NVLAP Lab Code 200087-0

SUBMITTAL APPLICATION REPORT

FOR GRANT OF CERTIFICATION

FOR

Model: RB912G-5HPnD
5740-5830 MHz
Broadband Digital Transmission System
FCC ID: TV7RB912G-5HPND

FOR

MIKROTIKLS SIA

Pernavas 46
Riga, Latvia LV-1009

Test Report Number: 120926

Authorized Signatory: Scot D Rogers
Scot D. Rogers

NVLAP Lab Code 200087-0

ROGERS LABS, INC.
4405 West 259th Terrace
Louisburg, KS 66053
Phone / Fax (913) 837-3214

Engineering Test Report
For Application of
Grant of Certification

FOR

47 CFR, PART 15C - Intentional Radiators
47 CFR Paragraph 15.247
License Exempt Intentional Radiator

For

MIKROTIKLS SIA

Pernavas 46
Riga, Latvia LV-1009

Broadband Digital Transmission System
Model: RB912G-5HPnD
Frequency Range 5740-5830 MHz
FCC ID#: TV7RB912G-5HPND

Test Date: September 26, 2012

Certifying Engineer: Scot D Rogers
Scot D. Rogers
Rogers Labs, Inc.
4405 West 259th Terrace
Louisburg, KS 66053
Telephone/Facsimile: (913) 837-3214

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Revisions

Revision 1 Issued April 13, 2013

Forward

The following information is submitted for consideration in obtaining Grant of Certification for License Exempt Digital Transmission System Intentional Radiator operating under 47 CFR Paragraph 15.247.

Name of Applicant:

Mikrotikls SIA

Pernavas 46

Riga, Latvia LV-1009

Model: RB912G-5HPnD

FCC I.D.: TV7RB912G-5HPND FRN: 0014 43 1100

Frequency Range: 5740-5830 MHz (5 and 10 MHz modes)

5745-5825 (20 MHz mode)

5755-5815 (40 MHz mode)

Operating Power: 27.0 dBm per chain (0.5W), 30 dBm total (1.0W) antenna port conducted

Opinion / Interpretation of Results

Tests Performed	Margin (dB)	Results
Emissions as per 47 CFR paragraphs 2 and 15.205	-2.0	Complies
Emissions as per 47 CFR paragraphs 2 and 15.207	-13.4	Complies
Emissions as per 47 CFR paragraphs 2 and 15.209	-1.1	Complies
Emissions as per 47 CFR paragraphs 2 and 15.247, Harmonics	-2.0	Complies

Environmental Conditions

Ambient Temperature	23.9° C
Relative Humidity	47%
Atmospheric Pressure	1015.2 mb

Statement of Modifications and Deviations

No modifications to the EUT were required for the design to demonstrate compliance with the CFR47 Part 15C emissions requirements. There were no deviations to the specifications.

Application for Certification

(1) Manufacturer: Mikrotikls SIA
Pernavas 46
Riga, Latvia LV-1009

(2) Identification: Model: RB912G-5HPnD

FCC I.D.: TV7RB912G-5HPND

(3) Instruction Book:

Refer to Exhibit for Instruction Manual.

(4) Description of Circuit Functions:

Refer to Exhibit of Operational Description.

(5) Block Diagram with Frequencies:

Refer to Exhibit of Operational Description.

(6) Report of Measurements:

Report of measurements follows in this Report.

(7) Photographs: Construction, Component Placement, etc.:

Refer to Exhibit for photographs of equipment.

(8) List of Peripheral Equipment Necessary for operation. The equipment operates from direct current (DC) power provided through authorized AC power adapter. The design offers connection ports for USB, network, and external antennas only and was interfaced through network cable to computer during testing.

(9) Transition Provisions of 15.37 are not being requested.

(10) Not Applicable. The unit is not a scanning receiver.

(11) Not Applicable. The EUT does not operate in the 59 – 64 GHz frequency band.

(12) The equipment is not software defined and this section is not applicable.

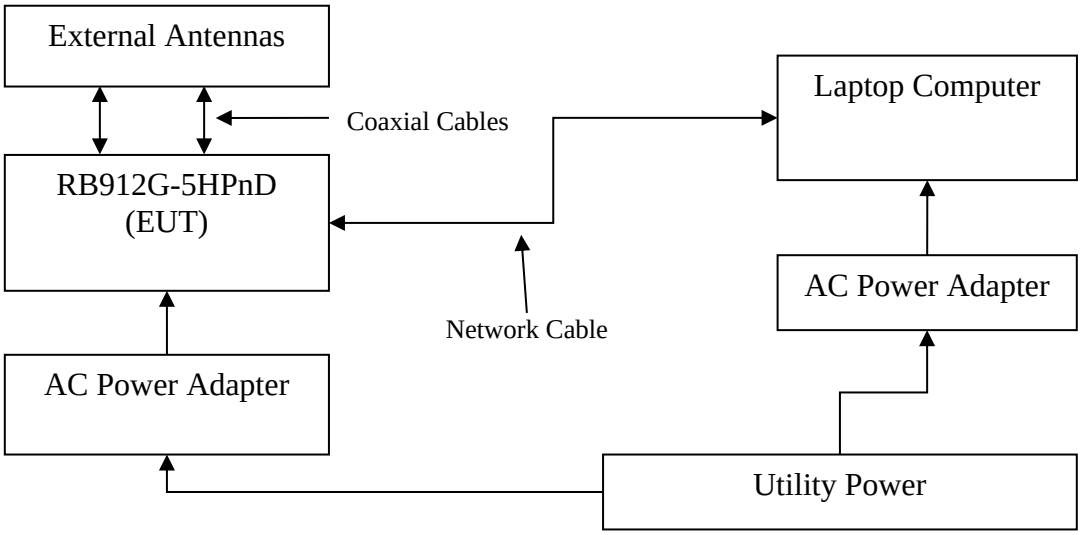
Equipment Tested

Equipment	Model	FCC I.D.
EUT	RB912G-5HPnD	TV7RB912G-5HPND
AC Adapter	FLD181-240075-U	14655
Dell Studio XPS	921LBN1	N/A
Omni Directional Antenna	MT-482016/N/A	N/A
Panel Antenna	PA58-24-ANT	N/A
Dish Antenna	HDDA5W-32-DP2	N/A

Equipment Function and Configuration

The EUT is a 5740-5830 MHz Digital Transmission System transmitter used to transmit data in applications offering broadband wireless connectivity. The equipment is marketed for use to incorporate a wireless link to exchange data information from one point to another. For testing purposes the RB912G-5HPnD transceiver was connected to the manufacturer supplied AC power adapter and communicating to the laptop computer. The network interface offered operational control of the transmitter and communications over the network interface between the EUT and supporting computer system. The EUT offers interface connection ports for external antennas, network, USB memory stick and power. No other interfacing options are provided on the design. For testing purposes the RB912G-5HPnD was powered from the manufacturer supplied AC adapter, connected to USB device and network interface to the computer. The network interface allowed the EUT to be set to transmit in available data modes during testing. The device is marketed for professionally installed use and complies with the unique antenna connection requirements.

Equipment Configuration



Test Site Locations

Conducted EMI — The AC power line conducted emissions testing performed in a shielded screen room located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS

Radiated EMI — The radiated emissions tests were performed at the 3 meters, Open Area Test Site (OATS) located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS

Site Registration — Refer to Annex for Site Registration Letters

NVLAP Accreditation — Lab code 200087-0

Units of Measurements

Conducted EMI — Data is in dBµV; dB referenced to one microvolt

Radiated EMI — Data is in dBµV/m; dB/m referenced to one microvolt per meter

Sample Calculation:

RFS = Radiated Field Strength, FSM = Field Strength Measured
A.F. = Receive antenna factor, Gain = amplification gains and/or cable losses
RFS (dBµV/m @ 3m) = FSM (dBµV) + A.F. (dB) - Gain (dB)

List of Test Equipment

A Rohde and Schwarz ESU40 and/or Hewlett Packard 8591EM was used as the measuring device for the emissions testing of frequencies below 1 GHz. A Rohde and Schwarz ESU40 and/or Hewlett Packard 8562A Spectrum Analyzer was used as the measuring device for testing the emissions at frequencies above 1 GHz. The analyzer settings used are described in the following table. Refer to the appendix for a complete list of test equipment.

HP 8591 EM Analyzer Settings		
Conducted Emissions		
RBW	AVG. BW	Detector Function
9 kHz	30 kHz	Peak / Quasi Peak
Radiated Emissions		
RBW	AVG. BW	Detector Function
120 kHz	300 kHz	Peak / Quasi Peak
HP 8562A Analyzer Settings		
RBW	Video BW	Detector Function
100 kHz	100 kHz	Peak
1 MHz	1 MHz	Peak / Average

Equipment	Manufacturer	Model	Band	Cal Date	Due
☒ LISN	Comp. Design	FCC-LISN-2-MOD.CD	.15-30MHz	10/11	10/12
☒ Antenna	ARA	BCD-235-B	20-350MHz	10/11	10/12
☒ Antenna	EMCO	3147	200-1000MHz	10/11	10/12
☒ Antenna	Com Power	AH-118	1-18 GHz	10/11	10/12
☒ Antenna	Com Power	AH-840	18-40 GHz	10/11	10/12
☒ Antenna	Standard	FXRY638A	10-18 GHz	3/12	5/13
☒ Antenna	EMCO	6509	.001-30 MHz	2/12	2/13
☐ Antenna	EMCO	3143	20-1200 MHz	5/12	5/13
☒ Antenna	Sunol	JB-6	30-1000 MHz	5/12	5/13
☐ Analyzer	HP	8591EM	9kHz-1.8GHz	5/12	5/13
☐ Analyzer	HP	8562A	9kHz-110GHz	5/12	5/13
☒ Analyzer	Rohde & Schwarz	ESU40	20Hz-40GHz	5/12	5/13
☒ Amplifier	Com-Power	PA-010	100Hz-30MHz	10/11	10/12
☒ Amplifier	Com-Power	CPPA-102	1-1000 MHz	10/11	10/12
☒ Amplifier	Com-Power	PA-22	0.5-22 GHz	10/11	10/12

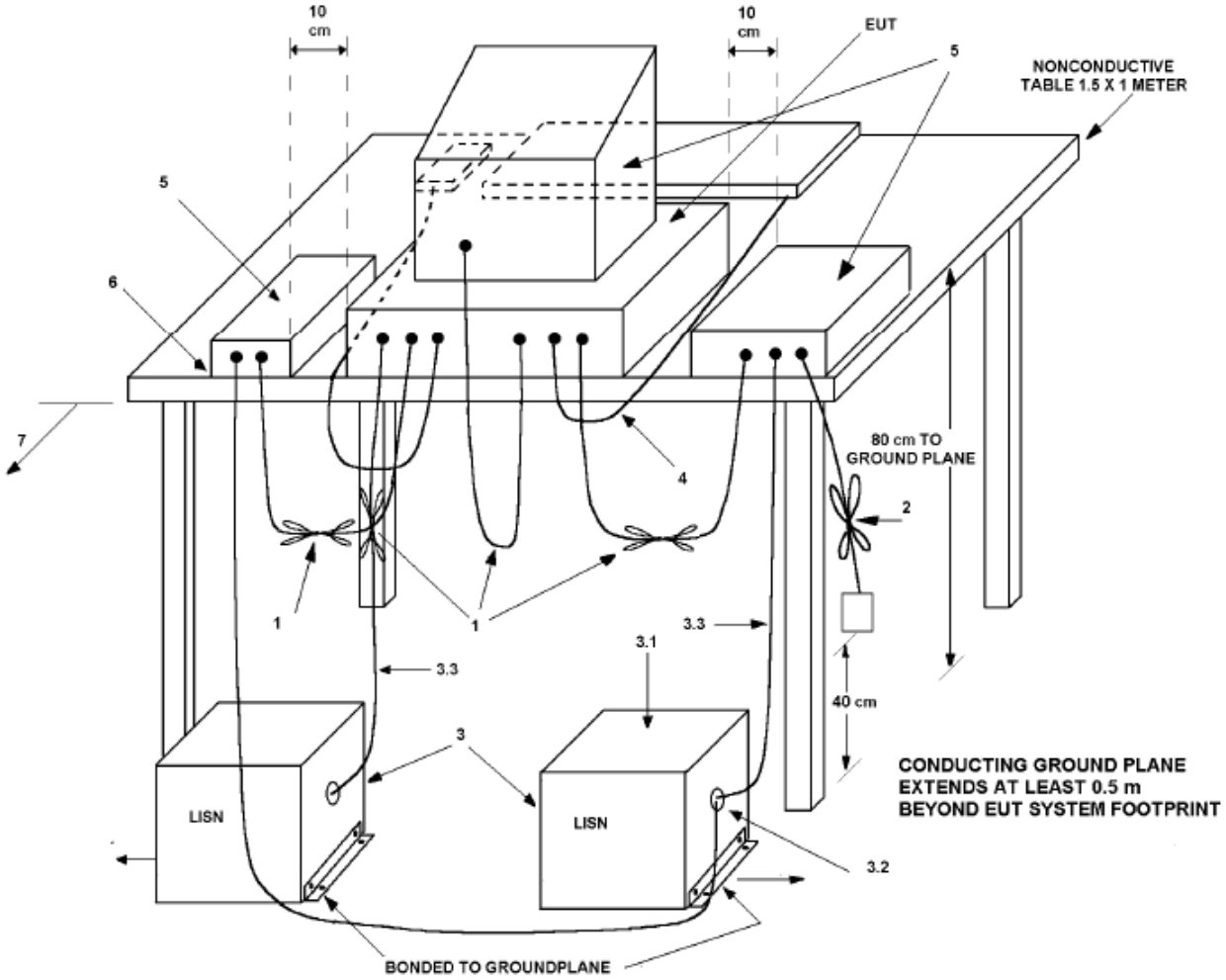
Applicable Standards & Test Procedures

In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 2011, Part 2, Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1031 through 2.1057, and applicable parts of paragraph 15, Part 15C Paragraph 15.247 the following information is submitted. Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in the ANSI C63.4-2009 Document, FCC document KDB 558074. Testing for the AC line-conducted emissions were performed as defined in sections 7 and 13.1.3, testing of the radiated emissions was performed as defined in sections 8 and 13.1.4 of ANSI C63.4-2009. Testing of the intentional radiated emissions was performed as defined in section 13 of ANSI C63.4-2009.

