FCC 47 CFR PART 15 SUBPART C & INDUSTRY CANADA RSS-210

TEST REPORT

For

Tablet PC (WIFI)

Model: 60015, 2298

Trade Name: lenovo

Issued to

Lenovo (Shanghai) Electronics Technology Co., Ltd.
No. 68 Building, 199 Fenju Road, Wai Gao Qiao FTZ , Shanghai , China

Issued by

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Issued Date: August 3, 2012

Testing Laboratory
1309

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TABLE OF CONTENTS

1. TEST RESULT CERTIFICATION 4

2. EUT DESCRIPTION 5

3. TEST METHODOLOGY 6

3.1 EUT CONFIGURATION 6
3.2 EUT EXERCISE 6
3.3 GENERAL TEST PROCEDURES 6
3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS 7
3.5 DESCRIPTION OF TEST MODES 8

4. INSTRUMENT CALIBRATION 9

4.1 MEASURING INSTRUMENT CALIBRATION 9
4.2 MEASUREMENT EQUIPMENT USED 9
4.3 MEASUREMENT UNCERTAINTY 10

5. FACILITIES AND ACCREDITATIONS 11

5.1 FACILITIES 11
5.2 EQUIPMENT 11
5.3 TABLE OF ACCREDITATIONS AND LISTINGS 12

6. SETUP OF EQUIPMENT UNDER TEST 13

6.1 SETUP CONFIGURATION OF EUT 13
6.2 SUPPORT EQUIPMENT 13

7. APPLICABLE RULES 14

8. FCC PART 15.247 REQUIREMENTS & RSS 210 REQUIREMENTS 23

8.1 99% BANDWIDTH 23
8.2 20 DB BANDWIDTH 27
8.3 PEAK POWER 34
8.4 BAND EDGES MEASUREMENT 35
8.5 FREQUENCY SEPARATION 53
8.6 NUMBER OF HOPPING FREQUENCY 58
8.7 TIME OF OCCUPANCY (DWELL TIME) 63
8.8 SPURIOUS EMISSIONS 71
8.9 POWERLINE CONDUCTED EMISSIONS 89

APPENDIX I RADIO FREQUENCY EXPOSURE 92

APPENDIX II PHOTOGRAPHS OF TEST SETUP 93

APPENDIX 1 - PHOTOGRAPHS OF EUT

1. TEST RESULT CERTIFICATION

Applicant: Lenovo (Shanghai) Electronics Technology Co., Ltd.
No. 68 Building, 199 Fenju Road,
Wai Gao Qiao FTZ , Shanghai , China

Manufacturer: Lenovo (Singapore) Pte Ltd.
151, Lorong Chuan, #02-01, New Tech Park, 556741, Singapore

Equipment Under Test: Tablet PC (WIFI)

Trade Name: lenovo

Model: 60015, 2298

Date of Test: June 9 ~ August 3, 2012

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
FCC 47 CFR Part 15 Subpart C & Industry Canada RSS-210 Issue 8 December, 2010	No non-compliance noted

We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in **ANSI C63.4: 2003** and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

The test results of this report relate only to the tested sample EUT identified in this report.

Approved by:

Jason Lin

Jason Lin
Section Manager
Compliance Certification Services Inc.

Reviewed by:

Gina Lo

Gina Lo
Section Manager
Compliance Certification Services Inc.

2. EUT DESCRIPTION

Product	Tablet PC (WIFI)
Trade Name	lenovo
Model Number	60015, 2298
Model Discrepancy	All the specification and layout are identical except they come with different model numbers for marketing purposes.
Received Date	June 6, 2012
Power Ratting	1. VDC from Power adapter 1) HuntKey / Model: HKA00905015-3C I/P: 100~240Vac 50/60Hz, 0.25A O/P: 5.0Vdc 1.5A 2) HuntKey / Model: HKA00905015-LC I/P:100~240Vac 50/60Hz, 0.25A O/P:5.0Vdc 1.5A 2. VDC from Battery Lenovo / L12T1P31 Rating: NOM: 3.7V, 13.7Wh, 3700mAh MIN: 3.7V, 13.7Wh, 3550mAh 3. Powered from host device via USB cable
Frequency Range	2402 ~ 2480 MHz
Transmit Power	6.70 dBm
Modulation Technique	GFSK for 1Mbps; π/4-DQPSK for 2Mbps; 8DPSK for 3Mbps
Transmit Data Rate	1, 2, 3Mbps
Number of Channels	79 Channels
Antenna Specification	Gain: 4.0 dBi
Antenna Designation	PIFA Antenna

Remark:

1. *The sample selected for test was production product and was provided by manufacturer.*
2. *This submittal(s) (test report) is intended for FCC ID: **O57A2107AF** filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.*
3. *For IC model number is 2298 only.*

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4: 2003 and FCC CFR 47 FCC CFR 47 Part 15.207, 15.209 and 15.247, RSS-GEN Issue 3, and RSS-210 Issue 8.

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

The tests documented in this report were performed in accordance with IC RSS-210, IC RSS-Gen, IC RSS-102, and ANSI C63.4: 2003.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4: 2003.

3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown 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	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	([2])
13.36 - 13.41	322 - 335.4		

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

3.5 DESCRIPTION OF TEST MODES

The EUT (model: 60015) had been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting mode was programmed.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz and power line conducted emissions below 30MHz, which worst case was in normal link mode only.

Following channels were selected for the radiated emission testing only as listed below:

Tested Channel	Modulation Type	Packet Type	Date Rate	Axis
Low, Mid, High	GFSK	DH 5	1	Y
Low, Mid, High	8DPSK	DH 5	3	Y

The field strength of spurious emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (Y axis) and the worst case was recorded.

4. INSTRUMENT CALIBRATION

4.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

4.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

Remark: *Each piece of equipment is scheduled for calibration once a year and Loop Antenna is scheduled for calibration once three years.*

Conducted Emissions Test Site				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	MY43360131	03/16/2013
Power Meter	Anritsu	ML2495A	1012009	04/26/2013
Power Sensor	Anritsu	MA2411B	0917072	04/26/2013

Wugu 966 Chamber A				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	US42510268	11/15/2012
EMI Test Receiver	R&S	ESCI	100064	03/01/2013
Pre-Amplifier	Mini-Circults	ZFL-1000LN	SF350700823	01/13/2013
Pre-Amplifier	MITEQ	AFS44-00102650-42-10P-44	1415367	11/20/2012
Bilog Antenna	Sunol Sciences	JB3	A030105	10/03/2012
Horn Antenna	EMCO	3117	00055165	01/11/2013
Horn Antenna	EMCO	3116	00026370	06/10/2013
Loop Antenna	EMCO	6502	8905/2356	N.C.R
Turn Table	CCS	CC-T-1F	N/A	N.C.R
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R
Controller	CCS	CC-C-1F	N/A	12/23/2012
Site NSA	CCS	N/A	N/A	12/25/2012
Test S/W	EZ-EMC (CCS-3A1RE)			

Conducted Emission room # B				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
EMI Test Receiver	R&S	ESCI	101073	07/28/2012
LISN	R&S	ENV216	101054	06/06/2013
LISN	SCHWARZBECK	NSLK 8127	8127-541	12/14/2012
Coaxial Cable	Commate	CFD300-NL	NA	05/27/2013
Capacitive Voltage Probe	FCC	F-CVP-1	100185	02/15/2013
Test S/W	CCS-3A1-CE			

4.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
Powerline Conducted Emission	+/- 1.2575
3M Semi Anechoic Chamber / 30M~200M	+/- 4.0138
3M Semi Anechoic Chamber / 200M~1000M	+/- 3.9483
3M Semi Anechoic Chamber / 1G~8G	+/- 2.5975
3M Semi Anechoic Chamber / 8G~18G	+/- 2.6112
3M Semi Anechoic Chamber / 18G~26G	+/- 2.7389
3M Semi Anechoic Chamber / 26G~40G	+/- 2.9683

***Remark**: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.*

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☐ No.199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.
Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

☒ No.11, Wu-Gong 6th Rd., Wugu Industrial Park, New Taipei City 248, Taiwan (R.O.C.)
Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045

☐ No.81-1, Lane 210, Bade 2nd Rd., Lujhu Township, Taoyuan County 33841, TAIWAN, R.O.C.
Tel: 886-3-324-0332 / Fax: 886-3-324-5235

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5.3 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3M Semi Anechoic Chamber (FCC MRA: TW1039) to perform FCC Part 15 measurements	FCC MRA: TW1039
Taiwan	TAF	LP0002, RTTE01, FCC Method-47 CFR Part 15 Subpart C, D, E, RSS-210, RSS-310 IDA TS SRD, AS/NZS 4268, AS/NZS 4771, TS 12.1 & 12,2, ETSI EN 300 440-1, ETSI EN 300 440-2, ETSI EN 300 328, ETSI EN 300 220-1, ETSI EN 300 220-2, ETSI EN 301 893, ETSI EN 301 489-1/3/7/17 FCC OET Bulletin 65 + Supplement C, EN 50360, EN 50361, EN 50371, RSS 102, EN 50383, EN 50385, EN 50392, IEC 62209, CNS 14958-1, CNS 14959 FCC Method –47 CFR Part 15 Subpart B IEC / EN 61000-3-2, IEC / EN 61000-3-3, IEC / EN 61000-4-2/3/4/5/6/8/11	TAF Testing Laboratory 1309
Canada	Industry Canada	3M Semi Anechoic Chamber (IC 2324G-1 / IC 2324G-2) to perform	Canada IC 2324G-1 IC 2324G-2

** No part of this report may be used to claim or imply product endorsement by A2LA or any agency of the US Government.*

6. SETUP OF EQUIPMENT UNDER TEST

6.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

6.2 SUPPORT EQUIPMENT

No.	Device Type	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1.	Headset	N/A	N/A	N/A	N/A	Unshielded, 1.1m	N/A
2.	Micro SD Card	SANDISK	N/A	N/A	N/A	N/A	N/A
3.	Wireless Router (Remote)	ASUS	WL-500g	471GA12838	MSQWL500G	N/A	Unshielded, 1.8m
4.	Bluetooth Headset (Remote)	COREGA	CG-BTHS01-10	10T90020500124	N/A	N/A	N/A

Remark:

1. *All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
2. *Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*

7. APPLICABLE RULES

RSS-210 §2 General Certification Requirements and Specifications

RSS-210 §2.1 RSS-Gen Compliance

In addition to RSS-210, the requirements in RSS-Gen, *General Requirements and Information for the Certification of Radio Apparatus*, must be met.

RSS-210 §2.2 Emissions Falling Within Restricted Frequency Bands

Category I licence-exempt equipment is required to comply with the provisions in RSS-Gen with respect to emissions falling within restricted frequency bands. These restricted frequency bands are listed in RSS-Gen.

RSS-210 §2.3 Receivers

Category I equipment receivers for use with transmitters subject to RSS-210 must comply with the applicable requirements set out in RSS-Gen and be certified under RSS-210. Category II equipment receivers for use with transmitters subject to RSS-210 are exempt from certification, but are subject to compliance with RSS-Gen and RSS-310.

RSS-210 §2.5 General Field Strength Limits

RSS-Gen includes the general field strength limits of unwanted emissions, where applicable, for transmitters and receivers operating in accordance with the provisions specified in this standard. Unwanted emissions of transmitters and receivers are permitted to fall within the restricted bands listed in RSS-Gen, and including the TV bands, but fundamental emissions are prohibited in the restricted bands.

RSS-210 §2.5.1 Transmitters with Wanted Emissions that are Within the General Field Strength Limits

Whether or not their operation is addressed by published RSS standards, transmitters whose wanted and unwanted emissions are within the general field strength limits shown in RSS-Gen, they may operate in any of the frequency bands, other than the restricted bands listed in RSS-Gen and including the TV bands, and shall be certified under RSS-210. Under no conditions may the level of any unwanted emissions exceed the level of the fundamental emission.

Note: Devices operating below 490 kHz in which all emissions are at least 40 dB below the limit listed in RSS-Gen (*General Field Strength Limits for Transmitters at Frequencies below 30 MHz*) are Category II devices and are subject to RSS-310.

RSS-210 §2.7 Tables

RSS-210 §Annex 8: Frequency Hopping and Digital Modulation Systems Operating in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz Bands

This section applies to systems that employ frequency hopping (FH) and digital modulation technology in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands. Systems in these bands may employ frequency hopping, digital modulation and or a combination (hybrid) of both techniques.
A frequency hopping system that synchronizes with another or several other systems (to avoid frequency collision among them) via off-air sensing or via connecting cables is not hopping randomly and therefore is not in compliance with RSS-210.

RSS-210 §A8.1 Frequency Hopping Systems

Frequency hopping systems are spread spectrum systems in which the carrier is modulated with coded information in a conventional manner causing a conventional spreading of the RF energy about the carrier frequency. The frequency of the carrier is not fixed but changes at fixed intervals under the direction of a coded sequence.
Frequency hopping systems are not required to employ all available hopping frequencies during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream.
Incorporation of intelligence into a frequency hopping system that enables it to recognize other users of the band and to avoid occupied frequencies is permitted, provided that the frequency hopping system does it individually, and independently chooses or adapts its hopset. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.
The following applies to frequency hopping systems in each of the three bands.
(a) The bandwidth of a frequency hopping channel is the 20 dB emission bandwidth, measured with the hopping stopped. The system RF bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. The hopset shall be such that the near term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hopset while the long term distribution appears evenly distributed.

(b) 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 0.125 W. 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.
(d) Frequency hopping systems operating in the 2400-2483.5 MHz band shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

RSS-210 §A8.2 Digital Modulation Systems

These include systems employing digital modulation techniques resulting in spectral characteristics similar to direct sequence systems. The following applies to all three bands.

RSS-210 §A8.4 Transmitter Output Power and e.i.r.p. Requirements

(4) For systems employing digital modulation techniques operating in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands, the maximum peak conducted power shall not exceed 1 W. Except as provided in Section A8.4(5), the e.i.r.p. shall not exceed 4 W.
As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power (see RSS-Gen)
(5) Point-to-point systems in the bands 2400-2483.5 MHz and 5725-5850 MHz are permitted to have an e.i.r.p. higher than 4 W, provided that the higher e.i.r.p. is achieved by employing higher gain directional antennas and not higher transmitter output powers. Point-to-multipoint systems, omni-directional applications and multiple co-located transmitters transmitting the same information are prohibited from exceeding 4 W e.i.r.p. However, remote stations of point-to-multipoint systems shall be allowed to operate at greater than 4 W e.i.r.p, under the same conditions as for point-to- point systems.
Note: “Fixed, point-to-point operation”, excludes point-to-multipoint systems, omnidirectional applications and multiple co-located transmitters transmitting the same information.

RSS-210 §A8.5 Out-of-band Emissions

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required.

RSS-Gen §2 General Information

RSS-Gen §2.1.2 Category II Equipment

Category II equipment comprises radio devices where a standard has been prescribed but for which a TAC is not required, that is, equipment certification by Industry Canada or a Certification Body (CB) is not required (certification exempt), pursuant to subsection 4(3) of the Radiocommunication Act. The manufacturer or importer shall nevertheless ensure that the standards are complied with. A test report shall be available on request and the device shall be properly labelled.

RSS-Gen §2.2 Receivers

Receivers that are used for radiocommunication other than broadcasting are defined as Category I equipment or Category II equipment, subject to compliance with applicable Industry Canada standards.
Receivers shall be capable of operation only with transmitters for which RSSs are published.
Receivers are classified as described in sections 2.2.1 and 2.2.2.

RSS-Gen §2.2.1 Category I Equipment Receivers

A receiver is classified as Category I equipment if it meets one of the following conditions:
(a) a stand-alone receiver (see Note 1, below), which operates on any frequency in the band 30-960 MHz, and is used for the reception of signals in that frequency band from a transmitter classified as Category I equipment;
(b) a Citizen's Band (CB) receiver (26.96-27.410 MHz);
(c) a scanner receiver.
Note 1: A *stand-alone receiver* is defined as any receiver that is not permanently combined together with a transmitter in a single case (transceiver), in which it functions as the receiver component of the transceiver.
Receivers classified as Category I equipment shall comply with the limits for receiver spurious emissions set out in RSS-Gen; however, equipment certification is granted under the applicable RSS standard along with the associated transmitter classified as Category I equipment. Scanner receivers are covered under their own specific RSS.

RSS-Gen §2.2.2 Category II Equipment Receivers

A receiver is classified as Category II equipment if it does not meet any of the conditions of Section 2.2.1.
Category II receivers shall comply with the applicable testing, labelling and user manual requirements in RSS-310.

RSS-Gen §5.6 Exposure of Humans to RF Fields

Category I and Category II equipment shall comply with the applicable requirements of RSS-102.

RSS-Gen §6 Receiver Spurious Emission Standard

Receivers shall comply with the limits of spurious emissions set out in this section, measured over the frequency range determined in accordance with Section 4.10.

RSS-Gen §6.1 Radiated Limits

Radiated spurious emission measurements shall be performed with the receiver antenna connected to the receiver antenna terminals.

Spurious emissions from receivers shall not exceed the radiated limits shown in the table below:

RSS-Gen Table 2 - Spurious Emission Limits for Receivers

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

*Measurements for compliance with limits in the above table may be performed at distances other than 3 metres, in accordance with Section 7.2.7.

RSS- Gen Table 3: Restricted Frequency Bands (Note)

MHz	MHz	MHz	MHz	GHz
0.090-0.110	8.37625-8.38675	--	1718.8-1722.2	9.0-9.2
--	8.41425-8.41475	156.52475-156.52525	2200-2300	9.3-9.5
2.1735-2.1905	12.29-12.293	156.7-156.9	2310-2390	10.6-12.7
3.020-3.026	12.51975-12.52025	--	--	13.25-13.4
4.125-4.128	12.57675-12.57725	--	2655-2900	14.47-14.5
4.17725-4.17775	13.36-13.41	240-285	3260-3267	15.35-16.2
4.20725-4.20775	16.42-16.423	322-335.4	3332-3339	17.7-21.4
5.677-5.683	16.69475-16.69525	399.9-410	3345.8-3358	22.01-23.12
6.215-6.218	16.80425-16.80475	608-614	3500-4400	23.6-24.0
6.26775-6.26825	25.5-25.67	960-1427	4500-5150	31.2-31.8
6.31175-6.31225	37.5-38.25	1435-1626.5	5350-5460	36.43-36.5
8.291-8.294	73-74.6; 74.8-75.2	1645.5-1646.5	7250-7750	Above 38.6
8.362-8.366	108-138	1660-1710	8025-8500	

Note: *Certain frequency bands listed in Table 2 and above 38.6 GHz are designated for low-power licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in this Standard as well as RSS-310.*

RSS- Gen Table 5: General Field Strength Limits for Transmitters at Frequencies Above 30 MHz

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

Note: *Transmitting devices are not permitted in Table 1 bands or, unless stated otherwise, in TV bands(54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-806 MHz).*

RSS- Gen Table 6: General Field Strength Limits for Transmitters at Frequencies Below 30 MHz (Transmit)

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

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

RSS-Gen §7.1.2 Transmitter Antenna

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

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer.
For transmitters of RF output power of 10 milliwatts or less, only the portion of the antenna gain that is in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power to demonstrate compliance with the radiated power limits specified in the applicable standard. For transmitters of output power greater than 10 milliwatts, the total antenna gain shall be added to the measured RF output power to demonstrate compliance to the specified radiated power limits.User manuals for transmitters shall display the following notice in a conspicuous location:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

The above notice may be affixed to the device instead of displayed in the user manual.

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, or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type 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) and required impedance for each.

RSS-Gen §7.2.4 Transmitter and Receiver AC Power Lines Conducted Emission Limits

Except when the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply, either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the table below. The more stringent limit applies at the frequency range boundaries.

The conducted emissions shall be measured with a 50 ohm/50 microhenry line impedance stabilization network (LISN).

RSS-Gen Table 4 – AC Power Line Conducted Emission Limits

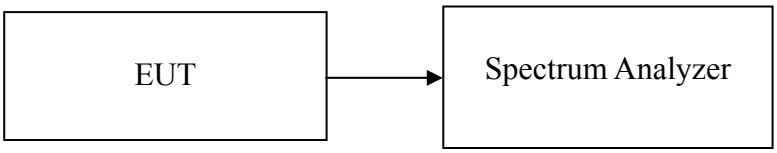
Frequency Range (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

**Decreases with the logarithm of the frequency.*

8. FCC PART 15.247 REQUIREMENTS & RSS 210 REQUIREMENTS

8.1 99% BANDWIDTH

Test Configuration



TEST PROCEDURE

The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold.

TEST RESULTS

No non-compliance noted.

Test Data

For GFSK

Channel	Frequency (MHz)	99% Bandwidth (kHz)
Low	2402	810.4784
Mid	2441	820.4503
High	2480	824.8390

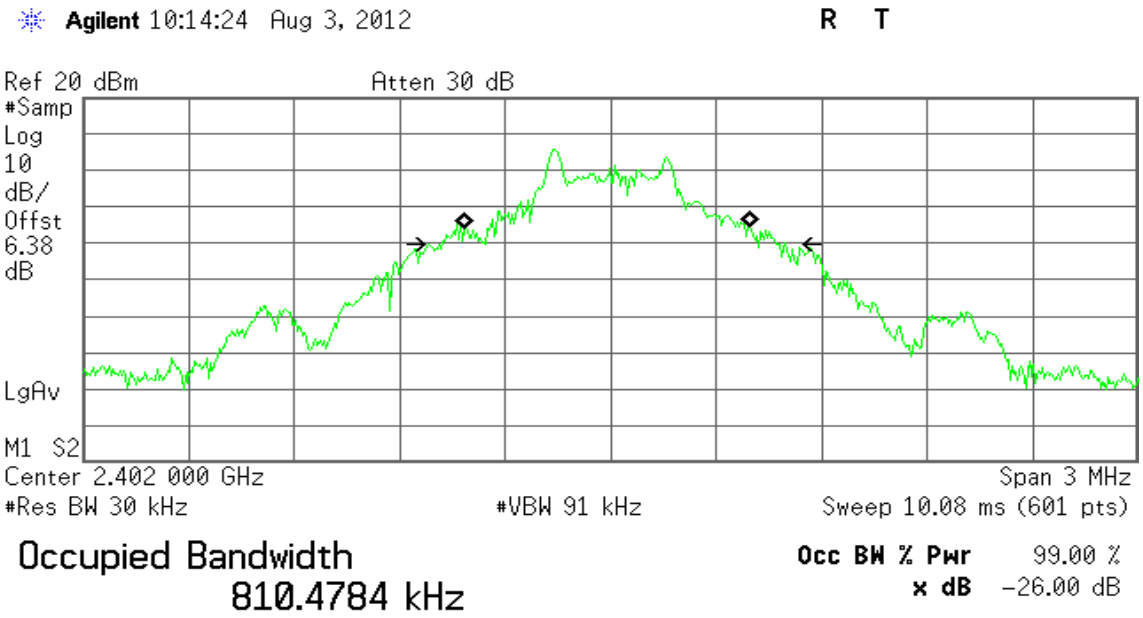
For 8DPSK

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0604
Mid	2441	1.0574
High	2480	1.0586

Test Plot

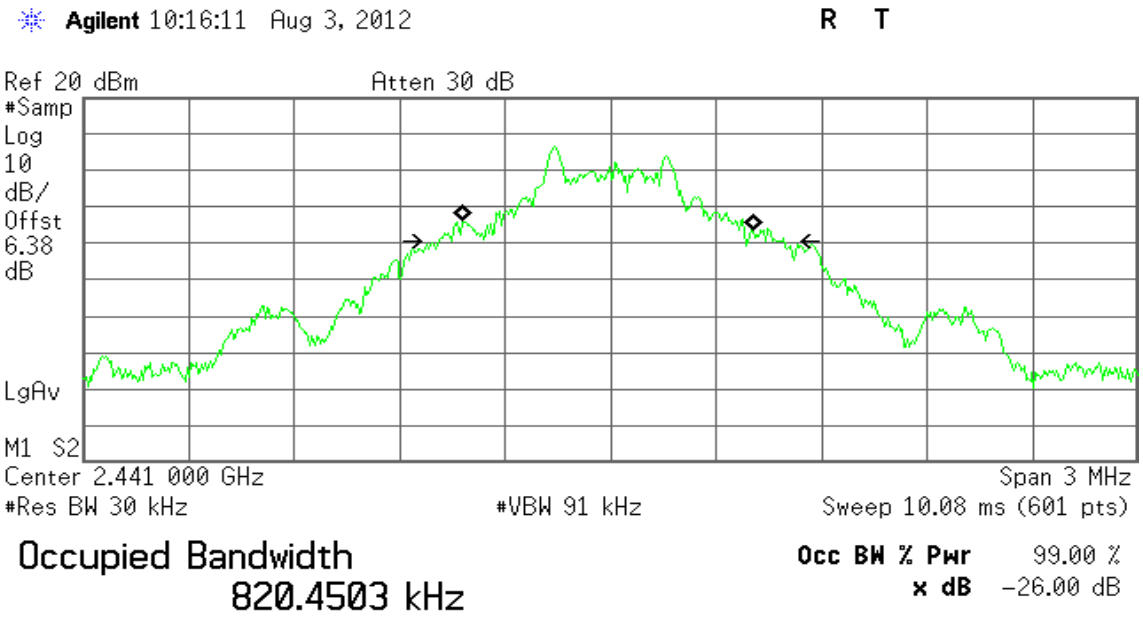
For GFSK / DH5

99% Bandwidth (CH Low)



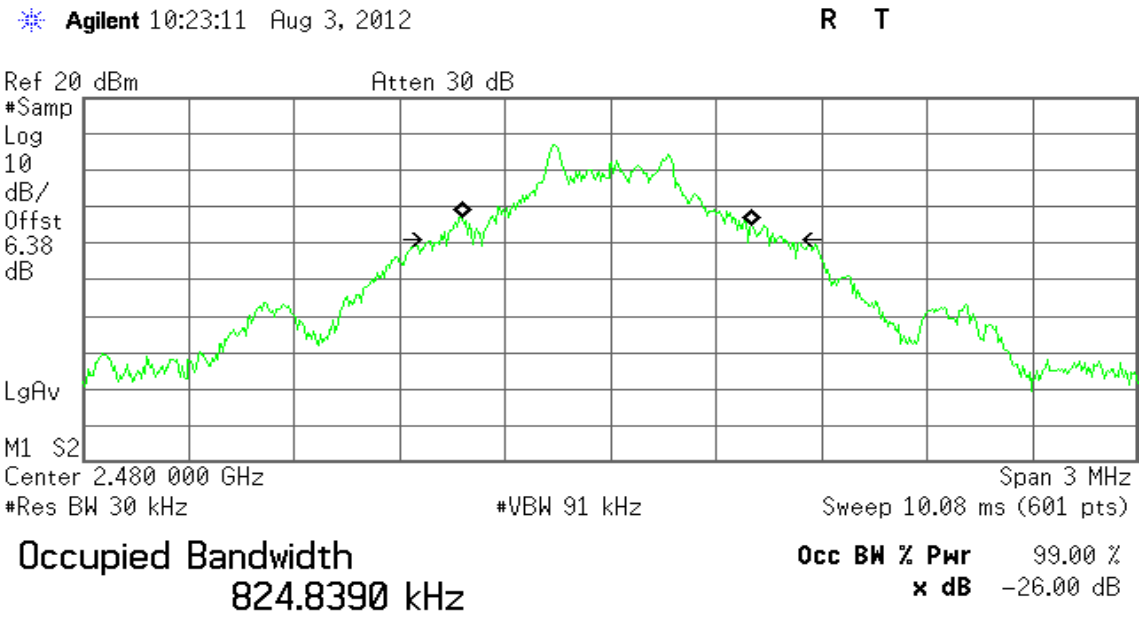
Transmit Freq Error -9.019 kHz
x dB Bandwidth 972.768 kHz*

99% Bandwidth (CH Mid)



