NVLAP Lab Code 200087-0

SUBMITTAL APPLICATION REPORT

FOR
FCC And INDUSTRY CANADA
GRANT OF CERTIFICATION

FOR

Model: M4T
906.624 - 925.056 MHz Digitally Modulated Transmitter

FCC ID: DBZM4T
IC: 8024A-M4T

FOR

LECTROSONICS, INC.
581 Laser Road
Rio Rancho, NM 87124

Test Report Number: 101116m4t

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

CFR47, PART 15C - Intentional Radiators
Paragraph 15.247 and Industry Canada, RSS-210
Digitally Modulated Transmitter

For

LECTROSONICS, INC.

581 Laser Road
Rio Rancho, NM 87124
Larry Fisher
President

Model: M4T

Frequency 906.624 - 925.056 MHz
FCC ID#: DBZM4T
IC: 8024A-M4T

Test Date: November 16, 2010

Certifying Engineer: Scot D Rogers

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

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The following information is submitted for consideration in obtaining Grant of Certification for license exempt digitally modulated intentional radiator operating under CFR47 Paragraph 15.247 and Industry Canada standard RSS-210.

Name of Applicant:

LECTROSONICS, INC.
581 Laser Road
Rio Rancho, NM 87124

Model: M4T

FCC I.D.: DBZM4T IC: 8024A-M4T

Frequency Range: 906.624 - 925.056 MHz

Operating Power: 1 watt antenna conducted, Peak radiated measured 117.90 dBµV/m @ 3-meters (3- meter radiated measurement), maximum Occupied Bandwidth 4,326.92 kHz, Power Spectral Density 4.71 dB

Opinion / Interpretation of Results

Tests Performed	Results
Emissions Tests	
Emissions as per CFR47 paragraphs 2 and 15.205, RSS-210 paragraph 2.2	Complies
Emissions as per CFR47 paragraphs 2 and 15.207, RSS-210 paragraph 2.5	Complies
Emissions as per CFR47 paragraphs 2 and 15.209, RSS-210 paragraph 2.5	Complies
Emissions as per CFR47 paragraphs 2 and 15.247, RSS-210 paragraph A8.2	Complies

Environmental Conditions

Ambient Temperature 23.1° C

Relative Humidity 28%

Atmospheric Pressure 1004.8 mb

Application for Certification

(1) Manufacturer: LECTROSONICS, INC.
581 Laser Road
Rio Rancho, NM 87124

(2) Identification: Model: M4T
FCC I.D.: DBZM4T
IC: 8024A-M4T

(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) No Peripheral Equipment was Necessary.

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

(10) Equipment is not a scanning receiver and this section is not applicable.

(11) The equipment does not operate in the 59 – 64 GHz frequency band and this section is not applicable.

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

Applicable Standards

In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 2009, 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, and Industry Canada standard RSS-210 the following information is submitted.

Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in the ANSI 63.4-2009 Document FCC, documents DA00-1407 and DA00-705.

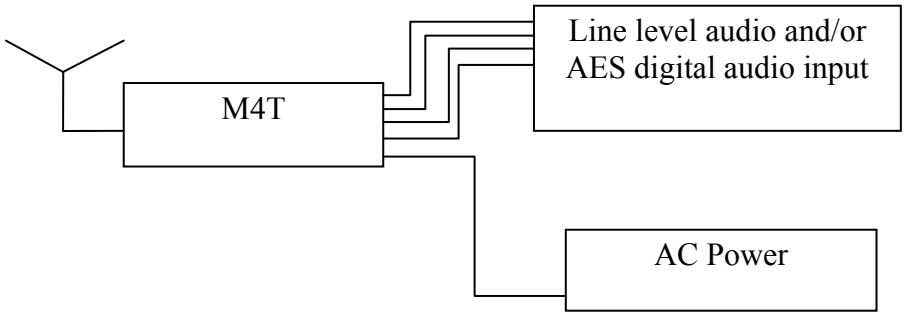
Equipment Tested

Equipment	Model	FCC ID	IC
EUT	M4T	DBZM4T	8024A-M4T

Equipment Function

The EUT is a 906.624 - 925.056 MHz radio transmitter used to provide high quality monaural audio for communications. The M4T is a transmitter for remote audio communications offering either 2 or 4 channel operational mode. The inputs are for either AES digital or line level audio. The equipment was tested for compliance while operating through all normal modes available. These configurations represented the worst-case emissions profile for the equipment and results are recorded in this report. The equipment operates from external AC power supplied from the manufacturer supplied AC power adapter.

Equipment Configuration



Test Site Locations

Conducted EMI — The AC power line conducted emissions testing was 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 Approval — Refer to Annex for FCC and Industry Canada Site Registration Letters

NVLAP Accreditation — 200087-0

List of Test Equipment

A Rohde & Schwarz ESU40 and/or Hewlett Packard 8591EM Spectrum Analyzer was used as the measuring device for the emissions testing of frequencies below 1 GHz. A Rohde & 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.

Analyzer Settings		
AC Line Conducted Emissions:		
RBW	AVG. BW	Detector Function
9 kHz	30 kHz	Peak/Quasi Peak
Radiated Emissions 30-1000 MHz		
RBW	AVG. BW	Detector Function
100 kHz	100 kHz	Peak
120 kHz	300 kHz	Peak/Quasi Peak
Radiated Emissions Above 1000 MHz		
RBW	Video BW	Detector Function
1 MHz	1 MHz	Peak / Average

Equipment	Manufacturer	Model	Calibration Date	Due
LISN	Comp. Design	FCC-LISN-2-MOD.CD	10/10	10/11
Antenna	ARA	BCD-235-B	10/10	10/11
Antenna	EMCO	3147	10/10	10/11
Antenna	EMCO	3143	5/10	5/11
Analyzer	HP	8591EM	5/10	5/11
Analyzer	HP	8562A	5/10	5/11
Analyzer	Rohde & Schwarz	ESU40	5/10	5/11

Units of Measurements and Test Procedure

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.

AC Line Conducted Emission Test Procedure

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 a typical equipment configuration 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.

Radiated Emission Test Procedure

Testing for the unintentional radiated emissions was performed as defined in section 8 and 13.1.4 of ANSI C63.4-2009. 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. 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. Refer to photographs in the exhibits for EUT placement.

Unintentional "General" Emissions

AC Line Conducted EMI

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 cord was connected to the LISN. 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 AC Line conducted emissions.

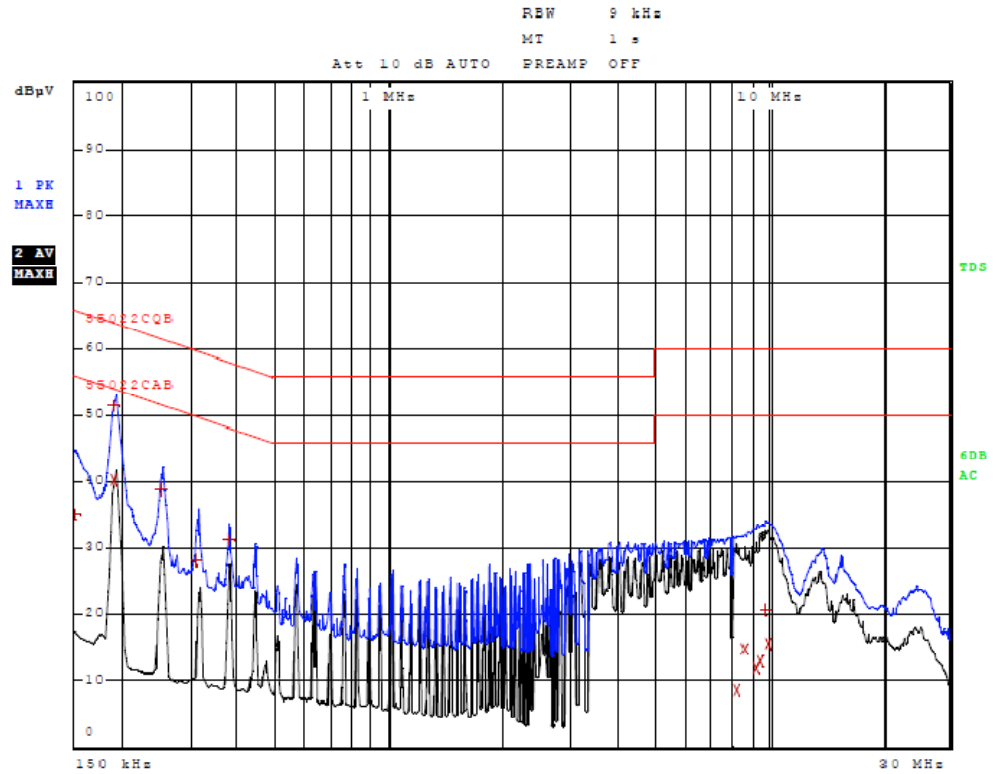


Figure One AC Line Conducted Emissions Line 1

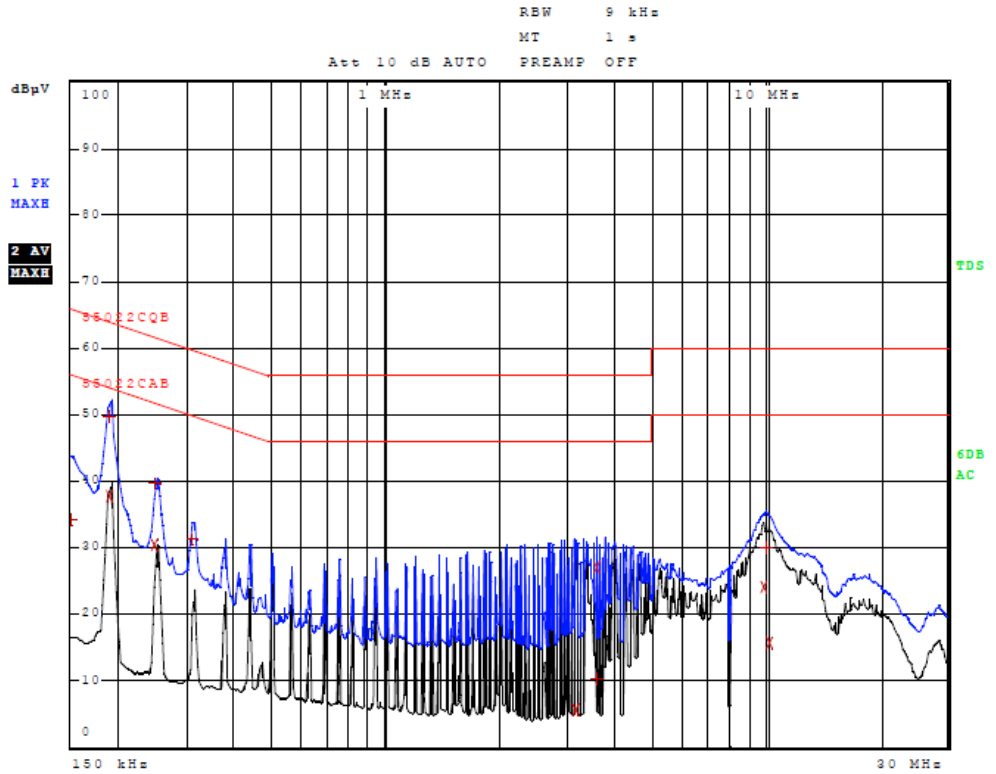


Figure Two AC Line Conducted Emissions Line 2

AC Line Conducted Emissions Data

Line L1

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	150.000000000 kHz	35.17	Quasi Peak	-30.83
2	190.000000000 kHz	40.28	Average	-13.75
1	190.000000000 kHz	51.44	Quasi Peak	-12.59
1	254.000000000 kHz	38.85	Quasi Peak	-22.77
1	314.000000000 kHz	28.17	Quasi Peak	-31.69
1	378.000000000 kHz	31.20	Quasi Peak	-27.12
2	8.224000000 MHz	8.57	Average	-41.43
2	8.576000000 MHz	14.73	Average	-35.27
2	9.220000000 MHz	11.94	Average	-38.06
2	9.472000000 MHz	12.89	Average	-37.11
1	9.804000000 MHz	20.66	Quasi Peak	-39.34
2	9.964000000 MHz	15.63	Average	-34.37

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

Line L2

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	150.000000000 kHz	34.13	Quasi Peak	-31.87
2	190.000000000 kHz	37.69	Average	-16.35
1	190.000000000 kHz	49.74	Quasi Peak	-14.30
2	250.000000000 kHz	30.29	Average	-21.47
1	250.000000000 kHz	39.62	Quasi Peak	-22.14
1	314.000000000 kHz	31.26	Quasi Peak	-28.60
2	3.146000000 MHz	5.60	Average	-40.40
2	3.578000000 MHz	27.00	Average	-19.00
1	3.586000000 MHz	10.21	Quasi Peak	-45.79
2	9.852000000 MHz	24.03	Average	-25.97
1	10.040000000 MHz	29.96	Quasi Peak	-30.04
2	10.244000000 MHz	15.61	Average	-34.39

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 requirements of CFR47 and RSS-210. The EUT demonstrated a minimum margin of 12.5 dB below the limit. Emissions measurements were taken using the peak, quasi peak, and average measurement functions as required. Emission amplitude levels were below the limits stated in the specification. Other emissions were present with recorded data representing worst-case amplitudes.

