ROGERS LABS, INC.

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

TEST REPORT

For

APPLICATION of CERTIFICATION

For

HARMON INDUSTRIES, INC.
Dillingham & Argo Road
Grain Valley, MO 64029
Phone: (816) 650-6171

Jeff Kleoppel,
Senior Design Engineer

MODEL: AATC-SSR
Advanced Automatic Train Control - Spread Spectrum Radio
Frequency 2400 - 2483.5 MHz
FCC ID: AJTAATCSSR-24

Test Date: June 15, 2000

Certification Date: June 15, 2000

Certifying Engineer: Scot D Rogers

Scot D. Rogers
ROGERS LABS, INC.
4405 West 259th Terrace
Louisburg, KS 66053
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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 15.247(a)(2).

Name of Applicant:

HARMON INDUSTRIES, INC.
Dillingham & Argo Road
Grain Valley, MO 64029

Model: AATC-SSR

FCC I.D.: AJTAATCSSR-24

Frequency Range: 2400 MHz to 2483.5 MHz

Operating Power: 1 Watt

1) Applicable Standards & Test Procedures

a) In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 1999, Part 2, Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1031 through 2.1057, Part 15C Paragraph 15.247, and FCC Document FCC98-58 the following is submitted:

b) Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in the ANSI 63.4-1992 Document.

2) Application for Certification per 2.1033(b)

(1) Manufacturer:
HARMON INDUSTRIES, INC.
Dillingham & Argo Road
Grain Valley, MO 64029

(2) Identification: Model: AATC-SSR
FCC I.D.: AJTAATCSSR-24

(3) Instruction Book:

Refer to Exhibit for Instruction Manual.

(4) Description of Circuit Functions:

Refer to Exhibit for Circuit Description.

(5) Block Diagram with Frequencies:

Refer to Exhibit for Block Diagram.

(6) Report of Measurements:

Follows in this Report.

(7) Photos: Construction, Component Placement, etc.:

Refer to Appendix of this report for Photographs of equipment and Exhibits for drawings.

(8) Brief description of peripheral equipment used with EUT.

The EUT utilizes a Product Identification Module (PIM), which contains nonvolatile memory initialized with information used for host device configurations at startup. Typically, the module remains permanently attached to the mounting assembly such that the function and identification for location will remain constant.

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

(10) Direct Sequence Spread Spectrum:

Applications for the certification of direct sequence spread spectrum, transmitters operated under Part 15 shall be accompanied by an exhibit describing compliance with the processing gain provisions of 15.247(e). Refer to appendix of this report.

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

(12) Not Applicable. The unit does not function in this range.

3) Equipment Tested

EQUIPMENT	MODEL/PART#	FCC I.D.
EUT	AATC-SSR	AJTAATCSSR-24
Power Supply	SRL 40-25	N/A

4) Equipment Function and Testing Procedures

The EUT is a multi-functional digital data radio transceiver used for digital data communication and range measurement. The AATC-SSR can be used in a variety of rail vehicle and wayside configurations and is designed specifically for the railroad environment.

5) Equipment and Cable Configurations

Conducted Emission Test Procedure

The EUT is operated from 20.5 to 40 volt direct current power sources and has no provision to connect to the utility power distribution system.

Radiated Emission Test Procedure

The EUT was placed on a rotatable 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. Refer to photos in Appendix for EUT placement.

6) 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	MFG.	MODEL	CAL. DATES	DUE.
LISN	Comp. Design	1762	9/99	9/00
Antenna	ARA	BCD-235-B	9/99	9/00
Antenna	EMCO	3147	9/99	9/00
Antenna	EMCO	3143	4/00	4/01
Analyzer	HP	8591EM	7/99	7/00

7) Units of Measurements

Radiated EMI: Data is in dBµV/m; dB/m referenced to one microvolt per meter.

8) Test Site Locations

Conducted EMI: The AC powerline 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 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 31040/SIT 1300F2, Dated February 6, 1998.

9) SUBPART B – Unintentional Radiators

Conducted EMI

The EUT is operated from 20.5 to 40 volt direct current power sources and has no provision to connect to the utility power distribution system. Therefore no AC line conducted emissions measurements 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 1000 MHz for the preliminary testing. Refer to figures 1 and 2 for plots of the frequency spectrum produced by the EUT and support equipment taken in a screen room at a distance of 1 meter. The EUT and cable locations were 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 1000 MHz 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 position between horizontal and vertical polarization. Antennas used were Broadband Biconical from 30 to 200 MHz, Log Periodic from 200 MHz to 5

GHz, and or a Biconilog from 30 to 1000 MHz, and pyramidal horns and/or mixers from 4 GHz to 25 GHz.

Sample Calculations:

RFS = Radiated Field Strength

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

dBµV/m @ 3m = 47.9 + 5.5 - 35

= 18.4

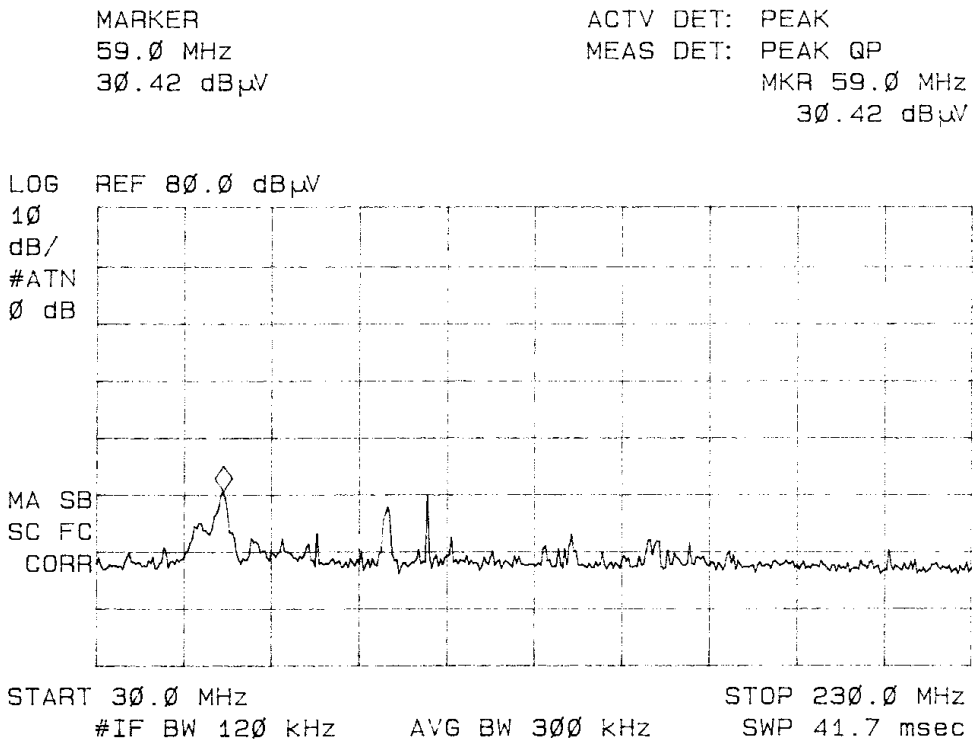


Figure 1 Radiated Emissions taken in screen room.

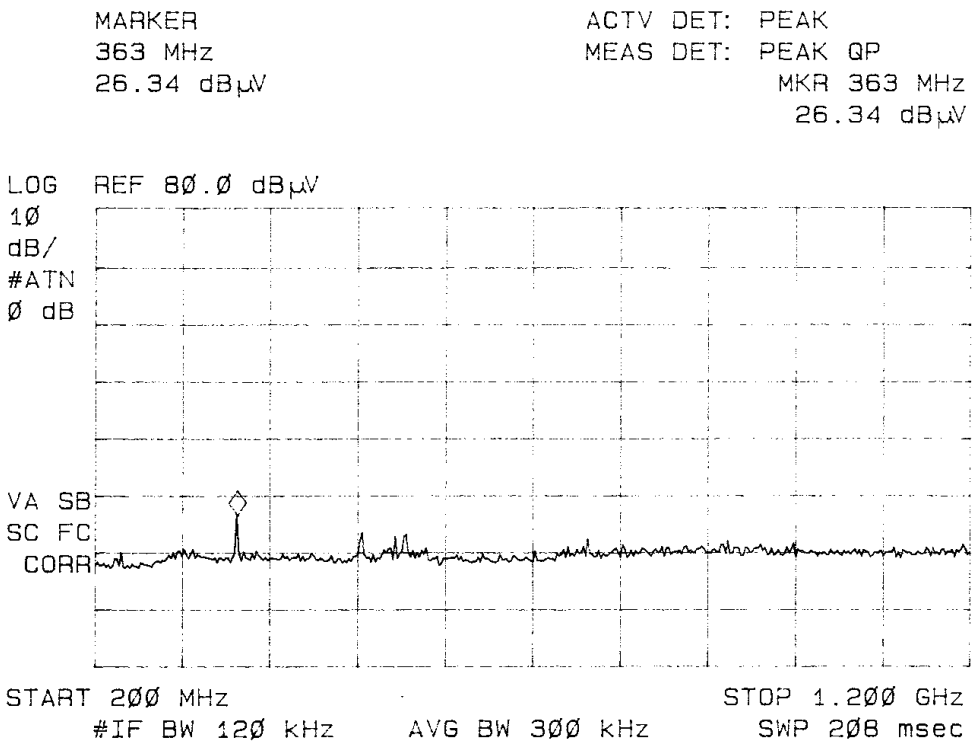


Figure 2 Radiated Emissions taken in screen room.

