

Submittal Application Report

FOR

Grant Of Certification

Model: XV-100
VHF Transceiver

FCC ID: U59XV-100

IC: 7555A-XV100

Frequency Band 150-174 MHz

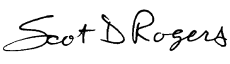
Operating under rule of CFR47, Paragraph 90, Subpart I and RSS-119

FOR

Tekk International Inc.

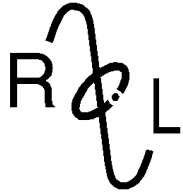
10601 NW Ambassador Drive, Suite G
Kansas City, MO 64153

Test Report Number 081118

Authorized Signatory: 
Scot D. Rogers



NVLAP Lab Code 200087-0



ROGERS LABS, INC.

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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: XV-100
VHF Transceiver
FREQUENCY: 150-174 MHz

FCC ID: U59XV-100
IC: 7555A-XV100

Test Date: November 18, 2008

Certifying Engineer: *Scot D. Rogers*

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Forward

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, 2.915, 2.925, 2.926, 2.1031 through 2.1057, applicable parts of CFR47 paragraphs 15, 90, and RSS-119 the following information is submitted.

Opinion / Interpretation of Results

| Tests Performed | Results |
|---|----------|
| Emissions Tests | |
| Requirements per CFR47 paragraphs 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, 2007, 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 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.: U59XV-100
IC: 7555A-XV100
Model: XV-100 S/N: #2

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

(4) Emission Type: 11K0F3E

(5) Frequency Range: 150 to 174 MHz

(6) Operating Power Level: 2.0 Watts

(7) Max Power output of equipment 2 Watts

(8) Power into final amplifier:
2 Watt operation, 4.00 Watts (2.0V @ 2.0A)

(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 dB μ V; dB referenced to one microvolt |
| Radiated EMI | Data is in dB μ V/m; dB/m referenced to one microvolt per meter |
| Antenna Conducted | Data is in dBm, dB referenced to one milliwatt |

Environmental Conditions

| | |
|----------------------|------------|
| Ambient Temperature | 20.22.2° C |
| Relative Humidity | 20% |
| Atmospheric Pressure | 1022.4 mb |

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. 259 th 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. 259 th Terrace, Louisburg, KS. |
| Site Approval | Refer to Annex for FCC Site Registration Letter, # 90910, and Industry Canada Site Registration Letter, IC3041A-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 |

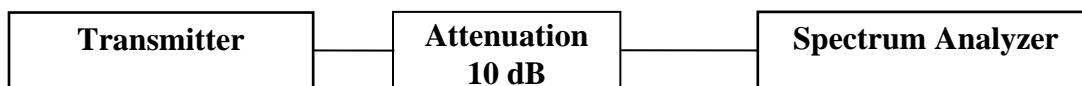
| Equipment | Mfg. | Model | Cal. Date | Due. |
|-----------|--------------|-------------------|-----------|-------|
| LISN | Comp. Design | FCC-LISN-2-MOD.CD | 10/08 | 10/09 |
| LISN | Comp. Design | 1762 | 2/08 | 2/09 |
| Antenna | ARA | BCD-235-B | 10/08 | 10/09 |
| Antenna | EMCO | 3147 | 10/08 | 10/09 |
| Antenna | EMCO | 3143 | 5/08 | 5/09 |
| Analyzer | HP | 8591EM | 5/08 | 5/09 |
| Analyzer | HP | 8562A | 5/08 | 5/09 |

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 and 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 | = $10^{(P_{dBm}/10)}$ |
| Watts | = (Milliwatts)(0.001)(W/mW) |
| 33.33 dBm | = $10^{(32.61/10)}$ |
| | = 1823.9 mW |
| | = 1.8 Watts |

Power Output Results

| Frequency | P(dBm) | P(mw) | P(w) |
|-----------|--------|--------|------|
| 150.000 | 32.61 | 1823.9 | 1.8 |
| 155.025 | 33.00 | 1995.3 | 2.0 |
| 174.000 | 32.64 | 1836.5 | 1.8 |

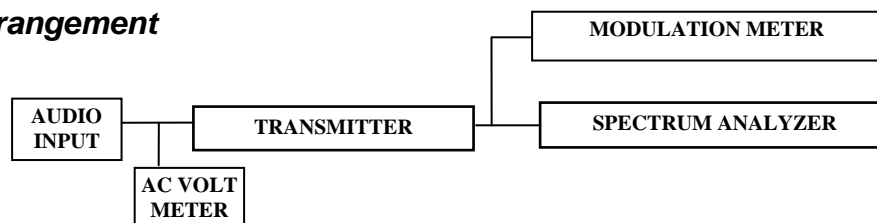
The testing procedures used conform to the procedures stated in the TIA/EIA-603 document. The specifications of Paragraph 2.1046(a) and applicable Parts of 90 are met. There are no deviations to the specifications.

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.

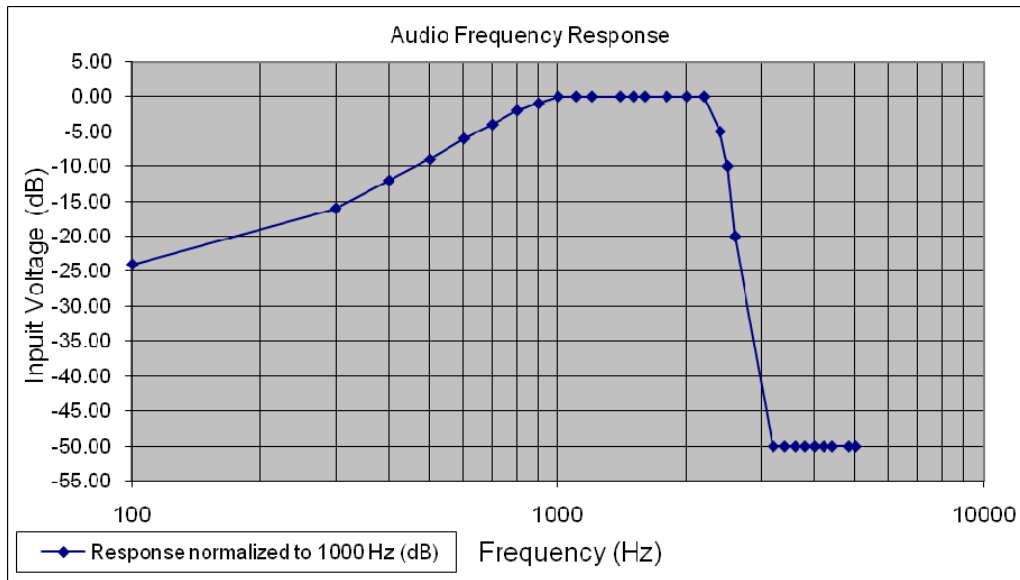


Figure one Audio Frequency Response Characteristics

Figure 2 shows the frequency deviation response of 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.

