NVLAP Lab Code 200087-0

Application For
Grant of Certification

FOR

Model: **01102257**

P/N 011-02257-xx

Low Power Transmitter

FCC ID: IPH-01617K

IC: 1792A-01617K

FOR

GARMIN INTERNATIONAL, INC.

1200 East 151st Street

Olathe, KS 66062

Test Report Number 090819

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: 01102257

P/N 011-02257-xx

Low Power Transmitter

Frequency Range: 2,402-2,480 MHz

FCC ID: IPH-01617K
IC: 1792A-01617K

Test Report Number: 090819

Test Date: August 19, 2009

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 is submitted for consideration in obtaining Grant of Certification for low power intentional radiator per CFR47 Paragraph 15.249, and Industry Canada RSS-210, operation in the 2400 – 2483.5 MHz band.

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

Model: 01102257, P/N 011-02257-xx

FCC ID: IPH-01617K Industry Canada ID: 1792A-01617K

Frequency Range: 2402-2480 MHz

Operating Power: Less than 2 mW (as design specification, measured peak 92.3 dBµV/m @ 3 meters), for operation in the 2402-2480 MHz, Occupied band width 889.4 kHz

Applicable Standards & Test Procedures

In accordance with the Federal Communications Commission, Code of Federal Regulations CFR47, dated October 1, 2008, Part 2, Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1031 through 2.1057, applicable parts of paragraph 15, Part 15C paragraph 15.249, and Industry Canada 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 63.4-2003 Document.

Opinion / Interpretation of Results

Test Performed	Minimum Margin (dB)	Results
Antenna requirement per CFR47 15.203	NA	Complies
Restricted Bands Emissions as per CFR47 15.205	25.0	Complies
AC Line Conducted Emissions as per CFR47 15.207	9.6	Complies
Radiated Emissions as per CFR47 15.209	22.4	Complies
Antenna Power conduction for Receivers per CFR47 15.111	14.5	Complies
Emissions per CFR47 15.249	1.9	Complies
Emissions per RSS-210	As Documented	Complies

Environmental Conditions

Ambient Temperature	24.9° C
Relative Humidity	45%
Atmospheric Pressure	1020.1 mb

Statement of Modifications and Deviations

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

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.

dBµV/m @ 3m = FSM(dBµV) + A.F.(dB/m) - Amp Gain(dB)
dBµV/m @ 3m = 17.4 + 32.8 – 25
= 25.2

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

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		
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

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-01617K IC: 1792A-01617K

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

(4) Description of Circuit Functions, Device Operation: The 01102257 is a location and navigation display device incorporating a low power Transmitter. This device features low power communications transmitter operation in frequency band of 2402-2480 MHz.

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

(6) Report of measurements demonstrating compliance with the pertinent FCC/IC technical requirements are 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 and USB cable for computer interface. The available configuration options were investigated for this and other reports in compliance to 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.#
01102257	011-02257-xx	IPH-01617K
EUT (Temp Antenna Port)	1617 3638240006	
CLA Power Adapter	320-00239-26	N/A
GTM25 Power Adapter	011-1958-xx	N/A
AC Power Adapter	362-00042-00	N/A
AC Power Adapter	362-00043-04	N/A

Equipment and Cable Configuration

Test Setup

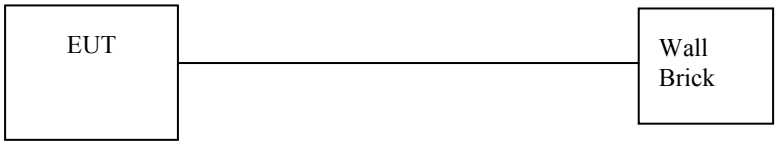
The 01102257 is a GPS receiver/display used for location and navigation and incorporates low power transmitter allowing short-range communications in the 2400-2483.5 MHz. The GPS receiver is used to receive and display location and navigation information for the user. The unit was designed as a portable hand held or automotive mounted device. The transmitter section allows for short-range communications to other compliant equipment. The EUT was arranged as 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 internal batteries or receives power from optional equipment 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 with transmitter operation capability in the 2400-2483.5 MHz frequency band (CFR47 15.249 and RSS-210). The equipment offers communications to other 2402-2480 MHz compliant devices. Two samples were offered for testing. EUT (Sample #1) was supplied for testing as a production design. Sample #2 was modified for testing purposes only replacing the integral antenna with a 50 ohm antenna port.

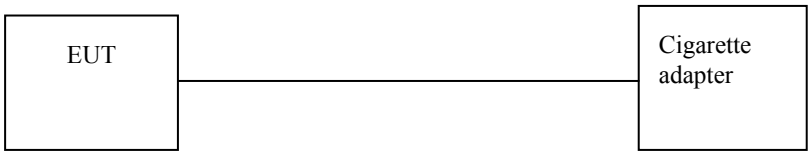
Configuration options for the EUT

1. EUT (GPN: 011-02257-XX) Li-Ion battery charged by the AC wall brick power supply (GPN: 362-00042-00 or 362-00043-04).



2. EUT (GPN: 011-02257-XX) connected to computer through USB cable (GPN: 325-00128-05).

3. EUT (GPN: 011-02257-XX) connected to car cigarette lighter power cable assembly (GPN: 320-00239-26)



4. EUT (GPN: 011-02257-XX) connected to GTM25 cable assembly (011-01958-xx)

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 CFR47 Part 15, Subpart C and RSS-210 the following information is submitted for consideration in obtaining grant of certification for unlicensed intentional radiators.

Antenna Requirements

The unit is produced with a permanently attached transmitter antenna inside the sealed plastic case. No provisions for modification or alterations of the antenna configuration are available to the end user. For testing purposes, a second test sample was modified to allow for antenna-conducted emissions testing of transceiver for this and other compliance standards. 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	17.4	17.7	32.8	25	25.2	25.5	54.0
2400.0	20.0	19.3	32.8	25	27.8	27.1	54.0
2483.5	18.1	18.1	33.5	25	26.6	26.6	54.0
4804.0	21.1	19.8	32.9	25	29.0	27.7	54.0
4882.0	19.6	19.4	32.9	25	27.5	27.3	54.0
4960.0	19.2	18.7	32.9	25	27.1	26.6	54.0
7206.0	14.3	14.2	36.0	25	25.3	25.2	54.0
7323.0	15.7	15.4	36.4	25	27.1	26.8	54.0
7440.0	15.0	15.0	36.7	25	26.7	26.7	54.0
12010.0	9.4	9.3	40.0	25	24.4	24.3	54.0
12205.0	9.2	9.1	40.4	25	24.6	24.5	54.0
12400.0	9.0	8.9	40.6	25	24.6	24.5	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 CFR47 Part 15.205 and RSS-210 restricted bands of operation. The EUT worst-case configuration demonstrated minimum margin of 25.0 dB below the CFR47 and RSS-210 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 configurations (AC power adapter). 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. Each AC adapter for the EUT 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 through four showing plots of the worst-case AC Line conducted emissions frequency spectrum of the AC adapter configurations taken in the screen room. Refer to Figures five and six showing plots of the worst-case AC Line conducted emissions frequency spectrum of the CPU AC adapter configuration taken in the screen room.

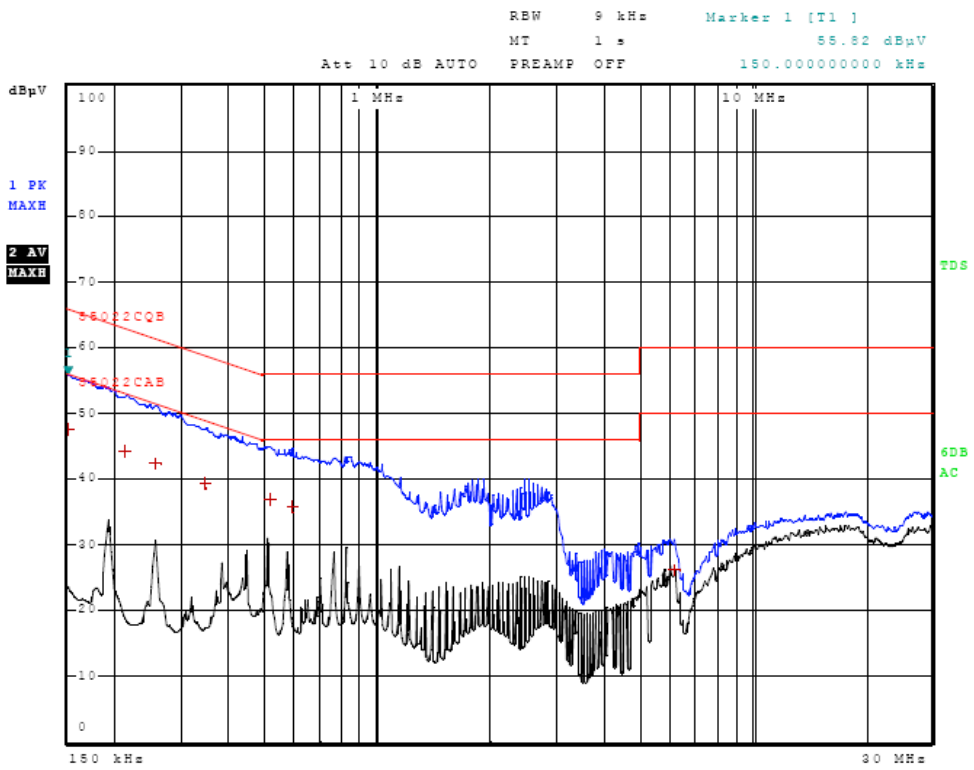


Figure One AC Line Conducted emissions of EUT line 1 (Configuration #1, 362-00042-00)

