



FCC PART 15 SUBPART C
IC RSS-210, ISSUE 8, DEC 2010

TEST AND MEASUREMENT REPORT

For

AnyDATA Corporation

5 Oldfield, Irvine, CA 92618, USA

FCC ID: P4M-ACT10
IC: 4594B-ACT10

Report Type: Original Report	Product Type: Bluetooth OBD Vehicle Device
Prepared By: Chen Ge <i>Chen Ge</i> Test Engineer	
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Reviewed By: Suhaila Khushzad <i>Suhaila K.</i> Engineering Manager	
Bay Area Compliance Laboratories Corp. 1274 Anvilwood Avenue, Sunnyvale, CA 94089, USA Tel: (408) 732-9162 Fax: (408) 732-9164	

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1409081-247 DSS	Original Report	2014-10-21

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, *model: ACT10; FCC ID: P4M-ACT10, IC: 4594B-ACT10*, or the “EUT” as referred to this report. The EUT is a 2.4GHz Bluetooth and BLE vehicle monitoring and management device.

1.2 Mechanical Description of EUT

The EUT measures approximately 45 mm (L) x 30 mm (W) x 24 mm (H) and weighs approximately 32 g.

The data gathered are from a typical production sample provided by the manufacturer with serial number: I94TI8.

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.

1.4 Related Submittal(s)/Grant(s)

N/A.

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 CISPR16-4-2:2011, The Treatment of Uncertainty in EMC Measurements, the values ranging from ± 2.0 dB 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 Corp.

1.7 Test Facility

Bay Area Compliance Laboratories Corp. (BACL) is:

1- An independent Commercial Test Laboratory accredited to ISO 17025: 2005 by A2LA, in the fields of: Electromagnetic Compatibility & Telecommunications covering Emissions, Immunity, Radio, RF Exposure, Safety and Telecom. This includes NEBS (Network Equipment Building System), Wireless RF, Telecommunications Terminal Equipment (TTE); Network Equipment; Information Technology Equipment (ITE); Medical Electrical Equipment; Industrial, Commercial, and Medical Test Equipment; Professional Audio and Video Equipment; Electronic (Digital) Products; Industrial and Scientific Instruments; Cabled Distribution Systems and Energy Efficiency Lighting.

2- An ENERGY STAR Recognized Laboratory, for the LM80 Testing, a wide variety of Luminaires and Computers.

3- A NIST Designated Phase-I and Phase-II CAB including: ACMA (Australian Communication and Media Authority), BSMI (Bureau of Standards, Metrology and Inspection of Taiwan), IDA (Infocomm Development Authority of Singapore), IC (Industry Canada), Korea (Ministry of Communications Radio Research Laboratory), NCC (Formerly DGT; Directorate General of Telecommunication of Chinese Taipei) OFTA (Office of the Telecommunications Authority of Hong Kong), Vietnam, VCCI - Voluntary Control Council for Interference of Japan and a designated EU CAB (Conformity Assessment Body) (Notified Body) for the EMC and R&TTE Directives.

4 - A Product Certification Body accredited to ISO Guide 65: 1996 by A2LA to certify:

1- Unlicensed, Licensed radio frequency devices and Telephone Terminal Equipment for the FCC. Scope A1, A2, A3, A4, B1, B2, B3, B4 & C.

2. Radio Standards Specifications (RSS) in the Category I Equipment Standards List and All Broadcasting Technical Standards (BETS) in Category I Equipment Standards List for Industry Canada.

3. Radio Communication Equipment for Singapore.

4. Radio Equipment Specifications, GMDSS Marine Radio Equipment Specifications, and Fixed Network Equipment Specifications for Hong Kong.

5. Japan MIC Telecommunication Business Law (A1, A2) and Radio Law (B1, B2 and B3).

6. Audio/Video, Battery Charging Systems, Computers, Displays, Enterprise Servers, Imaging Equipment, Set-Top Boxes, Telephony, Televisions, Ceiling Fans, CFLs (including GU24s), Decorative Light Strings, Integral LED Lamps, Luminaires, Residential Ventilating Fans.

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 C63.4-2009, 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.

2.2 EUT Exercise Software

The test utility used was *BTCmd version 1.1* was provided by AnyData Corporation., and was verified *Chen Ge* to comply with the standard requirements being tested against.

2.3 Special Accessories

N/A

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 Power Supply and Line Filters

Manufacturer	Description	Model No.	Serial No.
Hon-Kwang	AC Power Adapter	HK-Q106-A12	-

2.7 Interface Ports and Cabling

Cable Description	Length (m)	From	To
RF Cable	<1	EUT	Spectrum Analyzer

2.8 EUT Internal Configuration Details

Manufacturer	Description	Model	Serial Number
AnyData	Main board	ACT10 v1.0	-

3 Summary of Test Results

FCC & IC Rules	Description of Test	Result (s)
FCC §15.247 (i), §2.1091 IC RSS-102	RF Exposure	Compliant
FCC §15.203 IC RSS-Gen §7.1.2	Antenna Requirements	Compliant
FCC §15.207 (a) IC RSS-Gen §7.2.4	AC Line Conducted Emissions	Compliant
FCC §15.247(d) IC RSS-210 §A8.5	Spurious Emissions at Antenna Port	Compliant
FCC §15.205, §15.209, §15.247(d) IC RSS-210 §2.2, §A8.5	Restricted Bands, Spurious Radiated Emissions	Compliant
FCC §15.247 (a)(1) IC RSS-210 §A8.1	20 dB Channel Bandwidth	Compliant
FCC §15.247(a) IC RSS-210 §A8.4	Maximum Peak Output Power	Compliant
FCC §15.247(d) IC RSS-210 §A8.5	Band Edge	Compliant
FCC §15.247 (a)(1) IC RSS-210 §A8.1(b)	Hopping Channel Separation	Compliant
FCC §15.247 (a)(1) IC RSS-210 §A8.1(d)	Dwell Time	Compliant
FCC §15.247(b)(1) IC RSS-210 §A8.1	Number of Hopping Channels	Compliant

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	* (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

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 4 section 4.2, 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*	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 x 10 ⁻⁴ f ^{0.5}	6.67 x 10 ⁻⁵ f	616000 / f ^{1.2}

Note: f is frequency in MHz

* = 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

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>11.74</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>14.92</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>2440</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>-5</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>0.316</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm²):</u>	<u>0.00093</u>
<u>Power density of prediction frequency at 20.0 cm (W/m²):</u>	<u>0.0093</u>
<u>MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u>	<u>1.0</u>
<u>MPE limit for uncontrolled exposure at prediction frequency (W/m²):</u>	<u>10</u>

The device is compliant with the requirement MPE limit for uncontrolled exposure at 20 cm distance.

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

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 §7.1.2: A transmitter can only be sold or operated with antennas with which it was approved. Transmitter may be approved 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 approval is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type having equal or lesser gain as an antenna that had been successfully tested with the transmitter, will also be considered approved with the transmitter, and may be used and marketed with the transmitter. For Category I transmitters, 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. For transmitters of RF output power of 10 milliwatts or less, only the portion of the antenna gain that is in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power to demonstrate compliance with the radiated power limits specified in the applicable standard. For transmitters of output power greater than 10 milliwatts, the total antenna gain shall be added to the measured RF output power to demonstrate compliance to the specified radiated power limits.

5.2 Antenna List

Manufacturers	Antenna Type/Pattern	Antenna Gain (dBi) @ 2.4 GHz
AnyData	Internal PIFA	-5

The antenna gain is less than 6 dBi; therefore, it complies with the antenna requirement. Please refer to the internal photos.

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

6.1 Applicable Standards

As per FCC §15.207 and 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 μ H/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 in a shielded room. The test setup and measurement procedure was per ANSI C63.4-2009. The specification limits were in accordance with FCC §15.207 and IC RSS-Gen §7.2.4.

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 120 V / 60 Hz AC power.

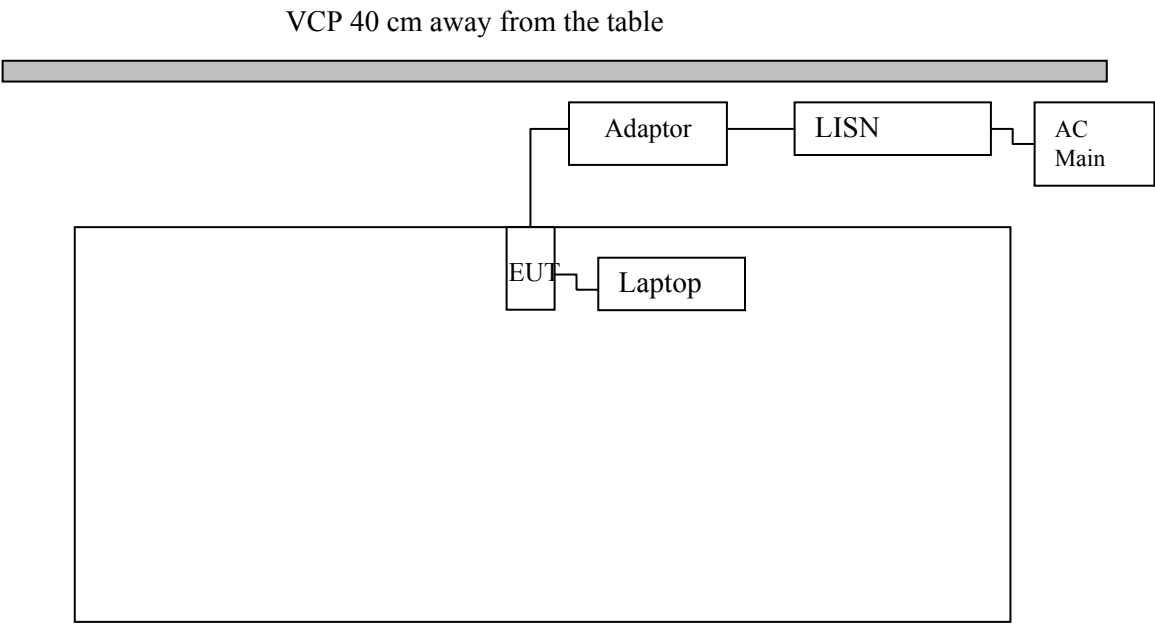
6.3 Test Procedure

During the conducted emissions test, the power cord of the EUT host system was connected to the mains outlet of the LISN-1.

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:

$$\text{Margin (dB)} = \text{Corrected Amplitude (dBuV)} - \text{Limit (dBuV)}$$

6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100338	2014-09-19	1 year
Solar Electronics	LISN	9252-R-24-BNC	511205	2014-06-25	1year

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:	21 °C
Relative Humidity:	45 %
ATM Pressure:	101.6 kPa

The testing was performed by Chen Ge on 2014-09-30 in 5m chamber 3.

6.8 Summary of Test Results

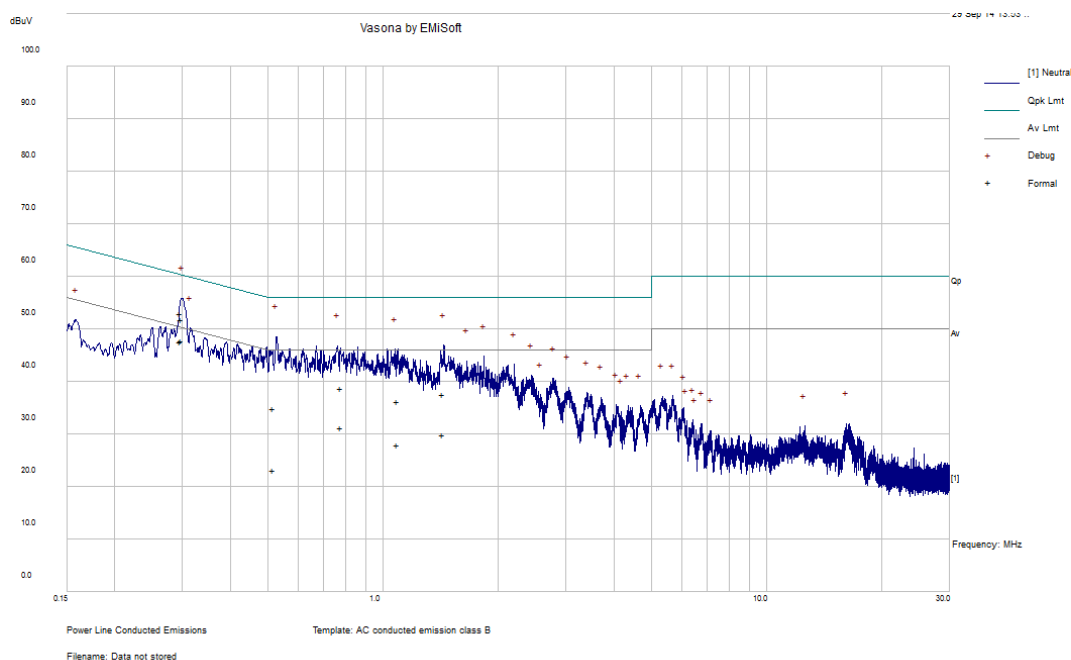
According to the recorded data in following table, the EUT complied with the FCC and IC standard's conducted emissions limits, with a worst case margin of:

Transmitter Mode Worst Case GFSK Middle Channel

Connection: AC/DC adapter of Laptop connected to 120 V/60 Hz, AC			
Margin (dB)	Frequency (MHz)	Conductor (Line/Neutral)	Range (MHz)
-2.47	0.298019	Line	0.15-30

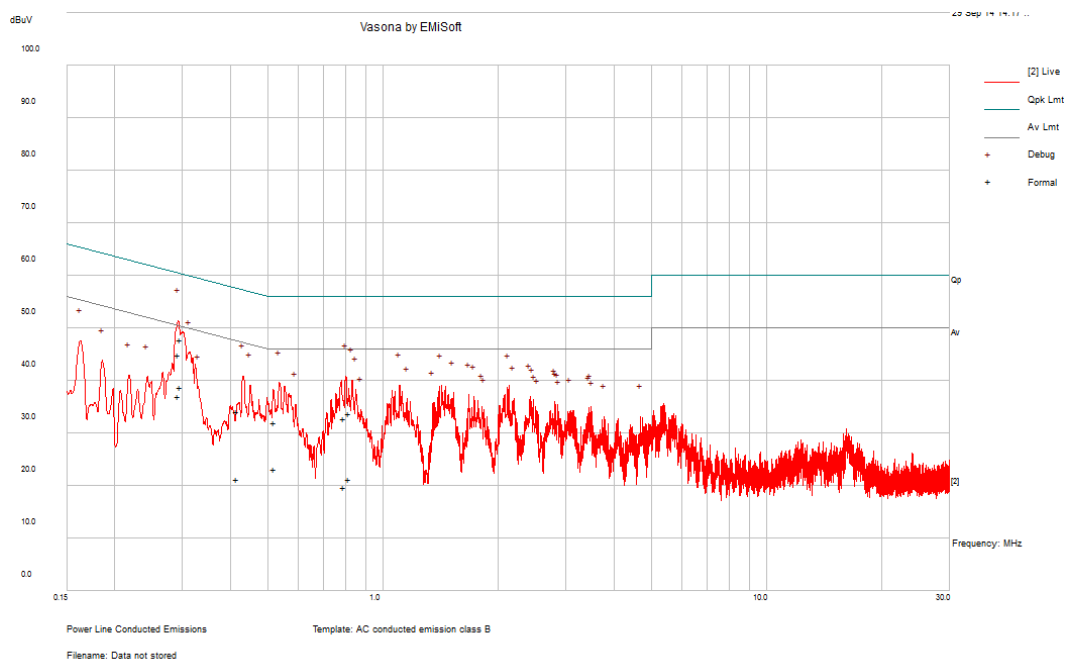
6.9 Conducted Emissions Test Plots and Data

BT: 8PSK, Middle Channel – 120 V, 60 Hz Line



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (L/N)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.298019	51.85	L	60.3	-8.45	QP
0.518813	34.91	L	56	-21.09	QP
1.435637	37.62	L	56	-18.38	QP
0.775479	38.74	L	56	-17.26	QP
0.296675	53	L	60.34	-7.34	QP
1.091534	36.29	L	56	-19.71	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (L/N)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.298019	47.83	L	50.3	-2.47	Ave.
0.518813	23.26	L	46	-22.74	Ave.
1.435637	30.03	L	46	-15.97	Ave.
0.775479	31.33	L	46	-14.67	Ave.
0.296675	47.63	L	50.34	-2.7	Ave.
1.091534	28	L	46	-18	Ave.

BT: 8PSK, Middle Channel – 120 V, 60 Hz Neutral

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (L/N)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.292731	44.99	N	60.45	-15.46	QP
0.295689	47.77	N	60.36	-12.59	QP
0.791589	32.79	N	56	-23.21	QP
0.814046	33.74	N	56	-22.26	QP
0.414917	34.22	N	57.55	-23.33	QP
0.521574	31.99	N	56	-24.01	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (L/N)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.292731	37.09	N	50.45	-13.35	Ave.
0.295689	38.75	N	50.36	-11.61	Ave.
0.791589	19.77	N	46	-26.23	Ave.
0.814046	21.26	N	46	-24.74	Ave.
0.414917	21.38	N	47.55	-26.17	Ave.
0.521574	23.14	N	46	-22.86	Ave.

