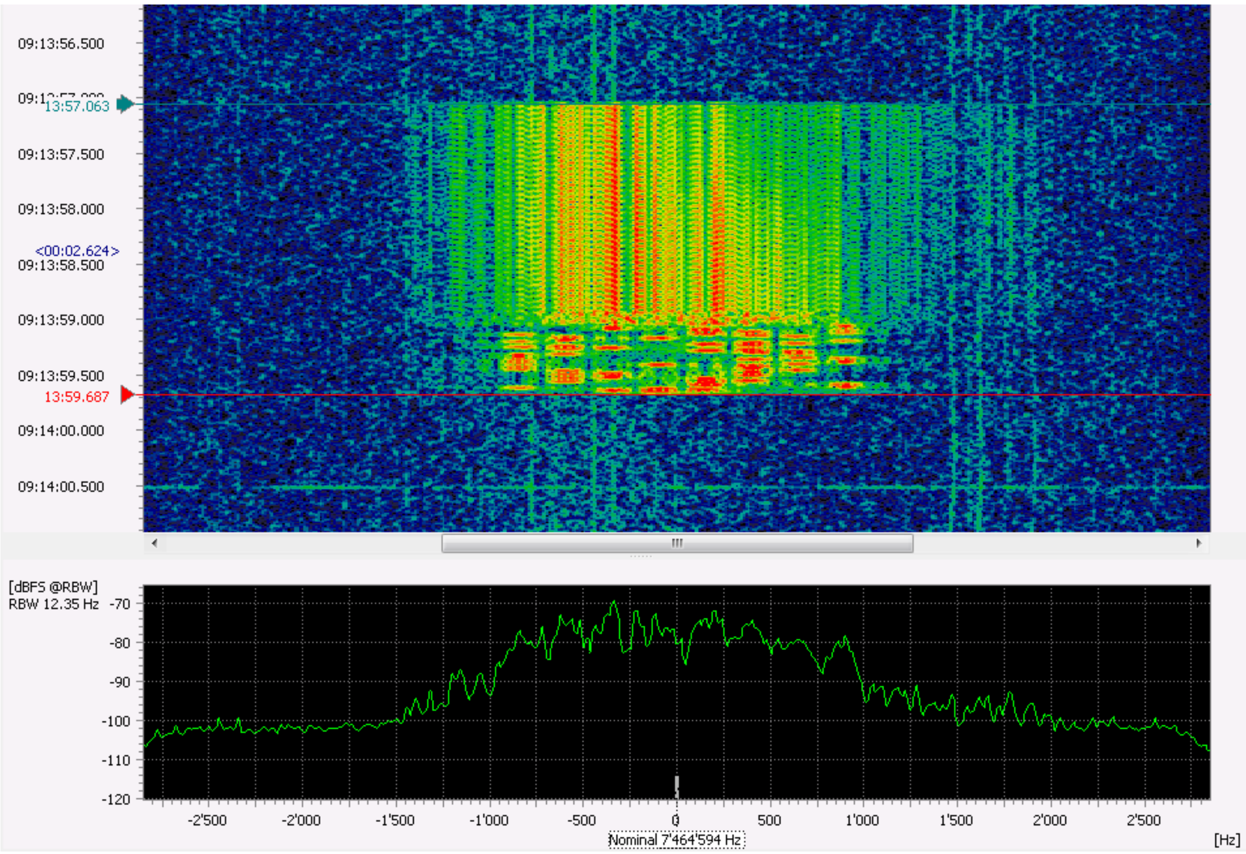


Figure 218: Thales System 3000 Skymaster SelCal

5.33. Turkish Navy FSK

General Information

Turkish Navy FSK is similar to the NATO standard STANAG-4481 for maritime shore-to-ship broadcast digital data communication, but using a different frequency shifts.

A KG-84 encryption device may be in use for transmissions. Decoding is limited to the detection of the message header which is shown together with the following data using hexadecimal encoding.

Usage

- Transfer of maritime related digital information over HF

Mode Details

	Item	Value
Demodulator Settings	Demodulator	FSK 2 discr.
	Symbol rate (Bd)	600 / 1200
	SR tolerance (Bd)	5
	Shift (Hz)	400 / 800
	Shift tolerance (Hz)	10
	Modulation order	2
	Version	-
Extras	Offset nominal frq. (Hz)	0
Features	Demodulation	yes
	Recognition	yes
	Decoding	Yes
	Automatic Polarity Adjustment	Yes
	Combination with other modems (modem list)	Yes

Table 230: Turkish Navy FSK

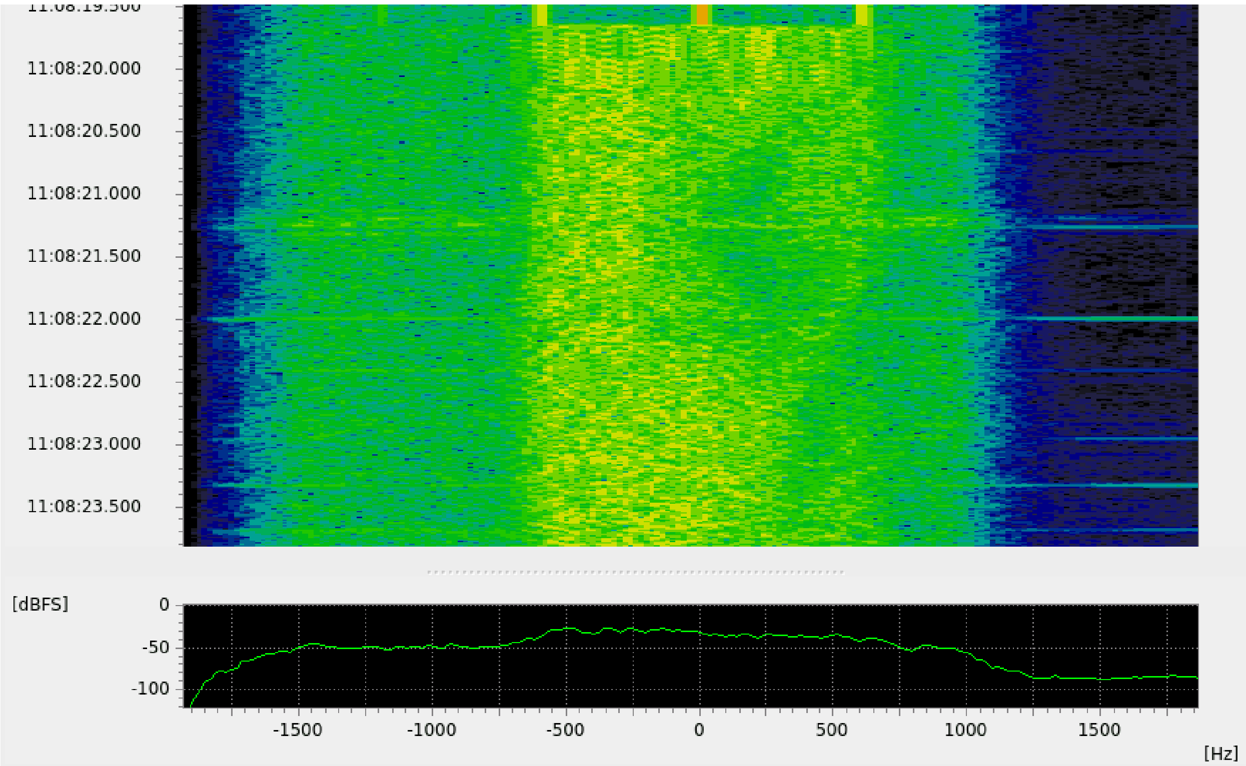


Figure 219: Turkish Navy FSK Spectrogram (1200Bd)

6. Universal Detectors

6.1. General

Some decoders are provided for general use to create new modem detectors in a few steps. In this way users can get individual solutions even without knowledge of the Decoder Description Language (py-DDL).

A suitable demodulator has to be set up first. The detector decoders provided are aiming on signal characteristics, which can be easily examined with the go2DECODE or go2ANALYSE analysis tools. Such characteristics may be unique bit patterns, code periods, burst characteristics etc. which will serve as input parameters.

The following chapters will describe application examples of different universal detection decoders. The easiest way to come to an own solution is to use these examples and apply modifications for the demodulators settings and decoder parameters.

A set of modem templates can be found in the modem folder *Universal_Detectors* of go2DECODE.

6.2. PeriodDetector

General Use

A universal period detector shall provide a quick solution to identify and detect signals, which contain a characteristic code period. Periods can be caused by block preambles, training sequences, repeated messages etc.

Example: HFDL-Detector

An HFDL-Signal contains periods, which can be used for detection. The periods are caused by demodulator training sequences, repeated in regular intervals. They are marked green in the bit display picture of Figure 220.

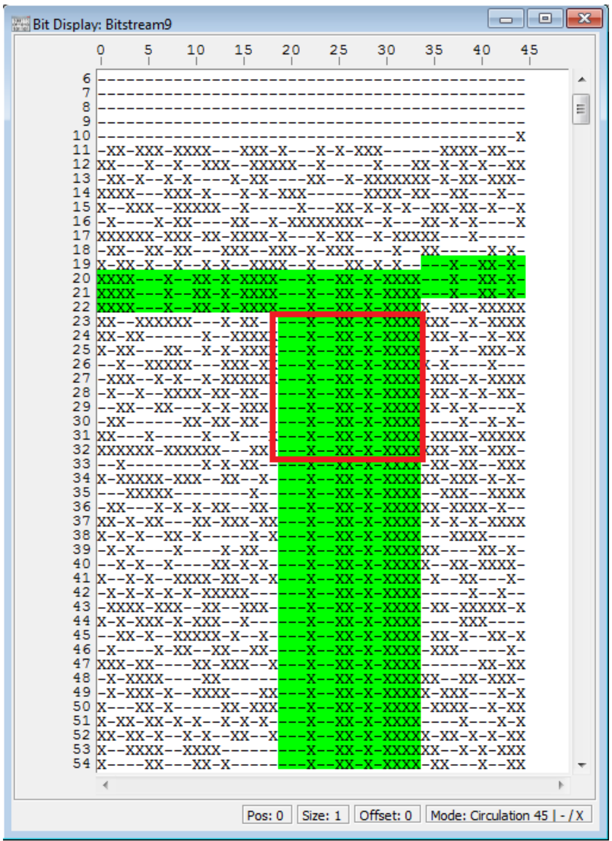


Figure 220: HFDL-Signal with periodic training sequences

One training sequence has a length of 15 bit. It will be repeated with a period of 45 bits. A reasonable minimum number of successive repetitions should be defined to prevent false detections. In this case 10 repetitions will be chosen. The first occurrence of 10 repetitions is outlined red in Figure 220.

A detection modem will be established as follows:

1. Setup the correct demodulator parameters
2. Select the decoder "period_detector"
3. Open the decoder source code in the decoder editor, modify the 4 parameters shown in Figure 221 and then export the decoder package.

```
# *** Read Gui-Parameters *****************************
PATTERN_LEN = apc.parameters.get("PatternLen", 15)
PERIOD_LEN = apc.parameters.get("PeriodLen", 45)
REPEATS = apc.parameters.get("Repeats", 10)
TOLERANCE = apc.parameters.get("MaxFaults", 1)
STORE_RAW_DATA = apc.parameters.get("StoreRawData", 1) != 0
```

Figure 221: Parameters of decoder "period_detector"

The parameter values shown in Figure 221 correspond to the example of HFDL described above. In addition a tolerance can be defined as the maximum number of faulty bits in the complete repetition sequence. In this case 1 bit may be wrong in 10 x 15 bits of the repeated pattern.

The modem "Period Detector Template" has implemented this decoder with the parameters shown above. For ease of use the modem was prepared with user interface parameters, so all 4 parameters can be set directly in go2DECODE as shown in Figure 222.

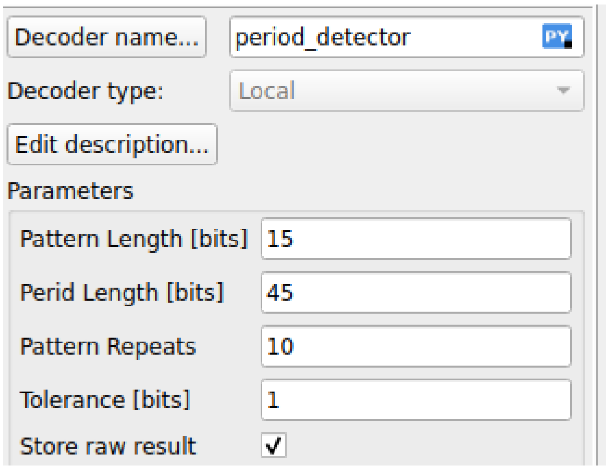


Figure 222: Decoder parameter field of modem HFDL-Detector

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Period Detector Template'

6.3. ValuePatternDetector

General Use

Some modem types are using unique long bit patterns e.g. preambles at the beginning of burst or code sections, mode marker etc. Quite often they are also long enough for a reliable detection even under noisy conditions. Noise will cause bit errors which has to be taken into account by defining a tolerance limit.

Example: HFDL-Detector

Bursts of HFDL signals always start with a unique preamble of 127 bits occurring twice. The hexadecimal annotation of this preamble is 7F4C 3429 6CAB 104F 9C91 9BC0 EA2E 3DDA (MSB-first). This sequence is marked in Figure 223. For the example only the last 32 bits 7F4C3429 (inverted: 0x6BD3CD01) will be used for detection. In order to have a more robust detection 3 bits of this set shall be allowed to be wrong.

This detection modem will be established as follows:

1. Setup the correct demodulator parameters
2. Select the decoder "value_pattern_detector"
3. Open the decoder source code in the decoder editor, modify the 4 parameters shown in Figure 224 and then export the decoder package.

The parameter values shown in Figure 224 correspond to the example described above. The modem "Pattern Value Detector Template" has implemented this decoder. For ease of use the modem was prepared with user interface parameters, so all 4 parameters can be set directly in go2DECODE as shown in Figure 225.

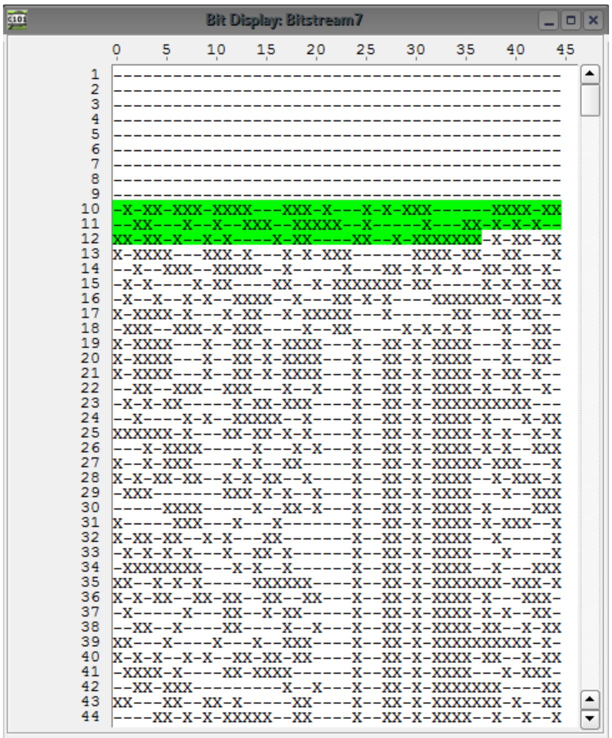


Figure 223: HFDL Preamble

```
# *** Read Gui-Parameters *****************************
PATTERN = apc.parameters.get('Pattern', 0x6BD3CD01)
PATTERN_LEN = apc.parameters.get("PatternLen", 32)
TOLERANCE = apc.parameters.get("MaxFaults", 3)
MSB_FIRST = apc.parameters.get("MSBfirst", 0) != 0
STORE_RAW_DATA = apc.parameters.get("StoreRawData", 1) != 0
```

Figure 224: Parameters of decoder "value_pattern_detector"

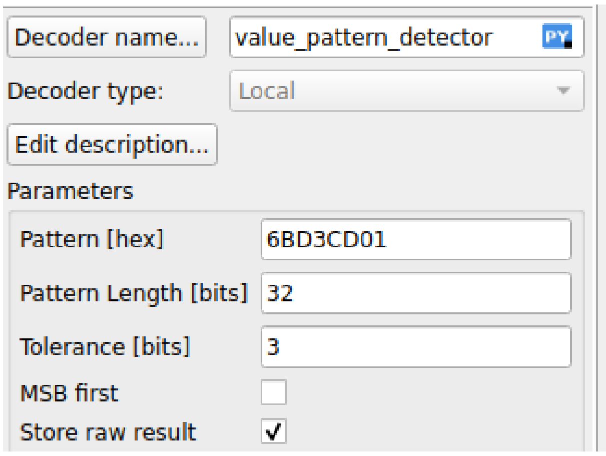


Figure 225: Decoder parameter field of modem HFDL-Detector

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Value Pattern Detector Template'

6.4. BitPatternDetector

General Use

Another way to search for bit patterns is to define pattern fields containing zeroes, ones and unknown bits. The bit field will be annotated binary containing the digits 1, 0 and X for unknown bits. The default bit order is LSB-first, i.e. identical to the bit ordering in the bit display.

If the defined fields appear as a repeating sequence, the number of repeats can be required as well.

Example: Baudot-Detector

Baudot signals can be detected by their regular sequence of start and stop bits. Figure 226 shows the demodulated bit stream of a baudot signal with one start bit (marked green) and two stop bits (marked yellow).

The detection modem will be established as follows:

1. Setup the correct demodulator parameters
2. Select the decoder "bit_pattern_detector"
3. Open the decoder source code in the decoder editor, modify the 4 parameters shown in Figure 227 and then export the decoder package.

In this example 5 repeats without bit errors of a start-stop-sequence has been chosen as the detection criterion. The pattern annotation is LSB-first (like in bit display).

The modem "Bit pattern Detector Template" has implemented this decoder. For ease of use the modem was prepared with user interface parameters, so all 4 parameters can be set directly in go2DECODE as shown in Figure 228.

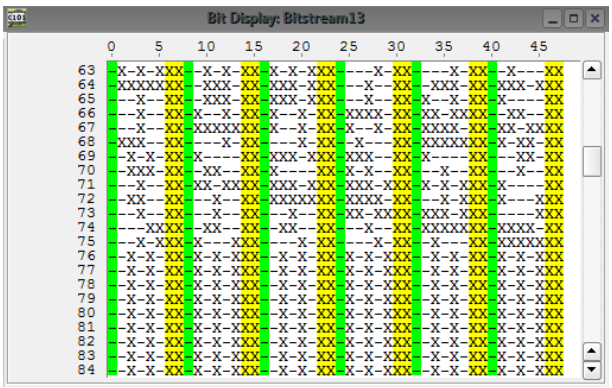


Figure 226: Baudot bit stream wit 1 start and 2 stop bits

```
# *** Read Gui-Parameters ******************************
PATTERN_STRING = apc.parameters.get('BitPattern', "1XXXXX00")
REPEATS = apc.parameters.get("Repeats", 5)
TOLERANCE = apc.parameters.get("MaxFaults", 0)
MSB_FIRST = apc.parameters.get("MSBfirst", 0) != 0
STORE_RAW_DATA = apc.parameters.get("StoreRawData", 1) != 0
```

Figure 227: Parameters of decoder "bit_pattern_detector"

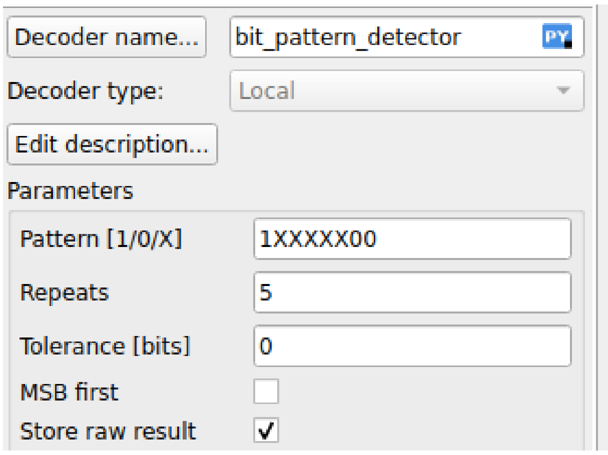


Figure 228: Decoder parameter field of modem Baudot12-Detector

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Bit Pattern Detector Template'

6.5. BurstPauseDetector

General Use

Many ARQ-signals modems use fixed values of burst and pause lengths. This appearance can be used sometimes to identify the modem without any further code analysis. Figure 229 shows the burst sequence of Sitor-A.

