NVLAP Lab Code 200087-0

Application For
Grant of Certification

FOR

Model: DC40

P/N 011-02433-00

Low Power Transmitter

FCC ID: IPH-01748

FOR

GARMIN INTERNATIONAL, INC.

1200 East 151st Street

Olathe, KS 66062

Test Report Number 100510

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

Garmin International, Inc.

1200 East 151st Street
Olathe, KS 66062

Phone: (913) 397-8200

Mr. Van Ruggles
Director of Quality Assurance

Model: DC40
GPN 011-02433-00
Low Power Transmitter

Frequency Range: 2,403-2,480 MHz

FCC ID: IPH-01748

Test Report Number: 100510

Test Date: May 10, 2010

Authorized Signatory: 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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The following information in this document is submitted for consideration in obtaining Grant of Certification for low power intentional radiator per CFR 47 Paragraph 15.249 operation in the 2400 – 2483.5 MHz band.

Name of Applicant: Garmin International, Inc.
1200 East 151st Street
Olathe, KS 66062

Model: DC40, GPN 011-02433-00

FCC ID: IPH-01748

Frequency Range: 2403-2480 MHz

Operating Power: Less than 2 mW (measured average power 60.4 dBµV/m @ 3 meters and peak 86.6 dBµV/m @ 3 meters), Occupied band width 1,226.0 kHz, and worst-case receiver radiated emission 32.3 dBµV/m @ 3 meters

Applicable Standards & Test Procedures

The following information is submitted in accordance with the Federal Communications Commission (FCC) and Code of Federal Regulations Title 47 (CFR 47), 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 Part 15C paragraph 15.249. Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in the ANSI 63.4-2003 Document.

Opinion / Interpretation of Results

Test Performed	Minimum Margin (dB)	Results
Antenna requirement per CFR 47 15.203	NA	Complies
Restricted Bands Emissions as per CFR 47 15.205	24.9	Complies
AC Line Conducted Emissions as per CFR 47 15.207	11.2	Complies
Radiated Emissions as per CFR 47 15.209	6.4	Complies
Antenna Power conduction for Receivers per CFR 47 15.111	21.7	Complies
Emissions per CFR 47 15.249 (Transmitter Peak)	7.4	Complies

Statement of Modifications and Deviations

No modifications to the EUT were required for the equipment to demonstrate compliance with requirements of CFR 47 Part 15C. There were no deviations or modification to the specifications.

Environmental Conditions

Ambient Temperature	21.6° C
Relative Humidity	49%
Atmospheric Pressure	1012.0 mb

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.

Radiated Emissions Calculations:

Note: The limit is expressed for a measurement in dBµV/m when the measurement is taken at a distance of 3 meters. Data taken for this report was taken at a distance of 3 meters.

$$dB\mu V/m \text{ @ } 3m = FSM(dB\mu V) + A.F.(dB/m) - Amp\ Gain(dB)$$

Test Site Locations

Conducted EMI	Rogers Labs, Inc. located at 4405 W. 259th Terrace, Louisburg, KS.
Radiated EMI	Performed at Rogers Labs, Inc. 3 meters Open Area Test Site (OATS) located at 4405 W. 259th Terrace, Louisburg, KS.
Site Registration	Refer to Annex for FCC Site Registration Letter, Reference 90910, Industry Canada Site Registration Reference 3041A-1
Accreditation	NVLAP Accreditation Lab Code 200087-0

List of Test Equipment

A Rohde and Schwarz ESU40, Hewlett Packard 8591EM and or 8562A Spectrum Analyzer was used as the measuring equipment for emissions testing. The analyzer settings used are described in the following table. Refer to the annex for a complete list of Test Equipment.

Spectrum 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
120 kHz	300 kHz	Peak/Quasi Peak
Spectrum Analyzer Settings		
Radiated Emissions (1 – 40 GHz)		
RBW	AVG. BW	Detector Function
1 MHz	1 MHz	Peak/Average
Antenna Conducted Emissions		
RBW	AVG. BW	Detector Function
120 kHz	300 kHz	Peak

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

Application for Certification

(1) Manufacturer: Garmin International, Inc.
1200 East 151st Street
Olathe, KS 66062
Telephone: (913) 397-8200

(2) Identification: FCC I.D.: IPH-01748

(3) Copy of the installation and operating manual: Refer to exhibit for Draft Instruction Manual.

(4) Description of Circuit Functions, Device Operation: This device features low power communications transmitter operation in frequency band of 2403-2480 MHz. The transceiver section of the design offers short range data communications with compliant equipment. A user initiates the transmission from another unit with a key press and that unit begins the communication process with the EUT. The microcontroller then sends and receives data.

(5) Block Diagram with Frequencies: Refer to another exhibit for Block Diagram

(6) Report of measurements demonstrating compliance with the pertinent FCC technical requirements is provided in this report.

(7) Photographs of equipment are provided in other application exhibits.

(8) Peripheral equipment or accessories for the equipment. Optional equipment available for the EUT includes AC and DC power adapters to recharge internal battery. The available configuration options were investigated for this and other reports in compliance with required standards with worst-case data presented.

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

(10) The equipment is not a scanning receiver.

(11) The equipment is not a transmitter operating in the 59-64 GHz frequency range.

Equipment Tested

Equipment	Serial Number/Model	FCC I.D.
DC40 (EUT)	#3	IPH-01748
AC Charger Adapter	362-00073-00	N/A
DC Charger Adapter	320-00584-00	N/A

Equipment and Cable Configuration

Test Setup

The EUT was arranged as a test sample emulating typical user equipment configurations for testing purposes. The transmitter offers no other interface connections than those in the configuration options shown below. The EUT is powered from rechargeable internal batteries only and requires placement into charging station to replenish battery power as shown in configuration diagrams. As requested by the manufacturer and required by regulations, the equipment was tested for emissions compliance using the available configurations with the worst-case data presented. Test results in this report relate only to the products described in this report.

Equipment Function and Testing Procedures

The EUT is a low power transmitter operating in the 2400-2483.5 MHz frequency band (CFR 47 15.249). The DC40 transmitter is mounted as a dog collar for placement on animals. The unit functions while attached to the collar or harness allowing sports enthusiast to monitor, locate and track the animal wearing the harness and transmitter. The EUT incorporates two separate transmitter sections, one operating as a low power license exempt intentional radiator operating between 2,400 – 2,483.5 MHz governed by CFR 47 15.249. The other transmitter operates on the approved MURS VHF frequencies governed by rule of CFR 47 paragraph 95.632. The low power transmitter allows for channel selection and synchronization of the VHF MURS transmitter with the remote receiver. The MURS transmissions are received on the synchronized receiver carried by the sports enthusiast allowing them to monitor the location of the transmitter.

The EUT enclosure is sealed allowing no user access inside. This approach hardens the equipment to adverse conditions the tracked animal experience. The internal rechargeable battery must be recharged using the approved charging accessories. Two charging options are available, AC wall adapter or DC car/cigarette lighter adapter as shown in the configuration diagrams below.

Configuration options for the EUT

1. DC40 (GPN: 011-02433-00) connected to car cigarette lighter adapter (GPN: 320-00584-00).

2. DC40's Li-Ion battery charged by the AC wall brick power supply (GPN: 362-00073-00).

AC Line Conducted Emission Test Procedure

Testing for the AC line-conducted emissions was performed as defined in sections 7.2.4 and 13 of ANSI C63.4. The test setup, including the EUT, was arranged in the test configurations as shown above 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 photographs in exhibits for EUT placement used during testing.

Radiated Emission Test Procedure

Testing for the radiated emissions was performed as defined in sections 8.3 and 13.1 of ANSI C63.4. The EUT was arranged in the test configurations as shown above and 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 final data was taken using a spectrum analyzer. Refer to photographs in exhibits for EUT placement used during testing.

Subpart C - Intentional Radiators

As per CFR 47 Part 15 Subpart C paragraph 15.249 the following information is submitted for consideration in obtaining grant of certification for unlicensed intentional radiators.

Antenna Requirements

The unit is produced with permanently attached transmitter antenna located inside the sealed case. No provisions for modification or alterations of the antenna configuration are available to the end user. The requirements of 15.203 are met 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 the OATS. The EUT utilizes frequency, determining circuitry, which generates harmonics falling in the restricted bands. Emissions were investigated at the OATS, using appropriate antennas or pyramidal horns, amplification stages, and a spectrum analyzer. Peak and average amplitudes of frequencies above 1000 MHz were compared to the required limits with worst-case data presented below. Test procedures of ANSI 63.4-2003 paragraphs 13.1 and 8.3.1.2 were used during testing. No other significant emission was observed which fell into the restricted bands of operation. Computed emission values take into account the received radiated field strength, receive antenna correction factor, amplifier gain stage, and test system cable losses.

Radiated Emissions in Restricted Bands Data

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)
2390.0	18.5	21.1	32.8	25.0	26.3	28.9	54.0
2483.5	18.0	18.0	33.3	25.0	26.3	26.3	54.0
4806.6	20.3	21.4	32.7	25.0	28.0	29.1	54.0
4882.6	18.1	20.8	32.8	25.0	25.9	28.6	54.0
4960.0	17.9	19.5	32.9	25.0	25.8	27.4	54.0
7209.9	13.3	13.5	36.2	25.0	24.5	24.7	54.0
7323.9	11.0	11.4	36.5	25.0	22.5	22.9	54.0
7440.0	12.3	11.9	36.7	25.0	24.0	23.6	54.0
12016.5	11.9	11.9	40.0	25.0	26.9	26.9	54.0
12206.5	11.9	11.9	40.4	25.0	27.3	27.3	54.0
12400.0	11.7	11.7	40.7	25.0	27.4	27.4	54.0

Other emissions found in the restricted bands were at least 20 dB below the limits.

Summary of Results for Radiated Emissions in Restricted Bands

The EUT demonstrated compliance with the radiated emissions requirements of FCC CFR 47 Part 15.205 restricted bands of operation. The EUT worst-case configuration demonstrated minimum margin of 24.9 dB below the CFR 47 limits. Other emissions were present with amplitudes at least 20 dB below the required limits.

AC Line Conducted Emissions

AC Line Conducted Emissions Testing Procedure

The EUT was arranged in typical equipment configuration. Testing was performed with the EUT 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. Testing for the line-conducted emissions were the procedures of ANSI 63.4-2003 paragraphs 13.1.3 and 7.2.4. The AC adapter for the charging station was connected to the LISN for line-conducted emissions testing. 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 was 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 frequencies of each of the emissions, which had the highest amplitudes. 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 data was recorded with maximum conducted emissions levels. Refer to figures one and two showing plots of the worst-case AC Line conducted emissions of the EUT.

