FCC PART 15, SUBPART C
IC RSS-247, ISSUE 1, MAY 2015

TEST AND MEASUREMENT REPORT

For

NVIDIA CORPORATION

2701 San Tomas Expressway,

Santa Clara, CA 95050, USA

FCC ID: VOB-P2290W
IC: 7361A-P2290W

Report Type:	**Product Type:**
Original Report	Tablet

Prepared By:	Todd Moy Test Engineer
Report Number:	R1511101-247 DSS
Report Date:	2016-04-07
Reviewed By:	Simon Ma RF Lead

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1511101-247 DSS	Original Report	2016-04-07

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *NVIDIA CORPORATION*, and their product model: *P2290W,* FCC ID: VOB-P2290W; IC: 7361A-P2290W or the "EUT" as referred to in this report. It is a tablet with Wi-Fi, Bluetooth and BLE functions. It operates in the 2.4 GHz and 5 GHz bands.

1.2 Mechanical Description of EUT

The EUT measures approximately 218 mm (L) x 123 mm (W) x 8 mm (H) and weight 350 g.

The test data gathered are from typical production sample, serial number: 0424515000300 assigned by NVIDIA CORPORATION

1.3 Objective

This report is prepared on behalf of *NVIDIA Corp,* in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commission's rules and IC RSS-247 Issue 1, MAY 2015.

The objective is to determine compliance with FCC Part 15.247 and IC RSS-247 rules for Output Power, Antenna Requirements, 20 dB Bandwidth, 100 kHz Bandwidth of Band Edges Measurement, Conducted and Radiated Spurious Emissions, Number of Hopping Channels, Dwell Time, and Hopping Channel Separation.

1.4 Related Submittal(s)/Grant(s)

FCC Part 15, Subpart C, Equipment DTS with FCC ID: VOB-P2290W
FCC Part 15, Subpart E, Equipment NII with FCC ID: VOB-P2290W

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

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 $\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.

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 Luminares 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:
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 C63.10-2013, ANSI C63.4-2014, 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 in accordance to ANSI C63.10.

The worst-case data rates are determined by measuring the peak power across all data rates.

2.2 EUT Exercise Software

The test utility used was Android Debug Bridge provided by *NVIDIA CORPORATION*, the software was verified by *Todd Moy* to comply with the standard requirements being tested against.

2.3 Equipment Modifications

A hole was cut in the back of the EUT to access the antenna ports.

2.4 Local Support Equipment

Manufacturer	Description	Model
Dell	Laptop	Latitude D630

2.5 EUT Internal Configuration Details

Manufacturer	Description	Model
NVIDIA	Main Board	P2290
BYD	battery	11416519-00

2.6 Support Equipment

Manufacturer	Description	Model
NVIDIA	USB Power Adapter	SPA011AU5W2

2.7 Interface Ports and Cabling

Cable Description	Length (m)	To	From
USB Cable	< 1 m	Laptop	EUT
U.FL-RSMA pigtail	< 1 m	EUT	PSA

3 Summary of Test Results

Results reported relate only to the product tested.

FCC & IC Rules	Description of Test	Results
FCC §15.203 IC RSS-Gen §8.3	Antenna Requirement	Compliant
FCC §15.207 IC RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
FCC §2.1093, §15.247(i) IC RSS-102	RF Exposure	Compliant[1]
FCC §2.1051, §15.247 (d) IC RSS-247 §5.5	Spurious Emissions at Antenna Port	Compliant
FCC §2.1053, §15.205, §15.209, §15.247(d) IC RSS-247 §5.5 IC RSS-Gen §8.9, §8.10	Radiated Spurious Emissions	Compliant
FCC §15.247(a)(1) IC RSS-247 §5.1 (1)	20 dB & 99% Emission Bandwidth	Compliant
FCC §15.247(b)(1) IC RSS-247 §5.1(2)	Maximum Peak Output Power	Compliant
FCC §15.247(d) IC RSS-247 §5.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
FCC §15.247(a)(1)(iii) IC RSS-247 §5.1(4)	Number of Hopping Channels	Compliant
FCC §15.247(a)(1) IC RSS-247 §5.1 (2)	Hopping Channel Separation	Compliant
FCC §15.247(a)(1)(iii) IC RSS-247 §5.1 (4)	Dwell Time	Compliant

Note[1]: RF exposure analysis is covered in a separate report.

4 FCC §15.203 & IC RSS-Gen §8.3 - Antenna Requirements

4.1 Applicable Standards

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 §8.3: Transmitter Antenna

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the license-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

License-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the license-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of license-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. 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 a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

4.2 Antenna Description

The antennas used by the EUT are permanent attached antennas.

Antenna Port	Maximum Antenna Gain (dBi) @ 2.4 GHz
Wi-Fi 0/Bluetooth	1.7

5 FCC §2.1093, §15.247(i) & IC RSS-102 - RF Exposure

5.1 Applicable Standards

FCC §2.1093, §15.247(i) & IC RSS-102

5.2 Test Results

Please refer to the SAR Report: R1511101- SAR.

6 FCC §15.207 & IC RSS-Gen §8.8 - AC Line Conducted Emissions

6.1 Applicable Standards

As per FCC §15.207 and IC RSS-Gen §8.8 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 2
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.
Note 2: A linear average detector is required

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.10-2013 measurement procedure. The specification used was FCC §15.207 and IC RSS-Gen §8.8 limits.

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

The AC/DC power adapter of the EUT was connected with LISN-1 which provided 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 and the power cords of support equipment were connected to LISN-2.

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

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

6.4 Corrected Amplitude & Margin Calculation

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

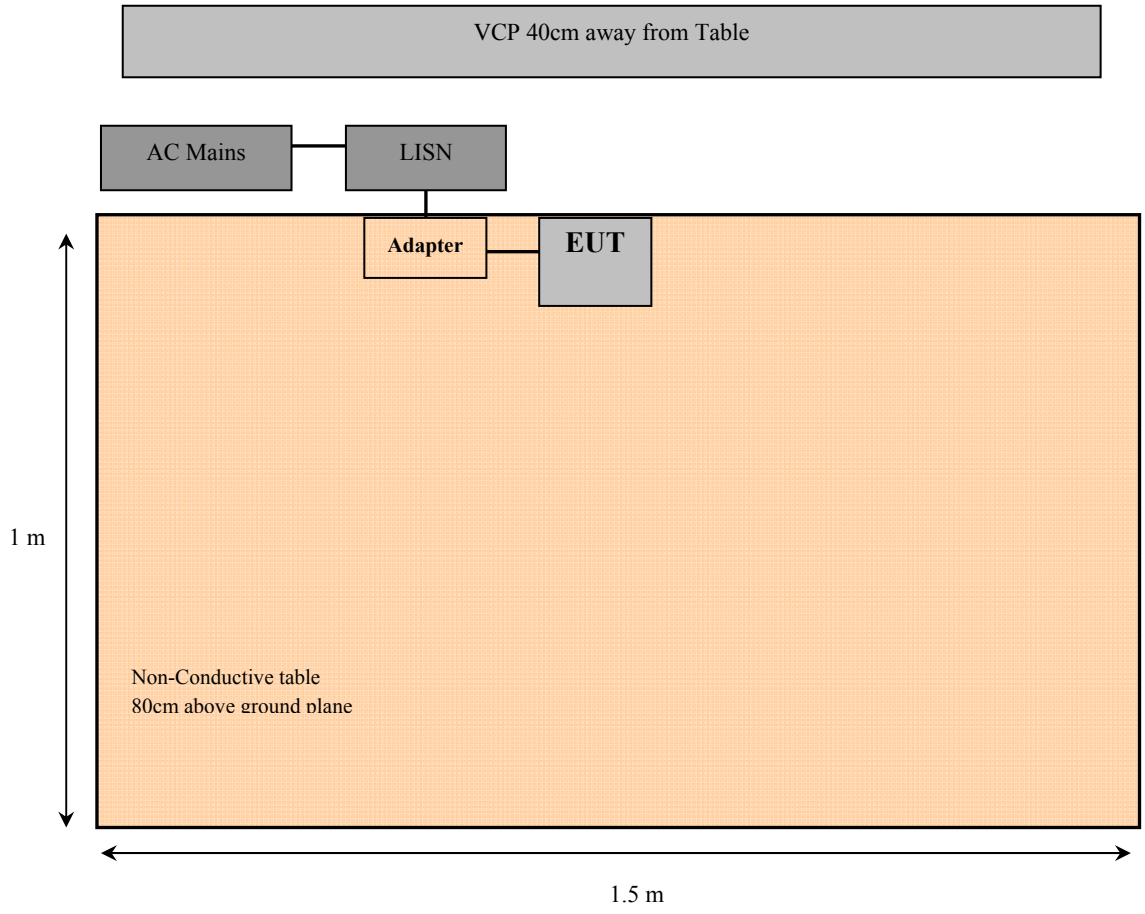
CA = Ai + CL + Atten

For example, a corrected amplitude of 46.2 dBuV = Indicated Reading (32.5 dBuV) + Cable Loss (3.7 dB) + Attenuator (10 dB)

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

Margin = Corrected Amplitude – Limit

6.5 Test Setup Block Diagram



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	100044	2015-07-23	1 year
Rohde & Schwarz	Impulse Limiter	ESH3-Z2	101963	2015-07-15	1 year
Keysight Technologies	RF Limiter	11867A	MY42242932	2015-12-15	1 year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150204	2015-03-06	1 year
Suirong	30 ft conductive emission cable	LMR 400	-	2015-03-05	1 year
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160129	2015-04-07	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:	15 ºC
Relative Humidity:	42 %
ATM Pressure:	101.31 kPa

The testing was performed by Leonard Grey on 2016-01-27 in 5 chamber 3.

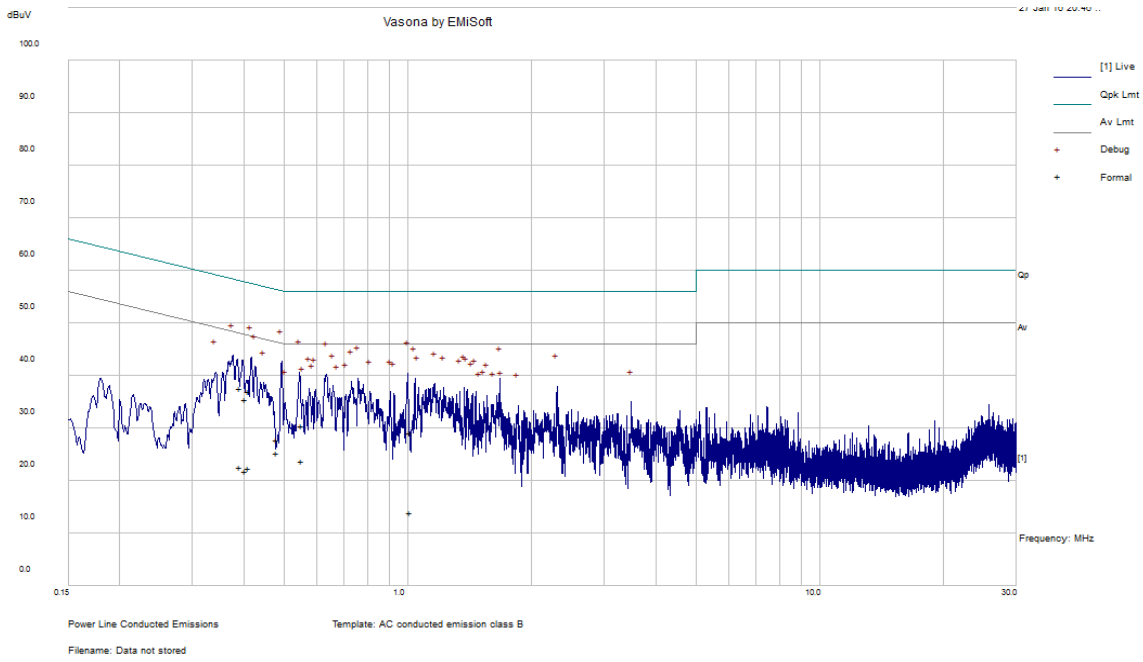
6.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC 15C and IC RSS-Gen standard's conducted emissions limits, with the margin reading of:

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Live/Neutral)**	**Range (MHz)**
-20.48	0.390888	Line	0.15-30

6.9 Conducted Emissions Test Plots and Data

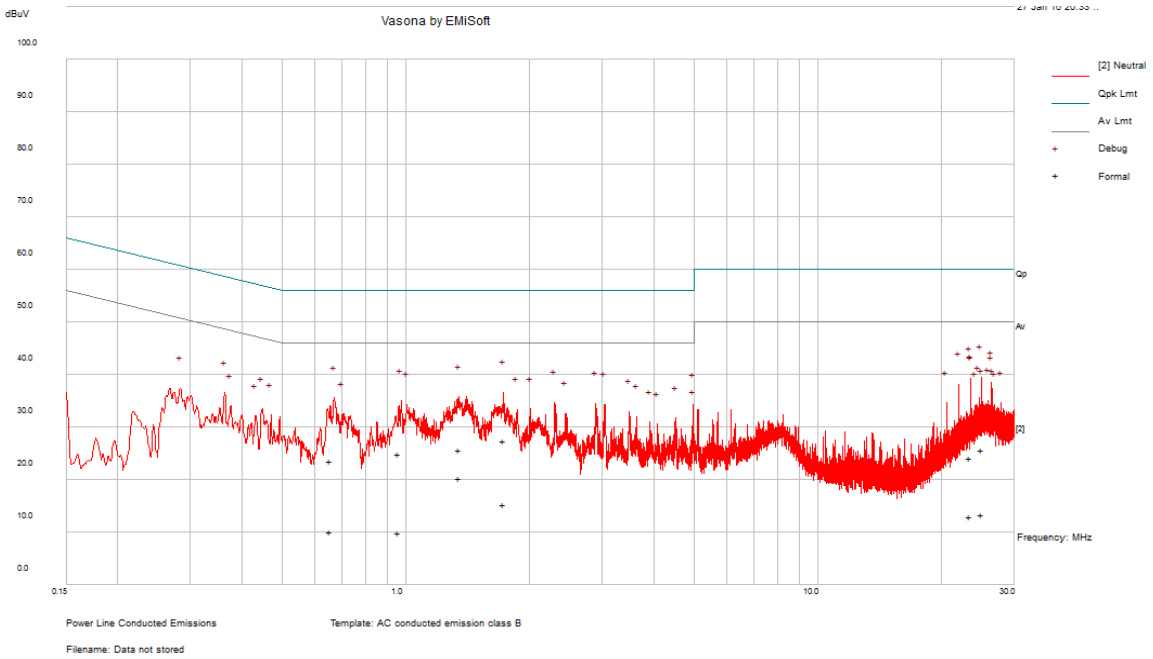
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.482328	27.74	Line	56.3	-28.56	QP
0.403896	35.44	Line	57.77	-22.33	QP
0.390888	37.57	Line	58.04	**-20.48**	QP
0.552468	30.55	Line	56	-25.45	QP
1.01667	29.27	Line	56	-26.73	QP
0.410472	36.98	Line	57.64	-20.66	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.482328	25.36	Line	46.3	-20.94	Ave.
0.403896	21.91	Line	47.77	-25.86	Ave.
0.390888	22.68	Line	48.04	-25.37	Ave.
0.552468	23.79	Line	46	-22.21	Ave.
1.01667	14.02	Line	46	-31.98	Ave.
0.410472	22.54	Line	47.64	-25.1	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
1.724856	27.52	Neutral	56	-28.48	QP
1.346004	25.76	Neutral	56	-30.24	QP
0.655836	23.51	Neutral	56	-32.49	QP
24.93322	25.69	Neutral	60	-34.31	QP
23.459	24.12	Neutral	60	-35.88	QP
0.957495	25.03	Neutral	56	-30.97	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
1.724856	15.31	Neutral	46	-30.69	Ave.
1.346004	20.26	Neutral	46	-25.74	Ave.
0.655836	10.17	Neutral	46	-35.83	Ave.
24.93322	13.39	Neutral	50	-36.61	Ave.
23.459	12.97	Neutral	50	-37.03	Ave.
0.957495	10.03	Neutral	46	-35.97	Ave.

7 FCC §15.209, §15.247(d) & IC RSS-247 §5.5, RSS-Gen §8.9, §8.10 - Spurious Radiated Emissions

7.1 Applicable Standards

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 §15.205(a) and RSS-Gen 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 §15.209(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 §15.247 (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-Gen 8.9,

> Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 4 or Table 5 below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 4 – General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Above 30 MHz

Frequency (MHz)	Field Strength (µv/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960*	500

* Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

Note: Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the specific RSS.

As per IC RSS-247 §5.5, 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 5.4(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.

7.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was the FCC 15 Subpart C and IC RSS-247 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.

7.3 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 was set 3 meter away from the testing antenna, which was varied from 1-4 meter, and the EUT was placed on a turntable, which was 0.8 meter and 1.5 meter above the ground plane for below and above 1000 MHz measurements, 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

7.4 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 indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (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 = Corrected Amplitude - Limit

7.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100044	2015-07-23	1 year
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2015-06-22	1 year
Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/R
Sunol Sciences	Antenna, Biconi-Log	JB3	A020106-2	2015-07-11	2 Years
EMCO	Antenna, Horn	3115	9511-4627	2016-01-18	2 years
Agilent	Pre-Amplifier	8447D	2944A10187	2015-03-20	1 year
Suirong	30 ft conductive emission cable	LMR 400	-	2015-03-05	1 year
-	SMA cable	-	C0002	Each time[1]	N/A
IW Microwave	High Frequency Cable	DC-1438	SPS-2303-3840-SPS	2016-01-18	1 year
Hewlett-Packard	5 ft N-type RF cable	-	1268	2015-05-15	1 year
Hewlett	Pre-Amplifier	8449B	3008A01978	2015-03-11	1year
Wisewave	Pre-Amplifier	ALN-22093530-01	12263-01	2015-04-28	1 year
Wisewave	Antenna, Horn	ARH-4223-02	10555-02	2013-09-20	3 year

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

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

7.6 Test Environmental Conditions

Temperature:	22 ºC
Relative Humidity:	42 %
ATM Pressure:	102.7 kPa

The testing was performed by Leonard Grey on 2016-01-27 in 5m chamber 3.