7 FCC §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 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	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2013-10-16	1 year

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

7.4 Test Environmental Conditions

Temperature:	21° C
Relative Humidity:	45 %
ATM Pressure:	101.6 kPa

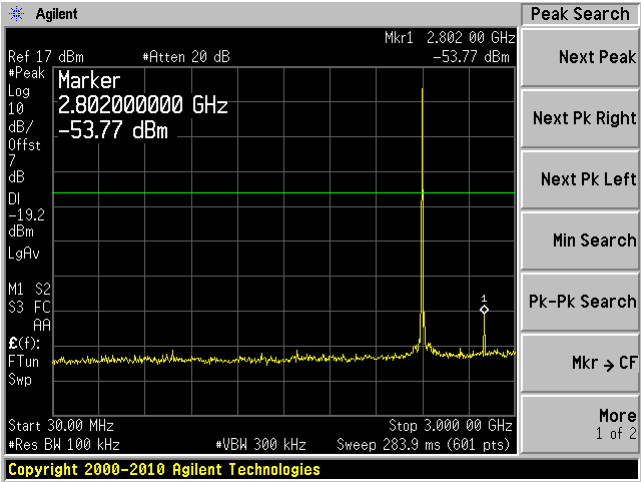
The testing was performed by Chen Ge on 2014-09-24 at RF site.

7.5 Test Results

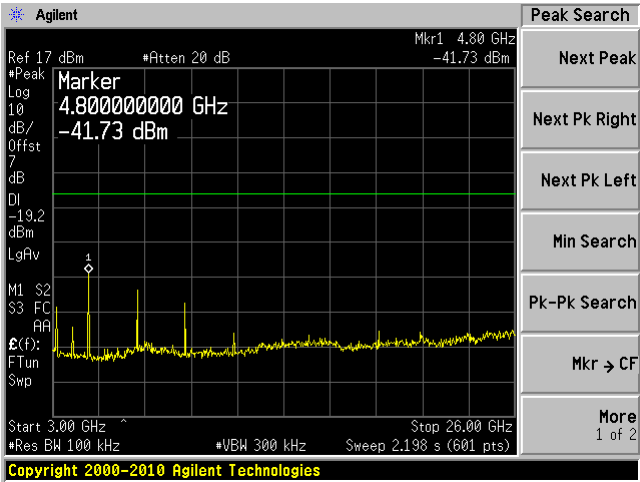
Please refer to following plots.

GFSK, Low Channel 2402 MHz

30 MHz – 3 GHz

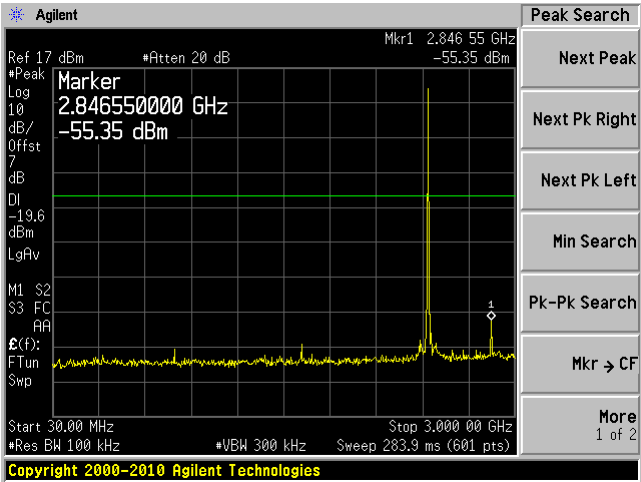


3 GHz – 26 GHz

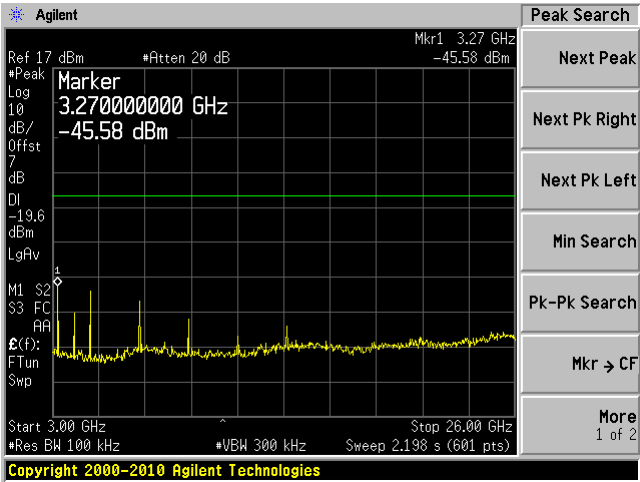


GFSK, Middle Channel 2440 MHz

30 MHz – 3 GHz

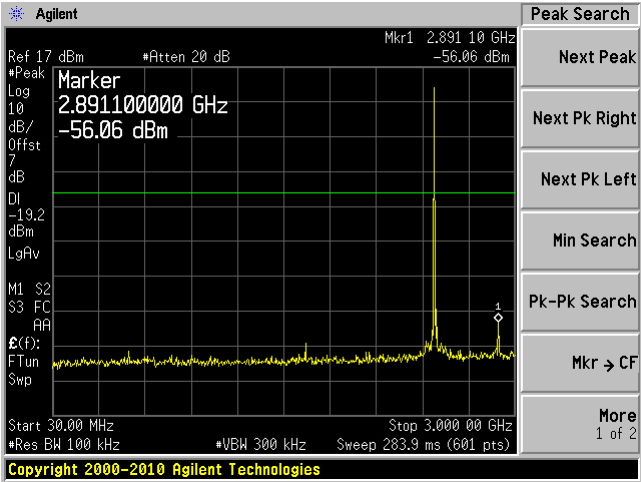


3 GHz – 26 GHz

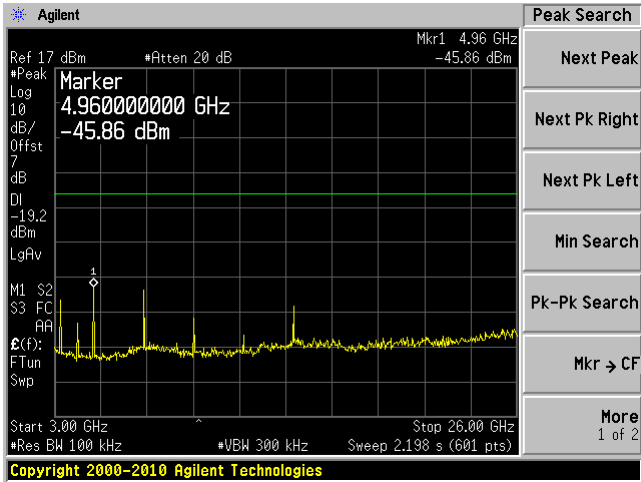


GFSK, High Channel 2480 MHz

30 MHz – 3 GHz

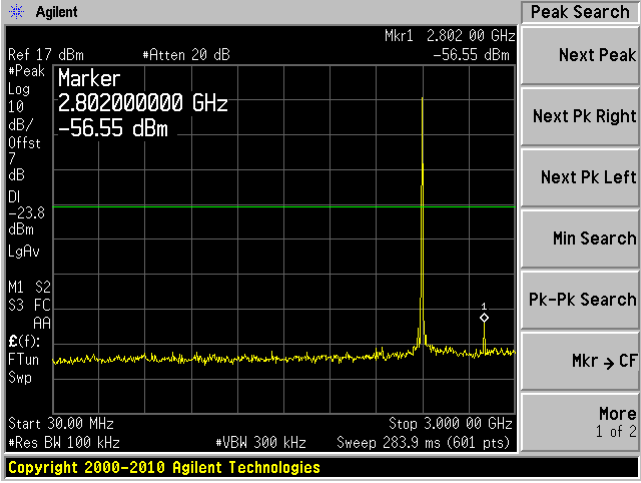


3 GHz – 26 GHz

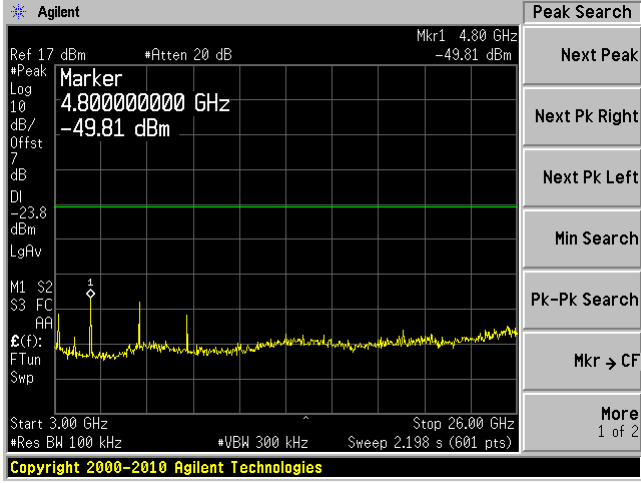


$\pi/4$ -DQPSK, Low Channel 2402 MHz

30 MHz – 3 GHz

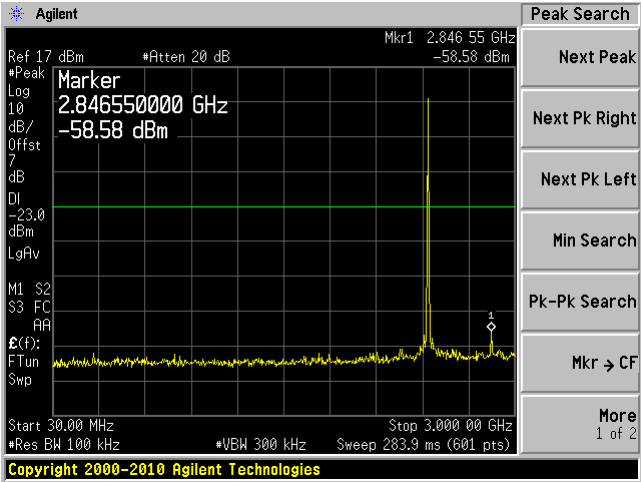


3 GHz – 26 GHz

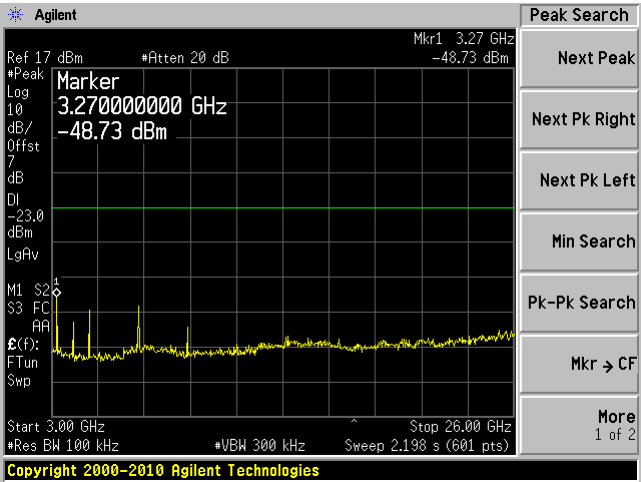


$\pi/4$ -DQPSK, Middle Channel 2440 MHz

30 MHz – 3 GHz

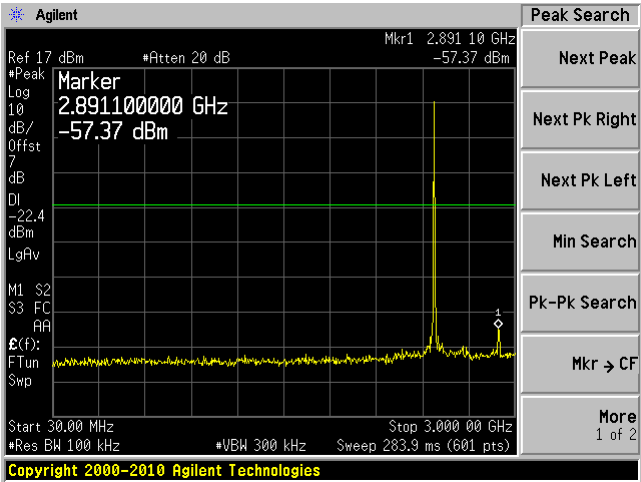


3 GHz – 26 GHz

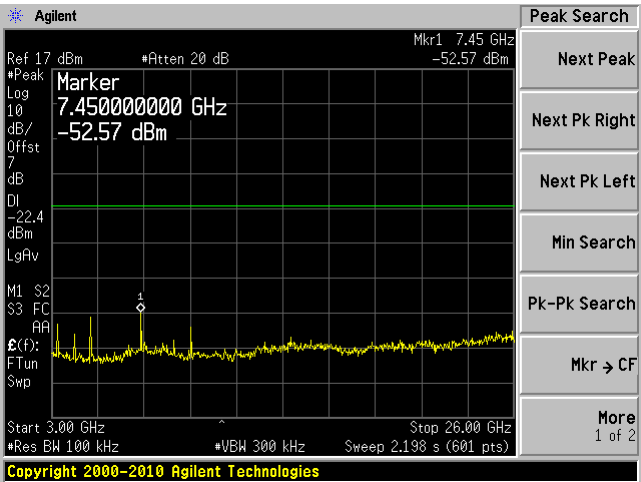


$\pi/4$ -DQPSK, High Channel 2480 MHz

30 MHz – 3 GHz

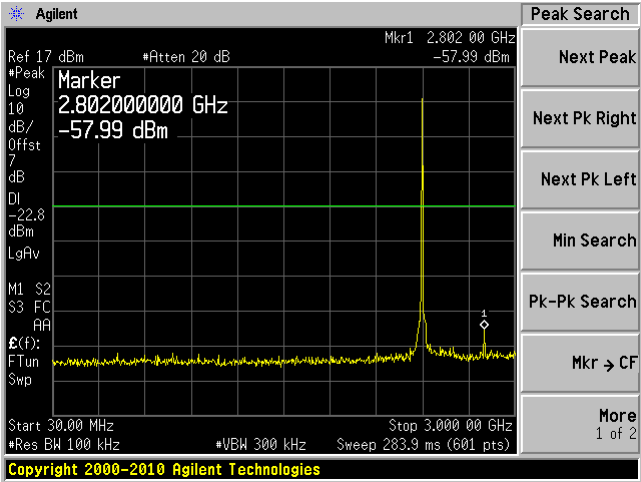


3 GHz – 26 GHz

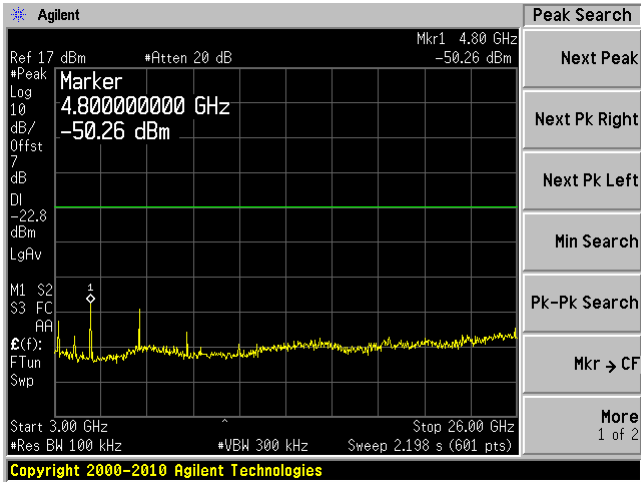


8PSK, Low Channel 2402 MHz

30 MHz – 3 GHz

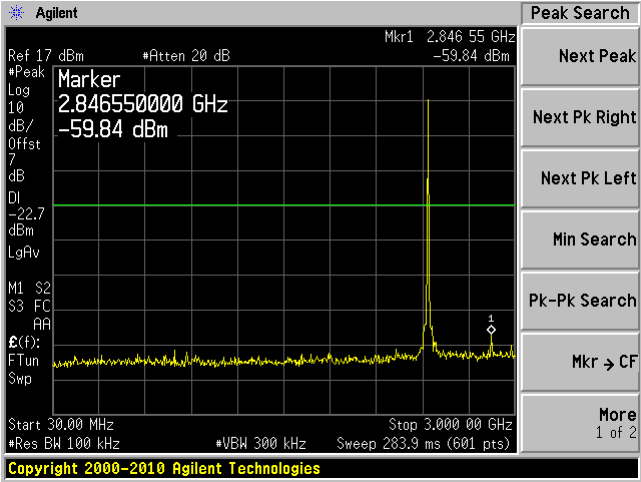


3 GHz – 26 GHz

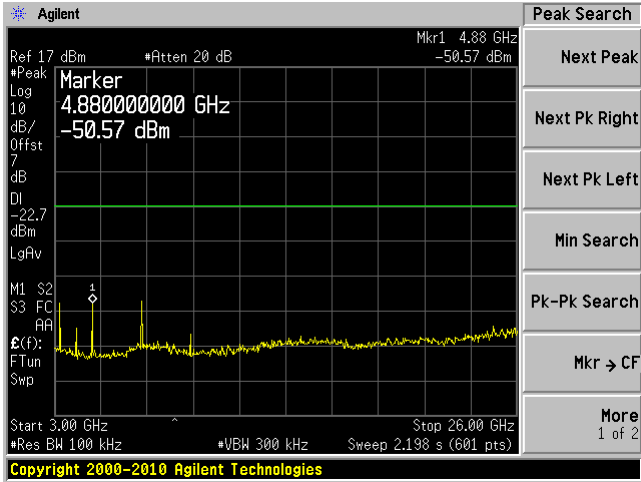


8PSK, Middle Channel 2440 MHz

30 MHz – 3 GHz

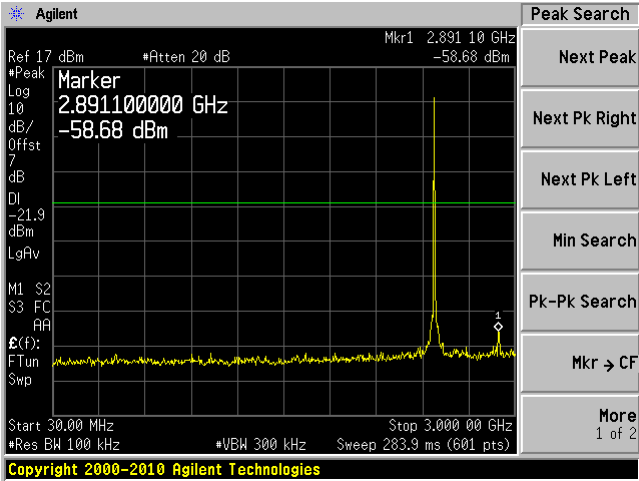


3 GHz – 26 GHz

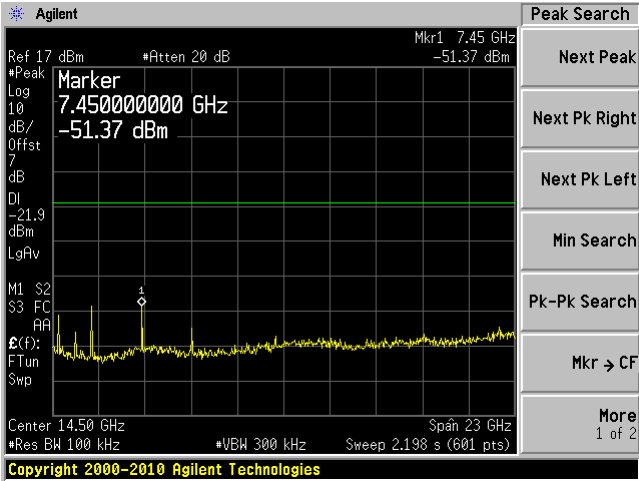


8PSK, High Channel 2480 MHz

30 MHz – 3 GHz



3 GHz – 26 GHz



8 FCC §15.205, §15.209 & §15.247(d) & 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 ^{Note 2}	3
88 - 216	150 ^{Note 2}	3
216 - 960	200 ^{Note 2}	3
Above 960	500	3

