EMC Test Report
Application for Grant of Equipment Authorization
Class II Permissive Change/Reassessment
pursuant to
Industry Canada RSS-Gen Issue 2 / RSS 210 Issue 7
FCC Part 15 Subpart C

Model: SP3000

IC CERTIFICATION #:	8398A-SP3000
FCC ID:	XGR-SP3000
APPLICANT:	Ambient Systems, B.V. Colosseum 15d 7521 PV Enschede, The Netherlands
TEST SITE(S):	Elliott Laboratories 684 W. Maude Avenue Sunnyvale, CA 94085
IC SITE REGISTRATION #:	2845A-2;
REPORT DATE:	November 5, 2009
FINAL TEST DATES:	October 26, 2009

AUTHORIZED SIGNATORY:

Mark E. Hill
Staff Engineer
Elliott Laboratories

Testing Cert #2016-01

REVISION HISTORY

Rev#	Date	Comments	Modified By
-	November 20, 2009	First Release	

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SCOPE

An electromagnetic emissions test has been performed on the Ambient Systems, B.V. model SP3000, pursuant to the following rules:

Industry Canada RSS-Gen Issue 2
RSS 210 Issue 7 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15 Subpart C

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in Elliott Laboratories test procedures:

ANSI C63.4:2003
FCC DTS Measurement Procedure KDB558074, March 2005

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, all unlicensed transmitters and transceivers require certification. Receive-only devices operating between 30 MHz and 960 MHz are subject to either certification or a manufacturer's declaration of conformity, with all other receive-only devices exempt from the technical requirements.

Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification. Class II devices are required to meet the appropriate technical requirements but are exempt from certification requirements.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

STATEMENT OF COMPLIANCE

The tested sample of Ambient Systems, B.V. model SP3000 complied with the requirements of the following regulations:

Industry Canada RSS-Gen Issue 2
RSS 210 Issue 7 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15 Subpart C

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

The test results recorded herein are based on a single type test of Ambient Systems, B.V. model SP3000 and therefore apply only to the tested sample. The sample was selected and prepared by Bob Ashlock of Ambient Systems, B.V..

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

TEST RESULTS SUMMARY

DIGITAL TRANSMISSION SYSTEMS (2400 – 2483.5MHz)

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.247(a)	RSS 210 A8.2	Digital Modulation	N/A – Not evaluated as part of this permissive change.		
15.247 (a) (2)	RSS 210 A8.2 (1)	6dB Bandwidth			
	RSP 100	99% Bandwidth			
15.247 (b) (3)	RSS 210 A8.2 (4)	Output Power (multipoint systems)	Field strength at the fundamental confirmed to be within 3 dB of original certification.		
15.247(d)	RSS 210 A8.2 (2)	Power Spectral Density	N/A – Not evaluated as part of this permissive change.		
15.247(c) / 15.209	RSS 210 A8.5	Radiated Spurious Emissions 30MHz – 25 GHz	47.2 dBuV/m @ 2483.5MHz (-6.8dB)	15.207 in restricted bands, all others < -20dBc	Complies

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	N/A – Not evaluated as part of this permissive change.		
15.109	RSS GEN 7.2.3 Table 1	Receiver spurious emissions	19.1 dBuV/m @ 75.016MHz (-10.9dB)	Refer to Standard	Complies
15.207	RSS GEN Table 2	AC Conducted Emissions	N/A – Not evaluated as part of this permissive change.		
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements			
-	RSP 100 RSS GEN 7.1.5	User Manual			

MEASUREMENT UNCERTAINTIES

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with UKAS document LAB 34.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	0.015 to 30	± 3.0
Radiated Emissions	30 to 1000	± 3.6
Radiated Emissions	1000 to 40000	± 6.0

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Ambient Systems, B.V. model SP3000 is a 2.4GHz ZigBee RFID tag module. It is designed to communicate with the RFID Gateway and Routers. The EUT is typically mounted on objects (such as containers) that are to be tracked and reported for inventory control. Because they can be placed in various orientations and positions which include table-top heights, the EUT was treated as table-top equipment during testing to simulate the end-user environment. The EUT is powered via 3.6 VDC, ~30 mA worst case.

The sample was received on October 26, 2009 and tested on October 26, 2009. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Ambient Systems	SP3000	2.4GHz ZigBee RFID tag	-	XGR-SP3000

OTHER EUT DETAILS

Minor change to the enclosure and the pcb to accommodate an optional humidity sensor. No changes to the RF circuitry.

The Ambient SP3000 with humidity sensor will also be marketed under the DeltaTrak brand, using model number 20173 for US and 20173-C for Canada.

ANTENNA SYSTEM

The antenna used with the Ambient Systems, B.V. model SP3000 is integral to the device

ENCLOSURE

The EUT enclosure is primarily constructed of plastic. It measures approximately 6 cm wide by 6 cm deep by 1.5 cm high.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at Elliott.

SUPPORT EQUIPMENT

No support equipment was used during testing.

EUT INTERFACE PORTS

The I/O cabling configuration during testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
None	-	-	-	-

EUT OPERATION

During emissions testing the EUT was configured to transmit continuously on the desired channel.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on October 26, 2009 at the test sites listed below. Pursuant to section 2.948 of the FCC's Rules and section 3.3 of RSP-100, construction, calibration, and equipment data has been filed with the Commission and with industry Canada.

