NVLAP Lab Code 200087-0

APPLICATION

For

GRANT OF CERTIFICATION

FOR

MODEL:

011-01943-xx Low Power Transmitter

FCC ID: IPH-01402

IC: 1792A-01402

FOR

GARMIN INTERNATIONAL, INC.

1200 East 151st Street

Olathe, KS 66062

Test Report number 080708A

Authorized Signatory: 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: 011-01943-xx Low Power Transmitter

Frequency Ranges: 88-107 MHz and 2,400-2,483.5 MHz

FCC ID: IPH-01402
IC: 1792A-01402

Test Report Number: 080708A

Test Date: July 8, 2008

Authorized Signatory: Scot D Rogers

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

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Forward

The following information is submitted for consideration in obtaining a Grant of Certification for low power intentional radiator per CFR47 Paragraphs 15.239 and 15.249, and Industry Canada RSS-210 Low Power Transmitter, operation in the 88-108 MHz and 2400 – 2483.5 MHz band.

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

Model: 011-01943-xx

FCC ID: IPH-01402 Industry Canada ID: 1792A-01402

Frequency Range: 88-108 MHz and 2400-2483.5 MHz

Operating Power: Less than 250 Microvolt per meter (88-108 MHz) and 1 mW (as design specification, measured 91.9 dBµV/m @ 3 meters), for operation in the 2400-2483.5 MHz

Applicable Standards & Test Procedures

In accordance with the Federal Communications Commission, Code of Federal Regulations CFR47, dated October 1, 2007, 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 paragraphs 15.239 and 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

Tests Performed	Results
Antenna requirement per CFR47 15.203	Complies
Conducted Emissions as per CFR47 15.207	Complies
Radiated Emissions as per CFR47 15.209	Complies
Emissions per CFR47 15.239	Complies
Emissions per CFR47 15.249	Complies
Emissions per RSS-210	Complies

Environmental Conditions

Ambient Temperature	23.9° C
Relative Humidity	40%
Atmospheric Pressure	29.96 in Hg

Equipment Tested

Equipment	Serial Number	FCC I.D.#
011-01943-xx (EUT)	4014E	IPH-01402
AC Power Adapter(362-00039-00)	N/A	N/A
AC Power Adapter(362-00043-00)	N/A	N/A
GTM 20	N/A	N/A
GTM 21	N/A	N/A
GDB50	N/A	N/A
GA—25 MCX	N/A	N/A
Dell Computer	2574199639	DoC
Printer	B94C2121X	N/A

List of Test Equipment

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

HP 8591EM 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
HP 8562A 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	MFG.	MODEL	CAL. DATE	DUE.
LISN	Comp. Design	FCC-LISN-2-MOD.CD	10/07	10/08
LISN	Comp. Design	1762	2/08	2/09
Antenna	ARA	BCD-235-B	10/07	10/08
Antenna	EMCO	3147	10/07	10/08
Antenna	EMCO	3143	5/08	5/09
Analyzer	HP	8591EM	5/08	5/09
Analyzer	HP	8562A	5/08	5/09

2.1033(b) 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-01402 IC: 1792A-01402

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

(4) Description of Circuit Functions, Device Operation: The 011-01943-xx is a low power Transmitter. This device features low power transmitter operation in the FM frequency band of 88-108 MHz and Blue Tooth communications in the 2400-2483.5 MHz frequency band.

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

(6) Report of measurements showing compliance with the pertinent FCC/IC technical requires are provided in this report.

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

(8) Peripheral equipment or accessories for the equipment. Optional equipment available for the EUT includes AC and DC power adapters, external GPS antenna, GTM20, GTM21, GDB50, external microphone, auxiliary audio output, and USB cable for computer interface. The available configuration options were investigated for this and other reports 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.

Statement of Modifications and Deviations

No modifications to the EUT were required for the unit to meet the FCC CFR47 Parts 15B & 15C, Class B Emissions Standards. There were no deviations to the specifications.

Equipment and Cable Configuration

Test Setup

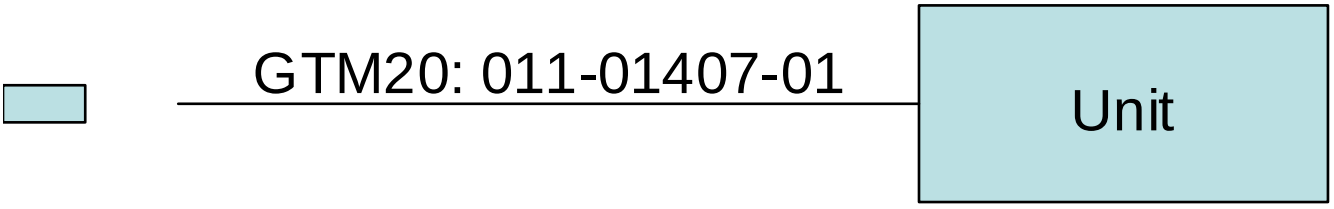
The 011-01943-xx is a GPS receiver/display used for location and navigation and incorporates low power transmitters operating under the Blue Tooth design specification allowing short-range communications in the 2400-2483.5 MHz band and in the FM radio band of 88-108 MHz. The GPS receiver is used to receive and display location and navigation information for the user. The unit was designed to be mounted in an automotive application and the transmitter section allows for short-range communications to other Blue Tooth devices or a FM stereo receiver. The EUT was arranged in 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 battery, and/or external A/C or D/C power adapter options. As requested by the manufacturer and required by standards, the unit 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.

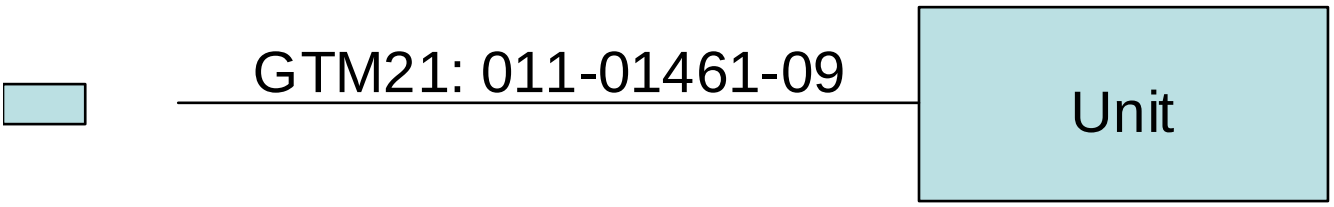
Equipment Function and Testing Procedures

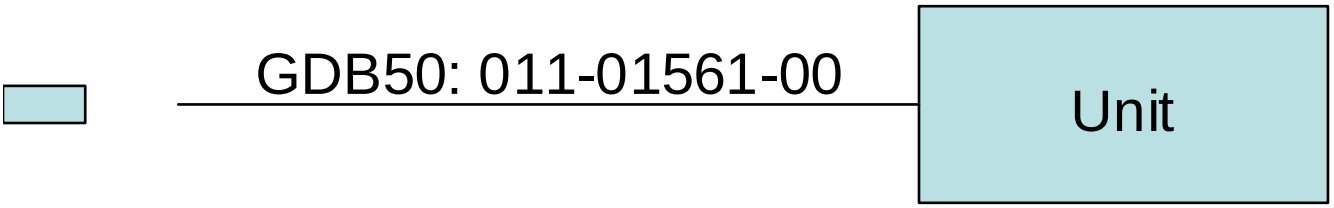
The EUT is a low power transmitter with transmitter operation capability in the 88-108 MHz band (15.239) and 2400-2483.5 MHz frequency band (15.249). The unit allows communications to other Blue Tooth enabled devices and/or a FM receiver.

Configuration options for the EUT

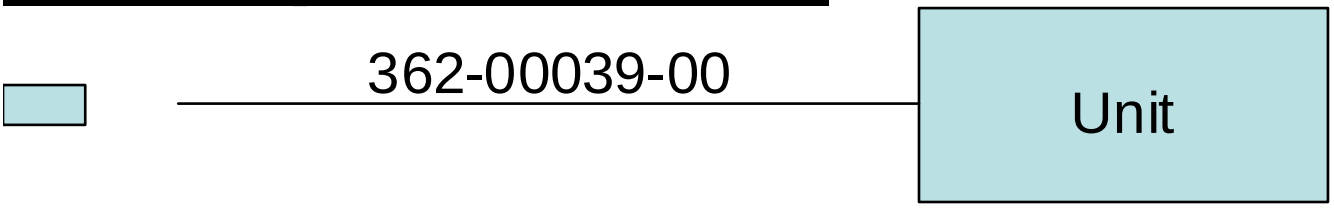
CLA's with car mount

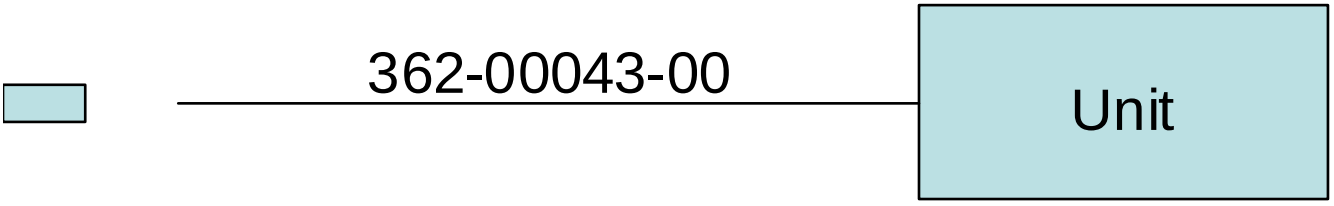




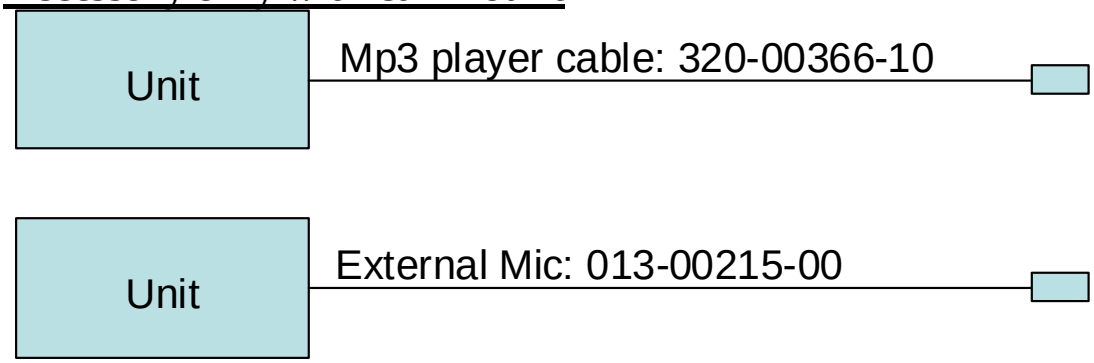


AC Wall adapters without car mount

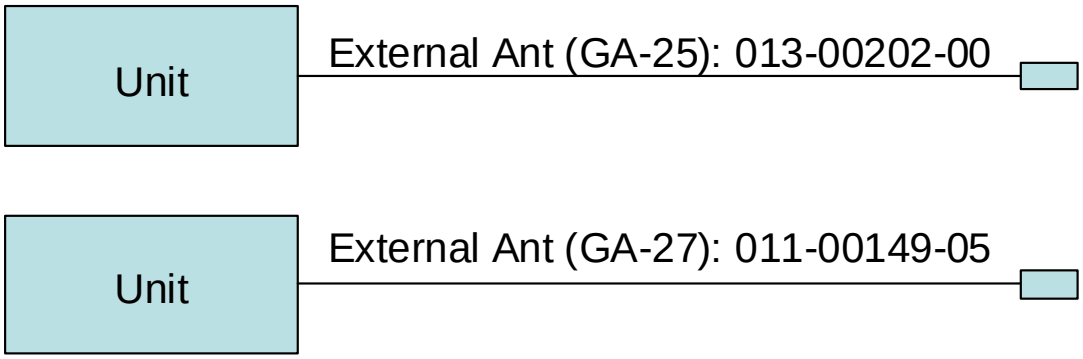




Accessory only with car mount

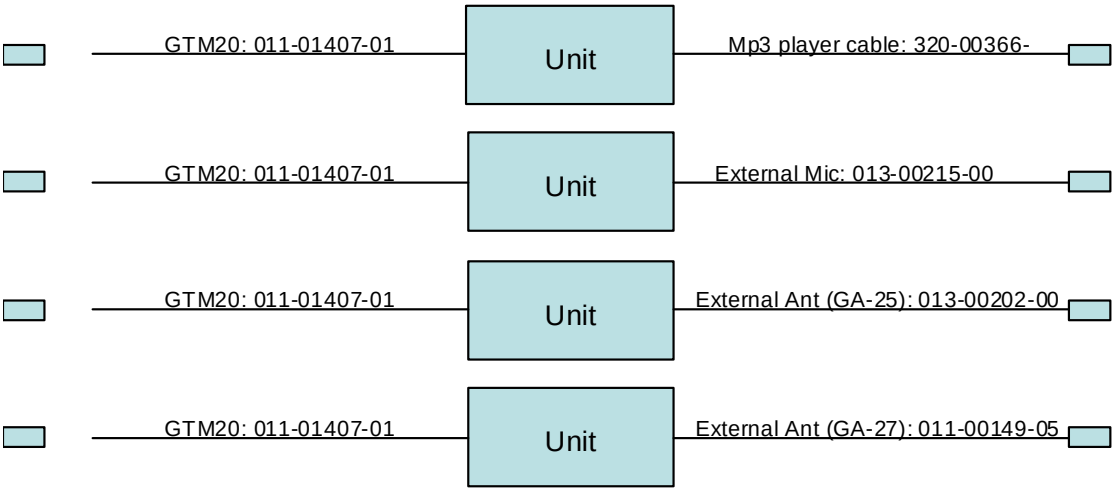


Plug into Unit's MCX connector while in car mount

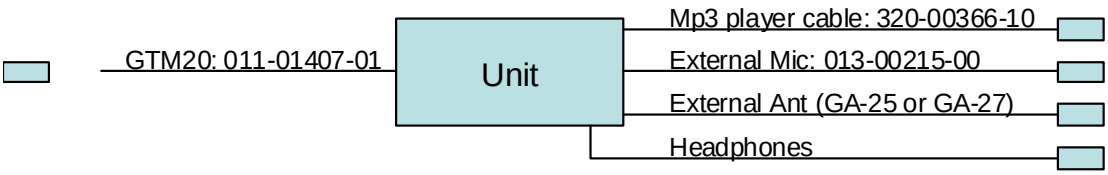


CLA's with car mount and Accessory

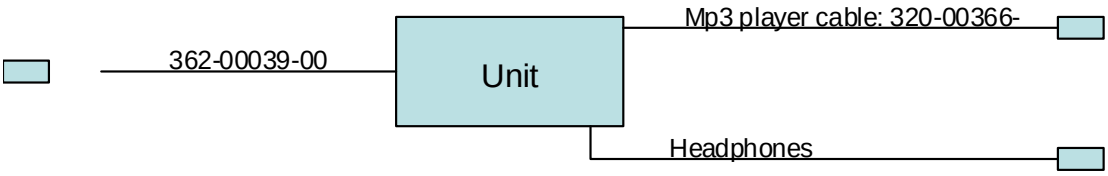
***All setups can be duplicated for each CLA**



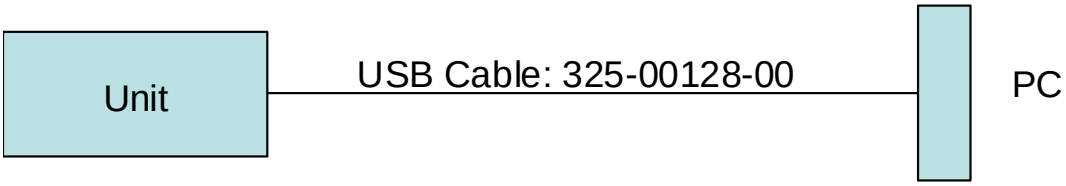
CLA's with car mount and multiple accessories
***All setups can be duplicated for each CLA**



AC adapter with car mount and multiple accessories
***All setups can be duplicated for each AC adapter**



USB Cable



AC Line Conducted Emission Test Procedure

Testing for the AC line-conducted emissions was performed as defined in section 7.2.4 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.

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.

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.

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

$$\text{dBµV/m @ 3m} = 32.5 + 16.3 - 30$$

$$= 18.8$$

Test Site Locations

Conducted EMI	Rogers Labs, Inc. located at 4405 W. 259th Terrace, Louisburg, KS.
Radiated EMI	The radiated emissions tests were performed at Rogers Labs, Inc. 3 meters Open Area Test Site (OATS) located at 4405 W. 259th Terrace, Louisburg, KS.
Site Approval	Refer to Annex for FCC Site Approval Letter, Reference 90910, Industry Canada Site Approval Reference 3041A-1

Subpart C - Intentional Radiators

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

15.203 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 test sample was modified to allow for antenna-conducted emissions testing of the FM and Blue Tooth transmitters for this and other compliance standards. The requirements of 15.203 are met there are no deviations or exceptions to the specification.

15.205 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 per 15.205

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)
403.8	32.5	30.7	16.3	30	18.8	17.0	46.0
1817.2	15.5	16.5	29.3	30	14.8	15.8	54.0
4804.0	16.0	16.6	32.5	30	18.5	19.1	54.0
4882.0	16.1	17.5	32.8	30	18.9	20.3	54.0
4960.0	16.5	18.5	32.9	30	19.4	21.4	54.0
7323.0	19.0	18.6	36.3	30	25.3	24.9	54.0
7440.0	19.1	18.1	36.7	30	25.8	24.8	54.0
12010.0	18.0	18.2	40.0	30	28.0	28.2	54.0
12205.0	18.5	19.0	40.4	30	28.9	29.4	54.0
12400.0	20.0	20.3	40.6	30	30.6	30.9	54.0

No other emissions found in the restricted bands.

Summary of Results for Radiated Emissions in Restricted Bands 15.205

The radiated emissions for the EUT meet the requirements for FCC CFR47 Part 15.205 restricted bands of operation. The EUT had a 23.1 dB minimum margin below the limits. Other emissions were present with amplitudes at least 20 dB below the required limits.

15.207 Conducted emissions limits; general requirements

AC Line Conducted EMI 15.207

The EUT was arranged in typical equipment configurations (AC power adapter or digital interface). 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 EUT was connected to the LISN for line-conducted emissions testing (AC Adapter 362-00043-00) or computer. 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 1 and 2 for plots of the EUT (AC adapter 362-00043-00) conducted emissions frequency spectrum taken in the screen room. Refer to Figures 3 and 4 for plots of the EUT (CPU and AC adapter) conducted emissions frequency spectrum taken in the screen room. Refer to Figures 5 and 6 for plots of the EUT (AC adapter 362-00039-00 and CLA's) conducted emissions frequency spectrum taken in the screen room.

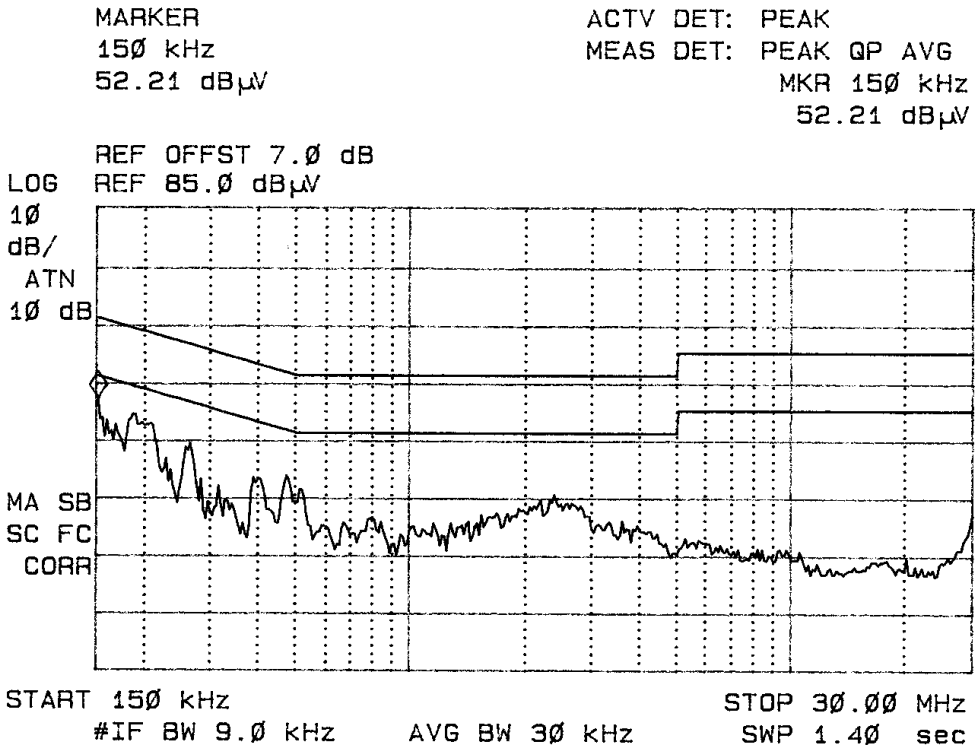


Figure one Conducted emissions of EUT line 1 (362-00043-00)

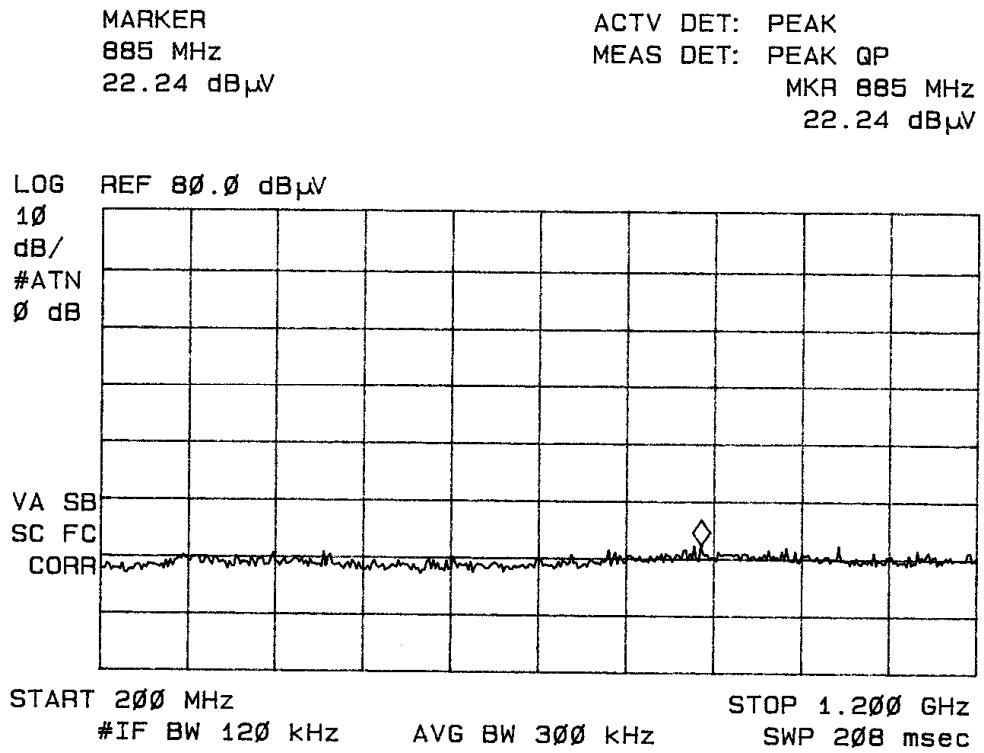


Figure two Conducted emissions of EUT line 2 (362-00043-00)

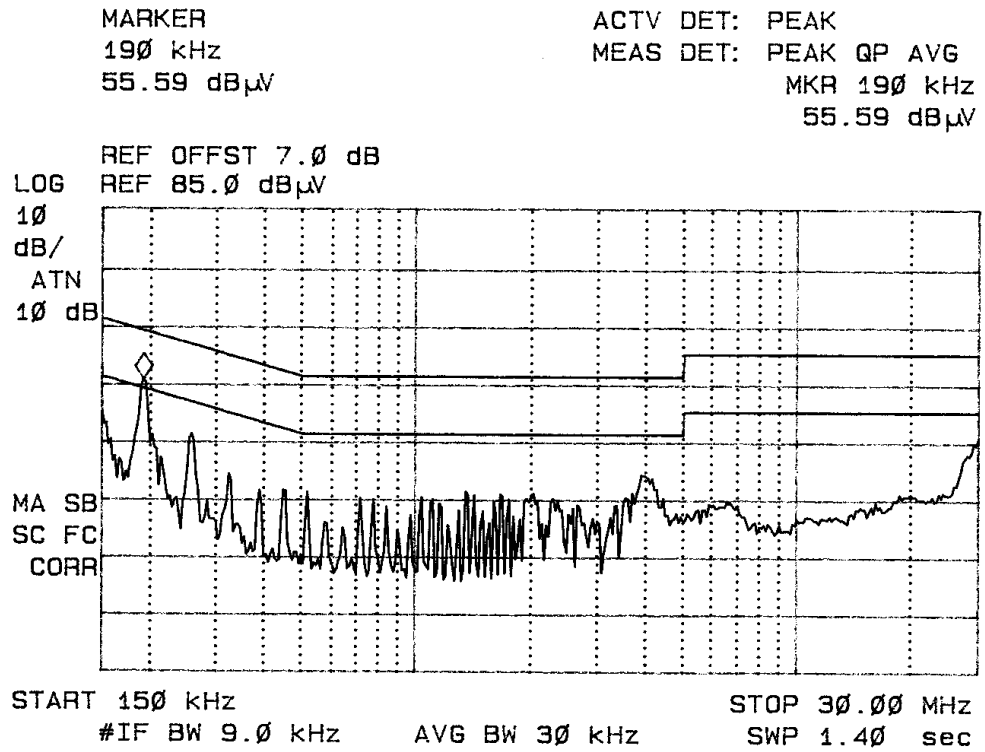


Figure three Conducted emissions of EUT line 1 (CPU)

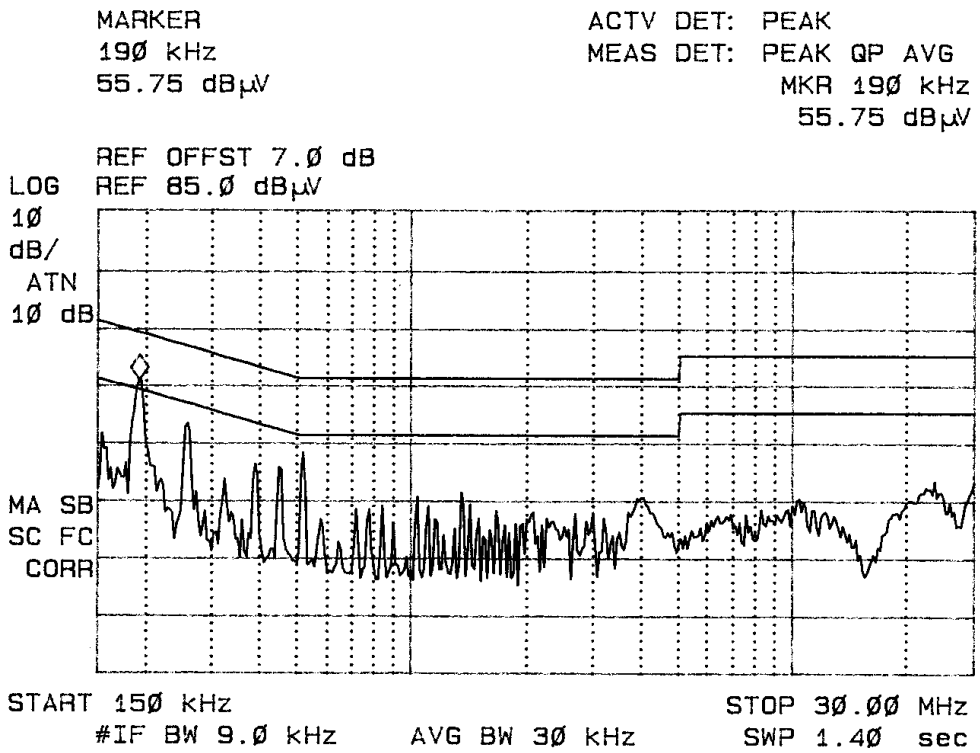


Figure four Conducted emissions of EUT line 2 (CPU)

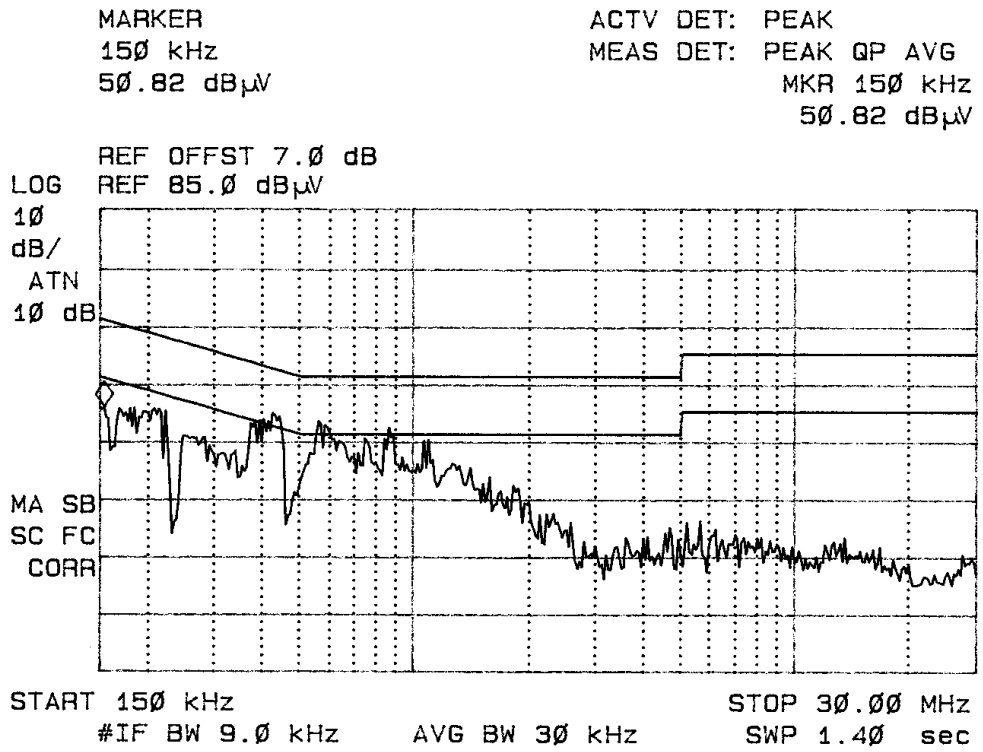


Figure five Conducted emissions of EUT line 1 (362-00039-00)

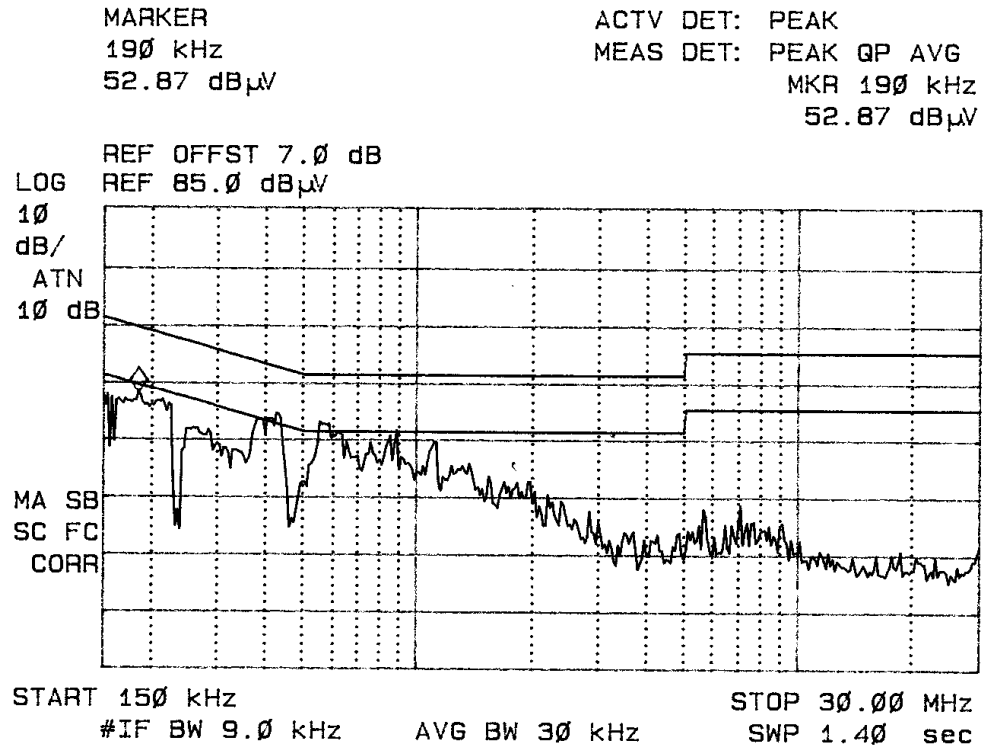


Figure Six Conducted emissions of EUT line 2 (362-00039-00)

Data Conducted Emissions (7 Highest Emissions) (362-00043-00)

Frequency band (MHz)	L1 Level (dBµV)			L2 Level (dBµV)			CISPR 22 Limit Q.P. Ave(dBµV)
	Peak	Q.P.	AVE	Peak	Q.P.	AVE	
0.15 – 0.5	52.2	42.0	27.3	42.3	41.5	32.5	66-56 / 56-46
0.5 – 5	38.7	34.0	25.5	39.8	35.7	29.8	56 / 46
5 – 10	29.8	24.9	18.1	31.1	26.8	20.4	60 / 50
10 – 15	25.0	20.5	14.1	29.1	24.9	18.2	60 / 50
15 – 20	24.5	19.4	13.0	24.9	18.6	12.2	60 / 50
20 – 25	21.9	18.6	12.4	23.9	19.9	13.2	60 / 50
25 – 30	29.9	25.3	16.9	31.7	26.3	18.8	60 / 50

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

Data Conducted Emissions (7 Highest Emissions) (CPU)

Frequency band (MHz)	L1 Level (dBµV)			L2 Level (dBµV)			CISPR 22 Limit Q.P. Ave(dBµV)
	Peak	Q.P.	AVE	Peak	Q.P.	AVE	
0.15 – 0.5	50.8	48.0	28.8	52.9	50.2	29.3	66-56 / 56-46
0.5 – 5	48.7	46.7	29.3	48.2	46.6	28.9	56 / 46
5 – 10	34.0	26.6	12.5	32.6	28.4	22.2	60 / 50
10 – 15	25.5	20.4	12.8	24.6	20.0	13.5	60 / 50
15 – 20	26.1	21.1	12.5	24.6	18.4	11.1	60 / 50
20 – 25	21.4	16.4	10.1	24.1	17.8	11.0	60 / 50
25 – 30	23.5	18.6	11.5	26.4	21.3	12.9	60 / 50

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

Data Conducted Emissions (7 Highest Emissions) (362-00039-00)

Frequency band (MHz)	L1 Level (dBµV)			L2 Level (dBµV)			CISPR 22 Limit Q.P. Ave(dBµV)
	Peak	Q.P.	AVE	Peak	Q.P.	AVE	
0.15 – 0.5	55.6	50.4	40.7	55.8	52.4	45.4	66-56 / 56-46
0.5 – 5	37.4	36.0	31.0	42.9	41.3	40.7	56 / 46
5 – 10	34.7	31.6	26.8	31.5	28.9	23.4	60 / 50
10 – 15	32.6	29.1	20.5	30.4	28.0	19.3	60 / 50
15 – 20	34.2	30.8	19.8	31.1	27.8	19.8	60 / 50
20 – 25	35.2	32.4	27.4	34.2	29.5	20.0	60 / 50
25 – 30	45.3	41.7	35.6	44.8	39.9	35.4	60 / 50

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

Summary of Results for AC Line Conducted General Emissions 15.207

The conducted emissions for the EUT meet the requirements for CFR47 Part 15C and other applicable standards for Intentional Radiators. The EUT worst-case configuration demonstrated a 13.6 dB minimum margin below the FCC/CISPR quasi peak limit, and a 5.3 dB minimum margin below the FCC/CISPR average limit. Other emissions were present with recorded data representing the worst-case amplitudes.

15.209 Radiated emissions limits; general requirements

General Radiated EMI per 15.209

The EUT was 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 12,000 MHz for the preliminary FM transmitter testing. Refer to figures 7 through eleven showing the worst-case radiated emission spectrum displayed on the spectrum analyzer taken in a screen room. Plots were made of the radiated emission frequency spectrum from 30 MHz to 22,000 MHz for the preliminary BT transmitter testing. Refer to figures twelve through eighteen 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.

Sample Calculations:

RFS = Radiated Field Strength

dBµV/m @ 3m = dBµV + A.F. - Amplifier Gain

dBµV/m @ 3m = 32.5 + 16.3 - 30

= 18.8

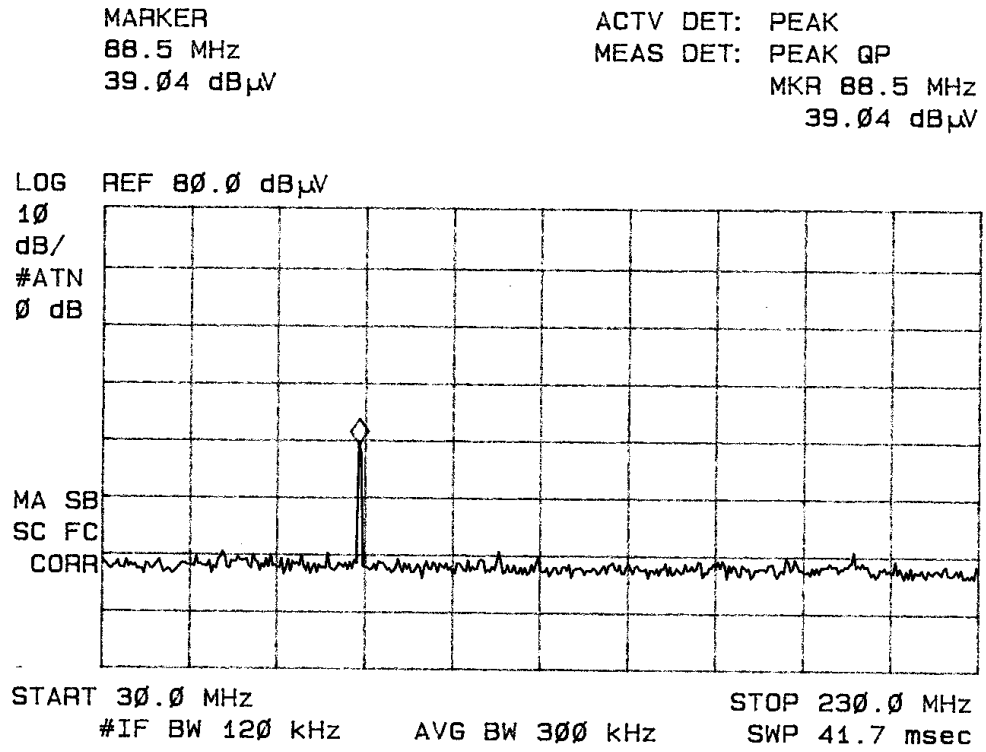


Figure seven Radiated Emissions in screen room (FM Tx).

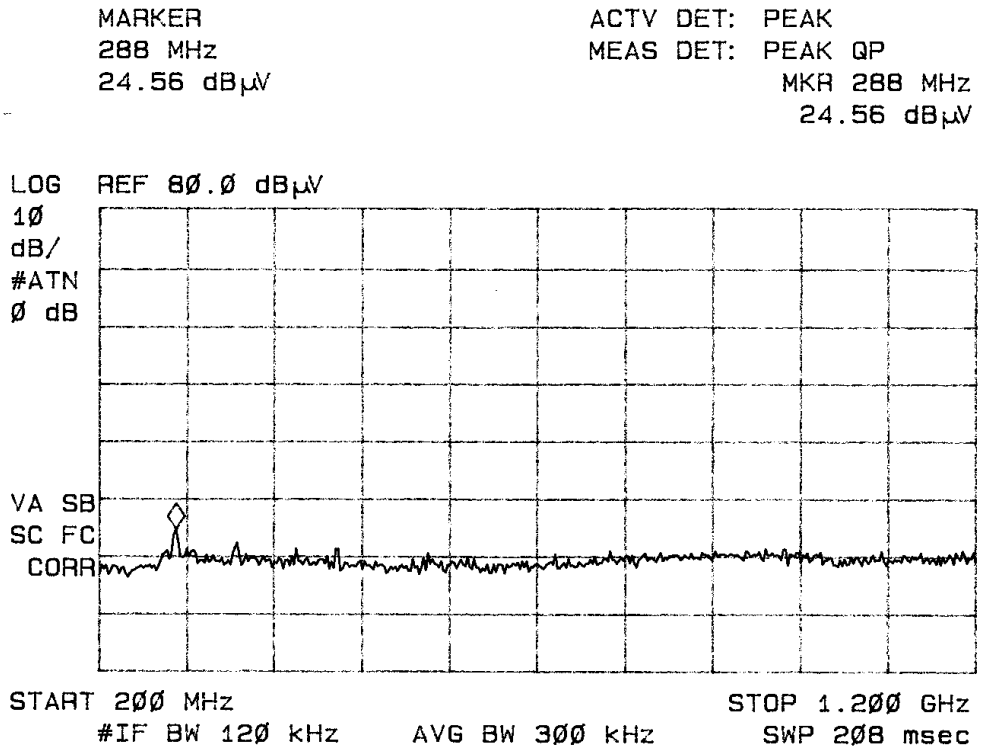


Figure eight Radiated Emissions in screen room (FM Tx).

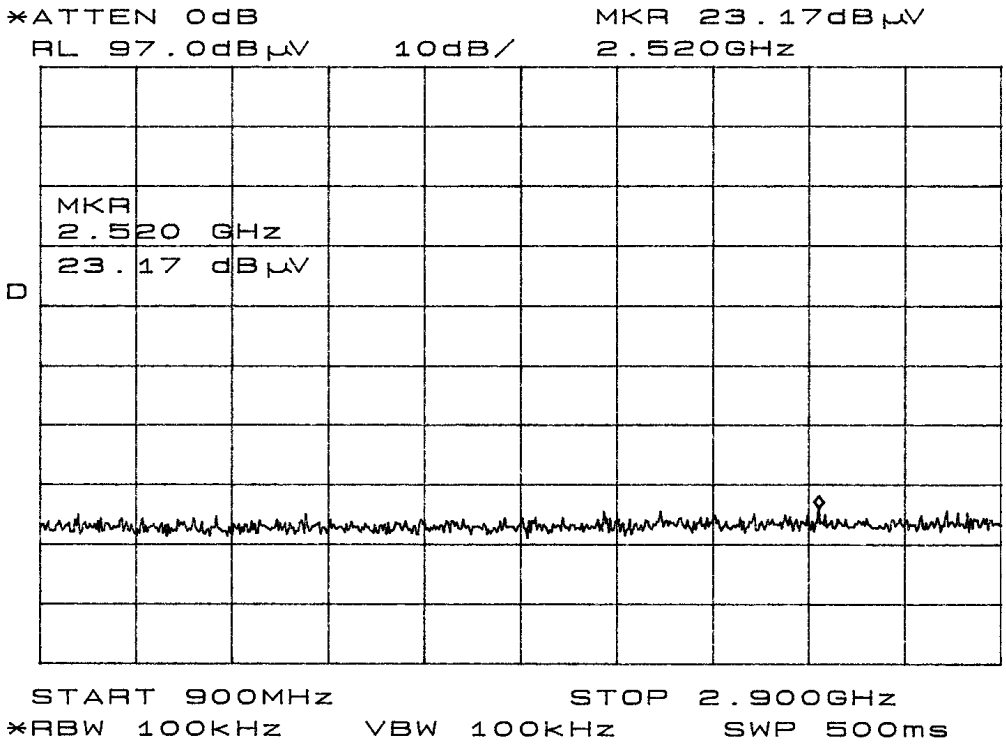


Figure nine Radiated Emissions in screen room (FM Tx).

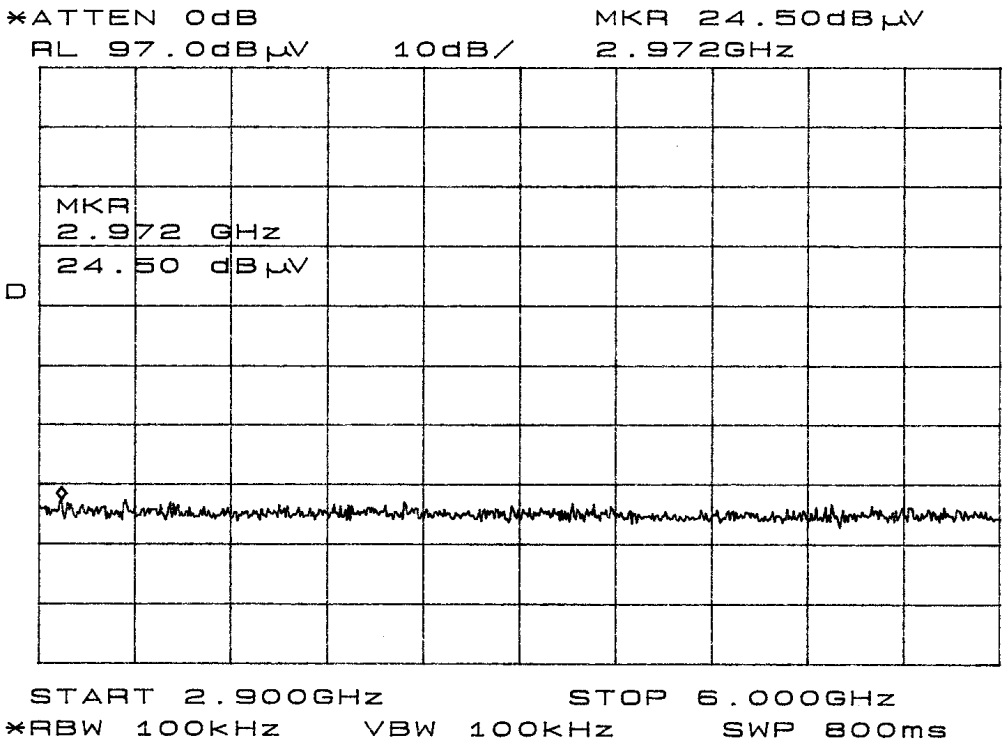


Figure ten Radiated Emissions in screen room (FM Tx).

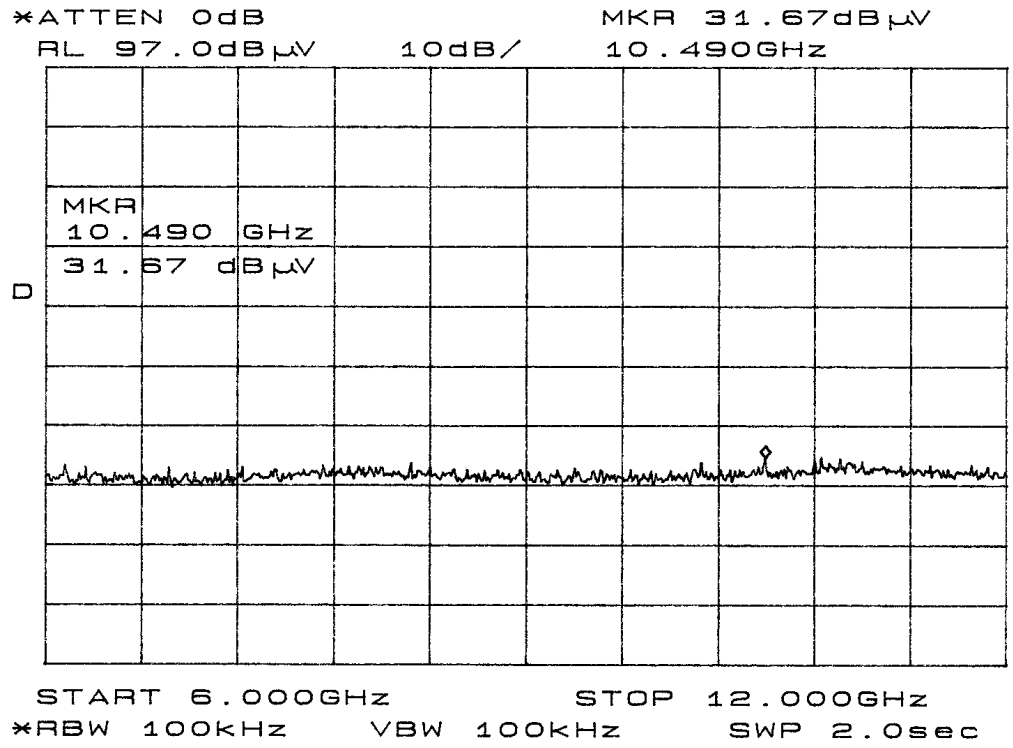


Figure eleven Radiated Emissions in screen room (FM Tx).

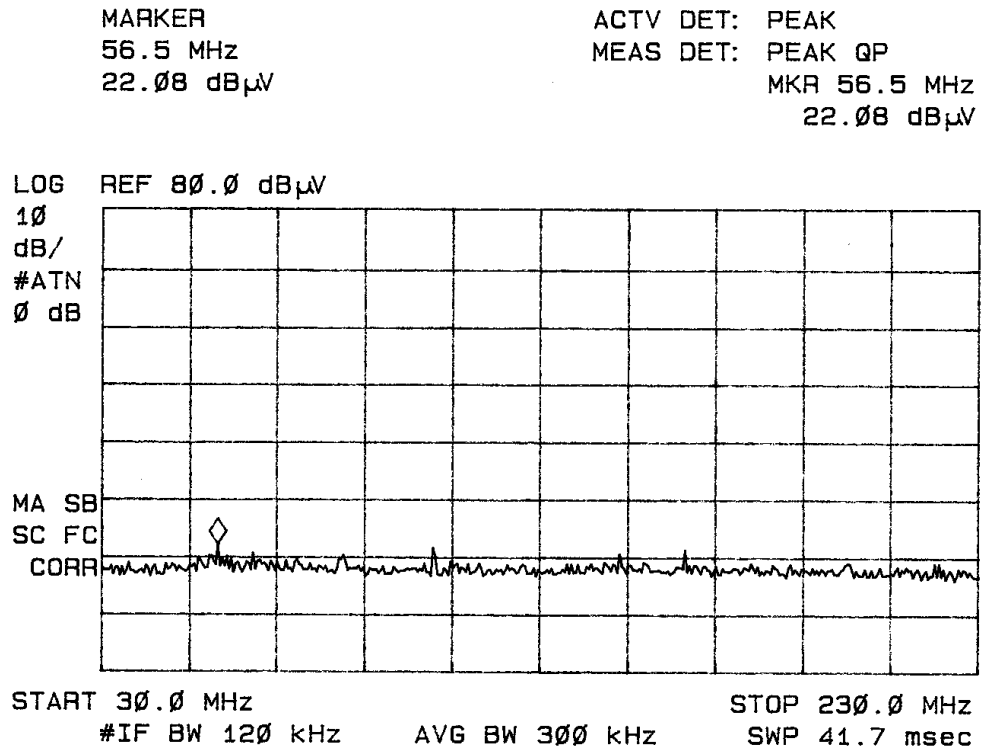


Figure twelve Radiated Emissions in screen room (BT Tx).

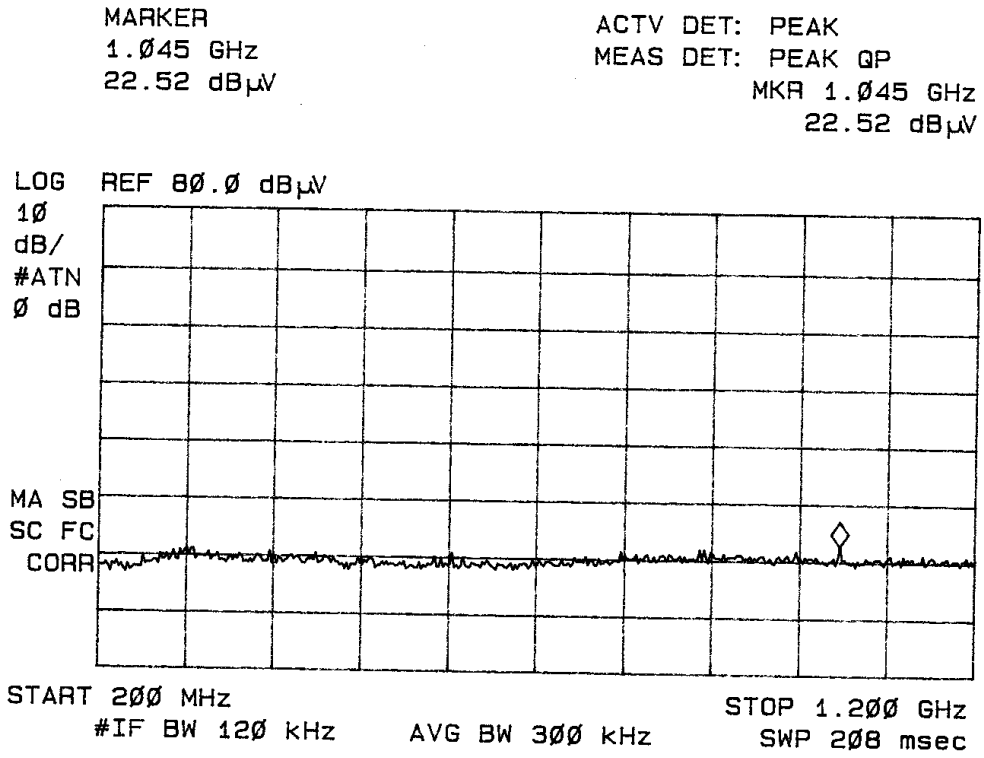


Figure thirteen Radiated Emissions in screen room (BT Tx).

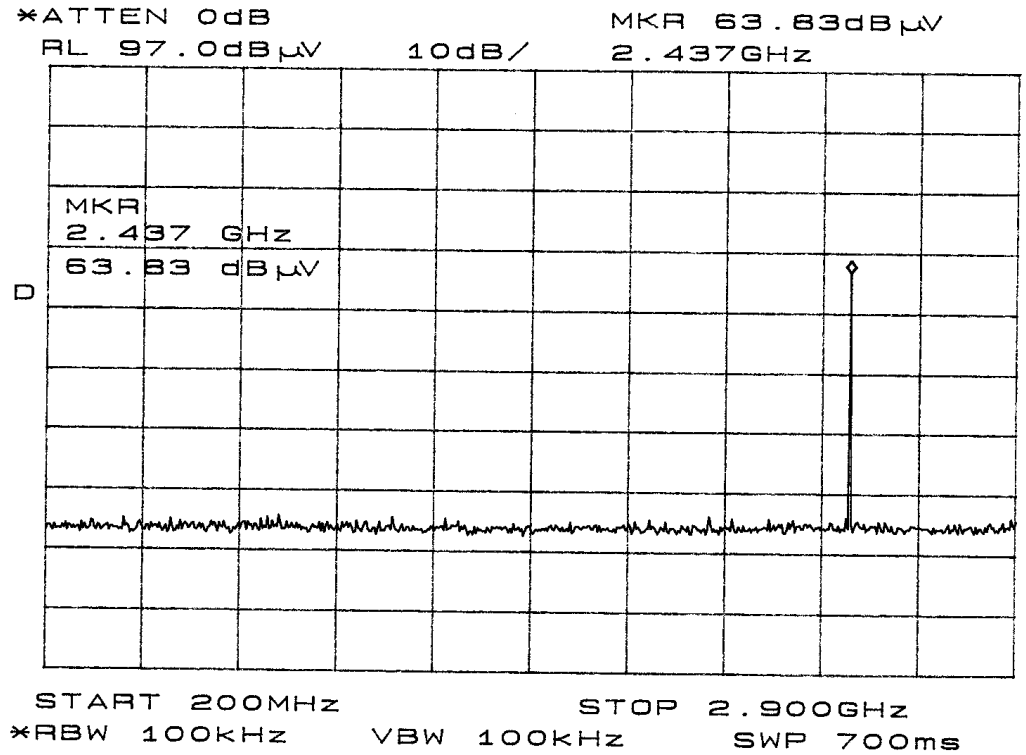


Figure fourteen Radiated Emissions in screen room (BT Tx).

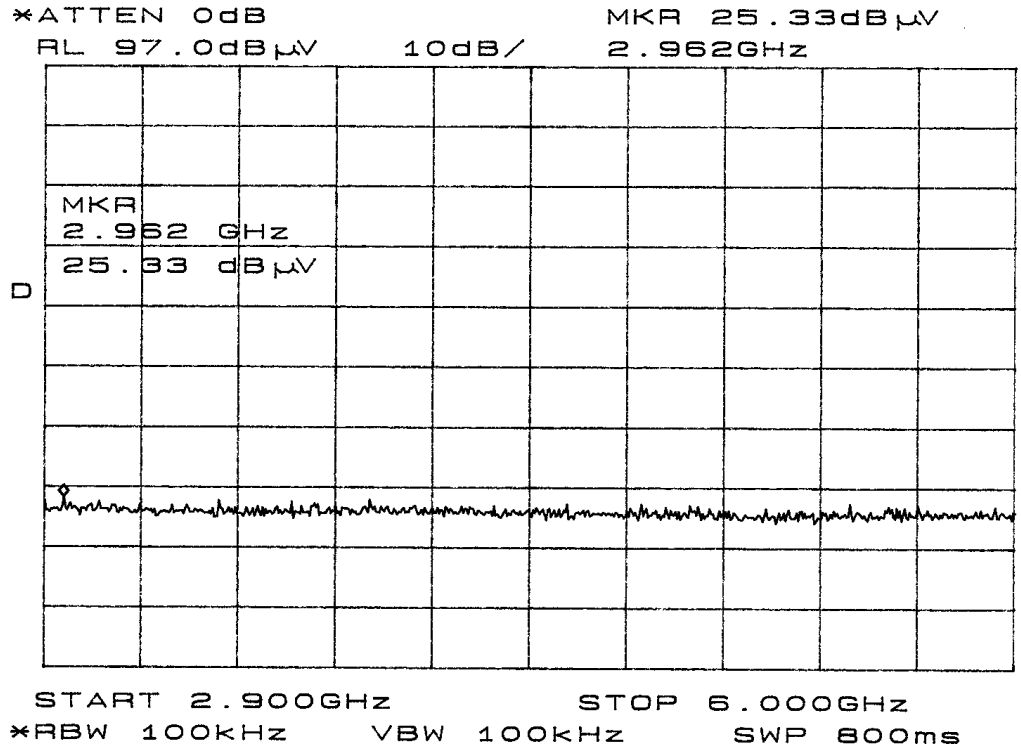


Figure fifteen Radiated Emissions in screen room (BT Tx).

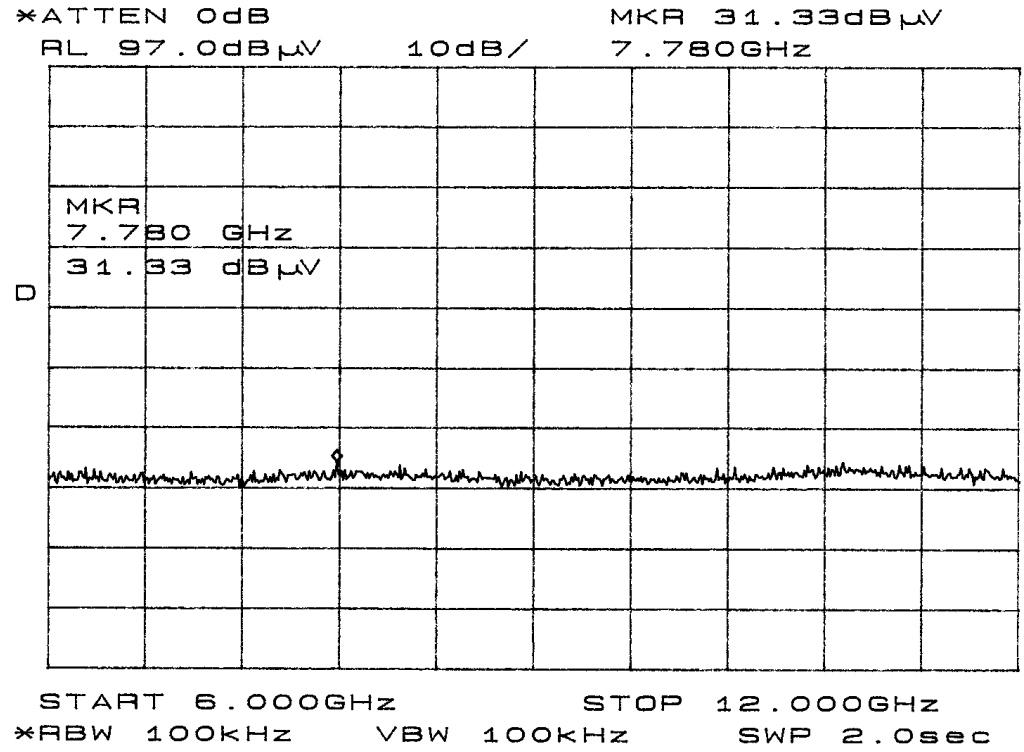


Figure sixteen Radiated Emissions in screen room (BT Tx).

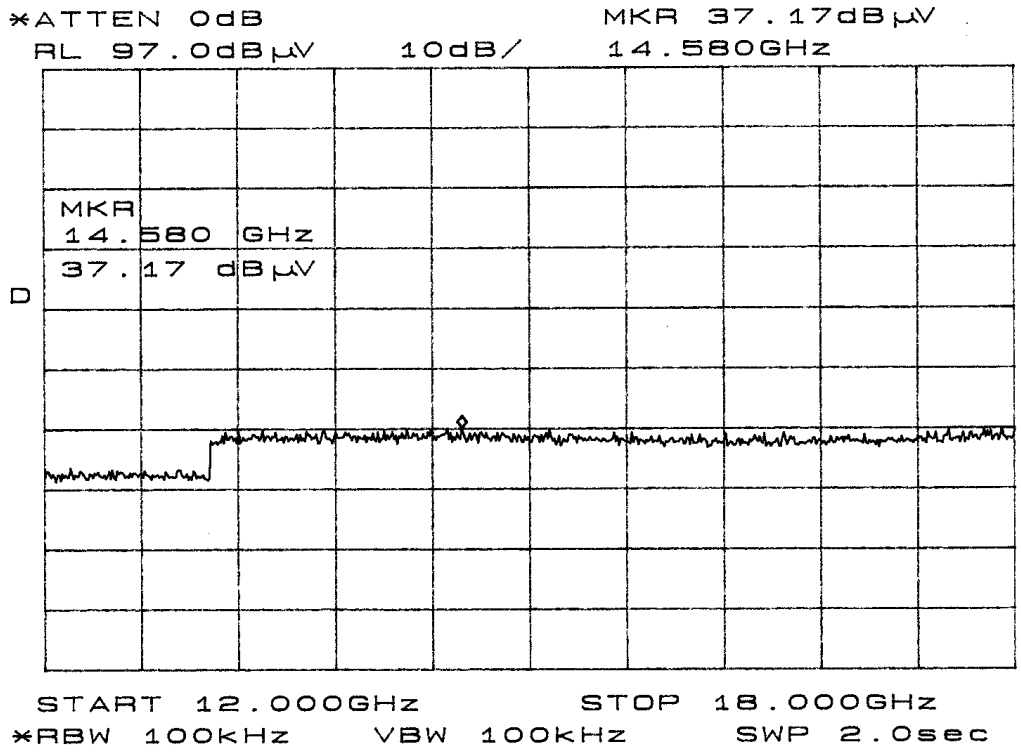


Figure seventeen Radiated Emissions in screen room (BT Tx).

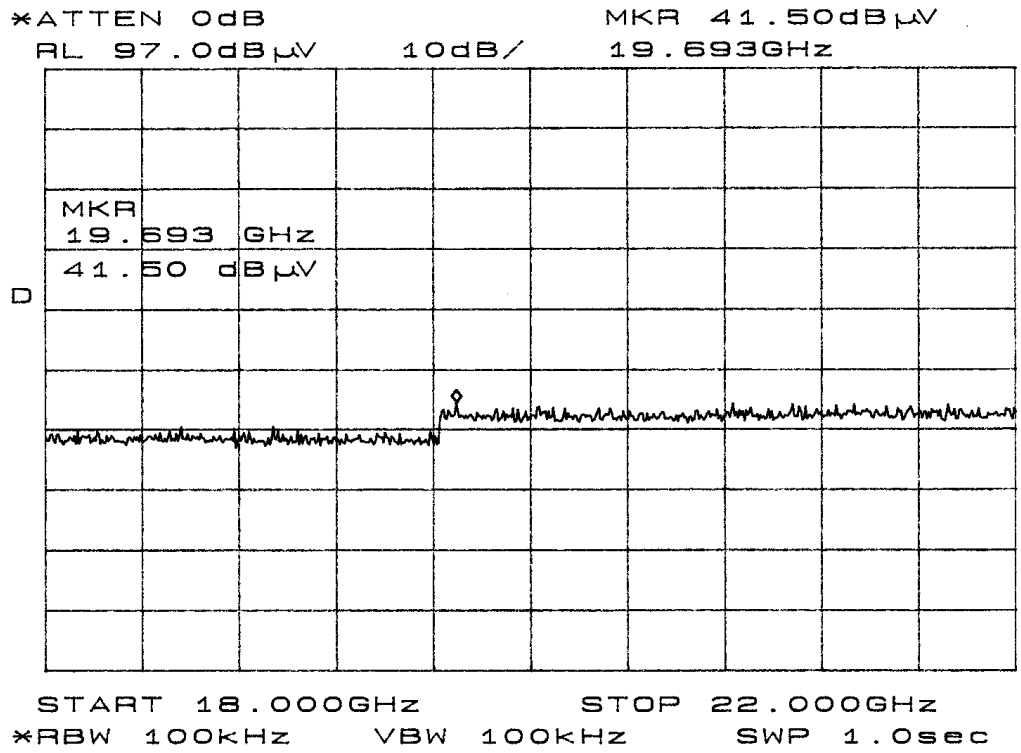


Figure eighteen Radiated Emissions in screen room (BT Tx).

General Radiated Emissions Data per 15.209

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)
403.8	32.5	30.7	16.3	30	18.8	17.0	46.0
1817.2	15.5	16.5	29.3	30	14.8	15.8	54.0
2209.2	16.6	16.5	31.1	30	17.7	17.6	54.0
2423.0	16.3	17.3	33.0	30	19.3	20.3	54.0

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

Summary of Results for General Radiated Emissions per 15.209

The radiated emissions for the EUT meet the requirements for FCC Part 15C and other applicable standards for Intentional Radiators. The EUT had a 27.2 dB minimum margin below the limits. Other emissions were present with amplitudes at least 20 dB below the FCC Limits.

15.239 Operation in the Band 88-108 MHz

Emissions from the intentional radiator shall be confined within a band 200 kHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the frequency range of 88-108 MHz. The EUT tunes channels in the 88.1-107.9 MHz band and the emissions meet the 200 kHz wide band restriction. Therefore, the requirements are met. There are no deviations or exceptions to the specification. The average field strength of any emission within the permitted 200 kHz band shall not exceed 250 micro volts/meter at 3 meters (48 dBµV/m). The emission limit in this paragraph is based on measuring equipment employing an average detector. Emissions were measured and data recorded for this report. No emission was measured above the limitations of this part for this transmitter. Therefore, the requirements are satisfied. There are no deviations or exceptions to the specifications. The field strength of any emissions radiated on any frequency outside of the 200 kHz band shall not exceed the general radiated emission limits in 15.209. Emissions were measured and data recorded for this report following the test procedures of ANSI 63.4-2003 paragraphs 13.1 and 8.3.1.2 during testing. No emission was measured above the limitations of this part for this transmitter. Therefore, the requirements are satisfied. The requirements of 15.209 are met there are no deviations or exceptions to the specification. Refer to figures nineteen through twenty-two showing plots of the emissions spectrum taken in a screen room demonstrating compliance to the requirements.

Intentional and Spurious Radiated Emissions Data per 15.239

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)
88.3	70.4	62.3	7.6	30	48.0	39.9	48.0
176.6	37.0	31.4	9.1	30	16.1	10.5	43.5
264.9	34.6	25.7	12.9	30	17.5	8.6	46.0
353.2	34.9	25.8	15.4	30	20.3	11.2	46.0
441.5	26.9	25.9	16.9	30	13.8	12.8	46.0
529.8	30.0	31.6	19.2	30	19.2	20.8	46.0
618.1	25.2	25.7	19.8	30	15.0	15.5	46.0
706.4	25.5	25.5	20.8	30	16.3	16.3	46.0
794.7	25.3	25.5	21.8	30	17.1	17.3	46.0
98.5	69.8	62.8	7.3	30	47.1	40.1	48.0
197.0	28.3	32.0	10.4	30	8.7	12.4	43.5
295.5	32.2	29.3	13.9	30	16.1	13.2	46.0
394.0	31.8	28.6	16.3	30	18.1	14.9	46.0
492.5	26.5	26.5	18.1	30	14.6	14.6	46.0
591.0	25.5	31.5	19.2	30	14.7	20.7	46.0
689.5	25.6	25.5	20.7	30	16.3	16.2	46.0
788.0	26.5	26.6	21.8	30	18.3	18.4	46.0
886.5	33.6	38.7	23.4	30	27.0	32.1	46.0
107.9	71.2	64.2	6.7	30	47.9	40.9	48.0
215.8	33.9	29.3	11.2	30	15.1	10.5	43.5
323.7	32.3	39.7	14.7	30	17.0	24.4	46.0
431.6	30.3	29.6	16.8	30	17.1	16.4	46.0
539.5	27.1	26.9	19.6	30	16.7	16.5	46.0
647.4	26.4	27.0	20.5	30	16.9	17.5	46.0
755.3	25.9	25.6	21.6	30	17.5	17.2	46.0
863.2	27.9	34.3	22.6	30	20.5	26.9	46.0
971.1	25.3	25.4	23.4	30	18.7	18.8	54.0

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

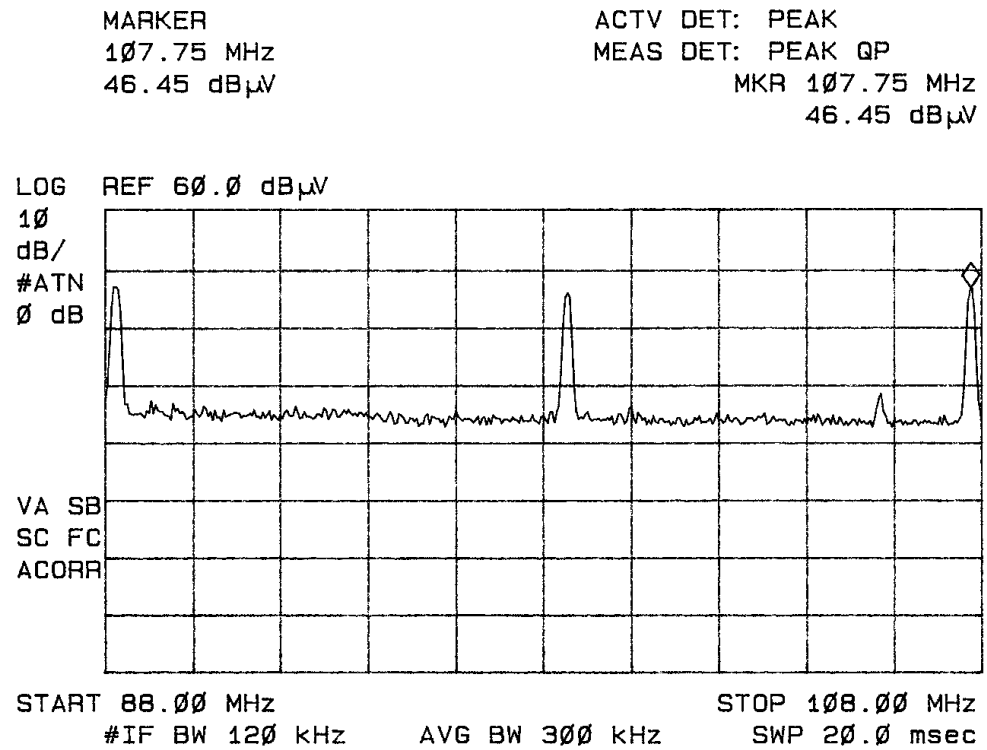


Figure nineteen Output power across the operational band

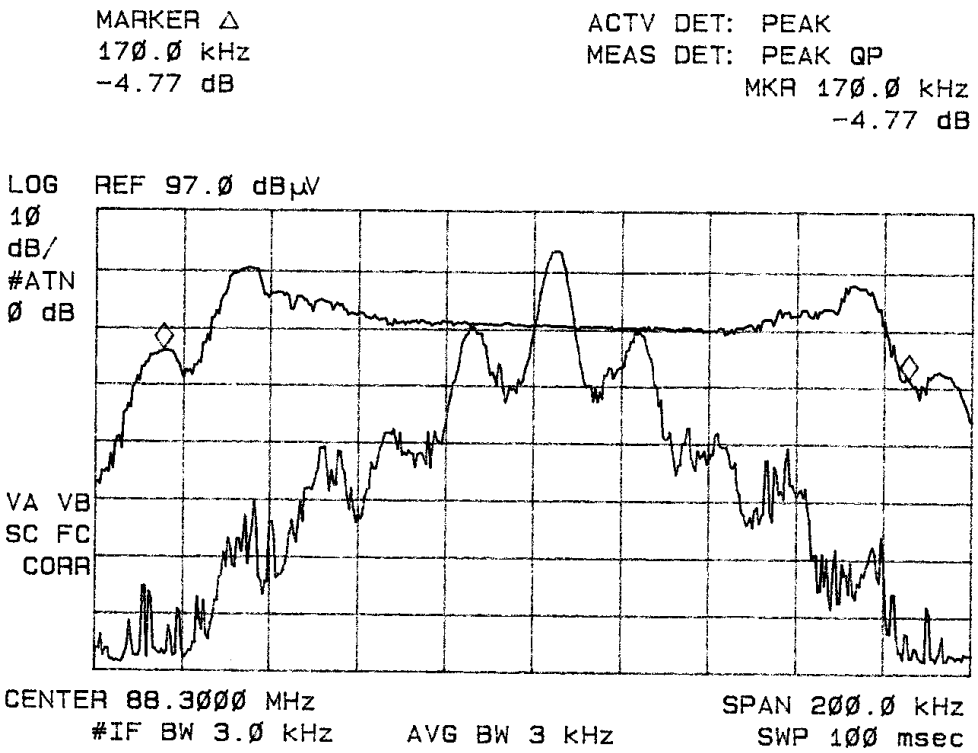


Figure twenty Band Edges and bandwidth

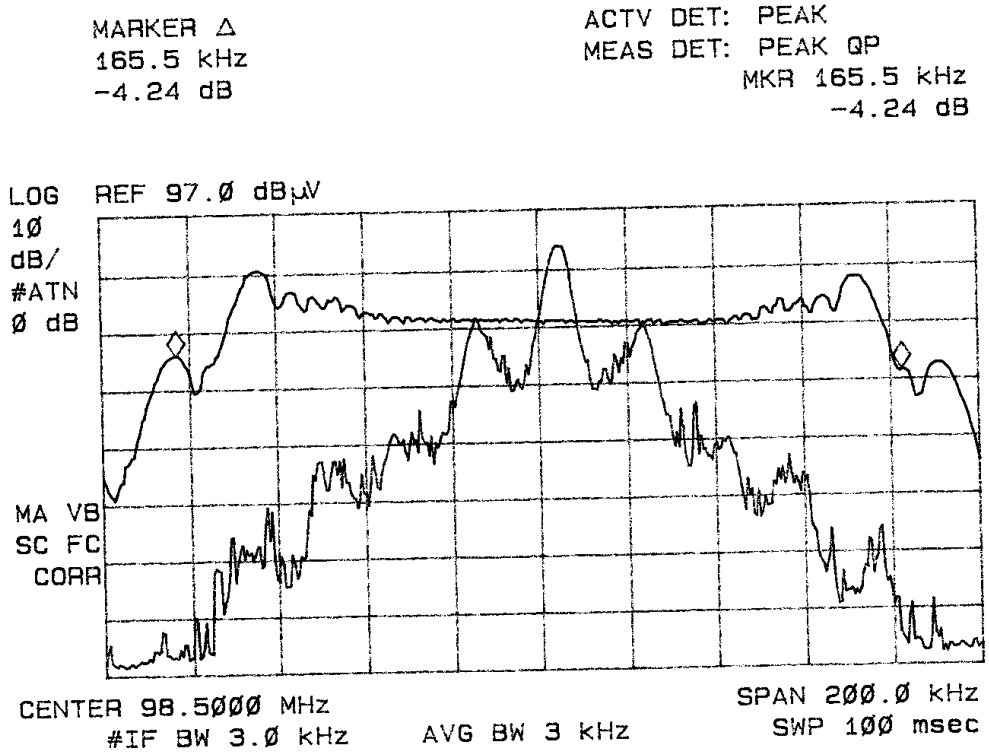


Figure twenty-one 200 kHz Occupied Bandwidth

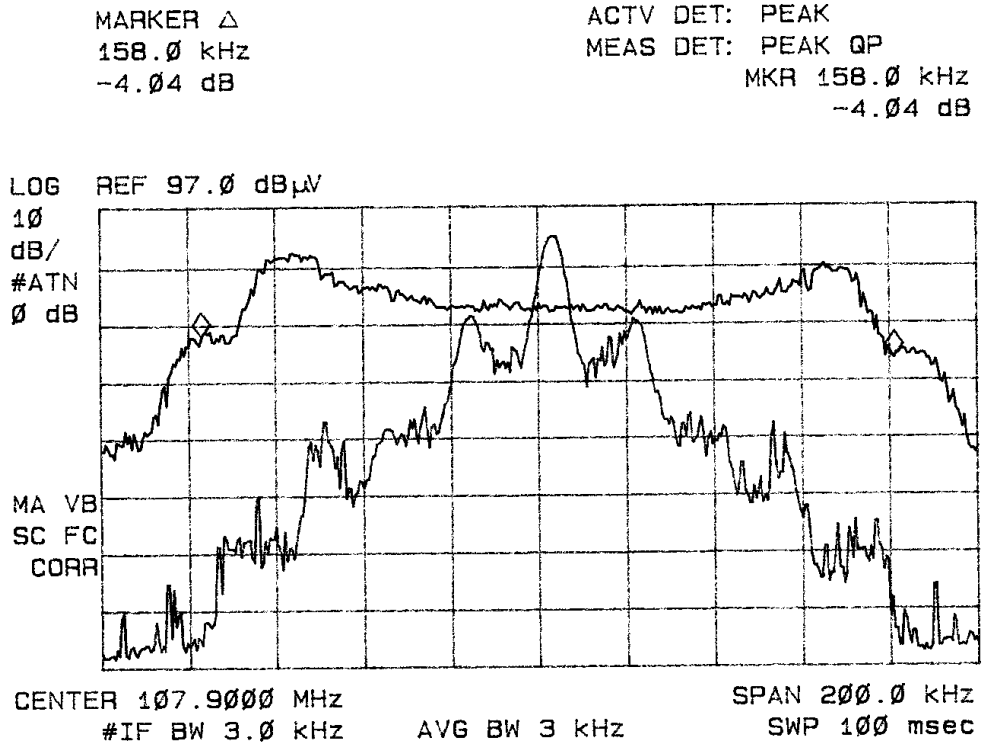


Figure twenty-two Band Edges and bandwidth

Summary of Results for Radiated Emissions per 15.239

The EUT had a 0 dB margin below the limits of 15.239. The radiated emissions for the EUT meet the requirements for FCC CFR47 Part 15.239 and other applicable standards for Intentional Radiators. There are no measurable emissions in the restricted bands other than those recorded in this report. Other emissions were present with amplitudes at least 20 dB below the FCC Limits.

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

The power output was measured on an open field 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 twenty-three through thirty-one showing the frequency and amplitude of emission displayed on the spectrum analyzer measured at the temporary test antenna, antenna-conducted emissions were taken in a screen room. The amplitudes of each spurious emission were measured both at the OATS at a distance of 3 meters from the FSM antenna and antenna conducted. 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.

Sample calculation.

dBµV/m@ 3m = FSM + A.F. + cable loss - amplifier Gain
= 81.5 + 32.9 – 30
= 84.4

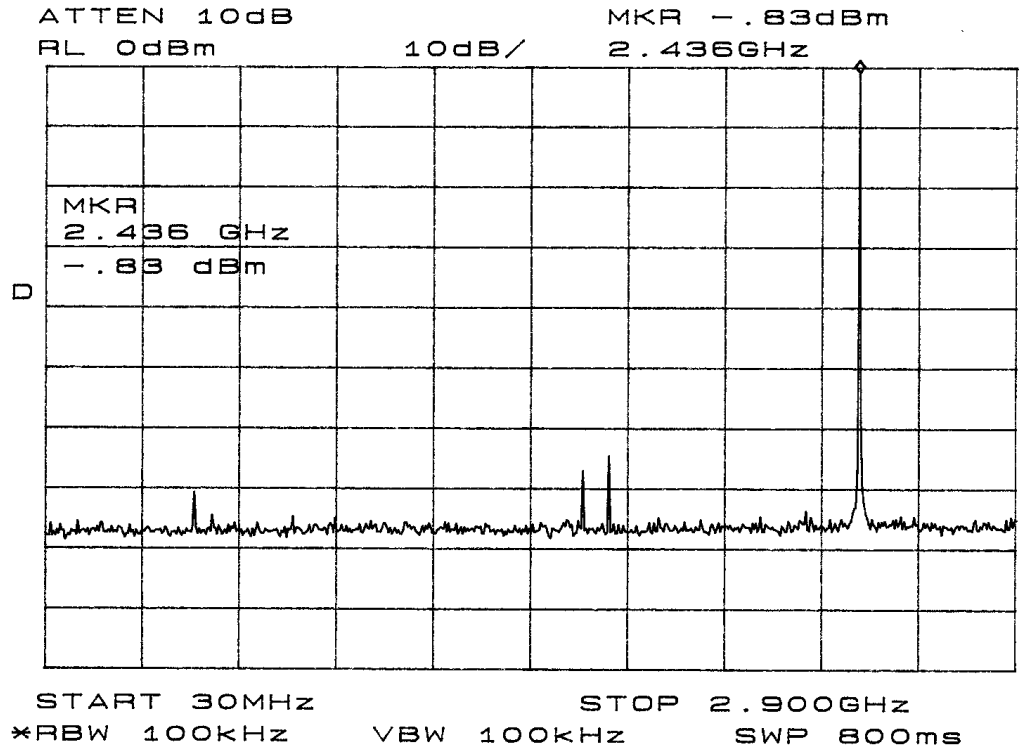


Figure twenty-three output measured at temporary antenna terminal

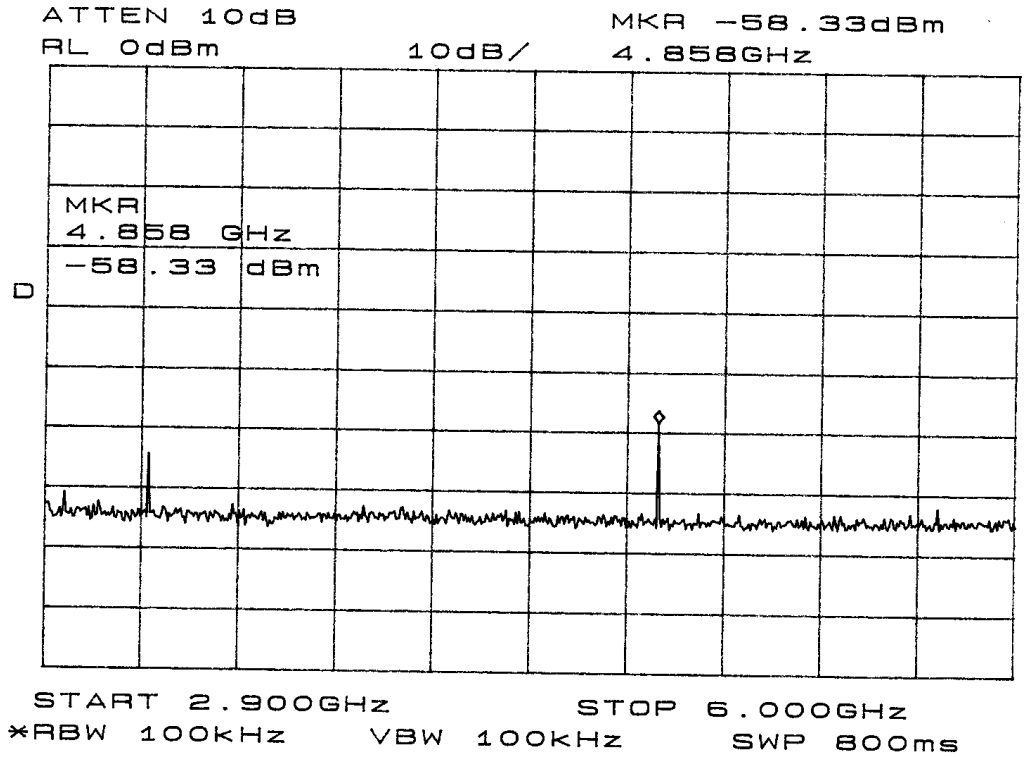


Figure twenty-four Power output measured at temporary antenna terminal

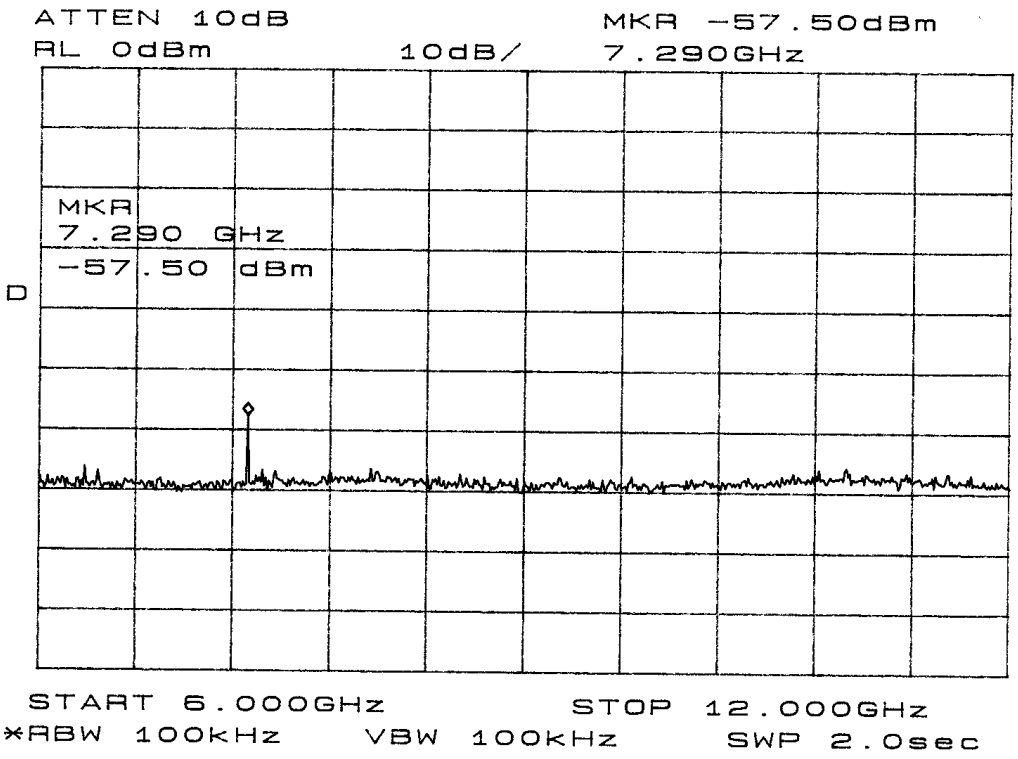


Figure twenty-five Power output measured at temporary antenna terminal

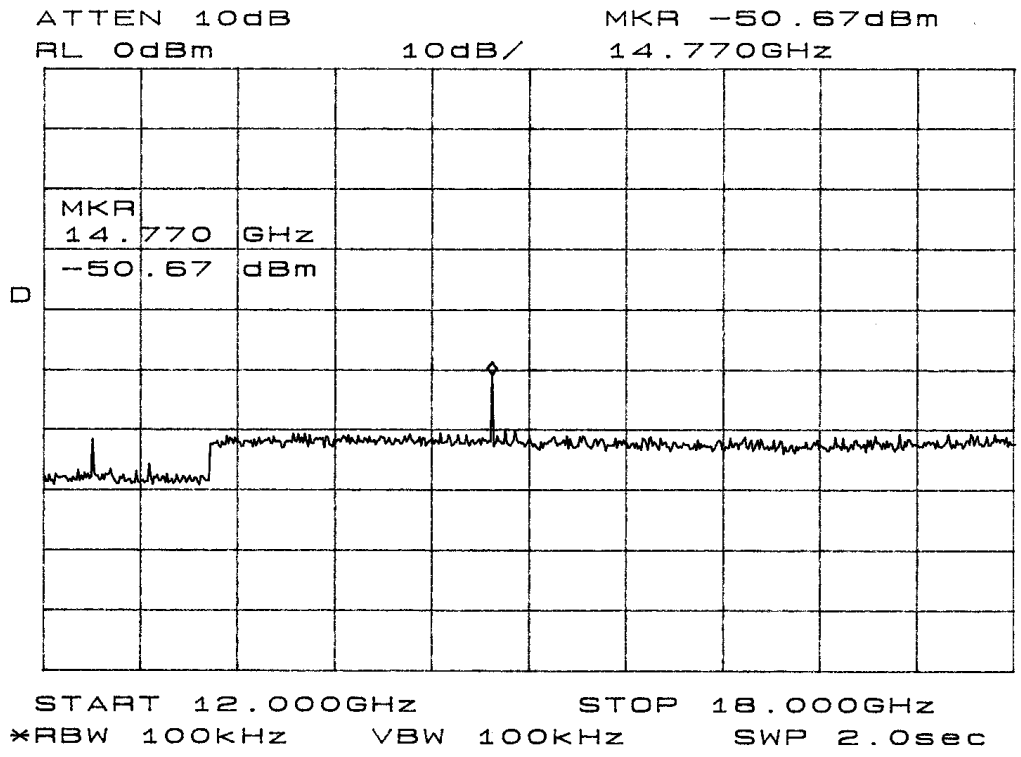


Figure twenty-six output measured at temporary antenna terminal

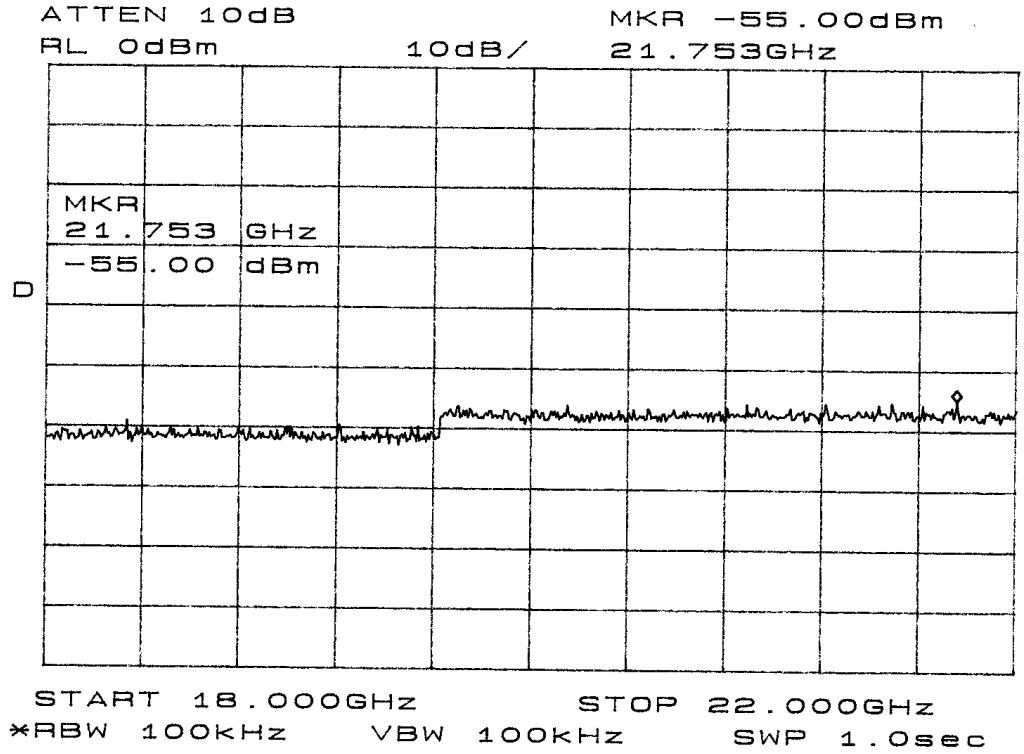


Figure twenty-seven output measured at temporary antenna terminal

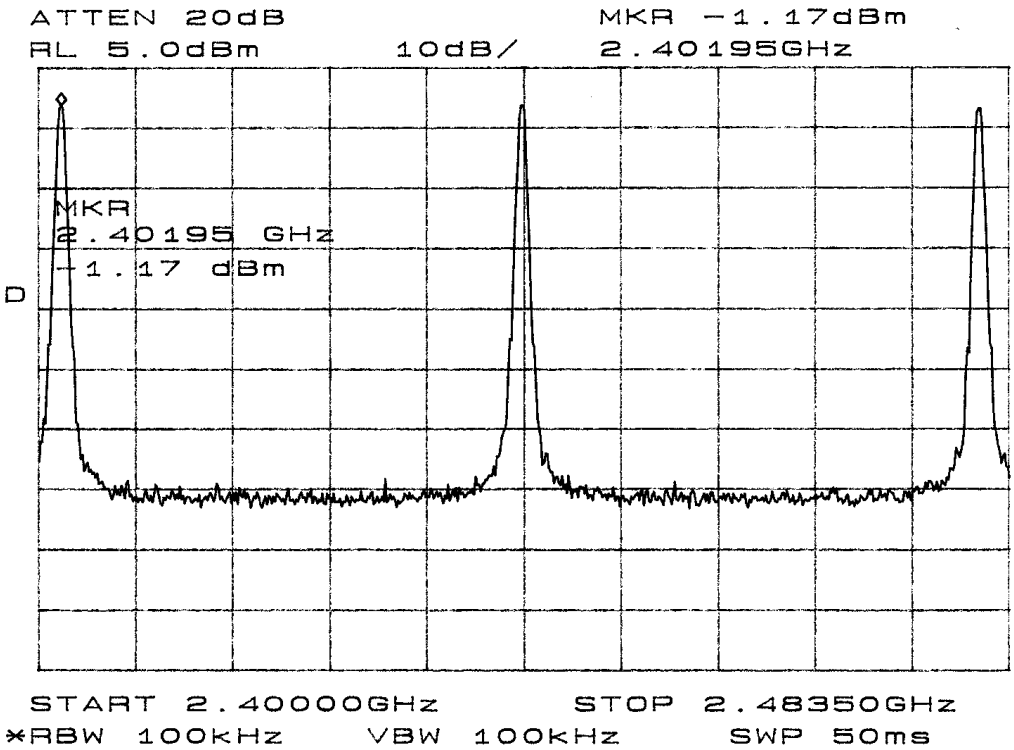


Figure twenty-eight output measured at temporary antenna terminal

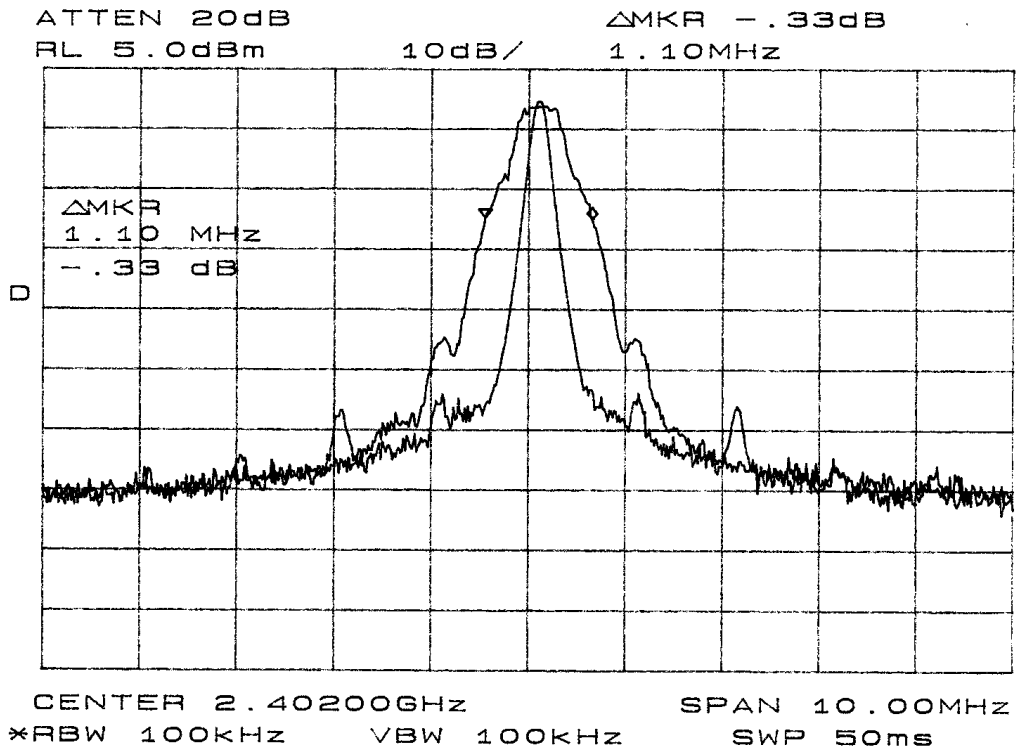


Figure twenty-nine Occupied Bandwidth

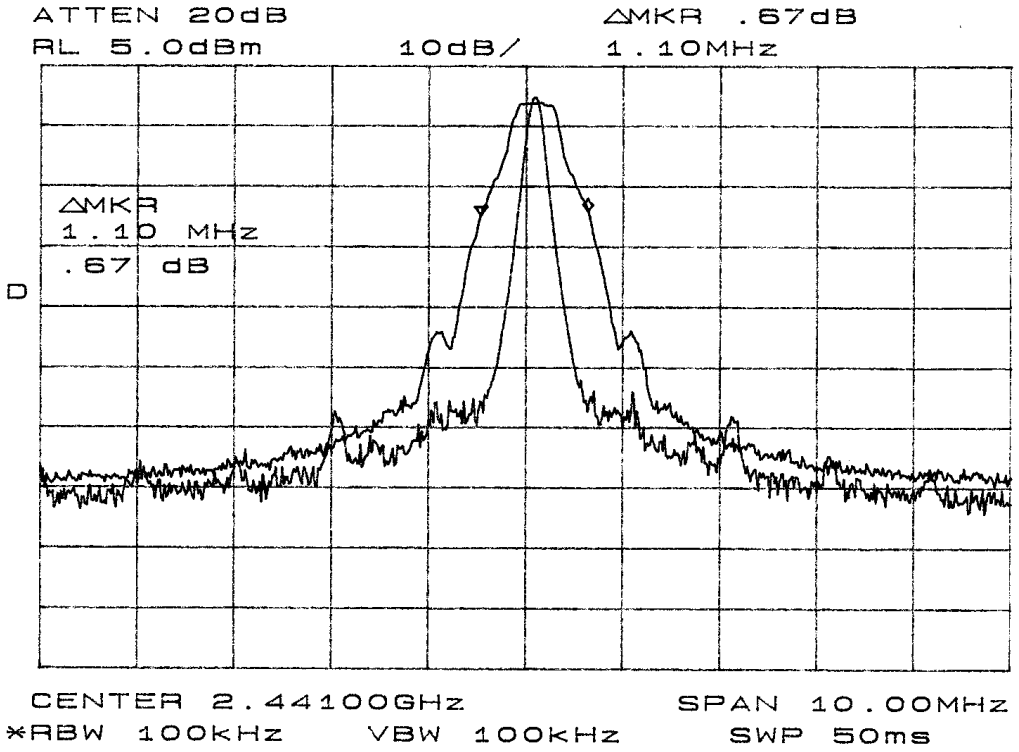


Figure thirty Occupied Bandwidth

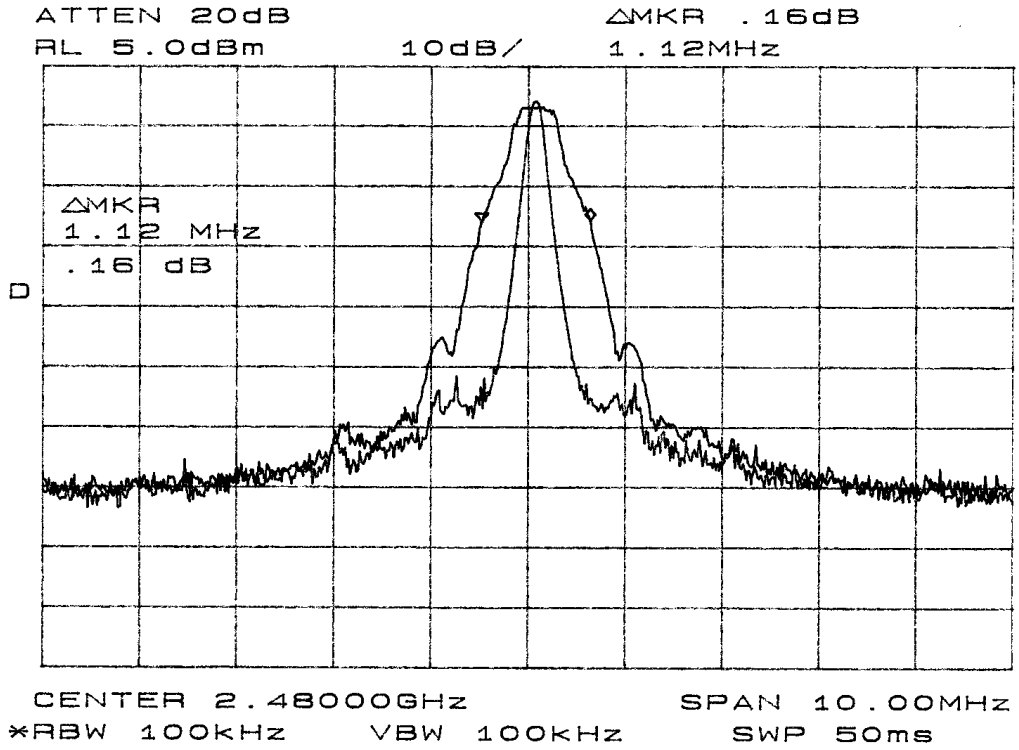


Figure thirty-one Occupied Bandwidth

Transmitter Radiated Emissions Data per 15.249

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	84.2	81.5	88.2	86.3	32.9	30	87.1	84.4	91.1	89.2	94.0
4804.0	23.8	16.0	25.8	16.6	32.5	30	26.3	18.5	28.3	19.1	54.0
7206.0	24.6	17.2	25.3	18.5	36.0	30	30.6	23.2	31.3	24.5	54.0
9608.0	28.0	19.0	30.0	19.6	38.1	30	36.1	27.1	38.1	27.7	54.0
12010.0	27.0	18.0	29.5	18.2	40.0	30	37.0	28.0	39.5	28.2	54.0
2441.0	85.2	82.0	88.5	86.2	33.4	30	88.6	85.4	91.9	89.6	94.0
4882.0	27.5	16.1	27.3	17.5	32.8	30	30.3	18.9	30.1	20.3	54.0
7323.0	28.5	19.0	29.3	18.6	36.3	30	34.8	25.3	35.6	24.9	54.0
9764.0	26.9	17.0	29.6	19.1	38.3	30	35.2	25.3	37.9	27.4	54.0
12205.0	26.5	18.5	29.3	19.0	40.4	30	36.9	28.9	39.7	29.4	54.0
2480.0	83.7	81.8	88.3	86.5	33.3	30	87.0	85.1	91.6	89.8	94.0
4960.0	24.0	16.5	27.2	18.5	32.9	30	26.9	19.4	30.1	21.4	54.0
7440.0	26.5	19.1	28.2	18.1	36.7	30	33.2	25.8	34.9	24.8	54.0
9920.0	29.0	19.0	28.6	19.5	38.4	30	37.4	27.4	37.0	27.9	54.0
12400.0	28.3	20.0	27.7	20.3	40.6	30	38.9	30.6	38.3	30.9	54.0

Note: Levels measured @ 3-meter OATS site.

Power from Antenna Substitution Method for 15.249

Frequency of Emission	Measured Peak Amplitude of EUT emission		Signal level to substitution antenna required to reproduce	
	Horizontal	Vertical	Horizontal	Vertical
(MHz)	dBµV	dBµV	dBm	dBm
2402.0	81.5	86.3	-10.8	-6.0
2441.0	82.0	86.2	-9.8	-5.6
2480.0	81.8	86.5	-10.1	-5.4

Transmitter Antenna Conducted Emissions Data

Frequency (MHz)	Emission level (dBm)
2441.0	0.17
4882.0	-58.8
7323.0	-57.3
9764.0	-71.6
12205.0	-64.1
14646.0	-56.3
17087.0	-61.3
19528.0	-64.2
21969.0	-58.0

Summary of Results for Transmitter Radiated Emissions per 15.249

The EUT had a peak amplitude emission of 2.1 dB margin below the average limit of CFR47 15.249. The EUT had worst-case radiated harmonic emission Peak amplitude of 23.1 dB margin below the average limit of 15.209 and 15.249. The radiated emissions for the EUT meet the requirements for FCC CFR47 Part 15.249 and other applicable standards for Intentional Radiators. There are no measurable emissions in the restricted bands other than those recorded in this report. Other emissions were present with amplitudes at least 20 dB below the FCC Limits.

Frequency Stability

Measurements Required

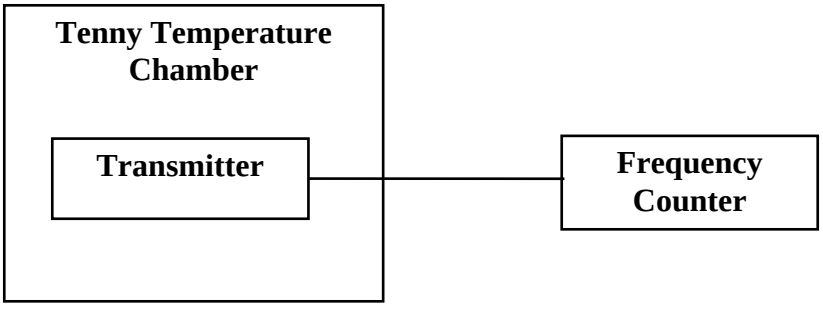
Temperature stability was measured for the operating temperature range and voltage variations of the unit and recorded. Test procedures used were those defined in ANSI 63.4-2003 paragraph 13.1.6.

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, batteries powered equipment, reduce primary supply voltage to the battery-operating end-point, which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided.

Test Arrangement



The measurement procedure outlined below shall be followed:

Step 1: The transmitter shall be installed in an environmental test chamber whose temperature is controllable. Provision shall be made to measure the frequency of the transmitter.

Step 2: With the transmitter inoperative (power switched "OFF"), the temperature of the test chamber shall be adjusted to +25ºC. After a temperature stabilization period of one hour at +25ºC, the transmitter shall be switched "ON" with standard test voltage applied.

Step 3: The carrier shall be keyed "ON", and the transmitter shall be operated unmodulated at full radio frequency power output at the duty cycle for which it is rated, for duration of at least 5 minutes. The radio frequency carrier frequency shall be monitored and measurements shall be recorded.

Step 4: The test procedures outlined in Steps 2 and 3, shall be repeated after stabilizing the transmitter at the environmental temperatures specified.

The frequency stability was measured with variations in the power supply voltage from 85 to 115 percent of the nominal value. The frequency was measured and the variation in parts per million was calculated.

Frequency Stability Data

Nominal frequency 2,441.00 MHz	Frequency Stability Vs Temperature In Parts Per Million (PPM) and Percent								
	Temperature in °C								
	-30	-20	-10	0	+10	+20	+30	+40	+50
Change (Hz)	1000.0	600.0	600.0	600.0	0.0	0.0	300.0	300.0	300.0
PPM	0.410	0.246	0.246	0.246	0.000	0.000	0.123	0.123	0.123
%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Frequency 2441.00 MHz	Stability Vs Voltage Variation ±15% In PPM Input Voltage		
	11.7 V_{dc}	13.8 V_{dc}	15.8 V_{dc}
2441.000	0	0	0

Specifications of Paragraphs 15.249 are met. There are no deviations to the specifications.

Summary of Results for Frequency Stability

The EUT fulfills the requirements for CFR47 Part 15C and other applicable standards for Intentional Radiators frequency stability. The EUT FM transmitter had a 43.9 PPM worst-case stability at -30 degrees centigrade. The EUT Bluetooth transmitter had a 1.0 PPM worst-case stability at -20 degrees centigrade.

Annex

Model: 011-01943-xx

1. Test Equipment List
2. Rogers Qualifications
3. FCC Site Approval Letter

Annex 1 Test Equipment List For Rogers Labs, Inc.

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	2/08
Wattmeter: Bird 43 with Load Bird 8085	2/08
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/08
H/V Power Supply: Fluke Model: 408B (SN: 573)	2/08
R.F. Generator: HP 606A	2/08
R.F. Generator: HP 8614A	2/08
R.F. Generator: HP 8640B	2/08
Spectrum Analyzer: HP 8562A, Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W HP Adapters: 11518, 11519, 11520	5/08
Spectrum Analyzer: HP 8591EM	5/08
Frequency Counter: Leader LDC825	2/08
Antenna: EMCO Biconilog Model: 3143	5/08
Antenna: EMCO Log Periodic Model: 3147	10/07
Antenna: Antenna Research Biconical Model: BCD 235	10/07
Antenna: EMCO Dipole Set 3121C	2/08
Antenna: C.D. B-101	2/08
Antenna: Solar 9229-1 & 9230-1	2/08
Antenna: EMCO 6509	2/08
Audio Oscillator: H.P. 201CD	2/08
R.F. Power Amp 65W Model: 470-A-1010	2/08
R.F. Power Amp 50W M185- 10-501	2/08
R.F. PreAmp CPPA-102	2/08
LISN 50 µHy/50 ohm/0.1 µf	10/07
LISN Compliance Eng. 240/20	2/08
LISN Fischer Custom Communications FCC-LISN-50-16-2-08	2/08
Peavey Power Amp Model: IPS 801	2/08
Power Amp A.R. Model: 10W 1010M7	2/08
Power Amp EIN Model: A301	2/08
ELGAR Model: 1751	2/08
ELGAR Model: TG 704A-3D	2/08
ESD Test Set 2010i	2/08
Fast Transient Burst Generator Model: EFT/B-101	2/08
Current Probe: Singer CP-105	2/08
Current Probe: Solar 9108-1N	2/08
Field Intensity Meter: EFM-018	2/08
KEYTEK Ecat Surge Generator	2/08
Shielded Room 5 M x 3 M x 3.0 M	

Annex 2 Qualifications

Scot D. Rogers

Rogers Labs, Inc.

Engineer

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

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

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

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

Scot D Rogers

Scot D. Rogers

July 8, 2008

NVLAP Lab Code 200087-0

Annex 3 FCC Site Registration Letter

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

May 16, 2006

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 16, 2006

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
Information Technician