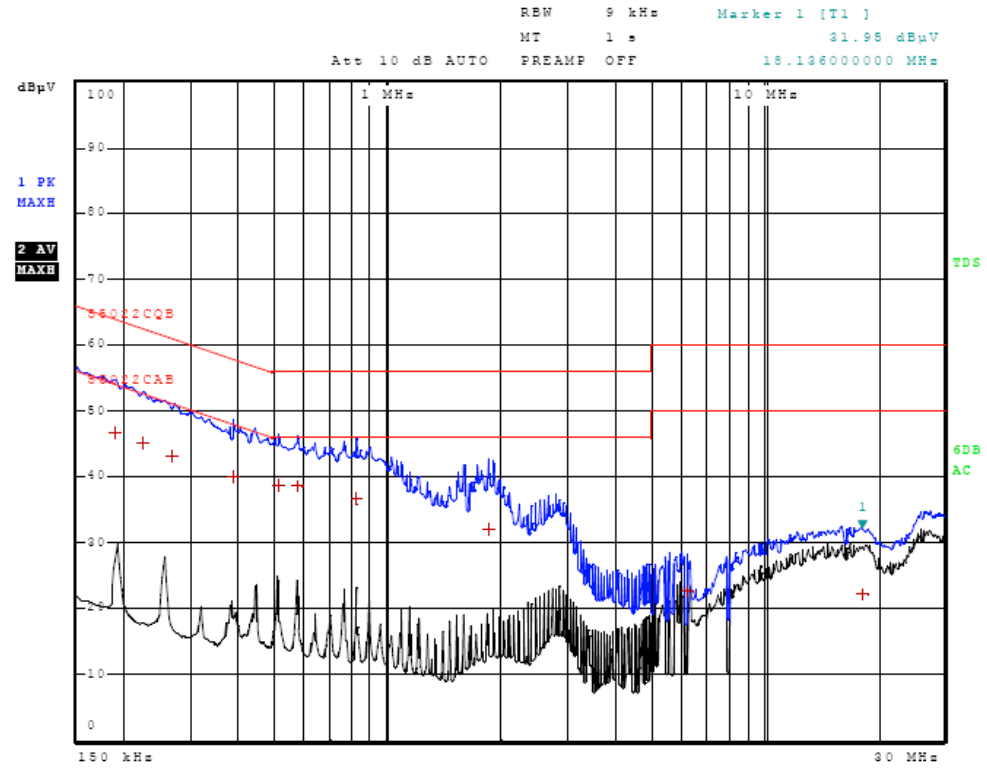


Figure Two AC Line Conducted emissions of EUT line 2 (Configuration #1, 362-00042-00)

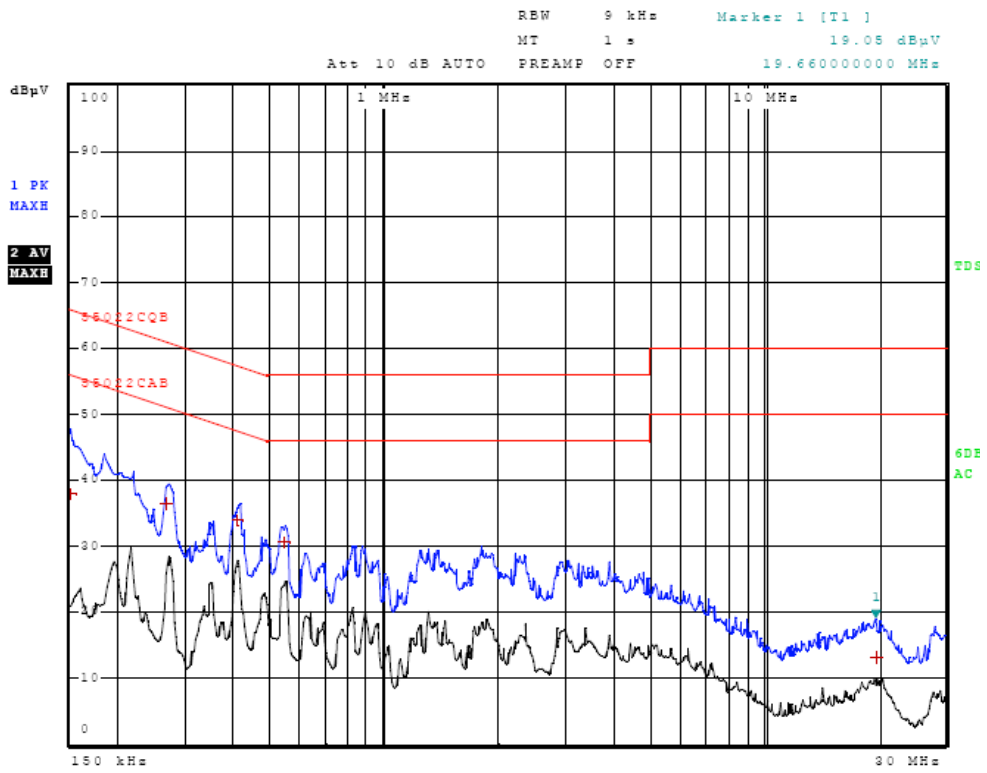


Figure Three AC Line Conducted emissions of EUT line 1 (Configuration #1, 362-00043-04)

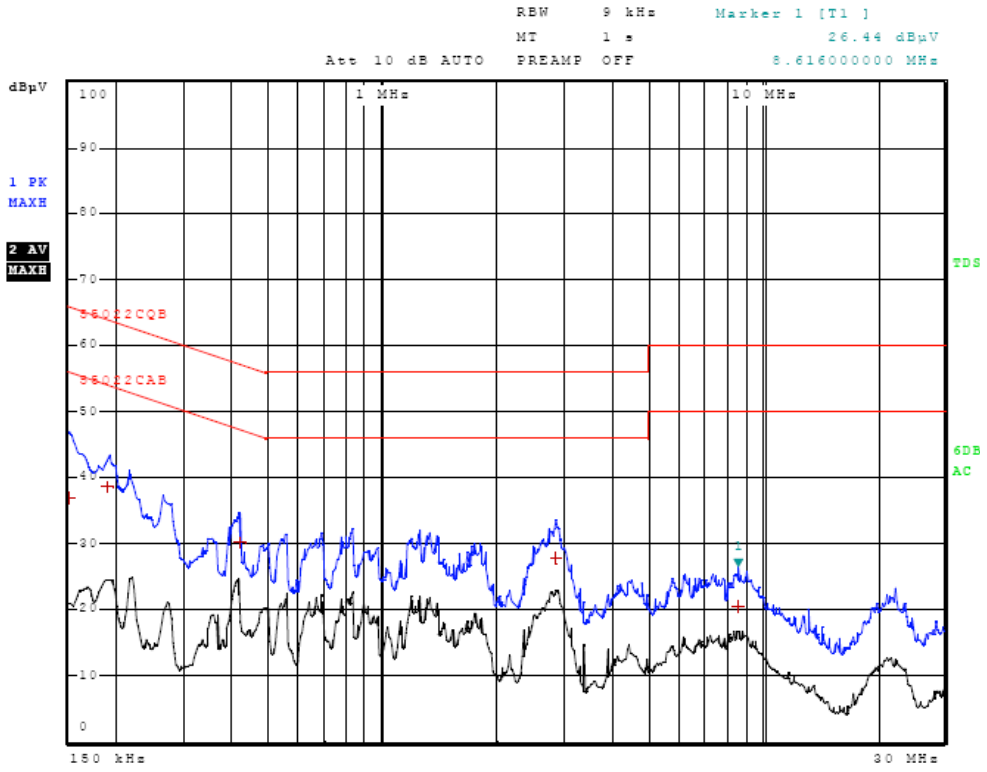


Figure Four AC Line Conducted emissions of EUT line 2 (Configuration #1, 362-00043-04)

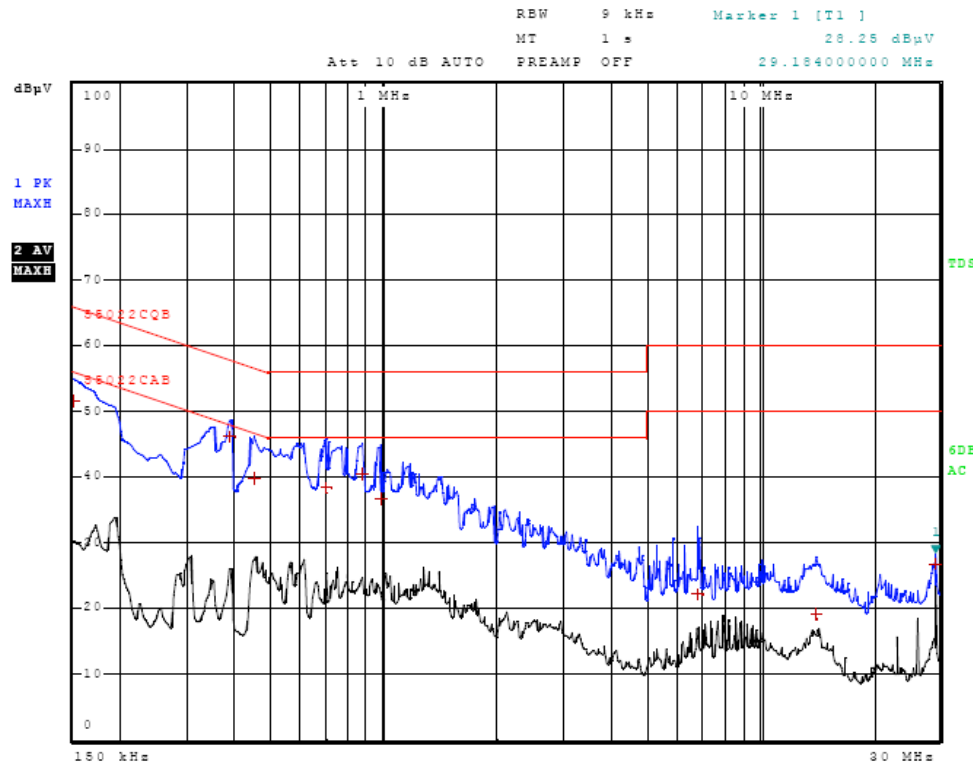


Figure Five AC Line Conducted emissions of EUT line 1 (Configuration #2, CPU)