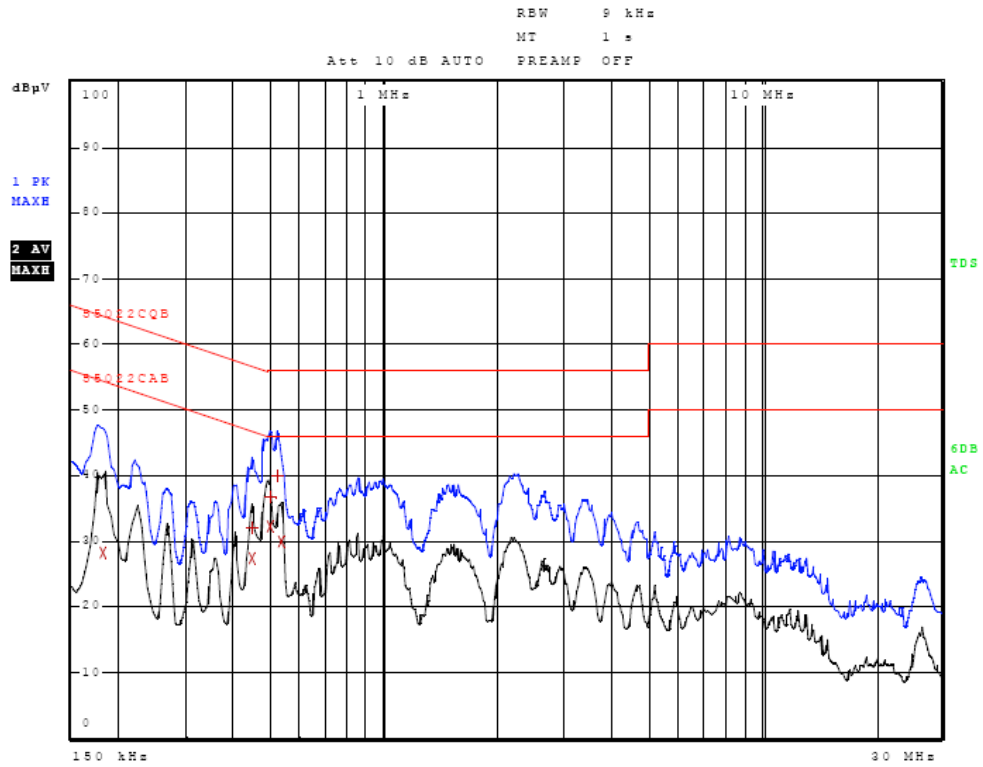

Figure One AC Line Conducted emissions of EUT line 1

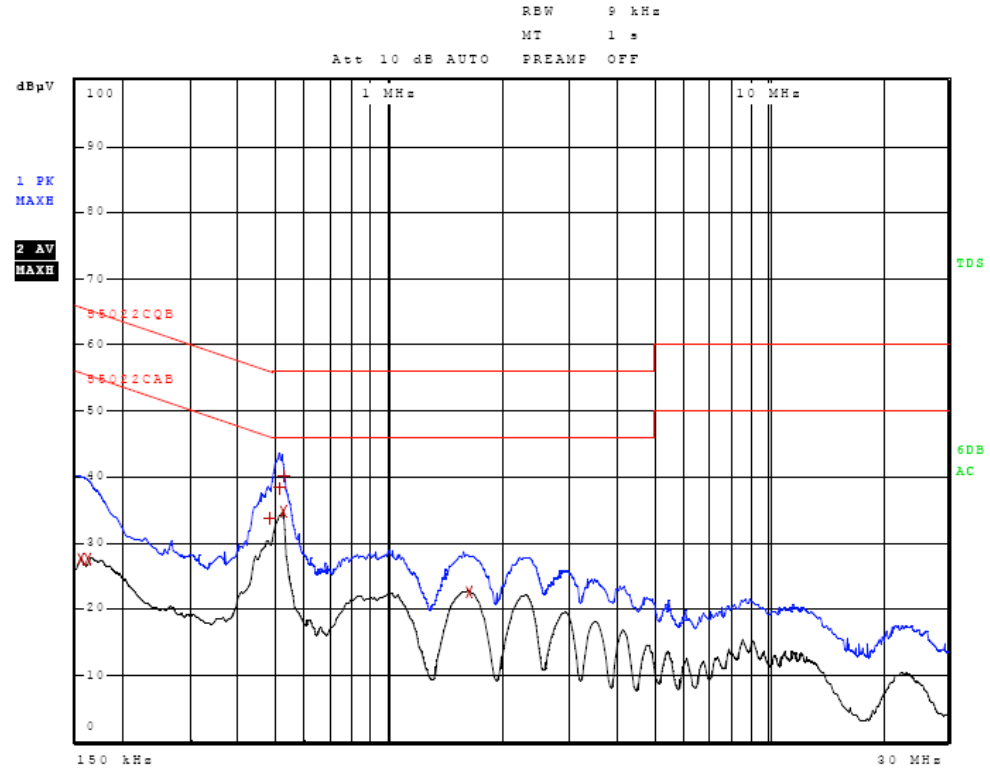

Figure Two AC Line Conducted emissions of EUT line 2

AC Line Conducted Emissions Data

Line 1

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
2	182.000000000 kHz	28.17	Average	-26.23
2	446.000000000 kHz	27.38	Average	-19.57
1	446.000000000 kHz	31.96	Quasi Peak	-24.99
1	498.000000000 kHz	36.75	Quasi Peak	-19.28
2	498.000000000 kHz	32.31	Average	-13.72
1	518.000000000 kHz	39.95	Quasi Peak	-16.05
2	534.000000000 kHz	29.86	Average	-16.14

Line 2

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
2	154.000000000 kHz	27.56	Average	-28.22
2	162.000000000 kHz	27.63	Average	-27.73
1	482.000000000 kHz	33.77	Quasi Peak	-22.54
1	510.000000000 kHz	38.39	Quasi Peak	-17.61
1	522.000000000 kHz	40.27	Quasi Peak	-15.73
2	522.000000000 kHz	34.71	Average	-11.29
2	1.622000000 MHz	22.53	Average	-23.47

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 CFR 47 Part 15C and other applicable standards for Intentional Radiators. The EUT worst-case configuration demonstrated minimum margin of 11.2 dB below the FCC/CISPR quasi peak limit. Other missions were present with recorded data representing the worst-case amplitudes.

Radiated emissions limits; general requirements

General Radiated EMI Testing Procedure

The EUT was investigated while arranged in all typical equipment configurations and operated through all applicable modes. Preliminary testing was performed in a screen room with the EUT positioned 1 meter from the FSM. Investigations were performed to identify the frequencies which produced the highest radiated emissions. Plots were made of the radiated emission frequency spectrum from 30 MHz to 25,000 MHz for preliminary transmitter testing. Refer to figures three through six representing the worst-case radiated emission spectrum as displayed on the spectrum analyzer of EUT powered from external AC supply taken in screen room. Refer to figures seven through thirteen showing the worst-case radiated emission spectrum of EUT operating as transmitter. Each emission was then re-maximized at the OATS site before final radiated emissions measurements were performed. Final data was taken with the EUT located at the open field test site at a distance of 3 meters between the EUT and the receiving antenna for transmitter testing. Final data was taken with the EUT located at the open field test site at a distance of 10 meters between the EUT and the receiving antenna during AC charger operation testing. Test procedures of ANSI 63.4-2003 paragraphs 13.1 and 8.3.1.2 were used during radiated emissions testing. The frequency spectrum from 30 MHz to 25,000 MHz was searched for radiated emissions of the EUT. Peak and average amplitudes of frequencies above 1000 MHz were compared to the required limits with worst-case data presented below. Measured emission levels were maximized by EUT placement on the table, changing cable location, rotating the turntable through 360 degrees, varying the antenna height between 1 and 4 meters above the ground plane and changing antenna polarization between horizontal and vertical. Antennas used were Broadband Biconical from 30 MHz to 200 MHz, Log Periodic from 200 MHz to 5 GHz, and/or Biconilog from 30 MHz to 1000 MHz, Double-Ridge horn and/or Pyramidal Horns from 5 GHz to 25 GHz, and amplification stages.

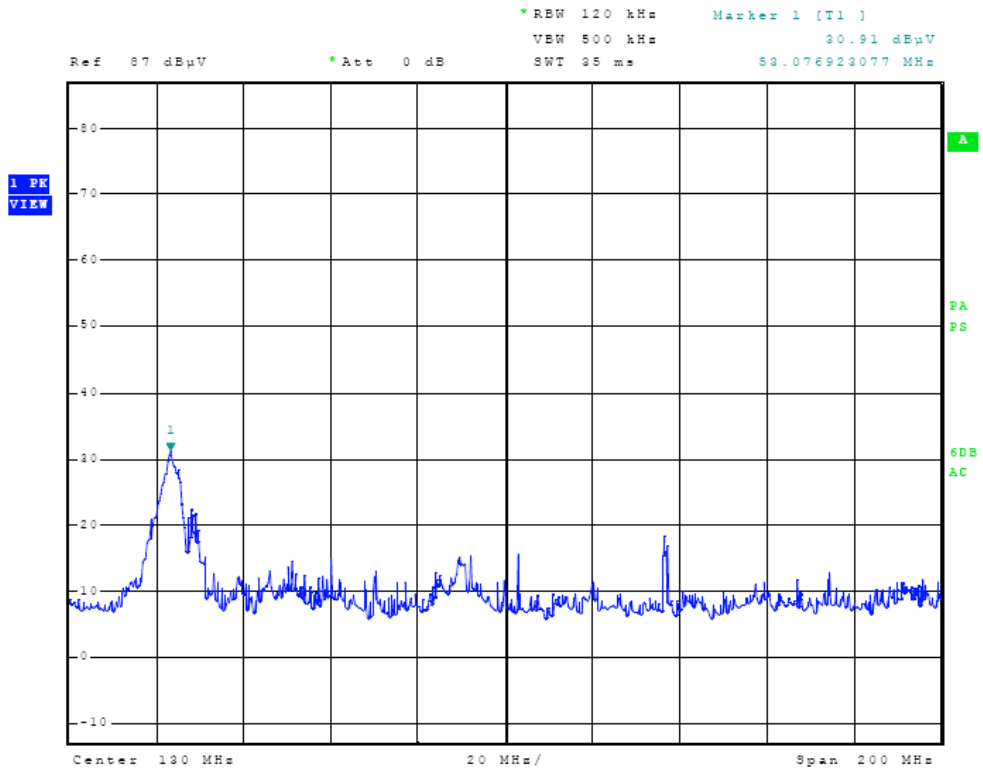

Figure Three Radiated Emissions in screen room (AC Charger operation)

