KES Co., Ltd.
C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

TEST REPORT

Part 15 Subpart C 15.247

Equipment under test	iriver on
Model name	IF-M100
Variant model	IF-M110
FCC ID	QJ8-IF-M100
Applicant	Samsin Innotec Co., Ltd.
Manufacturer	Samsin Innotec Co., Ltd.
Date of test(s)	2012.12.10 ~ 2013.03.22
Date of issue	2013.03.25

Issued to

Samsin Innotec Co., Ltd.
252-23, Sarihyun-Dong, Ilsandong-Gu, Goyang-City, Kyonggi-Do, South Korea

Issued by

KES Co., Ltd.
C3701 Dongil Techno Town, 889-1, Gwanyang 2-dong, Dongan-gu, Anyang-si,
Gyeonggi-do, 431-716, Korea
477-6, Hageo-ri, Yeoju-eup, Yeoju-gun, Gyeonggi-do, 469-803, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450

Test and report completed by :	**Report approval by :**
	
Kwang-Yeol Choo Test engineer	Jeff Do Technical manager

Revision history

Revision	Date of issue	Test report No.	Description
-	2013.03.25	KES-RF-F130002	Initial

TABLE OF CONTENTS

1.0 General information description 4
1.1 Test frequency 4
1.2 Information about variant model 4
1.3 Device modifications 4
1.4 Information about the FHSS characteristics: 5
1.4.1 Pseudorandom frequency hopping sequence 5
1.4.2 Equal hopping frequency use 5
1.4.3 System receiver input bandwidth 5
1.4.4 Equipment description 5
1.5 Test facility 6
1.6 Laboratory accreditations and listings 6
2.0 Summary of tests 7
2.1 Test data 8
2.1.1 Pre-scanned output power 8
2.1.2 Peak power output power 8
2.1.3 Conducted spurious emission & band edge 13
2.1.4 20 dB bandwidth 23
2.1.5 Frequency separation 28
2.1.6 Number of hopping frequency 30
2.1.7 Time of occupancy (Dwell time) 33
2.1.8 Radiated spurious emission & band edge 38
Appendix A. Test equipment used for test 54
Appendix B. Test setup photo 55

1.0 General information description

Equipment under test	iriver on
Model name	IF-M100(Variant model : IF-M110)
Serial number	N/A
Frequency Range	2 402 ㎒ ~ 2 480 ㎒(Bluetooth BDR & EDR)
Modulation technique	GFSK, 8DPSK
Number of channels	79(Bluetooth BDR & EDR)
Antenna type & gain	Fixed type(Metal antenna) // 1.31 dBi
Power source	DC 3.7 V

1.1 Test frequency

	Low channel	**Middle channel**	**High channel**
Frequency (㎒)	2 402	2 441	2 480

1.2 Information about variant model

Variant model (IF-M110) is same as basic model (IF-M100) for hardware, software and mechanical.

1.3 Device modifications

N/A

1.4 Information about the FHSS characteristics:

1.4.1 Pseudorandom frequency hopping sequence

The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master; the phase in the hopping sequence is determined by the Bluetooth clock of the master. The channel is divided into time slots where each slot corresponds to an RF hop frequency. Consecutive hops correspond to different RF hop frequencies. The nominal hop rate is 1 600 hops/s.

1.4.2 Equal hopping frequency use

All Bluetooth units participating in the piconet are time and hop-synchronized to the channel.

Example of a 79 hopping sequence in data mode:
40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 52, 35, 50, 65, 54, 67, 56, 37, 60, 39, 58, 69, 62, 71, 64, 25, 68, 27, 66, 57, 70, 59, 72, 29, 76, 31, 74, 61, 78, 63, 01, 41, 05, 43, 03, 73, 07, 75, 09, 45, 13, 47, 11, 77, 15, 00, 64, 49, 66, 53, 68, 02, 70, 06, 01, 51, 03, 55, 05, 04

1.4.3 System receiver input bandwidth

Each channel bandwidth is 1 ㎒

1.4.4 Equipment description

15.247(a)(1) that the rx input bandwidths shift frequencies in synchronization with the transmitted

15.247(g): In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.

15.247(h): In accordance with the Bluetooth Industry Standard, the system does not coordinate it channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

1.5 Test facility

C3701 Dongil Techno Town, 889-1, Gwanyang 2-dong, Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
477-6, Hageo-ri, Yeoju-eup, Yeoju-gun, Gyeonggi-do, 469-803, Korea

The open area test site is constructed in conformance with the requirements ANSI C63.4-2003.

1.6 Laboratory accreditations and listings

Country	Agency	Scope of accreditation	Certificate No.
USA	FCC	3 & 10 meter Open Area Test Sites and one conducted site to perform FCC Part 15/18 measurements.	343818
KOREA	KC	EMI (10 meter Open Area Test Site and two conducted sites) Radio (3 & 10 meter Open Area Test Sites and one conducted site)	KR0100
CANADA	IC	3 & 10 meter Open Area Test Sites and one conducted site	4769B-1

2.0 Summary of tests

Section in FCC Part 15	Parameter	Status
15.247(b)(1)	Peak output power	C
15.247(d)	Conducted spurious emission and band edge	C
15.247(a)(1)	20 dB bandwidth	C
15.247(a)(1)	Frequency separation	C
15.247(a)(1)(iii)	Number of hopping frequency	C
15.247(a)(1)(iii)	Time of occupancy(Dwell time)	C
15.205 15.209	Radiated spurious emission and band edge	C
Note 1: C=Complies NC=Not complies NT=Not tested NA=Not applicable		

Statement;

The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 ㎑ to 40 ㎓ (ANSI C63.4-2003) and the guidance provided in FCC OET Public notice DA 00-705 were used in the measurement of the DUT.

2.1 Test data

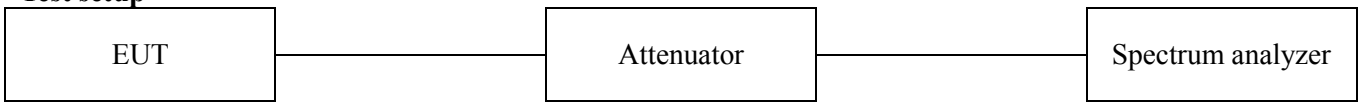
2.1.1 Pre-scanned output power

Preliminary tests were performed in different data rate as below table and the highest power data rates(1 Mbps, 2 Mbps, 3Mbps) were chosen for full test in the following section to demonstrate compliance to the FCC limit line.

Data rate	1 Mbps(GFSK)	2 Mbps(π/4-DQPSK)	3 Mbps(8DPSK)
Output power(dBm)	5.13	4.06	4.22

2.1.2 Peak power output power

Test setup



Test procedure

1. Use the following spectrum analyzer setting
   Center frequency: Lowest, middle and highest channels
   Span = 5 ㎒ (Approximately 5 times the 20 ㏈ bandwidth, centered on a hopping channel)
   RBW = 3 ㎒
   VBW = 3 ㎒ (≥ RBW)
   Sweep = auto
   Detector function = peak
   Trace = max hold
2. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.

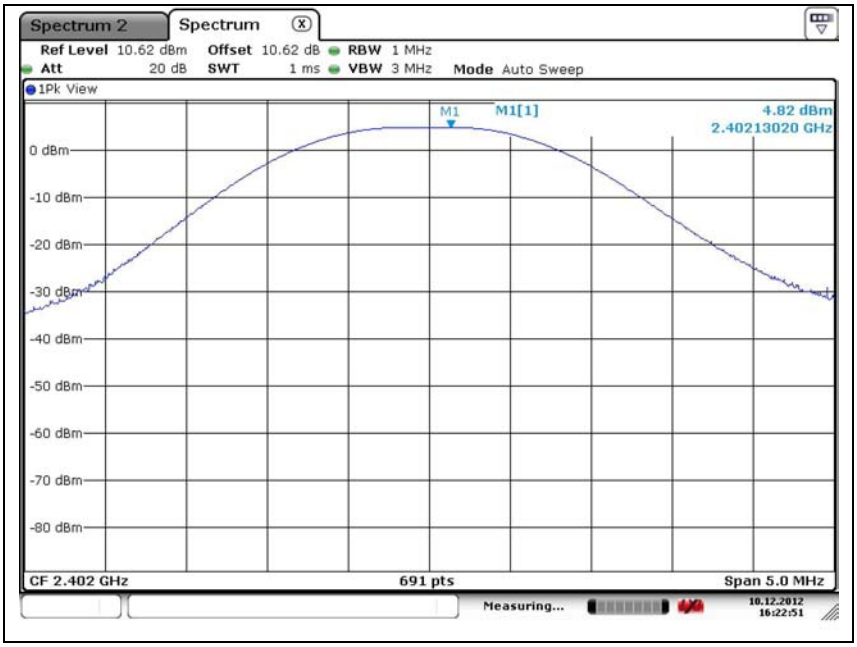
Limit

According to §15.247(b)(3), for systems using digital modulation in the 902 ~ 928 ㎒, 2 400 ~ 2 483.5 ㎒, and 5 725 ~ 5 850 ㎒ band: 1 Watt.

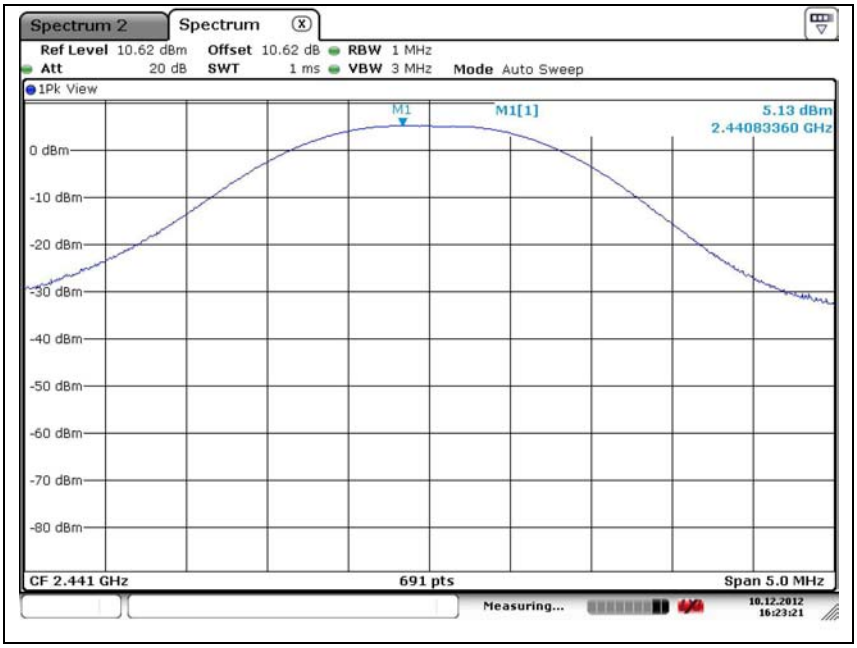
Test results

Operation mode	Frequency(㎒)	Output power (dBm)	Limit (dBm)
GFSK	2 402	4.82	30
	2 441	5.13	30
	2 480	5.01	30
8DPSK	2 402	3.96	30
	2 441	4.22	30
	2 480	3.98	30

