



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



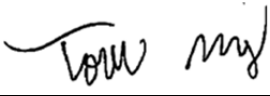
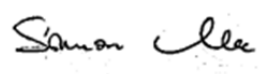
TEST AND MEASUREMENT REPORT

For

Intel Corporation

2200 Mission College Blvd.,
Santa Clara, CA 95054, USA

FCC ID: 2AB8ZND18
IC: 1000X-ND18

Report Type: Original Report	Product Type: Wearable Glasses
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Report Number: R1604212-247 DSS	
Report Date: 2016-06-07	
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* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "*" ...

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1604212-247 DSS	Original Report	2016-06-07

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *Intel Corporation*, and their product model: *Radar Pace*, FCC ID: 2AB8ZND18; IC: 1000X-ND18 or the “EUT” as referred to in this report. The EUT are wearable glasses with Bluetooth, Bluetooth Low Energy, and ANT+ capabilities.

1.2 Mechanical Description of EUT

The EUT measures approximately 140 mm (L) x 150 mm (W) x 53 mm (H) and weight 50 g.

The test data gathered are from typical production sample, serial number: FC5960FZ6030038-L assigned by Intel Corporation.

1.3 Objective

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

The objective is to determine compliance with FCC Part 15.247 and ISED 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: 2AB8ZND18
FCC Part 15, Subpart C, Equipment DXX with FCC ID: 2AB8ZND18

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 ± 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 BAEL 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 17065: 2012 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 Tera Term; the software was verified by *Todd Moy* to comply with the standard requirements being tested against.

2.3 Duty Cycle Correction Factor

According to ANSI C63.10-2013 section 7.5:

Unless otherwise specified, when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 s (100 ms). In cases where the pulse train exceeds 0.1 s, the measured field strength shall be determined during a 0.1 s interval. The following procedure is an example of how the average value may be determined. The average field strength may be found by measuring the peak pulse amplitude (in log equivalent units) and determining the duty cycle correction factor (in dB) associated with the pulse modulation as shown in following equation:

$$\delta(\text{dB}) = 20\log(\Delta)$$

where

δ is the duty cycle correction factor (dB)

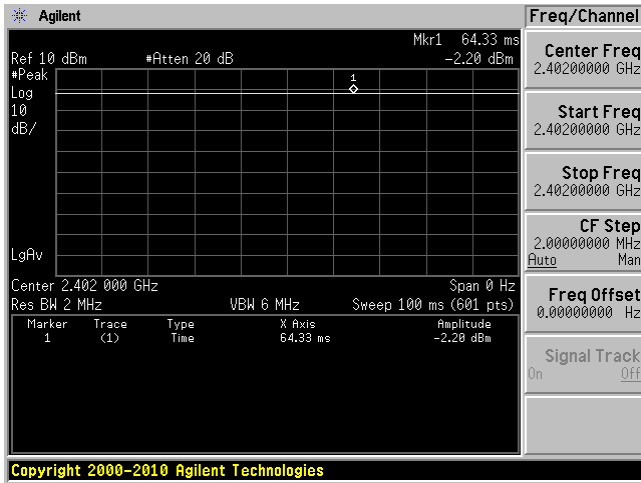
Δ is the duty cycle (dimensionless)

Radio Mode	On Time (μs)	Period (μs)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
GFSK	-	-	100	0
$\pi/4$ -DQPSK	-	-	100	0
8DPSK	-	-	100	0

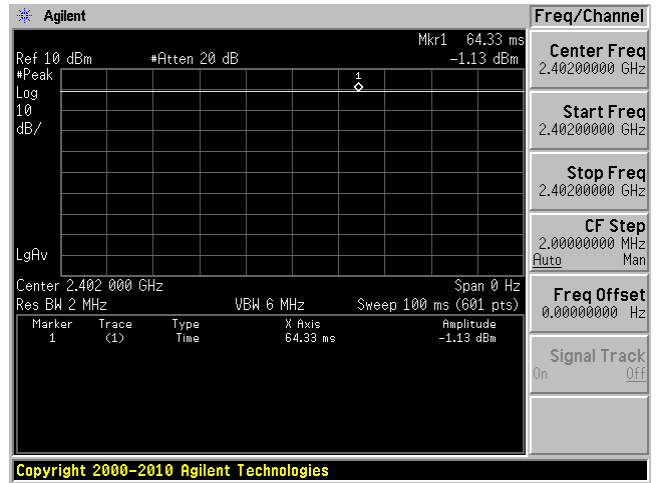
$$\text{Duty Cycle} = \text{On Time (ms)} / \text{Period (ms)}$$

Please refer to the following plots.

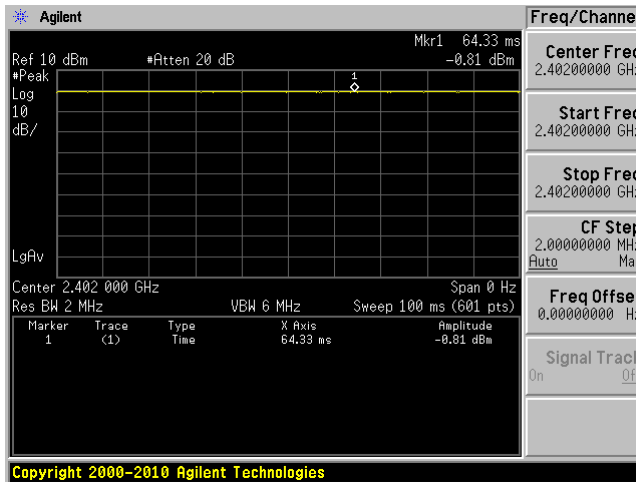
GFSK Mode



$\pi/4$ -DQPSK Mode



8DPSK Mode



2.4 Equipment Modifications

SMA cables were connected to the output trace of the Bluetooth and ANT+ circuits.

2.5 Local Support Equipment

Manufacturer	Description	Model
Dell	Laptop	Latitude D630

2.6 EUT Internal Configuration Details

Manufacturer	Description	Model
Intel	Main Board	Radar Pace

2.7 Support Equipment

Manufacturer	Description	Model
Intel	USB to UART Driver	H81964-001

2.8 Interface Ports and Cabling

Cable Description	Length (m)	To	From
USB Cable	< 1 m	Laptop	EUT
SMA Pigtailed	< 1 m	EUT	PSA

3 Summary of Test Results

Results reported relate only to the product tested.

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

4 FCC §15.203 & ISED 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 ISED 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 permanently attached antennas.

Radio	Maximum Antenna Gain (dBi) @ 2.4GHz
Bluetooth	-1.2
ANT+	-1.2

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

5.1 Applicable Standards

According to FCC KDB 447498 D01 General RF Exposure Guidance v05r02 Section 4.3.1, Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition, listed below, is satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions. The minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander (see 5) of section 4.1). To qualify for SAR test exclusion, the test separation distances applied must be fully explained and justified by the operating configurations and exposure conditions of the transmitter and applicable host platform requirements, typically in the SAR measurement or SAR analysis report, according to the required published RF exposure KDB procedures. When no other RF exposure testing or reporting is required, a statement of justification and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for the SAR test exclusion. When required, the device specific conditions described in the other published RF exposure KDB procedures must be satisfied before applying these SAR test exclusion provisions; for example, handheld PTT two-way radios, handsets, laptops & tablets etc.

- 1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$$\frac{[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})]}{[\sqrt{f(\text{GHz})}]} \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR, where}$$

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

- 2) At 100 MHz to 6 GHz and for test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following, and as illustrated in Appendix B:
- a) [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm) · ($f(\text{MHz})/150$)] mW, at 100 MHz to 1500 MHz
 - b) [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm) · 10] mW at > 1500 MHz and ≤ 6 GHz
- 3) At frequencies below 100 MHz, the following may be considered for SAR test exclusion, and as illustrated in Appendix C:
- a) The power threshold at the corresponding test separation distance at 100 MHz in step 2) is multiplied by $[1 + \log(100/f(\text{MHz}))]$ for test separation distances > 50 mm and < 200 mm
 - b) The power threshold determined by the equation in a) for 50 mm and 100 MHz is multiplied by $\frac{1}{2}$ for test separation distances ≤ 50 mm
 - c) SAR measurement procedures are not established below 100 MHz. When SAR test exclusion cannot be applied, a KDB inquiry is required to determine SAR evaluation requirements for any test results to be acceptable.

According to ISED RSS-102 Issue 5 §2.5.1,

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤ 5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤ 300	71	101	132	162	193
450	52	70	88	106	123
835	17	30	42	55	67
1900	7	10	18	34	60
2450	4	7	15	30	52
3500	2	6	16	32	55
5800	1	6	15	27	41

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥ 50 mm
≤ 300	223	254	284	315	345
450	141	159	177	195	213
835	80	92	105	117	130
1900	99	153	225	316	431
2450	83	123	173	235	309
3500	86	124	170	225	290
5800	56	71	85	97	106

Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in Table 1, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required. For medical implants devices, the exemption limit for routine evaluation is set at 1 mW.

The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.

5.2 RF Exposure Evaluation Results

The highest measured peak conducted power as reported in Section 9.5 of this report was 9.89 dBm (9.75 mW) at 2402 MHz. Due to the duty cycle of Bluetooth transmission in this device's normal operation is 6.25%, the calculated maximum average output power is $9.89 \text{ dBm} - 10 \cdot \log(1/6.25\%) = -2.15 \text{ dBm}$ (0.61 mW). The maximum average output power is lower than both FCC and ISED SAR Exemption limit. Thus, SAR was exempted for this device.

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

6.1 Applicable Standards

As per FCC §15.207 and ISED 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 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 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 ISED 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:

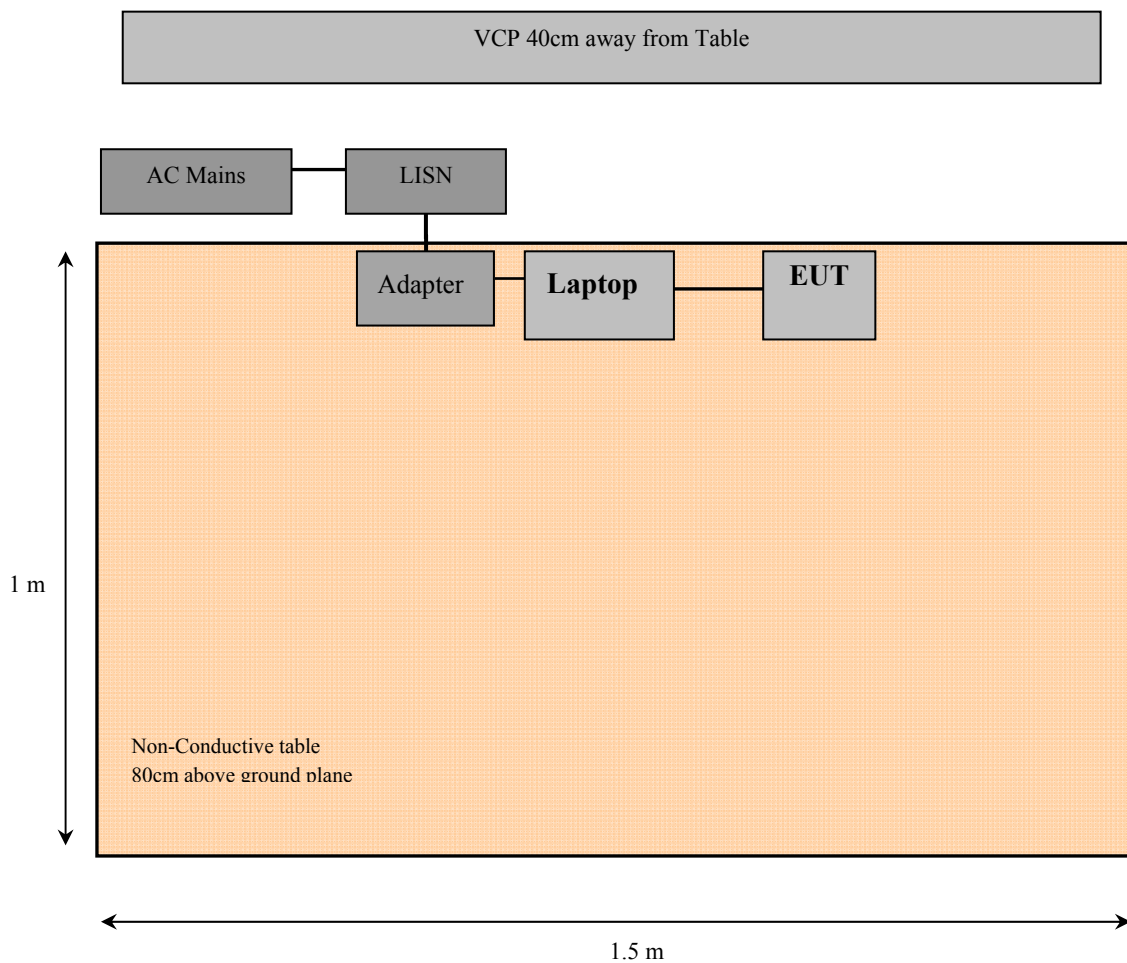
$$CA = A_i + CL + \text{Atten}$$

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:

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

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	Receiver, EMI Test	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	MY42242931	2015-12-15	1 year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150204	2016-03-09	1 Year
Wireless Solutions	Conducted Emission Cable	LMR 400	691	2015-07-02	1 year
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160129	2016-04-11	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° C
Relative Humidity:	42 %
ATM Pressure:	101.31 kPa

The testing was performed by Leonard Gray on 2016-05-06 in 5 chamber 3.

6.8 Summary of Test Results

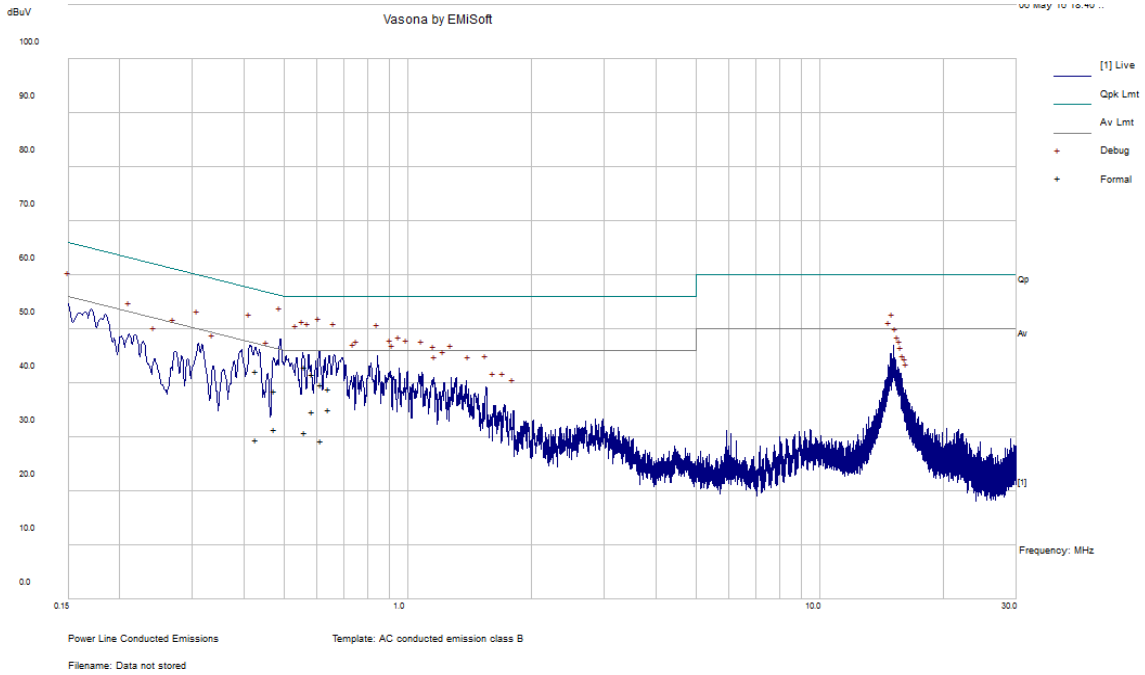
According to the recorded data in following table, the EUT complied with the FCC 15C and ISED RSS-Gen standard's conducted emissions limits, with the margin reading of:

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	Frequency (MHz)	Conductor Mode (Line/Neutral)	Range (MHz)
10.83	0.644217	Line	0.15-30

6.9 Conducted Emissions Test Plots and Data

Worst Mode of Operation: Hopping Mode

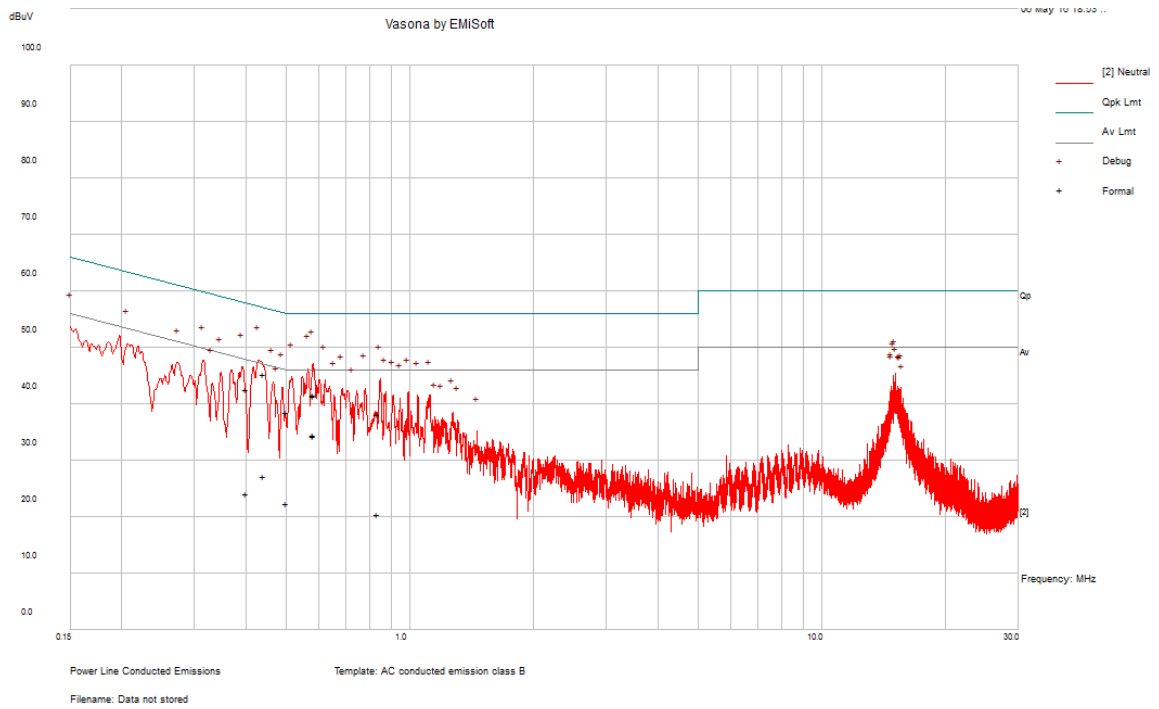
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.474849	38.6	Line	56.43	-17.83	QP
0.618252	39.76	Line	56	-16.24	QP
0.563595	43.05	Line	56	-12.95	QP
0.428871	42.29	Line	57.27	-14.98	QP
0.586125	41.57	Line	56	-14.43	QP
0.644217	39.02	Line	56	-16.98	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.474849	31.56	Line	46.43	-14.87	Ave.
0.618252	29.27	Line	46	-16.73	Ave.
0.563595	30.87	Line	46	-15.13	Ave.
0.428871	29.48	Line	47.27	-17.79	Ave.
0.586125	34.73	Line	46	-11.27	Ave.
0.644217	35.17	Line	46	-10.83	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.583134	41.49	Neutral	56	-14.51	QP
0.443076	45.29	Neutral	57	-11.71	QP
0.58329	41.76	Neutral	56	-14.24	QP
0.501243	38.56	Neutral	56	-17.44	QP
0.400593	42.61	Neutral	57.84	-15.23	QP
0.835395	38.28	Neutral	56	-17.72	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.583134	34.33	Neutral	46	-11.67	Ave.
0.443076	27.28	Neutral	47	-19.72	Ave.
0.58329	34.52	Neutral	46	-11.48	Ave.
0.501243	22.39	Neutral	46	-23.61	Ave.
0.400593	24.16	Neutral	47.84	-23.68	Ave.
0.835395	20.53	Neutral	46	-25.47	Ave.

