Lab Code: 200167-0

FCC PART 15C

IC RSS-210, ISSUE 7, JUNE 2007

TEST AND MEASUREMENT REPORT

For

SunPower Corporation

1414 Harbour Way South,

Richmond, CA 94804, USA

FCC ID: YAW110884
IC: 8917A-110884

Report Type:	**Product Type:**
Original Report	2.4GHz Zigbee Solar Tracker Controller

Test Engineers:	Kevin Li
Report Number:	R1003291-247
Report Date:	2010-07-28
Reviewed By:	Victor Zhang Test Engineer, RF Lead
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1003291-247	Original Report	2010-07-28

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *SunPower Corporation*, and their product FCC ID: YAW110884, IC: 8917A-110884 model: 110884 which will henceforth be referred to as the "EUT" (equipment Under Test). The EUT is an industrial motor controller for solar panel arrays toward the sun. It is designed to maximize the amount of solar electrical production in power plants. The operating frequency for the controller is 2405~2475 MHz using Zigbee technology.

1.2 Mechanical Description of EUT

The "EUT" measures *34.2cm (L) x 39.3cm (W) x 15.9cm (H),* and weighs approximately *4200*g.

The data gathered are from production sample(s) with serial numberR1003291-1, assigned by the BACL.

1.3 Objective

This report is prepared on behalf of *SunPower Corporation.* in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commissions rules and IC RSS-210 Issue 7, June 2007.

The objective is to determine compliance with FCC Part 15.247 and IC RSS-210 rules for Output Power, Antenna Requirements, 6 dB Bandwidth, and power spectral density, 100 kHz Bandwidth of Band Edges Measurement, Spurious Emissions, Conducted and Radiated Spurious Emissions.

1.4 Related Submittal(s)/Grant(s)

FCC ID: MCQ-PROS2B

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003, 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.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are: spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values range from +2.0 for Conducted Emissions tests and +4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL.

Detailed instrumentation measurement uncertainties can be found in BACL report QAP-018.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.7 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test sites at BACL have been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464, IC registration number: 3062A, and VCCI Registration Number: R-2463 and C-2698. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at http://ts.nist.gov/Standards/scopes/2001670.htm

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.4-2003.

The EUT was tested in a testing mode to represent worst-case results during the final qualification test.

2.2 EUT Exercise Software

The exercise s/w was provided by the manufacture.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Special Accessories

N/A

2.5 Local Support Equipment

N/A

2.6 Power Supply and Line Filters

N/A

2.7 Interface Ports and Cabling

Cable Description	Length (m)	From	To
RF cable	5.5	EUT	Inclinometer
Power Cable	< 1.0	EUT	Garmin GPS Module

2.8 EUT Configuration Details

Manufacturers	Description	Model No.	Serial No.
Netburner	CPU Module	MOD5282	-
Digi International	RF Module	XBeePro	-

3 Summary of Test Results

Results reported relate only to the product tested.

FCC & IC Rules	Description of Test	Results
FCC §15.247(i), §2.1091 IC RSS-102	RF Exposure	Compliant
FCC §15.203 IC RSS-Gen §7.1.4	Antenna Requirement	Compliant
FCC §15.207(a) IC RSS-Gen §7.2.2	Conducted Emissions	Compliant
FCC §15.247, §15.209 IC RSS-210 §A8.5, §2.6	Spurious Emissions at Antenna Port	Note[1]
FCC §15.209, §15.247 IC RSS-210 §A8.5, §2.6	Radiated Spurious Emissions	Compliant
FCC §15.247(a)(2) IC RSS-210 §A8.2	6 dB & 99% Bandwidth	Note[1]
FCC §15.247(b)(3) IC RSS-210 §A8.4	Maximum Peak Output Power	Note[1]
FCC §15.247(d) IC RSS-210 §A8.5	100 kHz Bandwidth of Frequency Band Edge	Note[1]
FCC §15.247(e) IC RSS-210 §A8.2(b)	Power Spectral Density	Note[1]
IC RSS-210 §2.6 & RSS-Gen §4.10	Receiver Spurious Emission	Compliant

Note [1]: Please refer to FCC ID: MCQ-PROS2B for test results

4 FCC §15.247 (i), §2.1091 & IC RSS-102 - RF Exposure

4.1 Applicable Standard

According to FCC §15.247(i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	Note¹ (100)	30
1.34-30	824/f	2.19/f	Note¹ ($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
Note¹ = Plane-wave equivalent power density

Before equipment certification is granted, the procedure of IC RSS-102 must be followed concerning the exposure of humans to RF fields.

