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FCC Certification Test Report

FCCID: ZQ3-SPS-SPAD1

STRATA PROXIMITY SYSTEMS

SURFACE PAD

MODELS HA-S-2200-S and HA-S-2201-S

WLL REPORT# **12029-01 Rev 2**
July 30, 2011

Re-issued September 23, 2011

Prepared for:

Strata Proximity Systems
1769 Jeff Road
Huntsville, AL 35806

Prepared By:

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

ACCREDITED TESTING

Testing Certificate AT-1448

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For the

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Prepared by:

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Reviewed by:

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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 PAD.

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 ACLASS under Certificate AT-1448 as an independent FCC test laboratory.

The Strata Proximity Systems Surface PAD complies with the limits for an Intentional Radiator device under FCC Part 15.249.

Revision History	Reason	Date
Rev 0	Initial Release	July 30, 2011
Rev 1	Corrected the model numbers per the client	September 7, 2011
Rev 2	Corrected Duty Cycle typographical error	September 23, 2011

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1 Introduction

1.1 Compliance Statement

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

1.2 Test Scope

Tests for radiated 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:	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):	6/27/11

1.5 Test and Support Personnel

Washington Laboratories, LTD	Steven Dovell
Client Representative	Stephen Gilbert

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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

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2 Equipment Under Test

2.1 EUT Identification & Description

The Surface PAD 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 PAD is worn by an individual. The Surface PAD is connected to an external rechargeable Lithium Ion battery pack containing an audible and visual warning device which is also worn by the individual.

The functions of the Surface PAD are:

1) To detect the presence of a 73kHz electromagnetic field generated by vehicles or machinery equipped with the HazardAvert system and to determine if the field strength level detected indicates that the individual and vehicle or machinery is approaching or is in a dangerous situation.

2) To provide an audible and visual indication to the wearer of the Surface PAD that they are approaching or are in a dangerous location as a result of the 73 kHz field strength level.

3) To transmit a 916.48MHz RF signal to vehicles or machinery equipped with the HazardAvert system signaling that the individual is entering or has entered into a dangerous area relative to the vehicle or machinery.

The Surface PAD has a 73 kHz receiver that is constantly on and monitoring the field strength of fields emitted by vehicles and machinery equipped with the HazardAvert proximity and collision avoidance system. The Surface PAD monitors the strength of the 73kHz fields in three axis and determines if the field strength has risen to a level that would indicate that the individual is approaching a “Warning Zone” or is in a “Danger Zone” due to being too close to the vehicle or machinery. If the Surface PAD determines that the individual is too close to the vehicle or machinery, it gives the individual both a visual and audible indication. At the same time, the Surface PAD transmits a 916.48MHz RF signal to inform the vehicle or machinery that the individual is approaching too close. If The Surface PAD determines that the field strength indicates that the individual is not in a Warning or Danger Zone area, it will transmit a data packet every 10 seconds via the 916.48MHz with its status condition.

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Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	Strata Proximity Systems
FCC ID:	ZQ3-SPS-SPAD1
Model:	HA-S-2200-S and HA-S-2201-S
FCC Rule Parts:	§15.249
Frequency Range:	916.48MHz
Maximum Output Power:	46489.2 µV/m @ 3 meters
Modulation:	FM
Occupied Bandwidth:	99.19kHz
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	1450 µV/m @ 3 meters
RX Spurious	1450 uV/m @ 3 meters

2.2 Test Configuration

The Surface PAD was configured with the 916.48MHz transmitter constantly on. A sample operating normally was use to determine the EUT duty cycle.

There are two models, which are identical with the exception of the antenna. Model HA-S-2200-S contains the ANT-916-JJB-RA antenna and HA-S-2201-S contains ANT-916-CW-RCS antenna. The model HA-S-2201-S has the highest output level.

2.3 Testing Algorithm

The Surface PAD was programmed for continuous operation by the vendor. Under normal conditions there are no user accessible settings. The unit is simply plugged in to the battery pack to operate.