7 FCC §15.209, §15.247(d) & ISED 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 ISED 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 ($\mu\text{v/m}$ 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 ISED 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 ISED 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:

$$\text{RBW} = 100 \text{ kHz} / \text{VBW} = 300 \text{ kHz} / \text{Sweep} = \text{Auto}$$

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:

$$\text{CA} = \text{Ai} + \text{AF} + \text{CL} + \text{Atten} - \text{Ga}$$

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:

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

7.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	Receiver, EMI Test	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
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2015-03-09	2 years
Agilent	Amplifier, Pre	8447D	2944A10187	2016-03-23	1 year
Wireless Solutions	Conducted Emission Cable	LMR 400	691	2015-07-02	1 year
-	SMA cable	-	606	Each time ¹	N/A
IW	High Frequency Co AX Cable	DC 1531	KPS-1501A3960KPS	2015-08-10	1 year
Agilent	Pre-Amplifier	8449B	3008A01978	2015-09-02	1 year
Wisewave	Amplifier, Low Noise	ALN-22093530-01	12263-01	2016-05-16	1 year
Wisewave	Antenna, Horn	ARH-4223-02	10555-02	2013-09-20	3 years

Note¹: 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:	20-22 °C
Relative Humidity:	42-50 %
ATM Pressure:	102.7 kPa

The testing was performed by Todd Moy from 2016-04-25 to 2016-05-11 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 ISED RSS-247 standard's radiated emissions limits, and had the worst margin of:

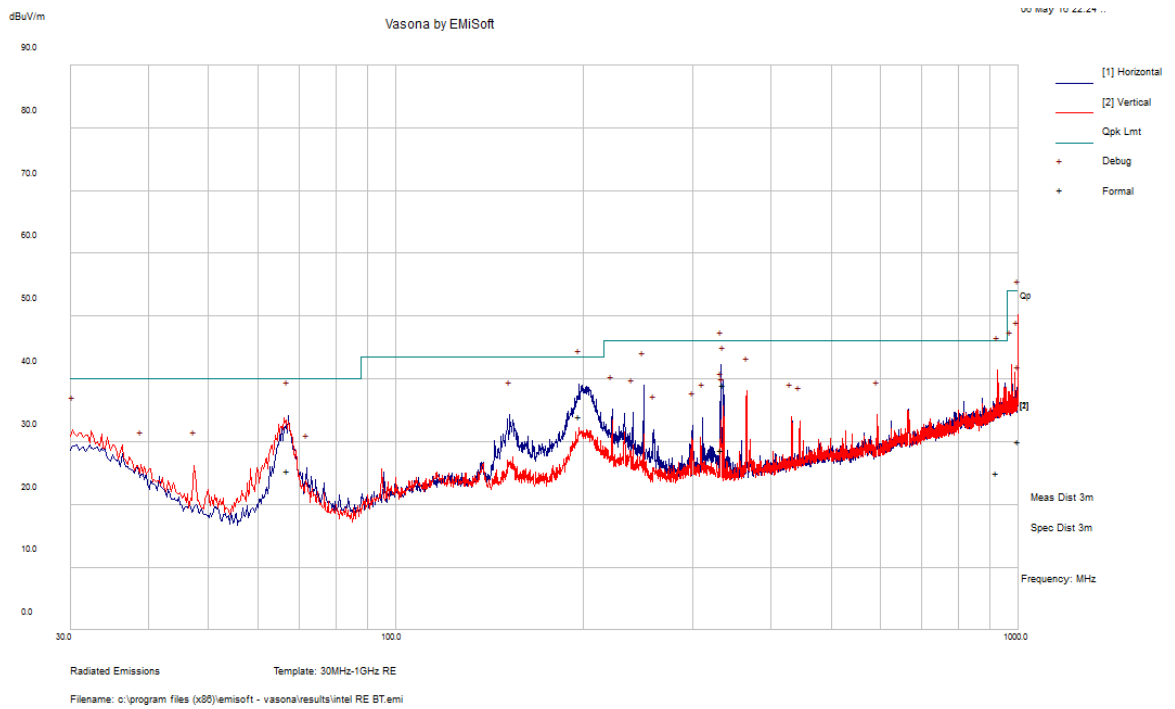
Mode: Transmitting			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Mode, Channel
0.01	2483.5	Vertical	8PSK, High Channel

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

7.8 Radiated Emissions Test Results

Worst Mode of Operation: Hopping Mode

1) 30 MHz- 1 GHz, 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
998.365	29.98	101	V	100	54	-24.02	QP
332.6195	28.67	118	H	27	46	-17.33	QP
197.0145	33.98	123	H	101	43.5	-9.52	QP
924.6518	25.06	284	V	22	46	-20.94	QP
67.0635	25.33	239	H	13	40	-14.67	QP
336.016	39.11	101	H	33	46	-6.89	QP

2) 1-25 GHz, Measured at 3 meters

GFSK Mode

Frequency (MHz)	Receiver		Rx Antenna		Cable Loss (dB)	Pre-Amp Gain (dB)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB/m)					
Frequency: 2402 MHz Power Setting: 12									
2402	71.26	PK	H	29.05	5.21	0.00	105.52	N/A	N/A
2402	71.2	AV	H	29.05	5.21	0.00	105.46	N/A	N/A
2402	69.06	PK	V	29.05	5.21	0.00	103.32	N/A	N/A
2402	68.92	AV	V	29.05	5.21	0.00	103.18	N/A	N/A
2390	28.41	PK	V	28.98	5.20	0.00	62.59	74.00	11.41
2390	16.6	AV	V	28.98	5.20	0.00	50.78	54.00	3.22
4804	52.38	PK	V	32.48	7.88	36.64	56.10	74.00	17.90
4804	47.19	AV	V	32.48	7.88	36.64	50.91	54.00	3.09
7206	48.18	PK	V	36.72	10.45	36.42	58.93	74.00	15.07
7206	40.31	AV	V	36.72	10.45	36.42	51.06	54.00	2.94
9608	50.17	PK	V	37.78	11.37	36.66	62.66	85.52	22.86
9608	42.15	AV	V	37.78	11.37	36.66	54.64	85.46	30.82
Frequency: 2441 MHz Power Setting: 11									
2441	67.21	PK	H	29.19	5.22	0.00	101.62	N/A	N/A
2441	67.02	AV	H	29.19	5.22	0.00	101.43	N/A	N/A
2441	64.78	PK	V	29.19	5.22	0.00	99.19	N/A	N/A
2441	64.58	AV	V	29.19	5.22	0.00	98.99	N/A	N/A
4882	53.02	PK	V	32.61	7.93	36.63	56.93	74.00	17.07
4882	48.44	AV	V	32.61	7.93	36.63	52.35	54.00	1.65
7323	48	PK	V	37.15	10.68	36.43	59.40	74.00	14.60
7323	40.32	AV	V	37.15	10.68	36.43	51.72	54.00	2.28
9764	50.11	PK	V	37.89	11.46	36.69	62.77	81.62	18.85
9764	41.35	AV	V	37.89	11.46	36.69	54.01	81.43	27.42
Frequency: 2480 MHz Power Setting: 11									
2480	69.55	PK	H	29.34	5.22	0.00	104.11	N/A	N/A
2480	69.45	AV	H	29.34	5.22	0.00	104.01	N/A	N/A
2480	67.3	PK	V	29.34	5.22	0.00	101.86	N/A	N/A
2480	67.01	AV	V	29.34	5.22	0.00	101.57	N/A	N/A
2483.5	28.22	PK	V	29.35	5.83	0.00	63.40	74.00	10.60
2483.5	16.7	AV	V	29.35	5.83	0.00	51.88	54.00	2.12
4960	53.48	PK	V	32.85	7.97	36.59	57.71	74.00	16.29
4960	49.63	AV	V	32.85	7.97	36.59	53.86	54.00	0.14
7440	47.36	PK	V	37.04	10.82	36.45	58.77	74.00	15.23
7440	38.19	AV	V	37.04	10.82	36.45	49.60	54.00	4.40
9920	48.86	PK	V	38.00	11.54	36.70	61.70	74.00	12.30
9920	38.69	AV	V	38.00	11.54	36.70	51.53	54.00	2.47

$\pi/4$ -DQPSK Mode

Frequency (MHz)	Receiver		Rx Antenna		Cable Loss (dB)	Pre-Amp Gain (dB)	Cord. Amp. (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
	Reading (dB μ V)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB/m)					
Frequency: 2402 MHz Power Setting: 12									
2402	70.91	PK	H	29.05	5.21	0.00	105.17	N/A	N/A
2402	67.84	AV	H	29.05	5.21	0.00	102.10	N/A	N/A
2402	68.73	PK	V	29.05	5.21	0.00	102.99	N/A	N/A
2402	65.63	AV	V	29.05	5.21	0.00	99.89	N/A	N/A
2390	27.84	PK	H	28.98	5.20	0.00	62.02	74.00	11.98
2390	16.45	AV	H	28.98	5.20	0.00	50.63	54.00	3.37
4804	51.56	PK	V	32.48	7.88	36.64	55.28	74.00	18.72
4804	43.7	AV	V	32.48	7.88	36.64	47.42	54.00	6.58
7206	48.41	PK	V	36.72	10.45	36.42	59.16	74.00	14.84
7206	39.52	AV	V	36.72	10.45	36.42	50.27	54.00	3.73
9608	49.05	PK	V	37.78	11.37	36.66	61.54	74.00	12.46
9608	38.51	AV	V	37.78	11.37	36.66	51.00	54.00	3.00
Frequency: 2441 MHz Power Setting: 12									
2441	67.74	PK	H	29.19	5.22	0.00	102.15	N/A	N/A
2441	65.33	AV	H	29.19	5.22	0.00	99.74	N/A	N/A
2441	65.29	PK	V	29.19	5.22	0.00	99.70	N/A	N/A
2441	62.87	AV	V	29.19	5.22	0.00	97.28	N/A	N/A
4882	53.5	PK	V	32.61	7.93	36.63	57.41	74.00	16.59
4882	45.31	AV	V	32.61	7.93	36.63	49.22	54.00	4.78
7323	47.77	PK	V	37.15	10.68	36.43	59.17	74.00	14.83
7323	38.48	AV	V	37.15	10.68	36.43	49.88	54.00	4.12
9764	49.27	PK	V	37.89	11.46	36.69	61.93	74.00	12.07
9764	39.75	AV	V	37.89	11.46	36.69	52.41	54.00	1.59
Frequency: 2480 MHz Power Setting: 12									
2480	70.48	PK	H	29.34	5.22	0.00	105.04	N/A	N/A
2480	67.37	AV	H	29.34	5.22	0.00	101.93	N/A	N/A
2480	68.06	PK	V	29.34	5.22	0.00	102.62	N/A	N/A
2480	64.97	AV	V	29.34	5.22	0.00	99.53	N/A	N/A
2483.5	29.44	PK	H	29.35	5.83	0.00	64.62	74.00	9.38
2483.5	18.72	AV	H	29.35	5.83	0.00	53.90	54.00	0.10
4960	54.23	PK	V	32.85	7.97	36.59	58.46	74.00	15.54
4960	46.91	AV	V	32.85	7.97	36.59	51.14	54.00	2.86
7440	48.32	PK	V	37.04	10.82	36.45	59.73	74.00	14.27
7440	37.67	AV	V	37.04	10.82	36.45	49.08	54.00	4.92
9920	47.11	PK	V	38.00	11.54	36.70	59.95	74.00	14.05
9920	36.29	AV	V	38.00	11.54	36.70	49.13	54.00	4.87

8DPSK Mode

Frequency (MHz)	Receiver		Rx Antenna		Cable Loss (dB)	Pre-Amp Gain (dB)	Cord. Amp. (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
	Reading (dB μ V)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB/m)					
Frequency: 2402 MHz Power Setting: 12									
2402	71.51	PK	H	29.05	5.21	0.00	105.77	N/A	N/A
2402	67.83	AV	H	29.05	5.21	0.00	102.09	N/A	N/A
2402	69.28	PK	V	29.05	5.21	0.00	103.54	N/A	N/A
2402	65.64	AV	V	29.05	5.21	0.00	99.90	N/A	N/A
2390	27.78	PK	H	28.98	5.20	0.00	61.96	74.00	12.04
2390	16.49	AV	H	28.98	5.20	0.00	50.67	54.00	3.33
4804	51.87	PK	V	32.48	7.88	36.64	55.59	74.00	18.41
4804	43.23	AV	V	32.48	7.88	36.64	46.95	54.00	7.05
7206	49.47	PK	V	36.72	10.45	36.42	60.22	74.00	13.78
7206	40.06	AV	V	36.72	10.45	36.42	50.81	54.00	3.19
9608	49.56	PK	V	37.78	11.37	36.66	62.05	74.00	11.95
9608	38.93	AV	V	37.78	11.37	36.66	51.42	54.00	2.58
Frequency: 2441 MHz Power Setting: 12									
2441	68.12	PK	H	29.19	5.22	0.00	102.53	N/A	N/A
2441	65.33	AV	H	29.19	5.22	0.00	99.74	N/A	N/A
2441	65.88	PK	V	29.19	5.22	0.00	100.29	N/A	N/A
2441	62.78	AV	V	29.19	5.22	0.00	97.19	N/A	N/A
4882	53.87	PK	V	32.61	7.93	36.63	57.78	74.00	16.22
4882	46.53	AV	V	32.61	7.93	36.63	50.44	54.00	3.56
7323	47.97	PK	V	37.15	10.68	36.43	59.37	74.00	14.63
7323	38.25	AV	V	37.15	10.68	36.43	49.65	54.00	4.35
9764	49.86	PK	V	37.89	11.46	36.69	62.52	74.00	11.48
9764	40.11	AV	V	37.89	11.46	36.69	52.77	54.00	1.23
Frequency: 2480 MHz Power Setting: 12									
2480	71.07	PK	H	29.34	5.22	0.00	105.63	N/A	N/A
2480	67.32	AV	H	29.34	5.22	0.00	101.88	N/A	N/A
2480	68.72	PK	V	29.34	5.22	0.00	103.28	N/A	N/A
2480	64.99	AV	V	29.34	5.22	0.00	99.55	N/A	N/A
2483.5	30.21	PK	V	29.35	5.83	0.00	65.39	74.00	8.61
2483.5	18.81	AV	V	29.35	5.83	0.00	53.99	54.00	0.01
4960	55.23	PK	V	32.85	7.97	36.59	59.46	74.00	14.54
4960	47.41	AV	V	32.85	7.97	36.59	51.64	54.00	2.36
7440	47.84	PK	V	37.04	10.82	36.45	59.25	74.00	14.75
7440	37.75	AV	V	37.04	10.82	36.45	49.16	54.00	4.84
9920	48.1	PK	V	38.00	11.54	36.70	60.94	74.00	13.06
9920	36.64	AV	V	38.00	11.54	36.70	49.48	54.00	4.52

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

8.1 Applicable Standards

According to FCC §15.247(a) (1) and ISED 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
-	SMA Pigtail	-	-	Each time ¹	N/A
-	10 dB attenuator	-	-	Each time ¹	N/A

Note¹: 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 °C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Todd Moy on 2016-04-26 in RF site.

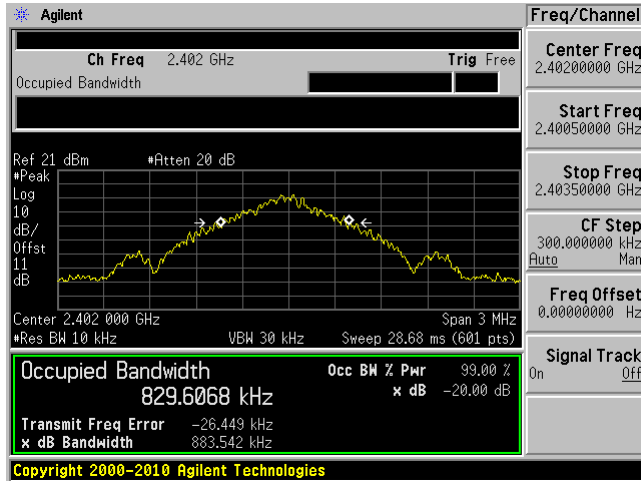
8.5 Test Results

Channel	Frequency (MHz)	99% OBW (kHz)	20 dB OBW (kHz)
GFSK			
Low	2402	829.6068	883.542
Middle	2441	855.5276	922.542
High	2480	857.2354	917.301
$\pi/4$ -DQPSK			
Low	2402	1269.7	1392
Middle	2441	1227.1	1359
High	2480	1236.2	1379
8DPSK			
Low	2402	1254.2	1388
Middle	2441	1272.5	1386
High	2480	1252.9	1385

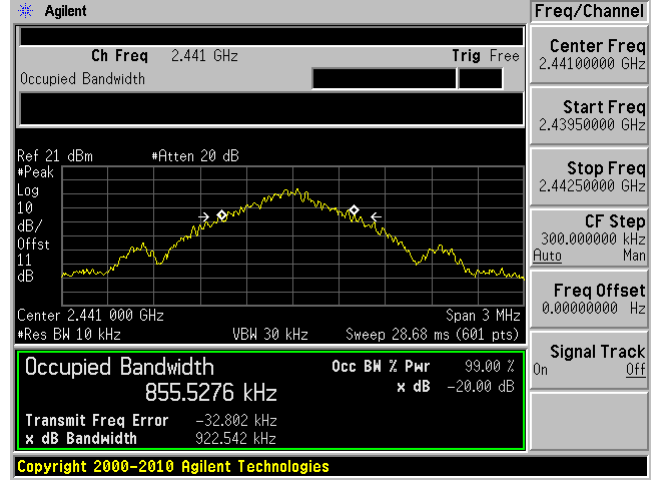
Please refer to the following plots for detailed test results.

GFSK

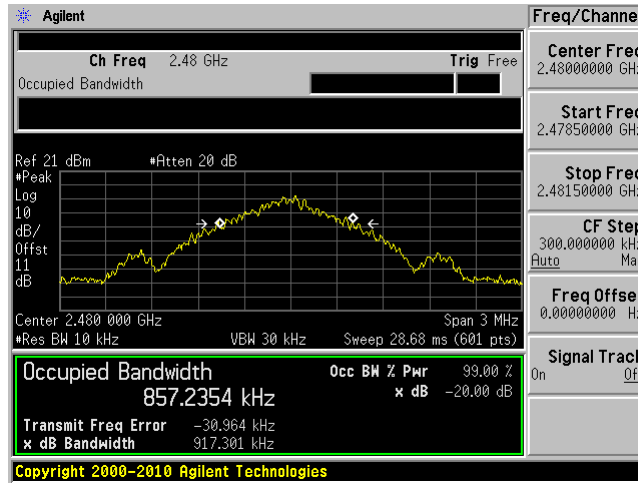
Low Channel 2402 MHz



Middle Channel 2441 MHz

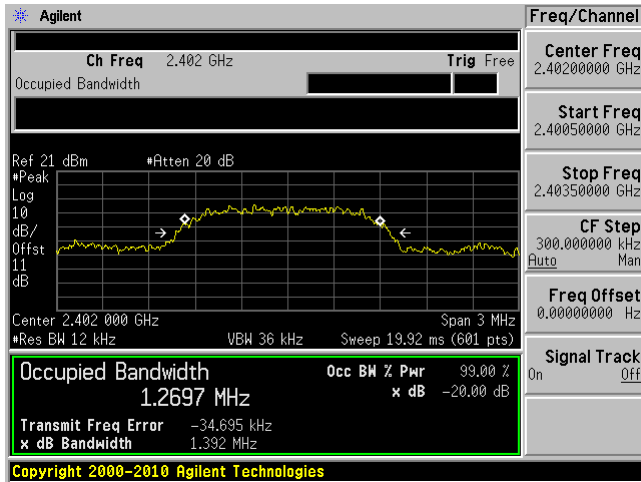


High Channel 2480 MHz

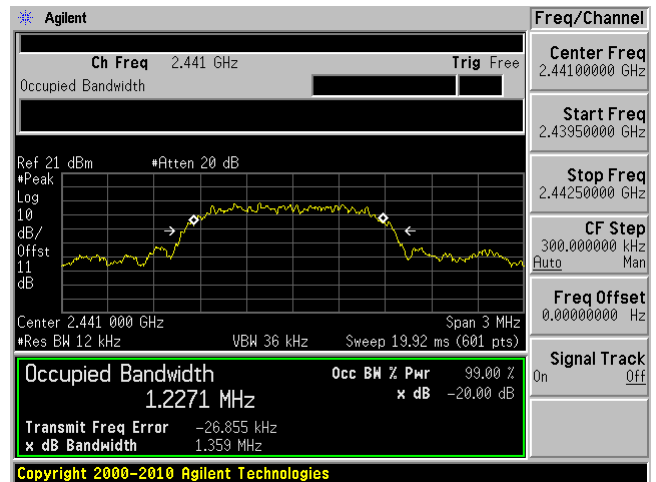


$\pi/4$ -DQPSK

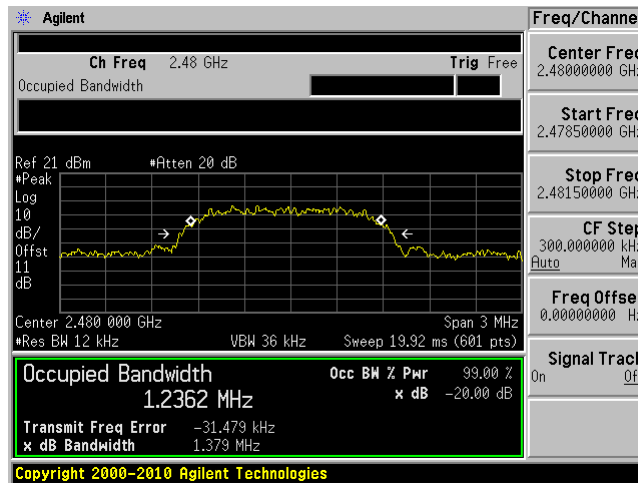
Low Channel 2402 MHz



Middle Channel 2441 MHz

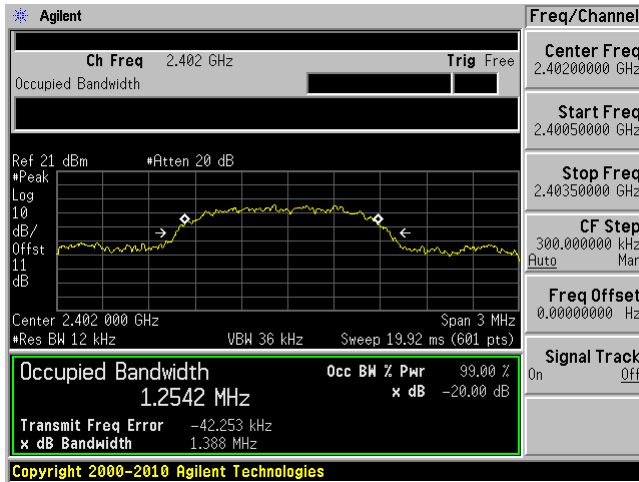


High Channel 2480 MHz

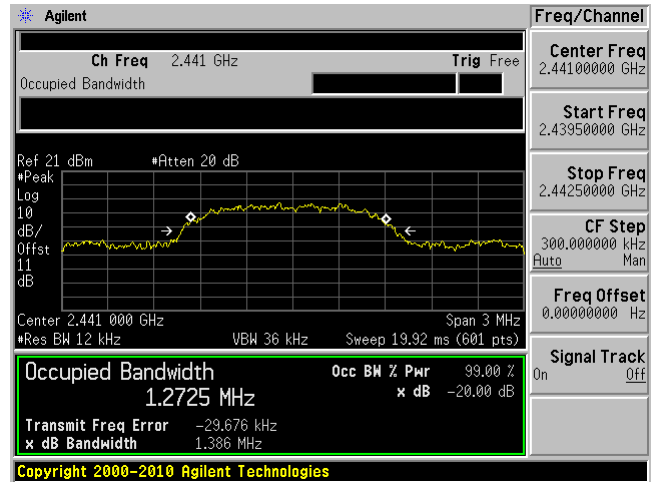


8DPSK

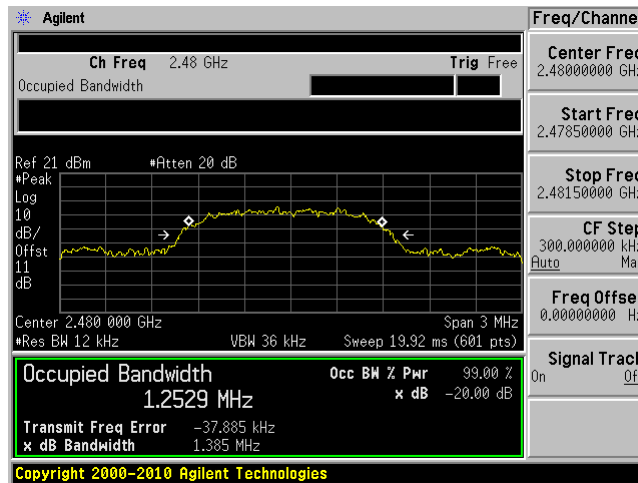
Low Channel 2402 MHz



Middle Channel 2441 MHz



High Channel 2480 MHz



9 FCC §15.247(b) (1) & ISED 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
Rohde & Schwarz	Signal Analyzer	FSQ26	200749	2016-03-24	1year
-	SMA Pigtail	-	-	Each time ¹	N/A
-	10 dB attenuator	-	-	Each time ¹	N/A

Note¹: 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 °C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Jose Martinez on 2016-05-27 in RF site.

