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TEST REPORT

Part 15 Subpart C 15.247

Equipment under test CareSens N LINK

Model name GM505LEB

FCC ID OELGM505LEB

Applicant i-SENS Inc.

Manufacturer i-SENS Inc.

Date of test(s) 2012.06.11 ~ 2012.06.18, 2012.07.19

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Issued to

i-SENS Inc.
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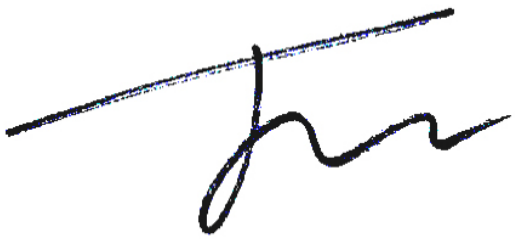
Test and report completed by :	Report approval by :
	
Jae Jun Lee Test engineer	Gyu-cheol Shin Technical manager

Revision history

Revision	Date of issue	Test report No.	Description
-	2012.06.22	KES-RF-120041	Initial
1	2012.07.19	KES-RF-120054	Retest Band Edge Radiated Emissions and add the data and the plots

TABLE OF CONTENTS

1.0 General product description

Equipment under test	CareSense N Link
Model name	GM505LEB
Serial number	N/A
Frequency Range	2 402 ㎒ ~ 2 480 ㎒ (Bluetooth BDR & EDR)
Modulation technique	GFSK, π/4-DQPSK, 8DPSK
Number of channels	79
Antenna type & gain	Chip antenna / -2.46 dBi
Power source	DC 3 V

1.1 Test frequency

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

1.2 Model differences

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	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

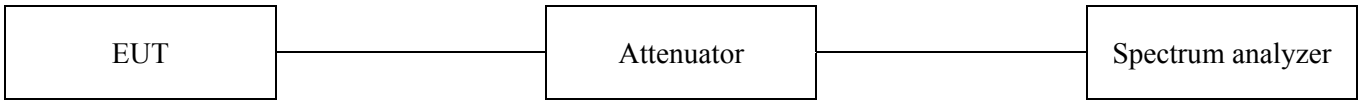
2.0 Summary of tests

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

2.1 Test data

2.1.1 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.

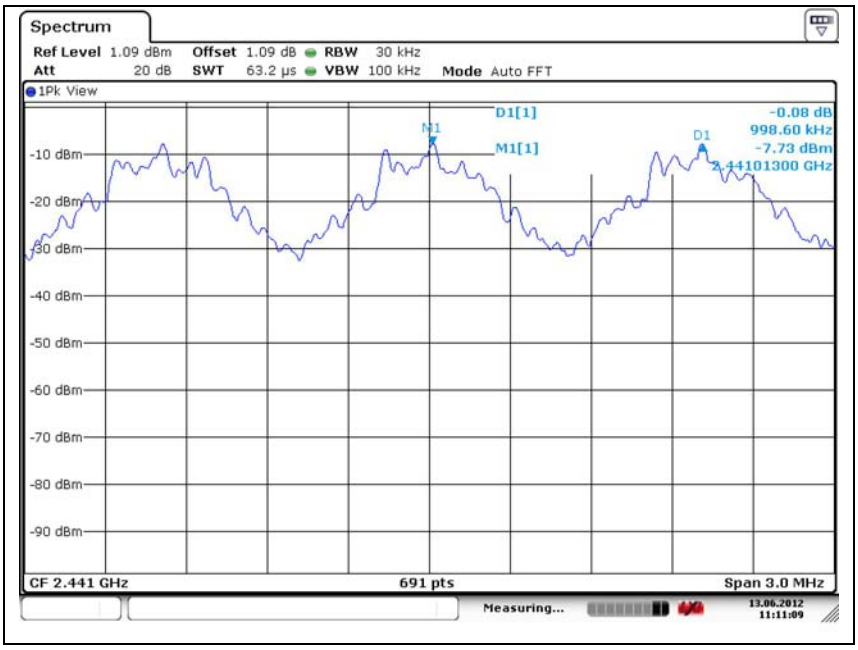
Limit

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 ㎽.