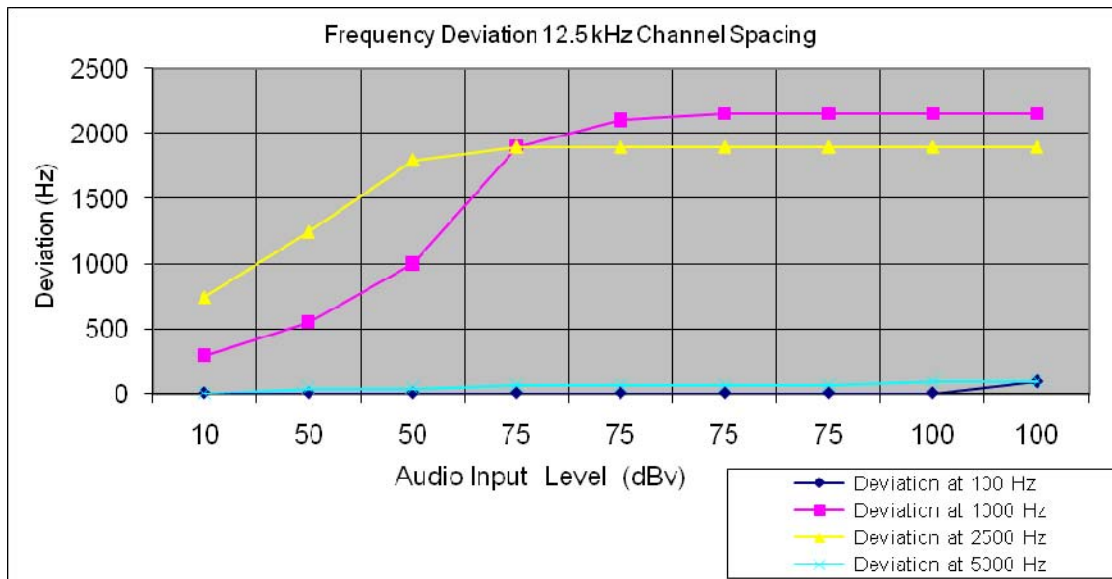


Figure two Frequency Deviation Characteristics (12.5 kHz Channel spacing)

Figure 3 shows the frequency response of the audio low pass filter.

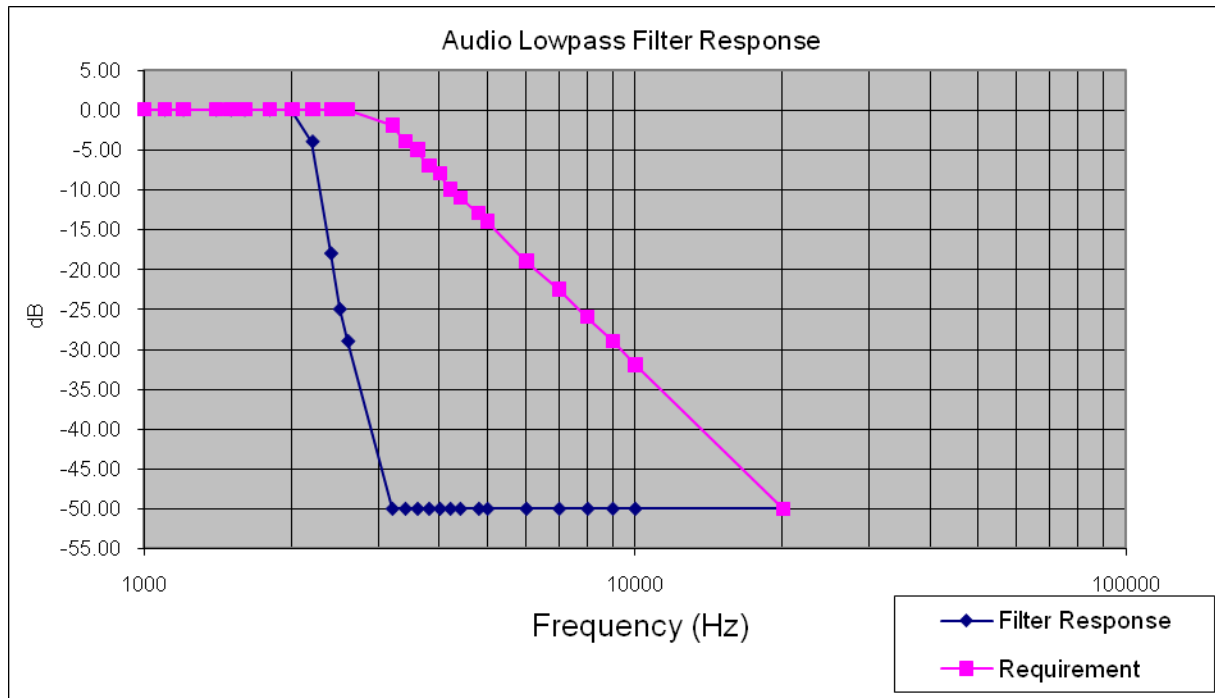


Figure three frequency response of low pass filter

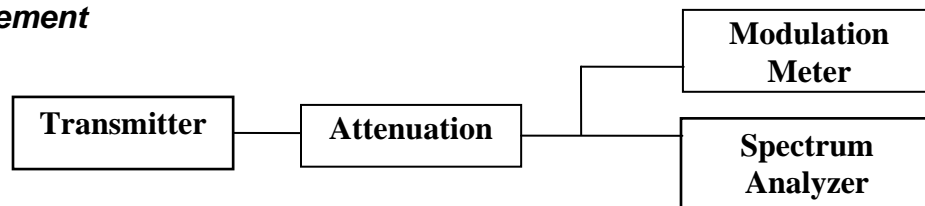
The specifications of Paragraph 2.1047 and applicable parts of 90 are met.

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) |
|----------------|--------------------------|
| Narrow / None | 10.45 |
| Narrow / CTCSS | 10.90 |
| Narrow / DCS | 10.80 |

A spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating through all normal modes, 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.

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

$$BN = 2M + 2Dk \text{ (k=1), } M=2500, \text{ and } D=3000$$

$$BN = 2(2500) + 2(3000)(1)$$

$$BN = 11.0 \text{ kHz Then BN equates to } 11\text{k}0$$

Refer to figures 4 through 12 for plots of 99.5% power. Requirements of 2.1049(c)(1) and applicable paragraphs of Part 90 are met. There are no deviations to the specifications.

