Washington Laboratories, Ltd.

FCC Certification Test Report
for the
MSA
Firehawk M7 RFID

FCC ID: P9R-10078565

WLL JOB# **9850**
March 31, 2008

Prepared for:

MSA
P.O. Box 426
Pittsburgh, PA, 15230 USA

Prepared By:

Washington Laboratories, Ltd.
7560 Lindbergh Drive
Gaithersburg, Maryland 20879

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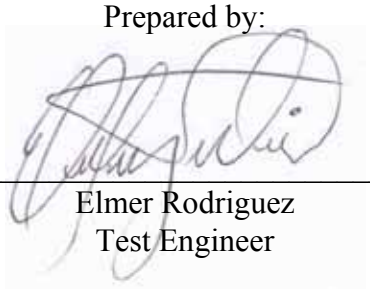
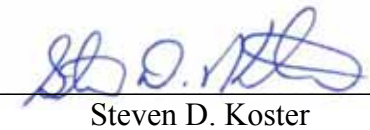


Elmer Rodriguez
Test Engineer

Reviewed by:



Steven D. Koster
EMC Operations Manager

Abstract

This report has been prepared on behalf of MSA to support the attached Application for Equipment Authorization. The test report and application are submitted for an Intentional Radiator under Part 15.225 of the FCC Rules and Regulations. This Certification Test Report documents the test configuration and test results for a MSA Firehawk M7 RFID. MSA is applying for a Limited Modular Approval for this unit. The module was tested in two devices for this report.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

The MSA Firehawk M7 RFID complies with the limits for an Intentional Radiator device under FCC Part 15.225.

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1 Introduction

1.1 Compliance Statement

The MSA Firehawk M7 RFID module complies with the limits for an Intentional Radiator device under FCC Part 15.225. The unit was tested for limited modular approval it two different devices. One was the Tag reader/writer, and the other was installed in the SCBA equipment.

1.2 Test Scope

Tests for radiated and conducted emissions were performed. All measurements were performed in accordance with the 2003 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	MSA P.O. Box 426 Pittsburgh, PA, 15230 USA
Purchase Order Number:	4500771334
Quotation Number:	63621A

1.4 Test Dates

Testing was performed on the following date(s):	December 20, 2007 - January 23, 2008

1.5 Test and Support Personnel

Washington Laboratories, LTD	Elmer Rodriguez
Client Representative	Greg Imblum

1.6 Abbreviations

A	**A**mpere
ac	**a**lternating **c**urrent
AM	Amplitude Modulation
Amps	**Amp**eres
b/s	**b**its per **s**econd
BW	**B**and**w**idth
CE	**C**onducted **E**mission
cm	**C**enti**m**eter
CW	**C**ontinuous **W**ave
dB	**D**eci**b**el
dc	**d**irect **c**urrent
EMI	**E**lectro**m**agnetic **I**nterference
EUT	**E**quipment **U**nder **T**est
FM	**F**requency **M**odulation
G	**g**iga - prefix for 10^9 multiplier
Hz	**H**ertz
IF	**I**ntermediate **F**requency
k	**k**ilo - prefix for 10^3 multiplier
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
M	**M**ega - prefix for 10^6 multiplier
m	**M**eter
µ	**m**icro - prefix for 10^{-6} multiplier
NB	**N**arrow**b**and
QP	**Q**uasi-**P**eak
RE	**R**adiated **E**missions
RF	**R**adio **F**requency
rms	**r**oot-**m**ean-**s**quare
SN	**S**erial **N**umber
S/A	**S**pectrum **A**nalyzer
V	**V**olt

2 Equipment Under Test

2.1 EUT Identification & Description

The MSA Firehawk M7 RFID is an Integrated Control Module (ICM) to be used for Fire Fighting Applications.

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	MSA
FCC ID:	P9R-10078565
Model:	Firehawk M7 with RFID
FCC Rule Parts:	§15.225
Frequency Range:	13.56MHz
Maximum Output Power:	278.8 µV/m at 10 meters
Modulation:	None
Occupied Bandwidth:	1.822 kHz
Type of Information:	Data
Number of Channels:	1
Power Output Level	Fixed
Antenna Type	Internal PCB
Frequency Tolerance:	>±0.01% (±100 ppm)
Interface Cables:	Power
Power Source & Voltage:	Four C-cell batteries/ 120 VAC

2.2 Test Configuration

The Firehawk M7 RFID was configured for testing as indicated in the figure below.