Transmit Freq Error -7.534 kHz
x dB Bandwidth 979.347 kHz*

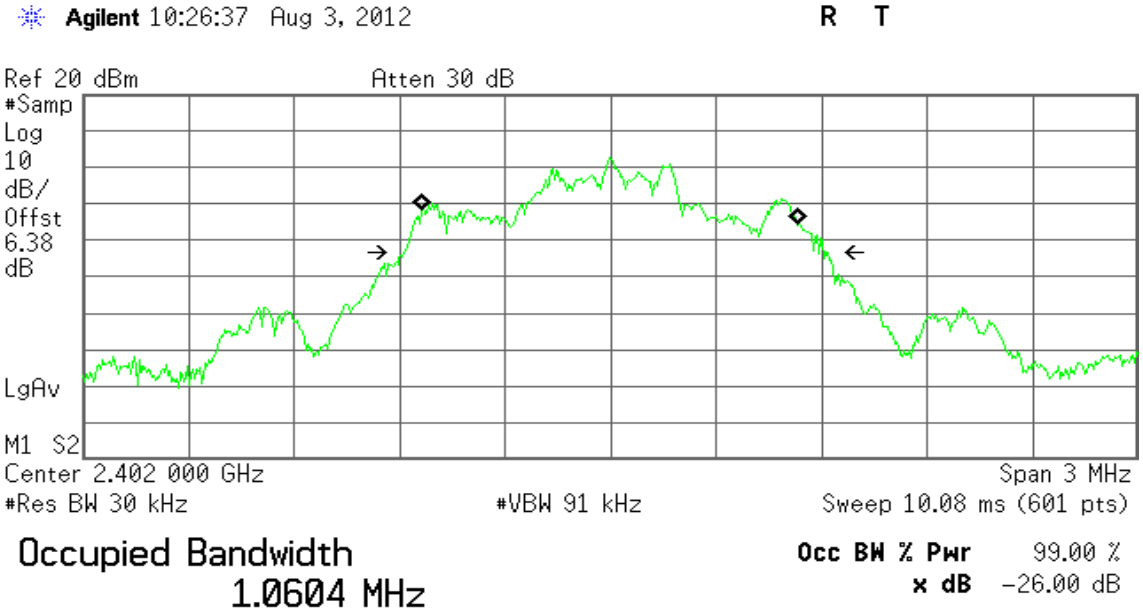
99% Bandwidth (CH High)



Transmit Freq Error -10.043 kHz
x dB Bandwidth 978.188 kHz*

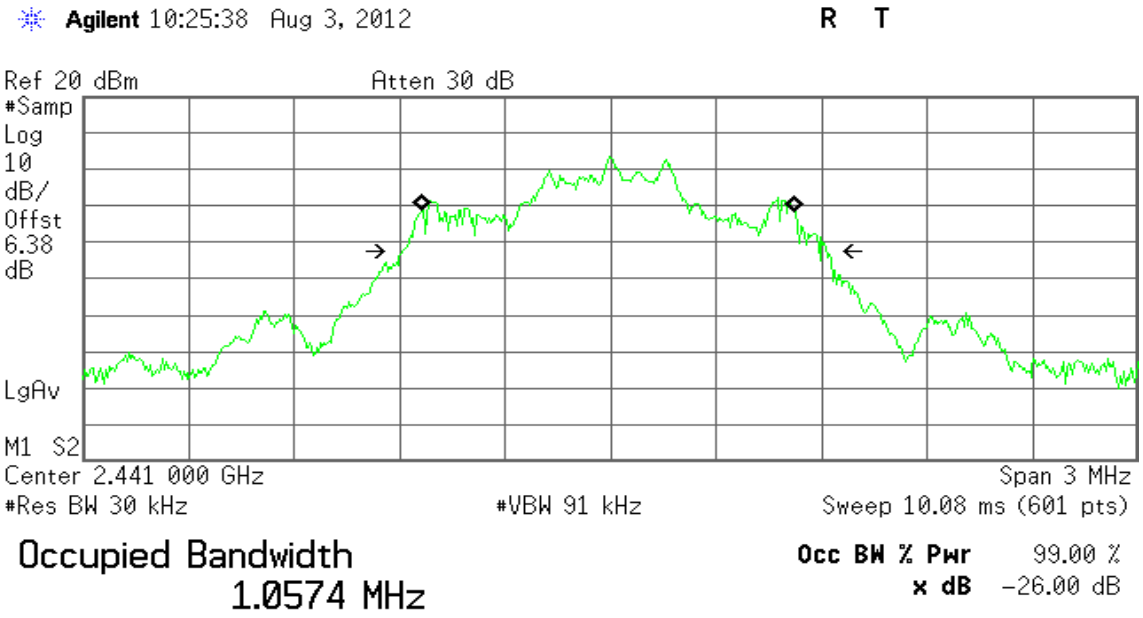
For GFSK / DH5

99% Bandwidth (CH Low)



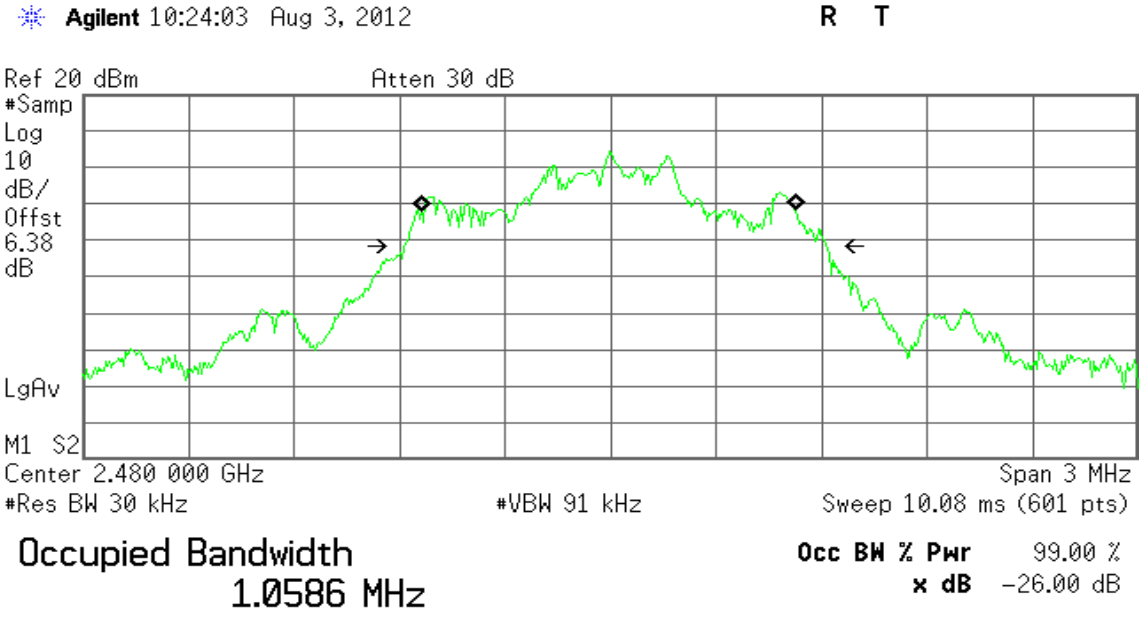
Transmit Freq Error -4.143 kHz
x dB Bandwidth 1.206 MHz*

99% Bandwidth (CH Mid)



Transmit Freq Error −6.439 kHz
x dB Bandwidth 1.205 MHz*

99% Bandwidth (CH High)



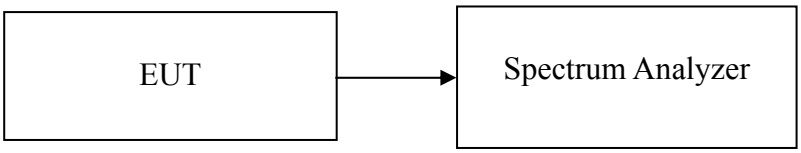
Transmit Freq Error −4.458 kHz
x dB Bandwidth 1.203 MHz*

8.2 20 DB BANDWIDTH

LIMIT

None; for reporting purposes only.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=300kHz, VBW = 300kHz, Span = 3MHz, Sweep = auto.
4. Mark the peak frequency and 20dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

TEST RESULTS

No non-compliance noted.

Test Data

For GFSK / DH5

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	0.97
Mid	2441	0.97
High	2480	0.965

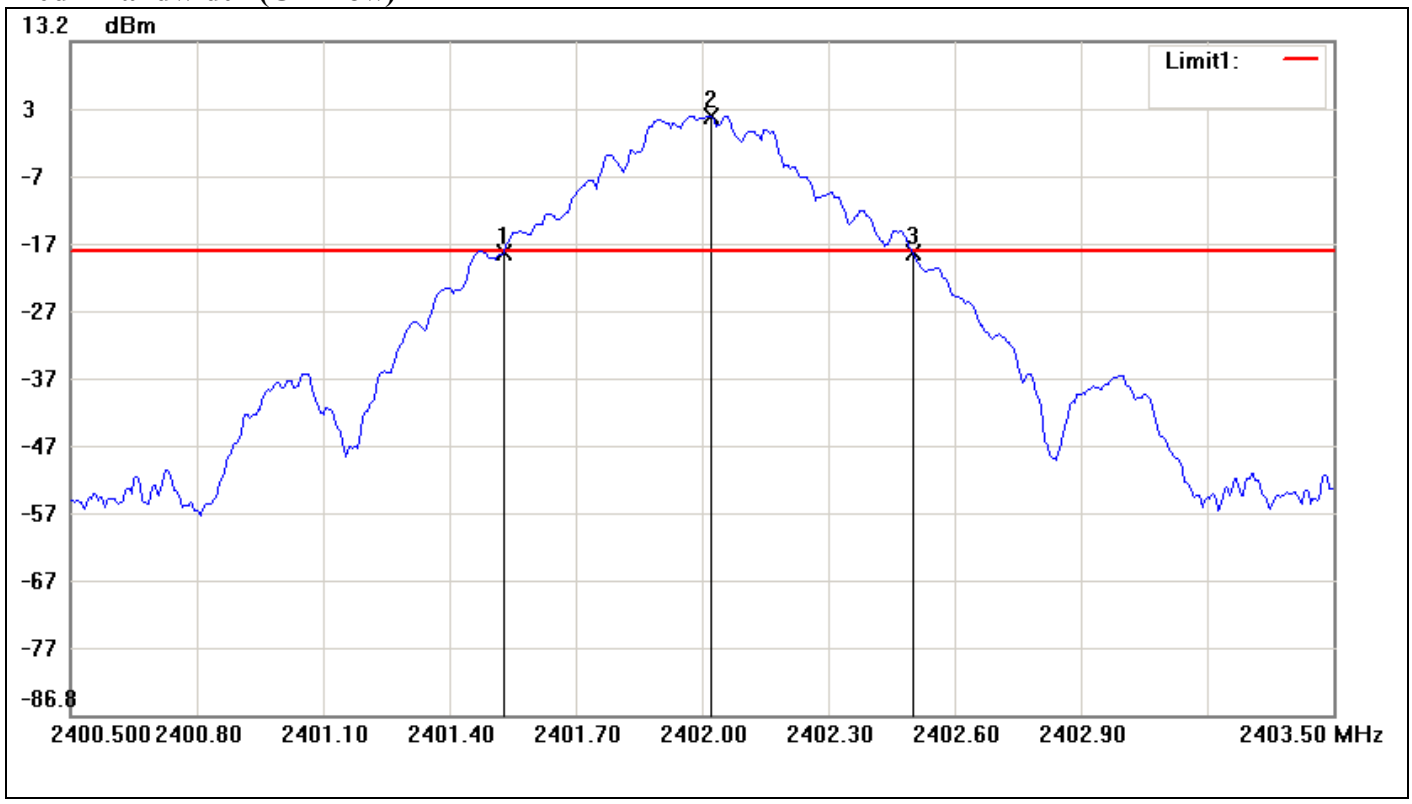
For 8DPSK / DH5

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	1.31
Mid	2441	1.285
High	2480	1.285

Test Plot

For GFSK / DH5

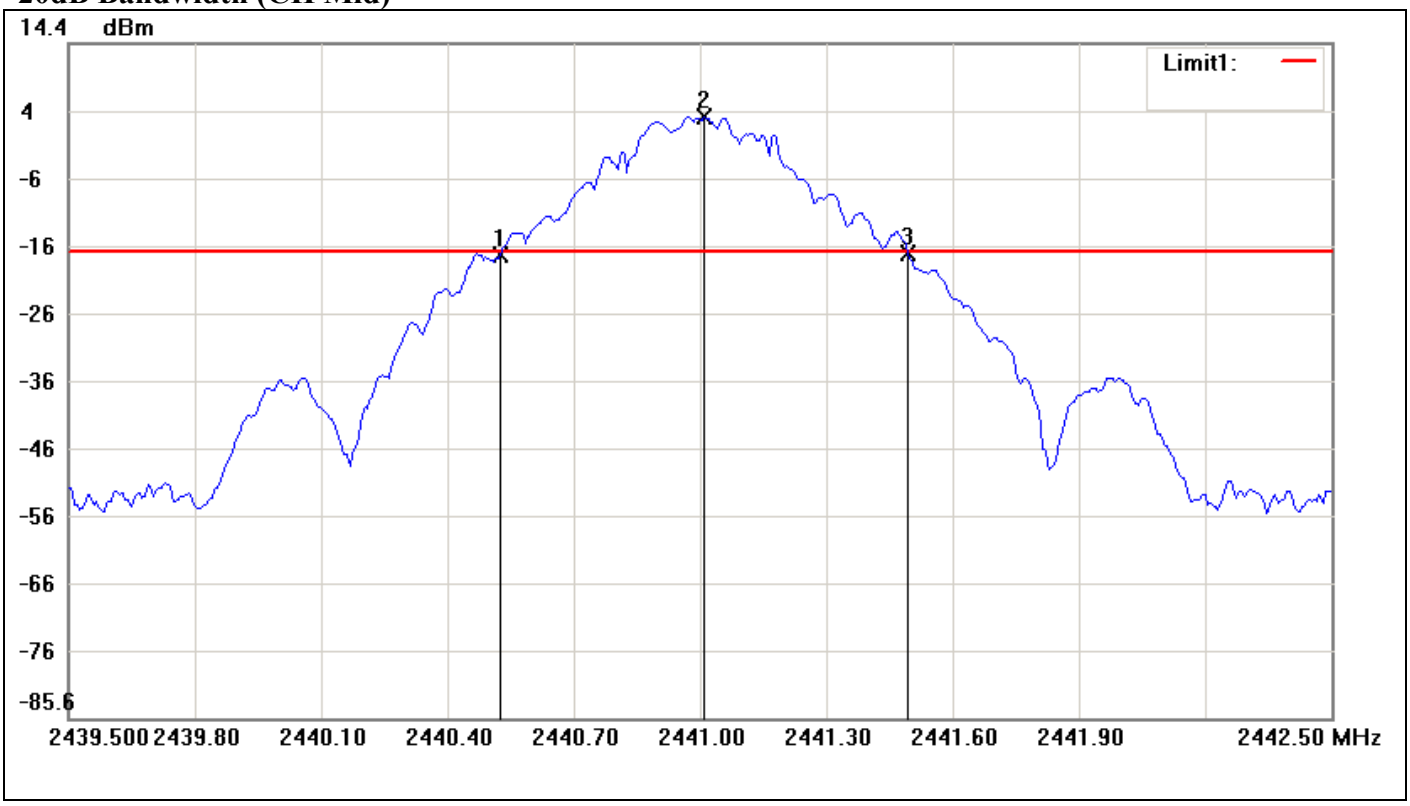
20dB Bandwidth (CH Low)



No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	2401.5300	-18.12	-17.81	-0.31
2	2402.0200	2.19	-17.81	20.00
3	2402.5000	-18.09	-17.81	-0.28

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	0.97	0.03

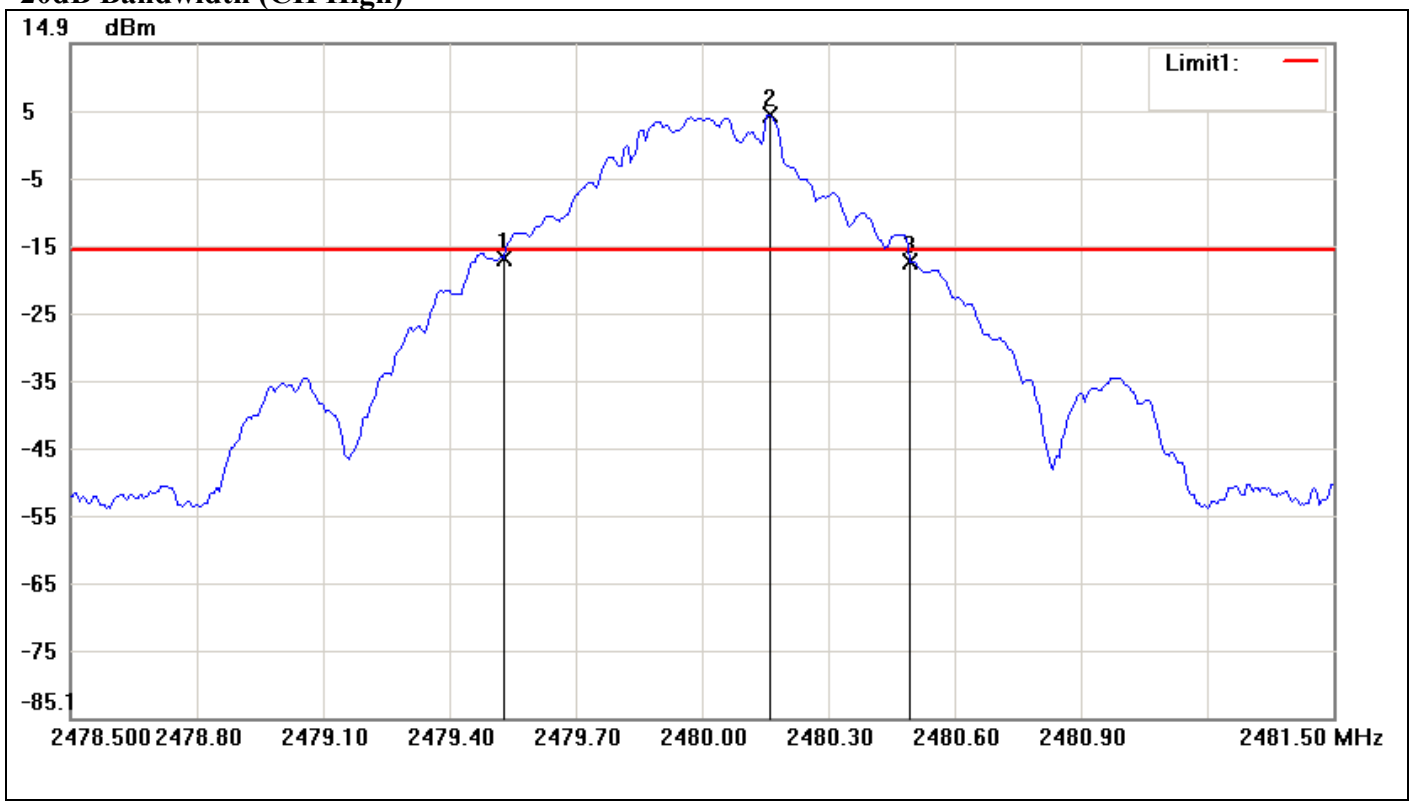
20dB Bandwidth (CH Mid)



No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	2440.5250	-17.06	-16.56	-0.50
2	2441.0100	3.44	-16.56	20.00
3	2441.4950	-16.60	-16.56	-0.04

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	0.97	0.46

20dB Bandwidth (CH High)

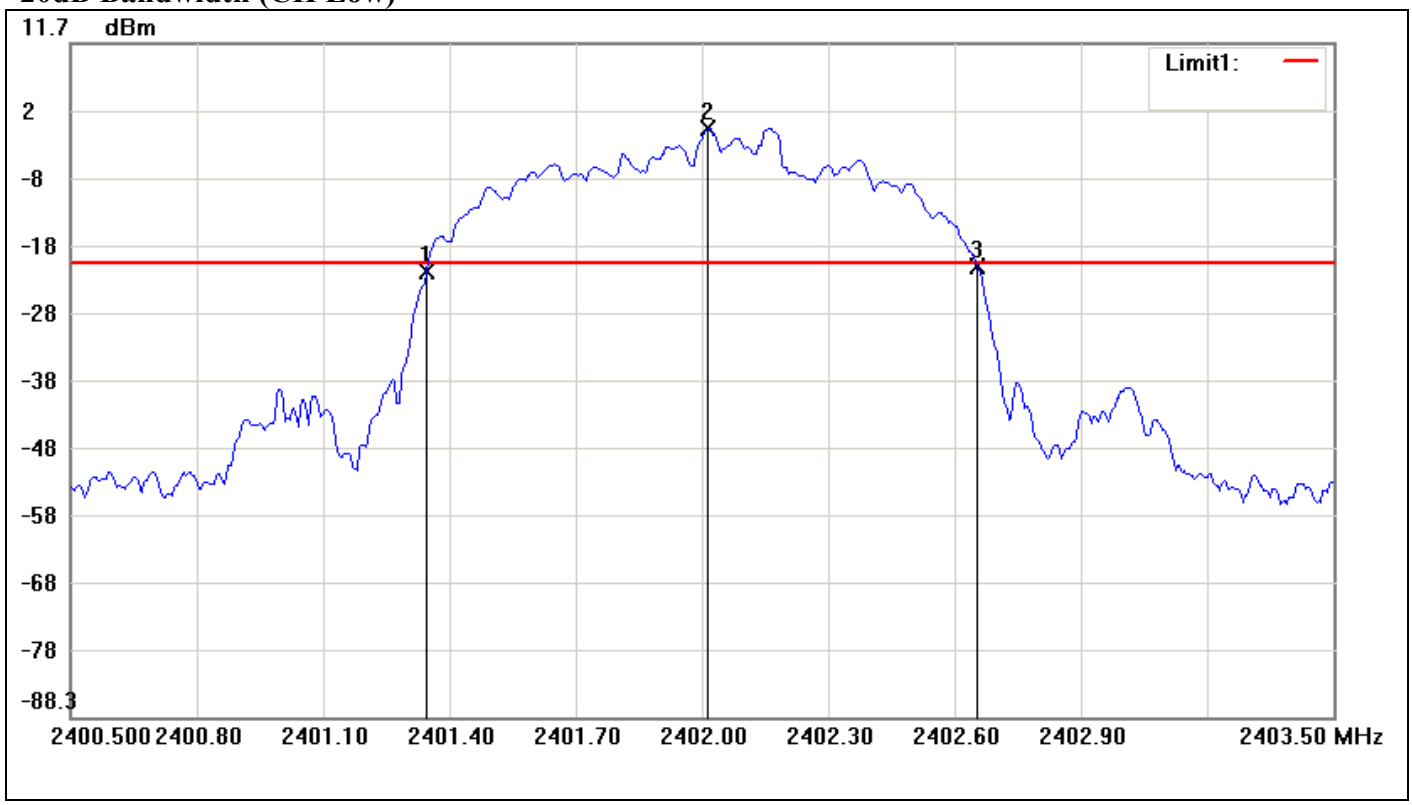


No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	2479.5300	-17.00	-15.70	-1.30
2	2480.1600	4.30	-15.70	20.00
3	2480.4950	-17.39	-15.70	-1.69

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	0.965	-0.39

For 8DPSK / DH5

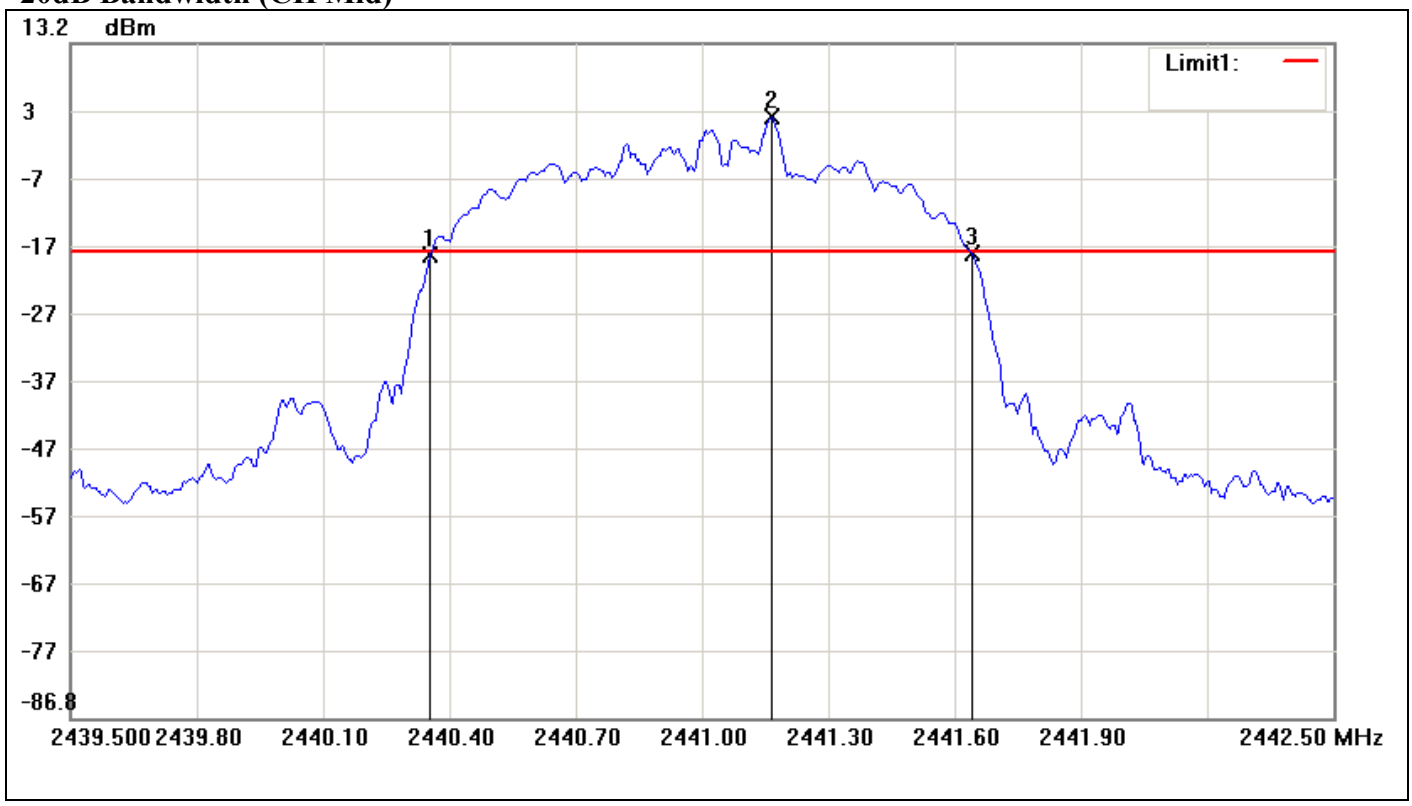
20dB Bandwidth (CH Low)



No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	2401.3450	-22.17	-20.96	-1.21
2	2402.0150	-0.96	-20.96	20.00
3	2402.6550	-21.53	-20.96	-0.57

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	1.31	0.64

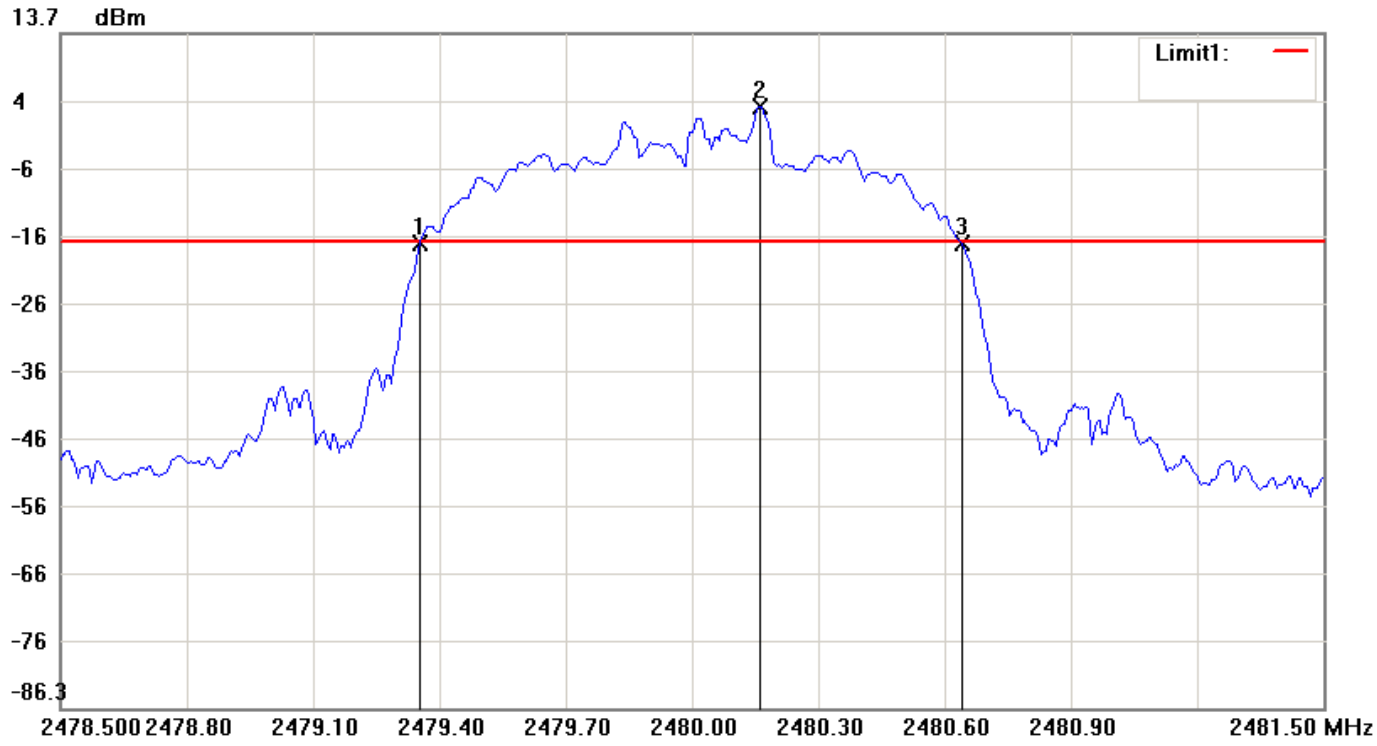
20dB Bandwidth (CH Mid)



No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	2440.3550	-18.10	-17.82	-0.28
2	2441.1650	2.18	-17.82	20.00
3	2441.6400	-17.96	-17.82	-0.14

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	1.285	0.14

20dB Bandwidth (CH High)



No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	2479.3550	-17.30	-17.17	-0.13
2	2480.1600	2.83	-17.17	20.00
3	2480.6400	-17.33	-17.17	-0.16

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	1.285	-0.03

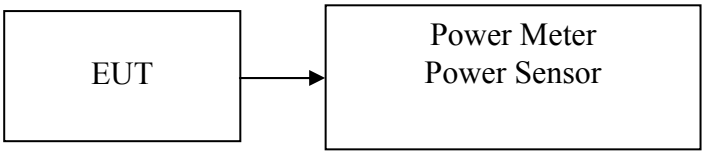
8.3 PEAK POWER

LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

1. According to §15.247(a)(1) & RSS-210 §A8.4(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.
2. According to §15.247(b)(3) & RSS 210 §A8.4(4),, for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the Power Meter. The Power Meter is set to the peak power detection.