7.7 Summary of Test Results

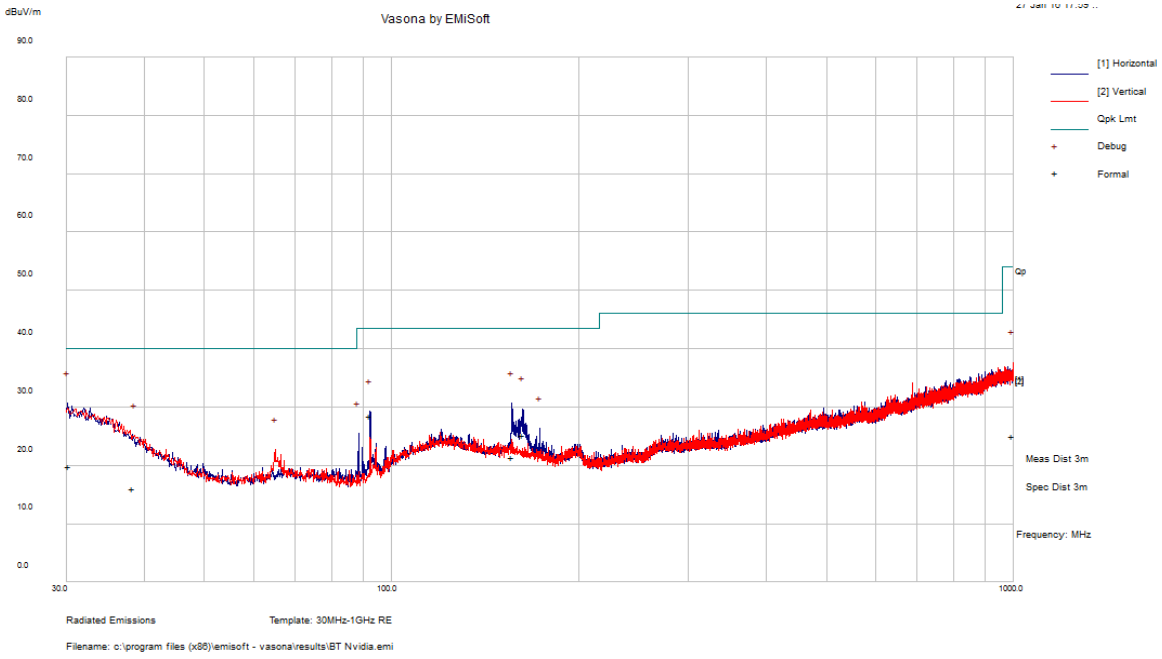
According to the data hereinafter, the EUT complied with FCC Title 47, Part 15C and IC RSS-247 standard's radiated emissions limits, and had the worst margin of:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-1.43	4960	Horizontal	GFSK, High Channel

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

7.8 Radiated Emissions Test Results

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



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
30.33125	19.92	150	H	169	40	-20.08	QP
156.2818	21.4	115	H	332	43.5	-22.1	QP
162.5238	25.14	100	H	94	43.5	-18.36	QP
92.3875	28.46	142	H	129	43.5	-15.04	QP
38.382	15.98	145	V	72	40	-24.02	QP
997.5203	25.11	134	V	182	54	-28.89	QP

2) 1–25 GHz Measured at 3 meters

GFSK mode

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											
2402	64.39	107	283	V	29.04	3.43	0.00	96.86	-	-	Peak
2402	64.79	23	262	H	29.04	3.43	0.00	97.26	-	-	Peak
2402	63.96	107	283	V	29.04	3.43	0.00	96.43	-	-	Ave
2402	64.26	23	262	H	29.04	3.43	0.00	96.73	-	-	Ave
2390	28.21	107	283	V	29.04	3.43	0.00	60.68	74	-13.32	Peak
2390	27.71	23	262	H	29.04	3.43	0.00	60.18	74	-13.82	Peak
2390	14.03	107	283	V	29.04	3.43	0.00	46.50	54	-7.50	Ave
2390	14.02	23	262	H	29.04	3.43	0.00	46.49	54	-7.51	Ave
4804	45.89	0	100	V	32.47	6.06	33.72	50.70	74	-23.30	Peak
4804	46.72	0	100	H	32.47	6.06	33.72	51.53	74	-22.47	Peak
4804	32.01	0	100	V	32.47	6.06	33.72	36.82	54	-17.18	Ave
4804	32.04	0	100	H	32.47	6.06	33.72	36.85	54	-17.15	Ave
7206	44.40	0	100	V	36.69	6.92	33.93	54.08	74	-19.92	Peak
7206	44.66	0	100	H	36.69	6.92	33.93	54.34	74	-19.66	Peak
7206	29.75	0	100	V	36.69	6.92	33.93	39.43	54	-14.57	Ave
7206	29.74	0	100	H	36.69	6.92	33.93	39.42	54	-14.58	Ave
9608	45.29	0	100	V	37.84	9.84	34.31	58.65	74	-15.35	Peak
9608	45.07	0	100	H	37.84	9.84	34.31	58.43	74	-15.57	Peak
9608	30.16	0	100	V	37.84	9.84	34.31	43.52	54	-10.48	Ave
9608	30.29	0	100	H	37.84	9.84	34.31	43.65	54	-10.35	Ave
Middle Channel 2441 MHz											
2441	66.54	82	279	V	29.41	3.43	0.00	99.38	-	-	Peak
2441	67.34	18	189	H	29.41	3.43	0.00	100.18	-	-	Peak
2441	66.08	82	279	V	29.41	3.43	0.00	98.92	-	-	Ave
2441	66.68	18	189	H	29.41	3.43	0.00	99.52	-	-	Ave
4882	48.57	333	129	V	32.64	6.06	33.75	53.52	74	-20.48	Peak
4882	49.44	183	150	H	32.64	6.06	33.75	54.39	74	-19.61	Peak
4882	41.20	333	129	V	32.64	6.06	33.75	46.15	54	-7.85	Ave
4882	41.62	183	150	H	32.64	6.06	33.75	46.57	54	-7.43	Ave
7323	43.87	0	100	V	37.15	7.39	33.99	54.43	74	-19.57	Peak
7323	44.44	0	100	H	37.15	7.39	33.99	55.00	74	-19.00	Peak
7323	29.28	0	100	V	37.15	7.39	33.99	39.84	54	-14.16	Ave
7323	29.19	0	100	H	37.15	7.39	33.99	39.75	54	-14.25	Ave
9764	46.00	0	100	V	37.92	8.72	34.31	58.33	74	-15.67	Peak
9764	46.10	0	100	H	37.92	8.72	34.31	58.43	74	-15.57	Peak
9764	30.79	0	100	V	37.92	8.72	34.31	43.12	54	-10.88	Ave
9764	30.82	0	100	H	37.92	8.72	34.31	43.15	54	-10.85	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											
2480	66.68	74	280	V	29.41	3.43	0.00	99.52	-	-	Peak
2480	68.18	358	300	H	29.41	3.43	0.00	101.02	-	-	Peak
2480	66.28	74	280	V	29.41	3.43	0.00	99.12	-	-	Ave
2480	67.83	358	300	H	29.41	3.43	0.00	100.67	-	-	Ave
2483.5	27.99	74	280	V	29.41	3.43	0.00	60.83	74	-13.17	Peak
2483.5	27.08	358	300	H	29.41	3.43	0.00	59.92	74	-14.08	Peak
2483.5	13.65	74	280	V	29.41	3.43	0.00	46.49	54	-7.51	Ave
2483.5	13.68	358	300	H	29.41	3.43	0.00	46.52	54	-7.48	Ave
4960	51.96	327	191	V	32.91	5.31	34.62	55.56	74	-18.44	Peak
4960	52.92	147	200	H	32.99	5.31	34.62	56.60	74	-17.41	Peak
4960	46.80	327	191	V	32.91	5.31	34.62	50.40	54	-3.60	Ave
4960	48.90	147	200	H	32.99	5.31	34.62	52.58	54	**-1.43**	Ave
7440	44.33	0	100	V	37.14	7.46	33.99	54.94	74	-19.06	Peak
7440	44.97	0	100	H	37.14	7.46	33.99	55.58	74	-18.42	Peak
7440	29.52	0	100	V	37.14	7.46	33.99	40.13	54	-13.87	Ave
7440	29.51	0	100	H	37.14	7.46	33.99	40.12	54	-13.88	Ave
9920	44.25	0	100	V	37.99	9.11	34.39	56.95	74	-17.05	Peak
9920	44.35	0	100	H	37.99	9.11	34.39	57.05	74	-16.95	Peak
9920	29.22	0	100	V	37.99	9.11	34.39	41.92	54	-12.08	Ave
9920	29.34	0	100	H	37.99	9.11	34.39	42.04	54	-11.96	Ave

π/4-DQPSK mode

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											
2402	63.08	107	284	V	29.04	3.43	0.00	95.55	-	-	Peak
2402	64.15	15	143	H	29.04	3.43	0.00	96.62	-	-	Peak
2402	59.54	107	284	V	29.04	3.43	0.00	92.01	-	-	Ave
2402	60.36	15	143	H	29.04	3.43	0.00	92.83	-	-	Ave
2390	28.81	107	284	V	29.04	3.43	0.00	61.28	74	-12.72	Peak
2390	28.02	15	143	H	29.04	3.43	0.00	60.49	74	-13.51	Peak
2390	14.03	107	284	V	29.04	3.43	0.00	46.50	54	-7.50	Ave
2390	14.06	15	143	H	29.04	3.43	0.00	46.53	54	-7.47	Ave
4804	46.22	327	243	V	32.47	6.06	33.72	51.03	74	-22.97	Peak
4804	46.14	8	270	H	32.47	6.06	33.72	50.95	74	-23.05	Peak
4804	32.43	327	243	V	32.47	6.06	33.72	37.24	54	-16.76	Ave
4804	32.31	8	270	H	32.47	6.06	33.72	37.12	54	-16.88	Ave
7206	44.78	0	100	V	36.69	6.92	33.93	54.46	74	-19.54	Peak
7206	43.81	0	100	H	36.69	6.92	33.93	53.49	74	-20.51	Peak
7206	29.30	0	100	V	36.69	6.92	33.93	38.98	54	-15.02	Ave
7206	29.34	0	100	H	36.69	6.92	33.93	39.02	54	-14.98	Ave
9608	45.16	0	100	V	37.84	9.84	34.31	58.52	74	-15.48	Peak
9608	44.99	0	100	H	37.84	9.84	34.31	58.35	74	-15.65	Peak
9608	30.46	0	100	V	37.84	9.84	34.31	43.82	54	-10.18	Ave
9608	30.41	0	100	H	37.84	9.84	34.31	43.77	54	-10.23	Ave
Middle Channel 2441 MHz											
2441	65.86	84	283	V	29.41	3.43	0.00	98.70	-	-	Peak
2441	64.85	154	108	H	29.41	3.43	0.00	97.69	-	-	Peak
2441	62.3	84	283	V	29.41	3.43	0.00	95.14	-	-	Ave
2441	61.32	154	108	H	29.41	3.43	0.00	94.16	-	-	Ave
4882	46.49	346	191	V	32.64	6.06	33.75	51.44	74	-22.56	Peak
4882	47.08	156	270	H	32.64	6.06	33.75	52.03	74	-21.97	Peak
4882	34.42	346	191	V	32.64	6.06	33.75	39.37	54	-14.63	Ave
4882	35.51	156	270	H	32.64	6.06	33.75	40.46	54	-13.54	Ave
7323	44.20	0	100	V	37.15	7.39	33.99	54.76	74	-19.24	Peak
7323	44.37	0	100	H	37.15	7.39	33.99	54.93	74	-19.07	Peak
7323	29.03	0	100	V	37.15	7.39	33.99	39.59	54	-14.41	Ave
7323	28.93	0	100	H	37.15	7.39	33.99	39.49	54	-14.51	Ave
9764	44.75	0	100	V	37.92	8.72	34.31	57.08	74	-16.92	Peak
9764	45.19	0	100	H	37.92	8.72	34.31	57.52	74	-16.48	Peak
9764	30.30	0	100	V	37.92	8.72	34.31	42.63	54	-11.37	Ave
9764	30.36	0	100	H	37.92	8.72	34.31	42.69	54	-11.31	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											
2480	66.15	98	264	V	29.41	3.43	0.00	98.99	-	-	Peak
2480	66.81	19	119	H	29.41	3.43	0.00	99.65	-	-	Peak
2480	62.7	98	264	V	29.41	3.43	0.00	95.54	-	-	Ave
2480	63.32	19	119	H	29.41	3.43	0.00	96.16	-	-	Ave
2483.5	27.32	98	264	V	29.41	3.43	0.00	60.16	74	-13.84	Peak
2483.5	27.66	19	119	H	29.41	3.43	0.00	60.50	74	-13.50	Peak
2483.5	13.73	98	264	V	29.41	3.43	0.00	46.57	54	-7.43	Ave
2483.5	13.67	19	119	H	29.41	3.43	0.00	46.51	54	-7.49	Ave
4960	49.00	342	187	V	32.91	5.31	34.62	52.60	74	-21.40	Peak
4960	49.18	166	257	H	32.99	5.31	34.62	52.86	74	-21.15	Peak
4960	39.73	342	187	V	32.91	5.31	34.62	43.33	54	-10.67	Ave
4960	40.08	166	257	H	32.99	5.31	34.62	43.76	54	-10.25	Ave
7440	44.18	0	100	V	37.14	7.46	33.99	54.79	74	-19.21	Peak
7440	44.06	0	100	H	37.14	7.46	33.99	54.67	74	-19.33	Peak
7440	29.08	0	100	V	37.14	7.46	33.99	39.69	54	-14.31	Ave
7440	29.16	0	100	H	37.14	7.46	33.99	39.77	54	-14.23	Ave
9920	43.65	0	100	V	37.99	9.11	34.39	56.35	74	-17.65	Peak
9920	43.79	0	100	H	37.99	9.11	34.39	56.49	74	-17.51	Peak
9920	28.57	0	100	V	37.99	9.11	34.39	41.27	54	-12.73	Ave
9920	28.54	0	100	H	37.99	9.11	34.39	41.24	54	-12.76	Ave

8DPSK mode

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											
2402	62.88	80	277	V	29.04	3.43	0.00	95.35	-	-	Peak
2402	62.45	227	100	H	29.04	3.43	0.00	94.92	-	-	Peak
2402	58.8	80	277	V	29.04	3.43	0.00	91.27	-	-	Ave
2402	58.42	227	100	H	29.04	3.43	0.00	90.89	-	-	Ave
2390	28.51	80	277	V	29.04	3.43	0.00	60.98	74	-13.02	Peak
2390	28.17	227	100	H	29.04	3.43	0.00	60.64	74	-13.36	Peak
2390	14.08	80	277	V	29.04	3.43	0.00	46.55	54	-7.45	Ave
2390	14.07	227	100	H	29.04	3.43	0.00	46.54	54	-7.46	Ave
4804	45.57	0	100	V	32.47	6.06	33.72	50.38	74	-23.62	Peak
4804	44.80	0	100	H	32.47	6.06	33.72	49.61	74	-24.39	Peak
4804	31.40	0	100	V	32.47	6.06	33.72	36.21	54	-17.79	Ave
4804	31.75	0	100	H	32.47	6.06	33.72	36.56	54	-17.44	Ave
7206	43.91	0	100	V	36.69	6.92	33.93	53.59	74	-20.41	Peak
7206	44.50	0	100	H	36.69	6.92	33.93	54.18	74	-19.82	Peak
7206	29.02	0	100	V	36.69	6.92	33.93	38.70	54	-15.30	Ave
7206	29.12	0	100	H	36.69	6.92	33.93	38.80	54	-15.20	Ave
9608	44.83	0	100	V	37.84	9.84	34.31	58.19	74	-15.81	Peak
9608	45.10	0	100	H	37.84	9.84	34.31	58.46	74	-15.54	Peak
9608	30.00	0	100	V	37.84	9.84	34.31	43.36	54	-10.64	Ave
9608	30.06	0	100	H	37.84	9.84	34.31	43.42	54	-10.58	Ave
Middle Channel 2441 MHz											
2441	64.56	98	301	V	29.41	3.43	0.00	97.40	-	-	Peak
2441	65.31	230	269	H	29.41	3.43	0.00	98.15	-	-	Peak
2441	60.61	98	301	V	29.41	3.43	0.00	93.45	-	-	Ave
2441	61.35	230	269	H	29.41	3.43	0.00	94.19	-	-	Ave
4882	45.07	343	266	V	32.64	6.06	33.75	50.02	74	-23.98	Peak
4882	45.34	160	283	H	32.64	6.06	33.75	50.29	74	-23.71	Peak
4882	33.20	343	266	V	32.64	6.06	33.75	38.15	54	-15.85	Ave
4882	31.94	160	283	H	32.64	6.06	33.75	36.89	54	-17.11	Ave
7323	42.76	0	100	V	37.15	7.39	33.99	53.32	74	-20.68	Peak
7323	43.52	0	100	H	37.15	7.39	33.99	54.08	74	-19.92	Peak
7323	27.85	0	100	V	37.15	7.39	33.99	38.41	54	-15.59	Ave
7323	28.12	0	100	H	37.15	7.39	33.99	38.68	54	-15.32	Ave
9764	44.12	0	100	V	37.92	8.72	34.31	56.45	74	-17.55	Peak
9764	44.26	0	100	H	37.92	8.72	34.31	56.59	74	-17.41	Peak
9764	29.32	0	100	V	37.92	8.72	34.31	41.65	54	-12.35	Ave
9764	29.47	0	100	H	37.92	8.72	34.31	41.80	54	-12.20	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											
2480	67.44	76	263	V	29.41	3.43	0.00	100.28	-	-	Peak
2480	68.89	22	117	H	29.41	3.43	0.00	101.73	-	-	Peak
2480	63.59	76	263	V	29.41	3.43	0.00	96.43	-	-	Ave
2480	64.61	22	117	H	29.41	3.43	0.00	97.45	-	-	Ave
2483.5	27.94	76	263	V	29.41	3.43	0.00	60.78	74	-13.22	Peak
2483.5	27.59	22	117	H	29.41	3.43	0.00	60.43	74	-13.57	Peak
2483.5	13.66	76	263	V	29.41	3.43	0.00	46.50	54	-7.50	Ave
2483.5	13.68	22	117	H	29.41	3.43	0.00	46.52	54	-7.48	Ave
4960	48.63	340	236	V	32.91	5.31	34.62	52.23	74	-21.77	Peak
4960	45.61	193	266	H	32.99	5.31	34.62	49.29	74	-24.72	Peak
4960	39.75	340	236	V	32.91	5.31	34.62	43.35	54	-10.65	Ave
4960	34.59	193	266	H	32.99	5.31	34.62	38.27	54	-15.74	Ave
7440	43.73	0	100	V	37.14	7.46	33.99	54.34	74	-19.66	Peak
7440	43.41	0	100	H	37.14	7.46	33.99	54.02	74	-19.98	Peak
7440	28.68	0	100	V	37.14	7.46	33.99	39.29	54	-14.71	Ave
7440	28.58	0	100	H	37.14	7.46	33.99	39.19	54	-14.81	Ave
9920	44.22	0	100	V	37.99	9.11	34.39	56.92	74	-17.08	Peak
9920	43.41	0	100	H	37.99	9.11	34.39	56.11	74	-17.89	Peak
9920	28.33	0	100	V	37.99	9.11	34.39	41.03	54	-12.97	Ave
9920	28.31	0	100	H	37.99	9.11	34.39	41.01	54	-12.99	Ave

8 FCC §15.247(a) (1) & IC RSS-247 §5.1, RSS-Gen §6.6 - Emission Bandwidth

8.1 Applicable Standards

According to FCC §15.247(a) (1) and IC RSS-247 §5.1: the maximum 20 dB bandwidth of the hopping channel shall be presented.

8.2 Measurement Procedure

Span = approximately 2 to 5 times the 99% occupied bandwidth, centered on a hopping channel

RBW = 1% to 5 % of the 99% occupied bandwidth

VBW = 3RBW

Sweep = auto

Detector function = peak

Trace = max hold

8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2015-06-22	1 year
-	U. FL to SMA pigtail	-	-	Each time[1]	N/A
-	10 dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

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

8.4 Test Environmental Conditions

Temperature:	22 ºC
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Todd Moy on 2016-01-26 in RF site.

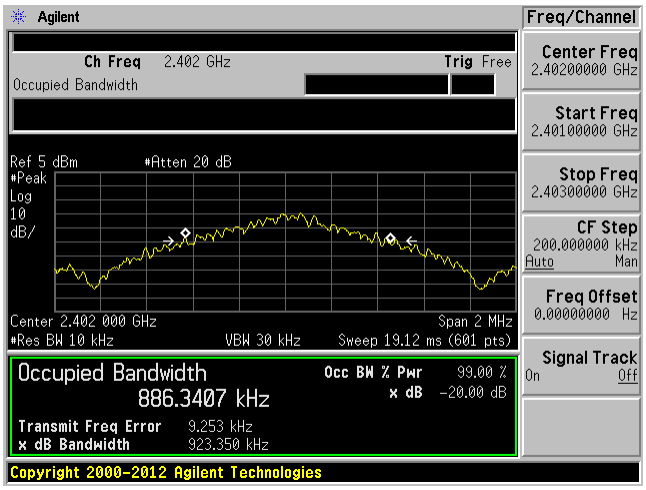
8.5 Test Results

Channel	Frequency (MHz)	99% OBW (kHz)	20 dB OBW (kHz)
GFSK			
Low	2402	886.34	923.35
Middle	2441	884.24	923.26
High	2480	881.86	923.40
π/4-DQPSK			
Low	2402	1226.9	1379
Middle	2441	1235.4	1387
High	2480	1232.4	1384
8DPSK			
Low	2402	1225	1374
Middle	2441	1228.2	1376
High	2480	1226.2	1373

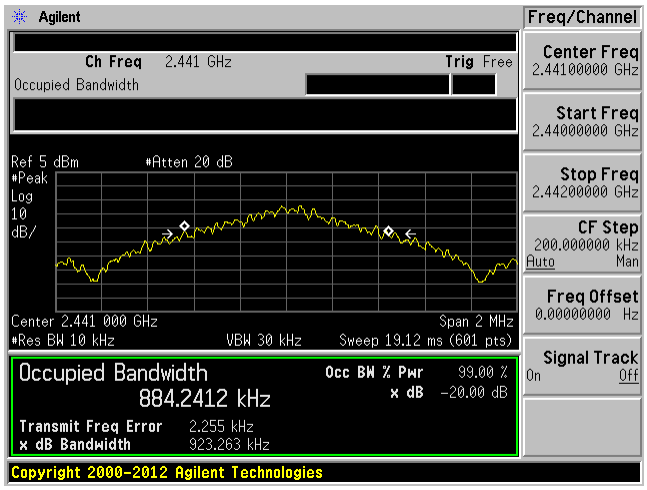
Please refer to the following plots for detailed test results.