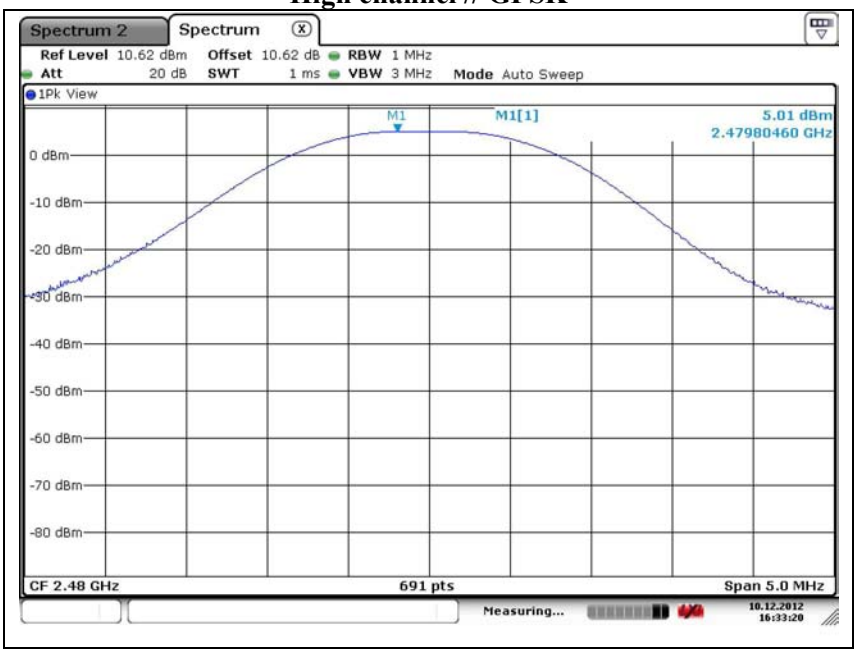
Low channel // GFSK



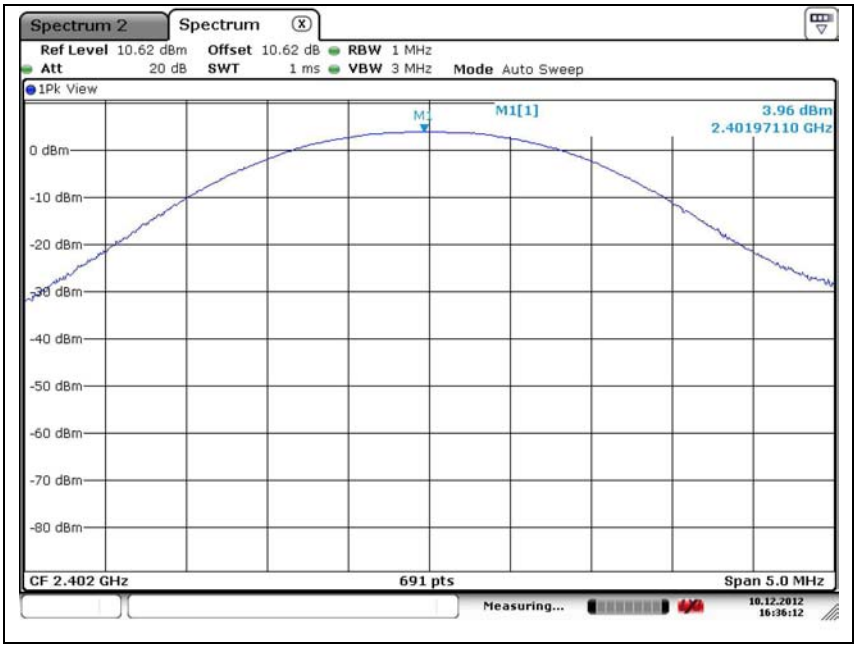
Middle channel // GFSK



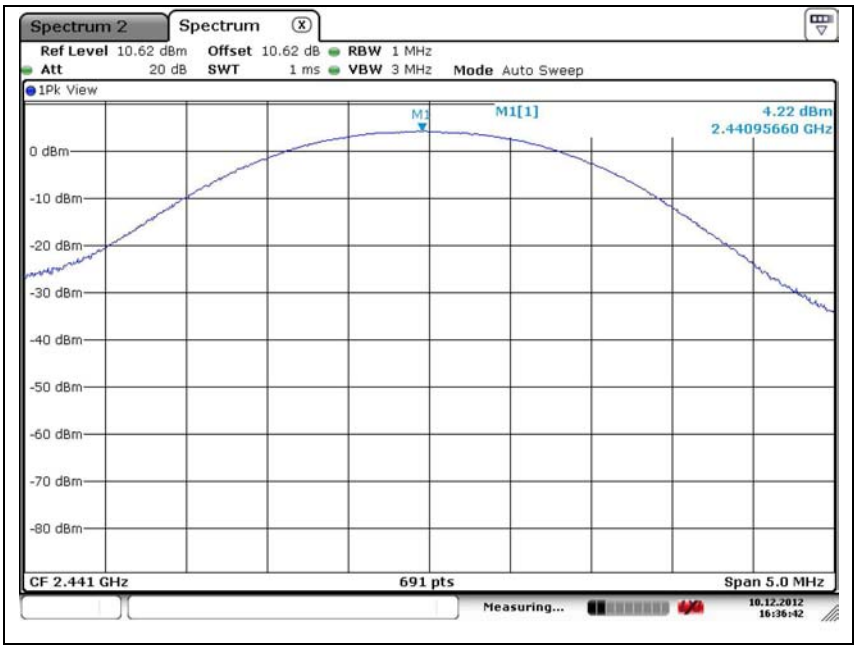
High channel // GFSK



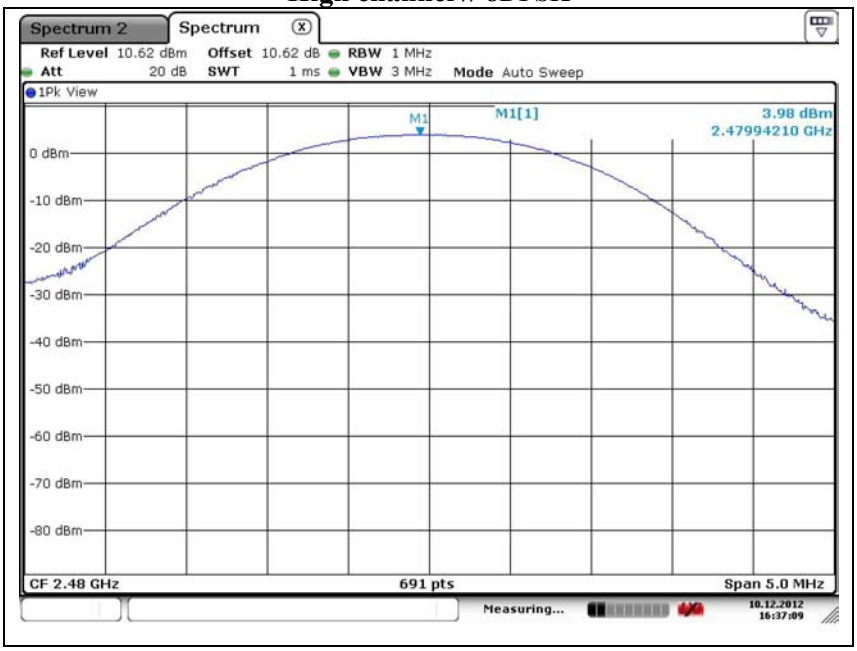
Low channel // 8DPSK



Middle channel // 8DPSK

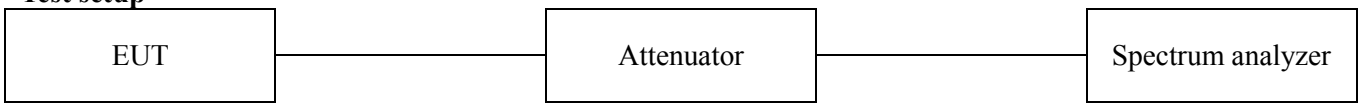


High channel // 8DPSK



2.1.3 Conducted spurious emission & band edge

Test setup



Test procedure for band edge

1. Use the following spectrum analyzer setting
   Center frequency: Low, middle and high channel.
   Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
   RBW = 100 ㎑
   VBW = 100 ㎑ (≥ RBW)
   Sweep = auto
   Detector function = peak
   Trace = max hold
2. Allow the trace to stabilize. Set the marker on the emission at the band edge, or on the highest modulation on product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission

Test procedure for spurious emission

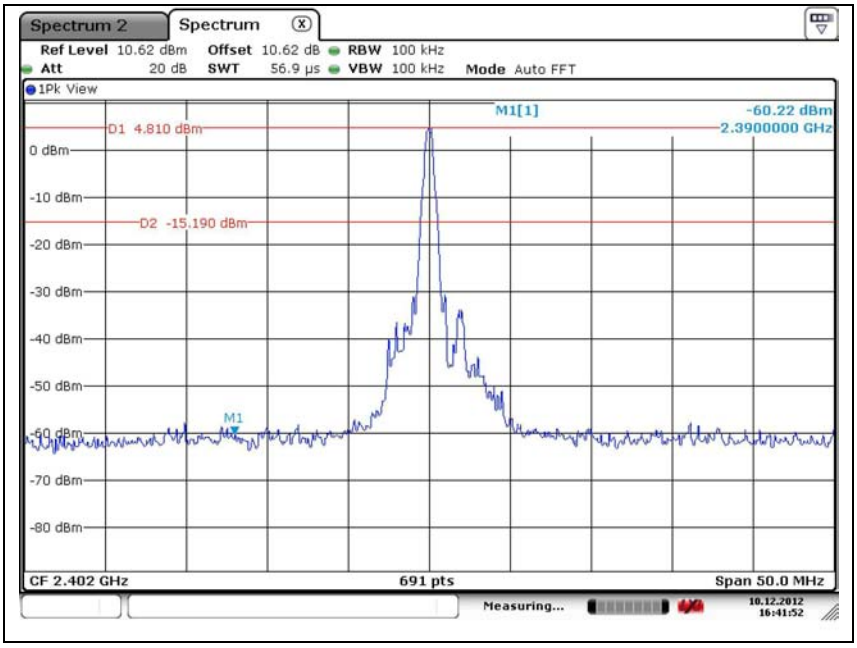
1. Use the following spectrum analyzer setting
   Center frequency: Low, middle and high channel.
   Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
   RBW = 100 ㎑
   VBW = 100 ㎑ (≥ RBW)
   Sweep = auto
   Detector function = peak
   Trace = max hold
2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.

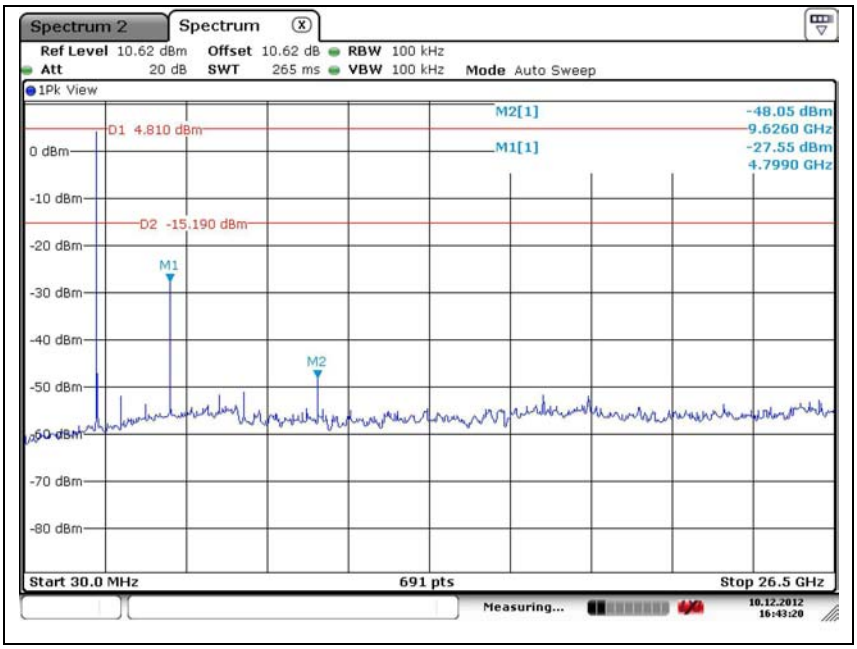
Limit

According to 15.247(d), in any 100 ㎑ bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval , as permitted under paragraph(b)(3) of this section , the attenuation required under this paragraph shall be 30 ㏈ instead of 20 ㏈. Attenuation below the general limits specified in section 15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section 15.205(a), must also comply the radiated emission limits specified in section 15.209(a) (see section 15.205(c))

