

**INDUSTRY CANADA RSS-247****TEST REPORT****For****7"Touchscreen Controller****Model: Galaxy****Trade Name: Zytronix***Issued to***Zytronix Inc. Taiwan Branch****6F-1., No.496, Bannan Rd., Jhonghe Dist, New Taipei City, Taiwan, R.O.C. 23556***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](mailto:service@ccsrf.com)****Issued Date: November 17, 2015**

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**Revision History**

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	November 17, 2015	Initial Issue	ALL	Kelly Cheng

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## 1. TEST RESULT CERTIFICATION

**Applicant:** Zykronix Inc. Taiwan Branch  
6F-1., No.496, Bannan Rd., Jhonghe Dist, New Taipei City,  
Taiwan, R.O.C. 23556

**Manufacturer:** Zykronix Inc. Taiwan Branch  
6F-1., No.496, Bannan Rd., Jhonghe Dist, New Taipei City,  
Taiwan, R.O.C. 23556

**Equipment Under Test:** 7"Touchscreen Controller

**Trade Name:** Zykronix

**Model:** Galaxy

**Date of Test:** October 15 ~ November 12, 2015

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
Industry Canada RSS-247 Issue 1	
Industry Canada RSS-GEN Issue 4	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.

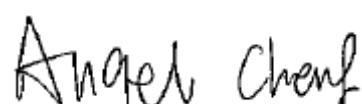
Approved by:



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Miller Lee  
Manager  
Compliance Certification Services Inc.

Reviewed by:



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Angel Cheng  
Section Manager  
Compliance Certification Services Inc.

## 2. EUT DESCRIPTION

<b>Product</b>	7"Touchscreen Controller
<b>Trade Name</b>	Zykronix
<b>Model Number</b>	Galaxy
<b>Model Discrepancy</b>	N/A
<b>Received Date</b>	October 19, 2015
<b>Power Supply</b>	VDC from Power Adapter LIEN ELECTRONICS, INC. / LE-0309BDSP12V I/P: 100-240Vac, 50-60Hz, 1.4A O/P: 12Vdc, 3.5A, Max.42W
<b>Frequency Range</b>	2402 ~ 2480 MHz
<b>Transmit Power</b>	3.15 dBm
<b>Modulation Technique</b>	GFSK for 1Mbps; $\pi/4$ -DQPSK for 2Mbps; 8DPSK for 3Mbps
<b>Number of Channels</b>	79 Channels
<b>Antenna Specification</b>	Gain: 3.93dBi
<b>Antenna Designation</b>	PIFA Antenna

**Remark:**

- 1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.*

### **3. TEST METHODOLOGY**

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

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

#### **3.1 EUT CONFIGURATION**

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

#### **3.2 EUT EXERCISE**

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

The tests documented in this report were performed in accordance with IC RSS-247, IC RSS-Gen, IC RSS-102, and ANSI C63.10: 2013.

#### **3.3 GENERAL TEST PROCEDURES**

##### **Conducted Emissions**

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in ANSI C63.10: 2013 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.

### 3.4 DESCRIPTION OF TEST MODES

The EUT (model: Galaxy) 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,  $\pi/4$ -QPSK & 8DPSK with DH1 were pre-tested and found that 8DPSK emits the highest output power. Then the tests were carried on with DH1 compare to DH3 & DH5 and found that 8DPSK with DH5 emit the highest output power, and therefore had been tested under operating condition.

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

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

#### For Radiated Emissions

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

#### For Conducted Emissions & Powerline conducted emissions

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

## 4. INSTRUMENT CALIBRATION

### 4.1 MEASURING INSTRUMENT CALIBRATION

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

### 4.2 MEASUREMENT EQUIPMENT USED

#### Equipment Used for Emissions Measurement

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

Conducted Emissions Test Site				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US42510252	11/23/2015
Thermostatic/Humidity Chamber	TAICHY	MHG-150LF	930619	10/07/2016
AC Power Source	EXTECH	6205	1140845	N.C.R
DC Power Supply	ABM	8301HD	D011531	N.C.R
Power Meter	Anritsu	ML2495A	1012009	07/07/2016
Power Sensor	Anritsu	MA2411A	0917072	07/07/2016
Spectrum Analyzer	ROHDE&SCHWARZ	FSV40	101073	07/19/2016

Wugu 966 Chamber A				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US42510268	01/25/2016
EMI Test Receiver	R&S	ESCI	100064	06/03/2016
Bilog Antenna	Sunol Sciences	JB3	A030105	08/05/2016
Horn Antenna	EMCO	3117	00055165	01/26/2016
Horn Antenna	EMCO	3116	26370	12/25/2015
Turn Table	CCS	CC-T-1F	N/A	N.C.R
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R
Pre-Amplifier	MITEQ	1652-3000	1490939	08/09/2016
Pre-Amplifier	EMC	EMC 01265	4035	06/04/2016
Pre-Amplifier	MITEQ	AMF-6F-260400-40-8P	985646	12/25/2015
Coaxial Cable	Huber+Suhner	102	29212/2	12/25/2015
Coaxial Cable	Huber+Suhner	102	29406/2	12/25/2015
Test S/W	EZ-EMC (CCS-3A1RE)			

Conducted Emission Room #B				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESCI	101073	09/08/2016
LISN	R&S	ENV216	101054	06/06/2016
LISN	SCHWARZBECK	NSLK 8127	8127-541	11/25/2015
Capacitive Voltage Probe	FCC	F-CVP-1	100185	03/12/2016
Test S/W	CCS-3A1-CE			

## 4.3 MEASUREMENT UNCERTAINTY

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

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

## 5. FACILITIES AND ACCREDITATIONS

### 5.1 FACILITIES

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

- No.199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.  
Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029
- No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.)  
Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045
- No.81-1, Lane 210, Bade 2nd Rd., Lujhu Township, Taoyuan County 33841, TAIWAN, R.O.C.  
Tel: 886-3-324-0332 / Fax: 886-3-324-5235

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10: 2013 for IC, ANSI C63.10: 2009 for FCC and CISPR Publication 22.

### 5.2 EQUIPMENT

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

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

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

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

## 5.3 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3M Semi Anechoic Chamber (FCC MRA: TW1039) to perform FCC Part 15 measurements	 FCC MRA: TW1039
Taiwan	TAF	LP0002, RTTE01, FCC Method-47 CFR Part 15 Subpart C, D, E, RSS-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	 Testing Laboratory 1309
Canada	Industry Canada	3M Semi Anechoic Chamber (IC 2324G-1 / IC 2324G-2) to perform	 IC 2324G-1 IC 2324G-2

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

## 6. SETUP OF EQUIPMENT UNDER TEST

### 6.1 SETUP CONFIGURATION OF EUT

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

### 6.2 SUPPORT EQUIPMENT

No.	Device Type	Brand	Model	Rating
1	Adapter	LIEN ELECTRONICS, INC.	LE-0309BDSP12V	I/P: 100-240Vac, 50-60Hz, 1.4A O/P: 12Vdc, 3.5A, Max.42W

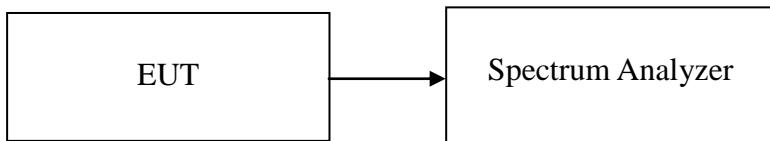
**Remark:**

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. RSS 247 REQUIREMENTS

### 7.1 99% BANDWIDTH

#### Test Configuration



#### TEST PROCEDURE

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

#### TEST RESULTS

*No non-compliance noted.*

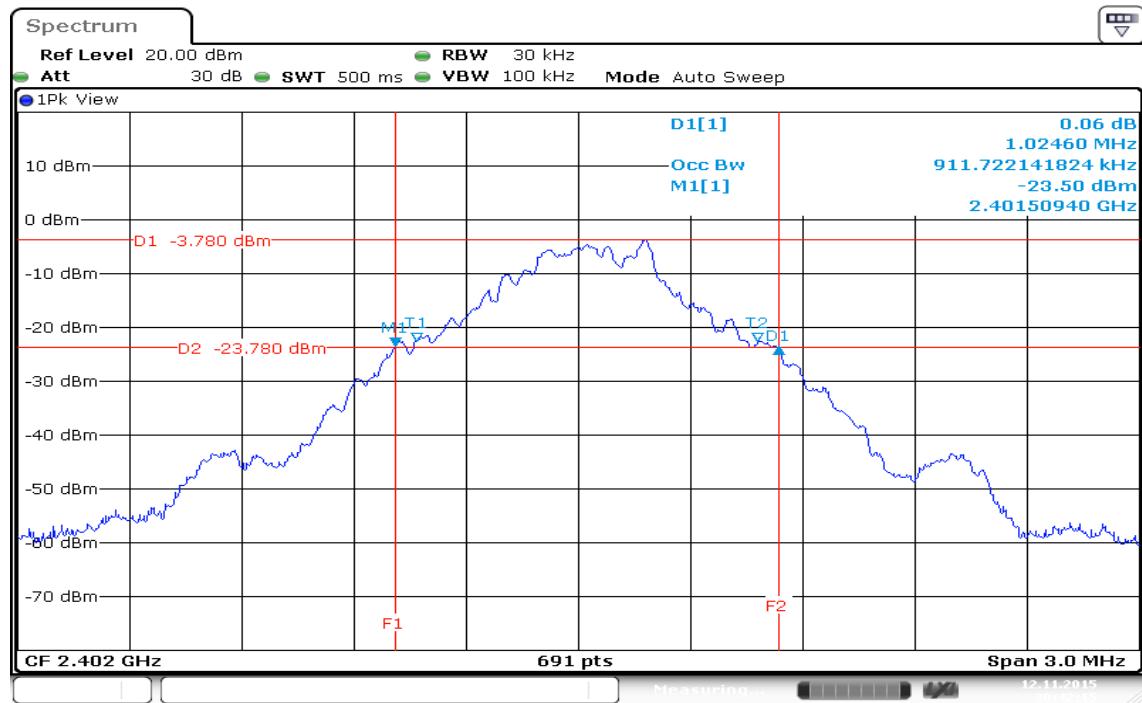
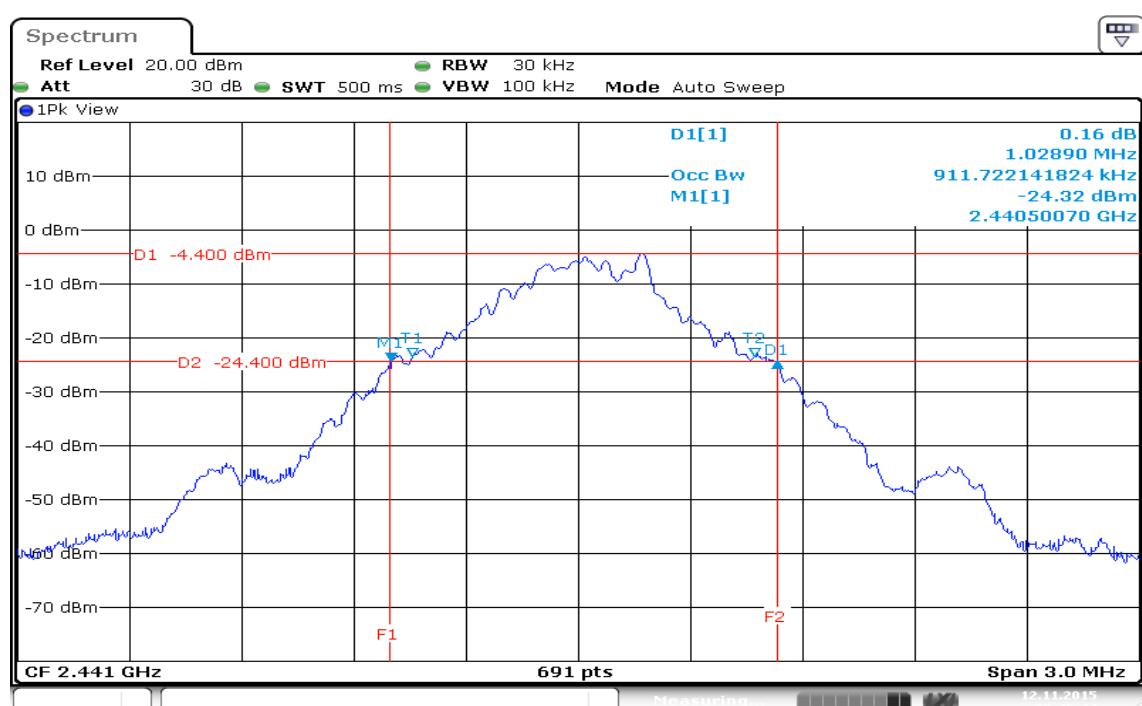
#### Test Data

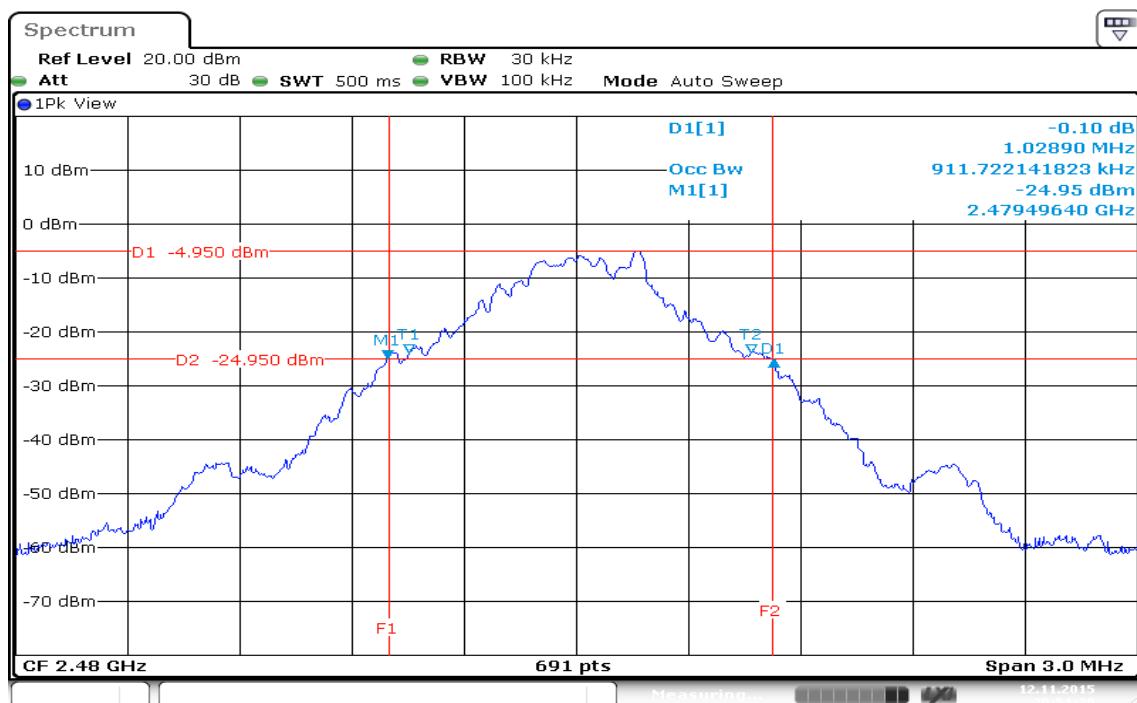
##### For GFSK

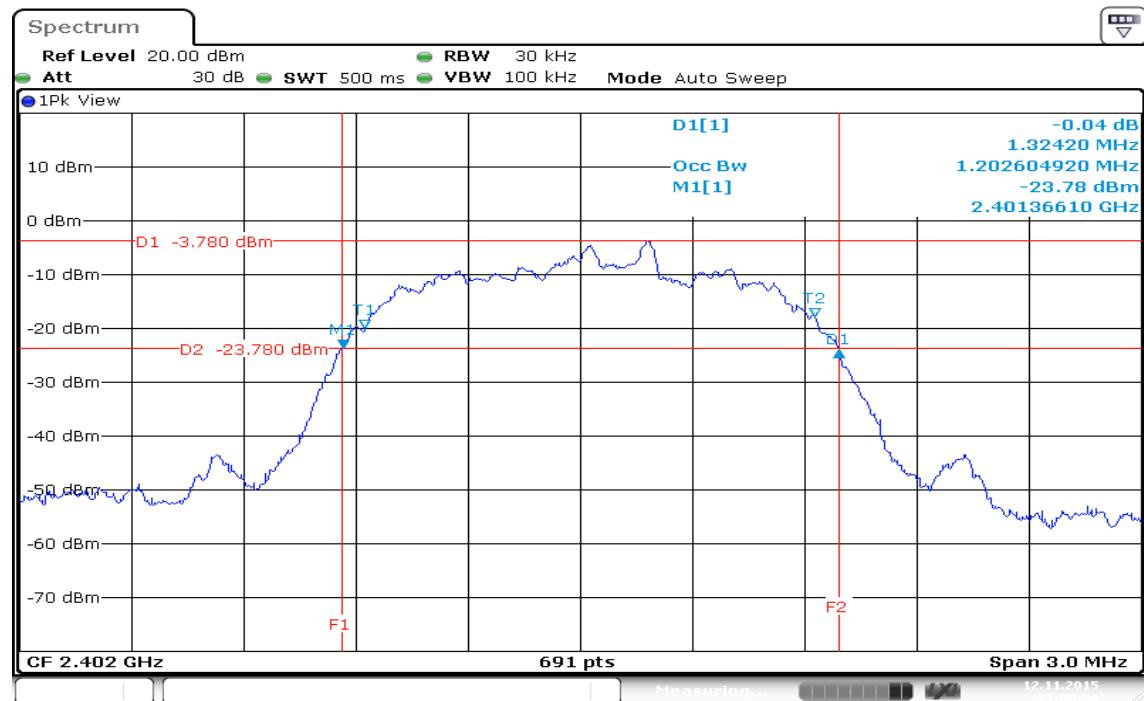
Channel	Frequency (MHz)	99% Bandwidth (KHz)
Low	2402	911.7221
Mid	2441	911.7221
High	2480	911.7221

##### For 8DPSK

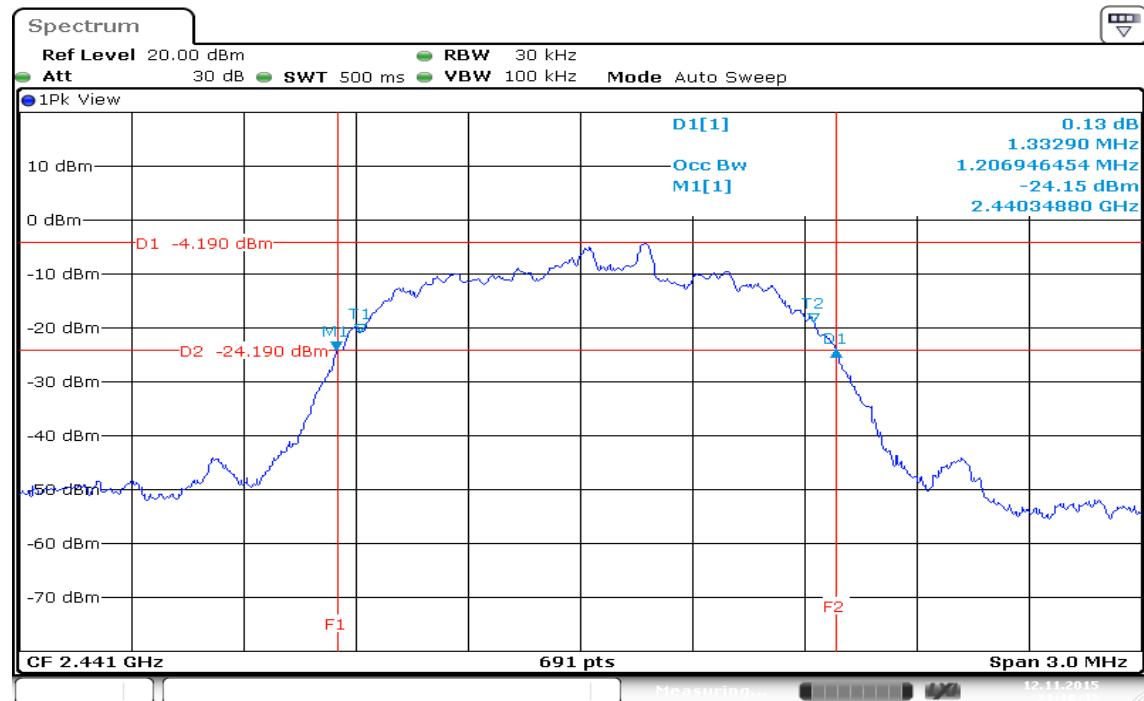
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.2026
Mid	2441	1.2069
High	2480	1.2069

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

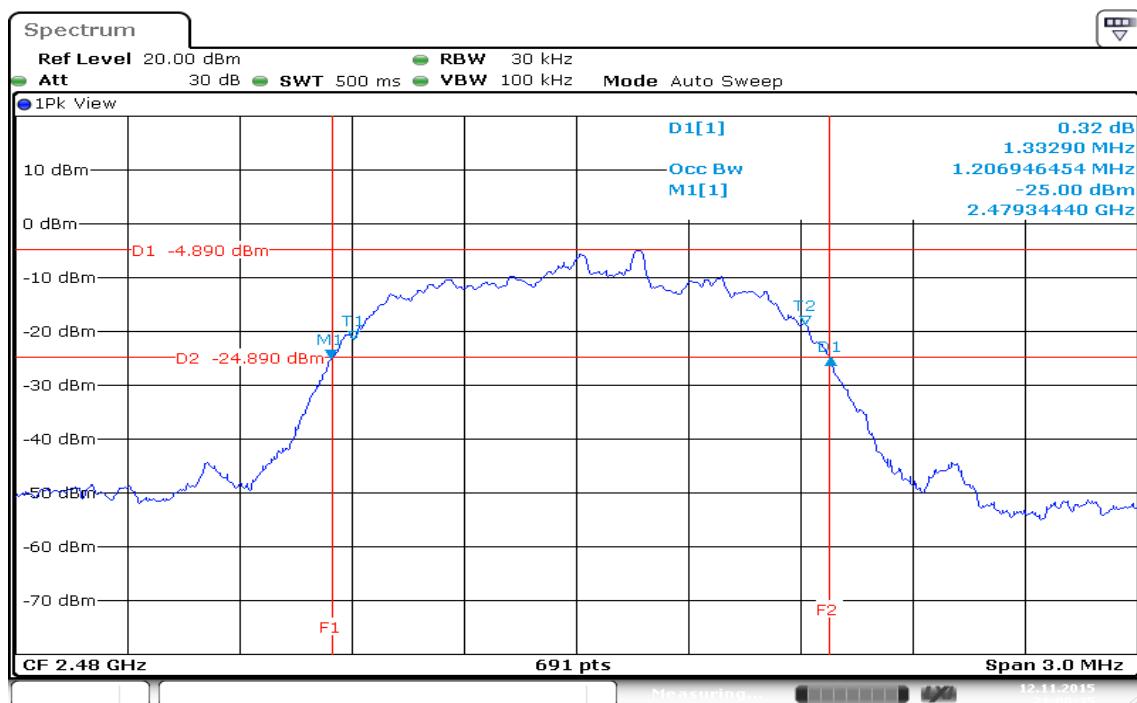
**99% Bandwidth (CH High)**

**For 8DPSK / DH5****99% Bandwidth (CH Low)**

Date: 12.NOV.2015 21:06:49

**99% Bandwidth (CH Mid)**

Date: 12.NOV.2015 21:16:42

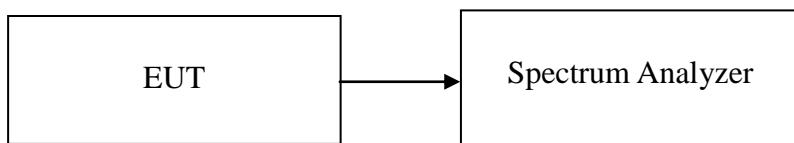
**99% Bandwidth (CH High)**

## 7.2 20 DB BANDWIDTH

### LIMIT

None; for reporting purposes only.

