NVLAP Lab Code 200087-0

SUBMITTAL APPLICATION REPORT

FOR

GRANT OF CERTIFICATION

Model: XU-1000
UHF Transceiver

FCC ID: U59XU-1000
IC: 7555A-XU1000

Operating under rule of CFR 47, Paragraph 90, Subpart I and RSS-119

FOR

Tekk International Inc.

10601 NW Ambassador Drive, Suite G
Kansas City, MO 64153

Test Report Number 0701207

Authorized Signatory: Scot D Rogers

Scot D. Rogers

NVLAP Lab Code 200087-0

ROGERS LABS, INC.

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

TEST REPORT
For
APPLICATION of CERTIFICATION

For

Tekk International Inc.

10601 NW Ambassador Drive, Suite G
Kansas City, MO 64153

Model: XU-1000
UHF Transceiver
FREQUENCY: 450-470 MHz

FCC ID: U59XU-1000
IC: 7555A-XU1000

Test Date: December 7, 2007

Certifying Engineer:

Scot D. Rogers
ROGERS LABS, INC.
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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, 2.915, 2.925, 2.926, 2.1031 through 2.1057, applicable parts of paragraphs 15, and 90, the following information is submitted.

Opinion / Interpretation of Results

Tests Performed	Results
Emissions Tests	
Requirements per CFR47 paragraphs 2 2.1031-2.1057	Complies
Requirements per CFR47 paragraphs 90.203(j)	Complies
Requirements per CFR47 paragraphs 90.207-90.210	Complies
Requirements per CFR47 paragraphs 90.213-90.215	Complies
Requirements per RSS-119	Complies

Applicable Standards & Test Procedures

In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 2006, Part 2, Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1031 through 2.1057, and applicable paragraphs of Part 90 and RSS-119 the following is submitted for consideration in obtaining a Grant of Certification. Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in ANSI 63.4-2003 and TIA/EIA 603. This equipment was tested for compliance with CFR47, Industry Canada and other regulatory agencies. Some information presented in the this document may not be related to CFR47 or RSS-119 requirements but represent compliance to other regulations.

2.1033(c) Application for Certification

(1) Manufacturer/Marketer/Vendor
Tekk International Inc.
10601 NW Ambassador Drive, Suite G
Kansas City, MO 64153

(2) Identification: FCC I.D.: U59XU-1000
IC: 7555A-XU1000
Model: XU-1000 S/N: #1

(3) Instruction Book:
Refer to exhibit for Draft Instruction Manual.

(4) Emission Type: 15K0F3E

(5) Frequency Range: 406.125 to 469.9875 MHz

(6) Operating Power Level: 2.0-watt low power, 4.4-Watts high power.

(7) Max Power output of equipment 4.4 Watts

(8) Power into final amplifier:
4-Watt operation, 9.0 Watts, (7.5V @ 1.2A)
2-Watt operation, 5.25 Watts (7.5V @ 0.7A)

(9) Tune Up Procedure for Output Power:
Refer to Exhibit for Transceiver Alignment Procedure.

(10) Circuit Diagrams; description of circuits, frequency stability, spurious suppression, and power and modulation limiting:
Refer to Exhibit for Circuit Diagrams.
Refer to Exhibit for Theory of Operation.

(11) Photograph or drawing of the Identification Plate:
Refer to Exhibit for Photograph or Drawing.

(12) Drawings of Construction and Layout:
Refer to Exhibit for Drawings of Components Layout and Chassis Drawings.

(13) Detail Description of Digital Modulation:
Not applicable.

(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) 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.

(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.

(18) An application for certification of a software defined radio must include the information required by 2.944. This paragraph does not apply to this equipment.

Units of Measurements

AC Line 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

Antenna Conducted — Data is in dBm, dB referenced to one milliwatt

Environmental Conditions

Ambient Temperature	22.2° C
Relative Humidity	54%
Atmospheric Pressure	30.13 in Hg

Test Site Locations

Conducted EMI	The AC power line conducted emissions testing 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 the 3 meters, Open Area Test Site (OATS) located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS.
Site Approval	Refer to Annex for FCC Site Registration Letter, # 90910, and Industry Canada Site Registration Letter, IC3041-1.

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 the 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

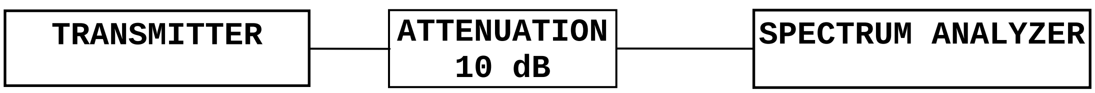
Equipment	Mfg.	Model	Cal. Date	Due.
LISN	Comp. Design	FCC-LISN-2-MOD.CD	10/07	10/08
LISN	Comp. Design	1762	2/07	2/08
Antenna	ARA	BCD-235-B	10/07	10/08
Antenna	EMCO	3147	10/07	10/08
Antenna	EMCO	3143	5/07	5/08
Analyzer	HP	8591EM	5/07	5/08
Analyzer	HP	8562A	2/07	2/08

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 terminal by replacing the antenna with a spectrum analyzer, 10-dB attenuation. The attenuator and spectrum analyzer had an 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. Data was taken per Paragraph 2.1046(a) and applicable parts of paragraph 90.

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

Milliwatts = $10^{(PdBm/10)}$

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

36.43 dBm = $10^{(36.43/10)}$
= 4,400 mW
= 4.4 Watts

33.00 dBm = $10^{(33.0010)}$
= 1,995.3 mW
= 2.0 Watts

Power Output Results

FREQUENCY	P(dBm)	P(mw)	P(w)
406.125	36.01	3,990.3	4.0
439.550	36.44	4,405.6	4.4
450.025	36.00	3,981.1	4.0
462.600	36.33	4,295.4	4.3
469.975	36.06	4,036.5	4.0
406.125	32.55	1,798.9	1.8
439.550	32.55	1,798.9	1.8
450.025	32.33	1,710.0	1.7
462.600	33.00	1,995.3	2.0
469.975	33.00	1,995.3	2.0

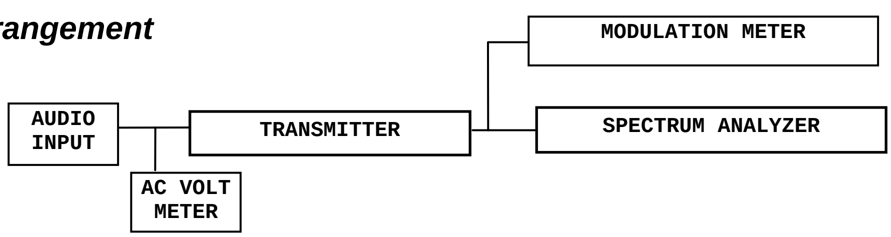
The testing procedures used conform to the procedures stated in the TIA/EIA-603 document. The specifications of Paragraph 2.1046(a) and applicable Parts of 90 are met. There are no deviations to the specifications.

2.1047 Modulation Characteristics

Measurements Required

A curve or equivalent data, which 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 Spectrum Analyzer and a modulation meter. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in its various modes. The modulation meter was used to measure the frequency deviation.

Modulation Characteristics Results

Figure 1 displays the graph made showing the audio frequency response of the modulator. The frequency generator was set to 1 kHz and injected into the audio input port of the EUT. The amplitude was adjusted to obtain 50% modulation at 1000 Hz. This level was then taken as the 0-dB reference. The frequency of the generator was then varied and the output level recorded while holding the input levels constant.