According to IC RSS-102 Issue 2 section 4.1, RF limits used for general public will be applied to the EUT.

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Time Averaging (min)
0.003 - 1	280	2.19	-	6
1 - 10	280 / f	2.19 / f	-	6
10 - 30	28	2.19 / f	-	6
30 – 300	28	0.073	2 (Note¹)	6
300 – 1 500	$1.585\ f^{0.5}$	$0.0042\ f^{0.5}$	f / 150	6
1 500 – 15 000	61.4	0.163	10	6
15 000 – 150 000	61.4	0.163	10	$616000 / f^{1.2}$
150 000- 300 000	$0.158\ f^{0.5}$	$4.21 \times 10^{-4}\ f^{0.5}$	$6.67 \times 10^{-5}\ f$	$616000 / f^{1.2}$

Note: f is frequency in MHz
Note¹ = Power density limit is applicable at frequencies greater than 100 MHz

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

4.3 MPE Results

Maximum peak output power at antenna input terminal (dBm):	19.22
Maximum peak output power at antenna input terminal (mW):	83.56
Prediction distance (cm):	20
Prediction frequency (MHz):	2470
Maximum Antenna Gain, typical (dBi):	1.5
Maximum Antenna Gain (numeric):	1.41
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.023
Power density of prediction frequency at 20.0 cm (W/m^2):	0.23
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0
MPE limit for uncontrolled exposure at prediction frequency (W/m^2):	10

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.023 mW/cm^2 (0.23 W/m^2).Limit is 1 mW/cm^2 (10 W/m^2).

5 FCC §15.203 & IC RSS-Gen §7.1.4 – Antenna Requirements

5.1 Applicable Standard

According to FCC §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to FCC §15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to IC RSS-Gen §7.1.4: Transmitter Antenna

A transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. Any antenna gain in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power before using the power limits specified in RSS-210 or RSS-310 for devices of RF output powers of 10 milliwatts or less. For devices of output powers greater than 10 milliwatts, except devices subject to RSS-210 Annex 8 (Frequency Hopping and Digital Modulation Systems Operating in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz Bands) or RSS-210 Annex 9 (Local Area Network Devices), the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

5.2 Antenna Connector Construction

EUT has one Transmitter/Receiver antenna, which features a permanent attachment to the EUT chassis as well as a non-standard connector. The Transmitter antenna has a max gain of 1.5 dBi which fulfills the requirements of FCC §15.203 and IC RSS-Gen §7.1.4

6 FCC §15.207 & IC RSS-Gen 7.2.2- Conducted Emissions

6.1 Applicable Standards

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* *Decreases with the logarithm of the frequency.*

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4-2003 measurement procedure. The specification used was FCC §15.207 and IC RSS-Gen §7.2.2 limits.

External I/O cables were draped along the edge of the test table and bundle when necessary.

