

# **EZ Automation CAP/EAS Encoder-Decoder**

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The EZ Automation CAP/EAS Encoder-Decoder was tested to comply with part 11 of the FCC rules (the assigned FCC ID is OTQEAS). It uses an Intel x86 platform which operates on Microsoft Windows™. All input and output functions are contained within software. FSK and tone-tone attention signals are generated digitally in software. This includes the following functions:

The Left/Right audio input serves as inputs from at least two audio receivers (inputs 3 and 4 are optional).

An "HD" audio output serves as the output of FSK, tone-tone and audio output of alert message.

Configuration of device is done through standard mouse, keyboard and VGA-type monitor.

The decoding/encoding status of EAS messages is shown on VGA monitor.

Two serial ports and a network interface are provided for operational control.

## **§ 11.31 EAS protocol**

(a) The EAS uses a four part message for an emergency activation of the EAS. The four parts are: Preamble and EAS Header Codes; audio Attention Signal; message; and, Preamble and EAS End Of Message (EOM) Codes.

The Unit complies with 11.31() for EAS protocol. During transmissions, this is generated digitally within software and outputted via a sound card. The unit is also capable to receiving the EAS protocol via audio card inputs, and complies with the revised provisions for expanded codes.

To test overall compliance, a series of tests were transmitted and received to and from several commonly commercially available EAS Encoder/Decoder Units (Holly-Anne model HU-961, Sage model 1822, Gorman-Redlich model EAS-1). These tests served as a "double-check" of compliance and real-world compatibility with the EAS Protocol. These tests were conducted during September 2012.

(1) The Preamble and EAS Codes must use Audio Frequency Shift Keying at a rate of 520.83 bits per second to transmit the codes. Mark frequency is 2083.3 Hz and space frequency is 1562.5 Hz. Mark and space time must be 1.92 milliseconds. Characters are ASCII seven bit characters as defined in ANSI X3.4-1977 ending with an eighth null bit (either 0 or 1) to constitute a full eight-bit byte.

See attached pictures of header FSK tones as captured from audio output, as viewed in Cool Edit audio editor program.

(2) The Attention Signal must be made up of the fundamental frequencies of 853 and 960 Hz. The two tones must be transmitted simultaneously. The Attention Signal must be transmitted after the EAS header codes.

See attached pictures of two-tone attention signal as captured from the units audio output, as viewed in Cool Edit audio editor program.

(3) The message may be audio, video or text.

(b) The ASCII dash and plus symbols are required and may not be used for any other purpose. Unused characters must be ASCII space characters. FM or TV call signs must use a slash ASCII character number

47 (/) in lieu of a dash.

(c) The EAS protocol, including any codes, must not be amended, extended or abridged without FCC authorization. The EAS protocol and message format are specified in the following representation.

Examples are provided in FCC Public Notices.

[PREAMBLE]ZCZC-ORG-EEE-PSSCCC+TTTT-JJHHMM-LLLLLLLLL-(one second pause)

[PREAMBLE]ZCZC-ORG-EEE-PSSCCC+TTTTpJJHHMM-LLLLLLLLL-(one second pause)

[PREAMBLE]ZCZC-ORG-EEE-PSSCCC+TTTT-JJHHMM-LLLLLLLLL-(at least a one second pause)

(transmission of 8 to 25 seconds of Attention Signal)

(transmission of audio, video or text messages)

(at least a one second pause)

[PREAMBLE]NNNN (one second pause)

[PREAMBLE]NNNN (one second pause)

[PREAMBLE]NNNN (at least one second pause)

See attached pictures of relayed Required Monthly Test as captured from audio output, as viewed in Cool Edit audio editor program (If a higher resolution jpeg file is required please contact us.) The sample shows the three FSK Header Burst with one second pause between each one, at least one second pause, relayed audio content, at least one second pause, and the three 'NNNN' FSK bursts (EOM).

[PREAMBLE] This is a consecutive string of bits (sixteen bytes of AB hexadecimal [8 bit byte 10101011]) sent to clear the system, set AGC and set asynchronous decoder clocking cycles. The preamble must be transmitted before each header and End of Message code.

ZCZC—This is the identifier, sent as ASCII characters ZCZC to indicate the start of ASCII code.

ORG—This is the Originator code and indicates who originally initiated the activation of the EAS. These codes are specified in paragraph (d) of this section.

EEE—This is the Event code and indicates the nature of the EAS activation. The codes are specified in paragraph (e) of this section. The Event codes must be compatible with the codes used by the NWS Weather Radio Specific Area Message Encoder (WRSAME).

