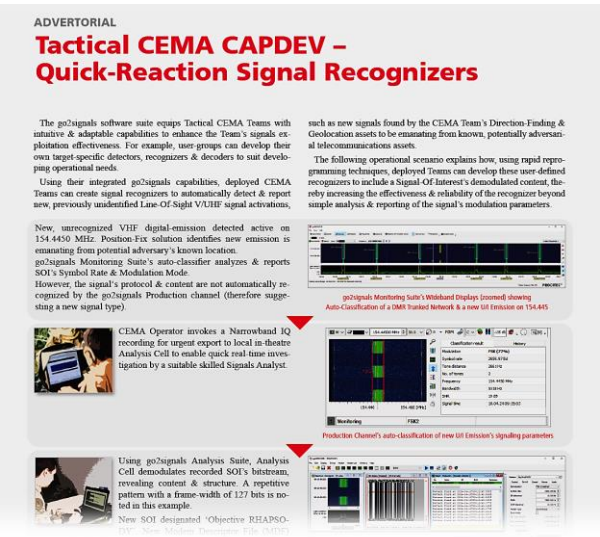
CASE STUDY 1008 v1.0
Synthesizing Digital Signals-Of-Interest with SOMO

INTRODUCTION

Our R&D Team recently submitted an Article to the Association of Old Crows' (AOC) 'Journal of Electromagnetic Dominance' (JED) magazine https://crows.org/jed/. The article, '*Tactical CEMA CAPDEV - Quick-Reaction Signal Recognizers*' was published in the JED August 2024 edition. Readers of the article have since contacted us to ask "what was the actual Signal-Of-Interest used in the article?".



ADVERTORIAL

Tactical CEMA CAPDEV – Quick-Reaction Signal Recognizers

The go2signals software suite equips Tactical CEMA Teams with intuitive & adaptable capabilities to enhance the Team's signals exploitation effectiveness. For example, user-groups can develop their own target-specific detectors, recognizers & decoders to suit developing operational needs.

Using their integrated go2signals capabilities, deployed CEMA Teams can create signal recognizers to automatically detect & report new, previously unidentified Line-Of-Sight V/UHF signal activations, such as new signals found by the CEMA Team's Direction-Finding & Geolocation assets to be emanating from known, potentially adversarial telecommunications assets.

The following operational scenario explains how, using rapid reprogramming techniques, deployed Teams can develop these user-defined recognizers to include a Signal-Of-Interest's demodulated content, thereby increasing the effectiveness & reliability of the recognizer beyond simple analysis & reporting of the signal's modulation parameters.

New, unrecognized VHF digital-emission detected active on 154.4450 MHz. Position-Fix solution identifies new emission is emanating from potential adversary's known location.
go2signals Monitoring Suite's auto-classifier analyzes & reports SOI's Symbol Rate & Modulation Mode.
However, the signal's protocol & content are not automatically recognized by the go2signals Production channel (therefore suggesting a new signal type).

go2signals Monitoring Suite's Wideband Displays (zoomed) showing Auto-Classification of a DMR Trunked Network & a new UH Emission on 154.445

CEMA Operator invokes a Narrowband IQ recording for urgent export to local in-theatre Analysis Cell to enable quick real-time investigation by a suitable skilled Signals Analyst.

Production Channel's auto-classification of new UH Emission's signalling parameters

Using go2signals Analysis Suite, Analysis Cell demodulates recorded SOI's bitstream, revealing content & structure. A repetitive pattern with a frame-width of 127 bits is noted in this example.

