FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

Wireless Pocket CCD Scanner

Trade Name: unitech

Model:
MS912+, MS912-FUBB00-SG, MS912-FUBB00-TG, MS912-KUBB00-SG, MS912-KUBB00-TG

Issued to

unitech Electronics Co., Ltd.
5F, No.136, Ln.235, Baoqiao Rd., Xindian Dist., New Taipei City 23141 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: October 11, 2016

Testing Laboratory
1309

Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	October 11, 2016	Initial Issue	ALL	Becca Chen

TABLE OF CONTENTS

1. TEST RESULT CERTIFICATION

Applicant: unitech Electronics Co., Ltd.
5F, No.136, Ln.235, Baoqiao Rd., Xindian Dist., New Taipei City 23141 Taiwan R.O.C

Equipment Under Test: Wireless Pocket CCD Scanner

Trade Name: unitech

Model Number: MS912+, MS912-FUBB00-SG, MS912-FUBB00-TG, MS912-KUBB00-SG, MS912-KUBB00-TG

Date of Test: September 22 ~ October 7, 2016

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
FCC 47 CFR Part 15 Subpart C	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 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:

Sam Chuang
Manager
Compliance Certification Services Inc.

Tested by:

Dennis Li
Engineer
Compliance Certification Services Inc.

2. TEST SUMMARY

The EUT has been tested according to the following specifications:

Item	Standard	Test Result
20dB Channel Bandwidth	**15.247 (a)(1)**	PASS
Maximum Output Power	**15.247 (b)(1), (3)**	PASS
Band Edge	**15.247(d)**	PASS
Frequency Separation	**15.247(a)(1)**	PASS
Number of Hopping Channels	**15.247(a)(1)(iii)**	PASS
Time of Occupancy (Dwell Time)	**15.247(a)(1)(iii)**	PASS
Radiated Emission	**15.205,15.209**	PASS
Powerline Conducted Emission	**15.207(a)**	PASS
Transmitter and the Receiver	**15.247(g), 15.247(h)**	PASS

3. EUT DESCRIPTION

<table>
<tr><td>Product</td><td>Wireless Pocket CCD Scanner</td></tr>
<tr><td>Trade Name</td><td>unitech</td></tr>
<tr><td>Model Number</td><td>MS912+, MS912-FUBB00-SG, MS912-FUBB00-TG,
MS912-KUBB00-SG, MS912-KUBB00-TG</td></tr>
<tr><td>Model Discrepancy</td><td>Difference of the model numbers (list on this report) are just for marketing purpose only and please see as below:
<table>
<tr><th rowspan="2">Model Number</th><th rowspan="2">Series Model Number</th><th colspan="2">Package</th><th colspan="2">Memory Chip</th></tr>
<tr><th>Carton Box</th><th>Retail Box</th><th>No</th><th>Yes</th></tr>
<tr><td rowspan="4">MS912+</td><td>MS912-FUBB00-SG</td><td>V</td><td></td><td></td><td>V</td></tr>
<tr><td>MS912-FUBB00-TG</td><td></td><td>V</td><td></td><td>V</td></tr>
<tr><td>MS912-KUBB00-SG</td><td>V</td><td></td><td>V</td><td></td></tr>
<tr><td>MS912-KUBB00-TG</td><td></td><td>V</td><td>V</td><td></td></tr>
</table></td></tr>
<tr><td>Received Date</td><td>September 19, 2016</td></tr>
<tr><td>EUT Power Rating</td><td>1. Powered from host device via USB
2. Powered from Li-ion Battery: 3.7V, 350mAh</td></tr>
<tr><td>Frequency Range</td><td>2402 ~ 2480 MHz</td></tr>
<tr><td>Transmit Power</td><td>4.59 dBm</td></tr>
<tr><td>Modulation Technique</td><td>GFSK for 1Mbps; π/4-DQPSK for 2Mbps; 8DPSK for 3Mbps</td></tr>
<tr><td>Number of Channels</td><td>79 Channels</td></tr>
<tr><td>Antenna Specification</td><td>Multilayer Ceramic Antenna
Walsin Technology Corp. / RFANT5220110A0T: Gain: 2.66dBi</td></tr>
</table>

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: **HLEMS912PBT** filing to comply with FCC Part 15C, Section 15.207, 15.209.*

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209, 15.247, DA00-70.

4.1 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.

4.2 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.

4.3 GENERAL TEST PROCEDURES

Conducted Emissions

According to the requirements in ANSI C63.10: 2013 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.

4.4 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.

4.5 DESCRIPTION OF TEST MODES

The EUT (model: MS912+) had been tested under operating condition.

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, π/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	Date 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 (Z axis) and the worst case was recorded.

***The system receivers have matched hopping input bandwidths of the dedicated transmitters, and synchronized shift frequencies with transmitted signals of the transmitters.**

5. INSTRUMENT CALIBRATION

5.1 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.

5.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

Conducted					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Power Meter	Anritsu	ML2495A	1012009	2016/07/04	2017/07/03
Power Meter	Anritsu	MA2411B	917072	2016/070/4	2017/07/03
Spectrum Analyzer	R&S	FSV 40	101073	2016/08/01	2017/07/31
Software	EZ-EMC (CCS-3A1RE)				

966A Chamber					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	US42510252	2015/12/08	2016/12/07
Bilog Antenna	Sunol Sciences	JB3	A030105	2016/07/03	2017/07/02
Pre-Amplifier	EMEC	EM330	60609	2016/06/08	2017/06/07
Horn Antenna	ETC	MCTD 1209	DRH13M02003	2016/09/02	2017/09/01
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R
Software	N/A				

Conducted Emission Room #B					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
LISN	SCHWARZBECK	NSLK 8127	8127-541	2015/11/23	2016/11/22
Receiver	R&S	ESCI	101073	2016/08/20	2017/08/19
Test S/W	CCS-3A1-CE				

Remark:

1. Each piece of equipment is scheduled for calibration once a year and Precision Dipole is scheduled for calibration once three years.

2. N.C.R. = No Calibration Required.

5.3 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.*

6. FACILITIES AND ACCREDITATIONS

6.1 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 and CISPR Publication 22.

6.2 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.”

6.3 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	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.*

7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

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

7.2 SUPPORT EQUIPMENT

No	Equipment	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1	PC	HP	HP Compag d530 CMT	N/A	DoC	Print Cable 1.5m,shielding	1.8m, Non-shielding
2	LCD Monitor	DELL	U2410F	N/A	DoC	VGA Cable 1.5m, shielding	1.8m, Non-shielding
3	Keyboard	DELL	SK-8115	T3A002	DoC	USB Cable 1.5m, Shielding	N/A
4	Mouse	DELL	M-UAL-96	R41105	DoC	USB Cable 1.5m, Shielding	N/A
5	Fixture Board	N/A	N/A	N/A	N/A	Fixture Line 0.3m, Non-Shielding	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.*

8. FCC PART 15.247 REQUIREMENTS

8.1 Pseudorandom Frequency Hopping Sequence

The Hopping sequence is unique for the piconet and the phase in the hopping sequence are determined by Bluetooth device address and Bluetooth clock of the master.

The channel is divided into time slots where each slot corresponds to an RF hop frequency. Consecutive hops correspond to different RF hop frequencies. In normal mode, hoping rate is 1600 hops/s with 6 slots in 79 hopping channels.

8.2 Channel List

The channel is represented by a Pseudor-andom Frequency Hopping Sequence through the 79 RF channels.

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	16	2418	32	2434	48	2450	64	2466
01	2403	17	2419	33	2435	49	2451	65	2467
02	2404	18	2420	34	2436	50	2452	66	2468
03	2405	19	2421	35	2437	51	2453	67	2469
04	2406	20	2422	36	2438	52	2454	68	2470
05	2407	21	2423	37	2439	53	2455	69	2471
06	2408	22	2424	38	2440	54	2456	70	2472
07	2409	23	2425	39	2441	55	2457	71	2473
08	2410	24	2426	40	2442	56	2458	72	2474
09	2411	25	2427	41	2443	57	2459	73	2475
10	2412	26	2428	42	2444	58	2460	74	2476
11	2413	27	2429	43	2445	59	2461	75	2477
12	2414	28	2430	44	2446	60	2462	76	2478
13	2415	29	2431	45	2447	61	2463	77	2479
14	2416	30	2432	46	2448	62	2464	78	2480
15	2417	31	2433	47	2449	63	2465		

8.3 Equal Hopping Frequency Use

Due to each of hopping frequency will be transmitted in accordance to the frequency tables in Part 7.2 , there is no any frequency will be able to hop more times than other. Therefore each frequency will be used equally.

8.4 Example of the hopping sequence channels in data mode

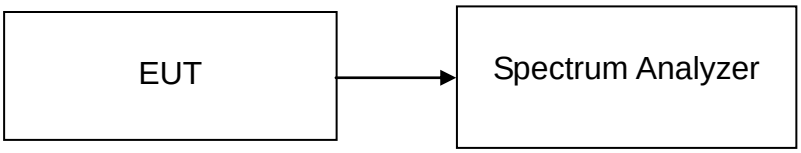
55, 63, 59, 74, 68, 16, 05, 66, 25, 03, 48, 54, 75, 65, 28, 19, 78, 26, 51, 14, 69, 38, 45, 49, 64, 47, 37, 46, 56, 33, 52, 77, 17, 32, 39, 76, 27, 18, 57, 53, 22, 12, 67, 04, 58, 61, 34, 15, 20, 69, 16, 08, 41, 11, 42, 62, 35, 72, 70, 07, 73, 13, 01, 71, 00, 09, 44, 50, 21, 06, 40, 23, 30, 36, 43, 10, 20, 24, 31, 05, 02

8.5 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	0.8653
Mid	2441	0.8653
High	2480	0.8749

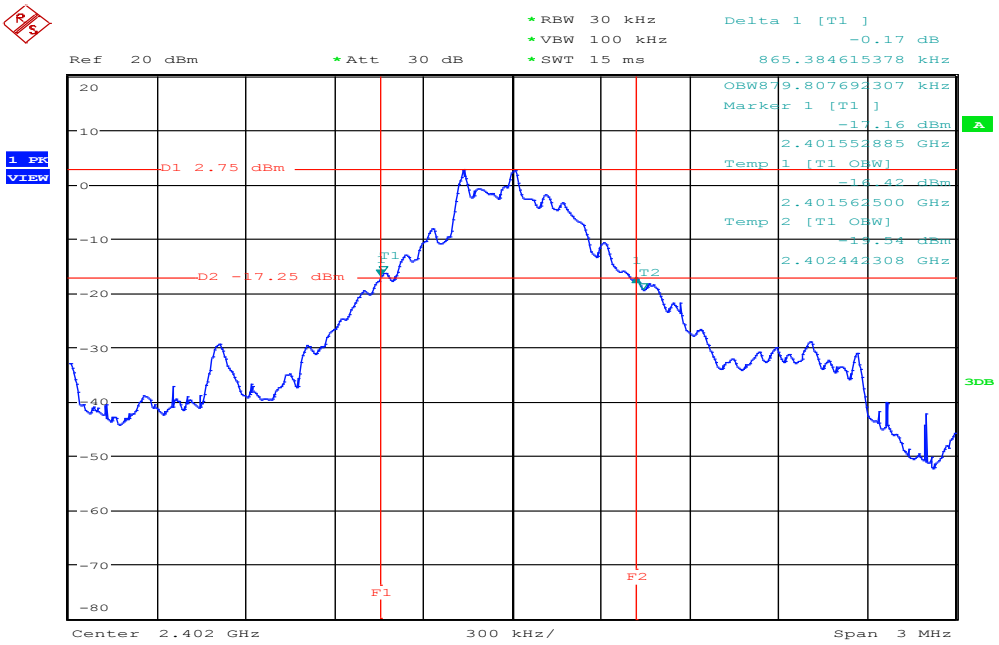
For 8DPSK / DH5

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	0.8317
Mid	2441	0.8413
High	2480	0.8413

Test Plot

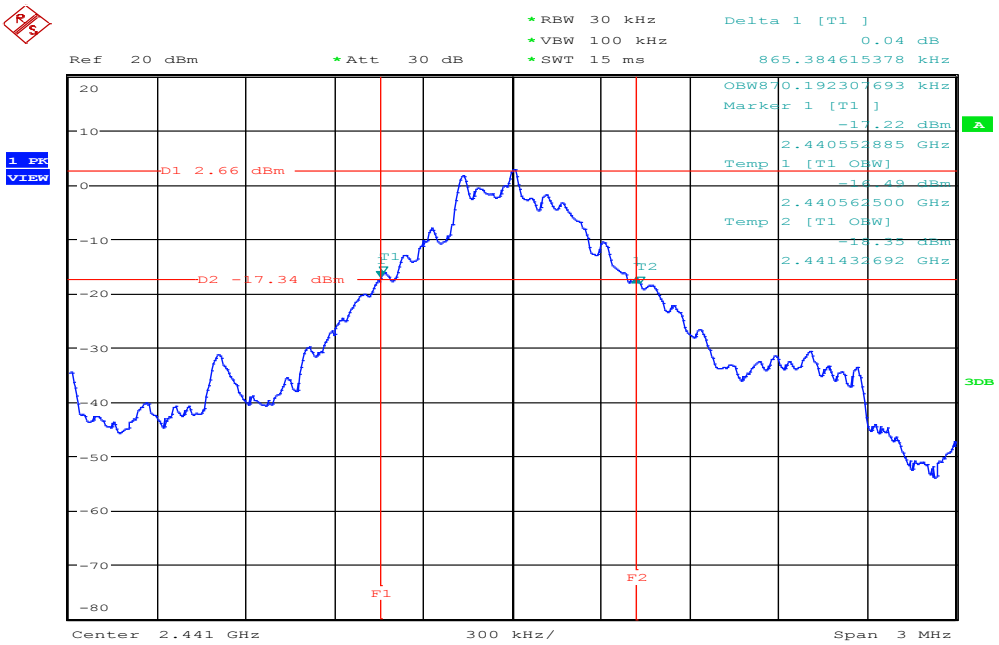
For GFSK / DH5

20dB Bandwidth (CH Low)



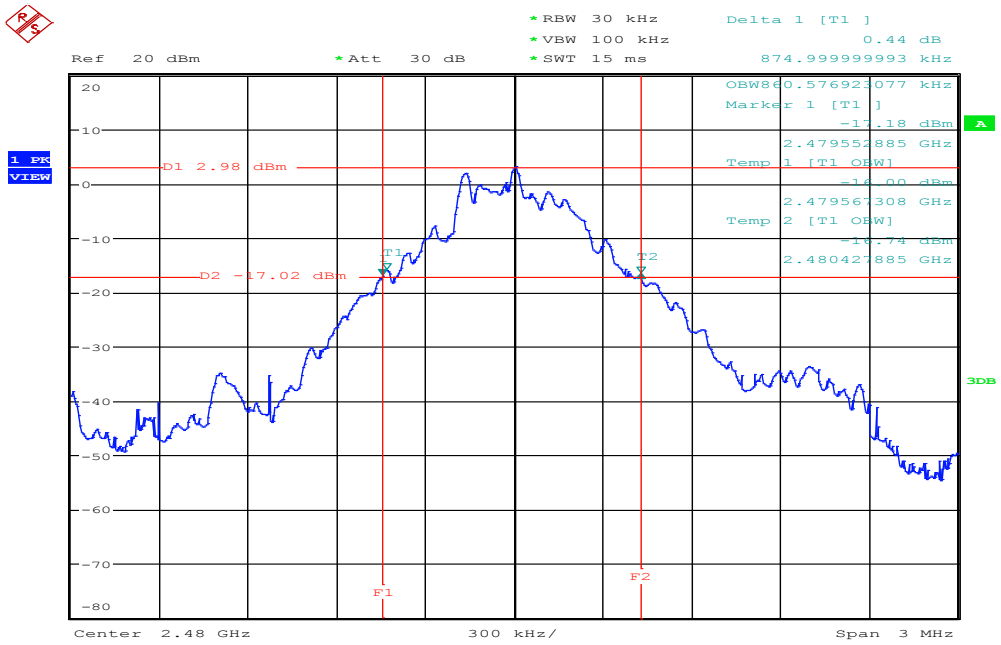
Date: 6.OCT.2016 17:33:50

20dB Bandwidth (CH Mid)



Date: 6.OCT.2016 17:38:22

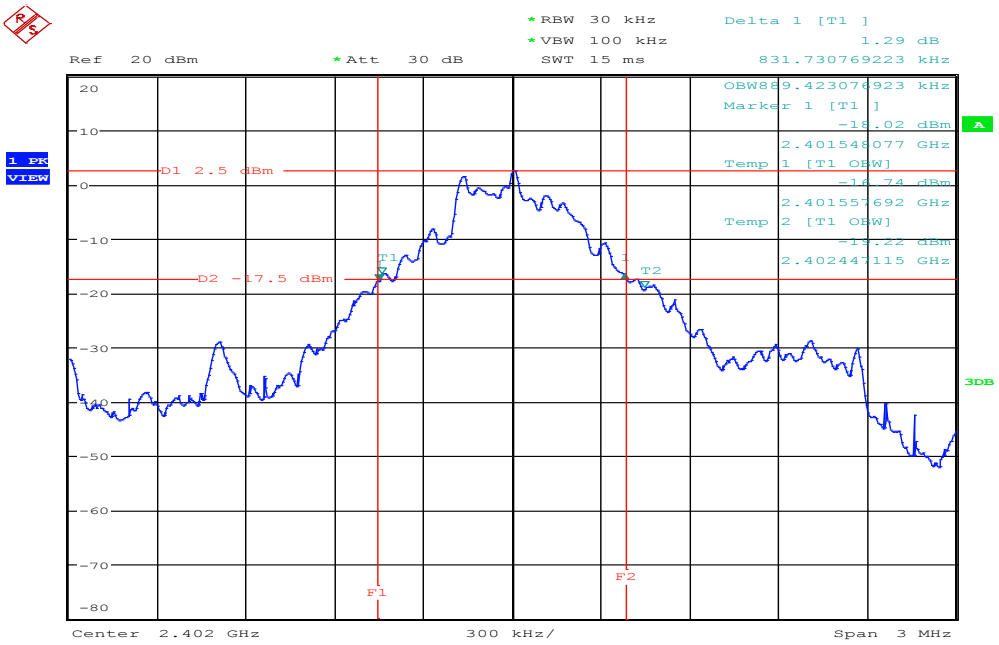
20dB Bandwidth (CH High)



