**TYPE OF EXHIBIT**: TABLE OF CONTENTS
**FCC PART**: 2.1033(c)(14)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Jan 29, 2016

**TYPE OF EXHIBIT**: LIST OF TEST EQUIPMENT USED
**FCC PART**: 2.947(d)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: VHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** October 23, 2015

| ITEM | MAKE/MODEL | SERIAL NO. | CAL. | NEXT CAL. |
|---|---|---|---|---|
| Agilent | N5181A | MY47070348 | 31 Oct 2014 | 31 Oct 2017 |
| RF Test Set | HP 8920A | 3352A03633 | 12 Oct 2015 | 12 Oct 2017 |
| Spectrum Analyzer | Advantest R3265A | 75060189 | 12 Oct 2015 | 12 Oct 2016 |
| Spectrum Analyzer | HP 8560E | 3720A02980 | 12 Oct 2015 | 12 Oct 2016 |
| Log periodic | Electro-Metrics LPA-25 | 8-101 | 30 Apr 2014 | 30 Apr 2017 |
| Gain Horn | EMCO 3105 | 2034 | N/A | N/A |
| Digital Oscilloscope | Link Instruments DSO-28 | 225100009800 | N/A | N/A |
| Temp. Chamber | Delta Design 3900 | 0-52-R | N/A | N/A |
| DC Power Supply | HQ PS3010U | | N/A | N/A |
| Multimeter | HP 3466A | | N/A | N/A |

| | |
|---|---|
| **TYPE OF EXHIBIT**: | MEASUREMENT METHODS |
| **FCC PART**: | 2.947 |
| **MANUFACTURER**: | RITRON, Inc. |
| **MODEL**: | RQX-417NX |
| **TYPE OF UNIT**: | VHF FM/NXDN 2-way callbox |
| **FCC ID:** | AIERIT41-417 |
| **DATE:** | October 23, 2015 |

Unless noted otherwise, all of the measurements made on this device and included in this report were made per ANSI/TIA-603-C-2004.

Dennis Zimmerman
Project Engineer
RITRON, Inc.

**TYPE OF EXHIBIT**: DESCRIPTION OF MEASUREMENT FACILITY
**FCC PART**: 2.948
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: VHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** April 21, 2015

**DESCRIPTION:**
The emission measurements filed with this application were made on a site certified by RITRON, Inc. Data pertaining to this site is on file with the FCC and Industry Canada.

Firm Registration Number: 536261
Firm FRN: 0004-3348-76
FCC Reference: ANSI STD C63.4-2003
Industry Canada Radio Standard: Procedure 212

This site is used on a continuing basis exclusively by RITRON, Inc. and is utilized only for RF field strength measurements of equipment designed and manufactured by RITRON, Inc. It is not used for measurements by, or for, any other party on a contract basis or otherwise.
All other measurements are taken at RITRON's engineering laboratory in Carmel, IN.

**PHOTO OF RITRON TEST SITE:**

**SIGNED:**

Dennis Zimmerman
Project Engineer
RITRON, Inc.

**TYPE OF EXHIBIT**: RADIO FREQUENCY OUTPUT POWER
**FCC PART**: 2.1046(a)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Jan 29, 2016

**PROCEDURE:**

1. The RQX-417NX was aligned for transmitter operation at three frequencies across the operating band. RF power output using an external 12 VDC was measured. The unit is capable of being powered by 3 D cells or an external 8 to 12 volt battery. The controller senses the battery voltage and adjusts to either low power (nominal 725 mW) or high power (nominal 2.5 W). Battery voltage ranges are as follows:

   3 D cells: 3.3 to 4.5 v
   12 v external battery: 8 v to 12 v

2. Power was supplied to the RQX-417NX by a PS3010U Power Supply. The RQX-417NX was connected to a HP8920A Test Set through an SMB test port connector used to measure the RF carrier power. The input to the Test Set provides a resistive 50-ohm termination at the frequencies and power levels used for this test.

3. The voltage (V tx) and current (I tx) into the power supply lead of the RF Power Module was measured by an HP3466A Digital Multimeter for the various supply voltages.

4. As can be seen in the table the 3 D cells yields a nominal 725 mW output while the external 12 VDC can yield up to 2.5 Watts output power.

**TYPE OF EXHIBIT**: RADIO FREQUENCY OUTPUT POWER
**FCC PART**: 2.1046(a)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Jan 29, 2016

**RESULTS:**

| | 3 D cells | | | | 12v ext input | | | |
|---|---|---|---|---|---|---|---|---|
| **Frequency (MHz)** | **Vin int (VDC)** | **Vtx (VDC)** | **I tx (A)** | **Power (W)** | **Vin ext (VDC)** | **Vtx (VDC)** | **I tx (A)** | **Power (W)** |
| 450 | 3.3 | 3.19 | 0.32 | 0.482 | | | | |
| | 4.5 | 4.39 | 0.42 | 0.824 | | | | |
| | | | | | 8 | 7.05 | 0.78 | 2.42 |
| | | | | | 12 | 7.14 | 0.78 | 2.48 |
| | | | | | | | | |
| 460 | 3.3 | 3.18 | 0.34 | 0.52 | | | | |
| | 4.5 | 4.4 | 0.36 | 0.725 | | | | |
| | | | | | 8 | 7.14 | 0.66 | 2.42 |
| | | | | | 12 | 7.36 | 0.72 | 2.5 |
| | | | | | | | | |
| 470 | 3.3 | 3.19 | 0.32 | 0.5 | | | | |
| | 4.5 | 4.4 | 0.35 | 0.737 | | | | |
| | | | | | 8 | 7.09 | 0.78 | 2.42 |
| | | | | | 12 | 7.34 | 0.78 | 2.5 |

**TYPE OF EXHIBIT**: MODULATOR RESPONSE-FM 12.5 kHz CHANNELS
**FCC PART**: 2.1047(a)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Jan 29, 2016

