

**APPLICATION
SUBMITTAL REPORT
FOR
GRANT OF CERTIFICATION**

FOR

**MODEL
E4 READER
LMS Transmitter
Location and Monitoring Service
902-928 MHz Transmitter
FCC ID: FIH05531
IC: 1584A-05531**

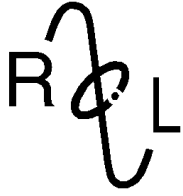
FOR

**TRANSCORE
AMTECH TECHNOLOGY CENTER
8600 Jefferson Street, NE
Albuquerque, NM 87113
Report Number 080508**

Authorized Signatory: *Scot D Rogers*
Scot D. Rogers



NVLAP Lab Code: 200087-0



ROGERS LABS, INC.

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Test Report For Application of Certification

For

TRANSCORE
AMTECH TECHNOLOGY CENTER
8600 Jefferson Street, NE
Albuquerque, NM 87113
Phone: (505) 856-8101

MODEL:
E4 READER
LMS Transmitter

FREQUENCY: 902-928 MHz

FCC ID: FIH05531
IC: 1584A-05531

Test Date: May 5, 2008

Certifying Engineer: *Scot D Rogers*

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Executive Summary

The following information is submitted for consideration in obtaining a Grant of Certification for the CFR47 Paragraph 90 and Industry Canada RSS-137, LMS transmitter.

Name of Applicant: Transcore
Amtech Technology Center
8600 Jefferson Street, NE
Albuquerque, NM 87113
Phone: (505) 856-8101

Model: E4 READER
FCC ID: FIH05531
IC: 1584A-05531

Frequencies of Operation: 902.25-903.75 MHz, 910.0-921.5 MHz

Opinion / Interpretation of Results

TESTS PERFORMED	RESULTS
Emissions Tests	
Emissions as per CFR47 paragraphs 2 and 90	Complies
Emissions as per RSS-137	Complies

Environmental Conditions

Ambient Temperature 22.2 ° C
Relative Humidity 40%
Atmospheric Pressure 30.03 in Hg

Applicable Standards and Test Procedures

In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 2007, Part 2 Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1031 through 2.1057; 90.201



through 90.217, 90.350 through 90.363 and RSS-137, the following information is submitted. Test procedures used were the established Methods of Measurement of Radio-Noise Emissions as described in ANSI 63.4-2003 and TIA/EIA 603. The unit has also been tested and found to comply with other applicable technical standards with relevant data recorded in appropriate test reports.

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
100 kHz	300 kHz	Peak



2.1033(c) Application for Certification

- 1. Manufacturer: TRANSCORE
 AMTECH TECHNOLOGY CENTER
 8600 Jefferson Street, NE
 Albuquerque, NM 87113
- 2. Identification: Model: E4 READER

 FCC I.D.: FIH05531 IC: 1584A-05531
- 3. A copy of the installation and operating instructions furnished to the end user. Refer to the instruction manual furnished with this application for details.
- 4. Emission Types: Continuous wave (CW) Emission Designator-NON Single channel, Data, Modulated in Width/duration-L1D

Frequency Range	Emission Designator
902.25 - 903.75	NON
910.00 - 921.50	NON
911.75 - 919.75	333kL1D
911.75 - 919.75	500kL1D

- 5. Frequency Range: 902.25 - 921.75MHz
- 6. Range of operating power values or specific operating power levels, and description of any means provided for variation of operating power. The output power is factory set to 2.00 Watt (nominal). The unit has internal attenuation capabilities allowing the end user to reduce the output power up to 15 dB in 1 dB increments.
- 7. Maximum power rating as defined in the applicable part(s) of the rules. As stated in CFR 47, 90.205(k), the maximum permissible output power allowed is 30 watts.
- 8. The dc voltages applied to and dc currents into the several elements of the final radio frequency amplifying device for normal operation over the power range. The EUT final



NVLAP Lab Code: 200087-0

amplification stage runs at 7.0 volts with 2.0 Amperes current for a power requirement of 14.0 W.

9. Provide the tune-up procedure over the power range, or at specific operating power levels. Refer to the tune-up procedure furnished with this application for details.
10. A schematic diagram and a description of all circuitry and devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation, and for limiting power. Refer to the schematics furnished with this application for details.
11. A photograph or drawing of the equipment identification plate, or label showing the information to be placed thereon shall be provided. Refer to the FCC identification label information furnished with this application for details.
12. Photographs (8'' x 10'') of the equipment of sufficient clarity to reveal equipment construction and layout, including meters, if any, and labels for controls and meters and sufficient views of the internal construction to define component placement and chassis assembly. Insofar as these requirements are met by photographs or drawings contained in instruction manuals supplied with the certification request, additional photographs are necessary only to complete the required showing. Refer to the exhibits of this report and or additional information furnished with the application for details.
13. For equipment employing digital modulation techniques, a detailed description of the modulation system to be used, including the response characteristics (frequency, phase, and amplitude) of any filters provided, and a description of the modulating wave train, shall be submitted for the



maximum rated conditions under which the equipment will be operated. The transmitter operates in a two modes, continuous wave (CW), and data transmitted using signals modulated with Shaped Amplitude Shift Keyed (Shaped ASK).

14. The data required by Sections 2.1046 through 2.1057, inclusive, measured in accordance with the procedures set out in Section 2.1041.
15. The application for certification of an external radio frequency power amplifier under Part 97 of this chapter need not be accompanied by the data required by Paragraph (b) (14) of this section. In lieu thereof, measurements shall be submitted to show compliance with the technical specifications in Subpart C of Part 97 of this chapter and such information as required by Section 2.1060 of this part. This paragraph does not apply to this equipment.
16. An application for certification of an AM broadcast stereophonic exciter-generator intended for interfacing with existing certified, or formerly type accepted or notified transmitters must include measurements made on a complete stereophonic transmitter. The instruction book must include complete specifications and circuit requirements for interconnecting with existing transmitters. The instruction book must also provide a full description of the equipment and measurement procedures to monitor modulation and to verify that the combination of stereo exciter-generator and transmitter meets the emission limitations of section 73.44. This paragraph does not apply to this equipment.
17. A single application may be filed for a composite system that incorporates devices subject to certification under multiple rule parts; however, the appropriate fee must be included for

each device. Separate applications must be filed if different FCC Identifiers will be used for each device.

2.1046 RF Power Output

Measurements Required

Measurements shall be made to establish the radio frequency power delivered by the transmitter into the standard output termination. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun, except as noted below:

If the power output is adjustable, measurements shall be made for the highest and lowest power levels.