Note 2: 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 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 RF 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 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:

$$\text{Margin (dB)} = \text{Corrected Amplitude (dBuV/m)} - \text{Limit (dBuV/m)}$$

8.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Sunol Science	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science	Combination Antenna	JB3	A020106-3	2014-07-11	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2014-06-09	1 year
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2014-05-09	1 year
Agilent	Spectrum Analyzer	E4446A	US44300386	2014-09-29	1 year
EMCO	Horn Antenna	3315	9511-4627	2013-10-17	1 year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2014-03-28	1 year

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

8.6 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	41 %
ATM Pressure:	101.34 kPa

The testing was performed by Chen Ge on 2014-09-26 in 5 meter chamber 3.

8.7 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 a worst case margin of:

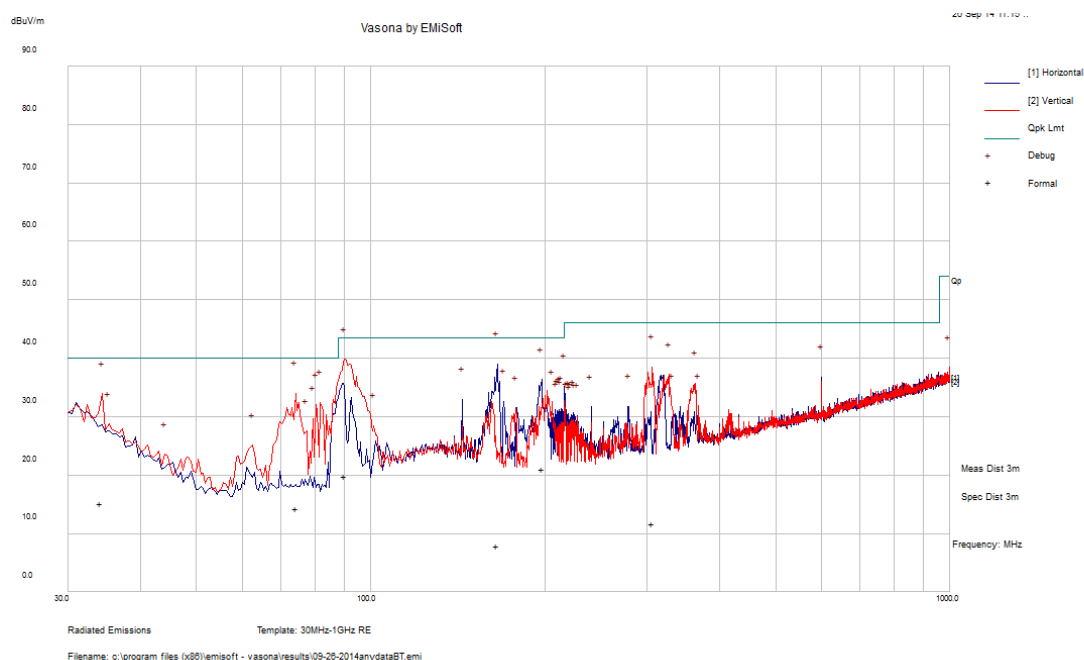
Mode: Transmitting			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Worst Channel, Range
-0.913	4960	Vertical	8PSK High Channel 30 MHz – 25 GHz

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

8.8 Radiated Emissions Test Data

1) 30 MHz – 1 GHz, Measured at 3 meters

Worst Case, GFSK Middle Channel



Frequency MHz	Cord. Reading (dBμV/m)	Measurement Type	Antenna Polarity (H/V)	Antenna Height (cm)	Turntable Azimuth (degrees)	Limit (dBμV/m)	Margin (dB)
90.2445	19.83	QP	V	160	69	43.5	-23.67
165.2153	7.95	QP	H	359	256	43.5	-35.55
74.36175	14.31	QP	V	108	6	40	-25.69
34.16825	15.26	QP	V	195	360	40	-24.74
197.5705	20.99	QP	H	153	356	43.5	-22.51
306.6058	11.80	QP	V	170	133	46	-34.20

2) 1–25 GHz, Measured at 3 meters

GFSK

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	76.51	42	100	V	28.956	3.42		108.886	-	-	Peak
2402	79.54	115	126	H	28.956	3.42		111.916	-	-	Peak
2402	76.29	42	100	V	28.956	3.42		108.666	-	-	Ave
2402	79.36	115	126	H	28.956	3.42		111.736	-	-	Ave
2390	27.47	0	100	V	28.956	3.42		59.846	74	-14.154	Peak
2390	27.69	0	100	H	28.956	3.42		60.066	74	-13.934	Peak
2390	12.73	0	100	V	28.956	3.42		45.106	54	-8.894	Ave
2390	12.39	0	100	H	28.956	3.42		44.766	54	-9.234	Ave
4804	58.21	72	100	V	33.097	5.36	34.29	62.377	74	-11.623	Peak
4804	53.04	183	105	H	33.097	5.36	34.29	57.207	74	-16.793	Peak
4804	48.39	72	100	V	33.097	5.36	34.29	52.557	54	-1.443	Ave
4804	46.57	183	105	H	33.097	5.36	34.29	50.737	54	-3.263	Ave
7206	50.32	72	100	V	35.928	6.7	34.39	58.558	88.886	-30.328	Peak
7206	46.54	183	100	H	35.928	6.7	34.39	54.778	91.916	-37.138	Peak
7206	40.32	72	100	V	35.928	6.7	34.39	48.558	88.666	-40.108	Ave
7206	33.54	183	100	H	35.928	6.7	34.39	41.778	91.736	-49.958	Ave
Middle Channel 2440 MHz, measured at 3 meters											
2440	76.84	44	100	V	28.956	3.42		109.216	-	-	Peak
2440	79.85	116	120	H	28.956	3.42		112.226	-	-	Peak
2440	76.47	44	100	V	28.956	3.42		108.846	-	-	Ave
2440	79.64	116	120	H	28.956	3.42		112.016	-	-	Ave
4880	58.36	72	100	V	33.327	5.36	34.29	62.757	74	-11.243	Peak
4880	53.41	182	100	H	33.327	5.36	34.29	57.807	74	-16.193	Peak
4880	47.69	72	100	V	33.327	5.36	34.29	52.087	54	-1.913	Ave
4880	46.21	182	100	H	33.327	5.36	34.29	50.607	54	-3.393	Ave
7320	49.35	72	106	V	36.369	6.7	34.39	58.029	74	-15.971	Peak
7320	46.21	182	100	H	36.369	6.7	34.39	54.889	74	-19.111	Peak
7320	39.57	72	106	V	36.369	6.7	34.39	48.249	54	-5.751	Ave
7320	33.22	182	100	H	36.369	6.7	34.39	41.899	54	-12.101	Ave

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	73.44	146	100	V	29.155	3.42		106.015	-	-	Peak
2480	76.98	116	115	H	29.155	3.42		109.555	-	-	Peak
2480	73.04	146	100	V	29.155	3.42		105.615	-	-	Ave
2480	76.47	116	115	H	29.155	3.42		109.045	-	-	Ave
2483.5	26.88	0	100	V	29.155	3.42		59.455	74	-14.545	Peak
2483.5	28.62	0	100	H	29.155	3.42		61.195	74	-12.805	Peak
2483.5	13.21	0	100	V	29.155	3.42		45.785	54	-8.215	Ave
2483.5	14.65	0	100	H	29.155	3.42		47.225	54	-6.775	Ave
4960	58.65	77	100	V	33.327	5.36	34.29	63.047	74	-10.953	Peak
4960	53.41	185	109	H	33.327	5.36	34.29	57.807	74	-16.193	Peak
4960	47.69	77	100	V	33.327	5.36	34.29	52.087	54	-1.913	Ave
4960	46.21	185	109	H	33.327	5.36	34.29	50.607	54	-3.393	Ave
7440	50.32	77	101	V	36.565	6.7	34.39	59.195	74	-14.805	Peak
7440	46.88	185	100	H	36.565	6.7	34.39	55.755	74	-18.245	Peak
7440	40.32	77	101	V	36.565	6.7	34.39	49.195	54	-4.805	Ave
7440	32.24	185	100	H	36.565	6.7	34.39	41.115	54	-12.885	Ave

$\pi/4$ -DQPSK

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	75.49	180	120	V	28.956	3.42		107.866	-	-	Peak
2402	76.81	116	100	H	28.956	3.42		109.186	-	-	Peak
2402	71.55	180	120	V	28.956	3.42		103.926	-	-	Ave
2402	73.53	116	100	H	28.956	3.42		105.906	-	-	Ave
2390	26.54	0	100	V	28.956	3.42		58.916	74	-15.084	Peak
2390	26.47	0	100	H	28.956	3.42		58.846	74	-15.154	Peak
2390	13.25	0	100	V	28.956	3.42		45.626	54	-8.374	Ave
2390	13.44	0	100	H	28.956	3.42		45.816	54	-8.184	Ave
4804	58.36	74	108	V	33.097	5.36	34.29	62.527	74	-11.473	Peak
4804	54.32	129	100	H	33.097	5.36	34.29	58.487	74	-15.513	Peak
4804	48.02	74	108	V	33.097	5.36	34.29	52.187	54	-1.813	Ave
4804	47.52	129	100	H	33.097	5.36	34.29	51.687	54	-2.313	Ave
7206	50.32	74	108	V	35.928	6.7	34.39	58.558	87.866	-29.308	Peak
7206	46.52	129	100	H	35.928	6.7	34.39	54.758	89.186	-34.428	Peak
7206	40.24	74	108	V	35.928	6.7	34.39	48.478	83.926	-35.448	Ave
7206	33.05	129	100	H	35.928	6.7	34.39	41.288	85.906	-44.618	Ave
Middle Channel 2440 MHz, measured at 3 meters											
2440	75.03	146	112	V	28.956	3.42		107.406	-	-	Peak
2440	75.92	117	100	H	28.956	3.42		108.296	-	-	Peak
2440	71.92	146	112	V	28.956	3.42		104.296	-	-	Ave
2440	72.63	117	100	H	28.956	3.42		105.006	-	-	Ave
4880	58.36	62	103	V	33.327	5.36	34.29	62.757	74	-11.243	Peak
4880	54.65	122	100	H	33.327	5.36	34.29	59.047	74	-14.953	Peak
4880	48.35	62	103	V	33.327	5.36	34.29	52.747	54	-1.253	Ave
4880	47.36	122	100	H	33.327	5.36	34.29	51.757	54	-2.243	Ave
7320	50.14	62	106	V	36.369	6.7	34.39	58.819	74	-15.181	Peak
7320	46.22	122	100	H	36.369	6.7	34.39	54.899	74	-19.101	Peak
7320	40.87	62	106	V	36.369	6.7	34.39	49.549	54	-4.451	Ave
7320	32.68	122	100	H	36.369	6.7	34.39	41.359	54	-12.641	Ave

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	72.99	182	123	V	29.155	3.42		105.565	-	-	Peak
2480	75.01	116	100	H	29.155	3.42		107.585	-	-	Peak
2480	69.84	182	123	V	29.155	3.42		102.415	-	-	Ave
2480	71.79	116	100	H	29.155	3.42		104.365	-	-	Ave
2483.5	36.54	182	123	V	29.155	3.42		69.115	74	-4.885	Peak
2483.5	33.74	120	100	H	29.155	3.42		66.315	74	-7.685	Peak
2483.5	18.96	182	123	V	29.155	3.42		51.535	54	-2.465	Ave
2483.5	15.95	120	100	H	29.155	3.42		48.525	54	-5.475	Ave
4960	58.36	56	100	V	33.327	5.36	34.29	62.757	74	-11.243	Peak
4960	54.25	131	105	H	33.327	5.36	34.29	58.647	74	-15.353	Peak
4960	48.69	56	100	V	33.327	5.36	34.29	53.087	54	-0.913	Ave
4960	47.68	131	105	H	33.327	5.36	34.29	52.077	54	-1.923	Ave
7440	50.36	56	100	V	36.565	6.7	34.39	59.235	74	-14.765	Peak
7440	46.87	131	100	H	36.565	6.7	34.39	55.745	74	-18.255	Peak
7440	40.05	56	100	V	36.565	6.7	34.39	48.925	54	-5.075	Ave
7440	32.39	131	100	H	36.565	6.7	34.39	41.265	54	-12.735	Ave

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	73.5	177	100	V	28.956	3.42		105.876	-	-	Peak
2402	77.95	117	102	H	28.956	3.42		110.326	-	-	Peak
2402	69.89	177	100	V	28.956	3.42		102.266	-	-	Ave
2402	73.33	117	102	H	28.956	3.42		105.706	-	-	Ave
2390	25.6	0	100	V	28.956	3.42		57.976	74	-16.024	Peak
2390	26.21	0	100	H	28.956	3.42		58.586	74	-15.414	Peak
2390	13.25	0	100	V	28.956	3.42		45.626	54	-8.374	Ave
2390	13.57	0	100	H	28.956	3.42		45.946	54	-8.054	Ave
4804	58.69	96	100	V	33.097	5.36	34.29	62.857	74	-11.143	Peak
4804	55.94	23	100	H	33.097	5.36	34.29	60.107	74	-13.893	Peak
4804	48.35	96	100	V	33.097	5.36	34.29	52.517	54	-1.483	Ave
4804	43.36	23	100	H	33.097	5.36	34.29	47.527	54	-6.473	Ave
7206	49.77	96	100	V	35.928	6.7	34.39	58.008	85.876	-27.868	Peak
7206	46.31	23	100	H	35.928	6.7	34.39	54.548	90.326	-35.778	Peak
7206	40.01	96	100	V	35.928	6.7	34.39	48.248	82.266	-34.018	Ave
7206	33.72	23	100	H	35.928	6.7	34.39	41.958	85.706	-43.748	Ave
Middle Channel 2440 MHz, measured at 3 meters											
2440	74.24	177	105	V	28.956	3.42		106.616	-	-	Peak
2440	75.91	44	110	H	28.956	3.42		108.286	-	-	Peak
2440	70.27	177	105	V	28.956	3.42		102.646	-	-	Ave
2440	72.35	44	110	H	28.956	3.42		104.726	-	-	Ave
4880	58.47	74	100	V	33.327	5.36	34.29	62.867	74	-11.133	Peak
4880	54.36	131	100	H	33.327	5.36	34.29	58.757	74	-15.243	Peak
4880	48.25	74	100	V	33.327	5.36	34.29	52.647	54	-1.353	Ave
4880	43.25	131	100	H	33.327	5.36	34.29	47.647	54	-6.353	Ave
7320	50.05	70	106	V	36.369	6.7	34.39	58.729	74	-15.271	Peak
7320	47.65	152	100	H	36.369	6.7	34.39	56.329	74	-17.671	Peak
7320	39.36	70	106	V	36.369	6.7	34.39	48.039	54	-5.961	Ave
7320	34.39	152	100	H	36.369	6.7	34.39	43.069	54	-10.931	Ave

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	73.58	175	100	V	29.155	3.42		106.155	-	-	Peak
2480	75.11	115	100	H	29.155	3.42		107.685	-	-	Peak
2480	69.58	175	108	V	29.155	3.42		102.155	-	-	Ave
2480	71.59	115	100	H	29.155	3.42		104.165	-	-	Ave
2483.5	37.93	175	100	V	29.155	3.42		70.505	74	-3.495	Peak
2483.5	39.46	115	100	H	29.155	3.42		72.035	74	-1.965	Peak
2483.5	18.48	175	100	V	29.155	3.42		51.055	54	-2.945	Ave
2483.5	19.84	115	100	H	29.155	3.42		52.415	54	-1.585	Ave
4960	58.3	172	103	V	33.327	5.36	34.29	62.697	74	-11.303	Peak
4960	56.84	165	109	H	33.327	5.36	34.29	61.237	74	-12.763	Peak
4960	47.25	172	103	V	33.327	5.36	34.29	51.647	54	-2.353	Ave
4960	48.16	165	109	H	33.327	5.36	34.29	52.557	54	-1.443	Ave
7440	51.14	172	101	V	36.565	6.7	34.39	60.015	74	-13.985	Peak
7440	51.94	153	100	H	36.565	6.7	34.39	60.815	74	-13.185	Peak
7440	41.07	172	101	V	36.565	6.7	34.39	49.945	54	-4.055	Ave
7440	41.25	153	100	H	36.565	6.7	34.39	50.125	54	-3.875	Ave

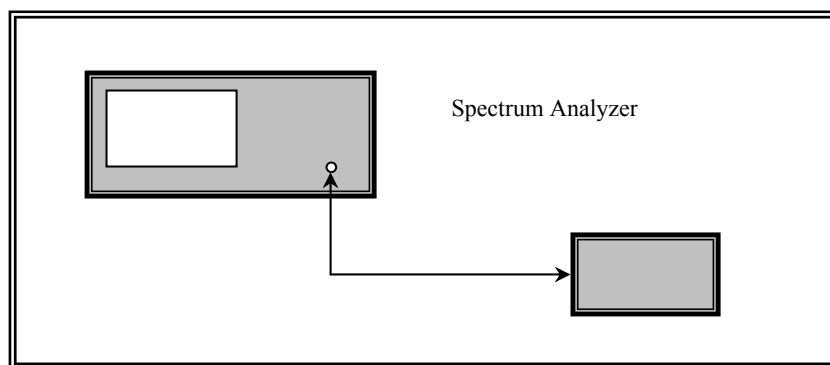
9 FCC §15.247(b) & IC RSS-210 §A8.4 - Peak Output Power Measurement

9.1 Applicable Standard

According to FCC §15.247(b) and IC RSS-210 §A8.4 (4) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

9.2 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.