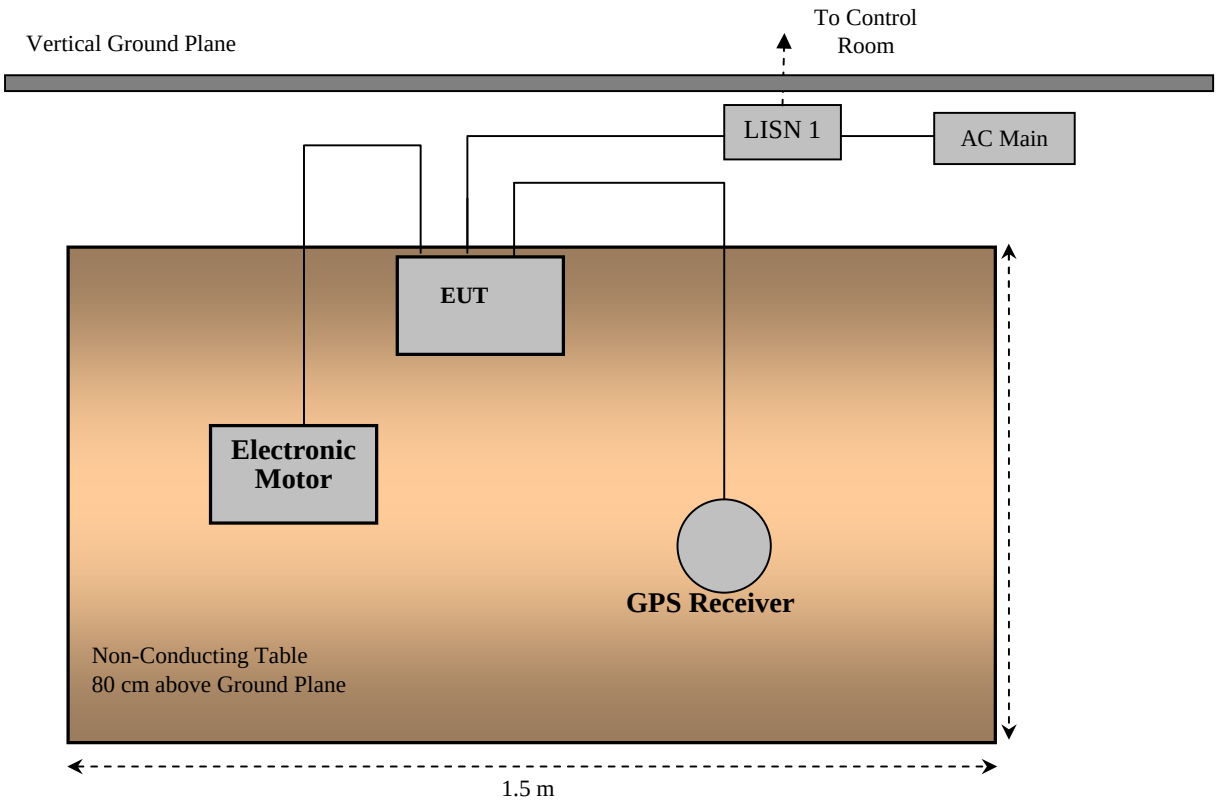
The AC/DC power adapter of the EUT was connected with LISN-1 which provided 3 phase AC power.

6.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Solar Electronics	LISN	9252-R-24-BNC	511205	2009-07-31
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2010-03-24

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

6.4 Test Setup Block Diagram



6.5 Test Procedure

During the conducted emissions test, the power cord of the EUT host system was connected to the mains outlet of the LISN-2.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Quasi-Peak readings are distinguished with a "QP." Average readings are distinguished with an "Ave".

6.6 Test Environmental Conditions

Temperature:	18~21 °C
Relative Humidity:	30~35 %
ATM Pressure:	101.2-102.2kPa

Testing was performed by Chakrit Tham on 2010-06-05 in chamber 1.
.

6.7 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Cable Loss, and Attenuator Factor adding to the Indicated Reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Cable Loss + Attenuator Factor

For example, a Corrected Amplitude of 34.08 dBuV/m = Indicated Reading (23.85 dBuV) + Cable Factor (0.22 dB) + Attenuator Factor (10 dB)