PSSCCC—This is the Location code and indicates the geographic area affected by the EAS alert. There may be 31 Location codes in an EAS alert. The Location code uses the codes described in the American National Standards Institute (ANSI) standard, ANSI INCITS 31-2009 ("Information technology—Codes for the Identification of Counties and Equivalent Areas of the United States, Puerto Rico, and the Insular Areas"). Each state is assigned an SS number as specified in paragraph (f) of this section. Each county and some cities are assigned a CCC number. A CCC number of 000 refers to an entire State or Territory. P defines county subdivisions as follows: 0 = all or an unspecified portion of a county, 1 = Northwest, 2 = North, 3 = Northeast, 4 = West, 5 = Central, 6 = East, 7 = Southwest, 8 = South, 9 = Southeast. Other numbers may be designated later for special applications. The use of

county subdivisions will probably be rare and generally for oddly shaped or unusually large counties. Any subdivisions must be defined and agreed to by the local officials prior to use.

+TTTT—This indicates the valid time period of a message in 15 minute segments up to one hour and then in 30 minute segments beyond one hour; i.e. , +0015, +0030, +0045, +0100, +0430 and +0600.

JJHHMM—This is the day in Julian Calendar days (JJJ) of the year and the time in hours and minutes (HHMM) when the message was initially released by the originator using 24 hour Universal Coordinated Time (UTC).

LLLLLLLL—This is the identification of the EAS Participant, NWS office, etc., transmitting or retransmitting the message. These codes will be automatically affixed to all outgoing messages by the EAS encoder.

NNNN—This is the End of Message (EOM) code sent as a string of four ASCII N characters.

(d) The only originator codes are:

Originator	ORG code
EAS Participant	EAS
Civil authorities	CIV
National Weather Service	WXR
Primary Entry Point System	PEP

(e) The following Event (EEE) codes are presently authorized:

Nature of activation	Event codes
National Codes (Required):	
Emergency Action Notification (National only) EAN.	
National Information Center	NIC
(.....)	
Winter Storm Watch	WSA.

<sup>^1</sup> Effective May 16, 2002, analog radio and television broadcast stations, analog cable systems and wireless cable systems may upgrade their existing EAS equipment to add these event codes on a voluntary basis until the equipment is replaced. All models of EAS equipment manufactured after August 1, 2003 must be capable of receiving and transmitting these event codes. EAS Participants that install or replace their EAS equipment after February 1, 2004 must install equipment that is capable of receiving and transmitting these event codes.

(f) The State, Territory and Offshore (Marine Area) ANSI number codes (SS) are as follows. County ANSI numbers (CCC) are contained in the State EAS Mapbook.

ANSI No.
State:
AL 01
(...)
St. Lawrence River above St. Regis 98

<sup>^1</sup> Effective May 16, 2002, analog radio and television broadcast stations, analog cable systems and wireless cable systems may upgrade their existing EAS equipment to add these marine area location codes on a voluntary basis until the equipment is replaced. All models of EAS equipment manufactured after August 1, 2003, must be capable of receiving and transmitting these marine area location codes. EAS Participants that install or replace their EAS equipment after February 1, 2004, must install equipment that is capable of receiving and transmitting these location codes.

Unit is capable of the extended codes required in this footnote.

## § 11.32 EAS Encoder.

(a) EAS Encoders must at a minimum be capable of encoding the EAS protocol described in §11.31 and providing the EAS code transmission requirements described in §11.51. EAS encoders must additionally provide the following minimum specifications:

The Unit complies with 11.32() for EAS protocol. During transmissions, this is generated digitally within software and outputted via a sound card. The unit is also capable to receiving the EAS protocol via audio card inputs, and complies with the revised provisions for expanded codes.

To test overall compliance, a series of tests were transmitted and received to and from several commonly commercially available EAS Encoder/Decoder Units (Holly-Anne model HU-961, Sage model 1822, Gorman-Redlich model EAS-1). These tests served as a "double-check" of compliance and real-world compatibility with the EAS Protocol. These tests were conducted during September 2012.

(1) *Encoder programming.* Access to encoder programming shall be protected by a lock or other security measures and be configured so that authorized personnel can readily select and program the EAS Encoder with Originator, Event and Location codes for either manual or automatic operation.

The unit contains a password lock to prevent unauthorized access. The unit can be programmed with Originator, Event and Location codes for either manual or automatic operation.

(2) *Inputs.* The encoder shall have at least one input port used for audio messages and at least one input port used for data messages.

The unit has two audio inputs (left/right can be used separately to equal four audio inputs), two audio outputs, two standard serial ports, four USB serial ports, one parallel port., and one Ethernet port.

