



Engineering Solutions & Electromagnetic Compatibility Services

**FCC Part 15.231 Test Data**

**433.92 MHz CO Sensor**

**Model: RE315 and RE615**

**for**

**Resolution Engineering, Inc.  
1402 Heggen Street  
Hudson, WI 54016  
Contact: Jake Peterson**

**Testing Conducted By:**

**Rhein Tech Laboratories, Inc.  
360 Herndon Parkway, Suite 1400  
Herndon, VA 20170**

**RTL Test Engineer: *Khue Do/Dan Baltzell***

**RTL Project/Report Number: 2017258**

**December 7, 2017**

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These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANAB. Refer to certificate and scope of accreditation AT-1445.

## Radiated Spurious Harmonics Emissions

The data and limits presented in this report are for radiated emissions per 15.231(b)(2) which references 15.35(b), and peak limiting for restricted bands per 15.209(e), which again references 15.35(b)(2), as procured by Resolution Engineering. No average data is presented in this report. Data is also presented for spurious, non-harmonic radiated emissions per 15.209. The Equipment Under Test (EUT) was the **433.92 MHz CO Sensor (RTL Bar Code 22208 (CW), 22212 (normal operation RE315 DSC), 22213 (normal operation RE615 Resolution))**.

## Test Procedure

Radiated fundamental and spurious emissions were tested at three meters. The EUT was tested in the three orthogonal planes with the receive antenna in both polarities. The emissions were maximized; that is, the measurement antenna height was varied between 1 and 4 m, and the EUT was rotated through 360° on a rotating turntable until the maximum emissions were found. Both horizontal and vertical measurement antenna polarizations were used. A resolution bandwidth of 120 kHz was used for frequencies less than 1000 MHz, and a resolution bandwidth of 1 MHz was used for frequencies greater than or equal to 1000 MHz. The video bandwidth was set to a value at least three times greater than the resolution bandwidth.

## EUT Disposition

The EUT was adapted to continuously transmit for testing purposes.

## 15.231 Radiated Spurious Harmonics Emissions Test Data – Peak


| Emission Frequency (MHz) | Test Detector | Antenna Polarity (H/V) | Analyzer Reading (dBuV) | Site Correction Factor (dB/m) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|--------------------------|---------------|------------------------|-------------------------|-------------------------------|-------------------------|----------------|-------------|
| 433.92                   | PK            | v                      | 76.0                    | 19.5                          | 95.5                    | 100.8          | -5.3        |
| 867.84                   | PK            | H                      | 80.5                    | -14.9                         | 65.6                    | 80.8           | -15.2       |
| 1301.76                  | PK            | H                      | 69.6                    | -10.3                         | 59.3                    | 74.0           | -14.7       |
| 1735.68                  | PK            | H                      | 59.4                    | -8.0                          | 51.4                    | 80.8           | -29.4       |
| 2169.60                  | PK            | H                      | 38.5                    | -4.5                          | 34.0                    | 80.8           | -46.8       |
| 2603.52                  | PK            | V                      | 39.1                    | -3.3                          | 35.8                    | 80.8           | -45.0       |
| 3037.44                  | PK            | H                      | 43.1                    | -0.9                          | 42.2                    | 80.8           | -38.6       |
| 3471.36                  | PK            | V                      | 43.8                    | 2.3                           | 46.1                    | 80.8           | -34.7       |
| 3905.28                  | PK            | V                      | 44.9                    | 4.3                           | 49.2                    | 74.0           | -24.8       |
| 4339.20                  | PK            | H                      | 43.4                    | 6.8                           | 50.2                    | 74.0           | -23.8       |

All spurious emissions in the applicable frequency range were investigated; only harmonic emissions were present as noted above.