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

6.8 Summary of Test Results

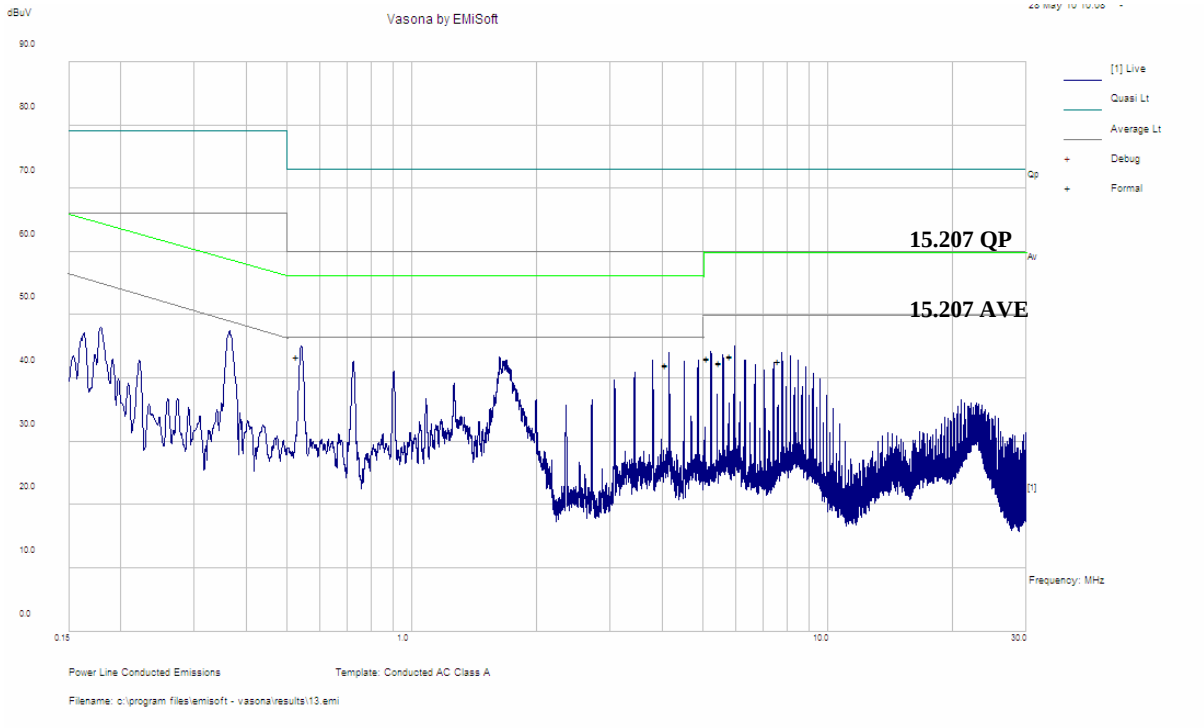
According to the recorded data in following table, the EUT complied with the FCC 15.207 standard's conducted emissions limits, with the margin reading of:

Worst Case: Low Channel Transmitting Mode

Connection: AC/DC adapter connected to3 phase AC power			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-0.57	0.540833	Line	0.15 to 30

6.9 Conducted Emissions Test Plots and Data

Line 1



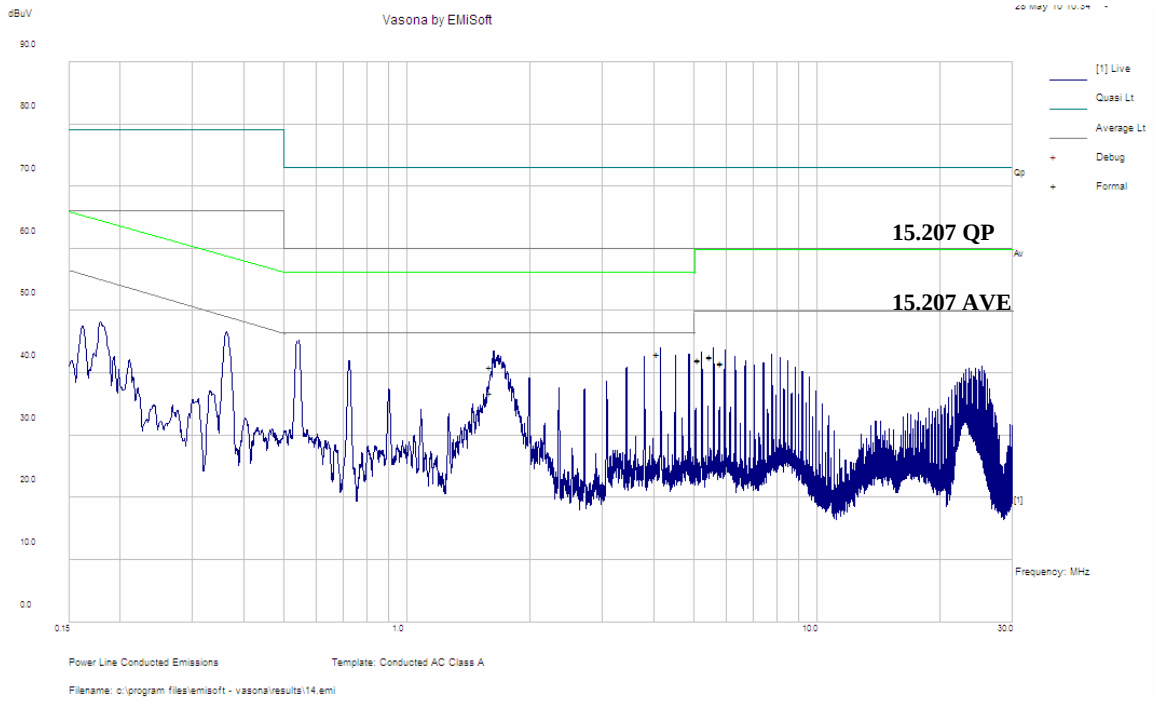
Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)
0.54141	43.37	Line	56	-12.63
5.95954	43.59	Line	60	-16.41
5.238203	43.02	Line	60	-16.98
7.766074	42.69	Line	60	-17.31
4.152527	42.16	Line	56	-13.84
5.598302	42.37	Line	60	-17.63