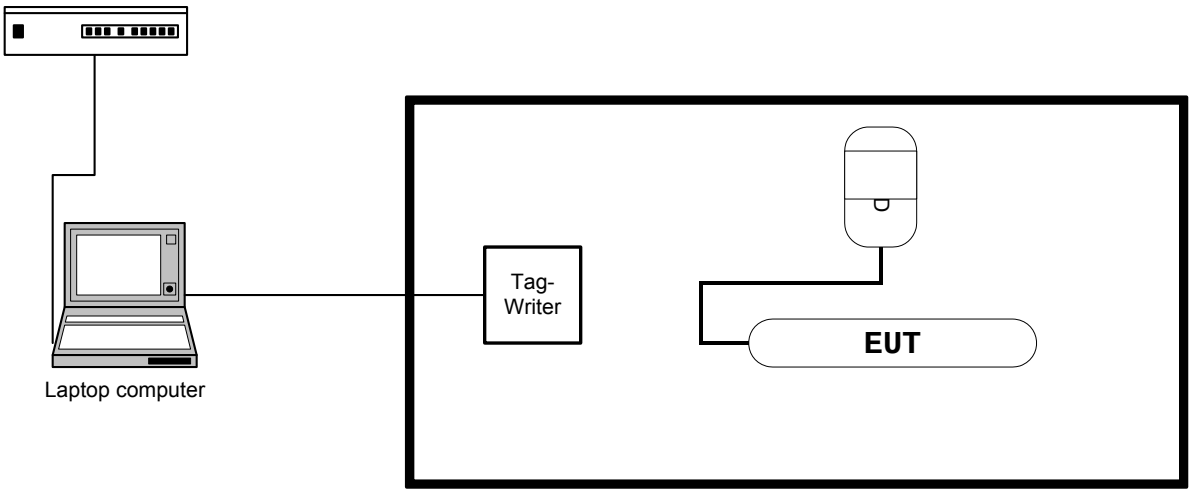

Figure 1: Test Configuration

2.3 Testing Algorithm

The Reader operates at 13.56MHz.

Functionality:

The Reader checks for the presence of an RF tag in its field.

Worst case emission levels are provided in the test results data.

2.4 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

2.5 Measurements

2.5.1 References

ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation

ANSI C63.4 American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

2.6 Measurement Uncertainty

All results reported herein relate only to the equipment tested. For the purposes of the measurements performed by Washington Laboratories, the measurement uncertainty is ±2.3 dB. This has been calculated for a *worst-case situation* (radiated emissions measurements performed on an open area test site).

The following measurement uncertainty calculation is provided:

$$\text{Total Uncertainty} = (A^2 + B^2 + C^2)^{1/2} / (n-1)$$

Where:

A = Antenna calibration uncertainty, in dB = 2 dB

B = Spectrum Analyzer uncertainty, in dB = 1 dB

C = Site uncertainty, in dB = 4 dB

n = number of factors in uncertainty calculation = 3

Thus, Total Uncertainty = $0.5\ (2^2 + 1^2 + 4^2)^{1/2} = \pm 2.3$ dB.

3 Test Equipment

Table 2 shows a list of the test equipment used for measurements along with the calibration information.

Table 2: Test Equipment List

Test Name: **RFFCC**		Test Date: **1/16/2008**	
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
00069	HP, 85650A	ADAPTER, QP	07/06/2008
00073	HP, 8568B	ANALYZER, SPECTRUM	07/06/2008
00071	HP, 85685A	PRESELECTOR, RF	07/06/2008
00125	SOLAR, 8028-50-TS-24-BNC	LISN	02/01/2008
00126	SOLAR, 8028-50-TS-24-BNC	LISN	02/01/2008
00007	ARA, LPB-2520	ANTENNA, BICONILOG ANTENNA	06/07/2008
00254	TENNEY, TR64	ENVIRONMENTAL CHAMBER	12/20/2008
00031	EMCO, 6502	ANTENNA, ACTIVE LOOP	2/12/2008
00117	RACAL DANA	COUNTER, FREQUENCY	5/8/2008
00474	HP, 8563E	ANALYZER, SPECTRUM	9/7/2008
00594	TEKTRONIC, P6139A	PROBE	Cal in Test
00642	HQ POWER	0-50V 5AMP DC SUPPLY	CNR

4 Test Results

4.1 Occupied Bandwidth

Occupied bandwidth measurement was performed by coupling the output of the EUT to the input of a spectrum analyzer.

