APPLICATION SUBMITTAL

FOR

GRANT OF CERTIFICATION

REPORT

FOR

MODEL: Directional Radar Unit II
24,125 MHz Transmitter
Field Disturbance Monitor

FOR

KUSTOM SIGNALS, INC.
9325 Pflumm
Lenexa, KS 66215-3347

Test Report Number: 060601

ROGERS LABS, INC.
4405 West 259th Terrace
Louisburg, KS 66053
Phone / Fax (913) 837-3214

TEST REPORT
For
APPLICATION of CERTIFICATION
For
KUSTOM SIGNALS, INC.

9325 Pflumm
Lenexa, KS 66215-3347

MODEL: DIRECTIONAL RADAR UNIT II

Field Disturbance Monitor
Frequency 24.125 GHz
FCC ID: IVQDRU-II

Test Date: June 1, 2006

Certification Date: June 1, 2006

Certifying Engineer: Scot D Rogers

Scot D. Rogers
ROGERS LABS, INC.
4405 West 259th Terrace
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FORWARD

The following is submitted for consideration in obtaining a Grant of Certification for low power intentional radiators operated under CFR 47, paragraph 15.245.

Name of Manufacturer:

KUSTOM SIGNALS, INC.
9325 Pflumm
Lenexa, KS 66215-3347

Model: DIRECTIONAL RADAR UNIT II Traffic monitor

FCC I.D.: IVQDRU-II

Frequency Range: 24,075 MHz to 24,175 MHz

Maximum Operating Power: 2,500 mV/m @ 3 Meters (128 dBµv/m @ 3 meters)

1) Applicable Standards & Test Procedures

In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 2005, Part 2, Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1031 through 2.1057, Part 15C Paragraph 15.245 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.

2.1033(b) Application for Certification

(1) Manufacturer:
KUSTOM SIGNALS, INC.
9325 Pflumm
Lenexa, KS 66215-3347

(2) Identification: Model: DIRECTIONAL RADAR UNIT II
FCC I.D.: IVQDRU-II

(3) Instruction Book:
Refer to the instruction manual furnished with this application for details.

(4) Description of Circuit Functions:
Refer to the circuit description furnished with this application for details.

(5) Block Diagram with Frequencies:
Refer to exhibit for block diagram furnished with this application for details.

(6) Report of Measurements:
Report of measurements follows in this Report.

(7) Photographs: Construction, Component Placement, etc.:
Refer to appendix of this report and exhibits furnished with this application for photographs of equipment.

(8) Brief description of peripheral equipment used with EUT.
The EUT offers communications over a standard RS-232 link for display function only. The unit operates solely from direct current power supplied from external 12-volt power source (battery).

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

(10) Direct Sequence Spread Spectrum:
Not Applicable.

(11) Not Applicable. The EUT is not a Scanning Receiver.

2) Equipment Tested

EQUIPMENT	MODEL/PART#	FCC I.D.
EUT	DIRECTIONAL RADAR UNIT II	IVQDRU-II

3) Equipment Function and Testing Procedures

The EUT is a 24.125 GHz field disturbance sensor, radio frequency transmitter used to monitor, measure, and display the speed of a moving object. The product was designed to monitor traffic situations and measure the speed of moving objects. The unit may be used in many situations. The unit uses the 24.125 GHz radio frequency field in its vicinity to detect and measure changes in that field resulting from the movement of objects within its range. Changes to the field are used to measure projectile speed and display the information on an external display receiving the information via the RS-232 interface. The EUT operates from 12-volt battery or external power and has no provision for connection to the utility power system. Since the EUT is battery operated, no line-conducted emissions testing was performed.

4) Equipment and Cable Configurations

Conducted Emission Test Procedure

The test setup, including the EUT, was arranged in a typical equipment configuration and placed on a 1 x 1.5 - meter wooden bench, 0.8 meters high located in a screen room. Since the EUT is battery operated, no AC power line-conducted emissions testing was performed.

Radiated Emission Test Procedure

The EUT was 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 data was taken using a spectrum analyzer.

5) List of Test Equipment

A Hewlett Packard 8591EM Spectrum Analyzer was used as the measuring device for the emissions testing of frequencies below 1 GHz. A Hewlett Packard 8562A Spectrum Analyzer was used as the measuring device for testing the emissions at frequencies above 1 GHz. The analyzer settings used are described in the following table. Refer to Appendix for a complete list of Test Equipment.

HP 8591 EM ANALYZER SETTINGS		
CONDUCTED EMISSIONS:		
RBW	AVG. BW	DETECTOR FUNCTION
9 kHz	30 kHz	Peak / Quasi Peak
RADIATED EMISSIONS:		
RBW	AVG. BW	DETECTOR FUNCTION
120 kHz	300 kHz	Peak / Quasi Peak
HP 8562A ANALYZER SETTINGS		
RBW	VIDEO BW	DETECTOR FUNCTION
100 kHz	100 kHz	PEAK
1 MHz	1 MHz	Peak / Average

Equipment	Manufacturer	Model	Cal. Date	Due
LISN	Comp. Design	FCC-LISN-2-MOD.CD	10/05	10/06
LISN	Comp. Design	1762	2/06	2/07
Antenna	ARA	BCD-235-B	10/05	10/06
Antenna	EMCO	3147	10/05	10/06
Antenna	EMCO	3143	5/06	5/07
Analyzer	HP	8591EM	5/06	5/07
Analyzer	HP	8562A	2/06	2/07

6) 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.

7) Test Site Locations

Conducted EMI	The AC power-line conducted emissions tests were performed in a shielded screen room located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS.
Radiated EMI	The radiated emissions tests were performed at Rogers Labs, Inc. 3 meter Open Area Test Site (OATS).
Site Approval	Refer to Appendix for FCC Site Approval FCC registration number 90910

NVLAP Accreditation Code 200087-0

8) SUBPART B – Unintentional Radiators

Conducted EMI

The EUT is battery operated only and has no provision to connect to utility power. Therefore no AC power line-conducted emissions testing were performed.

Radiated EMI

The EUT was arranged in a typical equipment configuration and operated in a standard mode. Preliminary testing was performed in a screen room with the EUT positioned 1 meter from the FSM. Radiated emissions measurements were performed to identify the frequencies, which produced the highest emissions. Plots were made of the frequency spectrum from 30 MHz to 1200 MHz for general emissions and to 110 GHz for the fundamental and related harmonics. Refer to figures 1 and 2 for plots of the general frequency spectrum produced by the EUT taken at a distance of 1 meter located in the screen room. The EUT location and orientation was noted and reconfigured at the open area test

site. The highest radiated emission was then re-maximized at this location before final radiated emissions measurements were performed. Final data was taken with the EUT located at the OATS at a distance of 3 meters between the EUT and the receiving antenna. The frequency spectrum from 30 MHz to 1200 MHz was searched for general radiated emissions. 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 position between horizontal and vertical polarization. Antennas used were Biconilog from 30 to 1000 MHz, Broadband Biconical from 30 to 200 MHz, Log Periodic from 200 MHz to 5 GHz, and or pyramidal horns and/or mixers from 4 GHz to 110 GHz.

Sample Calculations:

RFS = Radiated Field Strength
dBµV/m @ 3m = dBµV + A.F. - Amplifier Gain
dBµV/m @ 3m = 44.9 + 6.9 - 30
= 21.8

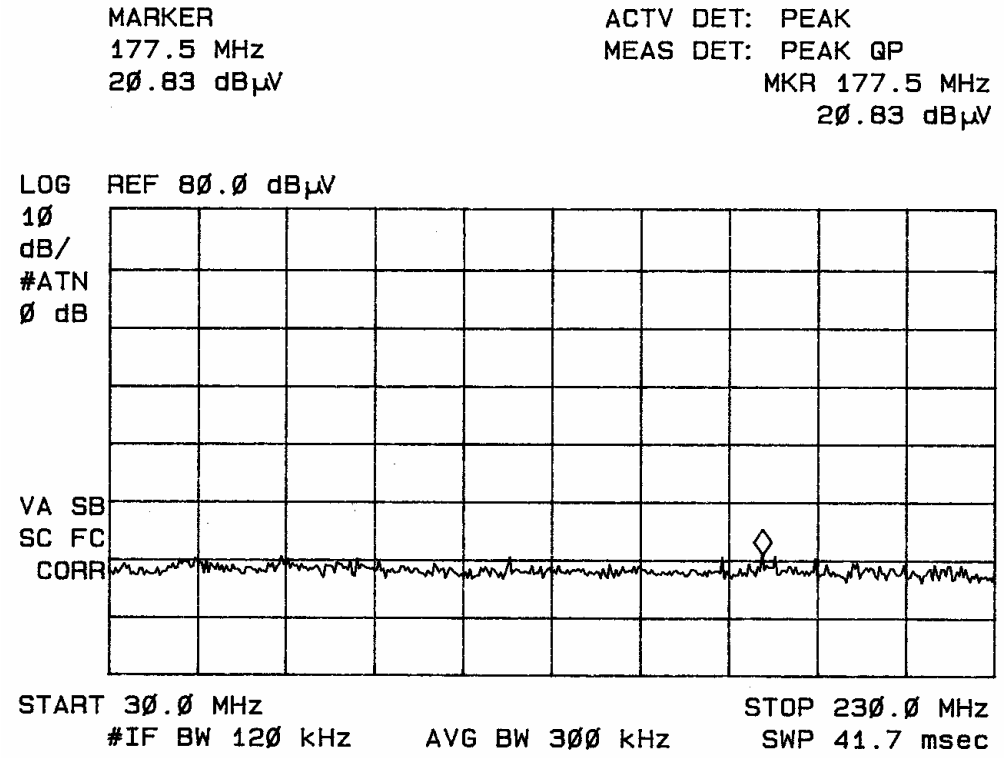

Figure one Radiated Emissions taken in screen room.

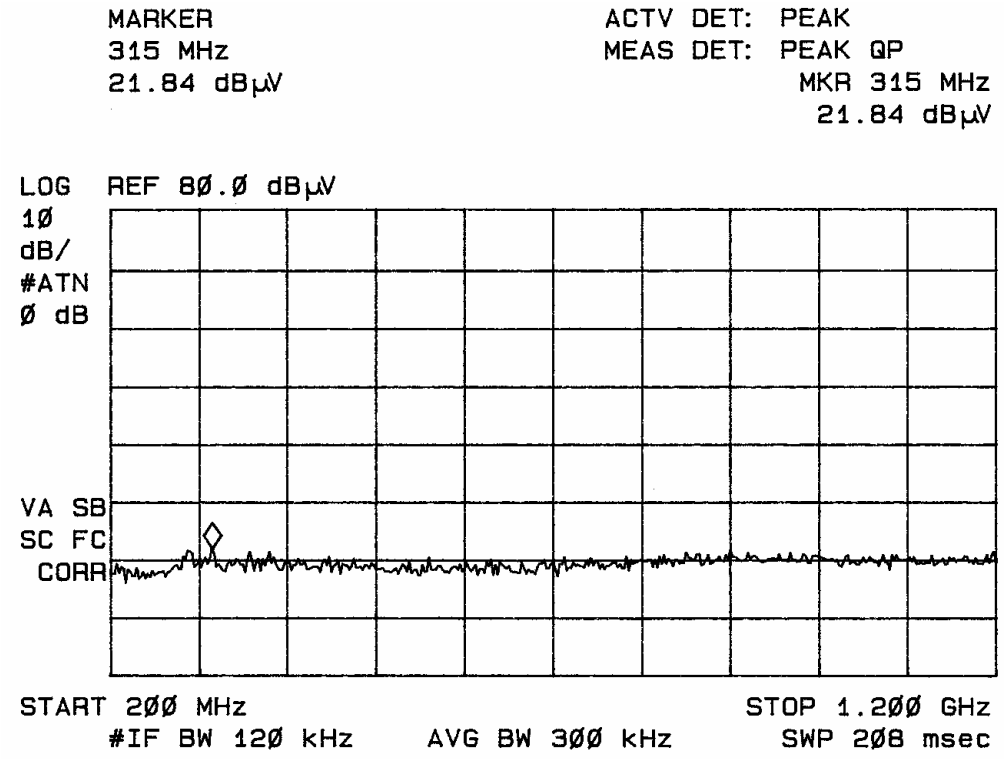

Figure two Radiated Emissions taken in screen room.

NOTE: No conducted emissions measurements taken for this battery operated device.

Data EUT and System Radiated Emissions (6 Highest)

Frequency In MHz	FSM Hor. (dBµV) Quasi-Peak	FSM Vert. (dBµV) Quasi-Peak	Ant. Fact. (dB)	Amp. Gain (dB)	Comp. Hor. (dBµV/m) @ 3m	Comp. Vert. (dBµV/m) @ 3 m	FCC Limit (dBµV)
120.0	44.9	33.9	6.9	30	21.8	10.8	43.5
285.0	45.2	32.8	12.9	30	28.1	15.7	46.0
288.0	43.5	33.1	13.7	30	27.2	16.8	46.0
291.0	41.2	30.4	13.7	30	24.9	14.1	46.0
312.0	41.0	40.8	14.2	30	25.2	25.0	46.0
315.0	38.8	40.5	14.2	30	23.0	24.7	46.0

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

Summary of Results for Conducted Emissions

The conducted emissions for the EUT meet the requirements for FCC Part 15B CLASS B Digital Devices.

Summary of Results for Radiated Emissions

The radiated emissions for the EUT meet the requirements for FCC Part 15B CLASS B Digital Devices. The EUT had a 17.9 dB minimum margin below the limit. Other emissions were present with amplitudes at least 20 dB below the limit.

Statement of Modifications

No modifications to the EUT were required for the unit to meet the FCC Part 15B CLASS B emissions standards. There were no deviations to the specifications.

9) Subpart C - Intentional Radiators

As per CFR Part 15, Subpart C, paragraph 15.245 the following information is submitted for consideration.

15.203 Antenna Requirements

The unit is produced with a permanently attached antenna. The antenna is not replaceable or user serviceable. The requirements of 15.203 are met. There are no deviations or exceptions to the specification.

Restricted Bands of Operation Per 15.205

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 checked at the OATS, using appropriate antennas or pyramidal horns, amplification stages, and a spectrum analyzer. No other significant emission was observed which fell into the restricted bands of operation.

Sample Calculations:

Computed Quasi-Peak (dBµV/m @ 3m) = FSM(dBµV) + A.F.(dB) - Gain(dB)
= 36.0 + 7.7 - 30
= 13.7

Data 15.205 Radiated Emissions In Restricted Bands

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)
73.7	36.0	33.1	7.7	30	13.7	10.8	40.0
120.0	44.9	33.9	6.9	30	21.8	10.8	43.5
285.0	45.2	32.8	12.9	30	28.1	15.7	46.0

No other emissions found in the restricted bands.

15.209 Radiated Emissions Limits; General Requirements

Radiated EMI

The EUT was arranged in a typical equipment configuration and operated in a standard mode. Preliminary testing was performed in a screen room with the EUT positioned 1 meter from the FSM. Radiated emissions measurements were performed to identify the frequencies, which produced the highest emissions. Plots were made of the frequency spectrum from 30 MHz to 100 GHz for the preliminary testing. Refer to Figures 3 through 11 showing plots taken in the screen room from the spectrum analyzer at a distance of 1 meter. The highest radiated emission was then re-maximized at this location 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. The frequency spectrum from 30 MHz to 100 GHz was searched for radiated emissions. 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; and pyramidal horns and or mixers from 4 GHz to 100 GHz.

Sample Calculations:

RFS = Radiated Field Strength
dBµV/m @ 3m = dBµV + A.F. - Amplifier Gain
dBµV/m @ 3m = 44.9 + 6.9 - 30
= 21.8

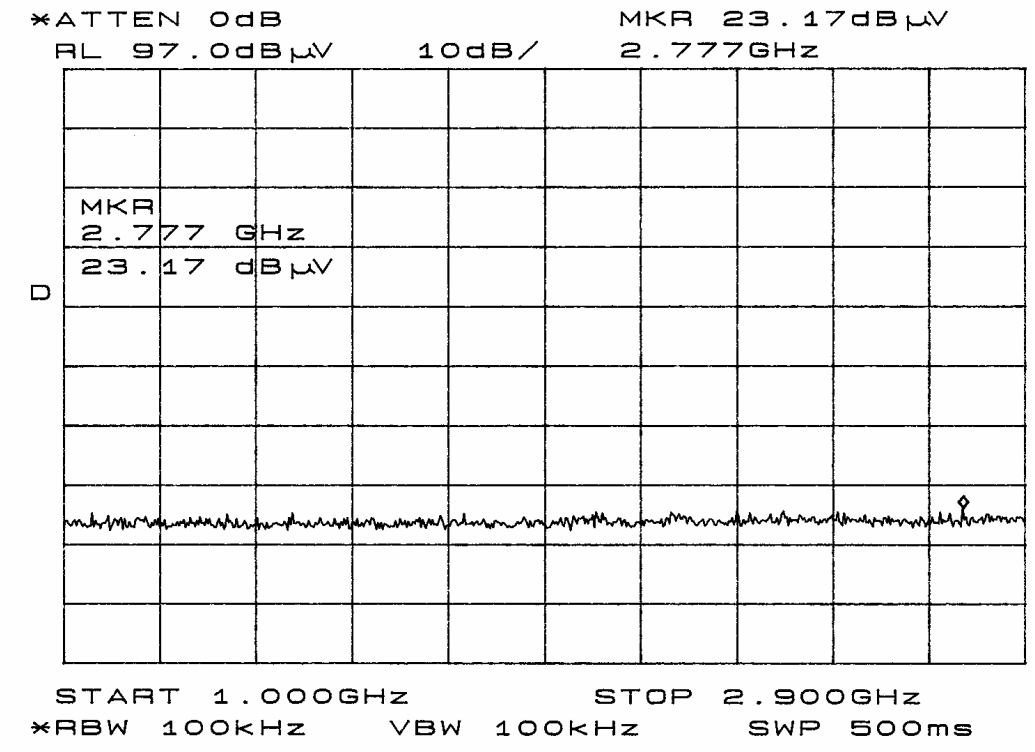

Figure three Radiated Emissions taken in screen room.

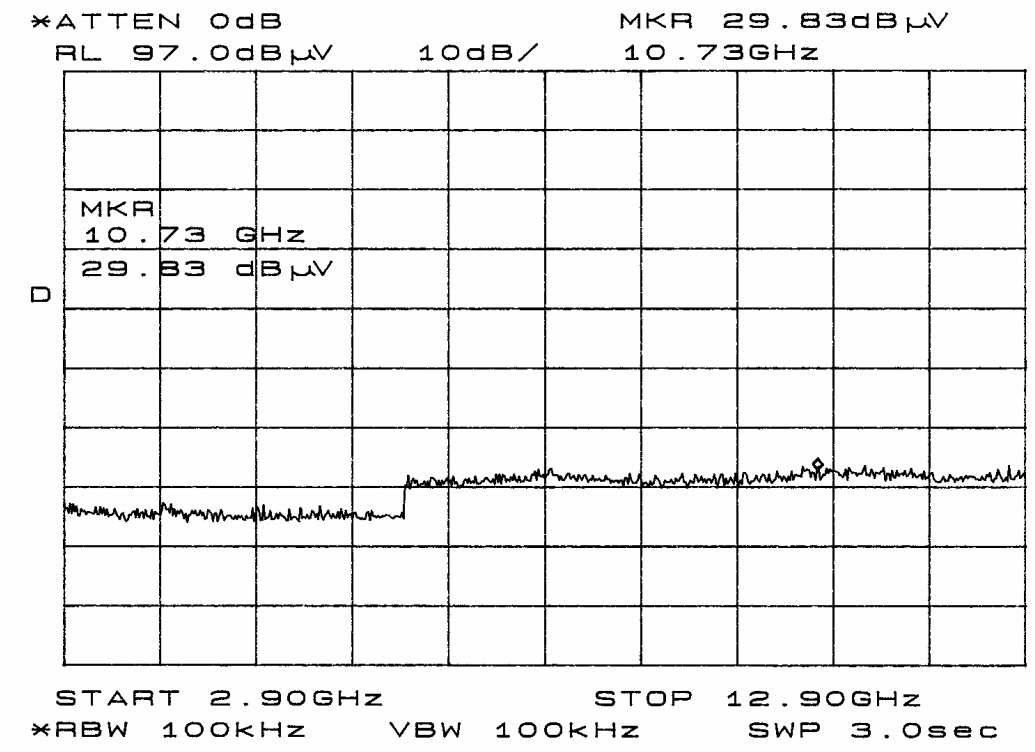

Figure four Radiated Emissions taken in screen room.

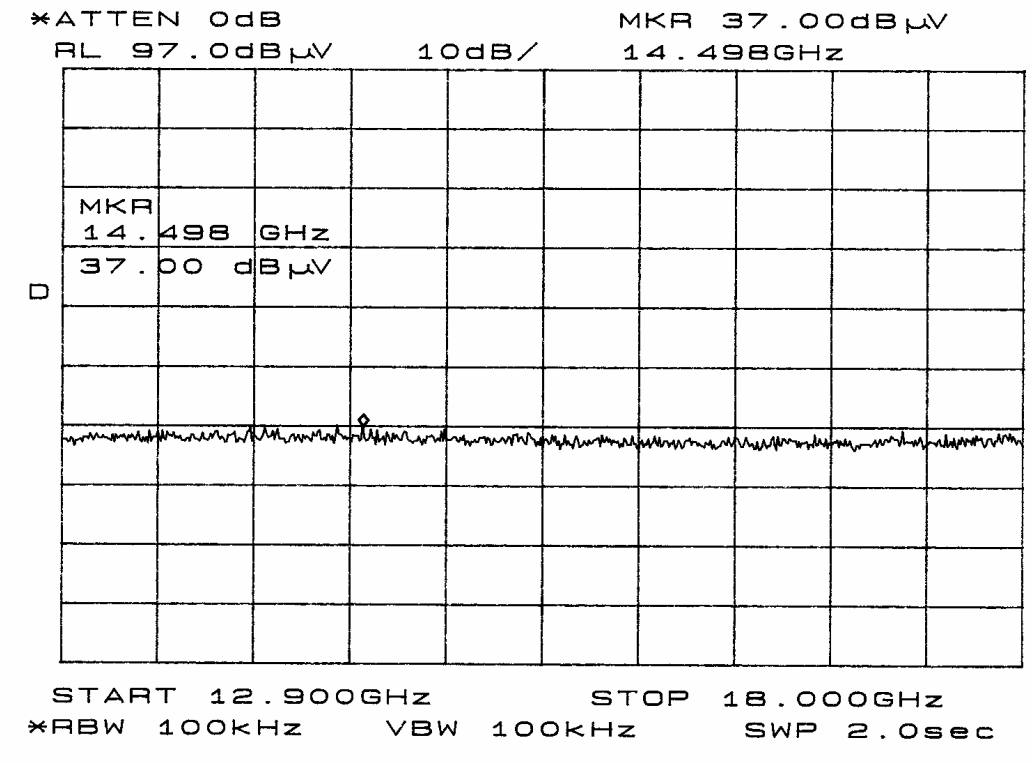

Figure five Radiated Emissions taken in screen room.

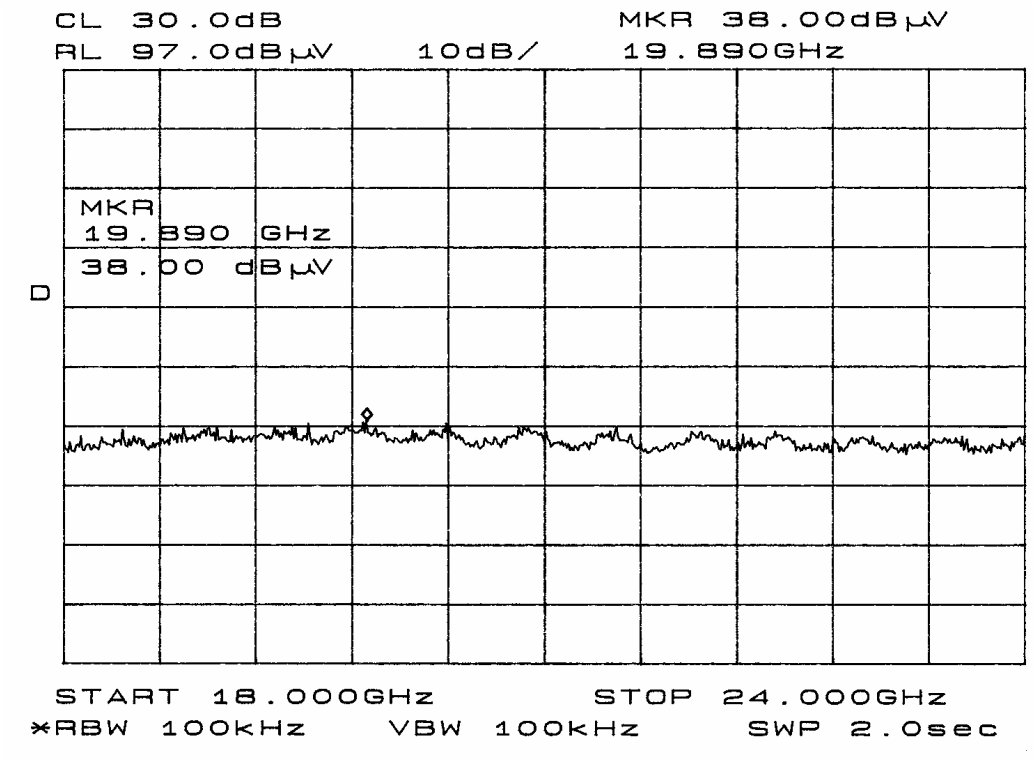

Figure six Radiated Emissions taken in screen room.

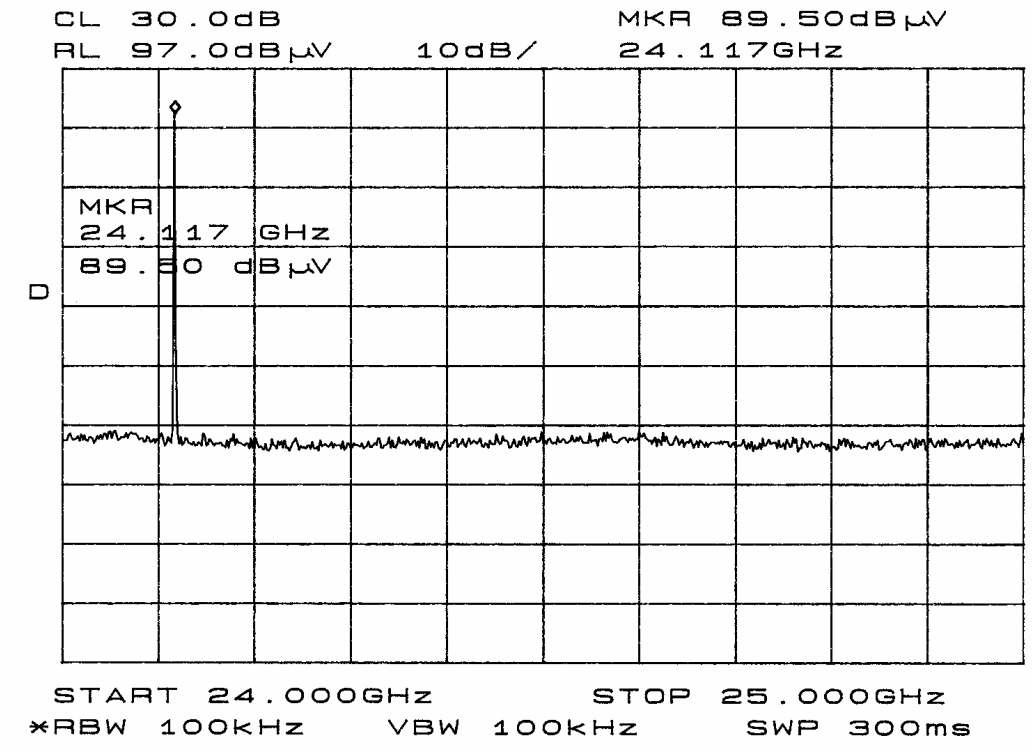

Figure seven Radiated Emissions taken in screen room.

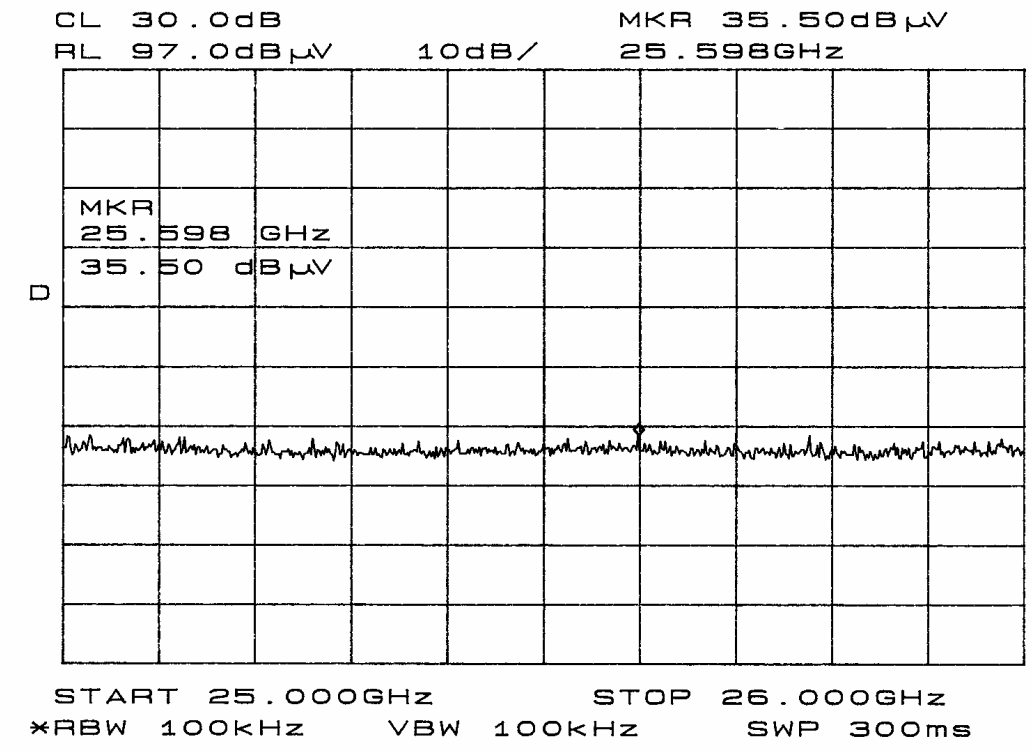

Figure eight Radiated Emissions taken in screen room.

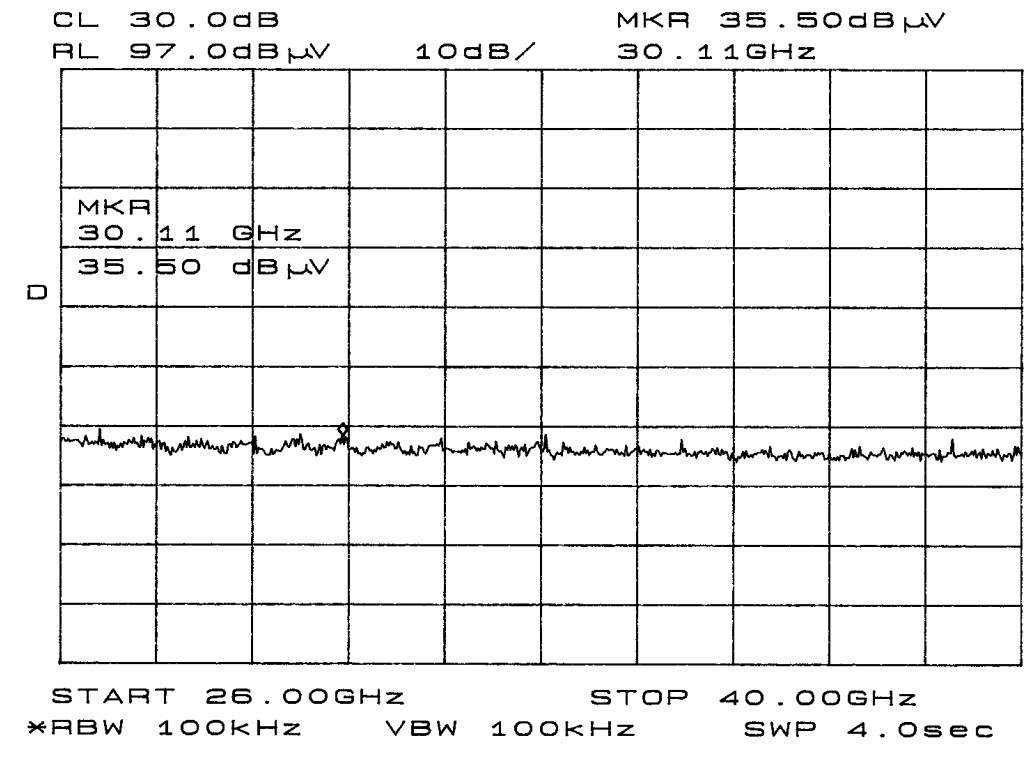

Figure nine Radiated Emissions taken in screen room.

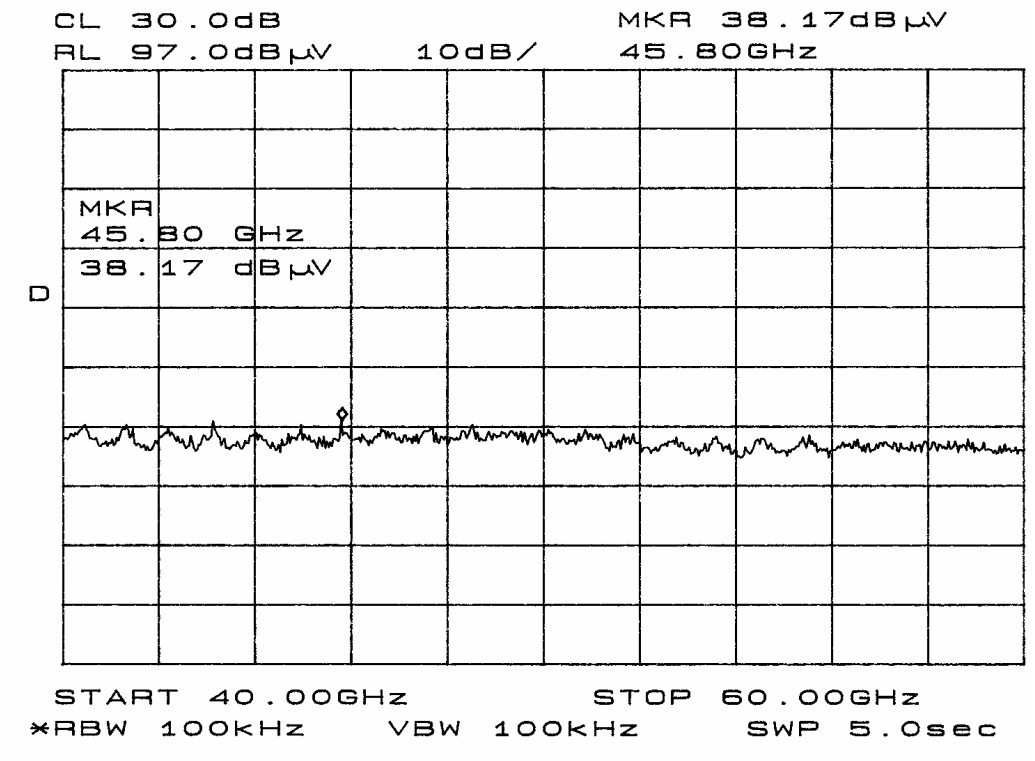

Figure ten Radiated Emissions taken in screen room.

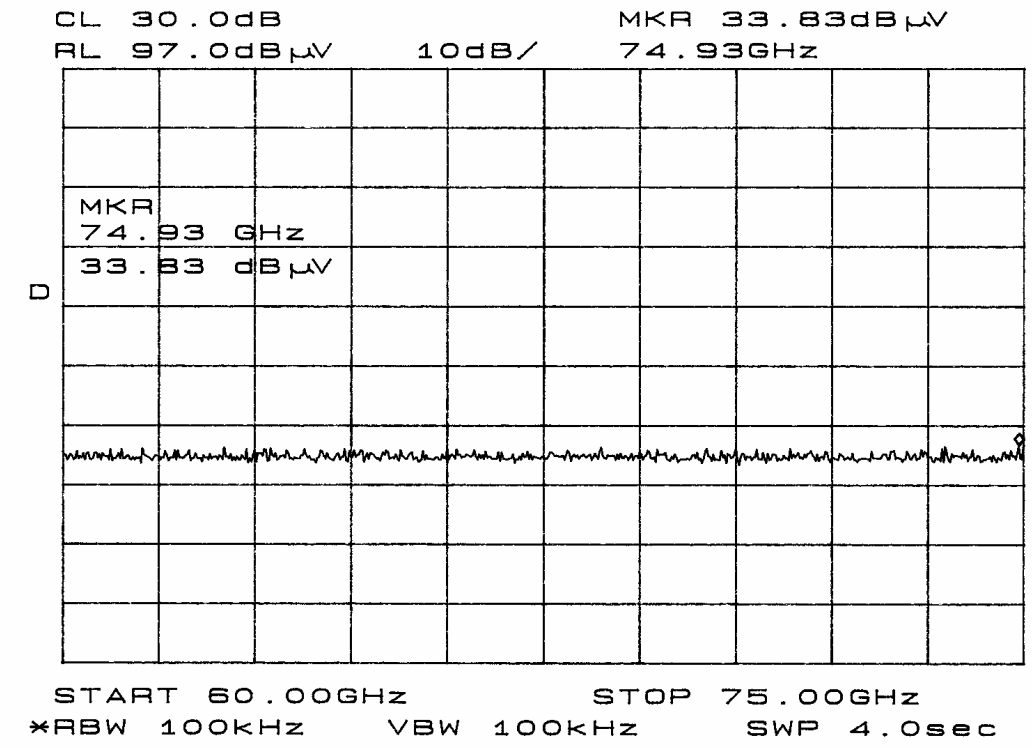

Figure eleven Radiated Emissions taken in screen room.

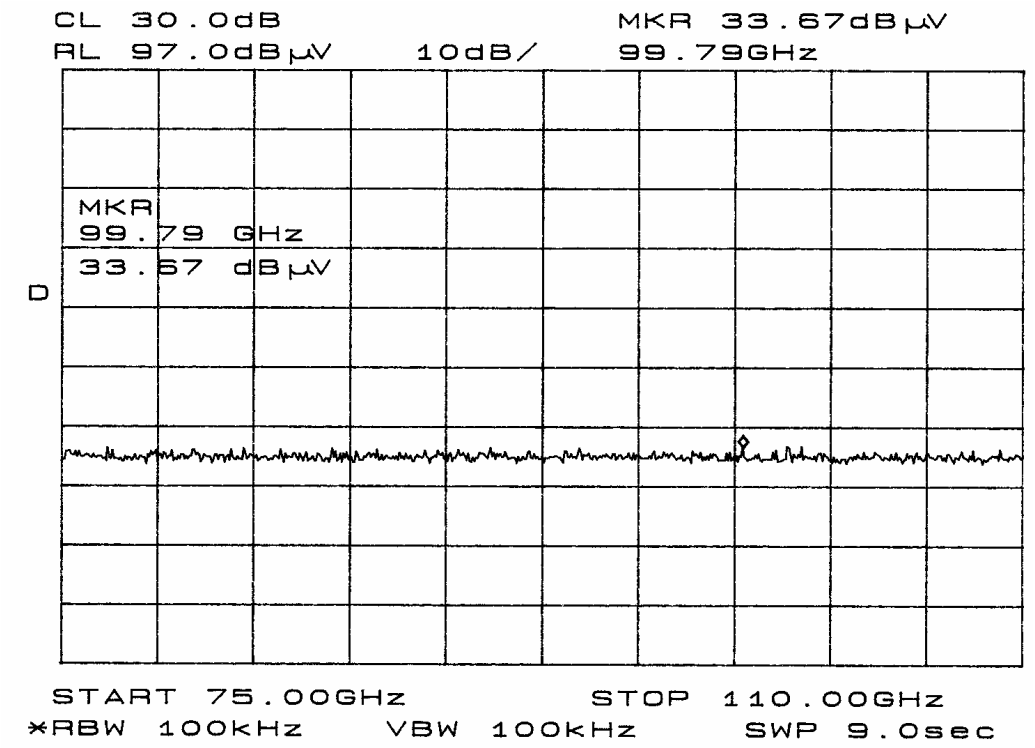

Figure twelve Radiated Emissions taken in screen room.

15.209 Data EUT and System Radiated Emissions (6 Highest)

Frequency In MHz	FSM Hor. (dBµV) Quasi-Peak	FSM Vert. (dBµV) Quasi-Peak	Ant. Fact. (dB)	Amp. Gain (dB)	Comp. Hor. (dBµV/m) @ 3m	Comp. Vert. (dBµV/m) @ 3 m	FCC Limit (dBµV)
120.0	44.9	33.9	6.9	30	21.8	10.8	43.5
285.0	45.2	32.8	12.9	30	28.1	15.7	46.0
288.0	43.5	33.1	13.7	30	27.2	16.8	46.0
291.0	41.2	30.4	13.7	30	24.9	14.1	46.0
312.0	41.0	40.8	14.2	30	25.2	25.0	46.0
315.0	38.8	40.5	14.2	30	23.0	24.7	46.0

Other emissions present had amplitudes at least 10 dB below the limit.

Summary of Results for Radiated Emissions

The radiated emissions for the EUT meet the requirements for FCC Part 15C Intentional Radiators. The EUT had an 11.1 dB minimum margin below the limits. Other emissions were present with amplitudes at least 10 dB below the FCC Limits.

15.245 Operation in the Band 24,075-24,175 MHz

The power output was measured on an open field test site @ 3 meters. Data was taken per Paragraph 2.1046(a) and 15.245.

(a) 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 amplitude of the carrier frequency was measured using a spectrum analyzer. The amplitude of the emission was then recorded from the analyzer display.

(b) Emissions radiated outside of the specified bands below 17.7 GHz, as specified in 15.205, shall not exceed the field strength limits shown in 15.209. Harmonic emissions above 17.7 GHz shall not exceed the following field strength limits: For field disturbance sensors, 7.5 mV/m. The amplitude of each spurious emission was measured at a distance of 3 meters from the FSM antenna at the OATS. The amplitude of each 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/or Pyramidal Horn Antennas from 4 to 18 GHz, and appropriate mixers from 18 GHz to 110 GHz.

Refer to Figures 13 through 23 showing plots taken in the screen room from the spectrum analyzer at a distance of 1 meter. The band edges are protected due to the frequency of operation. Emissions were measured in dBµV/m and converted to dBµV/m @ 3 meters using the following equation.

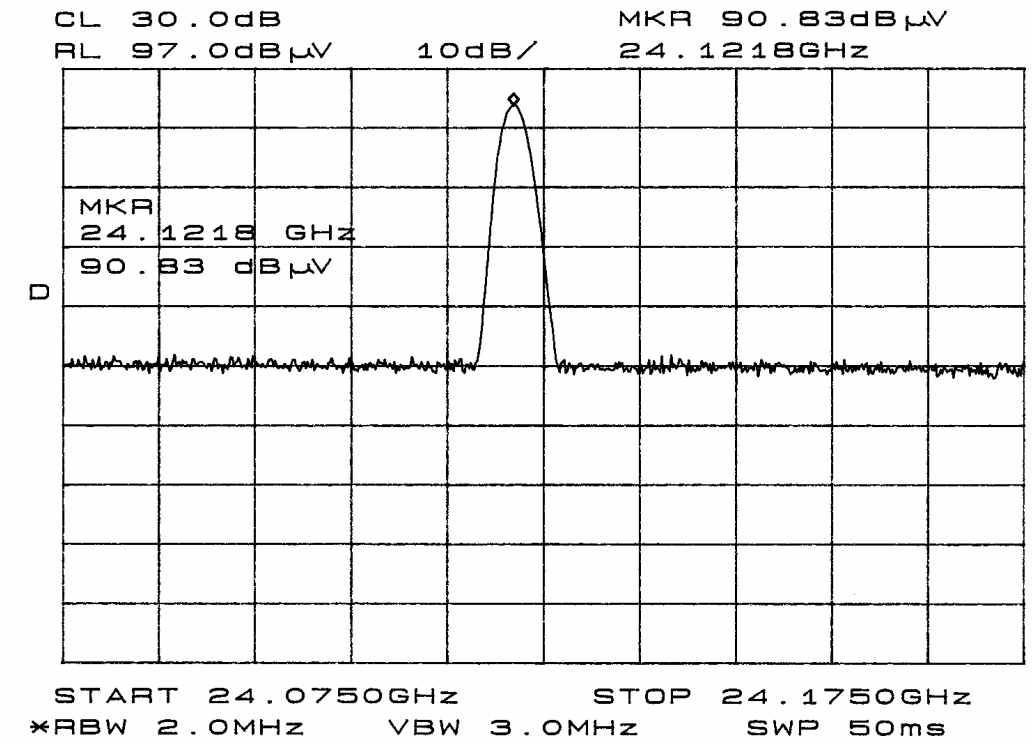

Figure thirteen Radiated Emissions taken in screen room.

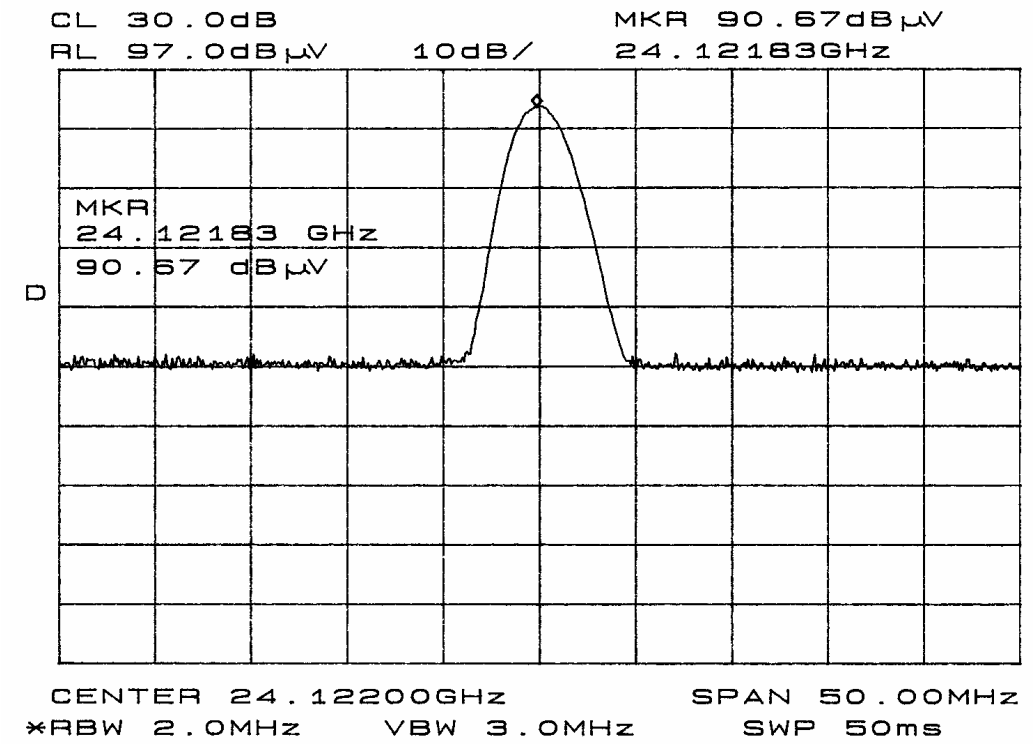

Figure fourteen Radiated Emissions taken in screen room.