GFSK

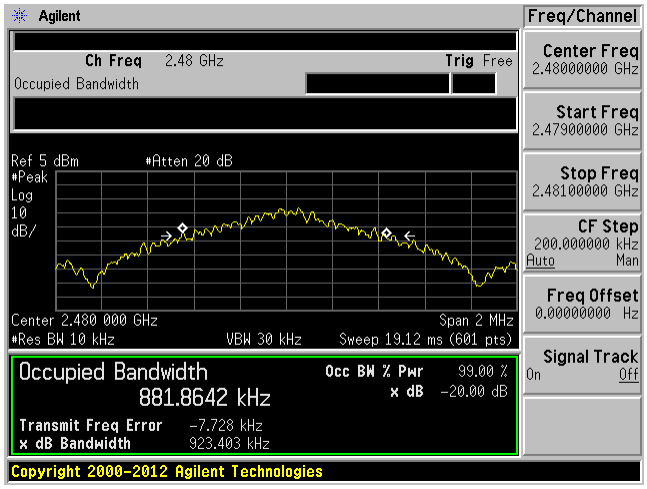
Low Channel 2402 MHz



Middle Channel 2441 MHz

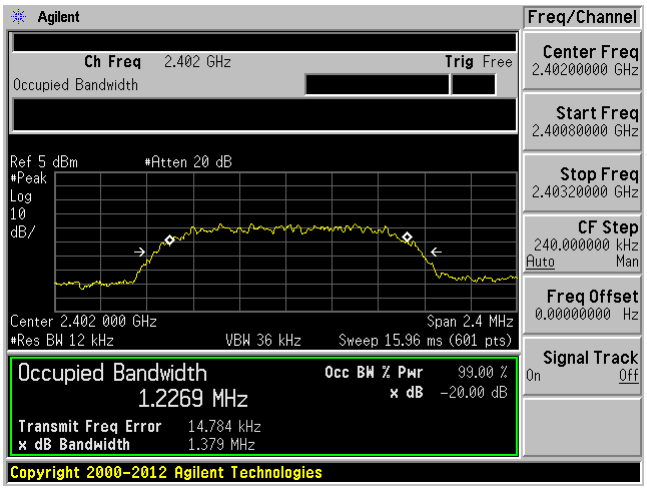


High Channel 2480 MHz

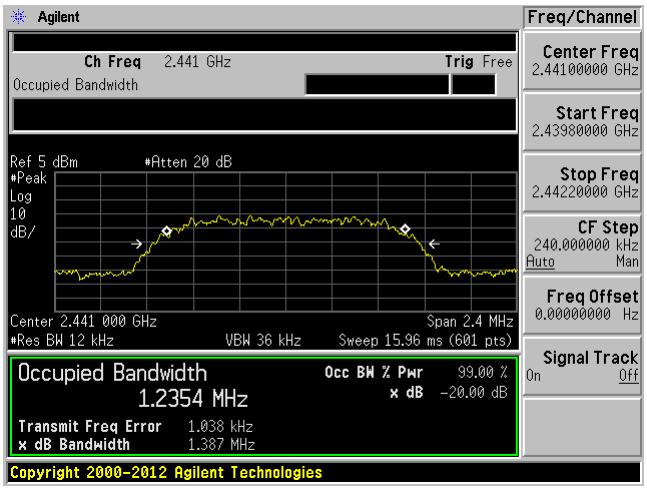


π/4-DQPSK

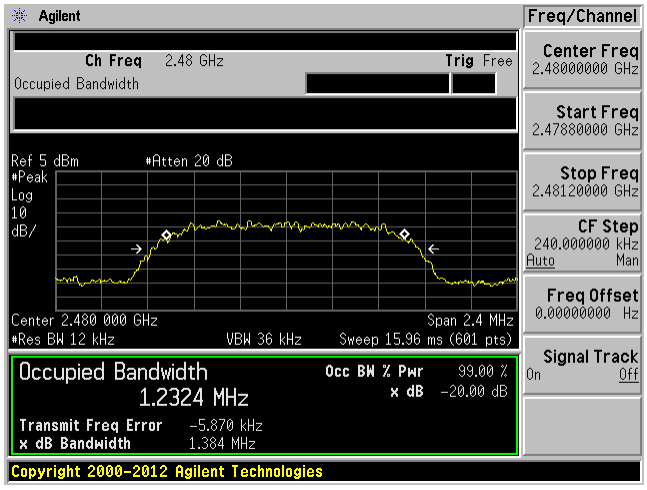
Low Channel 2402 MHz



Middle Channel 2441 MHz

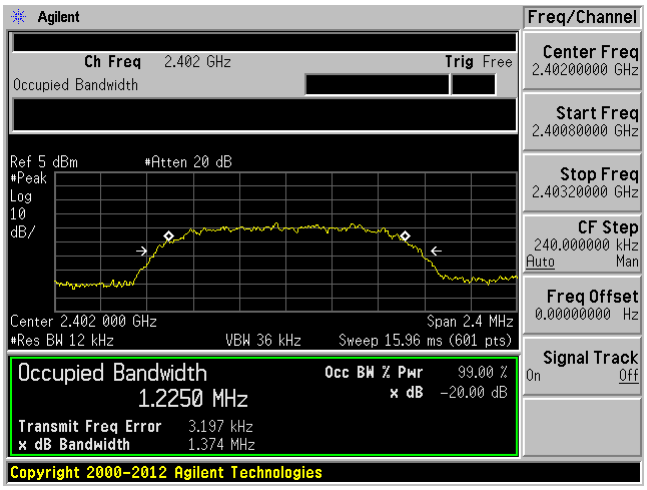


High Channel 2480 MHz

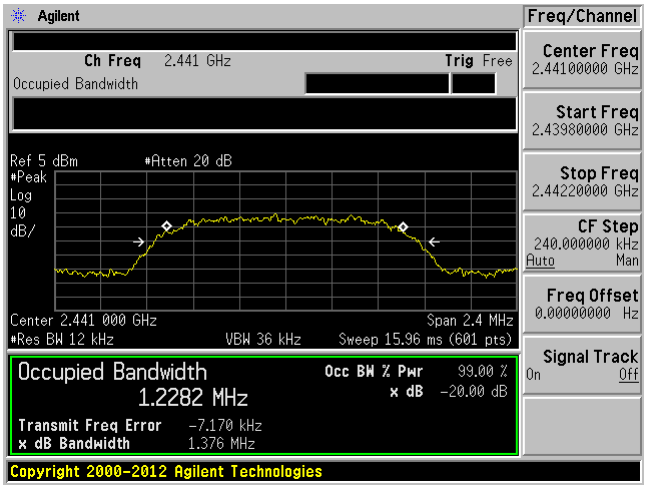


8DPSK

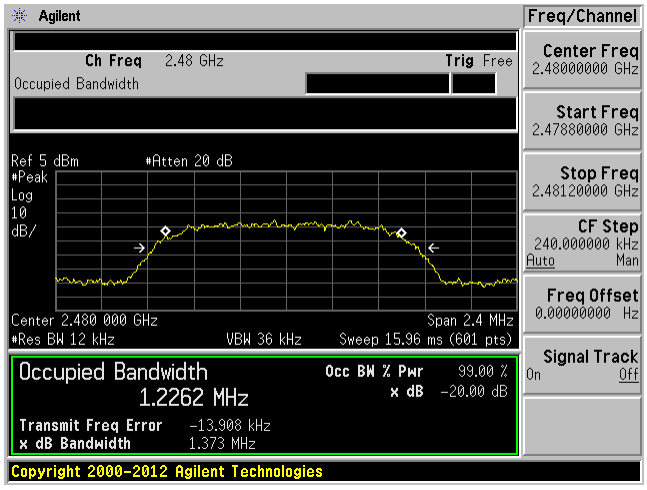
Low Channel 2402 MHz



Middle Channel 2441 MHz



High Channel 2480 MHz



9 FCC §15.247(b) (1) & IC RSS-247 §5.4 -Output Power

9.1 Applicable Standards

According to FCC §15.247(b) (1): 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.

According to RSS-247 §5.4: For frequency hopping systems operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W and the e.i.r.p. shall not exceed 4 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W and the e.i.r.p. shall not exceed 0.5 W if the hopset uses less than 75 hopping channels.

9.2 Measurement Procedure

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
RBW > the 20 dB bandwidth of the emission being measured
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2015-06-22	1 year
-	U. FL to SMA pigtail	-	-	Each time[1]	N/A
-	10dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

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:	22 ºC
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Todd Moy on 2016-01-26 in RF site.

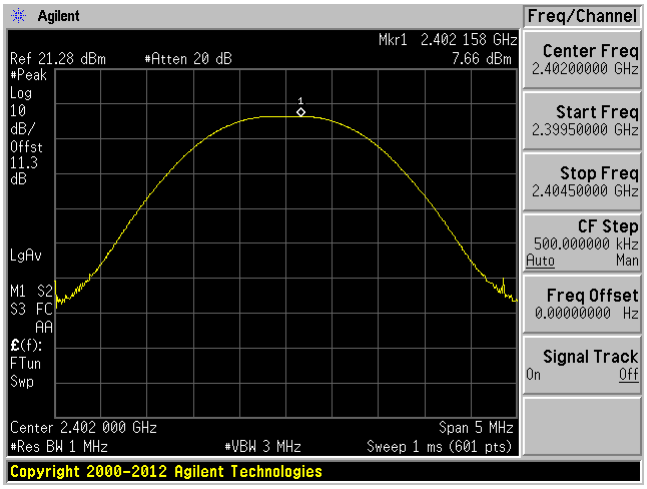
9.5 Test Results

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)
GFSK			
Low	2402	7.66	30
Middle	2441	10.74	30
High	2480	10	30
Π/4-DQPSK			
Low	2402	6.08	30
Middle	2441	8.58	30
High	2480	8.02	30
8DPSK			
Low	2402	6.54	30
Middle	2441	9.06	30
High	2480	8.39	30

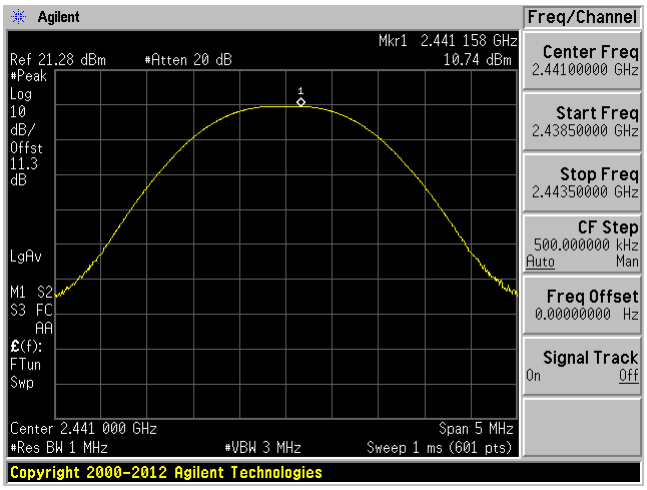
Please refer to the following plots for detailed test results.

GFSK

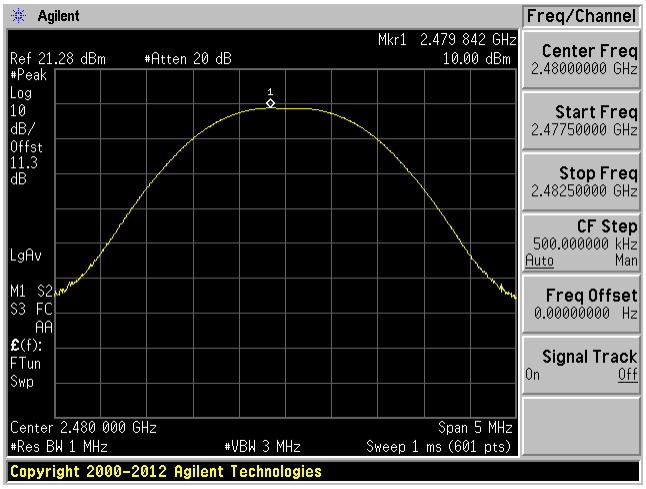
Low Channel 2402 MHz



Middle Channel 2441 MHz

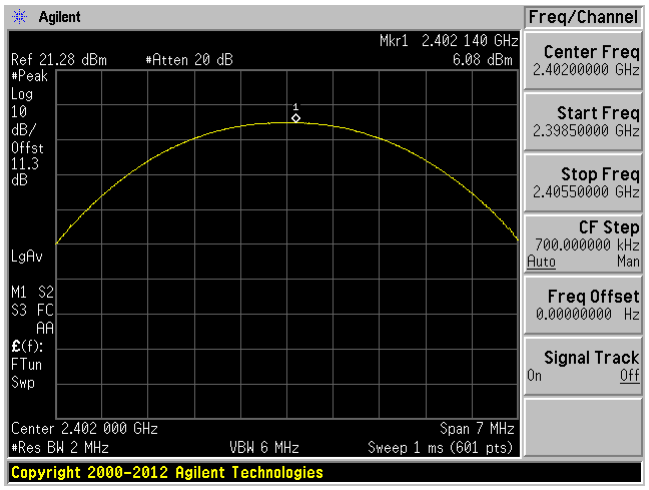


High Channel 2480 MHz

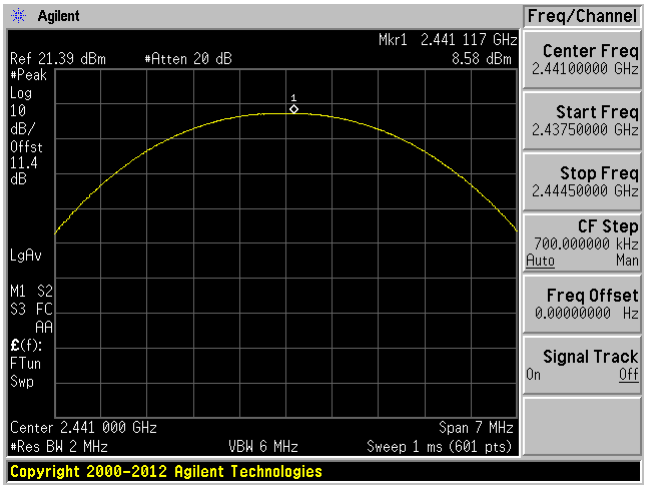


π/4-DQPSK

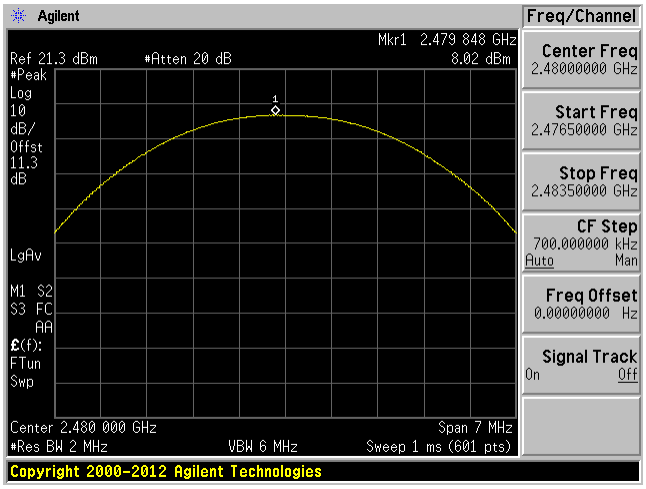
Low Channel 2402 MHz



Middle Channel 2441 MHz

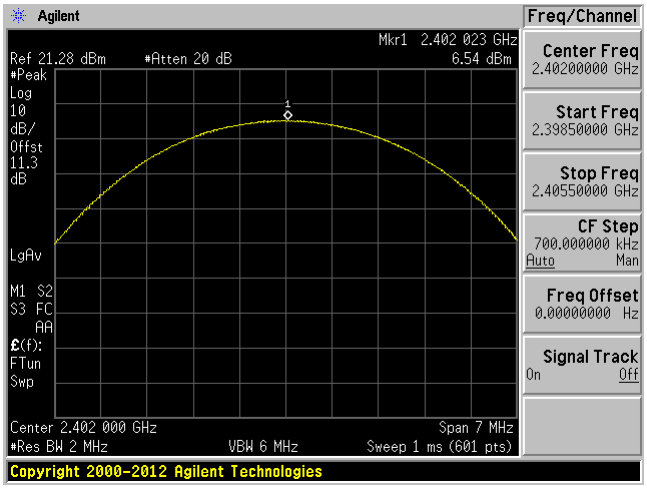


High Channel 2480 MHz

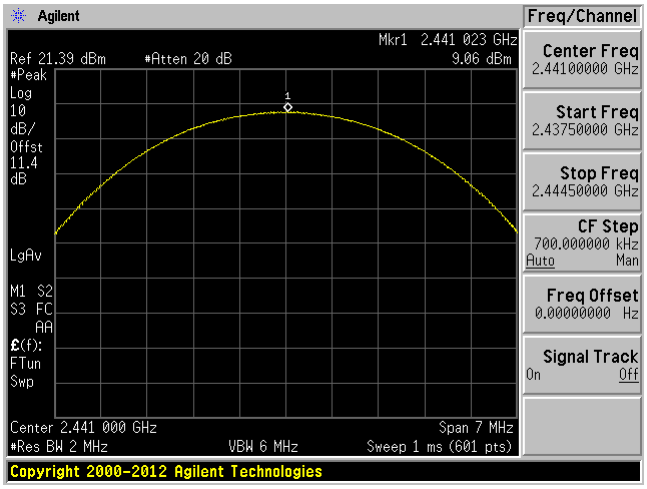


8DPSK

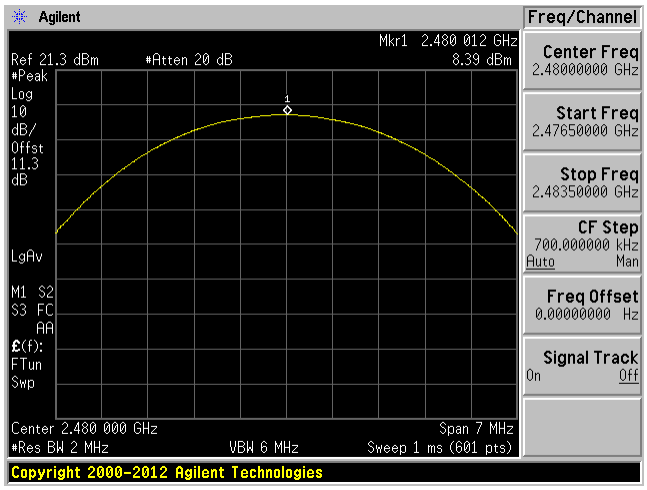
Low Channel 2402 MHz



Middle Channel 2441 MHz



High Channel 2480 MHz



10 FCC §15.247(d) & IC RSS-247 §5.5 - 100 kHz Bandwidth of Band Edges

10.1 Applicable Standards

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-247 §5.5.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 5.4(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.

10.2 Measurement Procedure

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation

RBW = 100 kHz
VBW = 300 kHz
Sweep = coupled
Detector function = peak
Trace = max hold

10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2015-06-22	1 year
-	U. FL to SMA pigtail	-	-	Each time[1]	N/A
-	10 dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

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

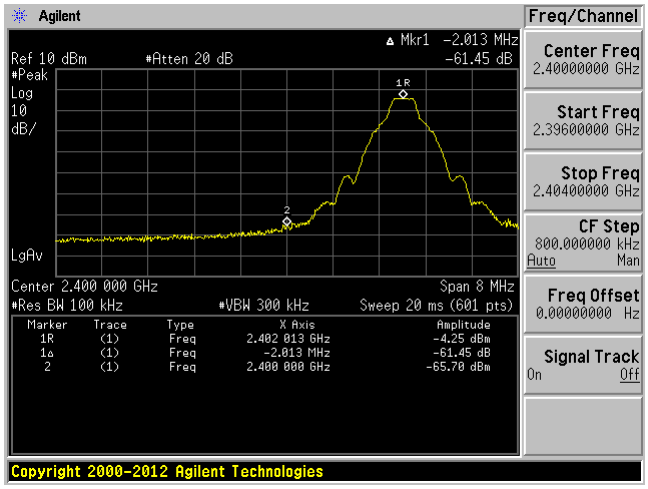
Temperature:	22 ºC
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Todd Moy on 2016-01-26 in RF site.