New SOI designated 'Objective RHAPSO-

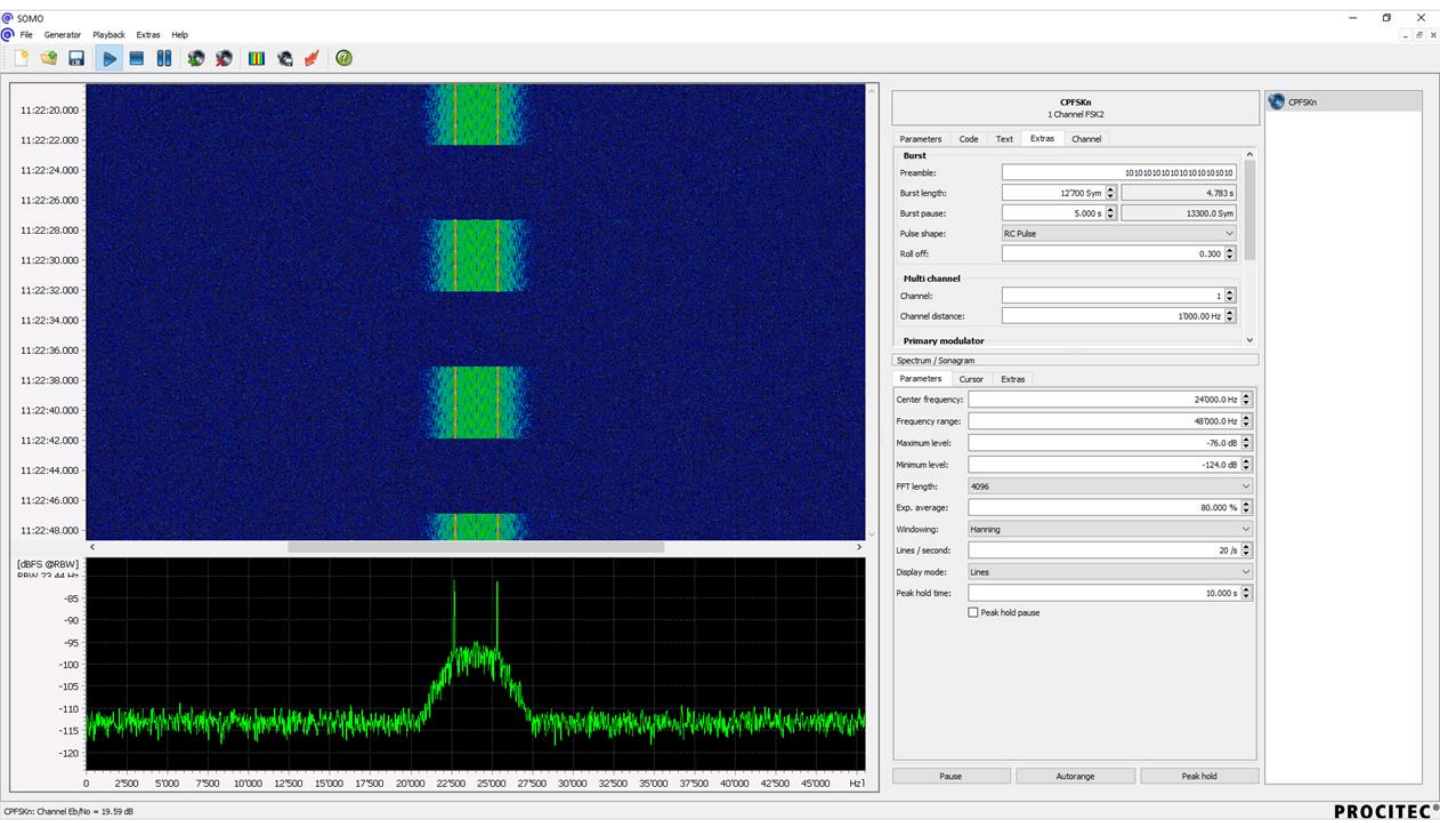
JED article (August 2024 edition)

The actual Signal-Of-Interest (SOI) used in the article was synthesized using our **go2signals** 'SOMO' Signal Generator application.

The SOI's signaling parameters were selected by our R&D Team to reflect 'real-world' signals such as those employed by certain telecommunications installation & management contractors during setup & test of their new, location-specific V/UHF networks.

SOMO is included in our '**go2DECODE-Professional**' package, together with a Decoder Development Tool ('PyDDL') & other useful applications for the professional Signals Analyst.

For the purposes of the JED article, the synthesized SOI was designated 'Objective RHAPSODY'.