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)
0.54141	43.33	Line	46	-2.67
5.95954	43.41	Line	50	-6.59
5.238203	43.14	Line	50	-6.86
7.766074	42.74	Line	50	-7.26
4.152527	41.95	Line	46	-4.05
5.598302	42.44	Line	50	-7.56

Line 2



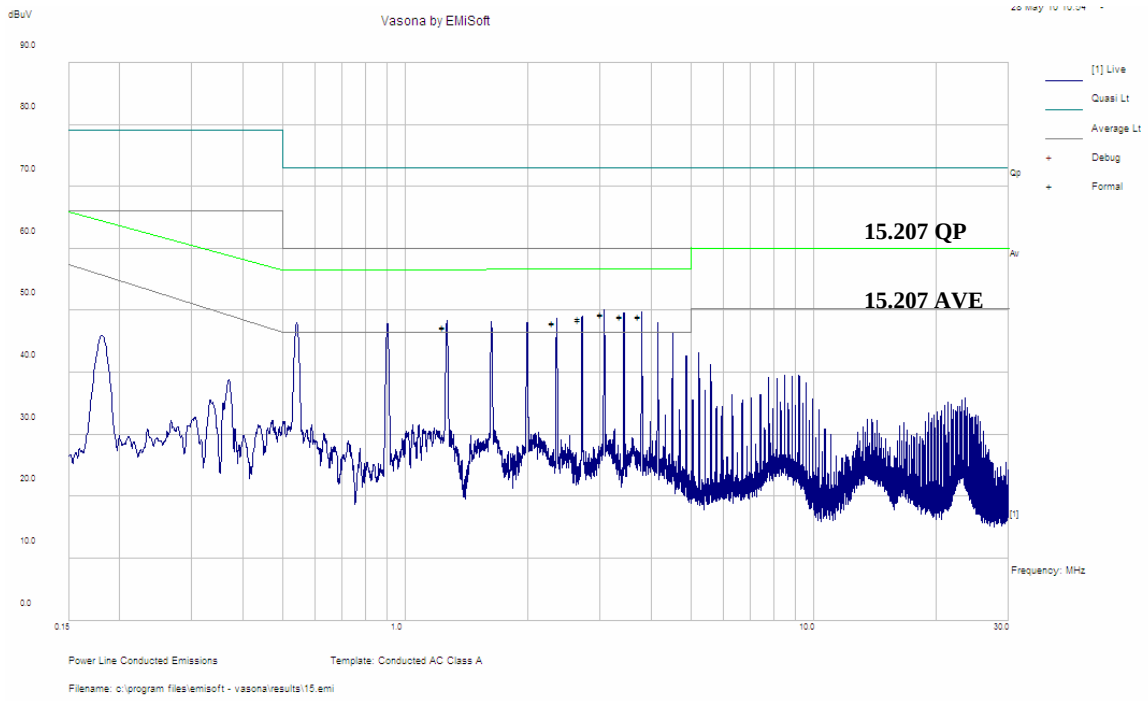
Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)
0.540833	45.46	Line	56	-10.54
4.152229	43.02	Line	56	-12.98
5.59628	42.71	Line	60	-17.29
5.956003	41.73	Line	60	-18.27
1.626824	40.95	Line	56	-15.05
5.235803	42.01	Line	60	-17.99