**PROCEDURE:**

1. The RQX-417NX was aligned for transmitter operation at 460 MHz at 2.5 Watts.

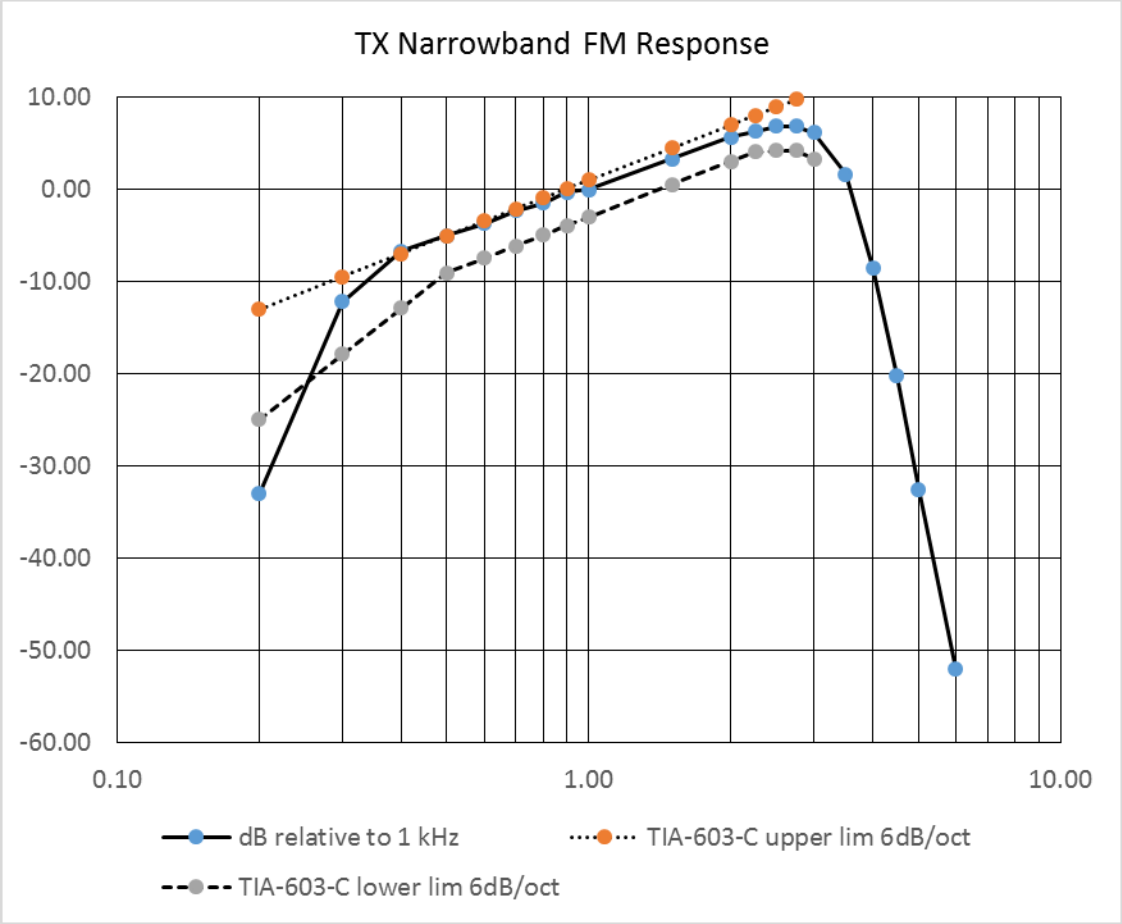
2. The audio output of the HP8920 was swept in frequency from 200 Hz to 6 kHz and was injected in the AUX_IN input.

3. The modulated signal was demodulated by an HP8920A and the audio output signal was sent to an HP8560E spectrum analyzer to obtain a larger dynamic range of measurement.

4. The overall FM deviation is plotted relative to deviation at 1 kHz. The TIA-603-C limits are plotted above and below the response curve. The frequency response is independent of carrier frequency.

**TYPE OF EXHIBIT**: MODULATOR RESPONSE-FM 12.5 kHz CHANNELS
**FCC PART**: 2.1047(a)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Jan 29, 2016

**RESULTS:** Pre-emphasized Transmitter



**TYPE OF EXHIBIT**: MODULATION LIMITING CURVES
**FCC PART**: 2.1047(b)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Jan 29, 2016

**PROCEDURE:**

1. The RQX-417NX was aligned for transmitter operation on 460.025 MHz.

2. The RF output was connected to the RF input of a radio Test Set configured to measure FM deviation. The audio output of the audio test set was routed to the audio input of the RQX-417NX.

3. The frequency of the audio generator was adjusted to find the frequency of maximum response. As outlined in the Maintenance manual the RQX-417NX transmit deviation was adjusted for 2.4 kHz maximum deviation for 12.5 kHz channel spacing. Other FM deviations were compared to this as a percentage of maximum deviation.

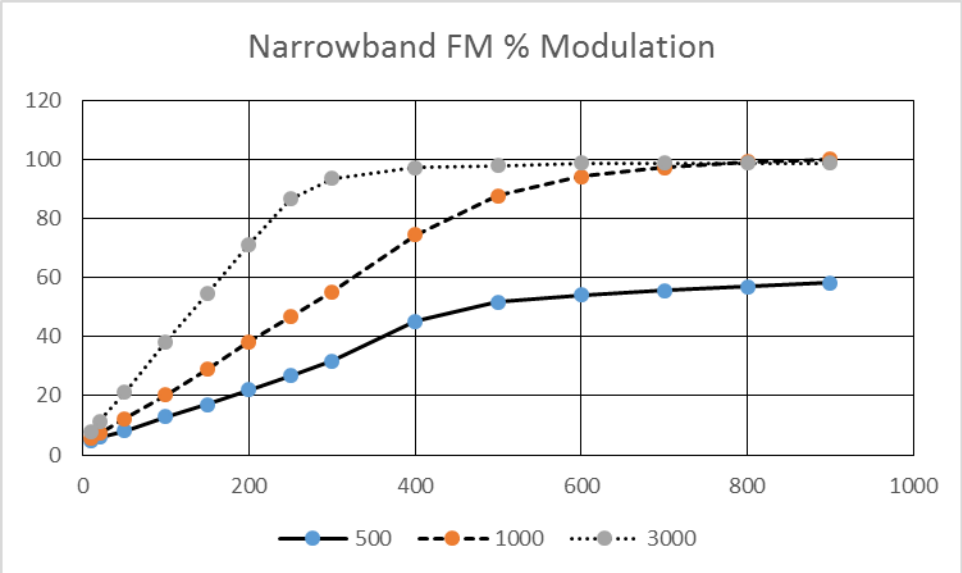
4. The audio frequency was set to 500 Hz and the output level was varied from zero to a level producing limiting.

5. Step 4 was repeated for audio frequencies of 500, 1000 and 3000 Hz for 12.5 kHz channel spacing.

**TYPE OF EXHIBIT**: MODULATION LIMITING CURVES-12.5 kHz CHANNELS
**FCC PART**: 2.1047(b)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Jan 29, 2016

**RESULTS:** Pre-emphasized TX

| Vinput | Frequency(kHz) | | |
|---|---|---|---|
| (mVrms) | 500 | 1000 | 3000 |
| 10 | 0.12 | 0.14 | 0.19 |
| 20 | 0.145 | 0.18 | 0.28 |
| 50 | 0.2 | 0.3 | 0.52 |
| 100 | 0.32 | 0.5 | 0.94 |
| 150 | 0.42 | 0.71 | 1.34 |
| 200 | 0.54 | 0.94 | 1.75 |
| 250 | 0.66 | 1.15 | 2.13 |
| 300 | 0.78 | 1.36 | 2.3 |
| 400 | 1.11 | 1.83 | 2.39 |
| 500 | 1.27 | 2.16 | 2.41 |
| 600 | 1.33 | 2.32 | 2.43 |
| 700 | 1.37 | 2.39 | 2.43 |
| 800 | 1.4 | 2.44 | 2.43 |
| 900 | 1.43 | 2.46 | 2.43 |



**TYPE OF EXHIBIT**: OCCUPIED BANDWIDTH
**FCC PART**: 2.1049(c)(1), 90.210(d), 90.210(e)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Feb 3, 2016

**PROCEDURE:**

1. A 20 dB attenuator was inserted between the RQX-417NX and the HP 8560E spectrum analyzer. Output power was set at the maximum 2.5 Watts. All plots have power spectra within the superimposed FCC occupied bandwidth masks. The occupied bandwidth plots are independent of carrier frequency, therefore, only the plots for 460.025 MHz are shown. Plot specifics for each plot follow:

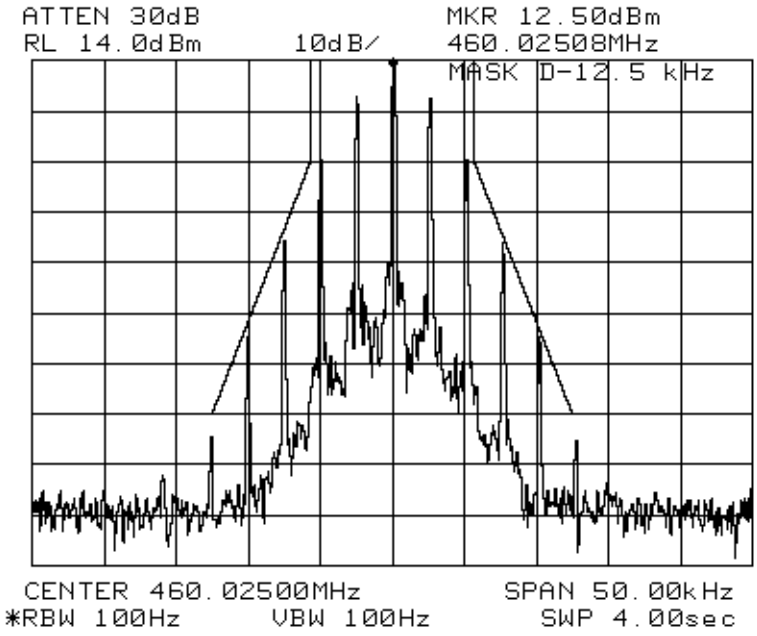
2. For 12.5 kHz analog channel voice operation, a 2.5 kHz audio signal was applied to the microphone input of the unit. Its level was adjusted to be 16 dB above that required to produce 50% of peak deviation at the frequency of maximum deviation. The deviation adjustment was set for 2.4 kHz maximum deviation for 12.5 kHz channel operation and a spectrum analyzer was connected to the RF output through an RF power attenuator. The analyzer was set to sweep +/-25 kHz of carrier with a reference level set to that of an unmodulated carrier.

3. For 12.5 kHz digital voice and data operation, the NXDN module transmits 4 FSK at about +/-3.1 kHz deviation. The analyzer was set to sweep +/-25 kHz of carrier with a reference level set to that of the unmodulated carrier. Digital voice and data are indistinguishable when viewed on a spectrum analyzer and therefore, will be shown as one plot.

4. For 6.25 kHz digital voice and data operation the NXDN module transmits 4 FSK at about +/-1.3 kHz deviation. The analyzer is set to sweep +/-10 kHz either side of the carrier. Digital voice and data are indistinguishable when viewed on a spectrum analyzer and therefore, will be shown as one plot. Also, digital and voice and data can also be combined as a common signal with the plot appearing the same as data or digitized voice.

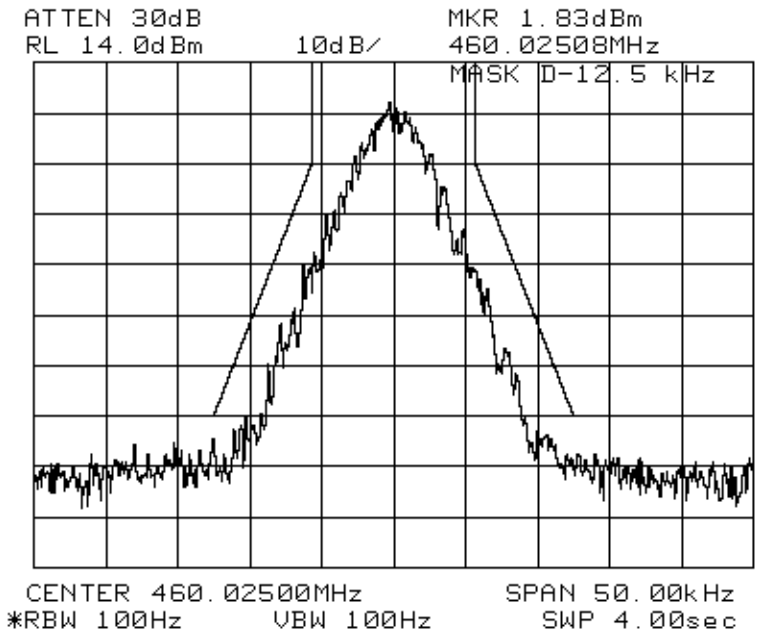
**TYPE OF EXHIBIT**: OCCUPIED BANDWIDTH-Analog 12.5 kHz CHANNELS
**FCC PART**: 2.1049(c)(1), 90.210(d)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Feb 3, 2016

**RESULTS:** Analog voice modulation



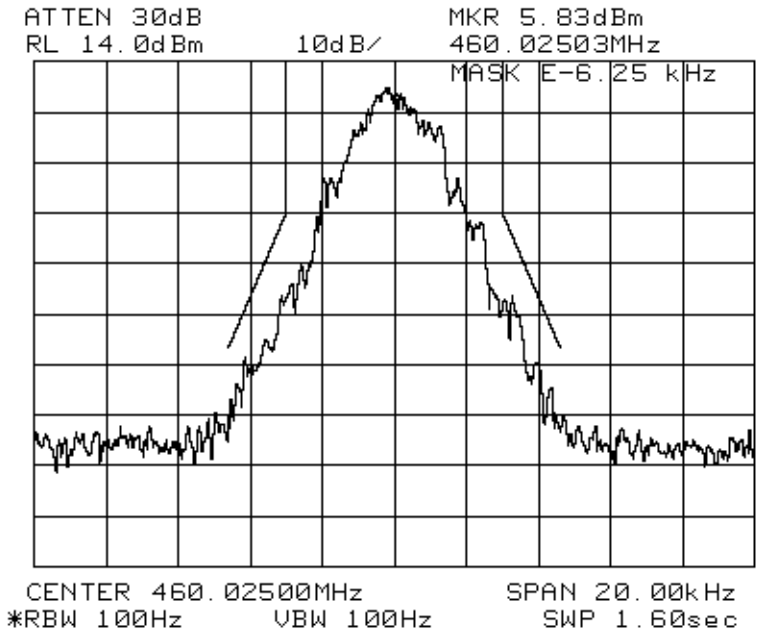
**TYPE OF EXHIBIT**: OCCUPIED BANDWIDTH- Digital 12.5 kHz CHANNELS
**FCC PART**: 2.1049(c) (1), 90.210(d)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Feb 3, 2016

**RESULTS:** narrow band digital voice/data modulation



**TYPE OF EXHIBIT**: OCCUPIED BANDWIDTH-6.25 kHz CHANNELS
**FCC PART**: 2.1049(c)(1), 90.210(e)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Feb 3, 2016

**RESULTS:** Super-narrow band digital voice/data modulation



**TYPE OF EXHIBIT**: BANDWIDTH CALCULATION/MODULATION TYPE
**FCC PART**: 2.1049(c)(1), 90.210(d), 90.210(e)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Feb 3, 2016

**RESULTS:**

Modulation:

Analog Voice

Analog voice signals directly modulates the transmitter carrier with a maximum peak deviation which is dependant upon the channel spacing. Voice signals are pre-emphasized, limited, and filtered prior to being sent to the modulator.

Digital Voice & Data -4FSK

NXDN digital voice and data is the 4-level (4FSK) filtered output of a digital voice encoder and directly modulates the transmitter carrier. The maximum deviation is dependent upon the channel spacing. The 4FSK data stream is encoded into dibits (2 bit symbols) at half the original data rate and used to create a 4-level signal which passes through a root-raised cosine filter and is then used to directly modulate the transmitter carrier. The maximum deviation is dependent upon the channel spacing which in NXDN is either super-narrow band at 6.25 kHz or wideband at 12.5 kHz.