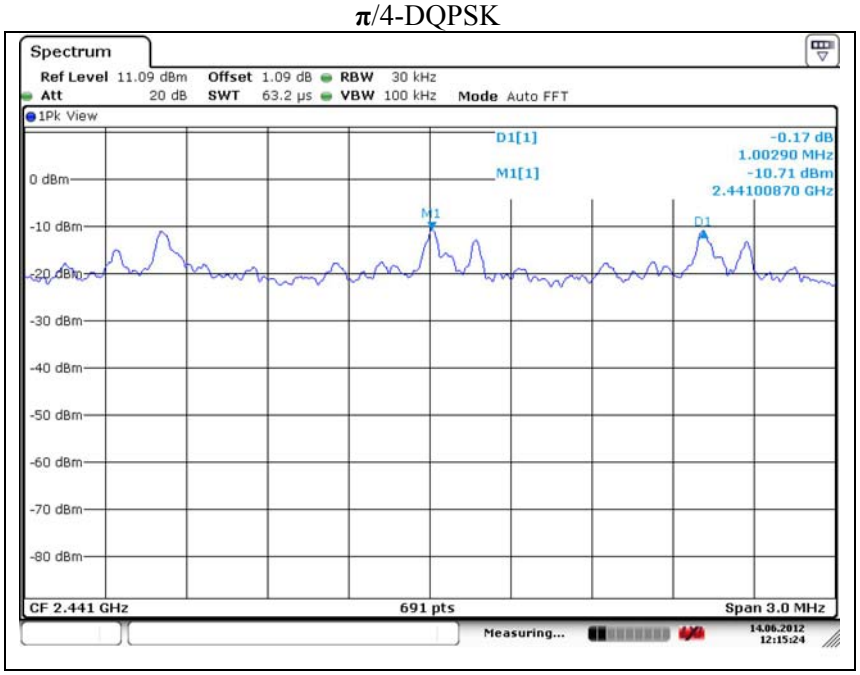
Test results

Operation mode	Frequency (㎒)	Adjacent hopping channel separation(㎒)	Two-third of 20 ㏈ bandwidth (㎑)	Minimum bandwidth (㎑)
GFSK(1Mbps)	2 441	0.998 6	622	25
π/4-DQPSK (2Mbps)	2 441	1.002 9	878	25
8DPSK(3Mbps)	2 441	1.007 2	839	25