Site	Registration Numbers		Location
	FCC	Canada	
SVOATS #2	90593	2845A-2	684 West Maude Ave, Sunnyvale CA 94085-3518

ANSI C63.4:2003 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception, on OATS sites, of predictable local TV, radio, and mobile communications traffic. The test site(s) contain separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4:2003.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment or in a semi-anechoic chamber. The test sites are maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4:2003 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4:2003.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde & Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A loop antenna is used below 30 MHz. For the measurement range 30 MHz to 1000 MHz either a combination of a biconical antenna and a log periodic or a bi-log antenna is used. Above 1000 MHz, horn antennas are used. The antenna calibration factors to convert the received voltage to an electric field strength are included with appropriate cable loss and amplifier gain factors to determine an overall site factor, which is then programmed into the test receivers or incorporated into the test software.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane.

ANSI C63.4:2003 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The regulations require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4:2003, and the worst-case orientation is used for final measurements.

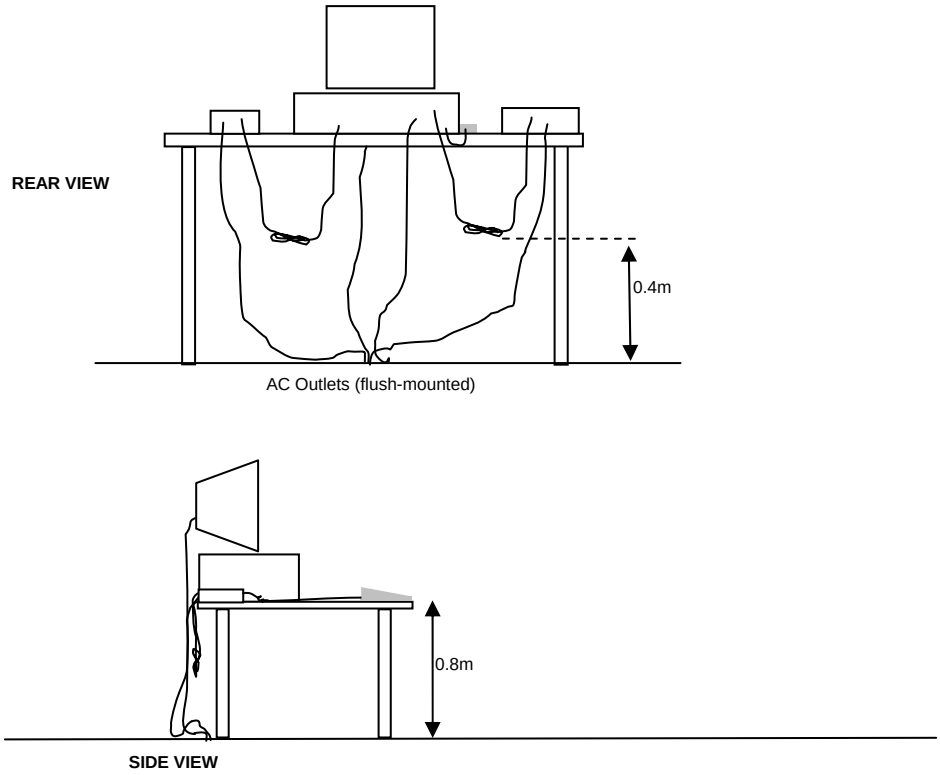
RADIATED EMISSIONS

A preliminary scan of the radiated emissions is performed in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed, one scan for each antenna polarization (horizontal and vertical; loop parallel and perpendicular to the EUT). During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied (for measurements above 30 MHz) and cable positions are varied to determine the highest emission relative to the limit. Preliminary scans may be performed in a fully anechoic chamber for the purposes of identifying the frequencies of the highest emissions from the EUT.

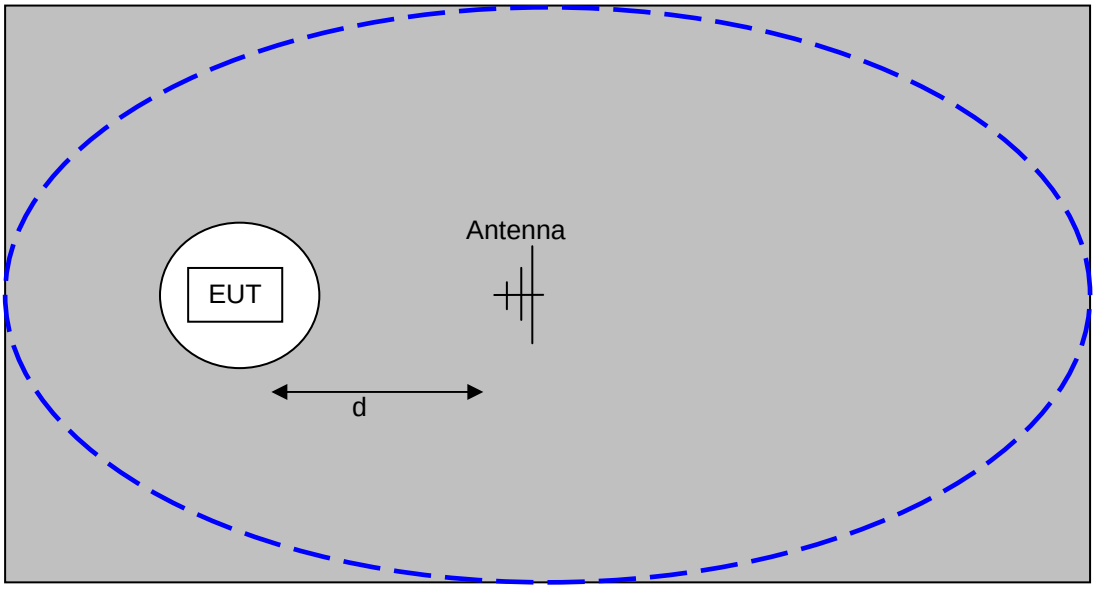
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters (for measurements above 30 MHz, measurements below 30 MHz are made with the loop antenna at a fixed height of 1m). The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain.

