

**FCC 47 CFR PART 15 SUBPART C &
INDUSTRY CANADA RSS-247**

TEST REPORT

For

802.11a/b/g/n/ac 2T2R + BT4.1LE USB Combo Module

Model: WCBN4502B

Trade Name: LITE-ON

Issued to

**Lite-On Technology Corp.
Bldg. C, 90, Chien 1 Road, Chung
Ho, New Taipei City 23585,
Taiwan, R.O.C**

Issued by

**Compliance Certification Services Inc.
No.11, Wugong 6th Rd., Wugu Dist.,
New Taipei City 24891, Taiwan. (R.O.C.)
<http://www.ccsrf.com>
service@ccsrf.com
Issued Date: June 16, 2015**



Note: This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc. This document may be altered or revised by Compliance Certification Services Inc. personnel only, and shall be noted in the revision section of the document.

Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	June 16, 2015	Initial Issue	ALL	Doris Chu

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. FCC PART 15.247 REQUIREMENTS & RSS 247 REQUIREMENTS	14
7.1 99% BANDWIDTH	14
7.2 20 DB BANDWIDTH.....	19
7.3 PEAK POWER.....	26
7.4 AVERAGE POWER	27
7.5 BAND EDGES MEASUREMENT	28
7.6 FREQUENCY SEPARATION.....	46
7.7 NUMBER OF HOPPING FREQUENCY.....	51
7.8 TIME OF OCCUPANCY (DWEIL TIME)	56
7.9 SPURIOUS EMISSIONS	65
7.10 RADIATED EMISSIONS.....	72
7.11 POWERLINE CONDUCTED EMISSIONS.....	96
APPENDIX I PHOTOGRAPHS OF TEST SETUP.....	97

1. TEST RESULT CERTIFICATION

Applicant: Lite-On Technology Corp.
Bldg. C, 90, Chien 1 Road, Chung
Ho, New Taipei City 23585,
Taiwan, R.O.C

Manufacturer: LITE-ON TECHNOLOGY (Changzhou) CO., LTD
A9 Building, No.88, Yanghu Road, Wujin Hi-Tech Industrial
Development Zone, Changzhou City, Jiangsu Province, P. R.
China

Equipment Under Test: 802.11a/b/g/n/ac 2T2R + BT4.1LE USB Combo Module

Trade Name: LITE-ON

Model: WCBN4502B

Date of Test: June 9, 2015

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 15 Subpart C Industry Canada RSS-247 Issue 1 Industry Canada RSS-GEN Issue 3	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 C63.10: 2013 for IC, ANSI C63.10: 2009 for FCC and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements set forth in the above standards. The test results of this report relate only to the tested sample EUT identified in this report.

Approved by:

Reviewed by:



Miller Lee
Manager
Compliance Certification Services Inc.



Angel Cheng
Section Manager
Compliance Certification Services Inc.

2. EUT DESCRIPTION

Product	802.11a/b/g/n/ac 2T2R + BT4.1LE USB Combo Module
Trade Name	LITE-ON
Model Number	WCBN4502B
Model Discrepancy	N/A
Received Date	May 28, 2015
Power Supply	Powered by host device
Frequency Range	2402 ~ 2480 MHz
Transmit Power	10.32 dBm
Modulation Technique	GFSK for 1Mbps; $\pi/4$ -DQPSK for 2Mbps; 8DPSK for 3Mbps
Number of Channels	79 Channels
Antenna Specification	1. Walsin / RFMTA400550IMAB301 PIFA Antenna Gain: 3.79 dBi 2. Walsin / RFMTA400536IMAB301 PIFA Antenna Gain: 3.79 dBi

Remark:

1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC&IC ID: **PPQ-WCBN4502B** & **4491A-WCBN4502B** filing to comply with FCC Part 15C, Section 15.207, 15.209 and IC RSS-247 & RSS-GEN.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2009 and FCC CFR 47 Part 15.207, 15.209, 15.247.

The tests documented in this report were performed in accordance with IC RSS-247, IC RSS-Gen and ANSI C63.10:2013.

This submittal(s) (test report) is intended for IC Certification with Industry Canada RSS-247.

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-247, IC RSS-Gen, IC RSS-102, and ANSI C63.4: 2009.

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 ANSI C63.10: 2013 for IC, ANSI C63.10: 2009 for FCC 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 1.5 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 ANSI C63.10: 2013 for IC, ANSI C63.10: 2009 for FCC.

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: WCBN4502B) had been tested under operating condition.

The EUT is a 2x2 configuration spatial MIMO (2Tx & 2Rx) without beam forming function that operate in double TX chains and double RX chains. The 2x2 configuration is implemented with two outside TX & RX chains (Chain 0 and 1).

Software used to control the EUT for staying in continuous transmitting and receiving mode was programmed.

After verification, all tests carried out are 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 and receiving radiated spurious emission above 1GHz, which worst case was in CH Mid mode only.

Channel Low (2402MHz), Mid (2441MHz) and High (2480MHz) with 1Mbps data rate was chosen for full testing.

During the preliminary test, GFSK, $\pi/4$ -QPSK & 8DPSK with DH1 were pre-tested and found that 8DPSK emits the highest output power. Then the tests were carried on with DH1 compare to DH3 & DH5 and found that 8DPSK with DH5 emit the highest output power, and therefore had been tested under operating condition.

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

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

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	US42510252	11/23/2015
Thermostatic/Hrgrosatic Chamber	TAICHY	MHG-150LF	930619	10/07/2015
AC Power Source	EXTECH	6205	1140845	N.C.R
DC Power Supply	ABM	8301HD	D011531	N.C.R
Power Meter	Anritsu	ML2495A	1012009	06/07/2016
Power Sensor	Anritsu	MA2411A	0917072	06/08/2016
Spectrum Analyzer	ROHDE&SCHWARZ	FSV40	101073	07/09/2015

Wugu 966 Chamber A				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US42510268	09/18/2015
EMI Test Receiver	R&S	ESCI	100064	06/04/2016
Bilog Antenna	Sunol Sciences	JB3	A030105	08/19/2015
Horn Antenna	EMCO	3117	00055165	01/26/2016
Horn Antenna	EMCO	3116	26370	12/25/2015
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	N.C.R
Pre-Amplifier	MITEQ	1652-3000	1490939	08/09/2016
Pre-Amplifier	EMC	EMC 01265	4035	06/04/2016
Pre-Amplifier	MITEQ	AMF-6F-260400-40-8P	985646	12/25/2015
Coaxial Cable	Huber+Suhner	102	29212/2	12/25/2015
Coaxial Cable	Huber+Suhner	102	29406/2	12/25/2015
Test S/W	EZ-EMC (CCS-3A1RE)			

4.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
Powerline Conducted Emission	N/A
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, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, 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 C63.10: 2013 for IC, ANSI C63.10: 2009 for FCC and CISPR Publication 22.

5.2 EQUIPMENT

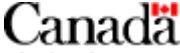
Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, ridged waveguide, horn and/or Loop. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

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-247, 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	
Canada	Industry Canada	3M Semi Anechoic Chamber (IC 2324G-1 / IC 2324G-2) to perform	 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 I 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	Notebook PC	ASUS	M5200AE	5BN0AG019631	PD9WM3B2100	N/A	AC I/P: Unshielded, 1.8m with a core DC O/P: Unshielded, 1.8m

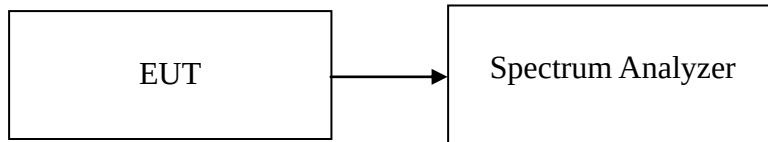
Remark:

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. FCC PART 15.247 REQUIREMENTS & RSS 247 REQUIREMENTS

7.1 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	912.0002
Mid	2441	912.0669
High	2480	909.2104

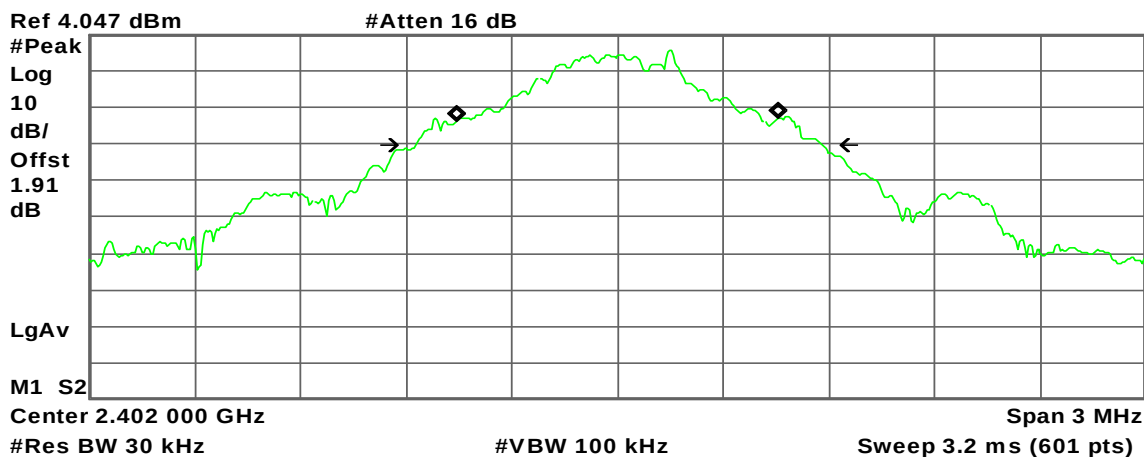
For 8DPSK

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.2067
Mid	2441	1.2083
High	2480	1.2018

Test Plot**For GFSK / DH5****99% Bandwidth (CH Low)**

Agilent

R L



Occupied Bandwidth
912.0002 kHz

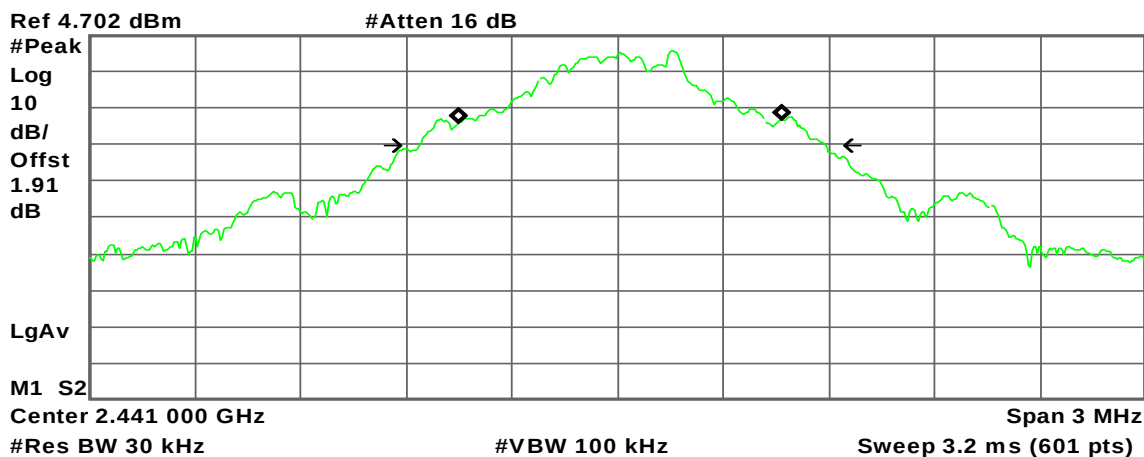
Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error -237.800 Hz
x dB Bandwidth 1.151 MHz

99% Bandwidth (CH Mid)

Agilent

R L



Occupied Bandwidth
912.0669 kHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error 7.210 kHz
x dB Bandwidth 1.154 MHz

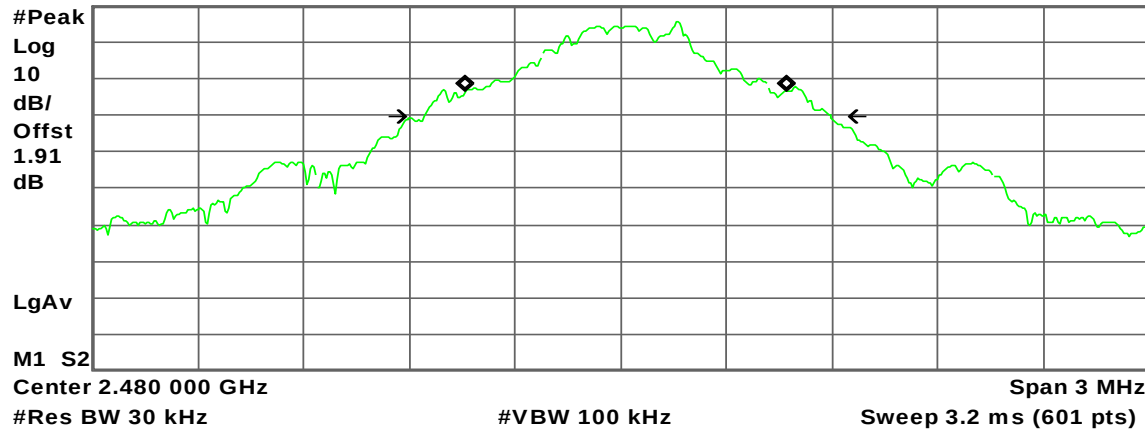
99% Bandwidth (CH High)

Agilent

R L

Ref 4.059 dBm

#Atten 16 dB



Occupied Bandwidth

909.2104 kHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

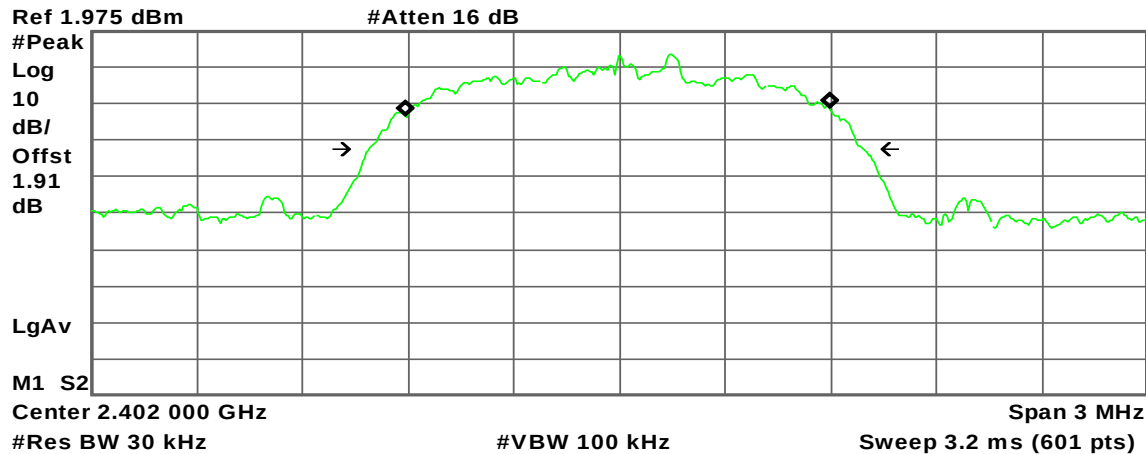
Transmit Freq Error 16.714 kHz
x dB Bandwidth 1.153 MHz

For 8DPSK / DH5

99% Bandwidth (CH Low)

Agilent

R L



Occupied Bandwidth
1.2067 MHz

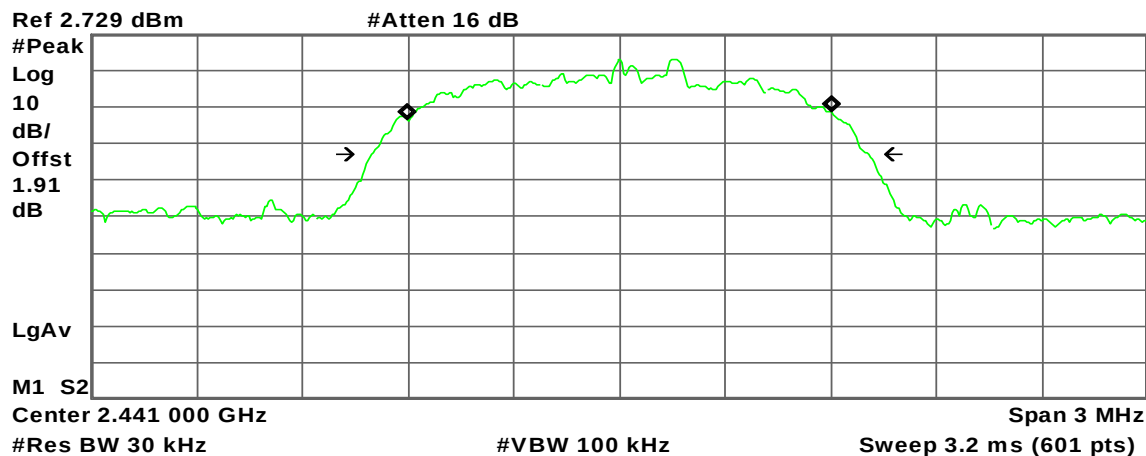
Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error -6.311 kHz
x dB Bandwidth 1.408 MHz

99% Bandwidth (CH Mid)

Agilent

R L



Occupied Bandwidth
1.2083 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error 2.061 kHz
x dB Bandwidth 1.410 MHz

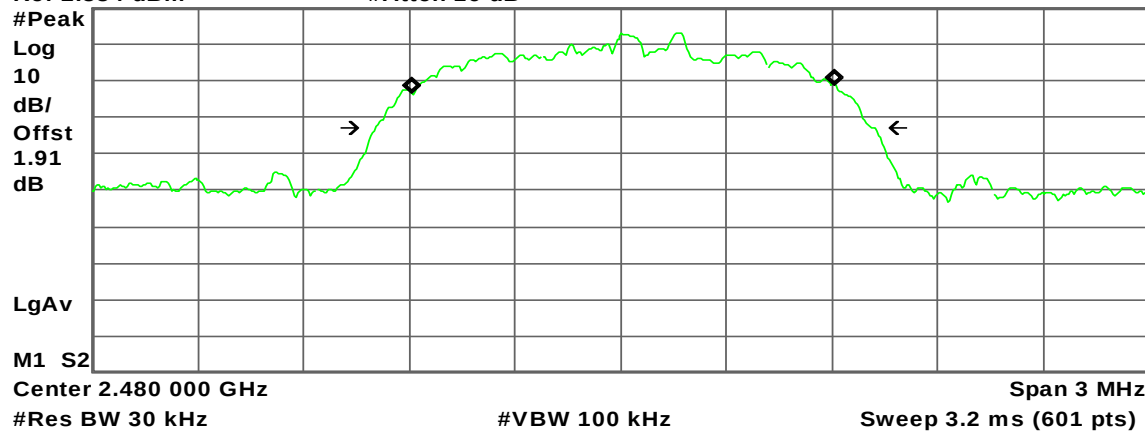
99% Bandwidth (CH High)

Agilent

R L

Ref 2.334 dBm

#Atten 16 dB



Occupied Bandwidth
1.2018 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

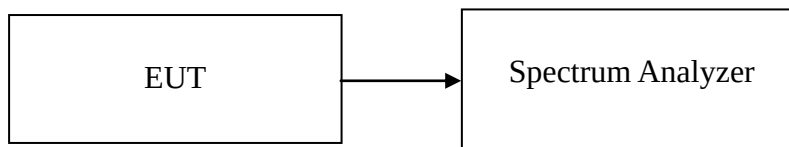
Transmit Freq Error 10.435 kHz
x dB Bandwidth 1.412 MHz

7.2 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=30 kHz, VBW = 100 kHz, Sweep = 3.2 ms.
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.

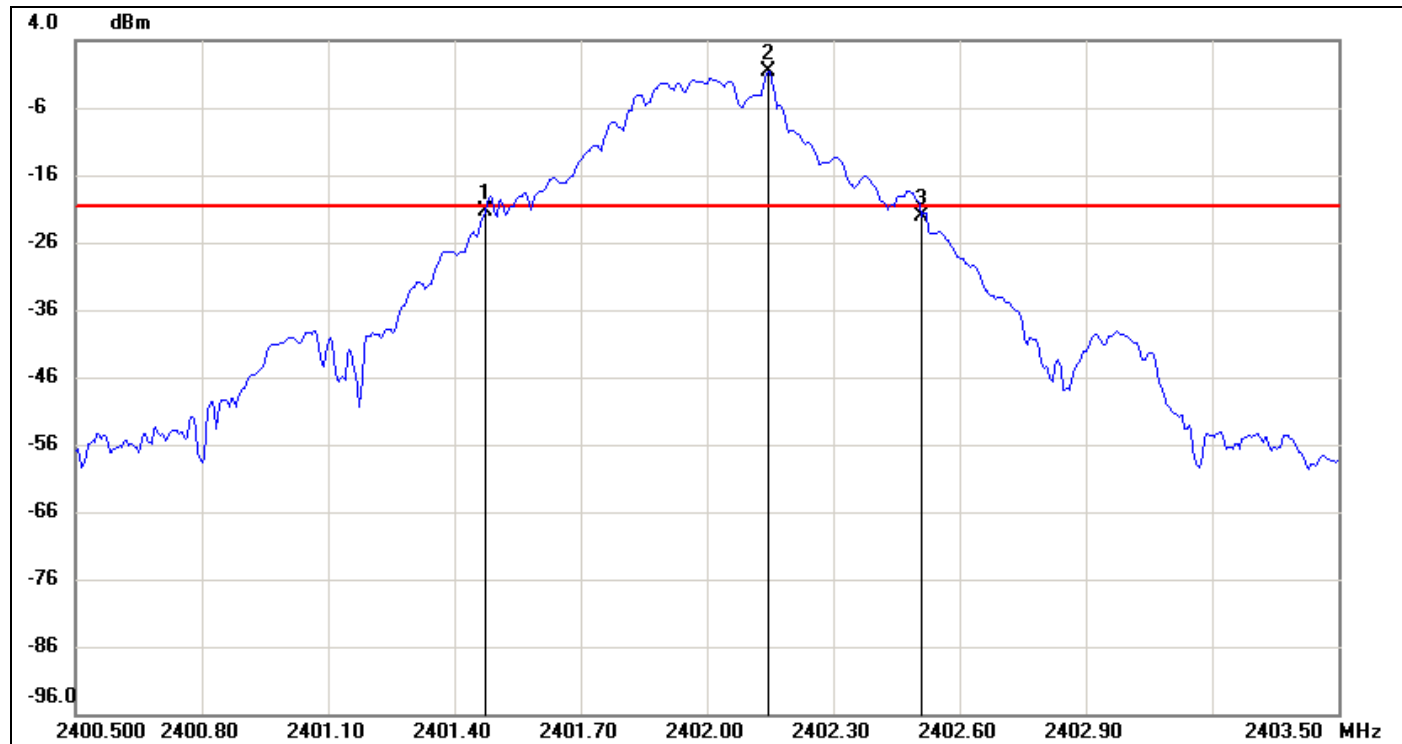
Test Data

For GFSK / DH5

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	1.035
Mid	2441	1.04
High	2480	1.04

For 8DPSK / DH5

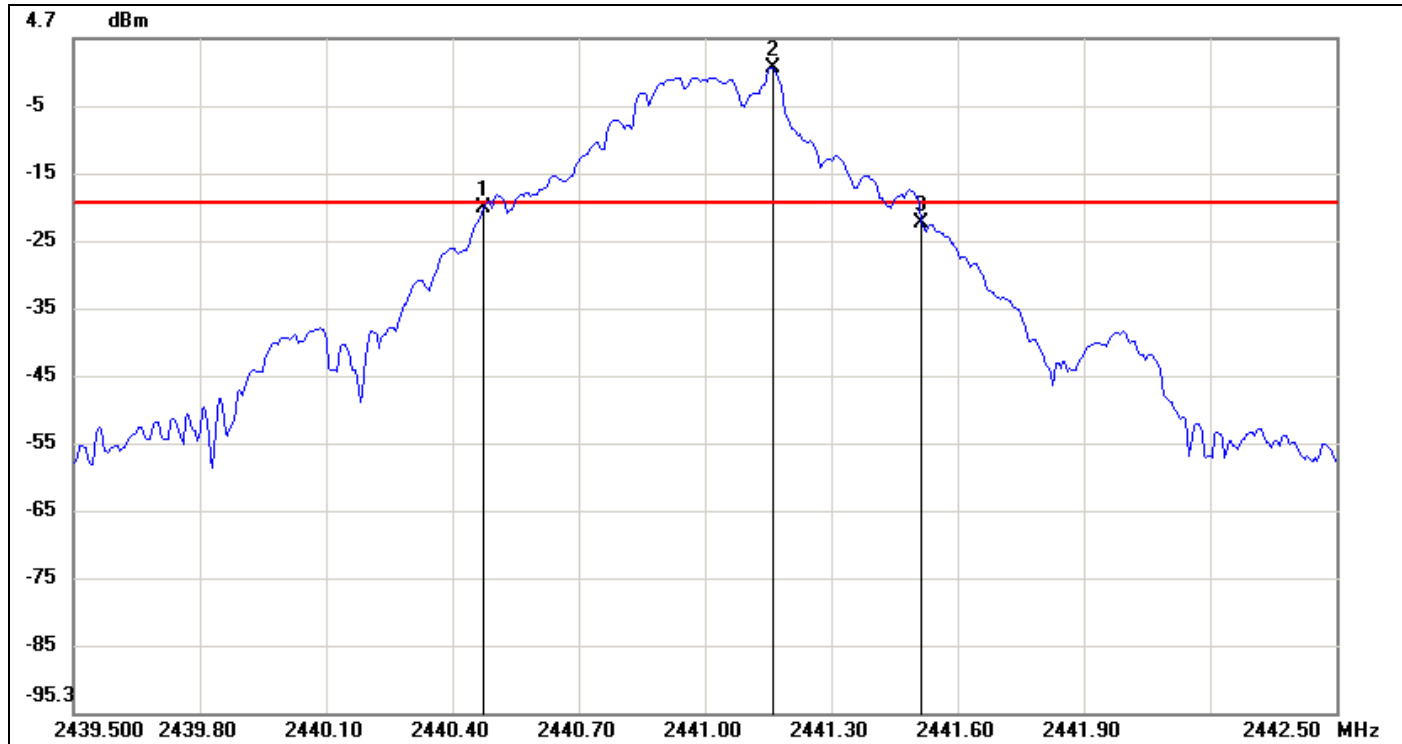
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	1.325
Mid	2441	1.325
High	2480	1.32

Test Plot**For GFSK / DH5****20dB Bandwidth (CH Low)**

No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2401.4750	-21.30	-20.55	-0.75
2	2402.1450	-0.55	-20.55	20.00
3	2402.5100	-21.95	-20.55	-1.40

No.		Δ Frequency(MHz)	Δ Level(dB)
1	mk3-mk1	1.035	-0.65

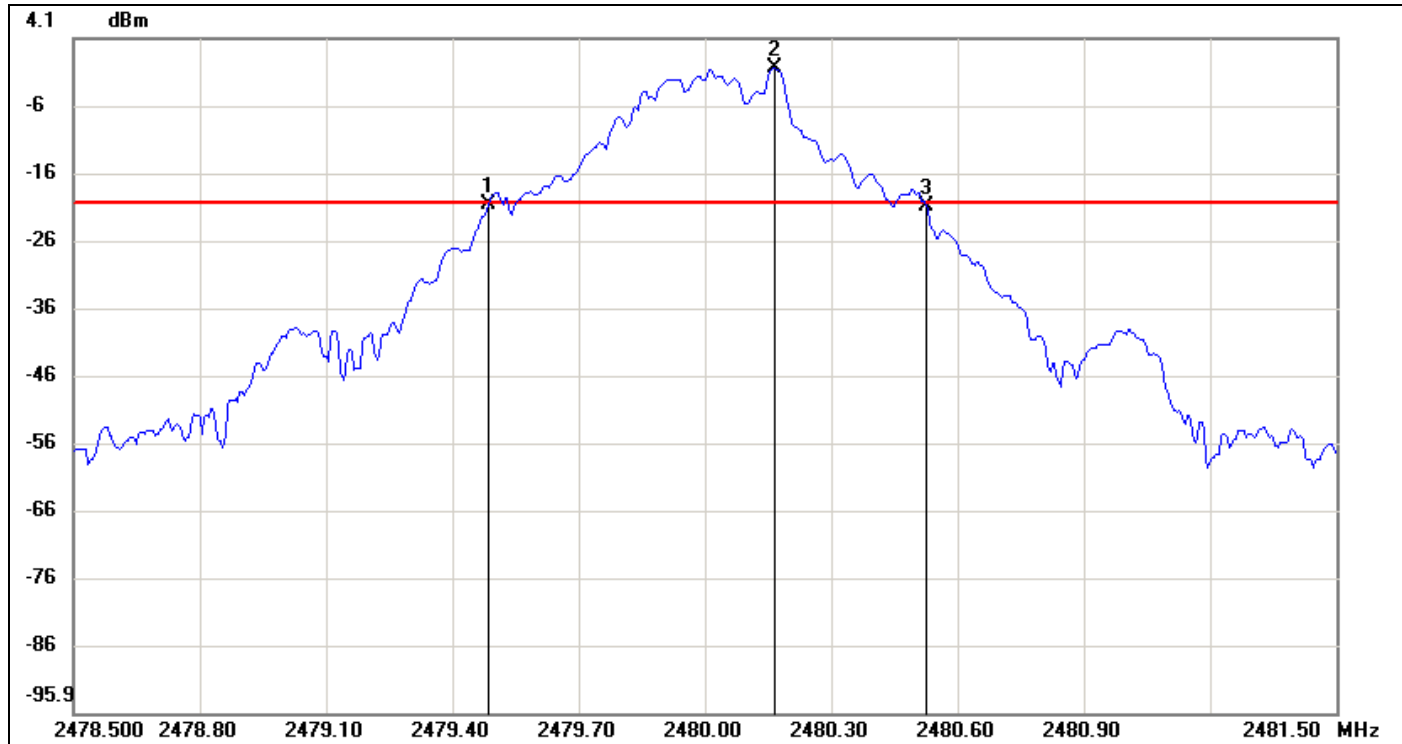
20dB Bandwidth (CH Mid)



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2440.4750	-20.51	-19.74	-0.77
2	2441.1600	0.26	-19.74	20.00
3	2441.5150	-22.72	-19.74	-2.98

No.		Δ Frequency(MHz)	Δ Level(dB)
1	mk3-mk1	1.04	-2.21

20dB Bandwidth (CH High)

