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FCC Certification Test Report

FCCID: ZQ3-SPS-SPROX

STRATA PROXIMITY SYSTEMS

SURFACE PROXIMITY MODULE

Models IA and MA

WLL REPORT# **12031-01 Rev 0**
October 20, 2011

Prepared for:

Strata Proximity Systems
1769 Jeff Road
Huntsville, AL 35806

Prepared By:

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

ACCLASS ACCREDITED TESTING

Testing Certificate AT-1448

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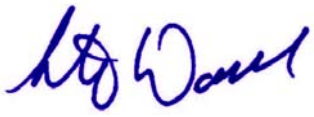

Steven Dovell
Compliance Engineer

Reviewed by:

Steven D. Koster
VP, EMC & Wireless

Abstract

This report has been prepared on behalf of Strata Proximity Systems to support the attached Application for Equipment Authorization. The test report and application are submitted for an Intentional Radiator under Part 15.249 (10/2009) of the FCC Rules. This Certification Test Report documents the test configuration and test results for a Strata Proximity Systems Surface Proximity Module.

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. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ACLASS under Certificate AT-1448 as an independent FCC test laboratory.

The Strata Proximity Systems Surface Proximity Module complies with the limits for an Intentional Radiator device under FCC Part 15.

Revision History	Reason	Date
Rev 0	Initial Release	October 20, 2011

Table of Contents

List of Tables

List of Figures

1 Introduction

1.1 Compliance Statement

The Strata Proximity Systems Surface Proximity Module complies with the limits for an Intentional Radiator device under FCC Part 15.249 (10/2009).

1.2 Test Scope

Tests for radiated and conducted emissions were performed. All measurements were performed in accordance with FCC Public Notice DA 00-705 and 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:	Strata Proximity Systems 1769 Jeff Road Huntsville, AL 35806
Purchase Order Number:	SP5195
Quotation Number:	66219

1.4 Test Dates

Testing was performed on the following date(s):	6/8/11

1.5 Test and Support Personnel

Washington Laboratories, LTD	Steven Dovell
Client Representative	Stephen Gilbert

1.6 Abbreviations

A	**A**mpere
ac	**a**lternating **c**urrent
AM	Amplitude Modulation
Amps	**Amp**ere**s**
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 Strata Proximity Systems Surface Proximity Module is part of a complete HazardAvert proximity warning system from Strata Proximity Systems which provides warnings to both individuals and to machinery to alert them that the individual has entered too close to an operating piece of equipment and is in a dangerous situation or that vehicles or machinery are getting close enough that a collision possibility exists. The Surface Proximity Module is mounted on a vehicle or piece of machinery and is connected to a central control unit. The Surface Proximity Module interfaces to a central control unit which interfaces directly to a vehicle or piece of machinery.

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	Strata Proximity Systems
FCC ID:	Models IA and MA
Model:	IA, MA
FCC Rule Parts:	§15.249
Frequency Range:	916.43kHz
Maximum Output Power:	34468.4 µV/m @ 3 meters
Modulation:	FM
Occupied Bandwidth:	104.58kHz
Keying:	Automatic
Type of Information:	Data
Number of Channels:	1
Power Output Level	Fixed
Antenna Connector	None
Antenna Type	Internal
Interface Cables:	None
Power Source & Voltage:	Battery
TX Spurious	243.9 µV/m @ 3 meters
RX Spurious	67.6 µV/m @ 3 meters

2.2 Test Configuration

The Strata Proximity Systems Surface Proximity Module, Equipment Under Test (EUT), was operated from 24VDC via a 120V AC/DC power supply.

The Surface Proximity Module is part of a complete HazardAvert proximity warning system from Strata Proximity Systems which provides warnings to both individuals and to machinery to alert them that the individual has entered too close to an operating piece of equipment and is in a dangerous situation or that vehicles or machinery are getting close enough that a collision possibility exists. The Surface Proximity Module is mounted on a vehicle or piece of machinery and is connected to a central control unit.

The functions of the Surface Proximity Module are:

To transmit a 73kHz field around a vehicle or piece of machinery to act as a protection zone for collision avoidance and for proximity detection for the protection of individuals.