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)
54.0	47.9	49.1	5.5	35	18.4	19.6	40.0
58.9	46.9	47.5	5.2	35	17.1	17.7	40.0
64.8	45.3	43.5	6.2	35	16.5	14.7	40.0
79.7	49.5	47.4	7.9	35	22.4	20.3	40.0
544.9	34.5	34.5	19.1	35	18.6	18.6	46.0
555.0	34.5	34.4	19.2	35	18.7	18.6	46.0

Other emissions present had amplitudes at least 10 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 minimum margin of 17.6 dB below the limit. Other emissions were present with amplitudes at least 10 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.

10) Subpart C - Intentional Radiators

As per CFR Part 15, Subpart C. The following information is submitted:

15.203 Antenna Requirements

The unit is produced with a female type N coupling from the transmitter to the antenna. The system is installed professionally and is not user serviceable. The system is designed to utilize a narrow frequency band, directional antenna, which is installed with the radio. 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 Average (dBµV/m @ 3m) = FSM(dBµV) + A.F.(dB) - Gain(dB)
= 40.5 + 29.9 - 35
= 50.4

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)
4847.50	40.5	39.5	29.9	20	50.4	49.4	54.0
7271.25	40.4	39.9	29.9	20	50.3	49.5	54.0
4885.50	40.3	39.3	29.9	20	50.2	49.2	54.0
7328.25	40.6	40.6	29.9	20	50.5	50.5	54.0
4925.50	40.1	40.3	29.9	20	50.0	50.2	54.0
7388.25	40.3	40.3	29.9	20	50.2	50.2	54.0

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. Antenna conducted emissions were measured and recorded in a screen room. Plots were made of the frequency spectrum from 30 MHz to 25 GHz for the preliminary testing. The highest radiated emission was then re-maximized at the OATS 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 25 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 Biconilog from 30 MHz to 1000 MHz, Log Periodic from 200 MHz to 5 GHz and pyramidal horns and or mixers from 4 GHz to 25 GHz.

Data 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)
54.0	47.9	49.1	5.5	35	18.4	19.6	40.0
58.9	46.9	47.5	5.2	35	17.1	17.7	40.0
64.8	45.3	43.5	6.2	35	16.5	14.7	40.0
79.7	49.5	47.4	7.9	35	22.4	20.3	40.0
544.9	34.5	34.5	19.1	35	18.6	18.6	46.0
555.0	34.5	34.4	19.2	35	18.7	18.6	46.0

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

Sample Calculations:

RFS = Radiated Field Strength

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

dBµV/m @ 3m = 47.9 + 5.5 - 35

= 18.4

Summary of Results for Radiated Emissions:

The radiated emissions for the EUT meet the requirements for FCC Part 15C Intentional Radiators. The EUT had a minimum margin of 17.6 dB below the limits. Other emissions were present with amplitudes at least 10 dB below the FCC Limits.

15.247 Operation in the Band 2400-2483.5 MHz

Operation under the provisions of this section is limited to frequency hopping and direct sequence spread spectrum intentional radiators. The EUT utilizes direct sequence spread spectrum and complies with the regulations as stated. Preliminary testing was performed in a screen room with the

EUT positioned 1 meter from the FSM. Emissions measurements were performed to identify the frequencies, which produced the highest emissions. Plots were made of the frequency spectrum, at the antenna terminal, from 1000 MHz to 25 GHz for the preliminary testing. Refer to figures 3 through 6 for plots of the frequency spectrum produced by the EUT at the antenna terminal. The output power was measured on an open field test site at 3 meters distance. Data was taken per Paragraph 2.1046(a) and 15.247. 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. The amplitudes of each spurious emission were 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 log Periodic Antenna was used for measuring emissions from 200 to 5000 MHz and Pyramidal Horn Antenna and/or mixers were used to measure emissions from 4 to 25 GHz. Emissions were measured in dBµV and converted to dBµV/m at 3 meters using the following equation.

dBµv/m@ 3m = FSM + A.F. – AMP. GAIN
= 104.5 + 31.6 - 20.0
= 116.1

Data: Intentional Radiated Emissions:

FREQ.	FSM IN HOR. DBµV	FSM IN VERT. dBµV	ANT. FACT. dB	AMP. GAIN dB	LEVEL IN dBµV/m @ 3m Horizontal	LEVEL IN dBµV/m @ 3m Vertical
2423.75	106.3	99.7	31.6	20	117.9	111.3
4847.50	40.5	39.5	29.9	20	50.4	49.4
7271.25	40.4	39.6	29.9	20	50.3	49.5
2442.75	104.2	97.7	31.6	20	115.8	109.3
4885.50	40.3	39.3	29.9	20	50.2	49.2
7328.25	40.6	40.6	29.9	20	50.5	50.5
2462.75	103.2	96.7	31.6	20	114.8	108.3
4925.50	40.1	40.3	29.9	20	50.0	50.2
7388.25	40.3	40.3	29.9	20	50.2	50.2

