KES Co., Ltd.
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TEST REPORT

Part 15 Subpart B&C 15.247

Equipment under test	Aramo Professional Microscope
Model name	APM
FCC ID	XYCAPM
Applicant	Aram Huvis Co., Ltd.
Manufacturer	Aram Huvis Co., Ltd.
Date of test(s)	2012.06.18 ~ 2012.06.23, 2012.09.13
Date of issue	2012.09.13

Issued to

Aram Hubis Co., Ltd.
801 Byucksan Technopia, 434-6 Sangdaewon-dong, Sungnam-City, Kyungki-do, 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
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Test and report completed by :	**Report approval by :**
	
Jae Jun Lee Test engineer	Gyu-cheol Shin Technical manager

Revision history

Revision	Date of issue	Test report No.	Description
-	2012.06.27	KES-RF-120045	Initial
1	2012.09.13	KES-RF-120065	Retest and add the data in Radiated spurious emission & band edge(P.45~P.50)

TABLE OF CONTENTS

1.0 General product description

Equipment under test	Aramo Professional Microscope
Model name	APM
Serial number	N/A
Frequency Range	2 412 ㎒ ~ 2 462 ㎒(802.11 b/g/n_HT20) // 2 422 ㎒ ~ 2 452 ㎒(802.11 n_HT40) 2 402 ㎒ ~ 2 480 ㎒(Bluetooth BDR & EDR)
Modulation technique	DSSS, OFDM, GFSK, 8DPSK
Number of channels	11(802.11 b/g/n_HT20) // 7(802.11 n_HT40) // 79(Bluetooth BDR & EDR)
Antenna type & gain	Fixed type(Chip antenna) // 1.3 ㏈i
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

N/A

1.3 Device modifications

N/A

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

1.5 Laboratory accreditations and listings

Country	Agency	Scope of accreditation	Logo
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 and 99 % 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
15.207	AC conducted emission	C
Note 1: C=Complies NC=Not complies NT=Not tested NA=Not applicable		

2.1 Test data

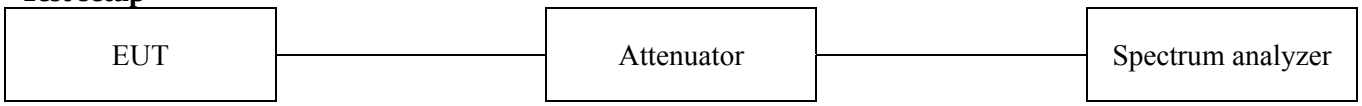
2.1.1 Pre-scanned output power

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)	4.83	3.10	3.30

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 = 1 ㎒ (the 20 ㏈ bandwidth of the emission being measured)
   VBW = 1 ㎒ (≥ 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.

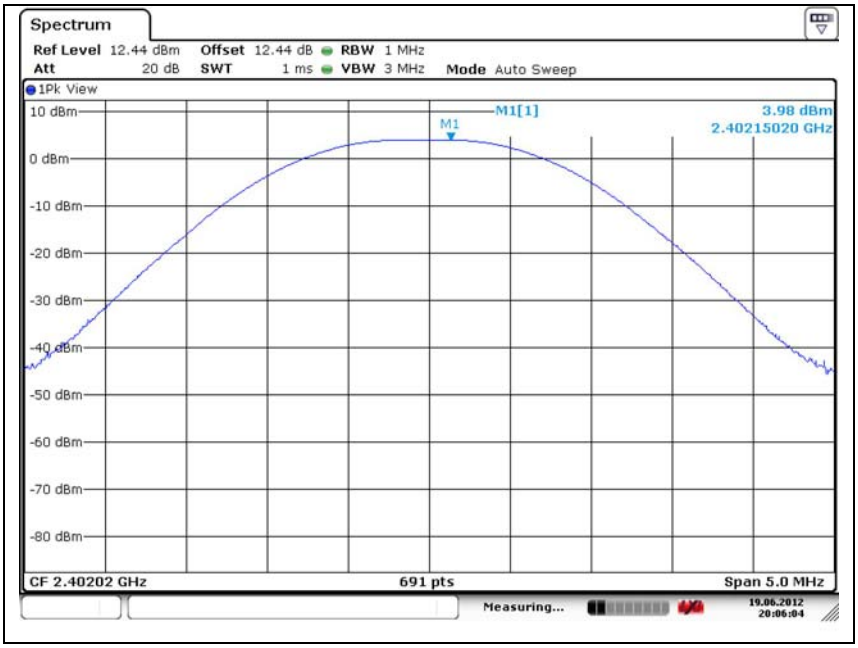
Limit

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.

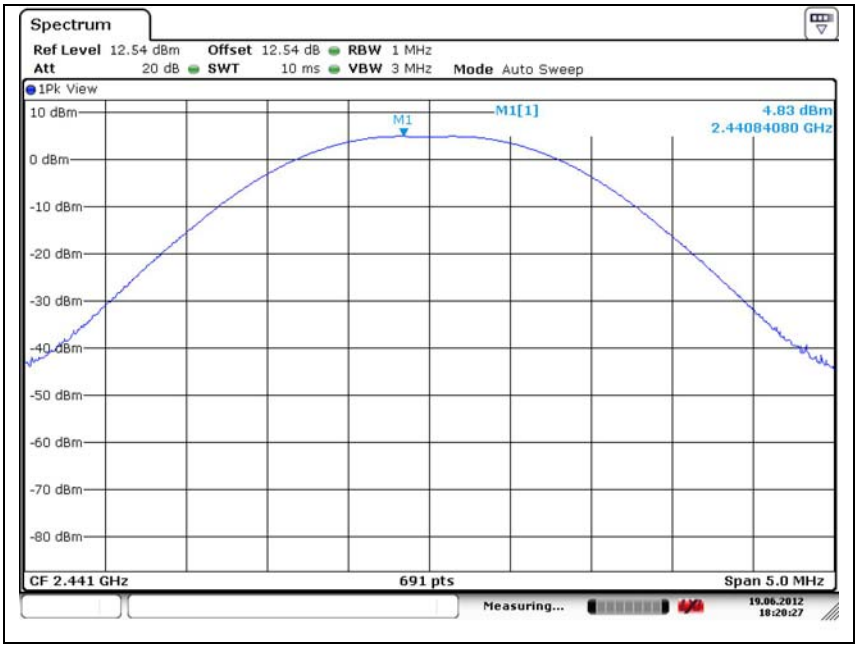
Test results

Operation mode	Frequency(㎒)	Output power (dBm)	Limit (dBm)
GFSK	2 402	3.98	30
	2 441	4.83	30
	2 480	4.37	30
Operation mode	**Frequency(㎒)**	**Output power (dBm)**	**Limit (dBm)**
8DPSK	2 402	2.71	30
	2 441	3.30	30
	2 480	2.93	30

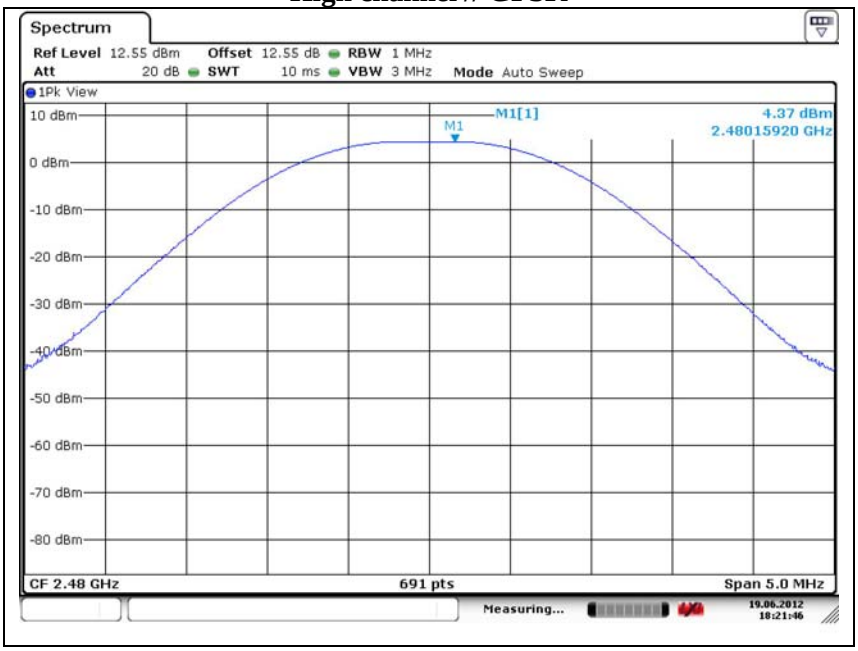
Low channel // GFSK



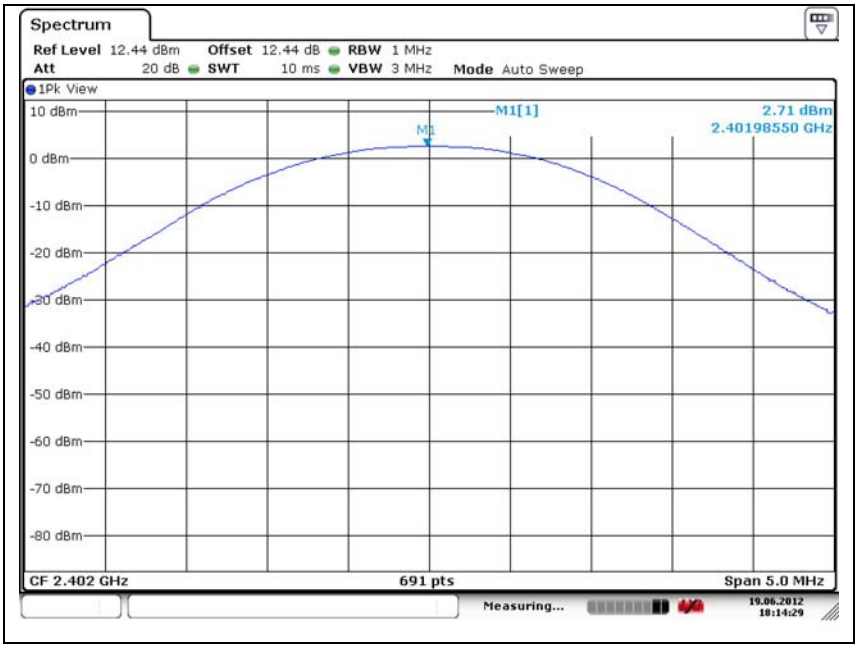
Middle channel // GFSK



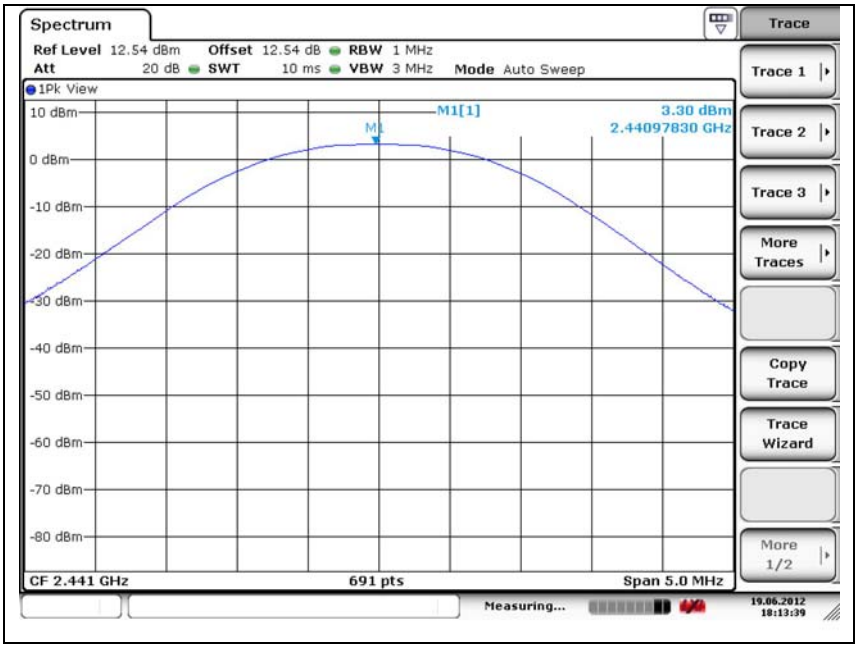
High channel // GFSK



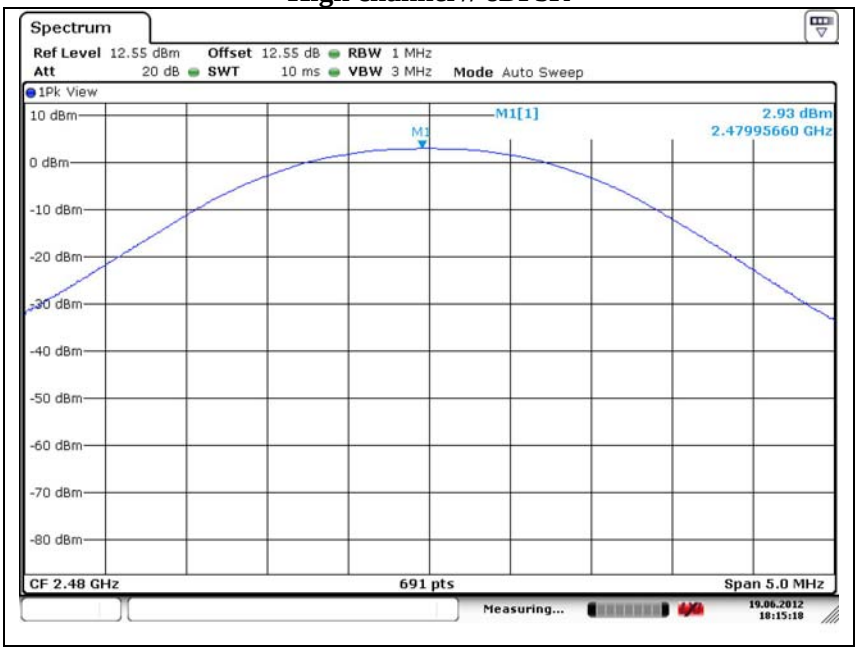
Low channel // 8DPSK



Middle channel // 8DPSK

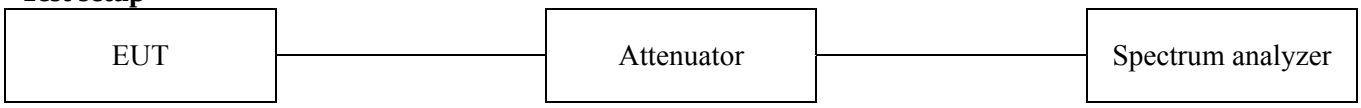


High channel // 8DPSK



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

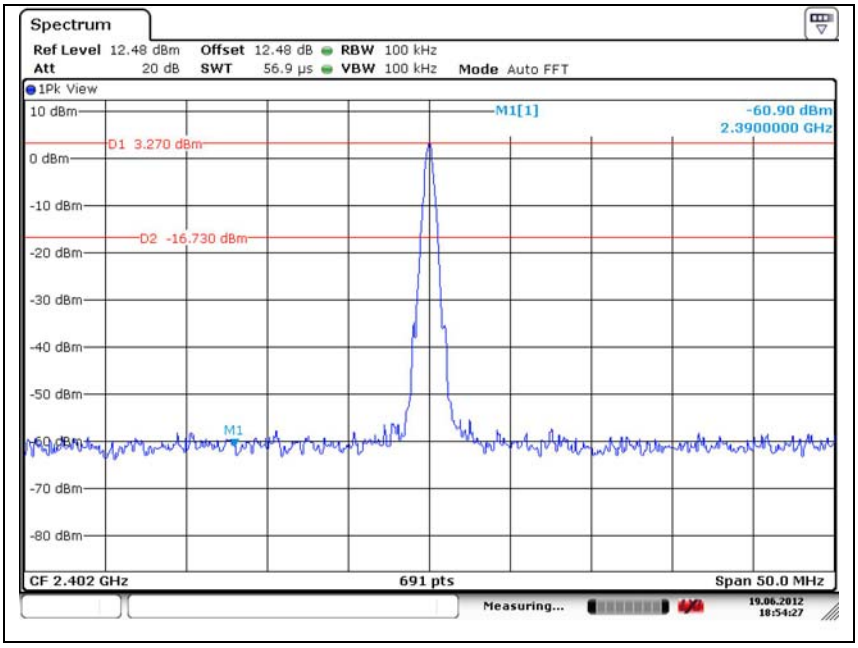
1. Use the following spectrum analyzer setting
   Center frequency: Low, middle and high channel.
   Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
   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.