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 ACLASS under Certificate AT-1448 as an independent FCC test laboratory.

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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.

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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: **Radiated Emissions**			Test Date: **06/27/2011**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
528	AGILENT - E4446A	ANALYZER SPECTRUM	9/27/2011
627	AGILENT - 8449B	AMPLIFIER 1-26GHZ	5/4/2012
4	ARA - DRG-118/A	ANTENNA DRG 1-18GHZ	2/15/2013
337	WLL - 1.2-5GHZ	FILTER BAND PASS	3/24/2012
280	ITC - 21C-3A1	WAVEGUIDE 3.45-11.0GHZ	3/24/2012
282	ITC - 21X-3A1	WAVEGUIDE 6.8-15GHZ	3/24/2012

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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

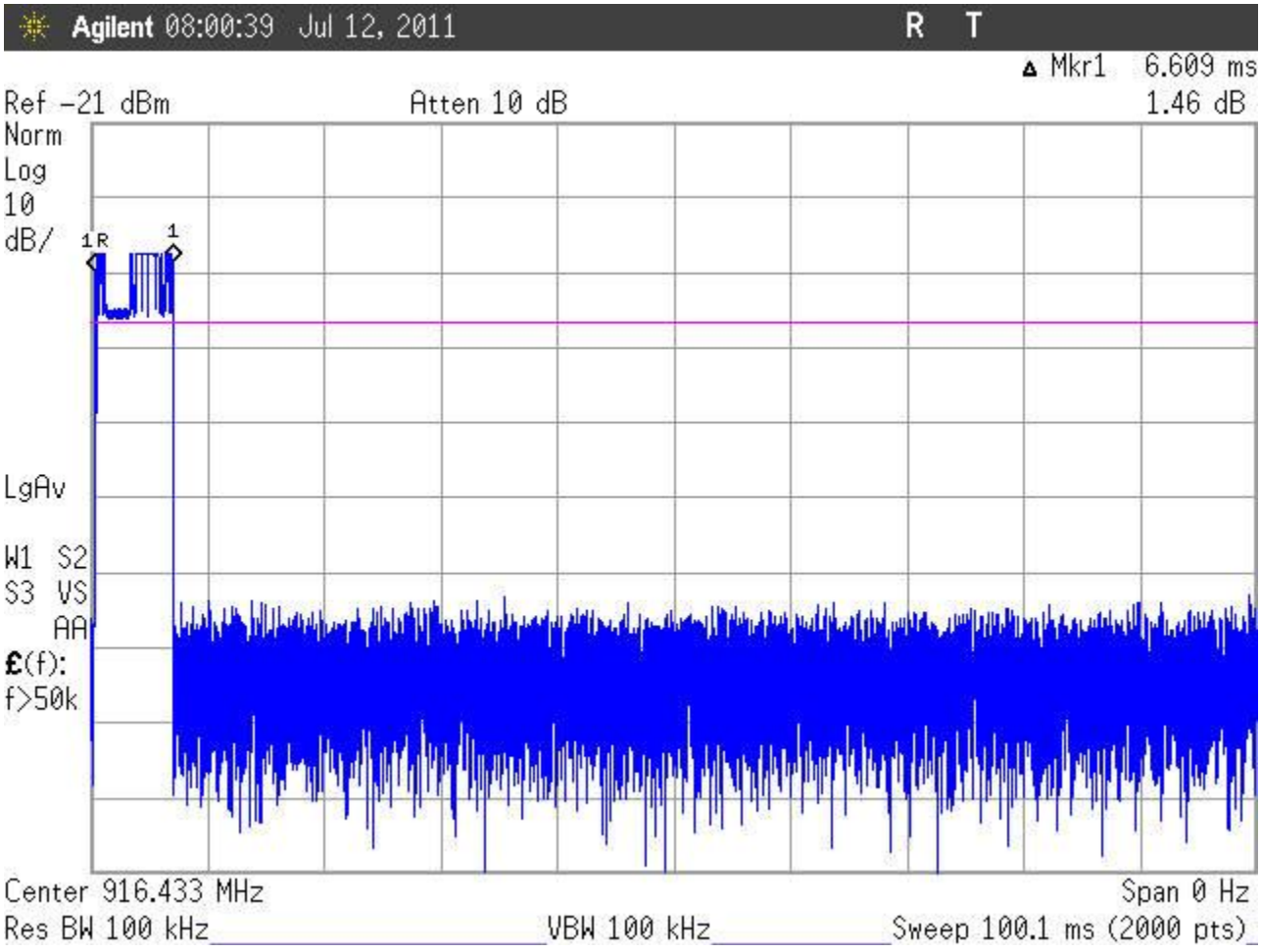

Figure 4-1. Duty Cycle

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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:

