RADIO TEST REPORT

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

Test Standard	**FCC Part 15.247 and IC RSS-247 issue 2**
FCC ID	**PPQ-WCBN3509A**
ISED No.	**4491A-WCBN3509A**
Product name	**802.11a/b/g/n/ac 2Tx2R+BT V4.1LE USB Combo Module**
Brand Name	**LITE-ON**
Model	**WCBN3509A**
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 Compliance Certification Services Inc.(Wugu Laboratory)

Testing Laboratory
1309

Approved by:

Sam Chuang
Manager

Reviewed by:

Eric Lee
Engineer

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Revision History

Rev.	Issue Date	Revisions	Revised By
00	December 5, 2017	Initial Issue	May Lin

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1. GENERAL INFORMATION

1.1 EUT INFORMATION

Applicant	LITE-ON Technology Corp. Bldg. C, 90, Chien 1 Road, Chung Ho, New Taipei City 23585, Taiwan, R.O.C
Manufacturer	LITE-ON TECHNOLOGY (Changzhou) CO., LTD A9 Building,No.88 Yanghu Road, Wujin Hi-Tech Industrial Development Zone ,Changzhou City,Jiangsu Province 213100 China
Equipment	802.11a/b/g/n/ac 2Tx2R+BT V4.1LE USB Combo Module
Model No.	WCBN3509A
Model Discrepancy	N/A
Trade Name	LITE-ON
Received Date	November 28, 2017
Date of Test	November 30 ~ December 2, 2017
Output Power (W)	GFSK : 0.01449 8DPSK : 0.01549
Power Operation	Powered from host device: DC 5V
HW Version	V05
FW Version	V37.27

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1.2 EUT CHANNEL INFORMATION

Frequency Range	2402MHz-2480MHz
Modulation Type	1. GFSK for BDR-1Mbps 2. π/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 and RSS-GEN Table A1 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 Type	☒ PIFA ☐ PCB ☐ Dipole ☐ Coils
Antenna Gain	

Brand	P/N	Type	Cable length	Peak Gain	Worst case
HongBo	290-10569	PIFA	300mm	3.74dBi	V

1. Power Directional Gain: 3.74
2. Power Density Directional Gain: 3.74

Other antenna information:

Brand	P/N	Type	Cable length	Peak Gain
HongBo	290-10310	PIFA	500mm	3.60dBi
Walsin	RFMTA401032IMLB702	PIFA	320mm	2.6dBi
Walsin	RFMTA401080IMLB701	PIFA	800mm	1.72dBi
Walsin	RFMTA401082IMLB701	PIFA	820mm	1.62dBi

Notes:
1. Power Directional Gain: 10LOG(((10^(Ant1/10)+10^(Ant2/10))/2))
2. Power Density Directional Gain: 10LOG(((10^(Ant1/10)+10^(Ant2/10))/2))+10log(NTX/NSS)

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1.4 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
AC Powerline Conducted Emission	+/- 1.2575
Emission bandwidth, 20dB bandwidth	+/- 1.4003
RF output power, conducted	+/- 1.1372
Power density, conducted	+/- 1.4003
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
3M Semi Anechoic Chamber / 40G~60G	+/- 1.8509
3M Semi Anechoic Chamber / 60G~75G	+/- 1.9869
3M Semi Anechoic Chamber / 75G~110G	+/- 2.9651
3M Semi Anechoic Chamber / 110G~170G	+/- 2.7807
3M Semi Anechoic Chamber / 170G~220G	+/- 3.6437
3M Semi Anechoic Chamber / 220G~325G	+/- 4.2982

***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.

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1.5 FACILITIES AND TEST LOCATION

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

No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.)

Test site	Test Engineer	Remark
AC Conduction Room	Eric Lee	
Radiation	Kevin Kuo	
RF Conducted	Kevin Kuo	

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					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Power Meter	Anritsu	ML2495A	1033009	04/11/2017	04/10/2018
Power Sensor	Anritsu	MA2411B	917072	07/03/2017	07/02/2018
Spectrum Analyzer	R&S	FSV 40	101073	10/02/2017	10/01/2018
Thermostatic/Hrgrosatic Chamber	GWINSTEK	GTC-288MH-CC	TH160402	05/23/2017	05/22/2018

Wugu 966 Chamber A					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Bilog Antenna	Sunol Sciences	JB3	A030105	06/20/2017	06/19/2018
Horn Antenna	EMCO	3117	00055165	02/20/2017	02/19/2018
Horn Antenna	ETS LINDGREN	3116	00026370	01/12/2017	01/11/2018
K Type Cable	Huber+Suhner	SUCOFLEX 102	29406/2	01/10/2017	01/09/2018
K Type Cable	Huber+Suhner	SUCOFLEX 102	22470/2	01/10/2017	01/09/2018
Pre-Amplifier	MITEQ	AMF-6F-260400-40-8P	985646	01/10/2017	01/09/2018
Pre-Amplifier	EMCI	EMC 012635	980151	08/01/2017	07/31/2018
Pre-Amplifier	EMEC	EM01M26G	60570	08/01/2017	07/31/2018
Pre-Amplifier	EMEC	EM330	060609	06/07/2017	06/06/2018
Spectrum Analyzer	Agilent	E4446A	US42510252	11/27/2017	11/26/2018
Loop Ant	COM-POWER	AL-130	121051	03/02/2017	03/01/2018
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R
Wideband Radio Communication Tester	R&S	CMW 500	116875	04/25/2017	04/24/2018

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Conducted Emission Room # B					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
LISN	R&S	ENV216	101054	05/18/2017	05/17/2018
LISN	SCHWARZBECK	NSLK 8127	8127-541	02/14/2017	02/13/2018
EMI Test Receiver	R&S	ESCI	100064	05/17/2017	05/16/2018

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.**	**BSMI ID**
1	NB(H)	Acer	Aspire 4320 series	N/A	QDS-BRCM1018

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, RSS-247 Issue 2 and RSS-GEN Issue 4.

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2. TEST SUMMERY

FCC Standard Section	IC Standard Section	Report Section	Test Item	Result
15.203	-	1.2	Antenna Requirement	Pass
15.207(a)	RSS-GEN 8.8	4.1	AC Conducted Emission	Pass
15.247(a)(1)	RSS-247(5.1)(a)	4.2	20 dB Bandwidth	-
-	RSS-GEN 6.6	4.2	Occupied Bandwidth (99%)	-
15.247(b)(1)	RSS-247(5.4)(b)	4.3	Output Power Measurement	Pass
15.247(a)(1)	RSS-247(5.1)(b)	4.4	Frequency Separation	Pass
15.247(a)(1)(iii)	RSS-247(5.1)(d)	4.5	Number of Hopping	Pass
15.247(d)	RSS-247(5.5)	4.6	Conducted Band Edge	Pass
15.247(d)	RSS-247(5.5)	4.6	Conducted Emission	Pass
15.247(a)(1)(iii)	RSS-247(5.1)(d)	4.7	Time of Occupancy	Pass
15.247(d)	RSS-GEN 8.9, 8.10	4.8	Radiation Band Edge	Pass
15.247(d)	RSS-GEN 8.9, 8.10	4.8	Radiation Spurious Emission	Pass

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3. DESCRIPTION OF TEST MODES

3.1 THE WORST MODE OF OPERATING CONDITION

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

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3.2 THE WORST MODE OF MEASUREMENT

AC Power Line Conducted Emission	
Test Condition	AC Power line conducted emission for line and neutral
Voltage/Hz	DC 5V
Test Mode	Mode 1: EUT power by Host System.
Worst Mode	☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ☐ Mode 4

Radiated Emission Measurement Below 1G	
Test Condition	Radiated Emission Below 1G
Voltage/Hz	DC 5V
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	DC 5V
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

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 (Z-Plane and Vertical) were recorded in this report
3. For below 1G, AC power line conducted emission and radiation emission were performed the EUT transmit at the highest output power channel as worse case.

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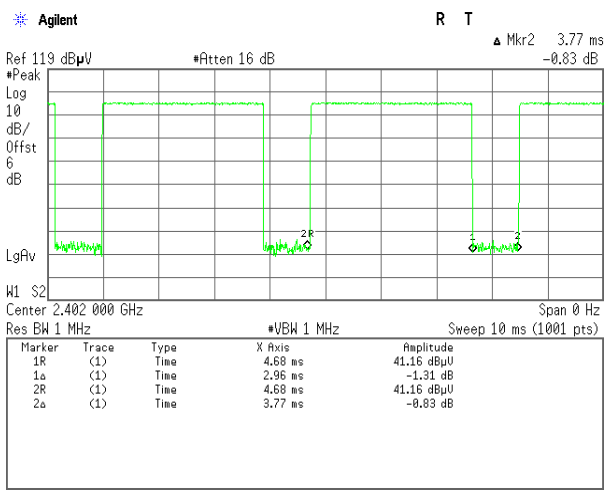
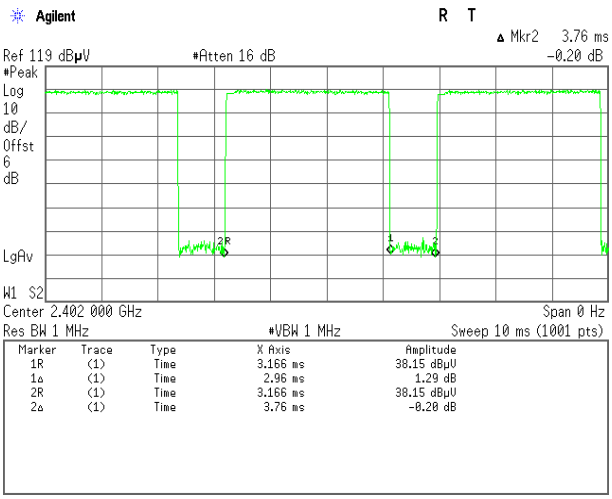
3.3 EUT DUTY CYCLE

Duty Cycle				
Configuration	TX ON (ms)	TX ALL (ms)	Duty Cycle (%)	Duty Factor(dB)
BDR-1Mbps	2.9600	3.7700	78.51%	1.05
EDR-3Mbps	2.9600	3.7600	78.72%	1.04

BDR-1Mbps



EDR-3Mbps



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4. TEST RESULT

4.1 AC POWER LINE CONDUCTED EMISSION

4.1.1 Test Limit

According to §15.207(a) and RSS-GEN section 8.8,

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

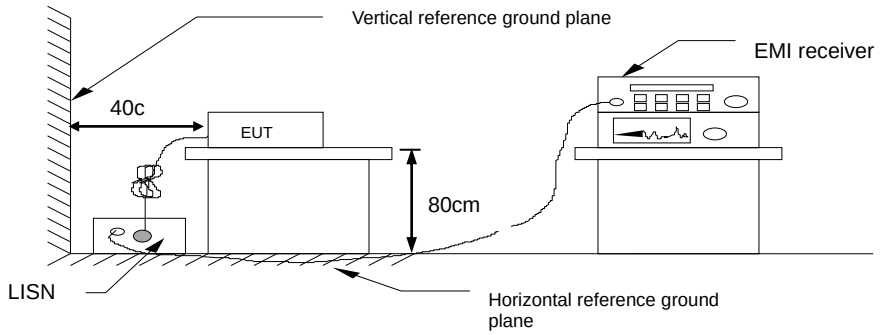
* Decreases with the logarithm of the frequency.

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

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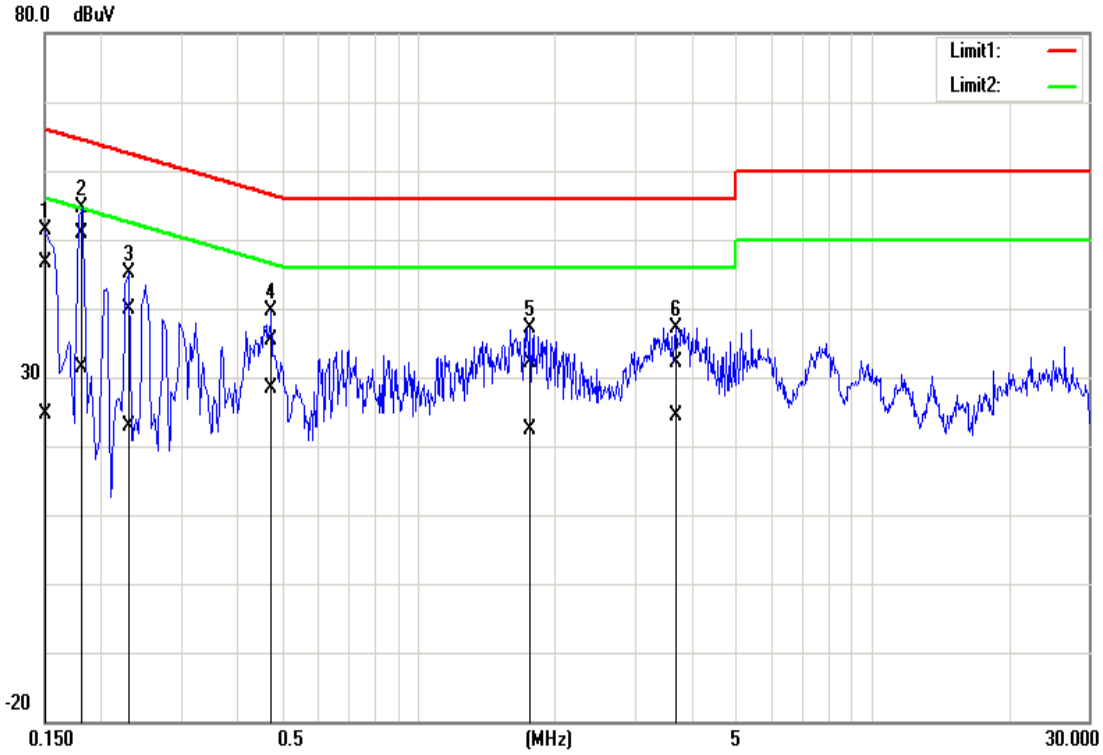
Test Data

Test Mode:	Mode 1	Temp/Hum	24.5(℃)/ 52.1%RH
Test Voltage:	120Vac / 60Hz	Test Date	November 30, 2017
Phase:	Line	Test Engineer	Eric Lee



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	46.67	24.58	0.08	46.75	24.66	66.00	56.00	-19.25	-31.34	Pass
0.1820	50.67	31.37	0.09	50.76	31.46	64.39	54.39	-13.63	-22.93	Pass
0.2300	39.89	22.89	0.09	39.98	22.98	62.45	52.45	-22.47	-29.47	Pass
0.4740	35.26	28.39	0.10	35.36	28.49	56.44	46.44	-21.08	-17.95	Pass
1.7700	31.86	22.27	0.16	32.02	22.43	56.00	46.00	-23.98	-23.57	Pass
3.7020	31.99	24.15	0.22	32.21	24.37	56.00	46.00	-23.79	-21.63	Pass