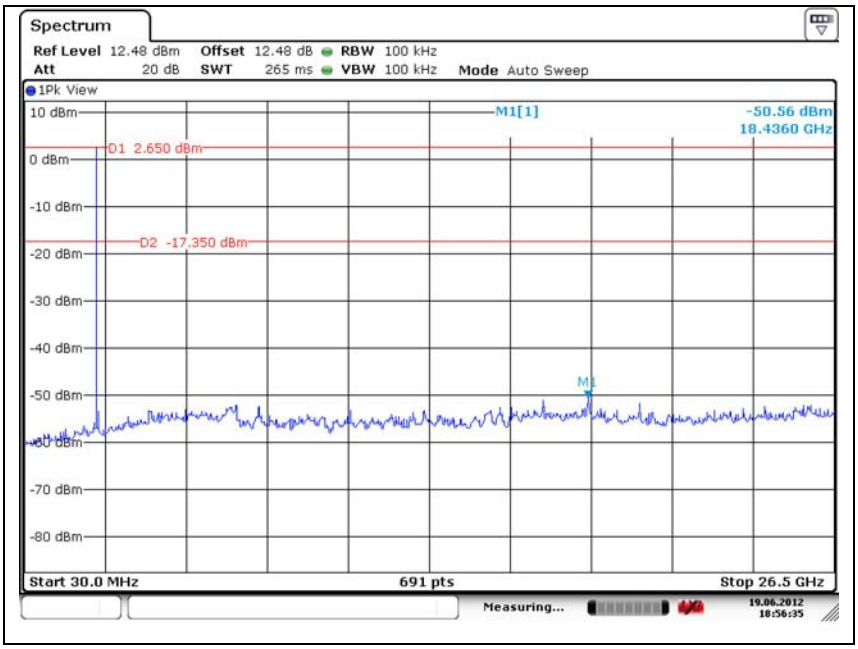
Limit

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))