### Test Configuration



### TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=30 kHz, VBW = 100 kHz, Sweep = 3.2 ms.
4. Mark the peak frequency and 20dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

### TEST RESULTS

*No non-compliance noted.*

#### Test Data

##### For GFSK / DH5

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	1.0246
Mid	2441	1.0289
High	2480	1.0289

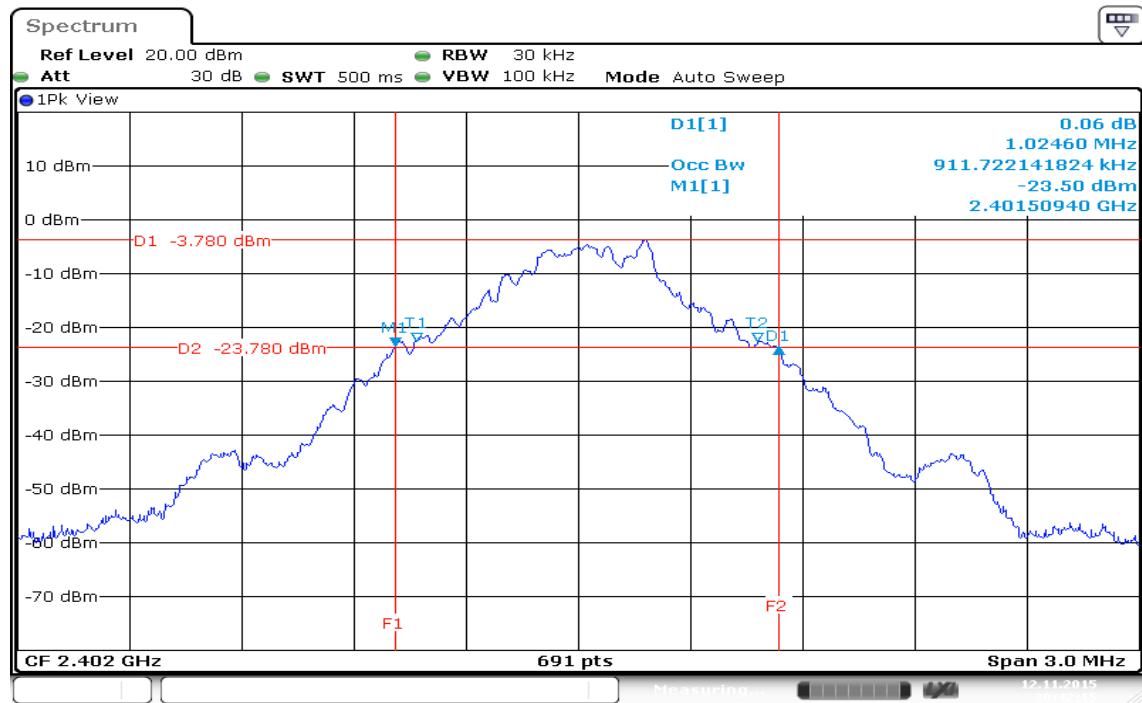
##### For 8DPSK / DH5

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	1.3242
Mid	2441	1.3329
High	2480	1.3329

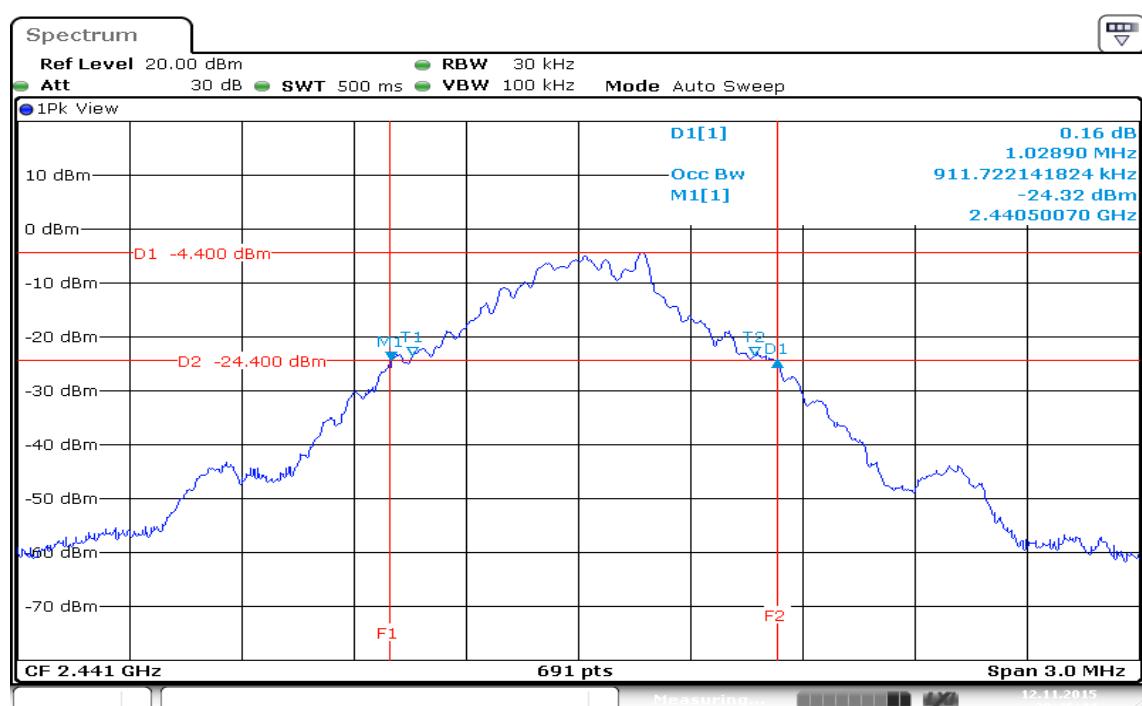
## Test Plot

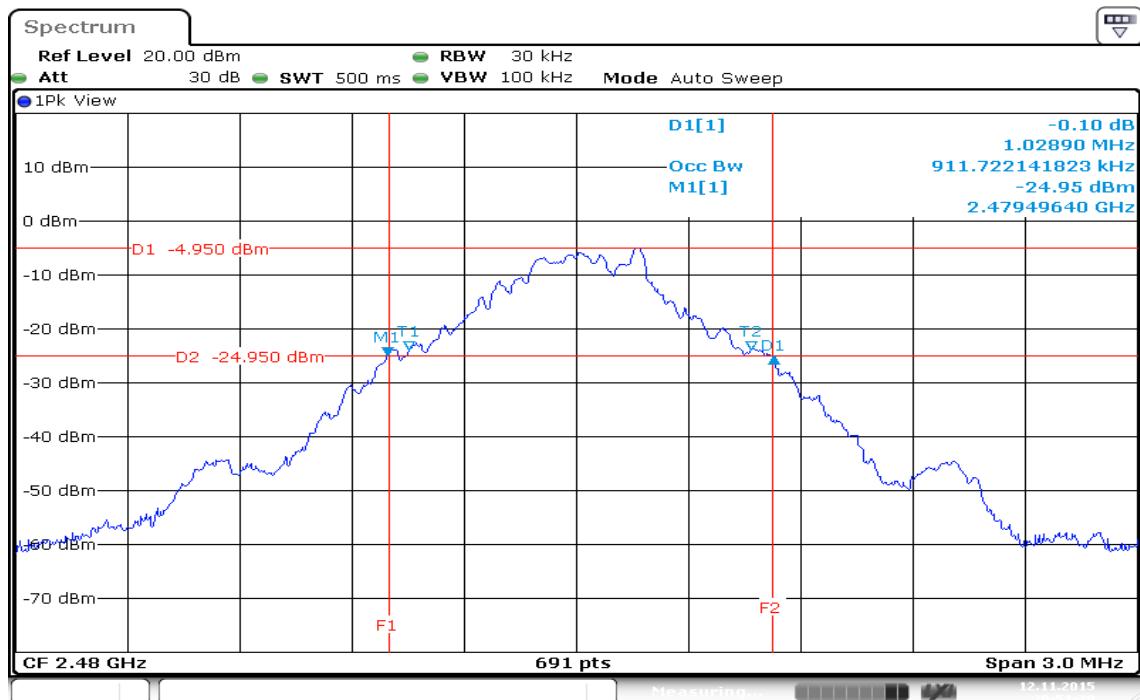
### For GFSK / DH5

#### 20dB Bandwidth (CH Low)



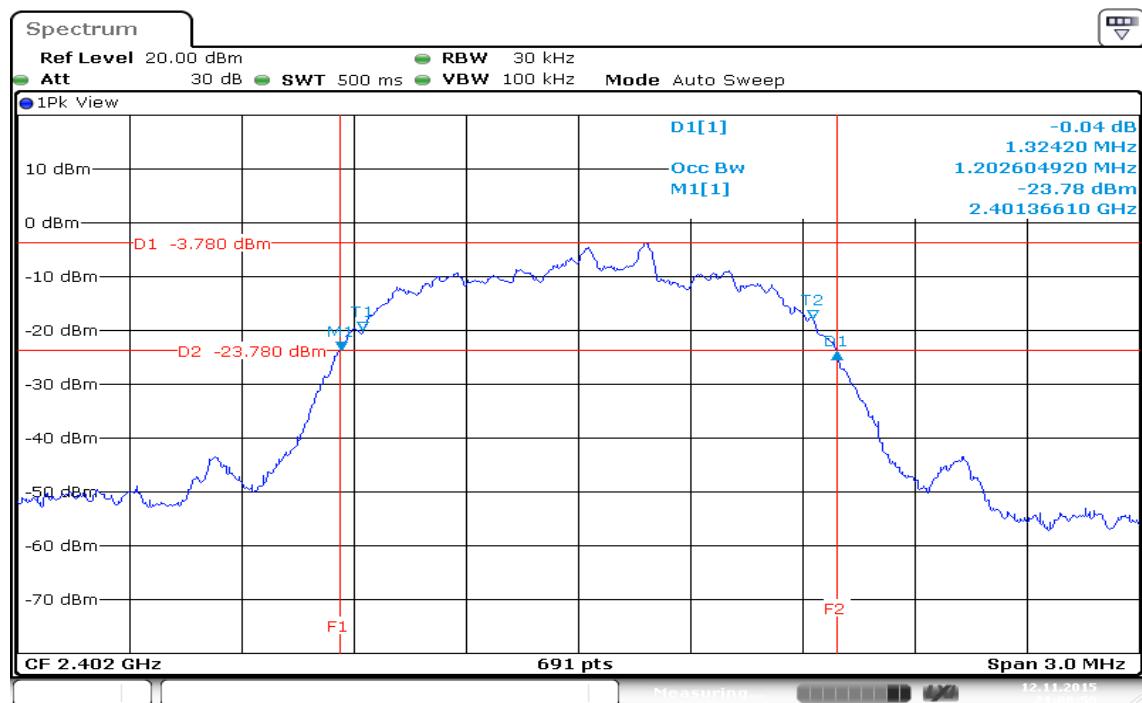
#### 20dB Bandwidth (CH Mid)



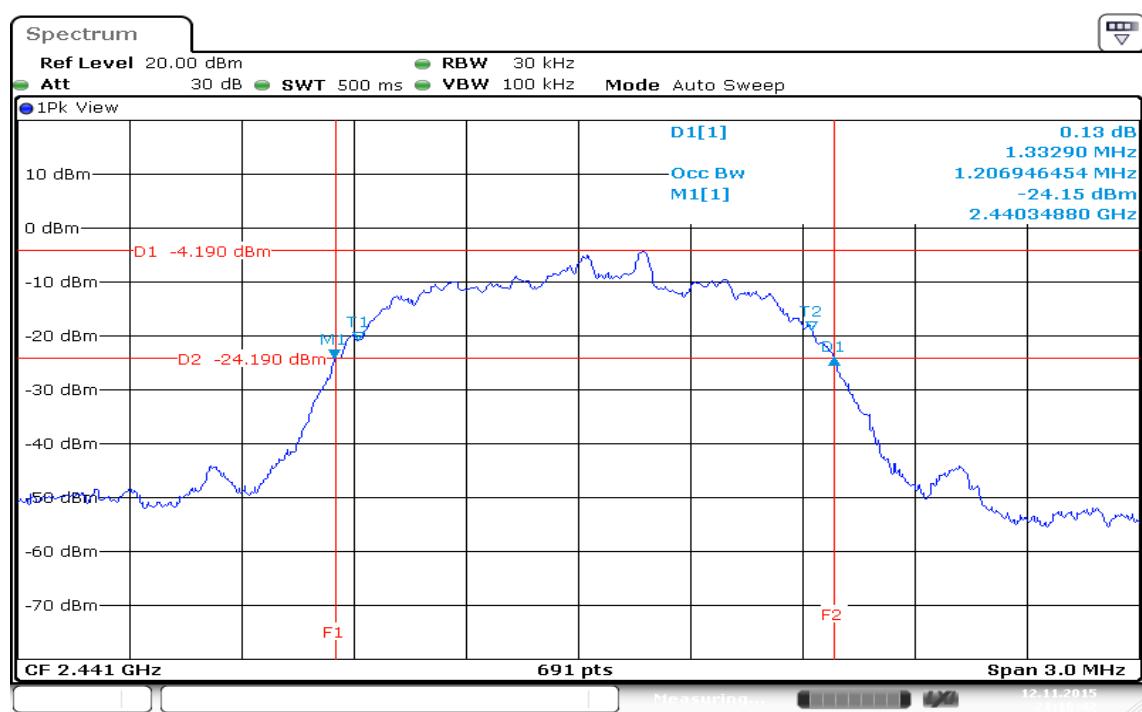
**20dB Bandwidth (CH High)**

## For 8DPSK / DH5

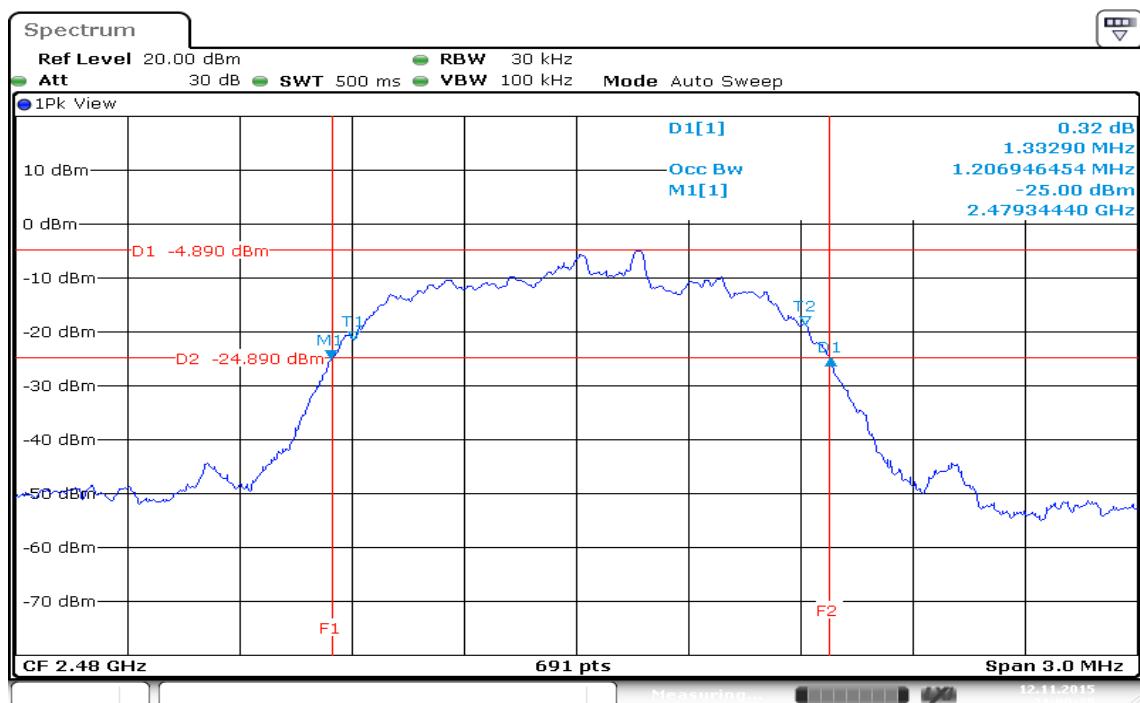
## 20dB Bandwidth (CH Low)



## 20dB Bandwidth (CH Mid)



## 20dB Bandwidth (CH High)



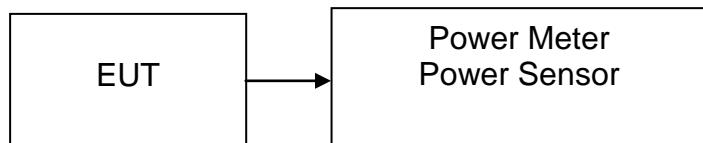
## 7.3 PEAK POWER

### LIMIT

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

1. According to RSS-247, Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.
2. According to RSS 247, for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.

### Test Configuration



## TEST PROCEDURE

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

## TEST RESULTS

*No non-compliance noted.*

### Test Data

#### For GFSK / DH5

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	3.05	0.0020	0.125	PASS
Mid	2441	3.12	0.0021		PASS
High	2480	3.07	0.0020		PASS

#### For 8DPSK / DH5

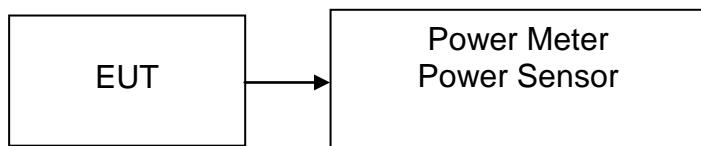
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	*3.15	0.0021	0.125	PASS
Mid	2441	2.98	0.0020		PASS
High	2480	3.01	0.0020		PASS

## 7.4 AVERAGE POWER

### LIMIT

None; for reporting purposes only.