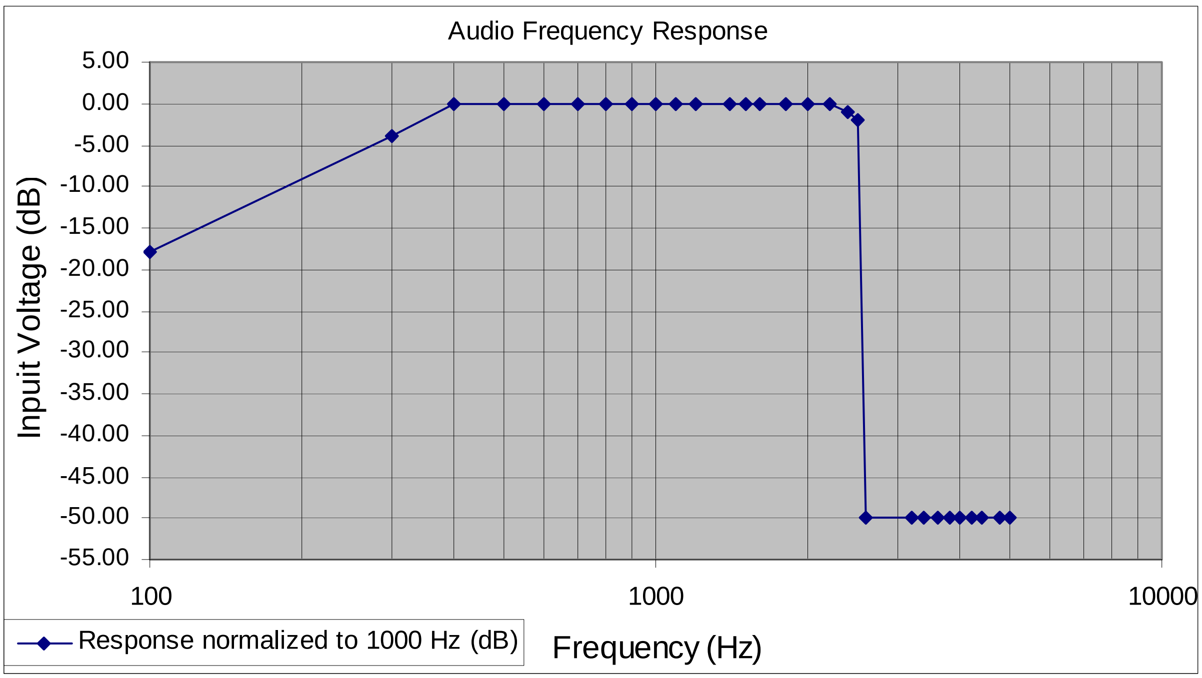


Figure one Audio Frequency Response Characteristics.

Figure 2 shows the frequency deviation response of 25 kHz channel operation for each of four frequencies while the input voltage was varied. Figure 3 shows the frequency deviation response of 12.5 kHz channel operation for each of four frequencies while the input voltage was varied. The frequency was held constant and the frequency deviation read from the deviation meter.

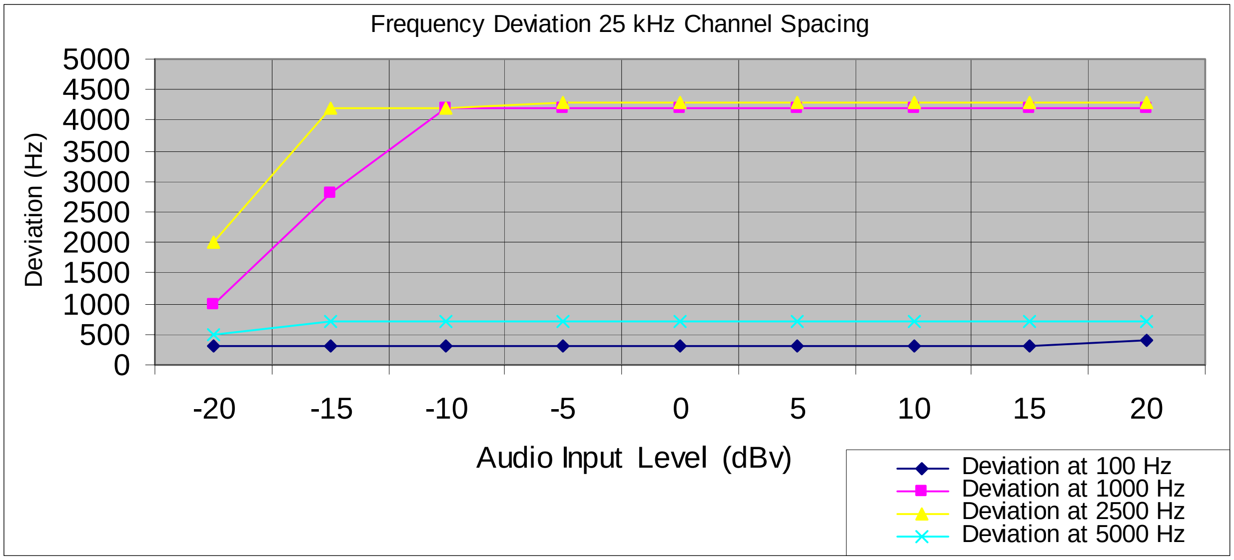


Figure two Frequency Deviation Characteristics (25kHz Channel)

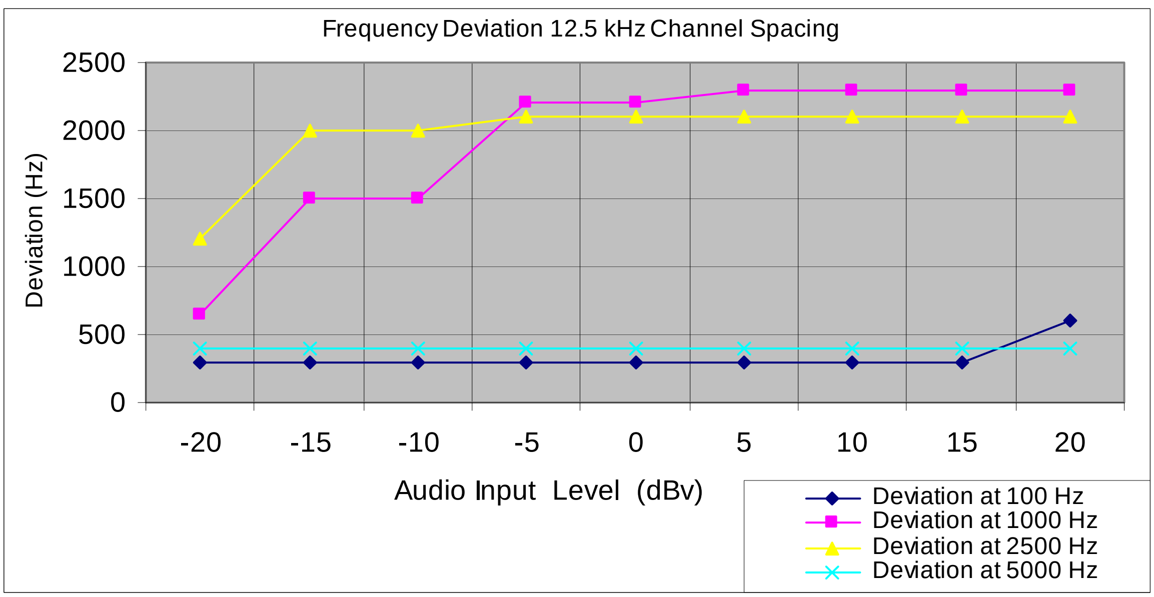


Figure three Frequency Deviation Characteristics (12.5 kHz Channel)

Figure 4 shows the frequency response of the audio low pass filter.

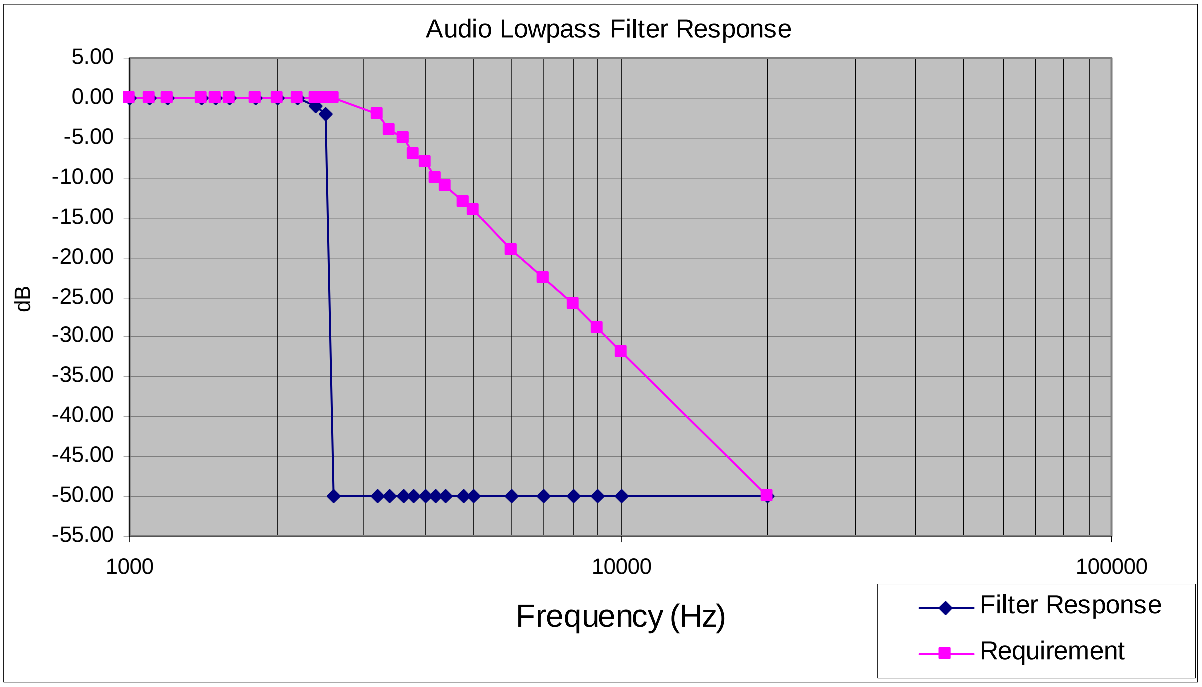


Figure four frequency response of low pass filter.