Date: 6.OCT.2016 17:42:52

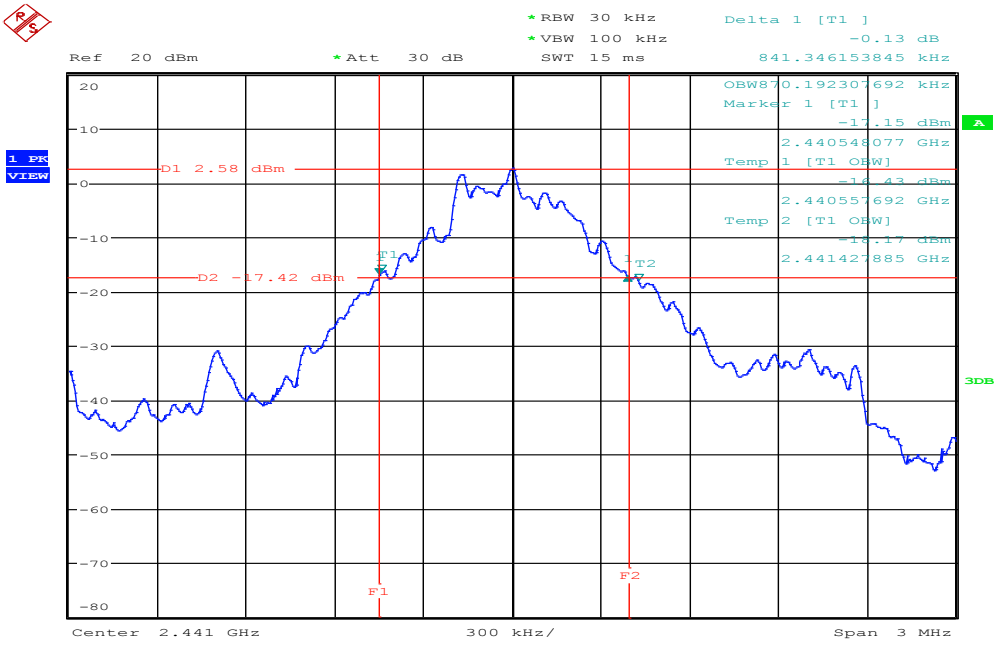
For 8DPSK / DH5

20dB Bandwidth (CH Low)



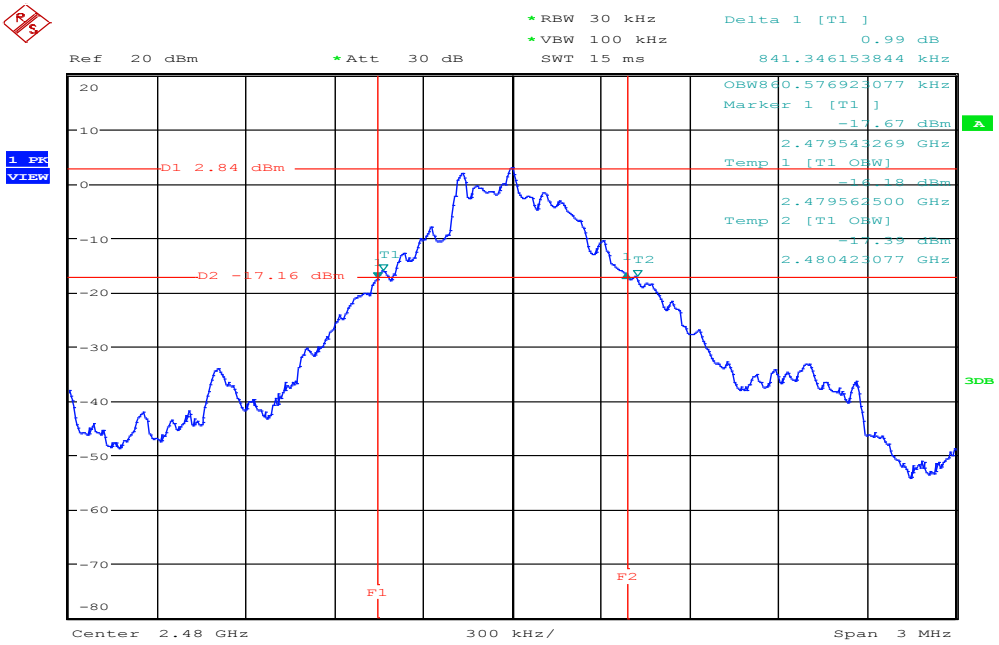
Date: 6.OCT.2016 18:46:43

20dB Bandwidth (CH Mid)



Date: 6.OCT.2016 19:06:27

20dB Bandwidth (CH High)



Date: 6.OCT.2016 19:08:57

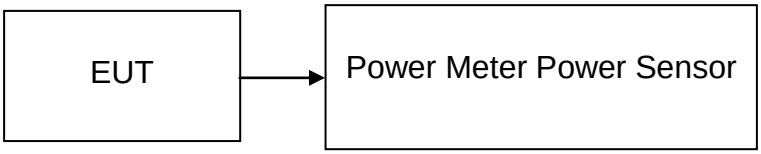
8.6 PEAK POWER

LIMIT

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

1. According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.
2. According to §15.247(b)(3), 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	4.07	0.0026	1	PASS
Mid	2441	3.84	0.0024		PASS
High	2480	***4.59**	0.0029		PASS

For 8DPSK / DH5

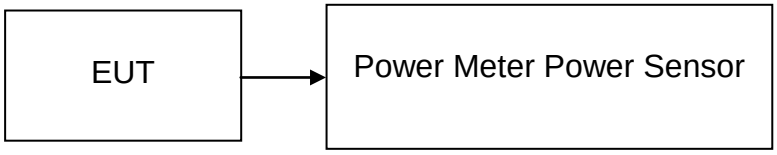
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	3.97	0.0025	1	PASS
Mid	2441	3.78	0.0024		PASS
High	2480	4.05	0.0025		PASS

8.7 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	3.86	0.0024
Mid	2441	3.65	0.0023
High	2480	***4.34**	0.0027

For 8DPSK / DH5

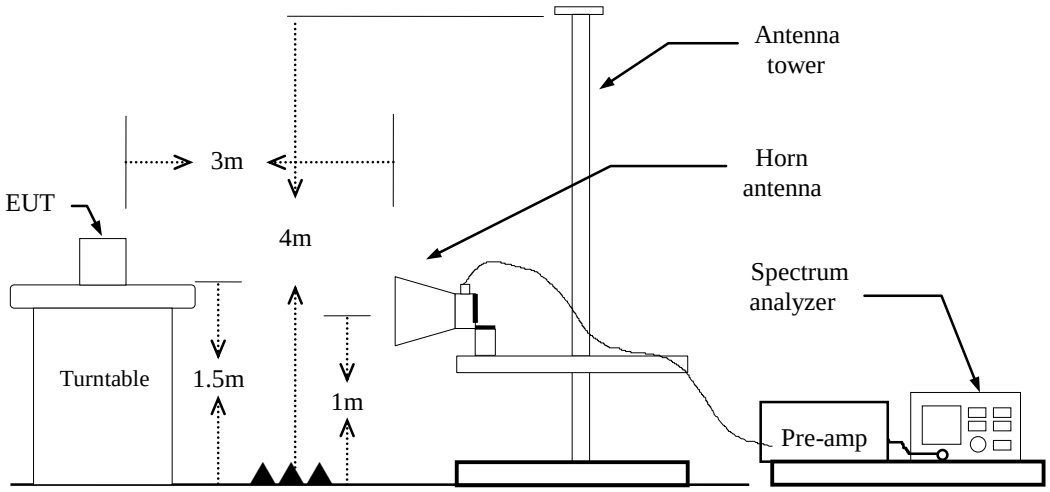
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2402	3.76	0.0024
Mid	2441	3.48	0.0022
High	2480	3.83	0.0024

8.8 BAND EDGES MEASUREMENT

LIMIT

According to §15.407(d), 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

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≧98%, VBW=10Hz.
   if duty cycle<98% VBW=1/T.

   BT: = 81%, VBW= 330Hz

   EDR = 81%, VBW= 330Hz
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.
6. Result = Spectrum Reading + cable loss(spectrum to Amp) - Amp Gain + Cable loss(Amp to receive Ant)+ Receive Ant

For Un-restricted Band Emissions

The peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level.

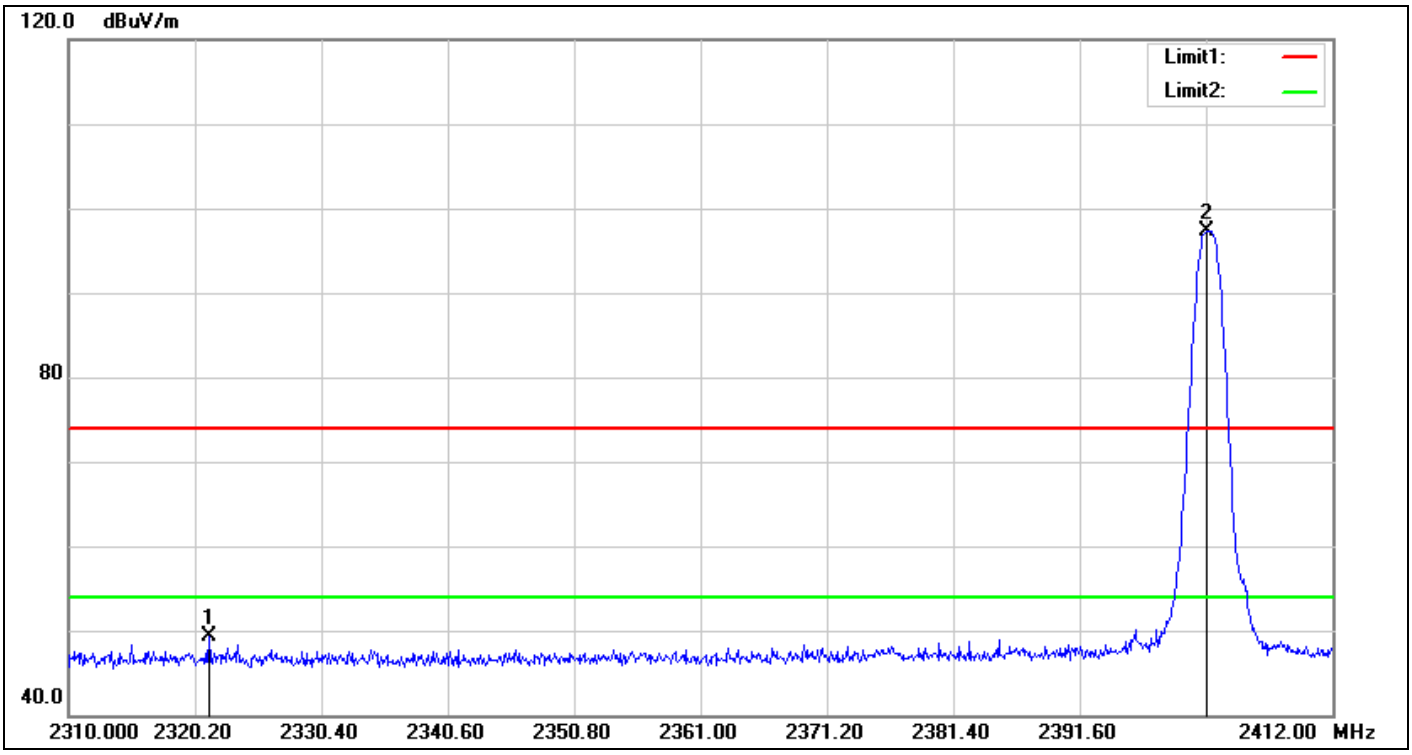
TEST RESULTS

Refer to attach spectrum analyzer data chart.

For GFSK

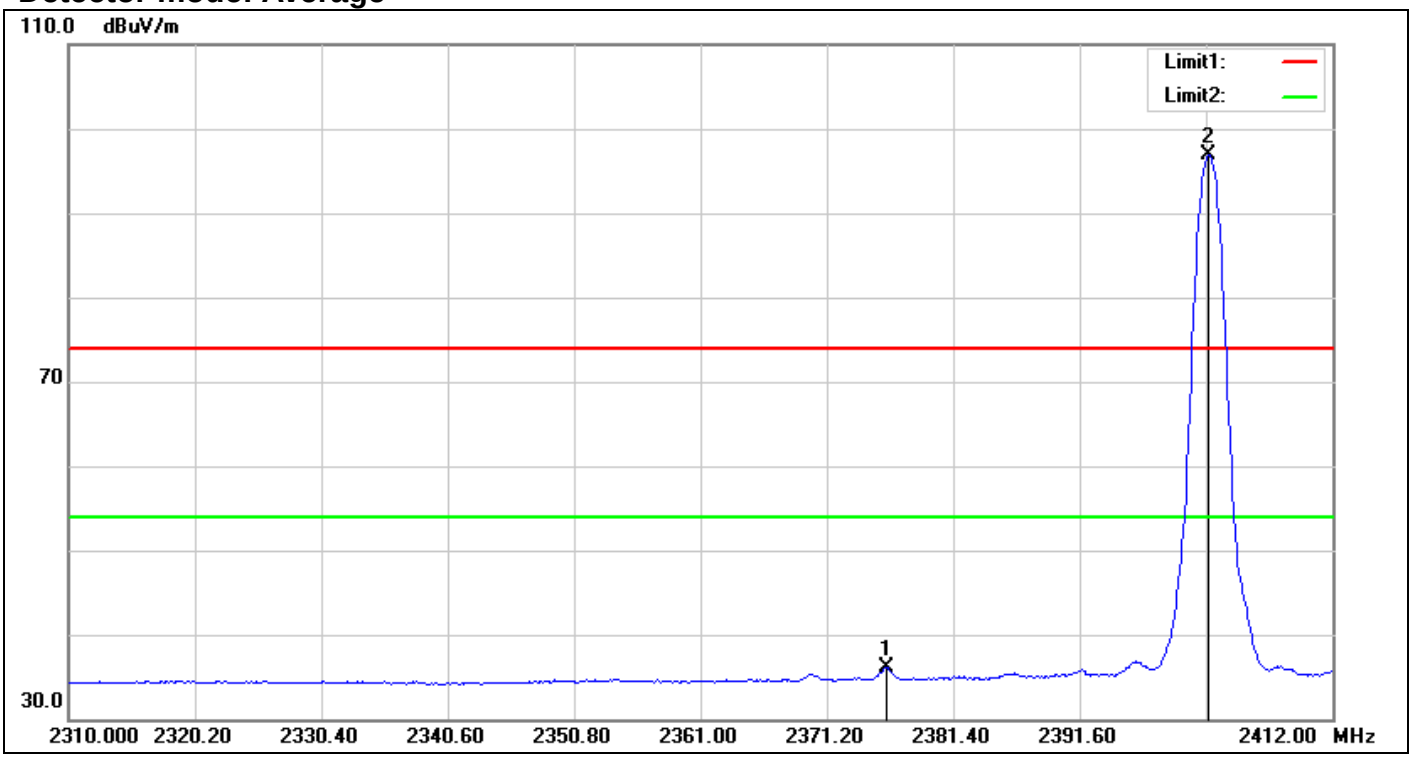
Band Edges (CH Low)

Detector mode: Peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2321.322	52.21	-2.97	49.24	74.00	-24.76	peak
2	2401.902	99.69	-2.41	97.28	--	--	peak

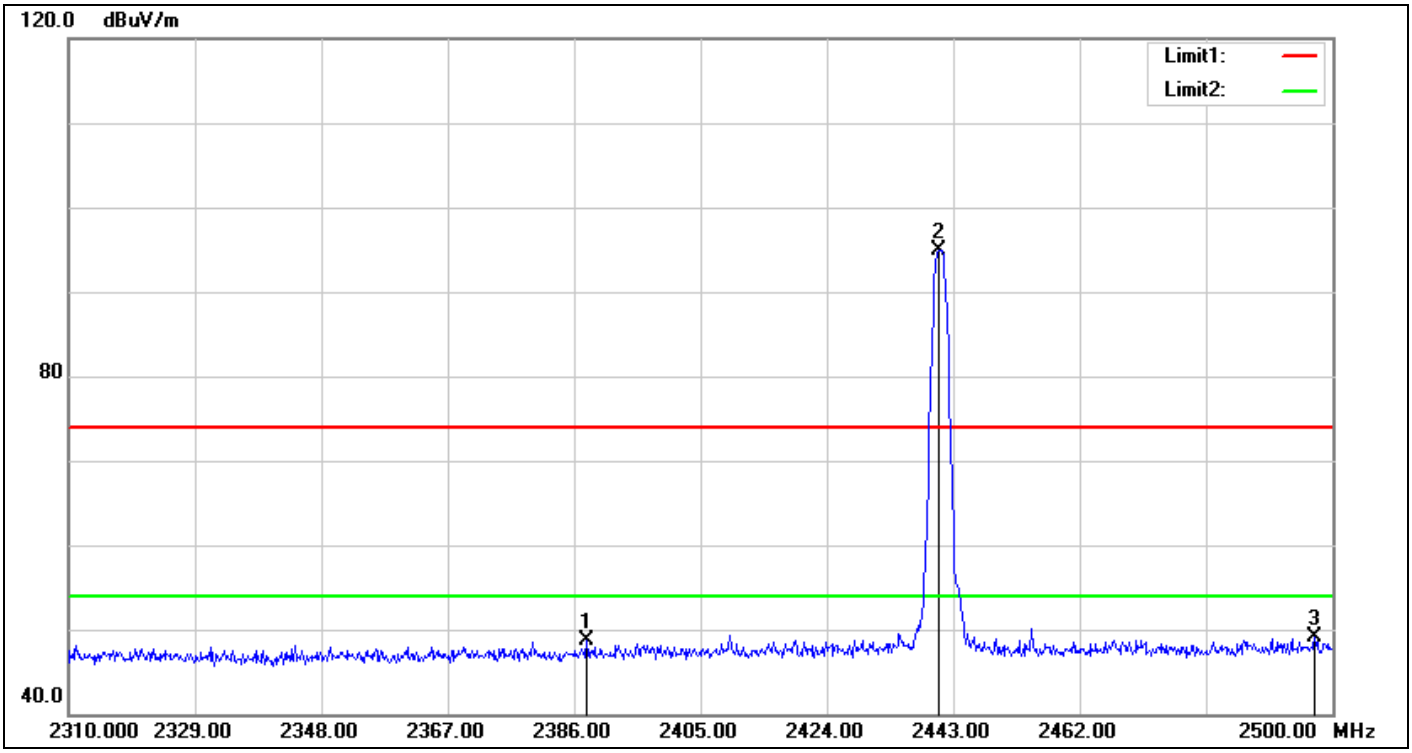
Detector mode: Average



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2375.994	38.72	-2.61	36.11	54.00	-17.89	AVG
2	2402.004	99.32	-2.41	96.91	--	--	AVG

