FCC PART 15.247
IC RSS-210, ISSUE 8, DECEMBER 2010
TEST AND MEASUREMENT REPORT

For

AnyDATA Corporation

5 Oldfield, Irvine, CA 92618, USA

FCC ID: P4M-ACT231
IC: 4594A-ACT231

Report Type:	**Product Type:**
Original Report	CDMA Vehicle Tracker with Bluetooth and RKE Function

Prepared By:	Wei Sun
Report Number:	R1207094-247
Report Date:	2012-08-24
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1207094-247	Original Report	2012-08-24

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *AnyDATA Corporation*, and their product FCC ID: P4M-ACT231, IC: 4594A-ACT231, model: *ACT231* or the "EUT" as referred on this report is a vehicle tracker with Bluetooth and RKE function.

1.2 Mechanical Description of EUT

The "EUT" measures approximately *80 mm (L) x 45mm (W) x 22mm (H)*, and weighs approximately *66.5*g.

The test data gathered are from typical production sample, serial number: 201206224815710 (6C4C727D) for radiated and 201206224815710(6C4C727E) for conducted provided by the manufacturer.

1.3 Objective

This report is prepared on behalf of *AnyDATA 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 8, Dec 2010.

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 Part 22H/24E and RSS-132/133 report No.: R1207094-2224
FCC Part 15.231 and RSS-210 report No.: R1207094-231

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2009, 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 the 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 CISPR16-4-2:2003, The Treatment of Uncertainty in EMC Measurements, the values ranging from $\pm$2.0 dB for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

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 site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have 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 test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2003, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: A-0027. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is an American Association for Laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.4-2009.

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

Radio Mode	Modulation	Frequency/Data Rate		
		Low CH (MHz)	Mid CH (MHz)	High CH (MHz)
Bluetooth	GFSK	2402	2441	2480
Bluetooth	QPSK	2402	2441	2480
Bluetooth	8PSK	2402	2441	2480

2.2 EUT Exercise Software

The test utility used was AC23VZO5 was provided by AnyDATA Corporation and was verified by Wei Sun to comply with the standard requirements being tested against.

2.3 Special Equipment

There were no special accessories were required, included, or intended for use with EUT during these tests.

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
Dell	Laptop	PP11L	CN-0D4571-48643-57F-7162

2.6 EUT Internal Configuration Details

Manufacturers	Descriptions	Models	Serial Numbers
AnyDATA Corporation	RKE Board	ACT231 TRANS V1.0	E170968
AnyDATA Corporation	STN Board	ACT231 STN V0.3	0.194V-0
AnyDATA Corporation	CDMA Board	ACT231 MAIN V0.3	5234V-0

2.7 Interface Ports and Cabling

Cable Description	Length (m)	From	To
Power Cable	< 3	EUT	DC/AC
USB Cable	< 3	EUT	Laptop
RF Cable	1	EUT	PSA

2.8 Power Supply List and Details

Manufacturer	Description	Model	Serial Number
HON-KWANG	AC/DC Adapter	HK-Q106-A12	-

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 §7.1.2	Antenna Requirement	Compliant
FCC §15.207(a) IC RSS-Gen §7.2.4	AC Line Conducted Emissions	Compliant
FCC §15.209 IC RSS-210 §A8.5	Spurious Emissions at Antenna Port	Compliant
FCC §15.205 IC RSS-210 §2.2	Restricted Bands	Compliant
FCC §15.209, §15.247(d) IC RSS-210 §A8.5	Radiated Spurious Emissions	Compliant
FCC §15.247 (a)(2) IC RSS-210 §A8.1	Hopping Channel Bandwidth	Compliant
FCC §15.247(b)(3) IC RSS-210 §A8.4	Maximum Peak Output Power	Compliant
FCC §15.247(a) (1) IC RSS-210 §A8.1(b)	Hopping Channel Separation	Compliant
FCC §15.247(a)(1)(iii) IC RSS-210 §A8.1(d)	Number of Hopping Channels	Compliant
FCC §15.247(a)(1)(iii) IC RSS-210 §A8.1(d)	Dwell Time	Compliant
FCC §15.247(d) IC RSS-210 §A8.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
FCC §15.247 (e) IC RSS-210 §A8.2(b)	Power Spectral Density	NA
FCC §15.109 IC RSS-Gen §4.10, §6	Receiver Spurious Emission	Compliant

Note: NA EUT is FHSS device; therefore no PSD measurement was required.

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

4.1 Applicable Standard

According to FCC §15.247(i), §1.1307(b)(1) and IC RSS-102, 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	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	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
* = Plane-wave equivalent power density

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):	9.03
Maximum peak output power at antenna input terminal (mW):	8.00
Prediction distance (cm):	20
Prediction frequency (MHz):	2480
Maximum Antenna Gain, typical (dBi):	-5.0
Maximum Antenna Gain (numeric):	0.32
Power density of prediction frequency at 20 cm (mW/cm^2):	0.0005
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0
Power density of prediction frequency at 20 cm (W/m^2):	0.005
MPE limit for uncontrolled exposure at prediction frequency (W/m^2):	10.0

The device is compliant with the requirement MPE limit for uncontrolled exposure.

5 FCC §15.203 & IC RSS-Gen §7.1.2 – Antenna Requirements

5.1 Applicable Standard

According to FCC Part §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used.

Per IC RSS-Gen §7.1.2, A transmitter can only be sold or operated with antennas with which it was certified. A transmitter maybe 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 IC 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 IC RSS-210 Annex 8 or RSS-210 Annex 9, the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to IC RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

5.2 Result

The EUT has maximum gain of -5.0 dBi antenna, which in accordance to sections FCC Part 15.203 and IC RSS-Gen §7.1.2, is considered sufficient to comply with the provisions of these sections.

6 FCC §15.207 (a) & IC RSS-Gen §7.2.4 – AC Line Conducted Emissions

6.1 Applicable Standard

As per FCC §15.207 & IC RSS-Gen §7.2.4 Conducted limits:

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 Note 1	56 to 46 Note 1
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4-2009 measurement procedure. The specification used was FCC Part15.207 limits and IC RSS-Gen §7.2.4 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 Supporting Laptop which connects the EUT was connected with LISN-1 which provided 120 V/60 Hz AC power.

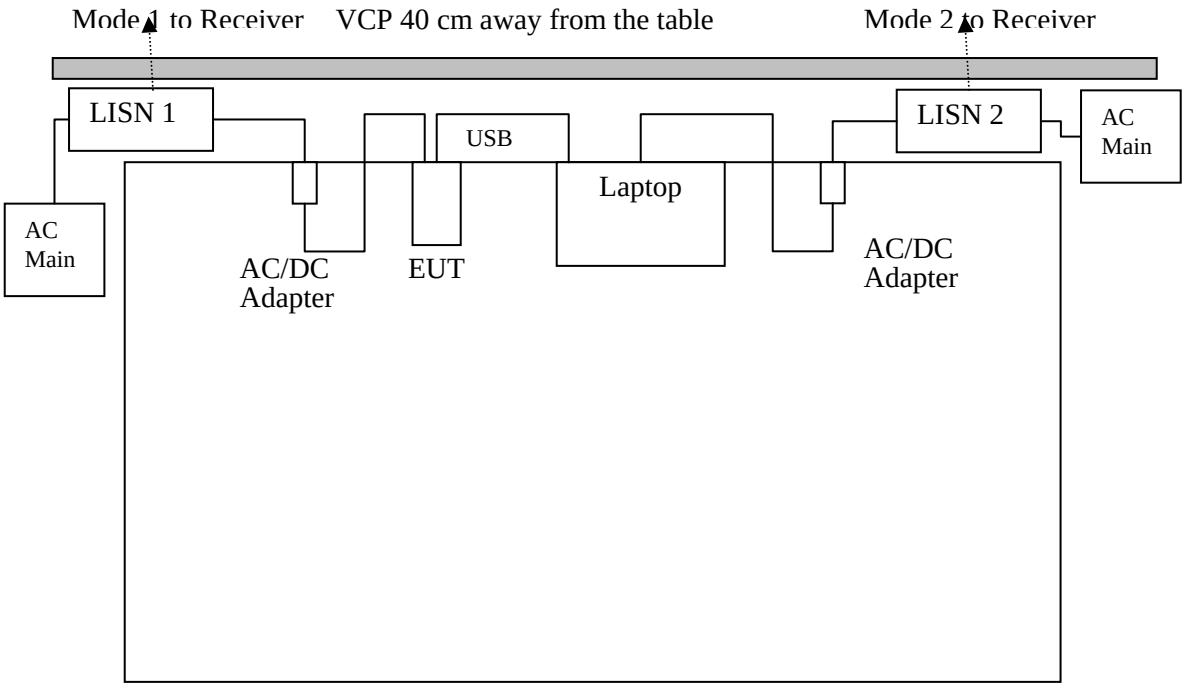
6.3 Test Procedure

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”.

6.4 Test Setup Block Diagram



6.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Cable Loss (CL) plus the High Pass Filter/Attenuator value (HA) and subtracting the Amplifier Gain (Ga) to the indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + CL + HA – Ga

For example, a corrected amplitude (CA) of 36 dBuV = Indicated Amplitude reading (Ai) of 50.0 dBuV + Cable Loss (CL) 1.0 dB + High Pass Filter/Attenuator (IA) 5 dB - Amplifier Gain (Ga) 20 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 (dB) = Corrected Amplitude (dBuV) - Limit (dBuV)

6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Solar Electronics	LISN	9252-50-R-24-N	511205	2012-06-25	1 year
Solar Electronics	LISN	9252-50-R-24-N	511213	2012-06-25	1 year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100338	2011-09-24	1 year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

6.7 Test Environmental Conditions

Temperature:	25°C
Relative Humidity:	49%
ATM Pressure:	101.9kPa

The testing was performed by Wei Sun on 2012-07-23 at 5 meter chamber #2.

6.8 Summary of Test Results

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

Bluetooth:

Worst Case: 8PSK – High Channel Transmitting Mode

Mode #1: Powered by AC/DC Adapter

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor (Line/Neutral)**	**Range (MHz)**
-11.12	0.290669	Line	0.15-30

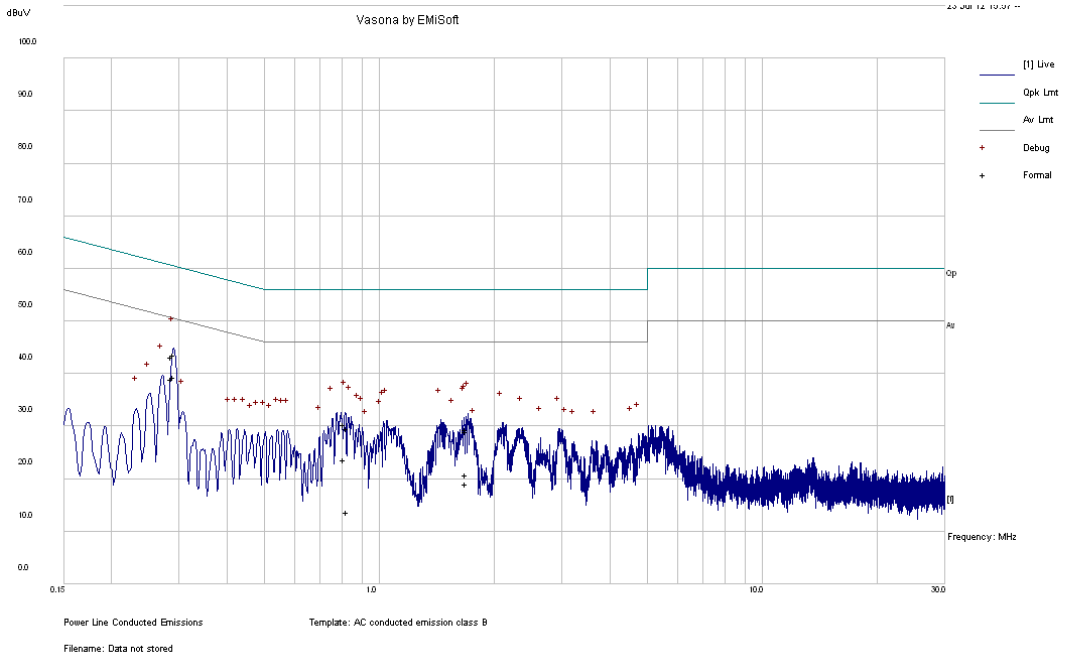
Mode #2: Using USB Connect to Laptop

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor (Line/Neutral)**	**Range (MHz)**
-2.37	0.291072	Line	0.15-30

6.9 Conducted Emissions Test Plots and Data

Mode 1: With AC/DC Adapter

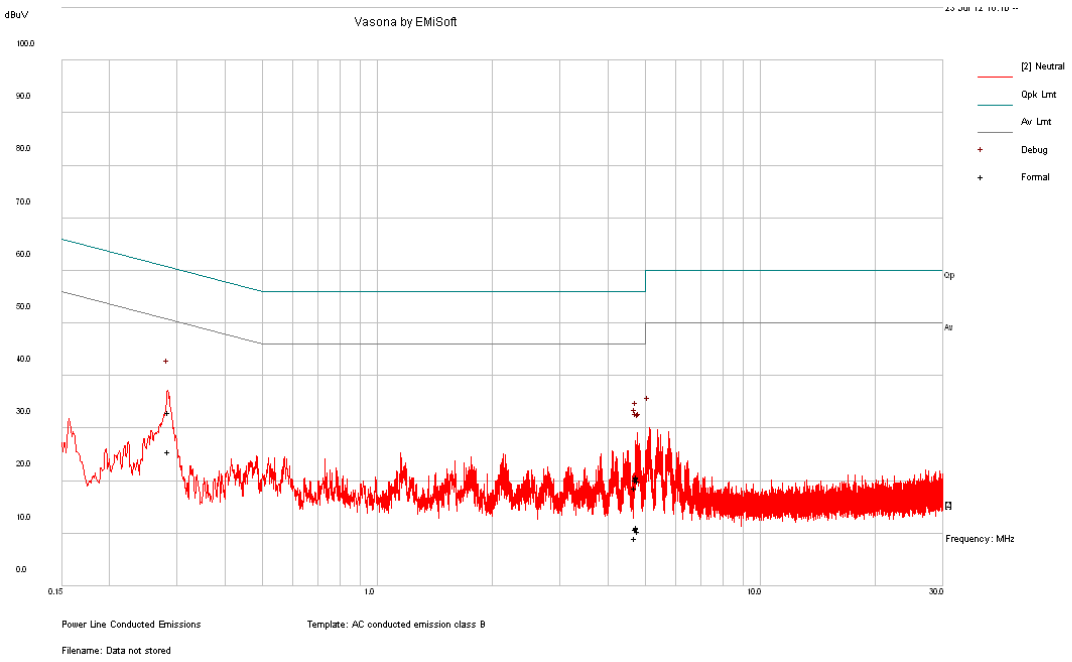
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)	Detector
0.290669	43.68	Line	60.51	-16.82	QP
0.287638	43.19	Line	60.59	-17.40	QP
0.812354	30.3	Line	56	-25.70	QP
0.827179	29.67	Line	56	-26.33	QP
1.688889	29.35	Line	56	-26.65	QP
1.684624	29.1	Line	56	-26.90	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)	Detector
0.290669	39.38	Line	50.51	-11.12	Ave.
0.287638	39.04	Line	50.59	-11.55	Ave.
0.812354	23.66	Line	46	-22.34	Ave.
1.684624	20.8	Line	46	-25.2	Ave.
1.688889	19.11	Line	46	-26.89	Ave.
0.827179	13.61	Line	46	-32.39	Ave.

120 V, 60 Hz – Neutral

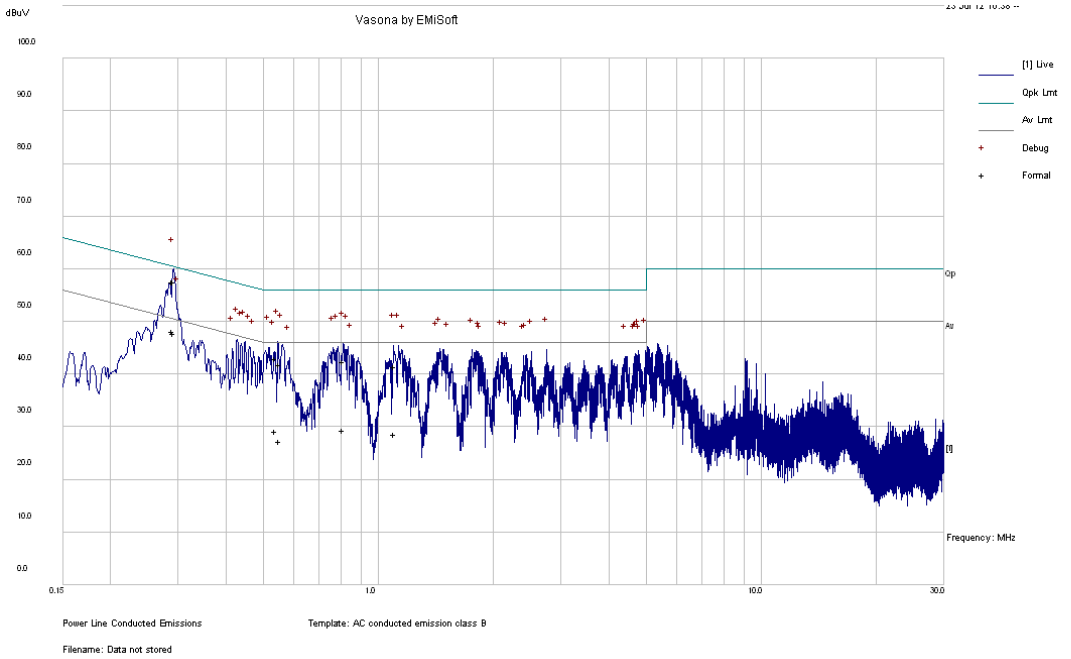


Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)	Detector
0.286011	33.04	Neutral	60.64	-27.60	QP
4.784147	20.75	Neutral	56	-35.25	QP
4.792778	20.56	Neutral	56	-35.44	QP
4.765673	20.25	Neutral	56	-35.75	QP
4.825853	20.02	Neutral	56	-35.98	QP
4.729862	18.64	Neutral	56	-37.36	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)	Detector
0.286011	25.58	Neutral	50.64	-25.06	Ave.
4.784147	11.25	Neutral	46	-34.75	Ave.
4.792778	11.07	Neutral	46	-34.93	Ave.
4.765673	10.8	Neutral	46	-35.20	Ave.
4.825853	10.39	Neutral	46	-35.61	Ave.
4.729862	9.1	Neutral	46	-36.90	Ave.