(3) *Outputs.* The encoder shall have at least one audio output port and at least one data output port.

The unit has two audio inputs (left/right can be used separately to equal four audio inputs), two audio outputs, two standard serial ports, four USB serial ports, one parallel port., and one Ethernet port.

(4) *Calibration.* EAS Encoders must provide a means to comply with the modulation levels required in §11.51(f).

The unit can output separate test tones for level calibration.

(5) *Day-Hour-Minute and Identification Stamps.* The encoder shall affix the JJJHHMM and LLLLLLLL codes automatically to all initial messages.

The unit complies with this requirement for Day-Hour-Minute and Identification Stamps.

(6) *Program Data Retention.* Program data and codes shall be retained even with the power removed.

The unit complies with this requirement, as everything is stored in multi-gigabyte storage device.

(7) *Indicator.* An aural or visible means that it activated when the Preamble is sent and deactivated at the End of Message code.

The unit complies with this requirement and provides a visible means via a VGA-type monitor

(8) *Spurious Response.* All frequency components outside 200 to 4000 Hz shall be attenuated by 40 dB or more with respect to the output levels of the mark or space frequencies.

The unit complies with this requirement, as all tones are generated digitally and output via a "HD" audio card. The spurious components were measured on a Leader LDM-170 Distortion Meter and was greater than 40 dB in every instance. This test was performed September 30, 2012.

(9) *Attention Signal generator.* The encoder must provide an attention signal that complies with the following:

(i) *Tone Frequencies.* The audio tones shall have fundamental frequencies of 853 and 960 Hz and not vary over  $\pm 0.5$  Hz.

The unit complies with this requirement, as all tones are generated digitally and outputted via a "HD" audio card. The frequency output was measured with a Radio Shack 22-306 Frequency Counter. The two frequencies measured to 852.9 Hz and 960.0 Hz. This test was performed September 30, 2012.

(ii) *Harmonic Distortion.* The total harmonic distortion of each of the audio tones may not exceed 5% at the encoder output terminals.

The unit complies with this requirement, as all tones are generated digitally and outputted via a "HD" audio card. The THD + Noise measured on a Leader LDM-170 were less than 0.7% on any tone. This test was performed September 30, 2012.

(iii) *Minimum Level of Output.* The encoder shall have an output level capability of at least +8 dBm into a 600 Ohm load impedance at each audio tone. A means shall be provided to permit individual activation of the two tones for calibration of associated systems.

The unit complies with this requirement, as all tones are generated digitally and outputted via a "HD" audio card. To meet the +8 dBm requirement the audio must exceed 5.503 Vpp. A Tektronix 212 oscilloscope was used to verify an output greater than the requirement. This test was performed September 30, 2012.

(iv) *Time Period for Transmission of Tones.* The encoder shall have timing circuitry that automatically generates the two tones simultaneously for a time period of 8 seconds.

The unit complies with this requirement, as all two-tones are generated digitally for 8-seconds and outputted via a "HD" audio card. See attachment for Two-Tone duration test.

(v) *Inadvertent activation.* The switch used for initiating the automatic generation of the simultaneous tones shall be protected to prevent accidental operation.

The unit contains a password lock to prevent unauthorized access

(vi) *Indicator Display.* The encoder shall be provided with a visual and/or aural indicator which clearly shows that the Attention Signal is activated.

The unit complies with this requirement and provides a visible means via a VGA-type monitor

(b) *Operating Temperature and Humidity.* Encoders shall have the ability to operate with the above specifications within an ambient temperature range of 0 to +50 degrees C and a range of relative humidity of up to 95%.

The unit complies with this requirement and was tested at 95% or greater humidity. It was also tested to operate 0 to +50 degrees C. A "loopback" test was performed by looping the audio output to audio input. A series of Required Weekly and Monthly tests were performed over a period of time from August to October 2012. Normal operation was noted under all phases of these conditions.

(c) *Primary Supply Voltage Variation.* Encoders shall be capable of complying with the requirements of this section during a variation in primary supply voltage of 85 percent to 115 percent of its rated value.

The unit complies with this requirement and was tested from 97.75V to 132.25V (nominal 115V).

(d) *Testing Encoder Units.* Encoders not covered by §11.34(e) of this part shall be tested in a 10 V/m minimum RF field at an AM broadcast frequency and a 0.5 V/m minimum RF field at an FM or TV broadcast frequency to simulate actual working conditions.