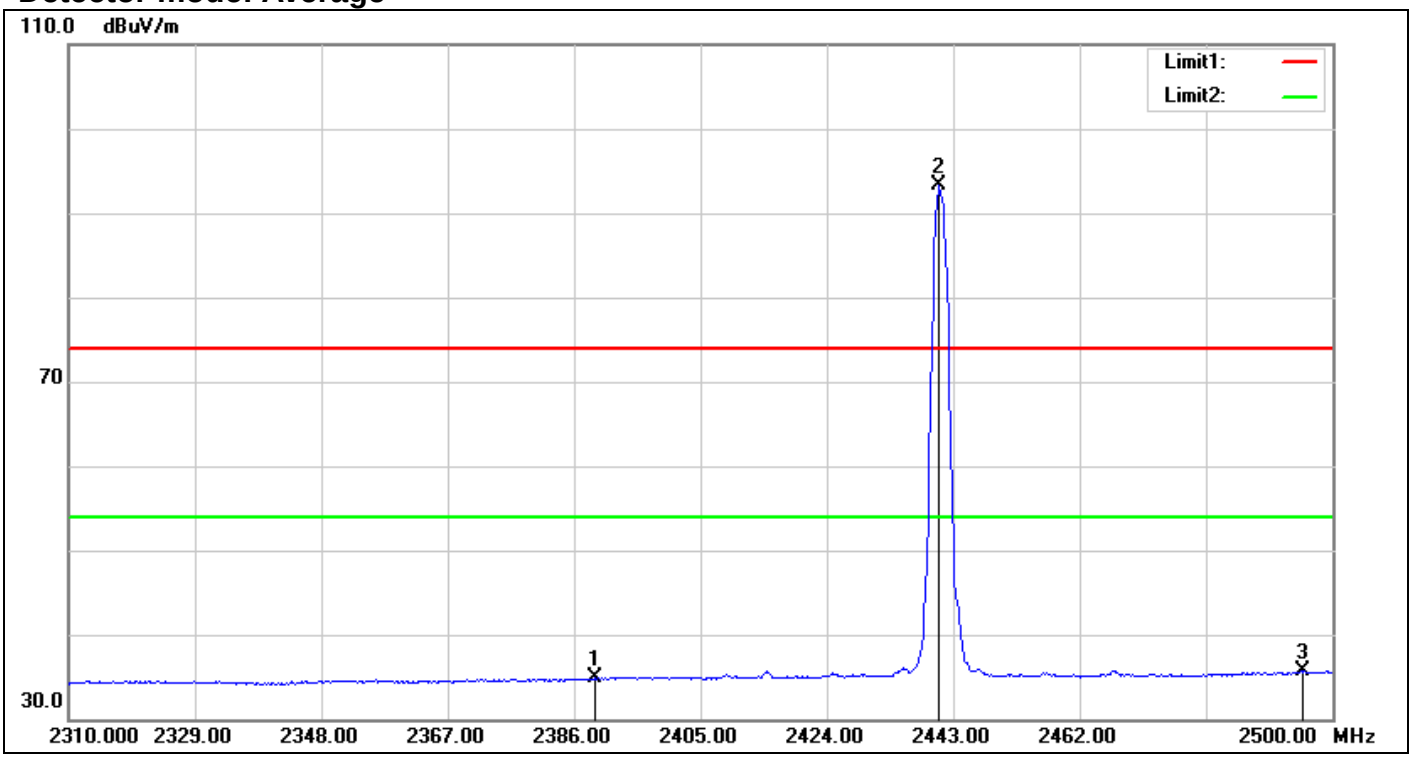
Band Edges (CH Mid)

Detector mode: Peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2387.900	51.23	-2.51	48.72	74.00	-25.28	peak
2	2440.720	97.20	-2.21	94.99	--	--	peak
3	2497.340	50.90	-1.88	49.02	74.00	-24.98	peak

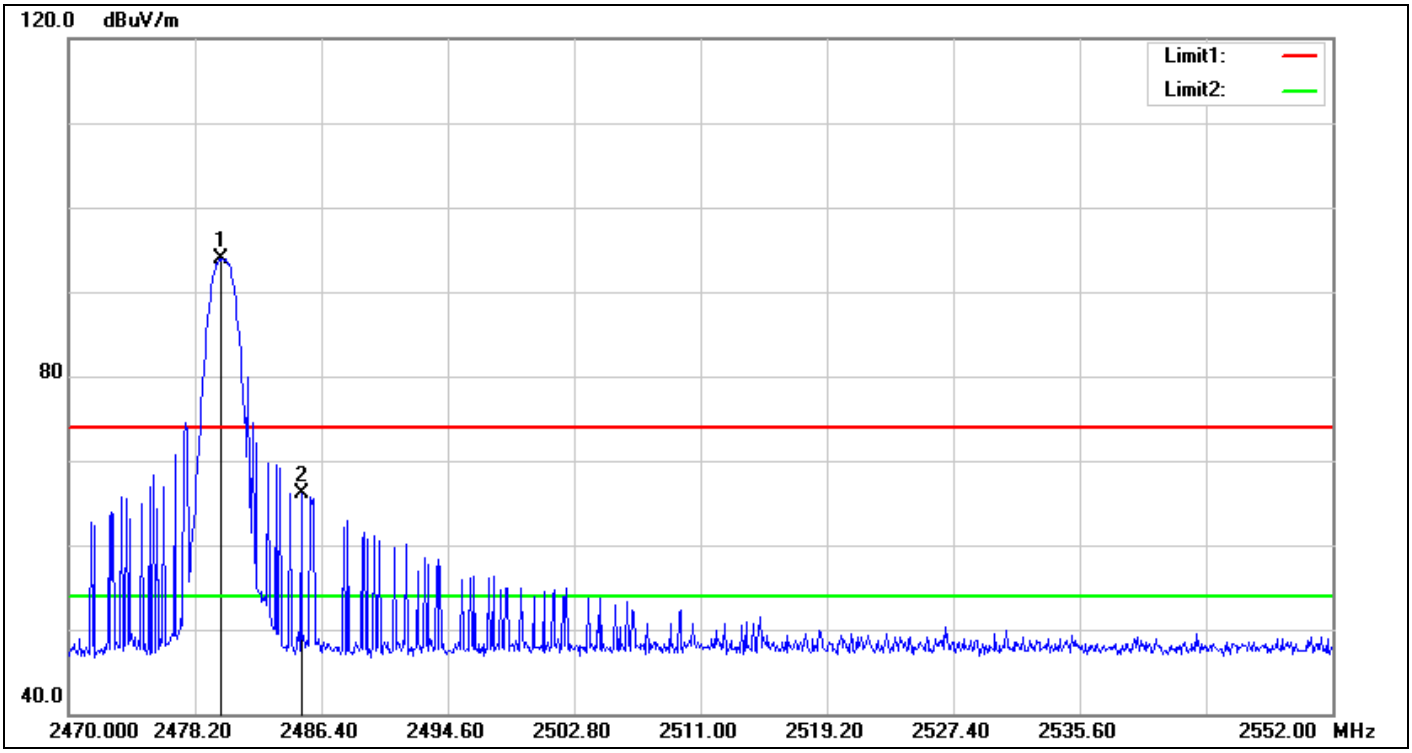
Detector mode: Average



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2389.040	37.32	-2.50	34.82	54.00	-19.18	AVG
2	2440.910	95.48	-2.21	93.27	--	--	AVG
3	2495.440	37.57	-1.89	35.68	54.00	-18.32	AVG

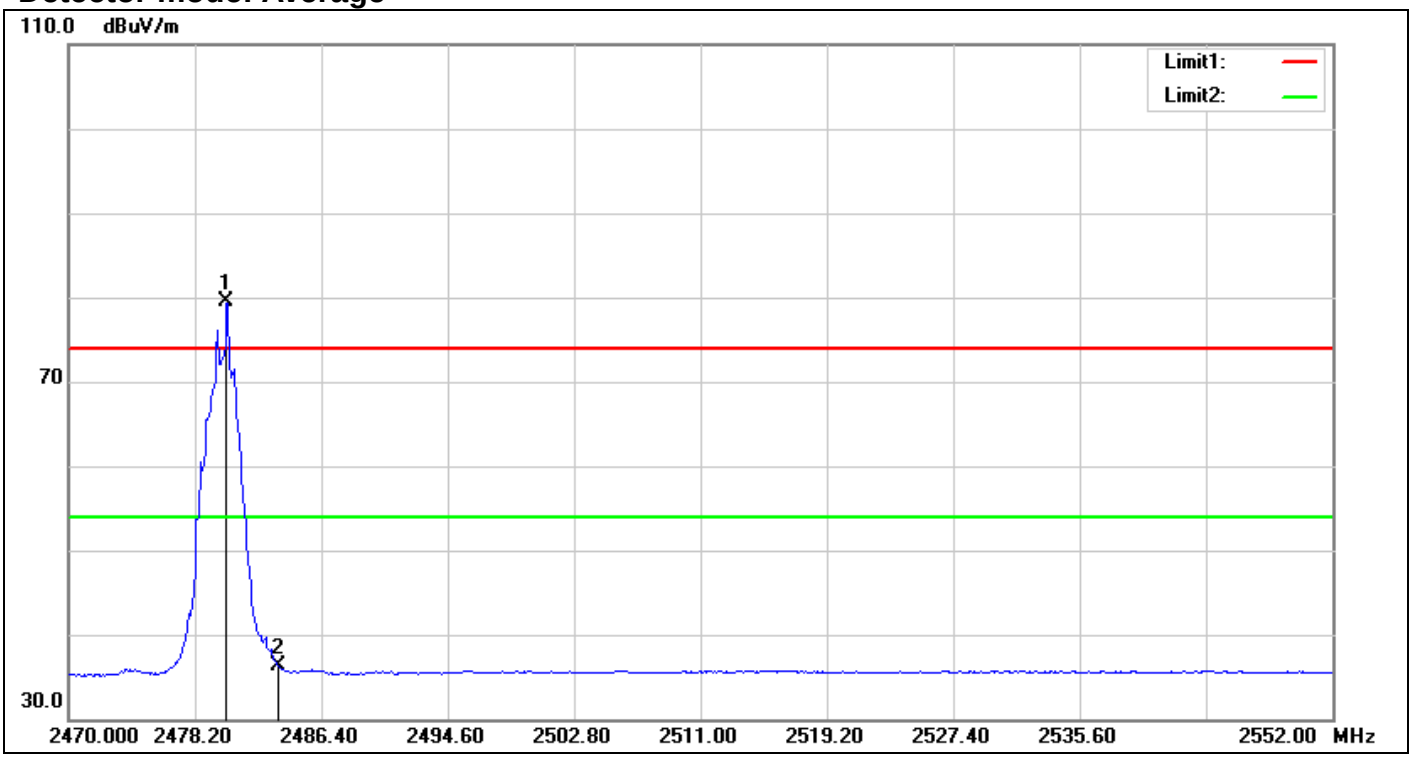
Band Edges (CH High)

Detector mode: Peak



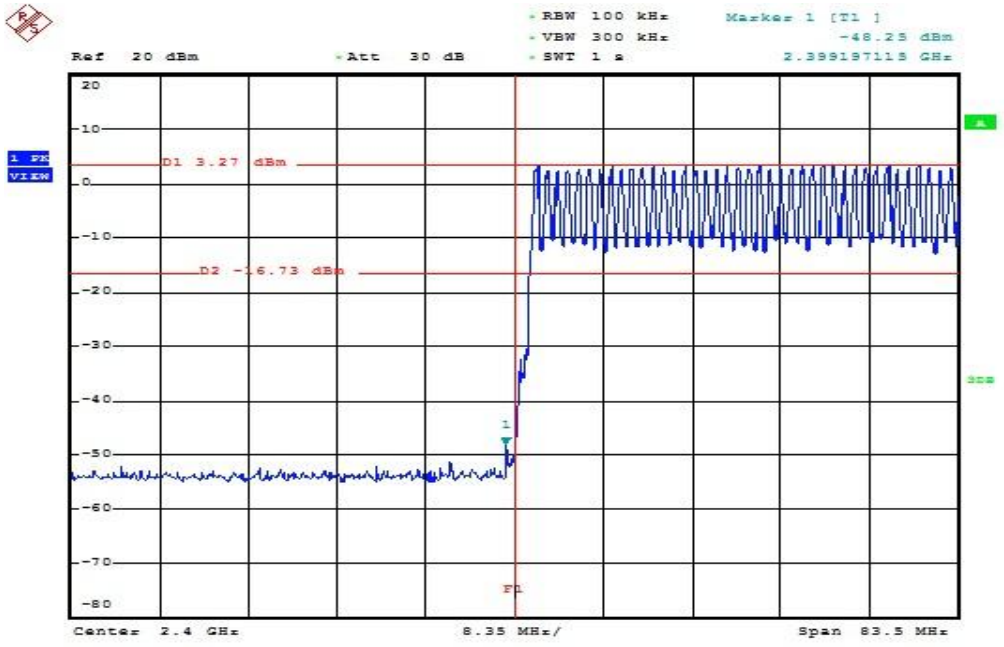
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2479.840	95.91	-2.03	93.88	--	--	peak
2	2485.088	68.12	-1.98	66.14	74.00	-7.86	peak

Detector mode: Average



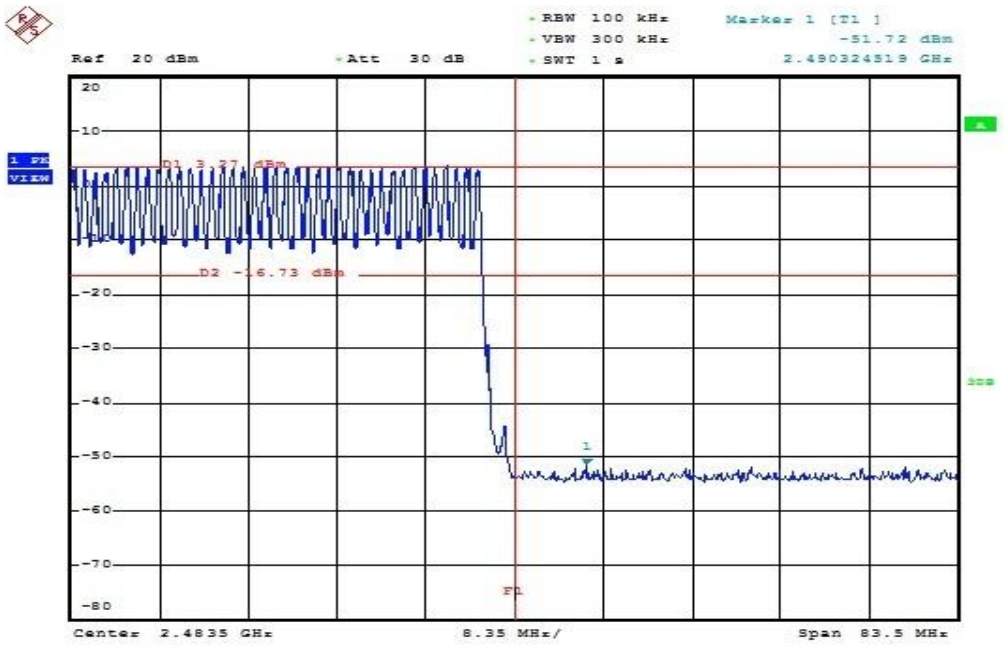
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2480.250	81.43	-2.03	79.40	--	--	AVG
2	2483.612	38.21	-1.99	36.22	54.00	-17.78	AVG

Hopping (CH Low)



Date: 6.OCT.2016 18:13:29

Hopping (CH High)

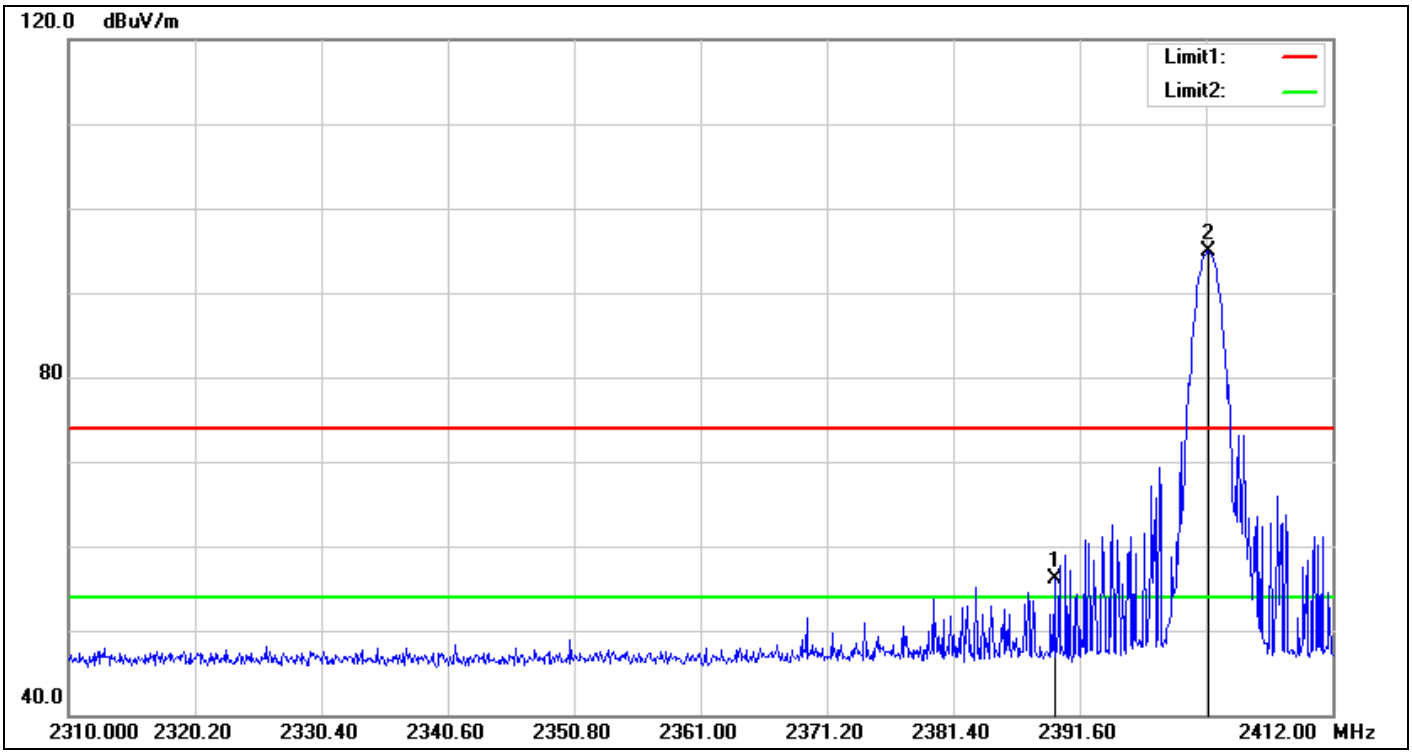


Date: 6.OCT.2016 18:19:12

For 8DPSK

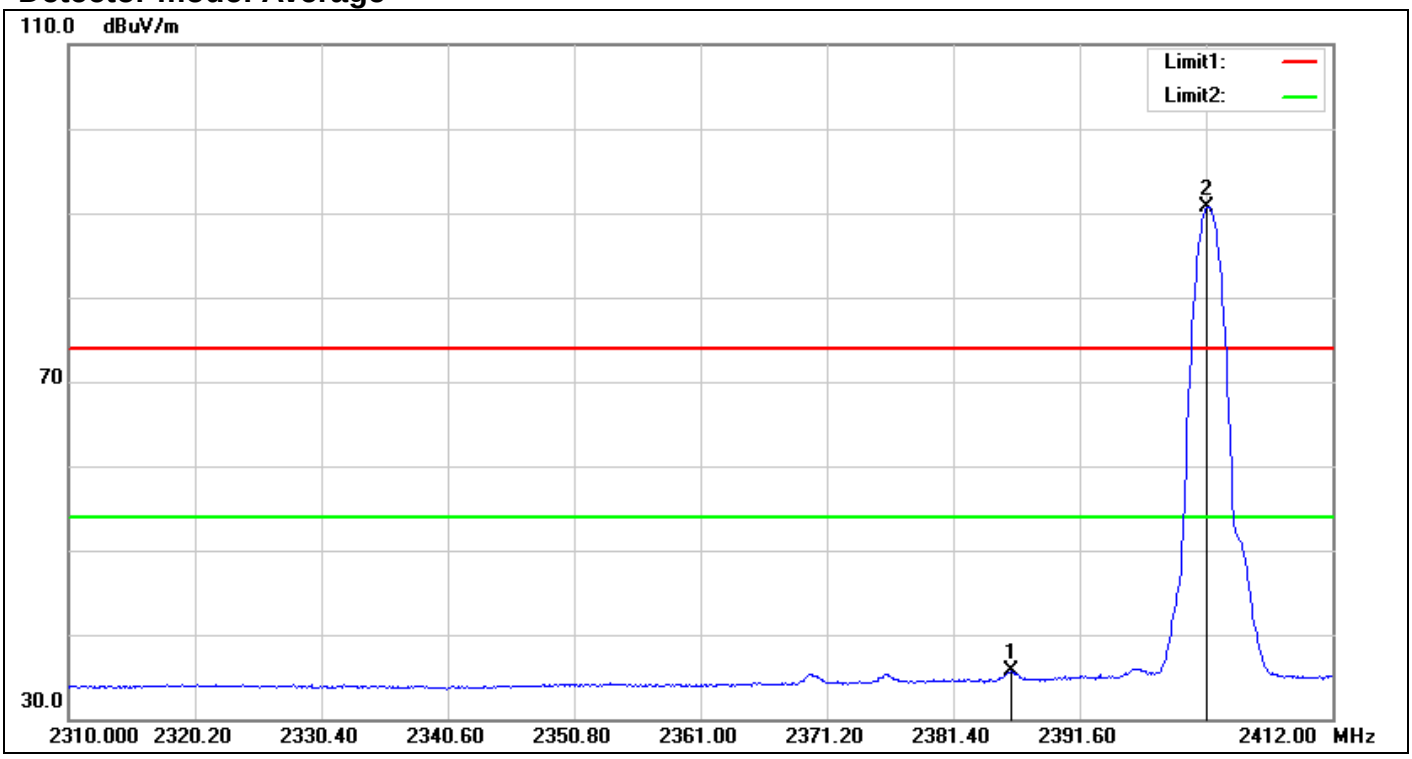
Band Edges (CH Low)