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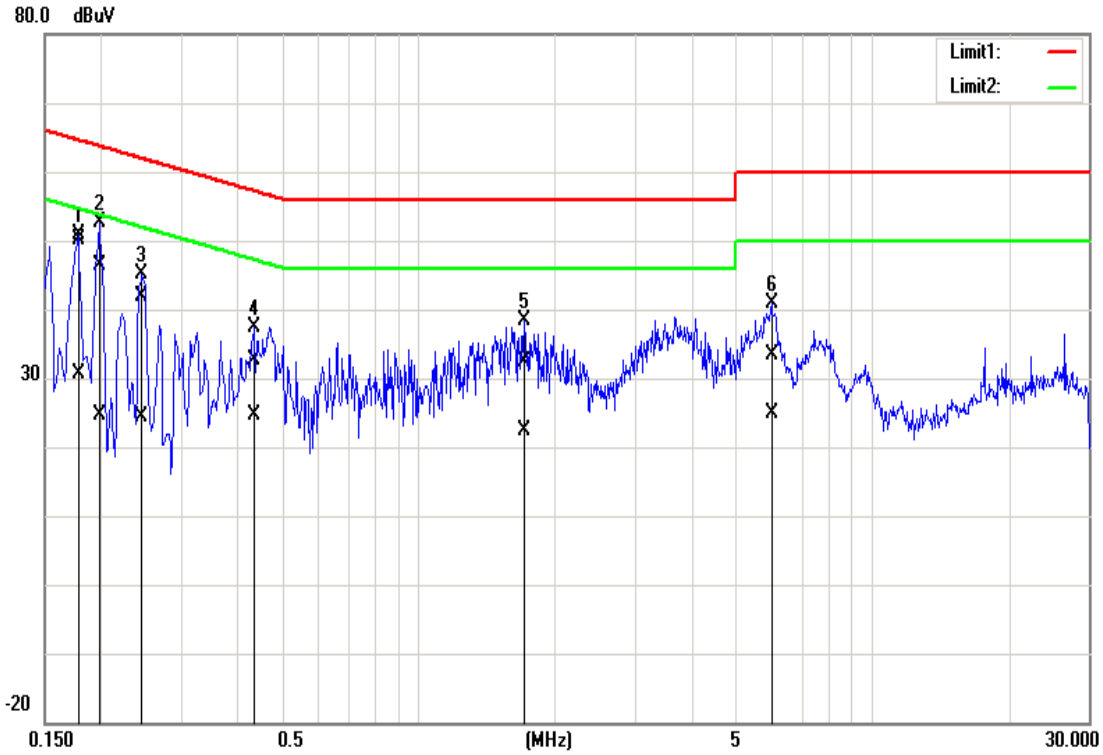
Test Mode:	Mode 1	Temp/Hum	24.5(℃)/ 52.1%RH
Test Voltage:	120Vac / 60Hz	Test Date	November 30, 2017
Phase:	Neutral	Test Engineer	Eric Lee



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
0.1780	50.05	30.43	0.16	50.21	30.59	64.57	54.58	-14.36	-23.99	Pass
0.1980	46.25	24.43	0.16	46.41	24.59	63.69	53.69	-17.28	-29.10	Pass
0.2460	41.66	24.15	0.16	41.82	24.31	61.89	51.89	-20.07	-27.58	Pass
0.4340	32.43	24.52	0.18	32.61	24.70	57.18	47.18	-24.57	-22.48	Pass
1.7100	32.18	22.20	0.23	32.41	22.43	56.00	46.00	-23.59	-23.57	Pass
6.0180	32.94	24.63	0.37	33.31	25.00	60.00	50.00	-26.69	-25.00	Pass

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4.2 20DB BANDWIDTH AND OCCUPIED BANDWIDTH (99%)

4.2.1 Test Limit

According to §15.247(a) (1), RSS-247 section 5.1(a) and RSS-GEN 6.6,

20 dB Bandwidth ：For reporting purposes only.

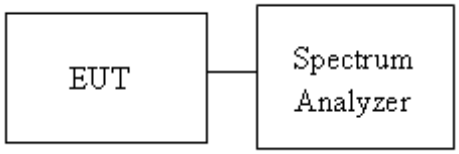
Occupied Bandwidth(99%) ：For reporting purposes only.

4.2.2 Test Procedure

Test method Refer as ANSI 63.10:2013 clause 11.8.1,

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_BDR-1Mbps mode / 2402-2480 MHz			
Channel	**Frequency (MHz)**	**OBW(99%) (MHz)**	**20dB BW (MHz)**
Low	2402	0.9117	0.9608
Mid	2441	0.9160	0.9869
High	2480	0.9160	0.9869

Test mode: 8DPSK_EDR-3Mbps mode / 2402-2480 MHz			
Channel	**Frequency (MHz)**	**OBW(99%) (MHz)**	**20dB BW (MHz)**
Low	2402	1.1852	1.3000
Mid	2441	1.1852	1.2956
High	2480	1.1895	1.2956

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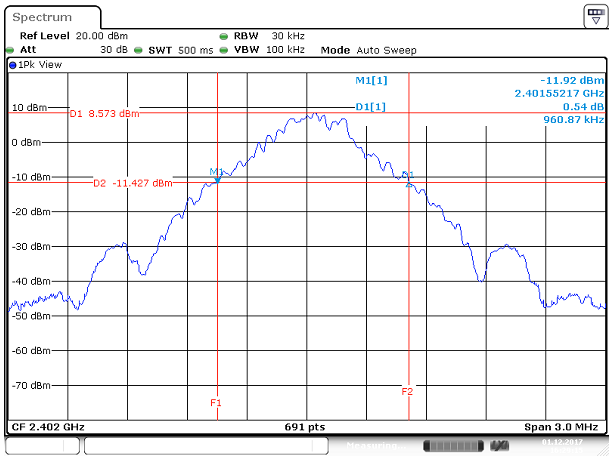
Test Data

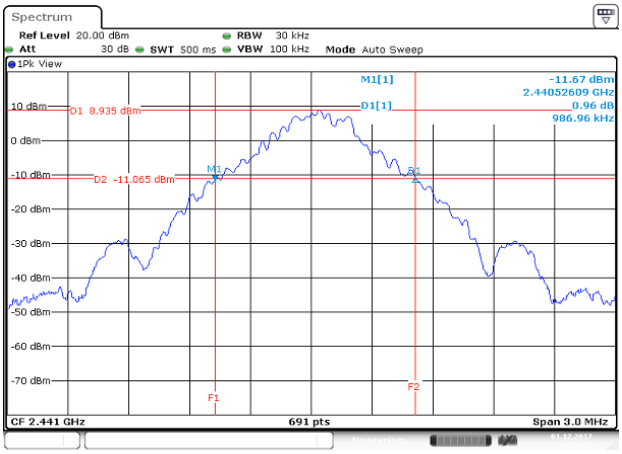
GFSK_BDR-1Mbps mode

Low CH



Date: 1.DEC.2017 16:29:15

Mid CH



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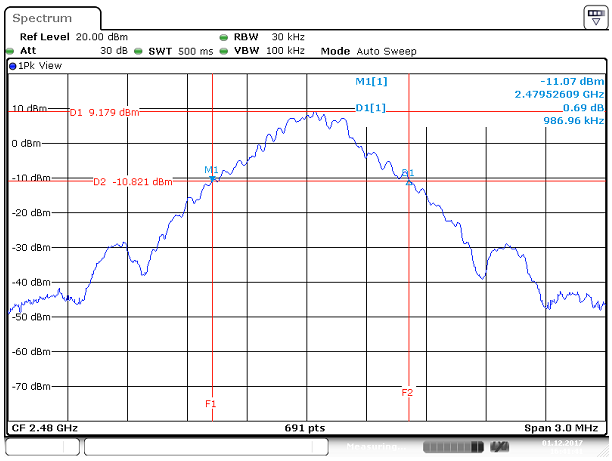
High CH



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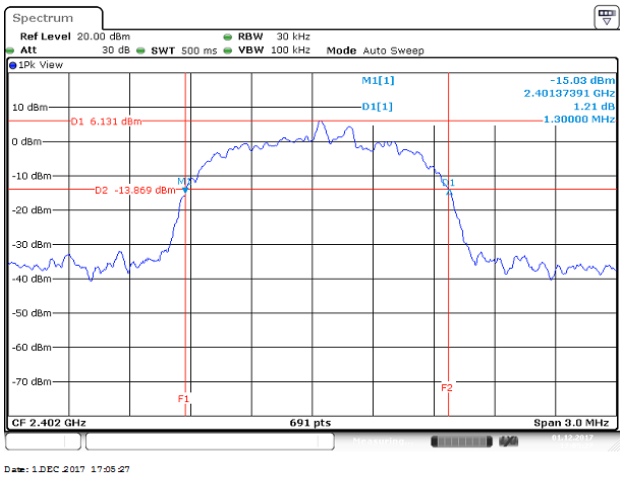
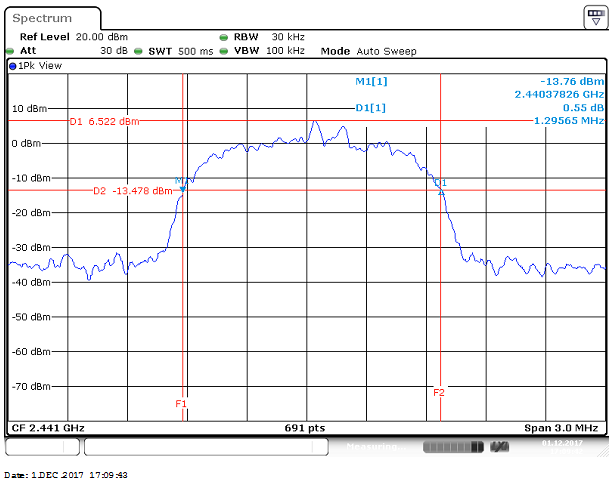
8DPSK_EDR-3Mbps mode

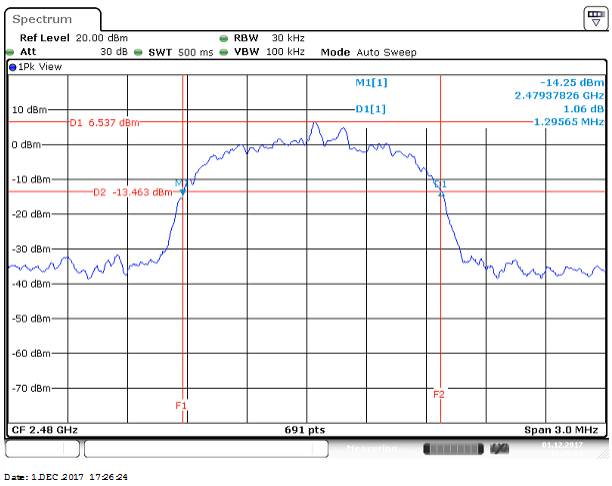
Low CH



Mid CH



High CH



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4.3 OUTPUT POWER MEASUREMENT

4.3.1 Test Limit

According to §15.247(a)(1) and RSS-247 section 5.4(b)

Peak output power：

FCC

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.

IC

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W and the e.i.r.p. shall not exceed 4 W if the hopset uses 75 or more hopping channels.

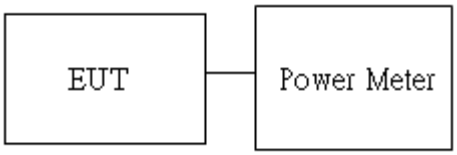
Limit	☒ Antenna not exceed 6 dBi：21dBm ☐ Antenna with DG greater than 6 dBi：21dBm [Limit = 30 – (DG – 6)]

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



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4.3.4 Test Result

Peak output power：

For GFSK / DH5

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	11.35	0.01365	0.125	PASS
Mid	2441	11.61	***0.01449**		PASS
High	2480	11.54	0.01426		PASS

For 8DPSK / DH5

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	11.68	0.01472	0.125	PASS
Mid	2441	11.90	***0.01549**		PASS
High	2480	11.86	0.01535		PASS

Average output power：

For GFSK / DH5

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	EIRP Power (dBm)	EIRP Power (W)
Low	2402	10.64	0.01159	15.44	0.03499
Mid	2441	10.95	0.01245	15.75	0.03758
High	2480	10.87	0.01222	15.67	0.03690

For 8DPSK / DH5

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	EIRP Power (dBm)	EIRP Power (W)
Low	2402	8.27	0.00671	14.30	0.02692
Mid	2441	8.56	0.00718	14.59	0.02877
High	2480	8.46	0.00701	14.49	0.02812

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4.4 FREQUENCY SEPARATION

4.4.1 Test Limit

According to §15.247(a)(1) and RSS-247 section 5.1(b)

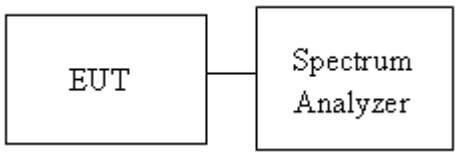
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 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_BDR-1Mbps mode / 2402-2480 MHz				
Channel	**Frequency (MHz)**	**Channel Separation (MHz)**	**Channel Separation Limits (MHz)**	**Result**
Low	2402	0.9942	0.641	PASS
Mid	2441	0.9942	0.658	PASS
High	2480	0.9942	0.658	PASS

Test mode: 8DPSK_EDR-3Mbps mode / 2402-2480 MHz				
Channel	**Frequency (MHz)**	**Channel Separation (MHz)**	**Channel Separation Limits (MHz)**	**Result**
Low	2402	0.9986	0.867	PASS
Mid	2441	0.9986	0.840	PASS
High	2480	0.9986	0.840	PASS

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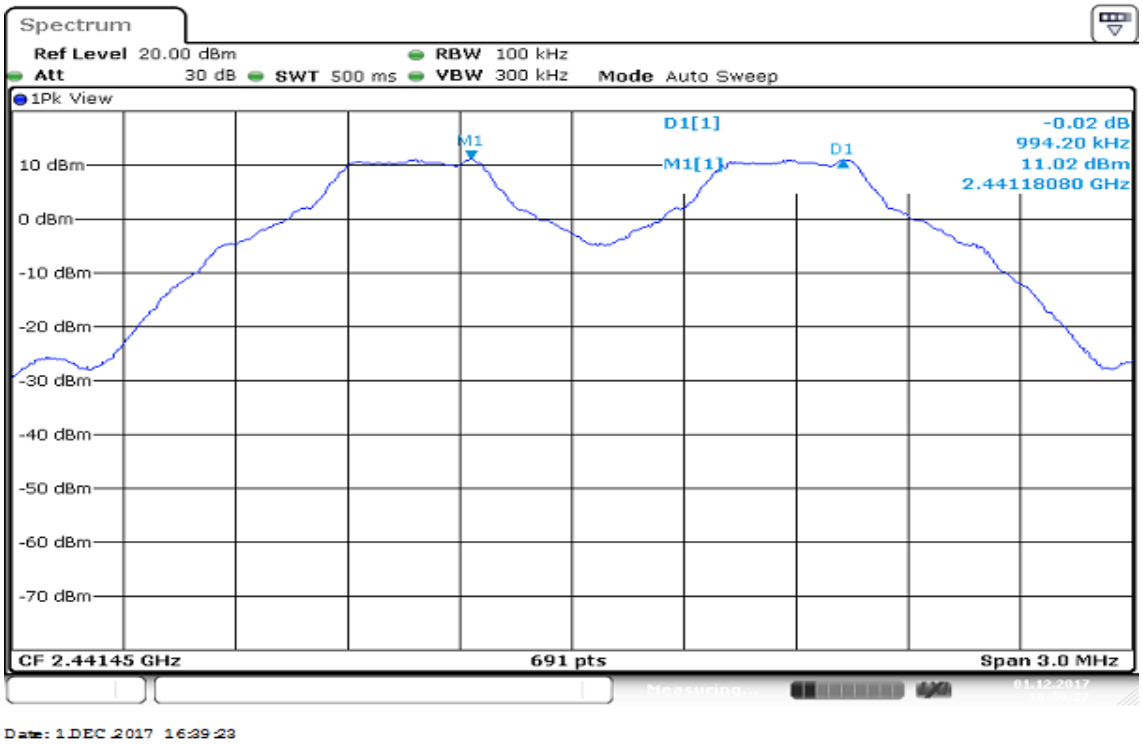
Test Data