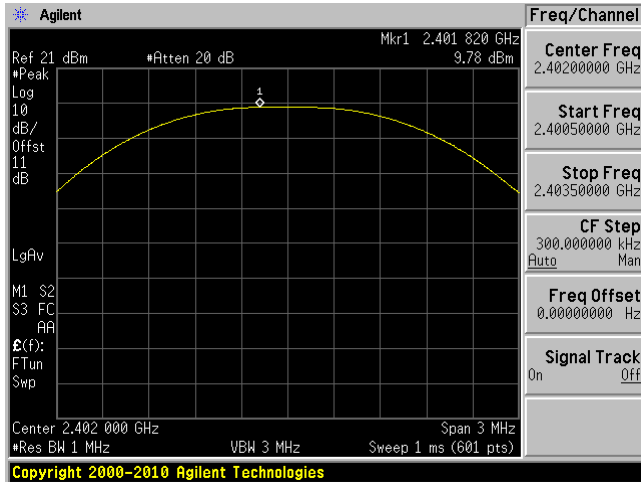
9.5 Test Results

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)
GFSK			
Low	2402	9.78	30
Middle	2441	7.31	30
High	2480	7.92	30
$\pi/4$ -DQPSK			
Low	2402	9.73	30
Middle	2441	8.37	30
High	2480	9.01	30
8DPSK			
Low	2402	9.89	30
Middle	2441	8.80	30
High	2480	9.34	30

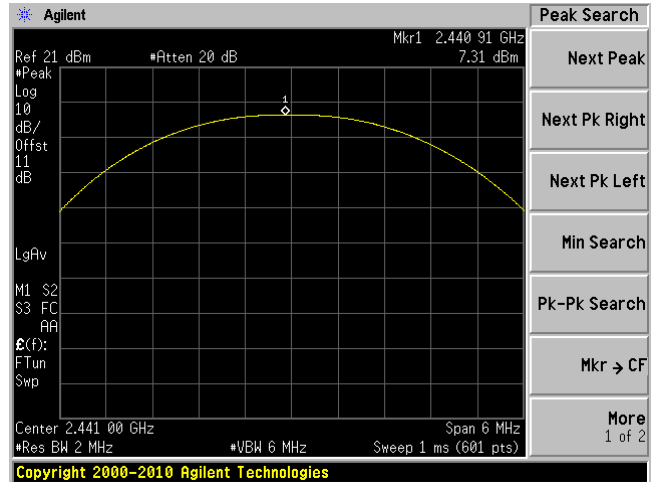
Please refer to the following plots for detailed test results.

GFSK

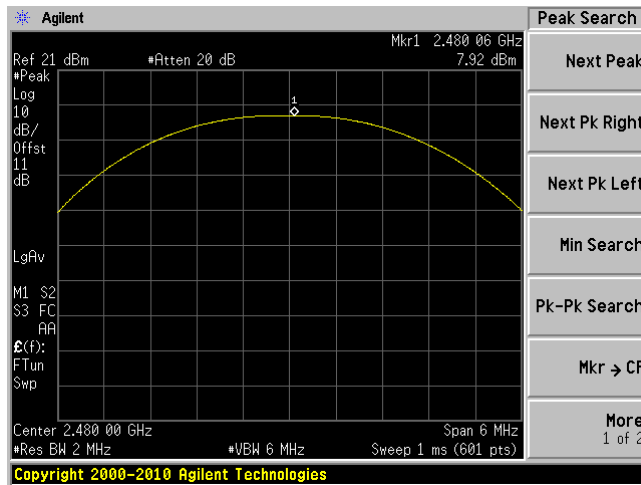
Low Channel 2402 MHz



Middle Channel 2441 MHz

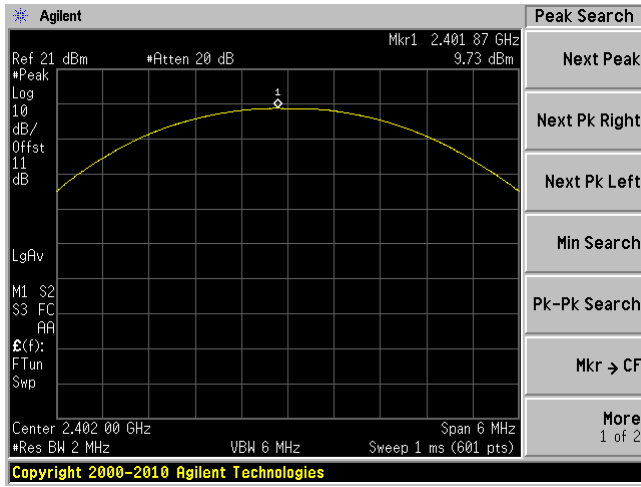


High Channel 2480 MHz

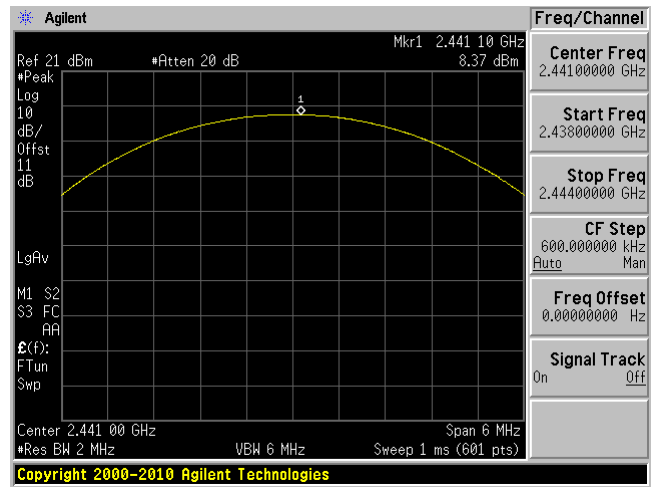


$\pi/4$ -DQPSK

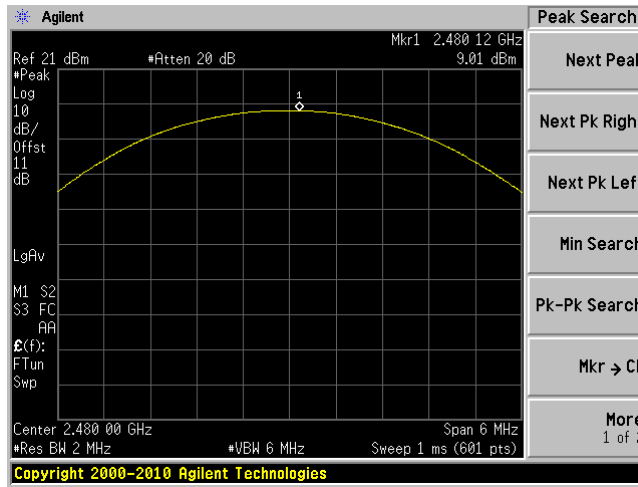
Low Channel 2402 MHz



Middle Channel 2441 MHz

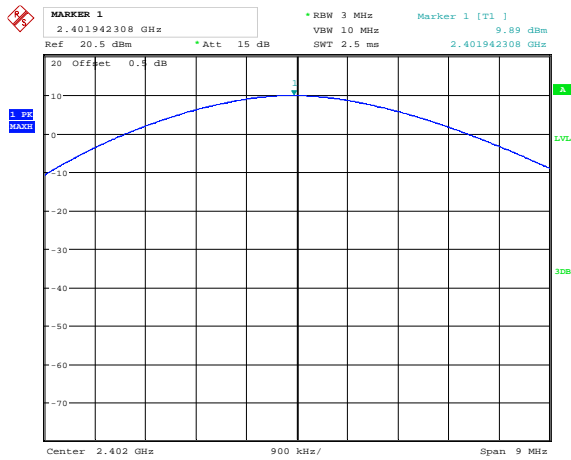


High Channel 2480 MHz



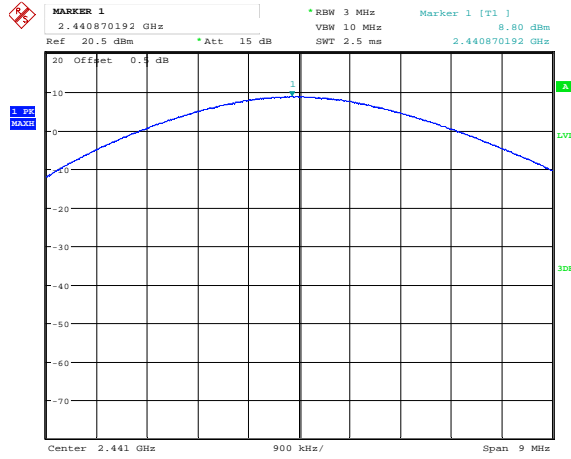
8DPSK

Low Channel 2402 MHz



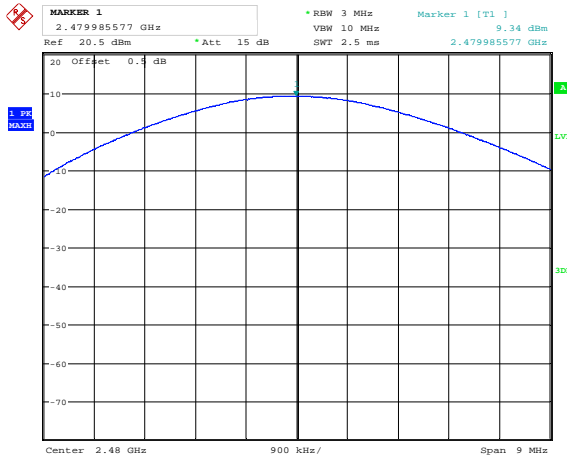
Date: 30.MAY.2016 21:35:12

Middle Channel 2441 MHz



Date: 30.MAY.2016 21:39:27

High Channel 2480 MHz



Date: 30.MAY.2016 21:40:37

10 FCC §15.247(d) & ISED 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 ISED 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
-	SMA Pigtail	-	-	Each time ¹	N/A
-	10 dB attenuator	-	-	Each time ¹	N/A

Note¹: 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 °C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

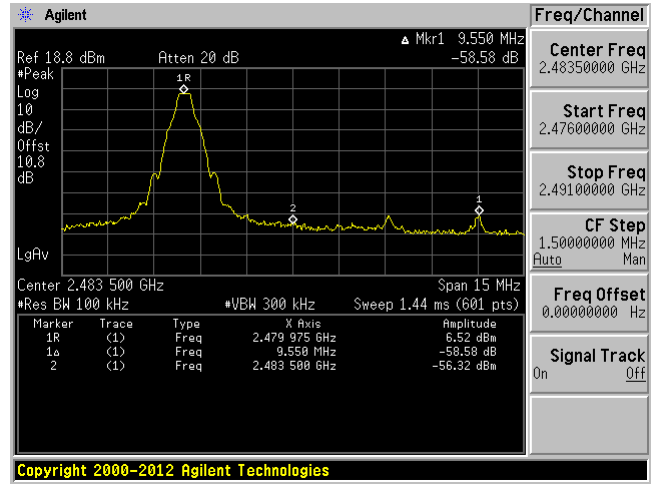
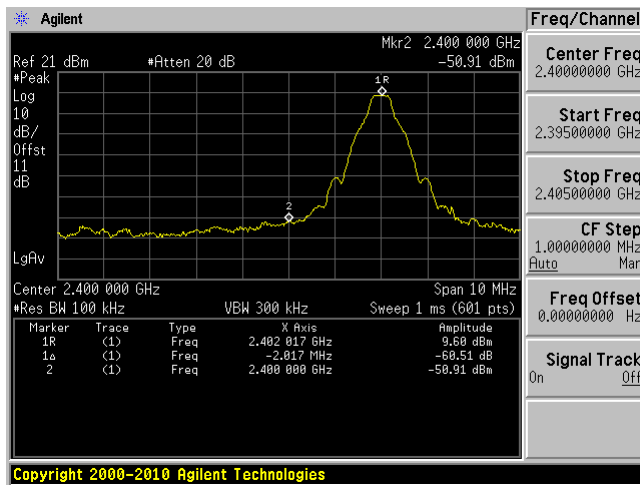
The testing was performed by Jose Martinez on 2016-05-27 in RF site.

10.5 Test Results

GFSK

Low Channel 2402 MHz

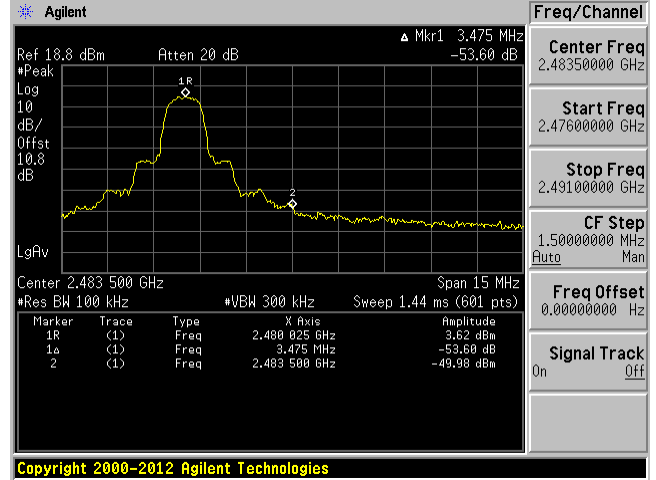
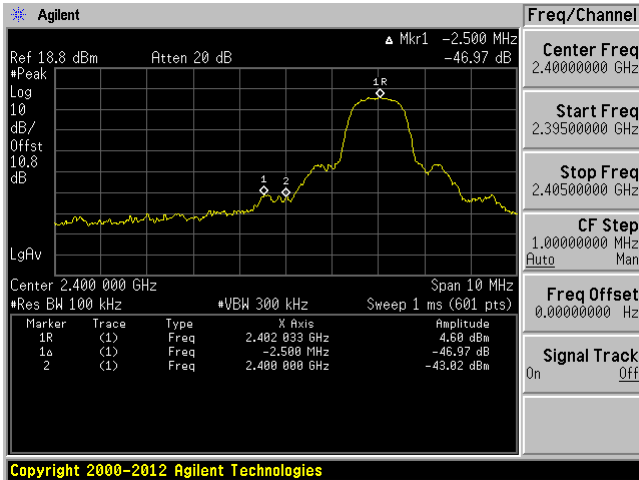
High Channel 2480 MHz



$\pi/4$ -DQPSK

Low Channel 2402 MHz

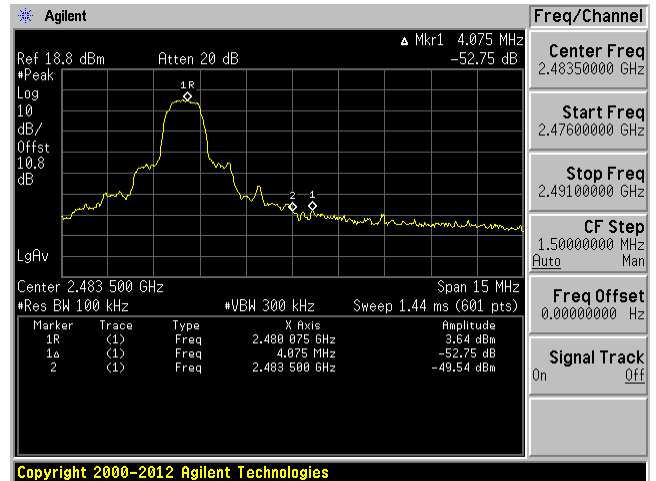
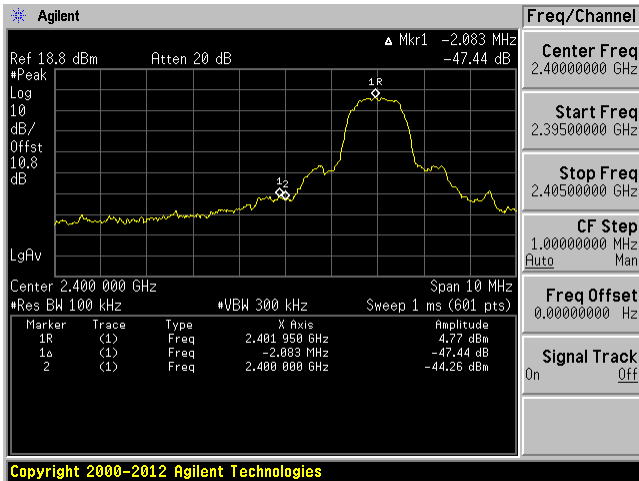
High Channel 2480 MHz



8DPSK

Low Channel 2402 MHz

High Channel 2480 MHz



11 FCC §15.247(a) (1) (iii) & ISED 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 \leq channel spacing and where possible RBW should be set $\gg 1/T$, 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:

$$\text{(Number of hops in the period specified in the requirements)} = \text{(number of hops on spectrum analyzer)} \times \text{(period specified in the requirements / analyzer sweep time)}$$

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
-	SMA Pigtail	-	-	Each time ¹	N/A
-	10 dB attenuator	-	-	Each time ¹	N/A

Note¹: 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 °C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Todd Moy on 2016-04-27 in RF site.

11.5 Test Results

Please refer to the following tables and plots.

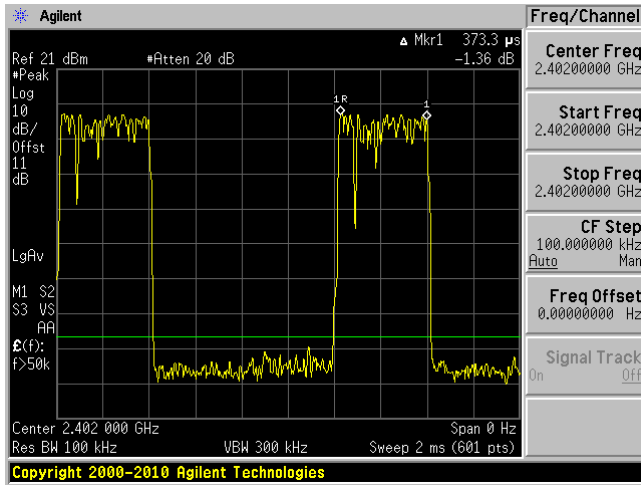
Channel	Pulse Width (ms)	Number of Hops in the Period Specified in the Requirements	Average Time of Occupancy (s)	Limit (sec)	Results
GFSK, DM1					
Low	0.3733	320	0.119456	0.4	Compliant
Middle	0.3733	320	0.119456	0.4	Compliant
High	0.3733	320	0.119456	0.4	Compliant
GFSK, DM3					
Low	1.617	170	0.27489	0.4	Compliant
Middle	1.633	140	0.22862	0.4	Compliant
High	1.617	140	0.22638	0.4	Compliant
GFSK, DM5					
Low	2.85	80	0.228	0.4	Compliant
Middle	2.85	100	0.285	0.4	Compliant
High	2.825	100	0.2825	0.4	Compliant
GFSK, DH1					
Low	0.3833	330	0.126489	0.4	Compliant
Middle	0.3833	330	0.126489	0.4	Compliant
High	0.3867	320	0.123744	0.4	Compliant
GFSK, DH3					
Low	1.617	150	0.24255	0.4	Compliant
Middle	1.617	150	0.24255	0.4	Compliant
High	1.617	160	0.25872	0.4	Compliant
GFSK, DH5					
Low	2.85	80	0.228	0.4	Compliant
Middle	2.875	120	0.345	0.4	Compliant
High	2.775	110	0.30525	0.4	Compliant

Channel	Pulse Width (ms)	Number of Hops in the Period Specified in the Requirements	Average Time of Occupancy (s)	Limit (sec)	Results
$\pi/4$ -DQPSK, DH1					
Low	0.39	310	0.1209	0.4	Compliant
Middle	0.39	290	0.1131	0.4	Compliant
High	0.3933	310	0.121923	0.4	Compliant
$\pi/4$ -DQPSK, DH3					
Low	1.633	140	0.22862	0.4	Compliant
Middle	1.633	140	0.22862	0.4	Compliant
High	1.65	190	0.3135	0.4	Compliant
$\pi/4$ -DQPSK, DH5					
Low	2.725	120	0.327	0.4	Compliant
Middle	2.725	100	0.2725	0.4	Compliant
High	2.7	140	0.378	0.4	Compliant
8DPSK, DH1					
Low	0.3867	320	0.123744	0.4	Compliant
Middle	0.3933	310	0.121923	0.4	Compliant
High	0.3833	310	0.118823	0.4	Compliant
8DPSK, DH3					
Low	1.65	150	0.2475	0.4	Compliant
Middle	1.617	140	0.22638	0.4	Compliant
High	1.65	160	0.264	0.4	Compliant
8DPSK, DH5					
Low	2.9	80	0.232	0.4	Compliant
Middle	2.875	130	0.37375	0.4	Compliant
High	2.875	100	0.2875	0.4	Compliant

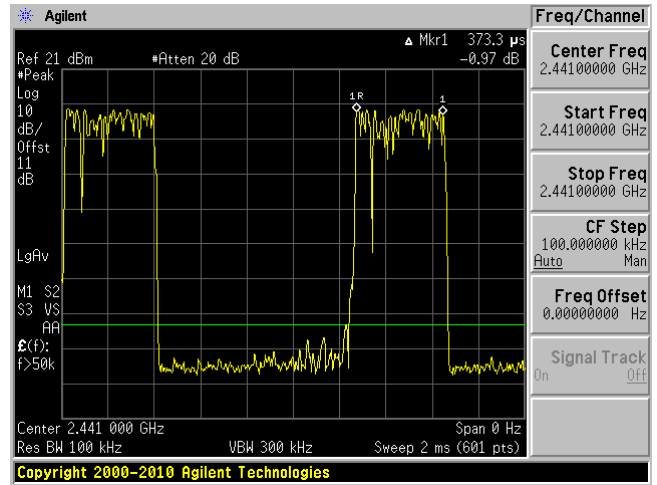
Note: The worst case hopping rates were used for testing.