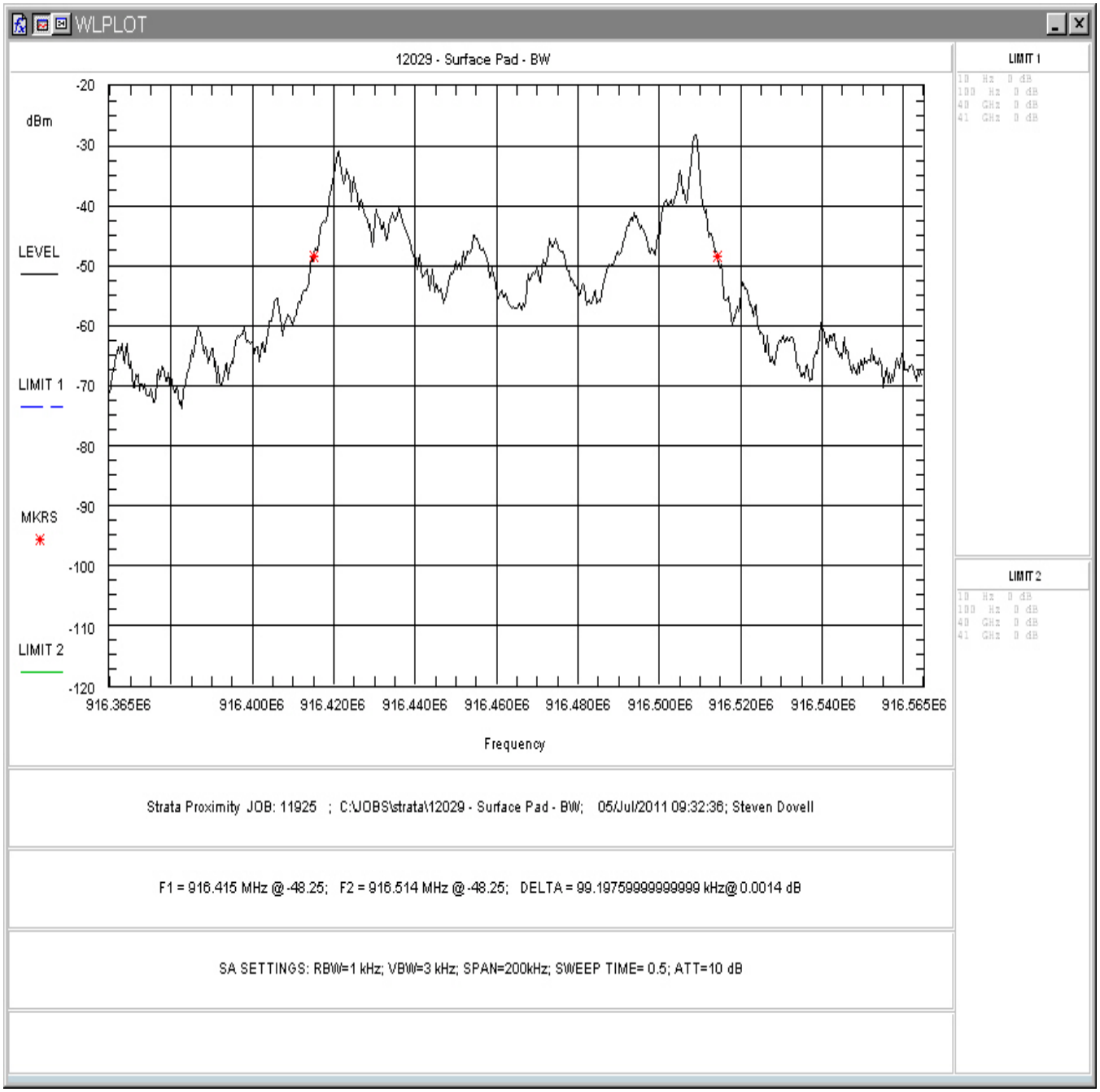

Figure 4-2. Occupied Bandwidth with ANT-916-CW-RCS antenna

