NVLAP Lab Code: 200087-0

Application Submittal Test Report

For

Grant of Certification

Model: MPRR
(Multiple Protocol Railroad Radio)
LMS Location and Monitoring Service
902.25 - 903.75 and 910.0 - 921.5 MHz
Transmitter

FCC ID: FIH05716

IC: 1584A-05716

FOR

TRANSCORE

AMTECH TECHNOLOGY CENTER

8600 Jefferson Street, NE

Albuquerque, NM 87113

Report Number 101001

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

Test Report
For
Application of Certification

For

Transcore Amtech Technology Center

8600 Jefferson Street, NE
Albuquerque, NM 87113
Phone: (505) 856-8101

Model: MPRR (MULTIPLE PROTOCOL RAILROAD RADIO)

LMS Transmitter
Frequency: 902.25 - 903.75 and 910.0 - 921.5 MHz
FCC ID: FIH05716
IC: 1584A-05716

Test Date: October 1, 2010

Certifying Engineer: Scot D Rogers

Scot D. Rogers
Rogers Labs, Inc.
4405 W. 259th Terrace
Louisburg, KS 66053
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Executive Summary

The following information is submitted for consideration in obtaining Grant of Certification of CFR47 Paragraph 90 (M) and Industry Canada RSS-137 Location Monitoring Service (LMS) transmitter equipment.

Name of Applicant: Transcore - Amtech Technology Center
8600 Jefferson Street, NE
Albuquerque, NM 87113
Phone: (505) 856-8101

Equipment Under Test

Model: MPRR (Multiple Protocol Railroad Radio) FCC ID: FIH05716 IC: 1584A-05716

The EUT operates as location and monitoring transceiver equipment for the rail industry. The design incorporates four input output radio frequency ports (antenna ports) for external antenna connection. The design utilizes a single port at anytime and may automatically switch between ports. Operation of design utilizes industry standardized modulation schemes offering ability to read RFID tags from multiple sources.

Frequency of Operation: 902.25 - 903.75 and 910.0 - 921.5 MHz

The EUT was tested for demonstration of compliance to CFR47 90(m) and RSS-137. The equipment offers operation at defined frequencies between 902.25-903.75, 910-921.5, and 911.75-919.75 MHz dependent on communications protocol.

Opinion / Interpretation of Results

Tests Performed	Results
Technical Requirements per CFR47 paragraphs 2 and 90(M)	Complies
Technical Requirements per RSS-137	Complies

Environmental Conditions

Ambient Temperature 21.2 ° C

Relative Humidity 39%

Atmospheric Pressure 1021.5 mb

Applicable Standards and Test Procedures

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; 90.201 through 90.217, 90.350 through 90.363 and RSS-137 the following information is submitted. Test procedures used were the established Methods of Measurement of Radio-Noise Emissions as described in ANSI 63.4-2003 and TIA/EIA 603. The unit has also been tested and found to comply with other applicable technical standards with relevant data recorded in appropriate test reports.

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 annex for 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

NVLAP Lab Code: 200087-0

Equipment	Manufacturer	Model	Calibration Date	Due
LISN	Comp. Design	FCC-LISN-2-MOD.CD	10/09	10/10
Antenna	ARA	BCD-235-B	10/09	10/10
Antenna	EMCO	3147	10/09	10/10
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

Test Site Location

Conducted EMI — Rogers Labs, Inc. located at 4405 W. 259th Terrace, Louisburg, KS.

Radiated EMI — Rogers Labs, Inc. (10 Meters) Open Area Test Site (OATS) located at 4405 W. 259th Terrace, Louisburg, KS.

Site Registration — Refer to Annex for FCC Site Registration 90910 and Industry Canada Site Registration 3041A-1

NVLAP Accreditation — Lab Code 200087-0

2.1033(c) Application for Certification

1. Manufacturer: Transcore - Amtech Technology Center
   8600 Jefferson Street, NE
   Albuquerque, NM 87113

2. Identification: Model: MPRR (Multiple Protocol Railroad Radio)

   FCC I.D.: FIH05716 IC: 1584A-05716

3. A copy of the installation and operating instructions furnished to the end user. Refer to the instruction manual furnished with this application for details.

4. Emission Types: Single channel, CW-N0N, and/or Data, Modulated in width/duration –L1D

Frequency Range	Operational Mode	Emission Designator
902-25 – 903.75	ATA	N0N
910.0 – 921.5	ATA	N0N
911.75 – 919.75	eGo	346K2L1D
911.75 – 919.75	SeGo	506K4L1D
911.75 – 919.75	IAG	381K0L1D

5. Frequency Range: 902.25 - 903.75 and 910.0 - 921.5 MHz

6. Range of operating power values or specific operating power levels, and description of any means provided for variation of operating power. The output power is factory set to 1.8 Watt (nominal) and power levels may be reduced in 1 dB increments (0-15 dB attenuation) offering output power level adjustable from 57 mW to 1,800 mW.

7. Maximum power rating as defined in the applicable part(s) of the rules. As stated in CFR47, 90.205(k), the maximum permissible output power allowed is 30 watts.

8. The dc voltages applied to and dc currents into the several elements of the final radio frequency amplifying device for normal operation over the power range. The EUT final amplification stage runs at a maximum of 7.0 volts with 1.7 amperes current for a power requirement of 11.9 Watts.

9. Provide the tune-up procedure over the power range, or at specific operating power levels. Refer to the tune-up procedure furnished with this application for details.

10. A schematic diagram and a description of all circuitry and devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation, and for limiting power. Refer to the schematics and technical exhibits furnished with this application for details.

11. A photograph or drawing of the equipment identification plate, or label showing the information to be placed thereon shall be provided. Refer to the identification label exhibit and information furnished with this application for details.

12. Photographs (8" x 10") of the equipment of sufficient clarity to reveal equipment construction and layout, including meters, if any, and labels for controls and meters and sufficient views of the internal construction to define component placement and chassis assembly. Insofar as these requirements are met by photographs or drawings contained in instruction manuals supplied with the certification request, additional photographs are necessary only to complete the required showing. Refer to the exhibits of this report and or additional information furnished with the application for details.

13. For equipment employing digital modulation techniques, a detailed description of the modulation system to be used, including the response characteristics (frequency, phase, and amplitude) of any filters provided, and a description of the modulating wave train, shall be submitted for the maximum rated conditions under which the equipment will be operated. Information about modulation is contained in Operational description exhibit.

14. The data required by Sections 2.1046 through 2.1057, inclusive, measured in accordance with the procedures set out in Section 2.1041.

15. The application for certification of an external radio frequency power amplifier under Part 97 of this chapter need not be accompanied by the data required by Paragraph (b)(14) of this section. In lieu thereof, measurements shall be submitted to show compliance with the technical specifications in Subpart C of Part 97 of this chapter and such information as required by Section 2.1060 of this part. This paragraph does not apply to this equipment.

16. An application for certification of an AM broadcast stereophonic exciter generator intended for interfacing with existing certified, or formerly type accepted or notified transmitters must include measurements made on a complete stereophonic transmitter. The instruction book must include complete specifications and circuit requirements for interconnecting with existing transmitters. The instruction book must also provide a full description of the equipment and measurement procedures to monitor modulation and to verify that the combination of stereo exciter generator and transmitter meets the emission limitations of section 73.44. This paragraph does not apply to this equipment.

17. A single application may be filed for a composite system that incorporates devices subject to certification under multiple rule parts; however, the appropriate fee must be included for each device. Separate applications must be filed if different FCC Identifiers will be used for each device.

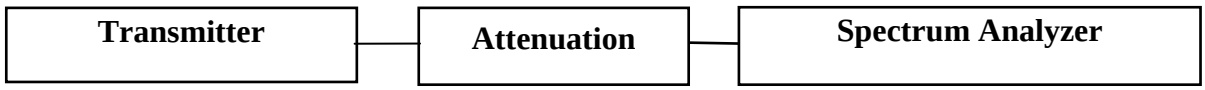
2.1046 RF Power Output

Measurements Required

Measurements shall be made to establish the radio frequency power delivered by the transmitter into the standard output termination. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun, except as noted below:

If the power output is adjustable, measurements shall be made for the highest and lowest power levels.

Test Arrangement



The radio frequency power output was measured at the antenna terminal by replacing the antenna with cabling, spectrum analyzer and appropriate attenuation. The spectrum analyzer offered impedance of 50Ω to match the impedance of the standard antenna. A Rohde &Schwarz ESU40 Spectrum Analyzer was used to measure the radio frequency power at the antenna port. The data was taken in dBm and converted to watts as shown in the following Table. Refer to Figures 1 and two displaying the output power of the transmitter. Data was taken per Paragraph 2.1046(a) and applicable paragraphs of Part 90 and RSS-137 paragraph 6.4.

P_{dBm} = power in dB above 1 milliwatt.
Milliwatts = $10^{(PdBm/10)}$
Watts = (Milliwatts)(0.001)(W/mW)

Milliwatts = $10^{(32.467/10)}$
= 1,761.98 mW
= 1.8 Watts

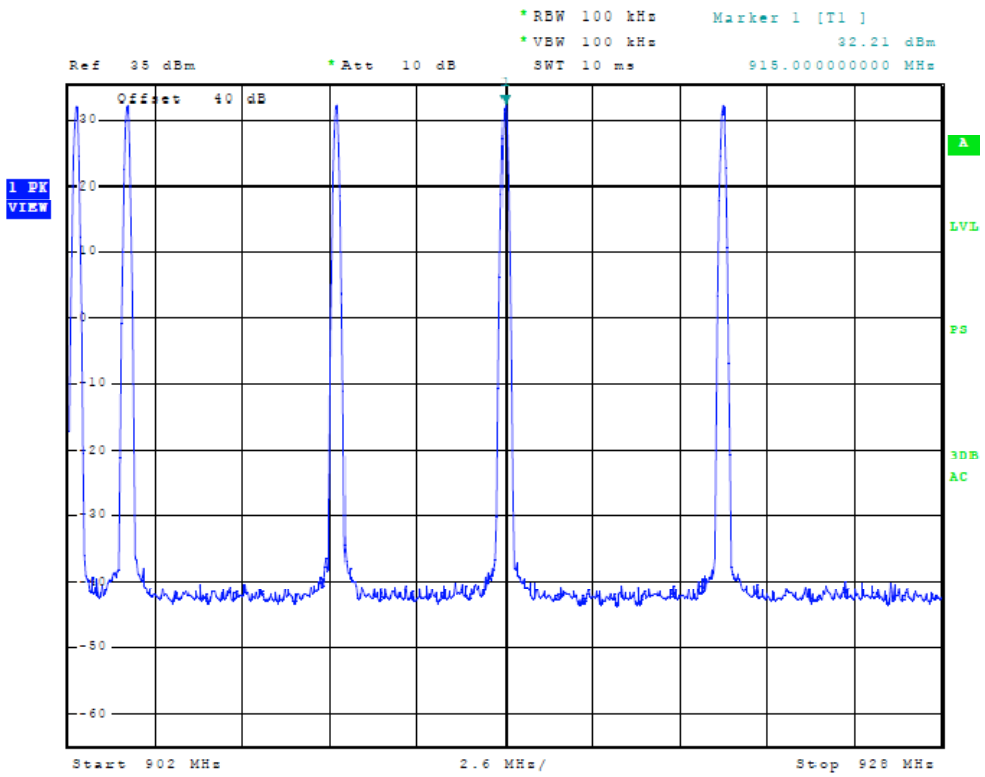


Figure One Power output at antenna terminal (ATA operation)