### Radiated Emissions Test Equipment

| RTL Bar Code | Manufacturer                  | Model             | Part Type                             | Serial Number | Calibration Due Date |
|--------------|-------------------------------|-------------------|---------------------------------------|---------------|----------------------|
| 901235       | IW Microwave Products         | KPS-1503-360-KPS  | High Frequency RF Cables              | 36"           | 8/21/18              |
| 901592       | Insulated Wire Inc.           | KPS-1503-3600-KPR | SMK RF Cables 20'                     | NA            | 8/18/18              |
| 901583       | Agilent Technologies          | N9010A            | EXA Signal Analyzer (10 Hz-26.5 GHz)  | MY51250846    | 4/21/18              |
| 901135       | Par Electronics               | 400-512 (25W)     | UHF Notch Filter                      | N/A           | 8/21/18              |
| 900811       | Rhein Tech Laboratories, Inc. | PR-1040           | Amplifier (20 MHz – 2 GHz)            | 900811        | 8/18/18              |
| 900932       | Hewlett Packard               | 8449B OPT H02     | Amplifier (1-26.5 GHz)                | 3008A00505    | 8/18/18              |
| 901669       | ETS-Lindgren                  | 3142E             | Biconilog Antenna (30 MHz – 6000 MHz) | 00166065      | 02/16/18             |

### Test Personnel:

|               |  |                    |
|---------------|--|--------------------|
| Khue Do       |  | December 4-6, 2017 |
| Test Engineer | Signature  | Date of Test       |

### FCC/IC Cross Reference

|                  |                      |
|------------------|----------------------|
| FCC 15.231(a)    | RSS-210 Issue 9 A1.1 |
| FCC 15.231(b)(2) | RSS-210 Issue 9 A1.2 |
| FCC 15.35(b)     | RSS-Gen Issue 4 6.10 |
| FCC 15.205       | RSS-Gen Issue 4 8.10 |
| FCC 15.209       | RSS-Gen Issue 4 8.9  |
| FCC 15.231(c)    | RSS-210 Issue 9 A1.3 |

## Occupied Bandwidth

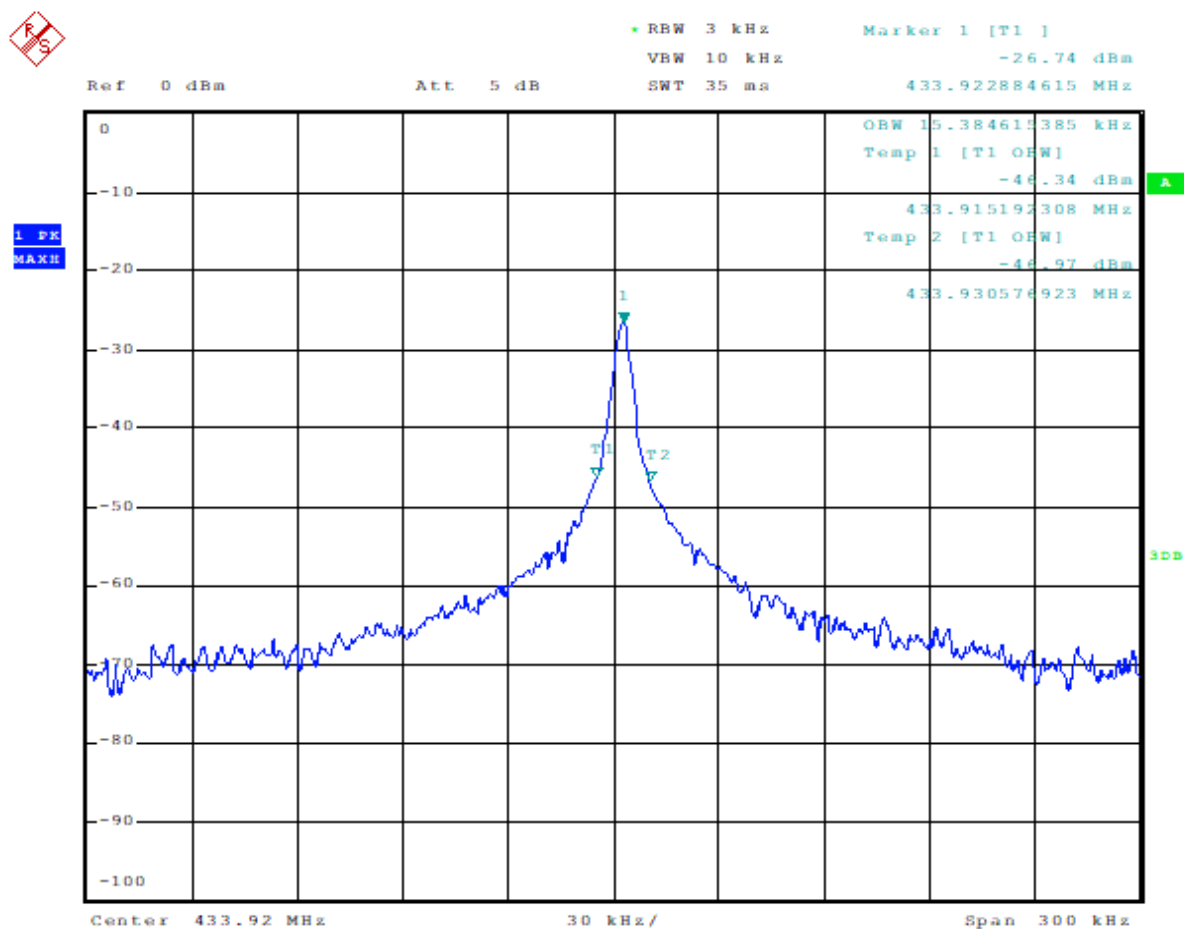
15.231(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz

$$433.92 \text{ MHz} * 0.25\% = 1085 \text{ kHz} = \text{Limit}$$

99% Bandwidth is 53.4 kHz RE315  
 114.9 kHz RE615

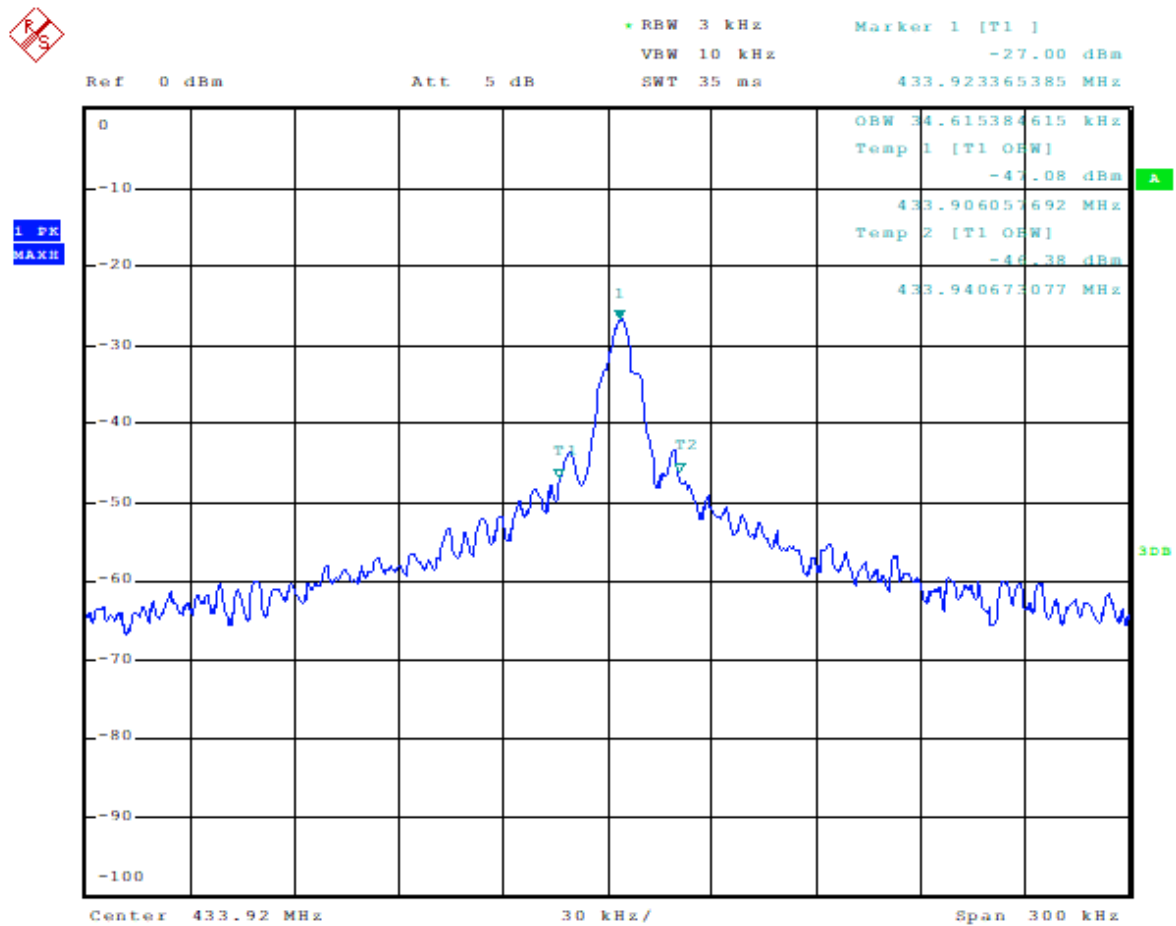
20 dB Bandwidth is 15.4 kHz RE315  
 34.6 kHz RE615