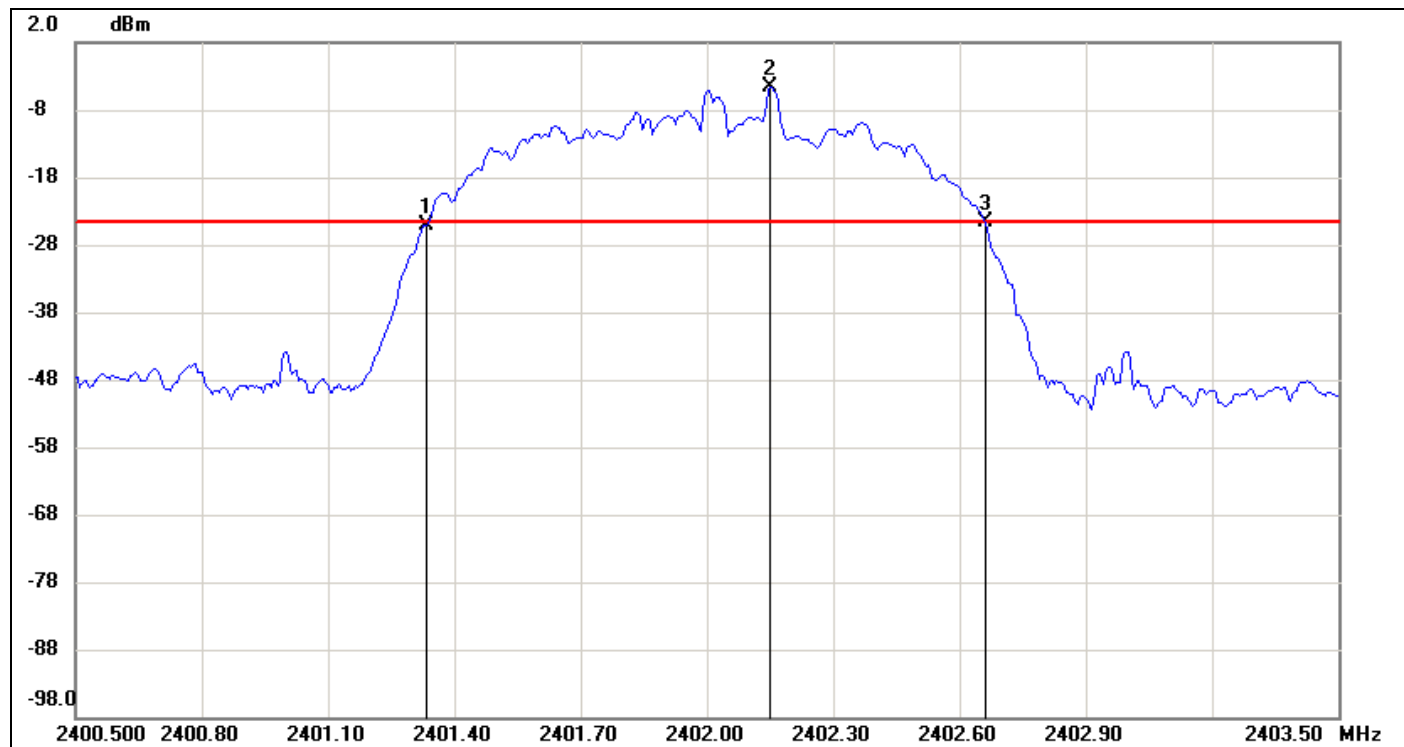


No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2479.4850	-20.47	-20.39	-0.08
2	2480.1650	-0.39	-20.39	20.00
3	2480.5250	-20.93	-20.39	-0.54

No.		Δ Frequency(MHz)	Δ Level(dB)
1	mk3-mk1	1.04	-0.46

For 8DPSK / DH5

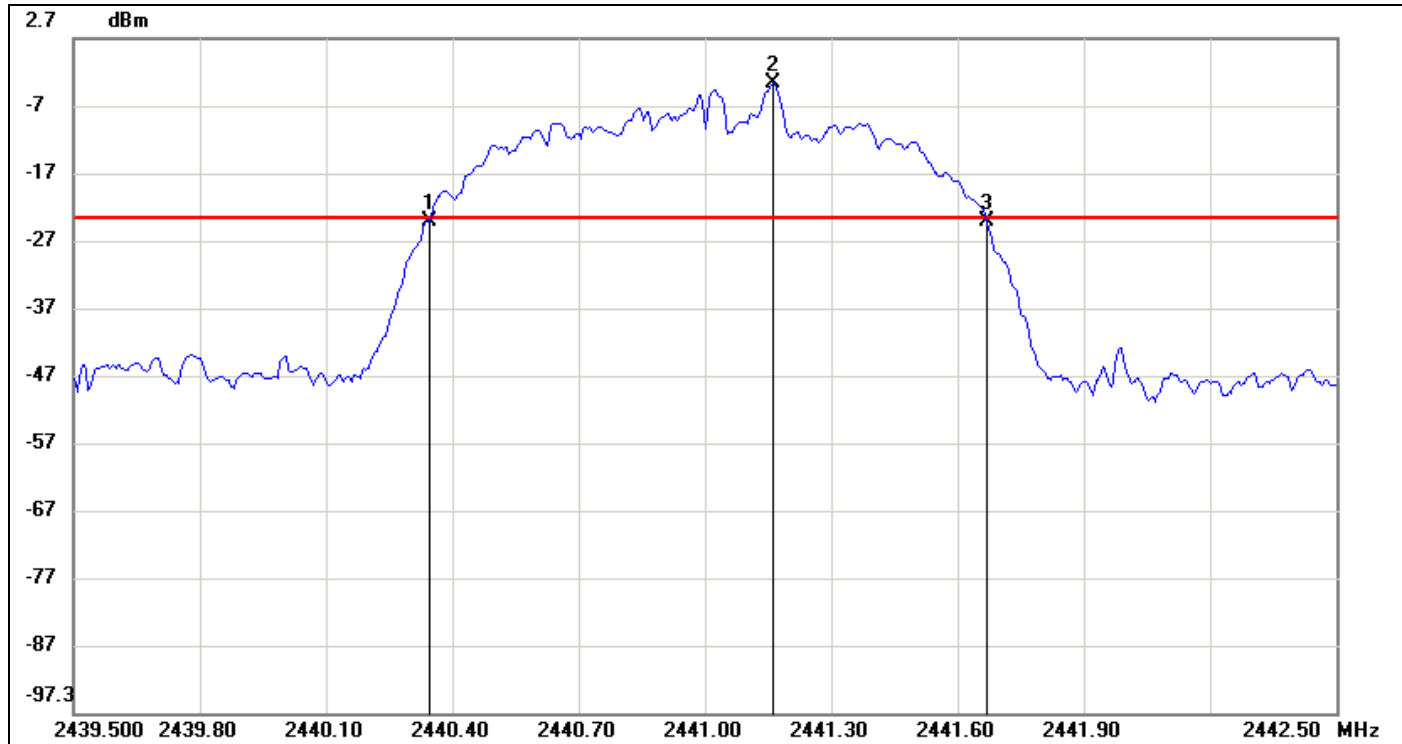
20dB Bandwidth (CH Low)



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2401.3350	-25.09	-24.57	-0.52
2	2402.1500	-4.57	-24.57	20.00
3	2402.6600	-24.59	-24.57	-0.02

No.		Δ Frequency(MHz)	Δ Level(dB)
1	mk3-mk1	1.325	0.5

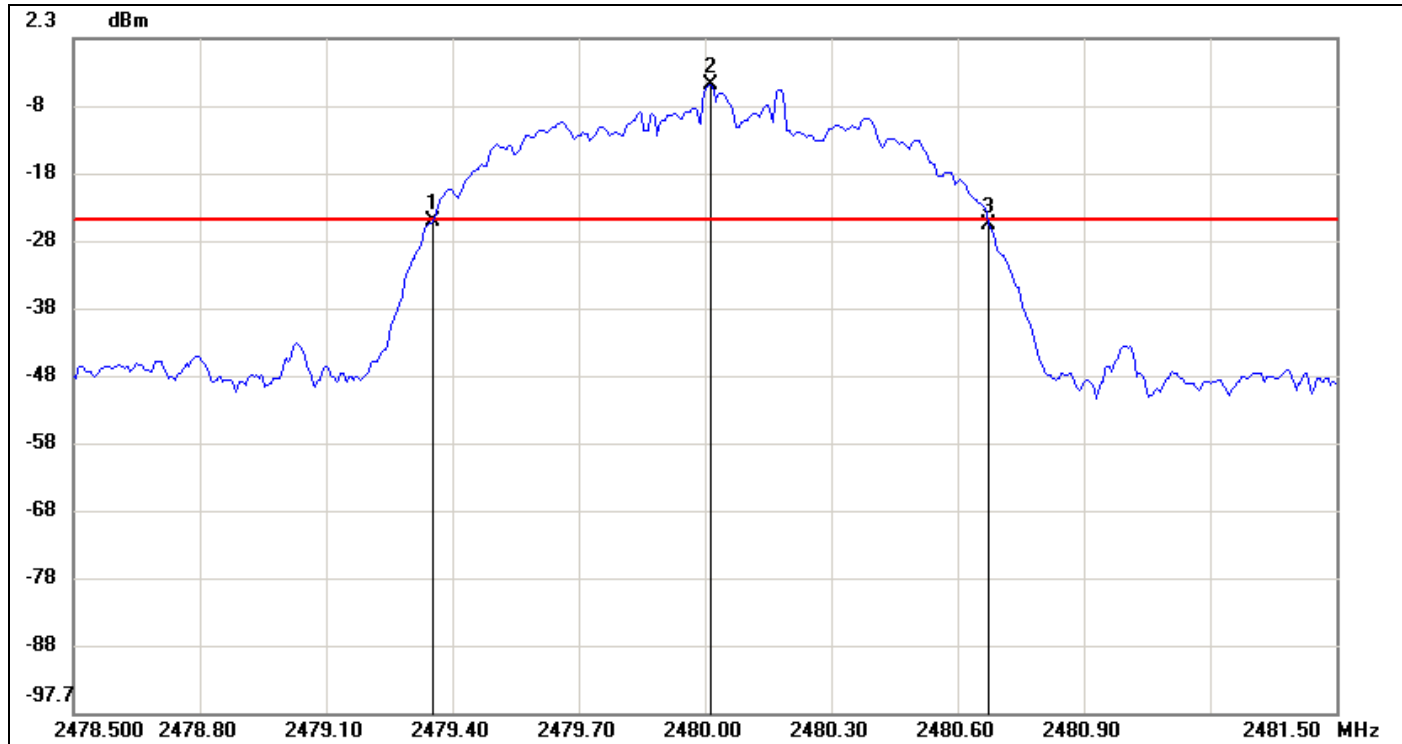
20dB Bandwidth (CH Mid)



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2440.3450	-24.45	-23.96	-0.49
2	2441.1600	-3.96	-23.96	20.00
3	2441.6700	-24.31	-23.96	-0.35

No.		Δ Frequency(MHz)	Δ Level(dB)
1	mk3-mk1	1.325	0.14

20dB Bandwidth (CH High)



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2479.3550	-24.83	-24.63	-0.20
2	2480.0150	-4.63	-24.63	20.00
3	2480.6750	-25.33	-24.63	-0.70

No.		Δ Frequency(MHz)	Δ Level(dB)
1	mk3-mk1	1.32	-0.5

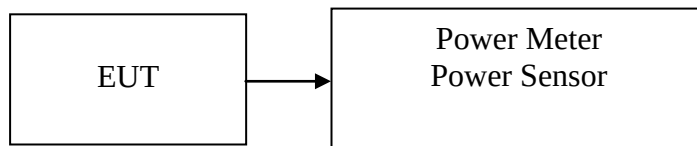
7.3 PEAK POWER

LIMIT

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

1. According to §15.247(a)(1) & RSS-247, 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 247, 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

For GFSK / DH5

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	*10.32	0.0108	0.125	PASS
Mid	2441	9.45	0.0088		PASS
High	2480	7.68	0.0059		PASS

For 8DPSK / DH5

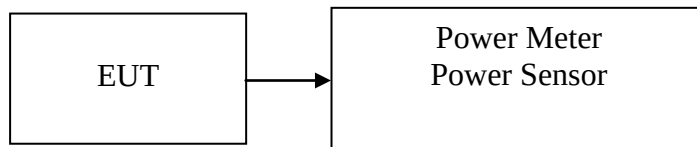
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	8.75	0.0075	0.125	PASS
Mid	2441	8.32	0.0068		PASS
High	2480	6.42	0.0044		PASS

7.4 AVERAGE POWER

LIMIT

None; for reporting purposes only.

Test Configuration



TEST PROCEDURE

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

TEST RESULTS

No non-compliance noted.

Test Data

For GFSK / DH5

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2402	10.16	0.0104
Mid	2441	9.23	0.0084
High	2480	7.46	0.0056

For 8DPSK / DH5

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2402	6.44	0.0044
Mid	2441	5.89	0.0039
High	2480	4.46	0.0028

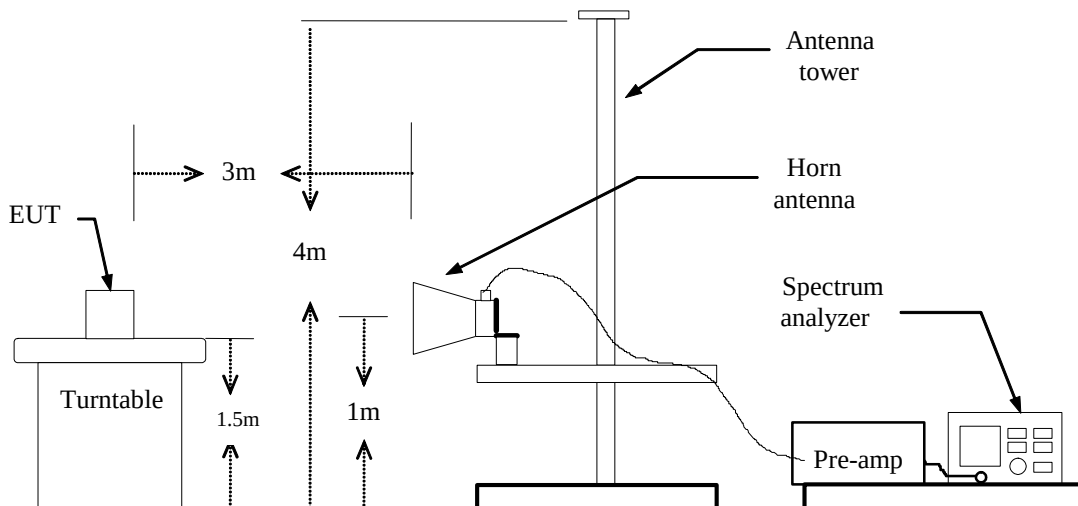
7.5 BAND EDGES MEASUREMENT

LIMIT

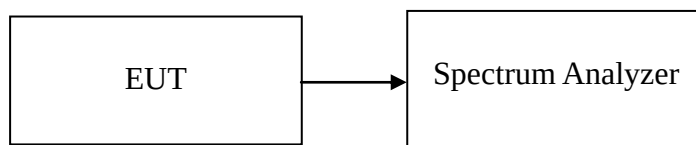
According to §15.247(d) & RSS-247, in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, 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

For Radiated



For Conducted



TEST PROCEDURE

For Radiated

1. The EUT is placed on a turntable, which is 1.5m 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,
if duty cycle $\geq 98\%$, VBW=10Hz.
if duty cycle $< 98\%$ VBW=1/T.
BT: = 78%, VBW= 350Hz
EDR = 78%, VBW= 350Hz
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.

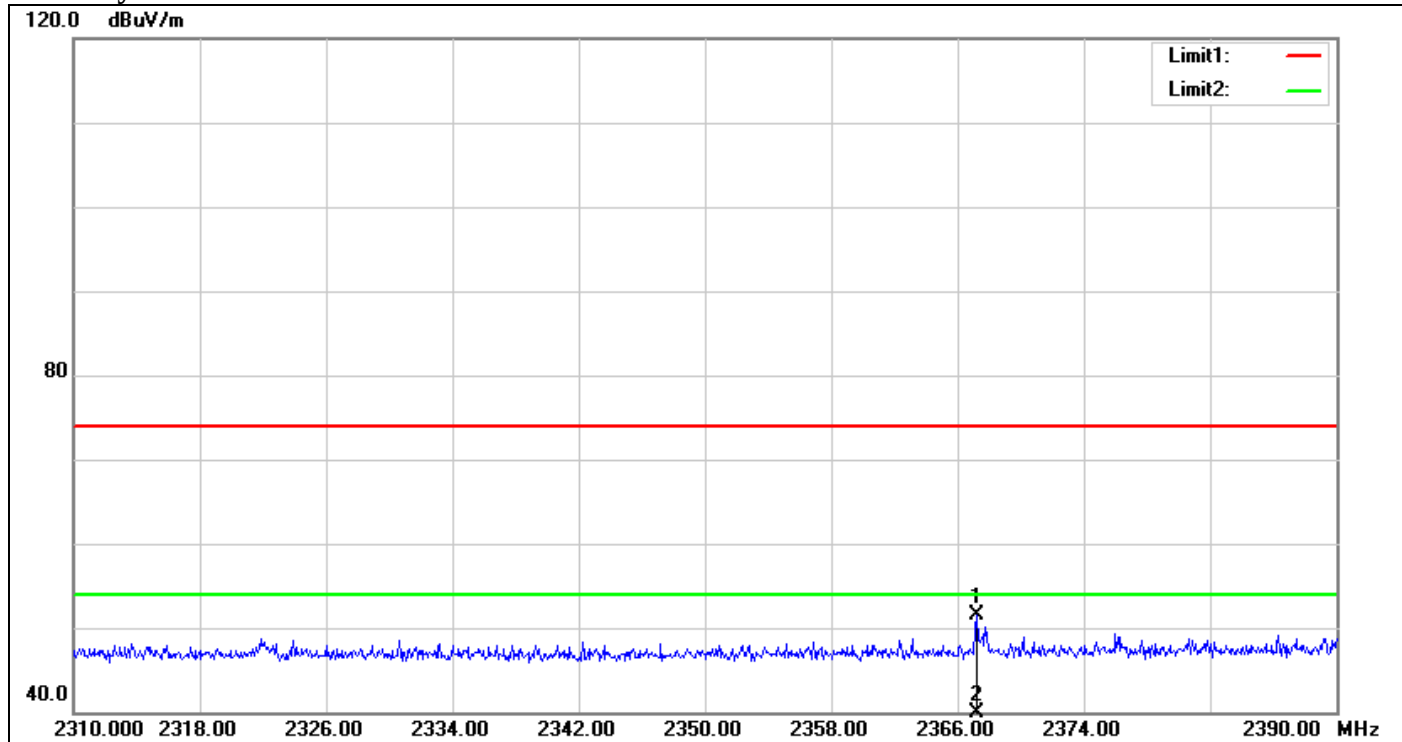
TEST RESULTS

Refer to attach spectrum analyzer data chart.

For GFSK / DH5

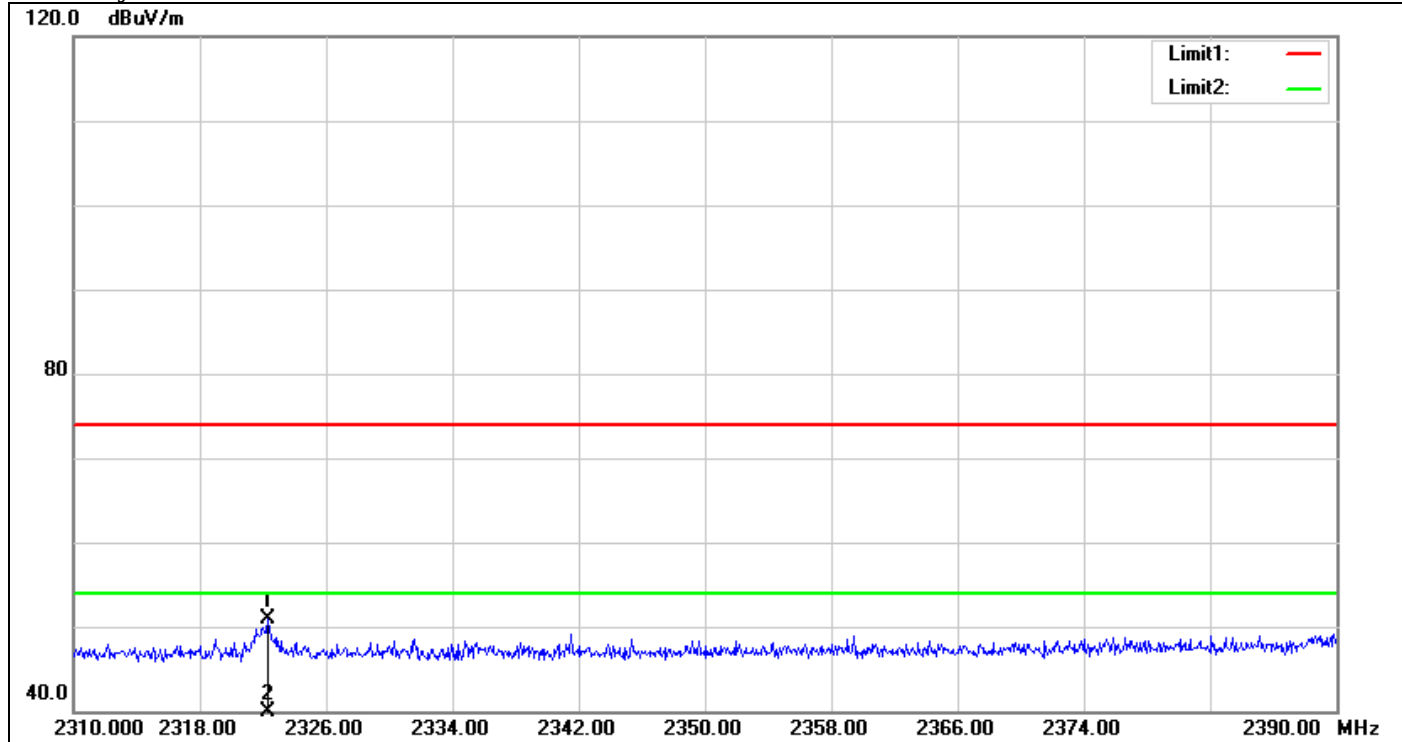
Band Edges (CH Low)

Polarity: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2367.200	54.18	-2.69	51.49	74.00	-22.51	100	178	peak
2	2367.200	38.63	-2.69	35.94	54.00	-18.06	100	178	AVG

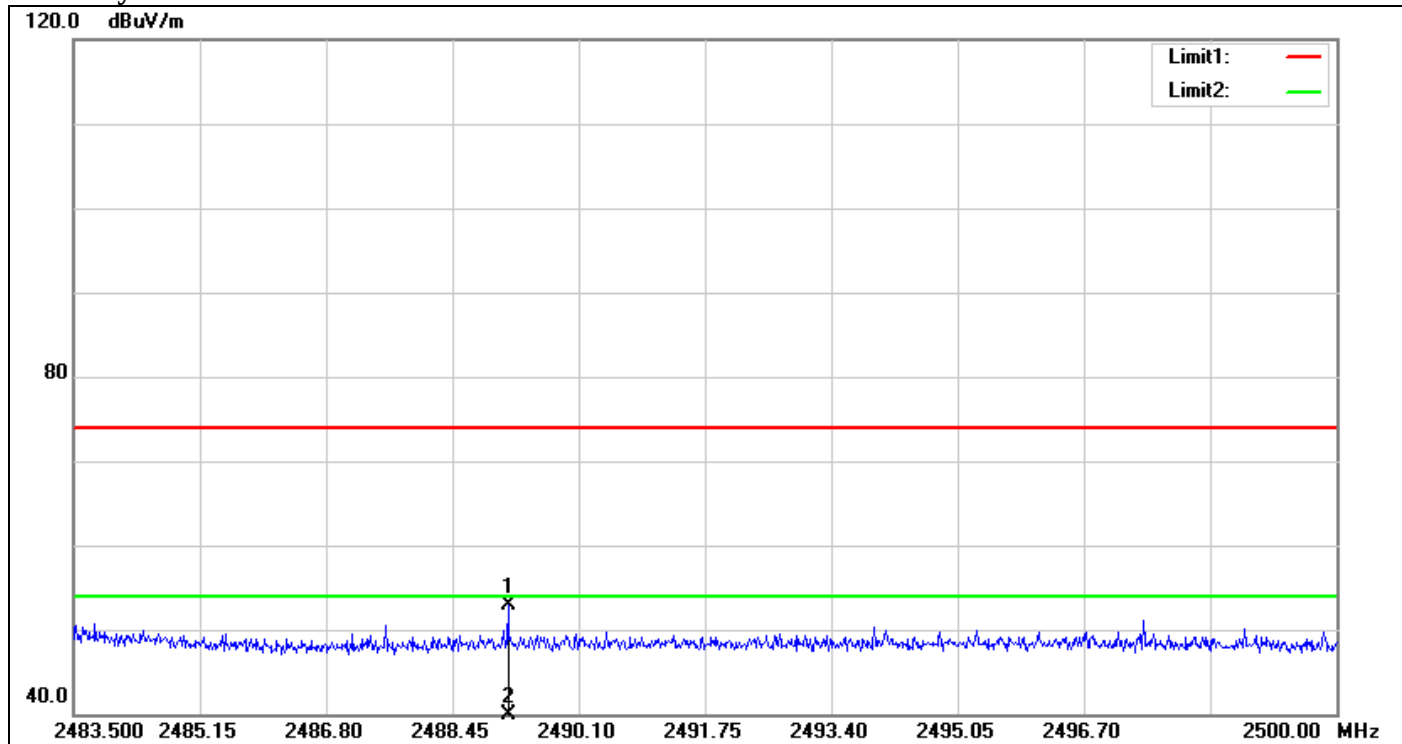
Polarity: Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2322.320	53.79	-2.96	50.83	74.00	-23.17	100	112	peak
2	2322.320	42.75	-2.96	39.79	54.00	-14.21	100	112	AVG

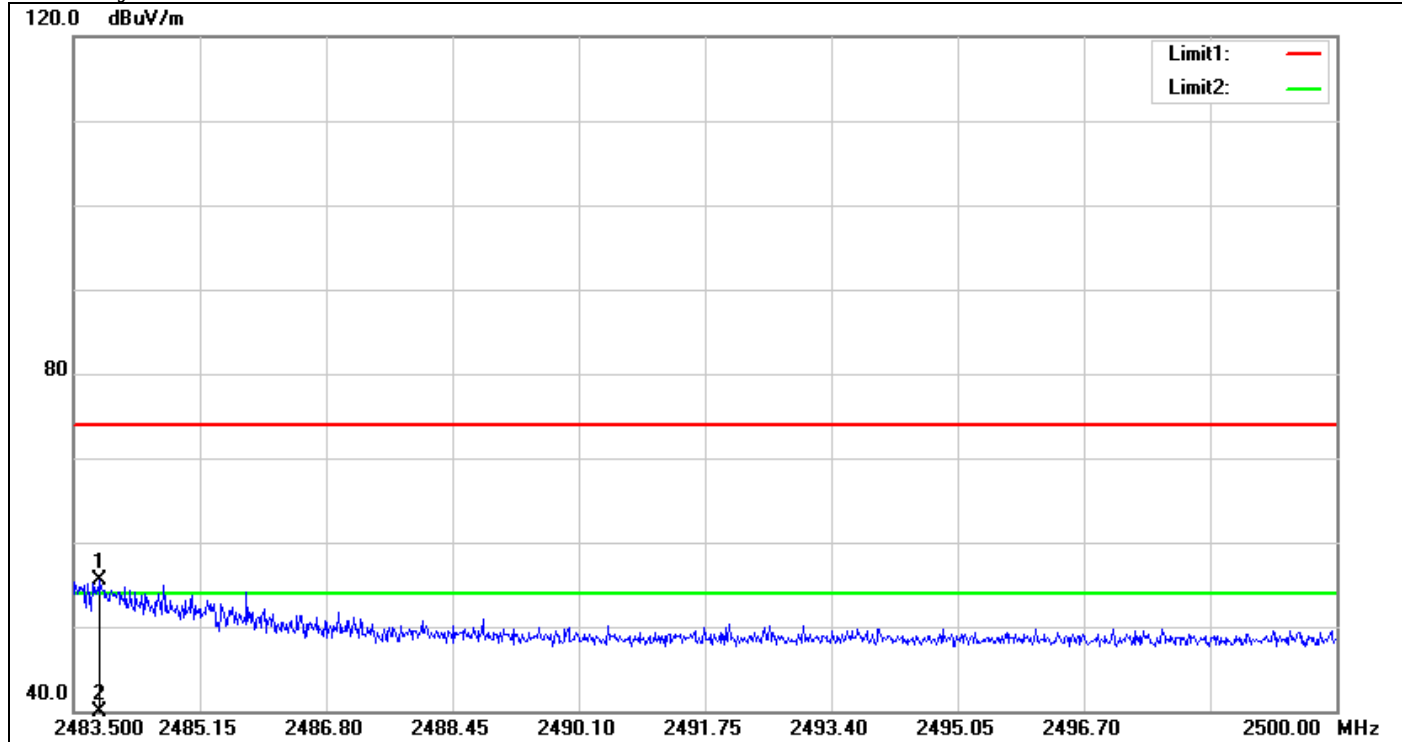
Band Edges (CH High)

Polarity: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2489.176	54.84	-1.94	52.90	74.00	-21.10	100	42	peak
2	2489.176	38.32	-1.94	36.38	54.00	-17.62	100	42	AVG