Test Arrangement



The radio frequency power output was measured at the antenna terminals by replacing the antenna with a spectrum analyzer, 10dB Attenuator, and 2.0 dB cable losses. The spectrum analyzer had impedance of 50Ω to match the impedance of the standard antenna.

A HP 8591EM Spectrum Analyzer was used to measure the radio frequency power at the antenna port. The data was taken in dBm and converted to watts as shown in the following Table. Refer to Figure one showing the output power of the transmitter. Data was taken per Paragraph 2.1046(a) and applicable parts of Part 90.

P_{dBm} = power in dB above 1 milliwatt.

Milliwatts = $10^{(P_{dBm}/10)}$

Watts = (Milliwatts) (0.001) (W/mW)

MARKER
903.78 MHz
32.91 dBm

ACTV DET: PEAK
MEAS DET: PEAK QP
MKR 903.78 MHz
32.91 dBm

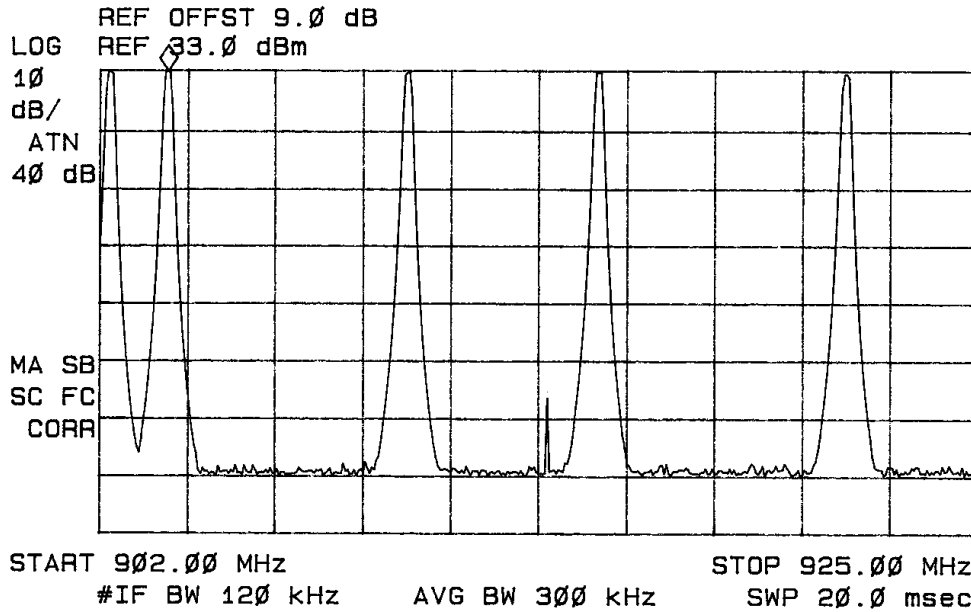


Figure one Power output at antenna terminal.

Results Output Power at Antenna Terminal

FREQUENCY	P _{dBm}	P _{mw}	P _w
902.25	32.98	1,986.1	2.0
902.25(8dB attn)	24.85	305.5	0.3
910.00	32.87	1,936.4	2.0
911.75	32.98	1,986.1	2.0
911.75(15dB attn)	17.00	50.1	0.05
915.00	32.93	1.963.4	2.0
919.75	32.88	1,940.9	2.0
921.50	32.88	1,940.9	2.0

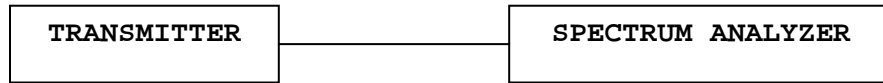
The specifications of Paragraphs 2.1046(a), 90.205 and RSS-137 are met. There are no deviations to the specifications.

2.1047 Modulation Characteristics

Measurements Required

A curve or equivalent data that shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed shall be submitted.

Test Arrangement



The radio frequency output was coupled to a HP 8591EM Spectrum Analyzer. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in its normal mode.

Results Modulation Characteristics

The transmitter operates in a two modes, continuous wave (CW), and data transmitted using signals modulated in amplitude/width/duration. Specifications of Paragraphs 2.1046(a), 90.205 and RSS-137 are met. There are no deviations to the specifications.

2.1049 Occupied Bandwidth

Measurements Required

The occupied bandwidth, that is the frequency bandwidth such that below its lower and above its upper frequency limits, the mean powers radiated are equal to 0.5 percent of the total mean power radiated by a given emission. Refer to figures two through five showing plots of the occupied bandwidth measurements. Figure 2 displays the occupied bandwidth for the continuous wave (CW) signal. Figure 3 displays the occupied bandwidth plots for the eGo modulated signal. Figure 4 displays the occupied bandwidth plots for the SeGo modulated signal. Figure 5 displays the occupied bandwidth plots for the IAG modulated signal.