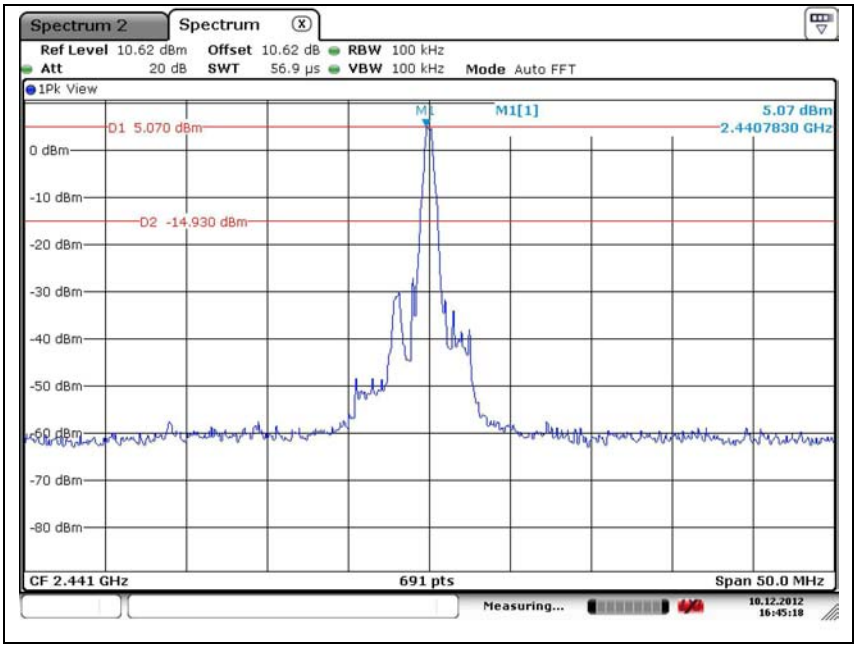
Test results

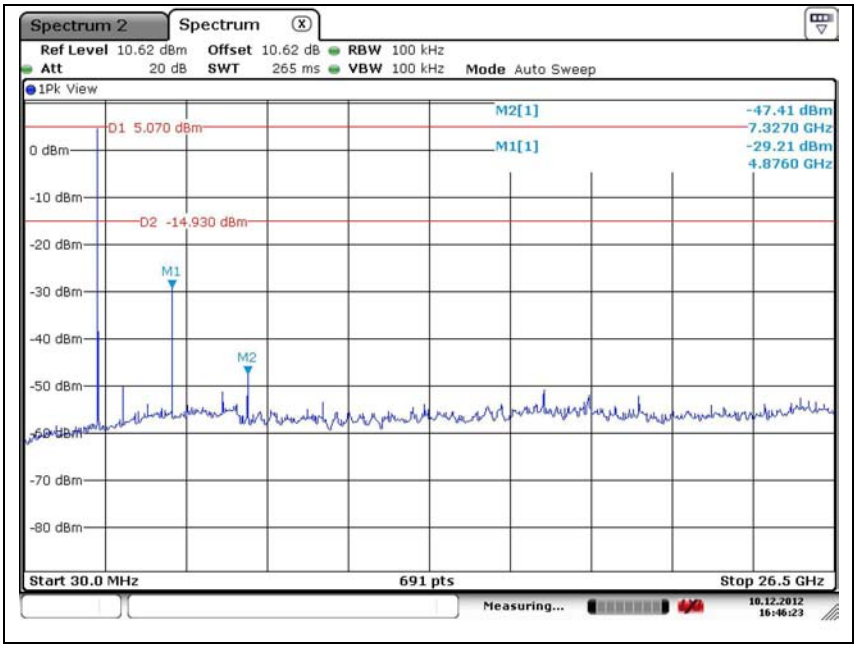
Low channel // GFSK



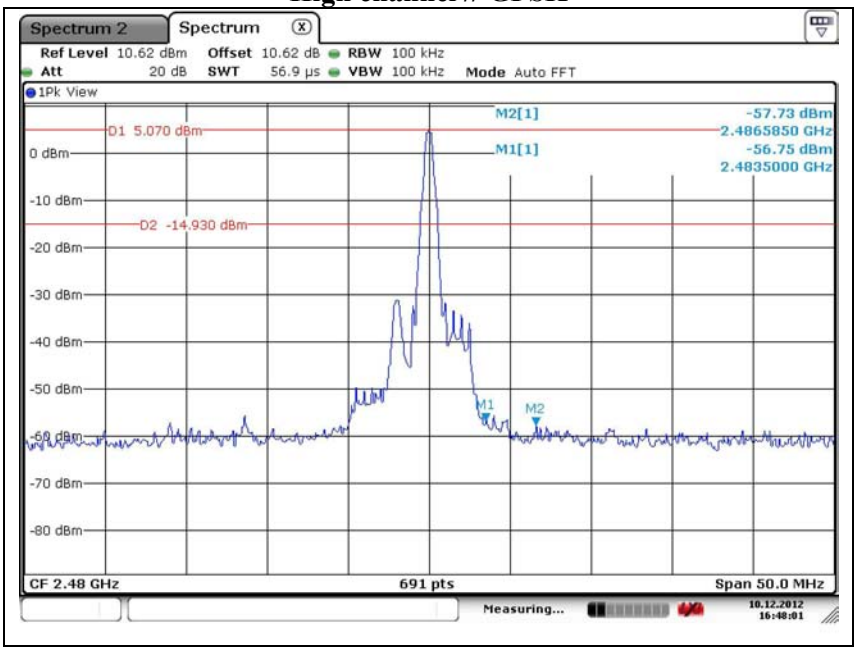


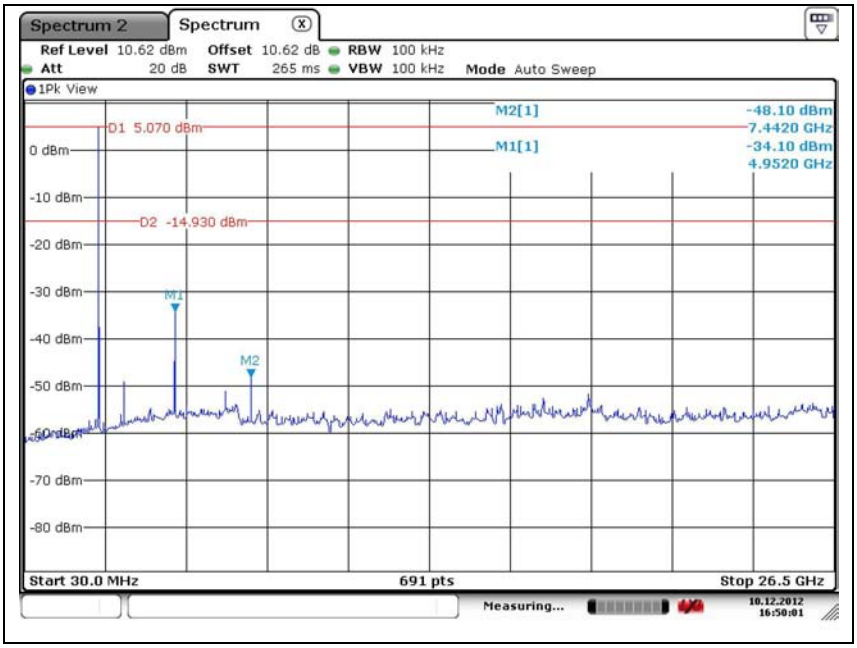
Middle channel // GFSK



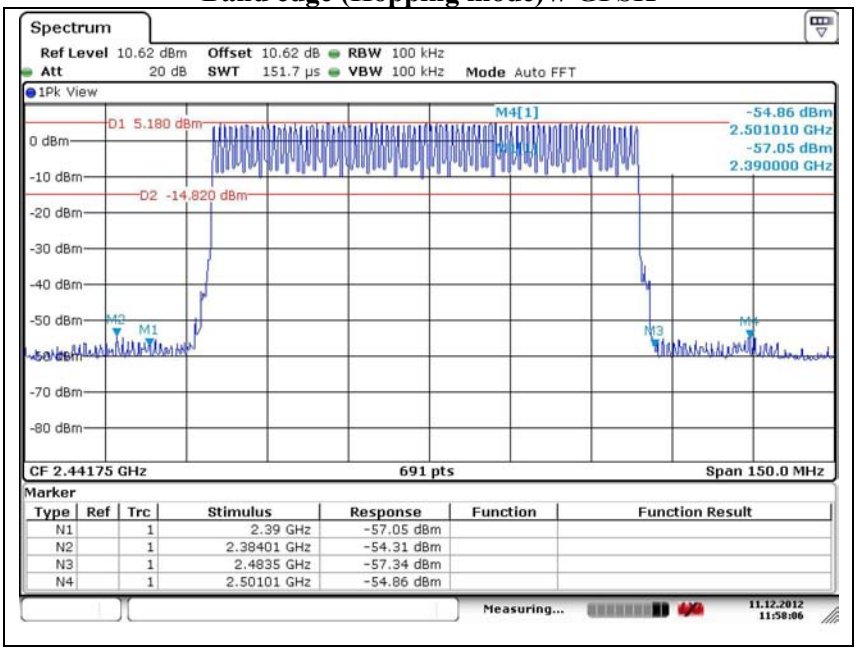


High channel // GFSK

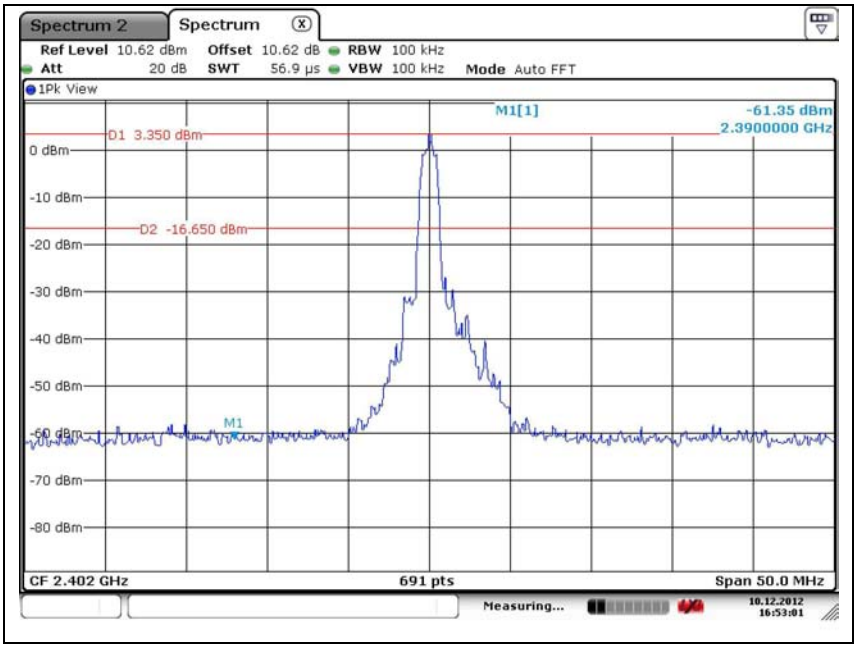


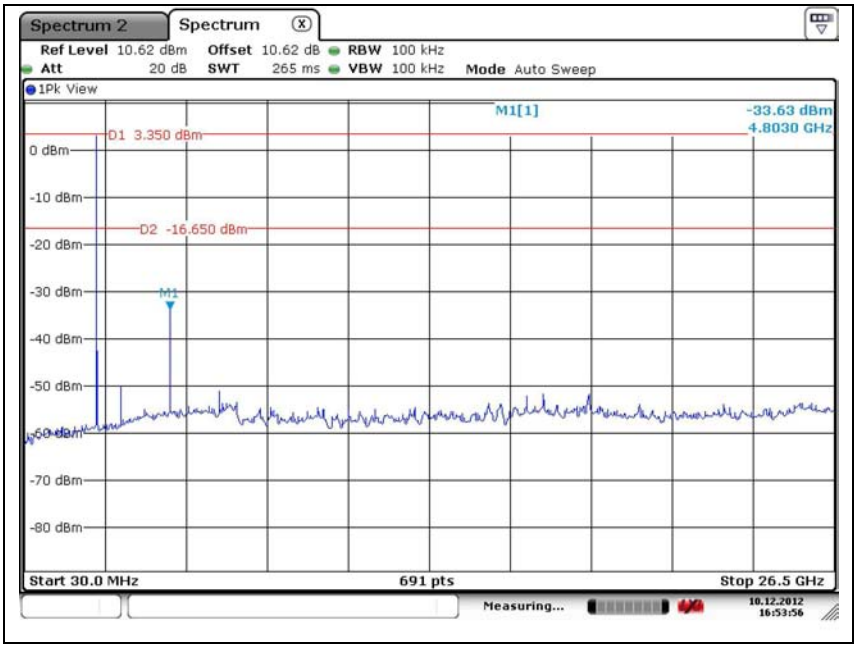


Band edge (Hopping mode) // GFSK

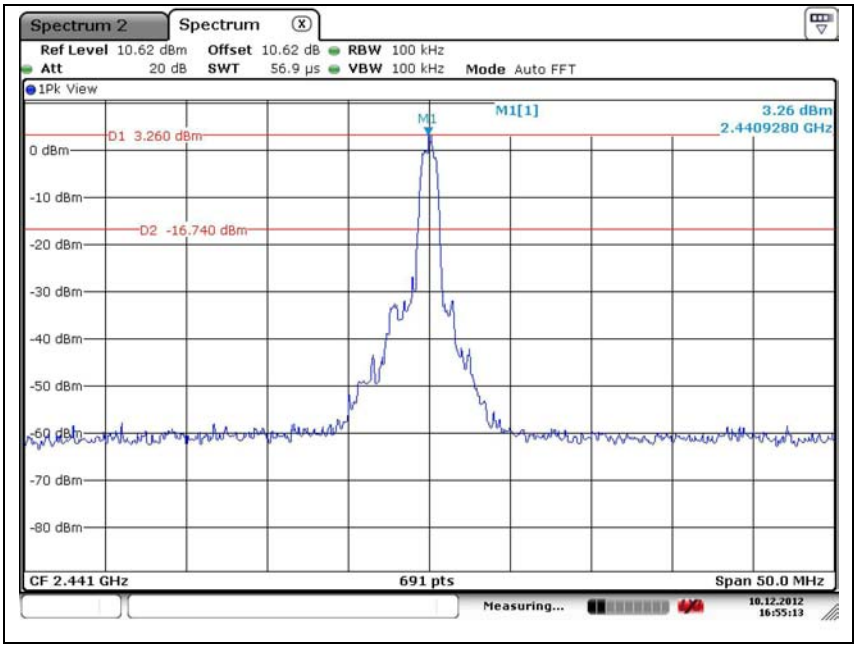


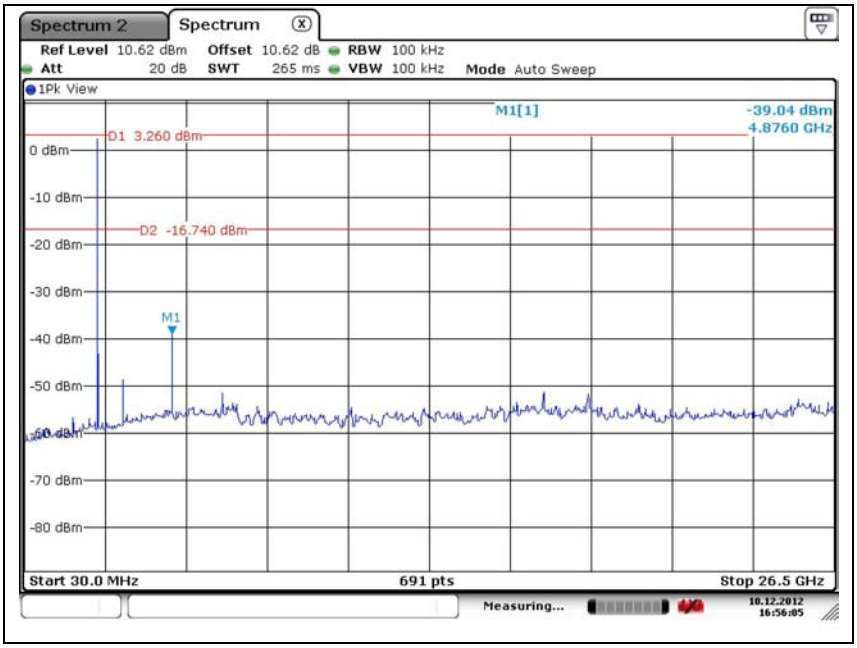
Low channel // 8DPSK



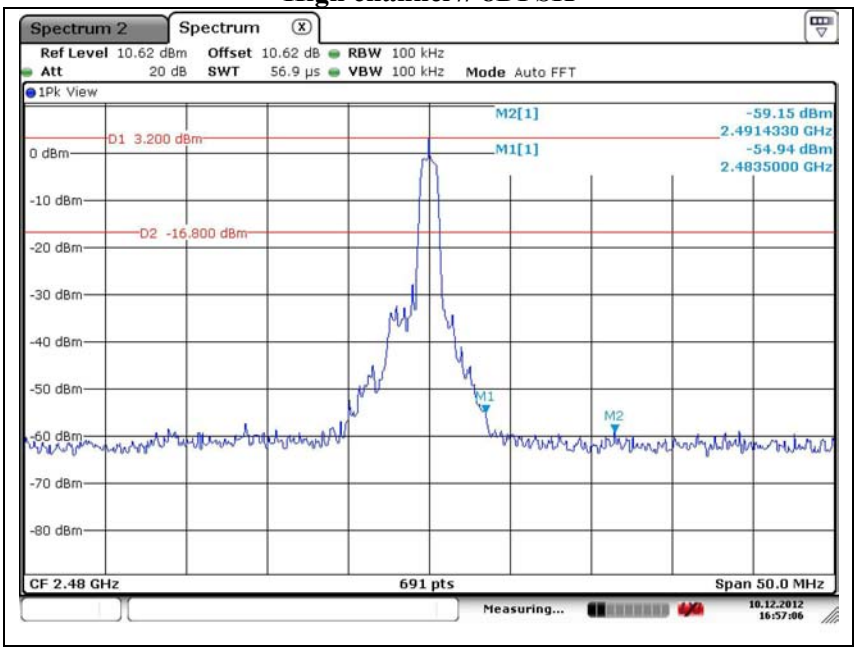


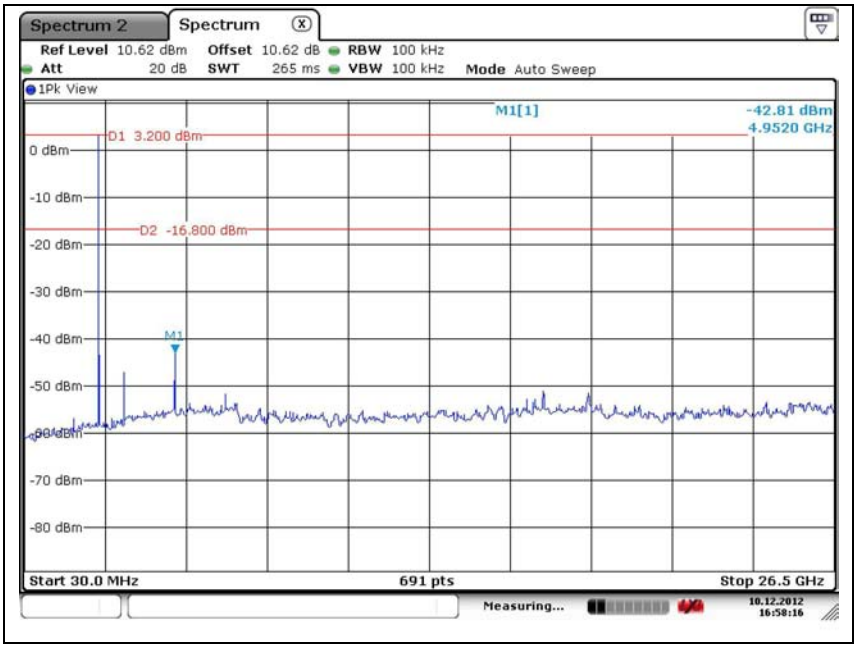
Middle channel // 8DPSK



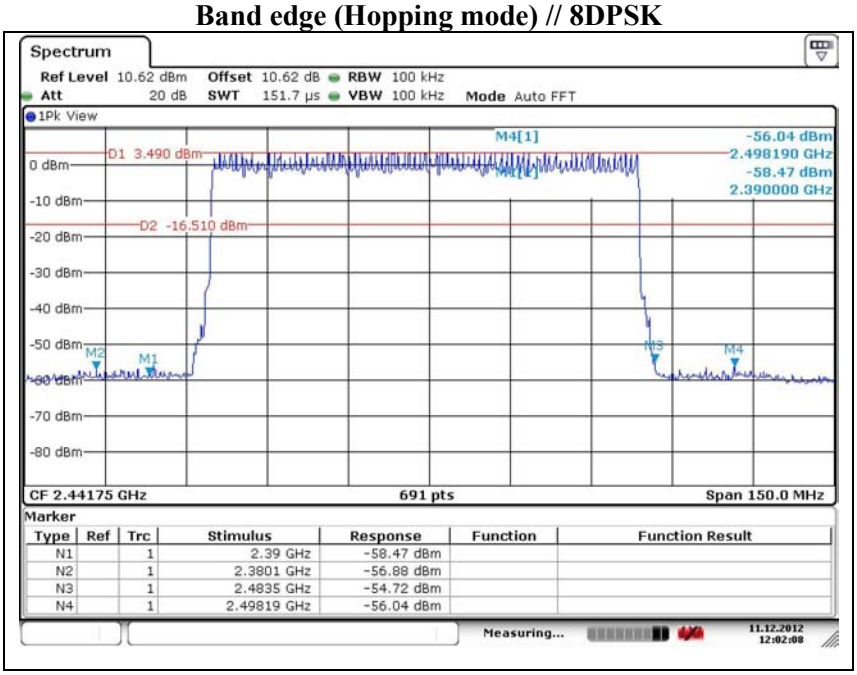


High channel // 8DPSK



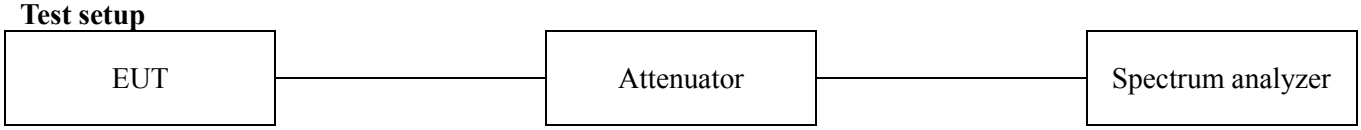


Band edge (Hopping mode) // 8DPSK



2.1.4 20 dB bandwidth

Test setup



Test procedure

1. Use the following spectrum analyzer setting
   Center frequency: Lowest, middle and highest channels
   Span = 3 ㎒ (Approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel)
   RBW = 30 ㎑ (≥ 1% of the span)
   VBW = 100 ㎑ (≥ RBW)
   Sweep = auto
   Detector function = peak
   Trace = max hold
2. The EUT should be transmitting at its maximum data rate. Allow the trance to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down on side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level.

