LS RESEARCH, LLC
WIRELESS PRODUCT DEVELOPMENT
ACCREDITED
Testing Cert. 1255.01
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TEST REPORT # 311238
LSR Job #:C-1272

Compliance Testing of:
900 MHz Radio Module

Test Date(s):
July 28, August 8, 9, 12, September 6, 2011

Prepared For:
InterSense
Attn: Dan Holmes
4 Federal Street
Billerica, MA 08121

In accordance with:
Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.247
Industry Canada (IC) RSS 210 Annex 8
Digital Modulation Transmitters (DTS) Operating in the Frequency Band 906 MHz – 924 MHz

This Test Report is issued under the Authority of: Thomas T. Smith

Signature: Thomas T. Smith Date: 10/5/2011

Test Report Reviewed by:	**Tested by:**
Signature: Thomas T. Smith Date: 10/5/2011	Peter Feilen, EMC Engineer Signature: Peter Feilen Date:

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EXHIBIT 1. INTRODUCTION

1.1 SCOPE

References:	FCC Part 15, Subpart C, Section 15.247 and 15.209 FCC Part 2, Section 2.1043 paragraph (b)1. RSS GEN and RSS 210 Annex 8
Title:	FCC : Telecommunication – Code of Federal Regulations, CFR 47, Part 15. IC : Low-power License-exempt Radio-communication Devices (All Frequency Bands): Category I Equipment
Purpose of Test:	To gain FCC and IC Certification Authorization for Low-Power License-Exempt Transmitters.
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute 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.
Environmental Classification:	• Commercial, Industrial or Business • Residential

1.2 NORMATIVE REFERENCES

Publication	Title
47 CFR, Parts 0-15 (FCC)	Code of Federal Regulations - Telecommunications
RSS 210 Annex 8	Low-power License-exempt Radio-communication Devices (All Frequency Bands): Category I Equipment
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.
CISPR 16-1-1	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus.
CISPR 16-2-1	Specification for radio disturbance and immunity measuring apparatus and methods. Part 201: Conducted disturbance measurement.
FCC Public Notice DA 00-1407	Part 15 Unlicensed Modular Transmitter Approval
FCC ET Docket No. 99-231	Amendment to FCC Part 15 of the Commission's Rules Regarding Spread Spectrum Devices.
FCC Procedures	Measurement of Digital Transmission Systems operating under Section 15.247.

1.3 LS Research, LLC TEST FACILITY

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025, 2005 "General Requirements for the Competence of Calibration and Testing Laboratories".

LS Research, LLC's scope of accreditation includes all test methods listed herein, unless otherwise noted. A copy of the accreditation may be accessed on our web site: www.lsr.com. Accreditation status can be verified at A2LA's web site: www.a2la2.net.

1.4 LOCATION OF TESTING

All testing was performed at LS Research, LLC, W66 N220 Commerce Court, Cedarburg, Wisconsin, 53012 USA, utilizing the facilities listed below, unless otherwise noted.

List of Facilities Located at LS Research, LLC:

- Compact Chamber
- Semi-Anechoic Chamber
- Open Area Test Site (OATS)

1.5 TEST EQUIPMENT UTILIZED

A complete list of equipment utilized in testing is provided in Appendix A of this test report. Calibration dates are indicated in Appendix A. All test equipment is calibrated in accordance with A2LA standards.

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1 CLIENT INFORMATION

Manufacturer Name:	**InterSense**
Address:	**4 Federal Street, Billerica, MA, 08121**
Contact Name:	**Dan Holmes**

2.2 EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information has been supplied by the applicant.

Product Name:	900 MHz Radio Module
Model Number:	R69-00198
Serial Number:	Engineering Sample

2.3 ASSOCIATED ANTENNA DESCRIPTION

Please see Appendix D

2.4 EUT'S TECHNICAL SPECIFICATIONS

Additional Information:

EUT Frequency Range (in MHz)	906 MHz – 924 MHz
EIRP in Watts	0.0033 W
Conducted Output Power (in dBm)	6.12
Occupied Bandwidth (99% BW)	1220 kHz
Type of Modulation	O-QPSK
Emission Designator	1M22G1D
Transmitter Spurious (worst case) at 3 meters	36.74 dBuV/m
Frequency Tolerance %, Hz, ppm	Better than 100 ppm
Transceiver Model # (if applicable)	Atmel ATZB-900 ZigBit 900MHz Radio Module
Antenna Information	
Detachable/non-detachable	Non-detachable
Type	Chip
Gain (in dBi)	-1 dBi
EUT will be operated under FCC Rule Part(s)	FCC Part 15.247 and 15.109
EUT will be operated under RSS Rule Part(s)	RSS 210 & RSS GEN
Modular Filing	☒ Yes ☐ No
Portable or Mobile?	Portable

RF Technical Information:

Type of Evaluation (check one)		SAR Evaluation: Device Used in the Vicinity of the Human Head
		SAR Evaluation: Body-worn Device
	X	RF Evaluation

Procedure for Portable RF Exposure from KDB 447498:

$$Output\ Power\ \leq \frac{60}{f\ (GHz)}(mW)$$

$$4.09\ mW\ \leq 66.67\ mW$$

Note: Since the peak output power of 4.09 mW is below the low threshold of 66.67mW this device does not need SAR evaluation

2.5 PRODUCT DESCRIPTION

The radio solution will revolve around the Atmel AT86RF212, which is a low-power, low-voltage 900 MHz transceiver specially designed for low-cost IEEE 802.15.4, ZigBee™, and high data rate ISM applications.

The InterSense 900MHz radio module is used for real-time applications where it isimportant to maintain low and predictable latency. The radio module is a lowpowered device that operates over a frequency range of 906MHz to 926MHz,allowing up to 10 simultaneous radio pairs to coexist.

EXHIBIT 3. EUT OPERATING CONDITIONS & CONFIGURATIONS DURING TESTS

3.1 CLIMATE TEST CONDITIONS

Temperature:	20-25 ˚C
Humidity:	35-45 % Relative Humidity

3.2 APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC and IC Paragraph	Test Requirements	Compliance (yes/no)
FCC : 15.207 IC : RSS GEN sect. 7.2.2	Power Line Conducted Emissions Measurements	Yes
FCC : 15.247(a)(2) IC : RSS 210 A8.2(a)	6 dB Bandwidth of a Digital Modulation System	Yes
IC : RSS GEN section 4.6.1	20 dB Bandwidth	Yes
FCC : 15.247(b) & 1.1310 IC : RSS 210 A8.4	Maximum Output Power	Yes
FCC : 15.247(i), 1.1307, 1.1310, 2.1091 & 2.1093 IC : RSS 102	RF Exposure Limit	Yes
FCC :15.247(c) IC : RSS 210 A8.5	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
FCC : 15.247(d) IC : RSS 210 A8.2(b)	Transmitted Power Spectral Density of a Digital Modulation System	Yes
FCC : 15.247(c), 15.209 & 15.205 IC : RSS 210 A8.2(b), section 2.2, 2.6 and 2.7	Transmitter Radiated Emissions	Yes
The digital circuit portion of the EUT has been tested and verified to comply with FCC Part 15, Subpart B, Class B Digital Devices (RSS GEN and RSS 210 of IC) and the associated Radio Receiver has also been tested and found to comply with Part 15, Subpart B – Radio Receivers (RSS GEN and RSS 210 of IC). The Receiver Test Report is available upon request.		

3.3 MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

☐ **None** ☒ **Yes (explain below)**

The maximum power setting is register value 0x00a1. This corresponds to a conducted value of 6.12 dBm maximum output power.

3.4 DEVIATIONS & EXCLUSIONS FROM TEST SPECIFICATIONS

☒ **None** ☐ **Yes (explain below)**

EXHIBIT 4. DECLARATION OF CONFORMITY

The EUT was found to MEET the requirements as described within the specification of FCC Title 47, CFR Part 15.247, and Industry Canada RSS-210, Issue 8 (2010), Section Annex 8 (section 8.2) for a Digital Spread Spectrum (DTS) Transmitter.

If some emissions are seen to be within 3 dB of their respective limits:
As these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

LS Research, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

EXHIBIT 5. RADIATED EMISSIONS TEST

5.1 Test Setup

The test setup was assembled in accordance with Title 47, CFR FCC Part 15, RSS GEN and ANSI C63.4. The EUT was placed on an 80cm high non-conductive pedestal, centered on a flush mounted 2-meter diameter turntable inside a 3 meter Semi-Anechoic, FCC listed Chamber. The EUT was operated in transmit mode, using power as provided by a power pack, converting 120VAC to 6VDC. The unit has the capability to operate on 10 channels, controllable via laptop PC.

The applicable limits apply at a 3 meter distance. Measurements above 4 GHz were performed at a 1.0 meter separation distance. The calculations to determine these limits are detailed in the following pages. Please refer to Appendix A for a complete list of test equipment. The test sample was operated on one of three (3) standard channels: low (1, 906 MHz), middle (5, 914 MHz) and high (10, 924 MHz) to comply with FCC Part 15.31(m). The channels and operating modes were changed using a PC.

5.2 Test Procedure

Radiated RF measurements were performed on the EUT in a 3 meter Semi-Anechoic, FCC listed Chamber. The frequency range from 30 MHz to 10000 MHz was scanned and investigated. The radiated RF emission levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. The EUT was placed on a non-conductive pedestal in the 3 meter Semi-Anechoic Chamber, with the antenna mast placed such that the antenna was 3 meters from the EUT. A Biconical Antenna was used to measure emissions from 30 MHz to 300 MHz, and a Log Periodic Antenna was used to measure emissions from 300 MHz to 1000 MHz. A Double-Ridged Waveguide Horn Antenna was used from 1 GHz to 1 GHz. The maximum radiated RF emissions were found by raising and lowering the antenna between 1 and 4 meters in height, using both horizontal and vertical antenna polarities.

The EUT was rotated along three orthogonal axis during the investigations to find the highest emission levels.

5.3 Test Equipment Utilized

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at an N.I.S.T. traceable site. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and anAgilent E4445A/N9039A EMI System. The resulting correction factors and the cable loss factors from these calibrations were entered into the EMI Receiver database. As a result, the data taken from the EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading. The EMI Receiver was operated with a resolution bandwidth of 120 kHz for measurements below 1 GHz (video bandwidth of 300 kHz), and a bandwidth of 1 MHz for measurements above 1 GHz (video bandwidth of 1 MHz for peak measurements, 10Hz for average measurements).

Test Equipment List

Please see Appendix A

5.4 Test Results

The EUT was found to **MEET** the Radiated Emissions requirements of Title 47 CFR, FCC Part 15.247 and Canada RSS-210, Issue 8 (2010), Annex 8 for a DTS transmitter. The frequencies with significant RF signal strength were recorded and plotted as shown in the Data Charts and Graphs.

5.5 CALCULATION OF RADIATED EMISSIONS LIMITS

The maximum peak output power of an intentional radiator in the 2400-2483.5 MHz band, as specified in Title 47 CFR 15.247 (b)(3) and RSS 210 A8.4 is 1 Watt. The harmonic and spurious RF emissions, as measured in any 100 kHz bandwidth, as specified in 15.247 (d) and RSS 210 A8.2(b), shall be at least 20 dB below the measured power of the desired signal, and must also meet the requirements described in 15.205(c) for FCC and section 2.2,2.6 and 2.7 of RSS 210 for IC.

The following table depicts the general radiated emission limits above 30 MHz. These limits are obtained from Title 47 CFR, Part 15.209, for radiated emissions measurements. These limits were applied to any signals found in the 15.205 restricted bands. The mentioned limits correspond to those limits listed in RSS 210 section 2.7.