AC Line Conducted Emission Test Procedure

For testing purposes, the manufacturer supplied AC/DC power adapter was used to power the EUT. Testing for the AC line-conducted emissions testing was performed as defined in sections 7 and 13.1.3 of ANSI C63.4-2009. The test setup including the EUT was arranged in typical equipment configurations and placed on a 1 x 1.5-meter wooden bench, 0.8 meters high located in a screen room. The power lines of the system were isolated from the power source using a standard LISN with a 50-µHy choke. EMI was coupled to the spectrum analyzer through a 0.1 µF capacitor internal to the LISN. The LISN was positioned on the floor beneath the wooden bench supporting the EUT. The power lines and cables were draped over the back edge of the table. Refer to diagram 1 showing typical test arrangement and photographs in the test setup exhibits for specific EUT placement during testing. Refer to photographs in the test setup exhibits for EUT placement during testing.

Diagram 1 Test arrangement for Conducted emissions



1. Interconnecting cables that hang closer than 40 cm to the ground plane were folded back and forth in the center forming a bundle 30 cm to 40 cm long.
2. Input/output (I/O) cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
3. EUT connected to one LISN. Unused LISN measuring port connectors are terminated into 50 Ω loads. LISN is placed on top of and bonded to reference ground plane.

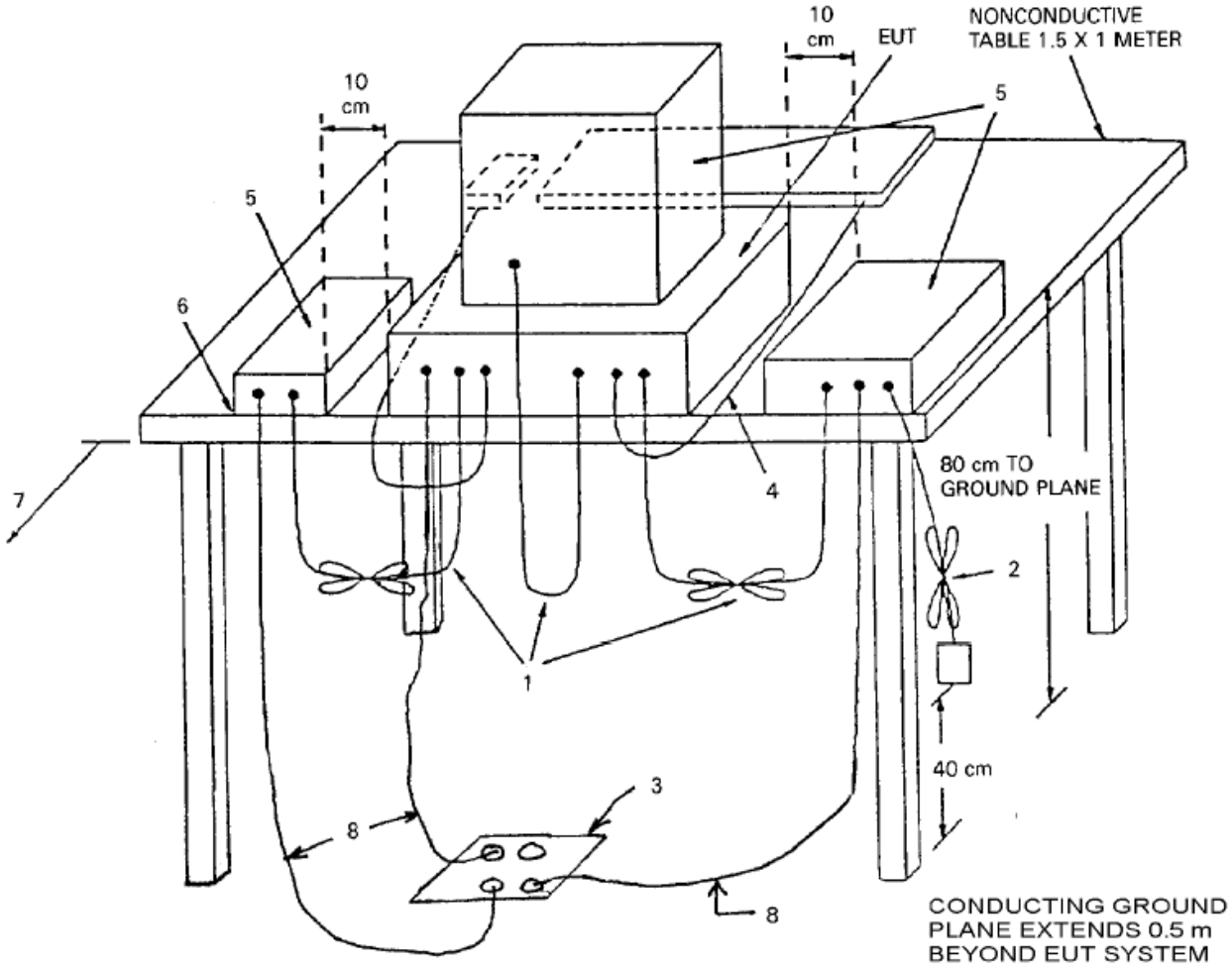
3.1 All other equipment powered from additional LISN(s).
3.2 Multiple outlet strips can be used for multiple power cords of non-EUT equipment.
3.3 LISN is positioned at least 80 cm from nearest part of EUT chassis.

4. Cables of hand-operated devices, such as keyboards, mice, and so on, shall be placed as for normal use.
5. Non-EUT components of EUT system being tested.
6. Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.
7. Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane (see 5.2.2 for options).

Radiated Emission Test Procedure

The EUT was placed on a rotating 1 x 1.5-meter wooden platform, 0.8 meters above the ground plane at a distance of 3 meters from the FSM antenna. Testing for the radiated emissions was performed as required by CFR47 15, RSS-210 and specified in sections 8 and 13.1.4 of ANSI C63.4-2009. EMI energy was maximized by equipment placement, raising and lowering the FSM antenna, changing the antenna polarization, and by rotating the turntable. Each emission was maximized before data was taken using a spectrum analyzer. The frequency spectrum from 9 kHz to 25,000 MHz was searched for during preliminary investigation. Refer to diagrams 2 and 3 showing typical test arrangement and photographs in the test setup exhibits for specific EUT placement during testing.

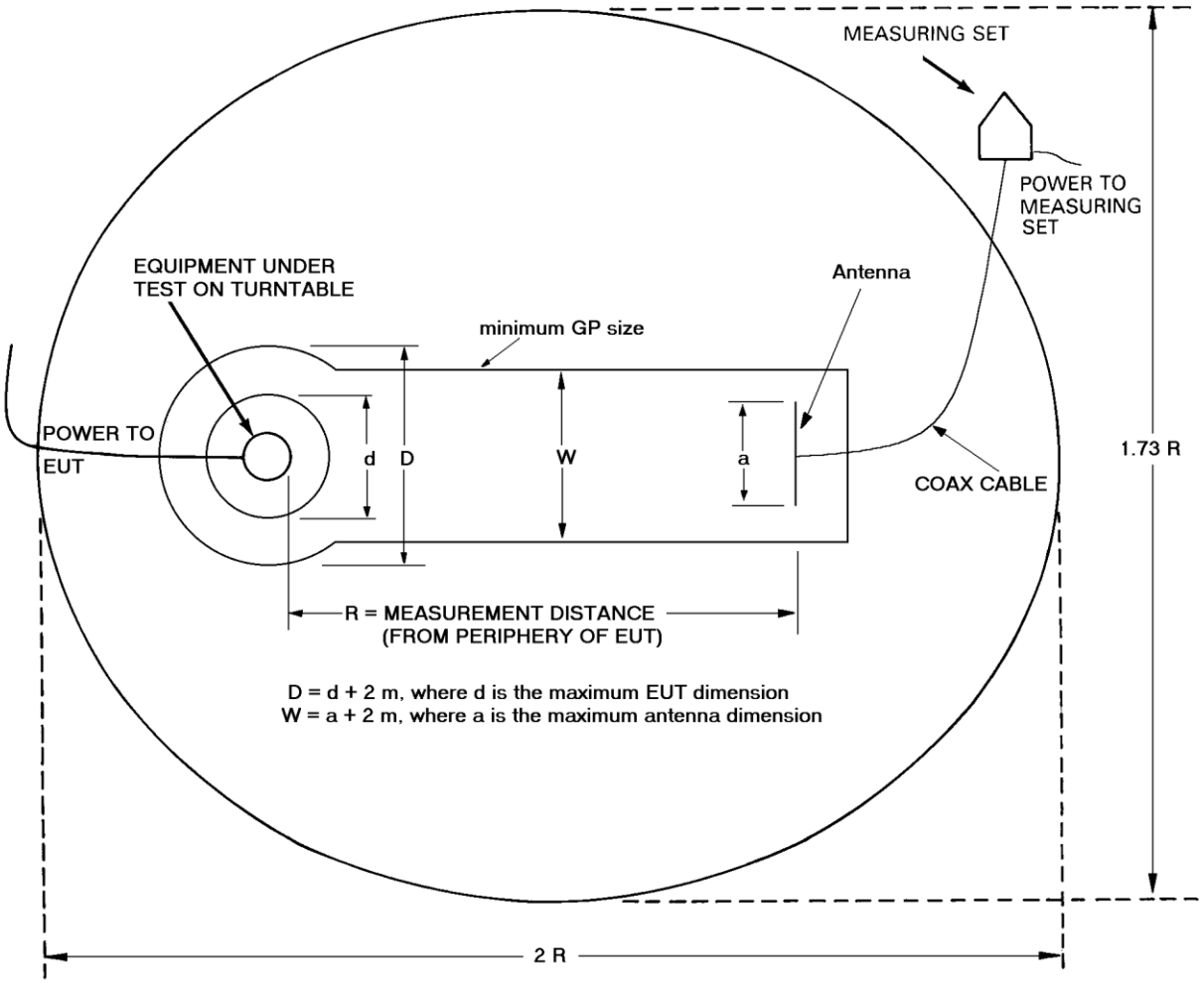
Diagram 2 Test arrangement for radiated emissions of tabletop equipment



1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center, forming a bundle 30 cm to 40 cm long.

2. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated if required using the correct terminating impedance. The total length shall not exceed 1 m.
3. If LISNs are kept in the test setup for radiated emissions, it is preferred that they be installed under the ground plane with the receptacle flush with the ground plane.
4. Cables of hand-operated devices, such as keyboards, mice, and so on, shall be placed as for normal use.
5. Non-EUT components of EUT system being tested.
6. Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop (possibly center of table for transmitter equipment).
7. No vertical conducting plane used.
8. Power cords drape to the floor and are routed over to receptacle.

Diagram 3 Test arrangement for radiated emissions tested on Open Area Test Site (OATS)



AREA DIMENSIONS =	R = 3m	R = 10 m	R = 30 m
	6 m x 5.2 m	20 m x 17.3 m	60 m x 52 m

Intentional Radiators

As per CFR47, Subpart C, paragraph 15.247 the following information is submitted.

Antenna Requirements

The EUT is produced with N-connectors for use with authorized external antenna systems. The design is marketed for professional installation and use as described in accompanying documentation. The antenna connection point complies with the unique antenna connection requirements. The requirements of 15.203 are fulfilled and there are no deviations or exceptions to the specification.

Restricted Bands of Operation

Spurious emissions falling in the restricted frequency bands of operation were measured at a distance of three meters at the OATS. The EUT utilizes frequency, determining circuitry, which generates harmonics falling in the restricted bands. Emissions were measured at the OATS, using appropriate antennas or pyramidal horns, amplification stages, and a spectrum analyzer. No other significant emission was observed which fell into the restricted bands of operation.

Table 1 Radiated Emissions in Restricted Bands Data (worst-case)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Quasi-Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Quasi-Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)
125.0	35.1	33.0	N/A	41.2	39.8	N/A	43.5
132.8	26.8	22.4	N/A	30.0	24.4	N/A	43.5
1593.0	40.9	N/A	24.4	45.8	N/A	25.4	54.0

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded above for frequency range of 30-1000 MHz. Peak and Average amplitude emissions are recorded above for frequency range above 1000 MHz.

Table 2 Harmonic Radiated Emissions in Restricted Bands Data (8.5 dBi Omni)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Quasi-Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Quasi-Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)
11490.0	49.6	N/A	36.4	49.5	N/A	36.5	54.0
11570.0	49.1	N/A	36.6	49.2	N/A	36.3	54.0
11650.0	52.3	N/A	39.0	49.4	N/A	38.9	54.0
22980.0	45.3	N/A	32.6	45.6	N/A	32.6	54.0

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded above for frequency range of 30-1000 MHz. Peak and Average amplitude emissions are recorded above for frequency range above 1000 MHz.

Table 3 Harmonic Radiated Emissions in Restricted Bands Data (24 dBi Panel)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Quasi-Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Quasi-Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)
11490.0	49.7	N/A	37.1	51.4	N/A	37.8	54.0
11570.0	50.1	N/A	37.2	53.2	N/A	40.3	54.0
11650.0	49.4	N/A	36.8	50.5	N/A	37.5	54.0
22980.0	49.5	N/A	36.4	48.7	N/A	36.0	54.0

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded above for frequency range of 30-1000 MHz. Peak and Average amplitude emissions are recorded above for frequency range above 1000 MHz.

Table 4 Harmonic Radiated Emissions in Restricted Bands Data (32 dBi Dish)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Quasi-Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Quasi-Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)
11490.0	56.7	N/A	44.0	63.7	N/A	49.5	54.0
11570.0	65.7	N/A	52.0	64.5	N/A	51.7	54.0
11650.0	65.5	N/A	52.0	65.0	N/A	51.8	54.0
22980.0	49.4	N/A	35.8	48.9	N/A	36.2	54.0

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded above for frequency range of 30-1000 MHz. Peak and Average amplitude emissions are recorded above for frequency range above 1000 MHz.

Summary of Results for Radiated Emissions in Restricted Bands

The EUT demonstrated compliance with the radiated emissions requirements of 47 CFR Part 15C Intentional Radiators. The EUT demonstrated a minimum margin of -2.0 dB below the requirements. Peak, Quasi-peak, and average amplitudes were checked for compliance with the regulations. Worst-case emissions are reported with other emissions found in the restricted frequency bands at least 20 dB below the requirements.