The occupied bandwidth was measured as shown:

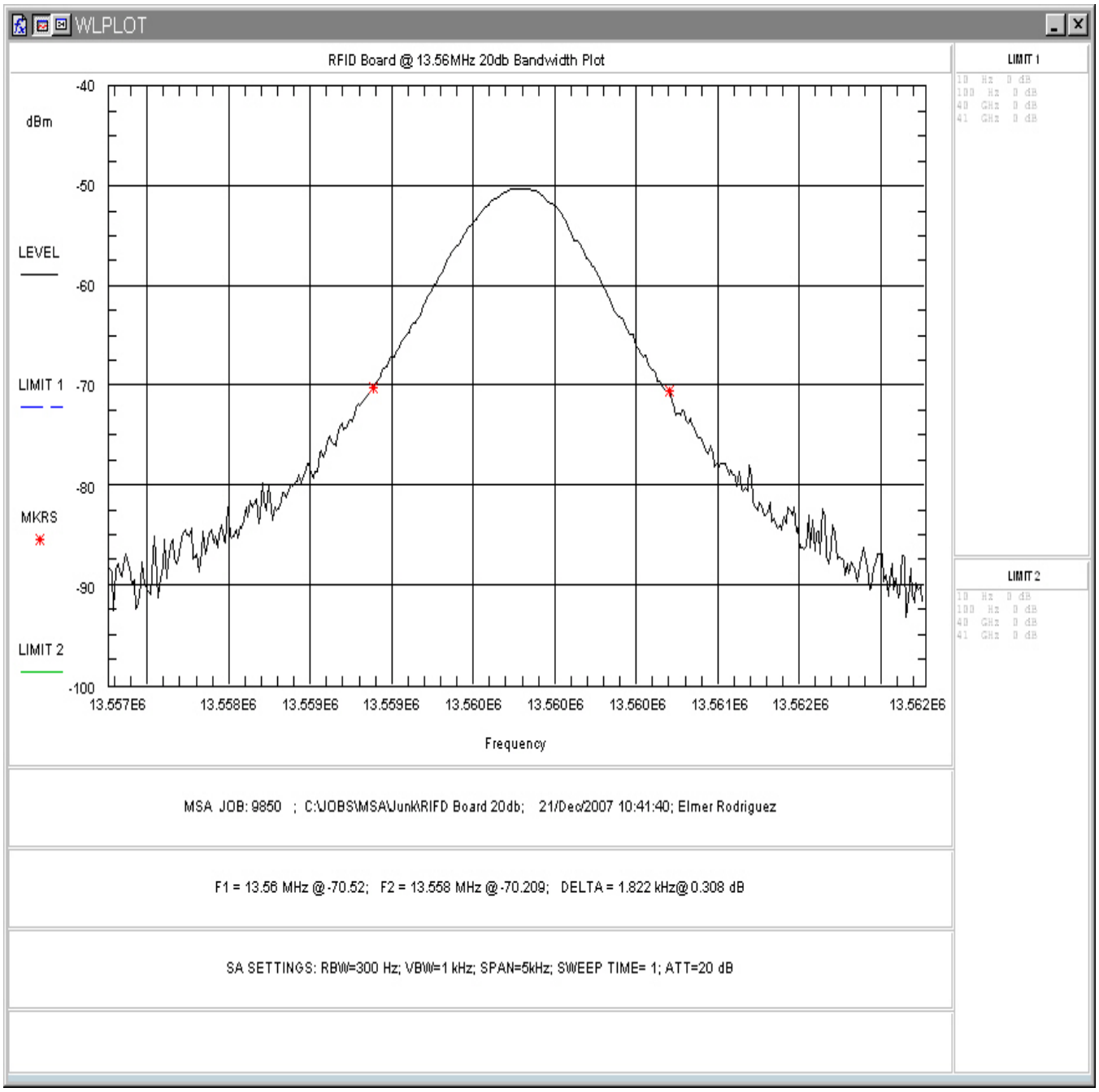

Figure 2. 20dB Occupied Bandwidth

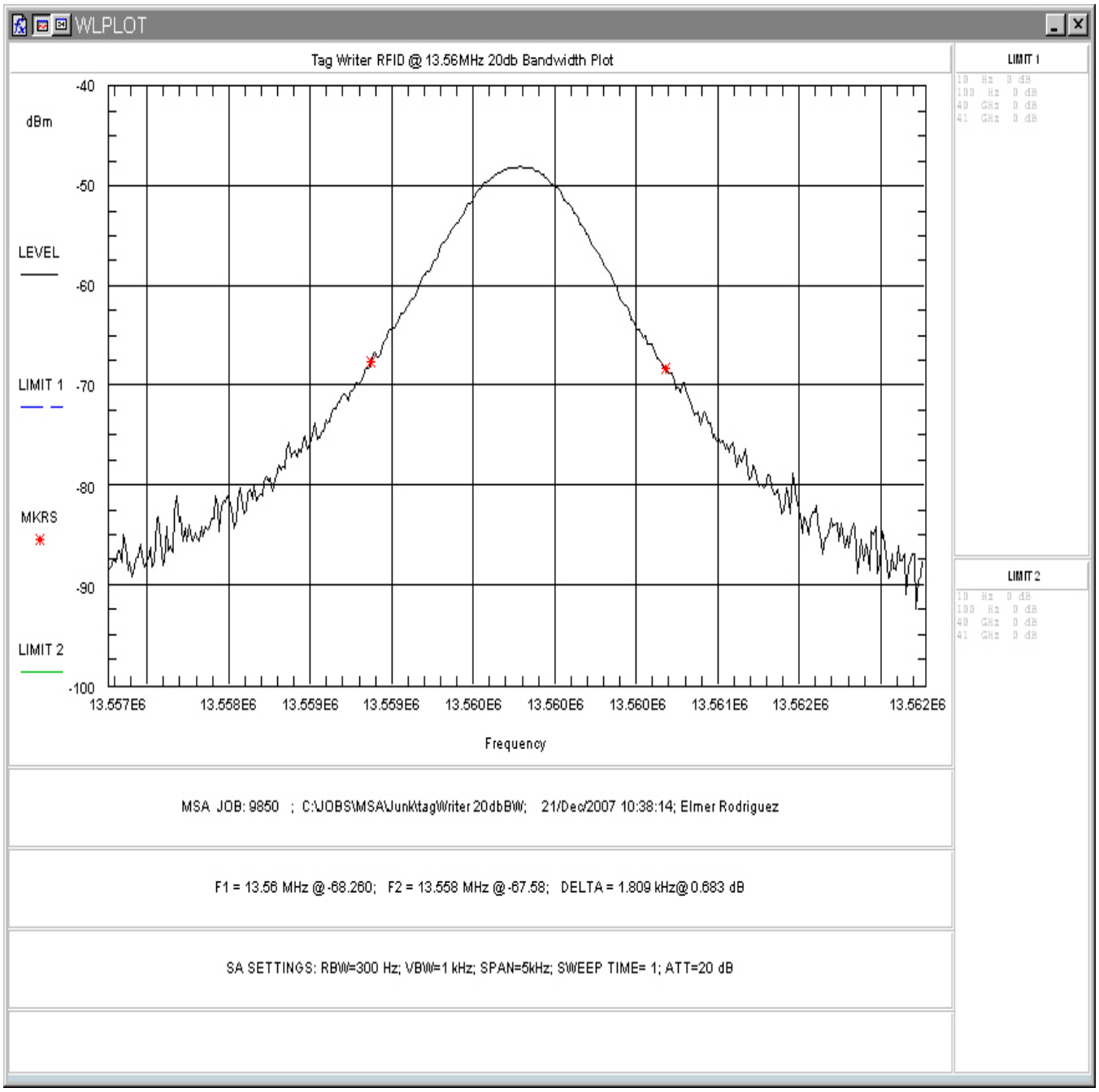

Figure 3. 20dB Occupied Bandwidth

Table 3 provides a summary of the Occupied Bandwidth Results.

Table 3: Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
13.560MHz	(20dB)1.822 kHz	N/A	Pass
13.560MHz	(20dB)1.809 kHz	N/A	Pass

4.2 Radiated Spurious Emissions: §15.225, §15.209

Radiated emissions from the EUT must comply with the field strength limits as specified in FCC Part 15.225 and 15.209. The limits for the radiated emissions are as shown in the following table.

Table 4: Radiated Spurious Emissions Limits

Frequency (MHz)	Limit (µV/m)	Rule Part Reference
13.553 - 13.567	15,848 (@ 30m)	§15.225(a)
13.410 – 13.553	334 (@ 30m)	§15.225(b)
13.567 – 13.710	334 (@ 30m)	§15.225(b)
13.110 – 13.410	106 (@ 30m)	§15.225(c)
13.710 – 14.010	106 (@ 30m)	§15.225(c)
1.705 – 13.110 14.010 – 30.0	30 (@ 30m)	§15.225(d), §15.209
30.00 – 88.00	100 (@ 3m)	§15.225(d), §15.209
88.00 – 216.00	150 (@ 3m)	§15.225(d), §15.209
216.00 – 960.00	200 (@ 3m)	§15.225(d), §15.209
Above 960	500 (@ 3m)	§15.225(d), §15.209

4.2.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on an Open Area Test Site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The peripherals were placed on the table in accordance with ANSI C63.4-2003. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured

Testing at frequencies below 30 MHz was performed at ten meters with a loop antenna. The 30 meter limits were normalized to 10m. Three orientations of the loop antenna were tested.

