RHEIN TECH LABORATORIES, INC.

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

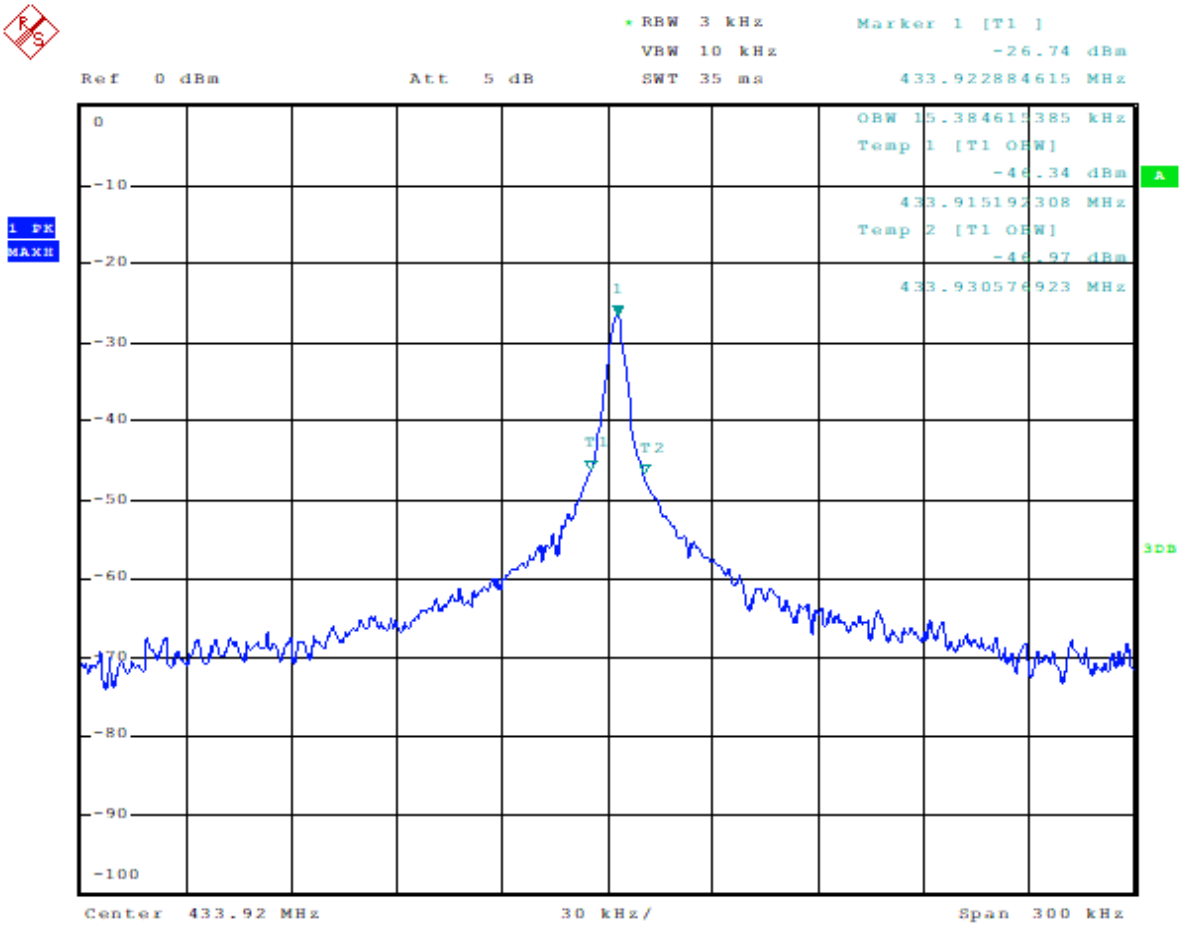
15.231(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz

433.92 MHz * 0.25% = 1085 kHz = 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



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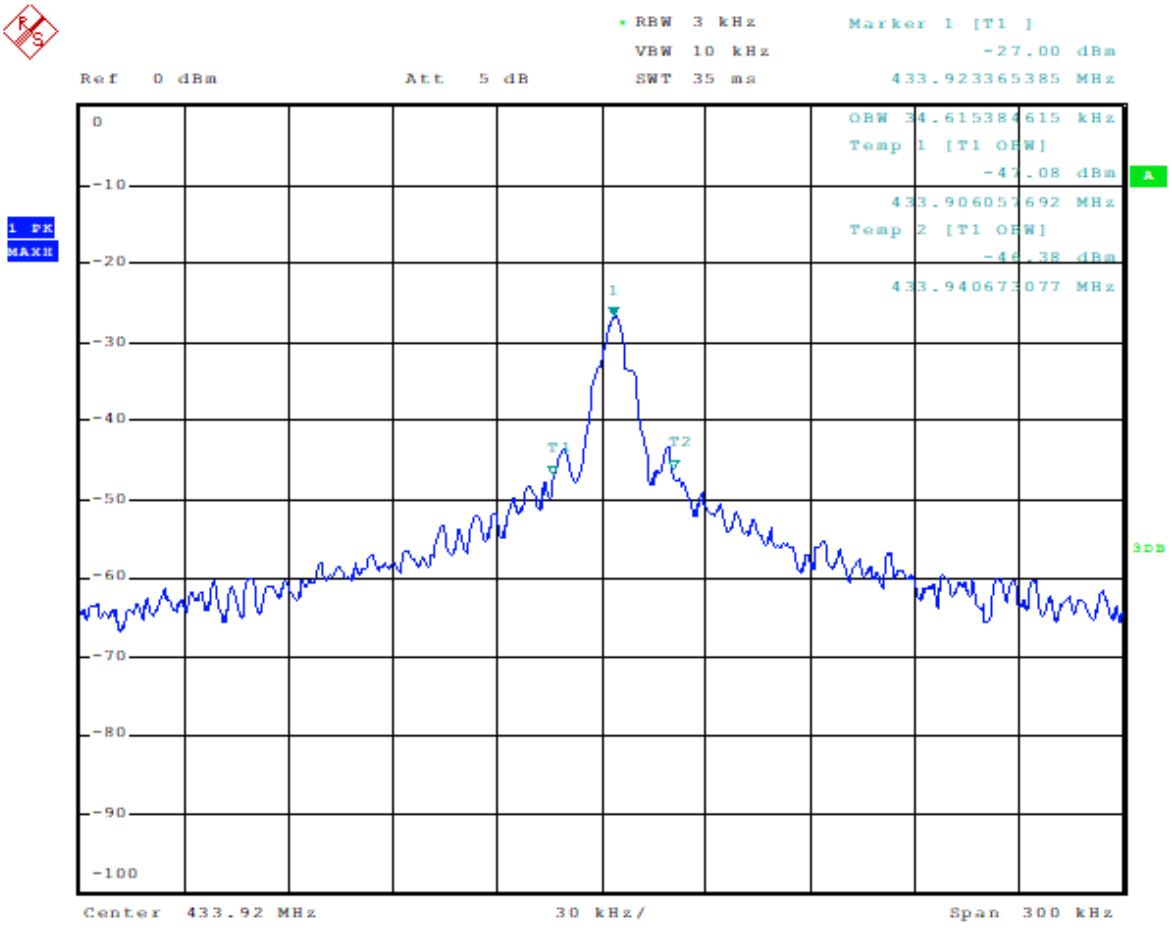
RE315 DSC