AC Line Conducted Emissions Procedure

The EUT was arranged in a typical equipment configuration and placed on a 1 x 1.5-meter wooden bench 80 cm above the conducting ground plane, floor of a screen room. The bench was positioned 40 cm away from the wall of the screen room. The LISN was positioned on the floor of the screen room 80-cm from the rear of the EUT. The manufacturer supplied AC power adapter was connected to the EUT and LISN providing power to the test system. A second LISN was positioned on the floor of the screen room 80-cm from the rear of the supporting equipment of the EUT. All power cords except the EUT were then powered from the second LISN. EMI was coupled to the spectrum analyzer through a 0.1 μF capacitor, internal to the LISN. Power line conducted emissions testing were carried out individually for each current carrying conductor of the EUT. The excess length of lead between the system and the LISN receptacle was folded back and forth to form a bundle not exceeding 40 cm in length. The screen room, conducting ground plane, analyzer, and LISN were bonded together to the protective earth ground. Preliminary testing was performed to identify the frequency of each radio frequency emission displaying the highest amplitude. The cables were repositioned to obtain maximum amplitude of measured EMI level. Once the worst-case configuration was identified, plots were made of the EMI from 0.15 MHz to 30 MHz then the data was recorded with maximum conducted emissions levels. Refer to figures one and two for plots of the EUT Power Line conducted emissions.

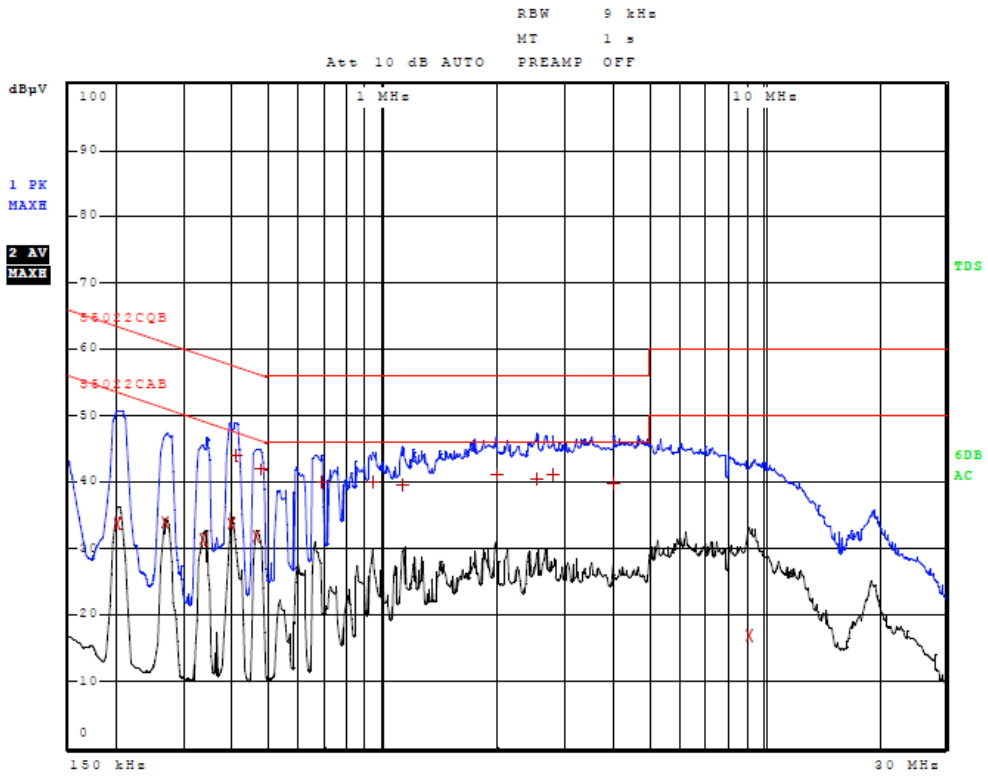


Figure One AC Line Conducted Emissions Line 1

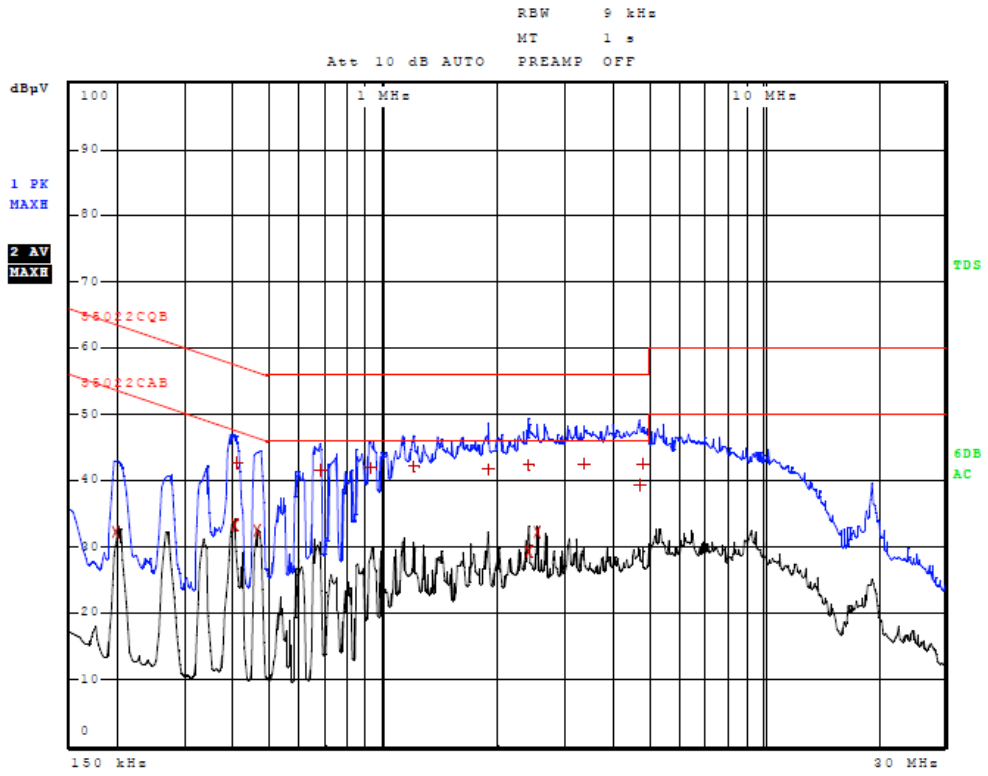


Figure Two AC Line Conducted Emissions Line 2

Table 5 AC Line Conducted Emissions Data (Highest Emissions)

Line 1

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
2	202.000000000 kHz	33.80	Average	-19.73
2	266.000000000 kHz	33.83	Average	-17.41
2	338.000000000 kHz	31.38	Average	-17.87
2	394.000000000 kHz	33.68	Average	-14.30
1	410.000000000 kHz	44.11	Quasi Peak	-13.54
2	462.000000000 kHz	31.86	Average	-14.79
1	474.000000000 kHz	42.01	Quasi Peak	-14.43
1	686.000000000 kHz	39.93	Quasi Peak	-16.07
1	938.000000000 kHz	39.92	Quasi Peak	-16.08
1	1.122000000 MHz	39.52	Quasi Peak	-16.48
1	1.970000000 MHz	41.06	Quasi Peak	-14.94
1	2.522000000 MHz	40.43	Quasi Peak	-15.57
1	2.778000000 MHz	41.16	Quasi Peak	-14.84
1	4.018000000 MHz	39.90	Quasi Peak	-16.10
2	9.140000000 MHz	16.94	Average	-33.06

Line 2

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
2	198.000000000 kHz	32.24	Average	-21.45
2	402.000000000 kHz	33.26	Average	-14.55
1	410.000000000 kHz	42.77	Quasi Peak	-14.88
2	462.000000000 kHz	32.36	Average	-14.30
1	674.000000000 kHz	41.47	Quasi Peak	-14.53
1	918.000000000 kHz	41.99	Quasi Peak	-14.01
1	1.202000000 MHz	42.17	Quasi Peak	-13.83
1	1.882000000 MHz	41.76	Quasi Peak	-14.24
1	2.402000000 MHz	42.37	Quasi Peak	-13.63
2	2.414000000 MHz	29.25	Average	-16.75
2	2.538000000 MHz	32.30	Average	-13.70
1	3.338000000 MHz	42.53	Quasi Peak	-13.47
1	4.690000000 MHz	39.45	Quasi Peak	-16.55
1	4.786000000 MHz	42.57	Quasi Peak	-13.43

Other emissions present had amplitudes at least 20 dB below the limit.

Summary of Results for AC Line Conducted Emissions

The EUT demonstrated compliance with the conducted emissions requirements of CFR47 Part 15C equipment. The EUT demonstrated minimum margin of -13.4 dB below the limit. Measurements were taken using the peak, quasi peak, and average, measurement function for each emissions amplitude and were below the limits stated in the specification. Other emissions were present with recorded data representing worst-case amplitudes.

General Radiated Emissions Procedure

The EUT was arranged in a typical equipment configuration and operated through all available modes with worst-case data recorded. Preliminary testing was performed in a screen room with the EUT positioned 1 meter from the FSM. Radiated emissions measurements were performed to identify the frequencies, which produced the highest emissions. Each radiated emission was then maximized at the OATS location before final radiated emissions measurements were performed. Final data was taken with the EUT located at the OATS at a distance of 3 meters between the EUT and the receiving antenna. The frequency spectrum from 30 MHz to 60,000 MHz was searched for general radiated emissions. Measured emission levels were maximized by EUT placement on the table, rotating the turntable through 360 degrees, varying the antenna height between 1 and 4 meters above the ground plane and changing antenna position between horizontal and vertical polarization. Antennas used include Loop from 9 kHz to 30 MHz, Broadband Biconical from 30 to 200 MHz, Biconilog from 30 to 1000 MHz, Log Periodic from 200 MHz to 1 GHz and or double Ridge or pyramidal horns and mixers from 1 GHz to 40 GHz, notch filters and appropriate amplifiers and external mixers.

General Radiated Emissions from EUT Data (Highest Emissions)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Quasi-Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Quasi-Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)
75.7	26.5	20.1	N/A	30.1	24.7	N/A	40.0
78.8	28.4	23.0	N/A	27.4	22.5	N/A	40.0
79.1	27.4	22.5	N/A	27.8	22.9	N/A	40.0
125.0	35.1	33.0	N/A	41.2	39.8	N/A	43.5
132.8	26.8	22.4	N/A	30.0	24.4	N/A	43.5
145.8	32.3	26.4	N/A	29.8	24.7	N/A	43.5
146.7	31.7	26.4	N/A	30.3	25.0	N/A	43.5
147.0	32.1	26.7	N/A	30.3	24.5	N/A	43.5
216.7	38.3	32.0	N/A	34.4	29.4	N/A	46.0
375.0	44.5	41.9	N/A	41.8	40.1	N/A	46.0
500.0	51.4	44.5	N/A	49.1	44.9	N/A	46.0
600.0	47.0	44.5	N/A	47.4	42.7	N/A	46.0
625.0	45.7	44.6	N/A	45.1	43.8	N/A	46.0
875.0	43.7	41.4	N/A	38.0	36.5	N/A	46.0

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded above for frequency range of 30-1000 MHz. Peak and Average amplitude emissions are recorded above for frequency range above 1000 MHz.

Summary of Results for General Radiated Emissions

The EUT demonstrated compliance with the radiated emissions requirements of CFR47 Part 15C paragraph 15.209 Intentional Radiators. The EUT demonstrated a minimum margin of -1.1 dB below the requirements. Other emissions were present with amplitudes at least 20 dB below the Limits.

Operation in the Band 5725 – 5850 MHz

The power output was measured at the antenna port and also the open area test site at a three-meter distance. The EUT was placed on a wooden turntable 0.8 meters above the ground plane at a distance of 3 meters from the FSM antenna. The peak and quasi-peak amplitude of radiated emissions below 1000 MHz were measured using a spectrum analyzer. The peak and average amplitude of radiated emissions above 1000 MHz including were measured using a test receiver and/or spectrum analyzer with data recorded from the receiver measurement result. The antenna conducted output power, power spectral density, and 6-dB bandwidth were measured with EUT operating in low, middle and highest available channel modes. The data reported below represents the worst-case operational conditions. Plots were made of transmitter performance taken at the antenna port connector. Refer to figures three through twenty-six showing plots taken of the EUT performance displaying compliance with the specifications.

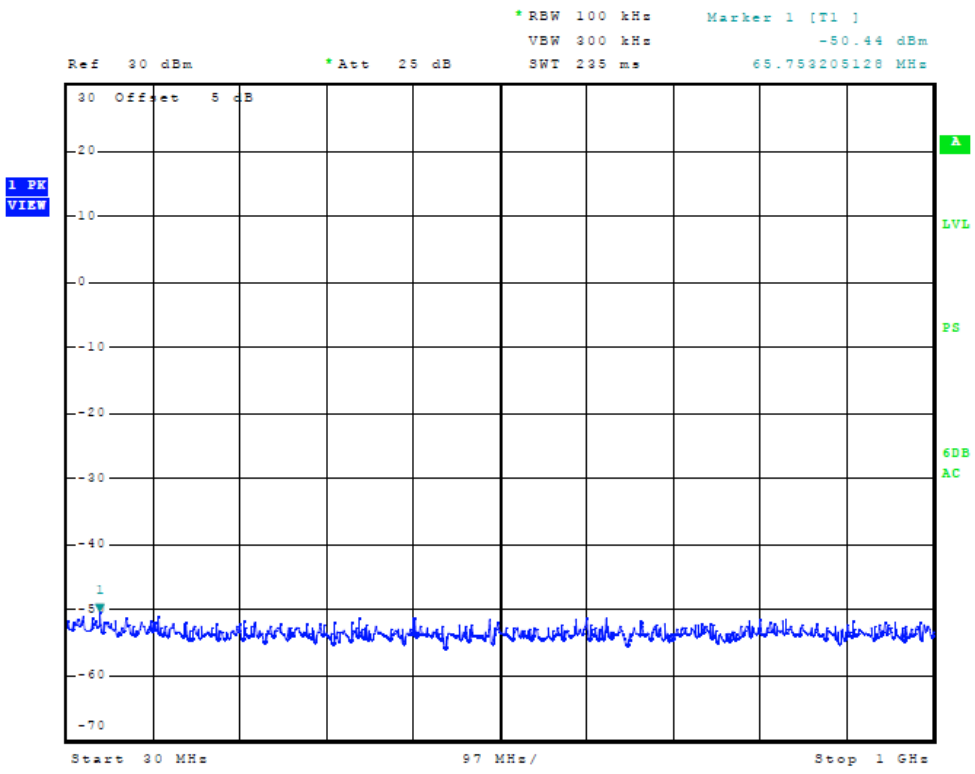


Figure Three Plot of Antenna Port Conducted Emissions (Frequency Spectrum, Chain 0)