General Radiated EMI

The EUT was arranged 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. Preliminary testing was performed in a screen room with the EUT positioned 1 meter from the FSM antenna. Radiated emissions measurements were performed to identify the frequencies producing the highest emissions. Plots were made of the frequency spectrum from 30 MHz to 12,000 MHz during preliminary testing. Refer to figures three through seven showing plots of the radiated emissions spectrum taken in a screen room. The highest radiated emission was then re-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 12,000 MHz was searched for 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 were Broadband Biconical from 30 to 200 MHz, Biconilog from 30 to 1000 MHz, Log Periodic from 200 MHz to 5 GHz and or, double ridge or pyramidal horns and mixers from 4 GHz to 40 GHz, notch filters and appropriate amplifiers were utilized.

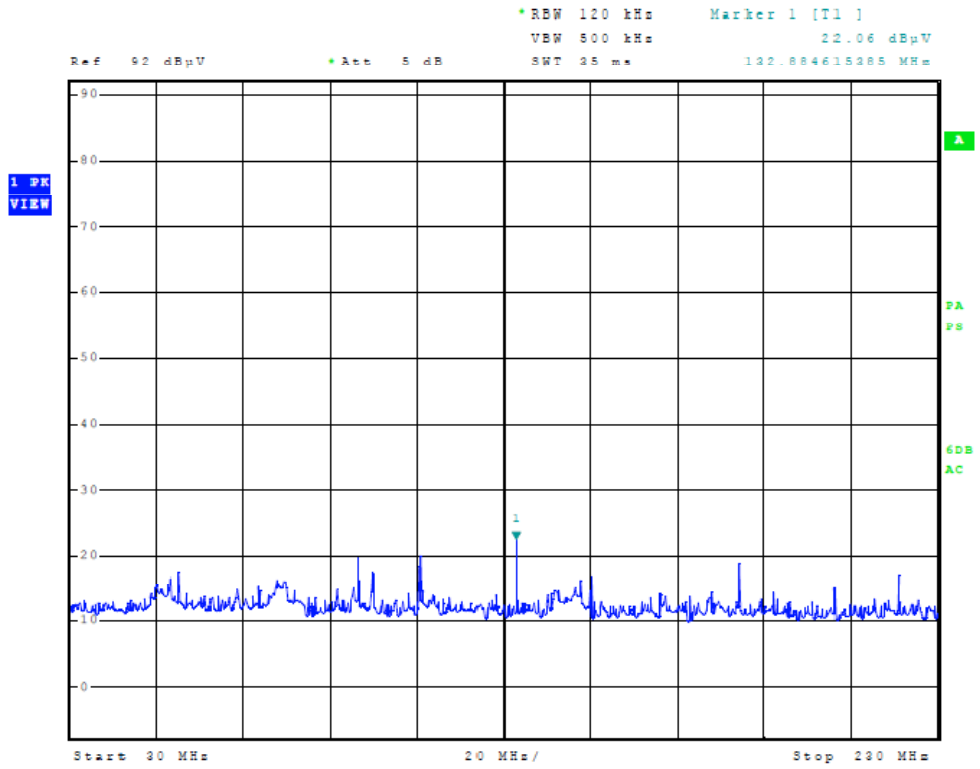


Figure Three Plot of General Radiated Emissions

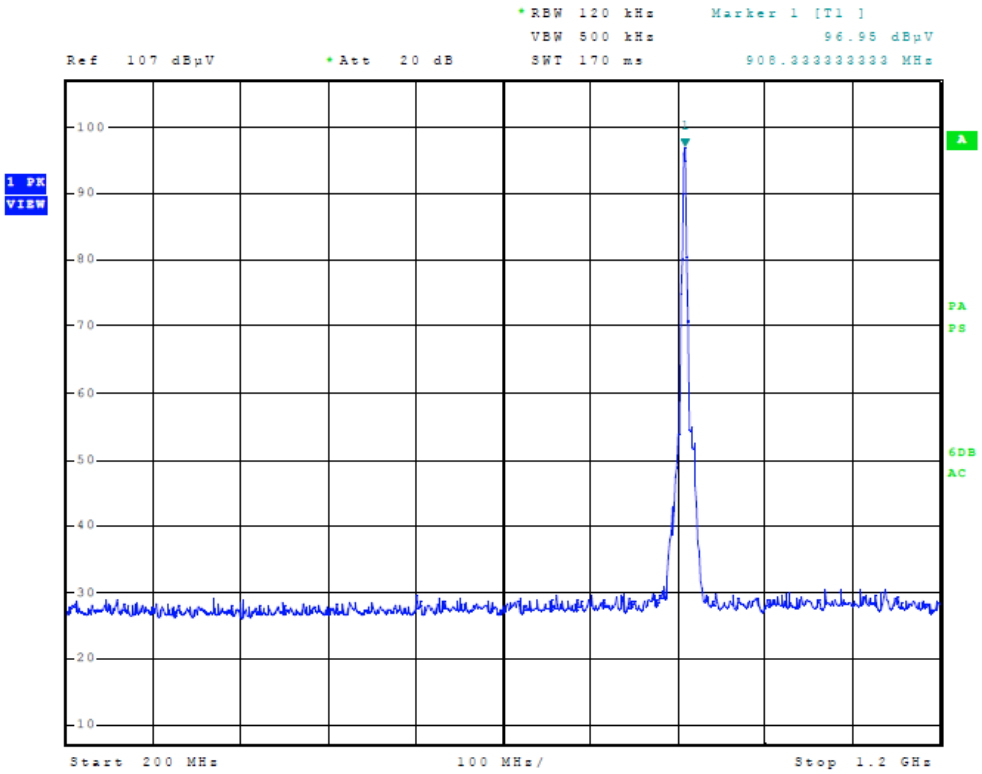


Figure Four Plot of General Radiated Emissions

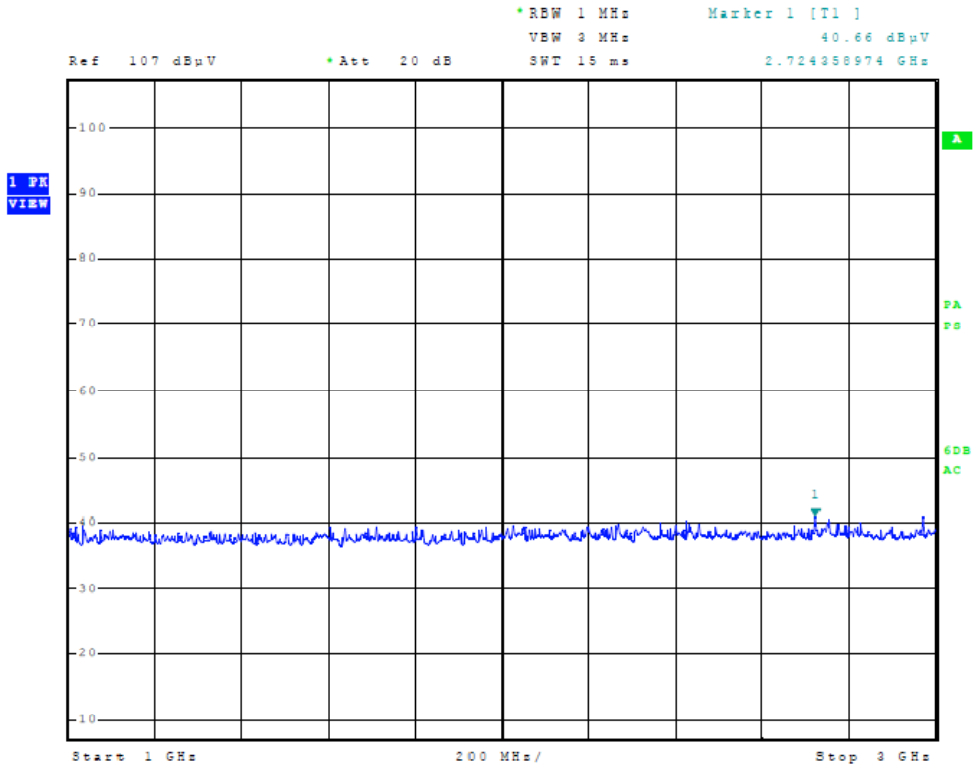


Figure Five Plot of General Radiated Emissions

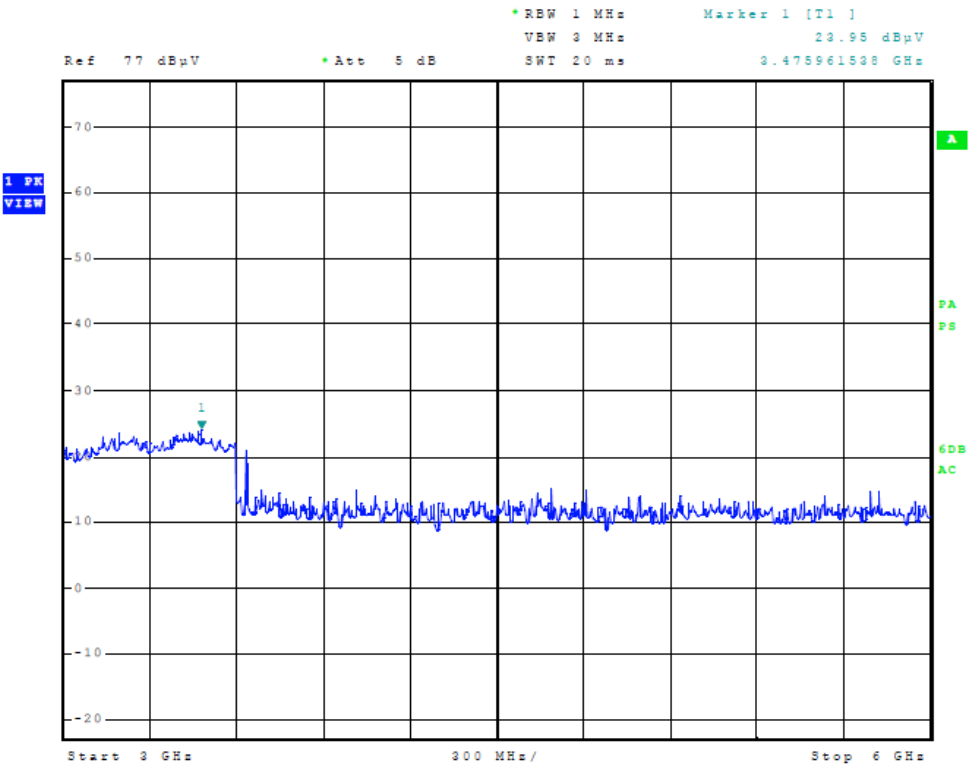


Figure Six Plot of General Radiated Emissions

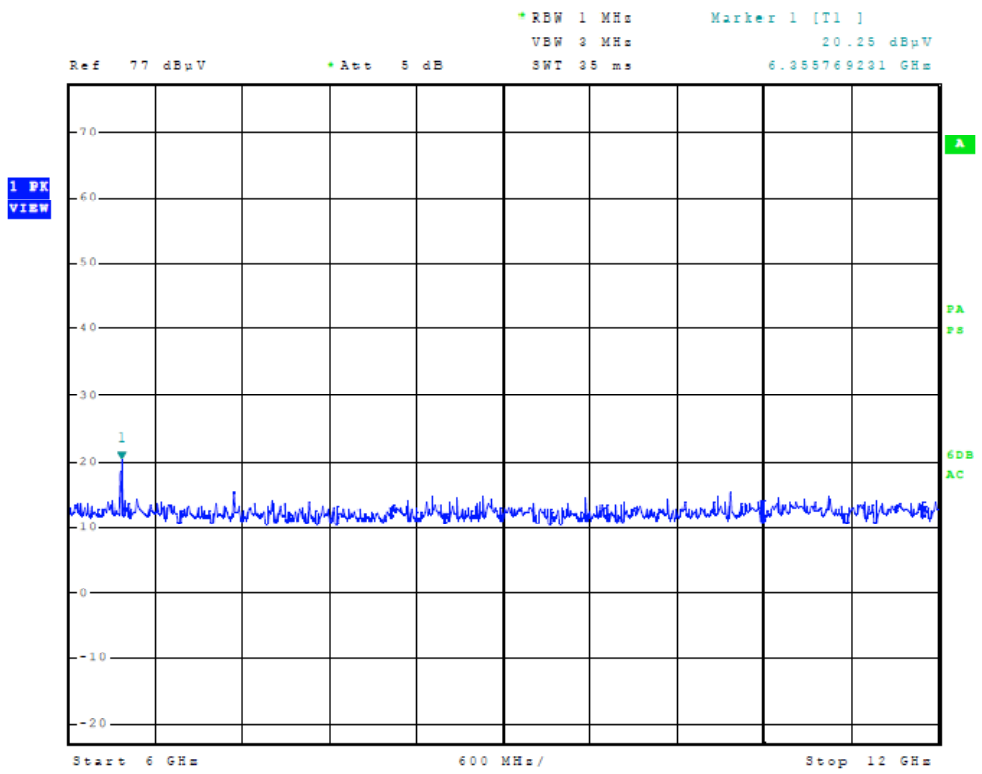


Figure Seven Plot of General Radiated Emissions

General Radiated Emissions Data from EUT

Frequency in MHz	FSM Horz. (dBµV)	FSM Vert. (dBµV)	A.F. (dB/m)	Amp. Gain (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	Class B Limit @ 3m (dBµV/m)
110.6	34.2	36.2	12.6	30	16.8	18.8	43.5
132.9	35.8	38.8	13.5	30	19.3	22.3	43.5
184.3	34.2	36.3	11.4	30	15.6	17.7	43.5
222.2	35.1	31.1	11.5	30	16.6	12.6	46.0

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

Summary of Results for General Radiated Emissions

The EUT demonstrated compliance with the radiated emission requirements of CFR47, and Industry Canada RSS-210. The EUT demonstrated minimum margin of 21.2 dB below the limit. Other emissions were present with amplitudes at least 20 dB below the limit.

Intentional Radiators

As per CFR47 Part 15, Subpart C, paragraphs 15.203, 15.205, 15.209, 15.247 and RSS-210 the following information is submitted.

Antenna Requirements

The equipment utilizes a compliant reverse SMA antenna port connection for use with approved antennas. The system is supplied with a center fed ½ wave 4" long dipole antenna. The requirements of CFR47 paragraph 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 checked 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.

Radiated Emissions Data in Restricted Bands (Worst-case)

Frequency in MHz	FSM Horz. (dBµV)	FSM Vert. (dBµV)	A.F. (dB/m)	Amp. Gain (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	Class B Limit @ 3m (dBµV/m)
2723.3	16.1	15.9	31.7	25	22.8	22.6	54.0
2751.0	15.1	13.2	32.1	25	22.2	20.3	54.0
2771.7	15.2	14.7	32.1	25	22.3	21.8	54.0
3631.1	14.8	14.7	35.5	25	25.3	25.2	54.0
3668.0	14.6	14.6	35.2	25	24.8	24.8	54.0
3695.6	14.9	14.9	35.5	25	25.4	25.4	54.0
4538.9	15.4	15.4	37.7	25	28.1	28.1	54.0
4585.0	15.5	15.5	37.6	25	28.1	28.1	54.0
4619.5	15.7	15.8	37.9	25	28.6	28.7	54.0
5446.7	14.3	13.1	33.1	25	22.4	21.2	54.0
2719.9	15.9	16.1	31.7	25	22.6	22.8	54.0
2747.5	15.6	15.5	32.1	25	22.7	22.6	54.0
2775.2	15.6	15.2	32.1	25	22.7	22.3	54.0