### Test Configuration



### TEST PROCEDURE

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

### TEST RESULTS

*No non-compliance noted.*

### Test Data

#### For GFSK / DH5

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2402	-2.40	0.0006
Mid	2441	-2.46	0.0006
High	2480	-2.44	0.0006

#### For 8DPSK / DH5

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2402	-2.22	0.0006
Mid	2441	-2.54	0.0006
High	2480	-2.75	0.0005

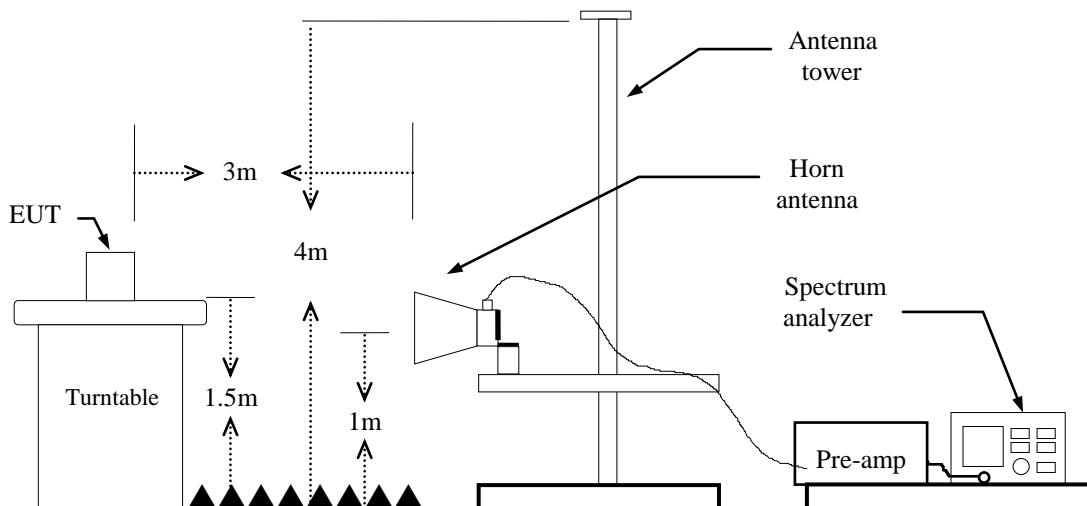
## 7.5 BAND EDGES MEASUREMENT

### LIMIT

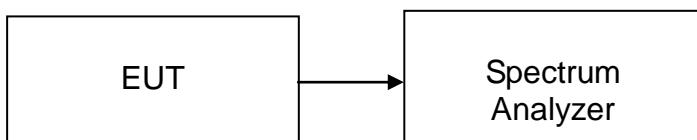
According to RSS-247, in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

### Test Configuration

#### For Radiated



#### For Conducted



## **TEST PROCEDURE**

### **For Radiated**

1. The EUT is placed on a turntable, which is 1.5m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
  - (a) PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO
  - (b) AVERAGE: RBW=1MHz,  
if duty cycle  $\geq$  98%, VBW=10Hz.  
if duty cycle < 98% VBW=1/T.  
**BT**: = 78%, VBW= 360Hz  
**EDR** = 78%, VBW= 360Hz
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

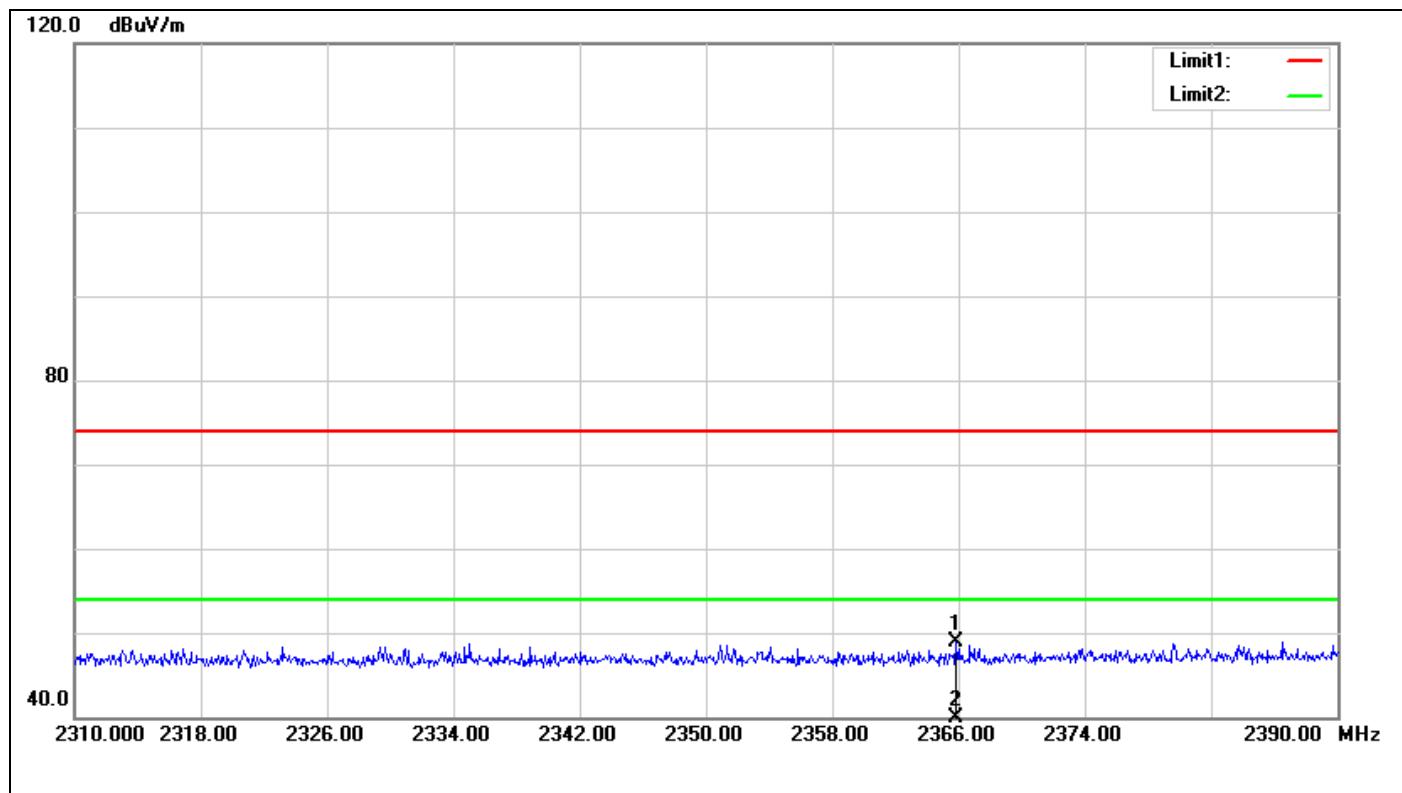
### **For Conducted**

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

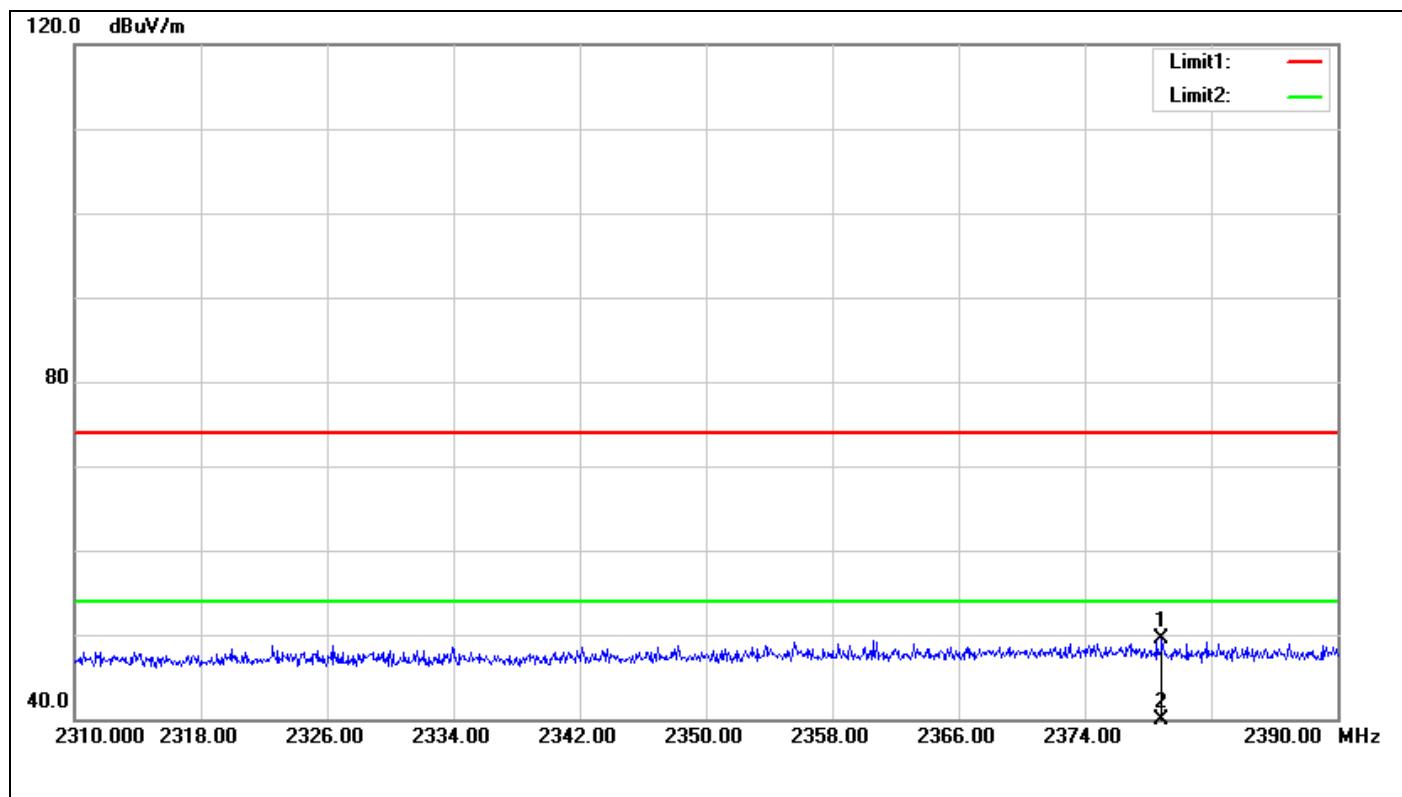
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

## **TEST RESULTS**

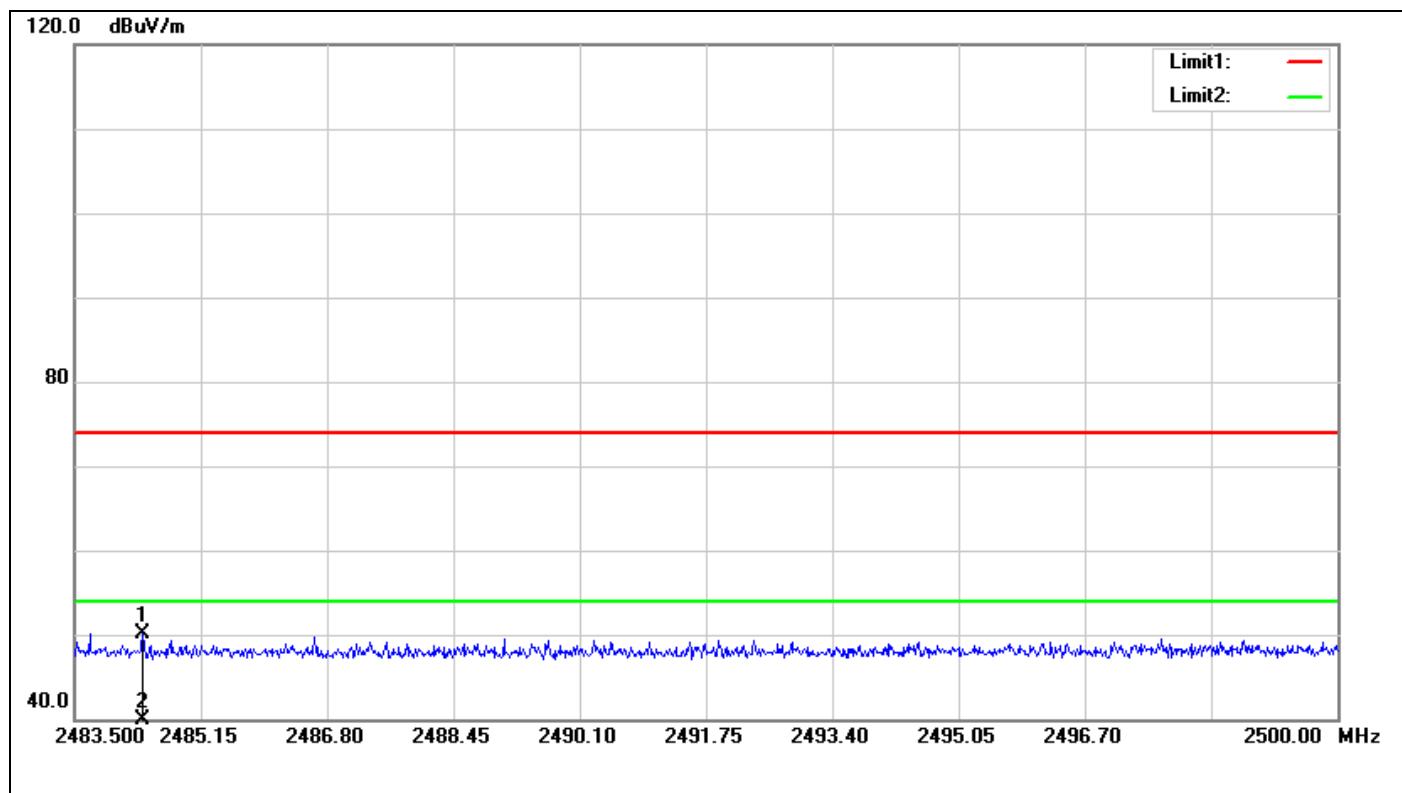
Refer to attach spectrum analyzer data chart.

**For GFSK / DH5****Band Edges (CH Low)****Polarity: Vertical**

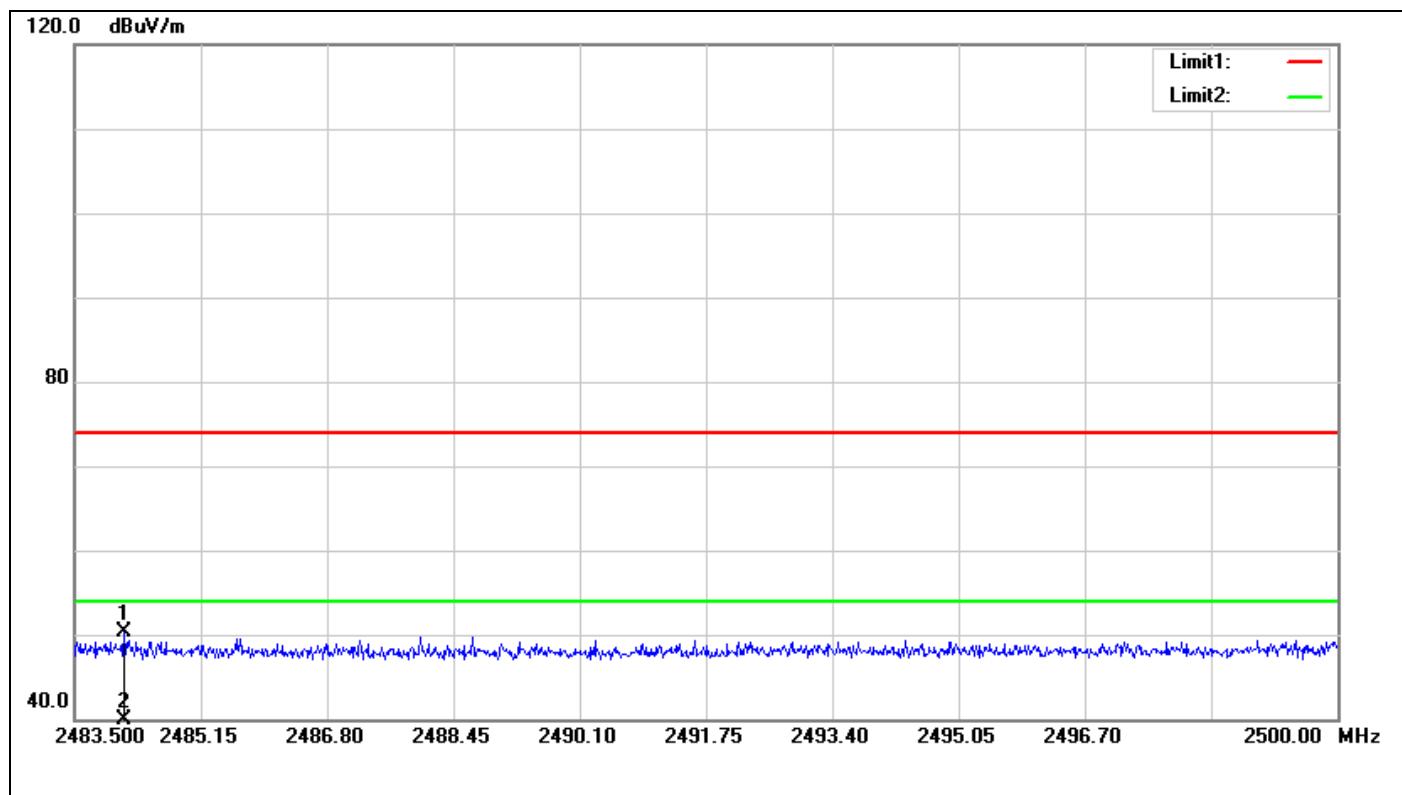
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2365.840	51.67	-2.72	48.95	74.00	-25.05	150	6	peak
2	2365.840	37.25	-2.72	34.53	54.00	-19.47	150	6	AVG

**Polarity: Horizontal**

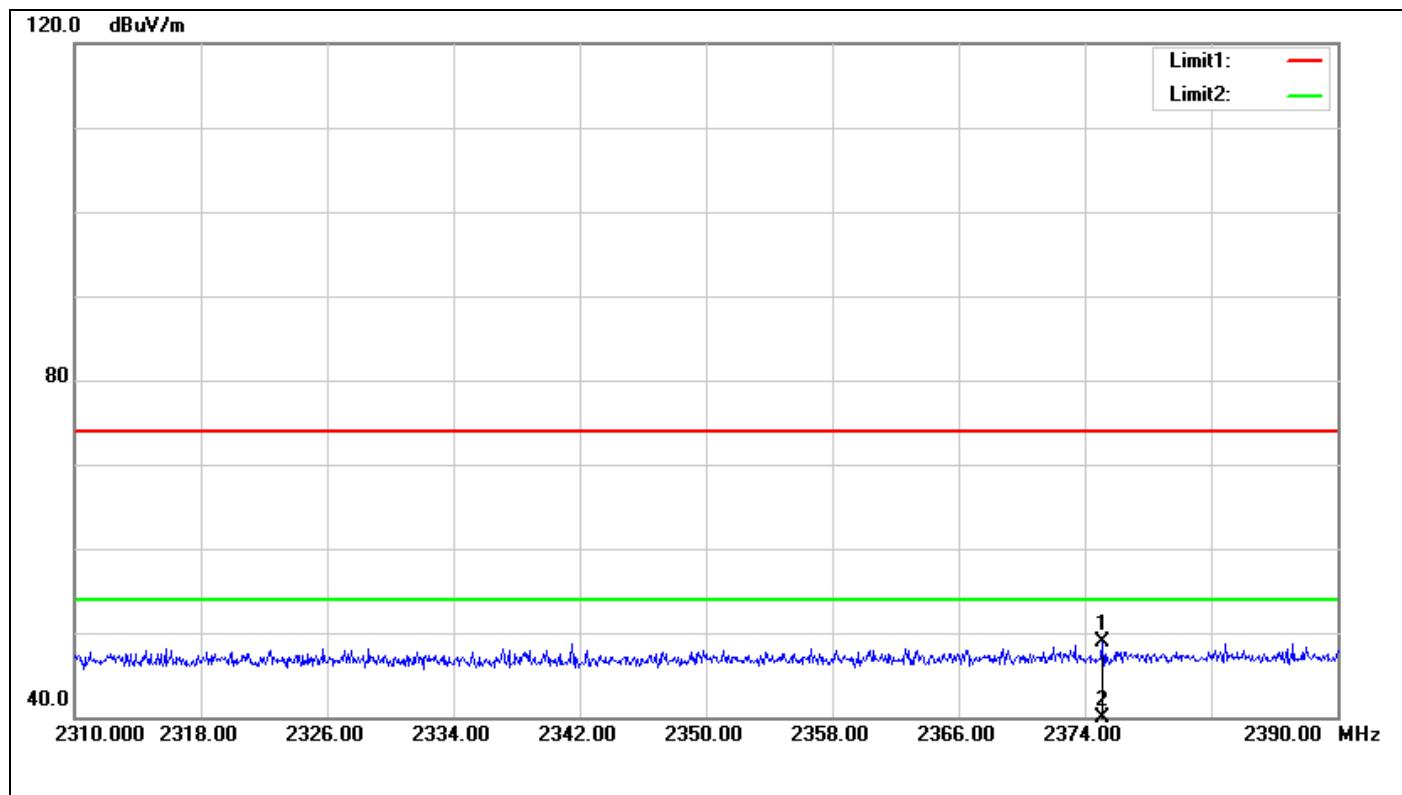
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2378.880	52.11	-2.59	49.52	74.00	-24.48	150	310	peak
2	2378.880	37.67	-2.59	35.08	54.00	-18.92	150	310	AVG

**Band Edges (CH High)****Polarity: Vertical**

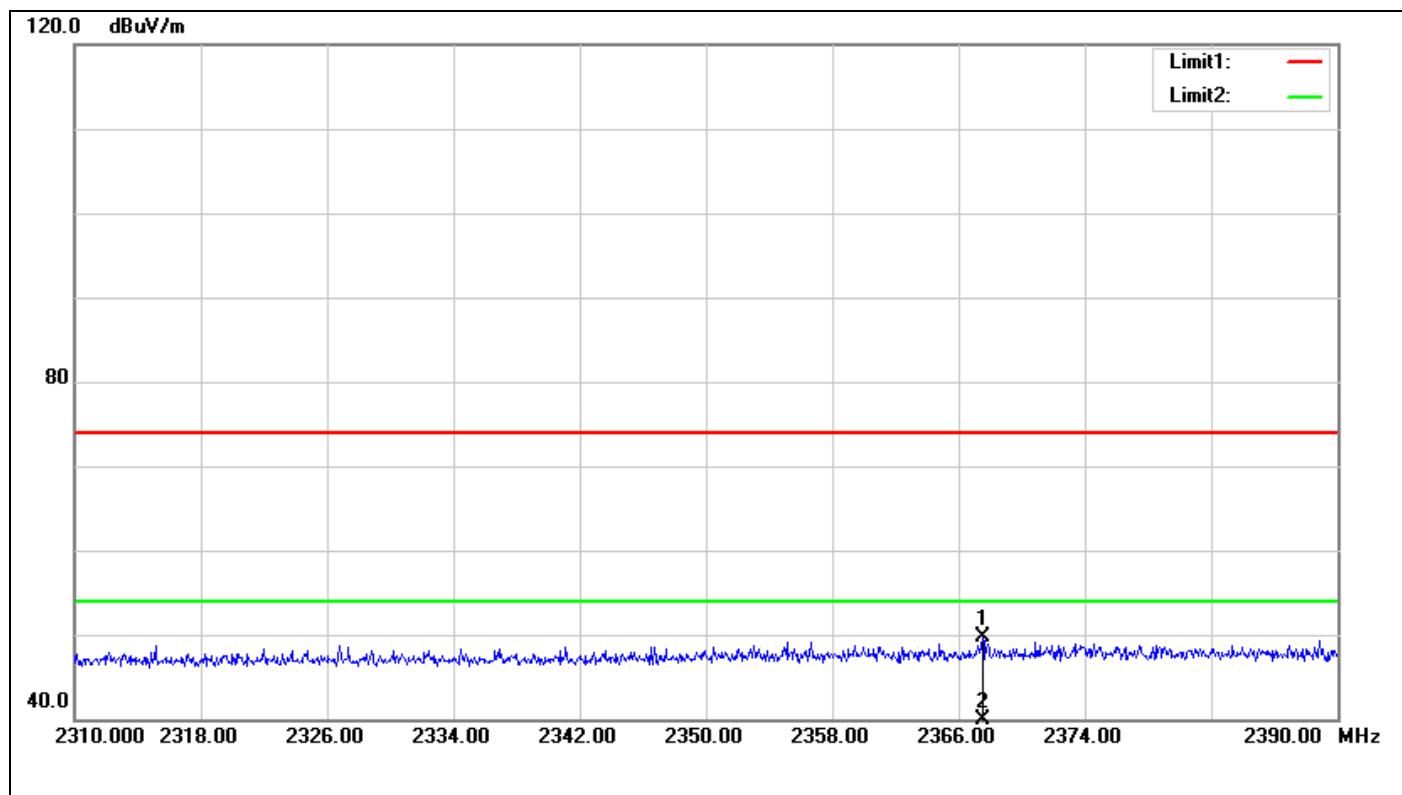
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2484.391	52.04	-1.99	50.05	74.00	-23.95	150	53	peak
2	2484.391	37.28	-1.99	35.29	54.00	-18.71	150	53	AVG

