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

TEST REPORT

For

Wi-Fi (11a/b/g/n 2Tx2R)+BT (V4.1LE) USB Combo Module

Model:
WCBN4515R, WCBN4515R(Ext), WCBN4515R(Emb)

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: November 17, 2016

Testing Laboratory
1309

Revision History

Rev.		Issue Date		Revisions	Effect Page	Revised By
00		November 17, 2016		Initial Issue	ALL	Doris Chu
01		December 10, 2016		1. Add remark for Part 15.203	P.5	Doris Chu

TABLE OF CONTENTS

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 213100 China
Equipment Under Test:	Wi-Fi (11a/b/g/n 2Tx2R)+BT (V4.1LE) USB Combo Module
Model Number:	WCBN4515R, WCBN4515R(Ext), WCBN4515R(Emb)
Trade Name:	LITE-ON
Date of Test:	September 7 ~ November 16, 2016

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
FCC 47 CFR Part 15 Subpart C Industry Canada RSS-247 Issue 1	No non-compliance noted

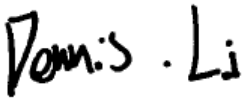
We hereby certify that:

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. EUT DESCRIPTION

Product	Wi-Fi (11a/b/g/n 2Tx2R)+BT (V4.1LE) USB Combo Module
Model Number	WCBN4515R, WCBN4515R(Ext), WCBN4515R(Emb)
Trade Name	LITE-ON
Model Discrepancy	WCBN4515R：PCB Antenna WCBN4515R(Ext)：WiFi PCB Antenna, BT PIFA Antenna WCBN4515R(Emb)：PCB Antenna
Received Date	September 5, 2016
Power Supply	Power form host device.
Frequency Range	2402 ~ 2480 MHz
Transmit Power	9.83 dBm
Modulation Technique	GFSK for 1Mbps; π/4-DQPSK for 2Mbps; 8DPSK for 3Mbps
Number of Channels	79 Channels
Antenna Specification	1. PCB Antenna Ant3: Gain: -0.80dBi 2. PIFA Antenna Gain: 2.28 dBi
Product SW/HW version	3.3.0 / V00
Radio SW version	3.3.0
Radio HW version	V00

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: **PPQ-WCBN4515R** & ISED No.： **4491A-WCBN4515R** filing to comply with FCC Part 15C, Section 15.207, 15.209 and IC RSS-247 & RSS-GEN.*
3. *Antenna was meets the rule of Part 15.203 Antenna requirement.*

Antenna Category	☒ Integral: antenna permanently attached ☐ External dedicated antennas ☐ External Unique antenna connector

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and FCC Part 15.205, Part 15.207, Part 15.209, Part 15.247, DA00-705., IC RSS-247, RSS-Gen.

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 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.

3.3 DESCRIPTION OF TEST MODES

The EUT (model: WCBN4515R) had been tested under operating condition.

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

3.3.1 Worst mode of modulation

Worst Mode			
Bluetooth Mode	Data Rate	Maximum Peak Conducted Output Power (dBm)	Worst Mode
BR	1 Mbps	9.83	V
EDR	2 Mbps	9.27	
EDR	3 Mbps	9.41	

3.2.1 The worst mode of measurement

AC Conducted Emission	
Test Condition	**AC Power line conducted emission for line and neutral**
Voltage/Hz	**120V/60Hz**
Test Mode	**Mode 1: Printed Antenna (EUT via USB link NB)** **Mode 2: PIFA Antenna (EUT via USB link NB)**
Worst Mode	☐ **Mode 1** ☒ **Mode 2** ☐ **Mode 3** ☐ **Mode 4**

Remark: The worst mode was record in this test report.

Radiated Emission Measurement	
Test Condition	**Band edge, Emission for Unwanted and Fundamental**
Voltage/Hz	**120V/60Hz**
Test Mode	**Mode 1: Printed Antenna (EUT via USB link NB)** **Mode 2: PIFA Antenna (EUT via USB link NB)**
Worst Mode	☒ **Mode 1** ☒ **Mode 2** ☐ **Mode 3** ☐ **Mode 4**
Position	☐ **P**laced in fixed position. ☒ **P**laced in fixed position at X-Plane (E2-Plane) ☐ **P**laced in fixed position at Y-Plane (E1-Plane) ☐ **P**laced in fixed position at Z-Plane (H-Plane)

Remark:
1. The worst mode was record in this test report.
2. The EUT pre-scanned in three axis ,X,Y, Z and two polarity, Horizontal and Vertical for radiated measurement. The worst case (X-Plane and Horizontal) were recorded in this report.

3.4 THE WORST CASE POWER SETTING PARAMETER

For GFSK / DH5

Channel	Frequency (MHz)	RF power setting in TEST SW
Low	2402	7
Mid	2441	7
High	2480	7

For 8DPSK / DH5

Channel	Frequency (MHz)	RF power setting in TEST SW
Low	2402	7
Mid	2441	7
High	2480	7

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.*

RF Conducted Test Site					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Power Meter	Anritsu	ML2495A	1012009	07/04/16	07/03/17
Power Meter	Anritsu	MA2411B	917072	07/04/16	07/03/17
Spectrum Analyzer	R&S	FSV 40	101073	08/01/16	07/31/17

Wugu 966 Chamber A					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	US42510252	12/08/15	12/07/16
Loop Ant	COM-POWER	AL-130	121051	02/25/16	02/24/17
Bilog Antenna	Sunol Sciences	JB3	A030105	07/03/16	07/02/17
Pre-Amplifier	EMEC	EM330	60609	06/08/16	06/07/17
Horn Antenna	ETC	MCTD 1209	DRH13M02003	09/02/16	09/01/17
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	EZ-EMC (CCS-3A1RE)				

Conducted Emission Room # B					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
LISN	SCHWARZBECK	NSLK 8127	8127-541	11/23/15	11/22/16
Receiver	R&S	ESCI	101073	08/20/16	08/19/17
Software	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 Request.

4.3 MEASUREMENT UNCERTAINTY

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

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

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

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

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

☒ No.11, 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.

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	TAF Testing Laboratory 1309
Canada	Industry Canada	3M Semi Anechoic Chamber (IC 2324G-1 / IC 2324G-2) to perform	Canada IC 2324G-1 IC 2324G-2

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

6. SETUP OF EQUIPMENT UNDER TEST

6.1 SETUP CONFIGURATION OF EUT

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

6.2 SUPPORT EQUIPMENT

No	Equipment	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
2	Notebook PC	IBM	7663 (T61)	L3E9812	N/A	N/A	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core

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 OCCUPIED BANDWIDTH(99%) AND 20 DB BANDWIDTH

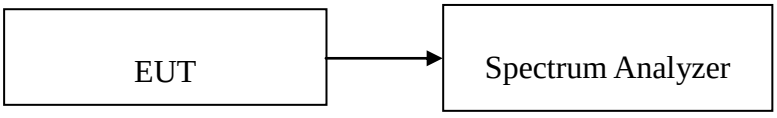
OCCUPIED BANDWIDTH(99%)

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.

20 DB BANDWIDTH

According to FCC §15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth (10*log1% = 20dB) taking the total RF output power.

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, ,Detector = Peak,
4. Set the spectrum analyzer as OBW(99%) function
5. Mark the peak frequency and 20dB (upper and lower) frequency.
6. Repeat until all the rest channels are investigated.

TEST RESULTS

For GFSK/DH5

Channel	Frequency (MHz)	99% Bandwidth (MHz)	20dB Bandwidth (MHz)
Low	2402	0.9030	1.0289
Mid	2441	0.9117	1.0376
High	2480	0.9030	1.0289

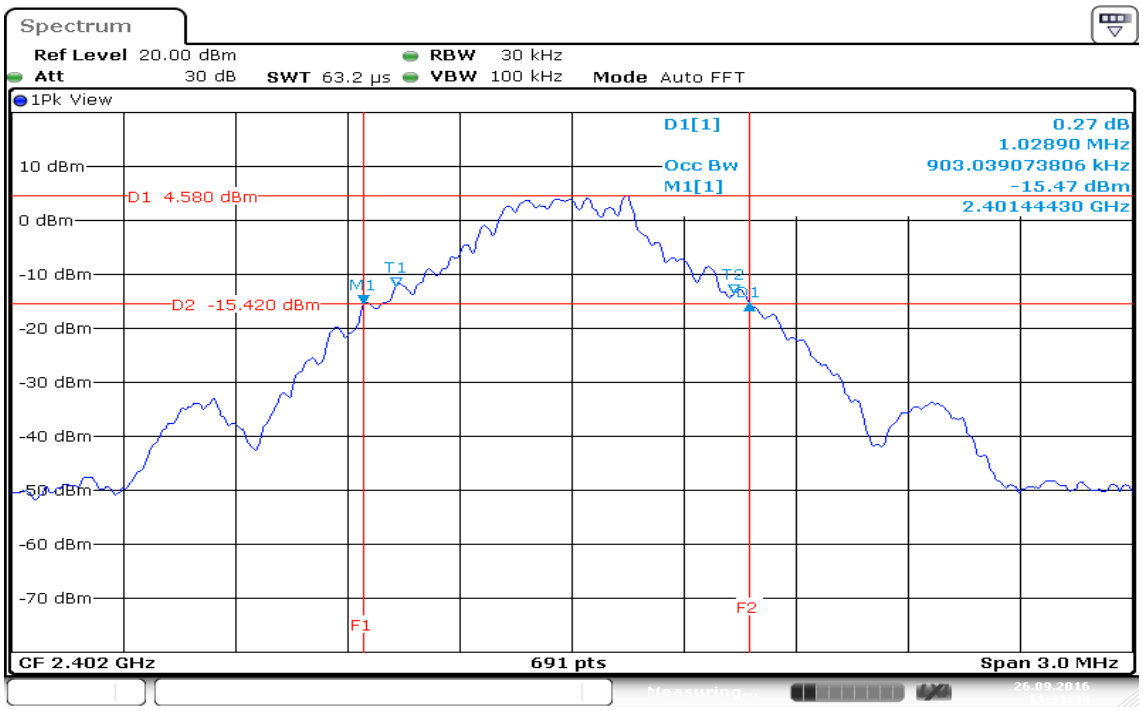
For 8DPSK/DH5

Channel	Frequency (MHz)	99% Bandwidth (MHz)	20dB Bandwidth (MHz)
Low	2402	1.1895	1.2938
Mid	2441	1.2026	1.3025
High	2480	1.1808	1.2938

Test Plot

For GFSK / DH5

CH Low



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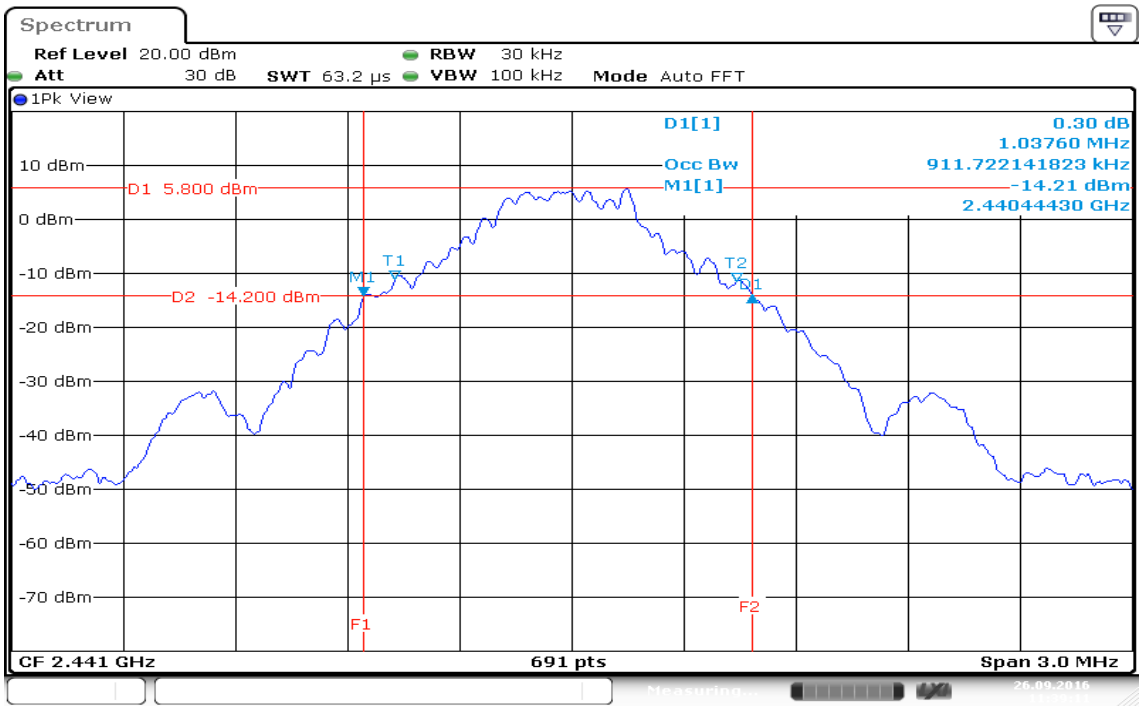
CH Mid



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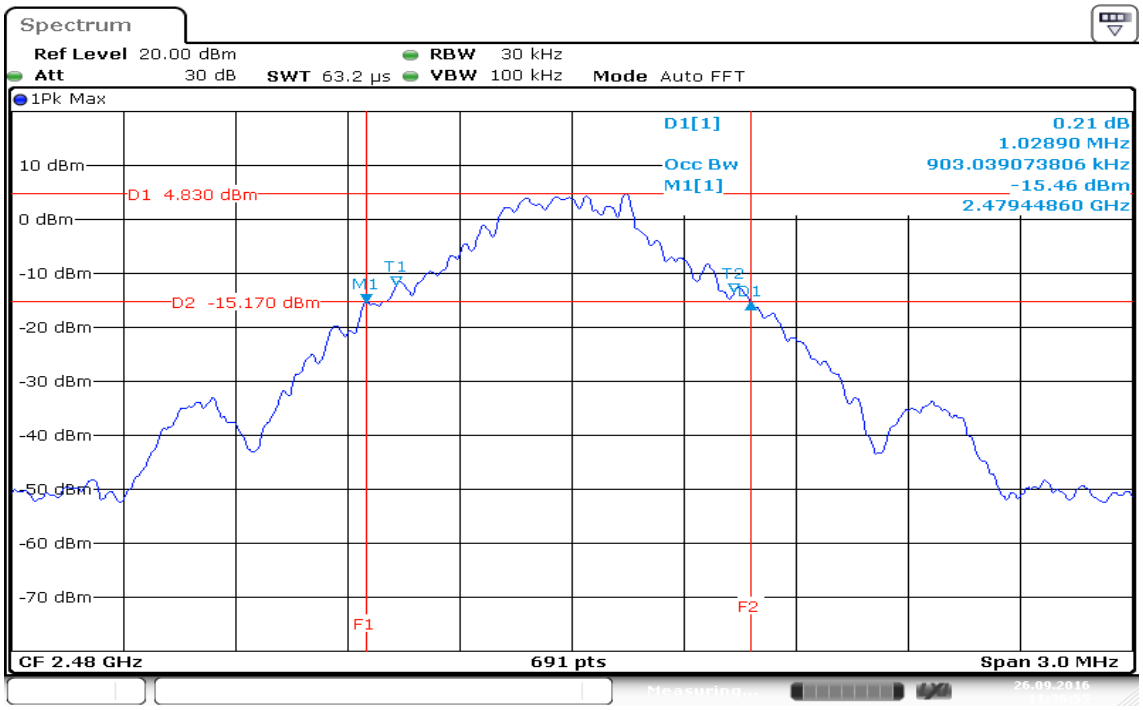
CH High



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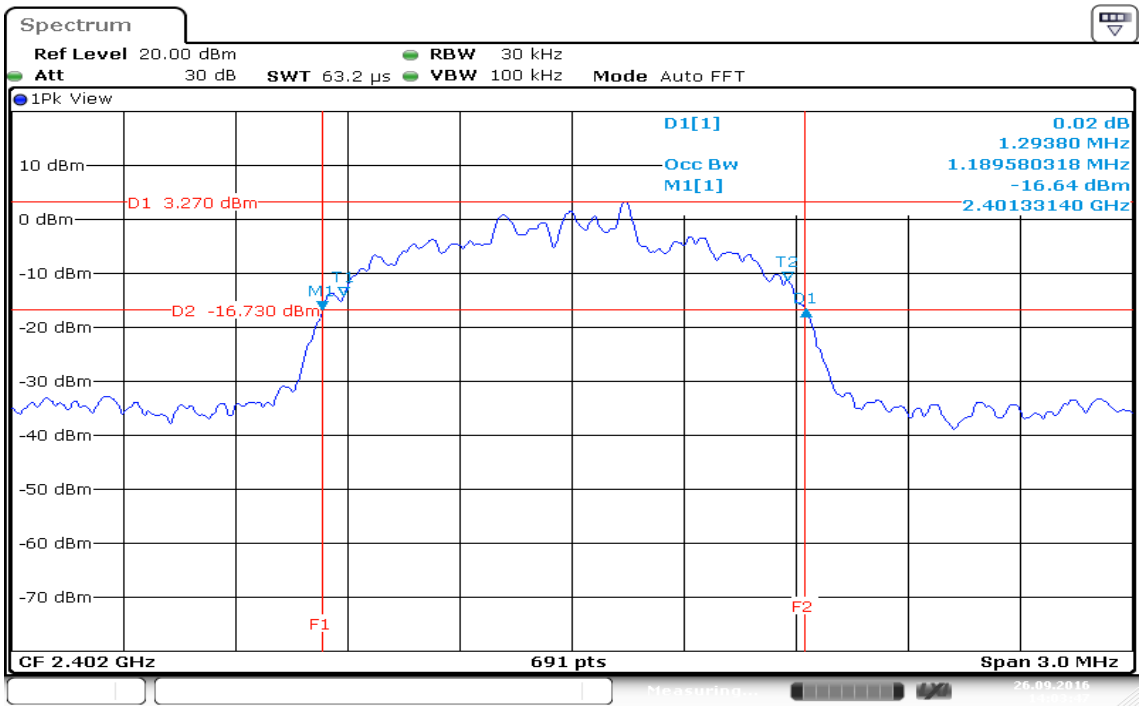
For 8DPSK / DH5

CH Low



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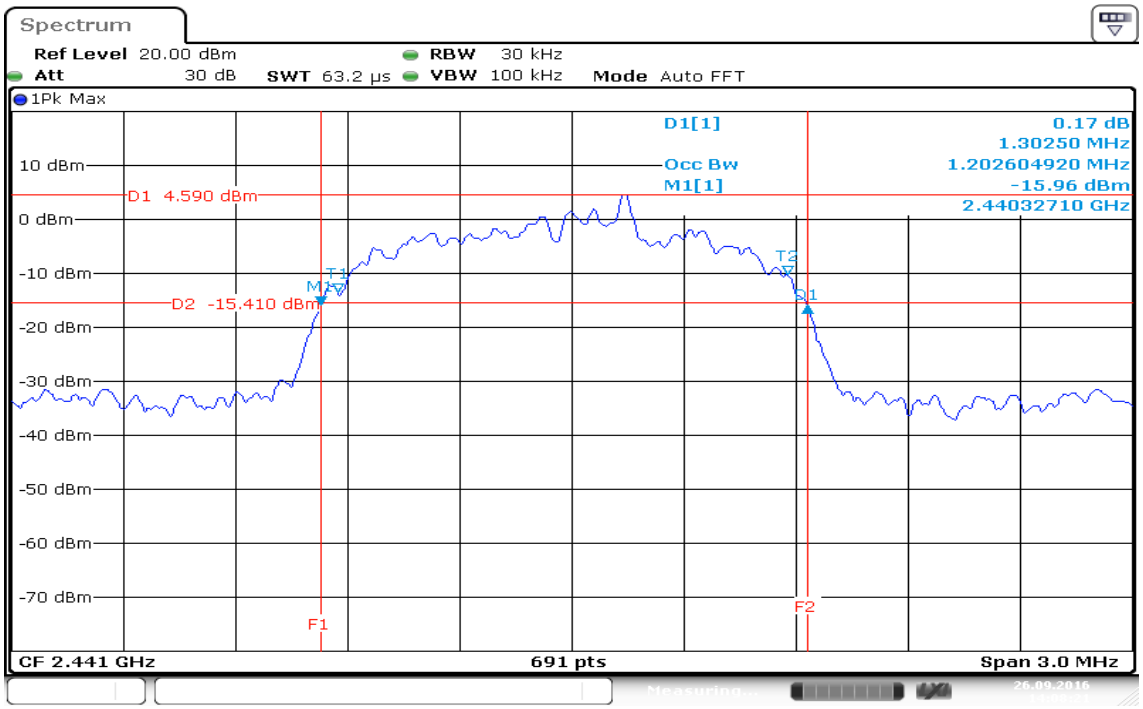
CH Mid



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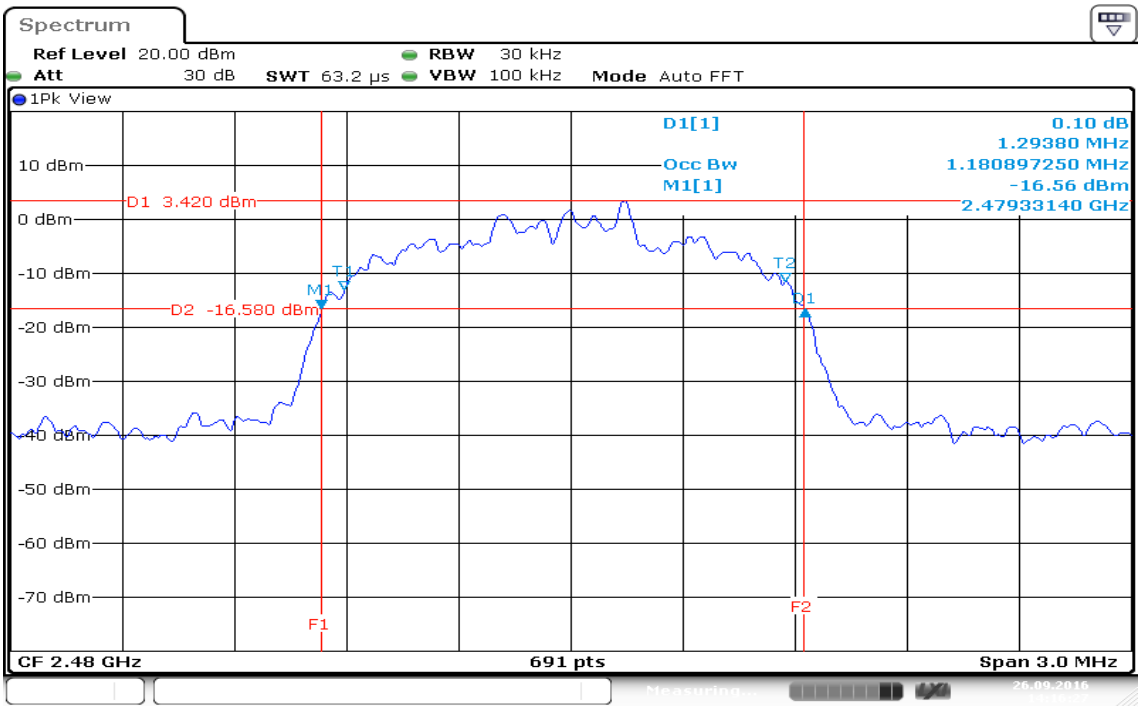
CH High



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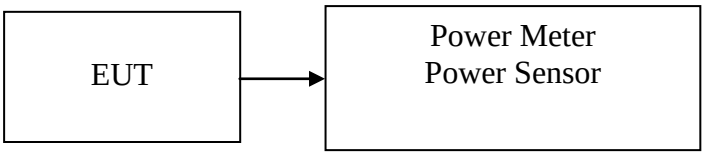
7.2 PEAK POWER

LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:
According to Part 15.247(b)(1)For frequency hopping systems operating in the 2400-2483.5MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1 watts. For all other frequency hopping systems in the 2400-2483.5MHz band: 0.125 watts.