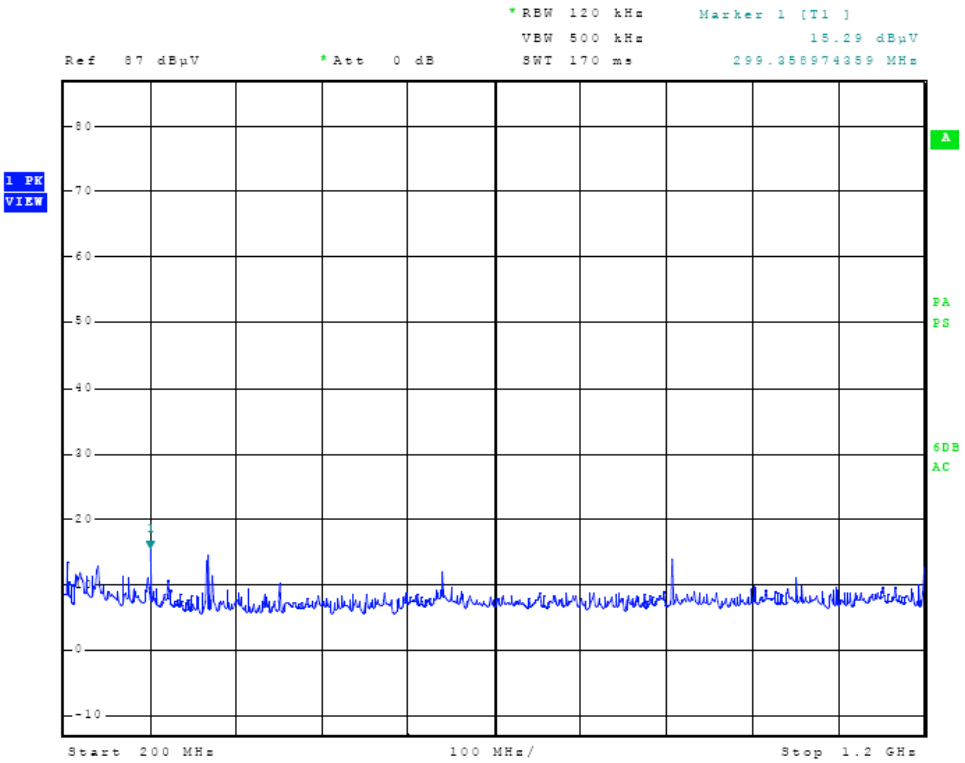

Figure Four Radiated Emissions in screen room (AC Charger operation)

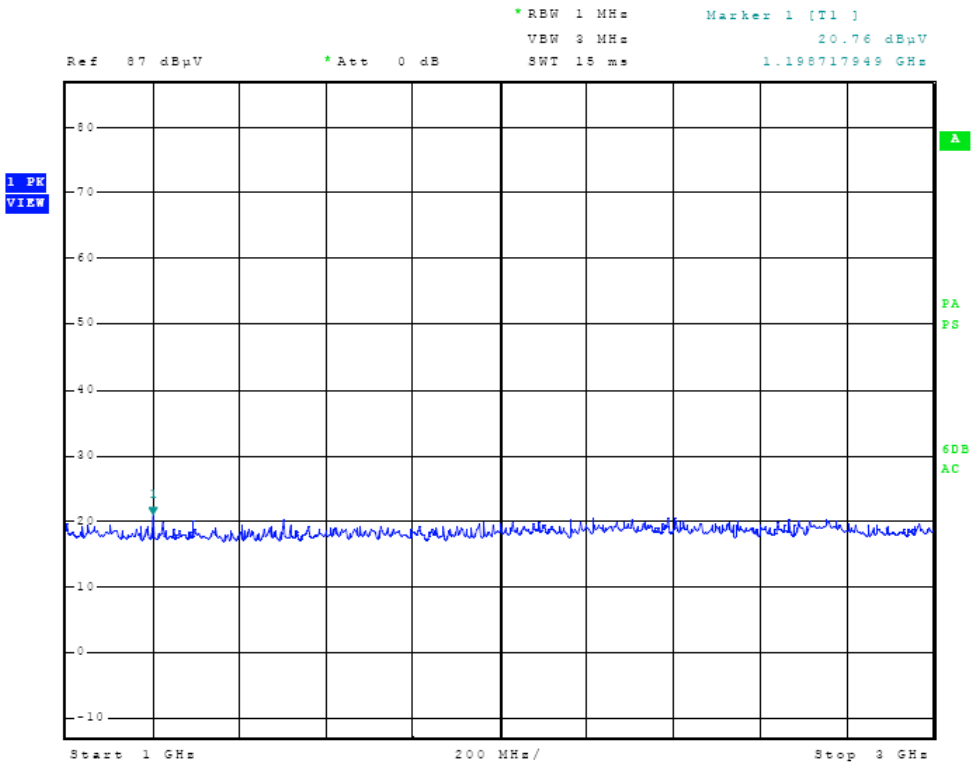

Figure Five Radiated Emissions in screen room (AC Charger operation)

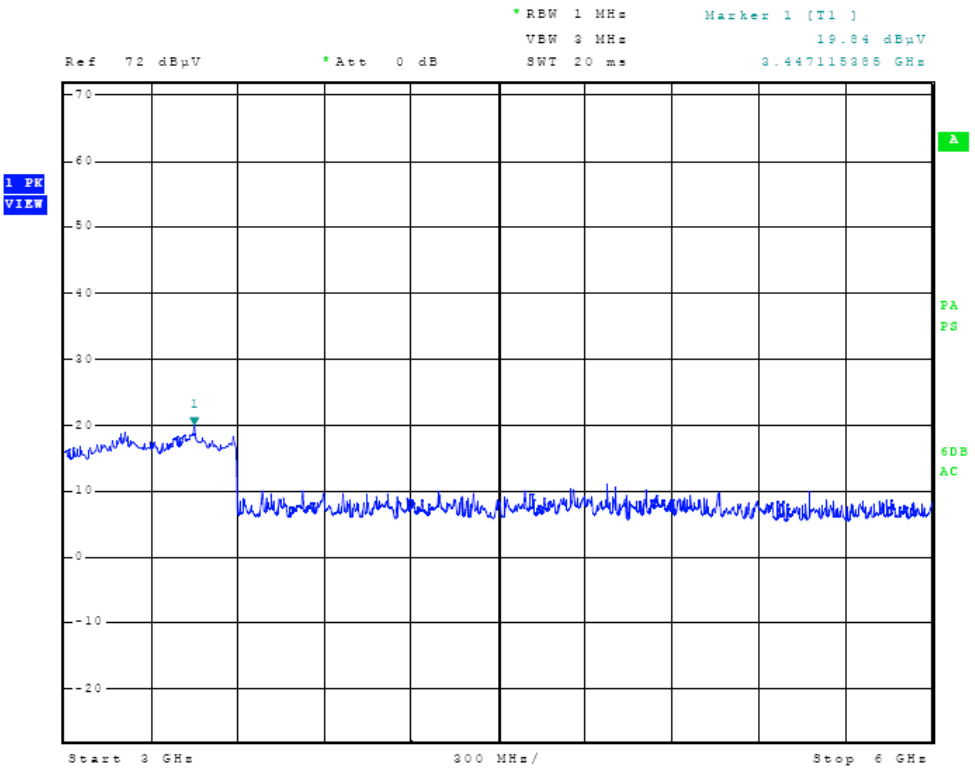

Figure Six Radiated Emissions in screen room (AC Charger operation)

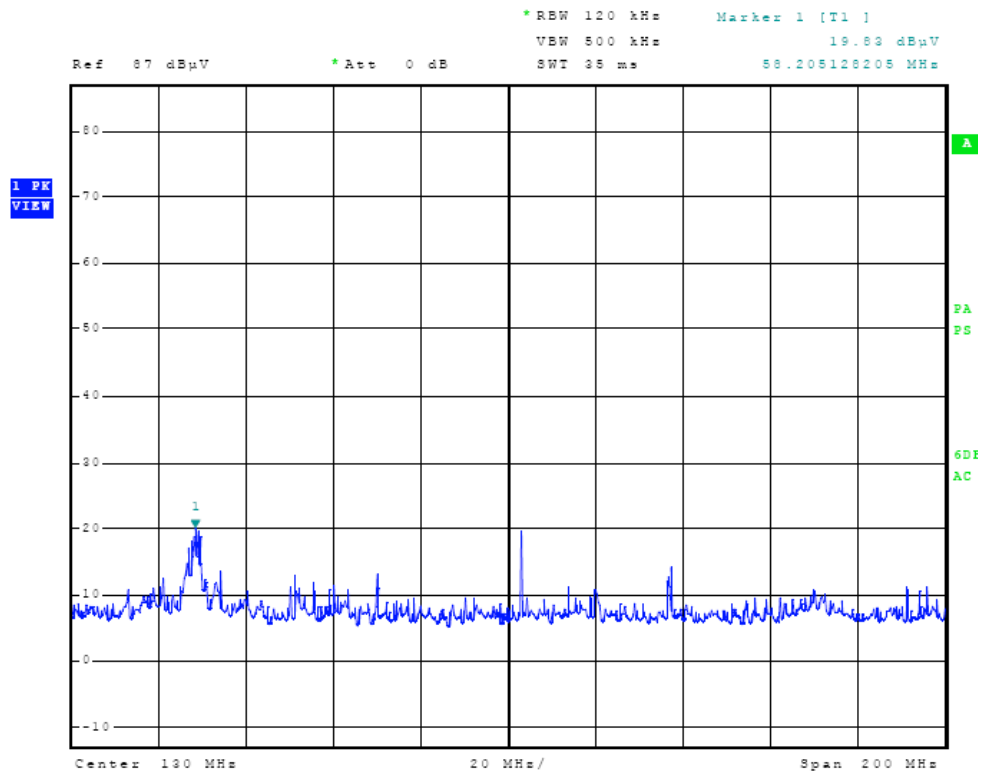

Figure Seven Radiated Emissions in screen room (Transmitter operation)