**Polarity: Horizontal**

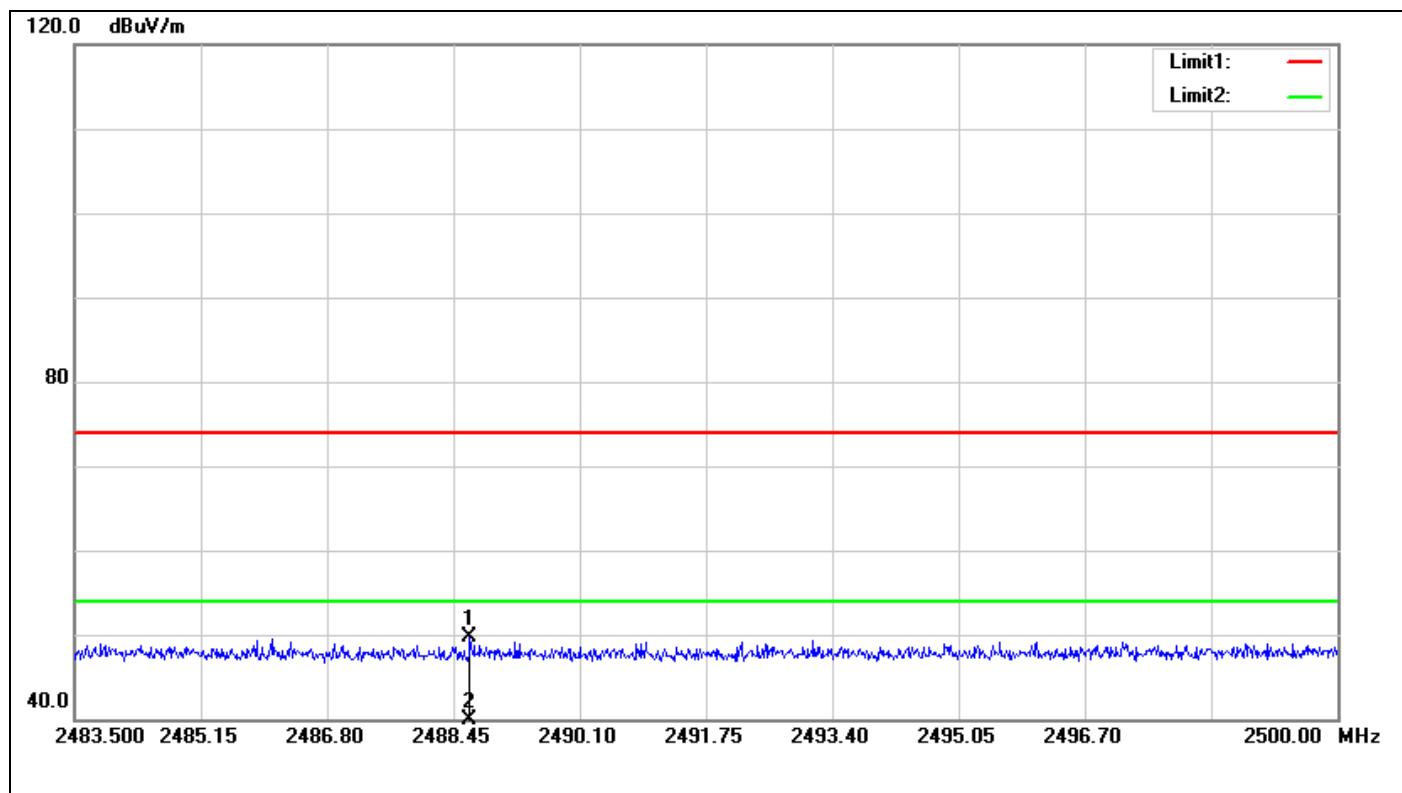
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2484.144	52.31	-1.99	50.32	74.00	-23.68	150	53	peak
2	2484.144	37.83	-1.99	35.84	54.00	-18.16	150	53	AVG

**For 8DPSK / DH5****Band Edges (CH Low)****Polarity: Vertical**

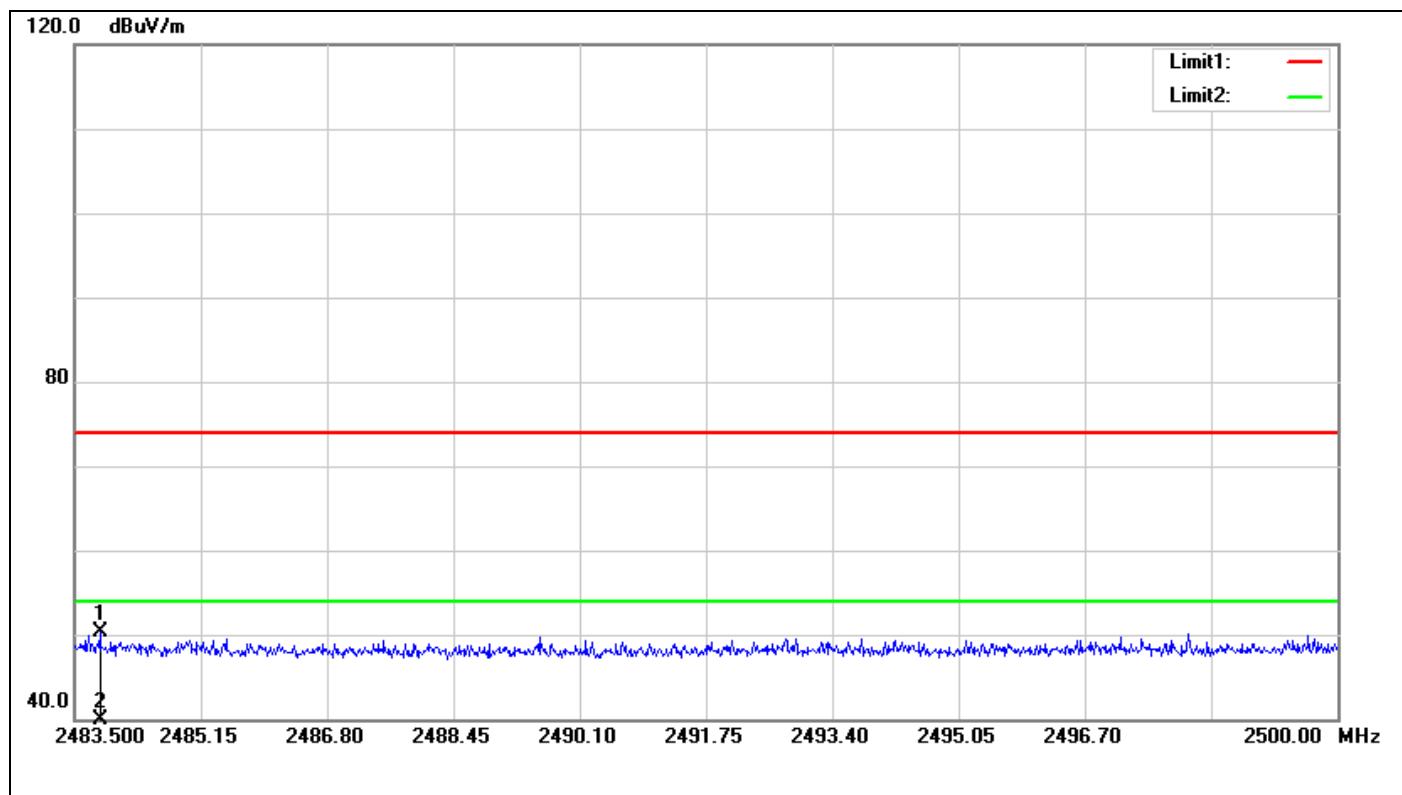
No.	Frequency (MHz)	Reading (dB <sub>uV</sub> )	Correct Factor(dB/m)	Result (dB <sub>uV/m</sub> )	Limit (dB <sub>uV/m</sub> )	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2375.120	51.49	-2.61	48.88	74.00	-25.12	150	314	peak
2	2375.120	37.14	-2.61	34.53	54.00	-19.47	150	314	AVG

**Polarity: Horizontal**

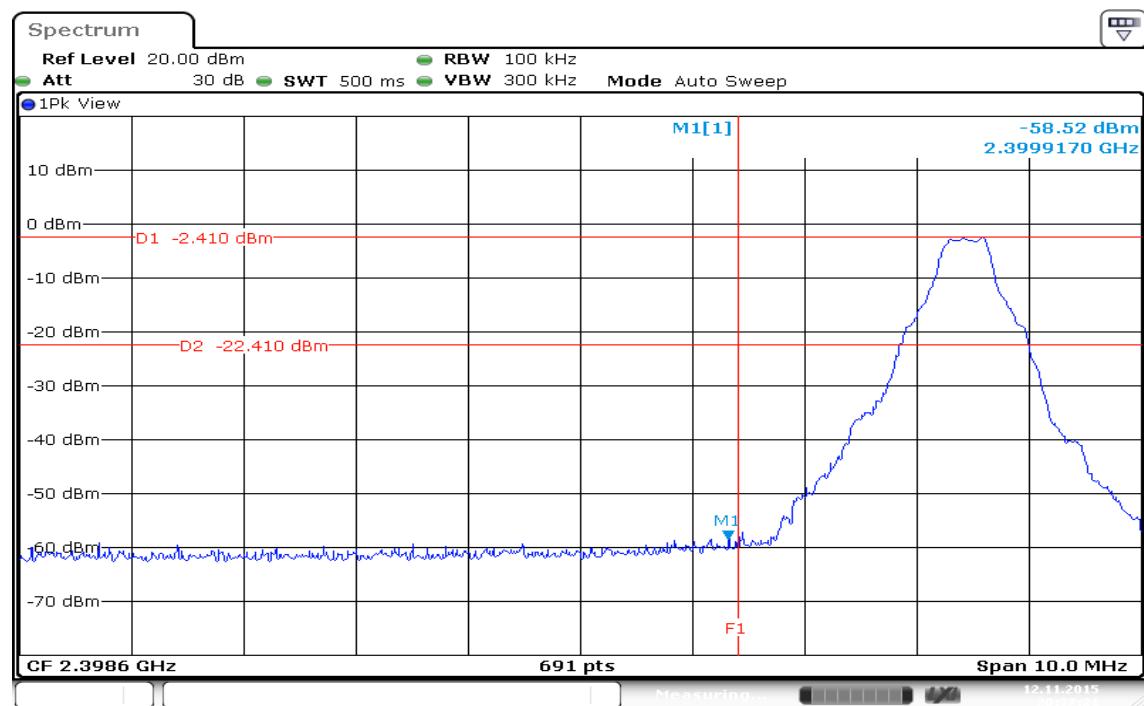
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2367.520	52.34	-2.69	49.65	74.00	-24.35	150	207	peak
2	2367.520	37.78	-2.69	35.09	54.00	-18.91	150	207	AVG

**Band Edges (CH High)****Polarity: Vertical**

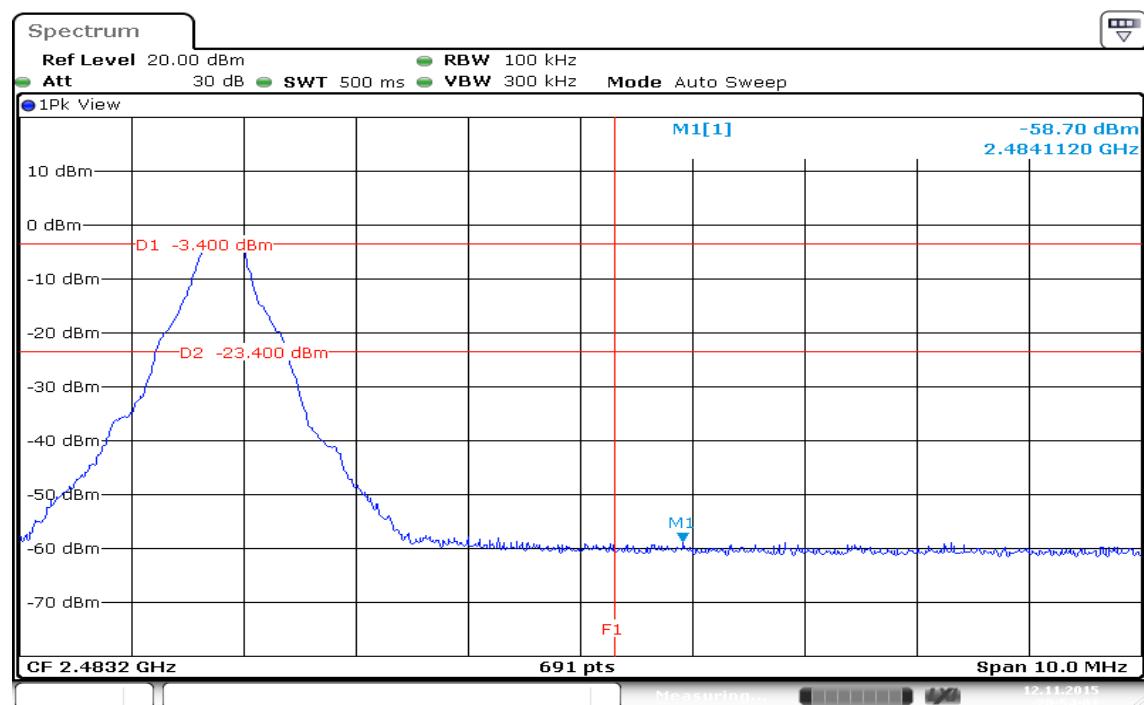
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2488.664	51.59	-1.94	49.65	74.00	-24.35	150	264	peak
2	2488.664	37.26	-1.94	35.32	54.00	-18.68	150	264	AVG

**Polarity: Horizontal**

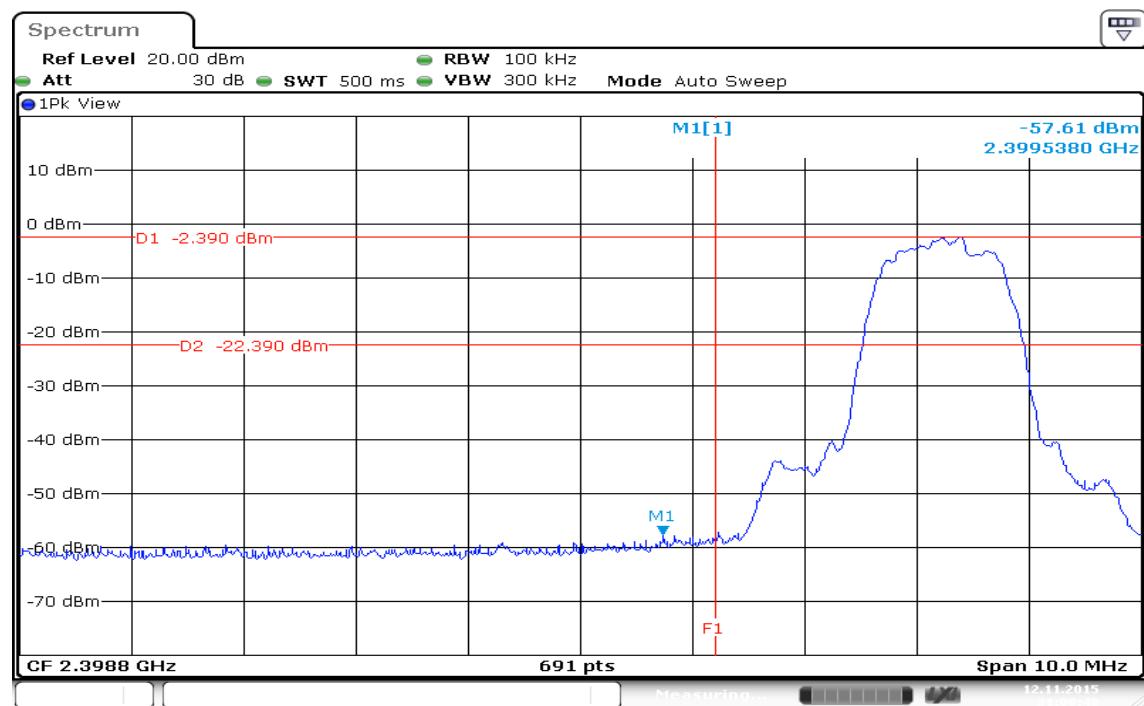
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2483.830	52.22	-1.99	50.23	74.00	-23.77	150	88	peak
2	2483.830	37.79	-1.99	35.80	54.00	-18.20	150	88	AVG

**GFSK****Band Edges (CH Low)**

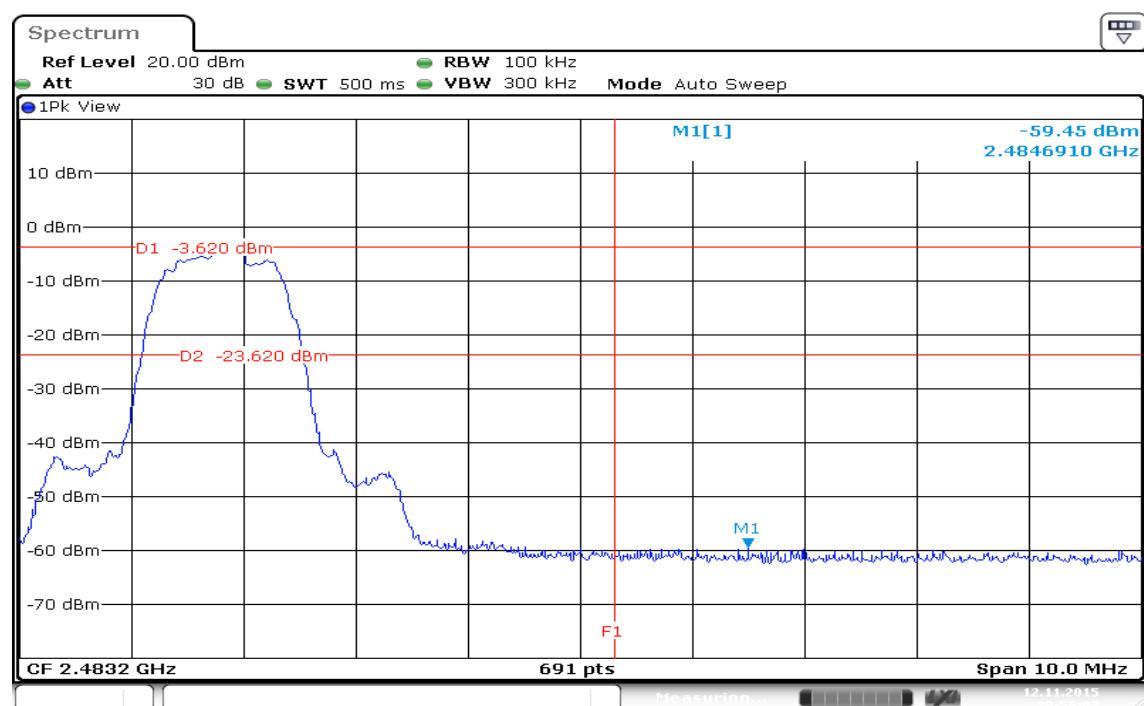
Date: 12.NOV.2015 20:37:20

**Band Edges (CH High)**

Date: 12.NOV.2015 20:54:01

**8DPSK****Band Edges (CH Low)**

Date: 12.NOV.2015 21:08:48

**Band Edges (CH High)**

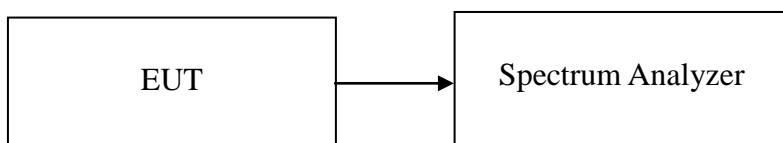
Date: 12.NOV.2015 20:56:07

## 7.6 FREQUENCY SEPARATION

### LIMIT

According to 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 1 peaks of hopping channel and record the 1 peaks frequency.