Frequency (MHz)	3 m Limit μV/m	3 m Limit (dBμV/m)	1 m Limit (dBμV/m)
30-88	100	40.0	-
88-216	150	43.5	-
216-960	200	46.0	-
>960	500	54.0	63.5

Sample conversion from field strength μV/m to dBμV/m:
$dB\mu V/m = 20 \log_{10} (100)$
= 40 dBμV/m (from 30-88 MHz)

For measurements made at 1.0 meter, a 9.5 dB correction has been invoked.

>960 MHz
500μV/m or 54.0 dB/μV/m at 3 meters
54.0 + 9.5 = 63.5 dB/μV/m at 1 meter

Sample Calculation using correction factors from the device

Raw Receiver Data + Antenna Factor + Cable Factor + = Reported Value

Generic example of reported data at 274.5 MHz:

Reported Measurement data = 10.07 (raw receiver measurement) + 20.20 (antenna factor) + 1.55 (cable factor) = 31.82 dBμV

5.6RADIATED EMISSIONS TEST DATA CHART

3 Meter Measurements of Electromagnetic Radiated Emissions
Test Standard: 47CFR, Part 15.205 and 15.247(DTS)
RSS 210 A8, sections 2.2,2.6 and 2.7
Frequency Range Inspected: 30 MHz to 10000 MHz

Manufacturer:	Intersense						
Date(s) of Test:	August 29-30, September 6-7, 2011						
Test Engineer(s):	Peter Feilen						
Voltage:	6 VDC						
Operation Mode:	Continuous modulated transmit						
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %						
EUT Power:		Single Phase ___VAC		3 Phase ___VAC			
		Battery	X	Other: DC Bench Supply			
EUT Placement:	X	80cm non-conductive table		10cm Spacers			
EUT Test Location:	X	3 Meter Semi-Anechoic FCC Listed Chamber		3/10m OATS			
Measurements:		Pre-Compliance		Preliminary	X	Final	
Detectors Used:	X	Peak	X	Quasi-Peak	X	Average	

The following table depicts the level of significant spurious radiated RF emissions found:

Frequency (MHz)	Height (m)	Azimuth (degree)	Quasi Peak Reading (dBµV/m)	Quasi Peak Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
999.8	1.00	0	35.71	54.0	18.3	h	h
675.9	1.00	0	30.8	46.0	15.2	v	h
30.0	1.19	26	31.24	40.0	8.8	h	v
298.0	1.00	0	25.65	46.0	20.4	V	V
274.5	1	0	31.82	46.0	14.2	h	h
287.7	1.00	0	23.03	46.0	23.0	H	V

RADIATED EMISSIONS DATA CHART *(continued)*

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 1:

Harmonic	Orientation	Freq	Antenna Polarity	Height (m)	Az (deg)	Peak (dBuV/m)	Avg (dBuV/m)	Limit (dBuV/m)	Margin (dB)
3fo	FLAT	2718					NF	54.0	
4fo	FLAT	3624	V	1.37	343	51.5	50.5	54.0	3.5
5fo	FLAT	4530					NF	54.0	
6fo	FLAT	5436					NF	54.0	
8fo	FLAT	7248					NF	54.0	
9fo	FLAT	8154					NF	54.0	
10fo	FLAT	9060					NF	54.0	

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 5:

Harmonic	Orientation	Freq	Antenna Polarity	Height (m)	Az (deg)	Peak (dBuV/m)	Avg (dBuV/m)	Limit (dBuV/m)	Margin (dB)
3fo	**SIDE**	**2742**					**NF**	**54**	
4fo	**SIDE**	**3656**	**V**	**1.25**	**20**	**53.7**	**50.0**	**54.0**	**4.0**
5fo	**SIDE**	**4570**					**NF**	**54.0**	
8fo	**SIDE**	**7312**					**NF**	**54.0**	
9fo	**SIDE**	**8226**					**NF**	**54.0**	
10fo	**SIDE**	**9140**					**NF**	**54.0**	

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 10:

Harmonic	Orientation	Freq	Antenna Polarity	Height (m)	Az (deg)	Peak (dBuV/m)	Avg (dBuV/m)	Limit (dBuV/m)	Margin (dB)
3fo	**SIDE**	**2772**					**NF**	**54**	
4fo	**SIDE**	**3696**	**H**	**1.15**	**305**	**52.1**	**48.1**	**54.0**	**5.9**
5fo	**SIDE**	**4620**					**NF**	**54.0**	
8fo	**SIDE**	**7392**					**NF**	**54.0**	
9fo	**SIDE**	**8316**					**NF**	**54.0**	
10fo	**SIDE**	**9240**					**NF**	**54.0**	

Notes:

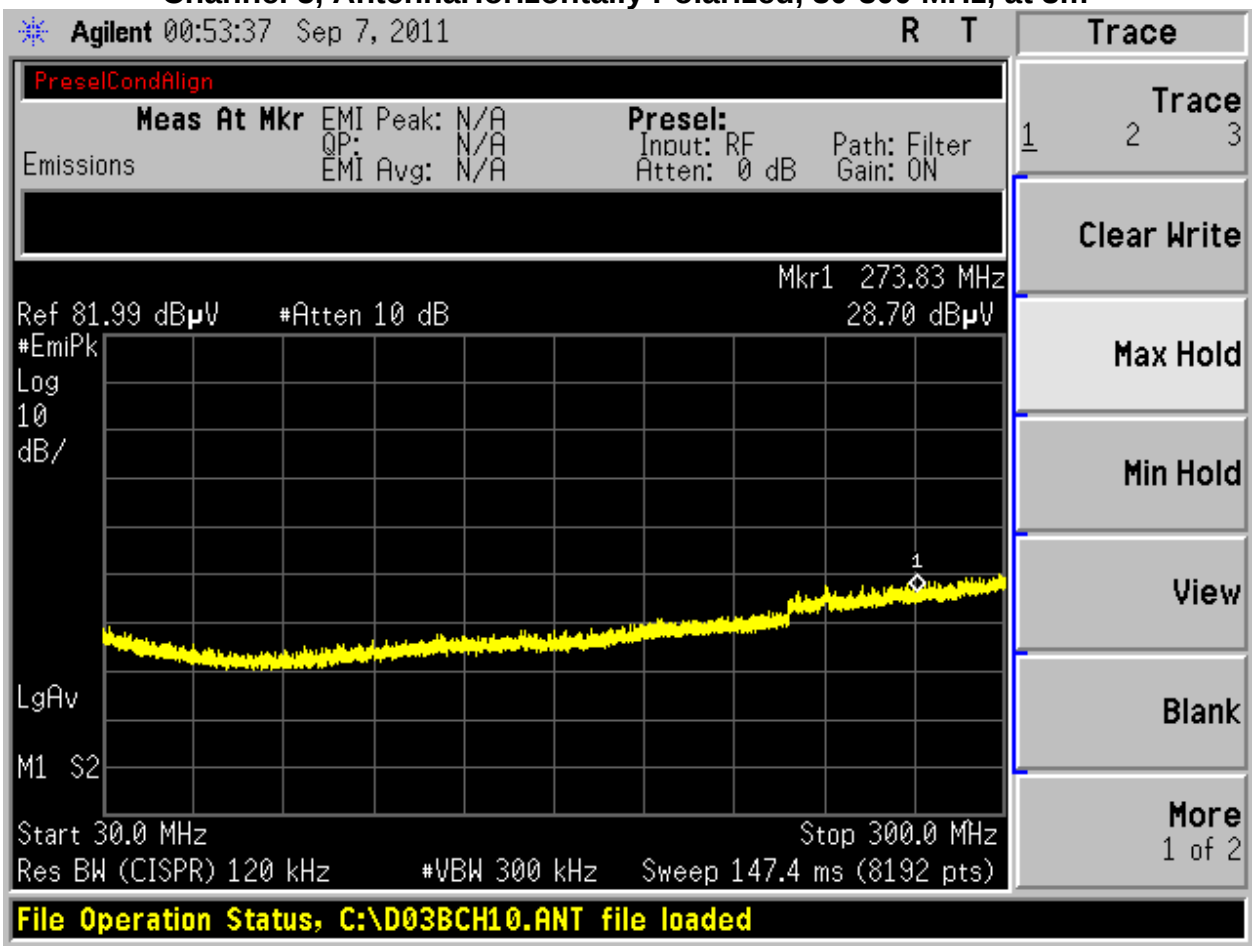
1) "NF" denotes measurement at receiver system noise floor.
2) A Peak as well as an Average Detector was used in measurements above 1 GHz. The peak detector was used to ensure the peak emissions did not exceed 20 dB above the limits.

5.7 Screen Captures - Radiated Emissions Test

These screen captures represent Peak Emissions. For radiated emission measurements, a Quasi-Peak detector function is utilized when measuring frequencies below 1 GHz, and an Average detector function is utilized when measuring frequencies above 1 GHz.

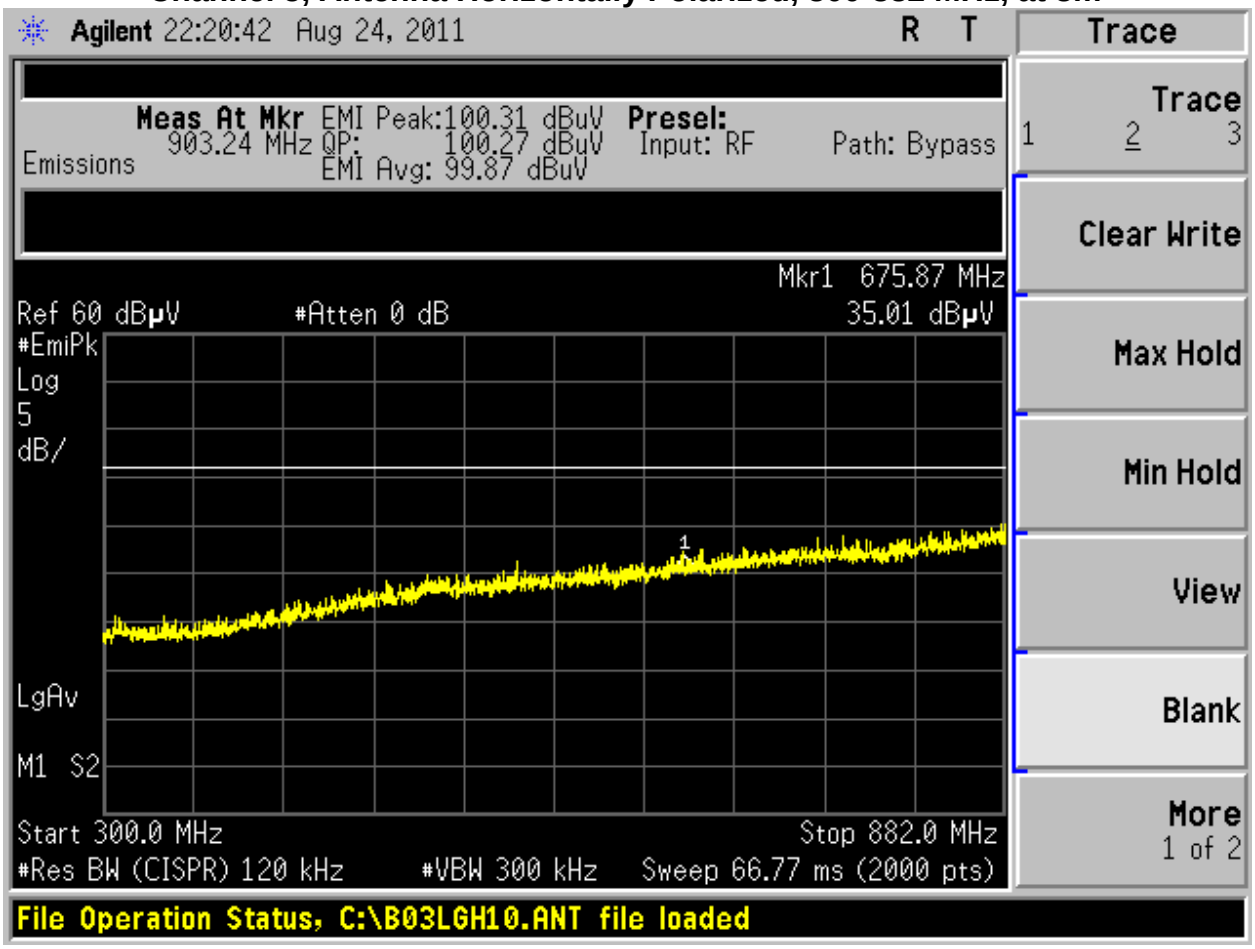
The signature scans shown here are from worst-case emissions, as measured on channels 1, 5, or 10, with the sense antenna both in vertical and horizontal polarity for worst case presentations.