GFSK, DM1 Pulse Width

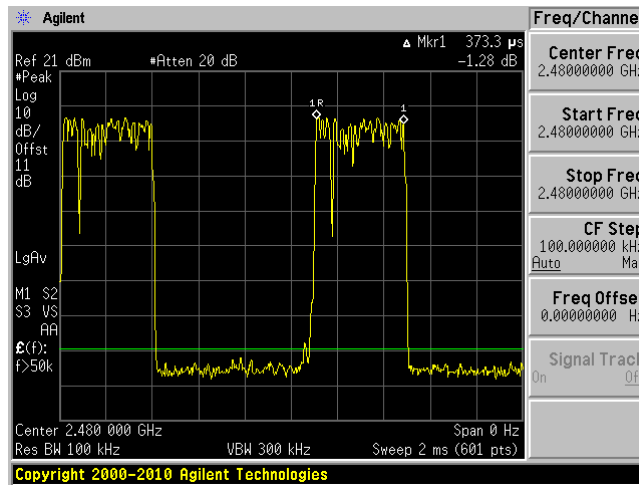
Low Channel 2402 MHz



Middle Channel 2441 MHz



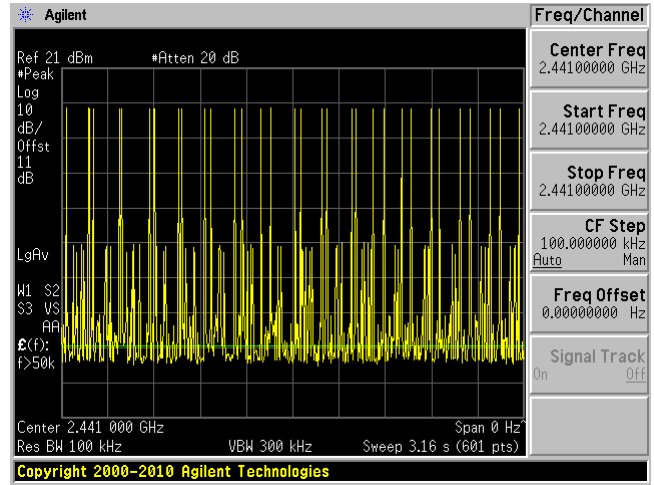
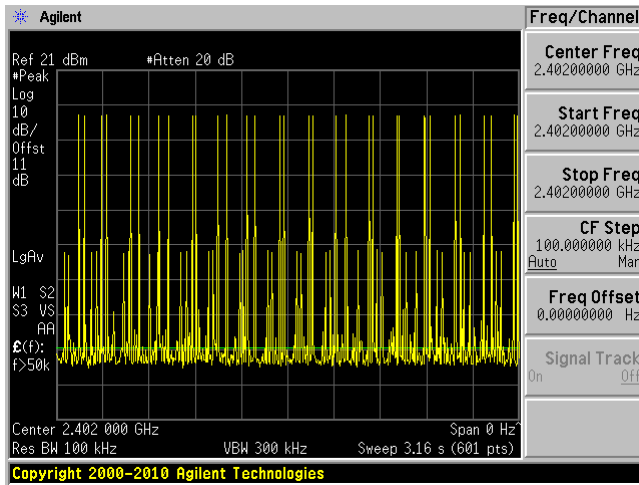
High Channel 2480 MHz



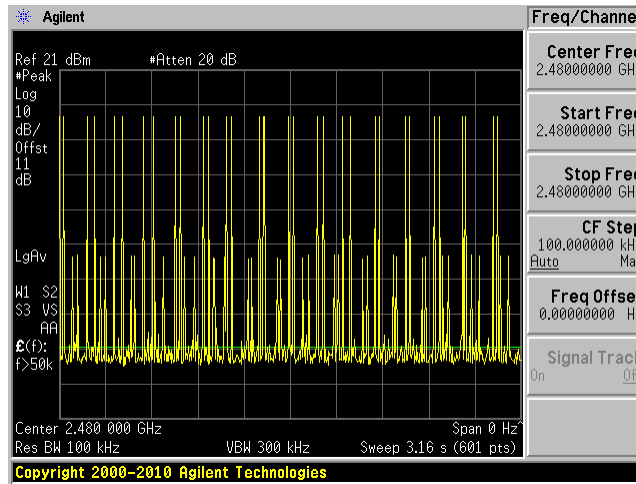
GFSK, DM1 Number of Pulses within a Specified Time

Low Channel 2402 MHz

Middle Channel 2441 MHz



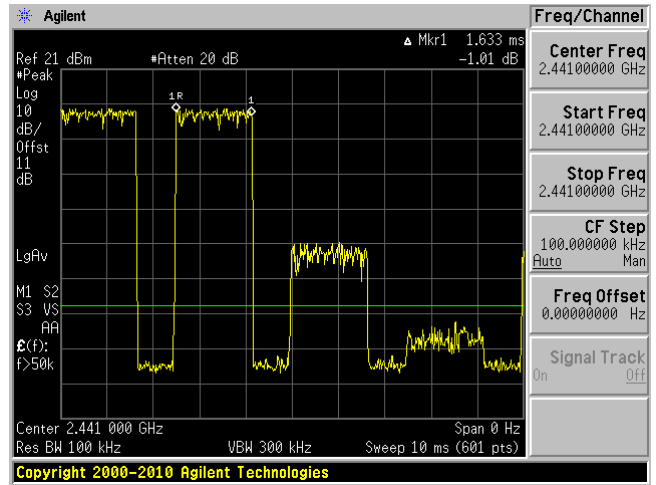
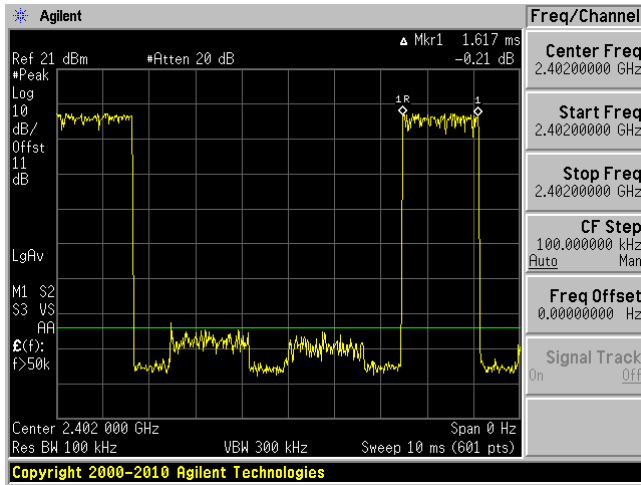
High Channel 2480 MHz



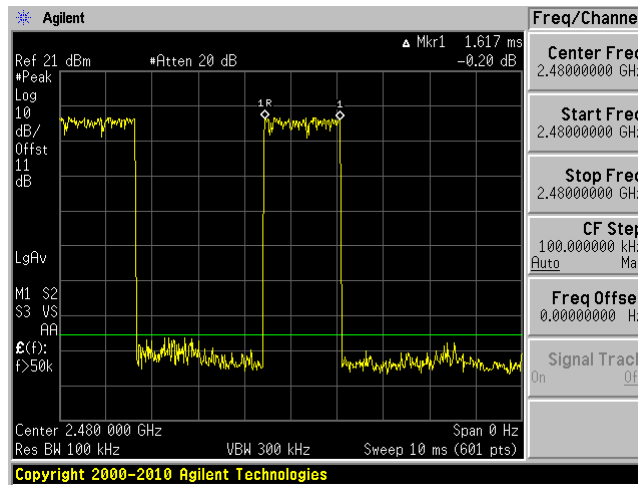
GFSK, DM3 Pulse Width

Low Channel 2402 MHz

Middle Channel 2441 MHz



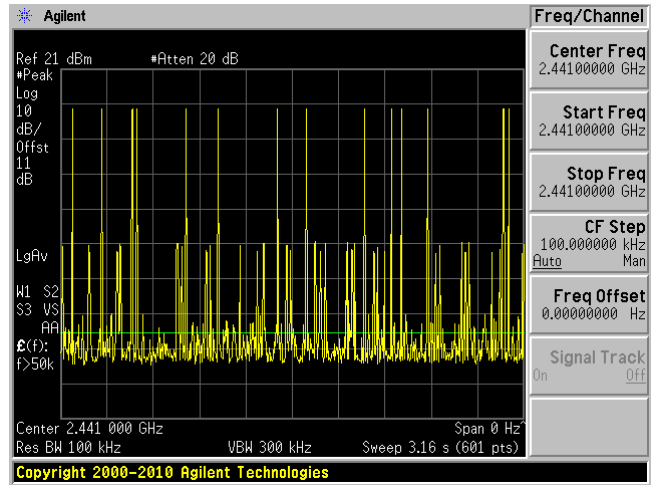
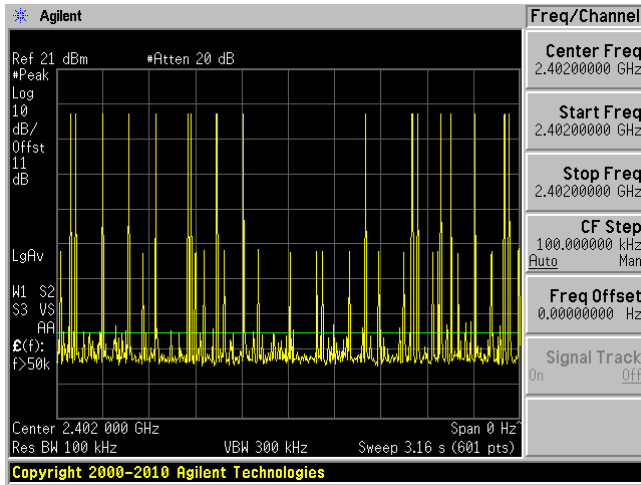
High Channel 2480 MHz



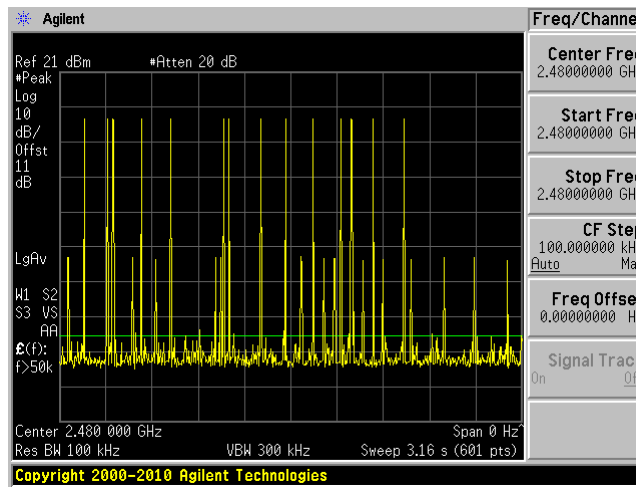
GFSK, DM3 Number of Pulses within a Specified Time

Low Channel 2402 MHz

Middle Channel 2441 MHz



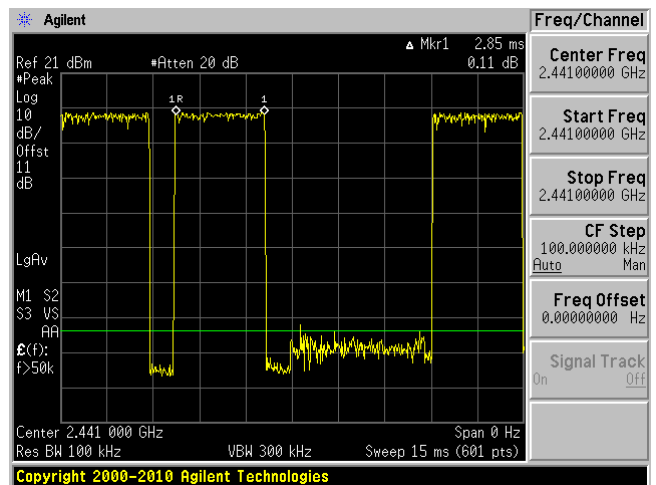
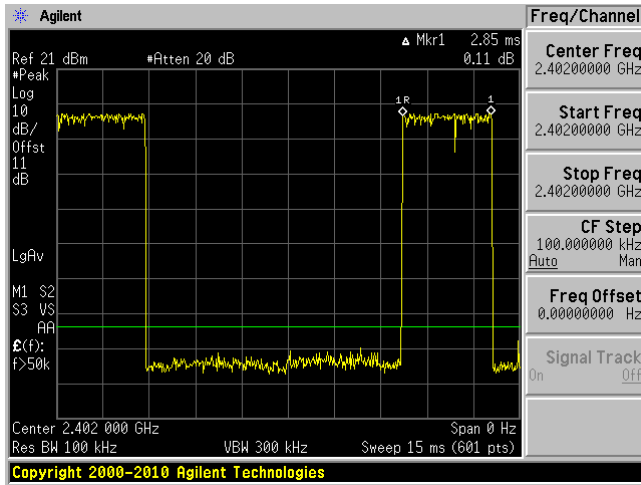
High Channel 2480 MHz



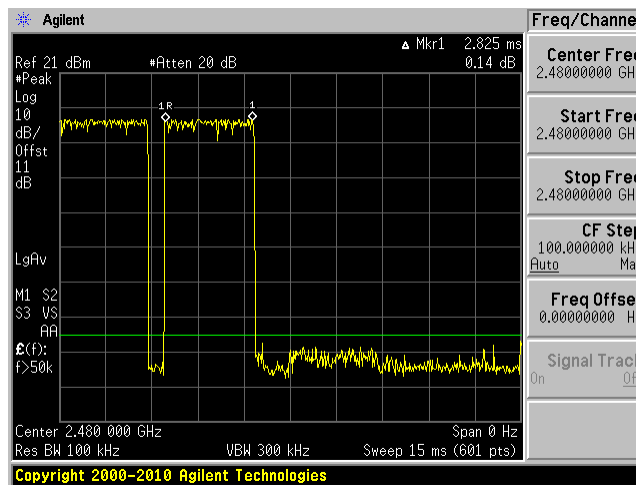
GFSK, DM5 Pulse Width

Low Channel 2402 MHz

Middle Channel 2441 MHz

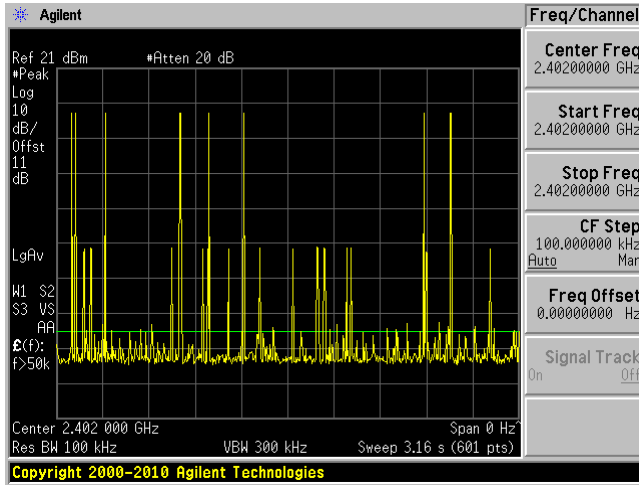


High Channel 2480 MHz

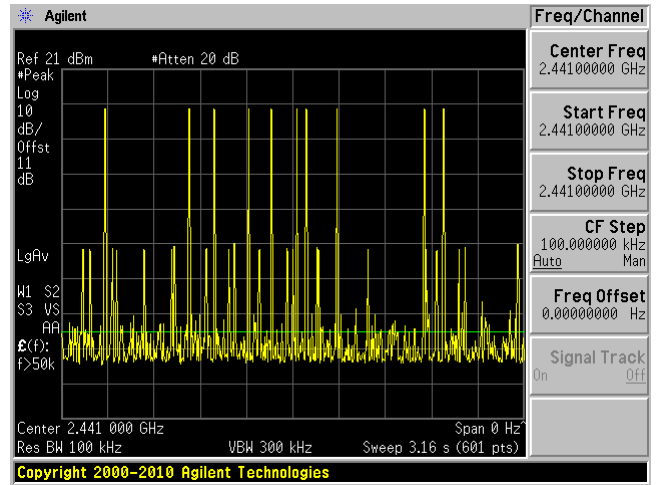


GFSK, DM5 Number of Pulses within a Specified Time

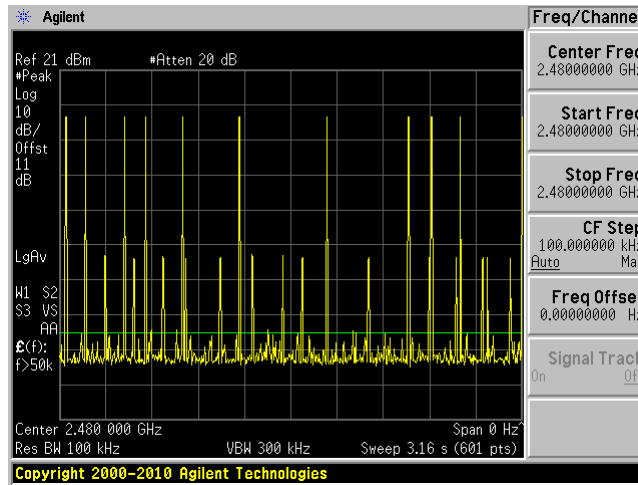
Low Channel 2402 MHz



Middle Channel 2441 MHz



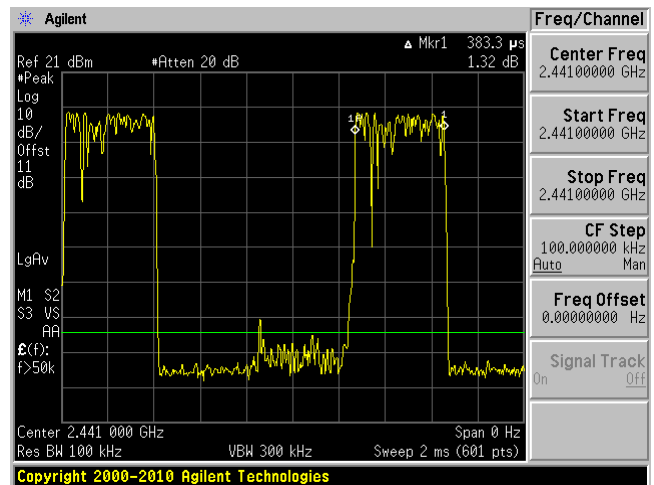
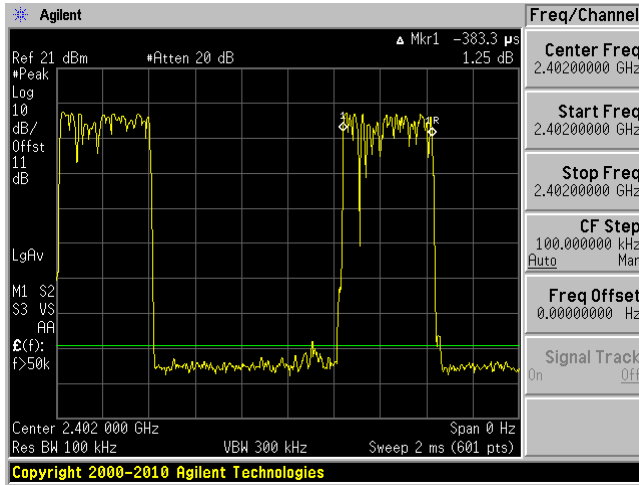
High Channel 2480 MHz



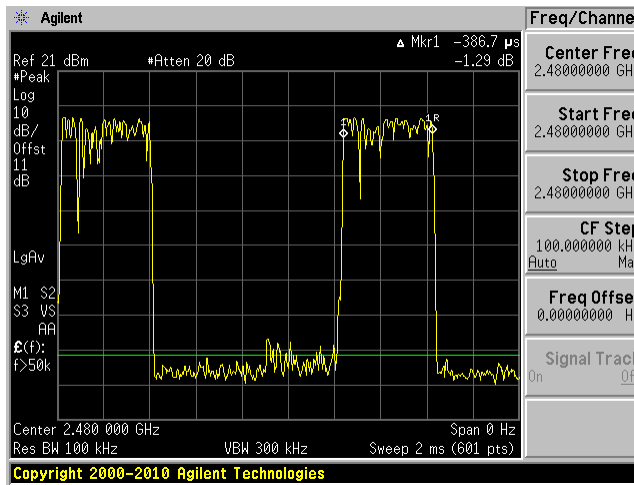
GFSK, DH1 Pulse Width

Low Channel 2402 MHz

Middle Channel 2441 MHz



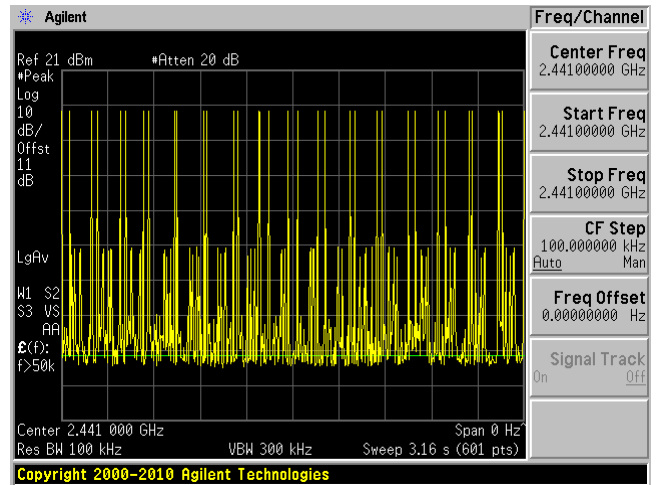
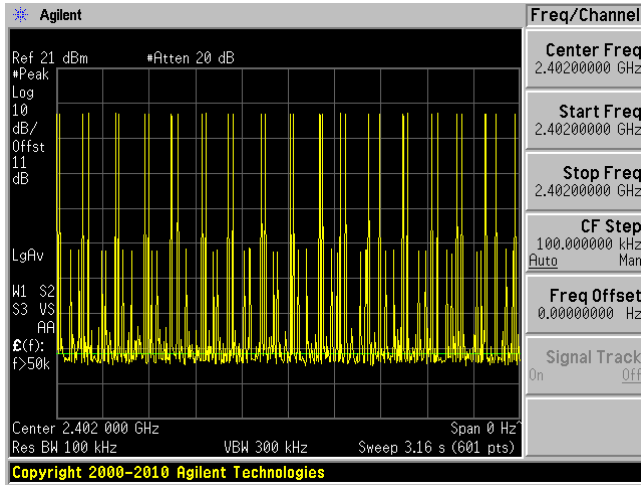
High Channel 2480 MHz



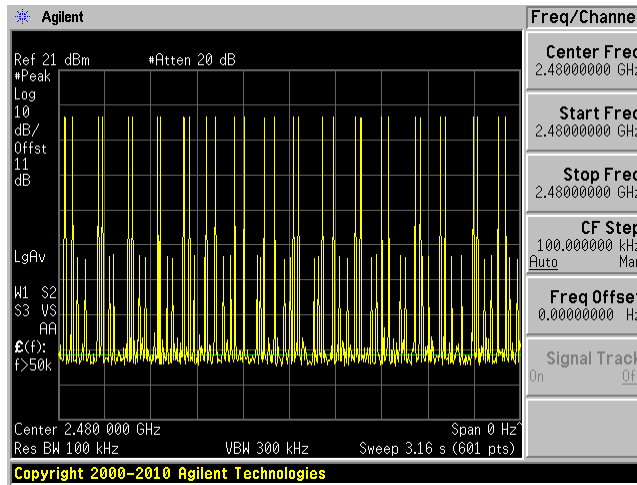
GFSK, DH1 Number of Pulses within a Specified Time

