

FCC RADIO TEST REPORT

FCC 47 CFR PART 15 SUBPART C

Test Standard	FCC Part 15.247
FCC ID	IRJ-MT110
Product name	Mini Wireless Barcode Reader
Brand name	Marson
Model name	MT110L, MT110LM, MT110, MT110M
Test Result	Pass

The test Result was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were given in ANSI C63.10: 2013 and compliance standards.

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

The test Report of full or partial shall not copy. Without written approval of CCS. Inc.

The sample selected for test was production product and was provided by manufacturer.



Approved by:

Davis Tseng

Davis Tseng
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Reviewed by:

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Asst. Section Manager

Revision History

Rev.	Issue Date	Revisions	Revised By
00	December 28, 2016	Initial Issue	Doris Chu
01	March 7, 2017	1. Modify Remark in page 4. 2. Modify calibration date in page 7. 3. Modify section 1.1 Output Power in page 20. 4. Modify section 4.8.2 Test Procedure in page 34. 5. Modify section 3.2 in page 11.	Doris Chu
02	March 20, 2017	1. Modify section 2 2. TEST SUMMERY in page 9. 2. Modify section 4.3.1 Test Limit in page 19. 3. Modify section 4.4.1 Test Limit in page 21. 4. Modify section 4.5.1 Test Limit in page 24. 5. Add remark in page 34. 6. Revise Setup Photo in page 59 & 60. 7. Add test setup photos in page 8. 8. Re-test radiation for below 1GHz.	Doris Chu
03	March 22, 2017	1. Modify Date of Test in section 1.1 in page 4. 2. Modify Support Equipment in section 1.7 in page 8. 3. Revise section 4.1 test data in page 14, 15.	Doris Chu

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1. GENERAL INFORMATION

1.1 EUT INFORMATION

Applicant	Marson Technology Co., Ltd.		
Applicant Address	9F, No. 108-3, Mincyuan Rd., Sindian Dist., New Taipei City 23141 Taiwan R.O.C.		
Equipment	Mini Wireless Barcode Reader		
Model Name	MT110L, MT110LM, MT110, MT110M		
Model Discrepancy	Mode Iname	Color	Module
	MT110L	Black	Laser module
	MT110LM	White	
	MT110	Black	LED module
	MT110M	White	
EUT Functions	BT2.1+EDR		
Received Date	Dec 15, 2016		
Date of Test	Dec 20, 2016 ~ Mar 21, 2017		
Output Power(W)	GFSK : 0.0035 W $\pi/4$ -DQPSK : 0.0023 W 8DPSK : 0.0024 W		
Power Operation	☐ AC 120V/60Hz ☐ Adapter ☐ PoE ☒ Host system : ☐ DC Type : ☒ Battery ☐ DC Power Supply ☐ External DC adapter		

Remark:

Due to similarity of RF product constructions of given model series, only dedicated model as described in test report with the most complexity constructions was selected for testing and record.

1.2 EUT CHANNEL INFORMATION

Frequency Range	2402MHz-2480MHz
Modulation Type	1. GFSK for BR-1Mbps 2. $\pi/4$ -DQPSK for EDR-2Mbps 3. 8DPSK for EDR-3Mbps
Number of channel	79 Channels

Remark:

Refer as ANSI 63.10:2013 clause 5.6.1 Table 4 for test channels

Number of frequencies to be tested		
Frequency range in which device operates	Number of frequencies	Location in frequency range of operation
☐ 1 MHz or less	1	Middle
☐ 1 MHz to 10 MHz	2	1 near top and 1 near bottom
☒ More than 10 MHz	3	1 near top, 1 near middle, and 1 near bottom

1.3 ANTENNA INFORMATION

Antenna Category	☒ Integral: antenna permanently attached ☐ External dedicated antennas ☐ External Unique antenna connector
Antenna Type	☐ PIFA(Printed) ☐ PCB ☐ Dipole ☒ Chip ☐ Coils
Antenna Gain	2.66 dBi

1.4 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 30 to 1000 MHz	+/- 3.97
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 1 to 18GHz	+/- 3.58
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 18 to 26 GHz	+/- 3.59
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 26 to 40 GHz	+/- 3.81
Conducted Emission (Mains Terminals), 9kHz to 30MHz	+/- 2.48

Remark:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$
2. ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report.

1.5 FACILITIES AND TEST LOCATION

All measurement facilities used to collect the measurement data are located at
No.989-1, Wenshan Rd., Shangshan Village, Qionglin Township, Hsinchu County 30741,
Taiwan (R.O.C.)

Test site	Test Engineer	Remark
AC Conduction Room	ED Chiang	
Radiation	ED Chiang	
RF Conducted	ED Chiang	

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

1.6 INSTRUMENT CALIBRATION

RF Conducted Test Site					
Equipment	Manufacturer	Model	S/N	Cal Date	Cal Due
Spectrum Analyzer 10Hz-40GHz	R&S	FSV 40	101073	08/01/2016	07/31/2017

3M 966 Chamber Test Site					
Equipment	Manufacturer	Model	S/N	Cal Date	Cal Due
Bi-log Antenna	TESEQ	CBL 6112D	35403	07/03/2016	07/02/2017
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-778	07/15/2016	07/14/2017
Horn Antenna	ETS • LINDGREN	3117	00078733	11/17/2016	11/16/2017
EMI Test Receiver	ROHDE & SCHWARZ	ESCI	100221	04/27/2016	04/26/2017
Horn Antenna	COM-POWER	AH-840	03077	12/02/2016	12/01/2017
Loop Antenna	COM-POWER	AL-130	121060	05/24/2016	05/23/2017
Preamplifier	Agilent	8447D	2944A10052	07/13/2016	07/12/2017
Preamplifier	Agilent	8449B	3008A01916	07/13/2016	07/12/2017
PSA Series Spectrum Analyzer	Agilent	E4446A	MY46180323	04/13/2016	04/12/2017

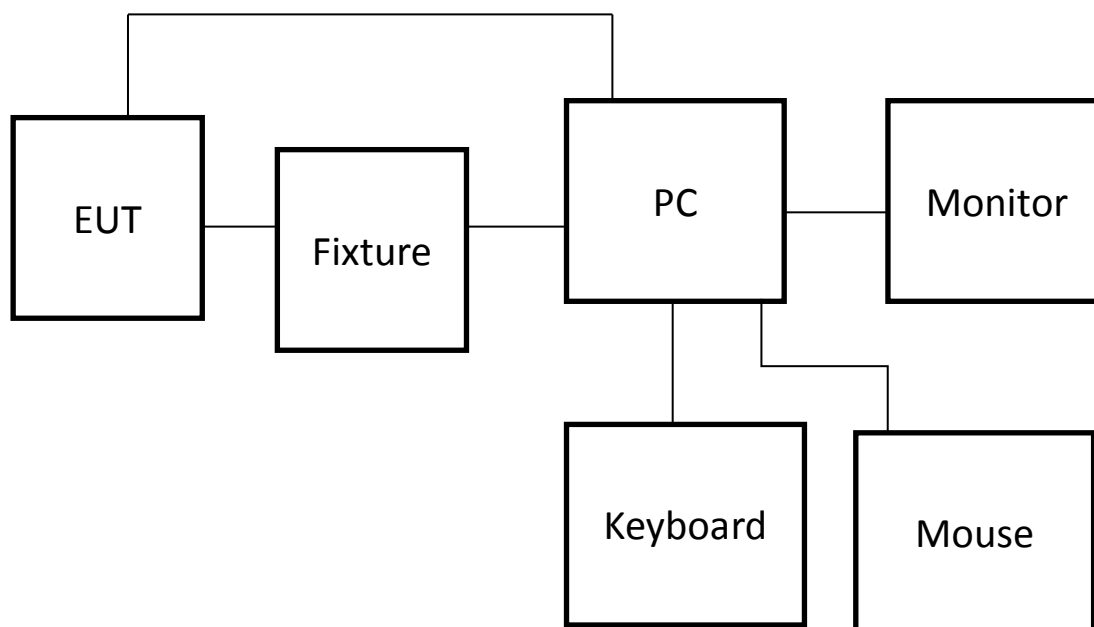
AC Conducted Emissions Test Site					
Equipment	Manufacturer	Model	S/N	Cal Date	Cal Due
EMI Test Receiver	ROHDE & SCHWARZ	ESHS 30	838550/003	10/26/2016	10/25/2017
LISN	SCHWARZBECK	NSLK 8127	8127465	07/29/2016	07/28/2017

Remark: Each piece of equipment is scheduled for calibration once a year.

1.7 SUPPORT AND EUT ACCESSORIES EQUIPMENT

EUT Accessories Equipment					
No.	Equipment	Brand	Model	Series No.	FCC ID
	N/A				

Support Equipment					
No.	Equipment	Brand	Model	Series No.	FCC ID
1	PC	HP	HP Compag dc5850	N/A	DoC
2	Monitor	Samsung	713N	N/A	DoC
3	KeyBoard	DELL	SK-8115	N/A	DoC
4	Mouse	DELL	M-UAL-96	N/A	DoC



1.8 Test methodology and applied standards

The test methodology, setups and results comply with all requirements in accordance with ANSI C63.10:2013, FCC Part 2, FCC Part 15.247

1.9 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: TW0240

2. TEST SUMMERY

FCC Standard Sec.	Report Sec.	Test Item	Result
15.203	1.2	Antenna Requirement	Pass
15.207	4.1	AC Conducted Emission	Pass
15.247(a)(1)	4.2	20 dB Bandwidth	Pass
-	4.2	Occupied Bandwidth (99%)	-
15.247(a)(1)	4.3	Output Power Measurement	Pass
15.247(a)(1)	4.4	Frequency Separation	Pass
15.247(a)(1)(iii)	4.5	Number of Hopping	Pass
15.247(d)	4.6	Conducted Band Edge	Pass
15.247(d)	4.6	Conducted Emission	Pass
15.247(a)(1)(iii)	4.7	Time of Occupancy (Dwell time)	Pass
15.247(d)	4.8	Radiation Band Edge	Pass

3. DESCRIPTION OF TEST MODES

3.1 THE WORST MODE OF OPERATING CONDITION

Operation mode	GFSK for BR-1Mbps (DH5) $\pi/4$ -DQPSK for EDR-2Mbps (DH5) 8DPSK for EDR-3Mbps (DH5)
Test Channel Frequencies	GFSK for BR-1Mbps: 1.Lowest Channel : 2402MHz 2.Middle Channel : 2441MHz 3.Highest Channel : 2480MHz $\pi/4$-DQPSK for EDR-2Mbps: 1.Lowest Channel : 2402MHz 2.Middle Channel : 2441MHz 3.Highest Channel : 2480MHz 8DPSK for EDR-3Mbps: 1.Lowest Channel : 2402MHz 2.Middle Channel : 2441MHz 3.Highest Channel : 2480MHz

Remark:

1. EUT pre-scanned data rate of output power for each mode, the worst data rate were recorded in this report.

3.2 THE WORST MODE OF MEASUREMENT

Worst Mode			
Mode	Data Rate	Maximum Peak Conducted Output Power (dBm)	Worst Mode
BR(GFSK)	1 Mbps	8.47	V
EDR(DQPSK)	2 Mbps		
EDR(8PSK)	3 Mbps	6.79	V

AC Power Line Conducted Emission	
Test Condition	AC Power line conducted emission for line and neutral
Voltage/Hz	120V/60Hz
Test Mode	Mode 1:EUT power by host system
Worst Mode	☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ☐ Mode 4

Radiated Emission Measurement Above 1G	
Test Condition	Band edge, Emission for Unwanted and Fundamental
Voltage/Hz	120V/60Hz
Test Mode	Mode 1:EUT power by host system
Worst Mode	☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ☐ Mode 4
Worst Position	☐ Placed in fixed position. ☒ Placed in fixed position at X-Plane (E2-Plane) ☐ Placed in fixed position at Y-Plane (E1-Plane) ☐ Placed in fixed position at Z-Plane (H-Plane)
Worst Polarity	☒ Horizontal ☐ Vertical

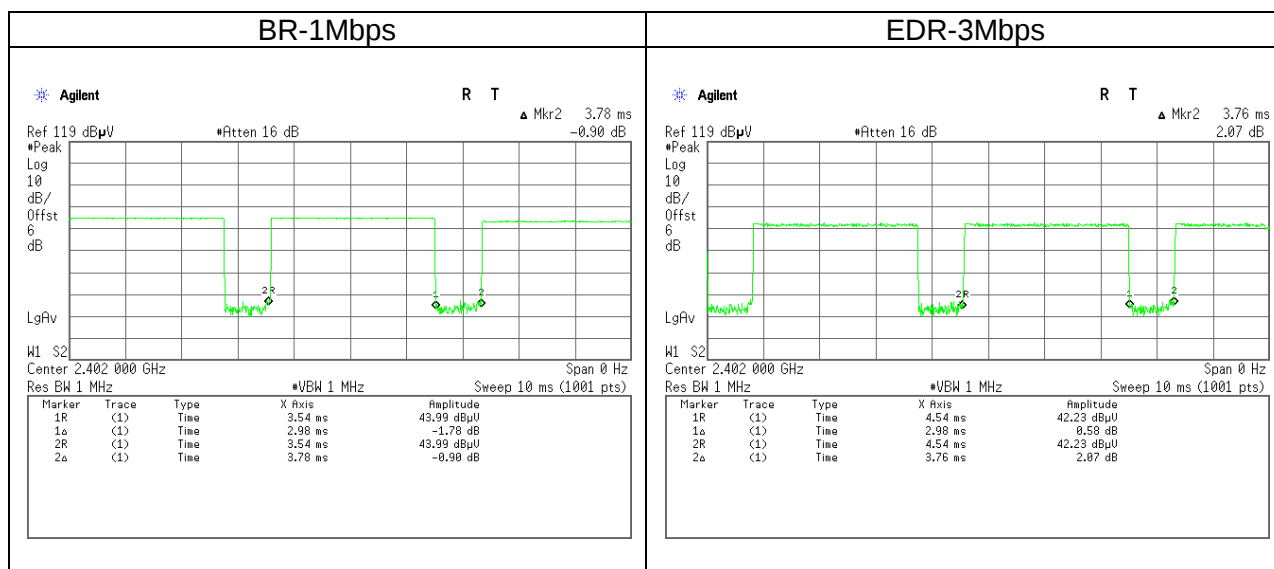
Radiated Emission Measurement Below 1G	
Test Condition	Radiated Emission Below 1G
Voltage/Hz	120V/60Hz
Test Mode	Mode 1:EUT power by host system Mode 2:EUT power by Battery
Worst Mode	☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ☐ Mode 4

Remark:

1. The worst mode was record in this test report.
2. EUT pre-scanned in three axis ,X, Y, Z and two polarity, Horizontal and Vertical for radiated measurement. The worst case(Y-Plane and Horizontal) were recorded in this report.
3. For AC power line conducted emission and below 1G radiation emission were performed the EUT transmit at the highest output power channel as worse case.

3.3 EUT DUTY CYCLE

Duty Cycle				
Configuration	TX ON (ms)	TX ALL (ms)	Duty Cycle (%)	Duty Factor(dB)
BR-1Mbps	2.98	3.78	79.03	1.02
EDR-3Mbps	2.98	3.76	80.05	0.96



4. TEST RESULT

4.1 AC POWER LINE CONDUCTED EMISSION

4.1.1 Test Limit

According to §15.207(a),

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

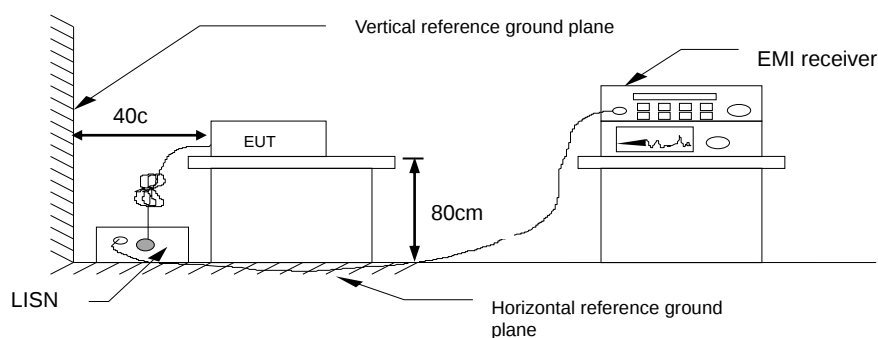
* Decreases with the logarithm of the frequency.

4.1.2 Test Procedure

Test method Refer as ANSI 63.10:2013 clause 6.2,

1. The EUT was placed on a non-conducted table, which is 0.8m above horizontal ground plane and 0.4m above vertical ground plane.
2. EUT connected to the line impedance stabilization network (LISN)
3. Receiver set RBW of 9kHz and Detector Peak, and note as quasi-peak and average.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. Recorded Line for Neutral and Line.

4.1.3 Test Setup

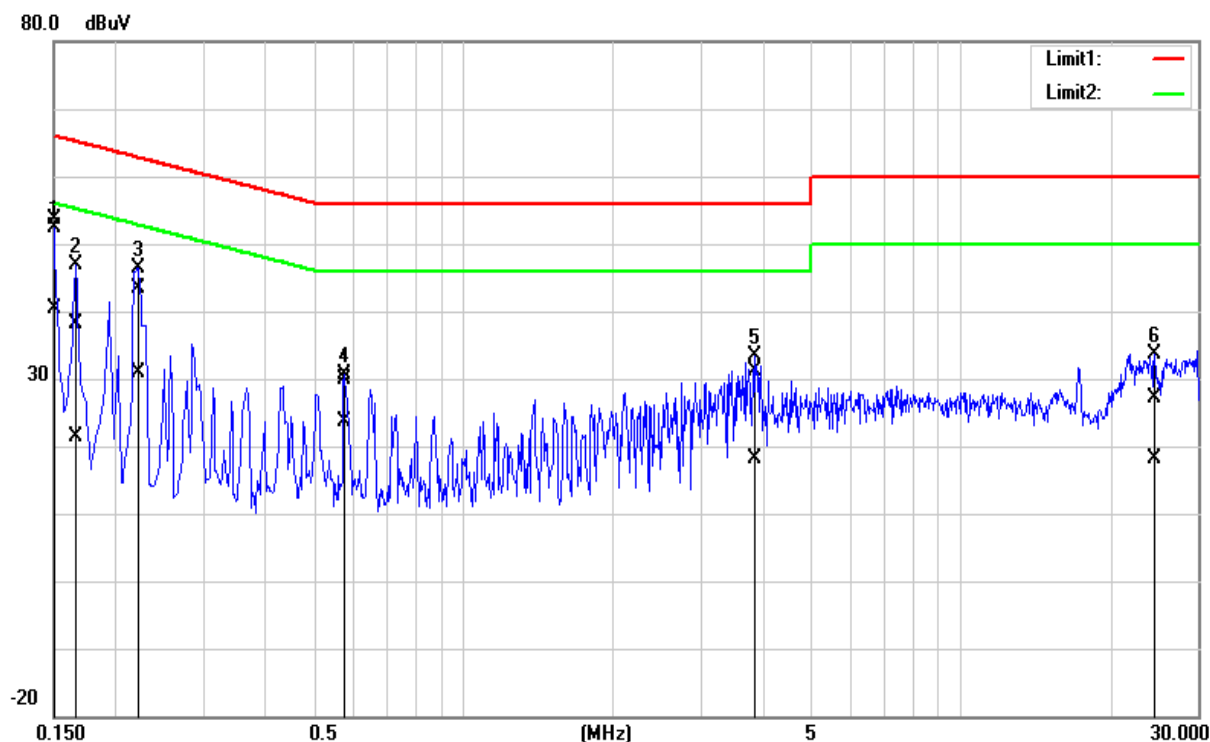


4.1.4 Test Result

Pass.