Channel 5, AntennaHorizontally Polarized, 30-300 MHz, at 3m



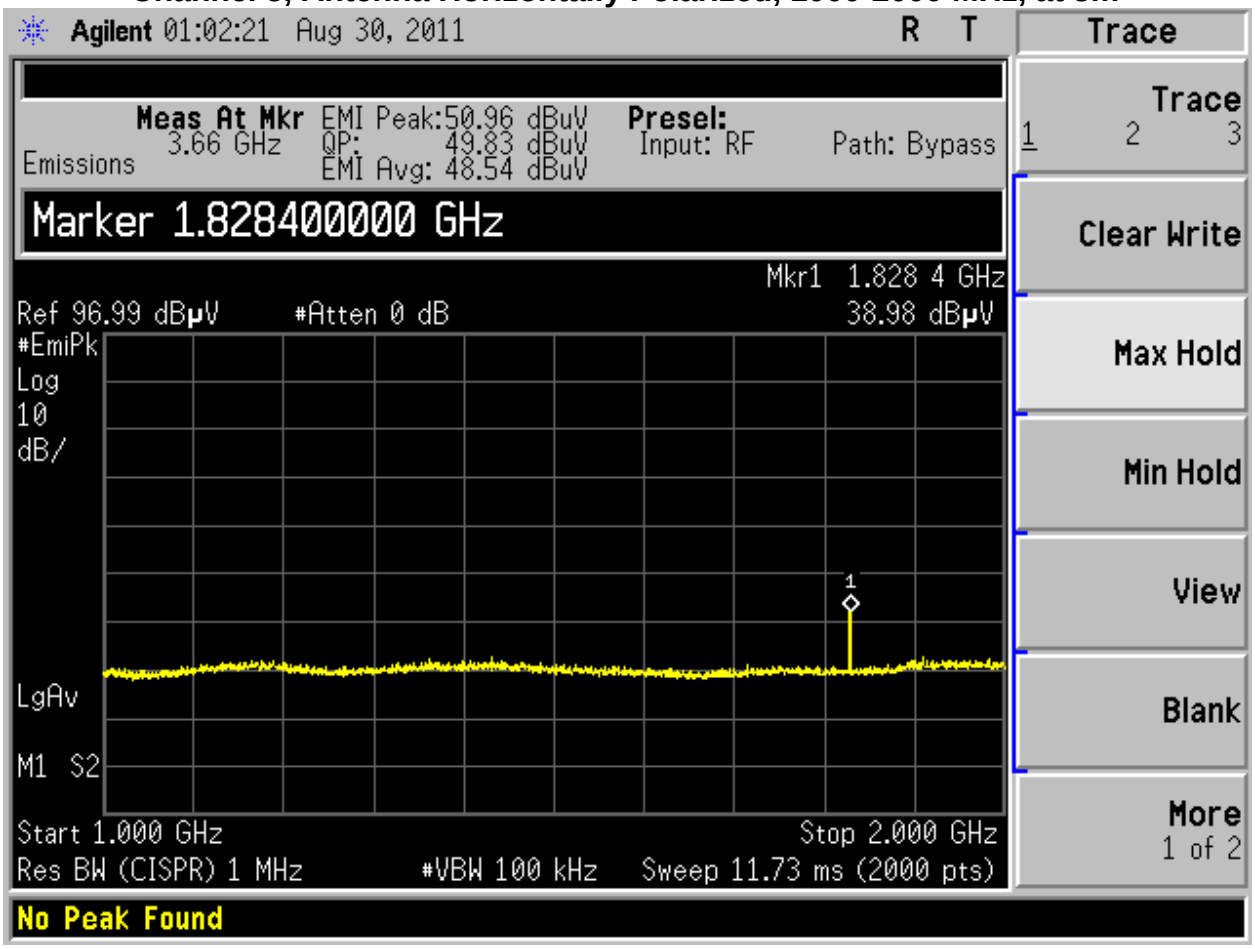
Screen Captures - Radiated Emissions Testing (continued)

Channel 5, Antenna Horizontally Polarized, 300-882 MHz, at 3m



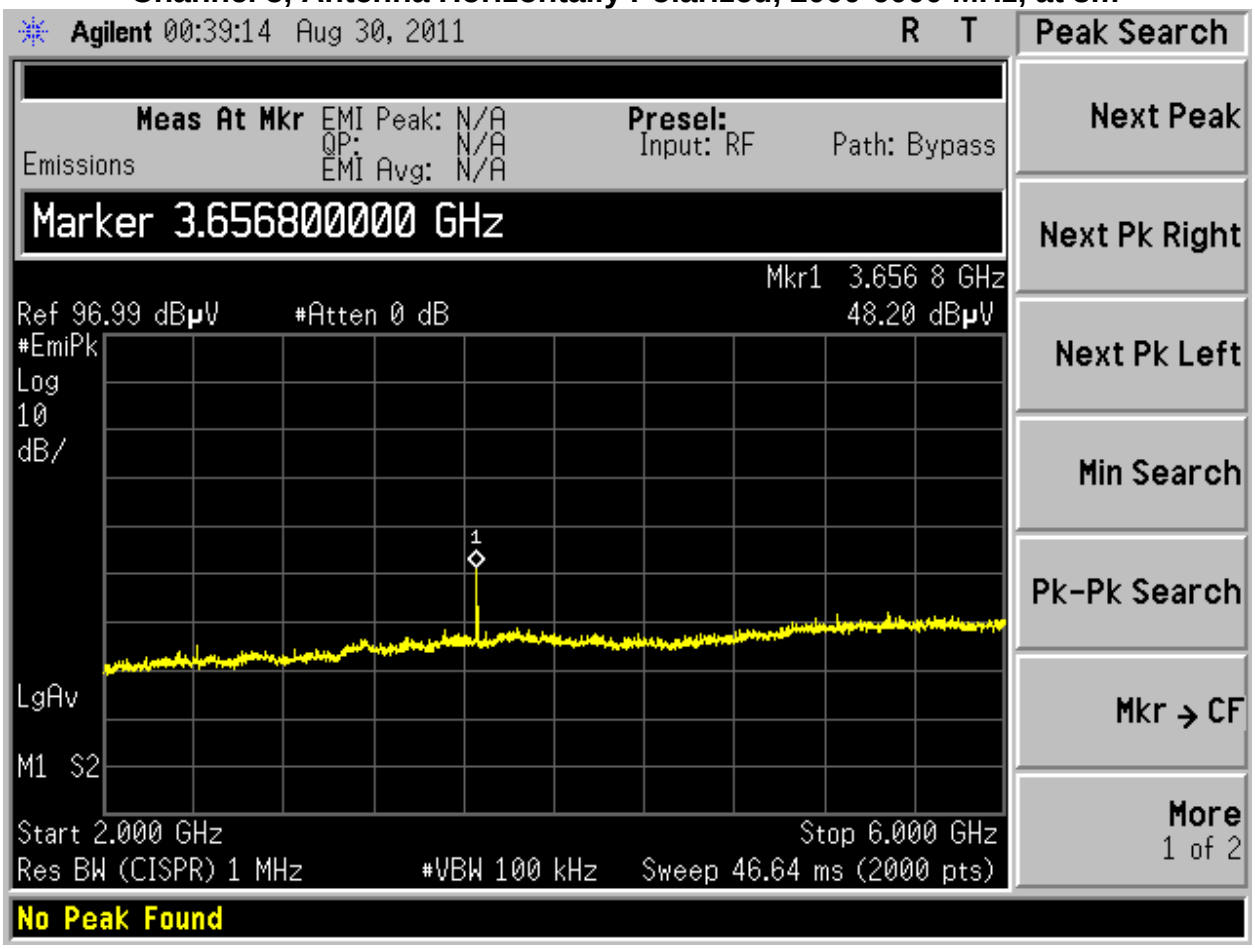
Screen Captures - Radiated Emissions Testing *(continued)*

Channel 5, Antenna Horizontally Polarized, 1000-2000 MHz, at 3m



Screen Captures - Radiated Emissions Testing *(continued)*

Channel 5, Antenna Horizontally Polarized, 2000-6000 MHz, at 3m



Screen Captures - Radiated Emissions Testing **(continued)**

Channel 5, Antenna Vertically Polarized, 6000-10000 MHz, at 1m

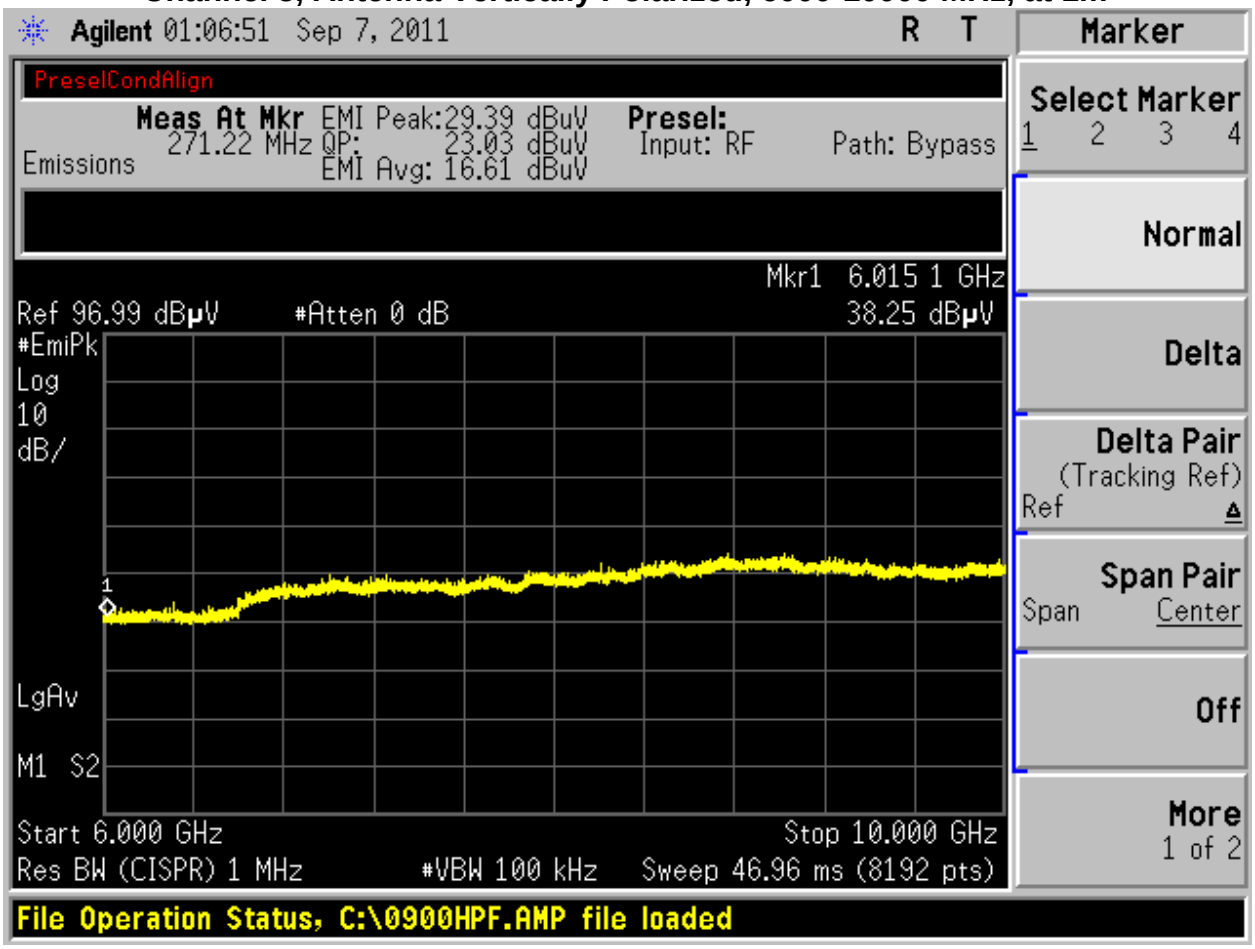


EXHIBIT 6. CONDUCTED EMISSIONS TEST, AC POWER LINE:

6.1 Test Setup

The test area and setup are in accordance with ANSI C63.4and with Title 47 CFR, FCC Part 15, Industry Canada RSS-210and RSS GEN. The EUT was placed on a non-conductive wooden table, with a height of 80 cm above the reference ground plane. The EUT's power cable was plugged into a 50Ω (ohm), 50/250 μH Line Impedance Stabilization Network (LISN). The AC power supply of 120V was provided at the LISN via an appropriate broadband EMI Filter, and then to the LISN line input. Final readings were then taken and recorded. After the EUT was setup and connected to the LISN, the RF Sampling Port of the LISN was connected to a 10 dB Attenuator-Limiter, and then to the Agilent E4445A/N9039A EMI System. The EMCO LISN used has the ability to terminate the unused port with a 50Ω (ohm) load when switched to either L1 (line) or L2 (neutral).

6.2 Test Procedure

The EUT was investigated in continuous modulated transmit mode for this portion of the testing. The appropriate frequency range and bandwidths were selected on the EMI Receiver, and measurements were made. The bandwidth used for these measurements is 9 kHz, as specified in CISPR 16-1, Section 1, Table 1, for Quasi-Peak and Average detectors in the frequency range of 150 kHz to 30MHz. Final readings were then taken and recorded.

6.3 Test Equipment Utilized

A list of the test equipment and accessories utilized for the Conducted Emissions test is provided in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. Calibrations of the LISN and Limiter are traceable to N.I.S.T. All cables are calibrated and checked periodically for conformance. The emissions are measured on the Agilent E4445A/N9039A EMI System, which has automatic correction for all factors stored in memory and allows direct readings to be taken.

Test Equipment List

Please see Appendix A

6.4 Test Results

The EUT was found to **MEET** the Conducted Emission requirements of FCC Part 15.207 Conducted Emissions for an Intentional Radiator. See the Data Charts and Graphs for more details of the test results.

6.5 FCC Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Class B Limits (dBµV)		Measuring Bandwidth
	Quasi-Peak	Average	
0.150 -0.50 *	66-56	56-46	RBW = 9 kHz VBW ≥ 9 kHz for QP VBW = 1 Hz for Average
0.5 – 5.0	56	46	
5.0 – 30	60	50	
* The limit decreases linearly with the logarithm of the frequency in this range.			

6.6CONDUCTED EMISSIONSTEST DATA CHART

FrequencyRange inspected: 150 KHz to 30 MHz
Test Standard: FCC 15.207 Class B
IC RSS GEN 7.2.2

Manufacturer:	InterSense					
Date(s) of Test:	September 7, 2011					
Test Engineer:	Peter Feilen					
Voltage:	6 VDC					
Operation Mode:	continuous modulated transmitmode					
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %					
Test Location:						Chamber
EUT Placed On:	X	40cm from Vertical Ground Plane				10cm Spacers
	X	80cm above Ground Plane				Other:
Measurements:		Pre-Compliance		Preliminary	X	Final
Detectors Used:		Peak	X	Quasi-Peak	X	Average

		Quasi-Peak			Average		
Frequency (MHz)	Line	Q-Peak Reading (dBµV)	Q-Peak Limit (dBµV)	Quasi-Peak Margin (dB)	Average Reading (dBµV)	Average Limit (dBµV)	Average Margin (dB)
0.620	L1	35.5	56	20.5	32.1	46	13.9
4.020	L2	31.6	56	24.4	30.4	46	15.6
0.620	L2	36.1	56	19.9	32.6	46	13.4

Notes:
1) All other emissions were better than 20 dB below the limits.

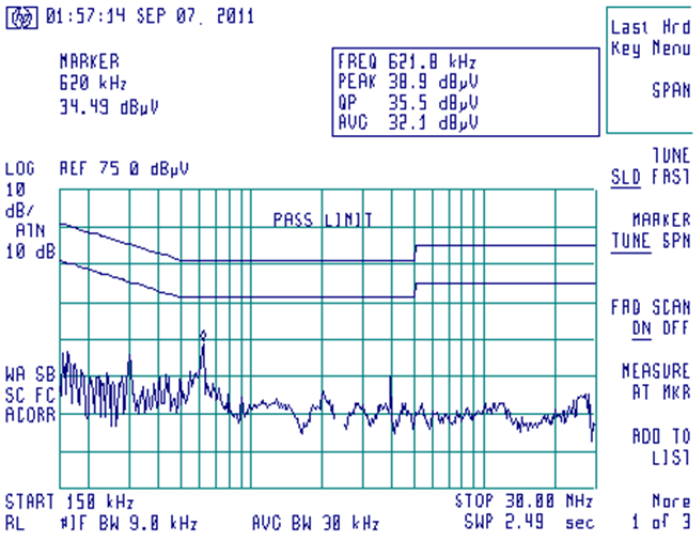
2) The EUT exhibited similar emissions in transmit (and receive) modes, and across the Low, Middle and High channels tested.

6.7 Screen Captures – Conducted Emissions Test

These screen captures represent Peak Emissions. For conducted emission measurements, both a Quasi-Peak detector function and an Average detector function are utilized. The emissions must meet both the Quasi-peak limit and the Average limit as described in 47 CFR 15.207 and RSS GEN 7.2.2 (Table 2).

The signature scans shown here are from channel 5, chosen as being a good representative of channels.

Line 1



Line 2

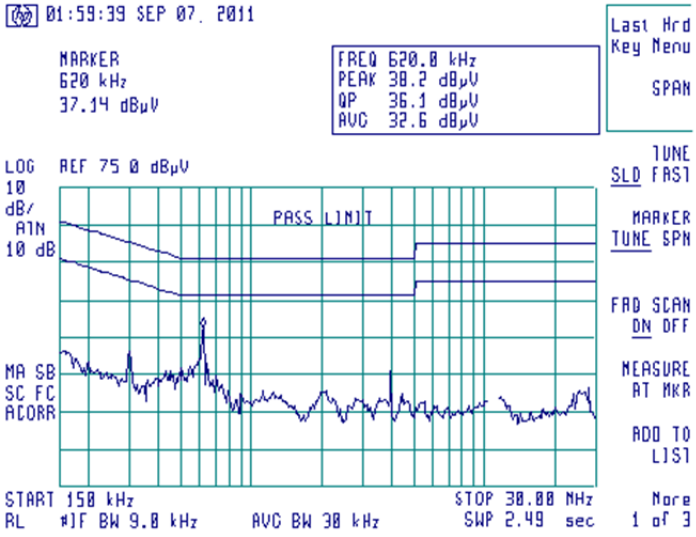


EXHIBIT 7. OCCUPIED BANDWIDTH:

7.1 Limits

For a Digital Modulation System, the 6 dB bandwidth shall be at least 500 kHz.

7.2 Method of Measurements

Refer to ANSI C63.4 and FCC Procedures (2007) for Digital Transmission Systems operating under 15.247.

The transmitter output was connected to the Spectrum Analyzer. The bandwidth of the fundamental frequency was measured with the Spectrum Analyzer using 100 kHz RBW and VBW=300 kHz.

The bandwidth requirement found in FCC Part 15.247(a)(2) and RSS 210 A8.2(a) requires a minimum -6dBc occupied bandwidth of 500 kHz. In addition, Industry Canada (IC RSS GEN 4.6.1) requires the measurement of the 99% occupied bandwidth. For this portion of the tests, a direct measurement of the transmitted signal was performed at the antenna port of the EUT, via a cable connection to the Agilent E4446A spectrum analyzer. An attenuator was placed in series with the cable to protect the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, thereby allowing direct measurements, without the need for any further corrections. An Agilent model E4446A spectrum analyzer was used with the resolution bandwidth set to 30 kHz for this portion of the tests. The EUT was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used in peak-hold mode while measurements were made, as presented in the chart below.

From this data, the closest measurement (6 dB bandwidth) when compared to the specified limit, is 751.50 kHz, which is above the minimum of 500 kHz.

7.3 Test Equipment List

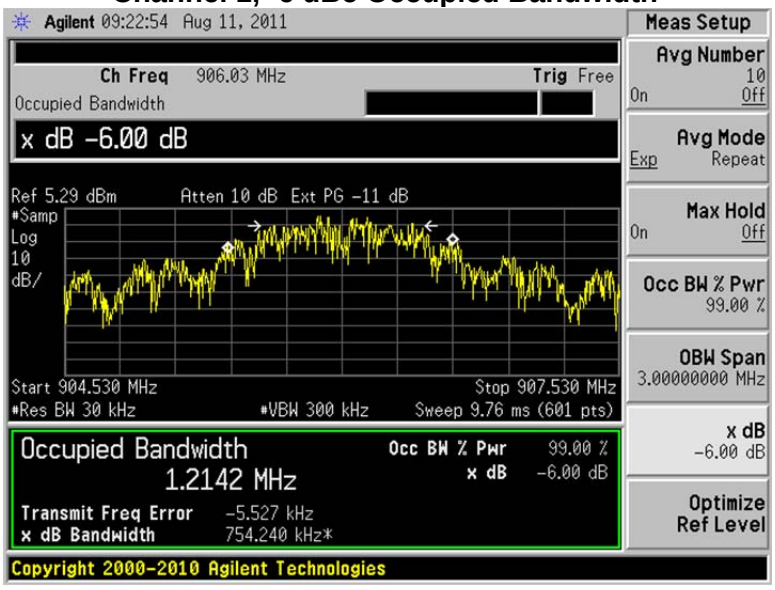
Please see Appendix A

7.4 Test Data

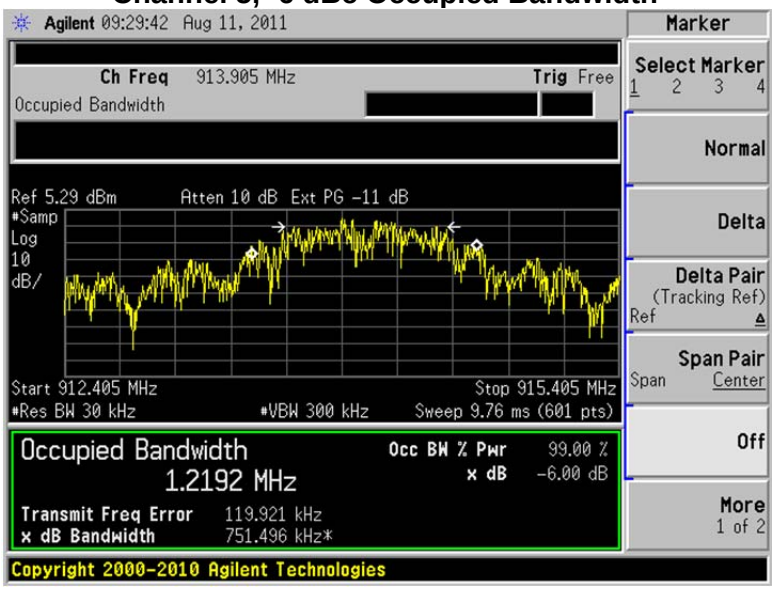
Channel	Center Frequency (MHz)	Measured -6 dBc Occ. BW (kHz)	Minimum -6 dBc Limit (kHz)	-6 dBc Margin (kHz)	Measured 99%Occ.Bw (kHz)
1	906	754.24	500	254.24	1203.50
5	914	751.50	500	251.50	1220.10
10	924	755.20	500	255.20	1199.70