Polarity: Horizontal

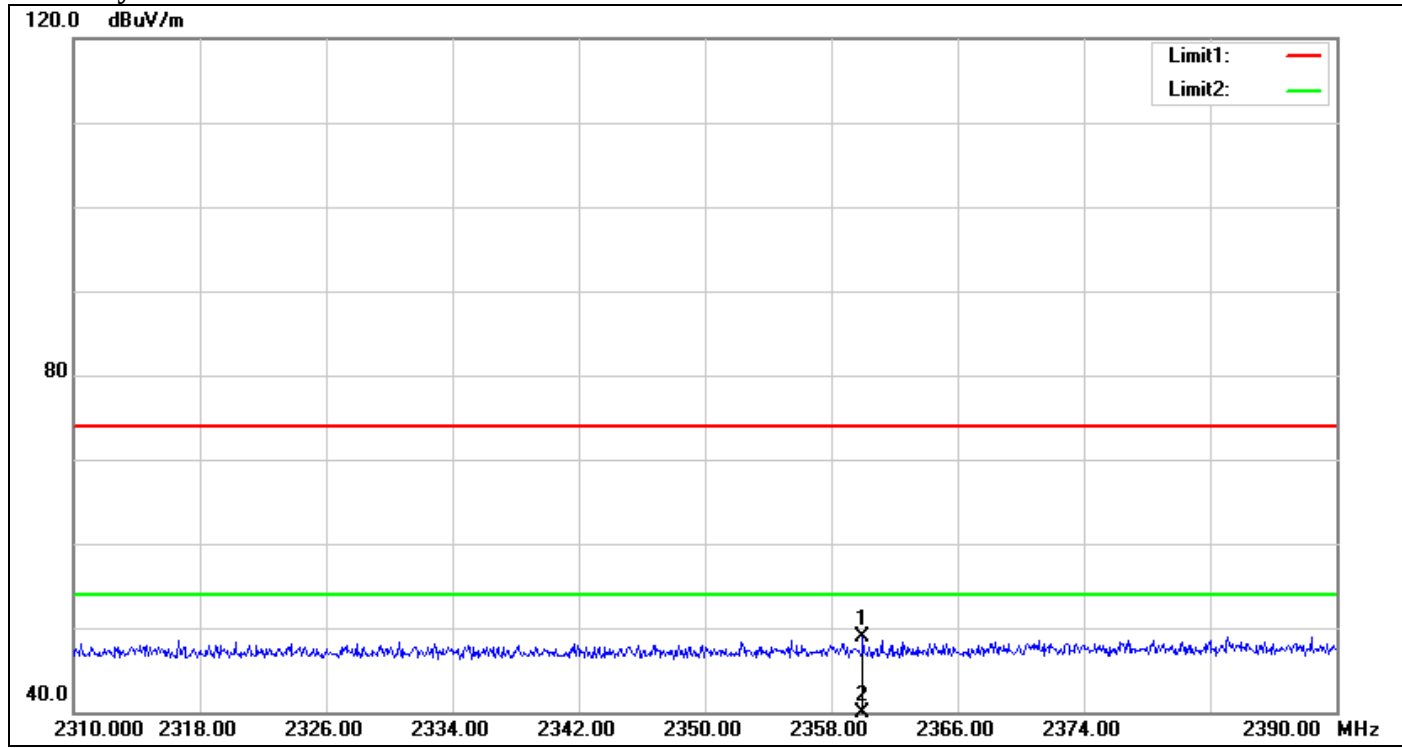


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2483.847	57.40	-1.99	55.41	74.00	-18.59	100	336	peak
2	2483.847	40.90	-1.99	38.91	54.00	-15.09	100	336	AVG

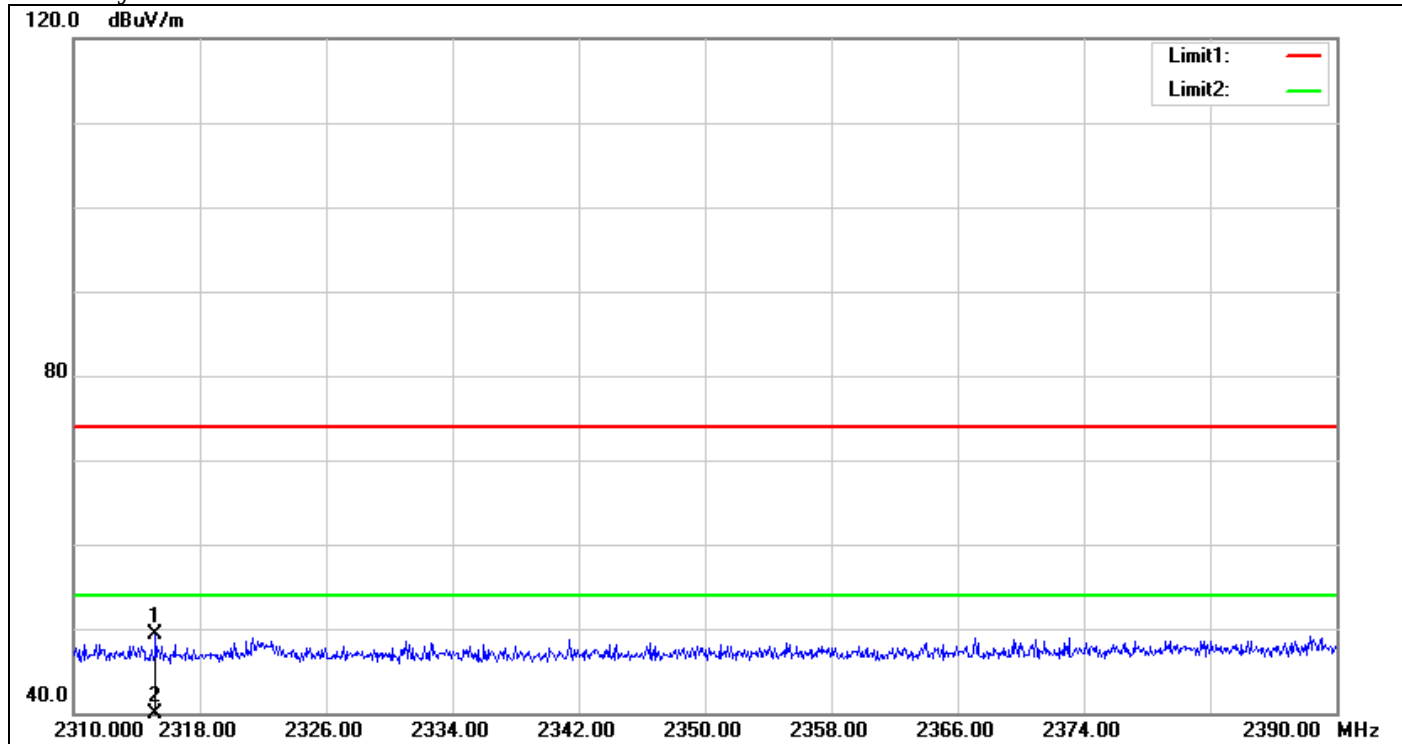
For 8DPSK / DH5

Band Edges (CH Low)

Polarity: Vertical



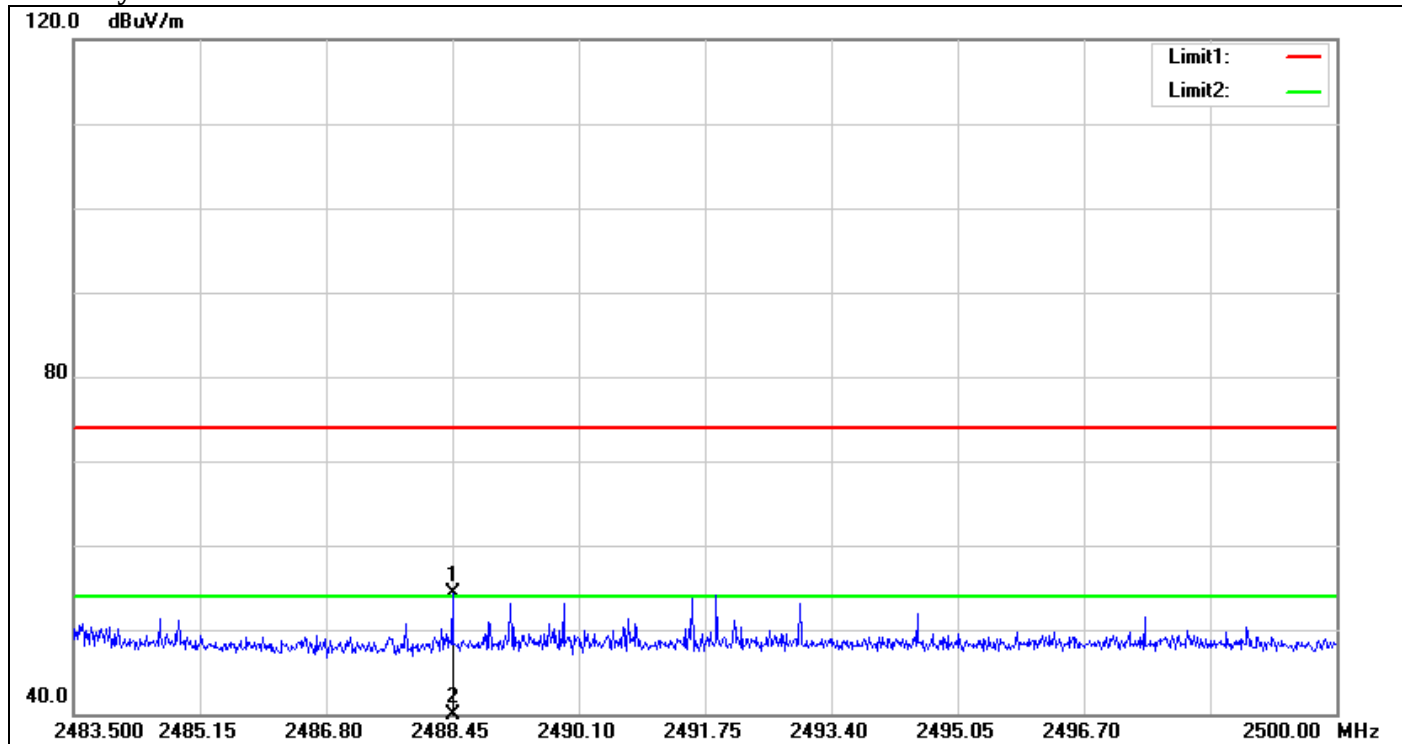
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2360.000	51.67	-2.81	48.86	74.00	-25.14	100	200	peak
2	2360.000	38.09	-2.81	35.28	54.00	-18.72	100	200	AVG

Polarity: Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2315.200	52.31	-2.98	49.33	74.00	-24.67	100	233	peak
2	2315.200	39.24	-2.98	36.26	54.00	-17.74	100	233	AVG

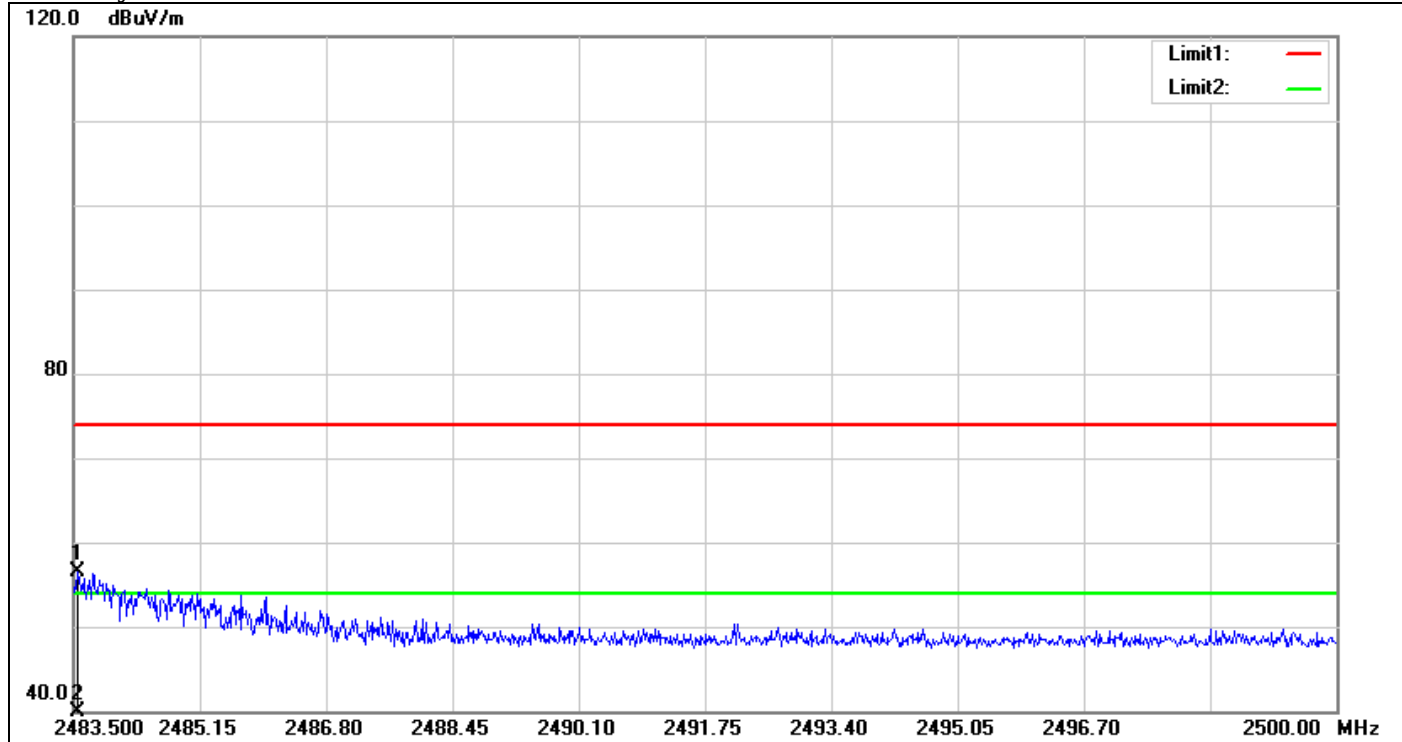
Band Edges (CH High)

Polarity: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2488.450	56.27	-1.95	54.32	74.00	-19.68	100	9	peak
2	2488.450	37.92	-1.95	35.97	54.00	-18.03	100	9	AVG

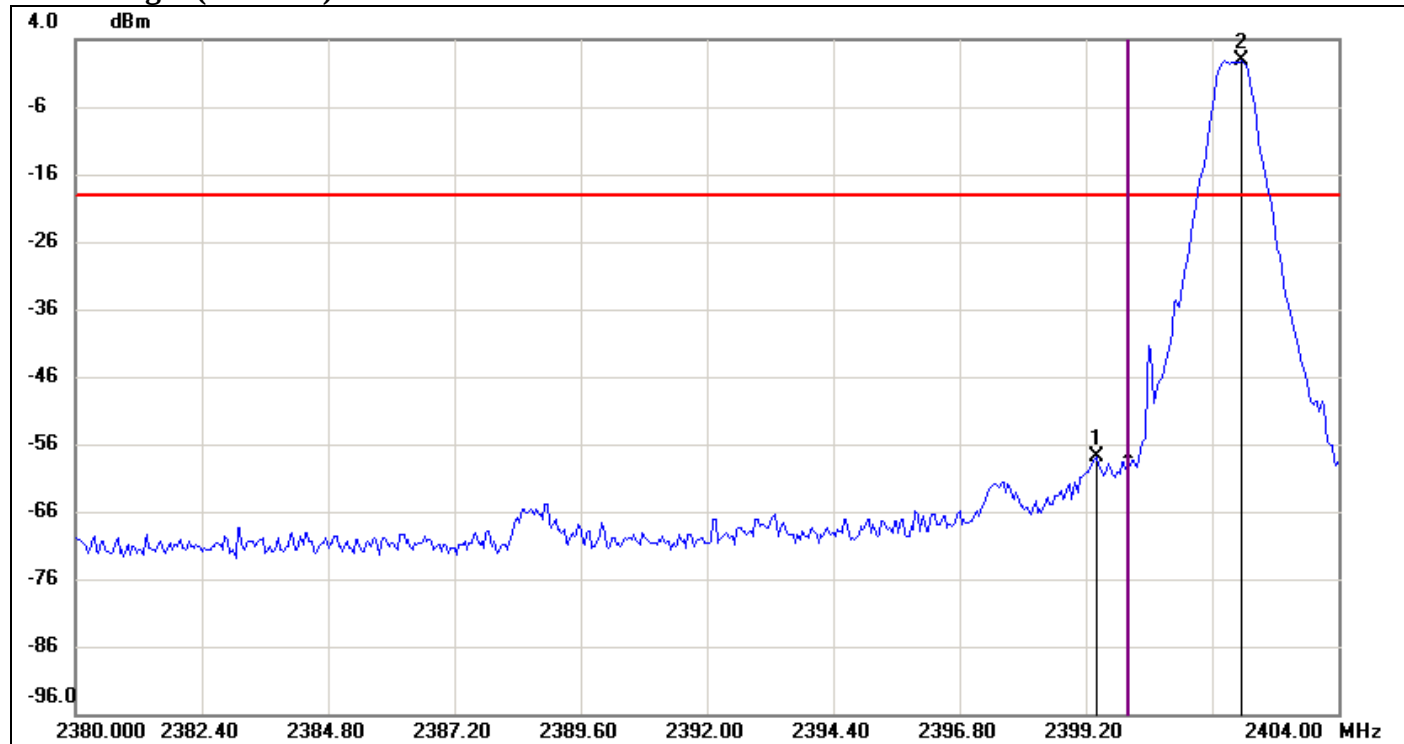
Polarity: Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2483.550	58.52	-1.99	56.53	74.00	-17.47	100	49	peak
2	2483.550	39.77	-1.99	37.78	54.00	-16.22	100	49	AVG

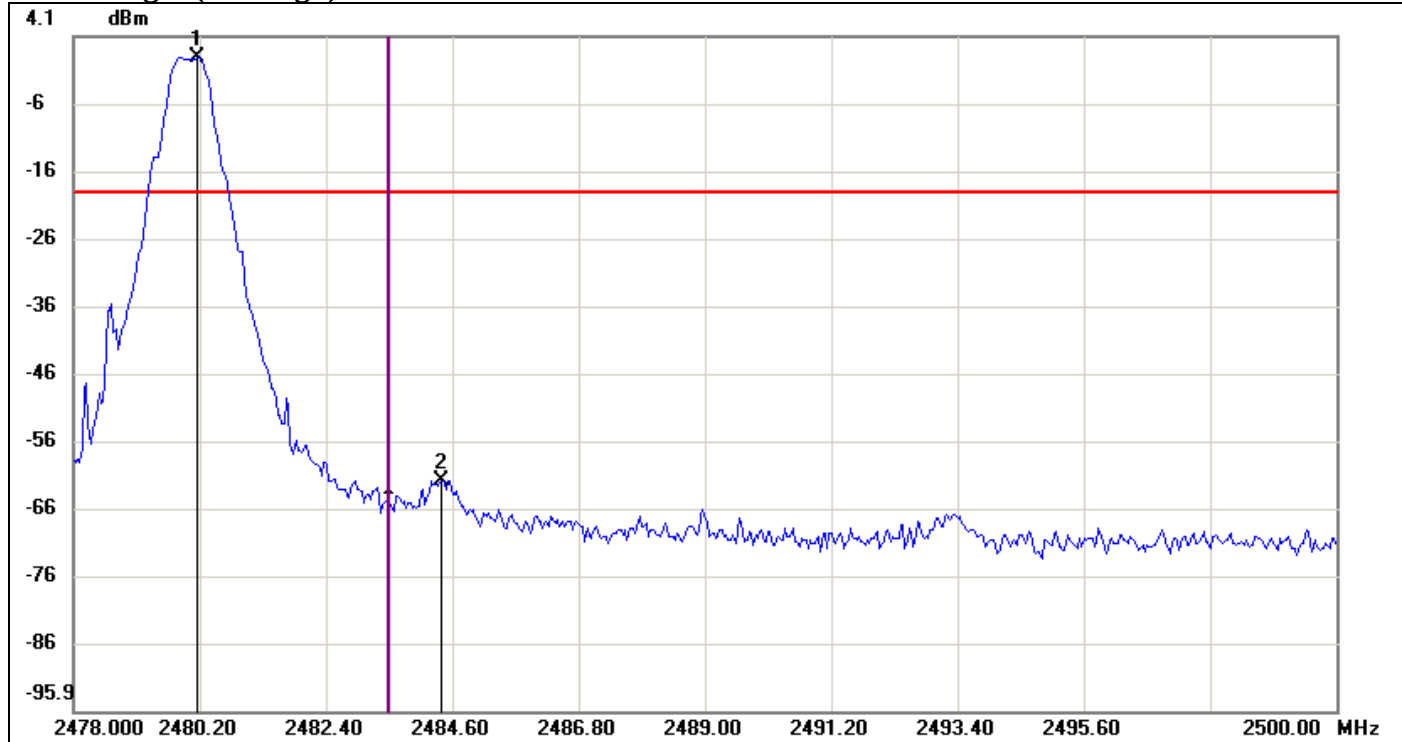
GFSK

Band Edges (CH Low)



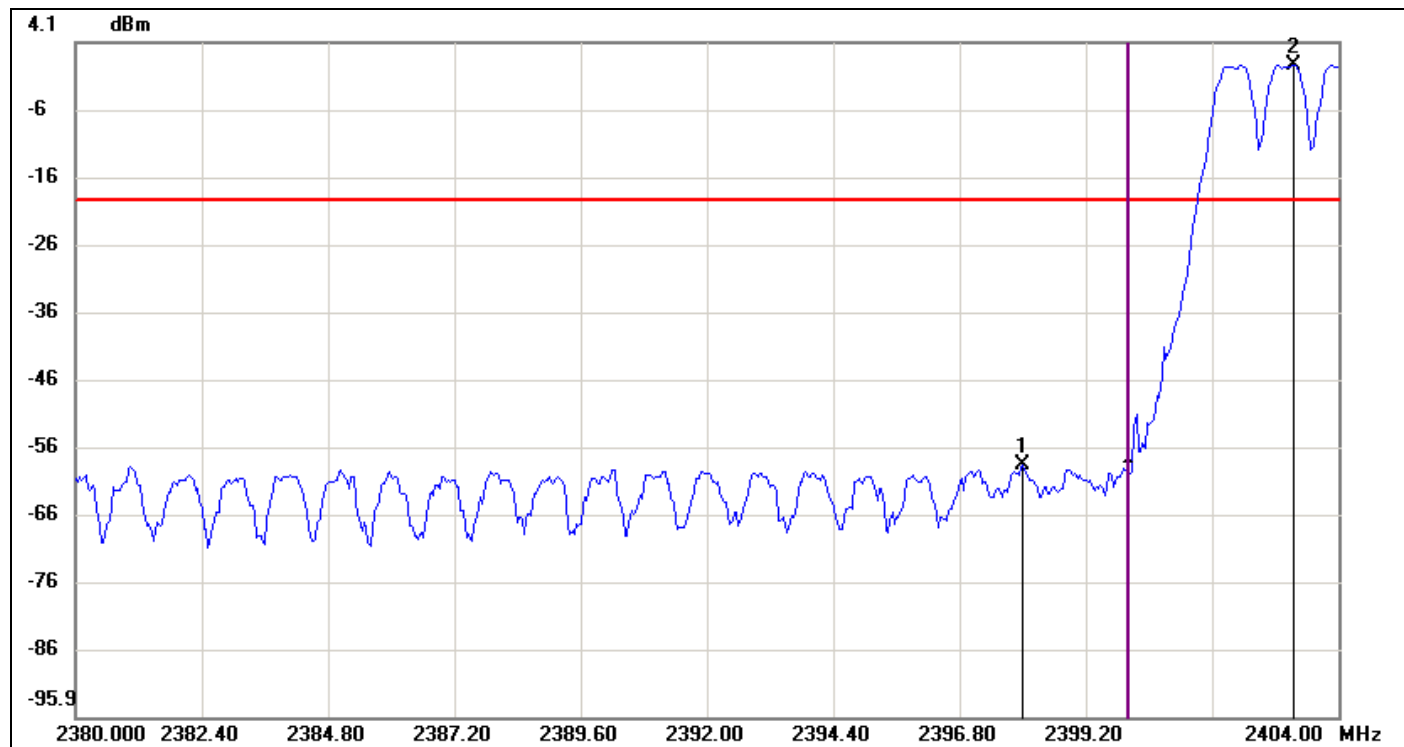
No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2399.4000	-57.94	-19.26	-38.68
2	2402.1600	0.74	-19.26	20.00

Band Edges (CH High)



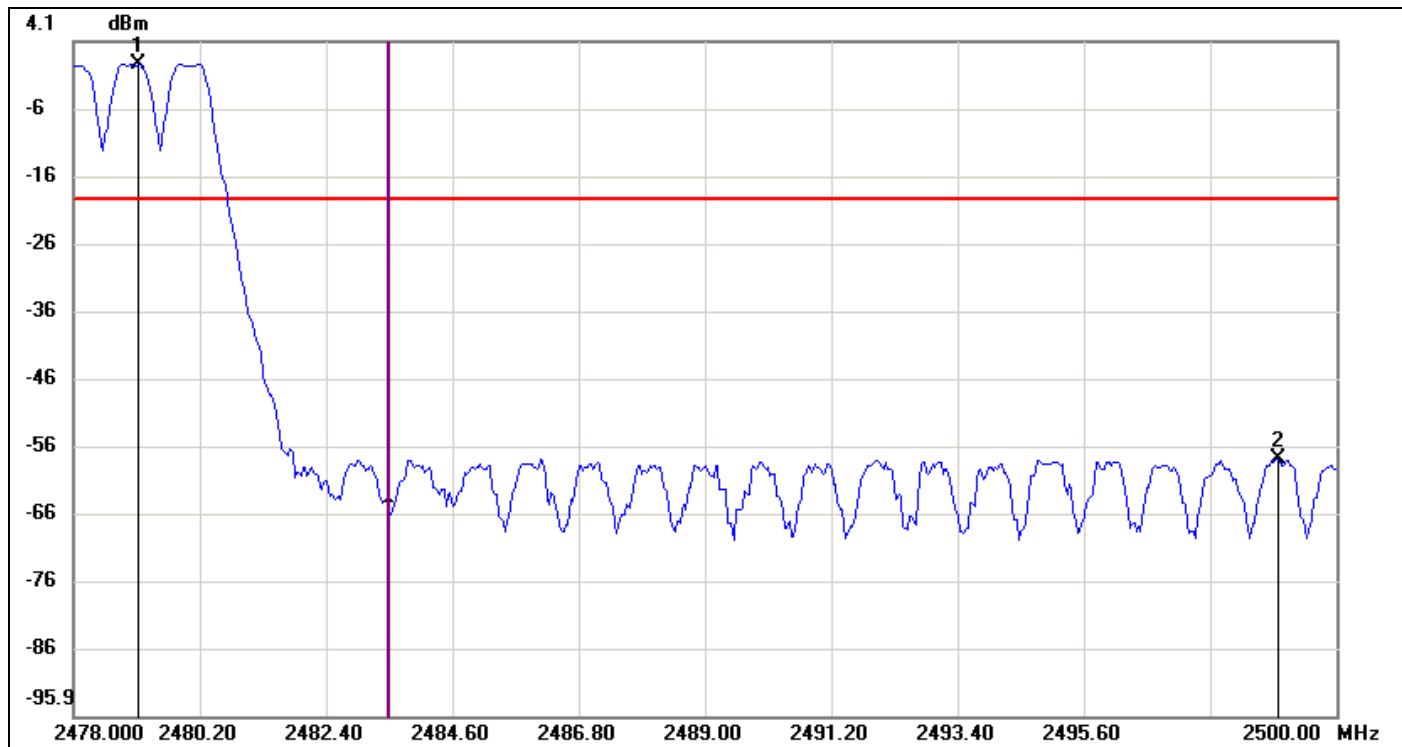
No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2480.1633	0.82	-19.18	20.00
2	2484.4167	-61.71	-19.18	-42.53

Hopping Mode (CH Low)



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2398.0000	-58.58	-19.31	-39.27
2	2403.1600	0.69	-19.31	20.00

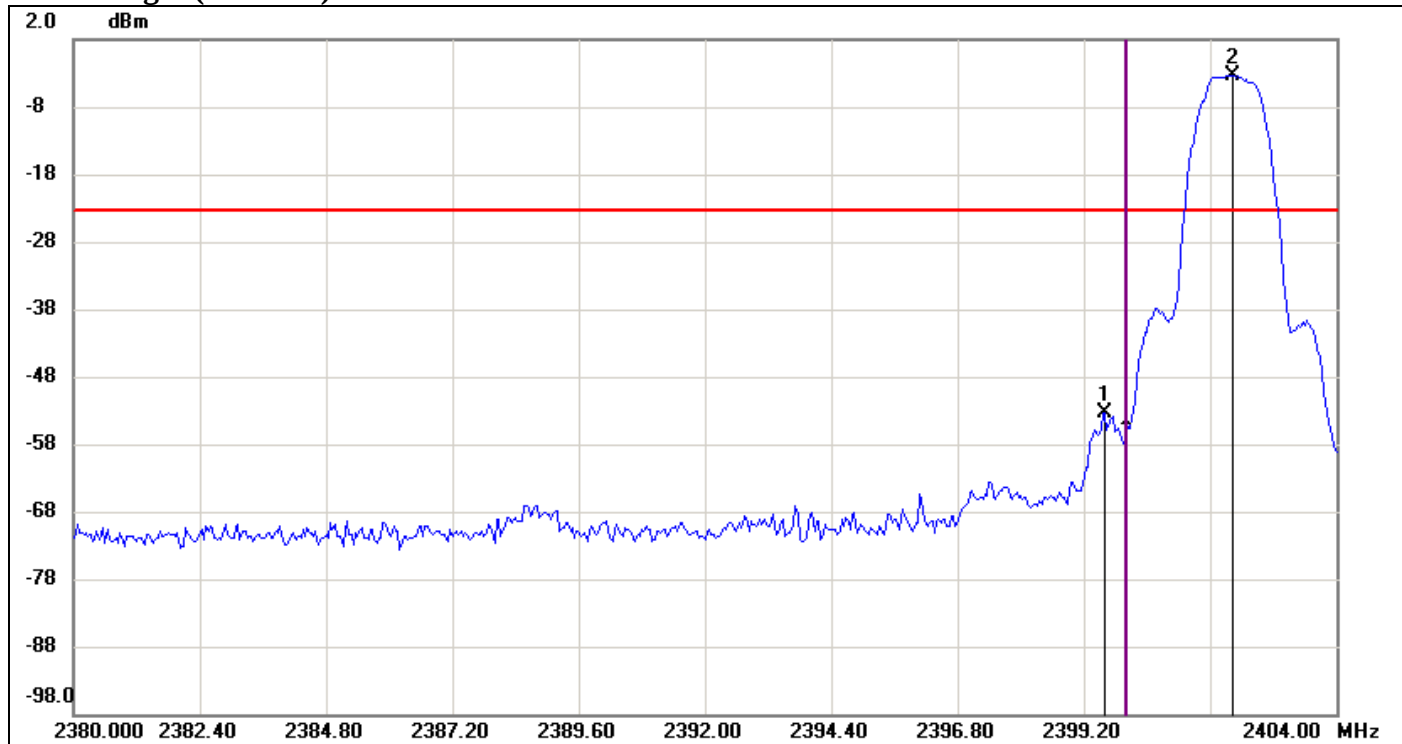
(CH High)