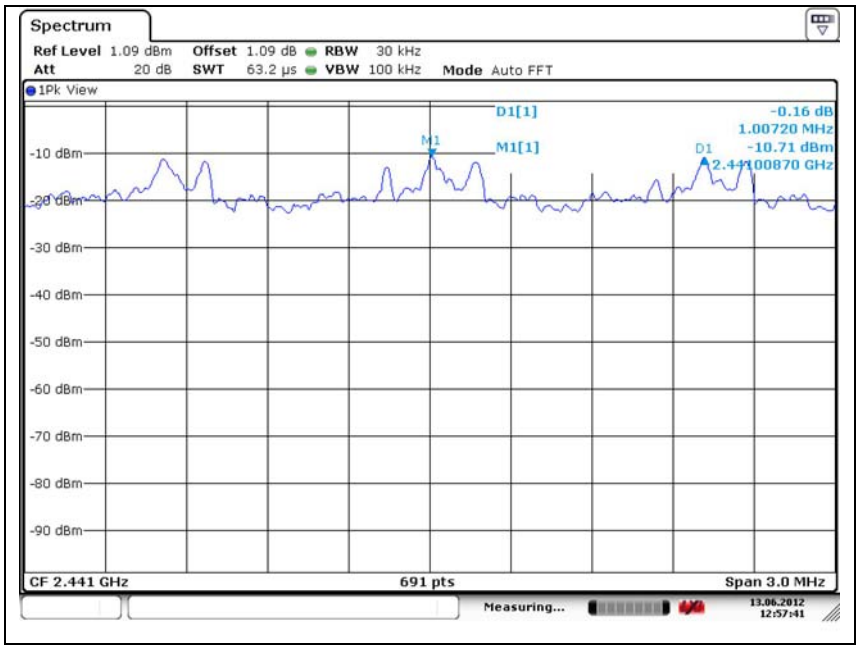
GFSK



π/4-DQPSK

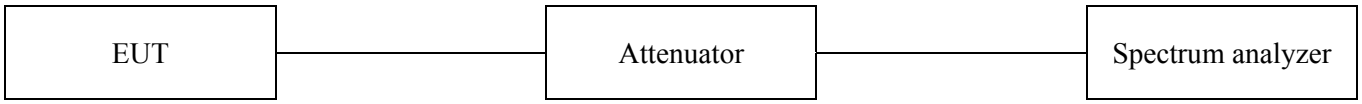


8DPSK



2.1.2 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.

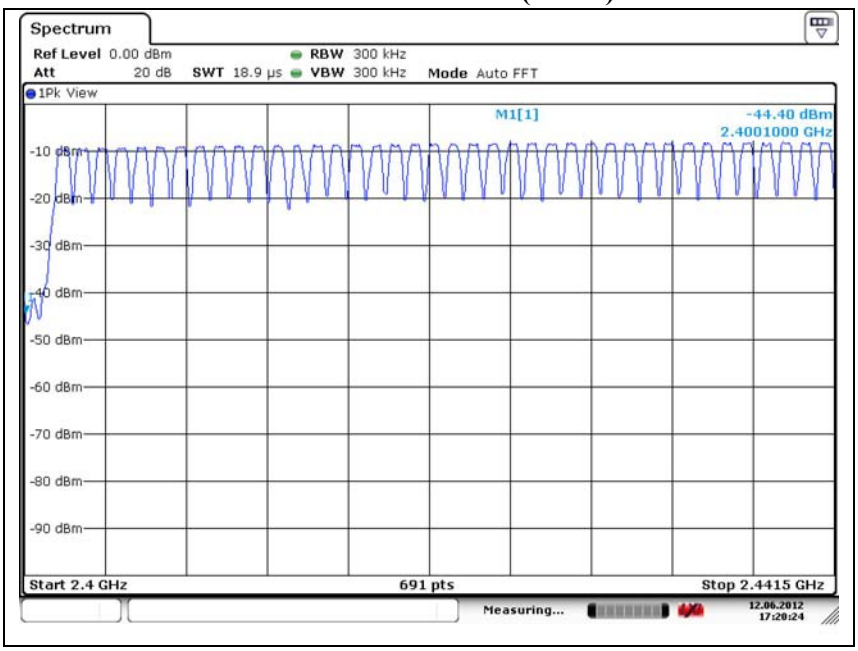
Limit

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.