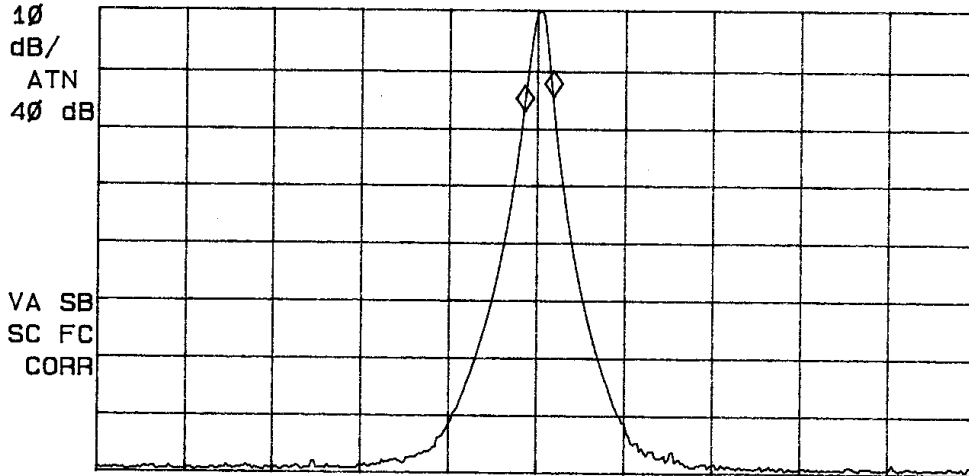
Test Arrangement



MARKER Δ
33 kHz
2.52 dB

ACTV DET: PEAK
MEAS DET: PEAK QP
MKR 33 kHz
2.52 dB

REF OFFST 9.0 dB
LOG REF 33.0 dBm



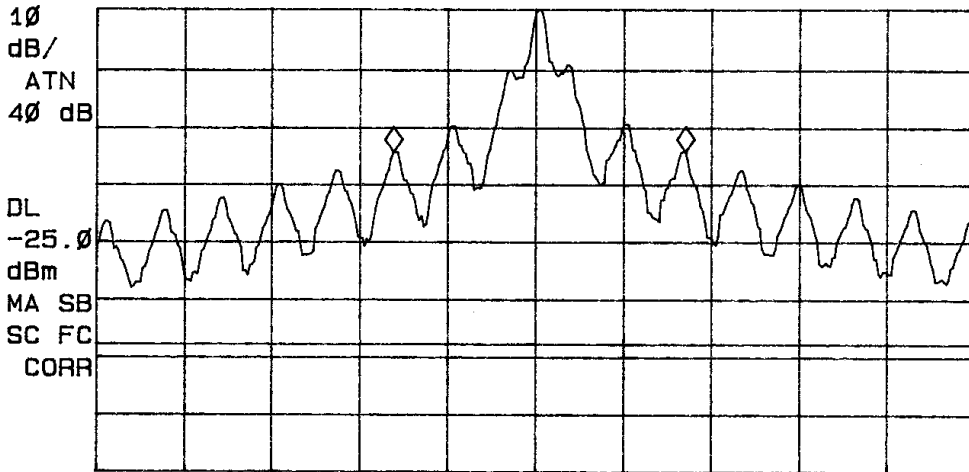
CENTER 910.000 MHz SPAN 1.000 MHz
#IF BW 10 kHz AVG BW 10 kHz SWP 30.0 msec

Figure two Occupied Bandwidth CW Operation

MARKER Δ
333 kHz
.14 dB

ACTV DET: PEAK
MEAS DET: PEAK QP
MKR 333 kHz
.14 dB

REF OFFST 9.0 dB
LOG REF 33.0 dBm



CENTER 915.000 MHz SPAN 1.000 MHz
#IF BW 10 kHz AVG BW 10 kHz SWP 30.0 msec

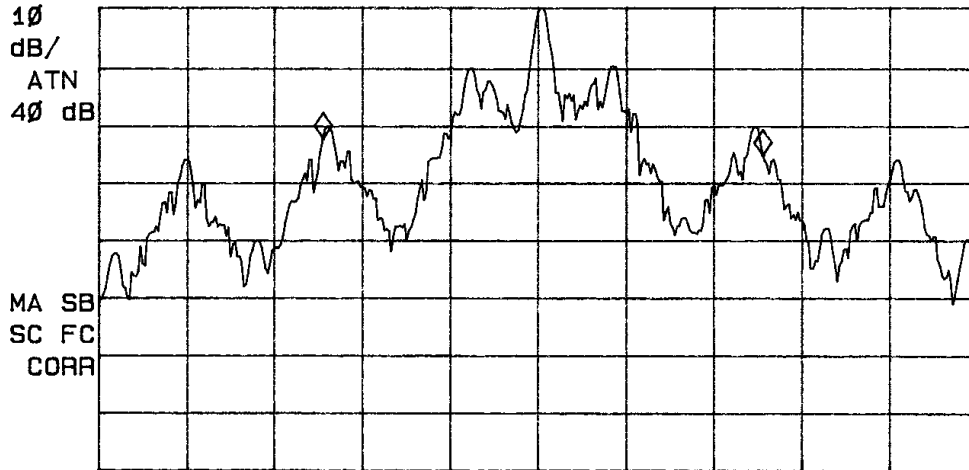
Figure three Occupied Bandwidth eGo Operation

MARKER Δ
 500 kHz
 -2.85 dB

ACTV DET: PEAK
 MEAS DET: PEAK QP
 MKR 500 kHz
 -2.85 dB

REF OFFST 9.0 dB

LOG REF 33.0 dBm



CENTER 915.000 MHz SPAN 1.000 MHz
 #IF BW 10 kHz AVG BW 10 kHz SWP 30.0 msec

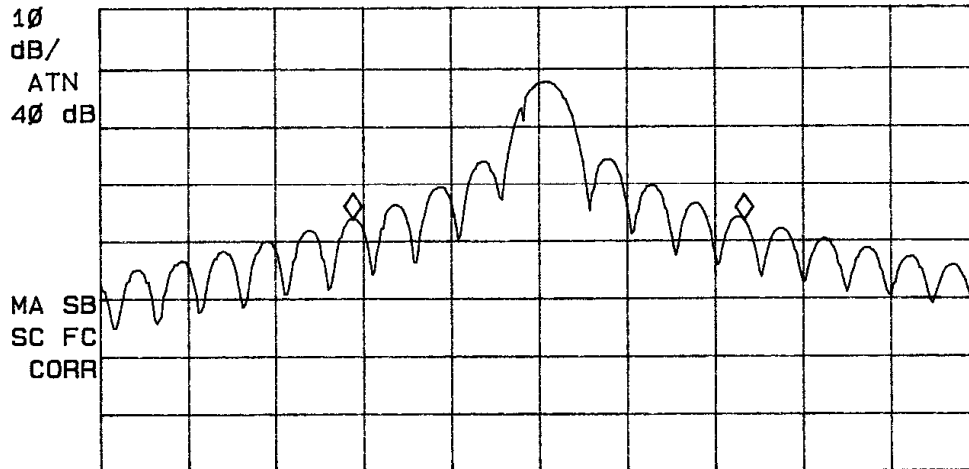
Figure four Occupied Bandwidth SeGo Operation

MARKER Δ
 445 kHz
 -.27 dB

ACTV DET: PEAK
 MEAS DET: PEAK QP
 MKR 445 kHz
 -.27 dB

REF OFFST 9.0 dB

LOG REF 33.0 dBm



CENTER 915.000 MHz SPAN 1.000 MHz
 #IF BW 10 kHz AVG BW 10 kHz SWP 30.0 msec

Figure five Occupied Bandwidth IAG Operation

Results of Occupied Band Width

MODE	f_c	O.B. kHz
ATA (CW)	902.25	33
eGo	915.00	333
SeGo	915.00	500
IGA	915.00	445

Requirements of Paragraphs 2.1046(a), 90.205 and RSS-137 are met. There are no deviations to the specifications.

2.1051 Spurious Emissions at Antenna Terminals

Measurements Required

The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. To gain dynamic range in the test equipment, a notch filter centered at 915 MHz may also used to observe the harmonic emissions.