The demodulator has to be set to "burst mode". Sometimes additional acknowledge burst of shorter duration can be observed within the burst pause. They have to be omitted by proper demodulator burst demodulator settings via "minimum burst length".

Example: Sitor-Detector

Sitor A signals can be detected in this way. They have a burst repetition period of 450 ms consisting of 210 ms burst and 240 ms pause intervals. The symbol rate is 100bd, so the burst length corresponds to 21 symbols, the pause length to 24 symbols.

The detection modem will be established as follows:

1. Setup the correct demodulator parameters
2. Select the decoder "burst_pause_detector"
3. Open the decoder source code in the decoder editor, modify the 4 parameters shown in Figure 230 and then export the decoder package.

The modem "Burst-Pause Detector Template" has implemented this decoder. For ease of use the modem was prepared with user interface parameters, so all 4 parameters can be set directly in go2DECODE as shown in Figure 231.

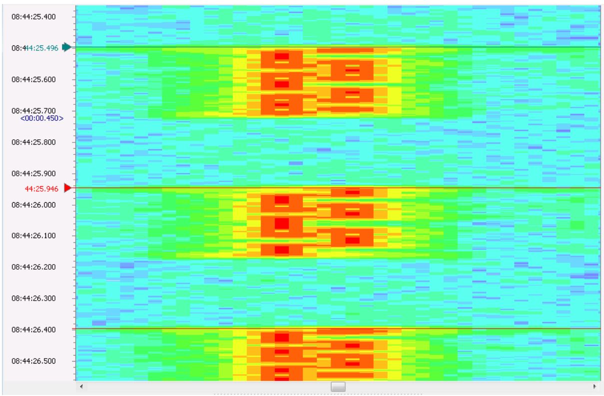


Figure 229: Sitor A bursts

```
# *** Read Gui-Parameters *****************************
BURST_LEN = apc.parameters.get("BurstLen", 21)
BURST_LEN_TOL = apc.parameters.get("TolBurstLen", 1)
PAUSE_LEN = apc.parameters.get("PauseLen", 240)
PAUSE_LEN_TOL = apc.parameters.get("TolPauseLen", 15)
STORE_RAW_DATA = apc.parameters.get("StoreRawData", 1) != 0
```

Figure 230: Parameters of decoder "burst_pause_detector"

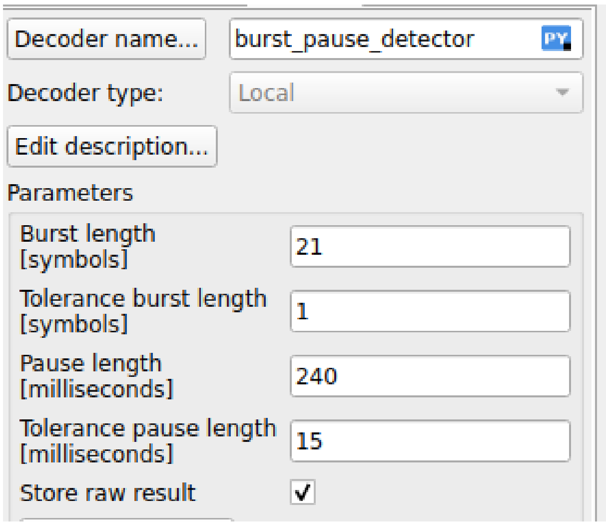


Figure 231: Decoder parameter field of modem Sitor-Detector

Decoder Output and Parameters

For further information about this decoder's output and parameters, refer to table 'Burst-Pause Detector Template'

7. Decoder Output and Parameters

General Information

This chapter provides more information about decoder outputs and decoder parameters.

Decoder outputs are structured as XML. Therefore, each element itself is presented as an XML-Tag as in **<decoder_tag>value<\decoder_tag>**.

Decoder parameters provide a possibility of managing a decoder's execution behaviour. Example: Morse decoder's output alphabet encryption can be selected between "Latin" or "Chyrillic". Depending on selection, data will be interpreted and decoded accordingly.

Note: A decoder's selectable parameters are dependent on the modem description the decoder is used in. Correspondingly, selectable parameters of the same decoder may vary from modem to modem.

Note: After a Changelog's decoder version there is, in parantheses, the according product release version the change in the decoder was published.

Thereafter, the meaning of

- **2.0.0** (20.2)
  - ported to Python
- **1.0.0** (20.1)
  - initial version

is that as of product release version 20.1 a decoder X was first published with version number *1.0.0*. With product release version 20.2, the decoder was ported to Python, whereupon the decoder's version was raised to *2.0.0*.

Following tables will provide information about each decoder's:

- possible output tags as well as possible values
- possible decoder parameters (if applicable)
- mentionable additional information (e.g. about binary output)

ACARS
Changelog

- **3.2.0** (24.1)
  - added support for decoding of OHMA messages
- **3.1.0** (22.1)
  - improved processing of ACARS messages, including reassembly of fragmented messages
  - decoding of MIAM and Media Advisory messages
- **3.0.0** (20.2)
  - ported to Python
- **2.0.0** (19.2)
  - added XML tags for metadata
- **1.0.0**
  - initial version

Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1.
adsc	Text of incoming Automatic Dependent Surveillance (ADS) message. • For more information about type ‘adsc’, see ‘Decoder Common Types’
callSign	Alphanumeric code to identify broadcaster or transmitter. • For more information about type ‘callSign’, see ‘Decoder Common Types’
cpdlc	Text of incoming Controller Pilot Data Link Communications (CPDLC) message. • For more information about type ‘cpdlc’, see ‘Decoder Common Types’
flightId	Flight identification. • For more information about type ‘flightId’, see ‘Decoder Common Types’
labelText	Label text of incoming message. • For more information about type ‘labelText’, see ‘Decoder Common Types’
labelType	Label Type of incoming message. • For more information about type ‘labelType’, see ‘Decoder Common Types’
mediaAdvisory	Text of incoming Media Advisory message. • For more information about type ‘mediaAdvisory’, see ‘Decoder Common Types’
miam	Text of incoming Media Independent Aircraft Messaging (MIAM) message. • For more information about type ‘miam’, see ‘Decoder Common Types’
newInfoUnit	Marks the beginning of a new information unit. • For more information about type ‘typeNewInfoUnit’, see ‘Decoder Common Types’

slotType	Gives directional information about a message according sender and receipient. • For more information about type 'typeSlotType', see 'Decoder Common Types'

Table 231: Decoder Output: "ACARS"

AIS	
Changelog	
• **3.0.0** (21.2) – ported to Python – complemented some binary broadcast and/or addressed messages – enabled evaluation of DGNSS data – overall enhanced and widened decoder output • **2.0.0** (19.2) – added XML tags for metadata • **1.0.0** – initial version	
Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1.
course	Course over ground relative to true north
heading	True heading (0-365°)
speed	Speed over ground in knots
mmsi	Maritime Mobile Service identity Number (MMSI). • For more information about type 'mmsi', see 'Decoder Common Types'
msgType	Type of message. • For more information about type 'msgType', see 'Decoder Common Types'
navStatus	Navigation status.
newInfoUnit	Marks the beginning of a new information unit. • For more information about type 'typeNewInfoUnit', see 'Decoder Common Types'
position	Position in ISO format. • For more information about type 'ISOCoordinates', see 'Decoder Common Types'
shipName	Name of ship. • For more information about type 'shipName', see 'Decoder Common Types'
shipType	Type of ship. • For more information about type 'shipType', see 'Decoder Common Types'

Table 232: Decoder Output: "AIS"

ALE-3G		
Changelog		
• **3.0.1** (24.1) – fixed runtime error (BW1) • **3.0.0** (23.2) – decoder ported to Python – added reassembly of data pdu for binary output – renamed addrType to communicationType – replaced destAddr and srcAddr with addr and origin attribut • **2.1.1** (21.2) – added bin file output decoder parameter • **2.1.0** (20.1) – added decoding of BW7 • **2.0.0** (19.2) – added XML tags for metadata • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
BW7 Full Mode Detection	BW7TestFull	Test much more BW7 modes. This could help in low snr scenarios, but results in higher computation load. Possible Values: • On/Off
Store raw burst data	StoreRawBurstData	Store each burst in a binary file(s). Possible Values: • On: Enable output • Off: Disable output
Reassemble data PDUs	ReassembleDataPDU	Reassemble data PDUs and store them in binary file(s). Also outputs an additional xml file with meta information. Possible Values: • On: Enable • Off: Disable

Additional Information	
About	**Description**
Binary output	For BW0, BW1, BW4, BW5 and BW6 the decoder provides binary output to file (MSB first) of all data after channel decoding (Viterbi). For BW2 (HDL), BW3 (LDL) and BW7 the output to file (MSB first) contains only the *payload* data after channel decoding (Viterbi). If StoreRawBurstData is set (default: off) then each burst is saved in a separate file. If ReassembleDataPDU is set (default: on) then a binary file for each participant is created (only BW2, BW3 and BW7).
Decoder Output	
Decoder-Tag	**Description**

text1	Output channel 1.
text16	Output of payload of BW2, BW3 and BW7 as hex (MSB first) and ascii (hex editor like)
address	Address of sender (origin = dest) or recipient (origin = src).
bw7Modulation	Modulation of BW7 signaled in BW7 Header.
communicationType	Type of communication: point2point, point2multipoint/broadcast
compatibleManufac-turer	Modem manufacturer known to be compatible with this data transmission mode. BW2/3 only.
crc	Indicates if cyclic redundancy check (CRC) was successful for current output frame Possible values: • Ok: CRC is correct • Wrong: raw data incomplete or contains erroneous data • Wrong/Encrypted: either CRC is wrong or frame is encrypted (this cannot be distinguished)
encryption	Detected encryption within payload. Possible values: • HarrisCitadel - Harris Citadel Encryption Preamble Detected
endOfMsg	Last data packet in transmission. LDL and HDL only.
packetBytesCnt	Number of payload bytes in transmission. LDL and HDL only.
packetNr	Packet number within transmission. LDL and HDL only.
pduType	Protocol type. Possible values: • unknown • FLSU : Fast Link Setup • RLSU : Robust Link Setup • FTM : Fast Traffic Management • HDL : High-throughput data link protocol • HDL_ACK : HDL Acknowledgment • HDL_EOM : HDL End-Of-Message • LDL : Low-latency data link protocol • HDLP_ACK : HDL+ Ack • HDLP_HEADER : HDL+ Header
priority	Priority of pdu.
startOfMsg	First data packet in transmission. LDL and HDL only.
trafficType	Traffic type signaled in FLSU/FTM. (e.g. STANAG4415)

waveform	Burst type / physical waveform on-air Possible values: • **BW0** : Burst Waveform 0 • **BW1** : Burst Waveform 1 • **BW2** : Burst Waveform 2 • **BW3** : Burst Waveform 3 • **BW4** : Burst Waveform 4 • **BW5** : Burst Waveform 5 • **BW6** : Burst Waveform 6 • **BW7** : Burst Waveform 7

Table 233: Decoder Output: "ALE-3G"

ALE2G	
Changelog	
• **3.0.0** (21.1) – ported to Python • **2.0.0** (19.2) – added XML tags for metadata • **1.0.0** – initial version	
Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1.
callSign	CallSign of sender (origin = dest) or recipient (origin = src).
type	Type of sender (origin = src) or recipient (origin = dest). • Output restricted as seen in 'aleFromType'.
contentText	Type of recipient.
contentType	Type of content.
newInfoUnit	Marks the beginning of a new information unit. • For more information about type 'typeNewInfoUnit', see 'Decoder Common Types'
time	Date time in ISO format. • Output complies with ISO 8601.

Table 234: Decoder Output: "ALE2G"

ALE4G	
Changelog	
• **1.0.0** (21.2) – initial version	
Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1. A string like "2003-01-01T00:00:02.877Z: detected ALE4G sync" is printed in case of positive detection of a sync sequence.

Table 235: Decoder Output: "ALE4G"

<table>
<tr><th colspan="3">ALIS</th></tr>
<tr><th colspan="3">Changelog</th></tr>
<tr><td colspan="3">2.0.0 (21.1)
ported to Python
1.0.0
initial version</td></tr>
<tr><th colspan="3">Decoder Parameters</th></tr>
<tr><th>Parameter</th><th>Variable Name</th><th>Description</th></tr>
<tr><td>ignore wrong CRC</td><td>ignore_wrong_crc</td><td>If activated, data frames will be processed, even though in case CRC is incorrect. Possible Values:
“On” : Process data, either way CRC is correct or wrong
“Off” : Process data only if CRC is correct</td></tr>
<tr><td>reset alphabet level (ITA2) after each burst</td><td>reset_alphabet_after_each_burst</td><td>Alphabets are decoded with state memory. If activated, this state memory is reset after each burst end. Possible Values:
“On” : Reset alphabet decoding state memory
“Off” : Do not reset alphabet decoding state memory (state is preserved across bursts)</td></tr>
<tr><th colspan="3">Additional Information</th></tr>
<tr><td colspan="3">None</td></tr>
<tr><th colspan="3">Decoder Output</th></tr>
<tr><th>Decoder-Tag</th><th colspan="2">Description</th></tr>
<tr><td>text1</td><td colspan="2">Output channel 1.</td></tr>
</table>

Table 236: Decoder Output: “ALIS”

APCO25	
Changelog	

• **2.0.0** (22.1)
  – decoder ported to Python
• **1.1.0** (21.1)
  – added encryption interface to status channel and as XML-Tag
• **1.0.0**
  – initial version	

Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1. Received and decoded MAC packets.
status	Output channel for current status information. Encryption mode, Network Access Code, Voice Activity" • For more information about type 'status', see 'Decoder Common Types'
ifcEncryption	Encryption mode. Interface encryption is disabled if value is 'plain'. Otherwise interface is encrypted. Possible values: • **ACCORDION 1.3** • **BATON(Auto Even)** • **FIREFLY Type 1** • **MAYFLY Type 1** • **SAVILLE** • **BATON (Auto Odd)** • **plain** – Unencrypted • **DES-OFB** • **2-key triple DES** • **3-key triple DES** • **AES** • **DES-XL** • **ADP/RC4** • **Unknown**

Table 237: Decoder Output: "APCO25"

APCO25 Phase2		
Changelog		
• **2.0.0** (22.1) – decoder ported to Python • **1.1.0** (20.1) – added status channel • **1.0.0** (19.2) – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Autom. descrambler	AutomaticIDCracking	Trying to determine the IDs (WACN, SysID, ColorCode) for descrambler seed automatically. Possible Values: • "On" : Enable automatic ID calculation • "Off" : Disable automatic ID calculation
Autom. descrambler from Network Status Packet	AutomaticIDFromNet-workStatus	Automatic descrambler seed initialization from Network Status Packet. Possible Values: • "On" : Enable initialization from network status packet • "Off" : Disable initialization from network status packet
Predefined descrambler	UseGivenIDsAsStart	Use predefined descrambler seed parameters when decoder starts. In case of selecting "On", all three parameters are mandatory. Possible Values: • "On" : Use predefined seed parameters as seen in – WACN – SYSTEM ID – COLOR CODE • "Off" : Do not use predefined seed parameters.
WACN (Hex)	wacn_id	Enter hexadecimal value for Wide Area Communications Network ID. Only used if "Predefined descrambler" checkbox is active.
SYSTEM ID (Hex)	sys_id	Enter hexadecimal value for System ID. Only used if "Predefined descrambler" checkbox is active.
COLOR CODE (Hex)	color_code	Enter hexadecimal value for color code. Only used if "Predefined descrambler" checkbox is active.
Additional Information		

About	Description
DescramblerInit	If none of the above stated parameters • Autom. descrambler • Autom. descrambler from Network Status Packet • Predefined descrambler is activated (e.g. Checkbox "On"), then the decoder will not be able to decode scrambled data frames (e.g. Speech/Voiced data).
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1. Received and decoded MAC packets.
status	Output channel for current status information. Voice activity and system IDs, e.g. "Voice Activity (Slot 0: x Slot 1: -) WACN: 0x12345 SystemID: 0x678 ColorCode: 0x90 (IDs valid)" • For more information about type 'status', see 'Decoder Common Types'
colorCode	Colour Code. Fixed code of a single APCO25 radio cell. Same value as the NAC (Network access code) of phase 1 links in the same cell. 0x293 is a default value. (12 bit) Hexadecimal value.
ifcEncryption	Encryption mode. Interface encryption is disabled if value is 'plain'. Otherwise interface is encrypted. Encryption type with current slot number as attribute. The decoder increments the slot number linearly with every "burst" received.
macColorCode	Color Code signaled in received packet. Hexadecimal value with the current slot number as attribute. The decoder increments the slot number linearly with every "burst" received.
macGrp	Group address signaled in received packet. Hexadecimal value with the current slot number as attribute. The decoder increments the slot number linearly with every "burst" received.
macPDUType	PDU type of received MAC packet. Possible values: • MAC_PTT • MAC_END_PTT • MAC_ACTIVE • MAC_IDLE • MAC_HANGTIME Possible values of a MAC PDU type with slot number as attribute.
macPttKeyID	Key ID used for the voice transmission signaled in the MAC_PTT packet. The Key ID is fixed value within a network/cell and corresponds to an unique key used for encryption/decryption. This allows the receiving device to select the correct key if it is present. Hexadecimal value with the current slot number as attribute. The decoder increments the slot number linearly with every "burst" received.
macSrc	Source address signaled in received packet. Hexadecimal value with the current slot number as attribute. The decoder increments the slot number linearly with every "burst" received.
sysID	System ID. Identifies system within an APCO25 network. (12 bit) Hexadecimal value.

wacn	Wide Area Communications Network. APCO25 network code. (20 bit) Hexadecimal value.

Table 238: Decoder Output: "APCO25 Phase2"

ASCII7		
Changelog		
• **2.1.0** (21.2) – optional transparent output – optional custom alphabet • **2.0.0** (20.2) – ported to Python • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Transparent output	Transparent	Show control characters as graphics using unicode.
Custom alphabet 1	CustomAlphabet1	Define your own alphabet in a 'custom.dict' file (located in decoders subfolder). Specify name of alphabet here which should be identical to your dict file. For details see ita2lower.dict in decoders subfolder of installation.
Additional Information		
None		
Decoder Output		
Decoder-Tag	**Description**	
text1	Default output channel using ITA5 (ASCII)) alphabet.	

Table 239: Decoder Output: "ASCII7"

ASCII8		
Changelog		
• **2.1.0** (21.2) – codec and number of stop bits as parameters • **2.0.0** (20.2) – ported to Python • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Number of stop bits	num_stop_bits	Number of stop bits. Possible Values: • "1" : 1 stop bit (8N1, default) • "2" : 2 stop bits
Codec channel 1	codec1	Specify codec (alphabet/codepage) to be applied to decode the 8 bit data. Only 8 bit codecs are supported! Examples are: cyrillic, iso-8859-8, cp866, windows-1250. Default: latin (iso-8859-1) A list of possible codecs are described here
Codec channel 2	codec2	Specify codec (alphabet) to be applied to decode the 8 bit data for output on channel 2. Default: no output
Auto invert	auto_invert	Possible Values: • "On" : try automatically to determine sideband • "Off" : no sideband detection (default)
Additional Information		
None		

Decoder Output	
Decoder-Tag	**Description**
text1	Default output channel using Latin alphabet. Codec (alphabet) can be parametrized.
text2	Optional second output. Only available if a codec (alphabet) is parametrized.

