RHEIN TECH LABORATORIES, INC.

Engineering Solutions & Electromagnetic Compatibility Services

FCC Part 15.231 Test Data

345 MHz Sensor

Model: 56-0098-02 RevA00
And RE261T

for

Resolution Products LLC
1402 Heggen Street
Hudson, WI 54016
Contact: Chris Weltzien

Testing Conducted By:

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

RTL Test Engineer: Dan Baltzell

RTL Project/Report Number: 2018012

March 27, 2018

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 Products LLC. 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 **345 MHz 56-0098-02 RevA00 Sensor (RTL Bar Code 22847) (CW)** and **345 MHz RE261T Sensor (RTL Bar Code 22872) (CW)**.

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: 56-0098-02 RevA00

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)
345.0	PK	H	106.1	-11.3	94.8	97.3	-2.5
690.0	PK	H	55.2	0.4	55.6	77.3	-21.7
1035.0	PK	H	47.5	7.5	55.0	74.0	-19.0
1380.0	PK	H	39.2	14.5	53.7	74.0	-20.3
1725.0	PK	H	31.2	21.9	53.1	77.3	-24.2
2070.0	PK	V	54.1	-10.1	44.0	77.3	-33.3
2415.0	PK	H	57.8	-9.5	48.3	77.3	-29.0
2760.0	PK	H	60.1	-8.5	51.6	77.3	-25.7
3105.0	PK	V	59.6	-7.8	51.8	77.3	-25.5
3450.0	PK	H	56.7	-6.9	49.8	77.3	-27.5

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

15.231 Radiated Spurious Harmonics Emissions Test Data – Peak: RE261T

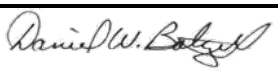
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
345.0	PK	H	97.1	-3.4	93.7	97.3	-3.6
690.0	PK	H	54.9	1.0	55.9	77.3	-21.4
1035.0	PK	H	51.3	-13.5	37.8	74.0	-36.2
1380.0	PK	H	51.0	-8.1	42.9	74.0	-31.1
1725.0	PK	H	49.5	-5.1	44.4	77.3	-32.9
2070.0	PK	H	55.7	-10.6	45.1	77.3	-32.2
2415.0	PK	V	57.7	-9.4	48.3	77.3	-29.0
2760.0	PK	H	60.8	-9.0	51.8	77.3	-25.5
3105.0	PK	H	54.8	-6.7	48.1	77.3	-29.2
3450.0	PK	H	57.1	-7.0	50.1	77.3	-27.2

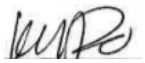
All spurious emissions in the applicable frequency range were investigated; only harmonic emissions were present as noted above.

Radiated Emissions Test Equipment

RTL Bar Code	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901592	Insulated Wire Inc.	KPS-1503-3600-KPR	SMK RF Cables 20’	NA	8/18/18
901593	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36”	NA	8/18/18
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 KHz – 6.5 GHz)	3325A00159	4/4/19
900914	Hewlett Packard	8546OA	RF Filter Section, 100 kHz to 6.5 GHz	3330A00107	4/4/19
901135	Par Electronics	400-512 (25W)	UHF Notch Filter	N/A	8/21/18
900905	Rhein Tech Labs	PR-1040	OATS 1 Preamplifier 40dB (30 MHz – 2 GHz)	1006	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	2/18/19
900772	EMCO	3161-02	Horn Antenna 2 - 4 GHz	9804-1044	4/9/18
901672	Rohde & Schwarz	FSEM30	Spectrum Analyzer	FSEM30	4/17/19

Test Personnel:

Dan Baltzell		January 31, 2018 – February 1, 2018
Test Engineer	Signature	Date of Test

Khue Do		March 15, 2018
Test Engineer	Signature	Date of Test

FCC/IC Cross Reference

5 second timing	FCC 15.231(a)	RSS-210 Issue 9 A1.1
Field Strength	FCC 15.231(b)(2)	RSS-210 Issue 9 A1.2
Timing correction	FCC 15.35(b)	RSS-Gen Issue 4 6.10
Restricted Band	FCC 15.205	RSS-Gen Issue 4 8.10
General Field Strength	FCC 15.209	RSS-Gen Issue 4 8.9
Bandwidth	FCC 15.231(c)	RSS-210 Issue 9 A1.3