Test Arrangement



The radio frequency output was coupled to a HP 8562A Spectrum Analyzer. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in its normal mode. The frequency spectrum from 30 MHz to 10 GHz was observed and plots produced of the frequency spectrum. Figures six through eight represent plots of the spurious emissions measurements for the EUT. Data was taken per 2.1051 and applicable parts of Part 90 and RSS-137.

Spurious emissions must be attenuated below the peak output power by the at least $55 + 10 \text{ Log } (P_o)$ dB.

2.0-watt transmitter limit specifies the out of band emissions must be suppressed by at least this amount.

$$\begin{aligned} \text{Attenuation} &= 55 + 10 \text{ Log}_{10}(P_w) \\ &= 55 + 10 \text{ Log}_{10}(2.0) \\ &= 58.0 \text{ dBc} \end{aligned}$$

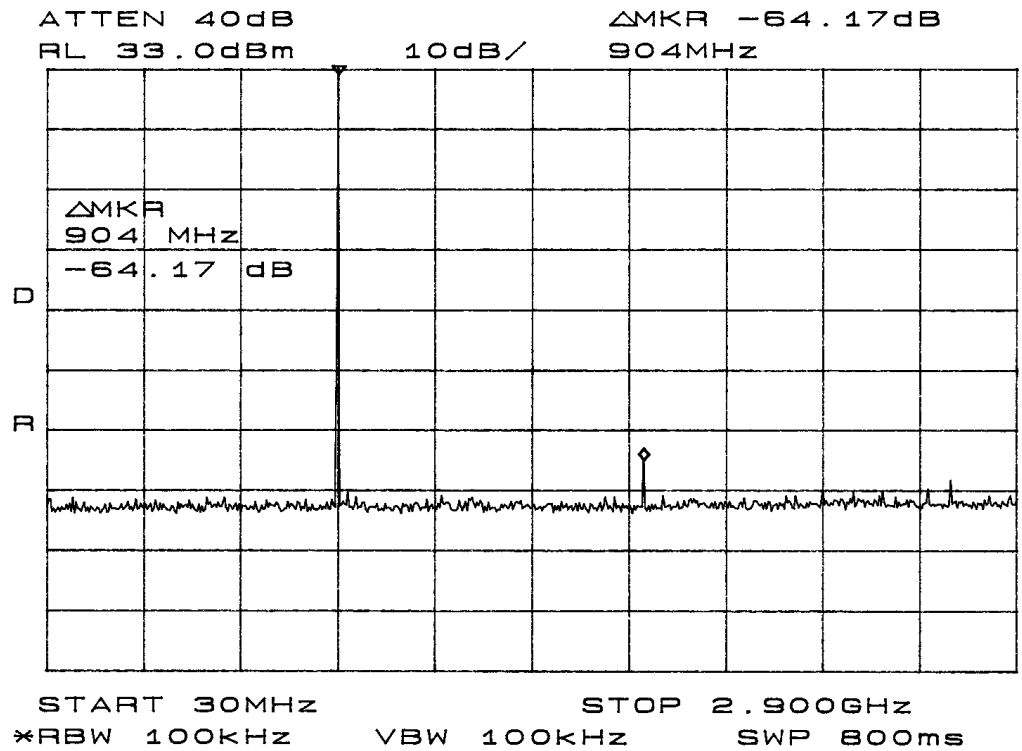


Figure six Spurious Emissions at Antenna Terminal



Results Spurious Emissions

FREQUENCY (MHz)	SPURIOUS FREQUENCY (GHz)	LEVEL ATTENUATED BELOW CARRIER (dBc)	FREQUENCY (MHz)	SPURIOUS FREQUENCY (GHz)	LEVEL ATTENUATED BELOW CARRIER (dBc)
ATA (CW Signal)			Modulated Signal		
902.3	32.98		911.8	32.98	
1804.5	-32.8	65.8	1823.5	-34.2	67.2
2706.8	-37.5	70.5	2735.3	-41.0	74.0
3609.0	-41.8	74.8	3647.0	-44.0	77.0
4511.3	-46.3	79.3	4558.8	-45.3	78.3
5413.5	-41.3	74.3	5470.5	-40.8	73.8
6315.8	-44.3	77.3	6382.3	-44.3	77.3
7218.0	-40.8	73.8	7294.0	-40.5	73.5
8120.3	-39.0	72.0	8205.8	-40.0	73.0
9022.5	-41.0	74.0	9117.5	-39.5	72.5
910.0	32.87		915.0	32.93	
1820.0	-32.0	64.9	1830.0	-35.0	67.9
2730.0	-36.1	69.0	2745.0	-38.3	71.2
3640.0	-40.7	73.6	3660.0	-45.0	77.9
4550.0	-45.7	78.6	4575.0	-45.8	78.7
5460.0	-41.8	74.7	5490.0	-40.7	73.6
6370.0	-44.3	77.2	6405.0	-44.0	76.9
7280.0	-41.1	74.0	7320.0	-39.0	71.9
8190.0	-39.7	72.6	8235.0	-38.0	70.9
9100.0	-41.8	74.7	9150.0	-39.8	72.7
921.5	32.88		919.8	32.88	
1843.0	-36.7	69.6	1839.5	-35.1	68.0
2764.5	-39.7	72.6	2759.3	-38.3	71.2
3686.0	-42.5	75.4	3679.0	-43.6	76.5
4607.5	-44.8	77.7	4598.8	-45.6	78.5
5529.0	-43.1	76.0	5518.5	-42.6	75.5
6450.5	-43.3	76.2	6438.3	-44.6	77.5
7372.0	-41.0	73.9	7358.0	-42.1	75.0
8293.5	-40.7	73.6	8277.8	-42.5	75.4
9215.0	-40.3	73.2	9197.5	-40.0	72.9

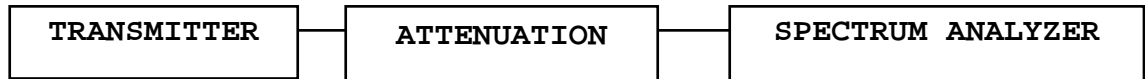
Data was taken per 2.1051 and applicable parts of Part 90 and RSS-137. Specifications of Paragraphs 2.1051, 2.1057, 90.210(k) and RSS-137 are met. There are no deviations to the specifications.

90.210 Emission Mask at Antenna Terminal

Measurements Required

Transmitters used in the radio services governed by this part must comply with the emissions masks outlined in this section. Paragraph 90.210(K) specifies the out of band emission limitations for this equipment. The spurious emissions at the antenna terminal for the device were measured at the maximum power output condition. The antenna port of the EUT was connected to the spectrum analyzer through coaxial cables and attenuation pads.