**TYPE OF EXHIBIT**: BANDWIDTH CALCULATION/MODULATION TYPE
**FCC PART**: 2.1049(c)(1), 90.210(d), 90.210(e)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Feb 3, 2016

**RESULTS:**

By Carson's rule, the occupied bandwidth for an FM signal may be calculated by:

$BW = 2(f_\Delta + f_m)$ where $f_\Delta$ is the frequency deviation and $f_m$ is the modulating frequency.

| Modulation | $f_\Delta$ | $f_m$ | BW | Emissions Designator |
|---|---|---|---|---|
| Analog Voice | | | | |
| 12.5 kHz | 2.5 | 3 | 11.0 | 11K0F3E |
| Digital Voice | | | | |
| 6.25 kHz | 1.05 | 0.95 | 4.0 | 4K00F1E |
| 12.5 kHz | 2.10 | 1.90 | 8.0 | 8K00F1E |
| 4FSK Data | | | | |
| 6.25 kHz | 1.05 | 0.95 | 4.0 | 4K00F1D |
| 12.5 kHz | 2.10 | 1.90 | 8.0 | 8K00F1D |
| Digital Voice/Data Combination | | | | |
| 6.25 kHz | 1.05 | 0.95 | 4.0 | 4K00F7W |
| 12.5 kHz | 2.10 | 1.90 | 8.0 | 8K00F7W |

**TYPE OF EXHIBIT**: CONDUCTED SPURIOUS EMISSIONS
**FCC PART**: 2.1051, 90.210(d)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Jan 29, 2016

**PROCEDURE:**

1. The RQX-417NX was aligned for transmitter operation low, mid and high frequencies and at a 2.5 Watt power level. The transmitter was modulated in a manner consistent with the type of signal to be transmitted.

2. The RF output was connected to an HP 8560E spectrum analyzer through a 20 dB, 10 watt, 50-ohm RF attenuator. The frequency spectrum around each carrier was searched from 9 kHz to 900 MHz. No spurious above -25 dBm exists in this range.

3. In searching above 900 MHz, a 900 MHz high pass filter was added after the attenuator in order to see only the harmonic spurious and negate the overload effects of the transmitter.

4. The transmitter was keyed and the output spectrum was examined up to 4.7 GHz. The attenuation of the high pass filter at the transmitter harmonic frequencies was measured and factored into the absolute results. These results are tabulated below.

**TYPE OF EXHIBIT**: CONDUCTED SPURIOUS EMISSIONS
**FCC PART**: 2.1051, 90.210(d)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Jan 29, 2016

**RESULTS:**

| Carrier Frequency (MHz) | Harmonic | Harmonic Frequency (MHz) | Spur level (dBm) | margin < -25dBm (dB) |
|---|---|---|---|---|
| 450 | | | | |
| | 2 | 900 | -50 | 25 |
| | 3 | 1350 | -50 | 25 |
| | 4 | 1800 | -50 | 25 |
| 460 | | | | |
| | 2 | 920 | -50 | 25 |
| | 3 | 1380 | -50 | 25 |
| | 4 | 1840 | -50 | 25 |
| 470 | | | | |
| | 2 | 940 | -47.5 | 22.5 |
| | 3 | 1410 | -49.3 | 24.3 |
| | 4 | 1880 | -48.8 | 23.8 |

**Passed:** predominate spurs at the 2nd, 3rd and 4th harmonics are well below the -25 dBm limit.

**TYPE OF EXHIBIT:** FIELD STRENGTH OF SPURIOUS EMISSIONS-TRANSMITTER
**FCC PART**: 2.1053(a), (b)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Nov 30, 2015

**PROCEDURE:**

1. The measurements for field strength of spurious emissions were taken at the RITRON, Inc. 3-meter test site, details of which are on file with the FCC and Industry Canada.

2. The RQX-417NX was aligned and programmed for transmitter operation close to the band edges of 451.025 and 469.975 MHz and the band center of 460.025 MHz at a 2.5 Watt power level.

3. The transmitter was connected to its internal UHF antenna.

4. All field strength measurements were made with the Advantest R3265A spectrum analyzer, log periodic antenna and EMCO gain horn.

5. The transmitter was keyed and the spectrum searched from 9 kHz to the $10^{th}$ harmonic of the transmitted carrier. When a spurious emission was found, the height of the field strength measurement antenna and orientation of the RQX-417NX were varied to provide maximum field strength. This level is noted as Pspur.

6. A substitution antenna, a calibrated dipole, was substituted for the RQX-417NX at the RQX-417NX's location. An RF signal generator was set at the frequency of the RQX-417NX spurious at a level of Pgen (0 dBm).

7. The height of the field strength measurement antenna was adjusted for maximum signal strength. The level at the field strength antenna was noted as Pref.

**TYPE OF EXHIBIT**: FIELD STRENGTH OF SPURIOUS EMISSIONS-TRANSMITTER
**FCC PART**: 2.1053(a), (b)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Nov 30, 2015

**EQUATIONS:**

For an absolute level of the spur, the equation is:

Spur Level(dBm) = Pspur (dBm) - Pref (dBm) + Lcab (dB) - Pgen (dBm)

For radiated emissions testing, Pspur (dBm) is the spurious emissions level as measured at the range receiving antenna.

Where:

Pgen is the RF signal generator level at the substitution antenna input.

Lcab is the cable loss from the substitution signal generator to the substitution antenna.

Pref is the power level of the substitution antenna emission at the receiving antenna output.

**TYPE OF EXHIBIT**: FIELD STRENGTH OF SPURIOUS EMISSIONS-TRANSMITTER
**FCC PART**: 2.1053(a), (b)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Nov 30, 2015

Three frequencies 451.025, 460.025 and 469.975 MHz were tested for spurious emissions exceeding the FCC limit of -25 dBm (relative level of -59 dBc). The substitution method of measurement was used. All spurious levels passed. The ones that where within 20 dB of the FCC limits are harmonics and are recorded below:

451.025 MHz harmonics:

Horizontal:

| | freq(GHz) | Sub pwr(dBm) | Sub horz ref(dBm) | Max Horz (dBm) | Max Spur ERP (dBm) | Max Spur ERP (dBc) | FCC limit (dBm) | FCC limit (dBc) | FCC Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.451025 | -1.59 | -24.13 | -2.59 | 20.0 | | | | |
| 2 | 0.90205 | -3.22 | -35.75 | -75.69 | -43.2 | -77.1 | -25 | -59.0 | 18.2 |
| 6 | 2.70615 | -6.94 | -51.09 | -82.69 | -38.5 | -72.5 | -25 | -59.0 | 13.5 |
| 7 | 3.157175 | -10.28 | -61.34 | -88.75 | -37.7 | -71.7 | -25 | -59.0 | 12.7 |
| 8 | 3.6082 | -14.41 | -69.41 | -93.38 | -38.4 | -72.4 | -25 | -59.0 | 13.4 |
| 9 | 4.059225 | -15.09 | -69.72 | -91.72 | -37.1 | -71.1 | -25 | -59.0 | 12.1 |
| 10 | 4.51025 | -15.66 | -72.59 | -98.38 | -41.5 | -75.4 | -25 | -59.0 | 16.5 |