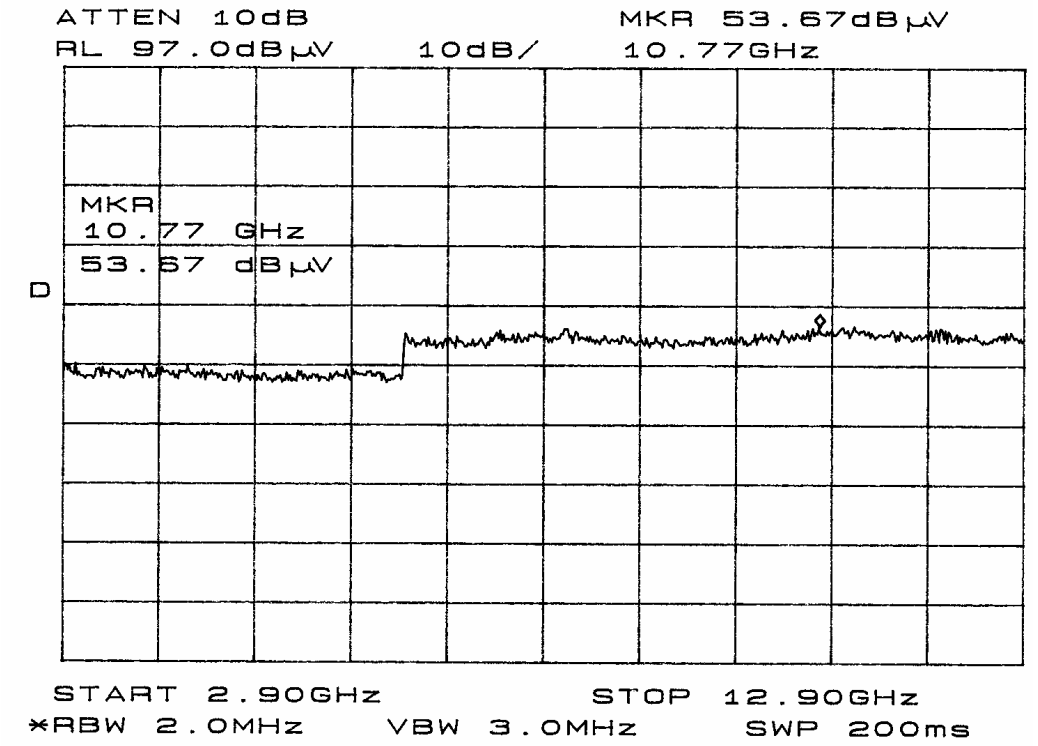

Figure fifteen Radiated Emissions taken in screen room.

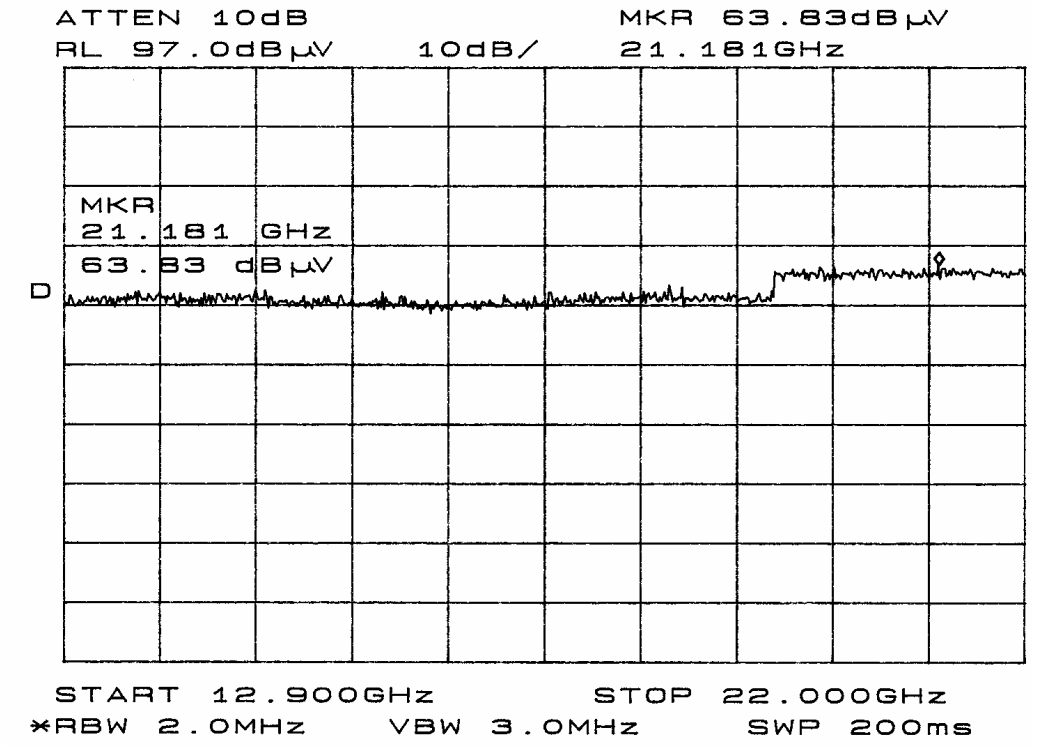

Figure sixteen Radiated Emissions taken in screen room.

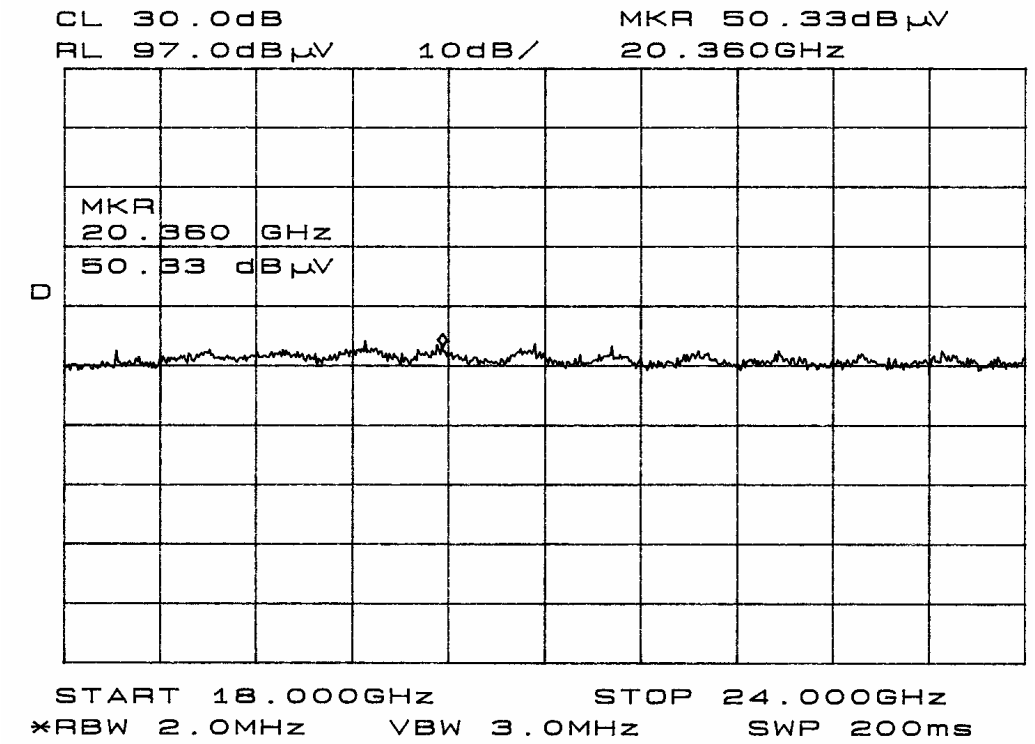

Figure seventeen Radiated Emissions taken in screen room.

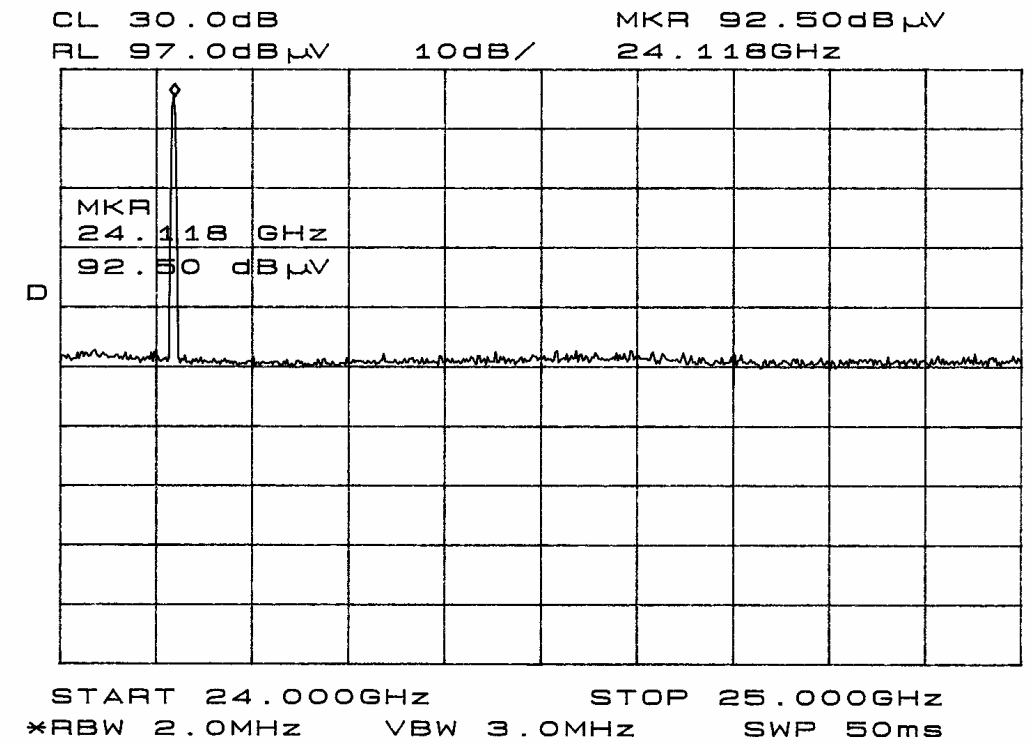

Figure eighteen Radiated Emissions taken in screen room.

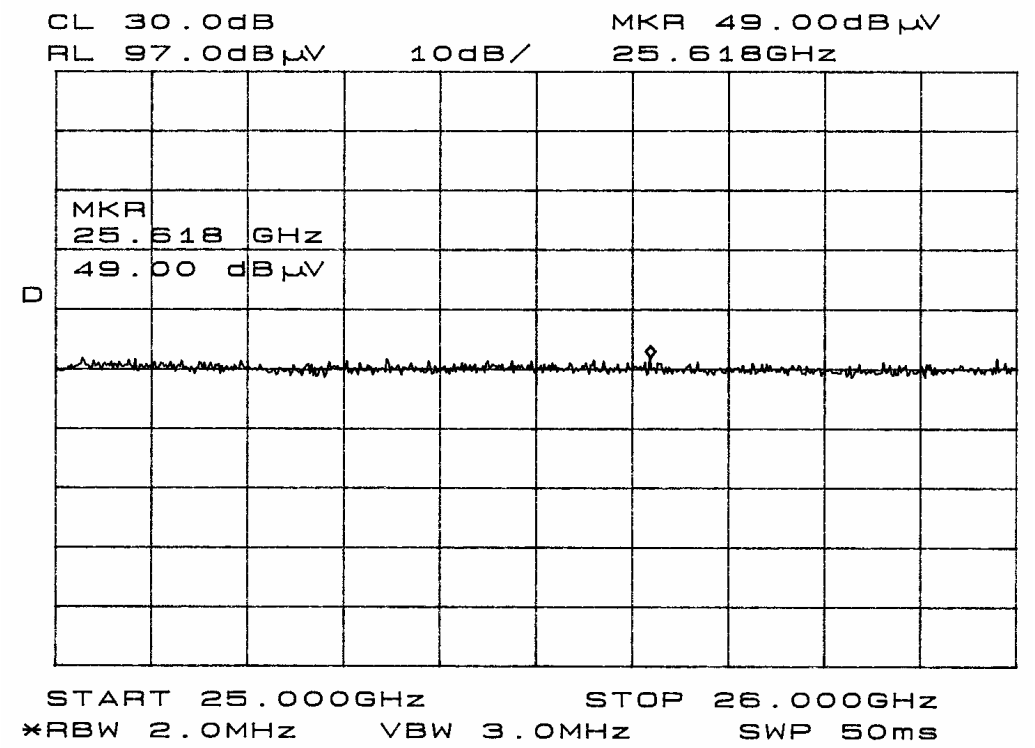

Figure nineteen Radiated Emissions taken in screen room.

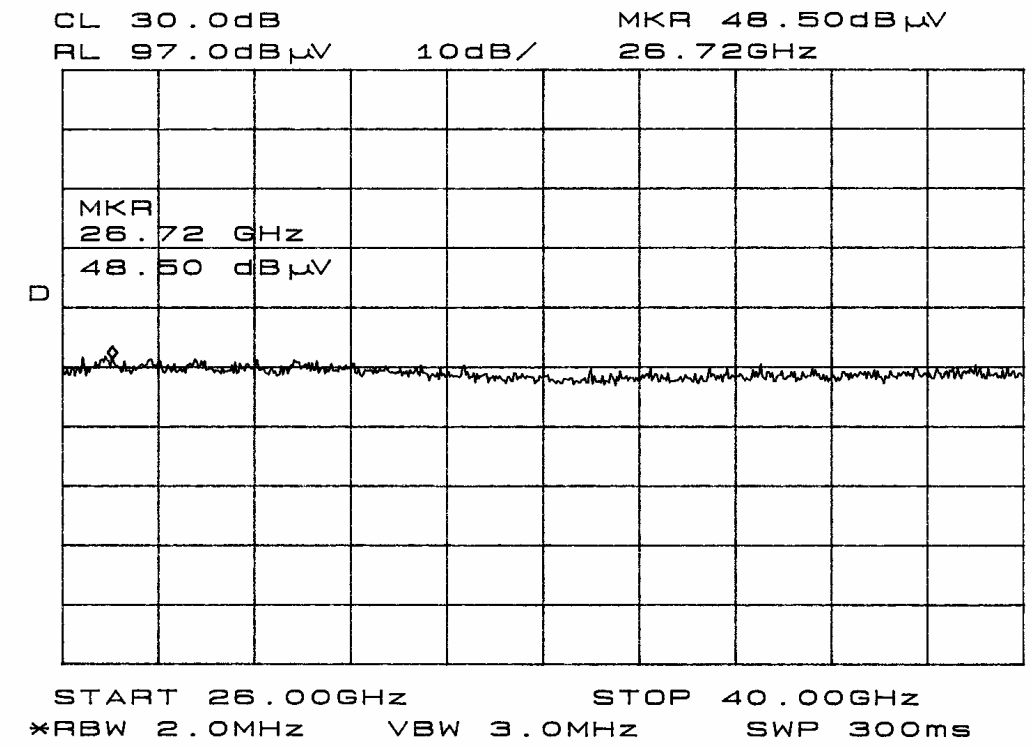

Figure twenty Radiated Emissions taken in screen room.

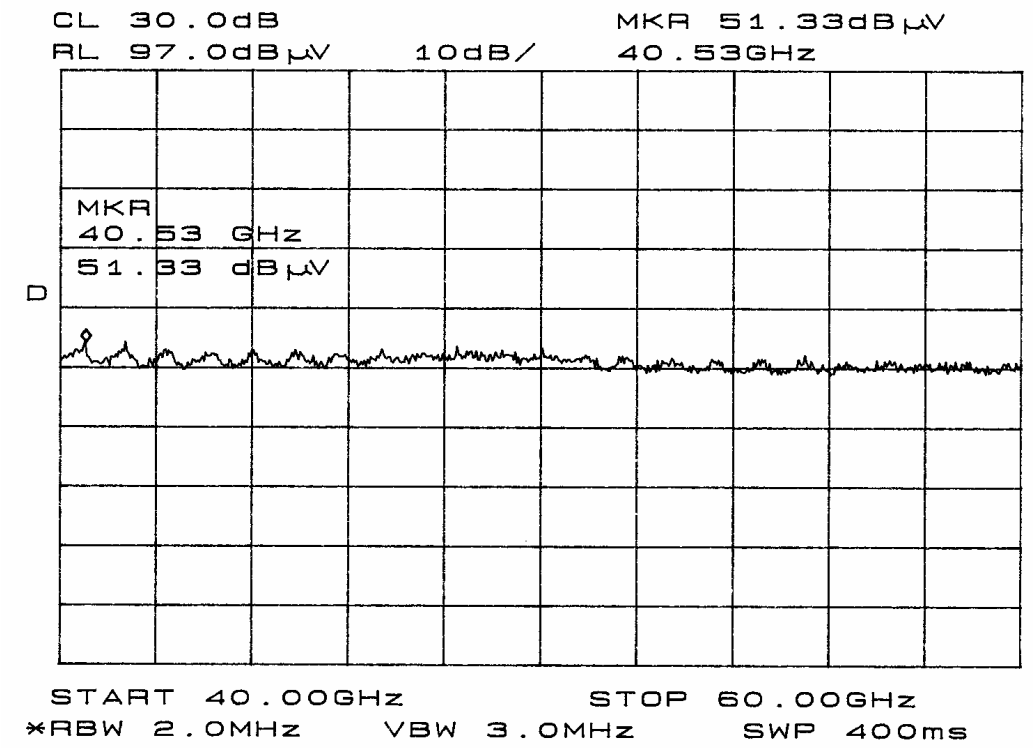

Figure twenty-one Radiated Emissions taken in screen room.