3626.5	14.7	15.1	35.5	25	25.2	25.6	54.0
3663.4	14.8	14.4	35.2	25	25.0	24.6	54.0
3700.2	14.8	14.8	35.5	25	25.3	25.3	54.0
4533.1	15.4	15.3	37.7	25	28.1	28.0	54.0
4579.2	15.3	15.3	37.6	25	27.9	27.9	54.0
4625.3	15.6	15.1	37.9	25	28.5	28.0	54.0
5439.7	14.2	13.3	33.1	25	22.3	21.4	54.0

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

Summary of Results for Radiated Emissions in Restricted Bands

The EUT demonstrated compliance with the radiated emissions requirements of CFR47 and RSS-210. The EUT demonstrated minimum margin of 25.3 dB below the limits for restricted bands of operation. Both average and peak amplitudes above 1000 MHz were checked for compliance with the regulations. No other significant emission was found in the restricted frequency bands. Other emissions were present with amplitudes at least 20 dB below the limit.

Operation in the Frequency Band of 906.624 - 925.056 MHz

The power output and harmonics were measured both on an Open Area Test Site at a 3 meters distance and antenna port conducted measurements performed at the antenna port. During radiated emissions measurements t EUT and test fixture was placed on a wooden turntable 0.8 meters above the ground plane and at a distance of 3 meters from the FSM antenna. The peak and quasi-peak amplitude of the carrier frequency was measured using a spectrum analyzer. The peak and average amplitude of the spurious emissions above 1000 MHz were measured using a spectrum analyzer then data was recorded from the analyzer display. The EUT is a digitally modulated intentional radiator utilizing occupied bandwidth greater than 500 kHz as required. Refer to figures eight through twenty-seven for plots of the transmitter antenna conducted emissions taken in the screen room. Refer to figures eight through eleven for plots of the spectrum analyzer display demonstrating antenna port emissions from 30 MHz to 12,000 MHz. Refer to figures twelve through twenty-seven for plots of the spectrum analyzer display demonstrating compliance of the EUT transmitter operation in the 902-928 MHz frequency band. Figures twelve and thirteen demonstrate number of channels used in 906.624 - 925.056 MHz frequency band of operation. Figures fourteen and fifteen demonstrate output power of channels in the 906.624 - 925.056 MHz frequency band of operation. Figures sixteen through twenty-one demonstrate compliance with 6-dB occupied bandwidth requirements of greater than 500 kHz. Figures twenty-two through twenty-seven demonstrate compliance with power spectral density requirements for channels in the 906.624 - 925.056 MHz frequency band. The maximum peak output power of the unit was measured at the antenna port and again at a distance of three meters while tested on the OATS with the available antenna option. The amplitudes of each emission and spurious emission were measured at a distance of 3 meters from the FSM antenna on the OATS. The amplitude of each emission was maximized by varying the FSM antenna height, polarization, and by rotating the turntable supporting the EUT. Emissions were measured in dBµV/m at three meters. A Biconilog Antenna was used for measuring emissions from 30 to 1000 MHz, a Log Periodic Antenna for 200 to 5000 MHz, and Double Ridge and/or Pyramidal Horn Antennas from 4 GHz to 40 GHz. Data was taken per CFR47 Paragraph 2.1046(a), 15.247 and RSS-210.