TEST RESULTS

No non-compliance noted.

Test Data

Test Data

For GFSK / DH5

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	4.93	0.0031	0.125	PASS
Mid	2441	6.13	0.0041		PASS
High	2480	6.70	0.0047		PASS

For 8DPSK / DH5

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	4.14	0.0026	0.125	PASS
Mid	2441	5.64	0.0037		PASS
High	2480	6.23	0.0042		PASS

8.4 BAND EDGES MEASUREMENT

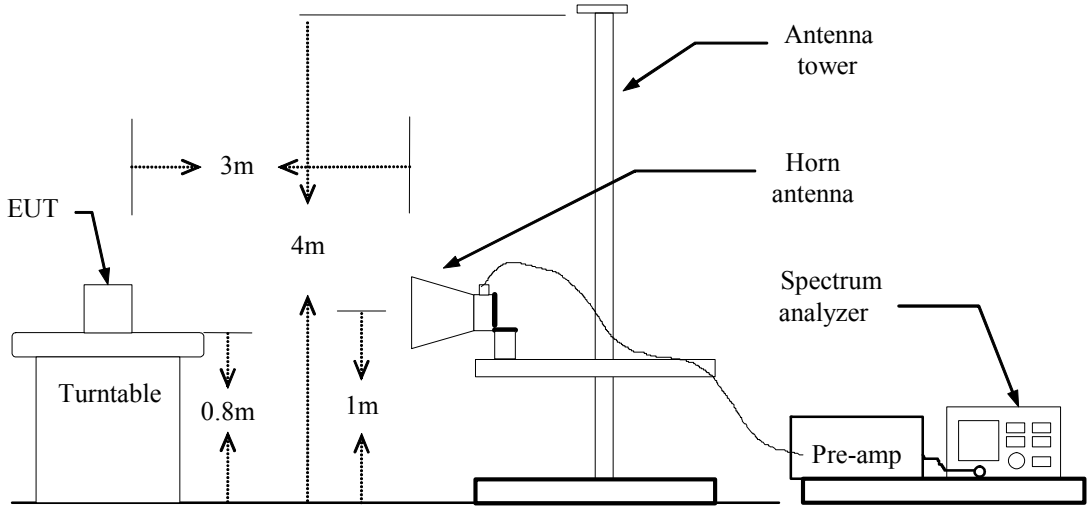
LIMIT

According to §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)).

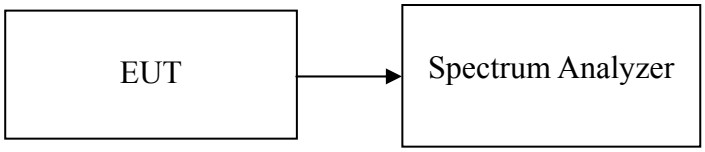
According to RSS-210 §A8.5, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.

Test Configuration

For Radiated



For Conducted



TEST PROCEDURE

For Radiated

1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
   (a) PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO
   (b) AVERAGE: RBW=1MHz / VBW ≥ 1/T / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

For Conducted

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

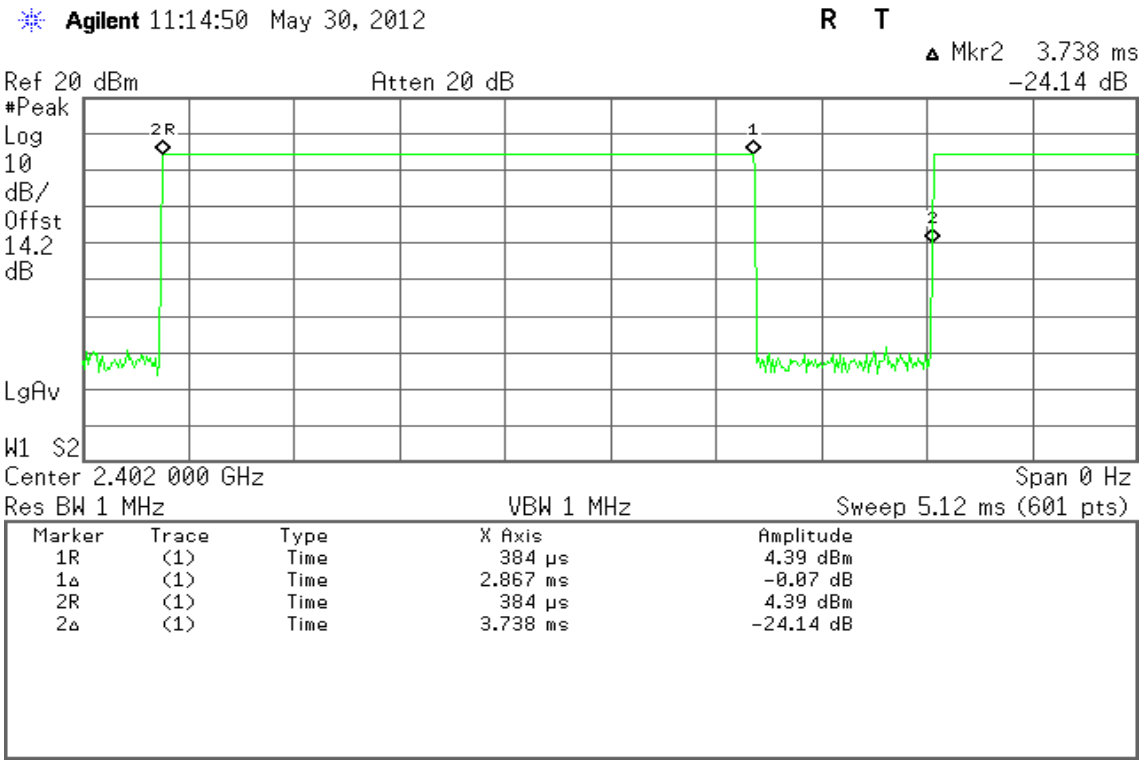
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 300 kHz. The video bandwidth is set to 300 kHz.

TEST RESULTS

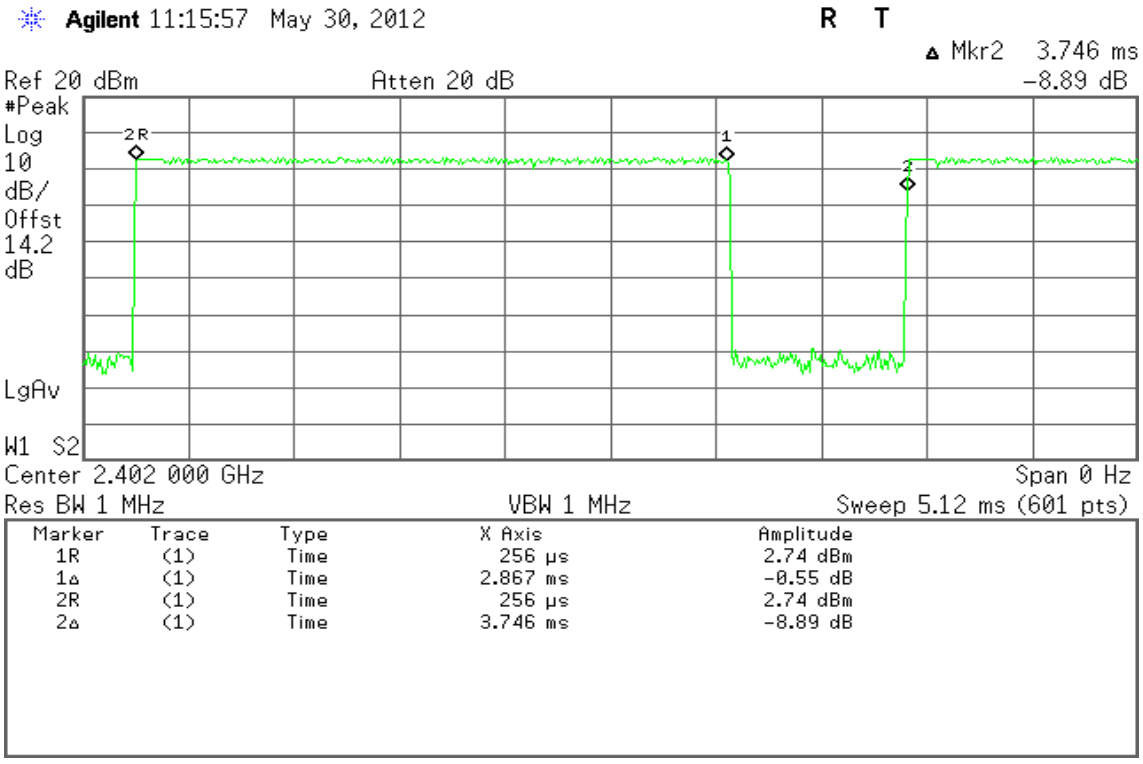
Refer to attach spectrum analyzer data chart.

Duty cycle

For GFSK / DH5



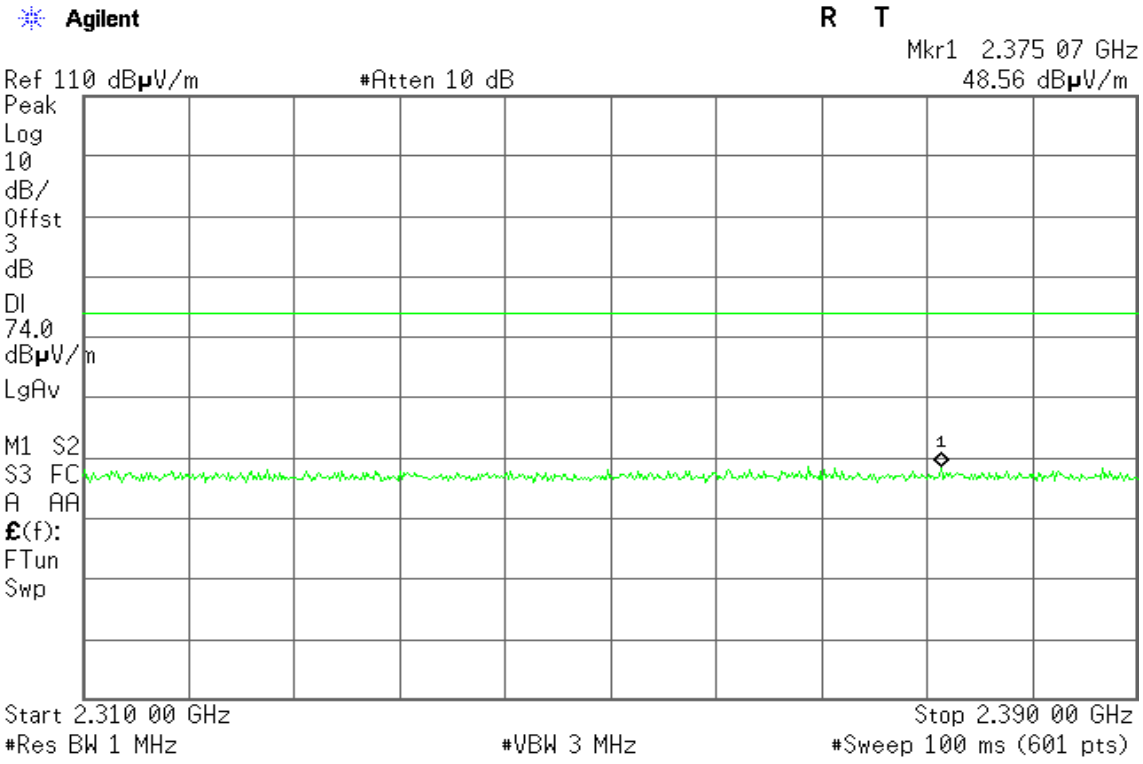
For 8DPSK / DH5



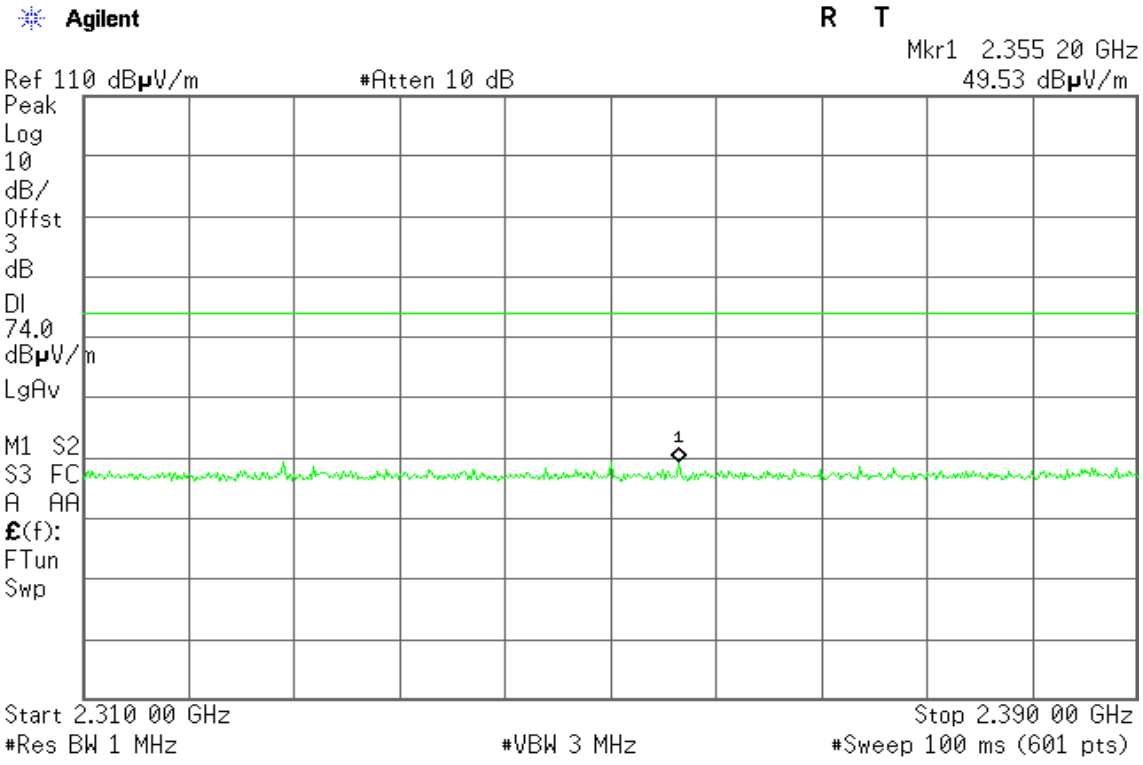
For GFSK / DH5

Band Edges (CH Low)

Detector mode: Peak **Polarity: Vertical**

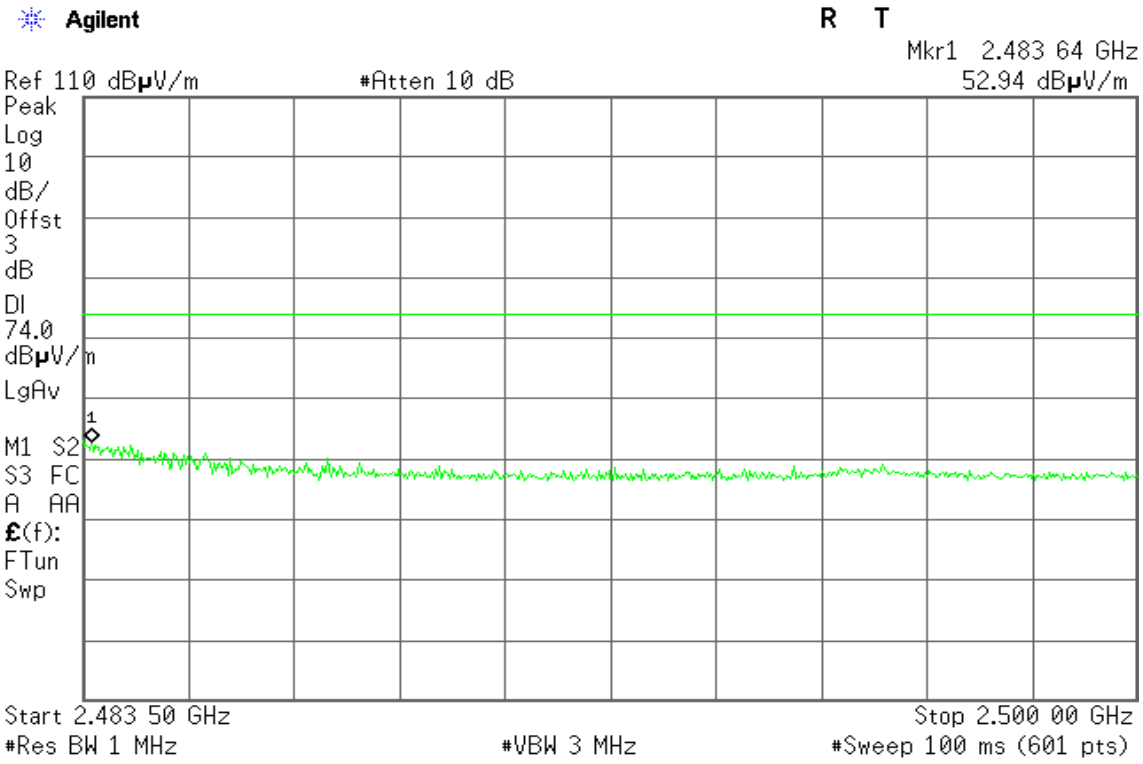


Detector mode: Peak **Polarity: Horizontal**

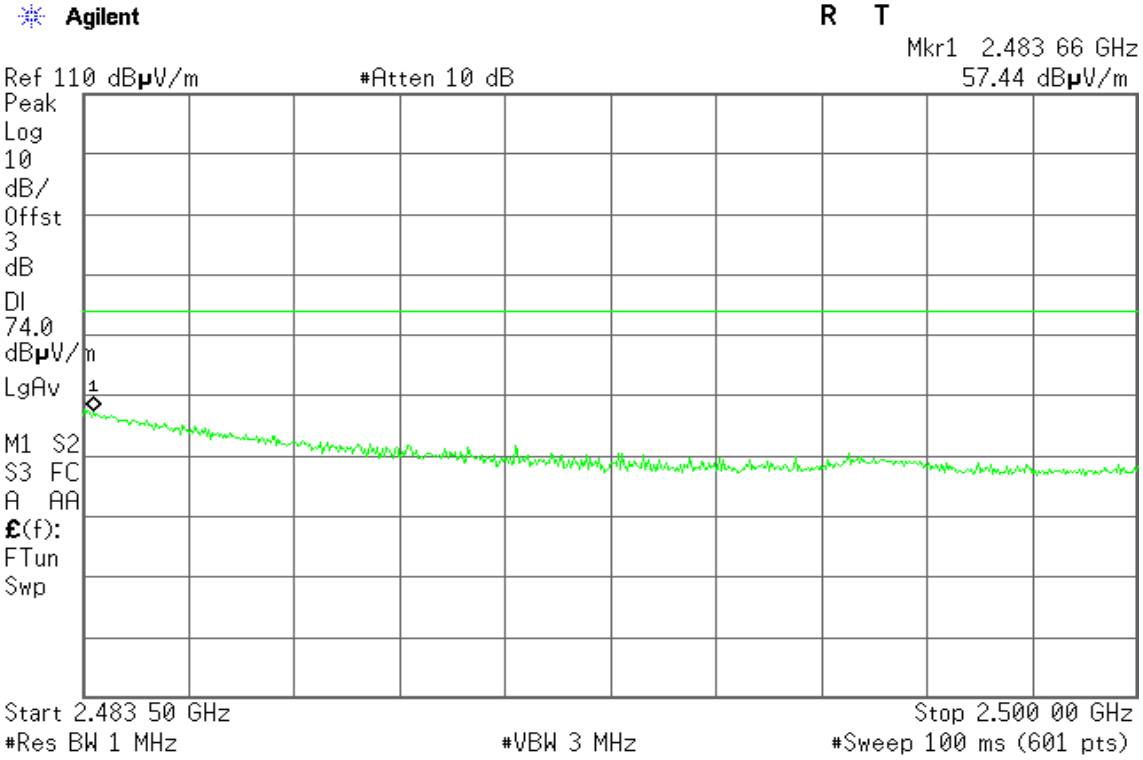


Band Edges (CH High)

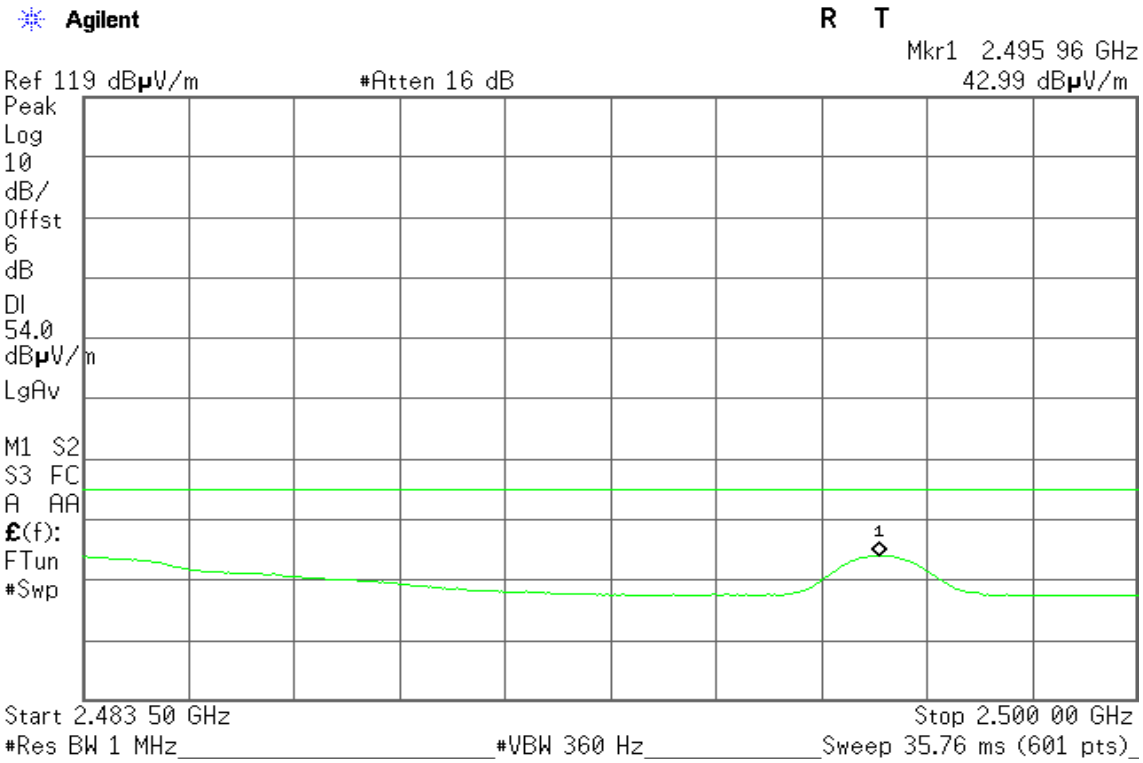
Detector mode: Peak Polarity: Vertical



Detector mode: Peak Polarity: Horizontal



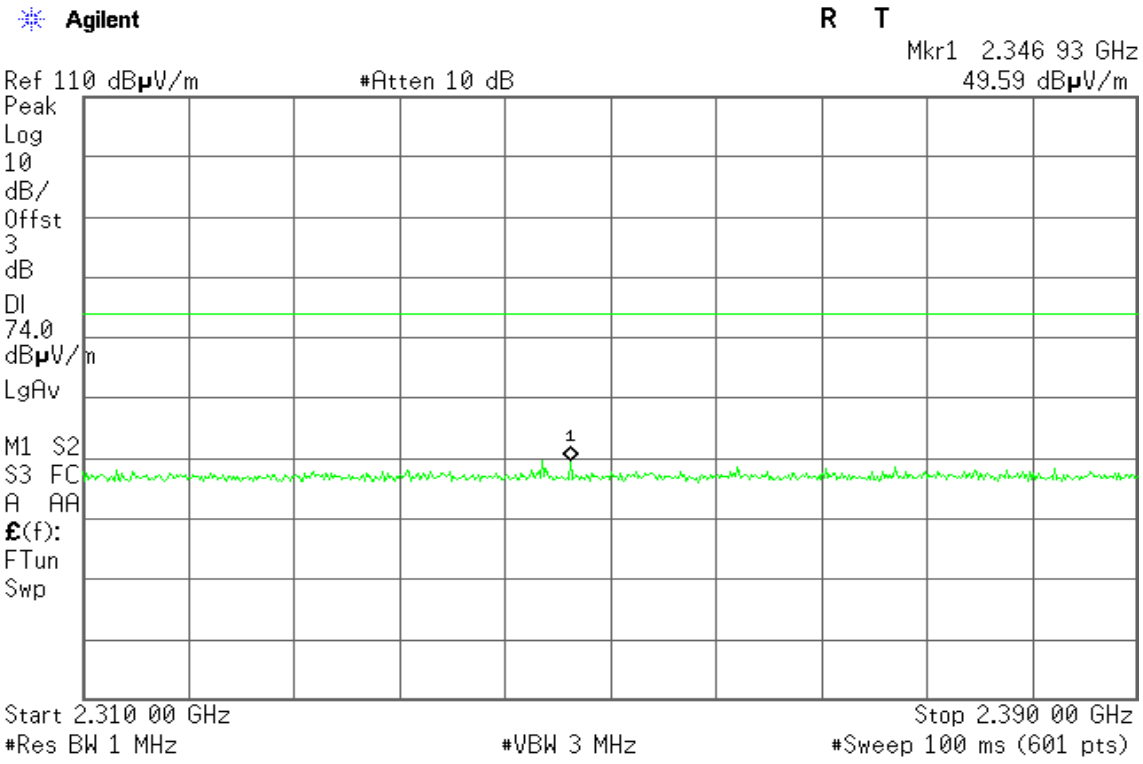
Detector mode: Average **Polarity: Horizontal**