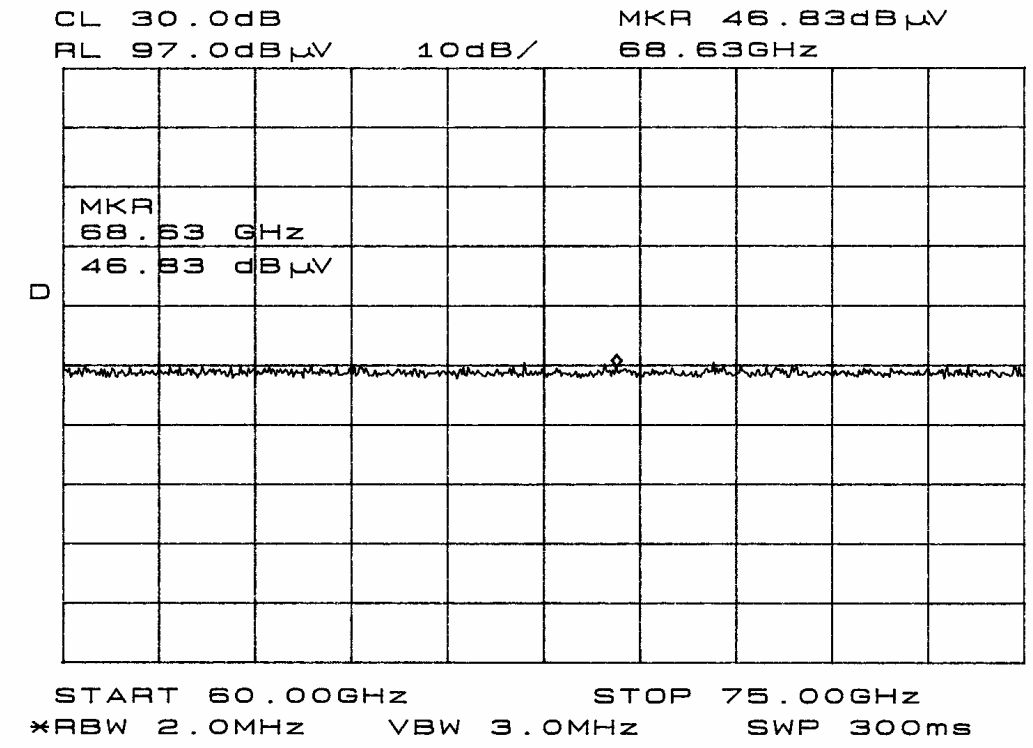

Figure twenty-two Radiated Emissions taken in screen room.

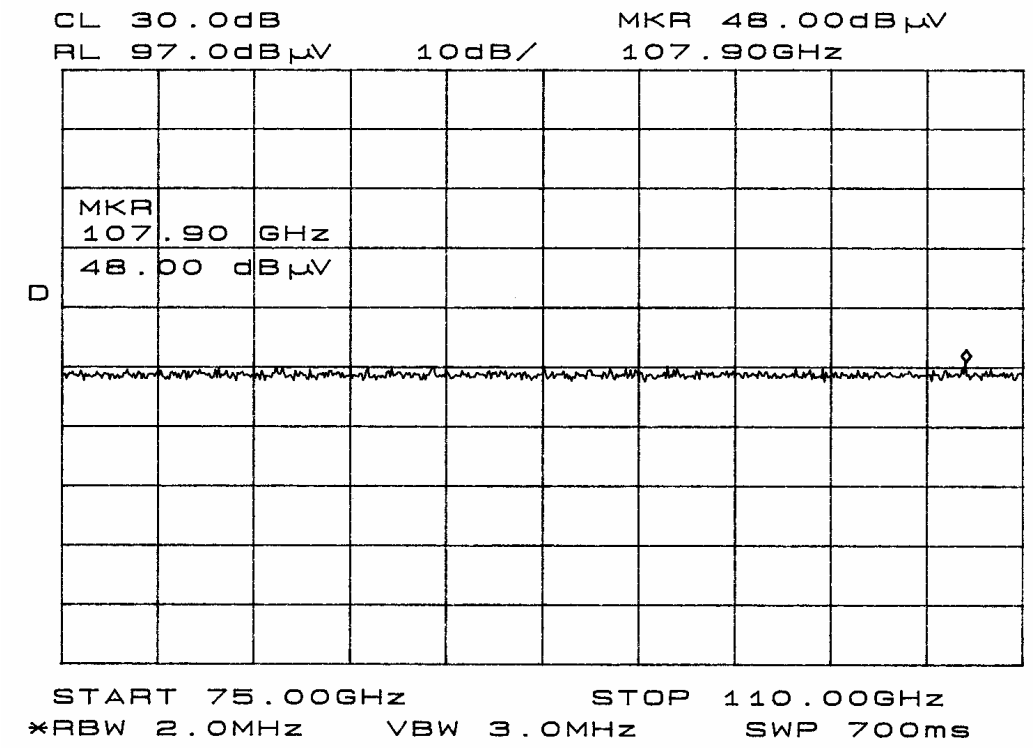

Figure twenty-three Radiated Emissions taken in screen room.

dBµv/m@ 3m = FSM + A.F. – AMP.GAIN
= 92.5 + 22.0
= 114.5

$\mu V/M = 10^{(dB\mu v/m/20)}$
= 0.530,884 µV/M
= 530 mV/m

Data Intentional Radiated Emissions

Frequency (MHz)	FSM IN HOR dBµV	FSM IN VERT dBµV	ANT FACT dB	CFS LEVEL IN dBµV/m @ 3m HOR	CFS LEVEL IN dBµV/m @ 3m VERT	Limit dBµV/m @ 3m
24,136	92.5	82.5	22.0	114.5	104.5	128.0

Note: Level was measured @ 3-meter site.

Data Harmonic Radiated Emissions

Frequency (MHz)	FSM IN HOR dBµV	FSM IN VERT dBµV	ANT FACT dB	CFS LEVEL IN dBµV/m @ 3m HOR	CFS LEVEL IN dBµV/m @ 3m VERT	Limit dBµV/m @ 3m
48,250	26.5	24.3	23.0	49.5	47.3	77.5
72,600	24.5	24.0	23.0	59.5	59.0	77.5
96,800	24.6	24.3	39.8	64.4	64.1	77.5

Note: Level was measured @ 3-meter site.

Radiated Emissions of Intentional Radiator

The EUT had a 13.1 dB margin below the limits. The radiated emissions for the EUT meet the requirements for FCC Part 15C, paragraph 15.245, 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. The specification of 15.245 are met, there are no deviations or exceptions to the requirements.

Statement of Modifications

No modifications to the EUT were required for the unit to meet the FCC Part 15B CLASS B emissions standards. There were no deviations to the specifications.

APPENDIX

Model: DIRECTIONAL RADAR UNIT II

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

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:
Scope: Tektronix 2230	2/06
Wattmeter: Bird 43 with Load Bird 8085	2/06
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/06
H/V Power Supply: Fluke Model: 408B (SN: 573)	2/06
R.F. Generator: HP 606A	2/06
R.F. Generator: HP 8614A	2/06
R.F. Generator: HP 8640B	2/06
Spectrum Analyzer: HP 8562A,	2/06
Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W	
HP Adapters: 11518, 11519, 11520	
Spectrum Analyzer: HP 8591 EM	5/06
Frequency Counter: Leader LDC 825	2/06
Antenna: EMCO Biconilog Model: 3143	5/06
Antenna: EMCO Log Periodic Model: 3147	10/05
Antenna: Antenna Research Biconical Model: BCD 235	10/05
Antenna: EMCO Dipole Set 3121C	2/06
Antenna: C.D. B-101	2/06
Antenna: Solar 9229-1 & 9230-1	2/06
Antenna: EMCO 6509	2/06
Audio Oscillator: H.P. 201CD	2/06
R.F. Power Amp 65W Model: 470-A-1010	2/06
R.F. Power Amp 50W M185- 10-501	2/06
R.F. PreAmp CPPA-102	2/06
LISN 50 µHy/50 ohm/0.1 µf	10/05
LISN Compliance Eng. 240/20	2/06
LISN Fischer Custom Communications FCC-LISN-50-16-2-08	6/05
Peavey Power Amp Model: IPS 801	2/06
Power Amp A.R. Model: 10W 1010M7	2/06
Power Amp EIN Model: A301	2/06
ELGAR Model: 1751	2/06
ELGAR Model: TG 704A-3D	2/06
ESD Test Set 2010i	2/06
Fast Transient Burst Generator Model: EFT/B-101	2/06
Current Probe: Singer CP-105	2/06
Current Probe: Solar 9108-1N	2/06
Field Intensity Meter: EFM-018	2/06
KEYTEK Ecat Surge Generator	2/06
Shielded Room 5 M x 3 M x 3.0 M (101 dB Integrity)	

5/2/2006

QUALIFICATIONS

Of

SCOT D. ROGERS, ENGINEER

ROGERS LABS, INC.

Mr. Rogers has approximately sixteen years experience in the field of electronics. Six years working in the automated controls industry and the remaining years working with the design, development and testing of radio communications and electronic equipment.

POSITIONS HELD:

Systems Engineer:	A/C Controls Mfg. Co., Inc. 6 Years
Electrical Engineer:	Rogers Consulting Labs, Inc. 5 Years
Electrical Engineer:	Rogers Labs, Inc. Current

EDUCATIONAL BACKGROUND:

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

June 1, 2006
Date

1/11/03

FCC Site Approval

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