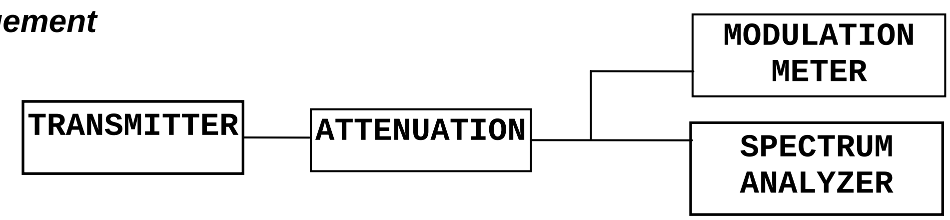
The specifications of Paragraph 2.1047 and applicable parts of 90 are met.

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.

Test Arrangement



Occupied Bandwidth Results

Mode / Squelch	Occupied Bandwidth (kHz)
Wide / None	15.0
Wide / CTCSS	14.88
Wide / DCS	14.75
Narrow / None	9.75
Narrow / CTCSS	9.25
Narrow / DCS	9.69

A spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in a normal mode, modulated by a frequency of 2500 Hz at a level 16 dB above 50% modulation. The power ratio in dB representing 99.5% of the total mean power was recorded from the spectrum analyzer. Refer to figures 5 through 10 for plots of 99.5% power.

The necessary bandwidth calculation for 25 kHz channel is as follows:

BN = 2M + 2Dk (k=1), M=2500, and D=5000

BN = 2(2500) + 2(5000)(1)

BN = 15.0 kHz Then BN equates to 15k0.

The necessary bandwidth calculation for 12.5 kHz channel is as follows:

BN = 2M + 2Dk (k=1), M=2500, and D=2500

BN = 2(2500) + 2(2500)(1)

BN = 10.0 kHz Then BN equates to 10k0

Requirements of 2.1049(c)(1) and applicable paragraphs of Part 90 are met. There are no deviations to the specifications.