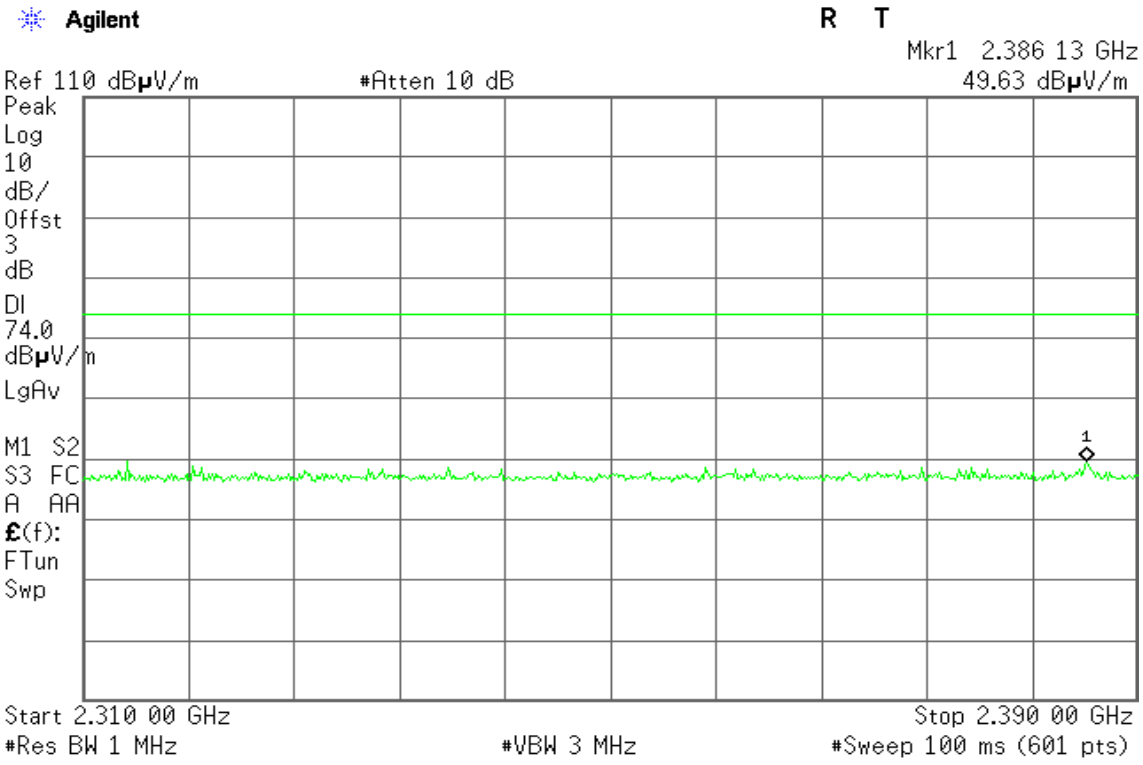
For 8DPSK / DH5

Band Edges (CH Low)

Detector mode: Peak **Polarity: Vertical**

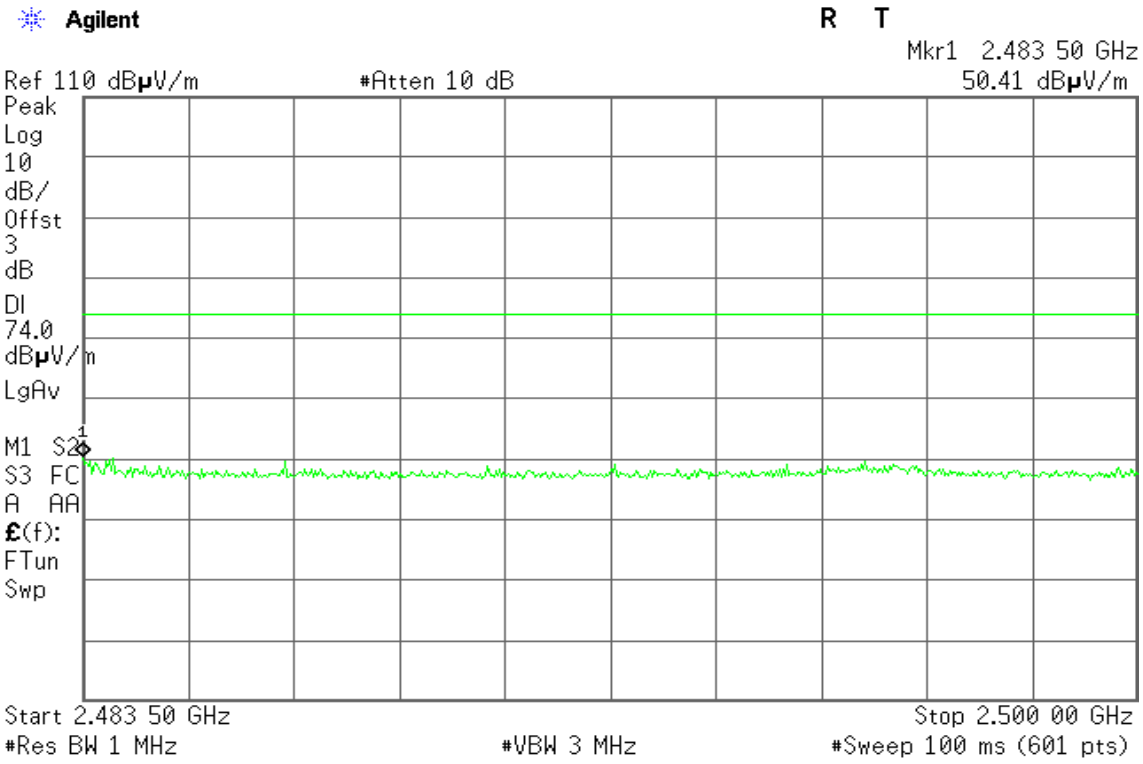


Detector mode: Peak **Polarity: Horizontal**

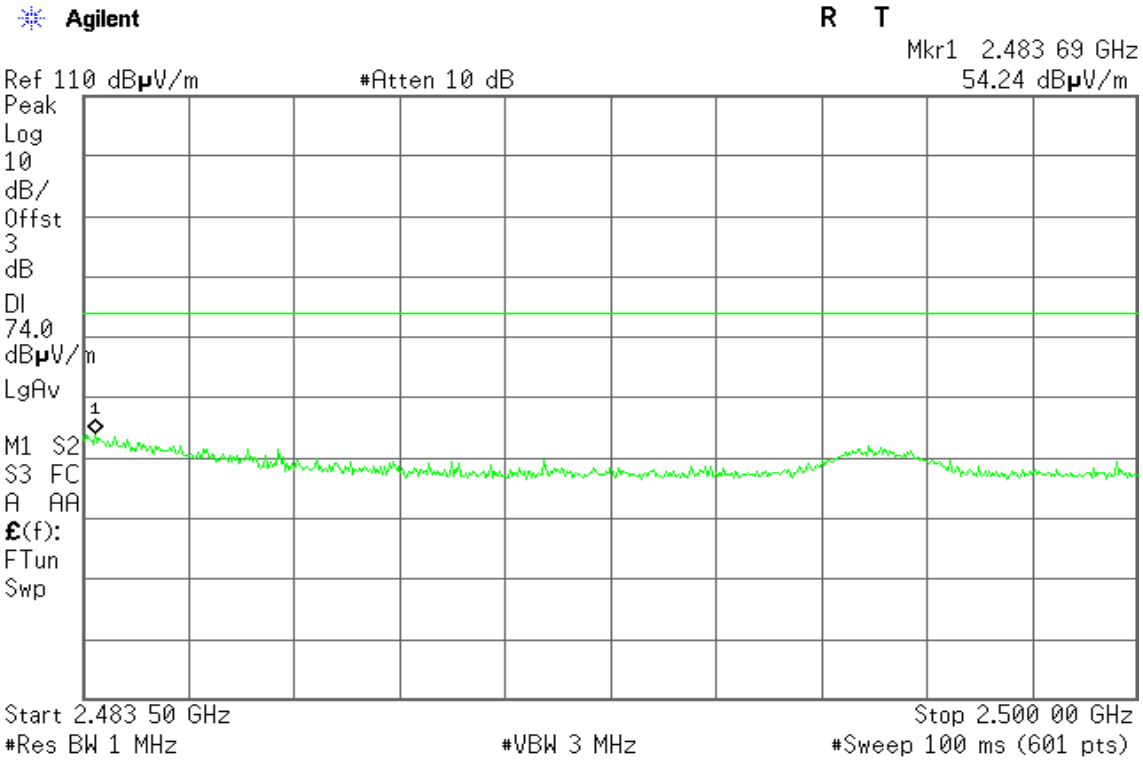


Band Edges (CH High)

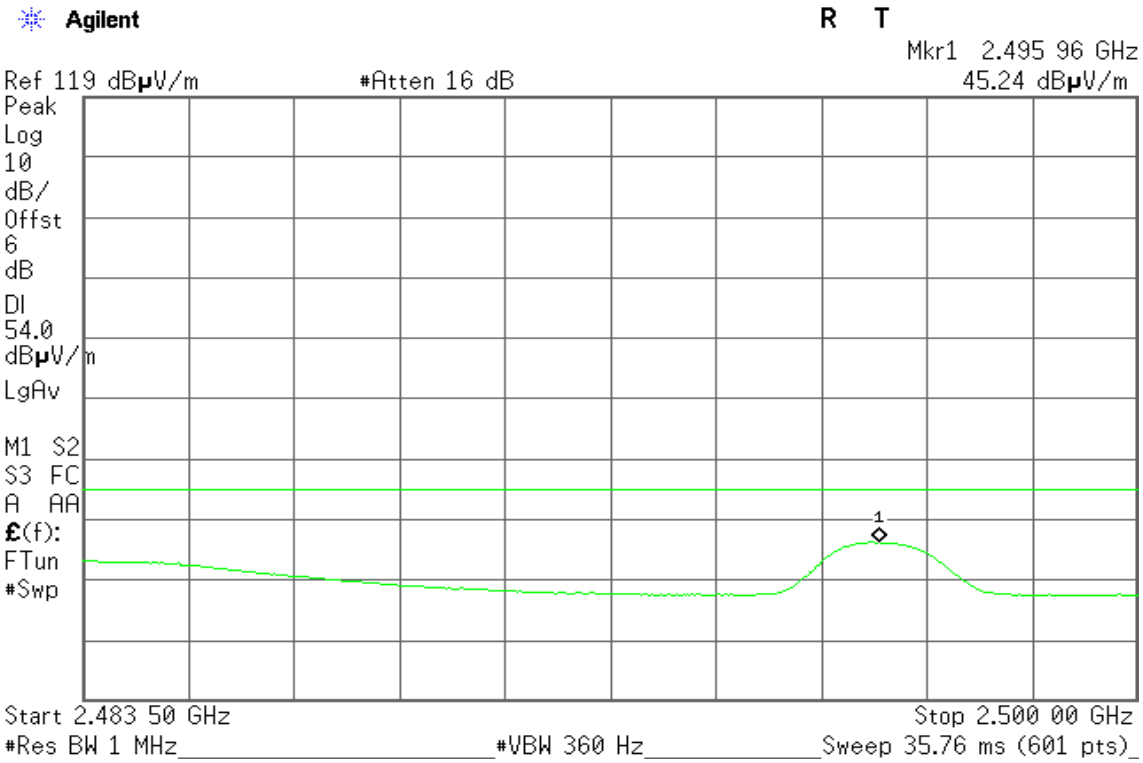
Detector mode: Peak Polarity: Vertical



Detector mode: Peak Polarity: Horizontal



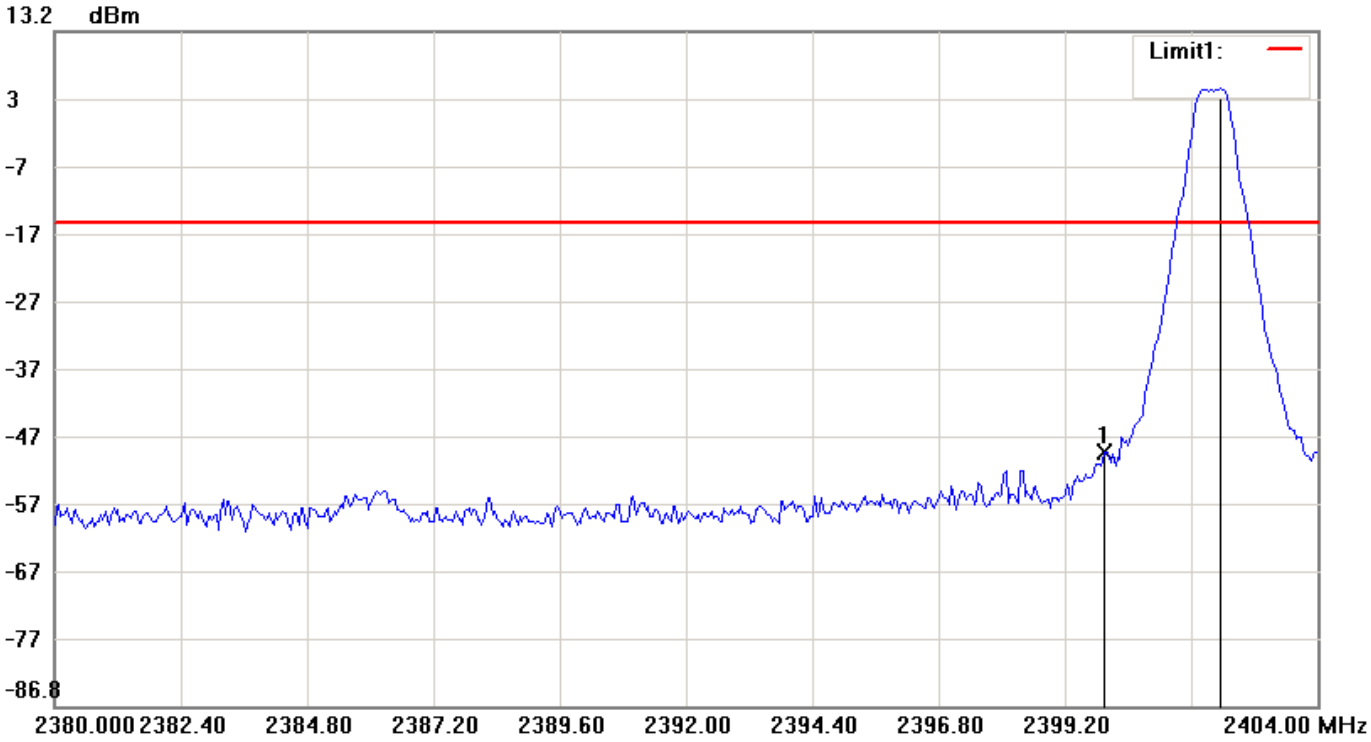
Detector mode: Average **Polarity: Horizontal**



Conducted Band Edge

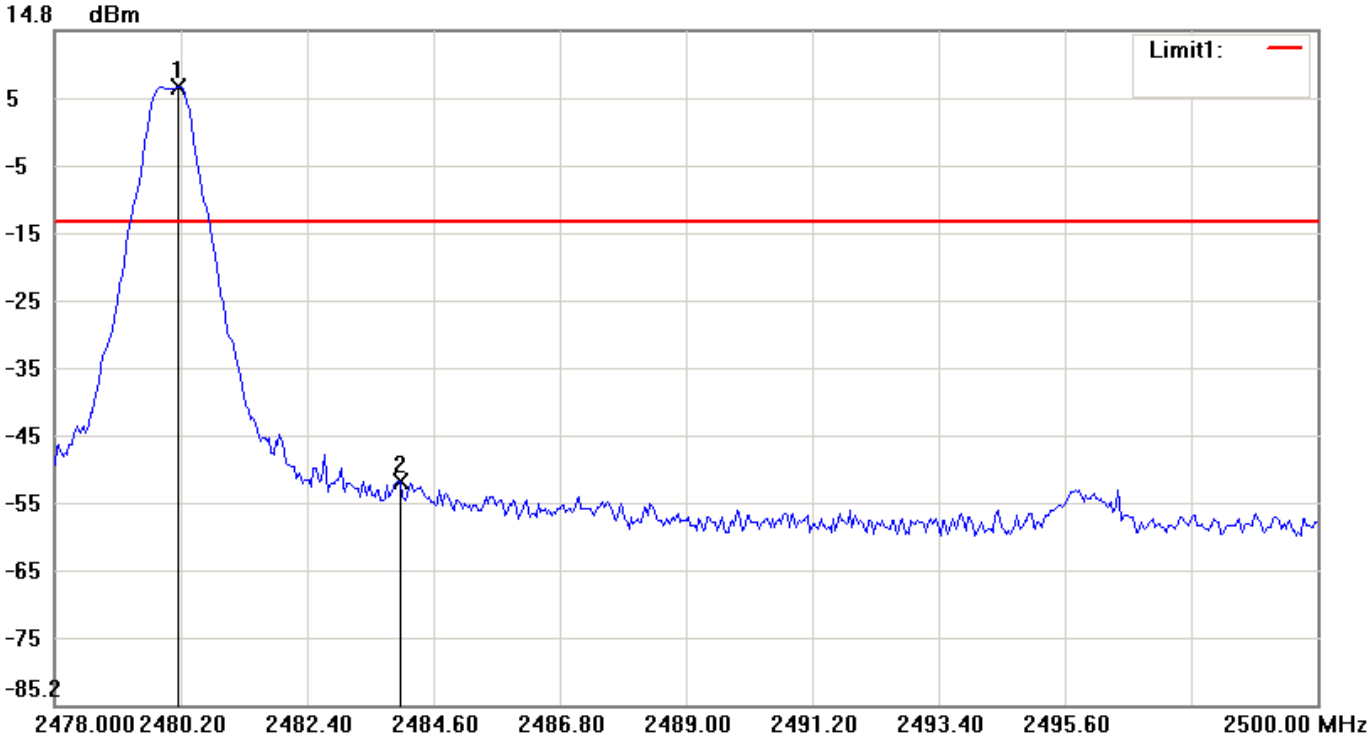
GFSK

(CH Low)



No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	2399.9600	-49.27	-15.31	-33.96
2	2402.1600	4.69	-15.31	20.00

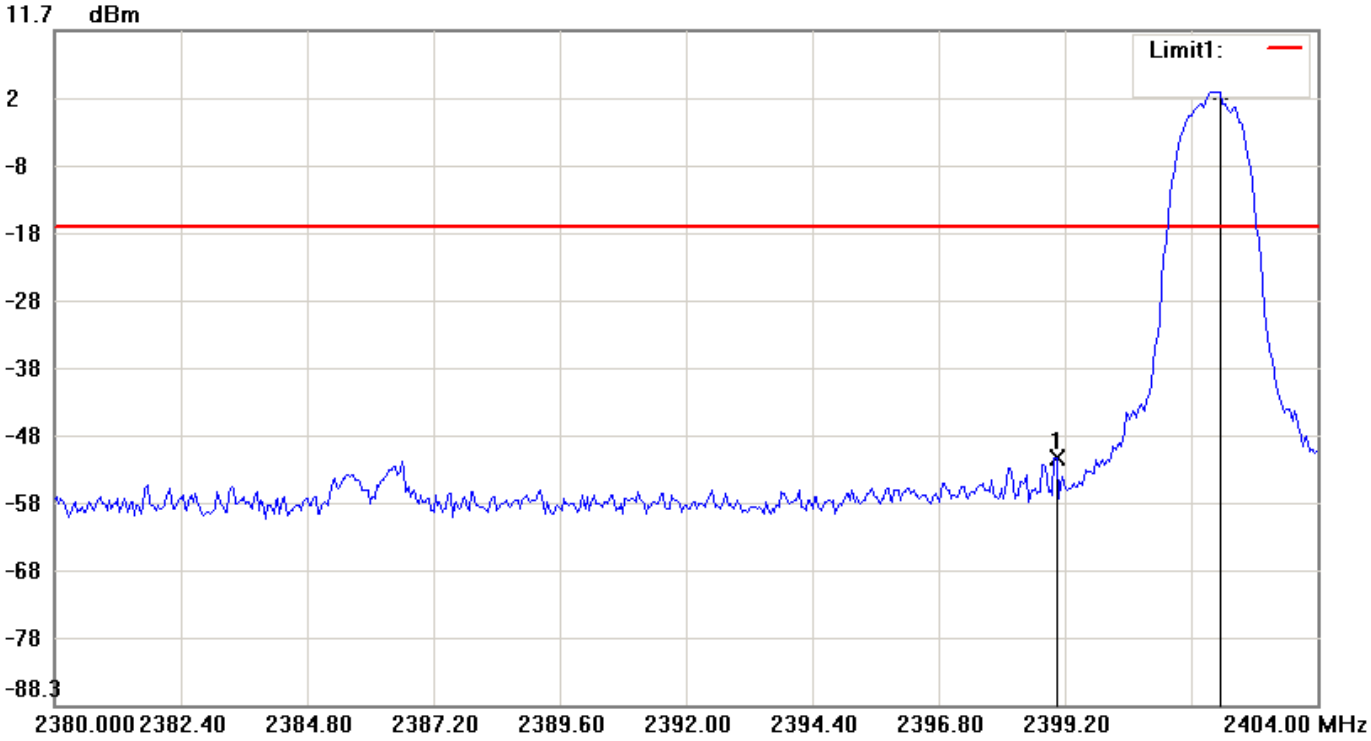
(CH High)



No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	2480.1633	6.50	-13.50	20.00
2	2484.0133	-51.97	-13.50	-38.47

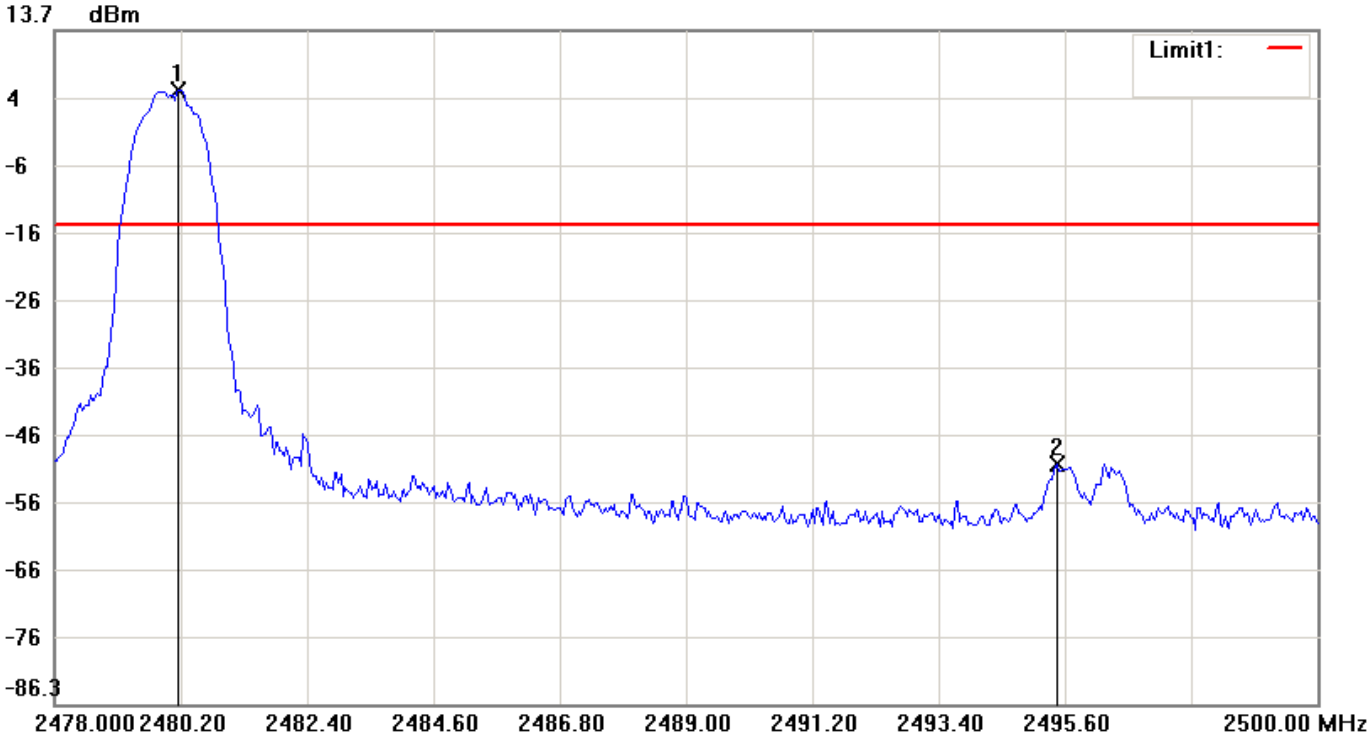
8DPSK

(CH Low)



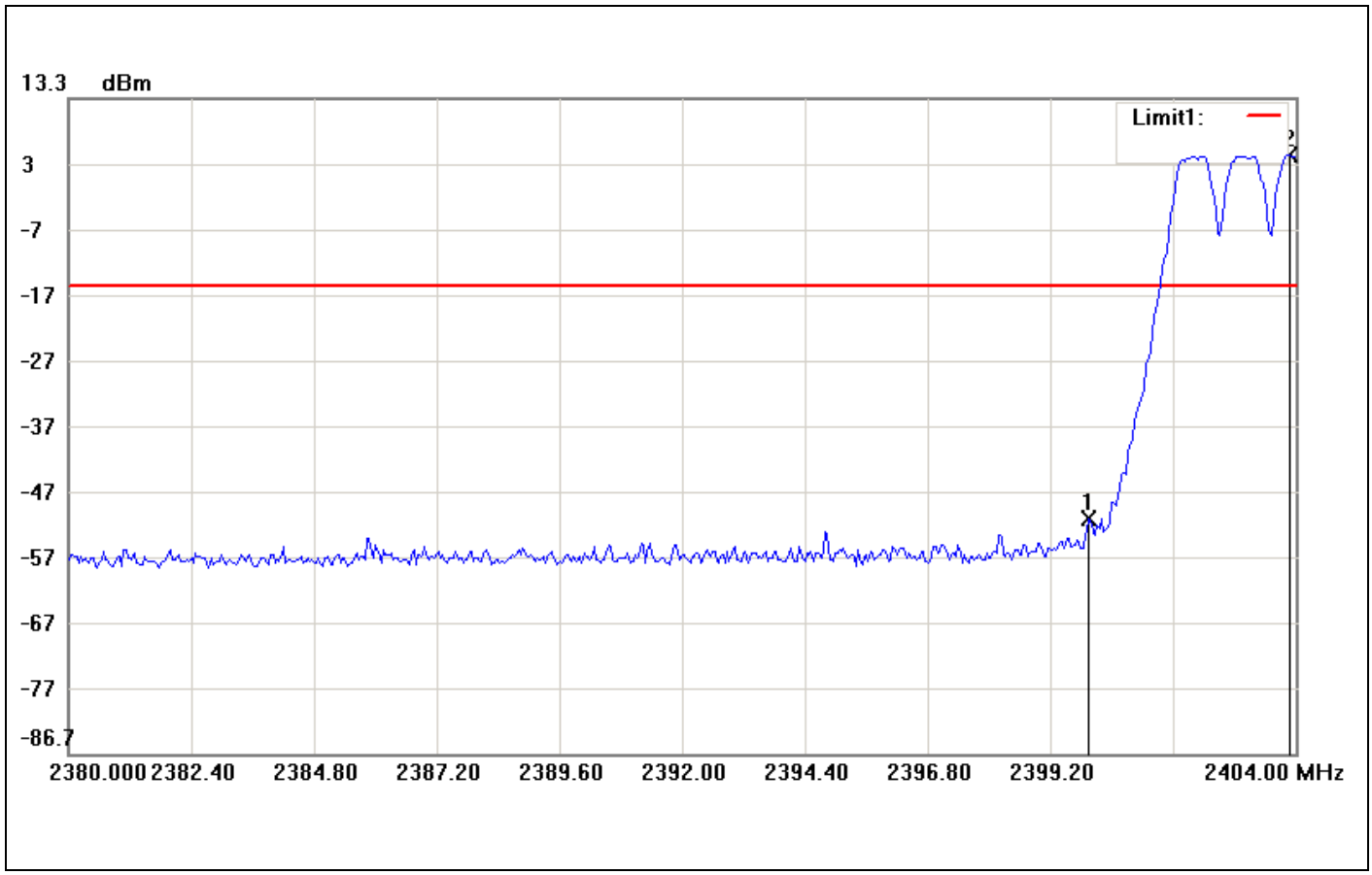
No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	2399.0400	-51.67	-17.37	-34.30
2	2402.1600	2.63	-17.37	20.00