Vertical:

| | freq(GHz) | Sub pwr(dBm) | Sub Vert ref(dBm) | Max Vert (dBm) | Max Spur ERP (dBm) | Max Spur ERP (dBc) | FCC limit (dBm) | FCC limit (dBc) | FCC Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.451025 | -1.59 | -27.50 | 1.4 | 27.3 | | | | |
| 2 | 0.90205 | -3.22 | -41.03 | -72 | -34.5 | -68.4 | -25 | -59.0 | 9.5 |
| 3 | 1.353075 | -4.53 | -45.75 | -84 | -42.6 | -76.6 | -25 | -59.0 | 17.6 |
| 6 | 2.70615 | -6.94 | -51.41 | -87 | -42.5 | -76.5 | -25 | -59.0 | 17.5 |
| 8 | 3.6082 | -14.41 | -64.63 | -92.88 | -42.7 | -76.6 | -25 | -59.0 | 17.7 |

**TYPE OF EXHIBIT**: FIELD STRENGTH OF SPURIOUS EMISSIONS-TRANSMITTER
**FCC PART**: 2.1053(a), (b)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Nov 30, 2015

460.025 harmonics:

Horizontal:

| | freq(GHz) | Sub pwr(dBm) | Sub horz ref(dBm) | Max Horz (dBm) | Max Spur ERP (dBm) | Max Spur ERP (dBc) | FCC limit (dBm) | FCC limit (dBc) | FCC Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 0.92005 | -3.19 | -37.38 | -77.38 | -43.2 | -25 | -77.2 | -59.0 | 18.2 |
| 6 | 2.76015 | -6.72 | -53.09 | -86.50 | -40.1 | -25 | -74.1 | -59.0 | 15.1 |
| 7 | 3.220175 | -10.16 | -63.16 | -91.28 | -38.3 | -25 | -72.3 | -59.0 | 13.3 |
| 8 | 3.6802 | -12.06 | -71.50 | -99.41 | -40.0 | -25 | -73.9 | -59.0 | 15.0 |
| 9 | 4.140225 | -14.16 | -69.91 | -97.34 | -41.6 | -25 | -75.6 | -59.0 | 16.6 |
| 10 | 4.60025 | -14.09 | -71.19 | -88.44 | -31.3 | -25 | -65.3 | -59.0 | 6.3 |

Vertical:

| | freq(GHz) | Sub pwr(dBm) | Sub Vert ref(dBm) | Max Vert (dBm) | Max Spur ERP (dBm) | Max Spur ERP (dBc) | FCC limit (dBm) | FCC limit (dBc) | FCC Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 0.92005 | -3.19 | -37.38 | -74 | -39.9 | -25 | -73.9 | -59.0 | 14.9 |
| 6 | 2.76015 | -6.72 | -53.09 | -89 | -42.6 | -25 | -76.6 | -59.0 | 17.6 |
| 7 | 3.220175 | -10.16 | -63.16 | -96.00 | -43.0 | -25 | -77.0 | -59.0 | 18.0 |
| 9 | 4.140225 | -14.16 | -69.91 | -92.00 | -36.3 | -25 | -70.2 | -59.0 | 11.3 |

**TYPE OF EXHIBIT**: FIELD STRENGTH OF SPURIOUS EMISSIONS-TRANSMITTER
**FCC PART**: 2.1053(a), (b)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Nov 30, 2015

469.975 harmonics:

Horizontal:

| | freq(GHz) | Sub pwr(dBm) | Sub horz ref(dBm) | Max Horz (dBm) | Max Spur ERP (dBm) | Max Spur ERP (dBc) | FCC limit (dBm) | FCC limit (dBc) | FCC Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 7 | 3.289825 | -11.69 | -66.69 | -96.28 | -41.3 | -25 | -75.3 | -59.0 | 16.3 |
| 8 | 3.7598 | -13.22 | -72.84 | -97.19 | -37.6 | -25 | -71.5 | -59.0 | 12.6 |
| 9 | 4.229775 | -14.97 | -74.34 | -92.88 | -33.5 | -25 | -67.5 | -59.0 | 8.5 |

Vertical:

| | freq(GHz) | Sub pwr(dBm) | Sub Vert ref(dBm) | Max Vert (dBm) | Max Spur ERP (dBm) | Max Spur ERP (dBc) | FCC limit (dBm) | FCC limit (dBc) | FCC Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 7 | 3.289825 | -11.69 | -59.28 | -101.00 | -53.4 | -25 | -87.4 | -59.0 | 28.4 |
| 8 | 3.7598 | -13.22 | -68.94 | -97.75 | -42.0 | -25 | -76.0 | -59.0 | 17.0 |
| 9 | 4.229775 | -14.97 | -73.66 | -100.80 | -42.1 | -25 | -76.1 | -59.0 | 17.1 |

**TYPE OF EXHIBIT**: FREQUENCY STABILITY VS TEMPERATURE
**FCC PART**: 2.1055(a)(1), 90.213
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** March 8, 2016

**PROCEDURE:**

1. The RQX-417NX uses both a 26 MHz reference oscillator for the analog radio and a 36.4 MHz reference oscillator for the digital radio. Both are aligned for transmitter operation at 460.025 MHz at 2.5 Watts.

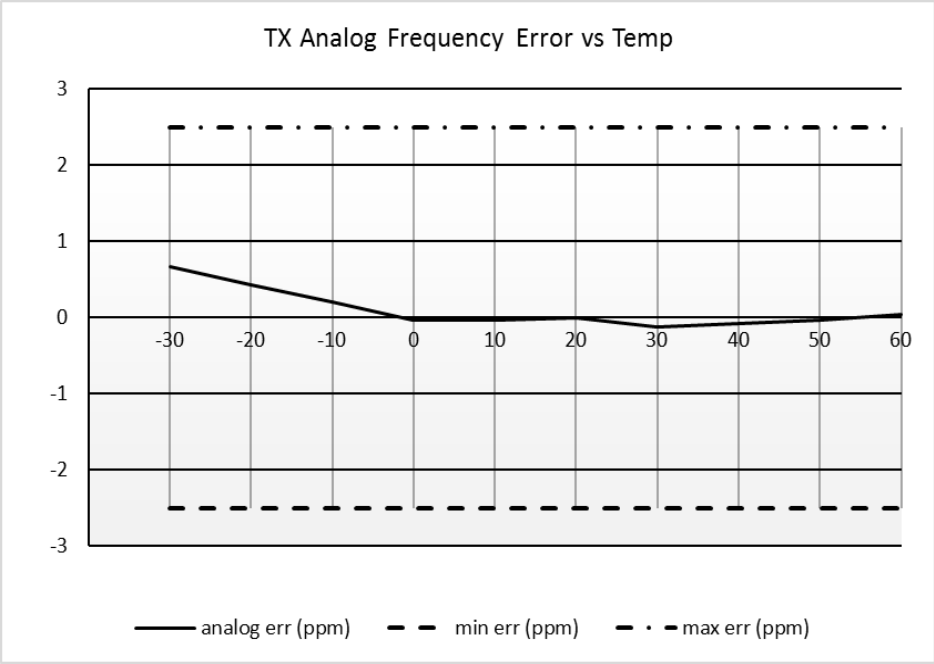
2. The RQX-417NX was placed in a Temperature Chamber. The RF output of the RQX-417NX was connected to an HP 8920 Test Set to monitor the transmitter frequency. A PS3010U Power Supply was adjusted for a nominal voltage of 12 VDC and connected to the DC power supply input of the RQX-417NX. An AD592 precision temperature transducer was used to monitor the temperature inside the chamber.