To receive a 916.48MHz RF signal from other vehicles or Personal Alarm Devices (PAD).

To receive a 73 kHz field that might be transmitted by other vehicles.

To generate a 916MHz RF signal to alert other vehicles or machinery that a collision possibility exists.

The Surface Proximity Module generates a 73 kHz field at the rate of 3mS on and 3mS off at a repetition rate of approximately 200mS. This creates a protection zone around the vehicle or machine. The Surface Proximity module has its 916.48MHz receiver on at this time to receive any transmissions from another vehicle, machine or individual equipped with the HazardAvert system that would indicate the individual or other piece of machinery is too close and warrants a warning or danger condition. During the time that the 73kHz generator is not transmitting, the Surface Proximity Generator 73kHz receiver is on to receive the field that may be emitted by another vehicle or piece of machinery in close proximity. If the received 73 kHz field strength is above a level determined to represent a possible collision or individual in too close of proximity, the Surface Proximity Module will turn off its 916MHz receiver and will transmit its own 916MHz signal to alert other vehicles or machinery of its close proximity to them.

The EUT normally is powered via vehicle power.

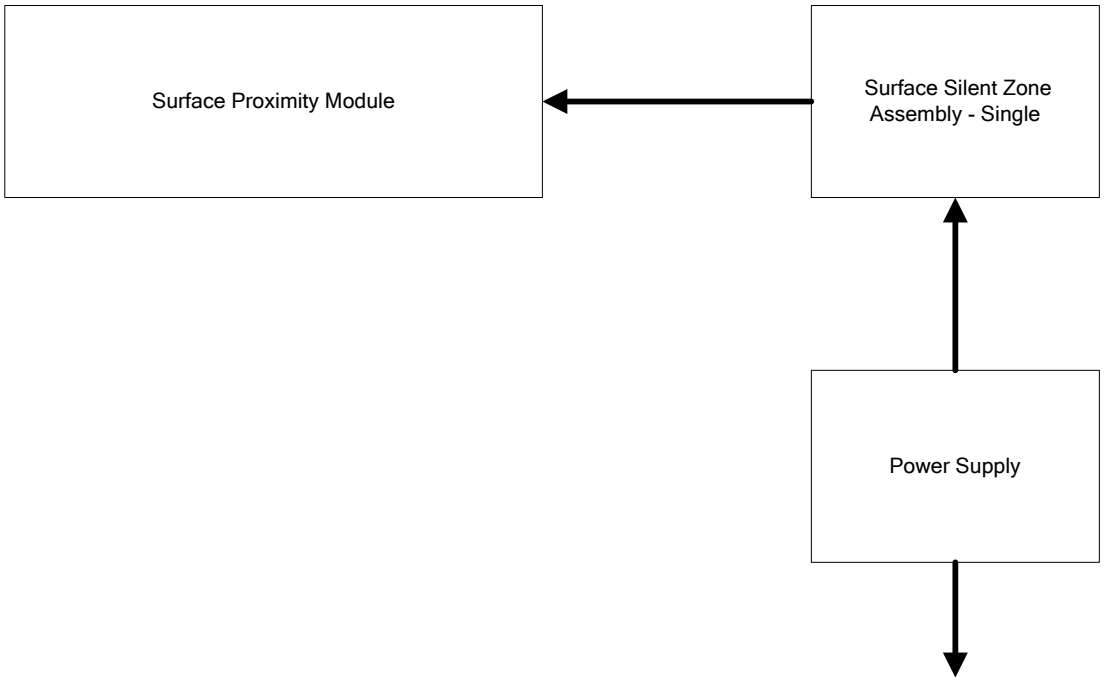

Figure 1: Test Configuration

2.3 Equipment Configuration

The EUT was set up as outlined in Figure 1. The EUT was comprised of the following equipment. (All Modules, PCBs, etc. listed were considered as part of the EUT, as tested.)