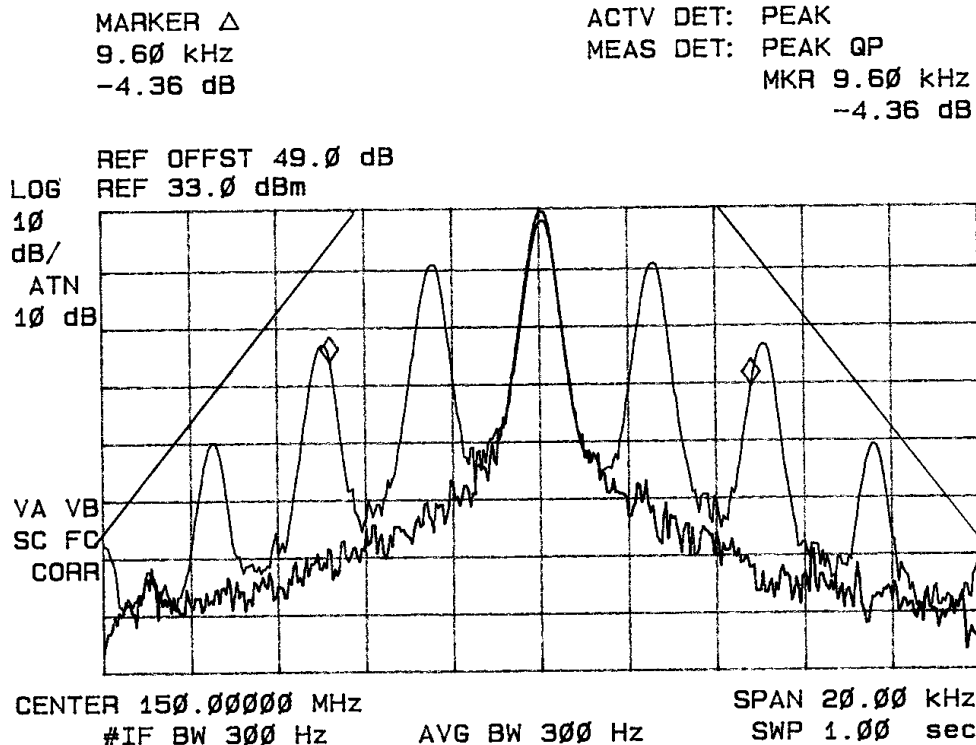


Figure four Occupied Band Width, no squelch tone

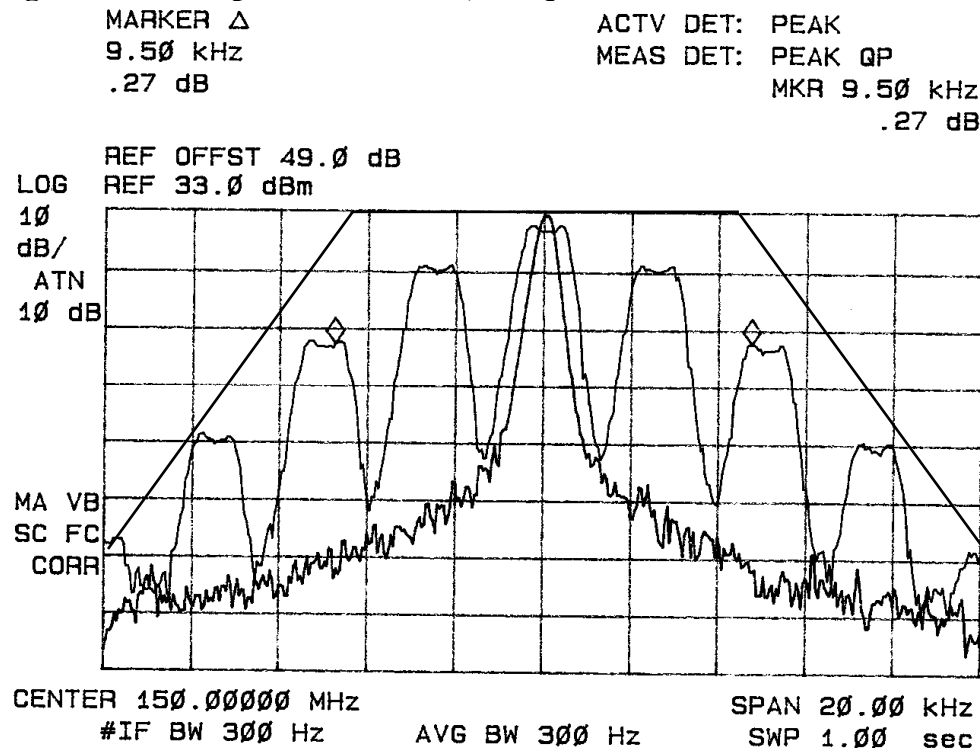


Figure five Occupied Band Width, CTCSS

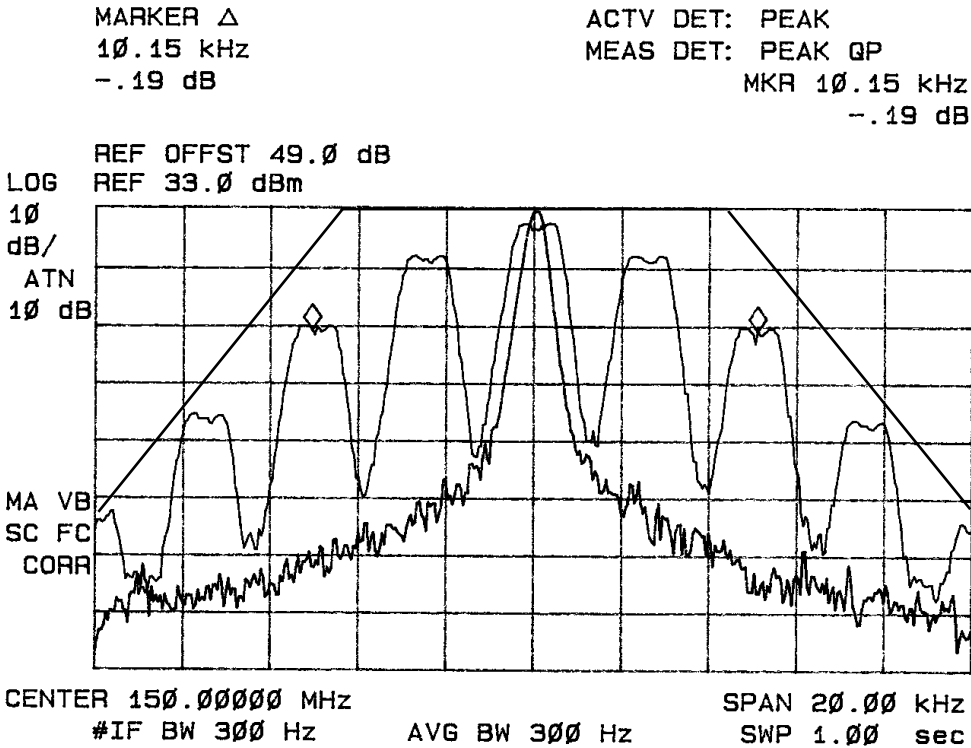


Figure six Occupied Band Width, DCS

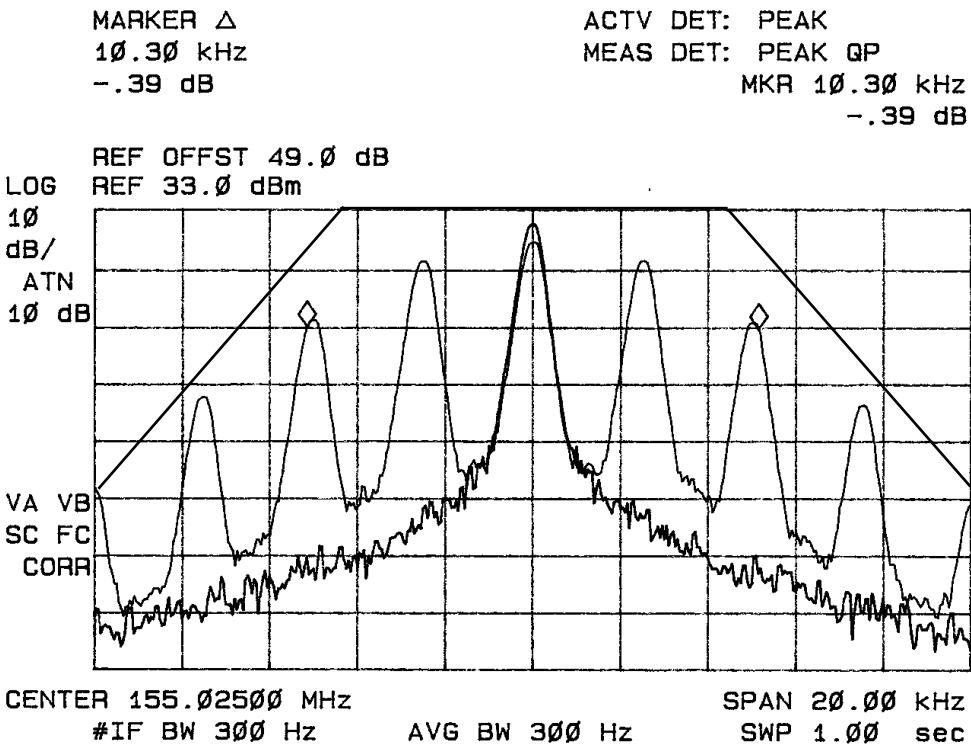


Figure seven Occupied Band Width, no squelch tone

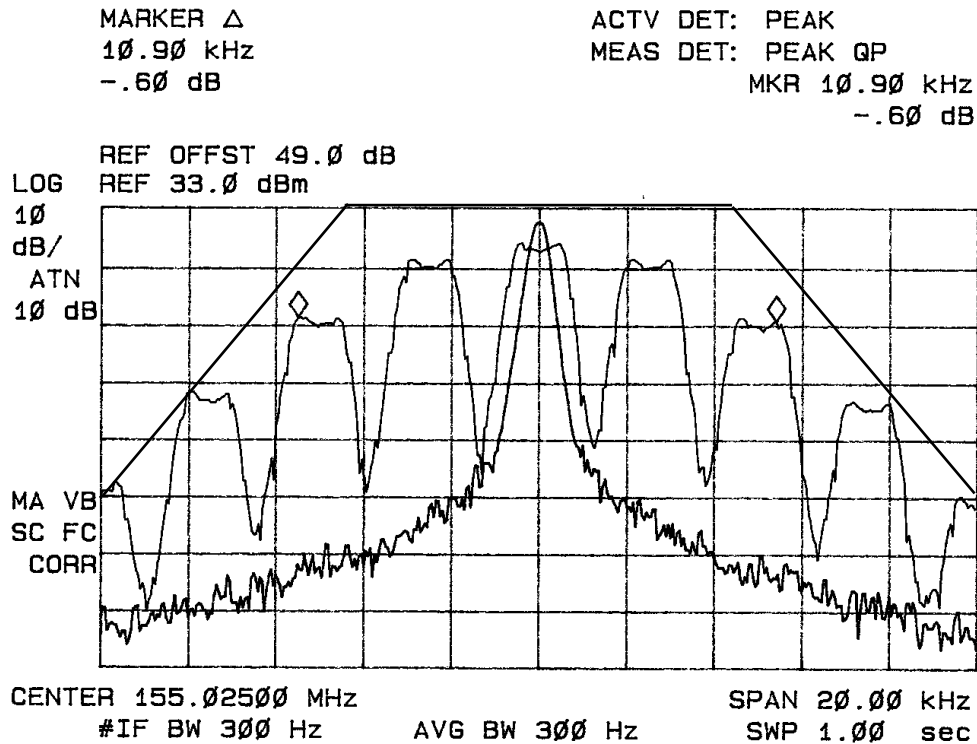


Figure eight Occupied Band Width, CTCSS

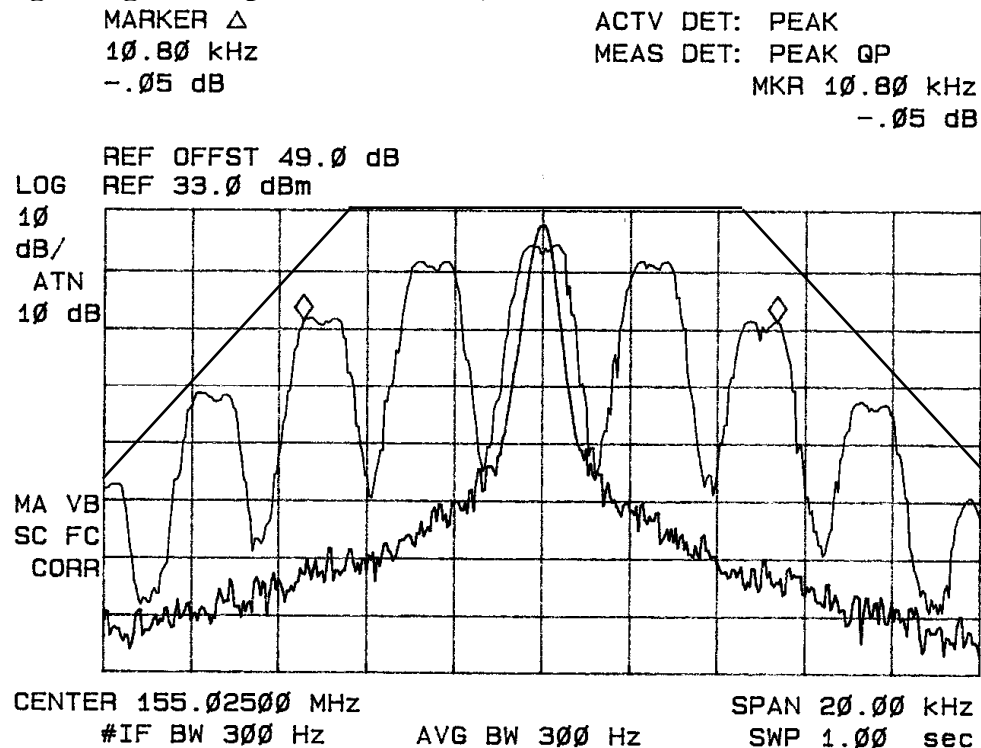


Figure nine Occupied Band Width, DCS

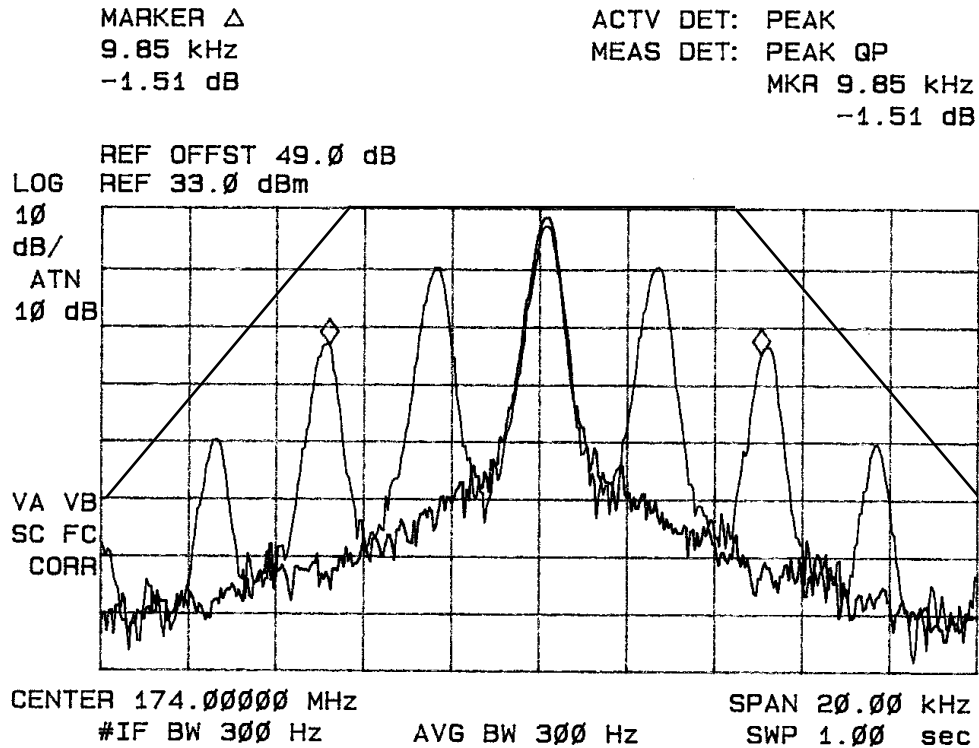