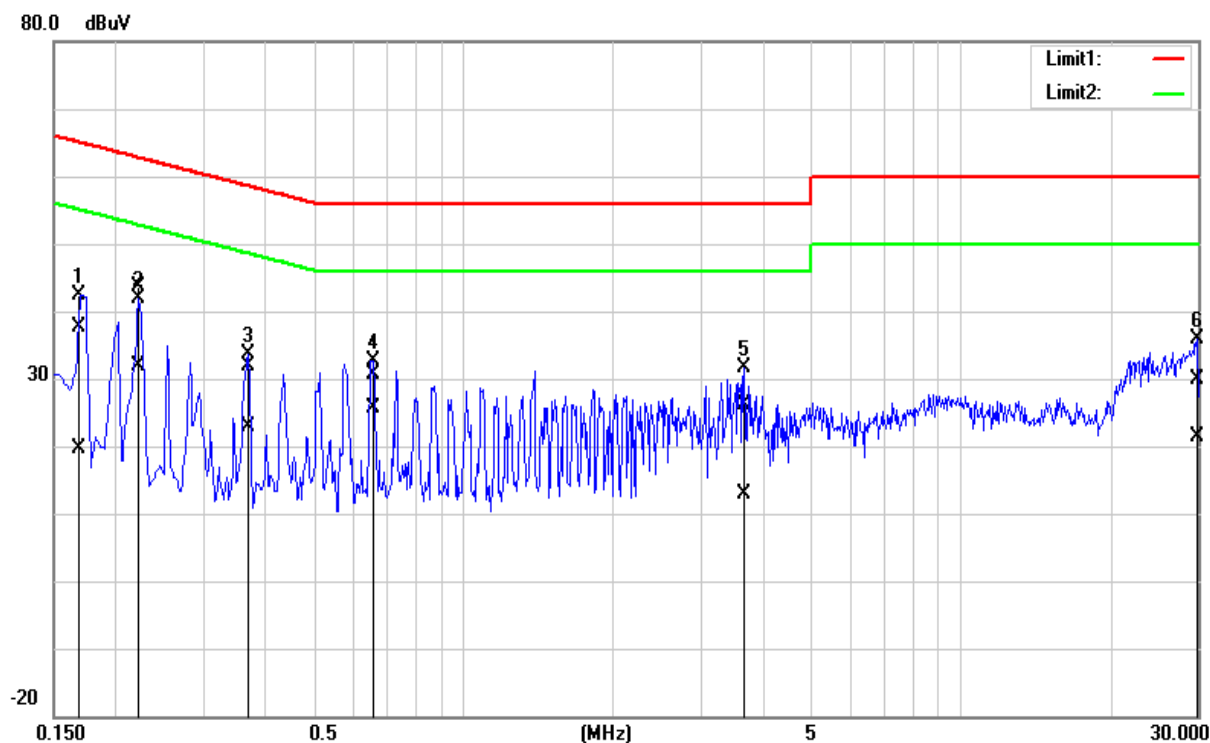
Test Data

Test Mode	Mode 1	Temp/Hum	24(°C)/ 50%RH
Test Voltage	120Vac / 60Hz	Test Date	Mar 21, 2017
Phase	Line	Test Engineer	ED Chiang



Frequency (MHz)	Quasi Peak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	Quasi Peak result (dBuV)	Average result (dBuV)	Quasi Peak limit (dBuV)	Average limit (dBuV)	Quasi Peak margin (dB)	Average margin (dB)	Remark
0.1500	43.90	30.72	9.71	53.61	40.43	66.00	56.00	-12.39	-15.57	Pass
0.1660	28.46	11.57	9.71	38.17	21.28	65.16	55.16	-26.99	-33.88	Pass
0.2220	33.57	21.20	9.70	43.27	30.90	62.74	52.74	-19.47	-21.84	Pass
0.5780	20.18	13.94	9.70	29.88	23.64	56.00	46.00	-26.12	-22.36	Pass
3.8780	21.39	8.34	9.74	31.13	18.08	56.00	46.00	-24.87	-27.92	Pass
24.5540	17.31	8.34	9.83	27.14	18.17	60.00	50.00	-32.86	-31.83	Pass

Test Mode	Mode 1	Temp/Hum	27(°C)/ 53%RH
Test Voltage	120Vac / 60Hz	Test Date	Mar 21, 2017
Phase	Neutral	Test Engineer	ED Chiang



Frequency (MHz)	Quasi Peak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	Quasi Peak result (dBuV)	Average result (dBuV)	Quasi Peak limit (dBuV)	Average limit (dBuV)	Quasi Peak margin (dB)	Average margin (dB)	Remark
0.1700	27.84	9.88	9.78	37.62	19.66	64.96	54.96	-27.34	-35.30	Pass
0.2220	33.94	22.10	9.77	43.71	31.87	62.74	52.74	-19.03	-20.87	Pass
0.3700	22.19	13.24	9.76	31.95	23.00	58.50	48.50	-26.55	-25.50	Pass
0.6580	20.91	15.78	9.76	30.67	25.54	56.00	46.00	-25.33	-20.46	Pass
3.6620	16.40	2.97	9.82	26.22	12.79	56.00	46.00	-29.78	-33.21	Pass
29.9220	19.39	11.12	10.38	29.77	21.50	60.00	50.00	-30.23	-28.50	Pass

4.2 20DB BANDWIDTH AND OCCUPIED BANDWIDTH (99%)

4.2.1 Test Limit

According to §15.247(a)(1)

20 dB Bandwidth : For reporting purposes only.

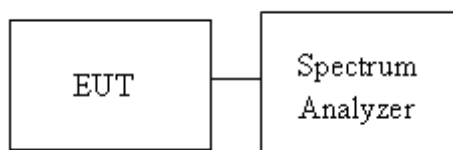
Occupied Bandwidth(99%) : For reporting purposes only.

4.2.2 Test Procedure

Test method Refer as ANSI 63.10:2013 clause 6.9.2,

1. The EUT RF output connected to the spectrum analyzer by RF cable.
2. Setting maximum power transmit of EUT
3. SA set RBW = 30kHz, VBW = 100kHz and Detector = Peak, to measurement 20 dB Bandwidth and 99% Bandwidth.
4. Measure and record the result of 20 dB Bandwidth and 99% Bandwidth. in the test report.

4.2.3 Test Setup

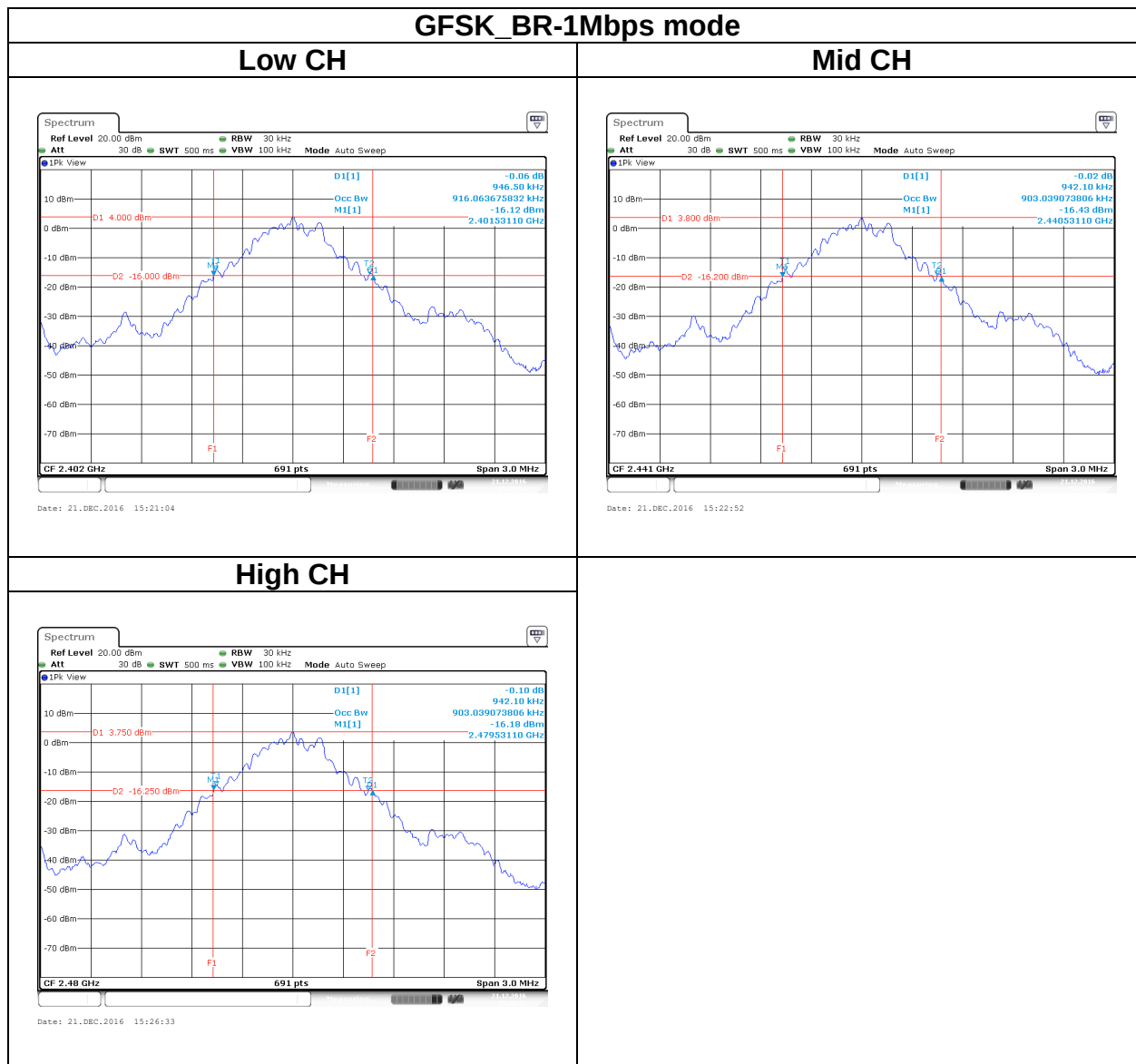


4.2.4 Test Result

Test mode: GFSK_BR-1Mbps mode / 2402-2480 MHz			
Channel	Frequency (MHz)	OBW (99%) (MHz)	20dB BW (MHz)
Low	2402	0.9160	0.9465
Mid	2440	0.9030	0.9421
High	2480	0.9030	0.9421

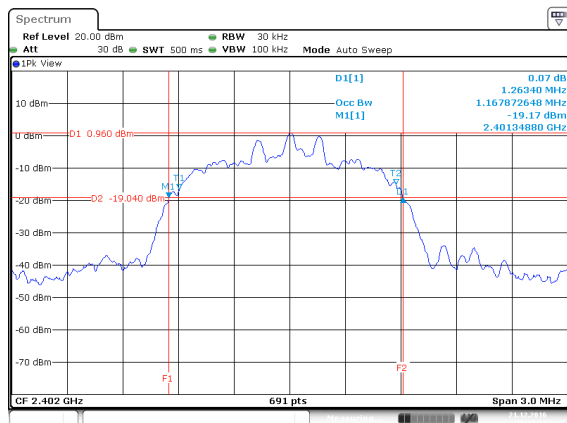
Test mode: 8DPSK_EDR-3Mbps mode / 2402-2480 MHz			
Channel	Frequency (MHz)	OBW (99%) (MHz)	20dB BW (MHz)
Low	2402	1.1678	1.2634
Mid	2440	1.1678	1.2590
High	2480	1.1635	1.2590

Test Data

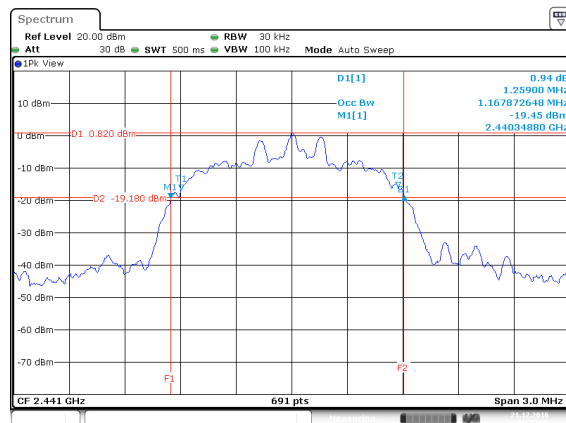


8DPSK _EDR-3Mbps mode

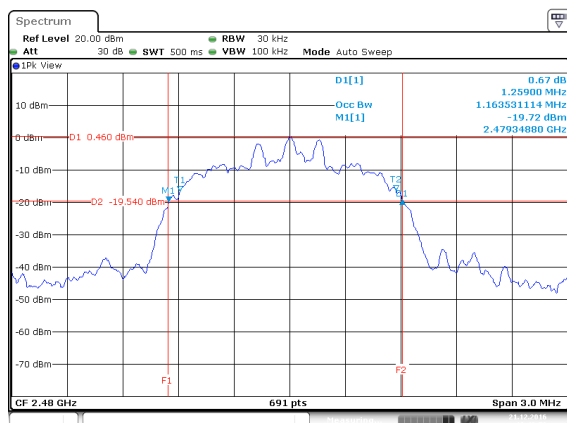
Low CH



Mid CH



High CH



4.3 OUTPUT POWER MEASUREMENT

4.3.1 Test Limit

According to §15.247(a)(1),

Peak output power :

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..

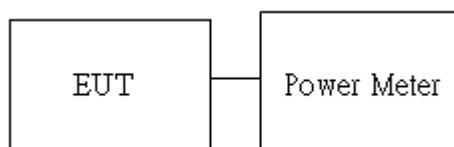
Limit	☒ Antenna not exceed 6 dBi : 21dBm ☐ Antenna with DG greater than 6 dBi : [Limit = 30 – (DG – 6)]
-------	---

Average output power : For reporting purposes only.

4.3.2 Test Procedure

1. The EUT RF output connected to the power meter by RF cable.
2. Setting maximum power transmit of EUT.
3. The path loss was compensated to the results for each measurement.
4. Measure and record the result of Peak output power and Average output power. in the test report.

4.3.3 Test Setup



4.3.4 Test Result

Peak output power :

BT					
Config.	CH	Freq. (MHz)	PK Power (dBm)	PK Power (W)	Limit (dBm)
GFSK BR-1Mbps (DH5)	0	2402	5.43	0.0035	21
	39	2441	5.32	0.0034	
	78	2480	5.47	0.0035	
$\pi/4$ -DQPSK EDR-2Mbps (DH5)	0	2402	3.66	0.0023	
	39	2441	3.23	0.0021	
	78	2480	3.14	0.0021	
8DPSK EDR-3Mbps (DH5)	0	2402	3.79	0.0024	
	39	2441	3.52	0.0022	
	78	2480	3.36	0.0022	

Average output power :

BT			
Config.	CH	Freq. (MHz)	AV Power (dBm)
GFSK BR-1Mbps (DH5)	0	2402	4.45
	39	2441	4.32
	78	2480	4.46
$\pi/4$ -DQPSK EDR-2Mbps (DH5)	0	2402	0.18
	39	2441	-1.12
	78	2480	-0.98
8DPSK EDR-3Mbps (DH5)	0	2402	0.57
	39	2441	-0.88
	78	2480	-0.61

4.4 FREQUENCY SEPARATION

4.4.1 Test Limit

According to §15.247(a)(1)

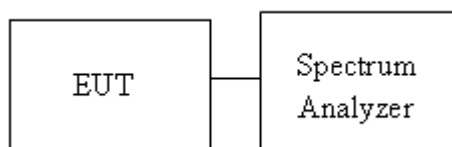
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

Limit	> two-thirds of the 20 dB bandwidth
-------	-------------------------------------

4.4.2 Test Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. EUT RF output port connected to the SA by RF cable.
3. Set the spectrum analyzer as RBW = 100kHz, VBW = 300kHz, Sweep = auto.
Max hold, mark 3 peaks of hopping channel and record the 3 peaks frequency