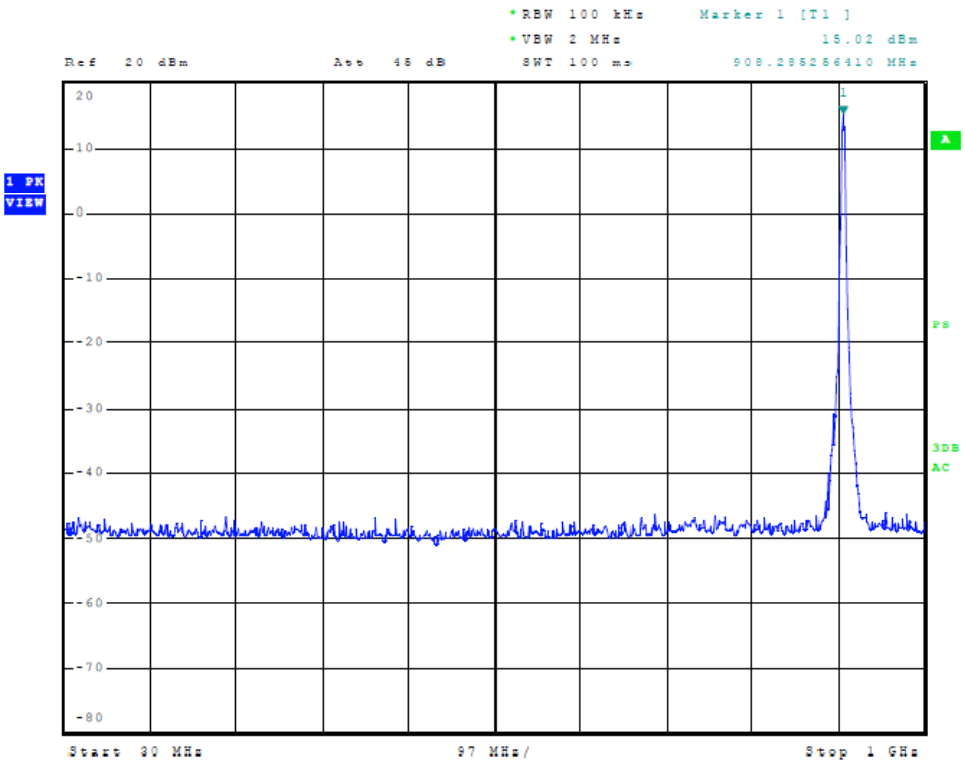


Figure Eight Plot of Antenna Conducted Emissions

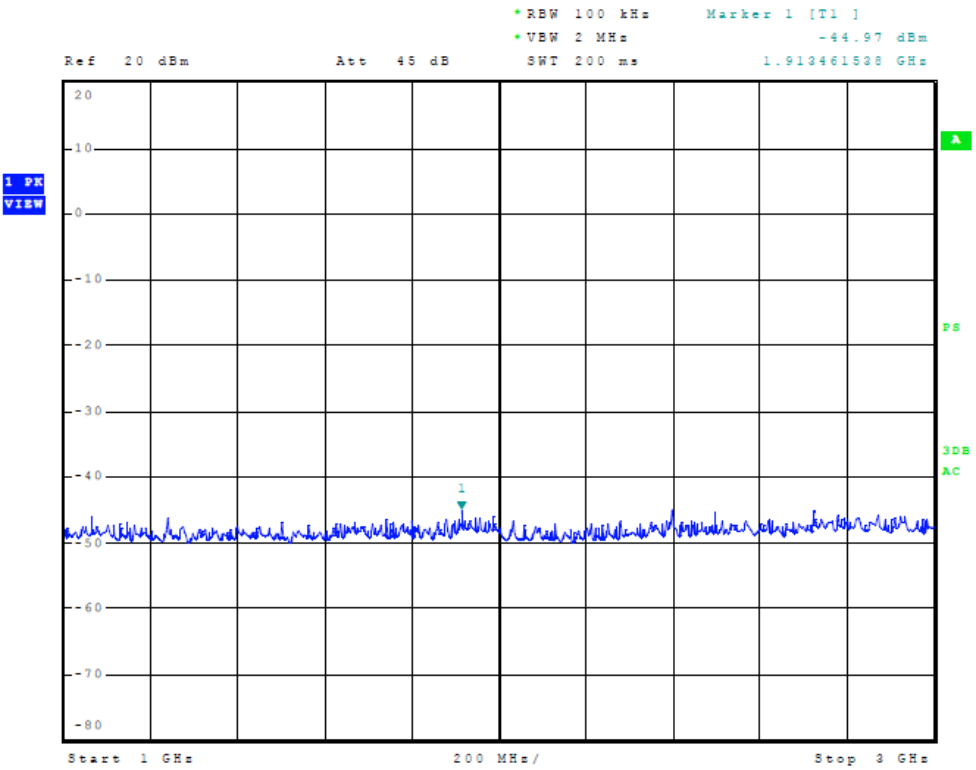


Figure Nine Plot of Antenna Conducted Emissions

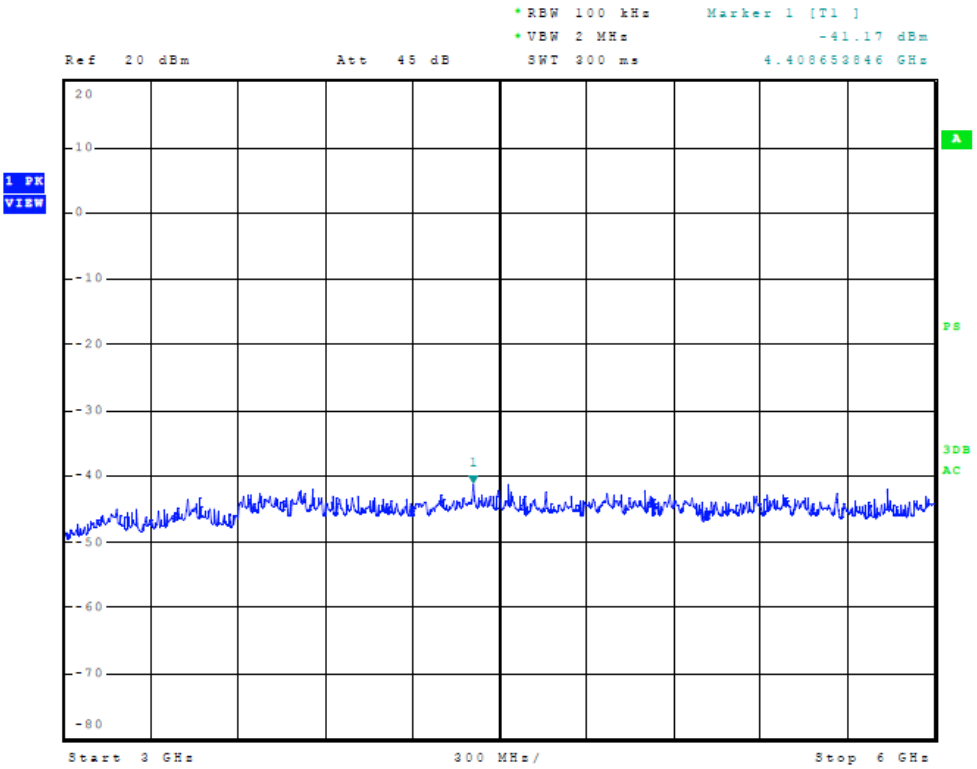


Figure Ten Plot of Antenna Conducted Emissions

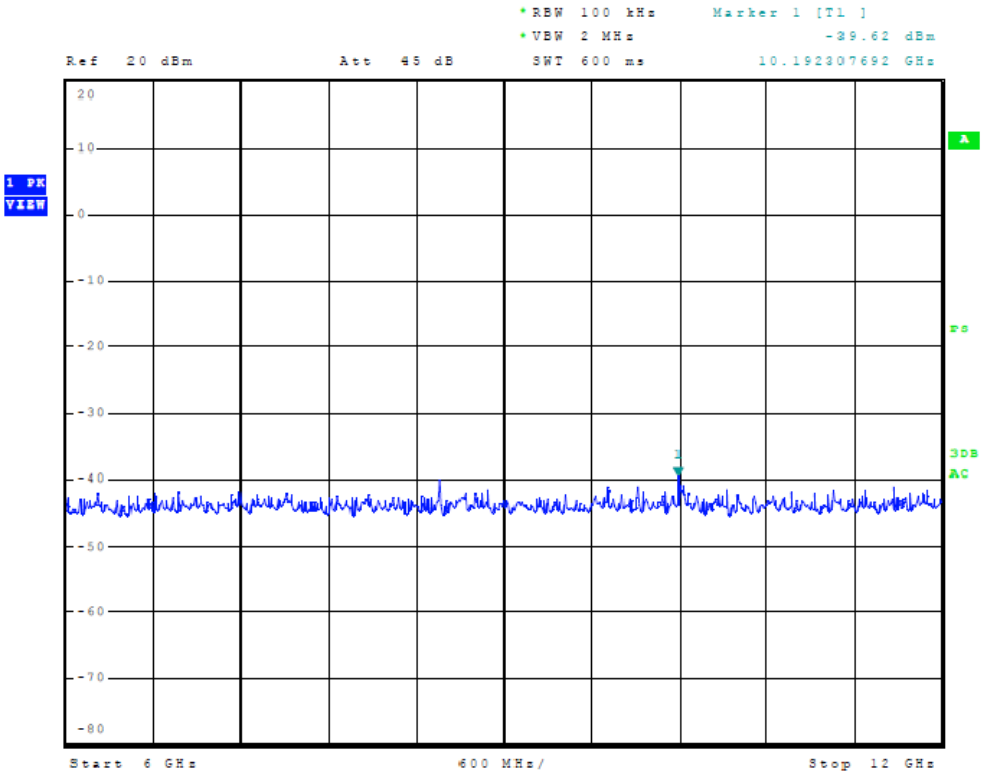


Figure Eleven Plot of Antenna Conducted Emissions

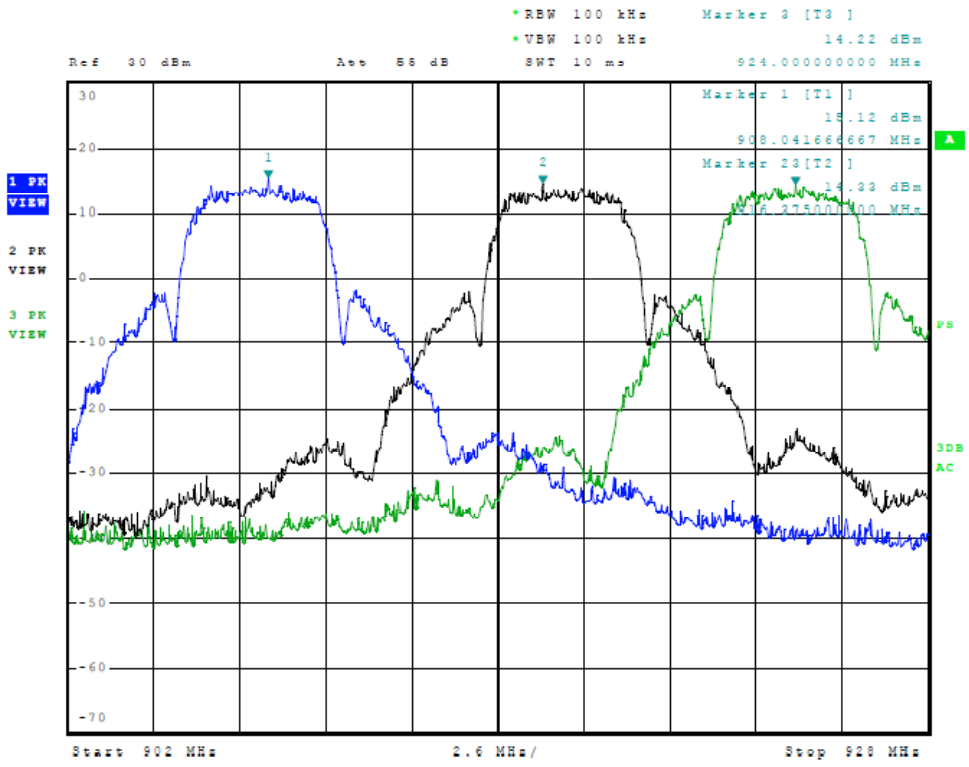


Figure Twelve Plot of Antenna Conducted Emissions Channels of Operation (4 channel)

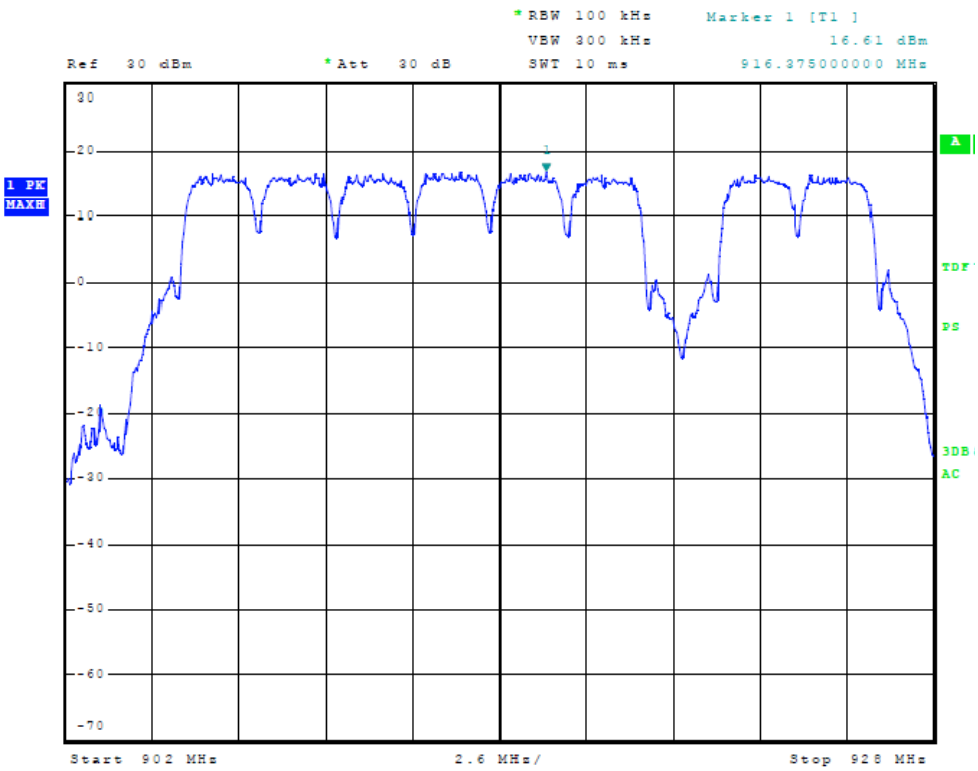


Figure Thirteen Plot of Antenna Conducted Emissions Channels of Operation (2 channel)