The unit complies with this requirement and was tested at 1.33 MHz at measured field strength of 75V/m. It was also tested at 95.1 MHz at 47 V/m. A "loopback" test was performed by looping the audio output to audio input through a typical length of shielded wire. A series of Required Weekly and Monthly tests were performed. No issues with RF sources were detected. This test was performed September 27, 2012

## **§ 11.33 EAS Decoder.**

(a) An EAS Decoder must at a minimum be capable of providing the EAS monitoring functions described in §11.52, decoding EAS messages formatted in accordance with the EAS Protocol described in §11.31, and converting Common Alerting Protocol (CAP)-formatted EAS messages into EAS alert messages that comply with the EAS Protocol, in accordance with §11.56(a)(2), with the exception that the CAP-related monitoring and conversion requirements set forth in §§11.52(d)(2) and 11.56(a)(2) can be satisfied via an

Intermediary Device, as specified in §11.56(b), provided that all other requirements set forth in this part are met. An EAS Decoder also must be capable of the following minimum specifications:

The Unit complies with 11.52() for CAP to EAS protocol. During transmissions, this is generated digitally within software and outputted via a "HD" sound card. The unit is also capable of receiving the EAS protocol via audio card inputs, and complies with the revised provisions for expanded codes.

(1) *Inputs.* Decoders must have the capability to receive at least two audio inputs from EAS monitoring assignments, and at least one data input. The data input(s) may be used to monitor other communications modes such as Radio Broadcast Data System (RBDS), NWR, satellite, public switched telephone network, or any other source that uses the EAS protocol.

The unit has two audio inputs (left/right can be used separately to equal four audio inputs), two audio outputs, two standard serial ports, four USB serial ports, one parallel port., and one Ethernet port.

(2) *Valid codes.* There must be a means to determine if valid EAS header codes are received and to determine if preselected header codes are received.

The unit complies with this requirement and provides a visible means via a VGA-type monitor

(3) *Storage.* Decoders must provide the means to:

(i) Record and store, either internally or externally, at least two minutes of audio or text messages. A decoder manufactured without an internal means to record and store audio or text must be equipped with a means (such as an audio or digital jack connection) to couple to an external recording and storing device.

The unit complies with this requirement, as everything is stored in an internal multi-gigabyte storage device.

(ii) Store at least ten preselected event and originator header codes, in addition to the seven mandatory event/originator codes for tests and national activations, and store any preselected location codes for comparison with incoming header codes. A non-preselected header code that is manually transmitted must be stored for comparison with later incoming header codes. The header codes of the last ten received valid messages which still have valid time periods must be stored for comparison with the incoming valid header codes for later messages. These last received header codes will be deleted from storage as their valid time periods expire.

The unit complies with this requirement, as everything is stored in an internal multi-gigabyte storage device.

(4) *Display and logging.* For received alert messages formatted in both the EAS Protocol and Common Alerting Protocol, a visual message shall be developed from any valid header codes for tests and national activations and any preselected header codes received. The message shall at a minimum include the Originator, Event, Location, the valid time period of the message and the local time the message was transmitted. The message shall be in the primary language of the EAS Participant and be fully displayed on the decoder and readable in normal light and darkness. The visual message developed from received alert messages formatted in the Common Alerting Protocol must conform to the requirements in §§11.51(d), (g)(3), (h)(3), and (j)(2) of this part. All existing and new models of EAS decoders manufactured after August 1, 2003 must provide a means to permit the selective display and logging of EAS messages containing header codes for state and local EAS events. Effective May 16, 2002, analog radio and television broadcast stations, analog cable systems and wireless cable systems may upgrade their decoders on an optional basis to include a selective display and logging capability for EAS messages containing header codes for state and local events. EAS Participants that install or replace their decoders after February 1, 2004 must install decoders that provide a means to permit the selective display and logging of EAS messages containing header codes for state and local EAS events.

The unit complies with this requirement and provides a visible means via a VGA-type monitor; logging is maintained on a long-term basis via an internal database.

(5) *Indicators.* EAS decoders must have a distinct and separate aural or visible means to indicate when any of the following conditions occurs:

(i) Any valid EAS header codes are received as specified in §11.33(a)(10).

(ii) Preprogrammed header codes, such as those selected in accordance with §11.52(d)(2) are received.

(iii) A signal is present at each audio input that is specified in §11.33(a)(1).

(6) *Program Data Retention.* The program data must be retained even with power removed.

The unit complies with this requirement and provides a visible means via a VGA-type monitor; configuration and logging is maintained on a long-term basis via an internal database.

(7) *Outputs.* Decoders shall have at least one data port where received valid EAS header codes and received preselected header codes are available, at least one audio port that is capable of monitoring each decoder audio input, and an internal speaker to enable personnel to hear audio from each input.