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)
0.540833	45.43	Line	46	-0.57
4.152229	43.11	Line	46	-2.89
5.59628	42.59	Line	50	-7.41
5.956003	41.43	Line	50	-8.57
1.626824	36.75	Line	46	-9.25
5.235803	42.13	Line	50	-7.87

Line 3



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)
3.068573	49.21	Line	56	-6.79
3.790909	48.94	Line	56	-7.06
3.429374	48.88	Line	56	-7.12
2.7079	48.45	Line	56	-7.55
2.346194	47.81	Line	56	-8.19
1.263696	47.24	Line	56	-8.76

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)
3.068573	45.41	Line	46	-0.59
3.790909	45.18	Line	46	-0.82
3.429374	45.16	Line	46	-0.84
2.7079	44.75	Line	46	-1.25
2.346194	44.05	Line	46	-1.95
1.263696	43.33	Line	46	-2.67

7 FCC §2.1051, §15.247(d) & IC RSS-210 §A8.5 - Spurious Emissions at Antenna Terminals

7.1 Applicable Standard

For FCC §15.247(d) and IC RSS-210 §A8.5 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, provided the transmitter demonstrates compliance with the peak conducted power limits.

7.2 Measurement Result:

Please refer to FCC ID: MCQ-PROS2B for results.

8 FCC §15.205, §15.209, §15.247(c) & IC RSS-210 §A8.5 - Spurious Radiated Emissions

8.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As per FCC §15.209(a) and RSS-210: Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100 (Note¹)	3
88 - 216	150 (Note¹)	3
216 - 960	200 (Note¹)	3
Above 960	500	3

(Note¹) : Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 –167.17 167.72 – 173.2 240 – 285 322 – 335.4 399.9 – 410 608 – 614	960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2690 – 2900 3260 – 3267 3332 – 3339 3345.8 – 3358 3600 – 4400	4. 5 – 5. 15 5. 35 – 5. 46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 Above 38.6

As per FCC §15.247 (d) 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c).

8.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C and IC RSS-210 limits.

8.3 EUT Setup

The radiated emissions tests were performed using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15C & IC RSS-210 limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

8.4 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
HP	Pre amplifier	8447D	2944A07030	2010-04-16
Sunol Science Corp.	Combination Antenna	JB1 Antenna	A020106-1	2010-05-28
Agilent	Spectrum Analyzer	E4440A	MY44303352	2010-05-09
A. H. Systems	Antenna, Horn	SAS-200/571	261	2009-09-23

Statement of Traceability: BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

8.5 Test Procedure

For the radiated emissions test, the EUT host, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000 MHz:

(1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
(2) Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

8.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Cable Loss, and Attenuator Factor adding to the Indicated Reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Cable Loss + Attenuator Factor

For example, a Corrected Amplitude of 34.08 dBuV/m = Indicated Reading (23.85 dBuV) + Cable Factor (0.22 dB) + Attenuator Factor (10dB)

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

8.7 Test Environmental Conditions

Temperature:	18~21 °C
Relative Humidity:	30~35 %
ATM Pressure:	101.2-102.2kPa

The testing was performed by Kevin Li on 06-20-2010 in 10 meter chamber 1.

8.8 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15C and IC RSS-210 standard's radiated emissions limits, and had the worst margin of:

30 MHz – 25 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-13.88	14797.66	Horizontal	30 MHz – 25 GHz

Note: All the Restricted Band Frequencies are under noise and/or 20 dB below the limit.