4.4.3 Test Setup

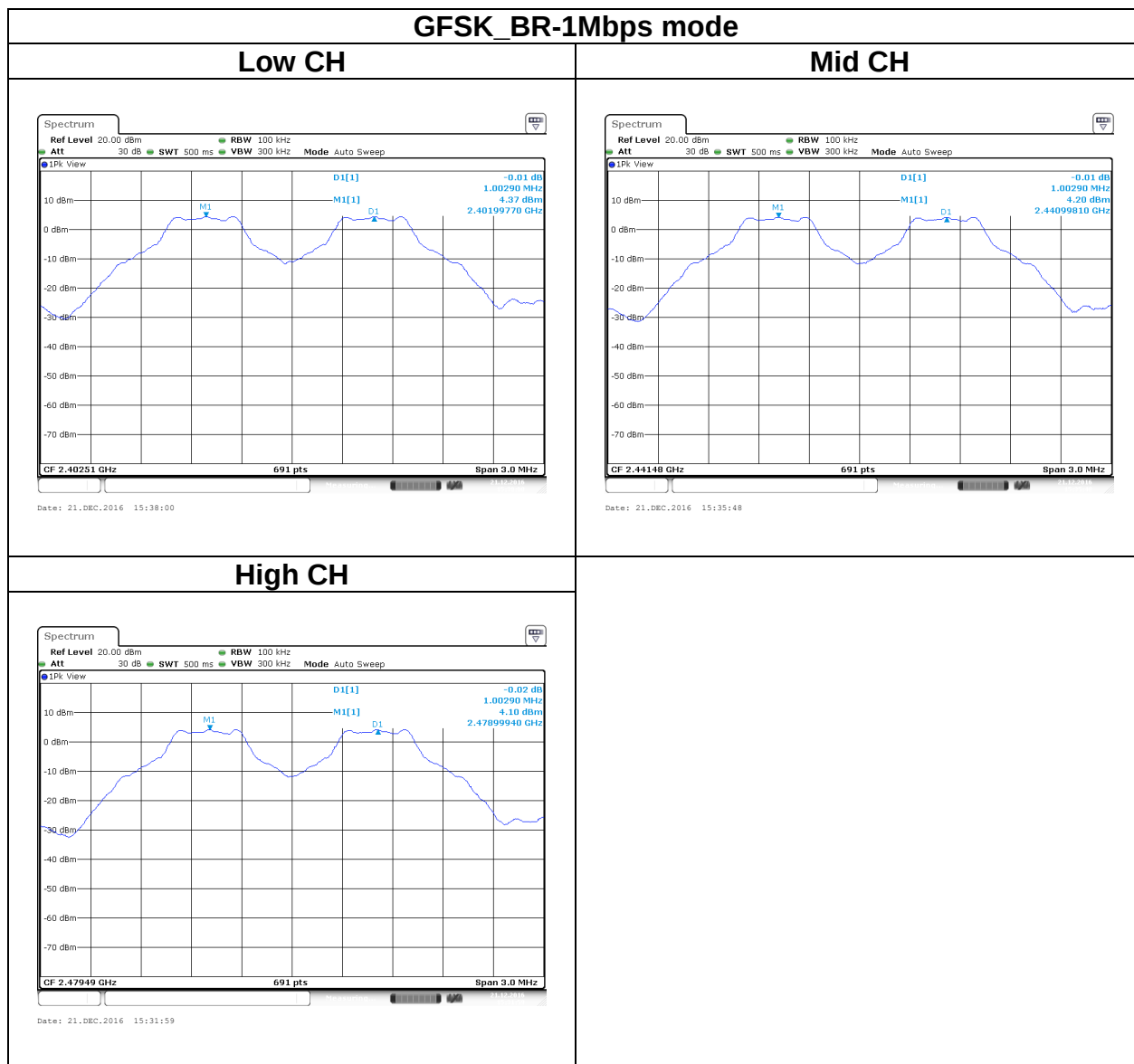


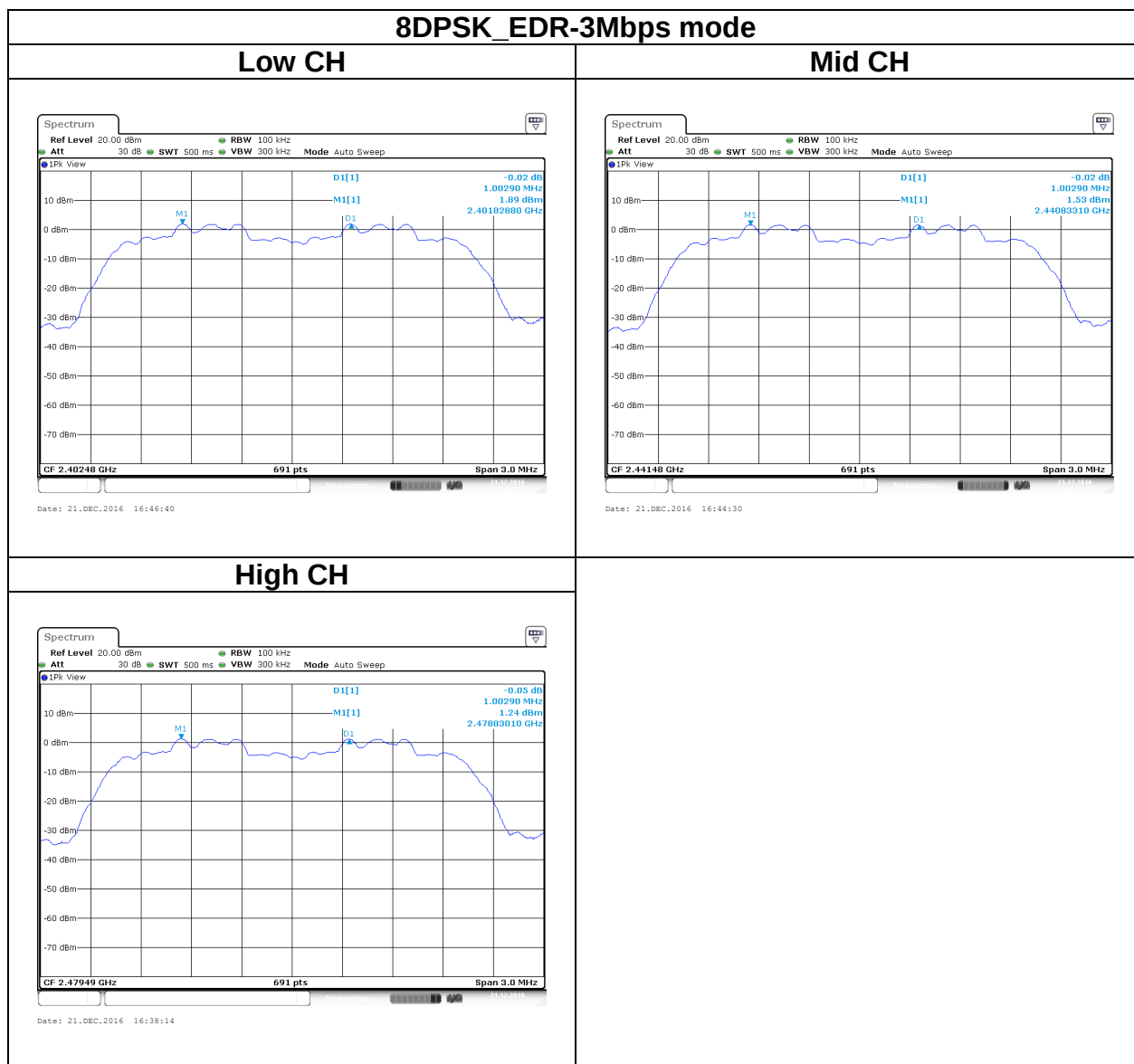
4.4.4 Test Result

Test mode: GFSK_BR-1Mbps mode / 2402-2480 MHz				
Channel	Frequency (MHz)	Channel Separation (MHz)	Channel Separation Limits (MHz)	Result
Low	2402	1.0029	0.631	PASS
Mid	2441	1.0029	0.628	PASS
High	2480	1.0029	0.628	PASS

Test mode: 8DPSK_EDR-3Mbps mode / 2402-2480 MHz				
Channel	Frequency (MHz)	Channel Separation (MHz)	Channel Separation Limits (MHz)	Result
Low	2402	1.0029	0.842	PASS
Mid	2441	1.0029	0.839	PASS
High	2480	1.0029	0.839	PASS

Test Data





4.5 NUMBER OF HOPPING

4.5.1 Test Limit

According to §15.247(a)(1)(iii),

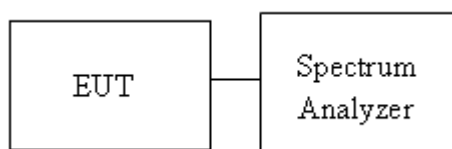
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

4.5.2 Test Procedure

Test method Refer as ANSI 63.10:2013 clause 7.8.3,

1. Place the EUT on the table and set it in transmitting mode.
2. EUT RF output port connected to the SA by RF cable.
3. Set spectrum analyzer Start Freq. = 2400 MHz, Stop Freq. = 2483.5 MHz, RBW=100KHz, VBW = 300KHz.Sweep Time = 1s
4. Max hold, view and count how many channel in the band.

4.5.3 Test Setup



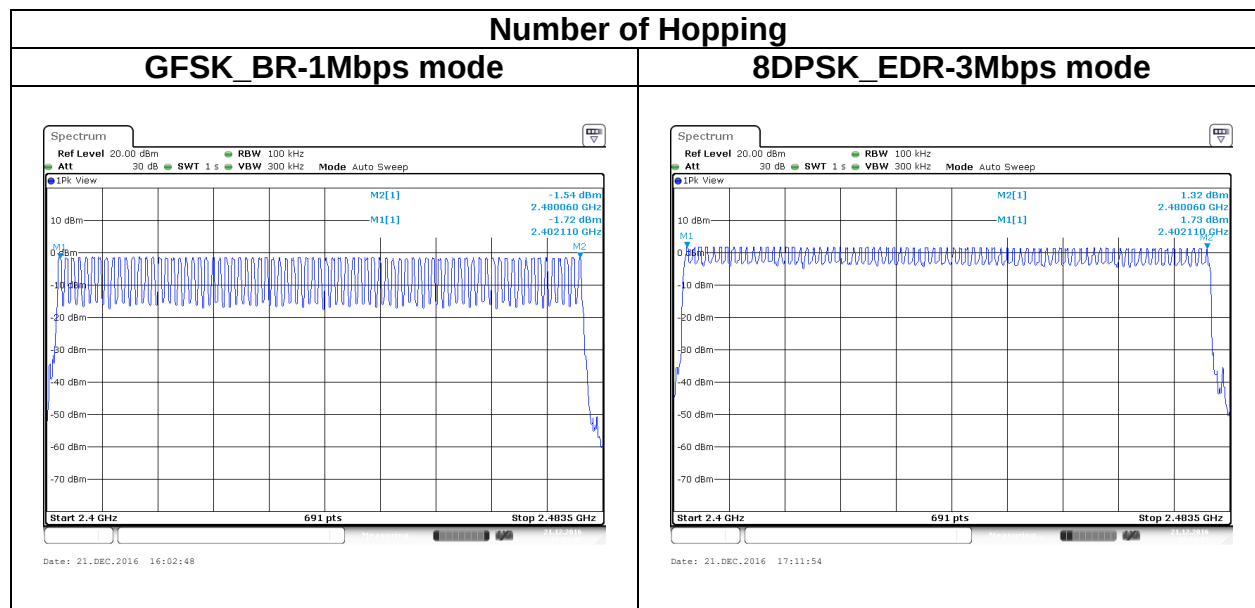
4.5.4 Test Result

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 Data



4.6 CONDUCTED BANDEDGE AND SPURIOUS EMISSION

4.6.1 Test Limit

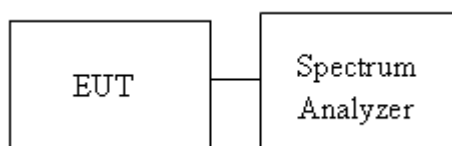
According to §15.247(d),

Limit	-20 dBc
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4.6.2 Test Procedure

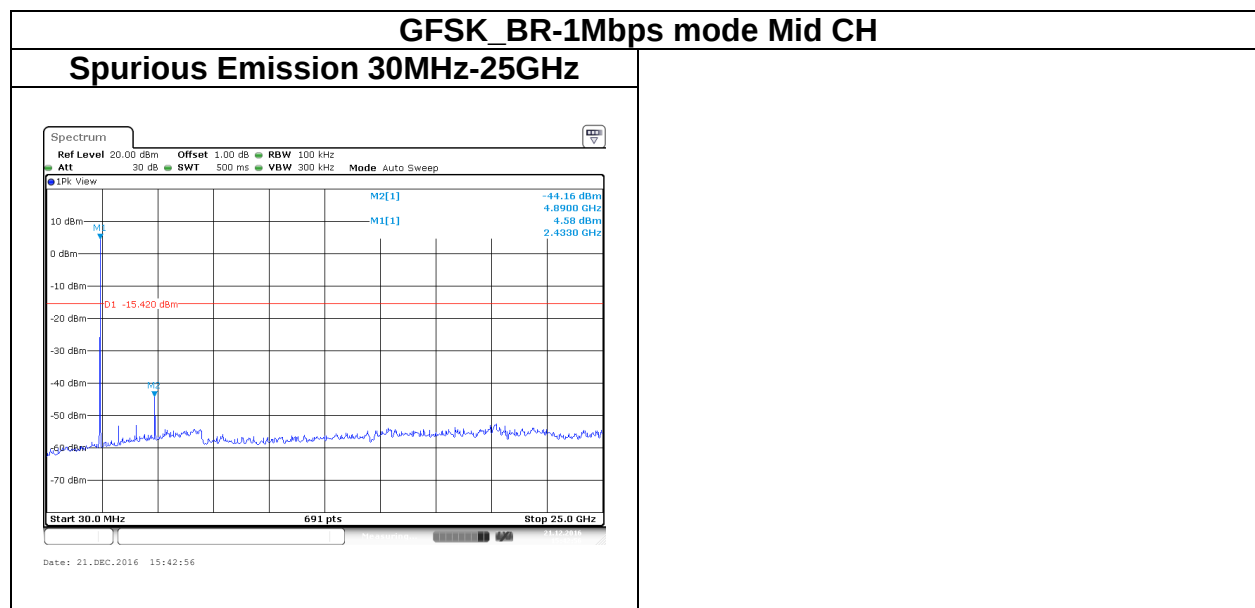
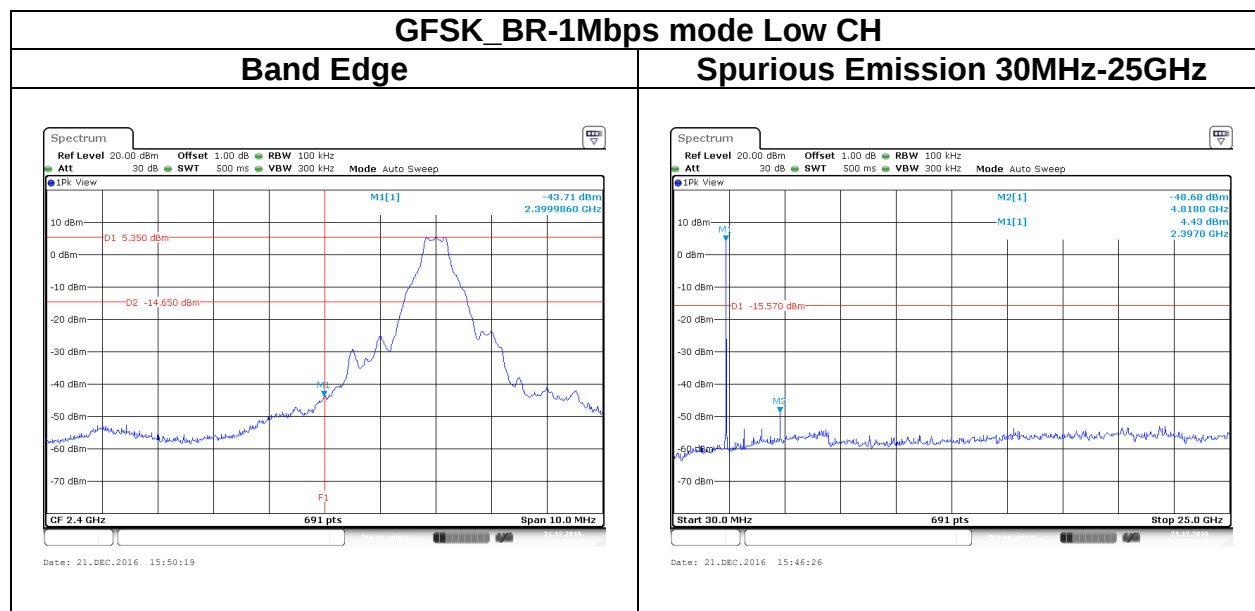
1. EUT RF output port connected to the SA by RF cable, and the path loss was compensated to result.
2. SA setting, RBW=100kHz, VBW=300kHz, Detector=Peak, Trace mode = max hold, SWT = Auto.
3. The Band Edge at 2.4GHz and 2.4835GHz are investigated with normal hopping mode.

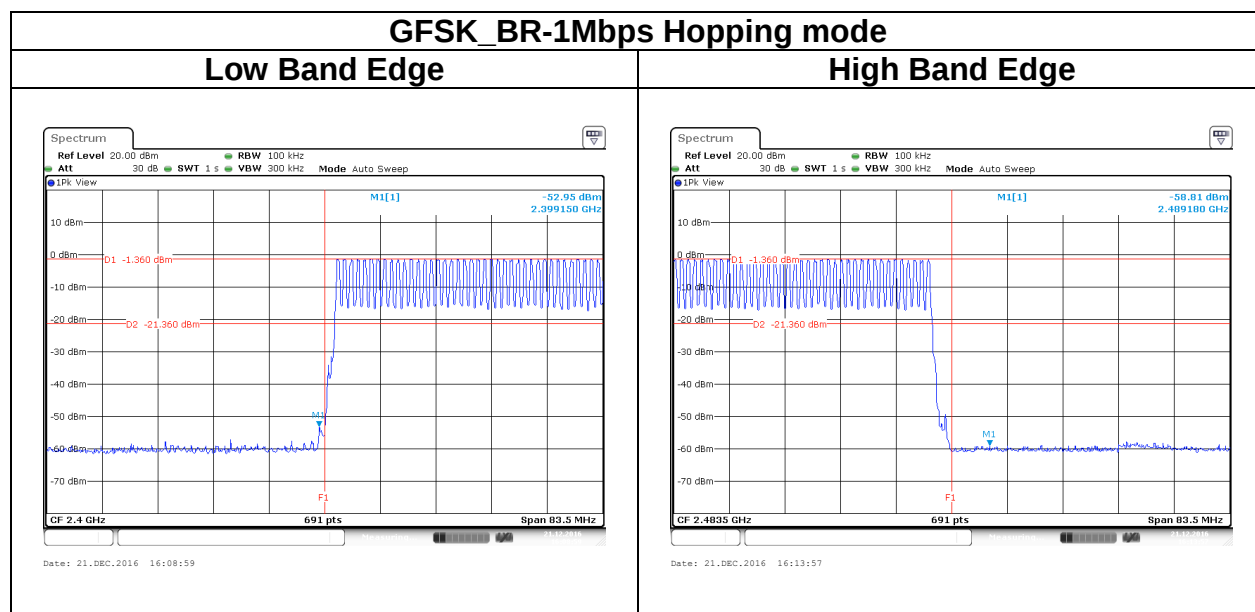
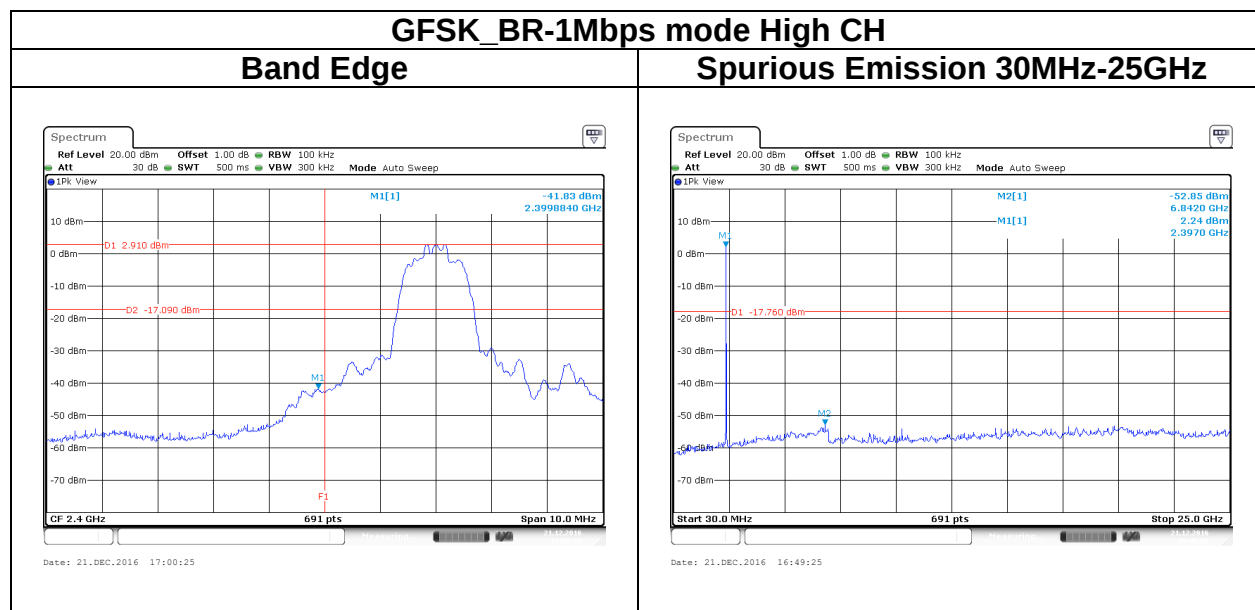
4.6.3 Test Setup