(CH High)



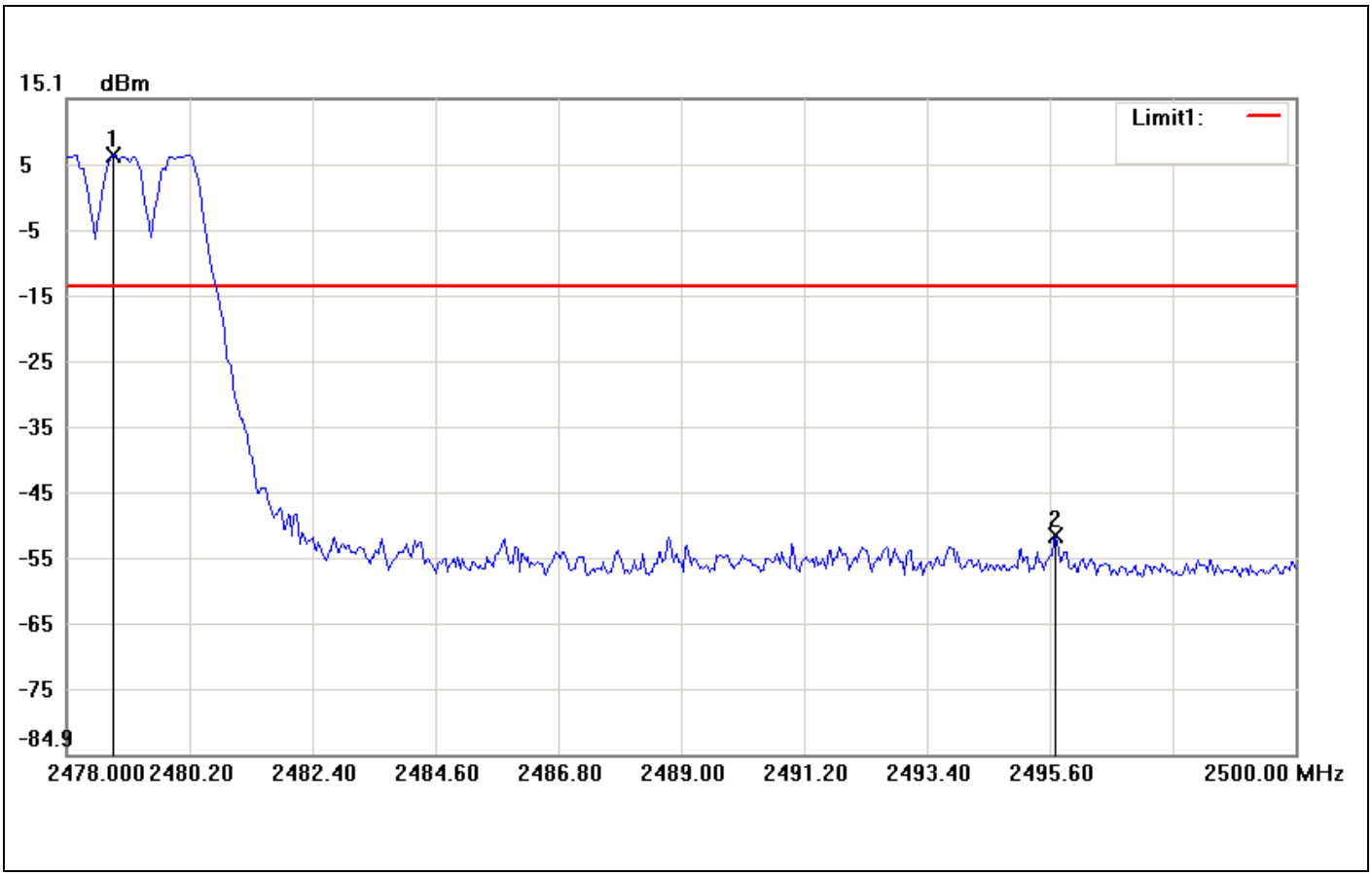
No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	2480.1633	4.80	-15.20	20.00
2	2495.4533	-50.54	-15.20	-35.34

GFSK
Hopping Mode
(CH Low)



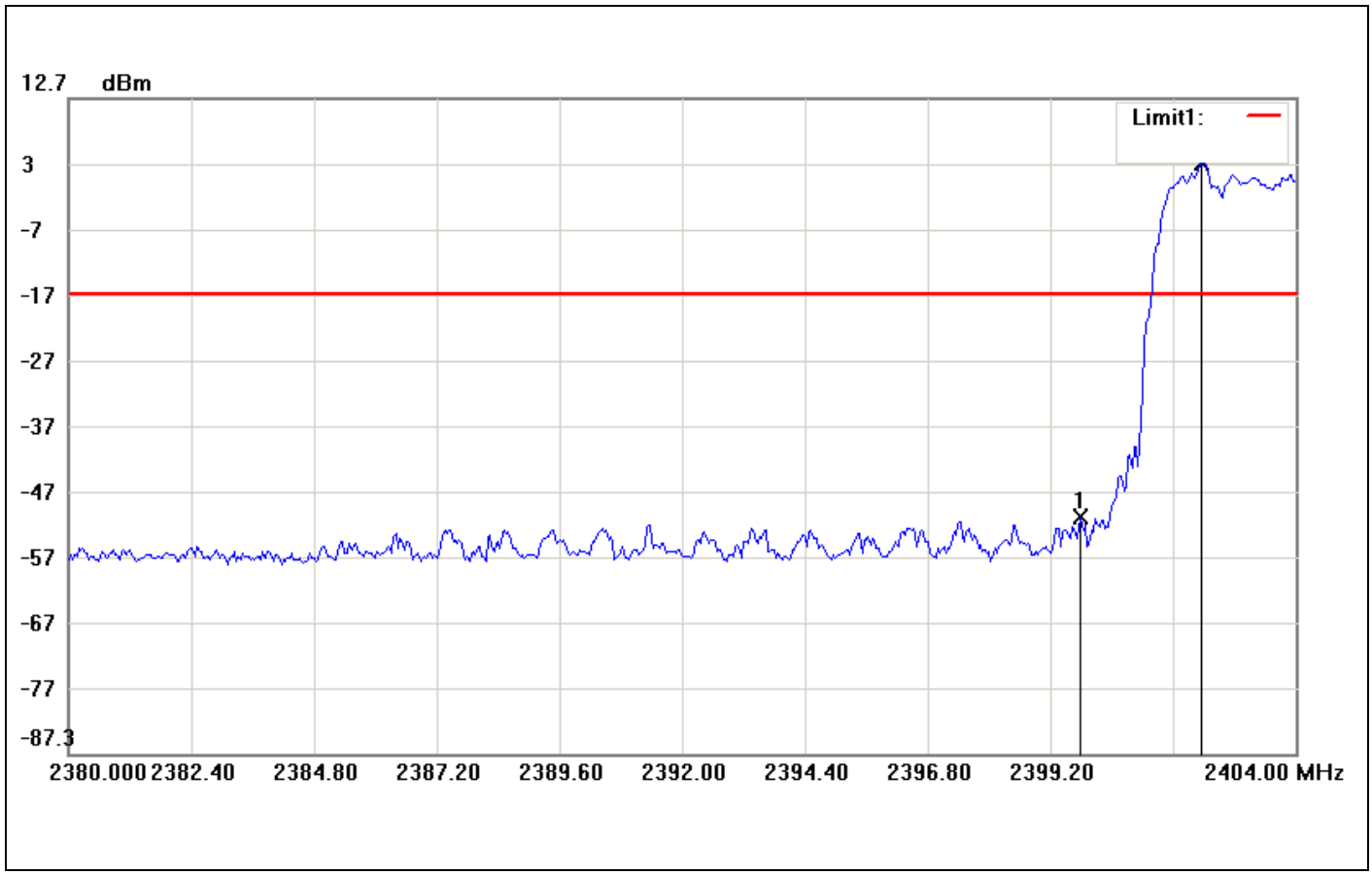
No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	2399.9600	-50.91	-15.37	-35.54
2	2403.8800	4.63	-15.37	20.00

(CH High)



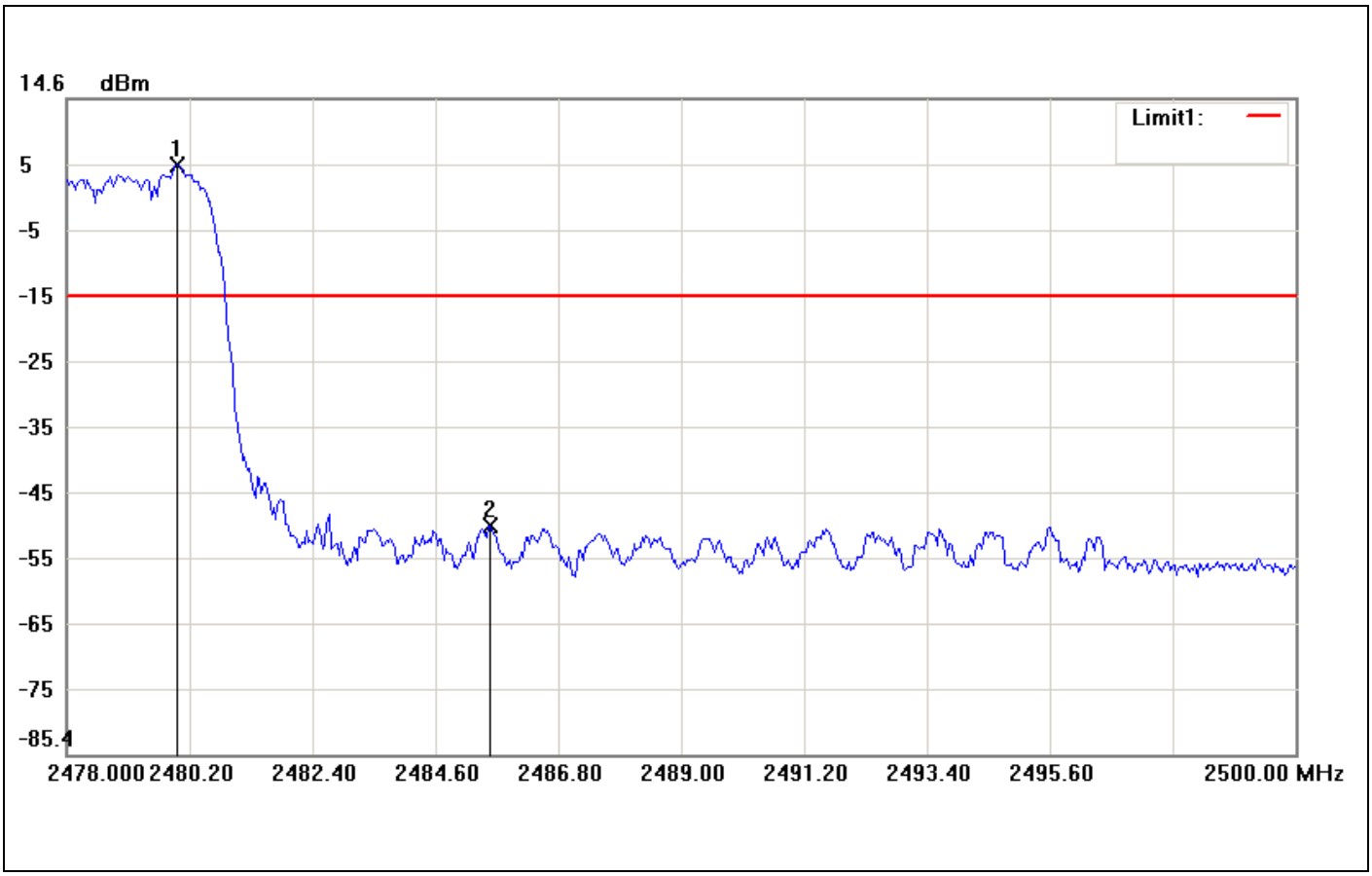
No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	2478.8433	6.53	-13.47	20.00
2	2495.7100	-51.62	-13.47	-38.15

8DPSK
Hopping Mode
(CH Low)



No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	2399.8000	-51.30	-17.21	-34.09
2	2402.1600	2.79	-17.21	20.00

(CH High)



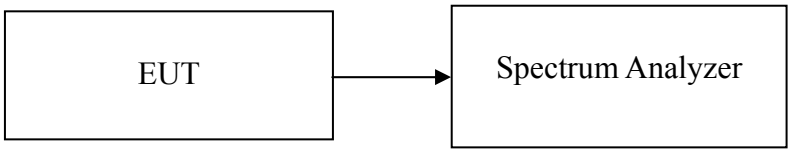
No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	2479.9800	4.46	-15.54	20.00
2	2485.5900	-50.48	-15.54	-34.94

8.5 FREQUENCY SEPARATION

LIMIT

According to §15.247(a)(1) & RSS-210 §A8.1 (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.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = middle of hopping channel.
4. Set the spectrum analyzer as RBW = 30kHz, VBW = 100kHz, Span = 3MHz, Sweep = auto.
5. Max hold, mark 3 peaks of hopping channel and record the 3 peaks frequency.

TEST RESULTS

No non-compliance noted

Test Data

For GFSK / DH5

Channel Separation (MHz)	two-thirds of the 20 dB bandwidth (kHz)	Channel Separation Limit	Result
1.05	646.6	>two-thirds of the 20 dB bandwidth	Pass

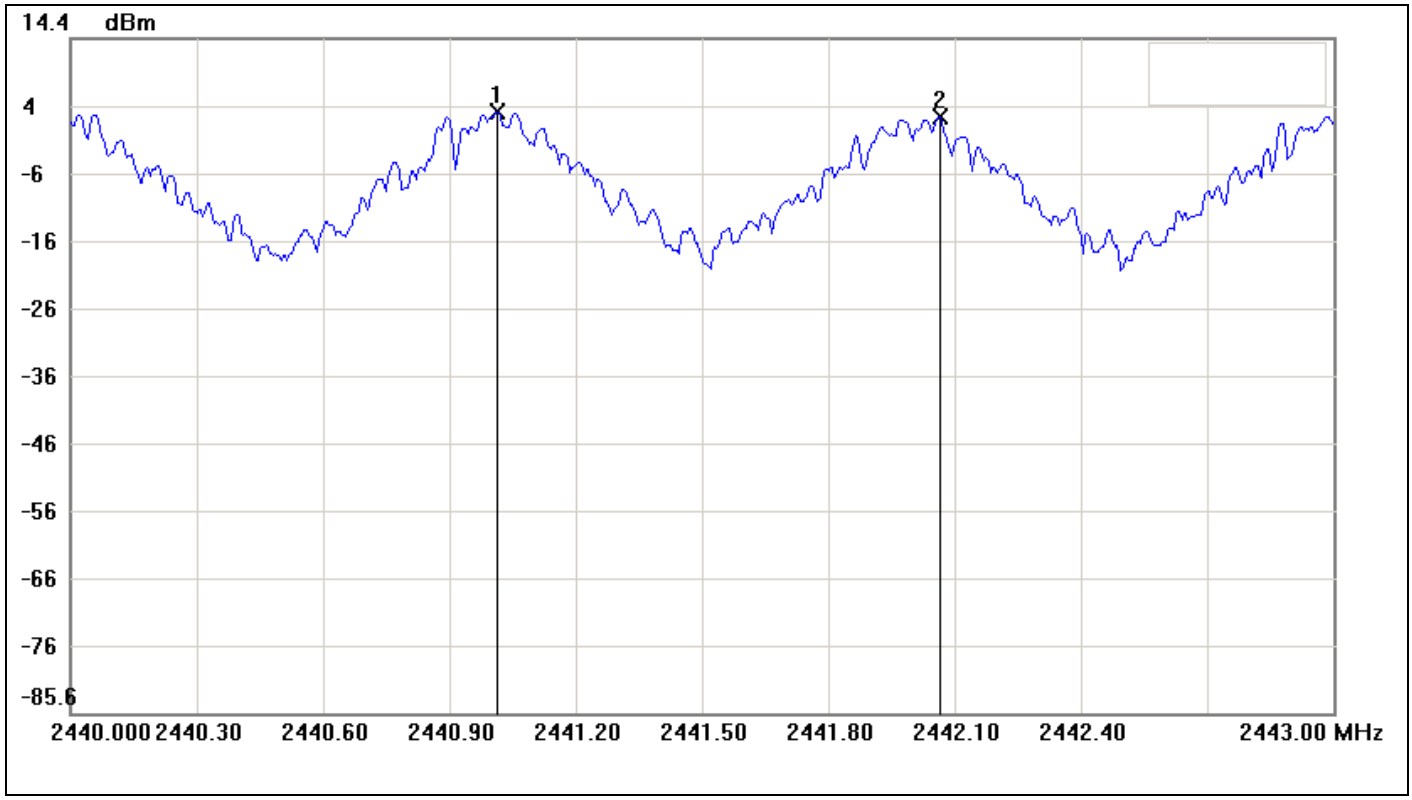
For 8DPSK / DH5

Channel Separation (MHz)	two-thirds of the 20 dB bandwidth (kHz)	Channel Separation Limit	Result
1.17	873.3	>two-thirds of the 20 dB bandwidth	Pass

Test Plot

For GFSK / DH5

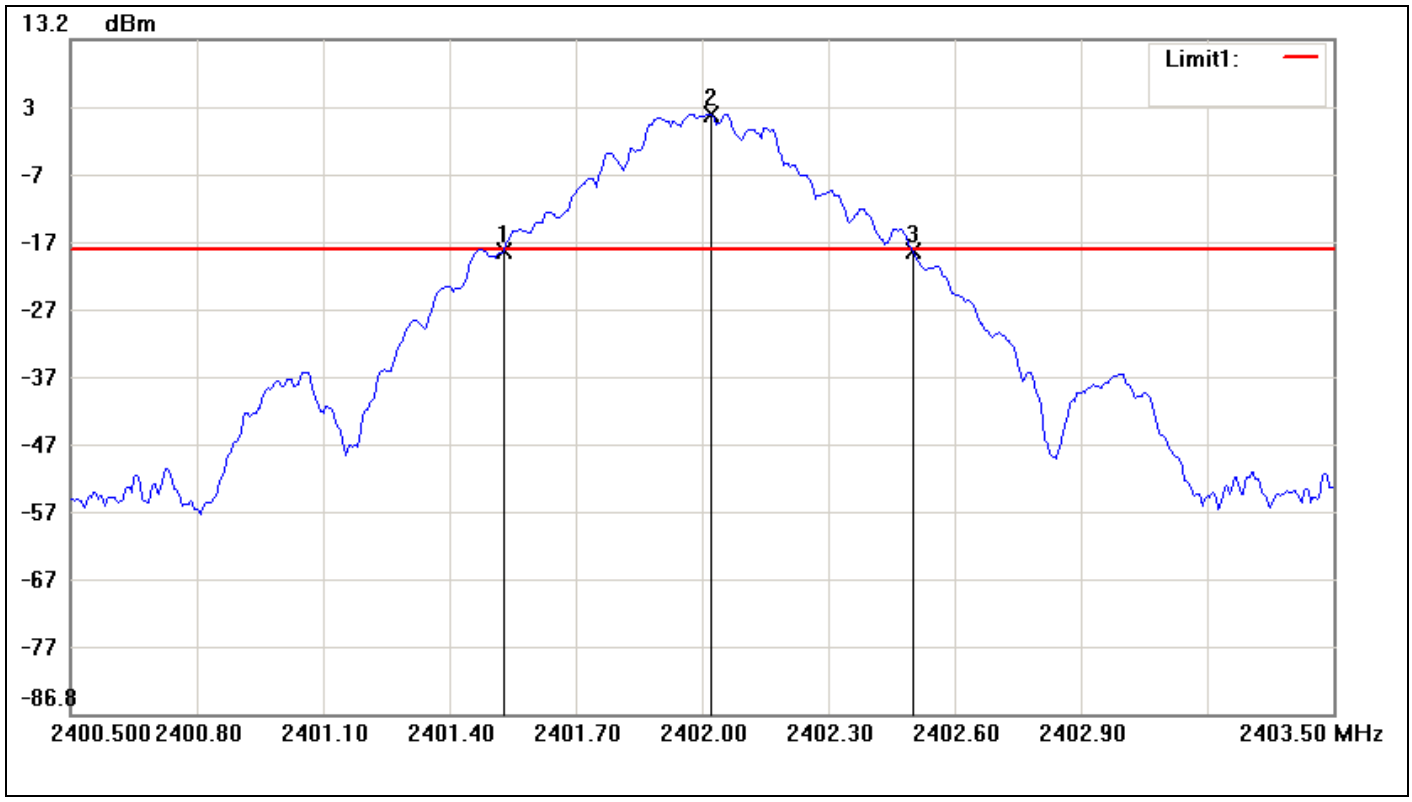
Measurement of Channel Separation



No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	2441.0150	3.53		
2	2442.0650	2.74		

No.		△Frequency(MHz)	△Level(dB)
1	mk2-mk1	1.05	-0.79

Measurement of 20dB Bandwidth

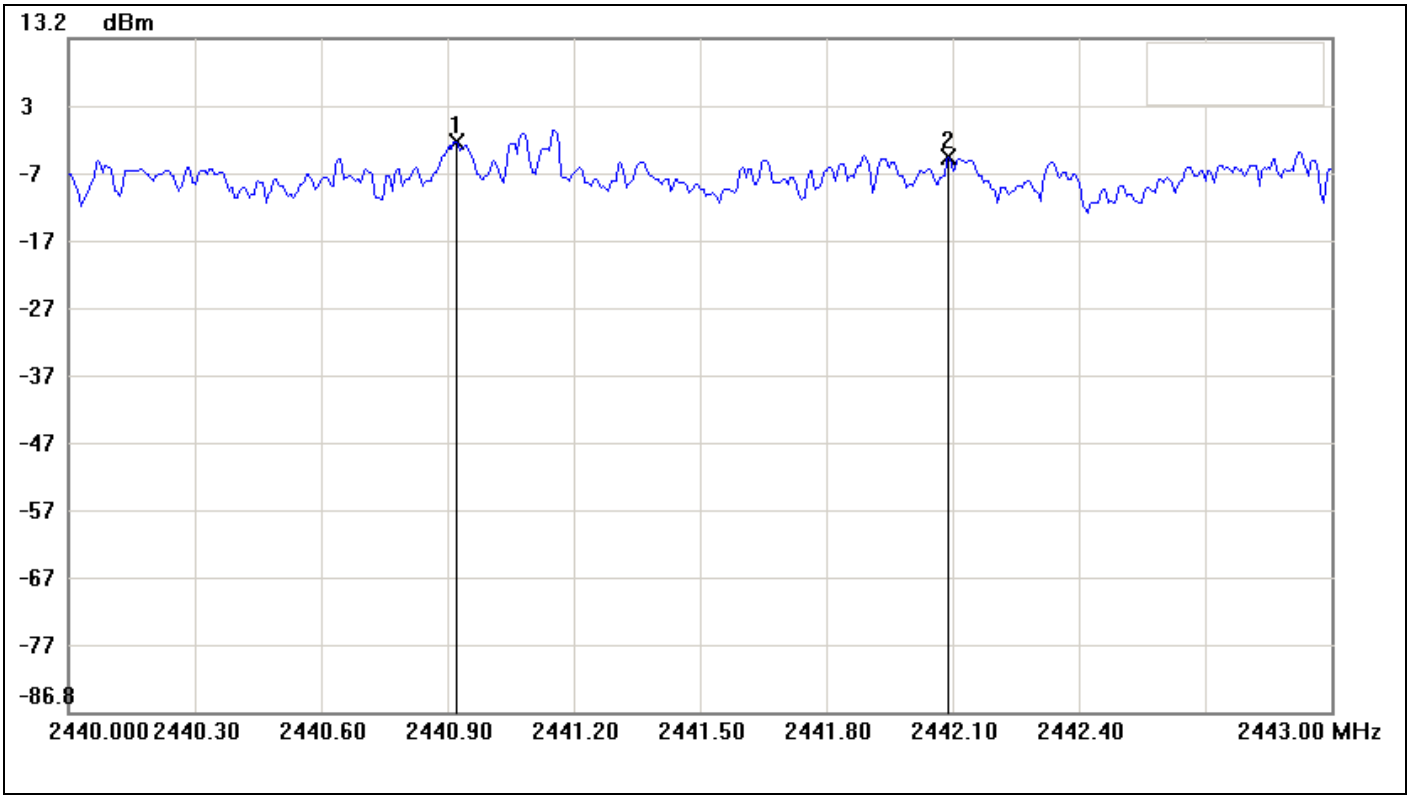


No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	2401.5300	-18.12	-17.81	-0.31
2	2402.0200	2.19	-17.81	20.00
3	2402.5000	-18.09	-17.81	-0.28

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	0.97	0.03

For 8DPSK / DH5

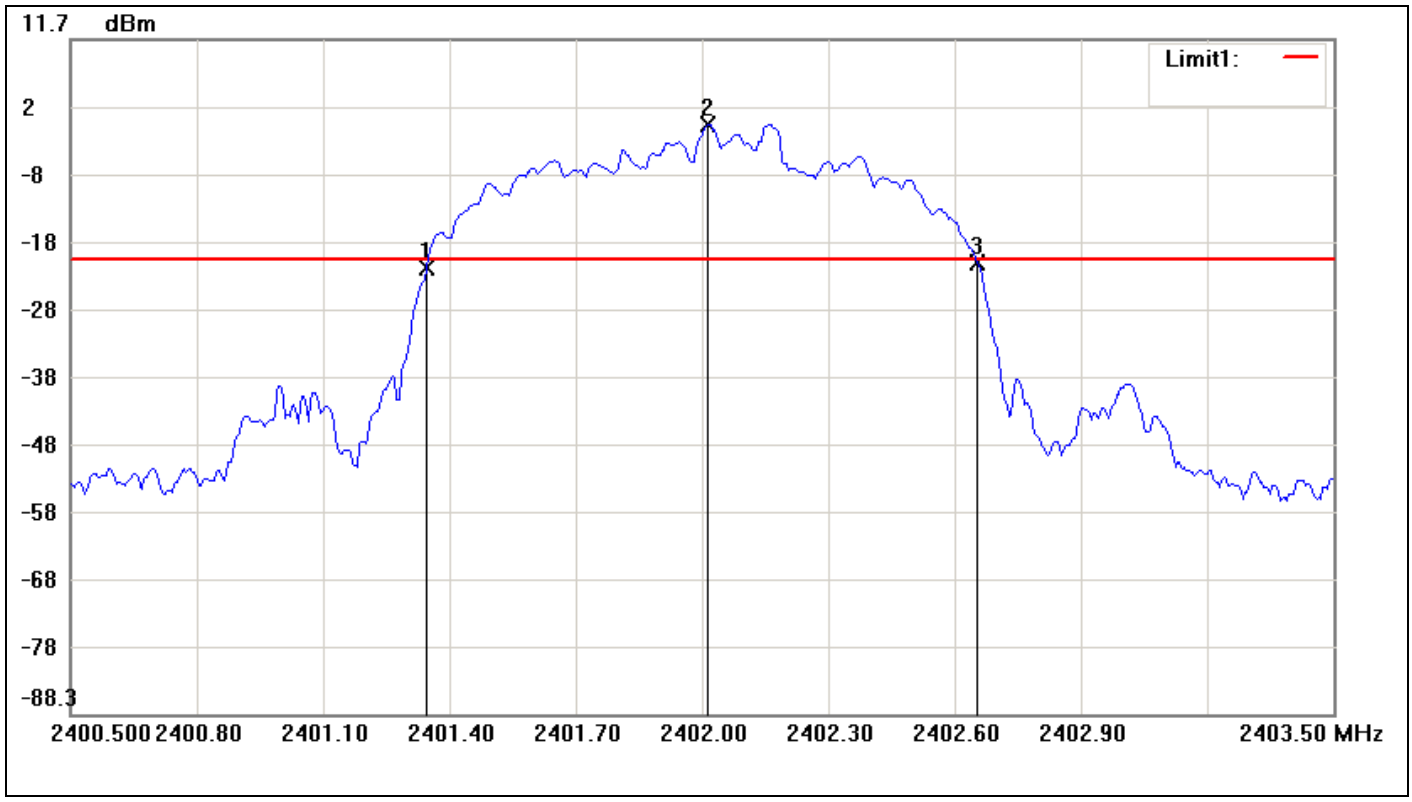
Measurement of Channel Separation



No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	2440.9200	-2.15		
2	2442.0900	-4.51		

No.		△Frequency(MHz)	△Level(dB)
1	mk2-mk1	1.17	-2.36

Measurement of 20dB Bandwidth



No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	2401.3450	-22.17	-20.96	-1.21
2	2402.0150	-0.96	-20.96	20.00
3	2402.6550	-21.53	-20.96	-0.57

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	1.31	0.64

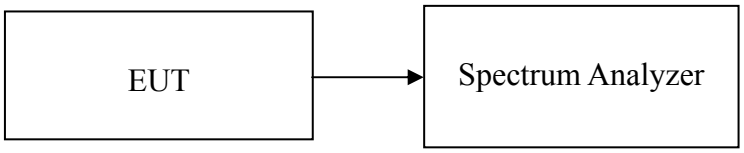
8.6 NUMBER OF HOPPING FREQUENCY

LIMIT

According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 75 hopping frequencies.