### 20 dB BW



Date: 4.DEC.2017 12:20:24

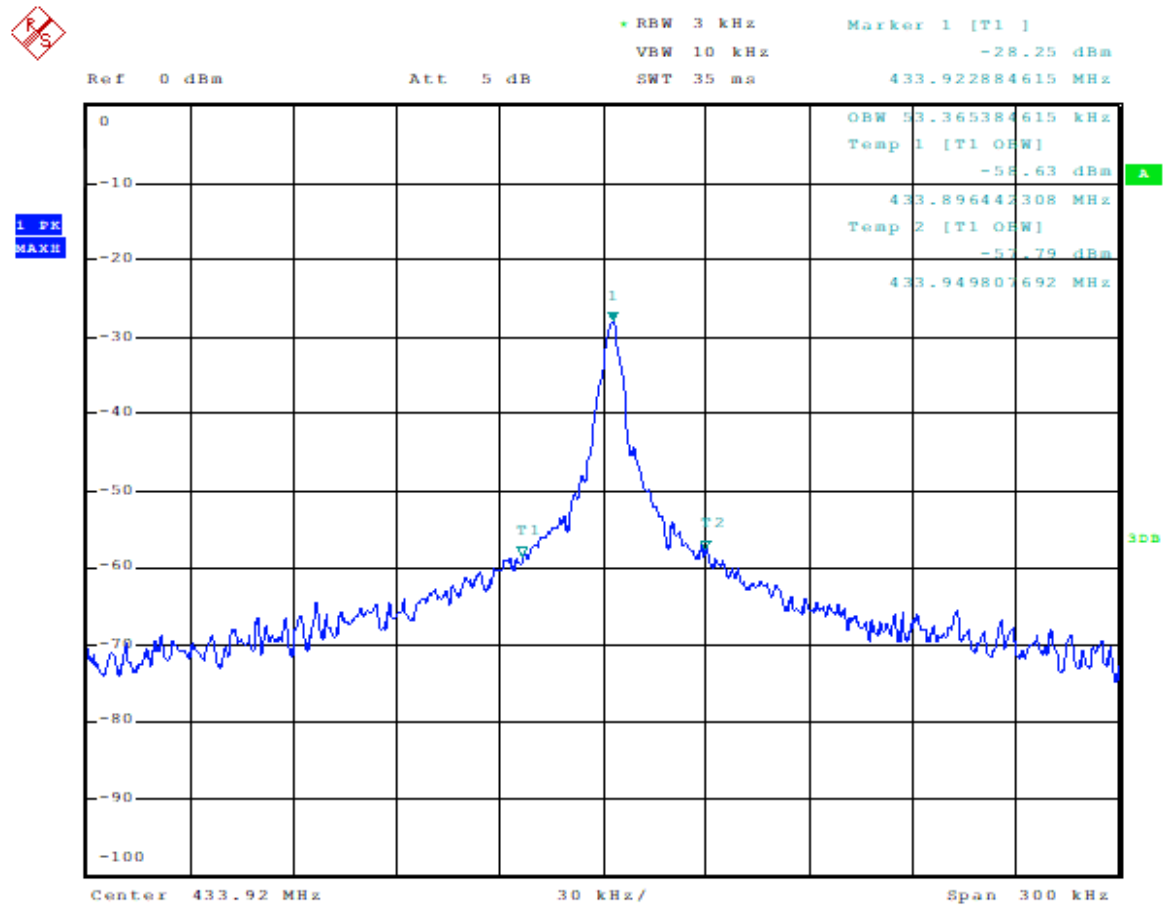
RE315 DSC



Date: 4.DEC.2017 12:31:59

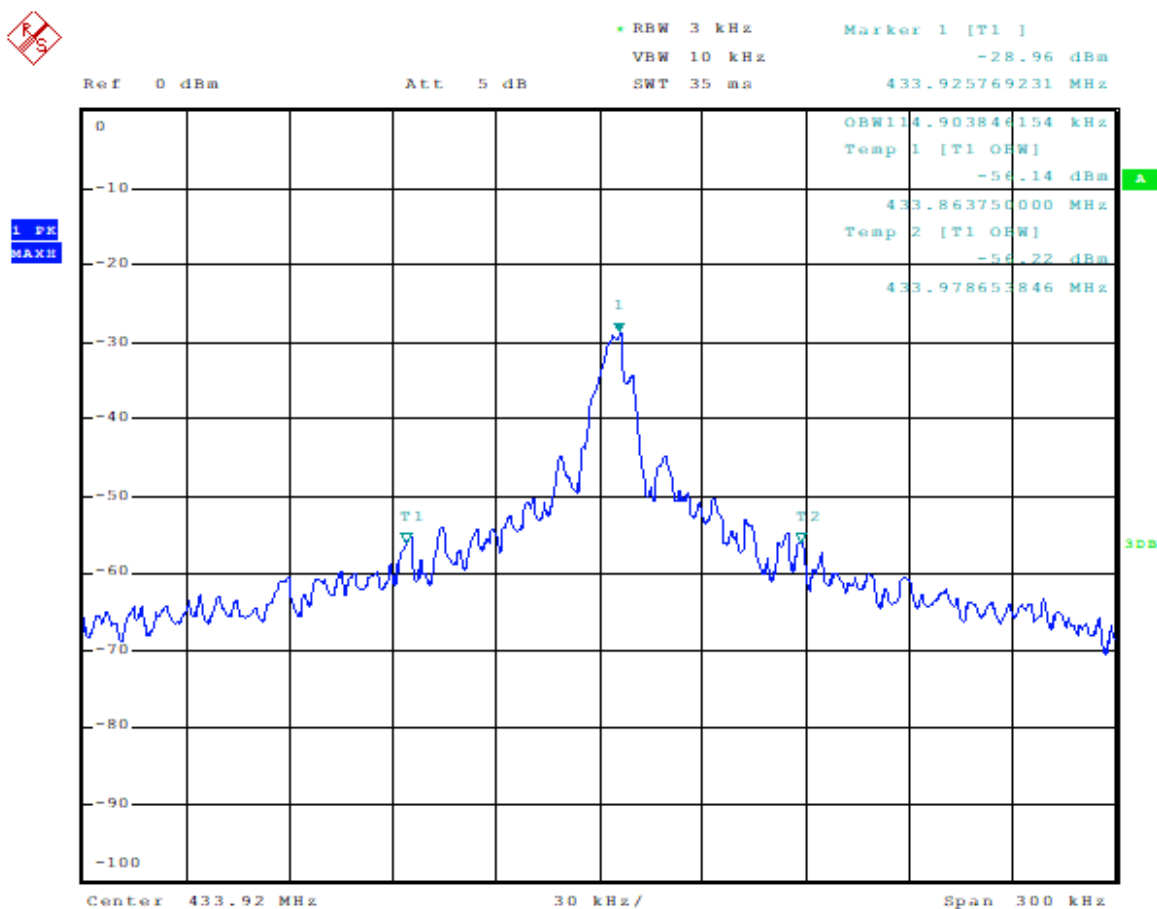
**RE615 RESOLUTION**

**99% BW**



Date: 4.DEC.2017 12:17:28

**RE315 DSC**




Date: 4.DEC.2017 12:15:55

## RE615 RESOLUTION

### Occupied Bandwidth Test Equipment

| RTL Bar Code | Manufacturer    | Model | Part Type         | Serial Number | Calibration Due Date |
|--------------|-----------------|-------|-------------------|---------------|----------------------|
| 901581       | Rohde & Schwarz | FSU   | Spectrum Analyzer | 1166.1660.50  | 3/22/18              |

### Test Personnel:

|               |   |                  |
|---------------|---|------------------|
| Dan Baltzell  |  | December 4, 2017 |
| Test Engineer | Signature   | Date of Test     |