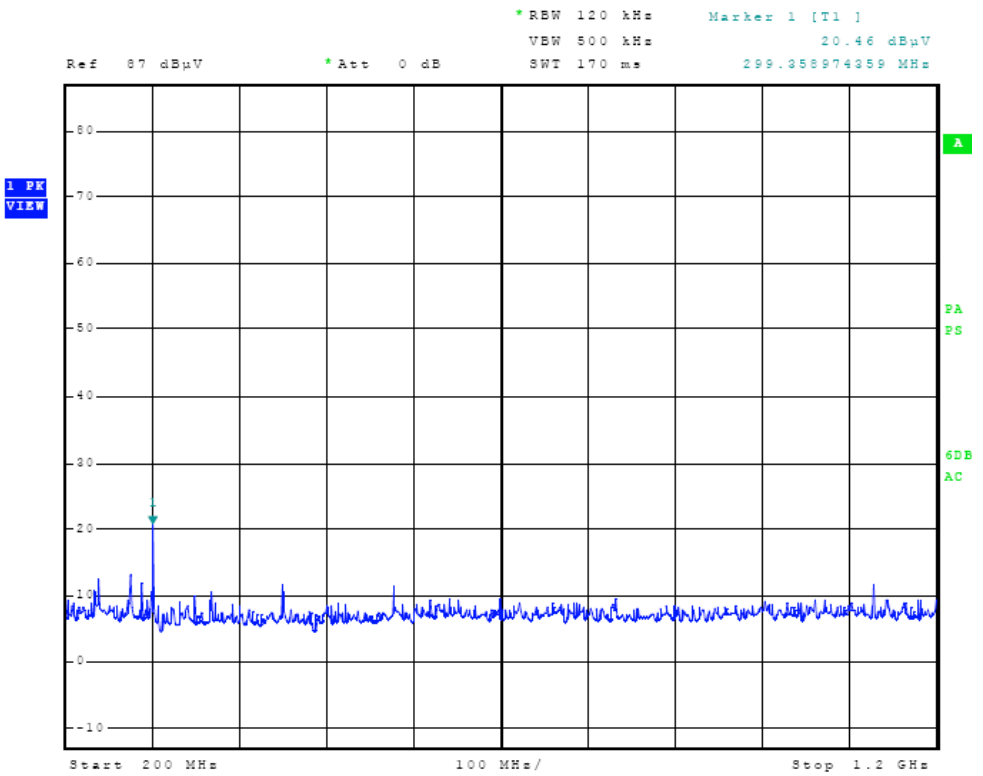

Figure Eight Radiated Emissions in screen room (Transmitter operation)

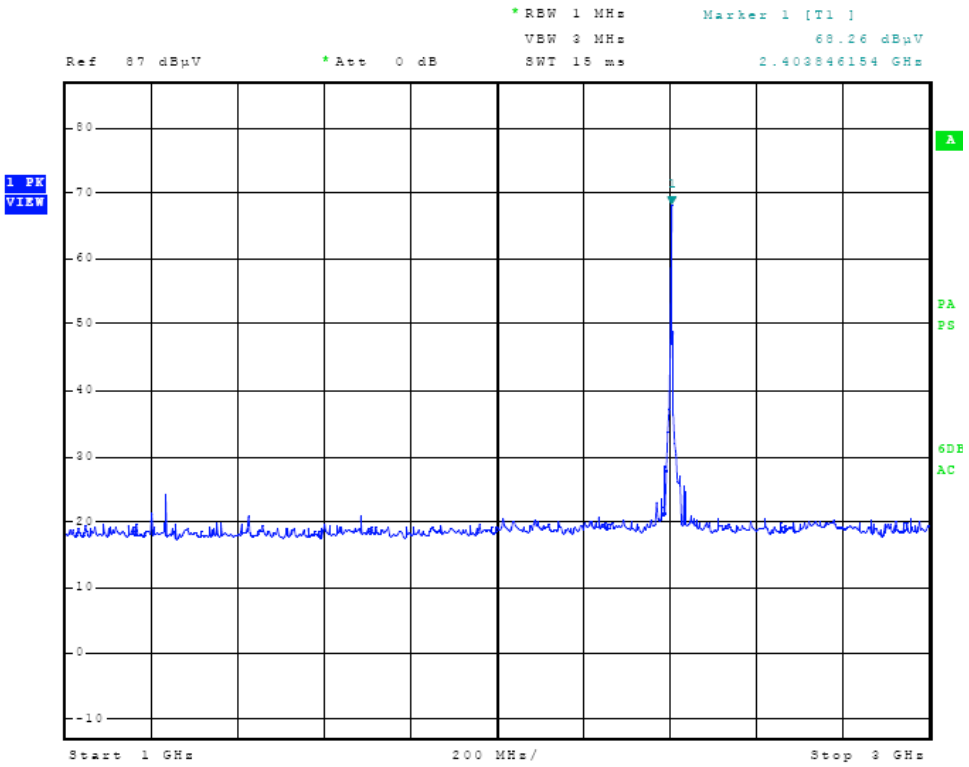

Figure Nine Radiated Emissions in screen room (Transmitter operation)

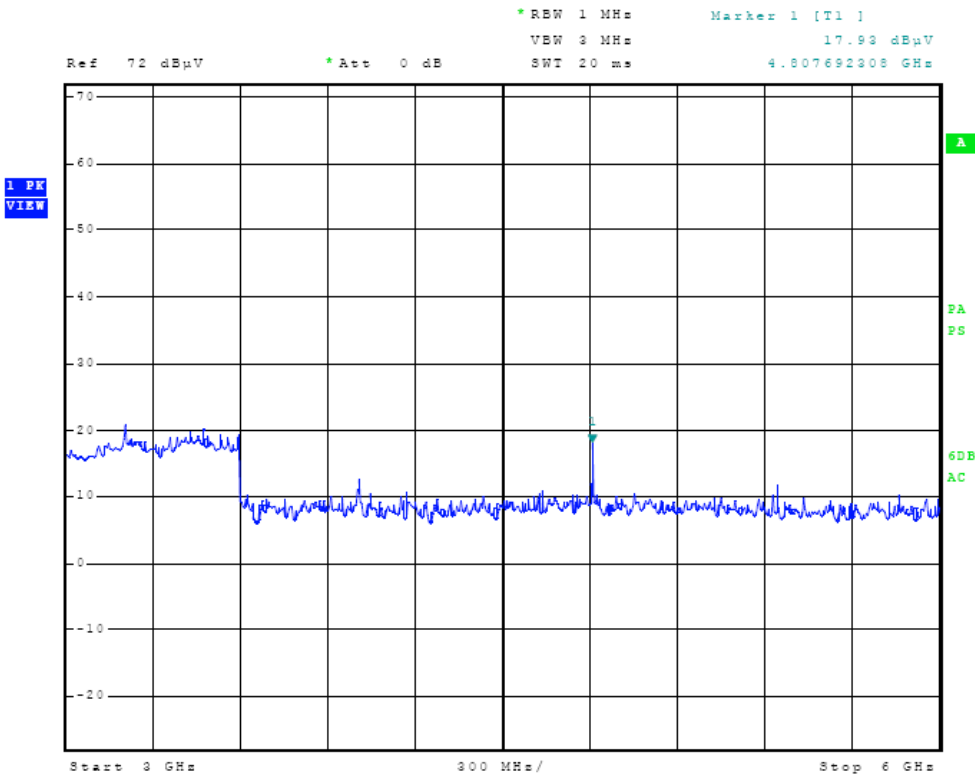

Figure Ten Radiated Emissions in screen room (Transmitter operation)

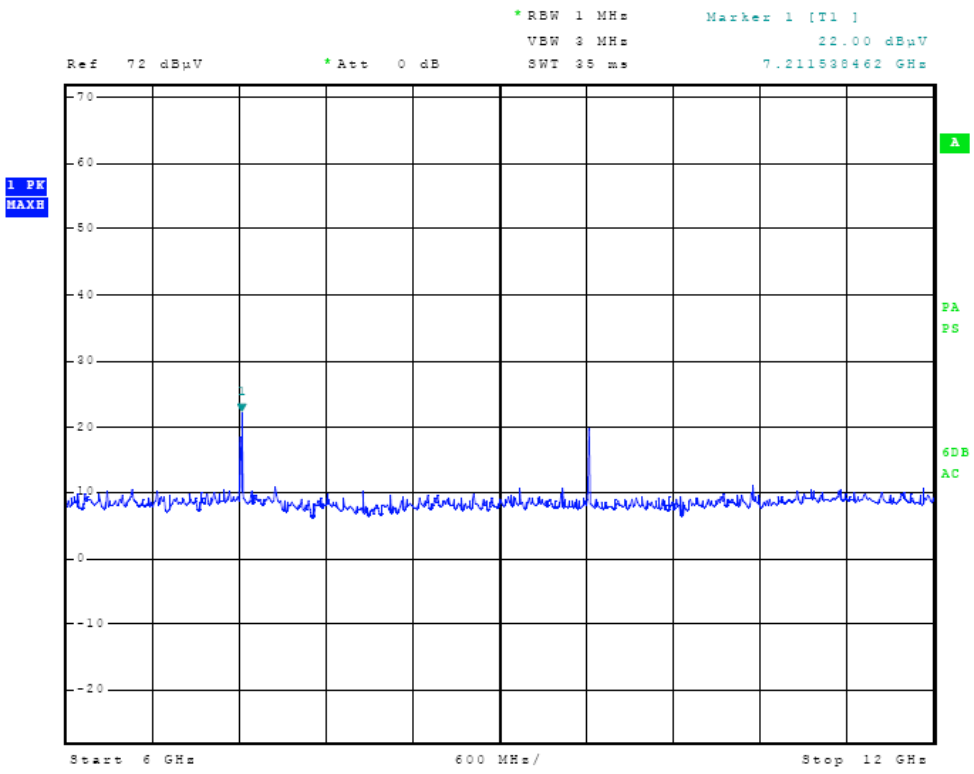

Figure Eleven Radiated Emissions in screen room (Transmitter operation)

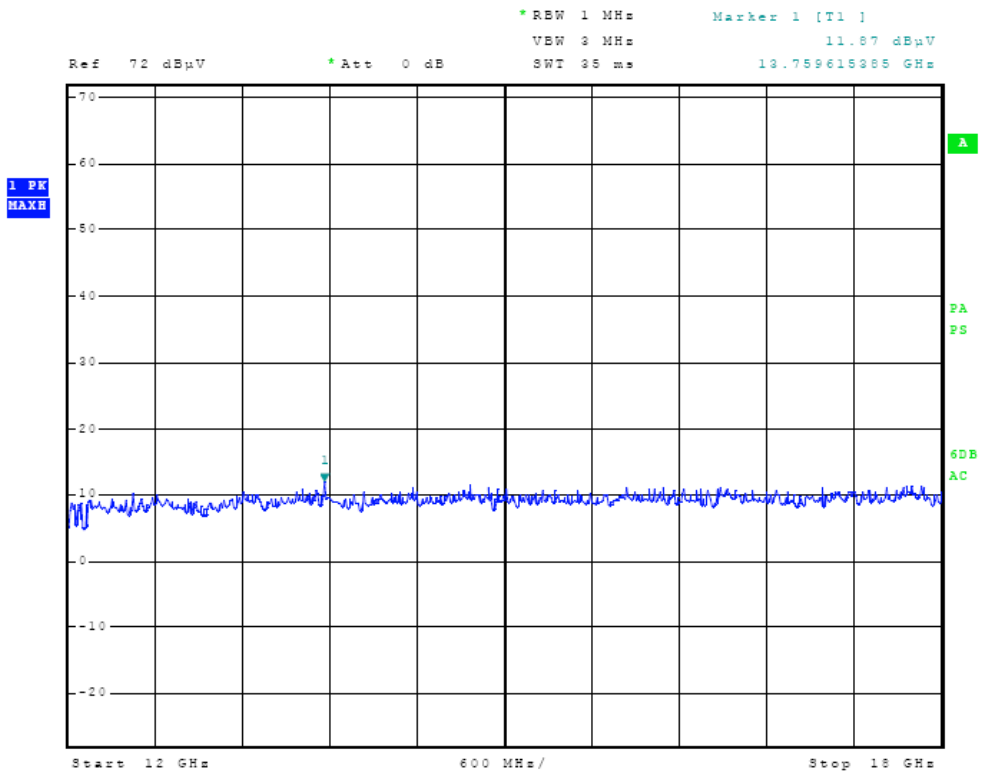

Figure Twelve Radiated Emissions in screen room (Transmitter operation)