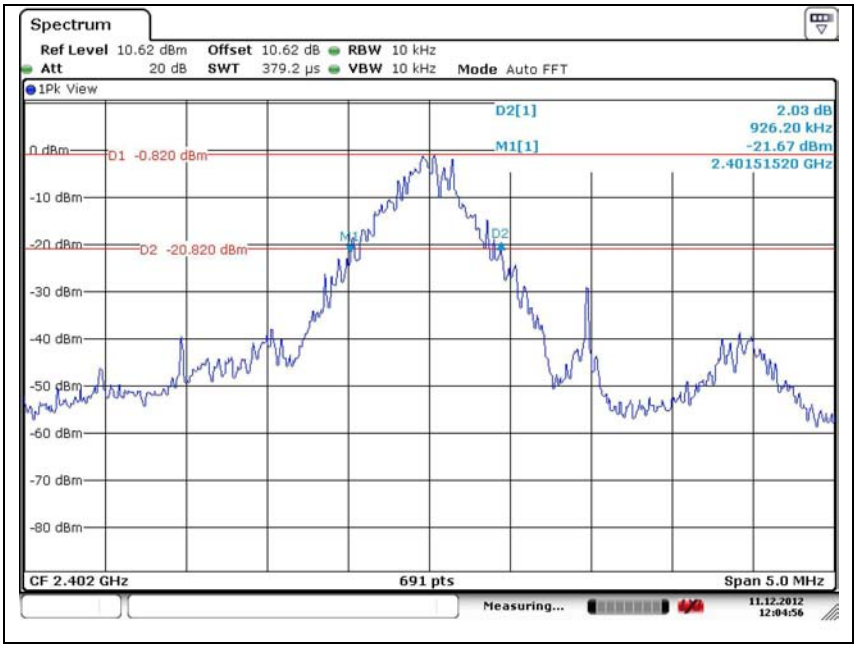
Limit

Not applicable

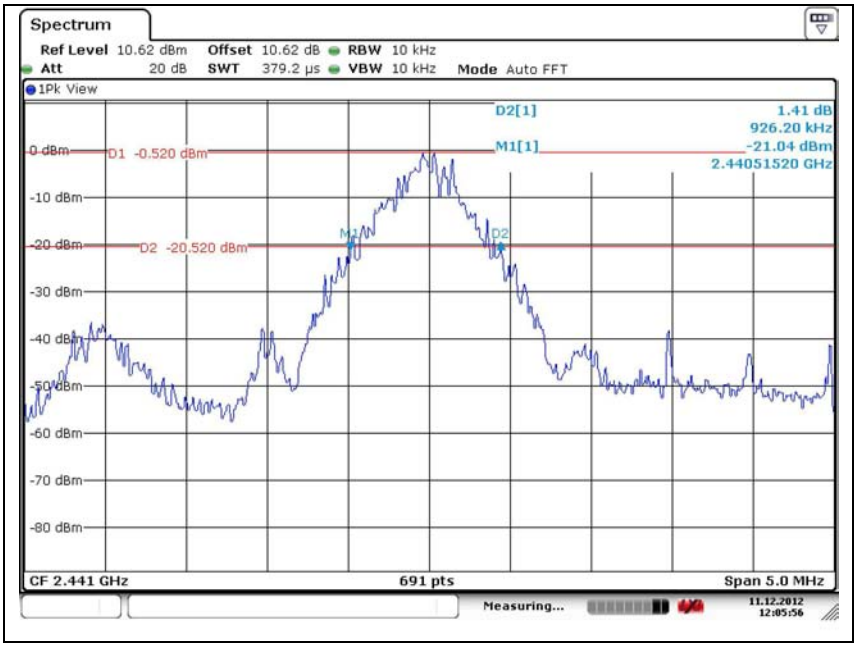
Test results

Operation mode	Frequency(㎒)	20 ㏈ bandwidth(㎒)
GFSK	2 402	0.926
	2 441	0.926
	2 480	0.926
8DPSK	2 402	1.251
	2 441	1.244
	2 480	1.259

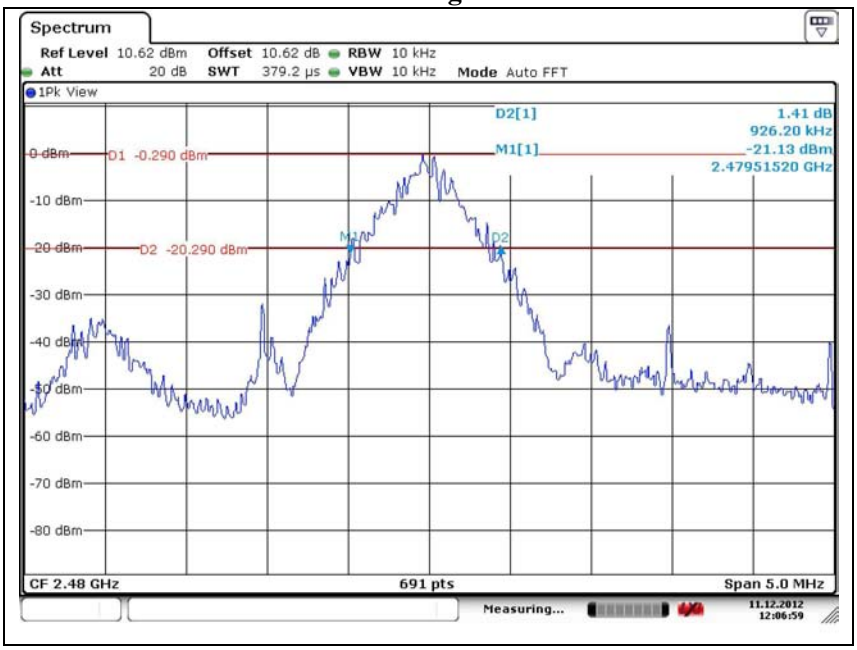
20 ㏈ bandwidth // Low channel // GFSK



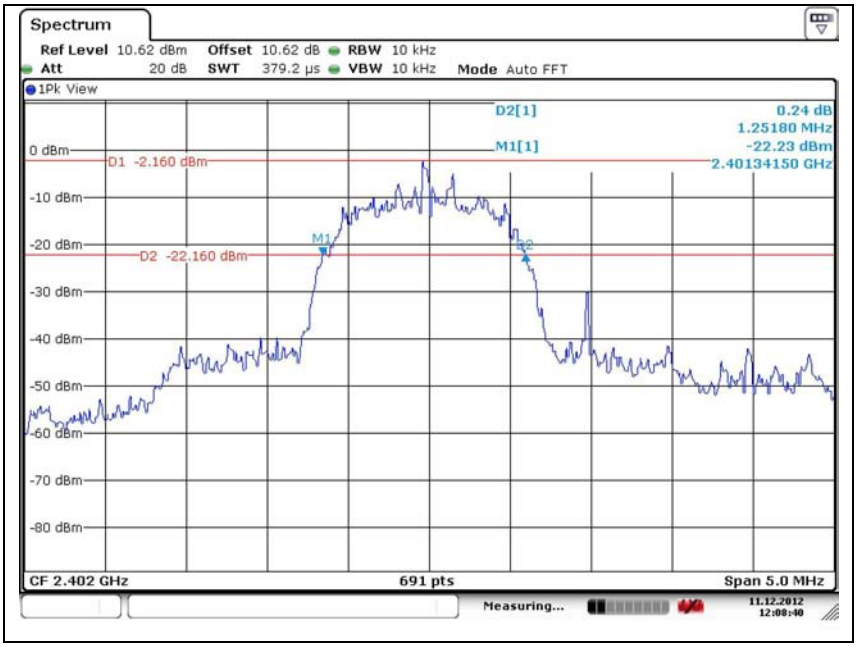
20 dB bandwidth // Middle channel // GFSK



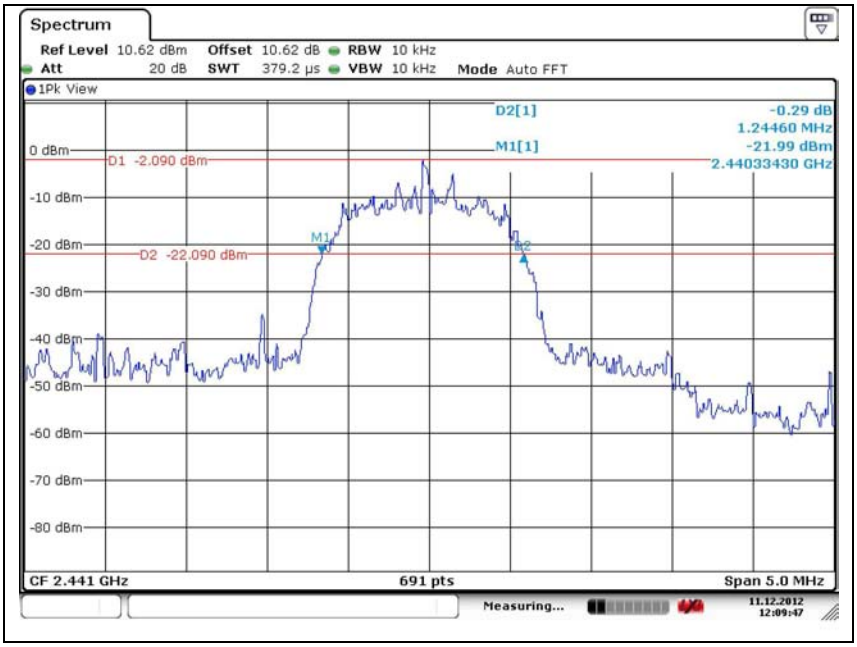
20 dB bandwidth // High channel // GFSK



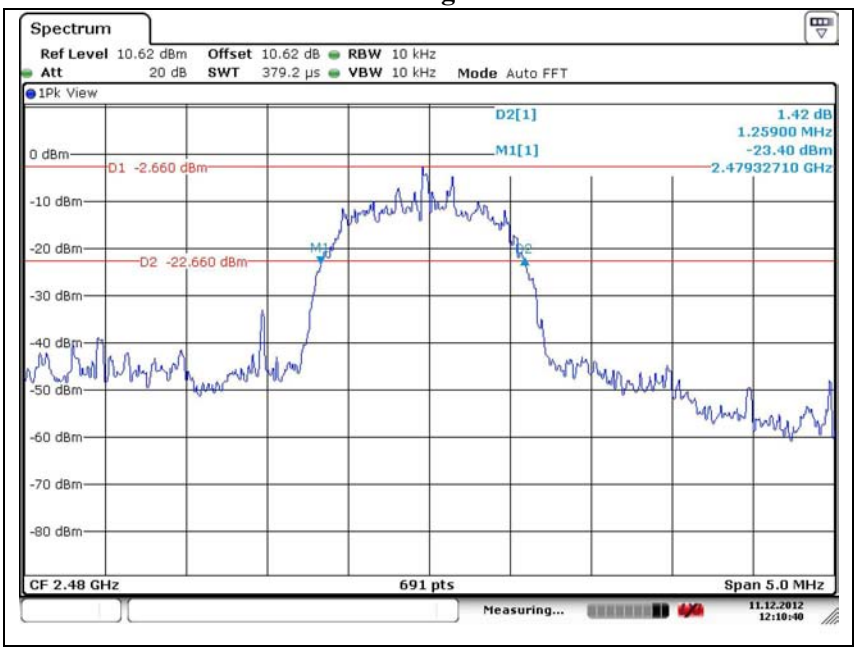
20 dB bandwidth // Low channel // 8DPSK



20 dB bandwidth // Middle channel // 8DPSK

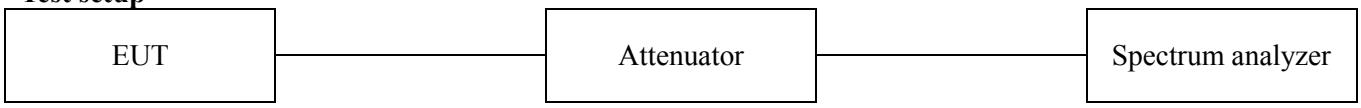


20 dB bandwidth // High channel // 8DPSK



2.1.5 Frequency separation

Test setup



Test procedure

1. The EUT must have its hopping function enabled.
2. Use the following spectrum analyzer setting
   Span = 3 ㎒ (wide enough to capture the peaks of two adjacent channels)
   RBW = 30 ㎑ (≥ 1% of the span)
   VBW = 100 ㎑ (≥ RBW)
   Sweep = auto
   Detector function = peak
   Trace = max hold
3. All the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

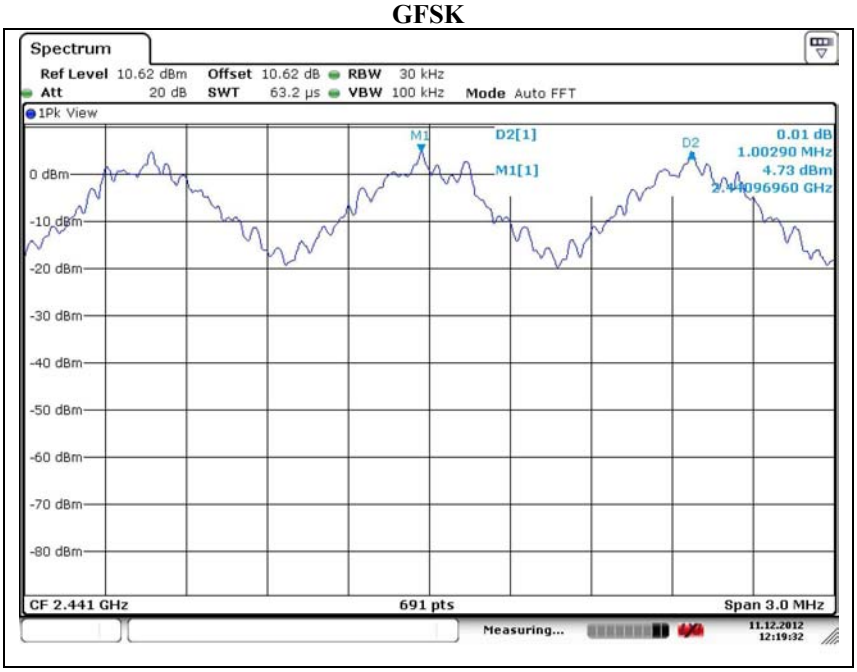
Limit

According to 15.247(a)(1), frequency hopping system operating in 2 400 ~ 2 483.5 ㎒. Band may have hopping channel carrier frequencies that are separated by 25 ㎑ or two-third of 20 ㏈ bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 ㎽.