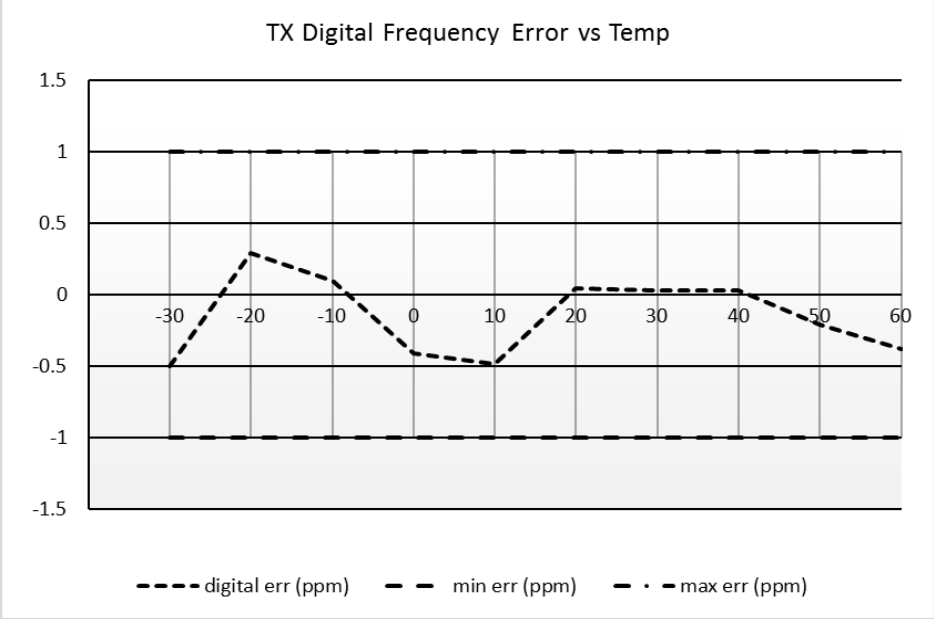
3. The chamber and the RQX-417NX were cooled to -30 degrees C and slowly raised in temperature. The temperature was allowed to stabilize for 10 minutes for each 10 degree increment in temperature until the unit reached a temperature of 60 degrees C.

4. The RF frequency at each temperature was recorded and compared with the frequency at 20 degrees C. All performance was well within the +/- 2.5 ppm FCC limits 12.5 kHz analog and +/- 1 ppm for 6.25 kHz digital.

**TYPE OF EXHIBIT**: FREQUENCY STABILITY VS TEMPERATURE
**FCC PART**: 2.1055(a)(1), 90.213
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** March 8, 2016

**RESULTS:**



| Temp (C) | analog error (ppm) | digital error (ppm) |
|---|---|---|
| -30 | 0.67 | -0.50 |
| -20 | 0.44 | 0.30 |
| -10 | 0.21 | 0.10 |
| 0 | -0.03 | -0.41 |
| 10 | -0.03 | -0.48 |
| 20 | 0.00 | 0.04 |
| 30 | -0.12 | 0.03 |
| 40 | -0.08 | 0.03 |
| 50 | -0.03 | -0.21 |
| 60 | 0.05 | -0.38 |

**TYPE OF EXHIBIT**: FREQUENCY STABILITY VS SUPPLY VOLTAGE
**FCC PART**: 2.1055(d)(1)
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Feb3, 2016

**PROCEDURE:**

1. The RQX-417NX was aligned for transmitter operation at 460.025 MHz with 2.5 Watts output power. The unit is capable of operating on an external power supply or internal batteries. The unit was initially setup with the external power option with a nominal range of 8 to 12 VDC.

2. The RF output of the RQX-417NX was connected to an HP 8920B Test Set to monitor the transmitter frequency. A PS3010U Supply was adjusted over the potential range of the external power supply input of the RQX-417NX. The output frequency of the RQX-417NX was noted. All readings were within the FCC +/- 2.5 ppm for 12.5 kHz and +/- 1 ppm for 6.25 kHz systems stability (90.213 footnote 8)

3. The above was repeated for the unit simulating the 3.3 to 4.5 VDC range of the internal 3 D cell batteries. In all cases frequency stability stays within the FCC limits.

**RESULTS:**

| External VDC | Analog Freq (MHz) | Freq Error (ppm) | Digital Freq (MHz) | Freq Error (ppm) |
|---|---|---|---|---|
| 6 | 460.025009 | 0.02 | 460.025016 | 0.03 |
| 7 | 460.025011 | 0.02 | 460.025018 | 0.04 |
| 8 | 460.025011 | 0.02 | 460.025008 | 0.02 |
| 9 | 460.025008 | 0.02 | 460.02499 | -0.02 |
| 10 | 460.025003 | 0.01 | 460.02499 | -0.02 |
| 11 | 460.025003 | 0.01 | 460.024985 | -0.03 |
| 12 | 460.025 | 0.00 | 460.02499 | -0.02 |
| 13 | 460.025003 | 0.01 | 460.024986 | -0.03 |

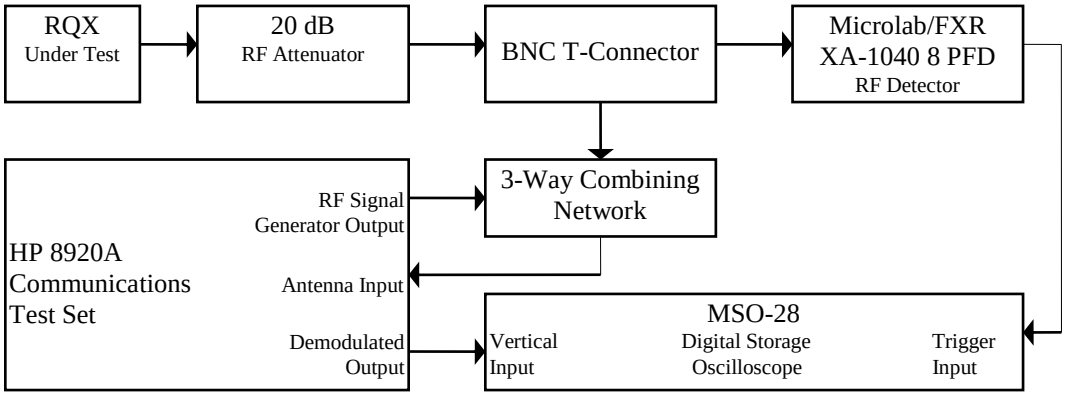
| Internal VDC | Analog Freq (MHz) | Freq Error (ppm) | Digital Freq (MHz) | Freq Error (ppm) |
|---|---|---|---|---|
| 3.3 | 460.025011 | 0.02 | 460.025008 | 0.02 |
| 3.5 | 460.025013 | 0.03 | 460.025005 | 0.01 |
| 4 | 460.025013 | 0.03 | 460.025 | 0.00 |
| 4.5 | 460.025013 | 0.03 | 460.025001 | 0.00 |

**TYPE OF TEST**: TRANSIENT FREQUENCY BEHAVIOR
**FCC PART**: 90.214
**MANUFACTURER**: RITRON, INC.
**MANUFACTURER**: RITRON, Inc.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Feb 2, 2016

**PROCEDURE**:

1. The RQX-417NX was aligned for transmitter operation on 460.025 MHz at full rated power. The following procedure will be run first for the narrowband analog radio subsystem and then for the NXDN digital subsystem.