7.5 Screen Captures - OCCUPIED BANDWIDTH

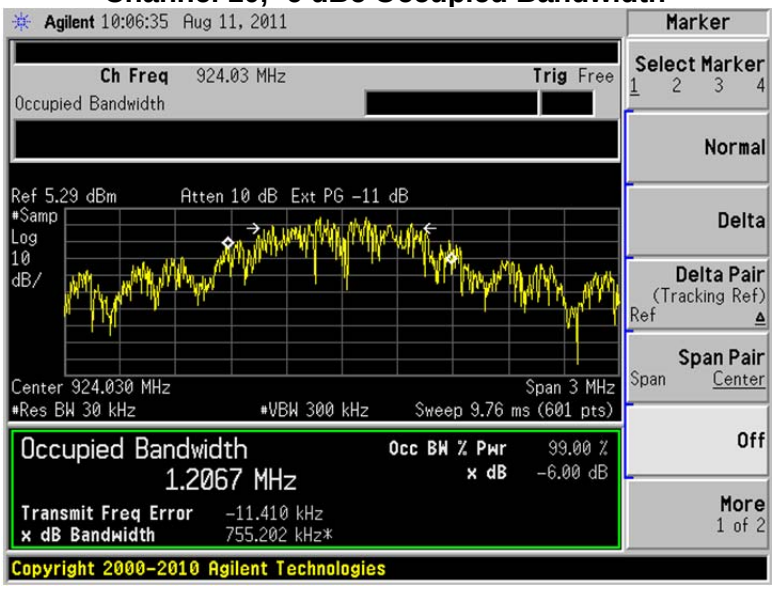
Channel 1, -6 dBc Occupied Bandwidth



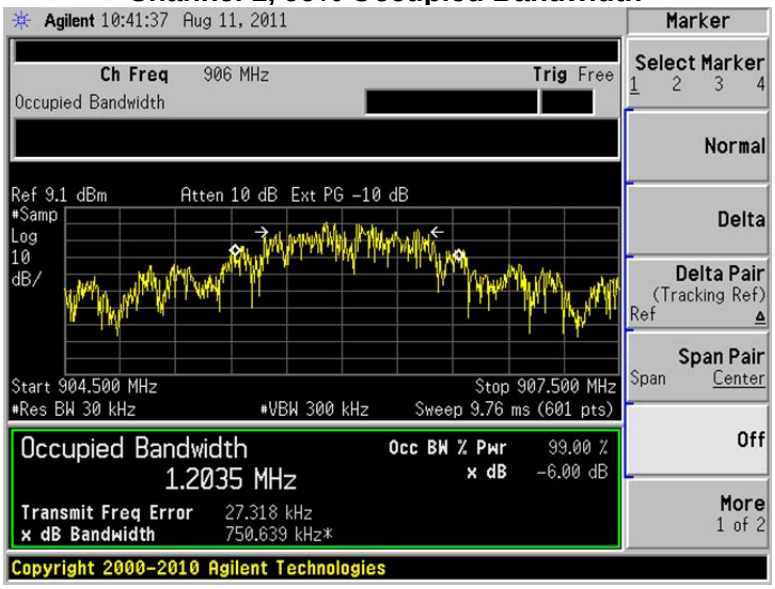
Channel 5, -6 dBc Occupied Bandwidth



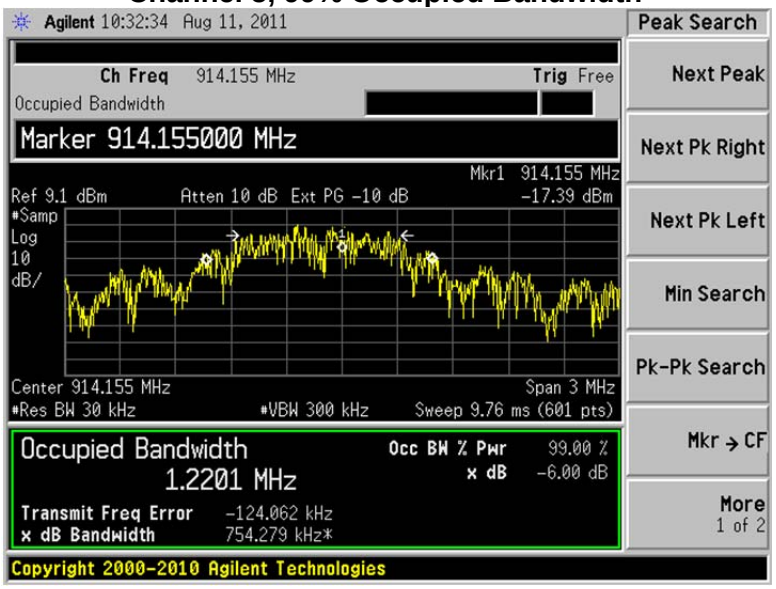
Channel 10, -6 dBc Occupied Bandwidth



Channel 1, 99% Occupied Bandwidth



Channel 5, 99% Occupied Bandwidth



Channel 10, 99% Occupied Bandwidth

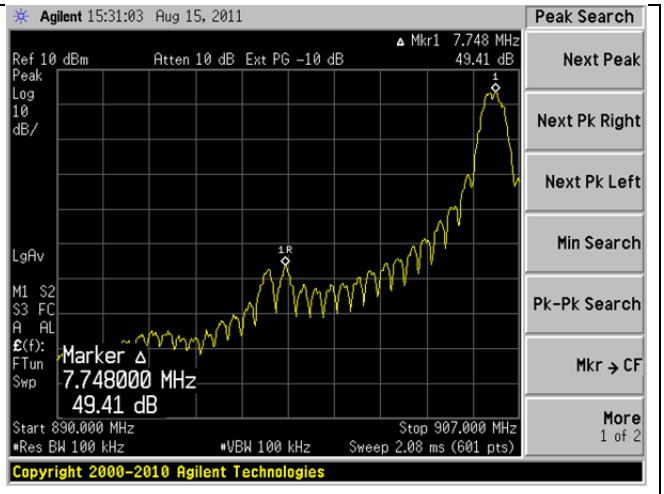
EXHIBIT 8. BAND-EDGE MEASUREMENTS

8.1 Method of Measurements

FCC 15.209(b) and 15.247(d) require a measurement of spurious emission levels to be at least 20 dB lower than the fundamental emission level, in particular at the Band-Edges where the intentional radiator operates. Also, RSS 210 Section 2.2 requires that unwanted emissions meet limits listed in tables 2 and 3 of the same standard and also to the limits in the applicable annex. The following screen captures demonstrate compliance of the intentional radiator at the Band-Edges. The EUT was operated in continuous transmit mode with continuous modulation, with internally generated data as the modulating source. The EUT was operated at the lowest channel for the investigation of the lower Band-Edge, and at the highest channel for the investigation of the higher Band-Edge.

8.2 Data and Analysis

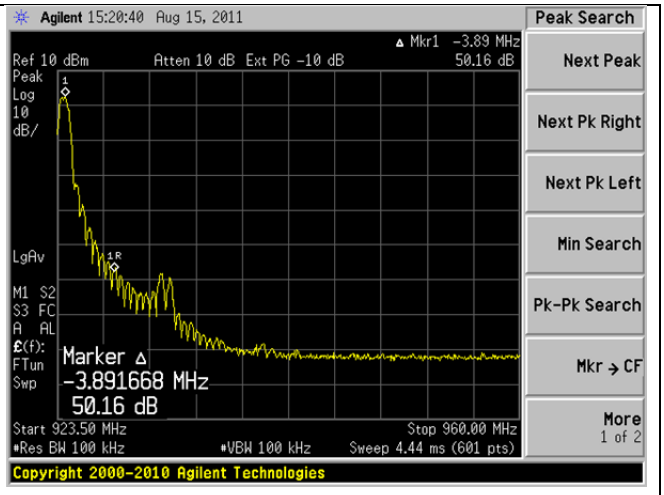
Screen Capture Demonstrating Compliance at the Lower Band-Edge



Conducted Lower Bandedge Measurement

Limit of 20 dBc met

Screen Capture Demonstrating Compliance at the Upper Band-Edge



Conducted Upper Band-edge Measurement

Limit of 20 dBc met.

9.1 Method of Measurements

The conducted RF output power of the EUT was measured at the antenna port using a short RF cable along with an attenuator as protection for the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, thereby allowing direct measurements without the need for any further corrections. The unit was configured to run in a continuous transmit mode, while being supplied internally with typical data as a modulation source. The spectrum analyzer was used with resolution and video bandwidths set to 3 MHz, and a span of 20 MHz, with measurements from a peak detector presented in the chart below.

9.2 Test Equipment List

Please see Appendix A for a list of test equipment used

9.3 Test Data

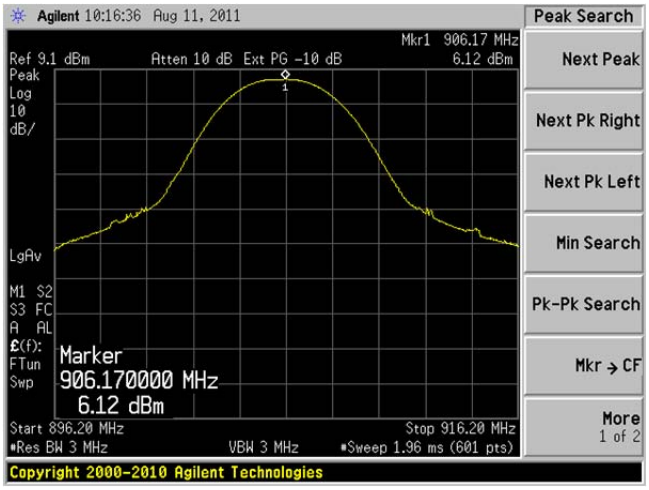
Test Data

Transmitter Channel	Freq. (MHz)	Peak Power at Antenna Terminal (dBm)	(1) Calculated EIRP (dBm)	Conducted Power Limit (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
Lowest	906	6.12	5.12	30.0	36.0	34.88
Middle	914	5.40	4.40	30.0	36.0	31.60
Highest	924	5.36	4.36	30.0	36.0	31.64

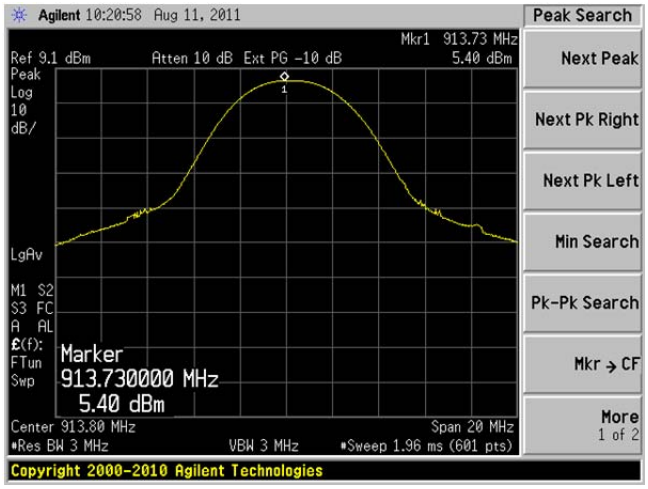
(1) EIRP Calculation:
EIRP = (Peak power at antenna terminal in dBm) + (EUT Antenna gain in dBi)