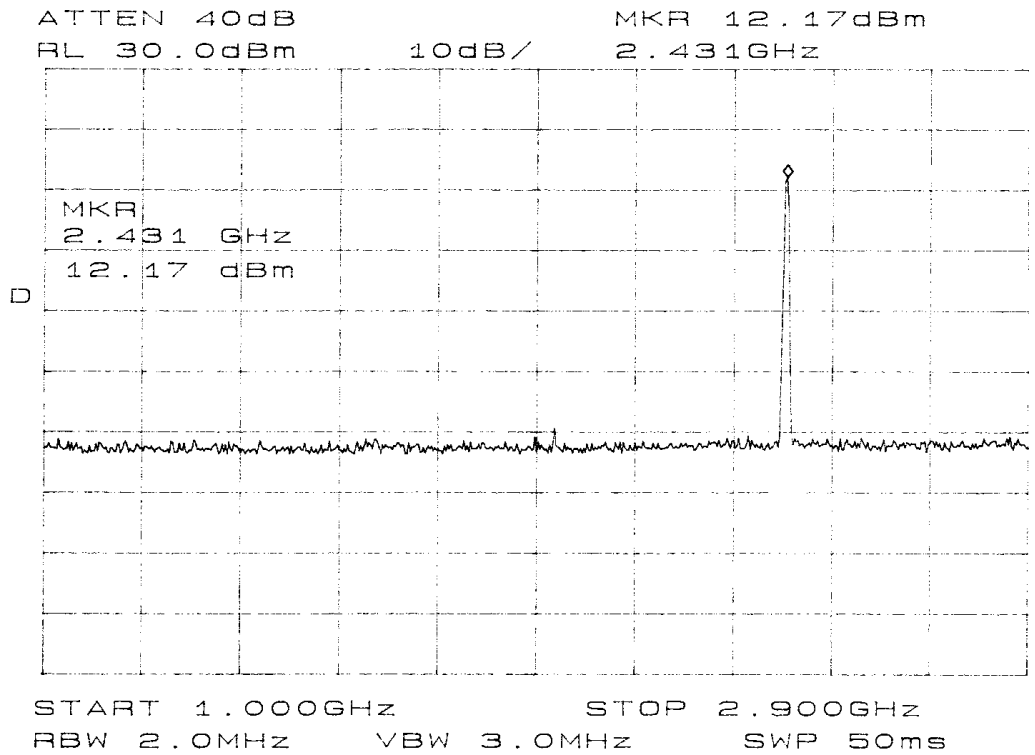


Figure 3 Emissions at Antenna Terminal

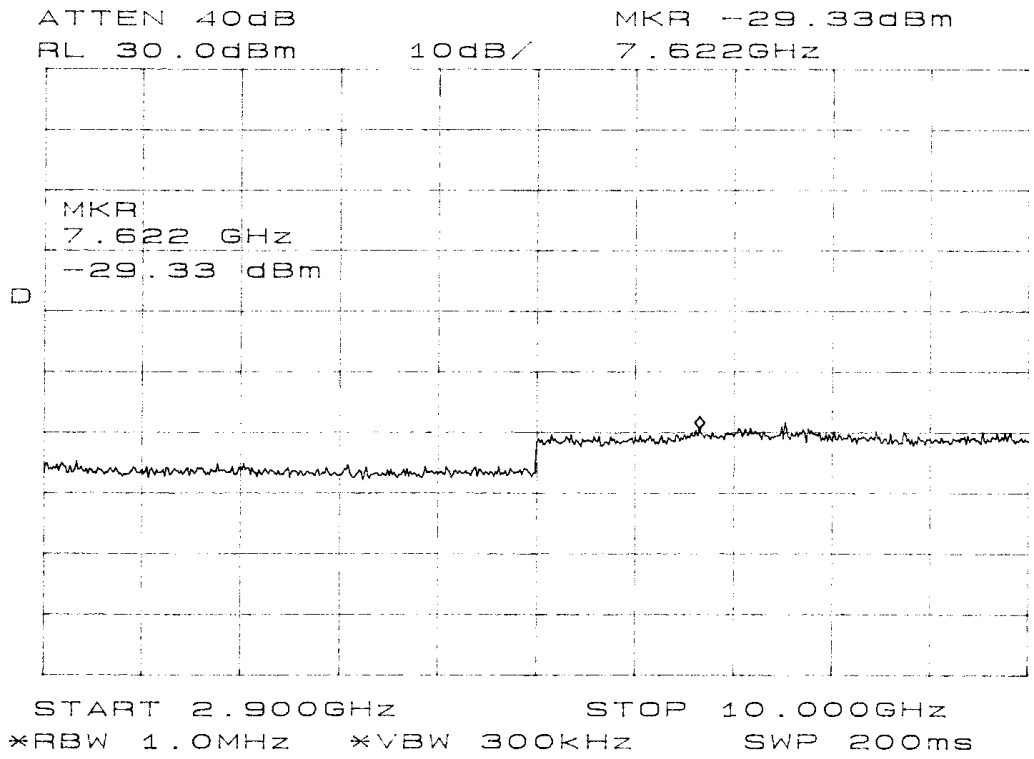


Figure 4 Emissions at Antenna Terminal

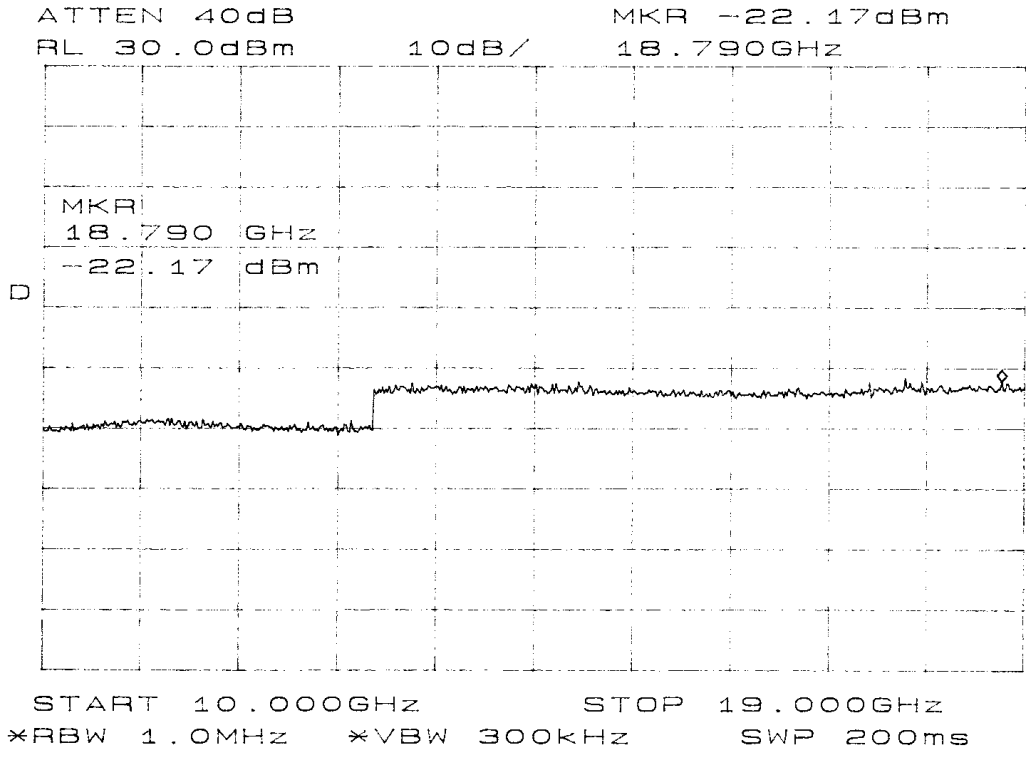


Figure 5 Emissions at Antenna Terminal

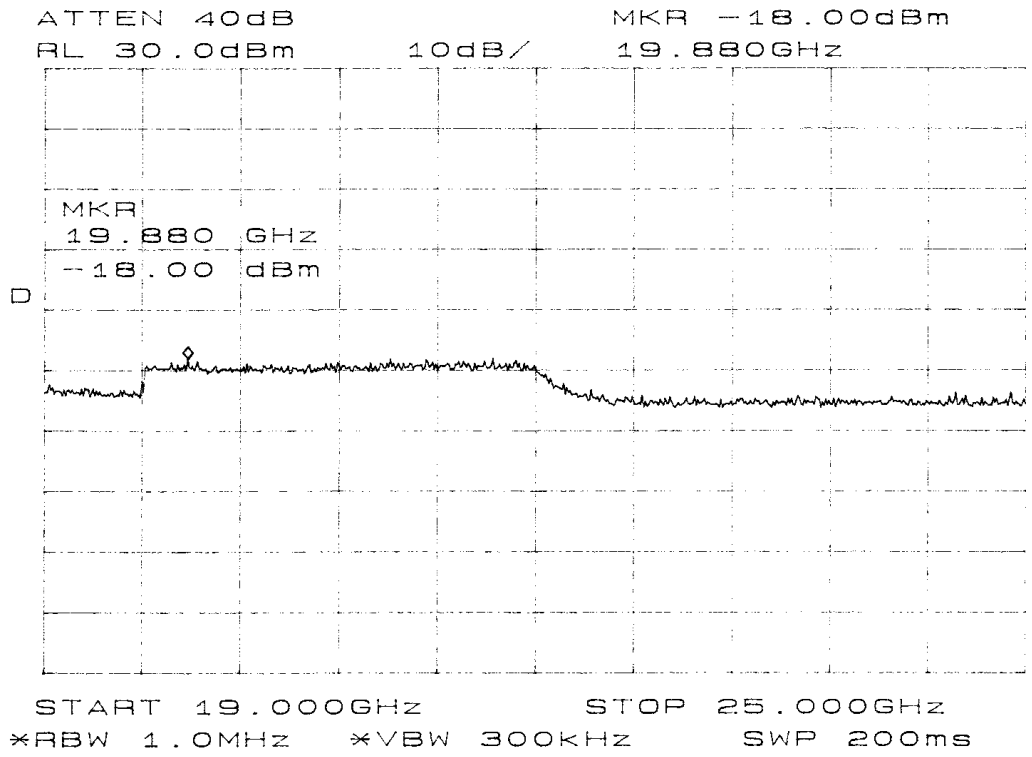


Figure 6 Emissions at Antenna Terminal

The 6-dB bandwidth was measured for three frequencies of operation per 15.247(a)(2). Refer to figures 7 through 9 for plots of the frequency spectrum produced by the EUT.