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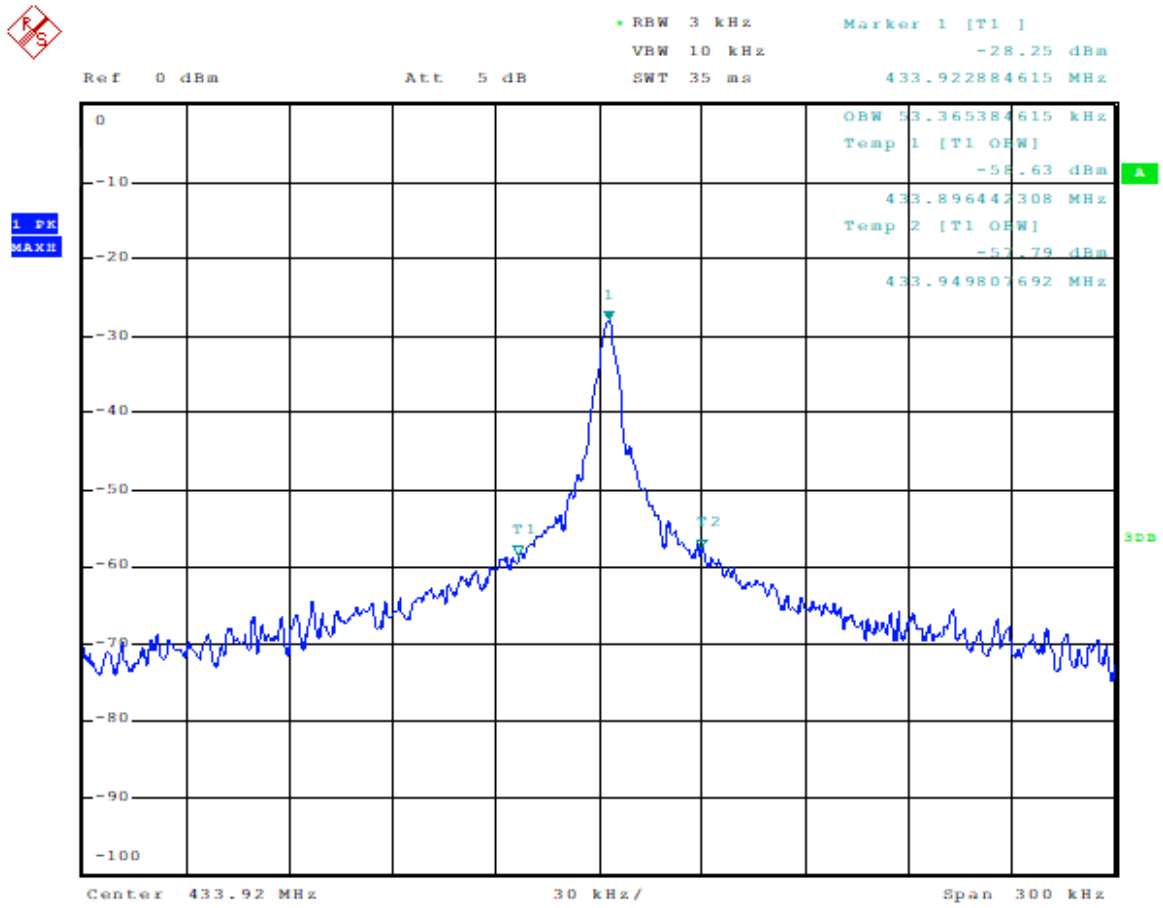
RE615 RESOLUTION

99% BW



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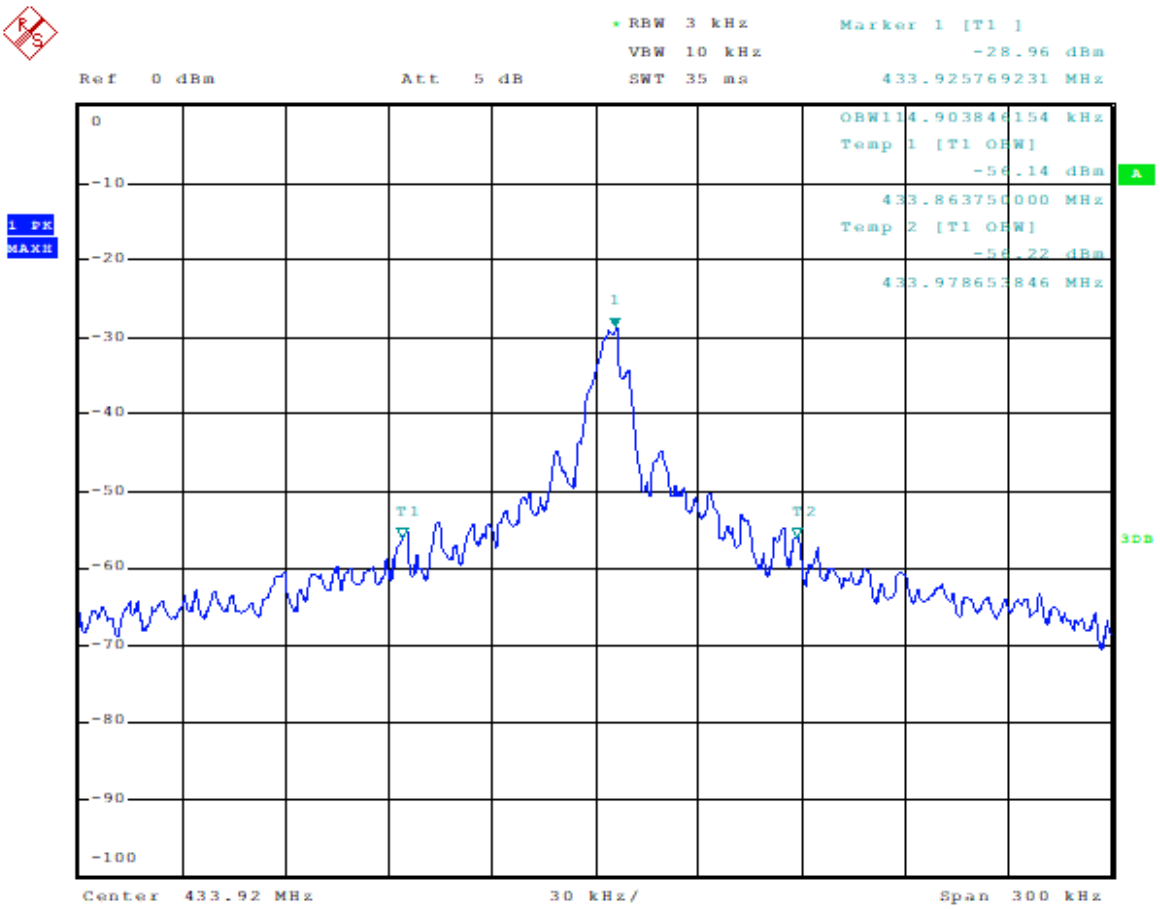
RE315 DSC