Detector mode: Peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2389.560	58.51	-2.49	56.02	74.00	-17.98	peak
2	2402.004	97.27	-2.41	94.86	--	--	peak

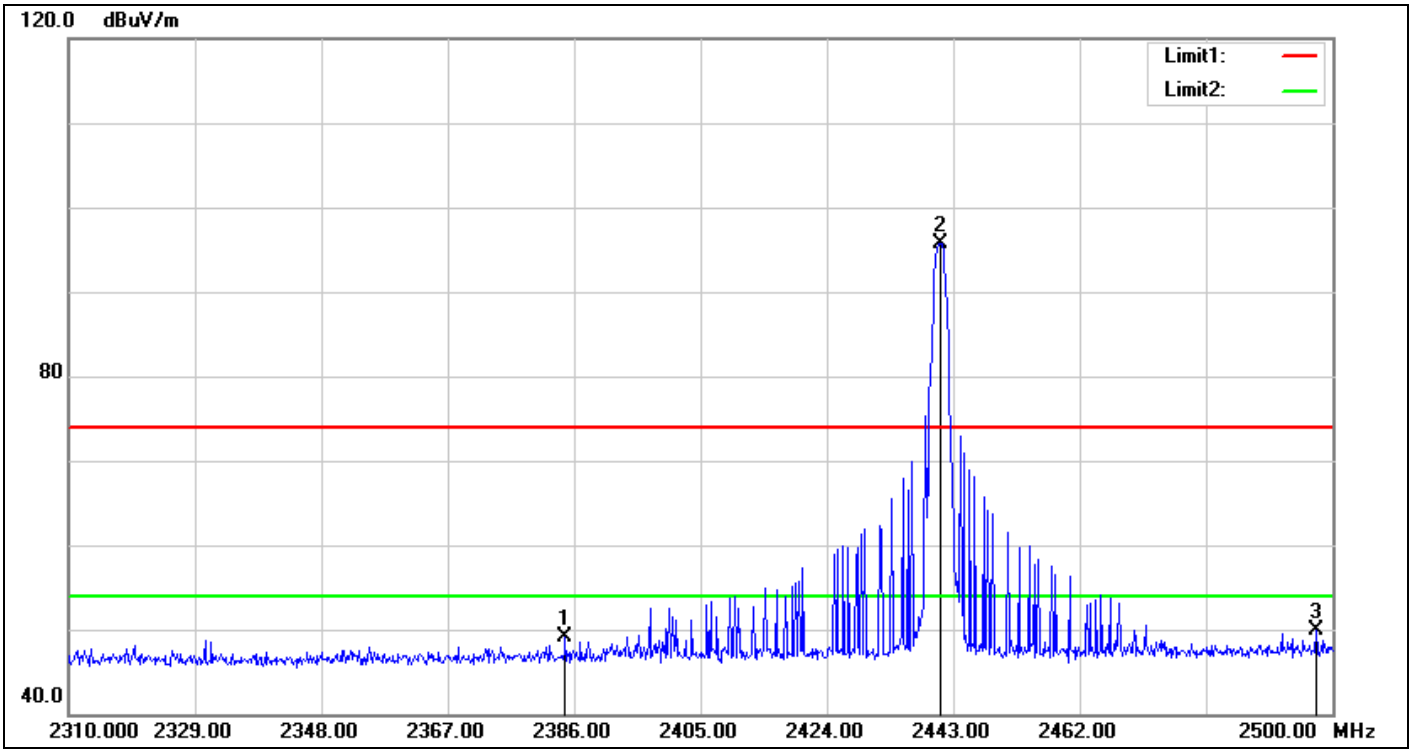
Detector mode: Average



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2386.092	38.14	-2.53	35.61	54.00	-18.39	AVG
2	2401.902	93.15	-2.41	90.74	--	--	AVG

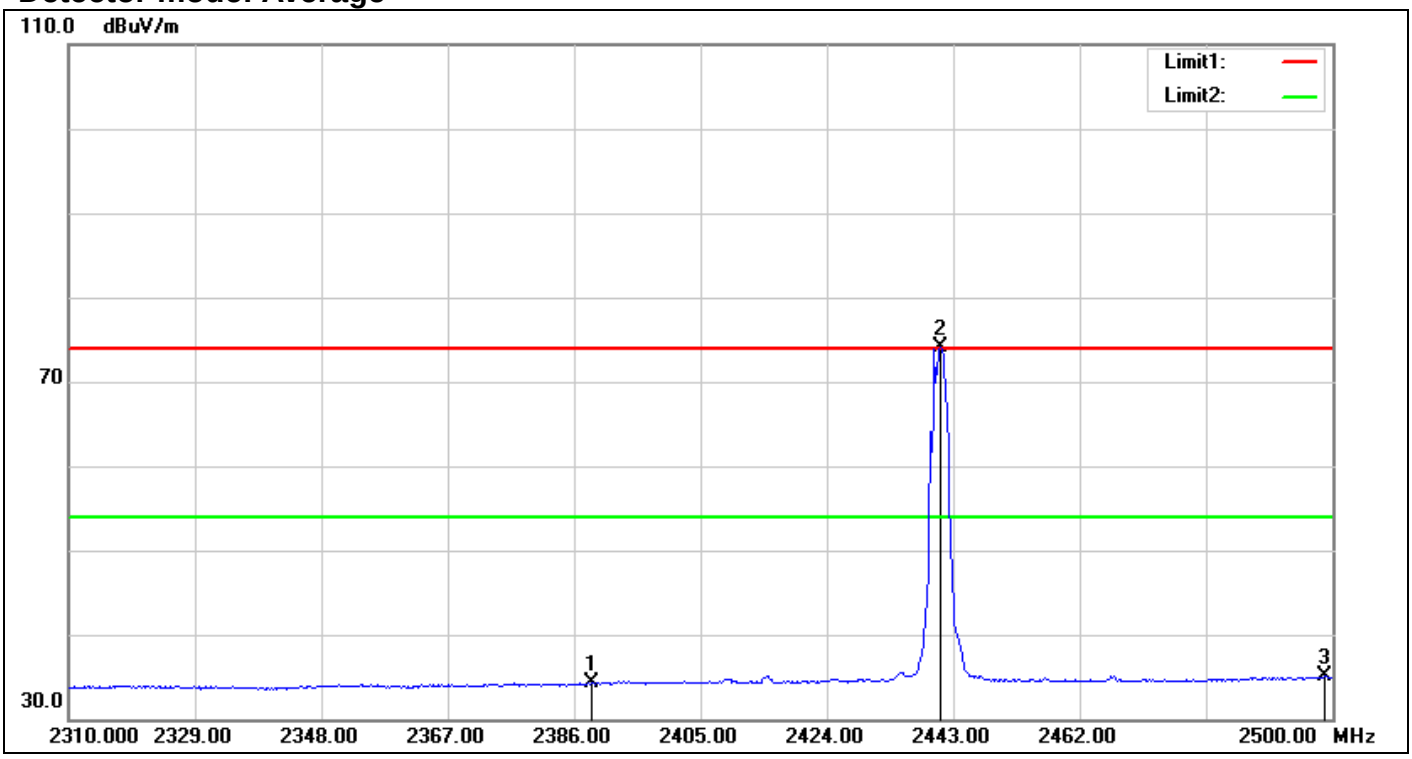
Band Edges (CH Mid)

Detector mode: Peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2384.670	51.69	-2.54	49.15	74.00	-24.85	peak
2	2441.100	97.92	-2.20	95.72	--	--	peak
3	2497.530	51.73	-1.88	49.85	74.00	-24.15	peak

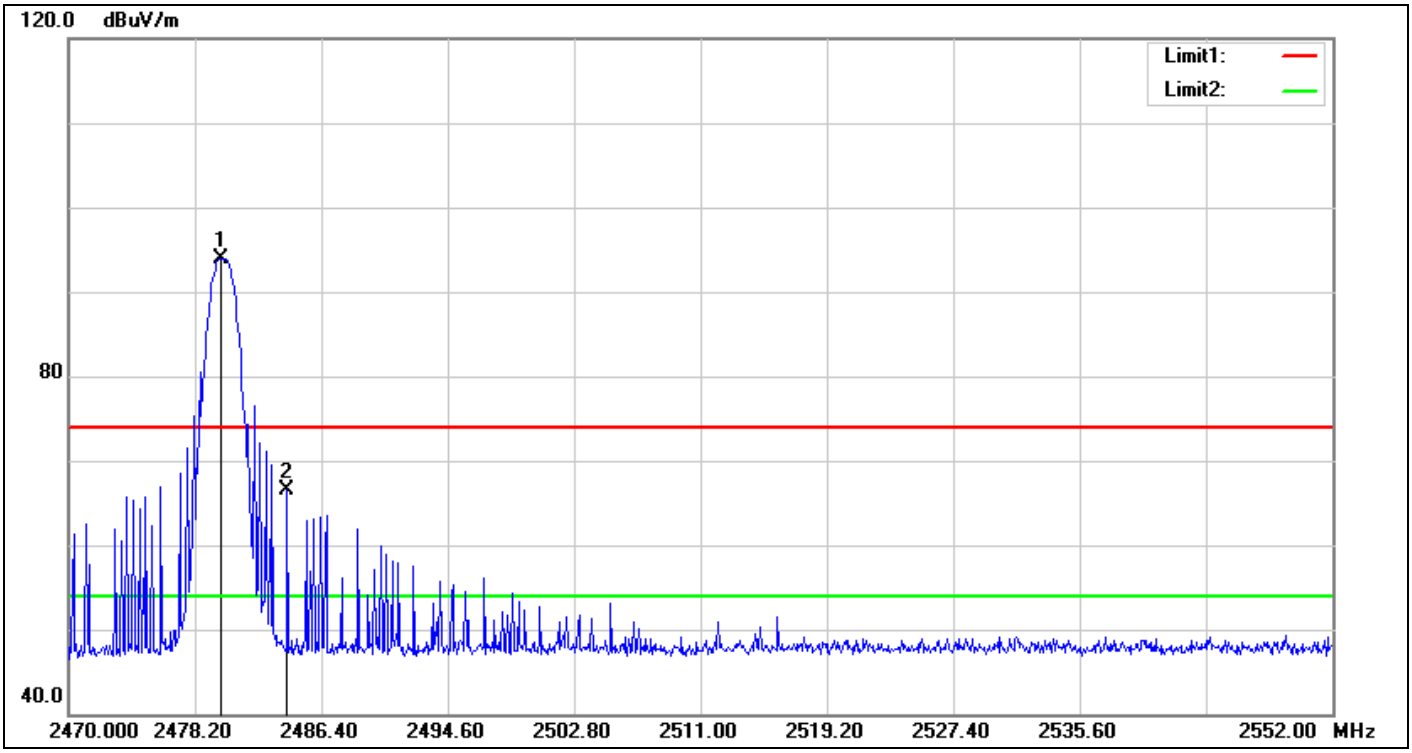
Detector mode: Average



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2388.660	36.77	-2.50	34.27	54.00	-19.73	AVG
2	2441.100	76.22	-2.20	74.02	--	--	AVG
3	2498.860	36.88	-1.87	35.01	54.00	-18.99	AVG

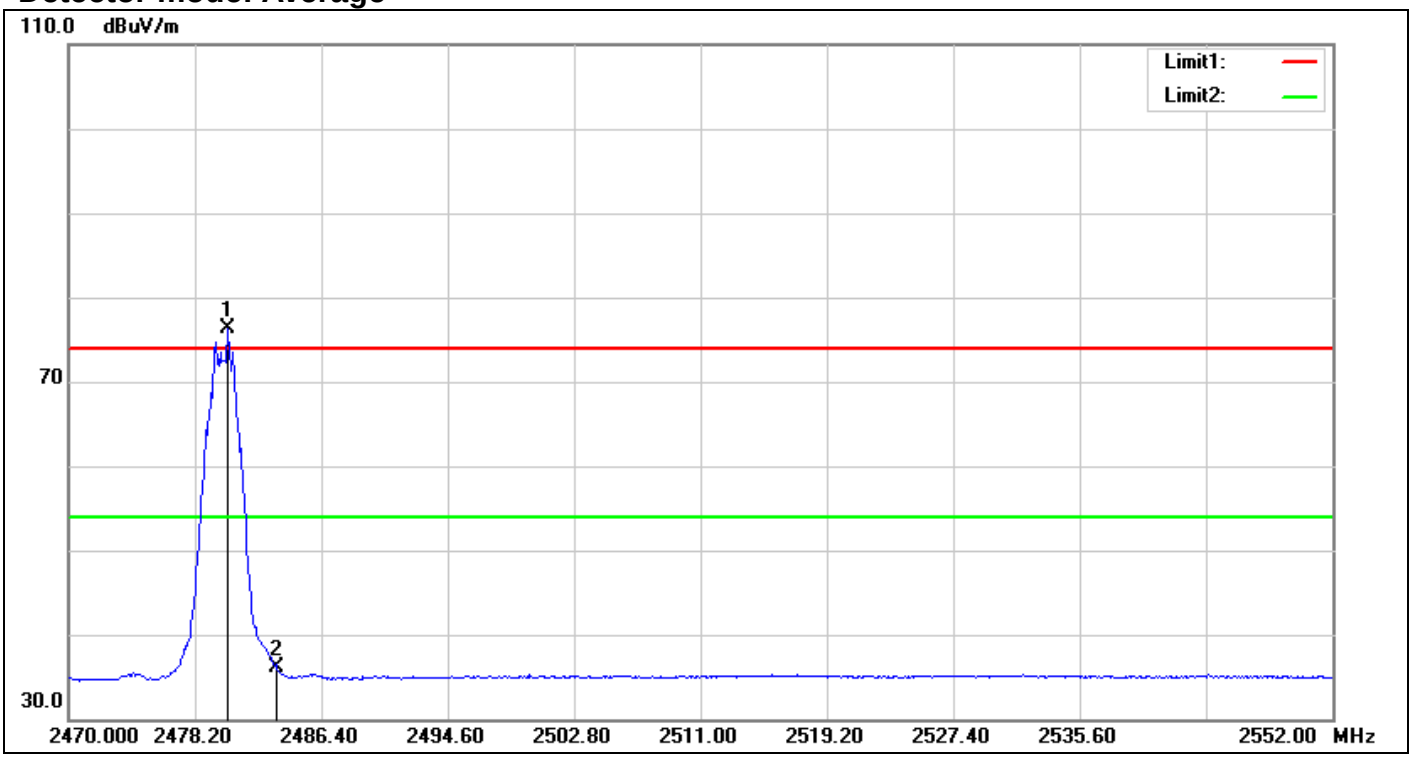
Band Edges (CH High)

Detector mode: Peak



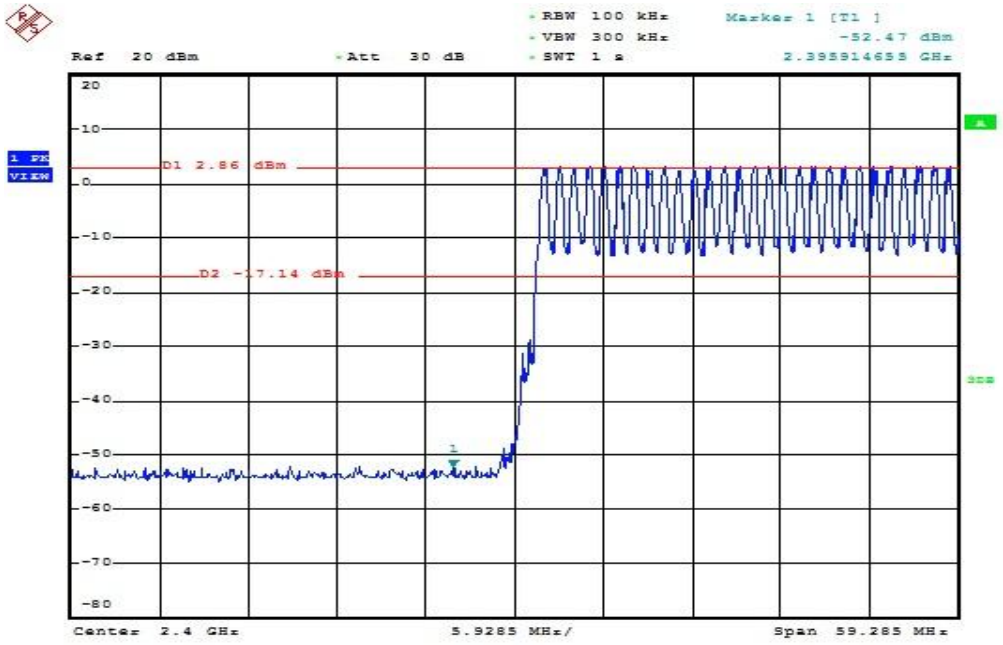
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2479.840	95.97	-2.03	93.94	--	--	peak
2	2484.186	68.52	-1.99	66.53	74.00	-7.47	peak