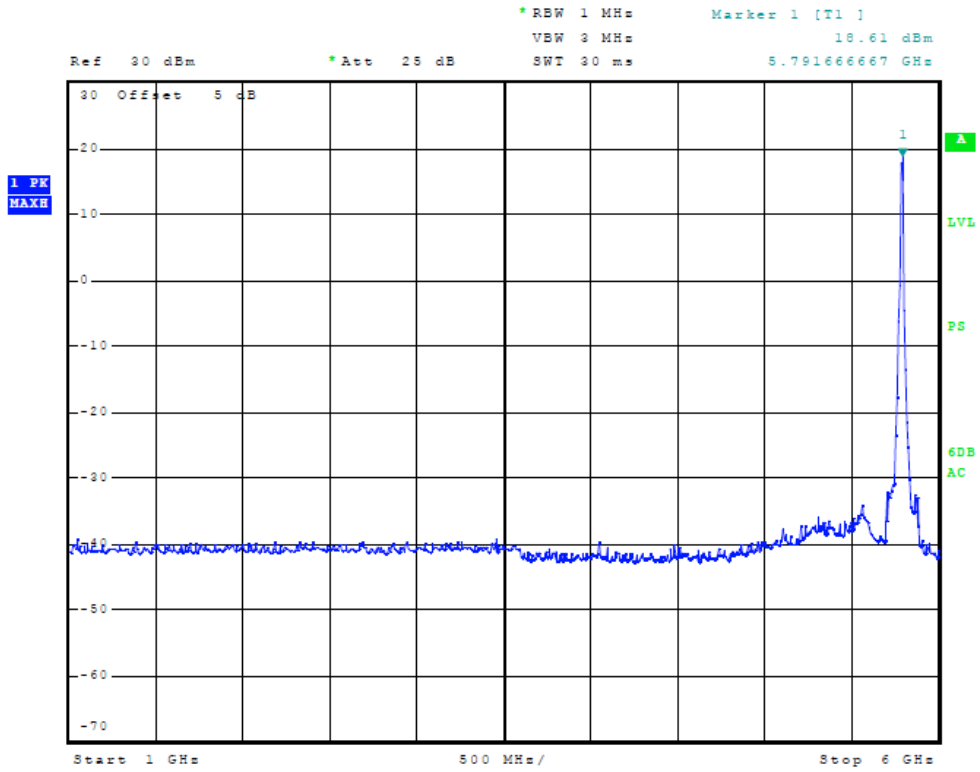


Figure Four Plot of Antenna Port Conducted Emissions (Frequency Spectrum, Chain 0)

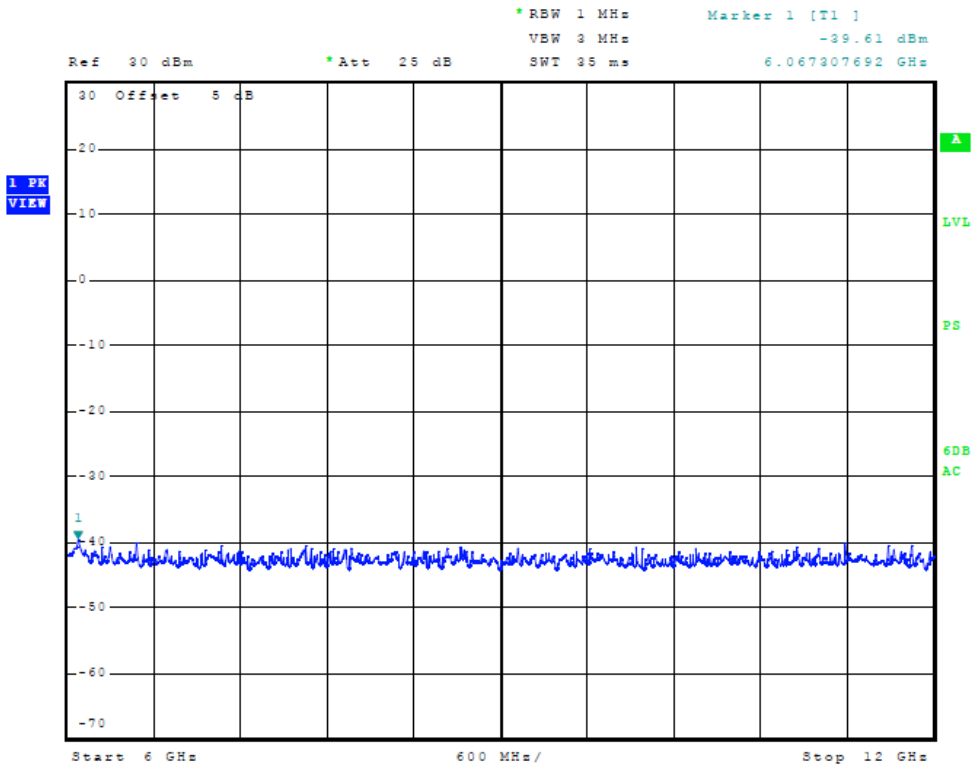


Figure Five Plot of Antenna Port Conducted Emissions (Frequency Spectrum, Chain 0)

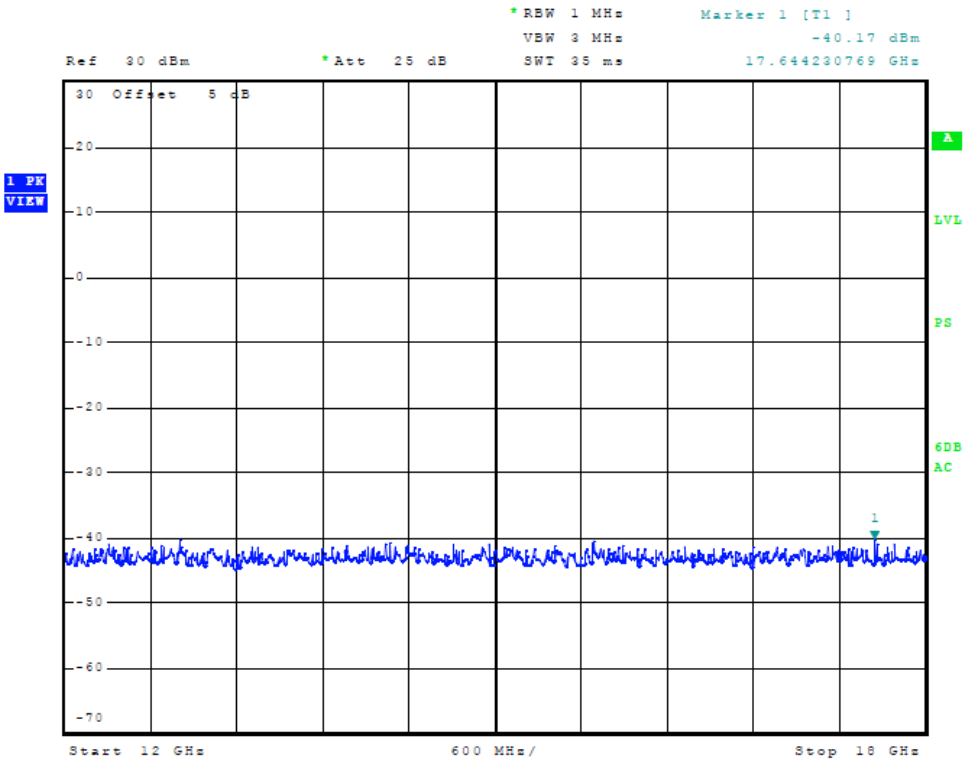


Figure Six Plot of Antenna Port Conducted Emissions (Frequency Spectrum, Chain 0)

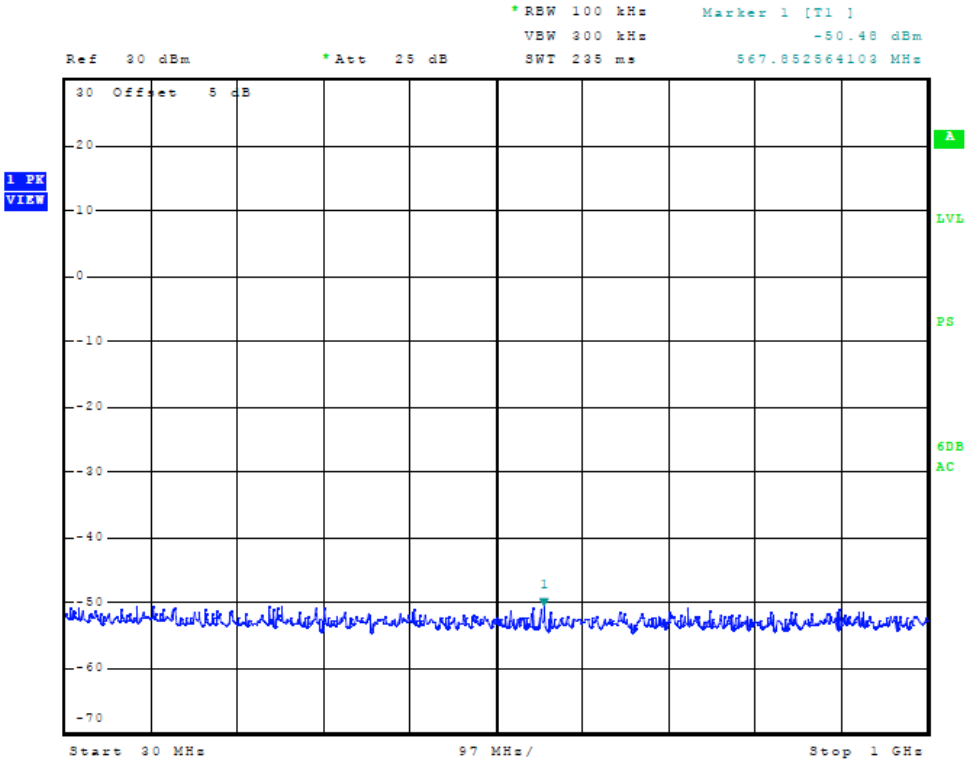


Figure Seven Plot of Antenna Port Conducted Emissions (Frequency Spectrum, Chain 1)

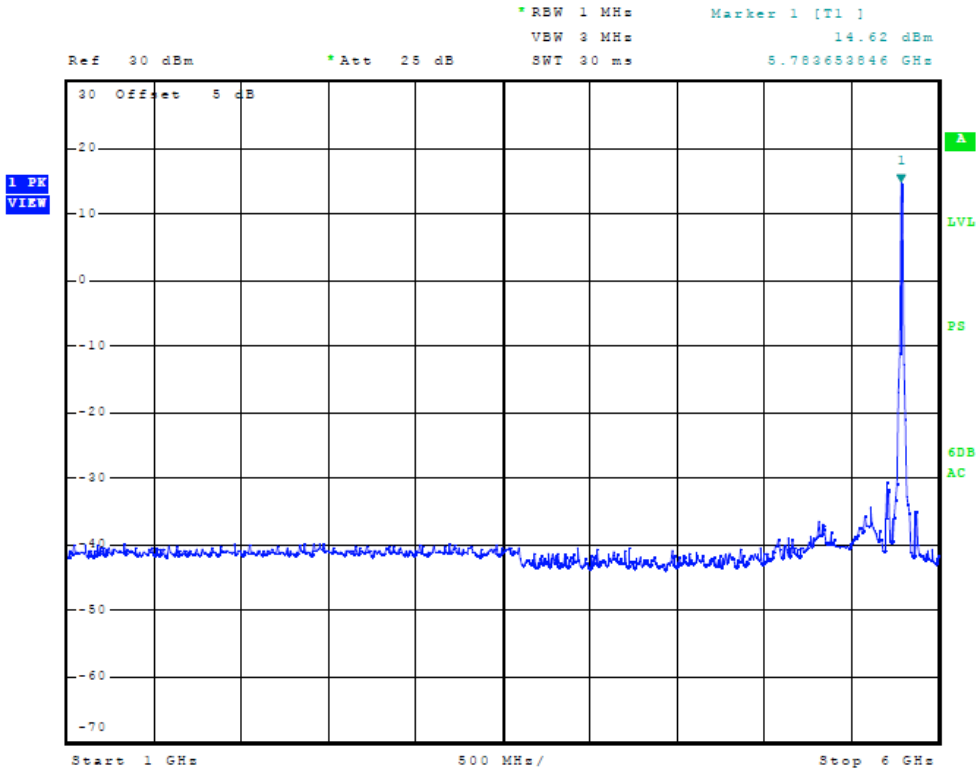


Figure Eight Plot of Antenna Port Conducted Emissions (Frequency Spectrum, Chain 1)

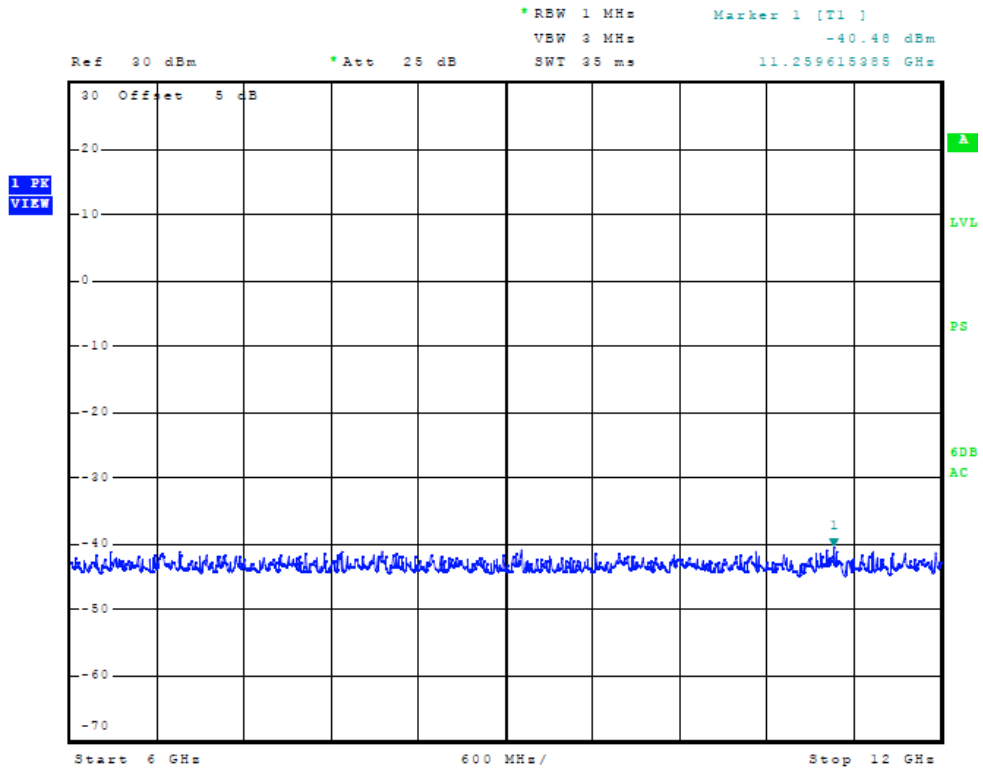


Figure Nine Plot of Antenna Port Conducted Emissions (Frequency Spectrum, Chain 1)