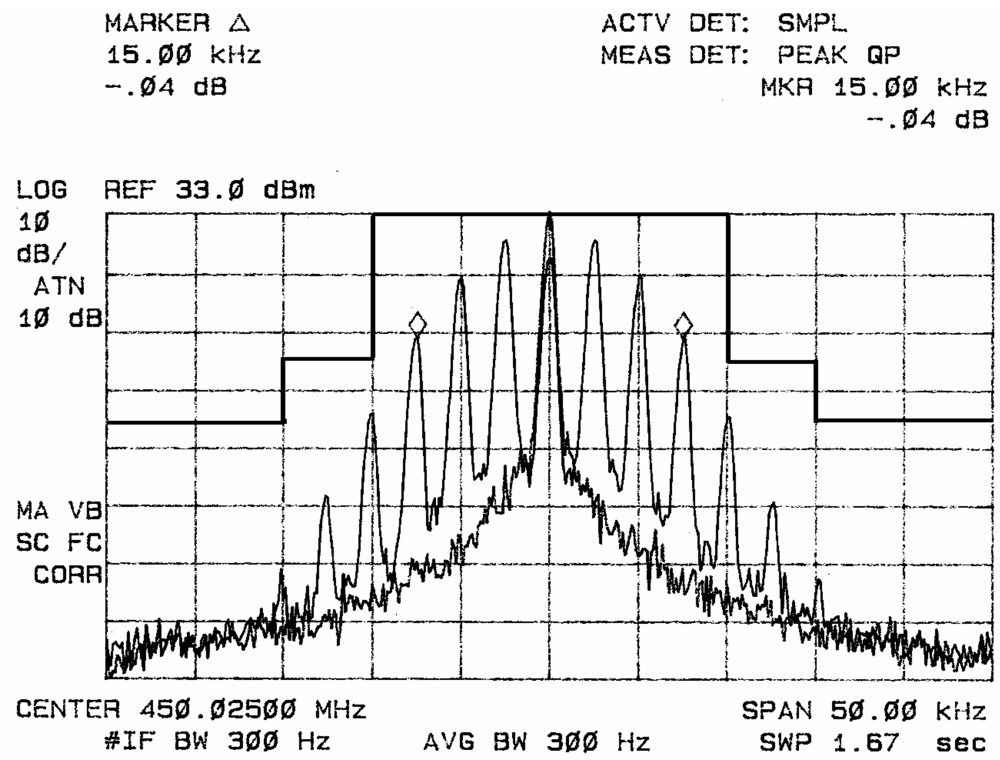


Figure five Occupied Band Width, wide band, no squelch tone

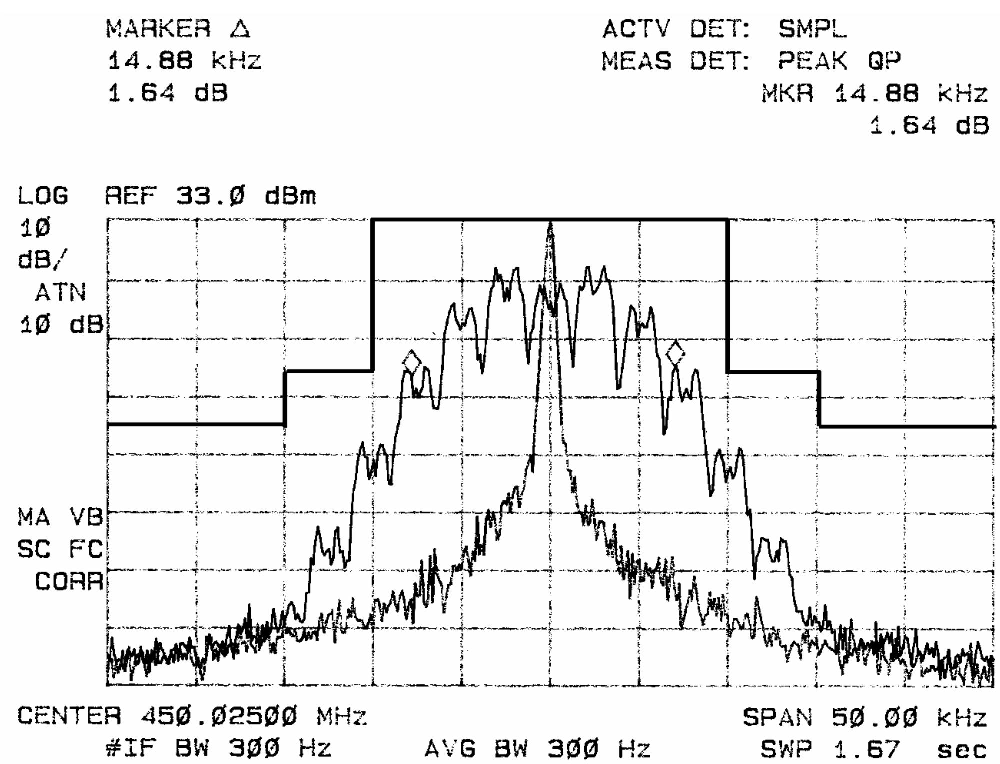


Figure six Occupied Band Width, wide band, CTCSS

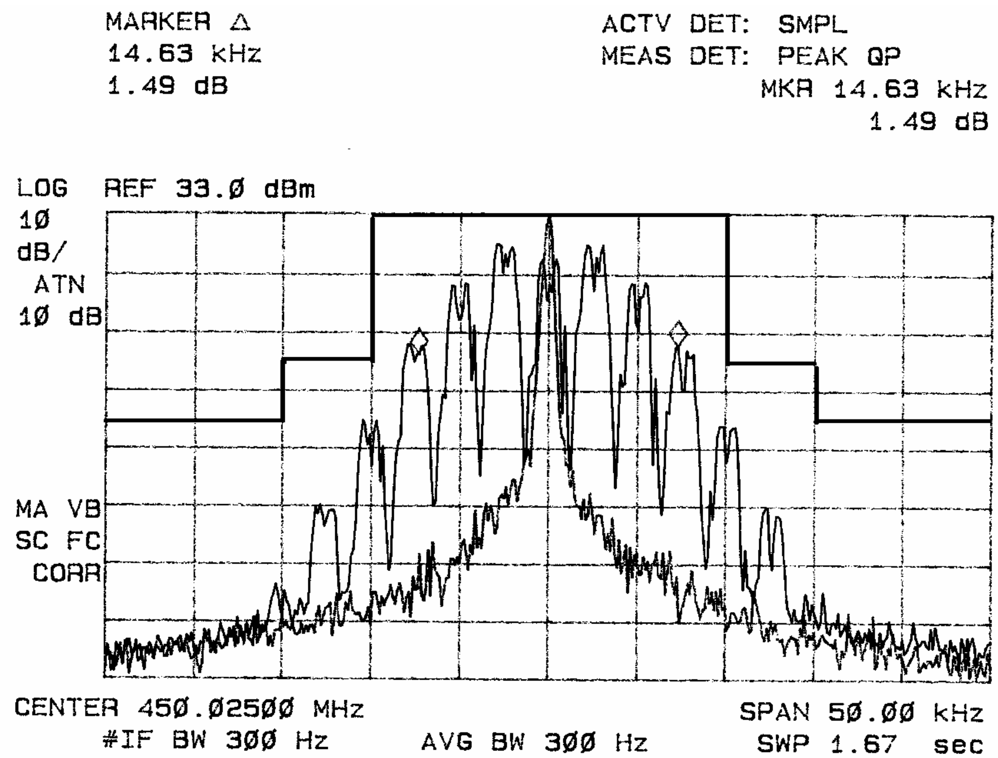


Figure seven Occupied Band Width, wide band, DCS

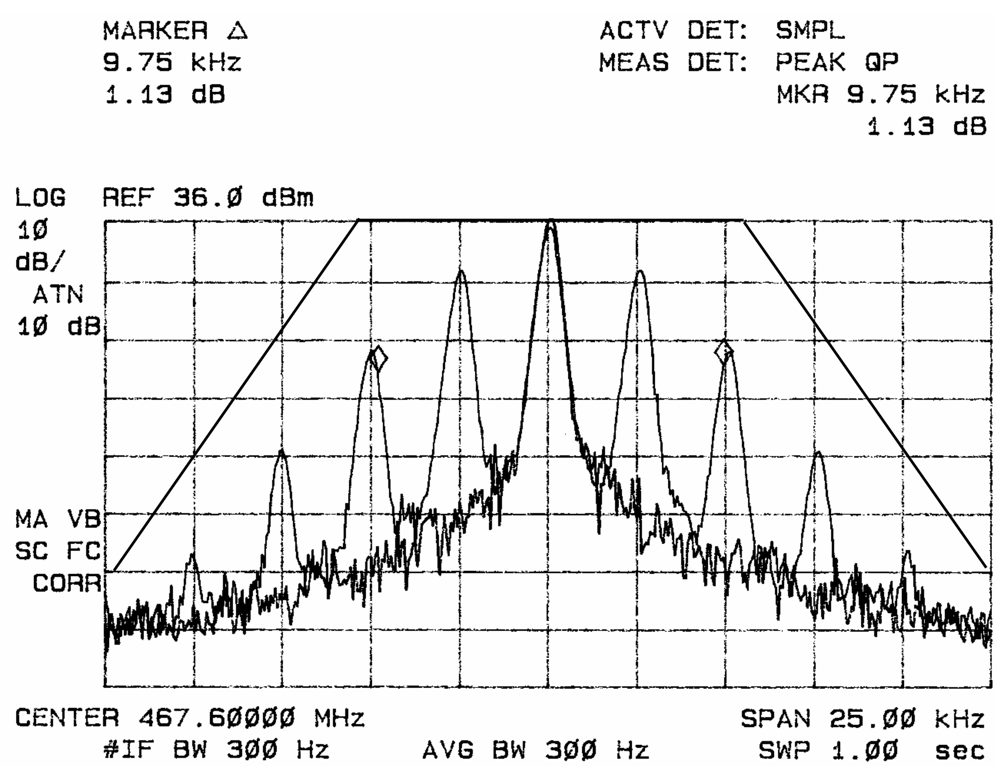


Figure eight Occupied Band Width, Narrow band, no squelch tone

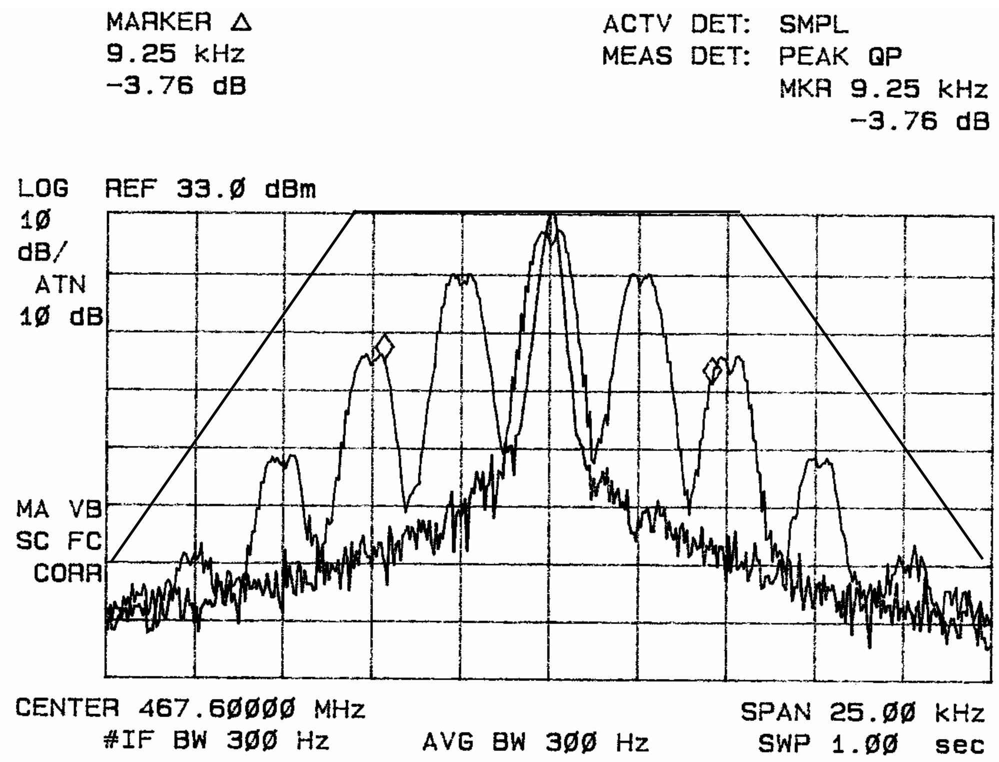


Figure nine Occupied Band Width, Narrow band, CTCSS

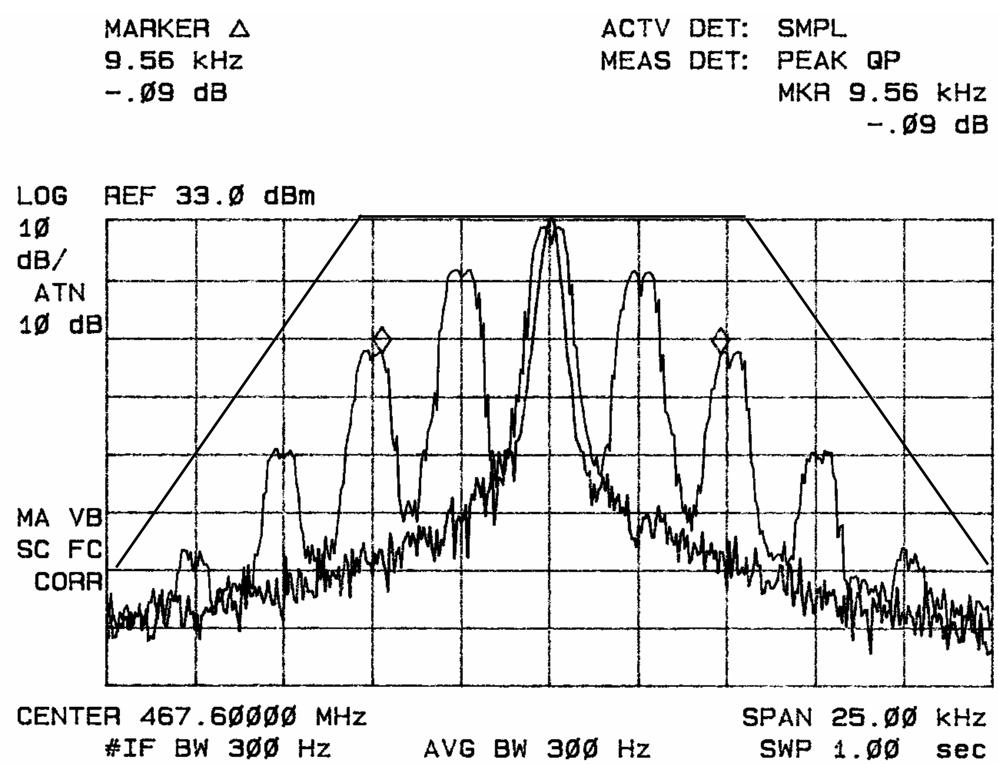


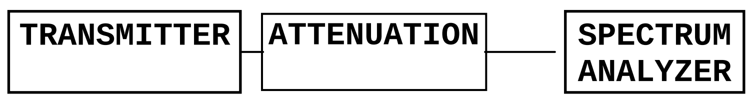
Figure ten Occupied Band Width, Narrow band, DCS

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.