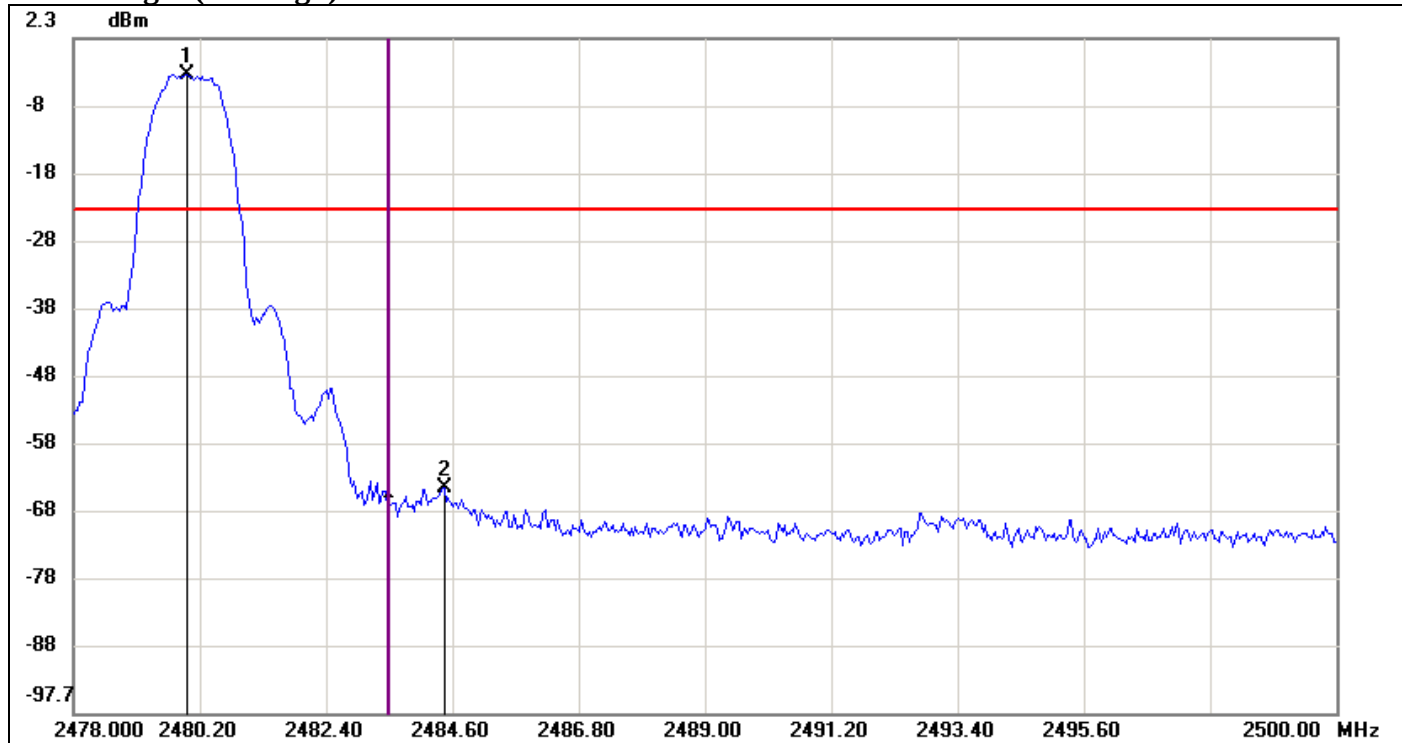
No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2479.1367	0.75	-19.25	20.00
2	2498.9733	-57.85	-19.25	-38.60

8DPSK

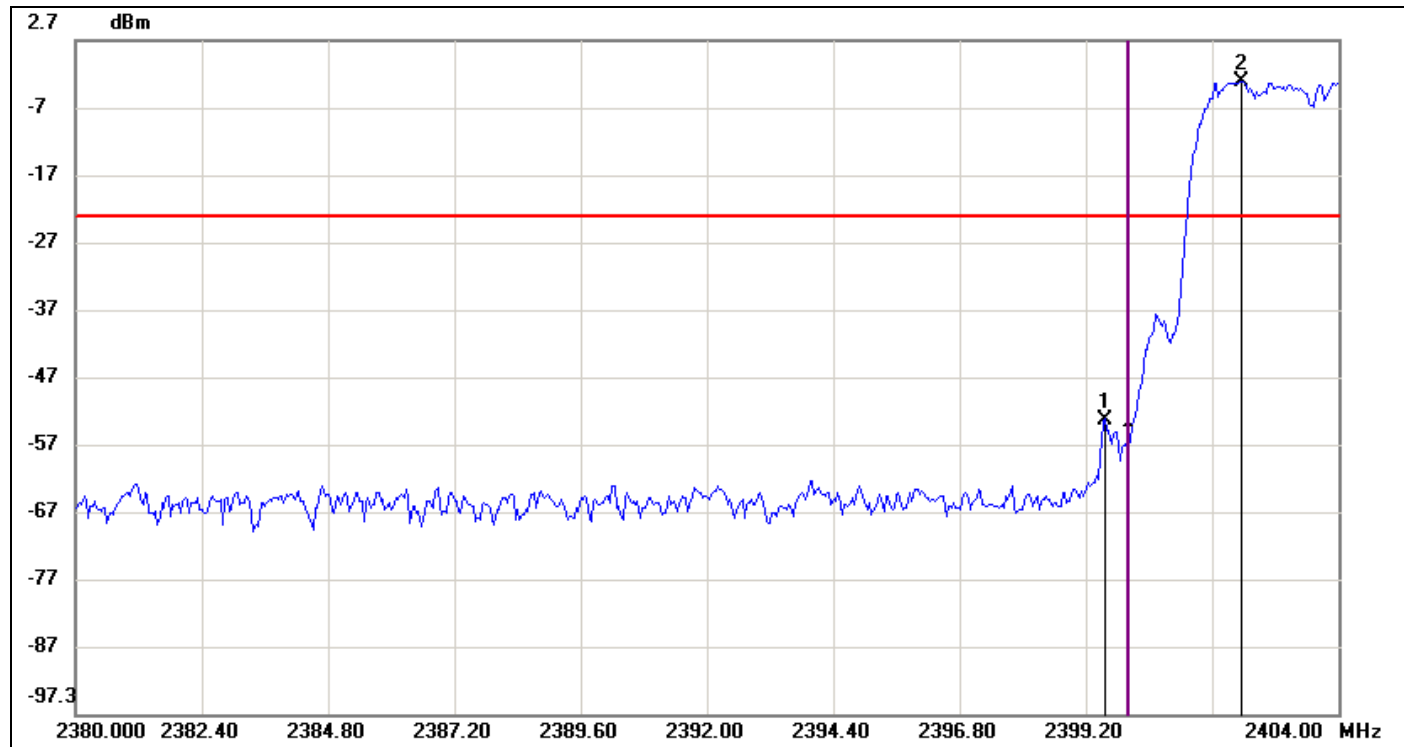
Band Edges (CH Low)



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2399.6000	-53.38	-23.36	-30.02
2	2402.0400	-3.36	-23.36	20.00

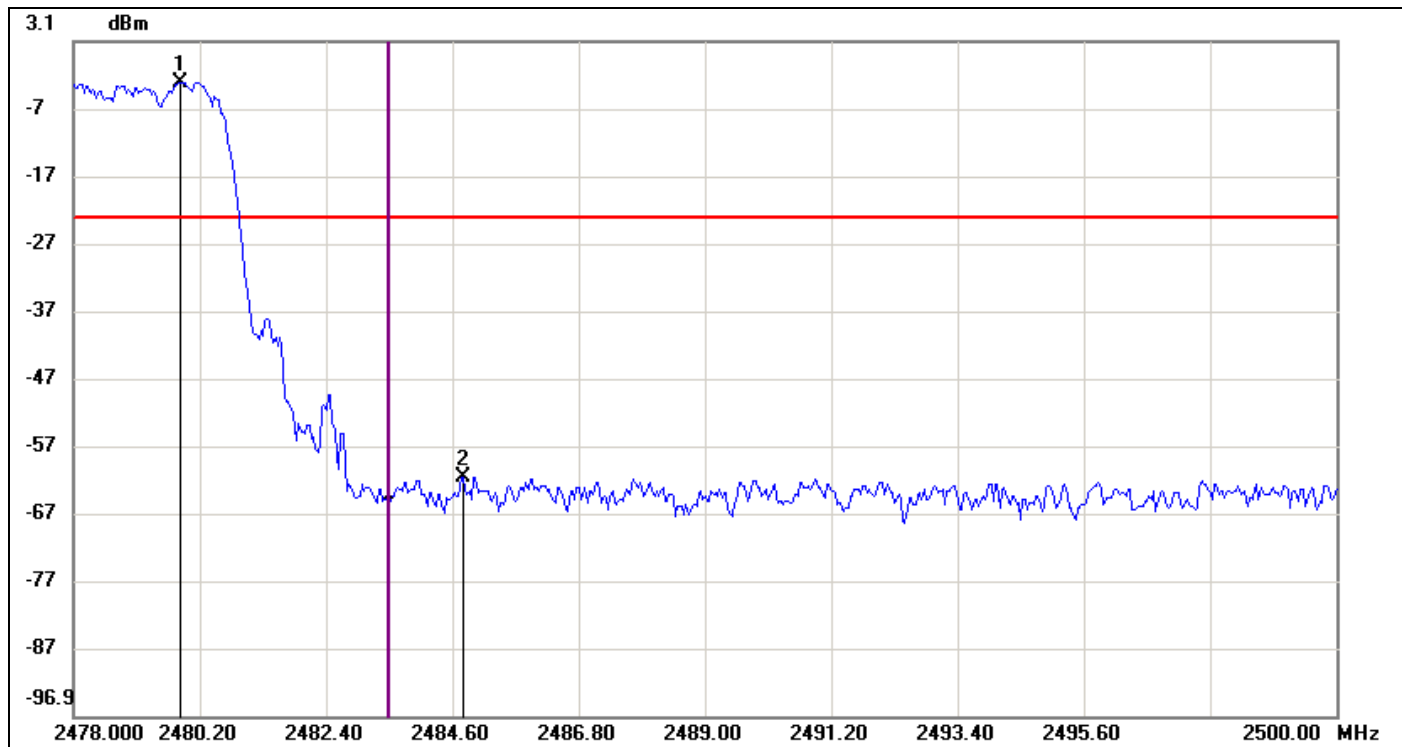
Band Edges (CH High)

No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2479.9800	-3.05	-23.05	20.00
2	2484.4533	-64.37	-23.05	-41.32

Hopping Mode**(CH Low)**

No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2399.5600	-53.53	-23.42	-30.11
2	2402.1600	-3.42	-23.42	20.00

(CH High)



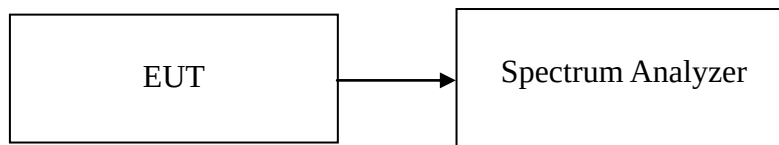
No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2479.8700	-3.03	-23.03	20.00
2	2484.7833	-61.54	-23.03	-38.51

7.6 FREQUENCY SEPARATION

LIMIT

According to §15.247(a)(1) & RSS-247, 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, Sweep = 3.2 ms.
5. Max hold, mark 3 peaks of hopping channel and record the 3 peaks frequency.

TEST RESULTS

No non-compliance noted

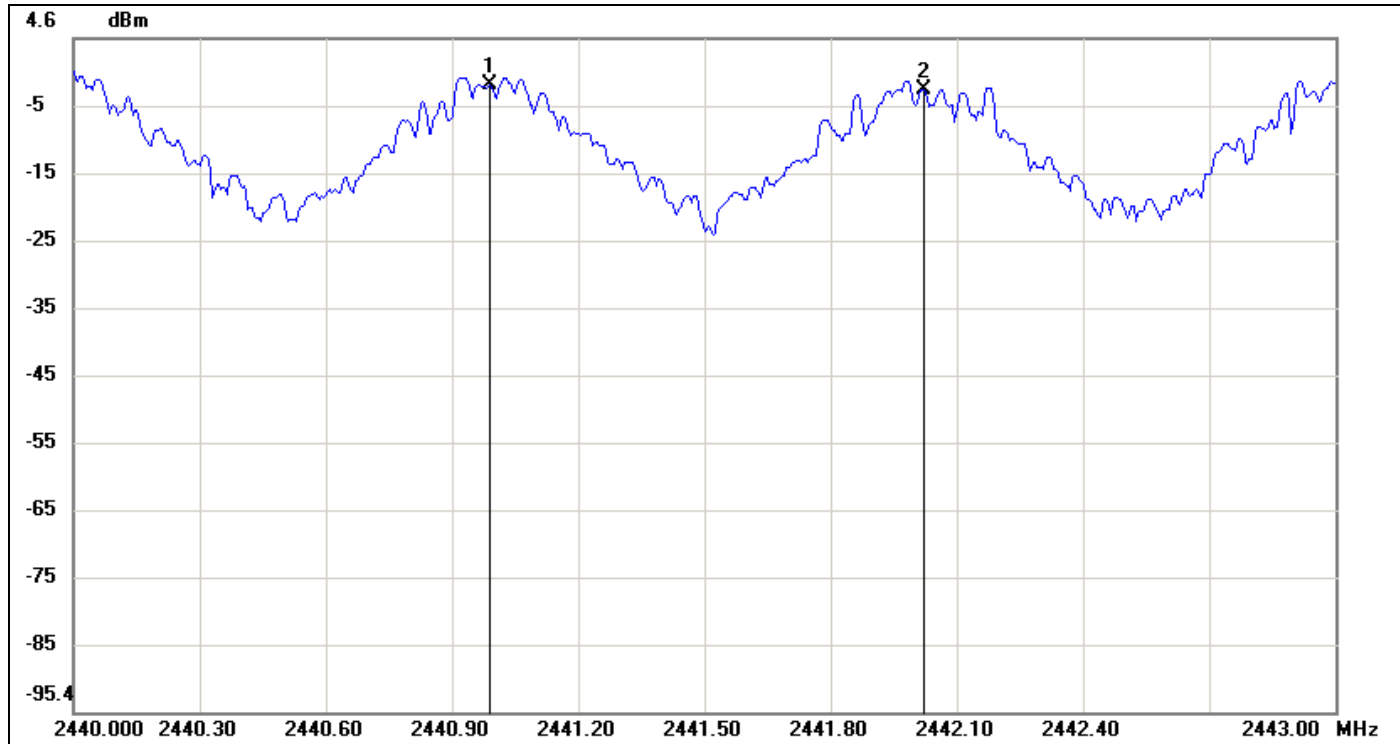
Test Data

For GFSK / DH5

Channel Separation (MHz)	two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit	Result
1.03	0.693	>two-thirds of the 20 dB bandwidth	Pass

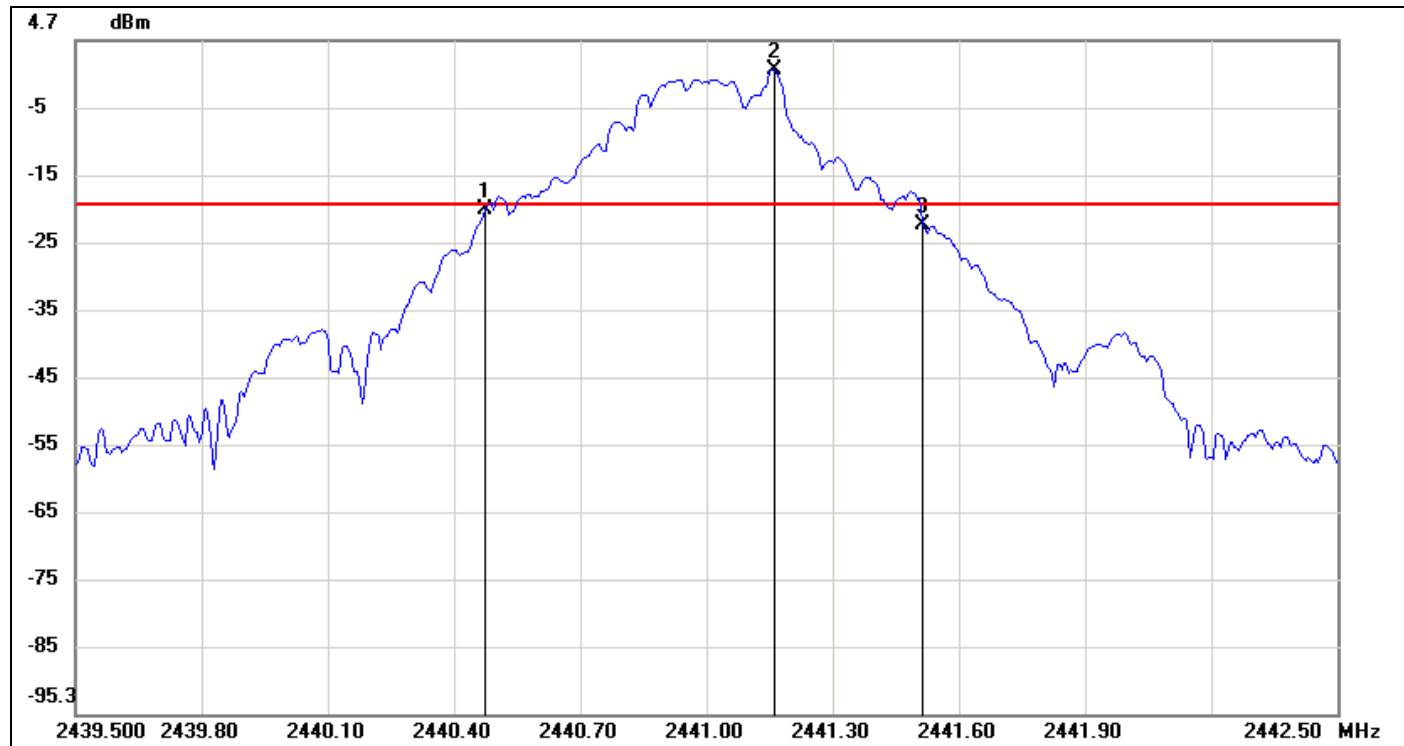
For 8DPSK / DH5

Channel Separation (MHz)	two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit	Result
1.045	0.883	>two-thirds of the 20 dB bandwidth	Pass

Test Plot**For GFSK / DH5****Measurement of Channel Separation**

No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2440.9900	-2.26		
2	2442.0200	-2.90		

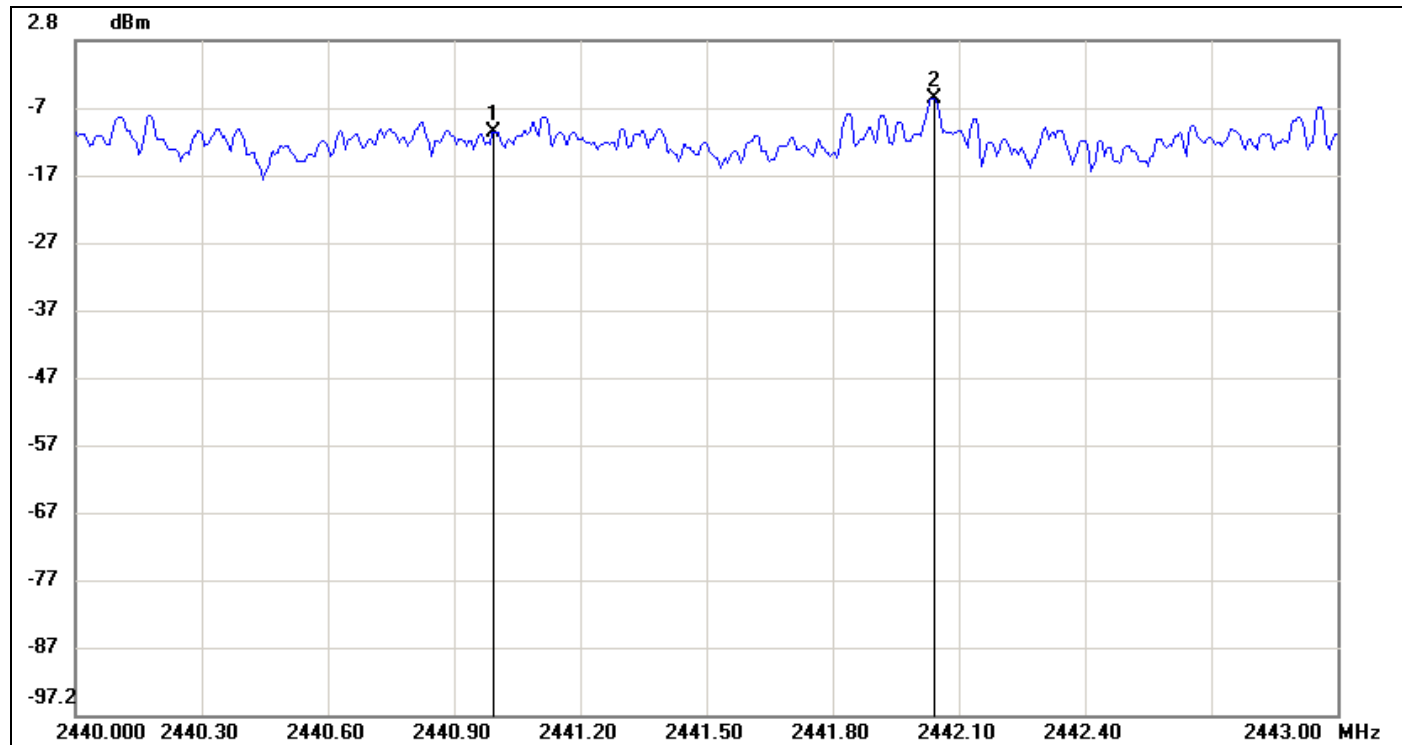
No.		Δ Frequency(MHz)	Δ Level(dB)
1	mk2-mk1	1.03	-0.64

Measurement of 20dB Bandwidth

No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2440.4750	-20.51	-19.74	-0.77
2	2441.1600	0.26	-19.74	20.00
3	2441.5150	-22.72	-19.74	-2.98

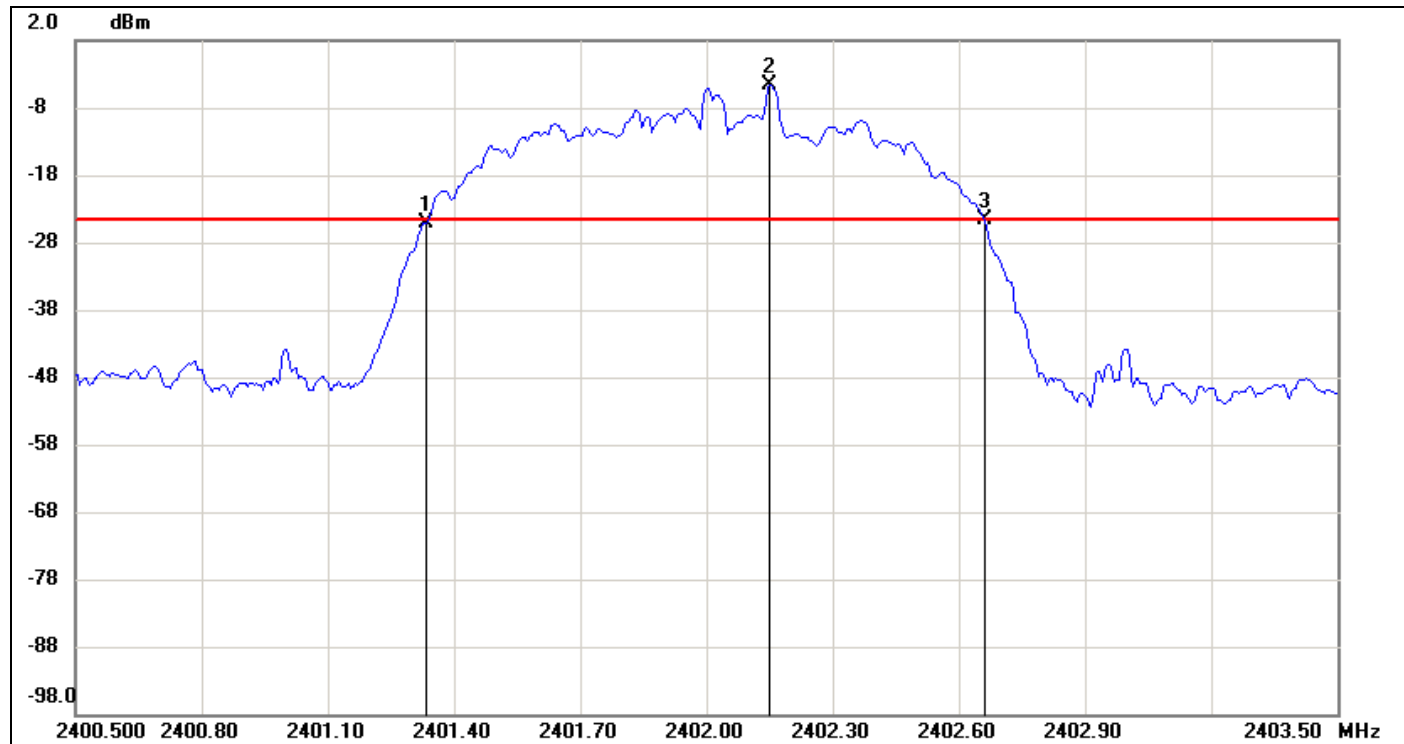
No.		Δ Frequency(MHz)	Δ Level(dB)
1	mk3-mk1	1.04	-2.21

For 8DPSK / DH5

Measurement of Channel Separation

No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2440.9950	-10.81		
2	2442.0400	-5.89		

No.		Δ Frequency(MHz)	Δ Level(dB)
1	mk2-mk1	1.045	4.92

Measurement of 20dB Bandwidth

No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2401.3350	-25.09	-24.57	-0.52
2	2402.1500	-4.57	-24.57	20.00
3	2402.6600	-24.59	-24.57	-0.02

No.		Δ Frequency(MHz)	Δ Level(dB)
1	mk3-mk1	1.325	0.5

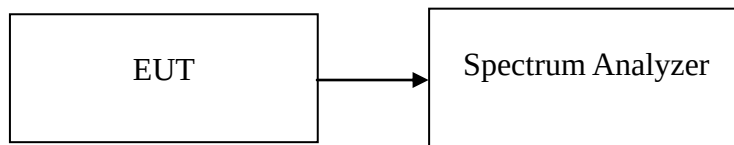
7.7 NUMBER OF HOPPING FREQUENCY

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-247, 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

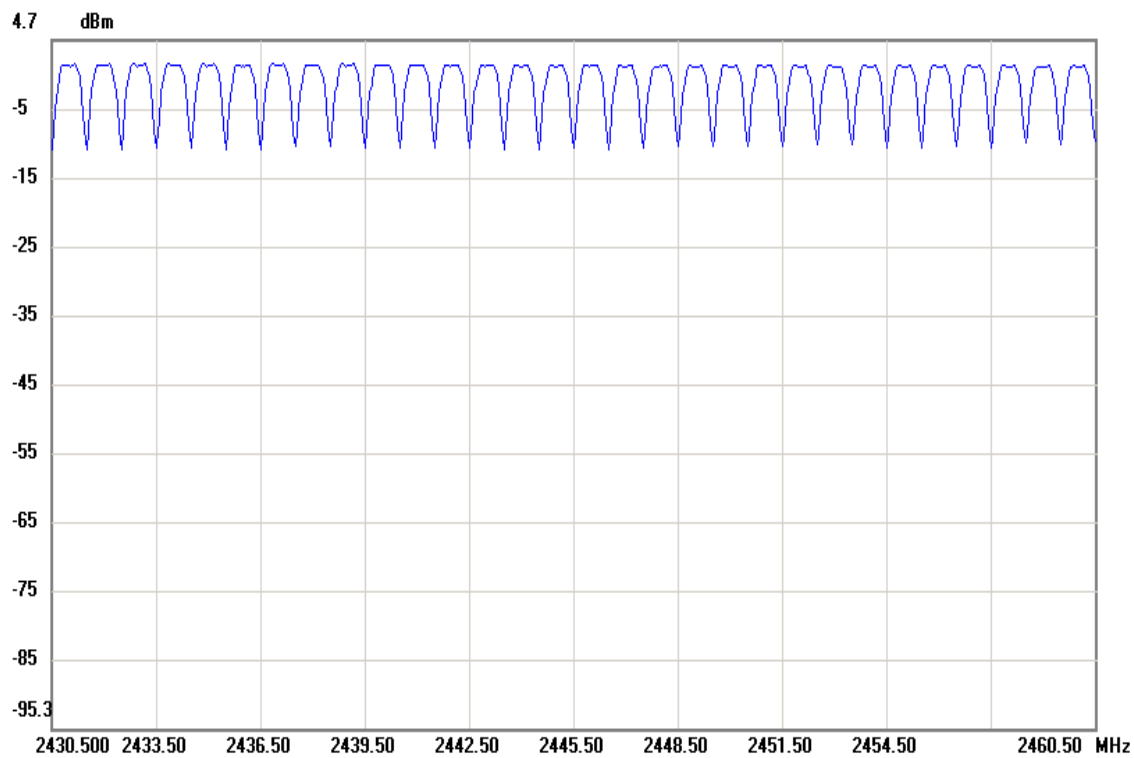
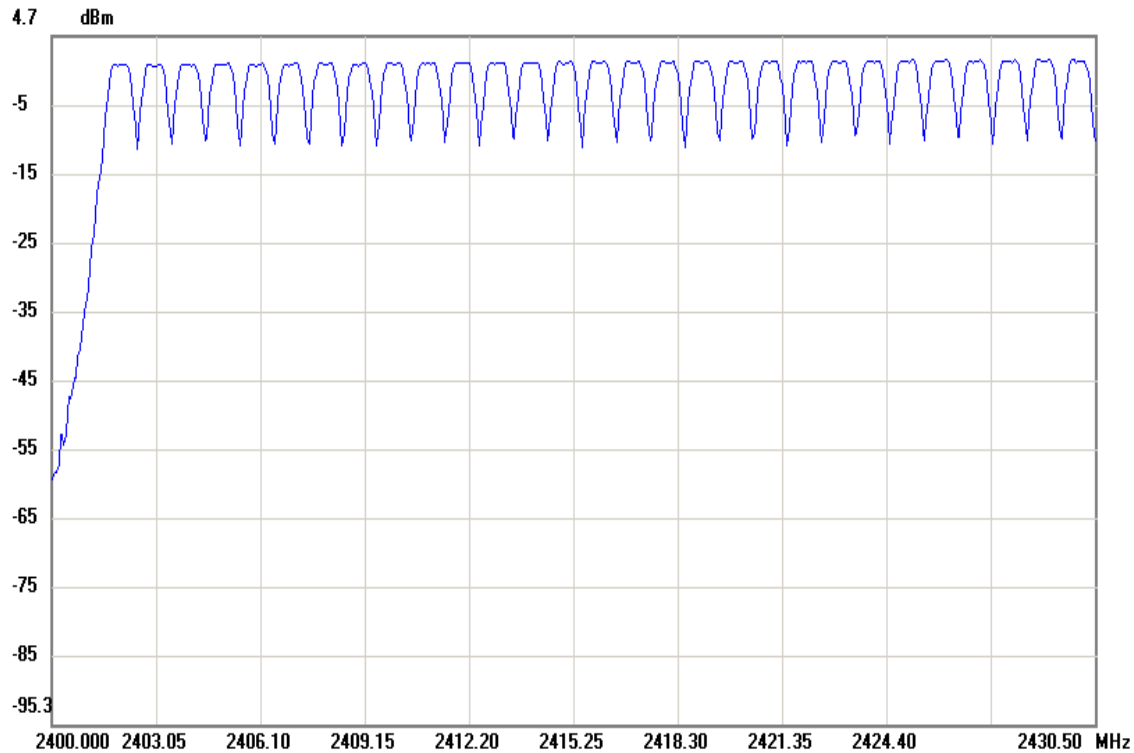
Test Data