Low Channel 2402 MHz

Middle Channel 2441 MHz



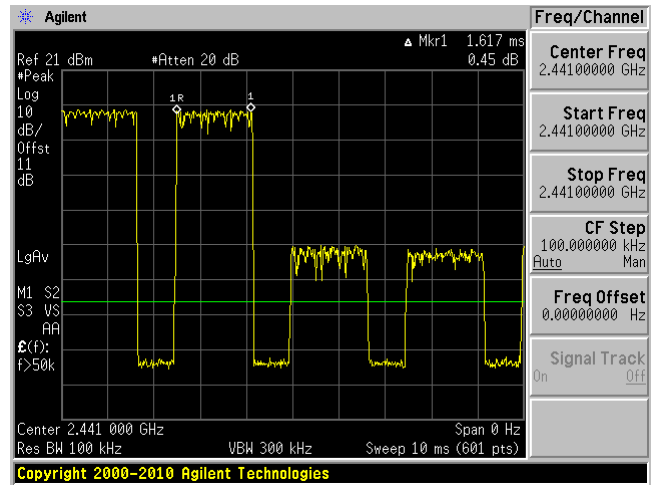
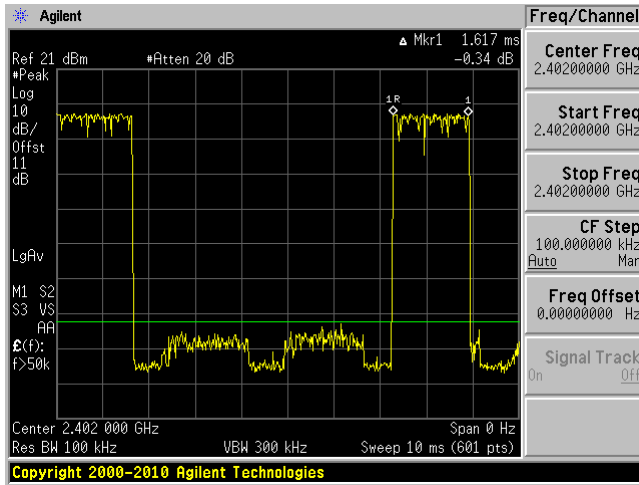
High Channel 2480 MHz



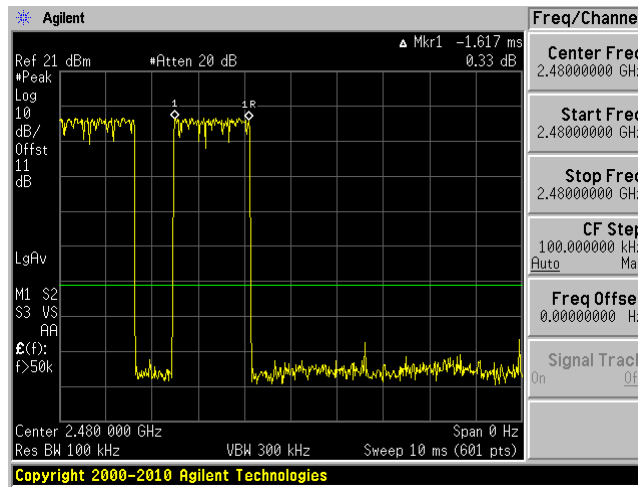
GFSK, DH3 Pulse Width

Low Channel 2402 MHz

Middle Channel 2441 MHz



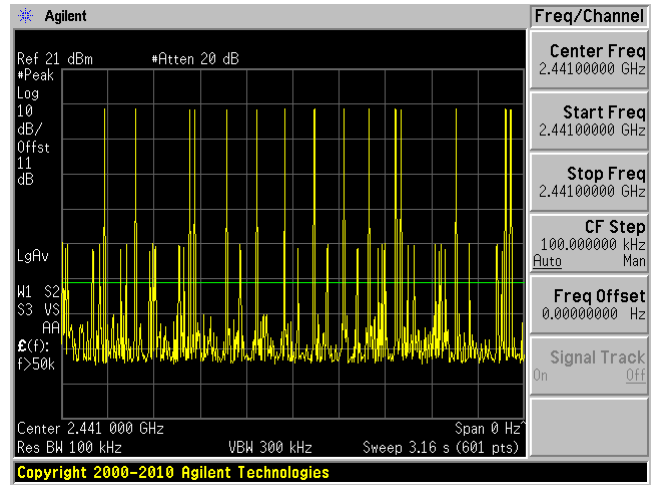
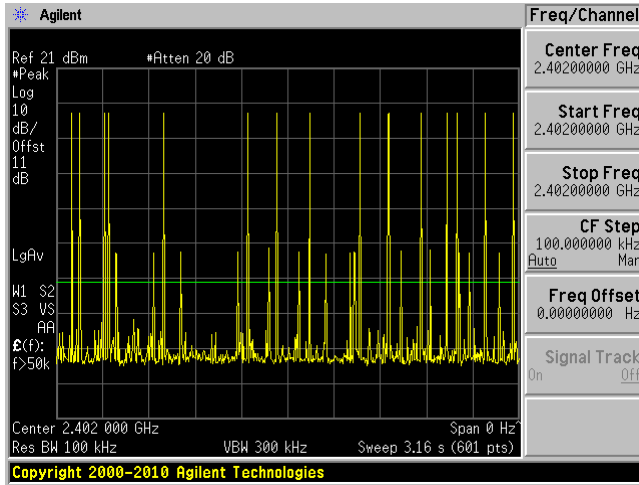
High Channel 2480 MHz



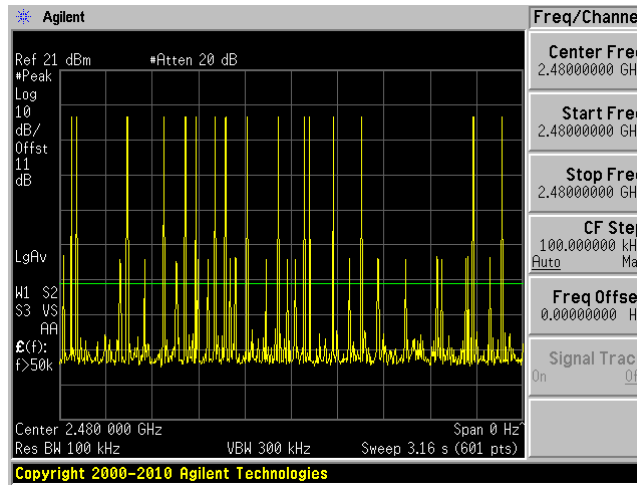
GFSK, DH3 Number of Pulses within a Specified Time

Low Channel 2402 MHz

Middle Channel 2441 MHz

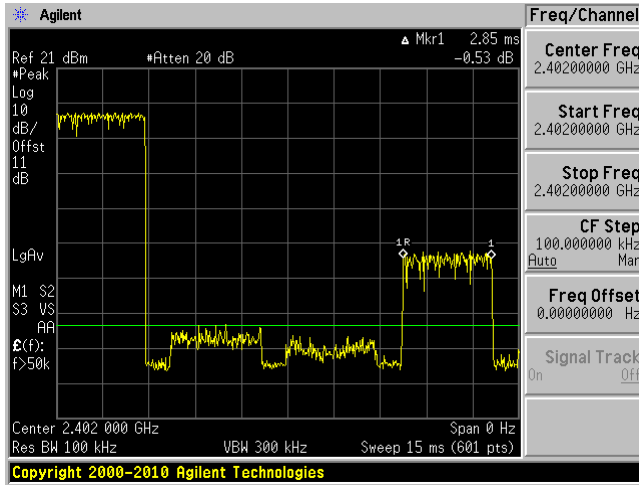


High Channel 2480 MHz

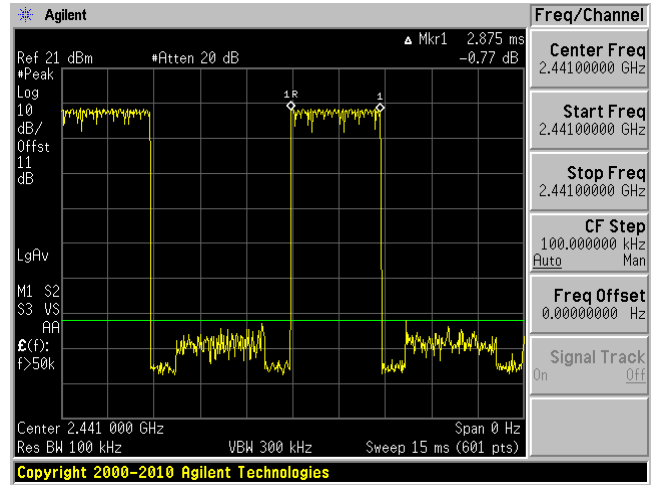


GFSK, DH5 Pulse Width

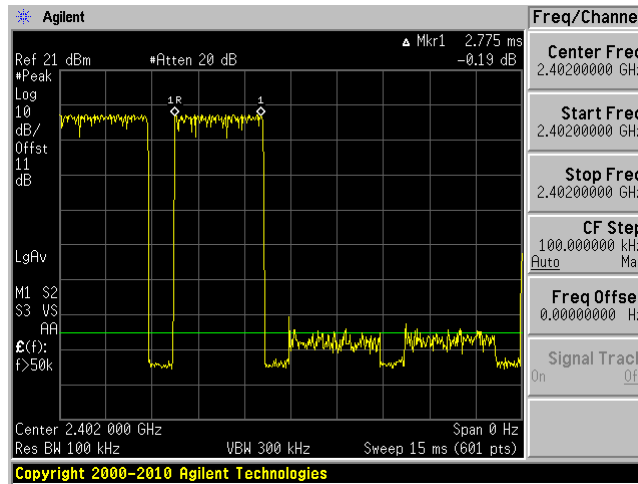
Low Channel 2402 MHz



Middle Channel 2441 MHz



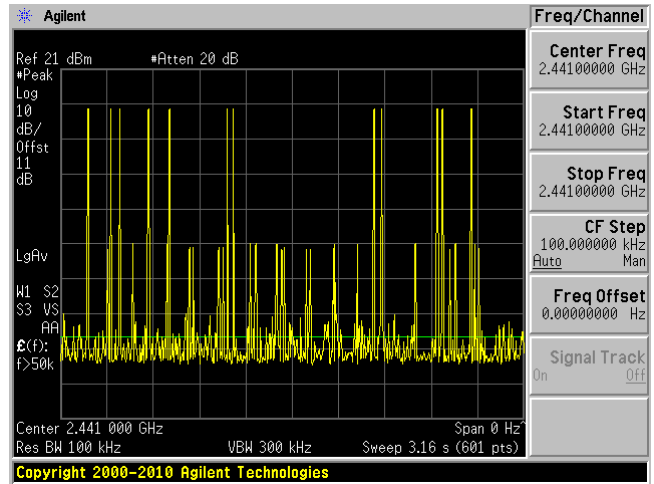
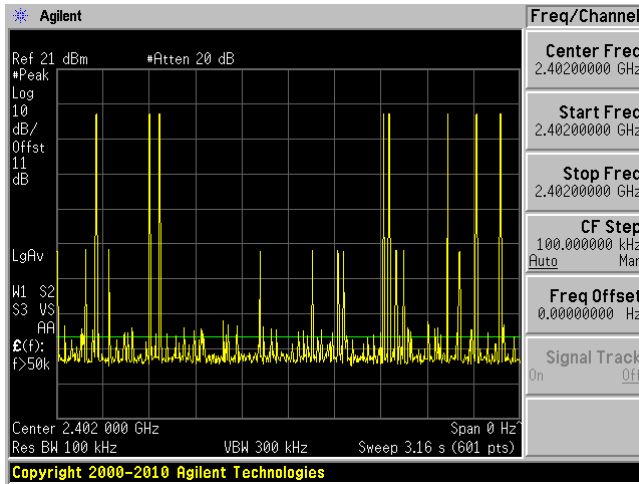
High Channel 2480 MHz



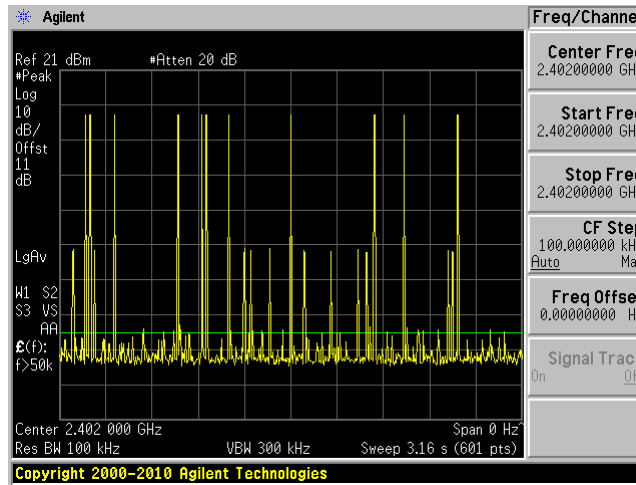
GFSK, DH5 Number of Pulses within a Specified Time

Low Channel 2402 MHz

Middle Channel 2441 MHz



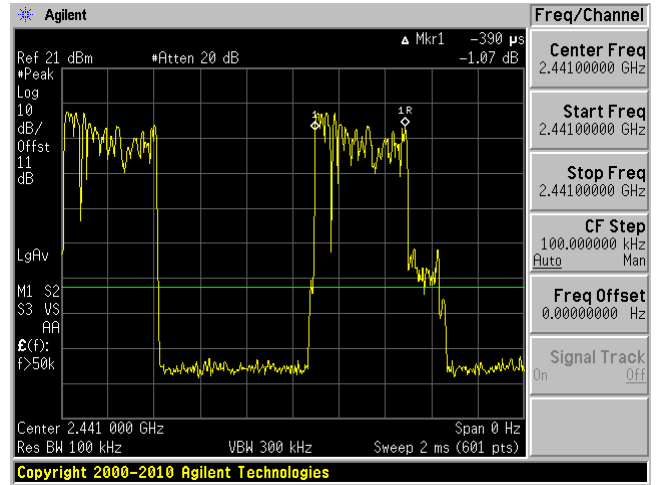
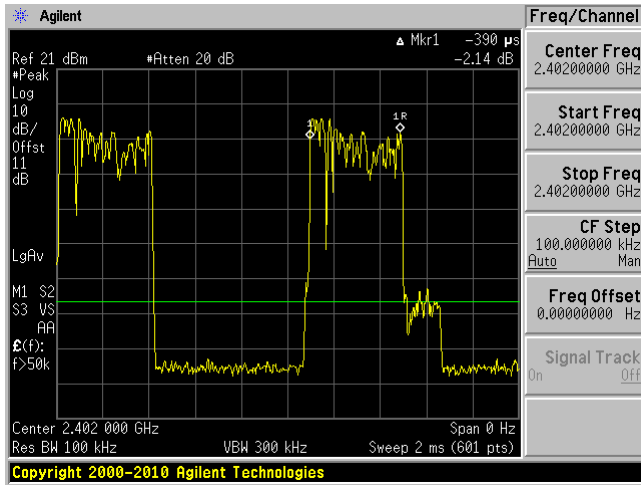
High Channel 2480 MHz



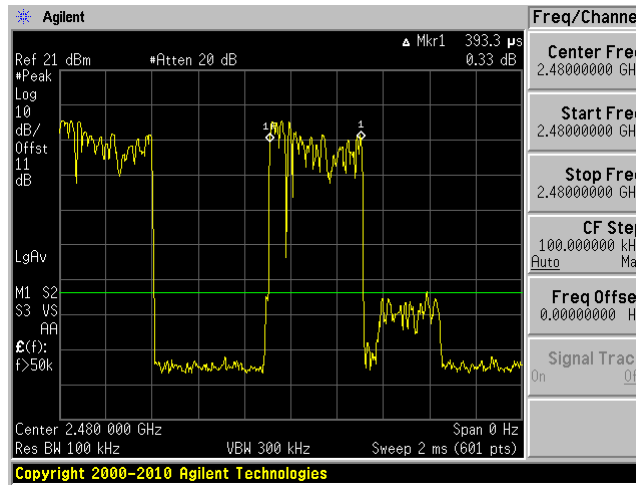
$\pi/4$ -DQPSK, DH1 Pulse Width

Low Channel 2402 MHz

Middle Channel 2441 MHz



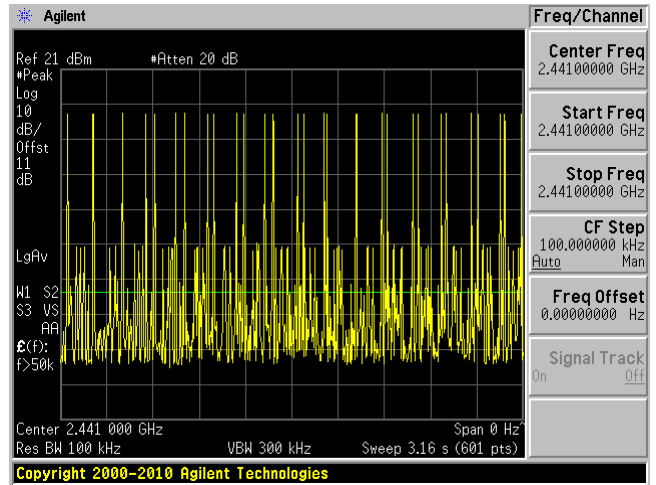
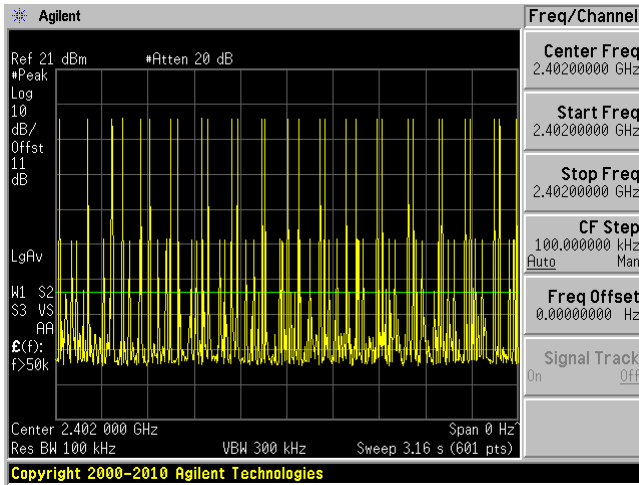
High Channel 2480 MHz



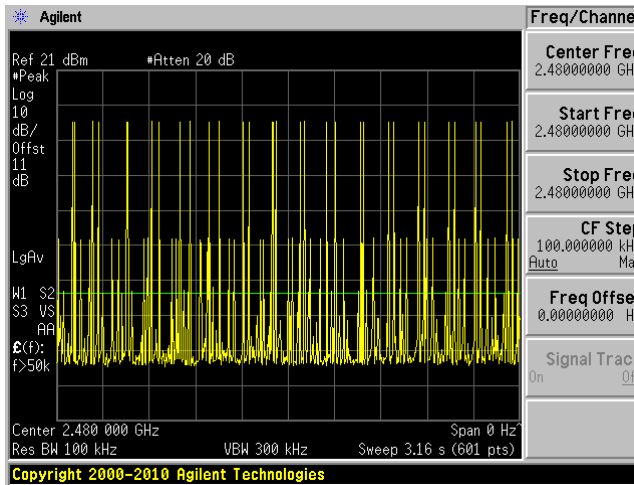
$\pi/4$ -DQPSK, DH1 Number of Pulses within a Specified Time

Low Channel 2402 MHz

Middle Channel 2441 MHz



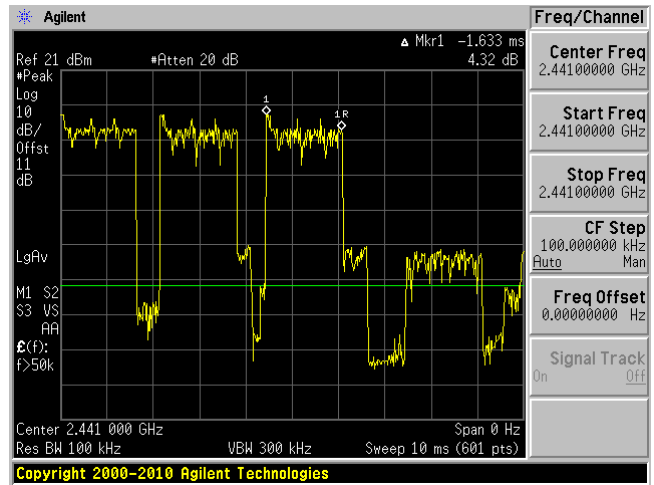
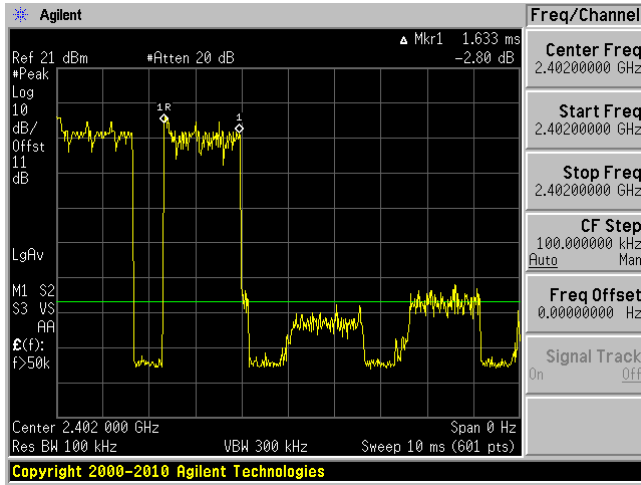
High Channel 2480 MHz