Emissions were scanned up to 1 GHz. Only the fundamental frequency was detected. No other emissions were detected that were related to the RFID Transmitter. All other emissions detected were related to digital emissions of the IUS electronics. Since the EUT is used in a commercial application, these digital emissions were compared to the Class A limit of §15.109(b). For emissions up to 30 MHz peak levels were recorded. Emissions from 30 MHz to 1000 MHz were measured using a Quasi-peak detector. Worst-case emissions are reported in the data table.

The following is a sample calculation used in the data tables for calculating the final field strength of spurious emissions and comparing these levels to the specified limits.

Sample Calculation:

Spectrum Analyzer Voltage (SA Level): VdBµV

Antenna Factor (Ant Corr): AFdB/m

Cable Loss Correction (Cable Corr): CCdB

Amplifier Gain: GdB (if applicable)

Electric Field (Corr Level): EdBµV/m = VdBµV + AFdB/m + CCdB - GdB

To convert to linear units: Eµ V/m = antilog (EdBµV/m/20)

4.2.2 Test Results

The EUT complies with the radiated emission requirements of §15.225.

Table 5: Radiated Emission Test Data, Fundamental Frequency

Frequency (MHz)	Polarity H/V	Antenna Degree	Ant. Height (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)	Notes
13.560	X	90.0	1.0	37.5	10.5	1.1	49.1	285.3	142636.0	-54.0	Face-up
27.119	X	90.0	1.0	10.0	8.8	1.2	20.0	10.0	270.0	-28.7	Face-up
13.559	Y	180.0	1.0	33.7	10.5	1.1	45.3	184.2	142636.0	-57.8	Face-up
27.119	Y	180.0	1.0	9.2	8.8	1.2	19.2	9.1	270.0	-29.5	Face-up
13.560	Z	0.0	1.0	39.9	10.5	1.1	51.5	376.1	142636.0	-51.6	Face-up
27.119	Z	0.0	1.0	8.3	8.8	1.2	18.3	8.2	270.0	-30.4	Face-up
13.560	X	90.0	1.0	37.3	10.5	1.1	48.9	278.8	142636.0	-54.2	Up-right
27.119	X	90.0	1.0	8.6	8.8	1.2	18.6	8.5	270.0	-30.1	Up-right
13.559	Y	141.0	1.0	33.7	10.5	1.1	45.3	184.2	142636.0	-57.8	Up-right
27.119	Y	141.0	1.0	9.1	8.8	1.2	19.1	9.0	270.0	-29.6	Up-right
13.560	Z	0.0	1.0	39.2	10.5	1.1	50.8	347.0	142636.0	-52.3	Up-right
27.119	Z	0.0	1.0	11.1	8.8	1.2	21.1	11.3	270.0	-27.6	Up-right
13.560	X	180.0	1.0	37.3	10.5	1.1	48.9	278.8	142636.0	-54.2	Side
27.119	X	180.0	1.0	9.2	8.8	1.2	19.2	9.1	270.0	-29.5	Side
13.559	Y	90.0	1.0	39.7	10.5	1.1	51.3	367.5	142636.0	-51.8	Side
27.119	Y	90.0	1.0	9.3	8.8	1.2	19.3	9.2	270.0	-29.4	Side
13.560	Z	40.0	1.0	39.5	10.5	1.1	51.1	359.2	142636.0	-52.0	Side
27.119	Z	40.0	1.0	9.1	8.8	1.2	19.1	9.0	270.0	-29.6	Side