Figure ten Occupied Band Width, no squelch tone

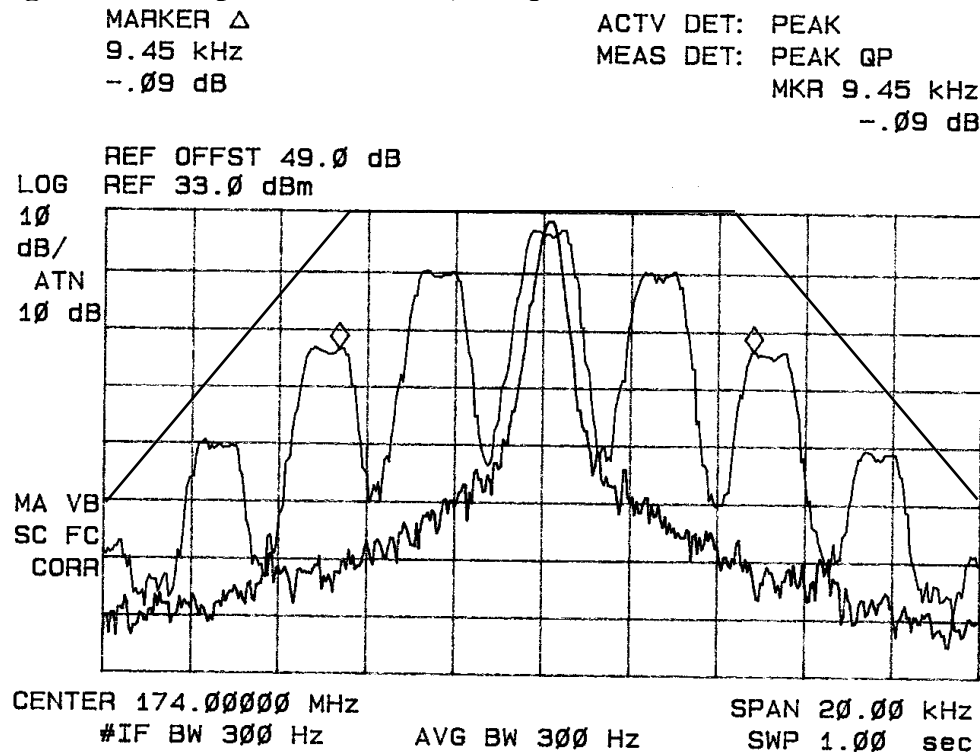


Figure eleven Occupied Band Width, CTCSS

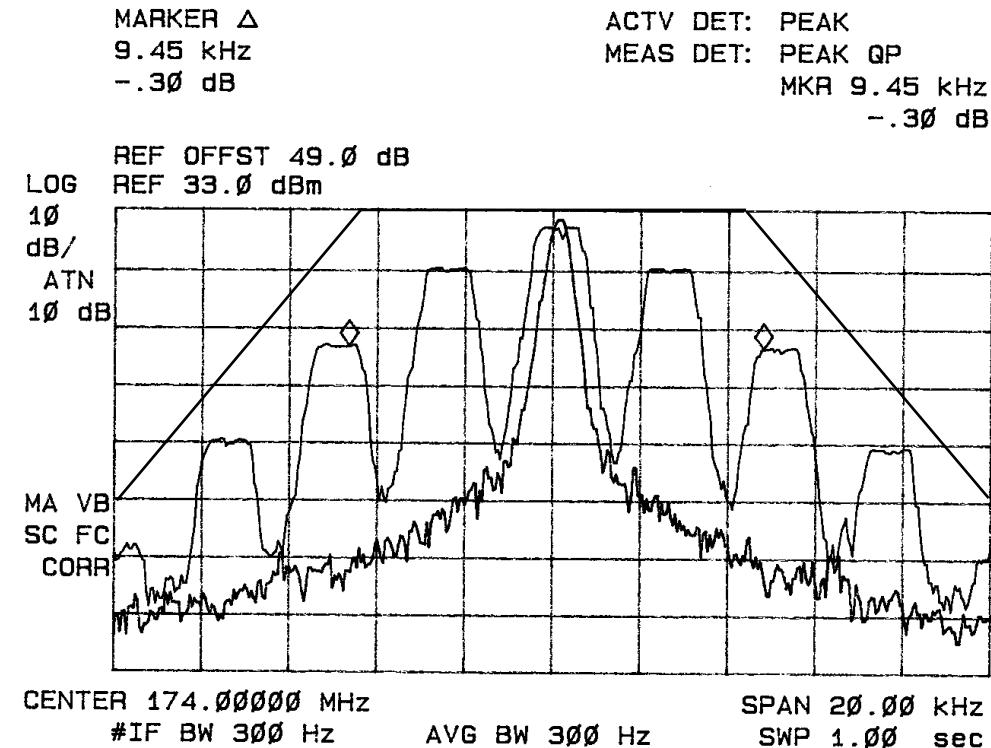


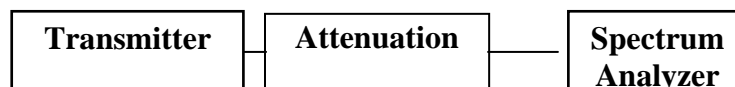
Figure twelve Occupied Band Width, DCS

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 Spectrum Analyzer for antenna spurious emissions testing. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operated in a normal mode. The frequency spectrum from 30 MHz to 2.9 GHz was observed and plots produced of the frequency spectrum. Figure 13 represents data for the XV-100. Data was taken per 2.1051, 2.1057, and applicable paragraphs of Part 90.

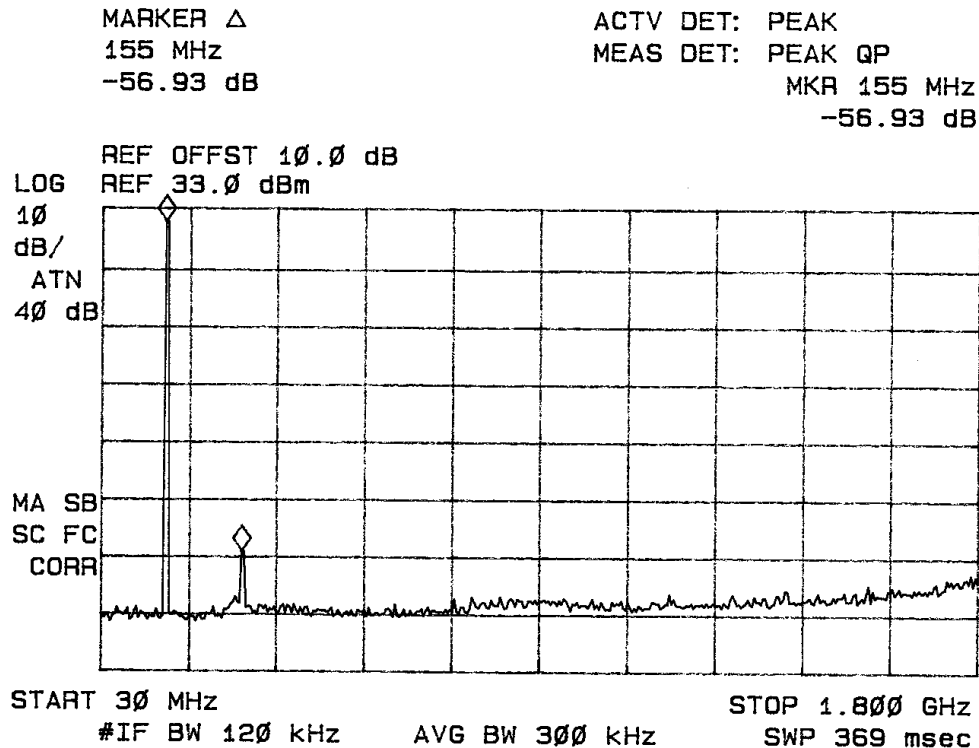


Figure thirteen Emissions at Antenna Terminal

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 $50 + 10\log(P_o)$ below the fundamental emission power level. The following equations represent the calculated attenuation levels for the equipment.

$$\begin{aligned} 2.0 \text{ Watt} &= 50 + 10 \text{ LOG}(P_o) \\ &= 50 + 10 \text{ LOG}(2.0) \\ &= 53.0 \end{aligned}$$

2 Watt Output Power Spurious Emissions at Antenna Results

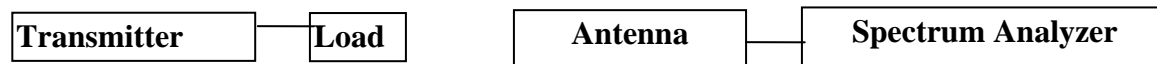
| Channel (MHz) | Spurious Freq. (MHz) | Measured (dBm) | Level Below Carrier (dB) |
|---------------|----------------------|----------------|--------------------------|
| 150.000 | 150.00 | 32.61 | 0 |
| | 300.00 | -30.51 | 63.1 |
| | 450.00 | -34.72 | 67.3 |
| | 600.00 | -35.44 | 68.1 |
| | 750.00 | -32.16 | 64.8 |
| | 900.00 | -34.88 | 67.5 |
| | 1050.00 | -34.44 | 67.1 |
| | 1200.00 | -36.01 | 68.6 |
| | 1350.00 | -35.34 | 68.0 |
| | 1500.00 | -35.81 | 68.4 |
| | | | |
| 155.025 | 155.025 | 33.00 | 0.0 |
| | 310.05 | -23.36 | 56.4 |
| | 465.08 | -34.45 | 67.5 |
| | 620.10 | -34.91 | 67.9 |
| | 775.13 | -32.13 | 65.1 |
| | 930.15 | -33.78 | 66.8 |
| | 1085.18 | -33.72 | 66.7 |
| | 1240.20 | -34.30 | 67.3 |
| | 1395.23 | -34.73 | 67.7 |
| | 1550.25 | -34.70 | 67.7 |
| | | | |
| 169.750 | 169.75 | 32.64 | 0.0 |
| | 339.50 | -24.22 | 56.9 |
| | 509.25 | -32.62 | 65.3 |
| | 679.00 | -34.17 | 66.8 |
| | 848.75 | -34.60 | 67.2 |
| | 1018.50 | -35.49 | 68.1 |
| | 1188.25 | -35.64 | 68.3 |
| | 1358.00 | -34.90 | 67.5 |
| | 1527.75 | -35.39 | 68.0 |
| | 1697.50 | -34.36 | 67.0 |
| | | | |

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 $50 + 10 \log(P_o)$ dB below fundamental.

2 watt transmitter

$$\begin{aligned} \text{Attenuation} &= 50 + 10 \log_{10}(P_w) \\ &= 50 + 10 \log_{10}(2) \\ &= 53.0 \text{ dB} \end{aligned}$$

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 2.0 watts of output power (33 dBm). Then the radiated spurious emission in dB is calculated from the following equation. Radiated spurious emission (dB) = RSE

$RSE = 10 \log_{10}[\text{Tx power(W)}/0.001] - \text{signal level required to reproduce observed level}$

Example: For 2 Watt output power

$$RSE = 10 \log_{10}[1.8/0.001] - (-54.53) = 87.1 \text{ dBc}$$

Channel frequency 150.000 MHz (1.8-Watt power) Radiated Spurious Emissions Results

| Frequency of Emission (MHz) | Amplitude of Spurious emission | | Signal level to dipole required to reproduce | | Emission level below carrier | | Limit dBc |
|--------------------------------|--------------------------------|------------------|--|-----------------|------------------------------|-----------------|--------------|
| | Horizontal dBμV | Vertical dBμV | Horizontal dBm | Vertical dBm | Horizontal dBc | Vertical dBc | |
| 300.0 | 57.8 | 56.1 | -54.53 | -56.23 | 87.1 | 88.9 | 53.0 |
| 450.0 | 38.4 | 57.0 | -70.03 | -51.43 | 102.7 | 84.1 | 53.0 |
| 600.0 | 66.9 | 70.1 | -39.13 | -35.93 | 71.8 | 68.6 | 53.0 |
| 750.0 | 66.0 | 70.5 | -38.53 | -34.03 | 71.2 | 66.7 | 53.0 |
| 900.0 | 64.9 | 74.3 | -38.13 | -28.73 | 70.8 | 61.4 | 53.0 |

Channel frequency 155.025 MHz (2.0-Watt power) Radiated Spurious Emissions Results

| Frequency of Emission (MHz) | Amplitude of Spurious emission | | Signal level to dipole required to reproduce | | Emission level below carrier | | Limit dBc |
|--------------------------------|--------------------------------|------------------|--|-----------------|------------------------------|-----------------|--------------|
| | Horizontal dBμV | Vertical dBμV | Horizontal dBm | Vertical dBm | Horizontal dBc | Vertical dBc | |
| 310.1 | 65.0 | 72.5 | -45.43 | -37.93 | 78.4 | 70.9 | 53.0 |
| 465.1 | 53.7 | 71.9 | -53.53 | -35.33 | 86.5 | 68.3 | 53.0 |
| 620.1 | 72.3 | 73.1 | -33.13 | -32.33 | 66.1 | 65.3 | 53.0 |
| 775.1 | 66.7 | 78.4 | -36.93 | -25.23 | 69.9 | 58.2 | 53.0 |
| 930.2 | 54.9 | 63.3 | -47.13 | -38.73 | 80.1 | 71.7 | 53.0 |

Channel frequency 174.00 MHz (1.8-Watt power) Radiated Spurious Emissions Results

| Frequency of Emission (MHz) | Amplitude of Spurious emission | | Signal level to dipole required to reproduce | | Emission level below carrier | | Limit dBc |
|--------------------------------|--------------------------------|------------------|--|-----------------|------------------------------|-----------------|--------------|
| | Horizontal dBμV | Vertical dBμV | Horizontal dBm | Vertical dBm | Horizontal dBc | Vertical dBc | |
| 348.0 | 58.3 | 60.2 | -51.93 | -50.03 | 84.6 | 82.7 | 53.0 |
| 522.0 | 65.8 | 73.2 | -40.83 | -33.43 | 73.5 | 66.1 | 53.0 |
| 696.0 | 67.6 | 73.9 | -36.93 | -30.63 | 69.6 | 63.3 | 53.0 |
| 870.0 | 67.3 | 75.1 | -35.53 | -27.73 | 68.2 | 60.4 | 53.0 |
| 1044.0 | 72.6 | 73.9 | -28.23 | -26.93 | 60.9 | 59.6 | 53.0 |

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

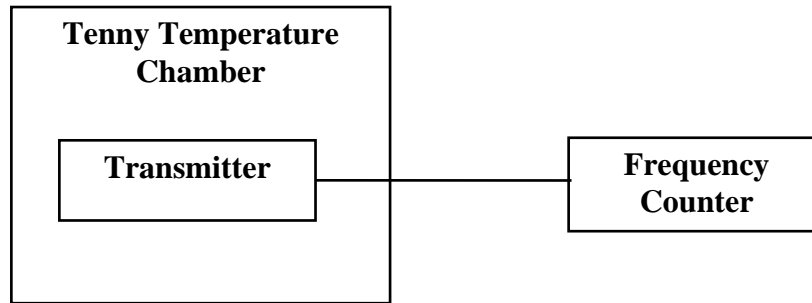
Measurements Required

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 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 3.14 Vdc to 4.25 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) 155.02498 | Frequency Stability Vs Temperature In Parts Per Million (Ppm) | | | | | | | | |
|---------------------------------|---|-------|-------|-------|-------|--------|--------|-------|-------|
| Temperature | -30 | -20 | -10 | 0 | 10 | 20 | 30 | 40 | 50 |
| Change(Hz) | 340.0 | 260.0 | 230.0 | 110.0 | 40.0 | -20.0 | -10.0 | 30.0 | 50.0 |
| PPM | 2.193 | 1.677 | 1.484 | 0.710 | 0.258 | -0.129 | -0.065 | 0.194 | 0.323 |

| Frequency 155.02498 MHz | Frequency Stability Vs Voltage Variation 3.7 volts nominal; Results In PPM Input Voltage | | |
|----------------------------|--|----------|----------|
| | 3.1.4 Vdc | 3.70 Vdc | 4.25 Vdc |
| Change (Hz) | 0.0 | 0.0 | 0.0 |

| Frequency 155.02498 MHz | Frequency Stability Vs Voltage Variation 3.7 volts nominal; Results In PPM Battery Endpoint Voltage 3.0 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.

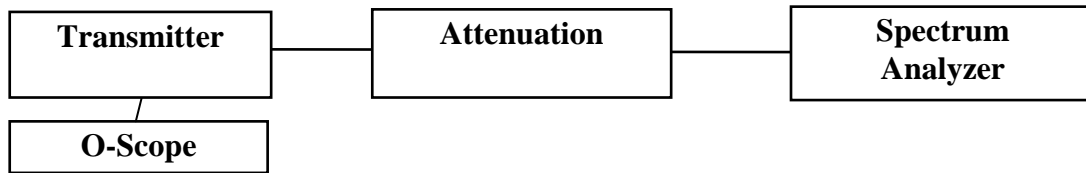
Minimum Standard

| 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

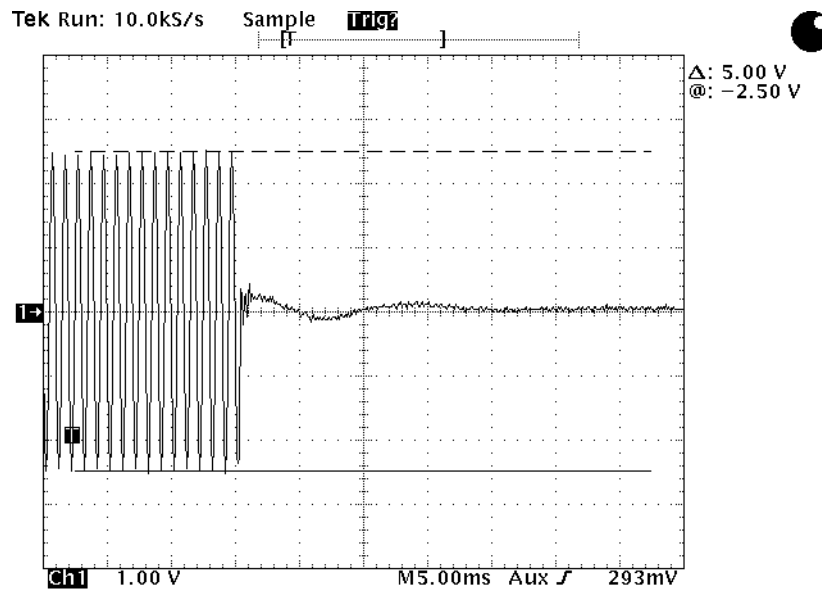


Figure fourteen Transient Behavior of Transmitter t1

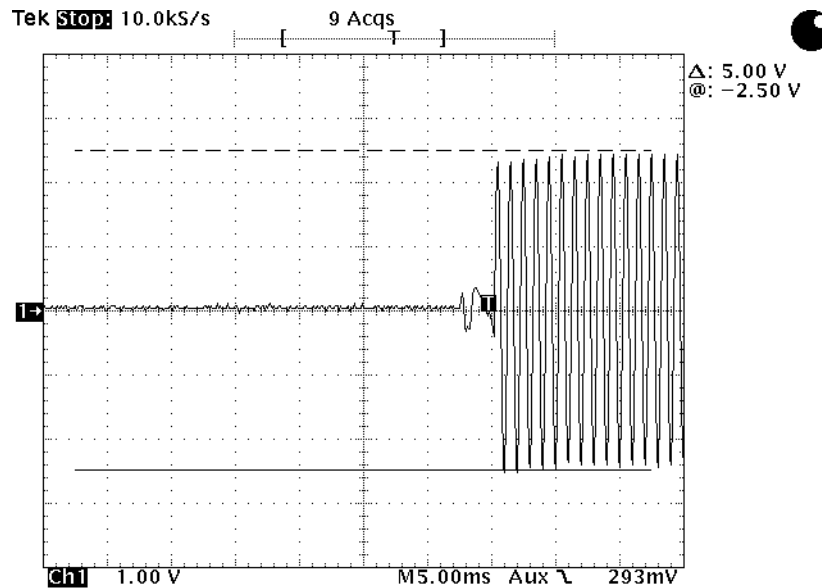


Figure fifteen Transient Behavior of Transmitter t3

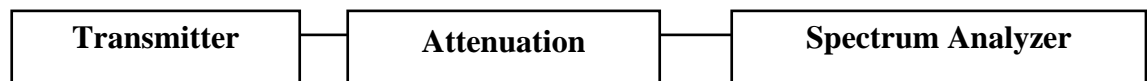
Specifications of Paragraph 90.214 are met. There are no deviations to the specifications.

Emissions Mask (90.210 and RSS-119 Mask “D”)

Measurements Required

Transmitters used in the LMRS governed by this part must comply with the emissions masks outlined in sections CFR47 90.210 D and RSS-119 D. Paragraph 90.210(D) 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.

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 through normal modes with maximum output power. The frequency spectrum at the band edges were observed and plots produced of the frequency spectrum. Figure sixteen and seventeen represent plots of emission mask compliance. Figure eighteen demonstrates compliance to adjacent channel power. Data was taken per 2.1051 and applicable parts of Part 90.210 (D) and RSS-119.

Emission Mask Results

The output of the unit was coupled to a HP Spectrum Analyzer and the frequency emissions were measured. On any frequency from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0 : Zero dB. On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of no more than 5.625 kHz but no more than 12.5 kHz: At least $7.27(f_d - 2.88 \text{ kHz})$ dB. On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10\log(P)$ dB or 70 dB, whichever is the lesser attenuation.

The following equation represents the calculated attenuation level for operation beyond 12.5 kHz from the authorized bandwidth.

$$\begin{aligned} 2.0 \text{ Watt} &= 50 + 10 \text{ LOG}(P_o) \\ &= 50 + 10 \text{ LOG}(2.0) \\ &= 53.0 \end{aligned}$$

There are no deviations to the specifications.