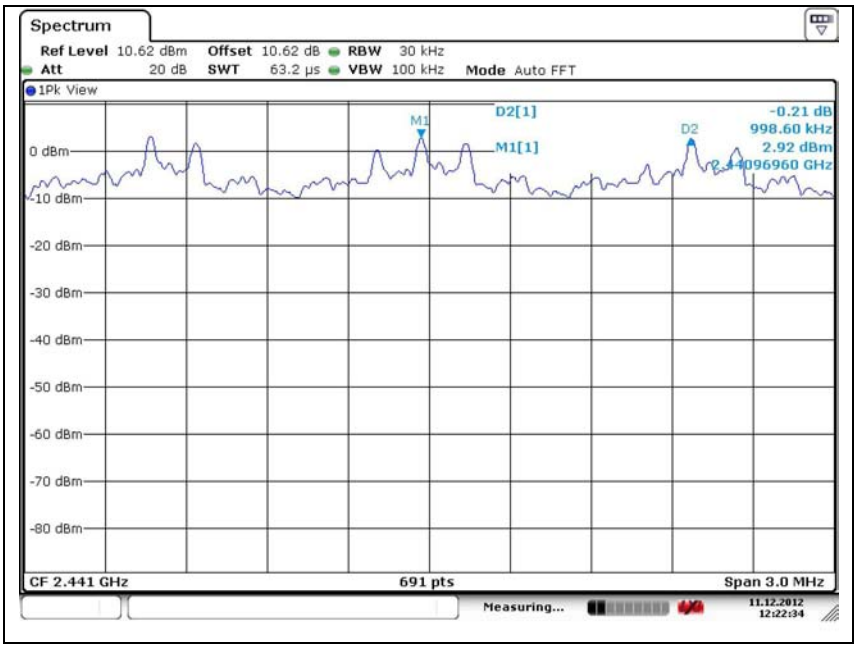
Test results

Operation mode	Frequency (㎒)	Adjacent hopping channel separation(㎑)	Two-third of 20 ㏈ bandwidth (㎑)	Minimum bandwidth (㎑)
GFSK	2 441	1.003	0.617	25
8DPSK	2 441	0.999	0.829	25

GFSK

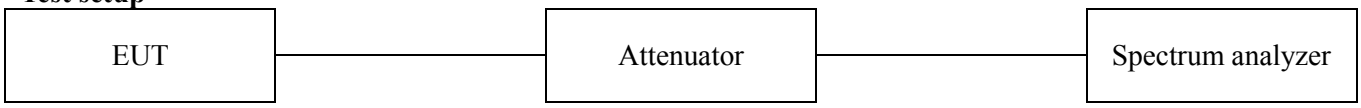


8DPSK



2.1.6 Number of hopping frequency

Test setup



Test procedure

1. The EUT must have its hopping function enabled.
2. Use the following spectrum analyzer setting
   Frequency range: 2 400 ㎒ ~ 2 441.5 ㎒, 2 441.5 ㎒ ~ 2 483.5 ㎒
   Span = the frequency band of operation
   RBW = 1 ㎒ (≥ 1% of the span)
   VBW = 1 ㎒ (≥ RBW)
   Sweep = auto
   Detector function = peak
   Trace = max hold
3. All the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

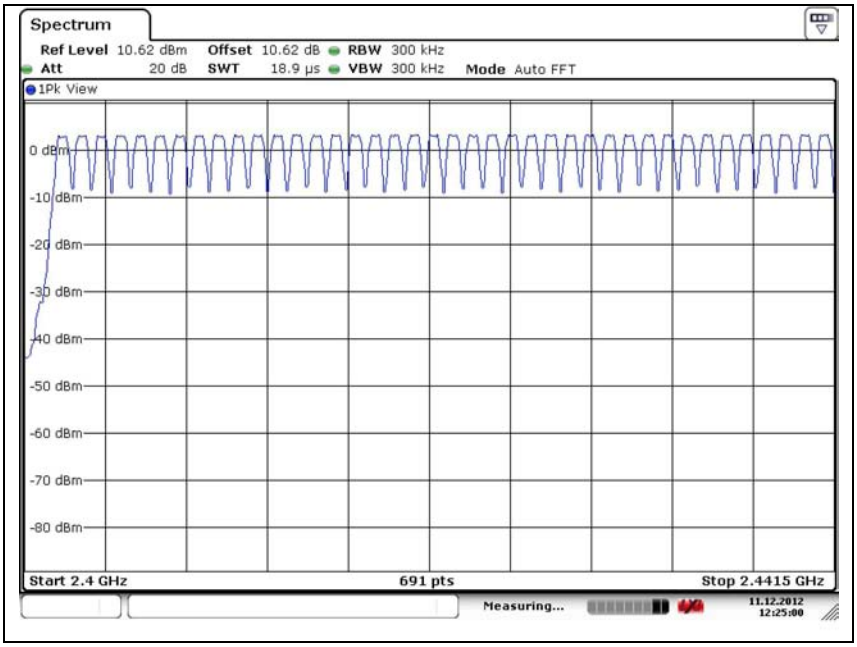
Limit

According to 15.247(a)(1)(iii), for frequency hopping system operating in the 2 400 ~ 2 483.5 ㎒ bands shall use at least 15 hopping frequencies.

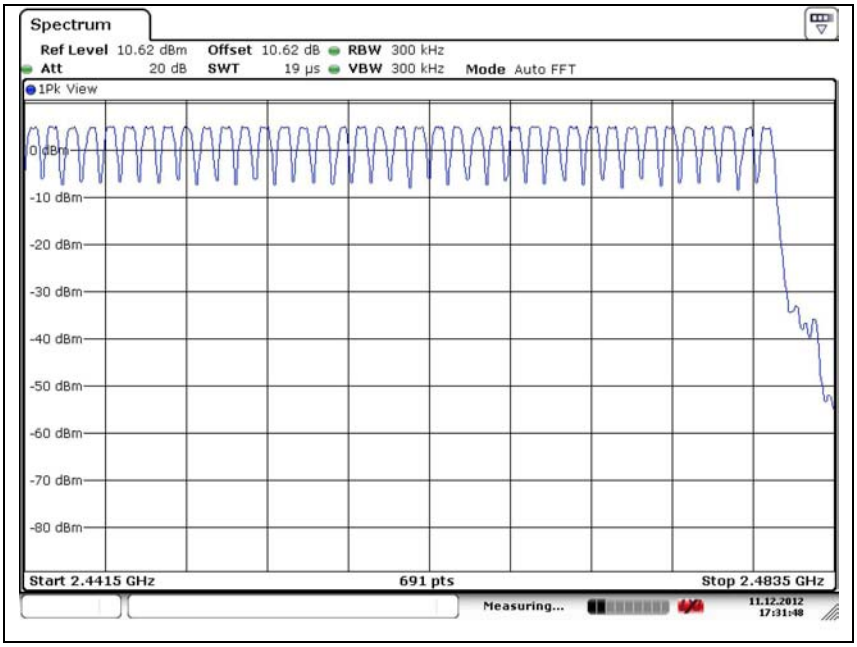
Test results

Operation mode	Number of hopping frequency	Limit
GFSK	79	≥ 15
8DPSK	79	≥ 15

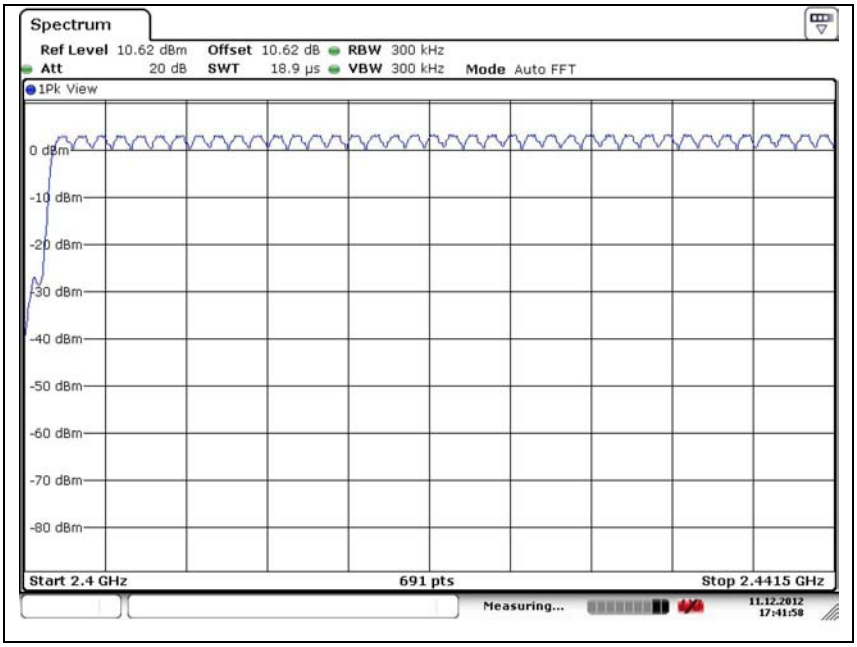
2 400 ㎒ ~ 2 441.5 ㎒ // GFSK



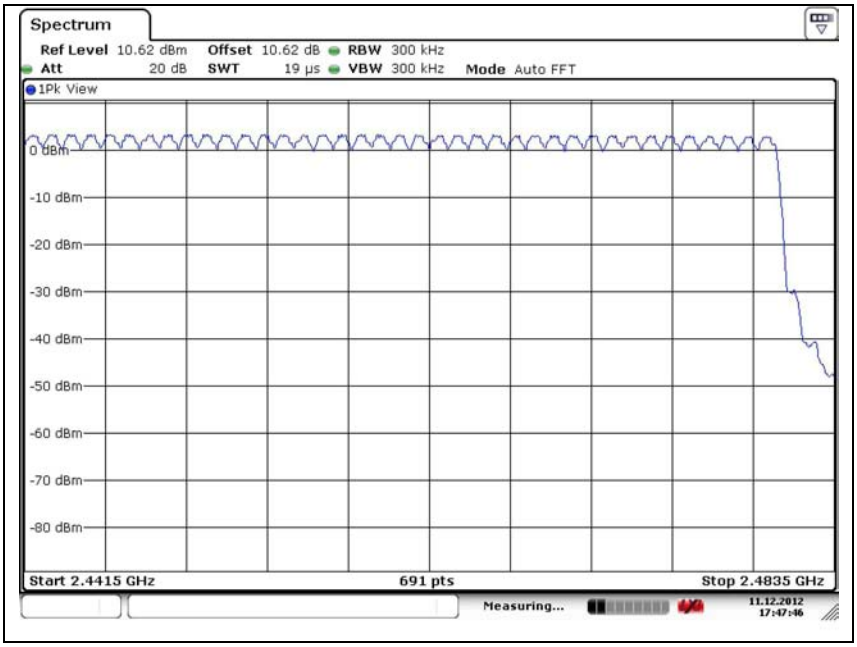
2 441.5 ㎒ ~ 2 483.5 ㎒ // GFSK



2 400 ㎒ ~ 2 441.5 ㎒ // 8DPSK

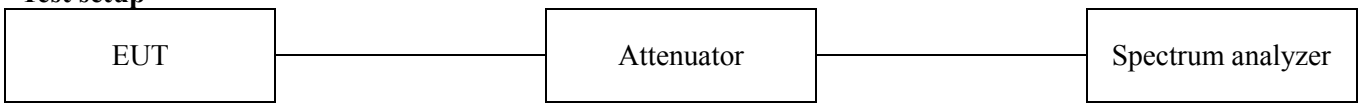


2 441.5 ㎒ ~ 2 483.5 ㎒ // 8DPSK



2.1.7 Time of occupancy (Dwell time)

Test setup



Test procedure

1. Use the following spectrum analyzer setting
   Center frequency: 2 441 ㎒
   Span = Zero span, centered on a hopping channel
   RBW = 1 ㎒
   VBW = 3 ㎒ (≥ RBW)
   Sweep = as necessary to capture the entire dwell time per hopping channel
   Detector function = peak
   Trace = max hold
2. If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., date rate, modulation format, etc.), repeat this test for each variation.
3. The Bluetooth has 3 type of payload DH1, DH3, DH5. The hopping rate is 1 600 per second.

Limit

According to 15.247(a)(1)(iii), for frequency hopping system operating in the 2 400 ~ 2 483.5 ㎒ band, the average time of occupancy on any frequency shall not be greater than 0.4 second within a 31.6 second period.

A period time = 0.4(s) × 79 = 31.6(s)

Test results

Time of occupancy on the TX channel in 31.6 sec
= time domain slot length × (hop rate ÷ number of hop per channel) × 31.6

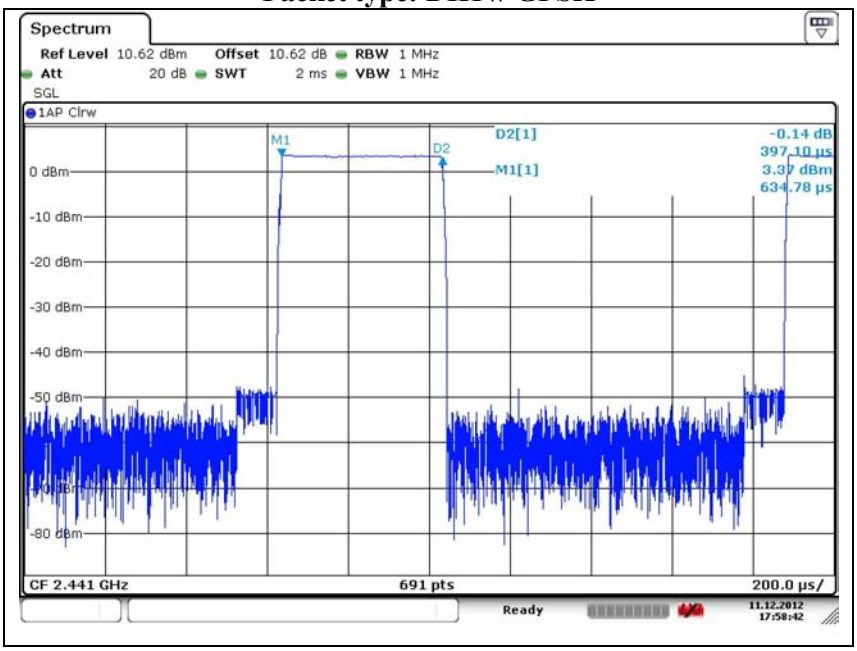
Operation mode: GFSK , 8DPSK

Packet type	Frequency (㎒)	Dwell time (ms)	Time of occupancy on the Tx channel in 31.6 sec (ms)	Limit for time of occupancy on the Tx channel in 31.6 sec (ms)
DH1	2 441	0.397	127.04	400
DH3	2 441	1.652	264.32	400
DH5	2 441	2.899	309.23	400
3-DH1	2 441	0.409	130.88	400
3-DH3	2 441	1.659	265.44	400
3-DH5	2 441	2.899	309.23	400

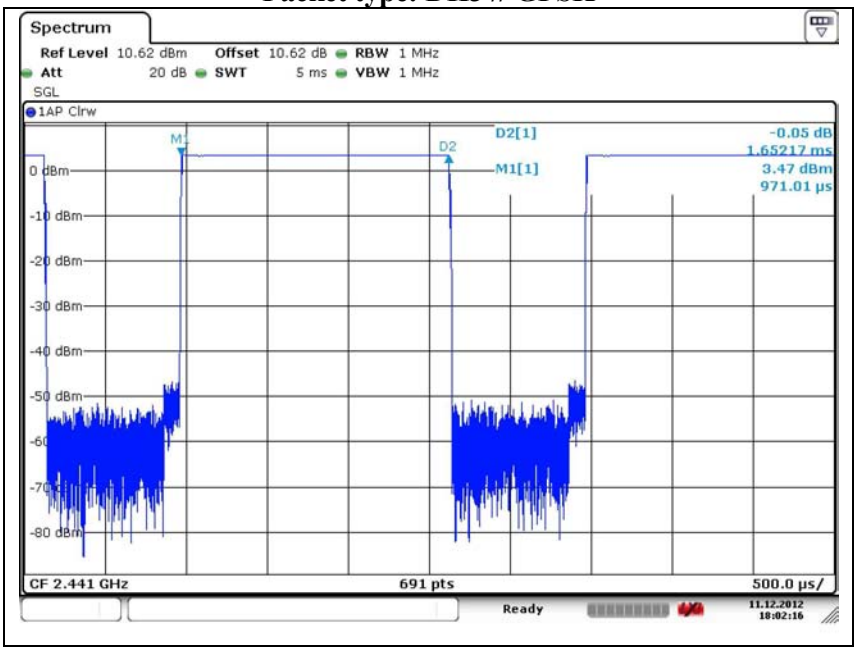
※ Remark:

DH1: Dwell time (ms) × [(1 600 ÷ 2) ÷ 79] × 31.6(s) = 127.04 (ms)
DH3: Dwell time (ms) × [(1 600 ÷ 4) ÷ 79] × 31.6(s) = 264.32 (ms)
DH5: Dwell time (ms) × [(1 600 ÷ 6) ÷ 79] × 31.6(s) = 309.23 (ms)
3-DH1: Dwell time (ms) × [(1 600 ÷ 2) ÷ 79] × 31.6(s) = 130.88 (ms)
3-DH3: Dwell time (ms) × [(1 600 ÷ 4) ÷ 79] × 31.6(s) = 265.44 (ms)
3-DH5: Dwell time (ms) × [(1 600 ÷ 6) ÷ 79] × 31.6(s) = 309.23 (ms)