According to §15.247(a)(1)(iii) & RSS-210 §A8.1(4), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set spectrum analyzer Start=2400MHz, Stop = 2430.5MHz, Sweep = auto, Start=2430.5MHz, Stop = 2460.5MHz, Sweep = auto and Start=2460.5MHz, Stop = 2485.5MHz, Sweep = auto.
4. Set the spectrum analyzer as RBW, VBW=510kHz.
5. Max hold, view and count how many channel in the band.

TEST RESULTS

No non-compliance noted

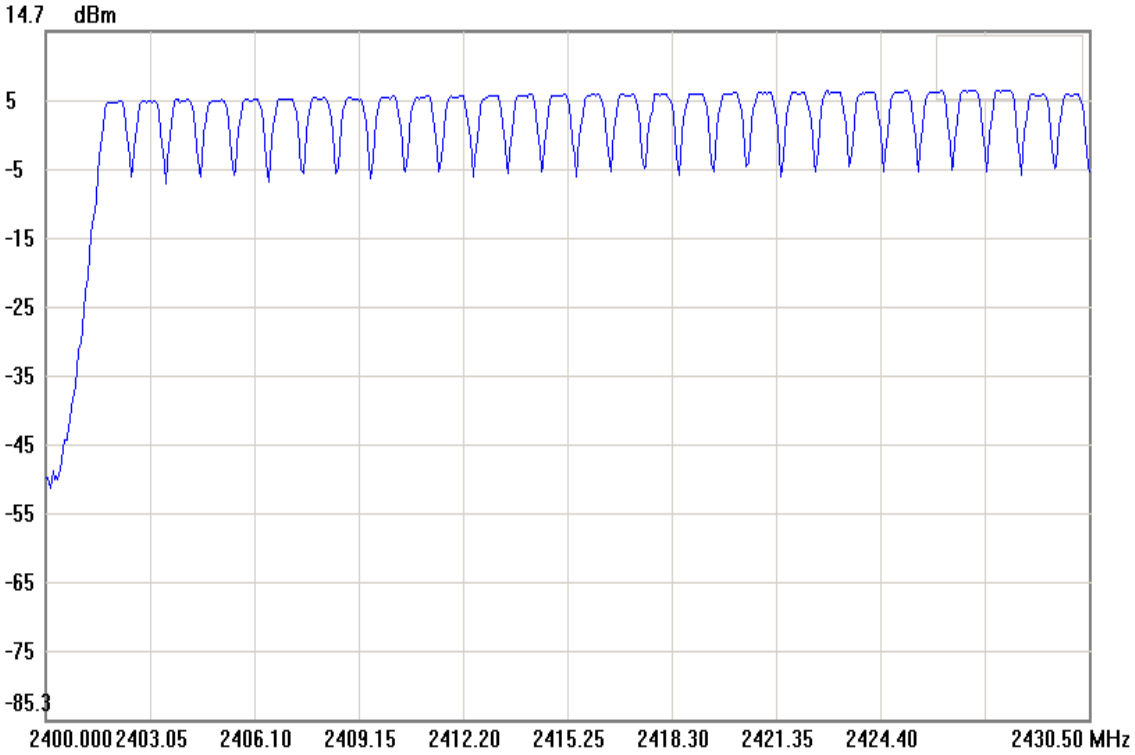
Test Data

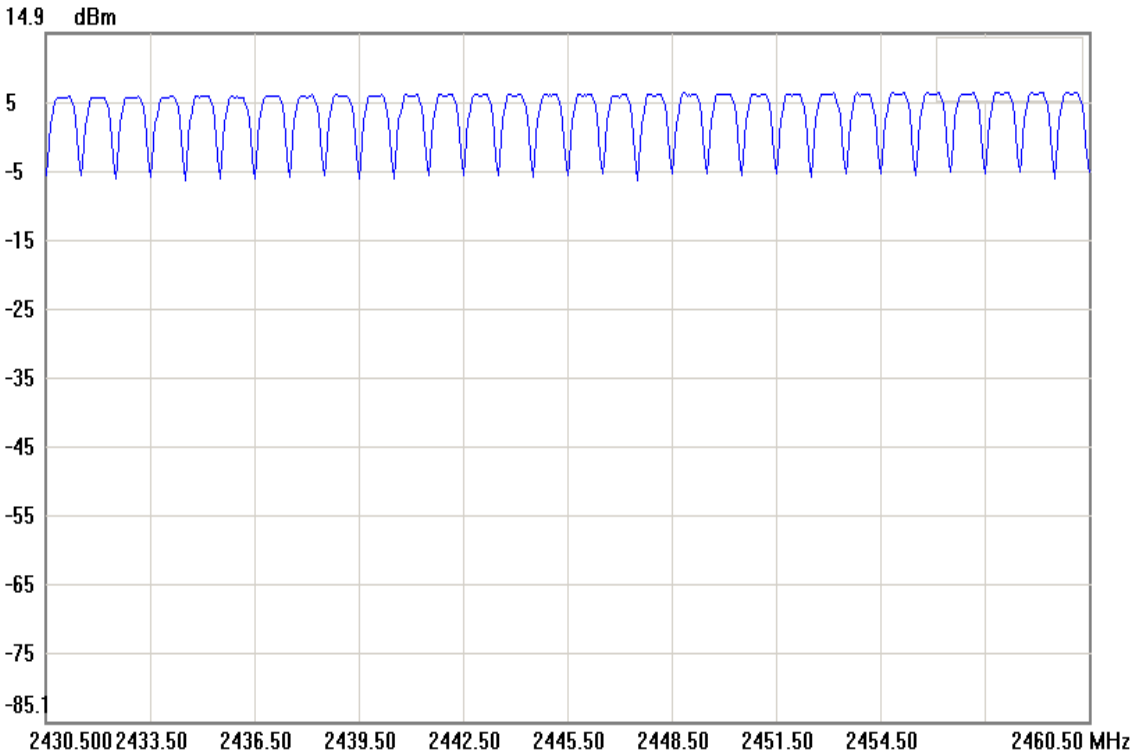
Result (No. of CH)	Limit (No. of CH)	Result
79	>15	PASS

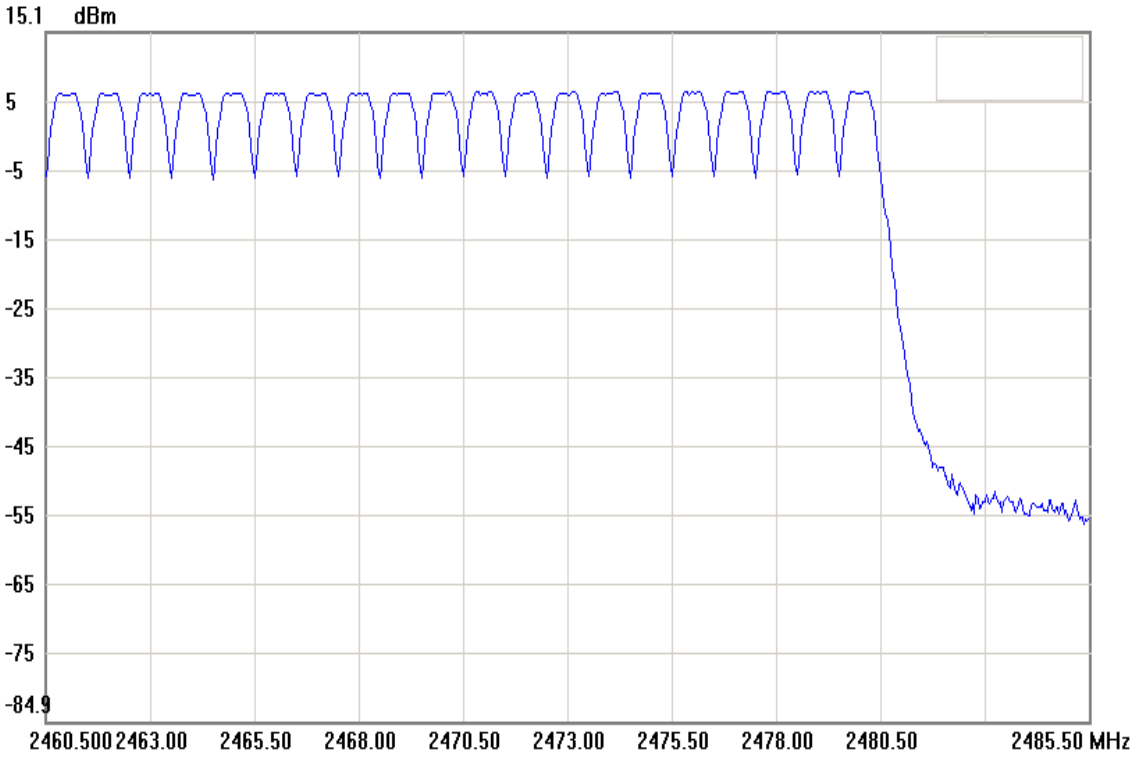
Test Plot

For GFSK

Channel Number

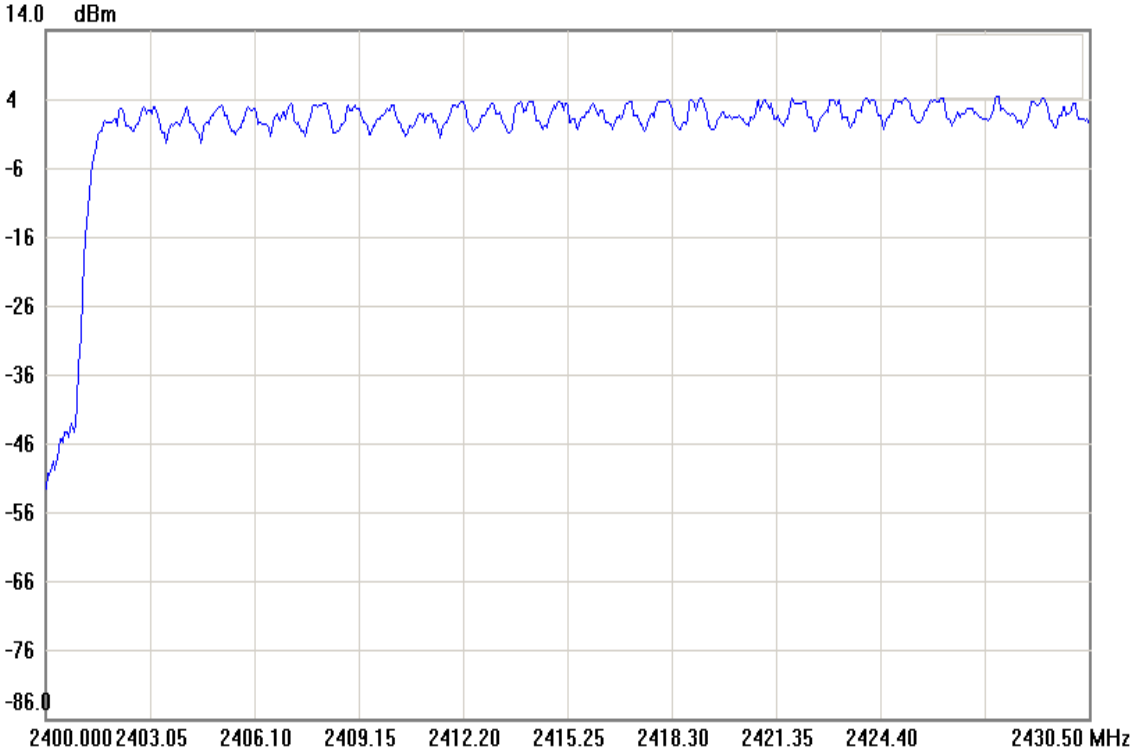


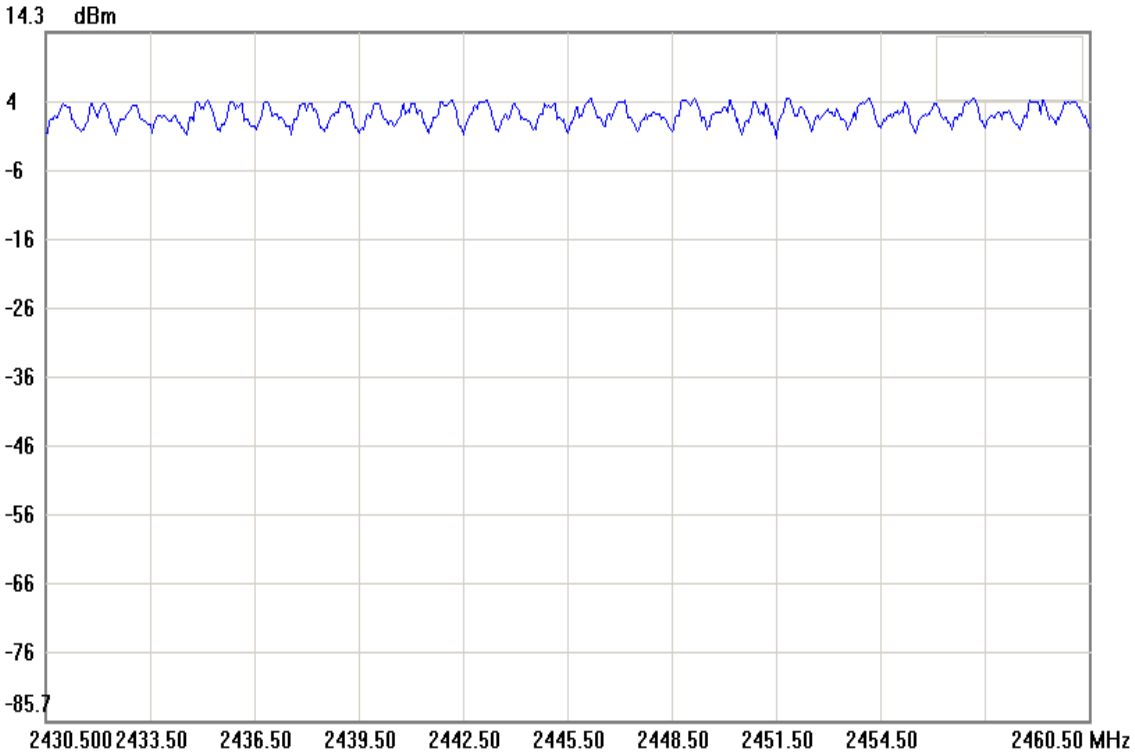


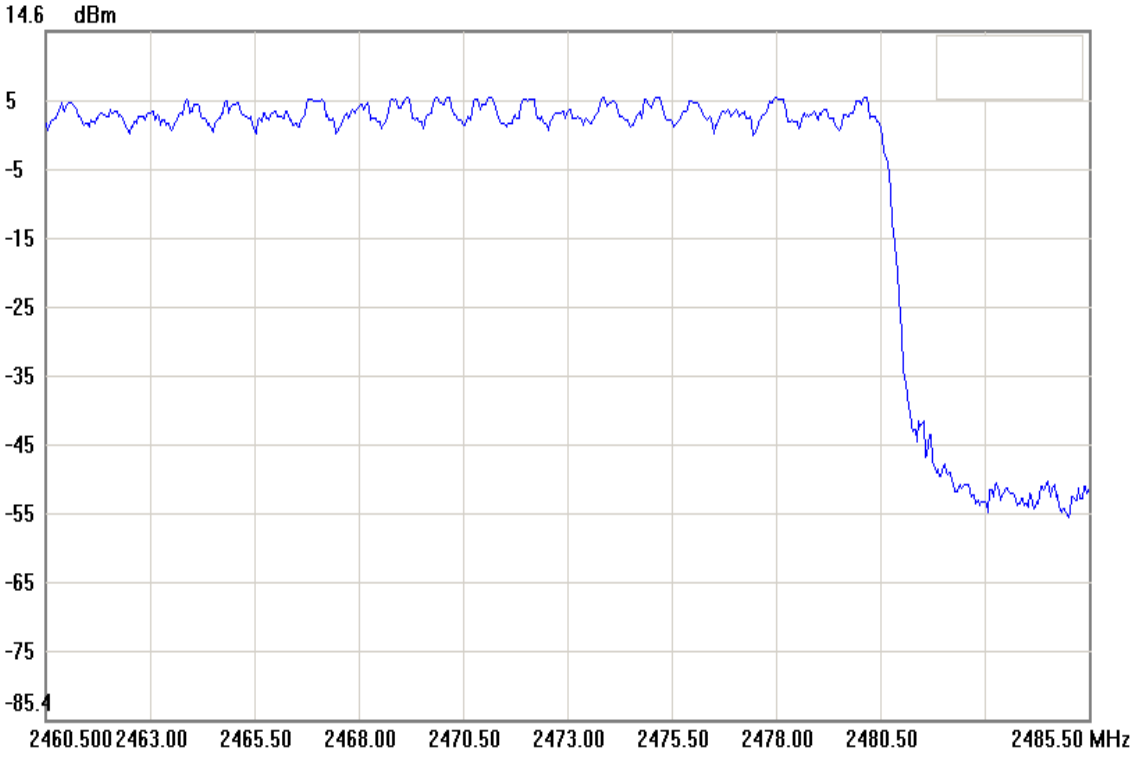

15.1 dBm
5
-5
-15
-25
-35
-45
-55
-65
-75
-84.9
2460.500 2463.00 2465.50 2468.00 2470.50 2473.00 2475.50 2478.00 2480.50 2485.50 MHz

For 8DPSK

Channel Number






14.6 dBm
5
-5
-15
-25
-35
-45
-55
-65
-75
-85.4
2460.500 2463.00 2465.50 2468.00 2470.50 2473.00 2475.50 2478.00 2480.50 2485.50 MHz

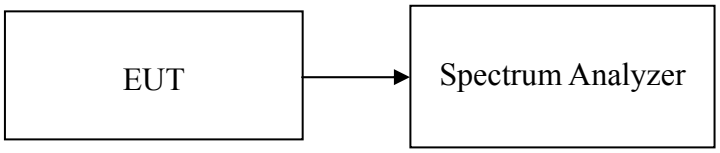
8.7 TIME OF OCCUPANCY (DWELL TIME)

LIMIT

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

According to RSS-210 §A8.1(4), the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=1MHz, Span = 0Hz, Sweep = auto.
5. Repeat above procedures until all frequency measured were complete.

TEST RESULTS

No non-compliance noted

Test Plot

For GFSK

Test Data

DH 1: 0.3717 * (1600/2)/79 * 31.6 = 118.944 (ms)

DH 3: 1.6350 * (1600/4)/79 * 31.6 = 261.600 (ms)

DH 5: 2.8917 * (1600/6)/79 * 31.6 = 308.448 (ms)

	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
DH 1	0.3717	118.944	31.60	400.00	PASS
DH 3	1.6350	261.600	31.60		PASS
DH 5	2.8917	308.448	31.60		PASS

For 8DPSK

Test Data

DH 1: 0.3800 * (1600/2)/79 * 31.6 = 121.600 (ms)

DH 3: 1.6400 * (1600/4)/79 * 31.6 = 262.400 (ms)

DH 5: 2.900 * (1600/6)/79 * 31.6 = 309.333 (ms)

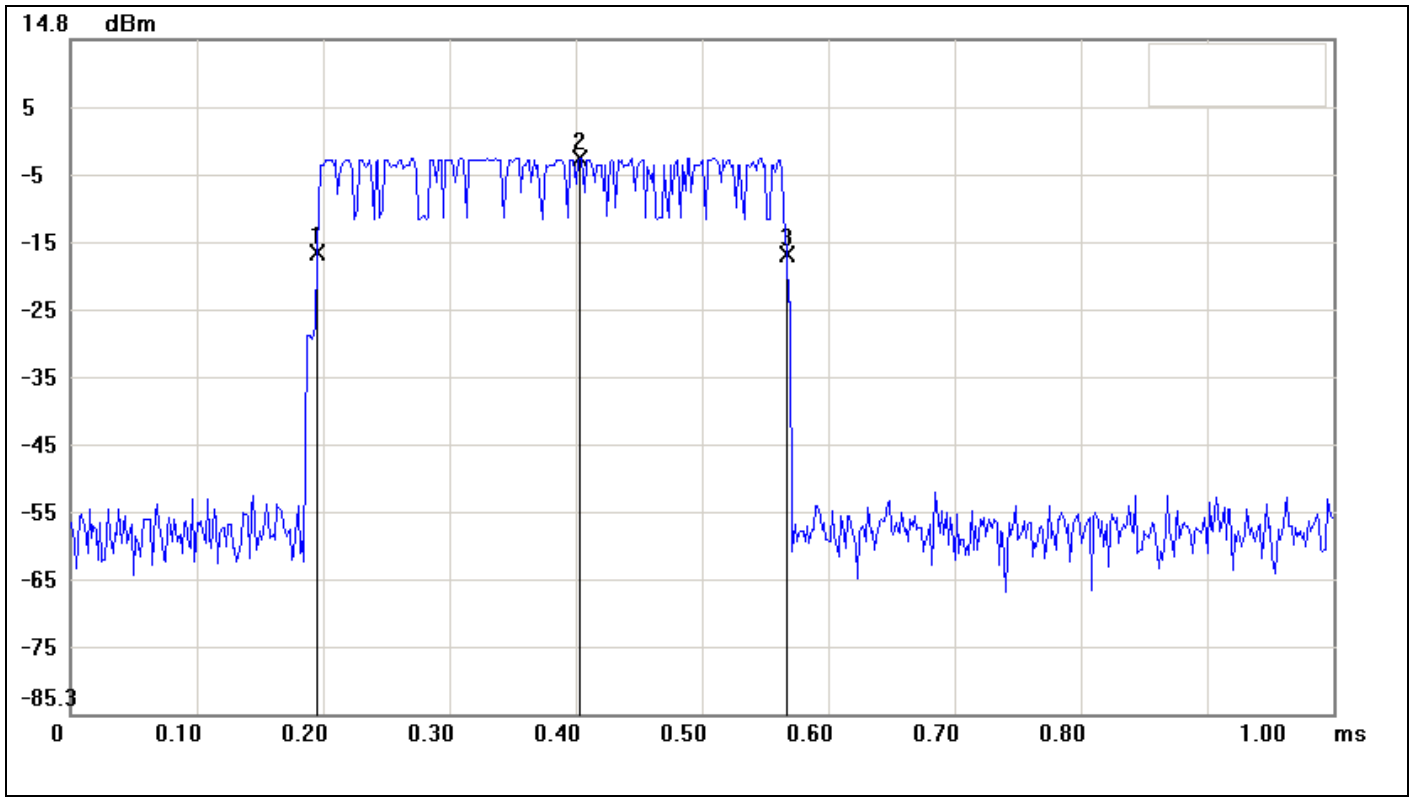
	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
DH 1	0.3800	121.600	31.60	400.00	PASS
DH 3	1.6400	262.400	31.60		PASS
DH 5	2.900	309.333	31.60		PASS

Test Plot

For GFSK

DH 1

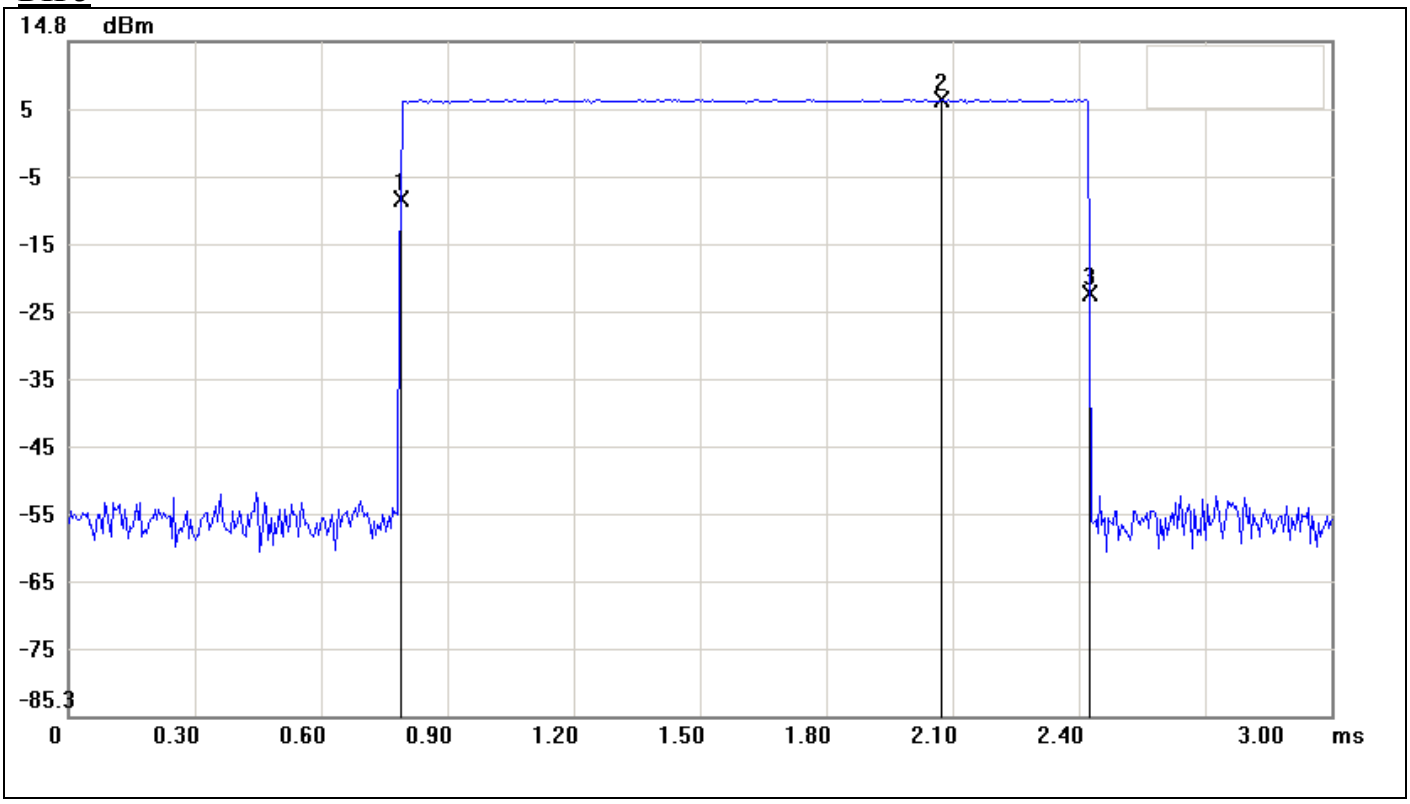
CH Low



No.	Sweep time(ms)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	0.1950	-16.95		
2	0.4033	-2.94		
3	0.5667	-17.11		