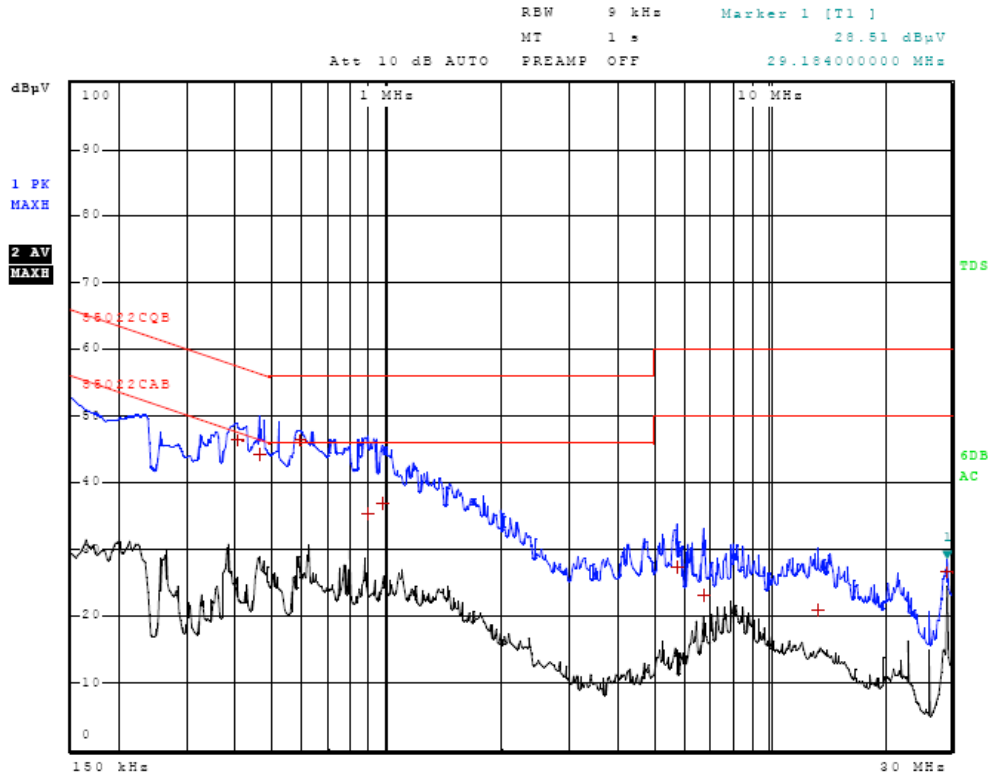


Figure Six AC Line Conducted emissions of EUT line 2 (Configuration #2, CPU)

AC Line Conducted Emissions Data (AC Charger Worst-case)

362-00042-00 Line 1

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	150.000000000 kHz	47.49	Quasi Peak	-18.51
1	214.000000000 kHz	44.31	Quasi Peak	-18.74
1	258.000000000 kHz	42.42	Quasi Peak	-19.08
1	350.000000000 kHz	39.49	Quasi Peak	-19.48
1	514.000000000 kHz	36.80	Quasi Peak	-19.20
1	590.000000000 kHz	35.88	Quasi Peak	-20.12
1	6.156000000 MHz	26.13	Quasi Peak	-33.87

362-00042-00 Line 2

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	190.000000000 kHz	46.78	Quasi Peak	-17.26
1	226.000000000 kHz	45.01	Quasi Peak	-17.59
1	270.000000000 kHz	43.26	Quasi Peak	-17.86
1	386.000000000 kHz	39.92	Quasi Peak	-18.23
1	510.000000000 kHz	38.78	Quasi Peak	-17.22
1	570.000000000 kHz	38.62	Quasi Peak	-17.38
1	822.000000000 kHz	36.61	Quasi Peak	-19.39
1	1.842000000 MHz	32.01	Quasi Peak	-23.99
1	6.216000000 MHz	22.64	Quasi Peak	-37.36
1	18.136000000 MHz	22.10	Quasi Peak	-37.90

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

362-00043-04 Line 1

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	150.000000000 kHz	38.00	Quasi Peak	-28.00
1	270.000000000 kHz	36.42	Quasi Peak	-24.70
1	414.000000000 kHz	33.87	Quasi Peak	-23.70
1	542.000000000 kHz	30.60	Quasi Peak	-25.40
1	19.660000000 MHz	13.08	Quasi Peak	-46.92

362-00043-04 Line 2

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	150.000000000 kHz	36.82	Quasi Peak	-29.18
1	190.000000000 kHz	38.53	Quasi Peak	-25.50
1	418.000000000 kHz	30.23	Quasi Peak	-27.26
1	2.842000000 MHz	27.76	Quasi Peak	-28.24
1	8.616000000 MHz	20.42	Quasi Peak	-39.58

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

CPU Line 1

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	150.000000000 kHz	51.53	Quasi Peak	-14.47
1	390.000000000 kHz	46.05	Quasi Peak	-12.01
1	450.000000000 kHz	39.89	Quasi Peak	-16.98
1	698.000000000 kHz	38.39	Quasi Peak	-17.61
1	874.000000000 kHz	40.38	Quasi Peak	-15.62
1	978.000000000 kHz	36.65	Quasi Peak	-19.35
1	6.776000000 MHz	22.09	Quasi Peak	-37.91
1	14.076000000 MHz	19.28	Quasi Peak	-40.72
1	29.184000000 MHz	26.84	Quasi Peak	-33.16

CPU Line 2

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	402.000000000 kHz	46.26	Quasi Peak	-11.55
1	462.000000000 kHz	44.19	Quasi Peak	-12.47
1	590.000000000 kHz	46.40	Quasi Peak	-9.60
1	890.000000000 kHz	35.34	Quasi Peak	-20.66
1	966.000000000 kHz	36.94	Quasi Peak	-19.06
1	5.712000000 MHz	27.41	Quasi Peak	-32.59
1	6.756000000 MHz	23.20	Quasi Peak	-36.80
1	13.340000000 MHz	20.92	Quasi Peak	-39.08
1	29.184000000 MHz	26.64	Quasi Peak	-33.36

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

Summary of Results for AC Line Conducted Emissions

The EUT demonstrated compliance with the conducted emissions requirements of CFR47 Part 15C and other applicable standards for Intentional Radiators. The EUT worst-case configuration demonstrated minimum margin of 9.6 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 of its various modes. Preliminary testing was performed in a screen room with the EUT positioned 1 meter from the FSM. Radiated emissions investigations were performed to identify the frequencies, which produced the highest emissions. Plots were made of the radiated emission frequency spectrum from 30 MHz to 25,000 MHz for preliminary transmitter testing. Refer to figures seven through twelve showing the worst-case radiated emission spectrum displayed on the spectrum analyzer taken in a screen room. The each radiated emission measured 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. 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. 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.