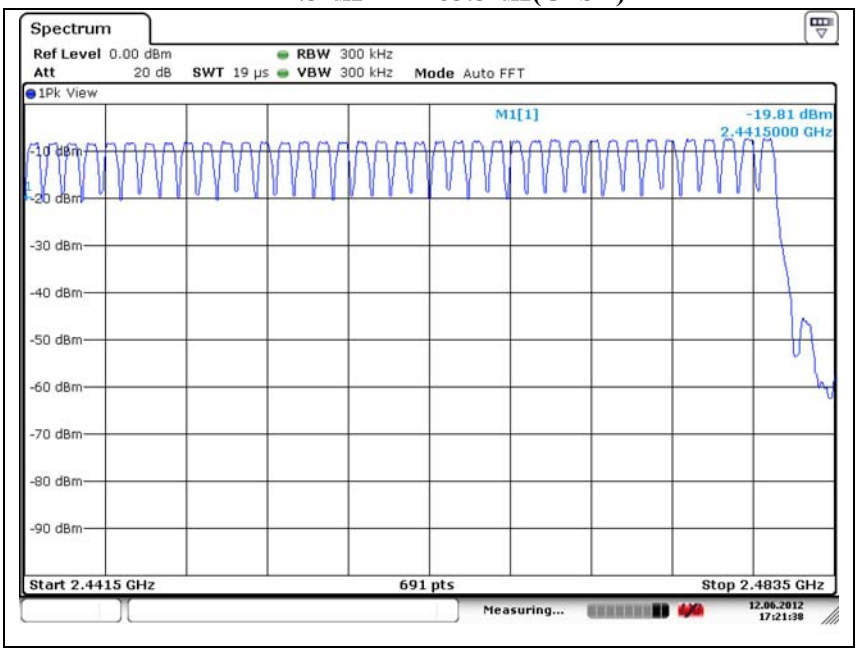
Test results

Operation mode	Number of Hopping Frequency	Limit
GFSK(1Mbps)	79	≥ 15
π/4-DQPSK(2Mbps)	79	≥ 15
8DPSK(3Mbps)	79	≥ 15

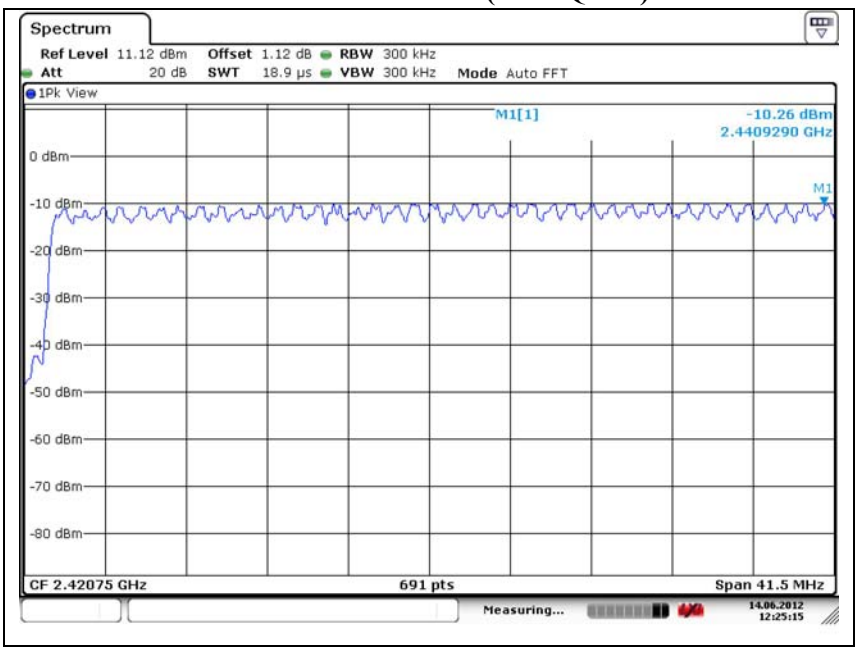
2 400 ㎒ ~ 2 441.5 ㎒(GFSK)