9.4 Screen Captures – Power Output (Conducted)

Channel 1



Channel 5



Channel 10

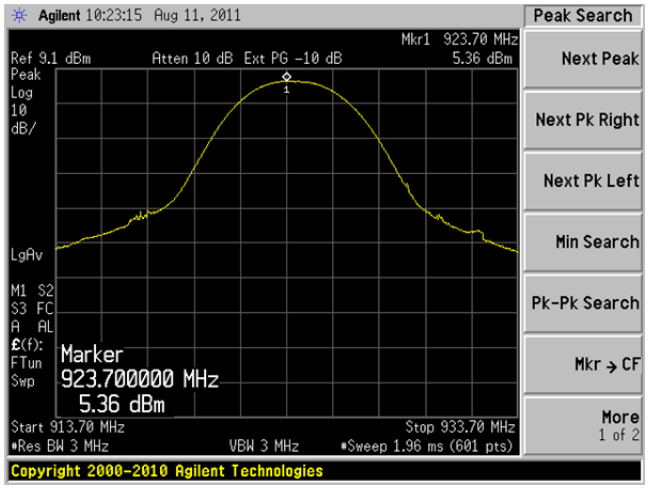


EXHIBIT 10 POWER SPECTRAL DENSITY: 15.247(e)

10.1 Limits

For digitally modulate systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

In accordance with FCC Part 15.247(e) and RSS 210 A8.2(b), the peak power spectral density should not exceed +8 dBm in any 3 kHz band. This measurement was performed along with the conducted power output readings performed as described in previous sections. The peak output frequency for each representative frequency was scanned, with a narrow bandwidth, and reduced sweep, and a power density measurement was performed using the utility built into the Agilent Analyzer. The resultant density was then corrected to a 3 kHz bandwidth. The highest density was found to be no greater than -12.2dBm, which is under the allowable limit by 20dB.

10.2 Test Equipment List

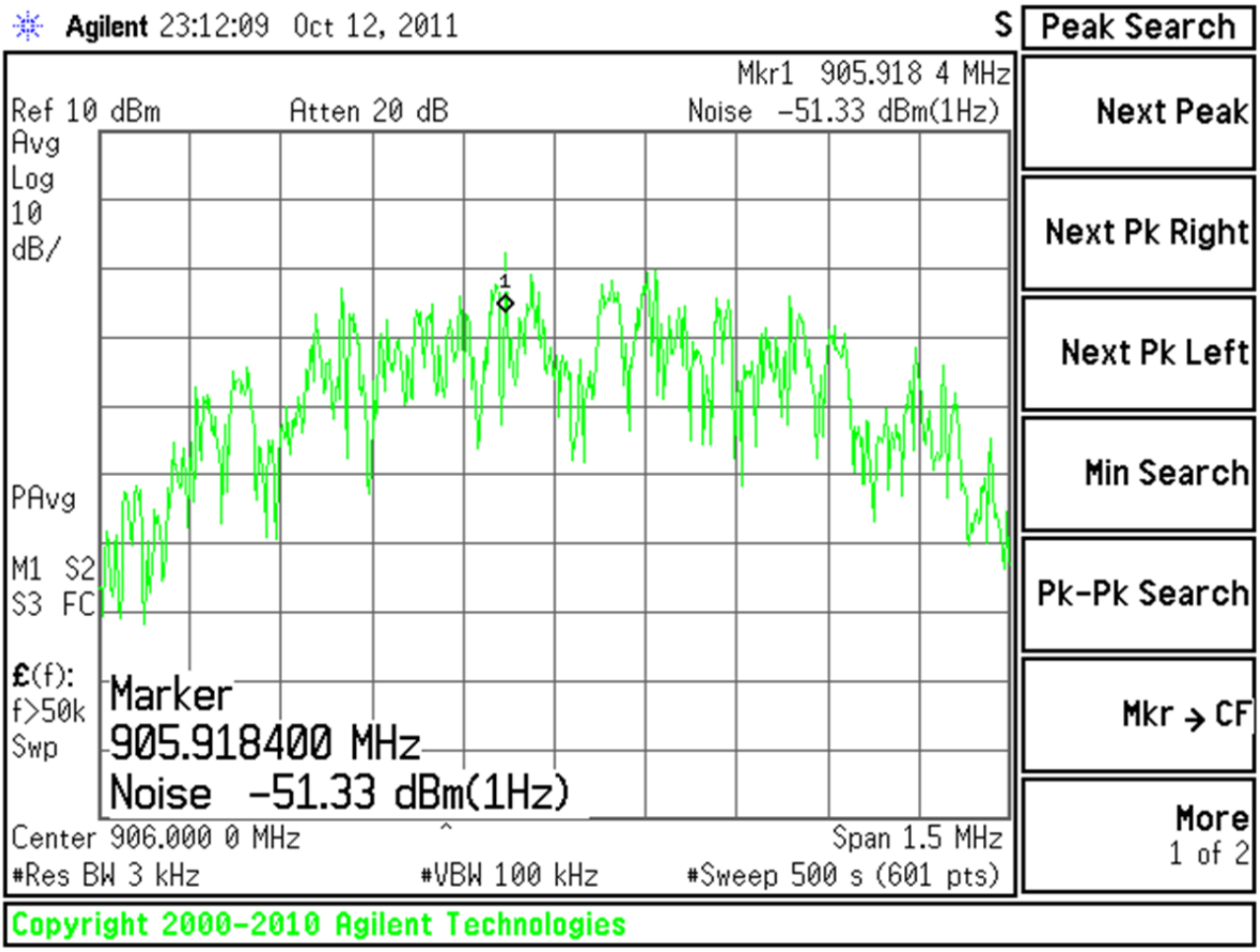
Please see Appendix A

10.3 Test Data

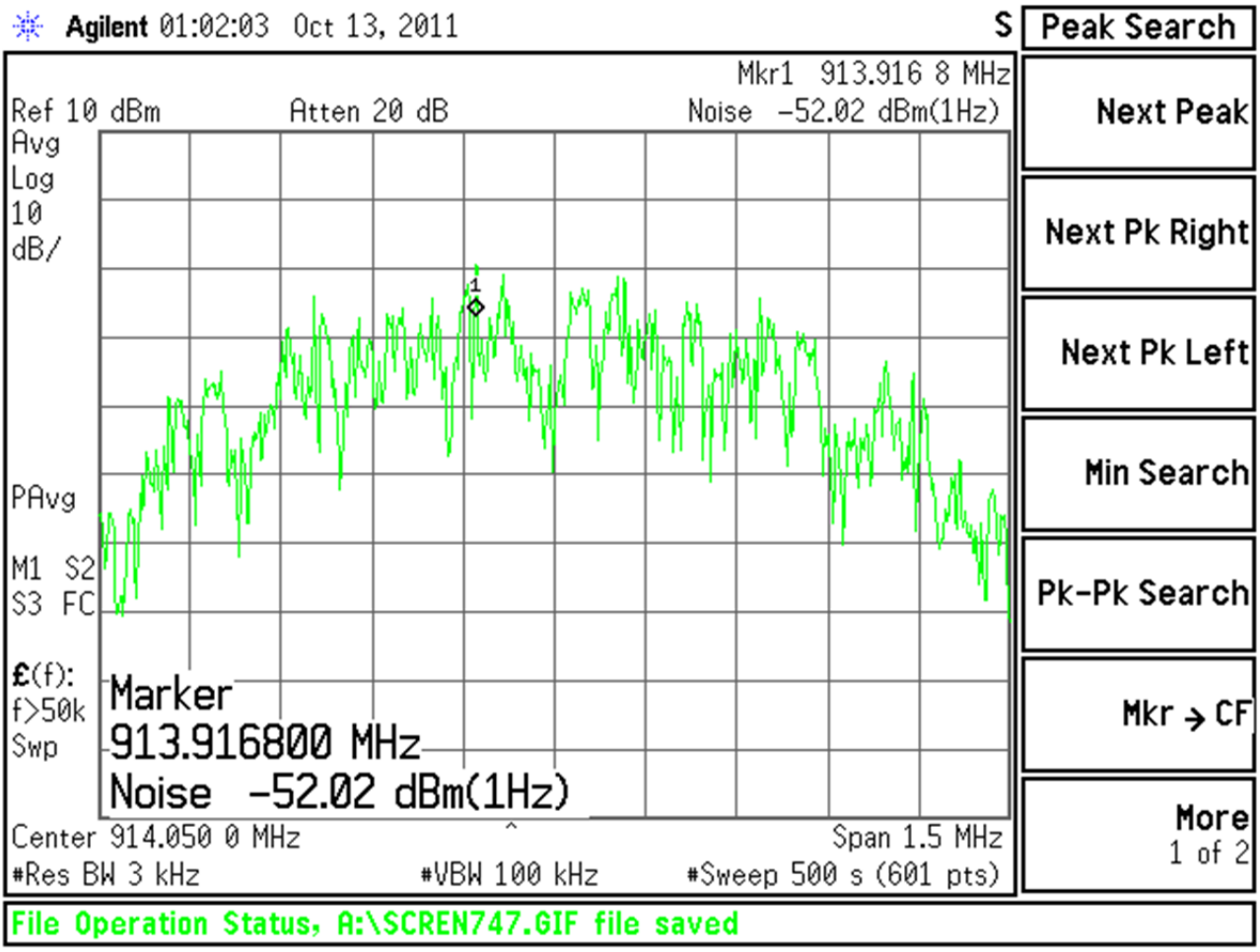
Channel	Noise Marker (1 Hz)	Noise Marker Correction to PSD/3 kHz	PSD/3kHz	Limit	Margin
1	-52.29	35	-17.29	8.00	-25.29
5	-52.02	35	-17.02	8.00	-25.02
10	-51.97	35	-16.97	8.00	-24.97

10.4 Screen Captures – Power Spectral Density

Channel 1



Channel 5


Agilent 01:02:03 Oct 13, 2011
S
Peak Search
Mkr1 913.916 8 MHz
Ref 10 dBm
Atten 20 dB
Noise -52.02 dBm(1Hz)
Next Peak
Avg
Log
10
dB/
Next Pk Right
Next Pk Left
Min Search
PAvg
M1 S2
S3 FC
Pk-Pk Search
£(f):
f>50k
Swp
Marker
913.916800 MHz
Noise -52.02 dBm(1Hz)
Mkr → CF
More
1 of 2
Center 914.050 0 MHz
Span 1.5 MHz
#Res BW 3 kHz
#VBW 100 kHz
#Sweep 500 s (601 pts)
File Operation Status, A:\SCREN747.GIF file saved