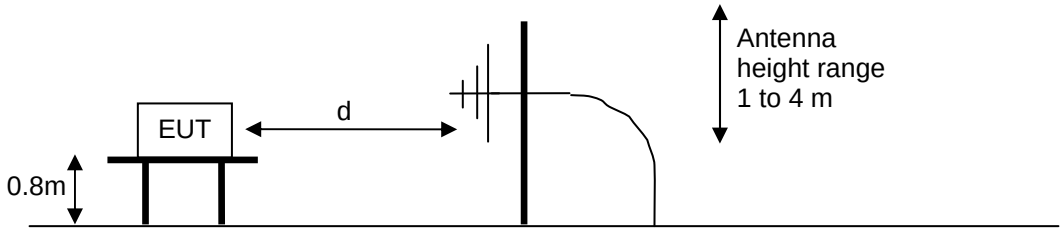
When testing above 18 GHz, the receive antenna is located at 1meter from the EUT and the antenna height is restricted to a maximum of 2.5 meters.



Typical Test Configuration for Radiated Field Strength Measurements



The ground plane extends beyond the ellipse defined in CISPR 16 / CISPR 22 / ANSI C63.4 and is large enough to accommodate test distances (d) of 3m and 10m. Refer to the test data tables for the actual measurement distance.



Test Configuration for Radiated Field Strength Measurements
OATS- Plan and Side Views

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands[1] (with the exception of transmitters operating under FCC Part 15 Subpart D and RSS 210 Annex 9), the limits for all emissions from a low power device operating under the general rules of RSS 310 (tables 3 and 4), RSS 210 (table 2) and FCC Part 15 Subpart C section 15.209.

Frequency Range (MHz)	Limit (uV/m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{KHz}$ @ 300m	$67.6-20*\log_{10}(F_{KHz})$ @ 300m
0.490-1.705	$24000/F_{KHz}$ @ 30m	$87.6-20*\log_{10}(F_{KHz})$ @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100 @ 3m	40 @ 3m
88 to 216	150 @ 3m	43.5 @ 3m
216 to 960	200 @ 3m	46.0 @ 3m
Above 960	500 @ 3m	54.0 @ 3m

RECEIVER RADIATED SPURIOUS EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from receivers as detailed in FCC Part 15.109, RSS 210 Table 2, RSS GEN Table 1 and RSS 310 Table 3. Note that receivers operating outside of the frequency range 30 MHz – 960 MHz are exempt from the requirements of 15.109.

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

[1] The restricted bands are detailed in FCC 15.203, RSS 210 Table 1 and RSS 310 Table 2

TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS – FHSS and DTS SYSTEMS

The limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands are those specified in the general limits sections of FCC Part 15 and RSS 210. All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level (30dB if the power is measured using the sample detector/power averaging method).

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

A distance factor, when used for electric field measurements above 30MHz, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40*LOG_{10} (D_m/D_s)$$

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp), or where a field strength measurement of output power is made in lieu of a direct measurement, the following formula is used to convert between eirp and field strength at a distance of 3m from the equipment under test:

$$E = \frac{1000000 \sqrt{30 P}}{3} \text{ microvolts per meter}$$

where P is the eirp (Watts)

Appendix A Test Equipment Calibration Data

Radiated Emissions, 30 - 10,000 MHz, 26-Oct-09
Engineer: Suhaila Khushzad

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	EMC Spectrum Analyzer, 9 KHz-26.5 GHz	8593EM	1141	29-Dec-09
Hewlett Packard	Microwave Preamplifier 0.5-26.5 GHz	83017A	1257	07-May-10
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1404	24-Feb-10
EMCO	Biconical Antenna, 30-300 MHz	3110B	1497	15-Sep-10
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	10-Jun-10
Hewlett Packard	Preamplifier, 100 kHz - 1.3 GHz	8447D OPT 010	1826	26-May-10

Radiated Emissions, 30 - 10,000 MHz, 26-Oct-09
Engineer: Suhaila Khushzad

Manufacturer	Description	Model #	Asset #	Cal Due
Elliott Laboratories	Biconical Antenna, 30-300 MHz	EL30.300	54	03-Apr-11
Rohde & Schwarz	Test Receiver, 20-1300 MHz	ESVP	213	02-Apr-10
EMCO	Antenna, Horn, 1-18 GHz	3115	487	15-Jul-10
EMCO	Antenna, Horn, 1-18 GHz (SA40-Red)	3115	1142	15-Jul-10
Hewlett Packard	SpecAn 30 Hz -40 GHz, SV (SA40) Red	8564E (84125C)	1148	12-Mar-10
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	29-Jul-10