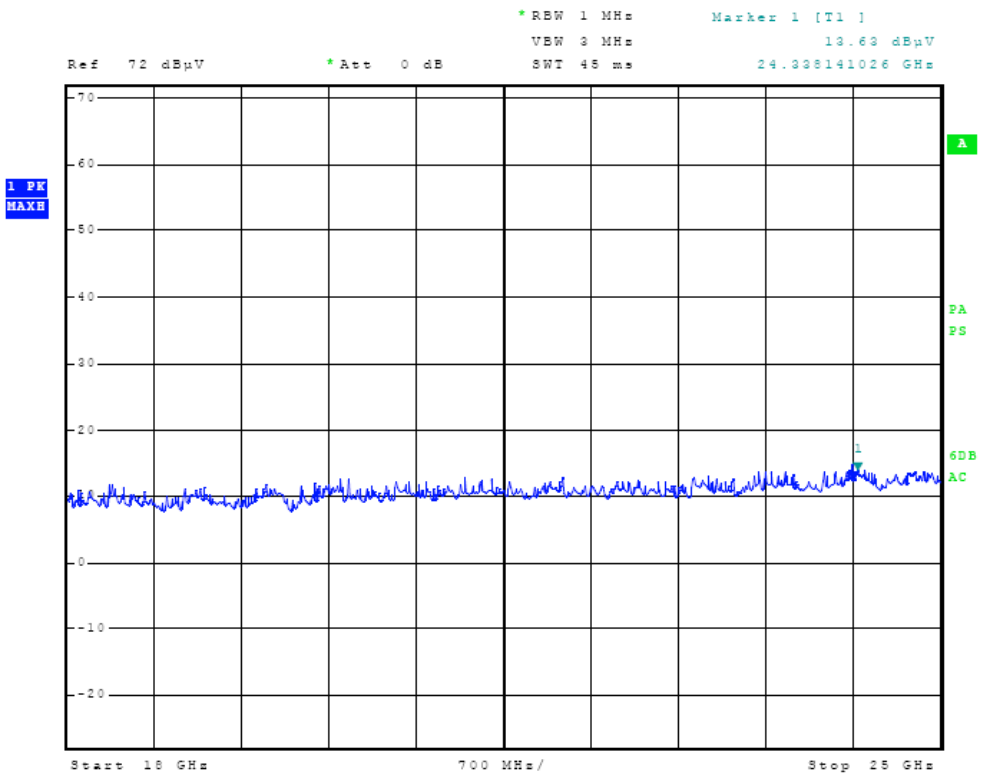

Figure Thirteen Radiated Emissions in screen room (Transmitter operation)

General Radiated Emissions Data

EUT operation in AC charger station

Emission Freq. (MHz)	FSM Horz. (dBµV)	FSM Vert. (dBµV)	Ant. Factor (dB)	Amp. Gain (dB)	RFS Horz. @ 10m (dBµV/m)	RFS Vert. @ 10m (dBµV/m)	Limit @ 10m (dBµV/m)
58.2	45.9	48.8	4.8	30	20.7	23.6	30.0
58.9	44.2	47.1	4.8	30	19.0	21.9	30.0
59.5	45.4	48.2	4.8	30	20.2	23.0	30.0
132.9	35.3	31.6	8.0	30	13.3	9.6	30.0
167.0	28.7	28.5	8.6	30	7.3	7.1	30.0
273.7	28.2	28.1	12.7	30	10.9	10.8	30.0
300.0	28.6	29.6	13.9	30	12.5	13.5	37.0

EUT transmitter operation

Emission Freq. (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)
2390.0	18.5	21.1	32.8	25	26.3	28.9	54

Other emissions were present with amplitudes at least 20 dB below limits.

Summary of Results for General Radiated Emissions

The EUT demonstrated compliance with the general radiated emissions requirements of FCC Part 15C and other applicable standards for Intentional Radiators. The EUT worst-case configuration demonstrated minimum margin of 6.4 dB below the limits. Other emissions were present with amplitudes at least 20 dB below the Limits.

Operation in the Band 2,400-2,483.5 MHz

The transmitter output power was measured on an open area test site at 3 meters distance. Test procedures of ANSI 63.4-2003 paragraphs 13.1 and 8.3.1.2 were used during testing. The amplitude of each radiated emission was measured on the OATS at a distance of 3 meters from the FSM antenna. The amplitude of each radiated emission was maximized by varying the FSM antenna height, polarization, and by rotating the turntable supporting the EUT. The amplitude of the emission was then recorded from the analyzer display. The peak and quasi-peak amplitude of frequencies below 1000 MHz were measured using a spectrum analyzer. The peak and average amplitude of frequencies above 1000 MHZ were measured using a spectrum analyzer. Emissions radiated outside of the specified bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in 15.209, whichever is the lesser attenuation. Plots of the EUT transmitting radiated emissions were taken in the screen room for reference. Refer to figures fourteen through twenty-six showing the frequency and amplitude of emission as displayed on the spectrum analyzer. 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 horn and/or Pyramidal Horn Antennas from 4 GHz to 25 GHz. Emissions were measured in dBμV/m @ 3 meters.