Mode 2: With Laptop

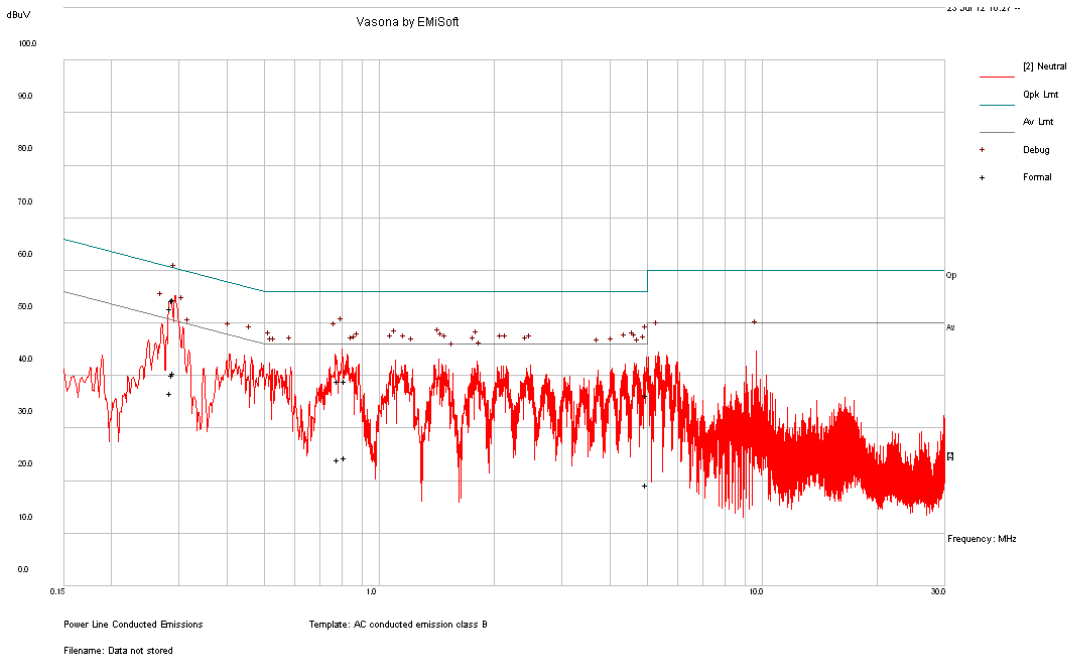
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)	Detector
0.291072	57.67	Line	60.49	-2.83	QP
0.293004	57.53	Line	60.44	-2.91	QP
0.540801	42.94	Line	56	-13.06	QP
0.809235	42.51	Line	56	-13.49	QP
0.553101	41.95	Line	56	-14.05	QP
1.10658	41.44	Line	56	-14.56	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)	Detector
0.291072	48.13	Line	50.49	-2.37	Ave.
0.293004	47.72	Line	50.44	-2.72	Ave.
0.809235	29.5	Line	46	-16.50	Ave.
0.540801	29.19	Line	46	-16.81	Ave.
1.10658	28.69	Line	46	-17.31	Ave.
0.553101	27.26	Line	46	-18.74	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)	Detector
0.290517	54.42	Neutral	60.51	-6.09	QP
0.289662	54.3	Neutral	60.53	-6.23	QP
0.286287	52.71	Neutral	60.63	-7.93	QP
0.817368	39.02	Neutral	56	-16.98	QP
0.782424	39	Neutral	56	-17.00	QP
4.992419	36.37	Neutral	56	-19.63	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)	Detector
0.290517	40.62	Neutral	50.51	-9.89	Ave.
0.289662	40.06	Neutral	50.53	-10.47	Ave.
0.286287	36.75	Neutral	50.63	-13.88	Ave.
0.817368	24.37	Neutral	46	-21.63	Ave.
0.782424	24.11	Neutral	46	-21.89	Ave.
4.992419	19.17	Neutral	46	-26.83	Ave.

7 FCC §2.1051, §15.247(d) & IC RSS-210 §A8.5 – Out-of-band 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 Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

7.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	48%
ATM Pressure:	102.5kPa

The testing was performed by Wei Sun on 2012-07-10 at RF Site.

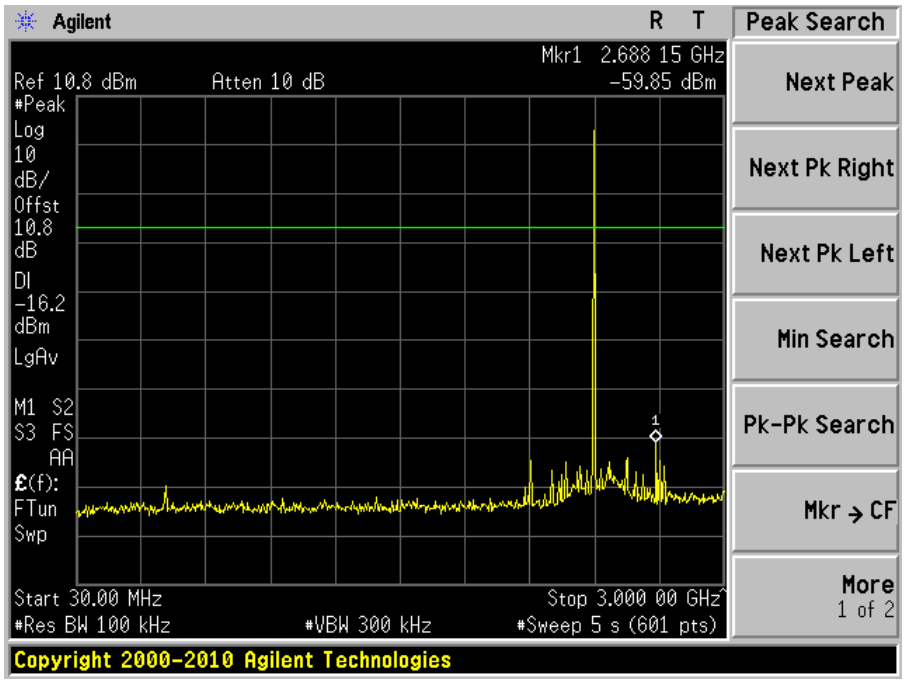
7.5 Test Results

Please refer to following plots of spurious emissions.