Table 240: Decoder Output: "ASCII8"

ATIS	
Changelog	

• **3.0.0** (20.2)
  – ported to Python
• **2.0.0** (19.2)
  – added XML tags for metadata
• **1.0.0**
  – initial version	

Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1.
callSign	Alphanumeric code to identify broadcaster or transmitter. • For more information about type 'callSign', see 'Decoder Common Types'
country	Country name extracted from MID. • For more information about type 'country', see 'Decoder Common Types'

Table 241: Decoder Output: "ATIS"

Baudot

Changelog

- **2.1.0** (21.2)
  - better parametrization of alphabet
- **2.0.0**
  - ported to Python
  - baudot11 (19.1)
  - baudot115 (20.2)
  - baudot_universal (20.2)
- **1.0.0**
  - initial version

Decoder Parameters

Parameter	Variable Name	Description
Alphabet channel 1	Alphabet1	(This Parameter is modifiable in "baudot_universal" and "baudot115" decoder only!) Possible Values: • ITA2 (default) • ITA2_ARABIC • ITA2_CYRILLIC • ITA2_HEBREW
Alphabet channel 2	Alphabet2	(This Parameter is modifiable in "baudot_universal" and "baudot115" decoder only!) Possible Values: • None (Default) • ITA2 • ITA2_ARABIC • ITA2_CYRILLIC • ITA2_HEBREW
Custom alphabet 1	CustomAlphabet1	(This Parameter is modifiable in "baudot_universal" and "baudot115" decoder only!) Define your own alphabet in a 'custom.dict' file (located in decoders subfolder). Specify name of alphabet here which should be identical to your dict file. For details see ita2lower.dict in decoders subfolder of installation.
Custom alphabet 2	CustomAlphabet2	This Parameter is modifiable in "baudot_universal" and "baudot115" decoder only! Custom alphabet for channel 2.
Stop Bits	StopBitPara	This Parameter is modifiable in "baudot_universal" decoder only! Possible Values: • 1: 1 stop bit • 2: 2 stop bits • >1: 1 or more stop bits • >2: 2 or more stop bits
Force Figure Shift	ForceFigureShift	(This Parameter is modifiable in "baudot_universal" and "baudot115" decoder only!) Force Figure Shift (show only level 0 characters).

Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Default output channel using ITA2 Latin alphabet. Alphabet can be parametrized. Available are: • ITA2 • ITA2 Arabaic • ITA2 Cyrillic • ITA2 Hebrew
text2	Optional second output. Only available if an alphabet is parametrized.

Table 242: Decoder Output: "Baudot"

Bit Pattern Detector Template		
Changelog		
• **2.0.0** (23.1) – ported to Python • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Pattern [1/0/X]	BitPattern	A string representing the wanted bit pattern consisting of 1, 0 and X (unknown)
Repeats	Repeats	The number of successive repeats of the pattern above.
Tolerance [bits]	MaxFaults	The maximum total number of faulty bits, which shall be accepted for detection.
MSB first	MSBfirst	If the pattern value shall be interpreted in MSB-first annotation i.e. most significant bit occurs first, this option has to be chosen. Possible Values: • On: Enable MSB first • Off: Disable MSB first(default)
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output(default) • Off: Disable output
Additional Information		
About	**Description**	
Binary output	The decoder provides binary output to file of data bits (LSB first) after demodulation (no channel decoding).	
Decoder Output		
Decoder-Tag	**Description**	
text1	Timestamp at which pattern was found	

Table 243: Decoder Output: "Bit Pattern Detector Template"

Burst-Pause Detector Template		
Changelog		
• **2.0.0** (23.1) – ported to Python • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Burst length [symbols]	BurstLen	The length of a burst in symbols
Tolerance burst length [symbols]:	TolBurstLen	The tolerance of the burst length in symbols
Pause length [milliseconds]	PauseLen	The length of the pause in milliseconds
Tolerance pause length [milliseconds]	TolPauseLen	The tolerance of the pause length in milliseconds
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output • Off: Disable output

Additional Information	
About	**Description**
Binary output	The decoder provides binary output to file of payload data (MSB first).
Decoder Output	
Decoder-Tag	**Description**
text1	Timestamp at which burst was found

Table 244: Decoder Output: "Burst-Pause Detector Template"

CHN 4+4		
Changelog		
• **2.1.0** (23.2) – avoid detection of wrong sideband (during idles) – fixed determination of channel with best quality – use channel with least BCH errors • **2.0.1** (21.2) – added binary file output • **2.0.0** (20.2) – ported to Python – improved decoding performance by exploiting time and frequency diversity • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output • Off: Disable output

Additional Information	
About	**Description**
Binary output	The decoder provides binary output to file of payload (5 bits, MSB first) after channel decoding.
Decoder Output	
Decoder-Tag	**Description**
text1	Default output channel. Letter or figure output mode is automatically detected.
text2	Letter only output. Ignores automatic mode detection.
text3	Figure only output. Ignores automatic mode detection.
text16	Output of payload as hex

Table 245: Decoder Output: "CHN 4+4"

CHN MIL Hybrid 8FSK-PSK		
Changelog		
• **2.1.0** (23.2) – decoding and error correction • **2.0.0** (23.1) – automatic recognition – more robust synchronization and detection due to new demodulator – removed QPSK demodulation after mode 62 – added per burst mode field to xml output • **1.0.1** (21.2) – add binary file output • **1.0.0** (21.1) – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output • Off: Disable output

Additional Information	
About	**Description**
Binary output	The decoder provides binary output to file of payload after demodulation and channel decoding. Since this is a hybrid modem, there are multiple modulations which can be demodulated. According to signal data, different modulations take place. There are three different modes of demodulation. Each mode describes one or two modulations. Modes and respective modulation(s) are listed below: • Mode 51: MFSK-8 (418 symbols) • Mode 62: MFSK-8 (28 symbols) • Mode QPSK: PSK-4 Each of these modes will create its own binary file (in case of appearance in the signal).

Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1. Decoded messages.
text2	Output channel 2. Received MFSK/QPSK symbols.
text16	Output channel 16. Decoded and error corrected data frames (payload) in hex format.
mode	Detected mode of burst. Possible values: • 51, 418 symbols MFSK-8 • 62, PSK-4 • 62, 28 symbols MFSK-8

Table 246: Decoder Output: "CHN MIL Hybrid 8FSK-PSK"

CHN pi/2 BPSK 2400Bd	
Changelog	
• **1.0.0** (24.1) – initial version	
Decoder Parameters	
None	
Additional Information	
About	**Description**
Binary output	The decoder provides binary output to file of payload after demodulation and channel decoding per burst.
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1. Decoded messages.
text16	Output channel 16. Decoded and error corrected data frames (payload) in hex format.

Table 247: Decoder Output: "CHN pi/2 BPSK 2400Bd"

CIS Datalink		
Changelog		
• **1.0.0** (24.1) – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Print Idle Frames	output_idle	Also prints idle frames if ON. Possible Values: • On: Enable output • Off: Disable output
Additional Information		
None		
Decoder Output		
Decoder-Tag	**Description**	
text1	Output channel 1. Decoded messages.	
status	Output about latest state of decoder syncing. • For more information about type 'status', see 'Decoder Common Types'	

Table 248: Decoder Output: "CIS Datalink"

CIS Hybrid MFSK-68 PSK-9000

Changelog

- **1.0.2** (22.2)
  - fixed binary output
- **1.0.1** (21.2)
  - add binary file output
- **1.0.0** (21.1)
  - initial version

Decoder Parameters

Parameter	Variable Name	Description
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output • Off: Disable output
Verbose text	verbose_text	Enable verbose debug output on text2. Possible Values: • On: Enable output • Off: Disable output
Raw demodulator output	raw_output	Enable raw hex output on text3. Possible Values: • On: Enable output • Off: Disable output

Additional Information

About	Description
Binary output	The decoder provides binary output to file of data bits (LSB first) after demodulation (no channel decoding). Binary files contain MFSK data (Tones) only. Intermediate PSK Sync data is omitted.

Decoder Output

Decoder-Tag	Description
text1	Output channel 1. Decoded messages.
text2	Verbose output channel.
text3	Raw data output channel.
text16	Symbols only output channel.
status	Output about latest state of decoder syncing. • For more information about type ‘status’, see ‘Decoder Common Types’

Table 249: Decoder Output: “CIS Hybrid MFSK-68 PSK-9000”

CIS Hybrid MFSK-80 PSK-250		
Changelog		
• **1.0.2** (22.2) – fixed binary output • **1.0.1** (21.2) – add binary file output • **1.0.0** (21.1) – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output • Off: Disable output
Verbose text	verbose_text	Enable verbose debug output on text2. Possible Values: • On: Enable output • Off: Disable output

Additional Information	
About	**Description**
Binary output	The decoder provides binary output to file of data after demodulation (no channel decoding). Binary files contain MFSK data (Tones) only. Intermediate PSK Sync data is omitted.
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1. Decoded messages.
text2	Debug output channel.
text16	Symbols only output channel.
status	Output about latest state of decoder syncing. • For more information about type ‘status’, see ‘Decoder Common Types’

Table 250: Decoder Output: “CIS Hybrid MFSK-80 PSK-250”

CIS-81-81	
Changelog	
• **2.0.0** (22.1) – decoder ported to Python – slightly improved synchronization behavior • **1.0.0** – initial version	
Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1. Raw hexadecimal output.

Table 251: Decoder Output: "CIS-81-81"

CIS-Akula	
Changelog	
• **2.1.1** (24.1) – increased recognition tolerance • **2.1.0** (23.2) – identify preamble group and session key – use special 6bit alphabet to decode data – save decoded data as octal value in text file • **2.0.1** (23.1) – reduced preamble length for detection • **2.0.0** (20.2) – decoder ported to Python • **1.0.0** (19.2) – initial version, detection and raw hex output only	
Decoder Parameters	
None	
Additional Information	
About	**Description**
Binary output	After synchronization write data as octal value to text file with extension .oct until EOM. • sync group (8 octets) • preamble group (7 octets) • session keys 824 octets) • data
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1. Raw octal / 6-bit-alphabet output.

Table 252: Decoder Output: "CIS-Akula"

CODAN 3212 1 Channel		
Changelog		
• **2.0.1** (24.1) – EOM detection • **2.0.0** (23.1) – ported to Python • **1.1.1** (21.2) – added binary file output • **1.1.0** (20.1) – added status channel • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Decode Stanag 5066	Enable5066	Enables decoding of Stanag 5066. Possible Values: • "On" : Enable decoding • "Off" : Disable decoding
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output • Off: Disable output

Additional Information	
About	**Description**
Binary output	The decoder provides binary output to file of payload data (MSB first) after channel decoding (Viterbi).
Decoder Output	
Decoder-Tag	**Description**
text1	Output of complete STANAG 5066 protocol (if S5066 module available)
text2	STANAG 5066 Messages (if S5066 module available)
text16	Output of payload as hex (MSB first) and ascii (hex editor like)
status	Output channel for current status information about detected bit rate, interleaving and alphabet • For more information about type 'status', see 'Decoder Common Types'
dataRate	Data rate in bits per second.
interleaving	Interleaving mode.
eom	End of message (EOM) signature detected • For more information about type 'type_eom', see 'Decoder Common Types'

Table 253: Decoder Output: "CODAN 3212 1 Channel"

CODAN 3212 1 Channel 75bps

Changelog

- **3.0.1** (24.1)
  - EOM detection
- **3.0.0** (23.1)
  - ported to Python
- **2.2.1** (21.2)
  - added binary output decoder parameter
- **2.2.0** (21.1)
  - added binary output
- **2.1.0** (20.1)
  - added status channel
- **2.0.0** (19.2)
  - added XML tags for metadata
- **1.0.0** (18.1)
  - initial version

Decoder Parameters

Parameter	Variable Name	Description
Decode Stanag 5066	Enable5066	Enables decoding of Stanag 5066. Possible Values: • "On" : Enable decoding • "Off" : Disable decoding
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output • Off: Disable output

Additional Information

About	Description
Binary output	The decoder provides binary output to file of payload data (MSB first) after channel decoding (Viterbi).

Decoder Output

Decoder-Tag	Description
text1	Output of complete STANAG 5066 protocol (if S5066 module available)
text2	STANAG 5066 Messages (if S5066 module available)
text16	Output of payload as hex (MSB first) and ascii (hex editor like)
status	Output channel for current status information about detected bit rate, interleaving and alphabet • For more information about type 'status', see 'Decoder Common Types'
dataRate	Data rate in bits per second.
interleaving	Interleaving mode.

eom	End of message (EOM) signature detected • For more information about type 'type_eom', see 'Decoder Common Types'

Table 254: Decoder Output: "CODAN 3212 1 Channel 75bps"

<table>
<tr><th colspan="3">CODAN 3212 1 Channel HDR</th></tr>
<tr><th colspan="3">Changelog</th></tr>
<tr><td colspan="3">

- **2.0.1** (24.1)
  - EOM detection
- **2.0.0** (23.1)
  - ported to Python
  - decoding of 4800, 6000 and 7200 bps modes (QAM)
- **1.1.1** (21.2)
  - added binary output decoder parameter
- **1.1.0** (20.1)
  - added status channel
- **1.0.0**
  - initial version

</td></tr>
<tr><th colspan="3">Decoder Parameters</th></tr>
<tr><th>Parameter</th><th>Variable Name</th><th>Description</th></tr>
<tr><td>Store raw result</td><td>StoreRawData</td><td>Store data in binary file(s).
Possible Values:
• On: Enable output
• Off: Disable output</td></tr>
<tr><td>Decode Stanag 5066</td><td>Enable5066</td><td>Enables decoding of Stanag 5066. Possible Values:
• "On" : Enable decoding
• "Off" : Disable decoding</td></tr>
</table>

Additional Information	
About	**Description**
Binary output	After deinterleaving and channel decoding the decoder delivers a binary output of the data into a file. All received interleaver blocks of a production are written to the same file, even if these blocks are from different bursts.

Decoder Output	
Decoder-Tag	**Description**
text1	Output of complete STANAG 5066 protocol (if S5066 module available)
text2	STANAG 5066 Messages (if S5066 module available)
text16	Output of payload as hex (MSB first) and ascii (hex editor like)
status	Output channel for current status information about detected bit rate, interleaving and alphabet • For more information about type 'status', see 'Decoder Common Types'
dataRate	Data rate in bits per second.
interleaving	Interleaving mode.
eom	End of message (EOM) signature detected • For more information about type 'type_eom', see 'Decoder Common Types'

Table 255: Decoder Output: "CODAN 3212 1 Channel HDR"

CODAN 3212 16 Channel PSK

Changelog

- **3.0.0** (22.2)
  - decoder ported to Python
  - decoder parameter to define text codec
- **2.1.1** (21.2)
  - added binary output decoder parameter
- **2.1.0** (20.1)
  - added notify channel
  - added parameter 'ModemSelect' to set mode: 1 = 3012, 2 = 3212, 0 = both
- **2.0.0** (19.2)
  - added XML tags for metadata
- **1.0.0**
  - initial version

Decoder Parameters

Parameter	Variable Name	Description
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output • Off: Disable output
Mode selection	ModemSelect	Select Modes. Depending on selection, either both Codan 3012 *and* Codan 3212 will be decoded, or selected only. Possible Values: • 3012 / 3212: 0 • 3012 only: 1 • 3212 only: 2
Prod. hold time [ms]	ProdHoldTime	This parameter controls production hold time (in ms). In burst mode, production will be held up until 5000ms (default) *after* last burst end. Changing this parameter leads to an according adaption of that time interval.
Text codec	TextCodec	Specify which codec to be used to display result. Possible Values: • "latin1" • "iso-8859-6" • "cyrillic" • etc.

Additional Information

About	Description
Binary output	After deinterleaving and channel decoding the decoder delivers a binary output of the data (MSB first) into a file. All received interleaver blocks of a production are written to the same file, even if these blocks are from different bursts.

Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1. Sorted raw result.
text2	Output channel 2. Decompressed result.
text3	Output channel 3. May contain some debug information in case of missing or defective frames.
mode	States the mode of Codan. An output of the mode occurs each time the mode changes from one mode to the other. If the mode does not change over time, there will be one single output at the time of the first mode detection. Possible values: • 3012 • 3212

Table 256: Decoder Output: "CODAN 3212 16 Channel PSK"

Clover 2000/2500

Changelog

- **3.0.0** (23.2)
  - decoder ported to Python
  - added post-processing of CloverMail
- **2.0.1** (21.2)
  - added binary file output (Broadcast)
- **2.0.0** (19.2)
  - added XML tags for metadata
- **1.0.0**
  - initial version

Decoder Parameters

Parameter	Variable Name	Description
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output • Off: Disable output
Clovermail post-processing	PostProcCloverMail	If enabled, Clovermail post-processing is started at end of signal. Possible payload will be saved as binary file. Possible Values: • On: Enable post-processing • Off: no post-processing

Additional Information

About	Description
Binary output	The decoder provides the following output files: • Binary output (.bin) of payload data after channel decoding. • XML output (.xdat) including framestructure and checksums When Clovermail post-processing is enabled: • XML output (.1.xdat) including frame numbering and repeat labels • Binary output (.1.bin) payload data without repeated frames • Binary output (.2.bin) payload data with converted Clovermail control codes If Clovermail compressed file is found: • Compressed output (.bz2) containing transferred file

Decoder Output

Decoder-Tag	Description
text1	Output channel 1.
text2	This output contains the output of each processed burst containing check-sum, modulation type, internal meta information etc.
text3	This optional output contains results of post-processing and evaluation of CloverMail headers. It will also contain paths of produced output files.

callSign	Alphanumeric code to identify broadcaster or transmitter. • For more information about type 'callSign', see 'Decoder Common Types'
checksumId	Checksum ID as hex value
eccMode	Error correction mode. Possible values: • Robust • Normal • Fast
modulation	Modulation type. Possible values: • PSK2 • PSK4 • PSK8 • P8A2 • P16A4 • 2DPSM

Table 257: Decoder Output: "Clover 2000/2500"

Clover II		
Changelog		
• **3.0.0** (23.2) – decoder ported to Python • **2.0.0** (19.2) – added XML tags for metadata • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output • Off: Disable output

Additional Information	
About	**Description**
Binary output	The decoder provides binary output to file of payload data and char info after channel decoding.

Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1.
text2	This output contains the output of each processed burst containing check-sum, modulation type, internal meta information etc.
callSign	Alphanumeric code to identify broadcaster or transmitter. • For more information about type 'callSign', see 'Decoder Common Types'
checksumId	Checksum ID as hex value
eccMode	Error correction mode. Possible values: • Robust • Normal • Fast
modulation	Modulation type. Possible values: • PSK2 • PSK4 • PSK8 • P8A2 • P16A4 • 2DPSM

Table 258: Decoder Output: "Clover II"

Codan Chirp		
Changelog		
• **2.1.0** (23.2) – stop production at end of signal • **2.0.0** (22.1) – decoder ported to Python – added burstinfo output • **1.1.1** (21.2) – added binary output decoder parameter • **1.1.0** (21.1) – added binary output • **1.0.0** (16.1) – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output • Off: Disable output
Additional Information		
About	**Description**	
Binary output	The decoder provides binary output to file of data after deinterleaving and channel decoding (Golay). Each data packet is written to one file in the following binary format and order (byteorder: LSB first): • source/transmitter: 3 bytes • destinaton/receiver: 3 bytes • command data: 3 bytes	
Decoder Output		
Decoder-Tag	**Description**	
text1	Output channel 1. Detection and decoded messages.	
command	Command data (24 bit)	
dest	Destination address (24 bit)	
newInfoUnit	Marks the beginning of a new information unit. • For more information about type 'typeNewInfoUnit', see 'Decoder Common Types'	
source	Source address (24 bit)	

Table 259: Decoder Output: "Codan Chirp"

<table>
<tr><th colspan="3">Codan Selcal</th></tr>
<tr><th colspan="3">Changelog</th></tr>
<tr><td colspan="3">

- **2.1.0** (22.2)
  - added beacon request (123) format
  - beginning of preamble (revs) as production start
  - added output of preamble length
  - improved detection
- **2.0.1** (21.2)
  - added binary file output decoder parameter
- **2.0.0** (20.1)
  - ported to Python
  - added parsing of 6-digit addresses
- **1.0.0**
  - initial version

</td></tr>
<tr><th colspan="3">Decoder Parameters</th></tr>
<tr><th>Parameter</th><th>Variable Name</th><th>Description</th></tr>
<tr><td>Store raw result</td><td>StoreRawData</td><td>Store data in binary file(s).
Possible Values:
• On: Enable output
• Off: Disable output</td></tr>
<tr><th colspan="3">Additional Information</th></tr>
<tr><th>About</th><th colspan="2">Description</th></tr>
<tr><td>Binary output</td><td colspan="2">

The decoder provides binary output to file of data after channel decoding (parity and repetition). Each selcal is written to one file in the following binary format and order depending on the received format_specifier.