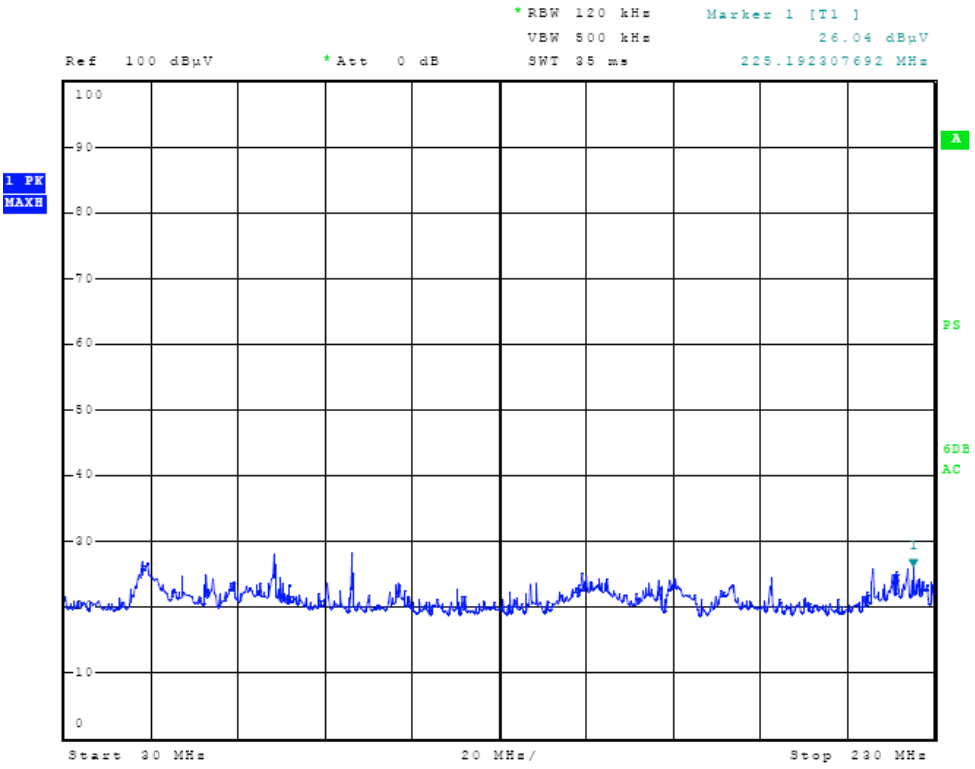


Figure Seven Radiated Emissions in screen room

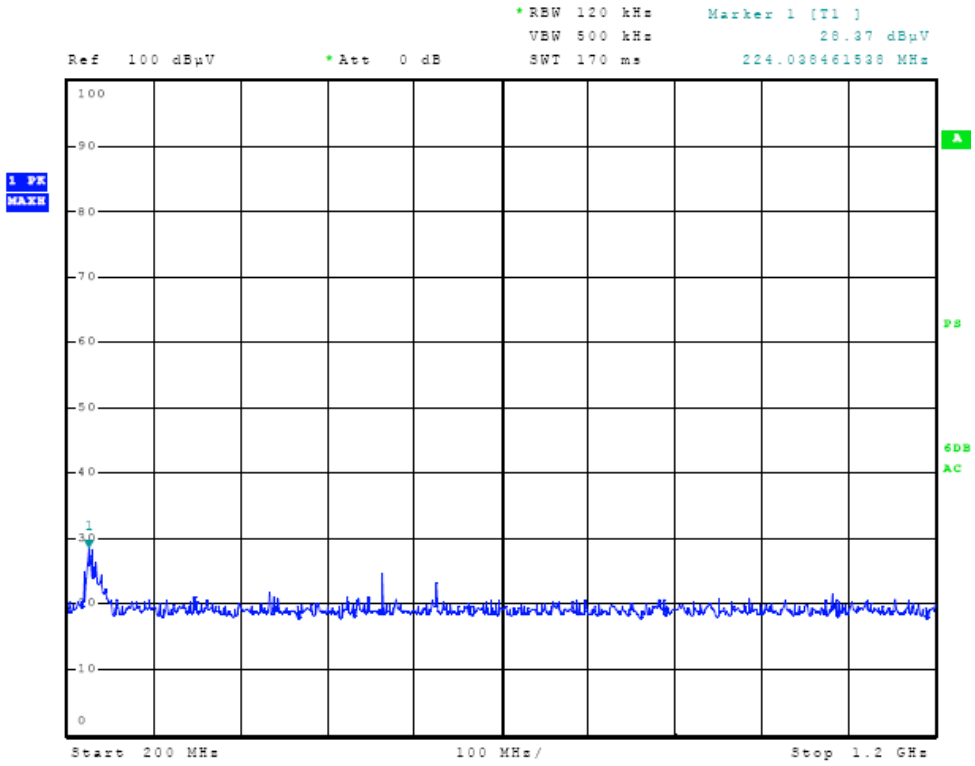


Figure Eight Radiated Emissions in screen room

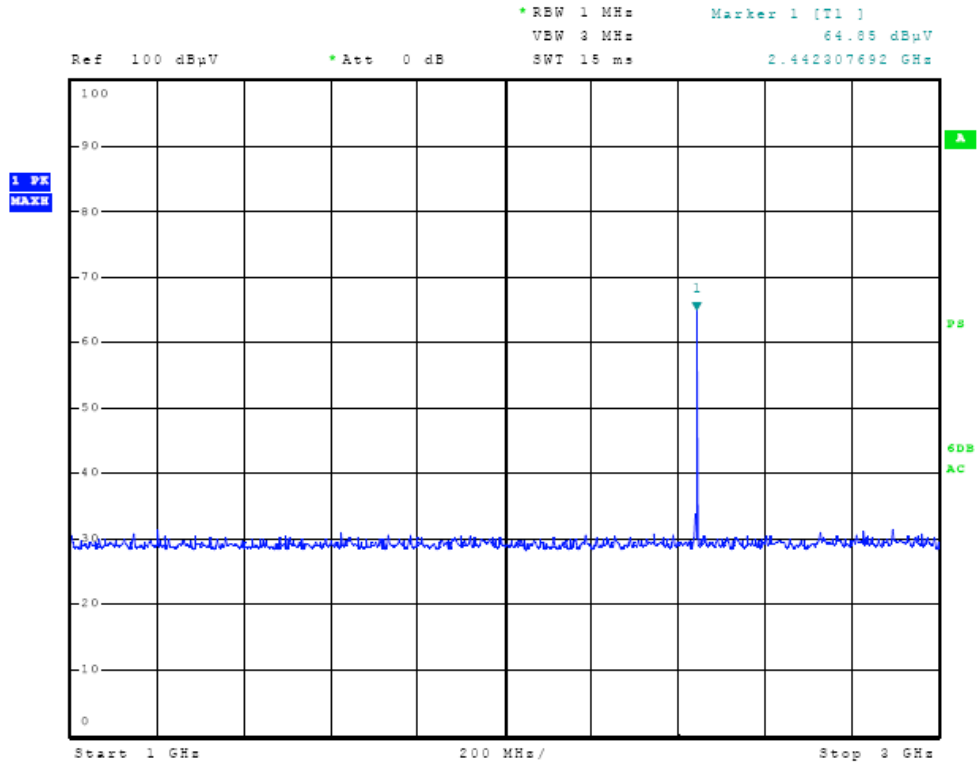


Figure Nine Radiated Emissions in screen room

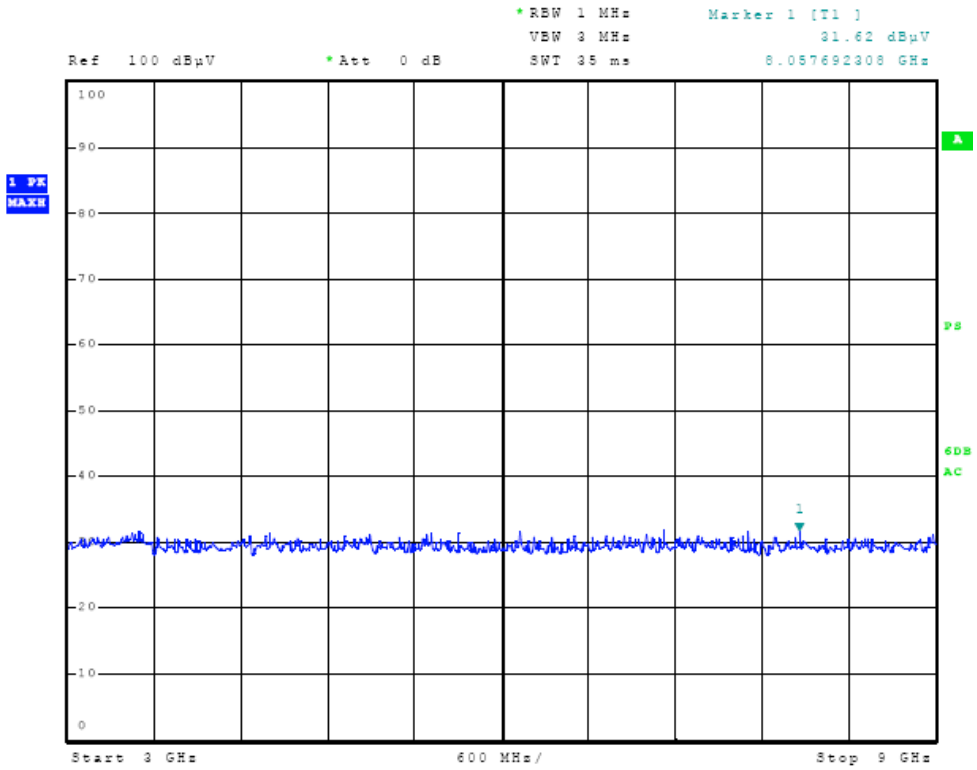


Figure Ten Radiated Emissions in screen room

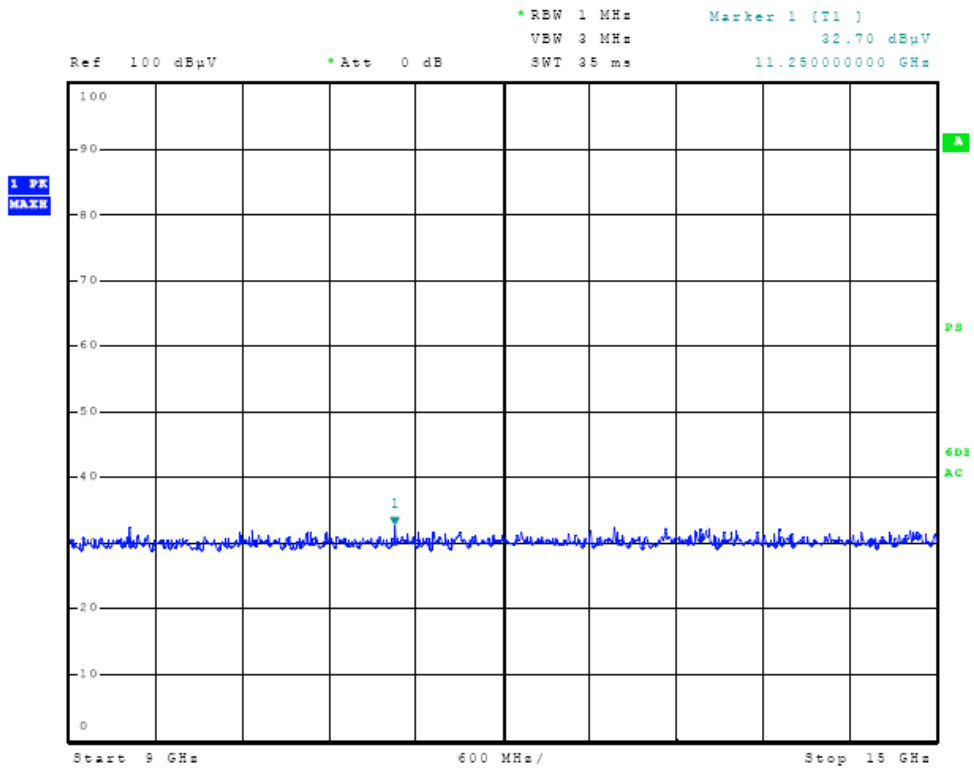


Figure Eleven Radiated Emissions in screen room

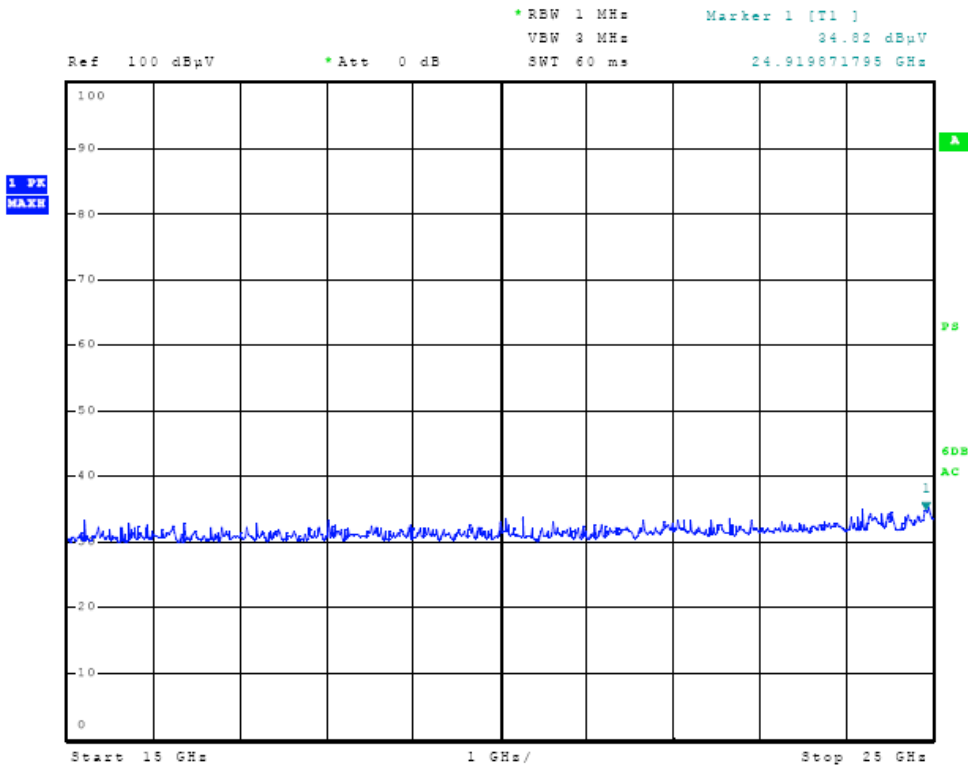


Figure Twelve Radiated Emissions in screen room

General Radiated Emissions Data

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)
47.1	33.9	39.3	8.3	30	12.2	17.6	40.0
167.0	28.6	29.6	8.7	30	7.3	8.3	43.5
224.7	28.7	29.2	11.2	30	9.9	10.4	46.0
227.0	29.5	30.1	11.2	30	10.7	11.3	46.0
227.4	31.2	36.1	11.2	30	12.4	17.3	46.0
228.3	29.1	30.3	11.2	30	10.3	11.5	46.0

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, RSS-210 and other applicable standards for Intentional Radiators. The EUT worst-case configuration demonstrated minimum margin of 22.4 dB below the limits. Other emissions were present with amplitudes at least 20 dB below the Limits.

Antenna Power Conduction Limits for Receivers

Receivers which provide terminals for the connection of an external receiving antenna may be tested to demonstrate compliance with the provisions of 15.109 with the antenna terminals shielded and terminated with a termination equal to the impedance specified for the antenna, provided these receivers also comply with the following: With the receiver antenna terminal connected to a resistive termination equal to the impedance specified or employed for the antenna, the power at the antenna terminal at any frequency within the range of measurements specified in 15.33 shall not exceed 2.0 nanowatts. The EUT incorporates an integral antenna system for production. A test sample was offered for testing allowing connection to antenna port for testing purposes. The test antenna port was connected to a spectrum analyzer for testing the antenna-conducted emissions. The antenna connection under test was connected to the spectrum analyzer through a short coaxial cable. The spectrum analyzer provided the 50-ohm load for the antenna port. The frequency spectrum was

investigated at the antenna port with the worst case data presented. Refer to figures thirteen through fifteen showing the spectrum analyzer display of worst-case receiver antenna conduction emissions. Antenna Port conducted emissions data is shown below. Compliance to receiver radiated emissions requirements were tested at 3 meter OATS with data presented elsewhere in this report.