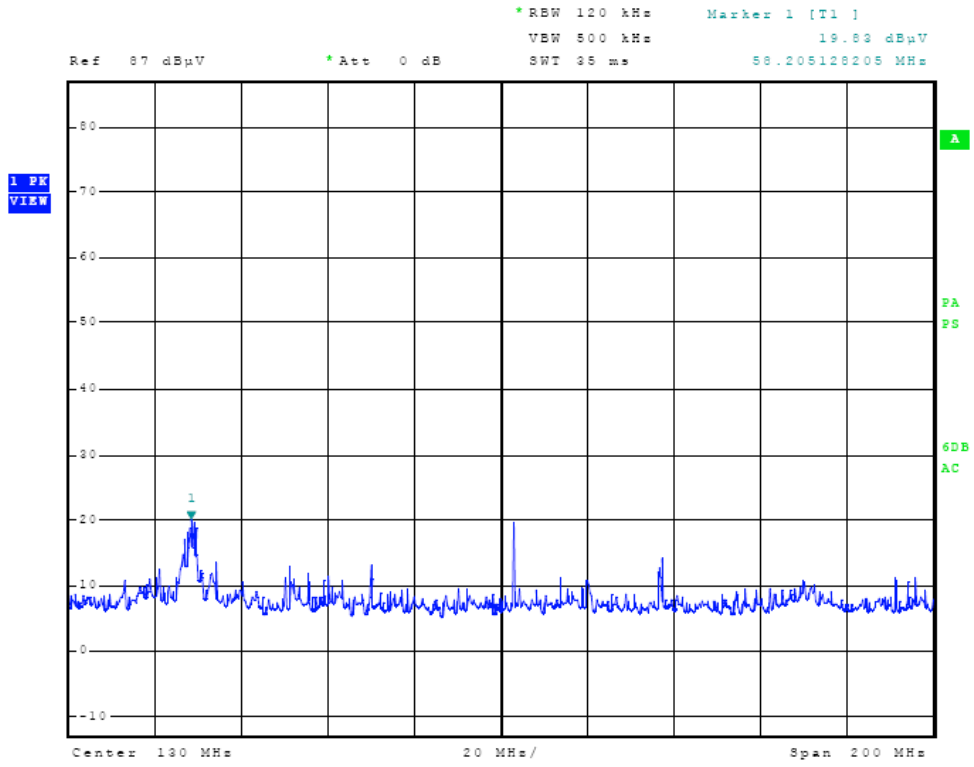

Figure Fourteen Transmitter Emissions Plot

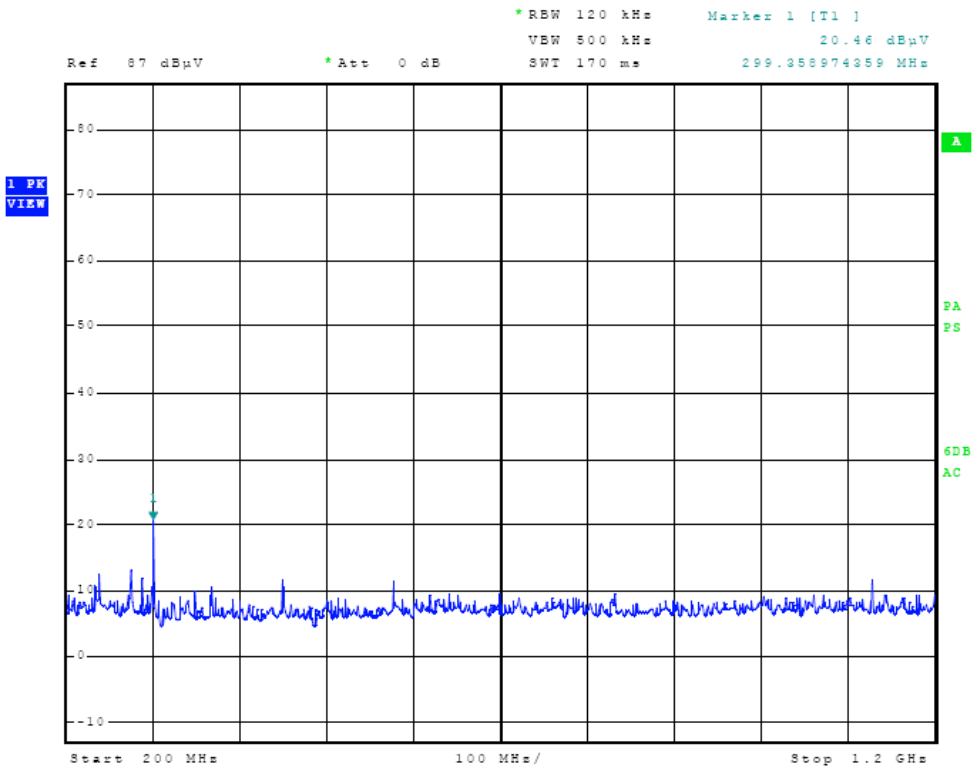

Figure Fifteen Transmitter Emissions Plot

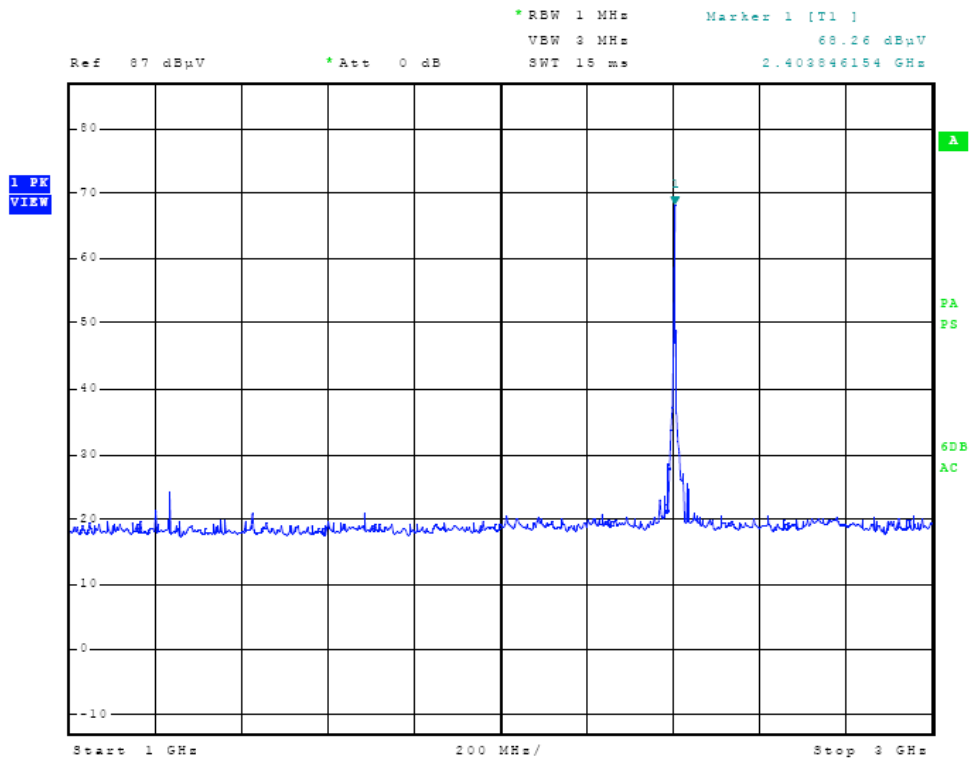

Figure Sixteen Transmitter Emissions Plot

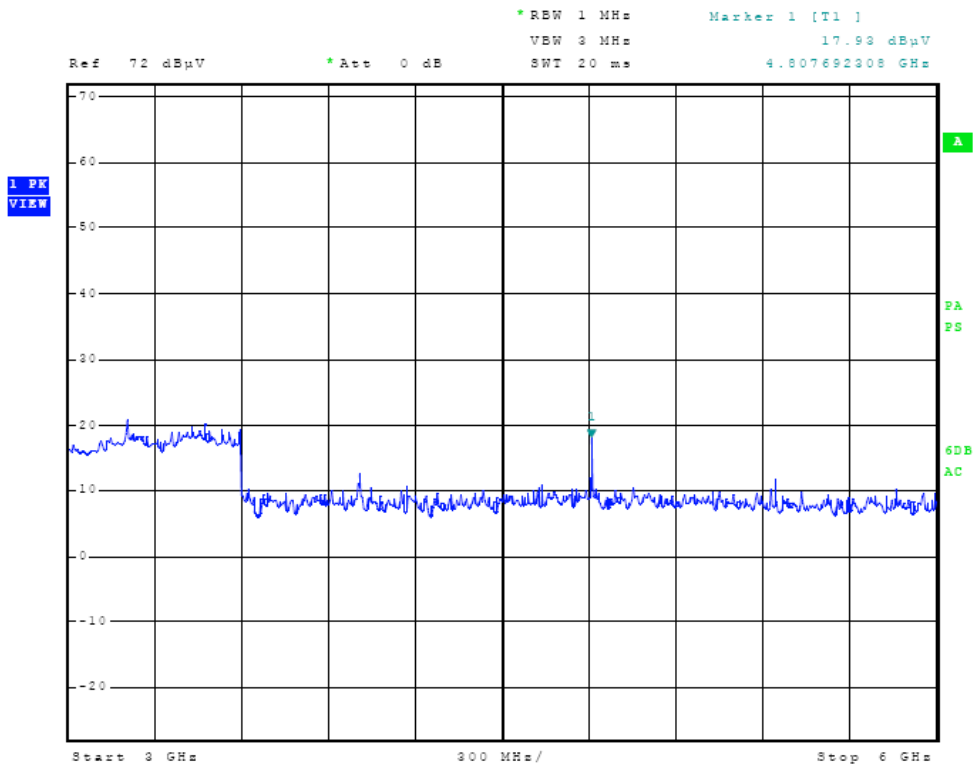

Figure Seventeen Transmitter Emissions Plot

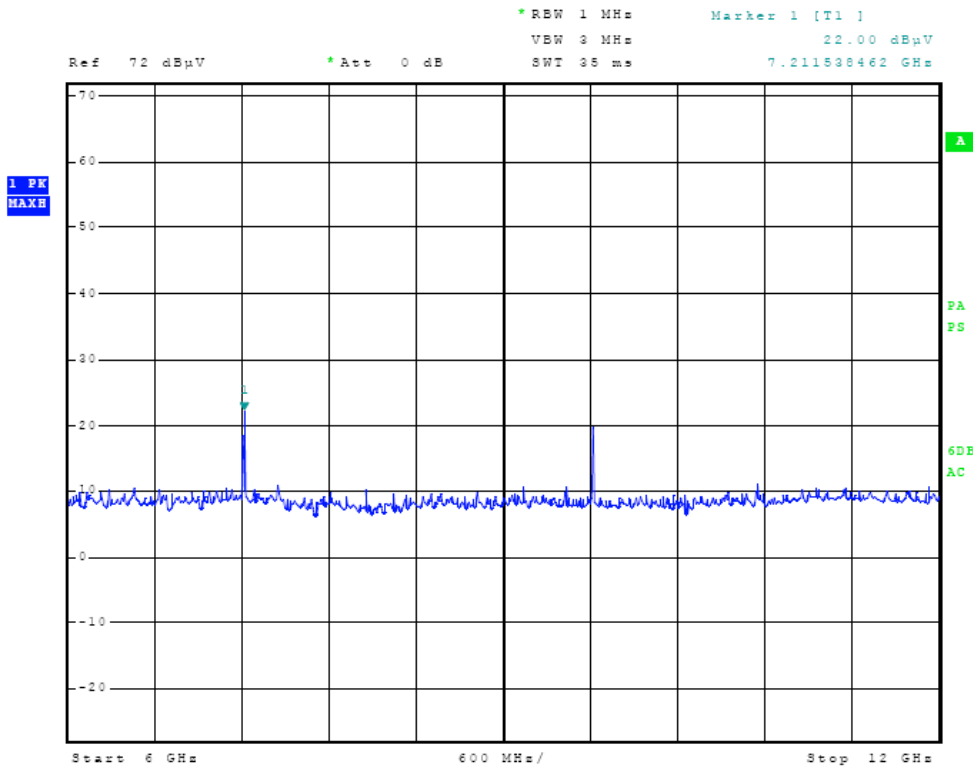

Figure Eighteen Transmitter Emissions Plot

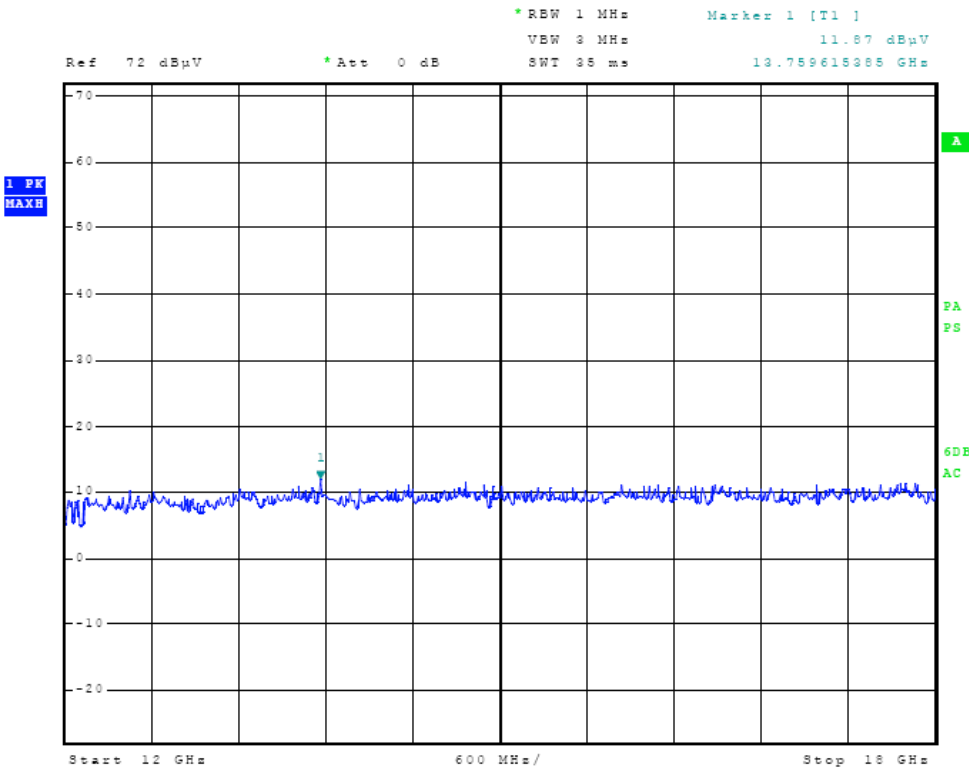