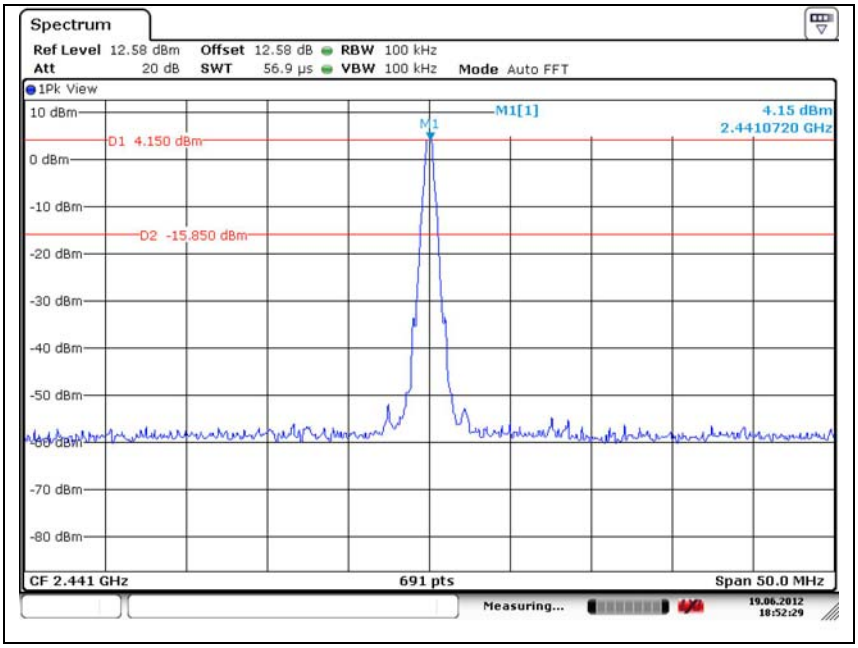
Test results

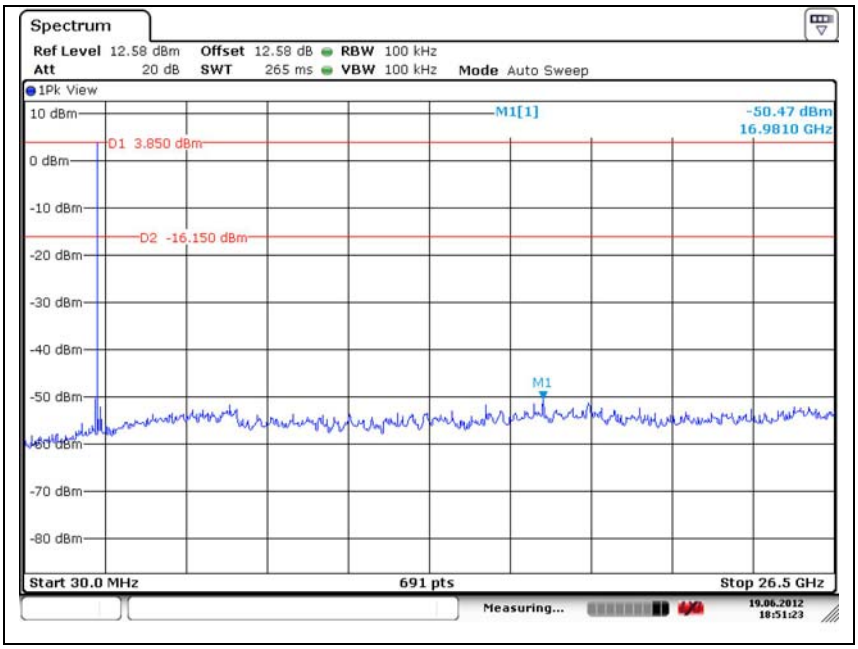
Low channel // GFSK



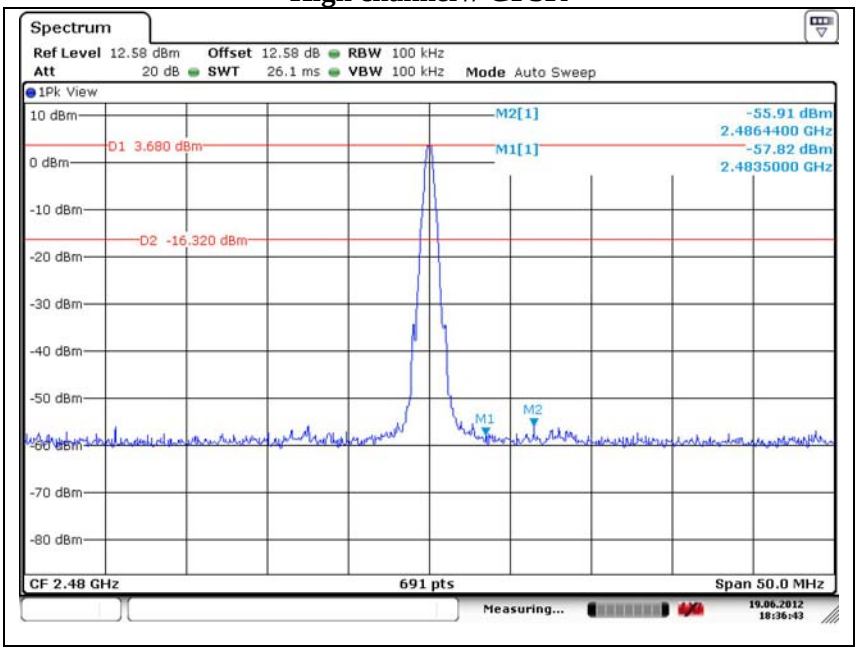


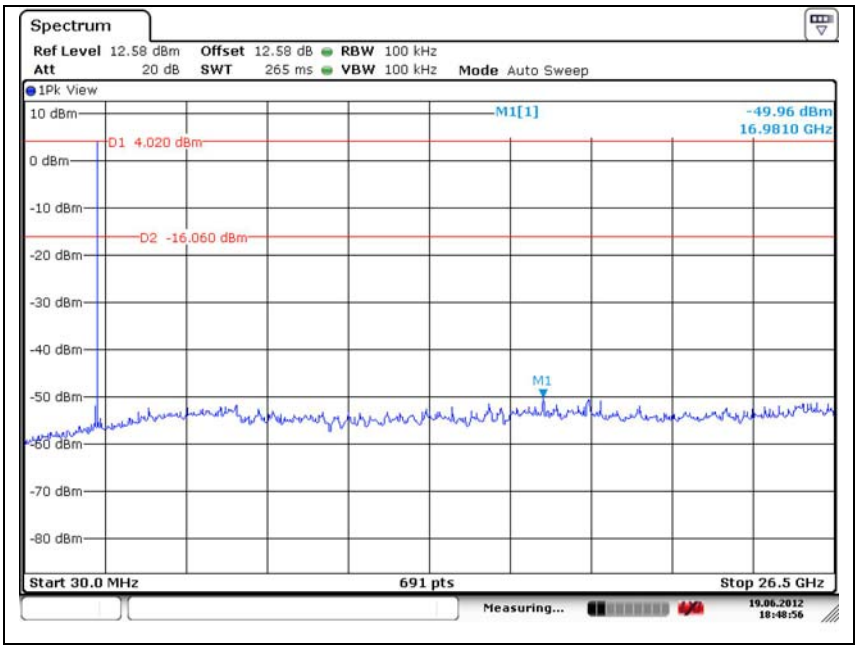
Middle channel // GFSK



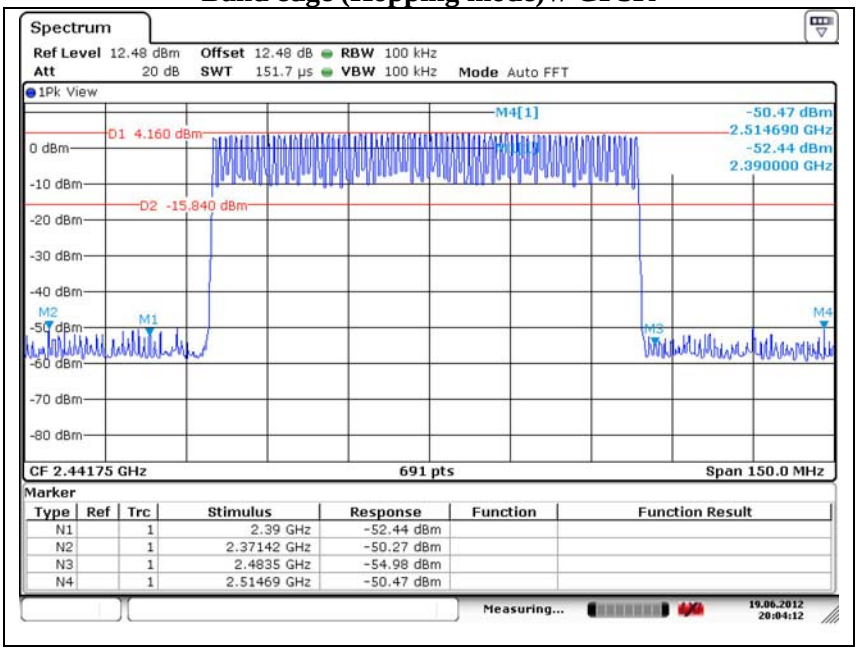


High channel // GFSK

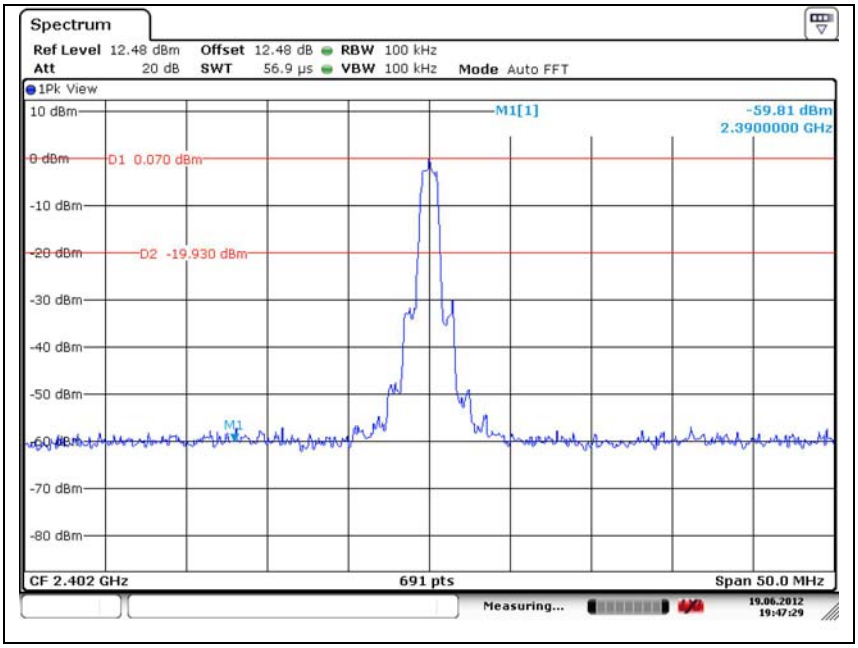


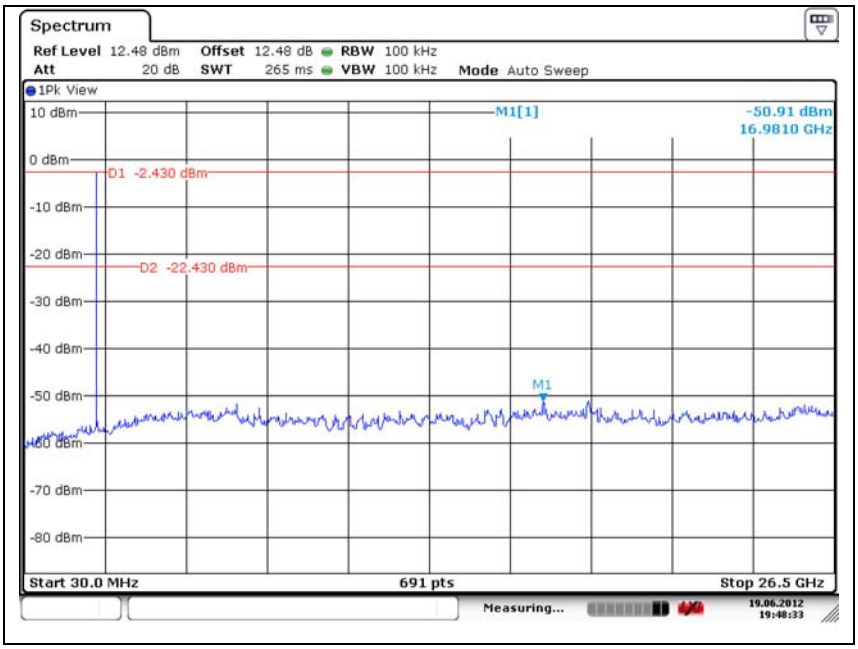


Band edge (Hopping mode) // GFSK

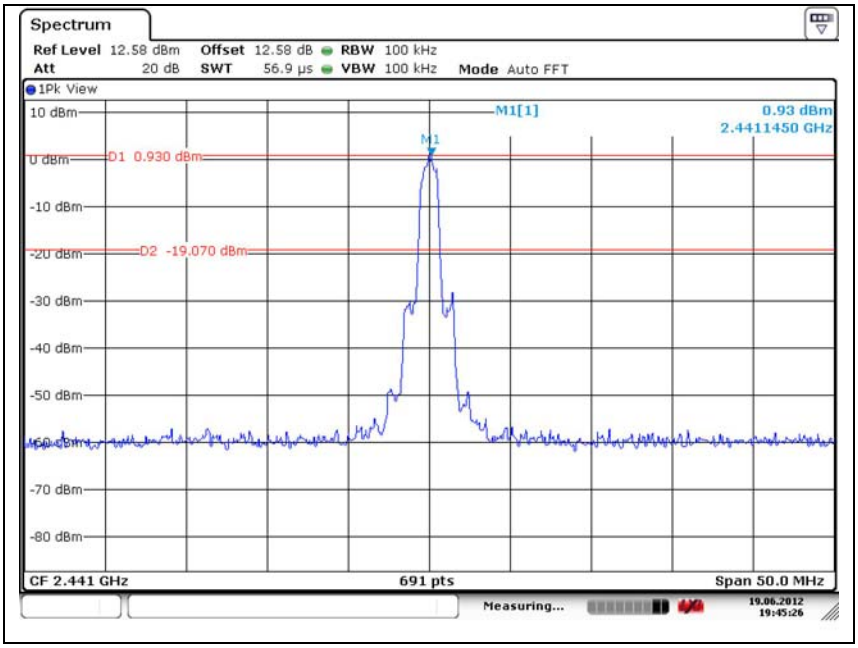


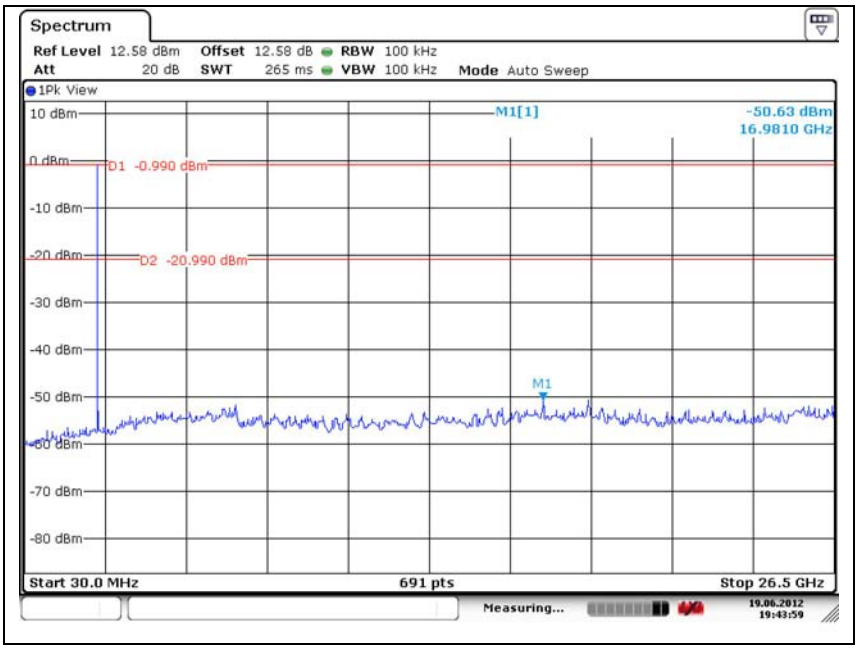
Low channel // 8DPSK



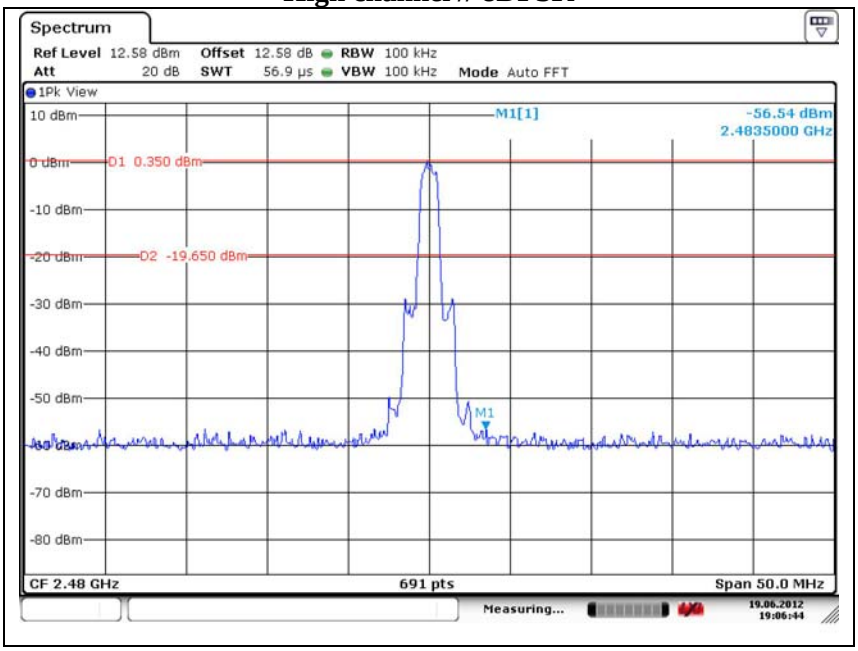


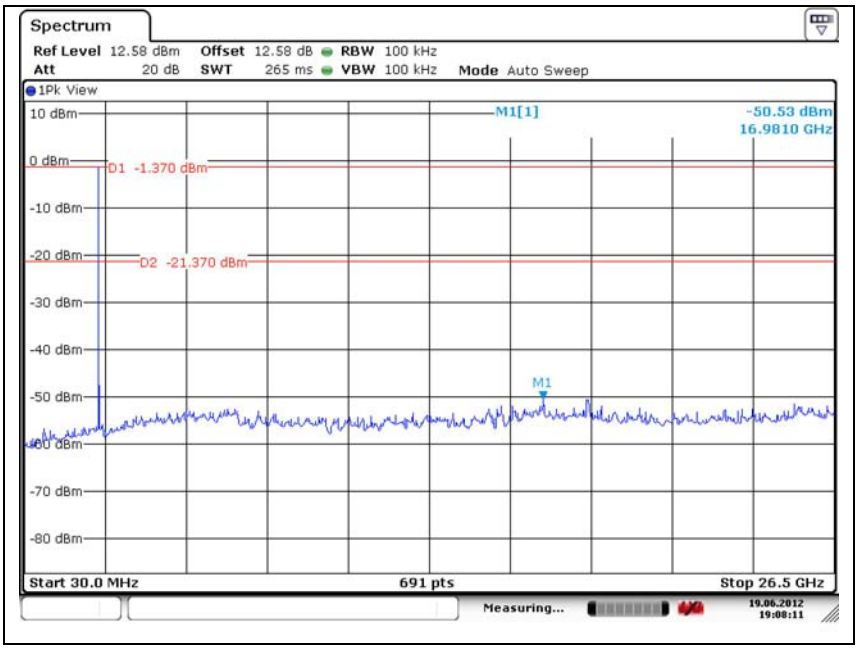
Middle channel // 8DPSK



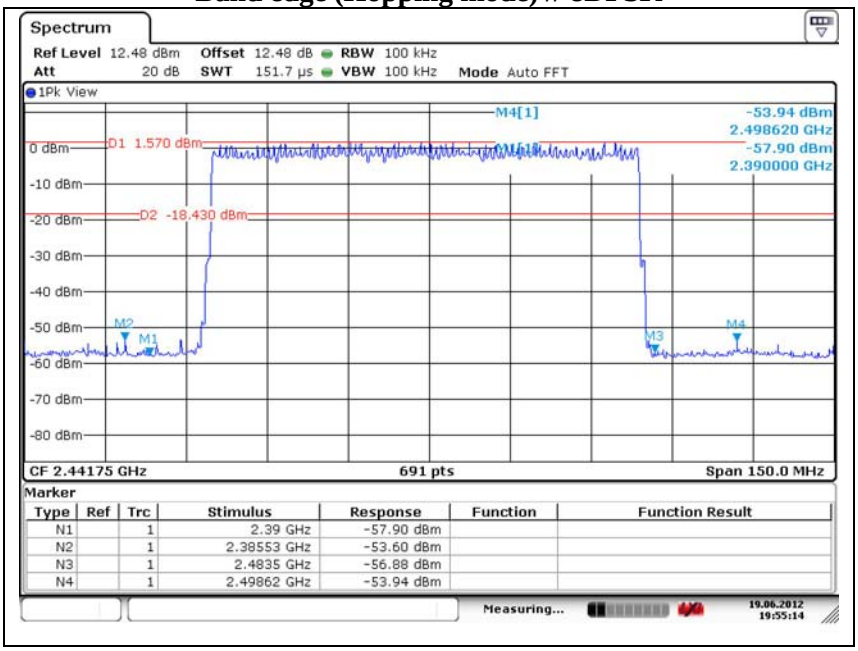


High channel // 8DPSK



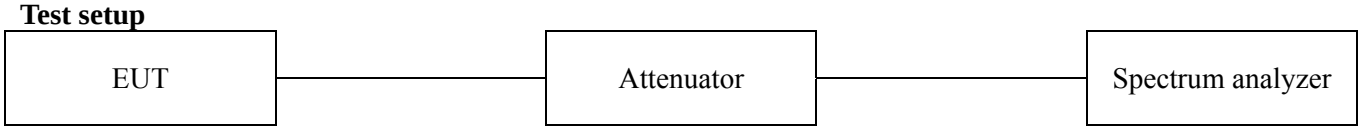


Band edge (Hopping mode) // 8DPSK



2.1.4 20 dB bandwidth and 99 % 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 = 30 ㎑ (≥ 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.

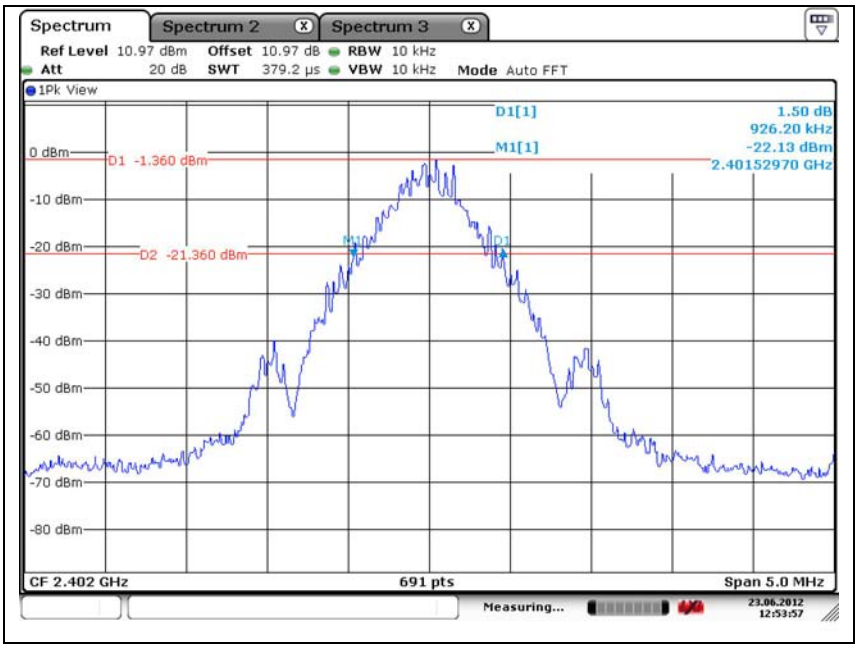
Limit

Not applicable

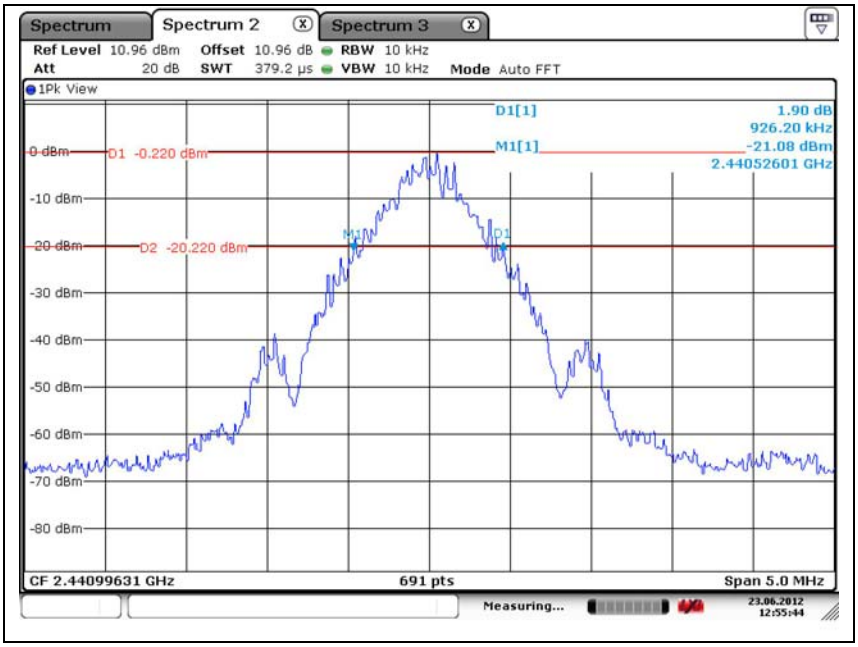
Test results

Operation mode	Frequency(㎒)	20 ㏈ bandwidth(㎒)	99 % bandwidth(㎒)
GFSK	2 402	0.926	0.861
	2 441	0.926	0.868
	2 480	0.926	0.861
Operation mode	**Frequency(㎒)**	**20 ㏈ bandwidth(㎒)**	**99 % bandwidth(㎒)**
8DPSK	2 402	1.316	1.186
	2 441	1.309	1.186
	2 480	1.309	1.193