Please refer to the following table and plots for test results

8.9 Radiated Emissions Test Data and Plots

Low Channel: 2405 MHz

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC & IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
1076.8	68.64	0	300	V	11.78	1.71	20.14	61.99	74	-12.01	peak[1]
1076.8	66.56	89	300	H	11.78	1.71	20.14	59.91	74	-14.09	peak[1]
1076.8	34.31	0	300	V	11.78	1.71	20.14	27.66	54	-26.34	Ave[1]
1076.8	32.18	89	300	H	11.78	1.71	20.14	25.53	54	-28.47	Ave[1]

[1]All emissions in the restrict band are 20 dB below the limit or/and under the noise floor level.

Middle Channel: 2440 MHz

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC & IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
1148.47	74.1	0	300	V	11.78	1.71	20.14	67.45	74	-6.55	peak[1]
1148.47	72.58	97	300	H	11.78	1.71	20.14	65.93	74	-8.07	peak[1]
1148.47	41.77	0	300	V	11.78	1.71	20.14	35.12	54	-18.88	Ave[1]
1148.47	39.62	97	300	H	11.78	1.71	20.14	32.97	54	-21.03	Ave[1]

[1]All emissions in the restrict band are 20 dB below the limit or/and under the noise floor level.

High Channel: 2475 MHz

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC & IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
1015.7	61.37	141	304	V	11.78	1.71	20.14	54.72	74	-19.28	peak[1]
1015.7	59.15	138	100	H	11.78	1.71	20.14	52.50	74	-21.5	peak[1]
1015.7	36.92	141	304	V	11.78	1.71	20.14	30.27	54	-23.73	Ave[1]
1015.7	35.43	138	100	H	11.78	1.71	20.14	28.78	54	-25.22	Ave[1]

[1]All emissions in the restrict band are 20dB below the limit or/and under the noise floor level.

Channel: 2480 MHz

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC & IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
-	-	-	-	-	-	-	-	-	54	-	-[1]

[1]All emissions in the restrict band are 20dB below the limit or/and under the noise floor level.

9 FCC §15.247(a)(2) & IC RSS-210 §A8.2– 6 dB & 99% Bandwidth

9.1 Applicable Standard

According to FCC §15.247(a)(2) and IC RSS-210 A8.2 (a), systems using digital modulation techniques may operate in the 902~928 MHz, 2400~2483.5 MHz, and 5725~5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz

9.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emissions bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

9.3 Summary of Test Results

Please refer to FCC ID: MCQ-PROS2B for results.

10 FCC §15.247(b) & IC RSS-210 §A8.4- Peak Output Power Measurement

10.1 Applicable Standard

According to FCC §15.247(b) and IC RSS-210 §A8.4 (4) for systems using digital modulation in the 902~928 MHz, 2400~2483.5 MHz, and 5725~5850 MHz bands: 1 Watt.

10.2 Measurement Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
3. Add a correction factor to the display.

10.3 Measurement Results

Please refer to FCC ID: MCQ-PROS2B for results.

11 FCC §15.247(d) & IC RSS-210 §A8.5 - 100 kHz Bandwidth of Band Edges

11.1 Applicable Standard

According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c).

According to IC Rss-210 §A8.5, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required.

11.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

11.3 Measurement Results

Please refer to FCC ID: MCQ-PROS2B for results.

12 FCC §15.247(e) & IC RSS-210 §A8.2(b) - Power Spectral Density

12.1 Applicable Standard

According to FCC §15.247(e) and RSS-210 §A8.2(b) , for digitally modulated 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.

12.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to 1.5MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Repeat above procedures until all frequencies measured were complete.

12.3 Summary of Test Results

Please refer to FCC ID: MCQ-PROS2B for results.

13 IC RSS-210 §2.6 & RSS-Gen §4.10-Receiver Spurious Radiated Emissions

13.1 Applicable Standard

According to IC RSS-Gen §4.10, the receiver shall be operated in the normal receive mode near the mid-point of the band over which the receiver is designed to operate.

Unless otherwise specified in the applicable RSS, the radiated emission measurement is the standard measurement method (with the device's antenna in place) to measure receiver spurious emissions.

Radiated emission measurements are to be performed using a calibrated open-area test site.