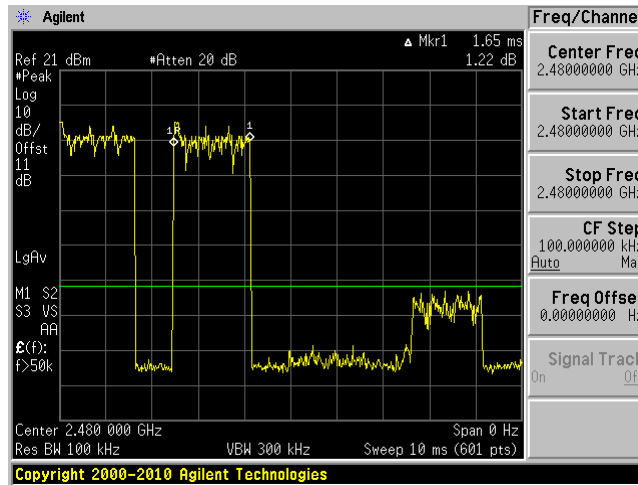
$\pi/4$ -DQPSK, DH3 Pulse Width

Low Channel 2402 MHz

Middle Channel 2441 MHz

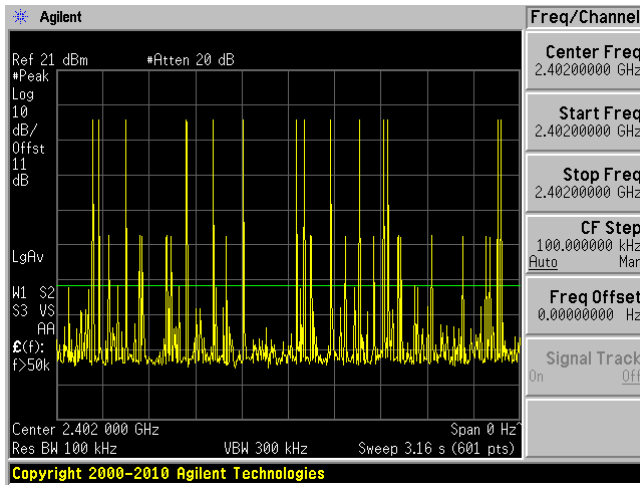


High Channel 2480 MHz

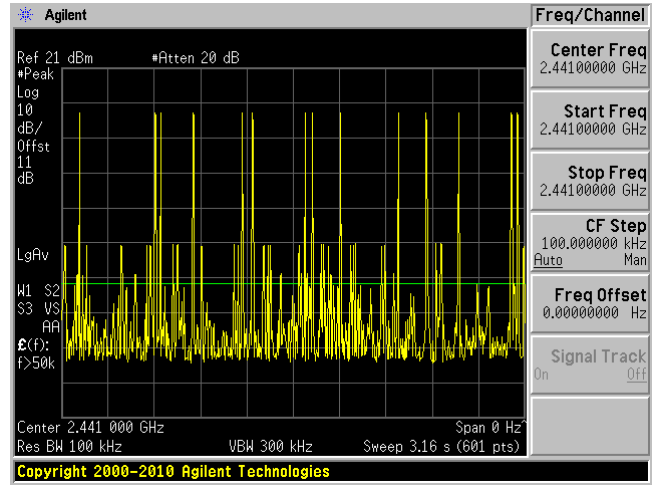


$\pi/4$ -DQPSK, DH3 Number of Pulses within a Specified Time

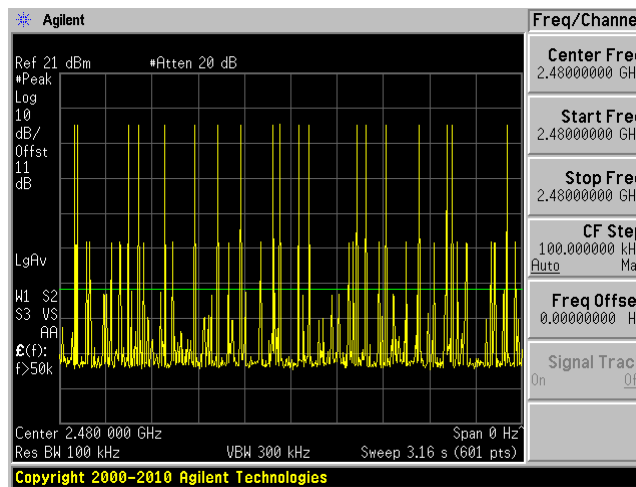
Low Channel 2402 MHz



Middle Channel 2441 MHz

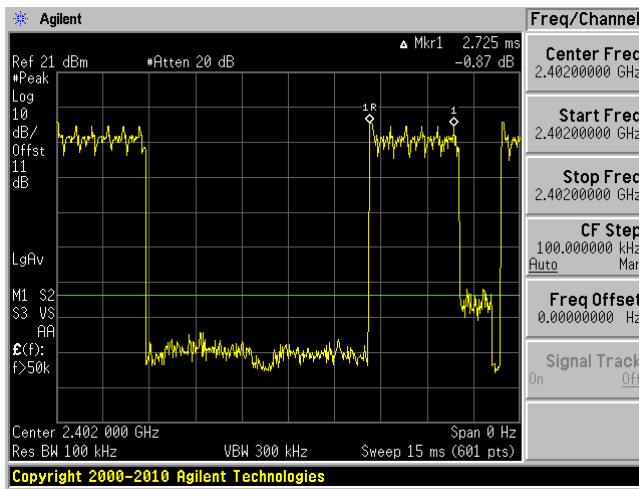


High Channel 2480 MHz

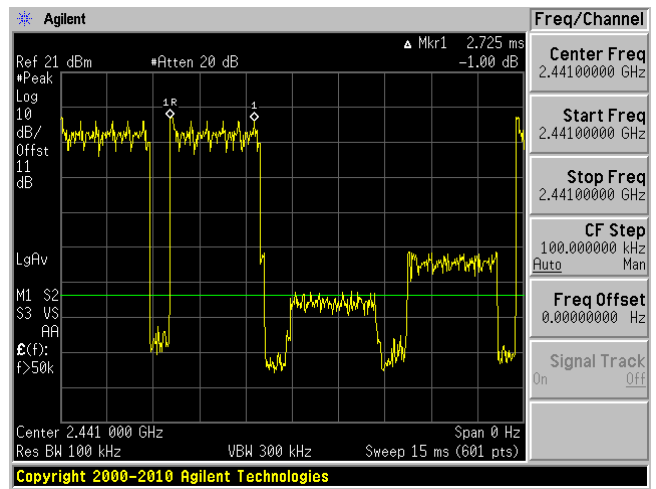


$\pi/4$ -DQPSK, DH5 Pulse Width

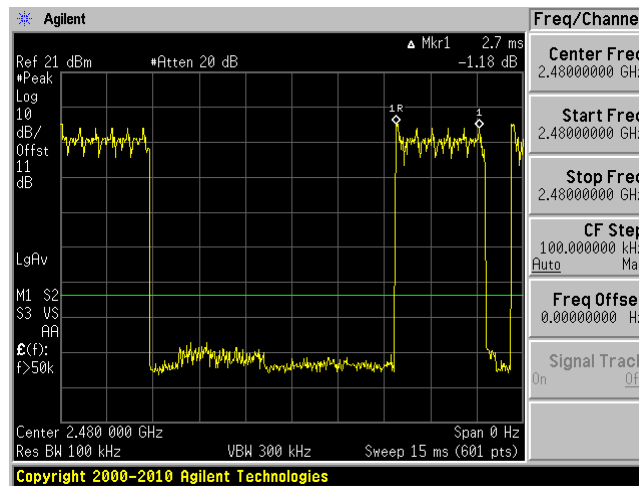
Low Channel 2402 MHz



Middle Channel 2441 MHz

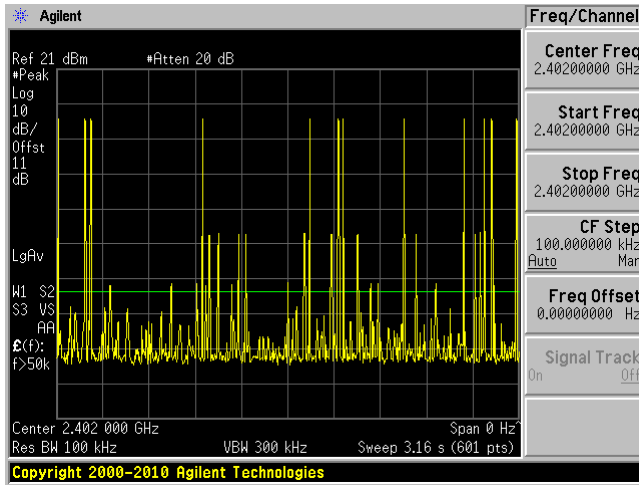


High Channel 2480 MHz

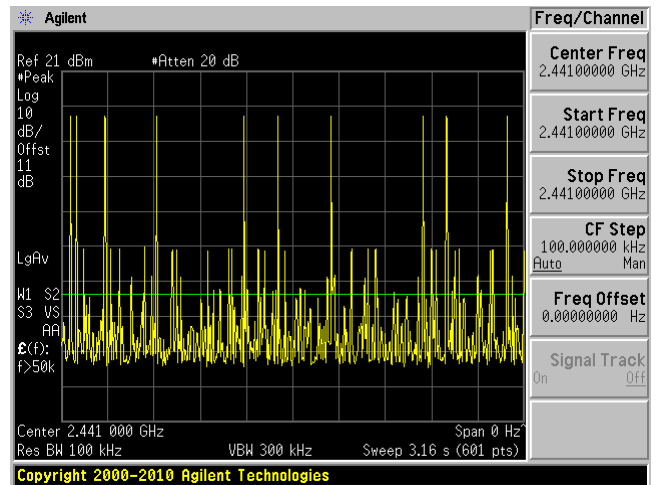


$\pi/4$ -DQPSK, DH5 Number of Pulses within a Specified Time

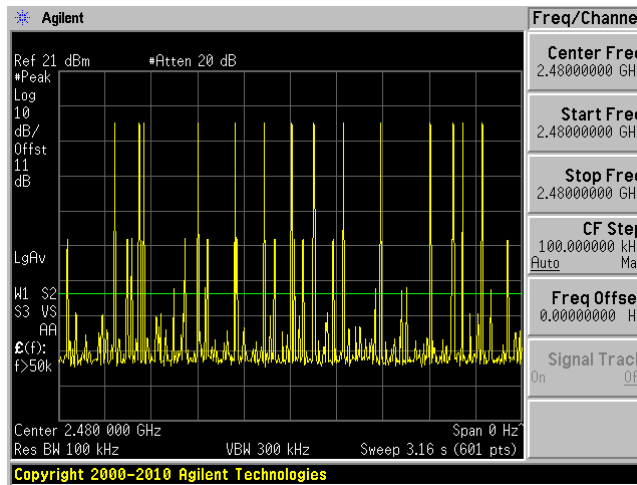
Low Channel 2402 MHz



Middle Channel 2441 MHz



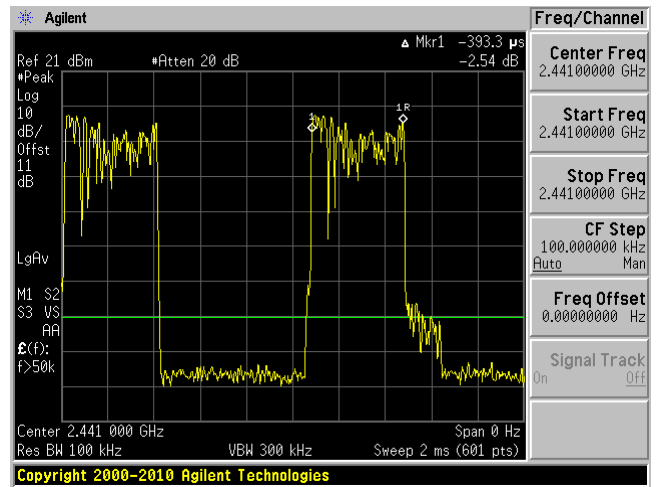
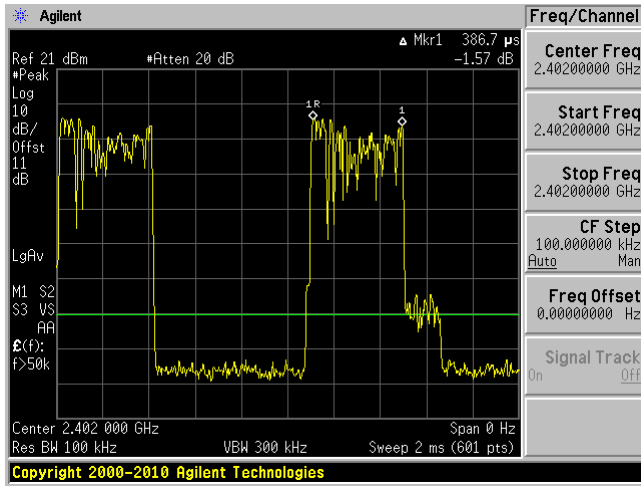
High Channel 2480 MHz



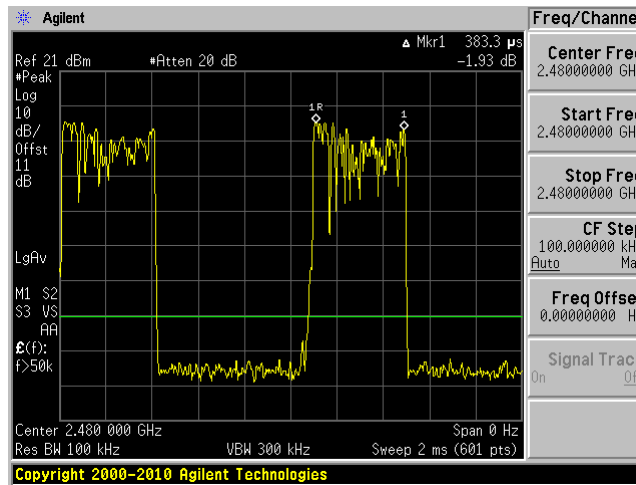
8DPSK, DH1 Pulse Width

Low Channel 2402 MHz

Middle Channel 2441 MHz

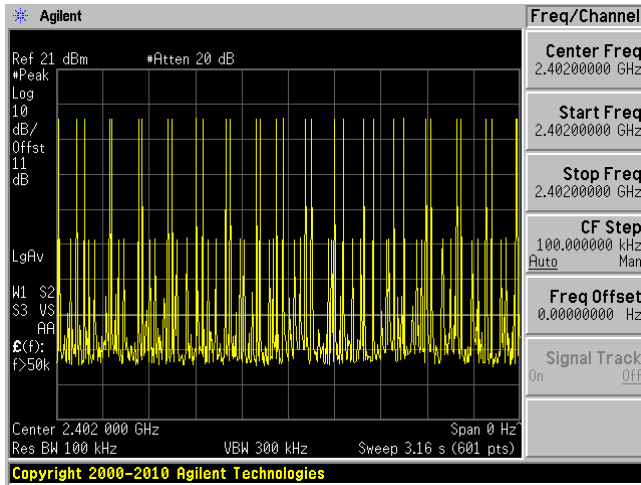


High Channel 2480 MHz

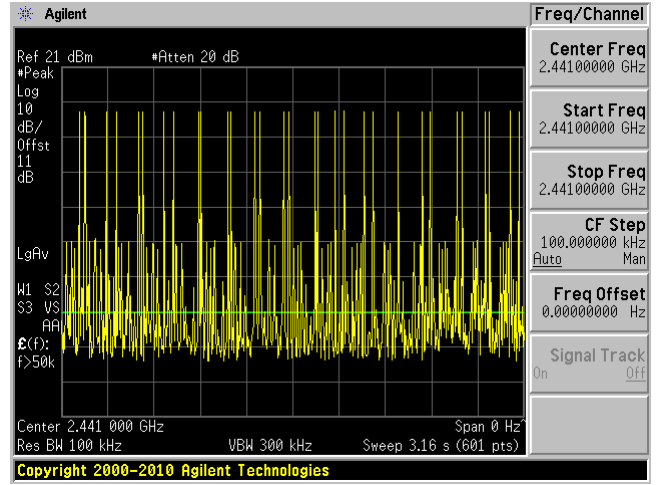


8DPSK, DH1 Number of Pulses within a Specified Time

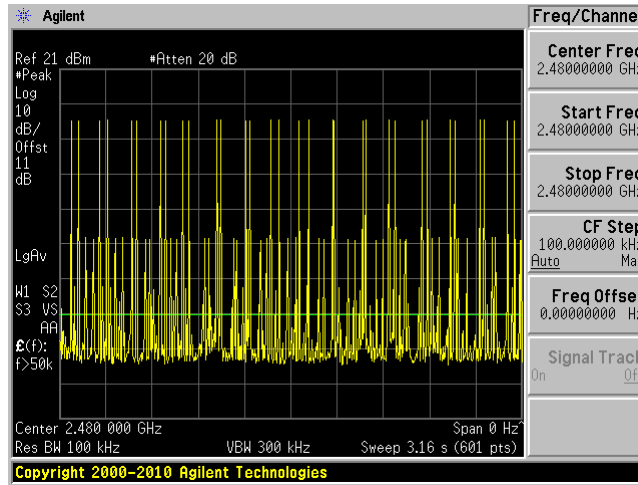
Low Channel 2402 MHz



Middle Channel 2441 MHz

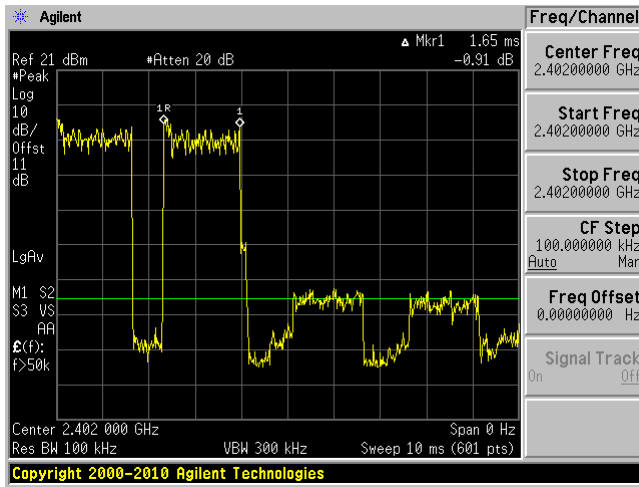


High Channel 2480 MHz

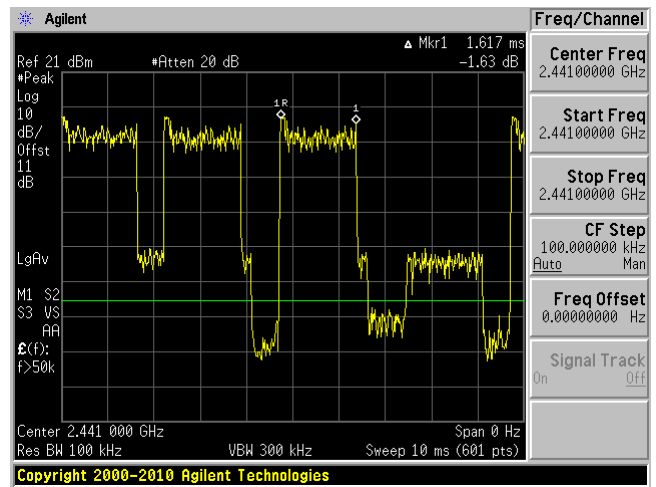


8DPSK, DH3 Pulse Width

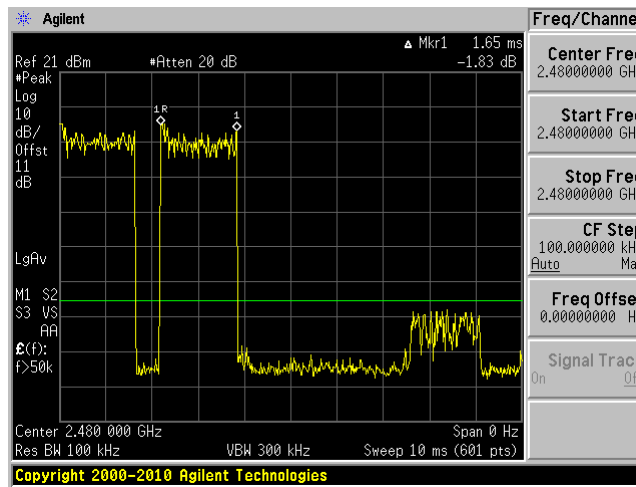
Low Channel 2402 MHz



Middle Channel 2441 MHz



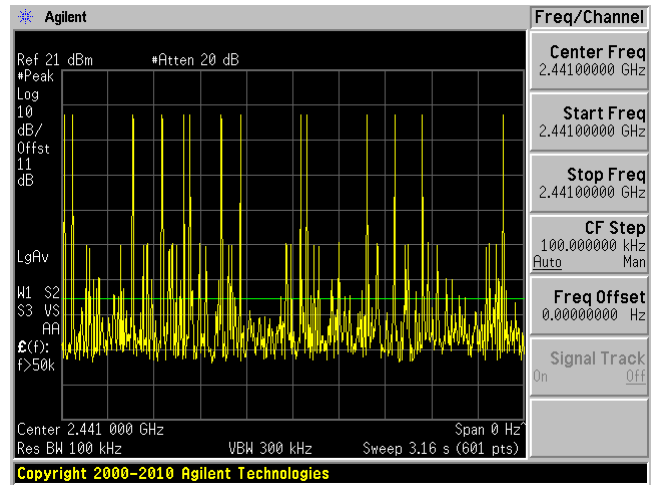
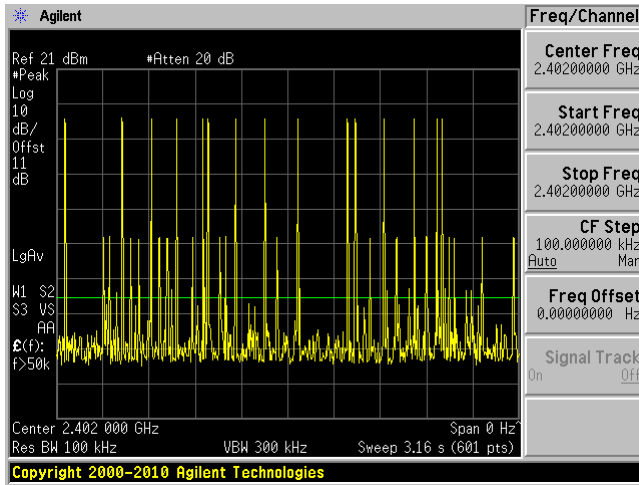
High Channel 2480 MHz



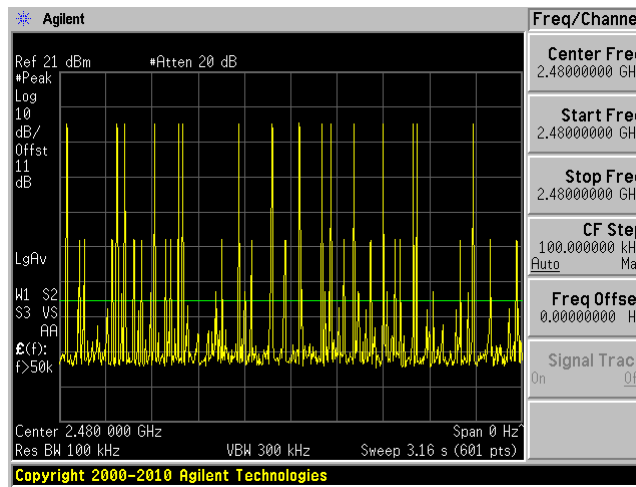
8DPSK, DH3 Number of Pulses within a Specified Time

Low Channel 2402 MHz

Middle Channel 2441 MHz



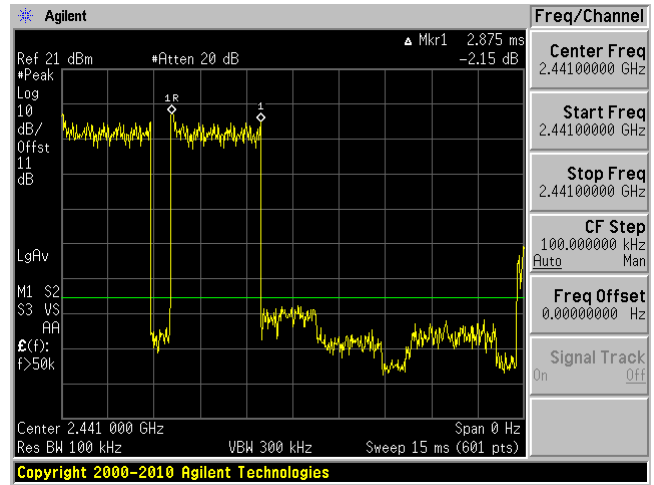
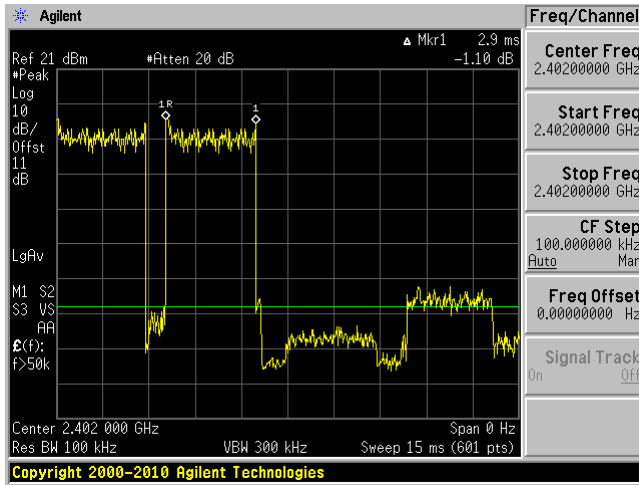
High Channel 2480 MHz