Test Arrangement



The radio frequency output was coupled to a HP 8562A Spectrum Analyzer. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in its normal mode with maximum output power. The frequency spectrum at the band edges were observed and plots produced of the frequency spectrum. Figures nine through fourteen represent plots of emission mask compliance at the band edges. Data was taken per 2.1051 and applicable parts of Part 90.210 (k).

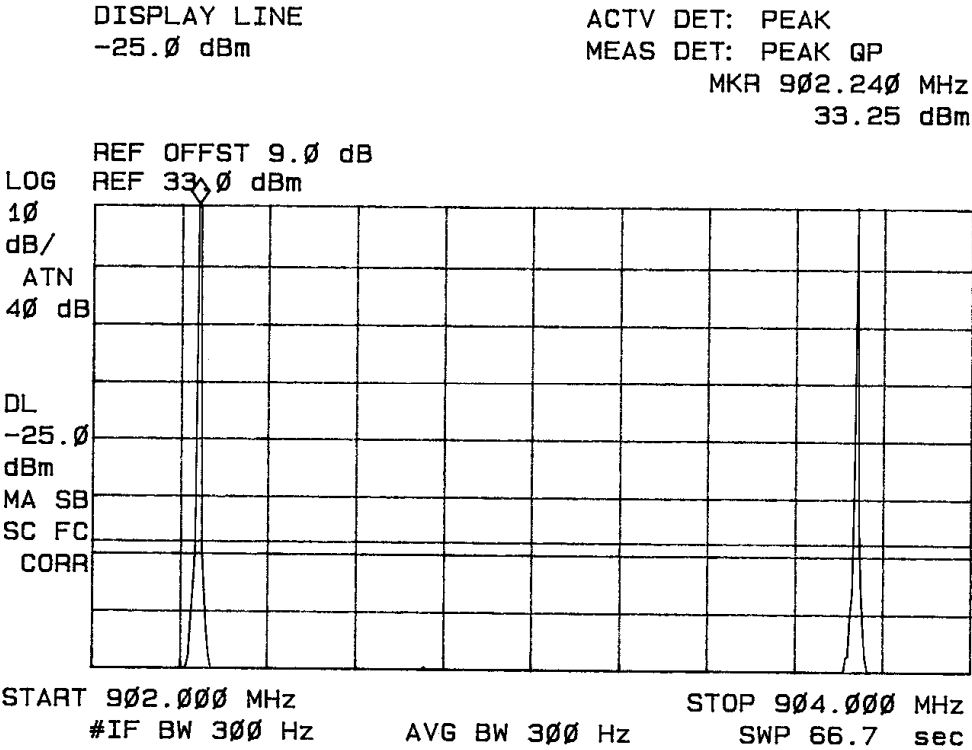


Figure nine Emissions Mask at Antenna Terminal

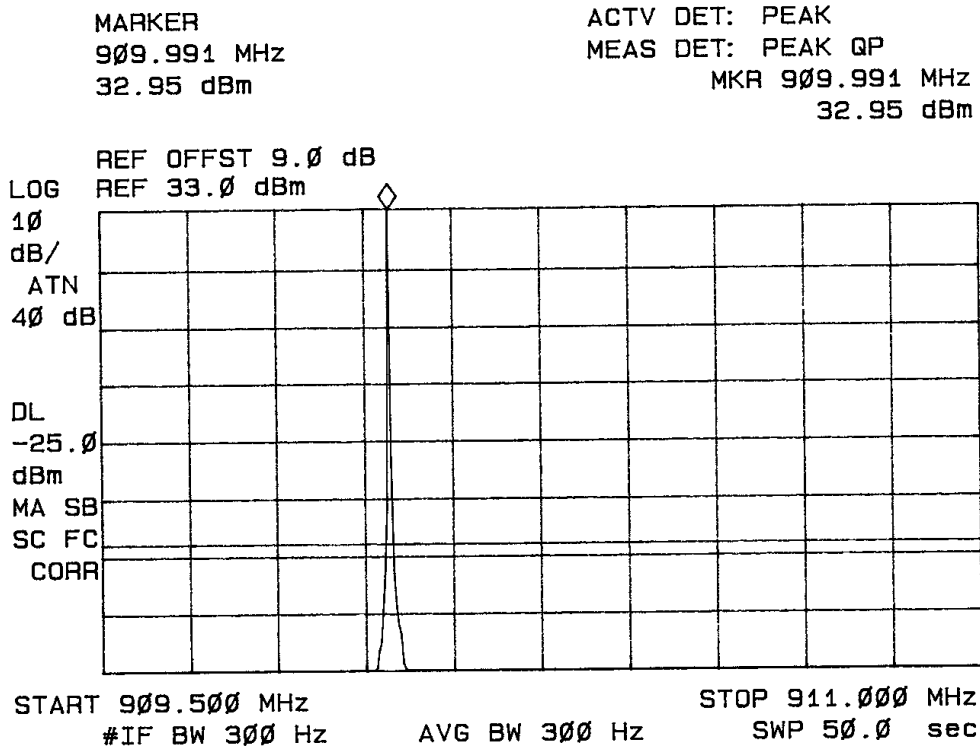
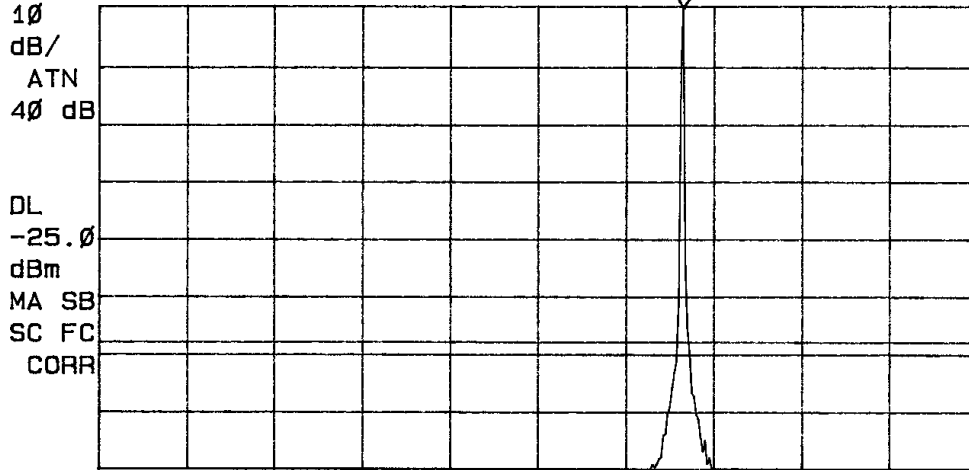