### TEST RESULTS

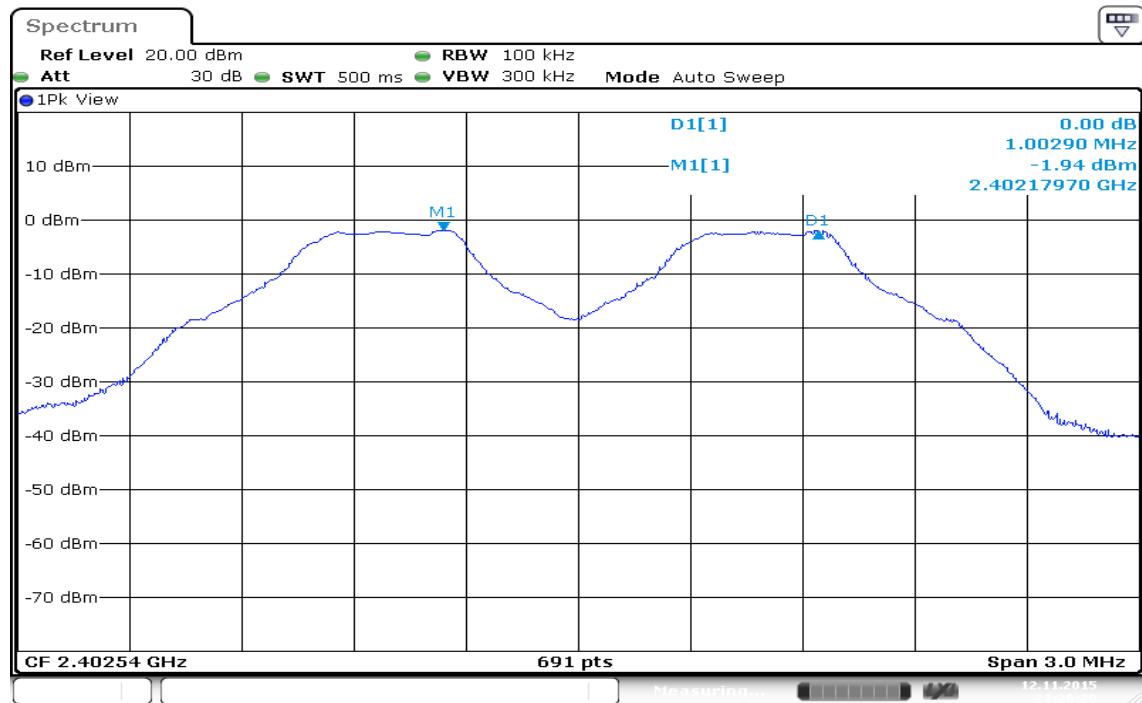
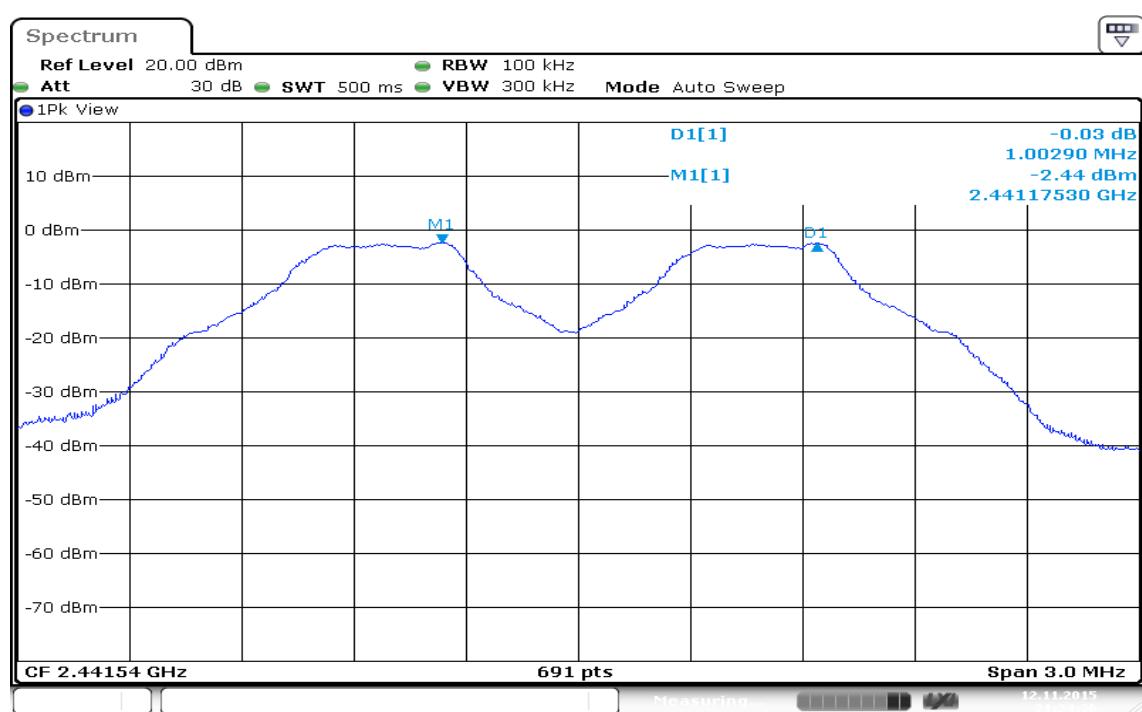
*No non-compliance noted*

**Test Data****For GFSK / DH5**

Channel	Channel Separation (MHz)	two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit	Result
Low	1.0029	0.683	>two-thirds of the 20 dB bandwidth	Pass
Mid	1.0029	0.685	>two-thirds of the 20 dB bandwidth	Pass
High	1.0029	0.685	>two-thirds of the 20 dB bandwidth	Pass

**For 8DPSK / DH5**

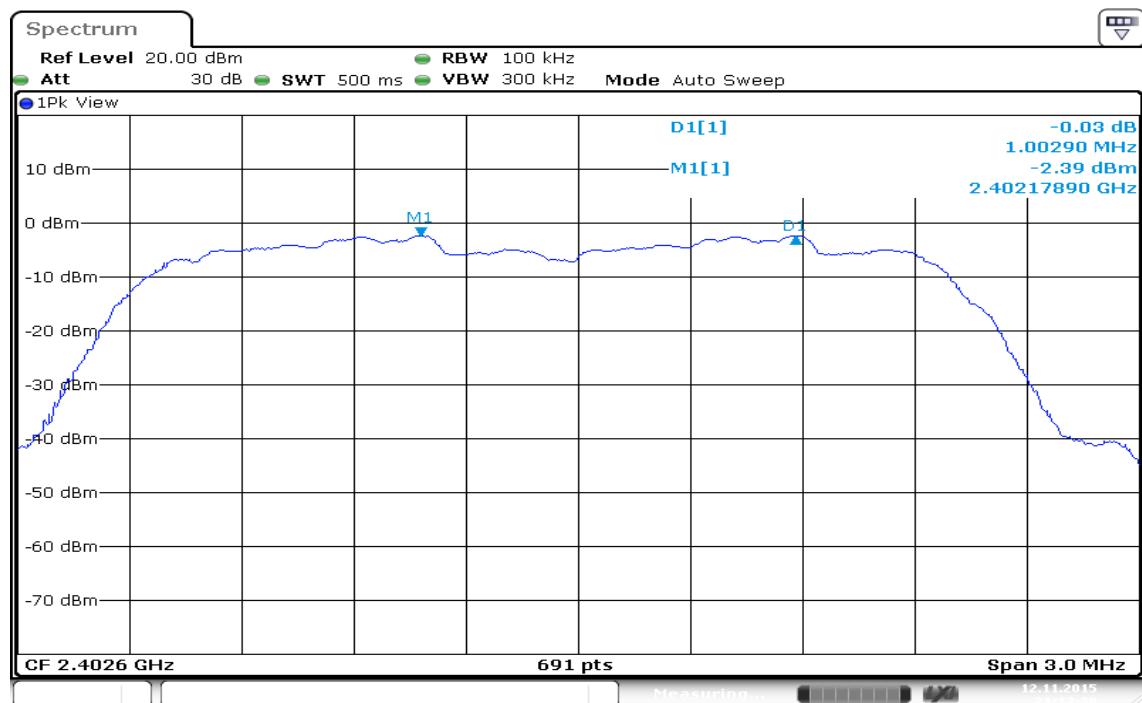
Channel	Channel Separation (MHz)	two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit	Result
Low	1.0029	0.882	>two-thirds of the 20 dB bandwidth	Pass
Mid	1.0029	0.888	>two-thirds of the 20 dB bandwidth	Pass
High	1.0029	0.888	>two-thirds of the 20 dB bandwidth	Pass

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

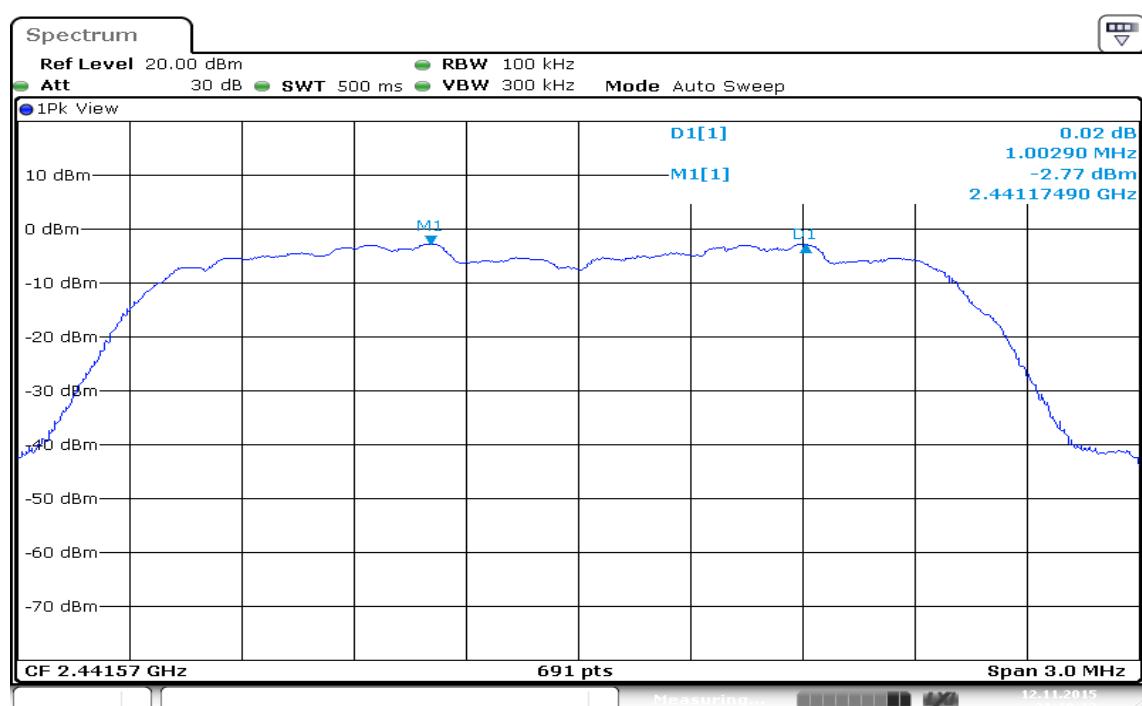
**For GFSK / DH5 / High**

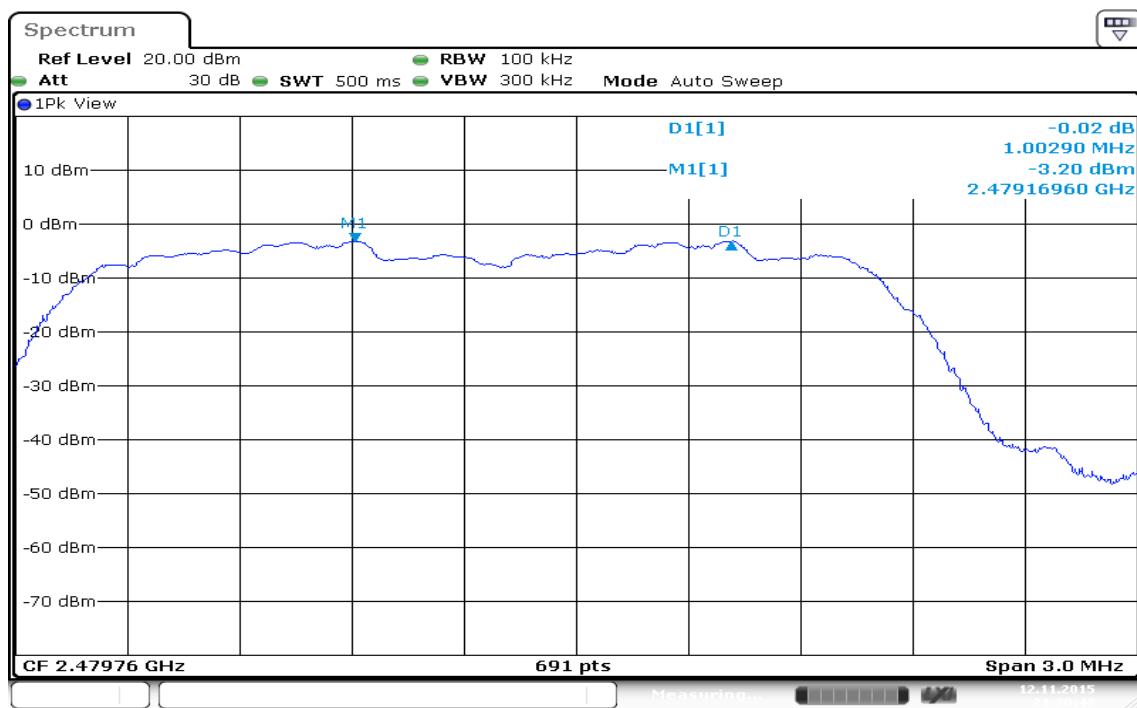
## Measurement of Channel Separation

### For 8DPSK / DH5 / Low



### For 8DPSK / DH5 / Mid



**For 8DPSK / DH5 / High**

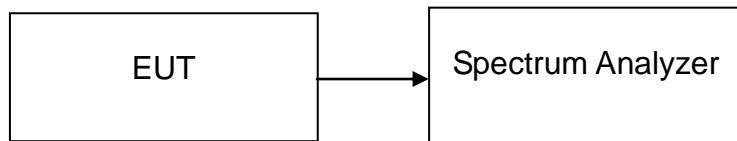
## 7.7 NUMBER OF HOPPING FREQUENCY

### LIMIT

According to RSS-247, Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 75 hopping frequencies.

According to RSS-247, Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

### Test Configuration



### TEST PROCEDURE

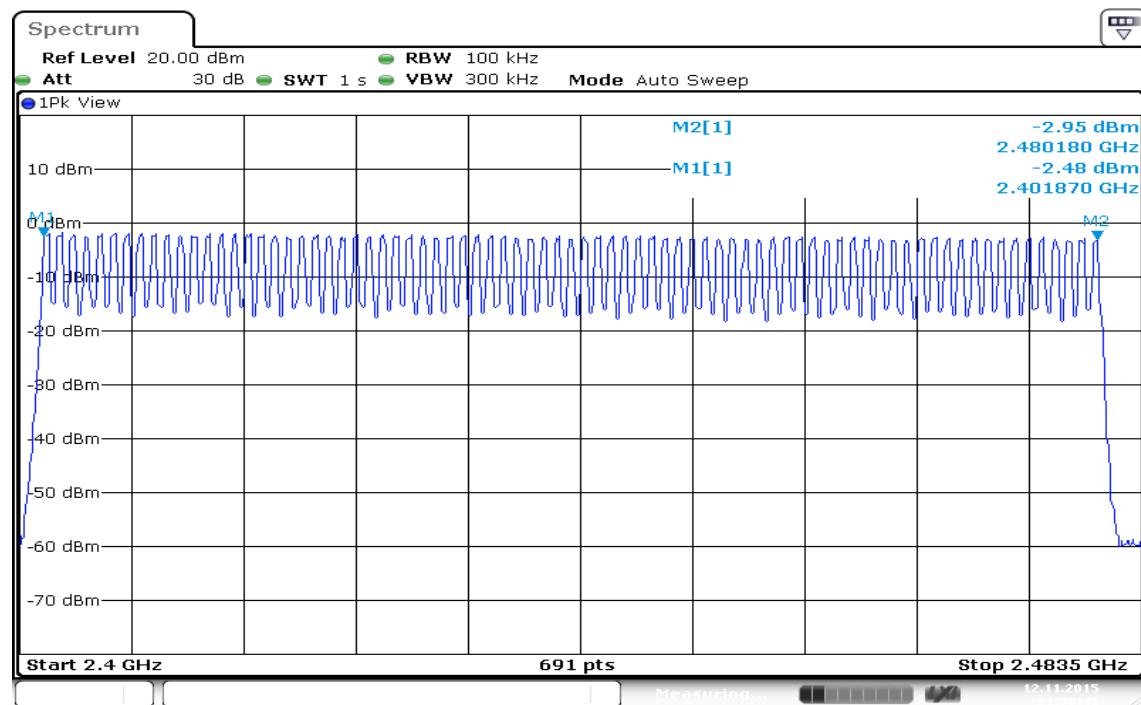
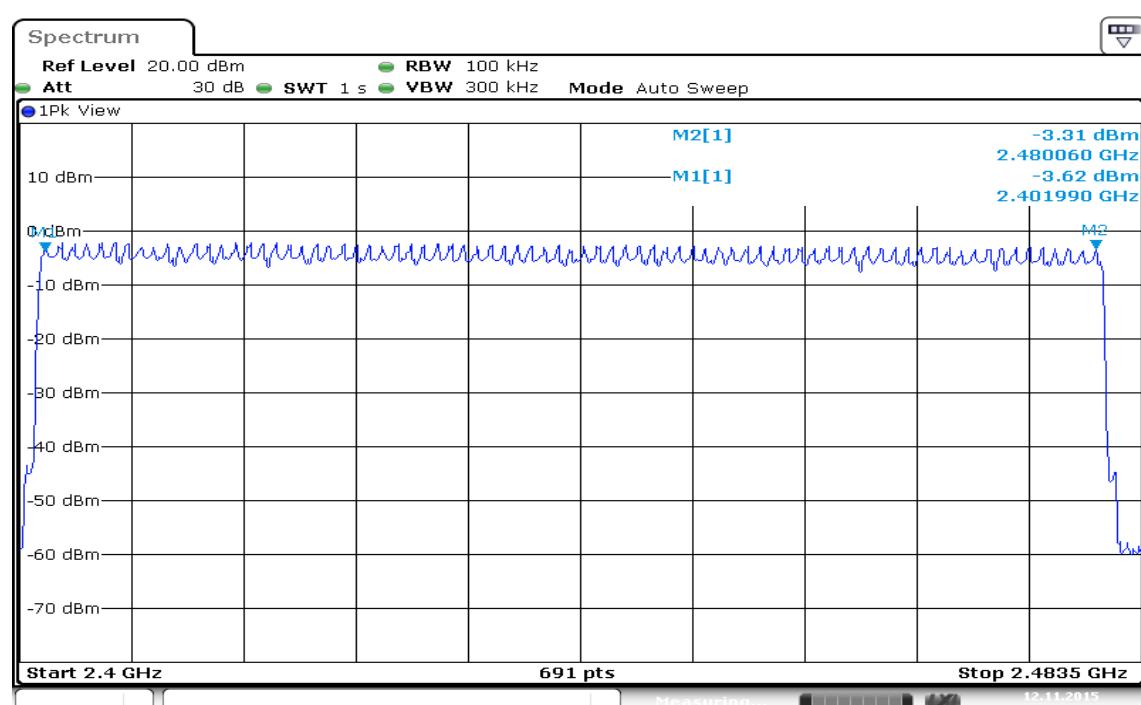
1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set spectrum analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto
4. Set the spectrum analyzer as RBW = 100kHz, VBW=300kHz.
5. Max hold, view and count how many channel in the band.

### TEST RESULTS

*No non-compliance noted*

### Test Data

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

**Test Plot****For GFSK****For 8DPSK**

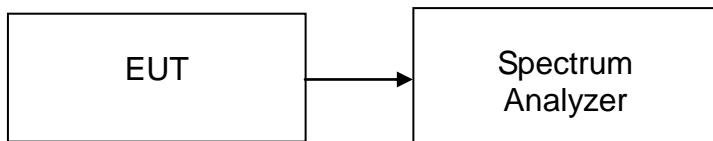
## 7.8 TIME OF OCCUPANCY (DWELL TIME)

### LIMIT

According to RSS-247, 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

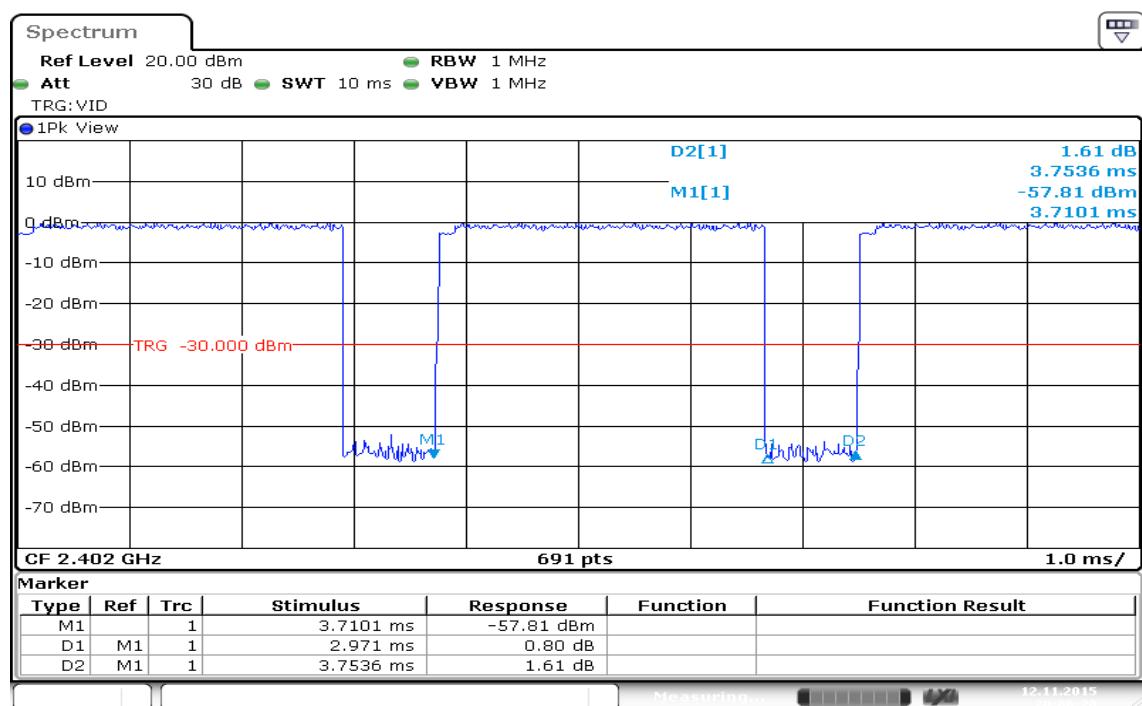
1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=1MHz, Sweep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

### TEST RESULTS

*No non-compliance noted*

**Test Data**DH 5:  $2.971 * (1600/6)/79 * 31.6 = 316.907$  (ms)

	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
DH 5	2.971	316.907	31.60	400.00	PASS



Date: 12.NOV.2015 20:06:20

## 7.9 RADIATED EMISSIONS

### LIMIT

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

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

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

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

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

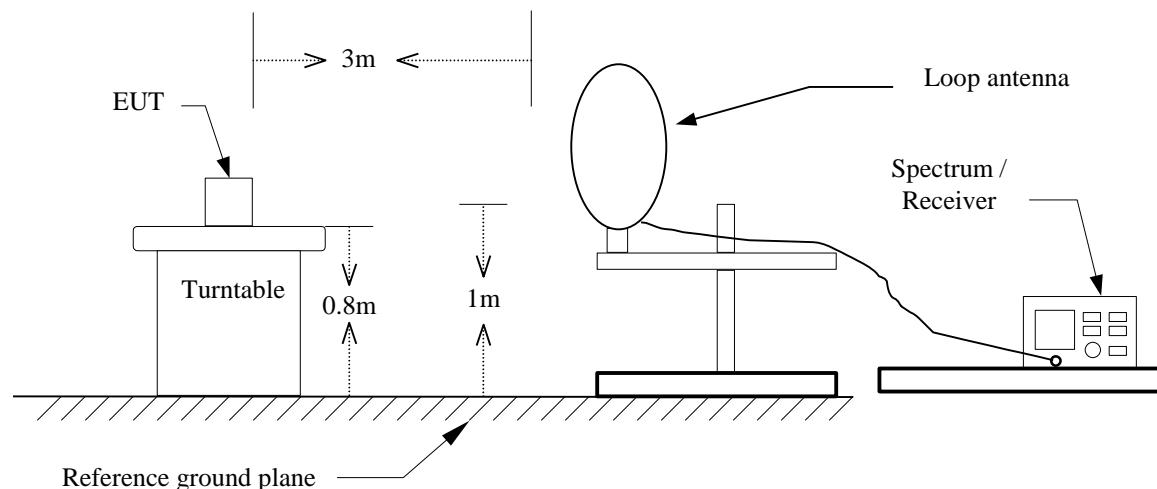
#### RSS-Gen Table 6: General Field Strength Limits for Transmitters at Frequencies Below 30 MHz (Transmit)

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

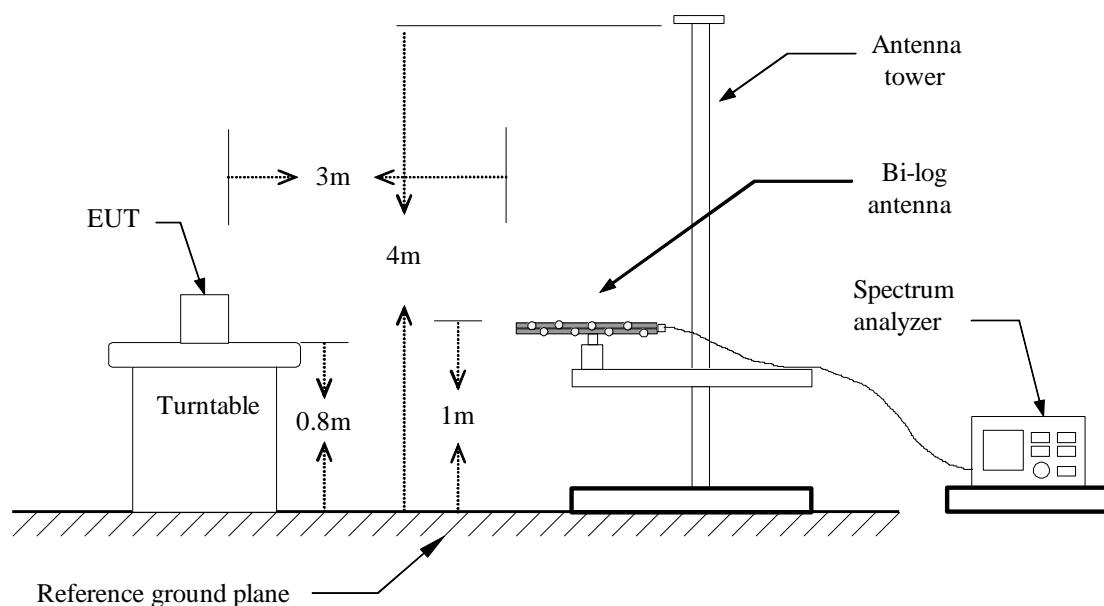
**Note:** The emission limits for the bands 9-90 kHz and 110-490 kHz are based on measurements employing an average detector.