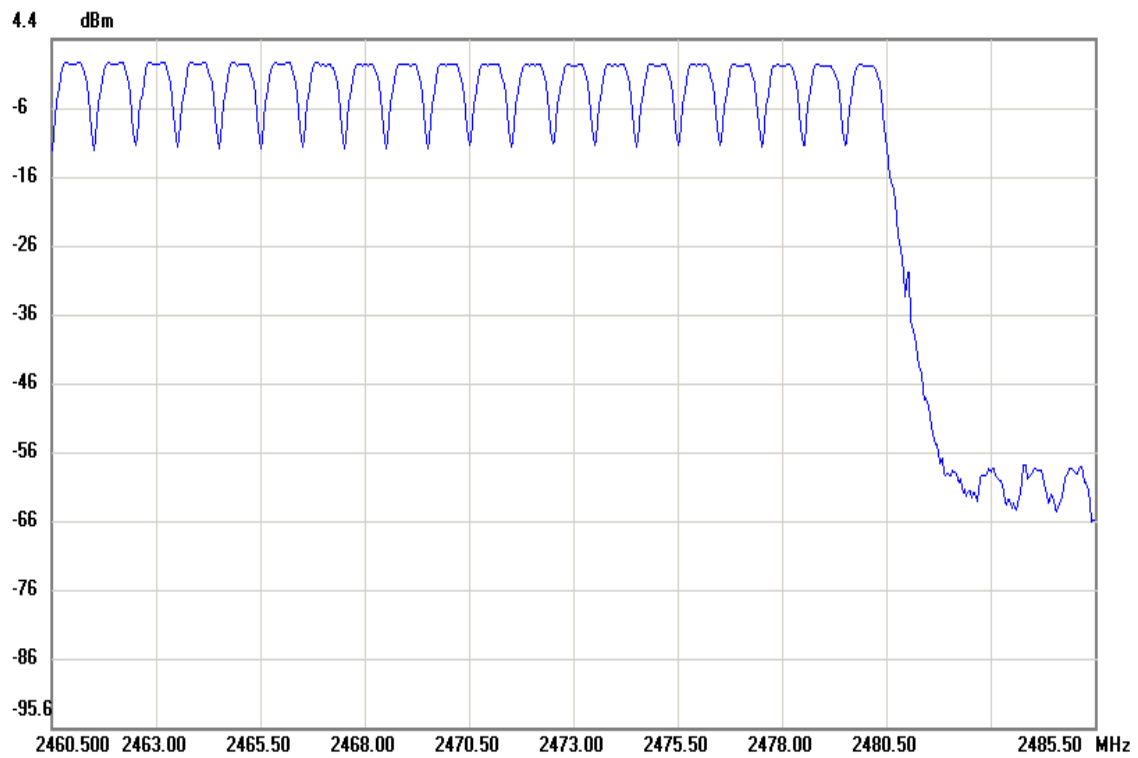
Result (No. of CH)	Limit (No. of CH)	Result
79	>15	PASS

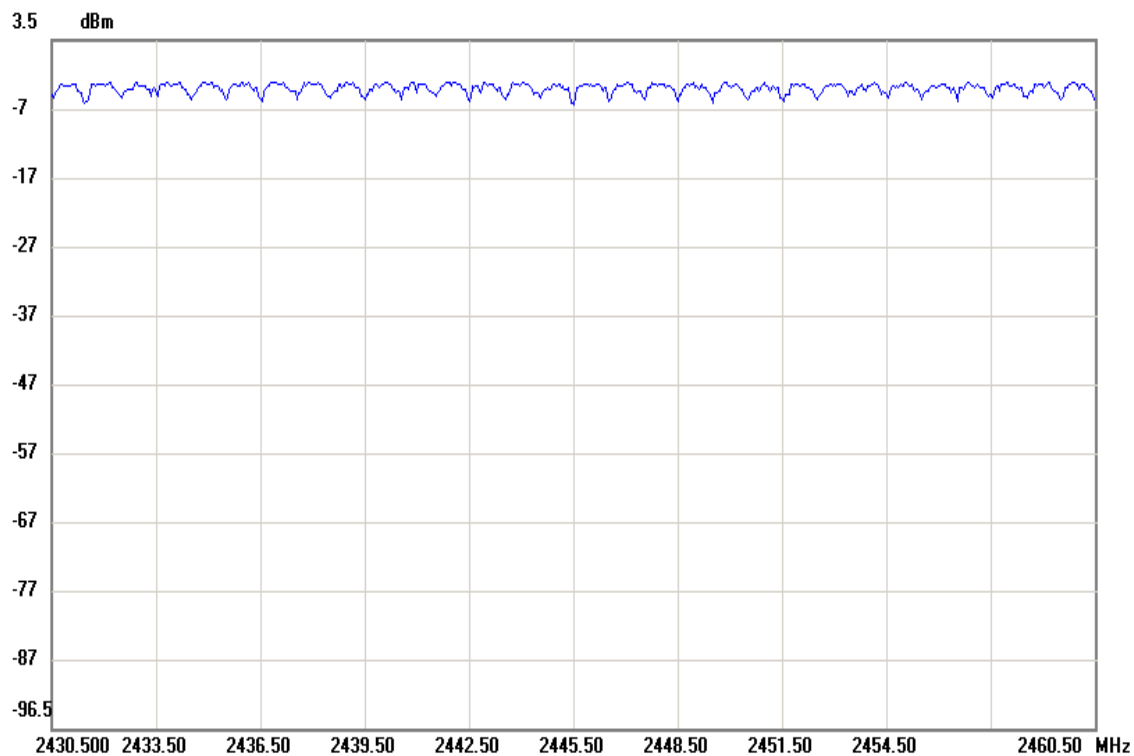
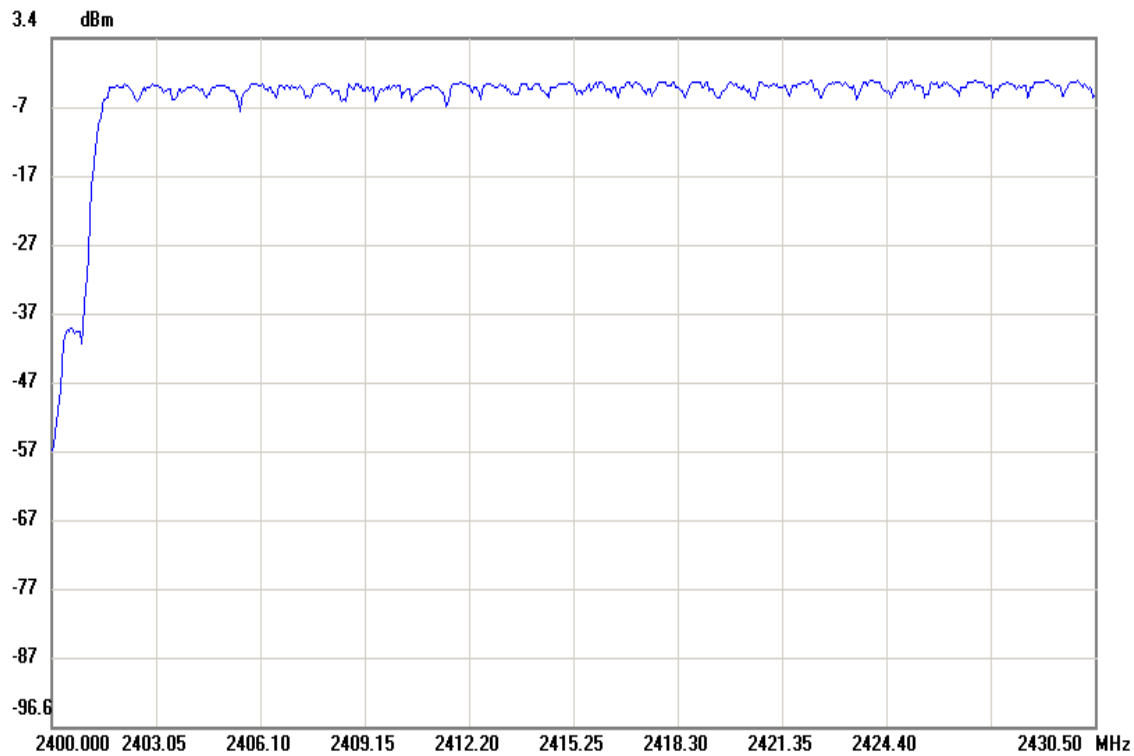
Test Plot

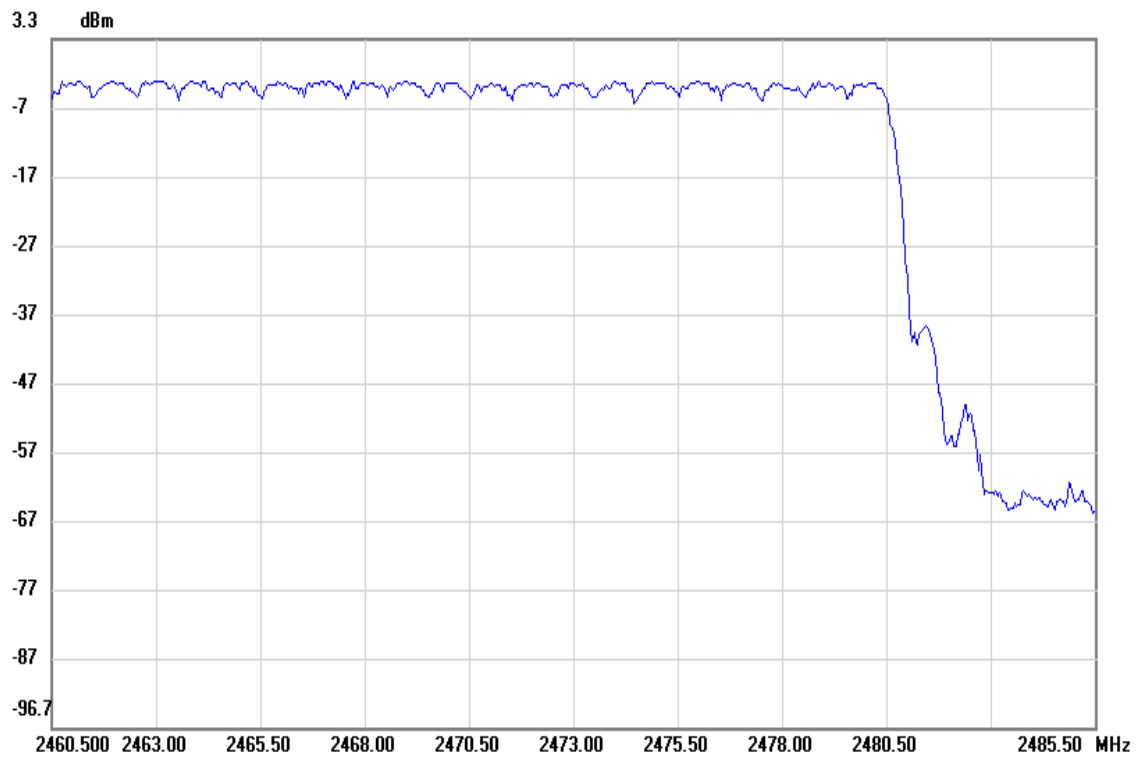
For GFSK

Channel Number





For 8DPSK**Channel Number**



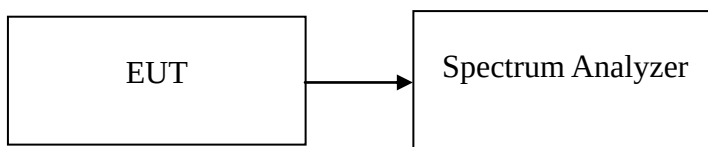
7.8 TIME OF OCCUPANCY (DWELL TIME)

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-247, 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, Sweep = 1 ms.
5. Repeat above procedures until all frequency measured were complete.

TEST RESULTS

No non-compliance noted

Test Data**For GFSK**

DH 1: $0.3867 * (1600/2)/79 * 31.6 = 123.7$ (ms)

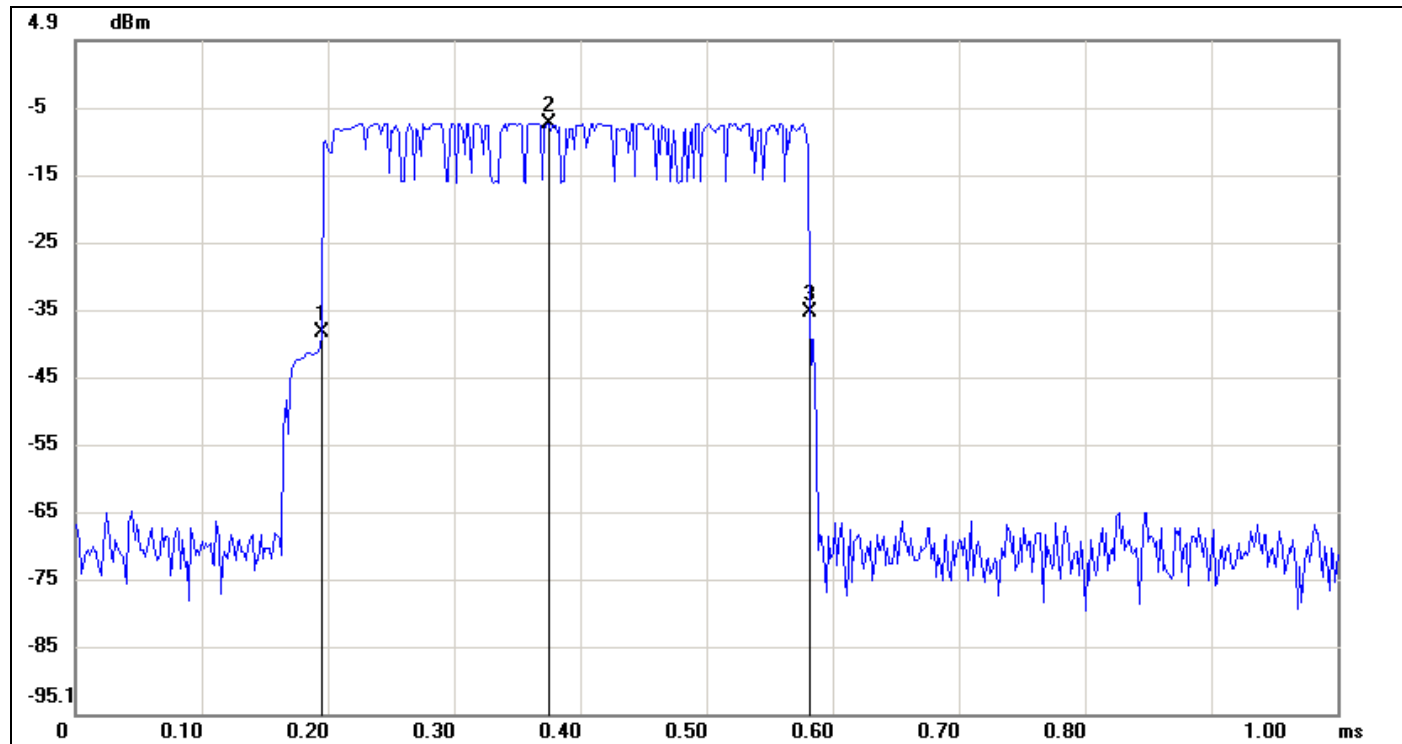
DH 3: $1.65 * (1600/4)/79 * 31.6 = 264.0$ (ms)

DH 5: $2.9083 * (1600/6)/79 * 31.6 = 310.2$ (ms)

	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
DH 1	0.3867	123.7	31.60	400.00	PASS
DH 3	1.65	264.0	31.60		PASS
DH 5	2.9083	310.2	31.60		PASS

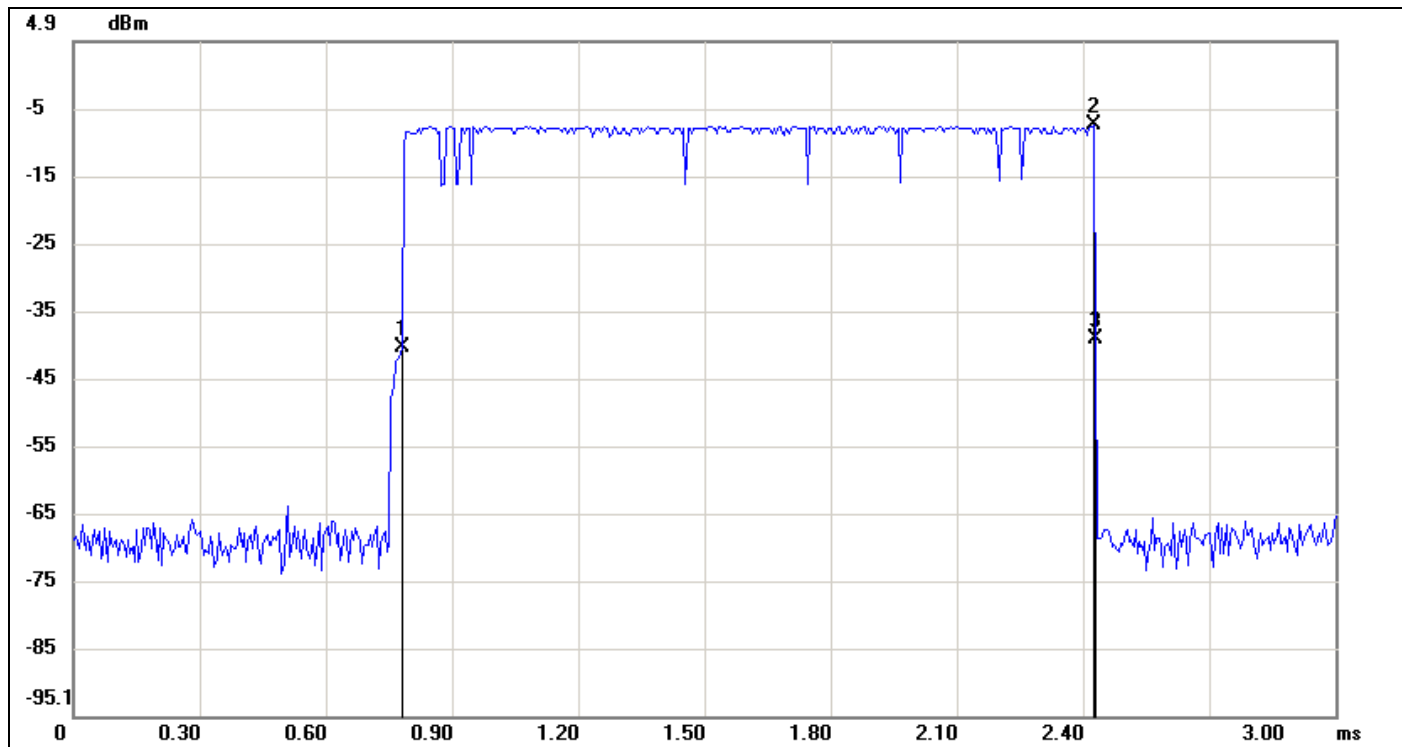
Test Plot
For GFSK

DH 1



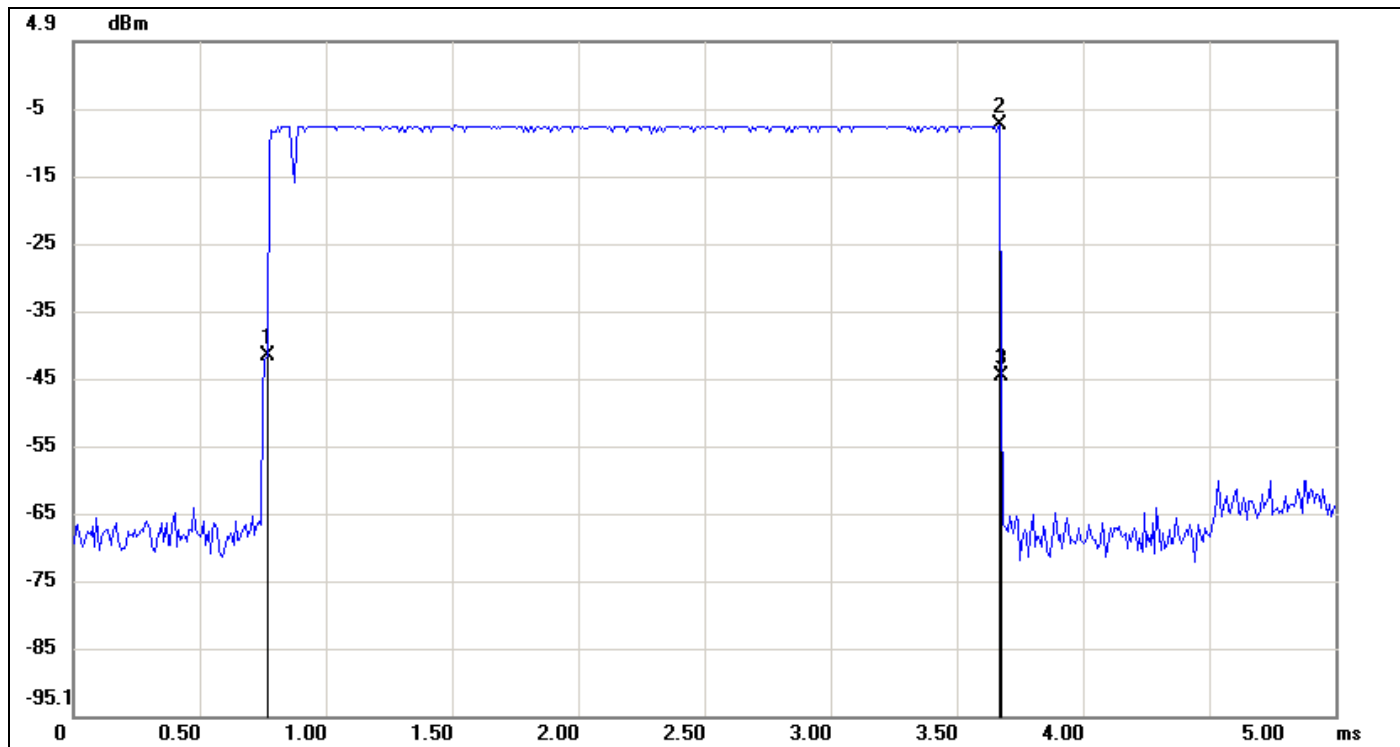
No.	Sweep time(ms)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	0.1950	-38.49		
2	0.3750	-7.42		
3	0.5817	-35.45		

No.		Δ Time(ms)	Δ Level(dB)
1	mk3-mk1	0.3867	3.04

DH 3

No.	Sweep time(ms)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	0.7800	-40.56		
2	2.4250	-7.49		
3	2.4300	-39.23		

No.		Δ Time(ms)	Δ Level(dB)
1	mk3-mk1	1.65	1.33

DH 5

No.	Sweep time(ms)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	0.7667	-41.74		
2	3.6667	-7.46		
3	3.6750	-44.77		

No.		Δ Time(ms)	Δ Level(dB)
1	mk3-mk1	2.9083	-3.03

Test Data**For 8DPSK**

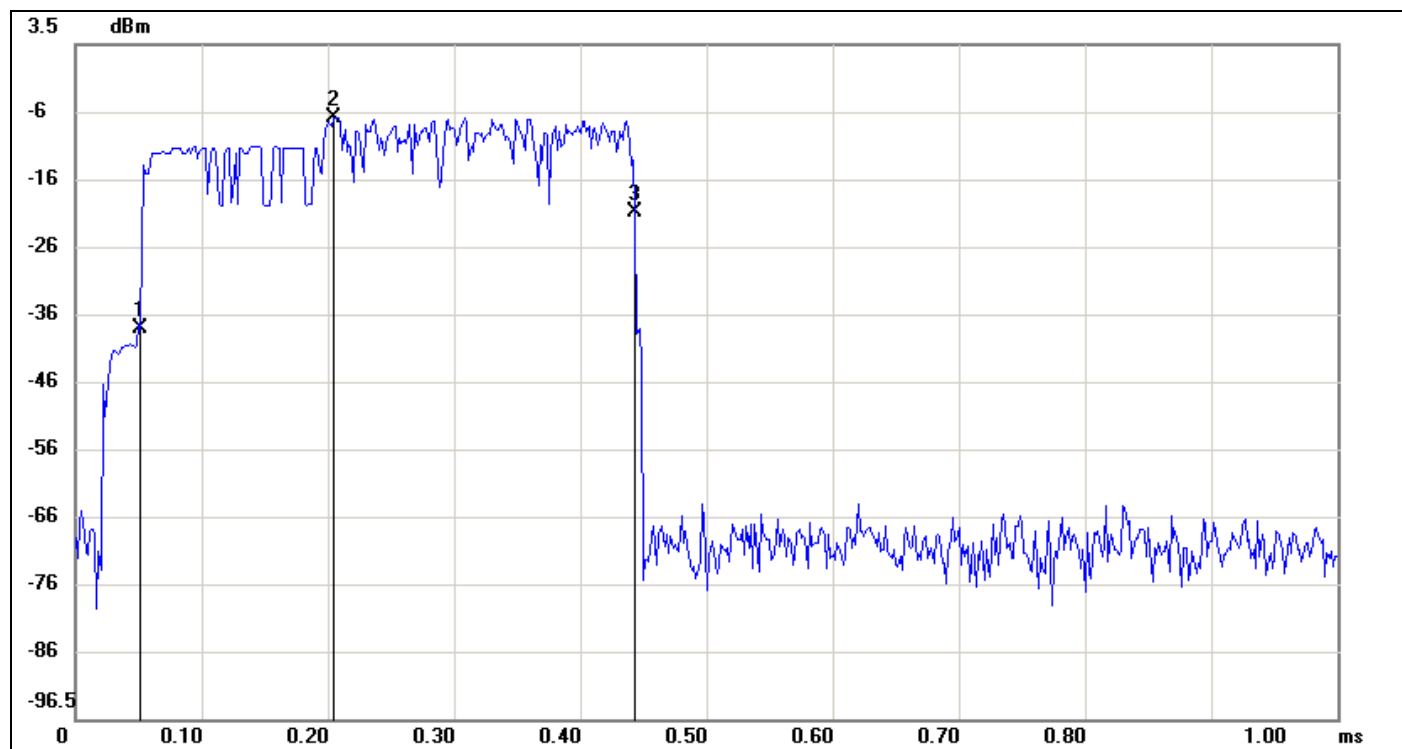
DH 1: $0.3916 * (1600/2)/79 * 31.6 = 125.3$ (ms)

DH 3: $1.65 * (1600/4)/79 * 31.6 = 264.0$ (ms)

DH 5: $2.9084 * (1600/6)/79 * 31.6 = 310.2$ (ms)

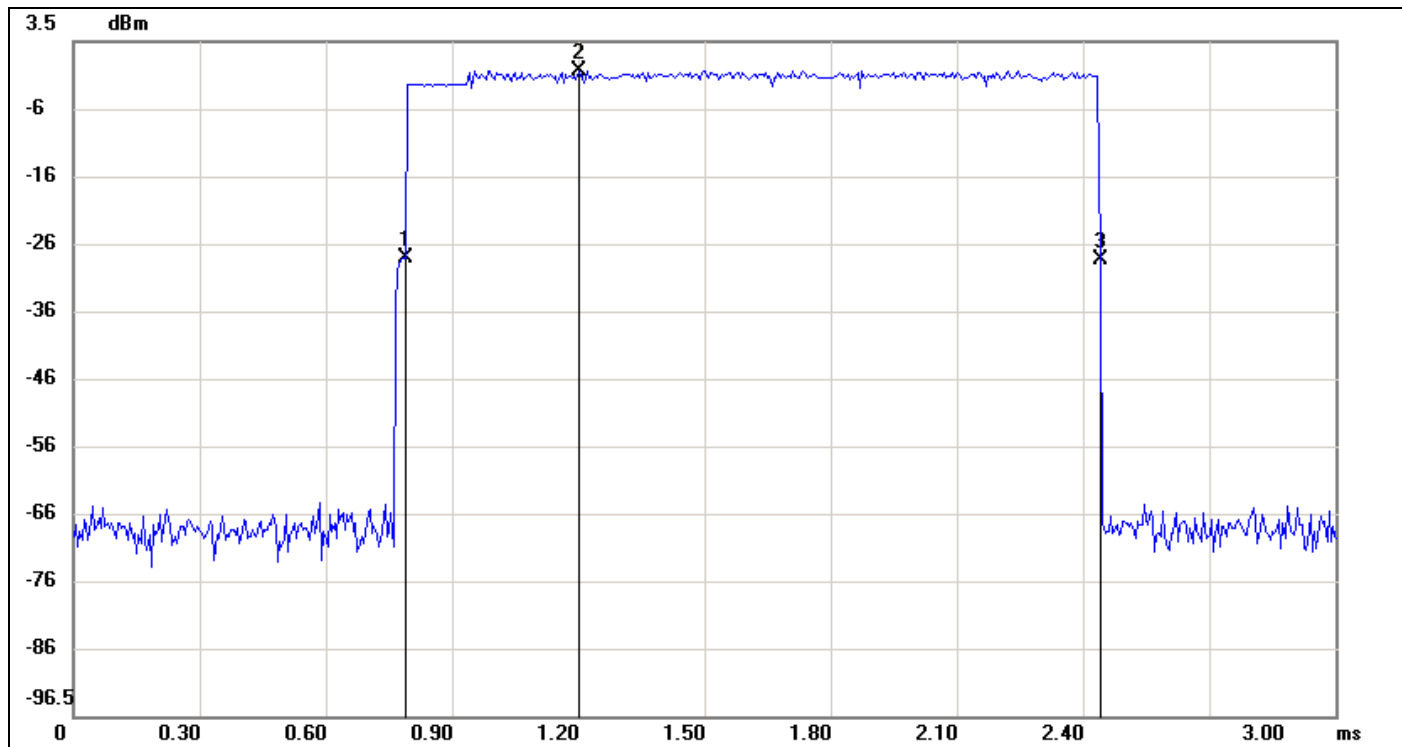
	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
DH 1	0.3916	125.3	31.60	400.00	PASS
DH 3	1.65	264.0	31.60		PASS
DH 5	2.9084	310.2	31.60		PASS