Figure ten Emissions Mask at Antenna Terminal

MARKER
921.4988 MHz
32.80 dBm

ACTV DET: PEAK
MEAS DET: PEAK QP
MKR 921.4988 MHz
32.80 dBm

REF OFFST 9.0 dB
LOG REF 33.0 dBm



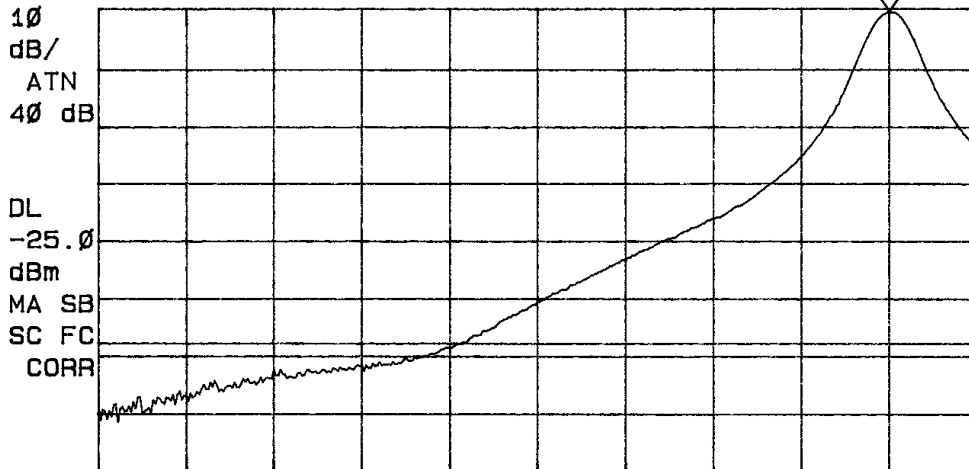
START 921.0000 MHz STOP 921.7500 MHz
#IF BW 300 Hz AVG BW 300 Hz SWP 25.0 sec

Figure eleven Emissions Mask at Antenna Terminal

MARKER
911.750 MHz
32.52 dBm

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 911.750 MHz
32.52 dBm

REF OFFST 9.0 dB
LOG REF 33.0 dBm



START 909.500 MHz STOP 912.000 MHz
#IF BW 100 kHz AVG BW 30 kHz SWP 20.0 msec

Figure twelve Emissions Mask at Antenna Terminal

MARKER
919.753 MHz
32.44 dBm

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 919.753 MHz
32.44 dBm

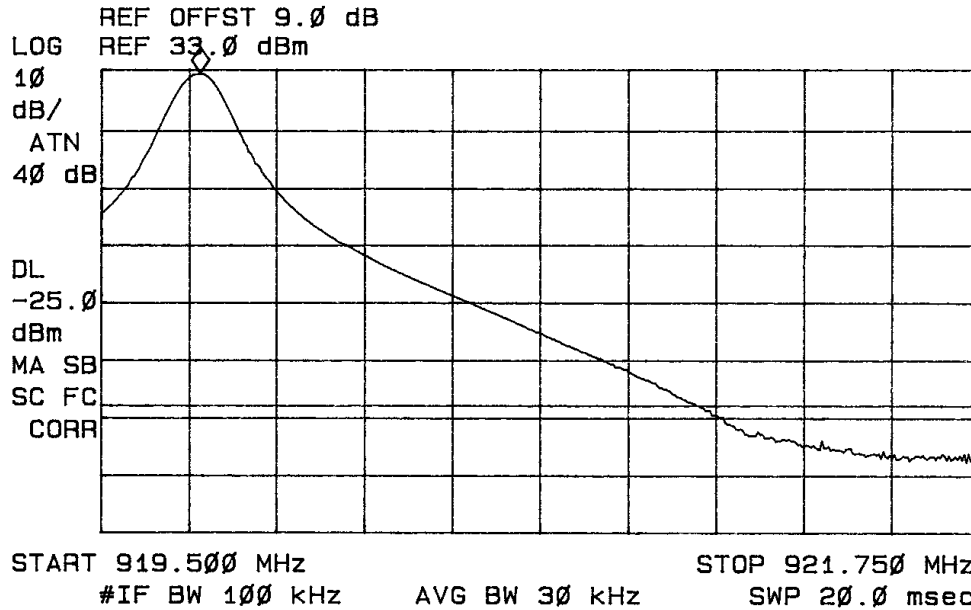


Figure thirteen Emissions Mask at Antenna Terminal

MARKER
911.77 MHz
31.00 dBm

ACTV DET: PEAK
MEAS DET: PEAK QP
MKR 911.77 MHz
31.00 dBm

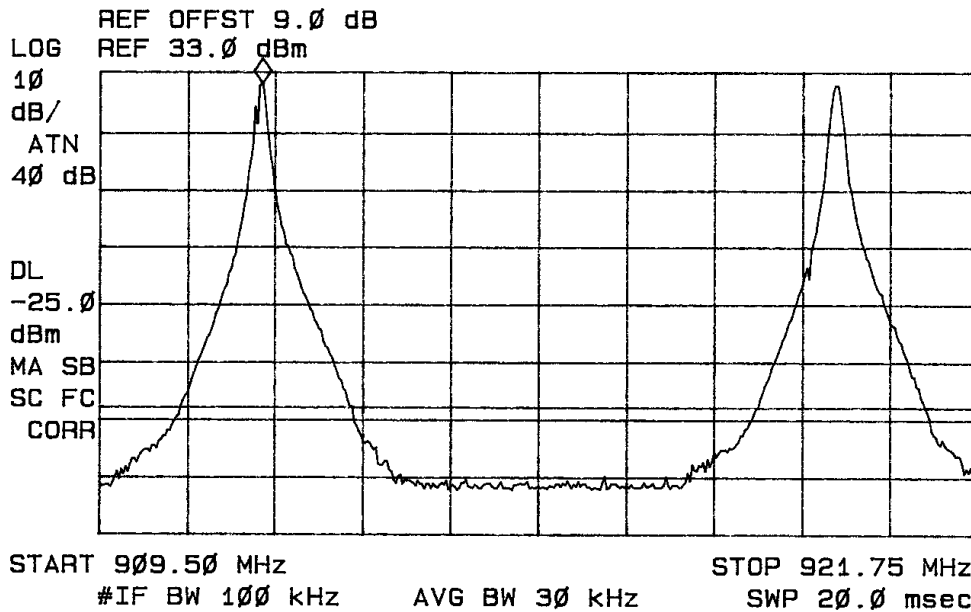


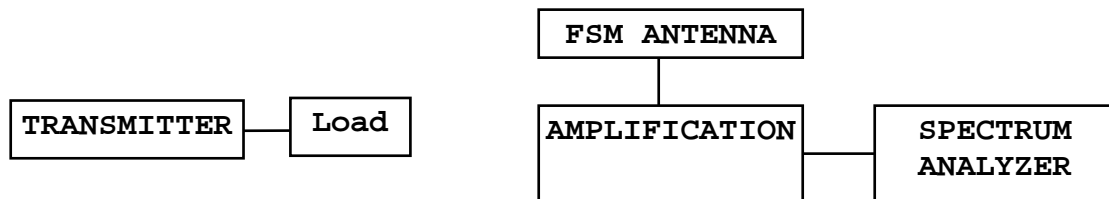
Figure fourteen Emissions Mask at Antenna Terminal