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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:

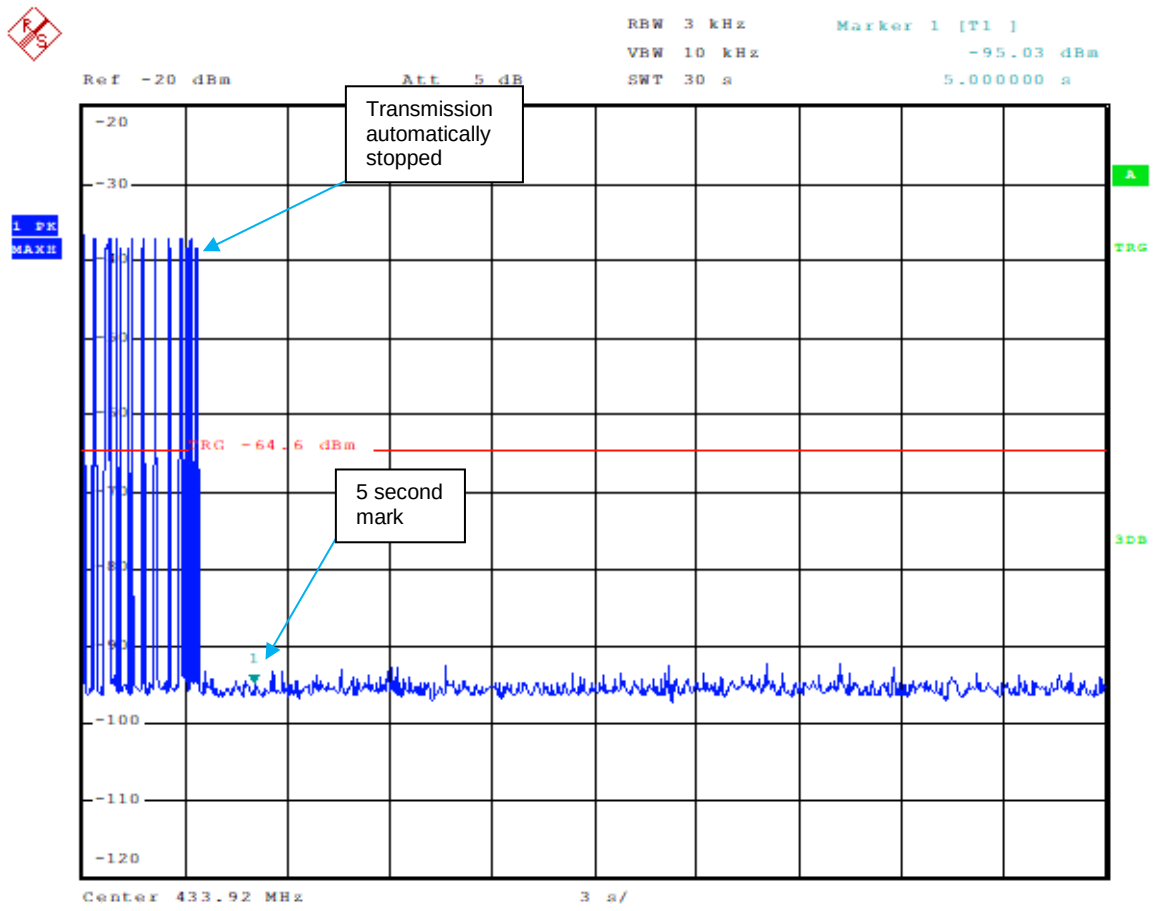
Dan Baltzell		December 4, 2017
Test Engineer	Signature	Date of Test