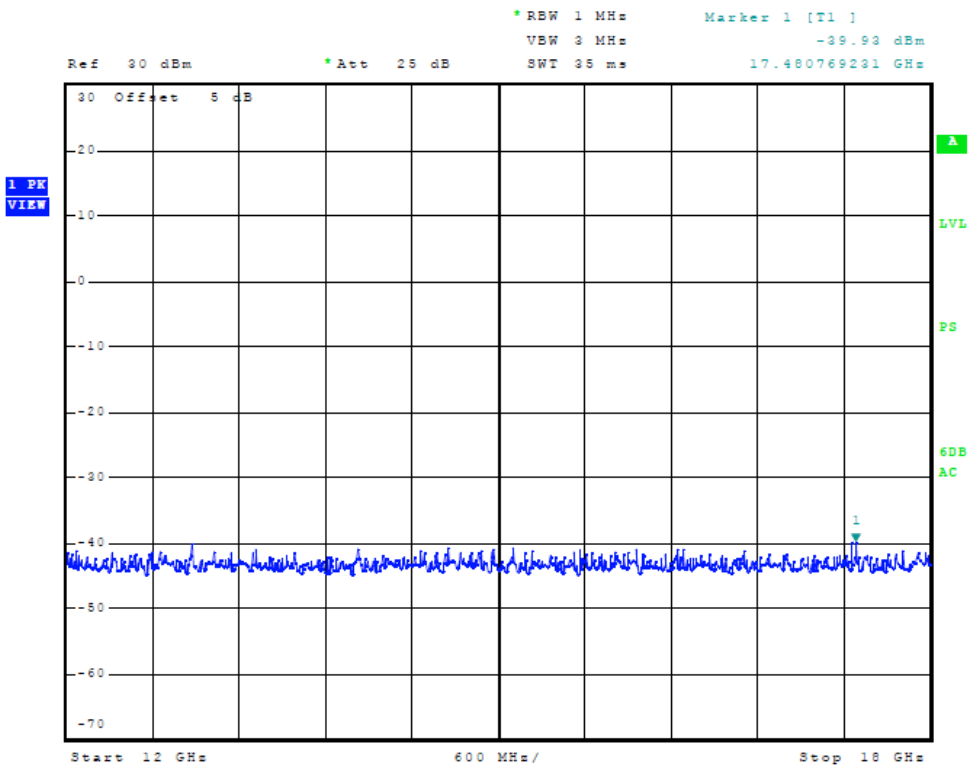


Figure Ten Plot of Antenna Port Conducted Emissions (Frequency Spectrum, Chain 1)

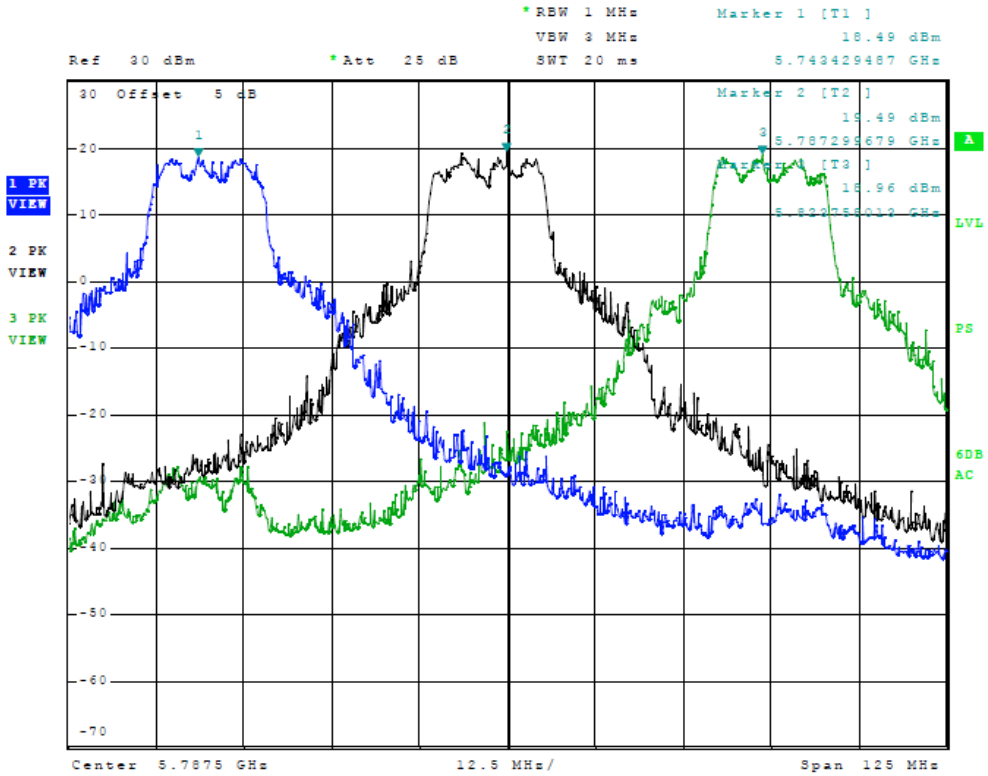


Figure Eleven Plot of Output Across Operational Band (20 MHz Mode, Chain 0)

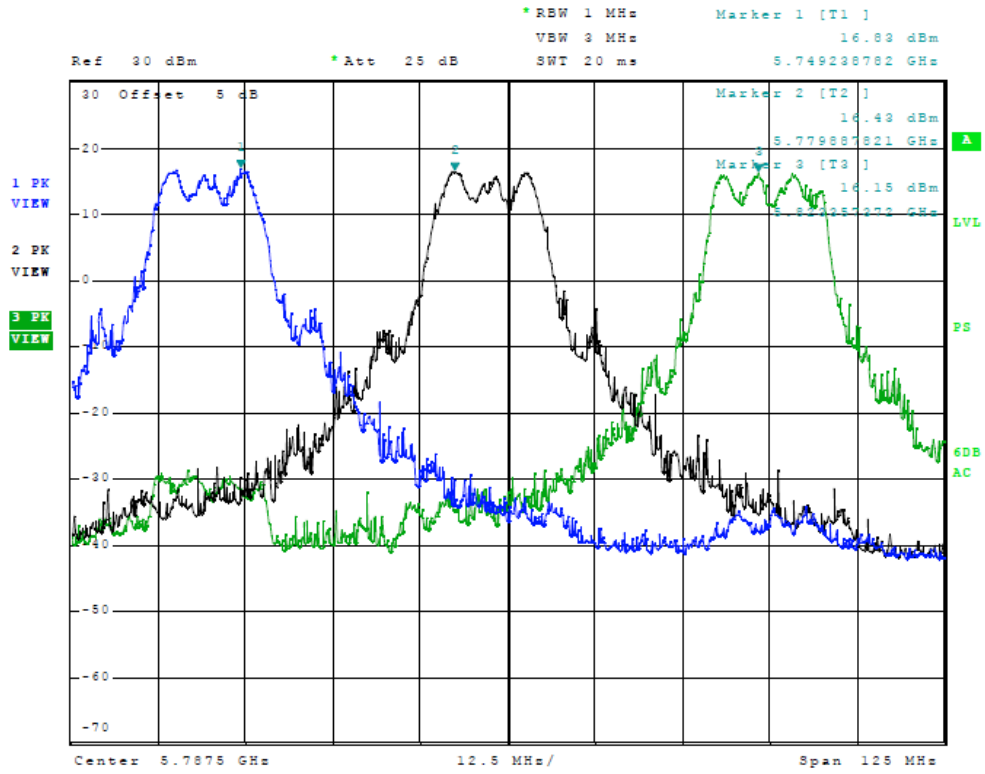


Figure Twelve Plot of Output Across Operational Band (20 MHz Mode, Chain 1)

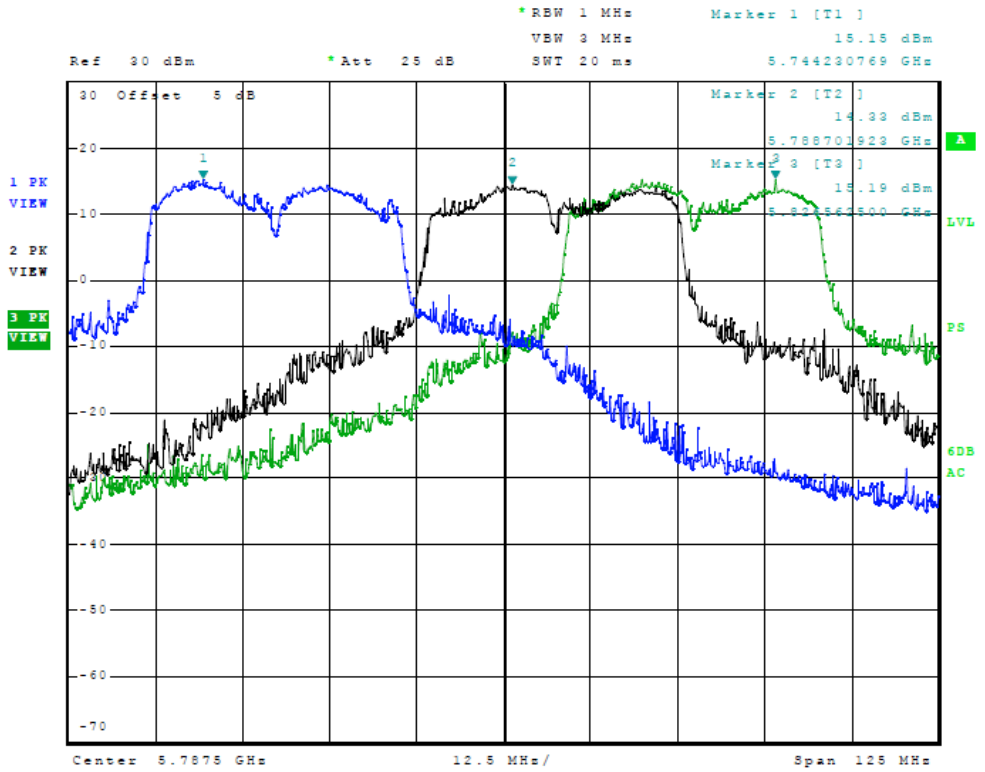


Figure Thirteen Plot of Output Across Operational Band (40 MHz Mode, Chain 0)

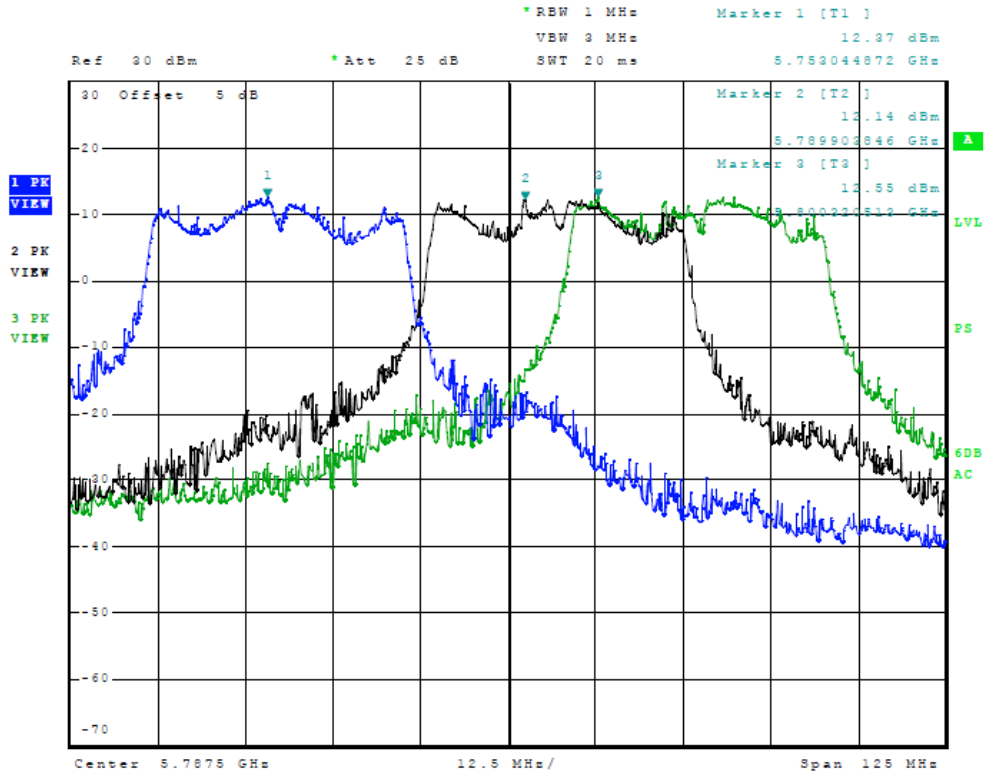


Figure Fourteen Plot of Output Across Operational Band (40 MHz Mode, Chain 1)