No.		△Time(ms)	△Level(dB)
1	mk3-mk1	0.3717	-0.16

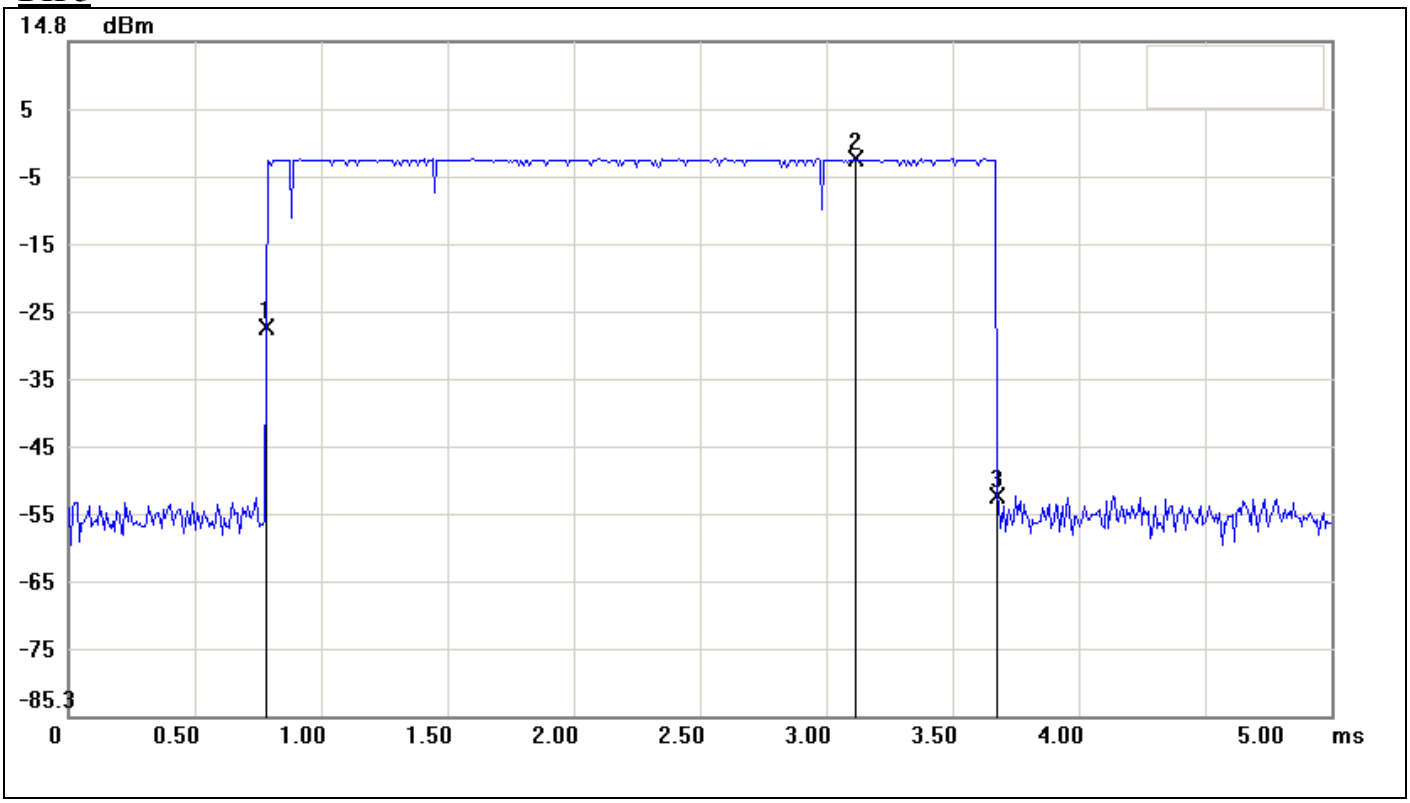
DH 3



No.	Sweep time(ms)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	0.7900	-8.67		
2	2.0750	6.06		
3	2.4250	-22.54		

No.		△Time(ms)	△Level(dB)
1	mk3-mk1	1.635	-13.87

DH 5

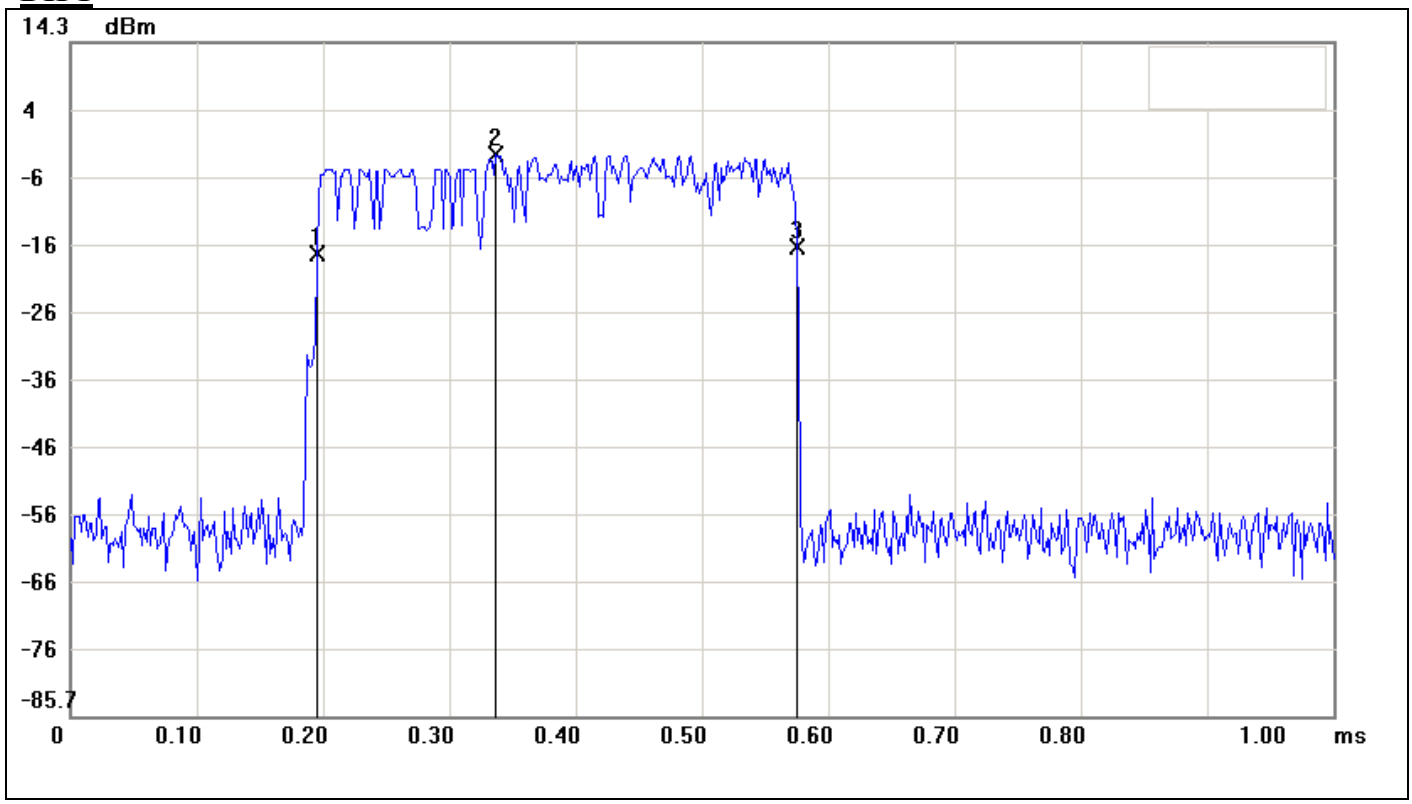


No.	Sweep time(ms)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	0.7833	-27.68		
2	3.1167	-2.66		
3	3.6750	-52.53		

No.		△Time(ms)	△Level(dB)
1	mk3-mk1	2.8917	-24.85

For 8DPSK

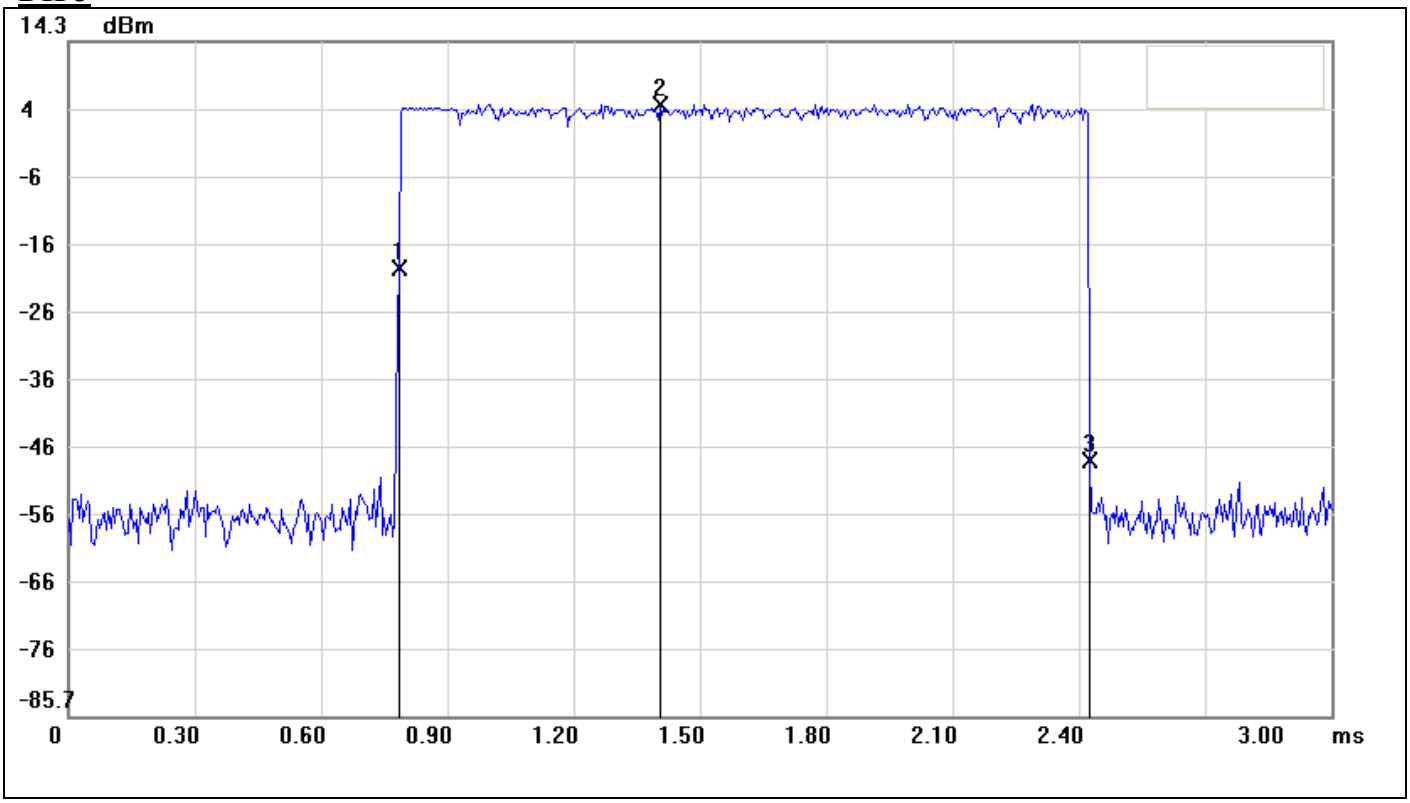
DH 1



No.	Sweep time(ms)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	0.1950	-17.05		
2	0.3367	-2.41		
3	0.5750	-16.13		

No.		△Time(ms)	△Level(dB)
1	mk3-mk1	0.38	0.92

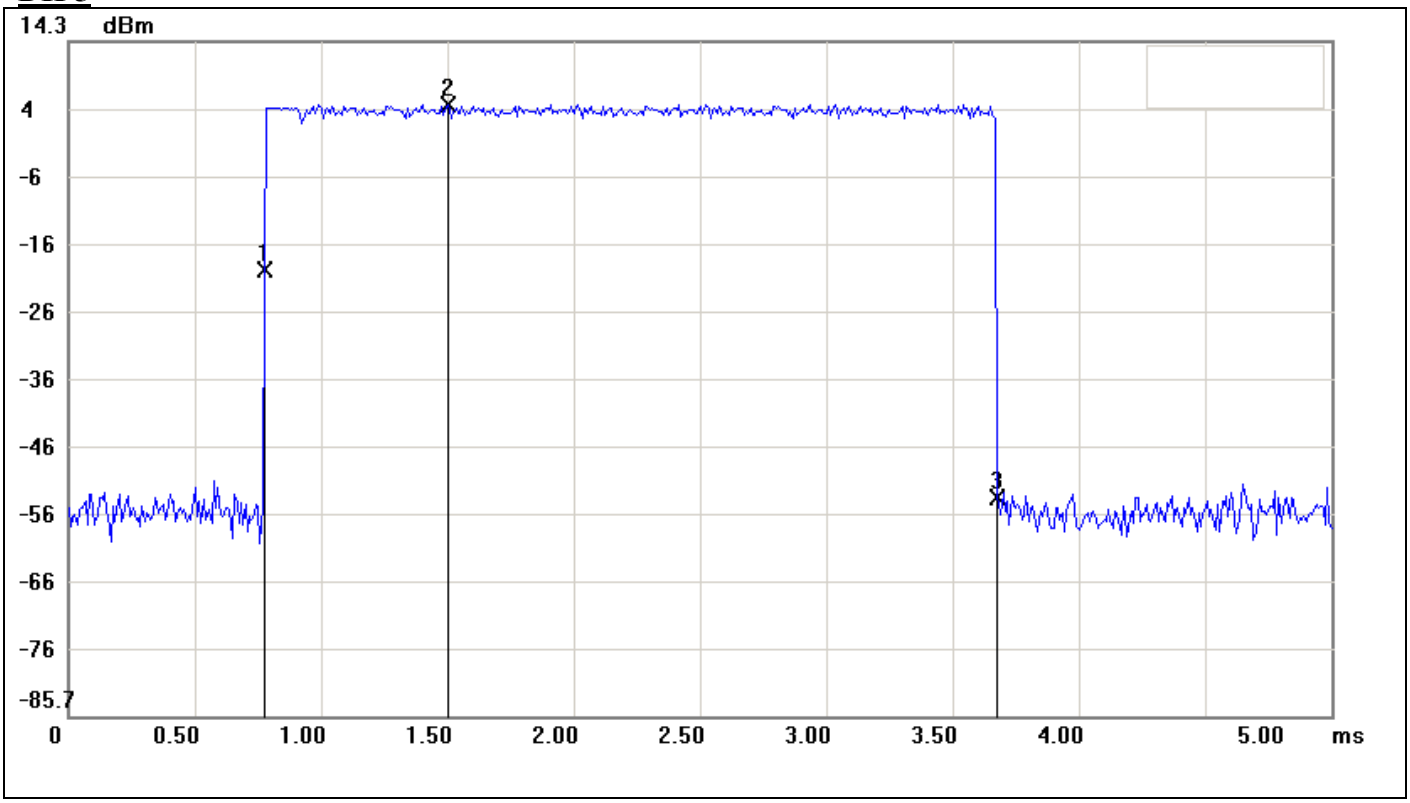
DH 3



No.	Sweep time(ms)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	0.7850	-19.44		
2	1.4050	4.88		
3	2.4250	-47.83		

No.		△Time(ms)	△Level(dB)
1	mk3-mk1	1.64	-28.39

DH 5



No.	Sweep time(ms)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	0.7750	-19.56		
2	1.5000	4.88		
3	3.6750	-53.29		

No.		△Time(ms)	△Level(dB)
1	mk3-mk1	2.9	-33.73

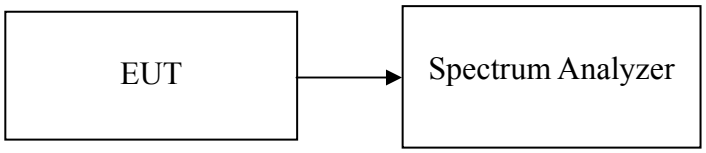
8.8 SPURIOUS EMISSIONS

8.8.1 Conducted Measurement

LIMIT

According to §15.247(d) & RSS-210 §A8.5, in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in 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. 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 Section 15.205(c)).

Test Configuration



TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

Measurements are made over the 30MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels.

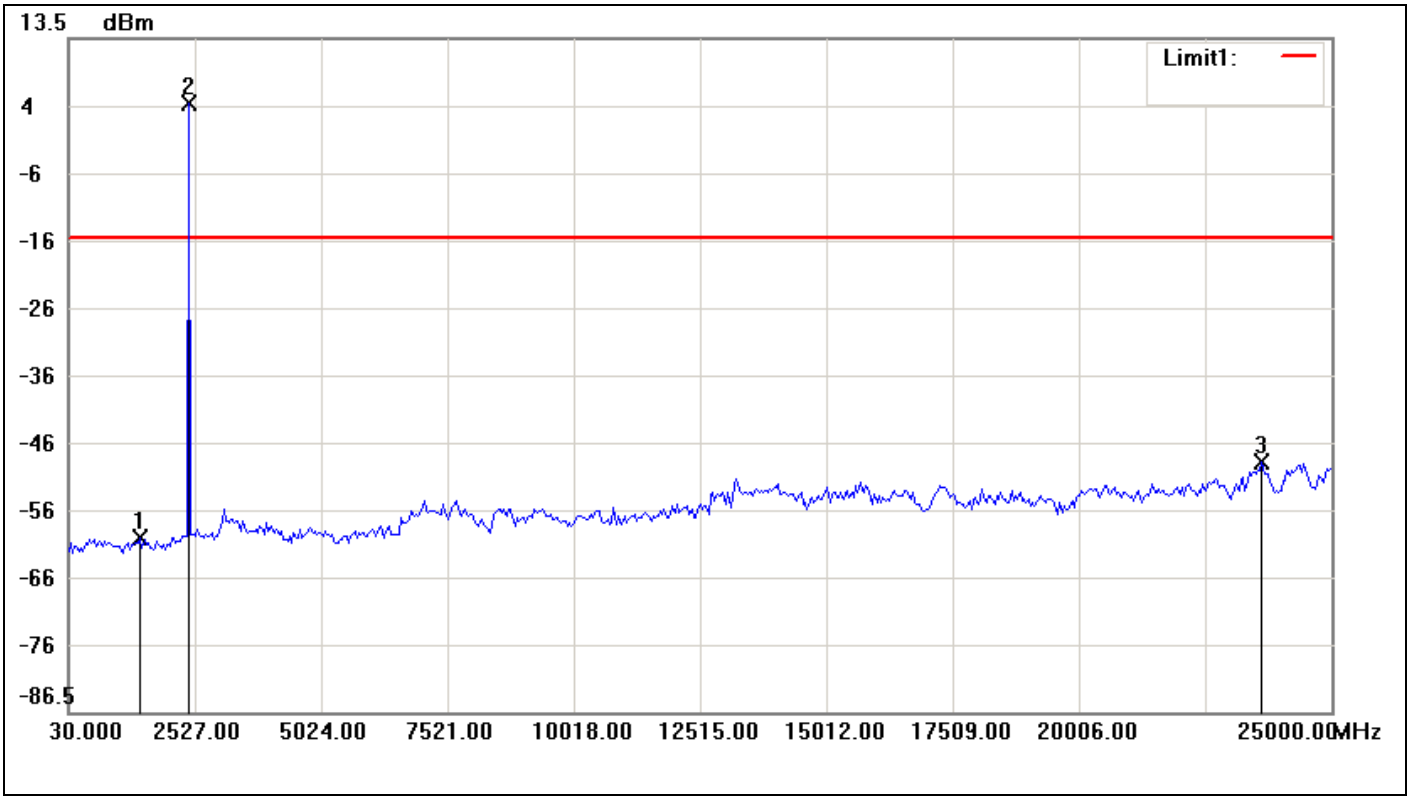
TEST RESULTS

No non-compliance noted

Test Plot

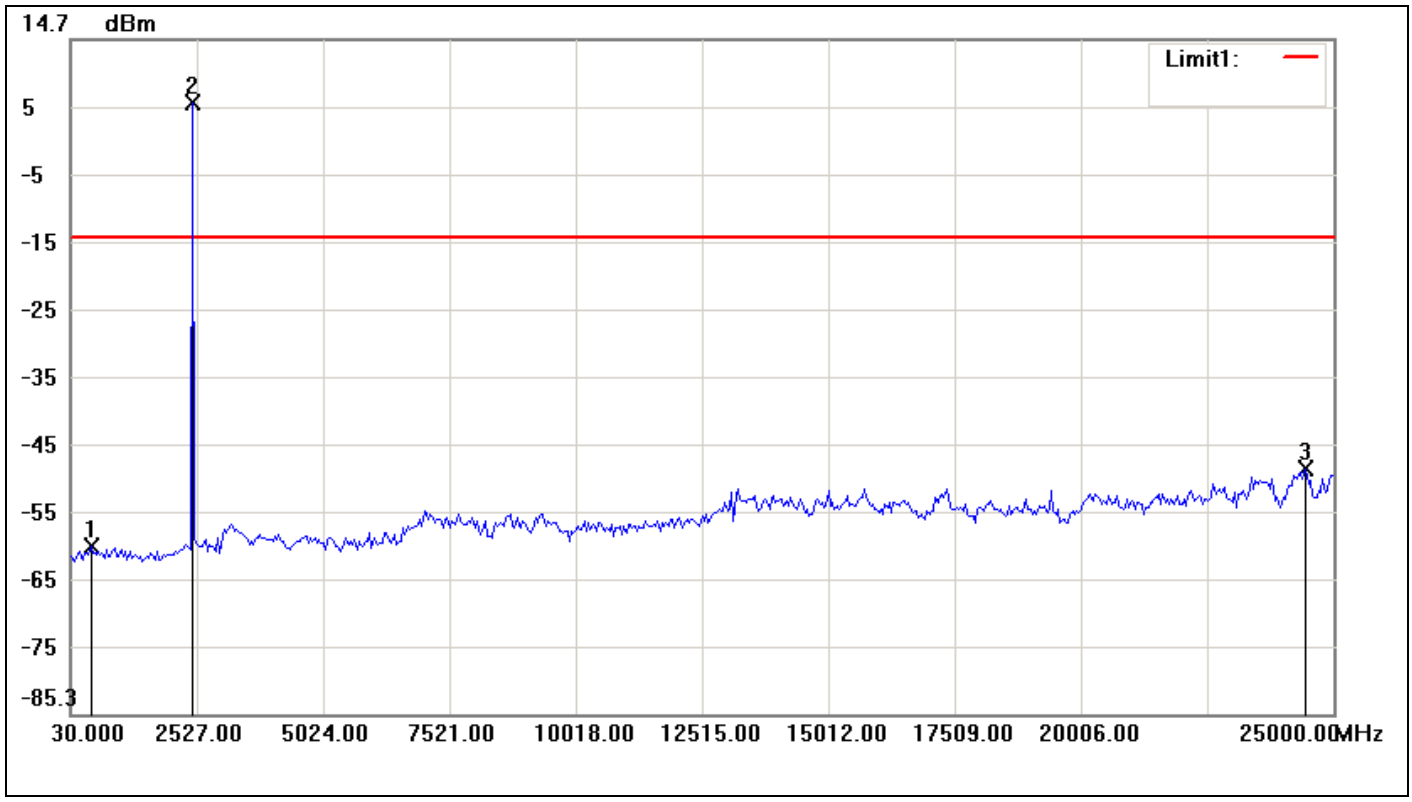
For GFSK / DH5

CH Low



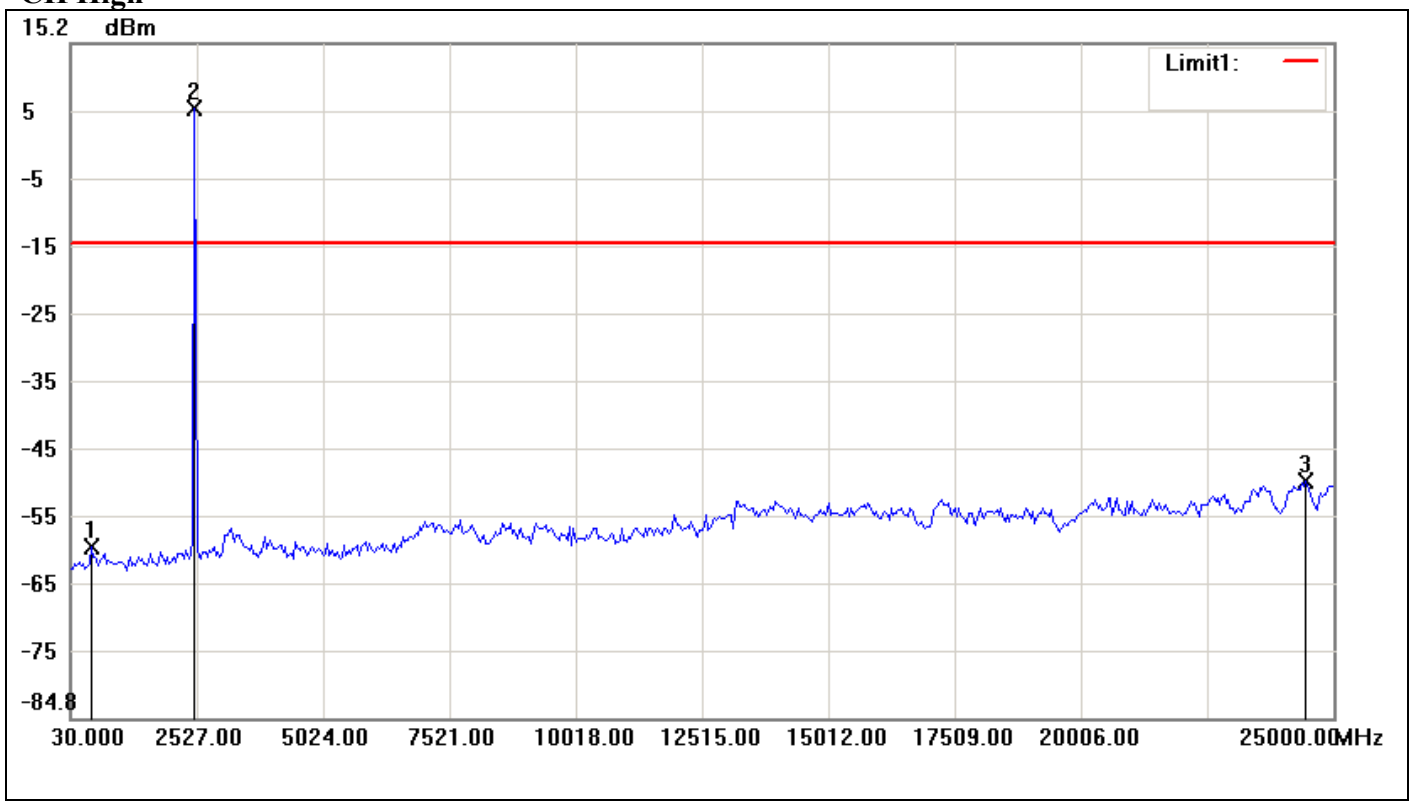
No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	1444.9667	-60.68	-16.12	-44.56
2	2402.1500	3.88	-16.12	20.00
3	23626.6500	-49.44	-16.12	-33.32