9.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2014-10-16	1 year

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

9.4 Test Environmental Conditions

Temperature:	21° C
Relative Humidity:	45 %
ATM Pressure:	101.6 kPa

The testing was performed by Chen Ge on 2014-09-24 at RF site.

9.5 Test Results

Peak:

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)	Margin (dB)
GFSK				
Low	2402	11.07	30	-18.93
Middle	2440	11.36	30	-18.64
High	2480	11.29	30	-18.71
$\pi/4$ -DQPSK				
Low	2402	11.00	30	-19.00
Middle	2440	11.31	30	-18.69
High	2480	11.27	30	-18.73
8PSK				
Low	2402	11.46	30	-18.54
Middle	2440	11.74	30	-18.26
High	2480	11.68	30	-18.32

Average:

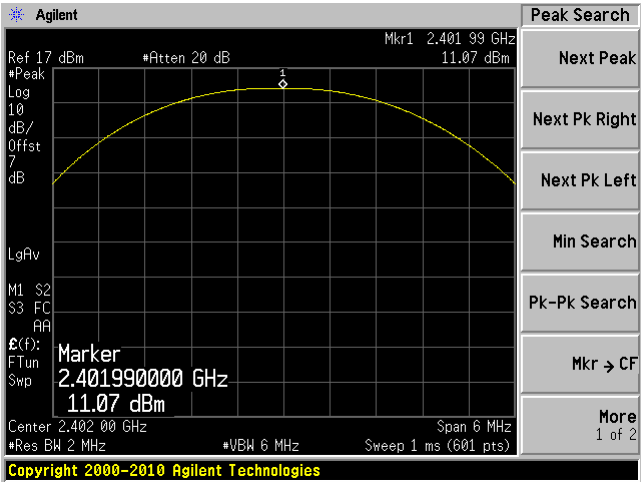
Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)	Margin (dB)
GFSK				
Low	2402	10.65	30	-19.35
Middle	2440	10.95	30	-19.05
High	2480	10.82	30	-19.18
$\pi/4$ -DQPSK				
Low	2402	9.36	30	-20.64
Middle	2440	9.67	30	-20.33
High	2480	9.58	30	-20.42
8PSK				
Low	2402	9.41	30	-20.59
Middle	2440	9.66	30	-20.34
High	2480	9.59	30	-20.41

Please refer to the following plots.

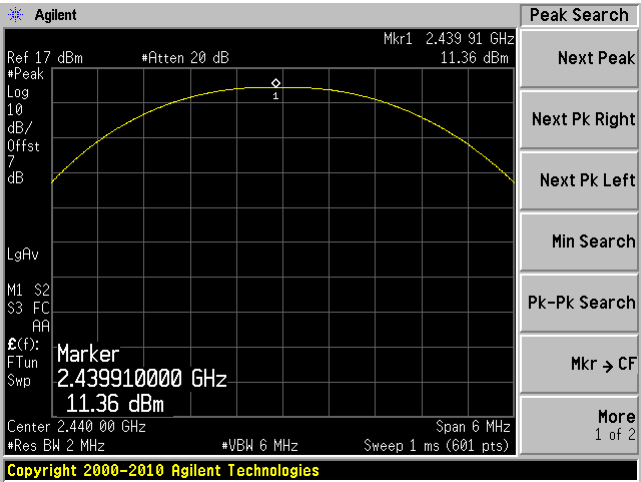
Peak:

GFSK

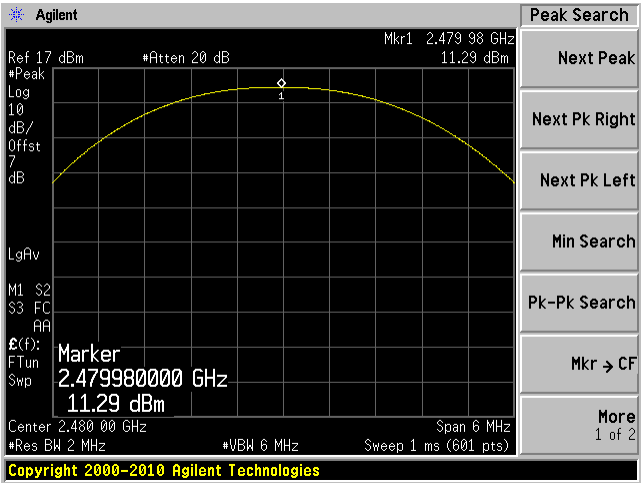
Low channel: 2402 MHz



Middle Channel: 2440 MHz

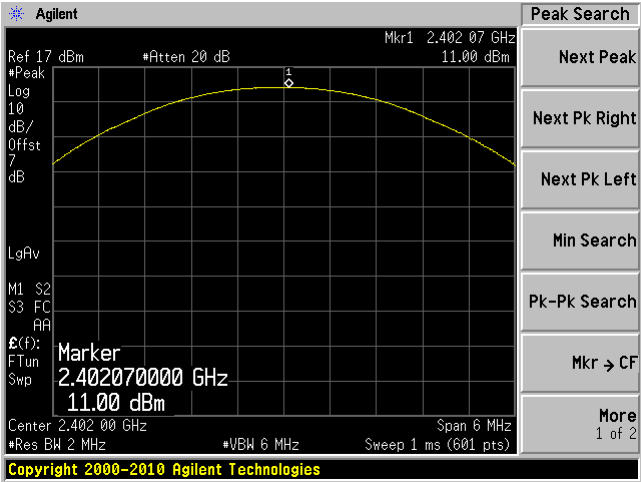


High Channel: 2480 MHz

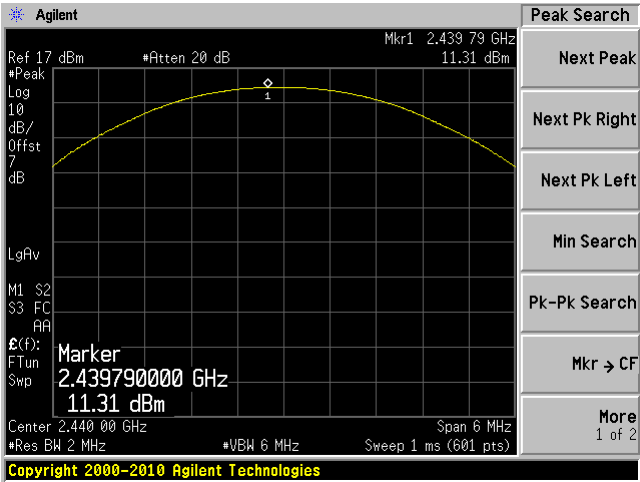


$\pi/4$ -DQPSK

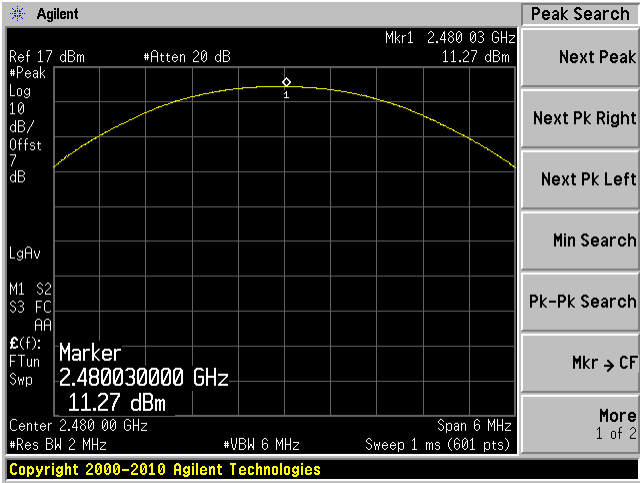
Low channel: 2402 MHz



Middle Channel: 2440 MHz

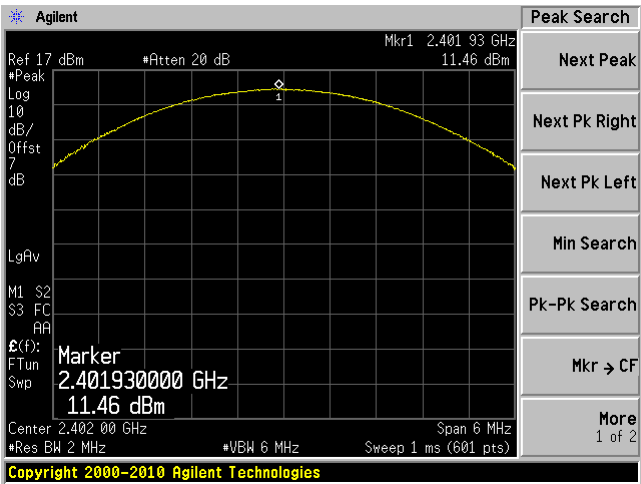


High Channel: 2480 MHz

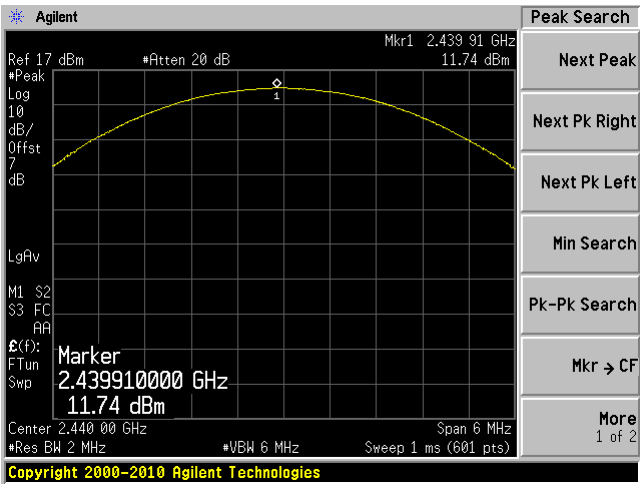


8PSK

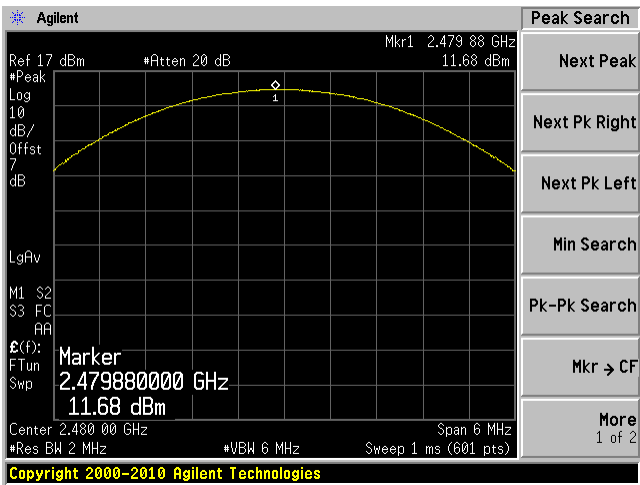
Low channel: 2402 MHz



Middle Channel: 2440 MHz



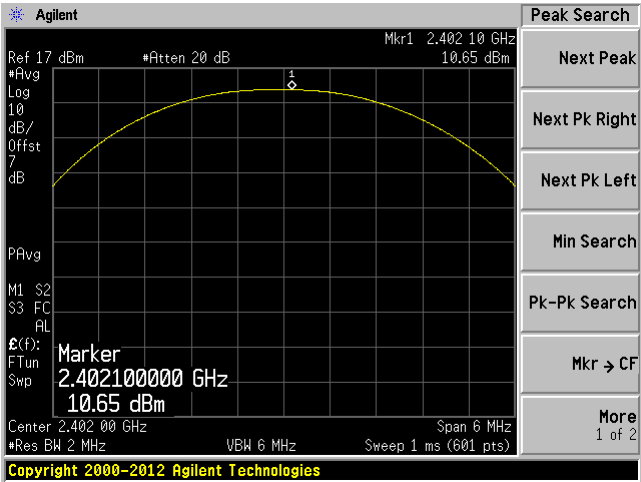
High Channel: 2480 MHz



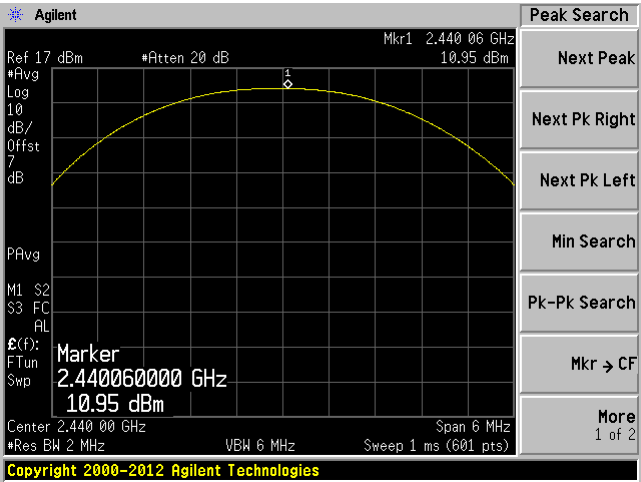
Average:

GFSK

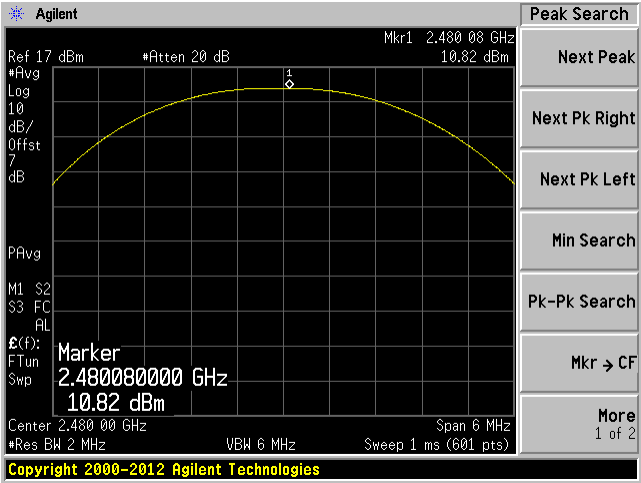
Low channel: 2402 MHz



Middle Channel: 2440 MHz

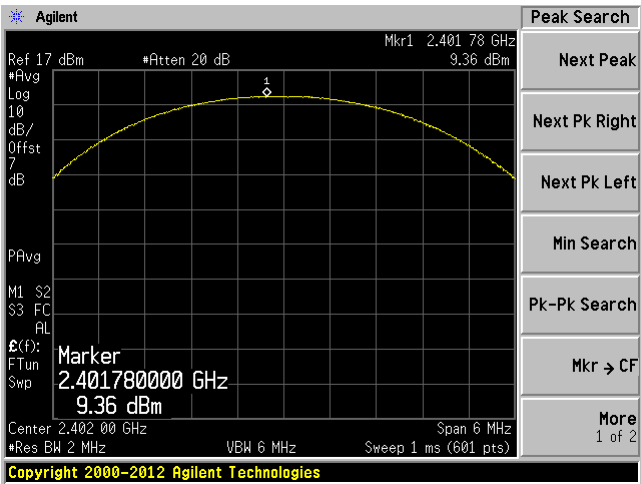


High Channel: 2480 MHz

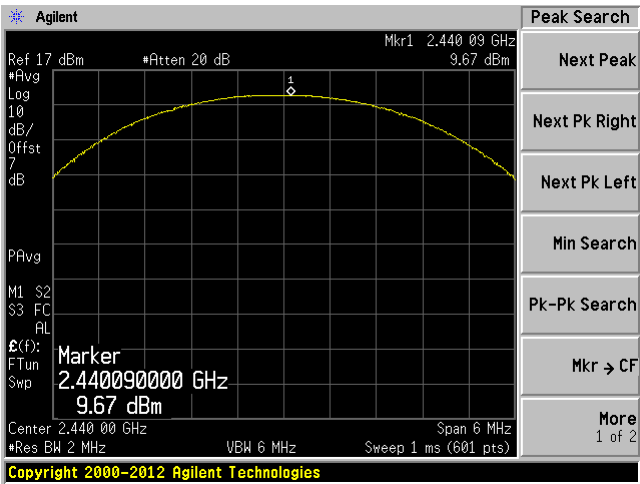


$\pi/4$ -DQPSK

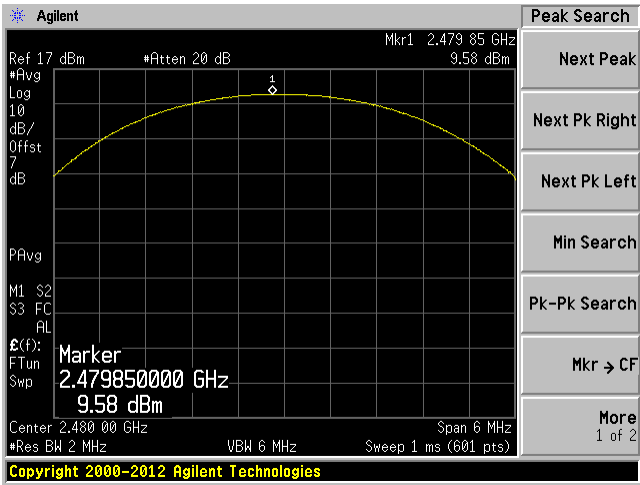
Low channel: 2402 MHz



Middle Channel: 2440 MHz

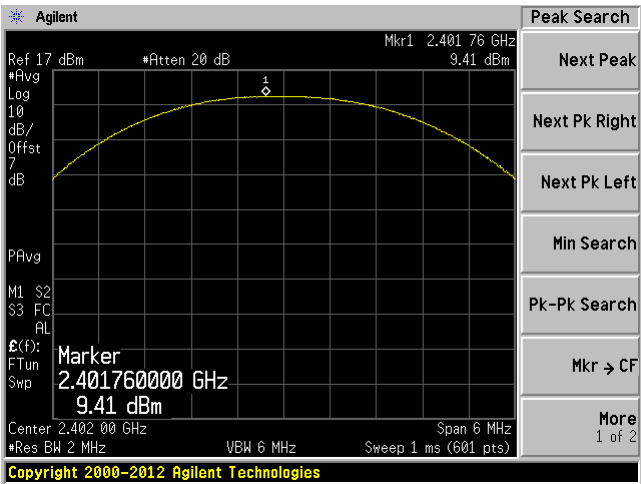


High Channel: 2480 MHz

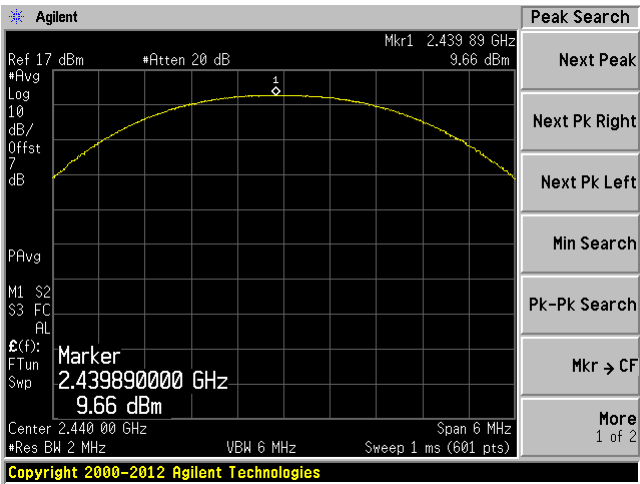


8PSK

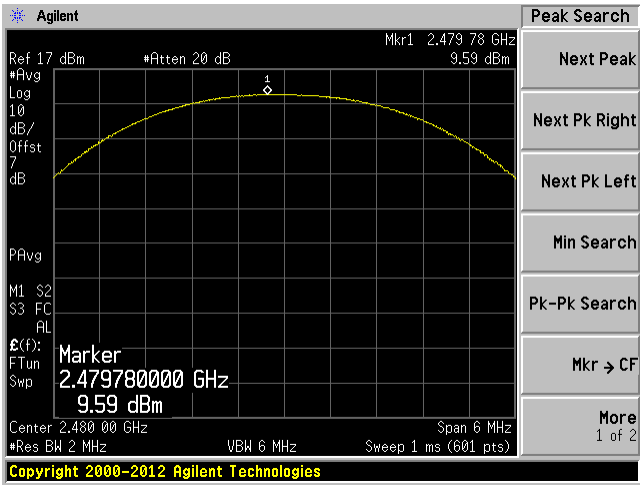
Low channel: 2402 MHz



Middle Channel: 2440 MHz



High Channel: 2480 MHz



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

10.1 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.

10.2 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.

10.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2014-10-16	1 year

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

10.4 Test Environmental Conditions

Temperature:	21° C
Relative Humidity:	45 %
ATM Pressure:	101.6 kPa

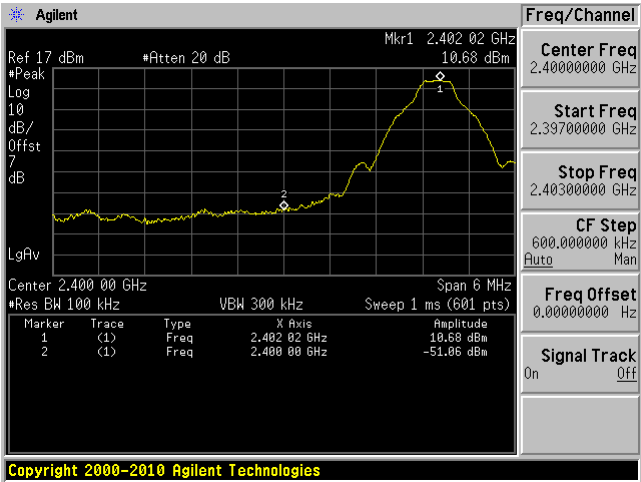
The testing was performed by Chen Ge on 2014-09-24 at RF site.

10.5 Test Results

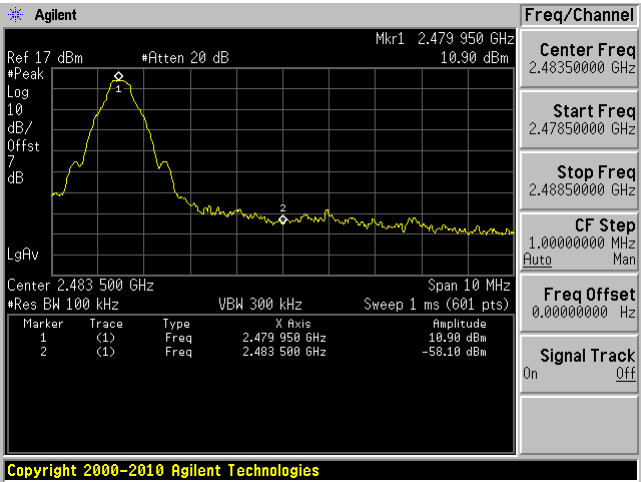
Please refer to following pages for plots of band edge.

GFSK

Low Band Edge

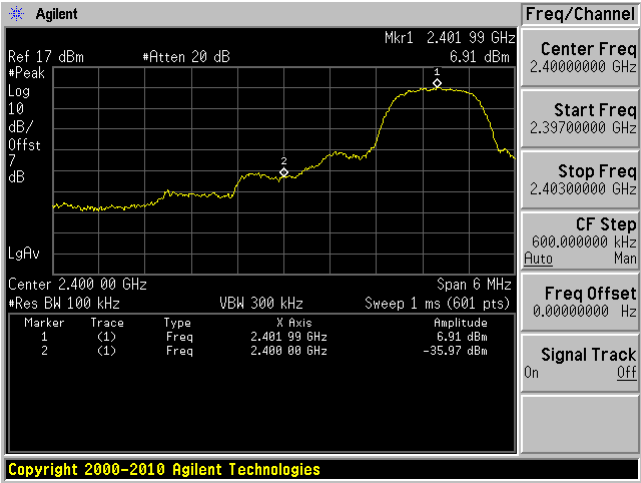


High Band Edge

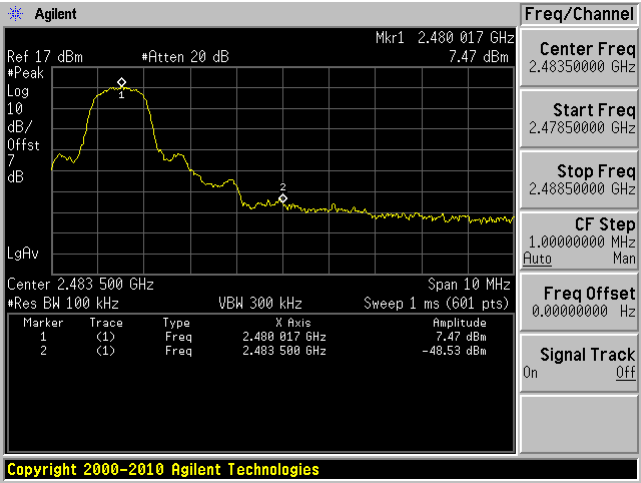


$\pi/4$ -DQPSK

Low Band Edge

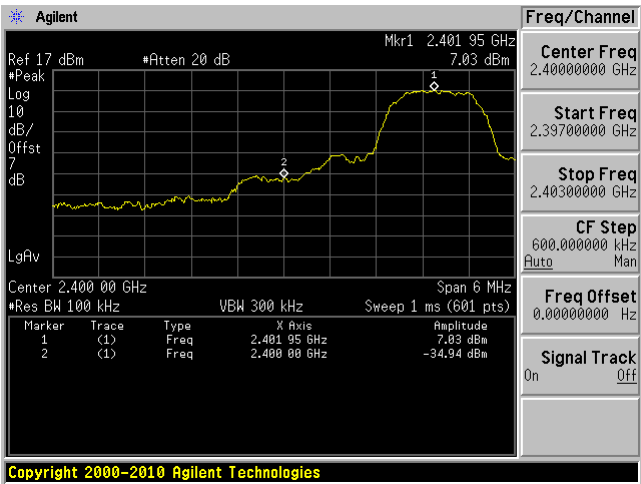


High Band Edge

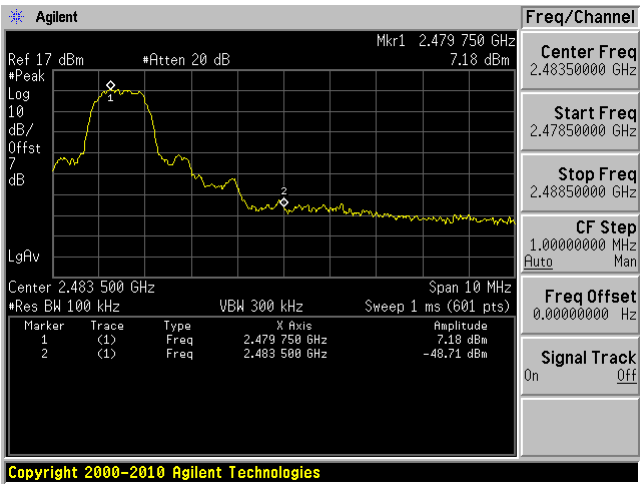


8PSK

Low Band Edge



High Band Edge



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

11.1 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.

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 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 20 dB from the reference level. Record the frequency difference as the emissions bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

11.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2014-10-16	1 year

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

11.4 Test Environmental Conditions

Temperature:	21° C
Relative Humidity:	45 %
ATM Pressure:	101.6 kPa

The testing was performed by Chen Ge on 2014-09-24 at RF site.

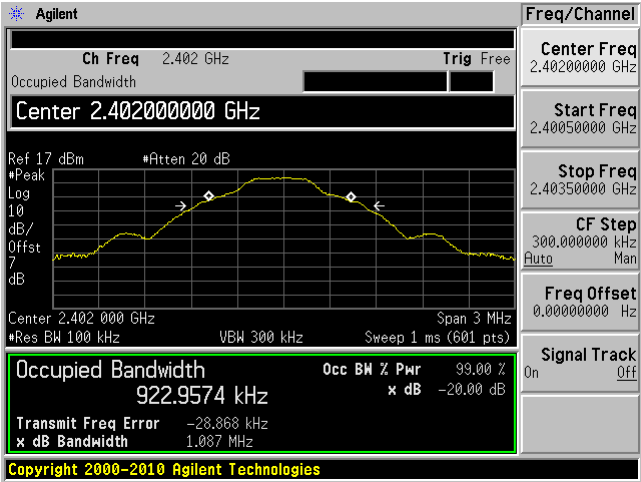
11.5 Test Results

Channel	Frequency (MHz)	99% Emission Bandwidth (MHz)	20 dB Emission Bandwidth (MHz)
GFSK			
Low	2402	0.9229	1.087
Middle	2440	0.9376	1.103
High	2480	0.9323	1.082
$\pi/4$ -DQPSK			
Low	2402	1.2538	1.430
Middle	2440	1.2559	1.440
High	2480	1.2572	1.438
8PSK			
Low	2402	1.2479	1.441
Middle	2440	1.2614	1.444
High	2480	1.2652	1.444

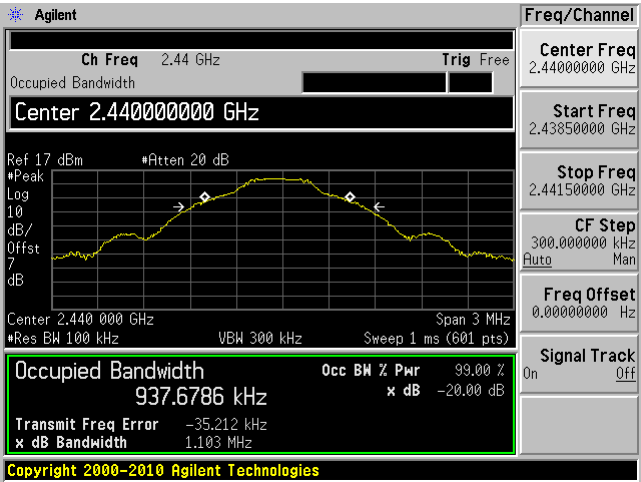
Please refer to the following plots.