- format_specifier is 120:
  - format_specifier: 1 byte (120)
  - called_party: 2 byte
  - category: 1 byte
  - calling_party: 2 byte
  - arq: 1 byte
- format is 125 or 126:
  - format_specifier: 1 byte (125 or 126)
  - called_party: 3 byte
  - category: 1 byte
  - calling_party: 3 byte
  - arq: 1 byte
  - subformat: 1 byte

Note: The selcal uses a 7 bit binary digit format. Therefore each byte is only in the range 0-127. Address-bytes of called and calling party are in range 0-99, service codes in range 100-127.

</td></tr>
<tr><th colspan="3">Decoder Output</th></tr>
<tr><th>Decoder-Tag</th><th colspan="2">Description</th></tr>
</table>

text1	Output channel 1. Detection and decoded messages.
selcall	Decoded and interpreted selcall. Content depends on format.

Table 260: Decoder Output: "Codan Selcal"

D-STAR

Changelog

- **2.1.0** (22.2)
  - fast data decoding
  - gps data parsing
  - xml output of position, altitude and speed if available
- **2.0.0** (21.1)
  - decoder ported to Python
- **1.1.0** (20.1)
  - status line output
- **1.0.0**
  - initial version

Decoder Parameters

None

Additional Information

None

Decoder Output

Decoder-Tag	Description
text1	Default output channel.
status	Output channel for current status information: Data/Voice, Repeater/Direct Mode, Control/Regular Signal • For more information about type 'status', see 'Decoder Common Types'
speed	Speed over ground in knots or km/h
altitude	Altitude in meters or feet (see unit) • For more information about type 'type_altitude', see 'Decoder Common Types'
position	Position in ISO format. • For more information about type 'ISOCoordinates', see 'Decoder Common Types'

Table 261: Decoder Output: "D-STAR"

DECT	
Changelog	
• **1.0.0** (20.2) – initial version	
Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1. Logging of detected bearers and identity information
text2	Output channel 2. Higher layer messages (C_s channel) including multi-keypad and calling-party information elements
text3	Output channel 3. Detailed output including MAC channels (e.g. paging broadcast, static system info)
status	Output channel for current status information. Number of currently active bearers, number of received bursts since decoder start and number of current data transmissions (likely voice) in B-Field. • For more information about type 'status', see 'Decoder Common Types'
calling_party	Identifier of calling party. Most likely a phone number, but could be any IA5 string.
encry_cmd	Encryption commands. Possible values of a encryption command element with RFP as attribute.
encry_support	1 if DECT Standard Cipher #1 encryption is supported by RFP else 0. Possible values of a encryption support element with RFP as attribute.
multi_keypad	Keypad input from user. Most likely a phone number, but could be any IA5 string. Possible values of a multi_keypad element.
rfpi	Radio fixed part identity. (40 bit) Hexadecimal value with the current slot number as attribute. The decoder increments the slot number linearly with every "burst" received.

Table 262: Decoder Output: "DECT"

DMR		
Changelog		
• **2.3.0** (24.1) – evaluation of Motorola LRRP location protocol – fix for ARC4 decryption in case of late entry • **2.2.1** (23.2) – improved automatic sideband detection – fix for late entry decoding • **2.2.0** (22.1) – Added automatic and manual decryption for Hytera Basic – save IP data as pcap file – improved decoding and output of IP data • **2.1.0** (21.2) – Added decryption of DES/AES with provided key – automatic decryption of Alinco Basic encryption – Added XML tags for MFID and short messages • **2.0.0** (21.1) – decoder ported to Python – decryption of Motorola ARC4 • **1.2.0** (20.2) – recognition of encryption type – automatic decryption of Motorola Basic encryption • **1.1.0** (20.1) – added status channel • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Hytera Basic Decryption	DecryptHyteraBasic	Select between three decryption modes. "Off" assumes data to be not encrypted. Selecting "Manual key setting" will presume a key entered in Parameter "Manual key", which will then be used for decryption. Selecting "Auto key finding", any entry in "Manual key" will be ignored and decryption key will be searched and used automatically as soon as voice is active. Possible Values: • Off: 0 • Manual key setting: 1 • Auto key finding: 2

Manual key	HyteraBasicKey	Hexadecimal decryption key. This key will be used only if parameter "Hytera Basic Decryption" is set to "Manual key setting" or "Auto key finding" before successful key finding. Note that automatic key finding will not work before end of first PTT burst. Possible Values: • Hexadecimal value with 40, 128 or 256 bits
Motorola Basic Decryption	DecryptMotorolaBasic	Select between three decryption modes. "Off" assumes data to be not encrypted. Selecting "Manual key setting" will presume a key entered in Parameter "Manual key", which will then be used for decryption. Selecting "Auto key finding", any entry in "Manual key" will be ignored and decryption key will be searched and used automatically as soon as voice is active. Possible Values: • Off: 0 • Manual key setting: 1 • Auto key finding: 2
Manual key(1-255)	MotorolaBasicKeyNo	Key number for decryption. This key will be used only if parameter "Decryption" is set to "Motorola basic manual". Possible Values: • 1-255
Alinco Normal key finding	DetectAlincoNormal	Enables key finding of Alinco encryption. This is only possible after receiving voice data. For decryption of voice data replay the signal with enabled decryption (see below) and found key. Possible Values: • Checked (1) • Not checked(0)
Alinco Normal decryption	DecryptAlincoNormal	Enables decryption of Alinco Normal with given key. Possible Values: • Checked (1) • Not checked(0)
Alinco Normal key(hex)	AlincoNormalKey	Binary key value used for Alinco decryption. Key length is 16 bit. Possible Values: • 0 - 0xFFFF

ARC4/DES/AES	Enhanced_Decryption	Select ARC4/DES/AES Decryption with known key values. This checkbox will switch ARC4/DES/AES decryption on or off. Decryption in any case will only take place if the algorithm is announced during transmission. In case of announcement a key-id is transmitted as well. This gives the possibility to automatically select different predefined keys. Possible Values: • Checked (1) • Not checked(0) Key lengths: • ARC4 : 40 bit • DES : 56 bit • AES : 128 / 256 bit
Record voice frames	record_voice_frames	Enables the recording of voice frames with meta information about encryption which can be used in go2key to find the actual key. Possible Values: • Checked (1) • Not checked(0)
Default key(hex)	Default_Key	This key will be used if the received key-id is not listed below. Possible Values (hexadecimal input): • positive 256 bit range
KeyID A	KeyNo_1	The first key-id. Possible Values: • 1-255
Key A	Key_1	The key value for key-id defined with KeyID A. Possible Values (hexadecimal input): • positive 256 bit range
KeyID B	KeyNo_2	The second key-id. Possible Values: • 1-255
Key B	Key_2	The key value for key-id defined with KeyID B. Possible Values (hexadecimal input): • positive 256 bit range
KeyID C	KeyNo_3	The third key-id. Possible Values: • 1-255
Key C	Key_3	The key value for key-id defined with KeyID C. Possible Values (hexadecimal input): • positive 256 bit range
Additional Information		
None		
Decoder Output		
Decoder-Tag	**Description**	

text1	Default output channel.
status	Output channel for current status information. • For more information about type 'status', see 'Decoder Common Types'
ShortMessage	Output tag of DMR's short message output.
encryptionKey	Encryption key in case of *scramble mode* encryption (Motorola/Hytera Basic or Alinco). Either manually set or automatically determined.
ifcEncryption	Encryption mode. Interface encryption is disabled if value is 'plain'. Otherwise interface is encrypted with the given algorithm. Possible values: • **plain** : unencrypted • **encrypted** : unknown type of encryption • **Basic** : Basic encryption (scrambling) • **Motorola Basic** : Basic encryption (scrambling) from Motorola • **Kenwood Basic** : Basic encryption (scrambling) from Kenwood • **Hytera Basic** : Basic encryption (scrambling) from Hytera • **Hytera Proprietary** : Basic encryption (scrambling) from Hytera • **ARC4** : ARC4 encryption algorithm • **DES-56** : DES encryption algorithm with 56 bits • **AES-128** : AES encryption algorithm with 128 bits • **AES-256** : AES encryption algorithm with 256 bits • **reserved(3)** : reserved encryption algorithm #3 • **reserved(6)** : reserved encryption algorithm #6 • **reserved(7)** : reserved encryption algorithm #7 • **Hytera Proprietary (3)** : Hytera proprietary encryption algorithm #3 • **Hytera Proprietary (6)** : Hytera proprietary encryption algorithm #6 • **Hytera Proprietary (6)** : Hytera proprietary encryption algorithm #7
keyID	Encryption key id-number
mfid	Manufacturer's ID
position	Position of sender (if available) in ISO format. • For more information about type 'ISOCoordinates', see 'Decoder Common Types'

Table 263: Decoder Output: "DMR"

DMR Continuous		
Changelog		
• **2.3.0** (24.1) – evaluation of Motorola LRRP location protocol • **2.2.0** (22.1) – automatic decryption of Motorola Basic encryption – decryption of ARC4/DES/AES with provided key – save IP data as pcap file – improved decoding and output of IP data • **2.1.0** (21.2) – some internal changes • **2.0.0** (21.1) – decoder ported to Python – recognition of encryption type • **1.2.0** (20.2) – less FP detection • **1.1.0** (20.1) – soft decision for voice vocoder – added status channel • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Motorola Basic Decryption	DecryptMotorolaBasic	Select between three decryption modes. "Off" assumes data to be not encrypted. Selecting "Manual key setting" will presume a key entered in Parameter "Manual key", which will then be used for decryption. Selecting "Auto key finding", any entry in "Manual key" will be ignored and decryption key will be searched and used automatically at the tie of speech start. "Manual / mode enforced" will not wait for automatic detection of Motorola Basic encrytion type before applying the manually entered key. This can be helpful e.g. when a record was started not from the beginning of speech. Note that in this mode plain speech will not be automatically detected as well. Possible Values: • Off: • Manual key setting: 1 • Manual / mode enforced: 3 • Auto key finding: 2

Manual key(1-255)	MotorolaBasicKeyNo	Key number for decryption. This key will be used only if parameter "Decryption" is set to "Motorola basic manual". Possible Values: • 1-255
Alinco Normal key finding	DetectAlincoNormal	Enables key finding of Alinco encryption. This is only possible after receiving voice data. For decryption of voice data replay the signal with enabled decryption (see below) and found key. Possible Values: • Checked (1) • Not checked(0)
Alinco Normal decryption	DecryptAlincoNormal	Enables decryption of Alinco Normal with given key. Possible Values: • Checked (1) • Not checked(0)
Alinco Normal key(hex)	AlincoNormalKey	Binary key value used for Alinco decryption. Key length is 16 bit. Possible Values: • 0 - 0xFFFF
ARC4/DES/AES	Enhanced_Decryption	Select ARC4/DES/AES Decryption with known key values. This checkbox will switch ARC4/DES/AES decryption on or off. Decryption in any case will only take place if the algorithm is announced during transmission. In case of announcement a key-id is transmitted as well. This gives the possibility to automatically select different predefined keys. Possible Values: • Checked (1) • Not checked(0) Key lengths: • ARC4 : 40 bit • DES : 56 bit • AES : 128 / 256 bit
Record voice frames	record_voice_frames	Enables the recording of voice frames with meta information about encryption which can be used in go2key to find the actual key. Possible Values: • Checked (1) • Not checked(0)
Default key(hex)	Default_Key	This key will be used if the received key-id is not listed below. Possible Values (hexadecimal input): • positive 256 bit range
KeyID A	KeyNo_1	The first key-id. Possible Values: • 1-255

Key A	Key_1	The key value for key-id defined with KeyID A. Possible Values (hexadecimal input): • positive 256 bit range
KeyID B	KeyNo_2	The second key-id. Possible Values: • 1-255
Key B	Key_2	The key value for key-id defined with KeyID B. Possible Values (hexadecimal input): • positive 256 bit range
KeyID C	KeyNo_3	The third key-id. Possible Values: • 1-255
Key C	Key_3	The key value for key-id defined with KeyID C. Possible Values (hexadecimal input): • positive 256 bit range
Additional Information		
None		

Decoder Output	
Decoder-Tag	**Description**
text1	Default output channel.
status	Output channel for current status information. • For more information about type ‘status’, see ‘Decoder Common Types’
ShortMessage	Output tag of DMR’s short message output.

ifcEncryption	Encryption mode. Interface encryption is disabled if value is 'plain'. Otherwise interface is encrypted with the given algorithm. Possible values: • **plain** : unencrypted • **encrypted** : unknown type of encryption • **Basic** : Basic encryption (scrambling) • **Motorola Basic** : Basic encryption (scrambling) from Motorola • **Kenwood Basic** : Basic encryption (scrambling) from Kenwood • **Hytera Basic** : Basic encryption (scrambling) from Hytera • **Hytera Proprietary** : Basic encryption (scrambling) from Hytera • **ARC4** : ARC4 encryption algorithm • **DES-56** : DES encryption algorithm with 56 bits • **AES-128** : AES encryption algorithm with 128 bits • **AES-256** : AES encryption algorithm with 256 bits • **reserved(3)** : reserved encryption algorithm #3 • **reserved(6)** : reserved encryption algorithm #6 • **reserved(7)** : reserved encryption algorithm #7 • **Hytera Proprietary (3)** : Hytera proprietary encryption algorithm #3 • **Hytera Proprietary (6)** : Hytera proprietary encryption algorithm #6 • **Hytera Proprietary (6)** : Hytera proprietary encryption algorithm #7
keyID	Encryption key id-number
mfid	Manufacturer's ID
position	Position of sender (if available) in ISO format. • For more information about type 'ISOCoordinates', see 'Decoder Common Types'

Table 264: Decoder Output: "DMR Continuous"

<table>
<tr><th colspan="2">DSC-Selcal</th></tr>
<tr><th colspan="2">Changelog</th></tr>
<tr><td colspan="2">3.0.0 (21.1)
ported to Python
2.0.0 (19.2)
added XML tags for metadata
1.0.0
initial version</td></tr>
<tr><th colspan="2">Decoder Parameters</th></tr>
<tr><td colspan="2">None</td></tr>
<tr><th colspan="2">Additional Information</th></tr>
<tr><td colspan="2">None</td></tr>
<tr><th colspan="2">Decoder Output</th></tr>
<tr><th>Decoder-Tag</th><th>Description</th></tr>
<tr><td>text1</td><td>Output channel 1.</td></tr>
<tr><td>category</td><td>Category of information.
Routine
Safety
Urgency
Distress: For distress relays, distress relay acknowledgements and distress acknowledgements</td></tr>
<tr><td>commType</td><td>Indicate the type of communication (telephone or FEC teleprinter) which is preferred by the station for subsequent exchange of traffic. Can also be distress relay.</td></tr>
<tr><td>country</td><td>Country name extracted from MID.
origin="src" : Self-identification
origin="dest" : called party (individual ship, a coast station or a group of stations)
origin="relay" : in case of a distress relay the vessel in distress
For more information about type 'country', see 'Decoder Common Types'</td></tr>
<tr><td>mmsi</td><td>Maritime Mobile Service Number.
origin="src" : Self-identification
origin="dest" : called party (individual ship, a coast station or a group of stations)
origin="relay" : in case of a distress relay the vessel in distress
For more information about type 'mmsi', see 'Decoder Common Types'</td></tr>
<tr><td>natureOfDistress</td><td>Nature of distress in case of a distress alert.</td></tr>
<tr><td>newInfoUnit</td><td>Marks the beginning of a new information unit.
For more information about type 'typeNewInfoUnit', see 'Decoder Common Types'</td></tr>
</table>

position	indicating the location of the vessel in distress (only in case of distress alert) • For more information about type 'ISOCoordinates', see 'Decoder Common Types'
time	time indication (UTC) when the coordinates given in **position** were valid (only in case of distress alert)

Table 265: Decoder Output: "DSC-Selcal"

Distress Radiobeacons	
Changelog	
• **1.2.0** (23.2) – improved signal detection and synchronisation • **1.1.0** (22.2) – output of country of origin of aircraft • **1.0.0** (21.1) – intial version	
Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1.
status	Status output about latest information about radiobeacon frames. • For more information about type 'status', see 'Decoder Common Types'
aircraftCoun-try	Country of origin of the aircraft based on its 24 bit ICAO address. • For more information about type 'icaoAircraftCountry', see 'Decoder Common Types'
beaconType	Type of Beacon. Possible values: • **EPIRB** : Beacon was transmitted by EPIRB sender (maritime) • **ELT** : Beacon was transmitted by ELT sender (aviation) • **PLB** : Beacon was transmitted by PLB sender (personal - handheld) • **Unknown** : Beacon was transmitted by an unknown sender
country	Country name extracted from MID. • For more information about type 'country', see 'Decoder Common Types'
hexID	15 Bit Hex ID unique to transmitting radiobeacon sender.
icaoNo	International Civil Aviation Organization (ICAO) 24 bit aircraft address. • **Output in hex format.** • For more information about type 'icaoNo', see 'Decoder Common Types'
mmsi	Maritime Mobile Service identity Number (MMSI). • For more information about type 'mmsi', see 'Decoder Common Types'
position	Position in ISO format. • For more information about type 'ISOCoordinates', see 'Decoder Common Types'

Table 266: Decoder Output: "Distress Radiobeacons"

FLARM		
Changelog		
• 1.0.0 – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Reference Latitude	Ref_Lat	Latitude of the reference ground station location (needed to calculate exact position of plane), example: 47.18686
Reference Longitude	Ref_Lon	Longitude of the reference ground station location (needed to calculate exact position of plane), example: 8.477258
Reference Altitude [m]	Ref_Alt	Altitude of the reference ground station location (needed to calculate exact position of plane), example: 482
Additional Information		
None		
Decoder Output		
Decoder-Tag	**Description**	
text1	Output channel 1.	
altitude	Altitude of the plane	
callSign	Unique radio ID of the FLARM device • For more information about type 'callSign', see 'Decoder Common Types'	
position	Position of the plane (output only if location of reference ground station is parametrized) • For more information about type 'ISOCoordinates', see 'Decoder Common Types'	

Table 267: Decoder Output: "FLARM"

<table>
<tr><th colspan="2">FLEX</th></tr>
<tr><th colspan="2">Changelog</th></tr>
<tr><td colspan="2">2.0.0 (22.1)
ported to Python
1.0.0
initial version</td></tr>
<tr><th colspan="2">Decoder Parameters</th></tr>
<tr><td colspan="2">None</td></tr>
<tr><th colspan="2">Additional Information</th></tr>
<tr><td colspan="2">None</td></tr>
<tr><th colspan="2">Decoder Output</th></tr>
<tr><th>Decoder-Tag</th><th>Description</th></tr>
<tr><td>text1</td><td>Automatic mode. Output is either alphanumeric or numeric.</td></tr>
</table>

Table 268: Decoder Output: "FLEX"

FT-X	
Changelog	
• **1.0.0** (21.1) – initial version	
Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1. Prints detected and decoded messages.
call	Decoded and parsed message.

Table 269: Decoder Output: "FT-X"

GSM	
Changelog	
• **1.0.0** (20.2) – initial version	
Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1: general cell information
text2	Output channel 2: paging requests
text3	Output channel 3: channel assignments
text4	Output channel 4: other meta information
status	Output channel for current status information. Information about cell location and operator. • For more information about type 'status', see 'Decoder Common Types'
assignment	Channel assignment for a mobile phone.
cell_arfcns	List of ARFCNs active in this cell. Sequence of Absolute Radio Frequency Channel Number (0-1023) with attribute count.
cell_frequencies	Absolute transmit frequency (Uplink and Downlink) of the GSM cell. Sequence of Uplink and Downlink frequency of a GSM cell with attribute count.
cell_info	Basic information about gsm cell.
cipher_mode	Ciphering start command.
neighbour_cell_arfcns	List of ARFCNs of neighbouring cells. Sequence of Absolute Radio Frequency Channel Number (0-1023) with attribute count.
neighbour_cell_frequencies	Absolute transmit frequency (Uplink and Downlink) of the neighbouring cells. Sequence of Uplink and Downlink frequency of a GSM cell with attribute count.
paging	Paging of a mobile endpoint.