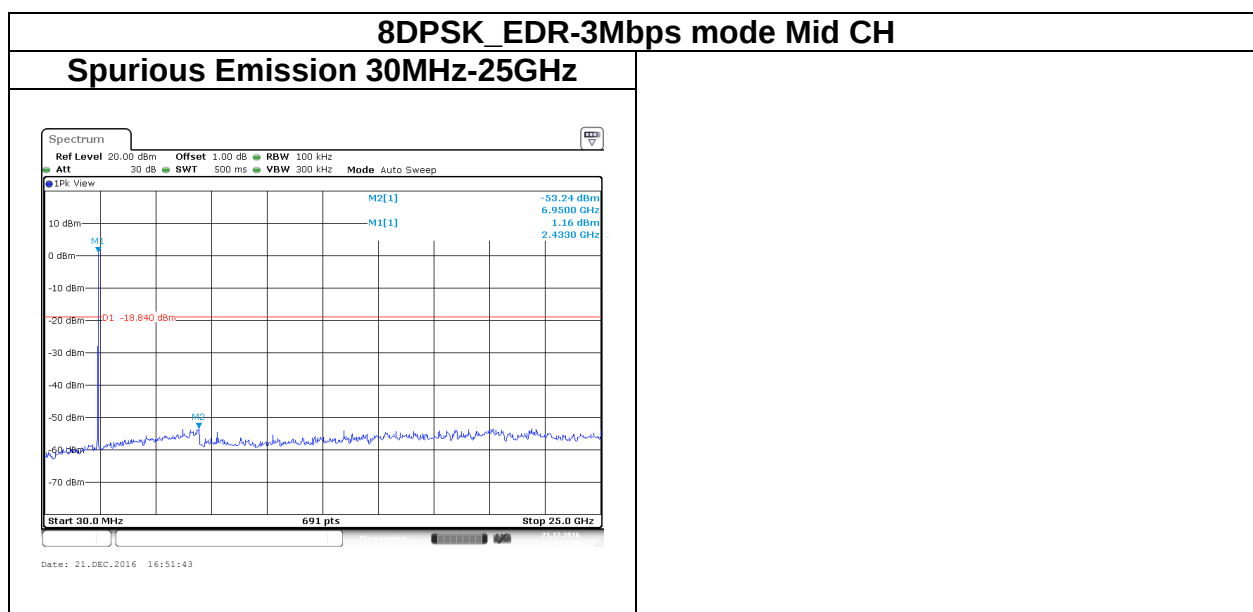
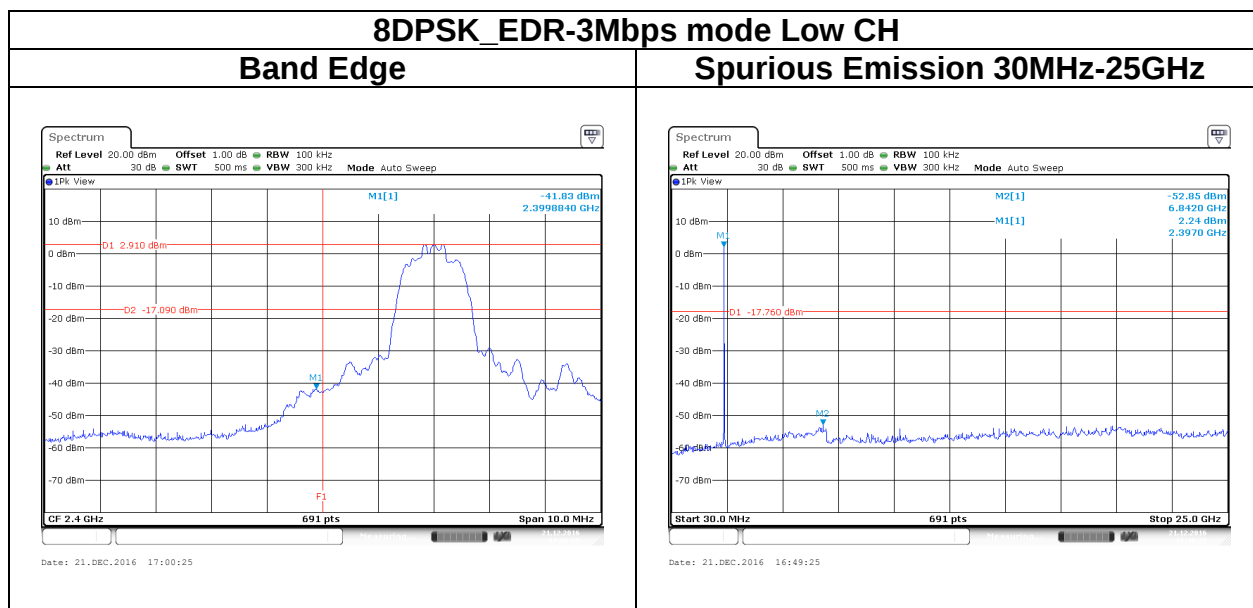


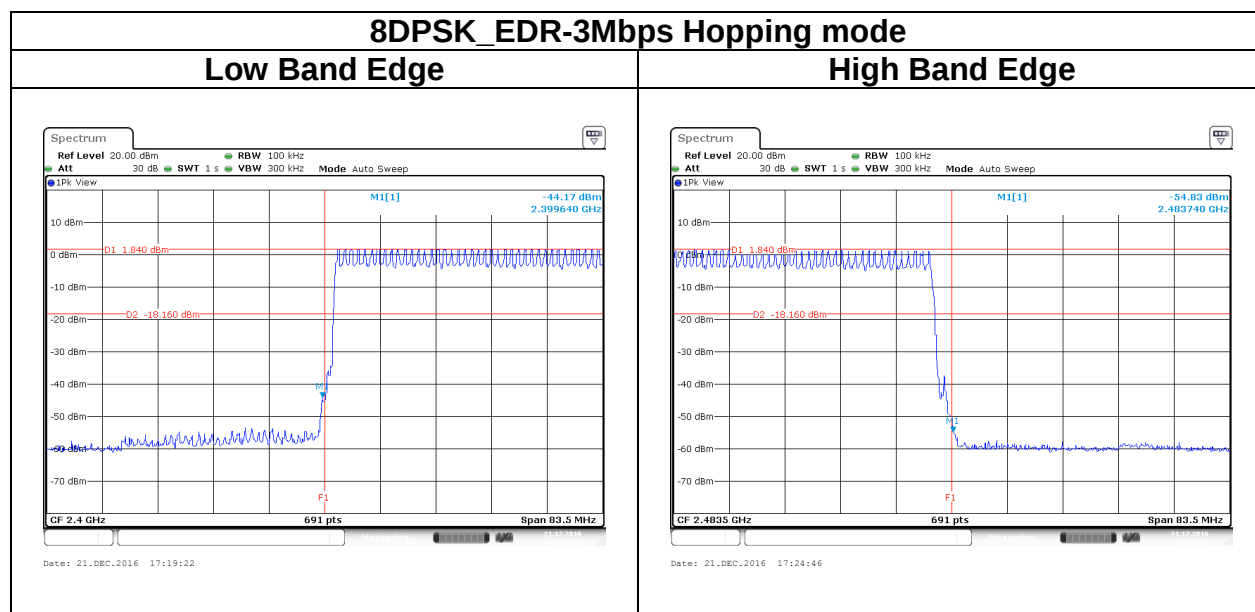
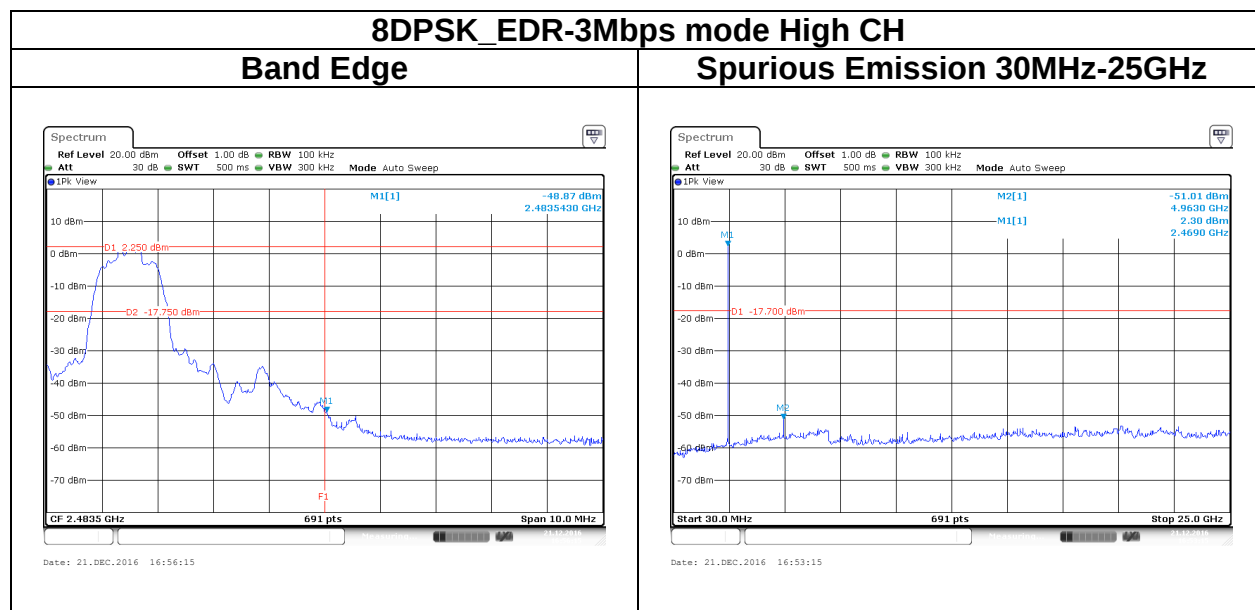
4.6.4 Test Result

Test Data









4.7 TIME OF OCCUPANCY (DWEELL TIME)

4.7.1 Test Limit

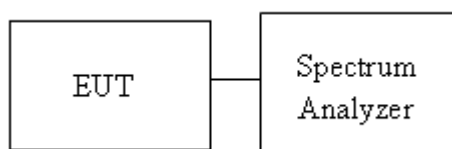
According to §15.247(a)(1)(iii),

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.

4.7.2 Test Procedure

1. EUT RF output port connected to the SA by RF cable.
2. Set center frequency of spectrum analyzer = operating frequency.
3. Set the spectrum analyzer as RBW, VBW=1MHz, Sweep = 1 ms

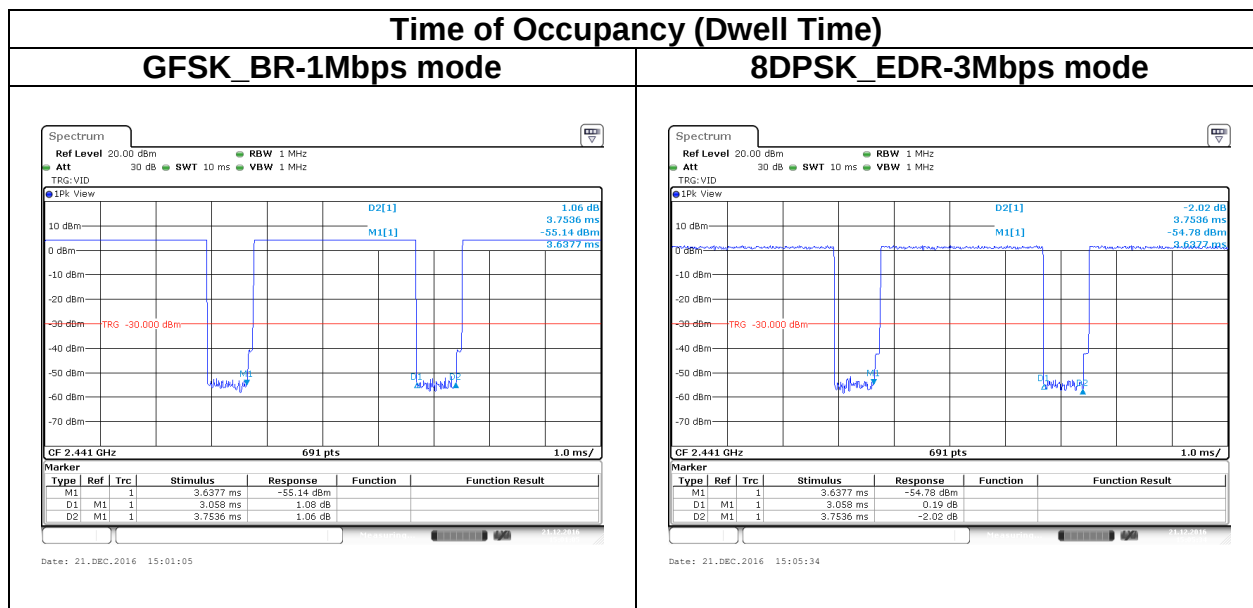
4.7.3 Test Setup



4.7.4 Test Result

Time of Occupancy (Dwell Time)							
Mode	Frequency (MHz)	Pulse Time Per Hopping (ms)	Minimum Number of Hopping Freq.	Number of pulse in	Dwell Time IN	Dwell Time Limits (s)	Result
				(0.4 * N sec)	(0.4 * N sec)		
BR-1Mbps	2441	3.058	79	106.67	0.3262	0.4	Pass
EDR-3Mbps	2441	3.058	79	106.67	0.3262	0.4	
AFH: DH5	2441	3.058	20	53.33	0.1631	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 $6.666 * 0.4 * 20 = 53.33$							

Test Data



4.8 RADIATION BANDEGE AND SPURIOUS EMISSION

4.8.1 Test Limit

According to §15.247(d), §15.209 and §15.205,

In any 100 kHz bandwidth outside the authorized frequency band, all harmonic and spurious must be least 20 dB below the highest emission level with the authorized frequency band. Radiation emission which fall in the restricted bands must also follow the FCC section 15.209 as below limit in table.

Below 30 MHz

Frequency	Field Strength (microvolts/m)	Magnetic H-Field (microamperes/m)	Measurement Distance (metres)
9-490 kHz	2,400/F (F in kHz)	2,400/F (F in kHz)	300
490-1,705 kHz	24,000/F (F in kHz)	24,000/F (F in kHz)	30
1.705-30 MHz	30	N/A	30

Above 30 MHz

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)

4.8.2 Test Procedure

Test method Refer as ANSI C63.10:2013.

1. The EUT is placed on a turntable, Above 1 GHz is 1.5m and below 1 GHz is 0.8m above ground plane. The EUT Configured un accordance with ANSI C63.10, and the EUT set in a continuous mode.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level. And EUT is set 3m away from the receiving antenna, which is scanned from 1m to 4m above the ground plane to find out the highest emissions. Measurement are made polarized in both the vertical and the horizontal positions with antenna.
3. Span shall wide enough to full capture the emission measured. The SA from 30MHz to 26.5GHz set to the low, Mid and High channels with the EUT transmit.
4. For harmonic, the worst case of output power was BR-1Mbps. Therefore only BR-1Mbps record in the report.
5. The SA setting following :
 - (1) Below 1G : RBW = 100kHz, VBW $\geq$ 3 RBW, Sweep = Auto, Detector = Peak, Trace = Max hold.
 - (2) Above 1G :
 - (2.1) For Peak measurement : RBW = 1MHz, VBW $\geq$ 3 RBW, Sweep = Auto, Detector = Peak, Trace = Max hold.
 - (2.2) For Average measurement : RBW = 1MHz, VBW
If Duty Cycle $\geq$ 98%, VBW=10Hz.
If Duty Cycle < 98%, VBW=1/T.