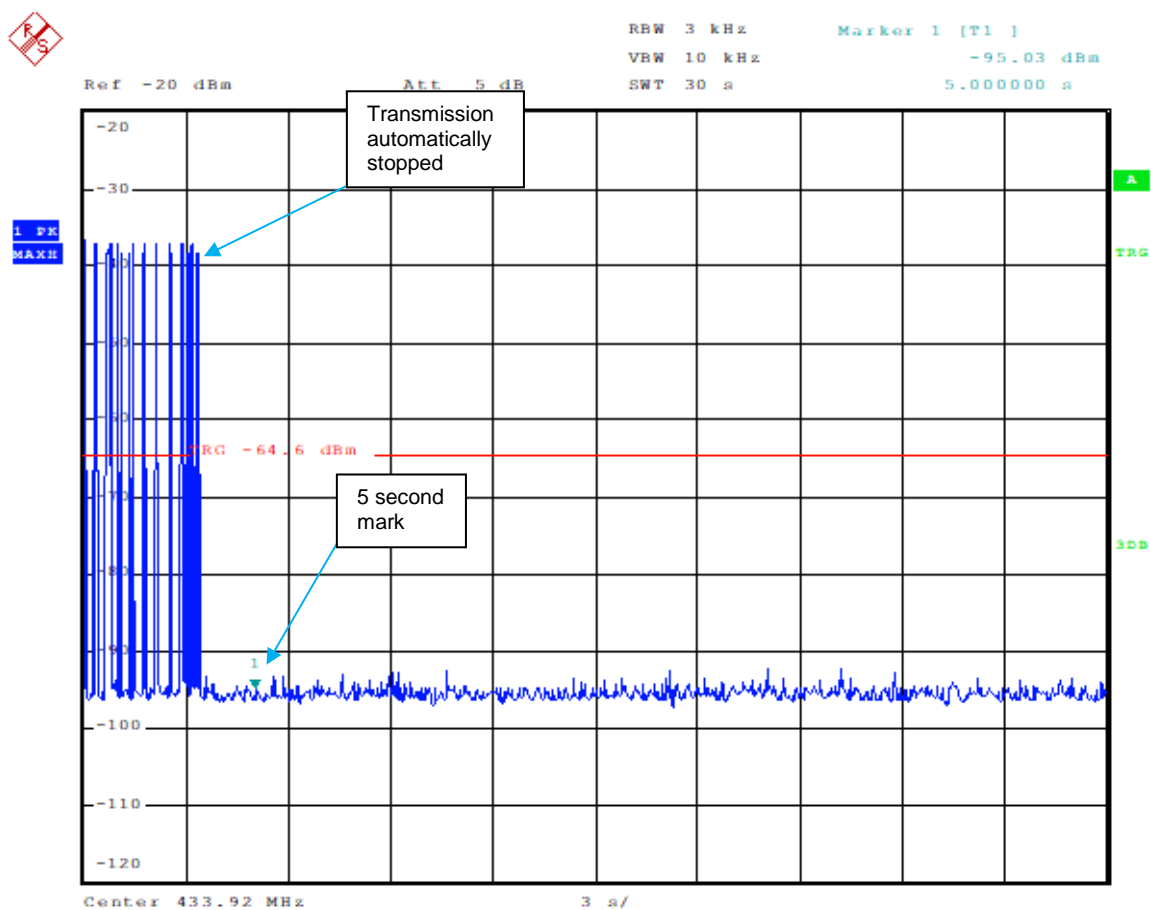
## Transmitter Deactivation

### 15.231(a)

- (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
- (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

## Test Equipment

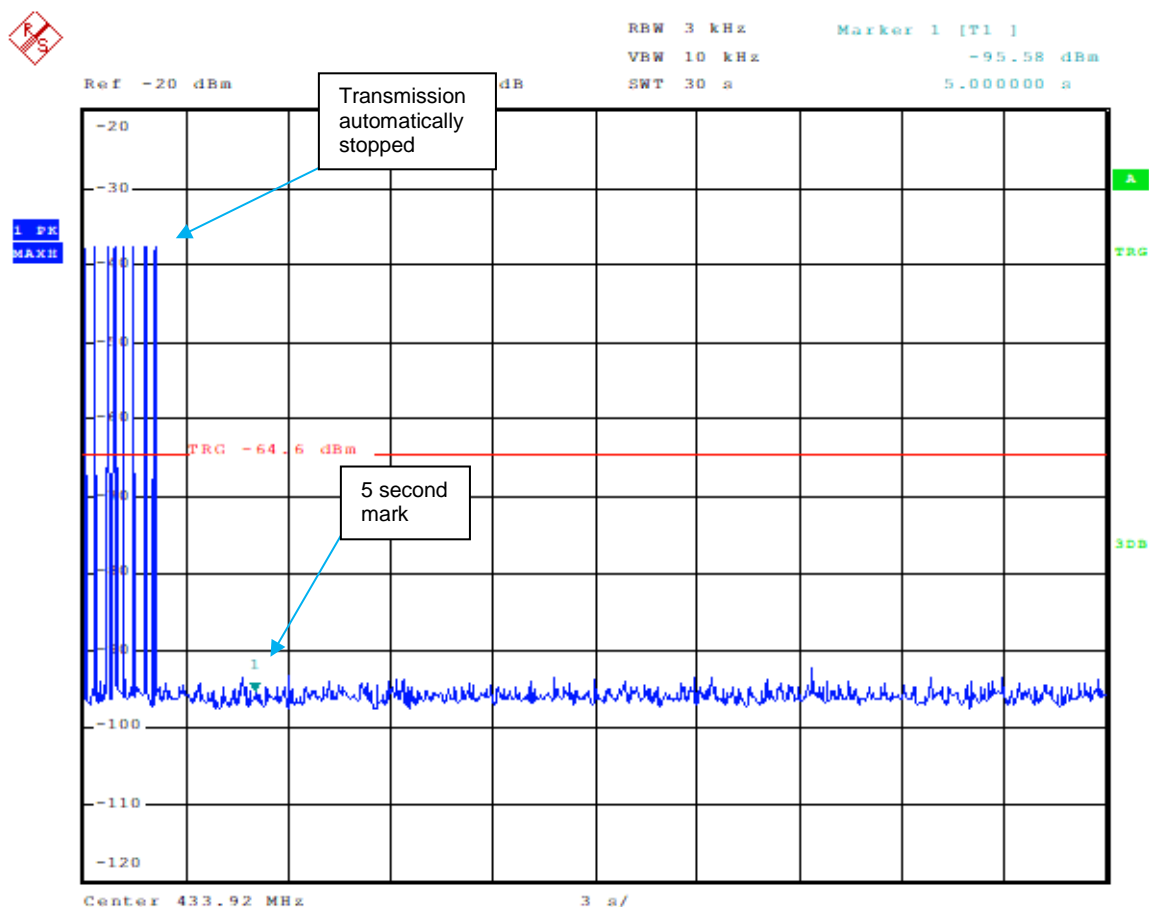
| RTL Bar Code | Manufacturer    | Model | Part Type         | Serial Number | Calibration Due Date |
|--------------|-----------------|-------|-------------------|---------------|----------------------|
| 901581       | Rohde & Schwarz | FSU   | Spectrum Analyzer | 1166.1660.50  | 3/22/18              |