2. The test equipment was connected per the following diagram:




3. The HP 8920A Receiver was set to measure FM deviation with the audio bandwidth set at <20 Hz to greater than 230 kHz with the RF frequency set to 460.025 MHz.

4. The RQX-417NX transmitter under test was activated and the HP 8920A was used to measure the RF response through the test network.

**TYPE OF TEST**: TRANSIENT FREQUENCY BEHAVIOR
**FCC PART**: 90.214
**MANUFACTURER**: RITRON, INC.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Feb 2, 2016

**PROCEDURE** (continued):

5. The RQX-417NX transmitter was turned off. The HP 8920A RF Signal Generator was set to 460.025 MHz at an RF level at the HP 8920A which was 30 dB below that measured in step 3 and modulated with a 1 kHz tone at +/-12.5 kHz for analog and +/-6.25 kHz deviation for digital.

6. The MSO-28 Digital Oscilloscope Horizontal Sweep Rate was set to 10 msec/div. The Vertical Amplitude Control was adjusted to display the 1000 Hz demodulated audio from the Signal Generator at +/-4 divisions, vertically centered on the screen.

7. The MSO-28 Digital Oscilloscope was set to trigger at 1 division from the left side of the display when the RF Detector sensed RF power from the RQX-417NX transmitter.

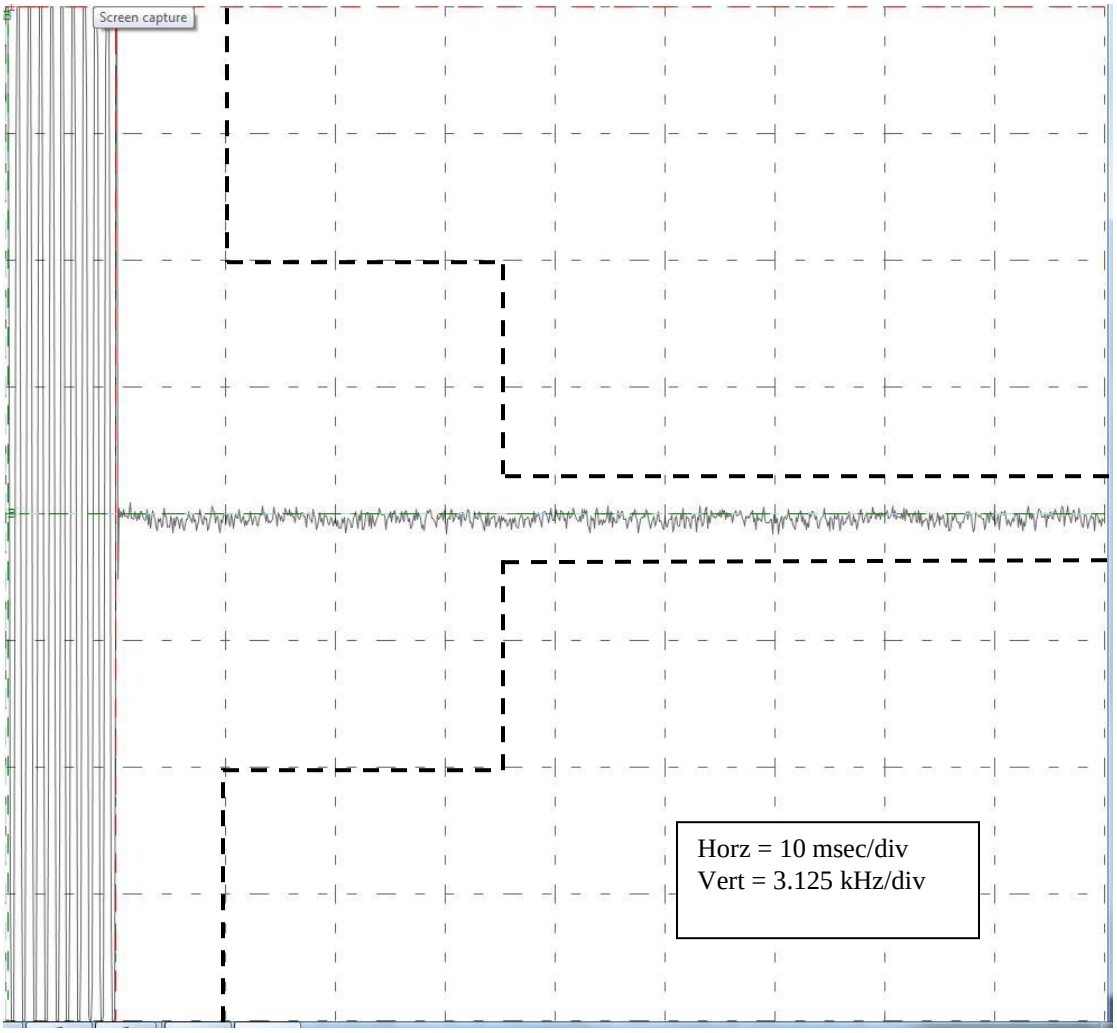
8. The RQX-417NX transmitter was activated and the resulting waveform on the oscilloscope display was stored and plotted. The FCC limits per Part 90.214 were added to the plot. The resulting plot is labeled “Switch On Condition” and shows compliance with FCC Part 90.214/IC RSS-119, section 6.5.

9. The MSO-28 Digital Oscilloscope was set to trigger at 1 division from the right side of the display when the RF Detector senses loss of RF power from the RQX-417NX transmitter.

10. The RQX-417NX transmitter was turned off and the resulting waveform on the oscilloscope display was stored and plotted. The limits per FCC Part 90.214/RSS-119, section 6.5 were added to the plot in the same manner illustrated in EIA-603 Part 3.2.19.2. The resulting plot is labeled “Switch Off Condition” and shows compliance.