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



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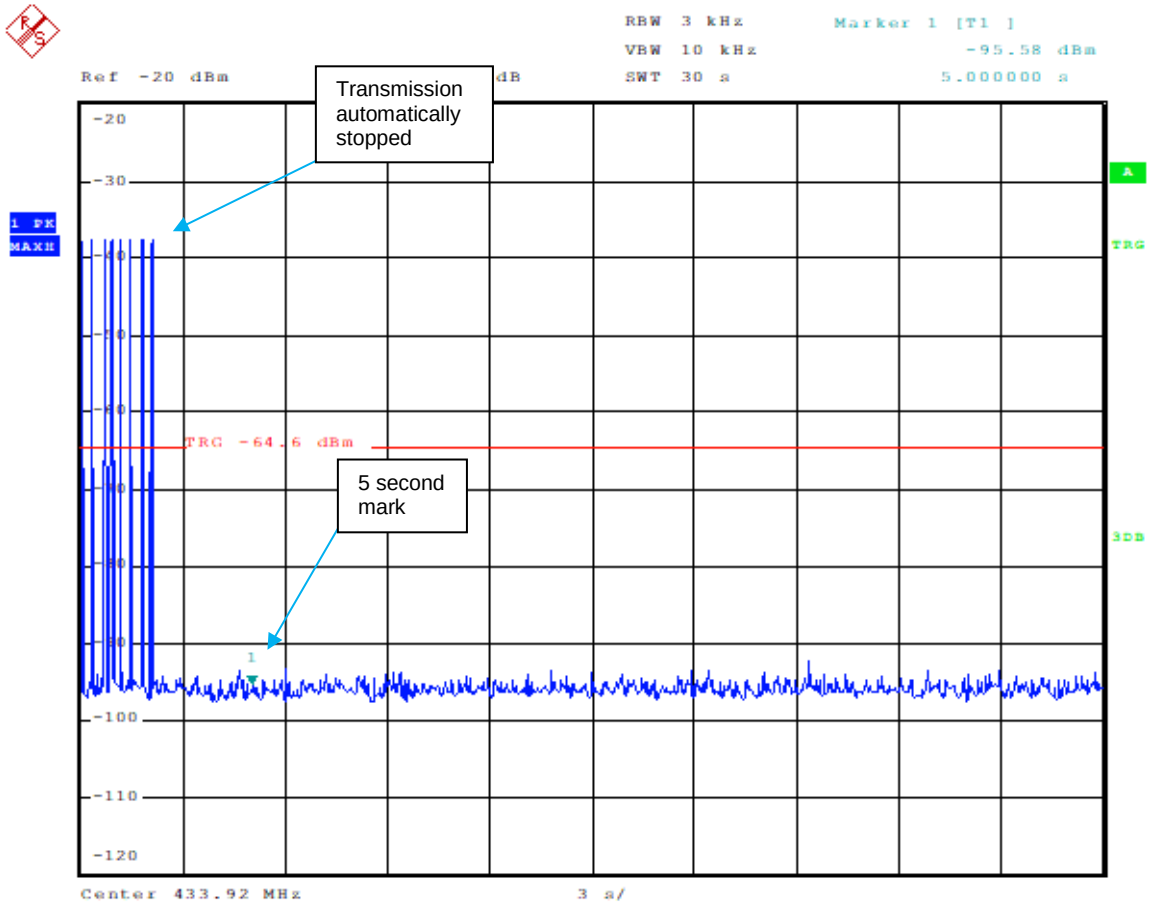
RE315 DSC



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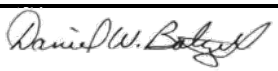
RE615 RESOLUTION

Test Personnel:

Dan Baltzell		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)