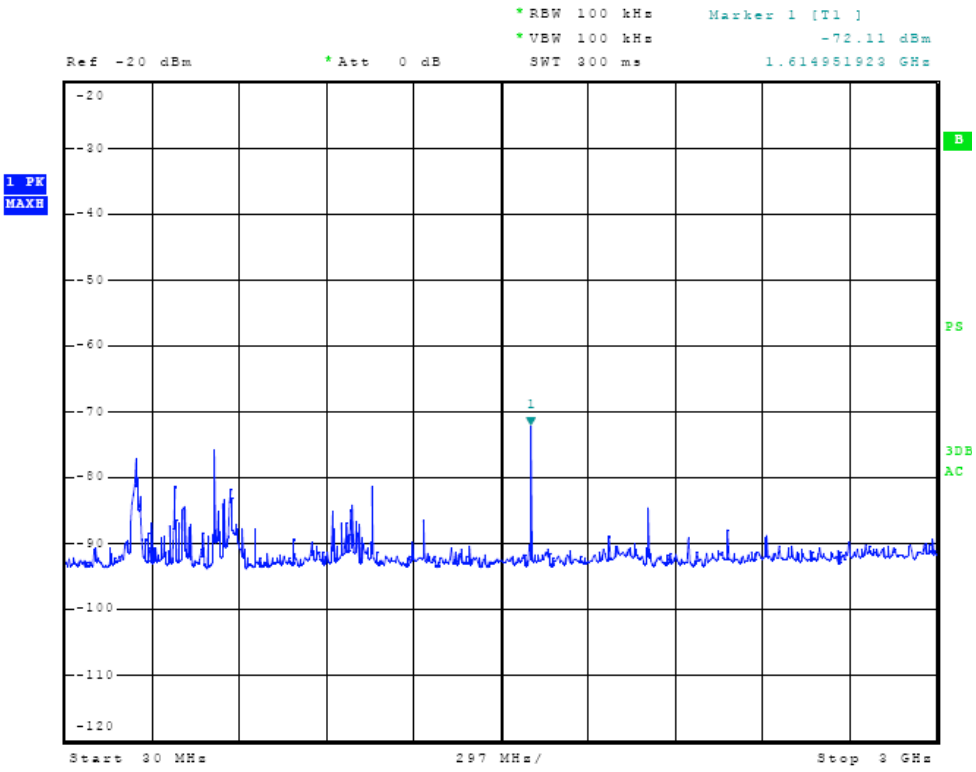


Figure Thirteen Receiver Antenna Port Conducted Emissions

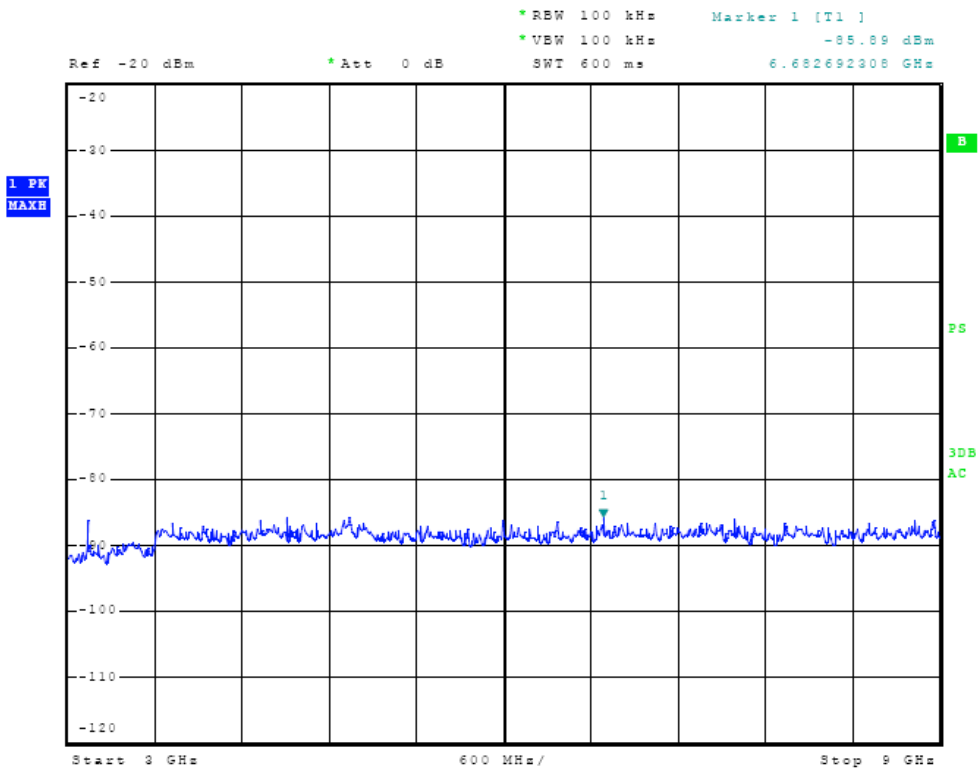


Figure Fourteen Receiver Antenna Port Conducted Emissions

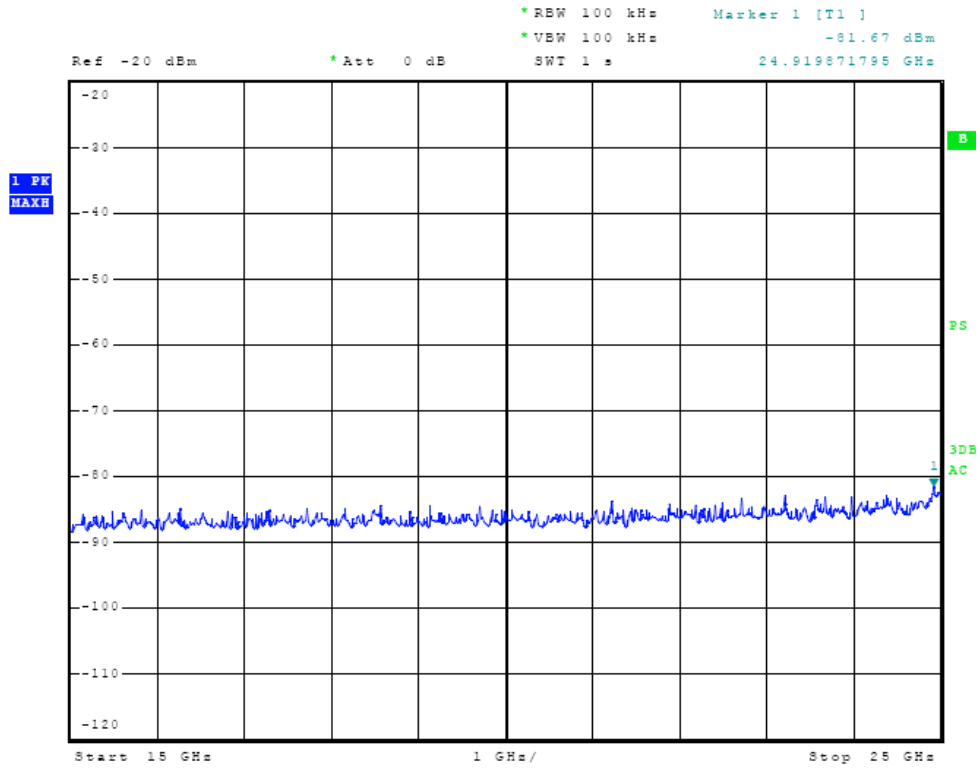


Figure Fifteen Receiver Antenna Port Conducted Emissions

Antenna Conducted Emissions Data (Sample 2 temporary antenna port)

Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
2402.0	-71.5	-57.0	14.5
2441.0	-74.2	-57.0	17.2
2480.0	-72.3	-57.0	15.3

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

Summary of Results for Antenna Conducted Emissions

The EUT demonstrated compliance with the antenna conducted emissions requirements of CFR47 Part 15B and RSS-GEN with a minimum 14.5 dB margin below the limit. Other emissions were present with amplitudes at least 20 dB below the CFR47 15B and RSS-GEN limits.

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

The power output was measured on an open area test site @ 3 meters. Test procedures of ANSI 63.4-2003 paragraphs 13.1 and 8.3.1.2 were used during testing. The EUT 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 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. The amplitude of the emission was then recorded from the analyzer display. 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. Refer to figures sixteen through twenty-four showing the frequency and amplitude of emission displayed on the spectrum analyzer measured at the temporary test antenna port (performed on sample #2). The amplitudes of each radiated spurious emission were measured at the OATS at a distance of 3 meters from the FSM antenna. The amplitude of each radiated spurious emission was maximized by varying the FSM antenna height, polarization, and by rotating the turntable. 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.