For 8DPSK

DH 1

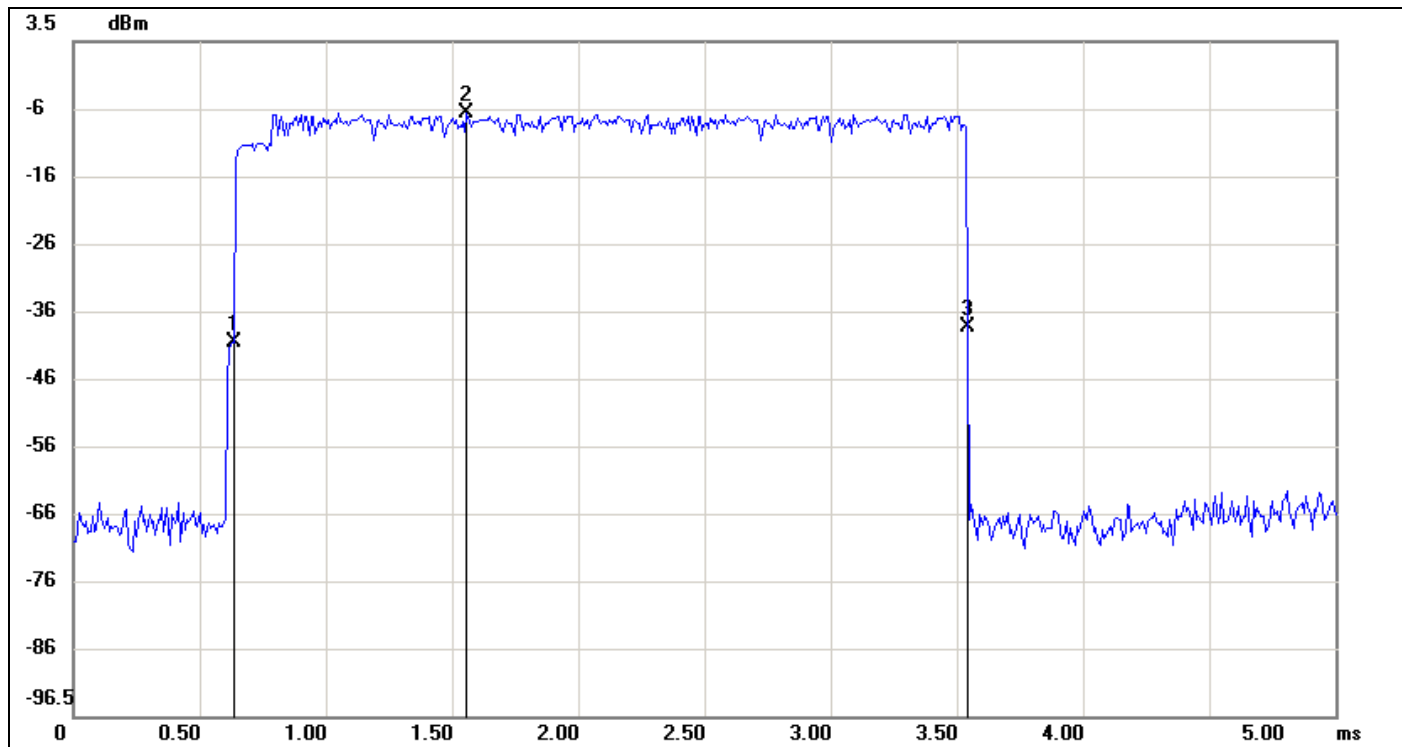
No.	Sweep time(ms)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	0.0517	-38.63		
2	0.2050	-7.27		
3	0.4433	-21.32		

No.		Δ Time(ms)	Δ Level(dB)
1	mk3-mk1	0.3916	17.31

DH 3

No.	Sweep time(ms)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	0.7900	-28.52		
2	1.2000	-0.75		
3	2.4400	-28.95		

No.		Δ Time(ms)	Δ Level(dB)
1	mk3-mk1	1.65	-0.43

DH 5

No.	Sweep time(ms)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	0.6333	-41.06		
2	1.5583	-7.18		
3	3.5417	-38.83		

No.		Δ Time(ms)	Δ Level(dB)
1	mk3-mk1	2.9084	2.23

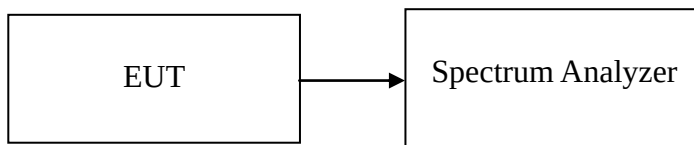
7.9 SPURIOUS EMISSIONS

7.9.1 Conducted Measurement

LIMIT

According to §15.247(d) & RSS-247, 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, 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

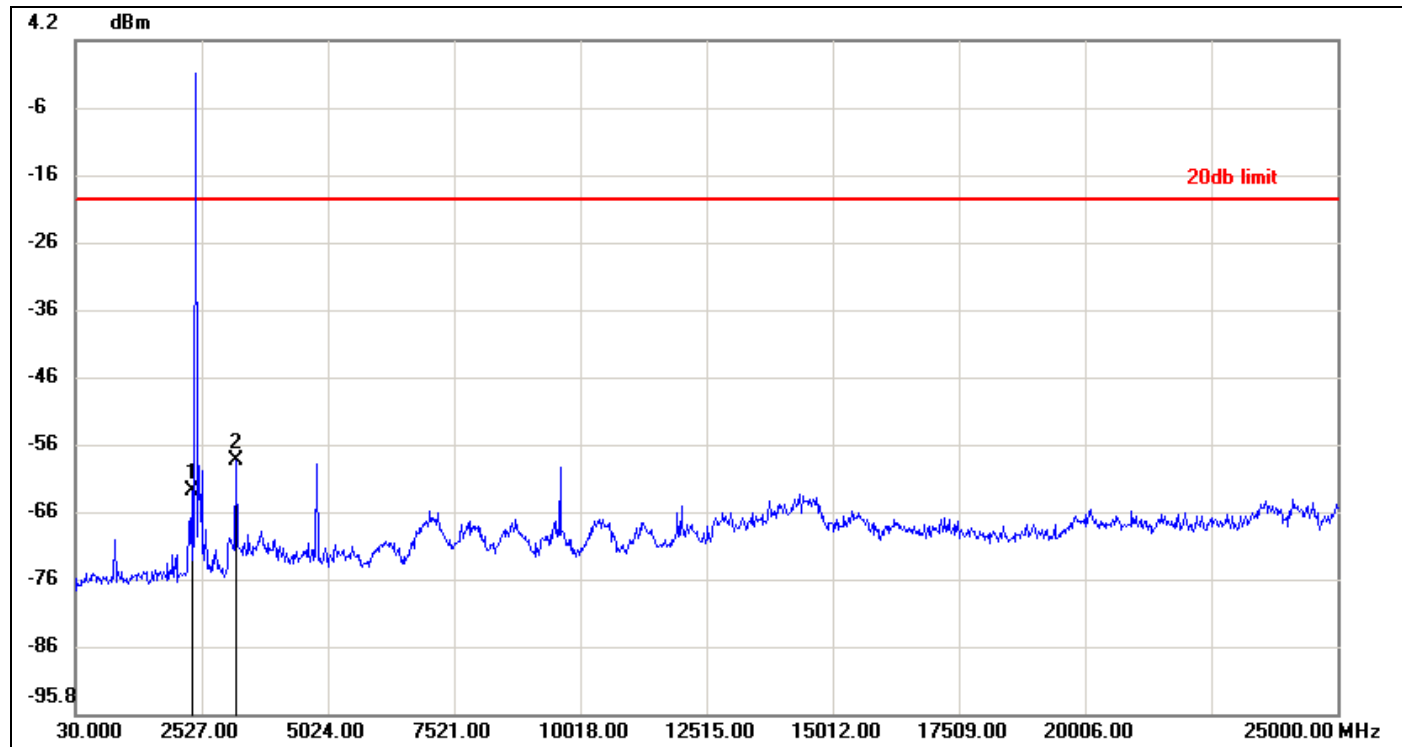
Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

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.

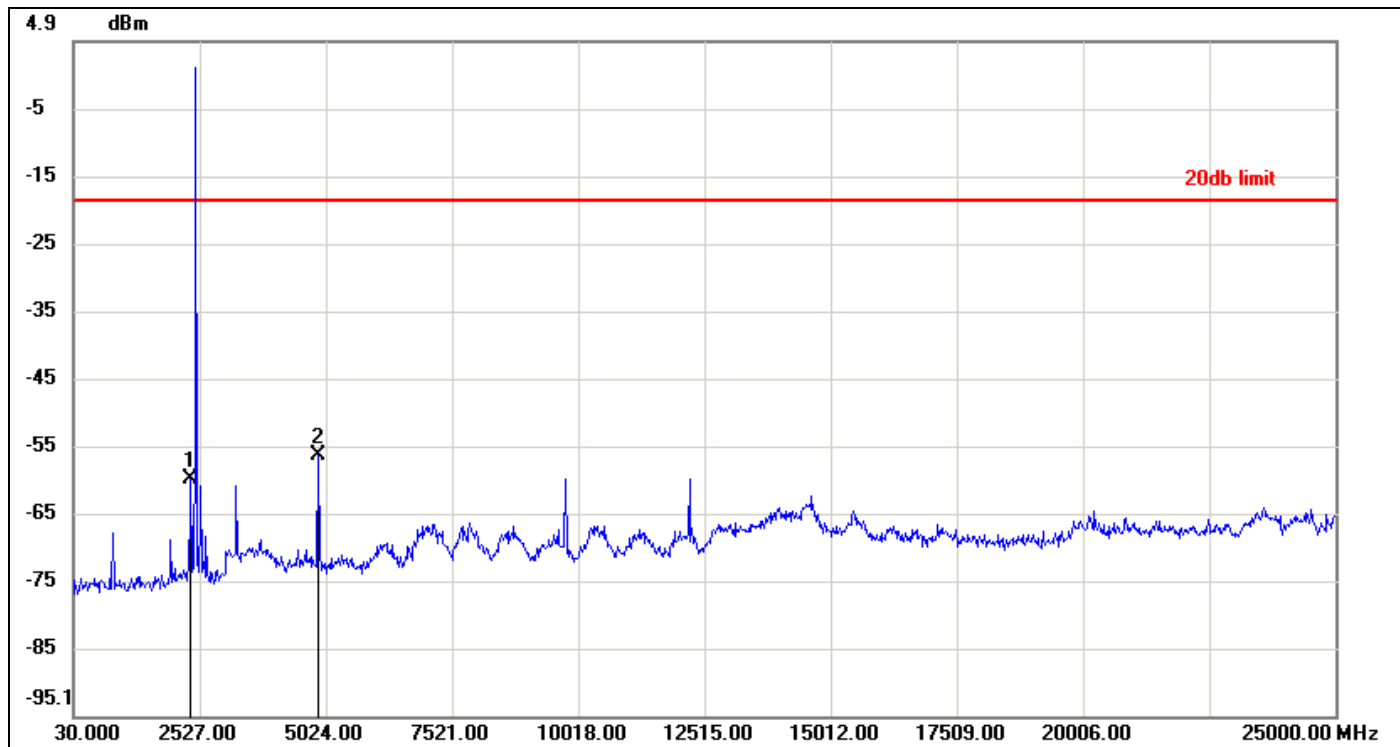
TEST RESULTS

No non-compliance noted

Test Plot**For GFSK / DH5****CH Low**

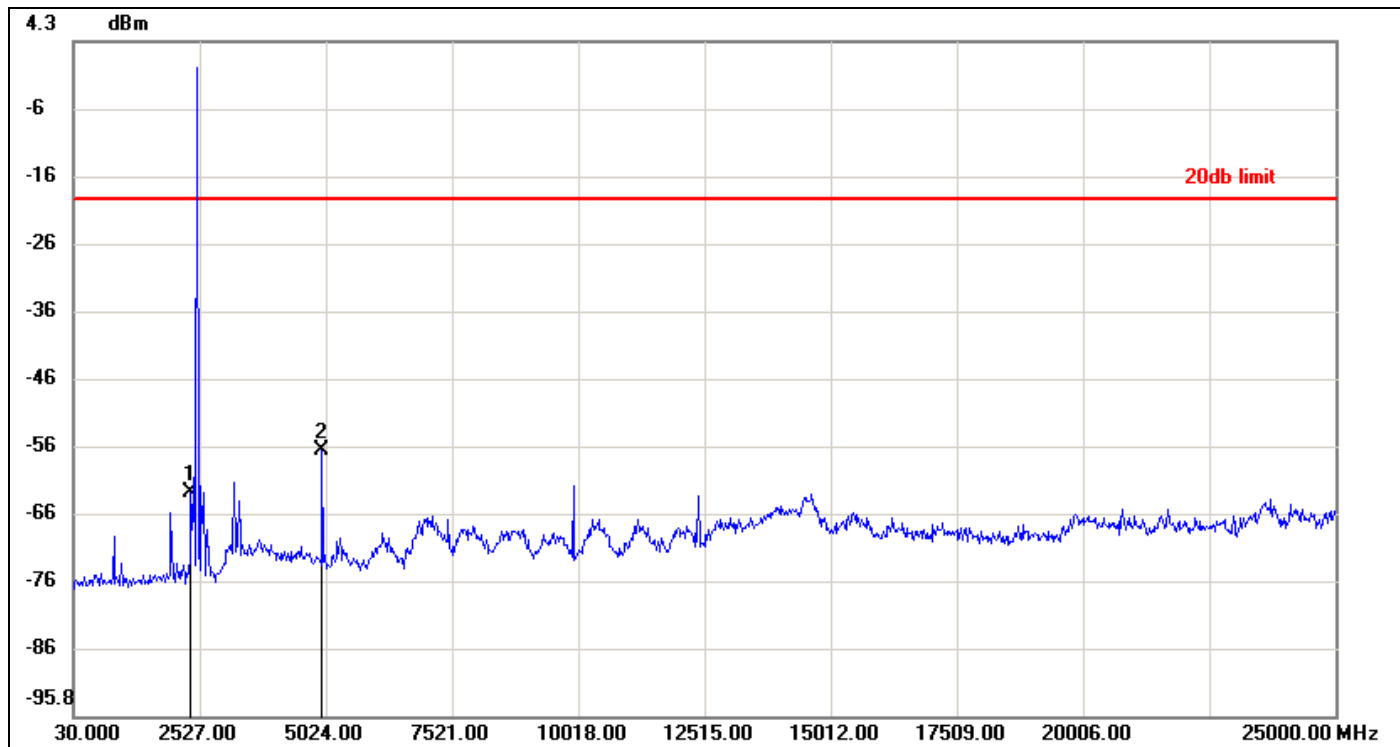
No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2327.2400	-62.70	-19.44	-43.26
2	3201.1900	-58.09	-19.44	-38.65

CH Mid



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2352.2100	-59.89	-18.63	-41.26
2	4874.1800	-56.42	-18.63	-37.79

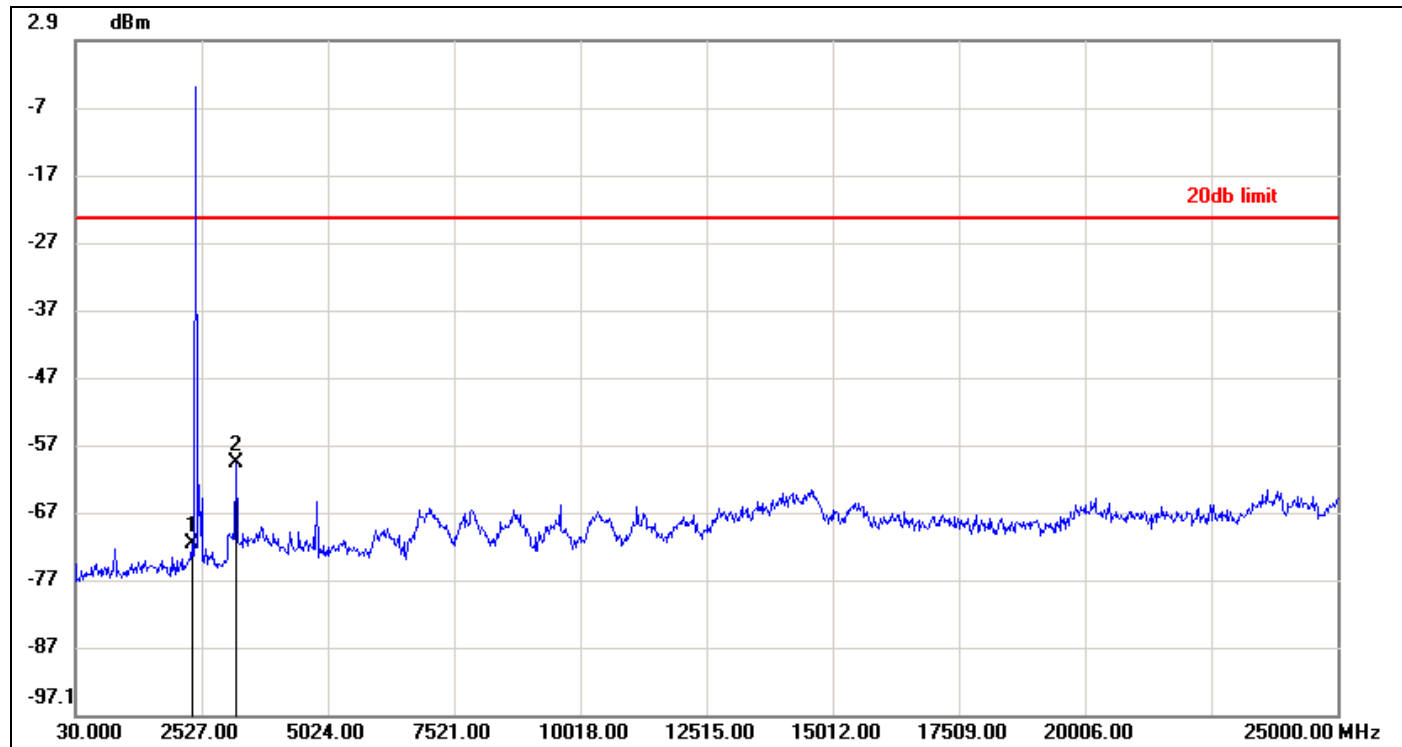
CH High



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2352.2100	-62.55	-19.19	-43.36
2	4949.0900	-56.28	-19.19	-37.09

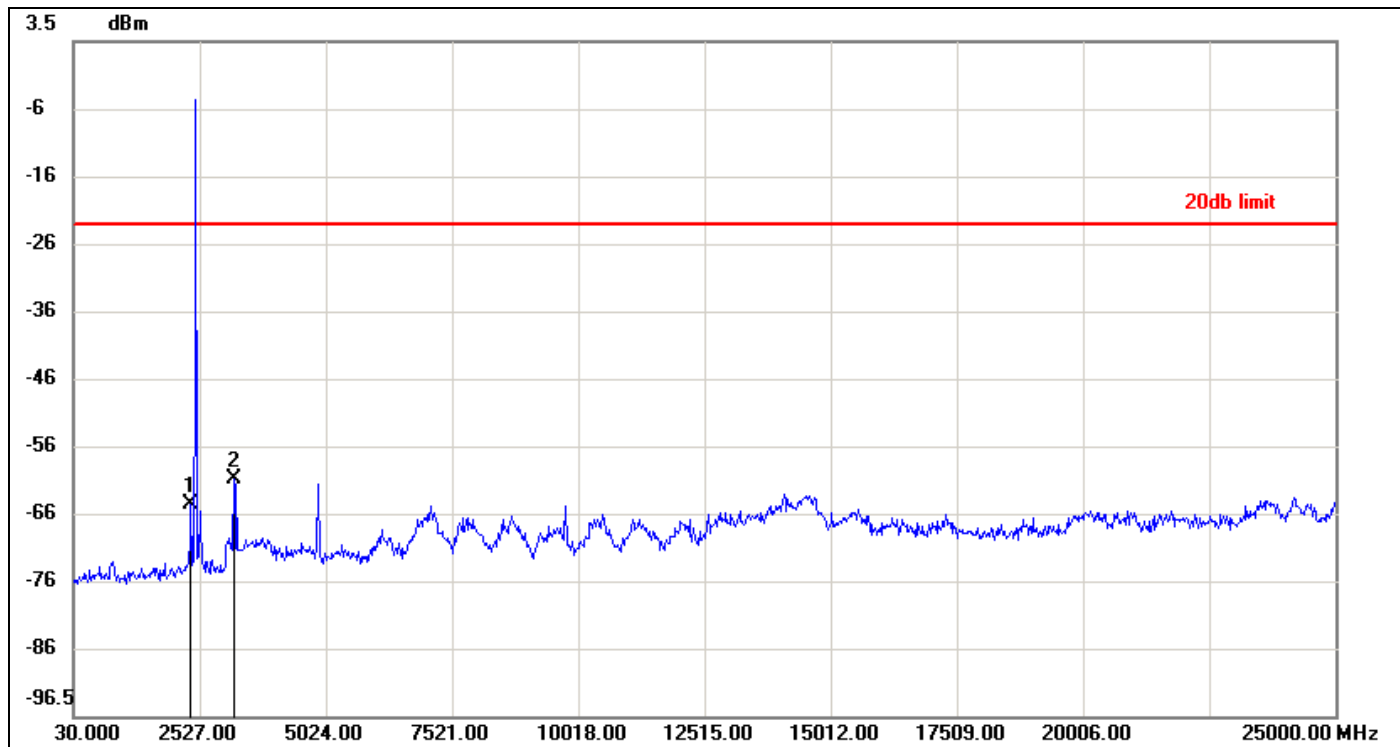
For 8DPSK / DH5

CH Low



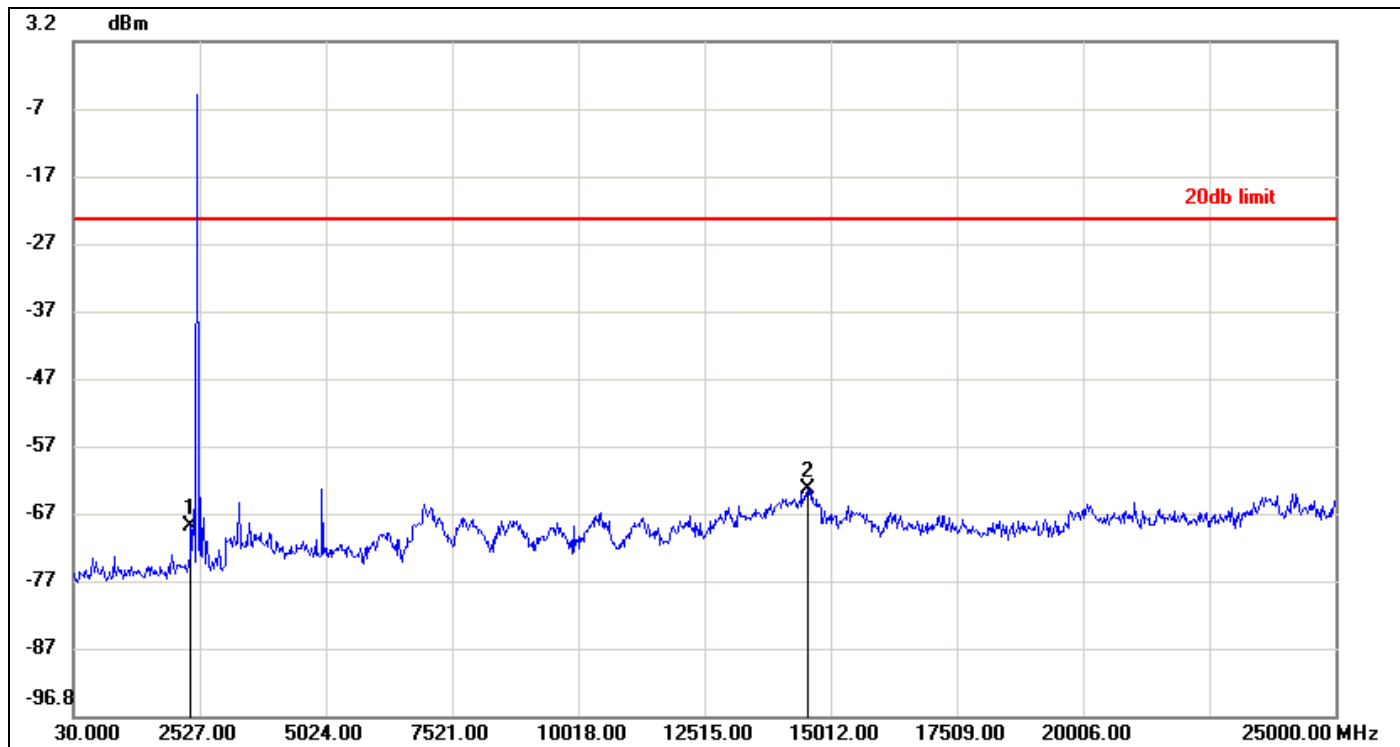
No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2327.2400	-71.78	-23.56	-48.22
2	3201.1900	-59.85	-23.56	-36.29

CH Mid



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2352.2100	-65.15	-23.51	-41.64
2	3201.1900	-61.38	-23.51	-37.87

CH High



No.	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dBm)
1	2352.2100	-68.68	-23.15	-45.53
2	14562.5400	-63.08	-23.15	-39.93

7.10 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).

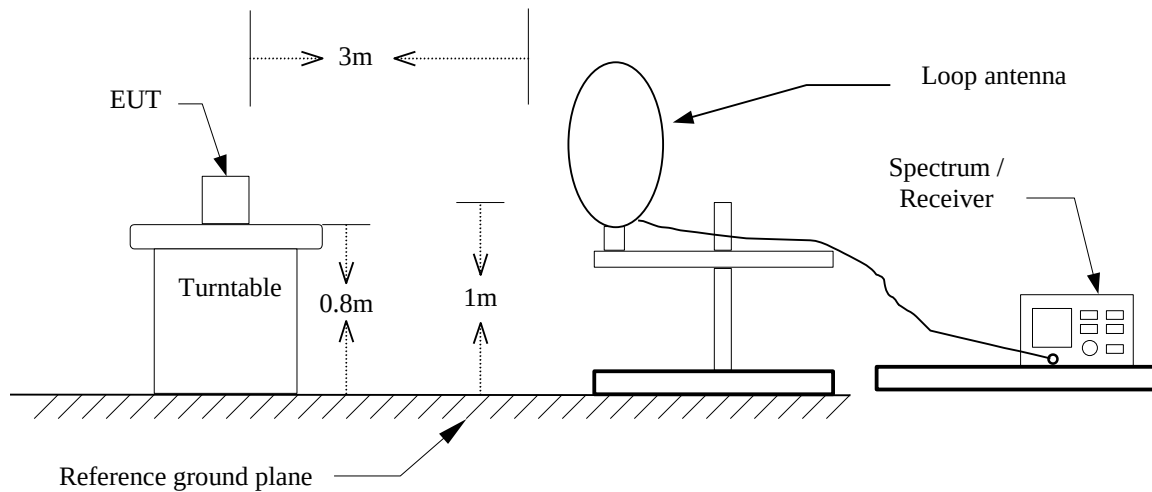
RSS-Gen Table 6: General Field Strength Limits for Transmitters at Frequencies Below 30 MHz (Transmit)

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

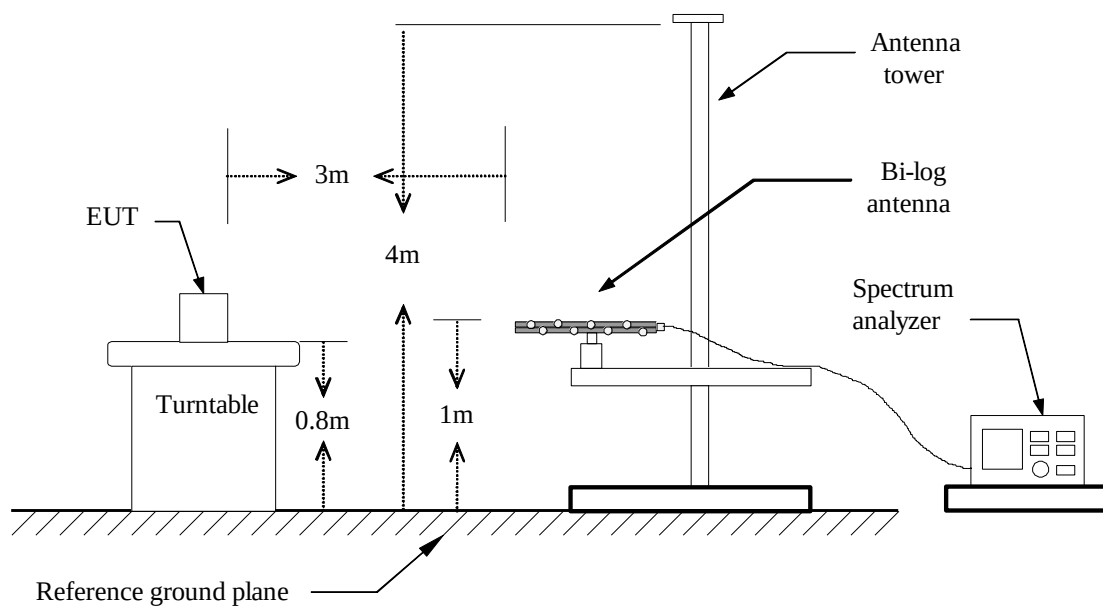
Note: The emission limits for the bands 9-90 kHz and 110-490 kHz are based on measurements employing an average detector.