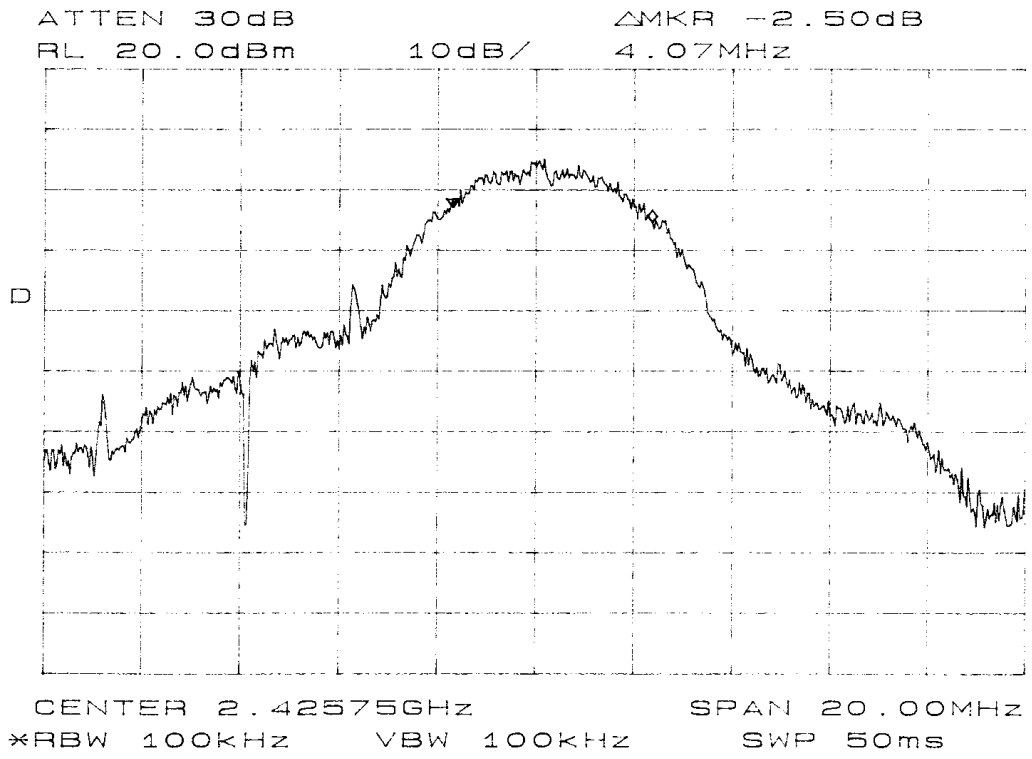


Figure 7 Emissions @ Antenna Port (6 dB Bandwidth)

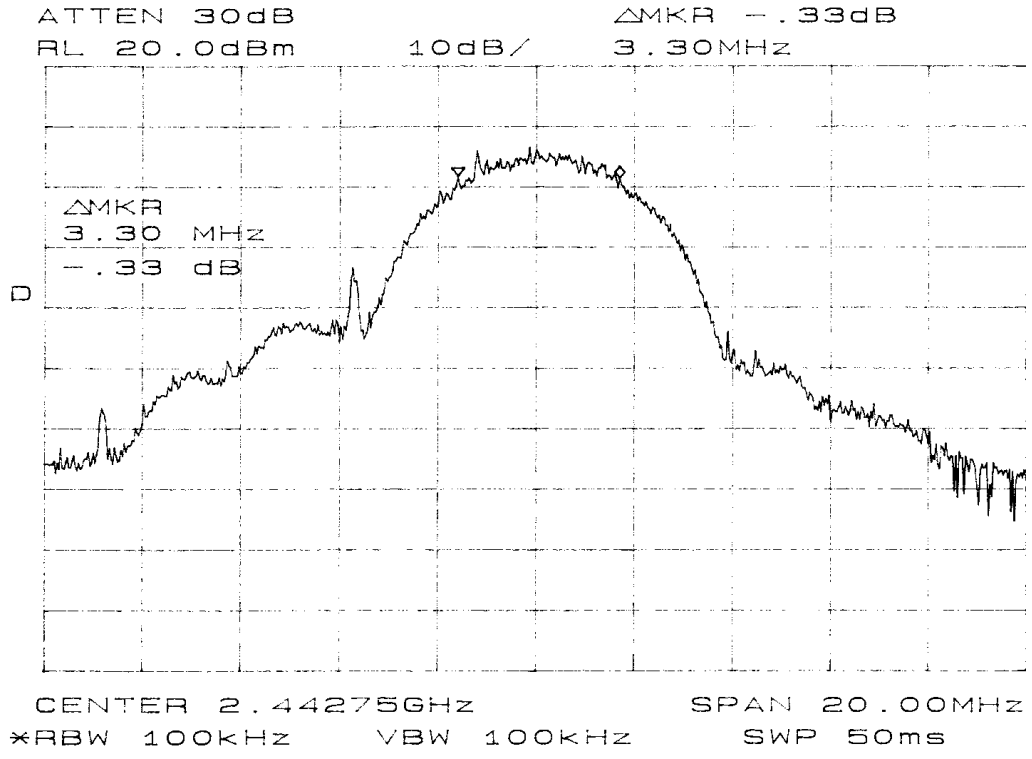


Figure 8 Emissions @ Antenna Port (6 dB Bandwidth)

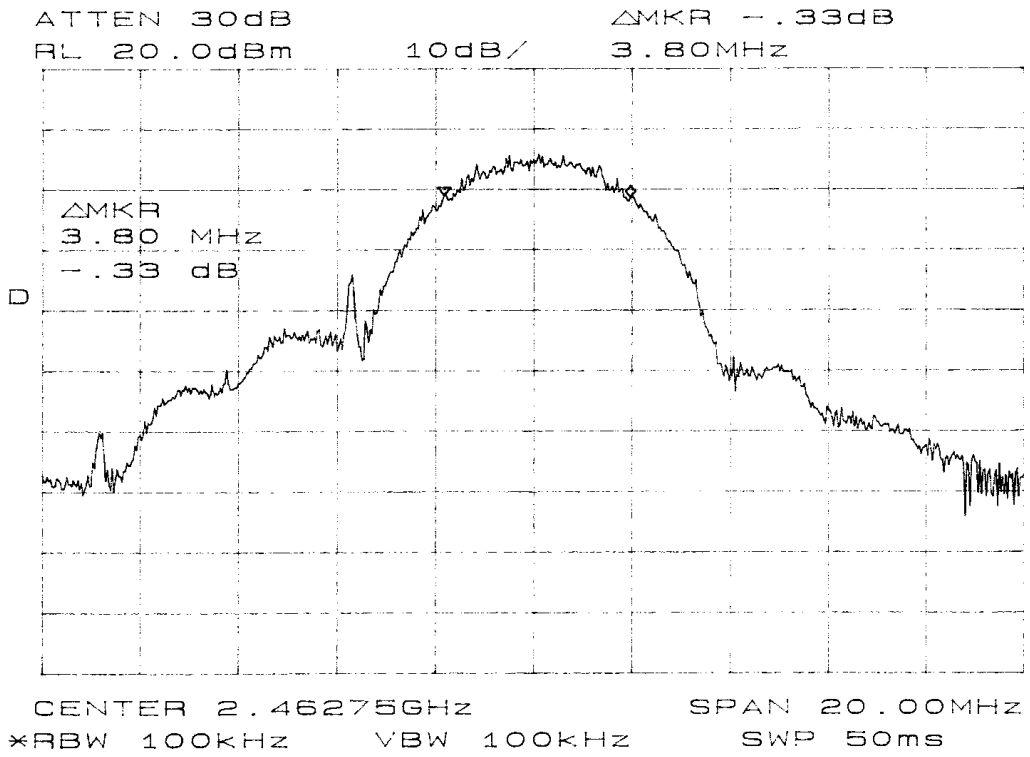


Figure 9 Emissions @ Antenna Port (6 dB Bandwidth)

Per 15.247(c) the 100 kHz bandwidth outside the frequency band in which the spread spectrum radiator operates was checked for compliance to the 20-dB limitation based on emissions at the antenna terminal. Refer to figures 10 through 12 for plots of the frequency spectrum produced by the EUT.