GFSK_BDR-1Mbps mode



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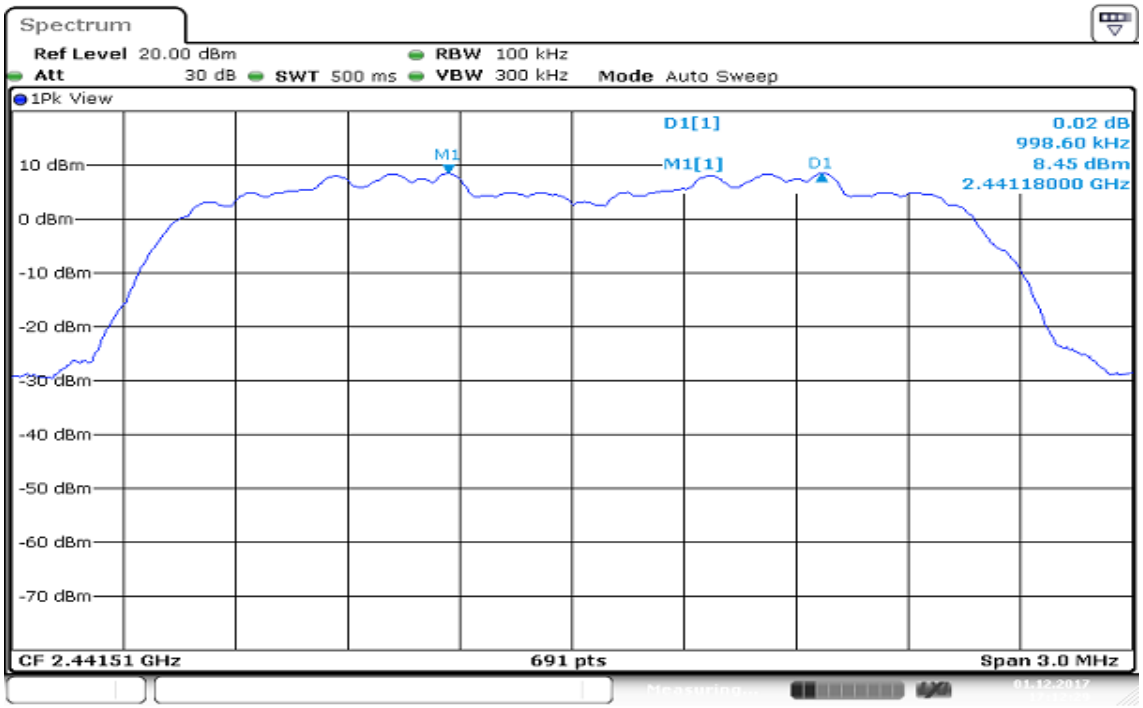
8DPSK_EDR-3Mbps mode



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4.5 NUMBER OF HOPPING

4.5.1 Test Limit

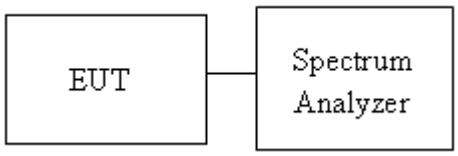
According to §15.247(a)(1)(iii) and RSS-247 section 5.1(d)

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.
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**
BDR-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

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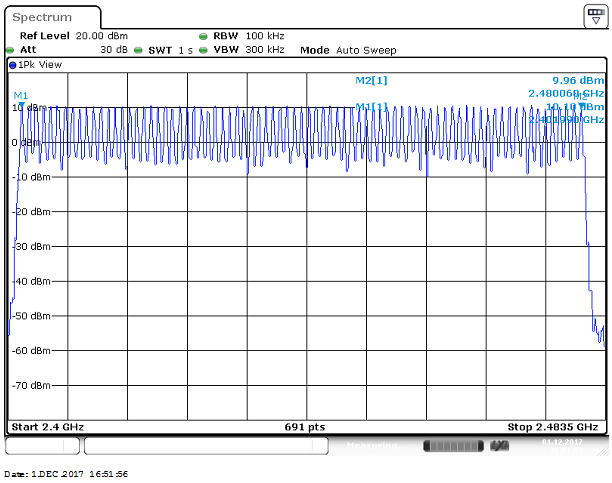
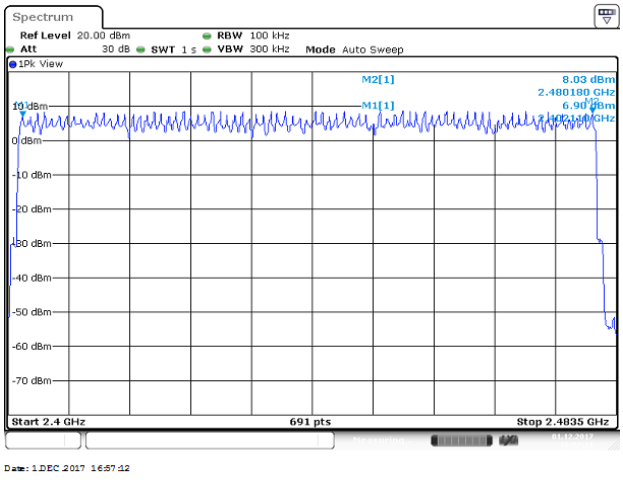
Test Data

Number of Hopping	
GFSK_BDR-1Mbps mode	**8DPSK_EDR-3Mbps mode**
	

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4.6 CONDUCTED BANDEDGE AND SPURIOUS EMISSION

4.6.1 Test Limit

According to §15.247(d) and RSS-247 section 5.5

Limit	-20 dBc

.

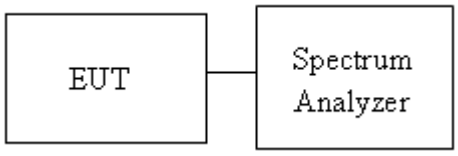
4.6.2 Test Procedure

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



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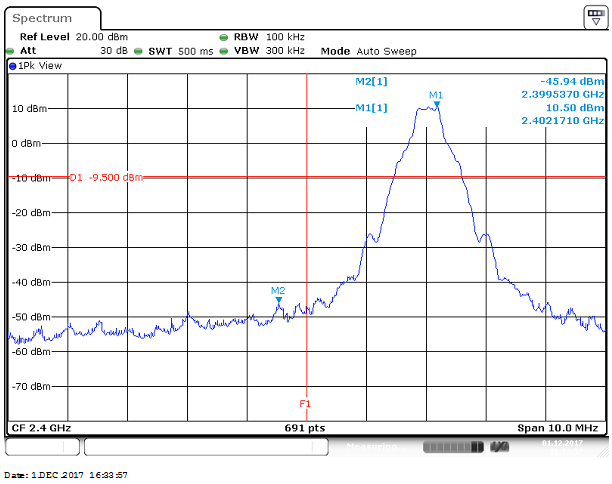
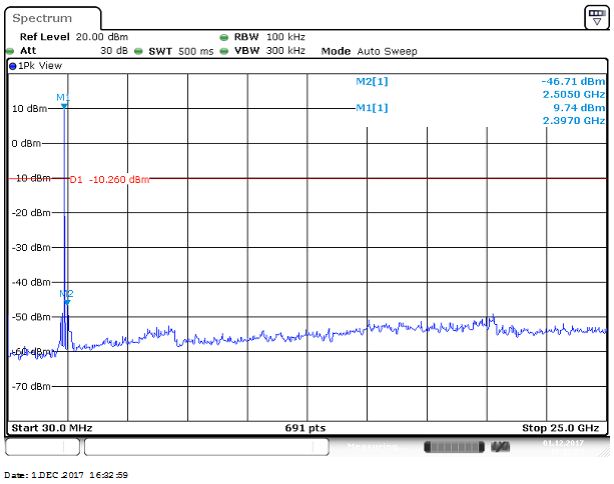
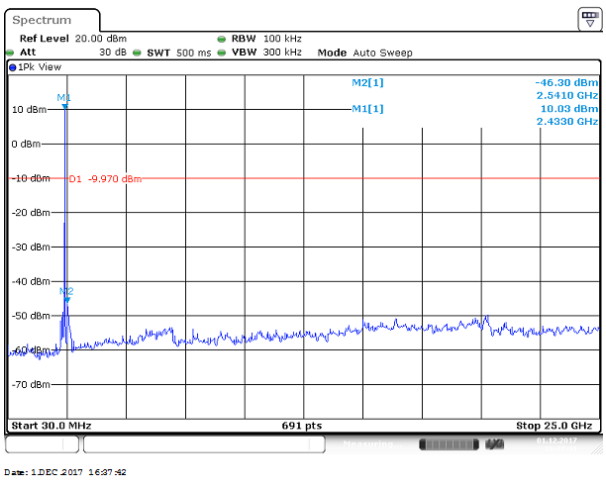
4.6.4 Test Result

Test Data

GFSK_BDR-1Mbps mode Low CH	
Band Edge	**Spurious Emission 30MHz-25GHz**
	

GFSK_BDR-1Mbps mode Mid CH	
Spurious Emission 30MHz-25GHz	
	

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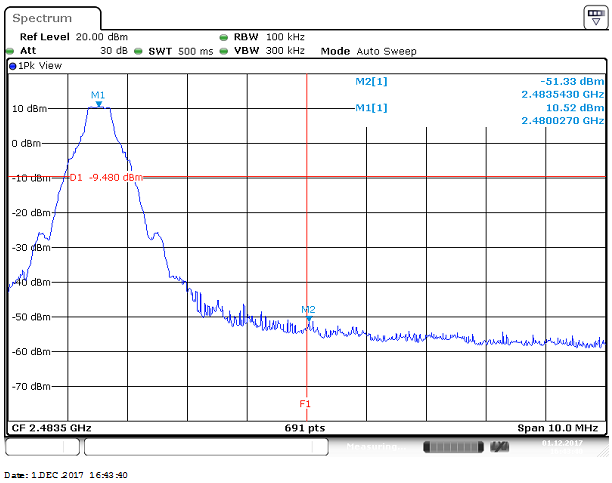
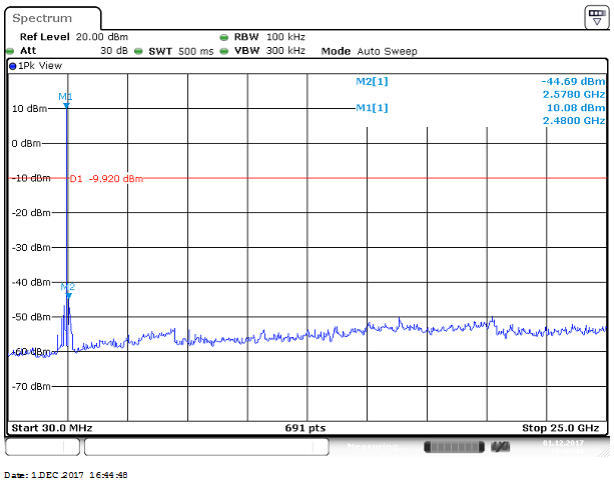
GFSK_BDR-1Mbps mode High CH

Band Edge

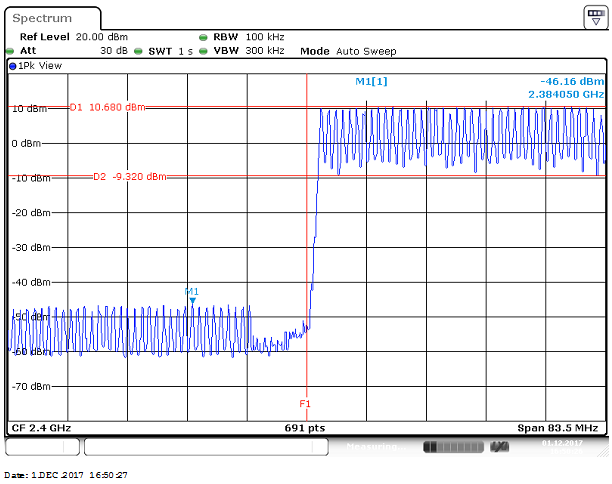


Spurious Emission 30MHz-25GHz

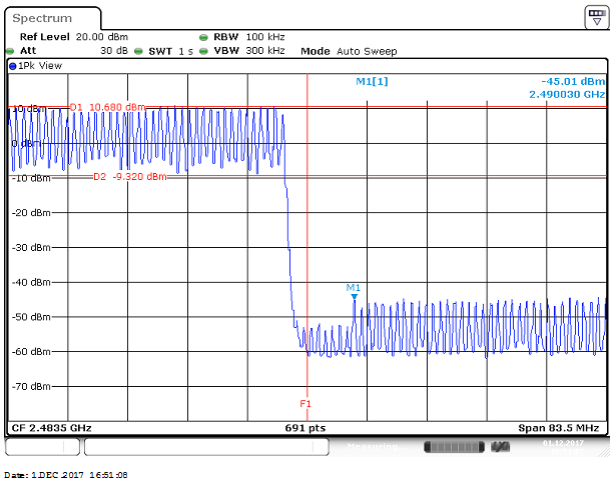


GFSK_BDR-1Mbps Hopping mode

Low Band Edge



High Band Edge



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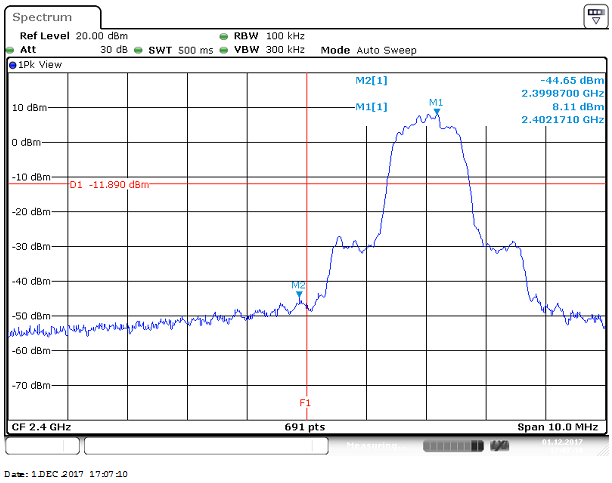
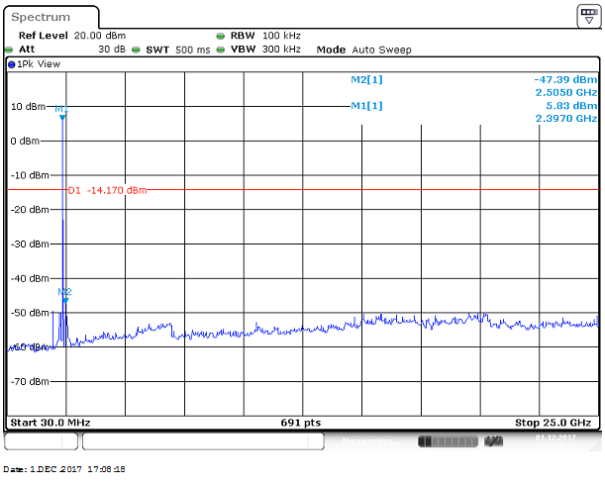
8DPSK_EDR-3Mbps mode Low CH