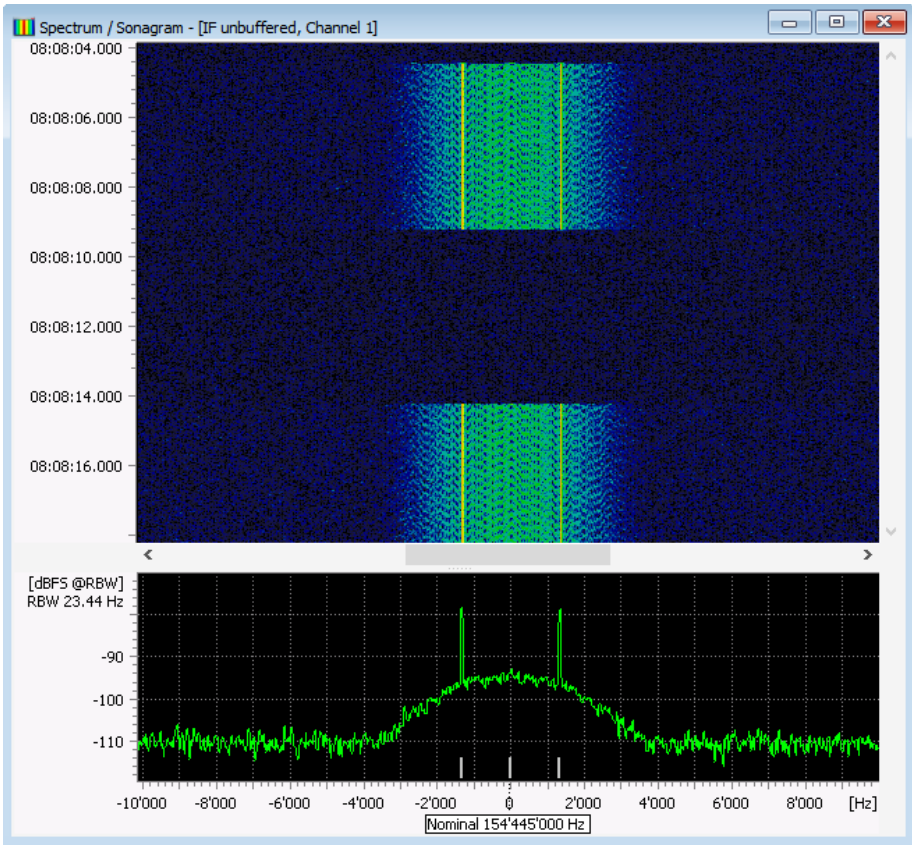


SOMO generating 'Objective RHAPSODY'

‘OBJECTIVE RHAPSODY’ SIGNALING CHARACTERISTICS

The screenshot (R) shows the synthesized Objective RHAPSODY as viewed in the go2DECODE spectro displays.

For the purposes of the JED article, the SOMO-synthesized signaling characteristics for Objective RHAPSODY (simulating a SOI activation on a VHF center-frequency of 154.445 MHz) were chosen to be a modulation mode of 2-level Frequency Shift Keying (FSK-2) with a frequency-shift of 2660 Hz & symbol-rate of 2660 Baud (realizing a Modulation Index of 1).



The screenshot (L) captures the Objective RHAPSODY demodulated bitstream as viewed in the **go2DECODE** Bit display.

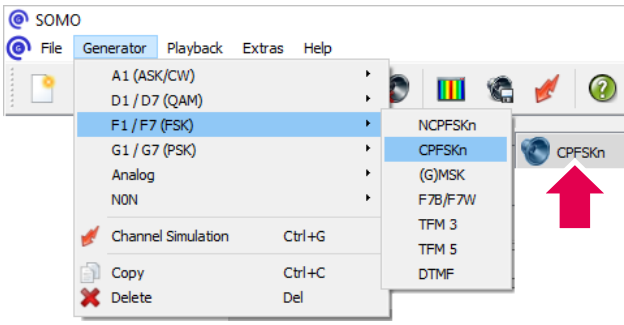
The internal signaling characteristics were chosen to comprise a preamble of 24x synchronization reversals (highlighted in orange) followed by a repeating pattern of 4.8 seconds duration, then off-air for 5 seconds before the SOI repeats.

The 127-bit repeating pattern is actually a Linear Recursive Sequence (‘LRS’ [R7/maximal]) generated by the SOMO ‘scrambler’ function.