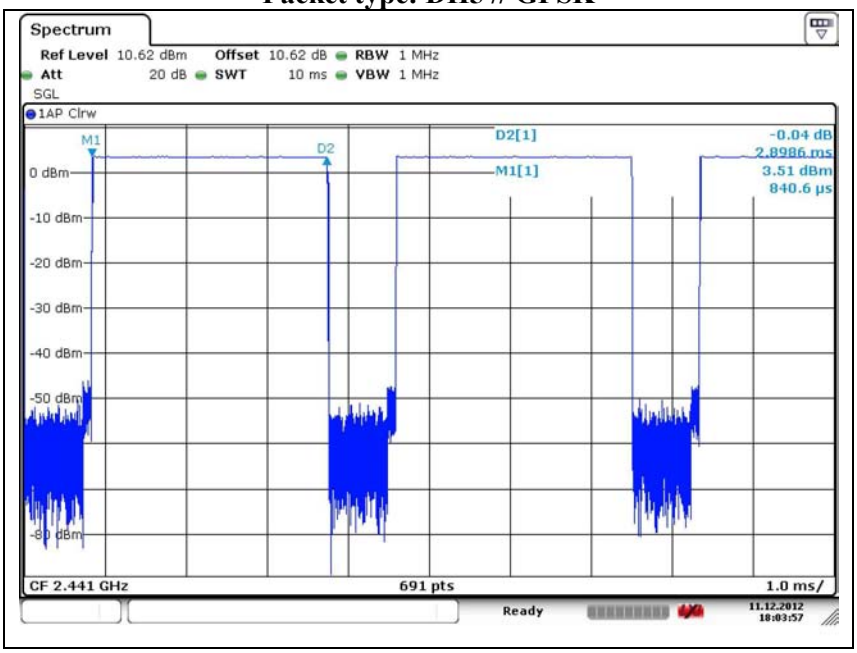
Packet type: DH1 // GFSK



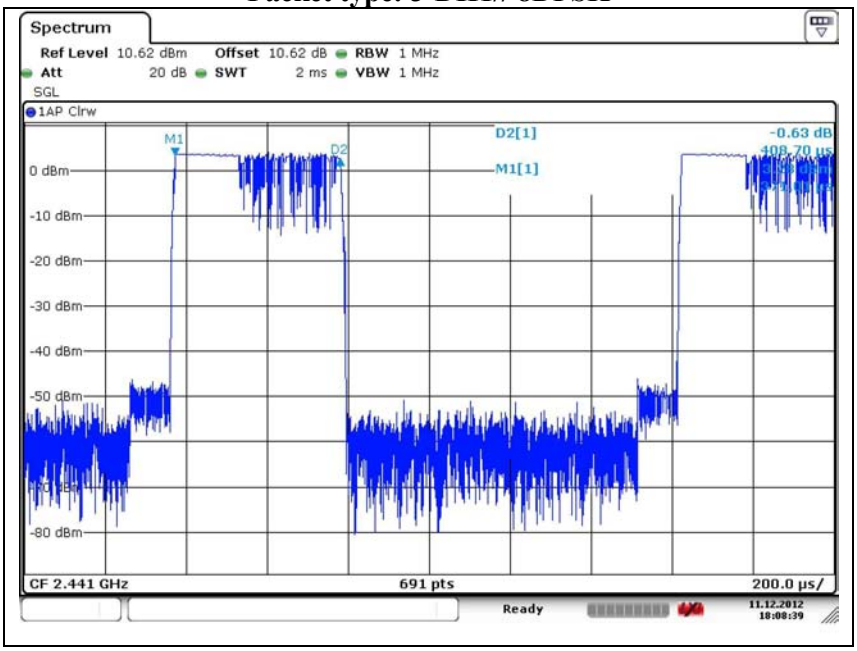
Packet type: DH3 // GFSK



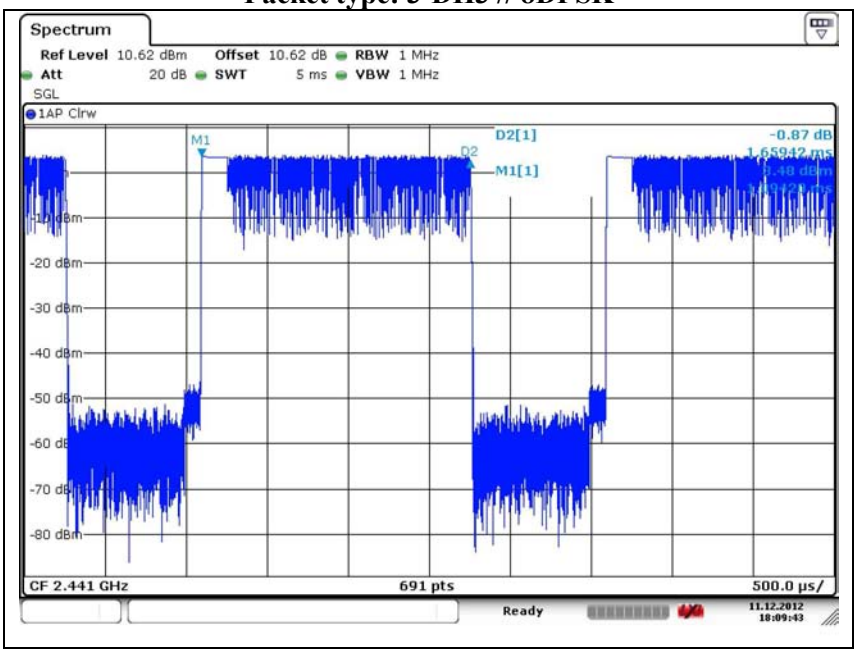
Packet type: DH5 // GFSK



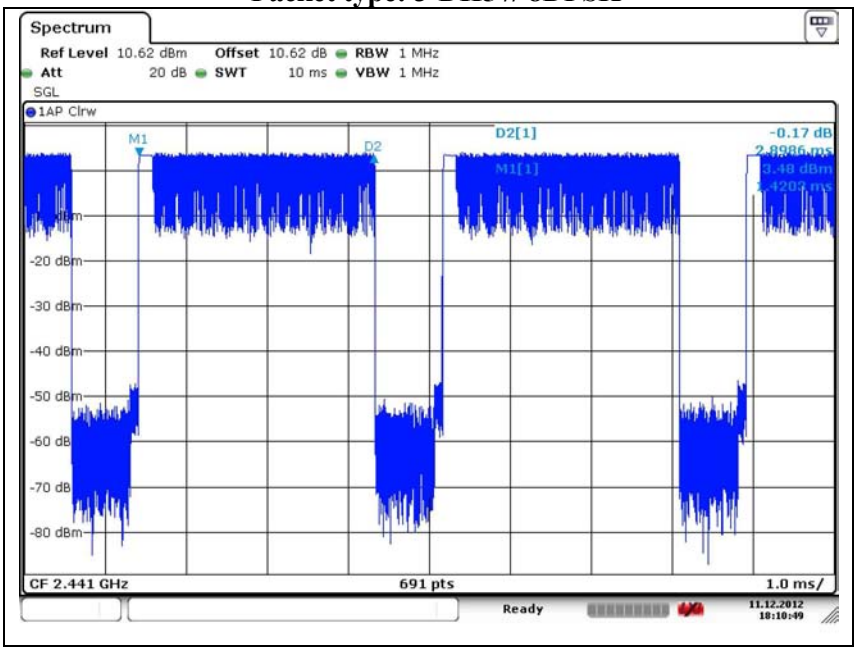
Packet type: 3-DH1// 8DPSK



Packet type: 3-DH3 // 8DPSK



Packet type: 3-DH5 // 8DPSK



2.1.8 Radiated spurious emission & band edge

Test location
Testing was performed at a test distance of 3 meter Open Area Test Site

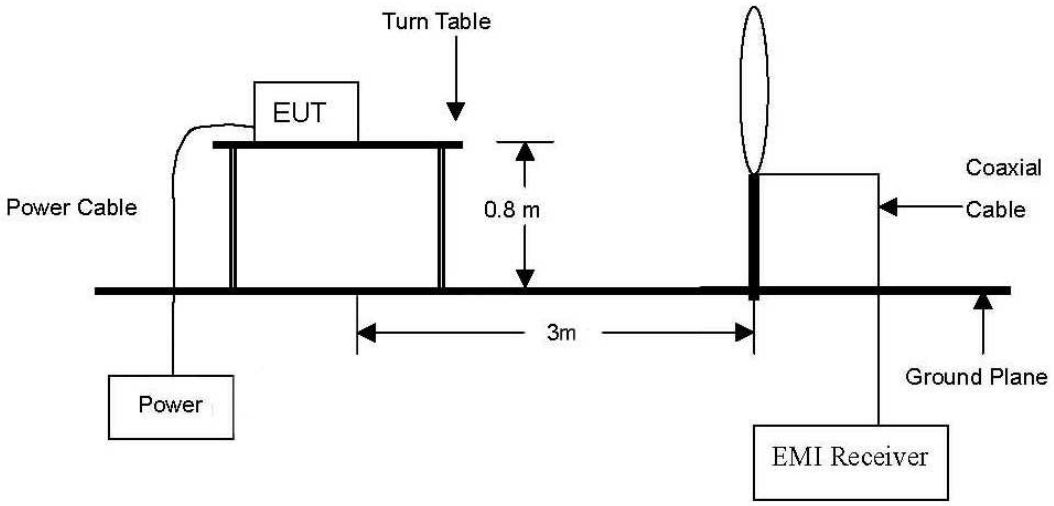
Test procedures
[9 ㎑ to 30 ㎒]
The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading. The test-receiver system was set to Quasi-peak function and specified bandwidth with maximum hold mode.

The spectrum analyzer is set to:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 200 ㎐ for Quasi-peak detection (QP) at frequency below 9 ㎑~ 150 ㎑.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 9 ㎑ for Quasi-peak detection (QP) at frequency below 150 ㎑~ 30 ㎒.

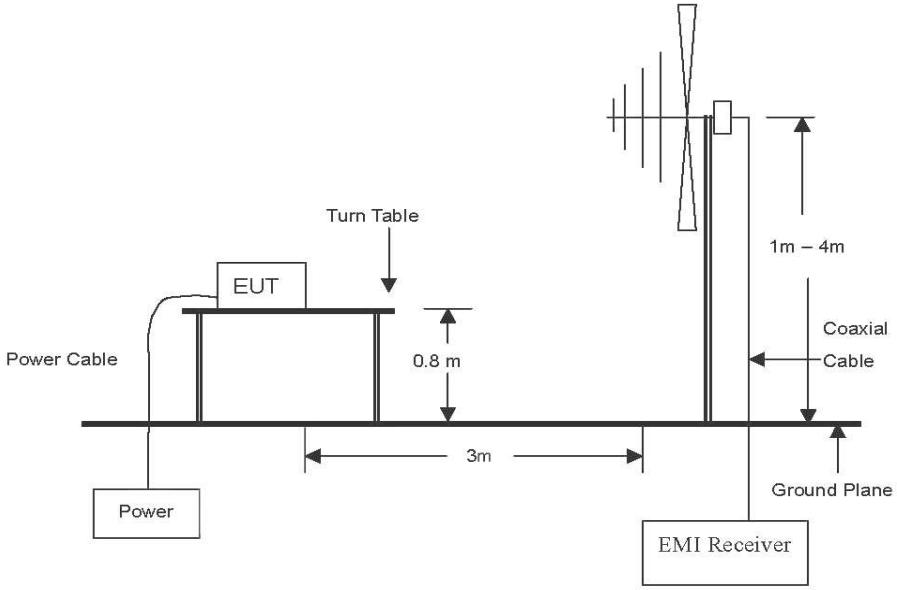
[30 ㎒ to 1 ㎓ and 1 ㎓ to 24 ㎓]
The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity.
The measurement was made in both the vertical and horizontal polarization, and the maximum value is presented in the report.

The spectrum analyzer is set to:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 120 ㎑ for Peak detection (PK) or Quasi-peak detection (QP) at frequency below 1 ㎓.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 ㎒ for Peak detection at frequency above 1 ㎓.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 ㎒ and the video bandwidth is 10 ㎐ for Average detection (AV) at frequency above 1 ㎓.

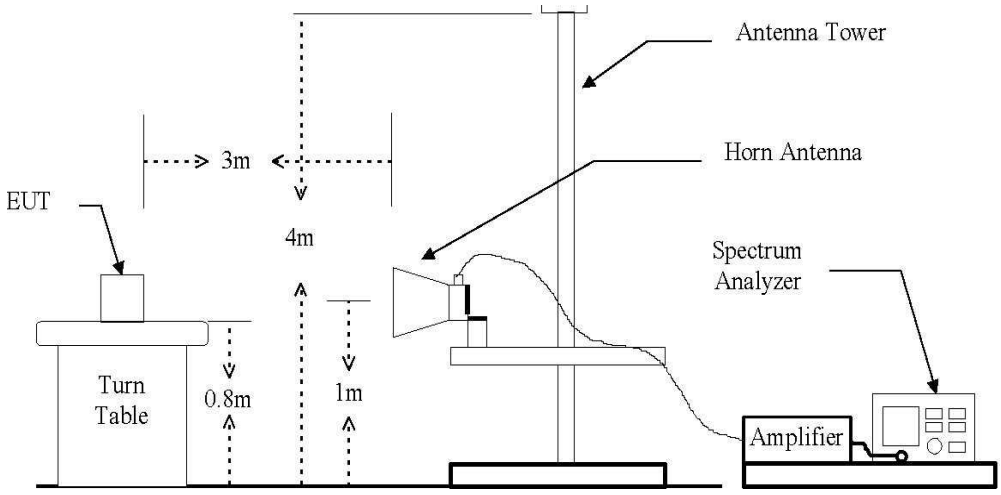
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to 24 ㎓ emissions.



Limit

According to 15.209(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values：

Frequency (㎒)	Distance (Meters)	Radiated (㎶/m)
0.009 ~ 0.490	300	2400 / F(㎑)
0.490 ~ 1.705	30	24000 / F(㎑)
1.705 ~ 30.0	30	30
30 ~ 88	3	100**
88 ~ 216	3	150**
216 ~ 960	3	200**
Above 960	3	500

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

Test results (Below 30 ㎒) – Worst case configuration: GFSK

The frequency spectrum from 9 ㎑ to 30 ㎒ was investigated. Emission levels are not reported much lower than the limits by over 20 ㏈.

Radiated emissions		Ant.	Correction factors			Total	Limit	
Frequency (㎒)	Reading (㏈㎶)	Pol.	Ant. factor (㏈/m)	Cable loss (㏈)	F_d (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
Below 30	Not detected							

※ Remark

1. All spurious emission at channels are almost the same below 30 ㎒, so that middle channel was chosen at representative in final test.
2. Actual = Reading + Ant. factor + Cable loss + F_d
3. $F_d = 40\log(D_m / D_s)$
   Where:
   F_d = Distance factor in ㏈
   D_m = Measurement distance in meters
   D_s = Specification distance in meters

Test results (Below 1 000 ㎒) – Worst case configuration: GFSK

The frequency spectrum from 30 ㎒ to 1 000 ㎒ was investigated.