Test Arrangement



The radio frequency output was coupled to a HP 8562 Spectrum Analyzer. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operated in a normal mode. The frequency spectrum from 100 MHz to 5.9 GHz was observed and plots produced of the frequency spectrum. Figures 11 through 14 represent data for the XU-1000. Data was taken per 2.1051, 2.1057, and applicable paragraphs of Part 90.

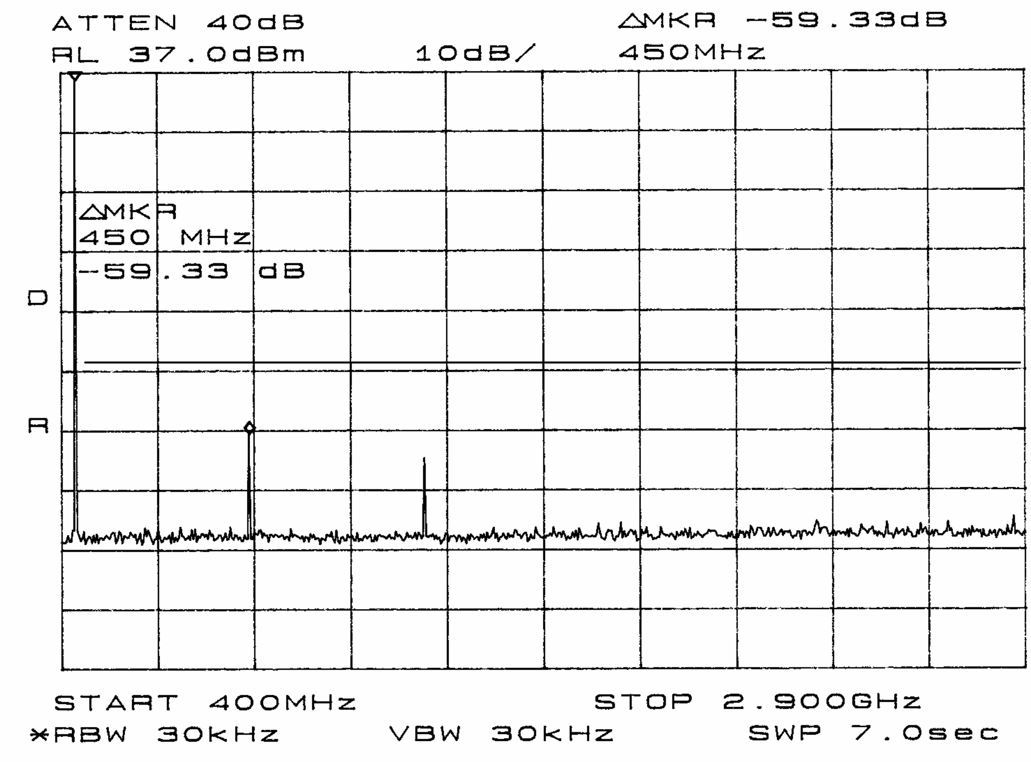


Figure eleven Emissions at Antenna Terminal (4 watt)

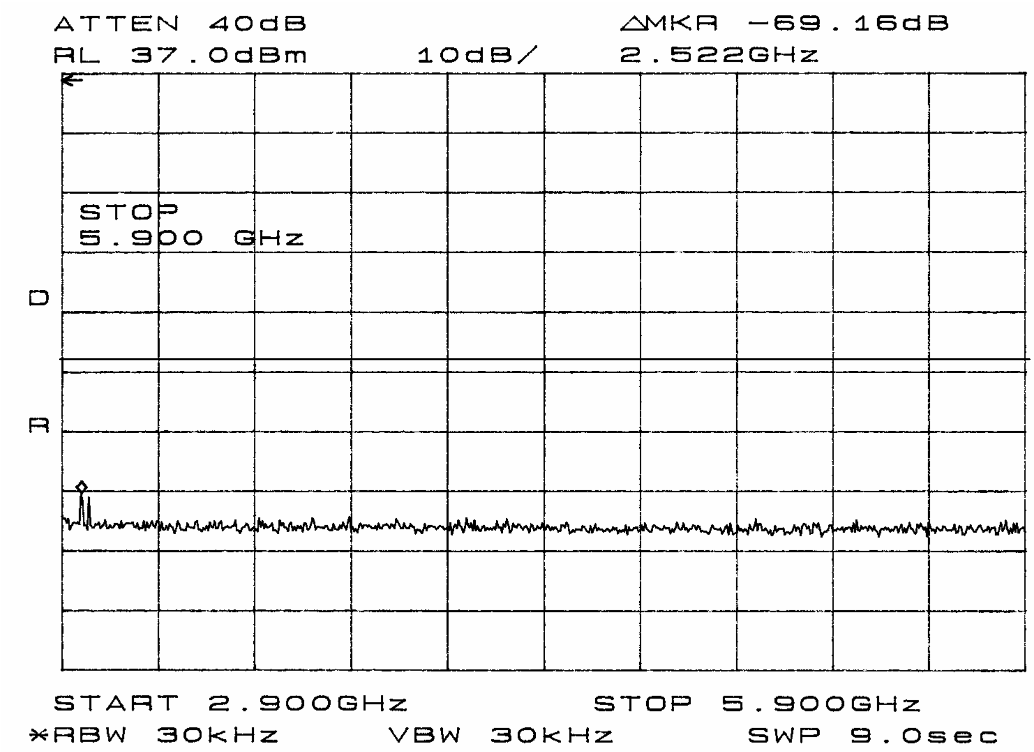


Figure twelve Emissions at Antenna Terminal (4 watt)

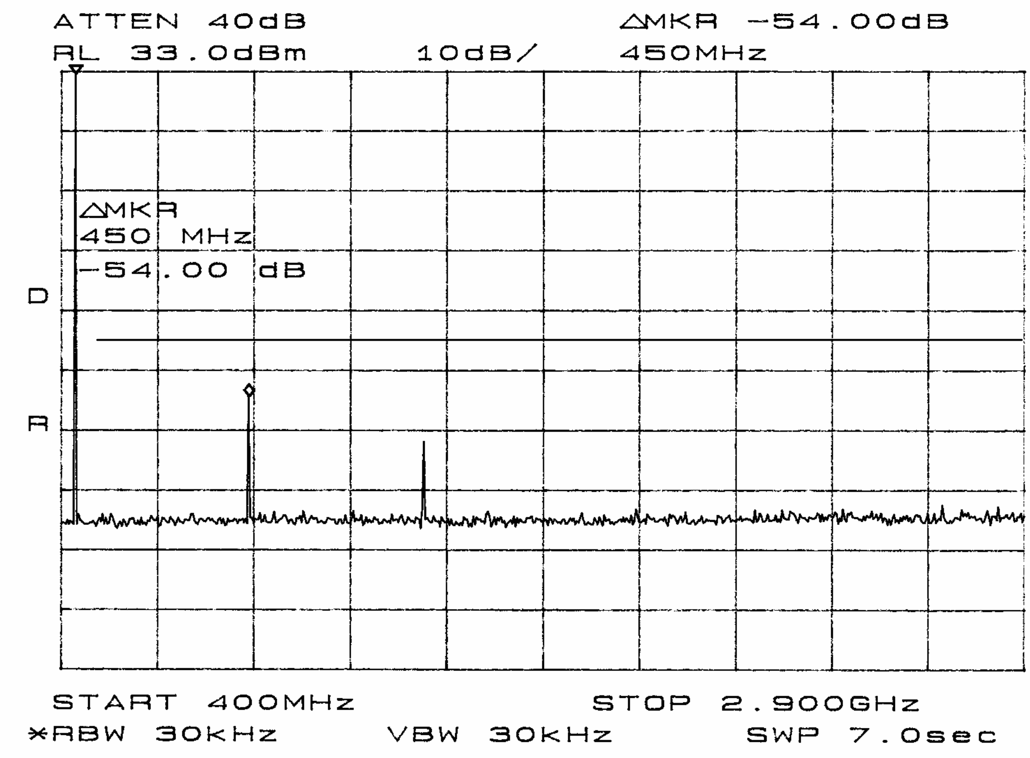


Figure thirteen Emissions at Antenna Terminal (2 Watt)