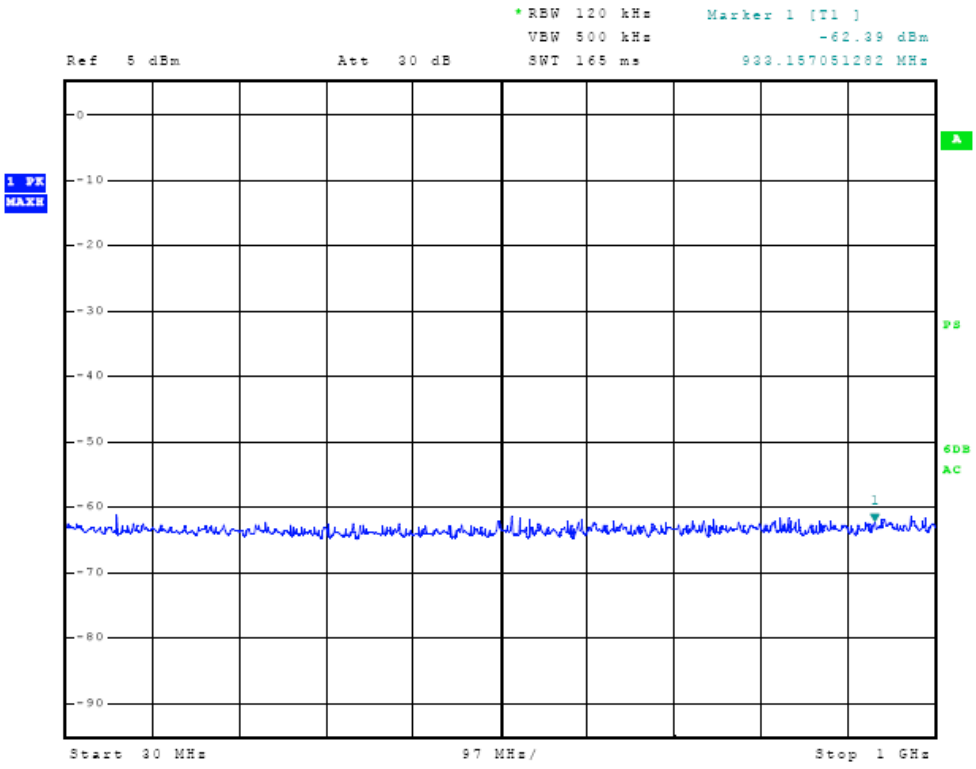


Figure Sixteen output measured at temporary antenna terminal

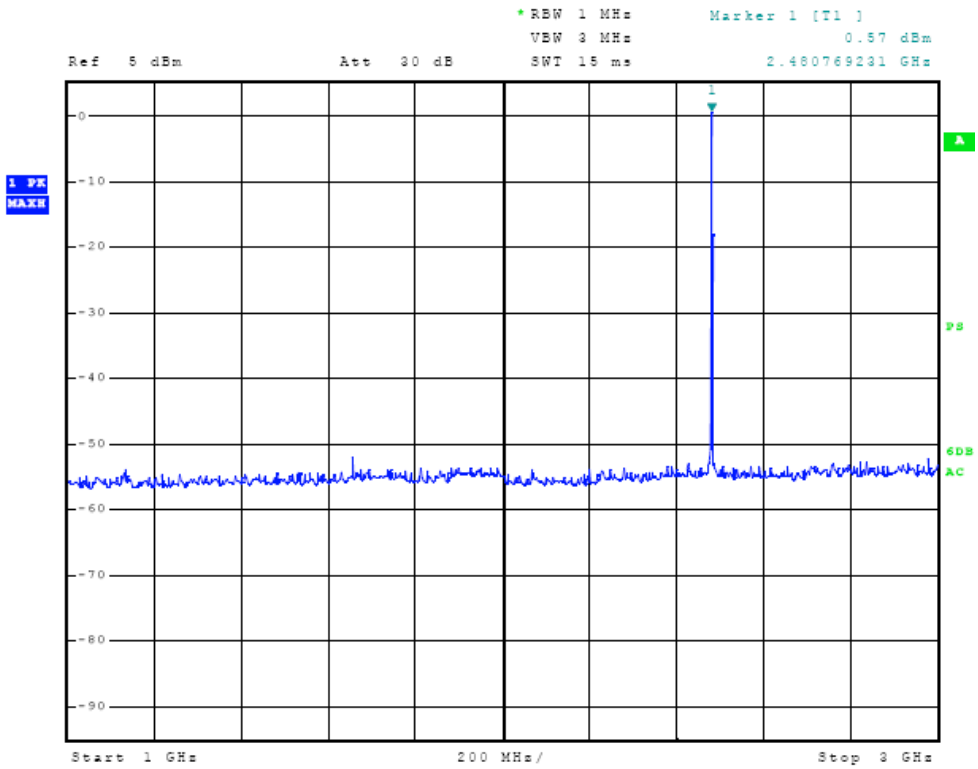


Figure Seventeen output measured at temporary antenna terminal

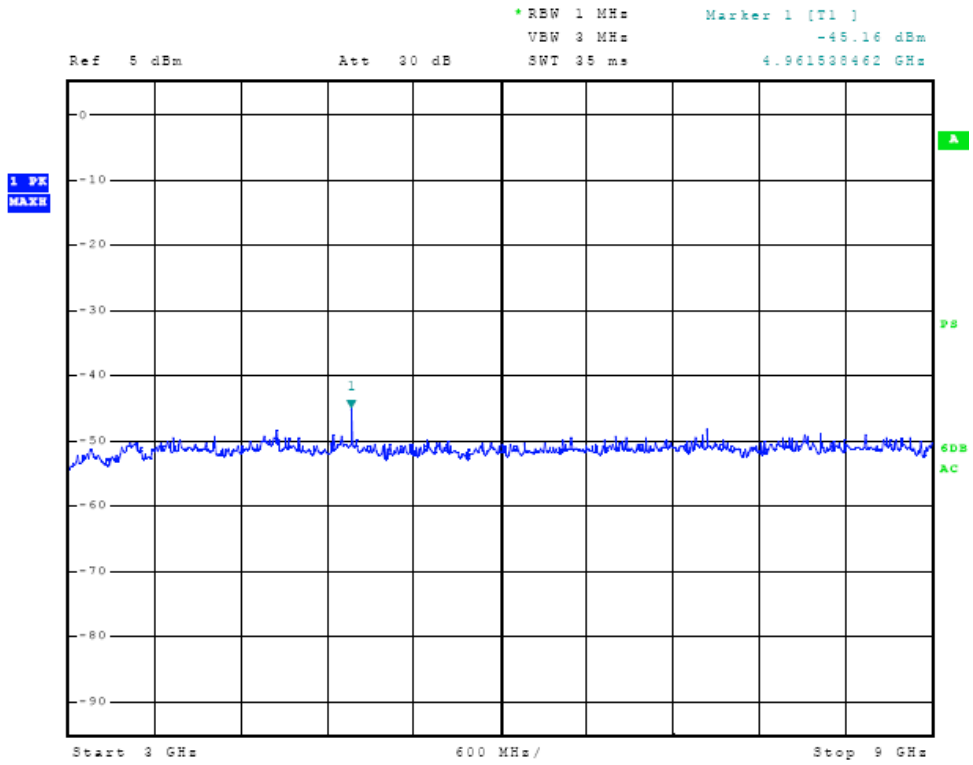


Figure Eighteen output measured at temporary antenna terminal

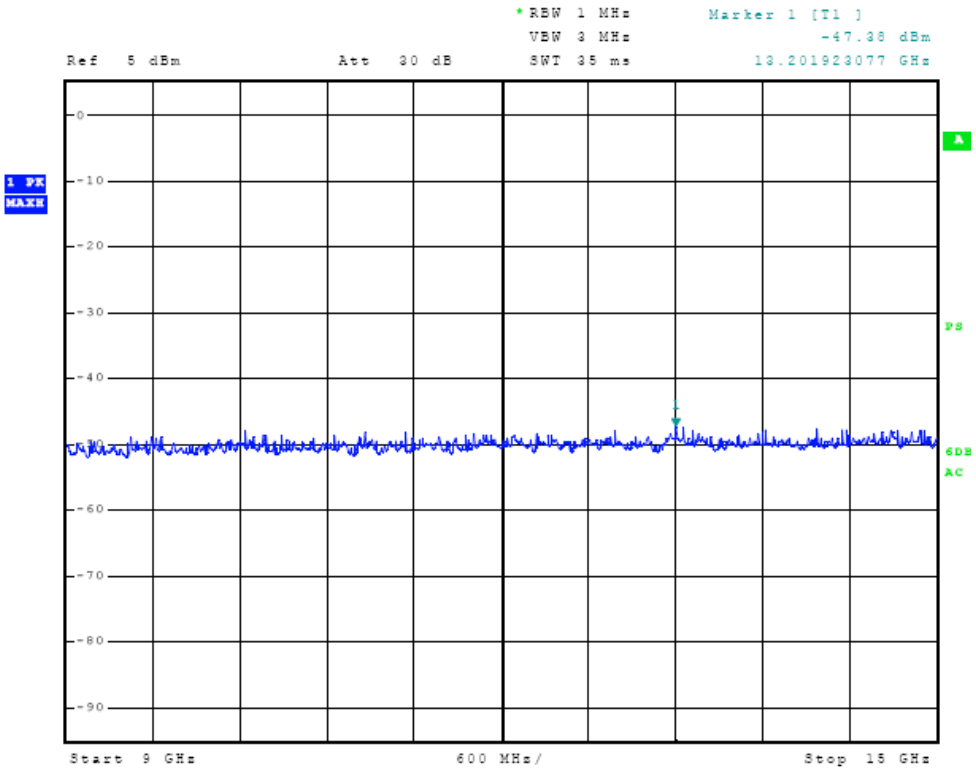


Figure Nineteen output measured at temporary antenna terminal

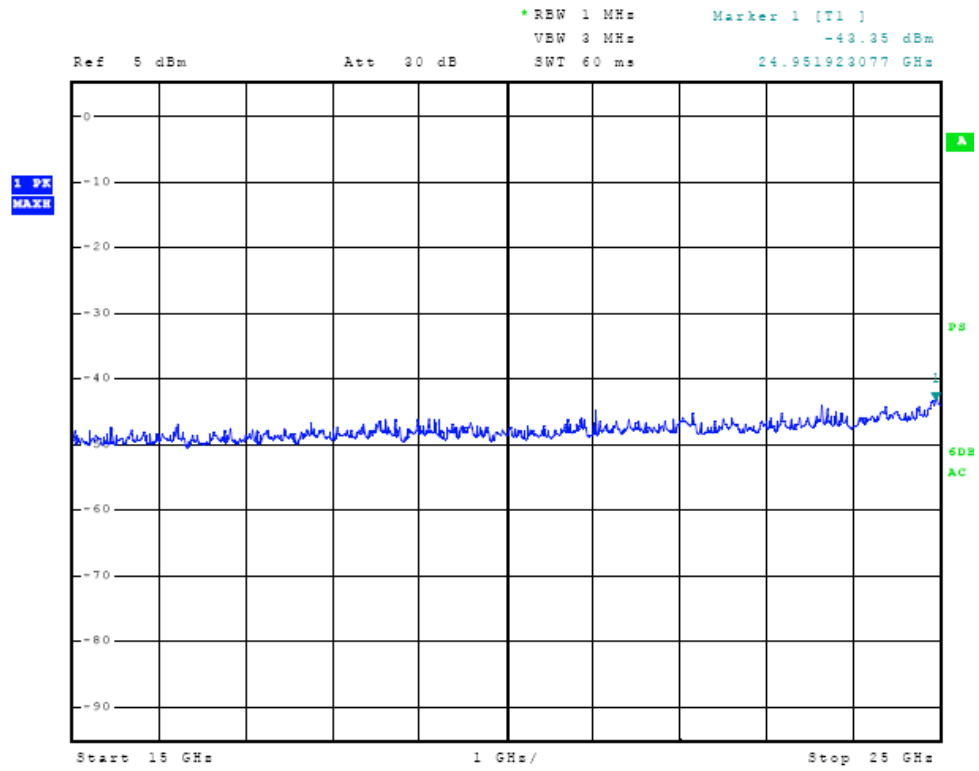


Figure Twenty output measured at temporary antenna terminal

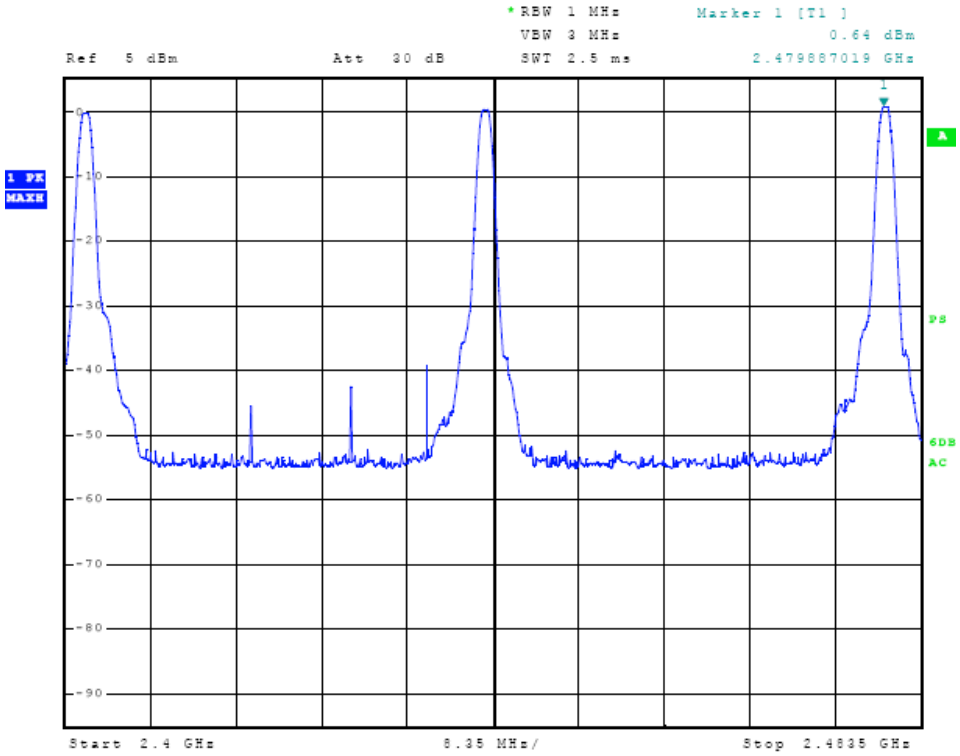


Figure Twenty-one Output power across band

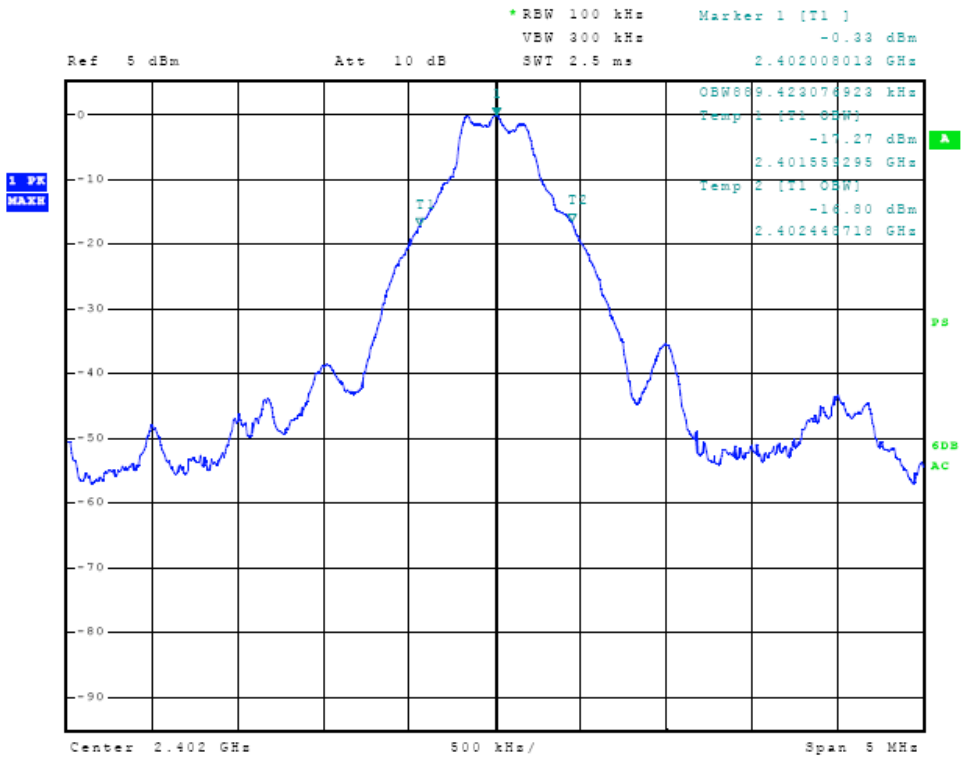


Figure Twenty-two Occupied Bandwidth

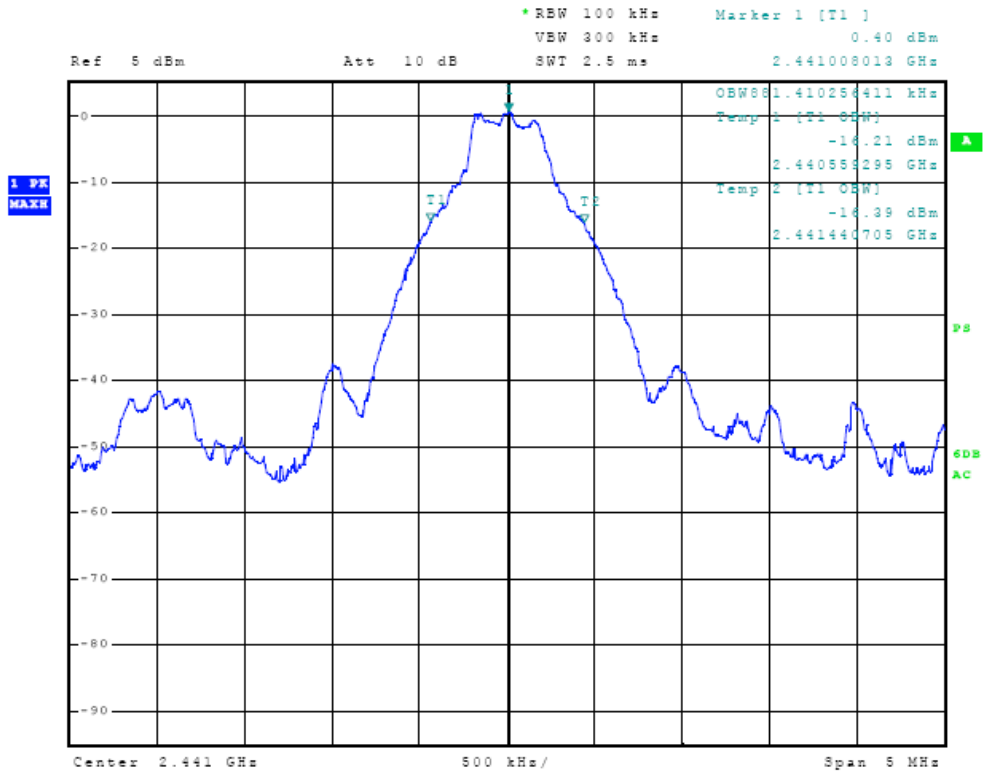


Figure Twenty-three Occupied Bandwidth

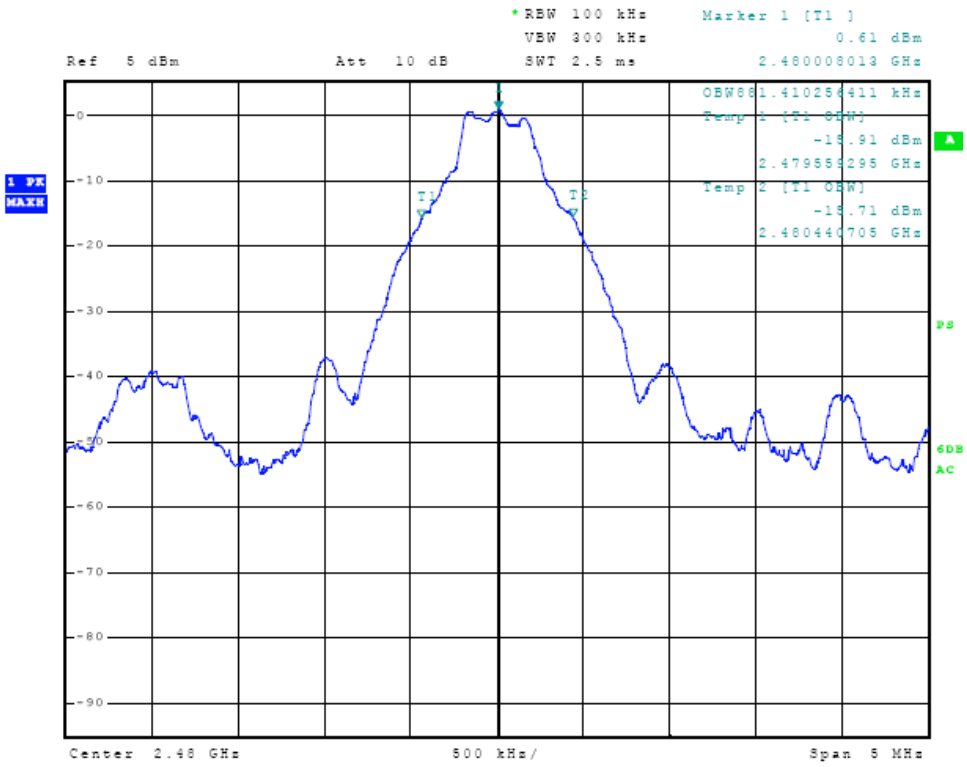


Figure Twenty-Four Occupied Bandwidth

Transmitter Radiated Emissions Data

Frequency	FSM Hor Peak	FSM Hor Ave	FSM Vert Peak	FSM Vert Ave	AF	Amp Gain	CFS @ 3 m Hor Peak	CFS @ 3 m Hor Ave	CFS @ 3 m Vert Peak	CFS @ 3 m Vert Ave	Ave Limit
2402.0	83.9	83.7	84.5	84.3	32.8	25	91.7	91.5	92.3	92.1	94.0
4804.0	30.6	21.1	30.8	19.8	32.9	25	38.5	29.0	38.7	27.7	54.0
7206.0	25.4	14.3	25.5	14.2	36.0	25	36.4	25.3	36.5	25.2	54.0
9608.0	27.0	14.6	26.6	14.6	38.1	25	40.1	27.7	39.7	27.7	54.0