Figure Nineteen Transmitter Emissions Plot

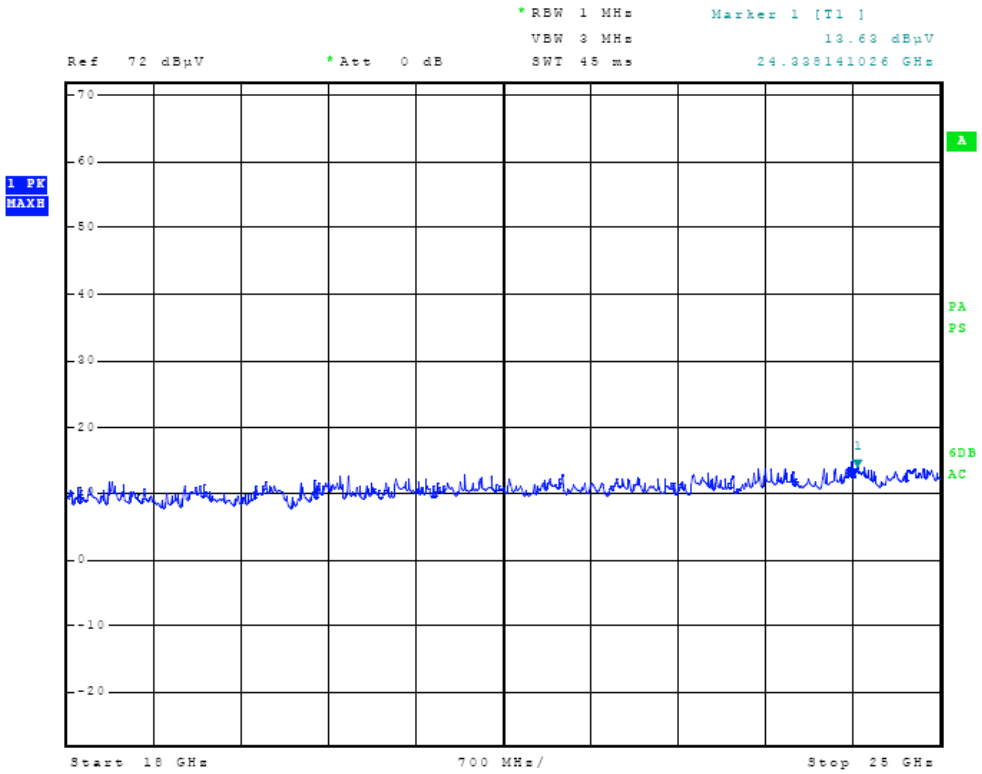

Figure Twenty Transmitter Emissions Plot

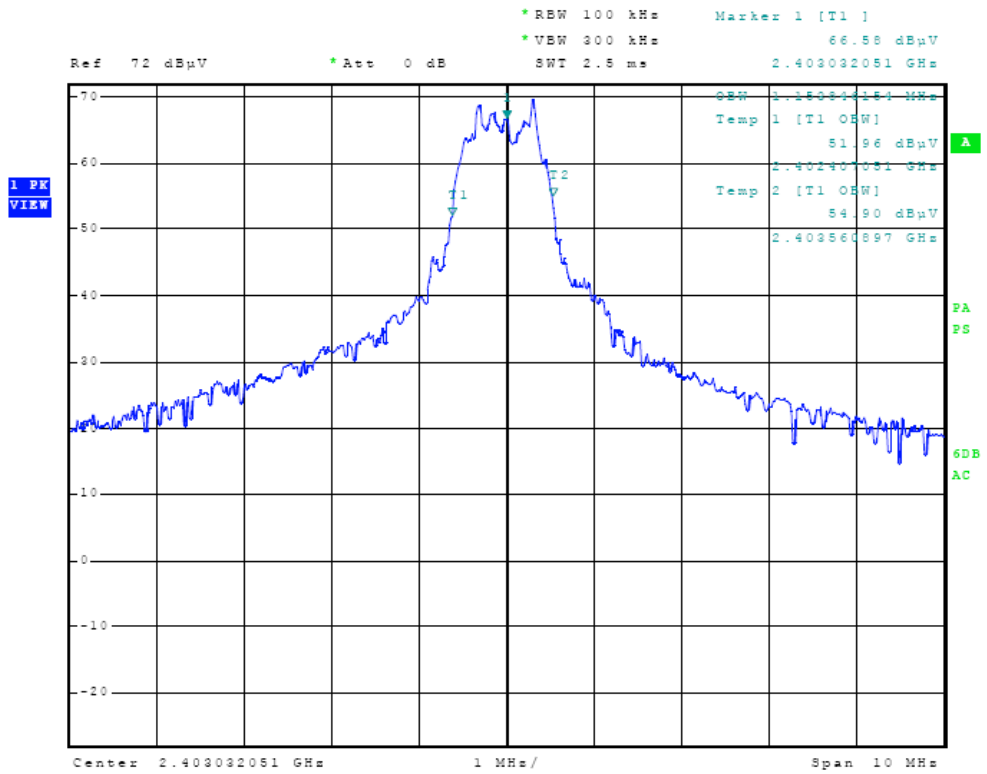

Figure Twenty-one Transmitter Emissions Plot Occupied Bandwidth (low channel)

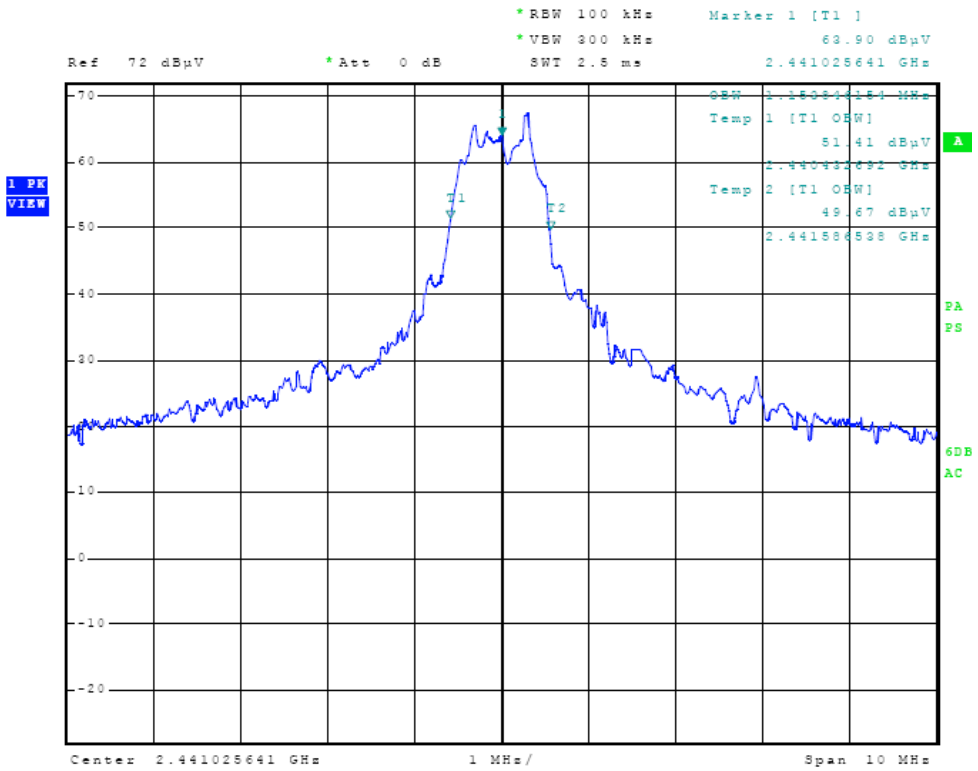

Figure Twenty-two Transmitter Emissions Plot Occupied Bandwidth (middle channel)

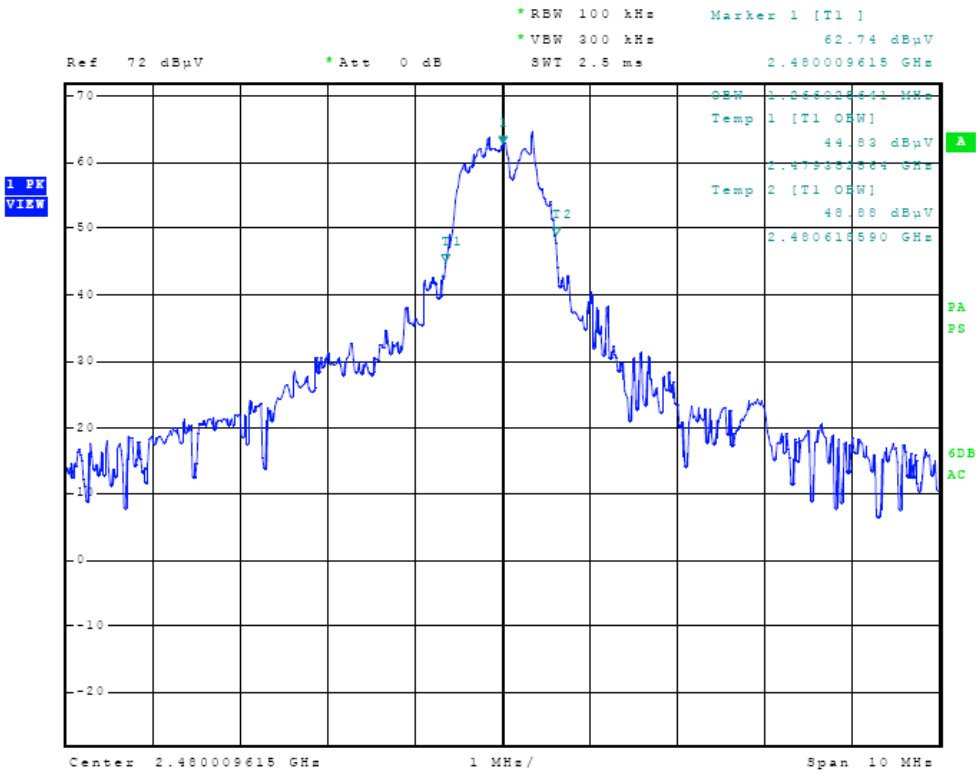

Figure Twenty-three Transmitter Emissions Plot Occupied Bandwidth (high channel)