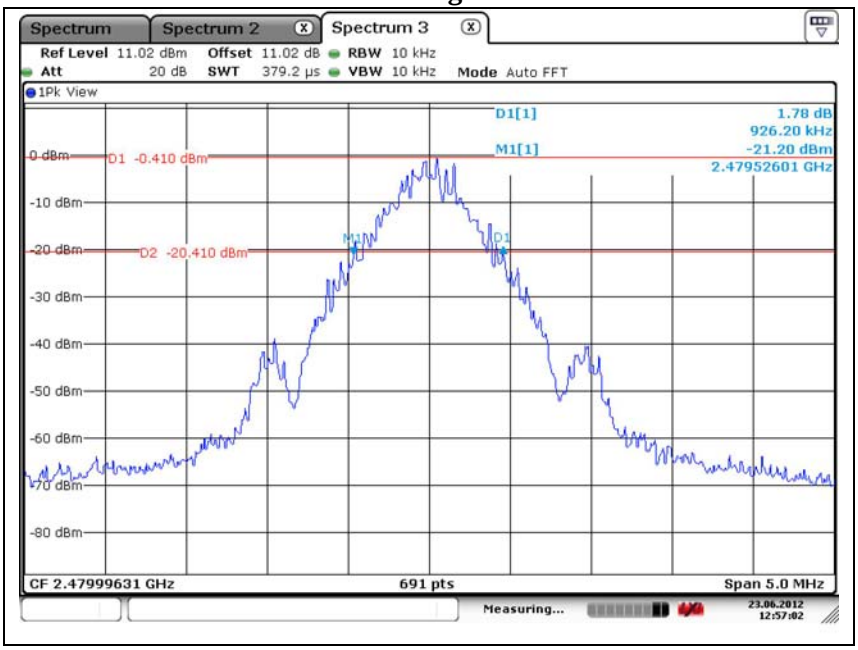
20 ㏈ bandwidth // Low channel // GFSK



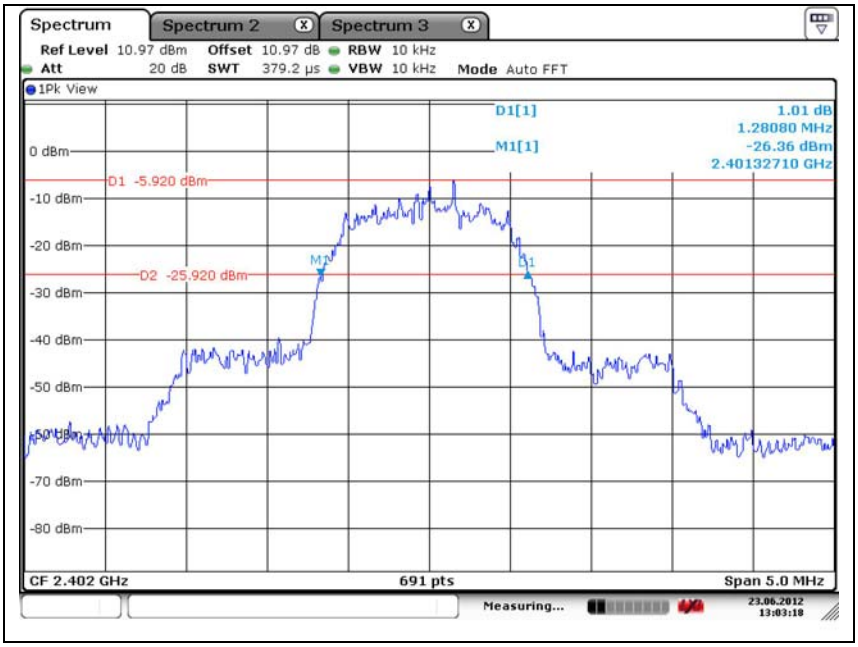
20 dB bandwidth // Middle channel // GFSK



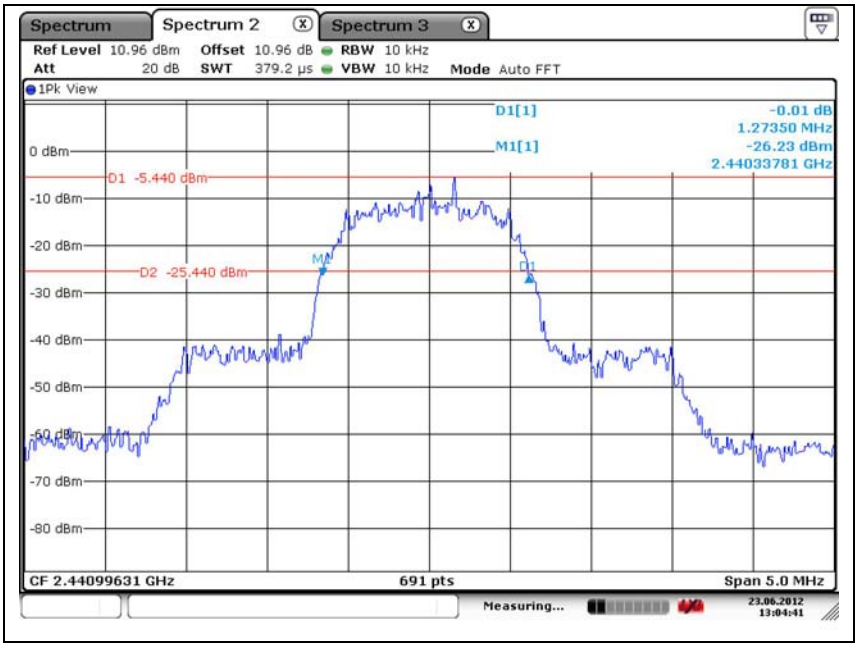
20 dB bandwidth // High channel // GFSK



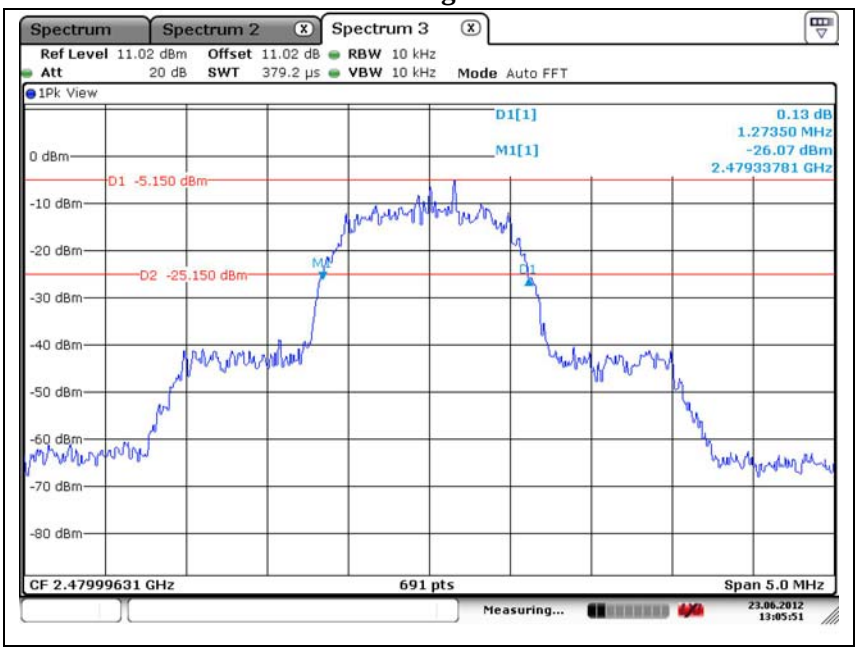
20 dB bandwidth // Low channel // 8DPSK



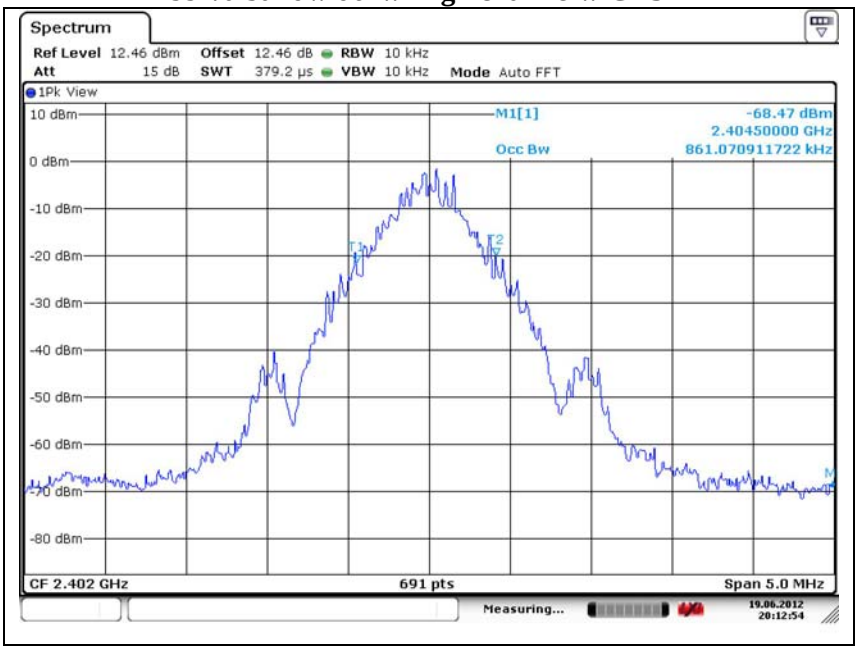
20 dB bandwidth // Middle channel // 8DPSK



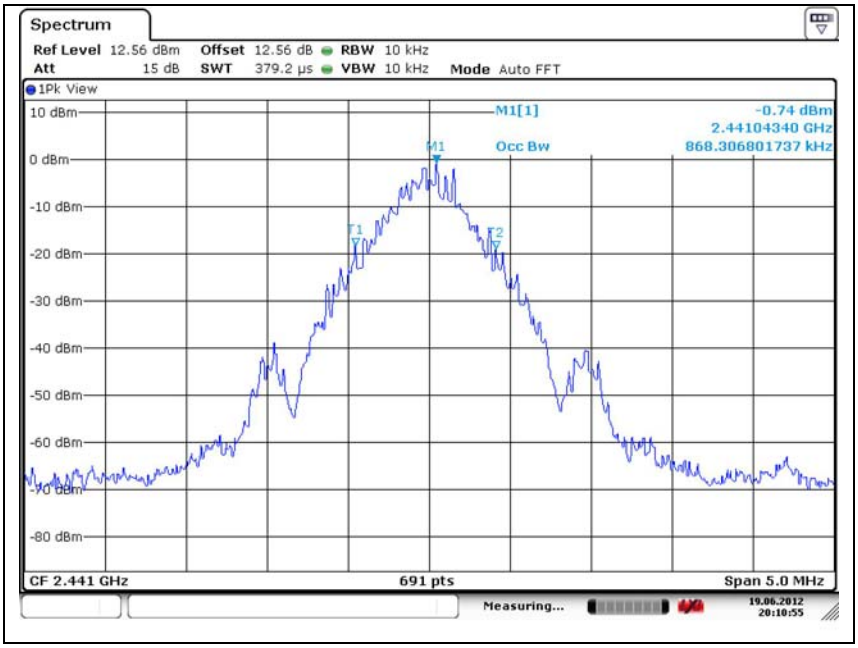
20 dB bandwidth // High channel // 8DPSK



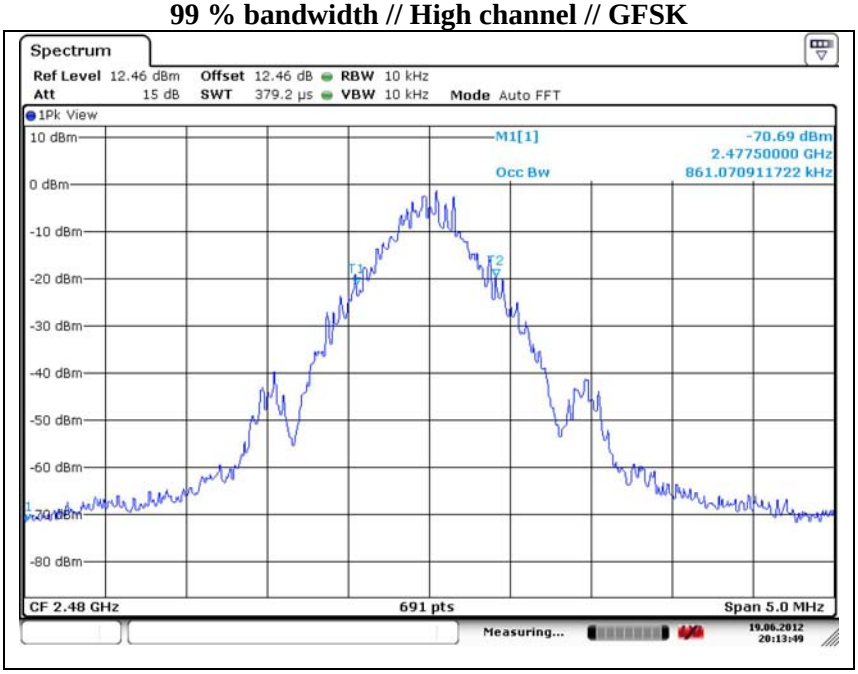
99 % bandwidth // High channel // GFSK



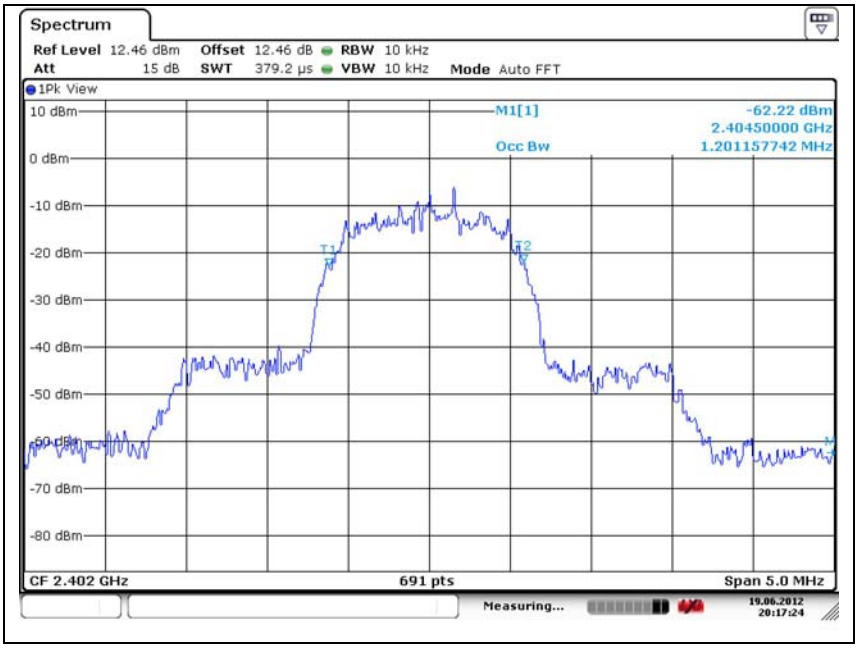
99 % bandwidth // Middle channel // GFSK