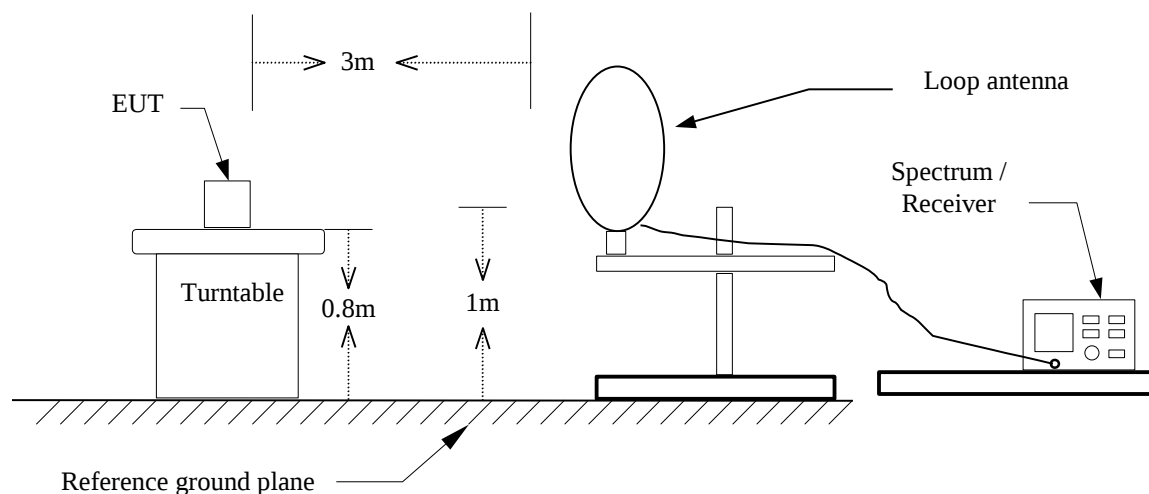
Configuration	Duty Cycle (%)	VBW
GFSK_BR-1Mbps	79.03%	360 Hz
8DPSK_EDR-3Mbps	80.05%	360 Hz

Remark:

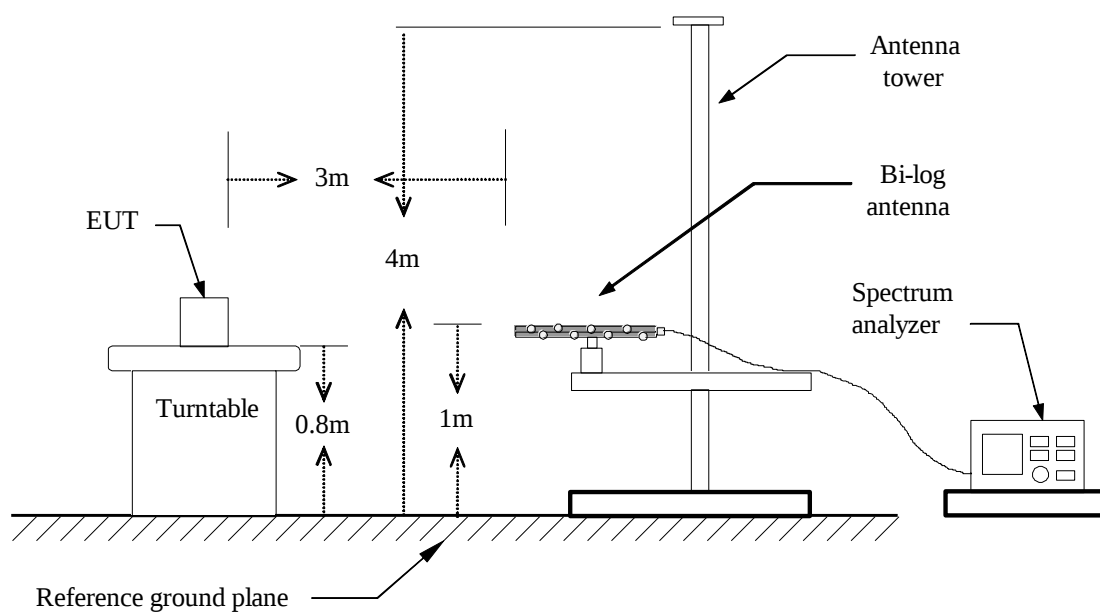
Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

4.8.3 Test Setup

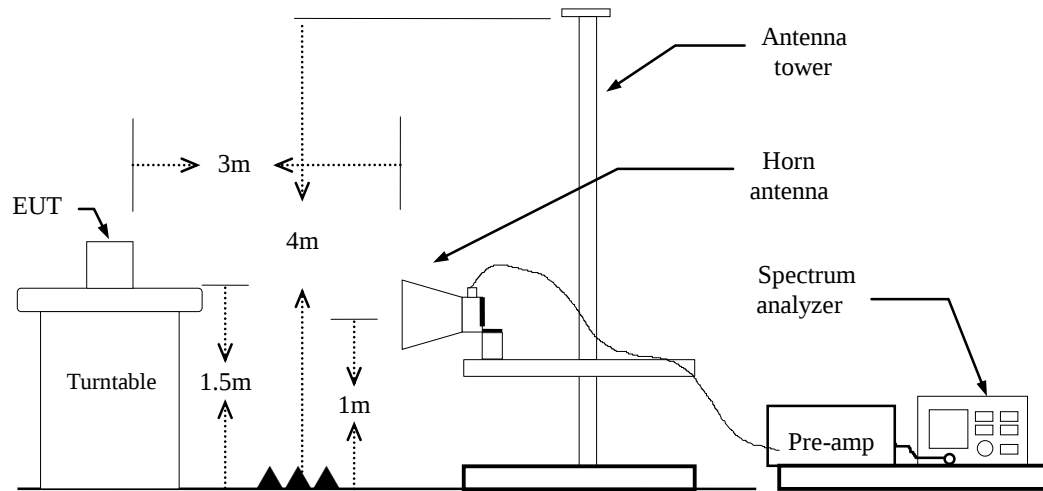
9kHz ~ 30MHz



30MHz ~ 1GHz



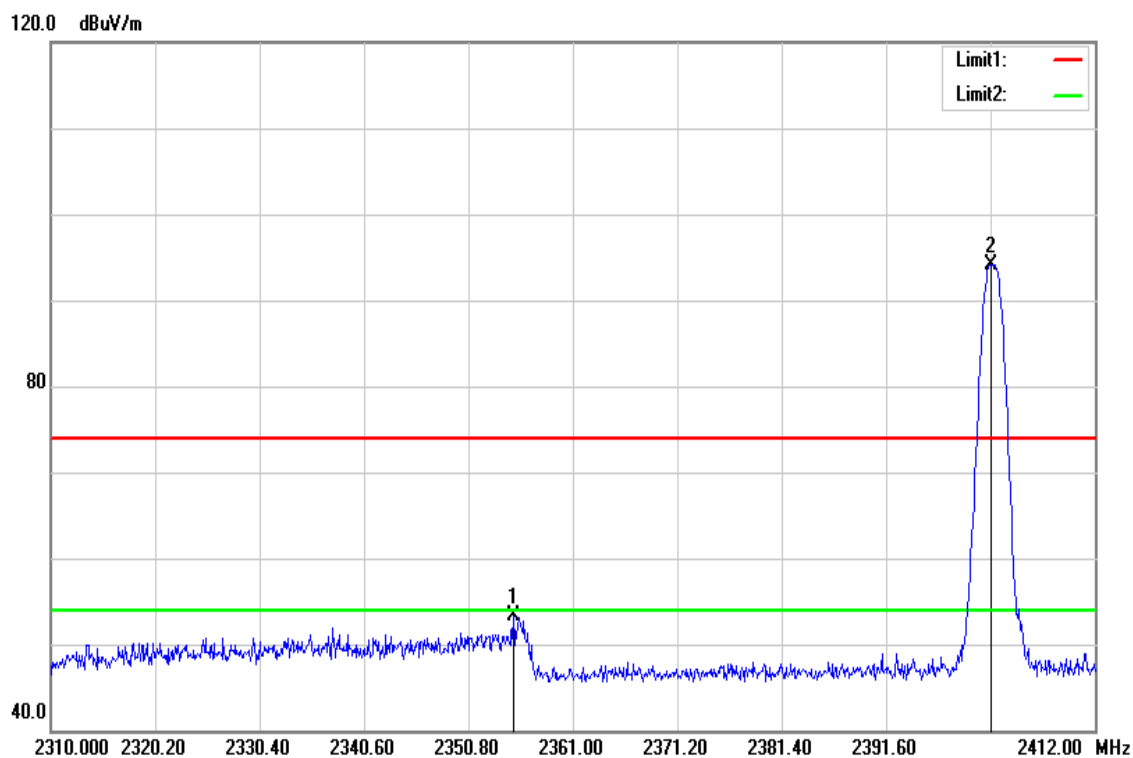
Above 1 GHz



4.8.4 Test Result

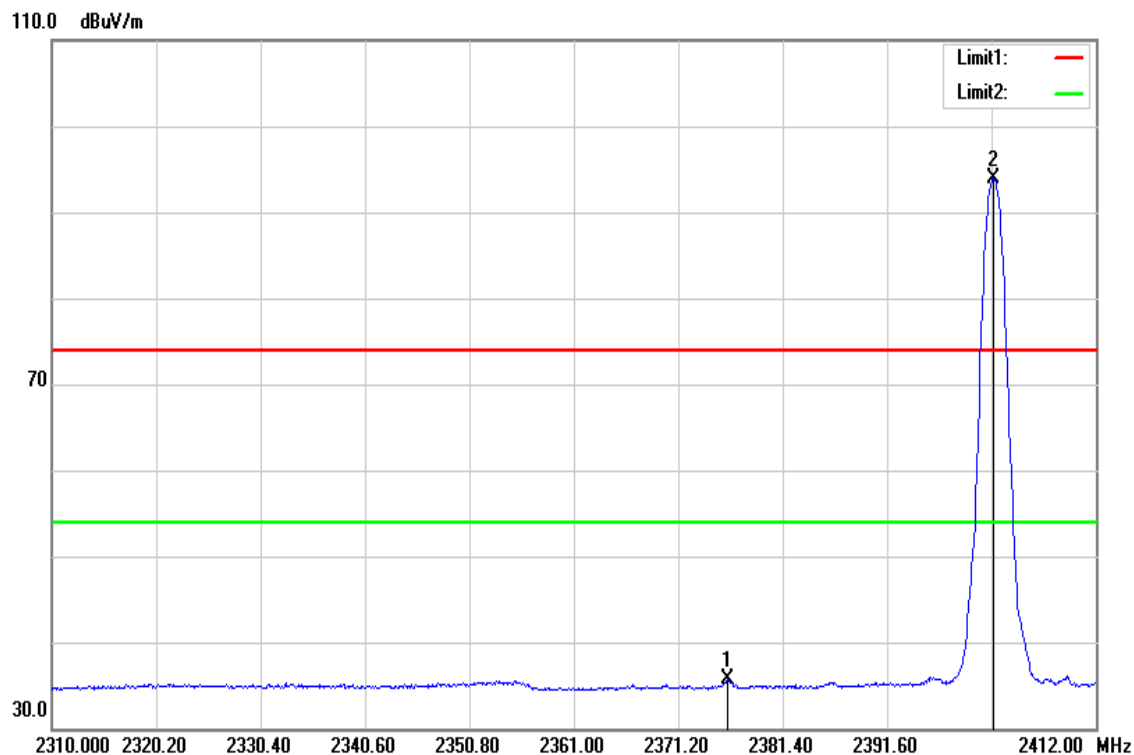
Band Edge Test Data

Test Mode	GFSK_BR-1Mbps Low CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Band Edge	Test Date	Dec 20, 2016
Polarize	Horizontal	Test Engineer	ED Chiang
Detector	Peak	Test Voltage	120Vac / 60Hz



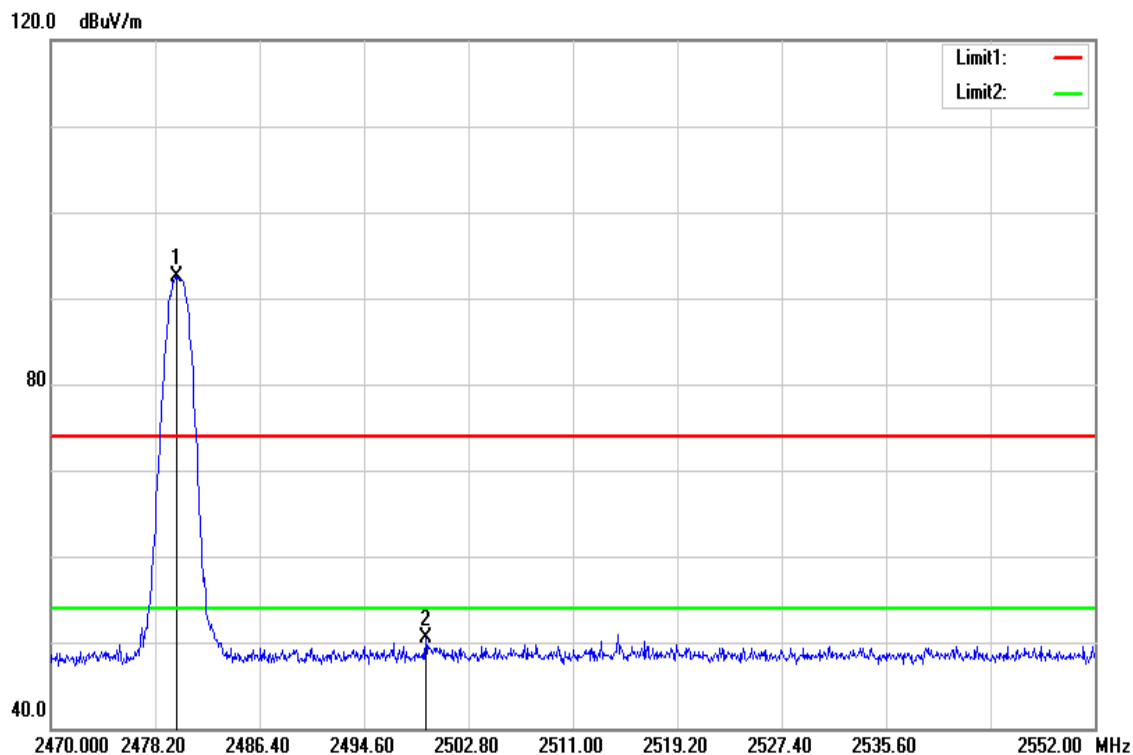
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
2355.186	56.12	-2.81	53.31	74.00	-25.69	Peak
2401.800	96.56	-2.41	-	-	20.15-	Peak

Test Mode	GFSK_BR-1Mbps Low CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Band Edge	Test Date	Dec 20, 2016
Polarize	Horizontal	Test Engineer	ED Chiang
Detector	Average	Test Voltage	120Vac / 60Hz



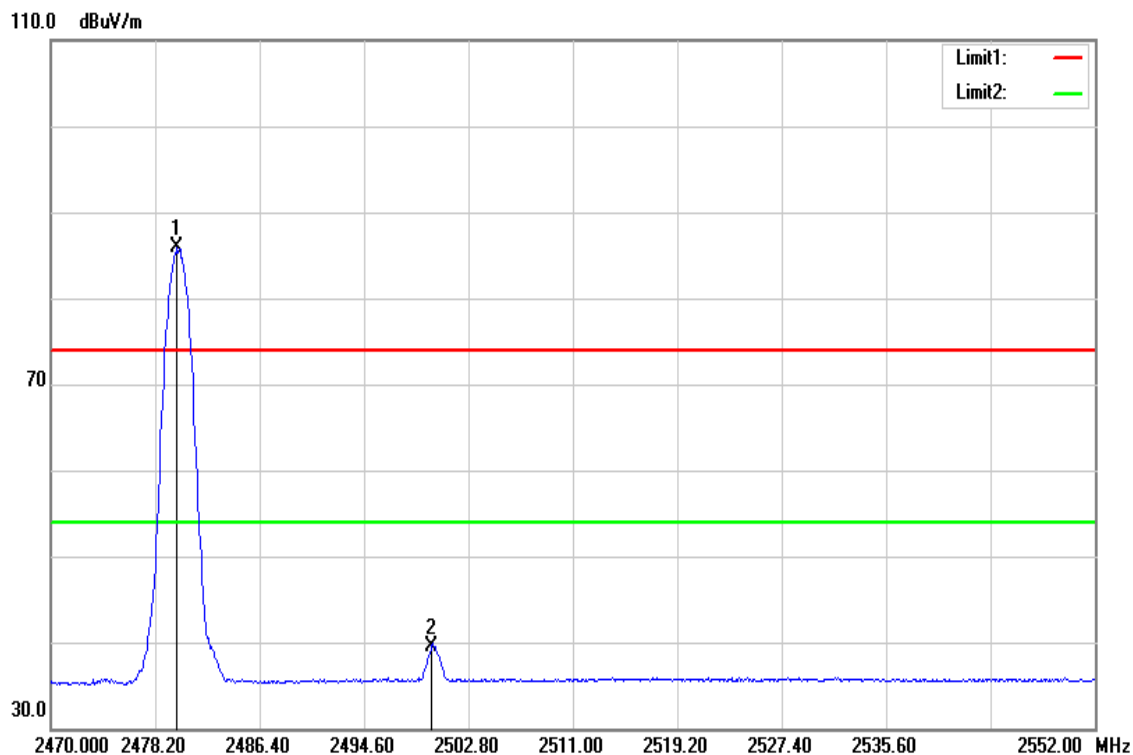
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
2375.994	38.21	-2.61	35.60	54.00	-18.40	AVG
2402.004	96.26	-2.41	93.85	-	-	AVG

Test Mode	GFSK_BR-1Mbps High CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Band Edge	Test Date	Dec 20, 2016
Polarize	Horizontal	Test Engineer	ED Chiang
Detector	Peak	Test Voltage	120Vac / 60Hz



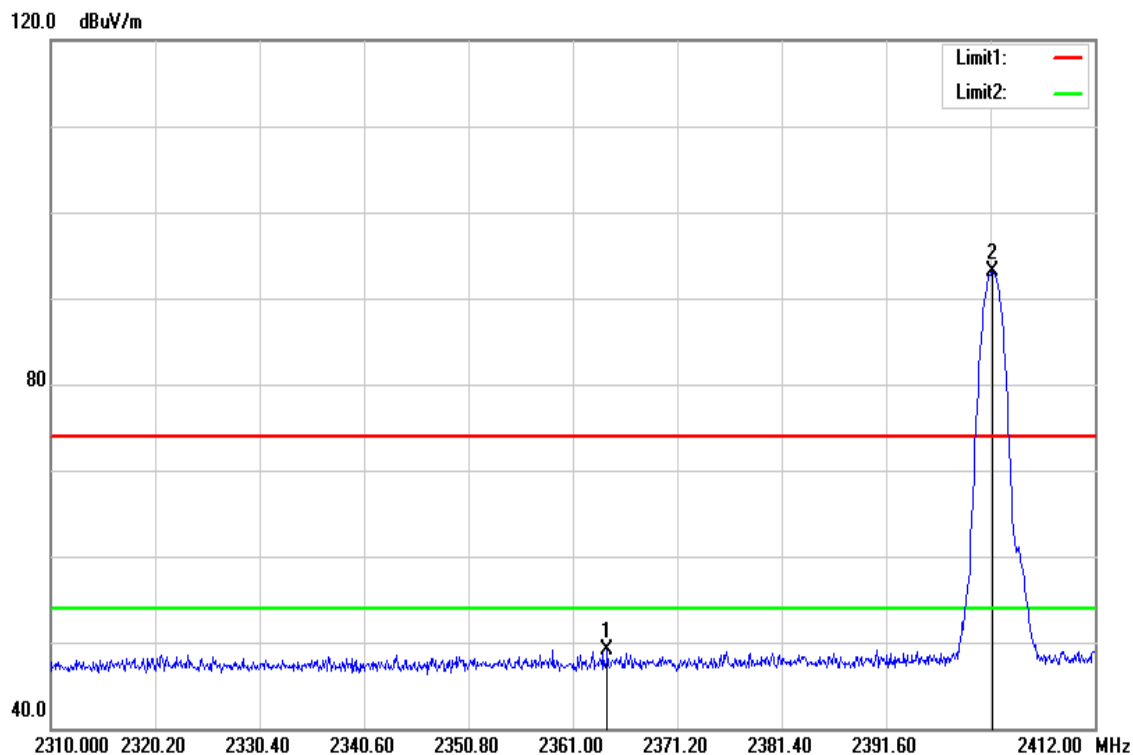
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
2479.840	94.47	-2.03	92.44	-	-	Peak
2499.438	52.27	-1.86	50.41	74.00	-23.59	Peak

Test Mode	GFSK_BR-1Mbps High CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Band Edge	Test Date	Dec 20, 2016
Polarize	Horizontal	Test Engineer	ED Chiang
Detector	Average	Test Voltage	120Vac / 60Hz