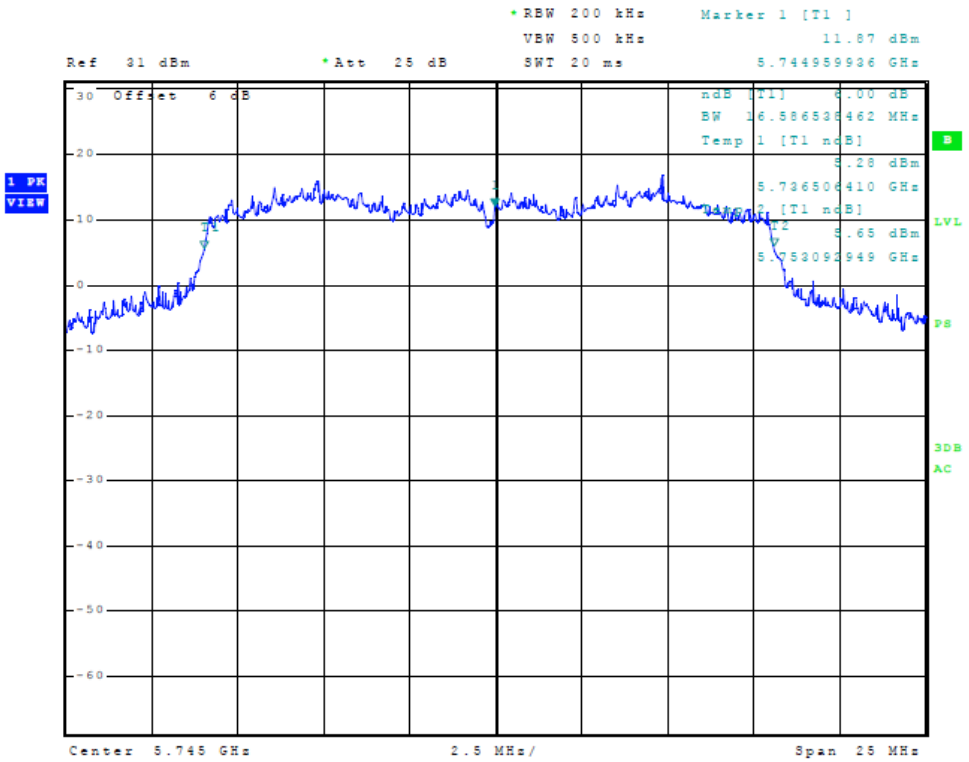


Figure Fifteen Plot of 6dB Band width (20 MHz Mode, 5745 MHz, Chain 0)

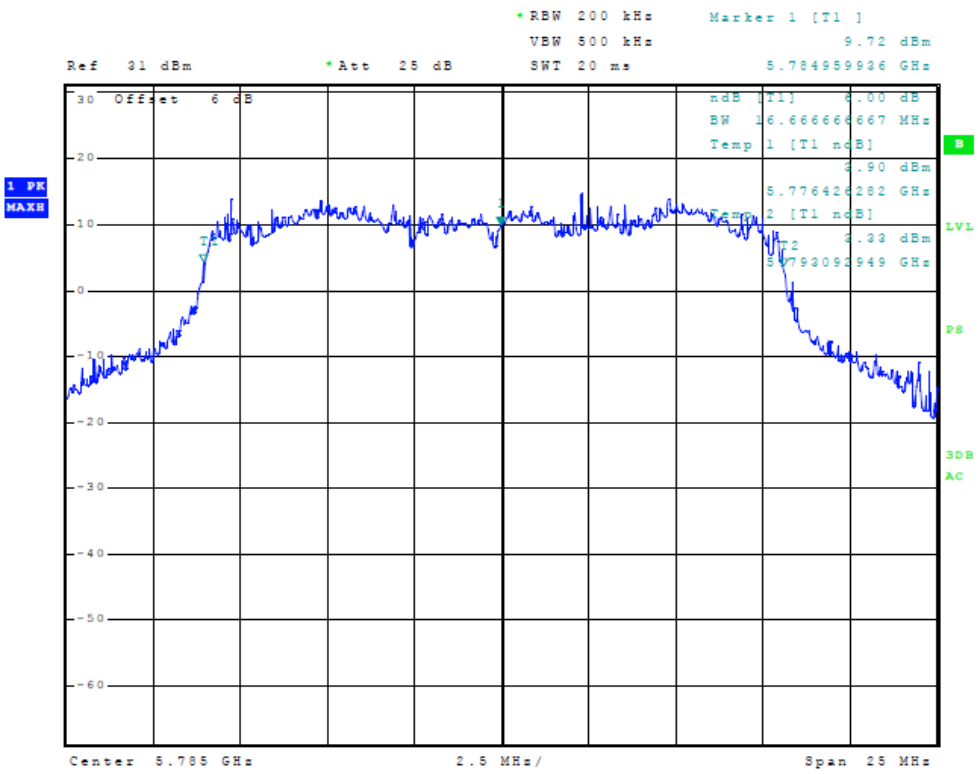


Figure Sixteen Plot of 6dB Band width (20 MHz Mode, 5785 MHz, Chain 0)

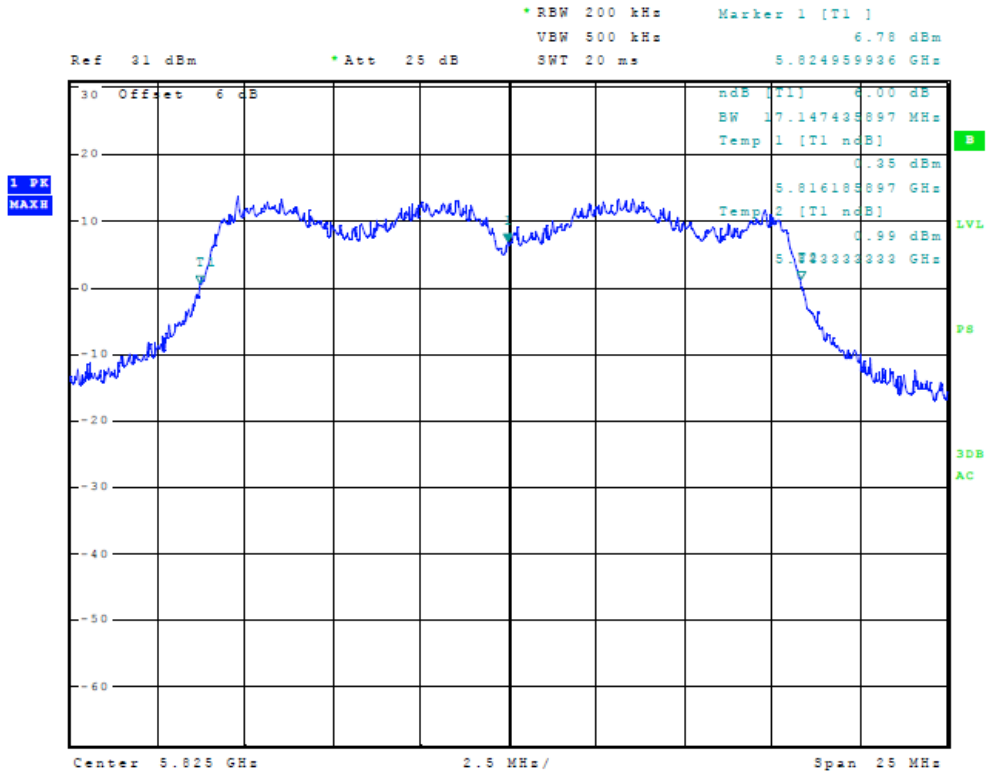


Figure Seventeen Plot of 6dB Band width (20 MHz Mode, 5825 MHz, Chain 0)

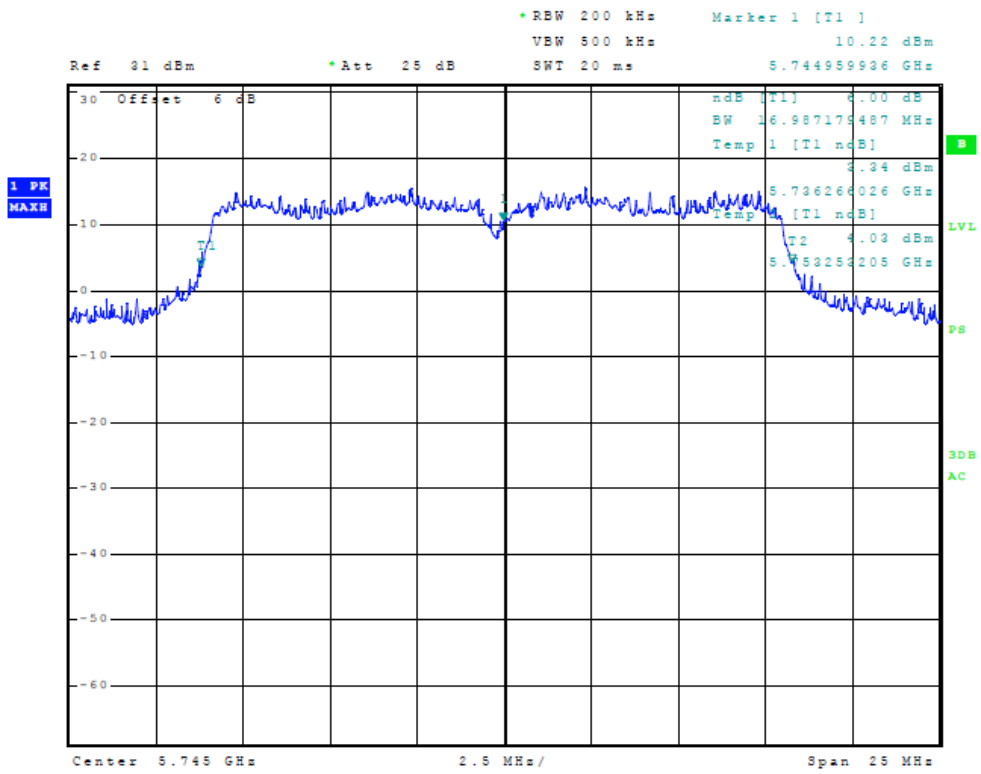


Figure Eighteen Plot of 6dB Band width (20 MHz Mode, 5745 MHz, Chain 1)

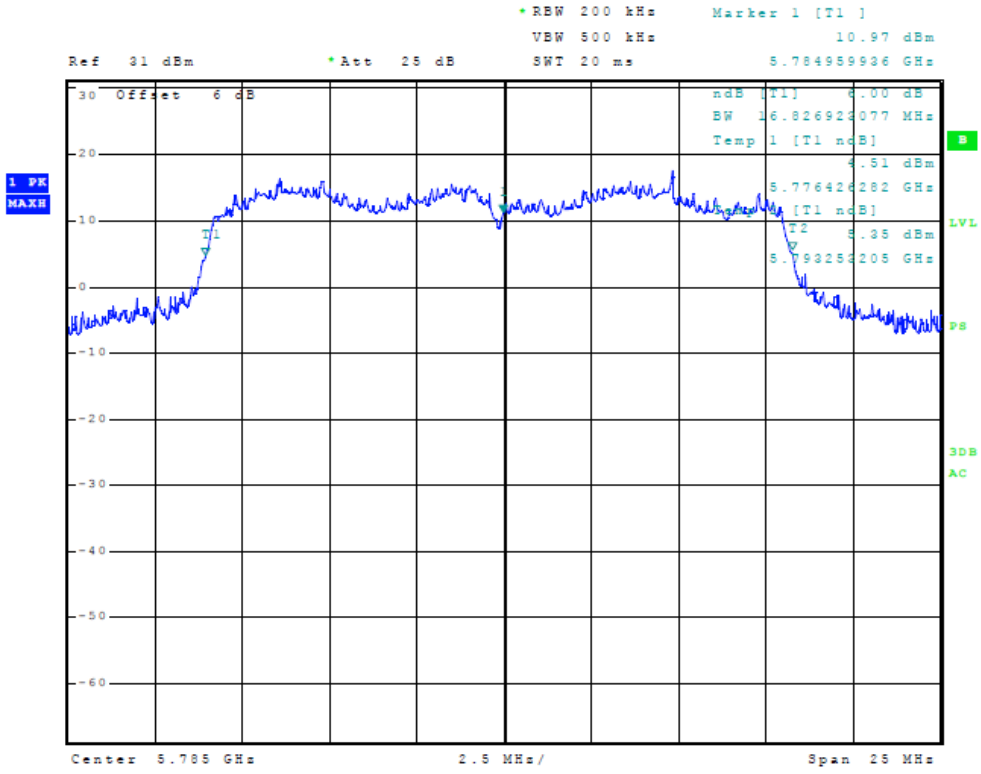


Figure Nineteen Plot of 6dB Band width (20 MHz Mode, 5785 MHz, Chain 1)

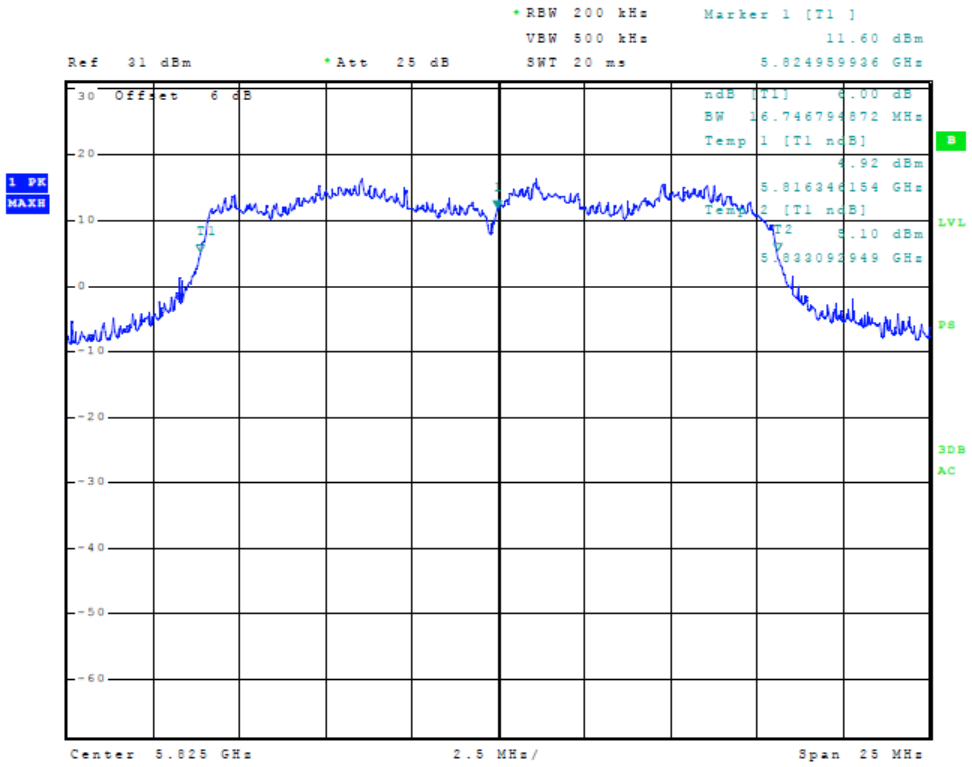


Figure Twenty Plot of 6dB Band width (20 MHz Mode, 5825 MHz, Chain 1)