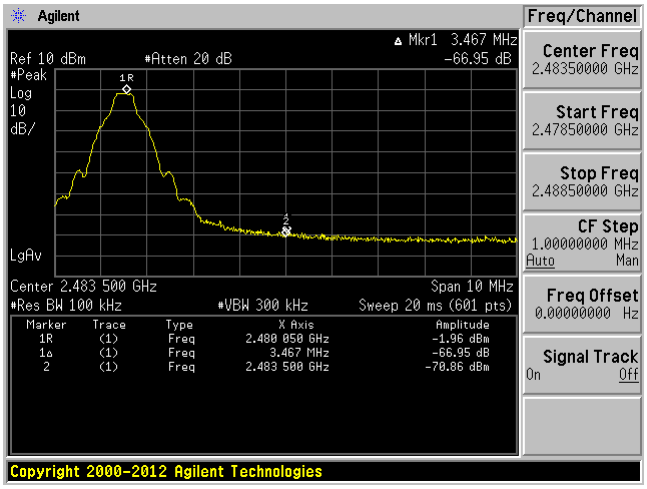
10.5 Test Results

GFSK

Low Channel 2402 MHz

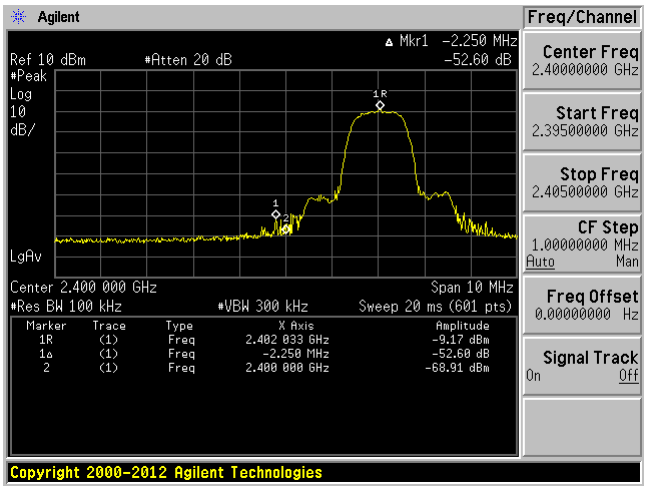


High Channel 2480 MHz

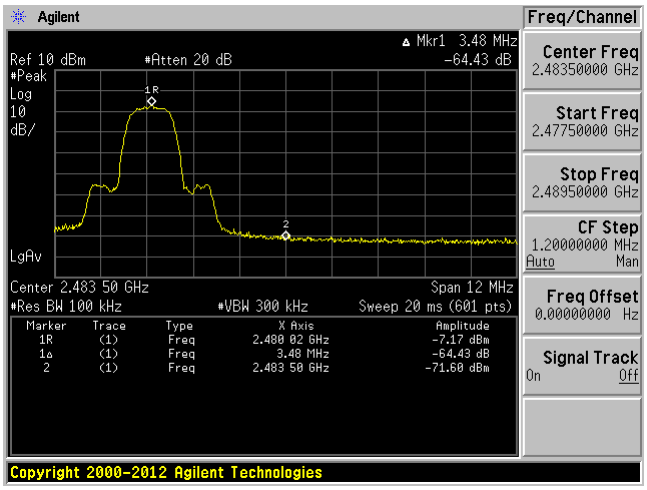


π/4-DQPSK

Low Channel 2402 MHz

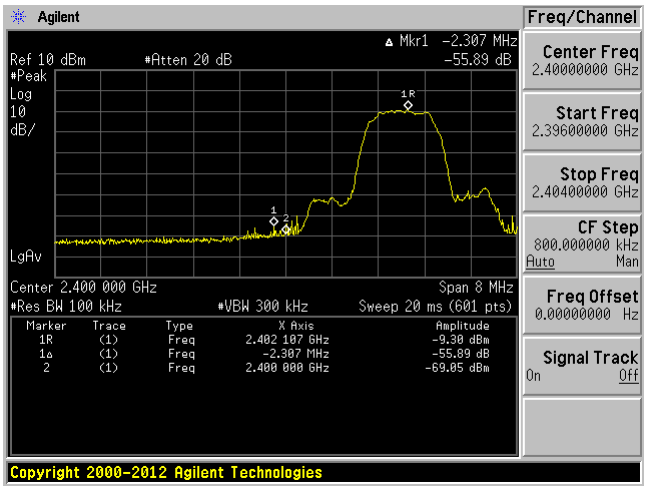


High Channel 2480 MHz

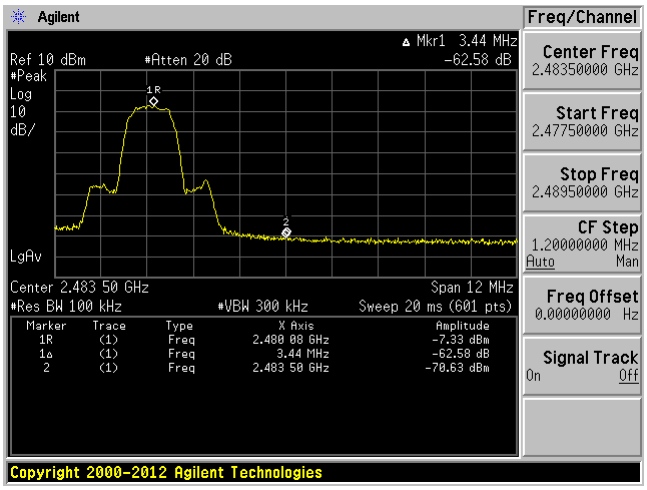


8DPSK

Low Channel 2402 MHz



High Channel 2480 MHz



11 FCC §15.247(a) (1) (iii) & IC RSS-247 §5.1 (4) - Dwell Time

11.1 Applicable Standards

According to FCC §15.247(a) (1) (iii) and RSS-247 §5.1(4), 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

11.2 Measurement Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = zero span, centered on a hopping channel
RBW ≤ channel spacing and where possible RBW should be set >> 1/*T*, where *T* is the expected dwell time per channel
Sweep = as necessary to capture the entire dwell time per hopping channel
Detector function = peak
Trace = max hold

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) =
(number of hops on spectrum analyzer) x (period specified in the requirements / analyzer sweep time)

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2015-06-22	1 year
Rohde & Schwarz	Signal Analyzer	FSQ26	200749	2015-03-09	1year
-	U. FL to SMA pigtail	-	-	Each time[1]	N/A
-	10 dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

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:	22 ºC
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Todd Moy on 2016-01-26 in RF site.

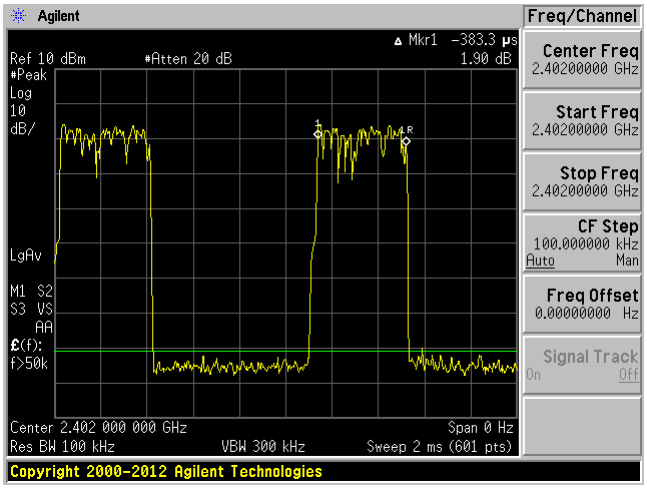
11.5 Test Results

Channel	Pulse Width (ms)	Number of Hops in the Period Specified in the Requirements	Average Time of Occupancy (s)	Limit (sec)	Results
GFSK,DH1					
Low	0.3833	310	0.1188	0.4	compliant
Middle	0.3967	300	0.1190	0.4	compliant
High	0.38	310	0.1178	0.4	compliant
GFSK,DH3					
Low	1.633	190	0.3103	0.4	compliant
Middle	1.633	120	0.1960	0.4	compliant
High	1.633	160	0.2613	0.4	compliant
GFSK,DH5					
Low	2.85	110	0.3135	0.4	compliant
Middle	2.85	120	0.3420	0.4	compliant
High	2.9	90	0.2610	0.4	compliant
Π/4-DQPSK,DH1					
Low	0.3917	320	0.1253	0.4	compliant
Middle	0.4	330	0.1320	0.4	compliant
High	0.4	320	0.1280	0.4	compliant
Π/4-DQPSK,DH3					
Low	1.483	160	0.2373	0.4	compliant
Middle	1.517	150	0.2276	0.4	compliant
High	1.483	160	0.2373	0.4	compliant
Π/4-DQPSK,DH5					
Low	2.99	100	0.2990	0.4	compliant
Middle	3	80	0.2400	0.4	compliant
High	3.04	80	0.2432	0.4	compliant
8DPSK,DH1					
Low	0.3901	300	0.1170	0.4	compliant
Middle	0.4053	320	0.1297	0.4	compliant
High	0.4307	320	0.1378	0.4	compliant
8DPSK,DH3					
Low	1.047	180	0.1885	0.4	compliant
Middle	1.047	160	0.1675	0.4	compliant
High	1.047	140	0.1466	0.4	compliant
8DPSK,DH5					
Low	Low	Low	Low	Low	Low
Middle	Middle	Middle	Middle	Middle	Middle
High	High	High	High	High	High

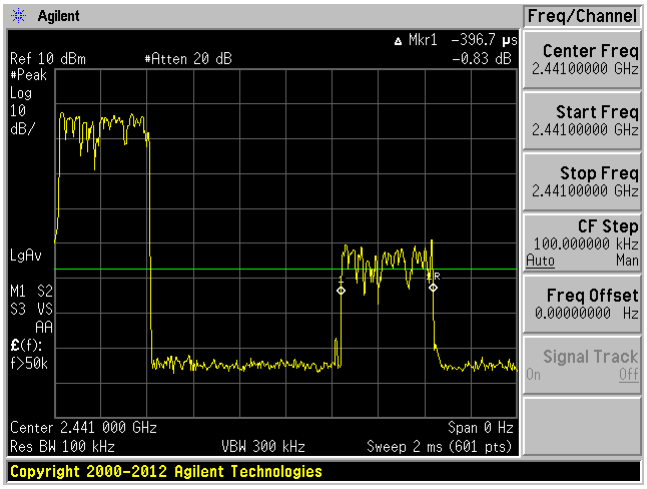
Please refer to the following plots for detailed test results.