Table 2: Equipment Configuration

Name / Description	Model Number	Part Number	Serial Number	Revision
Surface Proximity Module	IA, MA	N/A	N/A	A
Surface Silent Zone Assembly	SSZIFM	N/A	SZAAF000126	A

2.4 Support Equipment

The following support equipment was used during testing:

Table 3: Support Equipment

Item	Model/Part Number	Serial Number
AC/DC Power Supply	Mean Well SP300_24	EB05364225

2.5 Interface Cables

Table 4: Interface Cables

Port Identification	Connector Type	Cable Length	Shielded (Y/N)	Termination Point
I/O	DIN	5m	Y	Surface Silent Zone Assembly
I/O	Barrier Strip	5m	Y	Surface Proximity Module
Power	Barrier Strip	1m	N	Power Supply

2.6 EUT Modifications

No modifications were performed in order to meet the test requirements:.

2.7 Testing Algorithm

The unit was powered via the AC/DC supply and the Controller set to the Transmit 916.43kHz test setting.

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

2.8 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 the American Association for Laboratory Accreditation (A2LA) under Certificate 2675.01 as an independent FCC test laboratory.

2.9 Measurements

2.9.1 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

Land Mobile FM or PM Communications Equipment Measurement and Performance Standards (ANSI/TIA/EIA-603-93)

2.10 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 5 shows a list of the test equipment used for measurements along with the calibration information.

Table 5: Test Equipment List

Test Name: **Radiated Emissions**			Test Date: **06/08/2011**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
72	HP - 8568B	ANALYZER SPECTRUM	6/22/2012
70	HP - 85685A	PRESELECTOR RF W/OPT 8ZE	6/22/2012
68	HP - 85650A	ADAPTER QP	6/22/2012
382	SUNOL SCIENCES CORPORATION - JB1	ANTENNA BICONLOG	1/12/2012
31	EMCO - 6502	ANTENNA ACTIVE LOOP	3/8/2012
528	AGILENT - E4446A	ANALYZER SPECTRUM	9/27/2011
618	HP - 8563A	ANALYZER SPECTRUM	8/1/2011
522	HP - 8449B	PRE-AMPLIFIER 1-26.5GHZ	7/27/2011
4	ARA - DRG-118/A	ANTENNA DRG 1-18GHZ	2/15/2013

4 Test Results

4.1 Duty Cycle Correction

Measurements may be adjusted where pulsed RF is utilized to find the average level associated with a quantity. This calculation is applied to limits for pulsed licensed and unlicensed devices.

- For Unlicensed Intentional Radiators under 47CFR Part 15, all duty cycle measurements compared to a 100 millisecond period
- i.e. duty cycle = on time/100, milliseconds
- The EUT under normal operating conditions has 6.609ms on time. This results in a -23.6dB Duty Cycle Correction.
- DCC = 20*log(6.609e-3/100e-3) = -23.6dB