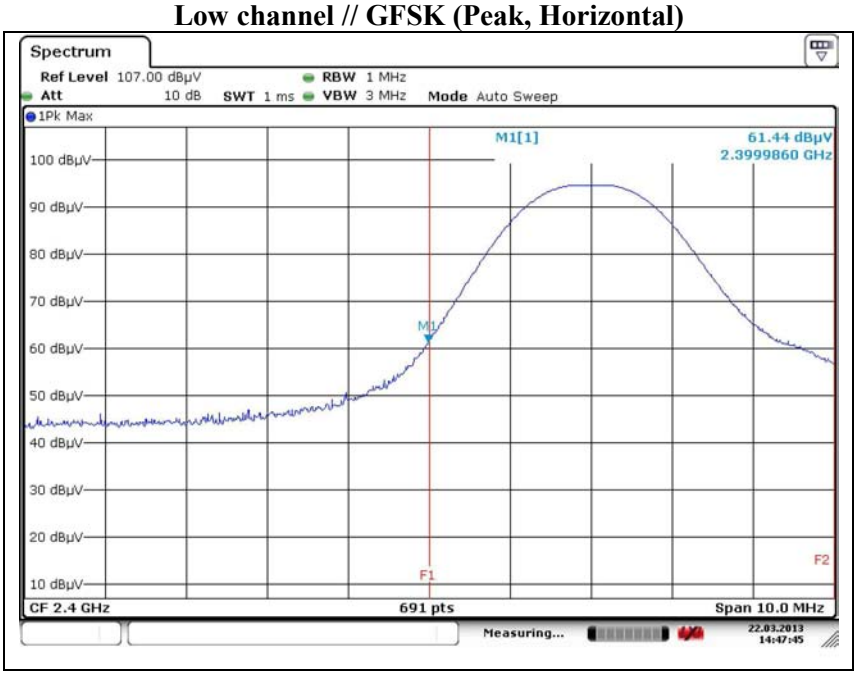
Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
163.974	14.20	V	12.98	2.49	29.67	43.50	13.83
172.543	15.70	H	12.26	2.53	30.49	43.50	13.01
176.455	15.10	V	11.94	2.56	29.60	43.50	13.90
192.011	17.00	H	10.62	2.77	30.39	43.50	13.11
223.973	22.50	H	10.77	3.07	36.34	46.00	9.66
224.026	16.00	V	10.77	3.07	29.84	46.00	16.16
249.337	25.90	H	11.65	3.28	40.83	46.00	5.17
270.402	16.90	V	12.36	3.42	32.68	46.00	13.32
353.174	16.50	V	14.56	3.96	35.02	46.00	10.98
353.205	20.30	H	14.56	3.96	38.82	46.00	7.18
420.621	15.50	H	16.05	4.35	35.90	46.00	10.10
551.516	12.30	V	18.76	5.08	36.14	46.00	9.86

※ Remark

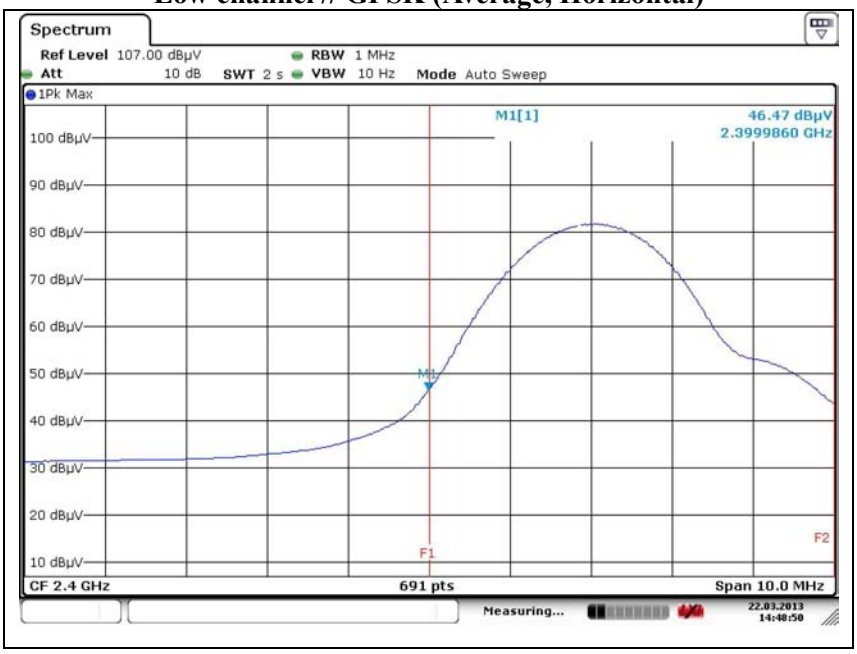
1. All spurious emission at channels are almost the same below 1 ㎓, so that middle channel was chosen at representative in final test.
2. Actual = Reading + Ant. factor + Cable loss
3. Detector mode: Quasi peak
4. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.

Test results (Above 1 000 ㎒)

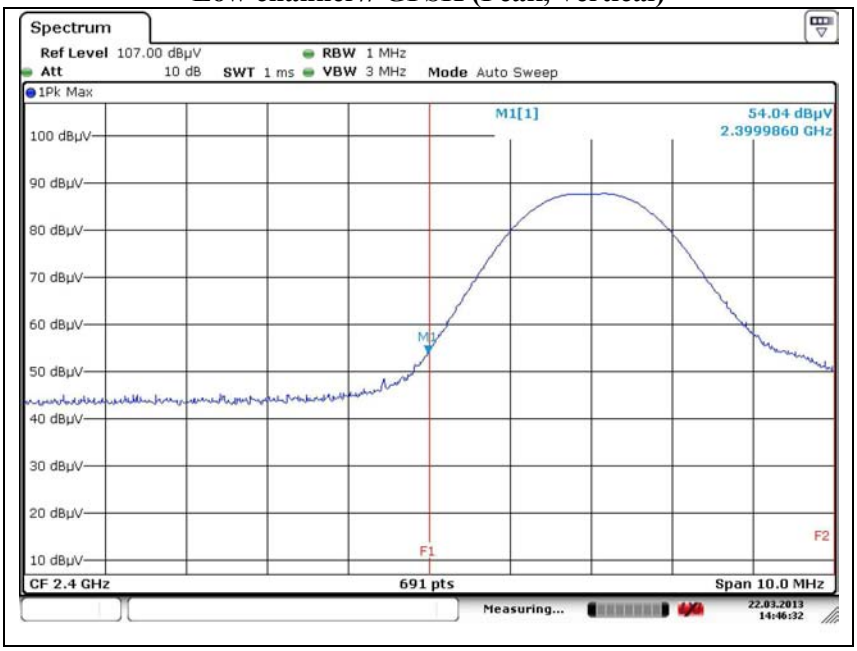
Low channel // GFSK (Peak, Horizontal)



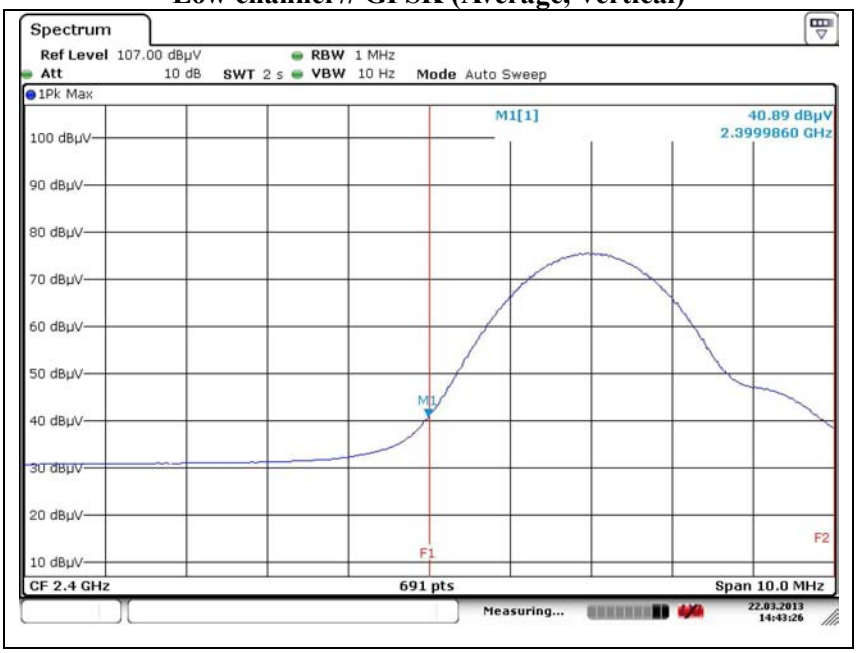
Low channel // GFSK (Average, Horizontal)



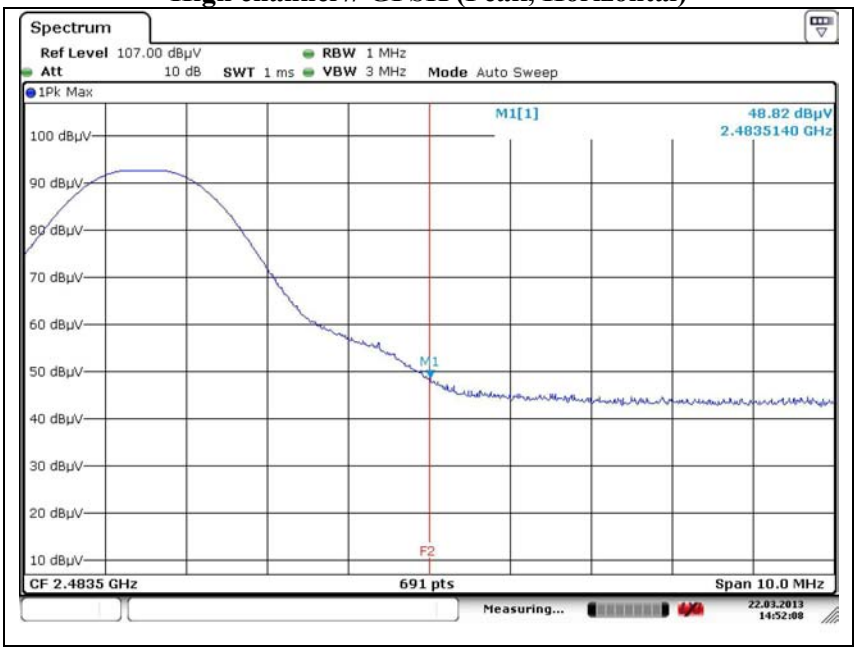
Low channel // GFSK (Peak, Vertical)



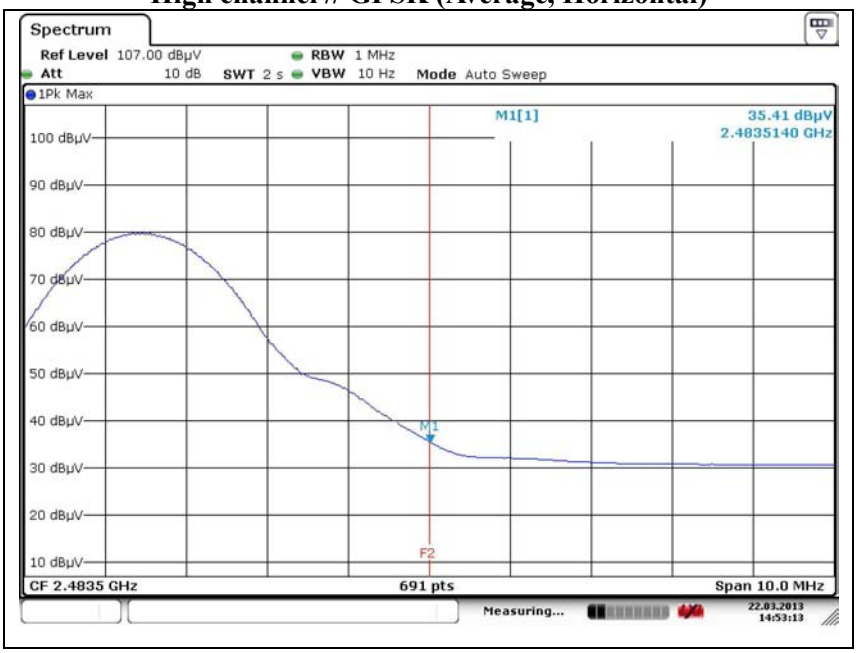
Low channel // GFSK (Average, Vertical)



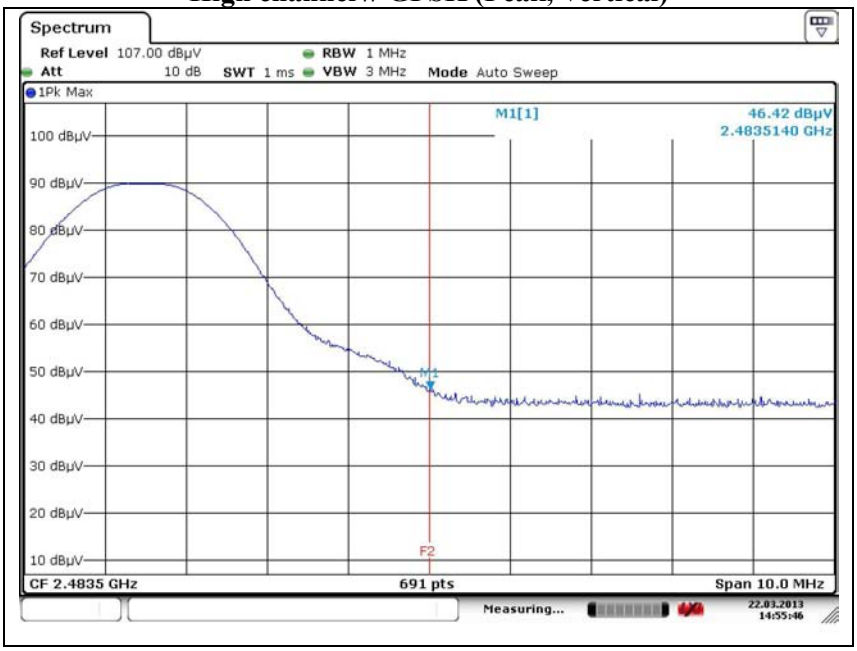
High channel // GFSK (Peak, Horizontal)



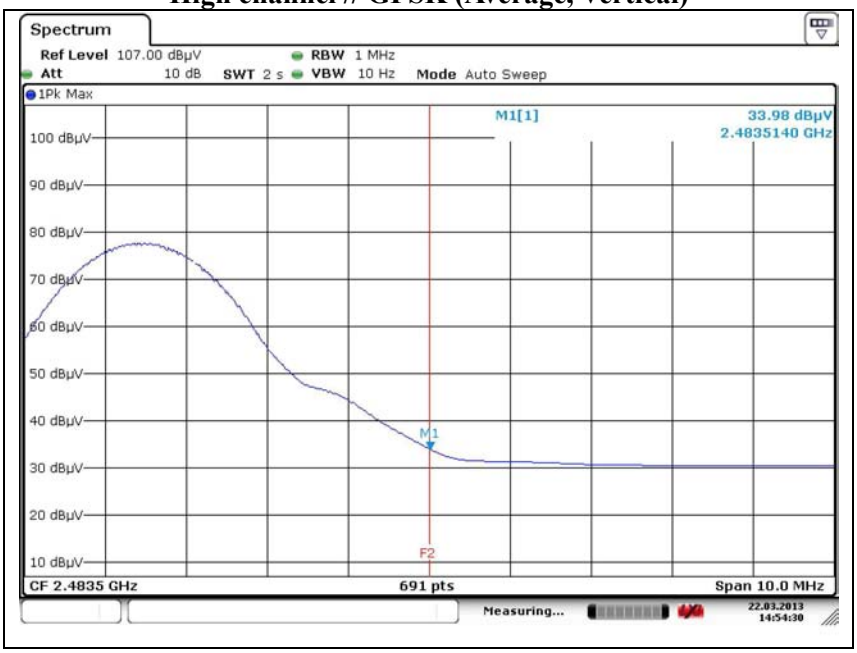
High channel // GFSK (Average, Horizontal)



High channel // GFSK (Peak, Vertical)



High channel // GFSK (Average, Vertical)



The frequency spectrum from 1 ㎓ to 25 ㎓ was investigated.