Band Edge

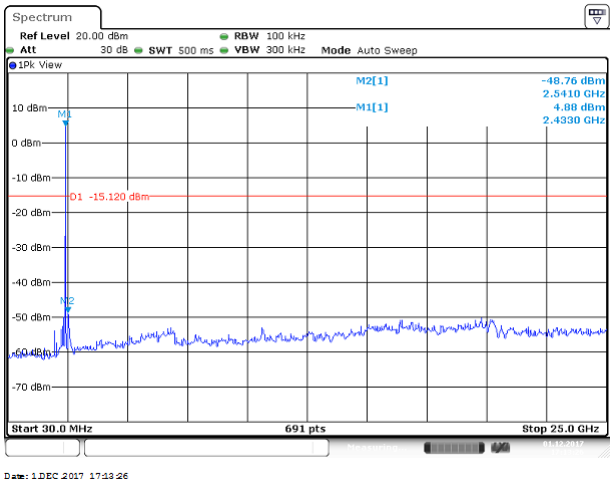


Spurious Emission 30MHz-25GHz



8DPSK_EDR-3Mbps mode Mid CH

Spurious Emission 30MHz-25GHz



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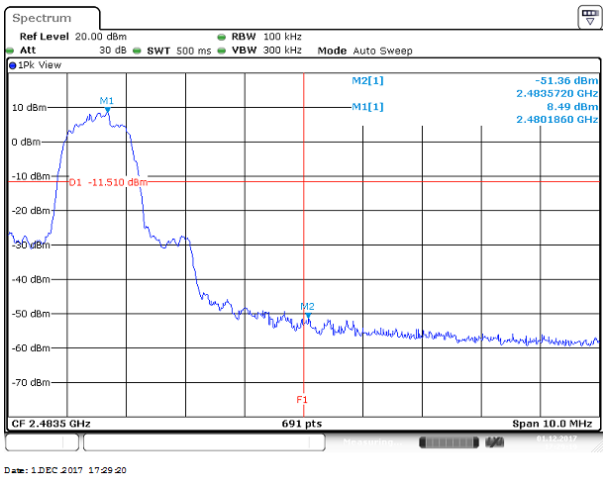
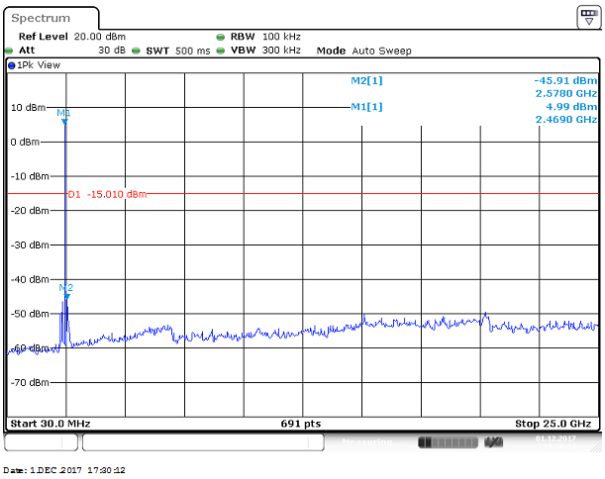
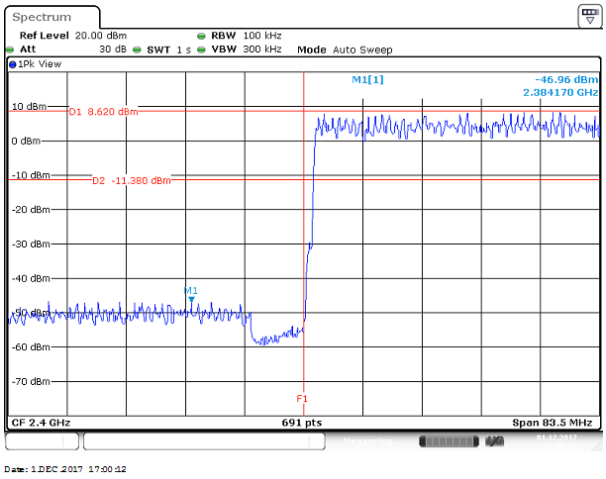
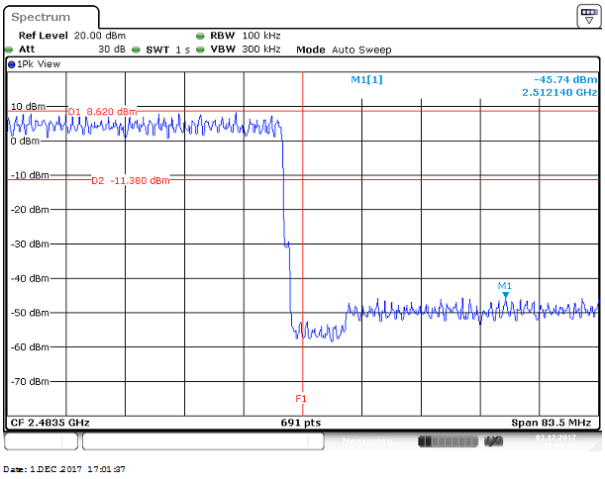
8DPSK_EDR-3Mbps mode High CH	
Band Edge	**Spurious Emission 30MHz-25GHz**
	

8DPSK_EDR-3Mbps Hopping mode	
Low Band Edge	**High Band Edge**
	

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4.7 TIME OF OCCUPANCY (DWELL TIME)

4.7.1 Test Limit

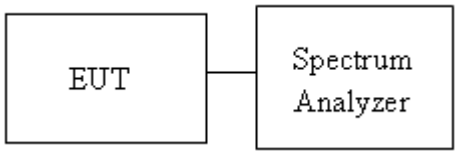
According to §15.247(a)(1)(iii)and RSS-247 section 5.1(d)

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 (0.4 * N sec)**	**Dwell Time IN (0.4 * N sec)**	**Dwell Time Limits (s)**	**Result**
BDR-1Mbps	2441	2.942	79	106.67	0.3138	0.4	Pass
EDR-3Mbps	2441	2.9565	79	106.67	0.3154	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							

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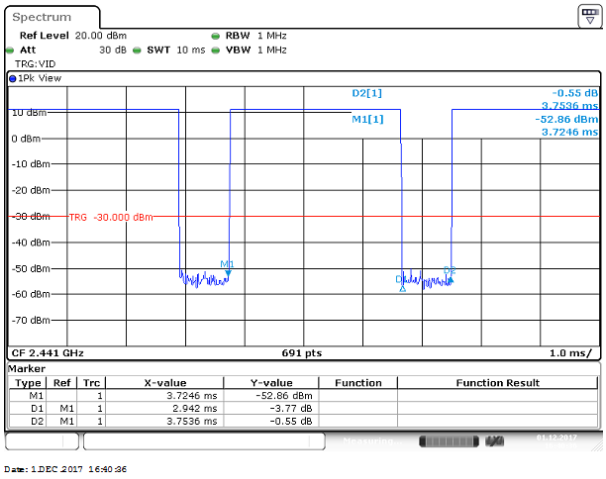
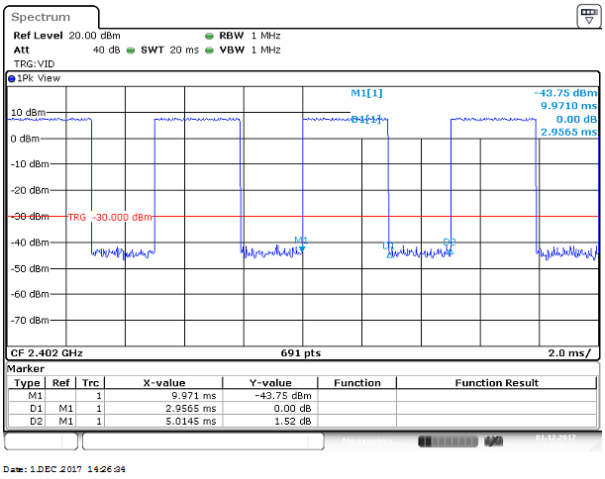
Test Data

Time of Occupancy (Dwell Time)

GFSK_BDR-1Mbps mode



8DPSK_EDR-3Mbps mode



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4.8 RADIATION BANDEDGE AND SPURIOUS EMISSION

4.8.1 Test Limit

FCC according to §15.247(d), §15.209 and §15.205,

IC according to RSS-247 section 5.5, RSS-Gen, Section 8.9 and 8.10

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)

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.

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4.8.2 Test Procedure

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 BDR-1Mbps. Therefore only BDR-1Mbps record in the report.

5. The SA setting following：

(1) Below 1G：RBW = 100kHz, VBW ≥ 3 RBW, Sweep = Auto, Detector = Peak, Trace = Max hold.

(2) Above 1G：

(2.1) For Peak measurement：RBW = 1MHz, VBW ≥ 3 RBW, Sweep = Auto, Detector = Peak, Trace = Max hold.

(2.2) For Average measurement：RBW = 1MHz, VBW

˙If Duty Cycle ≥ 98%, VBW=10Hz.

˙If Duty Cycle < 98%, VBW≥1/T.

Configuration	Duty Cycle (%)	T(ms)	1/T (Hz)	VBW setting
GFSK_BDR-1Mbps	79%	2.9600	0.338	360Hz
8DPSK_EDR-3Mbps	79%	2.9600	0.338	360Hz

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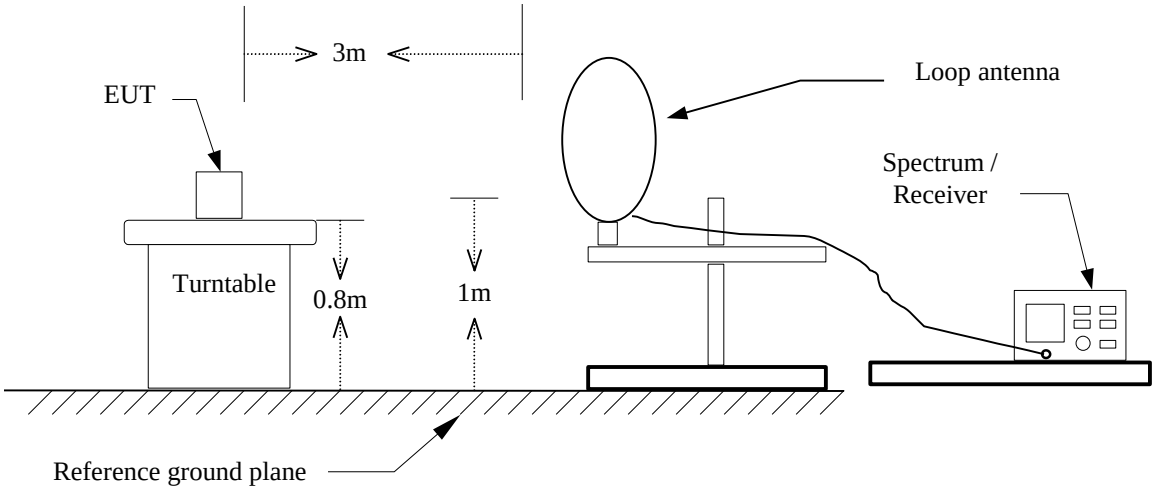
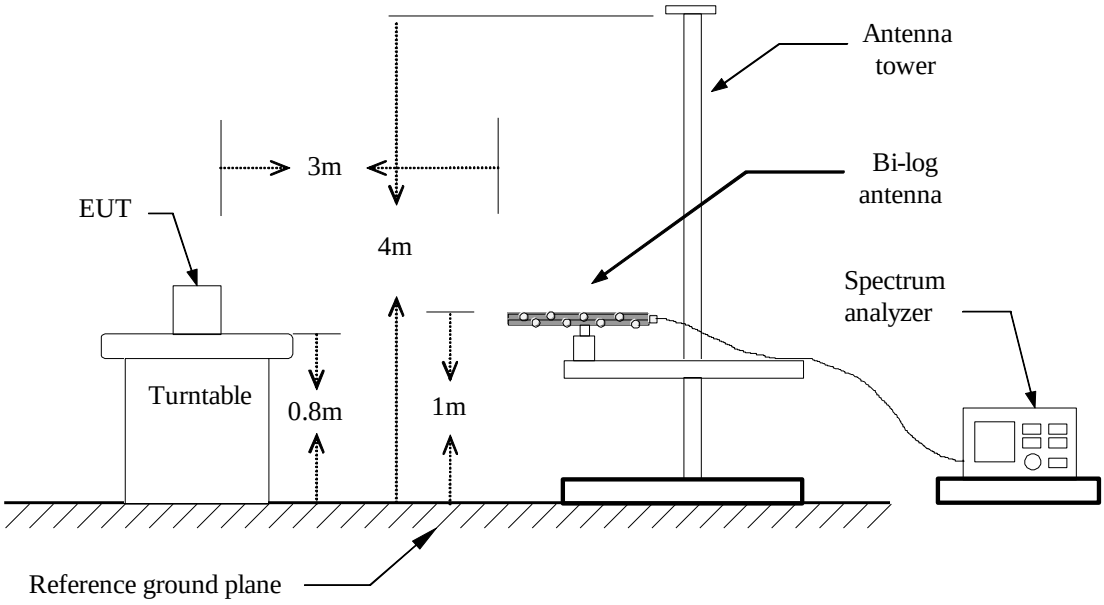
4.8.3 Test Setup

9kHz ~ 30MHz



30MHz ~ 1GHz



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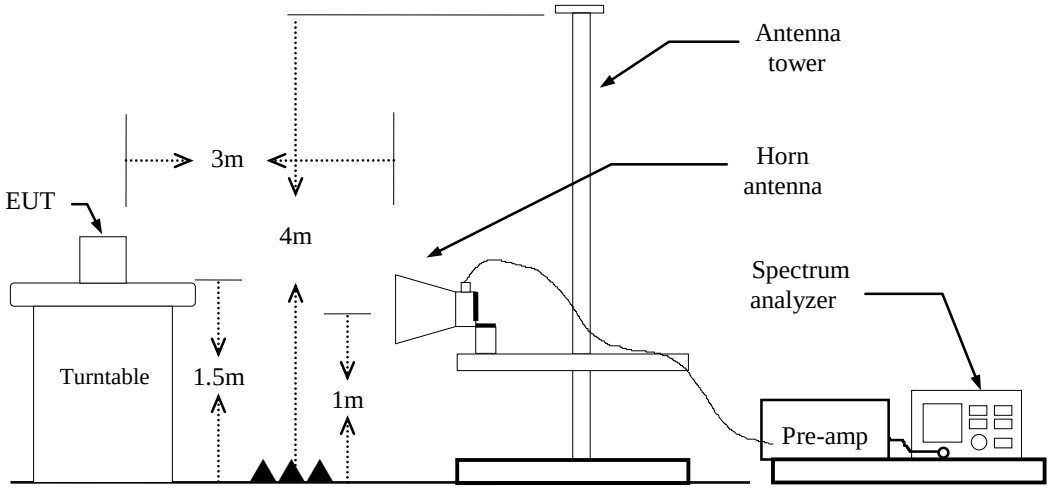
Above 1 GHz



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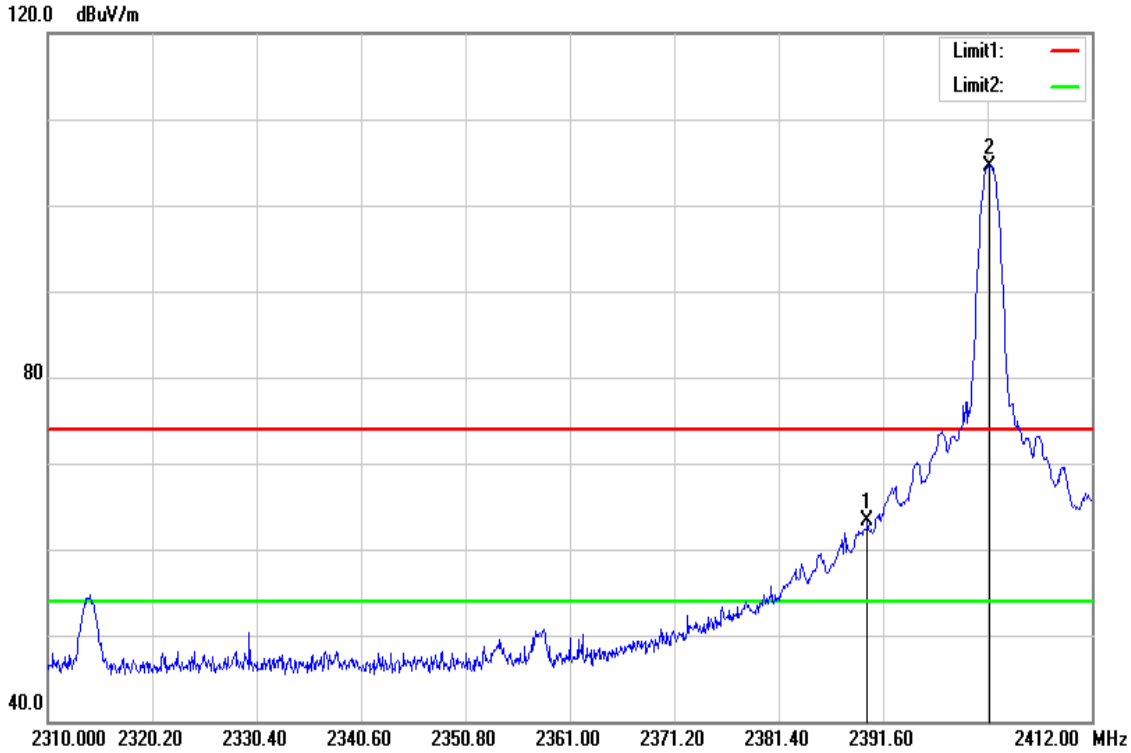
4.8.4 Test Result