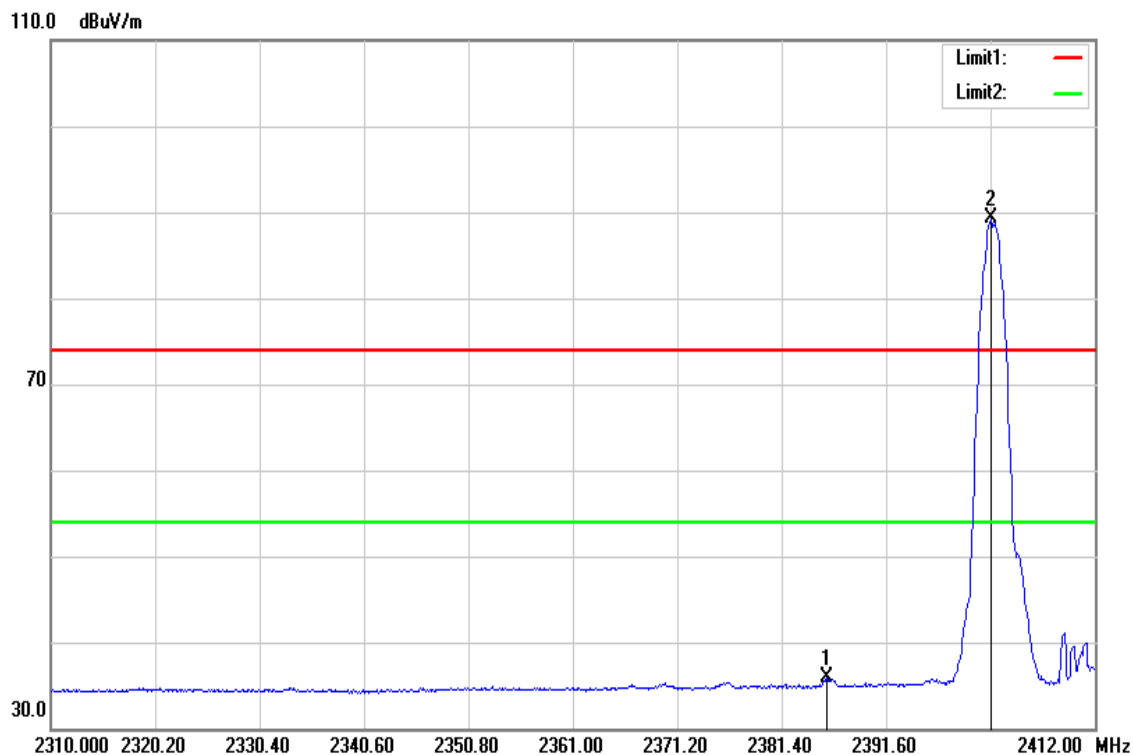
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
2479.922	88.01	-2.03	85.98	-	-	AVG
2499.930	41.27	-1.86	39.41	54.00	-14.59	AVG

Test Mode	8DPSK_EDR-3Mbps Low CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Band Edge	Test Date	Dec 20, 2016
Polarize	Horizontal	Test Engineer	ED Chiang
Detector	Peak	Test Voltage	120Vac / 60Hz



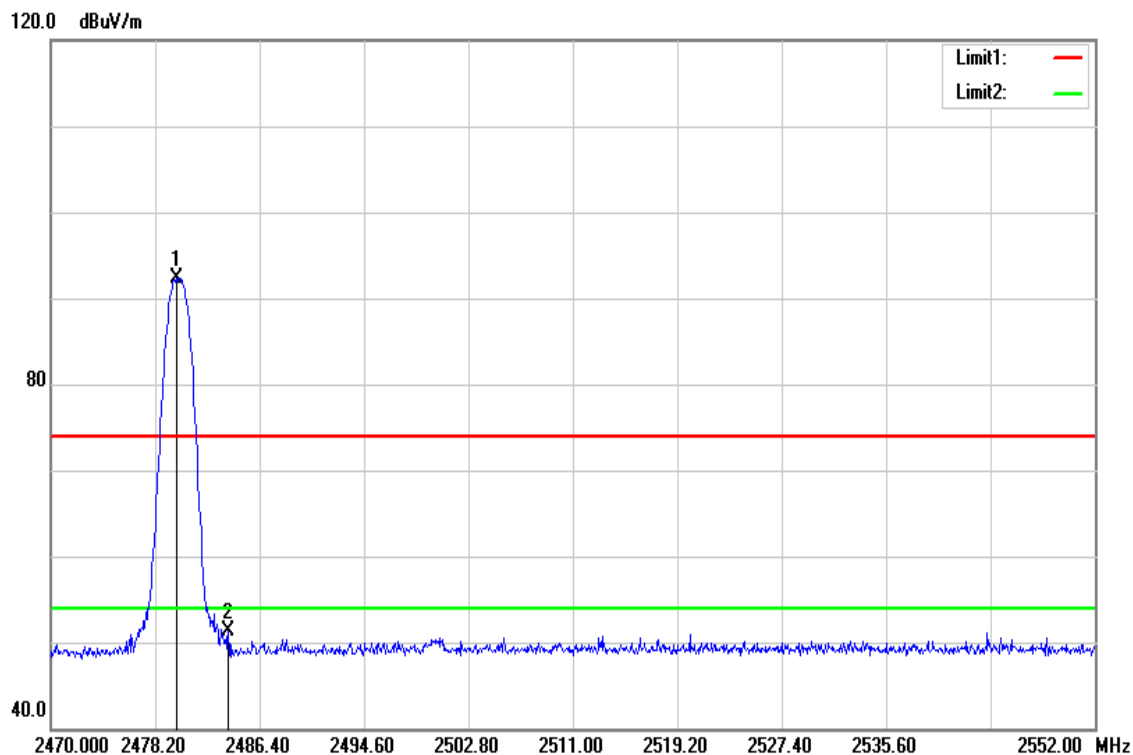
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
2364.366	51.88	-2.74	49.14	74.00	-24.86	Peak
2402.004	95.51	-2.41	93.10	-	-	Peak

Test Mode	8DPSK_EDR-3Mbps Low CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Band Edge	Test Date	Dec 20, 2016
Polarize	Horizontal	Test Engineer	ED Chiang
Detector	Average	Test Voltage	120Vac / 60Hz



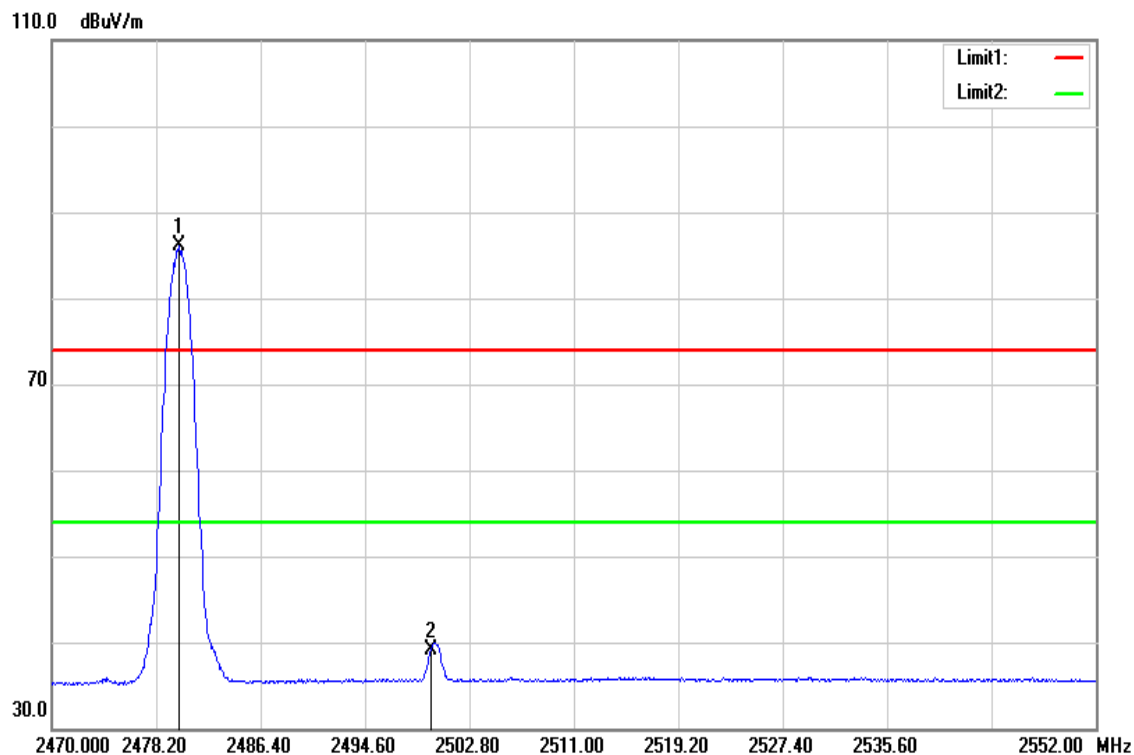
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
2385.786	38.36	-2.53	35.83	54.00	-18.17	AVG
2401.902	91.64	-2.41	89.23	-	-	AVG

Test Mode	8DPSK_EDR-3Mbps High CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Band Edge	Test Date	Dec 20, 2016
Polarize	Horizontal	Test Engineer	ED Chiang
Detector	Peak	Test Voltage	120Vac / 60Hz



Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
2479.840	94.36	-2.03	92.33	-	-	Peak
2483.940	53.24	-1.99	51.25	74.00	-22.75	Peak

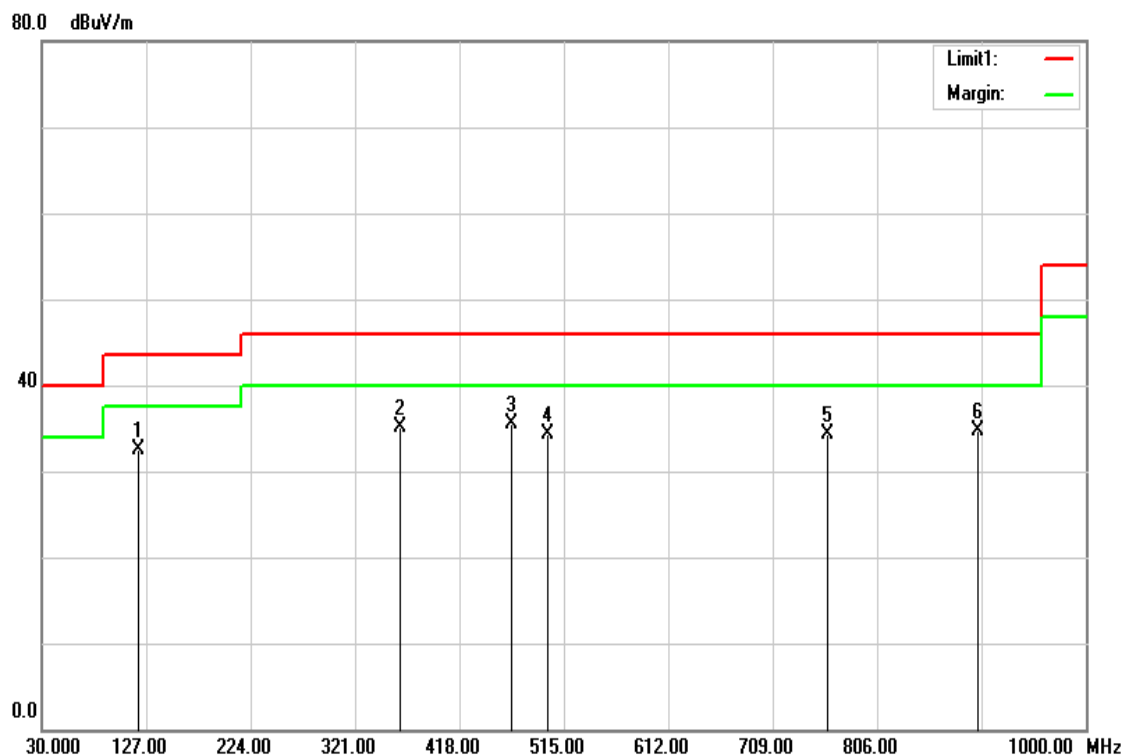
Test Mode	8DPSK_EDR-3Mbps High CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Band Edge	Test Date	Dec 20, 2016
Polarize	Horizontal	Test Engineer	ED Chiang
Detector	Average	Test Voltage	120Vac / 60Hz



Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
2480.004	88.04	-2.03	86.01	-	-	AVG
2499.766	40.90	-1.86	39.04	54.00	-14.96	AVG

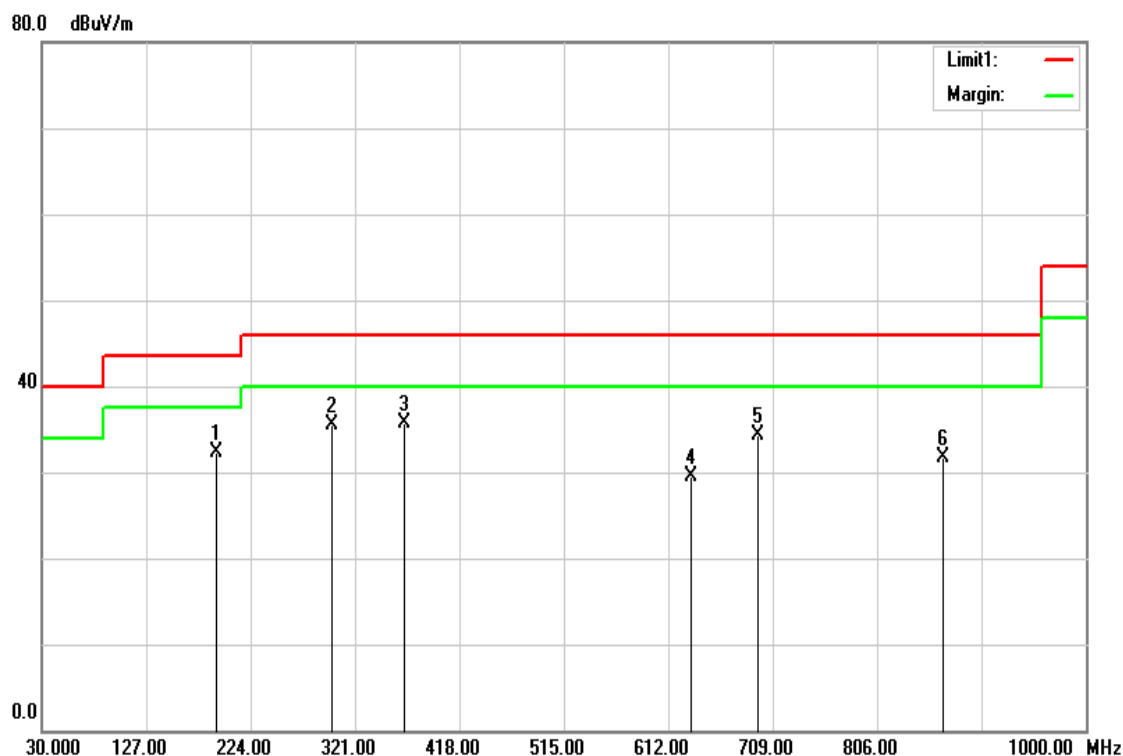
Below 1G Test Data

Test Mode	Mode 1	Temp/Hum	27(°C)/ 53%RH
Test Item	30MHz-1GHz	Test Date	March 20, 2017
Polarize	Vertical	Test Engineer	ED Chiang
Detector	Peak	Test Voltage	120Vac / 60Hz



Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
120.4200	48.05	-15.51	32.54	43.50	-10.96	peak
362.7500	47.77	-12.59	35.18	46.00	-10.82	peak
466.5000	45.29	-9.88	35.41	46.00	-10.59	peak
500.4500	43.44	-9.23	34.21	46.00	-11.79	peak
759.6400	39.16	-4.84	34.32	46.00	-11.68	peak
900.0800	37.88	-3.19	34.69	46.00	-11.31	peak

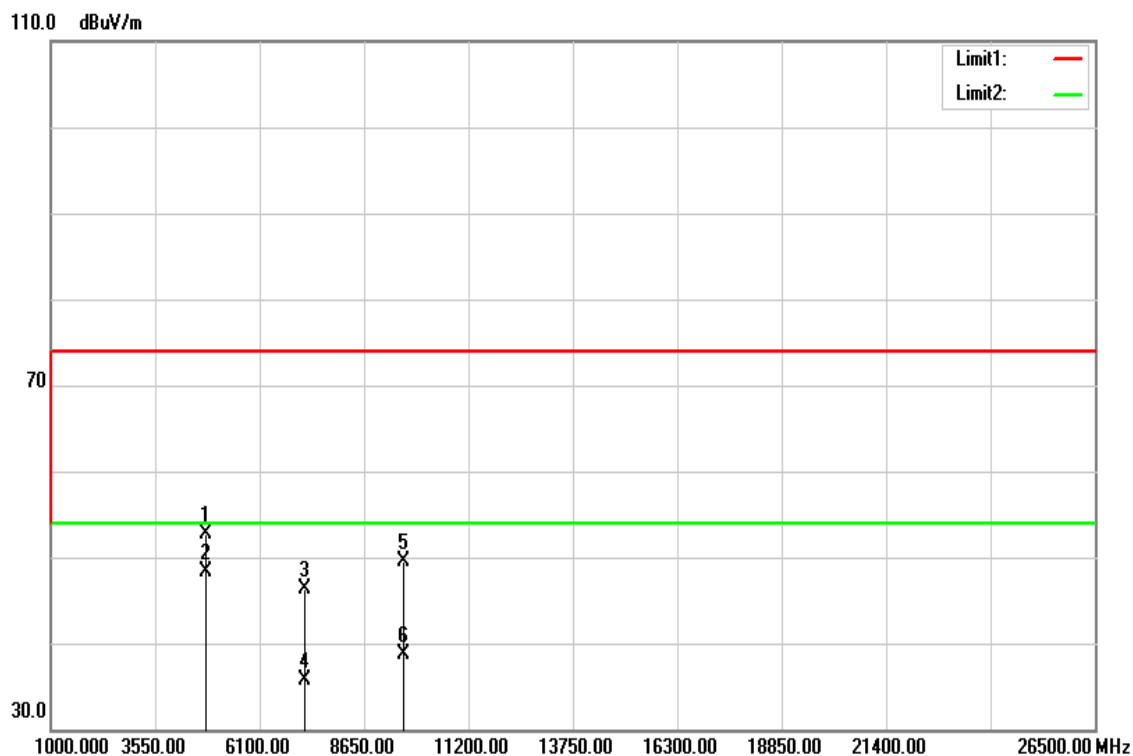
Test Mode	Mode 1	Temp/Hum	27(°C)/ 53%RH
Test Item	30MHz-1GHz	Test Date	March 20, 2017
Polarize	Horizontal	Test Engineer	ED Chiang
Detector	Peak	Test Voltage	120Vac / 60Hz



Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
191.8200	48.50	-16.28	32.22	43.50	-11.28	peak
299.6800	49.66	-14.25	35.41	46.00	-10.59	peak
366.5500	48.13	-12.50	35.63	46.00	-10.37	peak
633.3400	36.45	-6.97	29.48	46.00	-16.52	peak
695.4200	40.44	-6.12	34.32	46.00	-11.68	peak
867.1200	35.20	-3.58	31.62	46.00	-14.38	peak

Above 1G Test Data

Test Mode	GFSK_BR-1Mbps Low CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Harmonic	Test Date	Dec 20, 2016
Polarize	Vertical	Test Engineer	ED Chiang
Detector	Peak and Average	Test Voltage	120Vac / 60Hz