Low channel // GFSK

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detector mode	Pol.	AFCL (dB)	DCF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2399.986	61.44	Perak	H	3.42	0.00	64.86	74.00	9.14
2399.986	46.47	Average	H	3.42	-30.77	19.12	54.00	34.88
2399.986	54.04	Perak	V	3.42	0.00	57.46	74.00	16.54
2399.986	40.89	Average	V	3.42	-30.77	13.54	54.00	40.46
4803.971	56.09	Perak	H	13.59	0.00	69.68	74.00	4.32
4803.971	55.99	Average	H	13.59	-30.77	38.81	54.00	15.19
4804.043	54.40	Perak	V	13.59	0.00	67.99	74.00	6.01
4804.043	49.67	Average	V	13.59	-30.77	32.49	54.00	21.51

Middle channel // GFSK

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detector mode	Pol.	AFCL (dB)	DCF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
4882.130	53.80	Perak	H	13.91	0.00	67.71	74.00	6.29
4882.130	48.49	Average	H	13.91	-30.77	31.63	54.00	22.37
4882.058	50.03	Perak	V	13.91	0.00	63.94	74.00	10.06
4882.058	48.01	Average	V	13.91	-30.77	31.15	54.00	22.85

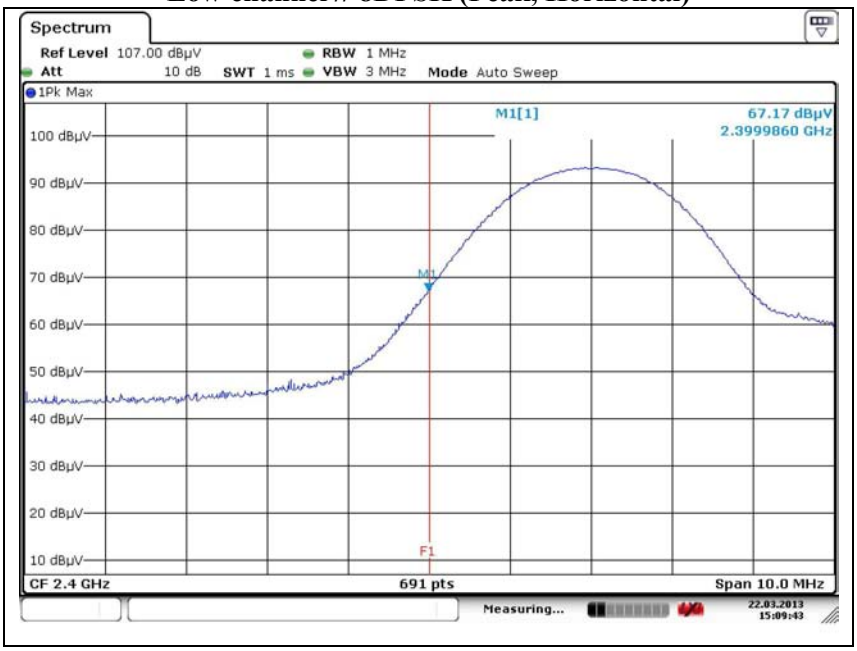
High channel // GFSK

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detector mode	Pol.	AFCL (dB)	DCF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2483.514	48.82	Perak	H	3.87	0.00	52.69	74.00	21.31
2483.514	35.41	Average	H	3.87	-30.77	8.51	54.00	45.49
2483.514	46.42	Perak	V	3.87	0.00	50.29	74.00	23.71
2483.514	33.98	Average	V	3.87	-30.77	7.08	54.00	46.92
4960.174	52.41	Perak	H	14.24	0.00	66.65	74.00	7.35
4960.174	44.30	Average	H	14.24	-30.77	27.77	54.00	26.23
4959.884	48.90	Perak	V	14.23	0.00	63.13	74.00	10.87
4959.884	44.02	Average	V	14.23	-30.77	27.48	54.00	26.52

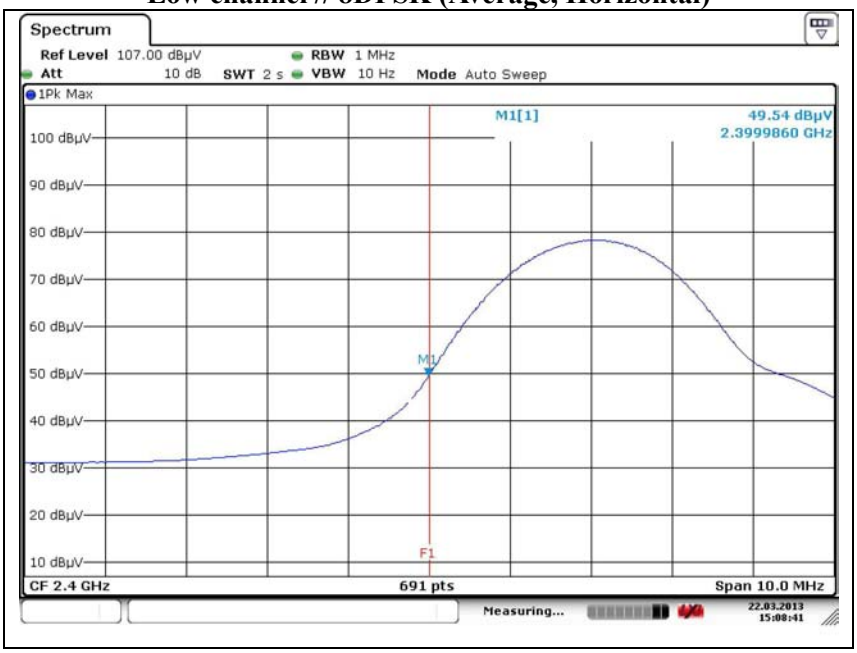
※ Remark

1. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit.
4. Actual = Reading + AFCL(Ant. factor – Amp. gain + Cable loss) + DCF(Duty cycle correction factor)
5. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.

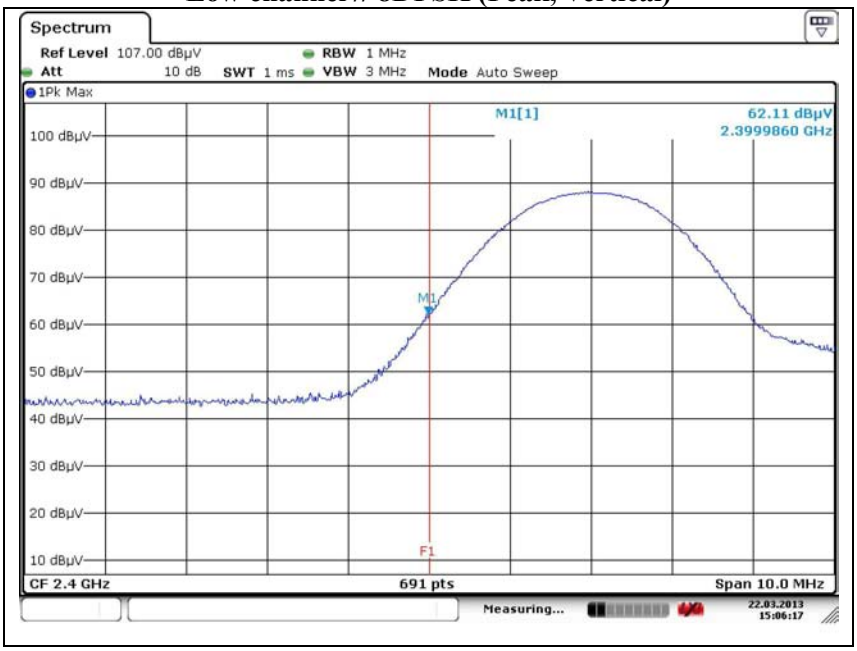
Low channel // 8DPSK (Peak, Horizontal)



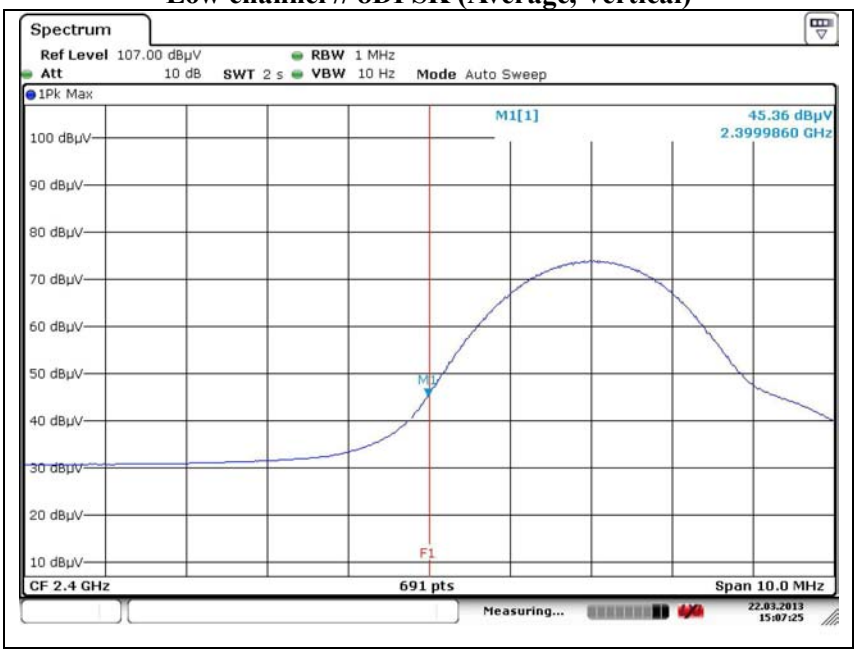
Low channel // 8DPSK (Average, Horizontal)



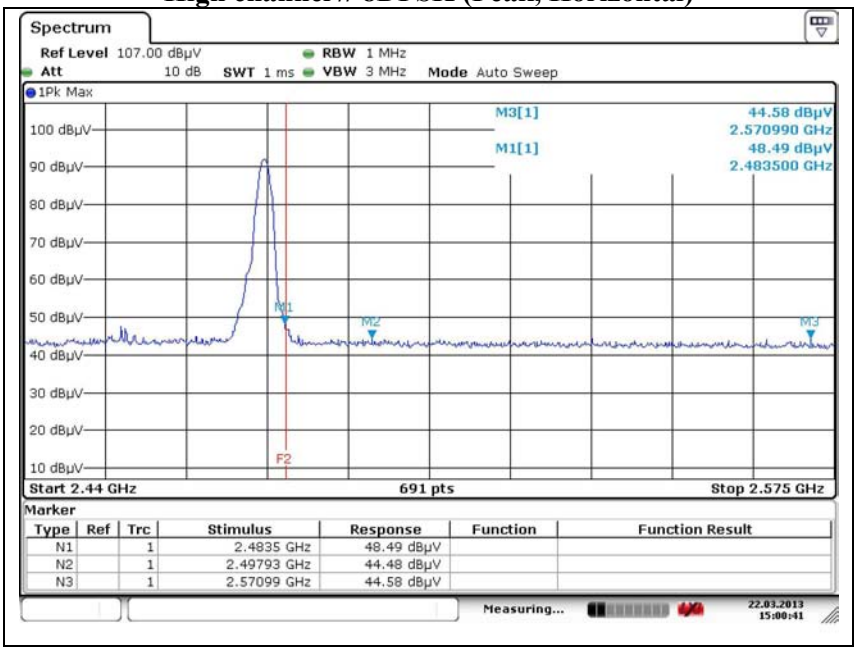
Low channel // 8DPSK (Peak, Vertical)



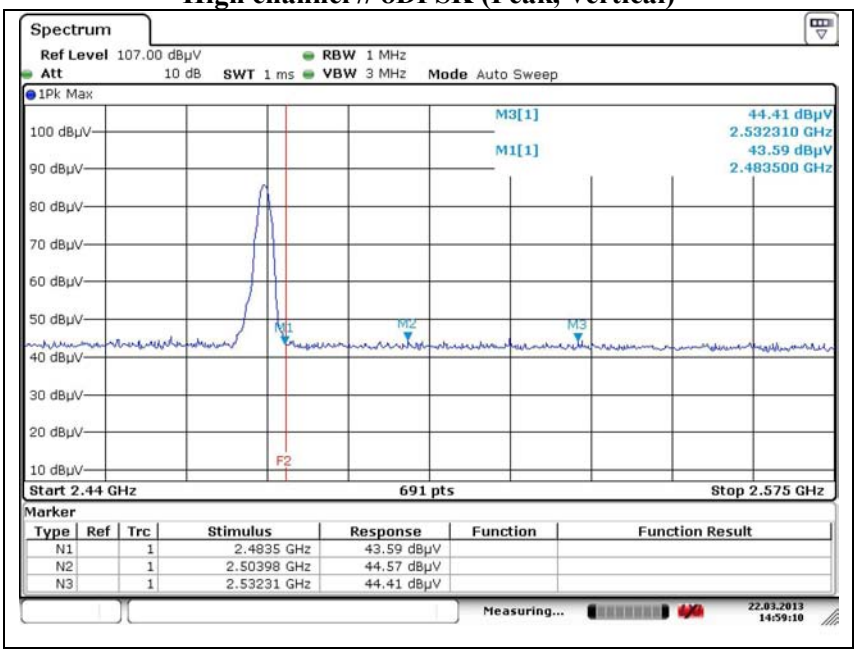
Low channel // 8DPSK (Average, Vertical)



High channel // 8DPSK (Peak, Horizontal)



High channel // 8DPSK (Peak, Vertical)



The frequency spectrum from 1 ㎓ to 25 ㎓ was investigated.

Low channel // 8DPSK

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detector mode	Pol.	AFCL (dB)	DCF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2399.986	67.17	Perak	H	3.42	0.00	70.59	74.00	3.41
2399.986	49.54	Average	H	3.42	-30.77	22.19	54.00	31.81
2399.986	62.11	Perak	V	3.42	0.00	65.53	74.00	8.47
2399.986	45.36	Average	V	3.42	-30.77	18.01	54.00	35.99
4804.416	49.10	Perak	H	13.59	0.00	62.69	74.00	11.31
4804.416	44.13	Average	H	13.59	-30.77	26.95	54.00	27.05
4803.913	45.73	Perak	V	13.59	0.00	59.32	74.00	14.68
4803.000	43.23	Average	V	13.59	-30.77	26.05	54.00	27.95

Middle channel // 8DPSK

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detector mode	Pol.	AFCL (dB)	DCF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
4881.826	45.72	Perak	H	13.91	0.00	59.63	74.00	14.37
4881.826	43.34	Average	H	13.91	-30.77	26.48	54.00	27.52
4881.913	45.90	Perak	V	13.91	0.00	59.81	74.00	14.19
4881.913	43.27	Average	V	13.91	-30.77	26.41	54.00	27.59

High channel // 8DPSK

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detector mode	Pol.	AFCL (dB)	DCF (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2483.500	48.49	Perak	H	3.87	0.00	52.36	74.00	21.64
2483.500	43.59	Perak	V	3.87	0.00	47.46	74.00	26.54
4804.941	51.94	Perak	H	13.59	0.00	65.53	74.00	8.47
4804.941	43.67	Average	H	13.59	-30.77	26.49	54.00	27.51
4803.978	50.53	Perak	V	13.59	0.00	64.12	74.00	9.88
4803.978	44.35	Average	V	13.59	-30.77	27.17	54.00	26.83

※ Remark

1. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit.
4. Actual = Reading + AFCL(Ant. factor – Amp. gain + Cable loss) + DCF(Duty cycle correction factor)
5. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.

Appendix A. Test equipment used for test

Equipment	Manufacturer	Model	Calibration due.
Spectrum Analyzer	R&S	FSV30	2014.01.09
8360B Series Swept Signal Generator	HP	83630B	2013.06.06
Attenuator	HP	8495B	2013.05.04
Attenuator	HP	8494B	2013.05.04
DC Power Supply	HP	6674A	2013.12.07
Loop Antenna	R&S	HFH2-Z2.335.4711.52	2013.03.10
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	2013.10.25
Horn Antenna	A.H. System	SAS-571	2015.02.28
High Pass Filter	Wainwright Instrument	WHJS3000-10TT	2014.01.10
Preamplifier	HP	8449B	2013.08.02
EMI Test Receiver	R&S	ESV10	2013.05.04
EMC Analyzer	Agilent	E7405A	2013.08.16

Appendix B. Test setup photo

Radiated field emissions