GFSK, DH1 Pulse Width

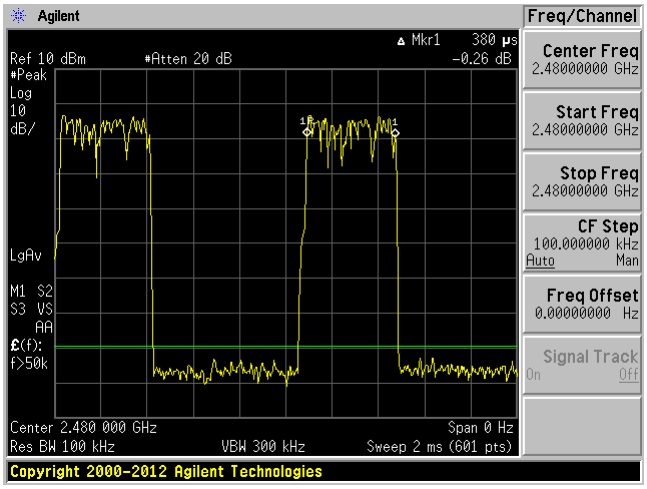
Low Channel 2402 MHz



Middle Channel 2441 MHz

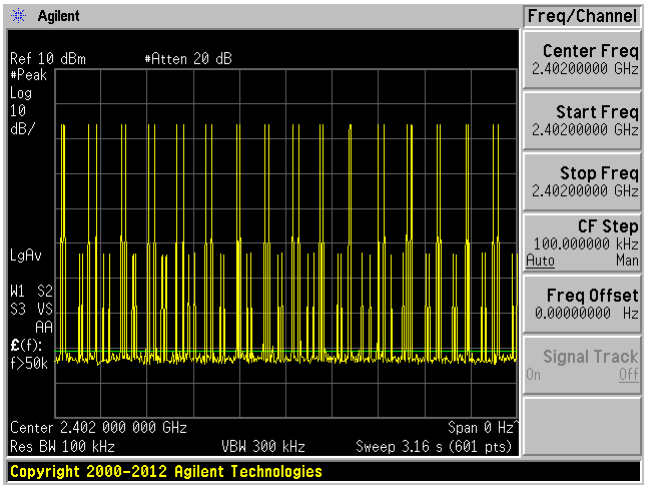


High Channel 2480 MHz

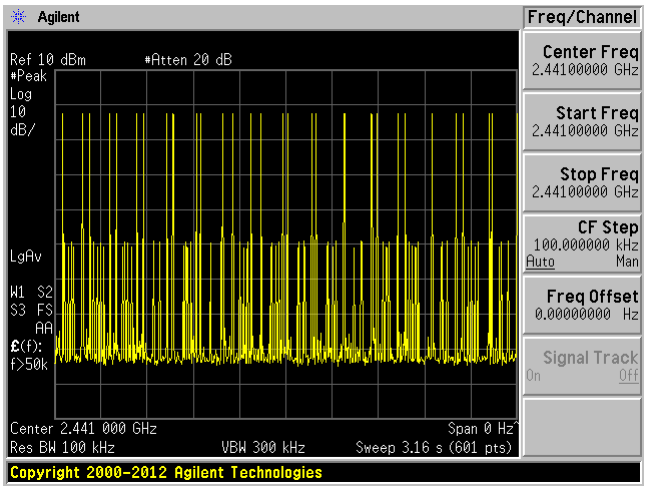


GFSK, DH1 Number of Pulses within a Specified Time

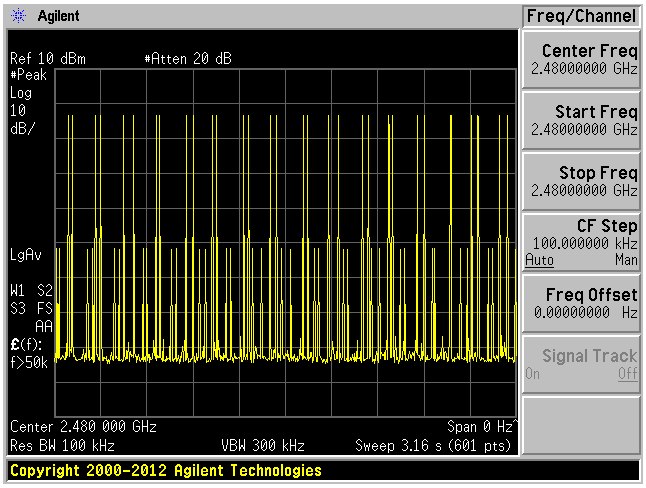
Low Channel 2402 MHz



Middle Channel 2441 MHz

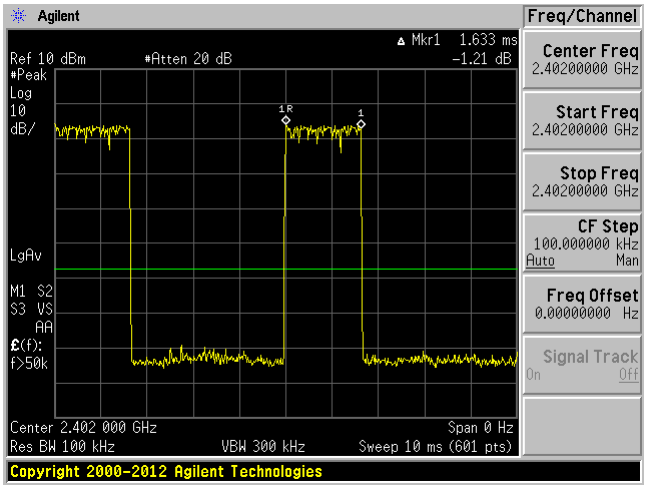


High Channel 2480 MHz

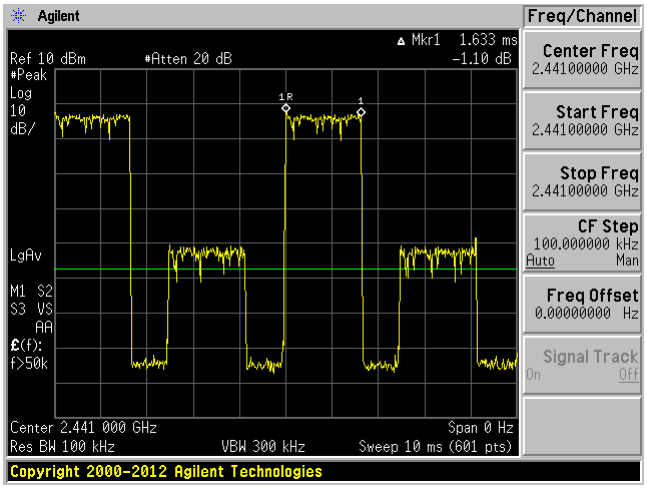


GFSK, DH3 Pulse Width

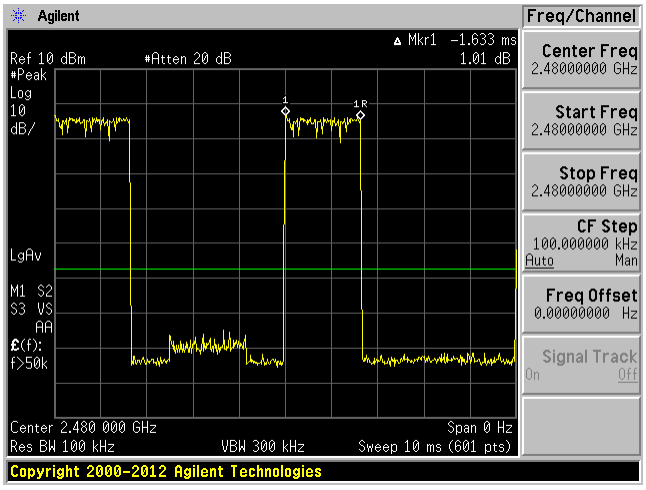
Low Channel 2402 MHz



Middle Channel 2441 MHz

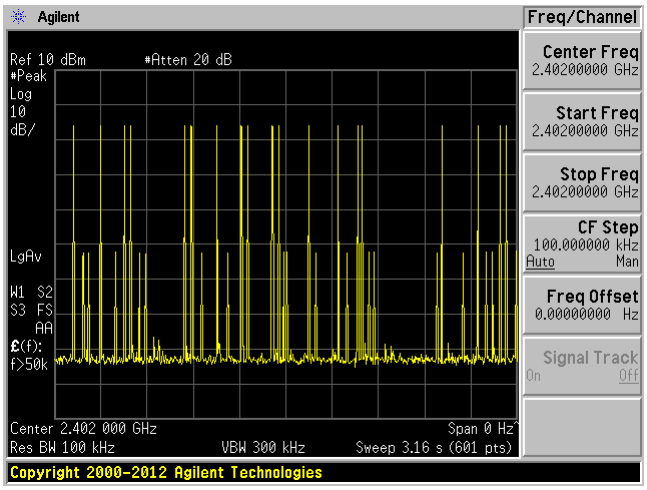


High Channel 2480 MHz

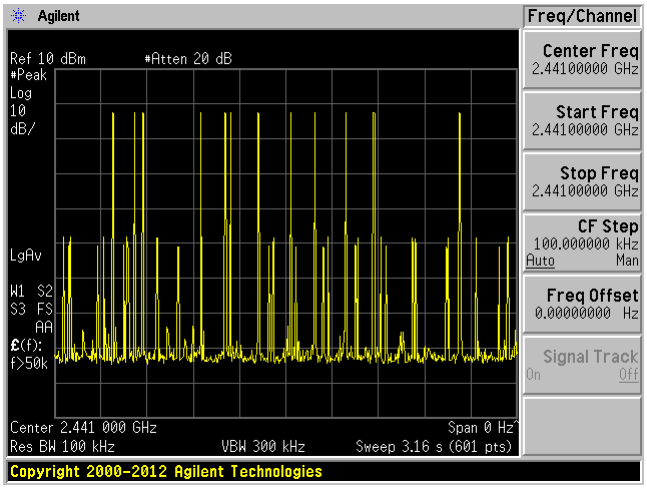


GFSK, DH3 Number of Pulses within a Specified Time

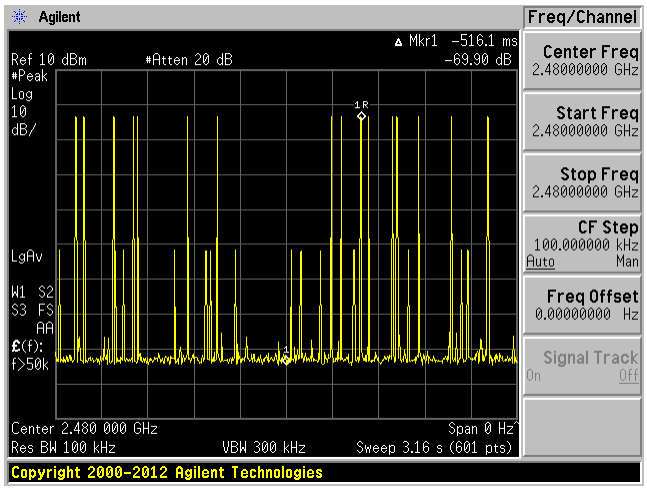
Low Channel 2402 MHz



Middle Channel 2441 MHz

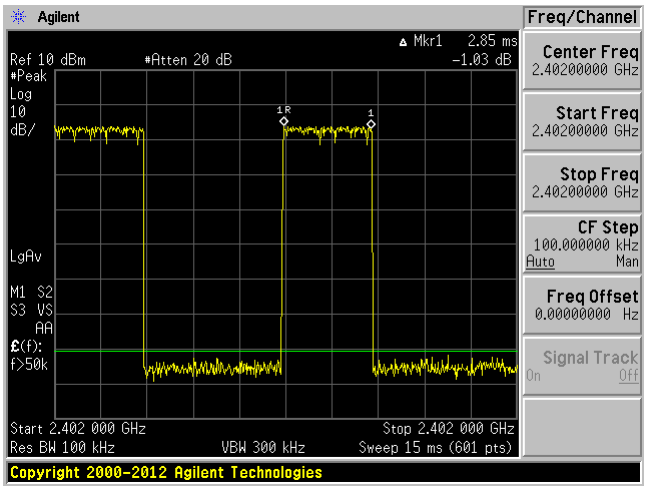


High Channel 2480 MHz

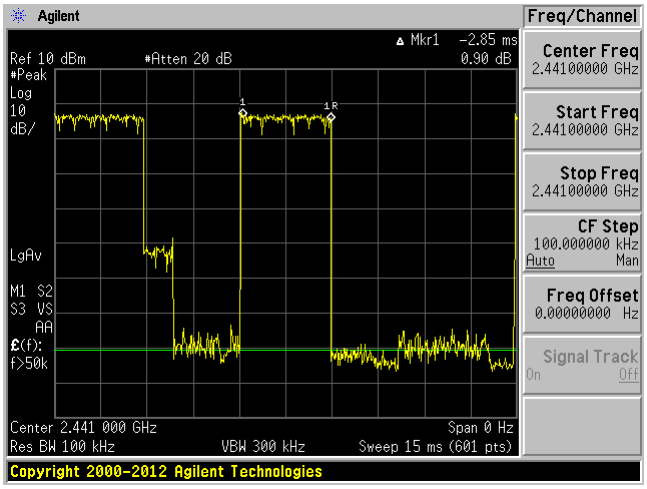


GFSK, DH5 Pulse Width

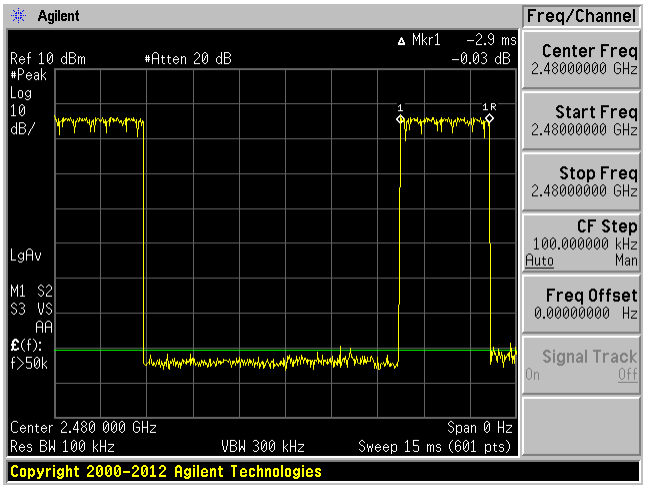
Low Channel 2402 MHz



Middle Channel 2441 MHz

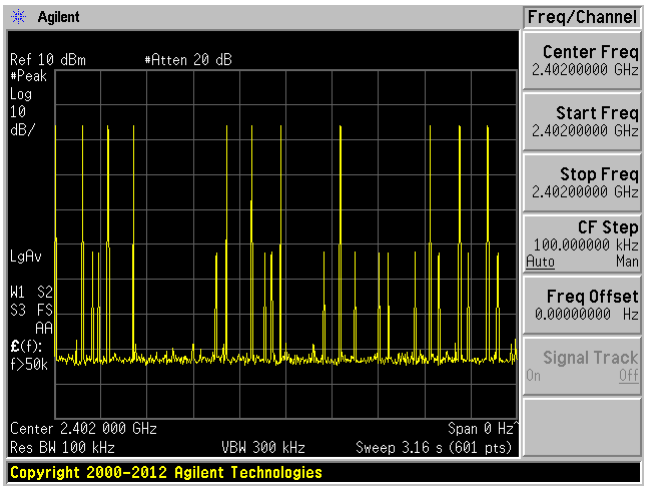


High Channel 2480 MHz

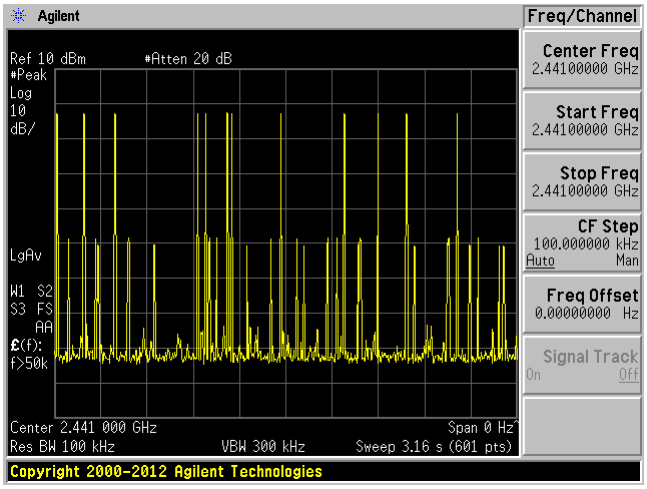


GFSK, DH5 Number of Pulses within a Specified Time

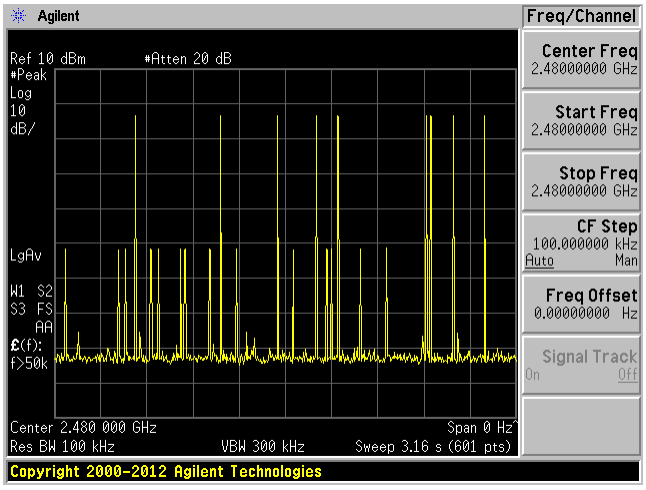
Low Channel 2402 MHz



Middle Channel 2441 MHz

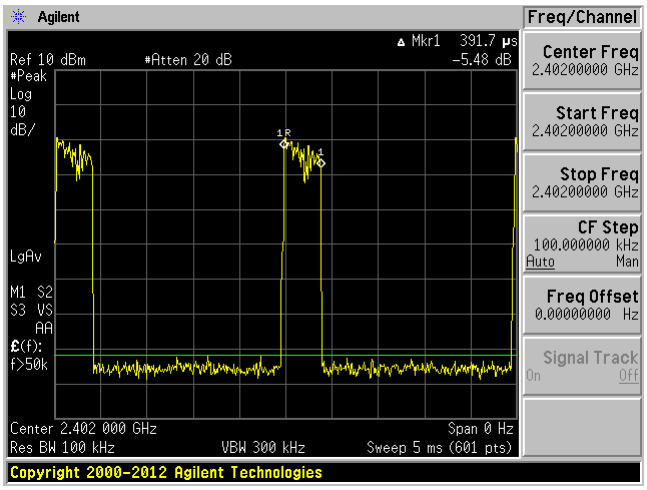


High Channel 2480 MHz

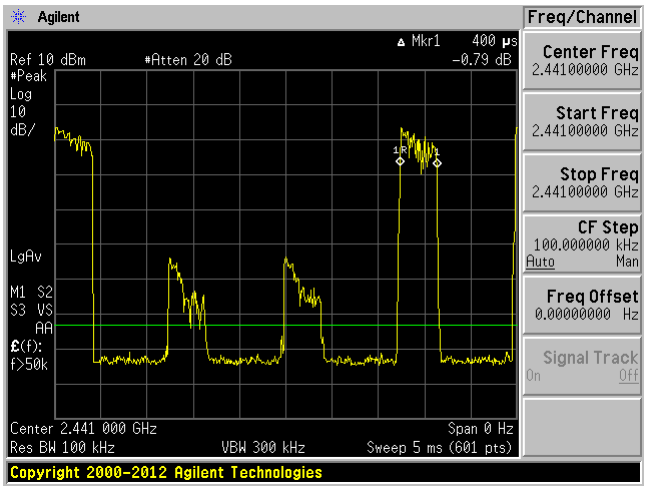


Π/4-DQPSK, DH1 Pulse Width

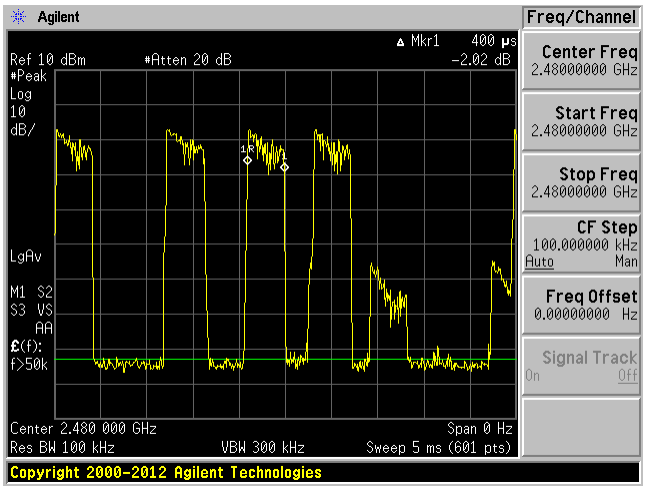
Low Channel 2402 MHz



Middle Channel 2441 MHz

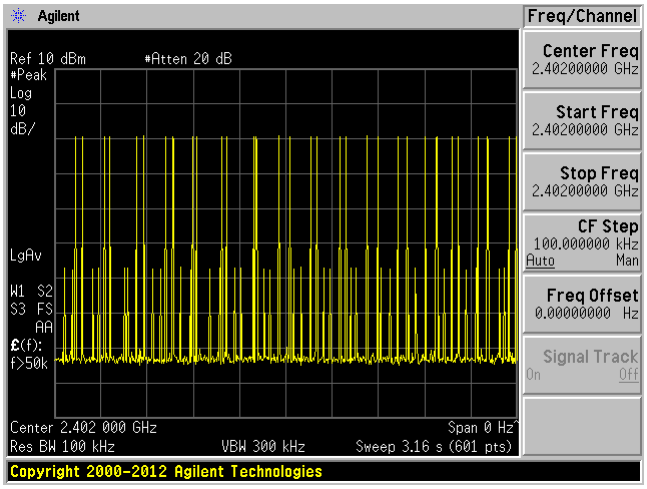


High Channel 2480 MHz

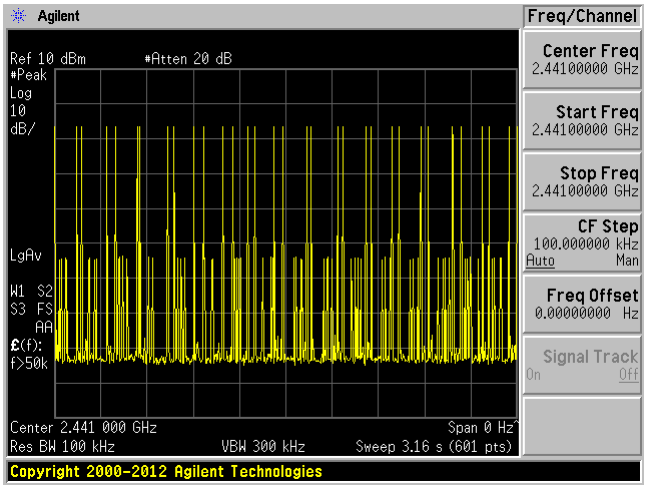


II/4-DQPSK, DH1 Number of Pulses within a Specified Time

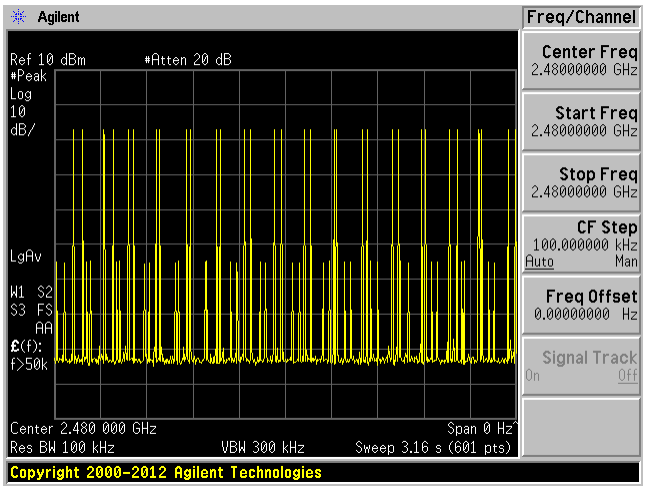
Low Channel 2402 MHz



Middle Channel 2441 MHz

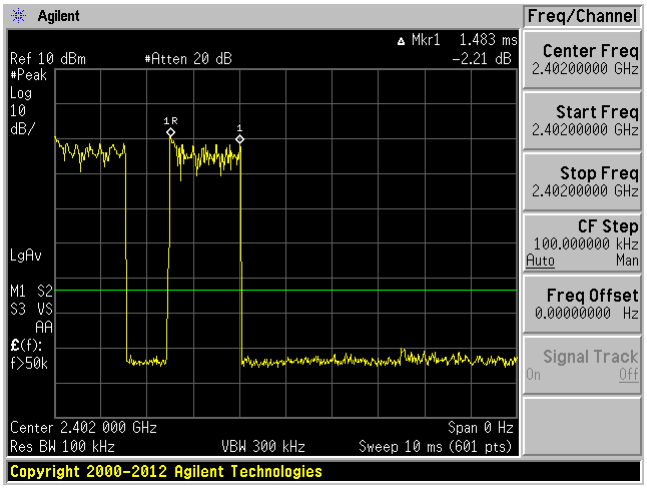


High Channel 2480 MHz

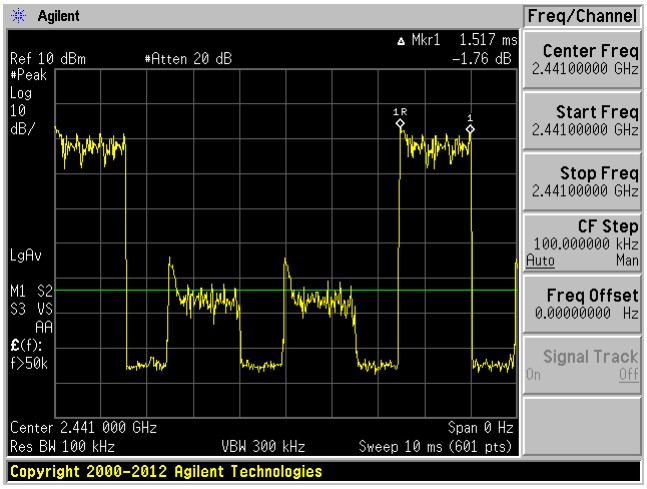


Π/4-DQPSK, DH3 Pulse Width

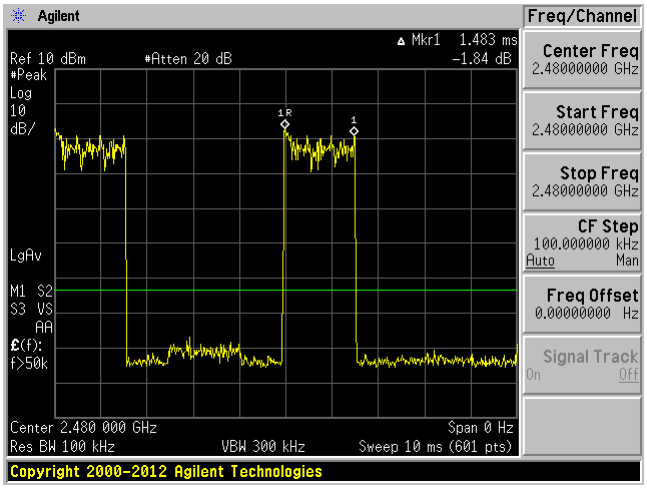
Low Channel 2402 MHz



Middle Channel 2441 MHz

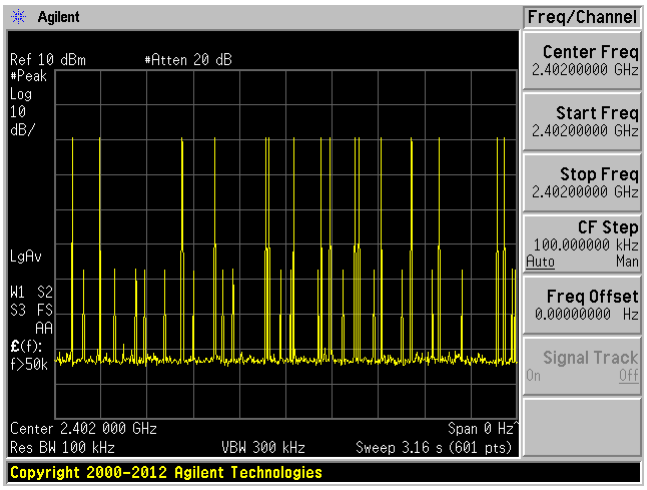


High Channel 2480 MHz

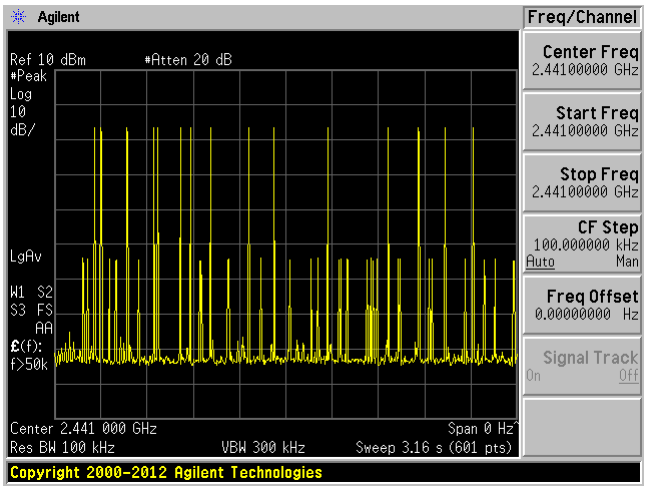


II/4-DQPSK, DH3 Number of Pulses within a Specified Time

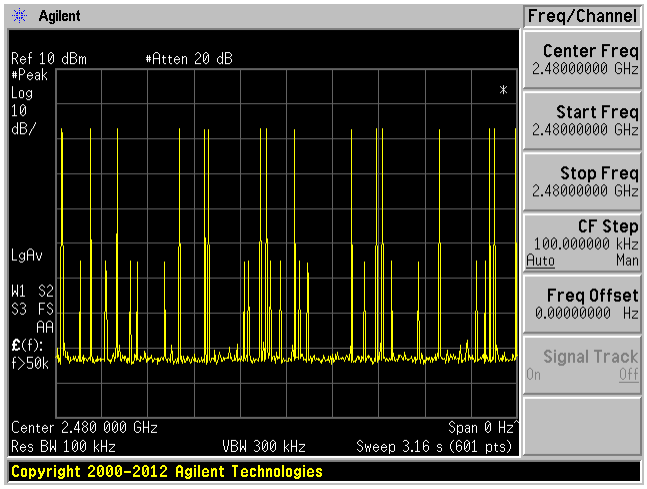
Low Channel 2402 MHz



Middle Channel 2441 MHz

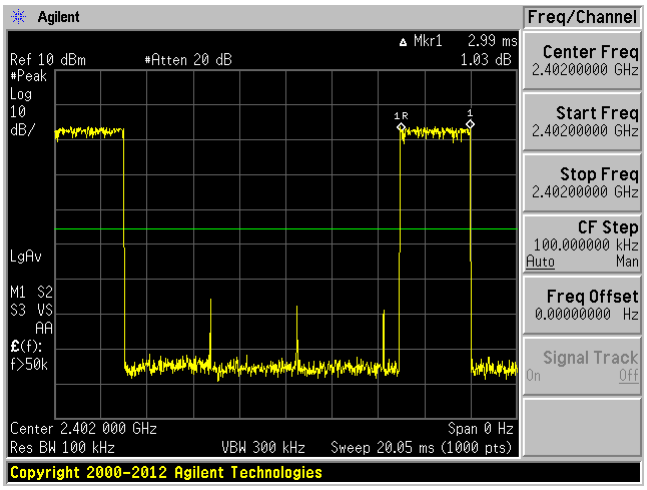


High Channel 2480 MHz

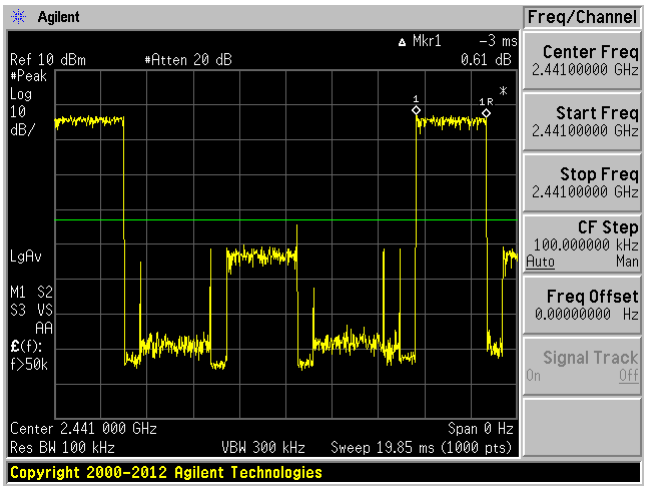