12010.0	20.4	9.4	21.3	9.3	40.0	25	35.4	24.4	36.3	24.3	54.0
2441.0	82.2	82.0	83.8	83.6	33.0	25	90.2	90.0	91.8	91.6	94.0
4882.0	30.8	19.6	30.1	19.4	32.9	25	38.7	27.5	38.0	27.3	54.0
7323.0	26.6	15.7	26.8	15.4	36.4	25	38.0	27.1	38.2	26.8	54.0
9764.0	25.6	13.7	25.0	13.6	38.3	25	38.9	27.0	38.3	26.9	54.0
12205.0	20.9	9.2	20.1	9.1	40.4	25	36.3	24.6	35.5	24.5	54.0
2480.0	81.3	80.5	82.3	81.4	33.5	25	89.8	89.0	90.8	89.9	94.0
4960.0	30.9	19.2	29.6	18.7	32.9	25	38.8	27.1	37.5	26.6	54.0
7440.0	26.7	15.0	26.7	15.0	36.7	25	38.4	26.7	38.4	26.7	54.0
9920.0	23.8	12.7	24.9	12.7	38.4	25	37.2	26.1	38.3	26.1	54.0
12400.0	20.1	9.0	20.0	8.9	40.6	25	35.7	24.6	35.6	24.5	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 CFR47 Part 15.249, RSS-210 and other applicable standards for Intentional Radiators. The EUT worst-case configuration demonstrated minimum average amplitude emission margin of 1.9 dB below limit. The EUT worst-case configuration demonstrated minimum radiated harmonic emission margin of 25.0 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	2/09
Wattmeter: Bird 43 with Load Bird 8085	2/09
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/09
H/V Power Supply: Fluke Model: 408B (SN: 573)	2/09
R.F. Generator: HP 606A	2/09
R.F. Generator: HP 8614A	2/09