2.1053 Field Strength of Spurious Radiation

Measurements Required

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation.

Test Arrangement



The transmitter spurious emissions were measured at the OATS with the antenna port connected to a 50-ohm load. The EUT was placed on a wooden turntable 0.8 meters above the ground plane at a distance of 3 meters from the FSM antenna. The turntable was rotated through 360 degrees to locate the position registering the highest amplitude emission. The frequency spectrum was then searched for spurious emissions generated from the transmitter. Raising and lowering the FSM antenna and rotating the turntable to maximize the emission. Data was measured and recorded for the maximum amplitude of each spurious emission. A Biconilog antenna was used to measure radiated emissions for frequencies of 30 MHz to 1000 MHz, and/or a log periodic antenna for frequencies of 200 MHz to 5 GHz, and pyramidal horn antennas for frequencies of 5 GHz to 40 GHz. The substitution method was used to measure harmonic spurious emissions. Emission levels from the EUT were measured and amplitude levels were recorded. The EUT transmitter was then removed and replaced with a substitution antenna, which was powered from a signal generator. The output signal from the generator was then adjusted such that the amplitude received was the same as that previously recorded for each frequency. This



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step was repeated for both horizontal and vertical polarizations.

The power in dBm required to produce the desired signal level was then recorded from the signal generator. The power in dBm was then calculated by reducing the previous readings by the gain in the substitution antenna. The testing procedures used conform to the procedures stated in the TIA/EIA-603 document.

The limits for the spurious radiated emissions are defined by the following equation.

Limit = Amplitude of the spurious emission must be attenuated by this amount below the level of the fundamental. On any frequency removed from the assigned frequency outside the assigned sub-band edges: at least $55 + 10 \text{ Log } (P_o)$ dB.

2.0-watt transmitter limit specifies the level below the carrier must be suppressed more than this amount.

$$\begin{aligned} \text{Attenuation} &= 55 + 10 \text{ Log}_{10}(P_w) \\ &= 55 + 10 \text{ Log}_{10}(2.0) \\ &= 58.0 \text{ dBc} \end{aligned}$$

The radiated spurious emission below the carrier in dB is calculated from the following equation:

$$\begin{aligned} \text{Decibels Below Carrier} &= \text{dBc} \\ \text{dBc} &= \\ &10 \text{ Log}_{10}[\text{Tx power(W)}/0.001] - \text{signal level required to} \\ &\text{reproduce measured spurious emission.} \end{aligned}$$

example:

$$\text{dBc} = 10 \text{ Log}_{10}[2.0/0.001] - (-58.2) = 91.2 \text{ dBc}$$



Results

Field Strength Spurious Radiation ATA (CW) Mode

Frequency of Emission (MHz)	Amplitude of EUT Spurious emission observed		Signal level to substitution antenna required to reproduce		Emission level below carrier		Limit per 90.210 dBc
	Horizontal dBµV	Vertical dBµV	Horizontal dBm	Vertical dBm	Horizontal dBc	Vertical dBc	
ATA (CW) Mode 902.25 MHz Po=32.97							
1804.5	16.7	17.5	-79.23	-78.43	112.2	111.4	58.0
2706.8	23.7	24.2	-67.13	-66.63	100.1	99.6	58.0
3609.0	23.5	25.3	-64.33	-62.53	97.3	95.5	58.0
4511.3	20.0	19.3	-64.23	-64.93	97.2	97.9	58.0
ATA (CW) Mode 910.00 MHz Po=32.95							
1820.0	18.7	15.8	-77.23	-80.13	110.2	113.1	58.0
2730.0	21.0	21.6	-69.83	-69.23	102.8	102.2	58.0
3640.0	32.3	27.7	-55.23	-59.83	88.2	92.8	58.0
4550.0	16.3	14.5	-67.43	-69.23	100.4	102.2	58.0
ATA (CW) Mode 921.50 MHz Po=32.92							
1843.0	15.0	18.3	-80.93	-77.63	113.9	110.6	58.0
2764.5	25.0	27.0	-65.63	-63.63	98.6	96.6	58.0
3686.0	37.0	19.3	-50.03	-67.73	83.0	100.7	58.0
4607.5	19.6	19.3	-63.93	-64.23	96.9	97.2	58.0

Field Strength Spurious Radiation eGo (modulated) Mode

Frequency of Emission (MHz)	Amplitude of EUT Spurious emission observed		Signal level to substitution antenna required to reproduce		Emission level below carrier		Limit per 90.210 dBc
	Horizontal dBµV	Vertical dBµV	Horizontal dBm	Vertical dBm	Horizontal dBc	Vertical dBc	
eGo (modulated) Mode 911.75 MHz Po=32.97							
1823.5	16.1	18.0	-79.73	-77.83	112.7	110.8	58.0
2735.3	24.5	23.8	-66.33	-67.03	99.3	100.0	58.0
3647.0	29.0	29.0	-58.43	-58.43	91.4	91.4	58.0
4558.8	17.3	18.0	-66.33	-65.63	99.3	98.6	58.0
eGo (modulated) Mode 915.00 MHz Po=32.97							
1830.0	20.8	17.1	-74.93	-78.63	107.9	111.6	58.0
2745.0	26.0	25.7	-64.93	-65.23	97.9	98.2	58.0
3660.0	29.3	28.3	-57.93	-58.93	90.9	91.9	58.0
4575.0	16.5	15.8	-67.03	-67.73	100.0	100.7	58.0
eGo (modulated) Mode 919.75 MHz Po=32.87							
1839.5	17.0	16.5	-78.83	-79.33	111.7	112.2	58.0
2759.3	27.2	27.6	-63.43	-63.03	96.3	95.9	58.0
3679.0	35.5	26.2	-51.53	-60.83	84.4	93.7	58.0
4598.8	16.0	18.0	-67.43	-65.43	100.3	98.3	58.0