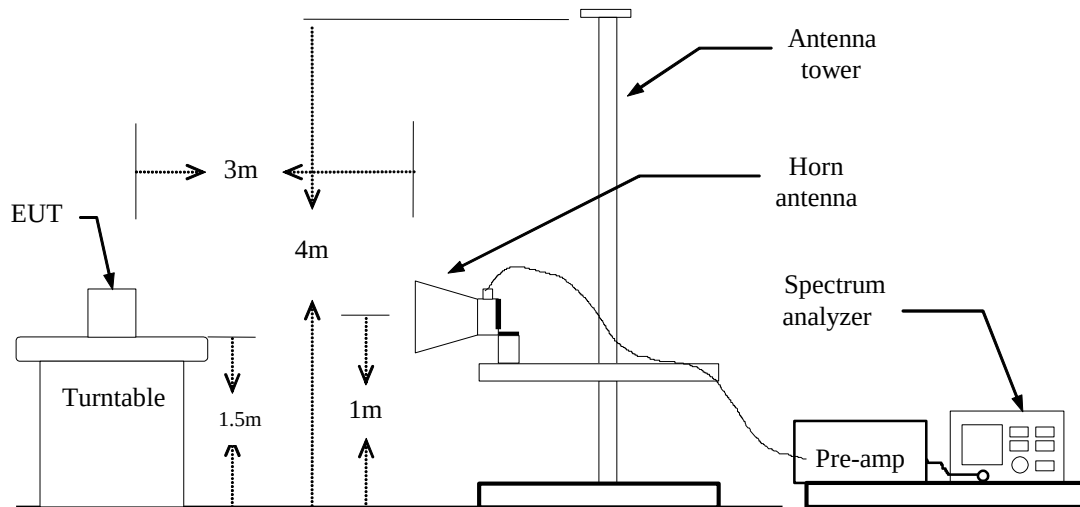
Test Configuration

9kHz ~ 30MHz



30MHz ~ 1GHz



Above 1 GHz

TEST PROCEDURE

1. The EUT is placed on a turntable, which is 1.5m 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:

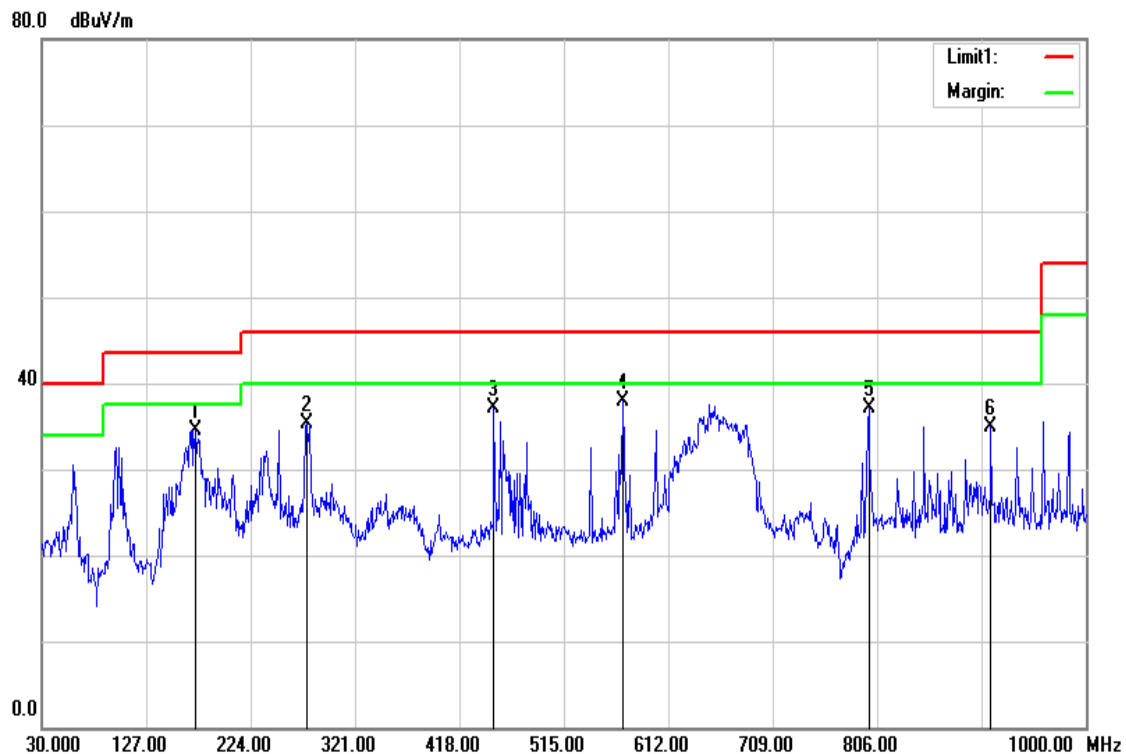
(a) PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO

(b) AVERAGE: RBW=1MHz,
if duty cycle $\geq$ 98%, VBW=10Hz.
if duty cycle < 98% VBW=1/T.

BT: = 78%, VBW= 350Hz

EDR = 78%, VBW= 350Hz

7. Repeat above procedures until the measurements for all frequencies are complete.

Below 1 GHz**Operation Mode:** Normal Link**Test Date:** June 6, 2015**Temperature:** 27°C**Tested by:** David Shu**Humidity:** 53% RH**Polarity:** Ver.

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
172.5900	51.48	-16.98	34.50	43.50	-9.00	Peak	V
276.3800	50.05	-14.68	35.37	46.00	-10.63	Peak	V
450.0100	47.20	-10.19	37.01	46.00	-8.99	Peak	V
570.2900	46.14	-8.19	37.95	46.00	-8.05	Peak	V
798.2400	41.61	-4.51	37.10	46.00	-8.90	Peak	V
911.7300	38.00	-3.00	35.00	46.00	-11.00	Peak	V

Remark:

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz 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).

Operation Mode: Normal Link

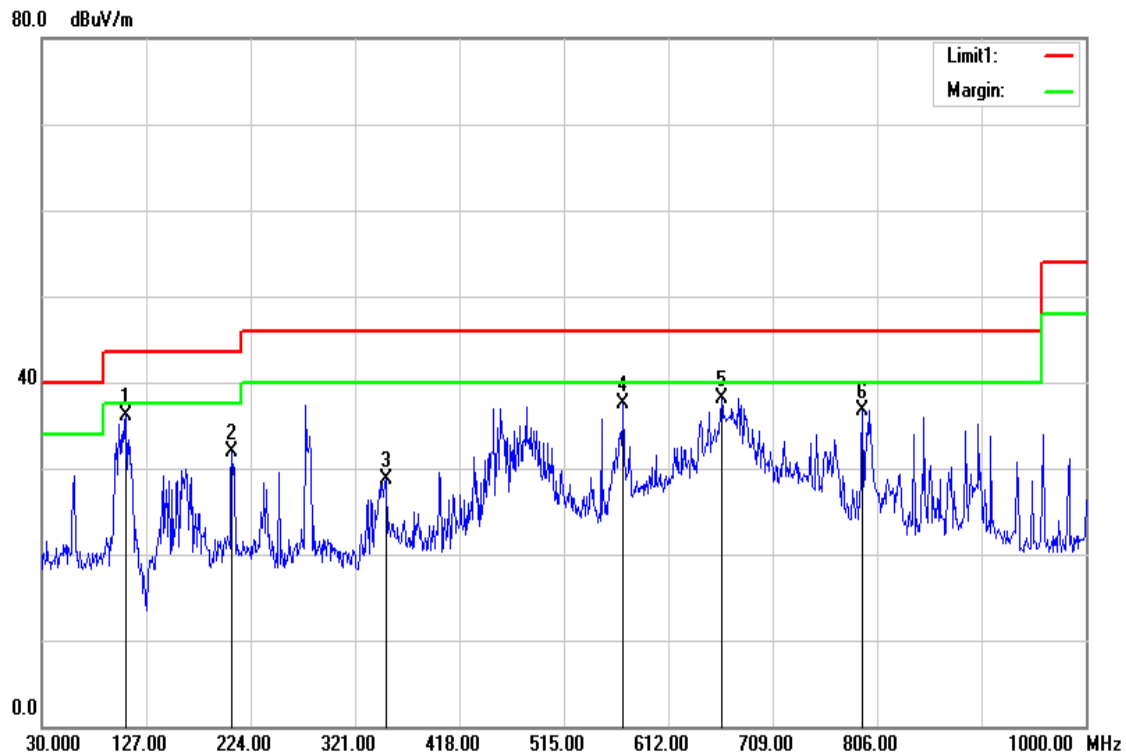
Test Date: June 6, 2015

Temperature: 27°C

Tested by: David Shu

Humidity: 53% RH

Polarity: Hor.



Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
108.5700	53.72	-17.52	36.20	43.50	-7.30	peak	H
206.5400	47.87	-16.01	31.86	43.50	-11.64	peak	H
350.1000	41.60	-12.89	28.71	46.00	-17.29	peak	H
570.2900	45.70	-8.19	37.51	46.00	-8.49	peak	H
661.4700	44.55	-6.46	38.09	46.00	-7.91	peak	H
792.4200	41.36	-4.56	36.80	46.00	-9.20	peak	H

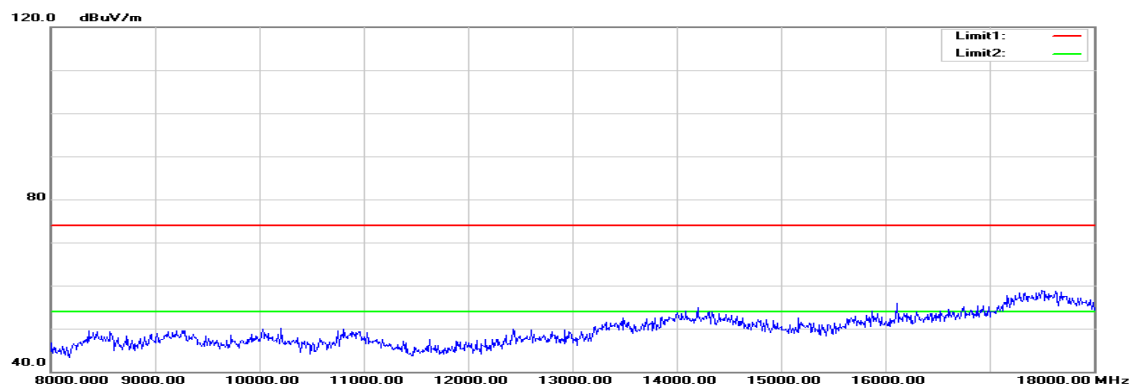
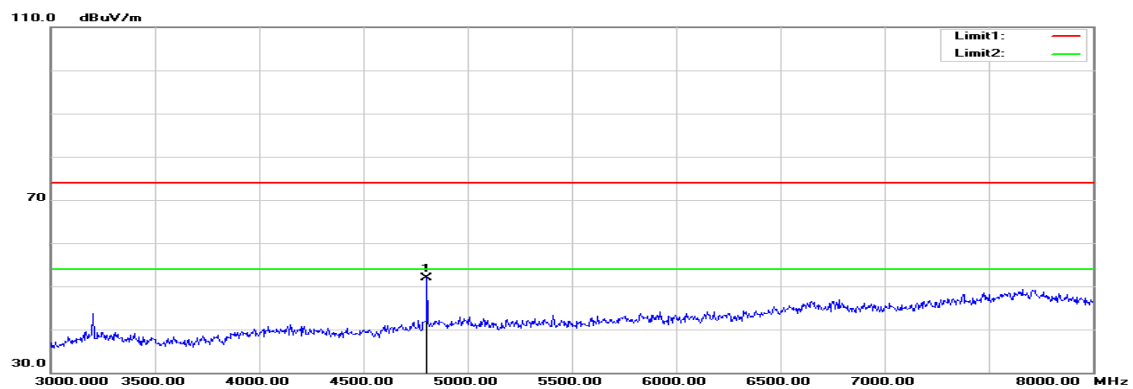
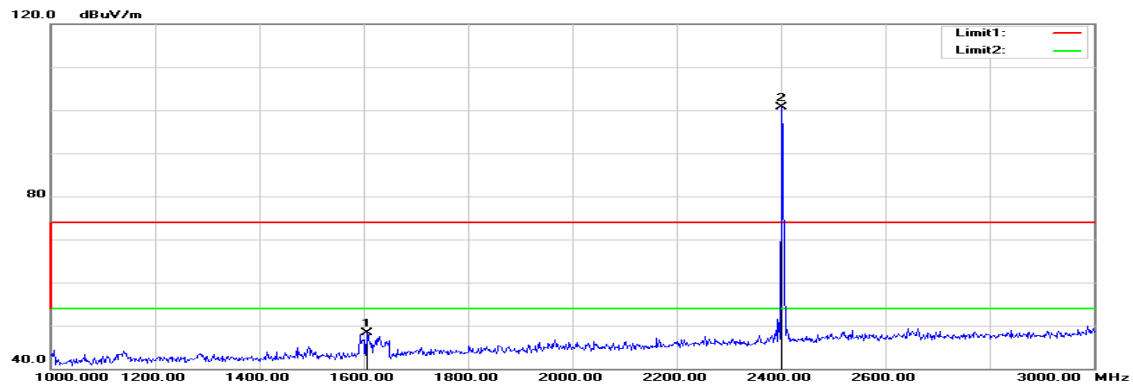
Remark:

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz 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).

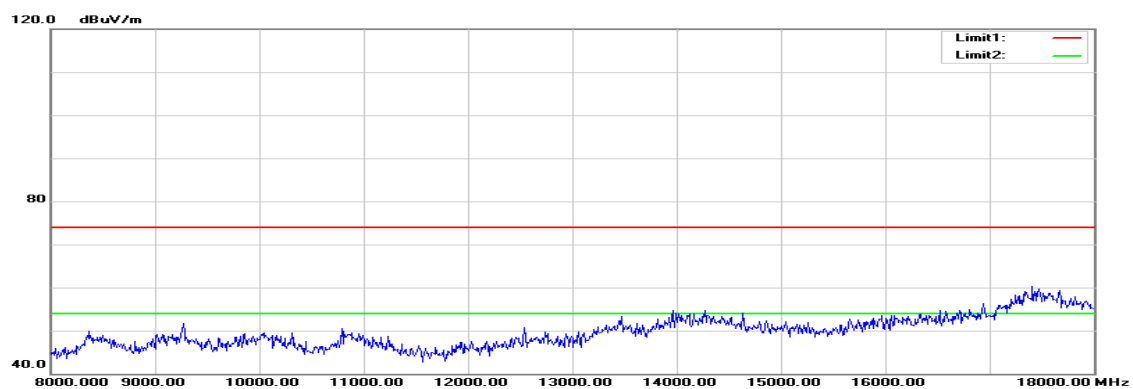
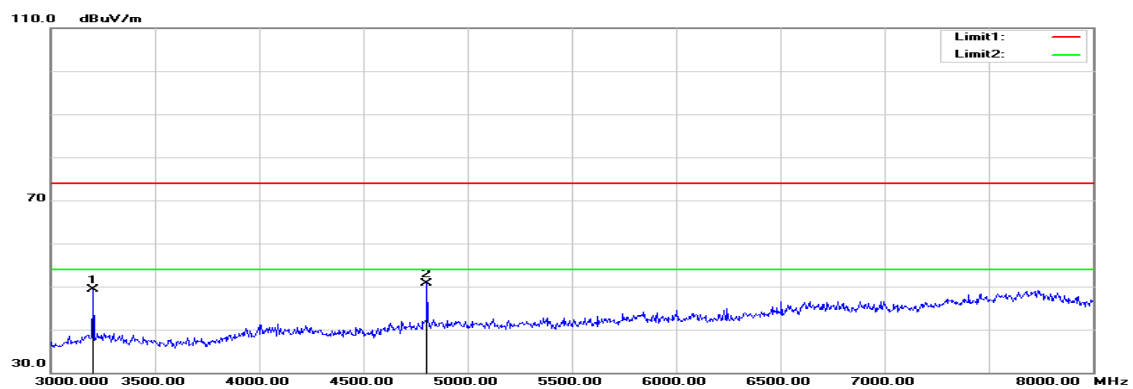
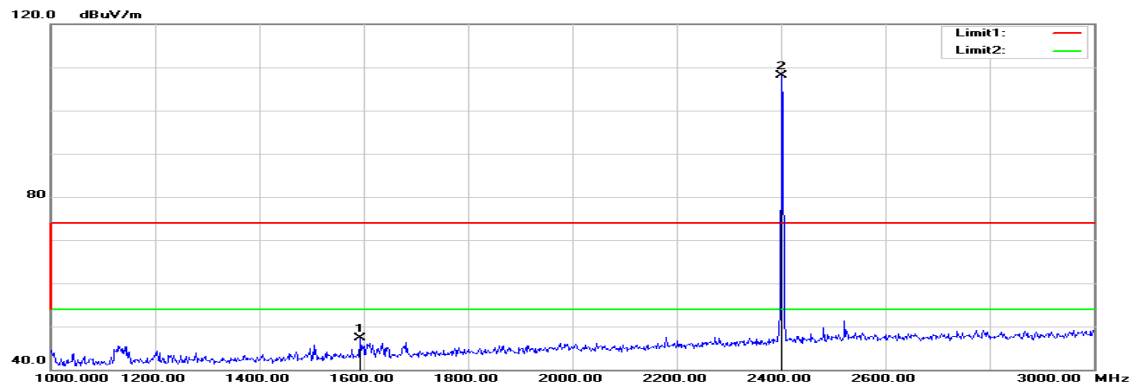
Above 1 GHz

TX / GFSK / DH5 / CH Low

Polarity: Vertical



Polarity: Horizontal



Above 1 GHz**Operation Mode:** TX / GFSK / DH5 / CH Low**Test Date:** June 9, 2015**Temperature:** 27°C**Tested by:** David Shu**Humidity:** 53 % RH**Polarity:** Ver. / Hor.

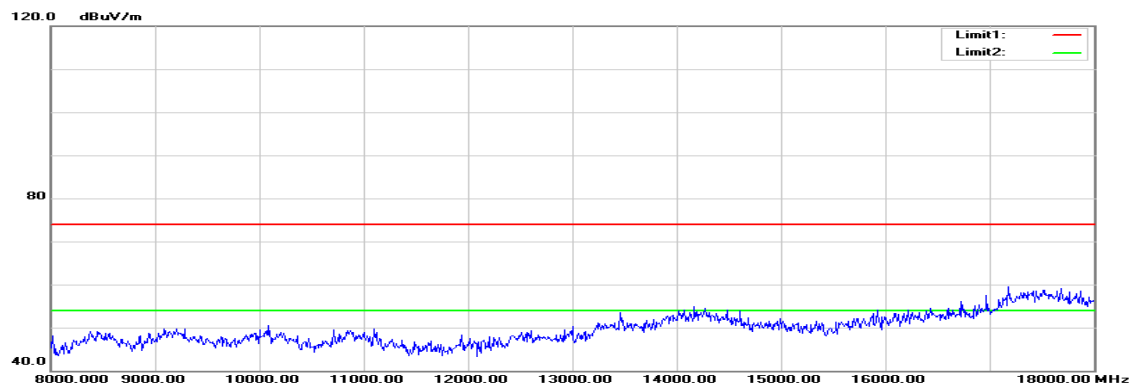
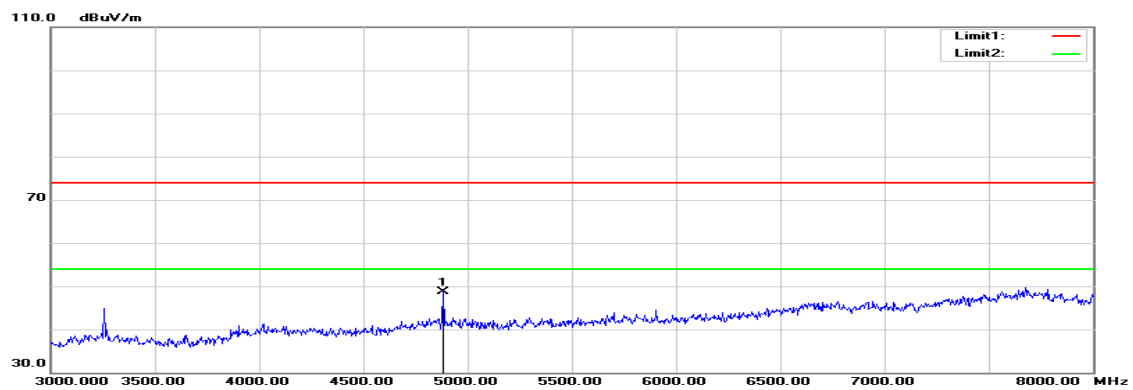
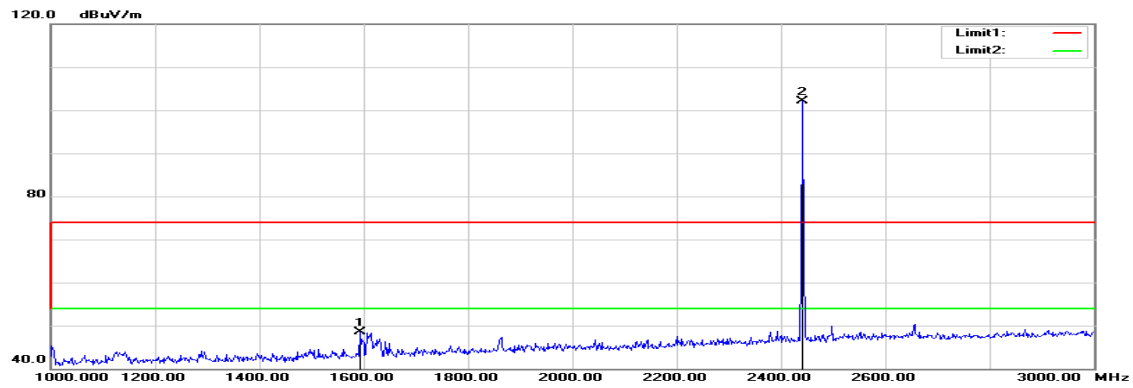
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1606.000	53.86	-5.64	48.22	74.00	-25.78	peak	V
4805.000	46.77	5.05	51.82	74.00	-22.18	peak	V
N/A							
1594.000	52.97	-5.70	47.27	74.00	-26.73	peak	H
3205.000	49.31	-0.11	49.20	74.00	-24.80	peak	H
4805.000	45.60	5.05	50.65	74.00	-23.35	peak	H
N/A							

Remark:

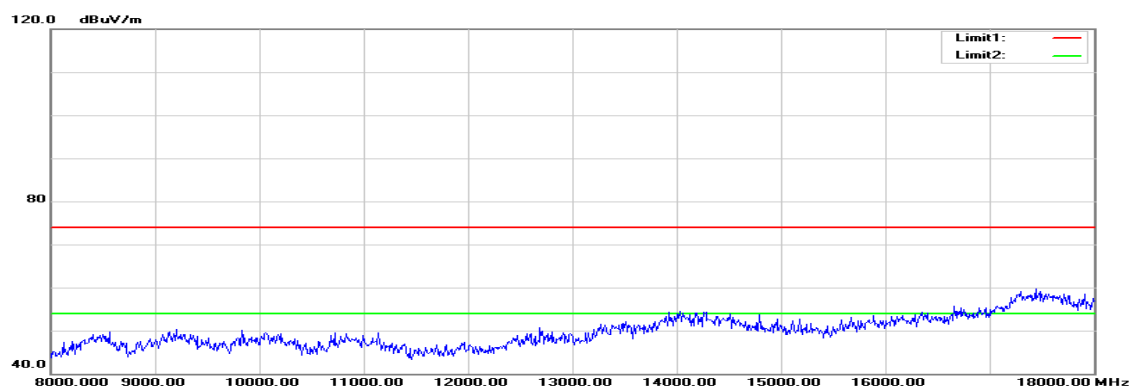
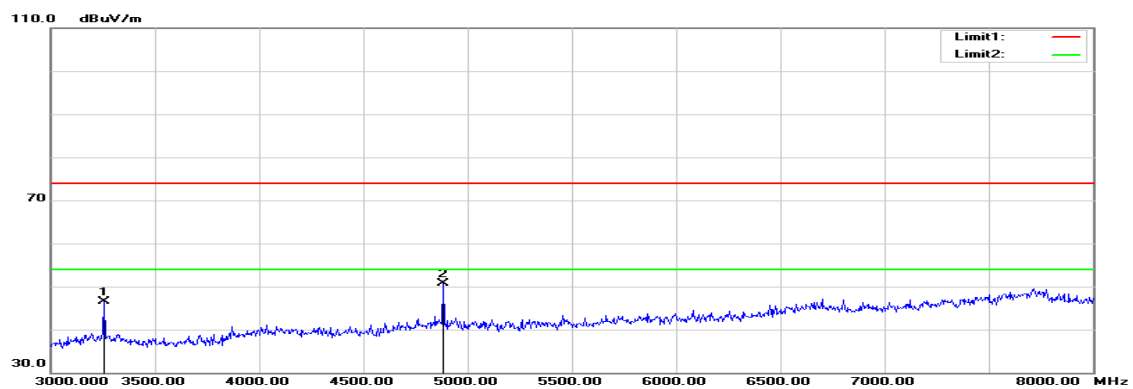
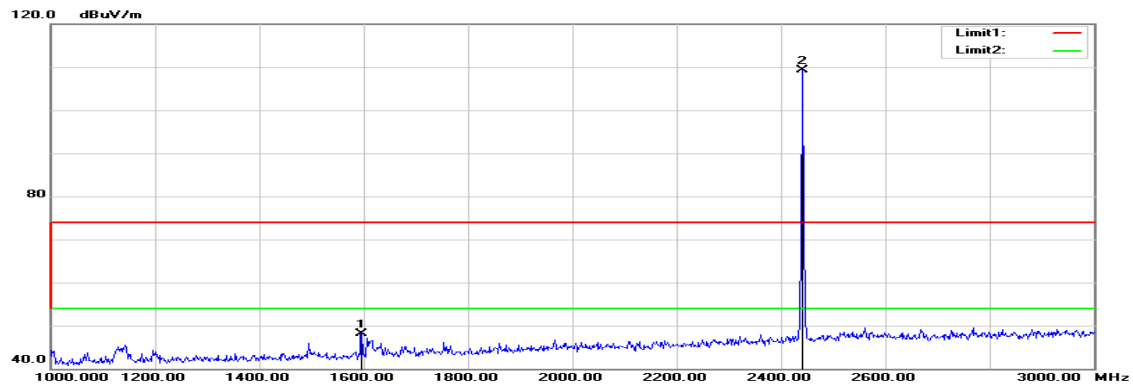
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit .
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).

TX / GFSK / DH5 / CH Mid

Polarity: Vertical



Polarity: Horizontal

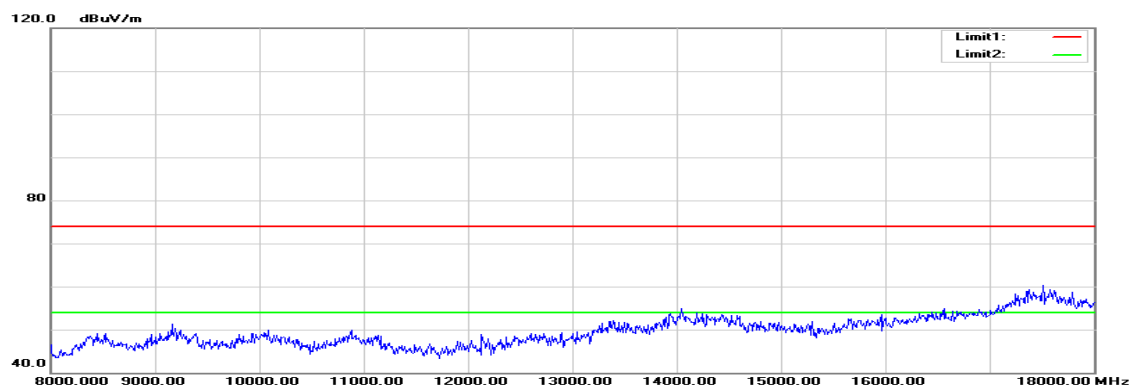
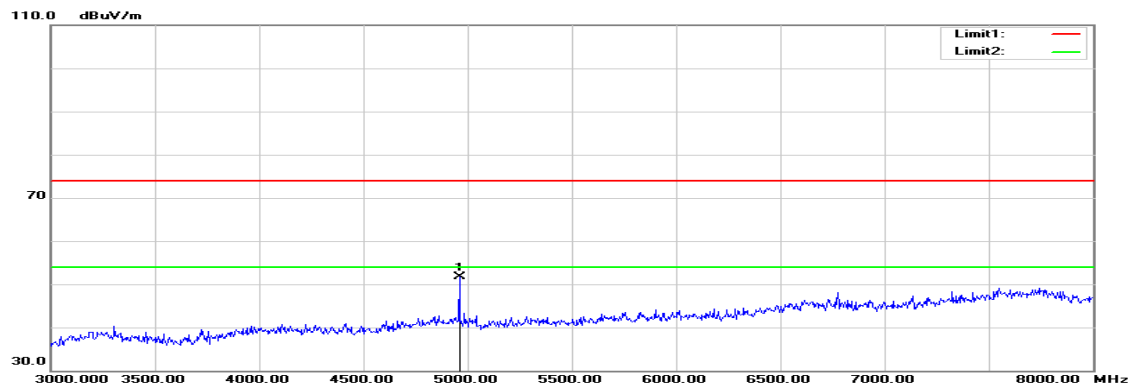
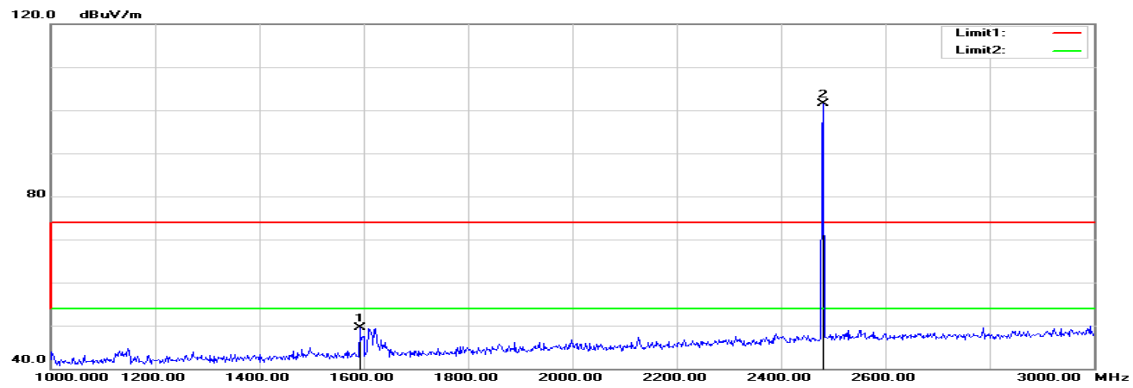


Operation Mode: TX / GFSK / DH5 / CH Mid**Test Date:** June 9, 2015**Temperature:** 26°C**Tested by:** David Shu**Humidity:** 50 % RH**Polarity:** Ver. / Hor.