Table 270: Decoder Output: "GSM"

HFDL
Changelog
• **3.4.0** (24.1) – added support for decoding of OHMA messages • **3.3.0** (22.2) – output of country of origin of aircraft • **3.2.0** (22.1) – improved processing of ACARS messages, including reassembly of fragmented messages – decoding of MIAM and Media Advisory messages • **3.1.0** (21.2) – added status line with information about last received burst – add xml tags with ground station coordinates and location • **3.0.0** (20.2) – ported to Python – added tuned and propagated frequencies – check system table • **2.0.0** (19.2) – added XML tags for metadata • **1.0.0** – initial version
Decoder Parameters
None
Additional Information
None

Decoder Output

Decoder-Tag	Description
text1	Output channel 1.
status	Output channel for current status information, e.g. 'Downlink GndId: 03 AirId: 81 FlightId: UP0203' • For more information about type 'status', see 'Decoder Common Types'
adsc	Text of incoming Automatic Dependent Surveillance (ADS) message. • For more information about type 'adsc', see 'Decoder Common Types'
aircraftCountry	Country of origin of the aircraft based on its 24 bit ICAO address. • For more information about type 'icaoAircraftCountry', see 'Decoder Common Types'
aircraftId	Aircraft identification • For more information about type 'aircraftId', see 'Decoder Common Types'
callSign	Alphanumeric code to identify broadcaster or transmitter. • For more information about type 'callSign', see 'Decoder Common Types'

cpdlc	Text of incoming Controller Pilot Data Link Communications (CPDLC) message. • For more information about type 'cpdlc', see 'Decoder Common Types'
flightId	Flight identification. • For more information about type 'flightId', see 'Decoder Common Types'
groundCoordinates	Ground Station Coordinates. • For more information about type 'ISOCoordinates', see 'Decoder Common Types'
groundId	Ground Station identification. • For more information about type 'groundId', see 'Decoder Common Types'
groundLocation	Ground Station Location. City and country.
icaoAircraftAddress	International Civil Aviation Organization (ICAO) 24 bit aircraft address. • **Output in hex format** • For more information about type 'icaoNo', see 'Decoder Common Types'
labelText	Label text of incoming message. • For more information about type 'labelText', see 'Decoder Common Types'
labelType	Label Type of incoming message. • For more information about type 'labelType', see 'Decoder Common Types'
mediaAdvisory	Text of incoming Media Advisory message. • For more information about type 'mediaAdvisory', see 'Decoder Common Types'
miam	Text of incoming Media Independent Aircraft Messaging (MIAM) message. • For more information about type 'miam', see 'Decoder Common Types'
newInfoUnit	Marks the beginning of a new information unit. • For more information about type 'typeNewInfoUnit', see 'Decoder Common Types'
position	Position of the aircraft in ISO format. • For more information about type 'ISOCoordinates', see 'Decoder Common Types'
slotType	Gives directional information about a message according sender and recipient. • For more information about type 'typeSlotType', see 'Decoder Common Types'
time	Time indication (UTC) when the coordinates given in **position** were valid. • Output complies with ISO 8601

Table 271: Decoder Output: "HFDL"

Harris RF 5800 SelCall		
Changelog		
• **1.0.0** (24.1) – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output • Off: Disable output
Additional Information		
About	**Description**	
Binary output	The decoder provides binary output to file of data bits (LSB first) after demodulation (no channel decoding).	
Decoder Output		
Decoder-Tag	**Description**	
text1	Default output channel. Letter or figure output mode is automatically detected.	

Table 272: Decoder Output: "Harris RF 5800 SelCall"

INMARSAT AERO-C	
Changelog	
• **2.0.0** (22.1) – ported to Python • **1.0.0** – initial version	
Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1.
text2	raw output of received signaling units (SU)

Table 273: Decoder Output: "INMARSAT AERO-C"

INMARSAT AERO-P	
Changelog	

• **2.1.0** (24.1)
  – added support for decoding of OHMA messages
• **2.0.0** (22.1)
  – ported to Python
  – improved processing of ACARS messages, including reassembly of fragmented messages
  – decoding of MIAM and Media Advisory messages
• **1.0.0**
  – initial version	

Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1.
text2	raw output of received signaling units (SU)
adsc	Text of incoming Automatic Dependent Surveillance (ADS) message. • For more information about type 'adsc', see 'Decoder Common Types'
callSign	Alphanumeric code to identify broadcaster or transmitter. • For more information about type 'callSign', see 'Decoder Common Types'
cpdlc	Text of incoming Controller Pilot Data Link Communications (CPDLC) message. • For more information about type 'cpdlc', see 'Decoder Common Types'
labelText	Label text of incoming message. • For more information about type 'labelText', see 'Decoder Common Types'
labelType	Label Type of incoming message. • For more information about type 'labelType', see 'Decoder Common Types'
mediaAdvisory	Text of incoming Media Advisory message. • For more information about type 'mediaAdvisory', see 'Decoder Common Types'
miam	Text of incoming Media Independent Aircraft Messaging (MIAM) message. • For more information about type 'miam', see 'Decoder Common Types'

Table 274: Decoder Output: "INMARSAT AERO-P"

INMARSAT AERO-R	
Changelog	
• **2.1.0** (24.1) – added support for decoding of OHMA messages • **2.0.0** (22.1) – ported to Python – improved processing of ACARS messages, including reassembly of fragmented messages – decoding of MIAM and Media Advisory messages • **1.0.0** – initial version	
Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1.
text2	raw output of received signaling units (SU)
adsc	Text of incoming Automatic Dependent Surveillance (ADS) message. • For more information about type 'adsc', see 'Decoder Common Types'
callSign	Alphanumeric code to identify broadcaster or transmitter. • For more information about type 'callSign', see 'Decoder Common Types'
cpdlc	Text of incoming Controller Pilot Data Link Communications (CPDLC) message. • For more information about type 'cpdlc', see 'Decoder Common Types'
labelText	Label text of incoming message. • For more information about type 'labelText', see 'Decoder Common Types'
labelType	Label Type of incoming message. • For more information about type 'labelType', see 'Decoder Common Types'
mediaAdvisory	Text of incoming Media Advisory message. • For more information about type 'mediaAdvisory', see 'Decoder Common Types'
miam	Text of incoming Media Independent Aircraft Messaging (MIAM) message. • For more information about type 'miam', see 'Decoder Common Types'

Table 275: Decoder Output: "INMARSAT AERO-R"

INMARSAT AERO-T	
Changelog	
• **2.1.0** (24.1) – added support for decoding of OHMA messages • **2.0.0** (22.1) – ported to Python – improved processing of ACARS messages, including reassembly of fragmented messages – decoding of MIAM and Media Advisory messages • **1.0.0** – initial version	
Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1.
text2	raw output of received signaling units (SU)
adsc	Text of incoming Automatic Dependent Surveillance (ADS) message. • For more information about type 'adsc', see 'Decoder Common Types'
callSign	Alphanumeric code to identify broadcaster or transmitter. • For more information about type 'callSign', see 'Decoder Common Types'
cpdlc	Text of incoming Controller Pilot Data Link Communications (CPDLC) message. • For more information about type 'cpdlc', see 'Decoder Common Types'
labelText	Label text of incoming message. • For more information about type 'labelText', see 'Decoder Common Types'
labelType	Label Type of incoming message. • For more information about type 'labelType', see 'Decoder Common Types'
mediaAdvisory	Text of incoming Media Advisory message. • For more information about type 'mediaAdvisory', see 'Decoder Common Types'
miam	Text of incoming Media Independent Aircraft Messaging (MIAM) message. • For more information about type 'miam', see 'Decoder Common Types'

Table 276: Decoder Output: "INMARSAT AERO-T"

<table>
<tr><th colspan="2">INMARSAT-C TDM</th></tr>
<tr><th colspan="2">Changelog</th></tr>
<tr><td colspan="2">2.0.0 (20.2)
ported to Python
1.0.0 (18.1)
status channel</td></tr>
<tr><th colspan="2">Decoder Parameters</th></tr>
<tr><td colspan="2">None</td></tr>
<tr><th colspan="2">Additional Information</th></tr>
<tr><td colspan="2">None</td></tr>
<tr><th colspan="2">Decoder Output</th></tr>
<tr><th>Decoder-Tag</th><th>Description</th></tr>
<tr><td>text1</td><td>Standard output. All received and successfully decoded packets</td></tr>
<tr><td>text2</td><td>Decoded messages. The data is interpreted as ASCII and Baudot, because both formats are used.</td></tr>
<tr><td>text3</td><td>Decoded EGC messages.</td></tr>
<tr><td>text16</td><td>Raw TDM Frames as Hex.</td></tr>
</table>

Table 277: Decoder Output: "INMARSAT-C TDM"

KG-STV	
Changelog	
• **1.0.0** (22.1) – initial version	
Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Standard output.
text2	Detailed/Debug output. Header of received frames is printed.
text16	Raw output as hex after channel decoding. One frame per line. The first 56 bit are the header, then data if included in frame.
status	Output channel for current decoder status (searching/receiving). • For more information about type 'status', see 'Decoder Common Types'
callSign	Alphanumeric code to identify broadcaster or transmitter. • For more information about type 'callSign', see 'Decoder Common Types'
freetext	Received free text (chat)

Table 278: Decoder Output: "KG-STV"

Link 22		
Changelog		
• **2.0.0** (21.2) – ported to Python – added binary file output • **1.0.0** (20.1) – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Store raw result	StoreRawData	Store data in binary file. Possible Values: • On: Enable output • Off: Disable output
Additional Information		
About	**Description**	
Binary output	The decoder provides binary output to file of data (MSB first) after channel decoding. A new binary file is created at new production start Note: One binary file may contain data of multiple bursts.	
Decoder Output		
Decoder-Tag	**Description**	
text1	Output channel 1.	

Table 279: Decoder Output: "Link 22"

<table>
<tr><th colspan="3">MIL-188-110 39 Tone</th></tr>
<tr><th colspan="3">Changelog</th></tr>
<tr><td colspan="3">

- **2.0.0** (22.2)
  - ported to Python
  - add manual mode, disables burst processing
- **1.0.1** (21.2)
  - added binary file output
- **1.0.0**
  - initial version

</td></tr>
<tr><th colspan="3">Decoder Parameters</th></tr>
<tr><th>Parameter</th><th>Variable Name</th><th>Description</th></tr>
<tr><td>Store raw result</td><td>StoreRawData</td><td>Store data in binary file(s).
Possible Values:
• On: Enable output
• Off: Disable output</td></tr>
<tr><td>Data Rate</td><td>ParaDataRate</td><td>Bit rate selection.
Possible Values:
• auto: Automatic
• 75 bps: 75 bit per second.
• 150 bps: 150 bit per second.
• 300 bps: 300 bit per second.
• 600 bps: 600 bit per second.
• 1200 bps: 1200 bit per second.
• 2400 bps, interl.[1-4]: 2400 bit per second.
• 2400 bps, interl.[5-8]: 2400 bit per second.</td></tr>
<tr><td>Interleaving</td><td>ParaInterl</td><td>Interleaving mode selection.
Possible Values:
• auto: Automatic
• very short
• medium short
• medium long</td></tr>
<tr><td>Data Bits</td><td>ParaDataBits</td><td>Number of data bits selection.
Possible Values:
• 5, 6, 7 or 8</td></tr>
</table>

Sync/Async	ParaAsync	Number of stop bits selection. Possible Values: • auto: Automatic • sync (8 data bits) • 1 stop bit • 2 stop bits • parity + 1 stop bit • parity + 2 stop bits
Diversity	ParaDiversity	Diversity mode selection. Possible Values: • auto: Automatic • frequency + time • frequency only
Burst Detection	burst_on	Enables burst processing. Decoding does not depend on a preamble detection and runs continuously if the option is not enabled. Possible Values: • On: Enable burst processing • Off: Disable burst processing

Additional Information	
About	**Description**
Binary output	The decoder provides binary output to file of payload data (MSB first) after channel decoding (Reed Solomon) and deinterleaving.

Decoder Output	
Decoder-Tag	**Description**
text1	Default output channel.
text16	Output of payload as hex (MSB first) and ascii (hex editor like)
status	Output channel for current status information : symbol rate, interleaving parameters • For more information about type ‘status’, see ‘Decoder Common Types’

Table 280: Decoder Output: “MIL-188-110 39 Tone”

MIL110APPD		
Changelog		
• **2.0.1** (21.2) – added binary file output decoder parameter • **2.0.0** (21.1) – ported to Python – complete decoding of protocol • **1.0.0** (17.2) – initial version – detection only		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output • Off: Disable output
burst end detection via EOM	eom_burstend	A detected EOM sequence (0x4B65A5B2) within decoded data triggers a stop after the interleaving block. Possible Values: • On/Off
burst end detection via energy drop	direct_burstend_detection	Do fast direct burstend detection via power drop estimation after probes. In fast fading channels this could lead to false signal termination. Not available/ignored for WNR 0 (Walsh). Possible Values: • On/Off
maximum interleaver blocks	max_interleaver_blocks	Maximum number of receiving interleaver blocks before receiving is terminated. Enter -1 for an unlimited number of blocks.
sync lost stop time (ms)	sync_lost_stop	Enter decimal value in ms. Receiving is stopped if synchronisation to waveform is lost and Value is clamped between 0.3 and 6s.
iterative equalization	iterative_decoding	Use an iterative decoding/equalization scheme to improve demodulation performance. Not applicable for Waveform Nr. 0 (Walsh) Possible Values: • On/Off
sync to single superframe(M=1)	sync_single_superframe	In case of a single superframe the preamble is not repeated and the fixed subsection is shortened. Possible Values: • On/Off

preamble correlators (absolute)	preamble_correlators_absolute	The preamble is searched for with two types of correlations. One is a differential The number of correlators is internally clamped to [0, 63].
verbose error metric (text2)	print_viterbi_error_metric	Prints the error metric from viterbi algorithm to text2. Possible Values: • On/Off
print all data to text16	print_full_hex	If checked, all received data is printed in hex format to text16. For high data rates it makes no sense to print all data to the XML file. Possible Values: • On/Off
number of preview bytes per block	print_bytes_per_interleaver_block	Number of bytes to print per interleaver block to main output channel (text1). For high data rates it makes no sense to print all data to the XML file.
file split: ultra short blocks	file_output_us_blocks	Number of ultra short interleaver blocks written to one file before opening a new file. The size of the interleaver block depends on the waveform number, bandwidth and interleaver setting. Set to 0 for infinite.
file split: short blocks	file_output_s_blocks	Number of short interleaver blocks written to one file before opening a new file. The size of the interleaver block depends on the waveform number, bandwidth and interleaver setting. Set to 0 for infinite.
file split: medium blocks	file_output_m_blocks	Number of medium interleaver blocks written to one file before opening a new file. The size of the interleaver block depends on the waveform number, bandwidth and interleaver setting. Set to 0 for infinite.
file split: long blocks	file_output_l_blocks	Number of long interleaver blocks written to one file before opening a new file. The size of the interleaver block depends on the waveform number, bandwidth and interleaver setting. Set to 0 for infinite.

Additional Information

About	Description
Binary output	The decoder provides binary output to file of payload data as bytes (MSB first) after channel decoding (deinterleaver).

Decoder Output

Decoder-Tag	Description
text1	Output channel 1. Output of decoder state and received bursts.

text2	Output channel 2. Verbose output if activated.
text16	Output channel 16. Raw hex output if activated.
status	Output channel for current status information. Shows current waveform configuration and some internal channel measurements from equalizer (not for walsh modulation). • For more information about type 'status', see 'Decoder Common Types'
block	Detected interleaver block and its configuration.
waveform	Detected waveform configuration.

Table 281: Decoder Output: "MIL110APPD"

MPT1327	
Changelog	
• **2.0.0** (21.1) – Added CCSC status line and XML Tagging – ported to Python • **1.0.0** – initial version	
Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Data + Control channel.
text2	Control channel only.
text3	Data channel only.
status	Status output about ALH (Aloha) typed control channel system codewords. • For more information about type 'status', see 'Decoder Common Types'
CCSC	Control Channel System Codeword. Gives information about Aloha and Ahoy message addressing. Possible values: Aloha Messages: • **ALH** : general • **ALHS** : standard data excluded • **ALHD** : *simple* calls excluded • **ALHE** : emergency only • **ALHR** : registration or emergency • **ALHX** : registration excluded • **ALHF** : fall-back mode • **ALres7** Ahoy Messages: • **AHY** : General availability check • **AHYX** : Cancel alert/waiting state • **AHYP** : Called Unit Presence Monitoring • **AHYQ** : Status message • **AHYC** : Short data invitation Attributes: • **SI** : System Identity • **origin** : Denotes directional information about current message's origin. • **ident** : Denotes identification of addressing.

Table 282: Decoder Output: "MPT1327"

<table>
<tr><th colspan="3">Mode-S</th></tr>
<tr><th colspan="3">Changelog</th></tr>
<tr><td colspan="3">1.1.0 (22.2)
output of country of origin of aircraft
1.0.0 (22.1)
intial version</td></tr>
<tr><th colspan="3">Decoder Parameters</th></tr>
<tr><th>Parameter</th><th>Variable Name</th><th>Description</th></tr>
<tr><td>Tabular output</td><td>UseTableOutput</td><td>Show primary ADS-B data in an overview table printed to output channel text1.
Possible Values:
On: Decoder outputs a table.
Off: No table output</td></tr>
<tr><td>Uncertainty Output</td><td>ShowUncertain-
ties</td><td>Some data as positional data or altitude have associated uncertainty values.
Possible Values:
On: Decoder outputs uncertainty values where applicable.
Off: No uncertainty value output</td></tr>
<tr><td>Flight Count</td><td>FlightCount</td><td>Maximum number of indivdual flights captured. This determines the maximum length of the overview table.</td></tr>
<tr><th colspan="3">Additional Information</th></tr>
<tr><td colspan="3">None</td></tr>
</table>

<table>
<tr><th colspan="2">Decoder Output</th></tr>
<tr><th>Decoder-Tag</th><th>Description</th></tr>
<tr><td>text1</td><td>Tabular output of mainly ADS-B data. Output is
“Address” (ICAO Number)
“Squawk” (Squawk Code)
“Callsign” (Flight ID)
“Altitude (ft)”
“Speed (kts)” (Ground Speed - in knots)
“Lattiude” (in degrees)
“Longitude” (in degrees)</td></tr>
<tr><td>text2</td><td>Complete text output of each message received.</td></tr>
<tr><td>status</td><td>Status output: Number and approximate rate of bursts received.
For more information about type ‘status’, see ‘Decoder Common Types’</td></tr>
</table>

speed	Speed value of the aircraft. There are two types of speed: • Ground speed = Air speed + Wind speed (Wind speed may be negative) • Air speed = Ground speed - Wind speed (Wind speed may be negative) The respective speed type is depicted via the according tag attribute "type": • "ground" for Ground Speed • "air" for Air Speed Output in knots
squawk	Squawk Code. There are 3 special Squawk Codes with international validity: • "7500" : Aircraft hijacking • "7600" : Radio failure • "7700" : Emergency • Output in octal (4 digits)
track	Track value of the aircraft. • Output in degrees. 0° being True North. Clockwise direction.
aircraftCoun-try	Country of origin of the aircraft based on its 24 bit ICAO address. • For more information about type 'icaoAircraftCountry', see 'Decoder Common Types'
altitude	Altitude of aircraft. • Output either in feet or meters. • For more information about type 'type_altitude', see 'Decoder Common Types'
flightId	Flight Identification • For more information about type 'flightId', see 'Decoder Common Types'
icaoNo	International Civil Aviation Organization (ICAO) 24 bit aircraft address. • **Output in hex format.** • For more information about type 'icaoNo', see 'Decoder Common Types'
newInfoUnit	Marks the beginning of a new information unit. • For more information about type 'typeNewInfoUnit', see 'Decoder Common Types'
position	Position in ISO format. • For more information about type 'ISOCoordinates', see 'Decoder Common Types'

Table 283: Decoder Output: "Mode-S"

Morse		
Changelog		
• **3.0.1** (24.1) – fixes call start and call end recognition in some edge cases • **3.0.0** (23.2) – added call and callsign recognition – added recognition of Q-Code, Z-Codes or arbitrary strings • **2.0.0** (22.2) – ported to Python • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Output Alphabet	Alphabet	Decoder output encoding. Possible Values: • Latin: L • Cyrillic: C
Detect Z-Codes	z_codes	Detect Z-Codes in morse text and remove or add spaces. A Z-Code consists of 3 characters starting with a Z and at least 2 of them are sent consecutively. E.g. "ZAA ZXY" or "ZFA ZXY ZZZ". "ZAA ZXY" within the string "ABZ A AZ X YS" would be detected and changed to "AB ZAA ZXY S" Possible Values: • On/Off
Verbose	verbose	If checked, prints output of timestamps per raw character on output channel text3. Possible Values: • On/Off
Q-Codes	q_codes	Detect arbitrary strings in morse text and remove or add spaces. There are some standardized codes mostly starting with a Q like QRZ. "QRZ" within the string "ABCQR ZXY" would be detected and changed to "ABC QRZ XY" Possible Values: List of strings without spaces.
Call detection strings	telegram_start_strings	Identifiers to search for a call start. DE is used often. Callsigns are sent alongside the identifier, sometimes repeated: CALLEE CALLEE CALLEE DE CALLER CALLER CALLER If there are small errors within a repeated callsign this is recognized and corrected. Possible Values: List of strings without spaces.