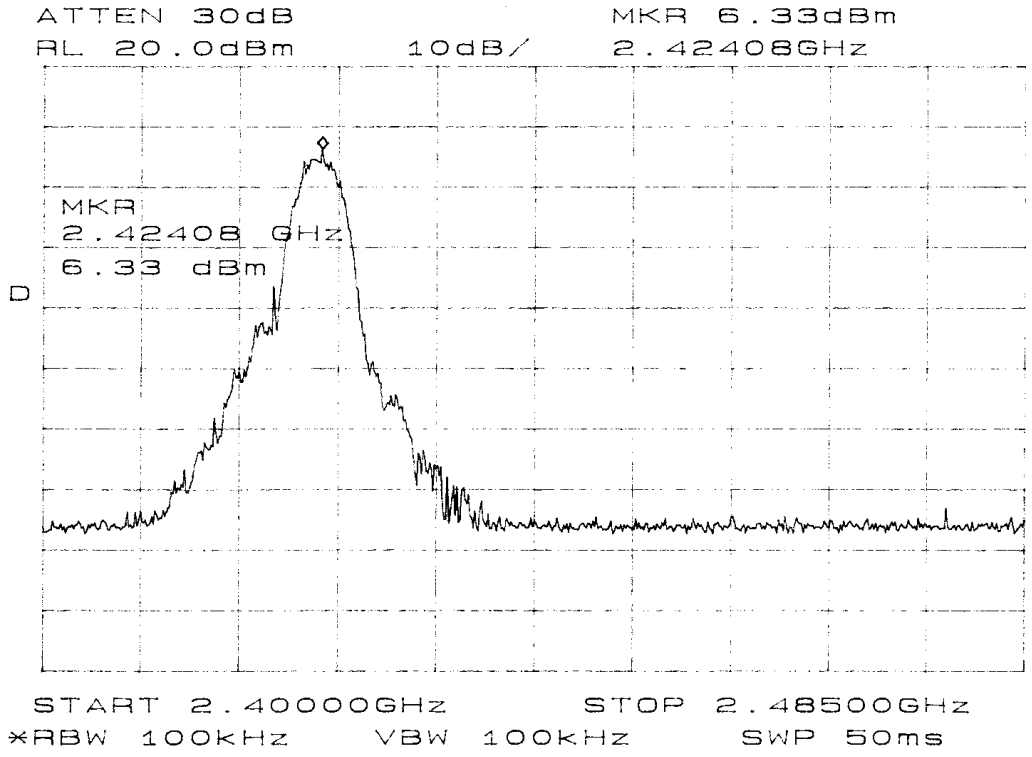


Figure 10 Emissions @ Antenna Port

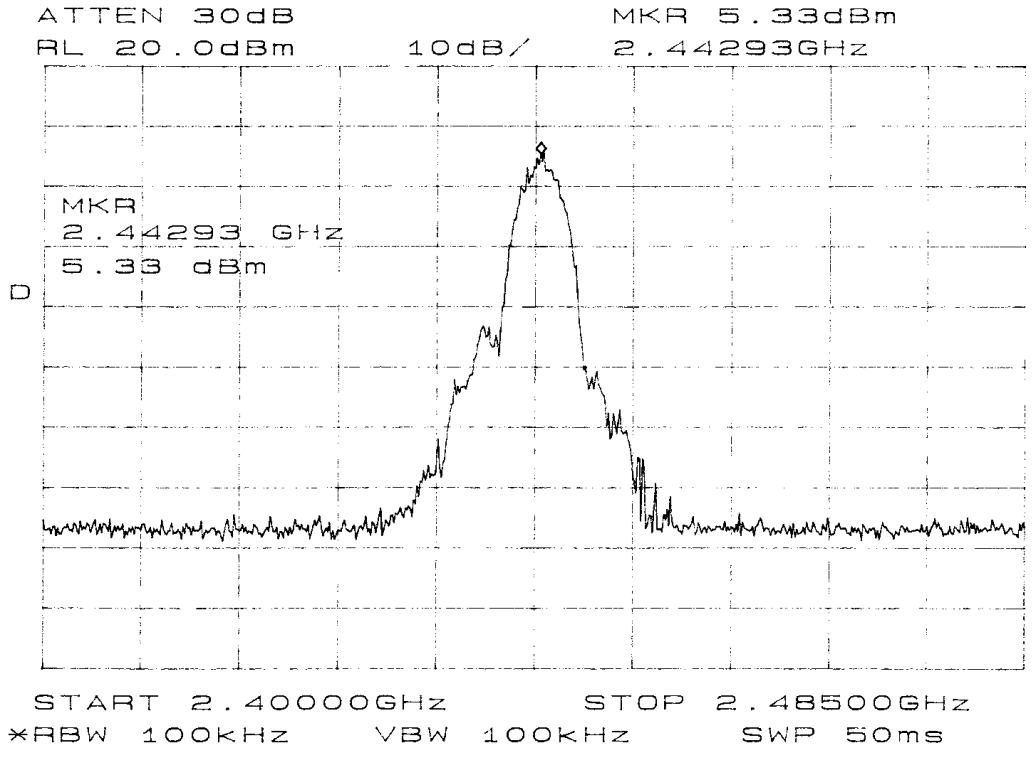


Figure 11 Emissions @ Antenna Port

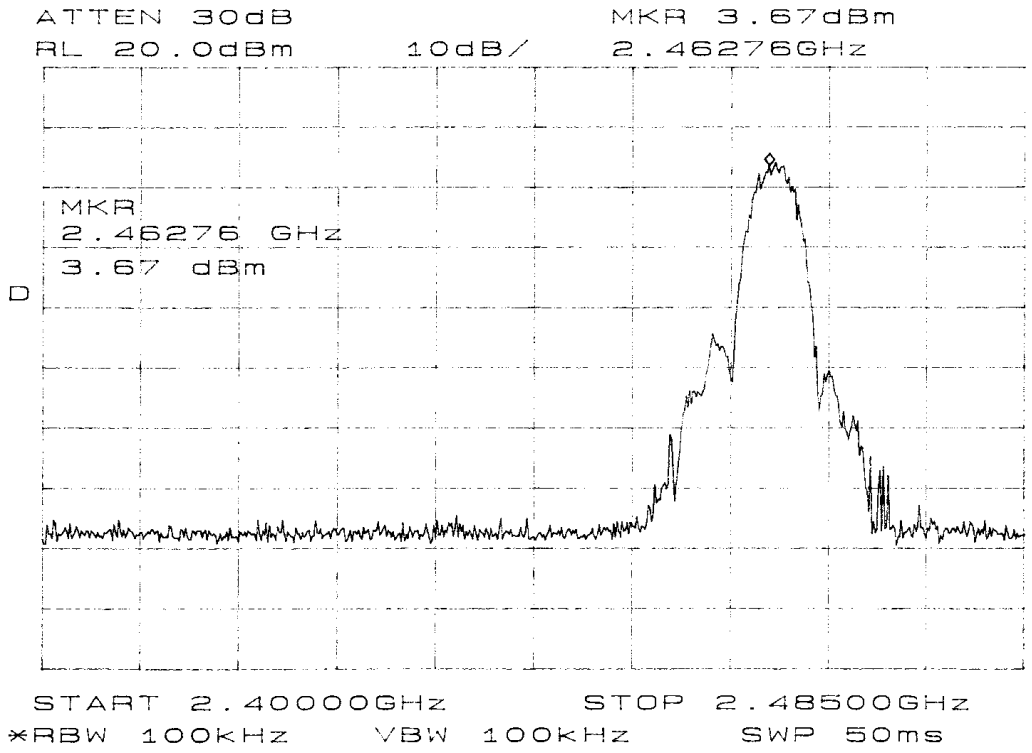


Figure 12 Emissions @ Antenna Port

Per 15.247(d) peak power spectral density conducted from the intentional radiator shall not be greater than 8dBm in any 3 kHz band during transmission. This was measured and verified at the antenna terminal. Refer to figure 13 for a plot of the frequency spectrum produced by the EUT.

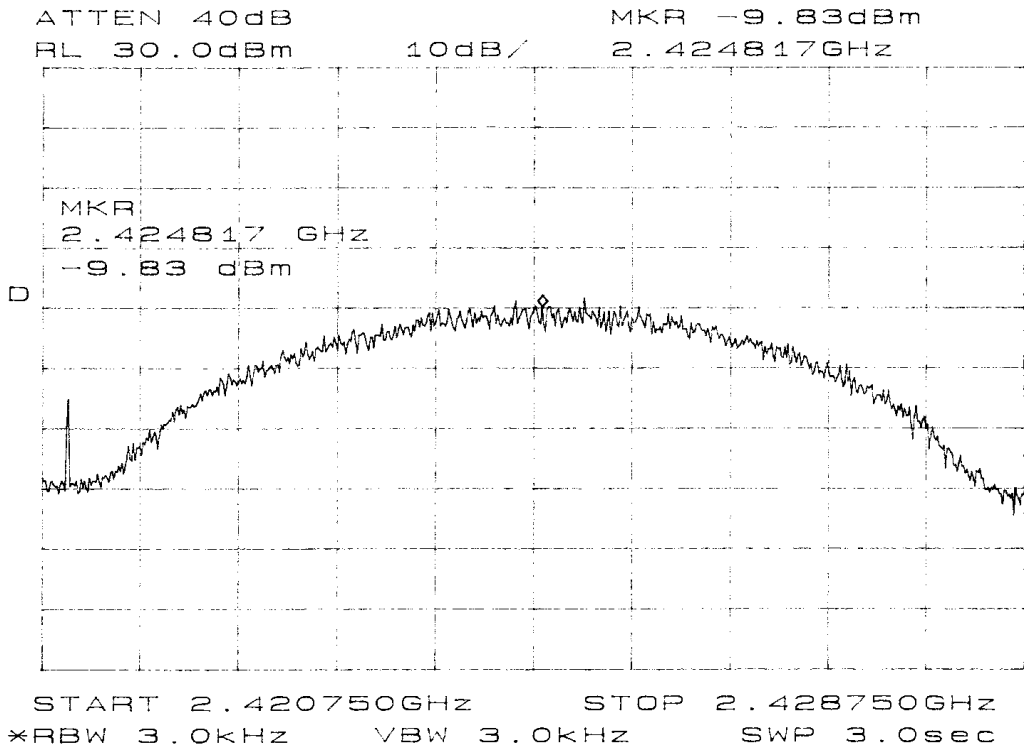


Figure 13 Emissions @ Antenna Port

The maximum output power was also measured at the antenna port by replacing the antenna with a spectrum analyzer and appropriate attenuation. This was measured and verified at the antenna terminal. Refer to figure 14 for a plot of the frequency spectrum produced by the EUT.