GFSK

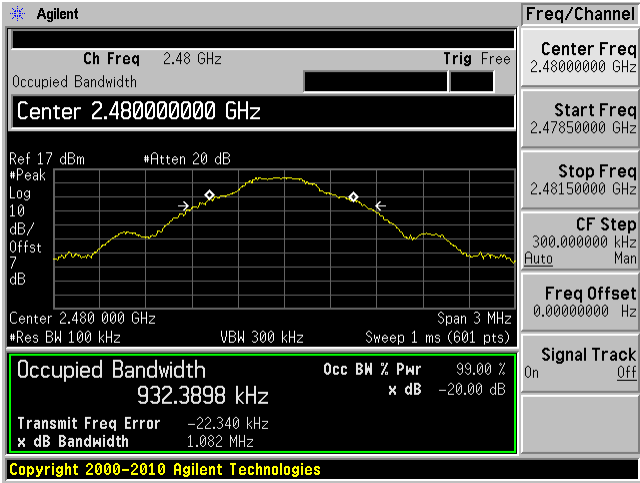
Low channel: 2402 MHz



Middle Channel: 2440 MHz

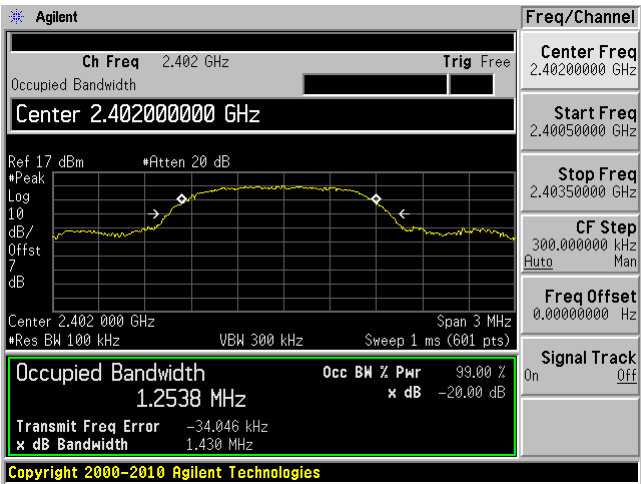


High Channel: 2480 MHz

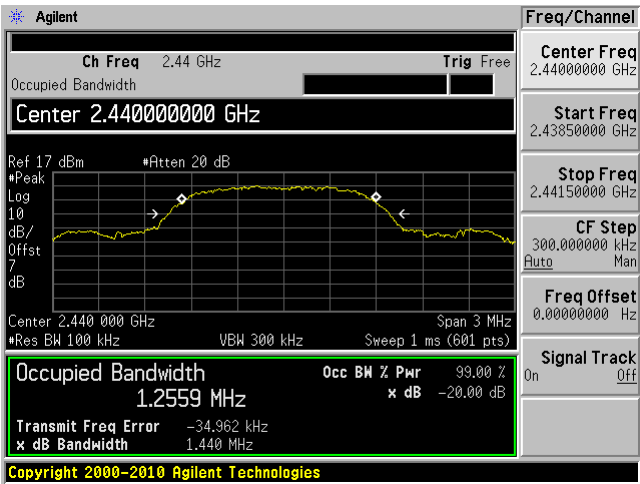


$\pi/4$ -DQPSK

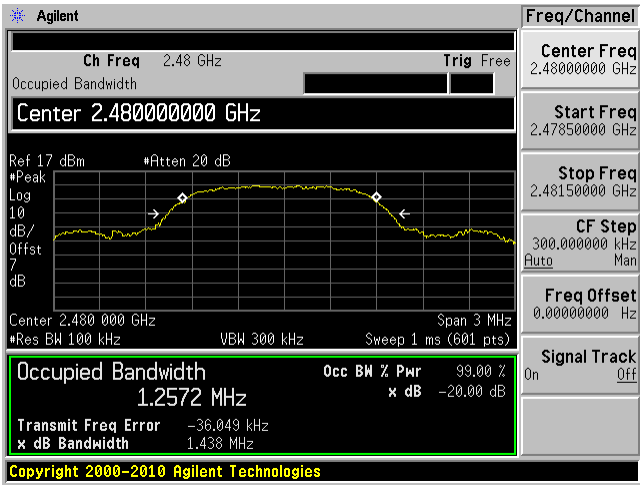
Low channel: 2402 MHz



Middle Channel: 2440 MHz

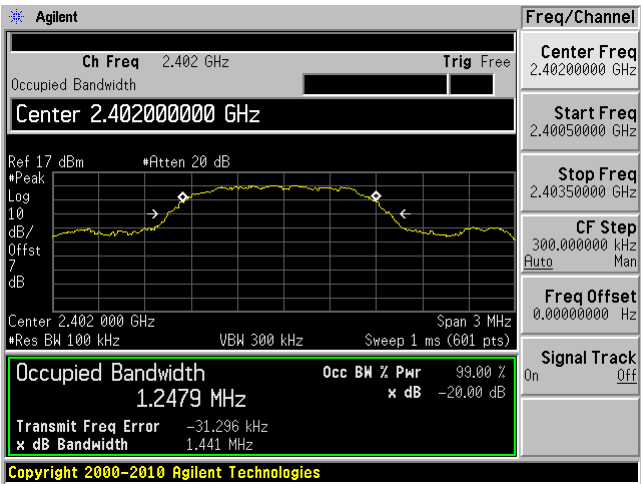


High Channel: 2480 MHz

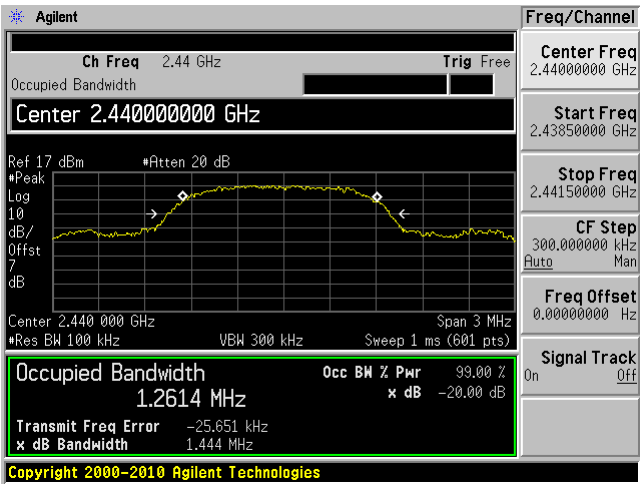


8PSK

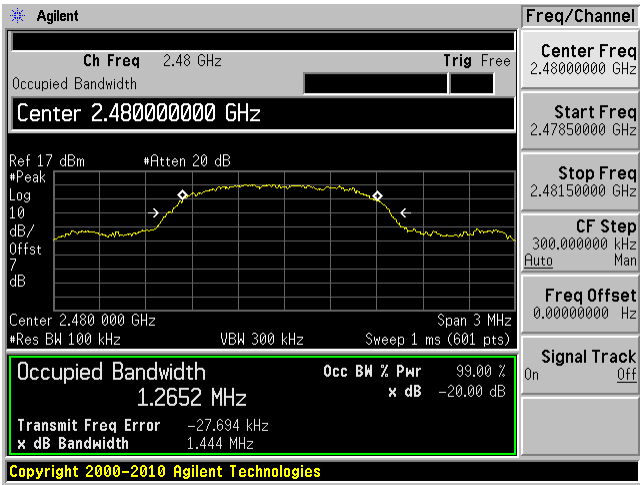
Low channel: 2402 MHz



Middle Channel: 2440 MHz



High Channel: 2480 MHz



12 FCC §15.247(a) & 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 hopping 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	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2014-10-16	1 year

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

12.4 Test Environmental Conditions

Temperature:	21 °C
Relative Humidity:	45 %
ATM Pressure:	101.6 KPa

The testing was performed by Chen Ge on 2014-09-24 at RF site.

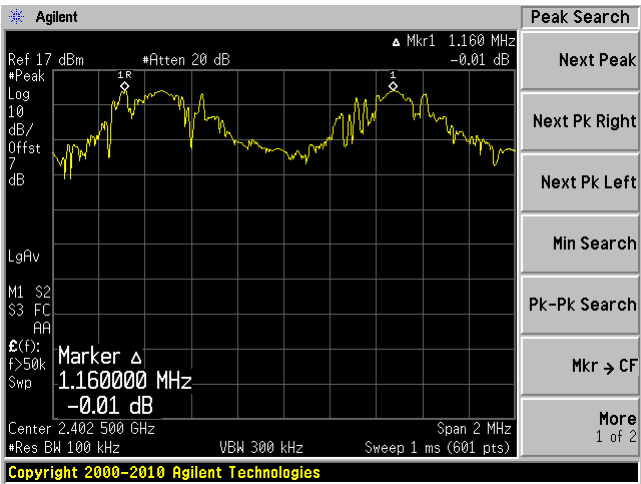
12.5 Test Results

Channel	Frequency (MHz)	Channel Separation (kHz)	Limit > 2/3 20 dB OBW (kHz)
GFSK			
Low	2402	1160	615.297
Middle	2441	1007	625.098
High	2480	1003	621.564
$\pi/4$ -DQPSK			
Low	2402	990	835.908
Middle	2441	1013	837.309
High	2480	1173	838.175
8PSK			
Low	2402	1170	831.975
Middle	2441	1167	840.975
High	2480	1013	843.509

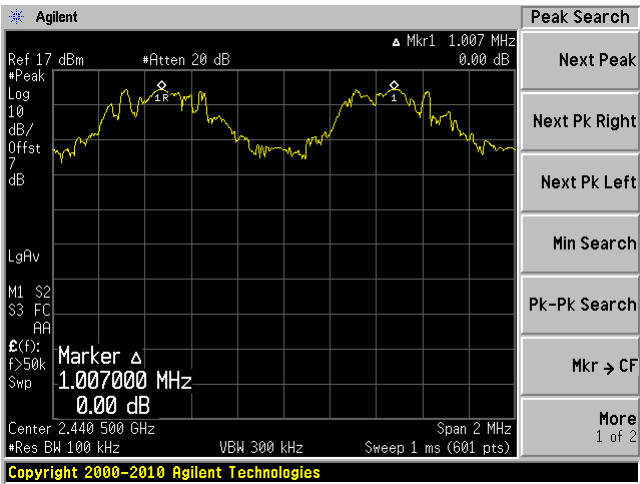
Please refer to the following plots.

GFSK

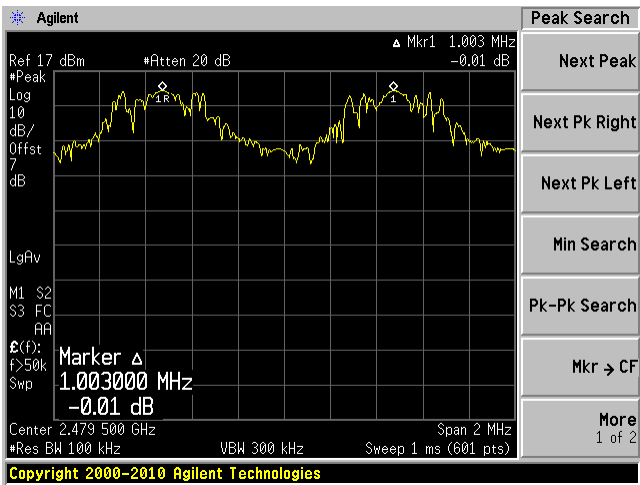
Low channel: 2402 MHz



Middle Channel: 2440 MHz

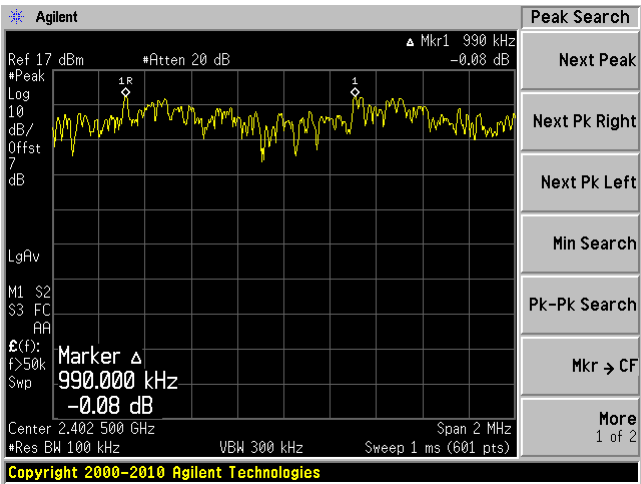


High Channel: 2480 MHz

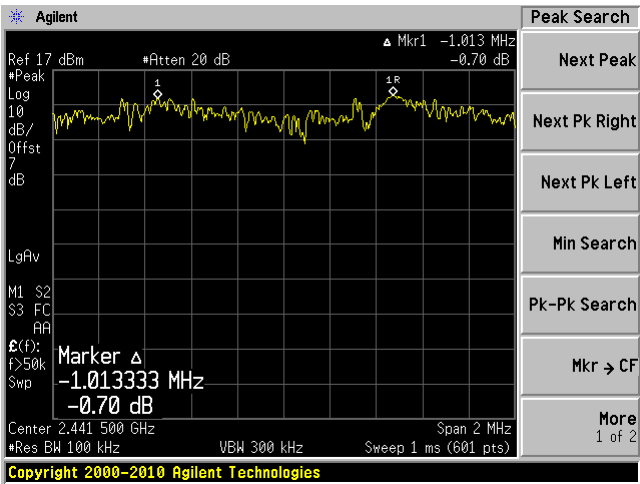


$\pi/4$ -DQPSK

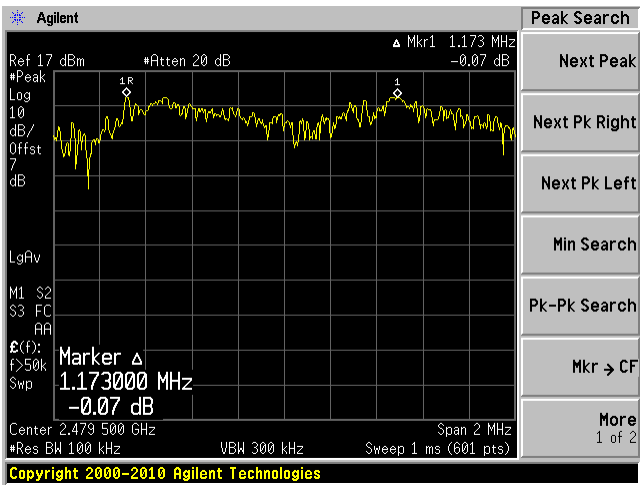
Low channel: 2402 MHz



Middle Channel: 2440 MHz

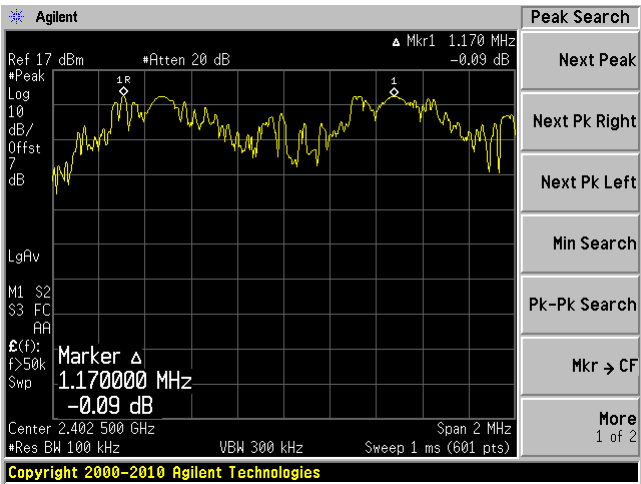


High Channel: 2480 MHz

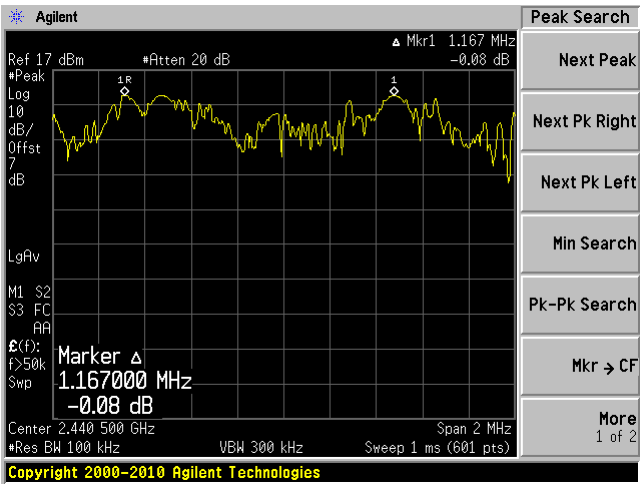


8PSK

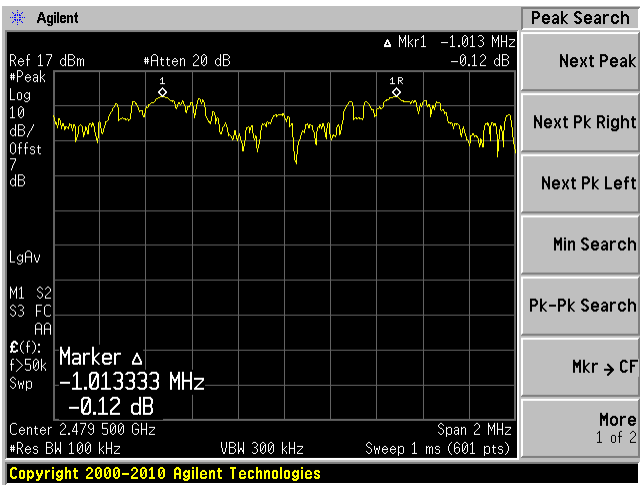
Low channel: 2402 MHz



Middle Channel: 2440 MHz



High Channel: 2480 MHz



13 FCC §15.247(a) & 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	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2014-10-16	1 year

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

13.4 Test Environmental Conditions

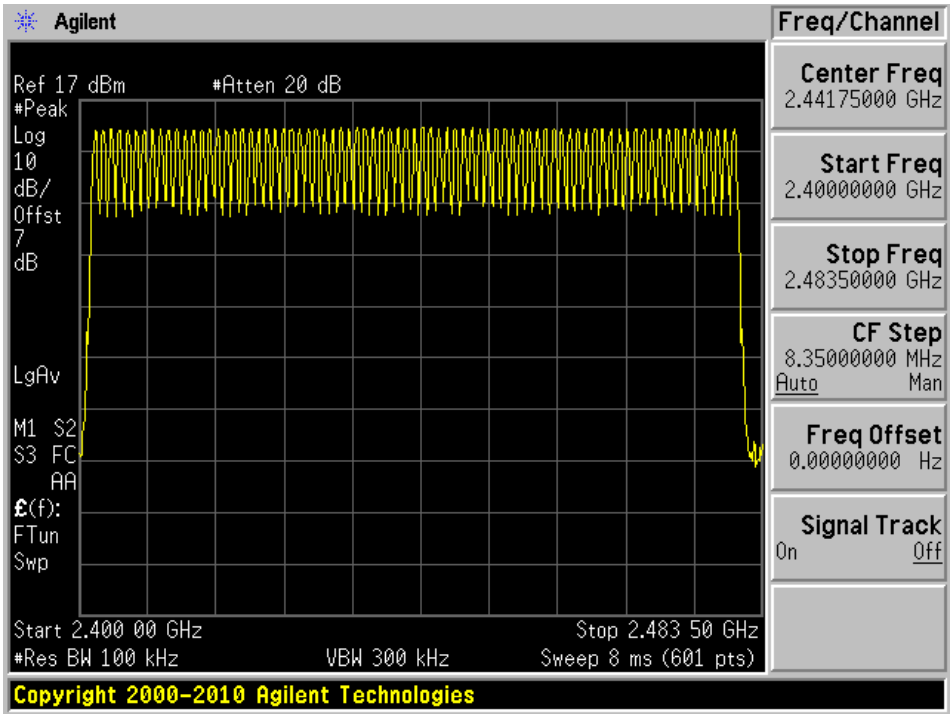
Temperature:	21° C
Relative Humidity:	45 %
ATM Pressure:	101.6 kPa

The testing was performed by Chen Ge on 2014-09-24 at RF site.