Notes: 30m limit normalized to 10m

0 degree azimuth; antenna height = one (1) meter

Table 6: Radiated Emission Test Data

X - Coordinate

Frequency (MHz)	Polarity H/V	Antenna Degree	Ant. Height (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
43.540	V	44.0	1.6	6.9	11.5	1.0	19.5	9.4	100.0	-20.5
84.159	V	71.0	1.5	9.0	7.8	1.1	17.9	7.9	100.0	-22.1
111.230	V	106.0	1.5	4.5	13.0	1.2	18.7	8.6	150.0	-24.8
165.397	V	20.0	1.6	1.5	11.9	1.2	14.6	5.4	150.0	-28.9
192.216	V	212.0	1.8	6.7	11.4	1.2	19.4	9.3	150.0	-24.2
267.540	V	186.0	1.7	5.6	12.8	1.3	19.7	9.6	200.0	-26.4
339.027	V	124.0	1.7	11.7	14.1	1.5	27.3	23.3	200.0	-18.7
352.581	V	113.0	1.6	9.0	14.4	1.6	24.9	17.6	200.0	-21.1
406.825	V	339.0	1.7	6.0	15.8	1.8	23.6	15.1	200.0	-22.5
433.951	V	135.0	1.6	4.0	16.5	1.9	22.5	13.3	200.0	-23.6
488.182	V	334.0	17.0	7.3	17.7	2.1	27.1	22.5	200.0	-19.0
515.290	V	181.0	1.5	14.9	17.9	2.2	35.0	56.1	200.0	-11.0
528.870	V	319.0	1.1	10.3	18.0	2.2	30.6	33.8	200.0	-15.5
583.098	V	36.0	1.0	7.0	18.6	2.4	28.0	25.2	200.0	-18.0
610.226	V	280.0	1.0	11.3	18.9	2.5	32.6	42.9	200.0	-13.4
637.327	V	5.0	1.0	9.2	19.6	2.5	31.3	36.9	200.0	-14.7
894.727	V	355.0	1.5	12.1	22.6	3.8	38.5	84.1	200.0	-7.5
122.070	H	219.0	3.5	5.7	13.9	1.2	20.7	10.9	150.0	-22.8
135.630	H	79.0	3.0	8.4	13.3	1.2	22.9	14.0	150.0	-20.6
162.750	H	345.0	3.1	12.6	12.1	1.2	25.9	19.7	150.0	-17.6
189.868	H	173.0	2.9	24.9	11.2	1.2	37.3	73.6	150.0	-6.2
203.428	H	159.0	2.8	15.0	12.0	1.2	28.3	25.9	150.0	-15.2
216.988	H	266.0	3.0	18.5	11.4	1.3	31.1	36.0	200.0	-14.9
244.108	H	58.0	3.3	11.4	11.4	1.3	24.1	16.0	200.0	-22.0
298.348	H	160.0	3.5	7.3	13.3	1.3	21.9	12.4	200.0	-24.1
311.903	H	25.0	3.4	10.4	13.6	1.4	25.4	18.5	200.0	-20.7
325.464	H	350.0	3.5	7.8	13.9	1.4	23.1	14.4	200.0	-22.9
339.000	H	54.0	3.5	9.5	14.1	1.5	25.1	18.1	200.0	-20.9
420.387	H	358.0	3.0	4.7	16.2	1.9	22.8	13.8	200.0	-23.2
515.306	H	320.0	3.1	13.4	17.9	2.2	33.5	47.2	200.0	-12.5

Y - Coordinate

Frequency (MHz)	Polarity H/V	Antenna Degree	Ant. Height (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
40.678	V	201.0	1.6	13.5	13.2	1.0	27.7	24.3	100.0	-12.3
108.478	V	246.0	1.5	6.3	12.5	1.2	20.0	10.0	150.0	-23.5
122.080	V	156.0	2.0	6.1	13.9	1.2	21.1	11.4	150.0	-22.4
135.630	V	163.0	2.0	6.6	13.3	1.2	21.1	11.3	150.0	-22.4
162.755	V	335.0	1.6	6.7	12.1	1.2	20.0	10.0	150.0	-23.5
189.850	V	66.0	1.7	21.2	11.2	1.2	33.6	48.1	150.0	-9.9
203.430	V	138.0	1.8	13.0	12.0	1.2	26.3	20.6	150.0	-17.2
216.990	V	344.0	1.4	17.4	11.4	1.3	30.0	31.7	200.0	-16.0
244.096	V	215.0	1.5	12.1	11.4	1.3	24.8	17.3	200.0	-21.3
257.660	V	106.0	1.5	9.5	12.1	1.3	22.9	13.9	200.0	-23.2
298.338	V	191.0	1.5	8.2	13.3	1.3	22.8	13.8	200.0	-23.2
325.460	V	93.0	1.6	6.8	13.9	1.4	22.1	12.8	200.0	-23.9
339.020	V	205.0	1.6	9.5	14.1	1.5	25.1	18.1	200.0	-20.9
40.706	H	123.0	3.0	4.4	13.2	1.0	18.6	8.5	100.0	-21.4
108.506	H	227.0	3.5	8.3	12.5	1.2	22.0	12.6	150.0	-21.5
122.070	H	87.0	3.5	9.3	13.9	1.2	24.3	16.5	150.0	-19.2
135.630	H	350.0	3.0	13.1	13.3	1.2	27.6	24.0	150.0	-15.9
162.750	H	325.0	3.3	15.6	12.1	1.2	28.9	27.8	150.0	-14.6
189.868	H	171.0	3.3	23.3	11.2	1.2	35.7	61.2	150.0	-7.8
203.428	H	181.0	3.2	15.9	12.0	1.2	29.2	28.8	150.0	-14.3
216.988	H	20.0	3.2	21.4	11.4	1.3	34.0	50.3	200.0	-12.0
244.108	H	65.0	3.1	15.4	11.4	1.3	28.1	25.3	200.0	-18.0
298.348	H	128.0	3.2	6.4	13.3	1.3	21.0	11.2	200.0	-25.0
311.903	H	218.0	3.2	6.9	13.6	1.4	21.9	12.4	200.0	-24.2
325.464	H	254.0	3.4	8.0	13.9	1.4	23.3	14.7	200.0	-22.7