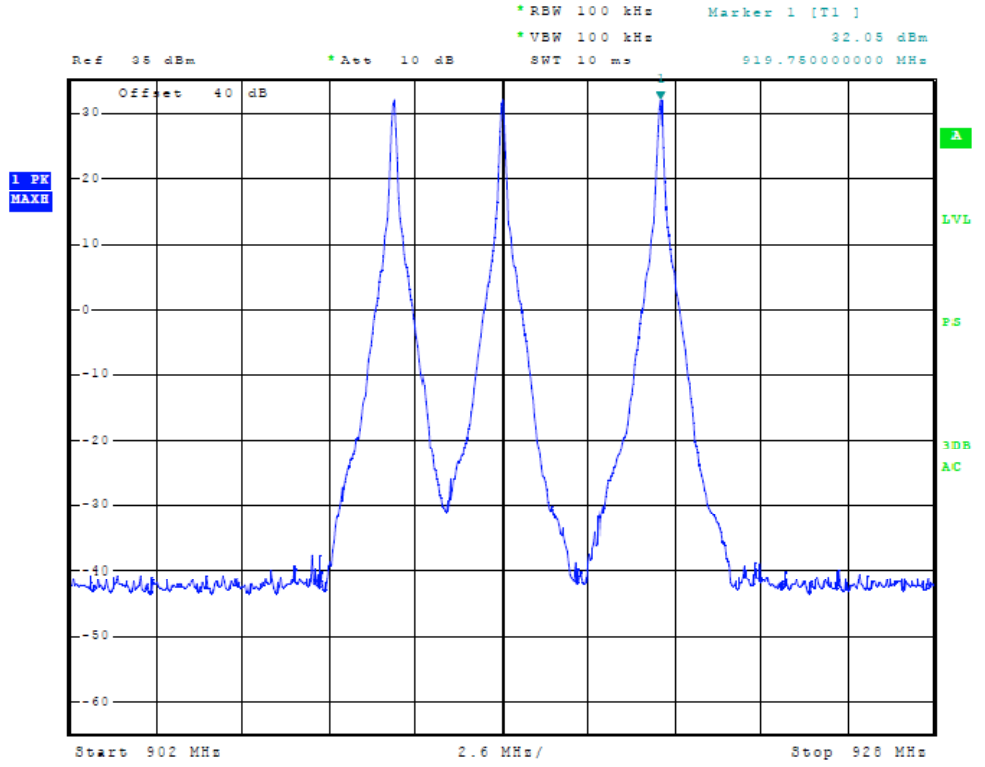


Figure Two Power output at antenna terminal (modulated operation)

Results Output Power at Antenna Terminal

Frequency	Operation mode	P_{dBm}	P_{mw}	P_w	OBW (kHz)
902.25	ATA	32.46	1,762	1.8	76.9
903.75	ATA	32.46	1,762	1.8	76.9
910.00	ATA	32.46	1,762	1.8	76.5
911.75	SeGo	32.34	1,762	1.8	506.4
919.75	SeGo	32.00	1,585	1.6	506.4
921.50	ATA	32.00	1,585	1.6	73.7

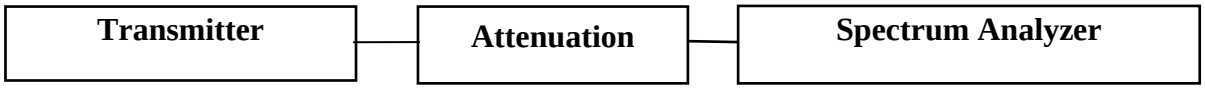
The EUT demonstrated compliance with the specifications of Paragraphs 2.1046(a), 90.205 and RSS-137. There are no deviations to the specifications.

2.1047 Modulation Characteristics

Measurements Required

A curve or equivalent data that shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed shall be submitted.

Test Arrangement



The radio frequency output was coupled to a Rohde &Schwarz ESU40 Spectrum Analyzer. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in its normal mode.

Results Modulation Characteristics

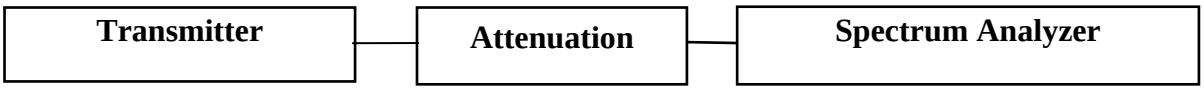
The transmitter operates in continuous wave (CW) and/or offering data transmitted signals modulated in amplitude/width/duration. The EUT demonstrated compliance with the specifications of Paragraphs 2.1046(a), 90.205 and RSS-137. There are no deviations to the specifications.

2.1049 Occupied Bandwidth

Measurements Required

The occupied bandwidth, that is the frequency bandwidth such that below its lower and above its upper frequency limits, the mean powers radiated are equal to 0.5 percent of the total mean power radiated by a given emission. Refer to figures three through ten displaying plots of occupied bandwidth measurements.

Test Arrangement



Results of Occupied Band Width

Operation Mode	Operational Frequency Band (MHz)	Occupied Bandwidth (kHz)
ATA	902.25-903.75	N/A
ATA	910.0-921.5	N/A
eGo	911.75-919.75	346.2
SeGo	911.75-919.75	506.4
IAG	911.75-919.75	381.4

The EUT demonstrated compliance with the requirements of Paragraphs 2.1046(a) 90.205 and RSS-137 paragraph 6.1. There are no deviations to the specifications.

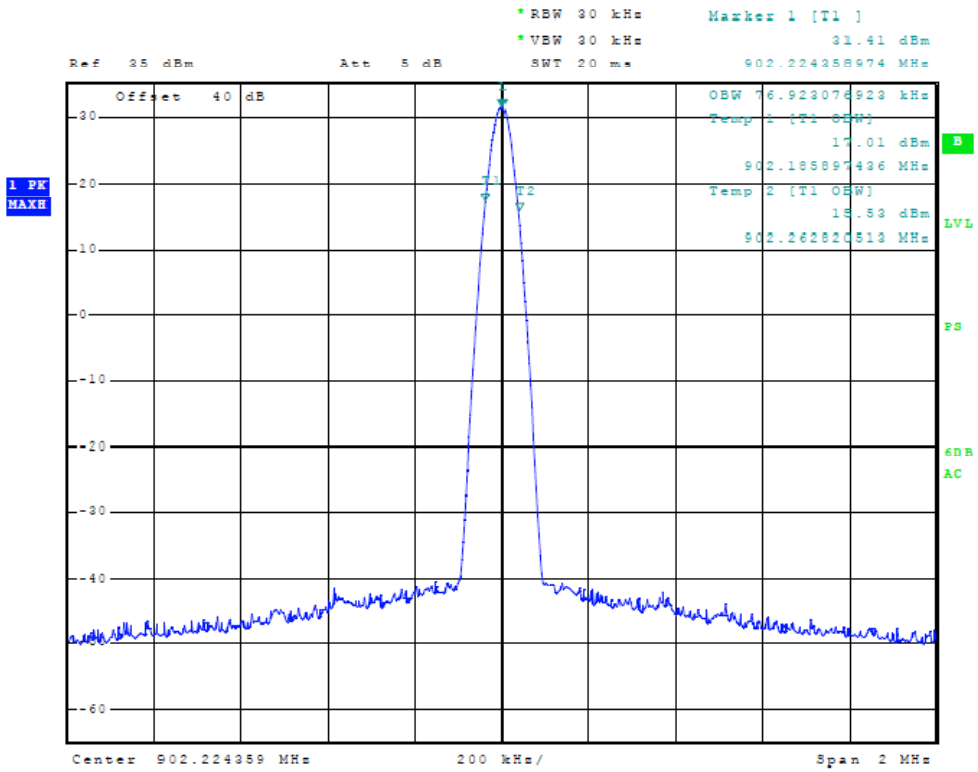


Figure Three Occupied Bandwidth 902.25 MHz (ATA)

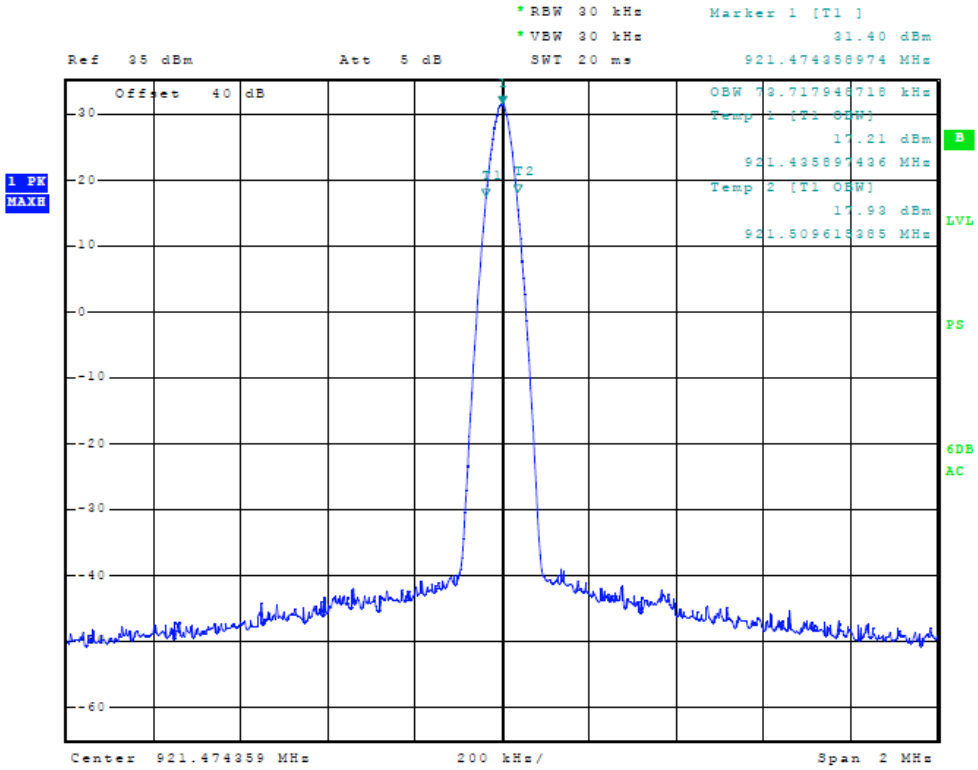


Figure Four Occupied Bandwidth 921.50 MHz (ATA)

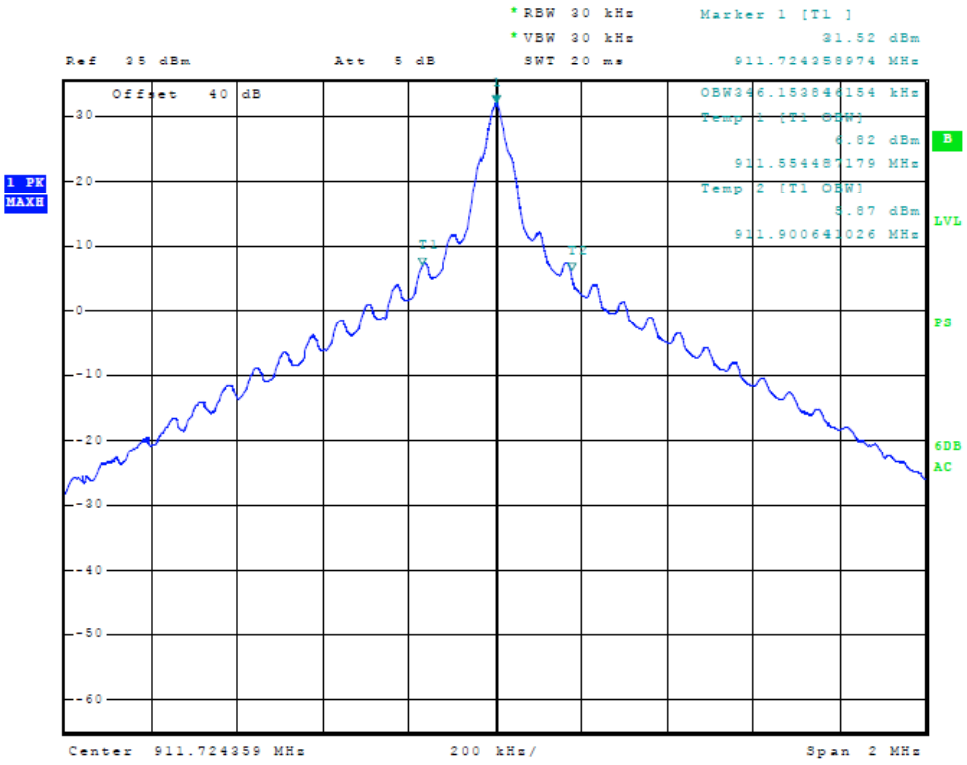


Figure Five Occupied Bandwidth 911.75 MHz (eGo)

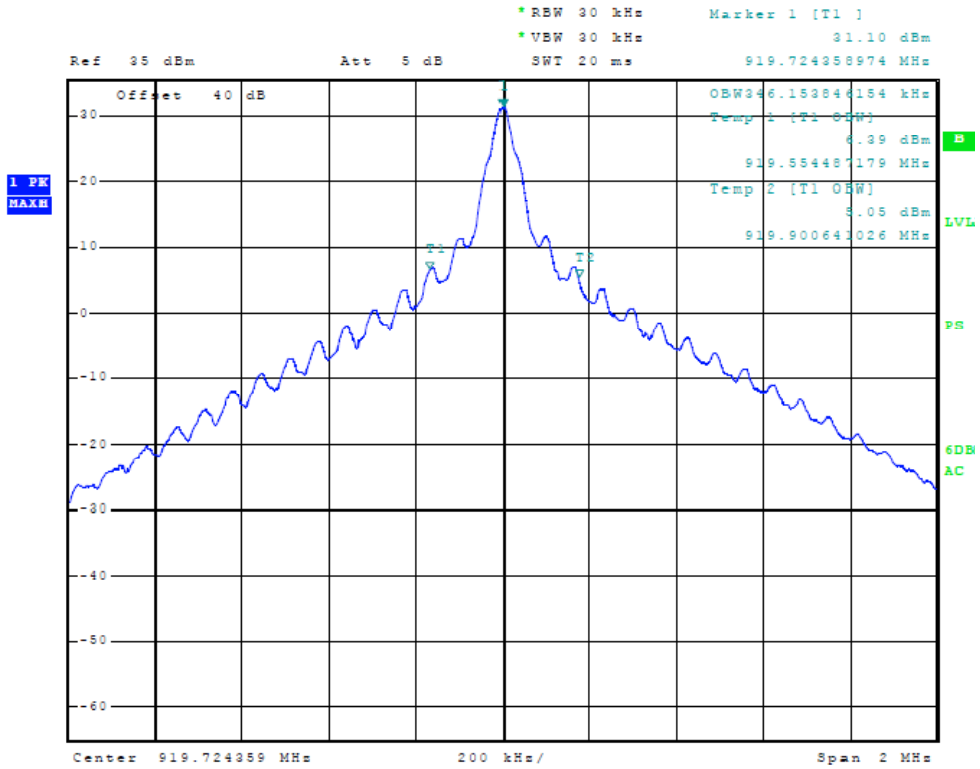


Figure Six Occupied Bandwidth 919.75 MHz (eGo)

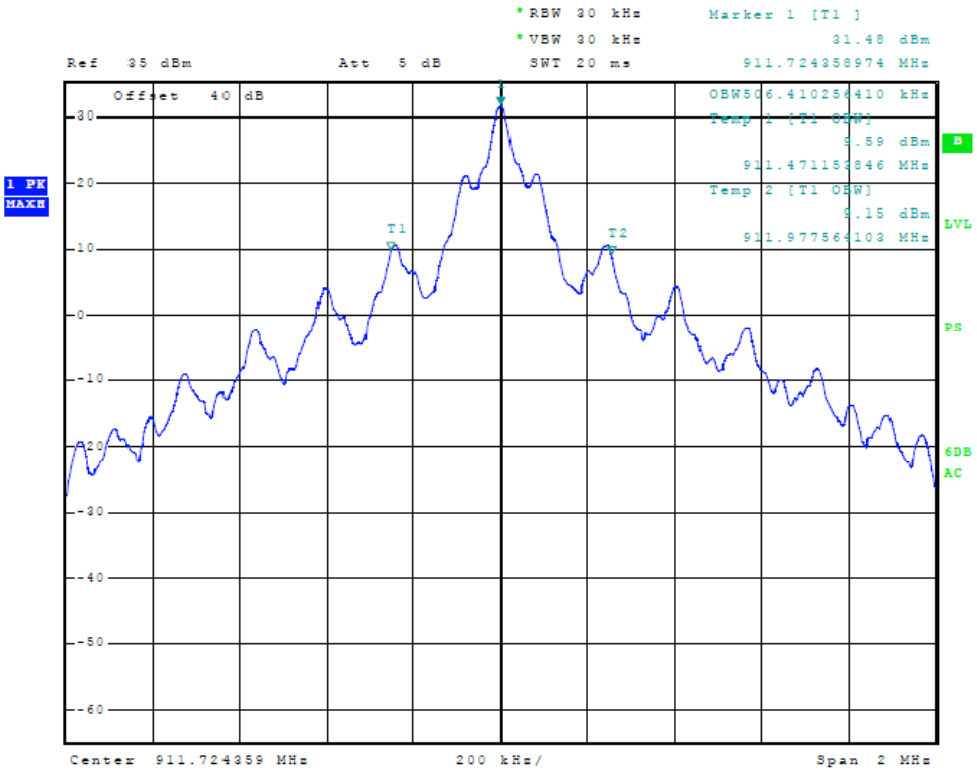


Figure Seven Occupied Bandwidth 911.75 MHz (SeGo)

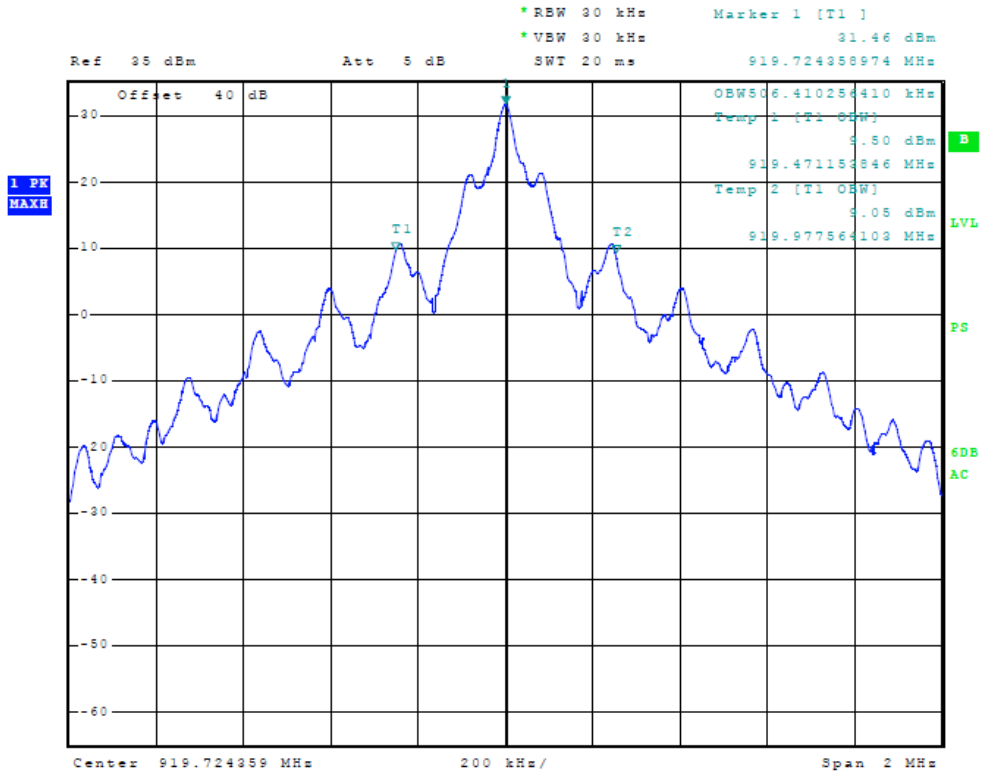


Figure Eight Occupied Bandwidth 919.75 MHz (SeGo)

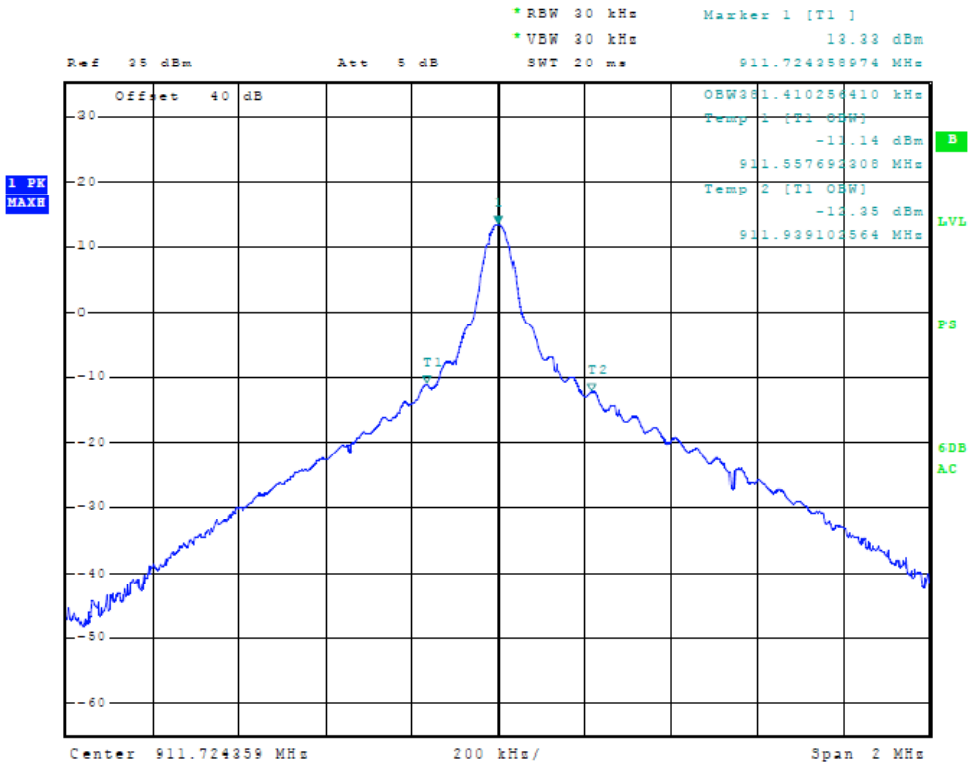


Figure Nine Occupied Bandwidth 911.75 MHz (IAG)

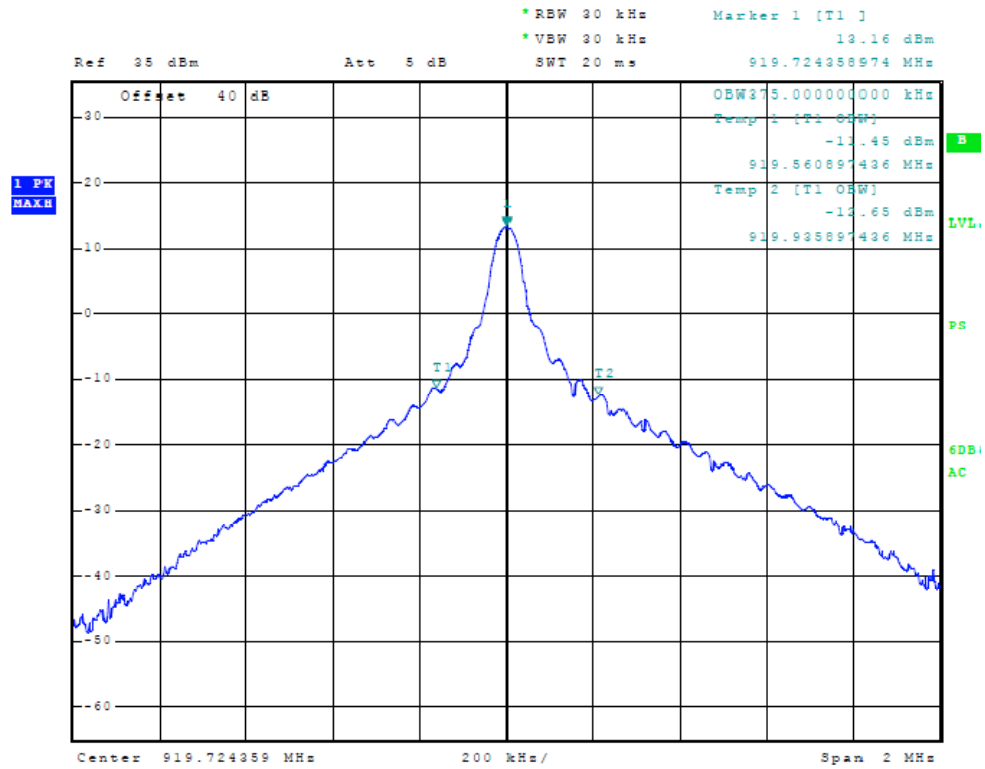


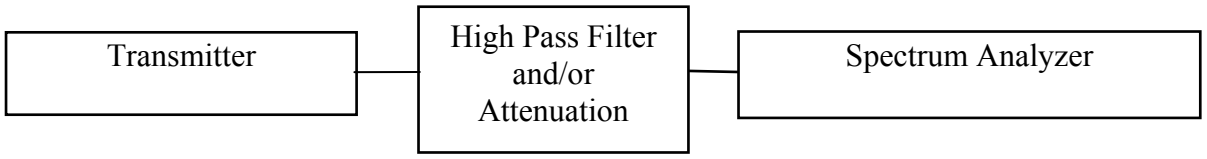
Figure Ten Occupied Bandwidth 919.75 MHz (IAG)

2.1051 Spurious Emissions at Antenna Terminals

Measurements Required

The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. To gain dynamic range in the test equipment, a high pass filter attenuated the fundamental frequency of operation was used to observe the harmonic emissions.

Test Arrangement



The radio frequency output was coupled to a Rohde &Schwarz ESU40 Spectrum Analyzer. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in its normal mode. The frequency spectrum from 30 MHz to 10 GHz was observed and plots produced of the frequency spectrum. Figures eleven through fourteen represent plots of the antenna conducted spurious emissions measurements for the EUT. Data was taken per CFR47 2.1051 and applicable paragraphs of Part 90 and RSS-137.

Limit: Spurious emissions must be attenuated below the peak output power by the at least 55 + 10 Log (P_o) dB.

1.8-watt transmitter limit specifies the out of band emissions must be suppressed by at least 57.5 dBc.

Attenuation $= 55 + 10 \text{ Log}_{10}(P_w)$

$= 55 + 10 \text{ Log}_{10}(1.8)$

$= 57.5$ dBc

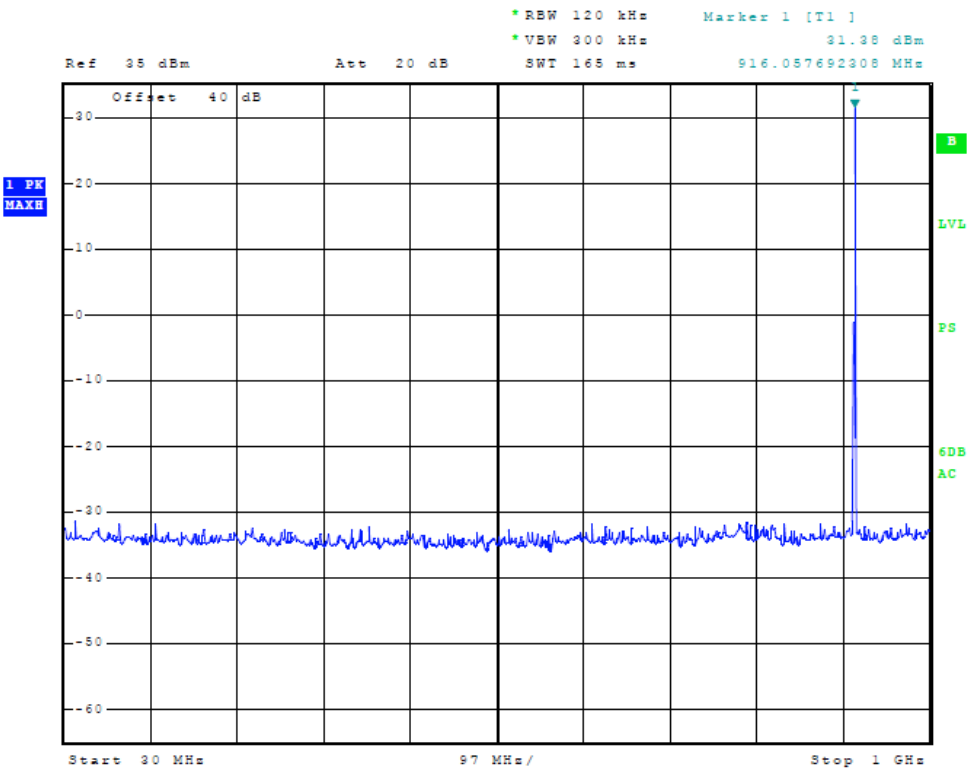


Figure Eleven Spurious Emissions at Antenna Terminal

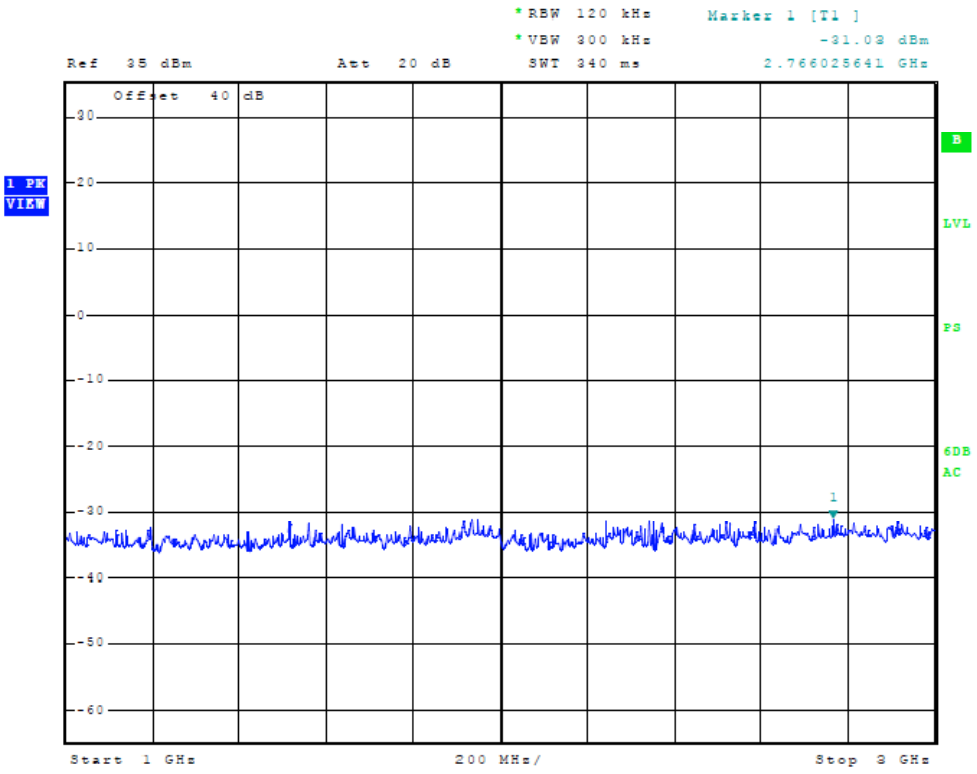


Figure Twelve Spurious Emissions at Antenna Terminal

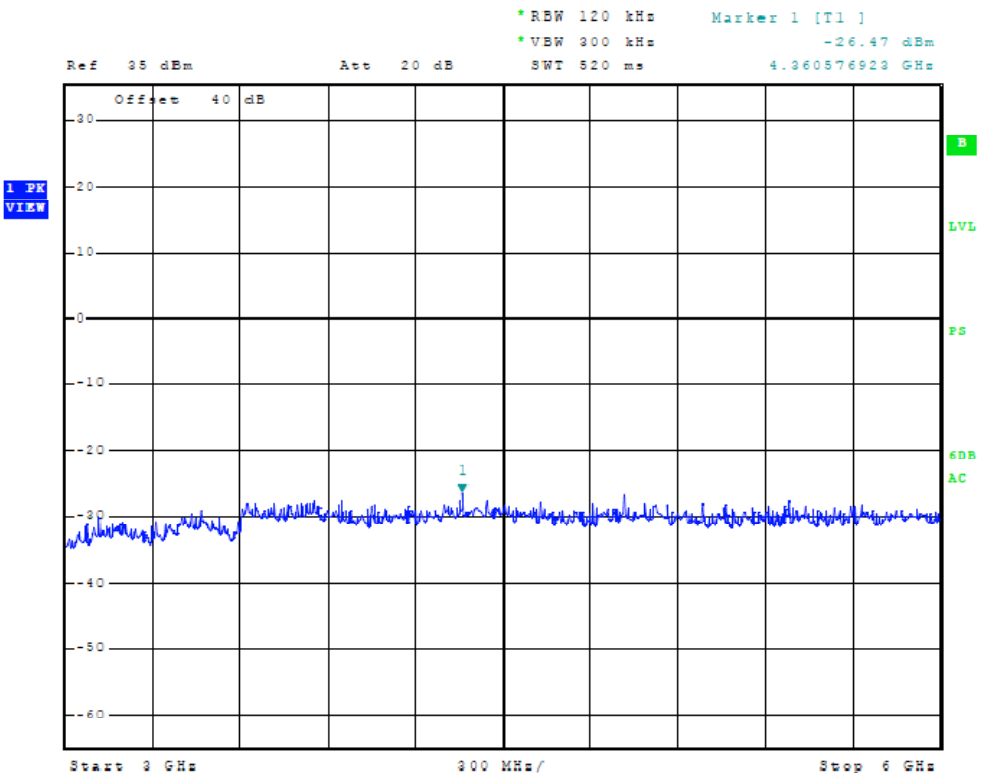


Figure Thirteen Spurious Emissions at Antenna Terminal

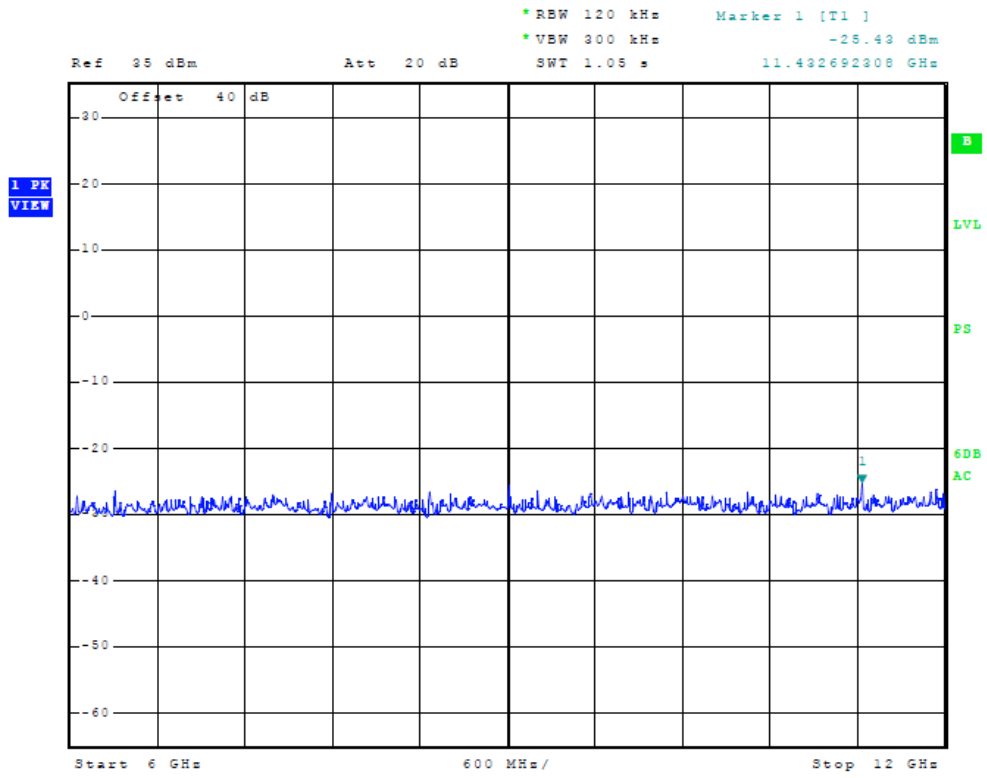


Figure Fourteen Spurious Emissions at Antenna Terminal

Results Spurious Emissions

Frequency (MHz)	Level (dBm)	Level Attenuated Below Carrier (dBc)
902.25	32.46	N/A
1804.5	-55.78	-88.2
2706.8	-52.78	-85.2
3609.0	-55.20	-87.7
4511.3	-58.29	-90.8
5413.5	-47.94	-80.4
6315.8	-57.23	-89.7
7218.0	-58.66	-91.1
8120.3	-62.85	-95.3
9022.5	-62.33	-94.8
910.00	32.46	N/A
1820.0	-55.60	-88.1
2730.0	-56.04	-88.5
3640.0	-55.62	-88.1
4550.0	-57.52	-90.0
5460.0	-47.90	-80.4
6370.0	-56.76	-89.2
7280.0	-62.36	-94.8
8190.0	-63.50	-96.0
9100.0	-61.59	-94.1
921.75	32.00	N/A
1843.5	-64.45	-96.9
2765.3	-57.05	-89.5
3687.0	-50.21	-82.7
4608.8	-56.41	-88.9
5530.5	-50.15	-82.6
6452.3	-59.08	-91.5
7374.0	-61.17	-93.6
8295.8	-63.79	-96.3
9217.5	-62.15	-94.6

Data was taken per 2.1051 and applicable parts of CFR47 90. The EUT demonstrated compliance with the specifications of Paragraphs CFR47 2.1051, 2.1057 and 90.210(k) and RSS-137 paragraph 6.5. There are no deviations to the specifications.

90.210 Emission Mask at Antenna Terminal

Measurements Required

Transmitters used in the radio services governed by this part must comply with the emissions masks outlined in this section. Paragraph 90.210(K) specifies the out of band emission limitations for this equipment. The spurious emissions at the antenna terminal for the device were measured at the maximum power output condition. The antenna port of the EUT was connected to the spectrum analyzer through coaxial cables and appropriate attenuation.

Test Arrangement

The radio frequency output was coupled to a Rohde &Schwarz ESU40 Spectrum Analyzer. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating through normal modes with maximum output power. The frequency spectrum at the band edges were observed and plots produced. Figures fifteen and nineteen representing plots of emission mask compliance at the band edges. Data was taken per CFR47 2.1051 and applicable parts of Part 90.210 (k) and RSS-137.

Results Emission Mask

The EUT demonstrated compliance with the specifications of Paragraphs CFR47 2.1051, 2.1057 and 90.210(k) and RSS-137 paragraph 6.5. There are no deviations to the specifications.

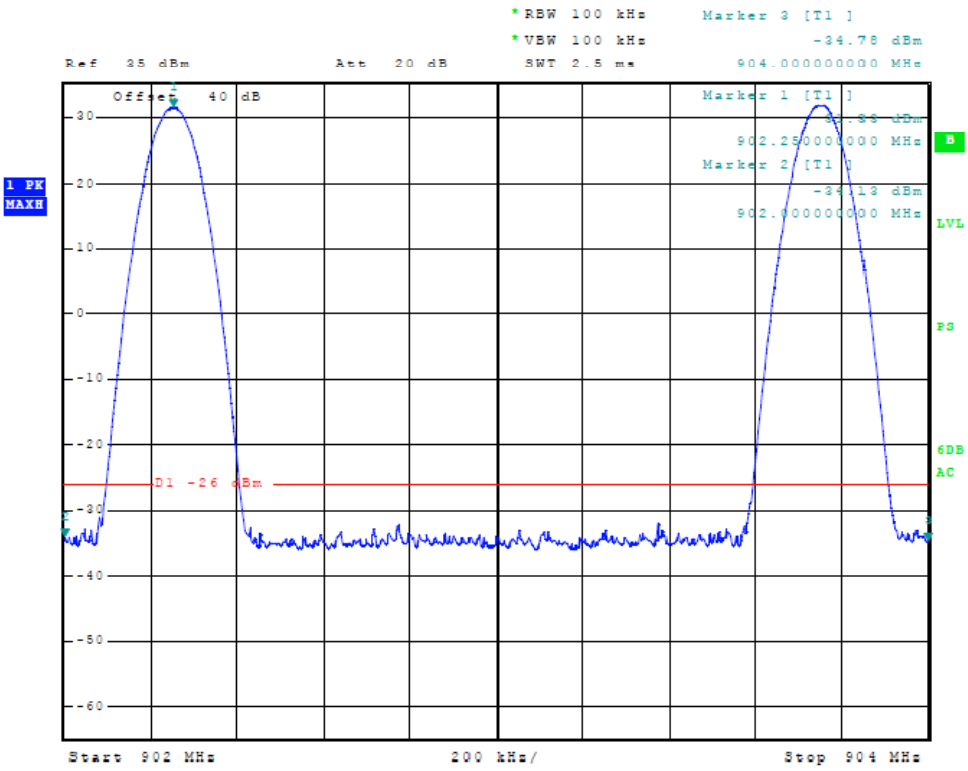


Figure Fifteen Emissions Mask at Antenna Terminal (ATA)

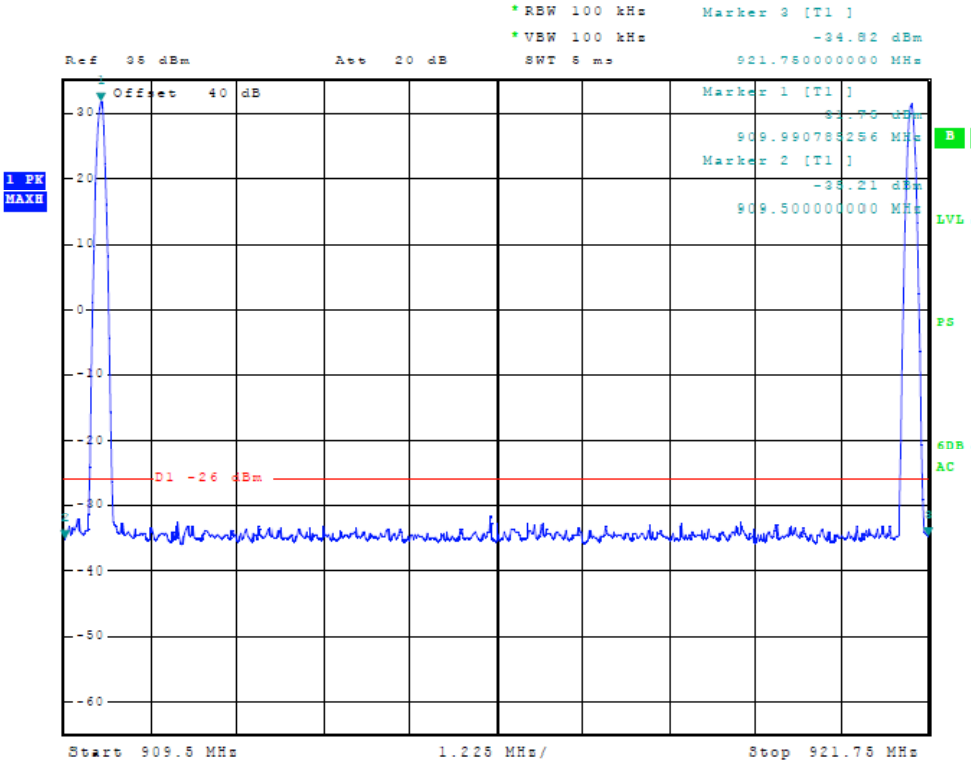


Figure Sixteen Emissions Mask at Antenna Terminal (ATA)

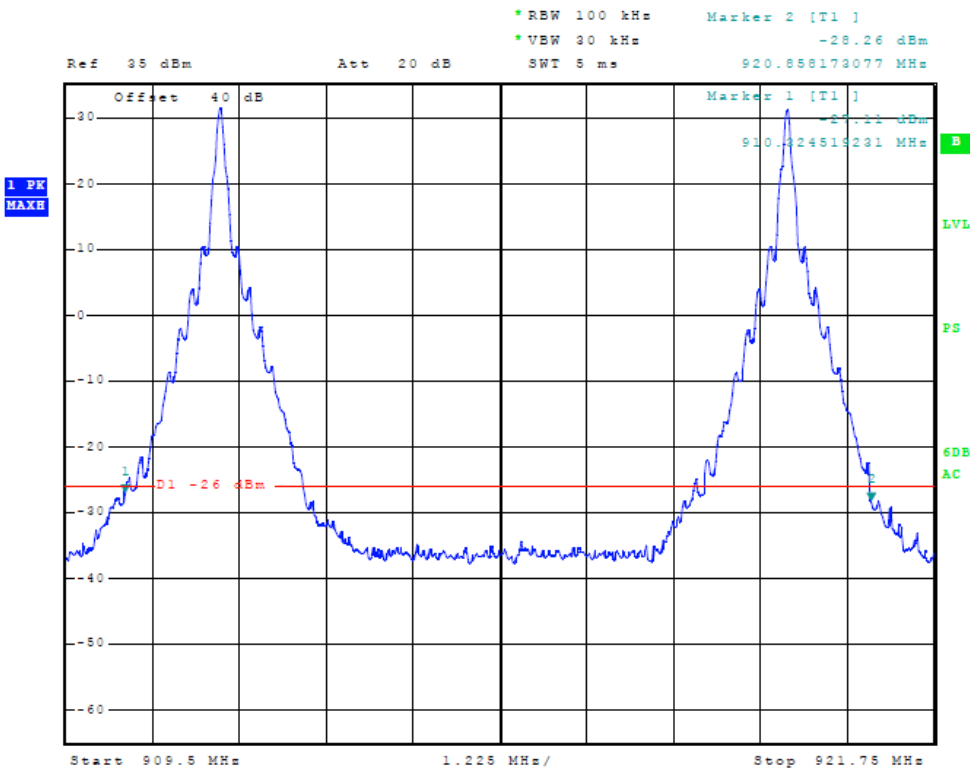


Figure Seventeen Emissions Mask at Antenna Terminal (Modulation)

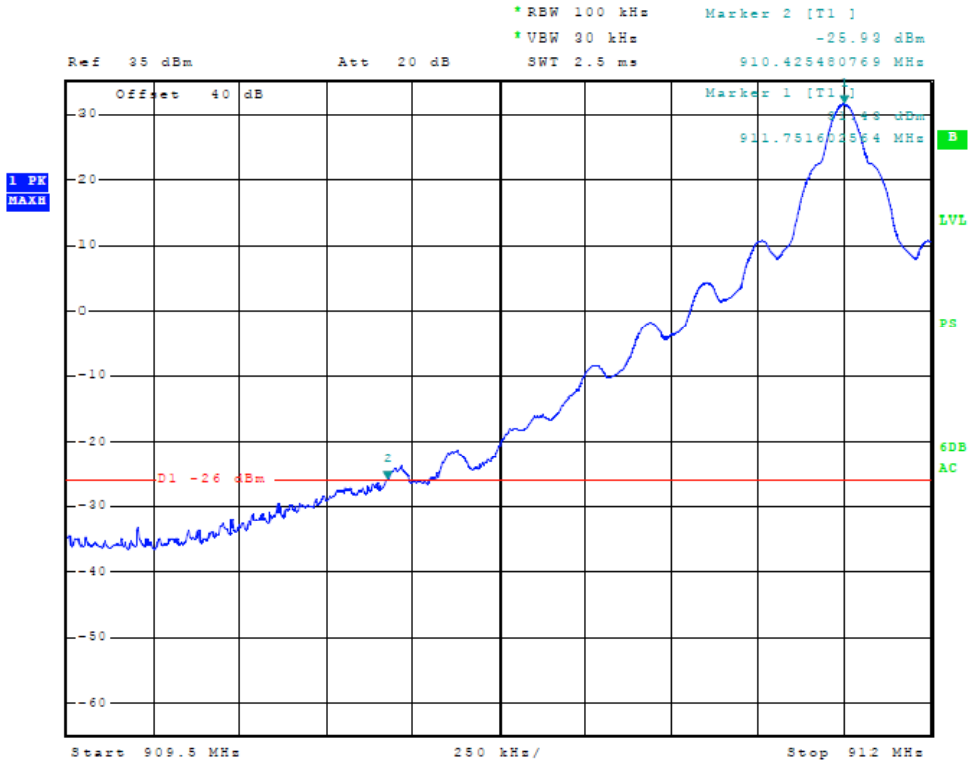


Figure Eighteen Emissions Mask at Antenna Terminal (Modulation)

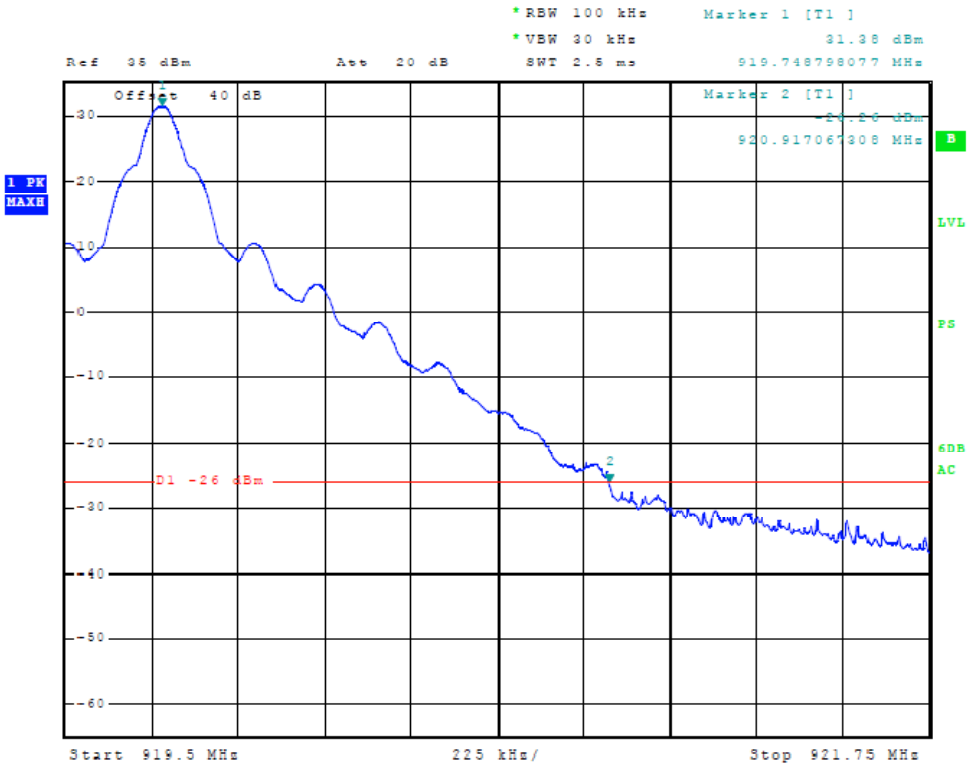


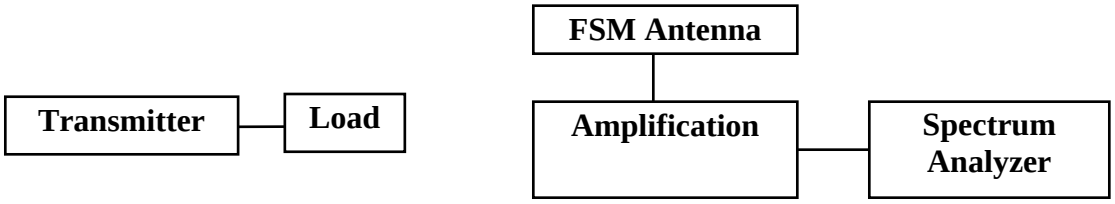
Figure Nineteen Emissions Mask at Antenna Terminal (Modulation)

2.1053 Field Strength of Spurious Radiation

Measurements Required

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation.

Test Arrangement



Preliminary radiated emissions plots were taken in a screen room to determine emission frequencies of the EUT. Refer to figures twenty through twenty-four showing plots of radiated emissions taken in screen room. The transmitter spurious emissions were measured at the OATS with the antenna port connected to a 50-ohm load. 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 turntable was rotated though 360 degrees to locate the position registering the highest amplitude emission. The frequency spectrum was then searched for spurious emissions generated from the transmitter. Raising and lowering the FSM antenna and rotating the turntable to maximize the emission. Data was measured and recorded for the maximum amplitude of each spurious emission. A Biconilog antenna was used to measure radiated emissions for frequencies of 30 MHz to 1000 MHz, and/or a log periodic antenna for frequencies of 200 MHz to 5 GHz, and pyramidal horn antennas for frequencies of 5 GHz to 40 GHz. The substitution method was used to measure harmonic spurious emissions. Harmonic emission levels from the EUT were measured and amplitude levels were recorded. The EUT transmitter was then removed and replaced with a substitution antenna, which was powered from a signal generator. The output signal from the generator was then adjusted such that the amplitude received was the same as that previously recorded for each frequency. This step was repeated for both horizontal and

vertical polarizations. The power in dBm required to produce the desired signal level was then recorded from the signal generator. The power in dBm was then calculated by reducing the previous readings by the gain in the substitution antenna. The testing procedures used conform to the procedures stated in the TIA/EIA-603 document.

The limits for the spurious radiated emissions are defined by the following equation.

Limit = Amplitude of the spurious emission must be attenuated by this amount below the level of the fundamental. On any frequency removed from the assigned frequency outside the assigned sub-band edges: at least $55 + 10 \text{ Log } (P_o)$ dB.

1.8-watt transmitter limit specifies the level below the carrier must be suppressed more than 57.5 dB.

$$\text{Attenuation} = 55 + 10 \text{ Log}_{10}(P_w)$$

$$= 55 + 10 \text{ Log}_{10}(1.8)$$

$$= 57.5 \text{ dBc}$$

The radiated spurious emission below the carrier in dB is calculated from the following equation:

Decibels below Carrier = dBc

$dBc = 10 \text{ Log}_{10}[\text{Tx power(W)}/0.001]$ – signal level required to reproduce measured spurious emission

example:

$dBc = 10 \text{ Log}_{10}[1.8/0.001]-(-73.7) = 106.3$ dBc

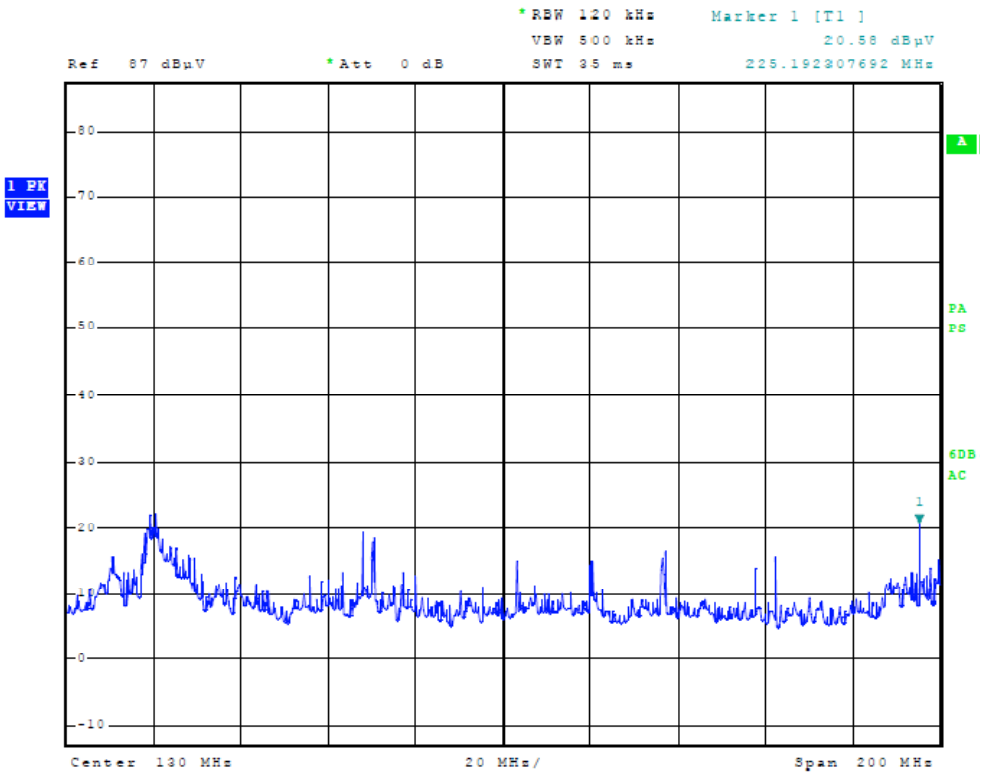


Figure Twenty Plot of Spurious Radiated Emissions

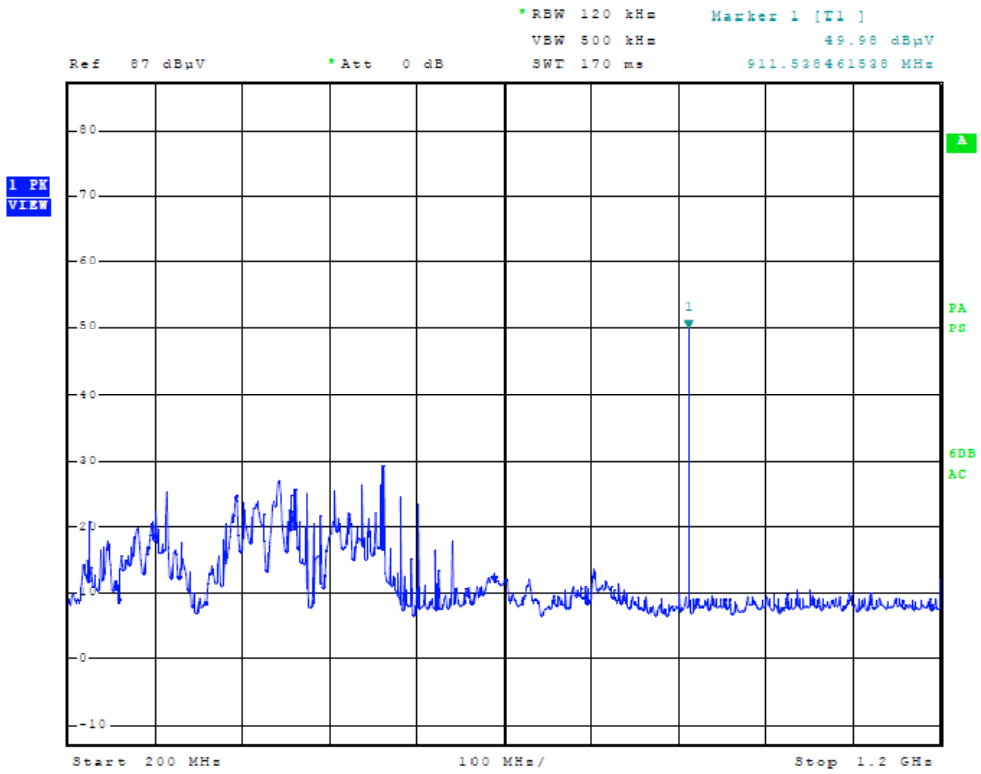


Figure Twenty-one Plot of Spurious Radiated Emissions

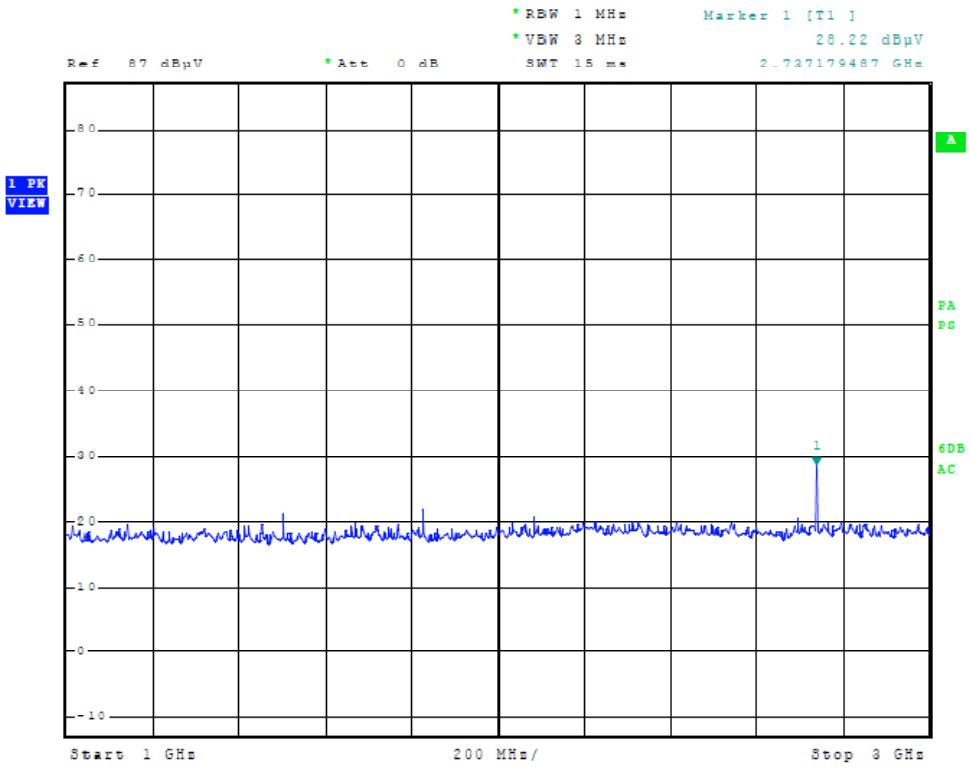


Figure Twenty-two Plot of Spurious Radiated Emissions

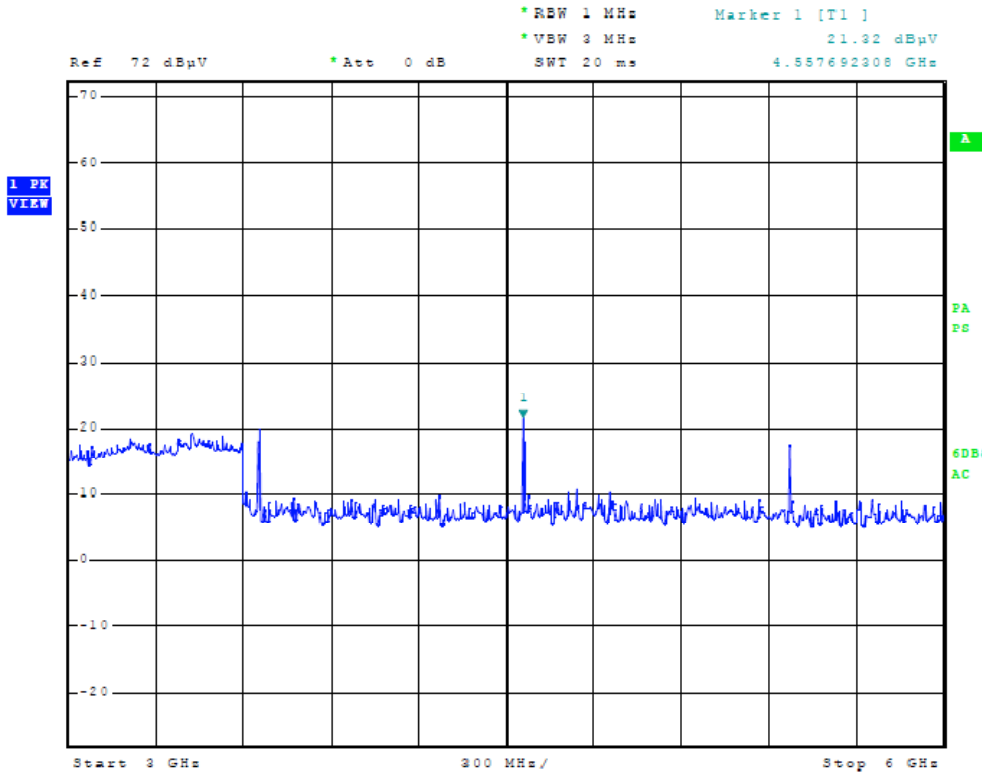


Figure Twenty-three Plot of Spurious Radiated Emissions

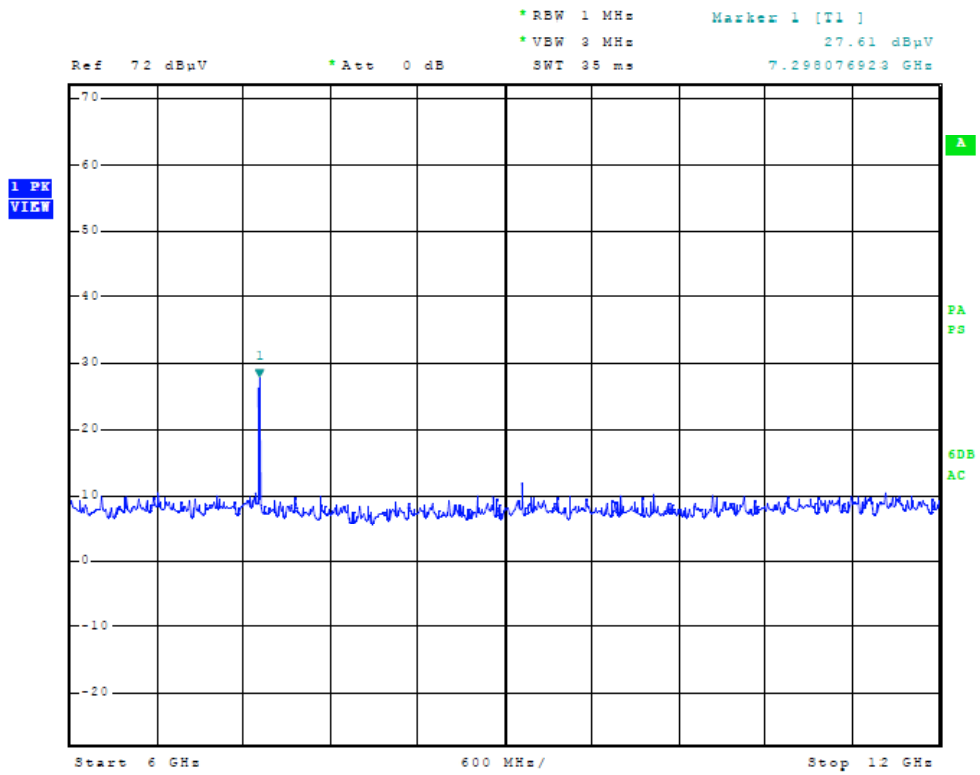


Figure Twenty-four Plot of Spurious Radiated Emissions

Results Spurious Radiation

General Radiated Emissions (Highest General Emissions)

Freq. In MHz	FSM Hor. (dBµV)	FSM Vert. (dBµV)	Ant. Fact. (dB)	Amp. Gain (dB)	Comp. Hor. (dBµV/m) @ 3m	Comp. Vert. (dBµV/m) @ 3 m	Limit per 15.109 (dBµV/m) @ 3 M
167.0	35.3	41.7	8.6	30	13.9	20.3	43.5
192.2	42.5	49.4	10.5	30	23.0	29.9	43.5
225.0	56.8	52.4	11.2	30	38.0	33.6	46.0
312.6	47.6	45.3	14.5	30	32.1	29.8	46.0
438.4	48.2	43.6	17.0	30	35.2	30.6	46.0
440.0	49.6	53.5	17.0	30	36.6	40.5	46.0
456.0	55.4	49.8	17.4	30	42.8	37.2	46.0
472.0	53.3	49.8	18.1	30	41.4	37.9	46.0
504.0	53.1	48.2	17.9	30	41.0	36.1	46.0
536.0	54.1	48.8	19.2	30	43.3	38.0	46.0
560.0	53.9	48.1	19.6	30	43.5	37.7	46.0

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

Field Strength Spurious Radiation

Frequency of Emission	Amplitude of EUT Spurious emission observed		Signal level to substitution antenna required to reproduce		Emission level below carrier		Limit per 90.210
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	
(MHz)	dBµV	dBµV	dBm	dBm	dBc	dBc	dBc
902.25 MHz, Po= 32.5 dBm							
1804.50	17.1	17.5	-73.73	-73.33	-106.3	-105.9	57.5
2706.75	20.3	24.1	-65.63	-61.83	-98.2	-94.4	57.5
3609.00	17.7	18.8	-65.33	-64.23	-97.9	-96.8	57.5
4511.25	17.0	17.1	-61.33	-61.23	-93.9	-93.8	57.5
5413.50	17.7	17.6	-69.43	-69.53	-102.0	-102.1	57.5
6315.75	15.0	14.5	-71.13	-71.63	-103.7	-104.2	57.5
915.75 MHz, Po= 32.5 dBm							
1823.50	16.9	16.8	-74.03	-74.13	-106.6	-106.7	57.5
2735.25	18.1	19.8	-64.73	-63.03	-97.3	-95.6	57.5
3647.00	19.1	19.8	-63.73	-63.03	-96.3	-95.6	57.5
4558.75	17.5	17.4	-60.23	-60.33	-92.8	-92.9	57.5
5470.50	18.3	18.0	-68.83	-69.13	-101.4	-101.7	57.5
6382.25	15.4	15.5	-70.73	-70.63	-103.3	-103.2	57.5
921.5 MHz, Po= 32.0 dBm							
1843.00	16.3	16.9	-74.63	-74.03	-107.2	-106.6	57.5
2764.50	17.6	18.1	-68.33	-67.83	-100.9	-100.4	57.5
3686.00	25.6	26.0	-57.13	-56.73	-89.7	-89.3	57.5
4607.50	17.5	17.5	-59.83	-59.83	-92.4	-92.4	57.5
5529.00	17.6	17.6	-69.53	-69.53	-102.1	-102.1	57.5
6450.50	15.5	15.2	-70.63	-70.93	-103.2	-103.5	57.5

Data was taken per 2.1051 and applicable parts of CFR47 90. The EUT demonstrated compliance with the specifications of Paragraphs CFR47 2.1051, 2.1057 and 90.210(k)(3) and RSS-137 The EUT demonstrated compliance with the specifications of Paragraphs CFR47 2.1051, 2.1057 and 90.210(k) and RSS-137 paragraph 6.5. There are no deviations to the specifications.

2.1055 Frequency Stability

Measurements Required

Pursuant to 90.213(a), Note 13, frequency stability testing is not required for this equipment. The equipment design incorporates frequency-determining components with acceptable operational frequency and tolerances rating. The equipment complies with the requirements of CFR47 part 90 and RSS-137 paragraph 6.3.

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 Calibrated
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	10/09
Antenna: Antenna Research Biconical Model: BCD 235	10/09
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	10/09
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. Working experiences include six years in the automated controls industry and the 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

Bachelor of Science Degree in Electrical Engineering from Kansas State University

Bachelor of Science Degree in Business Administration Kansas State University

Several Specialized Training courses and seminars pertaining to Microprocessors and Software programming

Scot D Rogers

Scot D. Rogers

NVLAP Lab Code: 200087-0

Annex D FCC 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 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