The unit has two audio inputs (left/right can be used separately to equal four audio inputs), two audio outputs, two standard serial ports, four USB serial ports, one parallel port., and one Ethernet port. An internal speaker is provided for monitoring.

(8) *Decoder Programming.* Access to decoder programming shall be protected by a lock or other security measures and be configured so that authorized personnel can readily select and program the EAS Decoder with preselected Originator, Event and Location codes for either manual or automatic operation.

The unit contains a password lock to prevent unauthorized access. The unit can be programmed with Originator, Event and Location codes for either manual or automatic operation

(9) *Reset.* There shall be a method to automatically or manually reset the decoder to the normal monitoring condition. Operators shall be able to select a time interval, not less than two minutes, in which the decoder would automatically reset if it received an EAS header code but not an end-of-message (EOM) code. Messages received with the EAN Event codes shall disable the reset function so that lengthy audio messages can be handled. The last message received with valid header codes shall be displayed as required by paragraph (a)(4) of this section before the decoder is reset.

The unit complies with this requirement and provides an adjustment for timeout. On EAN's this function is disabled. A visible means of showing last message received is provided via a VGA-type monitor.

(10) *Message Validity.* An EAS Decoder must provide error detection and validation of the header codes of each message to ascertain if the message is valid. Header code comparisons may be accomplished through the use of a bit-by-bit compare or any other error detection and validation protocol. A header code must only be considered valid when two of the three headers match exactly. Duplicate messages must not be relayed automatically.

The unit complies with this requirement and compares the received headers for validation. Duplicate message will be displayed with "{Duplicate}" in front of them and will not be relayed.

(11) A header code with the EAN Event code specified in §11.31(c) that is received through any of the audio or data inputs must override all other messages.

The unit complies with this requirement, as EAN's are assigned the highest priority for immediate transmission.

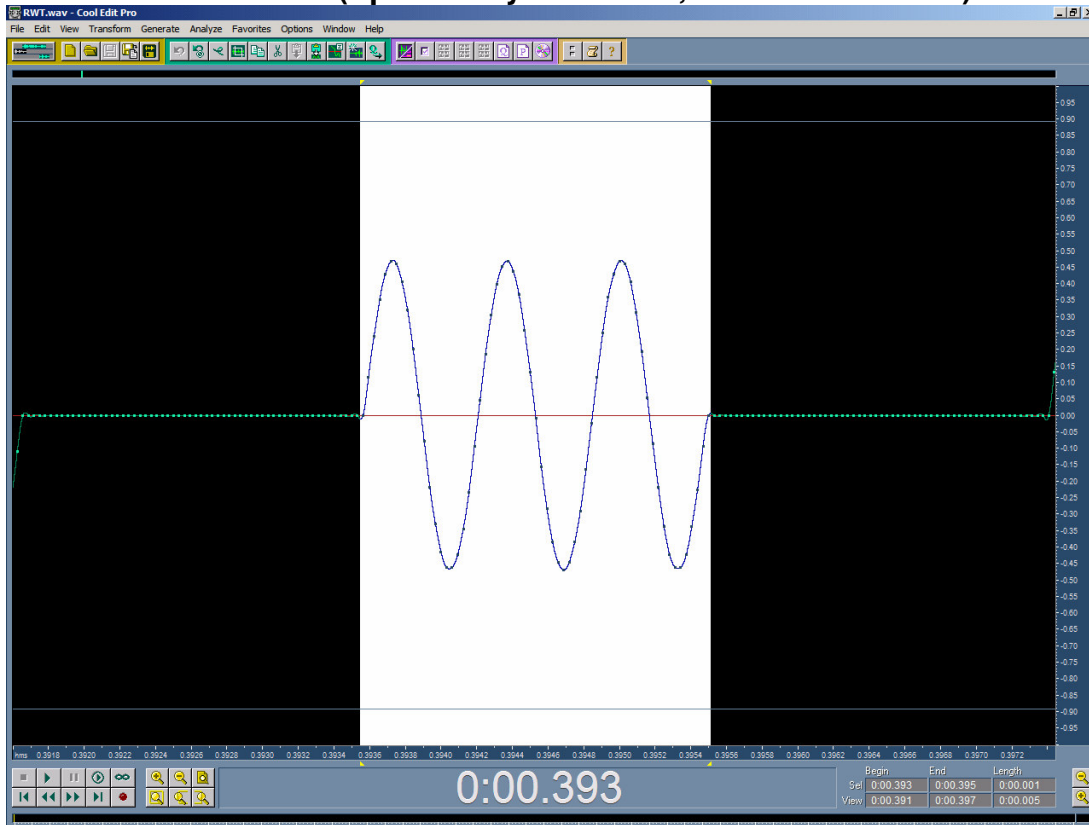
(b) Decoders shall be capable of operation within the tolerances specified in this section as well as those in §11.32 (b), (c) and (d).