Call end detection strings	telegram_stop_strings	Identifiers to search for a call end. K ist used often. After a call end, a new call start is assumed. Possible Values: List of strings without spaces.
Additional Information		
None		

Decoder Output	
Decoder-Tag	**Description**
text1	Output of revised characters.
text2	Raw output of detected characters using configured alphabet.
text3	Single Characters with time with verbose is enabled.
character	Meta information for each character.
newInfoUnit	Marks the beginning of a new information unit. • For more information about type 'typeNewInfoUnit', see 'Decoder Common Types'
qcode	Detected Q-Code or arbitrary configured string/word.
telegram_end	Telegram end sequence with some meta information.
telegram_start	Telegram start sequence with caller and callee if available.
zcode	Detected Z-Code.

Table 284: Decoder Output: "Morse"

<table>
<tr><th colspan="3">NXDN</th></tr>
<tr><th colspan="3">Changelog</th></tr>
<tr><td colspan="3">
2.2.0 (24.1)
decryption of DES
decryption/decoding of RTCH trunking Radio System - Voice
2.1.0 (22.1)
full decoding of trunking repeater frames
2.0.0 (21.2)
ported to Python
1.1.0 (20.1)
added status channel
1.0.0
initial version
</td></tr>
<tr><th colspan="3">Decoder Parameters</th></tr>
<tr><th>Parameter</th><th>Variable Name</th><th>Description</th></tr>
<tr><td>Autodetect key</td><td>FindKey</td><td>Check for automatic key detection. If unchecked ("Off"), a key must be given in parameter “Decryption key”. Possible Values:
On/Off</td></tr>
<tr><td>Decryption key</td><td>DecryptionKey</td><td>Key used for decryption (decimal). Will only be used if parameter “Autodetect” is selected to “Off”.</td></tr>
<tr><th colspan="3">Additional Information</th></tr>
<tr><td colspan="3">None</td></tr>
<tr><th colspan="3">Decoder Output</th></tr>
<tr><th>Decoder-Tag</th><th colspan="2">Description</th></tr>
<tr><td>text1</td><td colspan="2">Complete protocol output.</td></tr>
<tr><td>text2</td><td colspan="2">Compact Output.</td></tr>
<tr><td>status</td><td colspan="2">Output channel for current status information.
For more information about type ‘status’, see ‘Decoder Common Types’</td></tr>
<tr><td>encryptionKey</td><td colspan="2">Encryption key in case of scramble mode encryption. Either manually set or automatically determined.</td></tr>
<tr><td>ifcEncryption</td><td colspan="2">Encryption mode. Interface encryption is disabled if value is ‘plain’. Otherwise interface is encrypted with the given algorithm. Possible values:
plain : unencrypted
scrambled : A pseudorandom binary sequence created by combining an XOR bitwise operation on the audio or data stream and a 15-bit LFRSR. Encryption key is used as default for the PN sequence.
DES : 64 bit block encryption cipher operating in OFB mode using a 56 bit key expressed in 64 bits with parity bits.
AES : 128 bit block encryption cipher operating in OFB mode using a 256 bit key.</td></tr>
</table>

Table 285: Decoder Output: “NXDN”

Null decoder		
Changelog		
• **2.1.0** (23.1) – added binary file output • **2.0.0** (20.2) – ported to Python • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output(default) • Off: Disable output
Additional Information		
About	**Description**	
Binary output	The decoder provides binary output to file of data bits (LSB first) after demodulation (no channel decoding).	
Decoder Output		
Decoder-Tag	**Description**	
text1	The decoder shows ones as X-es and zeros as dashes.	

Table 286: Decoder Output: "Null decoder"

PACTOR I/II/III		
Changelog		
• **2.0.0** (22.2) – ported to Python • **1.0.2** (21.2) – added binary output decoder parameter • **1.0.1** (20.2) – crc as XML tag • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Stop after connect	CallOnly	Select between two modes (*Pactor I only*). Possible Values: • "On" : Stop modem after initial addressing • "Off": complete decoding
File Output	FileOutput	Select for file output (*Pactor II only*). Possible Values: • "On" : XML + Binary Output • "Off": No Output Files
Binary file post-processing	EnableResultDLLOut	Enable Evaluation of binary file after processing (*Pactor II/III only*). Possible Values: • "On" : Enable • "Off": Disable
Air/Sailmail header parser	EnableCrawlerDLLOut	Enable Crawler Stream Output Air/Sailmal (*Pactor II/III only*). Possible Values: • "On" : Enable • "Off": Disable
Xdat output	EnableXMLOut	Enable XML output in production memory (*Pactor II/III only*). Possible Values: • "On" : Enable • "Off": Disable
Binary file output	StoreRawData	Enable binary output in production memory (*Pactor II/III only*). Possible Values: • "On" : Enable • "Off": Disable

Additional Information	
About	**Description**
Binary output	The decoder provides binary output to file of payload data (MSB first) after channel decoding.

Decoder Output	
Decoder-Tag	**Description**
text1	Standard output.
text3	This optional output contains text evaluations of AirMail or SailMail headers. It will also contain paths of produced output files.
text4	This channel contains error and warning messages related to AirMail/SailMail postprocessing results.
crc	This output contains the user group's specific hexadecimal CRC-value.

Table 287: Decoder Output: "PACTOR I/II/III"

PACTOR-4
Changelog
• **2.0.0** (23.1) – ported to Python • **1.0.1** (20.2) – crc as XML tag • **1.0.0** (16.2) – initial version
Decoder Parameters

Parameter	Variable Name	Description
Binary file post-processing	EnableResultDLLOut	Enable Evaluation of binary file after processing. Possible Values: • "On" : Enable • "Off": Disable
Air/Sailmail header parser	EnableCrawlerDLLOut	Enable Crawler Stream Output Air/Sailmal. Possible Values: • "On" : Enable • "Off": Disable
Force ASCII alphabet	ForceASCII	Enable forcing ASCII output encoding. Possible Values: • "On" : Enable • "Off": Disable
Xdat output	EnableXMLOut	Enable XML output in production memory. Possible Values: • "On" : Enable • "Off": Disable
Binary file output	StoreRawData	Enable binary output in production memory. Possible Values: • "On" : Enable • "Off": Disable

Additional Information
None
Decoder Output

Decoder-Tag	Description
text1	This output contains only CRC-proved and repetition-eliminated payload contents.
text2	This output contains the output of each processed burst containing correct or faulty check-sums, repetitions, internal meta information etc.
text3	This optional output contains text evaluations of AirMail and SailMail headers. It will also contain paths of produced output files.
text4	This channel contains error and warning messages related to AirMail/SailMail evaluations.
crc	This output contains the user group's specific hexadecimal CRC-value.

Table 288: Decoder Output: "PACTOR-4"

<table>
<tr><th colspan="2">POCSAG</th></tr>
<tr><th colspan="2">Changelog</th></tr>
<tr><td colspan="2">2.0.1 (21.1)
added XML tag address
2.0.0 (20.2)
ported to Python
added status channel
1.0.0
initial version</td></tr>
<tr><th colspan="2">Decoder Parameters</th></tr>
<tr><td colspan="2">None</td></tr>
<tr><th colspan="2">Additional Information</th></tr>
<tr><td colspan="2">None</td></tr>
<tr><th colspan="2">Decoder Output</th></tr>
<tr><th>Decoder-Tag</th><th>Description</th></tr>
<tr><td>text1</td><td>Default output channel. Output as alphanumerical or numerical content. Switches automatically to alphanumerical output for some non-standard emissions.</td></tr>
<tr><td>text2</td><td>Output as alphanumerical or numerical content depending on the protocol specification.</td></tr>
<tr><td>status</td><td>Output channel for current status information about address and mode.
For more information about type ‘status’, see ‘Decoder Common Types’</td></tr>
<tr><td>address</td><td>Address of recipient (origin = dest). RIC - Radio Identity Code or CAP code - Channel Access Protocol code which is the unique ID code assigned to a particular pager. There can be multiple addresses in one emission/production.</td></tr>
</table>

Table 289: Decoder Output: “POCSAG”

Packet
Changelog
• **2.0.1** (22.2) – removed decoder parameter Descrambler, automatically descramble if symbol rate is 9600 Bd • **2.0.0** (20.2) – ported to Python – unified packet300 and packet9600 decoders – output of frame timestamp • **2.0.0** (19.2) – added XML tags for metadata (packet300) • **1.0.0** – initial version
Decoder Parameters

Parameter	Variable Name	Description
Suppress invalid CRC	valid_crc_only	Suppress output of frames with invalid CRC. Possible Values: • “On” : Suppress invalid CRC output frames. • “Off": Do not suppress invalid CRC output frames.

Additional Information
None
Decoder Output

Decoder-Tag	Description
text1	Output channel 1.
text16	Output of payload as hex
callSign	CallSign of sender (origin = src) or recipient (origin = dest). Note: callSign is only emitted if CRC is OK.
crc	Indicates if cyclic redundancy check (CRC) was successful for current output frame Note: There is a decoder parameter to suppress the output of invalid CRC frames. • For more information about type ‘type_crc’, see ‘Decoder Common Types’

Table 290: Decoder Output: “Packet”

Panther-H
Changelog
• **2.0.0** (21.2) – ported to Python – added binary output decoder parameter • **1.0.0** – initial version
Decoder Parameters

Parameter	Variable Name	Description
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output • Off: Disable output

Additional Information

About	Description
Binary output	The decoder provides binary output to file of data bits after demodulation (no channel decoding).

Decoder Output

Decoder-Tag	Description
text1	Default output channel.

Table 291: Decoder Output: "Panther-H"

Period Detector Template		
Changelog		
• **2.0.0** (20.2) – ported to Python • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Pattern length [bits]	PatternLen	The length of the sequence (in bits) which will be found repeated
Period Length [bits]	PeriodLen	The repetition period (in bits) for this sequence
Pattern Repeats	Repeats	The number of repetitions, which must be observed for a detection
Tolerance [bits]	MaxFaults	The maximum total number of faulty bits, which shall be accepted for detection. Period length: The repetition period (in bits) for this sequence
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output (default) • Off: Disable output

Additional Information	
About	**Description**
Binary output	The decoder provides binary output to file of payload data (MSB first).
Decoder Output	
Decoder-Tag	**Description**
text1	Timestamp at which pattern was found

Table 292: Decoder Output: "Period Detector Template"

<table>
<tr><th colspan="3">Robust Packet</th></tr>
<tr><th colspan="3">Changelog</th></tr>
<tr><td colspan="3">2.0.1 (22.2)
fixed binary output
2.0.0 (21.2)
ported to Python
added binary file output
1.0.0 (20.1)
initial version</td></tr>
<tr><th colspan="3">Decoder Parameters</th></tr>
<tr><th>Parameter</th><th>Variable Name</th><th>Description</th></tr>
<tr><td>Store raw result</td><td>StoreRawData</td><td>Store data in binary file.
Possible Values:
On: Enable output
Off: Disable output</td></tr>
<tr><th colspan="3">Additional Information</th></tr>
<tr><th>About</th><th colspan="2">Description</th></tr>
<tr><td>Binary output</td><td colspan="2">The decoder provides binary output to file of payload data (LSB first) after channel decoding (Viterbi).</td></tr>
<tr><th colspan="3">Decoder Output</th></tr>
<tr><th>Decoder-Tag</th><th colspan="2">Description</th></tr>
<tr><td>text1</td><td colspan="2">Default output channel.</td></tr>
</table>

Table 293: Decoder Output: "Robust Packet"

STANAG 4197		
Changelog		
• **2.0.1** (22.2) – fixed binary output • **2.0.0** (21.2) – ported to Python – added raw binary file output • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Store raw result	StoreRawData	Store raw data in binary file. Possible Values: • On: Enable output • Off: Disable output
Store vocal result	StoreVocalData	Store vocal data in binary file. Possible Values: • On: Enable output • Off: Disable output

Additional Information	
About	**Description**
Binary output	There are two types of binary output: • Raw data – data bits after demodulation (no channel decoding) • Vocal data – 7 bytes per voice frame – bytes little endian – 3 null frames are inserted between bursts Note: One binary file may contain data of multiple bursts.
Decoder Output	
Decoder-Tag	**Description**
text16	Output of payload as hex (7 bytes per voice frame)
status	Output channel for current decoding status. • For more information about type 'status', see 'Decoder Common Types'

Table 294: Decoder Output: "STANAG 4197"

STANAG 4285/4529		
Changelog		
• **3.1.1** (24.1) – EOM detection • **3.1.0** (23.2) – added detection of KW-46 synchronization sequence • **3.0.1** (22.2) – use PrettyBitFormatter for hex output • **3.0.0** (21.2) – ported to Python – added processing of uncoded modes (no automatic detection) – added decoding of 8 bit synchron mode (no automatic detection) – allow optional custom alphabet • **2.1.0** (20.1) – automatic mode search improved and increased error limit • **2.0.0** (19.2) – added XML tags for metadata • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Rate / interleaving	ModePara	Determine bitrate and interleaving mode (short/long)) Possible Values: • automatic (coded only): 0 • 75 bps short: 75 • 150 bps short: 150 • 300 bps short: 300 • 600 bps short: 600 • 1200 bps short: 1200 • 2400 bps short: 2400 • 75 bps long: 10075 • 150 bps long: 10150 • 300 bps long: 10300 • 600 bps long: 10600 • 1200 bps long: 11200 • 2400 bps long: 12400 • 1200 bps uncoded: 21200 • 2400 bps uncoded: 22400 • 3600 bps uncoded: 23600

Alphabet / framing	CodePara	Select alphabet/framing in use. Possible Values: • automatic: 0 • ITA2 5N1: 511 • ITA2 5N2: 512 • ITA5 (ASCII) 7N1: 711 • ITA5 (ASCII) 7N2: 712 • ITA5 (ASCII) 8N1: 811 • ITA5 (ASCII) 8N2: 812 • ITA5 (ASCII) 7N0 (no automatic detection): 700 • SYNC 8 bit (no automatic detection):800 Explanation: (e.g. *5N1*) • 5=5 DataBits • N=No ParityBit • 1=1 StopBit
Decode Stanag 5066	Enable5066	Enables decoding of Stanag 5066. Possible Values: • "On" : Enable decoding • "Off" : Disable decoding
Detect KG84	EnableKG84	Enables detection of KG-84. Possible Values: • "On" : Enable detection • "Off" : Disable detection
Detect KW-46	EnableKW46	Enables detection of KW-46. Possible Values: • "On" : Enable detection • "Off" : Disable detection
Custom ITA2 alphabet	Alphabet_ITA2	Define your own ITA2 alphabet in a 'custom.dict' file (located in decoders subfolder). Specify name of alphabet here which should be identical to your dict file. For details see ita2lower.dict in decoders subfolder of installation.
Custom ITA5 alphabet	Alphabet_ITA5	Define your own ITA5 alphabet in a 'custom.dict' file (located in decoders subfolder). Specify name of alphabet here which should be identical to your dict file. For details see ita2lower.dict in decoders subfolder of installation.

Codec for 8 bit	codec_8bit	In case of a 8 bit code (ITA5_8N1, ITA5_8N2, SYNC8) this specifies the codec (alphabet/codepage) to be used for decoding. Only 8 bit codecs are supported! Default: latin1 Possible Values: • "latin1" • "iso-8859-8" • "cyrillic" • "windows-1250" • etc. A list of possible codecs are described here
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output • Off: Disable output

Additional Information	
About	**Description**
Binary output	The decoder provides binary output to file of payload data (MSB first) after channel decoding (Viterbi).

Decoder Output	
Decoder-Tag	**Description**
text1	Standard output or complete STANAG 5066 protocol (if found)
text2	STANAG 5066 Messages (if found)
text3	KG-84 Output (if found) and KW-46 detection
text16	Output of payload as hex (MSB first) and ascii (hex editor like)
status	Output channel for current status information about detected bit rate, interleaving and alphabet • For more information about type 'status', see 'Decoder Common Types'
alphabet	Found and applied alphabet.
dataRate	Data rate in bits per second. 3600, 2400, 1200, 600, 300, 150, 75 for Stanag 4285 1200, 600, 300, 150, 75 for Stanag 4529
interleaving	Interleaving mode.
eom	End of message (EOM) signature detected • For more information about type 'type_eom', see 'Decoder Common Types'
kg84	Decoder Tag describing KG-84 output. • header - detected sync sequence • group1 - 32 byte of first group • group2 - 32 byte of second group • reserved- 1 byte of reserved data • data - data in hexadecimal • eom - cause of KG-84-eom

Table 295: Decoder Output: "STANAG 4285/4529"

STANAG 4415		
Changelog		
• **2.1.1** (24.1) – EOM detection • **2.1.0** (23.2) – added detection of KW-46 synchronization sequence • **2.0.0** (22.2) – ported to Python – manual setting of alphabet – allow optional custom alphabet • **1.1.1** (21.2) – added binary output decoder parameter • **1.1.0** (20.1) – added status channel • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Alphabet / framing	CodePara	Select alphabet/framing in use. Possible Values: • automatic: 0 • ITA2 5N1: 511 • ITA2 5N2: 512 • ITA5 (ASCII) 7N1: 711 • ITA5 (ASCII) 7N2: 712 • ITA5 (ASCII) 8N1: 811 • ITA5 (ASCII) 8N2: 812 • ITA5 (ASCII) 7N0 (no automatic detection): 700 • SYNC 8 bit (no automatic detection): 800 Explanation: (e.g. *5N1*) • 5=5 DataBits • N=No ParityBit • 1=1 StopBit
Decode Stanag 5066	Enable5066	Enables decoding of Stanag 5066. Possible Values: • "On" : Enable decoding • "Off" : Disable decoding
Custom ITA2 alphabet	Alphabet_ITA2	Define your own ITA2 alphabet in a 'custom.dict' file (located in decoders subfolder). Specify name of alphabet here which should be identical to your dict file. For details see ita2lower.dict in decoders subfolder of installation.

Custom ITA5 alphabet	Alphabet_ITA5	Define your own ITA5 alphabet in a 'custom.dict' file (located in decoders subfolder). Specify name of alphabet here which should be identical to your dict file. For details see ita2lower.dict in decoders subfolder of installation.
Codec for 8 bit	codec_8bit	In case of a 8 bit code (ITA5_8N1, ITA5_8N2, SYNC8) this specifies the codec (alphabet/codepage) to be used for decoding. Only 8 bit codecs are supported! Default: latin1 Possible Values: • "latin1" • "iso-8859-8" • "cyrillic" • "windows-1250" • etc. A list of possible codecs are described here
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output • Off: Disable output

Additional Information	
About	**Description**
Binary output	The decoder provides binary output to file of payload data (MSB first) after channel decoding (Viterbi).