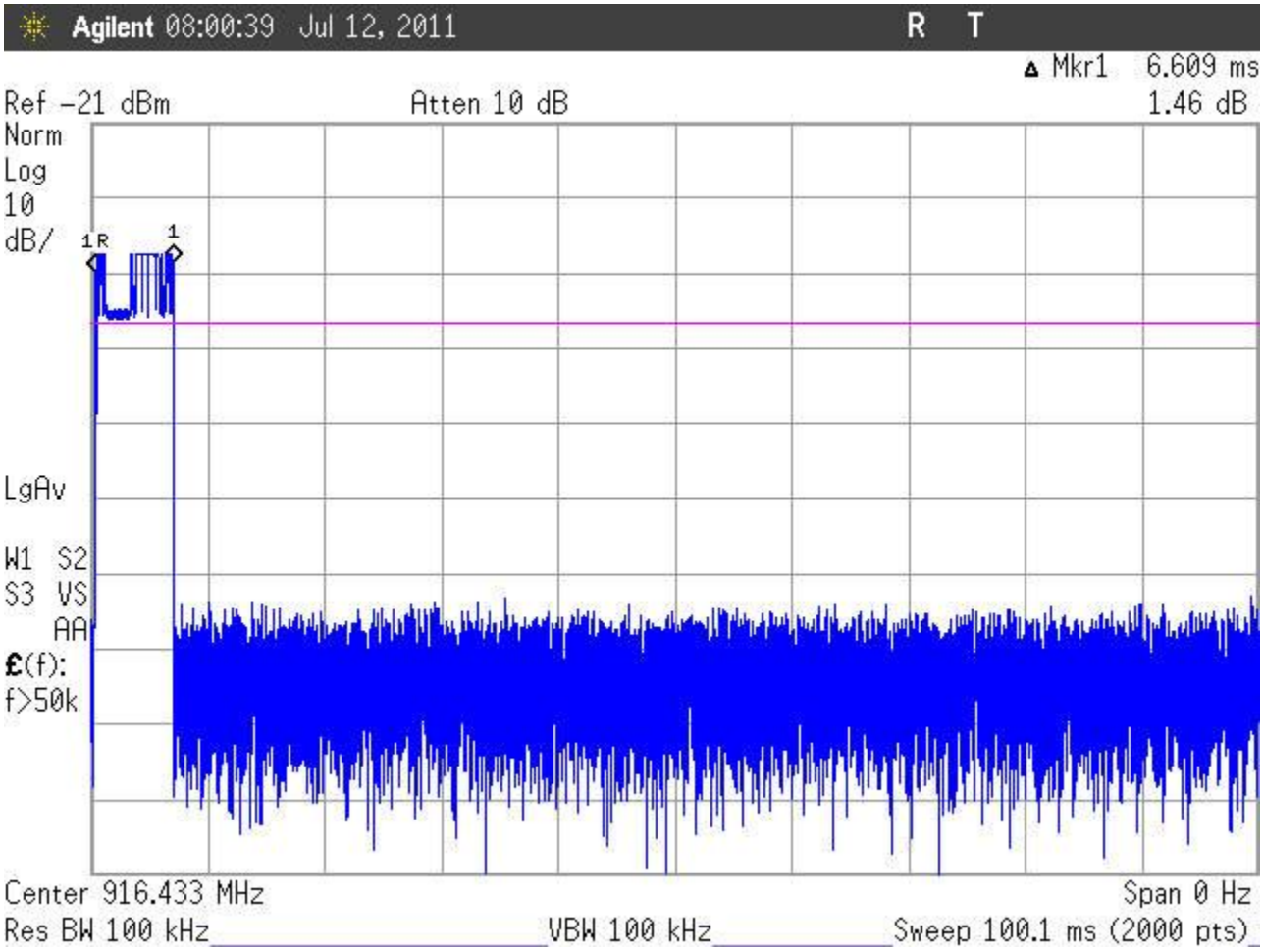

Figure 4-1. Duty Cycle

4.2 Occupied Bandwidth: (FCC Part §2.1049 and RSS-210 A1.1.3)

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

At full modulation, the occupied bandwidth was measured as shown:

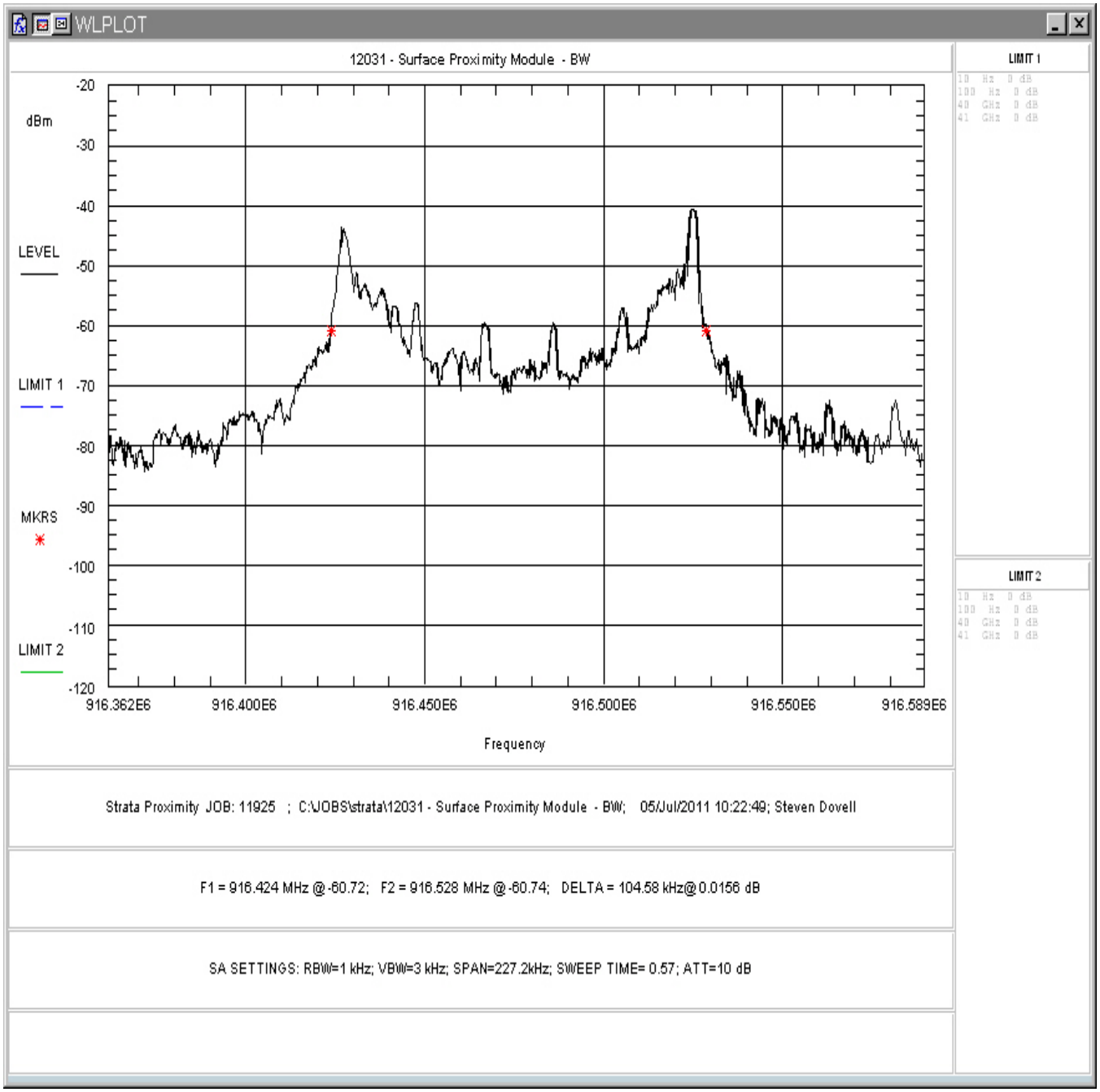

Figure 4-2. Occupied Bandwidth

Table 6 provides a summary of the Occupied Bandwidth Results.

Table 6. Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
916.43kHz	104.58kHz	N/A	Pass

4.3 Radiated Emissions: (FCC Part §2.1053, RSS210 A2.9)

The EUT must comply with the radiated emission limits of 15.249(a). The limits are as shown in the following table.

Table 7. Radiated Emissions Limits

Fundamental Frequency	Field Strength of Fundamental (µV/m)	Field Strength of Harmonics (µV/m)
902 – 928 MHz	50,000	500
2400 – 2483.5 MHz	50,000	500
5725 – 5875 MHz	50,000	500
24.00 – 24.25 GHz	250,000	2500

4.3.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field 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.

The emissions were measured using the following resolution bandwidths:

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	120kHz	>100 kHz
>1000 MHz	1 MHz	<30 Hz (Avg.) 1MHz (Peak)

Emissions were measured to the 10th harmonic of the transmit frequency. Worst case emission levels are reported.