The unit complies with this requirement; see pages above - under 11.32 for more detail on compliance with this requirement.

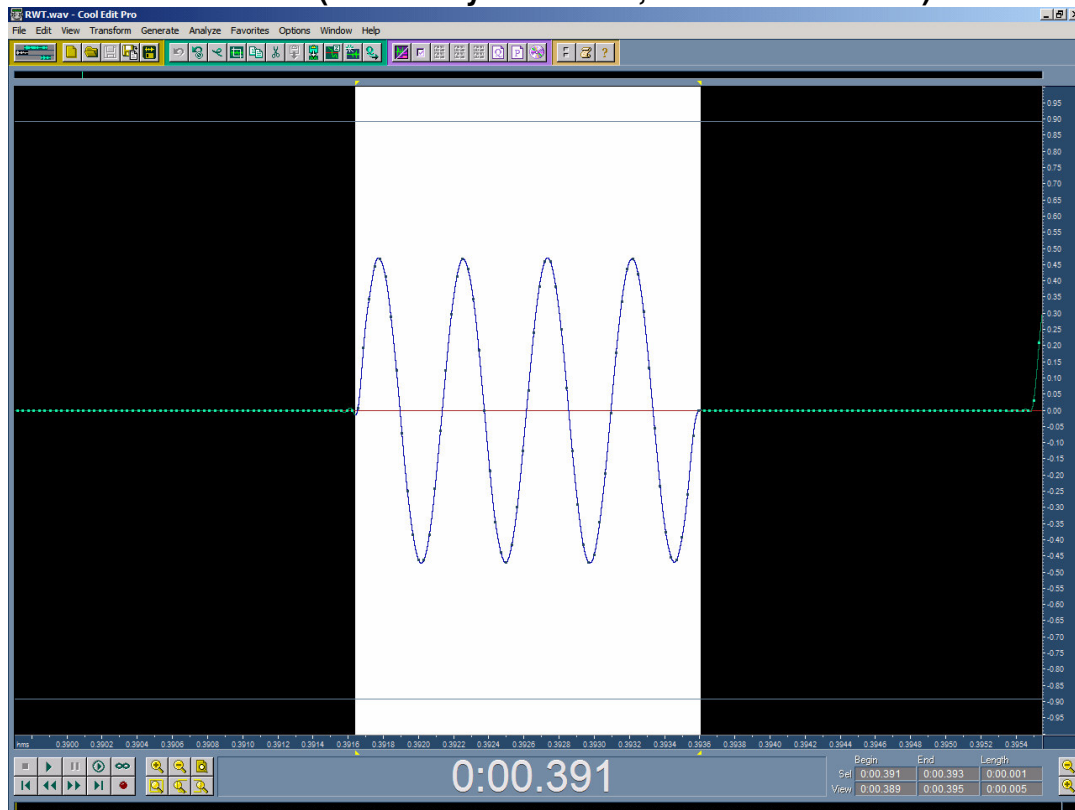
**[ATTACHMENTS FOLLOW THIS PAGE]**



## FSK Tone (Space Only 1562.5 Hz, 1.92 milliseconds)

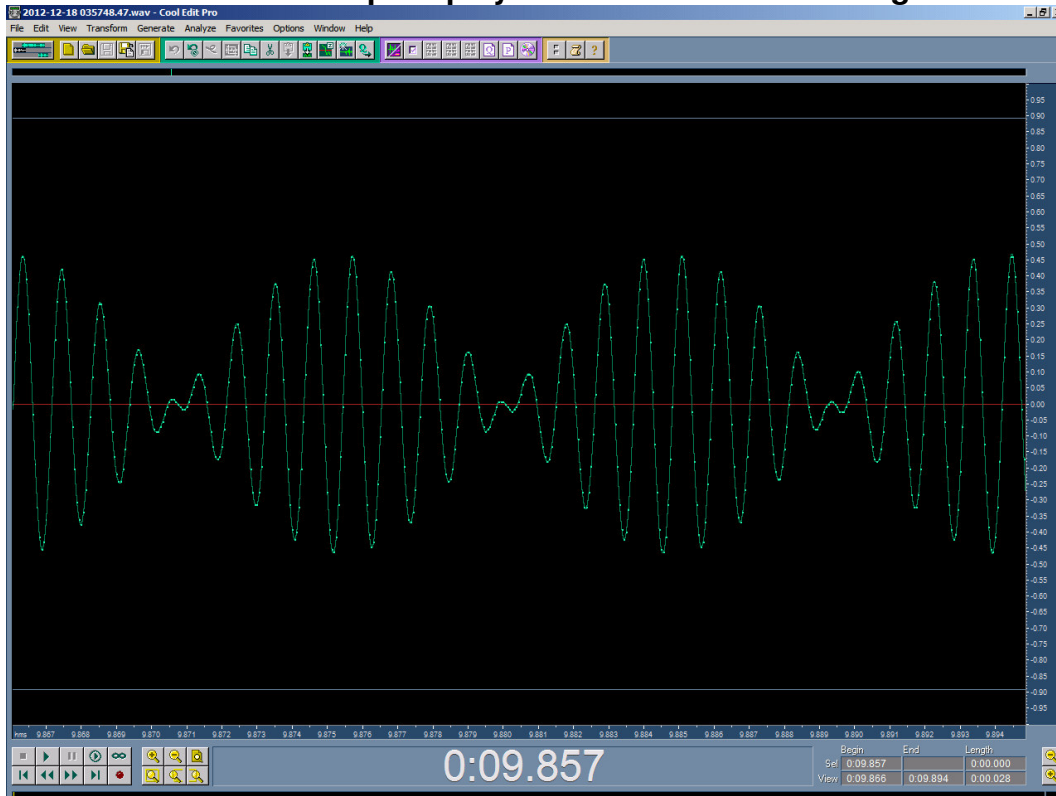


## FSK Tone (Mark Only 2083.3 Hz, 1.92 milliseconds)

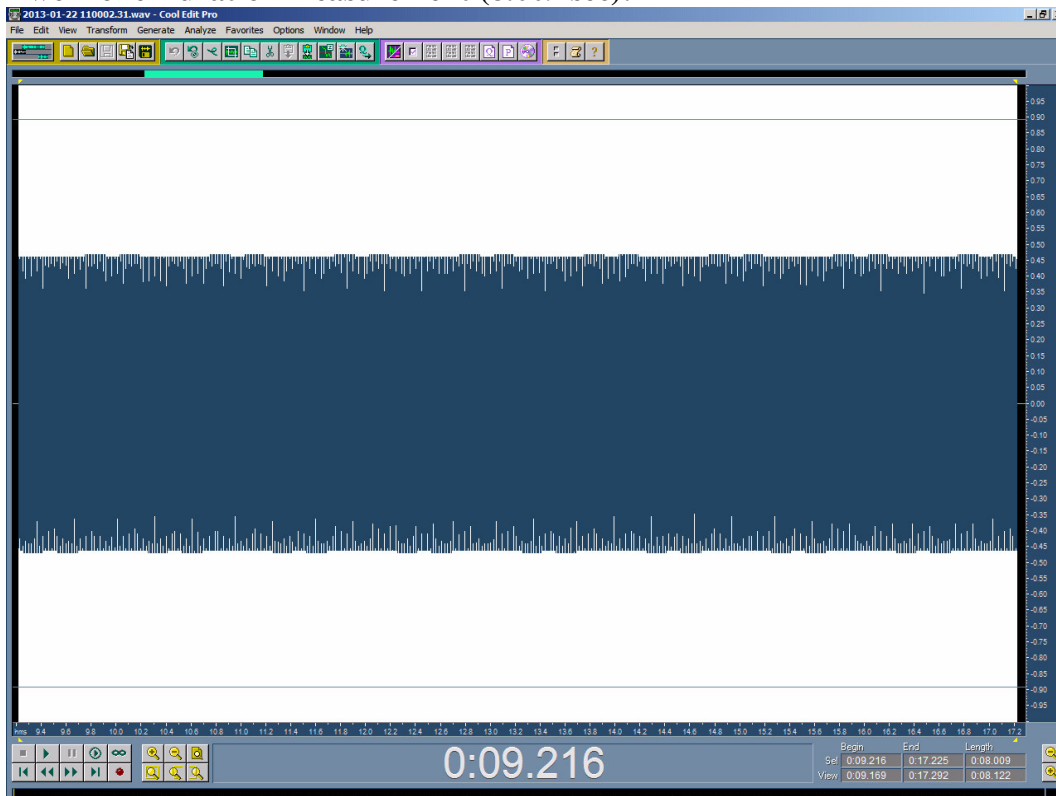




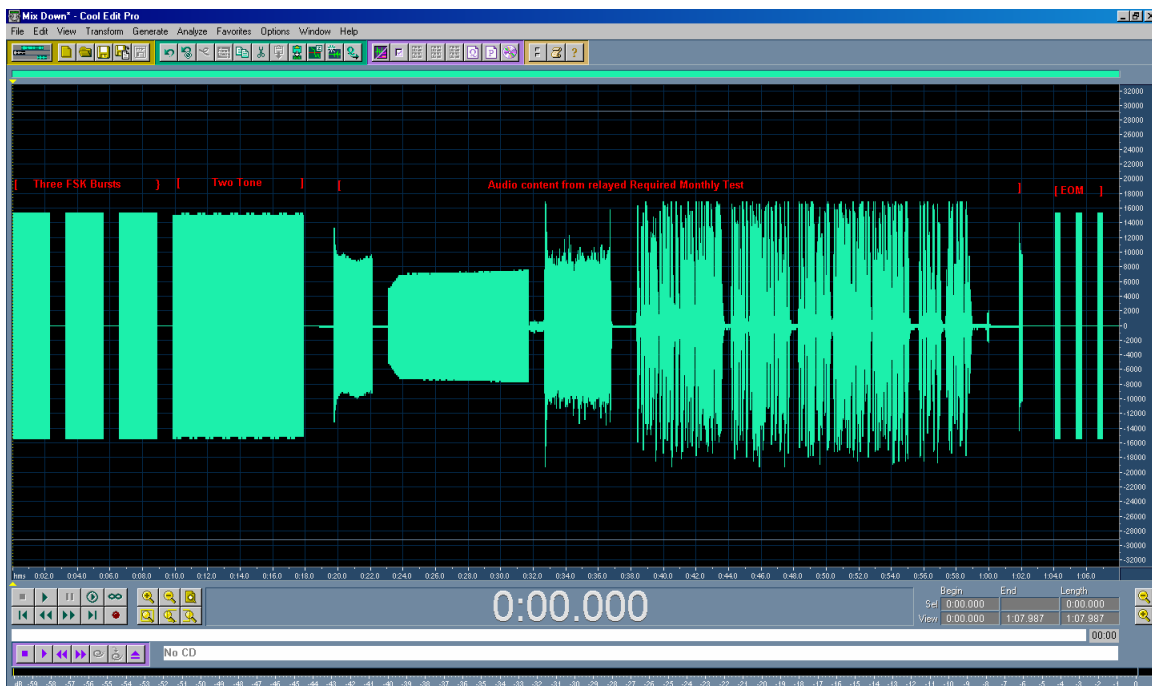
## Close-Up Display of Two-tone Attention Signal:



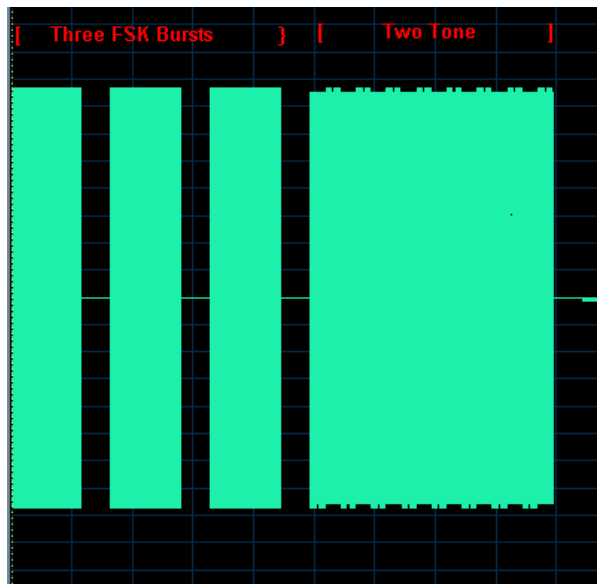
## Two-Tone Duration measurement (8.009 sec):



## Captured output from an actual relay of Required Monthly Test



(The sample shows the three FSK Header Burst with one second pause between each one, at least a one second pause, relayed audio content, at least one second pause, and three 'NNNN' FSK bursts (EOM).



The above header was generated by the unit, and then decoded and contains the following information:  
 “ZCZC-EAS-RMT-026011-026017-026049-026051-026057-026063-026069-026087-026111-026129-026135-026145-026151-026157+0100-3530845-WXYZ//FM”.

The decoded header which triggered the automatic relay of this message:  
 “ZCZC-EAS-RMT-026011-026017-026049-026051-026057-026063-026069-026087-026111-026129-026135-026145-026151-026157+0100-3530845-WHNN FM “

This test indicates the unit is capable is proper header generation, as required by 11.31() and 11.32() of the rules, as well as successful decoding and processing as required by 11.33(). This test was conducted on December 18, 2012. If additional information is needed please contact us.

Submitted by:

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Edward T. Czelada

February 12, 2013

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