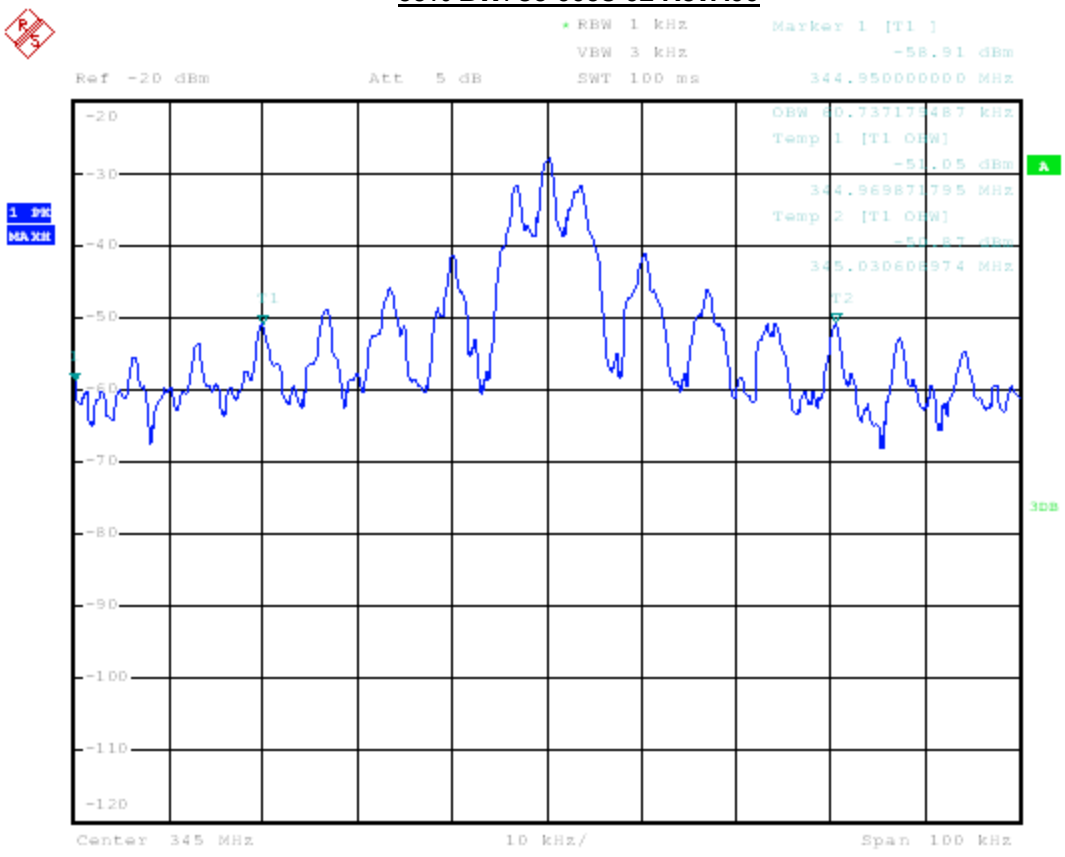
Occupied Bandwidth

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

56-0098-02 RevA00

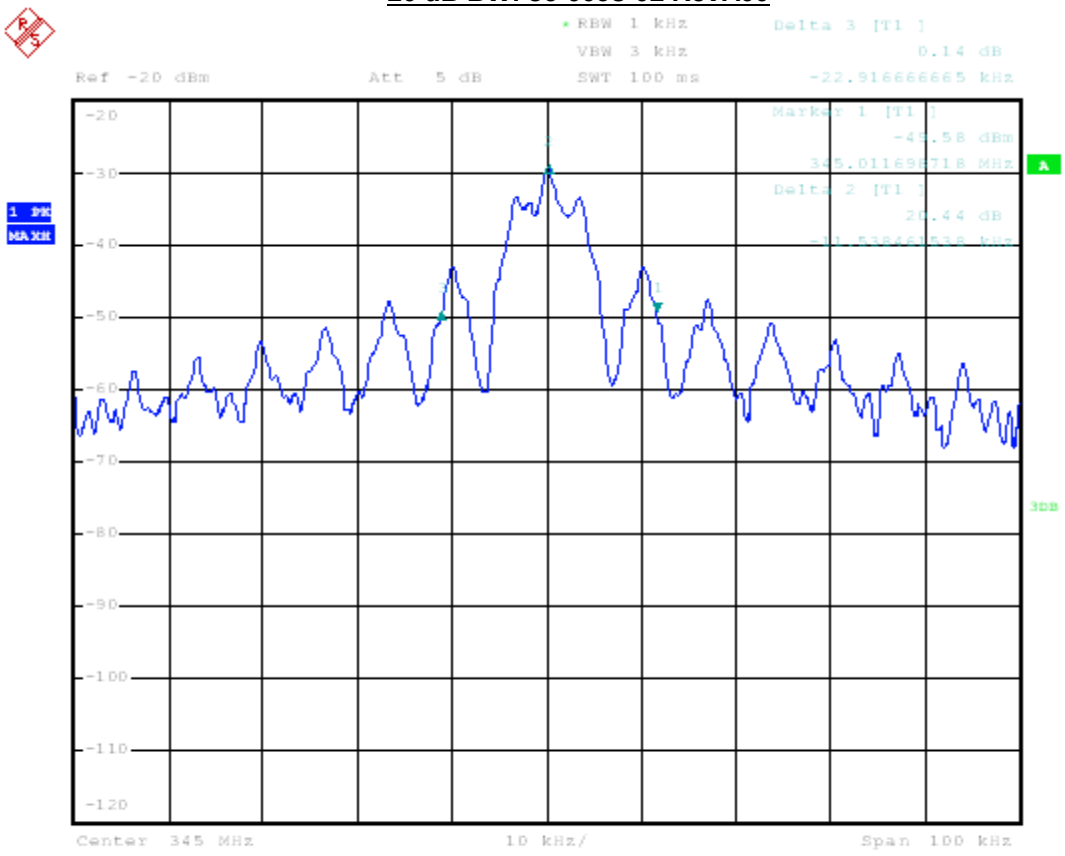
345 MHz * 0.25% = 86.25 kHz = Limit
99% Bandwidth is 60.73 kHz
20 dB Bandwidth is 22.9 kHz