### Test Configuration

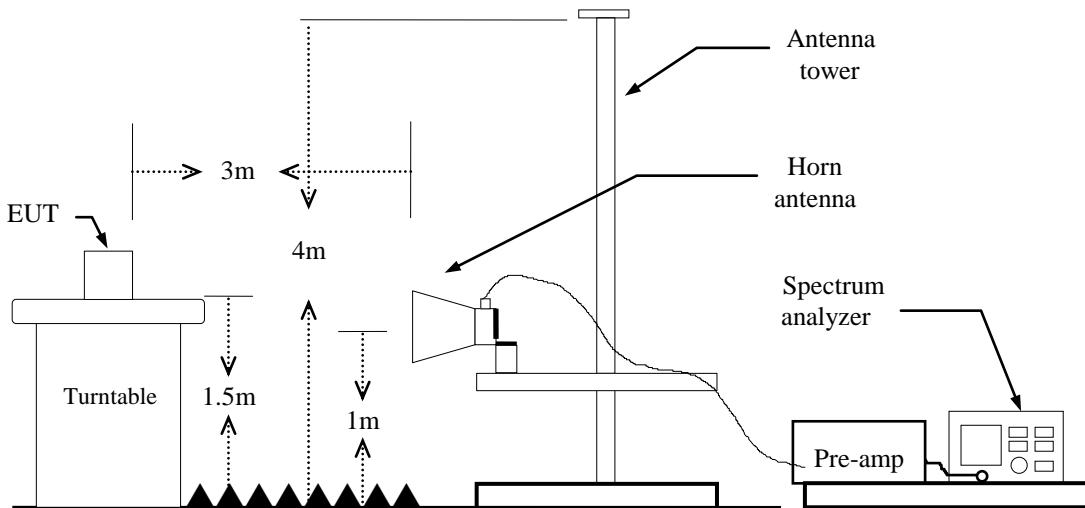
**9kHz ~ 30MHz**



**30MHz ~ 1GHz**



## Above 1 GHz



## TEST PROCEDURE

1. The EUT is placed on a turntable, 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

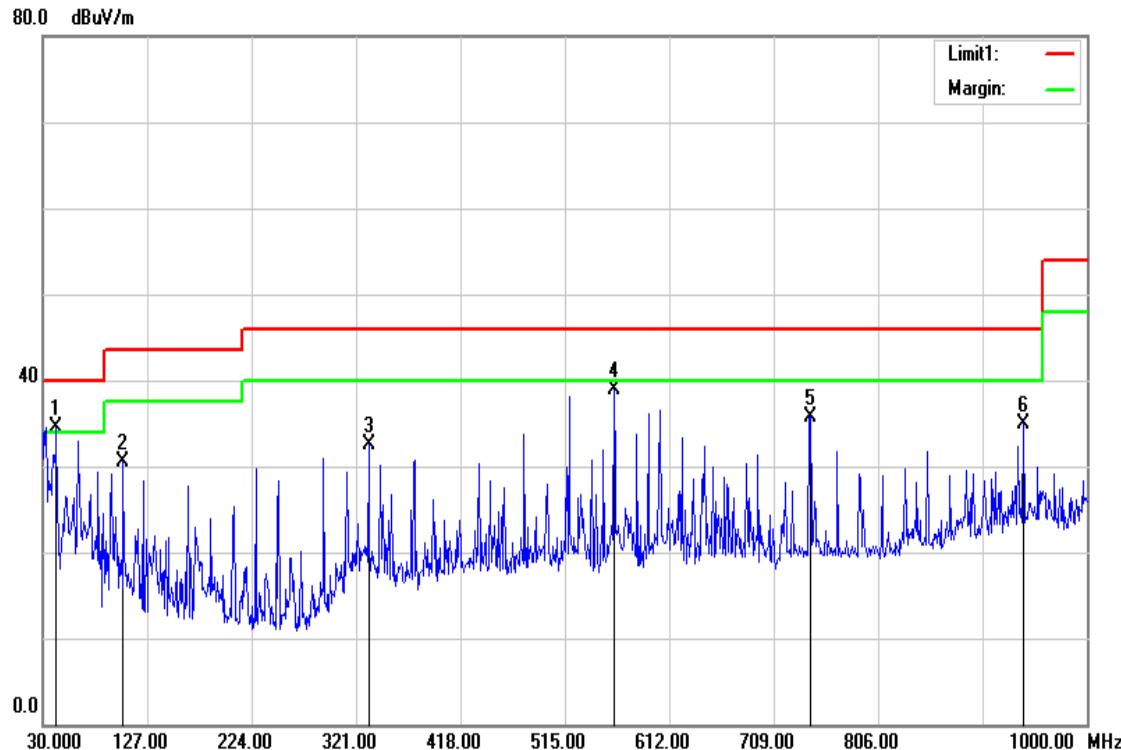
Above 1GHz:

- (a) PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO
- (b) AVERAGE: RBW=1MHz,  
if duty cycle  $\geq 98\%$ , VBW=10Hz.  
if duty cycle < 98% VBW=1/T.  
**BT**: = 78%, VBW= 360Hz  
**EDR** = 78%, VBW= 360Hz

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

**Below 1 GHz**

**Operation Mode:** Normal Link      **Test Date:** October 15, 2015  
**Temperature:** 27°C      **Tested by:** Jason Lu  
**Humidity:** 53% RH      **Polarity:** Ver.

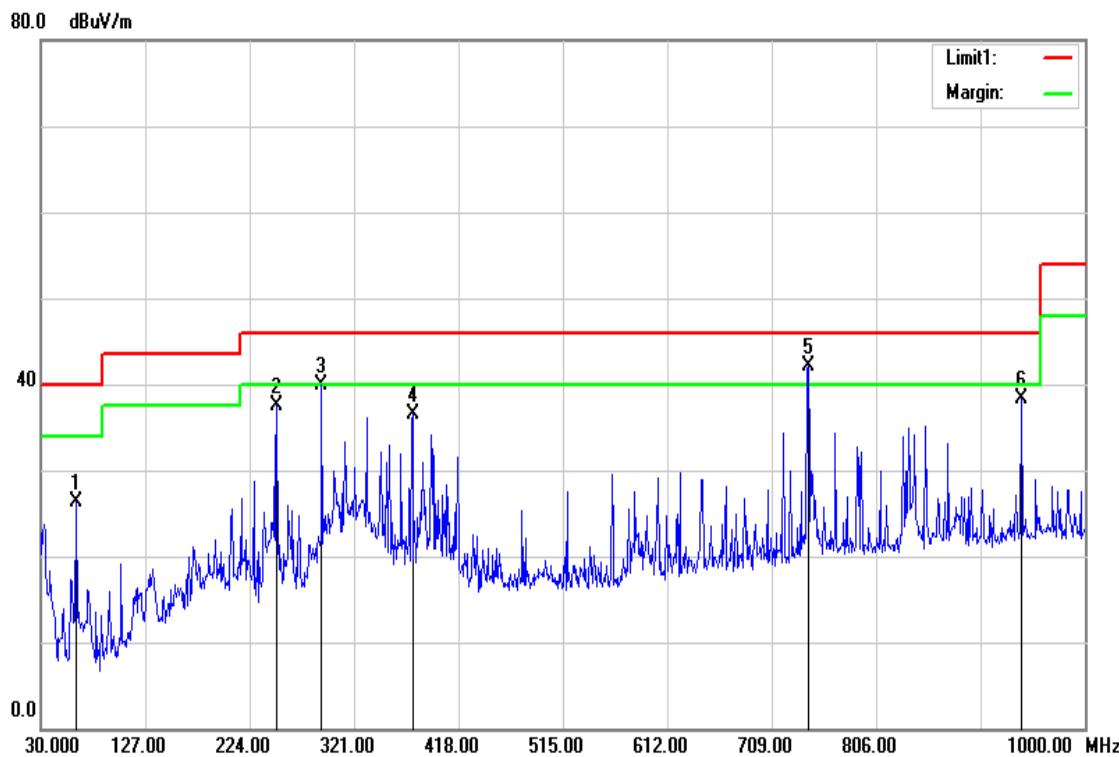


Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
42.6100	51.41	-16.84	34.57	40.00	-5.43	Peak	V
104.6900	48.72	-18.20	30.52	43.50	-12.98	Peak	V
332.6400	45.84	-13.36	32.48	46.00	-13.52	Peak	V
560.5900	47.17	-8.34	38.83	46.00	-7.17	Peak	V
742.9500	40.76	-5.08	35.68	46.00	-10.32	Peak	V
940.8300	37.45	-2.54	34.91	46.00	-11.09	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).

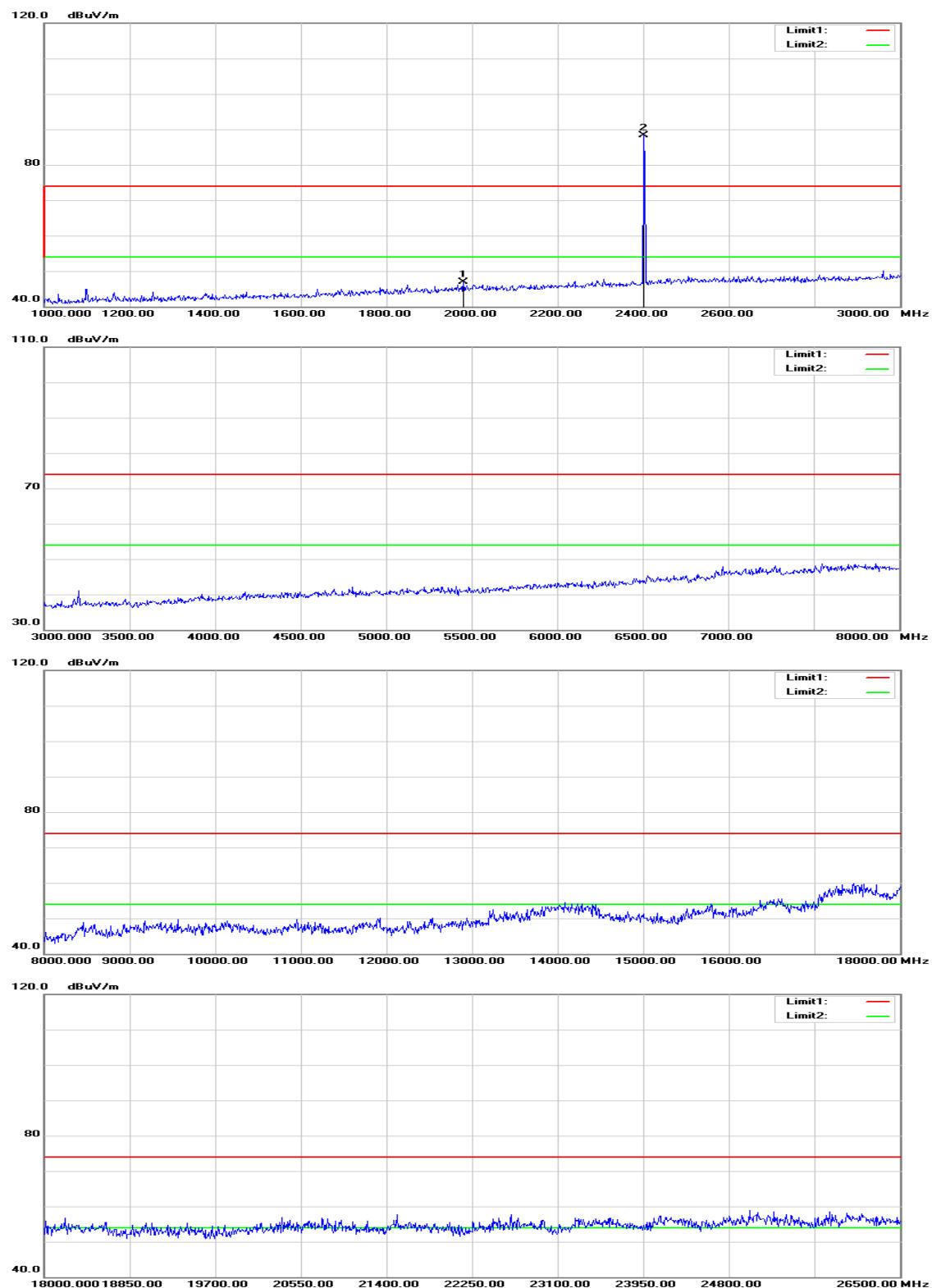
**Operation Mode:** Normal Link      **Test Date:** October 15, 2015  
**Temperature:** 27°C      **Tested by:** Jason Lu  
**Humidity:** 53% RH      **Polarity:** Hor.

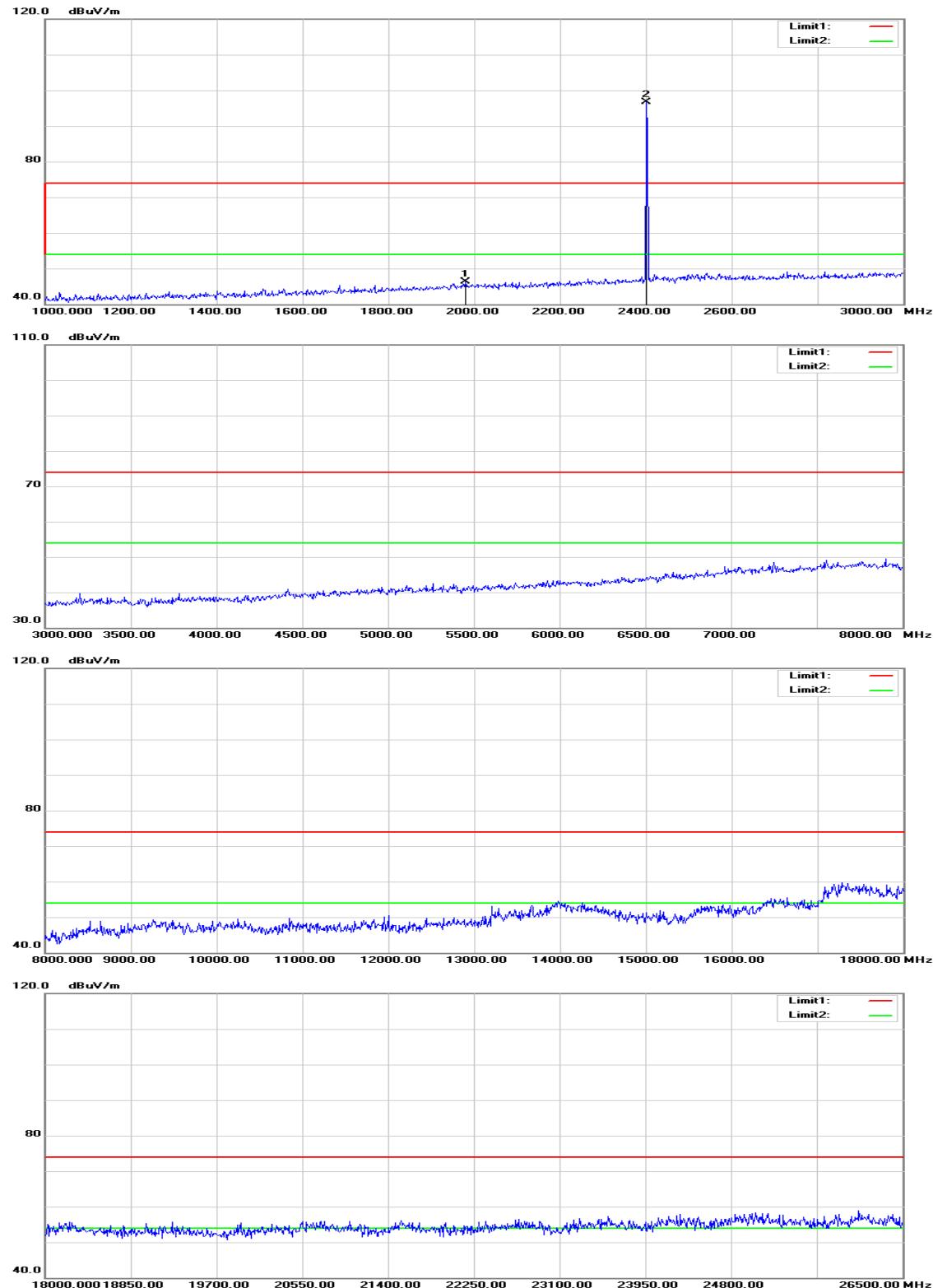


Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
62.9800	47.94	-21.70	26.24	40.00	-13.76	peak	H
249.2200	53.73	-16.30	37.43	46.00	-8.57	peak	H
290.9300	54.28	-14.41	39.87	46.00	-6.13	peak	H
375.3200	48.75	-12.29	36.46	46.00	-9.54	peak	H
742.9500	47.21	-5.08	42.13	46.00	-3.87	peak	H
940.8300	40.92	-2.54	38.38	46.00	-7.62	peak	H

**Remark:**

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).