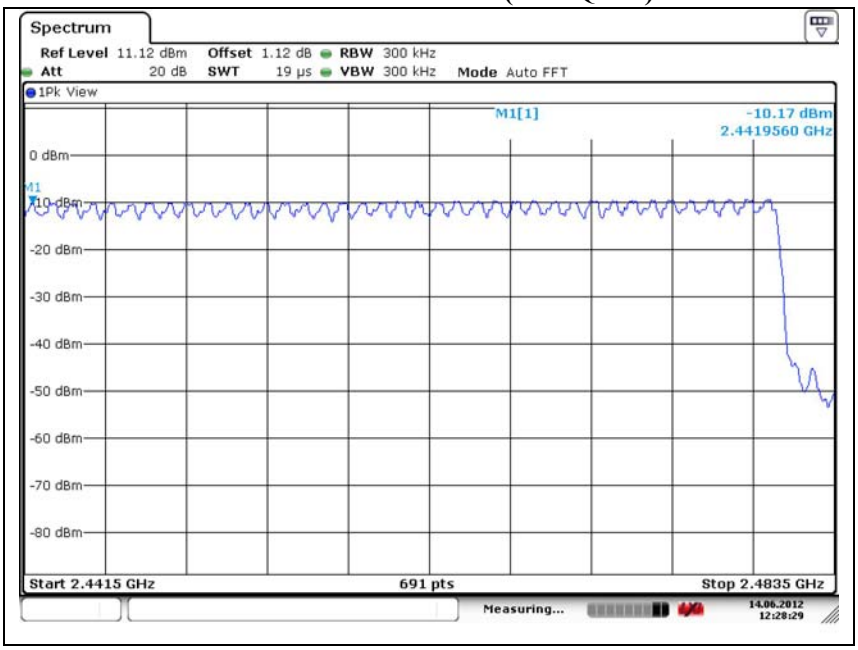
2 441.5 ㎒ ~ 2 483.5 ㎒(GFSK)



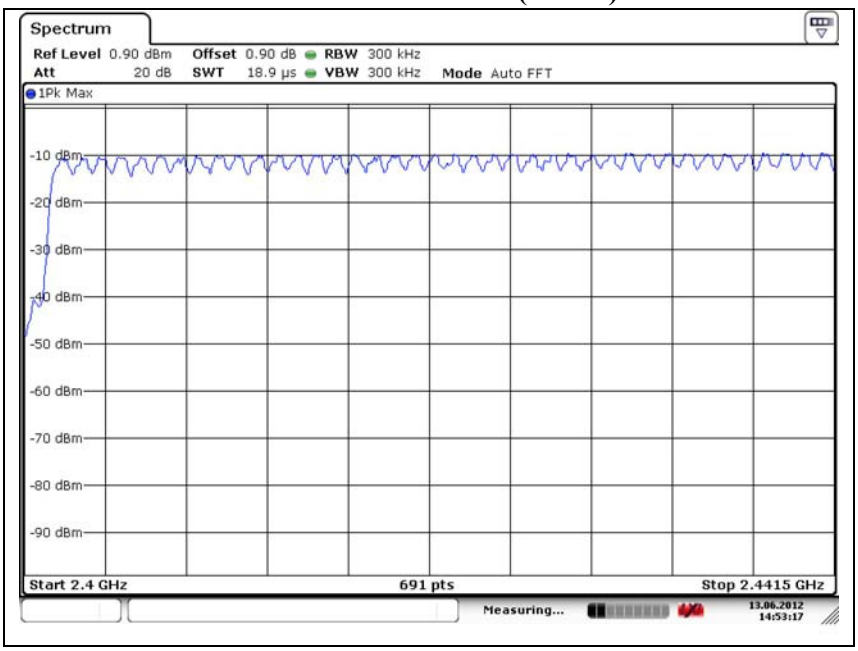
2 400 ㎒ ~ 2 441.5 ㎒(π/4-DQPSK)



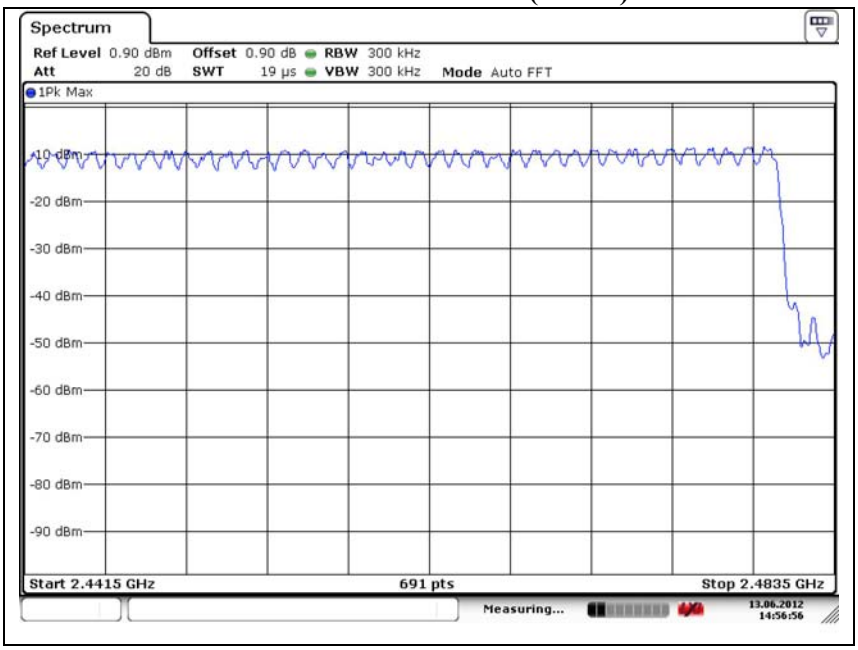
2 441.5 ㎒ ~ 2 483.5 ㎒(π/4-DQPSK)