99% BW: 56-0098-02 RevA00



Date: 25.JAN.2018 08:42:13

20 dB BW: 56-0098-02 RevA00

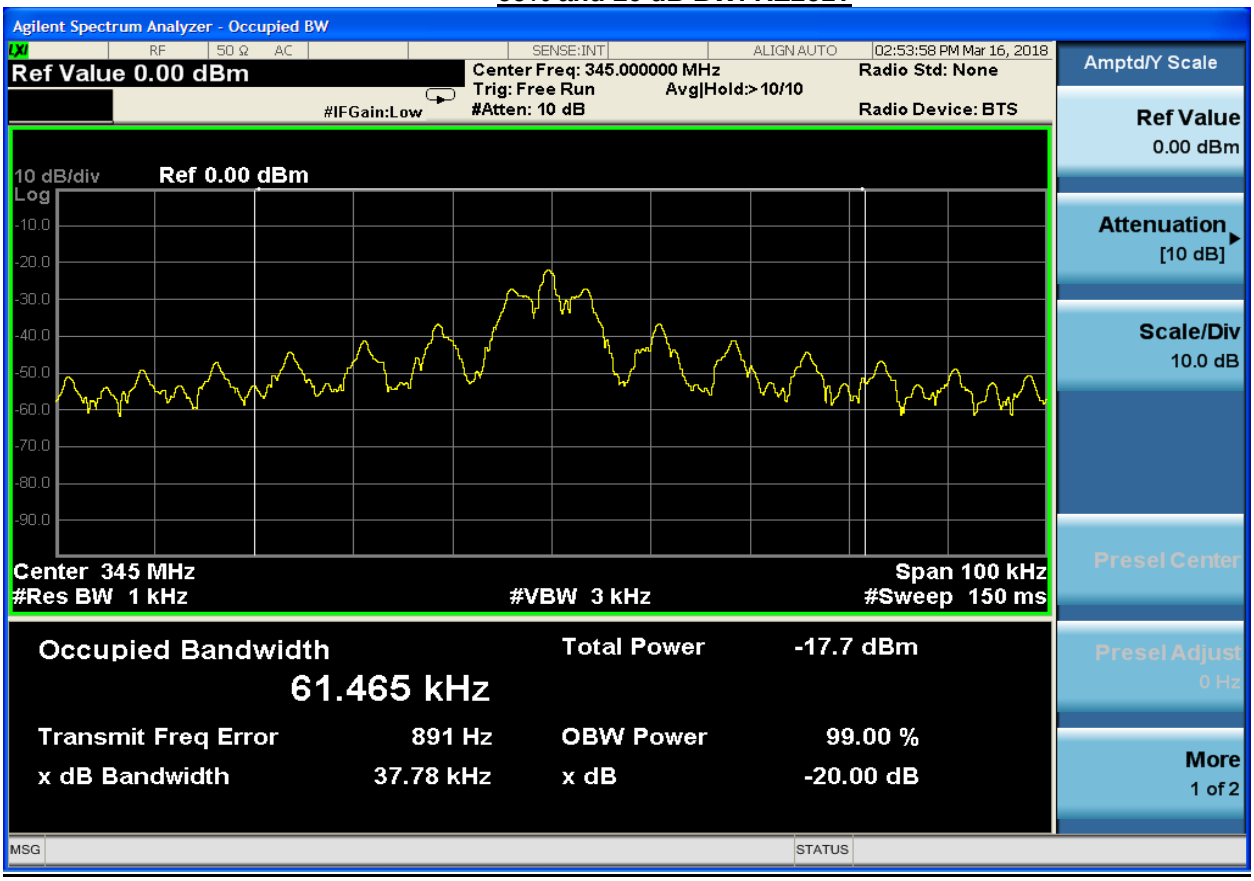


Date: 25.JAN.2018 09:04:02

RE261T

345 MHz * 0.25% = 86.25 kHz = Limit
99% Bandwidth is 61.47 kHz
20 dB Bandwidth is 37.78 kHz

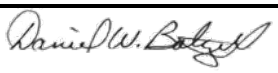
99% and 20 dB BW: RE261T