Detector mode: Average



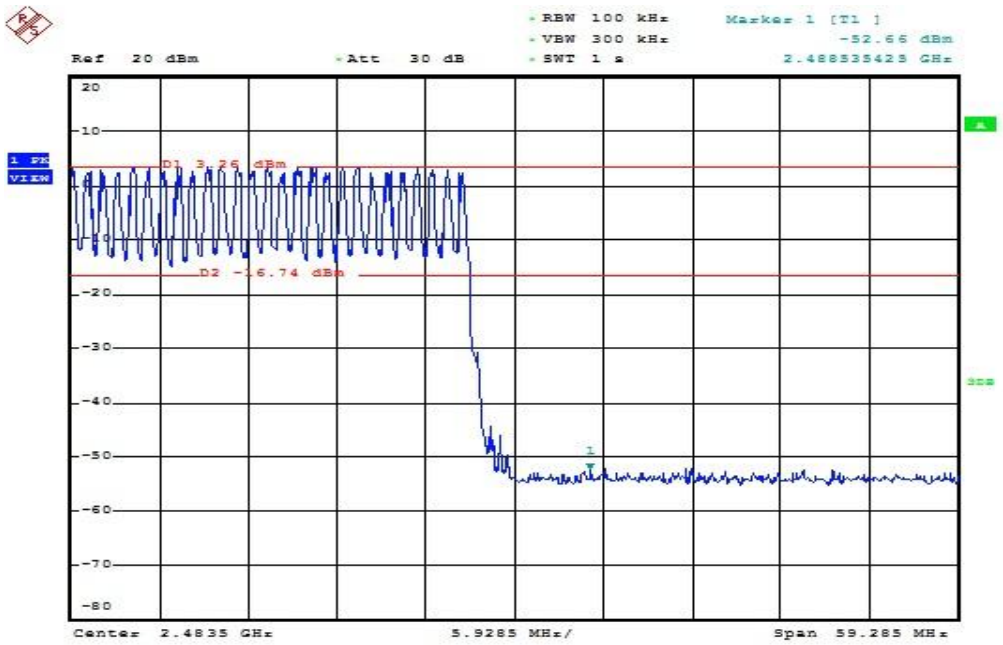
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2480.332	78.26	-2.03	76.23	--	--	AVG
2	2483.530	38.09	-1.99	36.10	54.00	-17.90	AVG

Hopping (CH Low)



Date: 6.OCT.2016 19:43:10

Hopping (CH High)

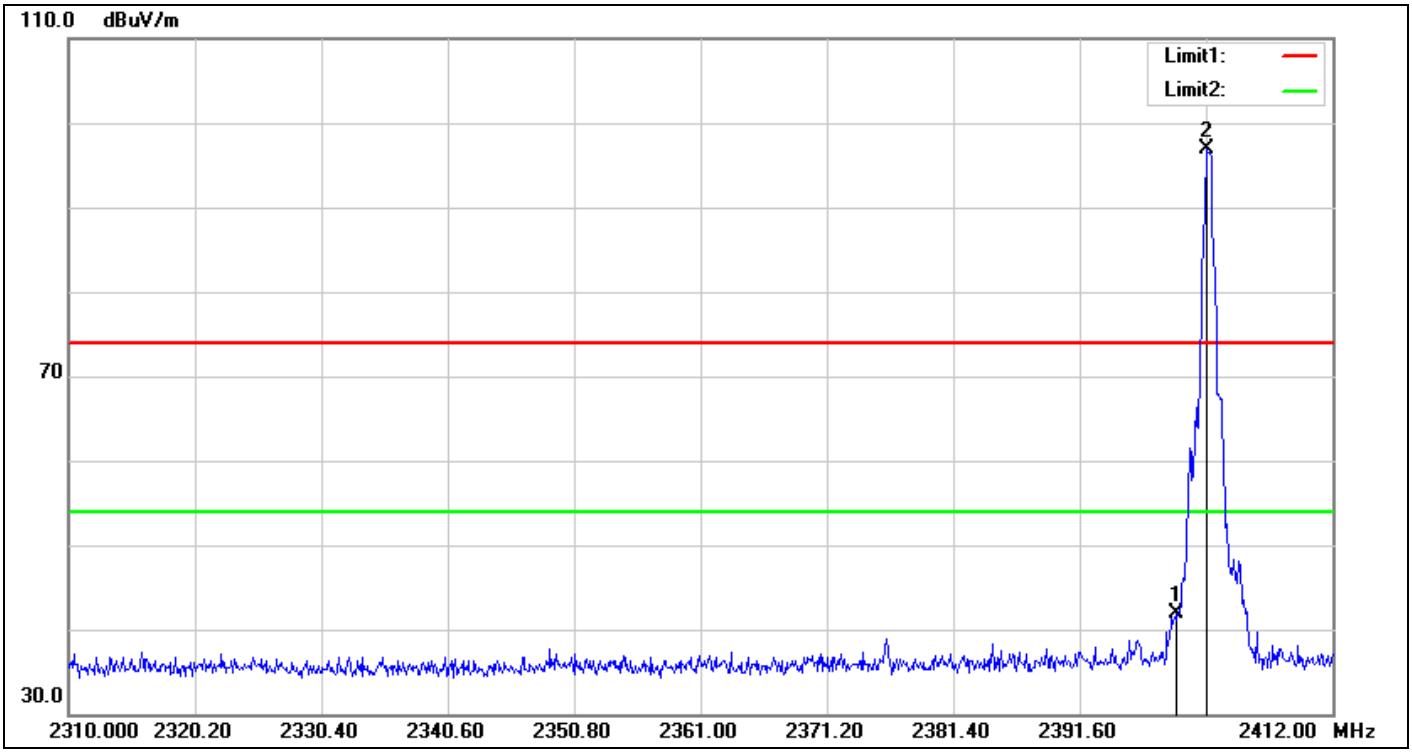


Date: 6.OCT.2016 19:37:58

Test Plot

For GFSK

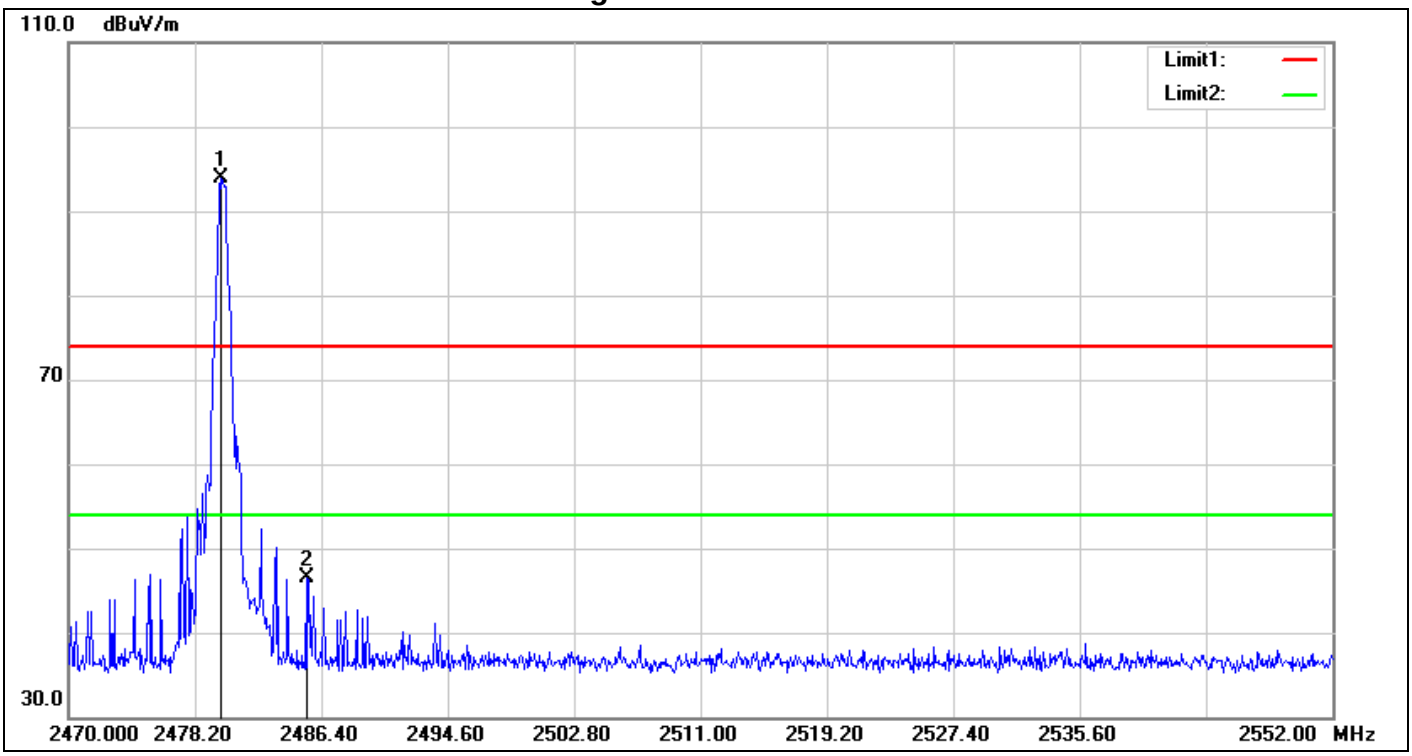
Un-restricted Band Emissions / CH Low



No.	Frequency	Reading	Correct	Result	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	
1	2399.454	44.29	-2.41	41.88	peak
2	2401.800	99.33	-2.41	96.92	peak

Note: Spurious emission levels that exceed the level of 20 dB below the applicable limit.

Un-restricted Band Emissions / CH High

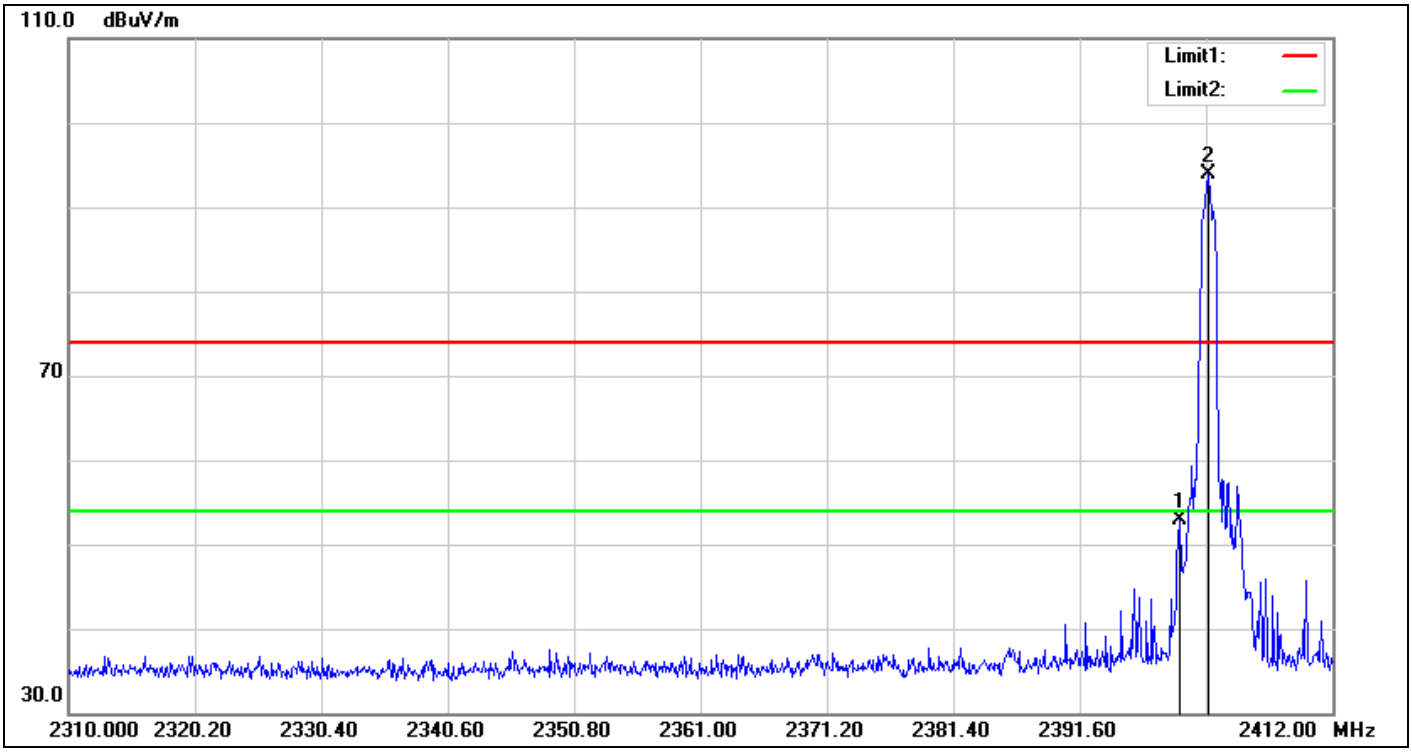


No.	Frequency	Reading	Correct	Result	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	
1	2479.840	95.90	-2.03	93.87	peak
2	2485.416	48.57	-1.98	46.59	peak

Note: Spurious emission levels that exceed the level of 20 dB below the applicable limit.

For 8DPSK

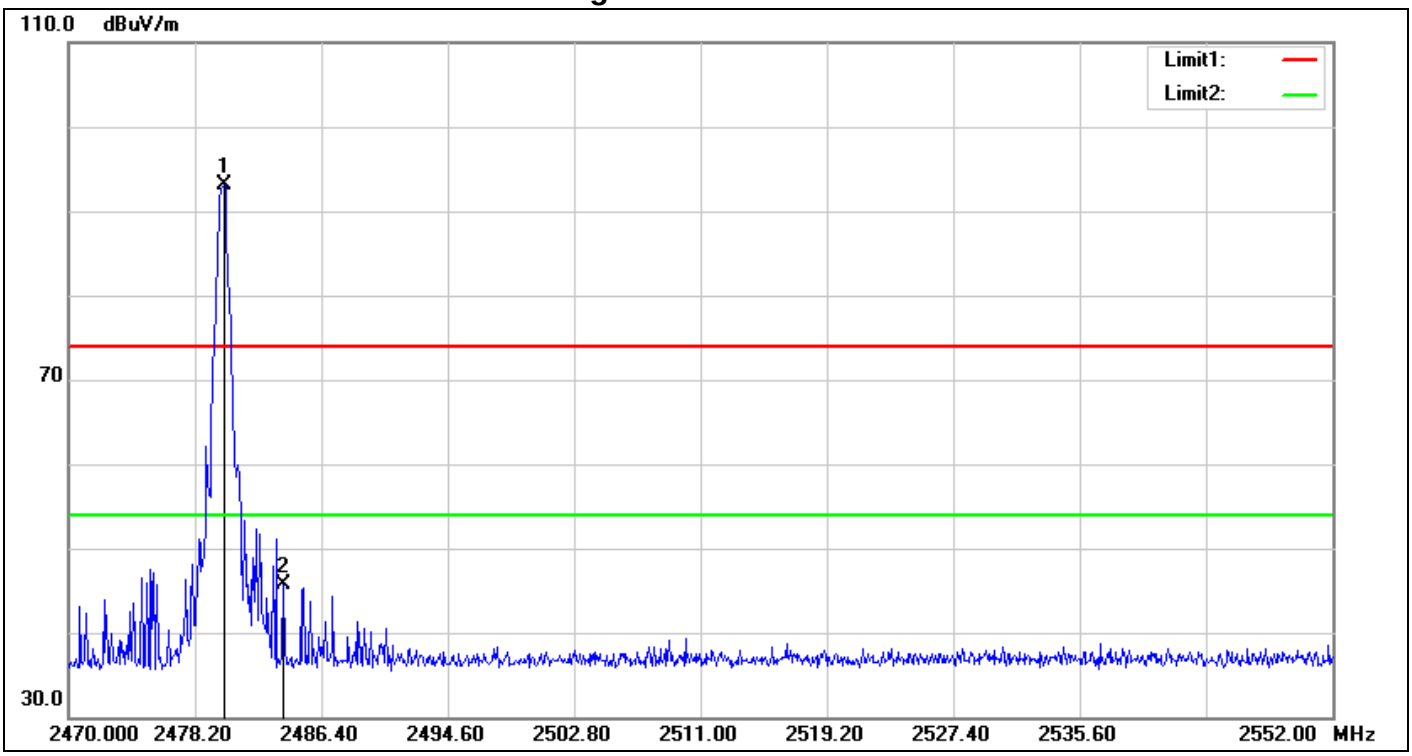
Un-restricted Band Emissions / CH Low



No.	Frequency	Reading	Correct	Result	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	
1	2399.658	55.36	-2.41	52.95	peak
2	2402.004	96.28	-2.41	93.87	peak

Note: Spurious emission levels that exceed the level of 20 dB below the applicable limit.

Un-restricted Band Emissions / CH High



No.	Frequency	Reading	Correct	Result	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	
1	2480.086	95.06	-2.03	93.03	peak
2	2483.940	47.74	-1.99	45.75	peak

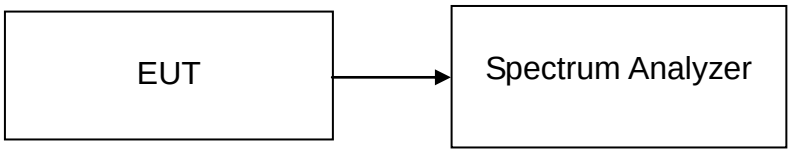
Note: Spurious emission levels that exceed the level of 20 dB below the applicable limit.