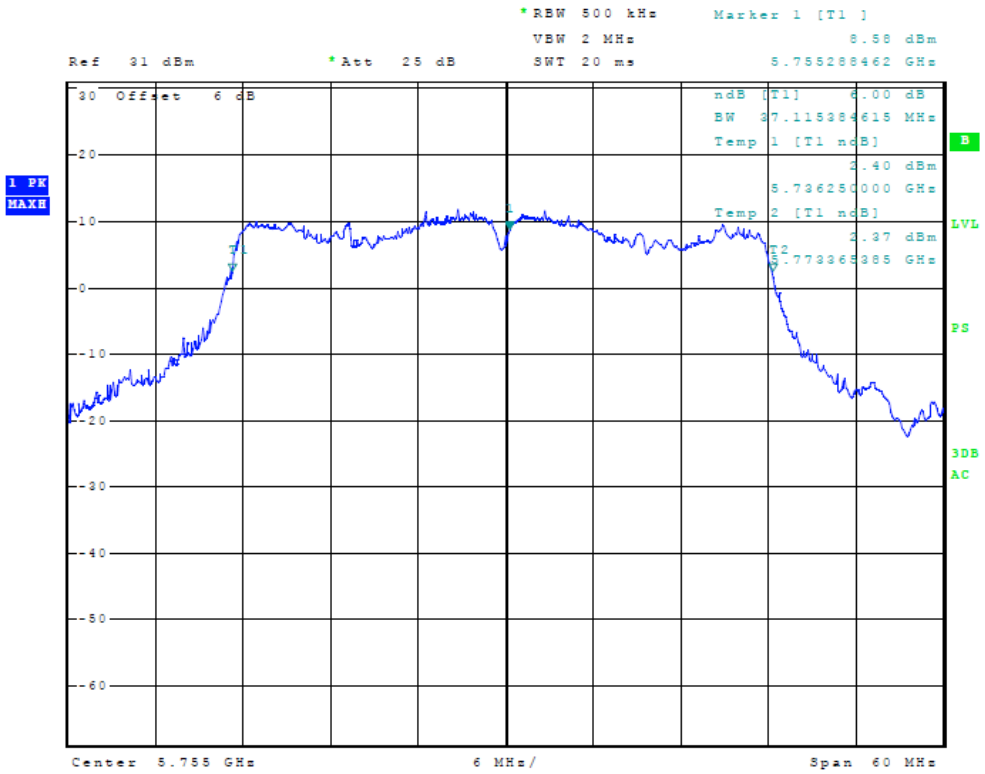


Figure Twenty-one Plot of 6dB Band width (40 MHz Mode, 5755 MHz, Chain 0)

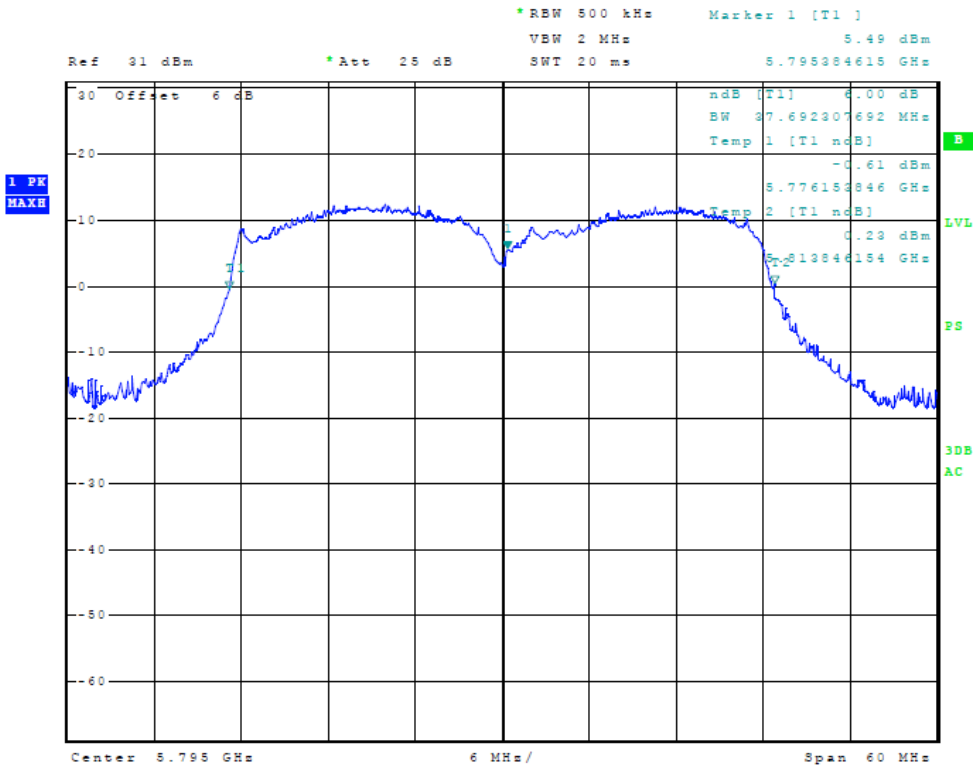


Figure Twenty-two Plot of 6dB Band width (40 MHz Mode, 5795 MHz, Chain 0)

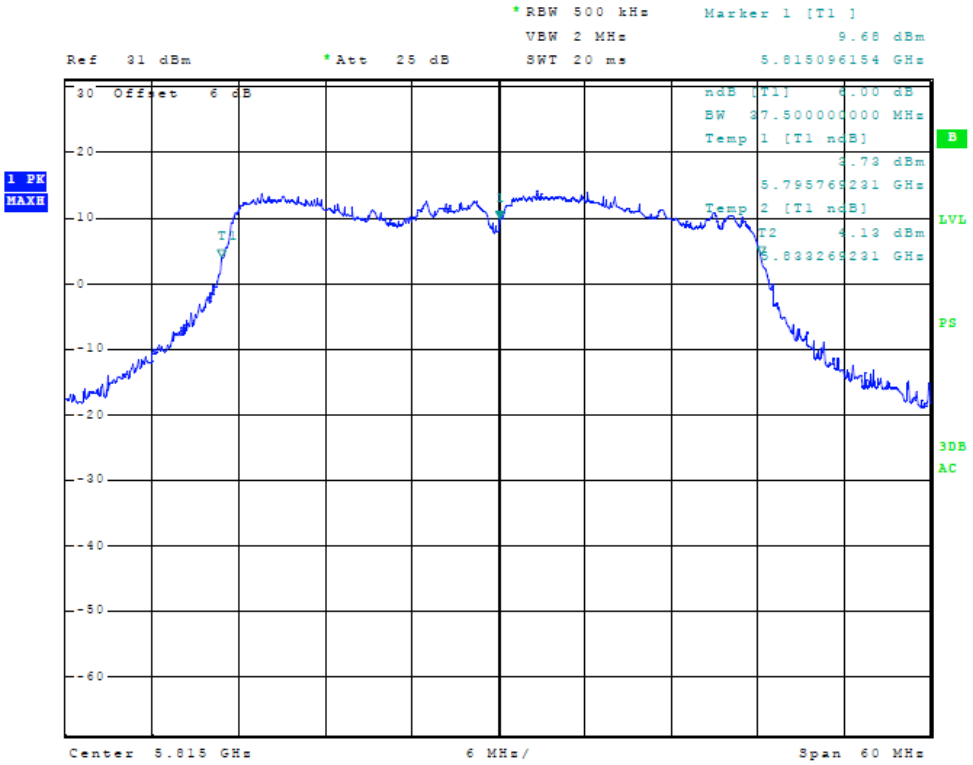


Figure Twenty-three Plot of 6dB Band width (40 MHz Mode, 5815 MHz, Chain 0)

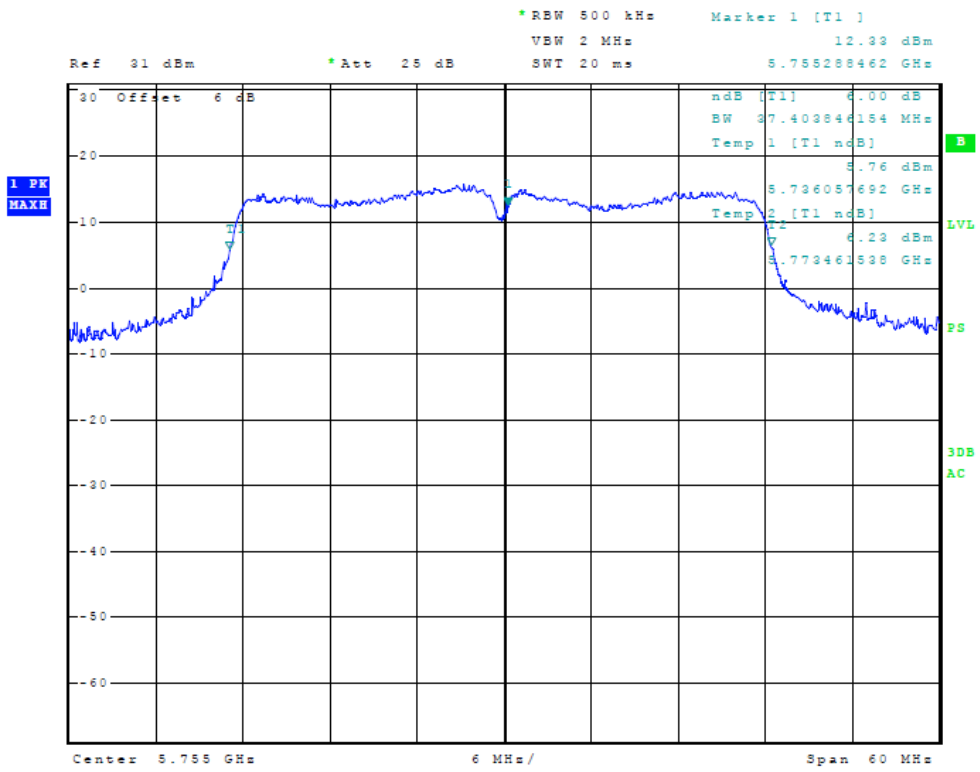


Figure Twenty-four Plot of 6dB Band width (40 MHz Mode, 5755 MHz, Chain 1)

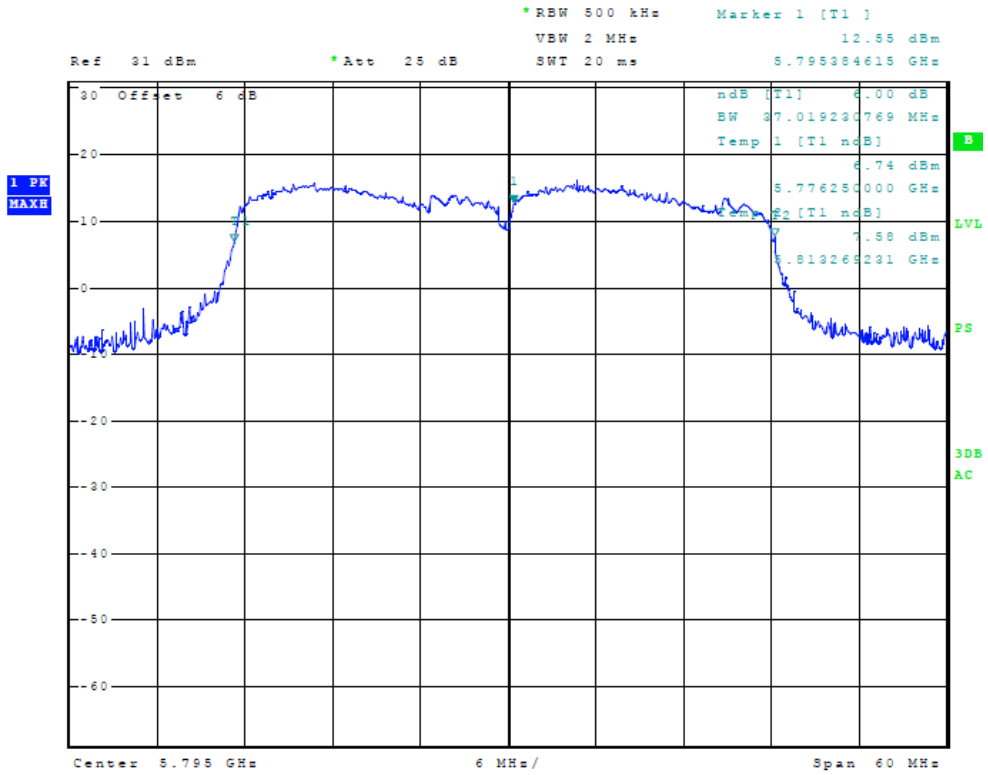


Figure Twenty-five Plot of 6dB Band width (40 MHz Mode, 5795 MHz, Chain 1)

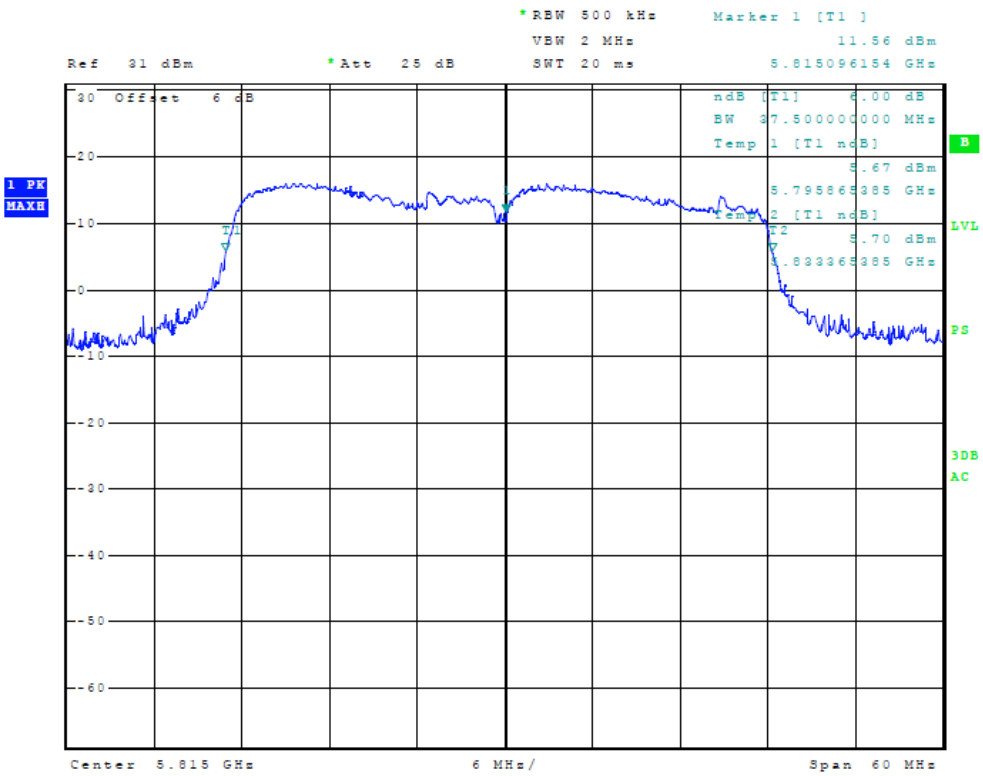


Figure Twenty-six Plot of 6dB Band width (40 MHz Mode, 5815 MHz, Chain 1)