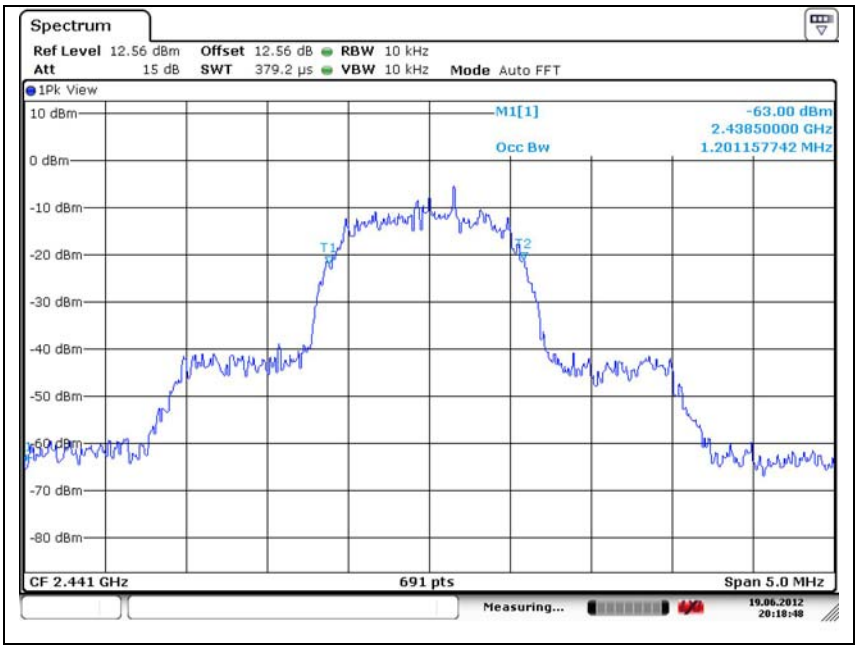
99 % bandwidth // High channel // GFSK



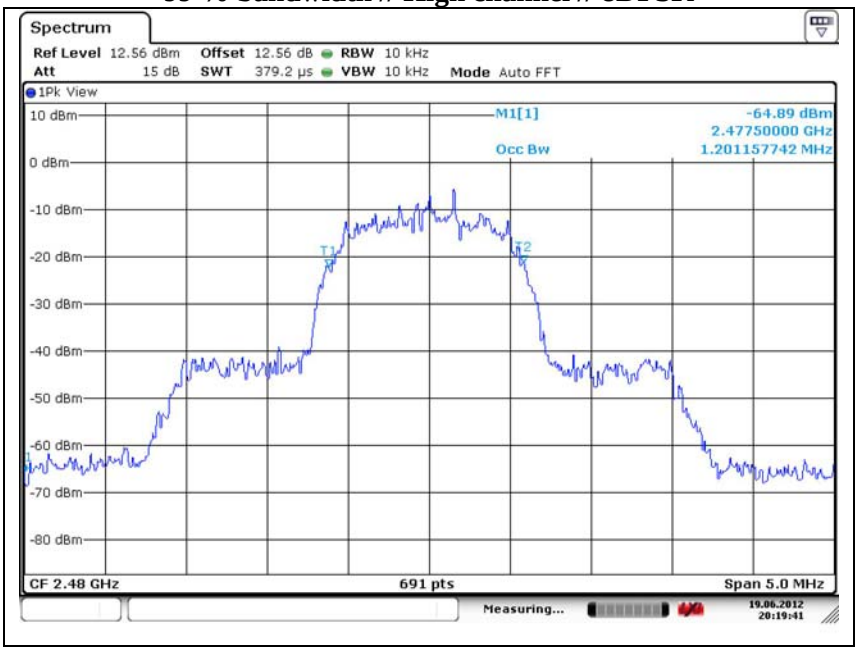
99 % bandwidth // Low channel // 8DPSK



99 % bandwidth // Middle channel // 8DPSK

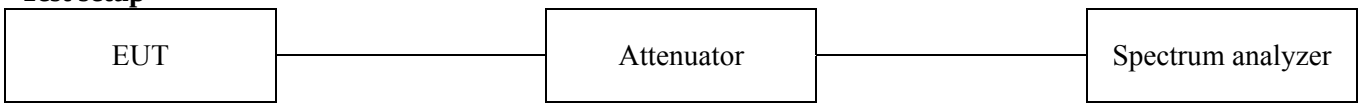


99 % bandwidth // High channel // 8DPSK



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 = 30 ㎑ (≥ 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.

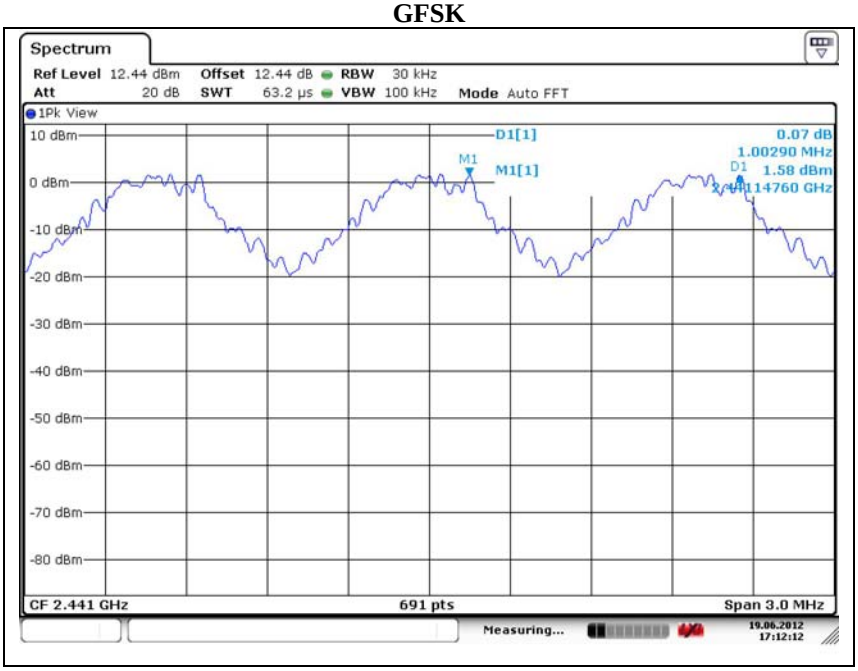
Limit

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 ㎽.

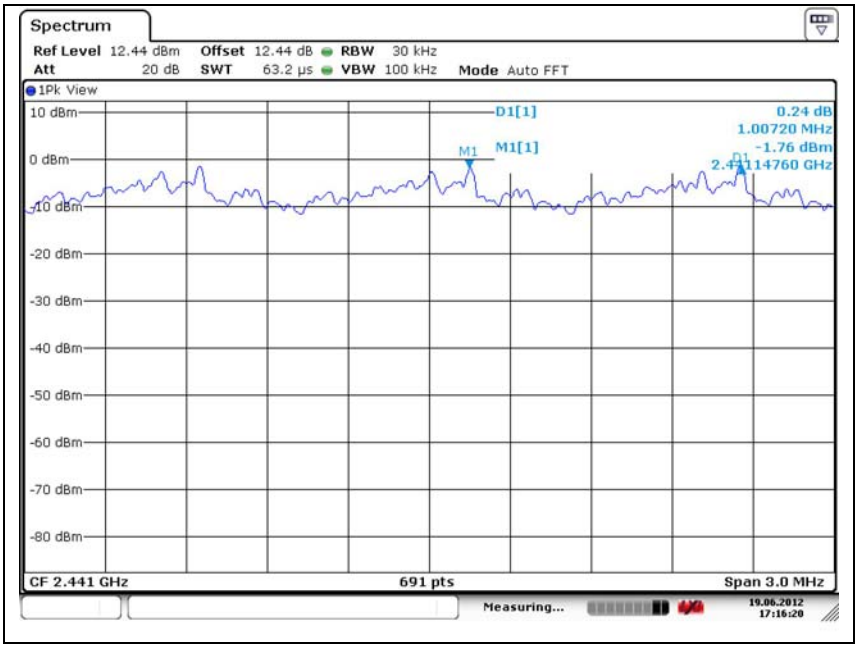
Test results

Operation mode	Frequency (㎒)	Adjacent hopping channel separation(㎑)	Two-third of 20 ㏈ bandwidth (㎑)	Minimum bandwidth (㎑)
GFSK	2 441	1 003	617.333	25
8DPSK	2 441	1 007	848.667	25

GFSK

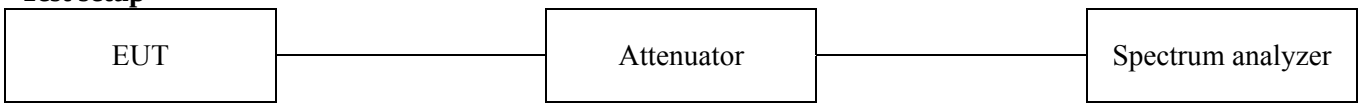


8DPSK



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 = 300 ㎑ (≥ 1% of the span)
   VBW = 300 ㎑ (≥ 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.

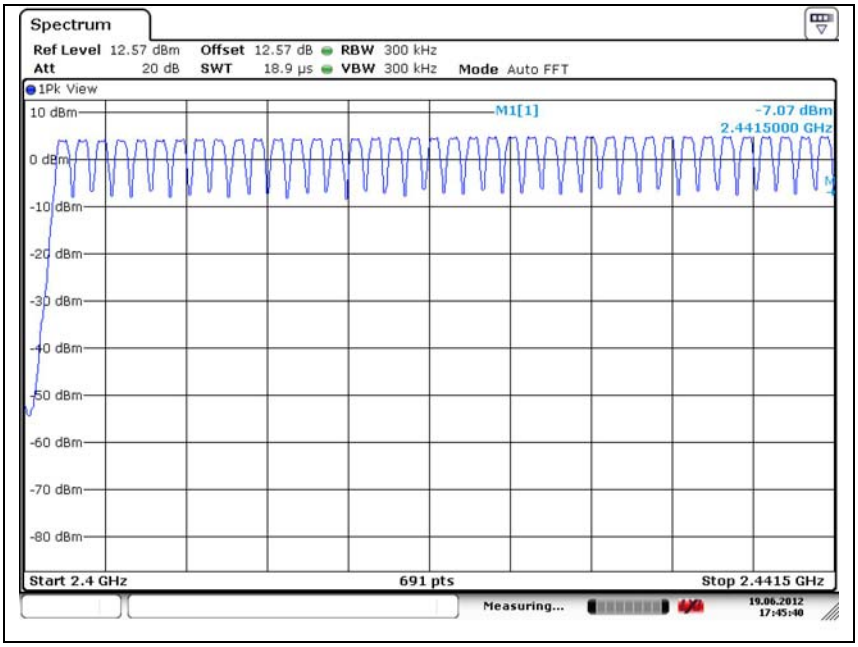
Limit

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.

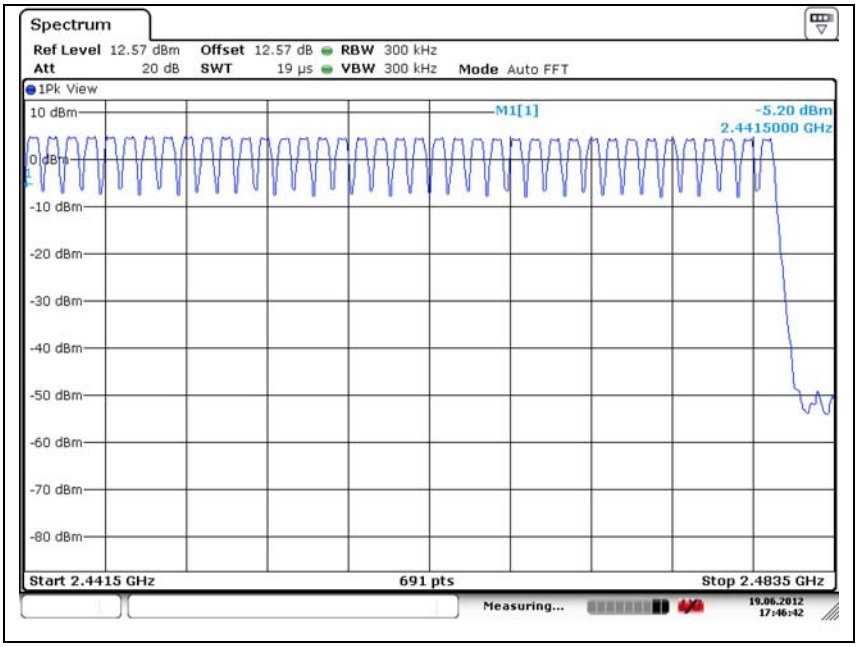
Test results

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

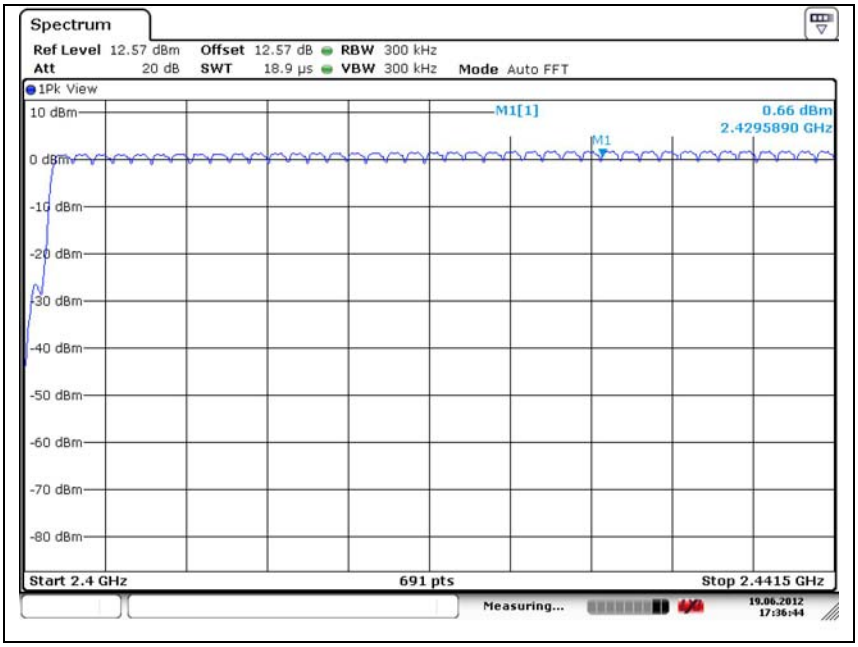
2 400 ㎒ ~ 2 441.5 ㎒ // GFSK



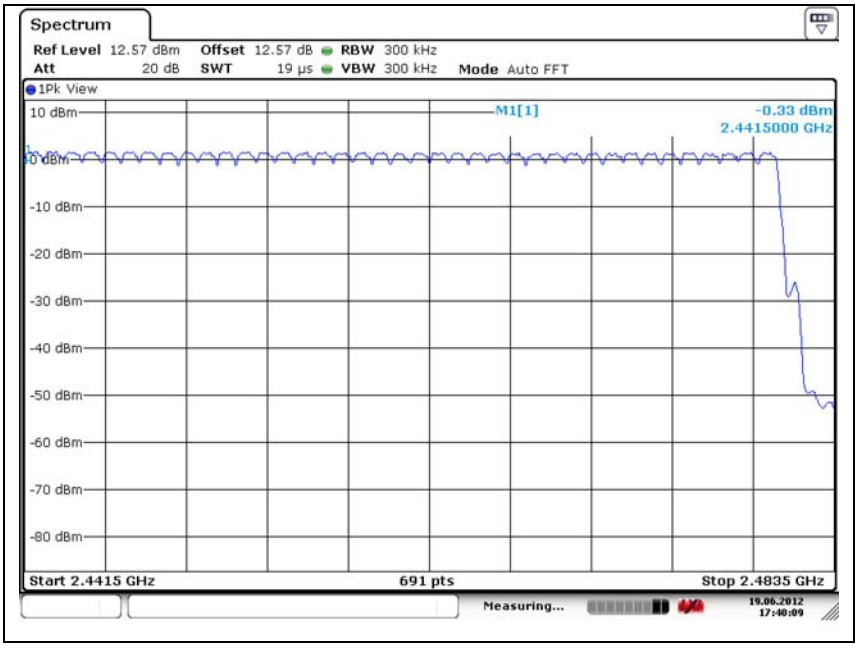
2 441.5 ㎒ ~ 2 483.5 ㎒ // GFSK



2 400 ㎒ ~ 2 441.5 ㎒ // 8DPSK

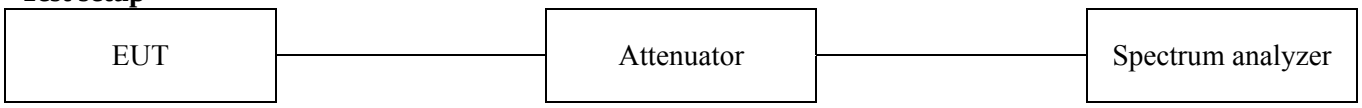


2 441.5 ㎒ ~ 2 483.5 ㎒ // 8DPSK



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 = 1 ㎒ (≥ 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