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	9.11	0.0081	0.125	PASS
Mid	2441	***9.83**	0.0096		PASS
High	2480	9.32	0.0086		PASS

For 8DPSK / DH5

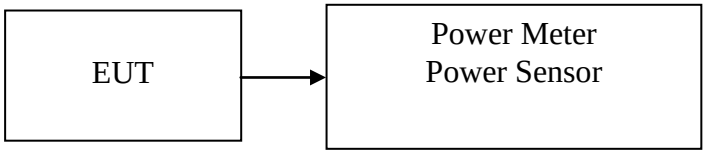
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	8.61	0.0073	0.125	PASS
Mid	2441	9.41	0.0087		PASS
High	2480	8.78	0.0076		PASS

7.3 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	8.95	0.0079
Mid	2441	9.46	0.0088
High	2480	9.28	0.0085

For 8DPSK / DH5

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2402	6.37	0.0043
Mid	2441	7.82	0.0061
High	2480	6.43	0.0044

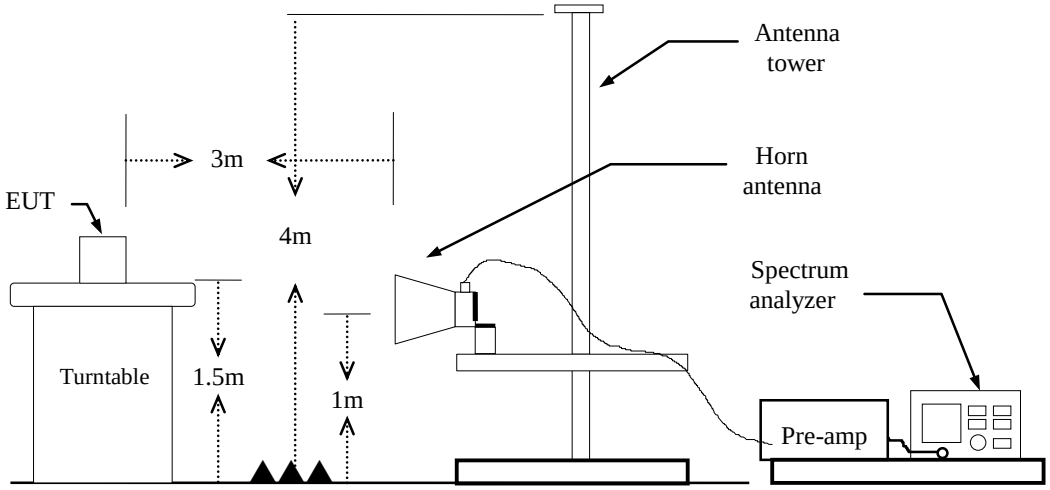
7.4 BAND EDGES MEASUREMENT

LIMIT

According to §15.247(d) & RSS-247, in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator 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

For Radiated



TEST PROCEDURE

For Radiated

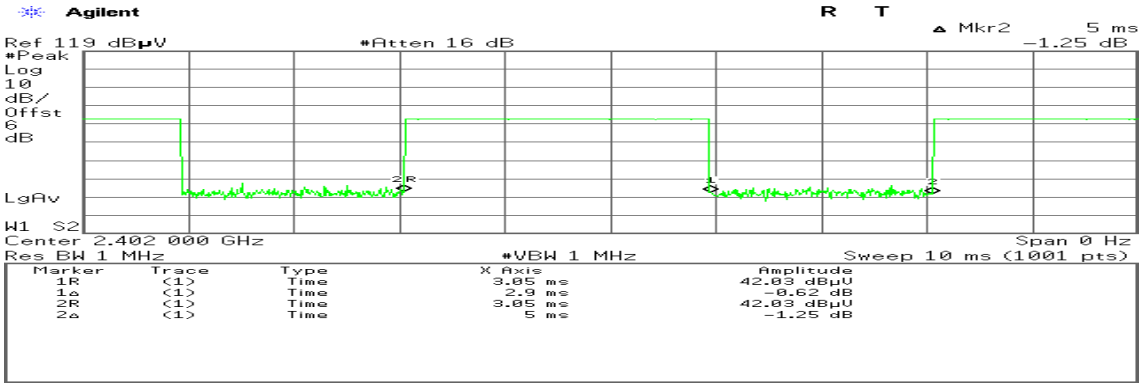
1. The EUT is placed on a turntable, which is 1.5m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the 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.
   For PIFA Antenna
   BT: = 58%, VBW= 360Hz
   EDR = 58%, VBW= 360Hz

   For PCB Antenna
   BT: = 58%, VBW= 360Hz
   EDR = 58%, VBW= 360Hz
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

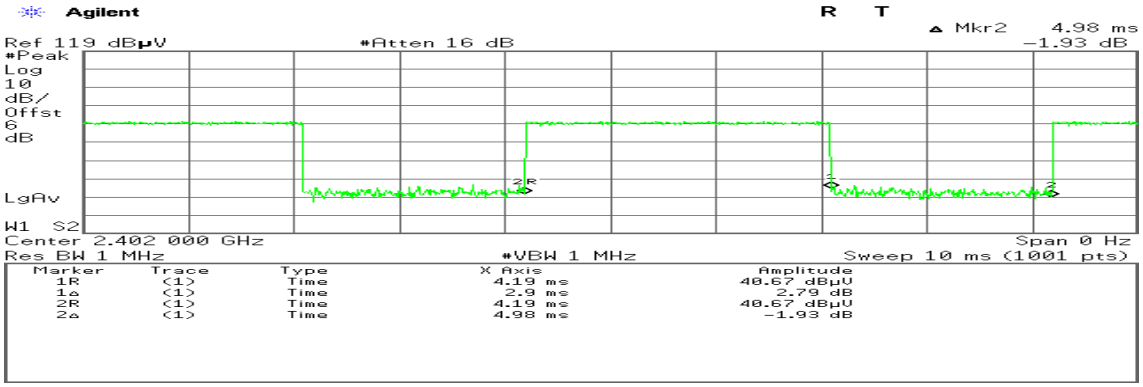
For PIFA Antenna

Duty Cycle

BR-1M DUTY

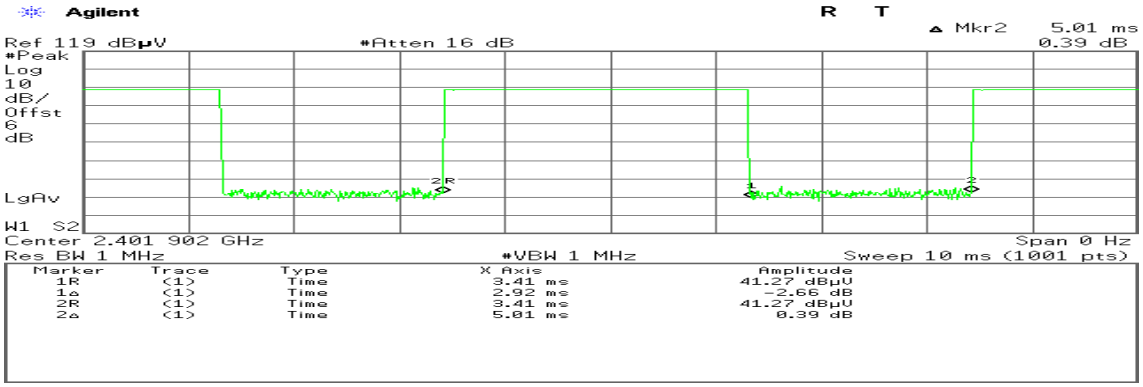


EDR-3M DUTY

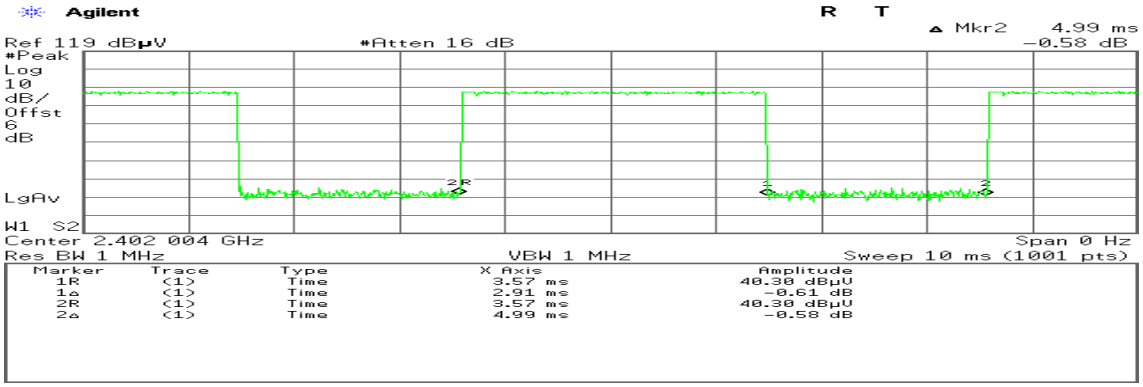


For PCB Antenna

BR-1M DUTY



EDR-3M DUTY



TEST RESULTS

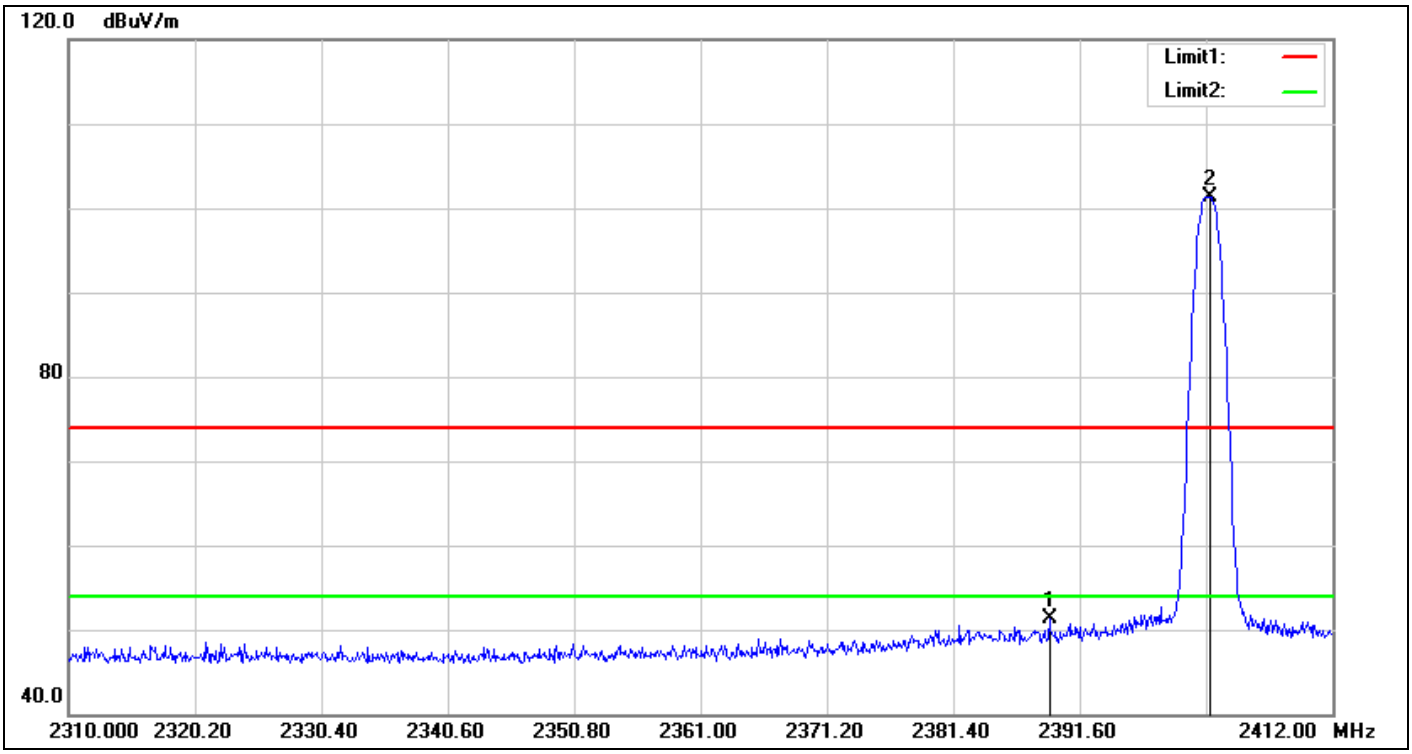
Refer to attach spectrum analyzer data chart.

For PIFA Antenna

For GFSK / DH5

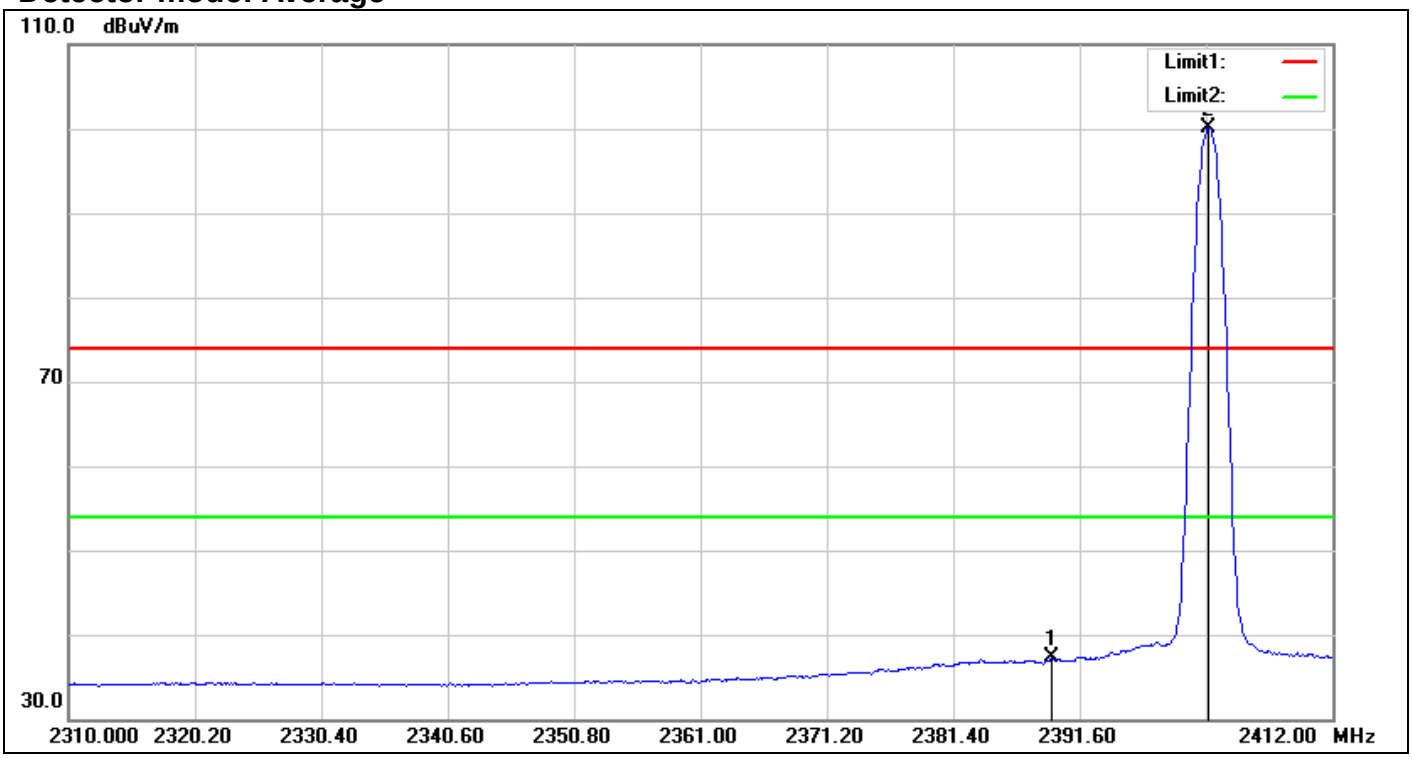
Band Edges (CH Low)

Detector mode: Peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2389.152	53.77	-2.50	51.27	74.00	-22.73	peak
2	2402.106	103.79	-2.41	101.38	-	-	peak

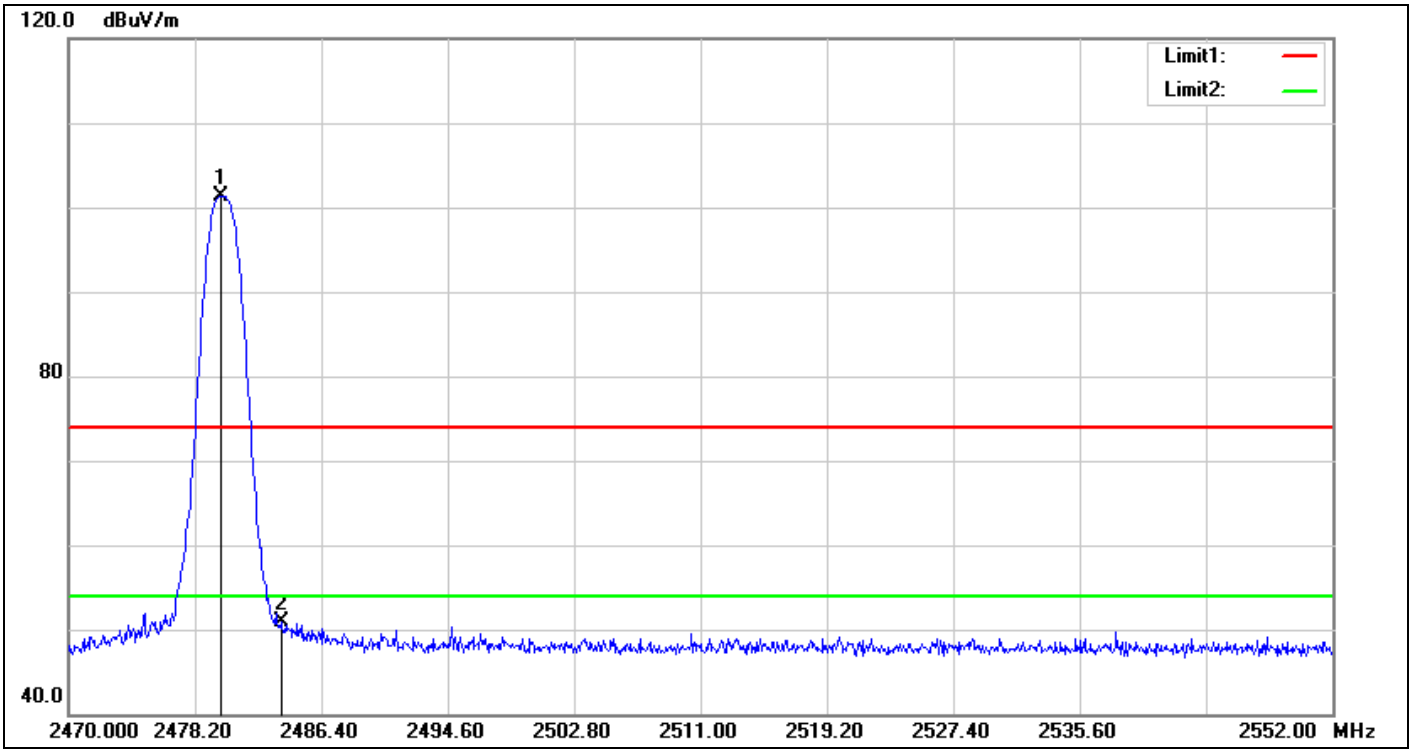
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2389.356	39.70	-2.50	37.20	54.00	-16.80	AVG
2	2402.004	102.56	-2.41	100.15	-	-	AVG

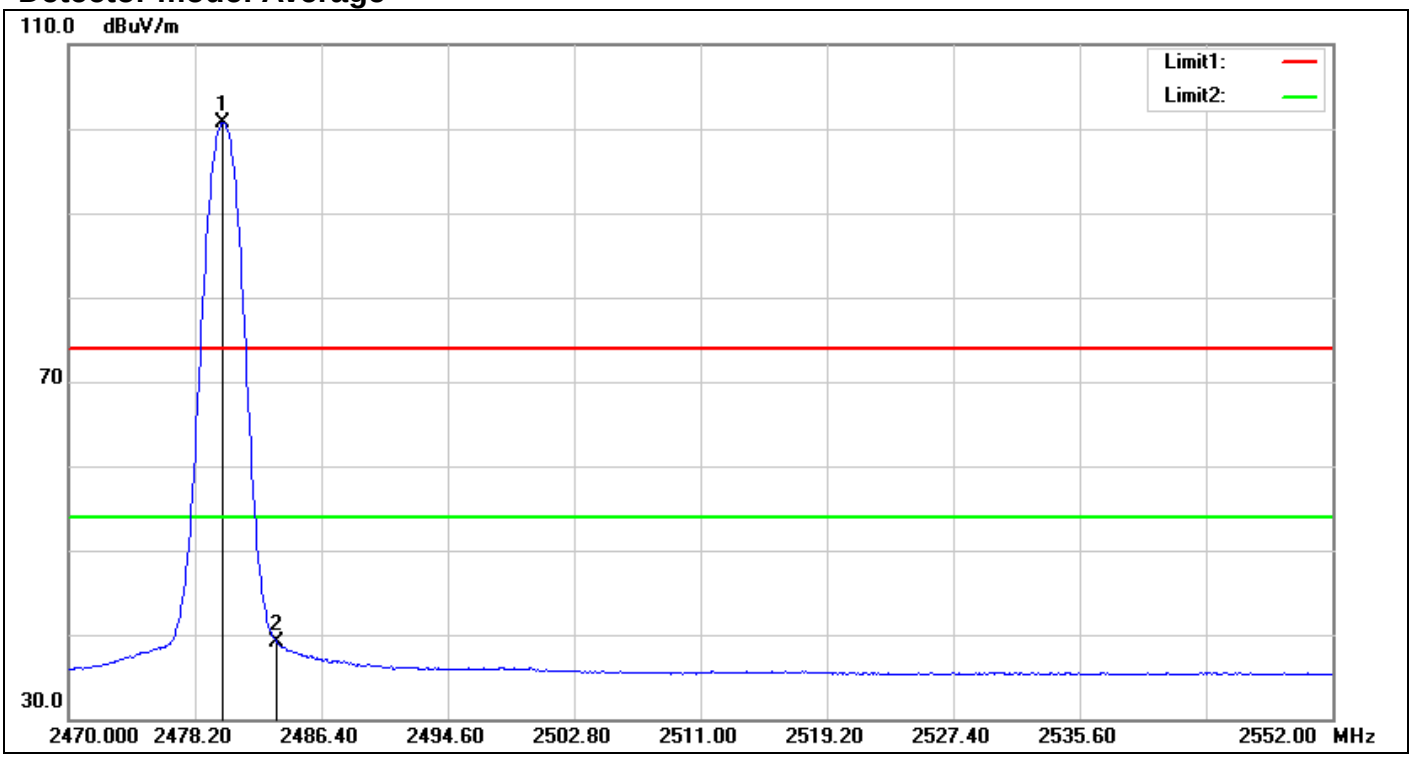
Band Edges (CH High)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2479.840	103.31	-2.03	101.28	-	-	peak
2	2483.776	52.81	-1.99	50.82	74.00	-23.18	peak

Detector mode: Average

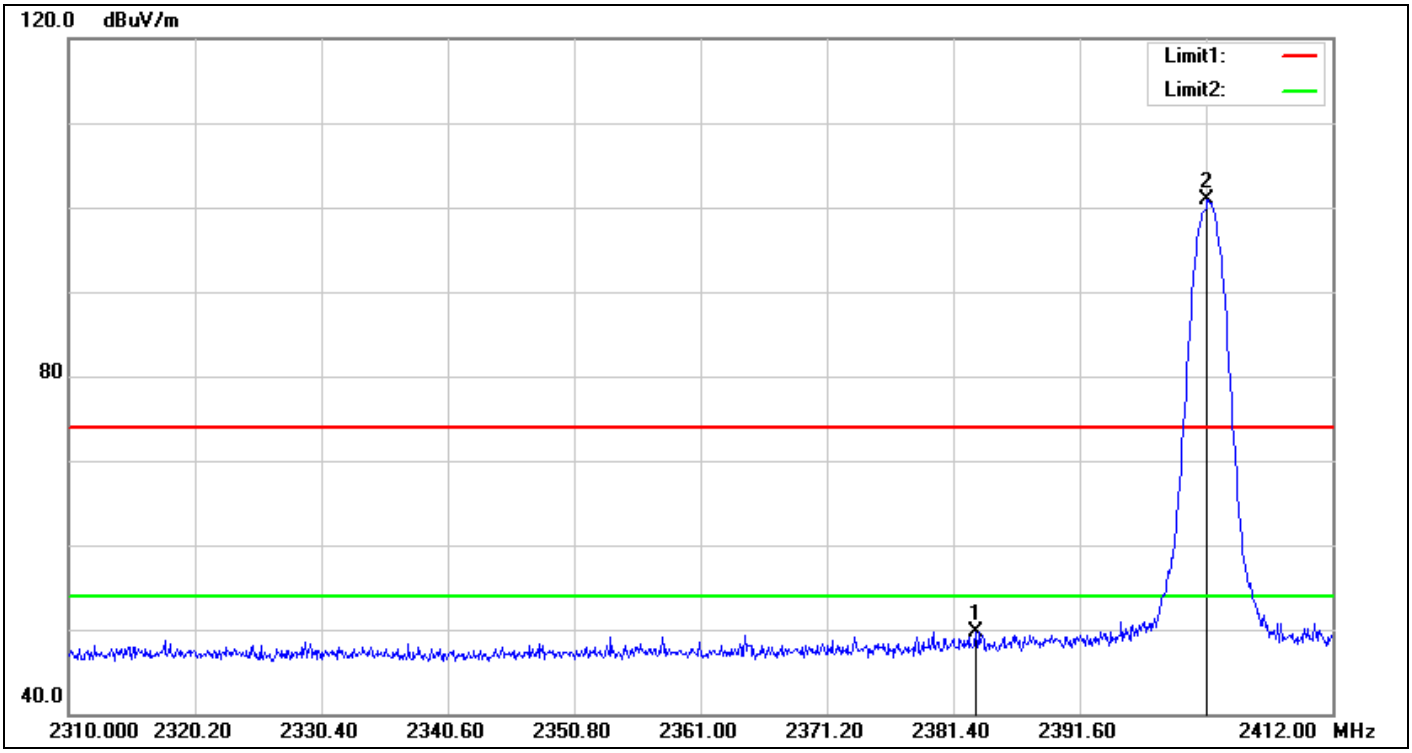


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.004	102.66	-2.03	100.63	-	-	AVG
2	2483.530	41.04	-1.99	39.05	54.00	-14.95	AVG

For 8DPSK

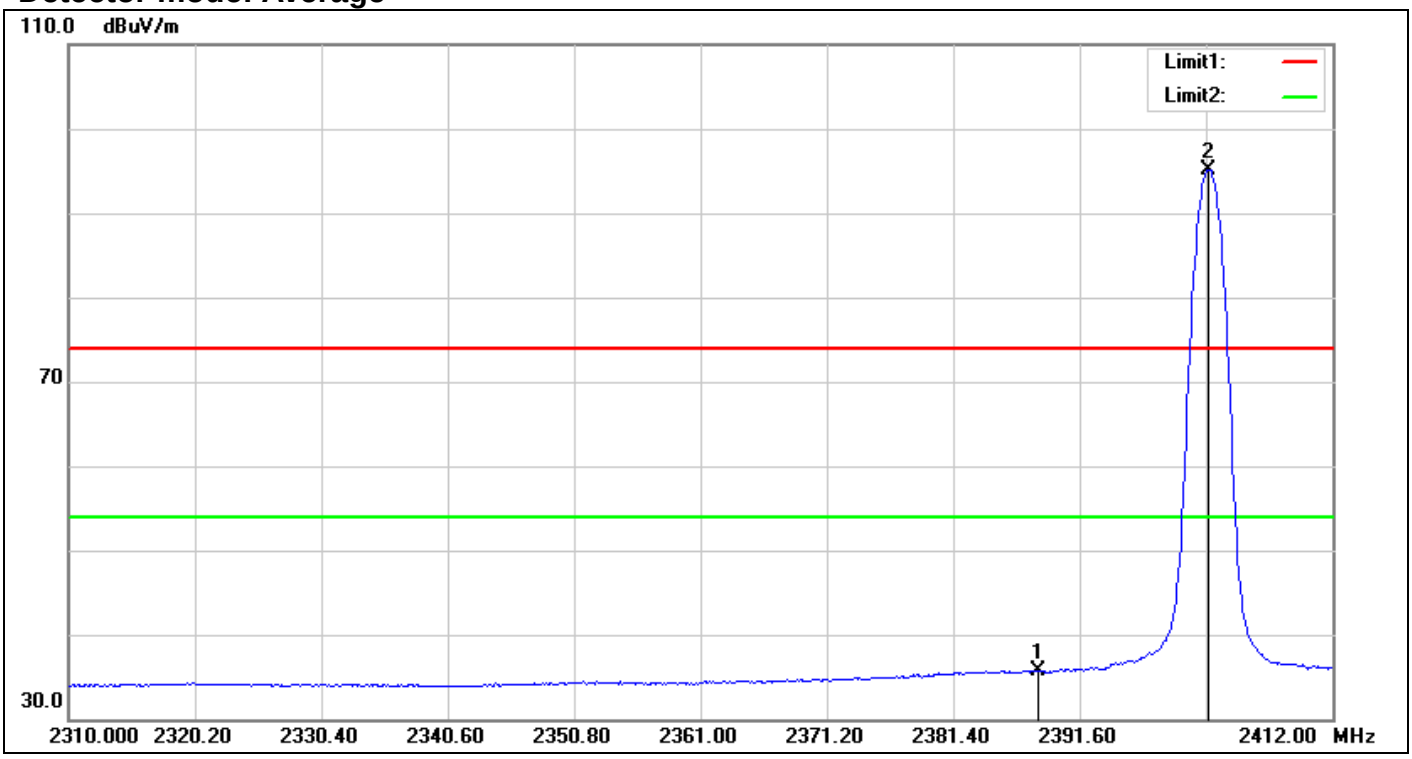
Band Edges (CH Low)

Detector mode: Peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2383.236	52.29	-2.55	49.74	74.00	-24.26	peak
2	2401.902	103.29	-2.41	100.88	-	-	peak

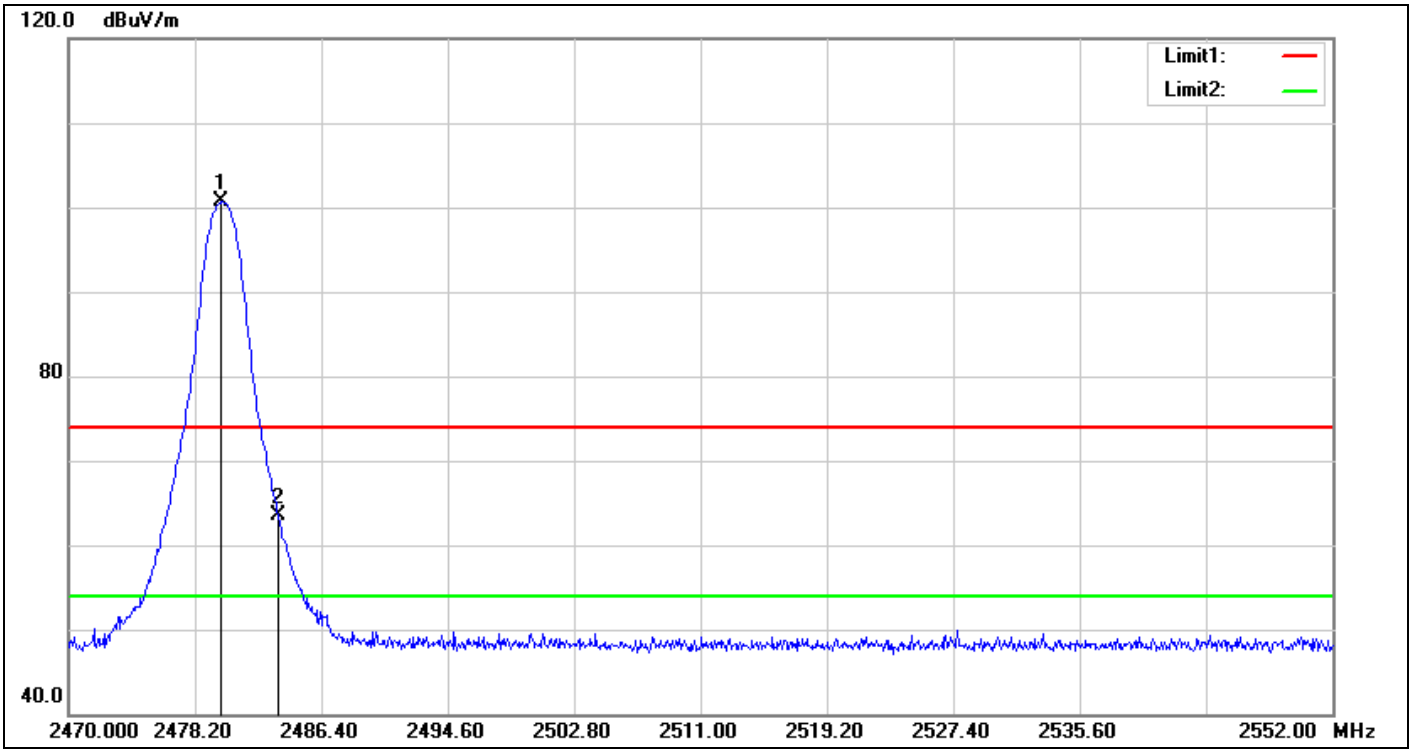
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2388.234	38.30	-2.51	35.79	54.00	-18.21	AVG
2	2402.004	97.60	-2.41	95.19	-	-	AVG

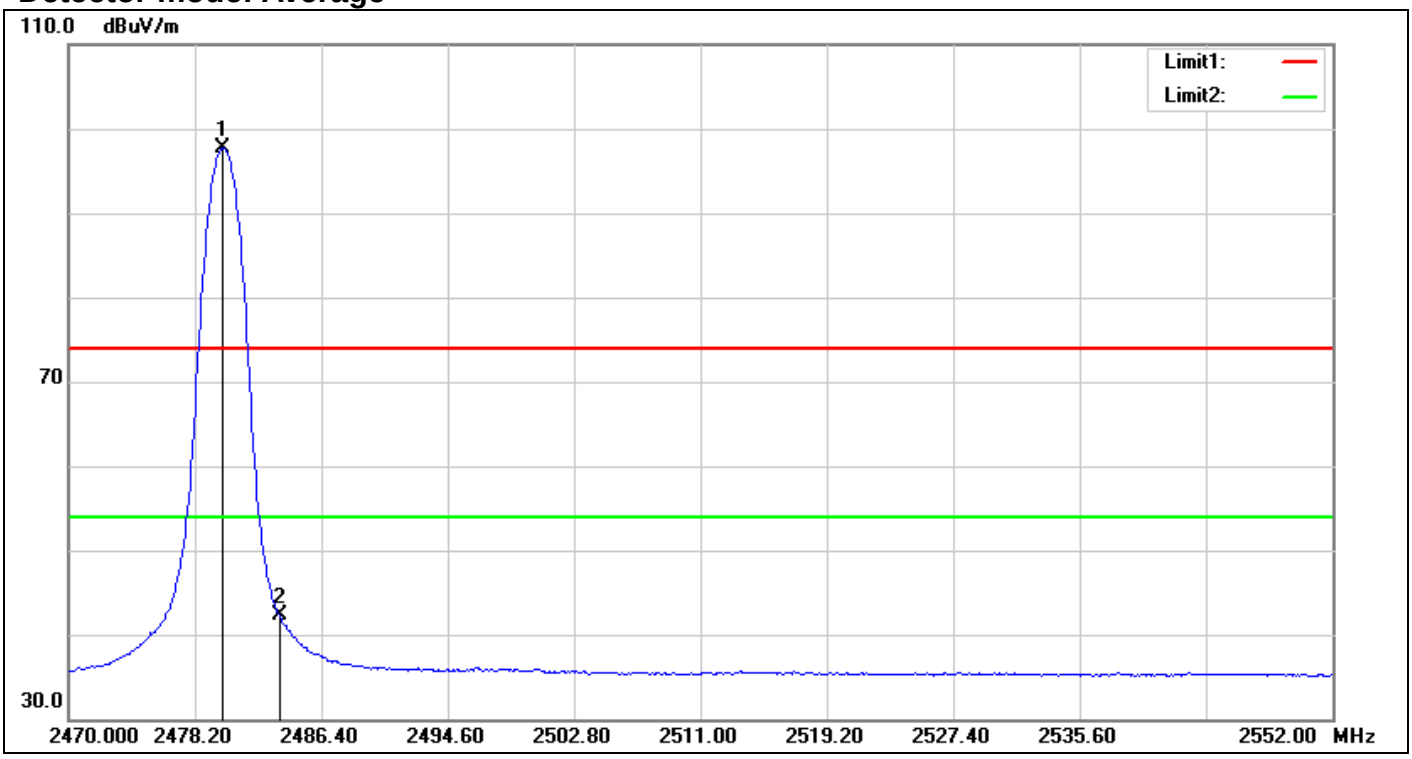
Band Edges (CH High)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2479.922	102.76	-2.03	100.73	-	-	peak
2	2483.612	65.53	-1.99	63.54	74.00	-10.46	peak

Detector mode: Average



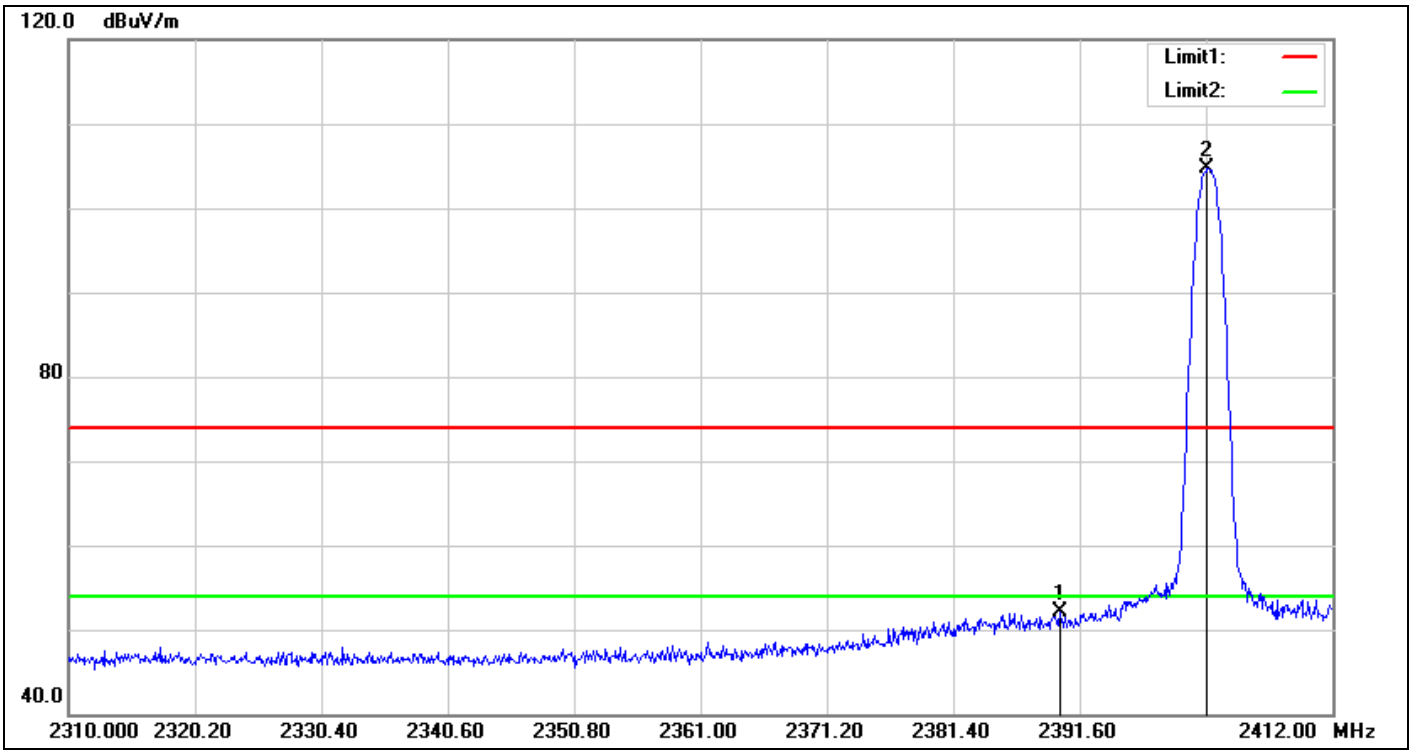
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.004	99.75	-2.03	97.72	-	-	AVG
2	2483.694	44.22	-1.99	42.23	54.00	-11.77	AVG

For PCB Antenna

For GFSK / DH5

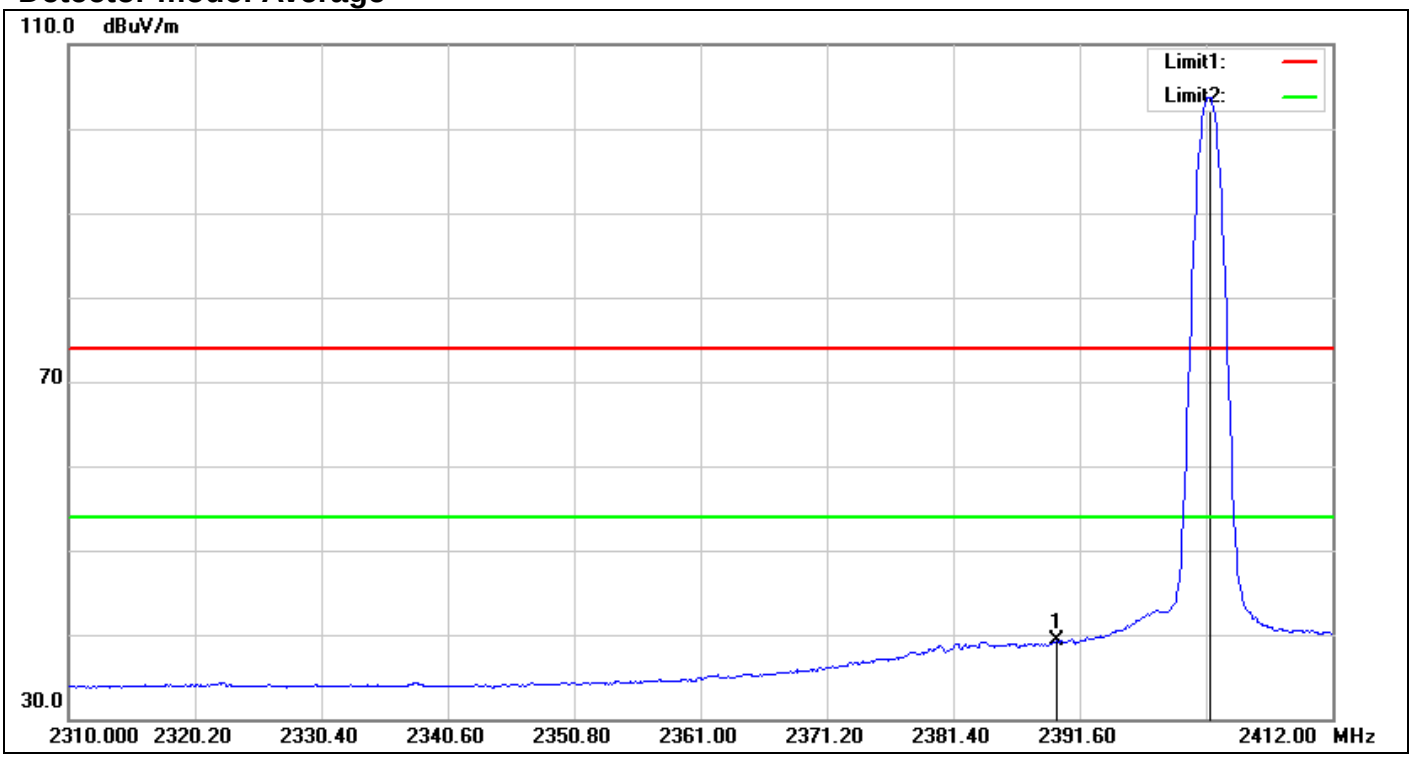
Band Edges (CH Low)

Detector mode: Peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2389.968	55.42	-3.28	52.14	74.00	-21.86	peak
2	2401.902	107.94	-3.25	104.69	-	-	peak

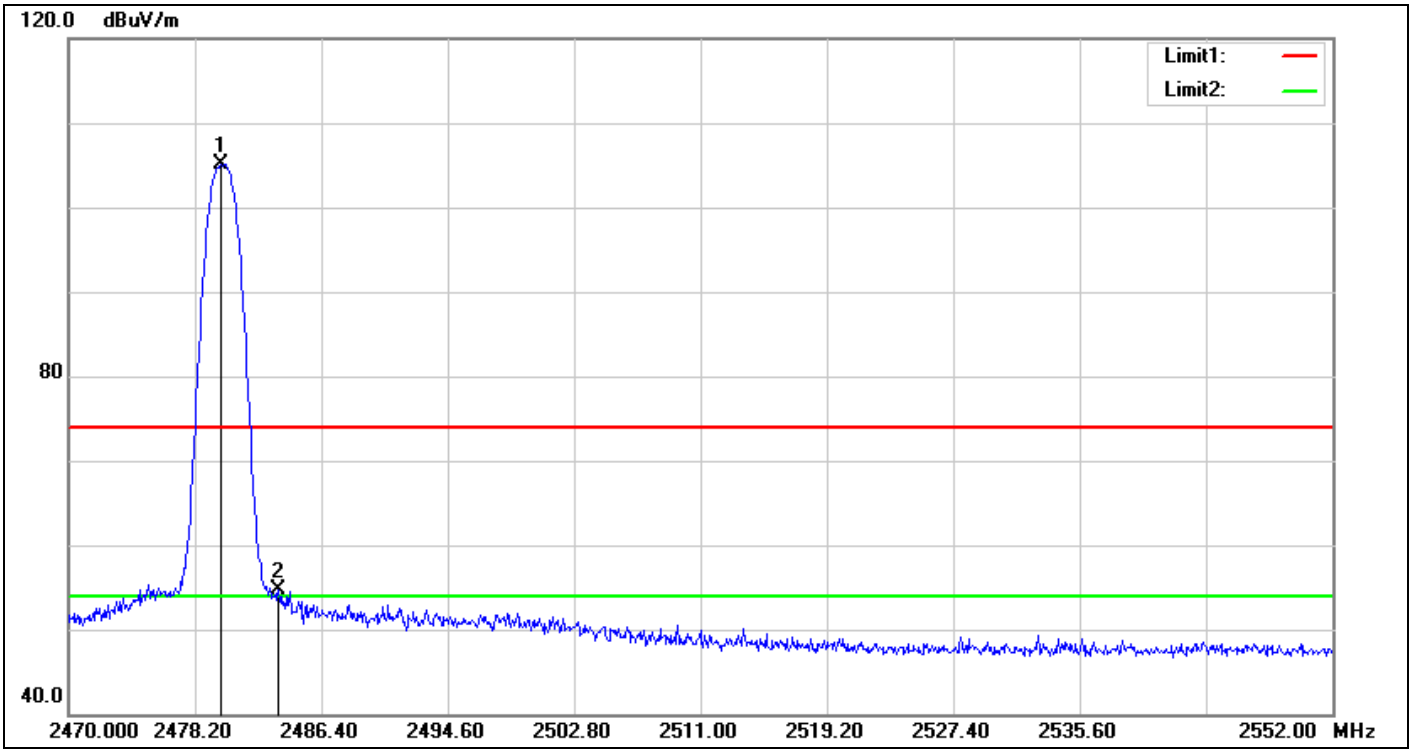
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2389.764	42.51	-3.28	39.23	54.00	-14.77	AVG
2	2402.106	107.00	-3.25	103.75	-	-	AVG

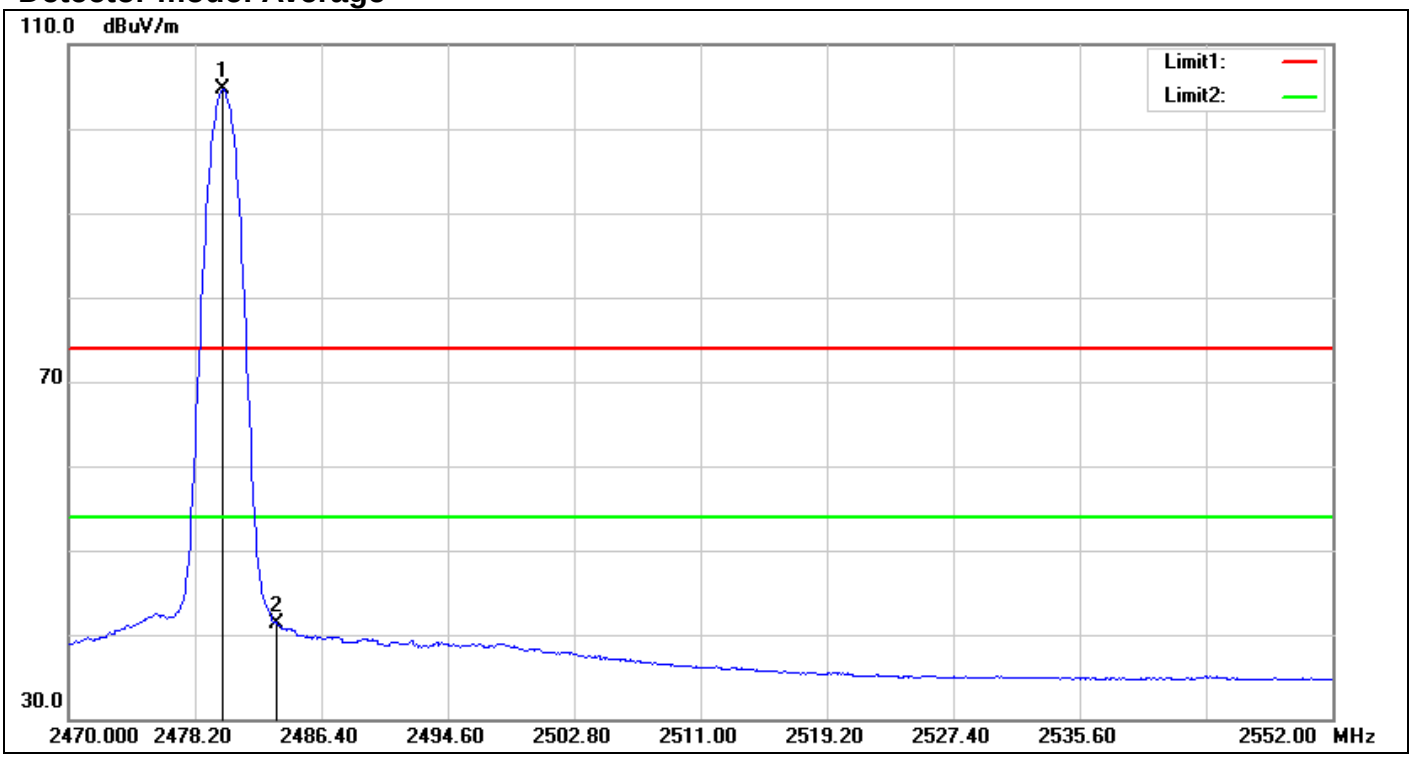
Band Edges (CH High)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2479.840	108.08	-3.03	105.05	-	-	peak
2	2483.612	57.70	-3.02	54.68	74.00	-19.32	peak

Detector mode: Average

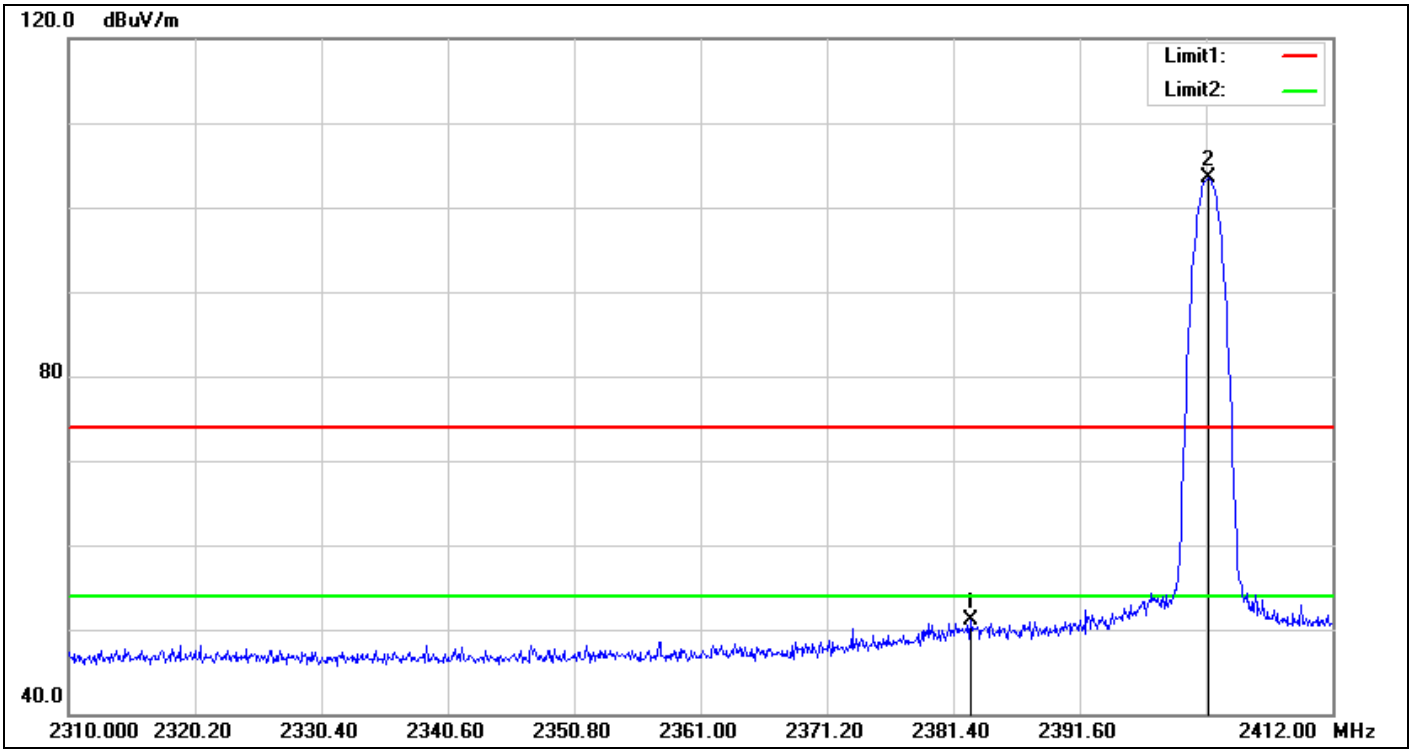


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.004	107.70	-3.03	104.67	-	-	AVG
2	2483.500	44.23	-3.02	41.21	54.00	-12.79	AVG

For 8DPSK

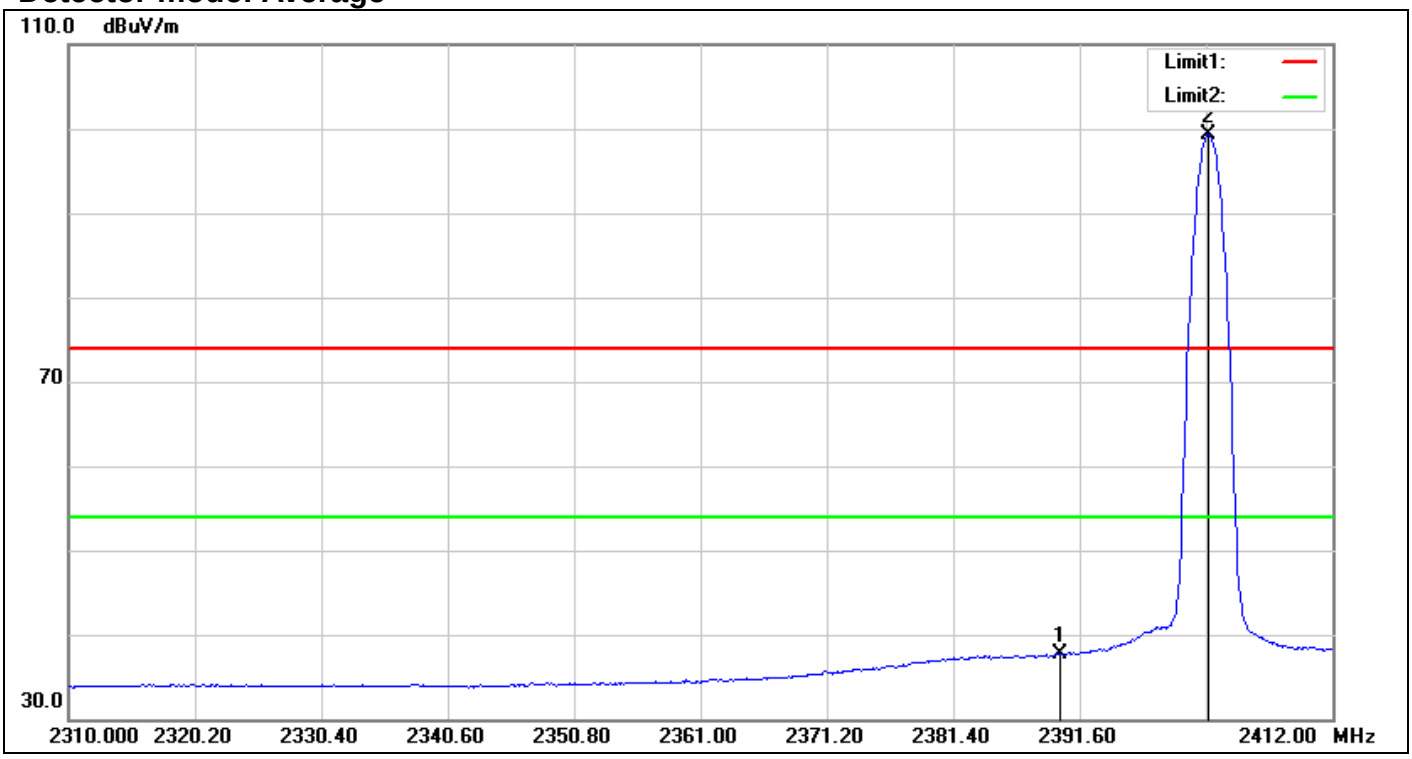
Band Edges (CH Low)

Detector mode: Peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2382.828	54.44	-3.34	51.10	74.00	-22.90	peak
2	2402.004	106.70	-3.25	103.45	-	-	peak

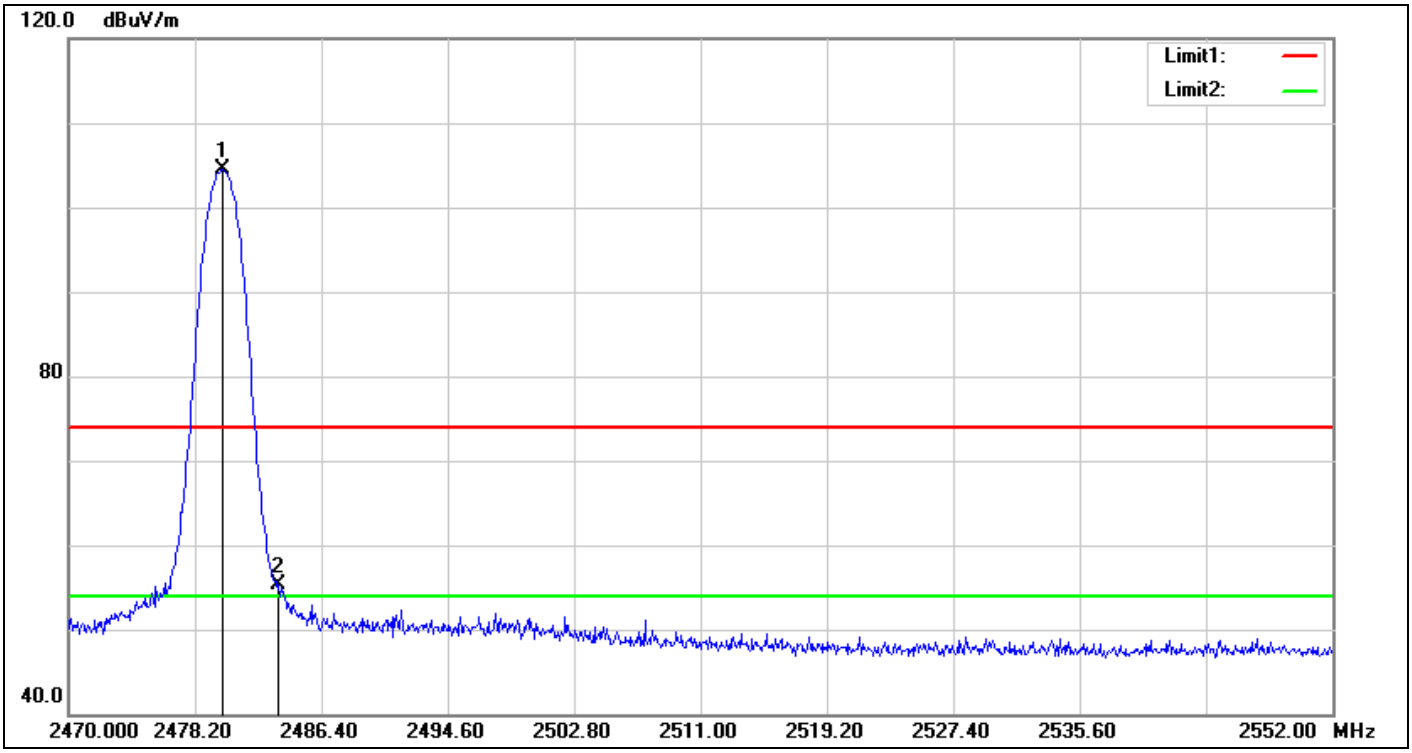
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2389.968	41.01	-3.28	37.73	54.00	-16.27	AVG
2	2402.004	102.54	-3.25	99.29	-	-	AVG

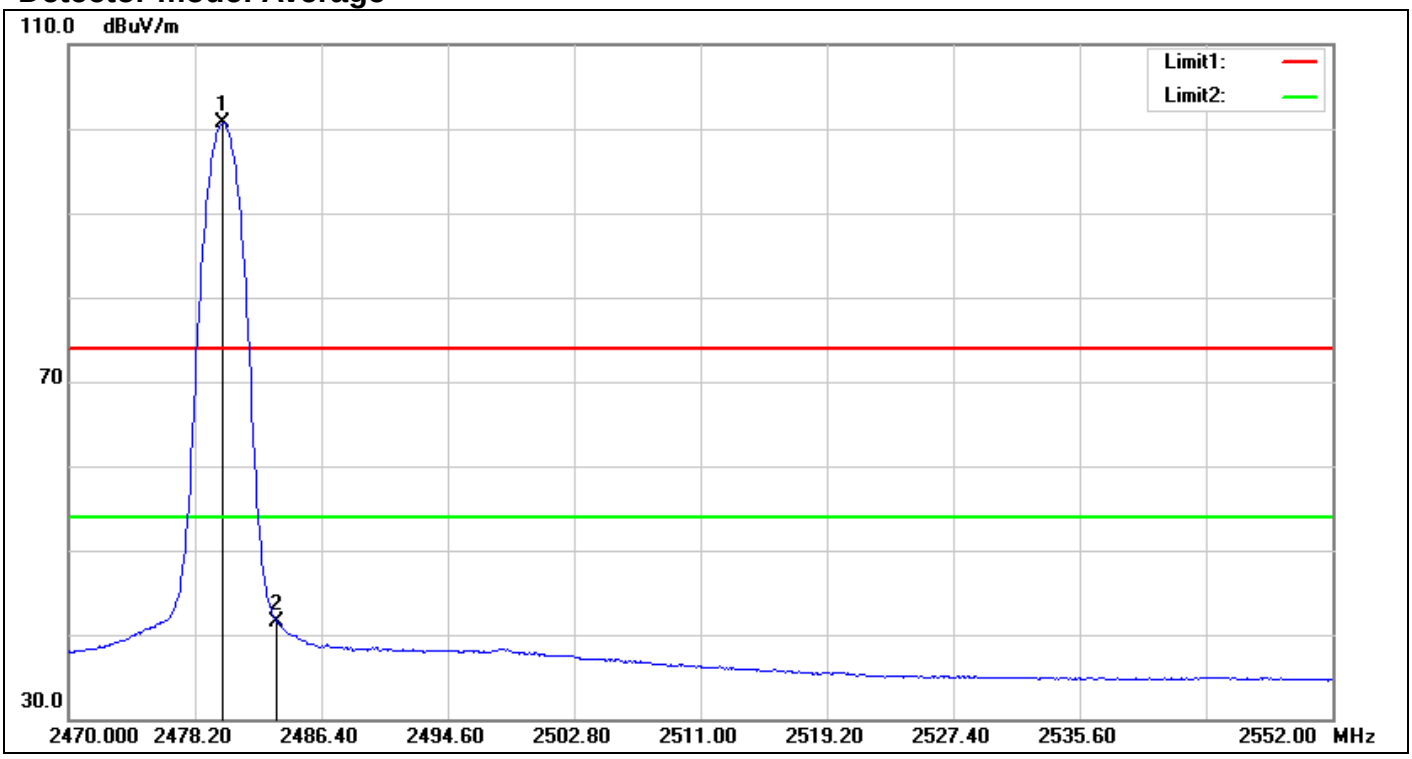
Band Edges (CH High)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.004	107.53	-3.03	104.50	-	-	peak
2	2483.612	58.32	-3.02	55.30	74.00	-18.70	peak

Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.004	103.66	-3.03	100.63	-	-	peak
2	2483.500	44.53	-3.02	41.51	74.00	-32.49	peak

7.5 CONDUCTED BAND EDGE AND SPURIOUS EMISSION

In any 100 kHz bandwidth outside the authorized frequency band,

Non-restricted bands shall be attenuated at least 20 dB/30 dB relative to the maximum PSD level in 100 kHz by RF conducted or a radiated measurement 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)

TEST PROCEDURE

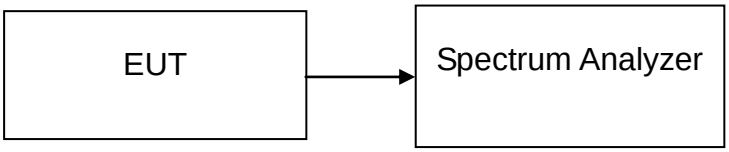
According to 15.247(d), ANSI C63.10:2013 clause 7.8.6 and clause 7.8.8.

1. EUT RF output port connected to the SA by RF cable, and the path loss was compensated to result.

2. SA setting, RBW=100kHz, VBW=300kHz, Detector=Peak, Trace mode = max hold, SWT = Auto.

3. In any 100 kHz bandwidth outside the authorized frequency band, shall be attenuated at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when conducted power procedure is used. f the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Test Configuration



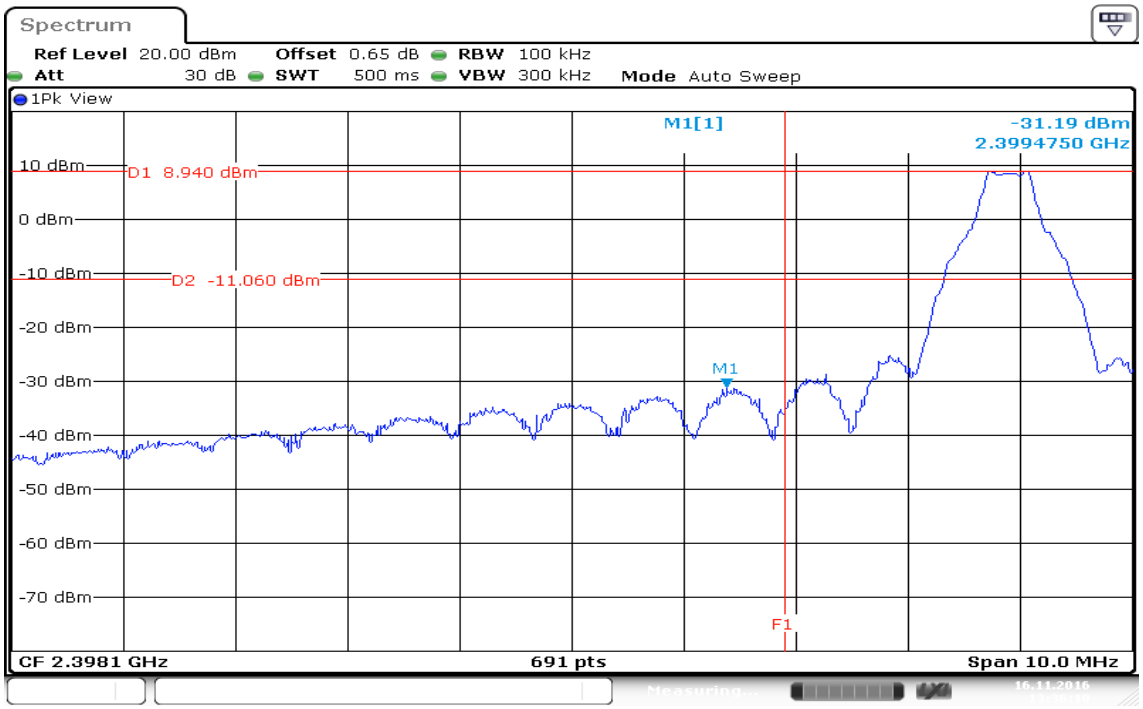
TEST RESULTS

Refer to attach spectrum analyzer data chart.

Test Data

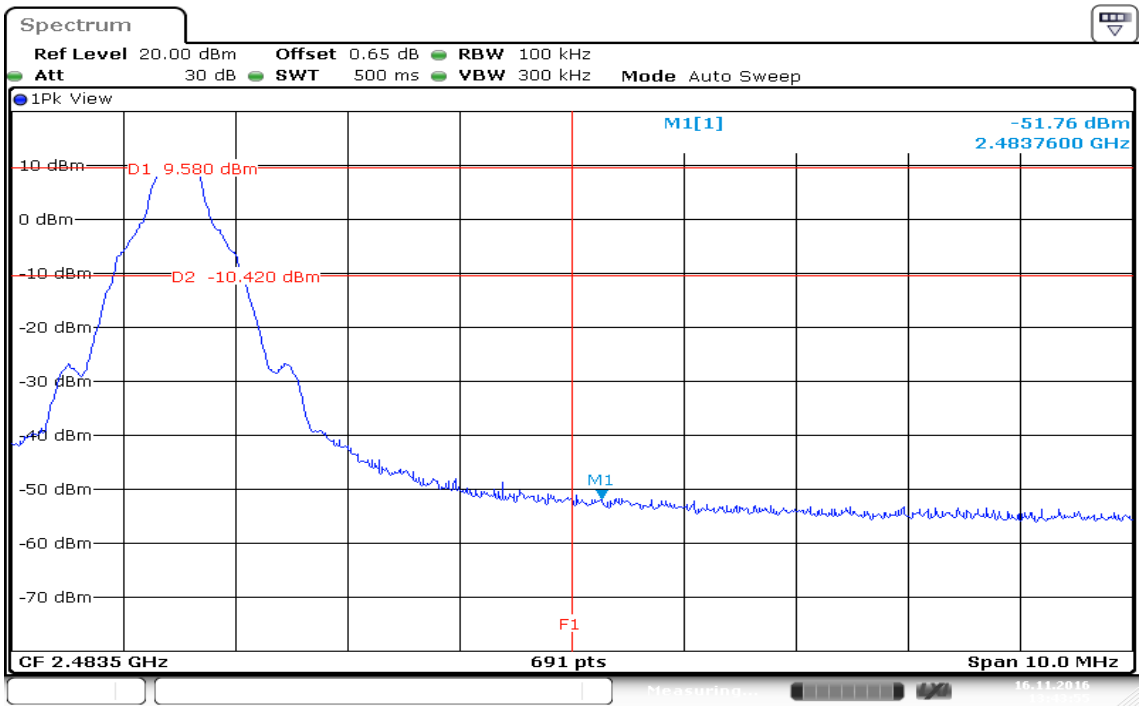
For GFSK/DH5

Low CH_Conducted Band edge



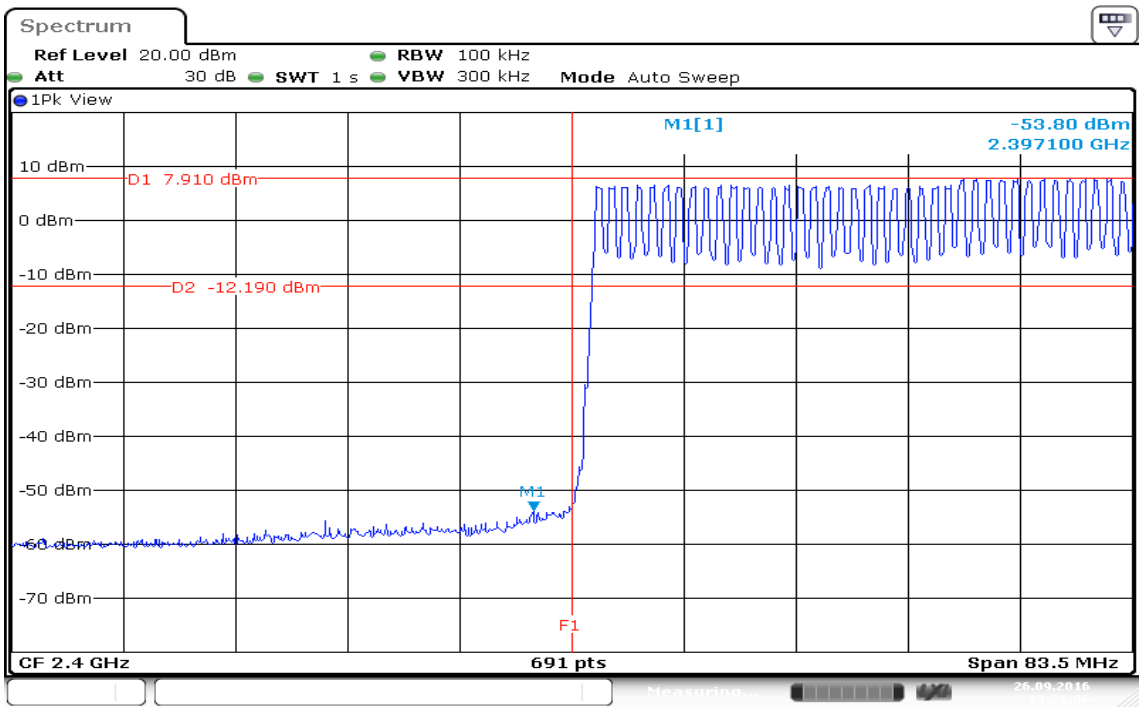
Date: 16.NOV.2016 13:36:10

High CH_Conducted Band edge



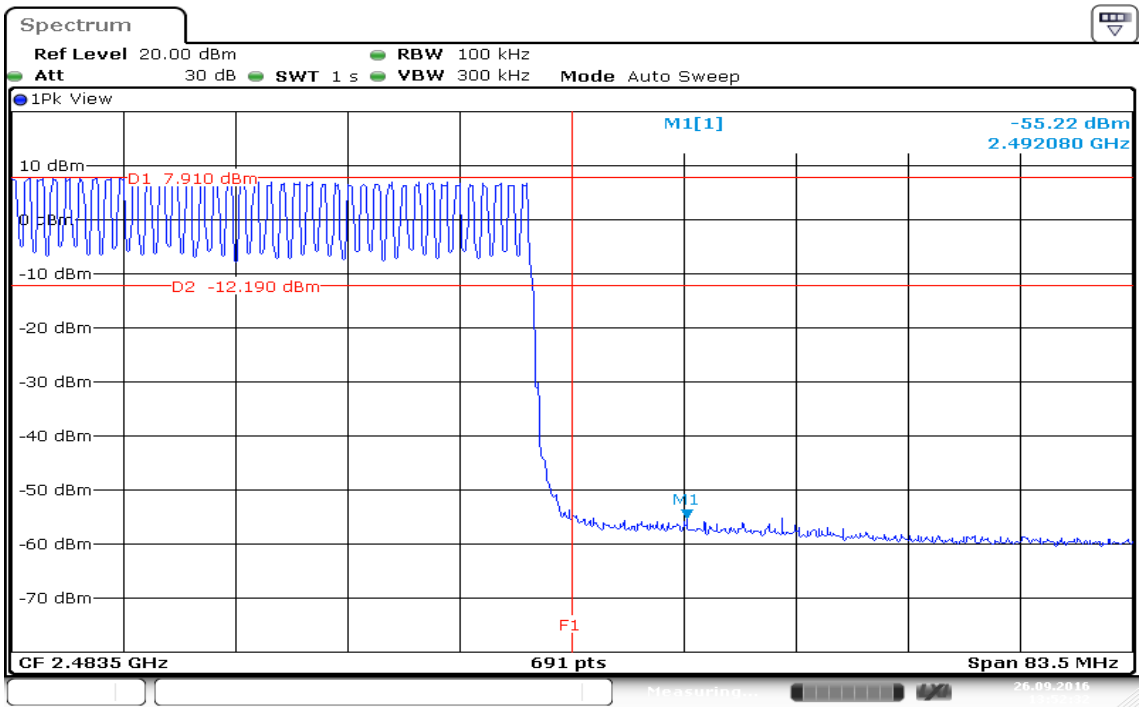
Date: 16.NOV.2016 13:43:56

Hopping Low CH_Conducted Band edge



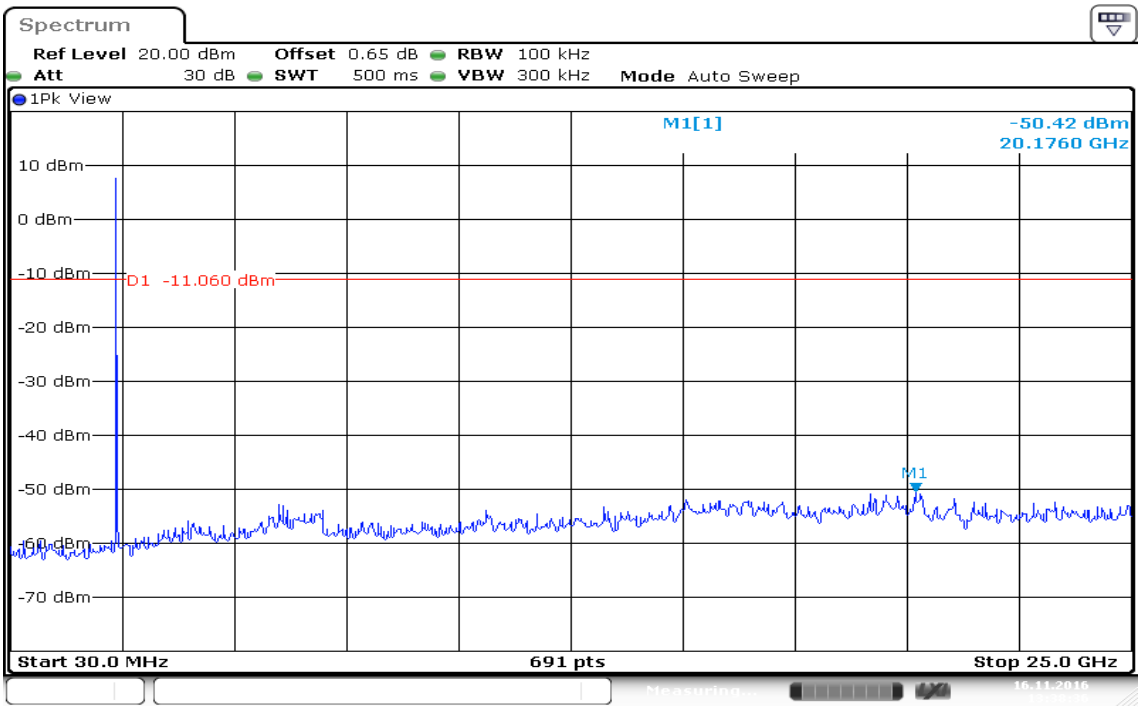
Date: 26.SEP.2016 13:21:06

Hopping High CH_Conducted Band edge



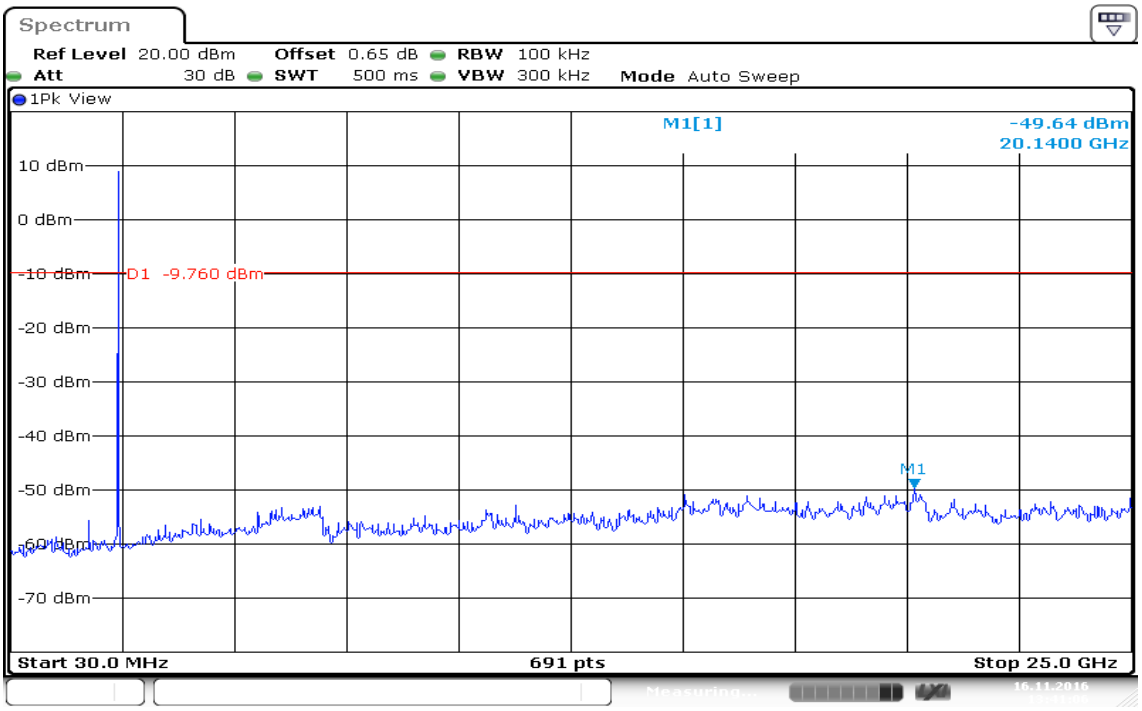
Date: 26.SEP.2016 13:52:32

Low CH_ Conducted spurious emission



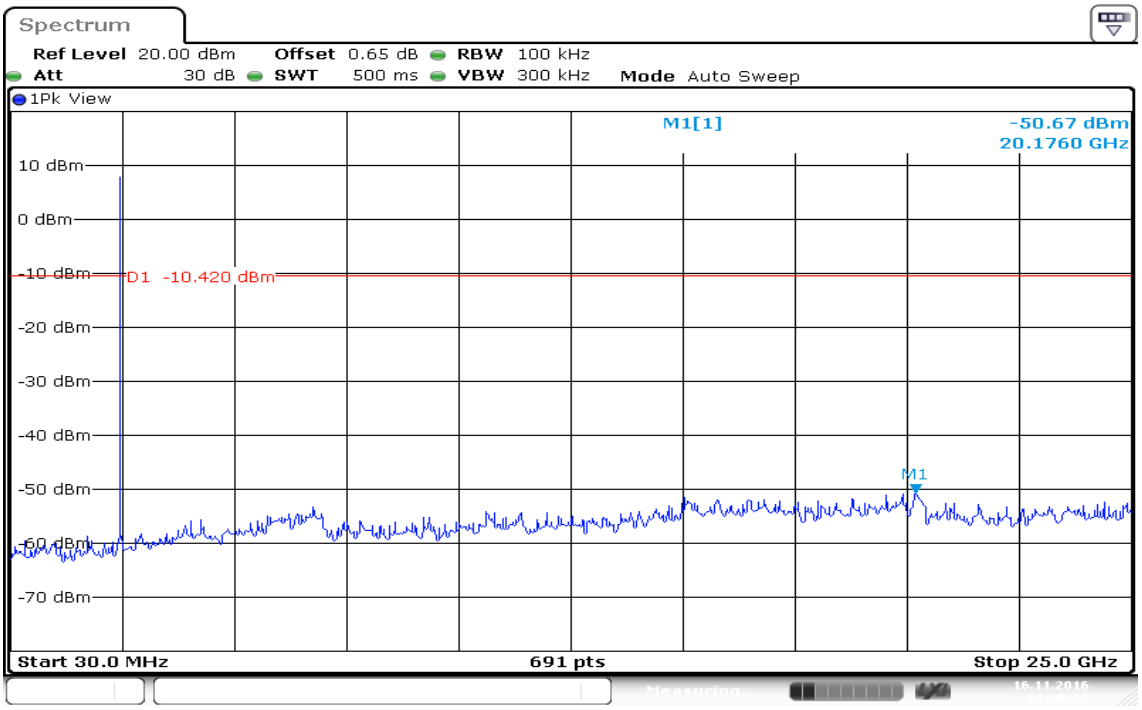
Date: 16.NOV.2016 13:38:36

Mid CH_ Conducted spurious emission



Date: 16.NOV.2016 13:41:07

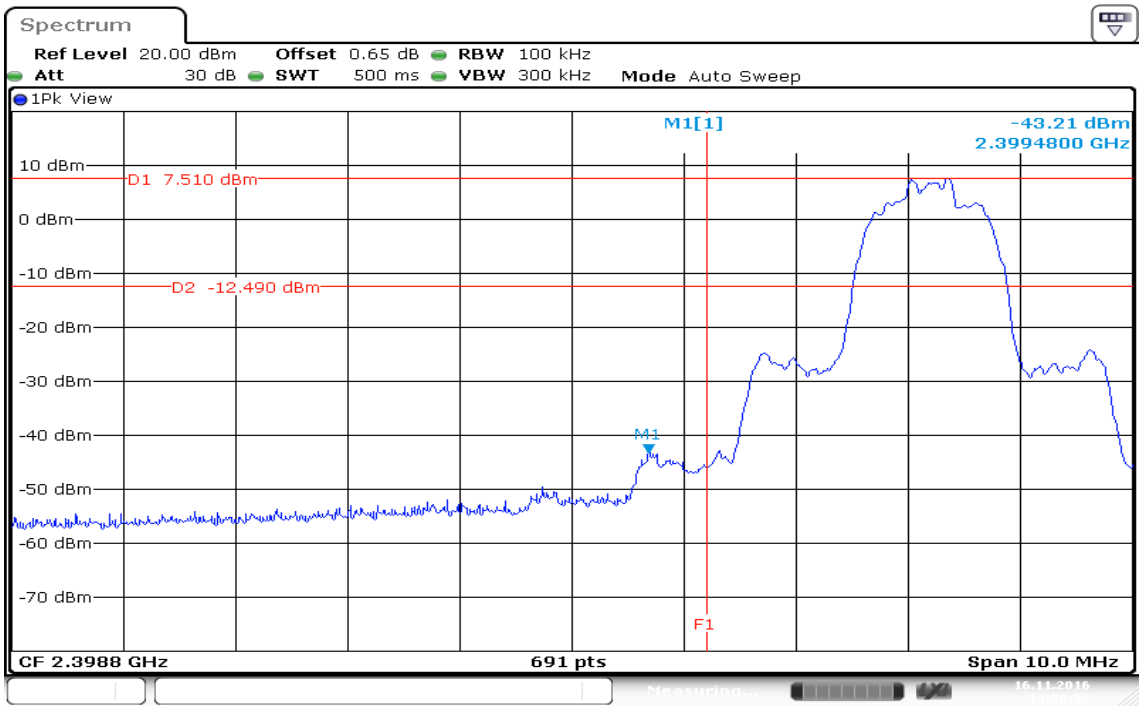
High CH_ Conducted spurious emission



Date: 16.NOV.2016 13:46:08

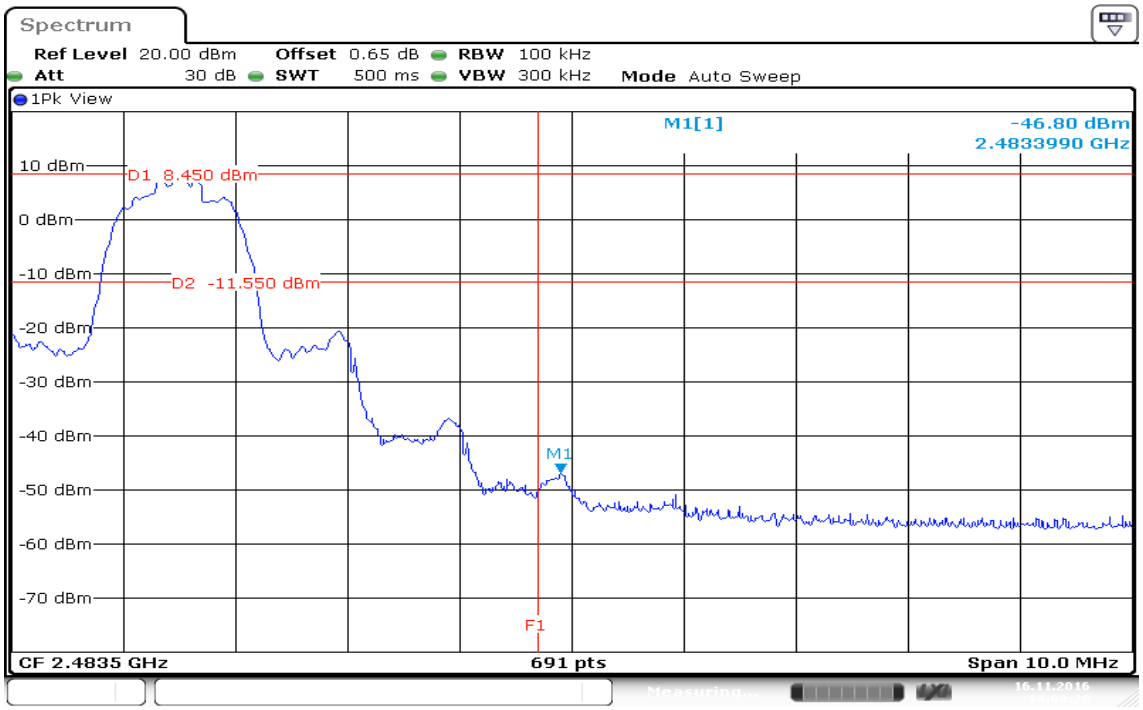
For 8DPSK/DH5

Low CH_Conducted Band edge



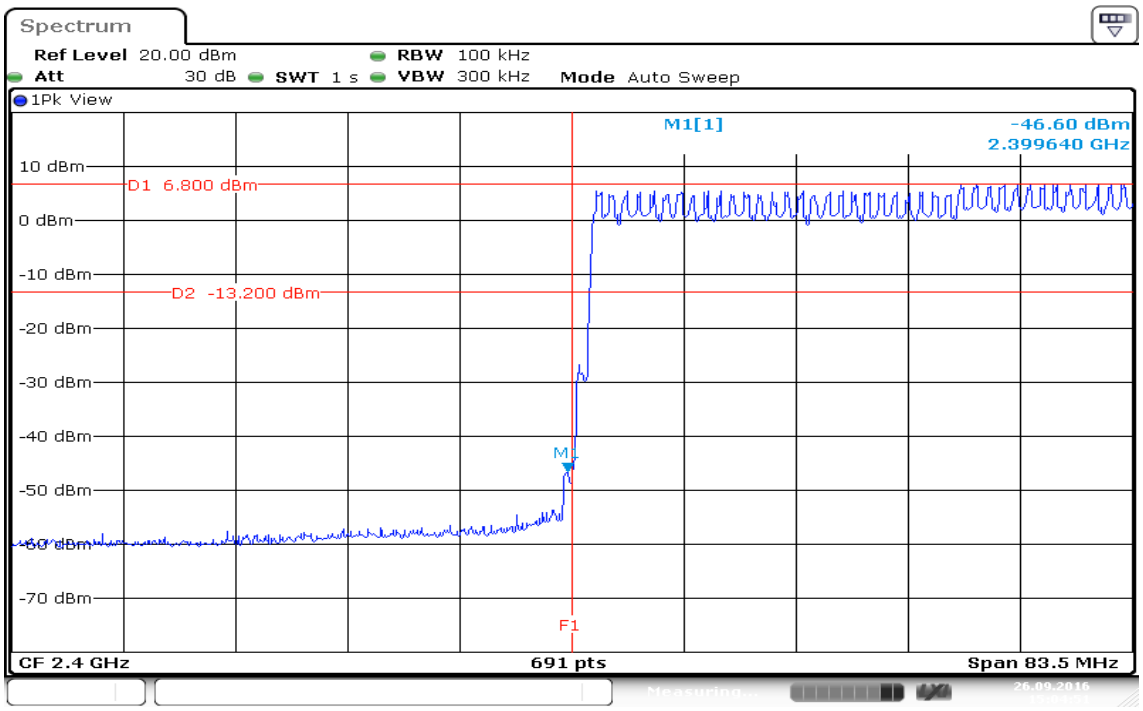
Date: 16.NOV.2016 14:00:57

High CH_Conducted Band edge



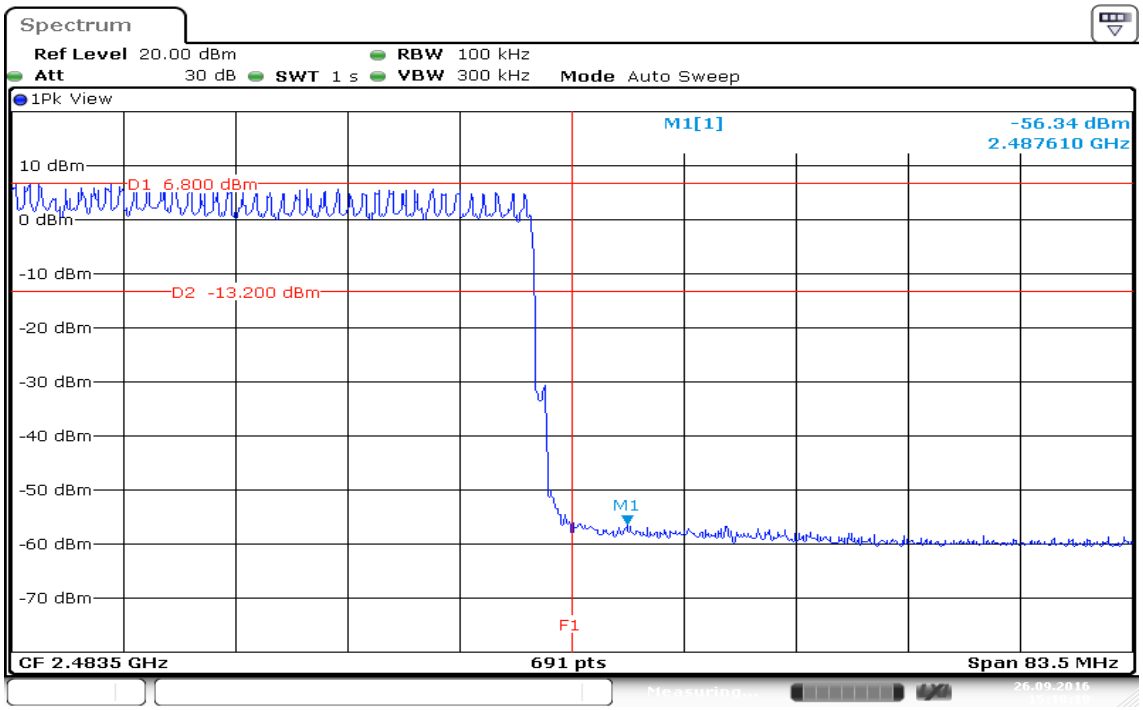
Date: 16.NOV.2016 14:08:28

Hopping Low CH_Conducted Band edge



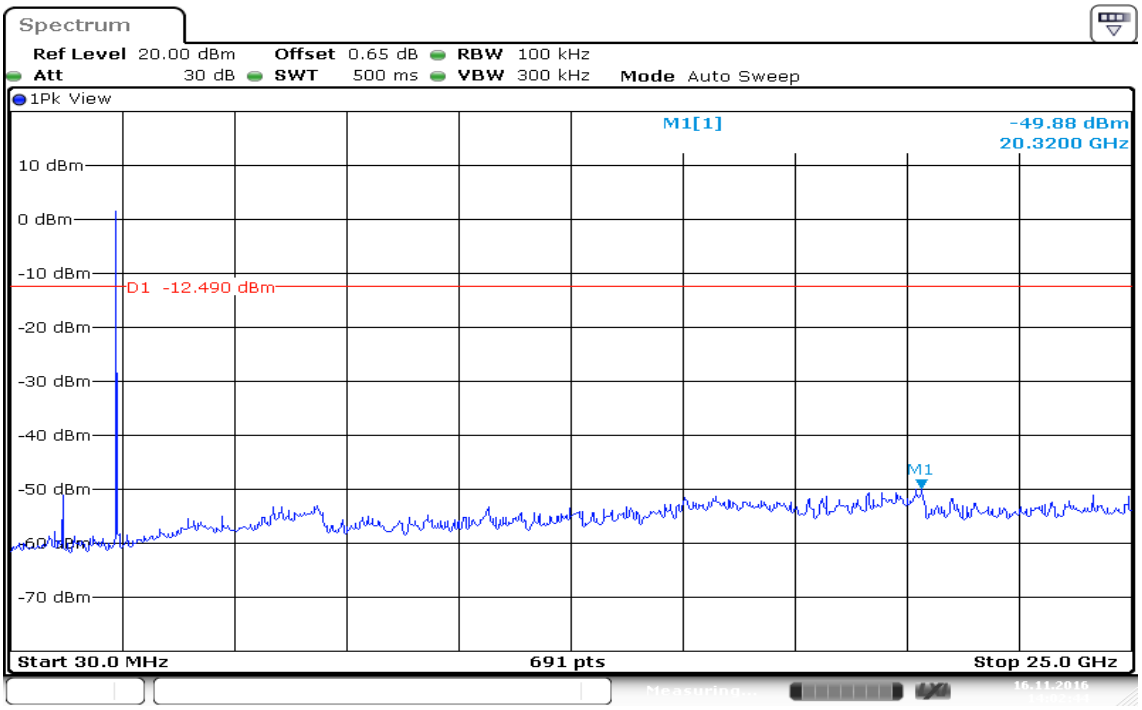
Date: 26.SEP.2016 15:04:51

Hopping High CH_Conducted Band edge



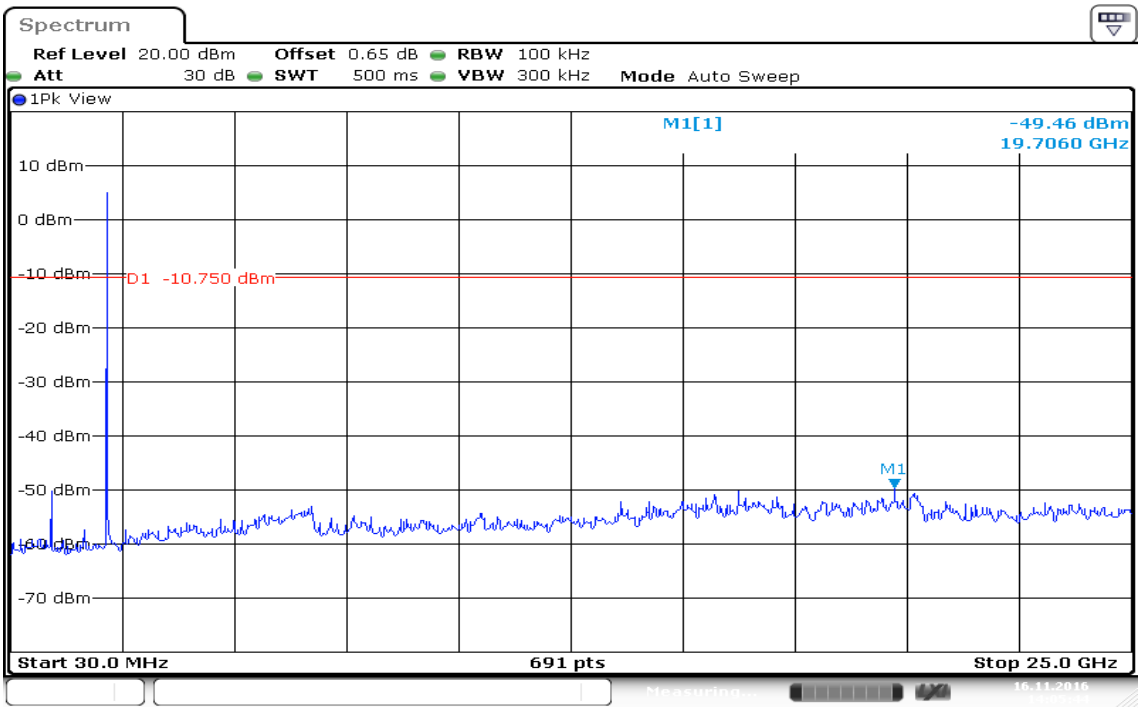
Date: 26.SEP.2016 15:18:19

Low CH_ Conducted spurious emission



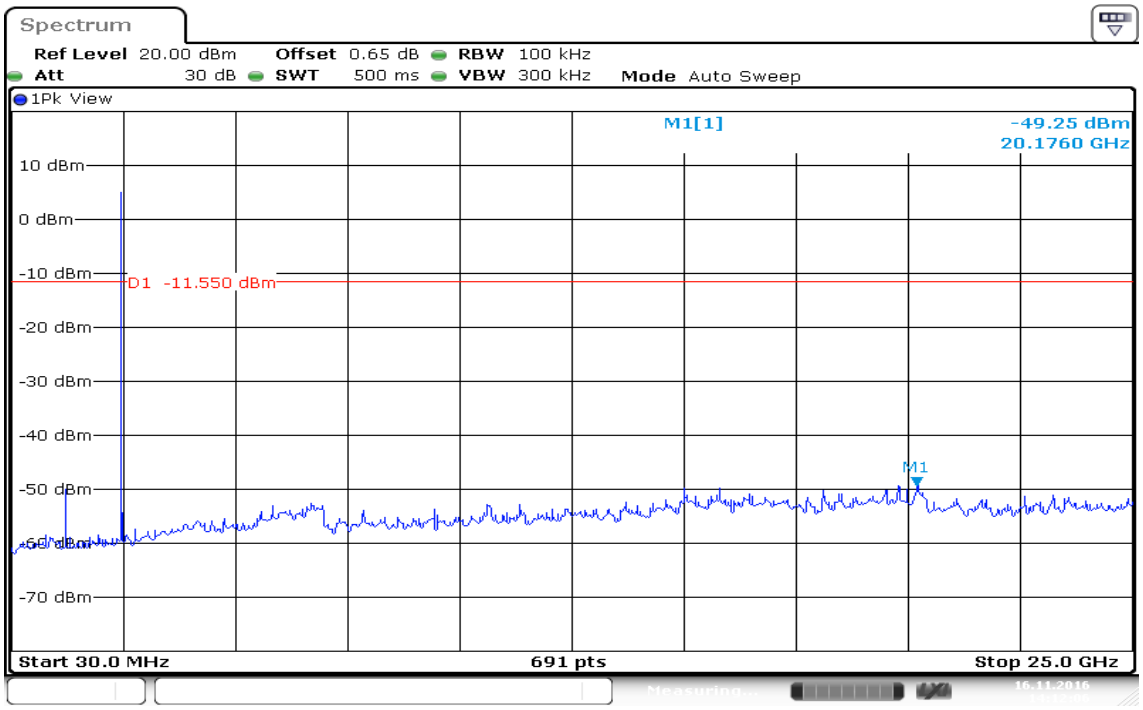
Date: 16.NOV.2016 14:02:44

Mid CH_ Conducted spurious emission



Date: 16.NOV.2016 14:05:44

High CH_ Conducted spurious emission



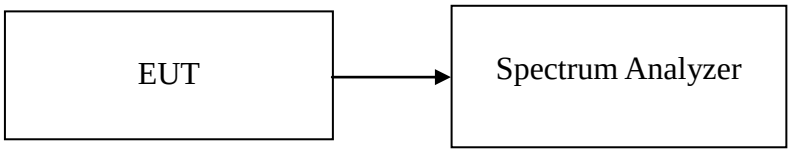
Date: 16.NOV.2016 14:12:06

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 = 100kHz, VBW = 300kHz, Sweep = auto.
5. Max hold, mark 3 peaks of hopping channel and record the 3 peaks frequency.

TEST RESULTS

No non-compliance noted

Test Data

For GFSK

Channel	Channel Separation (MHz)	two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit	Result
Low	1.0029	0.686	> two-thirds of the 20 dB bandwidth	Pass
Mid	1.0029	0.692	> two-thirds of the 20 dB bandwidth	Pass
High	1.0029	0.686	> two-thirds of the 20 dB bandwidth	Pass

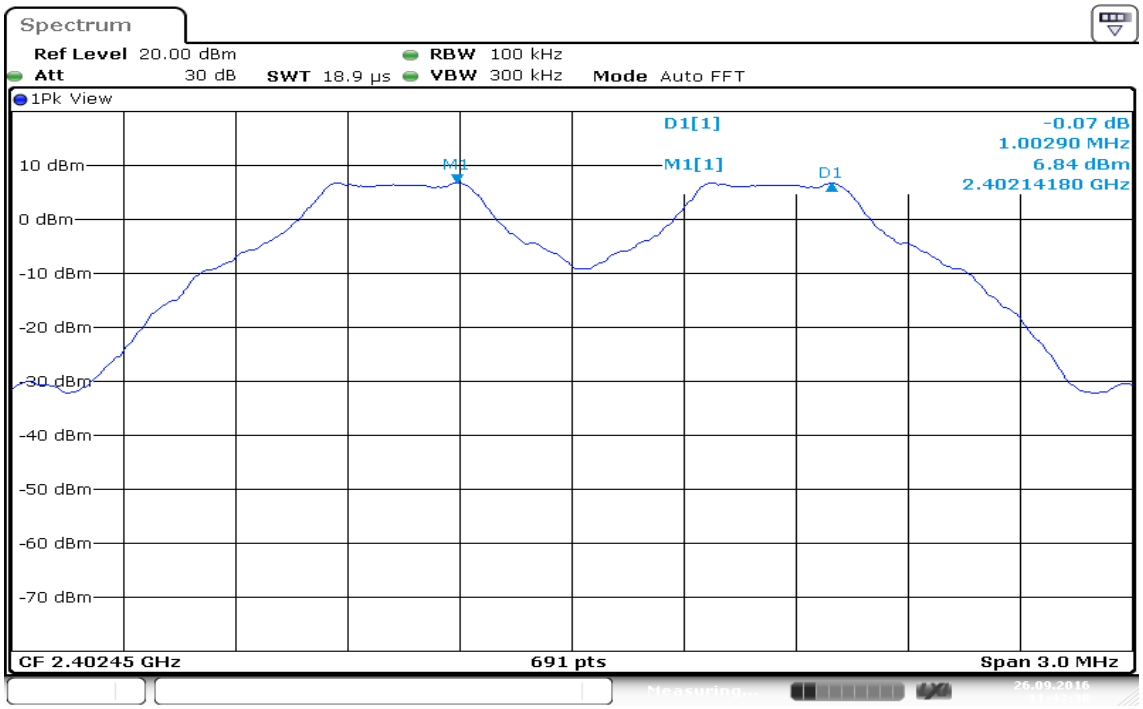
For 8DPSK

Channel	Channel Separation (MHz)	two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit	Result
Low	1.0029	0.863	> two-thirds of the 20 dB bandwidth	Pass
Mid	1.0029	0.868	> two-thirds of the 20 dB bandwidth	Pass
High	1.0029	0.863	> two-thirds of the 20 dB bandwidth	Pass

Test Plot

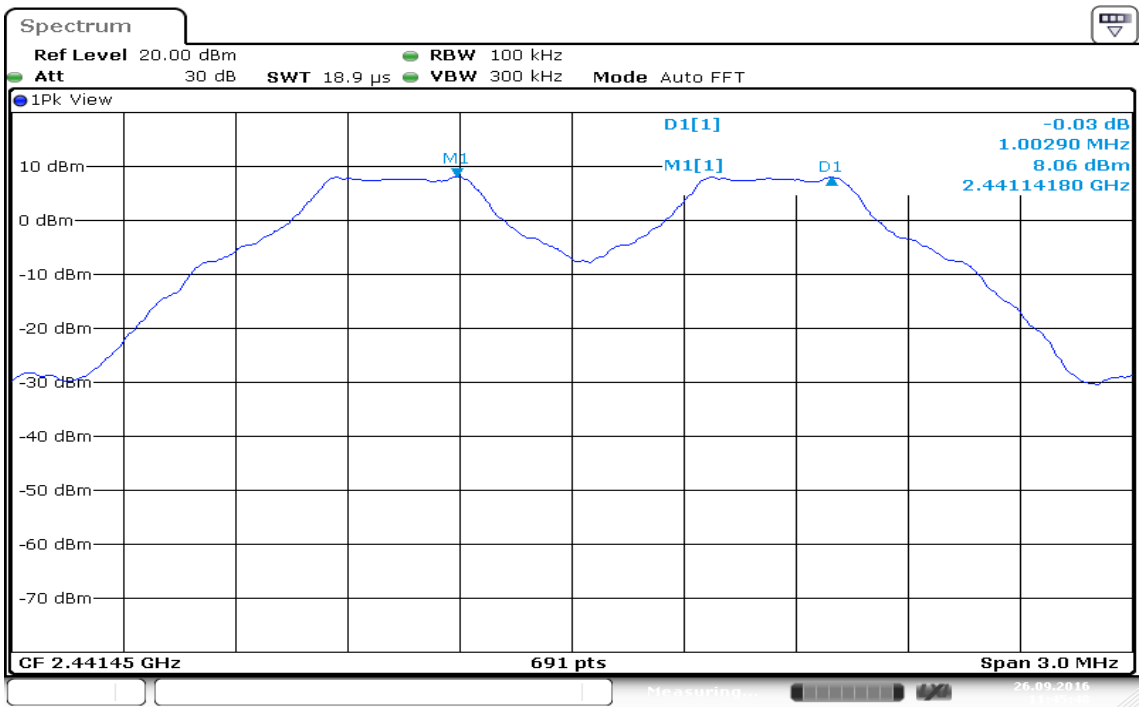
For GFSK / DH5

Measurement of Channel Separation / (CH Low)



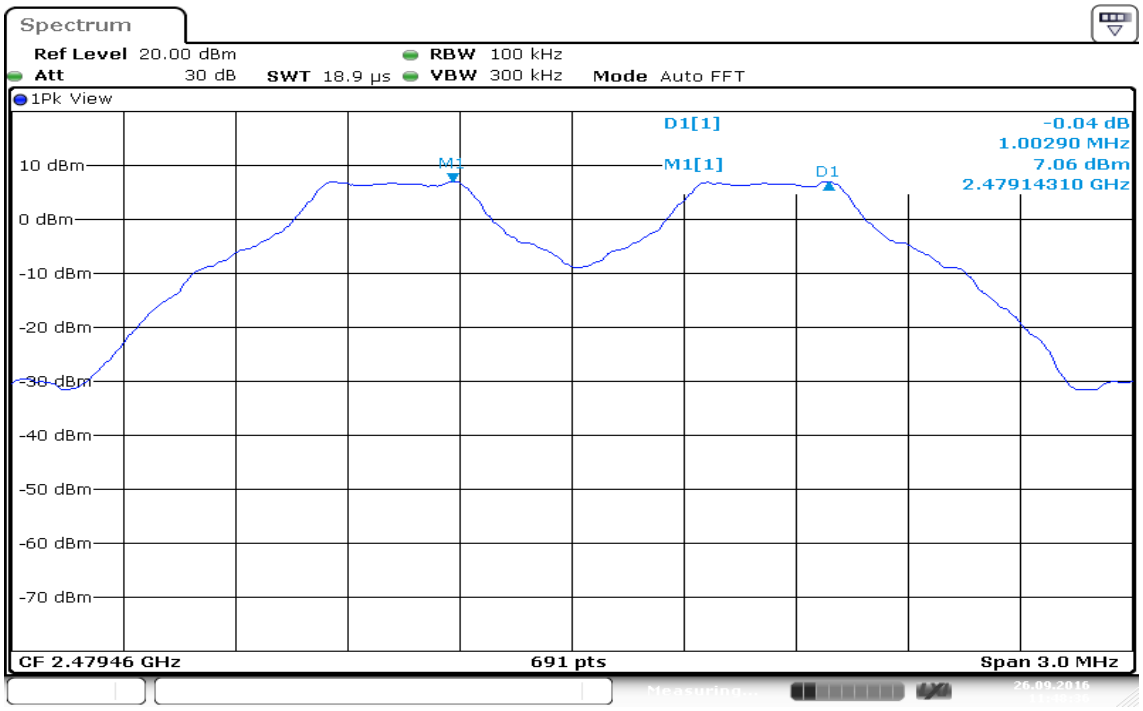
Date: 26.SEP.2016 11:43:37

Measurement of Channel Separation / (CH Mid)



Date: 26.SEP.2016 11:45:48

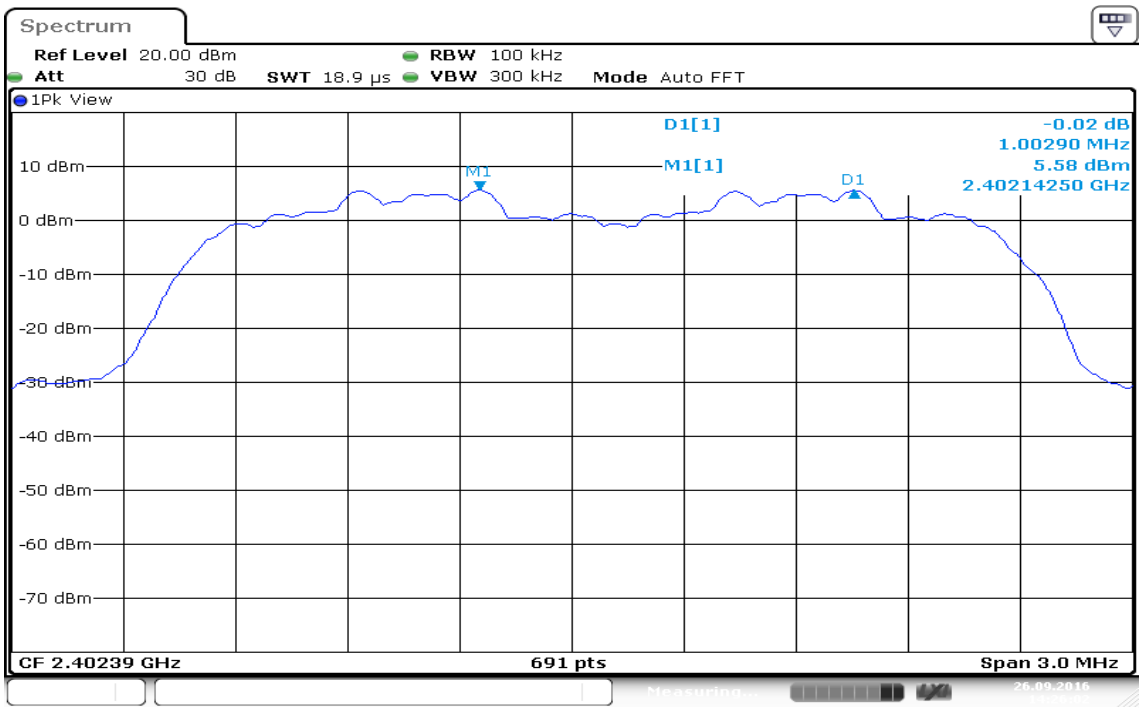
Measurement of Channel Separation / (CH High)



Date: 26.SEP.2016 11:48:36

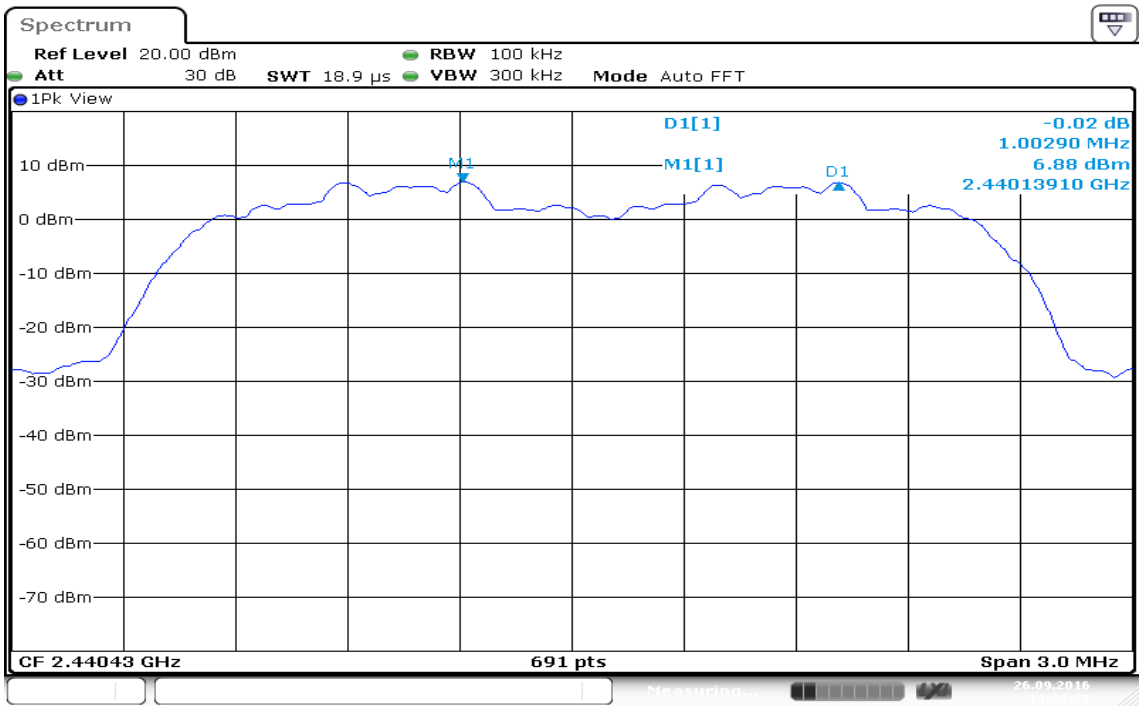
For 8DPSK / DH5

Measurement of Channel Separation / (CH Low)



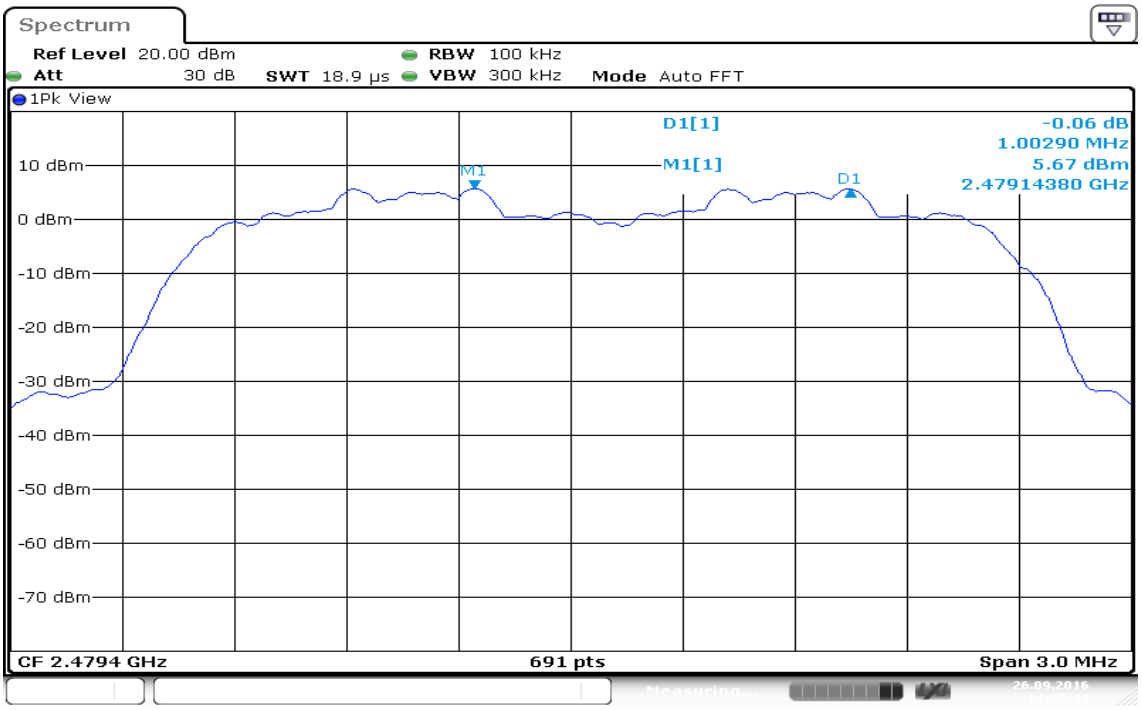
Date: 26.SEP.2016 14:26:02

Measurement of Channel Separation / (CH Mid)



Date: 26.SEP.2016 14:24:09

Measurement of Channel Separation / (CH High)



Date: 26.SEP.2016 14:20:41

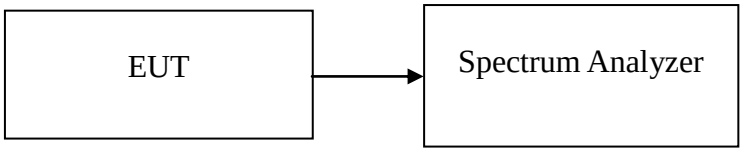
7.7 NUMBER OF HOPPING FREQUENCY

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. RBW < 30% or channel spacing or 20 dB bandwidth, whichever is smaller.
4. Set spectrum analyzer Start Freq. = 2400 MHz, Stop Freq. = 2483.5 MHz, 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	

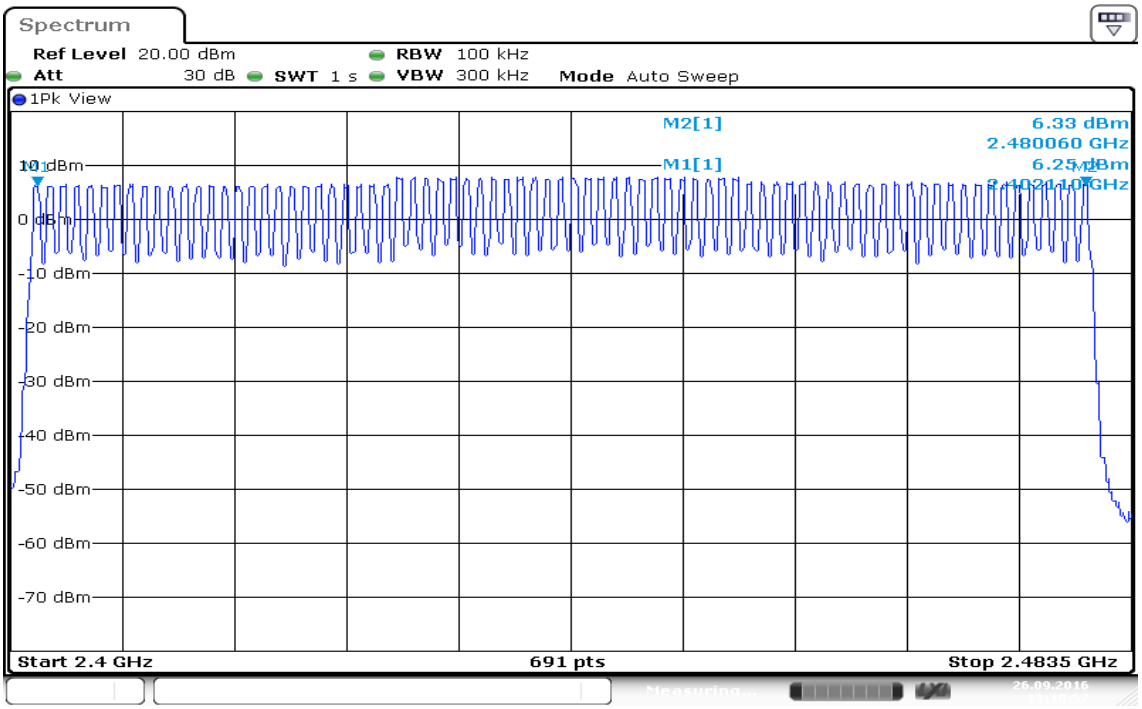
REMARK:

The frequency spectrum was broken up in to two sub-range to clearly show all of the hopping frequencies. In the AFH mode, this device operation was using 20 channels, so the requirement for minimum number of hopping channels is satisfied.

Test Plot

For GFSK

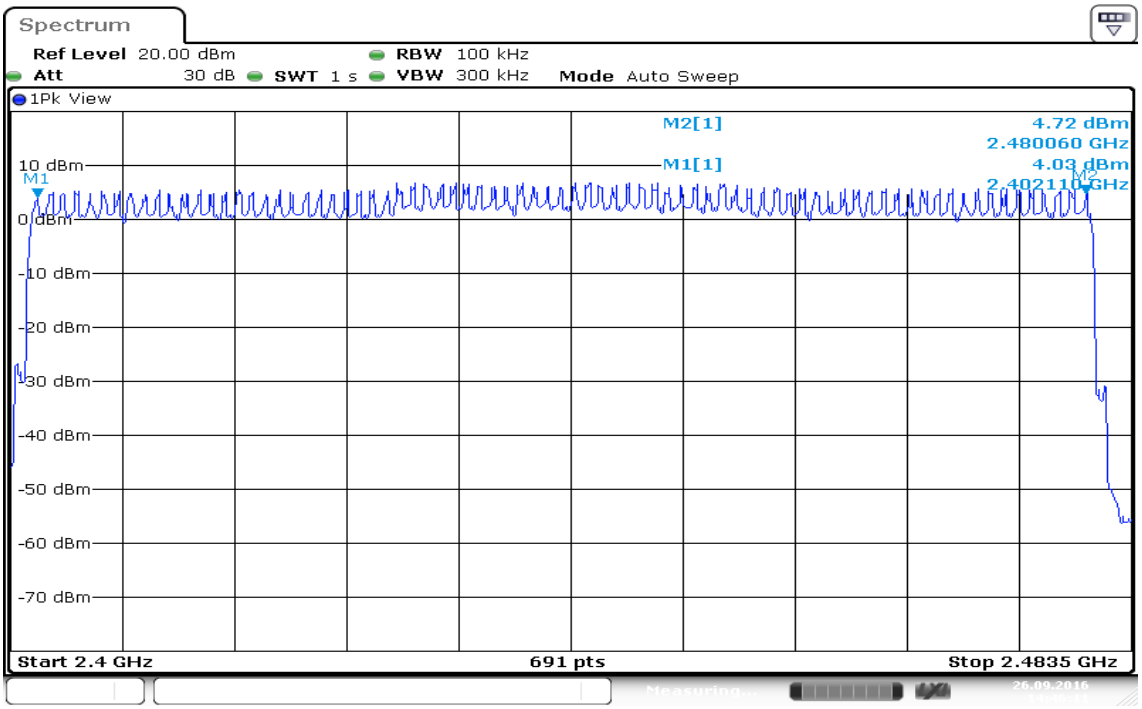
Channel Number



Date: 26.SEP.2016 13:10:57

For 8DPSK

Channel Number



Date: 26.SEP.2016 14:46:11

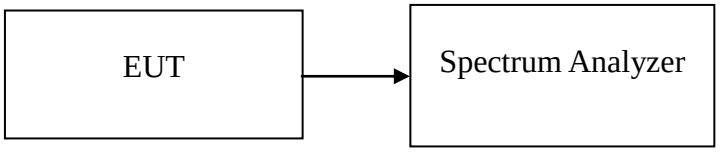
7.8 TIME OF OCCUPANCY (DWELL TIME)

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.

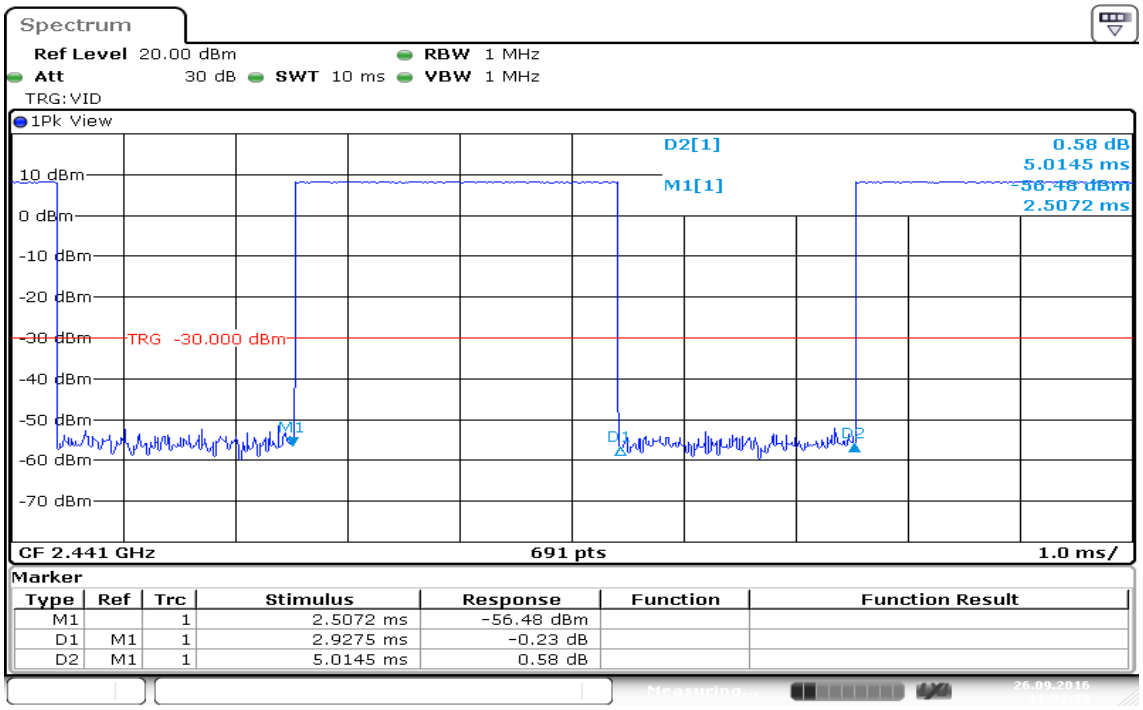
TEST RESULTS

No non-compliance noted

Test Data

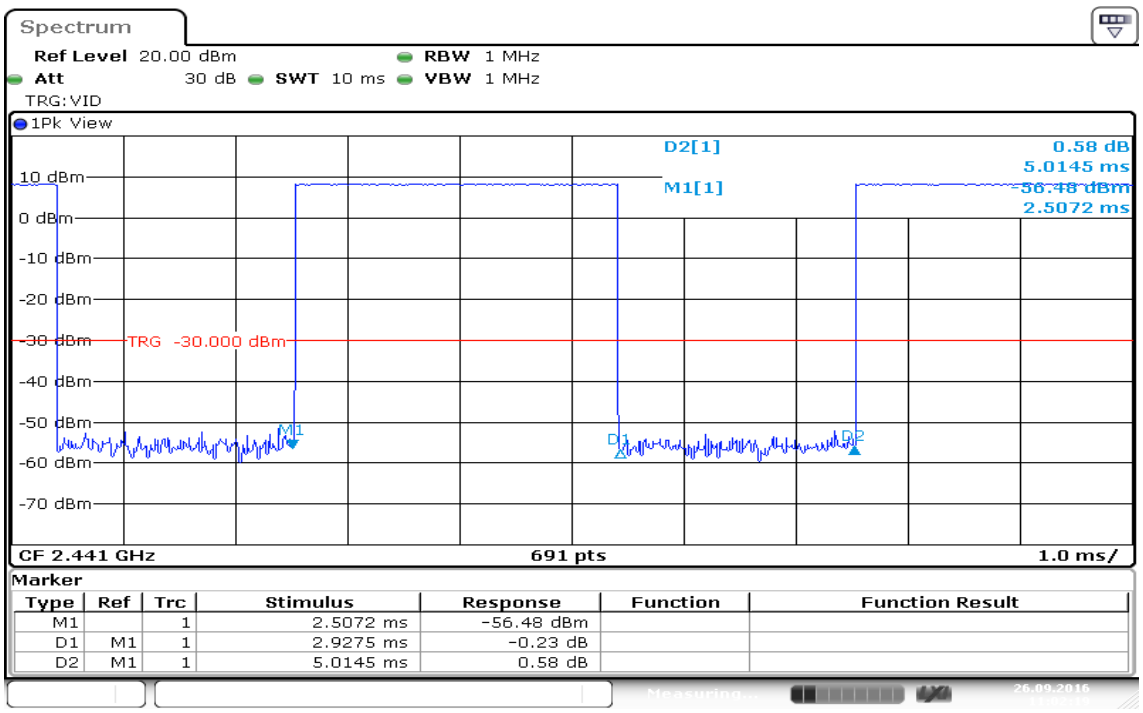
Time of Occupancy (Dwell Time)							
Mode	Frequency (MHz)	Pulse Time Per Hopping (ms)	Minimum Number of Hopping Freq.	Number of pulse in (0.4 * N sec)	Dwell Time IN (0.4 * N sec)	Dwell Time Limits (s)	Result
BR-1Mbps	2441	2.9275	79	106.67	0.3123	0.4	Pass
BR-3Mbps	2441	2.9275	79	106.67	0.3123	0.4	
AFH: DH5	2441	0.4058	20	53.33	0.0216	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							

BR-1Mbps



Date: 26.SEP.2016 11:02:19

EDR-3Mbps



Date: 26.SEP.2016 11:02:19

7.9 RADIATED EMISSIONS

LIMIT

All spurious emissions shall comply with the limits of §15.209(a) and RSS-Gen Table 2 & Table 4.

RSS-Gen Table 2 & Table 4: 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 6.5.
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).

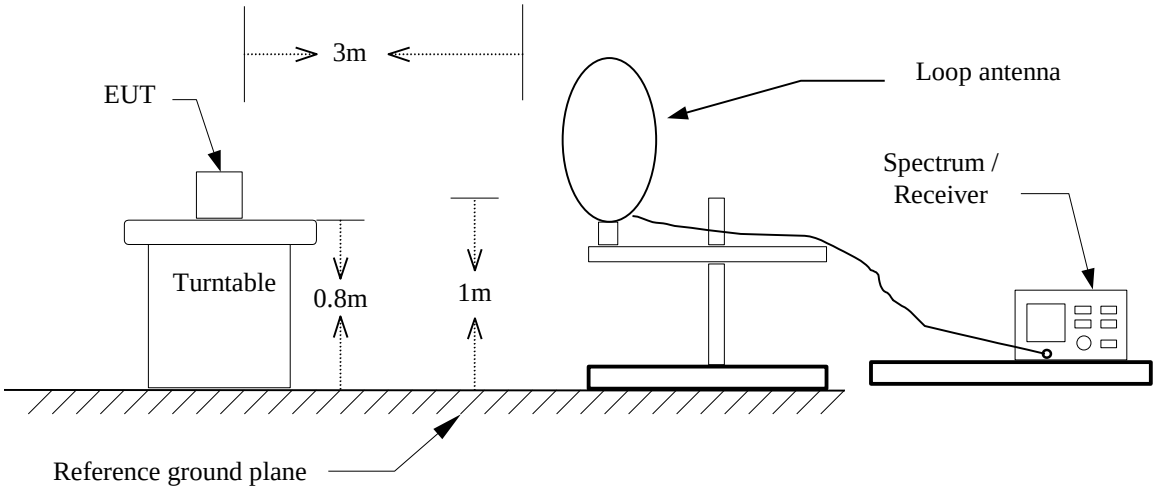
RSS-Gen Table 5: General Field Strength Limits for Transmitters at Frequencies Below 30 MHz (Transmit)

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

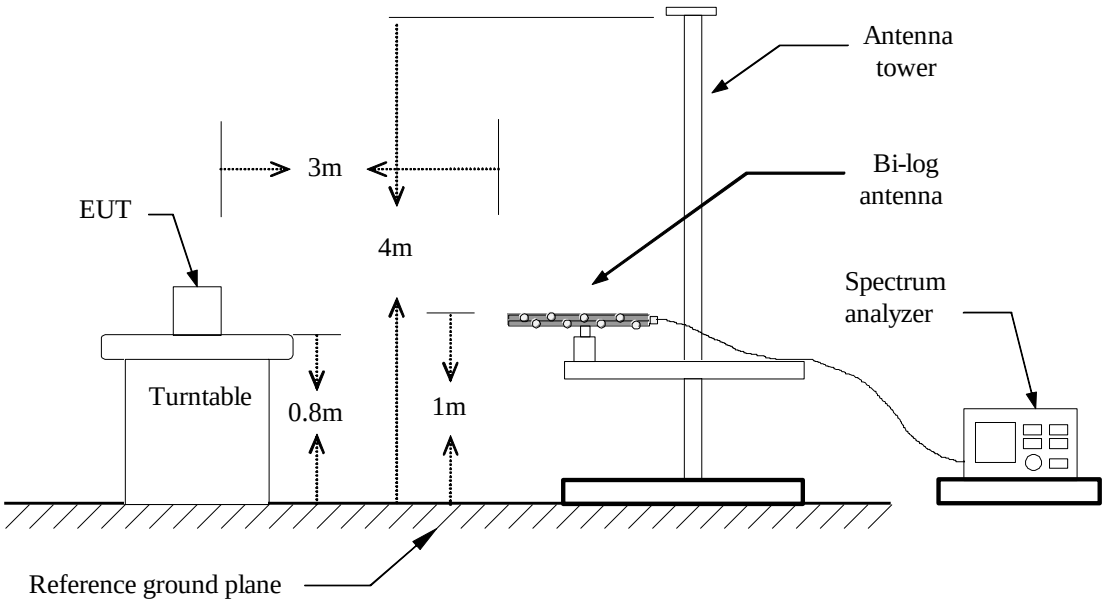
Note: The emission limits for the bands 9-90 kHz and 110-490 kHz are based on measurements
employing an average detector.

Test Configuration

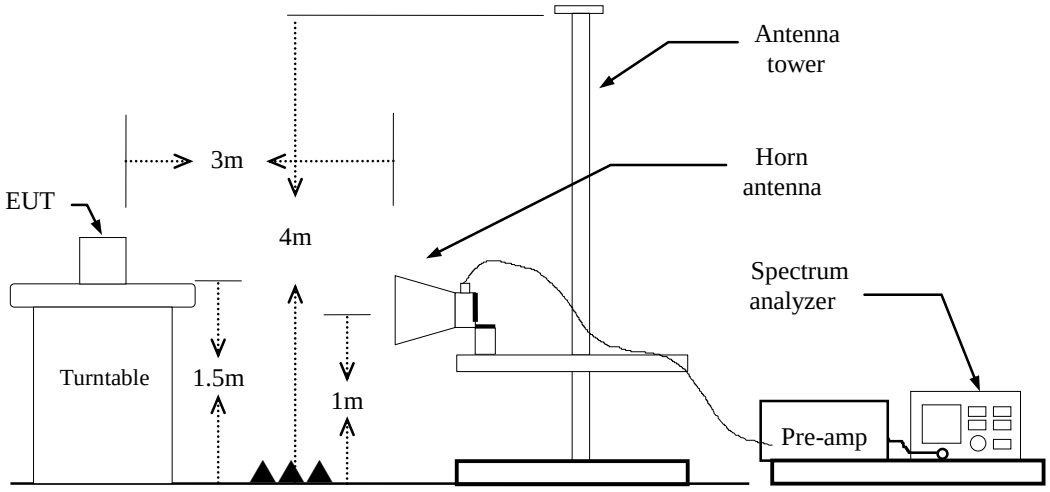
9kHz ~ 30MHz



30MHz ~ 1GHz



Above 1 GHz


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

   For PIFA Antenna
   BT: = 58%, VBW= 360Hz
   EDR = 58%, VBW= 360Hz

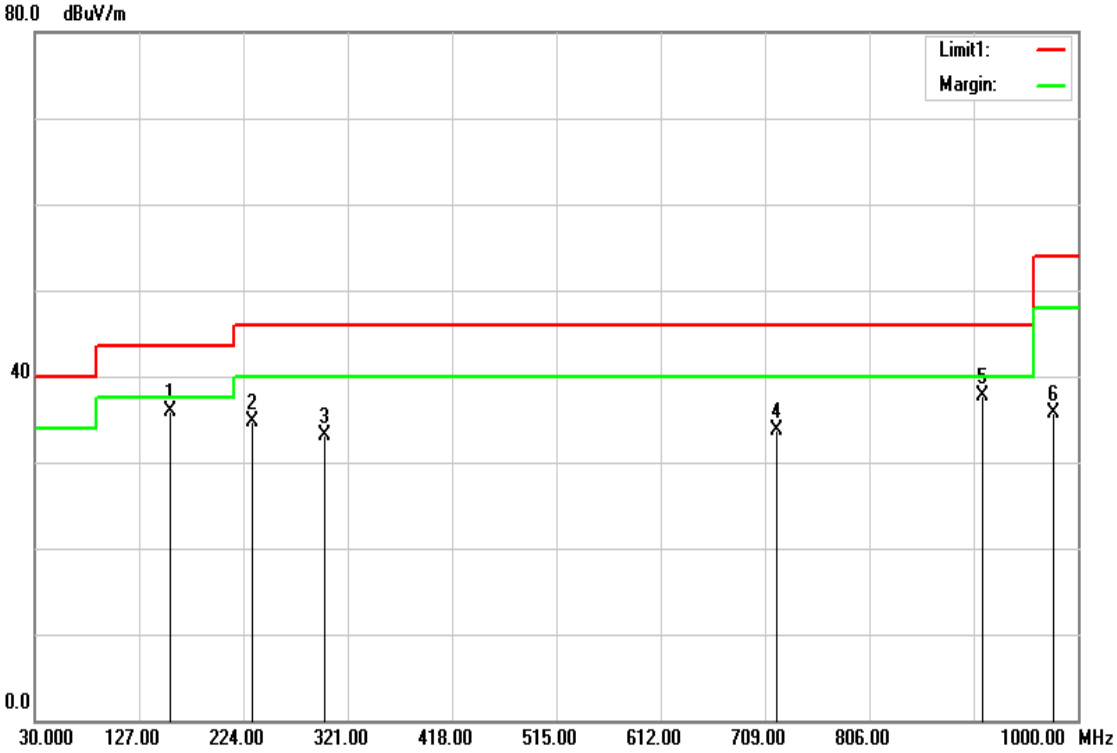
   For PCB Antenna
   BT: = 58%, VBW= 360Hz
   EDR = 58%, VBW= 360Hz

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. Transmitter Radiated Unwanted Emissions: For test mode BR and EDR were pretest. The worst case was BR-1Mbps in this test report.

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
For PIFA Antenna
Below 1GHz

Operation Mode:	Normal Link	**Test Date:**	October 13, 2016
Temperature:	27°C	**Tested by:**	Dennis Li
Humidity:	53% RH	**Polarity:**	Ver.

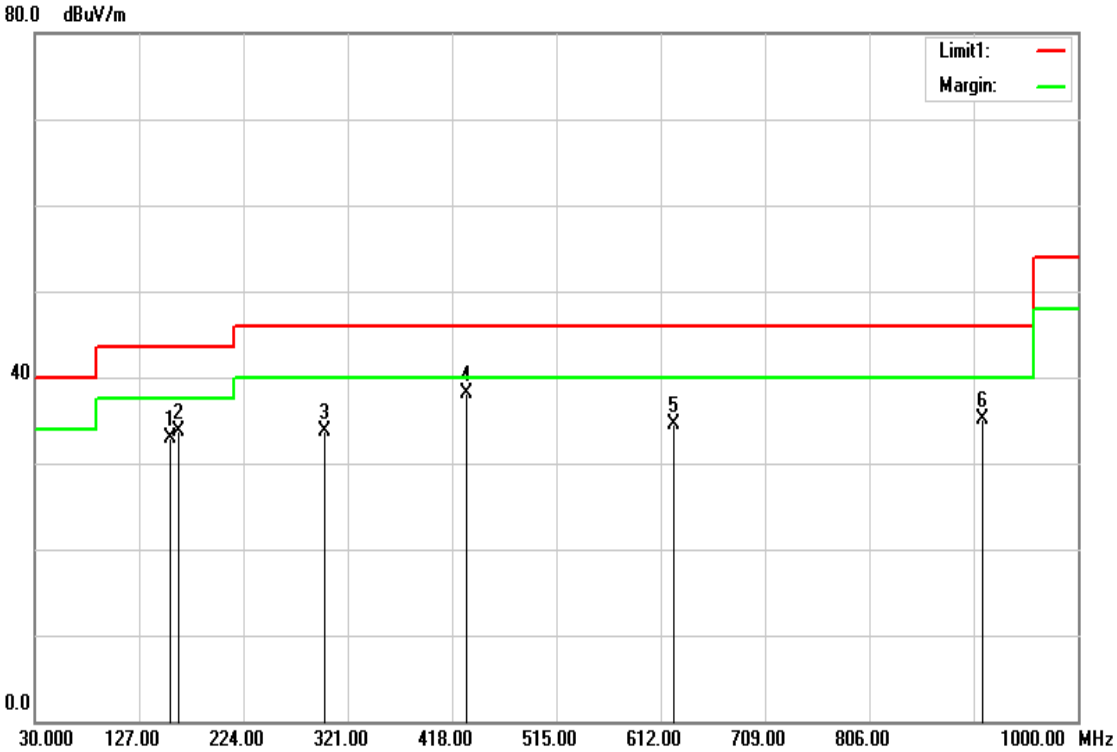


Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
156.1000	52.20	-16.25	35.95	43.50	-7.55	peak	V
232.7300	51.43	-16.67	34.76	46.00	-11.24	peak	V
299.6600	47.27	-14.25	33.02	46.00	-12.98	peak	V
719.6700	39.32	-5.62	33.70	46.00	-12.30	peak	V
911.7300	40.72	-3.00	37.72	46.00	-8.28	peak	V
977.6900	37.74	-1.95	35.79	54.00	-18.21	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:**	October 13, 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)
156.1000	49.17	-16.25	32.92	43.50	-10.58	QP	H
163.8600	50.26	-16.55	33.71	43.50	-9.79	QP	H
299.6600	47.86	-14.25	33.61	46.00	-12.39	QP	H
431.5800	48.81	-10.75	38.06	46.00	-7.94	peak	H
624.6100	41.60	-7.17	34.43	46.00	-11.57	peak	H
911.7300	38.15	-3.00	35.15	46.00	-10.85	peak	H

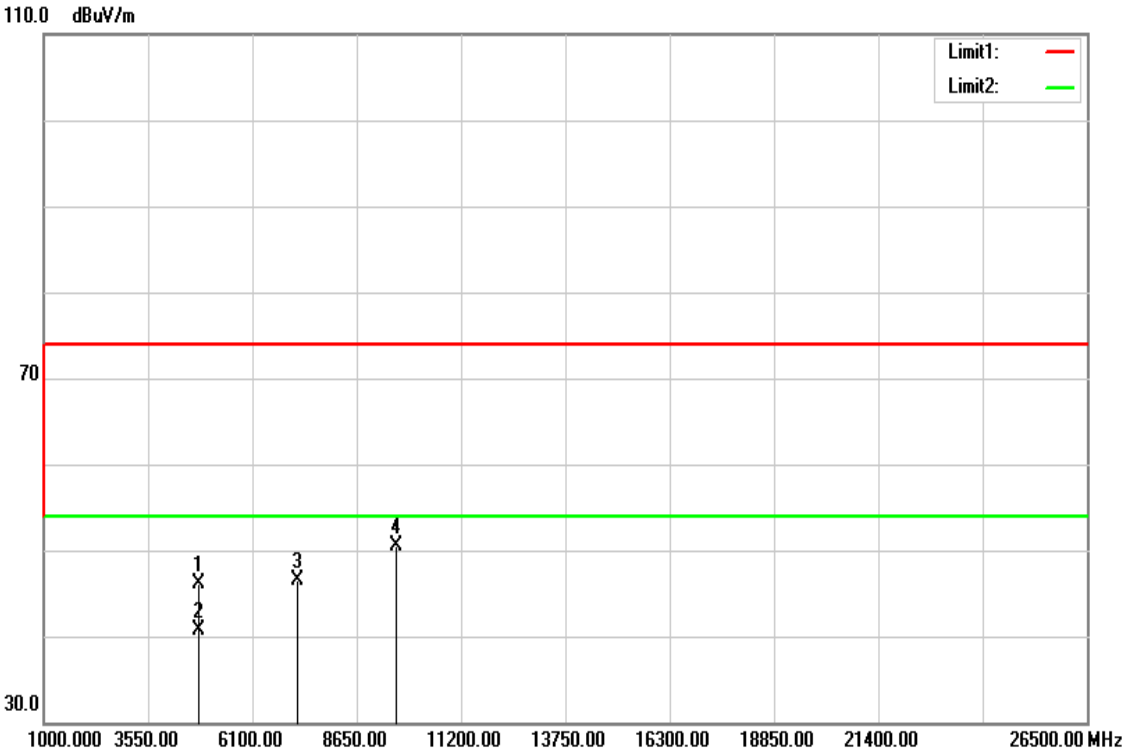
Remark:

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).*

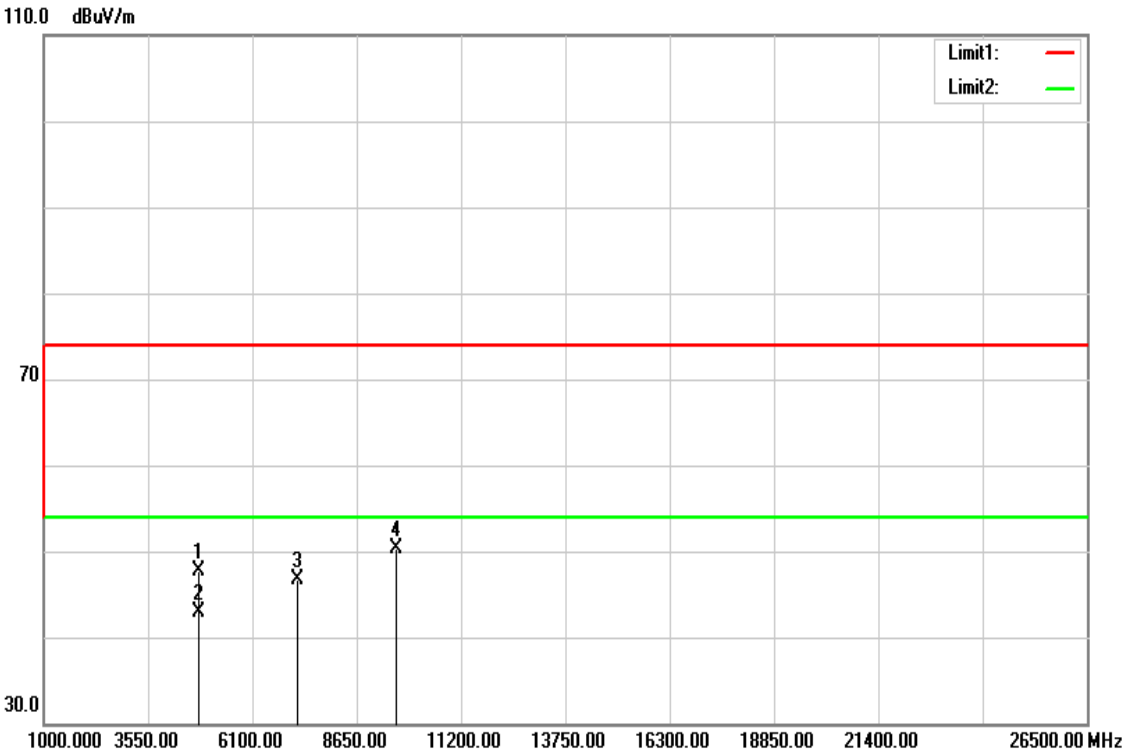
Above 1 GHz

TX /DH5 / CH Low

Polarity: Vertical



Polarity: Horizontal



Above 1 GHz

Operation Mode:	TX / DH5 / CH Low	**Test Date:**	October 13, 2016
Temperature:	27°C	**Tested by:**	Dennis Li
Humidity:	53 % RH	**Polarity:**	Ver. / Hor.

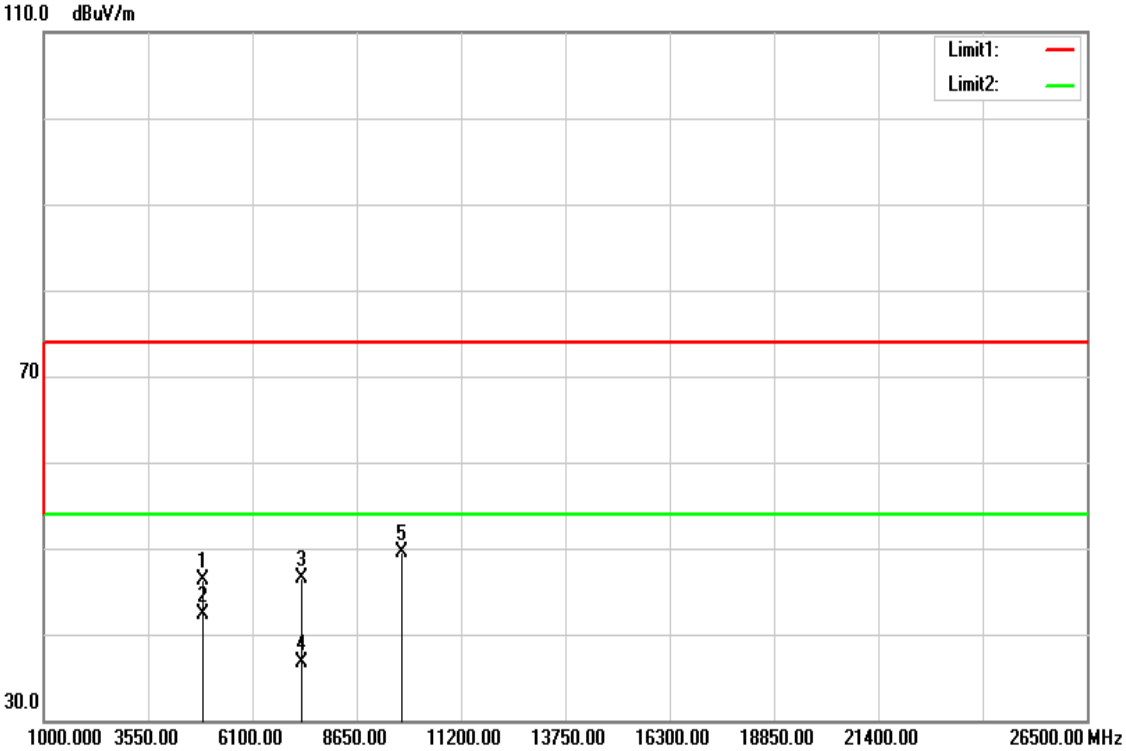
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
4804.000	41.09	5.04	46.13	74.00	-27.87	peak	V
4804.000	35.73	5.04	40.77	54.00	-13.23	AVG	V
7206.000	33.94	12.62	46.56	74.00	-27.44	peak	V
9608.000	32.97	17.60	50.57	74.00	-23.43	peak	V
N/A							
4804.000	42.62	5.04	47.66	74.00	-26.34	peak	H
4804.000	37.88	5.04	42.92	54.00	-11.08	AVG	H
7206.000	34.03	12.62	46.65	74.00	-27.35	peak	H
9608.000	32.78	17.60	50.38	74.00	-23.62	peak	H
N/A							

Remark:

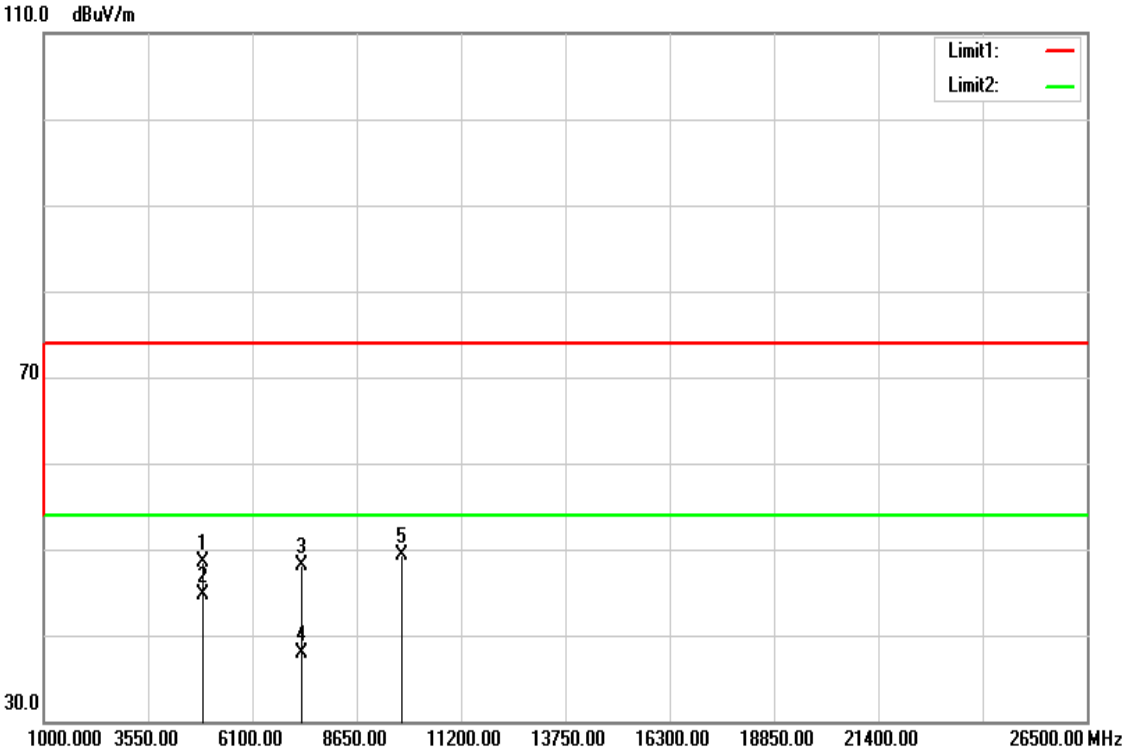
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average 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 / DH5 / CH Mid

Polarity: Vertical



Polarity: Horizontal



Operation Mode:	TX / DH5 / CH Mid	**Test Date:**	October 13, 2016
Temperature:	26°C	**Tested by:**	Dennis Li
Humidity:	50 % RH	**Polarity:**	Ver. / Hor.

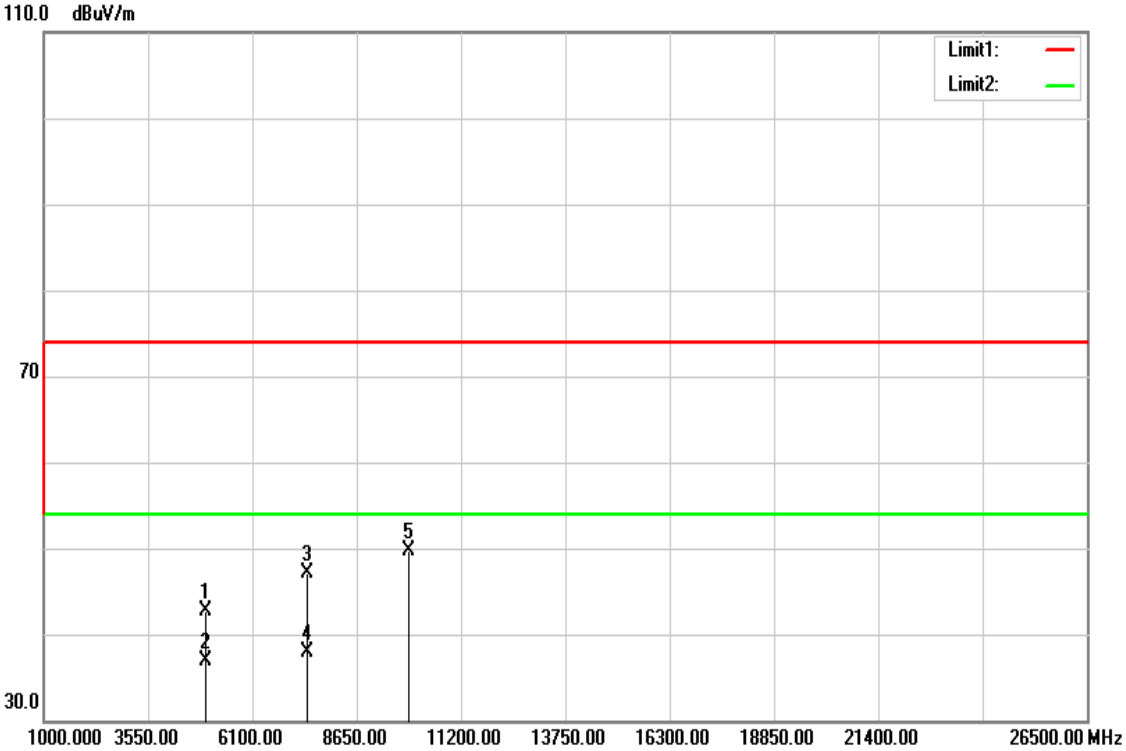
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
4880.000	41.12	5.25	46.37	74.00	-27.63	peak	V
4880.000	37.06	5.25	42.31	54.00	-11.69	AVG	V
7320.000	33.47	12.97	46.44	74.00	-27.56	peak	V
7320.000	23.82	12.97	36.79	54.00	-17.21	AVG	V
9760.000	31.97	17.60	49.57	74.00	-24.43	peak	V
N/A							
4880.000	43.25	5.25	48.50	74.00	-25.50	peak	H
4880.000	39.47	5.25	44.72	54.00	-9.28	AVG	H
7320.000	35.18	12.97	48.15	74.00	-25.85	peak	H
7320.000	24.94	12.97	37.91	54.00	-16.09	AVG	H
9760.000	31.73	17.60	49.33	74.00	-24.67	peak	H
N/A							

Remark:

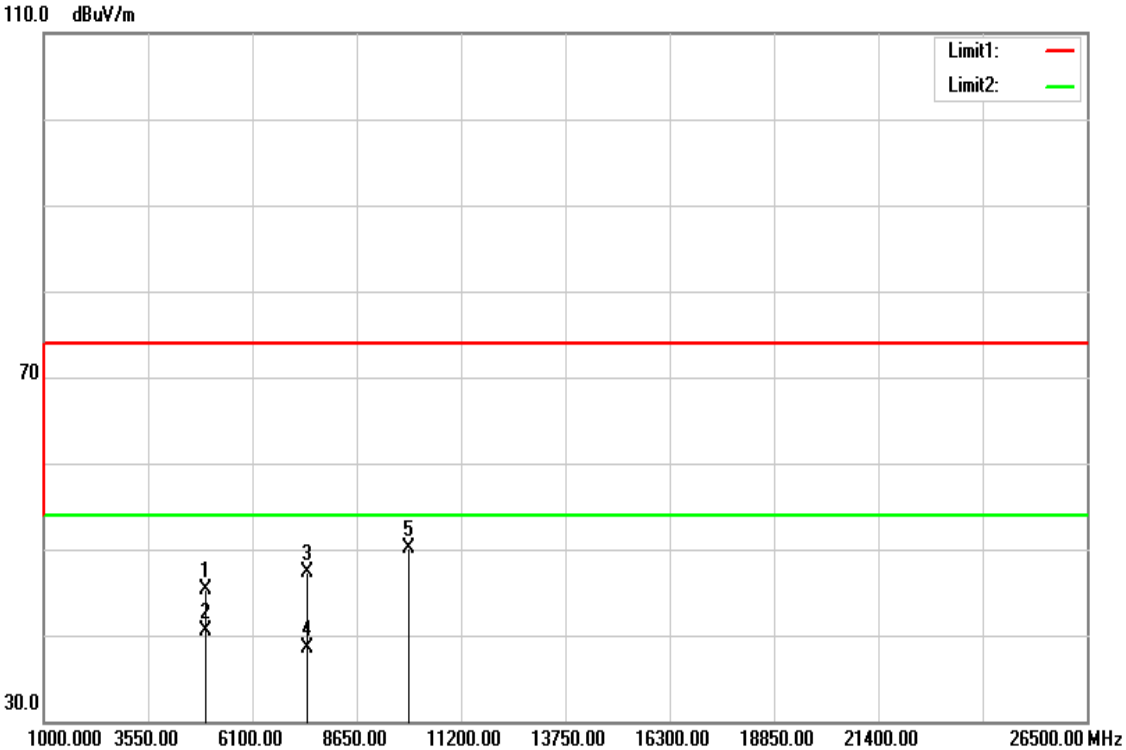
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average 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 / DH5 / CH High

Polarity: Vertical



Polarity: Horizontal



Operation Mode:	TX / DH5 / CH High	**Test Date:**	October 13, 2016
Temperature:	26°C	**Tested by:**	Dennis Li
Humidity:	50 % RH	**Polarity:**	Ver. / Hor.

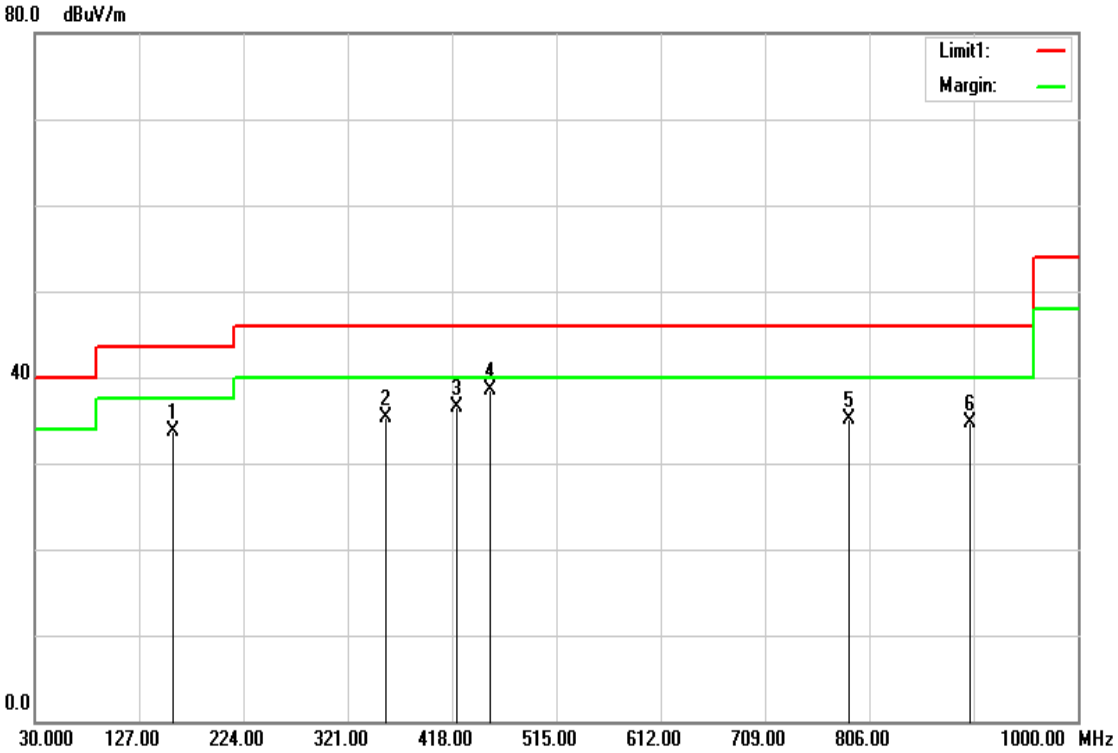
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
4960.000	37.17	5.46	42.63	74.00	-31.37	peak	V
4960.000	31.43	5.46	36.89	54.00	-17.11	AVG	V
7440.000	33.76	13.33	47.09	74.00	-26.91	peak	V
7440.000	24.66	13.33	37.99	54.00	-16.01	AVG	V
9920.000	32.10	17.60	49.70	74.00	-24.30	peak	V
N/A							
4960.000	39.91	5.46	45.37	74.00	-28.63	peak	H
4960.000	34.97	5.46	40.43	54.00	-13.57	AVG	H
7440.000	33.96	13.33	47.29	74.00	-26.71	peak	H
7440.000	25.22	13.33	38.55	54.00	-15.45	AVG	H
9920.000	32.43	17.60	50.03	74.00	-23.97	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).*

For Printed Antenna
Below 1GHz

Operation Mode:	Normal Link	**Test Date:**	September 13, 2016
Temperature:	27°C	**Tested by:**	Dennis Li
Humidity:	53% RH	**Polarity:**	Ver.

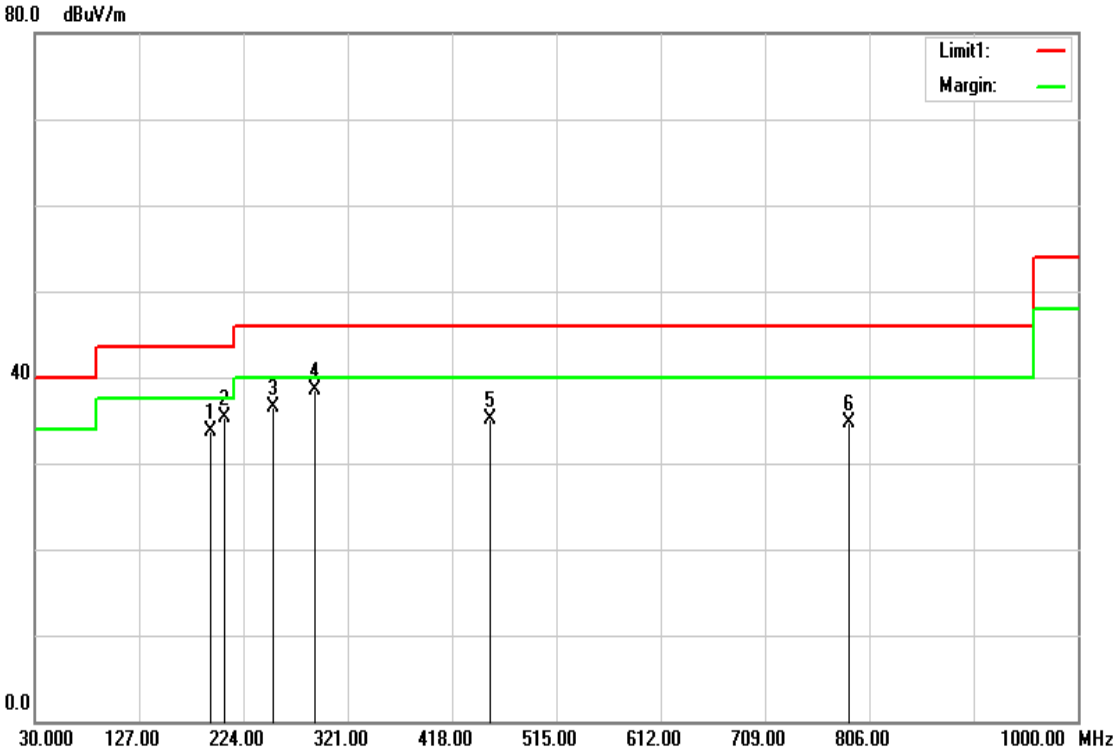


Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
158.0400	50.10	-16.30	33.80	43.50	-9.70	peak	V
355.9200	48.09	-12.75	35.34	46.00	-10.66	peak	V
421.8800	47.60	-11.04	36.56	46.00	-9.44	peak	V
452.9200	48.62	-10.13	38.49	46.00	-7.51	QP	V
786.6000	39.62	-4.61	35.01	46.00	-10.99	peak	V
900.0900	37.99	-3.19	34.80	46.00	-11.20	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:**	September 13, 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)
193.9300	49.89	-16.09	33.80	43.50	-9.70	QP	H
206.5400	51.35	-16.01	35.34	43.50	-8.16	QP	H
251.1600	52.75	-16.19	36.56	46.00	-9.44	peak	H
290.9300	52.90	-14.41	38.49	46.00	-7.51	peak	H
452.9200	45.14	-10.13	35.01	46.00	-10.99	peak	H
786.6000	39.41	-4.61	34.80	46.00	-11.20	peak	H

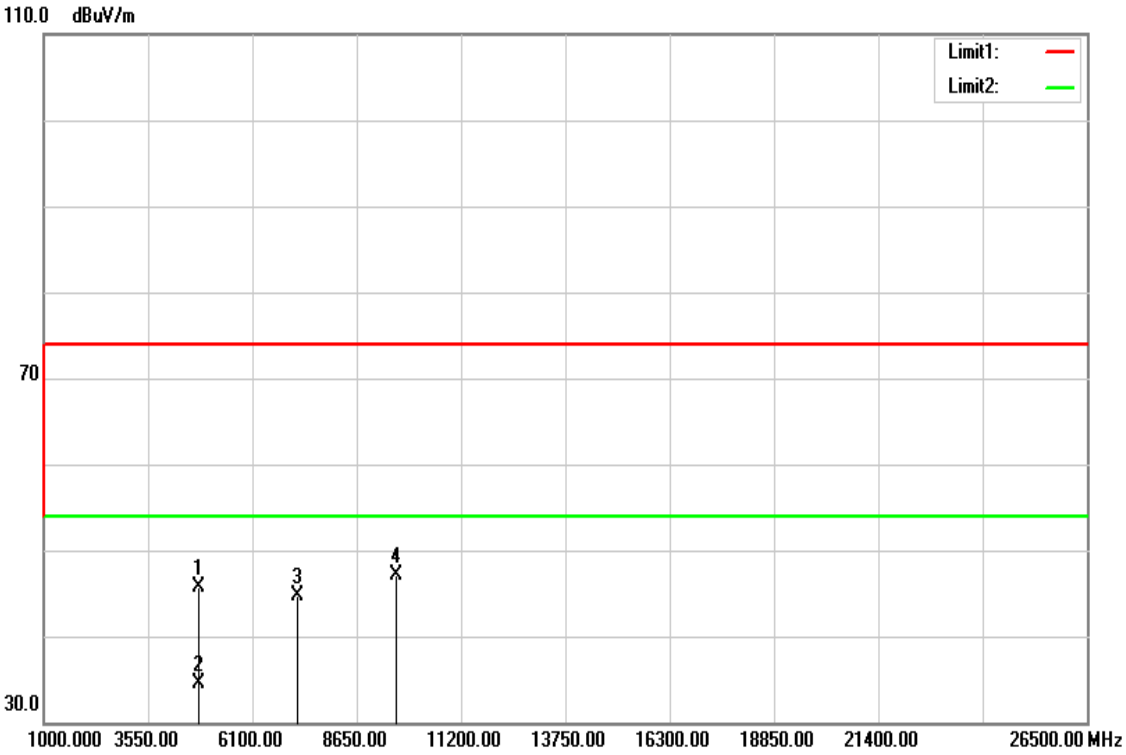
Remark:

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).*

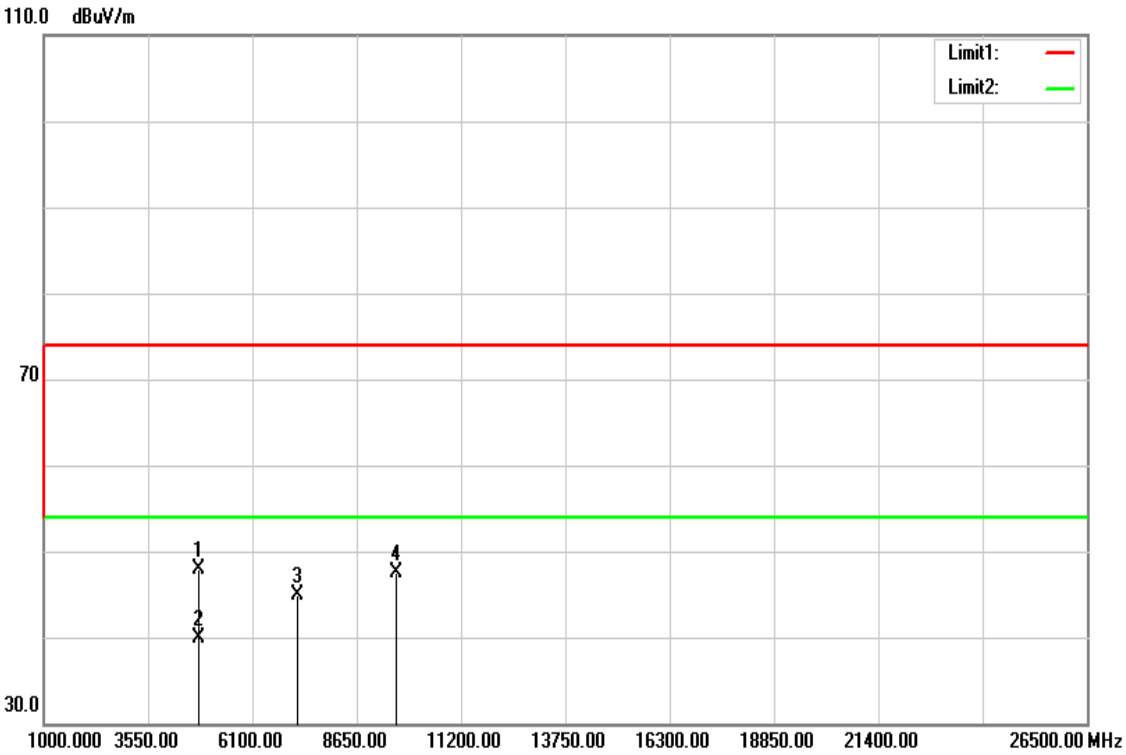
Above 1 GHz

TX /DH5 / CH Low

Polarity: Vertical



Polarity: Horizontal



Above 1 GHz

Operation Mode:	TX / DH5 / CH Low	**Test Date:**	September 7, 2016
Temperature:	27°C	**Tested by:**	Dennis Li
Humidity:	53 % RH	**Polarity:**	Ver. / Hor.

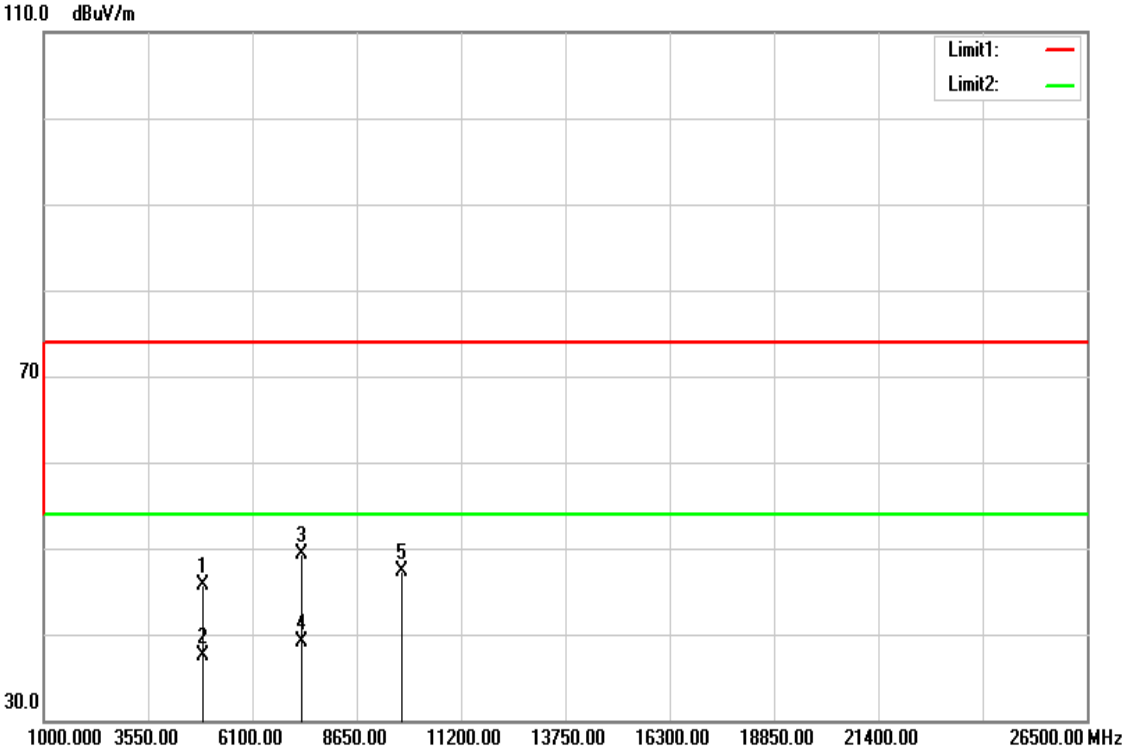
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
4804.000	41.52	4.14	45.66	74.00	-28.34	peak	V
4804.000	30.32	4.14	34.46	54.00	-19.54	AVG	V
7206.000	33.45	11.34	44.79	74.00	-29.21	peak	V
9608.000	31.74	15.29	47.03	74.00	-26.97	peak	V
N/A							
4804.000	43.80	4.14	47.94	74.00	-26.06	peak	H
4804.000	35.80	4.14	39.94	54.00	-14.06	AVG	H
7206.000	33.61	11.34	44.95	74.00	-29.05	peak	H
9608.000	32.27	15.29	47.56	74.00	-26.44	peak	H
N/A							

Remark:

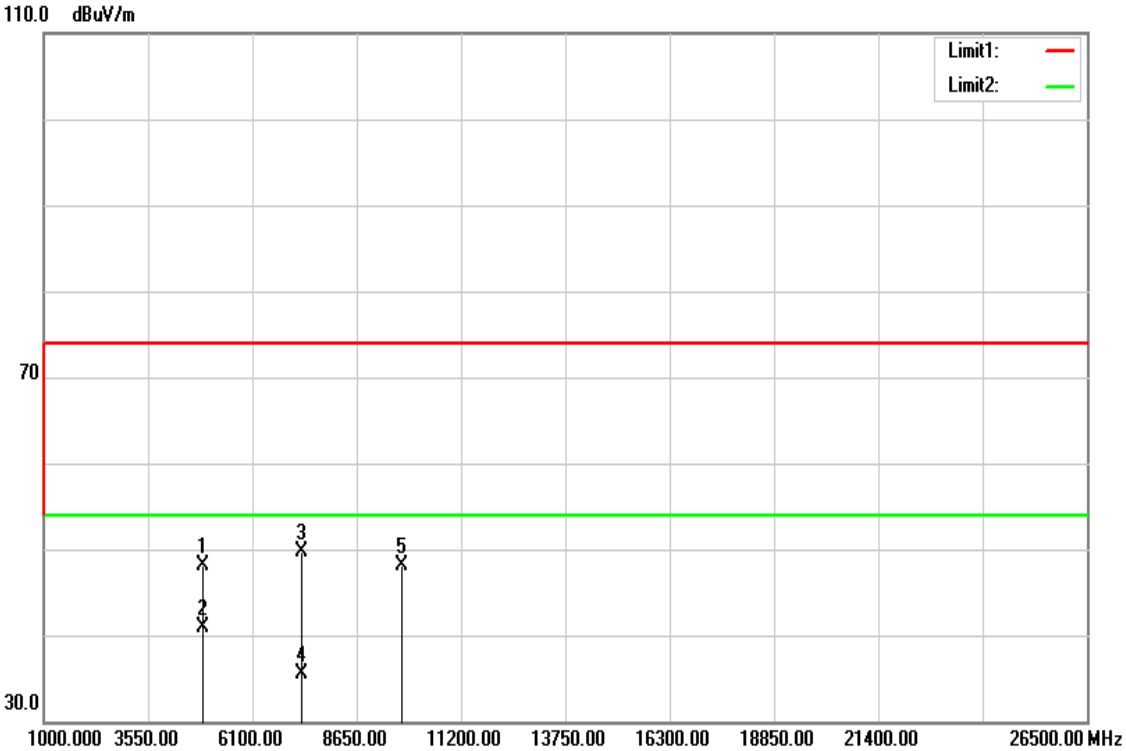
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average 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 / DH5 / CH Mid

Polarity: Vertical



Polarity: Horizontal



Operation Mode:	TX / DH5 / CH Mid	**Test Date:**	September 7, 2016
Temperature:	26°C	**Tested by:**	Dennis Li
Humidity:	50 % RH	**Polarity:**	Ver. / Hor.

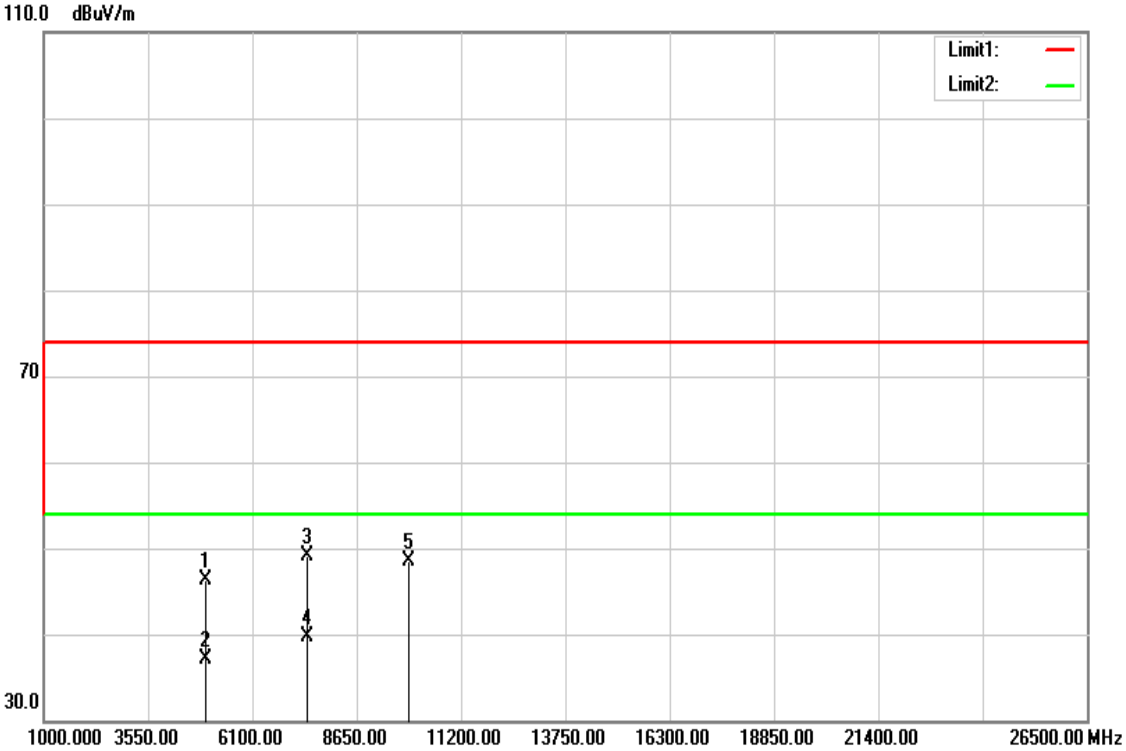
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
4883.000	41.38	4.34	45.72	74.00	-28.28	peak	V
4883.000	33.10	4.34	37.44	54.00	-16.56	AVG	V
7320.000	37.79	11.57	49.36	74.00	-24.64	peak	V
7320.000	27.55	11.57	39.12	54.00	-14.88	AVG	V
9760.000	31.75	15.50	47.25	74.00	-26.75	peak	V
N/A							
4880.000	43.86	4.33	48.19	74.00	-25.81	peak	H
4880.000	36.60	4.33	40.93	54.00	-13.07	AVG	H
7320.000	38.11	11.57	49.68	74.00	-24.32	peak	H
7320.000	23.89	11.57	35.46	54.00	-18.54	AVG	H
9760.000	32.55	15.50	48.05	74.00	-25.95	peak	H
N/A							

Remark:

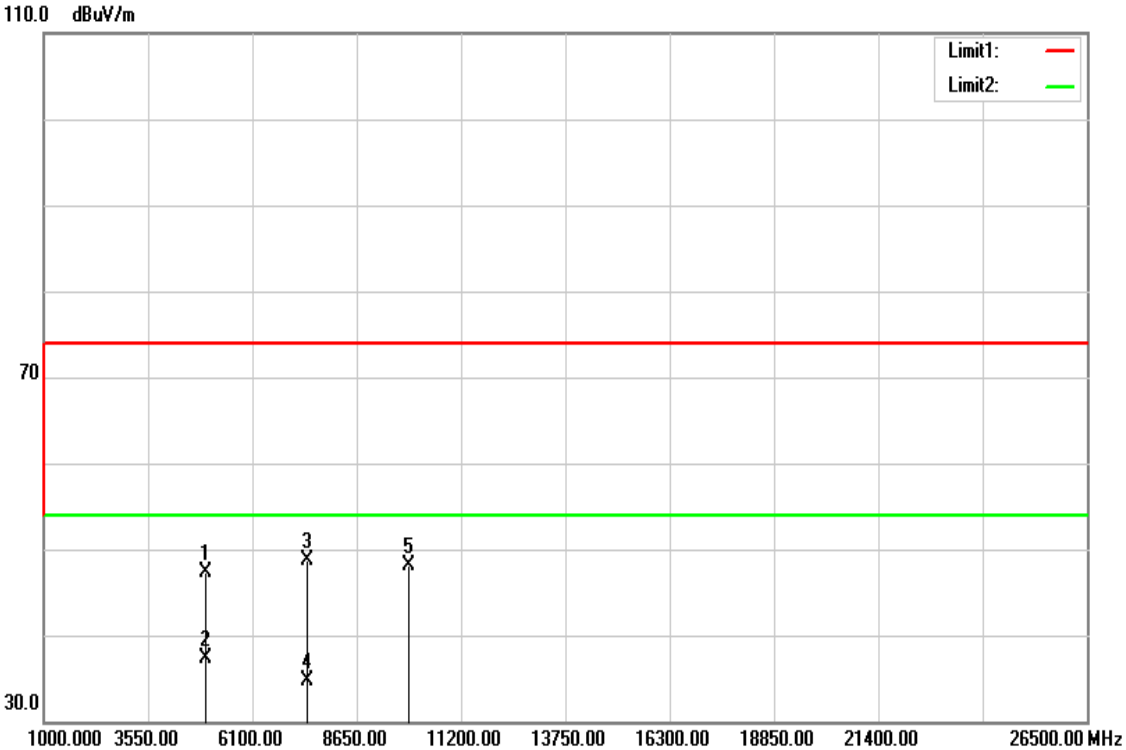
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average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

TX / DH5 / CH High

Polarity: Vertical



Polarity: Horizontal



Operation Mode:	TX / DH5 / CH High	**Test Date:**	September 7, 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	41.83	4.55	46.38	74.00	-27.62	peak	V
4960.000	32.50	4.55	37.05	54.00	-16.95	AVG	V
7440.000	37.34	11.81	49.15	74.00	-24.85	peak	V
7440.000	27.81	11.81	39.62	54.00	-14.38	AVG	V
9920.000	32.86	15.73	48.59	74.00	-25.41	peak	V
N/A							
4960.000	42.73	4.55	47.28	74.00	-26.72	peak	H
4960.000	32.75	4.55	37.30	54.00	-16.70	AVG	H
7440.000	36.87	11.81	48.68	74.00	-25.32	peak	H
7440.000	22.84	11.81	34.65	54.00	-19.35	AVG	H
9920.000	32.39	15.73	48.12	74.00	-25.88	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).*

7.10 POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §15.207(a) & RSS-Gen §8.8, 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

Test Data

Operation Mode:	Normal Link	**Test Date:**	September 26, 2016
Temperature:	24°C	**Tested by:**	Zeus Chen
Humidity:	56% RH		

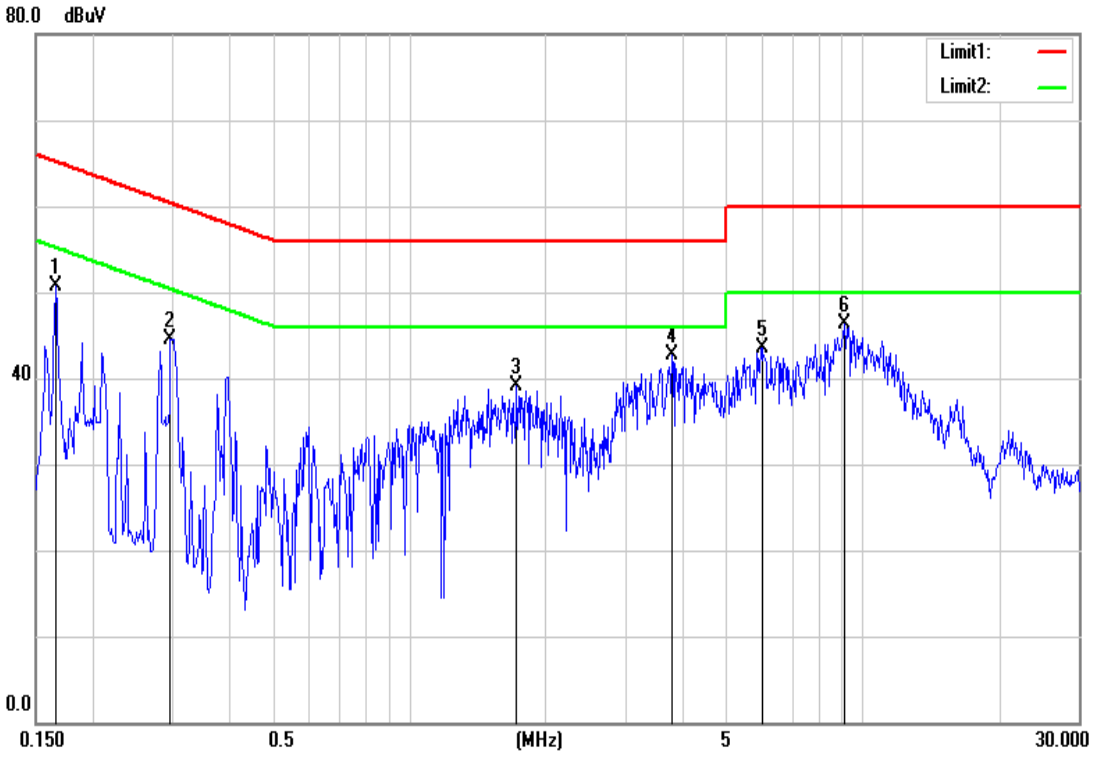
Freq. (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Corr. factor (dB/m)	QP Result (dBuV/m)	AV Result (dBuV/m)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.1660	41.08	39.51	9.69	50.77	49.20	65.15	55.16	-14.38	-5.96	L1
0.2980	34.85	32.58	9.68	44.53	42.26	60.30	50.30	-15.77	-8.04	L1
1.7340	29.09	27.55	9.96	39.05	37.51	56.00	46.00	-16.95	-8.49	L1
3.8140	32.88	30.28	9.82	42.70	40.10	56.00	46.00	-13.30	-5.90	L1
6.0140	33.71	30.78	9.86	43.57	40.64	60.00	50.00	-16.43	-9.36	L1
9.1340	36.41	34.53	9.92	46.33	44.45	60.00	50.00	-13.67	-5.55	L1
0.1700	40.98	38.48	9.64	50.62	48.12	64.96	54.96	-14.34	-6.84	L2
0.1900	39.24	37.88	9.64	48.88	47.52	64.03	54.04	-15.15	-6.48	L2
0.2980	36.91	34.87	9.64	46.55	44.51	60.30	50.30	-13.75	-5.79	L2
1.7780	29.02	27.44	9.89	38.91	37.33	56.00	46.00	-17.09	-8.67	L2
8.9020	35.95	33.74	9.89	45.84	43.63	60.00	50.00	-14.16	-6.37	L2
9.6500	35.69	33.94	9.91	45.60	43.85	60.00	50.00	-14.40	-6.15	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)