Z - Coordinate

Frequency (MHz)	Polarity H/V	Antenna Degree	Ant. Height (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
40.678	V	331.0	1.6	15.1	13.2	1.0	29.3	29.3	100.0	-10.7
108.478	V	47.0	1.5	6.7	12.5	1.2	20.4	10.5	150.0	-23.1
122.080	V	276.0	1.8	3.9	13.9	1.2	18.9	8.9	150.0	-24.6
135.630	V	222.0	1.9	8.5	13.3	1.2	23.0	14.1	150.0	-20.5
189.856	V	290.0	1.5	17.6	11.2	1.2	30.0	31.8	150.0	-13.5
203.440	V	148.0	1.5	14.3	12.0	1.2	27.6	23.9	150.0	-15.9
217.000	V	282.0	1.7	20.6	11.4	1.3	33.2	45.8	200.0	-12.8
230.560	V	276.0	1.6	16.7	11.1	1.3	29.1	28.4	200.0	-16.9
244.096	V	348.0	1.8	17.1	11.4	1.3	29.8	30.8	200.0	-16.3
257.660	V	296.0	1.7	14.6	12.1	1.3	28.0	25.0	200.0	-18.1
298.338	V	253.0	1.6	7.3	13.3	1.3	21.9	12.4	200.0	-24.1
325.460	V	260.0	1.7	10.3	13.9	1.4	25.6	19.1	200.0	-20.4
339.020	V	205.0	1.6	12.6	14.1	1.5	28.2	25.8	200.0	-17.8
40.706	H	6.0	3.9	5.2	13.2	1.0	19.4	9.3	100.0	-20.6
108.506	H	46.0	3.0	12.8	12.5	1.2	26.5	21.2	150.0	-17.0
122.070	H	73.0	3.5	11.9	13.9	1.2	26.9	22.2	150.0	-16.6
135.630	H	82.0	3.2	15.3	13.3	1.2	29.8	30.9	150.0	-13.7
162.750	H	312.0	3.3	15.5	12.1	1.2	28.8	27.5	150.0	-14.7
189.868	H	324.0	3.1	23.4	11.2	1.2	35.8	61.9	150.0	-7.7
203.428	H	240.0	3.2	20.8	12.0	1.2	34.1	50.6	150.0	-9.4
216.988	H	41.0	3.2	25.2	11.4	1.3	37.8	77.9	200.0	-8.2
244.108	H	263.0	3.0	17.7	11.4	1.3	30.4	33.0	200.0	-15.7
298.348	H	263.0	2.4	9.1	13.3	1.3	23.7	15.3	200.0	-22.3
311.903	H	198.0	3.0	14.8	13.6	1.4	29.8	30.7	200.0	-16.3
325.464	H	254.0	3.4	11.9	13.9	1.4	27.2	23.0	200.0	-18.8

Notes:

Clocks: Fundamental Frequency 13.56MHz.

4.3 Frequency Stability: (FCC Part §2.1055)

Frequency as a function of temperature and voltage variation shall be maintained within the FCC-prescribed tolerances. Per §15.225(e) the frequency tolerance shall be maintained within ±0.01% of the reference frequency.

4.3.1 Test Procedure

The temperature stability was measured with the unit in an environmental chamber used to vary the temperature of the sample. The sample was held at each temperature step to allow the temperature of the sample to stabilize.

The frequency stability of the transmitter was examined at the voltage extremes and for the temperature range of -30°C to +50°C. The carrier frequency was measured while the EUT was in the temperature chamber. The reference frequency of the EUT was measured at the ambient room temperature with the frequency counter.

The frequency stabilities can be maintained to a lesser temperature range provided that the transmitter is automatically inhibited from operating outside the lesser temperature range.

The RF carrier frequency shall not depart from the reference frequency (reference frequency is the frequency at 20ºC and rated supply voltage) in excess of +/-1356 Hz.