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
901583	Agilent	N9010A	Spectrum Analyzer	MY51250846	2/06/20

Test Personnel:

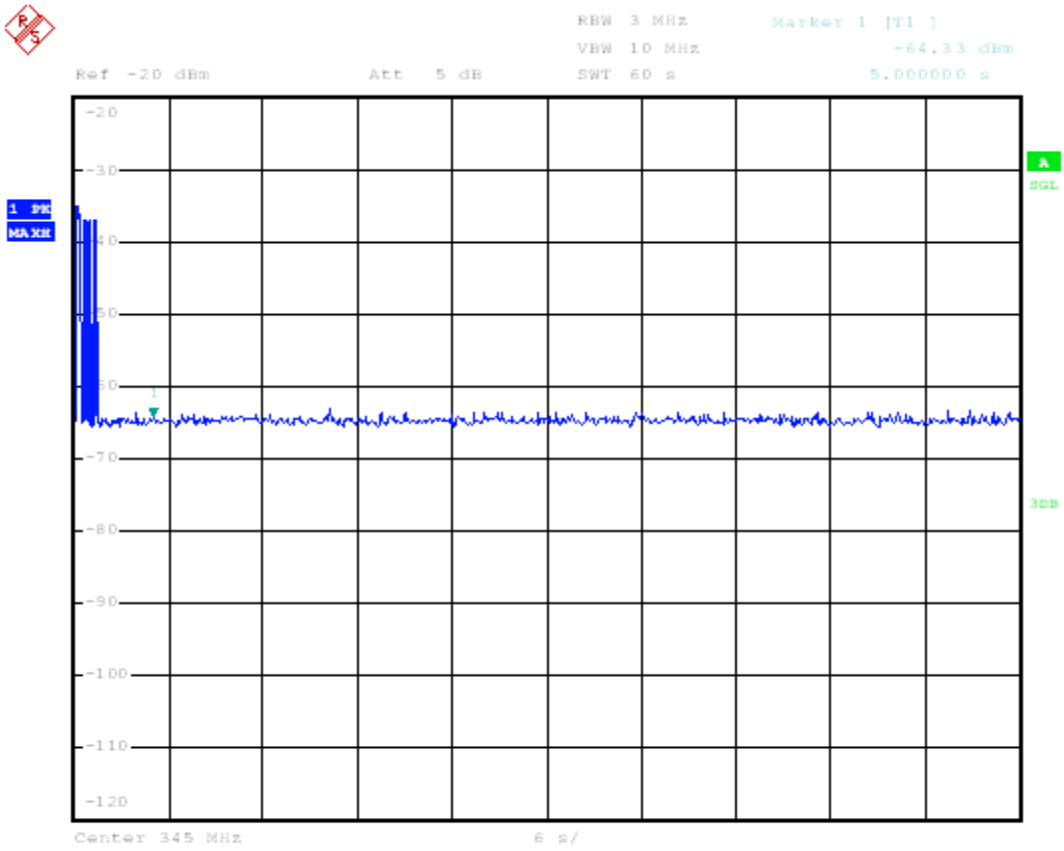
Dan Baltzell		January 25, 2018
Test Engineer	Signature	Date of Test

Khue Do		March 16, 2018
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.