Band Edge Test Data

Test Mode:	GFSK_BDR-1Mbps Low CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Band Edge	Test Date	December 2, 2017
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Peak		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2390.000	66.25	-2.98	63.27	74.00	-10.73	peak
2	2402.004	107.46	-2.95	104.51	-	-	peak

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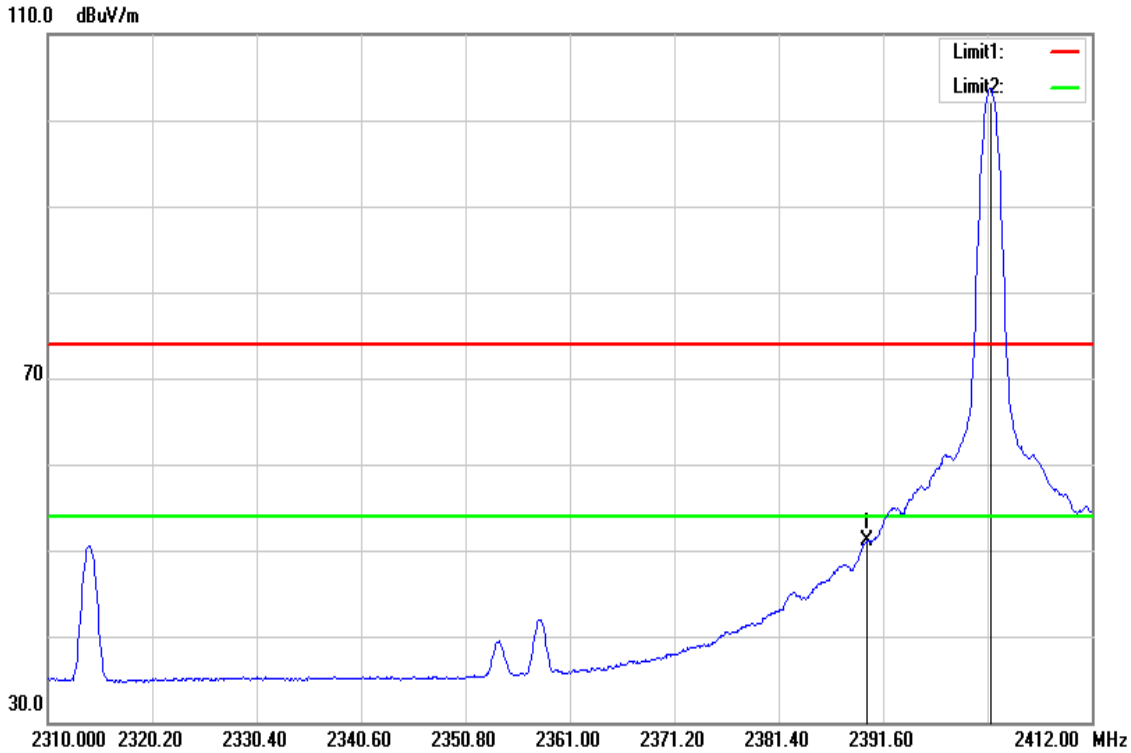
Test Mode:	GFSK_BDR-1Mbps Low CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Band Edge	Test Date	December 2, 2017
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Average		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2390.000	54.05	-2.98	51.07	54.00	-2.93	AVG
2	2402.106	106.61	-2.95	103.66	-	-	AVG

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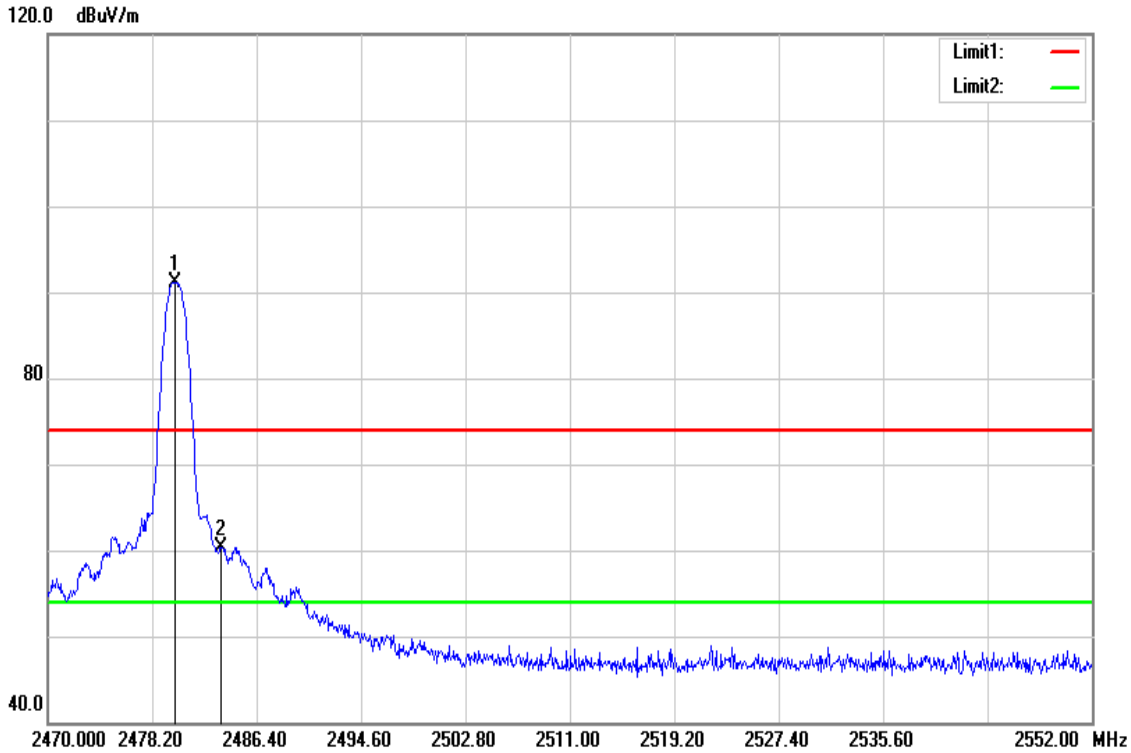
Test Mode:	GFSK_BDR-1Mbps High CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Band Edge	Test Date	December 2, 2017
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Peak		



No.	Frequenc	R ading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2480.004	93.82	-2.70	91.12	-	-	peak
2	2483.612	63.02	-2.69	60.33	74.00	-13.67	peak

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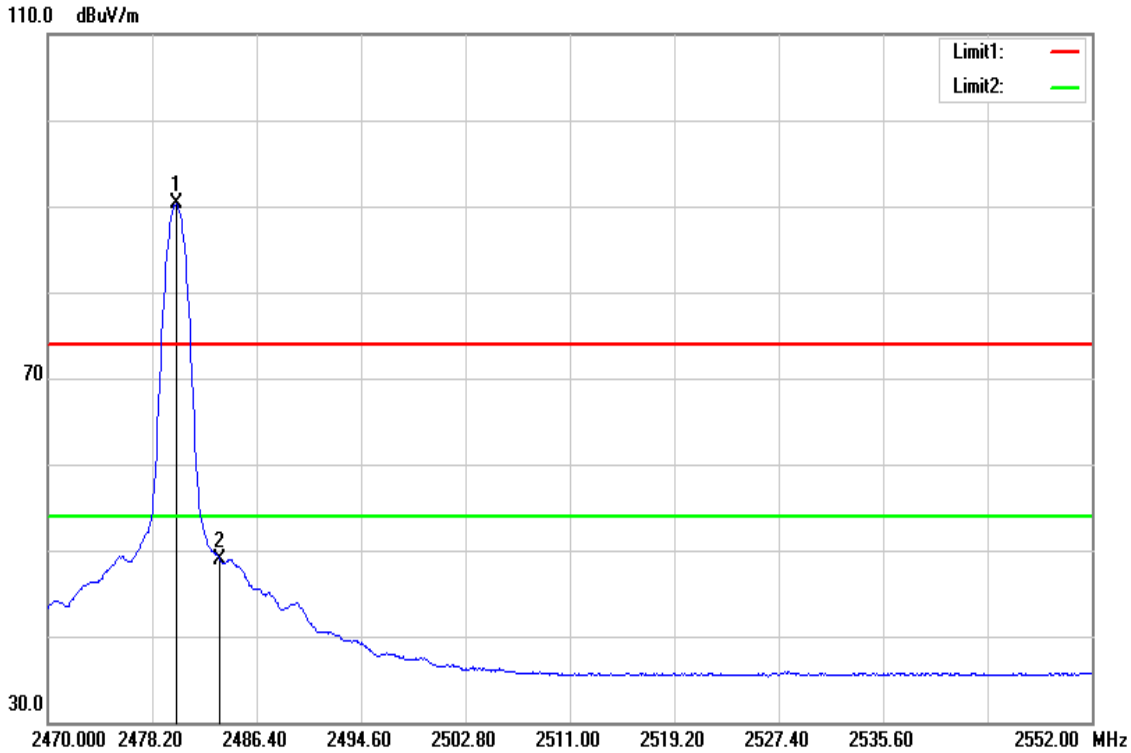
Test Mode:	GFSK_BDR-1Mbps High CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Band Edge	Test Date	December 2, 2017
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Average		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2480.086	92.91	-2.70	90.21	-	-	AVG
2	2483.500	51.56	-2.69	48.87	54.00	-5.13	AVG

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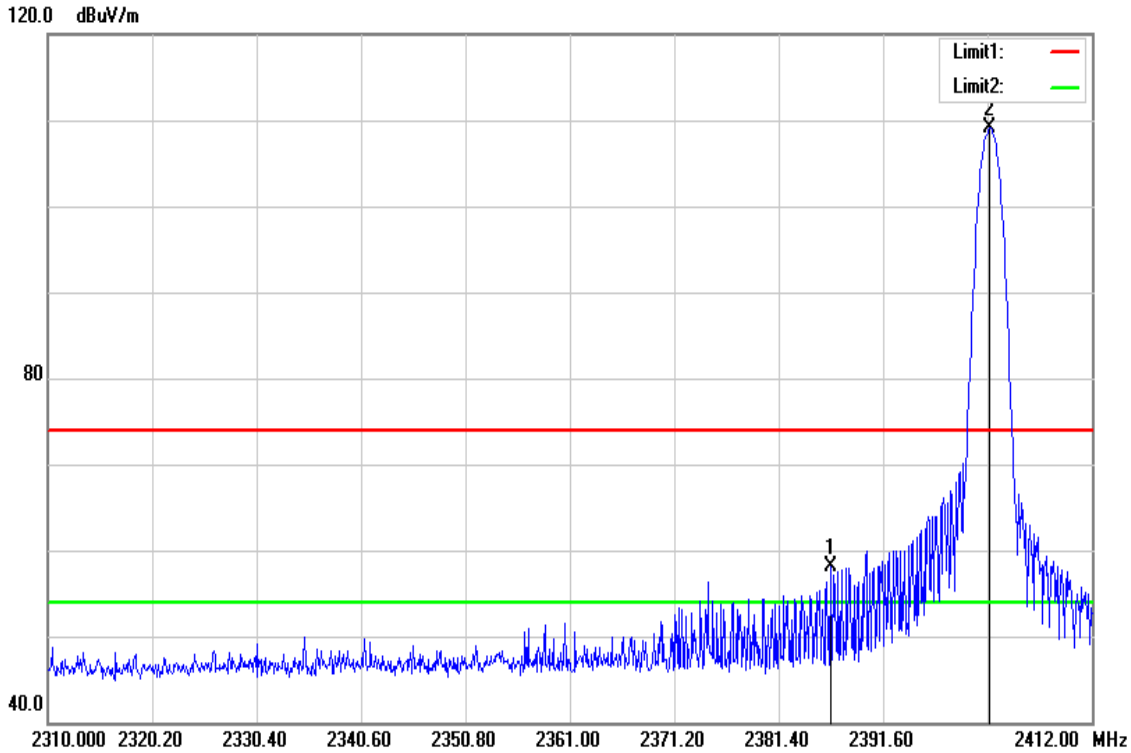
Test Mode:	8DPSK_EDR-3Mbps Low CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Band Edge	Test Date	December 2, 2017
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Peak		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2386.500	61.15	-2.99	58.16	74.00	-15.84	peak
2	2402.004	112.10	-2.95	109.15	-	-	peak

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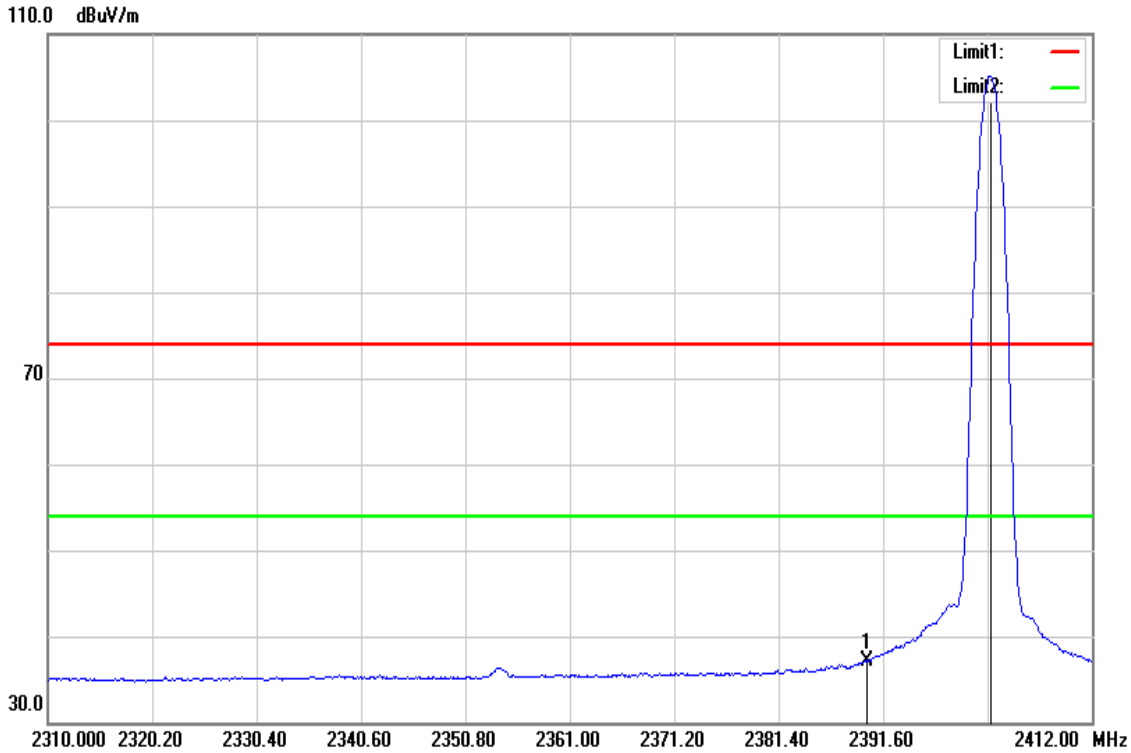
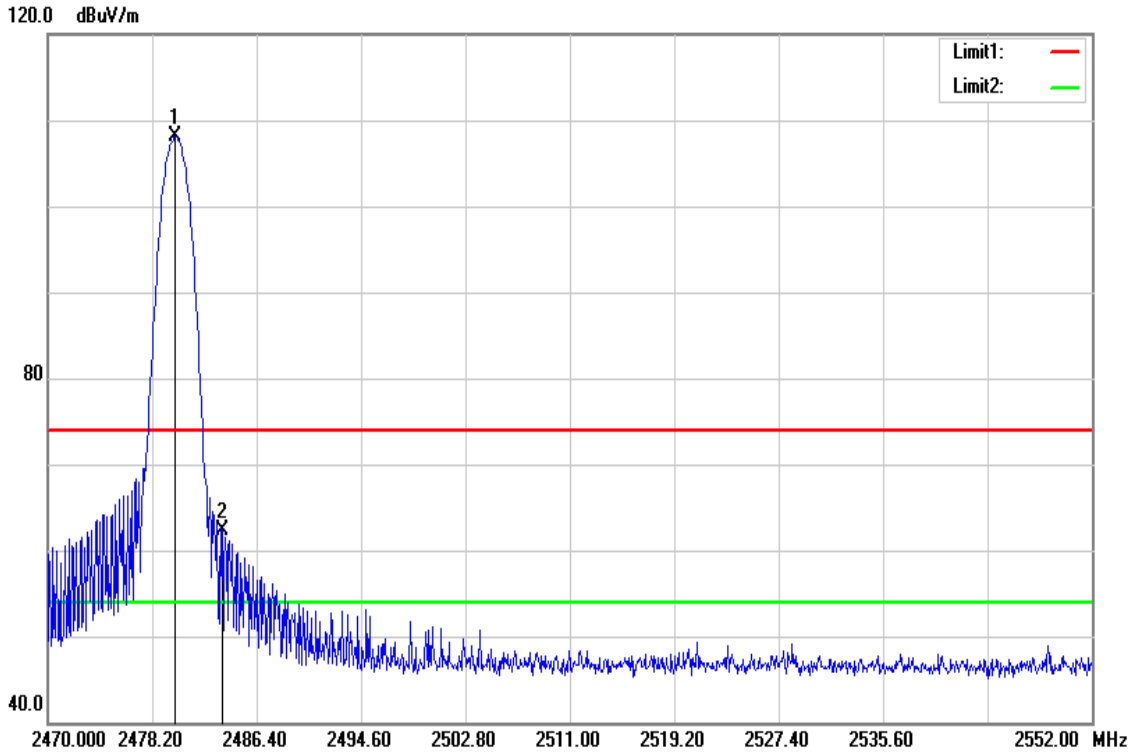
Test Mode:	8DPSK_EDR-3Mbps Low CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Band Edge	Test Date	December 2, 2017
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Average		



No.	Freque cy	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2390.000	40.09	-2.98	37.11	54.00	-16.89	AVG
2	2402.106	108.13	-2.95	105.18	-	-	AVG

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

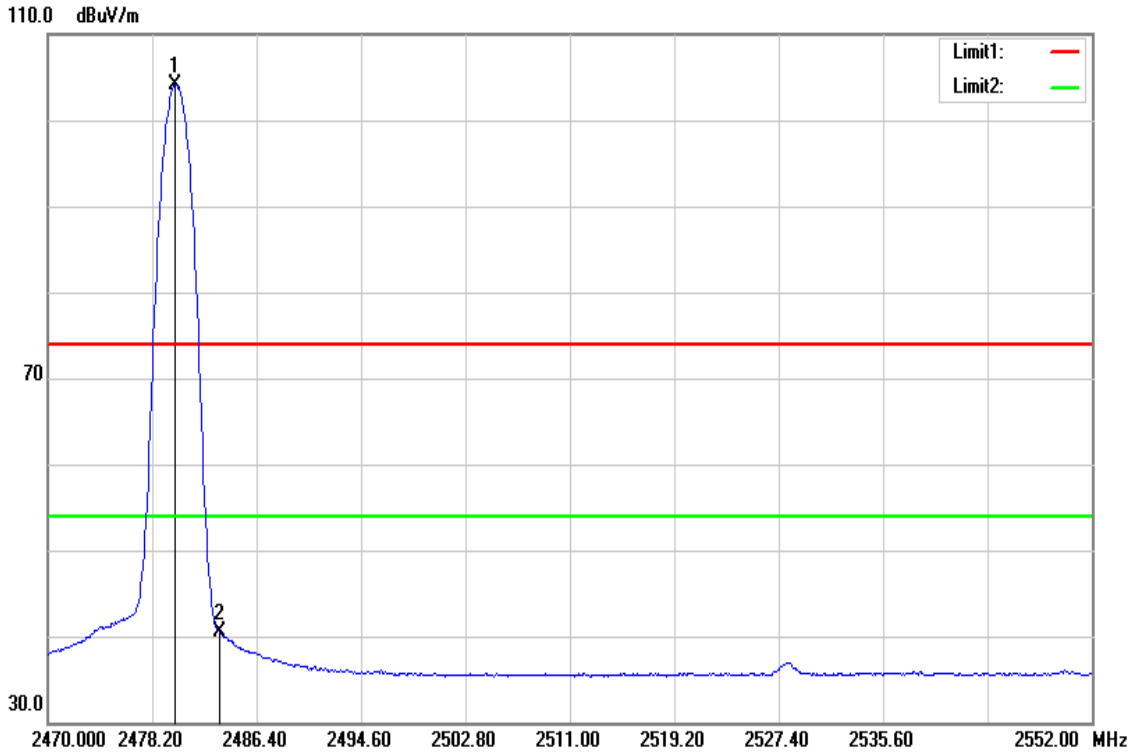
Test Mode:	8DPSK_EDR-3Mbps High CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Band Edge	Test Date	December 2, 2017
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Peak		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2480.004	110.82	-2.70	108.12	-	-	peak
2	2483.694	64.98	-2.69	62.29	74.00	-11.71	peak

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Test Mode:	8DPSK_EDR-3Mbps High CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Band Edge	Test Date	December 2, 2017
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Average		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2480.004	106.89	-2.70	104.19	-	-	AVG
2	2483.500	43.15	-2.69	40.46	54.00	-13.54	AVG

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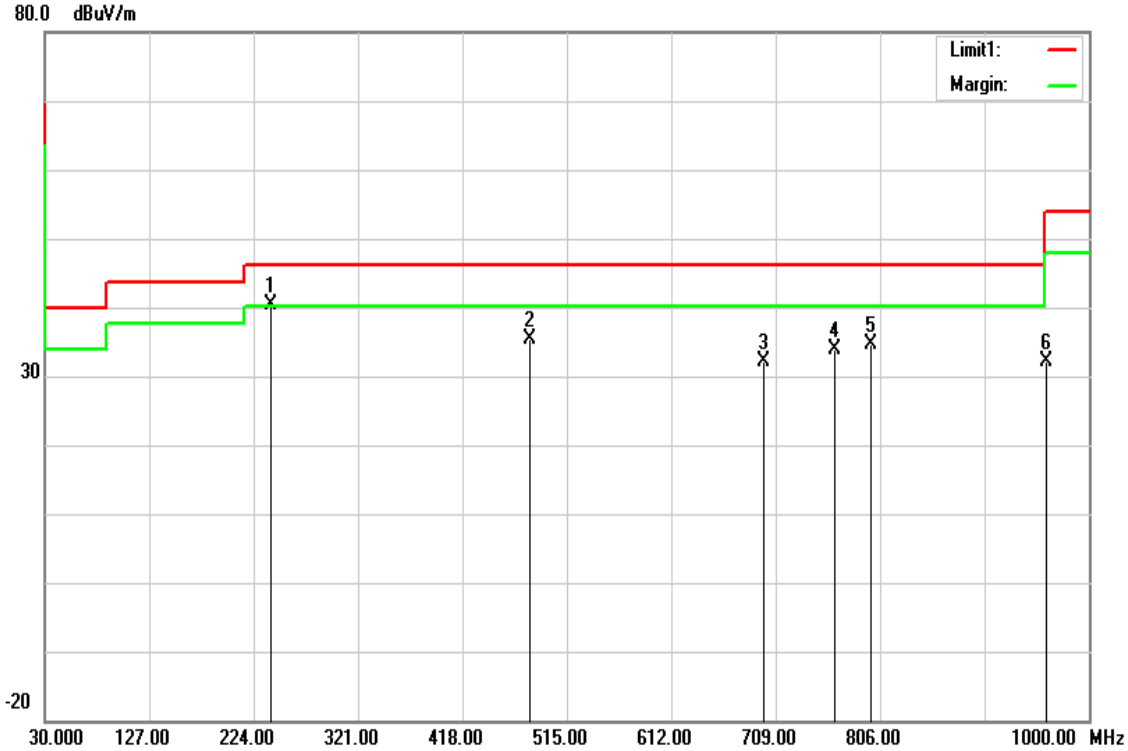
Below 1G Test Data

Test Mode:	BT Mode	Temp/Hum	24(℃)/ 33%RH
Test Item	30MHz-1GHz	Test Date	December 2, 2017
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Peak		

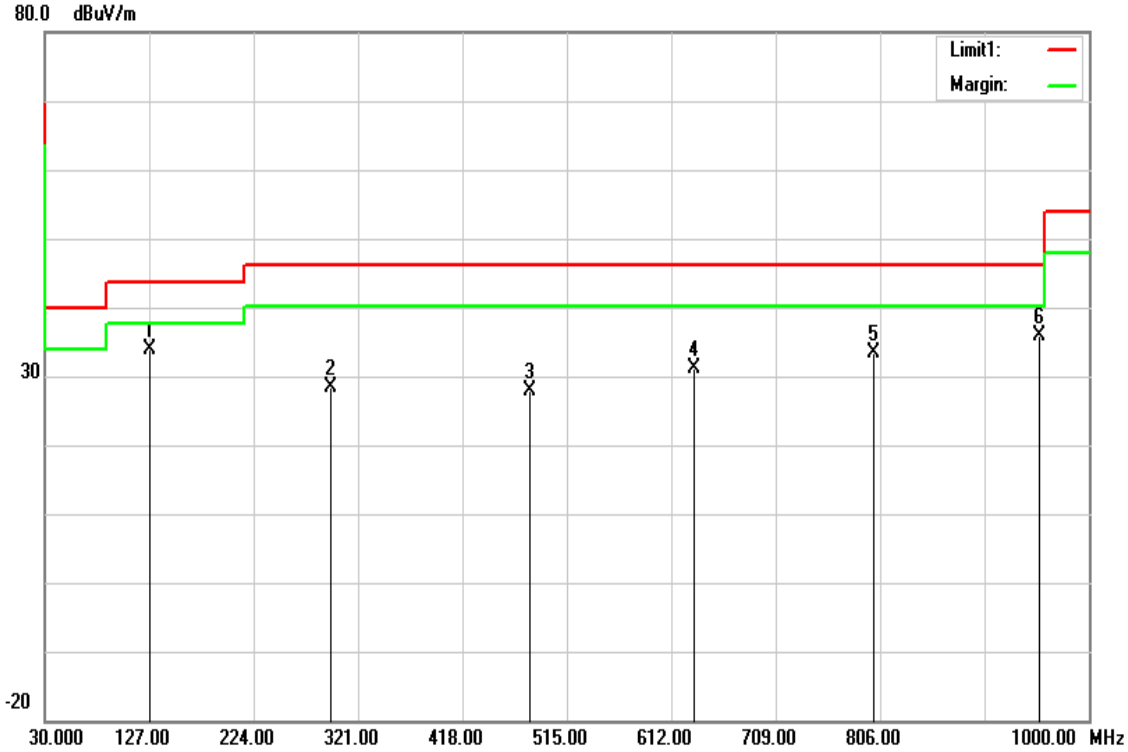


No.	requency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	240.4900	56.50	-16.12	40.38	46.02	-5.64	QP
2	480.0800	44.27	-8.94	35.33	46.02	-10.69	peak
3	697.3600	37.16	-4.93	32.23	46.02	-13.79	peak
4	764.2900	37.90	-4.03	33.87	46.02	-12.15	peak
5	797.2700	38.18	-3.43	34.75	46.02	-11.27	peak
6	960.2300	33.25	-1.08	32.17	54.00	-21.83	peak

Note: No emission found between lowest internal used/generated frequency to 30MHz(9KHz~30MHz)

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Test Mode:	BT Mode	Temp/Hum	24(℃)/ 33%RH
Test Item	30MHz-1GHz	Test Date	December 2, 2017
Polarize	Horizontal	Test Engineer	Kevin Kuo
Detector	Peak		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	127.9700	48.98	-15.21	33.77	43.52	-9.75	peak
2	295.7800	42.54	-14.11	28.43	46.02	-17.59	peak
3	480.0800	36.86	-8.94	27.92	46.02	-18.10	peak
4	633.3400	37.26	-6.01	31.25	46.02	-14.77	peak
5	800.1800	36.74	-3.38	33.36	46.02	-12.66	peak
6	954.4100	37.01	-1.14	35.87	46.02	-10.15	peak

Note: No emission found between lowest internal used/generated frequency to 30MHz(9KHz~30MHz)

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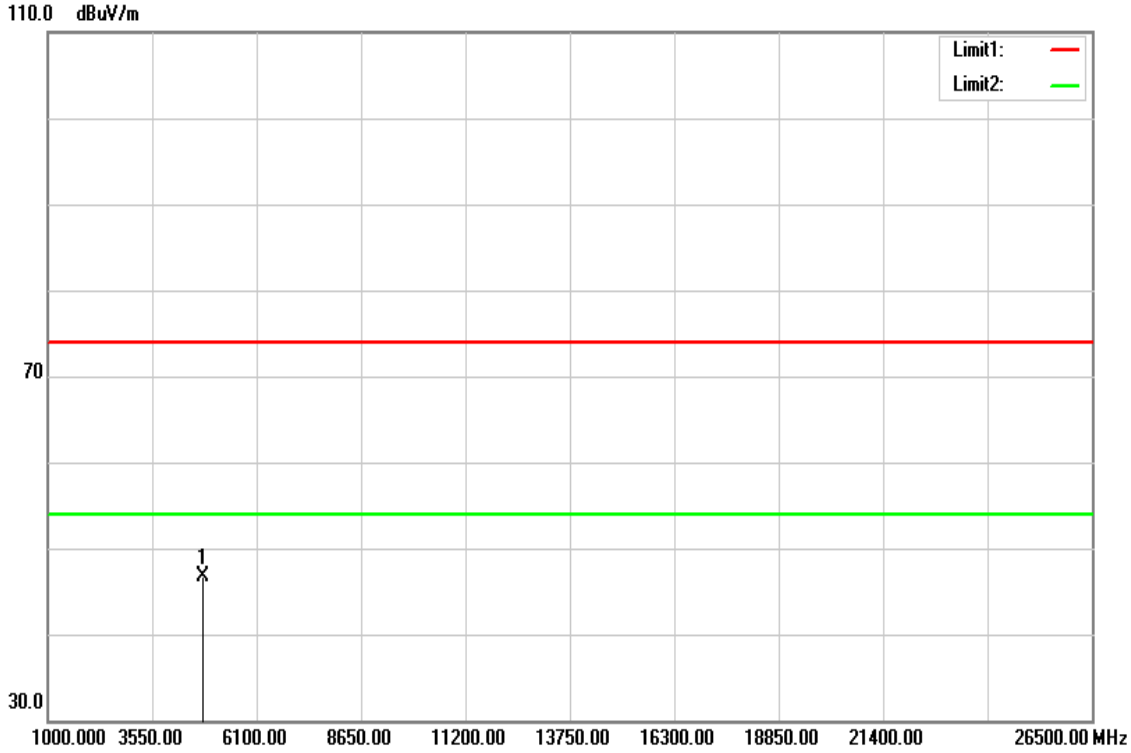
Above 1G Test Data

Test Mode:	GFSK_BDR-1Mbps Low CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Harmonic	Test Date	December 2, 2017
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Peak and Average		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	4806.000	42.26	4.35	46.61	74.00	-27.39	peak

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*

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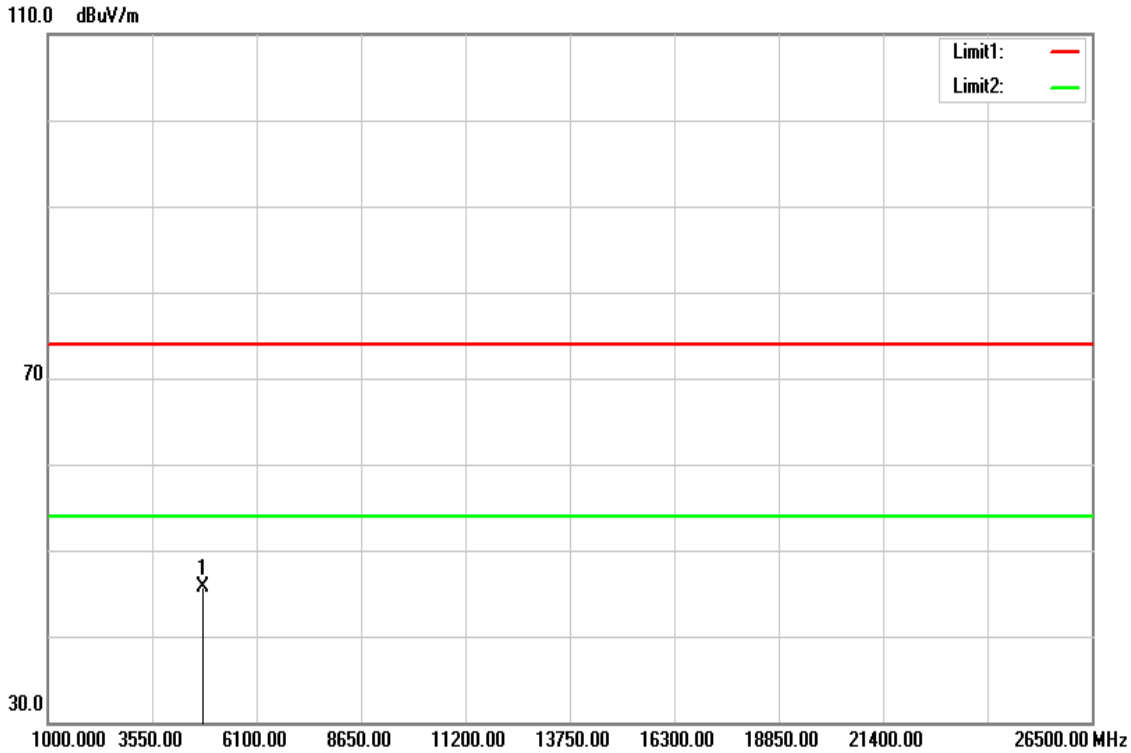
Test Mode:	GFSK_BDR-1Mbps Low CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Harmonic	Test Date	December 2, 2017
Polarize	Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average		



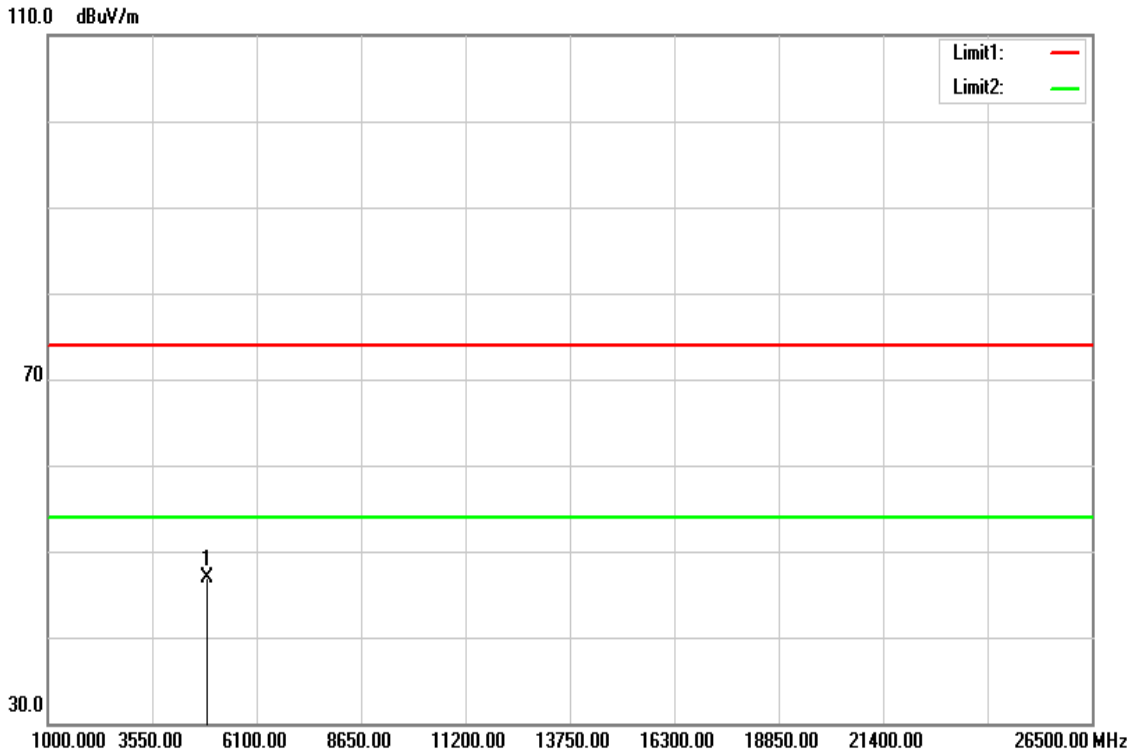
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	4806.000	41.32	4.35	45.67	74.00	-28.33	peak

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*

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Test Mode:	GFSK_BDR-1Mbps Mid CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Harmonic	Test Date	December 2, 2017
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Peak and Average		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	4883.000	42.41	4.49	46.90	74.00	-27.10	peak

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*

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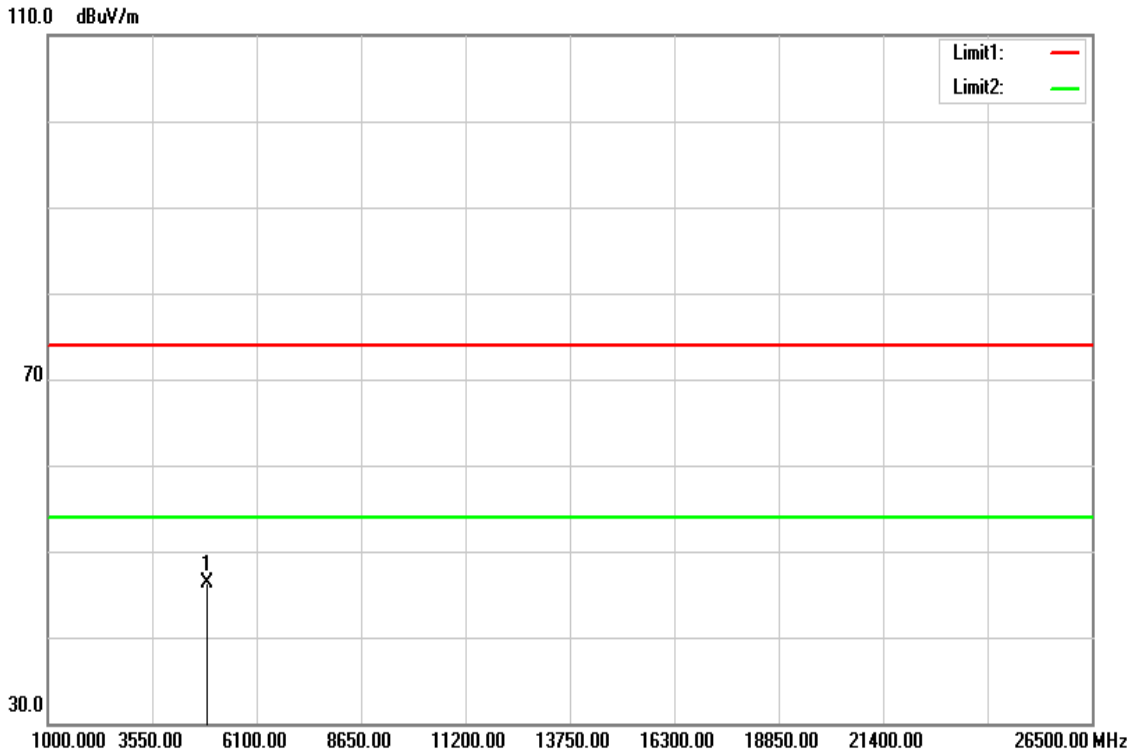
Test Mode:	GFSK_BDR-1Mbps Mid CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Harmonic	Test Date	December 2, 2017
Polarize	Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	4882.000	41.87	4.49	46.36	74.00	-27.64	peak

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*

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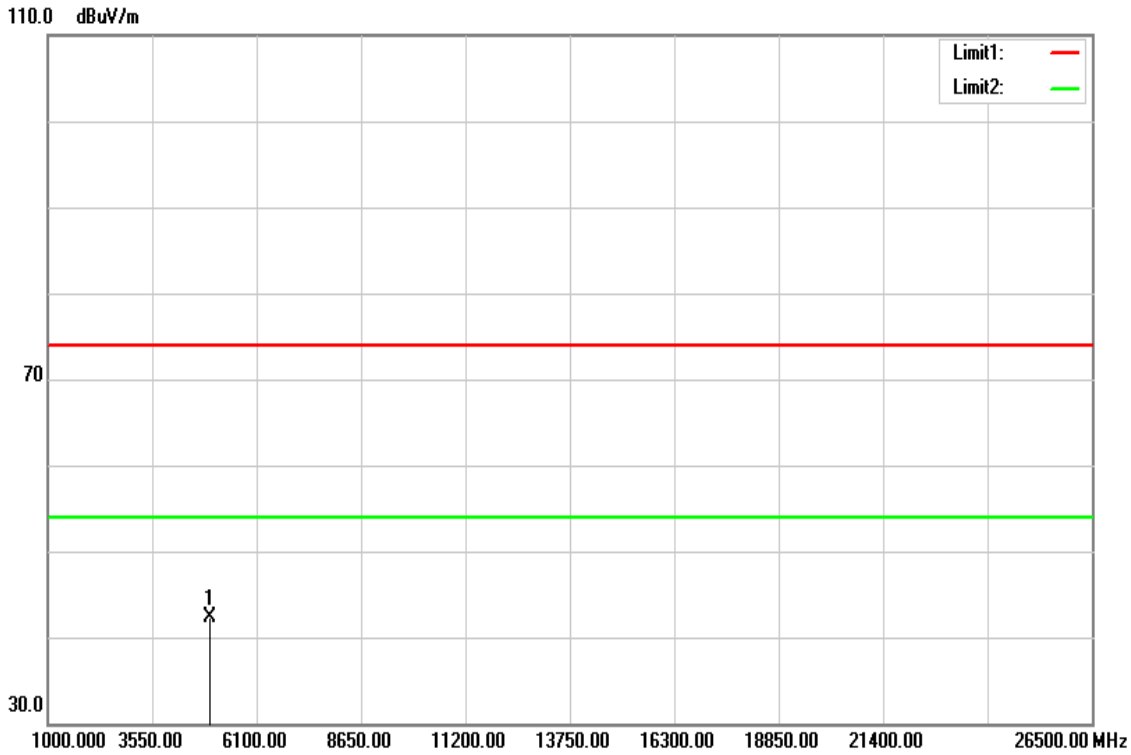
Test Mode:	GFSK_BDR-1Mbps High CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Harmonic	Test Date	December 2, 2017
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Peak and Average		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	4960.000	37.68	4.61	42.29	74.00	-31.71	peak

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*

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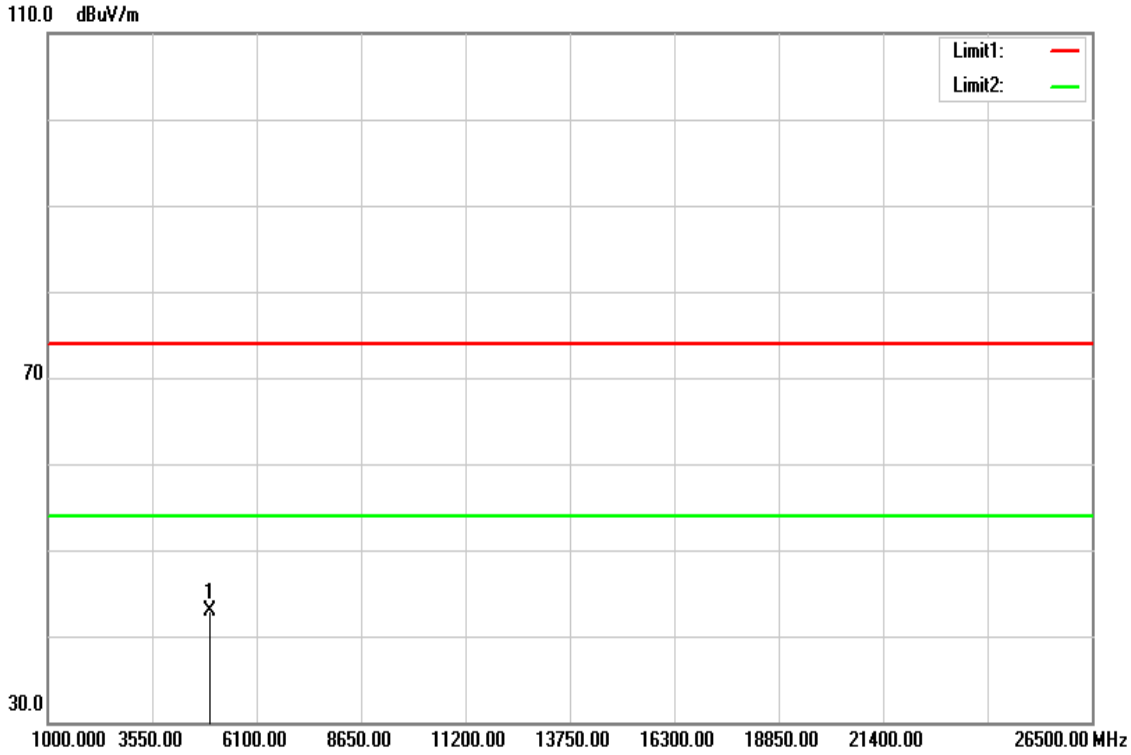
Test Mode:	GFSK_BDR-1Mbps High CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Harmonic	Test Date	December 2, 2017
Polarize	Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	4960.000	38.39	4.61	43.00	74.00	-31.00	peak

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*

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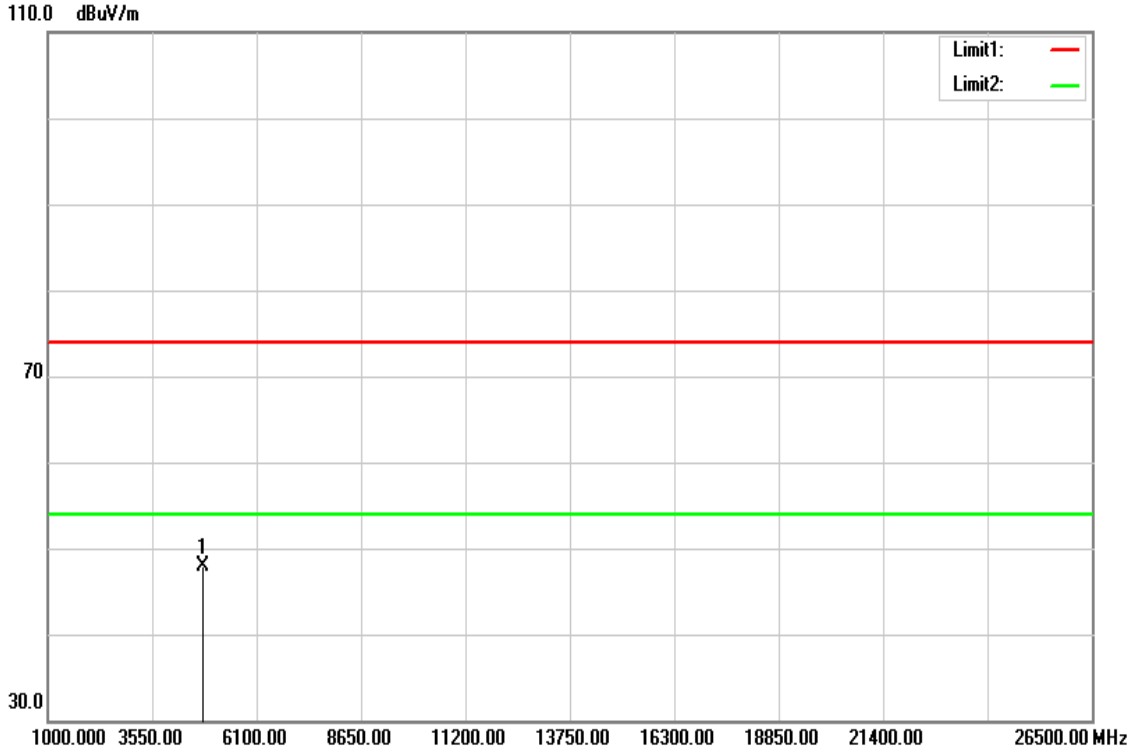
Test Mode	8DPSK_EDR-3Mbps Low CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Harmonic	Test Date	December 2, 2017
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Peak and Average		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	4806.000	43.59	4.35	47.94	74.00	-26.06	peak

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*

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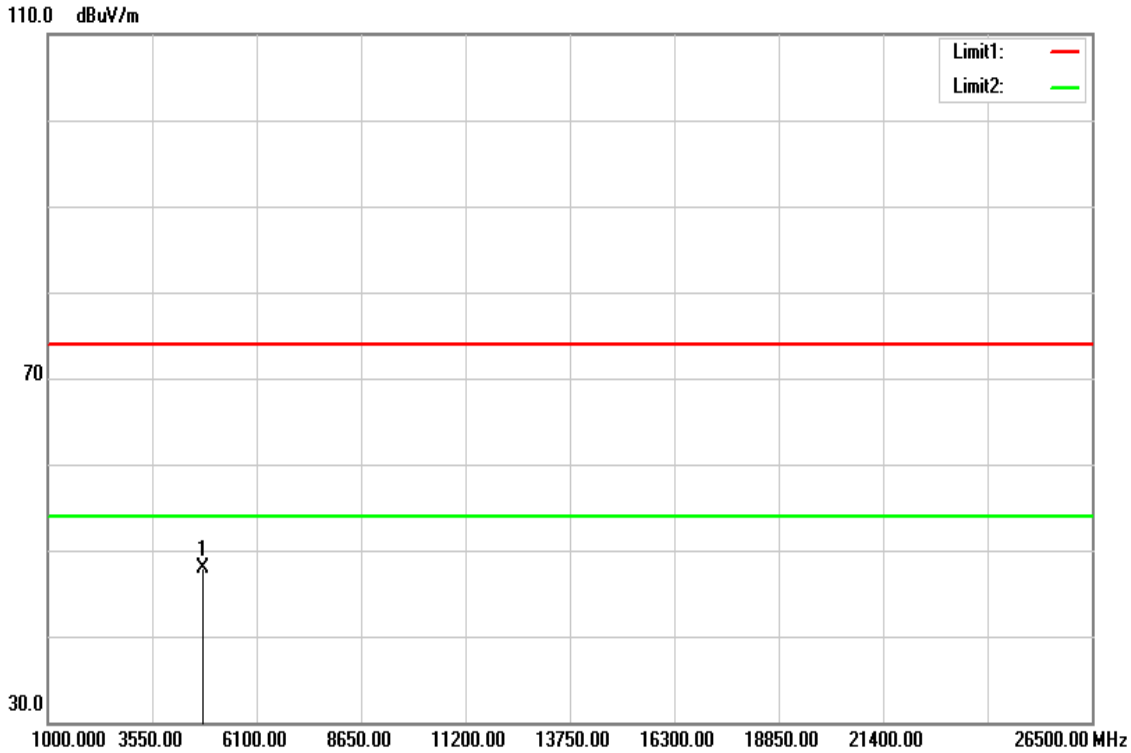
Test Mode	8DPSK_EDR-3Mbps Low CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Harmonic	Test Date	December 2, 2017
Polarize	Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average		



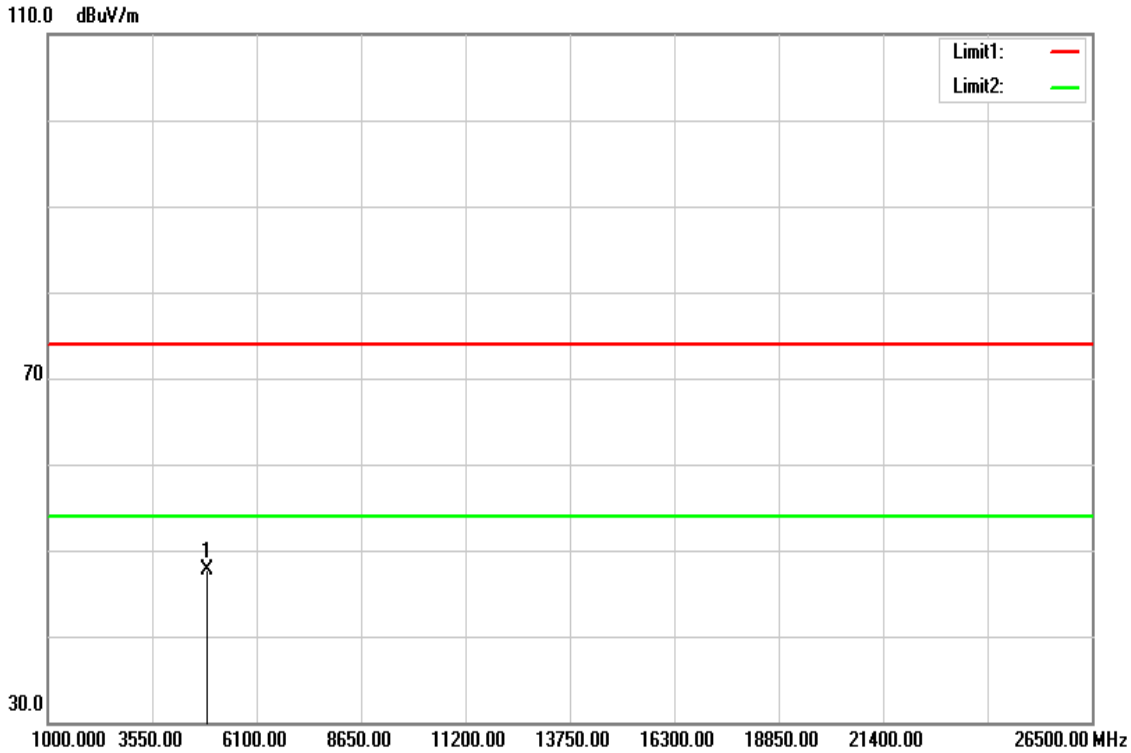
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	4806.000	43.59	4.35	47.94	74.00	-26.06	peak

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*

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Test Mode	8DPSK_EDR-3Mbps Mid CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Harmonic	Test Date	December 2, 2017
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Peak and Average		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	4883.000	43.18	4.49	47.67	74.00	-26.33	peak

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*

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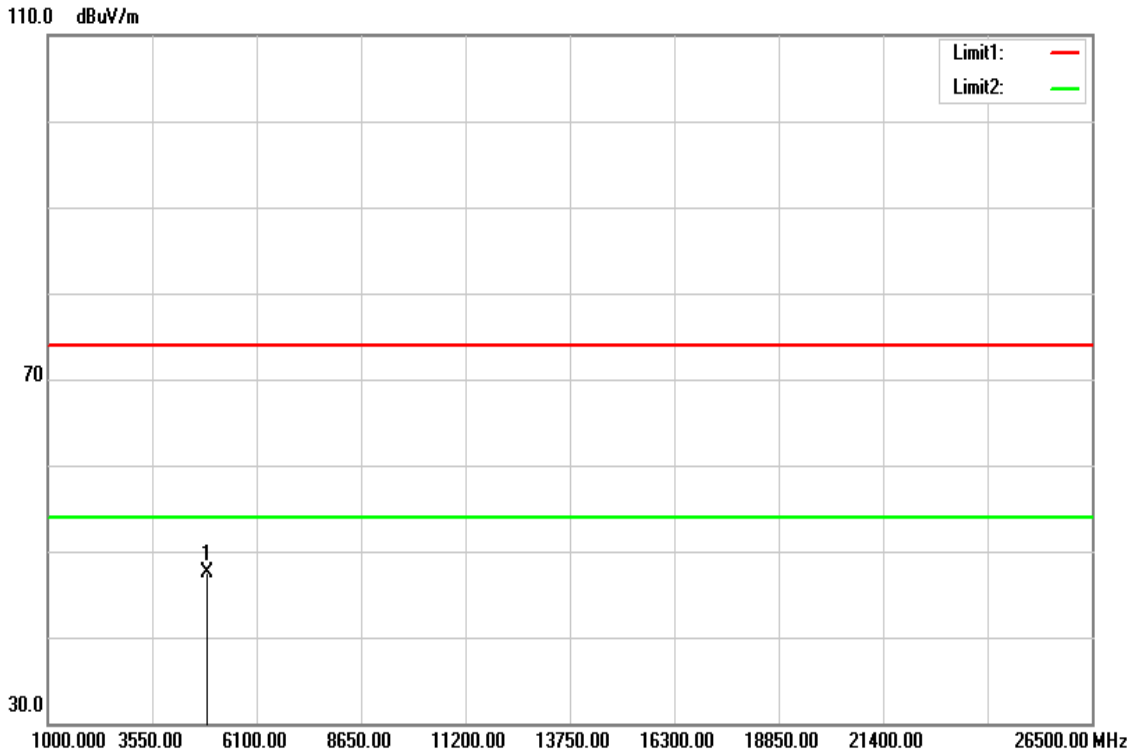
Test Mode	8DPSK_EDR-3Mbps Mid CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Harmonic	Test Date	December 2, 2017
Polarize	Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	4883.000	43.04	4.49	47.53	74.00	-26.47	peak

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*

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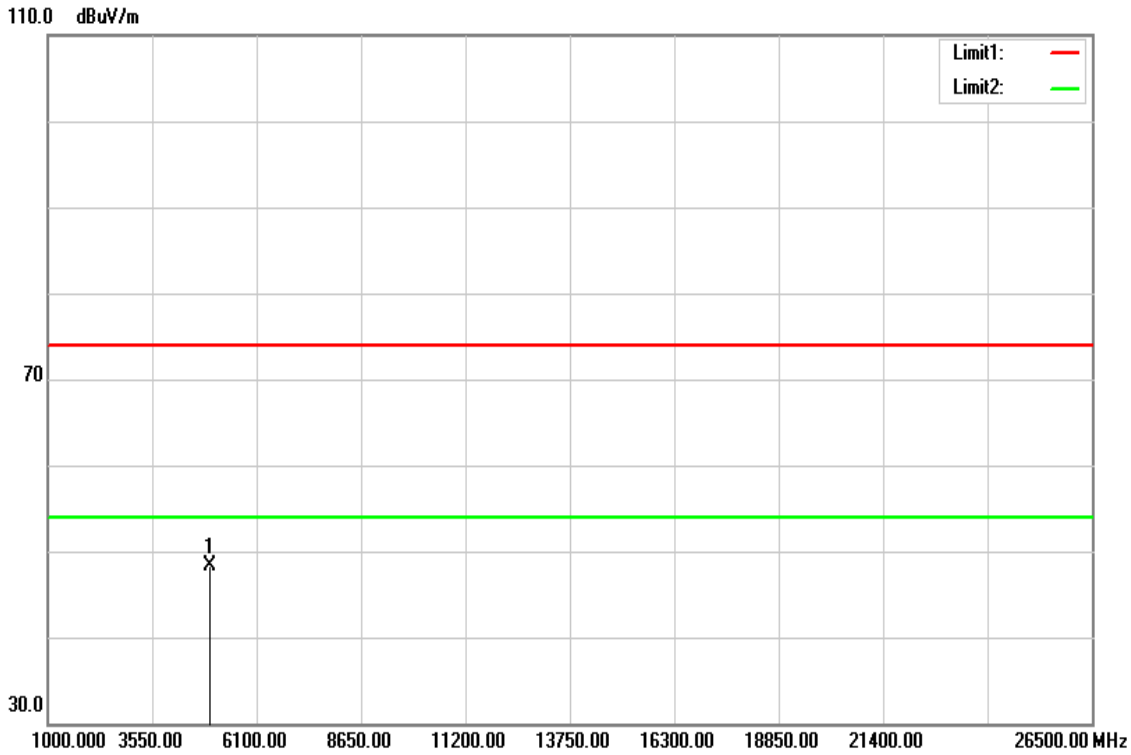
Test Mode	8DPSK_EDR-3Mbps High CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Harmonic	Test Date	December 2, 2017
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Peak and Average		



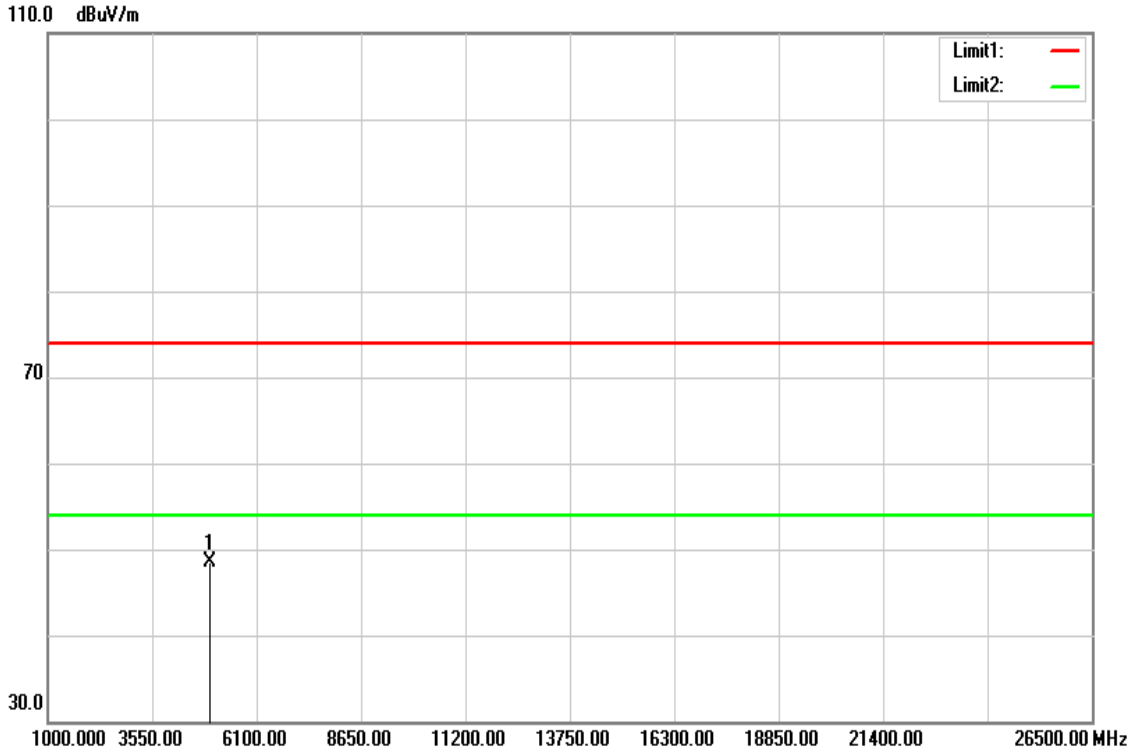
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	4960.000	43.60	4.61	48.21	74.00	-25.79	peak

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*

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Test Mode	8DPSK_EDR-3Mbps High CH	Temp/Hum	24(℃)/ 33%RH
Test Item	Harmonic	Test Date	December 2, 2017
Polarize	Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	4960.000	43.87	4.61	48.48	74.00	-25.52	peak

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*

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