8.9 FREQUENCY SEPARATION

LIMIT

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

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

Channel	Channel Separation (MHz)	two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit	Result
Low	1.0048	0.577	> two-thirds of the 20 dB bandwidth	Pass
Mid	1.0048	0.577	> two-thirds of the 20 dB bandwidth	Pass
High	1.0048	0.583	> two-thirds of the 20 dB bandwidth	Pass

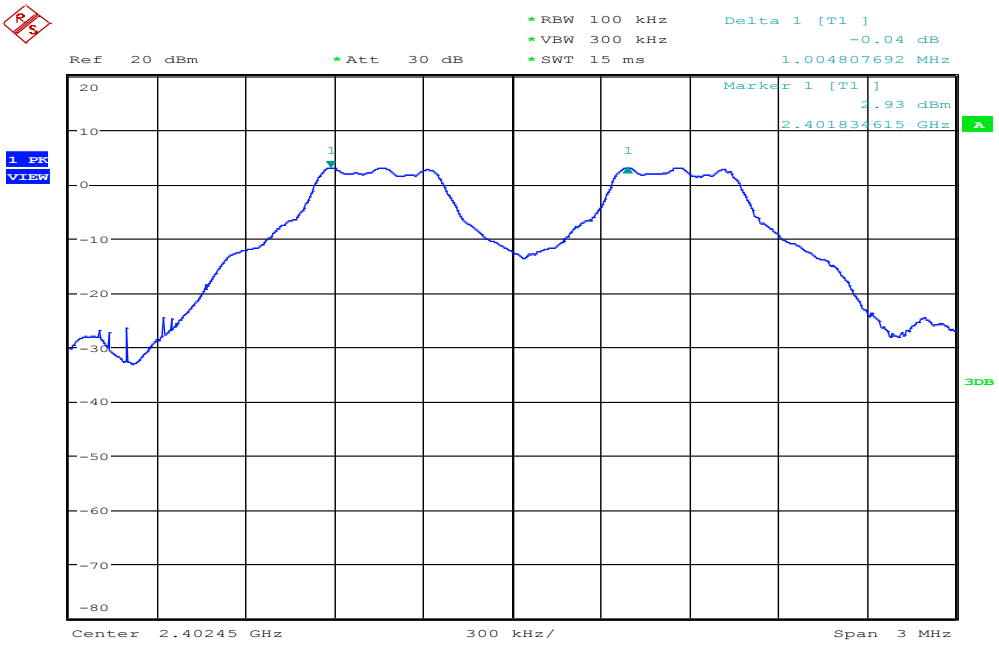
For 8DPSK

Channel	Channel Separation (MHz)	two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit	Result
Low	1.0048	0.554	> two-thirds of the 20 dB bandwidth	Pass
Mid	1.0048	0.561	> two-thirds of the 20 dB bandwidth	Pass
High	1.0048	0.561	> two-thirds of the 20 dB bandwidth	Pass

Test Plot

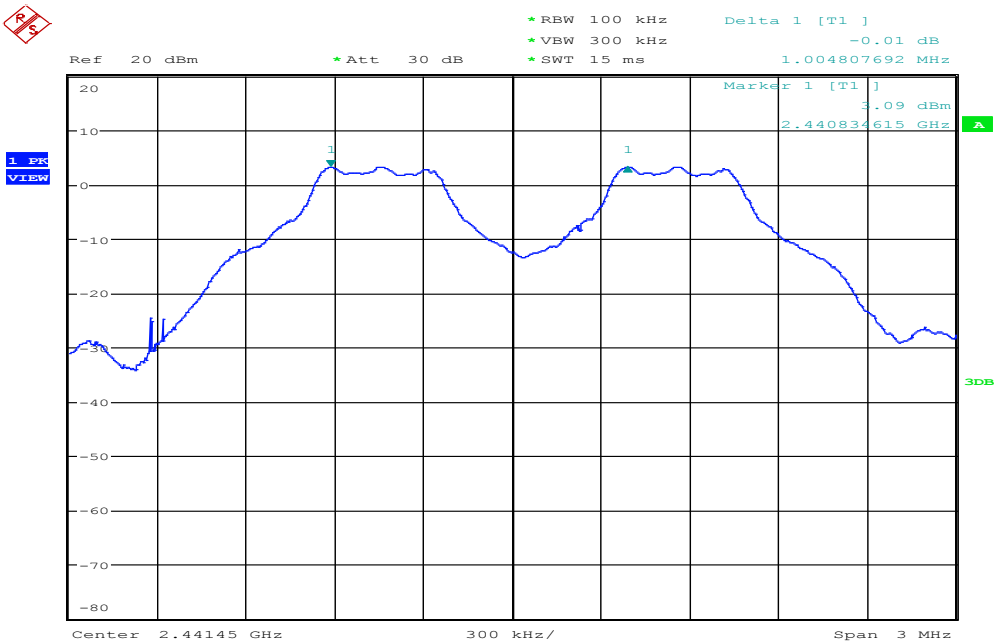
For GFSK

Measurement of Channel Separation / (CH Low)



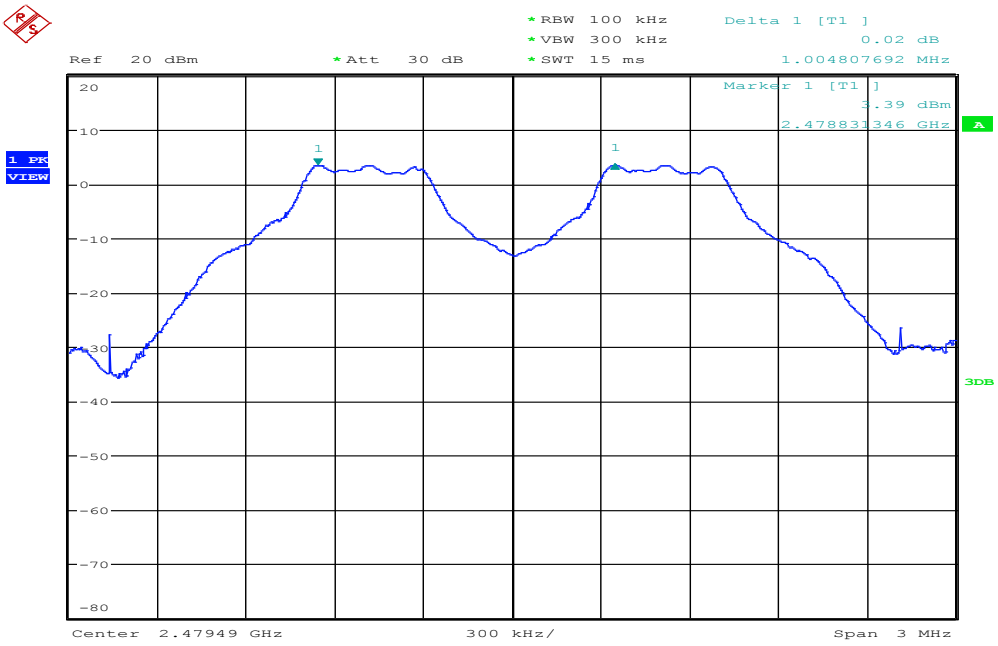
Date: 6.OCT.2016 17:52:45

Measurement of Channel Separation / (CH Mid)



Date: 6.OCT.2016 17:51:11

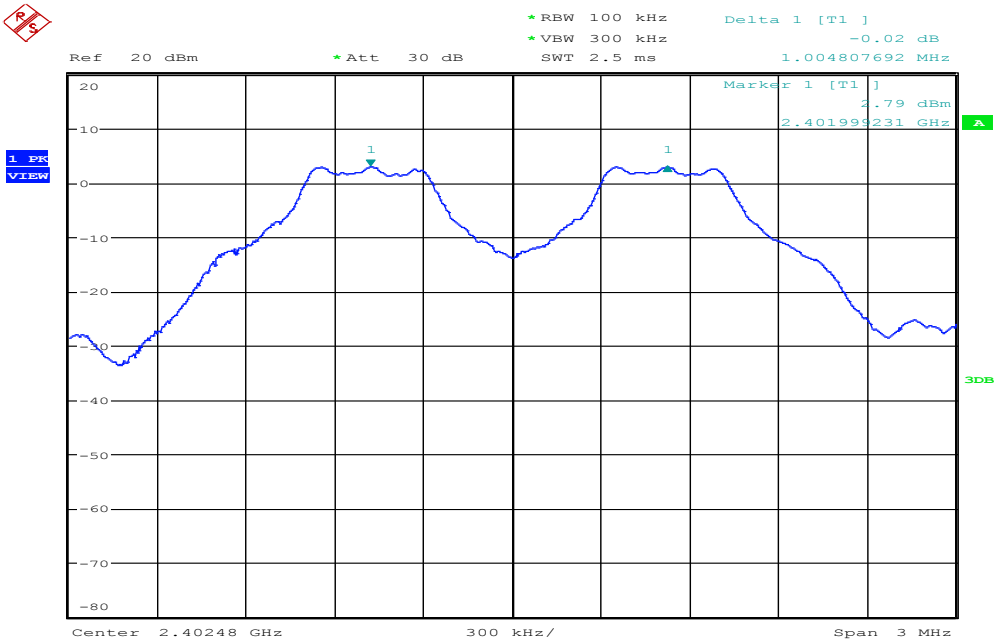
Measurement of Channel Separation / (CH High)



Date: 6.OCT.2016 17:47:31

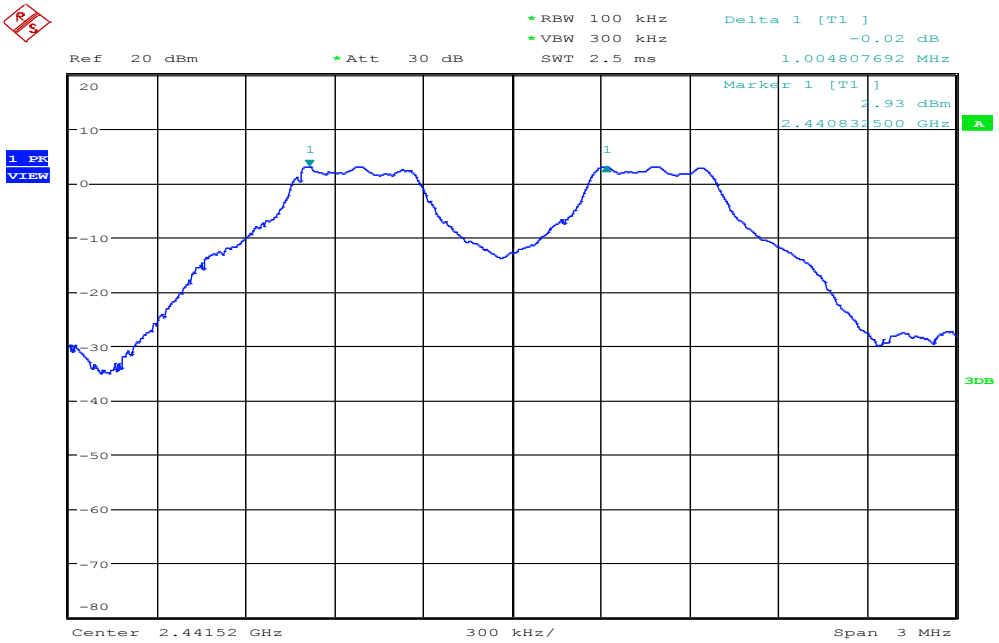
For 8DPSK

Measurement of Channel Separation / (CH Low)



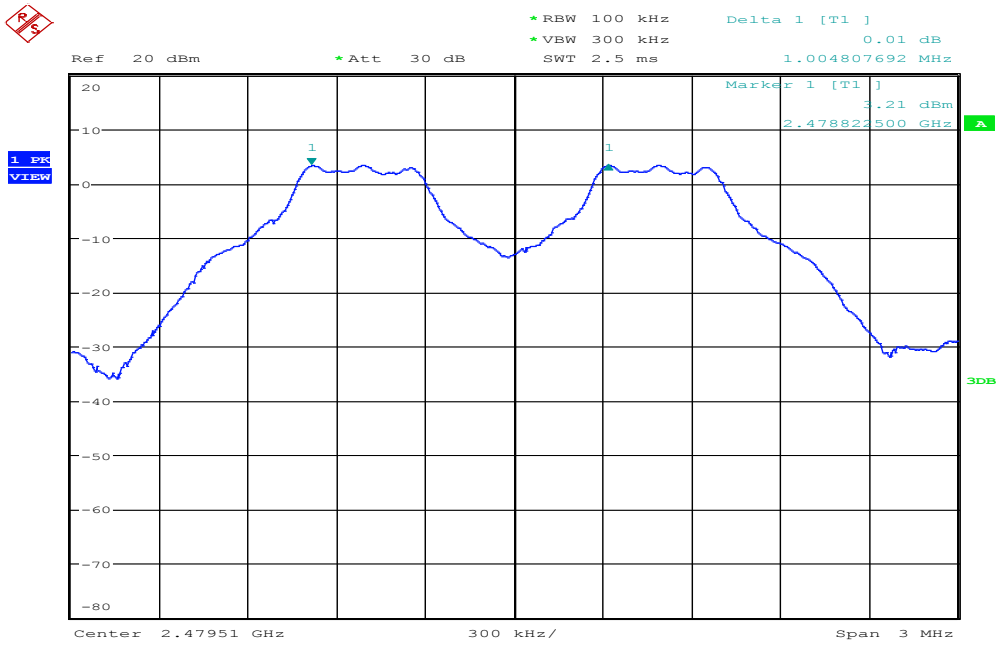
Date: 6.OCT.2016 19:12:09

Measurement of Channel Separation / (CH Mid)



Date: 6.OCT.2016 19:17:02

Measurement of Channel Separation / (CH High)



Date: 6.OCT.2016 19:19:01

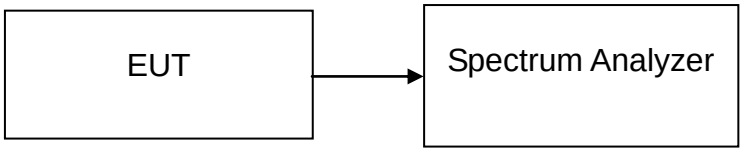
8.10 NUMBER OF HOPPING FREQUENCY

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), 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 = 2483.5MHz, SWT = 1s.
4. Set the spectrum analyzer as RBW = 100KHz, VBW = 300KHz.
5. Max hold, view and count how many channel in the band.

TEST RESULTS

No non-compliance noted

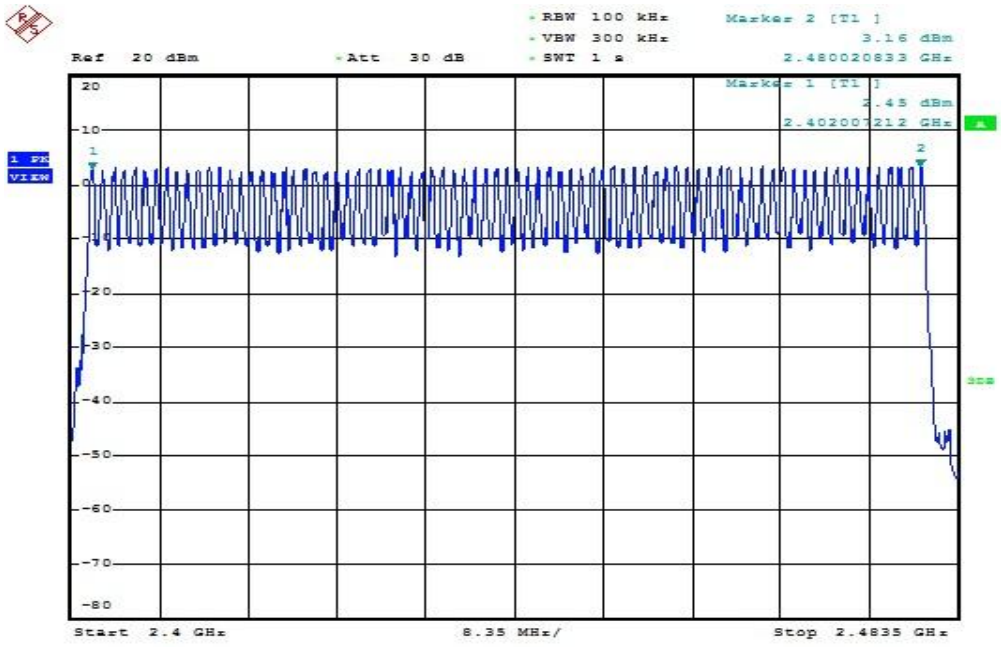
Test Data

Number of Hopping				
Mode	**Frequency (MHz)**	**Hopping Channel Number**	**Hopping Channel Number Limits**	**Result**
BR-1Mbps	2402-2480	79	15	Pass
EDR-3Mbps	2402-2480	79	15	

Test Plot

For GFSK

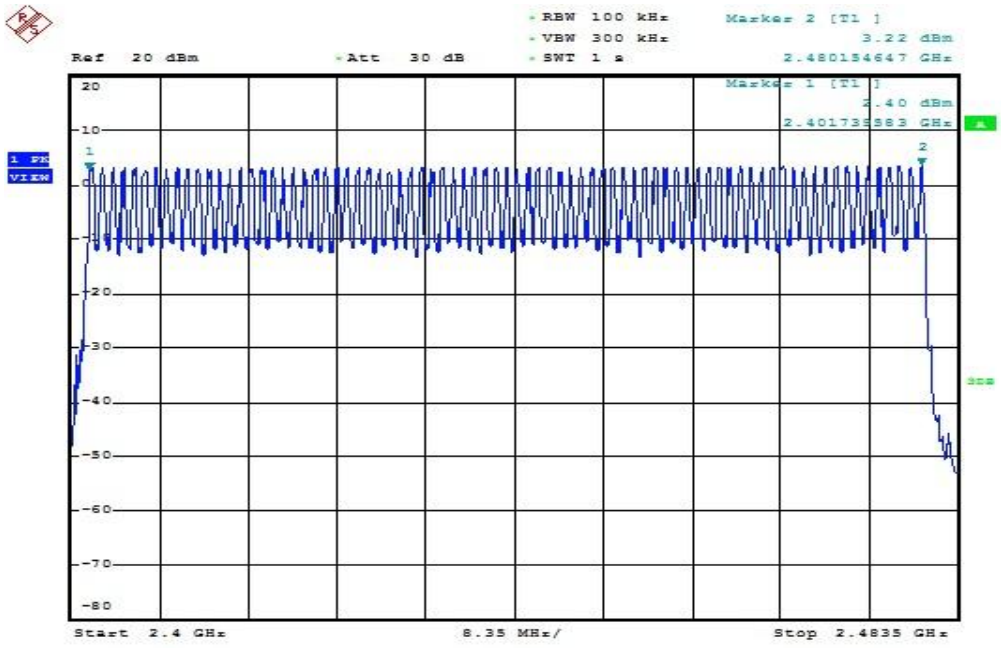
Channel Number



Date: 6.OCT.2016 18:05:10

For 8DPSK

Channel Number



Date: 6.OCT.2016 19:27:57

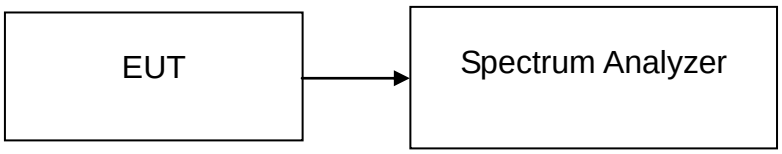
8.11 TIME OF OCCUPANCY (DWELL TIME)

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.

Test Configuration

TEST PROCEDURE



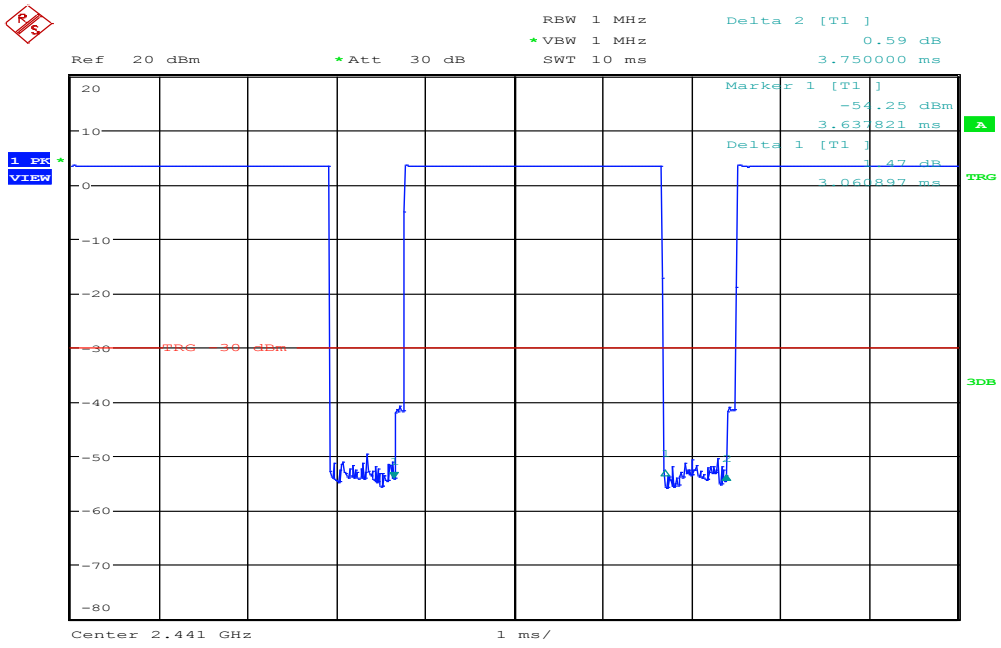
1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=1MHz, Sweep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

TEST RESULTS

No non-compliance noted

Test Data

Time of Occupancy (Dwell Time)							
Mode	Frequency (MHz)	Pulse Time Per Hopping (ms)	Minimum Number of Hopping Freq.	Number of pulse in (0.4 * N sec)	Dwell Time IN (0.4 * N sec)	Dwell Time Limits (s)	Result
BR-1Mbps	2441	3.0608	79	106.67	0.3265	0.4	Pass
BR-3Mbps	2441	3.0608	79	106.67	0.3265	0.4	
Non-AFH: DH5 Packet permit maximum 1600/ 79 / 6 = 3.37 hops per second in each channel (5 time slots RX, 1 time slot TX). So, the dwell time is the time duration of the pulse times 3.37 * 0.4 *79 = 106.6							
AFH: DH5 Packet permit maximum 800/ 20 / 6 = 6.666 hops per second in each channel (5 time slots RX, 1 time slot TX). So, the dwell time is the time duration of the pulse times 6.666*0.4*20 = 53.33							



8.12 RADIATED EMISSIONS

Limit

1. According to §15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

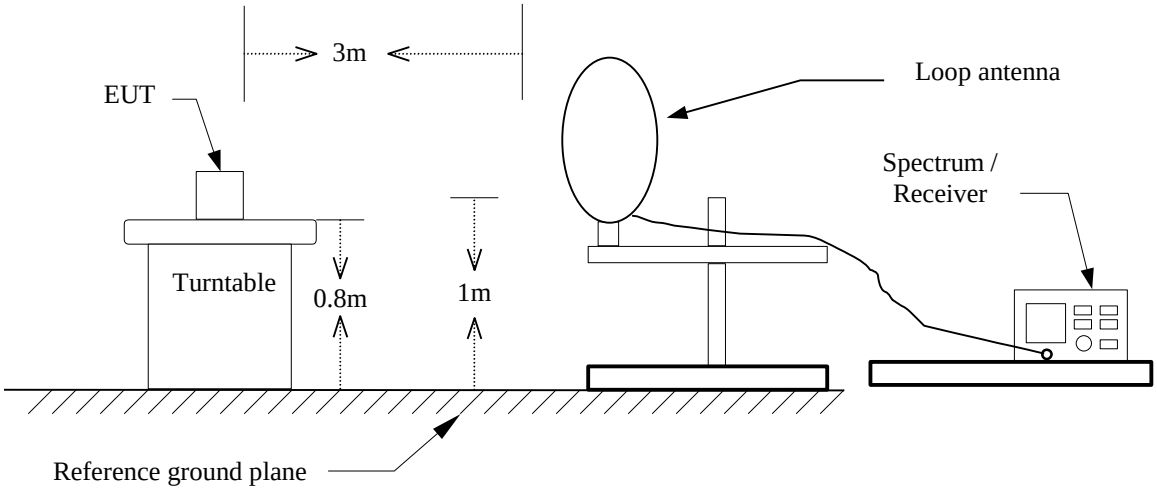
Remark: *Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.*

2. In the emission table above, the tighter limit applies at the band edges.

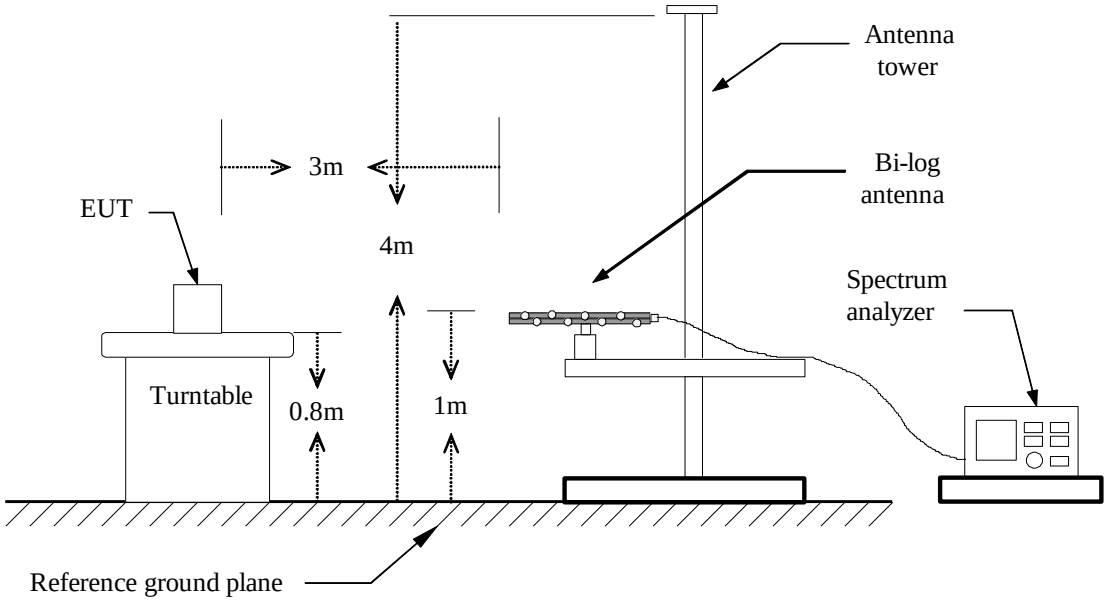
Frequency (MHz)	Field Strength (μV/m at 3-meter)	Field Strength (dBμV/m at 3-meter)
0.009 - 0.490	2400/F(kHz) +80	20LOG((2400/F(kHz))+80)
0.490 - 1.705	24000/F(kHz) +40	20LOG((24000/F(kHz))+40)
1.705 – 30.0	30	69.54
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Test Configuration

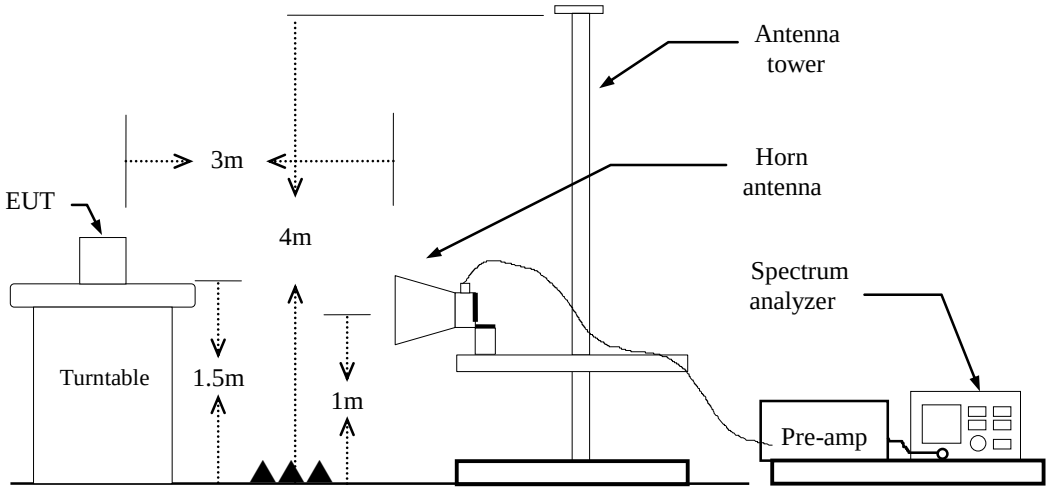
9kHz ~ 30MHz



30MHz ~ 1GHz



Above 1 GHz


Antenna
tower
3m
Horn
antenna
EUT
4m
Spectrum
analyzer
Turntable
1.5m
1m
Pre-amp

TEST PROCEDURE

1. The EUT is placed on a turntable, Above 1 GHz is 1.5m high and below 1 GHz is 0.8m high 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 $\geqq$ 98%, VBW=10Hz.
   if duty cycle<98% VBW=1/T.

   BT: = 81%, VBW= 330Hz

   EDR = 81%, VBW= 330Hz
7. Repeat above procedures until the measurements for all frequencies are complete.
8. Result = Spectrum Reading + cable loss(spectrum to Amp) - Amp Gain + Cable loss(Amp to receive Ant)+ Receive Ant
9. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)

Note: We checked every harmonics frequencies from Fundamental frequencies with reduced VBW, and we mark a point to prove pass or not if we find any emission. For this case, there are no emissions hidden in the noise floor.

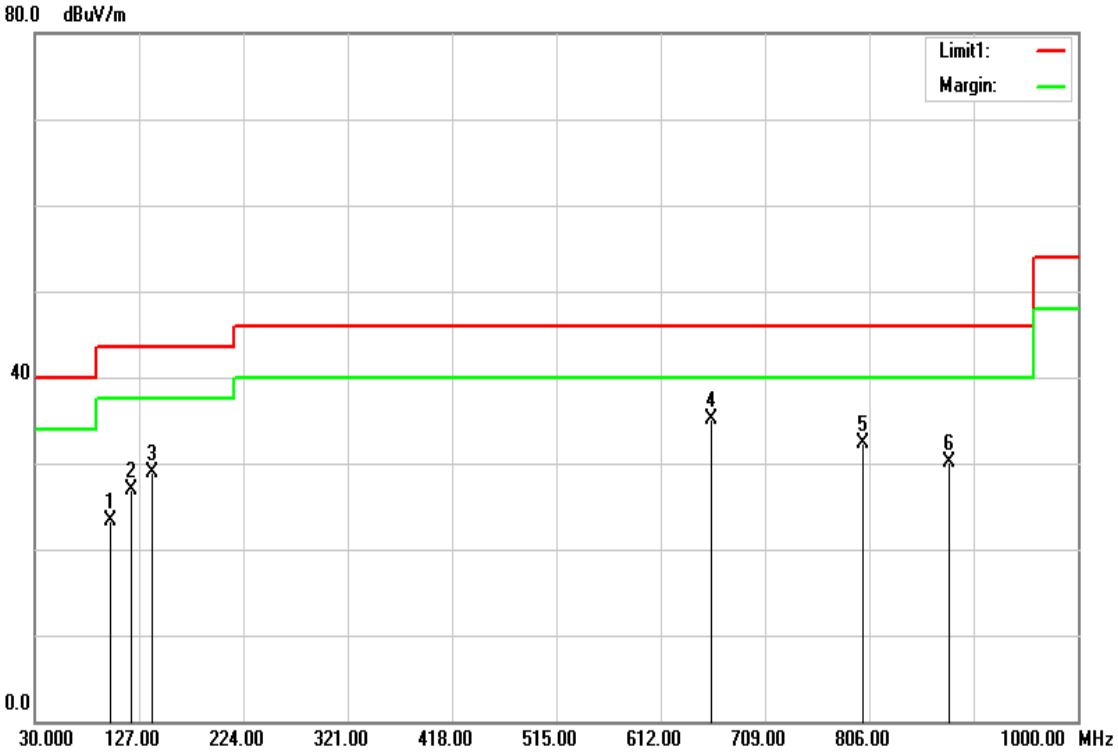
TEST RESULTS

Below 1GHz

Operation Mode: Normal Link **Test Date:** September 22, 2016

Temperature: 27°C **Tested by:** Dennis Li

Humidity: 53% RH **Polarity:** Ver.

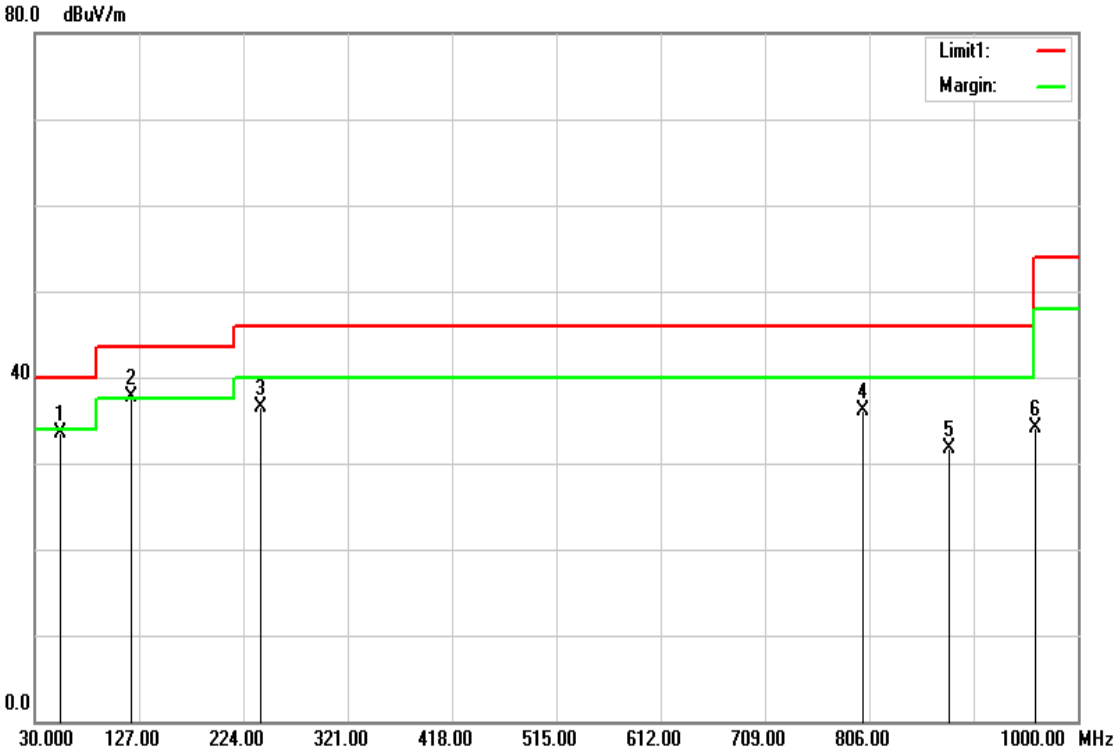


Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
99.8400	42.37	-19.07	23.30	43.50	-20.20	QP	V
120.2100	42.40	-15.50	26.90	43.50	-16.60	QP	V
139.6100	44.75	-15.77	28.98	43.50	-14.52	QP	V
659.5300	41.51	-6.47	35.04	46.00	-10.96	peak	V
800.1800	36.82	-4.50	32.32	46.00	-13.68	peak	V
879.7200	33.53	-3.43	30.10	46.00	-15.90	peak	V

Remark:

1. *Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.*
2. *Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.*
3. *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.*
4. *Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).*

Operation Mode:	Normal Link	**Test Date:**	September 22, 2016
Temperature:	27°C	**Tested by:**	Dennis Li
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)
53.2800	54.86	-21.41	33.45	40.00	-6.55	peak	H
120.2100	53.15	-15.50	37.65	43.50	-5.85	peak	H
240.4900	52.92	-16.50	36.42	46.00	-9.58	peak	H
800.1800	40.61	-4.50	36.11	46.00	-9.89	peak	H
879.7200	35.14	-3.43	31.71	46.00	-14.29	peak	H
960.2300	36.32	-2.23	34.09	54.00	-19.91	peak	H

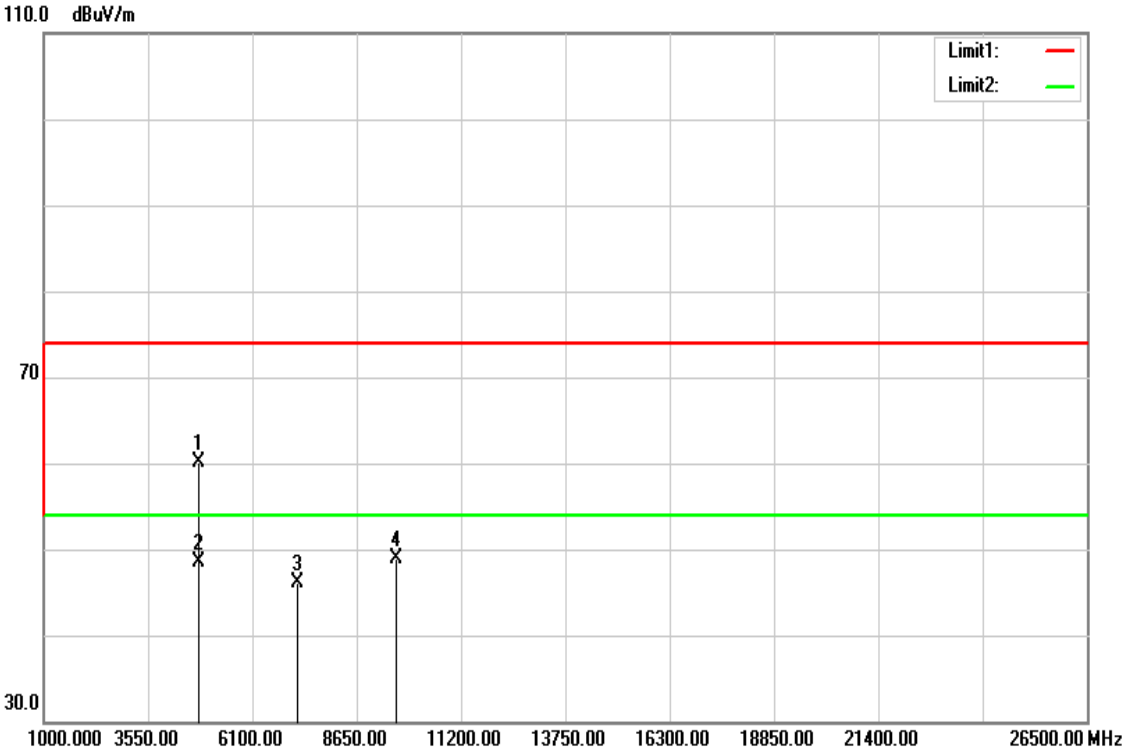
Remark:

1. *Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.*
2. *Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.*
3. *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.*
4. *Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).*

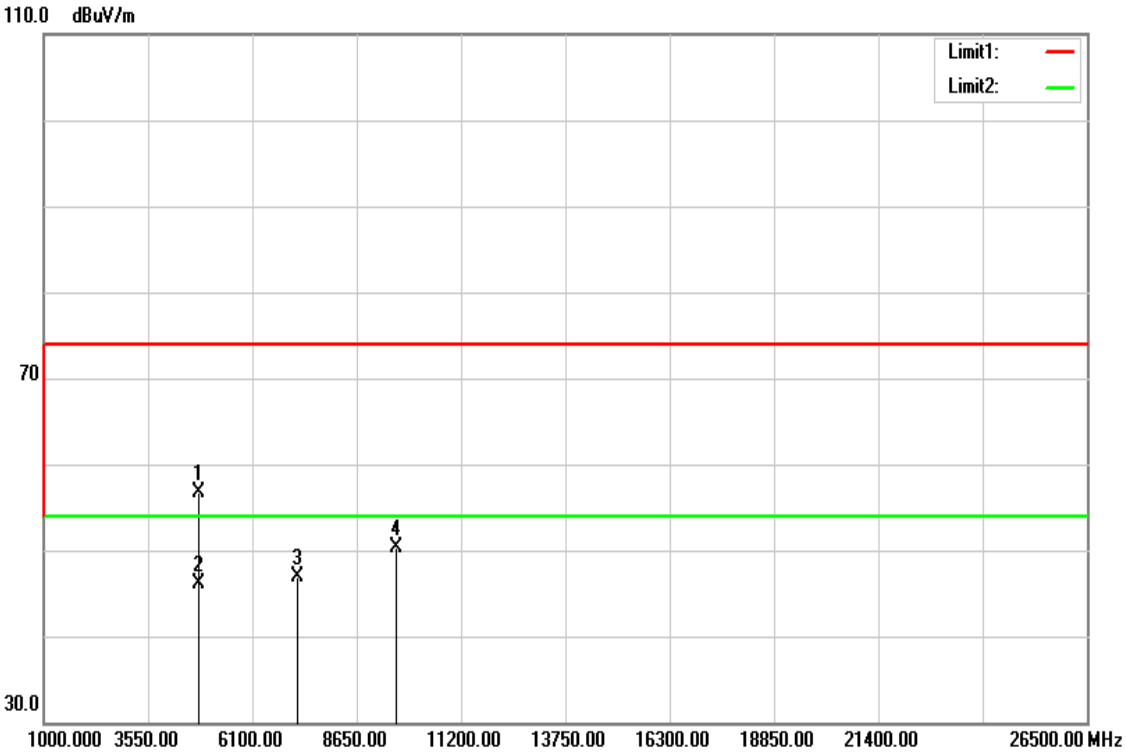
Above 1 GHz

TX / GFSK / DH5 / CH Low

Polarity: Vertical



Polarity: Horizontal



Operation Mode: TX / GFSK / DH5 / CH Low **Test Date:** October 4, 2016

Temperature: 27°C **Tested by:** Dennis Li

Humidity: 53 % RH **Polarity:** Ver. / Hor.