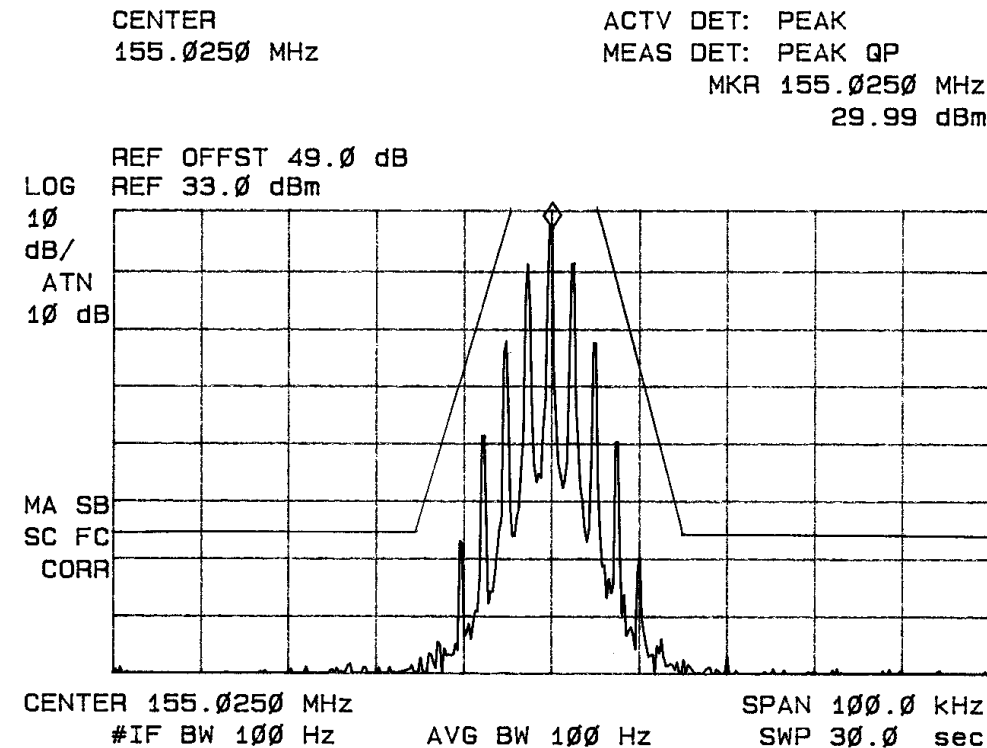


Figure sixteen Emissions Mask 100 kHz Span

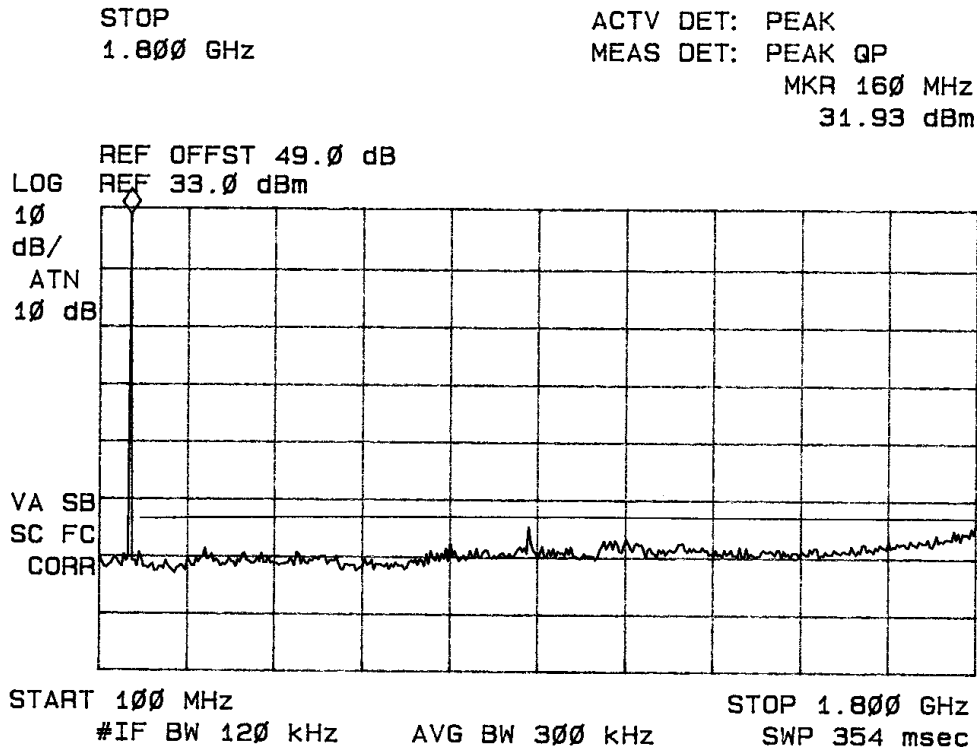


Figure seventeen Emissions Mask full Span

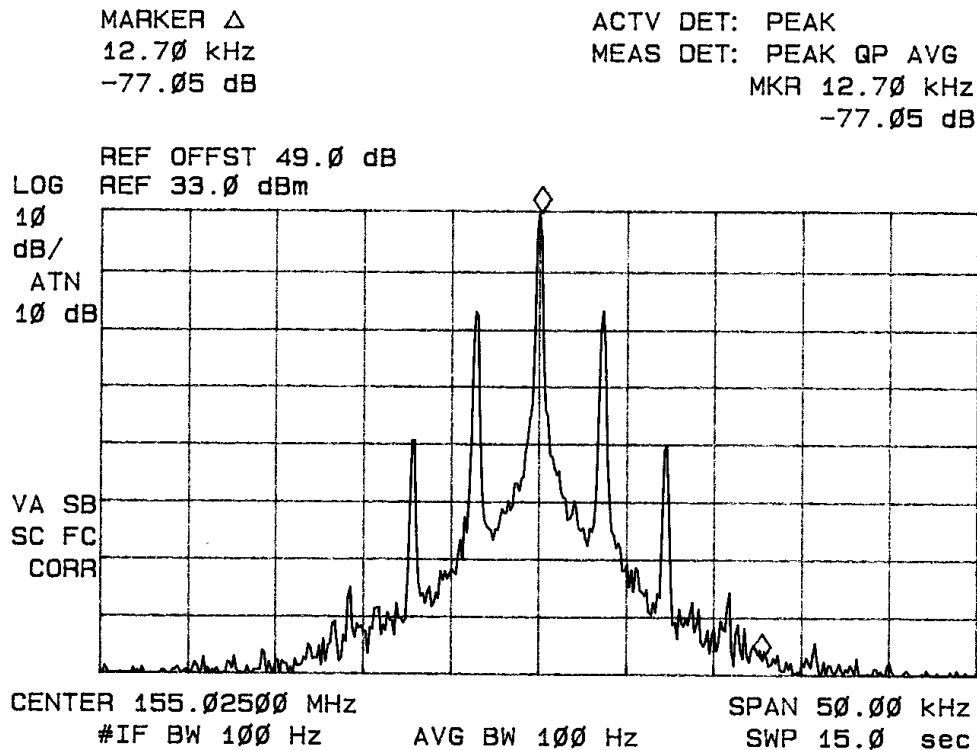


Figure eighteen Adjacent Channel Power

Annex

- Annex A Measurement Uncertainty Calculations
- Annex B Test Equipment List
- Annex C Rogers Qualifications
- Annex D FCC Site Registration Letter
- Annex E Industry Canada Registration 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 | 10/08 |
| Antenna: Antenna Research Biconical Model: BCD 235 | 10/08 |
| 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 μ Hy/50 ohm/0.1 μ f | 10/08 |
| 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 |



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. 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



NVLAP Lab Code 200087-0

Annex D FCC Site Approval Letter

FEDERAL COMMUNICATIONS COMMISSION

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

June 18, 2008

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: June 18, 2008

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
Industry Analyst

Rogers Labs, Inc.
4405 W. 259th Terrace
Louisburg, KS 66053
Phone/Fax: (913) 837-3214
Revision 2

Tekk International, Inc.
Model: XV-100 SN: #2
Test #: 081118
Test to: CFR47 90 and IC RSS-119
File: Tekk XV100 TstRpt LMRS

FCC ID#: U59XV-100
IC: 7555A-XV100
Page 35 of 36
Date: December 18, 2008

Annex E Industry Canada Site Approval Letter



July 29th, 2008

OUR FILE: 46405-3041
Submission No: 127059

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

Attention: Scot D. Rogers

Dear Sir/Madame:

The Bureau has received your application for the registration / renewal of a 3/10m OATS. Be advised that the information received was satisfactory to Industry Canada. The following number(s) is now associated to the site(s) for which registration / renewal was sought (**3040A-1**). Please reference the appropriate site number in the body of test reports containing measurements performed on the site. In addition, please be informed that the Bureau is now utilizing a **new site numbering scheme** in order to simplify the electronic filing process. Our goal is to reduce the number of secondary codes associated to one particular company. The following changes have been made to your records.

Your primary code is: **3041**

The company number associated to the site(s) located at the above address is: **3041A**

The table below is a summary of the changes made to the unique site registration number(s):

| New Site Number | Obsolete Site Number | Description of Site | Expiry Date (YYYY-MM-DD) |
|-----------------|----------------------|---------------------|--------------------------|
| 3041A-1 | 3041-1 | 3 / 10m OATS | 2010-07-29 |

Furthermore, to obtain or renew a unique site number, the applicant shall demonstrate that the site has been accredited to ANSI C63.4-2003 or later. A scope of accreditation indicating the accreditation by a recognized accreditation body to ANSI C63.4-2003 shall be accepted. Please indicate in a letter the previous assigned site number if applicable and the type of site (example: 3 meter OATS or 3 meter chamber). If the test facility is not accredited to ANSI C63.4-2003 or later, the test facility shall submit test data demonstrating full compliance with the ANSI standard. The Bureau 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. There is no fee or form associated with an OATS filing. OATS submissions are encouraged to be submitted electronically to the Bureau using the following URL;

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

Yours sincerely,



S. Proulx Wireless Laboratory
Manager Certification and
Engineering Bureau Industry Canada
3701 Carling Ave., Building 94
Ottawa, Ontario K2H 8S2
Canada