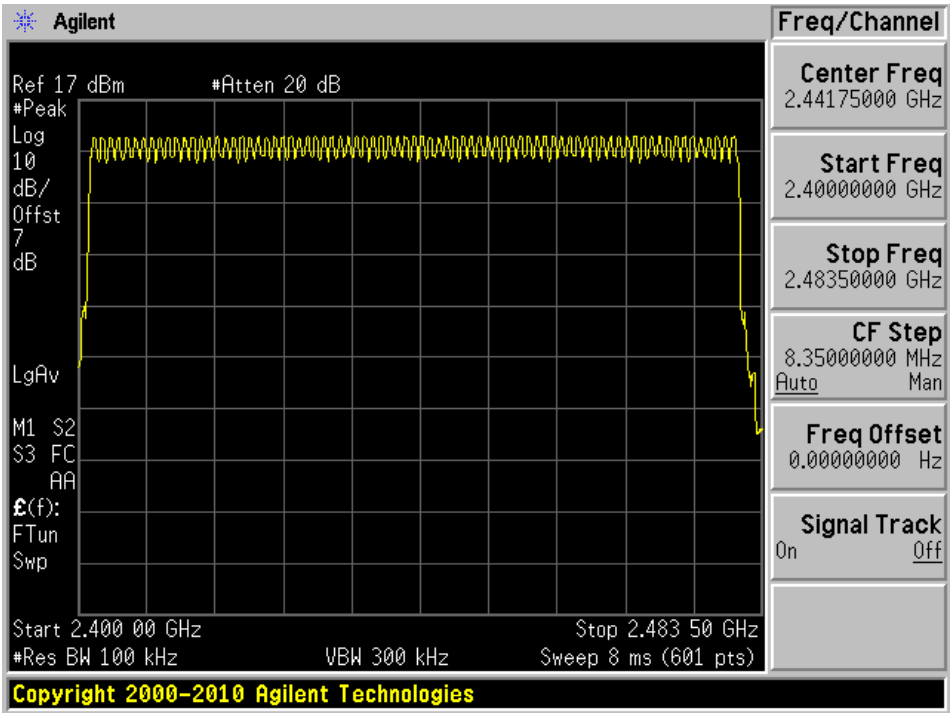
13.5 Test Results

Total 79 channels; please refer to the plots.

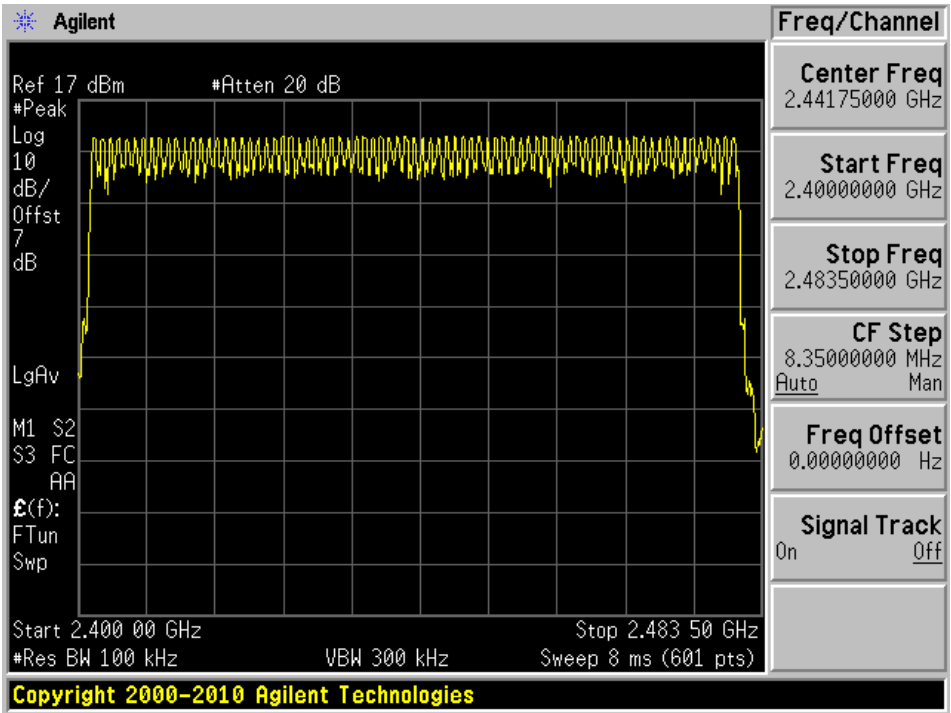
GFSK Hopping Channel Number: Total 79 Channels



$\pi/4$ -DQPSK Hopping Channel Number: Total 79 Channels



8PSK Hopping Channel Number: Total 79 Channels



14 FCC §15.247(a) & 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	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2014-10-16	1 year

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

14.4 Test Environmental Conditions

Temperature:	21° C
Relative Humidity:	45 %
ATM Pressure:	101.6 kPa

The testing was performed by Chen Ge on 2014-09-24 at RF site.

14.5 Test Results

Channel	Pulse Width (ms)	Dwell time (sec)	Limit (sec)	Results
GFSK, DH1: Packet Size = 27 byte				
Low	0.391	0.13	0.4	Pass
Mid	0.391	0.13	0.4	Pass
High	0.390	0.13	0.4	Pass
GFSK, DH3: Packet Size = 183 bytes				
Low	1.665	0.27	0.4	Pass
Mid	1.665	0.27	0.4	Pass
High	1.660	0.27	0.4	Pass
GFSK, DH5: Packet Size = 339 bytes				
Low	2.913	0.31	0.4	Pass
Mid	2.913	0.31	0.4	Pass
High	2.913	0.31	0.4	Pass
$\pi/4$ -DQPSK, DH1: Packet Size = 27 byte				
Low	0.295	0.09	0.4	Pass
Mid	0.295	0.09	0.4	Pass
High	0.295	0.09	0.4	Pass
$\pi/4$ -DQPSK, DH3: Packet Size = 183 bytes				
Low	0.924	0.15	0.4	Pass
Mid	0.924	0.15	0.4	Pass
High	0.924	0.15	0.4	Pass
$\pi/4$ -DQPSK, DH5: Packet Size = 339 bytes				
Low	1.546	0.16	0.4	Pass
Mid	1.546	0.16	0.4	Pass
High	1.546	0.16	0.4	Pass
8PSK, DH1: Packet Size = 27 byte				
Low	0.248	0.08	0.4	Pass
Mid	0.248	0.08	0.4	Pass
High	0.248	0.08	0.4	Pass
8PSK, DH3: Packet Size = 183 bytes				
Low	0.673	0.11	0.4	Pass
Mid	0.673	0.11	0.4	Pass
High	0.673	0.11	0.4	Pass
8PSK, DH5: Packet Size = 339 bytes				
Low	1.086	0.12	0.4	Pass
Mid	1.086	0.12	0.4	Pass
High	1.086	0.12	0.4	Pass

Note: DH1: Dwell time = Pulse time*(1600/2/79)*31.6S

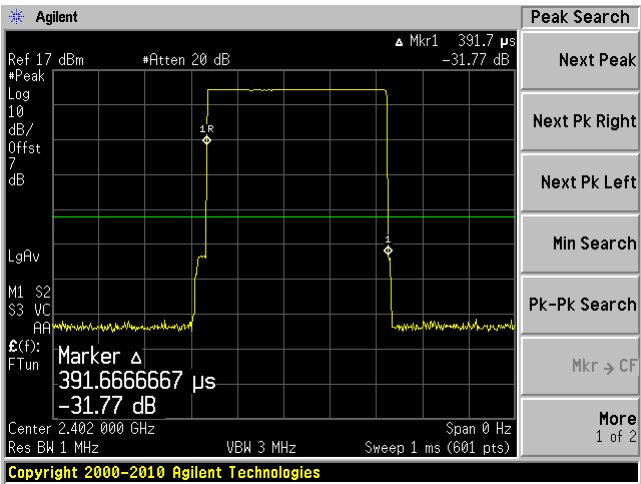
DH3: Dwell time = Pulse time*(1600/4/79)*31.6S

DH5: Dwell time = Pulse time*(1600/6/79)*31.6S

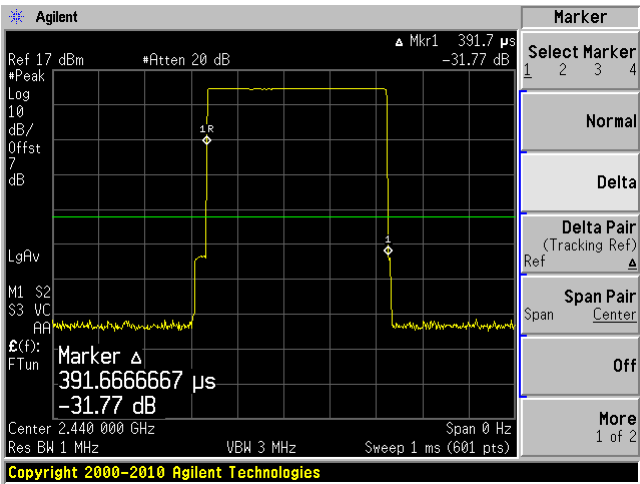
Please refer to following plots.