Field Strength Spurious Radiation SeGo (modulated) Mode

Frequency of Emission	Amplitude of EUT Spurious emission observed		Signal level to substitution antenna required to reproduce		Emission level below carrier		Limit per 90.210
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	
(MHz)	dBµV	dBµV	dBm	dBm	dBc	dBc	dBc
SeGo (modulated) Mode 911.75 MHz Po=32.97							
1823.5	17.3	18.0	-78.53	-77.83	111.5	110.8	58.0
2735.3	27.3	26.8	-63.53	-64.03	96.5	97.0	58.0
3647.0	34.6	30.1	-52.83	-57.33	85.8	90.3	58.0
4558.8	19.8	18.5	-63.83	-65.13	96.8	98.1	58.0
SeGo (modulated) Mode 915.00 MHz Po=32.97							
1830.0	18.6	15.7	-77.13	-80.03	110.1	113.0	58.0
2745.0	25.3	26.5	-65.63	-64.43	98.6	97.4	58.0
3660.0	34.8	30.0	-52.43	-57.23	85.4	90.2	58.0
4575.0	18.5	17.5	-65.03	-66.03	98.0	99.0	58.0
SeGo (modulated) Mode 919.75 MHz Po=32.87							
1839.5	19.3	16.0	-76.53	-79.83	109.4	112.7	58.0
2759.3	27.7	27.5	-62.93	-63.13	95.8	96.0	58.0
3679.0	36.0	22.3	-51.03	-64.73	83.9	97.6	58.0
4598.8	18.6	18.0	-64.83	-65.43	97.7	98.3	58.0

Field Strength Spurious Radiation IAG (modulated) Mode

Frequency of Emission	Amplitude of EUT Spurious emission observed		Signal level to substitution antenna required to reproduce		Emission level below carrier		Limit per 90.210
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	
(MHz)	dBµV	dBµV	dBm	dBm	dBc	dBc	dBc
IAG (modulated) Mode 911.75 MHz Po=32.87							
1823.5	19.2	17.3	-76.63	-78.53	109.5	111.4	58.0
2735.3	19.6	20.0	-71.23	-70.83	104.1	103.7	58.0
3647.0	18.3	18.5	-69.13	-68.93	102.0	101.8	58.0
4558.8	14.5	17.3	-69.13	-66.33	102.0	99.2	58.0
IAG (modulated) Mode 915.00 MHz Po=32.87							
1830.0	18.3	17.5	-77.43	-78.23	110.3	111.1	58.0
2745.0	20.0	19.3	-70.93	-71.63	103.8	104.5	58.0
3660.0	17.7	17.8	-69.53	-69.43	102.4	102.3	58.0
4575.0	17.0	17.5	-66.53	-66.03	99.4	98.9	58.0
IAG (modulated) Mode 919.75 MHz Po=32.87							
1839.5	18.3	16.7	-77.53	-79.13	110.4	112.0	58.0
2759.3	17.7	18.0	-72.93	-72.63	105.8	105.5	58.0
3679.0	18.0	17.5	-69.03	-69.53	101.9	102.4	58.0
4598.8	16.5	16.8	-66.93	-66.63	99.8	99.5	58.0

General Radiated Emissions (Highest General Emissions)

Freq. In MHz	FSM Hor. (dBµV)	FSM Vert. (dBµV)	Ant. Fact. (dB)	Amp. Gain (dB)	Comp. Hor. (dBµV/m) @ 3m	Comp. Vert. (dBµV/m) @ 3 m	Limit per 90.210 (dBµV/m) @ 3 M
140.8	42.5	50.2	9.6	30	22.1	29.8	82.0
144.0	47.1	49.3	12.1	30	29.2	31.4	82.0
158.0	39.1	49.2	8.9	30	18.0	28.1	82.0
165.0	41.5	44.9	8.7	30	20.2	23.6	82.0
179.7	47.8	47.9	9.2	30	27.0	27.1	82.0
213.8	48.2	41.2	11.2	30	29.4	22.4	82.0
216.0	46.5	43.3	11.2	30	27.7	24.5	82.0

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

Data was taken per 2.1051 and applicable parts of Part 90. Specifications of Paragraphs 2.1051, 2.1057 and 90.210(k) (3) are met. There are no deviations to the specifications.

2.1055 Frequency Stability

Measurements Required

Pursuant to 90.213(a), Note 13, frequency stability testing is not required. The equipment design incorporates frequency-determining components with tolerances rating of 1.5 parts per million. Temperature stability measurements made at temperatures of -40 and 75 degrees Celsius maintained stabilities -1.77 and 0.59. The equipment complies with the requirements of CFR47 part 90.



NVLAP Lab Code: 200087-0

Annex

- Annex A, Measurement Uncertainty Calculations
- Annex B, Test Equipment List.
- Annex C, Rogers Qualifications.
- Annex D, FCC Site 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

$$U_c(y) = \pm \sqrt{\left[\frac{1.0}{2}\right]^2 + \left[\frac{0.2}{2}\right]^2 + \left[\frac{1.0^2 + 0.1^2 + 2.0^2 + 0.1^2 + 0.2^2 + 1.5^2}{3}\right]}$$

$$U_c(y) = \pm 1.6 \text{ dB}$$

It is probable that $u_c(y) / s(q_k) > 3$, where $s(q_k)$ is estimated standard deviation from a sample of n readings unless the repeatability of the EUT is particularly poor, and a coverage factor of $k = 2$ will ensure that the level of confidence will be approximately 95%, therefore:

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

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

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



NVLAP Lab Code: 200087-0

Annex C Qualifications

SCOT D. ROGERS, ENGINEER
ROGERS LABS, INC.

Mr. Rogers has approximately 17 years experience in the field of electronics. Working experiences include six years 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
May 8, 2008



NVLAP Lab Code: 200087-0

Annex D FCC Site Registration Letter

FEDERAL COMMUNICATIONS COMMISSION

**Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046**

May 16, 2006

Registration Number: 90910

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

Attention: Scot Rogers

Re: Measurement facility located at Louisburg
3 & 10 meter site
Date of Renewal: May 16, 2006

Dear Sir or Madam:

Your request for renewal of the registration of the subject measurement facility has been received. The information submitted has been placed in your file and the registration has been renewed. The name of your organization will remain on the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Phyllis Parrish
Information Technician