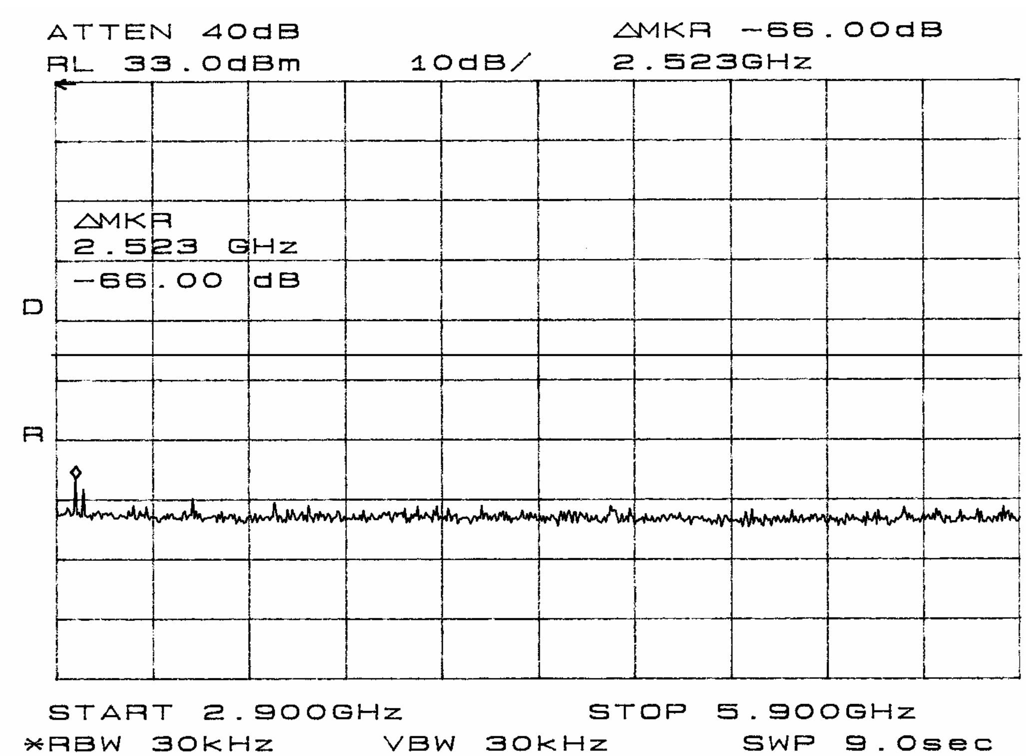


Figure fourteen Emissions at Antenna Terminal (2 Watt)

Spurious Emissions at Antenna Terminal Results

The output of the unit was coupled to a HP Spectrum Analyzer and the frequency emissions were measured. Data was taken as per 2.1051 and applicable paragraphs of Parts 2 and 90. Specifications of Paragraphs 2.1051, 2.1057 and applicable paragraphs of parts of 2 and 90 are met. There are no deviations to the specifications.

All spurious emissions must be attenuated at least 43+10log(Po) below the fundamental emission power level. The following equations represent the calculated attenuation levels for the equipment.

```
4.4 Watt  = 43 + 10 LOG(Po) 2.0 Watt = 43 + 10 LOG(Po)
          = 43 + 10 LOG(4.4)         = 43 + 10 LOG(2.0)
          = 49.4                     = 46.0
```

2 Watt Output Power Spurious Emissions at Antenna Results

CHANNEL MHz	SPURIOUS FREQ. (MHz)	Measured (dBm)	LEVEL BELOW CARRIER (dB)
450.025	900.1	-21.3	53.6
	1350.1	-28.3	60.6
	1800.1	-45.5	77.8
	2250.1	-45.3	77.6
	2700.2	-43.3	75.6
	3150.2	-44.5	76.8
462.600	925.1	-23.3	56.3
	1387.7	-33.7	66.7
	1850.2	-46.0	79.0
	2312.8	-45.3	78.3
	2775.3	-43.7	76.7
	3237.9	-44.5	77.5
469.975	940.0	-25.2	58.2
	1409.9	-35.3	68.3
	1879.9	-44.3	77.3
	2349.9	-43.3	76.3
	2819.9	-45.0	78.0
	3289.8	-42.8	75.8

4 Watt Output Power Spurious Emissions at Antenna Results

CHANNEL MHz	SPURIOUS FREQ. (MHz)	Measured (dBm)	LEVEL BELOW CARRIER (dB)
450.025	900.1	-22.7	58.7
	1350.1	-26.2	62.2
	1800.1	-42.5	78.5
	2250.1	-41.2	77.2
	2700.2	-40.5	76.5
	3150.2	-42.8	78.8
462.600	925.1	-24.5	60.8
	1387.7	-31.3	67.6
	1850.2	-43.3	79.6
	2312.8	-42.8	79.1
	2775.3	-41.0	77.3
	3237.9	-40.6	76.9
469.975	940.0	-25.0	61.1
	1409.9	-32.8	68.9
	1879.9	-43.3	79.4
	2349.9	-42.3	78.4
	2819.9	-42.8	78.9
	3289.8	-42.2	78.3

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 was placed on a wooden turntable 0.8 meters above the ground plane and at a distance of 3 meters from the FSM antenna. With the EUT radiating into a resistive 50 ohm load, the receiving antenna was raised and lowered from 1m to 4m to obtain the maximum reading of spurious radiation from the EUT on the spectrum analyzer. The turntable was rotated though 360 degrees to locate the position registering the highest amplitude of emission. The frequency spectrum was then searched for spurious emissions generated from the transmitter. The amplitude of each spurious emission was maximized by raising and lowering the FSM antenna, and rotating the turntable before final data was recorded. A Biconilog antenna was used for frequency measurements of 30 to 1000 MHz. A log periodic antenna was used for frequencies of 1000 MHz to 5 GHz and pyramidal horn antennas were used for frequencies of 5 GHz to 40 GHz. Emission levels were measured and recorded from the spectrum analyzer in dBm. The transmitter was then removed and replaced with a substitution antenna and signal generator. The signal from the generator was then adjusted such that the amplitude received was the same as that previously recorded for each frequency. This 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 power loss in the cable and further corrected for the gain in the substitution antenna. Data was taken at the ROGERS LABS, INC. 3 meters open area test site (OATS). A description of the test facility is on file with the FCC, Reference 90910. The testing procedures used conform to the procedures stated in the TIA/EIA-603 document.

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 by more than 250% of the authorized bandwidth.
Limit = Attenuation at least 43+10Log(Po)dB below fundamental.

1.0-watt low power transmitter	4.4-watt high power transmitter
Attenuation = 43 + 10 Log10(Pw)	Attenuation = 43 + 10 Log10(Pw)
= 43 + 10 Log10(2.0)	= 43 + 10 Log10(4.4)
= 46.0 dB	= 49.4 dB

Radiated Spurious Emissions Results

The EUT was connected to a 50-ohm load and set to transmit at the desired frequency. The amplitude of each spurious emission was then maximized and recorded. The transmitter produces 4.4 or 2.0 watts of output power (36.4 or 33 dBm). Then the radiated spurious emission in dB is calculated from the following equation. Radiated spurious emission (dB) = RSE

RSE = 10 Log10[Tx power(W)/0.001] – signal level required to reproduce observed level
Example: For 4.4 Watt output power
RSE = 10 Log[4.4/0.001]-(-28.83) = 65.2 dBc

Channel frequency 450.025 MHz (4.4-Watt power) Radiated Spurious Emissions Results

Frequency of Emission	Amplitude of Spurious emission		Signal level to dipole required to reproduce		Emission level below carrier		Limit
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	
(MHz)	dBµV	dBµV	dBm	dBm	dBc	dBc	dBc
900.1	43.1	52.7	-28.83	-19.23	65.2	55.6	49.4
1350.1	49.8	47.3	-18.93	-21.43	55.3	57.8	49.4
1800.1	26.3	29.8	-39.63	-36.13	76.0	72.5	49.4
2250.1	28.6	35.7	-35.33	-28.23	71.7	64.6	49.4
2700.2	30.5	34.0	-30.33	-26.83	66.7	63.2	49.4

Channel frequency 462.600 MHz (4.4-Watt power) Radiated Spurious Emissions Results