GFSK – DH1

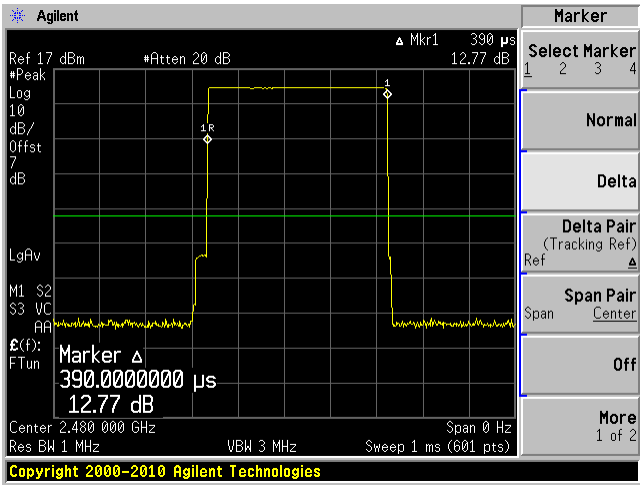
Low channel: 2402 MHz



Middle Channel: 2440 MHz

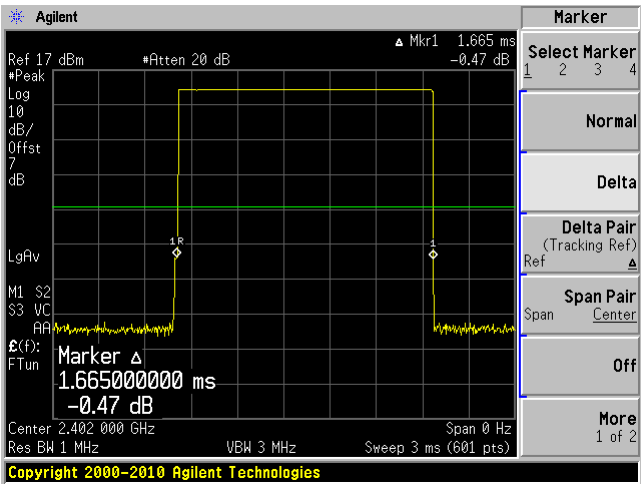


High Channel: 2480 MHz

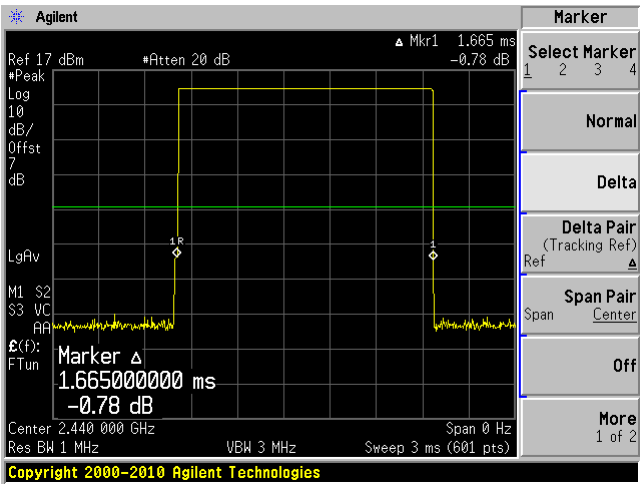


GFSK – DH3

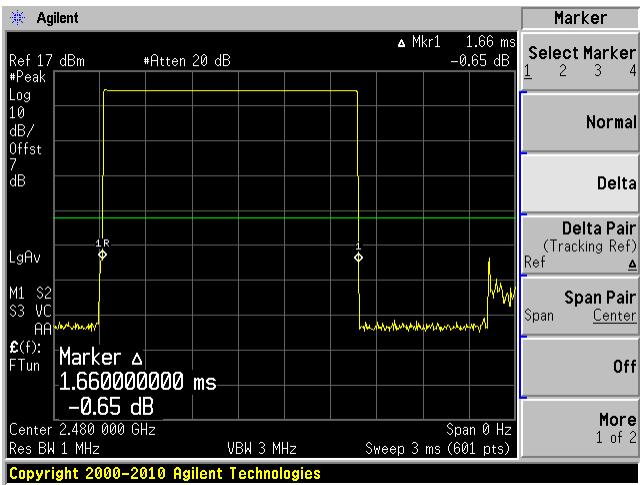
Low channel: 2402 MHz



Middle Channel: 2440 MHz

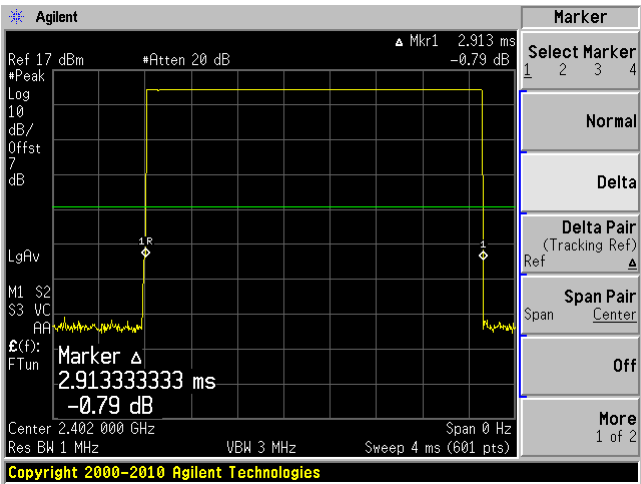


High Channel: 2480 MHz

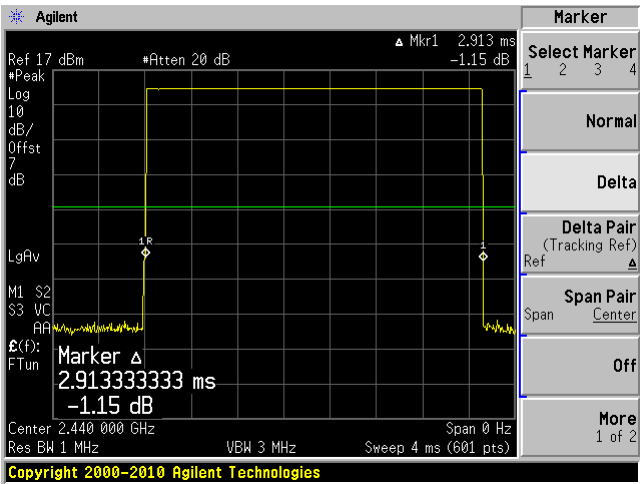


GFSK – DH5

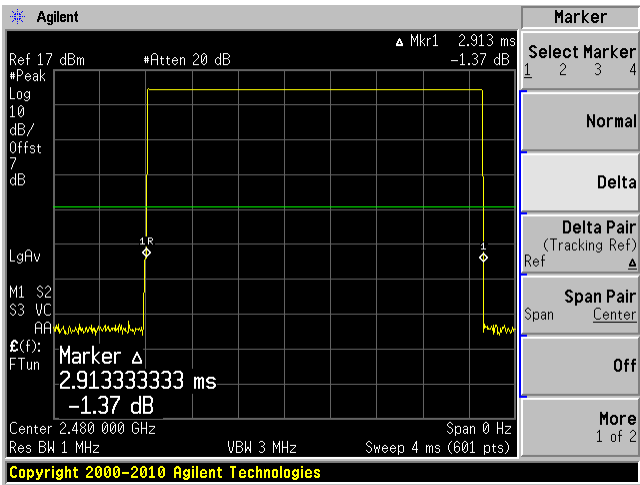
Low channel: 2402 MHz



Middle Channel: 2440 MHz

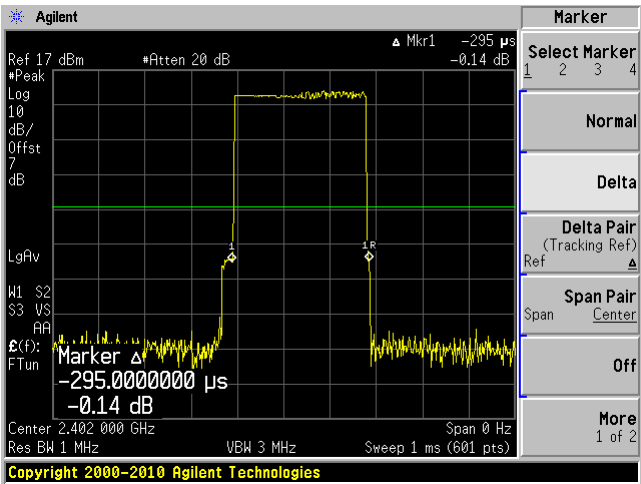


High Channel: 2480 MHz

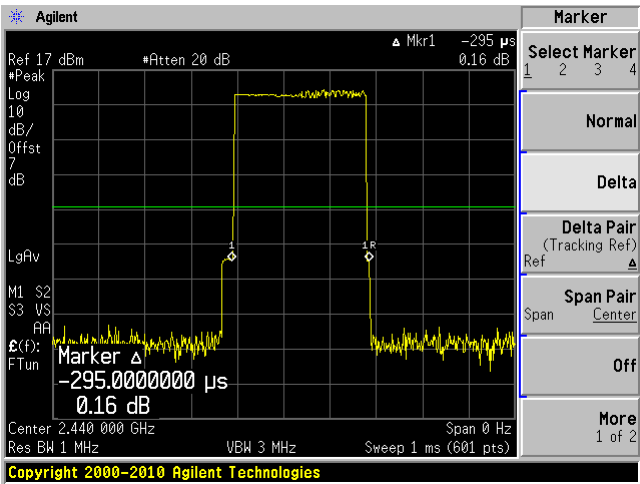


$\pi/4$ -DQPSK – DH1

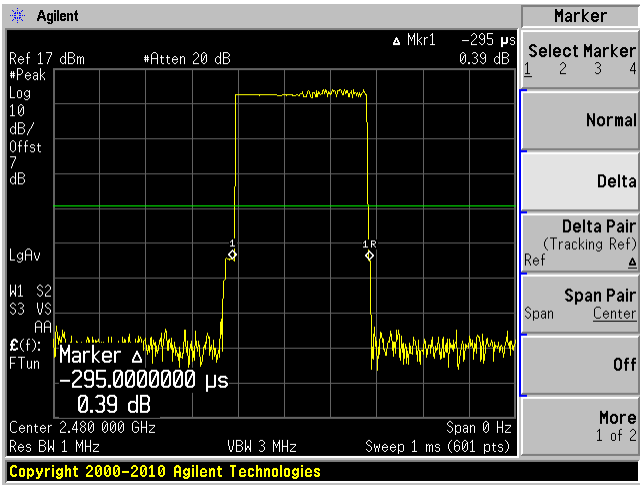
Low channel: 2402 MHz



Middle Channel: 2440 MHz

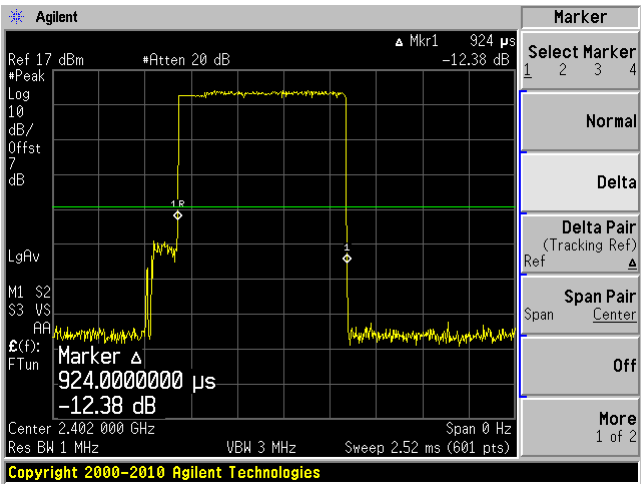


High Channel: 2480 MHz

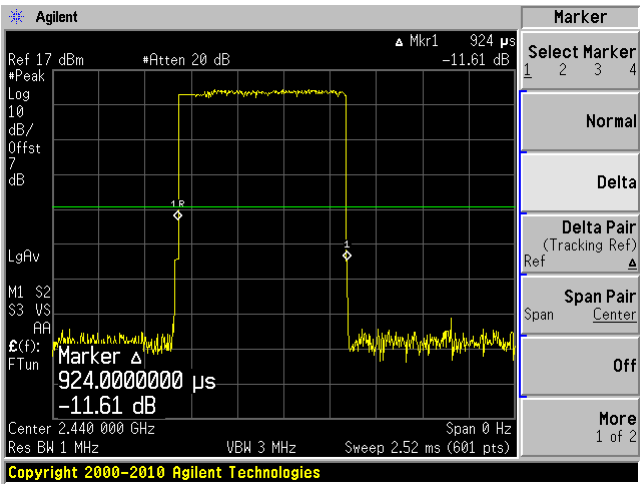


$\pi/4$ -DQPSK – DH3

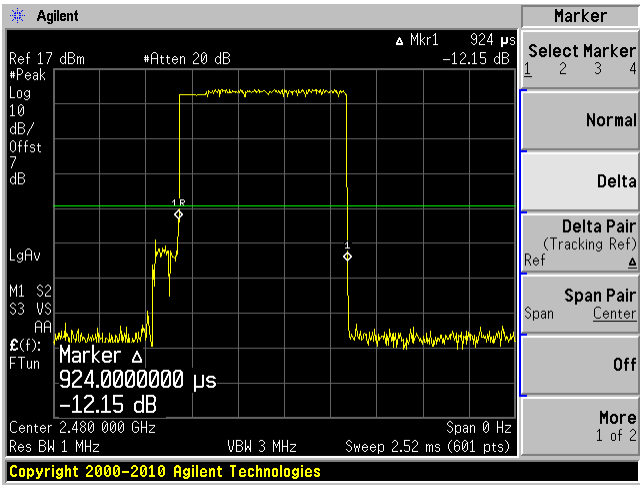
Low channel: 2402 MHz



Middle Channel: 2440 MHz

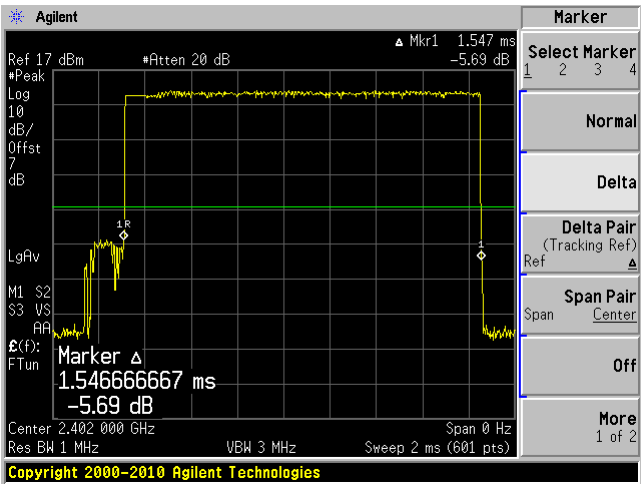


High Channel: 2480 MHz

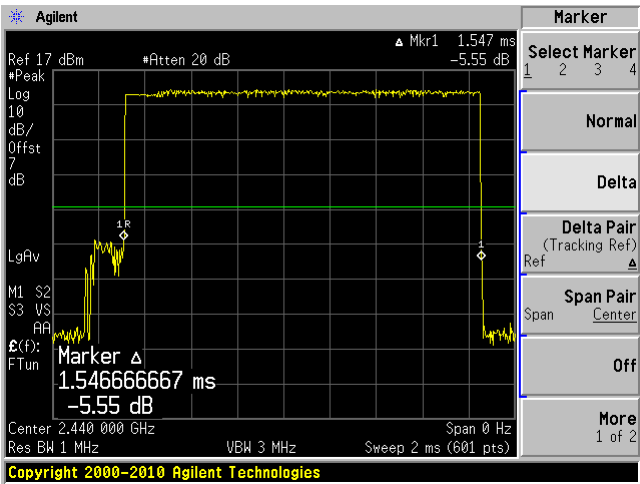


$\pi/4$ -DQPSK – DH5

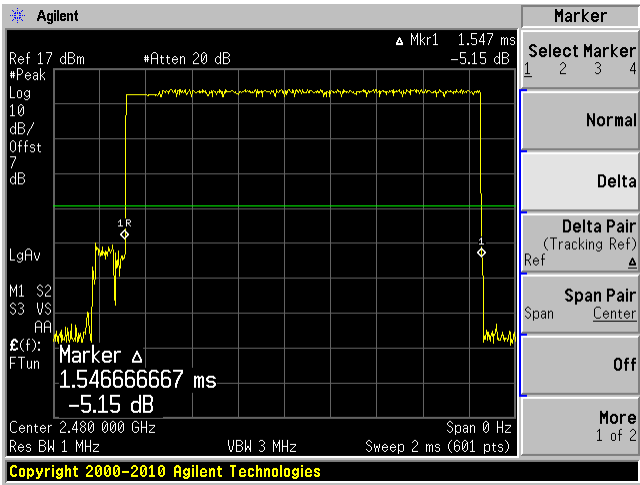
Low channel: 2402 MHz



Middle Channel: 2440 MHz

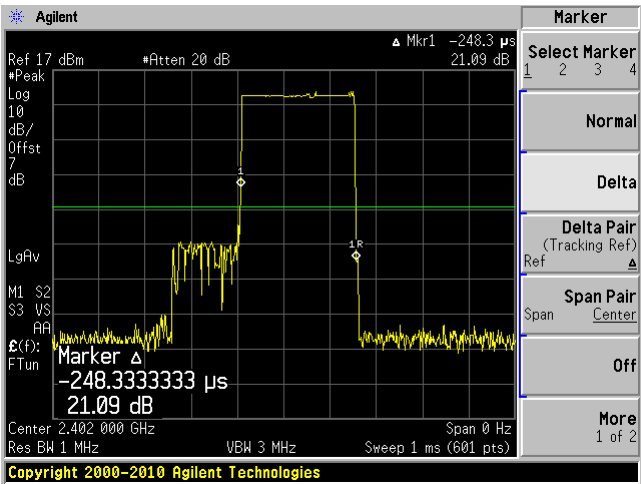


High Channel: 2480 MHz

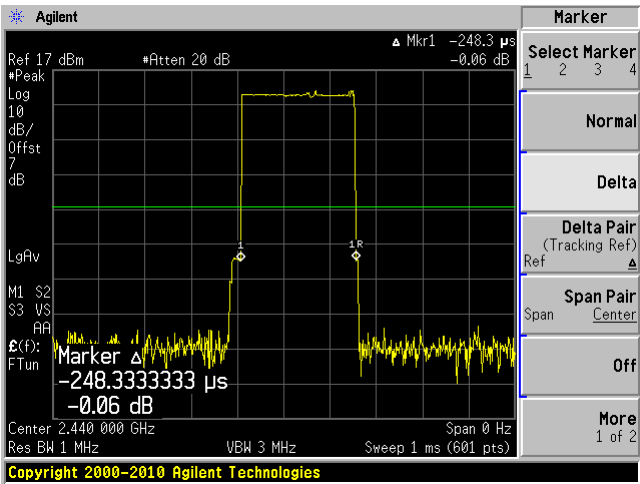


8PSK – DH1

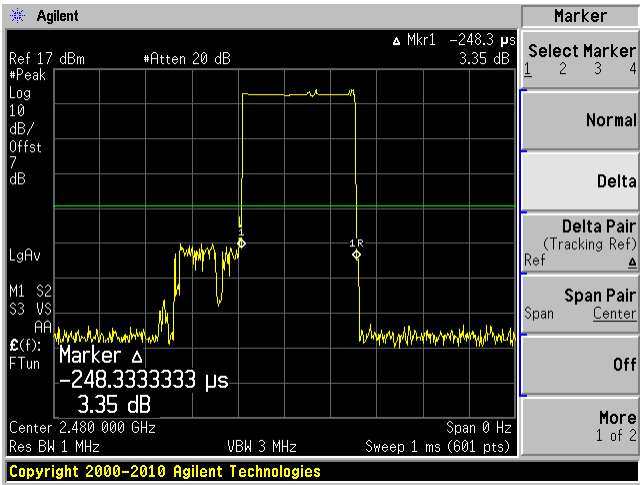
Low channel: 2402 MHz



Middle Channel: 2440 MHz

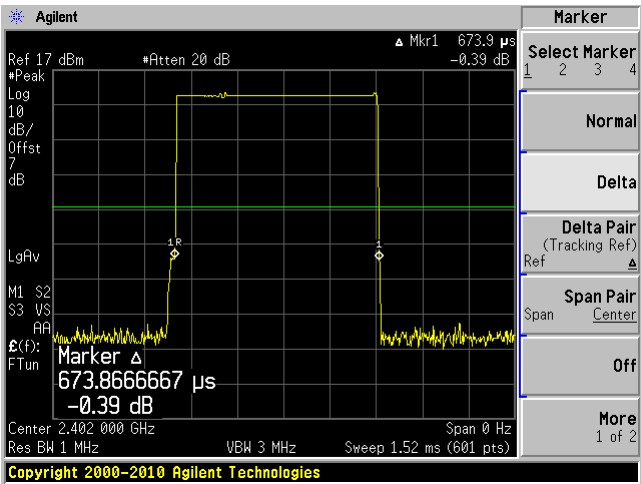


High Channel: 2480 MHz

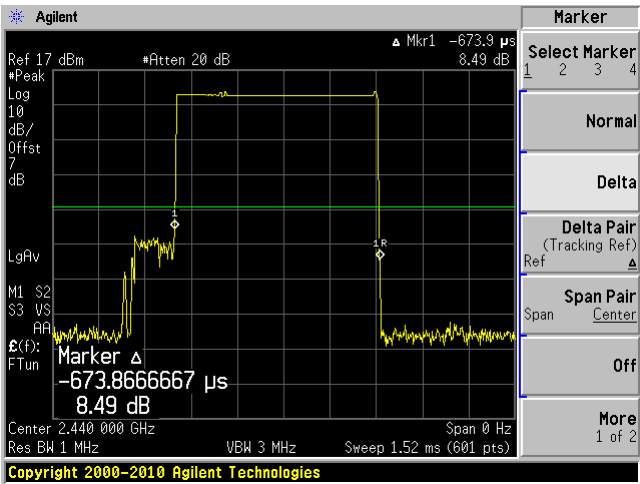


8PSK – DH3

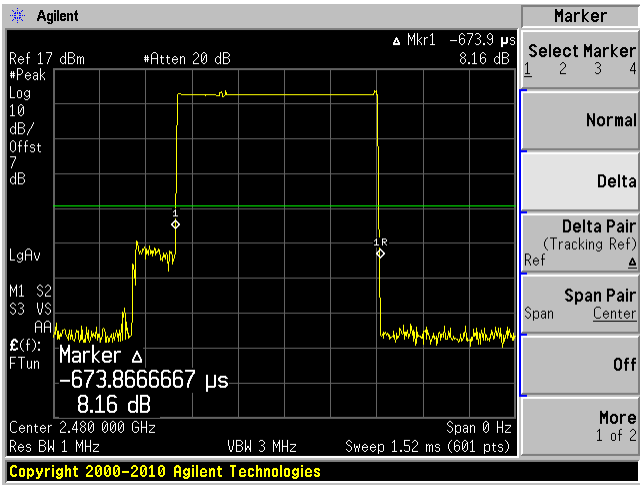
Low channel: 2402 MHz



Middle Channel: 2440 MHz

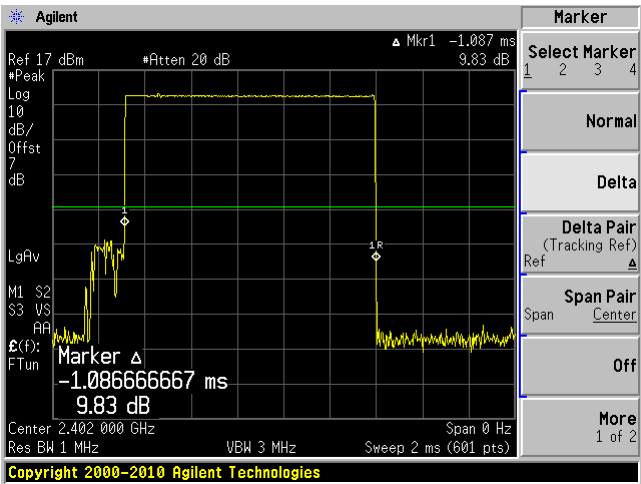


High Channel: 2480 MHz

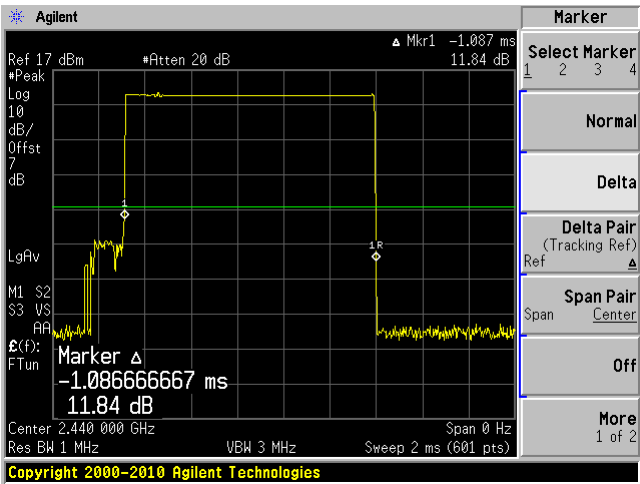


8PSK – DH5

Low channel: 2402 MHz



Middle Channel: 2440 MHz



High Channel: 2480 MHz