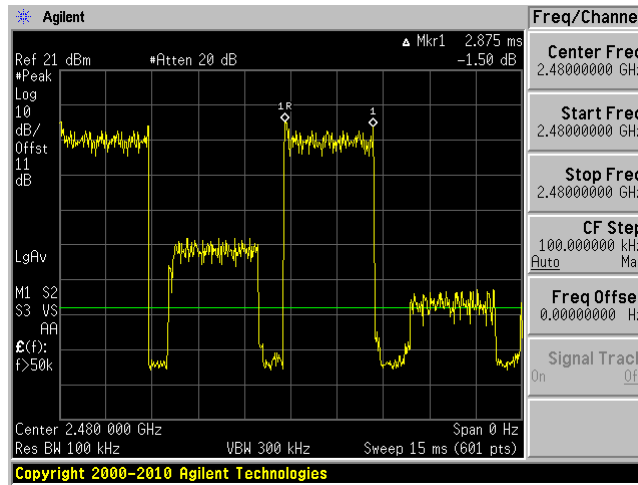
8DPSK, DH5 Pulse Width

Low Channel 2402 MHz

Middle Channel 2441 MHz

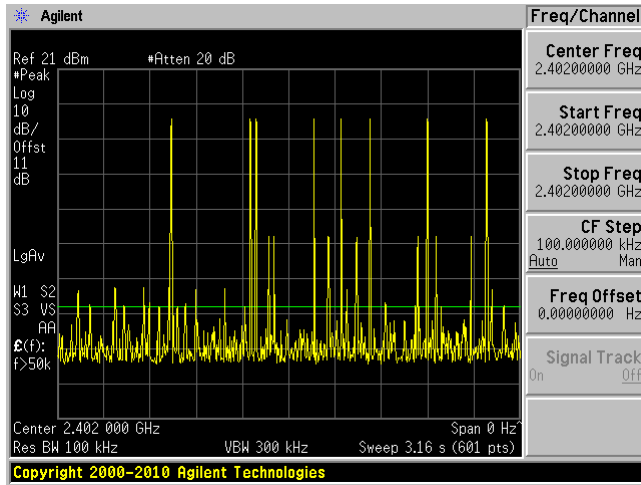


High Channel 2480 MHz

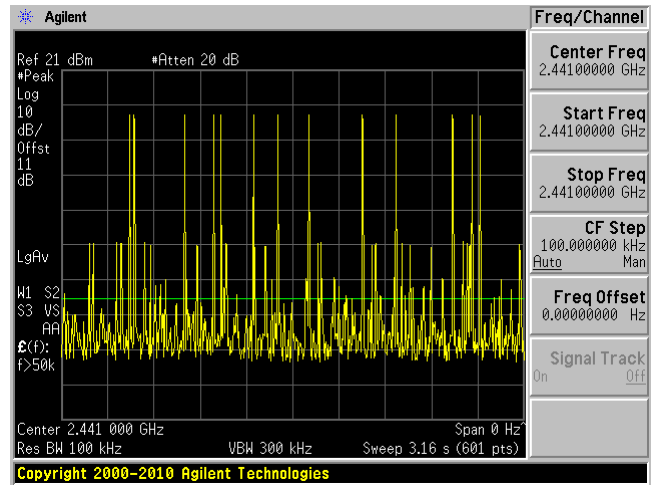


8DPSK, DH5 Number of Pulses within a Specified Time

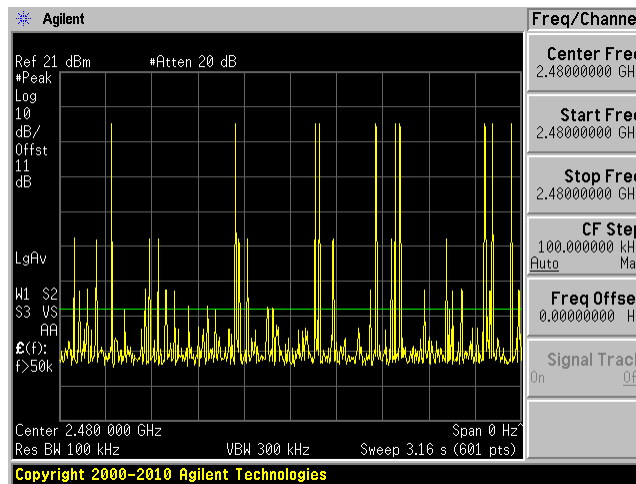
Low Channel 2402 MHz



Middle Channel 2441 MHz



High Channel 2480 MHz



12 FCC §15.247(a)(1)(iii) & ISED 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
-	SMA Pigtail	-	-	Each time ¹	N/A
-	10 dB attenuator	-	-	Each time ¹	N/A

Note¹: 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 °C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

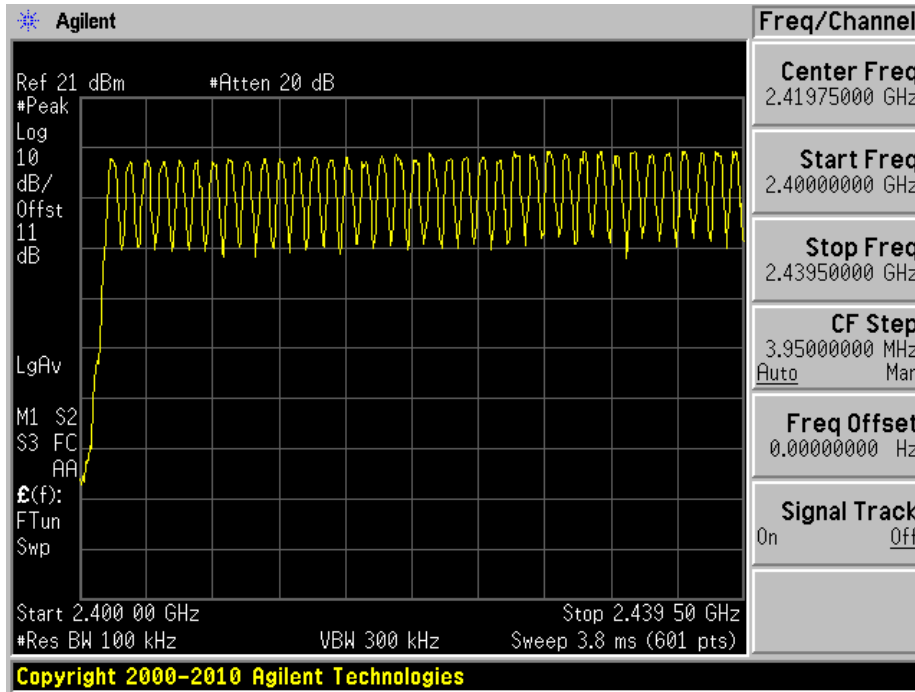
The testing was performed by Todd Moy on 2016-04-27 in RF site.

12.5 Test Results

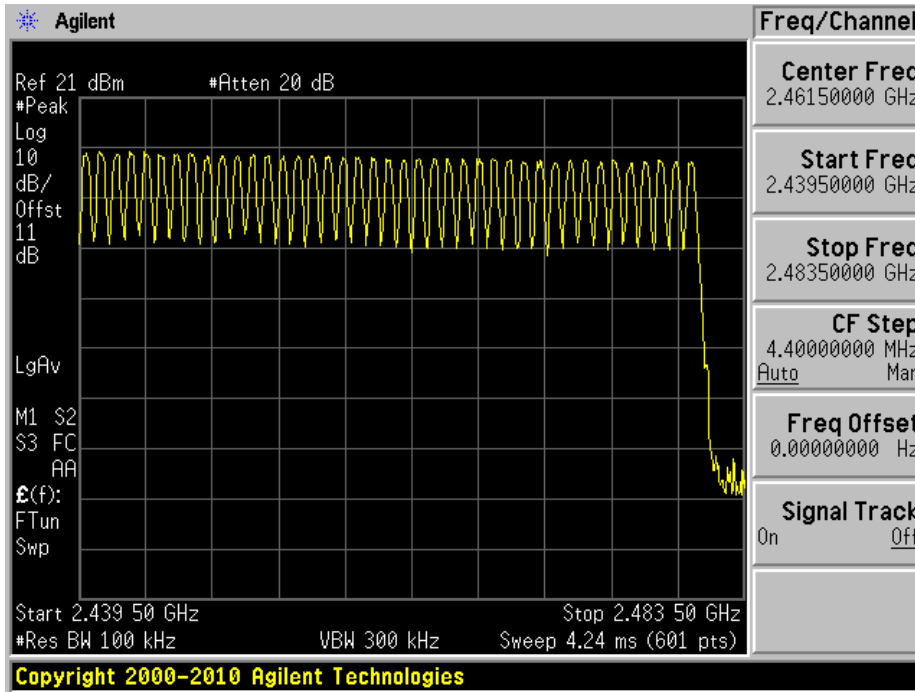
Modulation	Number of Hopping Channels
GFSK	79
$\pi/4$ -DQPSK	79
8DPSK	79

GFSK

2400 to 2439.5 MHz

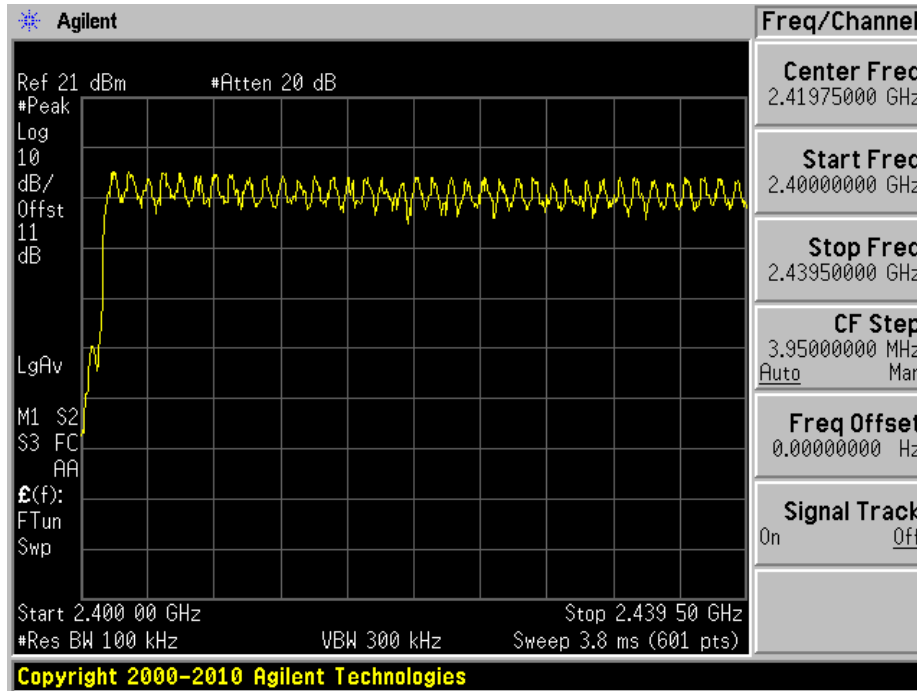


2439.5 to 2483.5 MHz

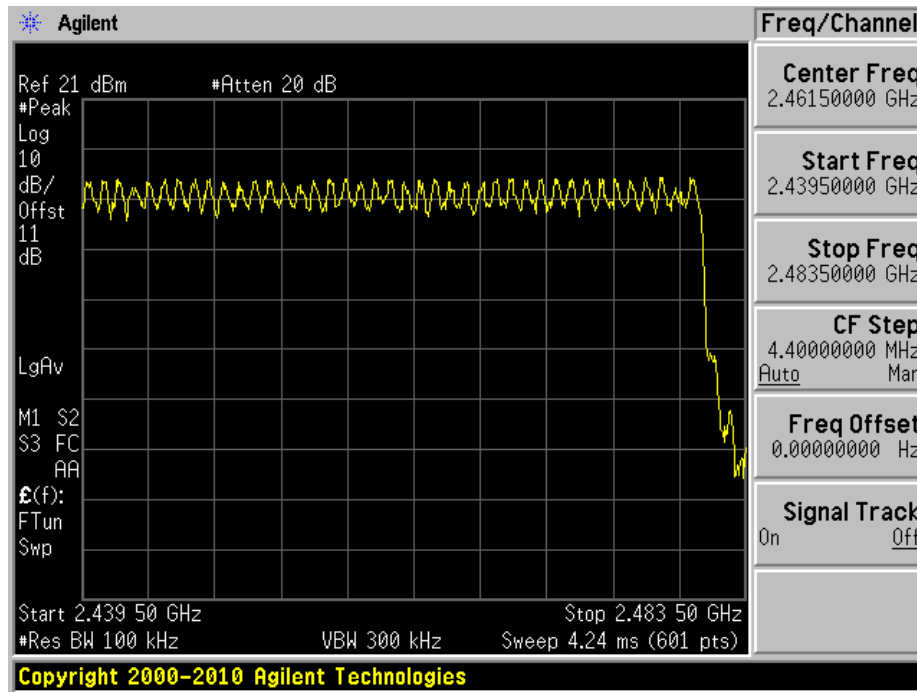


$\pi/4$ -DQPSK

2400 to 2439.5 MHz

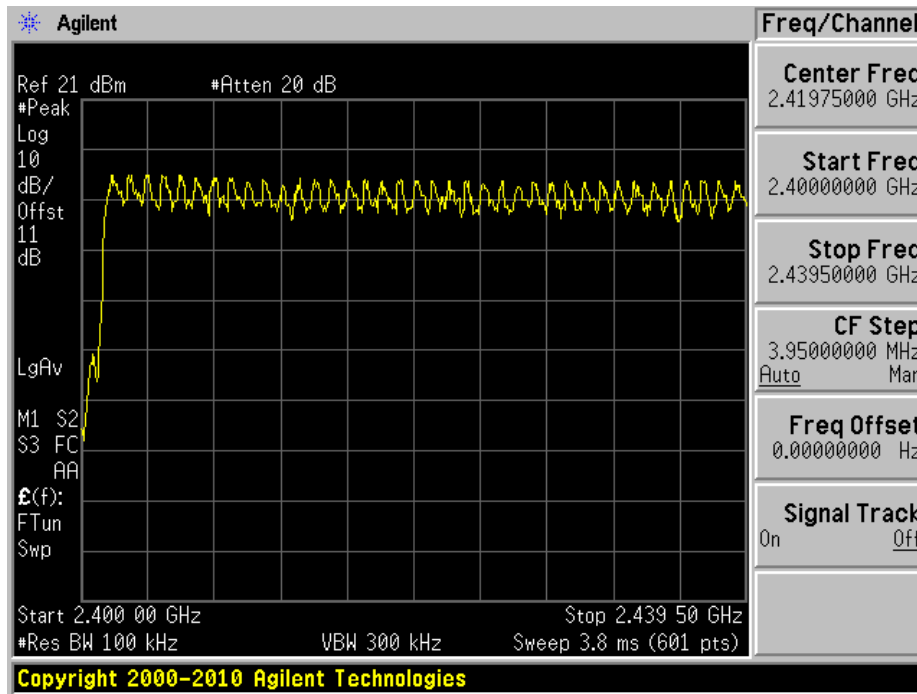


2439.5 to 2483.5 MHz

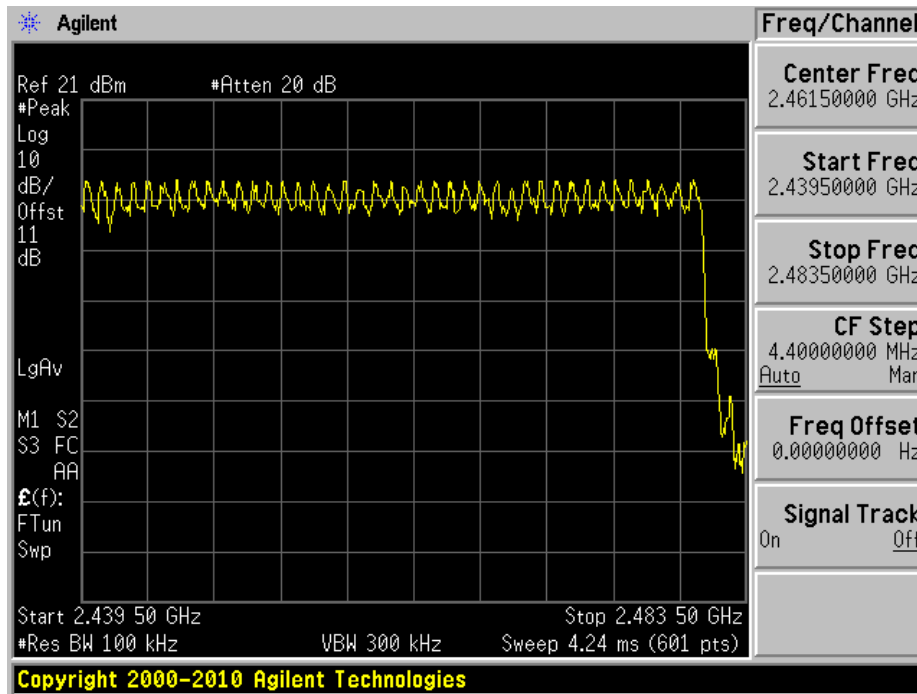


8DPSK

2400 to 2439.5 MHz



2439.5 to 2483.5 MHz



13 FCC §15.247(a) (1) & ISED 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) \approx 30% of the channel spacing, adjust as necessary to best identify the center of each individual channel

Video (or Average) Bandwidth (VBW) \geq 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

Note¹: 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 °C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Todd Moy on 2016-04-27 in RF site.

13.5 Test Results

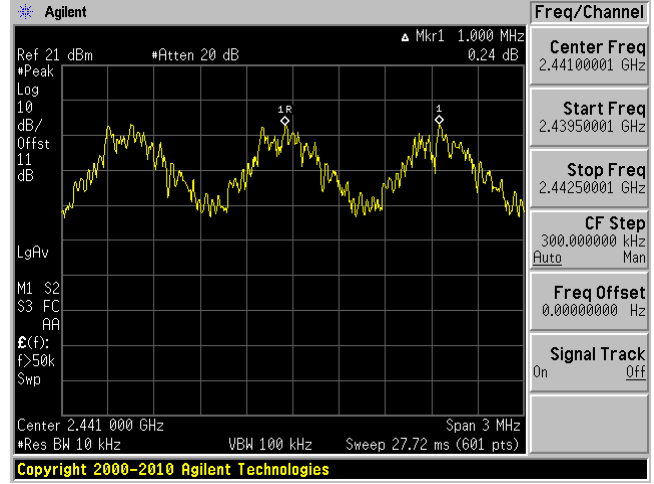
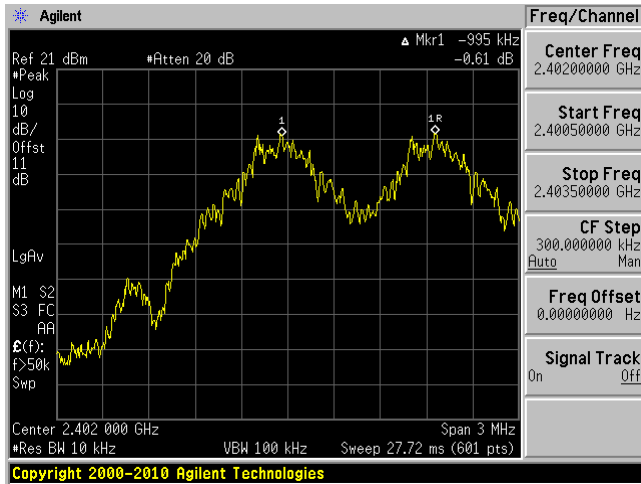
Channel	Frequency (MHz)	Channel Separation (kHz)	Limit > 2/3 20 dB Bandwidth (kHz)
GFSK			
Low	2402	995	589.03
Middle	2441	1000	615.03
High	2480	1005	611.53
$\pi/4$ -DQPSK			
Low	2402	1000	928.00
Middle	2441	1190	906.00
High	2480	1000	919.33
8DPSK			
Low	2402	1000	925.33
Middle	2441	1005	924.00
High	2480	995	923.33

Please refer to following plots.