Π/4-DQPSK, DH5 Pulse Width

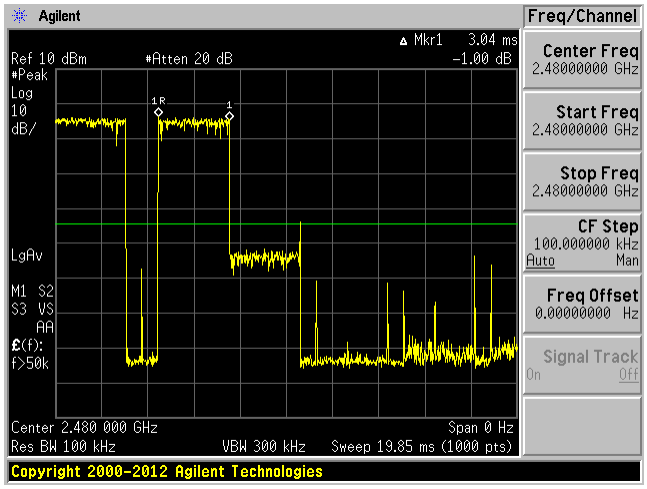
Low Channel 2402 MHz



Middle Channel 2441 MHz

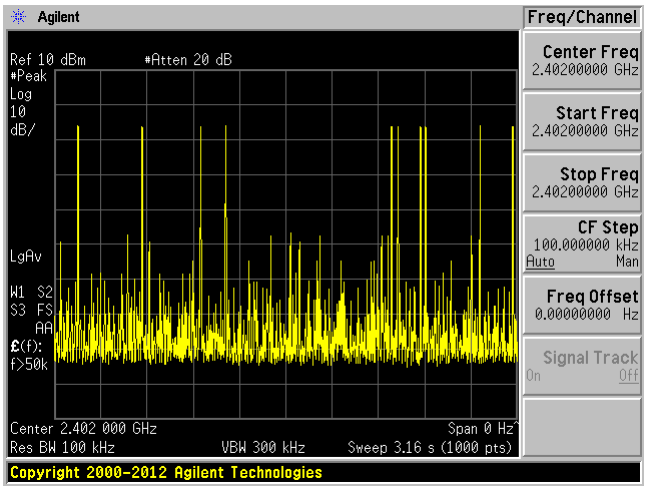


High Channel 2480 MHz

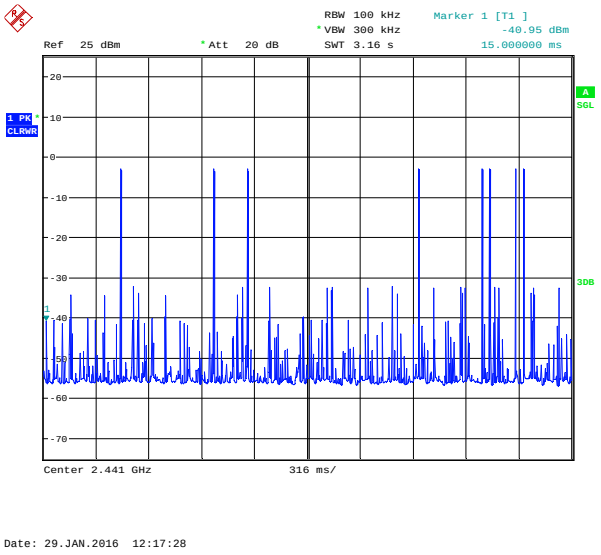


II/4-DQPSK, DH5 Number of Pulses within a Specified Time

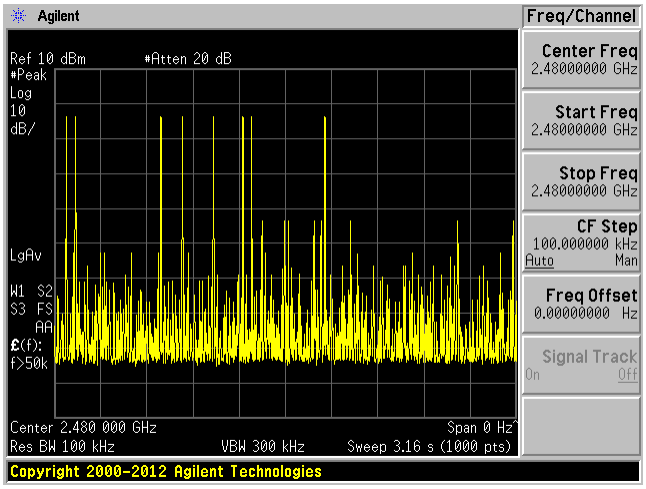
Low Channel 2402 MHz



Middle Channel 2441 MHz

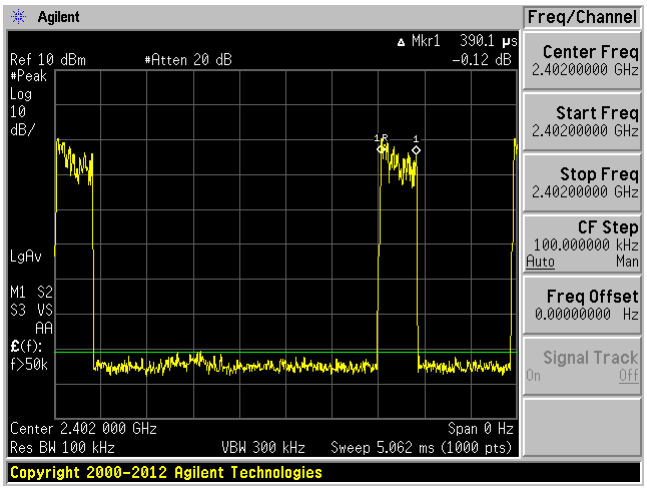


High Channel 2480 MHz

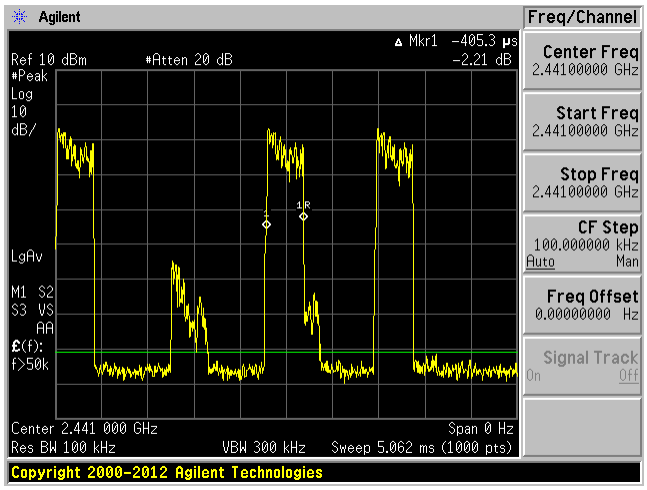


8DPSK, DH1 Pulse Width

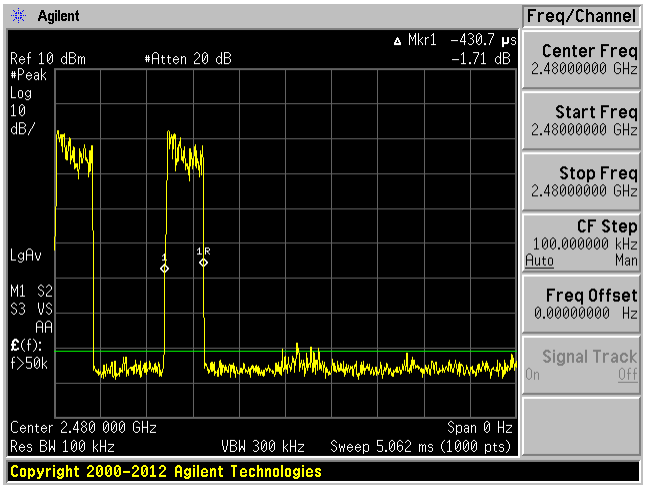
Low Channel 2402 MHz



Middle Channel 2441 MHz

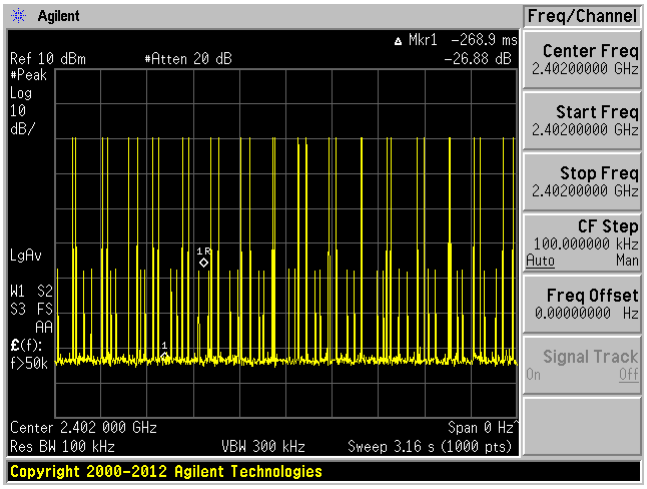


High Channel 2480 MHz

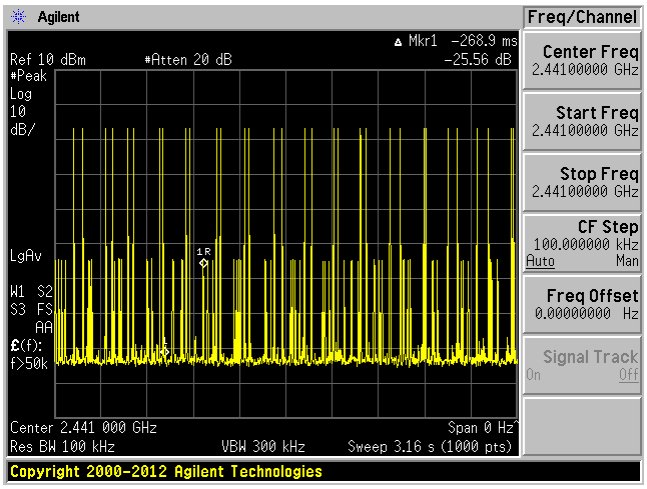


8DPSK, DH1 Number of Pulses within a Specified Time

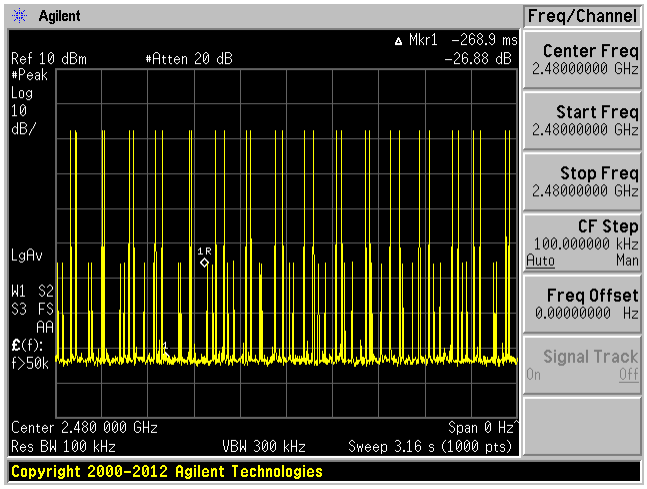
Low Channel 2402 MHz



Middle Channel 2441 MHz

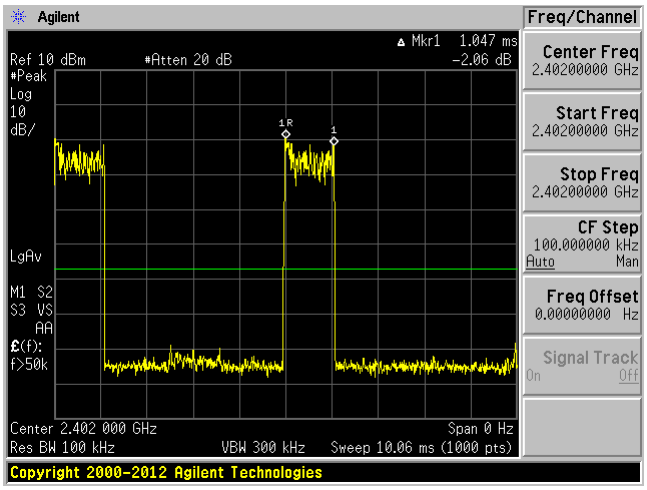


High Channel 2480 MHz

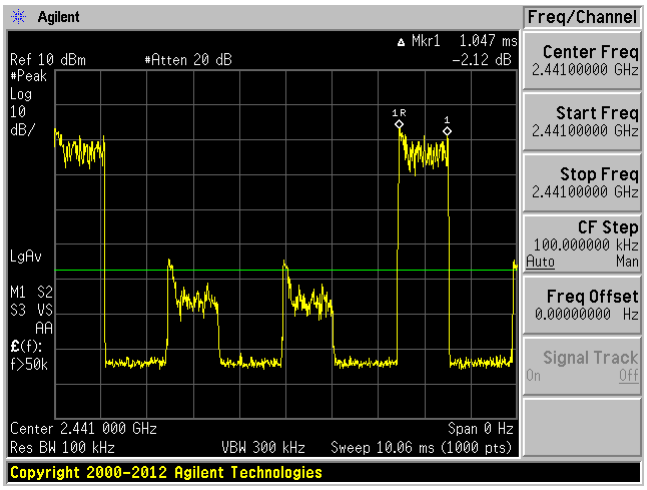


8DPSK, DH3 Pulse Width

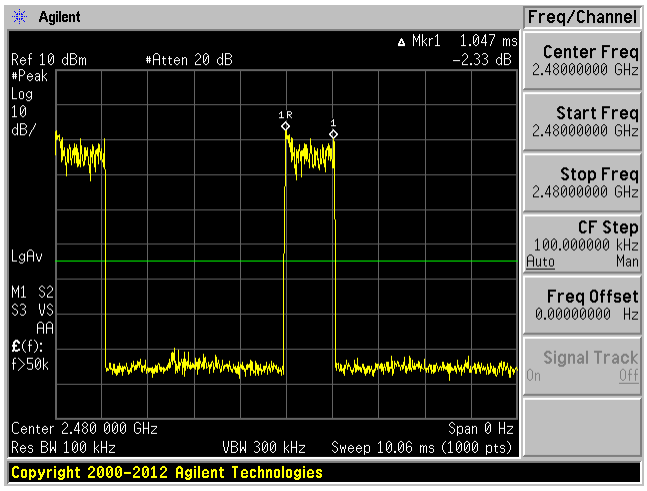
Low Channel 2402 MHz



Middle Channel 2441 MHz

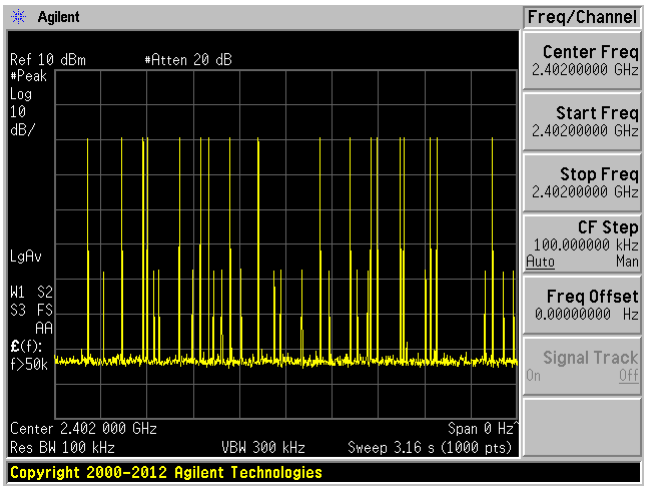


High Channel 2480 MHz

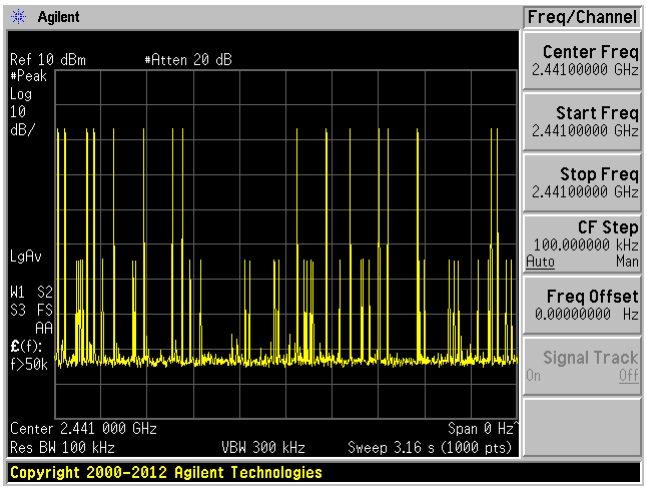


8DPSK, DH3 Number of Pulses within a Specified Time

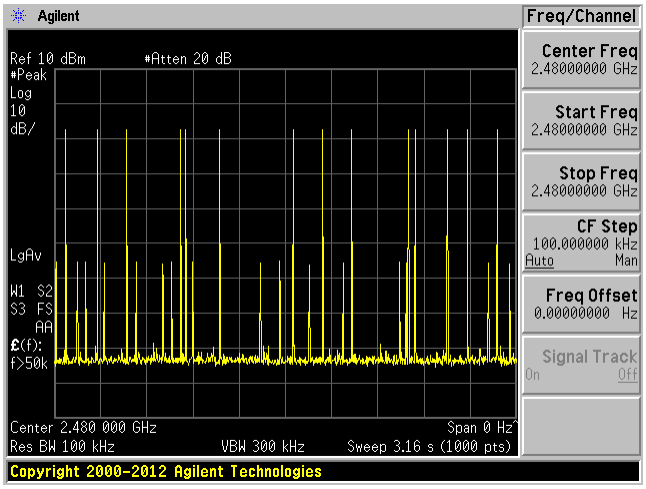
Low Channel 2402 MHz



Middle Channel 2441 MHz

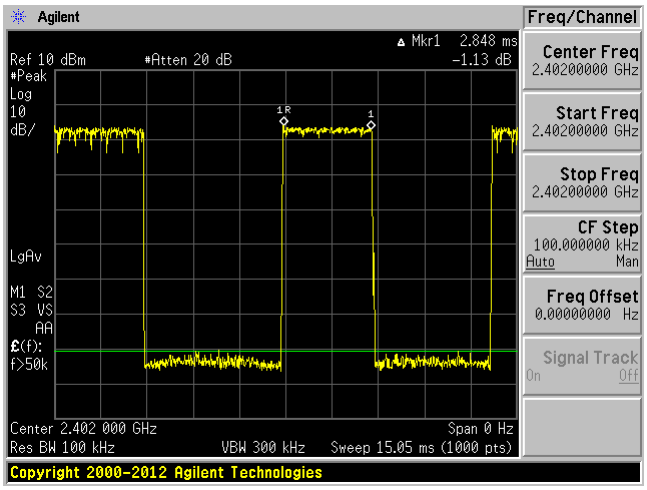


High Channel 2480 MHz

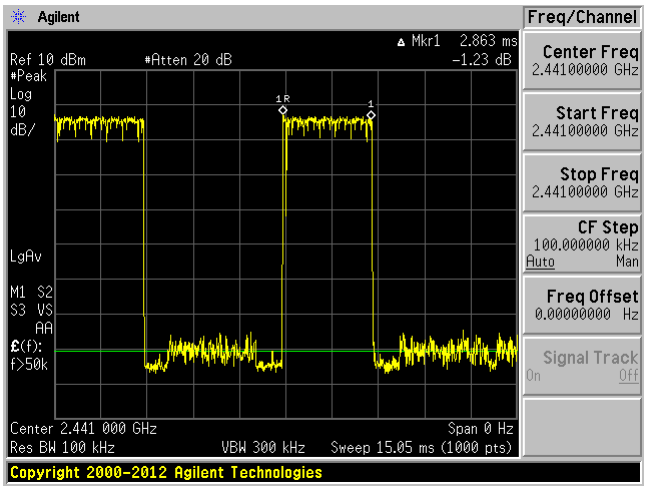


8DPSK, DH5 Pulse Width

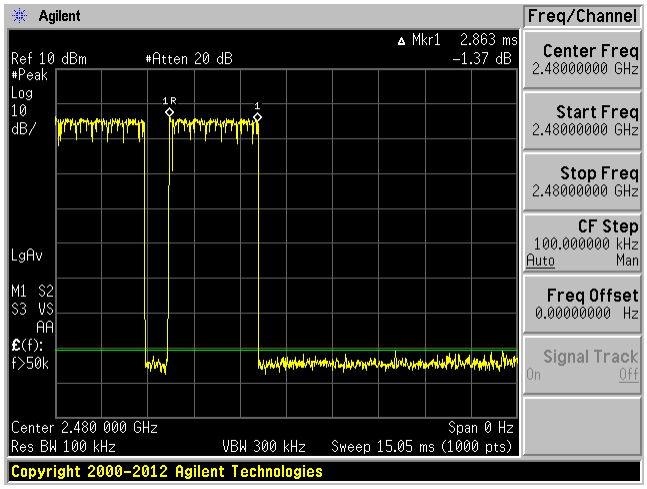
Low Channel 2402 MHz



Middle Channel 2441 MHz

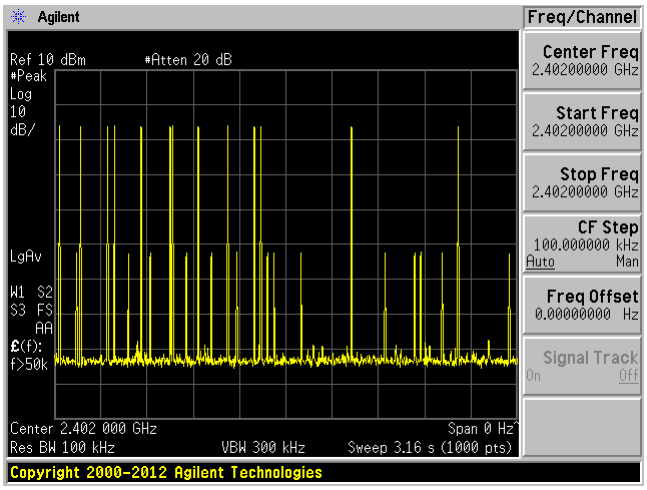


High Channel 2480 MHz

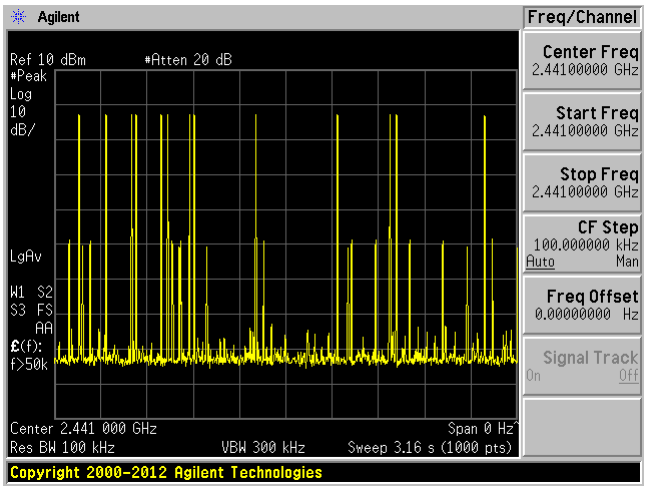


8DPSK, DH5 Number of Pulses within a Specified Time

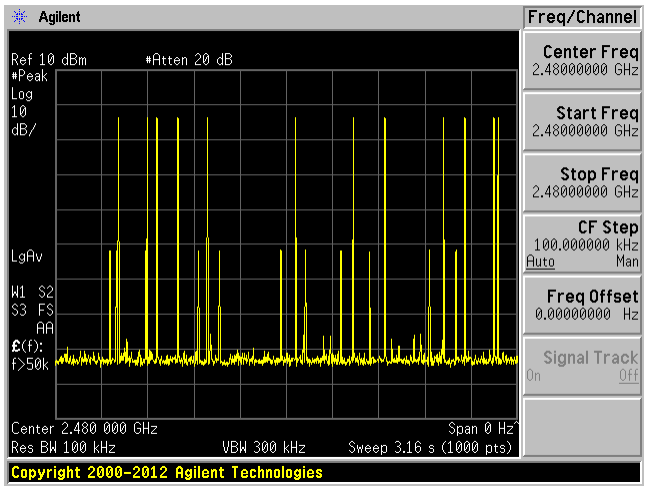
Low Channel 2402 MHz



Middle Channel 2441 MHz



High Channel 2480 MHz



12 FCC §15.247(a)(1)(iii) & IC RSS-247 §5.1(4) - Number of Hopping Channels

12.1 Applicable Standards

According to FCC §15.247(a) (1) (iii) and RSS-247 §5.1(4): 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

12.2 Test Procedure

Span = the frequency band of operation

RBW < 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2015-06-22	1 year
-	U. FL to SMA pigtail	-	-	Each time[1]	N/A
-	10dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

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

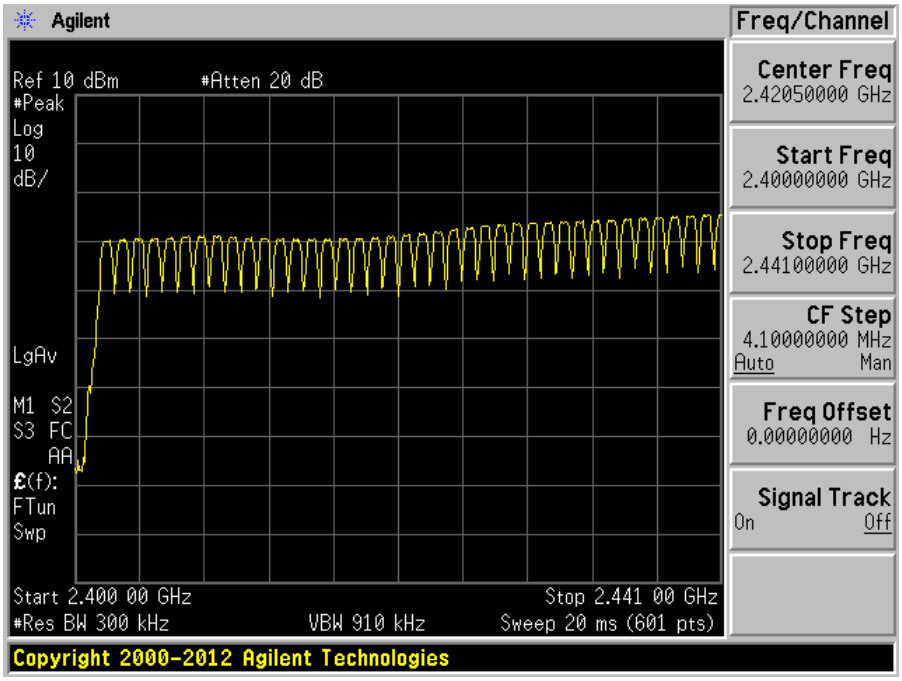