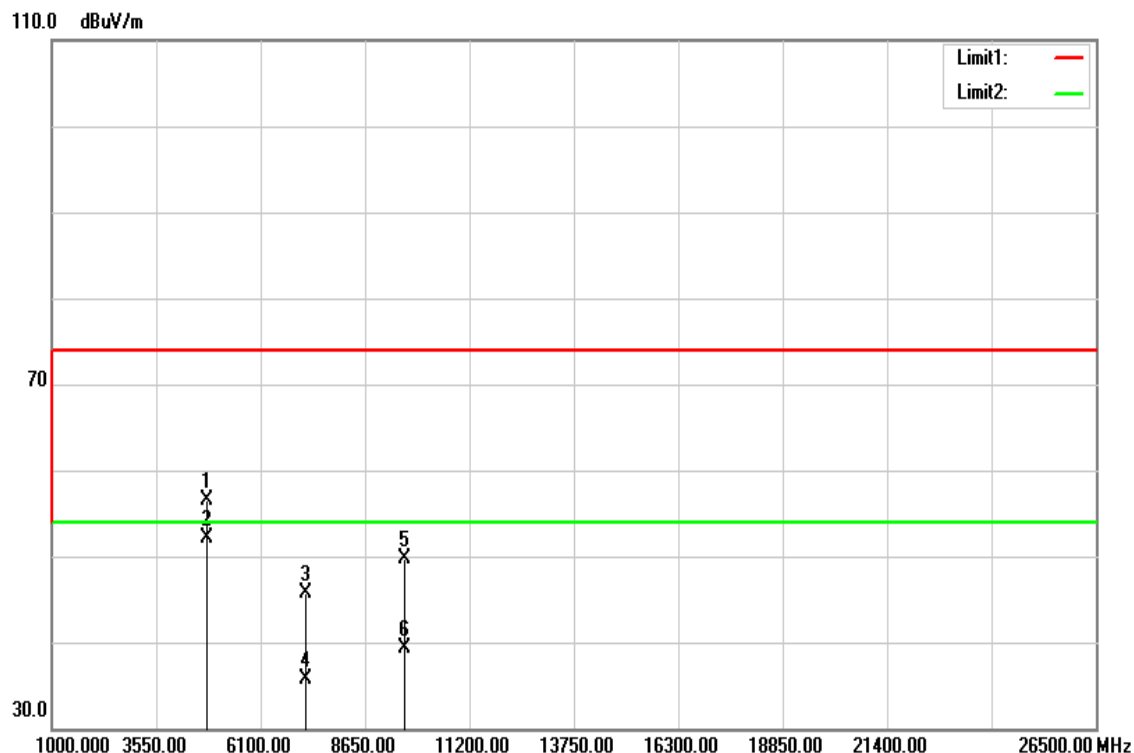


Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4804.000	47.57	5.04	52.61	74.00	-21.39	Peak
4804.000	43.32	5.04	48.36	54.00	-5.64	AVG
7206.000	33.76	12.62	46.38	74.00	-27.62	Peak
7206.000	23.11	12.62	35.73	54.00	-18.27	AVG
9608.000	31.92	17.60	49.52	74.00	-24.48	Peak
9608.000	21.05	17.60	38.65	54.00	-15.35	AVG

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

Test Mode	GFSK_BR-1Mbps Low CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Harmonic	Test Date	Dec 20, 2016
Polarize	Horizontal	Test Engineer	ED Chiang
Detector	Peak and Average	Test Voltage	120Vac / 60Hz

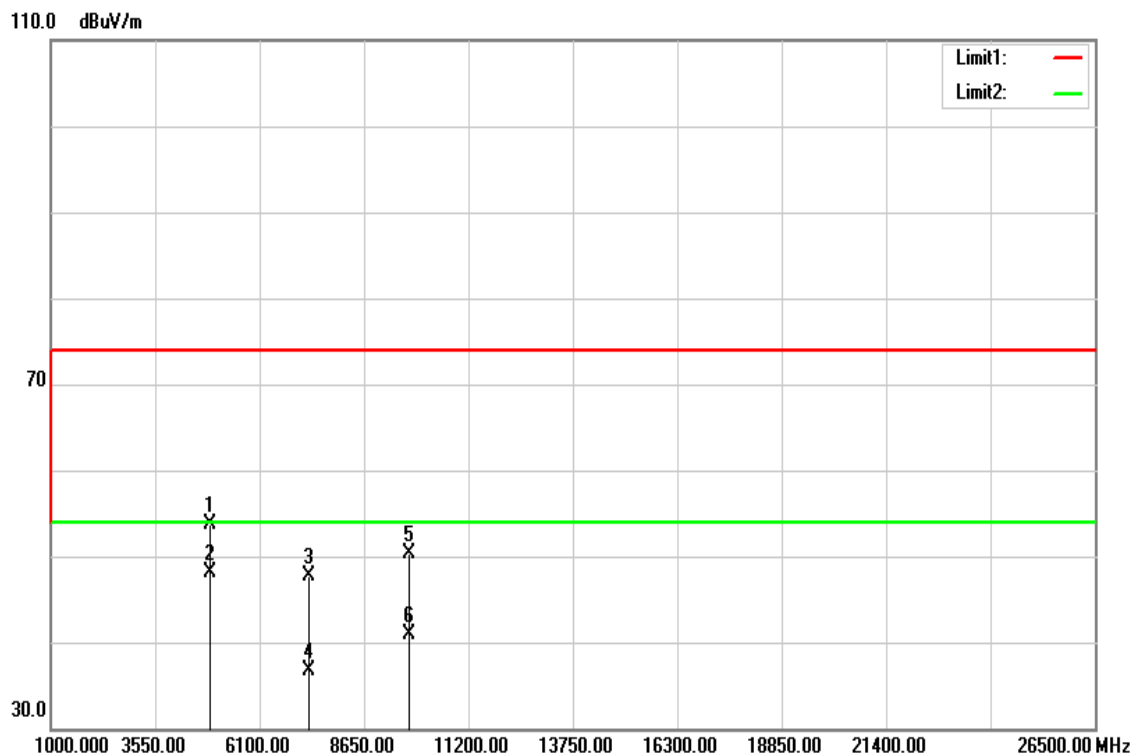


Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4804.000	51.51	5.04	56.55	74.00	-17.45	Peak
4804.000	47.15	5.04	52.19	54.00	-1.81	AVG
7206.000	33.11	12.62	45.73	74.00	-28.27	Peak
7206.000	23.00	12.62	35.62	54.00	-18.38	AVG
9608.000	32.03	17.60	49.63	74.00	-24.37	Peak
9608.000	21.67	17.60	39.27	54.00	-14.73	AVG

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

Test Mode	GFSK_BR-1Mbps Mid CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Harmonic	Test Date	Dec 20, 2016
Polarize	Vertical	Test Engineer	ED Chiang
Detector	Peak and Average	Test Voltage	120Vac / 60Hz

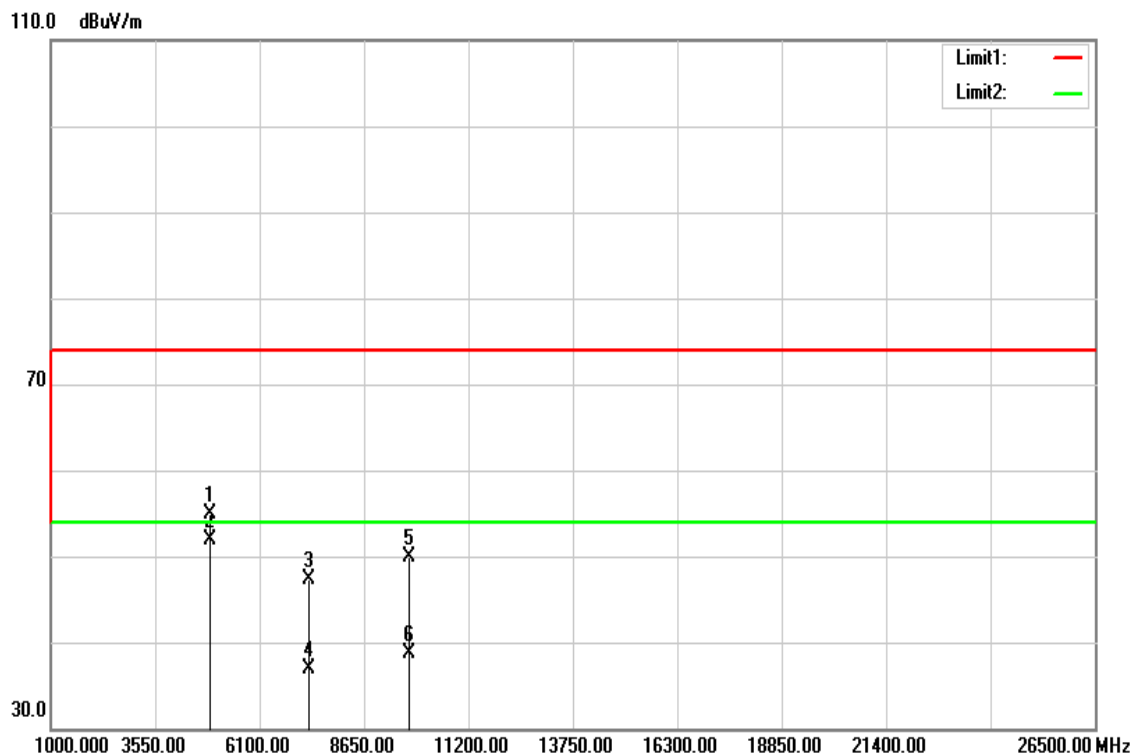


Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4882.000	48.48	5.25	53.73	74.00	-20.27	Peak
4882.000	42.80	5.25	48.05	54.00	-5.95	AVG
7323.000	34.74	12.98	47.72	74.00	-26.28	Peak
7323.000	23.65	12.98	36.63	54.00	-17.37	AVG
9764.000	32.71	17.60	50.31	74.00	-23.69	Peak
9764.000	23.29	17.60	40.89	54.00	-13.11	AVG

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

Test Mode	GFSK_BR-1Mbps Mid CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Harmonic	Test Date	Dec 20, 2016
Polarize	Horizontal	Test Engineer	ED Chiang
Detector	Peak and Average	Test Voltage	120Vac / 60Hz

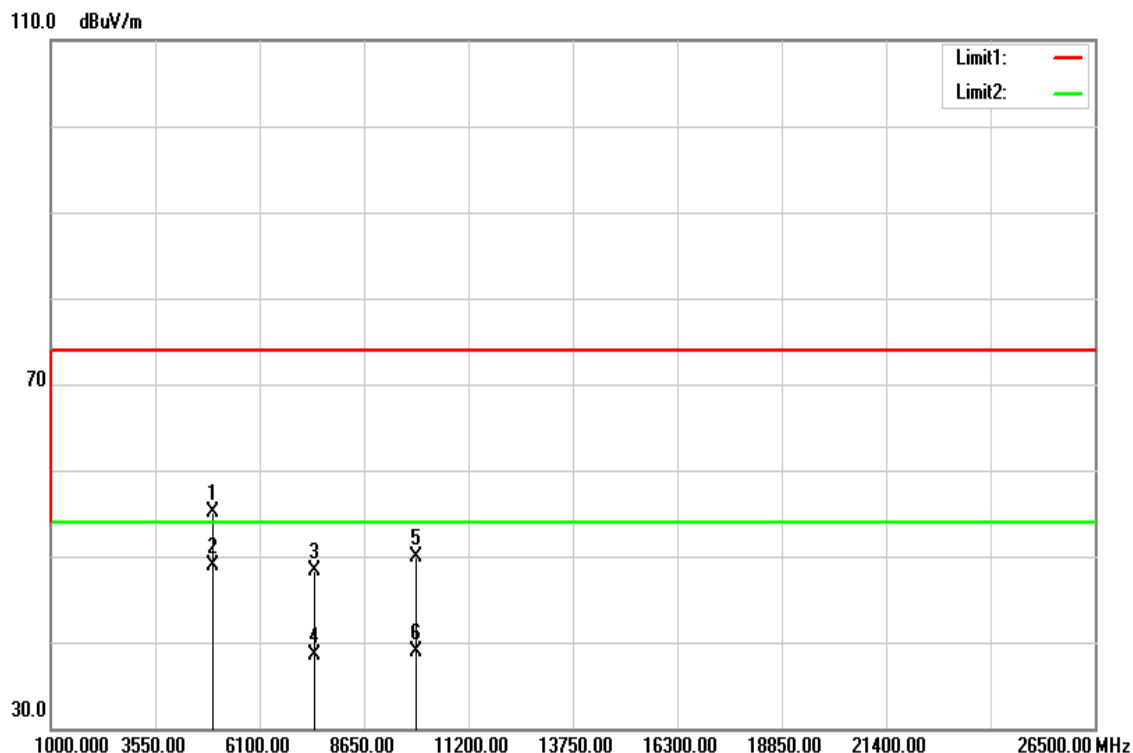


Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4882.000	49.66	5.25	54.91	74.00	-19.09	peak
4882.000	46.57	5.25	51.82	54.00	-2.18	AVG
7323.000	34.36	12.98	47.34	74.00	-26.66	peak
7323.000	23.87	12.98	36.85	54.00	-17.15	AVG
9764.000	32.29	17.60	49.89	74.00	-24.11	peak
9764.000	21.18	17.60	38.78	54.00	-15.22	AVG

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz,the EUT peak value was under average limit, therefore the Average value compliance with the average limit

Test Mode	GFSK_BR-1Mbps High CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Harmonic	Test Date	Dec 20, 2016
Polarize	Vertical	Test Engineer	ED Chiang
Detector	Peak and Average	Test Voltage	120Vac / 60Hz

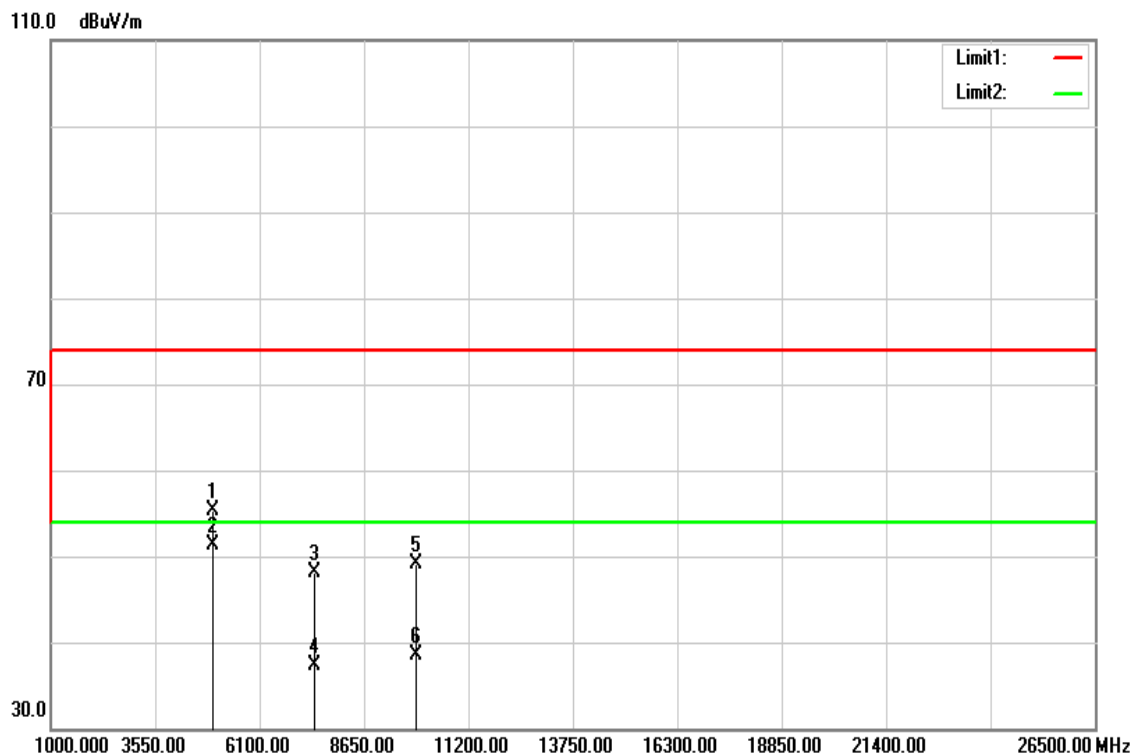


Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4960.000	49.65	5.46	55.11	74.00	-18.89	Peak
4960.000	43.48	5.46	48.94	54.00	-5.06	AVG
7440.000	35.01	13.33	48.34	74.00	-25.66	Peak
7440.000	25.23	13.33	38.56	54.00	-15.44	AVG
9920.000	32.31	17.60	49.91	74.00	-24.09	Peak
9920.000	21.36	17.60	38.96	54.00	-15.04	AVG

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

Test Mode	GFSK_BR-1Mbps High CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Harmonic	Test Date	Dec 20, 2016
Polarize	Horizontal	Test Engineer	ED Chiang
Detector	Peak and Average	Test Voltage	120Vac / 60Hz

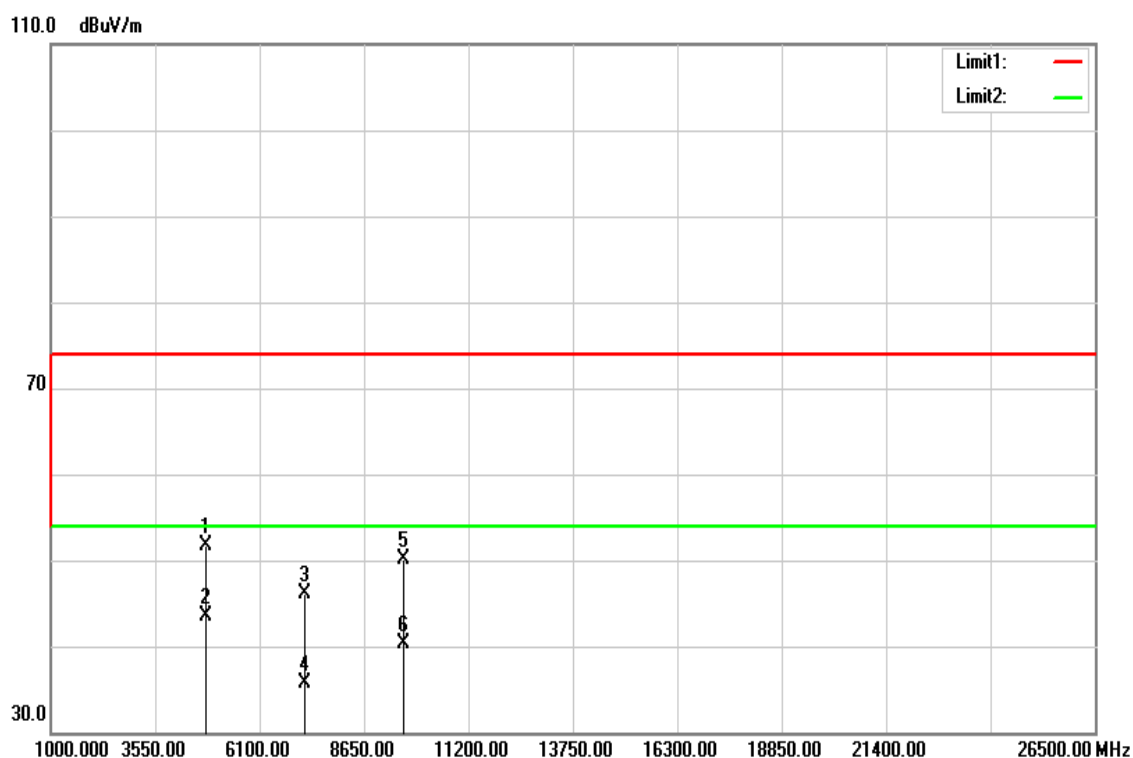


Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4960.000	49.86	5.46	55.32	74.00	-18.68	Peak
4960.000	45.85	5.46	51.31	54.00	-2.69	AVG
7440.000	34.85	13.33	48.18	74.00	-25.82	Peak
7440.000	23.95	13.33	37.28	54.00	-16.72	AVG
9920.000	31.48	17.60	49.08	74.00	-24.92	Peak
9920.000	20.91	17.60	38.51	54.00	-15.49	AVG