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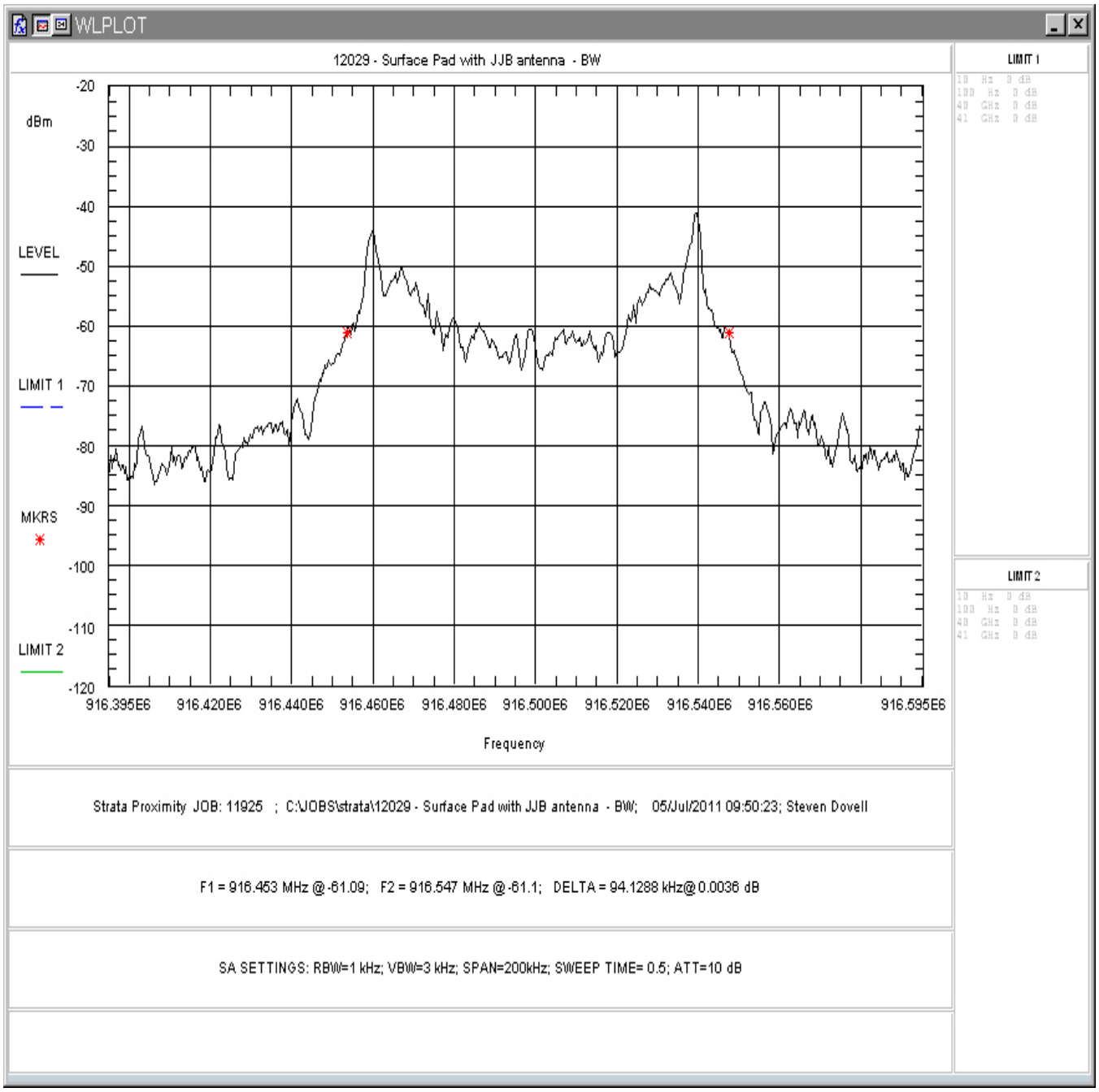