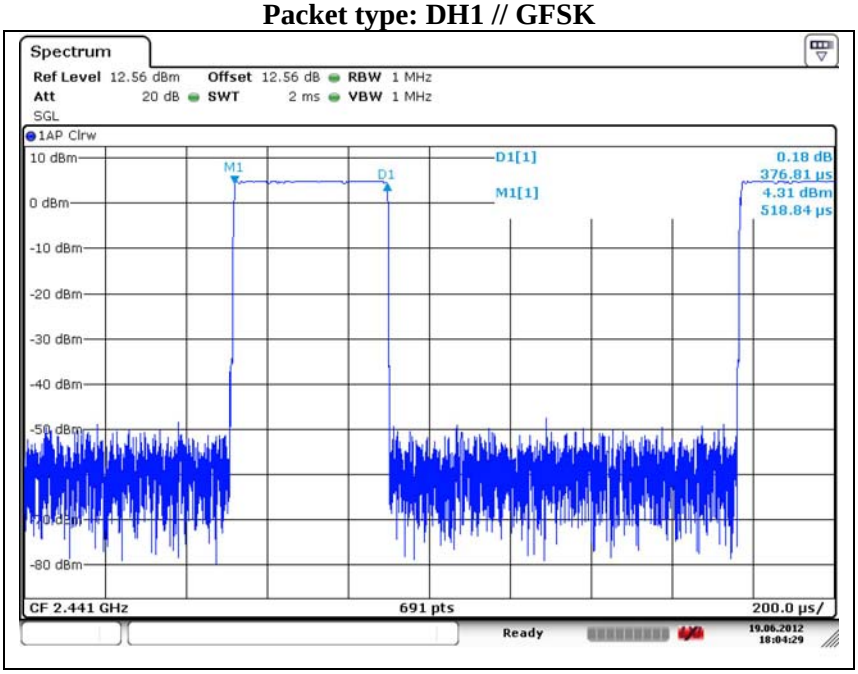
Operation mode: GFSK

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	0.376	120.32	400
DH3	2 441	1.633	261.28	400
DH5	2 441	2.865	305.60	400
3-DH1	2 441	0.379	121.28	400
3-DH3	2 441	1.631	260.96	400
3-DH5	2 441	2.871	306.24	400

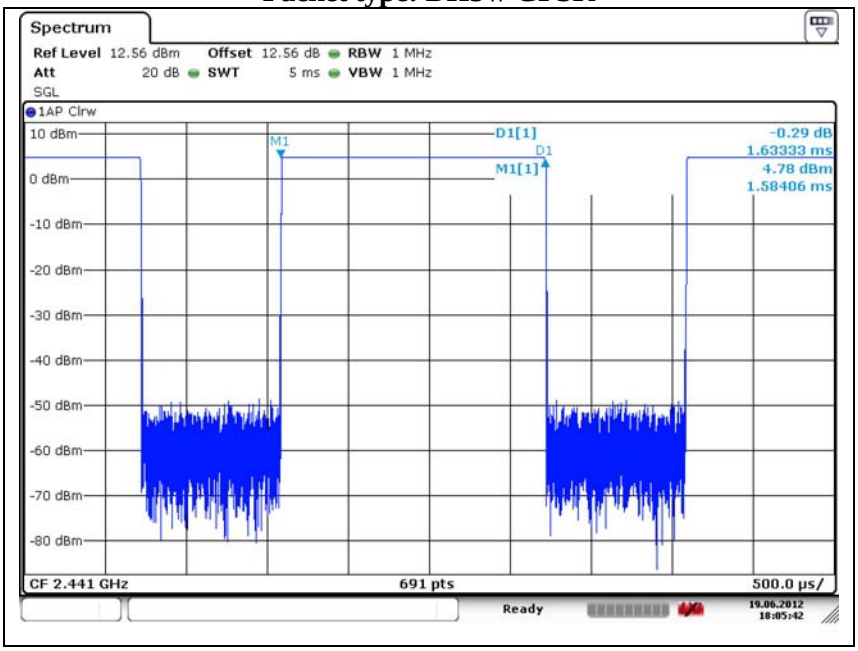
※ Remark:

DH1: Dwell time (ms) × [(1 600 ÷ 2) ÷ 79] × 31.6(s) = 120.32 (ms)
DH3: Dwell time (ms) × [(1 600 ÷ 4) ÷ 79] × 31.6(s) = 261.28 (ms)
DH5: Dwell time (ms) × [(1 600 ÷ 6) ÷ 79] × 31.6(s) = 305.60 (ms)
3-DH1: Dwell time (ms) × [(1 600 ÷ 2) ÷ 79] × 31.6(s) = 121.28 (ms)
3-DH3: Dwell time (ms) × [(1 600 ÷ 4) ÷ 79] × 31.6(s) = 260.96 (ms)
3-DH5: Dwell time (ms) × [(1 600 ÷ 6) ÷ 79] × 31.6(s) = 306.24 (ms)

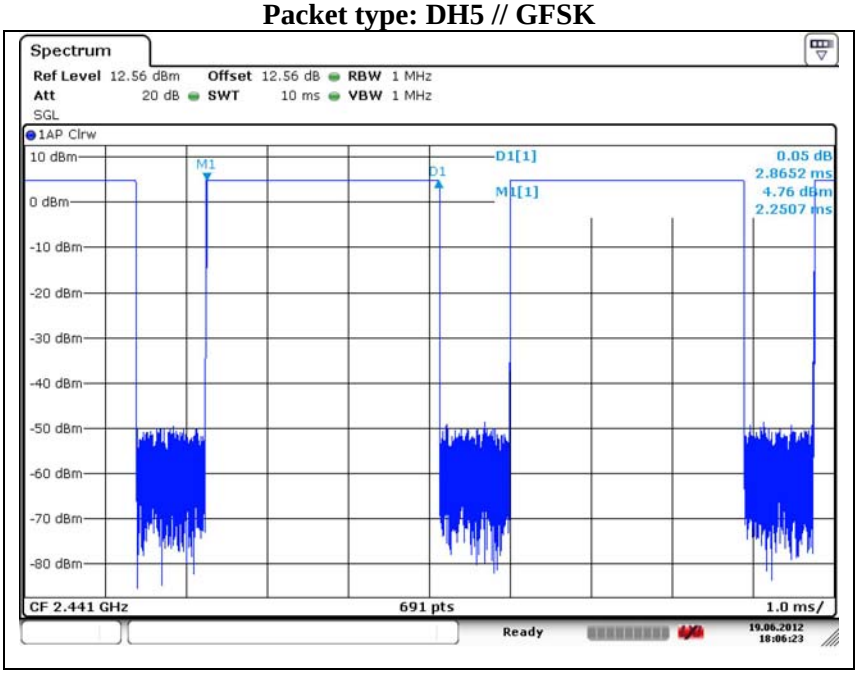
Packet type: DH1 // GFSK



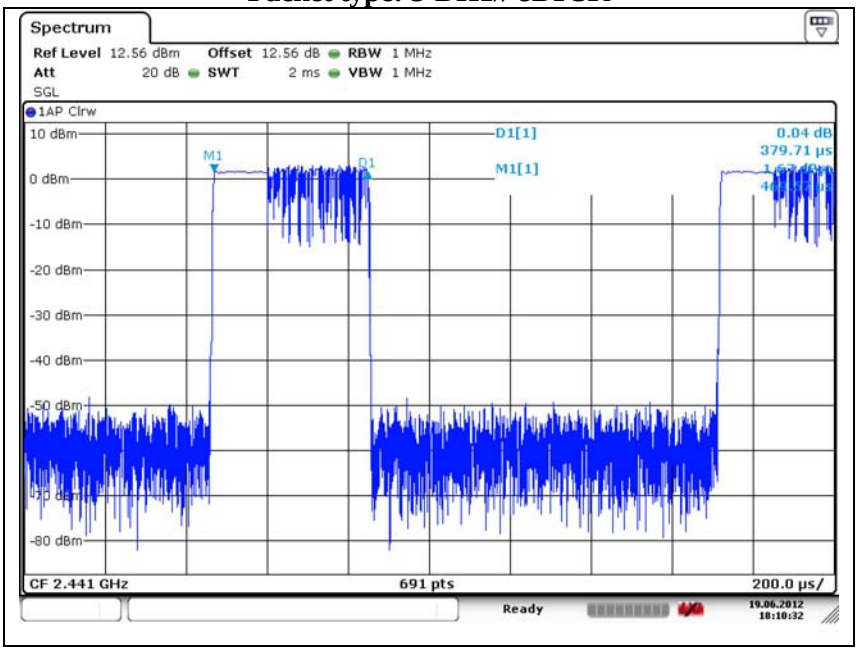
Packet type: DH3 // GFSK



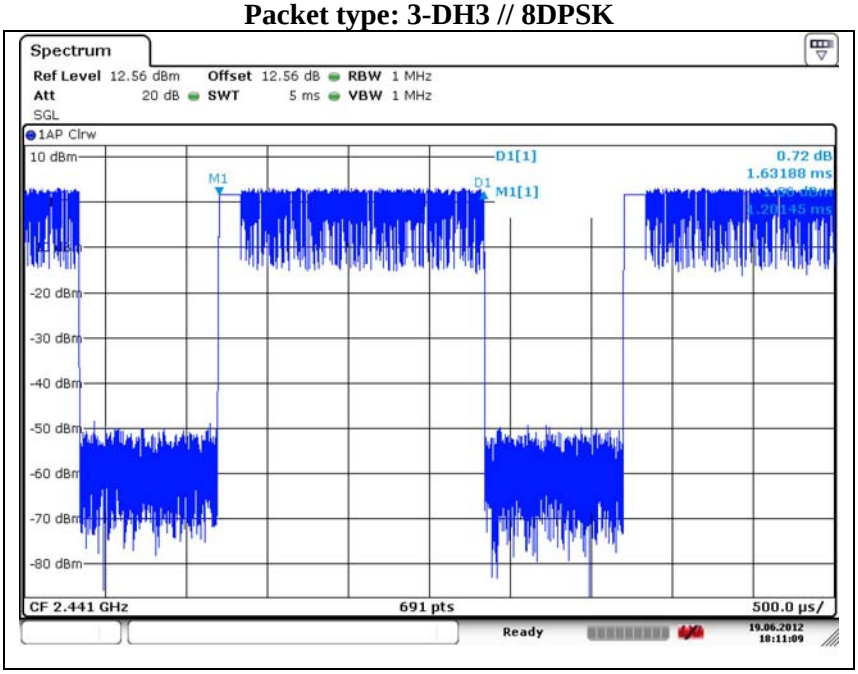
Packet type: DH5 // GFSK



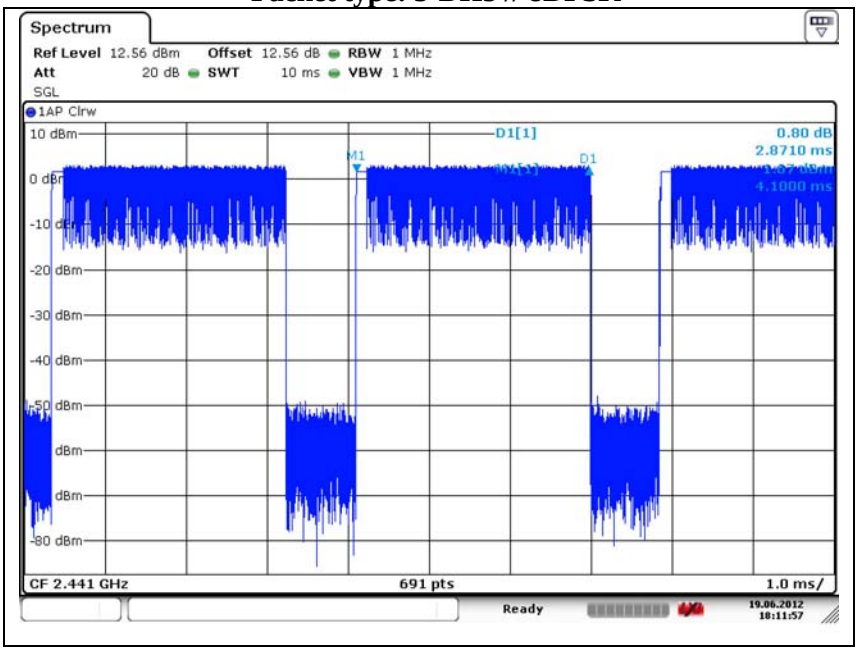
Packet type: 3-DH1// 8DPSK



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

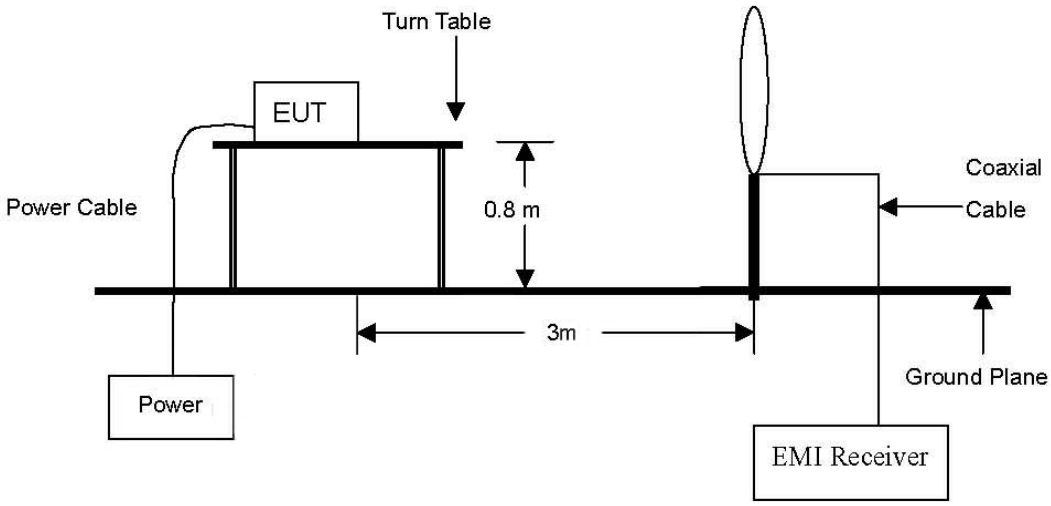
Test procedures
[9 ㎑ to 30 ㎒]
The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation. Then antenna is a loop antenna is fixed at one meter above the ground 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 ㎒.