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

Test Mode	8DPSK_EDR-3Mbps Low CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Harmonic	Test Date	Dec 21, 2016
Polarize	Vertical	Test Engineer	ED Chiang
Detector	Peak and Average	Test Voltage	120Vac / 60Hz

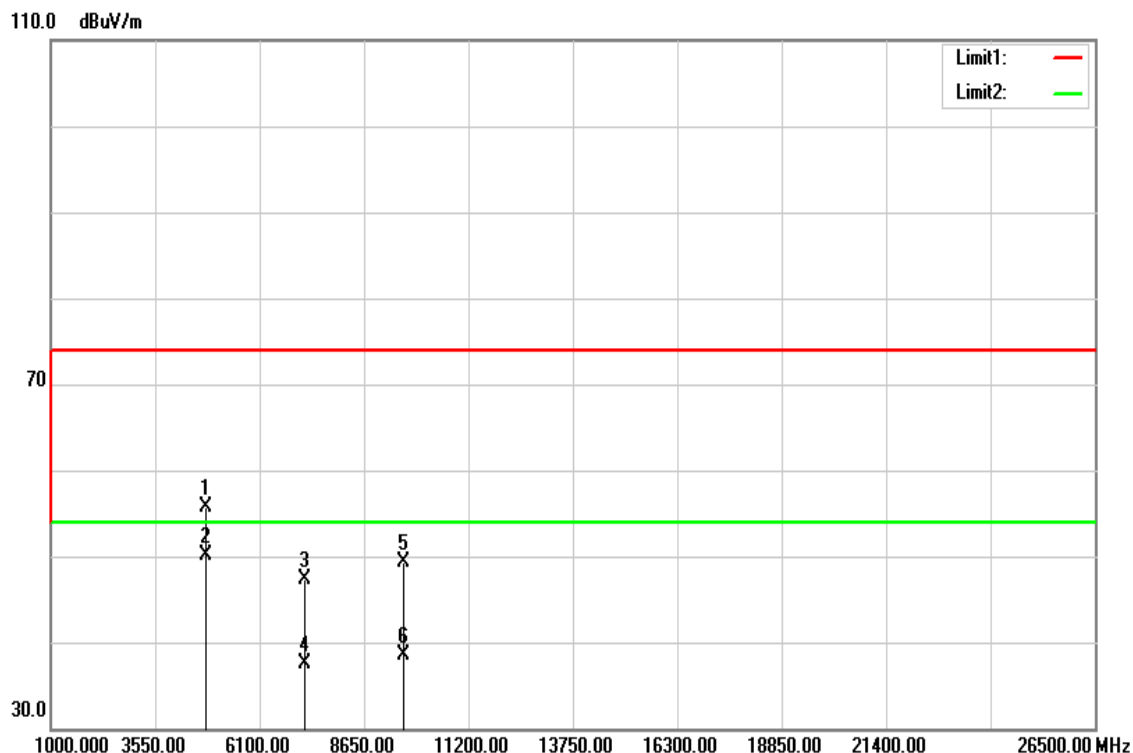


Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4804.000	46.62	5.04	51.66	74.00	-22.34	Peak
4804.000	38.48	5.04	43.52	54.00	-10.48	AVG
7206.000	33.44	12.62	46.06	74.00	-27.94	Peak
7206.000	23.05	12.62	35.67	54.00	-18.33	AVG
9608.000	32.54	17.60	50.14	74.00	-23.86	Peak
9608.000	22.68	17.60	40.28	54.00	-13.72	AVG

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

Test Mode	8DPSK_EDR-3Mbps Low CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Harmonic	Test Date	Dec 21, 2016
Polarize	Horizontal	Test Engineer	ED Chiang
Detector	Peak and Average	Test Voltage	120Vac / 60Hz

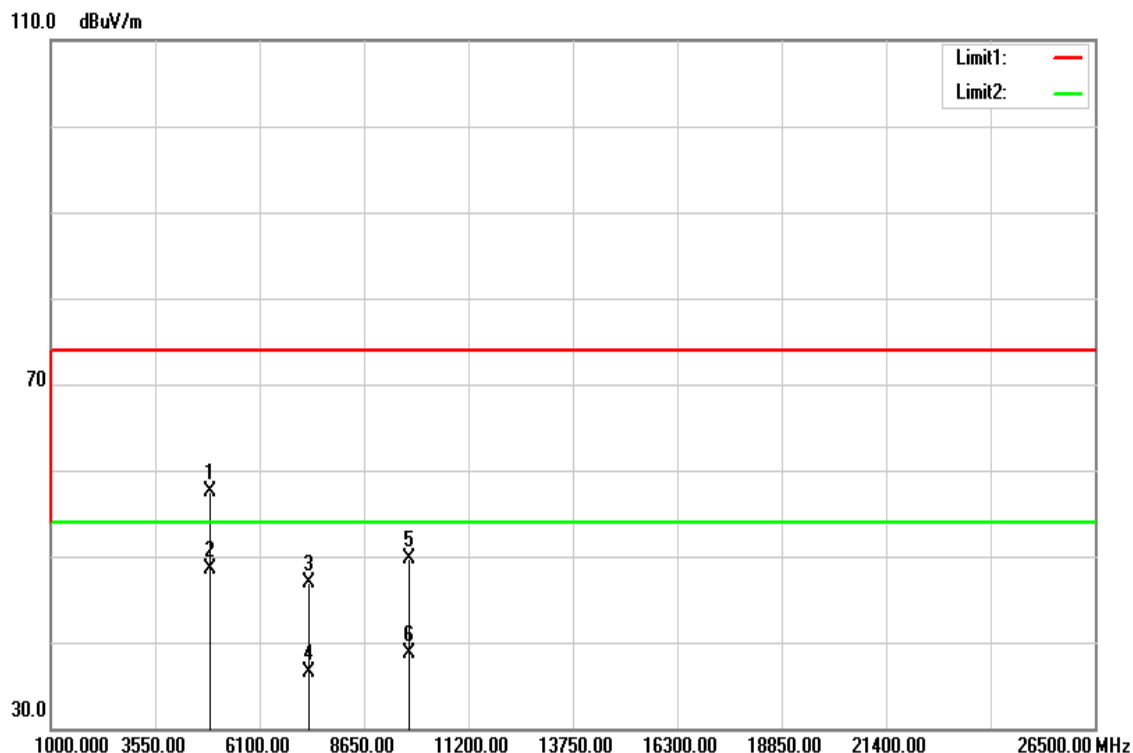


Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4804.000	50.61	5.04	55.65	74.00	-18.35	Peak
4804.000	45.06	5.04	50.10	54.00	-3.90	AVG
7206.000	34.60	12.62	47.22	74.00	-26.78	Peak
7206.000	24.85	12.62	37.47	54.00	-16.53	AVG
9608.000	31.65	17.60	49.25	74.00	-24.75	Peak
9608.000	20.89	17.60	38.49	54.00	-15.51	AVG

Remark:

- Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
- For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

Test Mode	8DPSK_EDR-3Mbps Mid CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Harmonic	Test Date	Dec 21, 2016
Polarize	Vertical	Test Engineer	ED Chiang
Detector	Peak and Average	Test Voltage	120Vac / 60Hz

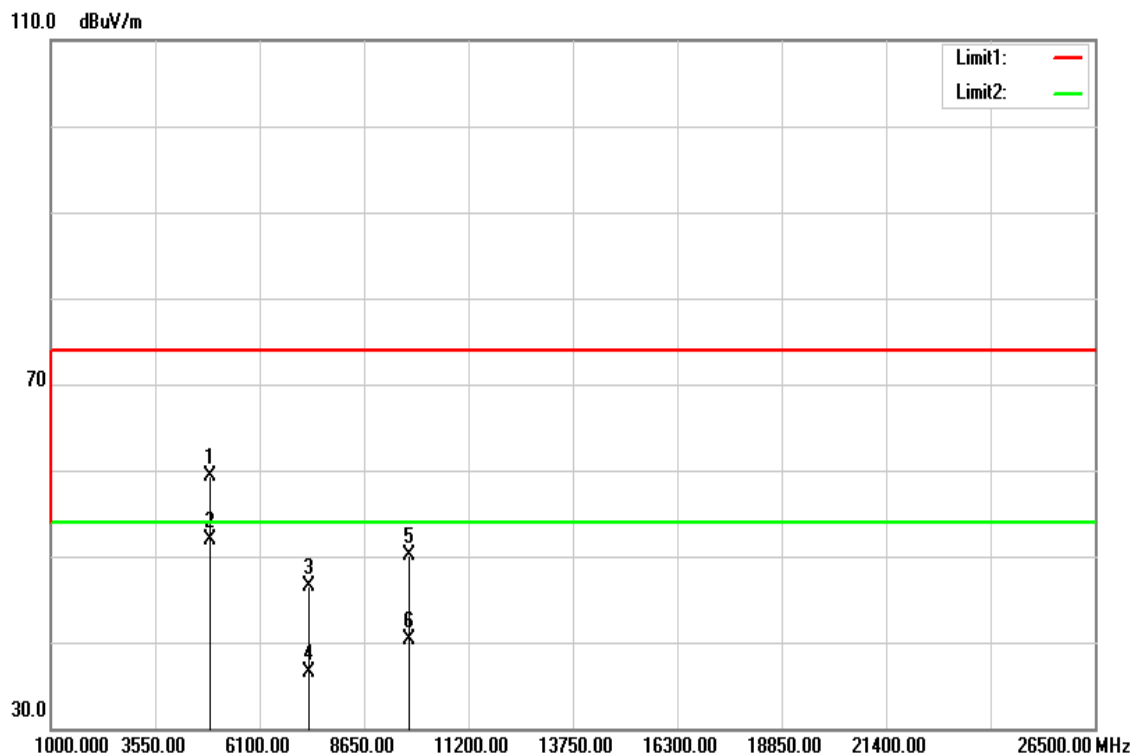


Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4882.000	52.18	5.25	57.43	74.00	-16.57	Peak
4882.000	43.22	5.25	48.47	54.00	-5.53	AVG
7323.000	33.97	12.98	46.95	74.00	-27.05	Peak
7323.000	23.47	12.98	36.45	54.00	-17.55	AVG
9764.000	32.01	17.60	49.61	74.00	-24.39	Peak
9764.000	21.18	17.60	38.78	54.00	-15.22	AVG

Remark:

- Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
- For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

Test Mode	8DPSK_EDR-3Mbps Mid CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Harmonic	Test Date	Dec 21, 2016
Polarize	Horizontal	Test Engineer	ED Chiang
Detector	Peak and Average	Test Voltage	120Vac / 60Hz

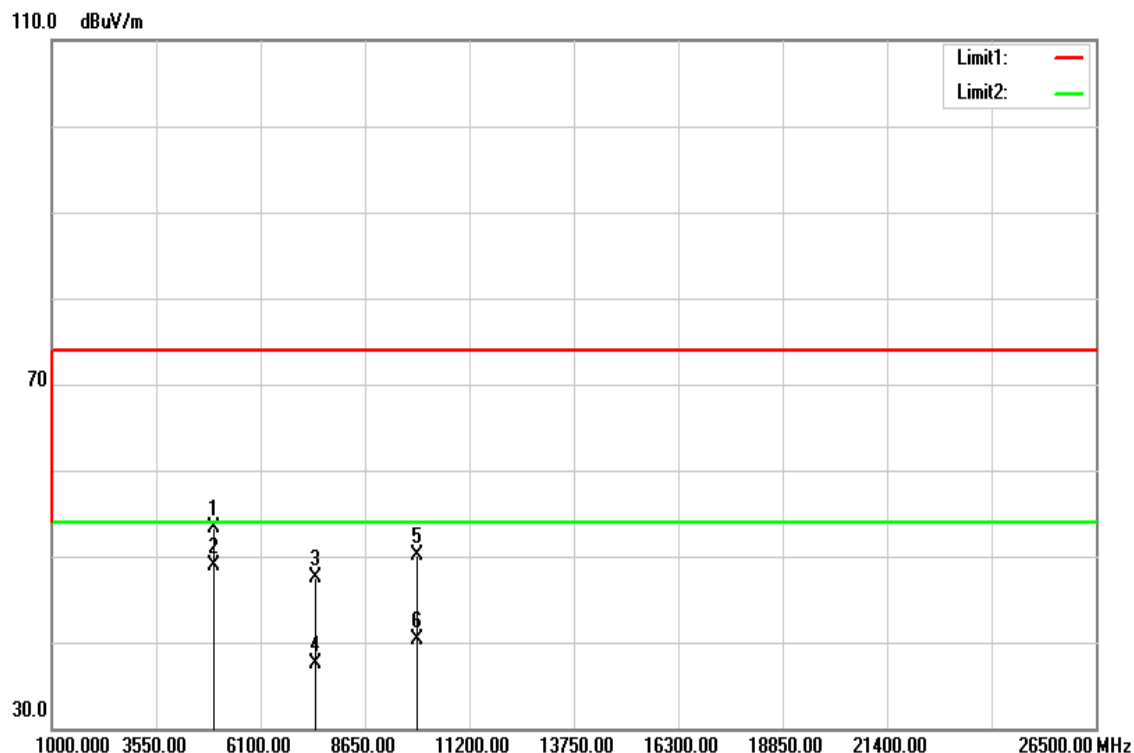


Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4882.000	53.98	5.25	59.23	74.00	-14.77	Peak
4882.000	46.62	5.25	51.87	54.00	-2.13	AVG
7323.000	33.58	12.98	46.56	74.00	-27.44	Peak
7323.000	23.43	12.98	36.41	54.00	-17.59	AVG
9764.000	32.41	17.60	50.01	74.00	-23.99	Peak
9764.000	22.68	17.60	40.28	54.00	-13.72	AVG

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

Test Mode	8DPSK_EDR-3Mbps High CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Harmonic	Test Date	Dec 21, 2016
Polarize	Vertical	Test Engineer	ED Chiang
Detector	Peak and Average	Test Voltage	120Vac / 60Hz

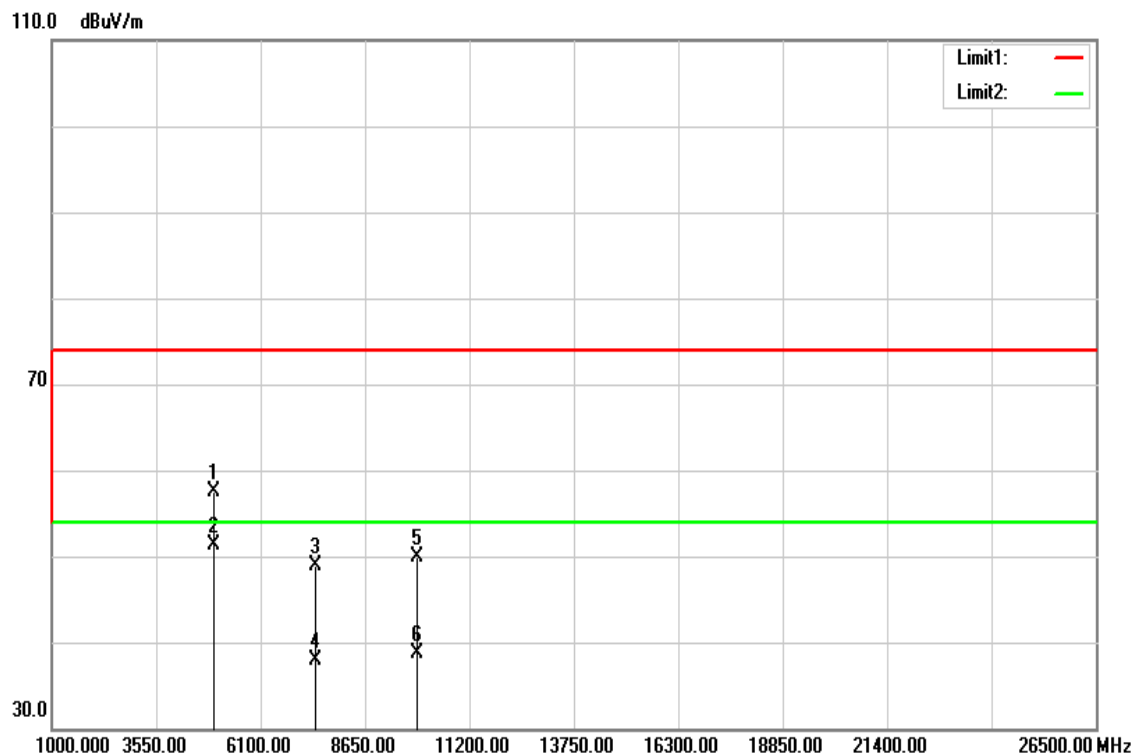


Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4960.000	47.85	5.46	53.31	74.00	-20.69	Peak
4960.000	43.45	5.46	48.91	54.00	-5.09	AVG
7440.000	34.18	13.33	47.51	74.00	-26.49	Peak
7440.000	24.21	13.33	37.54	54.00	-16.46	AVG
9920.000	32.50	17.60	50.10	74.00	-23.90	Peak
9920.000	22.68	17.60	40.28	54.00	-13.72	AVG

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

Test Mode	8DPSK_EDR-3Mbps High CH	Temp/Hum	27(°C)/ 53%RH
Test Item	Harmonic	Test Date	Dec 21, 2016
Polarize	Horizontal	Test Engineer	ED Chiang
Detector	Peak and Average	Test Voltage	120Vac / 60Hz



Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4960.000	51.96	5.46	57.42	74.00	-16.58	Peak
4960.000	45.78	5.46	51.24	54.00	-2.76	AVG
7440.000	35.50	13.33	48.83	74.00	-25.17	Peak
7440.000	24.62	13.33	37.95	54.00	-16.05	AVG
9920.000	32.29	17.60	49.89	74.00	-24.11	Peak
9920.000	21.07	17.60	38.67	54.00	-15.33	AVG

Remark:

- Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
- For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit