NVLAP Lab Code 200087-0

APPLICATION

For

GRANT OF CERTIFICATION

FOR

MODEL:

01101478

Low Power Transmitter

FCC ID: IPH-01093

IC: 1792A-01093

FOR

GARMIN INTERNATIONAL, INC.

1200 East 151st Street

Olathe, KS 66062

Test Report number 070425T

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: 01101478

Low Power Transmitter
Frequency Ranges: 88-107, 2,400-2,483.5 MHz

FCC ID: IPH-01093
IC: 1792A-01093

Test Report Number: 070425T

Test Date: April 25, 2007

Certifying Engineer: Scot D Rogers

Scot D. Rogers
ROGERS LABS, INC.
4405 West 259th Terrace
Louisburg, KS 66053
Telephone: (913) 837-3214
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 Paragraph 15.239, and Industry Canada RSS-210 Low Power Transmitter, operation in the 88-108 MHz band.

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

Model: 01101478

FCC ID: IPH-01093

Industry Canada ID: 1792A-01093

Frequency Range: 88-108 MHz and 2402-2480 MHz.

Operating Power: Less than 250 Microvolt per meter (88-108 MHz) and 1 mW (as design specification, measured 90.6 dBµV/m @ 3 meters), for operation in the 2400-2483.5 MHz.

Applicable Standards & Test Procedures

a) In accordance with the Federal Communications Commission, Code of Federal Regulations CFR47, dated October 1, 2006, 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 Industry Canada RSS-210, the following information is submitted.

b) Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in the ANSI 63.4-2003 Document.

Equipment Tested

Equipment	Serial Number	FCC I.D.#
01101478	33	IPH-01093
AC Power Adapter(JSP050 100UU)	E1	N/A
AC Power Adapter(ADP-5FH B)	03W0704041450	N/A
AC Power Adapter(PSC05R-050A1)	E3	N/A
GA 27C	E1GA27C	N/A
GTM 20	E1GTM20	N/A
GTM 21	128253432	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 Appendix 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	10/06	10/07
LISN	Comp. Design	1762	2/07	2/08
Antenna	ARA	BCD-235-B	10/06	10/07
Antenna	EMCO	3147	10/06	10/07
Antenna	EMCO	3143	5/06	5/07
Analyzer	HP	8591EM	5/06	5/07
Analyzer	HP	8562A	2/07	2/08

2.1033(b) Application for Certification

(1) Manufacturer: GARMIN INTERNATIONAL, INC.
1200 East 151st Street
Olathe, KS 66062
Telephone: (913) 397-8200

(2) FCC Identification: FCC I.D.: IPH-01093 IC: 1792A-1093

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

(4) Description of Circuit Functions, Device Operation: The 011-01478-xx is a low power Transmitter. This device features 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, GTM 20, GTM 21, external microphone, auxiliary audio output, I-Pod interface cable, and USB cable for computer interface. The available configuration options were investigated for this report 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 and Cable Configuration

Test Setup

The 01101478, is a GPS receiver 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 a typical user equipment configuration 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 the CFR47, 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.

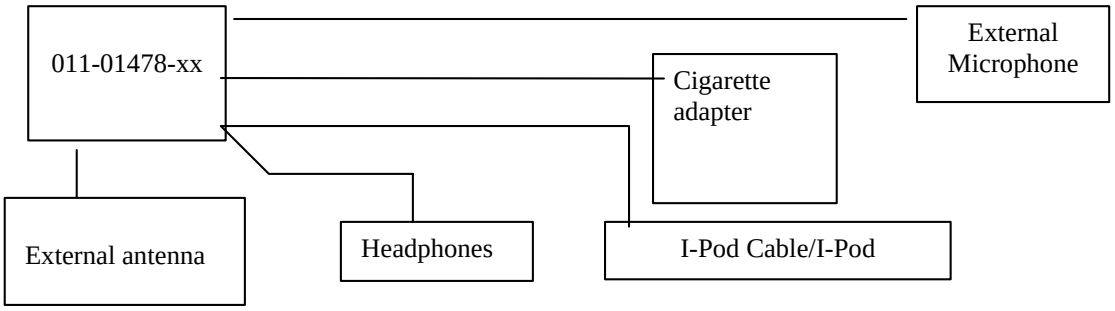
Equipment Function and Testing Procedures

The EUT is a low power transmitter with 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.

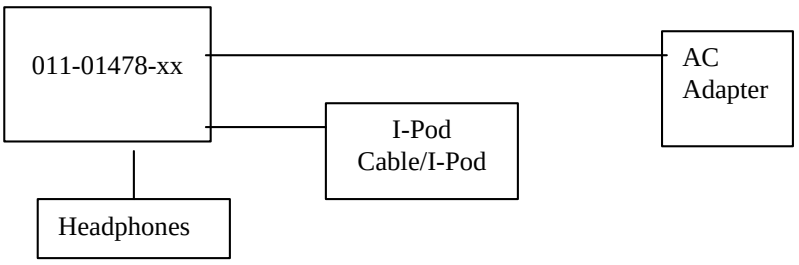
Configuration options for the EUT

Configurations for the 011-01478

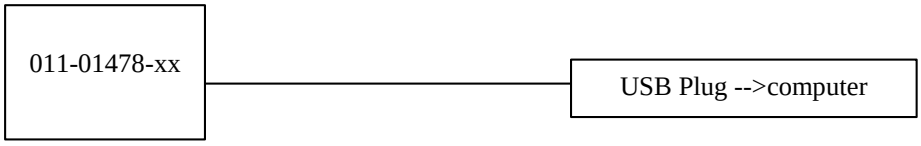
1. 011-01478 (GPN: 011-01478-XX) connected to car cigarette lighters adapters(GTM20:010-00544-01; GTM-21: 010-00566-00; 010-10747-03), GA 27C external antenna (GPN: 011-00149-05), External Microphone (GPN: 010-10804-00), I-pod cable/I-Pod(GPN: 320-00366-10) and headphones.



2. 011-01478 connected to AC Adapters (GPN: 362-00028-03; 362-00042-00; 362-00043-04) , I-pod Cable/ I-pod, and headphones.



3. 011-01478 connected to computer through USB cable (GPN: 325-00128-00).



AC Line Conducted Emission Test Procedure

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

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.

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 Appendix for FCC Site Approval Letter, Reference 90910, and Industry Canada Site Approval Letter Reference IC 3041-1.

Subpart C - Intentional Radiators

As per CFR47 Part 15, Subpart C 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 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 Blue Tooth transmitter 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.

Sample Calculations:

Computed Peak (dBµV/m @ 3m) = FSM (dBµV) + A.F. (dB) - Gain (dB)
= 40.4 + 8.0 - 30
= 18.4

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)
129.2	40.4	31.7	8.0	30	18.4	9.7	43.5
130.0	46.9	42.1	8.0	30	24.9	20.1	43.5
164.6	35.2	33.6	8.7	30	13.9	12.3	43.5
268.6	35.6	40.4	12.8	30	18.4	21.2	46.0
264.3	42.7	32.5	12.5	30	25.2	15.0	46.0
323.1	52.5	39.9	14.9	30	37.4	24.8	46.0
969.3	22.0	22.1	22.9	30	14.9	15.0	54.0
4804.0	18.3	16.8	40.6	30	28.9	27.4	54.0
4882.0	18.8	19.8	39.8	30	28.6	29.6	54.0
4960.0	19.0	19.1	39.8	30	28.8	28.9	54.0
7323.0	18.5	17.7	36.5	30	25.0	24.2	54.0
7440.0	18.8	18.8	36.7	30	25.5	25.5	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 18.6 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 a typical equipment configuration (configurations 2 and 3). 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 (configuration #2) or computer (configuration #3). 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 JSP050 100UU) conducted emissions frequency spectrum taken in the screen room. Refer to Figures 3 and 4 for plots of the EUT (AC adapter ADP-5FH B) conducted emissions frequency spectrum taken in the screen room. Refer to Figures 5 and 6 for plots of the EUT (AC adapter PSC05R-050A1) conducted emissions frequency spectrum taken in the screen room. Refer to Figures 7 and 8 for plots of the CPU conducted emissions frequency spectrum taken in the screen room.

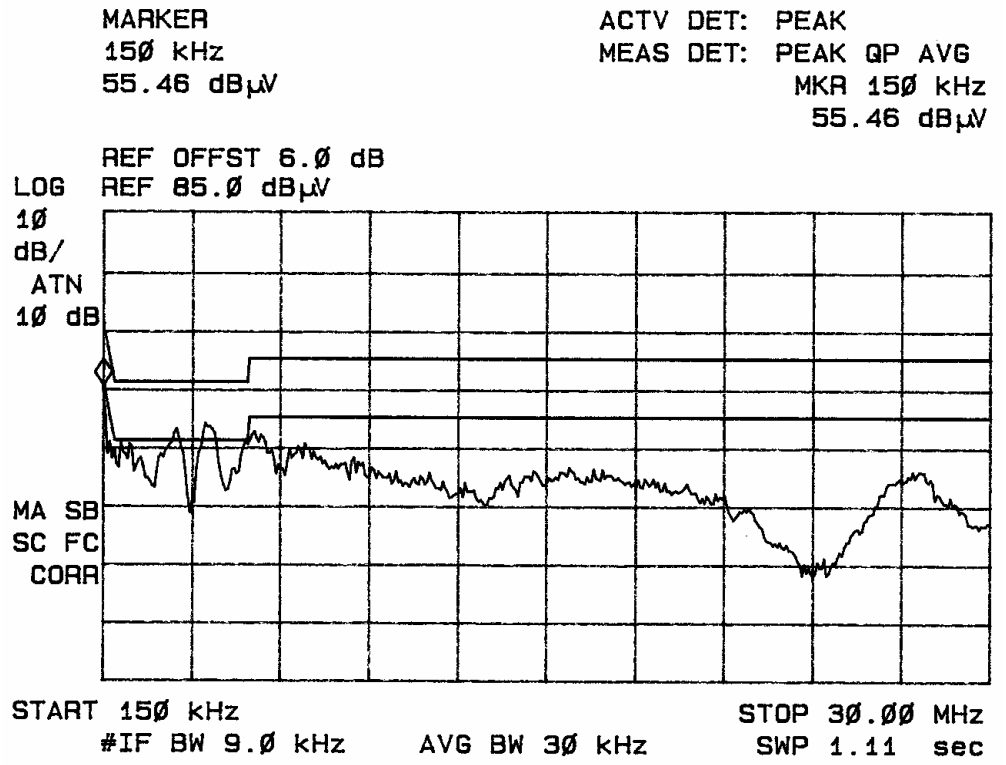


Figure one Conducted emissions of EUT line 1 (JSP050 100UU)

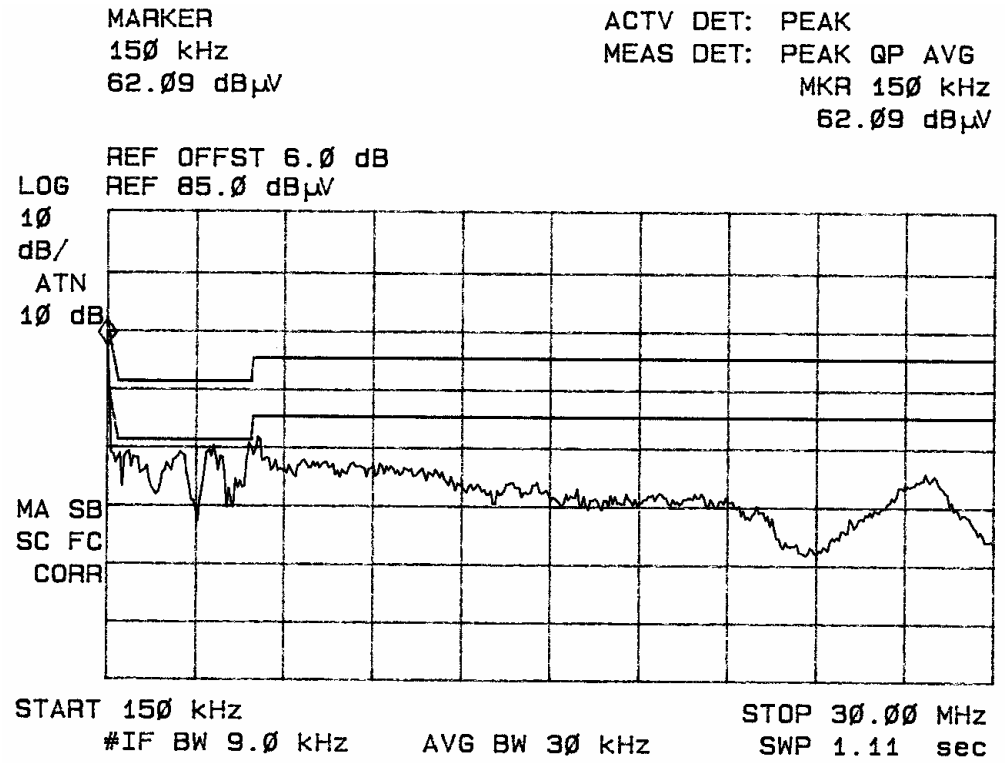


Figure two Conducted emissions of EUT line 2 (JSP050 100UU)

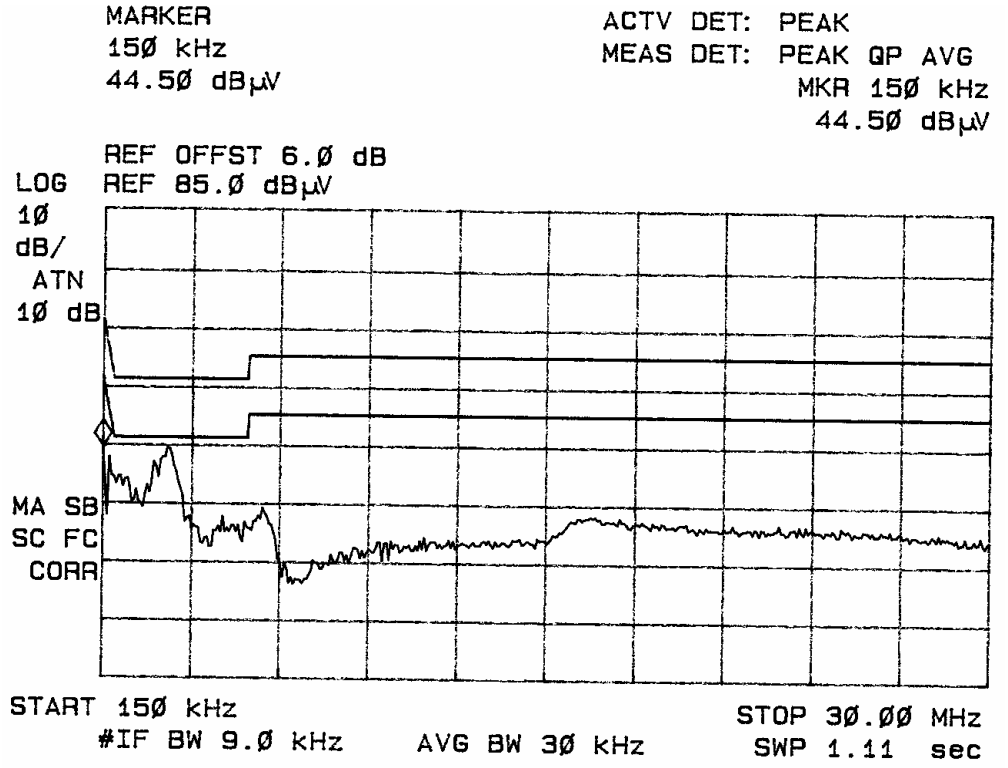


Figure three Conducted emissions of EUT line 1 (ADP-5FH B)

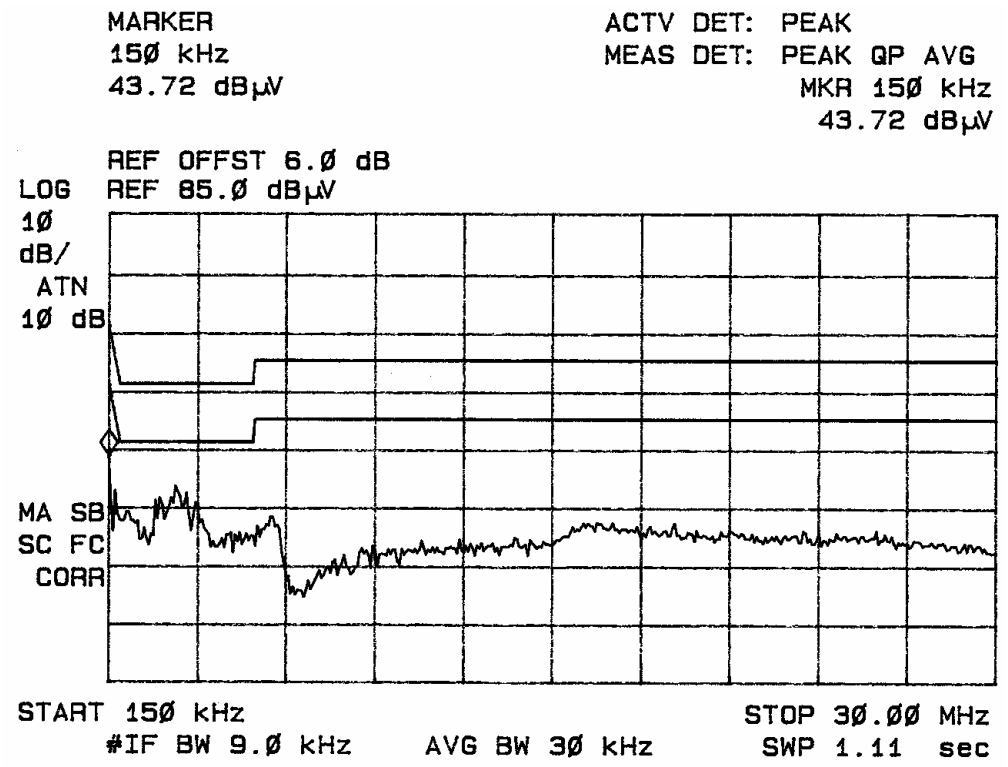


Figure four Conducted emissions of EUT line 2 (ADP-5FH B)

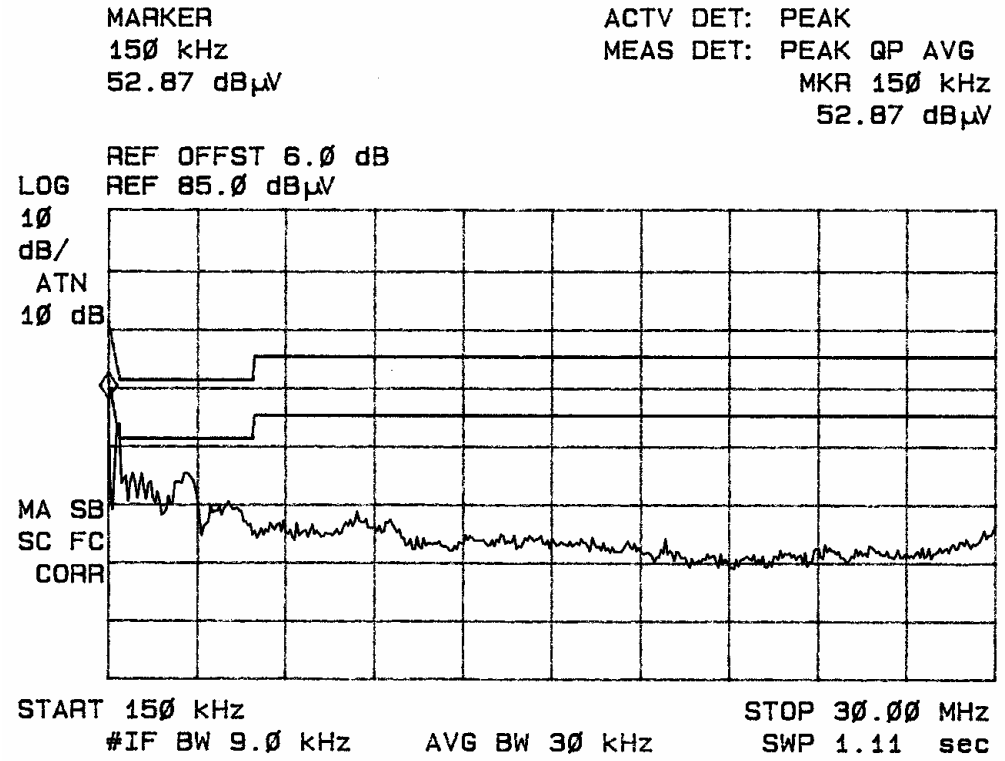


Figure five Conducted emissions of EUT line 1 (PSC05R-050A1)

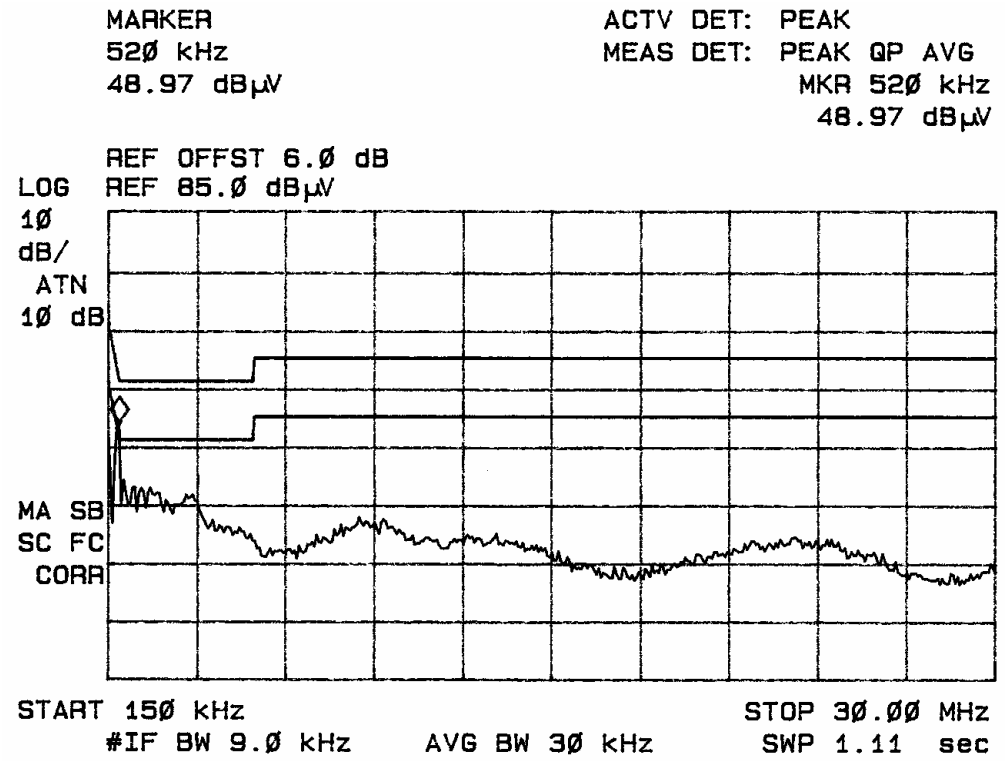


Figure Six Conducted emissions of EUT line 2 (PSC05R-050A1)

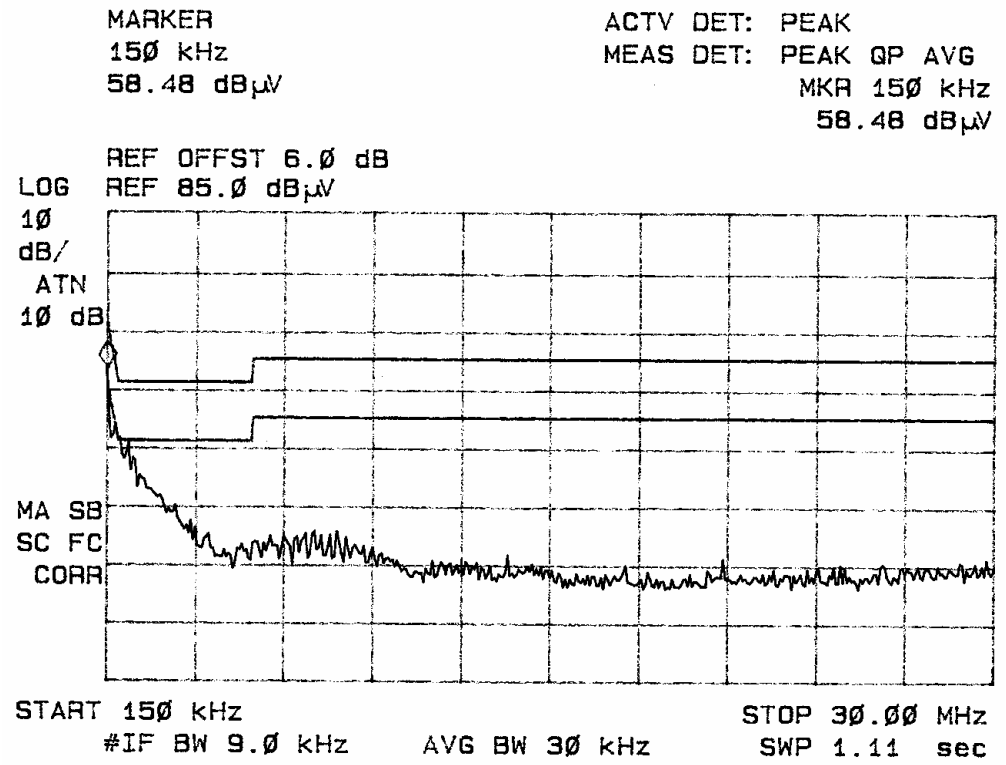


Figure seven Conducted emissions of EUT line 1 (CPU)

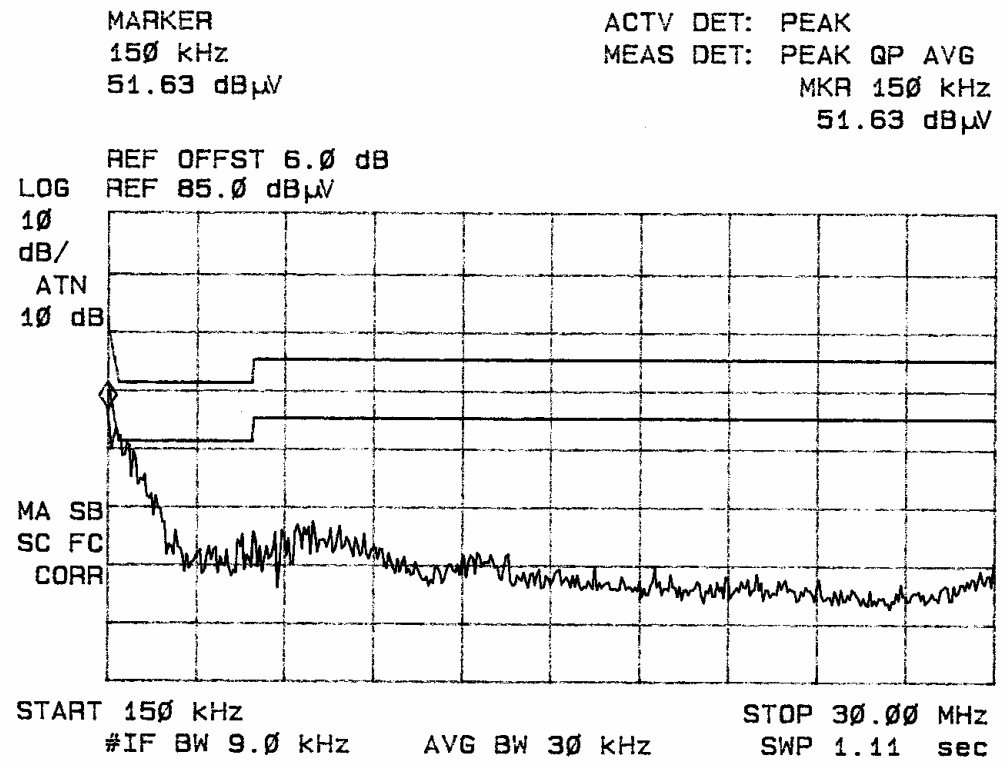


Figure eight Conducted emissions of EUT line 2 (CPU)

Data Conducted Emissions (7 Highest Emissions) (JSP050 100UU)

Frequency band (MHz)	L1 Level (dBµV) Peak	Q.P.	AVE	L2 Level (dBµV) Peak	Q.P.	AVE	CISPR 22 Limit Q.P. Ave(dBµV)
0.15 – 0.5	55.5	52.5	42.2	62.1	52.3	40.2	66-56 / 56-46
0.5 – 5	49.3	47.3	37.1	44.1	40.6	30.9	56 / 46
5 – 10	46.3	42.3	30.2	46.8	40.6	27.5	60 / 50
10 – 15	40.0	35.0	24.0	41.7	35.5	24.7	60 / 50
15 – 20	40.2	34.8	24.8	35.8	30.4	19.6	60 / 50
20 – 25	36.3	31.5	20.3	33.7	28.7	18.0	60 / 50
25 – 30	40.4	34.8	21.8	39.6	35.1	21.5	60 / 50

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

Data Conducted Emissions (7 Highest Emissions) (ADP-5FH B)

Frequency band (MHz)	L1 Level (dBµV) Peak	Q.P.	AVE	L2 Level (dBµV) Peak	Q.P.	AVE	CISPR 22 Limit Q.P. Ave(dBµV)
0.15 – 0.5	44.5	43.1	36.8	43.7	37.1	32.7	66-56 / 56-46
0.5 – 5	44.5	42.7	31.9	41.9	40.0	29.1	56 / 46
5 – 10	33.3	30.7	24.7	33.5	31.1	26.4	60 / 50
10 – 15	29.3	27.1	24.9	29.5	27.4	25.2	60 / 50
15 – 20	32.8	30.9	28.9	32.2	30.5	28.5	60 / 50
20 – 25	31.3	29.3	27.3	30.7	27.9	25.7	60 / 50
25 – 30	31.5	27.8	23.5	30.4	27.4	24.7	60 / 50

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

Data Conducted Emissions (7 Highest Emissions) (PSC05R-050A1)

Frequency band (MHz)	L1 Level (dBµV) Peak	Q.P.	AVE	L2 Level (dBµV) Peak	Q.P.	AVE	CISPR 22 Limit Q.P. Ave(dBµV)
0.15 – 0.5	52.9	45.1	36.3	46.4	44.0	36.4	66-56 / 56-46
0.5 – 5	50.7	48.1	41.7	50.7	48.4	41.9	56 / 46
5 – 10	31.9	27.3	21.1	32.0	27.0	20.9	60 / 50
10 – 15	29.4	25.0	19.1	28.3	24.3	18.4	60 / 50
15 – 20	29.1	24.3	18.6	25.1	21.2	15.4	60 / 50
20 – 25	26.2	22.2	16.1	28.5	24.1	18.2	60 / 50
25 – 30	31.6	27.0	20.7	27.6	23.0	17.0	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) Peak	Q.P.	AVE	L2 Level (dBµV) Peak	Q.P.	AVE	CISPR 22 Limit Q.P. Ave(dBµV)
0.15 – 0.5	58.5	48.7	31.1	51.6	46.9	30.6	66-56 / 56-46
0.5 – 5	46.8	44.2	26.0	47.2	44.6	24.3	56 / 46
5 – 10	28.3	22.1	11.9	30.6	25.5	19.9	60 / 50
10 – 15	24.9	19.5	11.5	26.3	20.6	11.8	60 / 50
15 – 20	25.3	17.2	10.2	22.7	17.8	10.4	60 / 50
20 – 25	22.0	17.1	10.1	23.7	16.8	9.7	60 / 50
25 – 30	26.0	18.4	10.9	23.9	18.8	10.9	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 7.6 dB minimum margin below the FCC/CISPR quasi peak limit, and a 4.1 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 6,000 MHz for the preliminary FM transmitter testing. Refer to figures nine through twelve 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 thirteen 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 = 46.9 + 8.0 - 30
= 24.9

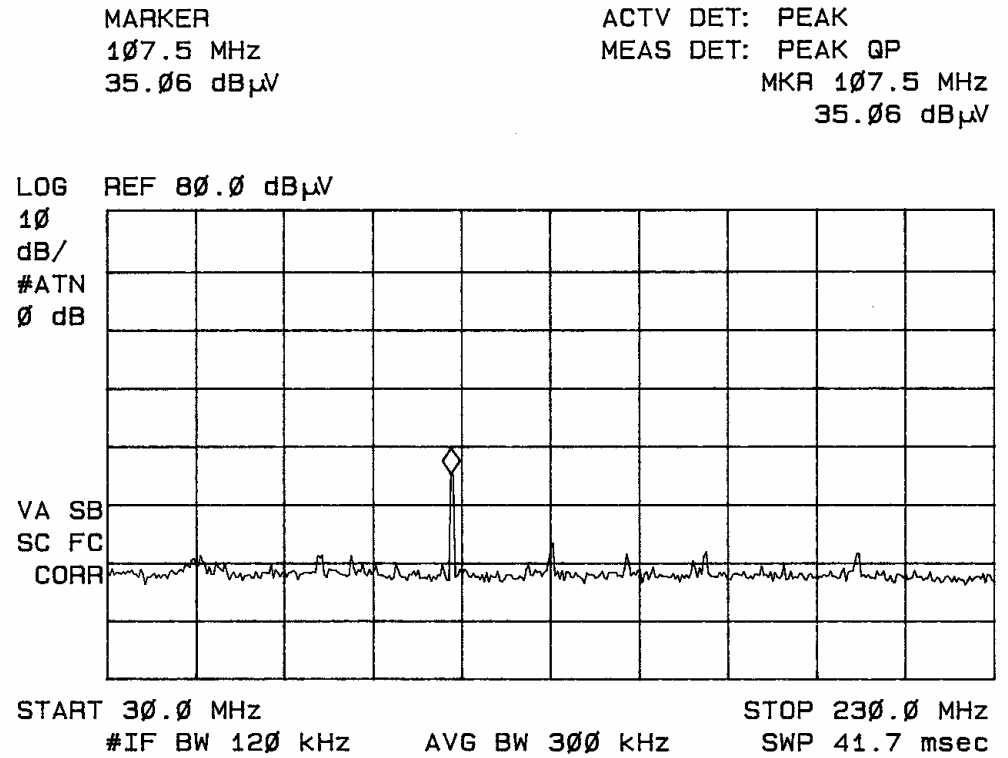


Figure nine Radiated Emissions in screen room (FM Tx).

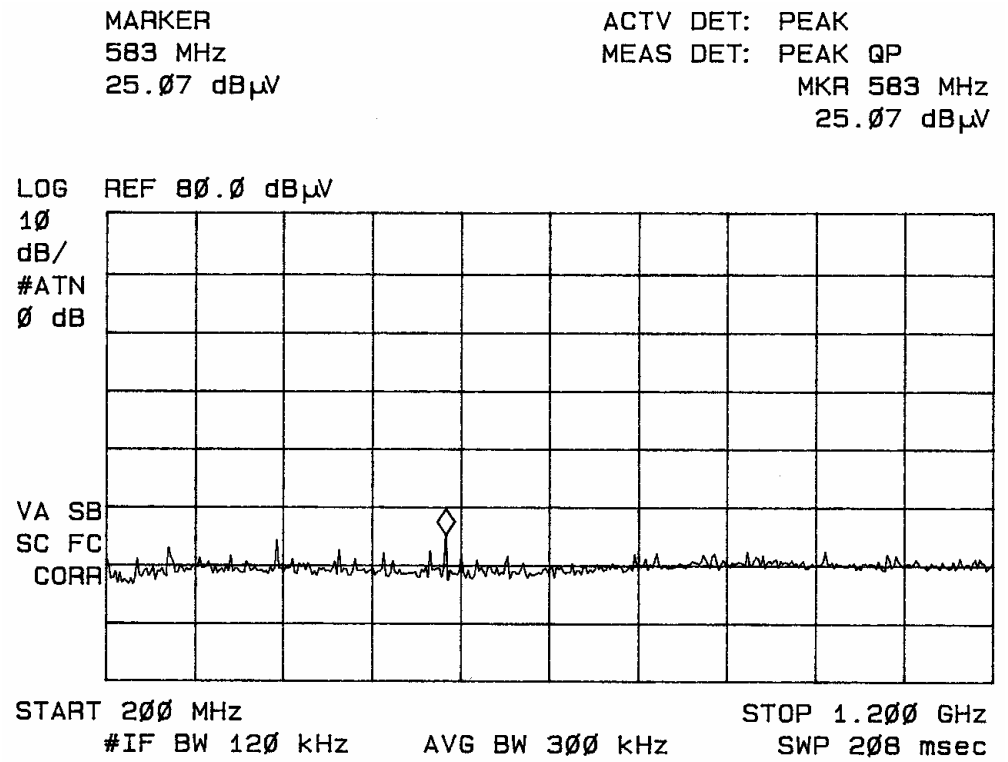


Figure ten Radiated Emissions in screen room (FM Tx).

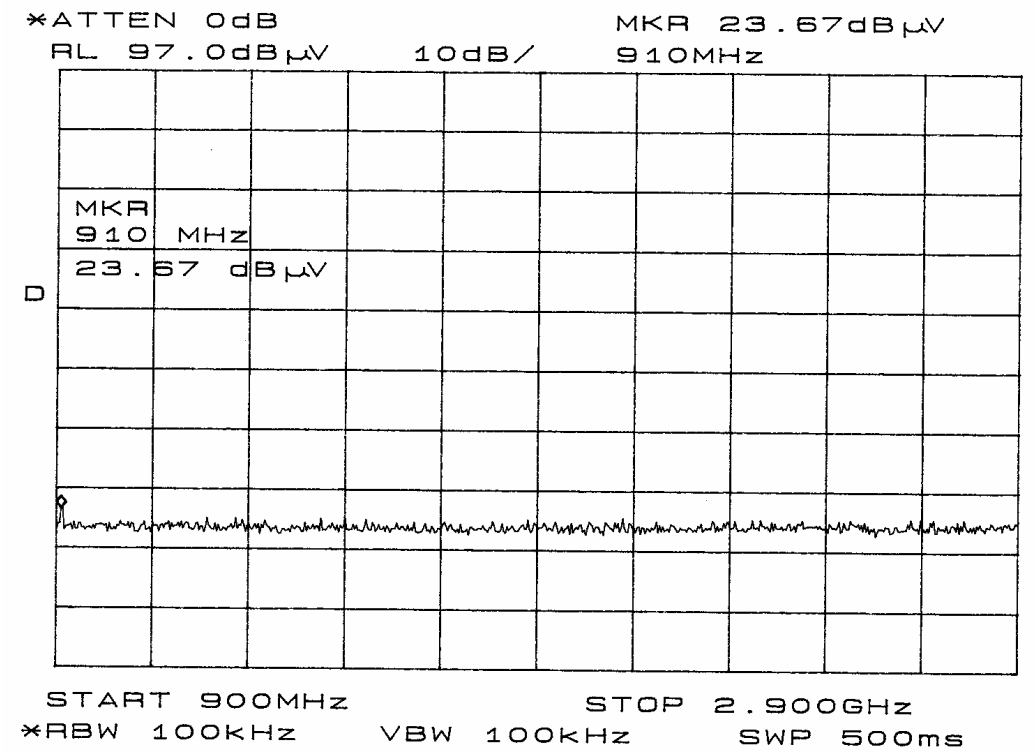


Figure eleven Radiated Emissions in screen room (FM Tx).

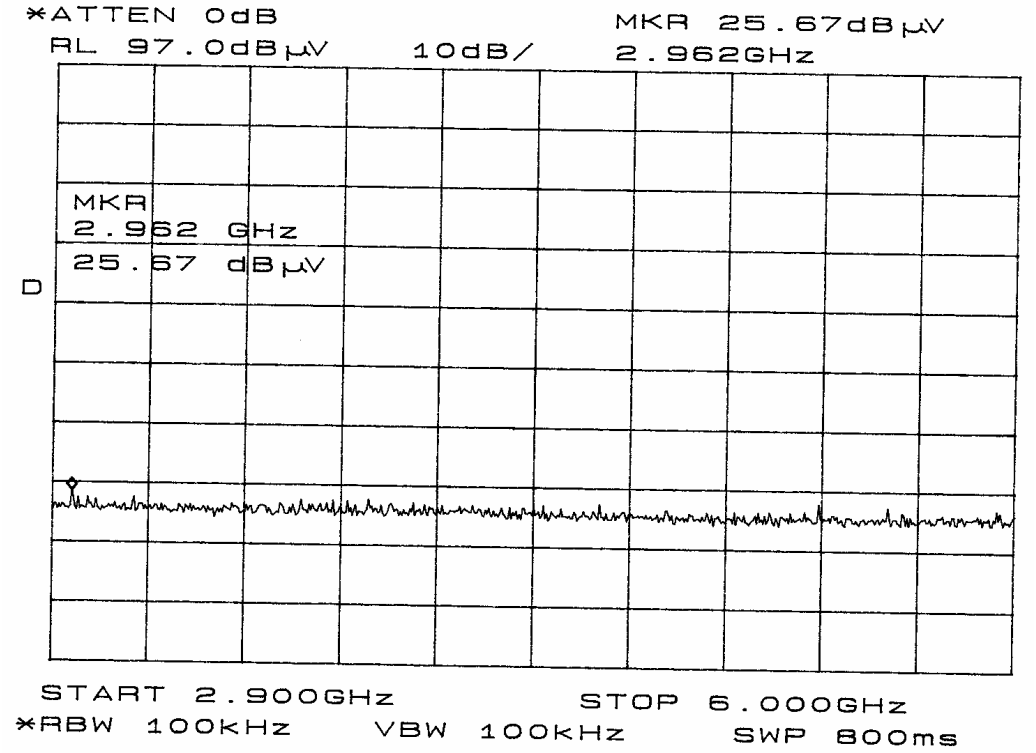


Figure twelve Radiated Emissions in screen room (FM Tx).

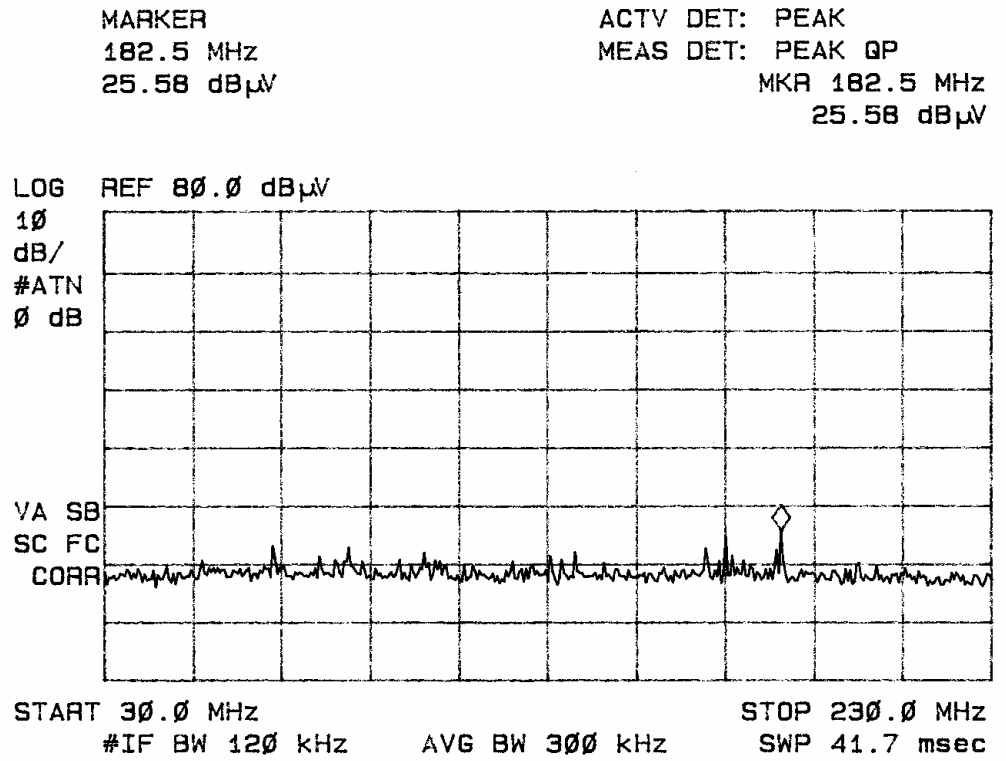


Figure thirteen Radiated Emissions in screen room (BT Tx).

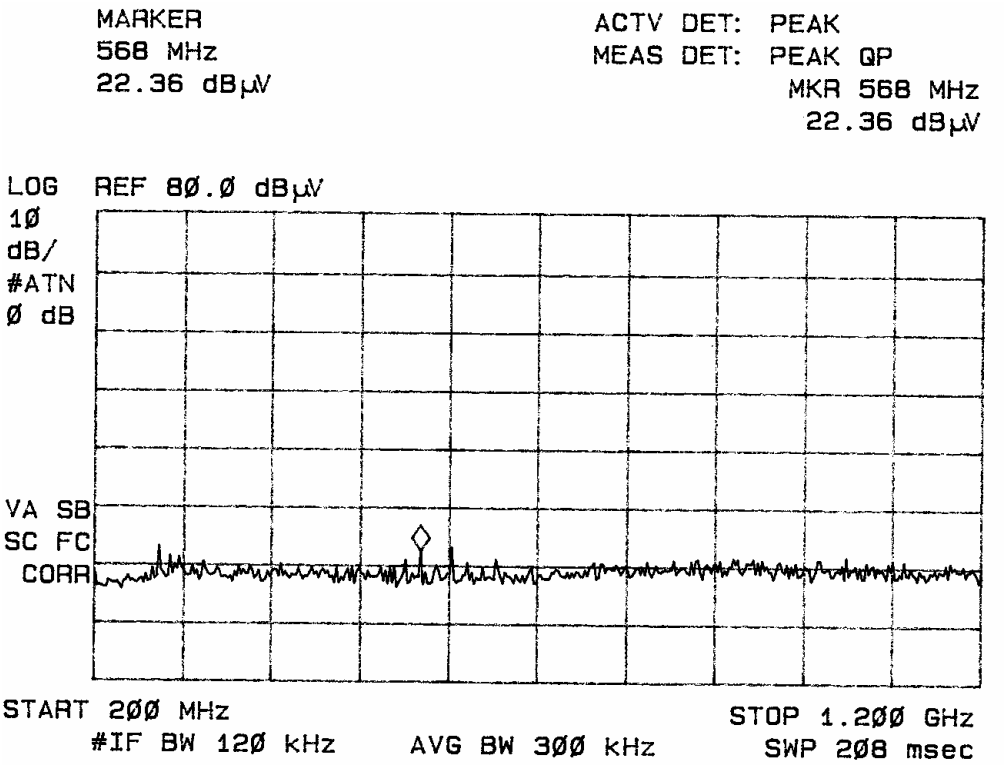


Figure fourteen Radiated Emissions in screen room (BT Tx).

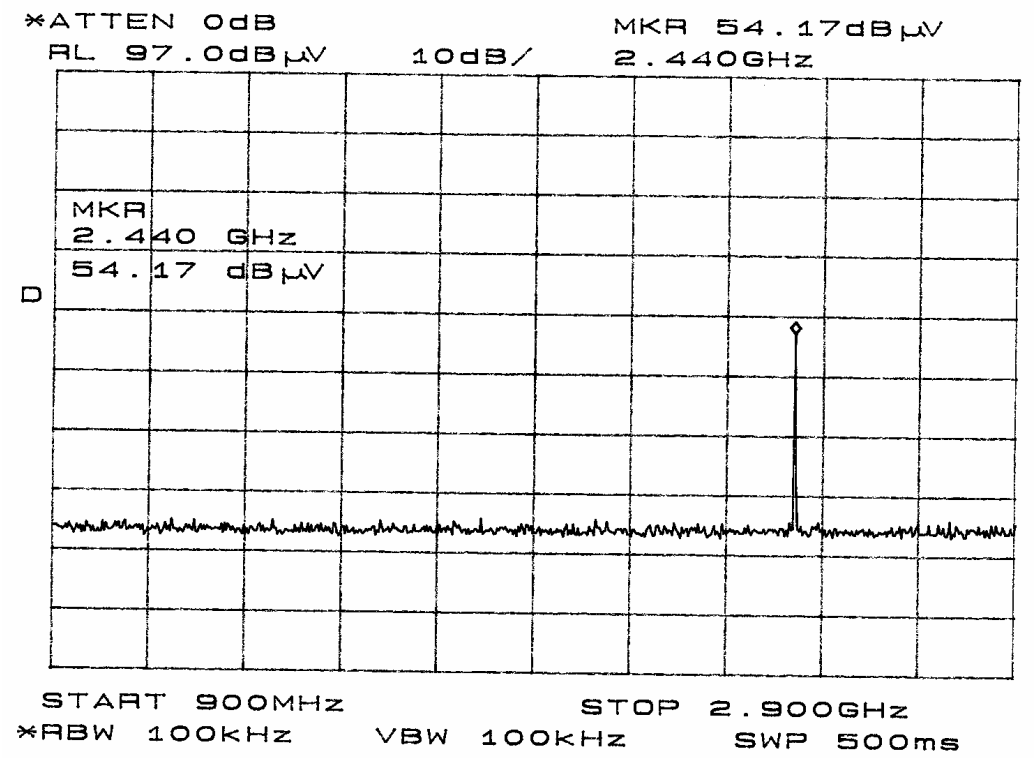


Figure fifteen Radiated Emissions in screen room (BT Tx).

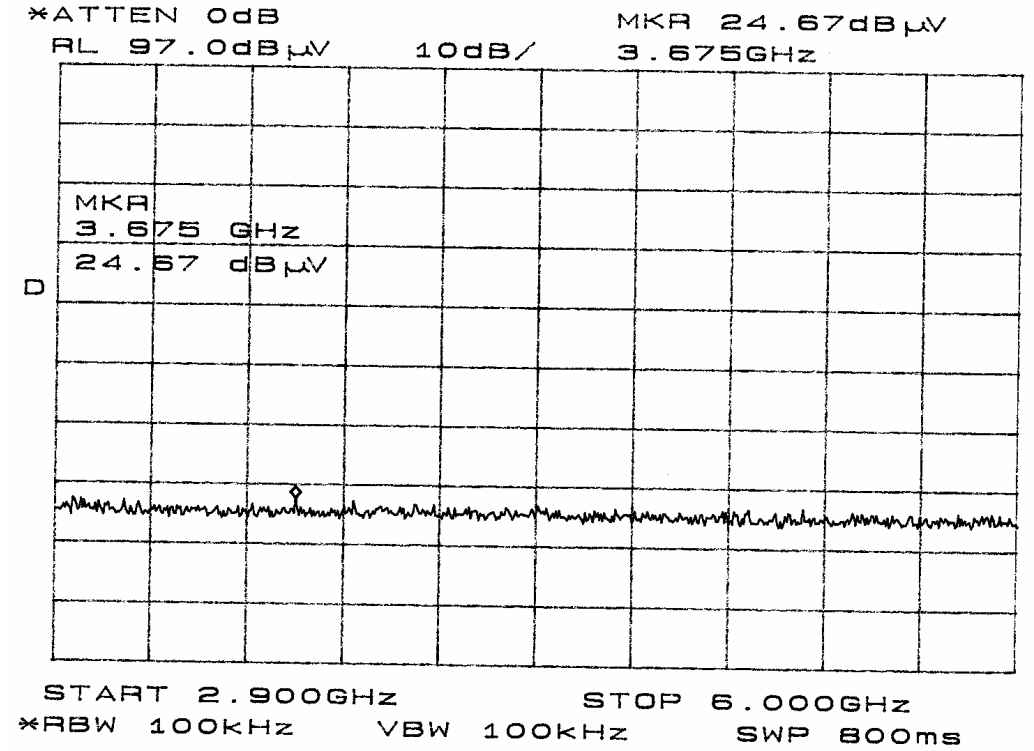


Figure sixteen Radiated Emissions in screen room (BT Tx).

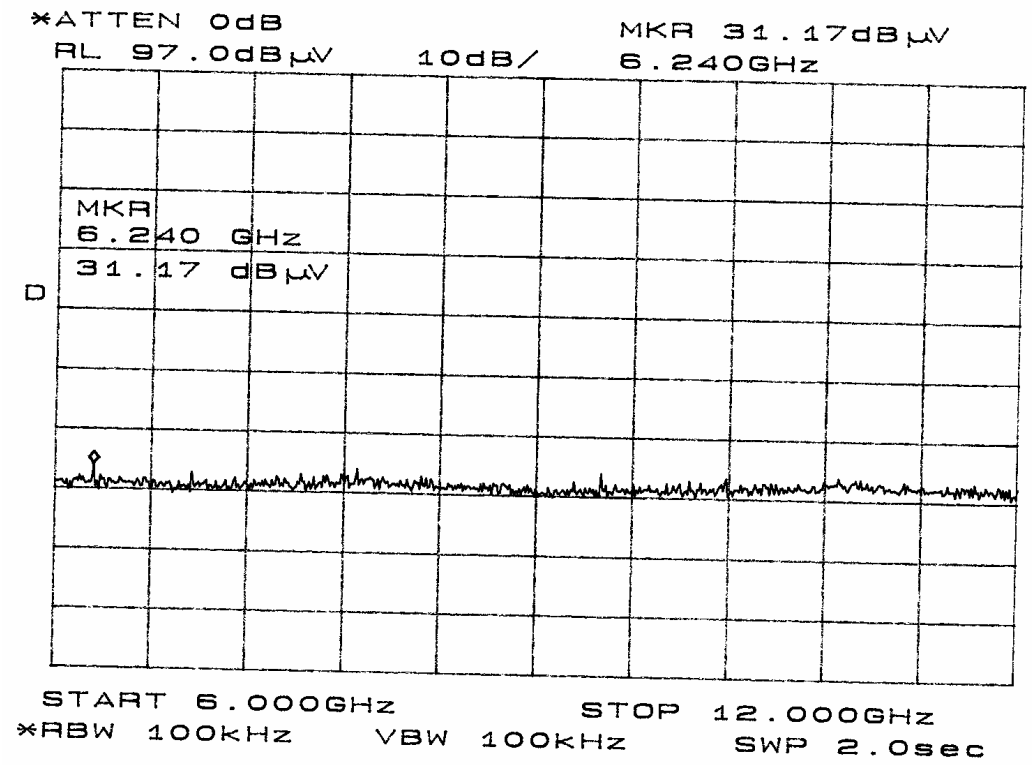


Figure seventeen Radiated Emissions in screen room (BT Tx).

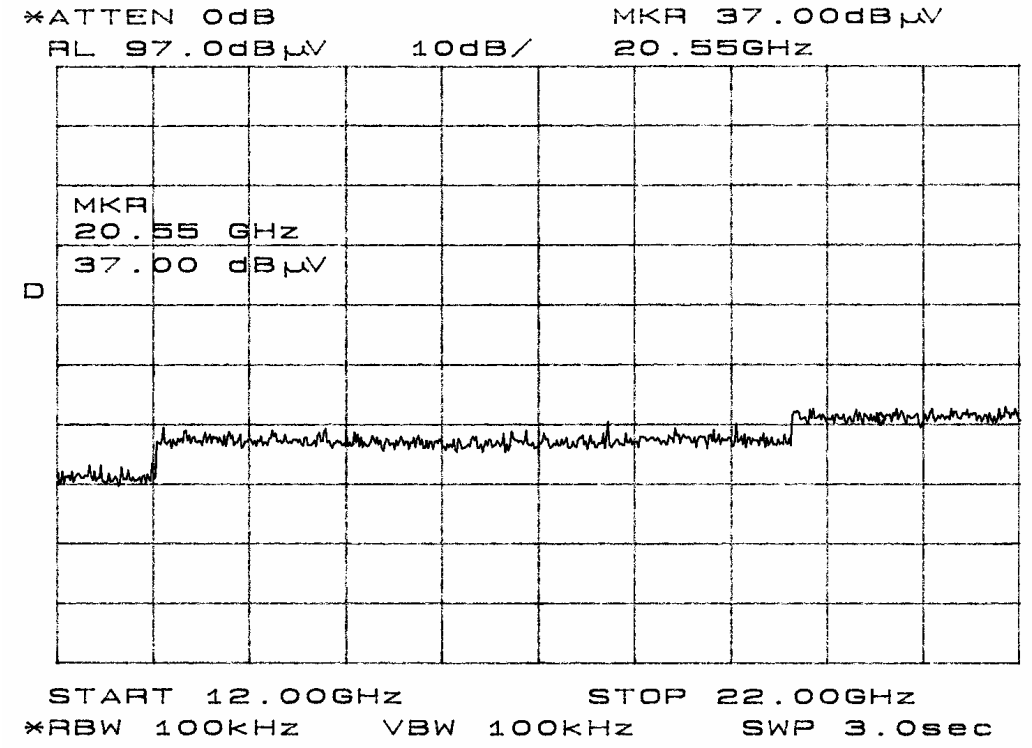


Figure eighteen Radiated Emissions in screen room (BT Tx).

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)
130.0	46.9	42.1	8.0	30	24.9	20.1	43.5
390.0	35.5	39.0	16.0	30	21.5	25.0	43.5
459.3	36.6	37.1	17.7	30	24.3	24.8	43.5
511.3	31.4	40.3	18.0	30	19.4	28.3	43.5
563.3	36.3	41.3	18.9	30	25.2	30.2	43.5
580.7	39.3	39.4	19.6	30	28.9	29.0	43.5

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 13.3 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 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 radiated emissions spectrum taken in a screen room at 1-meter distance, 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)
88.1	70.0	68.2	7.8	30	47.8	46.0	48.0
176.2	49.1	37.2	8.7	30	27.8	15.9	43.5
264.3	42.7	32.5	12.5	30	25.2	15.0	46.0
352.4	24.8	25.1	15.1	30	9.9	10.2	46.0
440.5	25.8	26.7	17.4	30	13.2	14.1	46.0
528.6	39.4	39.8	18.4	30	27.8	28.2	46.0
616.7	29.3	26.9	19.3	30	18.6	16.2	46.0
704.8	27.1	27.4	20.2	30	17.3	17.6	46.0
792.9	34.3	41.0	21.0	30	25.3	32.0	46.0
98.5	70.0	69.5	7.4	30	47.4	46.9	48.0
197.0	38.6	31.8	9.7	30	18.3	11.5	43.5
295.5	49.2	43.2	13.1	30	32.3	26.3	46.0
394.0	25.9	25.3	16.3	30	12.2	11.6	46.0
492.5	28.6	29.0	17.6	30	16.2	16.6	46.0
591.0	38.3	32.3	19.6	30	27.9	21.9	46.0
689.5	29.6	26.6	20.2	30	19.8	16.8	46.0
788.0	28.1	28.1	21.0	30	19.1	19.1	46.0
886.5	16.2	22.6	22.3	30	8.5	14.9	46.0
107.7	70.6	67.4	7.1	30	47.7	44.5	48.0
215.4	47.8	39.8	10.3	30	28.1	20.1	43.5
323.1	52.5	39.9	14.9	30	37.4	24.8	46.0
430.8	29.3	31.6	16.9	30	16.2	18.5	46.0
538.5	36.7	35.2	18.5	30	25.2	23.7	46.0
646.2	26.8	30.0	19.8	30	16.6	19.8	46.0
753.9	35.4	40.2	21.5	30	26.9	31.7	46.0
861.6	22.8	24.7	22.0	30	14.8	16.7	46.0
969.3	22.0	22.1	22.9	30	14.9	15.0	54.0

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

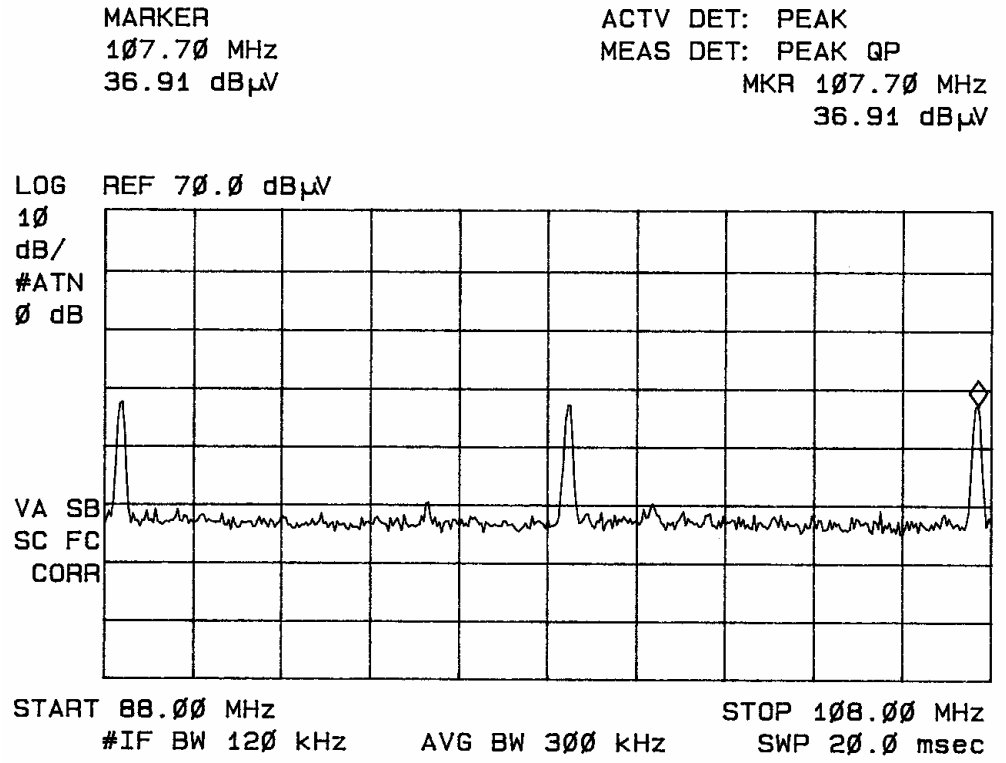


Figure nineteen Output power across the operational band

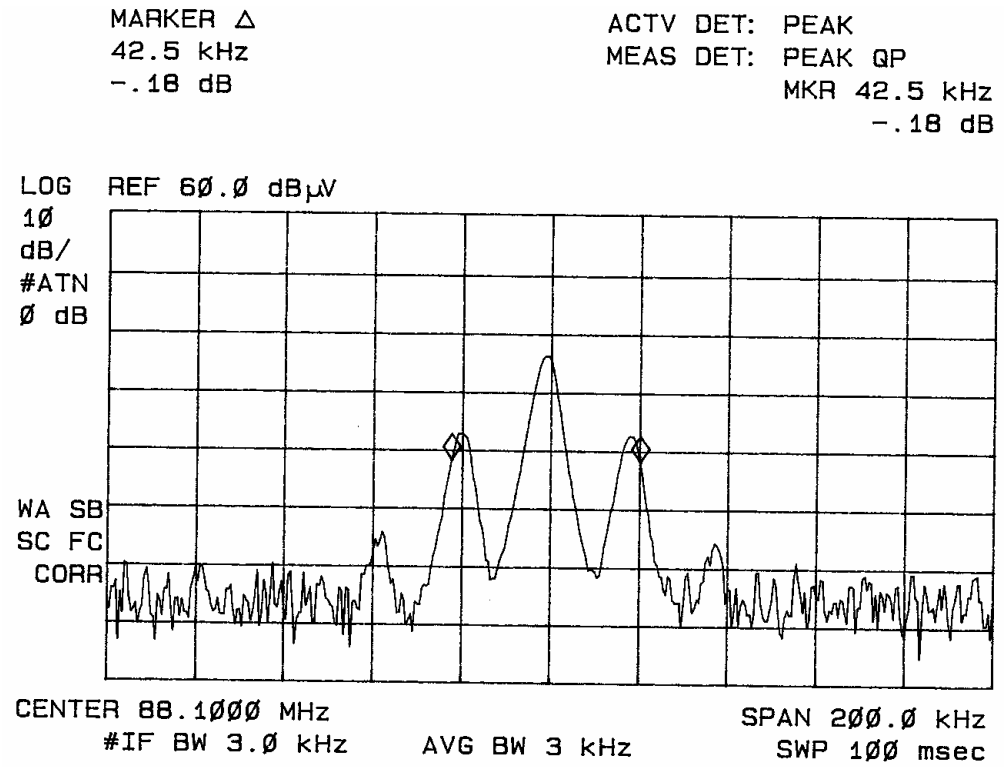


Figure twenty Band Edge and bandwidth (at 88.1 MHz)

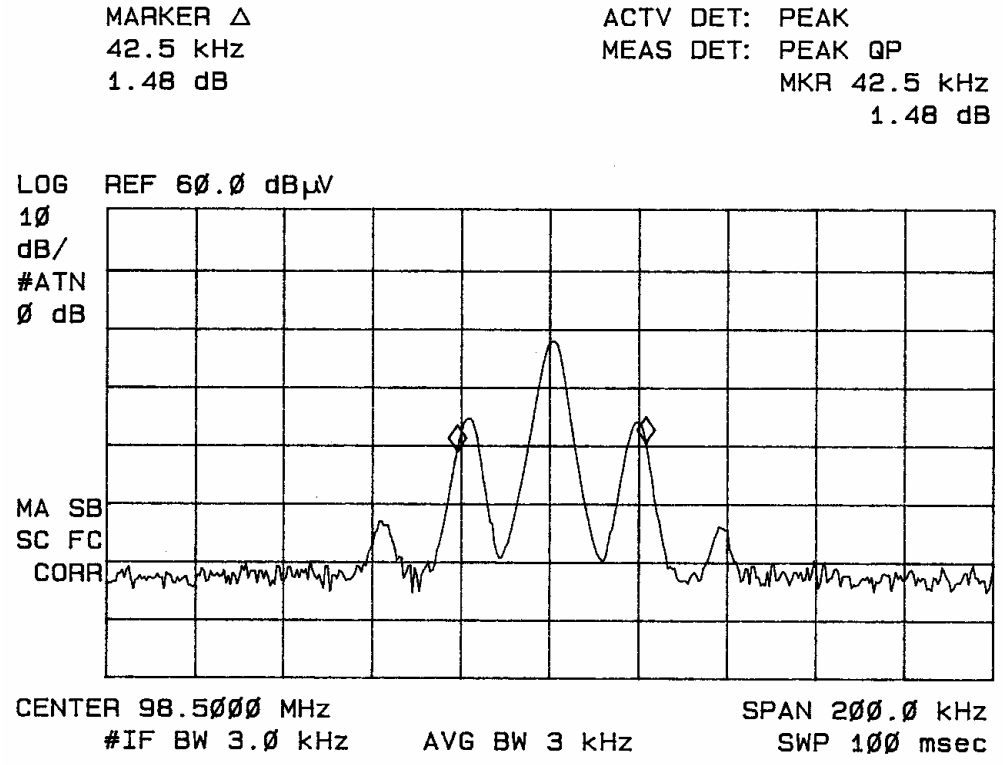


Figure twenty-one 200 kHz Occupied Bandwidth

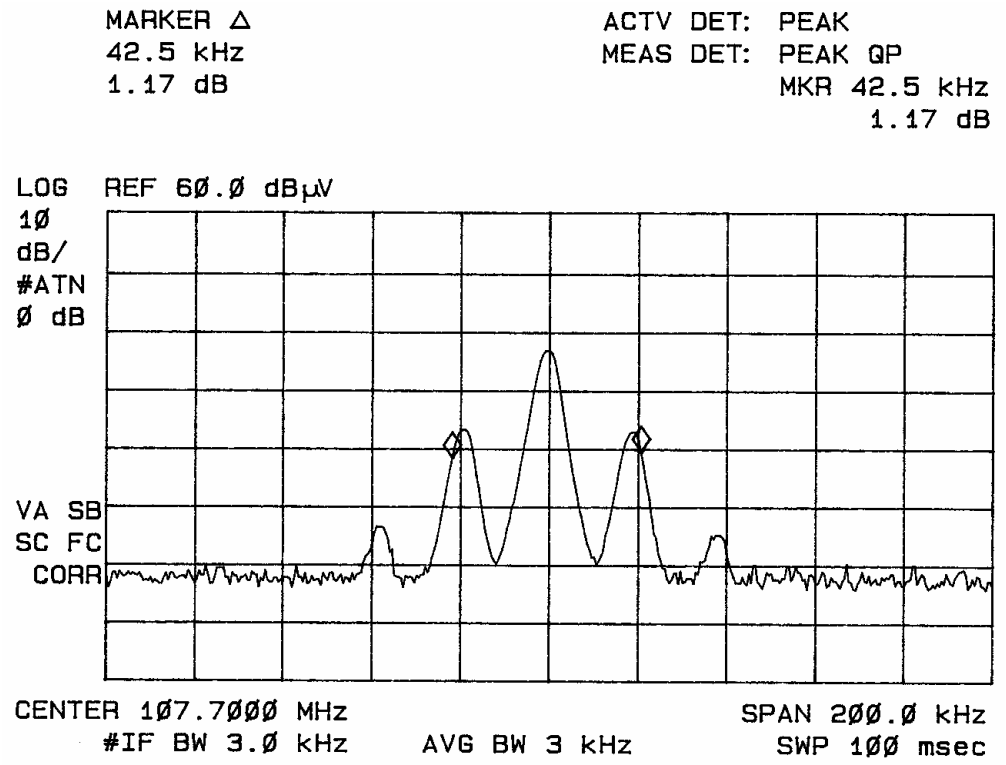


Figure twenty-two Band Edge and bandwidth (at 107.9 MHz)

Summary of Results for Radiated Emissions per 15.239

The EUT had a 0.2-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.

Annex

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

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

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:

$$U = 2\, U_C(y) = 2 \times \pm 1.6 \text{ dB} = \pm 3.2 \text{ dB}$$

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

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

$$U_C(y) = \pm 1.2 \text{ dB}$$

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:

$$U = 2\, U_C(y) = 2 \times \pm 1.2 \text{ dB} = \pm 2.4 \text{ dB}$$

Annex B 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	2/07
Wattmeter: Bird 43 with Load Bird 8085	2/07
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/07
H/V Power Supply: Fluke Model: 408B (SN: 573)	2/07
R.F. Generator: HP 606A	2/07
R.F. Generator: HP 8614A	2/07
R.F. Generator: HP 8640B	2/07
Spectrum Analyzer: HP 8562A, Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W HP Adapters: 11518, 11519, 11520	2/07
Spectrum Analyzer: HP 8591EM	5/06
Frequency Counter: Leader LDC825	2/07
Antenna: EMCO Biconilog Model: 3143	5/06
Antenna: EMCO Log Periodic Model: 3147	10/06
Antenna: Antenna Research Biconical Model: BCD 235	10/06
Antenna: EMCO Dipole Set 3121C	2/07
Antenna: C.D. B-101	2/07
Antenna: Solar 9229-1 & 9230-1	2/07
Antenna: EMCO 6509	2/07
Audio Oscillator: H.P. 201CD	2/07
R.F. Power Amp 65W Model: 470-A-1010	2/07
R.F. Power Amp 50W M185- 10-501	2/07
R.F. PreAmp CPPA-102	2/07
LISN 50 µHy/50 ohm/0.1 µf	10/06
LISN Compliance Eng. 240/20	2/07
LISN Fischer Custom Communications FCC-LISN-50-16-2-08	2/07
Peavey Power Amp Model: IPS 801	2/07
Power Amp A.R. Model: 10W 1010M7	2/07
Power Amp EIN Model: A301	2/07
ELGAR Model: 1751	2/07
ELGAR Model: TG 704A-3D	2/07
ESD Test Set 2010i	2/07
Fast Transient Burst Generator Model: EFT/B-101	2/07
Current Probe: Singer CP-105	2/07
Current Probe: Solar 9108-1N	2/07
Field Intensity Meter: EFM-018	2/07
KEYTEK Ecat Surge Generator	2/07
Shielded Room 5 M x 3 M x 3.0 M	

2/19/2007

Annex C 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:

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.

Annex D FCC Test 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

NVLAP Lab Code 200087-0

Annex E Industry Canada Test Site Registration Letter

Industry Canada Industrie Canada

May 23rd, 2006

OUR FILE: 46405-3041
Submission No: 115252

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

Dear Sir/Madame:

The Bureau has received your application for the Alternate Test Site or OATS and the filing is satisfactory to Industry Canada.

Please reference to the file number (**3041-1**) in the body of all test reports containing measurements performed on the site.

In the future, to obtain or renew a unique registration number, you may demonstrate that the site has been accredited to ANSI C63.4-2003 or later.

If the site is not accredited to ANSI C63.4-2003 or later, the test facility shall submit test data demonstrating conformance with the ANSI standard. The Department 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.

If you have any questions, you may contact the Bureau by e-mail at certification.bureau@ic.gc.ca
Please reference our file number above for all correspondence.

Yours sincerely,

Robert Corey
Manager Certification
Certification and Engineering Bureau
3701 Carling Ave., Building 94
Ottawa, Ontario K2H 8S2

Canada