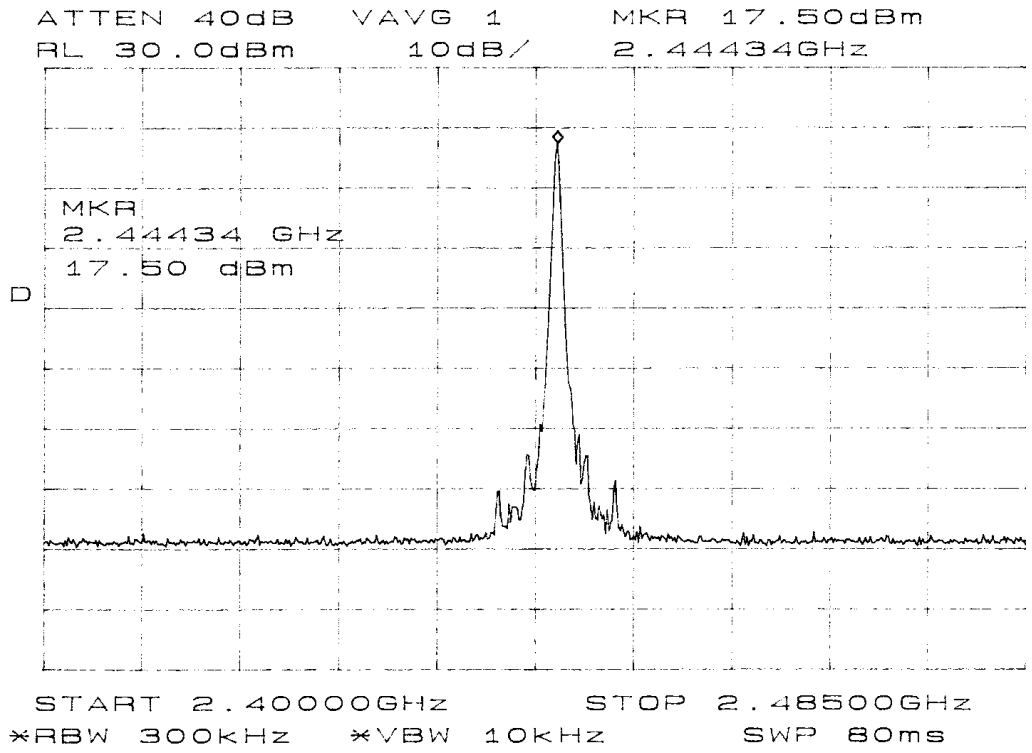


Figure 14 Emissions @ Antenna Port

Summary of Results for Radiated Emissions of Intentional Radiator:

The radiated emissions for the EUT meet the requirements for FCC Part 15C 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 10 dB below the FCC Limits. The specification of 15.247 are met, there are no deviations or exceptions to the requirements.

Statement of Modifications:

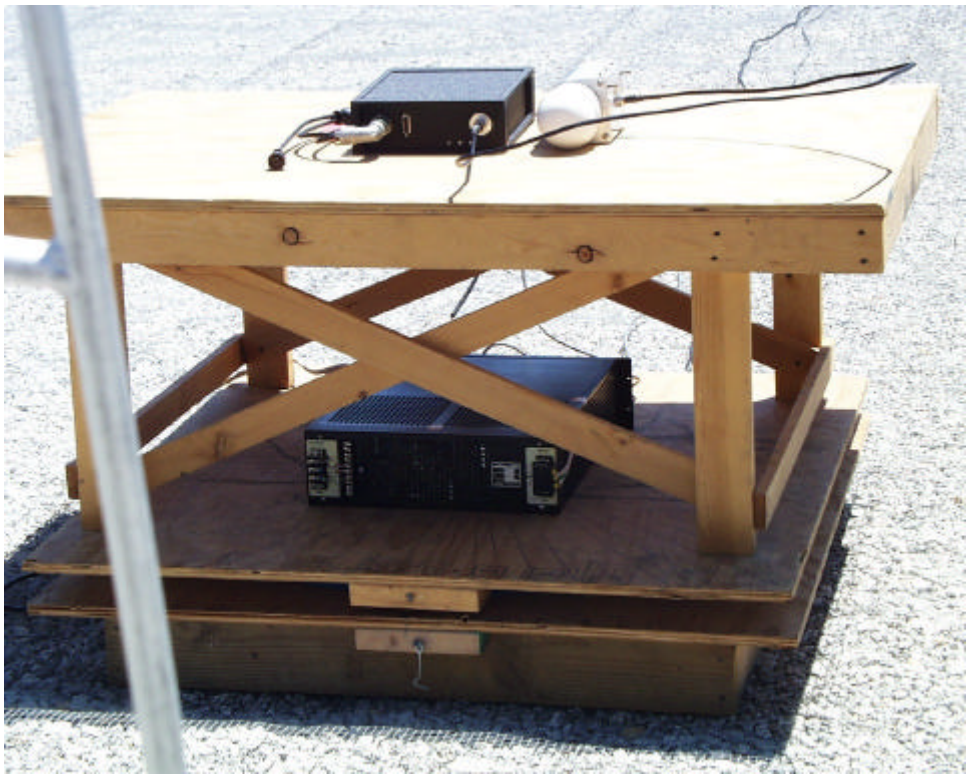
No modifications to the EUT were required for the unit to meet the FCC Part 15B CLASS B emissions standards or the requirements of Part 15C paragraph 15.247. There were no deviations to the specifications.