Figure 4-3. Occupied Bandwidth with ANT-916-JJB-RA antenna

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Table 3 provides a summary of the Occupied Bandwidth Results.

Table 3. Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
916.48MHz (ANT-916-JJB-RAantenna)	94.128kHz	N/A	Pass
916.48MHz (ANT-916-CW-RCS Antenna)	99.197kHz	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 4. 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. Readings under 1000Mhz were performed using a Quasi-Peak Detector function. Since the fundamental signal is FM modulation no pulse correction is required.

The emissions were measured using the following resolution bandwidths:

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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

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Table 5: Radiated Emission Test Data

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
916.49	H	180.00	1.00	65.80	27.5	46489.2	50000.0	-0.6	Fundamental
916.49	V	301.00	1.00	58.90	27.5	21006.4	50000.0	-7.5	Fundamental
Peak									
1833.11	V	0.00	1.41	56.40	-3.2	458.1	5000.0	-20.8	
2749.67	V	76.00	1.88	49.90	1.5	370.1	5000.0	-22.6	
3666.23	V	90.00	1.66	49.51	6.6	636.7	5000.0	-17.9	
4582.61	V	0.00	1.38	47.13	7.7	553.8	5000.0	-19.1	
5499.34	V	0.00	1.36	44.87	11.3	641.2	5000.0	-17.8	
1833.11	H	306.00	1.86	66.41	-3.2	1450.4	5000.0	-10.7	
2749.67	H	341.00	1.89	53.39	1.5	553.1	5000.0	-19.1	
3666.23	H	341.00	1.90	51.01	6.6	756.8	5000.0	-16.4	
4582.61	H	0.00	1.90	46.40	-16.2	32.5	5000.0	-43.7	
5499.34	H	0.00	1.50	44.70	-12.6	40.1	5000.0	-41.9	
Non Harmonics None									
AVG									
1833.11	V	0.00	1.41	56.40	-26.8	30.3	500.0	-24.4	
2749.67	V	76.00	1.88	49.90	-22.1	24.5	500.0	-26.2	
3666.23	V	90.00	1.66	49.51	-17.0	42.1	500.0	-21.5	
4582.61	V	0.00	1.38	47.13	-15.9	36.6	500.0	-22.7	
5499.34	V	0.00	1.36	44.87	-12.3	42.4	500.0	-21.4	
1833.11	H	306.00	1.86	66.41	-26.8	95.8	500.0	-14.3	
2749.67	H	341.00	1.89	53.39	-22.1	36.5	500.0	-22.7	
3666.23	H	341.00	1.90	51.01	-17.0	50.0	500.0	-20.0	
4582.61	H	0.00	1.90	46.40	-15.9	33.6	500.0	-23.4	
5499.34	H	0.00	1.50	44.70	-12.3	41.5	500.0	-21.6	

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