Channel 10

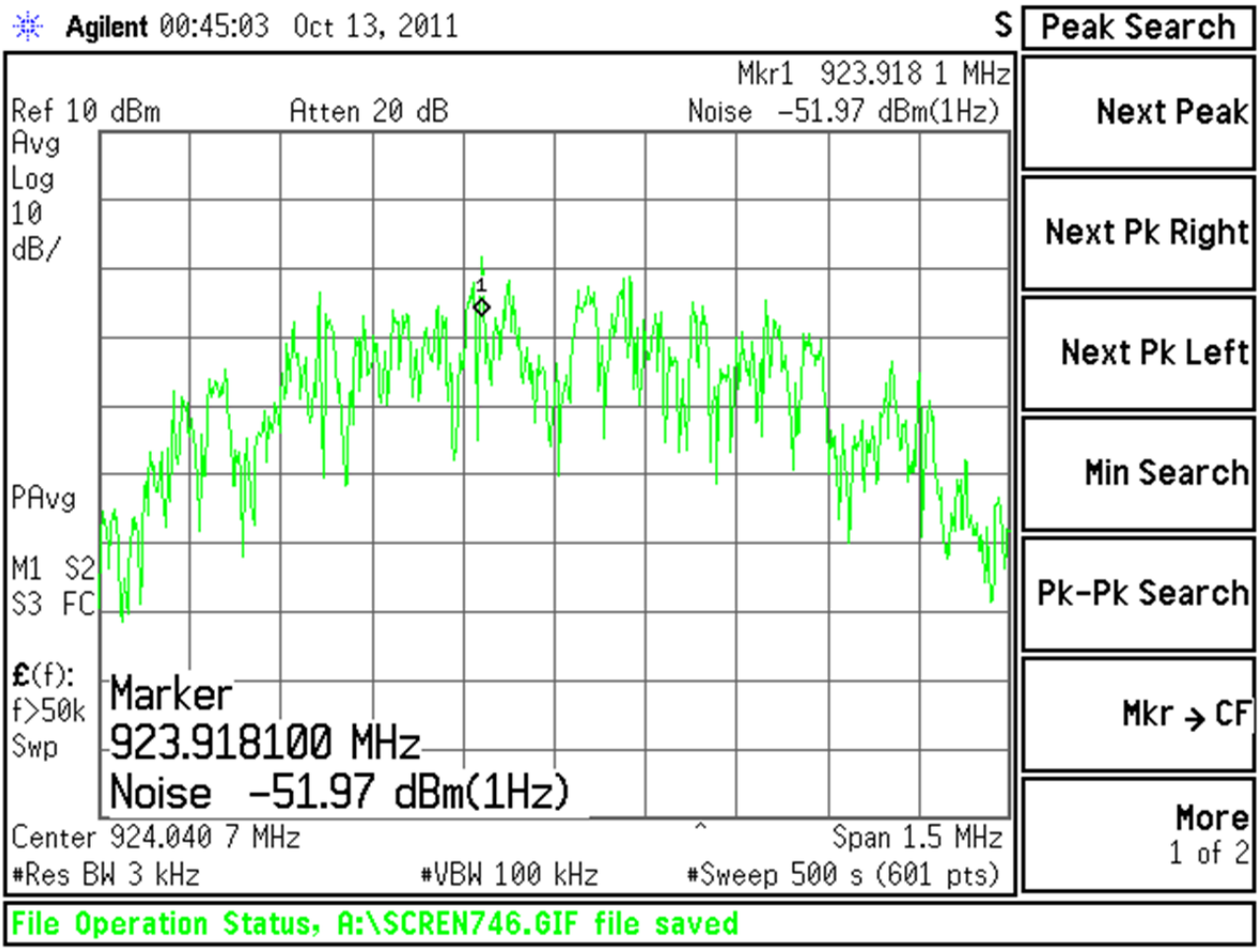

Agilent 00:45:03 Oct 13, 2011
S
Peak Search
Mkr1 923.918 1 MHz
Ref 10 dBm
Atten 20 dB
Noise -51.97 dBm(1Hz)
Next Peak
Avg
Log
10
dB/
Next Pk Right
Next Pk Left
Min Search
PAvg
M1 S2
S3 FC
Pk-Pk Search
£(f):
f>50k
Swp
Marker
923.918100 MHz
Noise -51.97 dBm(1Hz)
Mkr → CF
More
1 of 2
Center 924.040 7 MHz
Span 1.5 MHz
#Res BW 3 kHz
#VBW 100 kHz
#Sweep 500 s (601 pts)
File Operation Status, A:\SCREN746.GIF file saved

EXHIBIT 11. SPURIOUS CONDUCTED EMISSIONS: 15.247(d)

11.1 Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 db below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

FCC Part 15.247(d) and IC RSS 210 A8.5 requires a measurement of conducted harmonic and spurious RF emission levels, as reference to the carrier level when measured in a 100 kHz bandwidth. For this test, the spurious and harmonic RF emissions from the EUT were measured at the EUT antenna port using a short RF cable along with an attenuator as protection for the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, thereby allowing direct readings of the measurements made without the need for any further corrections. An Agilent model E4446A spectrum analyzer was used with the resolution bandwidth set to 100 kHz for this portion of the tests. The unit was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used with measurements from a peak detector presented in the chart below. Screen captures were acquired and any noticeable spurious and harmonic signals were identified and measured.

No significant emissions could be noted within -60 dBc of the fundamental level for this product.

11.2 Test Equipment List

Please see Appendix A

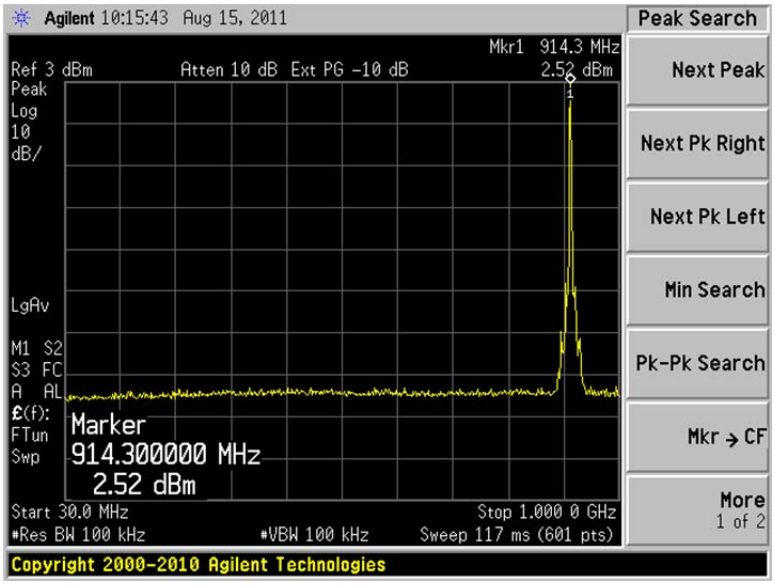
11.3 Test Data

Freq\Chan	1	5	10
fo	3.32	2.50	2.39
2fo	-59.88	-61.31	-61.68
3fo	-69.83	-70.13	-72.33
4fo	-73.28	-74.68	-75.18
5fo	NF	NF	NF
6fo	NF	NF	NF
7fo	NF	NF	NF
8fo	NF	NF	NF
9fo	-71.51	-70.31	-68.80
10fo	NF	NF	NF

Notes:
(1) NF denotes measurement at system noise floor.

11.4 Screen Captures – Spurious Radiated Emissions

Channel 5, shown from 30 MHz up to 1000 MHz



Channel 5, shown from 1000 MHz up to 10000 MHz

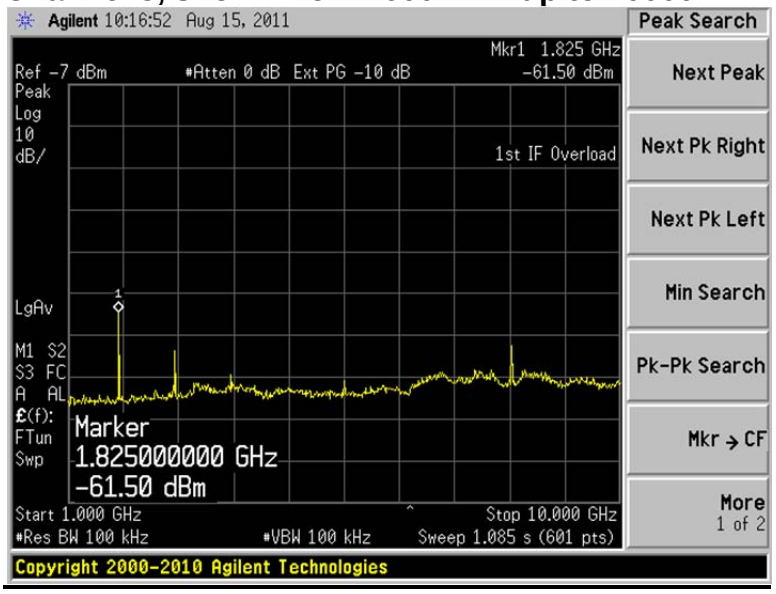


EXHIBIT 12. FREQUENCY & POWER STABILITY OVER VOLTAGE VARIATIONS

The stability of the device was examined as a function of the input voltage available to the EUT. A Spectrum Analyzer was used to measure the frequency at the appropriate frequency markers. Power was supplied by an external bench-type variable power supply, and the frequency of operation was monitored using the spectrum analyzer.

A spectrum analyzer was used to measure the frequency at the appropriate frequency markers. For this test, the EUT was placed in continuous transmit CW mode. Power to the EUT was supplied by an external bench-type variable power supply. The frequency of operation was monitored using the spectrum analyzer with RBW=VBW=1 kHz settings while the voltage was varied.

The RF Power Output of the EUT was also monitored in a separate test, also using a Spectrum Analyzer with RBW=VBW=3 MHz setting while the voltage was varied.

4.3VDC		5.0VDC		5.8VDC		
Power	Frequency	Power	Frequency	Power	Frequency	Channel
6.18	905918900	6.18	905918900	6.18	905918900	1
5.41	913919260	5.42	913919260	5.42	913919260	5
5.38	923919780	5.38	923919780	5.38	923919780	10

Channel	max	min	freq drift (Hz)
1	905918900	905918900	0
5	913919430	913919430	0
10	923919780	923919780	0

No anomalies were noted; in the measured transmit power, varying less than 1 dB, during the voltage variation tests.

APPENDIX A

Instrumentation Sheet

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 12-Aug-2011 Type Test : Radiated Emissions Job # : C-1272

Prepared By: Peter Customer : Intersense Quote #: 311238

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	10/19/2010	10/19/2011	Active Calibration
2	AA 960150	Bicon Antenna	ETS	3110B	0003-3346	10/19/2010	10/19/2011	Active Calibration
3	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	4/27/2011	4/27/2012	Active Calibration
4	EE 960158	RF Preselecter	Agilent	N9039A	MY46520110	6/11/2011	6/11/2012	Active Calibration
5	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	6/6/2011	6/6/2012	Active Calibration
6	EE 960156	100kHz-1GHz Analog Signal Generator	Agilent	N5181A	MY49060062	6/6/2011	6/6/2012	Active Calibration
7	EE 960147	Pre-Amp	Adv. Micro	WLA612	123101	1/4/2011	1/4/2012	Active Calibration

Project Engineer: Peter Fiduccia Quality Assurance:

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 12-Aug-2011 Type Test : Occupied Bandwidth (6dB & 20dB) Job # : C-1272

Prepared By: Peter Customer : Intersense Quote #: 311238

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	CC 000284C	Signal Generator	Agilent	E4421B	MY41000402	9/17/2009	9/17/2010	Decommission
2	AA 960144	Phaseflex	Gore	EKD01D010720	5800373	6/1/2011	6/1/2012	Active Calibration

Project Engineer: Peter Fiduccia Quality Assurance:

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 12-Aug-2011 Type Test : Conducted Power Output Job # : C-1272

Prepared By: Peter Customer : Intersense Quote #: 311238

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	CC 000284C	Signal Generator	Agilent	E4421B	MY41000402	9/17/2009	9/17/2010	Decommission
2	AA 960144	Phaseflex	Gore	EKD01D010720	5800373	6/1/2011	6/1/2012	Active Calibration

Project Engineer: Peter Fiduccia Quality Assurance:

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 12-Aug-2011 Type Test : Power Spectral Density Job # : C-1272