Radio Antenna Port (Power and Spurious Emissions), 26-Oct-09
Engineer: Rafael Varelas

Manufacturer	Description	Model #	Asset #	Cal Due
EMCO	Antenna, Horn, 1-18 GHz	3115	487	15-Jul-10
Hewlett Packard	SpecAn 30 Hz -40 GHz, SV (SA40) Red	8564E (84125C)	1148	12-Mar-10

Appendix B Test Data

T77364 9 Pages

Client:	Ambient Systems	Job Number:	J76724
Model:	SmartPoint (SP3000)	T-Log Number:	T77364
		Account Manager:	Christine Krebill
Contact:	Bob Ashlock	Project Manager:	Mark Hill
Emissions Standard(s):	FCC 15.247/RSS-210	Class:	B
Immunity Standard(s):	-	Environment:	-

EMC Test Data

For The

Ambient Systems

Model

SmartPoint (SP3000)

Date of Last Test: 10/26/2009

Client:	Ambient Systems	Job Number:	J76724
Model:	SmartPoint (SP3000)	T-Log Number:	T77364
		Account Manager:	Christine Krebill
Contact:	Bob Ashlock	Project Manager:	Mark Hill
Standard:	FCC 15.247/RSS-210	Class:	B

RSS 210 and FCC 15.247 (DTS) Radiated Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 10/26/2009
Test Engineer: Suhaila Khushzad
Test Location: Chamber # 2 & OATS # 2

Config. Used: 1
Config Change: None
EUT Voltage: 3.6 V DC

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 19.7 °C
Rel. Humidity: 48 %

Summary of Results - Device Operating in the 2400-2483.5 MHz Band

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
1b	-	Low 2405MHz	0.6	-	Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	46.9dBµV/m @ 2383.8MHz (-7.1dB)
			0.6	-	Radiated Emissions 1 - 26 GHz	FCC Part 15.209 / 15.247(c)	42.0dBµV/m @ 4828.3MHz (-12.0dB)
1d	-	Center 2440MHz	0.6	-	Radiated Emissions 1 - 26 GHz	FCC Part 15.209 / 15.247(c)	38.5dBµV/m @ 4879.9MHz (-15.5dB)
1e	-	High 2475MHz	0.6	-	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	47.2dBµV/m @ 2483.5MHz (-6.8dB)
			0.6	-	Radiated Emissions, 1 - 26 GHz	FCC Part 15.209 / 15.247(c)	40.8dBµV/m @ 4950.0MHz (-13.2dB)
4	RX /Digital Device	Center 2440MHz	0.6	-	Radiated Emissions, 30-1000 MHz, 1-10GHz	15.109/RSS-GEN	19.1dBµV/m @ 75.016MHz (-10.9dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Ambient Systems	Job Number:	J76724
Model:	SmartPoint (SP3000)	T-Log Number:	T77364
		Account Manager:	Christine Krebill
Contact:	Bob Ashlock	Project Manager:	Mark Hill
Standard:	FCC 15.247/RSS-210	Class:	B

Note: Preliminary testing showed that fundamental levels were maximized with the EUT in a vertical orientation. Harmonics outside of the band were measured with the EUT flat, based on preliminary measurements.

Run #1: Radiated Spurious Emissions, 30 - 25000 MHz (Power Setting: +0.6dBm)

Run #1b: Low Channel @ 2405 MHz

Fundamental Signal Field Strength: Peak and average values measured in 1 MHz, and peak value measured in 100kHz

Vertical Orientation

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
2405.120	100.1	V	-	-	AVG	148	1.0	RB 1 MHz; VB: 10 Hz
2405.580	102.9	V	-	-	PK	148	1.0	RB 1 MHz; VB: 1 MHz
2405.100	85.8	H	-	-	AVG	146	1.5	RB 1 MHz; VB: 10 Hz
2405.620	88.5	H	-	-	PK	146	1.5	RB 1 MHz; VB: 1 MHz
2405.050	84.2	H	-	-	PK	146	1.5	RB 100 kHz; VB: 100 kHz
2405.350	97.8	V	-	-	PK	149	1.0	RB 100 kHz; VB: 100 kHz

Fundamental emission level @ 3m in 100kHz RBW:	97.8 dBµV/m	
Limit for emissions outside of restricted bands:	77.8 dBµV/m	Limit is -20dBc (Peak power measurement)

Band Edge Signal Field Strength @ 2390 MHz- Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
2383.800	46.9	V	54.0	-7.1	AVG	148	1.0	RB 1 MHz; VB: 10 Hz
2384.130	57.9	V	74.0	-16.1	PK	148	1.0	RB 1 MHz; VB: 1 MHz
2350.530	46.2	H	54.0	-7.8	AVG	146	1.5	RB 1 MHz; VB: 10 Hz
2367.530	57.4	H	74.0	-16.6	PK	146	1.5	RB 1 MHz; VB: 1 MHz

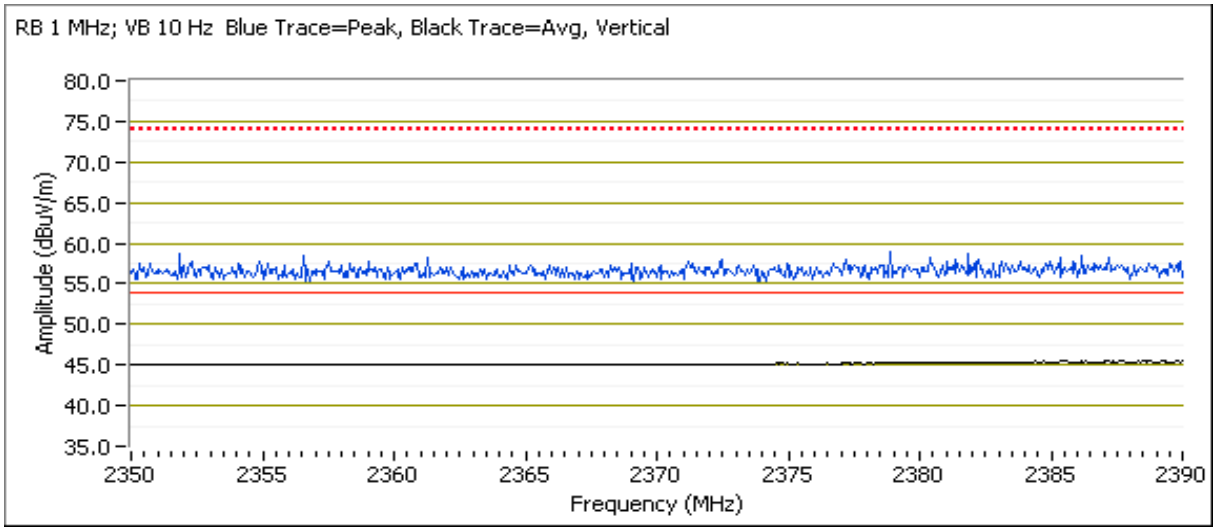
Other Spurious Emissions

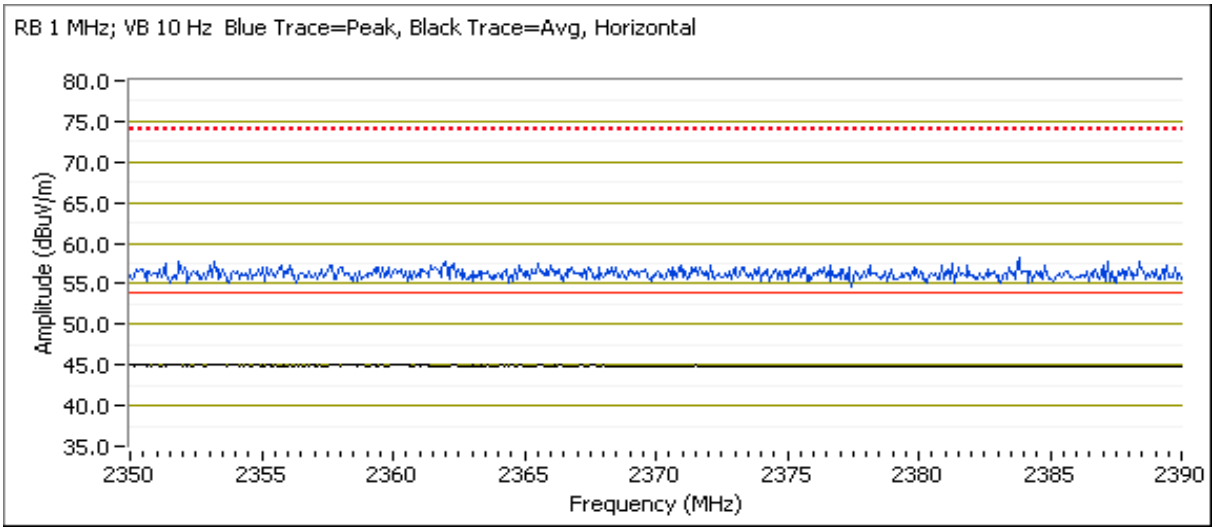
Flat Orientation

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
4828.270	42.0	H	54.0	-12.0	AVG	260	1.9	RB 1 MHz; VB: 10 Hz
4828.070	57.7	H	74.0	-16.3	PK	260	1.9	RB 1 MHz; VB: 1 MHz
4804.270	34.4	V	54.0	-19.6	AVG	245	1.0	RB 1 MHz; VB: 10 Hz
4803.670	48.8	V	74.0	-25.2	PK	245	1.0	RB 1 MHz; VB: 1 MHz
7212.200	46.8	H	74.0	-27.2	PK	360	1.4	RB 1 MHz; VB: 1 MHz
7205.070	46.4	V	74.0	-27.6	PK	162	1.0	RB 1 MHz; VB: 1 MHz
7216.370	36.2	H	74.0	-37.8	AVG	360	1.4	RB 1 MHz; VB: 10 Hz
7216.230	35.5	V	74.0	-38.5	AVG	162	1.0	RB 1 MHz; VB: 10 Hz

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental and measured in 100kHz.

Client:	Ambient Systems	Job Number:	J76724
Model:	SmartPoint (SP3000)	T-Log Number:	T77364
		Account Manager:	Christine Krebill
Contact:	Bob Ashlock	Project Manager:	Mark Hill
Standard:	FCC 15.247/RSS-210	Class:	B





Client:	Ambient Systems	Job Number:	J76724
Model:	SmartPoint (SP3000)	T-Log Number:	T77364
		Account Manager:	Christine Krebill
Contact:	Bob Ashlock	Project Manager:	Mark Hill
Standard:	FCC 15.247/RSS-210	Class:	B

Run #1d: Center Channel @ 2440 MHz. Software setting = +0.6dBm

Fundamental Signal Field Strength: Peak and average values measured in 1 MHz, and peak value measured in 100kHz
Vertical Orientation

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2440.130	85.8	H	-	-	AVG	164	1.9	RB 1 MHz; VB: 10 Hz
2440.720	88.5	H	-	-	PK	164	1.9	RB 1 MHz; VB: 1 MHz
2440.380	84.0	H	-	-	PK	163	1.9	RB 100 kHz; VB: 100 kHz
2440.130	97.3	V	-	-	AVG	146	1.1	RB 1 MHz; VB: 10 Hz
2439.600	100.0	V	-	-	PK	146	1.1	RB 1 MHz; VB: 1 MHz
2440.350	95.5	V	-	-	PK	146	1.0	RB 100 kHz; VB: 100 kHz

Fundamental emission level @ 3m in 100kHz RBW:	100	dBµV/m	
Limit for emissions outside of restricted bands:	80	dBµV/m	Limit is -20dBc (Peak power measurement)
Limit for emissions outside of restricted bands:	70	dBµV/m	Limit is -30dBc (UNII power measurement)

Spurious Emissions
Flat Orientation

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4879.900	38.5	H	54.0	-15.5	AVG	44	1.6	MHz; VB: 10 Hz
4879.200	38.3	V	54.0	-15.7	AVG	89	2.0	MHz; VB: 10 Hz
7321.570	37.9	H	54.0	-16.1	AVG	350	1.4	MHz; VB: 10 Hz
7321.300	36.5	V	54.0	-17.5	AVG	174	1.5	MHz; VB: 10 Hz
7321.530	48.4	H	74.0	-25.6	PK	350	1.4	MHz; VB: 1 MHz
7318.330	47.5	V	74.0	-26.5	PK	174	1.5	MHz; VB: 1 MHz
4880.700	47.1	H	74.0	-26.9	PK	44	1.6	MHz; VB: 1 MHz
4879.130	46.8	V	74.0	-27.2	PK	89	2.0	MHz; VB: 1 MHz

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental and measured in 100kHz.

Client:	Ambient Systems	Job Number:	J76724
Model:	SmartPoint (SP3000)	T-Log Number:	T77364
		Account Manager:	Christine Krebill
Contact:	Bob Ashlock	Project Manager:	Mark Hill
Standard:	FCC 15.247/RSS-210	Class:	B

Run #1e: High Channel @ 2475 MHz = +0.6dBm
Fundamental Signal Field Strength: Peak and average values measured in 1 MHz, and peak value measured in 100kHz
Vertical Orientation

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2475.070	99.0	V	-	-	AVG	146	1.0	RB 1 MHz; VB: 10 Hz
2475.620	101.6	V	-	-	PK	146	1.0	RB 1 MHz; VB: 1 MHz
2475.100	83.1	H	-	-	AVG	334	1.0	RB 1 MHz; VB: 10 Hz
2475.650	86.0	H	-	-	PK	334	1.0	RB 1 MHz; VB: 1 MHz
2475.030	80.6	H	-	-	PK	334	1.0	RB 100 kHz; VB: 100 kHz
2475.350	96.9	V	-	-	PK	146	1.0	RB 100 kHz; VB: 100 kHz

Fundamental emission level @ 3m in 100kHz RBW:	96.9	dBµV/m	
Limit for emissions outside of restricted bands:	76.9	dBµV/m	Limit is -20dBc (Peak power measurement)
Limit for emissions outside of restricted bands:	66.9	dBµV/m	Limit is -30dBc (UNII power measurement)

Band Edge Signal Field Strength @ 2483.5 MHz - Direct measurement of field strength

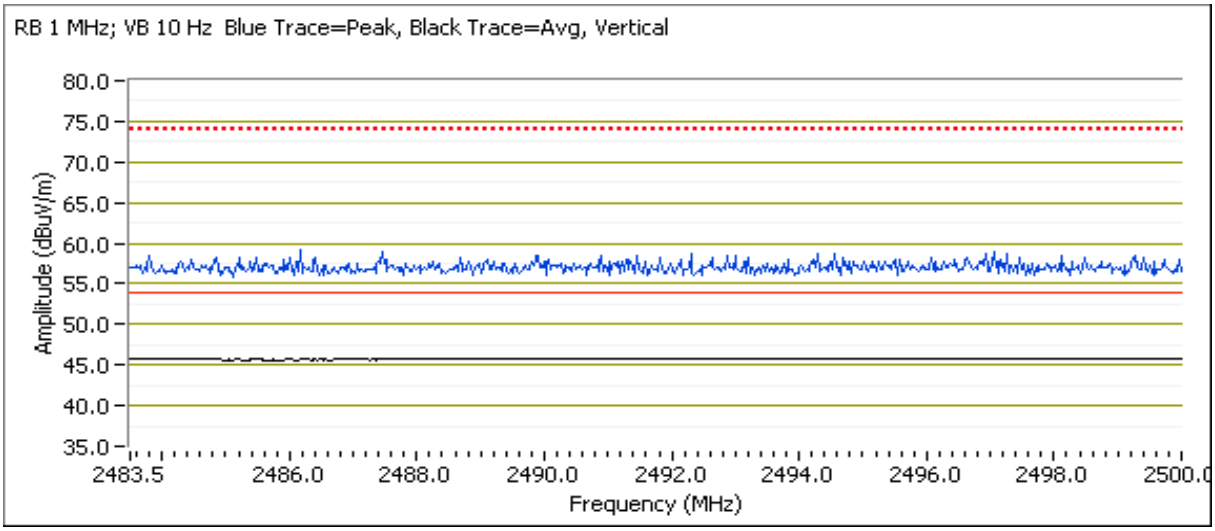
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.500	47.2	V	54.0	-6.8	AVG	146	1.0	RB 1 MHz; VB: 10 Hz
2494.090	58.7	V	74.0	-15.3	PK	146	1.0	RB 1 MHz; VB: 1 MHz
2495.240	46.9	H	54.0	-7.1	AVG	334	1.0	RB 1 MHz; VB: 10 Hz
2499.150	58.1	H	74.0	-15.9	PK	334	1.0	RB 1 MHz; VB: 1 MHz

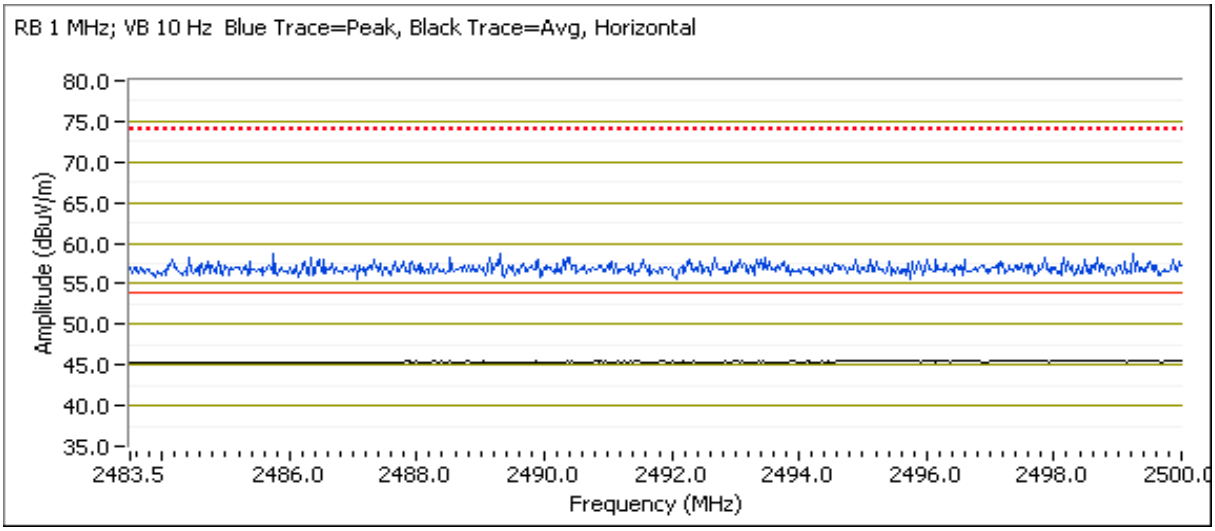
Other Spurious Emissions
Flat Orientation

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4949.970	40.8	H	54.0	-13.2	AVG	109	1.7	MHz; VB: 10 Hz
7423.630	40.6	H	54.0	-13.4	AVG	356	1.4	RB 1 MHz; VB: 10 Hz
7426.370	38.6	V	54.0	-15.4	AVG	157	1.4	RB 1 MHz; VB: 10 Hz
4949.270	37.7	V	54.0	-16.3	AVG	50	1.3	RB 1 MHz; VB: 10 Hz
7426.670	51.2	H	74.0	-22.8	PK	356	1.4	RB 1 MHz; VB: 1 MHz
7424.000	49.5	V	74.0	-24.5	PK	157	1.4	RB 1 MHz; VB: 1 MHz
4949.170	48.3	H	74.0	-25.7	PK	109	1.7	MHz; VB: 1 MHz
4949.470	46.7	V	74.0	-27.3	PK	50	1.3	RB 1 MHz; VB: 1 MHz

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental and measured in 100kHz.

Client:	Ambient Systems	Job Number:	J76724
Model:	SmartPoint (SP3000)	T-Log Number:	T77364
		Account Manager:	Christine Krebill
Contact:	Bob Ashlock	Project Manager:	Mark Hill
Standard:	FCC 15.247/RSS-210	Class:	B





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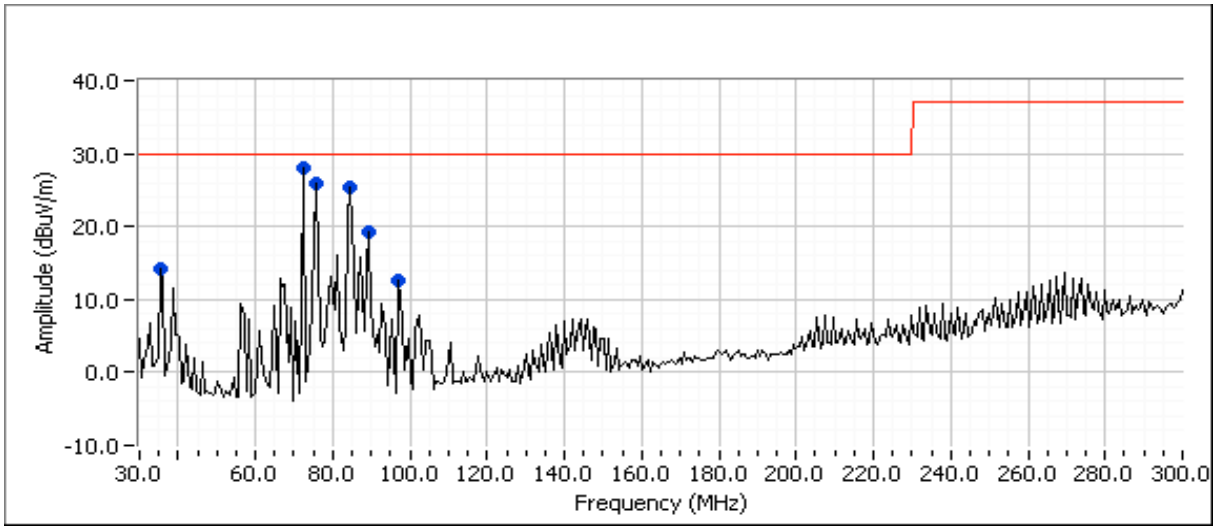
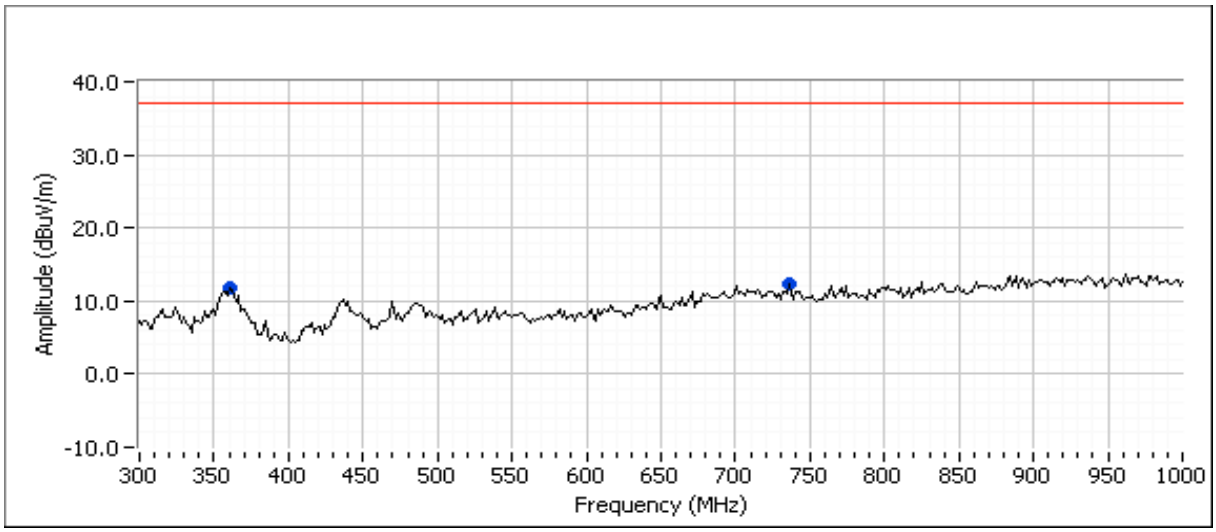
Model:	SmartPoint (SP3000)	T-Log Number:	T77364
		Account Manager:	Christine Krebill
Contact:	Bob Ashlock	Project Manager:	Mark Hill
Standard:	FCC 15.247/RSS-210	Class:	B

Run #4: Radiated Spurious Emissions, 30 - 1000 MHz, RX Mode (center channel @ 2440 MHz)
SP3000(With Sensor)





Client:	Ambient Systems	Job Number:	J76724
Model:	SmartPoint (SP3000)	T-Log Number:	T77364
		Account Manager:	Christine Krebill
Contact:	Bob Ashlock	Project Manager:	Mark Hill
Standard:	FCC 15.247/RSS-210	Class:	B

Preliminary peak readings captured during pre-scan

Frequency	Level	Pol	RSS-GEN		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
75.016	28.0	V	30.0	-2.0	Peak	158	1.7	
75.025	25.9	V	30.0	-4.1	Peak	250	1.7	
85.028	25.4	V	30.0	-4.6	Peak	32	1.7	
87.027	19.3	V	30.0	-10.7	Peak	17	1.7	
33.010	14.3	V	30.0	-15.7	Peak	337	1.7	
99.013	12.5	V	30.0	-17.5	Peak	271	1.7	
737.146	12.3	V	37.0	-24.7	Peak	70	1.7	
357.060	11.8	H	37.0	-25.2	Peak	319	1.7	

Final quasi-peak readings

Frequency	Level	Pol	RSS-GEN		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
75.016	19.1	V	30.0	-10.9	QP	0	2.0	
85.028	17.3	V	30.0	-12.7	QP	0	2.8	
85.028	16.2	H	30.0	-13.8	QP	229	3.9	
75.025	15.1	H	30.0	-14.9	QP	358	4.0	

Appendix C Photographs of Test Configurations

Uploaded as a separate exhibit

Appendix D Detailed Photographs

Uploaded as a separate exhibit

Appendix E Schematic Diagrams

Uploaded as a separate exhibit