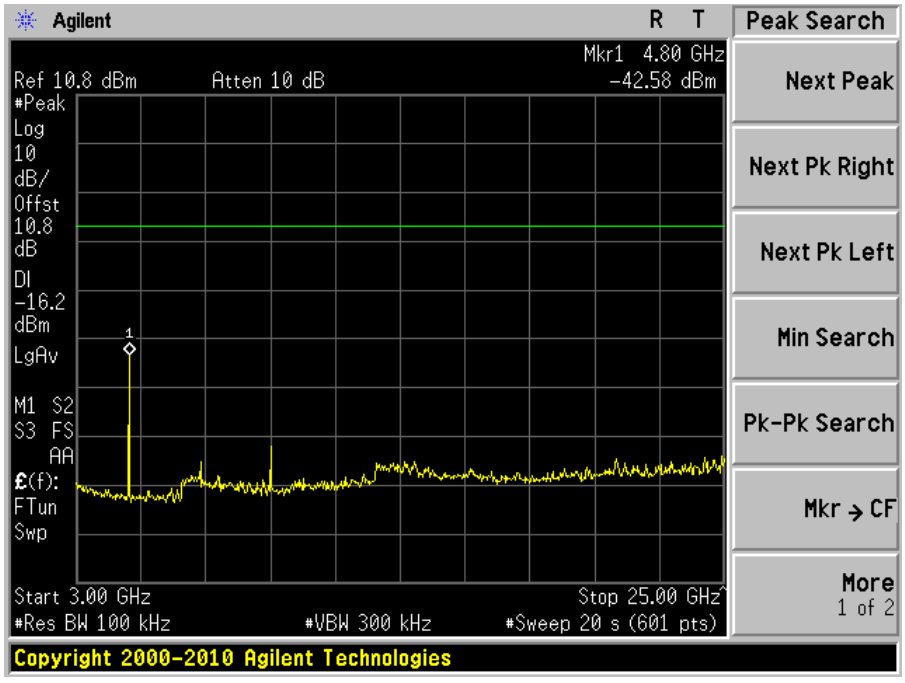
Modulation: GFSK

Low Channel 2402 MHz

Plot #1 30 MHz – 3 GHz

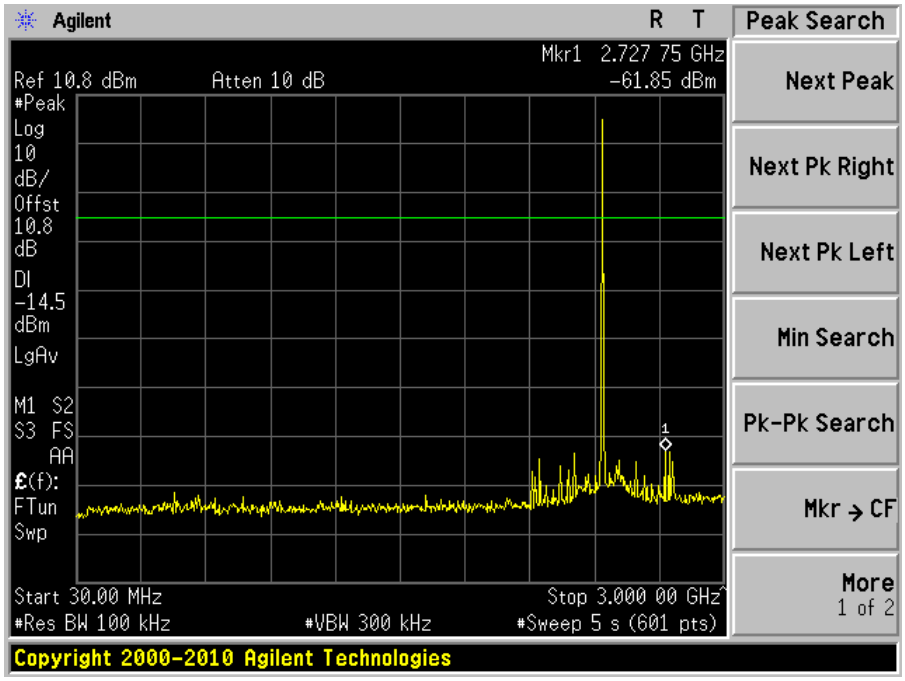


Plot #2 3 GHz – 25 GHz

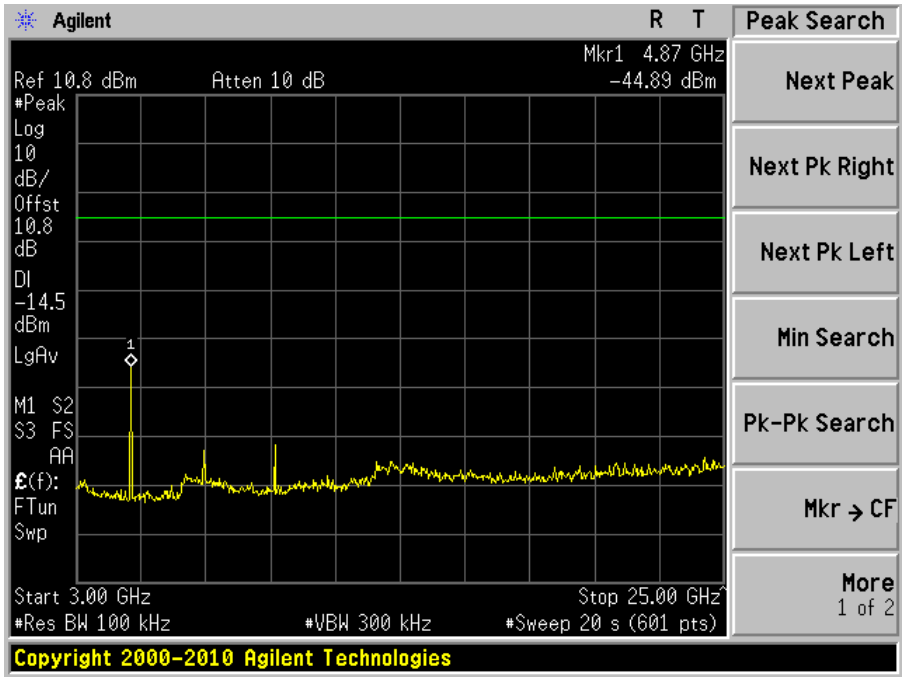


Middle Channel 2441 MHz

Plot #1 30 MHz – 3 GHz

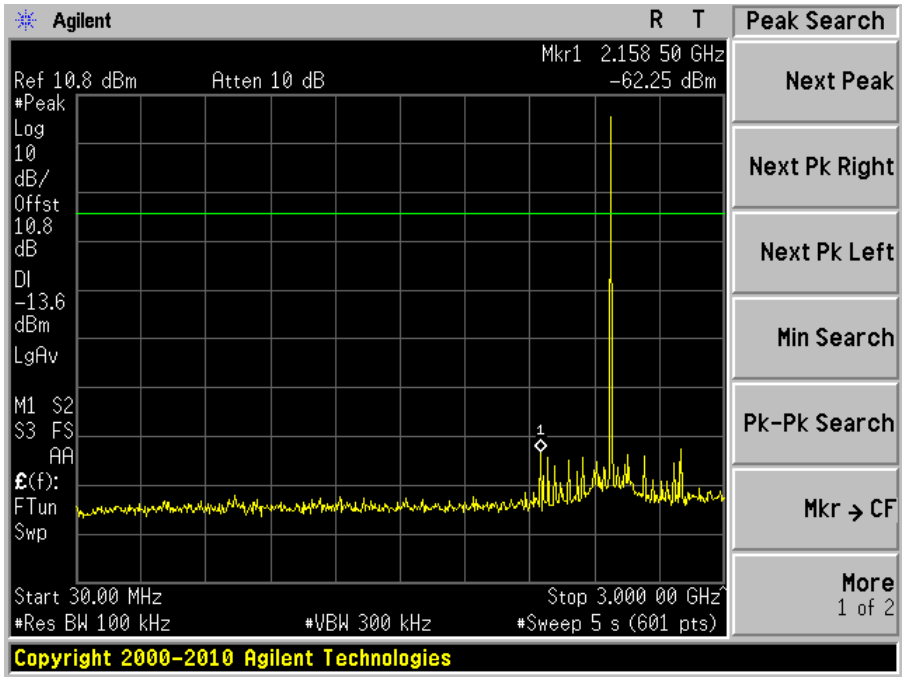


Plot #2 3 GHz – 25 GHz

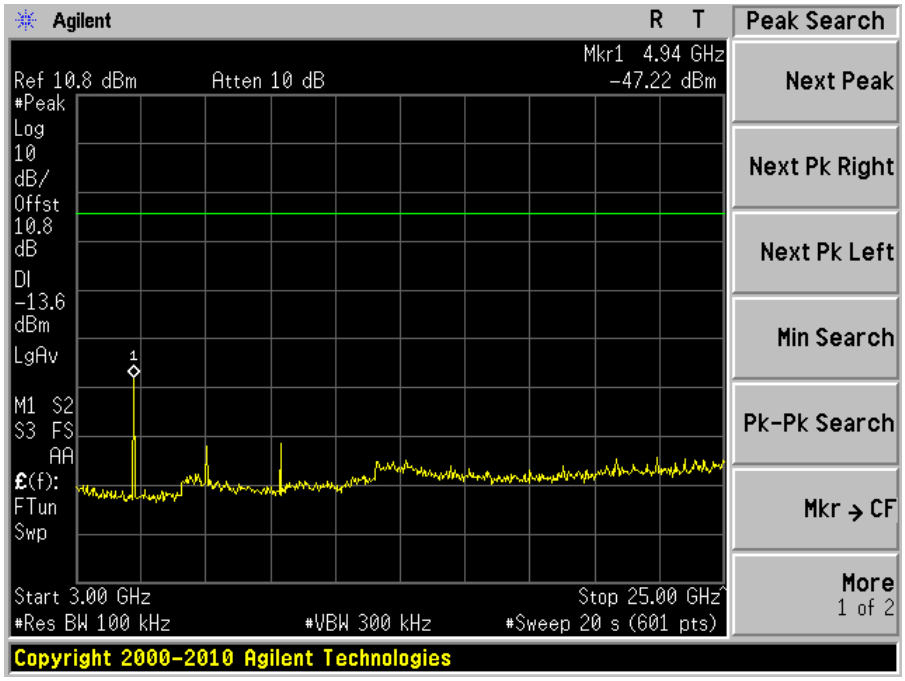


High Channel 2480 MHz

Plot #1 30 MHz – 3 GHz



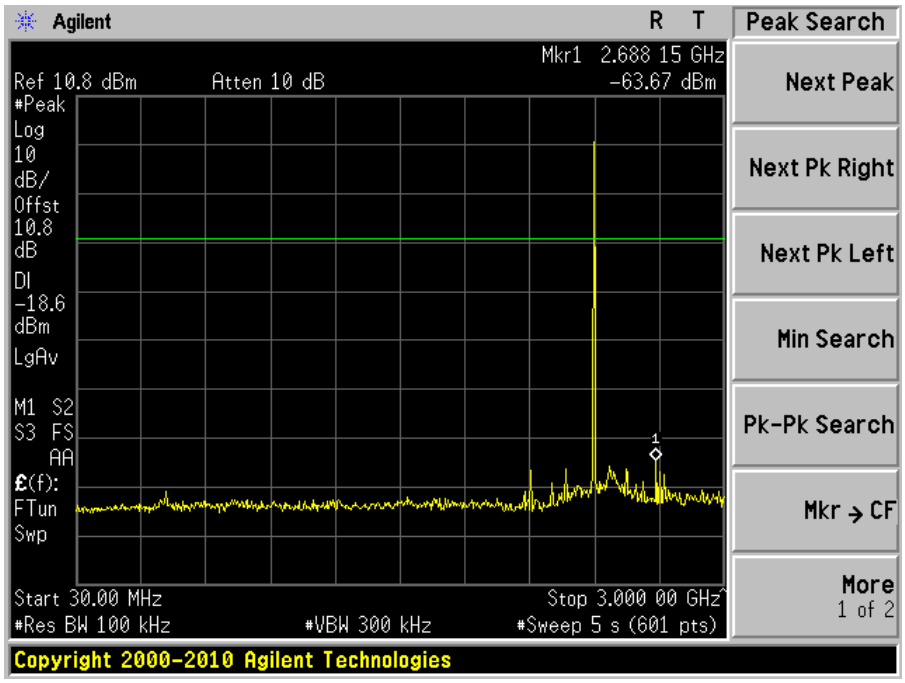
Plot #2 3 GHz – 25 GHz



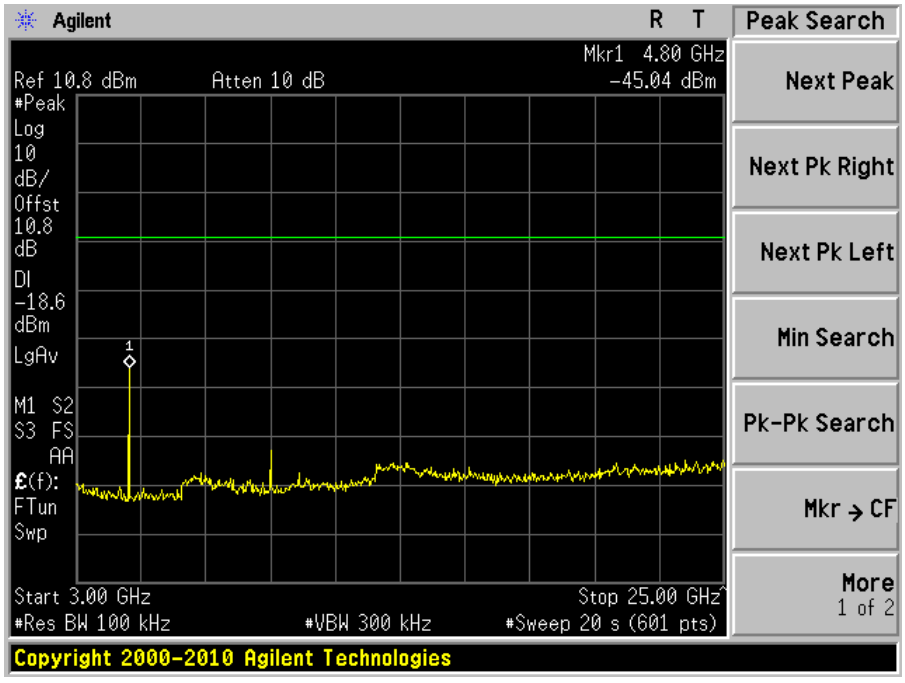
Modulation: QPSK

Low Channel 2402 MHz

Plot #1 30 MHz – 3 GHz

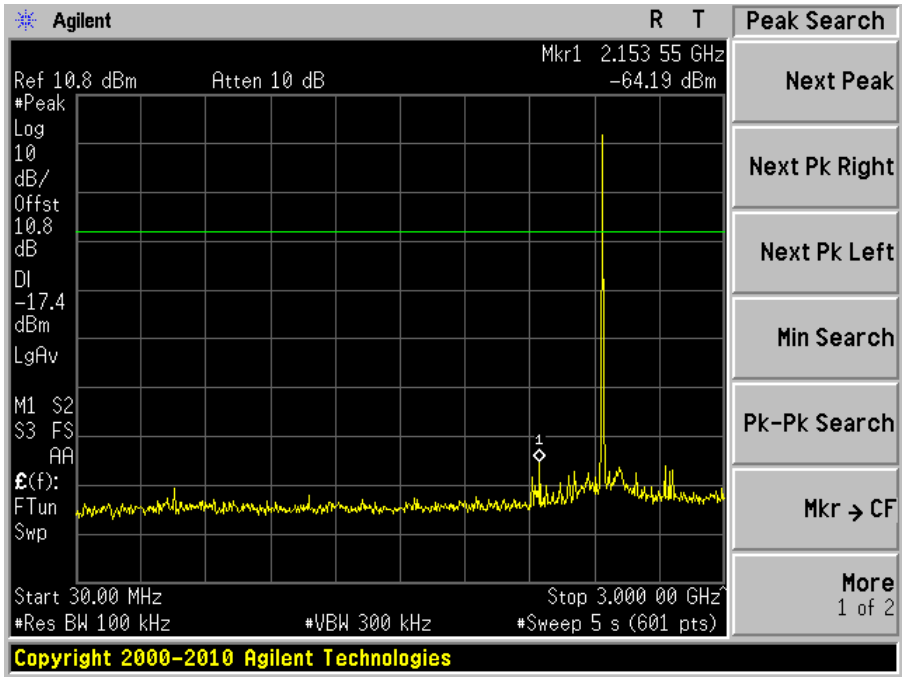


Plot #2 3 GHz – 25 GHz

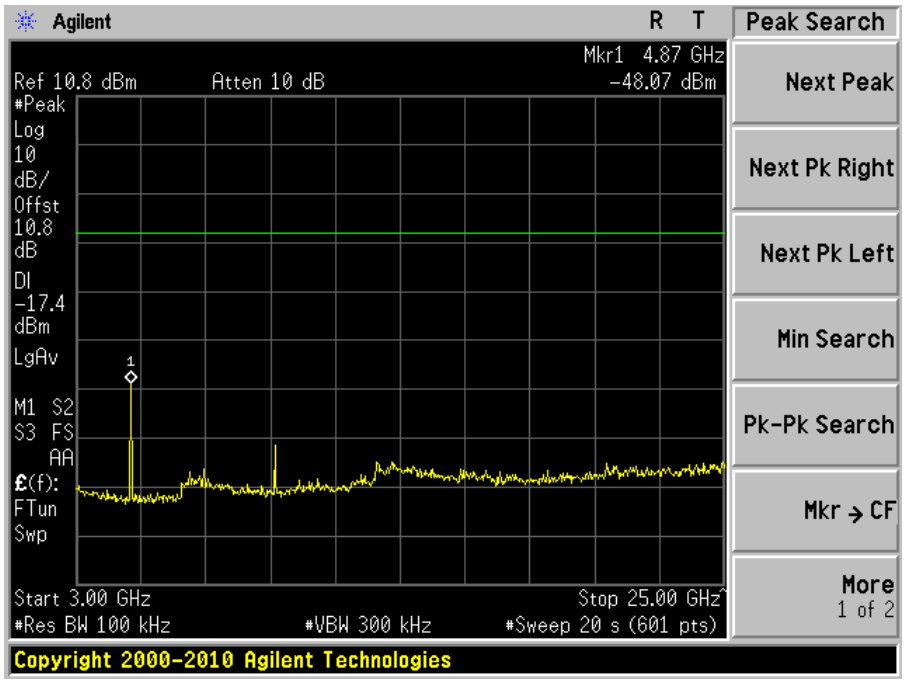


Middle Channel 2441 MHz

Plot #1 30 MHz – 3 GHz

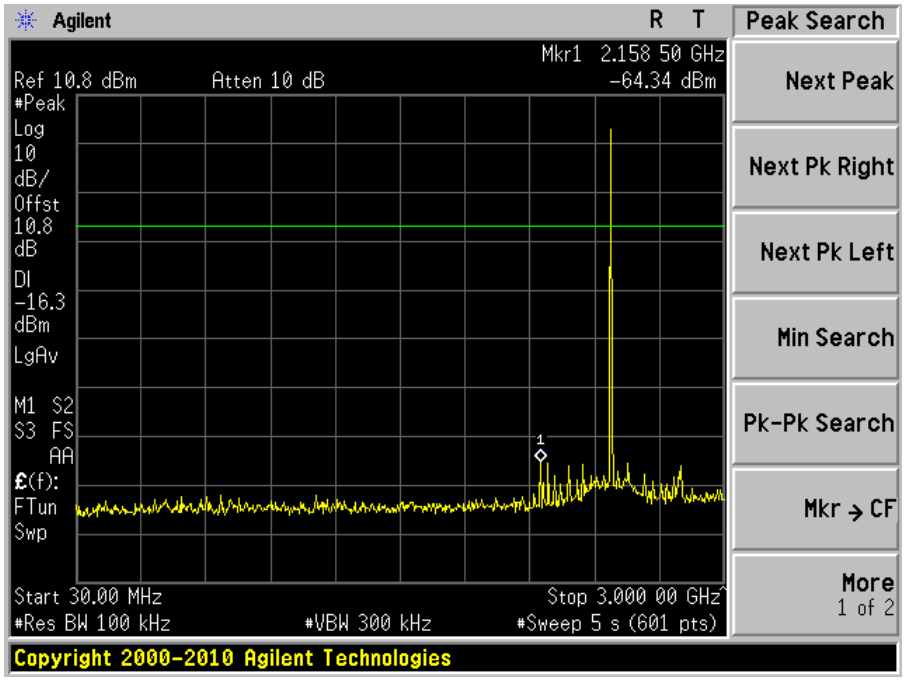


Plot #2 3 GHz – 25 GHz

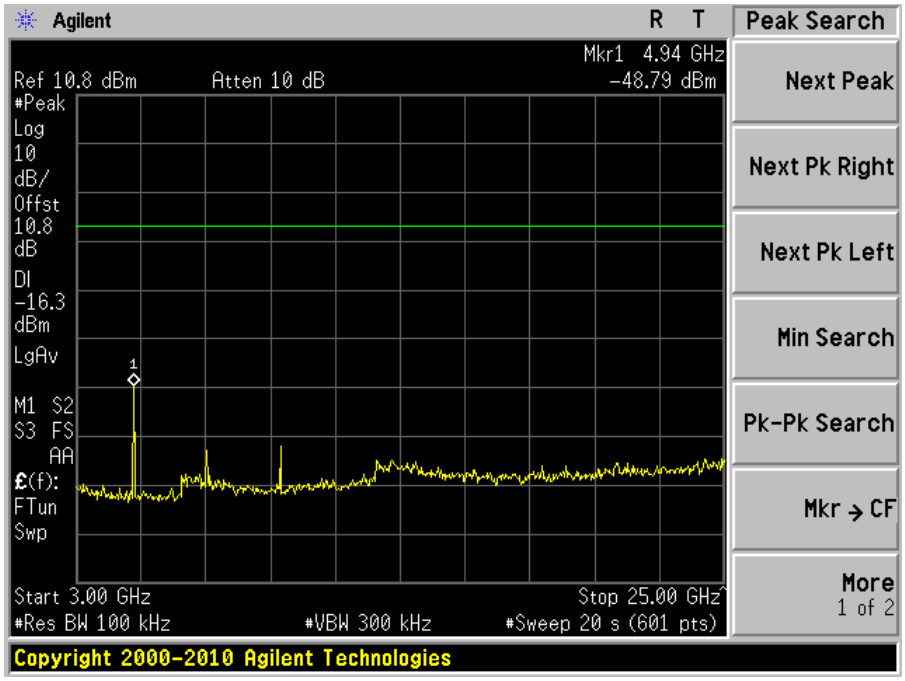


High Channel 2480 MHz

Plot #1 30 MHz – 3 GHz



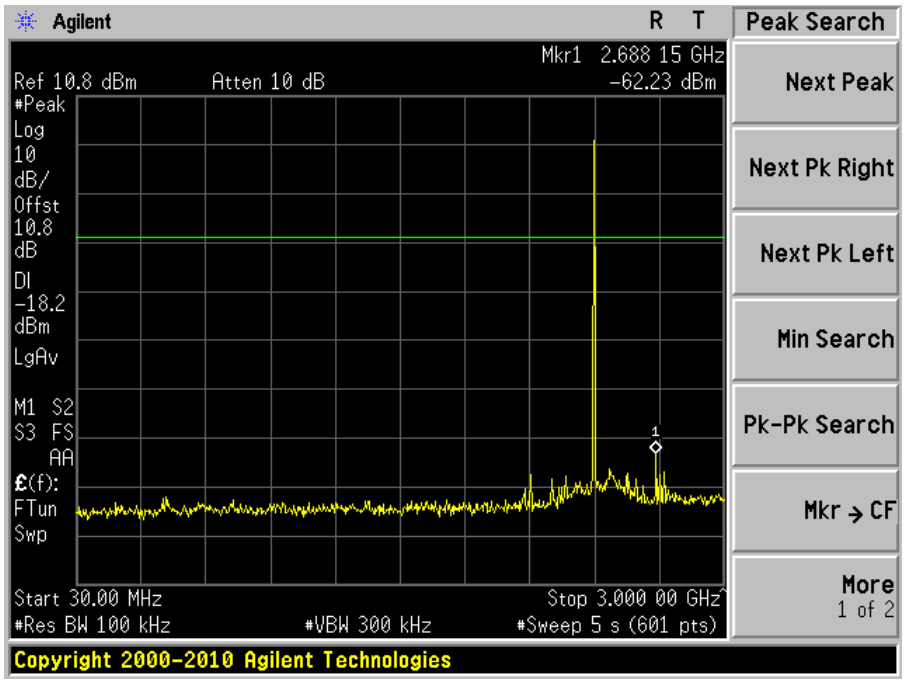
Plot #2 3 GHz – 25 GHz



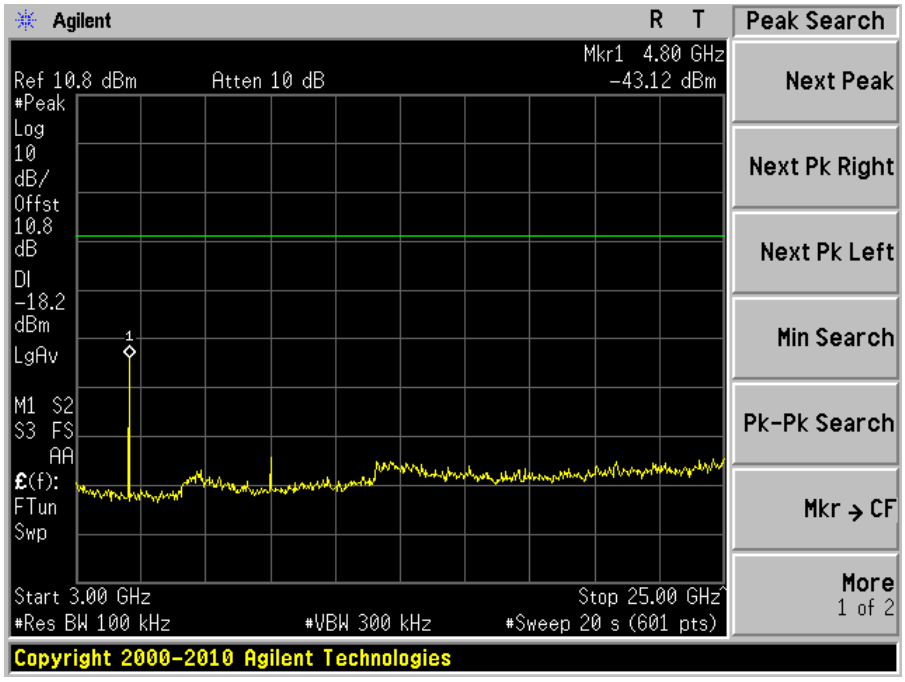
Modulation: 8PSK

Low Channel 2402 MHz

Plot #1 30 MHz – 3 GHz

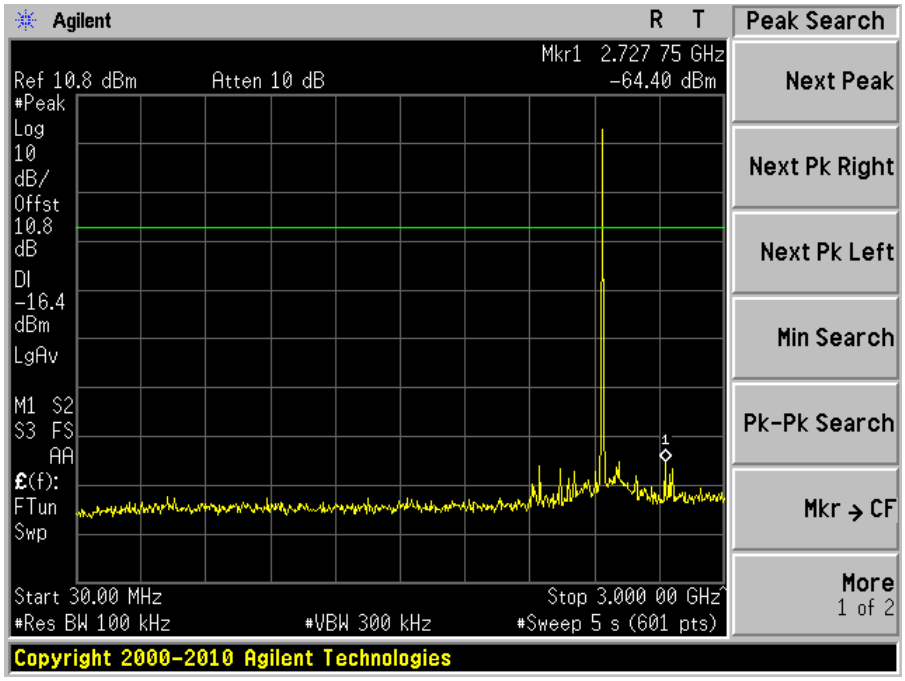


Plot #2 3 GHz – 25 GHz

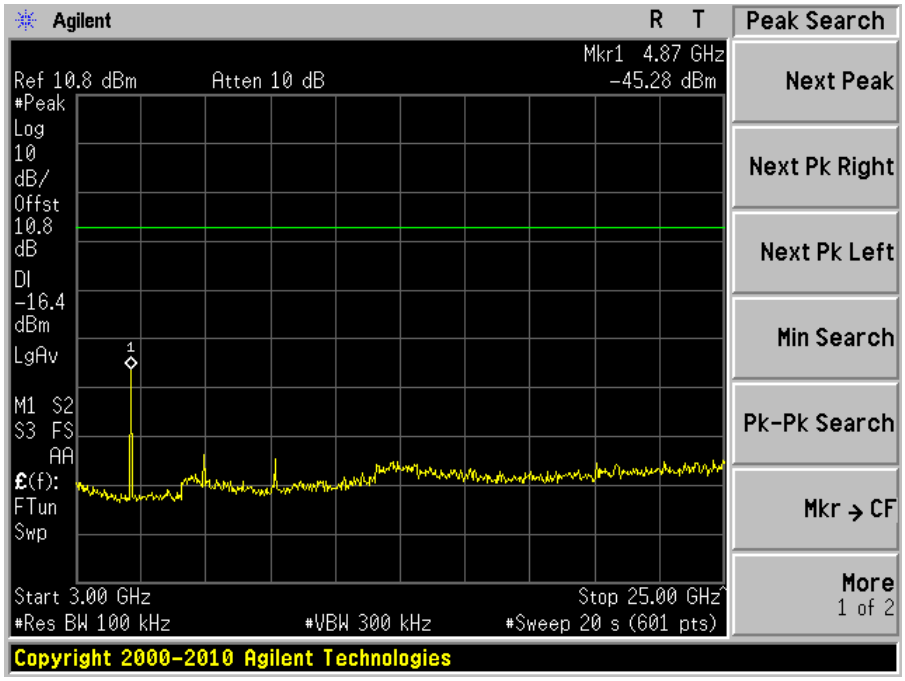


Middle Channel 2441 MHz

Plot #1 30 MHz – 3 GHz

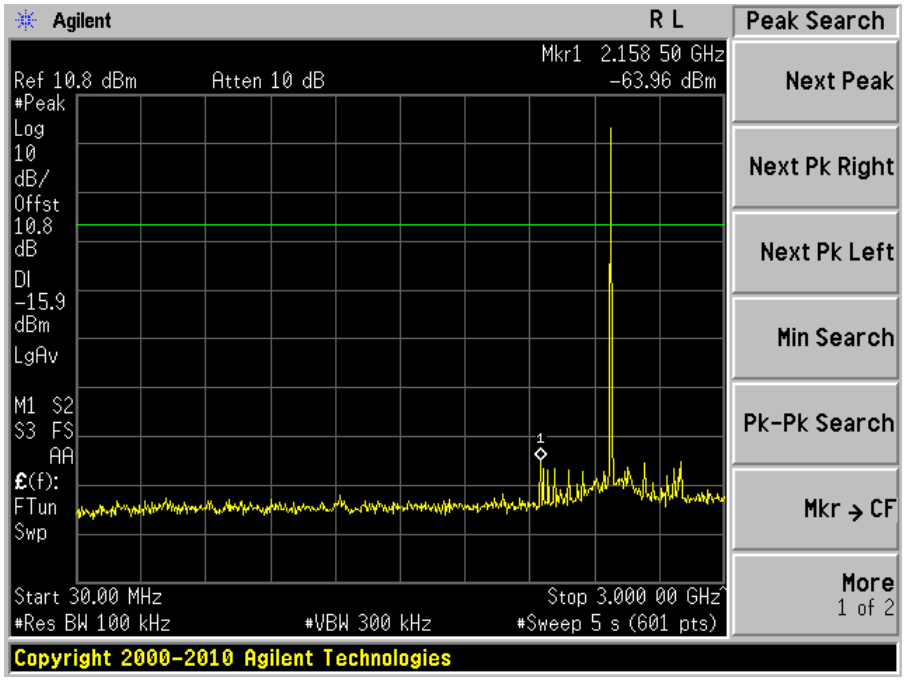


Plot #2 3 GHz – 25 GHz

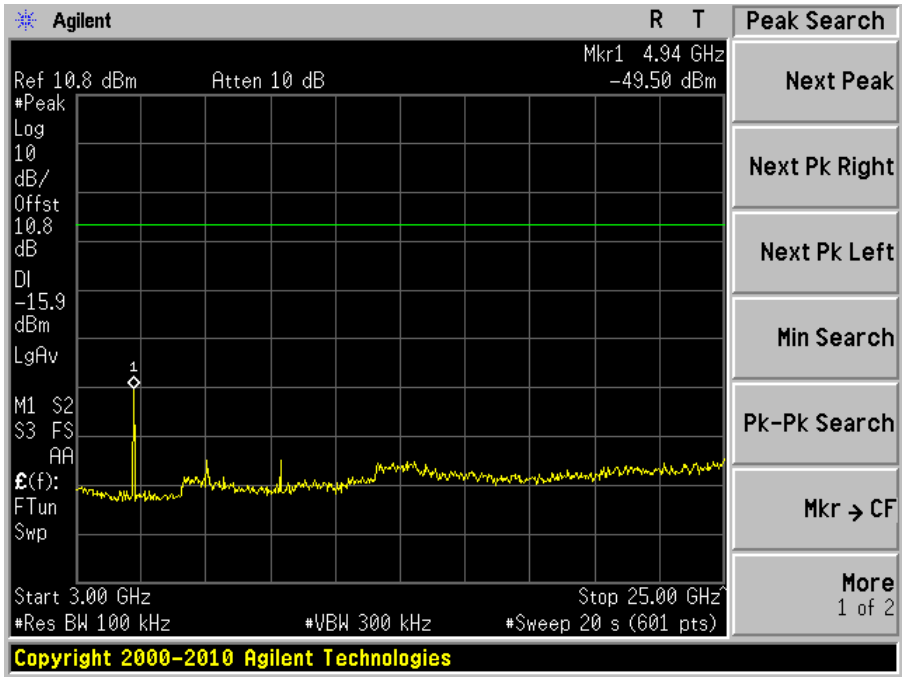


High Channel 2480 MHz

Plot #1 30 MHz – 3 GHz



Plot #2 3 GHz – 25 GHz



8 FCC §15.205, §15.209, §15.247(d) & IC RSS-210 §2.2, §2.6, §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): 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**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** 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	16.42 – 16.423	960 – 1240	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5. 35 – 5. 46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 –167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3 3458 – 3 358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

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).

As per ID 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 RF power that is produced shall be at least 20 dB below that in the100 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square 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 field strength limits specified in RSS-Gen is not required.

8.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2009. The specification used was the FCC 15C and 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.

8.3 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

8.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to the indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, the Corrected Amplitude (CA) of 40.3 dBuV/m = indicated Amplitude reading (Ai) 32.5 dBuV + Antenna Factor (AF) 23.5dB + Cable Loss (CL) 3.7 dB + Attenuator (Atten) 10 dB - Amplifier Gain (Ga) 29.4 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 (dB) = Corrected Amplitude (dBuV/m) - Limit (dBuV/m)

8.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	-
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2011-08-10	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A10187	2012-03-08	1 year
A.H. Systems	Horn antenna	SAS-200/571	261	2012-01-18	1 year
Mini-Circuits	Pre-amplifier	ZVA-183-S	667400960	2012-05-08	1 year
HP	Signal Generator	8648C	3426A00417	2011-08-18	1 year
Wisewave	Horn antenna	ARH-4223-02	10555-02	2010-06-14 [1]	3 years

Statement of Traceability: BACL attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

8.6 Test Environmental Conditions

Temperature:	24 °C
Relative Humidity:	49%
ATM Pressure:	101.9kPa

The testing was performed by Wei Sun on 2012-07-23 at 5 meter chamber 2.

8.7 Summary of Test Results

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

Bluetooth Worst mode: 8PSK

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-5.88	2483.5	Vertical	30 MHz – 25 GHz

Please refer to the following table for specific test result details

8.8 Radiated Emissions Test Result Data

Radiated Emission at 3 meters, 30 MHz – 25 GHz on the worst modulation: 8PSK

Frequency (MHz)	S.A. Reading (dBµV)	Turntable 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)	
Low Channel 2402 MHz, measured at 3 meters											
2402	67.38	71	100	V	28.53	2.92	0	98.83	-	-	Fund/Peak
2402	66.9	323	110	V	28.53	2.92	0	98.35	-	-	Fund/Ave
2402	74.54	71	100	H	28.53	2.92	0	105.99	-	-	Fund/Peak
2402	73.52	323	110	H	28.53	2.92	0	104.97	-	-	Fund/Ave
4804	36.11	0	100	V	33.59	4.75	27.78	46.67	74	-27.33	Harm/Peak
4804	21.4	0	100	V	33.59	4.75	27.78	31.96	54	-22.04	Harm/Ave
4804	35.94	0	100	H	33.59	4.75	27.78	46.5	74	-27.50	Harm/Peak
4804	20.69	0	100	H	33.59	4.75	27.78	31.25	54	-22.75	Harm/Ave
7206	34.04	0	100	V	38.65	6.54	27.59	51.64	78.83	-27.19	Harm/Peak
7206	20.51	0	100	V	38.65	6.54	27.59	38.11	78.25	-40.14	Harm/Ave