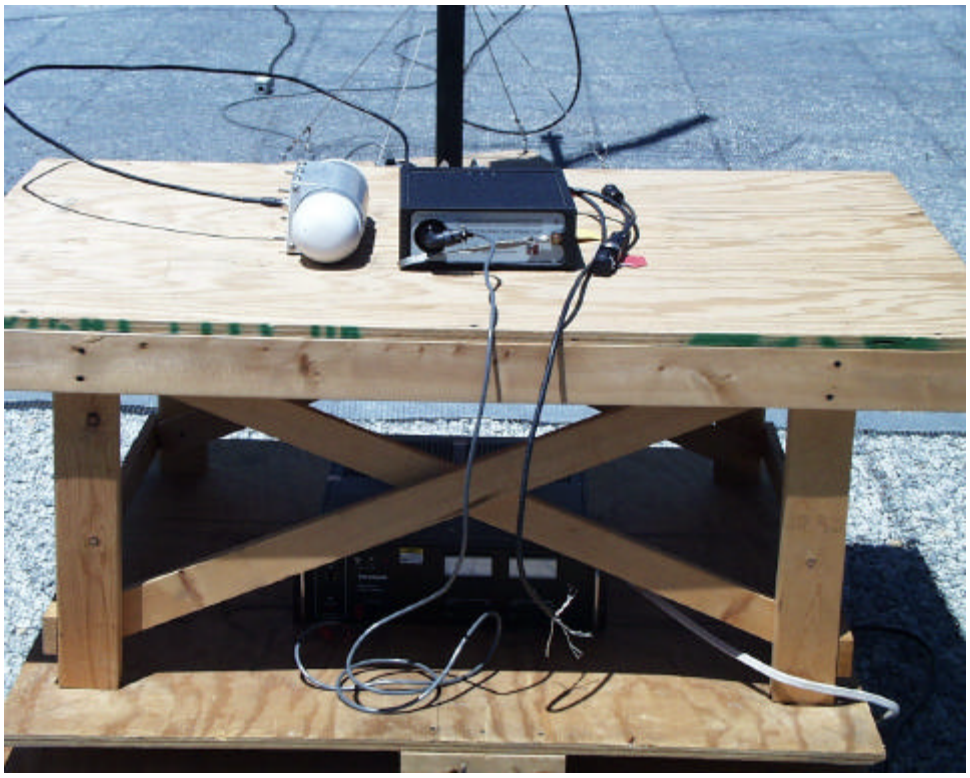
APPENDIX

Model: AATC-SSR

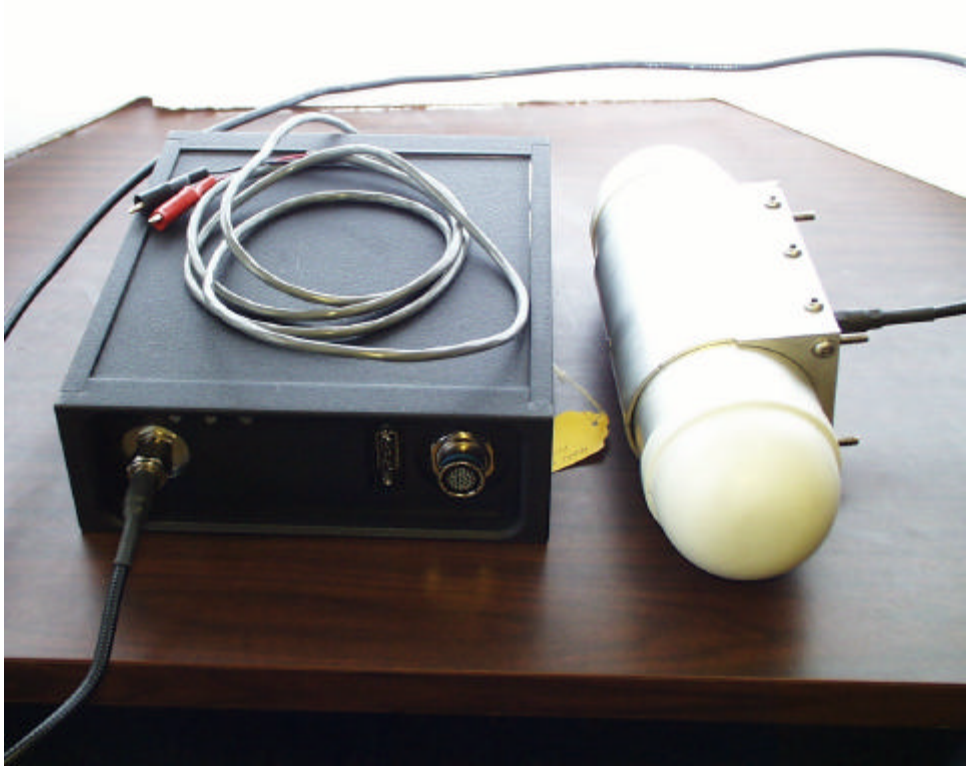
1. Photos of Radiated Emissions Test Set Up
2. Photos of Case Front and Back
3. Photo Inside of Case
4. Photos RF Printed Circuit Board
5. Photo Antenna
6. Photo FCC ID Label Location
7. Processing Gain Test Program
8. Rogers Qualifications
9. Test Equipment List
10. FCC Site Approval Letter

HARMON INDUSTRIES, INC.
MODEL: AATC-SSR
PHOTOS OF RADIATED EMISSIONS TEST SET UP

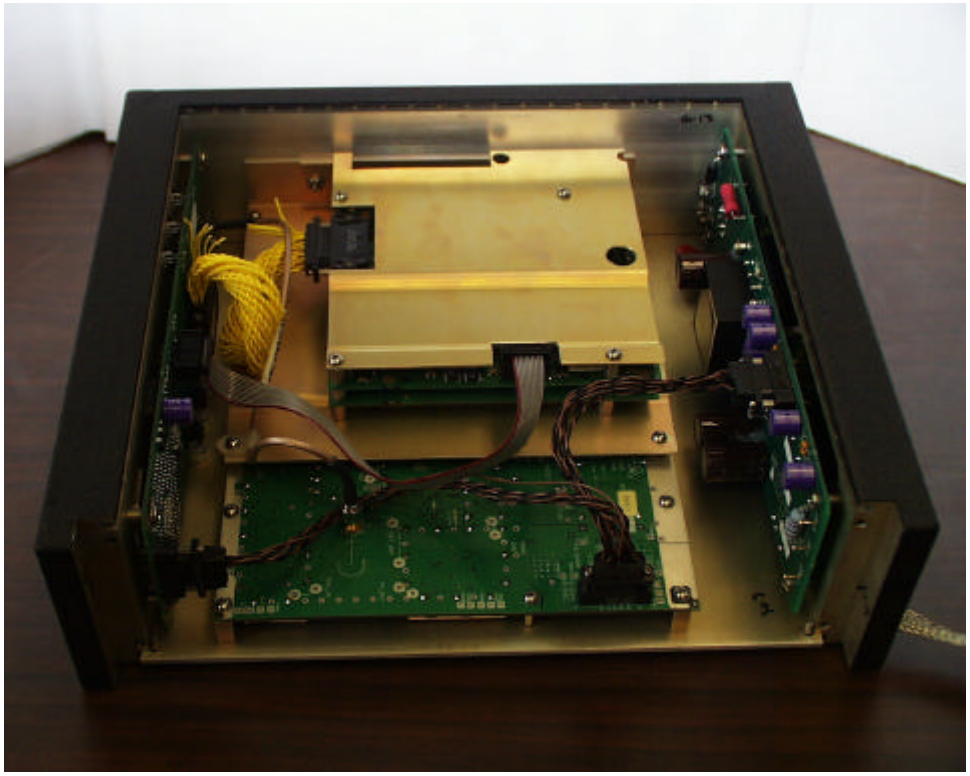




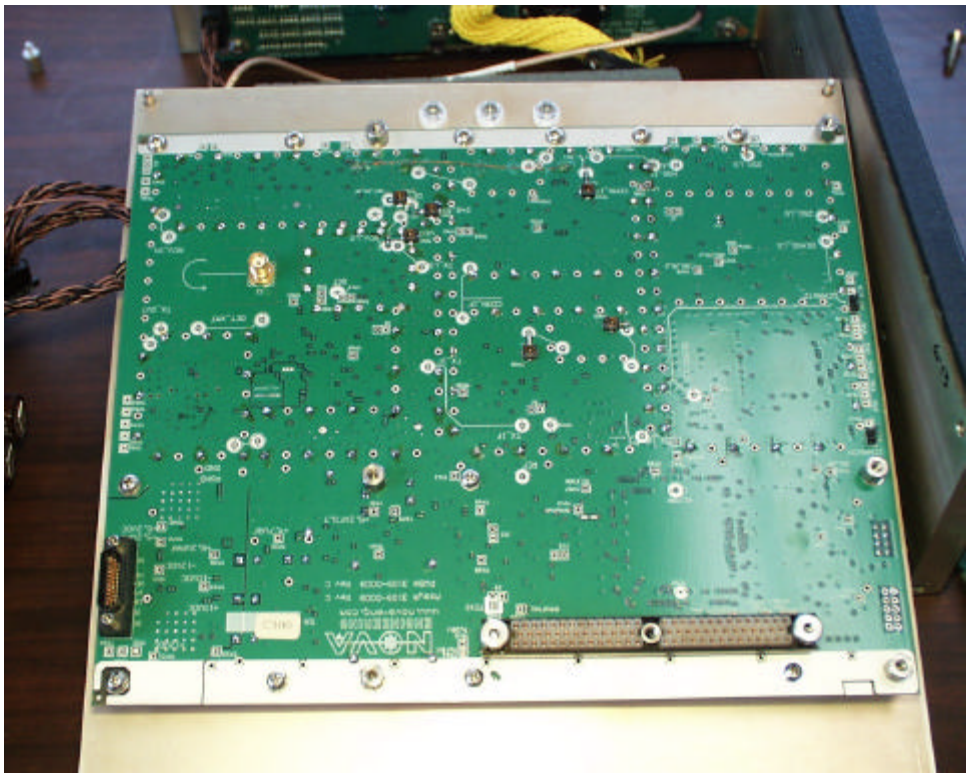
HARMON INDUSTRIES, INC.
MODEL: AATC-SSR
PHOTOS OF CASE FRONT AND BACK



HARMON INDUSTRIES, INC.
MODEL: AATC-SSR
PHOTO OF INSIDE CASE



HARMON INDUSTRIES, INC.
MODEL: AATC-SSR
PHOTOS OF RF PRINTED CIRCUIT BOARD



HARMON INDUSTRIES, INC.
MODEL: AATC-SSR
PHOTO FCC ID LABEL LOCATION

PROCESSING GAIN TEST PROGRAM

Effective processing gain for direct sequence spread spectrum is often tested by measuring the narrow-band interference ratio to signal (J/S) which results in a specific bit error rate (BER). This measured J/S is then compared to the theoretical J/S for a reference narrow-band modulation technique, such as BPSK. The difference between the theoretical J/S and the measured J/S is the effective processing gain.