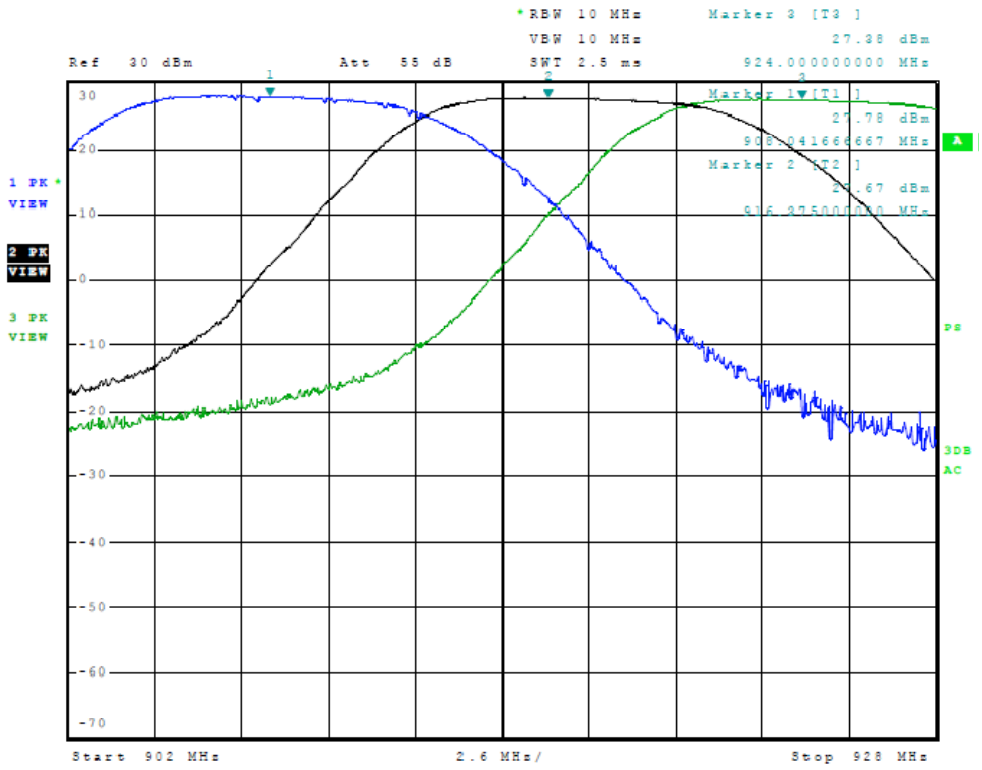


Figure Fourteen Plot of Antenna Conducted Output Power (4 channel)

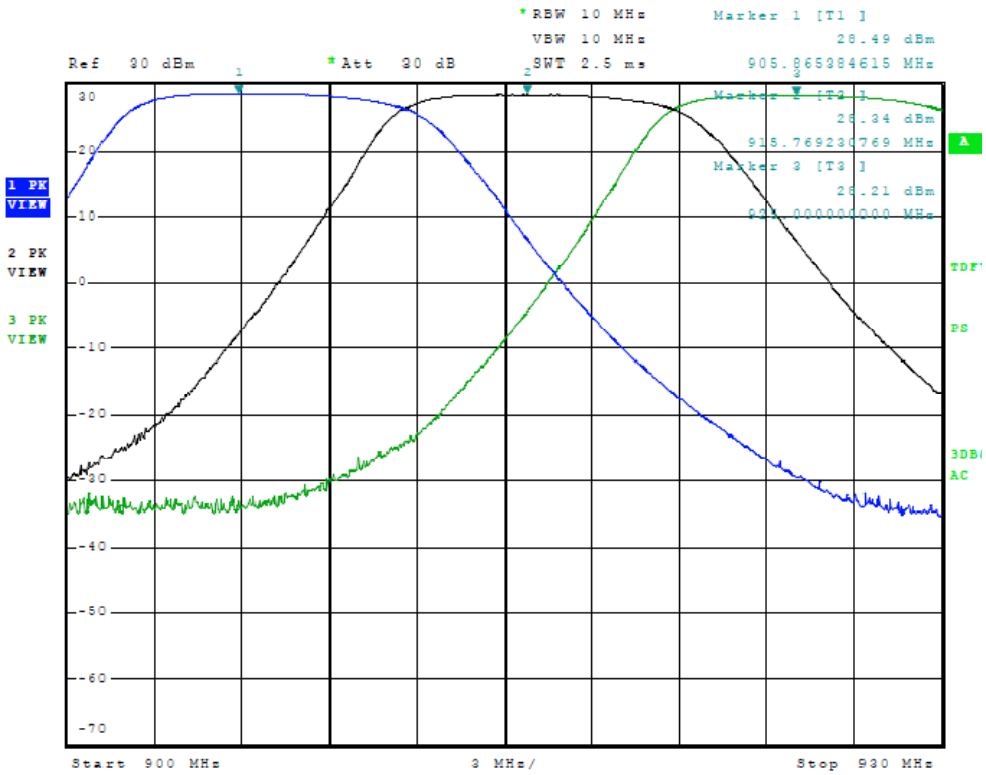


Figure Fifteen Plot of Antenna Conducted Output Power (2 channel)

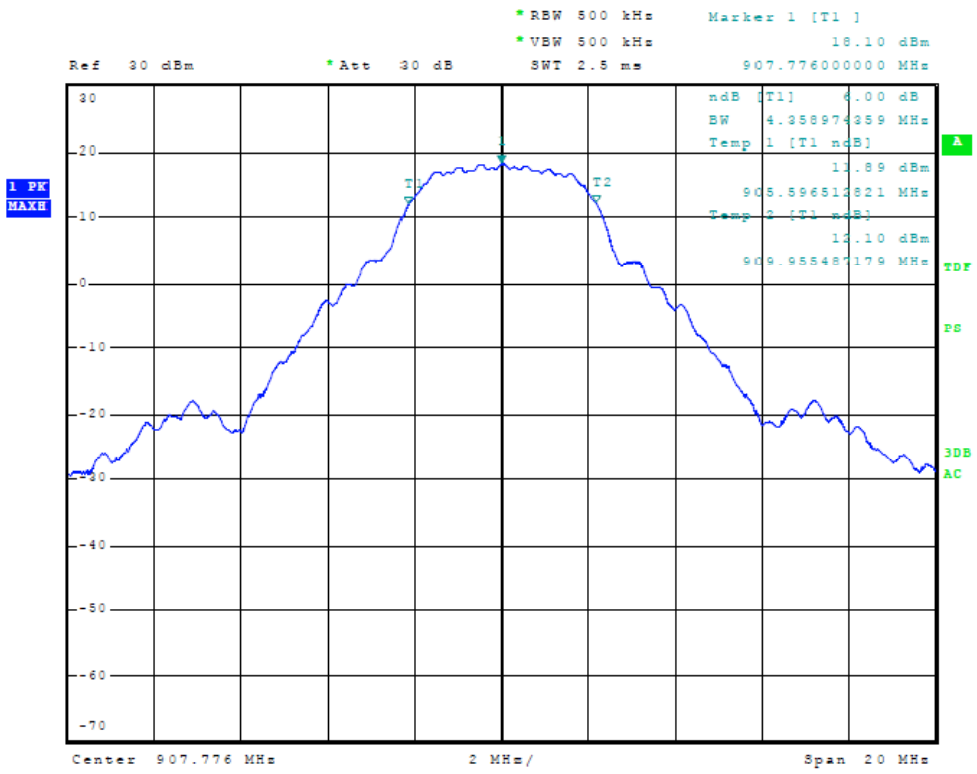


Figure Sixteen Plot of Antenna Conducted 6 dB Occupied Bandwidth (4 channel, low)

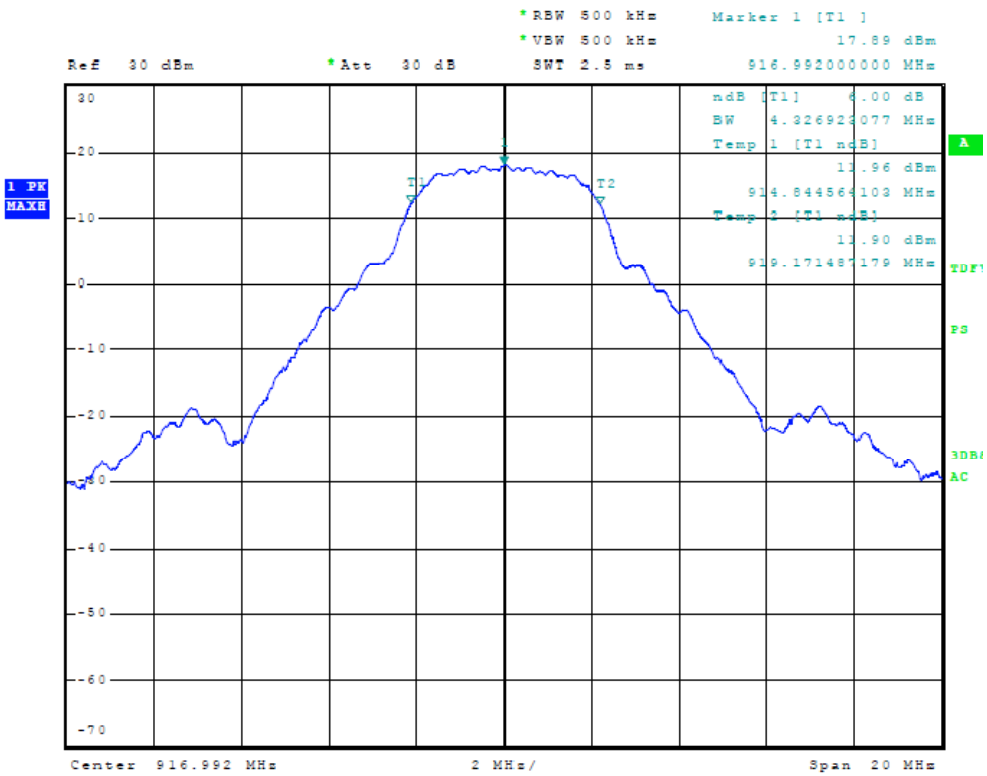


Figure Seventeen Plot of Antenna Conducted 6 dB Occupied Bandwidth (4 channel, mid)