7206	34.11	0	100	H	38.65	6.54	27.59	51.71	85.99	-34.28	Harm/Peak
7206	20.44	0	100	H	38.65	6.54	27.59	38.04	84.97	-46.93	Harm/Ave
9608	32.91	0	100	V	38.54	7.34	27.05	51.74	78.83	-27.09	Harm/Peak
9608	19.65	0	100	V	38.54	7.34	27.05	38.48	78.25	-39.77	Harm/Ave
9608	32.88	0	100	H	38.54	7.34	27.05	51.71	85.99	-34.28	Harm/Peak
9608	19.61	0	100	H	38.54	7.34	27.05	38.44	84.97	-46.53	Harm/Ave
2390	28.16	0	100	V	28.53	2.92	0	59.61	74	-14.39	Spur/Peak
2390	28.06	0	100	H	28.53	2.92	0	59.51	74	-14.49	Spur/Peak
2390	15.82	0	100	V	28.53	2.92	0	47.27	54	-6.73	Spur/Ave
2390	15.91	0	100	H	28.53	2.92	0	47.36	54	-6.64	Spur/Ave
74.6	13.34	68	100	V	8.7	10.22	25.17	7.09	40	-32.91	Spur/QP
74.6	10.61	119	100	H	8.7	10.22	25.17	4.36	40	-35.64	Spur/QP
125.4	11.19	77	100	V	14.4	10.67	25.16	11.1	43.5	-32.40	Spur/QP
125.4	9.21	281	100	H	14.4	10.67	25.16	9.12	43.5	-34.38	Spur/QP

Frequency (MHz)	S.A. Reading (dBµV)	Turntable 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)	
Middle channel 2441 MHz measured at 3 meters											
2441	71.18	69	100	V	28.53	2.92	0	102.63	-	-	Fund/Peak
2441	77.94	323	110	H	28.53	2.92	0	109.39	-	-	Fund/Ave
2441	70.66	69	100	V	28.53	2.92	0	102.11	-	-	Fund/Peak
2441	76.83	323	110	H	28.53	2.92	0	108.28	-	-	Fund/Ave
4882	36.37	0	100	V	33.59	4.92	27.67	47.21	74	-26.79	Harm/Peak
4882	21.36	0	100	V	33.59	4.92	27.67	32.2	54	-21.80	Harm/Ave
4882	35.13	0	100	H	33.59	4.92	27.67	45.97	74	-28.03	Harm/Peak
4882	20.69	0	100	H	33.59	4.92	27.67	31.53	54	-22.47	Harm/Ave
7323	34.78	0	100	V	38.33	6.75	27.51	52.35	74	-21.65	Harm/Peak
7323	20	0	100	V	38.33	6.75	27.51	37.57	54	-16.43	Harm/Ave
7323	34.02	0	100	H	38.33	6.75	27.51	51.59	74	-22.41	Harm/Peak
7323	20.08	0	100	H	38.33	6.75	27.51	37.65	54	-16.35	Harm/Ave
9764	32.1	0	100	V	38.15	7.67	26.98	50.94	82.63	-31.69	Harm/Peak
9764	19.11	0	100	V	38.15	7.67	26.98	37.95	82.11	-44.16	Harm/Ave
9764	32.16	0	100	H	38.15	7.67	26.98	51	89.39	-38.39	Harm/Peak
9764	19.7	0	100	H	38.15	7.67	26.98	38.54	88.28	-49.74	Harm/Ave
74.53	12.94	39	100	V	8.7	10.22	25.17	6.69	40	-33.31	Spur/QP
74.53	6.49	29	100	H	8.7	10.22	25.17	0.24	40	-39.76	Spur/QP
123	11.25	101	100	V	14.4	10.67	25.16	11.16	43.5	-32.34	Spur/QP
123	9.67	197	100	H	14.4	10.67	25.16	9.58	43.5	-33.92	Spur/QP
108	9.78	140	100	V	12.8	10.67	25.17	8.08	43.5	-35.42	Spur/QP
108	8.37	173	100	H	12.8	10.67	25.17	6.67	43.5	-36.83	Spur/QP

Frequency (MHz)	S.A. Reading (dBµV)	Turntable 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)	
High channel 2480 MHz measured at 3 meters											
2480	65.26	70	100	V	29.12	3.04	0	97.42	-	-	Fund/Peak
2480	71.23	323	110	H	29.12	3.04	0	103.39	-	-	Fund/Ave
2480	64.45	70	100	V	29.12	3.04	0	96.61	-	-	Fund/Peak
2480	70.08	323	110	H	29.12	3.04	0	102.24	-	-	Fund/Ave
4960	36.1	0	100	V	33.59	4.92	27.67	46.94	74	-27.06	Harm/Peak
4960	21.09	0	100	V	33.59	4.92	27.67	31.93	54	-22.07	Harm/Ave
4960	35.34	0	100	H	33.59	4.92	27.67	46.18	74	-27.82	Harm/Peak
4960	20.17	0	100	H	33.59	4.92	27.67	31.01	54	-22.99	Harm/Ave
7440	34.51	0	100	V	38.33	6.75	27.51	52.08	74	-21.92	Harm/Peak
7440	20.09	0	100	V	38.33	6.75	27.51	37.66	54	-16.34	Harm/Ave
7440	33.9	0	100	H	38.33	6.75	27.51	51.47	74	-22.53	Harm/Peak
7440	20.41	0	100	H	38.33	6.75	27.51	37.98	54	-16.02	Harm/Ave
9920	32.51	0	100	V	38.15	7.67	26.98	51.35	77.42	-26.07	Harm/Peak
9920	19.2	0	100	V	38.15	7.67	26.98	38.04	76.61	-38.57	Harm/Ave
9920	32.18	0	100	H	38.15	7.67	26.98	51.02	83.39	-32.37	Harm/Peak
9920	19	0	100	H	38.15	7.67	26.98	37.84	82.24	-44.40	Harm/Ave
2483.5	28.29	0	100	V	29.12	3.04	0	60.45	74	-13.55	Spur/Peak
2483.5	27.99	0	100	H	29.12	3.04	0	60.15	74	-13.85	Spur/Peak
2483.5	15.96	0	100	V	29.12	3.04	0	48.12	54	-5.88	Spur/Ave
2483.5	15.88	0	100	H	29.12	3.04	0	48.04	54	-5.96	Spur/Ave
75.08	11.7	48	118	V	8.7	10.22	25.17	5.45	40	-34.55	Spur/QP
75.08	5.91	127	131	H	8.7	10.22	25.17	-0.34	40	-40.34	Spur/QP
323.76	11.94	73	125	V	14.7	11.79	25.26	13.17	46	-32.83	Spur/QP
323.76	16.14	324	156	H	14.7	11.79	25.26	17.37	46	-28.63	Spur/QP

9 FCC §15.247(a)(2) & IC RSS-210 §A8.1 – Hopping Channel Bandwidth

9.1 Applicable Standard

According to FCC§15.247(a) (l) & RSS-210 §A8.1 (a), the maximum 20 dB bandwidth of the hopping channel shall be presented.

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 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

9.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	48%
ATM Pressure:	102.5kPa

The testing was performed by Wei Sun on 2012-07-10 at RF Site.

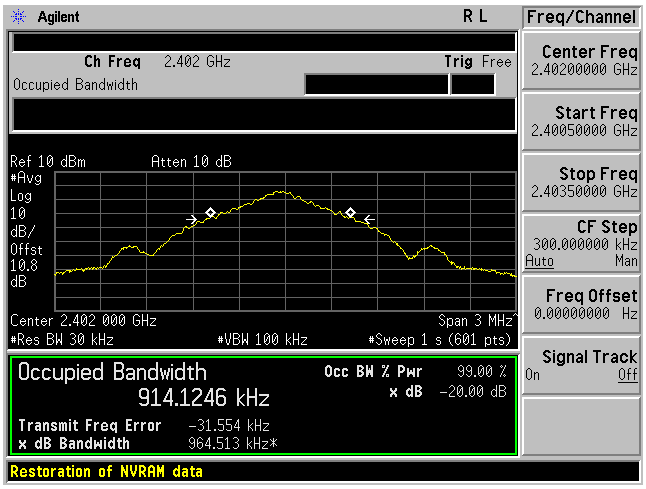
9.5 Test Results

Mode	Channel	Frequency (MHz)	20 dB Channel Bandwidth (kHz)
GFSK	Low	2402	964.513
	Middle	2441	965.187
	High	2480	975.444
QPSK	Low	2402	1361
	Middle	2441	1367
	High	2480	1379
8PSK	Low	2402	1360
	Middle	2441	1365
	High	2480	1371

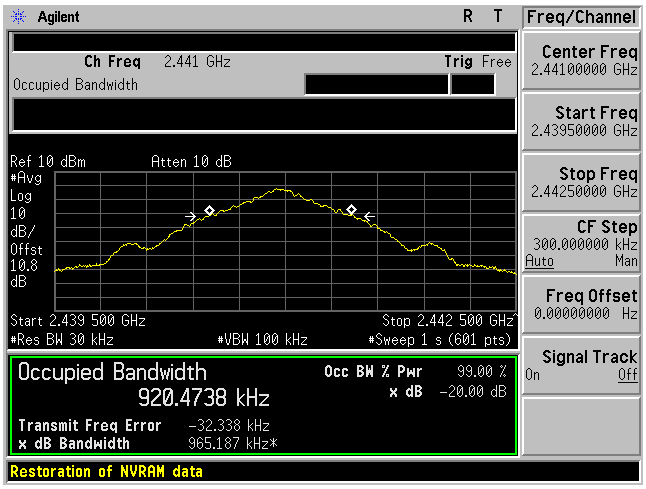
Please refer to the following plots for detailed test results:

GFSK

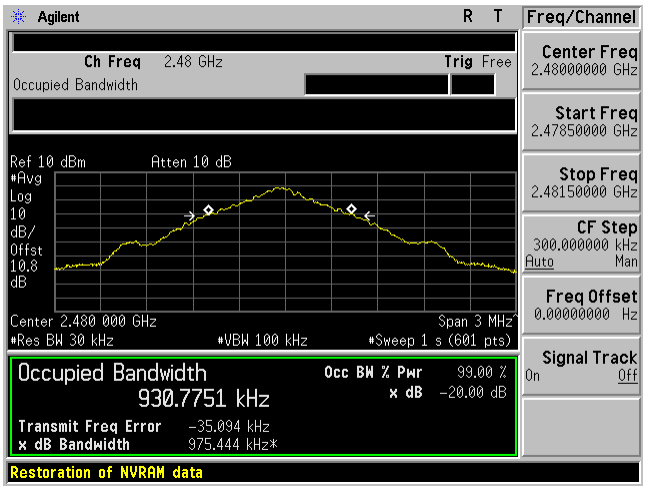
Low Channel 2412 MHz



Middle Channel 2441 MHz

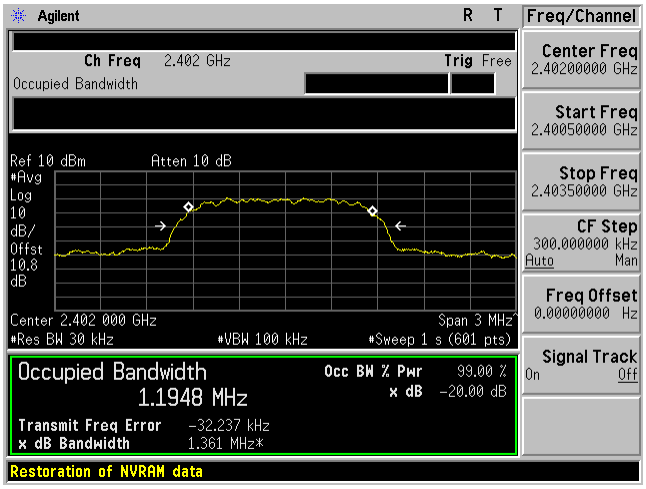


High Channel 2480 MHz

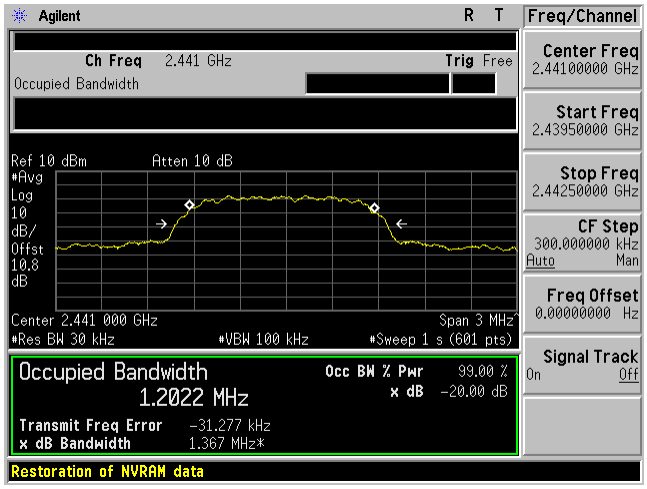


QPSK

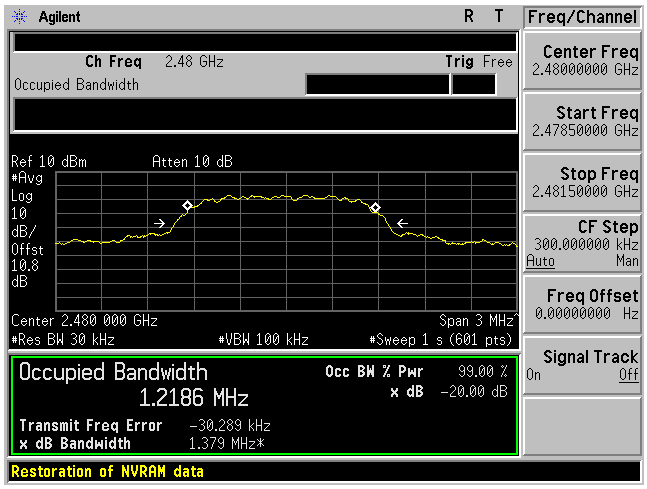
Low Channel 2412 MHz



Middle Channel 2441 MHz

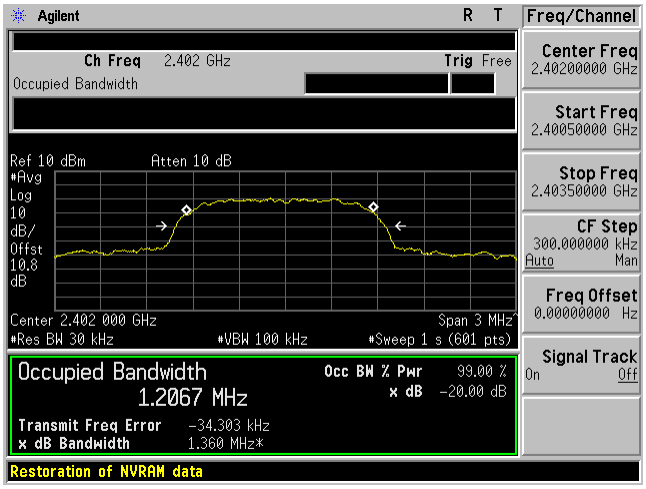


High Channel 2480 MHz

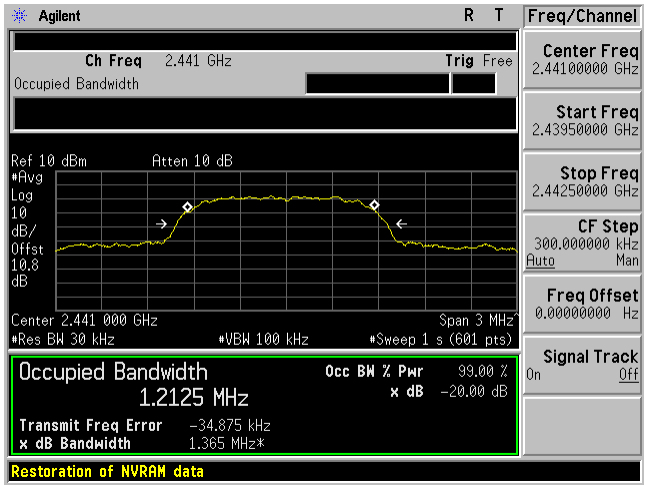


8DPSK

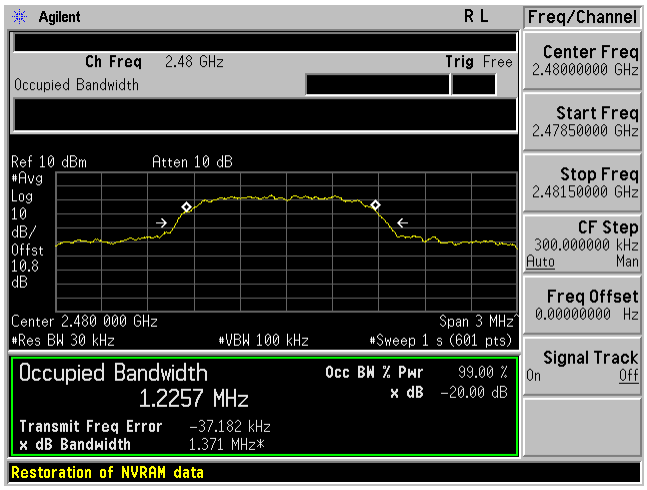
Low Channel 2412 MHz



Middle Channel 2441 MHz



High Channel 2480 MHz



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

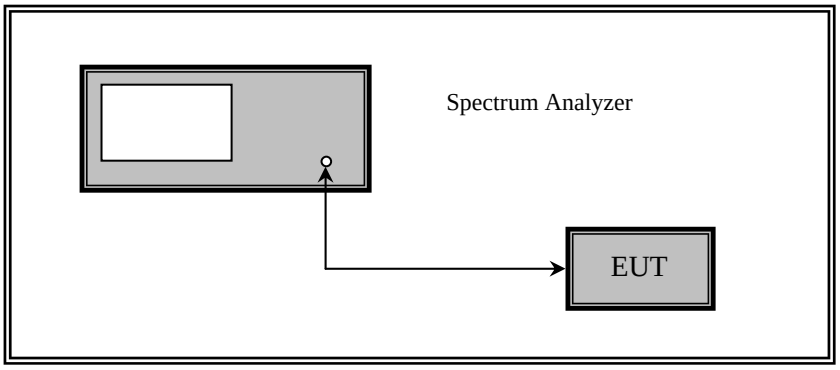
10.1 Applicable Standard

According to FCC §15.247(b) (1), for frequency hopping systems in the 2400-2483.5MHz band employing at least 75 hopping channels, and all direct sequence systems, the maximum peak output power of the transmitter shall not exceed 1 Watt. For all other frequency hopping system in the 2400 – 2483.5 MHz band, the maximum peak output power of the transmitter shall not exceed 0.125 Watt.

According to IC RSS-210 §8.4(2), For frequency hopping systems operating in the band 2400-2483.5 MHz employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W.

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 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

10.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	48%
ATM Pressure:	102.5kPa

The testing was performed by Wei Sun on 2012-07-10 at RF Site.

10.5 Test Results

Modulation GFSK:

Channel	Frequency (MHz)	Max Peak Output Power		Limit (mw)	Result
		(dBm)	(mw)		
Low	2402	4.87	3.07	1000	Pass
Mid	2441	6.47	4.44	1000	Pass
High	2480	7.46	5.57	1000	Pass

Modulation QPSK:

Channel	Frequency (MHz)	Max Peak Output Power		Limit (mw)	Result
		(dBm)	(mw)		
Low	2402	6.50	4.47	1000	Pass
Mid	2441	7.94	6.22	1000	Pass
High	2480	8.78	7.55	1000	Pass

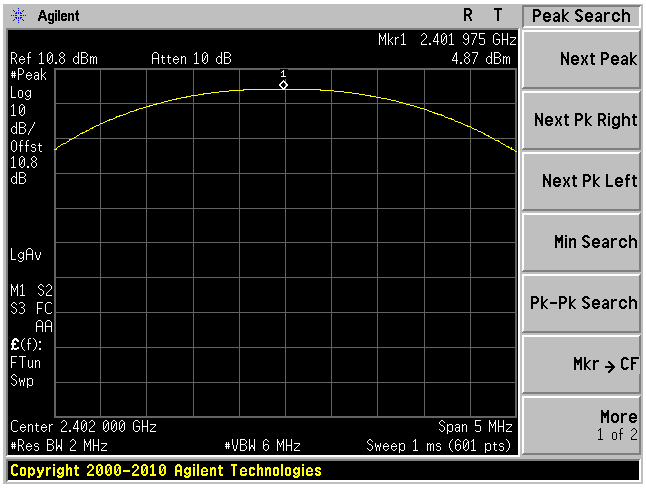
Modulation 8DPSK:

Channel	Frequency (MHz)	Max Peak Output Power		Limit (mw)	Result
		(dBm)	(mw)		
Low	2402	6.87	4.86	1000	Pass
Mid	2441	8.22	6.64	1000	Pass
High	2480	9.03	8.00	1000	Pass

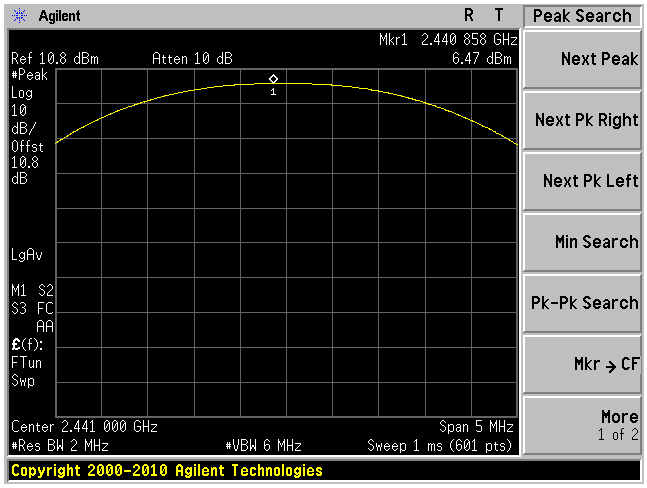
Please refer to the following plots for detailed test results:

GFSK

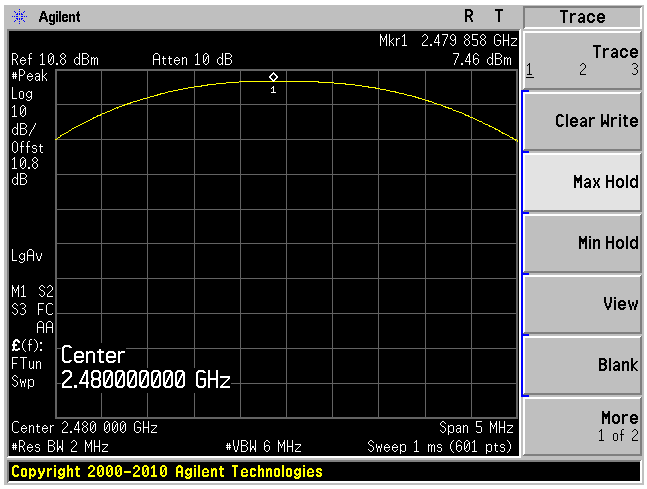
Low Channel 2412 MHz



Middle Channel 2441 MHz

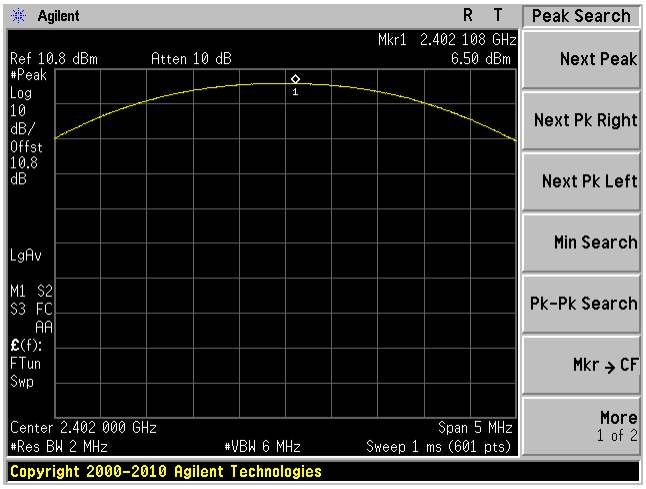


High Channel 2480 MHz

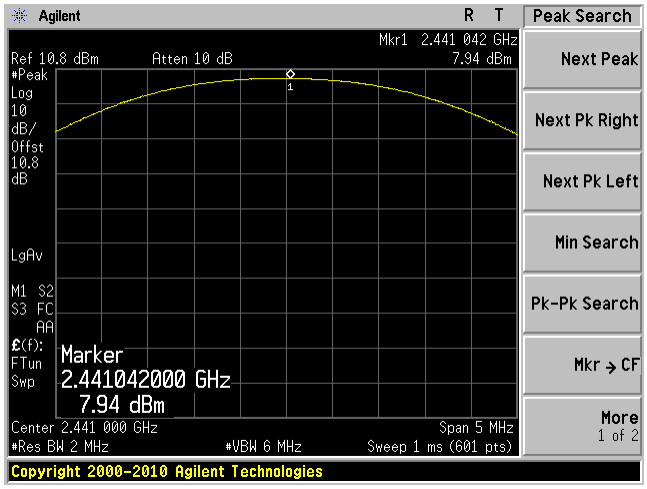


QPSK

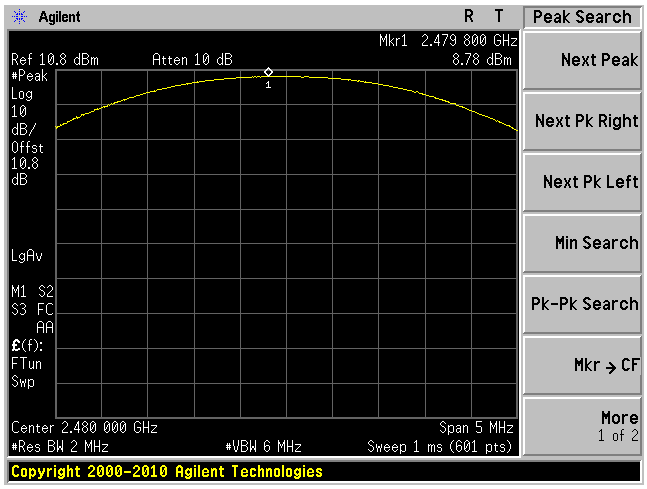
Low Channel 2412 MHz



Middle Channel 2441 MHz

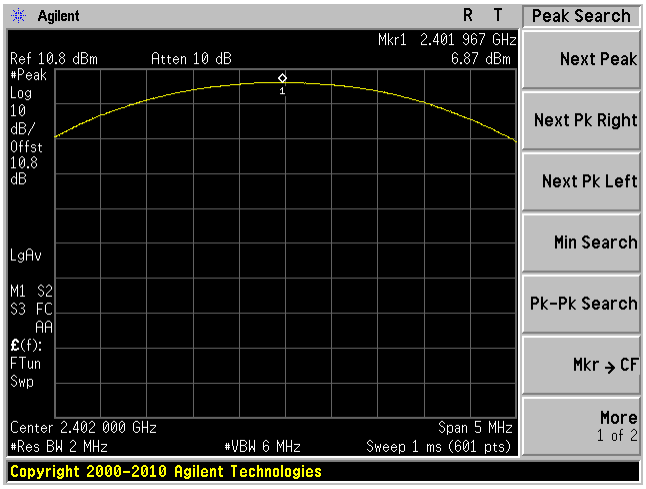


High Channel 2480 MHz

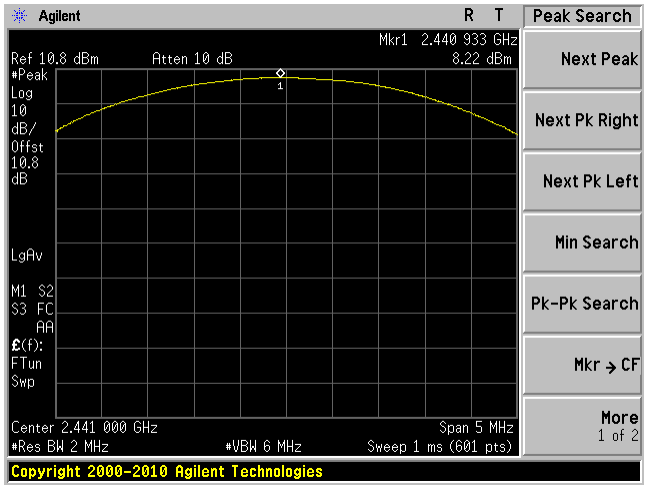


8DPSK

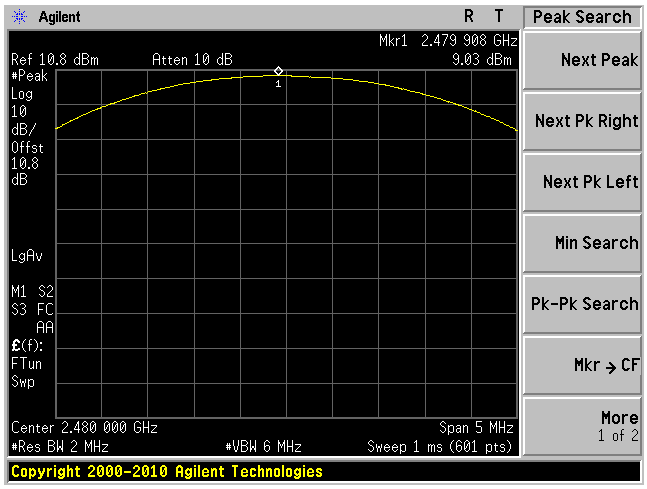
Low Channel 2412 MHz



Middle Channel 2441 MHz



High Channel 2480 MHz



11 FCC §15.247(d) & IC RSS-210 §A 8.5 – 100 kHz Bandwidth of Band Edges

11.1 Applicable Standard

According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency band 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. Attenuation below the general limits specified in §15.209(a) is not required.