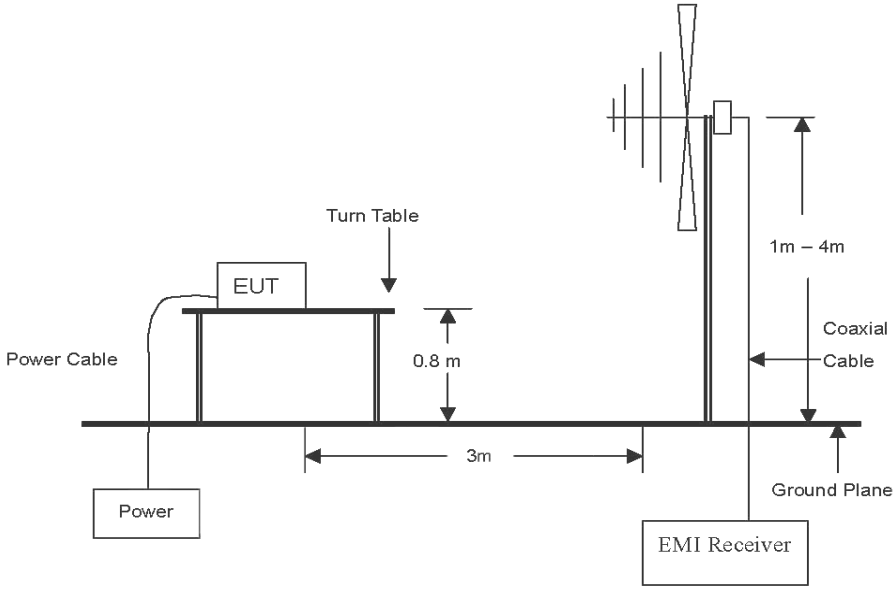
[30 ㎒ to 1 ㎓ and 1 ㎓ to 24 ㎓]
The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity.
The measurement was made in both the vertical and horizontal polarization, and the maximum value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

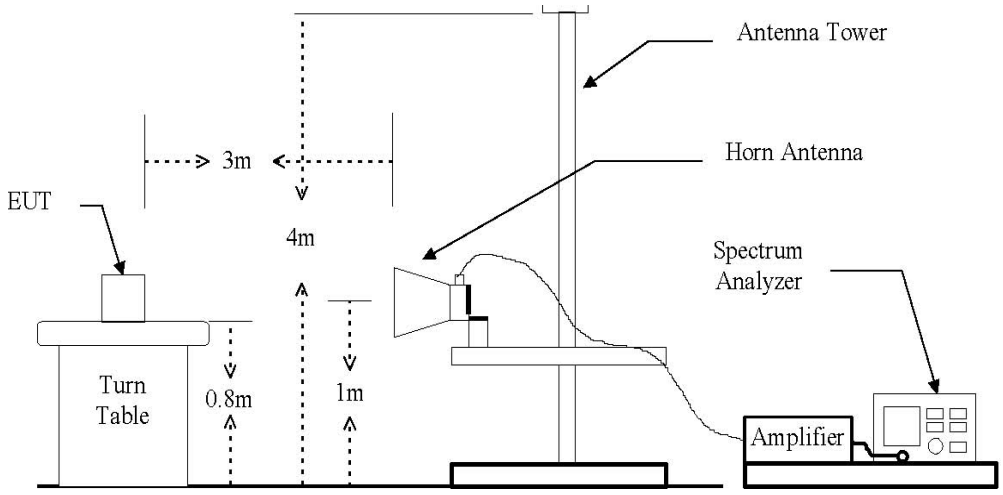
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



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 high 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. Emission levels are not reported much lower than the limits by over 20 ㏈.

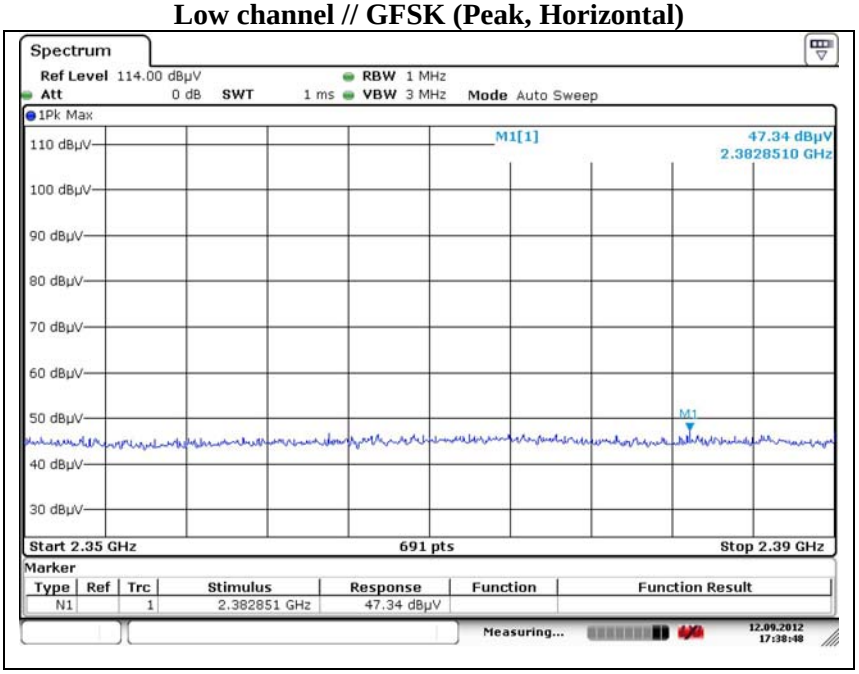
Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (㏈㎶)	Pol.	Ant. factor (㏈/m)	Cable loss (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
128.0	10.83	H	11.81	1.31	23.95	43.50	19.55
139.0	14.74	V	12.61	1.32	28.67	43.50	14.83
169.5	11.74	H	12.52	1.62	25.88	43.50	17.62
191.5	16.88	V	10.66	1.71	29.25	43.50	14.25
192.0	9.84	H	10.62	1.71	22.17	43.50	21.33
227.5	14.35	V	10.89	1.84	27.08	46.00	18.92
243.5	12.37	V	11.45	1.88	25.70	46.00	20.30
301.2	11.51	V	13.39	1.98	26.88	46.00	19.12
357.1	11.22	H	14.64	2.10	27.96	46.00	18.04
405.2	13.91	H	15.72	2.21	31.84	46.00	14.16
453.3	14.64	H	16.74	2.39	33.77	46.00	12.23
453.3	11.36	V	16.74	2.39	30.49	46.00	15.51

※ Remark

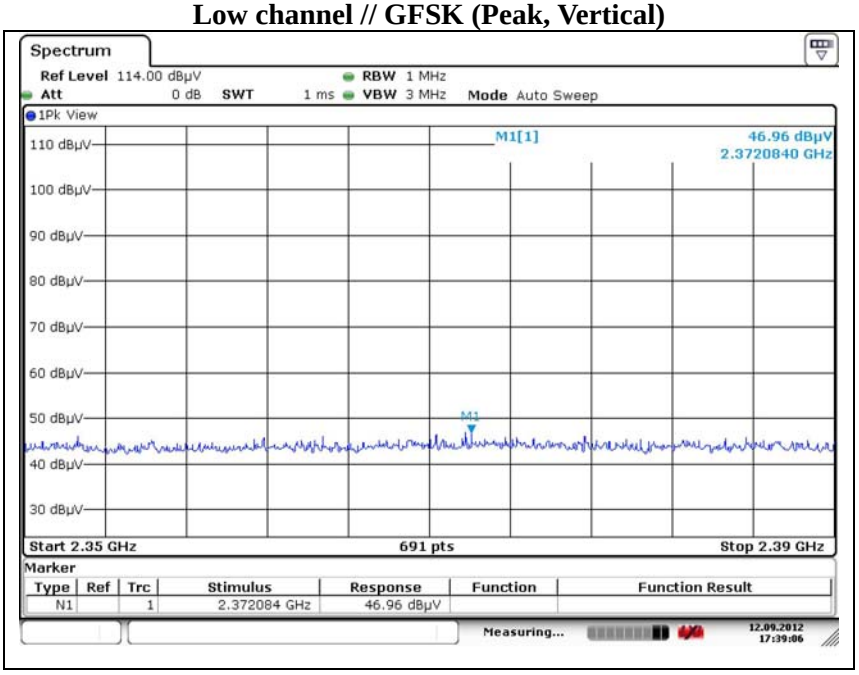
1. All spurious emission at channels are almost the same below 1 ㎓, so that middle channel was chosen at representative in final test.
2. Actual = Reading + Ant. factor + Amp + CL (Cable loss)
3. Detector mode: Quasi peak
4. To get a maximum emission level from the EUT, the EUT was moved throughout the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

Test results (Above 1 000 ㎒)

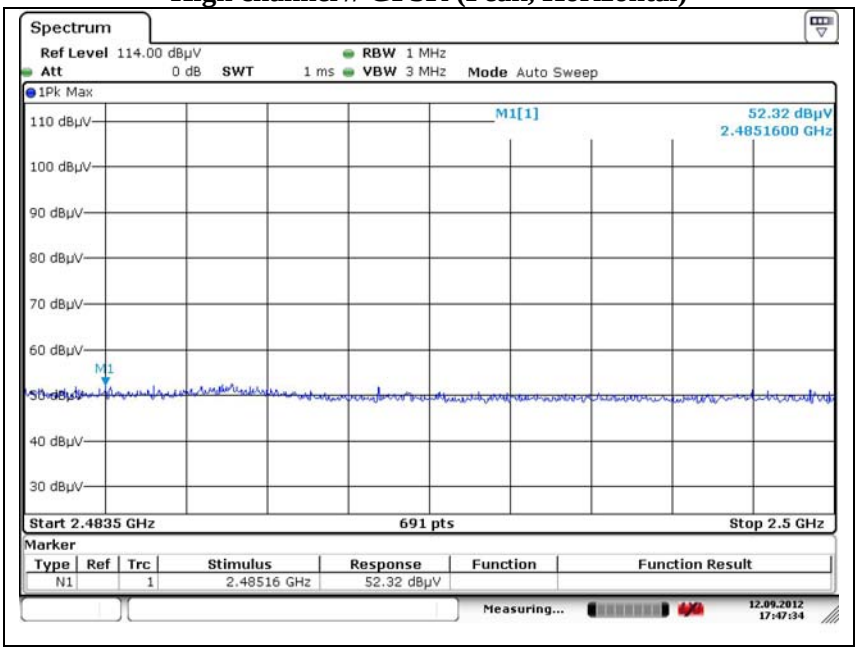
Low channel // GFSK (Peak, Horizontal)



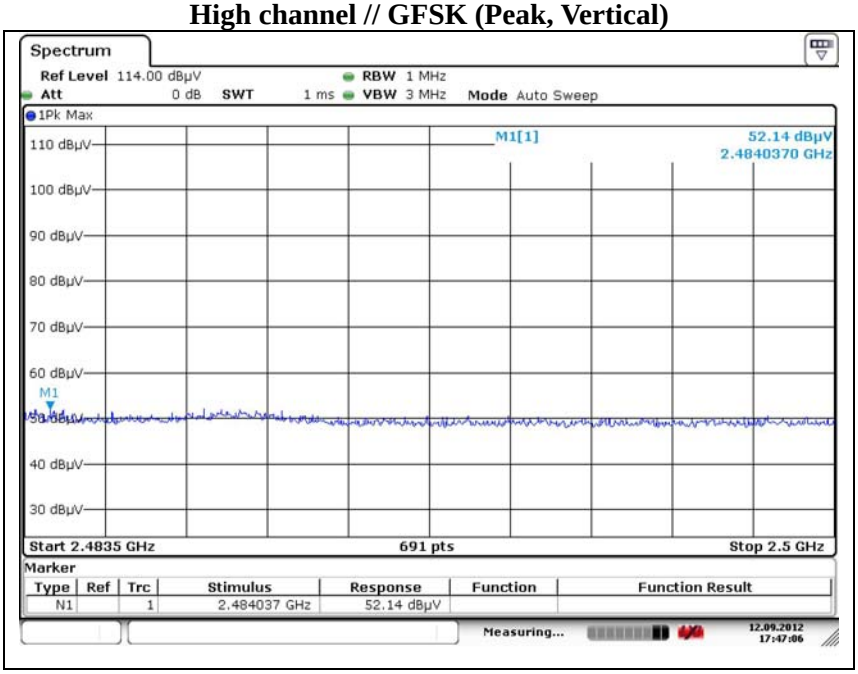
Low channel // GFSK (Peak, Vertical)



High channel // GFSK (Peak, Horizontal)



High channel // GFSK (Peak, Vertical)



Low channel // GFSK

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2 382.8	47.34	Peak	H	28.30	-38.89	36.75	74.00	37.25
2 372.0	46.96	Peak	V	28.28	-38.91	36.32	74.00	37.68

Middle channel // GFSK

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
Above 1 000	Not detected							

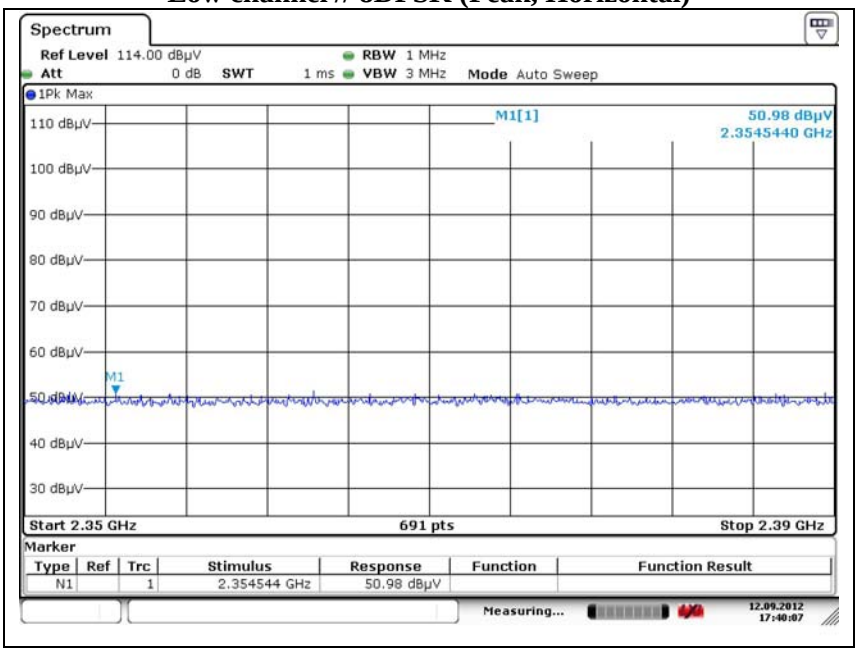
High channel // GFSK

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2 485.1	52.32	Peak	H	28.50	-38.73	42.09	74.00	31.91
2 484.0	52.14	Peak	V	28.50	-38.73	41.91	74.00	32.09

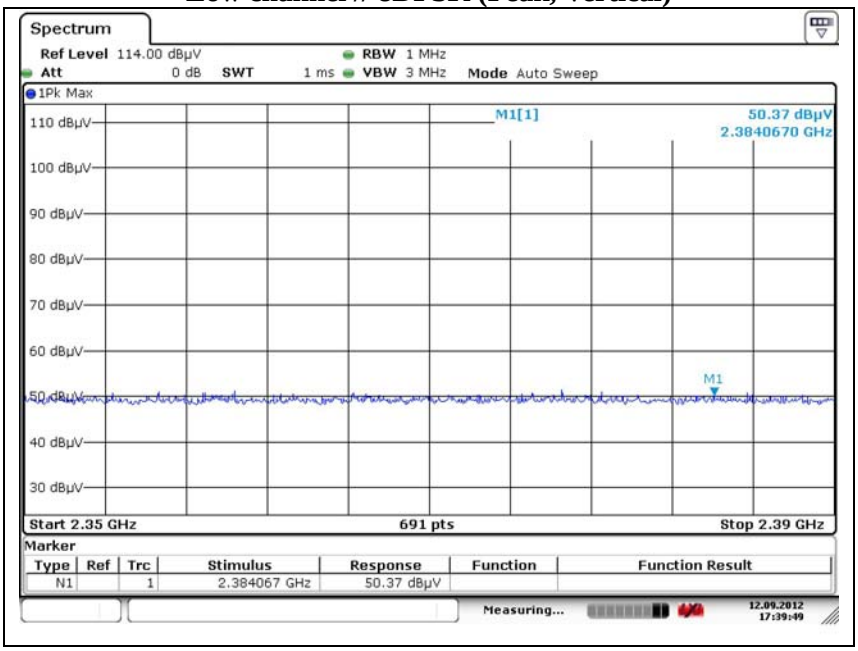
※ Remark

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 + Ant. factor + Amp + CL (Cable loss)
5. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.