Decoder Output	
Decoder-Tag	**Description**
text1	Standard output or complete STANAG 5066 protocol (if found)
text2	STANAG 5066 Messages (if found)
text16	Output of payload as hex (MSB first) and ascii (hex editor like)
status	Output channel for current status information about detected bit rate, interleaving and alphabet • For more information about type 'status', see 'Decoder Common Types'
alphabet	Found and applied alphabet.
dataRate	Data rate in bits per second.
interleaving	Interleaving mode.
eom	End of message (EOM) signature detected • For more information about type 'type_eom', see 'Decoder Common Types'

Table 296: Decoder Output: "STANAG 4415"

STANAG 4481 FSK		
Changelog		
• **2.1.0** (23.2) – added detection of KW-46 synchronisation sequence • **2.0.1** (22.2) – fixed binary output • **2.0.0** (21.2) – ported to Python – added decoder parameters for ASCII codec and alphabets – added XML tag for alphabet – added binary file output – added status output • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
KG-84 detection only	KG84Only	If enabled, this decoder will act like a KG-84 encrypted data detector. Any other functionality will be disabled. Possible Values: • "On" : KG-84 detection only • "Off" : Full decoder functionality (incl. KG-84 detection)
ASCII Codec	codec	Specify codec (alphabet/codepage) to be applied to decode the ASCII 8 bit data. Only 8 bit codecs are supported! Examples are: cyrillic, iso-8859-8, cp866, windows-1250. Default: latin (iso-8859-1) A list of possible codecs are described here
Custom ITA2 alphabet	Alphabet_ITA2	Define your own ITA2 alphabet in a 'custom.dict' file (located in decoders subfolder). Specify name of alphabet here which should be identical to your dict file. For details see ita2lower.dict in decoders subfolder of installation.
Custom ITA5 alphabet	Alphabet_ITA5	Define your own ITA5 alphabet in a 'custom.dict' file (located in decoders subfolder). Specify name of alphabet here which should be identical to your dict file. For details see ita2lower.dict in decoders subfolder of installation.
Store raw result	StoreRawData	Store raw data in binary file. Possible Values: • On: Enable output • Off: Disable output
Additional Information		
About	**Description**	

Binary output	The decoder provides binary output to file of raw data (MSB first) after demodulation (no channel decoding). In case of KG-84 there is no binary output (see XML output for KG-84 data).
Decoder Output	
Decoder-Tag	**Description**
text1	ASCII output with codec.
text2	Output of KG-84 data
status	Status output of currently used alphabet or if KG-84 was found. • For more information about type 'status', see 'Decoder Common Types'
alphabet	Found and applied alphabet.
eom	Decoder Tag stating that end of message has been reached.
kg84	Decoder Tag describing KG-84 output. Note: 'Found' is displayed everytime this tag is displayed. All remaining XML subtags are only shown, if KG-84 header was found.Possible values: • Found • Header • Groups • Reserved • Data

Table 297: Decoder Output: "STANAG 4481 FSK"

STANAG 4539		
Changelog		
• **2.1.1** (24.1) – EOM detection • **2.1.0** (23.2) – added detection of KW-46 synchronisation sequence • **2.0.0** (23.1) – ported to Python – manual setting of alphabet – allow optional custom alphabet • **1.1.1** (21.2) – added binary file output • **1.1.0** (20.1) – added status channel • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Alphabet / framing	CodePara	Select alphabet/framing in use. Possible Values: • automatic: 0 • ITA2 5N1: 511 • ITA2 5N2: 512 • ITA5 (ASCII) 7N1: 711 • ITA5 (ASCII) 7N2: 712 • ITA5 (ASCII) 8N1: 811 • ITA5 (ASCII) 8N2: 812 • ITA5 (ASCII) 7N0 (no automatic detection): 700 • SYNC 8 bit (no automatic detection):800 Explanation: (e.g. *5N1*) • 5=5 DataBits • N=No ParityBit • 1=1 StopBit
Decode Stanag 5066	Enable5066	Enables decoding of Stanag 5066. Possible Values: • "On" : Enable decoding • "Off" : Disable decoding
Custom ITA2 alphabet	Alphabet_ITA2	Define your own ITA2 alphabet in a 'custom.dict' file (located in decoders subfolder). Specify name of alphabet here which should be identical to your dict file. For details see ita2lower.dict in decoders subfolder of installation.

Custom ITA5 alphabet	Alphabet_ITA5	Define your own ITA5 alphabet in a 'custom.dict' file (located in decoders subfolder). Specify name of alphabet here which should be identical to your dict file. For details see ita2lower.dict in decoders subfolder of installation.
Codec for 8 bit	codec_8bit	In case of a 8 bit code (ITA5_8N1, ITA5_8N2, SYNC8) this specifies the codec (alphabet/codepage) to be used for decoding. Only 8 bit codecs are supported! Default: latin1 Possible Values: • "latin1" • "iso-8859-8" • "cyrillic" • "windows-1250" • etc. A list of possible codecs are described here
Detect KW-46	kw46_detection	Enables detection of KW-46. Possible Values: • "On" : Enable detection • "Off" : Disable detection
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output • Off: Disable output

Additional Information	
About	**Description**
Binary output	The decoder provides binary output to file of payload data (MSB first) after channel decoding (Viterbi).

Decoder Output	
Decoder-Tag	**Description**
text1	Standard output or complete STANAG 5066 protocol (if found)
text2	STANAG 5066 Messages (if found)
text16	Output of payload as hex (MSB first) and ascii (hex editor like)
status	Output channel for current status information about detected bit rate, interleaving, alphabet and KW-46 encryption. • For more information about type 'status', see 'Decoder Common Types'
alphabet	Found and applied alphabet.
dataRate	Data rate in bits per second.
interleaving	Interleaving mode.
eom	End of message (EOM) signature detected • For more information about type 'type_eom', see 'Decoder Common Types'

Table 298: Decoder Output: "STANAG 4539"

STANAG 4539 HDR		
Changelog		
• **2.0.1** (24.1) – EOM detection • **2.0.0** (23.1) – ported to Python – decoding of STANAG5066 layer (if present) – decoding of 6400, 8000, 9600 and 12800 bps modes (QAM) – manual setting of alphabet – allow optional custom alphabet • **1.1.1** (21.2) – added binary output decoder parameter • **1.1.0** (20.1) – added status channel • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Alphabet / framing	CodePara	Select alphabet/framing in use. Possible Values: • automatic: 0 • ITA2 5N1: 511 • ITA2 5N2: 512 • ITA5 (ASCII) 7N1: 711 • ITA5 (ASCII) 7N2: 712 • ITA5 (ASCII) 8N1: 811 • ITA5 (ASCII) 8N2: 812 • ITA5 (ASCII) 7N0 (no automatic detection): 700 • SYNC 8 bit (no automatic detection):800 Explanation: (e.g. *5N1*) • 5=5 DataBits • N=No ParityBit • 1=1 StopBit
Decode Stanag 5066	Enable5066	Enables decoding of Stanag 5066. Possible Values: • "On" : Enable decoding • "Off" : Disable decoding
Custom ITA2 alphabet	Alphabet_ITA2	Define your own ITA2 alphabet in a 'custom.dict' file (located in decoders subfolder). Specify name of alphabet here which should be identical to your dict file. For details see ita2lower.dict in decoders subfolder of installation.

Custom ITA5 alphabet	Alphabet_ITA5	Define your own ITA5 alphabet in a 'custom.dict' file (located in decoders subfolder). Specify name of alphabet here which should be identical to your dict file. For details see ita2lower.dict in decoders subfolder of installation.
Codec for 8 bit	codec_8bit	In case of a 8 bit code (ITA5_8N1, ITA5_8N2, SYNC8) this specifies the codec (alphabet/codepage) to be used for decoding. Only 8 bit codecs are supported! Default: latin1 Possible Values: • "latin1" • "iso-8859-8" • "cyrillic" • "windows-1250" • etc. A list of possible codecs are described here
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output • Off: Disable output

Additional Information	
About	**Description**
Binary output	The decoder provides binary output to file of payload data (MSB first) after channel decoding (Viterbi).
Decoder Output	
Decoder-Tag	**Description**
text1	Standard output or complete STANAG 5066 protocol (if found)
text2	STANAG 5066 Messages (if found)
text16	Output of payload as hex (MSB first) and ascii (hex editor like)
status	Output channel for current status information about detected bit rate, interleaving and alphabet • For more information about type 'status', see 'Decoder Common Types'
alphabet	Found and applied alphabet.
dataRate	Data rate in bits per second.
interleaving	Interleaving mode.
eom	End of message (EOM) signature detected • For more information about type 'type_eom', see 'Decoder Common Types'

Table 299: Decoder Output: "STANAG 4539 HDR"

STANAG 5065 (FSK)		
Changelog		
• **2.1.0** (23.2) – added detection of KW46 synchronisation sequence • **2.0.0** (23.1) – ported to Python • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Use ASCII alphabet	UseASCII	Switch between ASCII (ITA5) or Baudot (ITA2) alphabet. Possible Values: • "1" : ASCII ITA5 (7 bit) • "0" : Baudot ITA2 (5 bit)
Additional Information		
About	**Description**	
Binary output	The decoder provides binary output to file of payload data (MSB first) after removal of frame synchronization (start/stop bits).	
Decoder Output		
Decoder-Tag	**Description**	
text1	Default output channel.	
text16	Output of payload as hex (MSB first) and ascii (hex editor like)	

Table 300: Decoder Output: "STANAG 5065 (FSK)"

STANAG 5511 SLEW		
Changelog		
• **2.0.0** (21.2) – ported to Python – added XML tags – added binary file output • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Store raw result	StoreRaw-Data	Store data in binary file. Possible Values: • On: Enable output • Off: Disable output

Additional Information	
About	**Description**
Binary output	The decoder provides binary output to file of data (header and CDS data) after channel decoding (bytes with MSB first). A new binary file is created at new production start. Note: One binary file may contain data of multiple bursts.
Decoder Output	
Decoder-Tag	**Description**
text1	Default output channel.
Address	Picket Address (Octal).
EOM	Decoder Tag stating that end of message has been reached.
MessageType	Type of message.

Table 301: Decoder Output: "STANAG 5511 SLEW"

Smartnet		
Changelog		
• **2.0.0** (20.2) – ported to Python • **1.0.0** (17.2) – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Parsed code output	ParsedDataOut	Enables parsed code output. Possible Values: • "On" : Enable parsed code output. • "Off" : Disable parsed code output.
Filter repetions of status	FilterRepStat	Status messages are frequently received in this protocol. Enabling this parameter will filter out redundant (unchanged) status messages. Possible Values: • "On" : Enable filtering • "Off" : Disable filtering
Raw code output	RawDataOut	If activated, raw data output (Hex format) will be put on according output channel. Possible Values: • "On" : Enable output • "Off" : Disable output
Additional Information		
None		

Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1. Parsed commands in textform.
text2	Output channel 2. Commands as raw data. Each command consists of a command value (10bit hex), a group/individual flag (G/I) and a subscriber ID (16bit hex).

Table 302: Decoder Output: "Smartnet"

Symbols decoder	
Changelog	
• 1.0.0 – initial version	
Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel of bit stream.

Table 303: Decoder Output: "Symbols decoder"

TETRA		
Changelog		

- **3.1.2** (24.1)
  - evaluation of Motorola LRRP location protocol
- **3.1.1** (23.2)
  - added decoder parameter Min. period voice gap′
  - added XML tagcommunicationType′
  - renamed XML tag commType′ toslotType′
- **3.1.0** (22.1)
  - Added decryption (TEA1, TEA3, TEA4) with provided key (SCK/DCK/CCK/MGCK)
- **3.0.0** (21.2)
  - decoder ported to Python
- **2.1.1** (21.1)
  - added LA to status channel
- **2.1.0** (20.1)
  - added status channel
  - faster detection
- **2.0.0** (19.2)
  - added XML tags for metadata
- **1.0.0**
  - initial version

Decoder Parameters

Parameter	Variable Name	Description
Decryption	TEA	Choose between three decryption algorithms. “Off” assumes data to be not encrypted. Setting a decryption algorithm will presume a valid key entered in parameter “SCK/DCK/CCK/MGCK”, which will then be used for decryption. Possible Values: • Off: 0 • TEA1: 1 • TEA3: 3 • TEA4: 4
Decrypt SSI	DecryAdr	Enable if separate decryption of SSI is desired. This is not necessary for decryption of voice/data. **Attention:** Decryption of SSI is very CPU and memory intensive and so, in general, it is recommded to disable it. Possible Values: • Checked (1) • Not checked(0)

SCK/DCK/CCK/MGCK	Key	Hexadecimal key value used for decryption. Key length is 80 bit. The type of key (SCK/DCK/CCK/MGCK) depends on the type of TETRA network. For securityClass 2 with static keys enter SCK otherwise DCK, CCK or MGCK. • SCK: Static Cipher Key (securityClass 2 with static keys) • DCK: Dynamic Cipher Key (securityClass 3 with dynamic keys) • CCK: Common Cipher Key (securityClass 3 with dynamic keys) • MGCK: Modified Group Cipher Key (securityClass 3 with dynamic keys) For details see document ETSI EN 300 392-7. Possible Values (hexadecimal input): • positive 80 bit range
Min. period voice gap [ms]	FillGap	If a speaking pause exceeds this value then the voice recording will be split into several files. Otherwise the gap will be filled with silence. Default: 5400ms
Additional Information		
None		
Decoder Output		

Decoder-Tag	**Description**
text1	Output channel 1.
text4	Frame number output.
status	Output channel for current status information, e.g. MCC:288 MNC:8889 CC:1 LA: 101 • For more information about type ‘status’, see ‘Decoder Common Types’
burstType	Type of the received burst.
callID	Call identifier.
callingSSI	SSI of the calling party
callingSSIExtInfo	Identification extension of the calling party.
callingSSIType	Address type of the calling party. • Output in *Tetra* modem only. Possible values: • **0** : Reserved • **1** : SSI • **2** : TSI • **3** : Reserved

channel	Timeslot, channel of a TETRA radio cell.(for data transfers allocation of multiple channels by same user is supported). Used for display of allocated channel by a mobile station. • Output in *Tetra* modem only. Possible values: • **0** - **3**
colorCode	Colour Code. Unique code of a single TETRA radio cell.
communicationType	Type of communication: • Output in *Tetra* modem only. Possible values: • **0** : Point-to-point • **1** : Point-to-multipoint • **2** : Point-to-multipoint Acknowledged • **3** : Broadcast
dataType	Type of the transmitted data. • Output in *Tetra* modem only. Possible values: • **0** : voice • **1** : data
disconnectCause	The disconnect cause information element shall inform the MS or the infrastructure of the reason for the release/disconnection.
e2eEncryption	End-to-end encryption flag. Possible values: • **0** : unencrypted • **1** : encrypted
frequency	Frequency assignment for a mobile station.
granted	The transmission grant information element shall inform the MS about permission to transmit. • Output in *Tetra* modem only. Possible values: • **0** : Transmission granted • **1** : Transmission not granted • **2** : Transmission request queued • **3** : Transmission granted to another user
hookMethod	Type of the connection. • Output in *Tetra* modem only. Possible values: • **0** : no hook signaling • **1** : hook on/off signaling
ifcEncryption	Encryption mode. Interface encryption is disabled if value is 'plain'. Otherwise interface is encrypted. Possible values: • **plain** : unencrypted • **mode 2** : encrypted, encryption mode element has value 2 (This is not identical to security class or TEA!) • **mode 3** : encrypted, encryption mode element has value 3 (This is not identical to security class or TEA!)

locArea	Location area: an area within a TETRA network that may comprise one, several or all cells. An MS may move freely without re-registering within a location area. An MS has continuity of service within a location area. A location area is geographically static.
mainCarrier	Main carrier.
mcc	Mobile Country Code. Country code within the TETRA network.
mnc	Mobile Network Code. Network code within the TETRA network.
pduType	PDU type.
powerControl	Control of the transmission power +- 5 dBm steps. • Output in *Tetra* modem only. Possible values: • **0** - **15**
protocolType	Type of the protocol data unit. Output e.g. : • D-Setup, D-Connect, D-Disconnect, D-Release, U-Setup. ...
serviceLevel	The cell service level information element shall define the level of service a MS may receive in a cell as defined in. • Output in *Tetra* modem only. Possible values: • **0** : Cell load unknown • **1** : Low cell load • **2** : Medium cell load • **3** : High cell load
slotType	Indicates type allocated connection. • Output in *Tetra* modem only. Possible values: • **0** : Reserved • **1** : Downlink only • **2** : Uplink only • **3** : Both Uplink and Downlink
ssi	Short Subscriber Identity. ID of a called party on a down-Link.
ssiExtInfo	Additional SSI information e.g. sender, receipient, group, ...
ssiType	Address type. Possible values: • **0** : Null PDU • **1** : SSI • **2** : Event Label • **3** : USSI • **4** : SMI • **5** : SSI + Event Label • **6** : SSI + Usage Marker • **7** : SMI + Event Label

ssiUsageMarker	Usage Marker. Additional short identifier for a called party with the TETRA network. • Output in *Tetra* modem only. Possible values: • **0** - **63**
time	Timestamp of the decoder.
transmissionMode	Type of the connection (simplex/duplex). Possible values: • **0** : simplex • **1** : duplex

Table 304: Decoder Output: "TETRA"

TETRA DMO

Changelog

- **3.1.2** (24.1)
  - evaluation of Motorola LRRP location protocol
- **3.1.1** (22.2)
  - automatically retrieve carrier frequency for decryption
- **3.1.0** (22.1)
  - Added decryption of DM-2A, DM-2B, DM-2C (TEA1, TEA3, TEA4) with provided key
- **3.0.0** (21.2)
  - recognize communication type (normal/repeater/gateway)
  - decoder ported to Python
- **2.1.0** (20.1)
  - added status channel
- **2.0.0** (19.2)
  - added XML tags for metadata
- **1.0.0**
  - initial version

Decoder Parameters

Parameter	Variable Name	Description
Decryption on	EncryOn	Enable if decryption is desired. The key of the corresponding key number will then be used for decryption. If no key is set for the required key number then the default key is applied. Possible Values: • Checked (1) • Not checked(0)
Automatic carrier setting	AutoCarrier	Enable automatic retrieval of carrier frequency from input signal. Carrier frequency must then be given. Possible Values: • Checked (1) • Not checked(0)
Carrier frequency (kHz)	CarrierFreq	Carrier frequency (in kHz) of emission. Only used when 'Automatic carrier setting ' is disabled.
Default key (hex)	Default_Key	This is used when no key is given for the required key number. Possible Values (hexadecimal input): • positive 80 bit range
Key number A (0-31)	KeyNo_0	Key number for slot A Possible Values: • 0..31
Key A (hex)	SCK_0	Key for slot A Possible Values (hexadecimal input): • positive 80 bit range
Key number B (0-31)	KeyNo_1	Key number for slot B Possible Values: • 0..31

Key B (hex)	SCK_1	Key for slot B Possible Values (hexadecimal input): • positive 80 bit range
Key number C (0-31)	KeyNo_2	Key number for slot C Possible Values: • 0..31
Key C (hex)	SCK_2	Key for slot A Possible Values (hexadecimal input): • positive 80 bit range
Key number D (0-31)	KeyNo_3	Key number for slot D Possible Values: • 0..31
Key D (hex)	SCK_3	Key for slot D Possible Values (hexadecimal input): • positive 80 bit range
Additional Information		
None		

Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1.
text4	Frame number output.
status	Output channel for current status information, e.g. MCC:288 MNC:8889 • For more information about type 'status', see 'Decoder Common Types'
callType	Call type.
callingSSI	SSI of the calling party
commType	Type of DMO communication. Possible values: • **normal** : direct connection between two communication partners • **repeater** : A repeater acts as an intermediate amplifier to increase the range. Comparable to an analogue relais station. • **gateway** : Enables communication with the control centre from a point from which there is no TMO connection possible
destSSI	Destination SSI.
encrAlgorithm	Tetra Encryption Algorithm Possible values: • **1** : for commercial use in EU • **2** : restricted to European public safety organisations • **3** : authorities in third countries outside EU • **4** : for commercial use in third countries outside EU
gatewayAddr	Gateway address (only available if 'commType' is 'gateway').

ifcEncryption	Encryption mode. Interface encryption is disabled if value is 'plain'. Otherwise interface is encrypted. Possible values: • **plain** : unencrypted • **mode 1** : encrypted, encryption mode element has value 1 (This is not identical to security class or TEA!) • **mode 2** : encrypted, encryption mode element has value 2 (This is not identical to security class or TEA!) • **mode 3** : encrypted, encryption mode element has value 3 (This is not identical to security class or TEA!)
mcc	Mobile Country Code. Country code within the TETRA DMO network.
messageType	Type of the received burst.
mnc	Mobile Network Code. Network code within the TETRA DMO network.
pduType	PDU type.
repeaterAddr	Repeater address (only available if 'commType' is 'repeater').
srcSSI	Source SSI.
time	Timestamp of the decoder. • complies with ISO 8601.

Table 305: Decoder Output: "TETRA DMO"

TETRA SDS	
Changelog	
• **3.0.1** (24.1) – evaluation of Motorola LRRP location protocol • **3.0.0** (21.2) – initial version	
Decoder Parameters	
None	
Additional Information	
About	**Description**
Decoder Tags	This document shows all SDS related tags for the *TETRA* modems.
Decoder Output	
Decoder-Tag	**Description**
status	SDS status.
altitude	Altitude in meters.
data	SDS data.
messRef	SDS message reference.
position	Position in ISO format. • For more information about type 'ISOCoordinates', see 'Decoder Common Types'
protID	SDS protocol identifier.
report	Short report type information element shall indicate the reason for report [29.4.3.11]
text	SDS text.