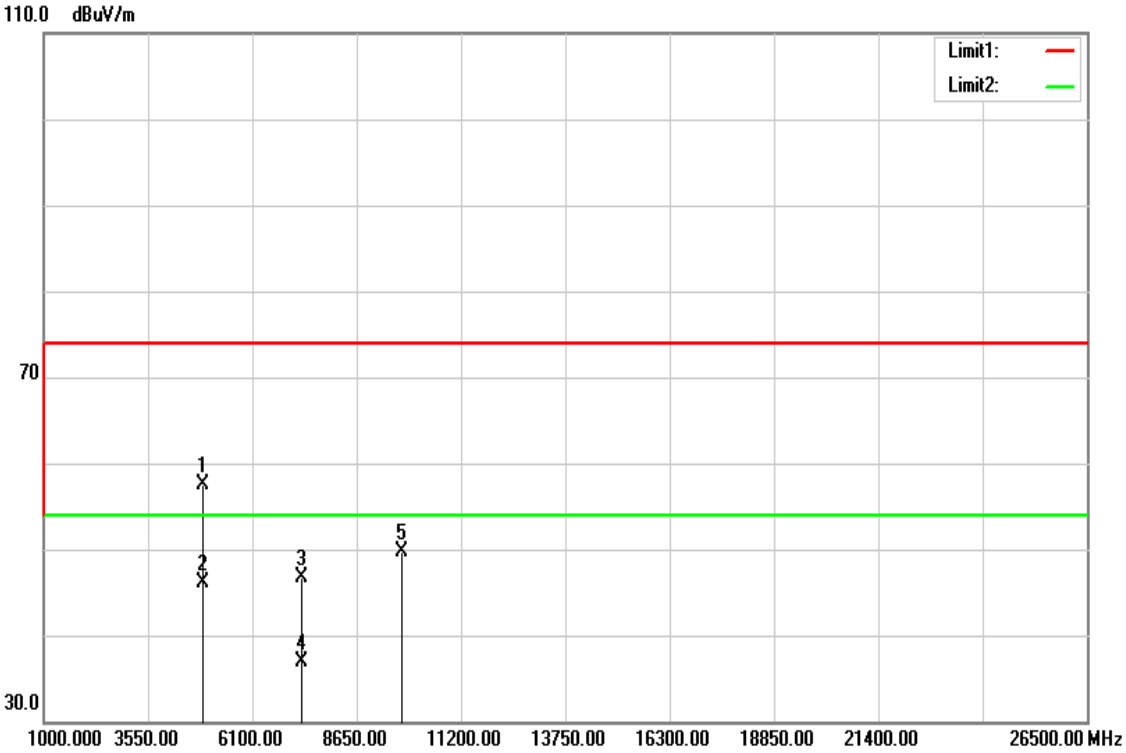
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
4804.000	55.04	5.04	60.08	74.00	-13.92	peak	V
4804.000	43.47	5.04	48.51	54.00	-5.49	AVG	V
7206.000	33.53	12.62	46.15	74.00	-27.85	peak	V
9608.000	31.32	17.60	48.92	74.00	-25.08	peak	V
N/A							
4804.000	51.71	5.04	56.75	74.00	-17.25	peak	H
4804.000	41.04	5.04	46.08	54.00	-7.92	AVG	H
7206.000	34.33	12.62	46.95	74.00	-27.05	peak	H
9608.000	32.75	17.60	50.35	74.00	-23.65	peak	H
N/A							

Remark:

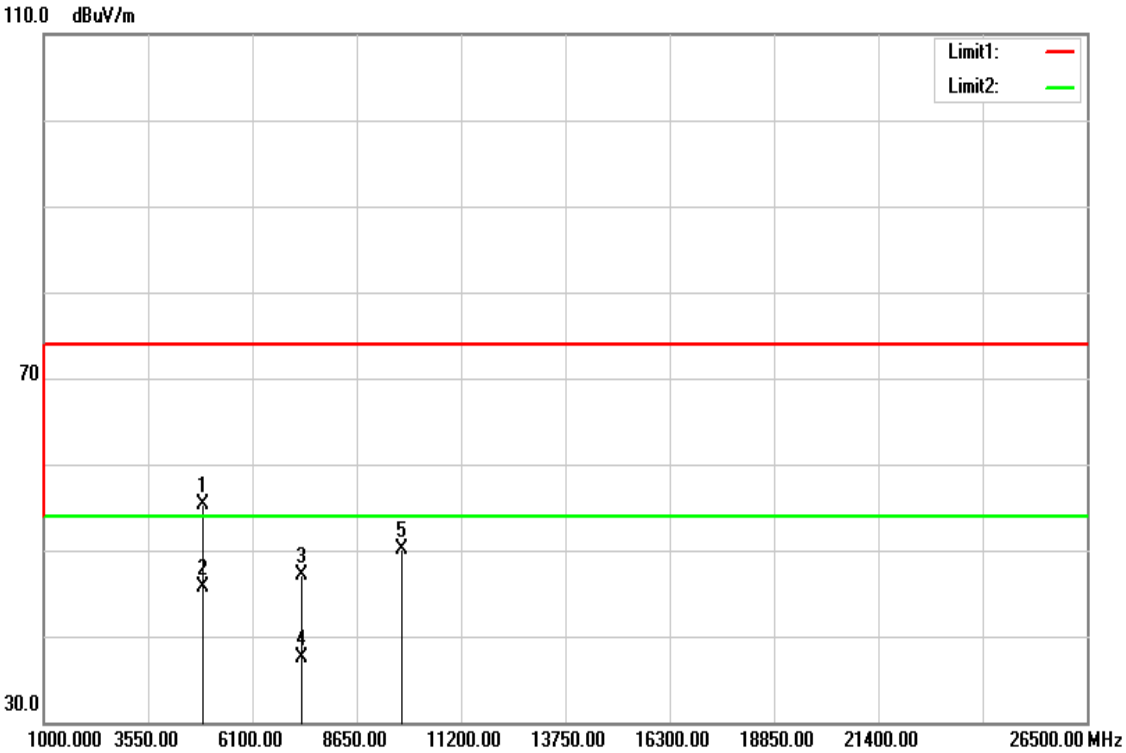
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average 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:** October 4, 2016

Temperature: 26°C **Tested by:** Dennis Li

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

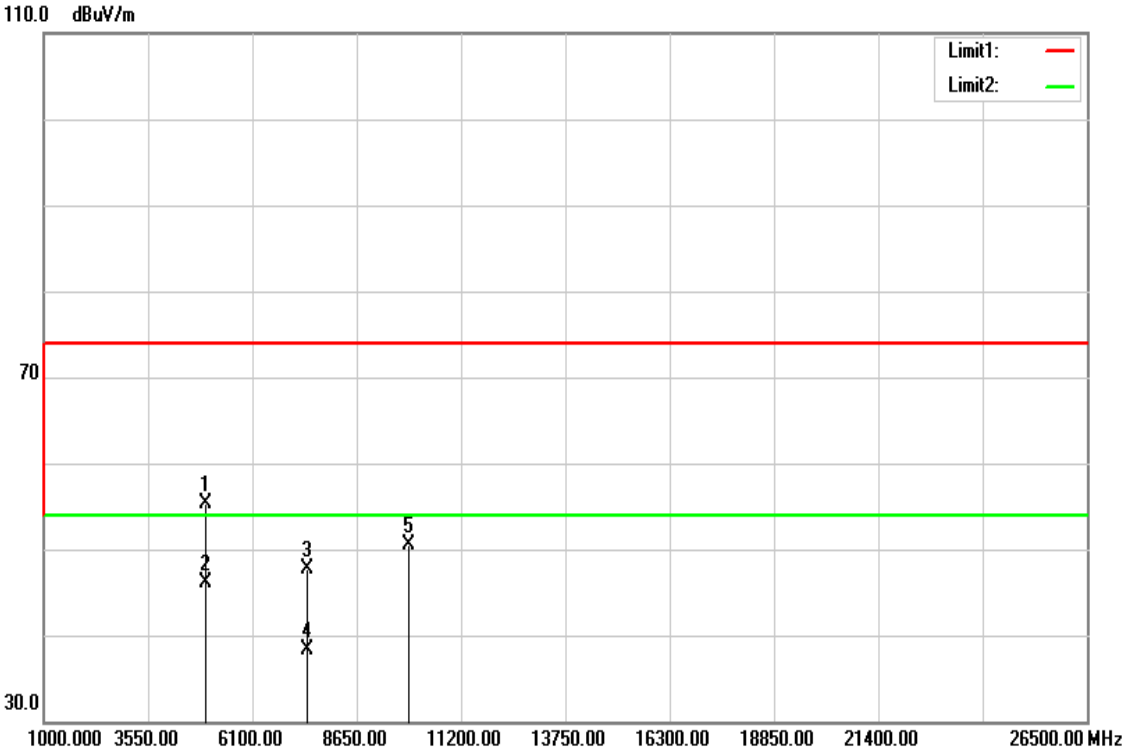
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
4880.000	52.16	5.25	57.41	74.00	-16.59	peak	V
4880.000	40.94	5.25	46.19	54.00	-7.81	AVG	V
7320.000	33.69	12.97	46.66	74.00	-27.34	peak	V
7320.000	23.84	12.97	36.81	54.00	-17.19	AVG	V
9760.000	32.04	17.60	49.64	74.00	-24.36	peak	V
N/A							
4880.000	50.15	5.25	55.40	74.00	-18.60	peak	H
4880.000	40.45	5.25	45.70	54.00	-8.30	AVG	H
7320.000	34.16	12.97	47.13	74.00	-26.87	peak	H
7320.000	24.44	12.97	37.41	54.00	-16.59	AVG	H
9760.000	32.47	17.60	50.07	74.00	-23.93	peak	H
N/A							

Remark:

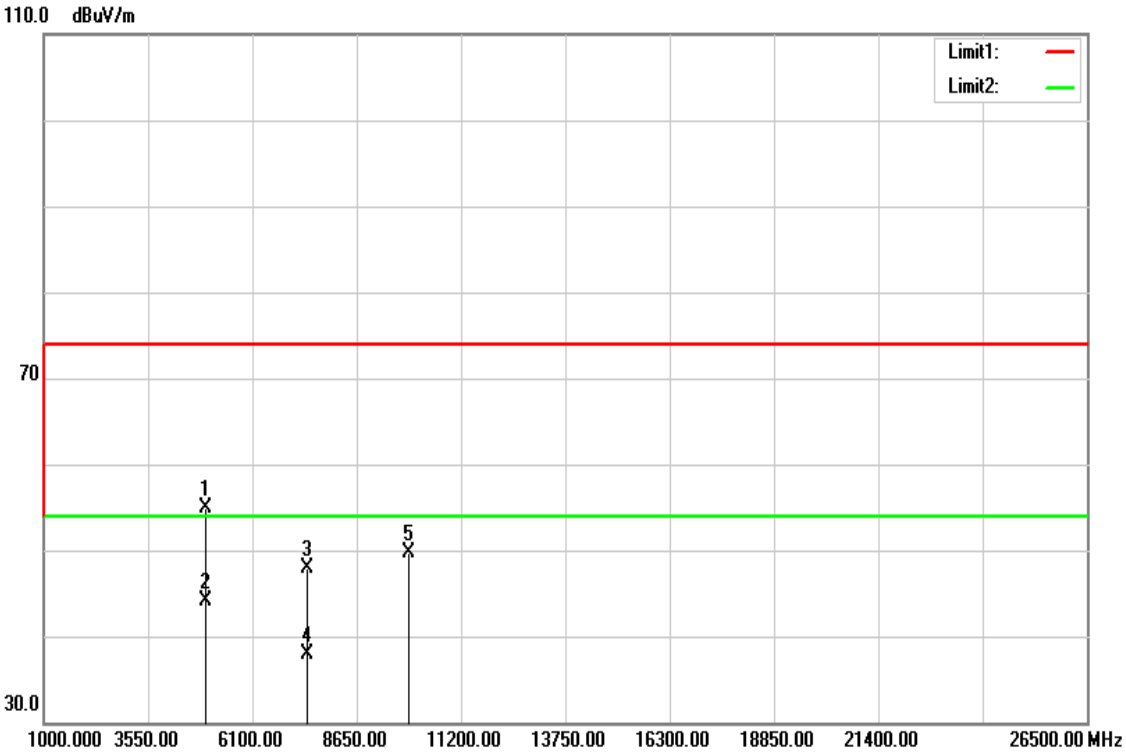
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average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

Polarity: Vertical



Polarity: Horizontal



Operation Mode:	TX / GFSK / DH5 / CH High	**Test Date:**	October 4, 2016
Temperature:	26°C	**Tested by:**	Dennis Li
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)
4960.000	49.88	5.46	55.34	74.00	-18.66	peak	V
4960.000	40.73	5.46	46.19	54.00	-7.81	AVG	V
7440.000	34.45	13.33	47.78	74.00	-26.22	peak	V
7440.000	24.87	13.33	38.20	54.00	-15.80	AVG	V
9920.000	32.99	17.60	50.59	74.00	-23.41	peak	V
N/A							
4960.000	49.40	5.46	54.86	74.00	-19.14	peak	H
4960.000	38.68	5.46	44.14	54.00	-9.86	AVG	H
7440.000	34.61	13.33	47.94	74.00	-26.06	peak	H
7440.000	24.56	13.33	37.89	54.00	-16.11	AVG	H
9920.000	32.15	17.60	49.75	74.00	-24.25	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).*

8.13 POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §15.207(a), 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:** October 7, 2016

Temperature: 24°C **Tested by:** Zeus Chen

Humidity: 50% RH

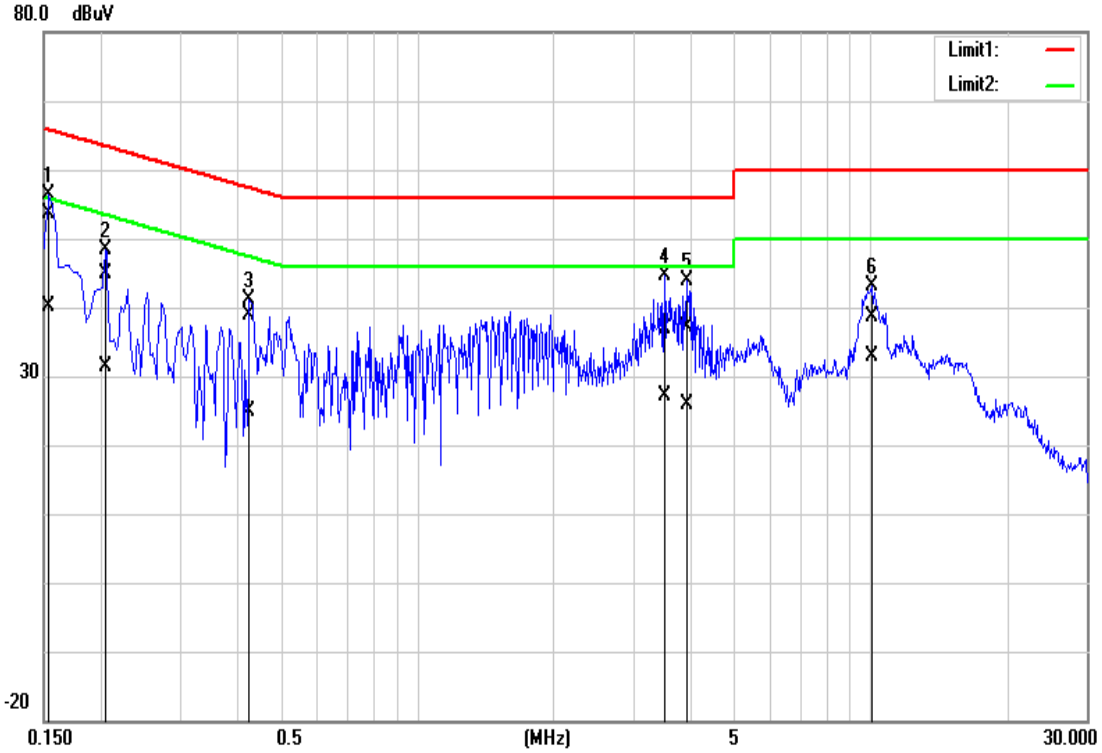
Freq. (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Corr. factor (dB/m)	QP Result (dBuV/m)	AV Result (dBuV/m)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.1539	43.89	30.34	9.77	53.66	40.11	65.78	55.79	-12.12	-15.68	L1
0.2060	35.08	21.67	9.76	44.84	31.43	63.36	53.37	-18.52	-21.94	L1
0.4260	28.98	15.17	9.81	38.79	24.98	57.33	47.33	-18.54	-22.35	L1
3.5140	27.08	17.16	9.90	36.98	27.06	56.00	46.00	-19.02	-18.94	L1
3.9260	27.23	15.90	9.91	37.14	25.81	56.00	46.00	-18.86	-20.19	L1
10.0740	28.47	22.75	10.05	38.52	32.80	60.00	50.00	-21.48	-17.20	L1
0.1500	44.18	29.91	9.84	54.02	39.75	65.99	56.00	-11.97	-16.25	L2
0.1860	36.58	26.47	9.83	46.41	36.30	64.21	54.21	-17.80	-17.91	L2
0.5020	30.23	19.19	9.97	40.20	29.16	56.00	46.00	-15.80	-16.84	L2
0.5340	30.21	22.82	10.02	40.23	32.84	56.00	46.00	-15.77	-13.16	L2
3.7860	27.31	16.98	9.99	37.30	26.97	56.00	46.00	-18.70	-19.03	L2
9.9340	28.55	22.84	10.28	38.83	33.12	60.00	50.00	-21.17	-16.88	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 to 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9kHz;*
4. *L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)*

Test Plots

Conducted emissions (Line 1)



Conducted emissions (Line 2)