SYNTHESIZING 'OBJECTIVE RHAPSODY' IN SOMO

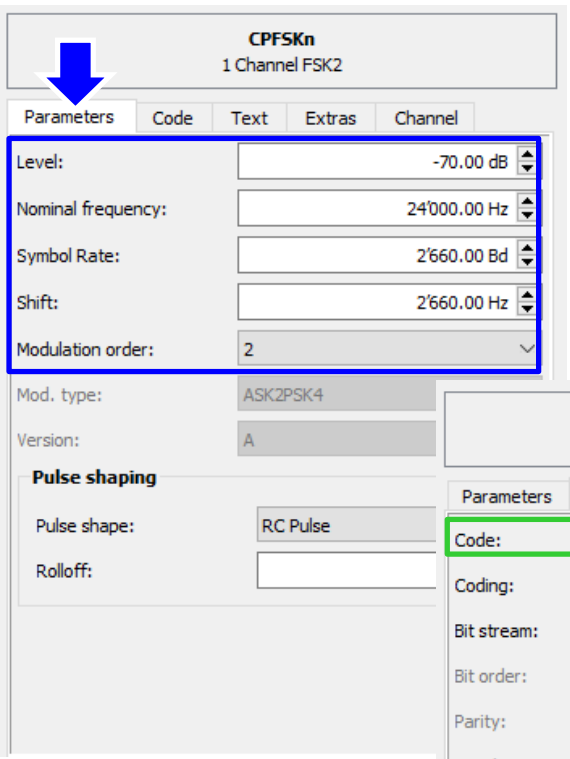
The SOMO Operator has chosen to synthesize an FSK waveform, so selects the 'Continuous Phase Frequency Shift Keying n-levels' ('CPFSKn') Generator from the available Generator options.

The Operator now populates the selected Generator with their chosen external & internal signaling parameters:



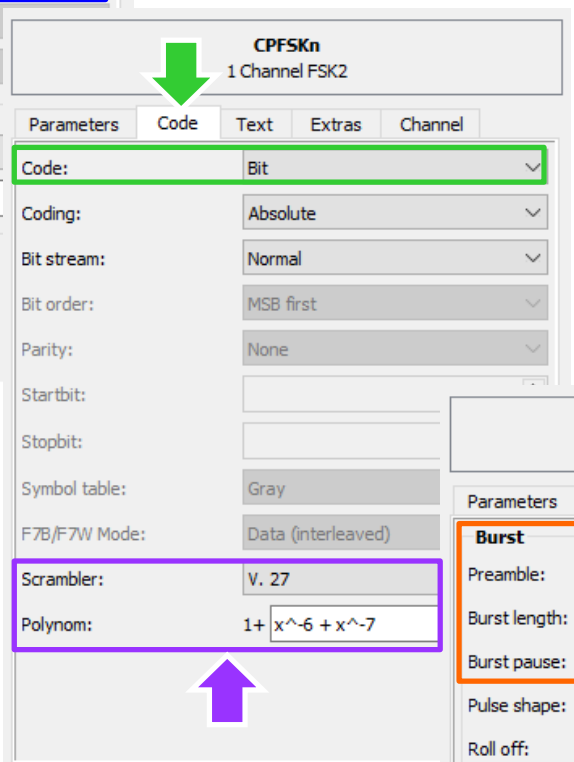
PARAMETERS

A signal level, nominal center-frequency, symbol rate, shift & modulation order are entered to match the SOI's chosen external signaling parameters.



CODE

Alphanumeric characters are not to be encoded for this Objective RHAPSODY SOI, so simply 'Bit' is selected from the drop-down list of available encoders.



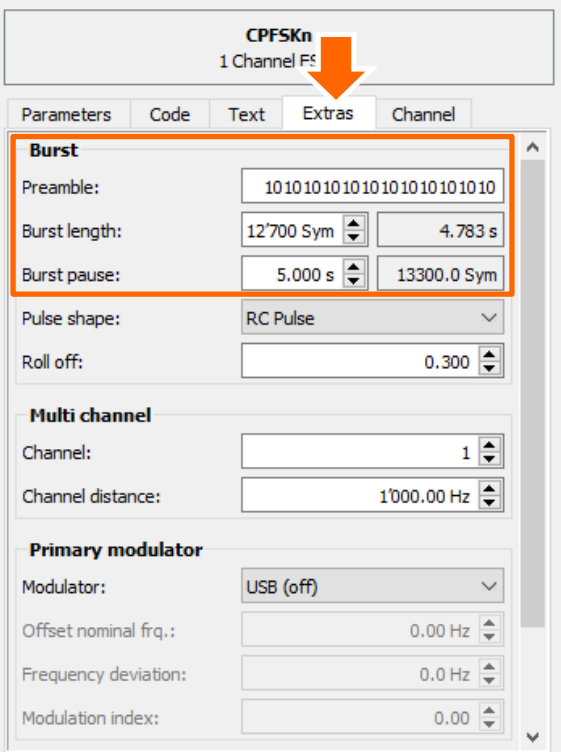
THE LRS

A V.27 scrambler is selected to generate the (R7) LRS. The SOMO Operator has intentionally entered no alphanumeric text to be encoded, so the scrambler will run 'empty', sending only the LRS itself.