According to IC RSS-210 §A 8.5.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 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

11.4 Test Environmental Conditions

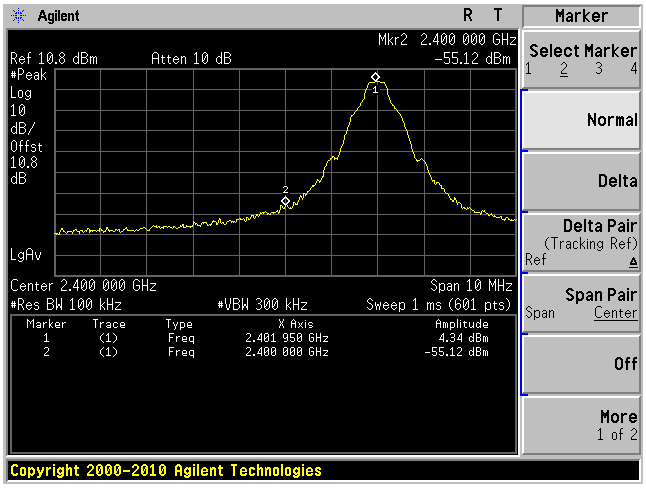
Temperature:	23 °C
Relative Humidity:	48%
ATM Pressure:	102.5kPa

The testing was performed by Wei Sun on 2012-07-10 at RF Site.

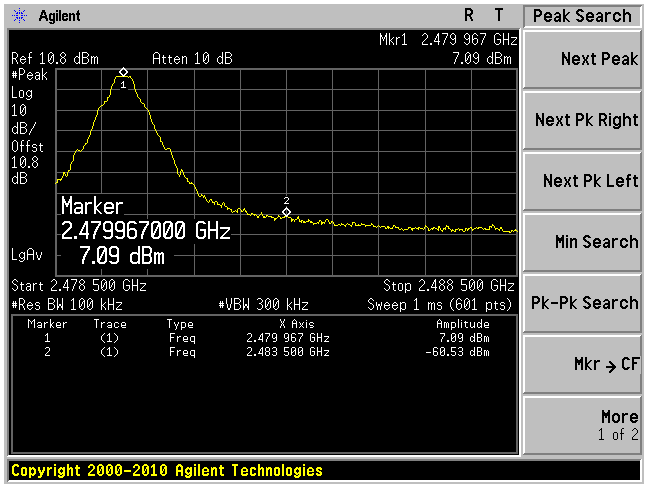
11.5 Test Results

GFSK:

Low Band Edge

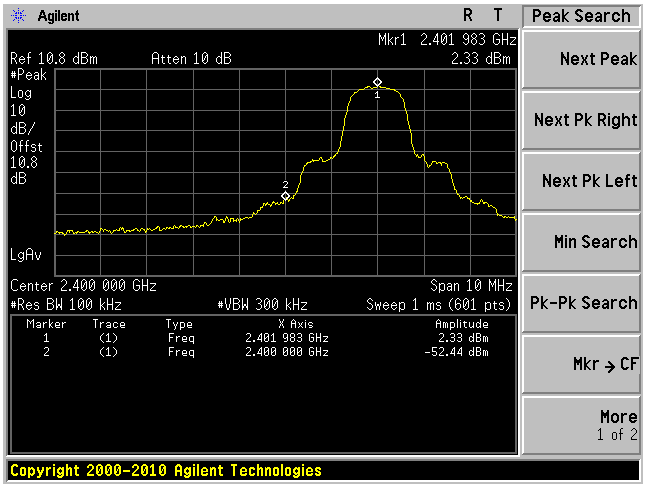


High Band Edge

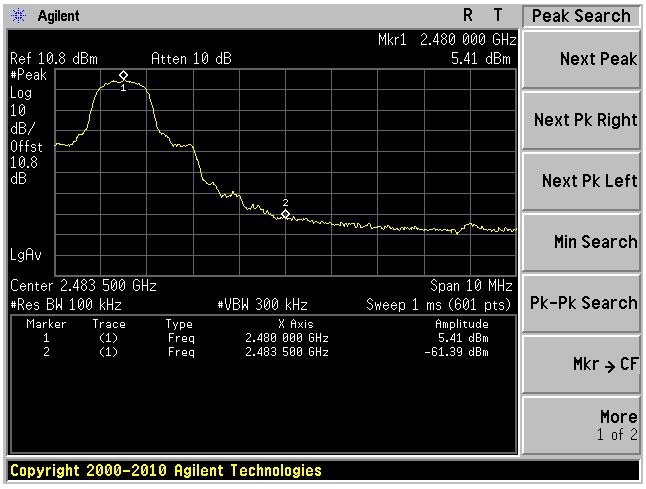


QPSK:

Low Band Edge

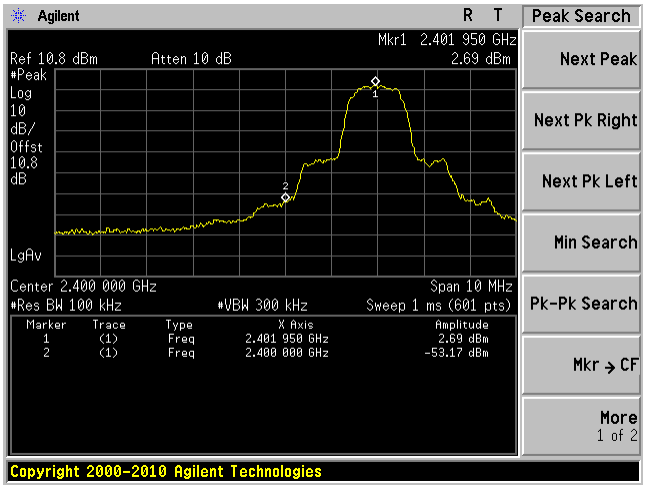


High Band Edge

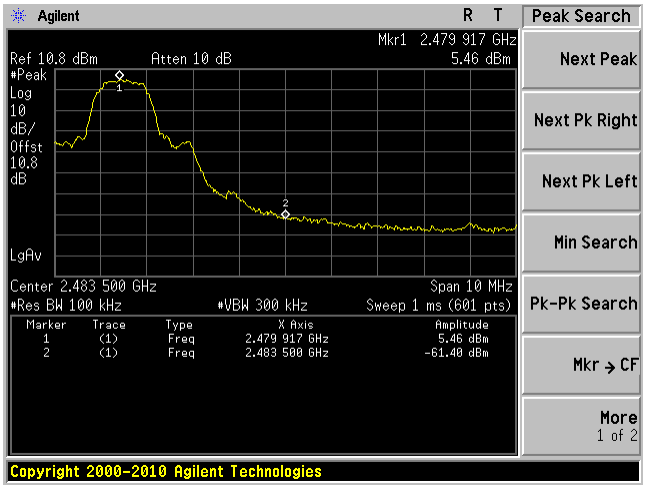


8DPSK:

Low Band Edge



High Band Edge



12 FCC §15.247(a) (1) & IC RSS-210 §A8.1 – Hopping Channel Separation

12.1 Applicable Standard

According to FCC §15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

According to IC RSS-210 §A8.1(b)(1)Frequency hopping systems shall have hoping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 125 mW. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

12.2 Measurement Procedure

1) Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2) Position the EUT on a bench without connection to measurement instrument Turn on the EUT and set it to any one convenient frequency within its operating range.
3) By using the Max-Hold function record the separation of two adjacent channels.
4) Measure the frequency difference of these two adjacent channels by SA MARK function, and then plot the result on SA screen.
5) Repeat above procedures until all frequencies measured were complete.

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

12.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	48%
ATM Pressure:	102.5kPa

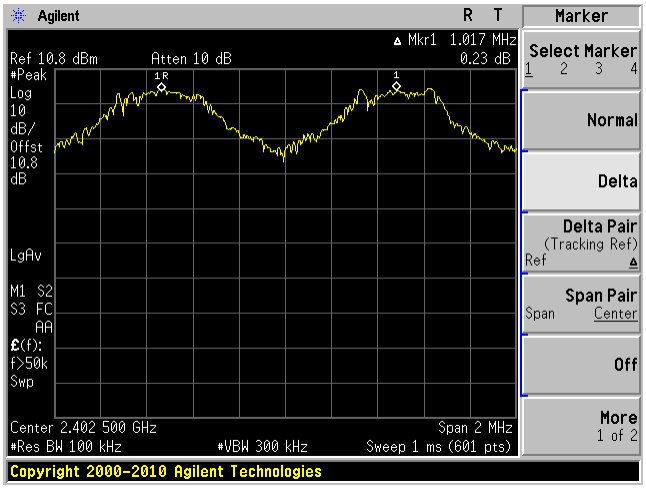
The testing was performed by Wei Sun on 2012-07-10 at RF Site.

12.5 Test Results

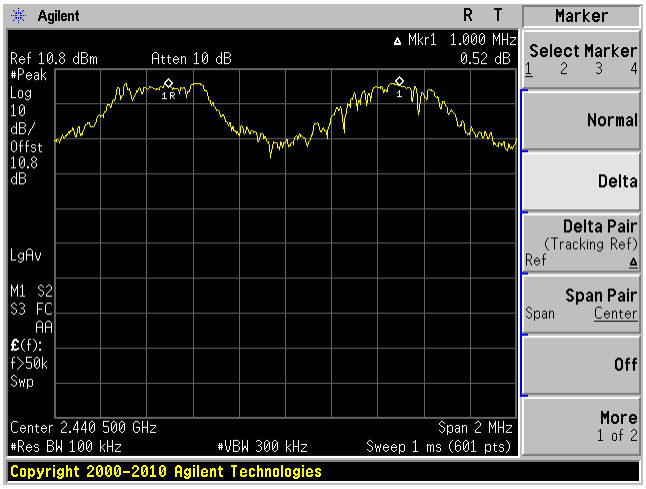
Channel	Frequency (MHz)	Channel Separation (kHz)	GFSK Limit > 2/3 20 dB BW >(kHz)	QPSK Limit > 2/3 20 dB BW >(kHz)	8PSK Limit > 2/3 20 dB BW >(kHz)
Low	2402	1017.00	643.01	907.33	906.67
Mid	2441	1000.00	643.46	911.33	910.00
High	2480	1003.00	650.30	919.33	914.00

Please refer to the following plots.

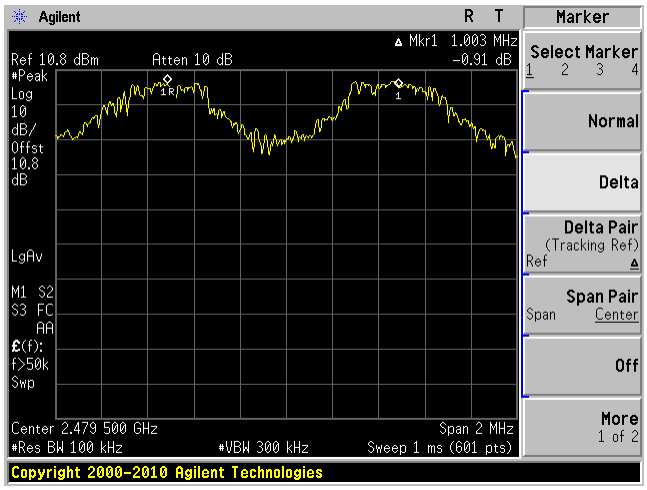
Low Channel



Middle Channel



High Channel



13 FCC §15.247(a)(1)(iii) & IC RSS-210 §A8.1 – Number of Hopping Channels

13.1 Applicable Standard

According to FCC §15.247(a)(1)(iii), frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

According to IC RSS-210 §A8.1 (d), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

13.2 Measurement Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the bench without connection to measurement instrument. Turn on the EUT and set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the SA on Max-Hold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

13.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

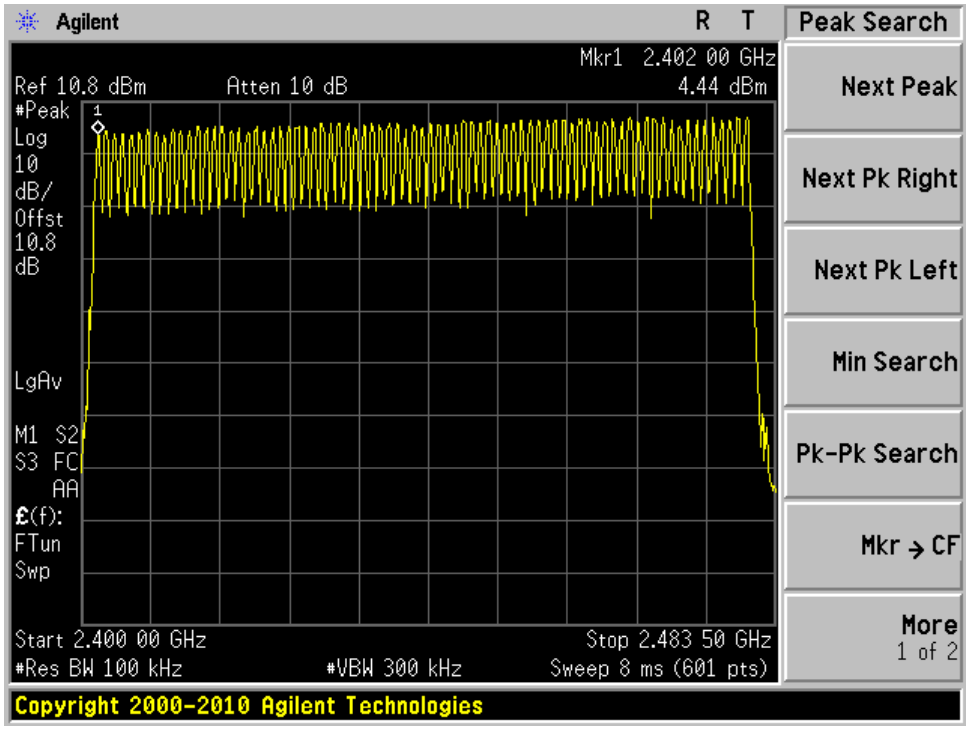
13.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	48%
ATM Pressure:	102.5kPa

The testing was performed by Wei Sun on 2012-07-10 at RF Site.

13.5 Test Results

Hopping Channel Number: Total 79 Channels



14 FCC §15.247(a)(1)(iii) & IC RSS-210 §A8.1 – Dwell Time

14.1 Applicable Standard

According to FCC §15.247 (a)(1)(iii), the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

According to IC RSS-210 §A8.1 (d) ,Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

14.2 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 zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all frequencies measured were complete.

14.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

14.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	48%
ATM Pressure:	102.5kPa

The testing was performed by Wei Sun on 2012-07-10 at RF Site.

14.5 Test Results

GFSK

DH1: Packet Size = 27 byte

Channel	Pulse Width (ms)	Dwell time (sec)	Limit (sec)	Results
Low	0.410	0.13	0.4	Pass
Mid	0.410	0.13	0.4	Pass
High	0.410	0.13	0.4	Pass

Note: Dwell time = Pulse time*(1600/2/79)*31.6S

DH3: Packet Size = 183 bytes

Channel	Pulse Width (ms)	Dwell time (sec)	Limit (sec)	Results
Low	1.665	0.27	0.4	Pass
Mid	1.665	0.27	0.4	Pass
High	1.665	0.27	0.4	Pass

Note: Dwell time = Pulse time*(1600/4/79)*31.6S

DH5: Packet Size = 339 bytes

Channel	Pulse Width (ms)	Dwell time (sec)	Limit (sec)	Results
Low	2.908	0.31	0.4	Pass
Mid	2.908	0.31	0.4	Pass
High	2.917	0.31	0.4	Pass

Note: Dwell time = Pulse time*(1600/6/79)*31.6S

QPSK

DH1: Packet Size = 27 byte

Channel	Pulse Width (ms)	Dwell time (sec)	Limit (sec)	Results
Low	0.410	0.13	0.4	Pass
Mid	0.410	0.13	0.4	Pass
High	0.410	0.13	0.4	Pass

Note: Dwell time = Pulse time*(1600/2/79)*31.6S

DH3: Packet Size = 183 bytes

Channel	Pulse Width (ms)	Dwell time (sec)	Limit (sec)	Results
Low	1.66	0.27	0.4	Pass
Mid	1.66	0.27	0.4	Pass
High	1.66	0.27	0.4	Pass

Note: Dwell time = Pulse time*(1600/4/79)*31.6S

DH5: Packet Size = 339 bytes

Channel	Pulse Width (ms)	Dwell time (sec)	Limit (sec)	Results
Low	2.917	0.31	0.4	Pass
Mid	2.917	0.31	0.4	Pass
High	2.917	0.31	0.4	Pass

Note: Dwell time = Pulse time*(1600/6/79)*31.6S

8DPSK

DH1: Packet Size = 27 byte

Channel	Pulse Width (ms)	Dwell time (sec)	Limit (sec)	Results
Low	0.4133	0.13	0.4	Pass
Mid	0.4133	0.13	0.4	Pass
High	0.4133	0.13	0.4	Pass

Note: Dwell time = Pulse time*(1600/2/79)*31.6S

DH3: Packet Size = 183 bytes

Channel	Pulse Width (ms)	Dwell time (sec)	Limit (sec)	Results
Low	1.66	0.27	0.4	Pass
Mid	1.66	0.27	0.4	Pass
High	1.66	0.27	0.4	Pass

Note: Dwell time = Pulse time*(1600/4/79)*31.6S

DH5: Packet Size = 339 bytes

Channel	Pulse Width (ms)	Dwell time (sec)	Limit (sec)	Results
Low	2.917	0.31	0.4	Pass
Mid	2.917	0.31	0.4	Pass
High	2.917	0.31	0.4	Pass

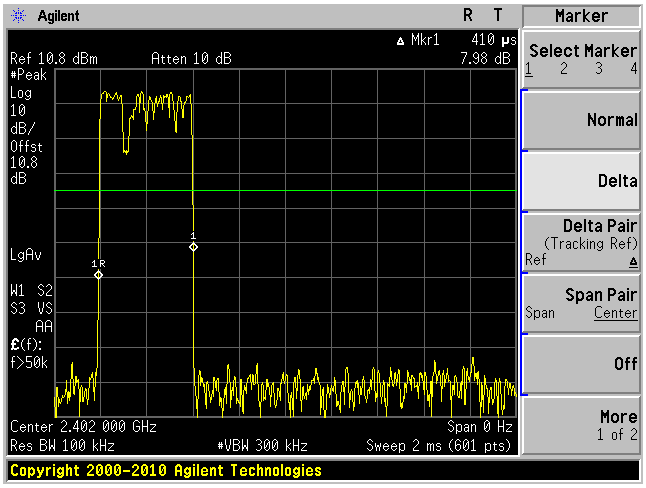
Note: Dwell time = Pulse time*(1600/6/79)*31.6S

Please refer the following plots.