The EUT is powered by four (4) C-cell batteries.

4.3.2 Test Results

The EUT complies with the temperature stability requirements of FCC §15.225(e). Test results are given in Table 7.

Table 7: Frequency Stability Test Data

Temperature (Centigrade)	Frequency (MHz)	Difference (Hz)	Deviation (%)
Ambient (22.5)	13.559815	0.0	0
-30	13.559882	67.0	0.000494
-20	13.559876	61.0	0.000450
-10	13.559900	85.0	0.000627
0	13.559908	93.0	0.000686
10	13.559890	75.0	0.000553
20	13.559868	53.0	0.000391
30	13.559836	21.0	0.000155
40	13.559807	-8.0	0.000059
50	13.559775	-40.0	0.000295

Voltage (Volts)	Frequency (MHz)	Difference (Hz)	Deviation (%)	Voltage (Volts)
At rated	13.559857	0	0.0	6.00
At 85%	13.559858	-1	0.000007	5.10
At 115%	13.559854	3	0.000022	6.90

Card - Reader

Temperature (Centigrade)	Frequency (MHz)	Difference (Hz)	Deviation (%)
Ambient (22.5)	13.559851	0.0	0
-30	13.559853	2.0	0.000015
-20	13.559920	69.0	0.000509
-10	13.559909	58.0	0.000428
0	13.559934	83.0	0.000612
10	13.559917	66.0	0.000487
20	13.559876	25.0	0.000184
30	13.559851	0.0	0.000000
40	13.559817	-34.0	0.000251
50	13.559784	-67.0	0.000494

4.4 Conducted Emissions (AC Power Line)

The EUT was placed on an 80 cm high 1 x 1.5 m non-conductive table above a ground plane. Power to the EUT was provided through a Solar Corporation 50 Ω/50 µH Line Impedance Stabilization Network bonded to a 3 x 2 meter ground plane. The LISN has its AC input supplied from a filtered AC power source. Power and data cables were moved about to obtain maximum emissions.

The 50 Ω output of the LISN was connected to the input of the spectrum analyzer and the emissions in the frequency range of 150 kHz to 30 MHz were measured. The detector function was set to quasi-peak or peak, as appropriate, and the resolution bandwidth during testing was at least 9 kHz, with all post-detector filtering no less than 10 times the resolution bandwidth.

The unit was tested with the antenna terminated.

AC Power Line conducted emissions test data are included in Table 8.

Table 8: AC Power Conducted Emissions Test Data

LINE 1 - NEUTRAL

Frequency (MHz)	Level QP (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Limit QP (dBµV)	Level Corr (dBµV)	Level AVG (dBµV)	Cable Loss (dB)	Level Corr (dBµV)	Limit AVG (dBµV)	Margin AVG (dB)	Margin QP (dB)
0.150	50.8	10.0	0.8	66.0	61.6	36.8	10.0	47.6	56.0	-8.4	-4.4
0.866	39.0	10.5	0.2	56.0	49.7	18.6	10.5	29.3	46.0	-16.7	-6.3
1.340	31.3	10.6	0.2	56.0	42.1	15.5	10.6	26.3	46.0	-19.7	-13.9
7.523	14.3	11.1	1.0	60.0	26.4	3.6	11.1	15.7	50.0	-34.3	-33.6
13.559	19.3	11.8	2.0	60.0	33.1	13.8	11.8	27.6	50.0	-22.4	-26.9
20.717	12.8	12.6	3.3	60.0	28.7	1.7	12.6	17.6	50.0	-32.4	-31.3

LINE 2 - PHASE

Frequency (MHz)	Level QP (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Limit QP (dBµV)	Level Corr (dBµV)	Level AVG (dBµV)	Cable Loss (dB)	Level Corr (dBµV)	Limit AVG (dBµV)	Margin AVG (dB)	Margin QP (dB)
0.206	41.6	10.1	0.3	63.4	52.0	21.2	10.1	31.6	53.4	-21.8	-11.4
0.862	34.2	10.5	0.2	56.0	44.9	18.9	10.5	29.6	46.0	-16.4	-11.2
1.340	24.9	10.6	0.3	56.0	35.7	12.0	10.6	22.9	46.0	-23.1	-20.3
7.523	14.1	11.1	1.4	60.0	26.6	3.7	11.1	16.2	50.0	-33.8	-33.4
13.559	19.2	11.8	2.7	60.0	33.6	10.9	11.8	25.4	50.0	-24.6	-26.4
20.140	12.9	12.6	4.1	60.0	29.6	1.7	12.6	18.4	50.0	-31.6	-30.4