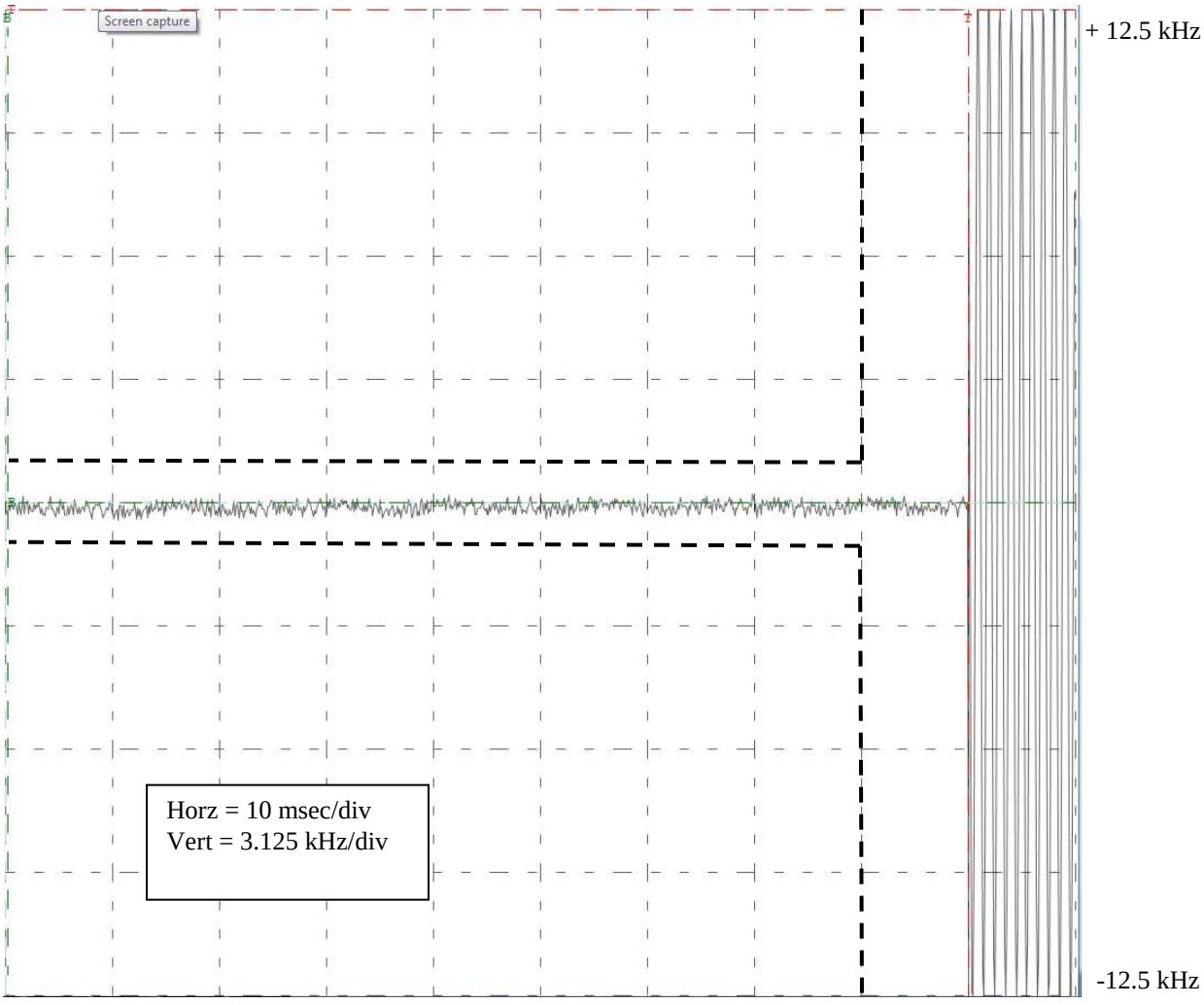
**TYPE OF TEST**: TRANSIENT FREQUENCY BEHAVIOR
**FCC PART**: 90.214
**MANUFACTURER**: RITRON, INC.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Feb 2, 2016

**RESULTS:** Analog Narrowband Switch-On Condition



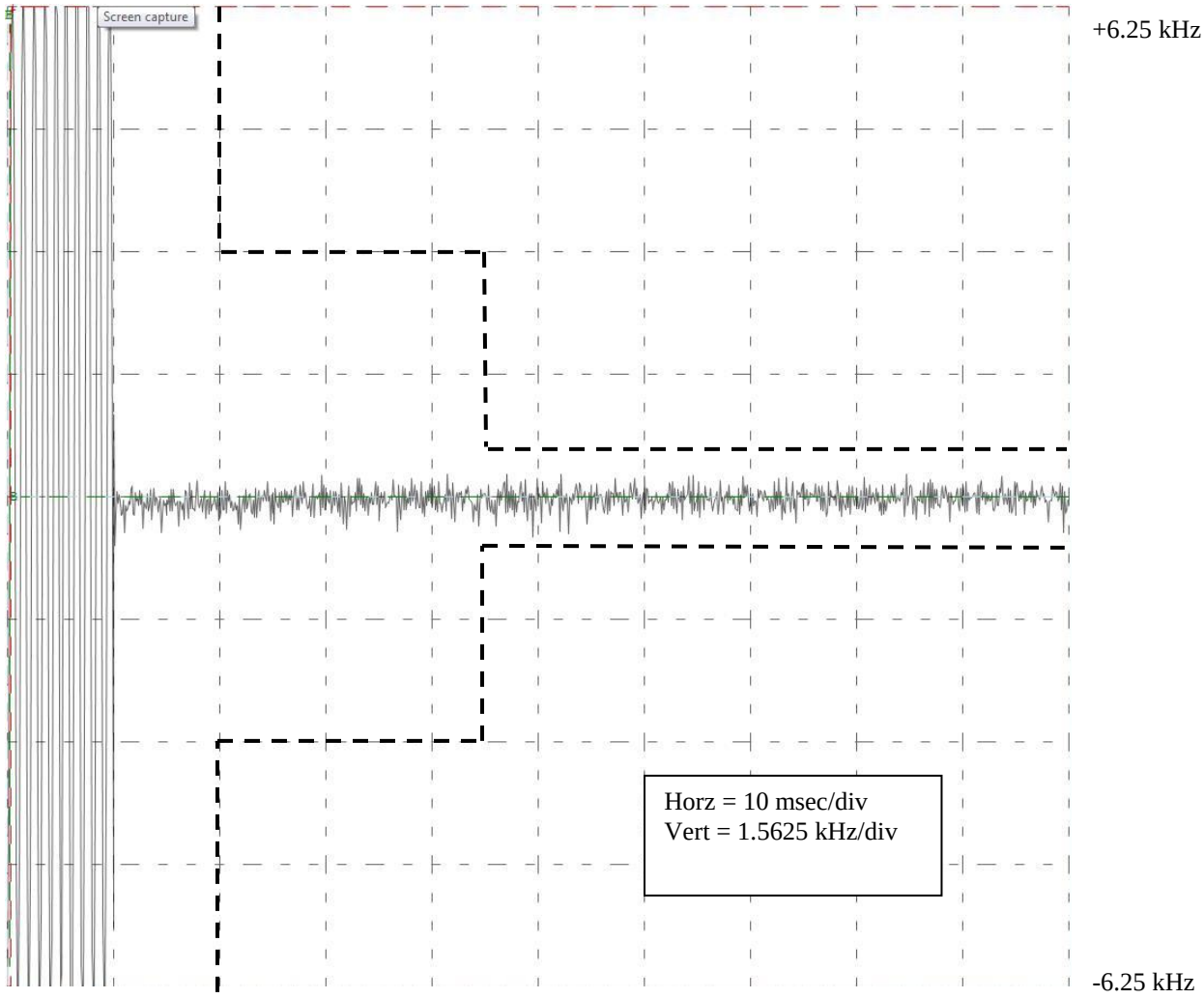
**TYPE OF TEST**: TRANSIENT FREQUENCY BEHAVIOR
**FCC PART**: 90.214
**MANUFACTURER**: RITRON, INC.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Feb 2, 2016

**RESULTS:** Analog Narrowband Switch-Off Condition



**TYPE OF TEST**: TRANSIENT FREQUENCY BEHAVIOR
**FCC PART**: 90.214
**MANUFACTURER**: RITRON, INC.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Feb 2, 2016

**RESULTS:** Digital Super Narrowband Switch-On Condition



**TYPE OF TEST**: TRANSIENT FREQUENCY BEHAVIOR
**FCC PART**: 90.214
**MANUFACTURER**: RITRON, INC.
**MODEL**: RQX-417NX
**TYPE OF UNIT**: UHF FM/NXDN 2-way callbox
**FCC ID:** AIERIT41-417
**DATE:** Feb 2, 2016

**RESULTS:** Digital Super Narrowband Switch-Off Condition