R.F. Generator: HP 8640B	2/09
Spectrum Analyzer: Rohde & Schwarz ESU40	2/09
Spectrum Analyzer: HP 8562A, Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W HP Adapters: 11518, 11519, 11520	5/09
Spectrum Analyzer: HP 8591EM	5/09
Frequency Counter: Leader LDC825	2/09
Antenna: EMCO Biconilog Model: 3143	5/09
Antenna: EMCO Log Periodic Model: 3147	10/08
Antenna: Antenna Research Biconical Model: BCD 235	10/08
Antenna: EMCO Dipole Set 3121C	2/09
Antenna: C.D. B-101	2/09
Antenna: Solar 9229-1 & 9230-1	2/09
Antenna: EMCO 6509	2/09
Audio Oscillator: H.P. 201CD	2/09
R.F. Power Amp 65W Model: 470-A-1010	2/09
R.F. Power Amp 50W M185- 10-501	2/09
R.F. PreAmp CPPA-102	2/09
LISN 50 µHy/50 ohm/0.1 µf	10/08
LISN Compliance Eng. 240/20	2/09
LISN Fischer Custom Communications FCC-LISN-50-16-2-08	2/09
Peavey Power Amp Model: IPS 801	2/09
Power Amp A.R. Model: 10W 1010M7	2/09
Power Amp EIN Model: A301	2/09
ELGAR Model: 1751	2/09
ELGAR Model: TG 704A-3D	2/09
ESD Test Set 2010i	2/09
Fast Transient Burst Generator Model: EFT/B-101	2/09
Current Probe: Singer CP-105	2/09
Current Probe: Solar 9108-1N	2/09
Field Intensity Meter: EFM-018	2/09
KEYTEK Ecat Surge Generator	2/09
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

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