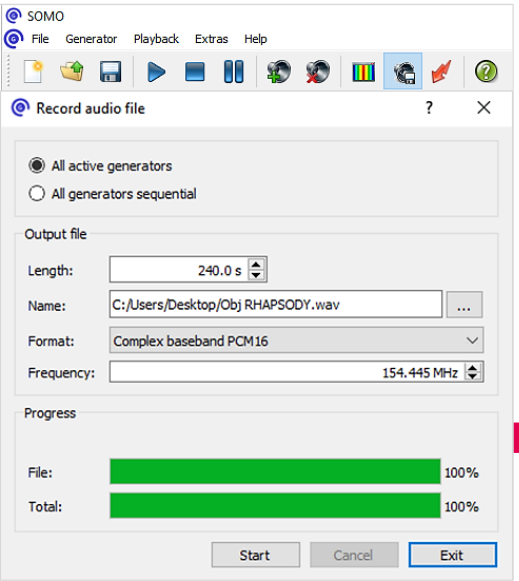
BURST PARAMETERS

The Operator-defined Preamble of 24x reversals is entered, then a burst-length of 12,700 symbols to represent 100 repetitions of the 127-bit R7 LRS.

A burst-pause of 5 seconds is selected to render a SOI duty-cycle of approximately 50% (as visualized in the Spectro displays).

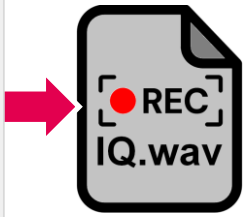


GENERATING THE I&Q RECORDING FOR TEST & DISTRIBUTION



The synthesized Objective RHAPSODY SOI can now be recorded for testing, distribution & the development of associated Modem Descriptor File (MDF) Recognizers as illustrated in the related JED article.

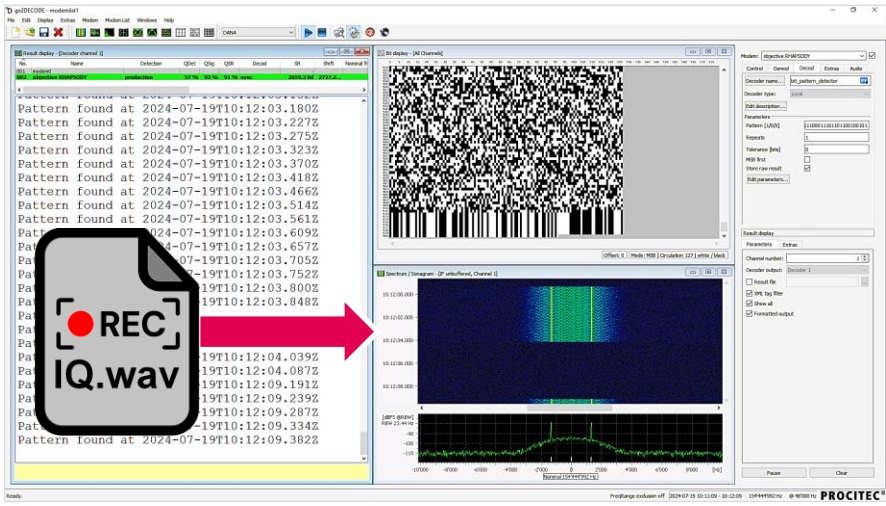
A suitable recording-length, filename & IQ recording-format are selected, then an appropriate RF center-frequency is entered – the recording is then started.



The manually entered center-frequency will be captured in the recording-header to automatically set **go2signals** & other software applications to the entered center-frequency upon playback of the recording.

The Objective RHAPSODY I&Q recording is now available for further testing, training & distribution.

The screenshot (R) shows the Objective RHAPSODY I&Q recording streaming into **go2DECODE** to test an associated Modem Descriptor File prior to distribution to CEMA Detachments' Sensors running **go2MONITOR**.



ONLINE OPERATIONS WORKSHOPS

Remote (online) Ops Workshops & Training Modules are available for those **go2signals** user-groups who may wish to further explore their awareness of SOMO. Please contact us for further information & scheduling.

FURTHER INFORMATION

For further information relating to the awareness of SOMO, please contact sales@procitec.com

PROCITEC®
HOUSE OF SIGNALS

PROCITEC GmbH
Rastatter Straße 41
75179 Pforzheim
Phone +49 7231 155 61 0
Fax +49 7231 155 61 11

go2signals