CH Mid



No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	446.1667	-60.54	-14.62	-45.92
2	2443.7667	5.38	-14.62	20.00
3	24458.9833	-48.99	-14.62	-34.37

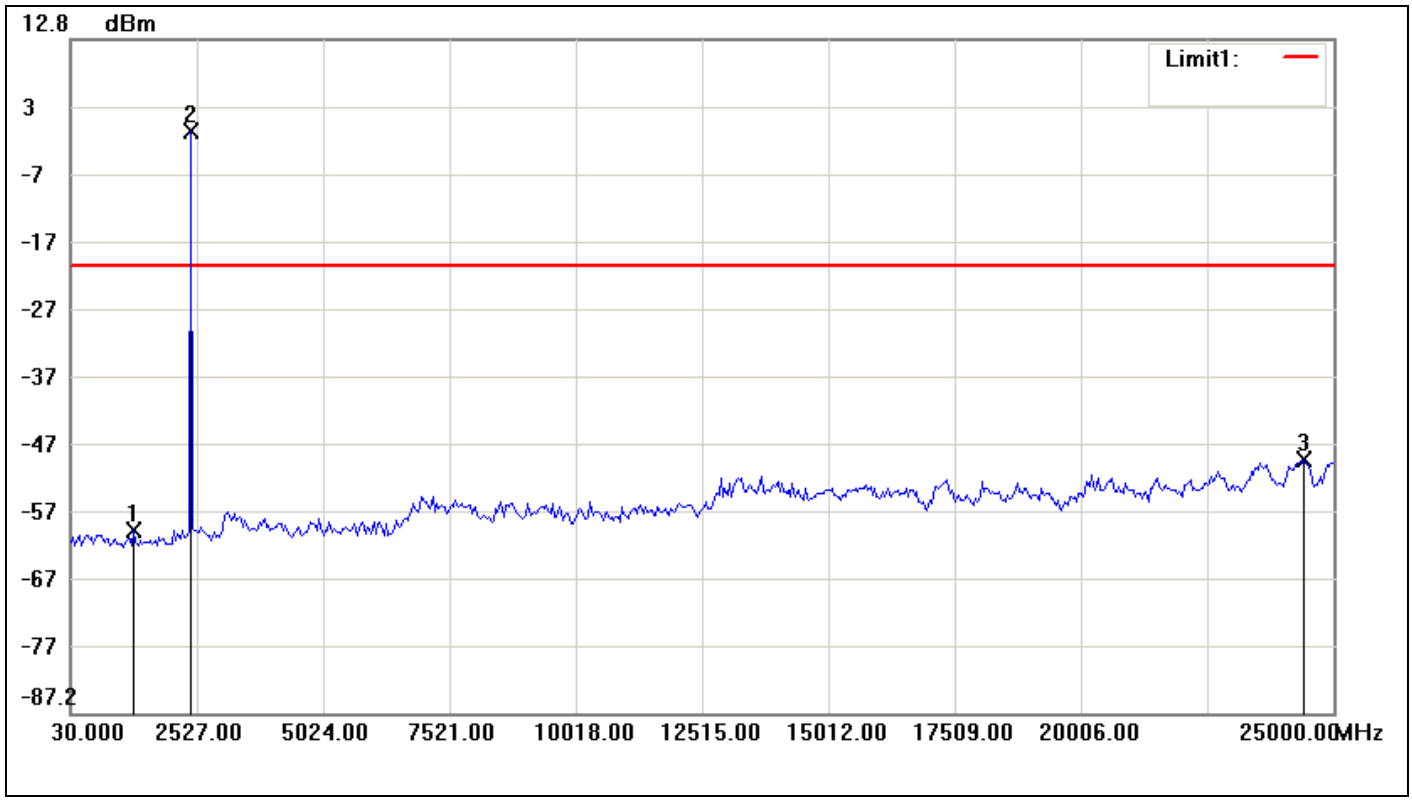
CH High



No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	446.1667	-59.44	-14.37	-45.07
2	2485.3833	5.63	-14.37	20.00
3	24458.9833	-49.72	-14.37	-35.35

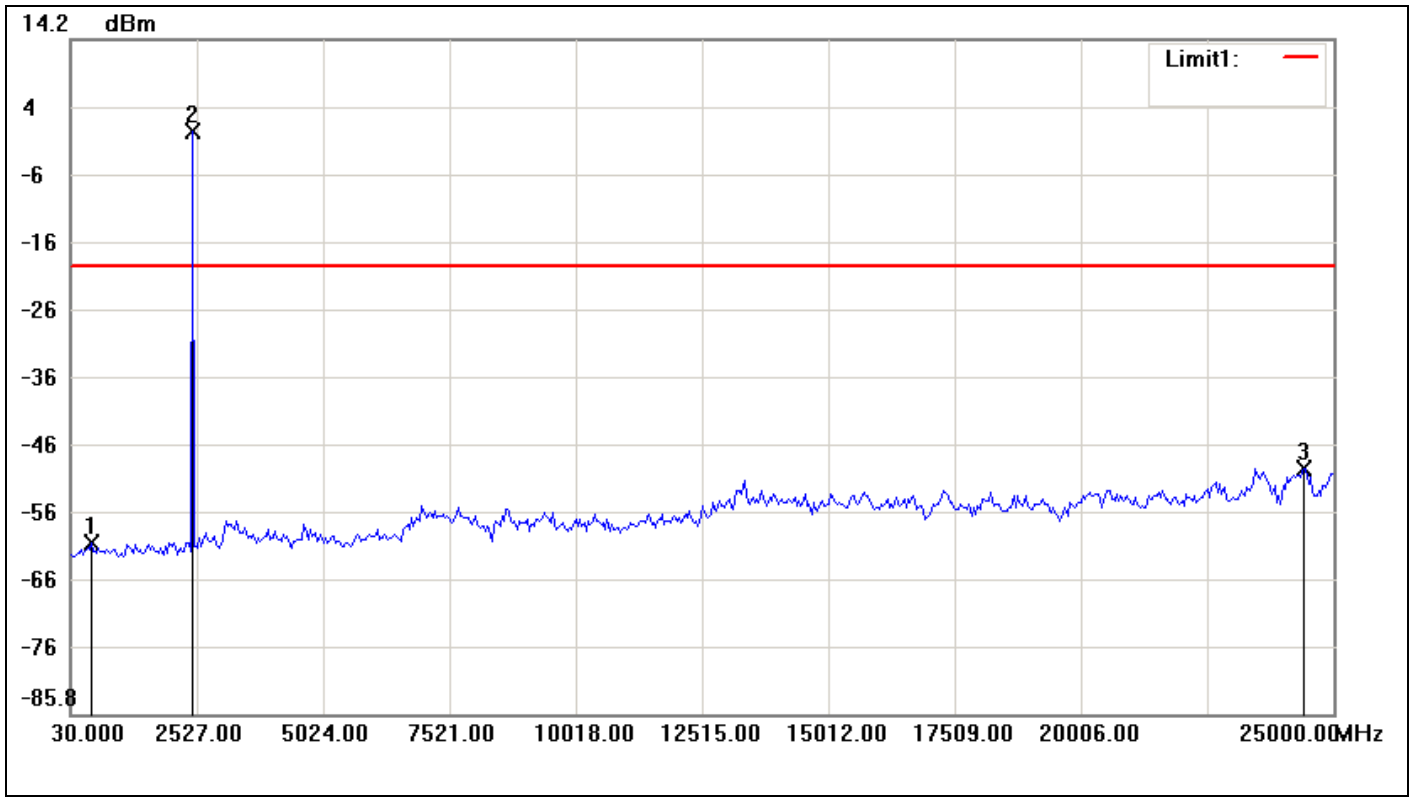
For 8DPSK / DH5

CH Low



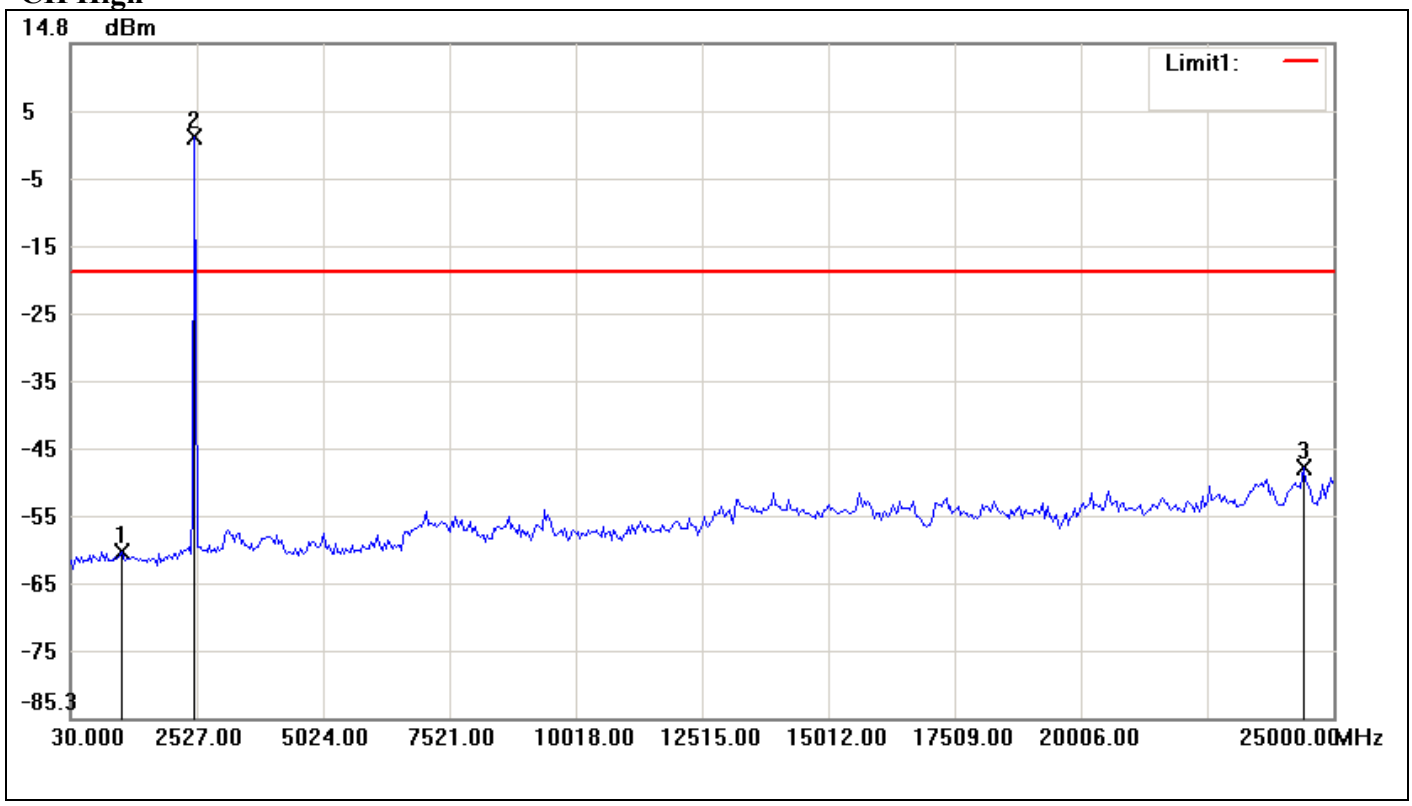
No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	1278.5000	-60.04	-20.80	-39.24
2	2402.1500	-0.80	-20.80	20.00
3	24417.3667	-49.61	-20.80	-28.81

CH Mid



No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	446.1667	-60.41	-19.51	-40.90
2	2443.7667	0.49	-19.51	20.00
3	24417.3667	-49.43	-19.51	-29.92

CH High



No.	Frequency(MHz)	Level(dBm)	Limit(dBm)	Margin(dBm)
1	1028.8000	-60.64	-19.22	-41.42
2	2485.3833	0.78	-19.22	20.00
3	24417.3667	-48.07	-19.22	-28.85

8.8.2 Radiated Emissions

LIMIT

All spurious emissions shall comply with the limits of §15.209(a) and RSS-Gen Table 2 & Table 5.

RSS-Gen Table 2 & Table 5: General Field Strength Limits for Transmitters and Receivers at Frequencies Above 30 MHz (Note)

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

Note: *Measurements for compliance with limits in the above table may be performed at distances other than 3 metres, in accordance with Section 7.2.7.
Transmitting devices are not permitted in Table 1 bands or, unless stated otherwise, in TV bands (54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-806 MHz).

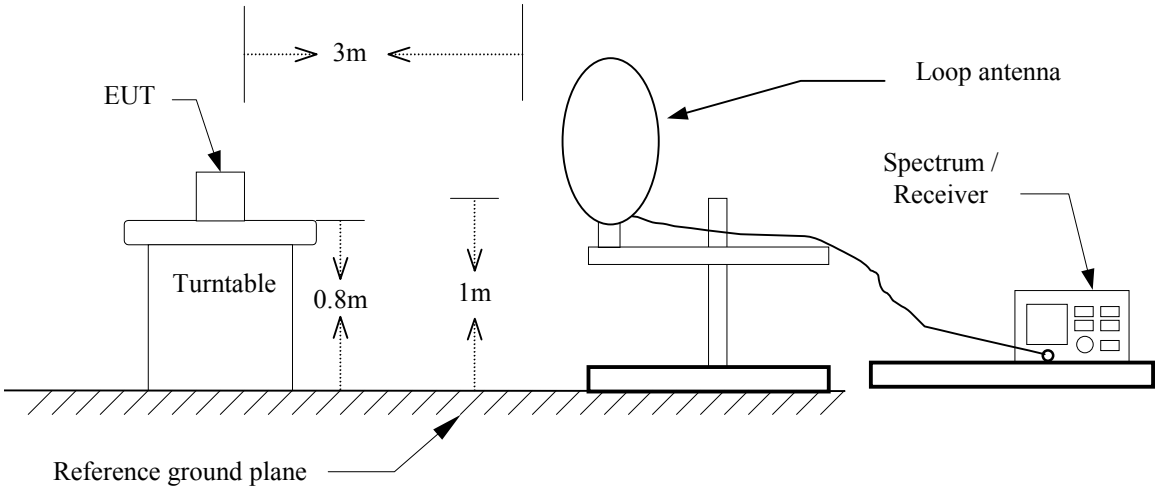
RSS-Gen Table 6: General Field Strength Limits for Transmitters at Frequencies Below 30 MHz (Transmit)

Frequency	Field Strength (microvolts/m)	Magnetic H-Field (microamperes/m)	Measurement Distance (metres)
9-490 kHz	2,400/F (F in kHz)	2,400/377F (F in kHz)	3000
490-1,705 kHz	24,000/F (F in kHz)	24,000/377F (F in kHz)	30
1.705-30 MHz	30	N/A	30

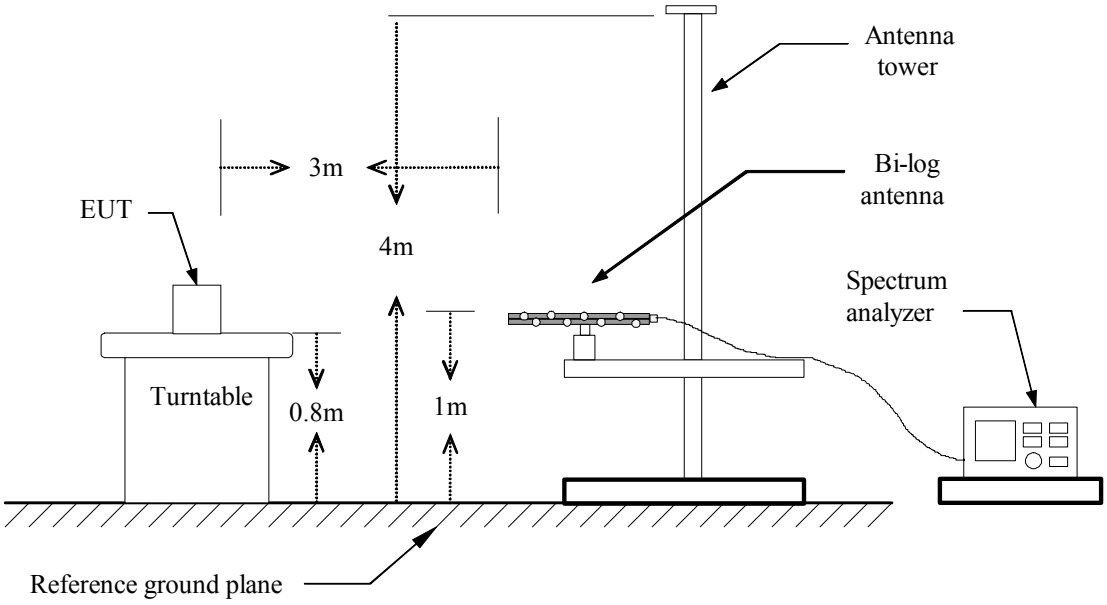
Note: The emission limits for the bands 9-90 kHz and 110-490 kHz are based on measurements employing an average detector.

Test Configuration

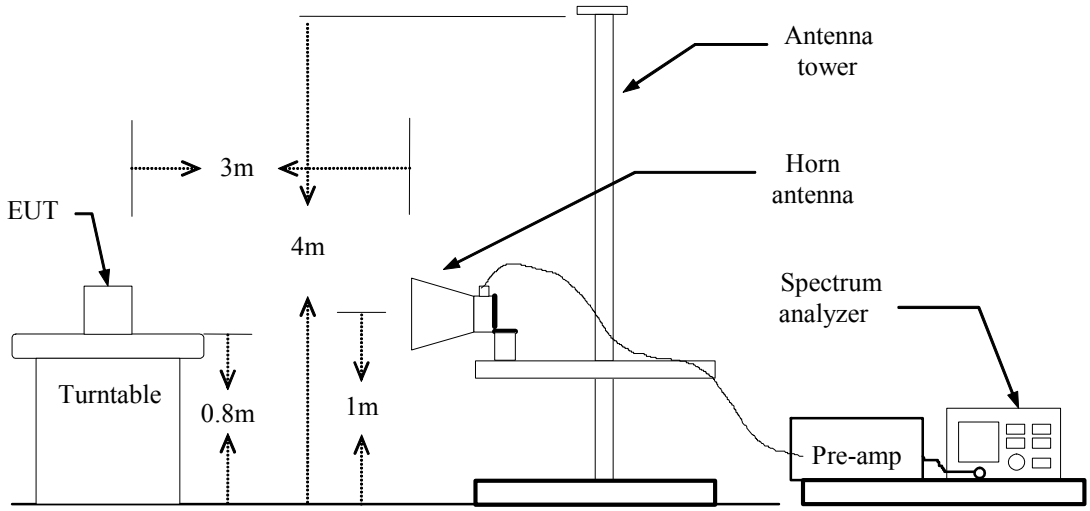
9kHz ~ 30MHz



30MHz ~ 1GHz



Above 1 GHz


Antenna
tower
Horn
antenna
Spectrum
analyzer
3m
4m
EUT
Turntable
0.8m
1m
Pre-amp

TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

   Below 1GHz:

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

   Above 1GHz:

   (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

   (b) AVERAGE: RBW=1MHz / VBW ≥ 1/T / Sweep=AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

Below 1 GHz

Operation Mode: Normal Link **Test Date:** June 9, 2012

Temperature: 26°C **Tested by:** Shawn Wu

Humidity: 50 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
30.00	46.12	-19.87	26.25	40.00	-13.75	Peak	V
99.52	55.52	-31.37	24.16	43.50	-19.34	Peak	V
169.03	55.20	-29.18	26.02	43.50	-17.48	Peak	V
448.72	46.26	-22.87	23.39	46.00	-22.61	Peak	V
631.40	41.61	-20.02	21.59	46.00	-24.41	Peak	V
780.13	43.45	-17.72	25.72	46.00	-20.28	Peak	V
30.00	41.61	-19.87	21.74	40.00	-18.26	Peak	H
136.70	42.01	-27.94	14.07	43.50	-29.43	Peak	H
204.60	43.16	-28.40	14.76	43.50	-28.74	Peak	H
429.32	42.39	-23.26	19.13	46.00	-26.87	Peak	H
663.73	40.96	-19.34	21.62	46.00	-24.38	Peak	H
780.13	46.12	-17.72	28.39	46.00	-17.61	Peak	H

Remark:

1. *No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).*
2. *Radiated emissions measured were made with an instrument using peak/quasi-peak detector mode.*
3. *Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.*
4. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
5. *Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).*

Above 1 GHz

Operation Mode: TX / GFSK / DH5 / CH Low **Test Date:** June 9, 2012

Temperature: 26°C **Tested by:** Shawn Wu

Humidity: 50 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
2213.33	52.52	---	-4.92	47.61	---	74.00	54.00	-6.39	Peak	V
N/A										
2270.00	51.61	---	-4.77	46.85	---	74.00	54.00	-7.15	Peak	H
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / GFSK / DH5 / CH Mid **Test Date:** June 9, 2012

Temperature: 26°C **Tested by:** Shawn Wu

Humidity: 50 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
2103.33	52.22	---	-5.20	47.02	---	74.00	54.00	-6.98	Peak	V
N/A										
2013.33	52.49	---	-5.44	47.05	---	74.00	54.00	-6.95	Peak	H
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / GFSK / DH5 / CH High **Test Date:** June 9, 2012

Temperature: 26°C **Tested by:** Shawn Wu

Humidity: 50 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
2133.33	51.87	---	-5.12	46.75	---	74.00	54.00	-7.25	Peak	V
N/A										
2170.00	53.38	---	-5.03	48.35	---	74.00	54.00	-5.65	Peak	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / 8DPSK / DH5 / CH Low **Test Date:** June 9, 2012

Temperature: 26°C **Tested by:** Shawn Wu

Humidity: 50 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
2050.00	52.26	---	-5.34	46.92	---	74.00	54.00	-7.08	Peak	V
N/A										
2223.33	52.41	---	-4.89	47.52	---	74.00	54.00	-6.48	Peak	H
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / 8DPSK / DH5 / CH Mid **Test Date:** June 9, 2012

Temperature: 26°C **Tested by:** Shawn Wu

Humidity: 50 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
2183.33	51.84	---	-4.99	46.84	---	74.00	54.00	-7.16	Peak	V
N/A										
2176.67	51.94	---	-5.01	46.93	---	74.00	54.00	-7.07	Peak	H
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / 8DPSK / DH5 / CH High **Test Date:** June 9, 2012

Temperature: 26°C **Tested by:** Shawn Wu

Humidity: 50 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)	Reading (Peak) (dBuV)
2336.67	51.59	---	-4.54	47.05	---	74.00	54.00	-6.95	Peak	V
N/A										
2116.67	51.25	---	-5.17	46.08	---	74.00	54.00	-7.92	Peak	H
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

8.9 POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §15.207(a) & RSS-Gen §7.2.4, except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

***** *Decreases with the logarithm of the frequency.*

Test Configuration

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

Test Data

Operation Mode:	Normal Link	**Test Date:**	June 14, 2012
Temperature:	24°C	**Tested by:**	Stan Lin
Humidity:	50% RH		

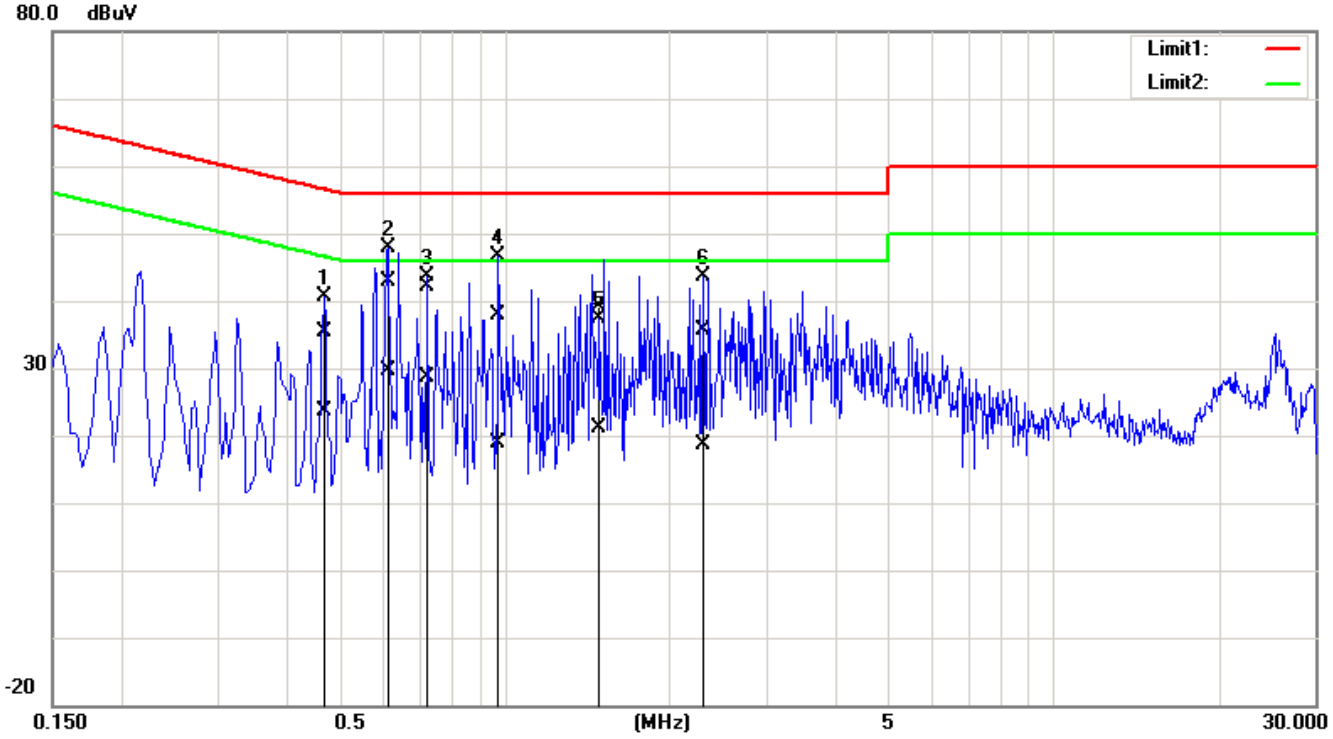
Freq. (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Corr. factor (dB/m)	QP Result (dBuV/m)	AV Result (dBuV/m)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.4735	25.62	14.08	9.66	35.28	23.74	56.45	46.45	-21.17	-22.71	L1
0.6122	33.13	19.90	9.67	42.80	29.57	56.00	46.00	-13.20	-16.43	L1
0.7205	32.55	19.06	9.68	42.23	28.74	56.00	46.00	-13.77	-17.26	L1
0.9643	28.23	9.26	9.69	37.92	18.95	56.00	46.00	-18.08	-27.05	L1
1.4730	29.33	11.54	9.70	39.03	21.24	56.00	46.00	-16.97	-24.76	L1
2.2729	25.96	8.90	9.74	35.70	18.64	56.00	46.00	-20.30	-27.36	L1
0.5754	32.92	19.18	9.68	42.60	28.86	56.00	46.00	-13.40	-17.14	L2
0.6126	33.26	20.22	9.68	42.94	29.90	56.00	46.00	-13.06	-16.10	L2
0.7238	32.25	19.77	9.69	41.94	29.46	56.00	46.00	-14.06	-16.54	L2
0.9770	32.81	19.64	9.70	42.51	29.34	56.00	46.00	-13.49	-16.66	L2
1.4364	29.59	11.33	9.71	39.30	21.04	56.00	46.00	-16.70	-24.96	L2
1.8366	30.52	14.40	9.73	40.25	24.13	56.00	46.00	-15.75	-21.87	L2

Remark:

1. *Measuring frequencies from 0.15 MHz to 30MHz.*
2. *The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.*
3. *The IF bandwidth of SPA between 0.15MHz and 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9kHz;*
4. *L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)*

Test Plots

Conducted emissions (Line 1)



Conducted emissions (Line 2)