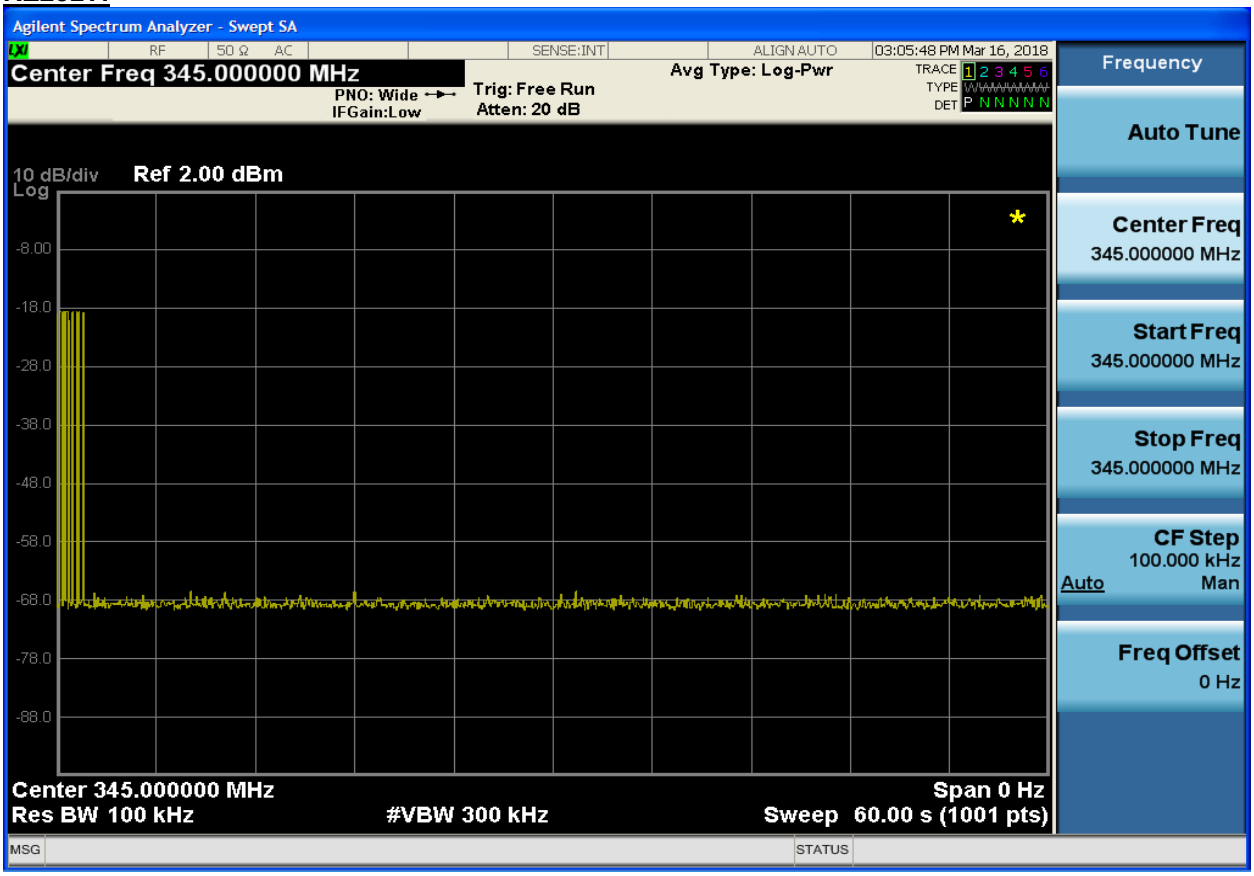
56-0098-02 RevA00:



Date: 25.JAN.2018 08:36:54

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.

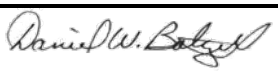
RE261T:

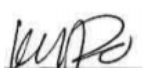


Test Equipment

RTL Bar Code	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde&Schwarz	FSU	Spectrum Analyzer	1166.1660.50	3/22/18
901583	Agilent	N9010A	Spectrum Analyzer	MY51250846	2/06/20

Test Personnel:

Dan Baltzell		January 25, 2018
Test Engineer	Signature	Date of Test

Khue Do		March 16, 2018
Test Engineer	Signature	Date of Test

Appendix A: Test Configuration Photographs

Radiated Emissions (Less Than 1 GHz)

Radiated Emissions (Greater Than 1 GHz)