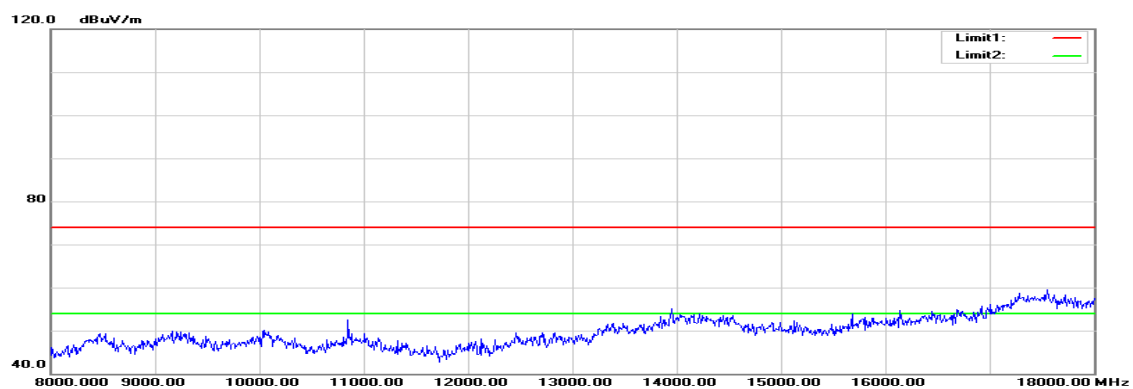
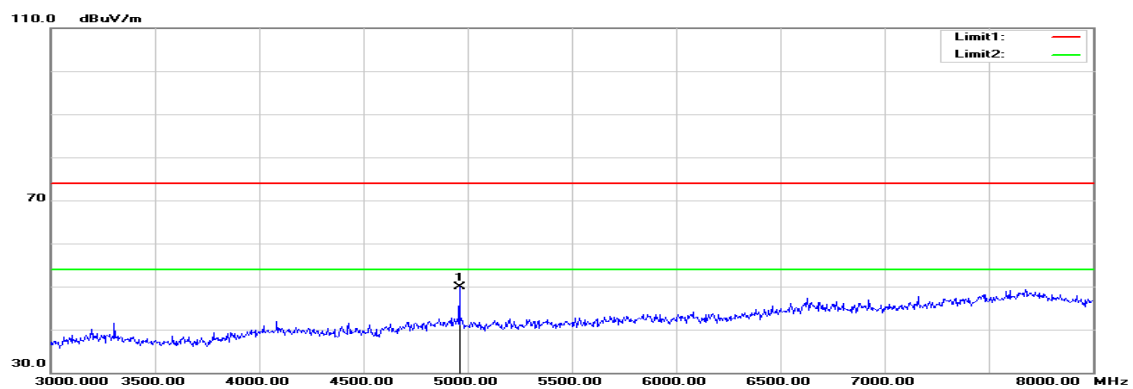
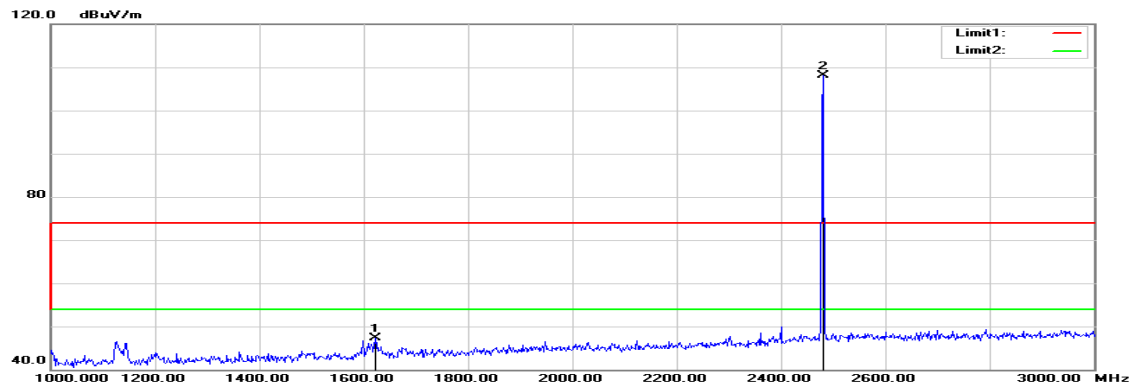
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1594.000	54.16	-5.70	48.46	74.00	-25.54	peak	V
4885.000	43.43	5.26	48.69	74.00	-25.31	peak	V
N/A							
1596.000	53.87	-5.69	48.18	74.00	-25.82	peak	H
3255.000	46.55	0.00	46.55	74.00	-27.45	peak	H
4880.000	45.52	5.25	50.77	74.00	-23.23	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. $\text{Margin (dB)} = \text{Remark result (dBuV/m)} - \text{Average limit (dBuV/m)}$.

TX / GFSK / DH5 / CH High**Polarity: Vertical**

Polarity: Horizontal

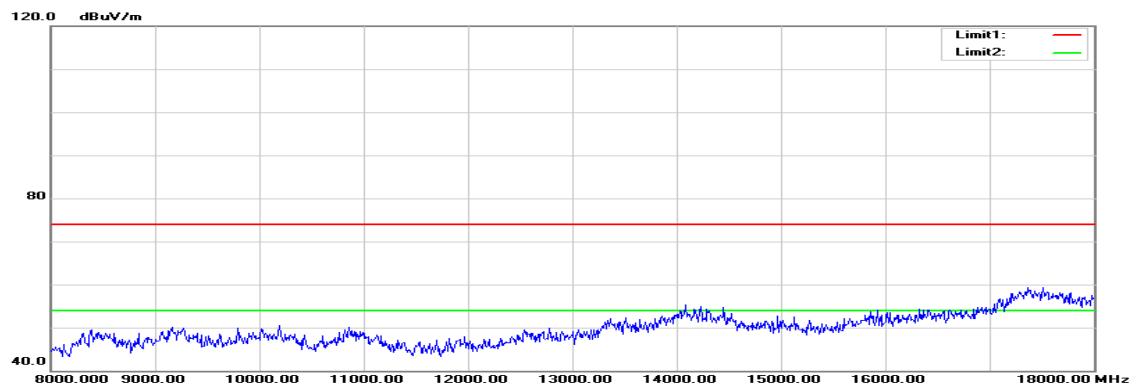
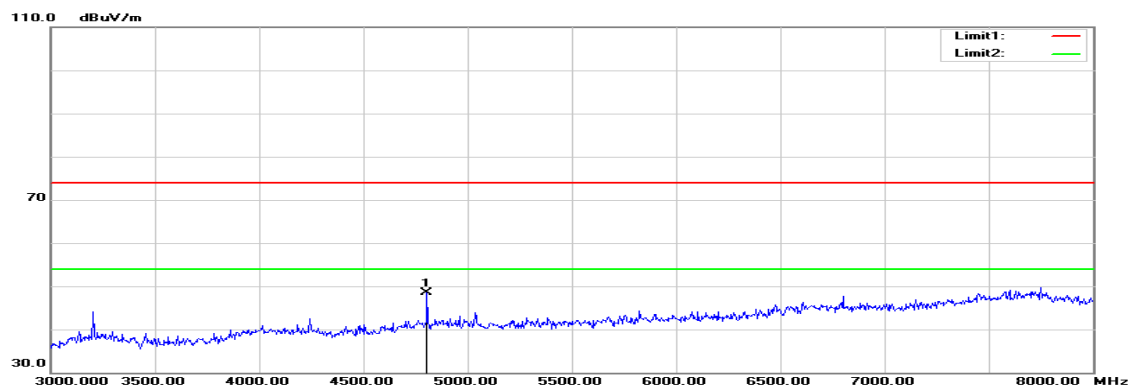
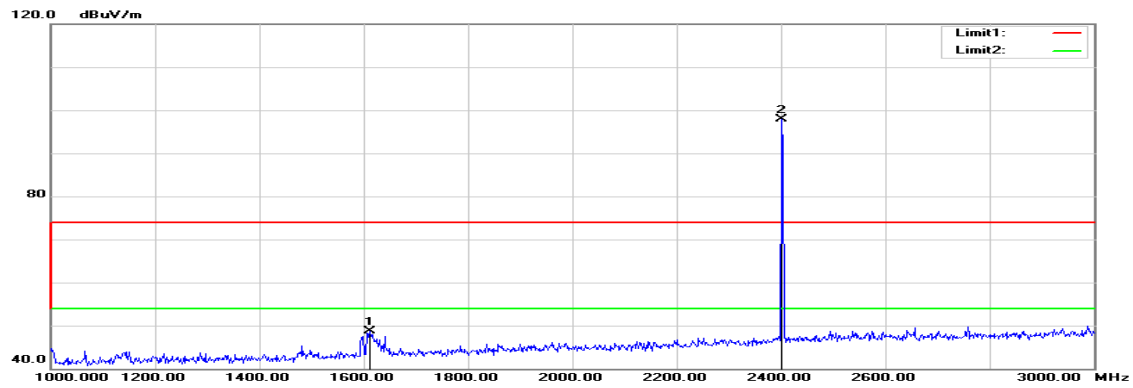


Operation Mode: TX / GFSK / DH5 / CH High**Test Date:** June 9, 2015**Temperature:** 26°C**Tested by:** David Shu**Humidity:** 50 % RH**Polarity:** Ver. / Hor.

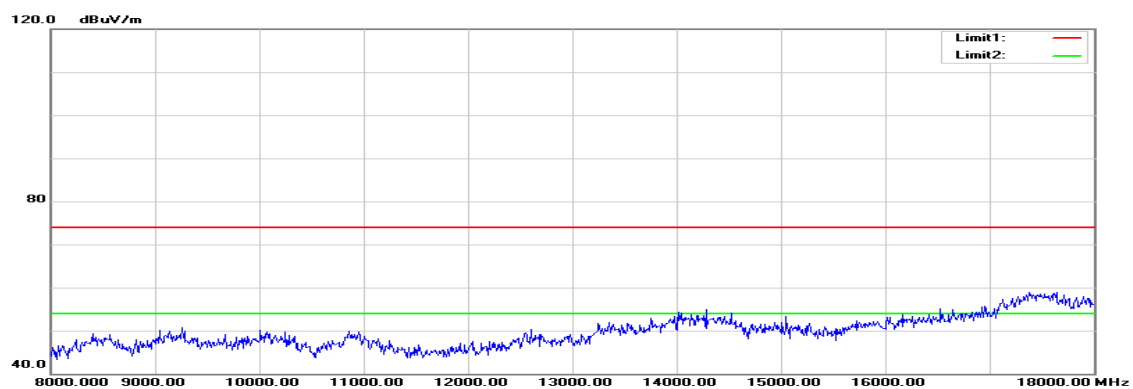
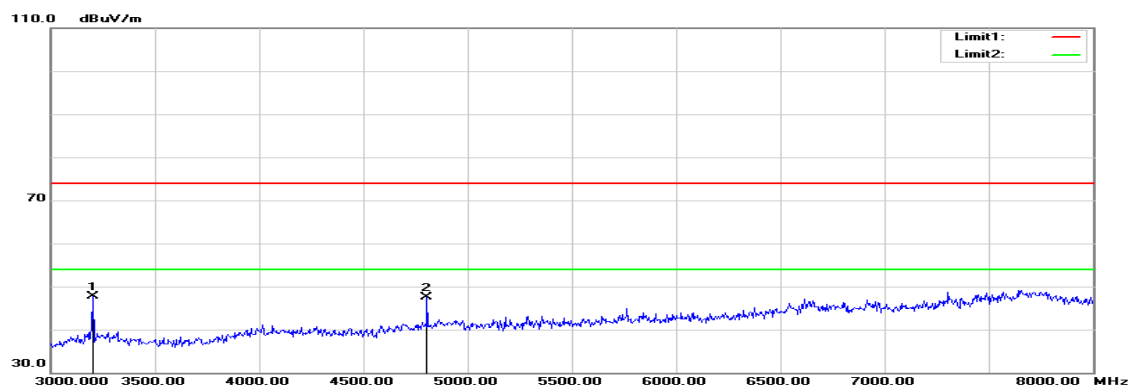
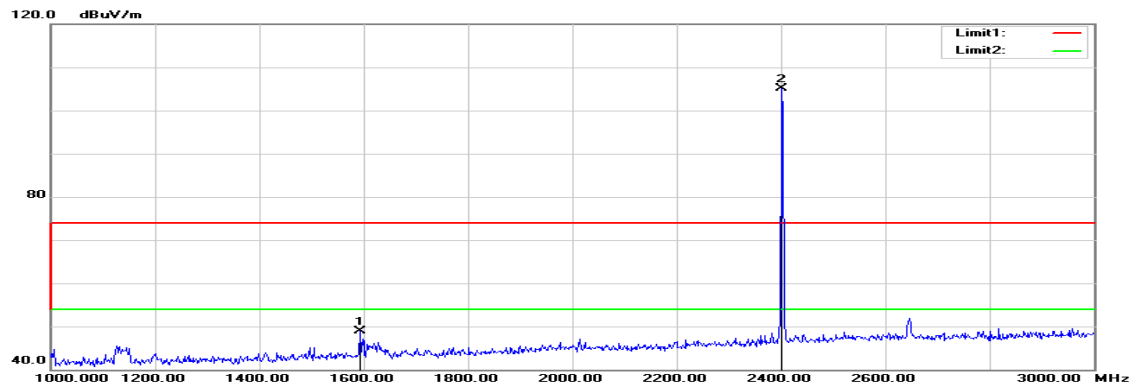
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1592.000	55.27	-5.71	49.56	74.00	-24.44	peak	V
4960.000	46.29	5.46	51.75	74.00	-22.25	peak	V
N/A							
1622.000	52.86	-5.56	47.30	74.00	-26.70	peak	H
4960.000	44.50	5.46	49.96	74.00	-24.04	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).

TX / 8DPSK / DH5 / CH Low**Polarity: Vertical**

Polarity: Horizontal

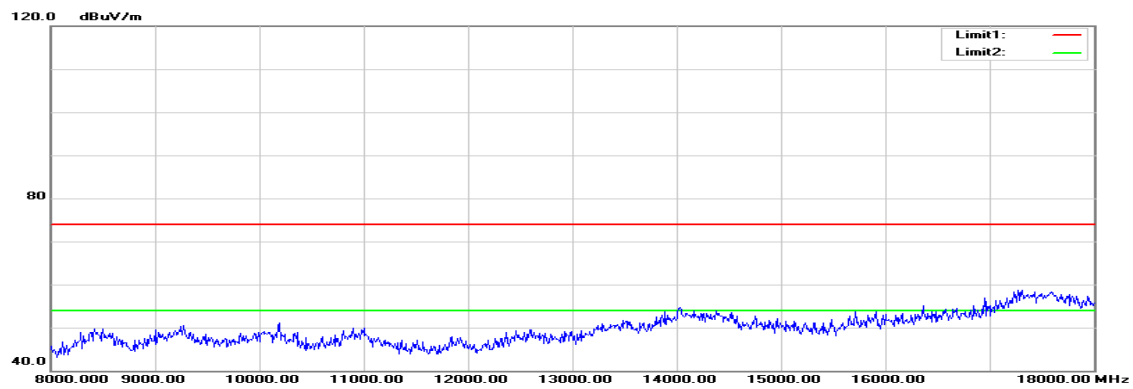
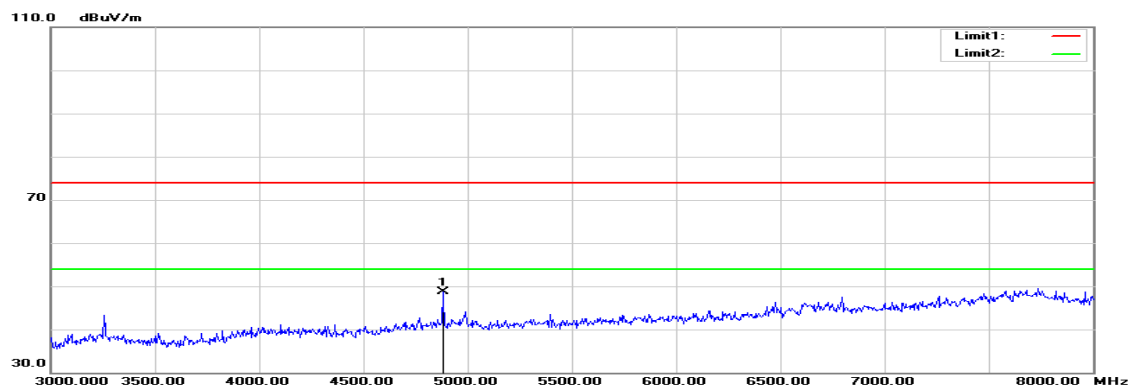
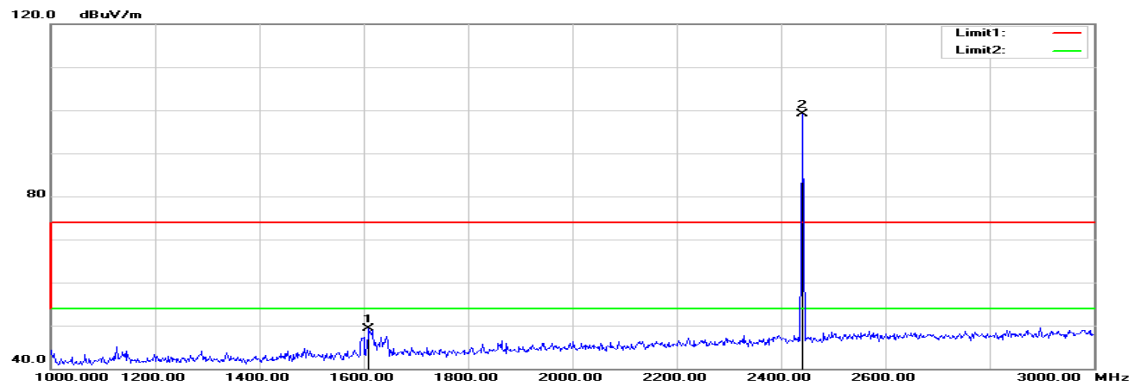


Operation Mode: TX / 8DPSK / DH5 / CH Low**Test Date:** June 9, 2015**Temperature:** 26°C**Tested by:** David Shu**Humidity:** 50 % RH**Polarity:** Ver. / Hor.

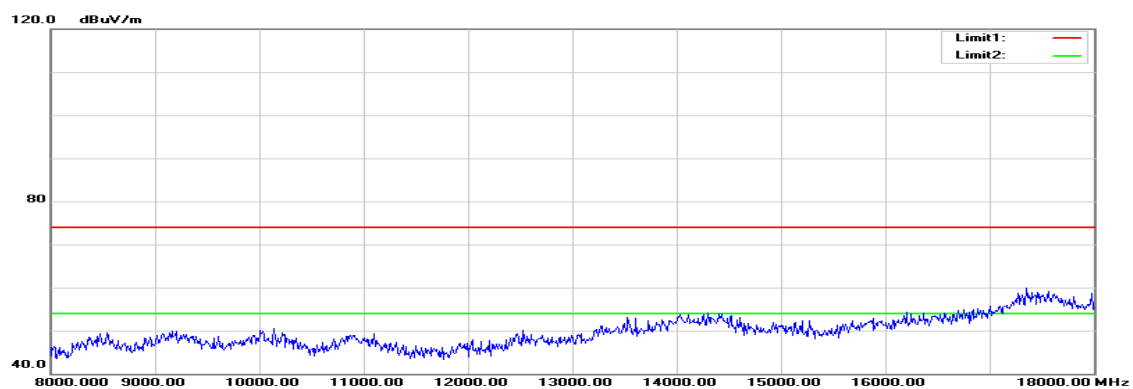
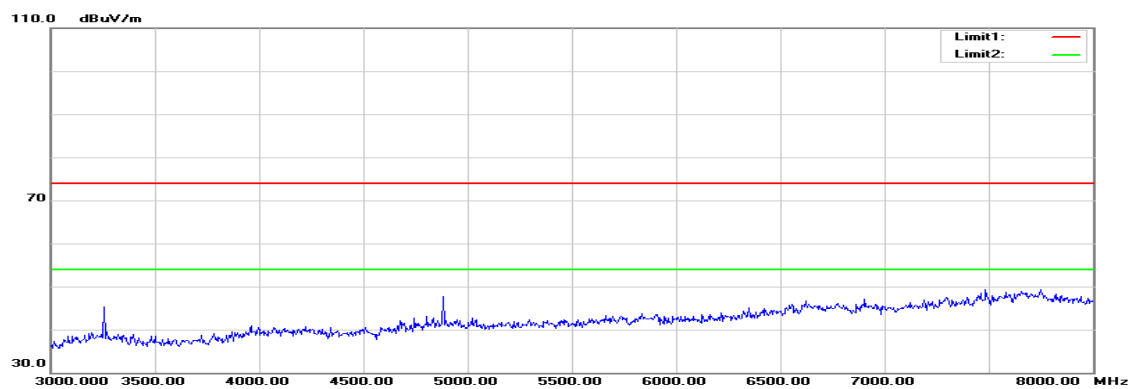
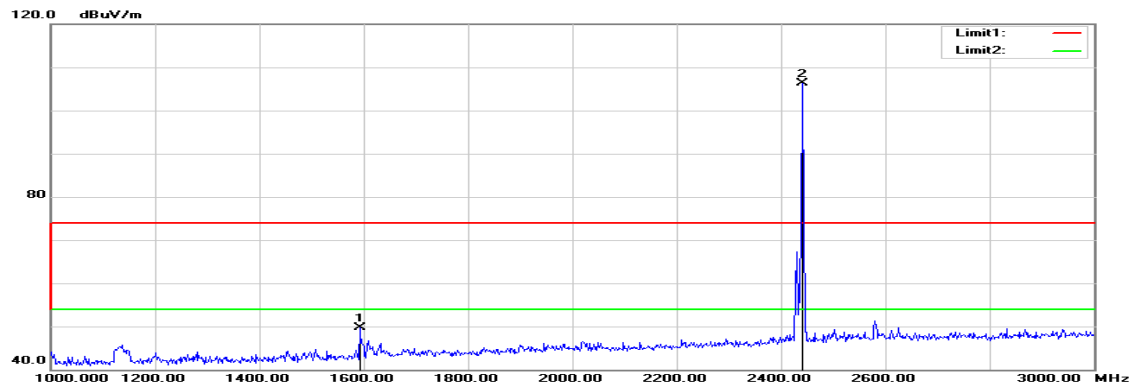
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1612.000	54.36	-5.61	48.75	74.00	-25.25	peak	V
4805.000	43.51	5.05	48.56	74.00	-25.44	peak	V
N/A							
1594.000	54.61	-5.70	48.91	74.00	-25.09	peak	H
3205.000	47.88	-0.11	47.77	74.00	-26.23	peak	H
4805.000	42.44	5.05	47.49	74.00	-26.51	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. $\text{Margin (dB)} = \text{Remark result (dBuV/m)} - \text{Average limit (dBuV/m)}$.

TX / 8DPSK / DH5 / CH Mid**Polarity: Vertical**

Polarity: Horizontal



Operation Mode: TX / 8DPSK / DH5 / CH Mid**Test Date:** June 9, 2015**Temperature:** 26°C**Tested by:** David Shu**Humidity:** 50 % RH**Polarity:** Ver. / Hor.

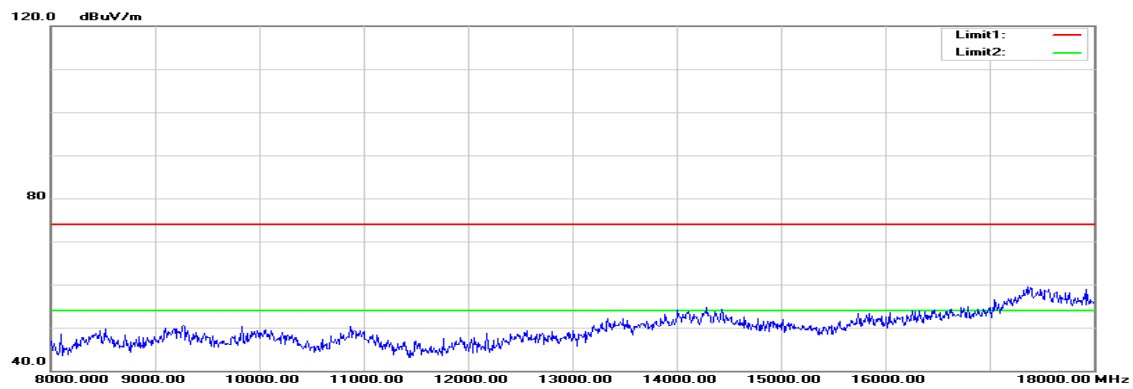
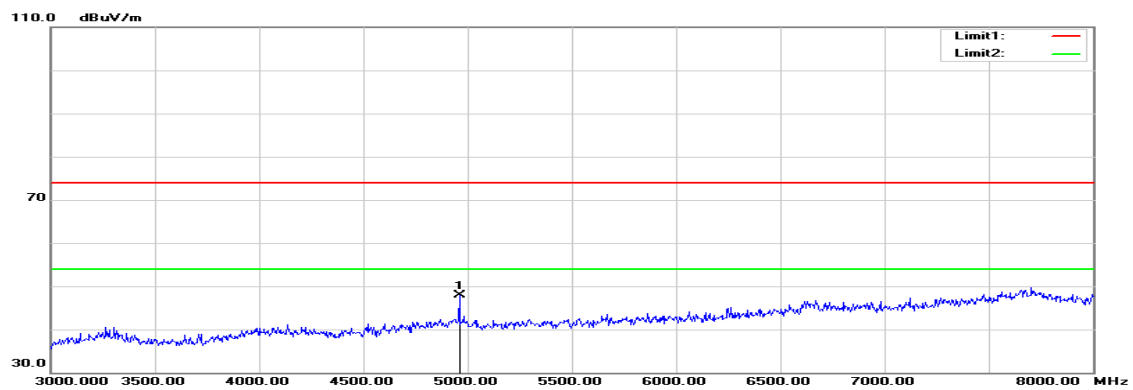
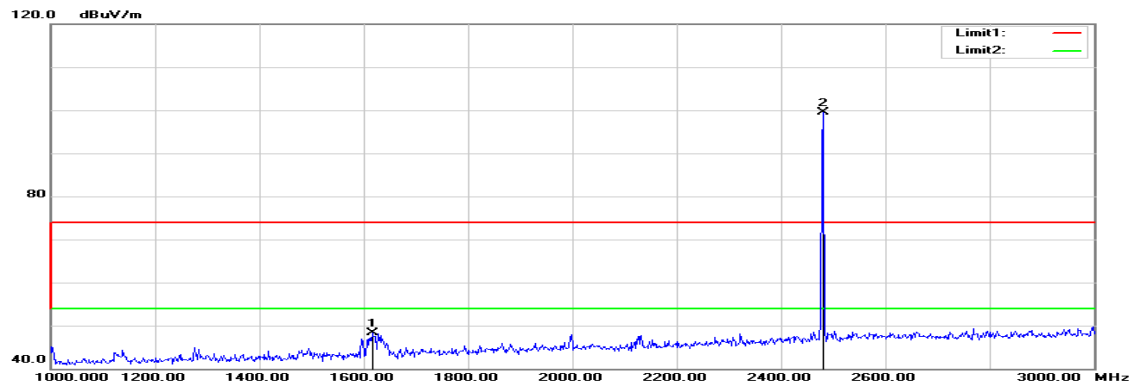
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1610.000	54.84	-5.62	49.22	74.00	-24.78	peak	V
4880.000	43.41	5.25	48.66	74.00	-25.34	peak	V
N/A							
1592.000	55.35	-5.71	49.64	74.00	-24.36	peak	H
N/A							

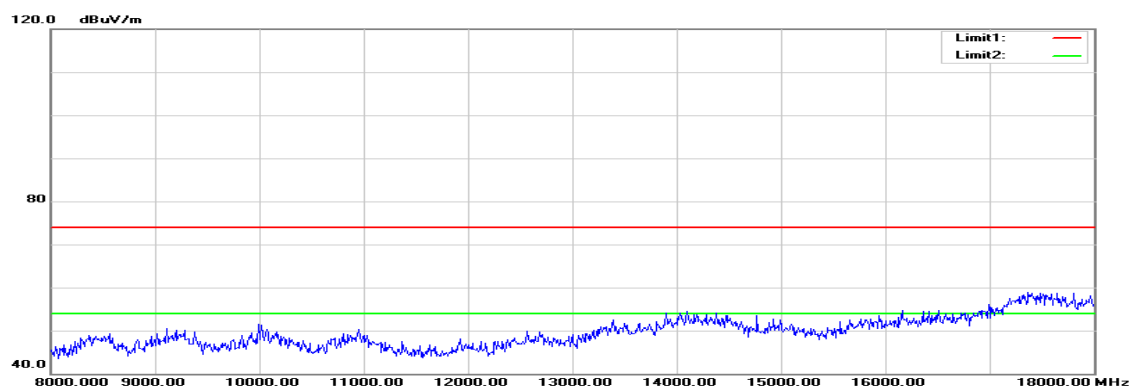
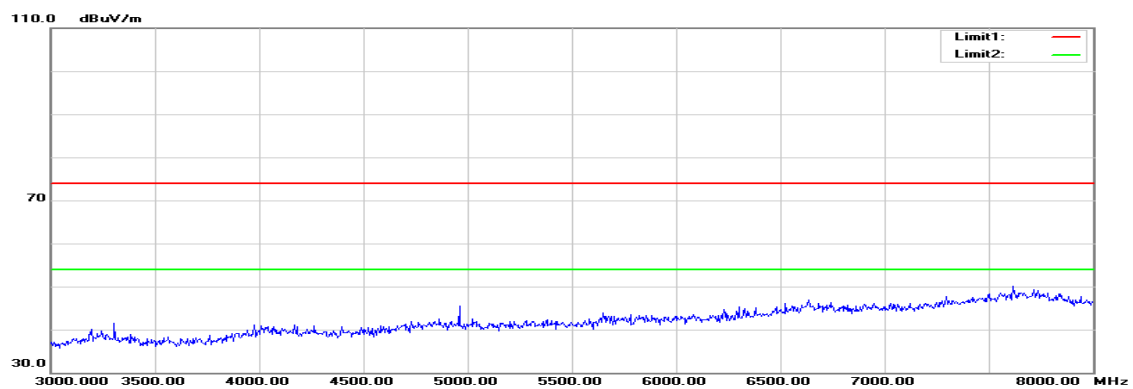
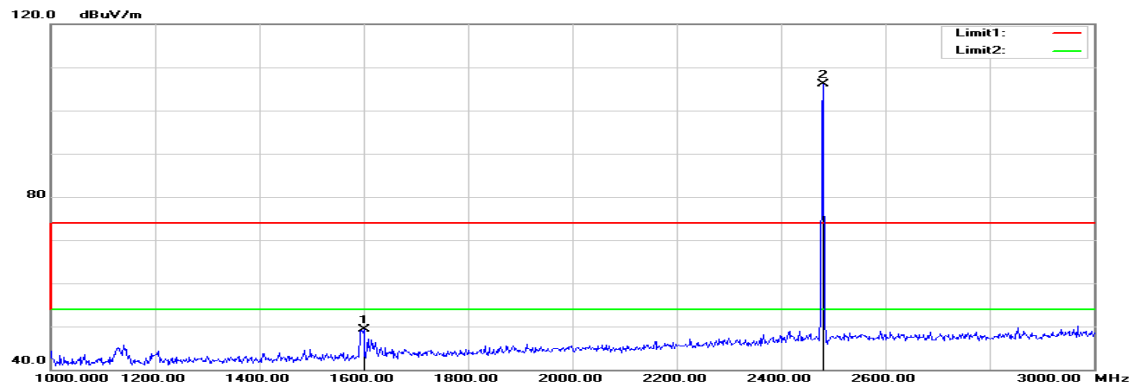
Remark:

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).

TX / 8DPSK / DH5 / CH High

Polarity: Vertical



Polarity: Horizontal

Operation Mode: TX / 8DPSK / DH5 / CH High**Test Date:** June 9, 2015**Temperature:** 26°C**Tested by:** David Shu**Humidity:** 50 % RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1616.000	53.91	-5.59	48.32	74.00	-25.68	peak	V
4960.000	42.52	5.46	47.98	74.00	-26.02	peak	V
N/A							
1600.000	54.93	-5.67	49.26	74.00	-24.74	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. $\text{Margin (dB)} = \text{Remark result (dBuV/m)} - \text{Average limit (dBuV/m)}$.

7.11 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 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 frequency ranges.

Frequency Range (MHz)	Limits (dB μ V)	
	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

Not applicable, because EUT not connect to AC Main Source direct.