Temperature:	22 ºC
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Todd Moy on 2016-01-27 in RF site.

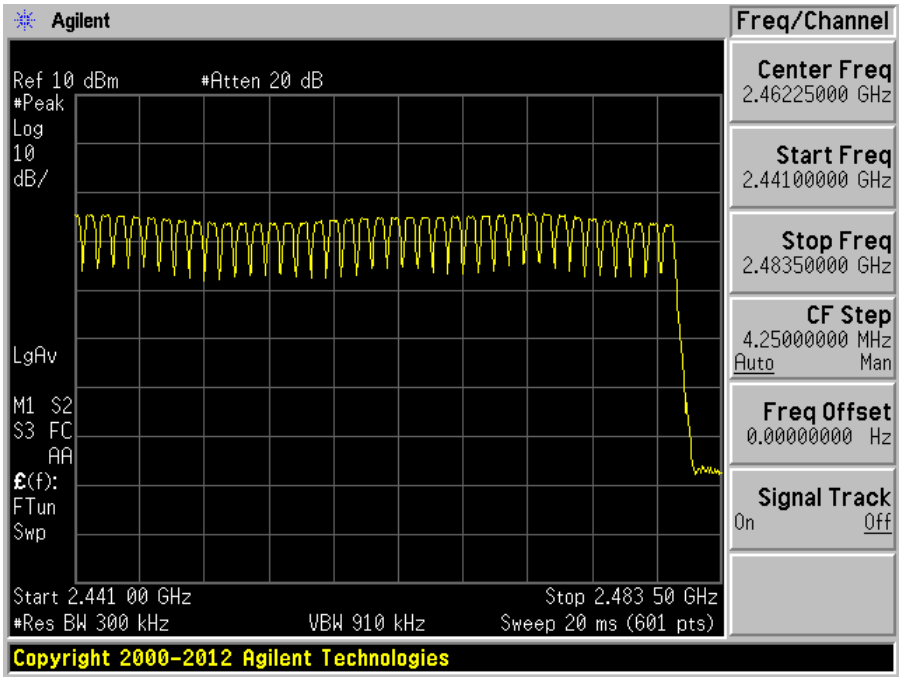
12.5 Test Results

Total 79 channels; please refer to the plots hereinafter.

40 Channels between 2400 to 2441 MHz



39 Channels between 2441 to 2483.5 MHz



13 FCC §15.247(a) (1) & IC RSS-247 §5.1(2) - Hopping Channel Separation

13.1 Applicable Standards

According to FCC §15.247(a) (1) and RSS-247 §5.1(2): 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.

13.2 Test Procedure

Span = wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW) ≈ 30% of the channel spacing, adjust as necessary to best identify the center of each individual channel

Video (or Average) Bandwidth (VBW) ≥RBW
Sweep = auto
Detector function = peak
Trace = max hold

13.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2015-06-22	1 year
-	U. FL to SMA pigtail	-	-	Each time[1]	N/A
-	10dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

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:	22 ºC
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Todd Moy on 2016-01-27 in RF site.

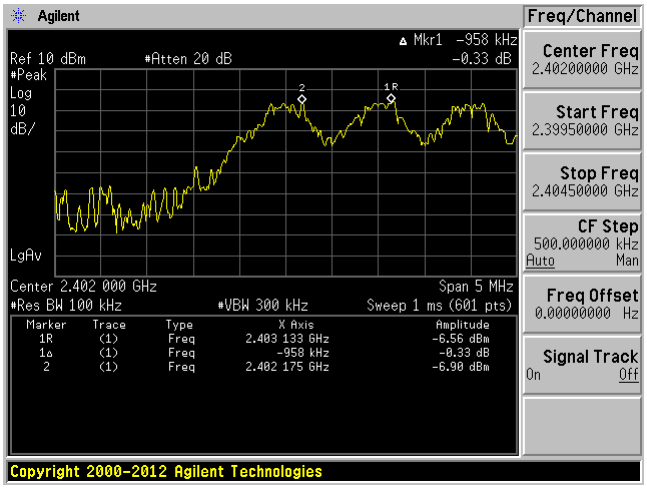
13.5 Test Results

Channel	Frequency (MHz)	Channel Separation (kHz)	Limit > 2/3 20 dB OBW (kHz)
GFSK			
Low	2402	958	615.57
Middle	2441	1067	615.51
High	2480	925	615.60
π/4-DQPSK			
Low	2402	1025	919.33
Middle	2441	992	924.67
High	2480	992	922.67
8DPSK			
Low	2402	992	916.00
Middle	2441	992	917.33
High	2480	992	915.33

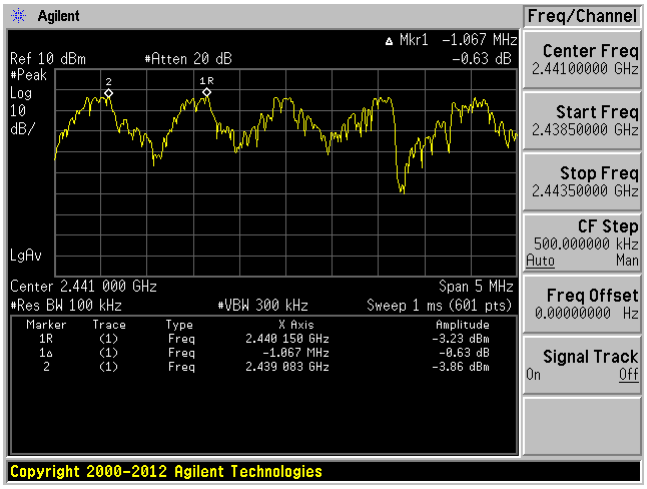
Please refer to following plots.

GFSK

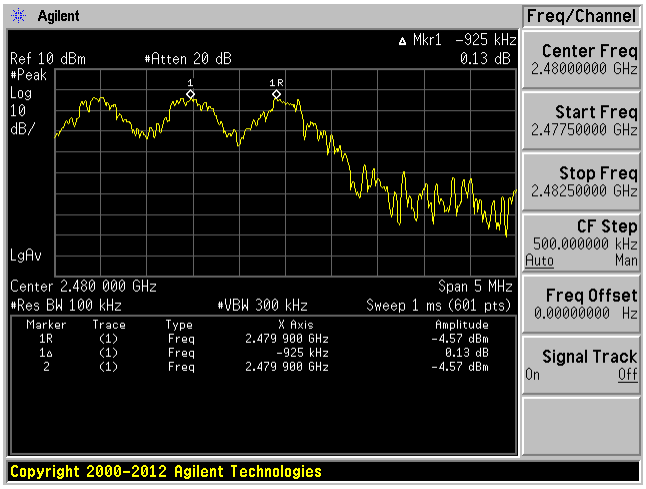
Low Channel 2402 MHz



Middle Channel 2441 MHz

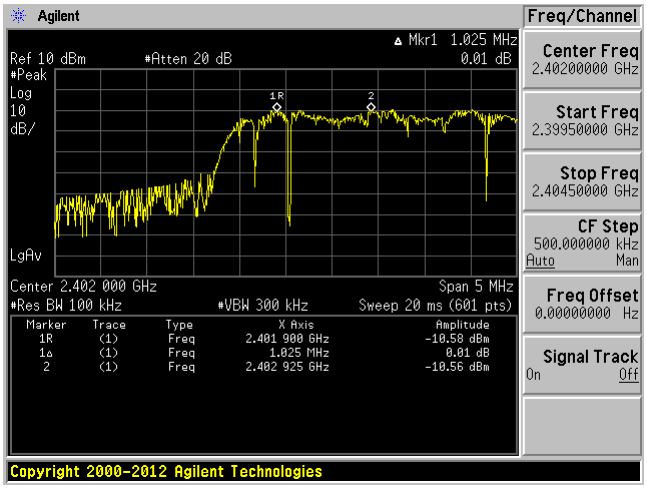


High Channel 2480 MHz

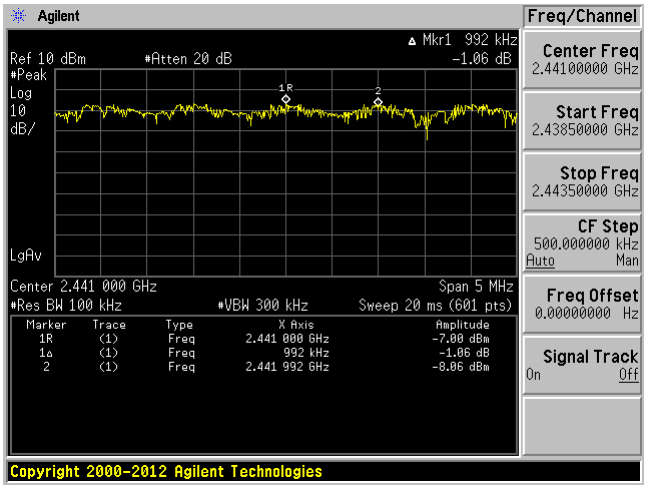


π/4-DQPSK

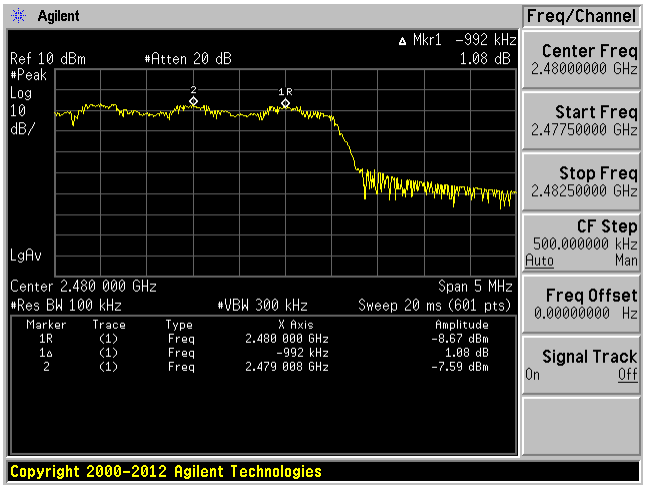
Low Channel 2402 MHz



Middle Channel 2441 MHz

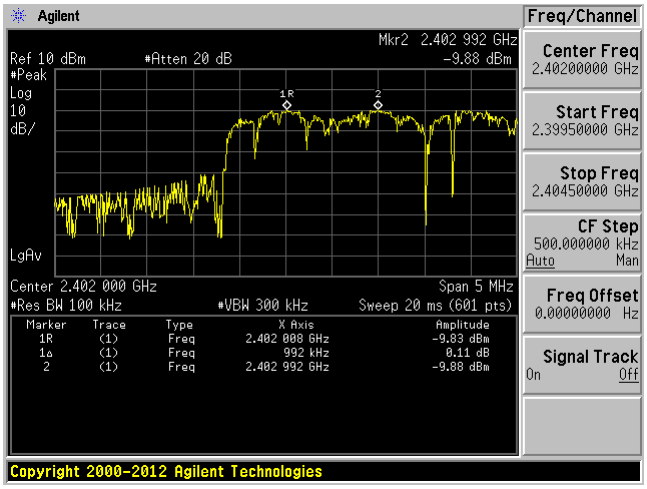


High Channel 2480 MHz

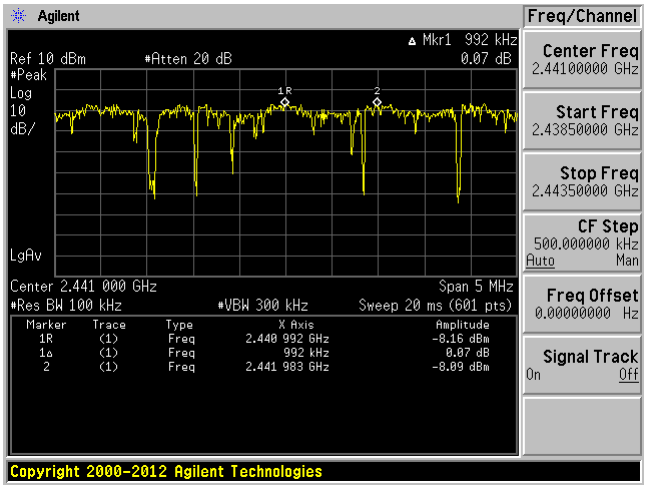


8DPSK

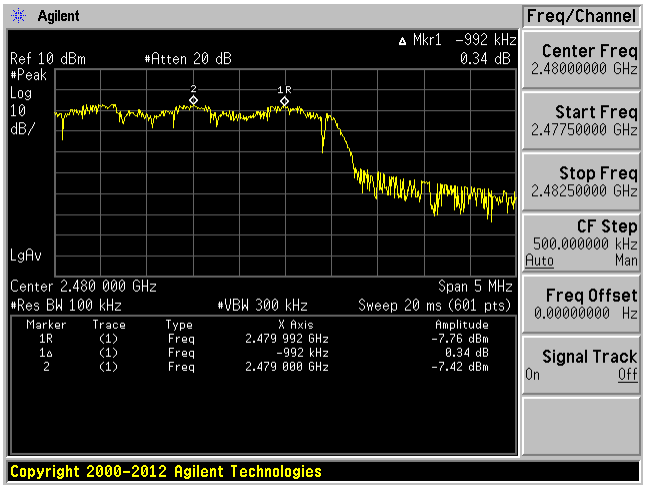
Low Channel 2402 MHz



Middle Channel 2441 MHz



High Channel 2480 MHz



14 FCC §15.247(d) & IC RSS-247 §5.5 - Spurious Emissions at Antenna Terminals

14.1 Applicable Standards

For 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-247 §5.5, 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 5.4(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.