Table 306: Decoder Output: "TETRA SDS"

TETRA Uplink		
Changelog		
• **3.0.2** (24.1) – evaluation of Motorola LRRP location protocol • **3.0.1** (23.1) – added decoder parameter MarkSSI • **3.0.0** (21.2) – decoder ported to Python – SDS and GPS output • **2.2.0** (20.2) – added SSI to status channel • **2.1.0** (20.1) – added status channel • **2.0.0** (19.2) – added XML tags for metadata • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Country Code (MCC)	MCC	The Mobile Country Code of the network (e.g. 262 for Germany). Possible Values: • 0 . . . 1023
Network Code (MNC)	MNC	The Mobile Network Code, identifying the TETRA network. Possible Values: • 0 . . . 16383
Base Sation Colour Code	ColourCode	A code identifying the receiving base station. Possible Values: • 0 . . . 63
Autom. Colour Code Detection	SearchColourCode	If activated, the decoder will try all possible colourcodes to find a valid result. Possible Values: • On/Off
Mark SSI-Units	MarkSSI	If activated, the decoder will mark each burst containing the MAC-Headers of "MAC-ACCESS" and "MAC-DATA" as a new information unit. These headers contain an unencrypted or statically encrypted SSI. Possible Values: • On/Off
Additional Information		
None		

Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1.

text4	Frame number output.
status	Output channel for current status information, e.g. MCC:288 MNC:8889 CC:1 SSI:645 • For more information about type 'status', see 'Decoder Common Types'
callID	Call identifier.
colorCode	Colour Code. Unique code of a single TETRA radio cell.
encrAlgorithm	Tetra Encryption Algorithm Possible values: • **1** : for commercial use in EU • **2** : restricted to European public safety organisations • **3** : authorities in third countries outside EU • **4** : for commercial use in third countries outside EU
ifcEncryption	Encryption mode. Interface encryption is disabled if value is 'plain'. Otherwise interface is encrypted. Possible values: • **plain** : unencrypted • **mode1** : encrypted, encryption mode element has value 1 (This is not identical to security class or TEA!) • **mode2** : encrypted, encryption mode element has value 2 (This is not identical to security class or TEA!) • **mode3** : encrypted, encryption mode element has value 3 (This is not identical to security class or TEA!)
mcc	Mobile Country Code. Country code within the TETRA network.
mnc	Mobile Network Code. Network code within the TETRA network.
newInfoUnit	If decoder parameter *Mark SSI-Units* is enabled then each burst containing the MAC-Headers of "MAC-ACCESS" and "MAC-DATA" will be marked as a new information unit. • For more information about type 'typeNewInfoUnit', see 'Decoder Common Types'
pduType	PDU type.
protocolType	Type of the protocol data unit. Output e.g. : • D-Setup, D-Connect, D-Disconnect, D-Release, U-Setup. ...
securityClass	Security class Possible values: • **1** : not encrypted (plain) • **2** : encrypted with static keys (SCK-Static Cipher Keys) • **3** : encrypted with dynamic keys (DCK-Dynamic Cipher Keys)
ssi	Short Subscriber Identity. ID of a calling party on an up-Link.

ssiType	Address type. Possible values: • **0** : Null PDU • **1** : SSI • **2** : Event Label • **3** : USSI • **4** : SMI • **5** : SSI + Event Label • **6** : SSI + Usage Marker • **7** : SMI + Event Label
time	Timestamp of the decoder.
transmission-Mode	Type of the connection (simplex/duplex). Possible values: • **0** : simplex • **1** : duplex

Table 307: Decoder Output: "TETRA Uplink"

Tetrapol		
Changelog		
• **3.0.0** (22.1) – decoder ported to Python • **2.0.0** (20.1) – added status channel • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
VHF mode	Mode_VHF	Enable VHF protocol. Default is UHF. Possible Values: • On/Off
Additional Information		
None		
Decoder Output		
Decoder-Tag	**Description**	
text1	Complete protocol output as a chronological data stream list.	
text2	Evaluated data units.	
text3	Debug Output.	
text4	Frame number output.	
status	Output channel for current status information. • For more information about type 'status', see 'Decoder Common Types'	

Table 308: Decoder Output: "Tetrapol"

<table>
<tr><th colspan="3">Thales System 3000 Skymaster SelCall</th></tr>
<tr><th colspan="3">Changelog</th></tr>
<tr><td colspan="3">

- **2.0.3** (22.2)
  - fixed binary output
- **2.0.2** (22.1)
  - adjusted detection algorithm to improve false positive rate
- **2.0.1** (21.2)
  - added binary file output
- **2.0.0** (21.1)
  - ported to Python
- **1.0.0**
  - initial version

</td></tr>
<tr><th colspan="3">Decoder Parameters</th></tr>
<tr><th>Parameter</th><th>Variable Name</th><th>Description</th></tr>
<tr><td>Store raw result</td><td>StoreRawData</td><td>Store data in binary file(s).
Possible Values:
• On: Enable output
• Off: Disable output</td></tr>
<tr><th colspan="3">Additional Information</th></tr>
<tr><th>About</th><th colspan="2">Description</th></tr>
<tr><td>Binary output</td><td colspan="2">The decoder provides binary output to file of data bits (LSB first) after demodulation (no channel decoding).</td></tr>
<tr><th colspan="3">Decoder Output</th></tr>
<tr><th>Decoder-Tag</th><th colspan="2">Description</th></tr>
<tr><td>text1</td><td colspan="2">Default output channel. Letter or figure output mode is automatically detected.</td></tr>
</table>

Table 309: Decoder Output: "Thales System 3000 Skymaster SelCall"

Thuraya	
Changelog	
• **2.0.0** (21.1) – ported to Python • **1.0.0** (20.1) – initial version	
Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Detected bursts with type. In case of RACH burst inclusive decoding.
phoneNumber	International phone number transmitted in RACH uplink bursts. • For more information about type 'typePhoneNumberWithOrigin', see 'Decoder Common Types'
position	GPS-Position transmitted in RACH-Channel. • For more information about type 'ISOCoordinates', see 'Decoder Common Types'

Table 310: Decoder Output: "Thuraya"

VDL 2	
Changelog	
• **3.3.0** (24.1) – added support for decoding of OHMA messages • **3.2.0** (22.2) – output of ground station name and position – output of country of origin of aircraft • **3.1.0** (22.1) – improved processing of ACARS messages, including reassembly of fragmented messages – decoding of MIAM and Media Advisory messages • **3.0.0** (20.2) – ported to Python • **2.0.0** (19.2) – added XML tags for metadata • **1.0.0** – initial version	
Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Output channel 1.
adsc	Text of incoming Automatic Dependent Surveillance (ADS) message. • For more information about type 'adsc', see 'Decoder Common Types'
aircraftCountry	Country of origin of the aircraft based on its 24 bit ICAO address. • For more information about type 'icaoAircraftCountry', see 'Decoder Common Types'
altitude	Altitude in feet. • For more information about type 'type_altitude', see 'Decoder Common Types'
callSign	Alphanumeric code to identify broadcaster or transmitter. • For more information about type 'callSign', see 'Decoder Common Types'
cpdlc	Text of incoming Controller Pilot Data Link Communications (CPDLC) message. • For more information about type 'cpdlc', see 'Decoder Common Types'
flightId	Flight identification. • For more information about type 'flightId', see 'Decoder Common Types'

groundCoordinates	Coordinates (position) of ground station in ISO format. • For more information about type 'ISOCoordinates', see 'Decoder Common Types'
groundId	Ground Station identification as 24 bit ICAO address • **Output in hex format.** • For more information about type 'groundId', see 'Decoder Common Types'
groundLocation	Ground Station Location. City and country.
icaoAircraftAddress	International Civil Aviation Organization (ICAO) 24 bit aircraft address. • **Output in hex format.** • For more information about type 'icaoNo', see 'Decoder Common Types'
labelText	Label text of incoming message. • For more information about type 'labelText', see 'Decoder Common Types'
labelType	Label Type of incoming message. • For more information about type 'labelType', see 'Decoder Common Types'
mediaAdvisory	Text of incoming Media Advisory message. • For more information about type 'mediaAdvisory', see 'Decoder Common Types'
miam	Text of incoming Media Independent Aircraft Messaging (MIAM) message. • For more information about type 'miam', see 'Decoder Common Types'
newInfoUnit	Marks the beginning of a new information unit. • For more information about type 'typeNewInfoUnit', see 'Decoder Common Types'
position	Position of aircraft in ISO format. • For more information about type 'ISOCoordinates', see 'Decoder Common Types'
slotType	Gives directional information about a message according sender and receipient. • Ouput restricted as seen in *typeSlotType*. • For more information about type 'typeSlotType', see 'Decoder Common Types'

Table 311: Decoder Output: "VDL 2"

Value Pattern Detector Template		
Changelog		
• **2.0.0** (23.1) – ported to Python • **1.0.0** – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Pattern [hex]	Pattern	The pattern for which to be searched defined as a hexadecimal value.
Pattern Length [bits]	PatternLen	The length of the pattern in bits.
Tolerance [bits]	MaxFaults	The maximum total number of faulty bits, which shall be accepted for detection.
MSB first	MSBfirst	If the pattern value shall be interpreted in MSB-first annotation i.e. most significant bit occurs first, this option has to be chosen. Possible Values: • On: Enable MSB first • Off: Disable MSB first(default)
Store raw result	StoreRawData	Store data in binary file(s). Possible Values: • On: Enable output(default) • Off: Disable output
Additional Information		
About	**Description**	
Binary output	The decoder provides binary output to file of payload data (MSB first).	
Decoder Output		
Decoder-Tag	**Description**	
text1	Timestamp at which pattern was found	

Table 312: Decoder Output: "Value Pattern Detector Template"

<table>
<tr><th colspan="2">VoiceInfo</th></tr>
<tr><th colspan="2">Changelog</th></tr>
<tr><td colspan="2">

- **2.0.1** (21.2)
  - support additional voice modes
- **2.0.0** (20.2)
  - ported to Python
  - added XML tags for metadata
  - unified all F3E selcals
- **1.0.0**
  - initial version

</td></tr>
<tr><th colspan="2">Decoder Parameters</th></tr>
<tr><td colspan="2">None</td></tr>
<tr><th colspan="2">Additional Information</th></tr>
<tr><td colspan="2">None</td></tr>
<tr><th colspan="2">Decoder Output</th></tr>
<tr><th>Decoder-Tag</th><th>Description</th></tr>
<tr><td>text1</td><td>Output channel 1.</td></tr>
<tr><td>status</td><td>Output channel for current selcal type and value information, e.g. DCS Code : 25
• For more information about type ‘status’, see ‘Decoder Common Types’</td></tr>
<tr><td>selcal</td><td>Type of selcal in F3E voice emissions. Different types of selcals can occur. Depending on which selcal is active, different values will be shown. Value interpretation for according selcal:
• CTCSS : Channel number + Private Line (from Motorola)
• DCS : Code number
• DTMF : Active dialed digits
• ZVEI : 5-tone squence. There are six different standards (ZVEI, ZVEI2, ZVEI3, DZVEI, PDZVEI and PZVEI) with different tone-to-value matchings. If tone sequence is applicable to a standard, the according standard’s sequence interpretation will be shown.</td></tr>
</table>

Table 313: Decoder Output: “VoiceInfo”

Yaesu Fusion	
Changelog	
• **2.0.0** (22.1) – decoder ported to Python • **1.1.0** (20.1) – added status channel • **1.0.0** (19.1) – initial version	
Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Complete protocol output.
text2	Additional debug information.
text3	FEC Error Output.
status	Output channel for current status information. • For more information about type 'status', see 'Decoder Common Types'

Table 314: Decoder Output: "Yaesu Fusion"

dPMR	
Changelog	
• 2.0.0 (21.2) – decoder ported to Python • 1.0.0 – initial version	
Decoder Parameters	
None	
Additional Information	
None	
Decoder Output	
Decoder-Tag	**Description**
text1	Default output channel.
text2	Some debug output.

Table 315: Decoder Output: "dPMR"

<table>
<tr><th colspan="3">fax</th></tr>
<tr><th colspan="3">Changelog</th></tr>
<tr><td colspan="3">1.0.0 (24.1)
initial version</td></tr>
<tr><th colspan="3">Decoder Parameters</th></tr>
<tr><th>Parameter</th><th>Variable Name</th><th>Description</th></tr>
<tr><td>Compression</td><td>compression</td><td>Specifies the compression method. If “auto” is used, the value from DCS is used if available. Possible Values:
auto: “auto”
T4 1D: “T4_1D”
T4 2D: “T4_2D”
T6: “T6”
T85: “T85”
T85_L0: “T85_L0”</td></tr>
<tr><td>Error correcting mode</td><td>error_correcting_mode</td><td>Specifies if ECM is active. If “auto” is used, the value from DCS is used if available. Possible Values:
auto: “auto”
OFF: “off”
ON: “on”</td></tr>
<tr><td>X Resolution</td><td>x_resolution</td><td>Specifies the resolution in x-direction. If “auto” is used, the value from DCS is used if available. Possible Values:
auto: “auto”
R4: “R4”
R8: “R8”
R16: “R16”</td></tr>
<tr><td>Y Resolution</td><td>y_resolution</td><td>Specifies the resolution in x-direction. If “auto” is used, the value from DCS is used if available. Possible Values:
auto: “auto”
standard: “standard”
fine: “fine”
superfine: “superfine”</td></tr>
<tr><td>Recording width</td><td>recording_width</td><td>Specifies the recoding width. If “auto” is used, the value from DCS is used if available. Possible Values:
auto: 0
215mm: 215
255mm: 255
303mm: 303</td></tr>
</table>

Ignore DCS	ignore_dcs	If this option is enabled, the setting values from the DCS are not used for decoding fax images, only the manually specified values. Possible Values: • "On" : Do not use values from DCS • "Off" : Use values from DCS
Additional Information		
None		
Decoder Output		
Decoder-Tag	**Description**	
text1	Output of decoding protocol and meta information.	

Table 316: Decoder Output: "fax"

freedv		
Changelog		
• **1.0.0** (24.1) – initial version		
Decoder Parameters		
Parameter	**Variable Name**	**Description**
Compression	compression	Specifies which mode is to be synchronized. If "Auto (HF)" is selected, all HF modes are active. Possible Values: • auto (HF): "auto_hf" • 1600 (HF): "1600" • 700C (HF): "700C" • 700D (HF): "700D" • 700E (HF): "700E" • 2020 (HF): "2020" • 2020B (HF): "2020B" • 800XA (VHF): "800XA"
Force production	force_ production	Forces a single mode to run. Not suitable for modem recognition. This helps in decoding very weak signals, as detection of the specified mode is always assumed. Possible Values: • "On" : Force production • "Off" : Do not force production
Additional Information		
None		
Decoder Output		
Decoder-Tag	**Description**	
text1	Output of detection messages and text channel. There is no text transmission available in FreeDV Mode 700C or 800XA.	
status	Output channel for current status information about detected mode, SNR and audio codec. • For more information about type 'status', see 'Decoder Common Types'	

Table 317: Decoder Output: "freedv"

7.1. Common Decoder Types

General Information

This section provides complimentary information about common decoder element types. Decoder element types can contribute to a more precise containment of an element's possible output values. Whereas some output elements of decoders are only used by themselves, some other output elements are commonly used by multiple decoders. These kind of decoder element types are further described in the following table.

Common Decoder Types	
Tag-Type	**Description**
ISOCoordinates	Restricts the structure of coordinate outputs defined by ISO standard ISO6709 • format: <latitude><longitude>e.g. "41.12268 -150.21682"
adsc	Text of incoming Automatic Dependent Surveillance (ADS) message.
aircraftId	Aircraft identification.
callSign	Alphanumeric code to identify broadcaster or transmitter.
country	Country of registration extracted from MID (Maritime Identification Digit). https://www.itu.int/en/ITU-R/terrestrial/fmd/Pages/mid.aspx
cpdlc	Text of incoming Controller Pilot Data Link Communications (CPDLC) message.
flightId	Flight identification.
groundId	Ground Station identification.
icaoAircraftCountry	Country of origin of the aircraft based on its 24 bit ICAO address.
icaoNo	International Civil Aviation Organization (ICAO) 24 bit aircraft address. • **Output in hex format.**
labelText	Label Text of incoming message
labelType	Label Type of incoming message
mediaAdvisory	Text of incoming Media Advisory message.
miam	Text of incoming Media Independent Aircraft Messaging (MIAM) message.
mmsi	Maritime Mobile Service identity Number (MMSI).
msgType	Type of message.
shipName	Name of ship.
shipType	Type of ship.

status	Output channel for current status information. • This output channel summarizes important meta data and status information (e.g. Country Code, idle/traffic) in one single line. • This information targets mainly GUI applications that show decoder results. This way the current status can be display independently from the continuously shown decoder result text. • The status is only updated when one parameter changes its value.
text1	Output channel 1. • standard decoder text output.
text16	Output channel 16.
text2	Output channel 2.
text3	Output channel 3.
text4	Output channel 4.
typeNewInfoUnit	Marks the beginning of a new information unit. • Output of attribute 'time' complies with ISO 8601.
typePhoneNumberWithOrigin	Generic international phone number with origin attribute.
typeSlotType	Possible values: • Uplink • Downlink • Squitter
type_altitude	altitude above or below sea level. Unit can be feet (ft) or meter (m).
type_crc	Type for cyclic redundancy check (CRC) Possible values: • Ok: CRC is correct • Wrong: raw data incomplete or contains erroneous data
type_eom	End of message (EOM) signature detected

Table 318: Common Decoder Types

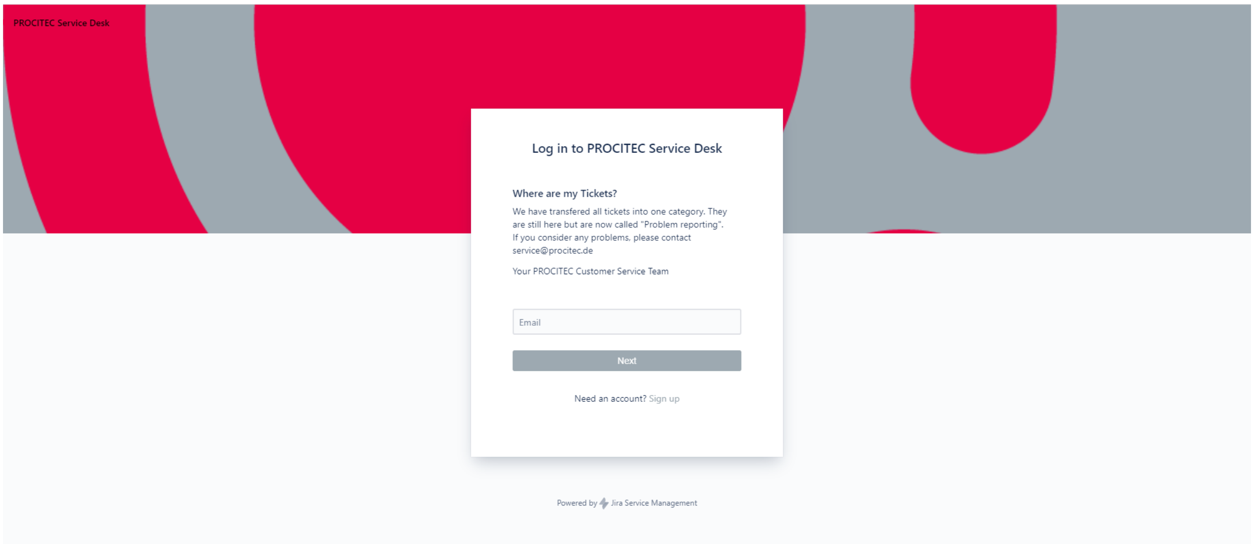
A. Support

Requests and suggestions?

All requests or suggestions regarding our go2signals product-range are very much appreciated; we would be delighted to hear from you.

Any questions? We are happy to assist you!

If you have any further questions, please do not hesitate to contact our Support Team for rapid assistance – just raise a service request at: **http://servicedesk.procitec.com**.



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