The AATC-SSR radio uses a digital combination of de-spreading, data error correction, and residual data error correction within the Signal Message Processor (SMP) module. Because of this design, direct monitoring of BER is not practical. This is because any burst message which contains a residual error following the data error correction is rejected, and no message is output by the receiving radio. However, rate of message rejection due to excess bit errors can be monitored, and this can be related to the received BER.

The test setup consists of a Personal Computer (PC) connected to two AATC-SSR radios by data cables. The two radios are connected to each other via a cabled RF network, including attenuation and an interference source. The PC transfers a series of burst messages to one radio, termed the test asset radio, over a data cable. Each of these burst messages contains 168 bits of data and is addressed to the other radio, termed the radio under test. The test asset radio encodes, spreads and transmits the message over the air (RF cable) to the radio under test. The error correction algorithm used is a double block 31,19 Reed Solomon code. This produces a total of 62 each 5-bit Reed –Solomon code symbols, for a total of 310 bits over the air per burst message. The radio under test receives, de-spreads, decodes, and error checks each burst message. The radio under test then transfers each received message, which passes the error check, over a second data cable back to the PC> The PC then verifies that the received message is identical to the message which it sent, and counts the number of validly transferred messages. For each group of 200 attempted message transfers, the result is then displayed for the test operator, on the PC’s monitor. The interference level is increased until the message throughput is just above an acceptable criteria, and this J/S is noted.

The criteria used for message throughput is >90% acceptance (i.e. <10% loss). Since the output message contains 38 Reed-Solomon code symbols, a 10% message loss rate corresponds to approximately a 2.6×10^{-3} Reed-Solomon code output symbol error rate. This corresponds to an equivalent output BER of 5.3×10^{-4} . When error correction capability of the data coding is taken

into account, this represents a BER of about 1.69% for randomly distributed errors.

The 1.69% channel BER corresponds to a (S/N)o of 3.52 dB for coherent PSK modulation, based on a white noise distribution, which is reasonable for the output of a direct sequence de-spreading function.

From FCC Part 15.247(e)(2):

Gp (Processing Gain) = (S/N)o + Mj + Lsys

where:

Mj = Lowest J/S measured at 50 kHz increments over the receiver bandwidth after discarding the worse 20%.

Lsys = 2 dB

Gp = 3.65 dB + Mj + 2 dB = 5.65 dB + Mj

AATC-SSR Jam Signal Margin Data

Center Frequency = 2.439750GHz Add 2.06db to Generator Setting to get J/S
Message Throughput = 90%

Data Points	Frequency	Distance From Center	Generator Setting dBm	Jam/Sig Margin dBm	Excluded Data Points			Processing Gain
1	2.43975	0	3.94	6	*			11.65
2		+50KHz	4.94	7				12.65
3		-50KHz	4.44	6.5	*			12.15
4		+100KHz	4.94	7				12.65
5		-100KHz	4.94	7				12.65
6		+200KHz	5.04	7.1				12.75
7		-200KHz	4.64	6.7				12.35
8		+400KHz	4.74	6.8				12.45
9		-400KHz	4.94	7				12.65
10		+1.00MHz	6.24	8.3				13.95
11		-1.00MHz	6.94	9				14.65
12		+1.75MHz	10.04	12.1				17.75
13		-1.75MHz	11.34	13.4				19.05

Processing Gain Final Results:

As shown below all processing gain is greater than 10db as required by 15.247(e)(2).

Calculated Processing Gain:

Gp (Processing Gain) = (S/N)o + Mj + Lsys
Gp = 3.65 dB + Mj + 2 dB = 5.65 dB + Mj

Gp(2) = 3.65 dB + 7.0 + 2 dB = **12.65 dB**
Gp(4) = 3.65 dB + 7.0 + 2 dB = **12.65 dB**
Gp(5) = 3.65 dB + 7.0 + 2 dB = **12.65 dB**
Gp(6) = 3.65 dB + 7.1 + 2 dB = **12.75 dB**
Gp(7) = 3.65 dB + 6.7 + 2 dB = **12.35 dB**
Gp(8) = 3.65 dB + 6.8 + 2 dB = **12.45 dB**
Gp(9) = 3.65 dB + 7.0 + 2 dB = **12.65 dB**
Gp(10) = 3.65 dB + 8.3 + 2 dB = **13.95dB**
Gp(11) = 3.65 dB + 9.0 + 2 dB = **14.65 dB**
Gp(12) = 3.65 dB + 12.1 + 2 dB = **17.75 dB**
Gp(13) = 3.65 dB + 13.4 + 2 dB = **19.05 dB**

Note: Data points 1 and 3 are the worst case jam signal margin and were excluded as the worst 20% per 15.247(e).

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	2/00
Wattmeter: Bird 43 with Load Bird 8085	2/00
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/00
H/V Power Supply: Fluke Model: 408B (SN: 573)	2/00
R.F. Generator: HP 606A	2/00
R.F. Generator: HP 8614A	2/00
R.F. Generator: HP 8640B	2/00
Spectrum Analyzer: HP 8562A, Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W HP Adapters: 11518, 11519, 11520	2/00
Spectrum Analyzer: HP 8591 EM	7/99
Frequency Counter: Leader LDC 825	2/00
Antenna: EMCO Biconilog Model: 3143	4/00
Antenna: EMCO Log Periodic Model: 3147	10/99
Antenna: Antenna Research Biconical Model: BCD 235	10/99
Antenna: EMCO Dipole Set 3121C	2/00
Antenna: C.D. B-100	2/00
Antenna: Solar 9229-1 & 9230-1	2/00
Antenna: EMCO 6509	2/00
Audio Oscillator: H.P. 200CD	2/00
R.F. Power Amp 65W Model: 470-A-1000	2/00
R.F. Power Amp 50W M185- 10-500	2/00
R.F. PreAmp CPPA-102	2/00
Shielded Room 5 M x 3 M x 3.0 M (100 dB Integrity)	
LISN 50 µHy/50 ohm/0.1 µf	10/99
LISN Compliance Eng. 240/20	2/00
Peavey Power Amp Model: IPS 800	2/00
Power Amp A.R. Model: 10W 1000M7	2/00
Power Amp EIN Model: A300	2/00
ELGAR Model: 1751	2/00
ELGAR Model: TG 704A-3D	2/00
ESD Test Set 2000i	10/95
Fast Transient Burst Generator Model: EFT/B-100	10/95
Current Probe: Singer CP-105	2/00
Current Probe: Solar 9108-1N	2/00
Field Intensity Meter: EFM-018	10/95
KETEK Ecat Surge Generator	10/99

04/20/2000

QUALIFICATIONS

Of

SCOT D. ROGERS, ENGINEER

ROGERS LABS, INC.

Mr. Rogers has approximately 12 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:

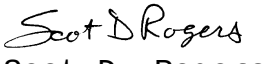
Systems Engineer:	A/C Controls Mfg. Co., Inc. 6 Years
Electrical Engineer:	Rogers Consulting Labs, Inc. 5 Years
Electrical Engineer:	Rogers Labs, Inc. Current

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

March 29, 2000
Date

1/11/99

FEDERAL COMMUNICATIONS COMMISSION

7435 Oakland Mills Road
Columbia, MD 21046
Telephone: 301-725-1585 (ext-218)
Facsimile: 301-344-2050

February 6, 1998

IN REPLY REFER TO
31040/SIT
1300F2

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

Attention: Scot D. Rogers

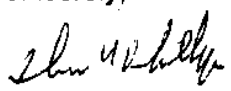
Re: Measurement facility located at above address
(3 and 10 meter site)

Gentlemen:

Your submission of the description of the subject measurement facility has been reviewed and found to be in compliance with the requirements of Section 2.948 of the FCC Rules. The description has, therefore, been placed on file and the name of your organization added to the Commission's list of facilities whose measurement data will be accepted in conjunction with applications for certification or notification under Parts 15 or 18 of the Commission's Rules. Our list will also indicate that the facility complies with the radiated and AC line conducted test site criteria in ANSI C63.4-1992. Please note that this filing must be updated for any changes made to the facility, and at least every three years the data on file must be certified as current.

Per your request, the above mentioned facility has been also added to our list of those who perform these measurement services for the public on a fee basis. This list is updated monthly and is available on the Laboratory's Public Access Link (PAL) at 301-725-1072, and also on the Internet at the FCC Website www.fcc.gov/oet/info/database/testsite/.

Sincerely,



Thomas W. Phillips
Electronics Engineer
Customer Service Branch