14.2 Test 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.

14.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2015-06-22	1 year
-	U. FL to SMA pigtail	-	-	Each time[1]	N/A
-	10dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

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:	22º C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

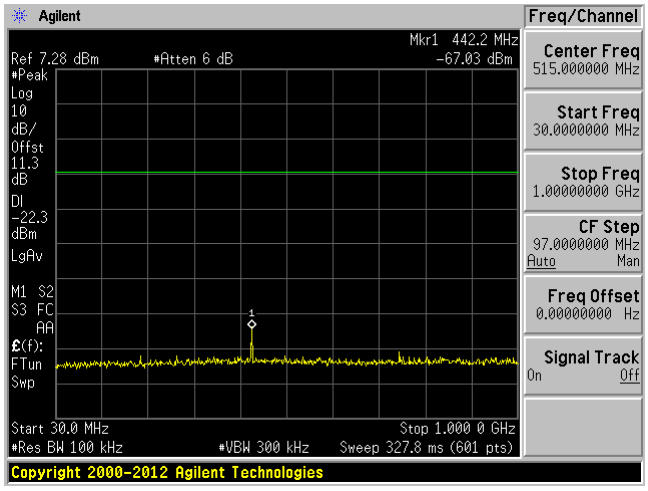
The testing was performed by Todd Moy on 2016-01-27 in RF site.

14.5 Test Results

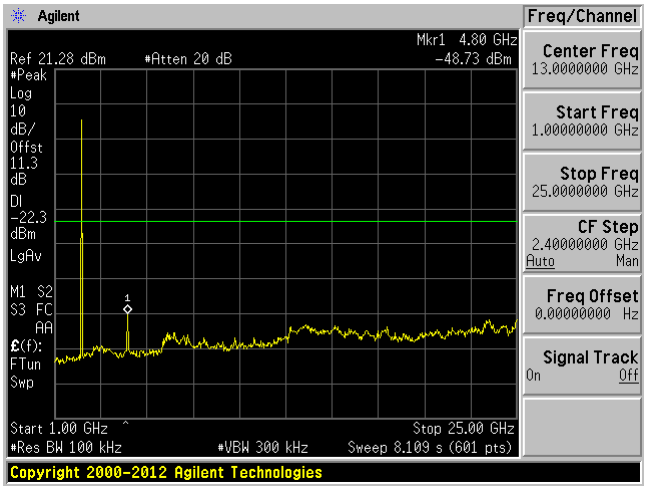
Please refer to following plots.

GFSK

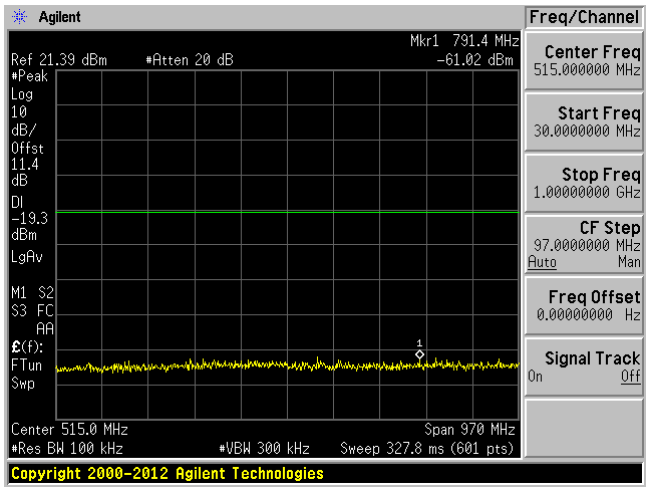
Low Channel 30 MHz – 1 GHz



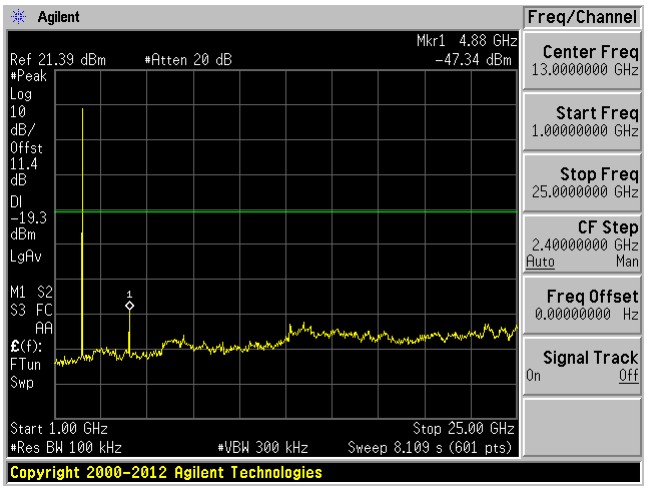
Low Channels 1GHz – 25 GHz



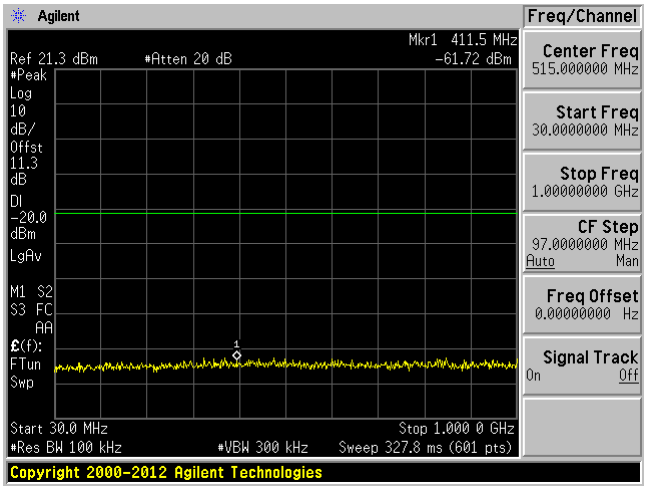
Middle Channel 30 MHz – 1 GHz



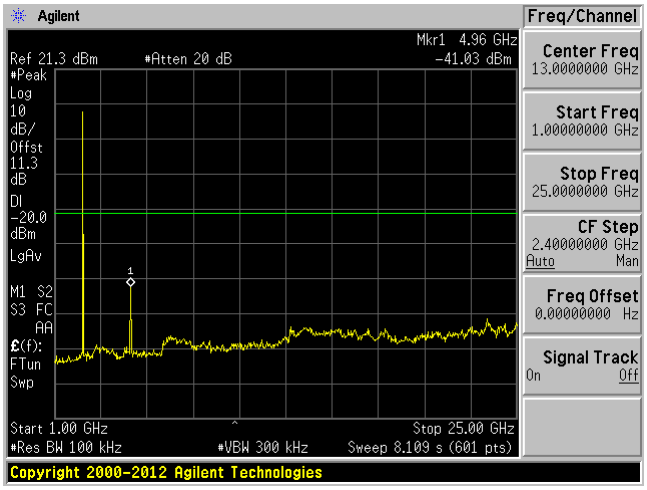
Middle Channels 1 GHz – 25 GHz



High Channel 30 MHz – 1 GHz

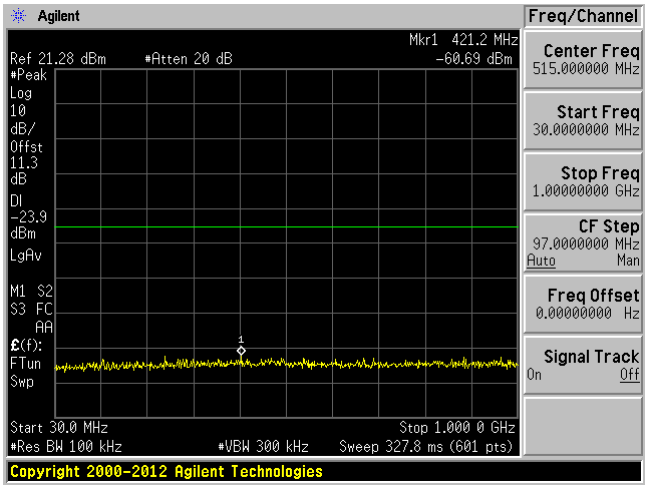


High Channels 1 GHz – 25 GHz

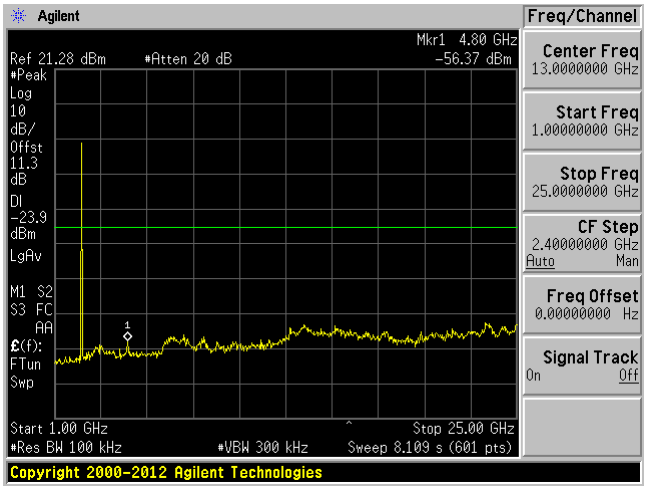


π/4-DQPSK

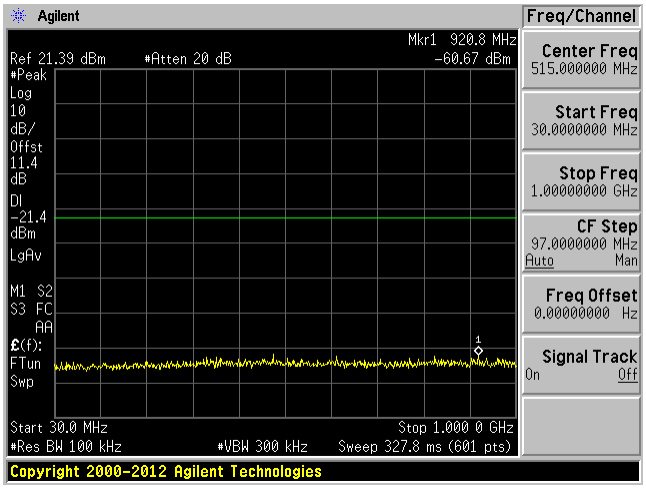
Low Channel 30 MHz – 1 GHz



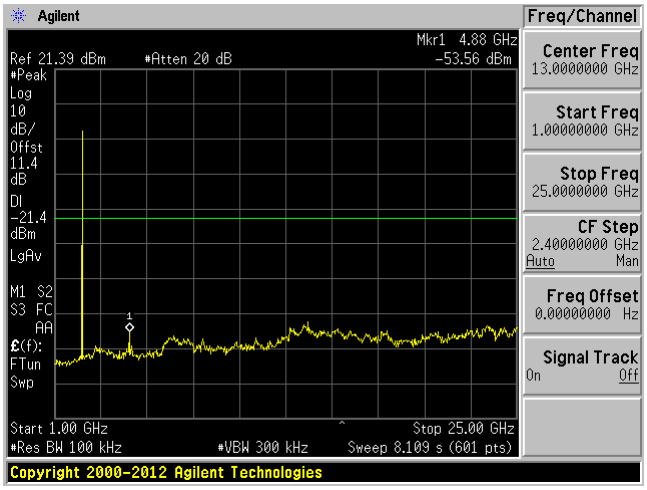
Low Channels 1 GHz – 25 GHz



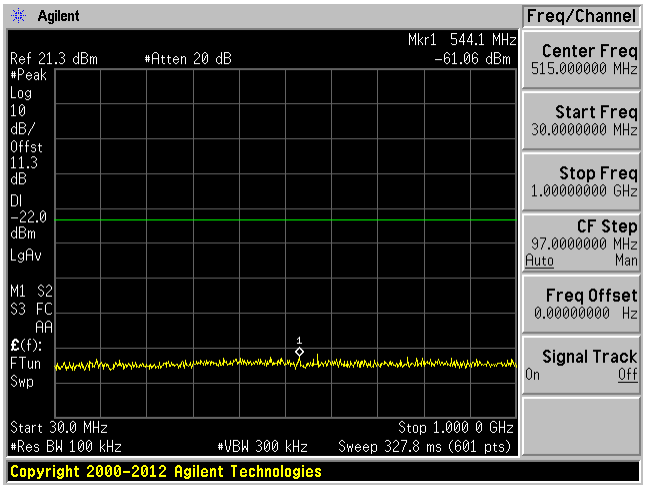
Middle Channel 30 MHz – 1 GHz



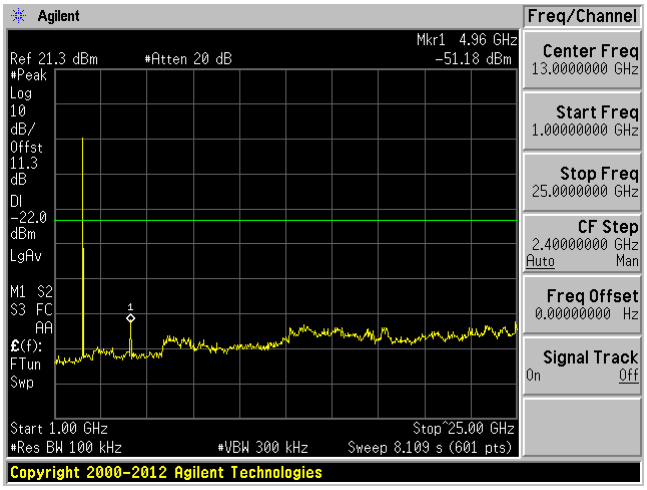
Middle Channels 1 GHz – 25 GHz



High Channel 30 MHz – 1 GHz

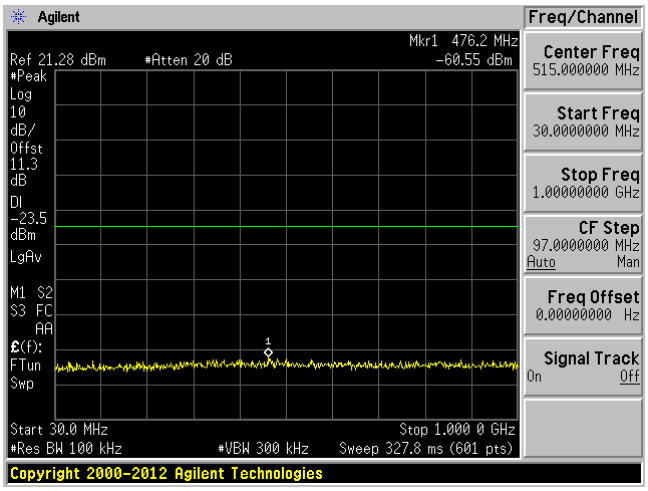


High Channels 1 GHz – 25 GHz

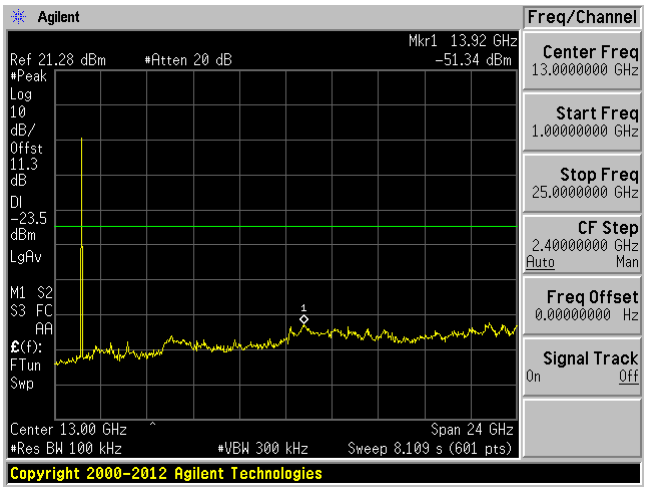


8DPSK

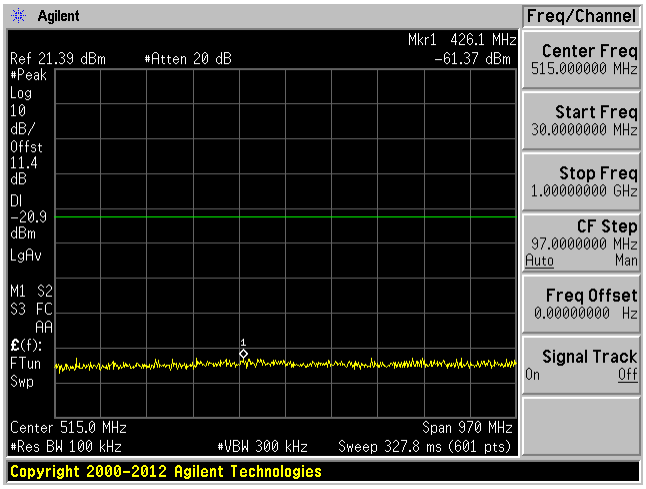
Low Channel 30 MHz –1 GHz



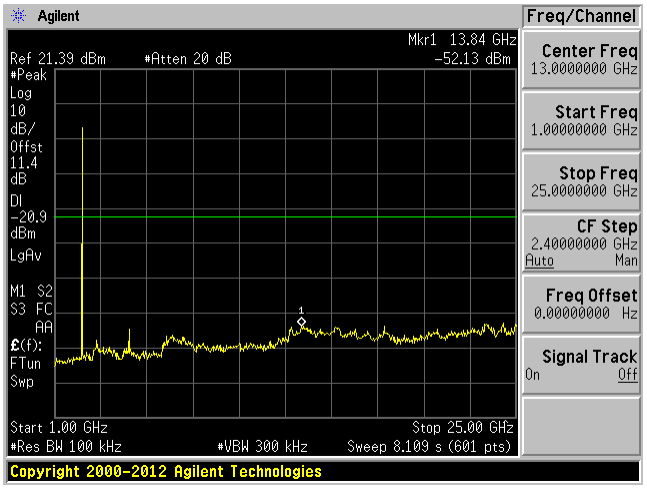
Low Channels 1 GHz – 25 GHz



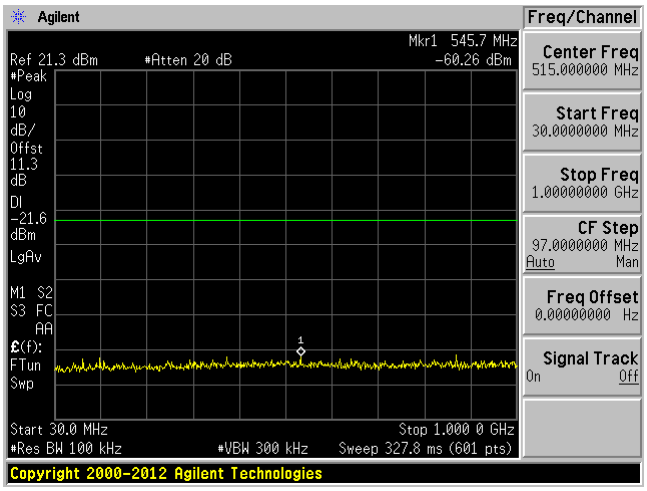
Middle Channel 30 MHz – 1 GHz



Middle Channels 1 GHz – 25 GHz



High Channel 30 MHz – 1 GHz



High Channels 1 GHz – 25 GHz