Frequency of Emission	Amplitude of Spurious emission		Signal level to dipole required to reproduce		Emission level below carrier		Limit
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	
(MHz)	dBµV	dBµV	dBm	dBm	dBc	dBc	dBc
925.2	53.0	52.8	-18.83	-19.03	55.2	55.4	49.4
1387.8	37.2	41.3	-31.53	-27.43	67.9	63.8	49.4
1850.4	32.3	39.0	-33.53	-26.83	69.9	63.2	49.4
2313.0	22.5	30.5	-40.93	-32.93	77.3	69.3	49.4
2775.6	25.2	31.3	-35.73	-29.63	72.1	66.0	49.4

Channel frequency 469.975 MHz (4.4-Watt power) Radiated Spurious Emissions Results

Frequency of Emission	Amplitude of Spurious emission		Signal level to dipole required to reproduce		Emission level below carrier		Limit
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	
(MHz)	dBµV	dBµV	dBm	dBm	dBc	dBc	dBc
940.0	48.0	49.8	-23.73	-21.93	60.1	58.3	49.4
1409.9	44.0	46.3	-24.53	-22.23	60.9	58.6	49.4
1879.9	32.6	31.7	-33.53	-34.43	69.9	70.8	49.4
2349.9	24.8	37.3	-38.03	-25.53	74.4	61.9	49.4
2819.9	38.8	37.3	-21.03	-22.53	57.4	58.9	49.4

Channel frequency 450.025 MHz (2.0-Watt power) Radiated Spurious Emissions Results

Frequency of Emission	Amplitude of Spurious emission		Signal level to dipole required to reproduce		Emission level below carrier		Limit
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	
(MHz)	dBμV	dBμV	dBm	dBm	dBc	dBc	dBc
900.1	42.8	55.3	-29.13	-16.63	62.3	49.8	46.0
1350.1	39.8	48.5	-28.93	-20.23	62.1	53.4	46.0
1800.1	25.0	27.8	-40.93	-38.13	74.1	71.3	46.0
2250.1	24.8	34.7	-39.13	-29.23	72.3	62.4	46.0
2700.2	30.6	32.8	-30.23	-28.03	63.4	61.2	46.0

Channel frequency 462.600 MHz (2.0-Watt power) Radiated Spurious Emissions Results

Frequency of Emission	Amplitude of Spurious emission		Signal level to dipole required to reproduce		Emission level below carrier		Limit
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	
(MHz)	dBμV	dBμV	dBm	dBm	dBc	dBc	dBc
925.2	43.0	54.2	-28.83	-17.63	62.0	50.8	46.0
1387.8	39.8	39.3	-28.93	-29.43	62.1	62.6	46.0
1850.4	22.1	26.5	-43.73	-39.33	76.9	72.5	46.0
2313.0	17.5	30.5	-45.93	-32.93	79.1	66.1	46.0
2775.6	29.5	29.3	-31.43	-31.63	64.6	64.8	46.0

Channel frequency 469.975 MHz (2.0-Watt power) Radiated Spurious Emissions Results

Frequency of Emission	Amplitude of Spurious emission		Signal level to dipole required to reproduce		Emission level below carrier		Limit
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	
(MHz)	dBμV	dBμV	dBm	dBm	dBc	dBc	dBc
940.0	37.5	49.5	-34.23	-22.23	67.4	55.4	46.0
1409.9	30.5	44.2	-38.03	-24.33	71.2	57.5	46.0
1879.9	27.6	25.0	-38.53	-41.13	71.7	74.3	46.0
2349.9	21.5	35.1	-41.33	-27.73	74.5	60.9	46.0
2819.9	28.5	25.5	-31.33	-34.33	64.5	67.5	46.0

All other spurious emissions measured were 20 db or more below the limit. The worst-case data is represented in this report. Specifications of Paragraph 2.1053, 2.1057, applicable paragraphs of parts 2 and 90 are met. There are no deviations to the specifications.

2.1055 Frequency Stability

Measurements Required

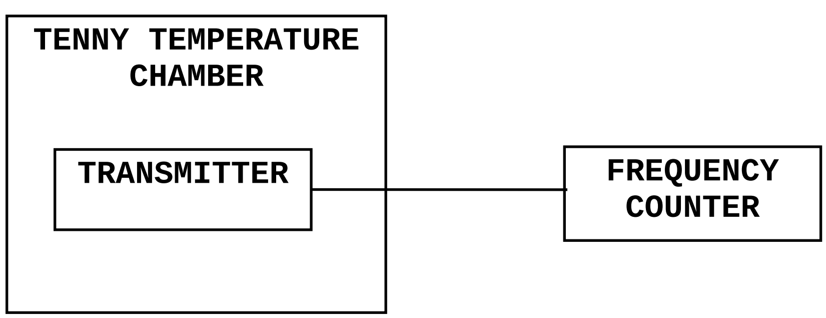
The frequency stability shall be measured with variations of ambient temperature from -30° to +50° centigrade. Measurements shall be made at the extremes of the temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. In addition to temperature stability, the frequency stability shall be measured with variation of primary supply voltage as follows:

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

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

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

Test Arrangement



The measurement procedure outlined below shall be followed:

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

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

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

(4) The test procedures outlined in Steps 2 and 3, shall be repeated after stabilizing the transmitter at the environmental temperatures specified, -30°C to 50°C in 10-degree increments.

The frequency stability was measured with variations in the power supply voltage from 85 to 115 percent of the nominal value. A BK Precision DC Power Supply was used to vary the dc voltage for the power input from 6.3 Vdc to 8.5 Vdc. The frequency was measured and the variation in parts per million was calculated. Data was taken per Paragraphs 2.1055 and applicable paragraphs of part 90.

Frequency Stability Results

Frequency (MHz) 450.02500	Frequency Stability Vs Temperature In Parts Per Million (Ppm) Temperature in °C								
Temperature	-30	-20	-10	0	10	20	30	40	50
Change(Hz)	-530.0	-200.0	180.0	310.0	-20.0	0.0	20.0	80.0	120.0
PPM	-1.178	-0.444	0.400	0.689	-0.044	0.000	0.044	0.178	0.267

Frequency 450.02500 MHz	Frequency Stability Vs Voltage Variation 7.4 volts nominal; RESULTS IN PPM INPUT VOLTAGE		
	6.3 Vdc	7.4 Vdc	8.5 Vdc
Change (Hz)	0.0	0.0	0.0

Frequency 450.02500 MHz	Frequency Stability Vs Voltage Variation 7.4 volts nominal; RESULTS IN PPM BATTERY ENDPOINT VOLTAGE 5.5 Vdc
Change (Hz)	0.0

Specifications of Paragraphs 2.1055 and applicable paragraphs of part 90 are met. There are no deviations to the specifications.

Transient Frequency Behavior, Per 90.214

Measurements Required

When a transmitter is turned on, the radio frequency may take some time to stabilize. During this initial period, the frequency error must not exceed the limits specified in 90.214.

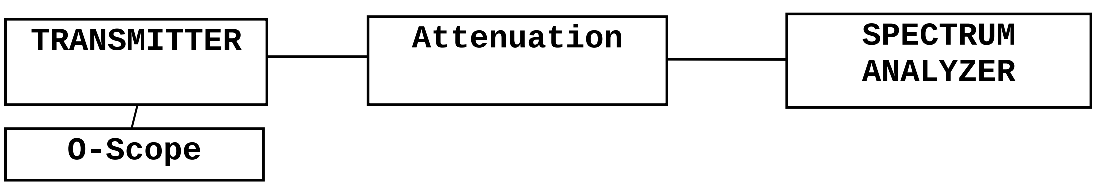
Minimum Standard

Transient Behavior for Equipment Designed to Operate on 25 kHz Channels			
Time Intervals	Maximum Frequency Difference (kHz)	Frequency Range	
		138-174 MHz	406.1-470 MHz
t1	± 25	5 mS	10 mS
t2	± 12.5	20 mS	25 mS
t3	± 25	5 mS	10 mS

Transient Behavior for Equipment Designed to Operate on 12.5 kHz Channels			
Time Intervals	Maximum Frequency Difference (kHz)	Frequency Range	
		138-174 MHz	406.1-470 MHz
t1	± 12.5	5 mS	10 mS
t2	± 6.25	20 mS	25 mS
t3	± 12.5	5 mS	10 mS

Test Arrangement

As recommended, the method given in ETA/TIA standard 603, was used. Refer to figures 14 and 15 displaying the transient behavior of the transmitter.