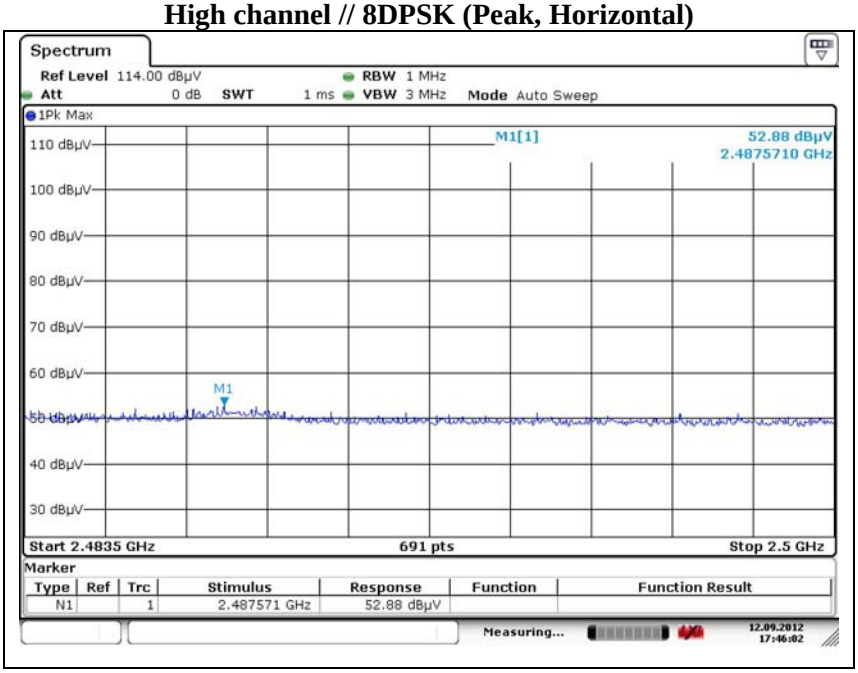
Low channel // 8DPSK (Peak, Horizontal)



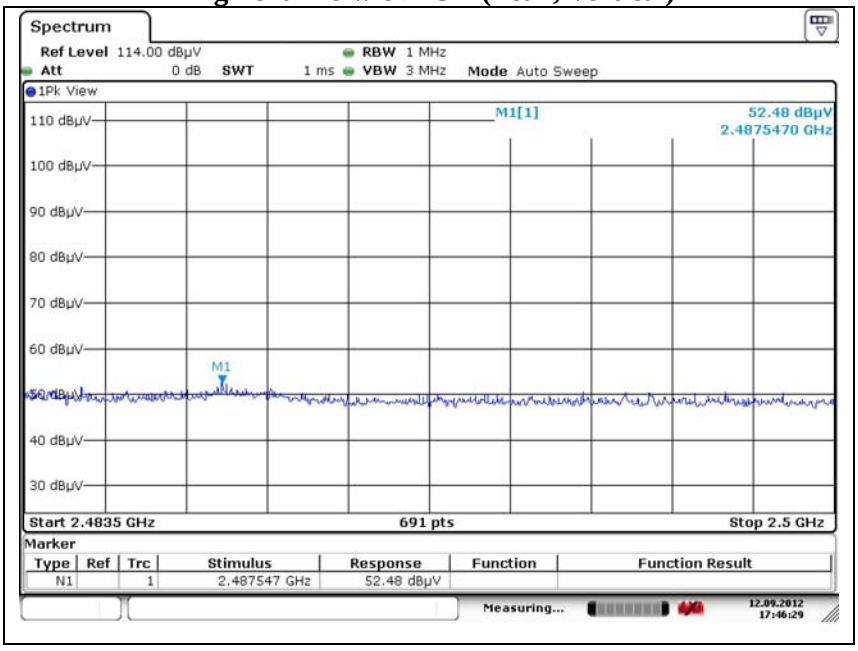
Low channel // 8DPSK (Peak, Vertical)



High channel // 8DPSK (Peak, Horizontal)



High channel // 8DPSK (Peak, Vertical)



Low channel // 8DPSK

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2 354.5	50.98	Peak	H	28.24	-38.94	40.28	74.00	33.72
2 384.0	50.37	Peak	V	28.30	-38.89	39.78	74.00	34.22

Middle channel // 8DPSK

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
Above 1 000	Not detected							

High channel // 8DPSK

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2 487.5	52.88	Peak	H	28.51	-38.73	42.66	74.00	31.34
2 487.5	52.48	Peak	V	28.51	-38.73	42.26	74.00	31.74

※ 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 + Ant. factor + Amp + CL (Cable loss)
5. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.

2.1.9 AC conducted emissions

Frequency range of measurement
150 ㎑ to 30 ㎒

Instrument settings
IF Band Width: 9 ㎑

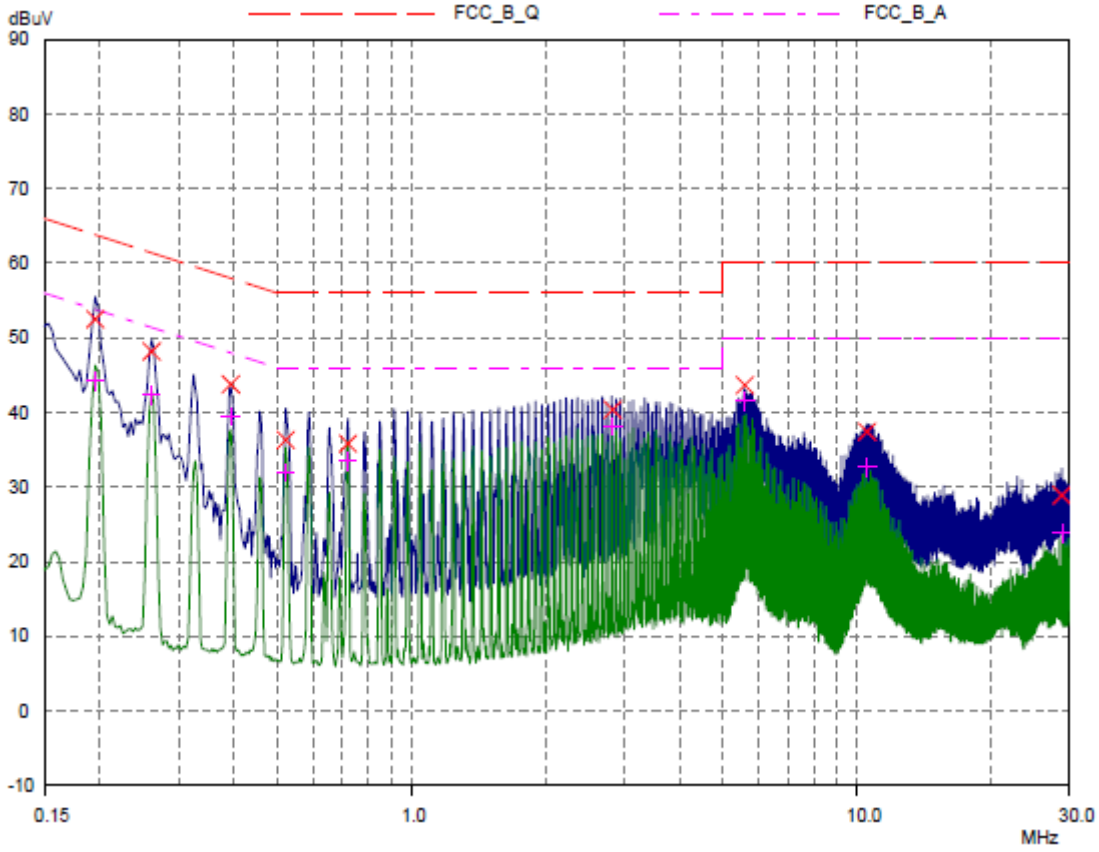
Test procedures
The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m. Amplitude measurements were performed with a quasi-peak detector and an average detector.

Limit
According to 15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50uH/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequencies ranges.

Frequency of Emission (㎒)	Conducted limit (dB㎶/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

※ Remark
Decreases with the logarithm of the frequency.

Test results

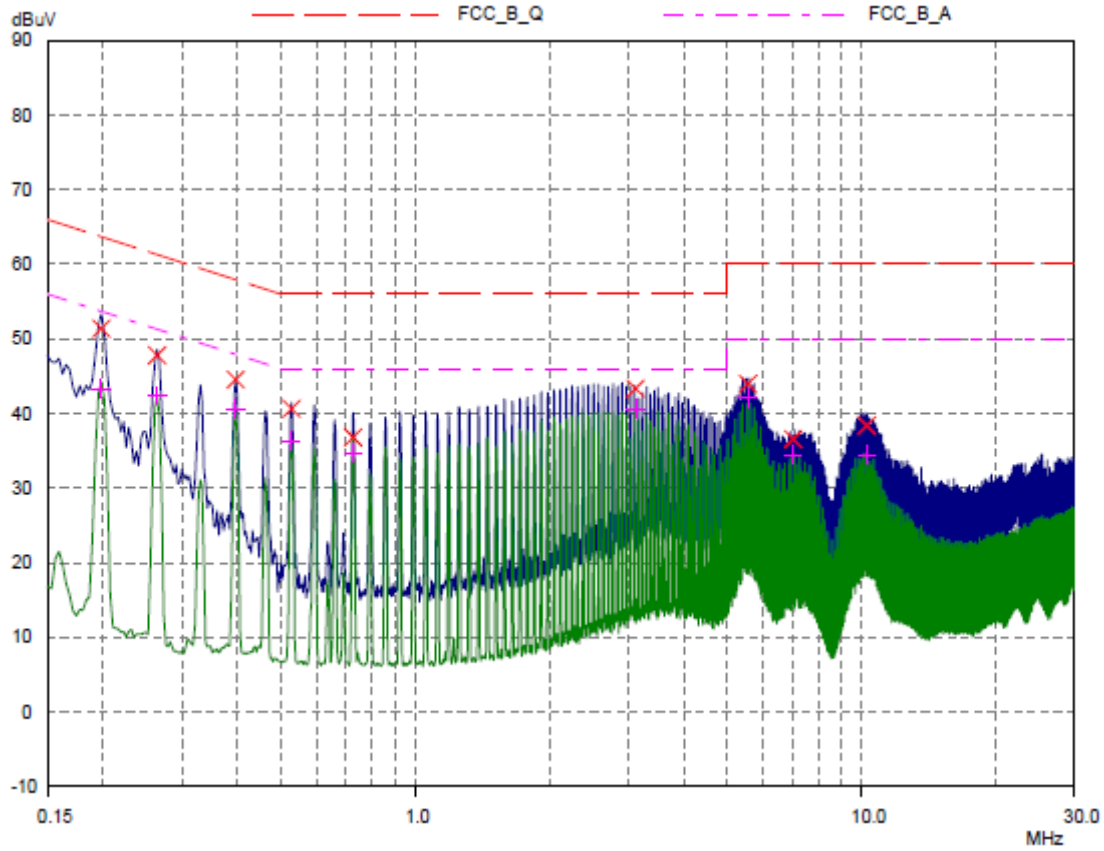


Final Measurement Results

Frequency MHz	QP Level dBuV	QP Limit dBuV	QP Delta dB
0.195	52.50	63.82	11.32
0.261	48.19	61.40	13.21
0.393	43.79	58.00	14.21
0.522	36.32	56.00	19.68
0.72	35.84	56.00	20.16
2.832	40.38	56.00	15.62
5.61	43.68	60.00	16.32
10.55	37.42	60.00	22.58
28.929	28.94	60.00	31.06

Frequency MHz	AV Level dBuV	AV Limit dBuV	AV Delta dB
0.195	44.22	53.82	9.60
0.261	42.34	51.40	9.06
0.393	39.43	48.00	8.57
0.522	32.00	46.00	14.00
0.72	33.44	46.00	12.56
2.832	38.14	46.00	7.86
5.61	41.50	50.00	8.50
10.55	32.66	50.00	17.34
28.929	23.85	50.00	26.15

Note;
Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).



Final Measurement Results

Frequency MHz	QP Level dBuV	QP Limit dBuV	QP Delta dB
0.198	51.38	63.69	12.31
0.264	47.79	61.30	13.51
0.396	44.55	57.94	13.39
0.528	40.64	56.00	15.36
0.726	36.80	56.00	19.20
3.12	43.33	56.00	12.67
5.576	43.96	60.00	16.04
7.035	36.58	60.00	23.42
10.291	38.38	60.00	21.62

Frequency MHz	AV Level dBu	AV Limit dBuV	AV Delta dB
0.198	43.35	53.69	10.34
0.264	42.39	51.30	8.91
0.396	40.63	47.94	7.31
0.528	36.36	46.00	9.64
0.726	34.70	46.00	11.30
3.12	40.60	46.00	5.40
5.576	42.03	50.00	7.97
7.035	34.46	50.00	15.54
10.291	34.51	50.00	15.49

Note;
Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).

Appendix A. Test equipment used for test

Equipment	Manufacturer	Model	Calibration due.
Spectrum Analyzer	R&S	FSV30	2013.01.10
Vector Signal Generator	R&S	SMBV2100A	2013.01.10
Signal Generator	HP	83630B	2013.06.06
Attenuator	HP	8495B	2013.05.04
Attenuator	HP	8494B	2013.05.04
DC Power Supply	Agilent	6632B	2013.05.04
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	2013.03.22
High Pass Filter	Wainwright Instrument	WHJS3000-10TT	2013.01.10
Preamplifier	A.H. System	PAM-0118	2013.05.04
EMC Analyzer	Agilent	E7405A	2012.08.16
EMI TEST Receiver	R & S	ESHS10	2013.05.04
LISN	R & S	ENV216	2013.02.27
LISN	EMCO	3810/2	2013.04.18

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
Notebook	Samsung electronics	NT-R410Y	Z9YJ93CS300631H
Netbook	Lenovo	S10-2	2957N5K

Appendix B. Test setup photo

Radiated field emissions

AC conducted emission