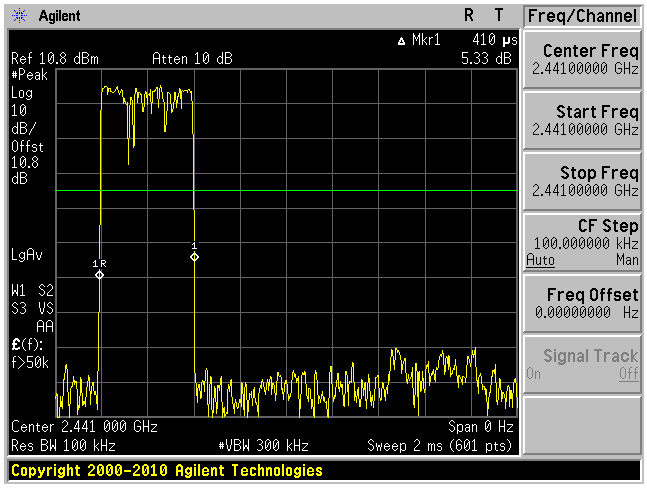
GFSK

DH1

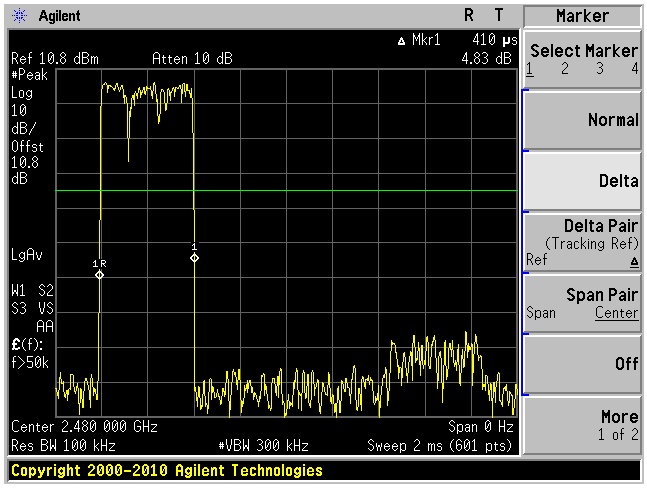
Low Channel



Middle Channel

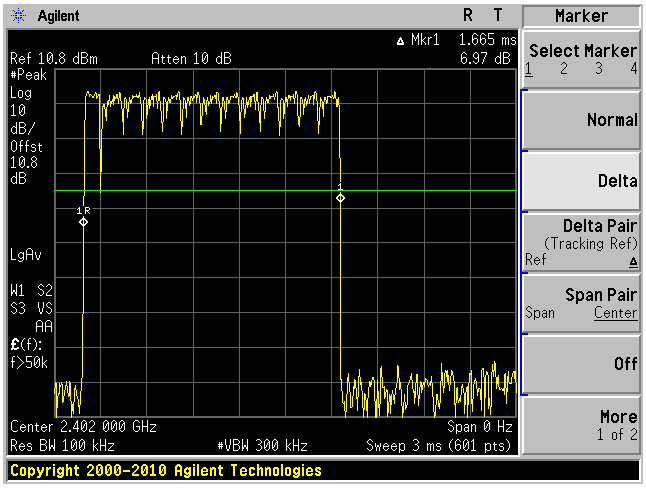


High Channel

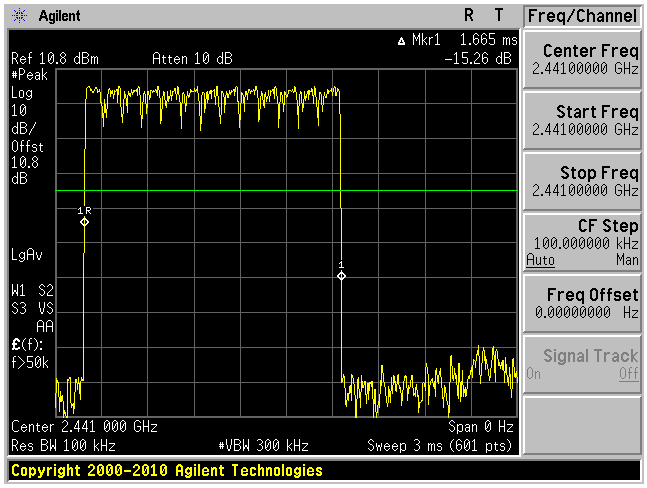


DH3

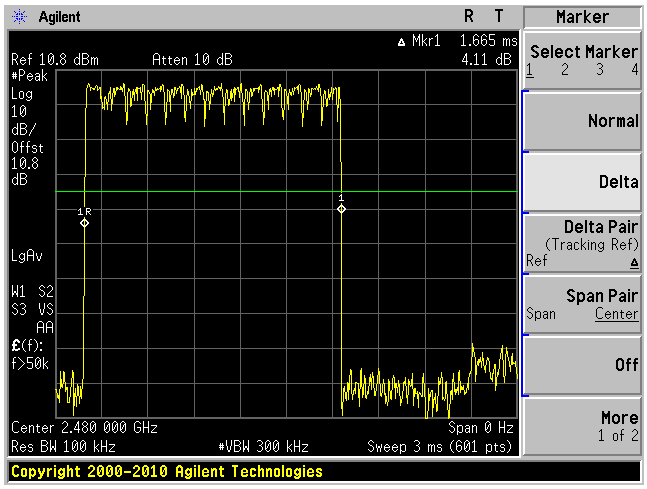
Low Channel



Middle Channel

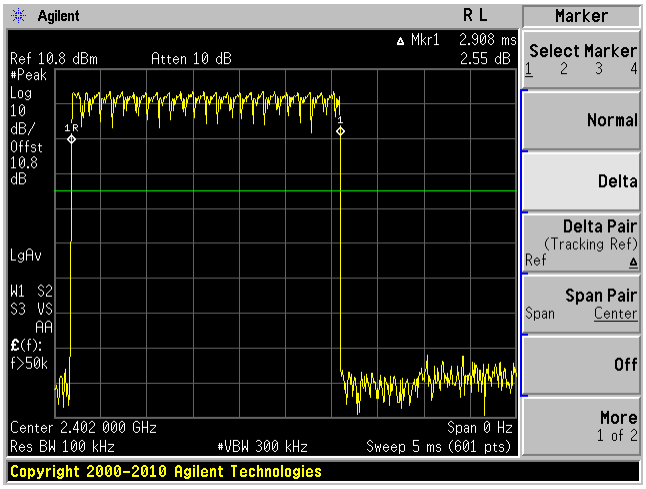


High Channel

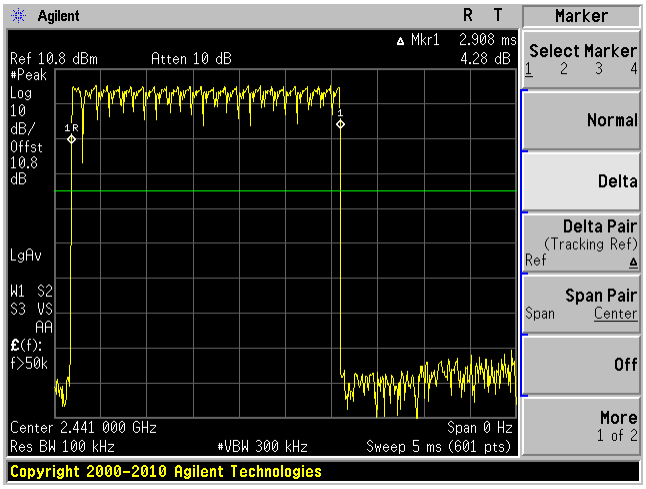


DH5

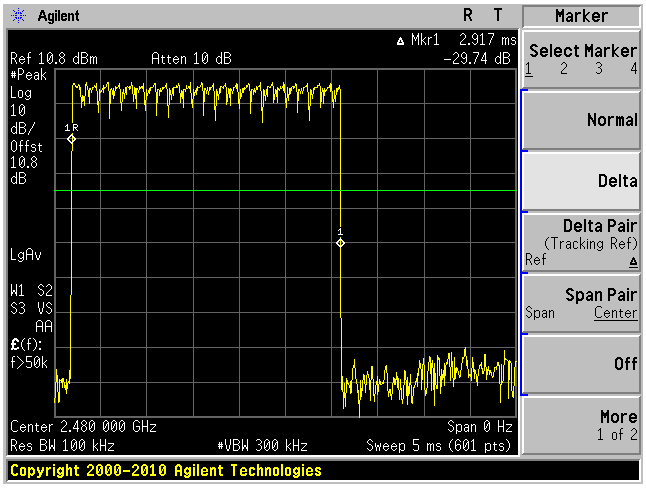
Low Channel



Middle Channel



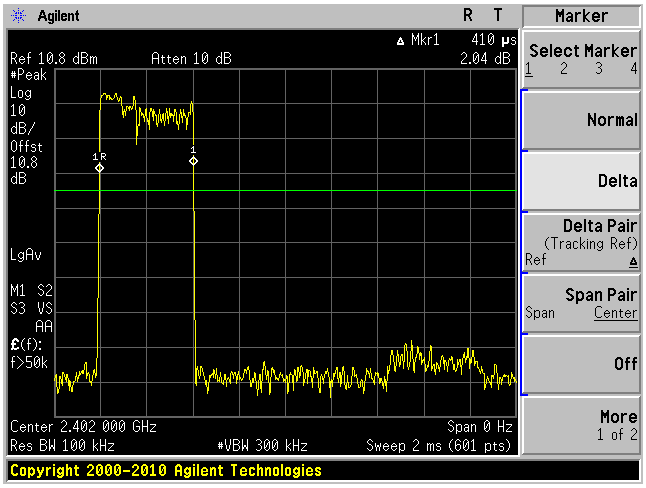
High Channel



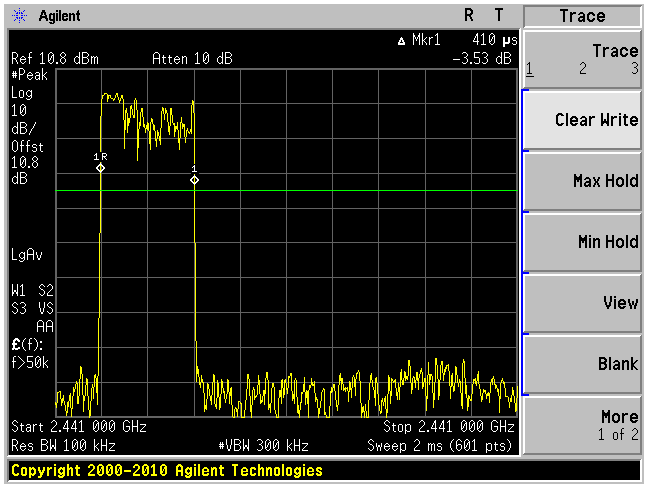
QPSK

DH1

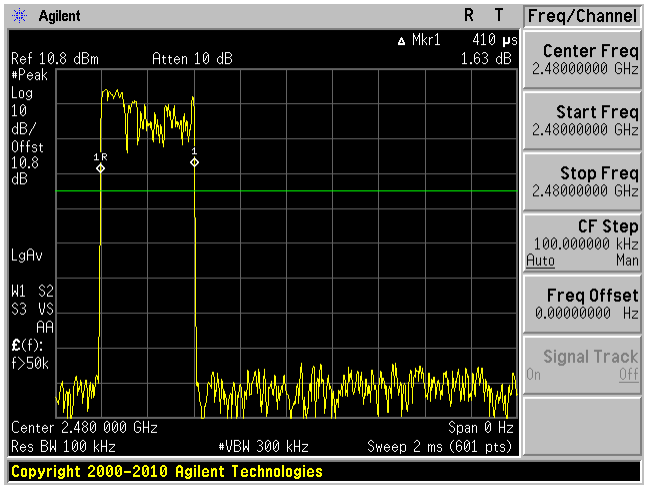
Low Channel



Middle Channel

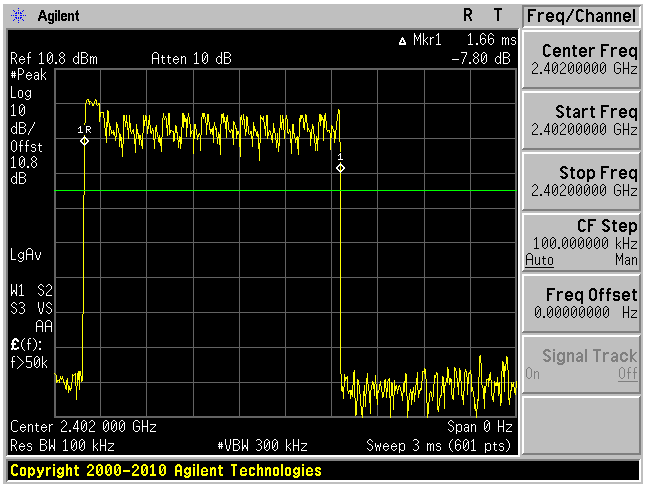


High Channel

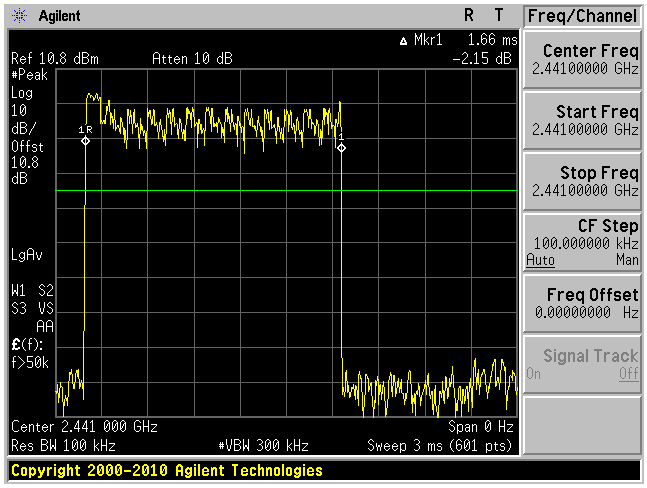


DH3

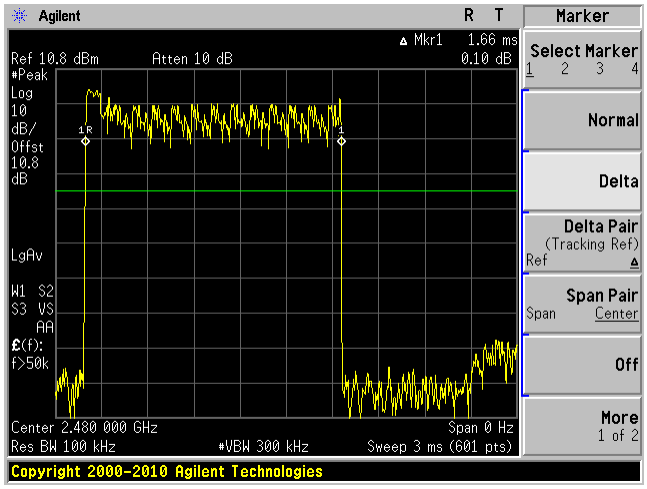
Low Channel



Middle Channel

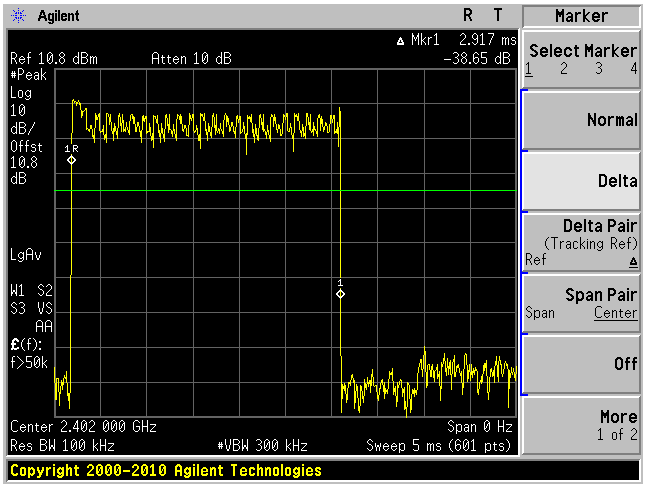


High Channel

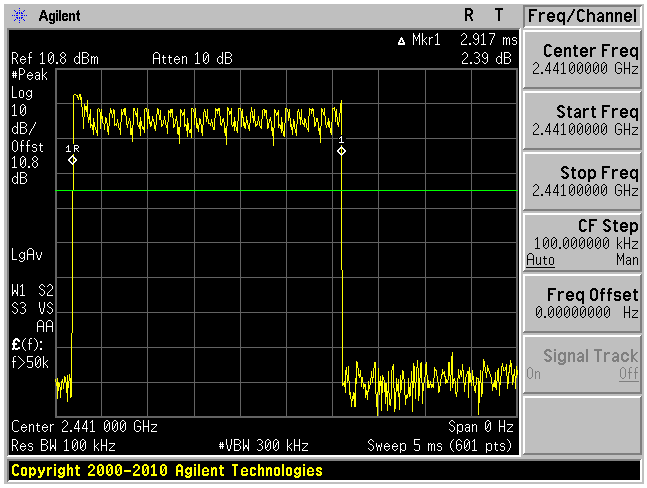


DH5

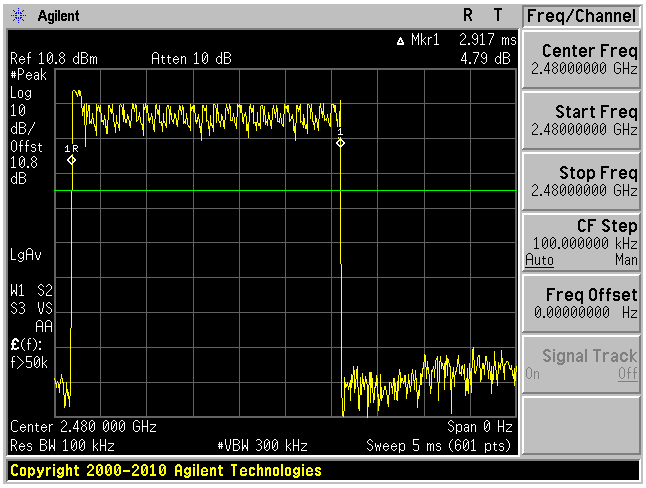
Low Channel



Middle Channel



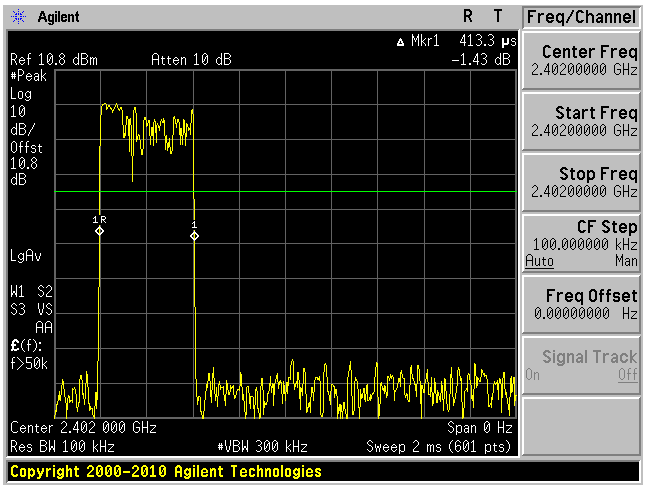
High Channel



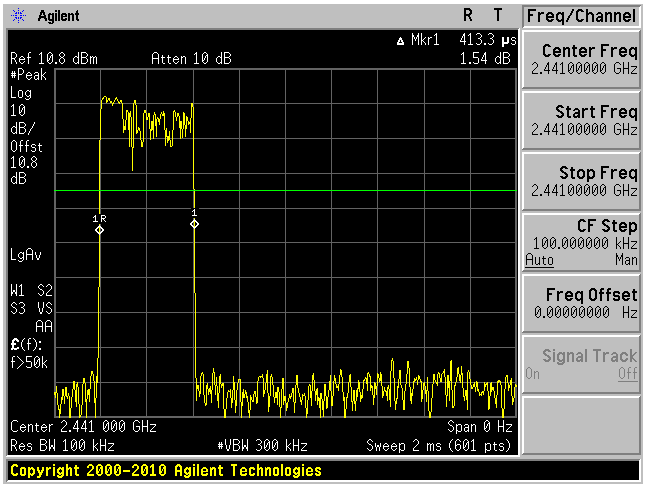
8DPSK

DH1

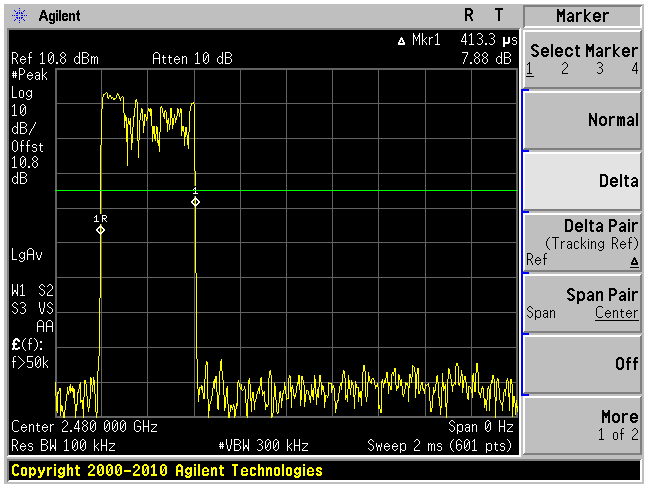
Low Channel



Middle Channel

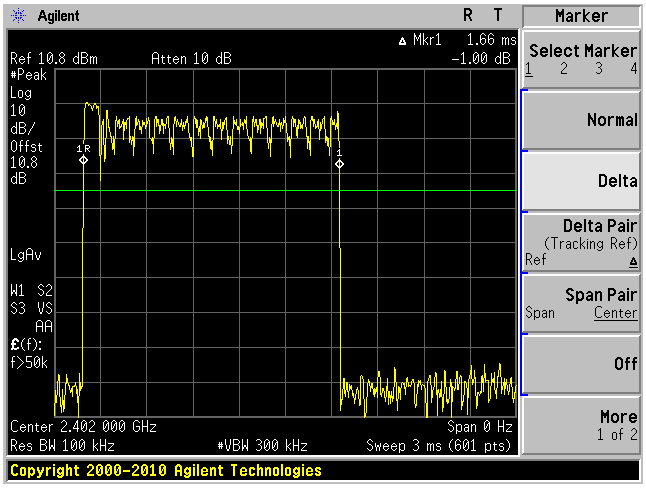


High Channel

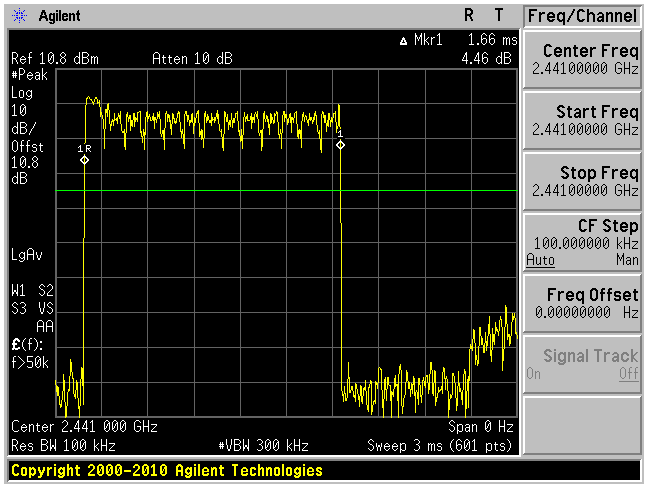


DH3

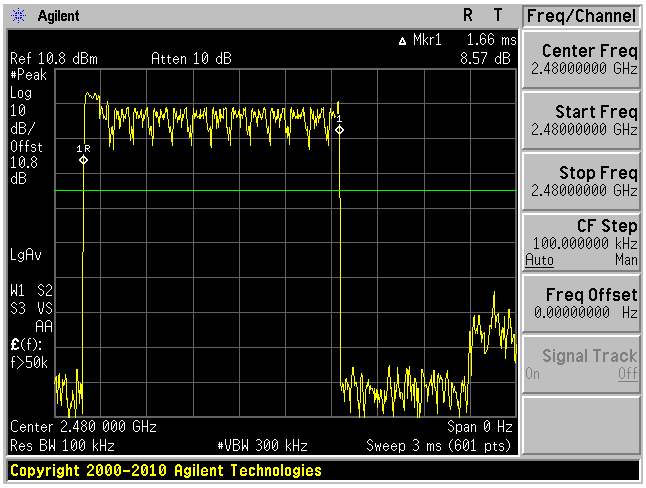
Low Channel



Middle Channel

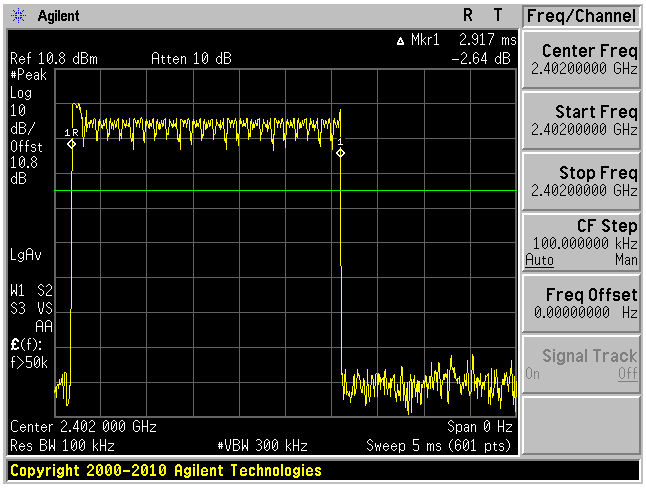


High Channel

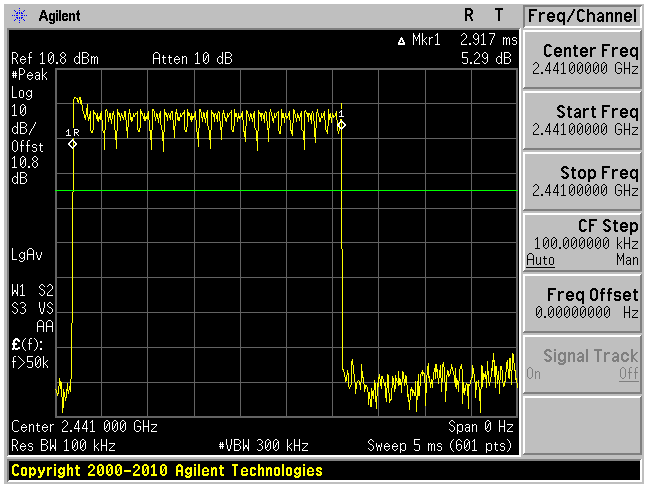


DH5

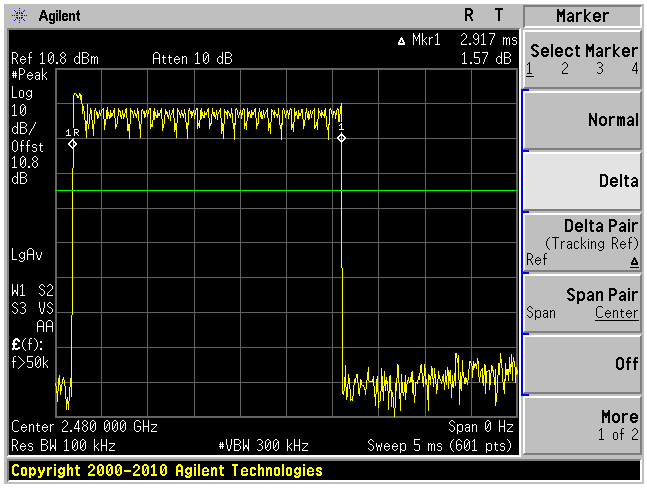
Low Channel



Middle Channel



High Channel



15 FCC §15.109 & IC RSS-Gen §4.10, §6 – Receiver Radiated Spurious Emissions

15.1 Applicable Standards

FCC §15.109 and IC RSS-Gen §4.10, §6

15.2 EUT Setup

The radiated emissions tests were performed in the 3 meter chamber, using the setup in accordance with ANSI C63.4-2009.

15.3 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.