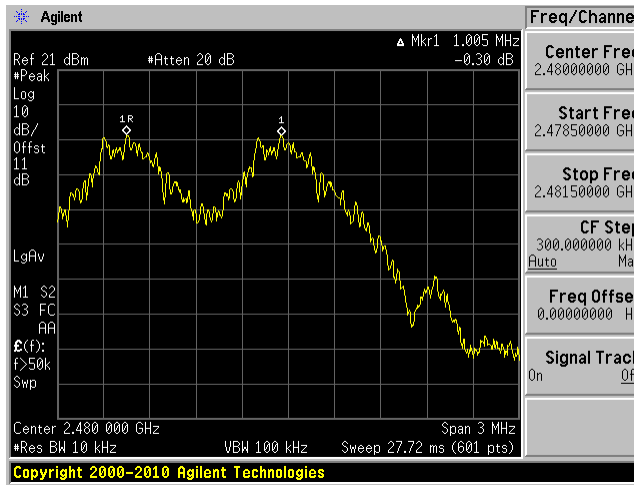
GFSK

Low Channel 2402 MHz

Middle Channel 2441 MHz



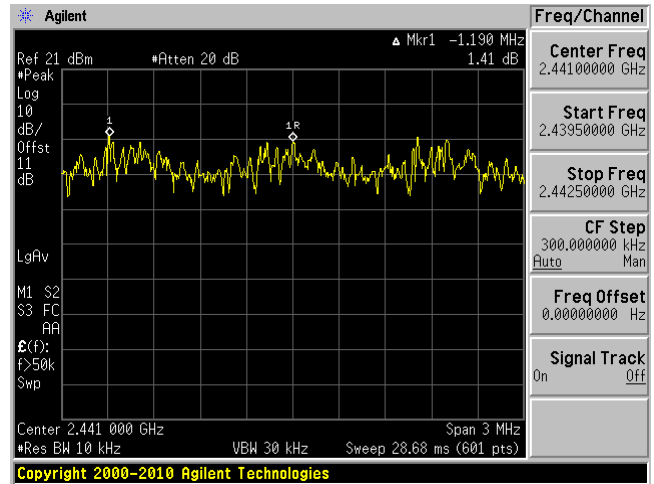
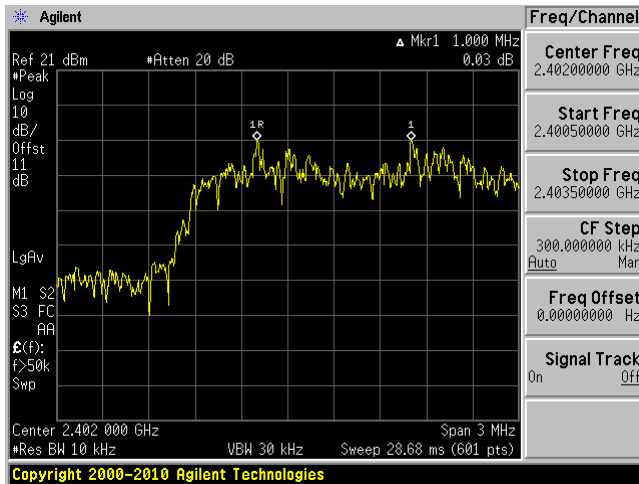
High Channel 2480 MHz



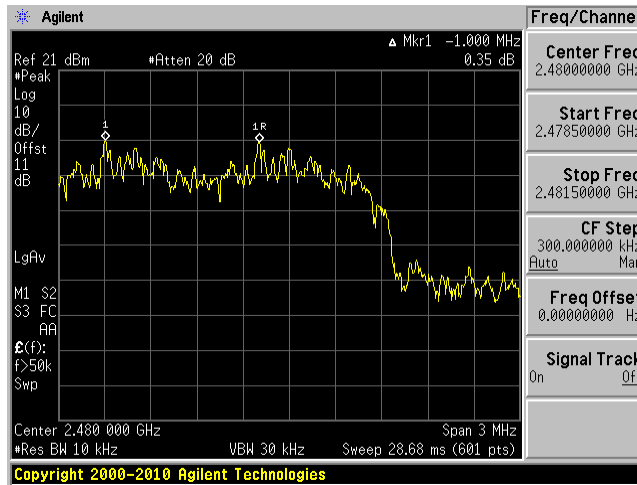
$\pi/4$ -DQPSK

Low Channel 2402 MHz

Middle Channel 2441 MHz

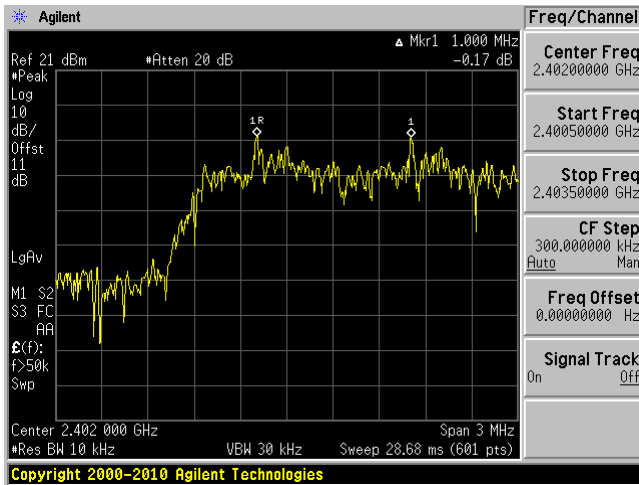


High Channel 2480 MHz

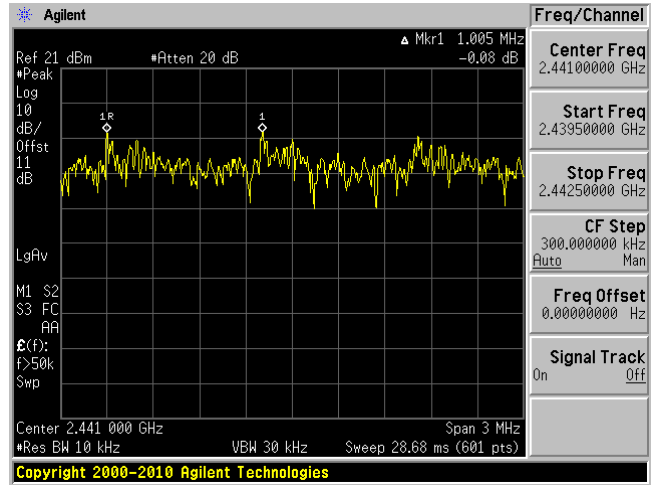


8DPSK

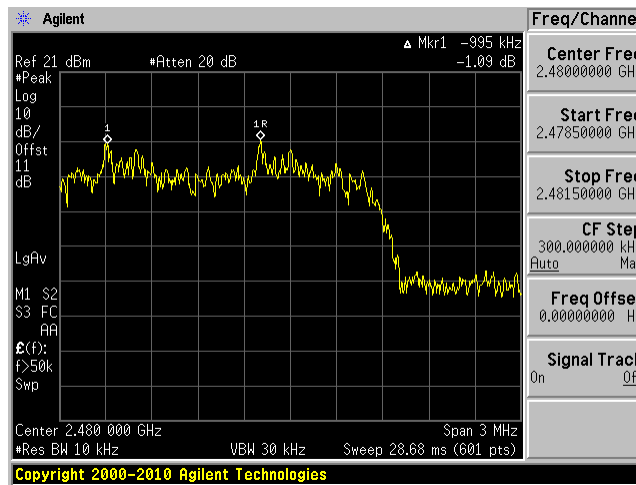
Low Channel 2402 MHz



Middle Channel 2441 MHz



High Channel 2480 MHz



14 FCC §15.247(d) & ISED 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 ISED 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

Note¹: 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:	22 °C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Jose Martinez on 2016-05-27 in RF site.

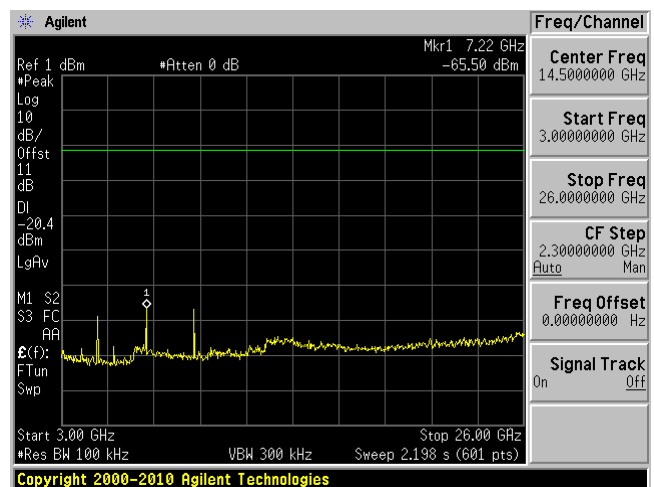
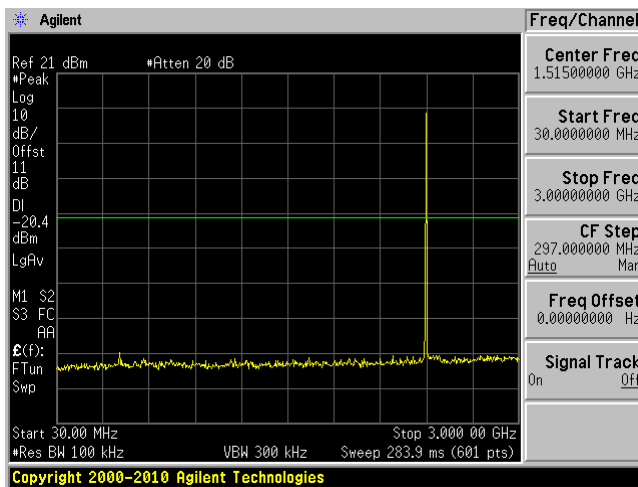
14.5 Test Results

Please refer to following plots.

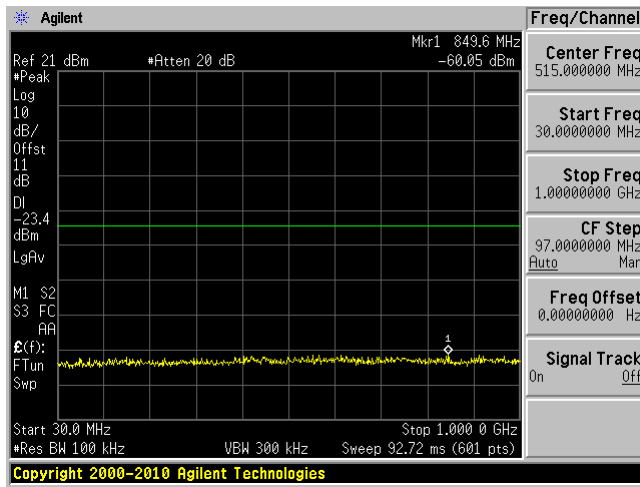
GFSK

Low Channel 30 MHz – 3 GHz

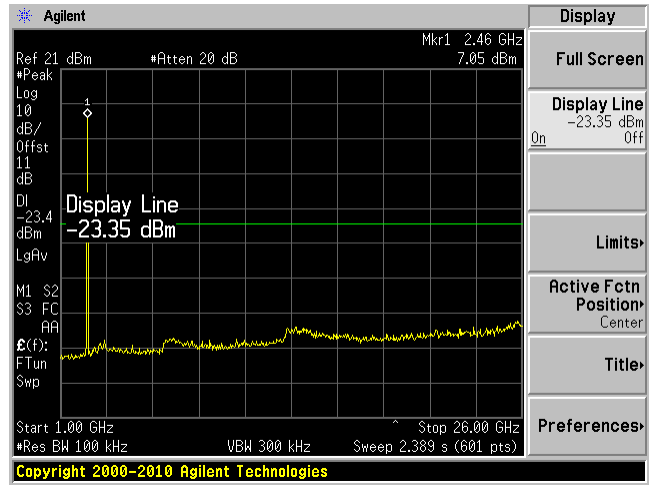
Low Channel 3GHz – 25 GHz



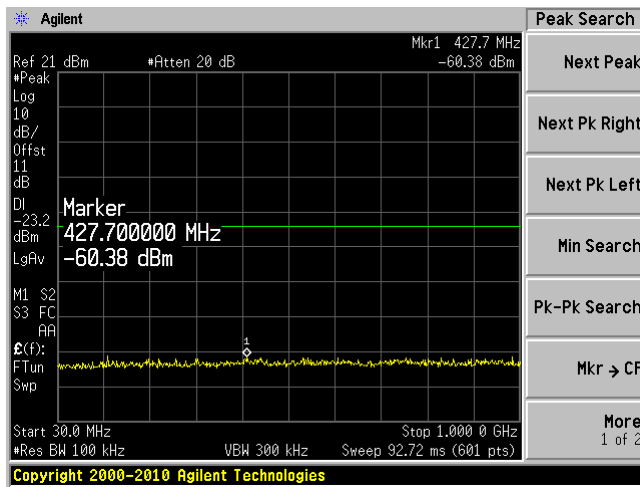
Middle Channel 30 MHz – 1 GHz



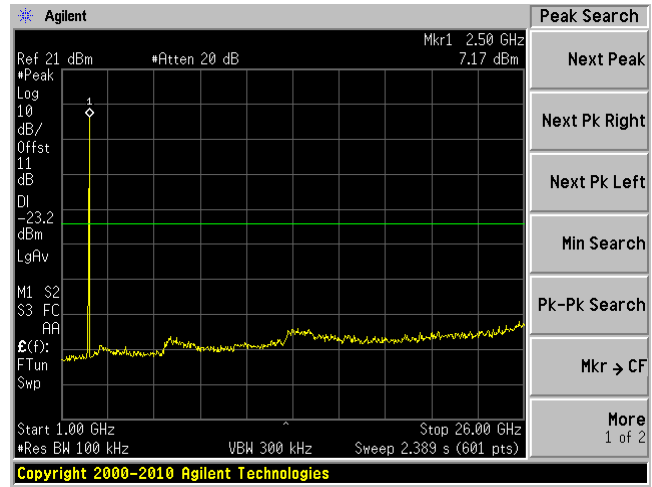
Middle Channel 1 GHz – 25 GHz



High Channel 30 MHz – 1 GHz

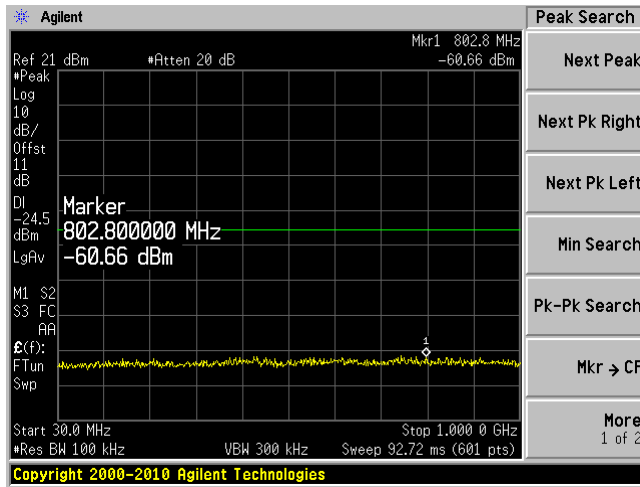


High Channel 1 GHz – 25 GHz

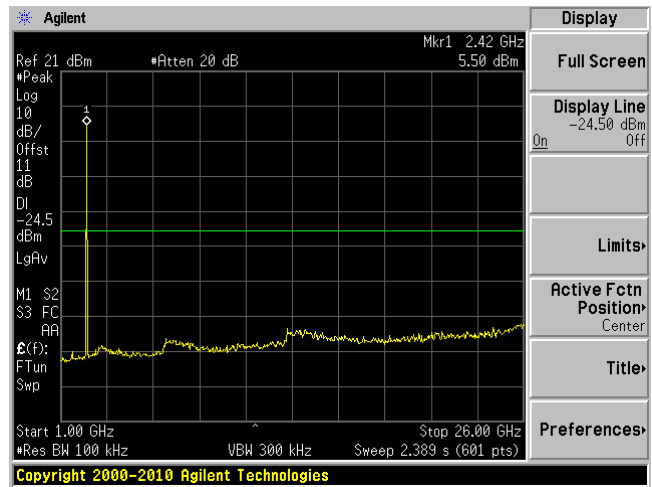


$\pi/4$ -DQPSK

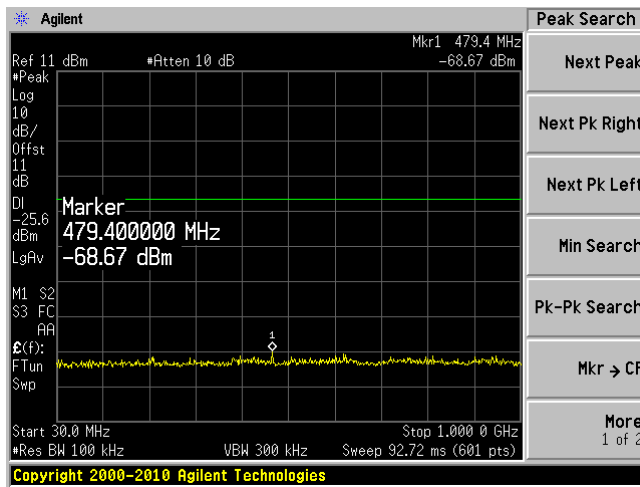
Low Channel 30 MHz – 1 GHz



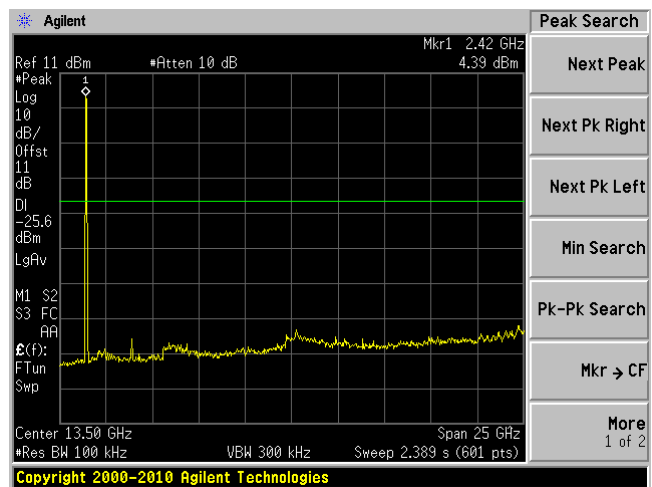
Low Channel 1 GHz – 25 GHz



Middle Channel 30 MHz – 1 GHz

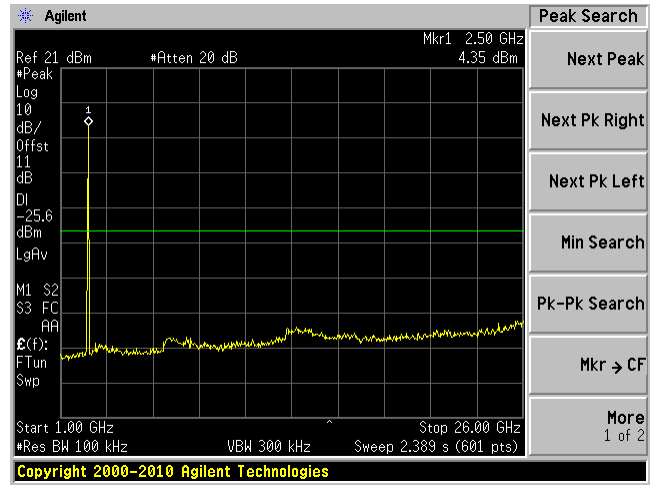
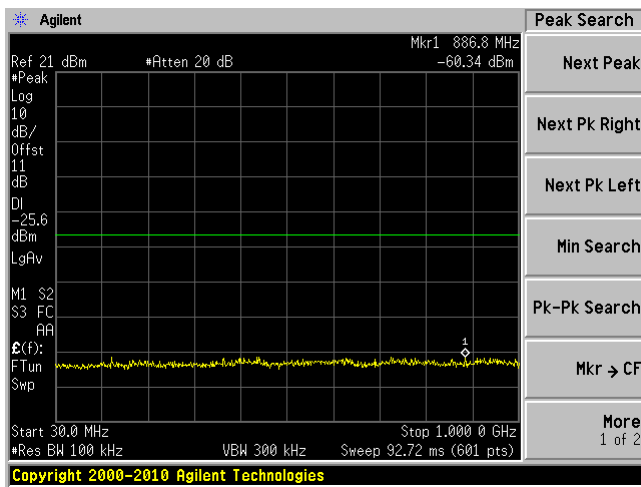


Middle Channel 1 GHz – 25 GHz



High Channel 30 MHz – 1 GHz

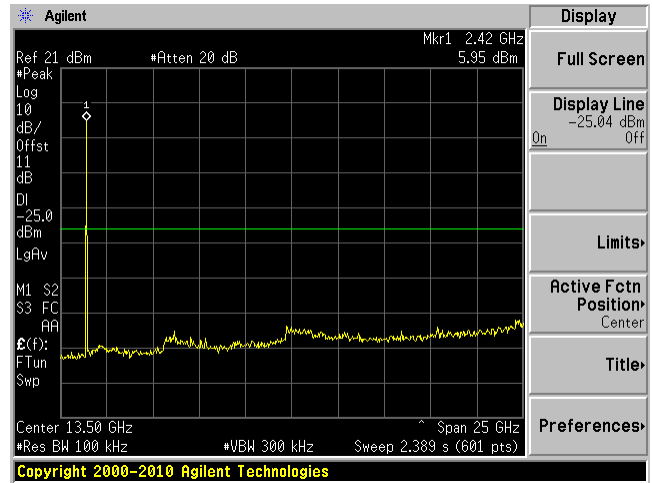
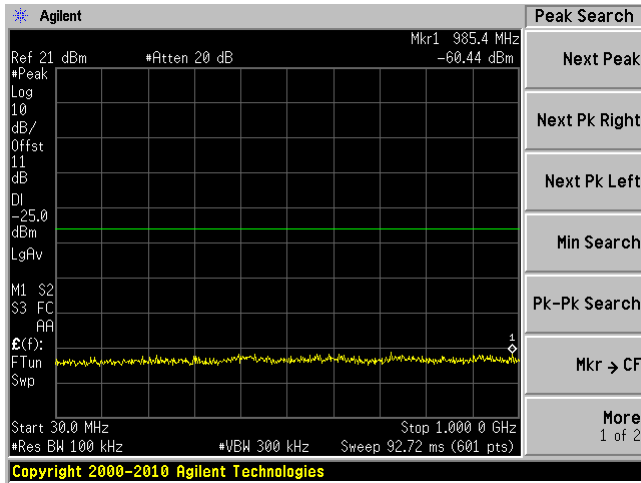
High Channel 1 GHz – 25 GHz



8DPSK

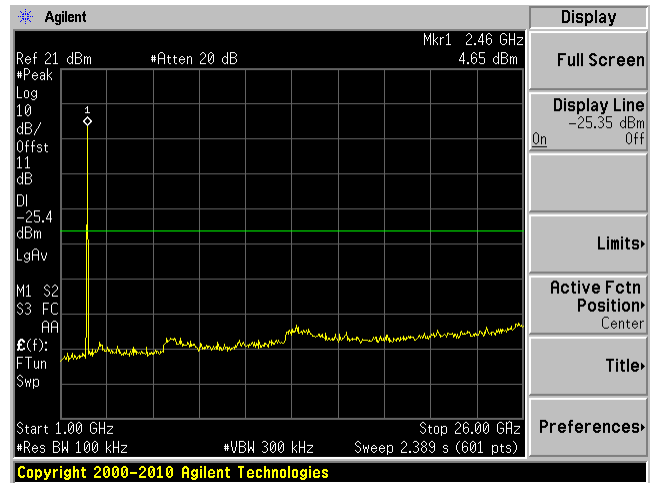
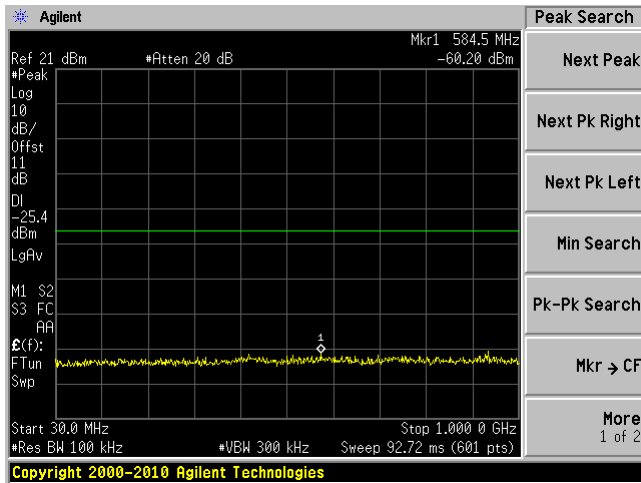
Low Channel 30 MHz – 1 GHz

Low Channel 1 GHz – 25 GHz



Middle Channel 30 MHz – 1 GHz

Middle Channel 1 GHz – 25 GHz



High Channel 30 MHz – 1 GHz

High Channel 1 GHz – 25 GHz