Prepared By: Peter Customer : Intersense Quote #: 311238

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	CC 000284C	Signal Generator	Agilent	E4421B	MY41000402	9/17/2009	9/17/2010	Decommission
2	AA 960144	Phaseflex	Gore	EKD01D010720	5800373	6/1/2011	6/1/2012	Active Calibration

Project Engineer: Peter Fiduccia Quality Assurance:

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 12-Aug-2011 Type Test : Spurious Emissions Job # : C-1272

Prepared By: Peter Customer : Intersense Quote #: 311238

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	CC 000284C	Signal Generator	Agilent	E4421B	MY41000402	9/17/2009	9/17/2010	Decommission
2	AA 960144	Phaseflex	Gore	EKD01D010720	5800373	6/1/2011	6/1/2012	Active Calibration

Project Engineer: Peter Fiduccia Quality Assurance: _____

APPENDIX B

STANDARD #	DATE	Am. 1	Am. 2
ANSI C63.4	2009		
ANSI C63.10	2009		
CISPR 11	2009-05	2009-12 P	
CISPR 12	2007-05		
CISPR 14-1	2005-11	2008-11	
CISPR 14-2	2001-11	2001-11	2008-05
CISPR 16-1-1 Note 1	2010-01		
CISPR 16-1-2 Note 1	2003	2004-04	2006-07
CISPR 22	2008-09		
CISPR 24	1997-09	2001-07	2002-10
EN 55011	2009		
EN 55014-1	2006		
EN 55014-2	1997		
EN 55022	2006	2007	
EN 60601-1-2	2007-03		
EN 61000-3-2	2006-05		
EN 61000-3-3	2008-12		
EN 61000-4-2	2009-05		
EN 61000-4-3	2006-07	2008-05	
EN 61000-4-4	2004		
EN 61000-4-5	2006-12		
EN 61000-4-6	2009-05		
EN 61000-4-8	1994	2001	
EN 61000-4-11	2004-10		
EN 61000-6-1	2007-02		
EN 61000-6-2	2005-12		
EN 61000-6-3	2007-02		
EN 61000-6-4	2007-02		
FCC 47 CFR, Parts 0-15, 18,	2009		
FCC Public Notice DA 00-1407	2000		
FCC ET Docket # 99-231	2002		
FCC Procedures	2007		
ICES 001	2006-06		
ICES 002	2009-08		
ICES 003	2004-02		
IEC 60601-1-2 Note 1	2007-03		
IEC 61000-3-2	2005-11	2008-03	2009-02
IEC 61000-3-3	2008-06		
IEC 61000-4-2	2008-12		
IEC 61000-4-3	2008-04	incl in 2008-	2009-12

STANDARD #	DATE	Am. 1	Am. 2
IEC 61000-4-4	2004-07	2010-10	
IEC 61000-4-5	2005-11		
IEC 61000-4-6	2008-10		
IEC 61000-4-8	2009-09		
IEC 61000-4-11	2004-03		
IEC 61000-6-1	2005-03		
IEC 61326-1	2006-06		
ISO 14982	1998-07		
MIL Std. 461E	1999-08		
RSS GEN	2007-06		
RSS 119	2007-06		
RSS 123	1999-11		
RSS 125	2000-03		
RSS 131	2003-07		
RSS 136	2002-10		
RSS 137	2009-02		
RSS 210	2010-12		
RSS 213	2005-12		
RSS 243	2010-02		
RSS 310	2007-06		

Note 1: Test not on LSR Scope of Accreditation.

APPENDIX C
Uncertainty Statement

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k=2.

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.24 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.8 dB
Radiated Emissions	10-Meter OATS, Biconical Antenna	4.18 dB
Radiated Emissions	10-Meter OATS, Log Periodic Antenna	3.92 dB
Conducted Emissions	Shielded Room/EMCO LISN	1.60 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	1.128 Volts/Meter

Appendix D
Antenna Specification(s)

"High Frequency Ceramic Solutions"

915 MHz Antenna **P/N 0915AT43A0026**

Detail Specification: 07/26/2010 Page 1 of 3

Recommended Application ISM

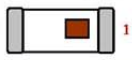
General Specifications

Part Number	0915AT43A0026
Frequency Range	902 - 928
Peak Gain	-1.0 dBi typ. (XZ-total)
Average Gain	-4.0 dBi typ. (XZ-total)
Return Loss	8.5 dB min.
Impedance	50 Ω
Input Power	2W max.

Operating Temperature	-40 to +85°C
Storage Temperature Range	+5~+35°C, Humidity 45~75%RH
Reel Quanity	1,000

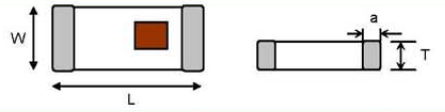
No.	Function
1	Feeding Point
2	NC

Terminal Configuration



Mechanical Dimensions

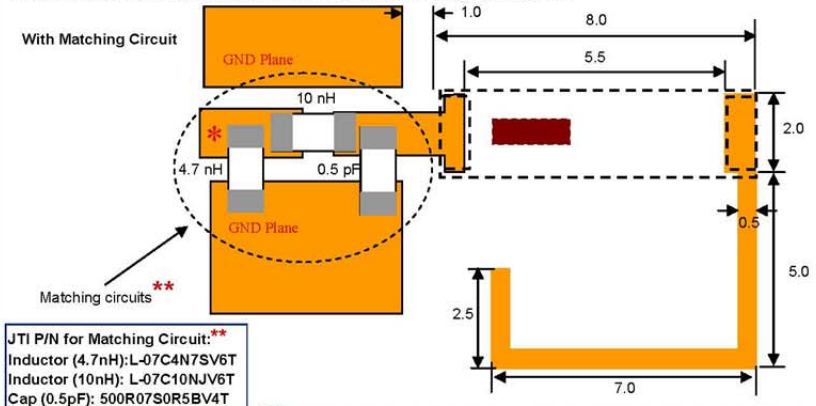
	In	mm
L	0.276 ± 0.008	7.00 ± 0.20
W	0.079 ± 0.008	2.00 ± 0.20
T	0.031 +.004/-.008	0.80 +0.1/-0.2
a	0.020 ± 0.012	0.50 ± 0.30



Mounting Considerations

Mount these devices with brown mark facing up. Units: mm

* Line width should be designed to provide 50 Ω impedance matching characteristics.



JTI P/N for Matching Circuit:**
Inductor (4.7nH):L-07C4N7SV6T
Inductor (10nH): L-07C10NJV6T
Cap (0.5pF): 500R07S0R5BV4T

** matching circuit and component values will depend on PCB layout, thickness, material, etc.

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JOHANSON TECHNOLOGY

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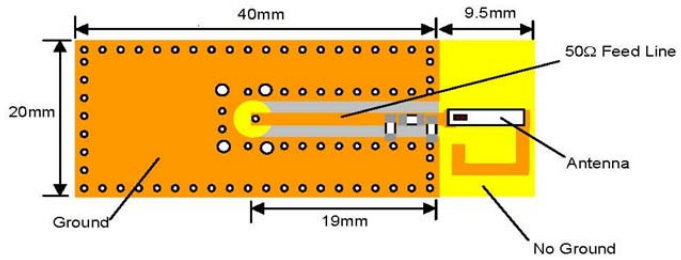
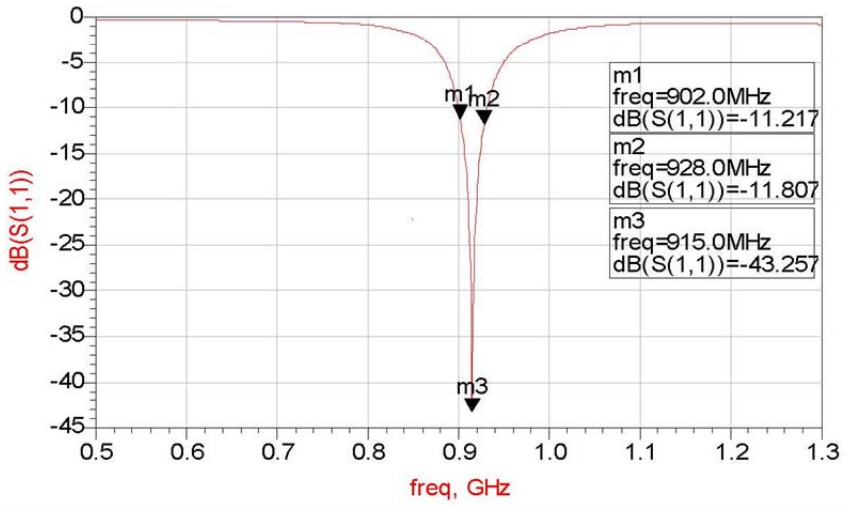
Mounting Considerations

Test Board



Return Loss (with matching)



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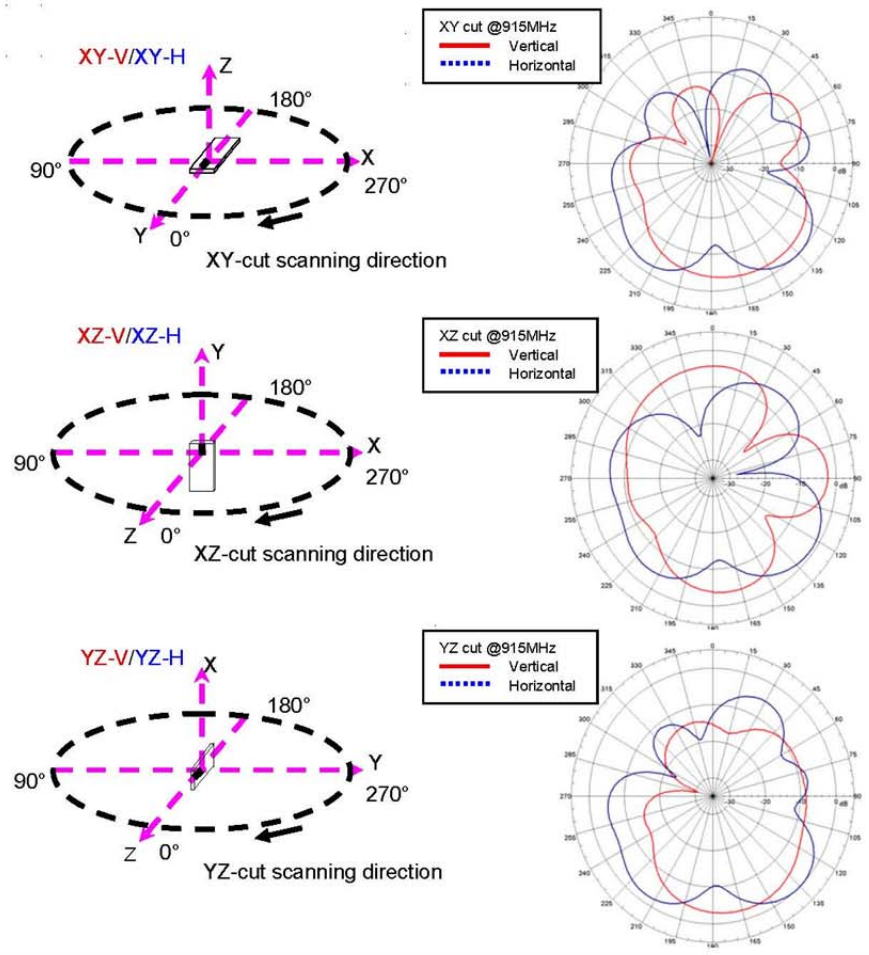
"High Frequency Ceramic Solutions"

915 MHz Antenna **P/N 0915AT43A0026**

Detail Specification: 07/26/2010 Page 3 or 3

Recommended Application ISM

Typical Radiation Patterns



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