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):	V dBμV
Antenna Factor (Ant Corr):	AFdB/m
Cable Loss Correction (Cable Corr):	CCdB
Duty Cycle Correction (Average)	DCCdB
Amplifier Gain:	GdB
Electric Field (Corr Level):	EdBμV/m = VdBμV + AFdB/m + CCdB + DCCdB - GdB

Table 8: Radiated Emission Test Data < 1GHz

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)
32.449	V	180.00	1.00	8.80	18.8	24.1	100.0	-12.4
45.690	V	135.00	1.00	13.50	10.2	15.2	100.0	-16.3
50.020	V	135.00	1.00	28.10	8.5	67.6	100.0	-3.4
52.149	V	135.00	1.00	14.10	8.2	13.1	100.0	-17.7
62.232	V	180.00	1.00	7.50	8.1	6.1	100.0	-24.4
80.015	V	90.00	1.00	20.10	9.0	28.5	100.0	-10.9
84.350	V	180.00	1.00	6.90	9.1	6.3	100.0	-24.0
150.000	V	135.00	1.00	3.70	13.9	7.6	150.0	-25.9
250.000	V	135.00	1.00	6.30	13.6	9.9	200.0	-26.1
300.000	V	135.00	1.50	2.30	15.6	7.9	200.0	-28.1
500.000	V	135.00	1.50	2.50	20.6	14.3	200.0	-22.9
916.43 *	V	0.00	1.10	57.10	27.5	17054.5	50000.0	-9.3
33.412	H	0.00	4.00	2.10	18.0	10.1	100.0	-19.9
45.690	H	0.00	4.00	4.80	10.2	5.6	100.0	-25.0
50.010	H	180.00	4.00	27.20	8.5	60.9	100.0	-4.3
52.149	H	180.00	4.00	4.20	8.2	4.2	100.0	-27.6
62.232	H	180.00	4.00	4.20	8.1	4.1	100.0	-27.7
80.015	H	135.00	4.00	17.60	9.0	21.4	100.0	-13.4
84.350	H	180.00	4.00	2.90	9.1	4.0	100.0	-28.0
150.000	H	270.00	3.70	5.30	13.9	9.1	150.0	-24.3
250.000	H	315.00	3.20	5.90	13.6	9.4	200.0	-26.5
300.000	H	180.00	3.20	2.30	15.6	7.9	200.0	-28.1
450.000	H	180.00	3.20	4.50	20.2	17.1	200.0	-21.4
916.43 *	H	315.00	1.00	63.20	27.5	34468.4	50000.0	-3.2

* Fundamental frequency

Table 9: Radiated Emission Test Data > 1GHz

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
peak									
1833.11	V	165.00	2.60	50.67	-8.0	136.1	5000.0	-31.3	
2749.67	V	0.00	2.54	48.50	-3.6	174.8	5000.0	-29.1	
3666.23	V	180.00	2.00	47.00	-0.9	202.8	5000.0	-27.8	
4582.61	V	90.00	2.05	45.50	0.9	208.7	5000.0	-27.6	
5499.34	V	180.00	2.00	42.50	3.4	198.2	5000.0	-28.0	
1833.11	H	180.00	2.96	52.80	-8.0	173.9	5000.0	-29.2	
2749.67	H	90.00	3.00	48.00	-3.6	165.0	5000.0	-29.6	
3666.23	H	220.00	3.00	48.20	-0.9	232.9	5000.0	-26.6	
4582.61	H	270.00	2.90	46.80	0.9	242.4	5000.0	-26.3	
5499.34	H	185.00	2.90	44.30	3.4	243.9	5000.0	-26.2	
	V								
AVG	V								
1833.11	V	165.00	2.60	50.67	-30.6	10.1	500.0	-33.9	
2749.67	V	0.00	2.54	48.50	-26.3	12.8	500.0	-31.8	
3666.23	V	180.00	2.00	47.00	-22.9	16.0	500.0	-29.9	
4582.61	V	90.00	2.05	45.50	-21.1	16.5	500.0	-29.6	
5499.34	V	180.00	2.00	42.50	-18.8	15.4	500.0	-30.2	
1833.11	H	180.00	2.96	52.80	-30.6	12.9	500.0	-31.8	
2749.67	H	90.00	3.00	48.00	-26.3	12.1	500.0	-32.3	
3666.23	H	220.00	3.00	48.20	-22.9	18.4	500.0	-28.7	
4582.61	H	270.00	2.90	46.80	-21.1	19.2	500.0	-28.3	
5499.34	H	185.00	2.90	44.30	-18.8	18.9	500.0	-28.4	