For either method, the search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is the higher, to at least 3 times the highest tuneable or local oscillator frequency, whichever is the higher, without exceeding 40 GHz.

For emissions below 1 GHz, measurements shall be performed using a CISPR quasi-peak detector and the related measurement bandwidth. As an alternative to CISPR quasi-peak measurement, compliance with the emission limit can be demonstrated using measuring equipment employing a peak detector with the same measurement bandwidth as that for CISPR quasi-peak measurements. Above 1 GHz, measurements shall be performed using an average detector and a resolution bandwidth of 300 kHz to 1 MHz.

According to RSS-210 §2.6, Tables 2 and 3 show the general field strength limits of unwanted emissions, where applicable, for transmitters and receivers operating in accordance with the provisions specified in this RSS. Transmitters whose wanted emissions are also within the limits shown in Tables 2 and 3 may operate in any of the frequency bands of Tables 2 and 3, other than the restricted bands of Table 1 and the TV bands, and shall be certified under RSS-210.

Table 2: General Field Strength Limits for Transmitters and Receivers at Frequencies above 30 MHz **(Note)**

Frequency (MHz)	**Field Strength Microvolts/m at 3 meters (watts, e.i.r.p.)**	
	Transmitters	**Receivers**
30-88	100 (3 nW)	100 (3 nW)
88-216	150 (6.8 nW)	150 (6.8 nW)
216-960	200 (12 nW)	200 (12 nW)
Above 960	500 (75 nW)	500 (75 nW)

Note: Transmitting devices are not permitted in Table 1 bands or in TV bands (54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz, and 614-806 MHz). Prohibition of operation in TV bands does not apply to momentary devices, or to medical telemetry devices in the band 174-216 MHz, and to perimeter protection systems in the bands 54-72 and 76-88 MHz. The perimeter protection devices are to meet Table 3 field strengths limits.

Table 3: General Field Strength Limits for Transmitters at Frequencies below 30 MHz (Transmit)

Frequency (fundamental or spurious)	Field Strength (microvolts/m)	Magnetic H-Field (microamperes/m)	Measurement Distance (metres)
9-490 kHz	2,400/F (F in kHz)	2,400/377F (F in kHz)	300
490-1,705 kHz	24,000/F (F in kHz)	24,000/377F (F in kHz)	30
1.705-30 MHz	30	N/A	30

Note: The emission limits for the bands 9-90 kHz and 110-490 kHz are based on measurements employing an average detector.

13.2 EUT Setup

The radiated emissions tests were performed in the 3 meter chamber, using the setup in accordance with ANSI C63.4-2003.

13.3 Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations.

All data were recorded in the peak detection mode. Quasi-peak readings was performed only when an emissions was found to be marginal (within -4 dB of specification limits), and are distinguished with a "**QP**" in the data table.

13.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Cable Loss, and Attenuator Factor adding to the Indicated Reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Cable Loss + Attenuator Factor

For example, a Corrected Amplitude of 34.08 dBuV/m = Indicated Reading (23.85 dBuV) + Cable Factor (0.22 dB) + Attenuator Factor (10 dB)

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

13.5 Test Equipment Lists and Details

Manufacturer	Description	Model Number	Serial Number	Calibration Date
HP	Pre amplifier	8447D	2944A06639	2009-06-05
Sunol Science Corp.	Combination Antenna	JB1 Antenna	A020106-1	2009-05-27
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27
A. H. Systems	Antenna, Horn	SAS-200/571	261	2009-09-23
HP	Pre amplifier	8447D	2944A06639	2009-06-05

Statement of Traceability: BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

13.6 Test Environmental Conditions

Temperature:	18~21 °C
Relative Humidity:	30~35 %
ATM Pressure:	101.2-102.2kPa

The testing was performed by Kevin Li on 2010-04-27.

13.7 Test Results

Below 1 GHz:

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-1.35	103.0136	Vertical	30 to 1000

Above 1 GHz:

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
-	-	-	-	-	-	-	-	-	-	-	-[1]

[1] *All the emissions from the intentional radiator were under the noise floor level and/or 20 dB below the limit.*