Date: 4.DEC.2017 12:10:19

**RE315 DSC**





Date: 4.DEC.2017 12:12:32

## RE615 RESOLUTION

Test Personnel:

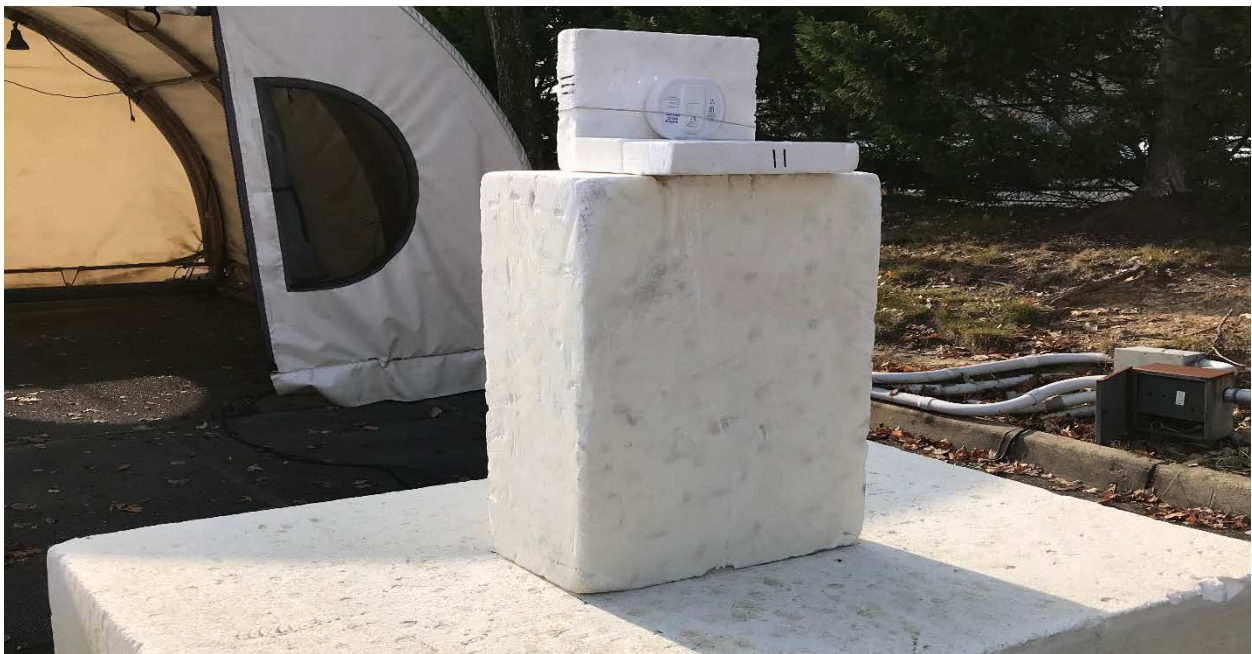
|               |                        |                  |
|---------------|------------------------|------------------|
| Dan Baltzell  | <i>Dan W. Baltzell</i> | December 4, 2017 |
| Test Engineer | Signature              | Date of Test     |

## Appendix A: Test Configuration Photographs



**Radiated Emissions (Less Than 1 GHz)**





**Radiated Emissions (Greater Than 1 GHz)**