Transient Behavior Results

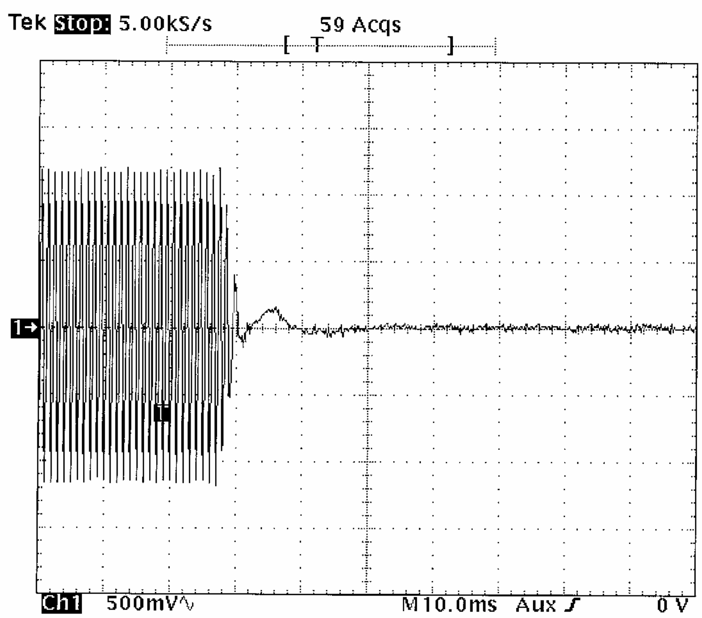


Figure fourteen Transient Behavior of Transmitter t1

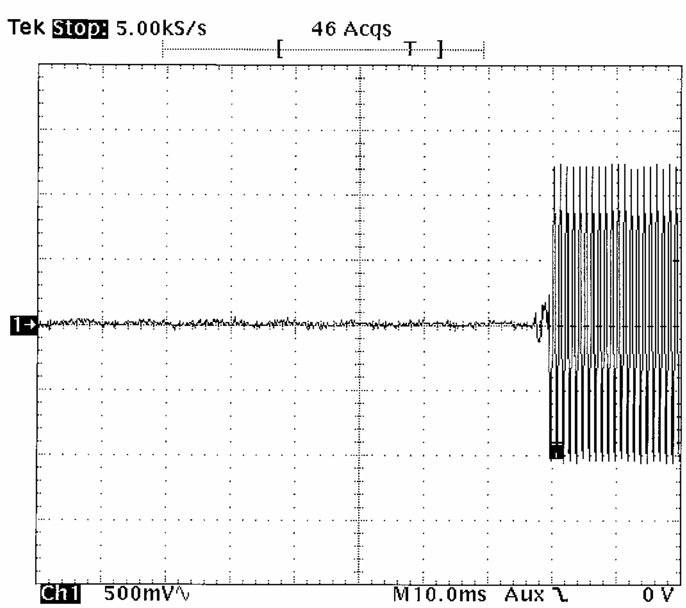


Figure fifteen Transient Behavior of Transmitter t3

Specifications of Paragraph 90.214 are met. There are no deviations to the specifications.

Annex

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

Annex A Measurement Uncertainty Calculations

Radiated Emissions Measurement Uncertainty Calculation

Measurement of vertically polarized radiated field strength over the frequency range 30 MHz to 1 GHz on an open area test site at 3m and 10m includes following uncertainty:

Contribution	Probability Distribution	Uncertainty (dB)
Antenna factor calibration	normal (k = 2)	±0.58
Cable loss calibration	normal (k = 2)	±0.2
Receiver specification	rectangular	±1.0
Antenna directivity	rectangular	±0.1
Antenna factor variation with height	rectangular	±2.0
Antenna factor frequency interpolation	rectangular	±0.1
Measurement distance variation	rectangular	±0.2
Site Imperfections	rectangular	±1.5

Combined standard uncertainty $u_c(y)$ is

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

$U_c(y) = \pm$ 1.6 dB

It is probable that $u_c(y) / s(q_k) > 3$, where $s(q_k)$ is estimated standard deviation from a sample of n readings 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:

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

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

Notes:

1.1 Uncertainties for the antenna and cable were estimated, based on a normal probability distribution with k = 2.

1.2 The receiver uncertainty was obtained from the manufacturer's specification for which a rectangular distribution was assumed.

1.3 The antenna factor uncertainty does not take account of antenna directivity.

1.4 The antenna factor varies with height and since the height was not always the same in use as when the antenna was calibrated an additional uncertainty is added.

1.5 The uncertainty in the measurement distance is relatively small but has some effect on the received signal strength. The increase in measurement distance as the antenna height is increased is an inevitable consequence of the test method and is therefore not considered a contribution to uncertainty.

1.6 Site imperfections are difficult to quantify but may include the following contributions:
-Unwanted reflections from adjacent objects.
-Ground plane imperfections: reflection coefficient, flatness, and edge effects.
-Losses or reflections from "transparent" cabins for the EUT or site coverings.
-Earth currents in antenna cable (mainly effect biconical antennas).

The specified limits for the difference between measured site attenuation and the theoretical value (± 4 dB) were not included in total since the measurement of site attenuation includes uncertainty contributions already allowed for in this budget, such as antenna factor.

Conducted Measurements Uncertainty Calculation

Measurement of conducted emissions over the frequency range 9 kHz to 30 MHz includes following uncertainty:

Contribution	Probability Distribution	Uncertainty (dB)
Receiver specification	rectangular	±1.5
LISN coupling specification	rectangular	±1.5
Cable and input attenuator calibration	normal (k=2)	±0.5

Combined standard uncertainty $u_c(y)$ is

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

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

As with radiated field strength uncertainty, it is probable that $u_c(y) / s(q_k) > 3$ and a coverage factor of k = 2 will suffice, therefore:

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

Annex B Test Equipment List For Rogers Labs, Inc.

The test equipment used is maintained in calibration and good operating condition. Use of this calibrated equipment ensures measurements are traceable to national standards.

List of Test Equipment	Calibration Date
Oscilloscope Scope: Tektronix 2230	2/07
Wattmeter: Bird 43 with Load Bird 8085	2/07
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/07
H/V Power Supply: Fluke Model: 408B (SN: 573)	2/07
R.F. Generator: HP 606A	2/07
R.F. Generator: HP 8614A	2/07
R.F. Generator: HP 8640B	2/07
Spectrum Analyzer: HP 8562A,	2/07
Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W	
HP Adapters: 11518, 11519, 11520	
Spectrum Analyzer: HP 8591EM	5/07
Frequency Counter: Leader LDC825	2/07
Antenna: EMCO Biconilog Model: 3143	5/07
Antenna: EMCO Log Periodic Model: 3147	10/07
Antenna: Antenna Research Biconical Model: BCD 235	10/07
Antenna: EMCO Dipole Set 3121C	2/07
Antenna: C.D. B-101	2/07
Antenna: Solar 9229-1 & 9230-1	2/07
Antenna: EMCO 6509	2/07
Audio Oscillator: H.P. 201CD	2/07
R.F. Power Amp 65W Model: 470-A-1010	2/07
R.F. Power Amp 50W M185- 10-501	2/07
R.F. PreAmp CPPA-102	2/07
LISN 50 µHy/50 ohm/0.1 µf	10/07
LISN Compliance Eng. 240/20	2/07
LISN Fischer Custom Communications FCC-LISN-50-16-2-08	2/07
Peavey Power Amp Model: IPS 801	2/07
Power Amp A.R. Model: 10W 1010M7	2/07
Power Amp EIN Model: A301	2/07
ELGAR Model: 1751	2/07
ELGAR Model: TG 704A-3D	2/07
ESD Test Set 2010i	2/07
Fast Transient Burst Generator Model: EFT/B-101	2/07
Current Probe: Singer CP-105	2/07
Current Probe: Solar 9108-1N	2/07
Field Intensity Meter: EFM-018	2/07
KEYTEK Ecat Surge Generator	2/07

Annex C Qualifications

SCOT D. ROGERS, ENGINEER
ROGERS LABS, INC.

Mr. Rogers has approximately 17 years experience in the field of electronics. Six years working in the automated controls industry and 6 years working with the design, development and testing of radio communications and electronic equipment.

POSITIONS HELD:

Systems Engineer: A/C Controls Mfg. Co., Inc. 6 Years

Electrical Engineer: Rogers Consulting Labs, Inc. 5 Years

Electrical Engineer: Rogers Labs, Inc. Current

EDUCATIONAL BACKGROUND:

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

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

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

Scot D Rogers

Scot D. Rogers

Annex D FCC Site Approval 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

Annex E Industry Canada Site Approval Letter

Industry Canada Industrie Canada

May 23rd, 2006

OUR FILE: 46405-3041
Submission No: 115252

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

Dear Sir/Madame:

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

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

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

If the site is not accredited to ANSI C63.4-2003 or later, the test facility shall submit test data demonstrating conformance with the ANSI standard. The Department will evaluate the filing to determine if recognition shall be granted.

The frequency for re-validation of the test site and the information that is required to be filed or retained by the testing party shall comply with the requirements established by the accrediting organization. However, in all cases, test site re-validation shall occur on an interval not to exceed two years.

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

Yours sincerely,

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

Canada