15.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

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

Margin = Corrected Amplitude - Limit

15.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	-
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2011-08-10	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A10187	2012-03-08	1 year
A.H. Systems	Horn antenna	SAS-200/571	261	2012-01-18	1 year
Mini-Circuits	Pre-amplifier	ZVA-183-S	667400960	2012-05-08	1 year
HP	Signal Generator	8648C	3426A00417	2011-08-18	1 year
Wisewave	Horn antenna	ARH-4223-02	10555-02	2010-06-14 [1]	3 years

Statement of Traceability: BACL attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

15.6 Test Environmental Conditions

Temperature:	24 °C
Relative Humidity:	49%
ATM Pressure:	101.9kPa

The testing was performed by Wei Sun on 2012-07-23 at 5 meter chamber #2.

15.7 Summary of Test Results

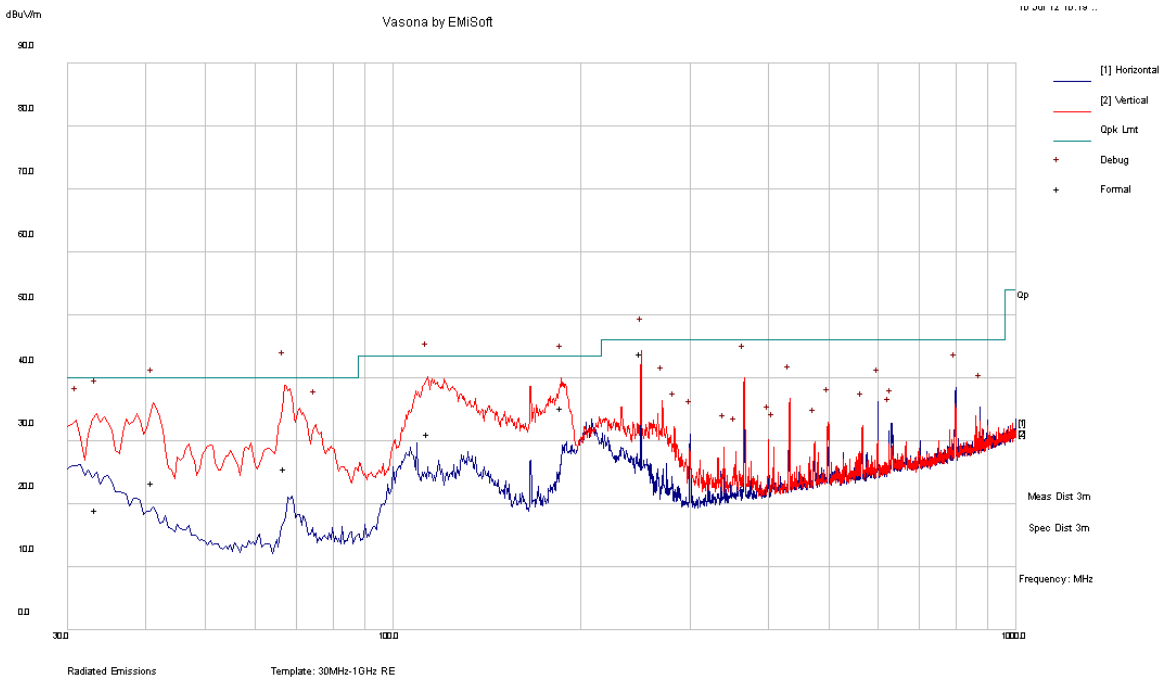
According to the test data,, the EUT complied with the FCC Part 15.109 and IC RSS-Gen, with the closest margins from the limit listed below:

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-2.10	249.9968	Vertical	30-12750

Please refer to the following table and plots for specific test result details

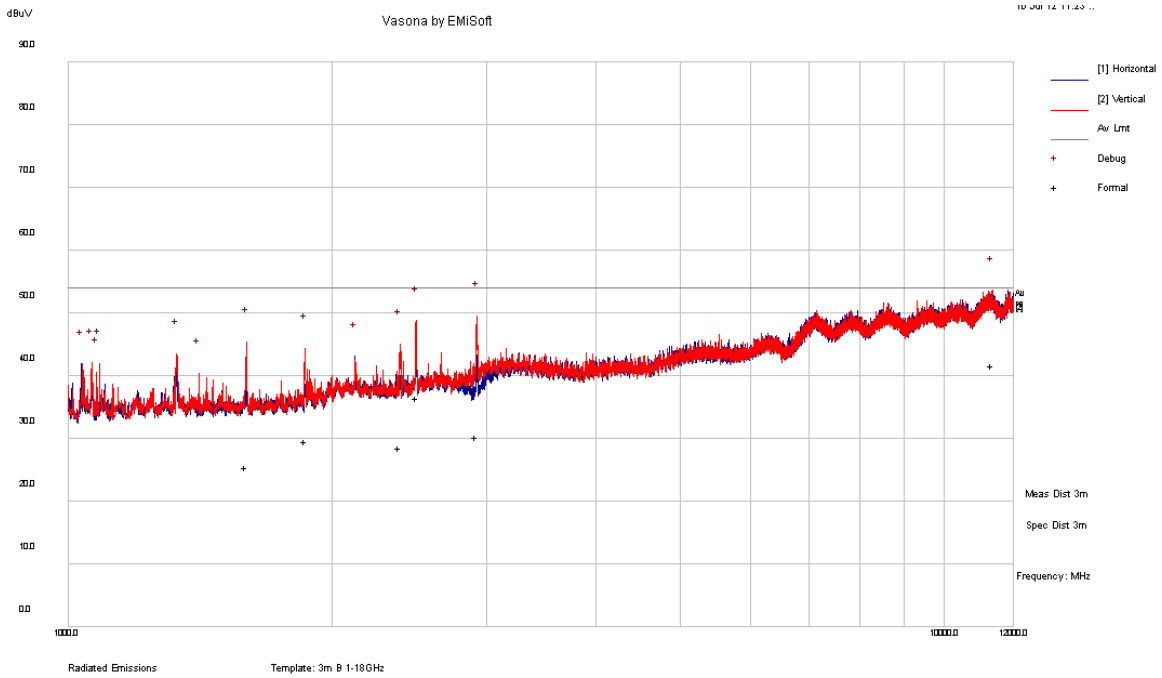
15.8 Test Results

1) 30 MHz -1 GHz, measured at 3 meters



Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector
249.9968	43.9	100	V	172	46	-2.10	QP
186.285	35.31	110	V	119	43.5	-8.19	QP
113.5448	31.08	105	V	93	43.5	-12.42	QP
66.94875	25.54	195	V	90	40	-14.46	QP
41.00825	23.43	170	V	88	40	-16.57	QP
33.3615	19.05	135	V	194	40	-20.95	QP

2) 1 – 12.75 GHz, measured at 3 meters



Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector
11350.92	41.59	155	V	33	54	-12.41	Ave.
2497.446	36.56	100	V	352	54	-17.44	Ave.
2926.212	30.23	100	V	52	54	-23.77	Ave.
1865.138	29.58	119	V	360	54	-24.42	Ave.
2389.46	28.58	108	V	360	54	-25.42	Ave.
1597.073	25.5	142	V	304	54	-28.50	Ave.