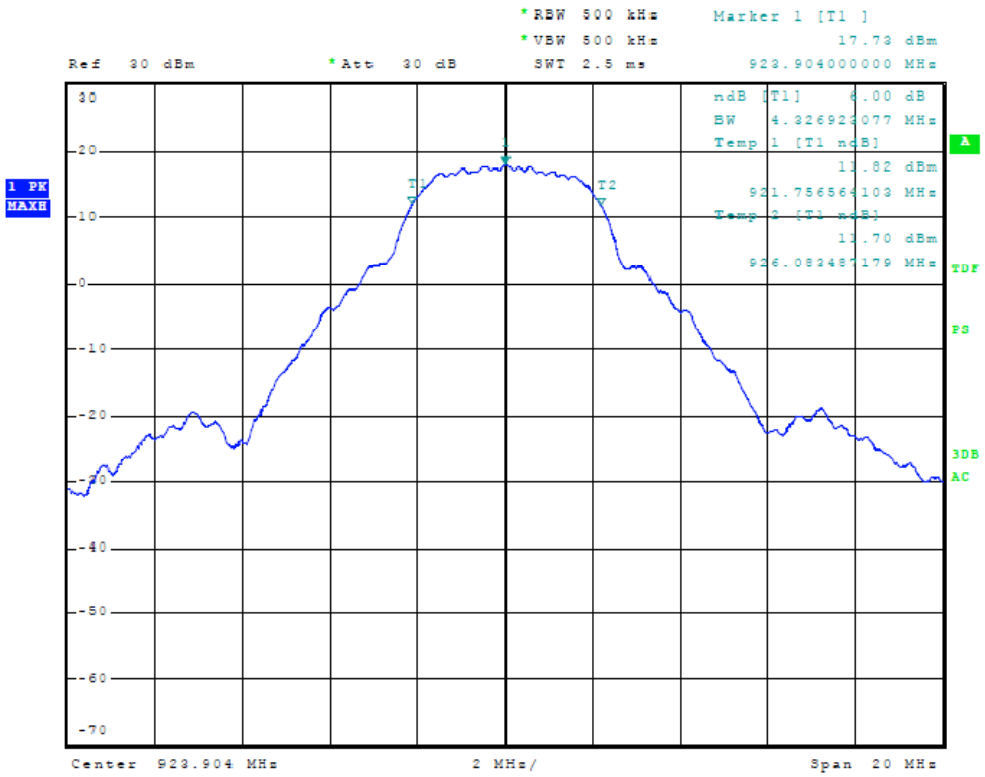


Figure Eighteen Plot of Antenna Conducted 6 dB Occupied Bandwidth (4 channel, high)

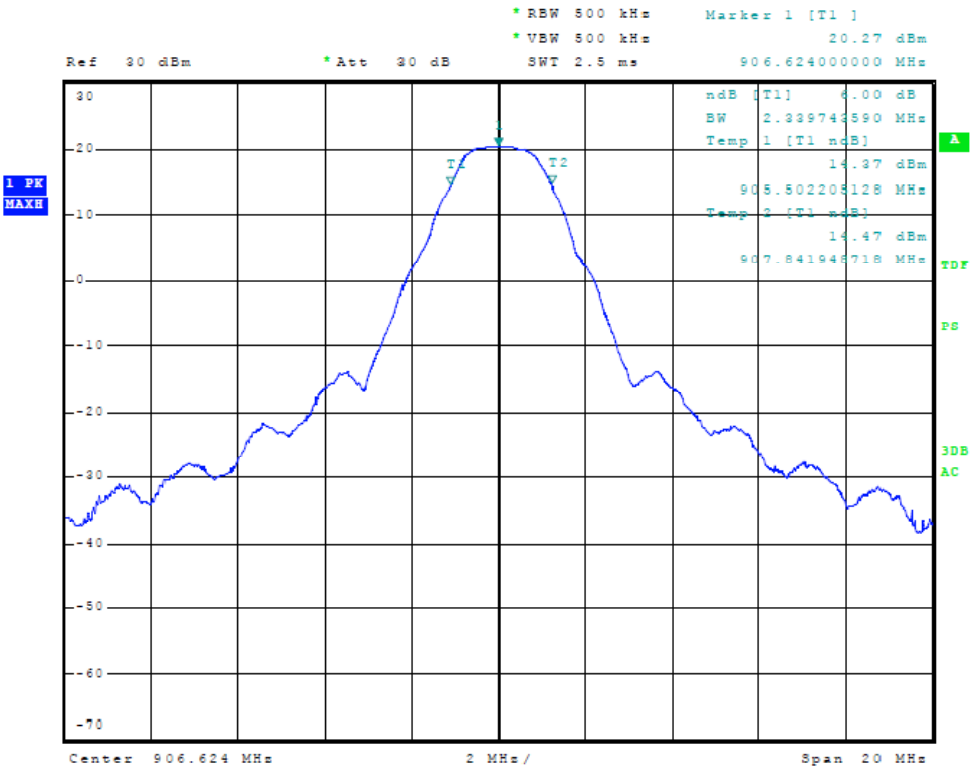


Figure Nineteen Plot of Antenna Conducted 6 dB Occupied Bandwidth (2 channel, low)

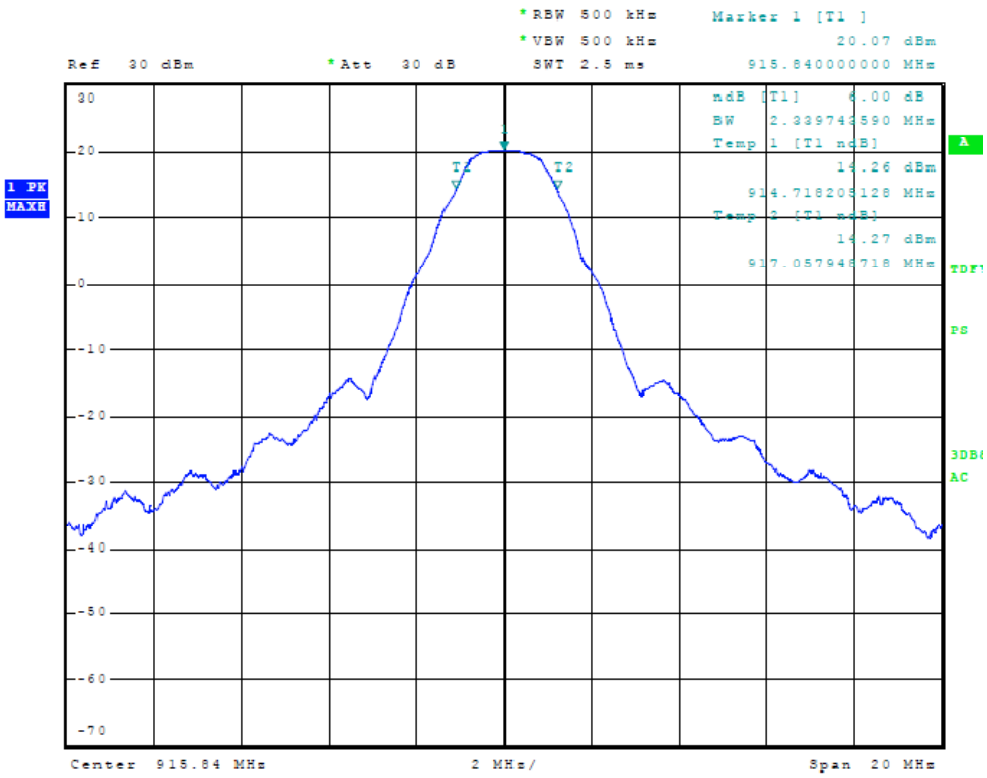


Figure Twenty Plot of Antenna Conducted 6 dB Occupied Bandwidth (2 channel, mid)

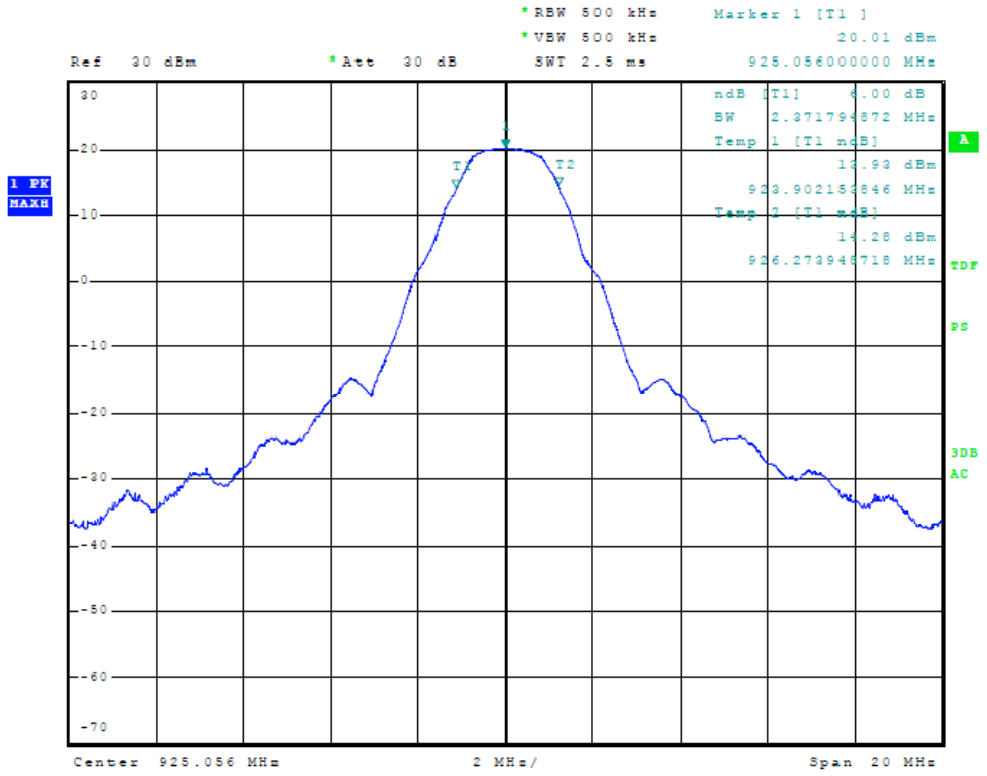


Figure Twenty-One Plot of Antenna Conducted 6 dB Occupied Bandwidth (2 channel, high)

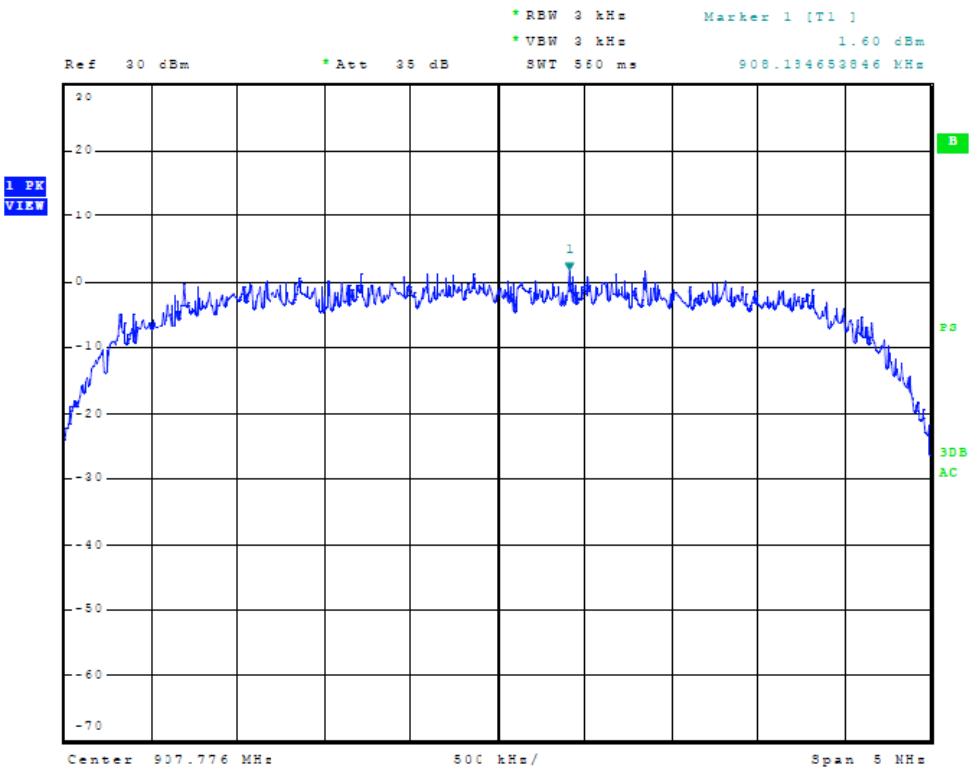


Figure Twenty-Two Plot of Power Spectral Density (4 channel low)

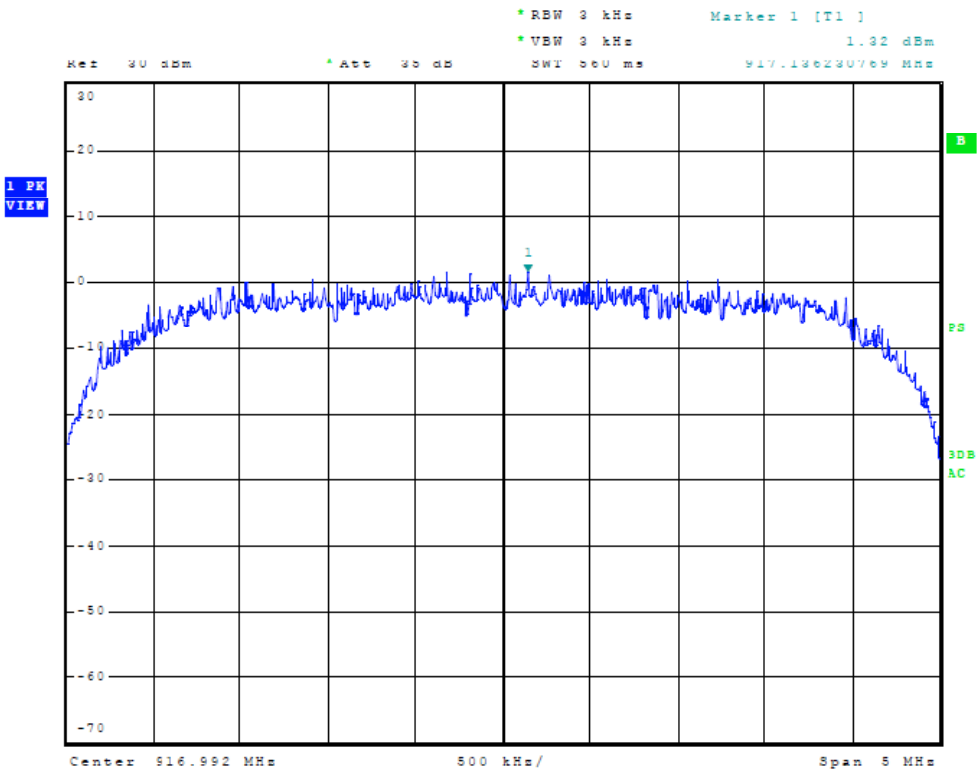


Figure Twenty-Three Plot of Power Spectral Density (4 channel mid)

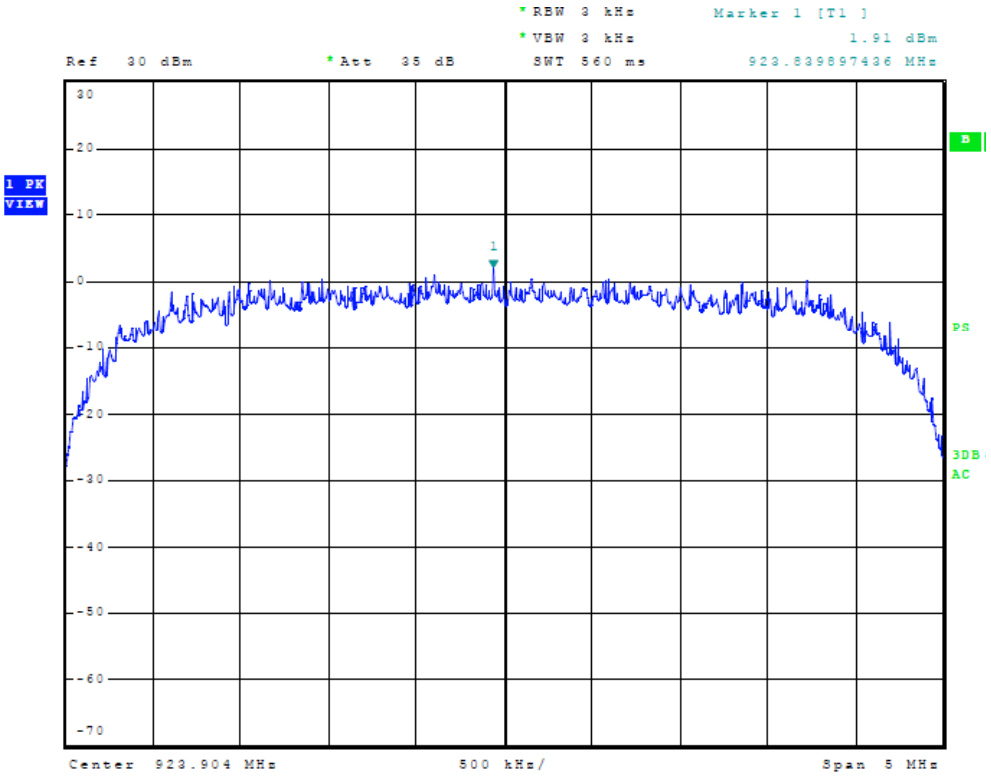


Figure Twenty-Four of Power Spectral Density (4 channel high)

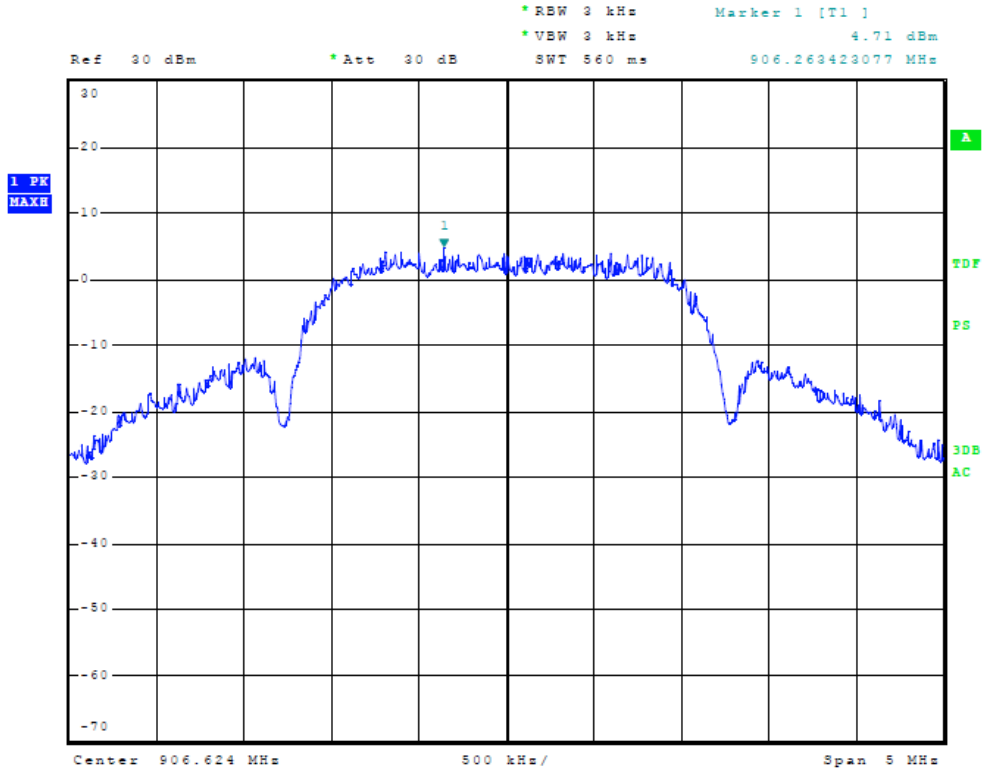


Figure Twenty-Five Plot of Power Spectral Density (2 channel low)

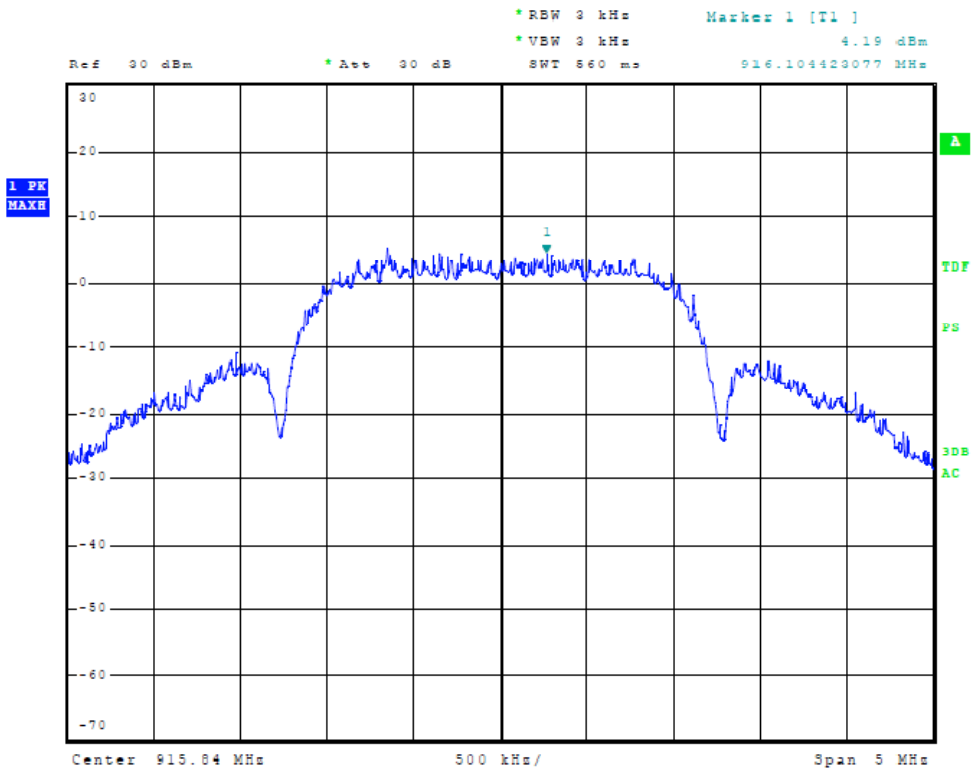


Figure Twenty-Six Plot of Power Spectral Density (2 channel mid)

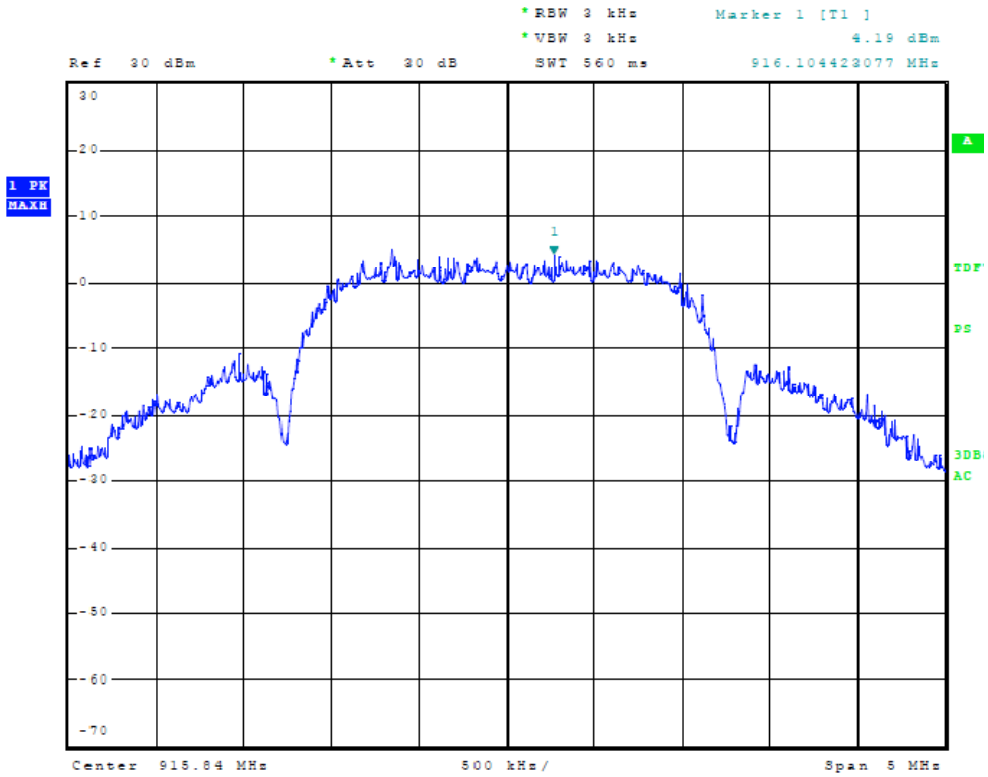


Figure Twenty-Seven Plot of Power Spectral Density (2 channel high)

Radiated Emissions Data per CFR47 15.247 and RSS-210 (4 channel)

Emission Frequency (MHz)	FSM Horz. (dBµV)	FSM Vert. (dBµV)	Ant. Factor (dB)	Amp Gain (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	Limit @ 3m (dBµV/m)
907.8(Peak)	113.9	119.3	22.7	25	111.6	117.0	--
1815.6	15.6	15.5	28.4	25	19.0	18.9	54.0
2723.3	16.1	15.9	31.7	25	22.8	22.6	54.0
3631.1	14.8	14.7	35.5	25	25.3	25.2	54.0
4538.9	15.4	15.4	37.7	25	28.1	28.1	54.0
5446.7	14.3	13.1	33.1	25	22.4	21.2	54.0
917.0(Peak)	116.5	119.7	22.7	25	114.2	117.4	--
1834.0	15.3	15.1	28.4	25	18.7	18.5	54.0
2751.0	15.1	13.2	32.1	25	22.2	20.3	54.0
3668.0	14.6	14.6	35.2	25	24.8	24.8	54.0
4585.0	15.5	15.5	37.6	25	28.1	28.1	54.0
5502.0	13.2	12.5	33.1	25	21.3	20.6	54.0
923.9(Peak)	116.4	119.6	22.8	25	114.2	117.4	--
1847.8	14.8	13.4	28.6	25	18.4	17.0	54.0
2771.7	15.2	14.7	32.1	25	22.3	21.8	54.0
3695.6	14.9	14.9	35.5	25	25.4	25.4	54.0
4619.5	15.7	15.8	37.9	25	28.6	28.7	54.0
5543.4	15.0	12.4	33.1	25	23.1	20.5	54.0

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

Radiated Emissions Data per CFR47 15.247 and RSS-210 (2 channel)

Emission Frequency (MHz)	FSM Horz. (dBµV)	FSM Vert. (dBµV)	Ant. Factor (dB)	Amp Gain (dB)	RFS Horz. @ 3m (dBµV/m)	RFS Vert. @ 3m (dBµV/m)	Limit @ 3m (dBµV/m)
906.6(Peak)	114.3	119.5	22.7	25	112.0	117.2	--
1813.2	15.5	15.6	28.4	25	18.9	19.0	54.0
2719.9	15.9	16.1	31.7	25	22.6	22.8	54.0
3626.5	14.7	15.1	35.5	25	25.2	25.6	54.0
4533.1	15.4	15.3	37.7	25	28.1	28.0	54.0
5439.7	14.2	13.3	33.1	25	22.3	21.4	54.0
915.8(Peak)	116.9	120.2	22.7	25	114.6	117.9	--
1831.7	15.5	15.3	28.4	25	18.9	18.7	54.0
2747.5	15.6	15.5	32.1	25	22.7	22.6	54.0
3663.4	14.8	14.4	35.2	25	25.0	24.6	54.0
4579.2	15.3	15.3	37.6	25	27.9	27.9	54.0
5495.0	13.8	13.1	33.1	25	21.9	21.2	54.0
925.1(Peak)	116.8	120.1	22.8	25	114.6	117.9	--
1850.1	15.4	15.4	28.6	25	15.4	19.0	54.0
2775.2	15.6	15.2	32.1	25	15.2	22.3	54.0
3700.2	14.8	14.8	35.5	25	14.8	25.3	54.0
4625.3	15.6	15.1	37.9	25	15.1	28.0	54.0
5550.3	14.9	12.9	33.1	25	12.9	21.0	54.0

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

Antenna Port Conducted Output Power and Transmitter Measurement Data

Frequency (MHz)	Output Power (dBm)	6 dB Occupied Bandwidth (kHz)	Power Spectral Density (dB)	Output Power (Watts)
906.624	28.49	2,339.74	4.71	1
907.776	28.35	4,326.92	1.91	1
915.840	28.34	2,339.74	4.19	1
916.992	28.29	4,326.92	1.32	1
923.904	28.17	4,326.92	1.60	1
925.056	28.21	2,371.80	4.19	1

Summary of Results for Emissions of Intentional Radiator

The EUT fundamental frequency of operation demonstrated the highest radiated peak emission measurement at 3 meters distance of 117.9 dBµV/m. The EUT demonstrated worst-case harmonic emissions margin of 25.3 dB below the limit. The EUT demonstrated compliance with the radiated emission requirements of CFR47 Part 15.247 Intentional Radiators and RSS-210. There are no measurable emissions in the restricted bands other than those recorded in this report. Other emissions were present with amplitudes at least 20 dB below the limits. The specifications of 15.247 and RSS-210 were met; there are no deviations or exceptions to the requirements.

Statement of Modifications and Deviations

No modifications to the EUT were required for the equipment to demonstrate compliance with CFR47 Part 15C or RSS-210 emissions standards. There were no modifications, deviations or exceptions to the specifications.

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

Radiated Emissions Measurement Uncertainty Calculation

Measurement of vertically polarized radiated field strength over the frequency range 30 MHz to 1 GHz on an open area test site at 3m and 10m includes following uncertainty:

Contribution	Probability Distribution	Uncertainty (dB)
Antenna factor calibration	normal (k = 2)	±0.58
Cable loss calibration	normal (k = 2)	±0.2
Receiver specification	rectangular	±1.0
Antenna directivity	rectangular	±0.1
Antenna factor variation with height	rectangular	±2.0
Antenna factor frequency interpolation	rectangular	±0.1
Measurement distance variation	rectangular	±0.2
Site Imperfections	rectangular	±1.5

Combined standard uncertainty $u_c(y)$ is

$$U_c(y) = \pm \sqrt{\left[\frac{1.0}{2}\right]^2 + \left[\frac{0.2}{2}\right]^2 + \left[\frac{1.0^2 + 0.1^2 + 2.0^2 + 0.1^2 + 0.2^2 + 1.5^2}{3}\right]}$$

$U_c(y) = \pm 1.6$ dB

It is probable that $u_c(y) / s(q_k) > 3$, where $s(q_k)$ is estimated standard deviation from a sample of n readings unless the repeatability of the EUT is particularly poor, and a coverage factor of k = 2 will ensure that the level of confidence will be approximately 95%, therefore:

$$s(q_k) = \sqrt{\frac{1}{(n-1)} \sum_{k-1}^{n} (q_k - \bar{q})^2}$$

$U = 2\ U_c(y) = 2 \times \pm 1.6$ dB $= \pm 3.2$ dB

Notes:

1.1 Uncertainties for the antenna and cable were estimated, based on a normal probability distribution with k = 2.

1.2 The receiver uncertainty was obtained from the manufacturer's specification for which a rectangular distribution was assumed.

1.3 The antenna factor uncertainty does not take account of antenna directivity.

1.4 The antenna factor varies with height and since the height was not always the same in use as when the antenna was calibrated an additional uncertainty is added.

1.5 The uncertainty in the measurement distance is relatively small but has some effect on the received signal strength. The increase in measurement distance as the antenna height is increased is an inevitable consequence of the test method and is therefore not considered a contribution to uncertainty.

1.6 Site imperfections are difficult to quantify but may include the following contributions:
-Unwanted reflections from adjacent objects.
-Ground plane imperfections: reflection coefficient, flatness, and edge effects.
-Losses or reflections from "transparent" cabins for the EUT or site coverings.
-Earth currents in antenna cable (mainly effect Biconical antennas).

The specified limits for the difference between measured site attenuation and the theoretical value (± 4 dB) were not included in total since the measurement of site attenuation includes uncertainty contributions already allowed for in this budget, such as antenna factor.

Conducted Measurements Uncertainty Calculation

Measurement of conducted emissions over the frequency range 9 kHz to 30 MHz includes following uncertainty:

Contribution	Probability Distribution	Uncertainty (dB)
Receiver specification	rectangular	±1.5
LISN coupling specification	rectangular	±1.5
Cable and input attenuator calibration	normal (k=2)	±0.5

Combined standard uncertainty $u_c(y)$ is

$$U_c(y) = \pm \sqrt{\left[\frac{0.5}{2}\right]^2 + \frac{1.5^2 + 1.5^2}{3}}$$

$U_c(y) = \pm 1.2$ dB

As with radiated field strength uncertainty, it is probable that $u_c(y) / s(q_k) > 3$ and a coverage factor of k = 2 will suffice, therefore:

$U = 2\ U_c(y) = 2 \times \pm 1.2$ dB $= \pm 2.4$ dB

Annex B Rogers Labs Test Equipment List

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

Equipment	Date of last Calibration
Oscilloscope Scope: Tektronix 2230	2/10
Wattmeter: Bird 43 with Load Bird 8085	2/10
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/10
H/V Power Supply: Fluke Model: 408B (SN: 573)	2/10
R.F. Generator: HP 606A	2/10
R.F. Generator: HP 8614A	2/10
R.F. Generator: HP 8640B	2/10
Spectrum Analyzer: Rohde & Schwarz ESU40	5/10
Spectrum Analyzer: HP 8562A, Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W HP Adapters: 11518, 11519, 11520	5/10
Spectrum Analyzer: HP 8591EM	5/10
Frequency Counter: Leader LDC825	2/10
Antenna: EMCO Biconilog Model: 3143	5/10
Antenna: EMCO Log Periodic Model: 3147	10/10
Antenna: Antenna Research Biconical Model: BCD 235	10/10
Antenna: EMCO Dipole Set 3121C	2/10
Antenna: C.D. B-101	2/10
Antenna: Solar 9229-1 & 9230-1	2/10
Antenna: EMCO 6509	2/10
Audio Oscillator: H.P. 201CD	2/10
R.F. Power Amp 65W Model: 470-A-1010	2/10
R.F. Power Amp 50W M185- 10-501	2/10
R.F. Preamp CPPA-102	2/10
LISN 50 µHy/50 ohm/0.1 µf	10/10
LISN Compliance Eng. 240/20	2/10
LISN Fischer Custom Communications FCC-LISN-50-16-2-08	2/10
Peavey Power Amp Model: IPS 801	2/10
Power Amp A.R. Model: 10W 1010M7	2/10
Power Amp EIN Model: A301	2/10
ELGAR Model: 1751	2/10
ELGAR Model: TG 704A-3D	2/10
ESD Test Set 2010i	2/10
Fast Transient Burst Generator Model: EFT/B-101	2/10
Current Probe: Singer CP-105	2/10
Current Probe: Solar 9108-1N	2/10
Field Intensity Meter: EFM-018	2/10
KEYTEK Ecat Surge Generator	2/10
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. Work experience includes six years working 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.

NVLAP Lab Code 200087-0

Annex D FCC Test Site Registration Letter

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

May 18, 2010

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: May 18, 2010

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 Test Site Registration Letter

Industry Canada Industrie Canada

May 26, 2010

OUR FILE: 46405-3041
Submission No: 140719

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

Attention: Mr. Scot D. Rogers

Dear Sir/Madame:

The Bureau has received your application for the renewal of a 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 **(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;

- Your primary code is: **3041**

- The company number 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 two 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