Table 6 Transmitter Antenna port Conducted Emissions Data (Total Highest)

Channel Mode	Total Output Power (dBm / Watts)	Total Power Spectral Density (dBm)
5 MHz	30.0 dBm / 1.0 Watts	6.1
10 MHz	30.0 dBm / 1.0 Watts	3.8
20 MHz	30.0 dBm / 1.0 Watts	1.6
40 MHz	29.5 dBm / 0.9 Watts	-1.1

Table 7 Transmitter Antenna Conducted Emissions Data (per Chain)

Frequency MHz	Antenna Conducted Output Power dBm	Occupied Bandwidth kHz	Power Spectral Density dBm
5MHz Mode (Chain 0)			
5740.0	26.85	4231.8	1.9
5785.0	26.87	4321.9	2.7
5830.0	26.31	4303.5	2.7
5 MHz Mode (Chain 1)			
5740.0	26.87	4,280.5	3.1
5785.0	26.94	4,328.5	3.2
5830.0	26.99	4,326.5	3.5
10 MHz Mode (Chain 0)			
5740.0	26.99	8,445.8	0.7
5785.0	26.88	8,445.8	0.0
5830.0	26.92	8,437.5	0.7
10 MHz Mode (Chain 1)			
5740.0	26.88	8,445.8	0.0
5785.0	26.96	8,437.5	0.7
5830.0	26.98	8,655.9	-0.2
20 MHz Mode (Chain 0)			
5745.0	26.81	17,067.0	-2.9
5785.0	26.68	16,627.0	-3.0
5825.0	26.89	17,147.0	-3.0
20 MHz Mode (Chain 1)			
5745.0	26.91	16,987.0	-0.6
5785.0	26.37	16,827.0	-0.3
5825.0	26.99	16,747.0	-0.7
40 MHz Mode (Chain 0)			
5755.0	26.41	37,212.0	-4.1
5795.0	26.33	37,692.0	-6.8
5815.0	26.47	37,500.0	-6.3
40 MHz Mode (Chain 1)			
5755.0	26.52	37,308.0	-4.1
5795.0	26.25	37,212.0	-4.3
5815.0	26.42	37,500.0	-3.9

Table 8 Transmitter Radiated Emission (8.5 dBi Omni, Worst-Case)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)
5745.0	--	--	--	--	--
11490.0	49.6	36.4	49.5	36.5	54.0
17235.0	55.4	42.4	55.5	42.4	54.0
22980.0	45.3	32.6	45.6	32.6	54.0
28725.0	39.2	26.7	40.1	26.8	54.0
5785.0	--	--	--	--	--
11570.0	49.1	36.6	49.2	36.3	54.0
17355.0	55.2	41.9	55.1	41.9	54.0
23140.0	45.9	32.5	45.3	32.6	54.0
28925.0	38.5	26.5	39.4	26.5	54.0
5825.0	--	--	--	--	--
11650.0	52.3	39.0	49.4	38.9	54.0
17475.0	56.4	43.3	56.8	43.4	54.0
23300.0	45.0	32.6	45.7	32.6	54.0
29125.0	39.0	26.5	39.2	26.5	54.0

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded above for frequency range of 30-1000 MHz. Peak and Average amplitude emissions are recorded above for frequency range above 1000 MHz.

Transmitter Radiated Emission (24 dBi Panel, Worst-Case)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)
5745.0	--	--	--	--	--
11490.0	49.7	37.1	51.4	37.8	54.0
17235.0	55.1	42.3	54.7	42.2	54.0
22980.0	49.5	36.4	48.7	36.0	54.0
28725.0	39.5	27.1	39.7	27.1	54.0
5785.0	--	--	--	--	--
11570.0	50.1	37.2	53.2	40.3	54.0
17355.0	54.7	41.8	54.5	41.8	54.0
23140.0	48.8	35.9	48.3	35.7	54.0
28925.0	39.5	26.9	39.7	26.9	54.0
5825.0	--	--	--	--	--
11650.0	49.4	36.8	50.5	37.5	54.0
17475.0	56.8	43.9	57.4	43.7	54.0
23300.0	45.5	33.2	45.6	33.1	54.0
29125.0	39.5	26.6	39.5	26.6	54.0

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded above for frequency range of 30-1000 MHz. Peak and Average amplitude emissions are recorded above for frequency range above 1000 MHz.

Transmitter Radiated Emission (32 dBi Dish, Worst-Case)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)
5745.0	--	--	--	--	--
11490.0	56.7	44.0	63.7	49.5	54.0
17235.0	55.6	43.0	55.7	43.0	54.0
22980.0	49.4	35.8	48.9	36.2	54.0
28725.0	39.9	27.1	39.9	27.1	54.0
5785.0	--	--	--	--	--
11570.0	65.7	52.0	64.5	51.7	54.0
17355.0	56.0	43.1	55.2	42.4	54.0
23140.0	48.2	35.8	48.4	35.8	54.0
28925.0	39.9	27.2	39.7	27.2	54.0
5825.0	--	--	--	--	--
11650.0	65.5	52.0	65.0	51.8	54.0
17475.0	56.8	43.8	55.9	43.5	54.0
23300.0	45.6	32.8	44.3	32.4	54.0
29125.0	39.2	26.5	39.4	26.5	54.0

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded above for frequency range of 30-1000 MHz. Peak and Average amplitude emissions are recorded above for frequency range above 1000 MHz.

Summary of Results for Transmitter Radiated Emissions of Intentional Radiator

The EUT demonstrated antenna conducted output power of 500 milliwatt per chain with total system output power of 1.0 watt. The EUT demonstrated a minimum margin of -2.0 dB below the harmonic emissions requirements. The EUT demonstrated compliance with the emissions requirements for CFR47 Part 15.247 Intentional Radiators. There were no other significantly measurable emissions in restricted bands than those recorded in this report. Other emissions were present with amplitudes at least 20 dB below the requirements. The EUT demonstrated compliance with specifications of 15.247. There are no deviations or exceptions to the requirements.

Annex

- Annex A Measurement Uncertainty Calculations
- Annex B Rogers Labs Test Equipment List
- Annex C Rogers Qualifications
- Annex D FCC Site Registration Letter
- Annex E Industry Canada Site Registration Letter

Annex A Measurement Uncertainty Calculations

Measurement uncertainty calculations were made for the laboratory. Result of measurement uncertainty calculations are recorded below for AC line conducted and radiated emission measurements.

Measurement Uncertainty	$U_{(E)}$	$U_{(lab)}$
3 Meter Horizontal 30-200 MHz Measurements	2.08	4.16
3 Meter Vertical 30-200 MHz Measurements	2.16	4.33
3 Meter Vertical Measurements 200-1000 MHz	2.99	5.97
10 Meter Horizontal Measurements 30-200 MHz	2.07	4.15
10 Meter Vertical Measurements 30-200 MHz	2.06	4.13
10 Meter Horizontal Measurements 200-1000 MHz	2.32	4.64
10 Meter Vertical Measurements 200-1000 MHz	2.33	4.66
3 Meter Measurements 1-6 GHz	2.57	5.14
3 Meter Measurements 6-18 GHz	2.58	5.16
AC Line Conducted	1.72	3.43

Annex B Rogers Labs Test Equipment List

The test equipment is maintained in calibration and good operating condition. Use of this calibrated equipment ensures measurements are traceable to national standards.

List of Test Equipment	Calibration Date
Spectrum Analyzer: Rohde & Schwarz ESU40	5/12
Spectrum Analyzer: HP 8562A, HP Adapters: 11518, 11519, and 11520 Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W	5/12
Spectrum Analyzer: HP 8591EM	5/12
Antenna: EMCO Biconilog Model: 3143	5/12
Antenna: Sunol Biconilog Model: JB6	10/11
Antenna: EMCO Log Periodic Model: 3147	10/11
Antenna: Antenna Research Biconical Model: BCD 235	10/11
LISN: Compliance Design Model: FCC-LISN-2.Mod.cd, 50 µHy/50 ohm/0.1 µf	10/11
R.F. Preamp CPPA-102	10/11
Attenuator: HP Model: HP11509A	10/11
Attenuator: Mini Circuits Model: CAT-3	10/11
Attenuator: Mini Circuits Model: CAT-3	10/11
Cable: Belden RG-58 (L1)	10/11
Cable: Belden RG-58 (L2)	10/11
Cable: Belden 8268 (L3)	10/11
Cable: Time Microwave: 4M-750HF290-750	10/11
Cable: Time Microwave: 10M-750HF290-750	10/11
Frequency Counter: Leader LDC825	2/12
Oscilloscope Scope: Tektronix 2230	2/12
Wattmeter: Bird 43 with Load Bird 8085	2/12
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/12
R.F. Generators: HP 606A, HP 8614A, HP 8640B	2/12
R.F. Power Amp 65W Model: 470-A-1010	2/12
R.F. Power Amp 50W M185- 10-501	2/12
R.F. Power Amp A.R. Model: 10W 1010M7	2/12
R.F. Power Amp EIN Model: A301	2/12
LISN: Compliance Eng. Model 240/20	2/12
LISN: Fischer Custom Communications Model: FCC-LISN-50-16-2-08	2/12
Antenna: EMCO Dipole Set 3121C	2/12
Antenna: C.D. B-101	2/12
Antenna: Solar 9229-1 & 9230-1	2/12
Antenna: EMCO 6509	2/12
Audio Oscillator: H.P. 201CD	2/12
Peavey Power Amp Model: IPS 801	2/12
ELGAR Model: 1751	2/12
ELGAR Model: TG 704A-3D	2/12
ESD Test Set 2010i	2/12
Fast Transient Burst Generator Model: EFT/B-101	2/12
Field Intensity Meter: EFM-018	2/12
KEYTEK Ecat Surge Generator	2/12
Shielded Room 5 M x 3 M x 3.0 M	

Annex C Rogers Qualifications

Scot D. Rogers, Engineer

Rogers Labs, Inc.

Mr. Rogers has approximately 17 years' experience in the field of electronics. Engineering experience includes six years in the automated controls industry and remaining years working with the design, development and testing of radio communications and electronic equipment.

Positions Held

Systems Engineer:	A/C Controls Mfg. Co., Inc.	6 Years
Electrical Engineer:	Rogers Consulting Labs, Inc.	5 Years
Electrical Engineer:	Rogers Labs, Inc.	Current

Educational Background

1) Bachelor of Science Degree in Electrical Engineering from Kansas State University.

2) Bachelor of Science Degree in Business Administration Kansas State University.

3) Several Specialized Training courses and seminars pertaining to Microprocessors and Software programming.

Scot D Rogers

Scot D. Rogers

Annex D FCC Site Registration Letter

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

November 01, 2011

Registration Number: 90910

Rogers Labs, Inc.
4405 West 259th Terrace,
Louisburg, KS 66053

Attention: Scot Rogers,

Re: Measurement facility located at Louisburg
3 & 10 meter site
Date of Renewal: November 01, 2011

Dear Sir or Madam:

Your request for renewal of the registration of the subject measurement facility has been received. The information submitted has been placed in your file and the registration has been renewed. The name of your organization will remain on the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Phyllis Parrish
Industry Analyst

NVLAP Lab Code 200087-0

Annex E Industry Canada Site Registration Letter

Industry Canada Industrie Canada

December 28, 2011

OUR FILE: 46405-3041
Submission No: 152685

Rogers Labs Inc.
4405 West 259th Terrance
Louisburg, KS, 66053
USA

Attention: Mr. Scot D. Rogers

Dear Sir/Madame:

The Bureau has received your application for the renewal of 3/10m OATS. Be advised that the information received was satisfactory to Industry Canada. The following number(s) is now associated to the site(s) for which registration / renewal was sought **(Site# 3041A-1).** Please reference the appropriate site number in the body of test reports containing measurements performed on the site. In addition, please keep for your records the following information;

- The company address code associated to the site(s) located at the above address is: **3041A**

Furthermore, to obtain or renew a unique site number, the applicant shall demonstrate that the site has been accredited to ANSI C63.4-2003 or later. A scope of accreditation indicating the accreditation by a recognized accreditation body to ANSI C63.4-2003 or later shall be accepted. Please indicate in a letter the previous assigned site number if applicable and the type of site (example: 3 metre OATS or 3 metre chamber). If the test facility is not accredited to ANSI C63.4-2003 or later, the test facility shall submit test data demonstrating full compliance with the ANSI standard. The Bureau will evaluate the filing to determine if recognition shall be granted.

The frequency for re-validation of the test site and the information that is required to be filed or retained by the testing party shall comply with the requirements established by the accrediting organization. However, in all cases, test site re-validation shall occur on an interval not to **exceed three years**. There is no fee or form associated with an OATS filing. OATS submissions are encouraged to be submitted electronically to the Bureau using the following URL;
http://strategis.ic.gc.ca/epic/internet/inceb-bhst.nsf/en/h_tt00052e.html.

If you have any questions, you may contact the Bureau by e-mail at certification.bureau@ic.gc.ca Please reference our file and submission number above for all correspondence.

Yours sincerely,

Dalwinder Gill

Dalwinder Gill
For: Wireless Laboratory Manager
Certification and Engineering Bureau
3701 Carling Ave., Building 94
P.O. Box 11490, Station "H"
Ottawa, Ontario K2H 8S2
Email: dalwinder.gill@ic.gc.ca
Tel. No. (613) 998-8363
Fax. No. (613) 990-4752