**Above 1 GHz****TX / GFSK / DH5 / CH Low****Polarity: Vertical**

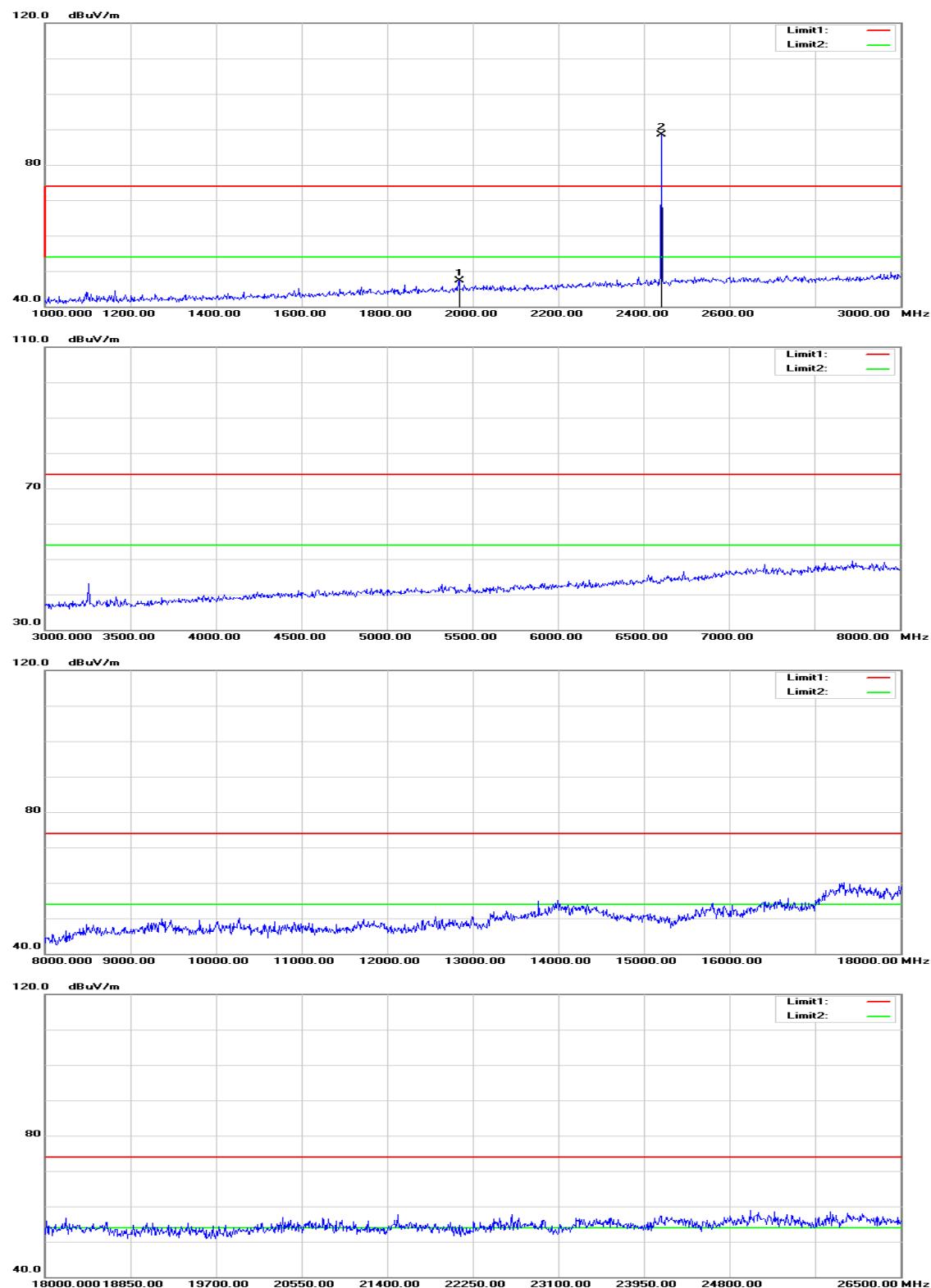
**Polarity: Horizontal**

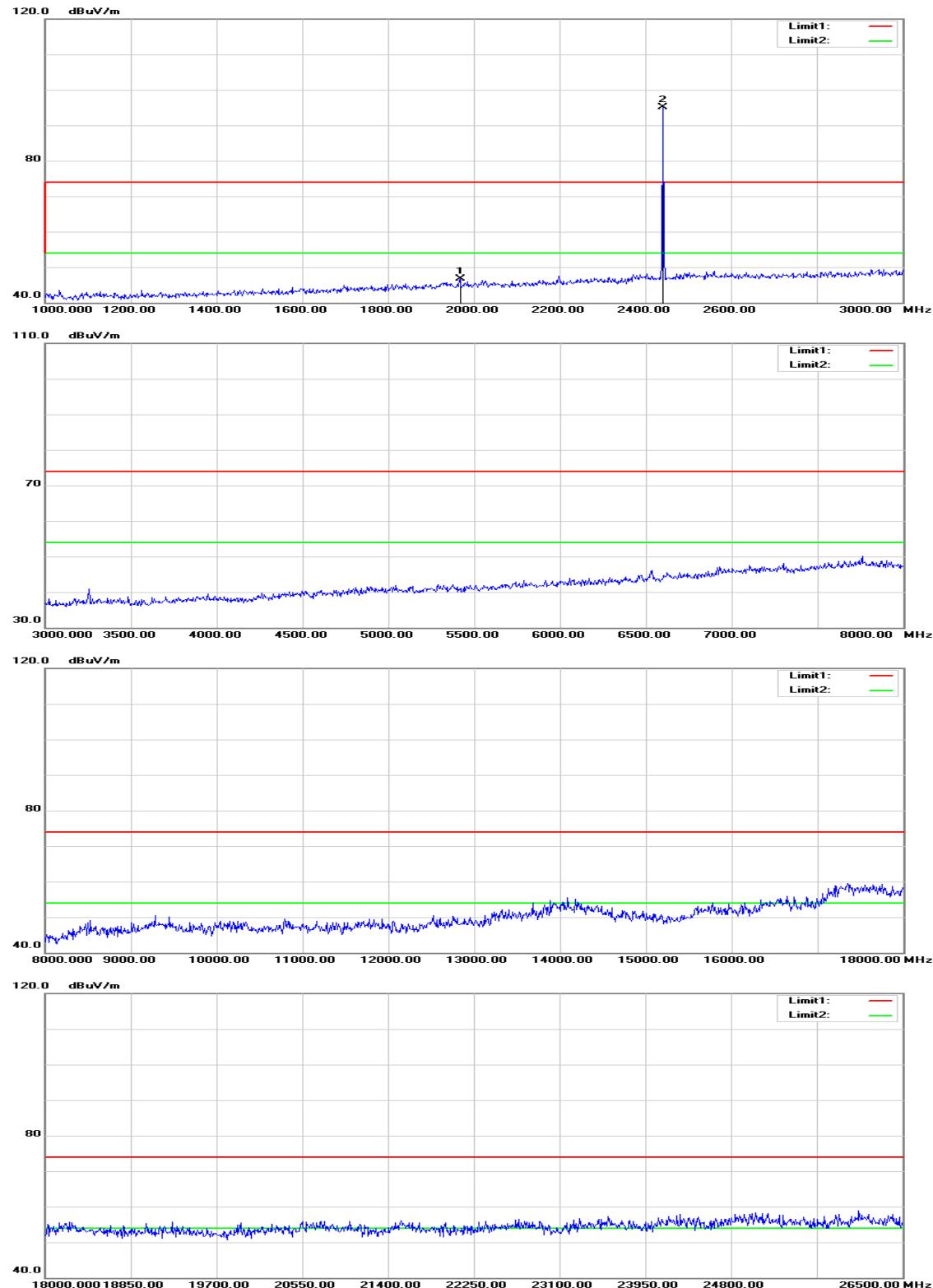
**Above 1 GHz****Operation Mode:** TX / GFSK / DH5 / CH Low**Test Date:** October 15, 2015**Temperature:** 27°C**Tested by:** Jason Lu**Humidity:** 53 % RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1980.000	50.69	-3.70	46.99	74.00	-27.01	peak	V
N/A							
1980.000	50.04	-3.70	46.34	74.00	-27.66	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 15, 2015

**Temperature:** 26°C

**Tested by:** Jason Lu

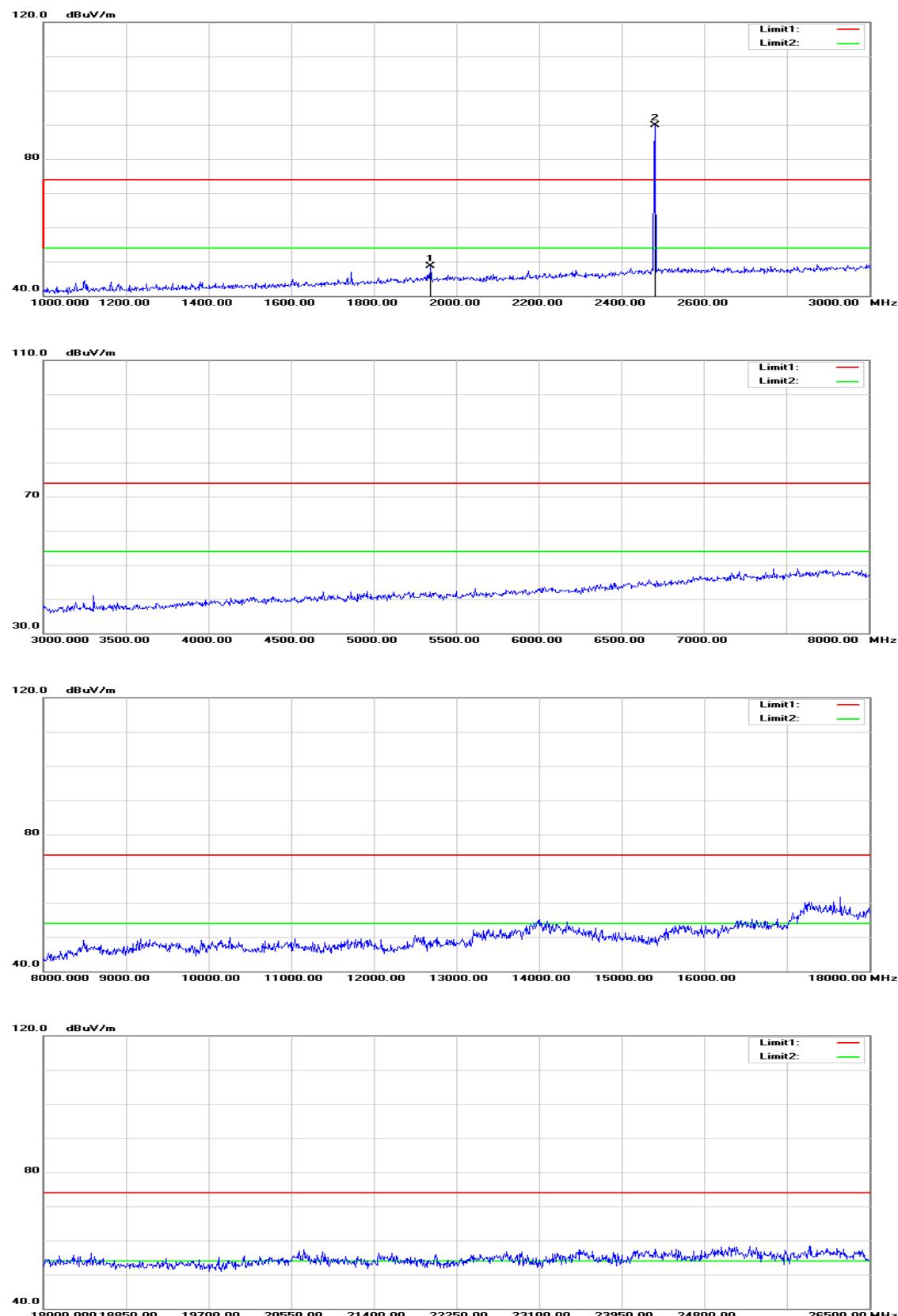
**Humidity:** 50 % RH

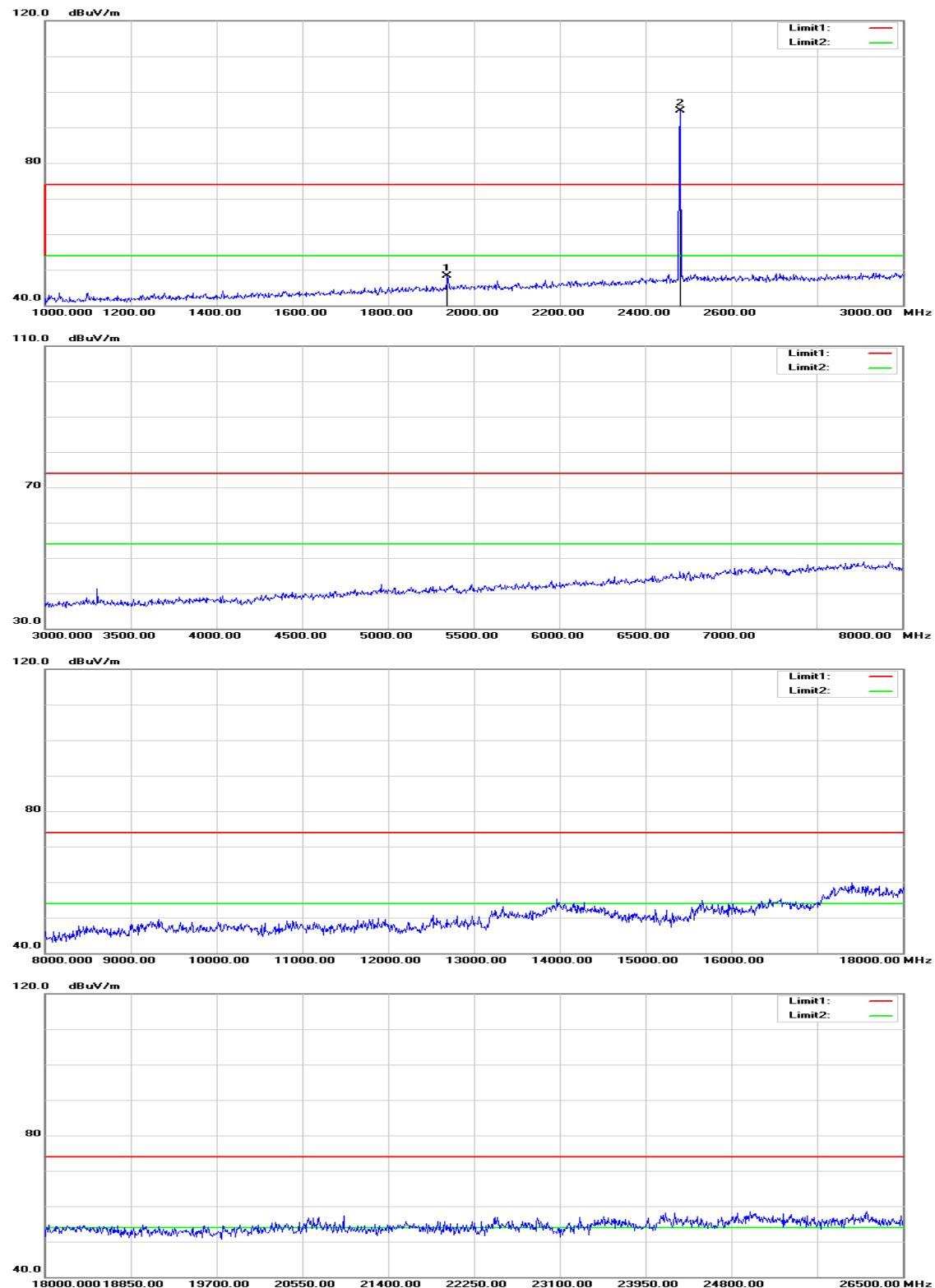
**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1968.000	50.98	-3.77	47.21	74.00	-26.79	peak	V
N/A							
1968.000	50.51	-3.77	46.74	74.00	-27.26	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 15, 2015

**Temperature:** 26°C

**Tested by:** Jason Lu

**Humidity:** 50 % RH

**Polarity:** Ver. / Hor.

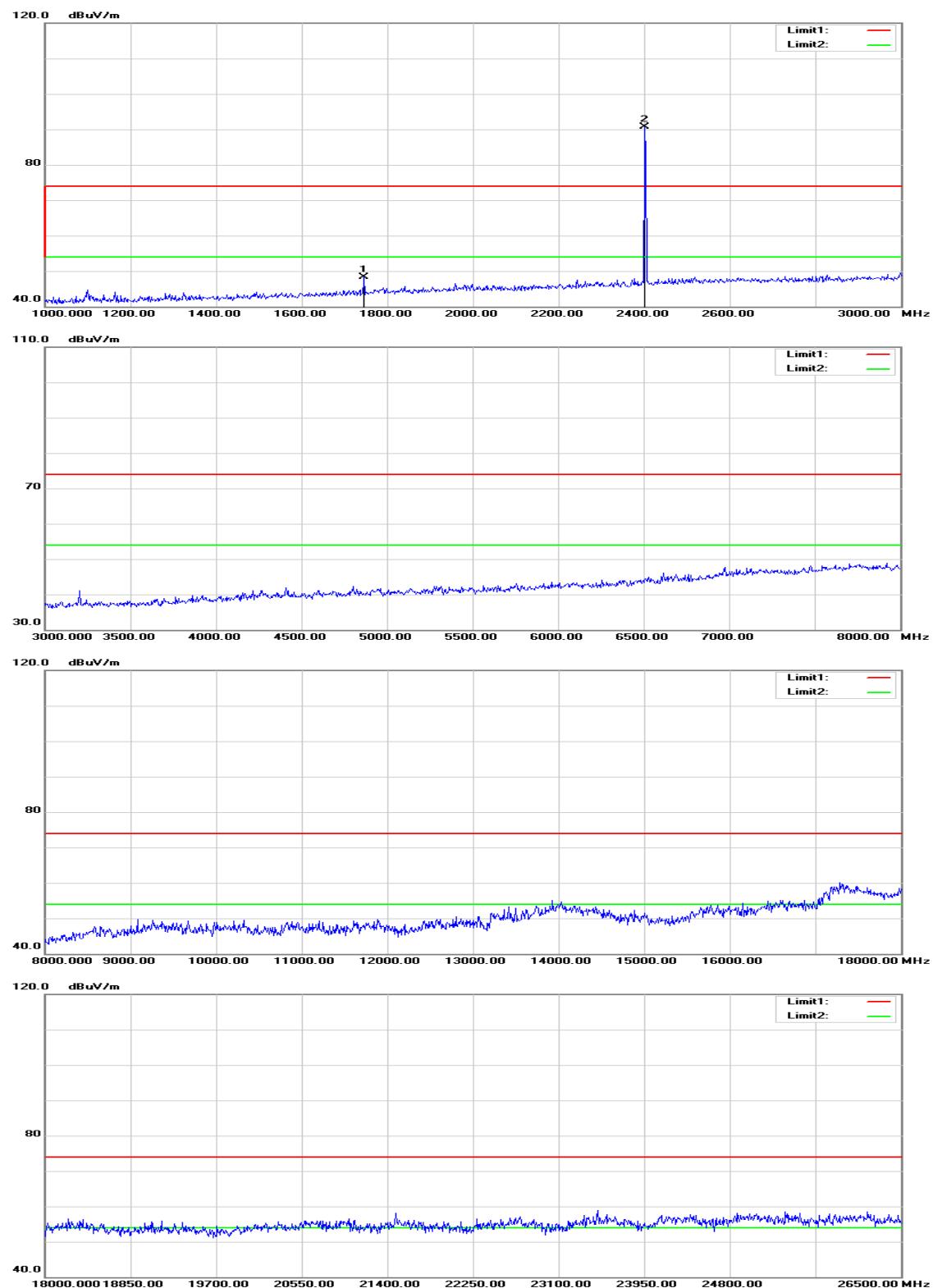
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1938.000	52.65	-3.92	48.73	74.00	-25.27	peak	V
N/A							
1938.000	52.15	-3.92	48.23	74.00	-25.77	peak	H
N/A							

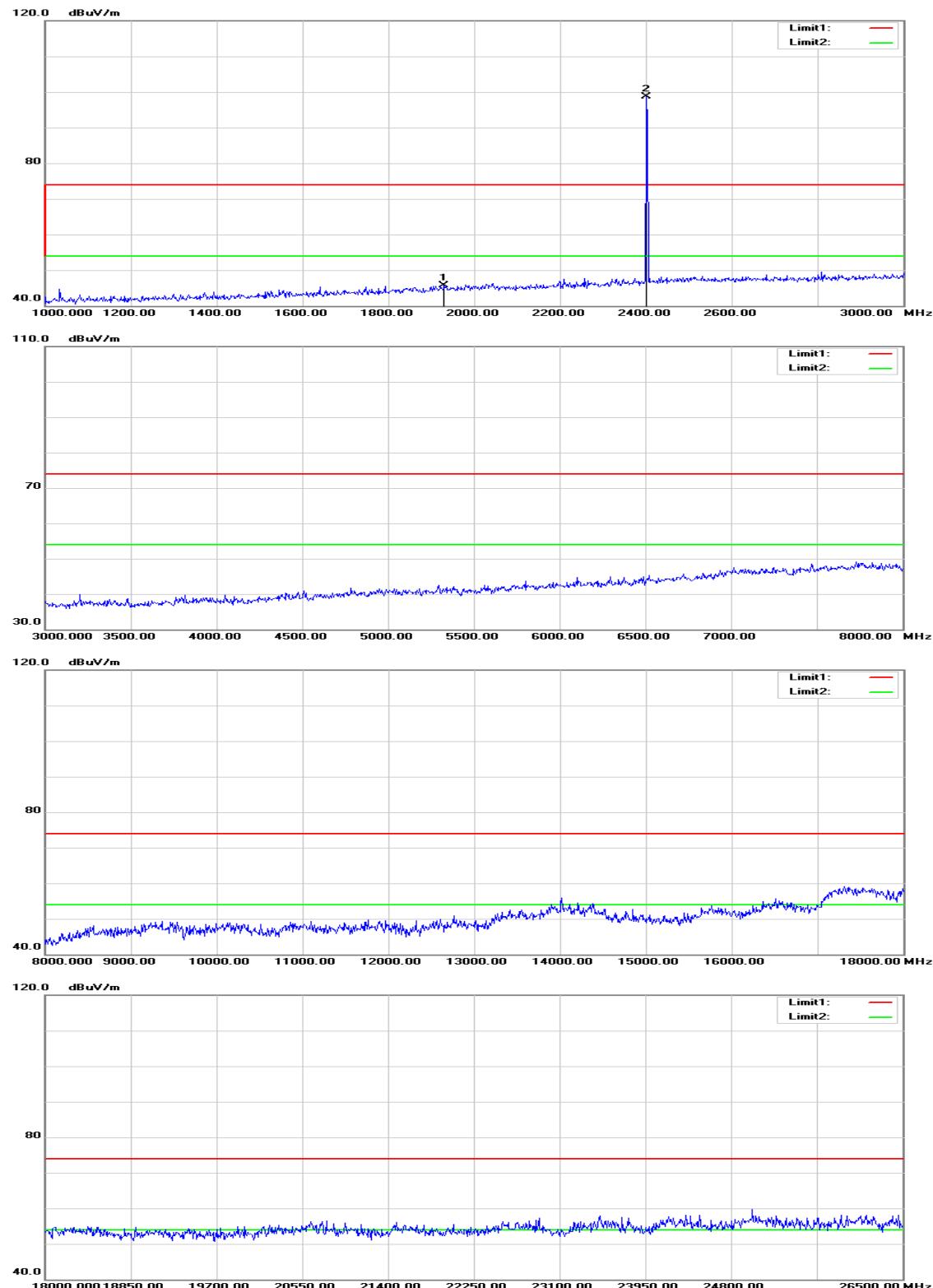
**Remark:**

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

**TX / 8DPSK / DH5 / CH Low**

**Polarity: Vertical**



**Polarity: Horizontal**

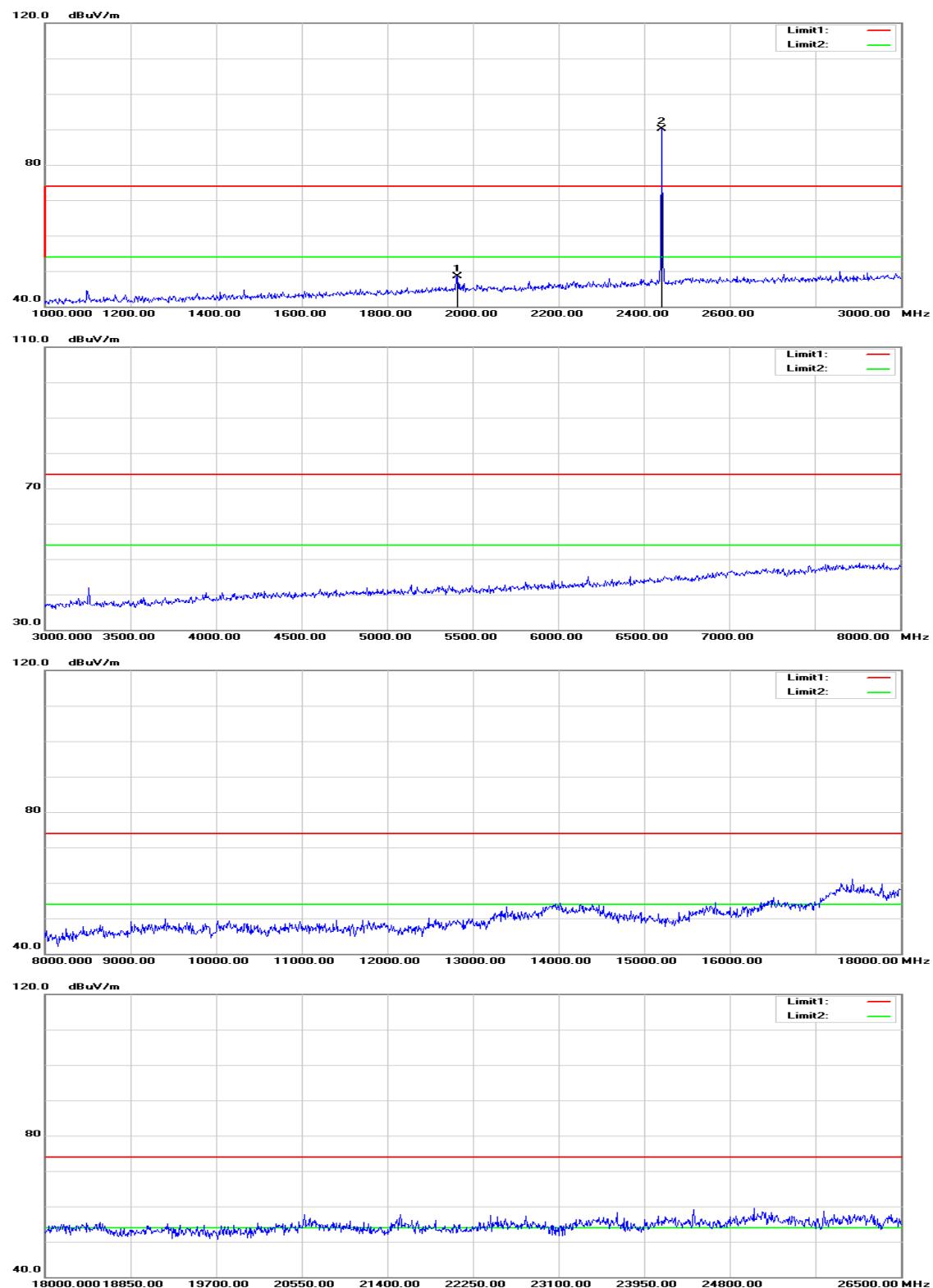
**Operation Mode:** TX / 8DPSK / DH5 / CH Low  
**Temperature:** 26°C  
**Humidity:** 50 % RH

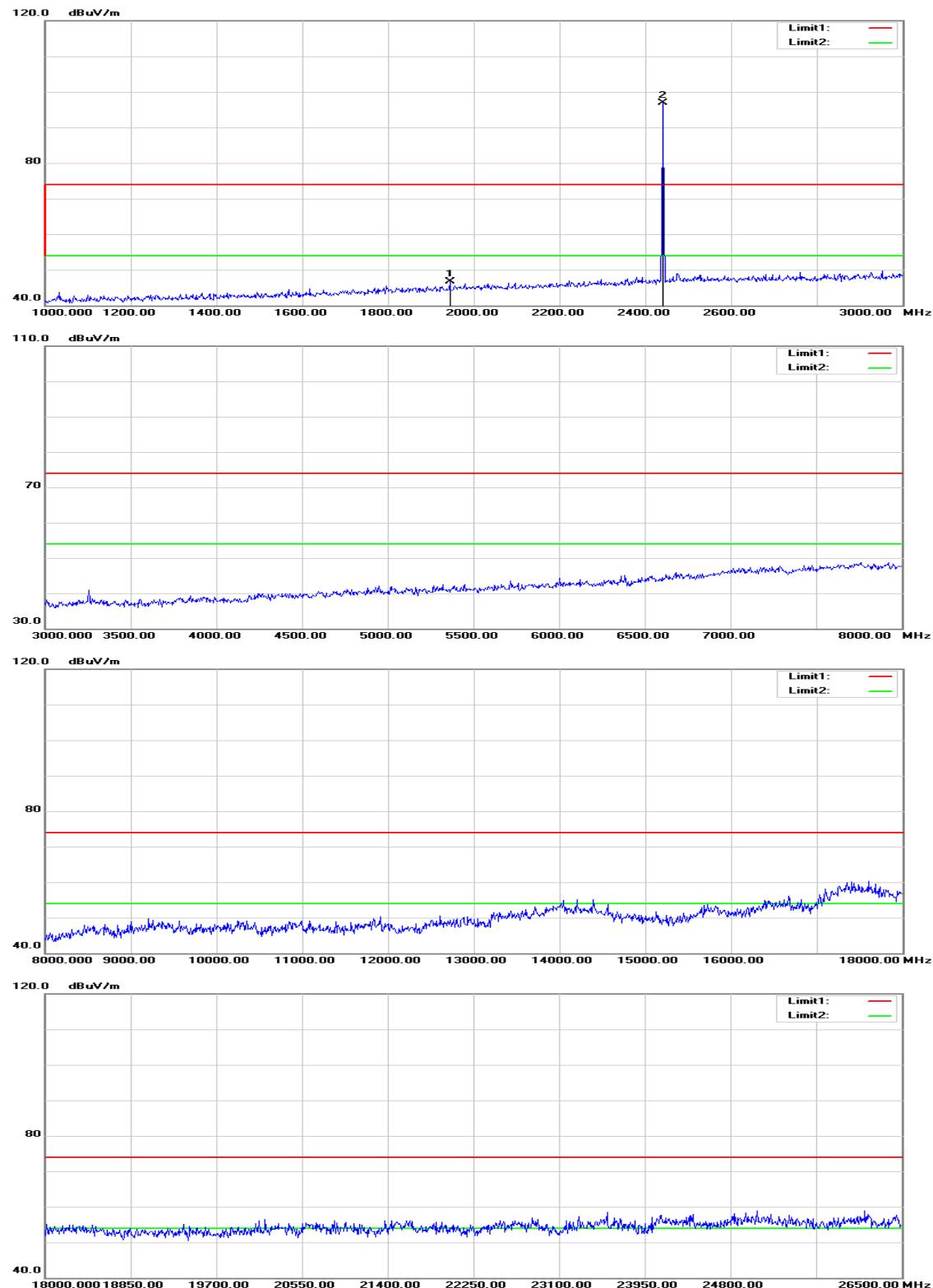
**Test Date:** October 15, 2015  
**Tested by:** Jason Lu  
**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1746.000	53.16	-4.92	48.24	74.00	-25.76	peak	V
N/A							
1930.000	49.64	-3.96	45.68	74.00	-28.32	peak	H
N/A							

**Remark:**

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

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

**Polarity: Horizontal**

**Operation Mode:** TX / 8DPSK / DH5 / CH Mid

**Test Date:** October 15, 2015

**Temperature:** 26°C

**Tested by:** Jason Lu

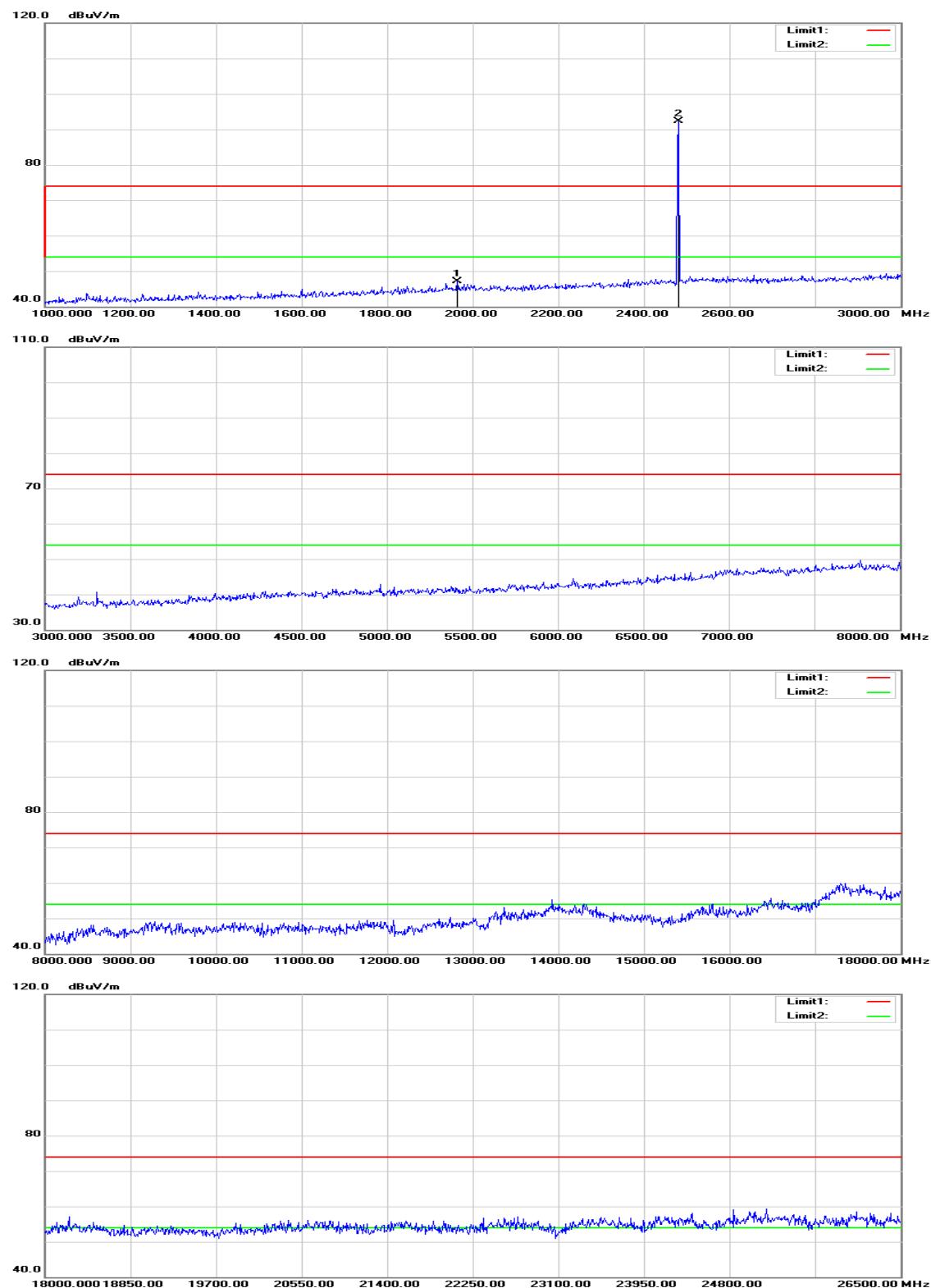
**Humidity:** 50 % RH

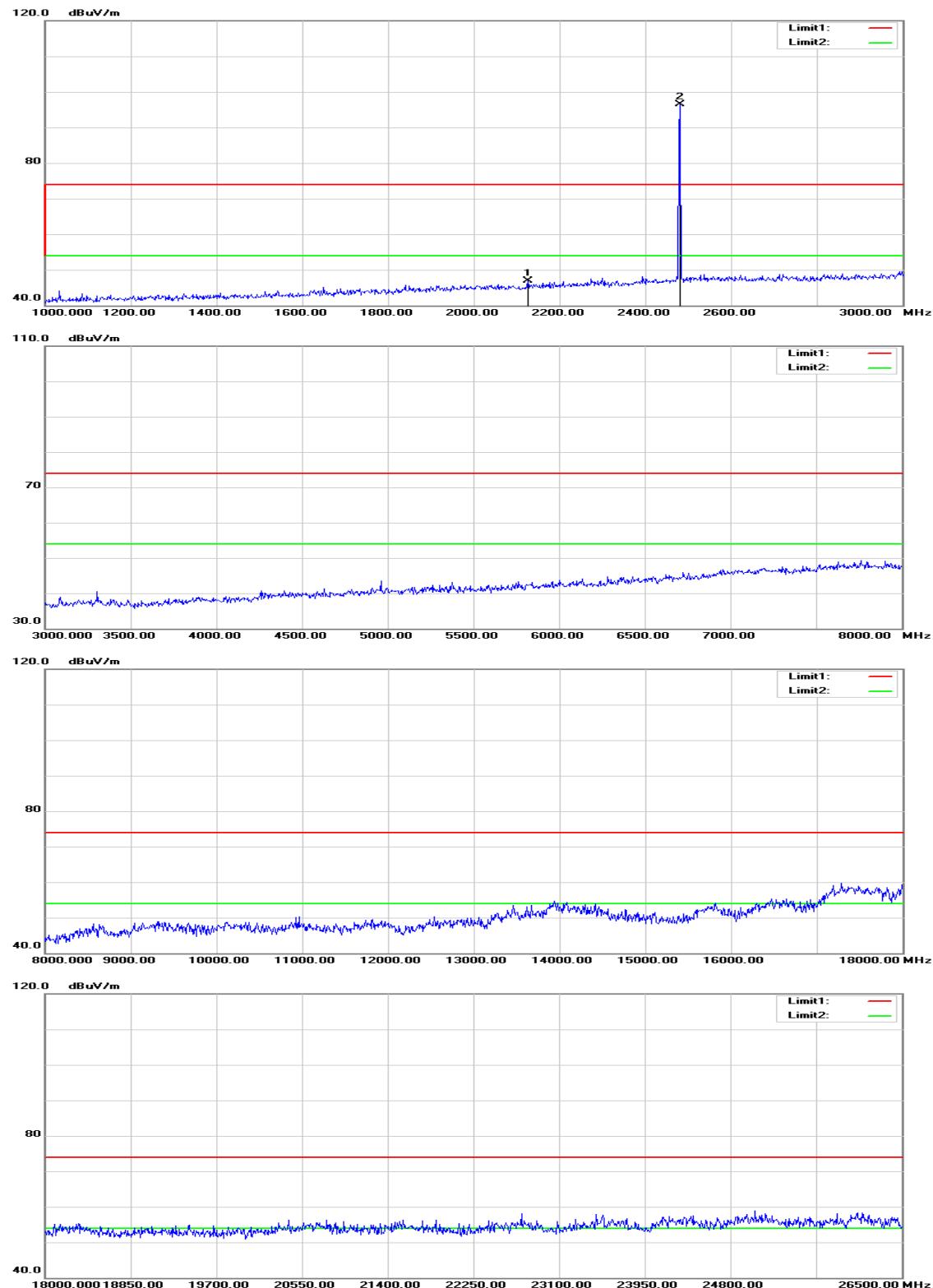
**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1964.000	52.29	-3.79	48.50	74.00	-25.50	peak	V
N/A							
1944.000	50.51	-3.89	46.62	74.00	-27.38	peak	H
N/A							

**Remark:**

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

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

**Polarity: Horizontal**

**Operation Mode:** TX / 8DPSK / DH5 / CH High

**Test Date:** October 15, 2015

**Temperature:** 26°C

**Tested by:** Jason Lu

**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)
1964.000	50.81	-3.79	47.02	74.00	-26.98	peak	V
N/A							
2126.000	50.38	-3.56	46.82	74.00	-27.18	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 §7.2.4, except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits (dB $\mu$ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

\* Decreases with the logarithm of the frequency.

### Test Configuration

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

### TEST PROCEDURE

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

### TEST RESULTS

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

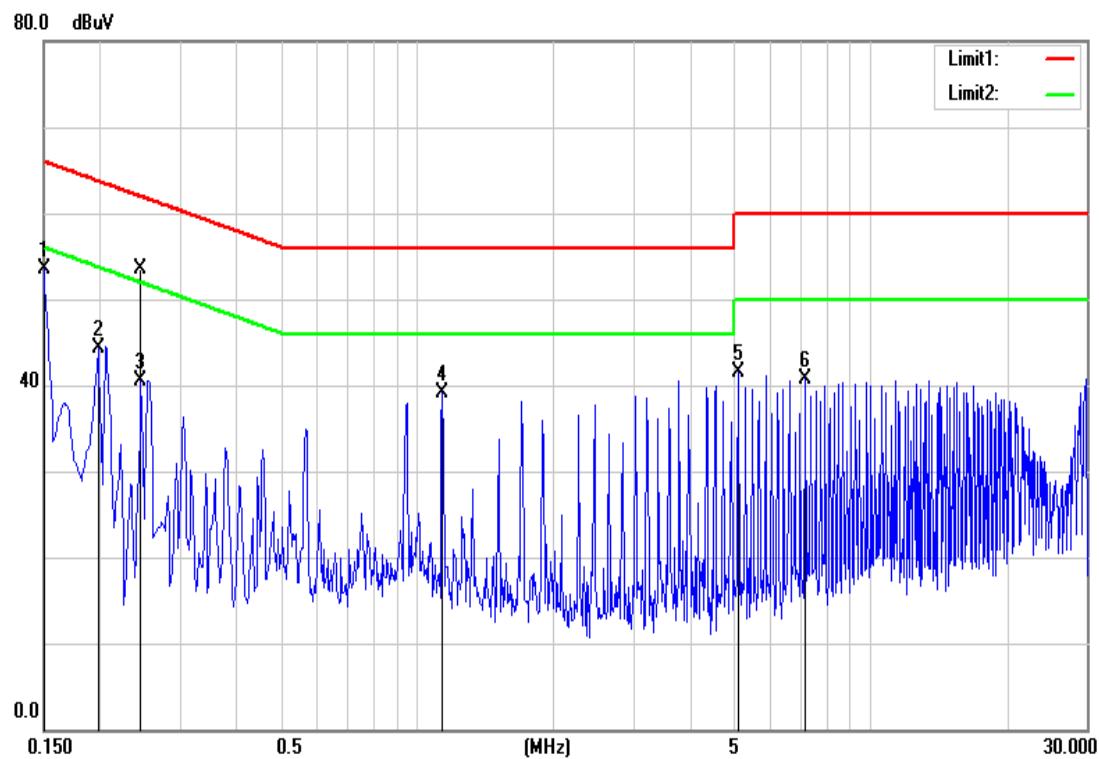
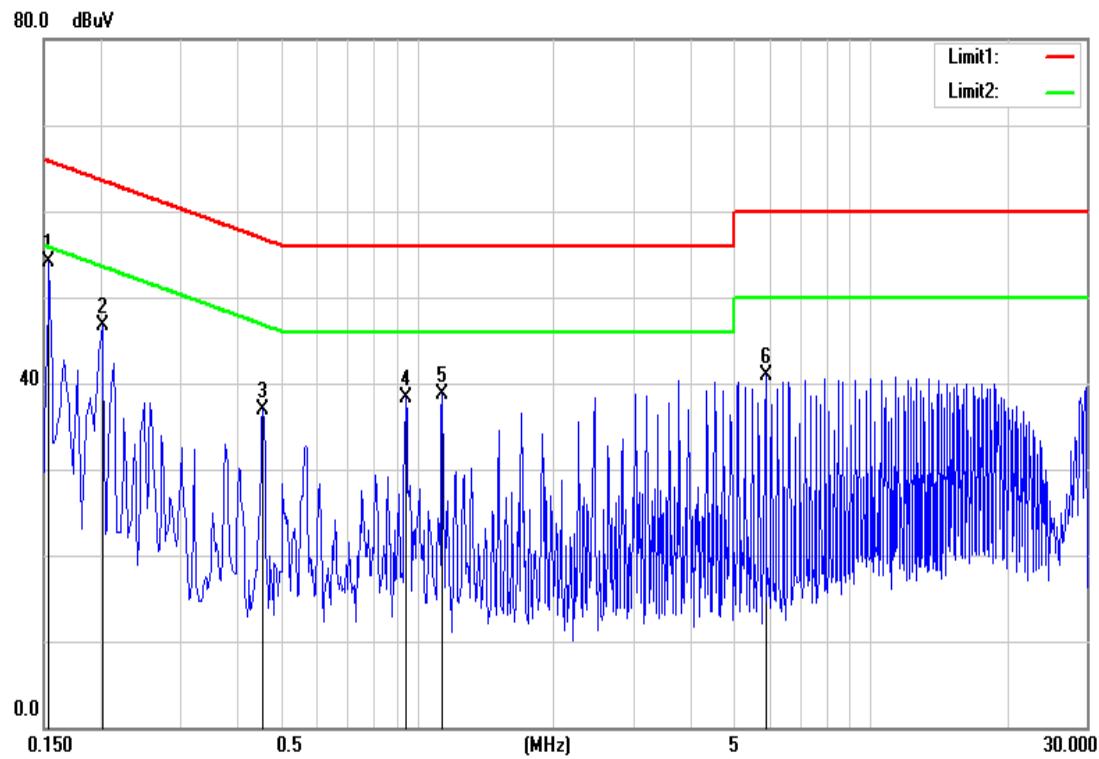
**Test Data**

**Operation Mode:** Normal Link      **Test Date:** November 3, 2015  
**Temperature:** 24°C      **Tested by:** Jason Lu  
**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	44.37	42.64	9.64	54.01	52.28	65.78	55.79	-11.77	-3.51	L1
0.2020	37.13	35.41	9.64	46.77	45.05	63.52	53.53	-16.75	-8.48	L1
0.4580	27.16	24.57	9.73	36.89	34.30	56.73	46.73	-19.84	-12.43	L1
0.9460	27.81	26.21	10.41	38.22	36.62	56.00	46.00	-17.78	-9.38	L1
1.1380	28.31	24.58	10.37	38.68	34.95	56.00	46.00	-17.32	-11.05	L1
5.8700	31.00	28.94	9.83	40.83	38.77	60.00	50.00	-19.17	-11.23	L1
0.1500	43.79	41.85	9.69	53.48	51.54	66.00	56.00	-12.52	-4.46	L2
0.1980	34.70	32.41	9.68	44.38	42.09	63.69	53.69	-19.31	-11.60	L2
0.2460	43.80	38.82	9.68	53.48	48.50	61.89	51.89	-8.41	-3.39	L2
1.1380	28.79	26.84	10.41	39.20	37.25	56.00	46.00	-16.80	-8.75	L2
5.1180	31.61	29.11	9.85	41.46	38.96	60.00	50.00	-18.54	-11.04	L2
7.2020	30.86	27.94	9.88	40.74	37.82	60.00	50.00	-19.26	-12.18	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)***

## **APPENDIX I**

### **PHOTOGRAPHS OF TEST SETUP**

#### **CONDUCTED EMISSION SETUP PHOTO**