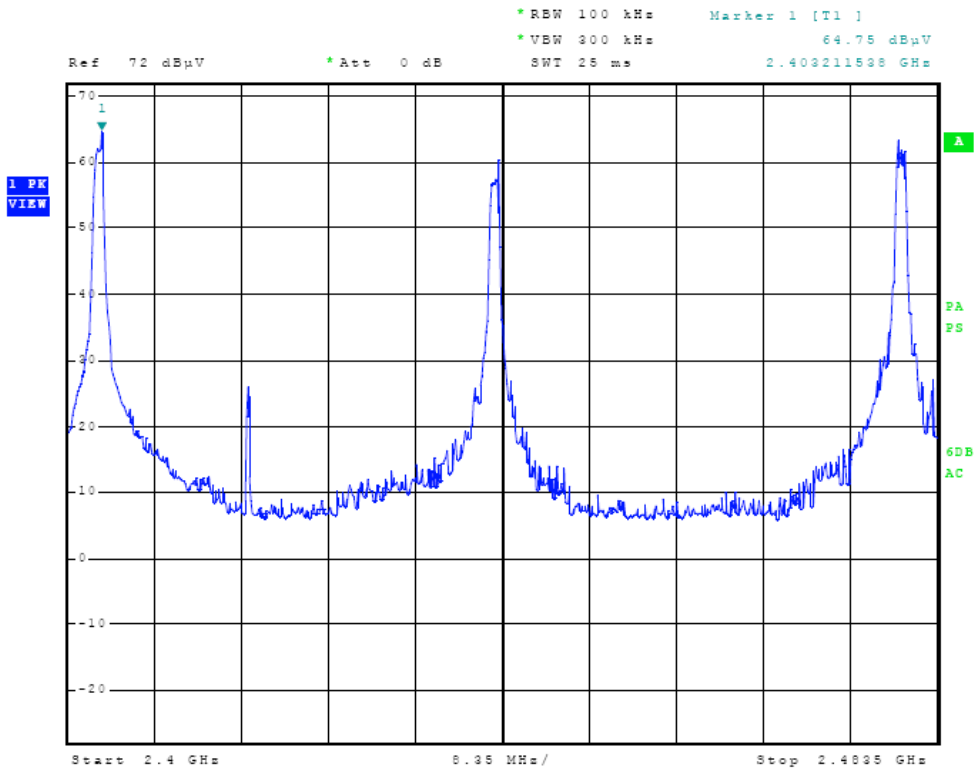

Figure Twenty-four Transmitter Emissions Operation across frequency band

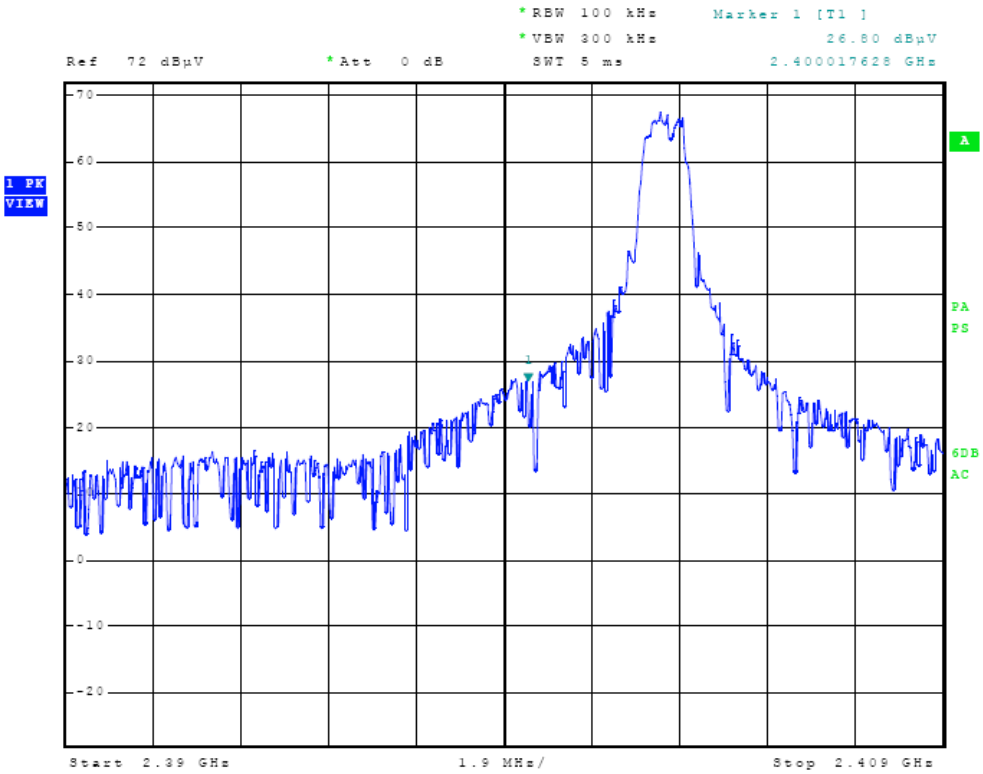

Figure Twenty-five Transmitter Emissions Low Band Edge

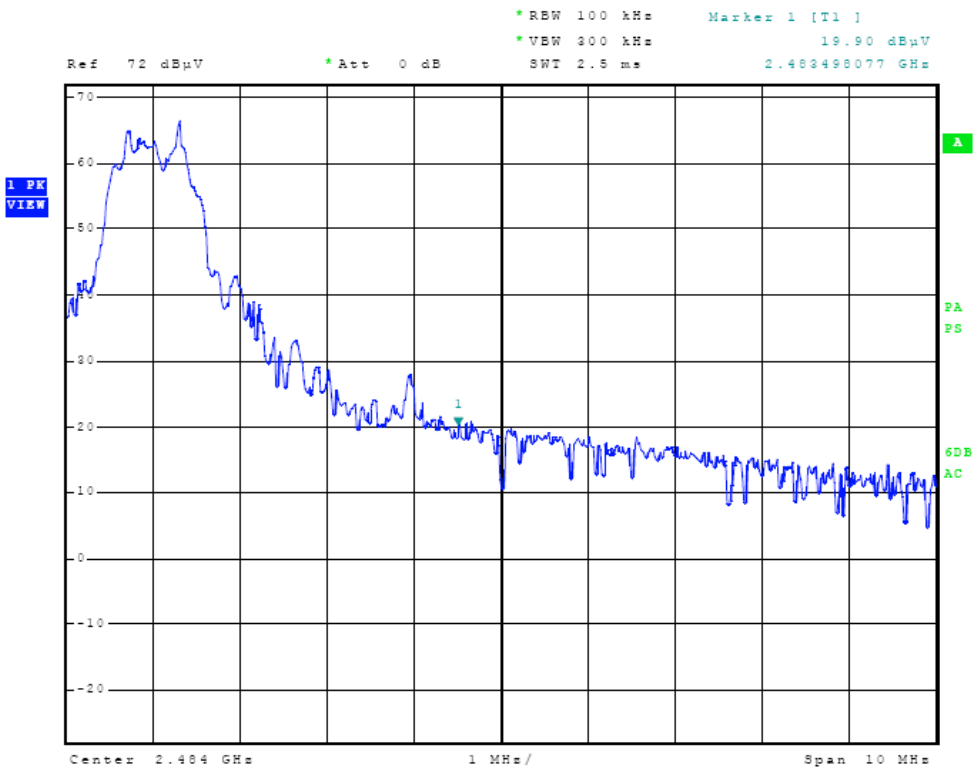

Figure Twenty-six Transmitter Emissions High Band Edge

Transmitter Radiated Emissions Data

Transmitter Emissions Summary Data

Frequency MHz	Peak Radiated Output Power dBµV/m	Occupied Bandwidth kHz
2403	86.4	1,153.8
2441	86.5	1,153.8
2480	86.6	1.266.0

Transmitter Radiated Emissions

Frequency	FSM Hor Peak	FSM Hor Ave	FSM Vert Peak	FSM Vert Ave	AF	Amp Gain	RFS @ 3 m Hor Peak	RFS @ 3 m Hor Ave	RFS @ 3 m Vert Peak	RFS @ 3 m Vert Ave	Ave Limit
2403.3	78.5	51.3	74.8	49.6	32.9	25	86.4	59.2	82.7	57.5	94.0
4806.6	40.5	20.3	43.5	21.4	32.7	25	48.2	28.0	51.2	29.1	54.0
7209.9	26.1	13.3	27.0	13.5	36.2	25	37.3	24.5	38.2	24.7	54.0
9613.2	27.3	15.0	27.1	14.9	38.1	25	40.4	28.1	40.2	28.0	54.0
12016.5	24.0	11.9	24.1	11.9	40.0	25	39.0	26.9	39.1	26.9	54.0
2441.3	78.1	50.8	73.9	48.9	33.4	25	86.5	59.2	82.3	57.3	94.0
4882.6	34.2	18.1	39.8	20.8	32.8	25	42.0	25.9	47.6	28.6	54.0
7323.9	23.4	11.0	25.7	11.4	36.5	25	34.9	22.5	37.2	22.9	54.0
9765.2	27.4	15.6	27.8	15.4	38.2	25	40.6	28.8	41.0	28.6	54.0
12206.5	23.3	11.9	23.7	11.9	40.4	25	38.7	27.3	39.1	27.3	54.0
2480.0	78.3	52.1	72.9	48.3	33.3	25	86.6	60.4	81.2	56.6	94.0
4960.0	35.1	17.9	36.9	19.5	32.9	25	43.0	25.8	44.8	27.4	54.0
7440.0	25.2	12.3	24.6	11.9	36.7	25	36.9	24.0	36.3	23.6	54.0
9920.0	27.3	15.5	27.6	15.4	38.4	25	40.7	28.9	41.0	28.8	54.0
12400.0	23.8	11.7	23.5	11.7	40.7	25	39.5	27.4	39.2	27.4	54.0

Note: Levels measured @ 3-meter OATS site.

Summary of Results for Transmitter Radiated Emissions

The EUT demonstrated compliance with the radiated emissions requirements of FCC CFR 47 Part 15.249 and other applicable standards for Intentional Radiators. The EUT worst-case configuration demonstrated minimum peak amplitude emission margin of 7.4 dB below average limit. The EUT worst-case configuration demonstrated minimum radiated harmonic emission margin of 24.9 dB below the limits. No other radiated emissions were found in the restricted bands less than 20 dB below limits than those recorded in this report. Other emissions were present with amplitudes at least 20 dB below the Limits.

Annex

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

List of Test Equipment	Calibration Date
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. Six years working in the automated controls industry and 6 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

NVLAP Lab Code 200087-0

Annex D FCC Test Site Registration Letter

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

June 18, 2008

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: June 18, 2008

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

Annex E Industry Canada Test Site Registration Letter

Industry Canada Industrie Canada

July 29th, 2008

OUR FILE: 46405-3041
Submission No: 127059

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

Attention: Scot D. Rogers

Dear Sir/Madame:

The Bureau has received your application for the registration / 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 **(3040A-1).** Please reference the appropriate site number in the body of test reports containing measurements performed on the site. In addition, please be informed that the Bureau is now utilizing a **new site numbering scheme** in order to simplify the electronic filing process. Our goal is to reduce the number of secondary codes associated to one particular company. The following changes have been made to your records.

Your primary code is: **3041**
The company number associated to the site(s) located at the above address is: **3041A**
The table below is a summary of the changes made to the unique site registration number(s):

New Site Number	Obsolete Site Number	Description of Site	Expiry Date (YYYY-MM-DD)
3041A-1	3041-1	3 / 10m OATS	2010-07-29

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 shall be accepted. Please indicate in a letter the previous assigned site number if applicable and the type of site (example: 3 meter OATS or 3 meter 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;

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,

S. Proulx Wireless Laboratory
Manager Certification and
Engineering Bureau Industry Canada
3701 Carling Ave., Building 94
Ottawa, Ontario K2H 8S2
Canada

Canada