2 400 ㎒ ~ 2 441.5 ㎒(8DPSK)

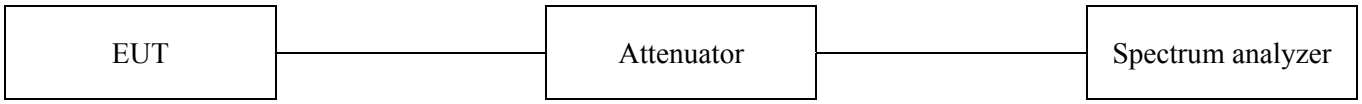


2 441.5 ㎒ ~ 2 483.5 ㎒(8DPSK)



2.1.3 20 dB bandwidth

Test setup



Test procedure

1. Use the following spectrum analyzer setting
   Center frequency: Lowest, middle and highest channels
   Span = 5 ㎒ (Approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel)
   RBW = 10 ㎑ (≥ 1% of the span)
   VBW = 10 ㎑ (≥ 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.

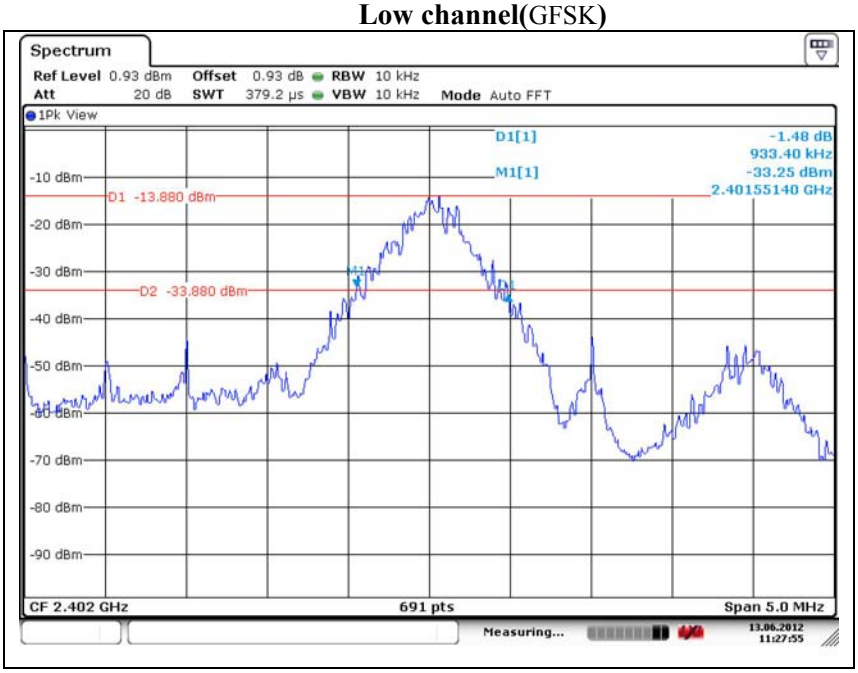
Limit

Not applicable

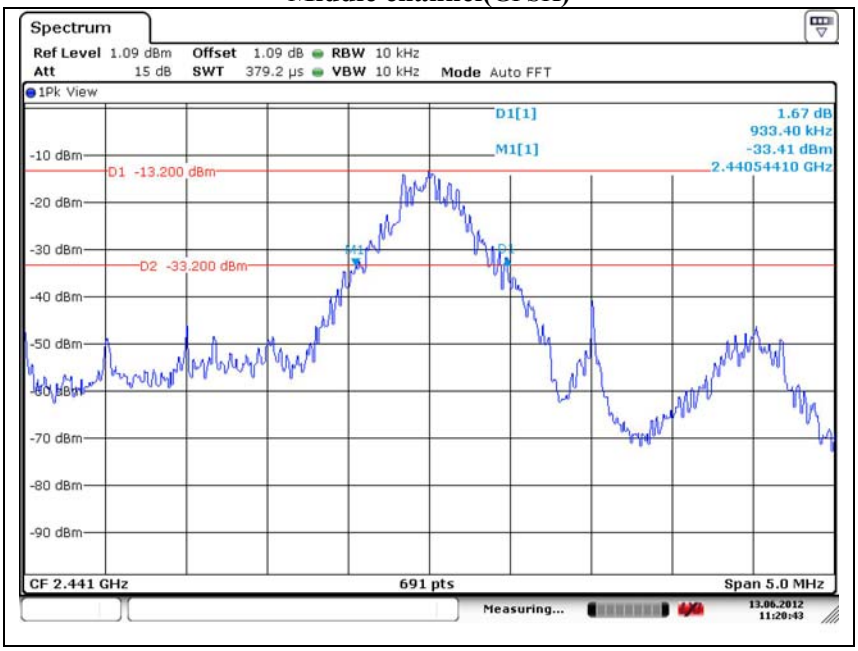
Test results

Operation mode	Frequency(㎒)	20 ㏈ bandwidth(㎒)
GFSK(1Mbps)	2 402	0.933
	2 441	0.933
	2 480	0.940

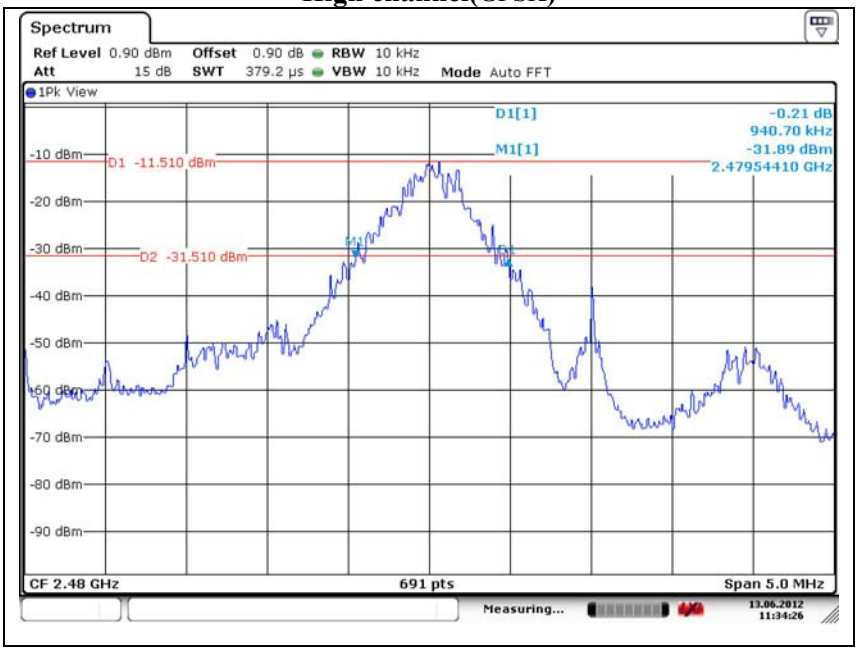
Low channel(GFSK)



Middle channel(GFSK)



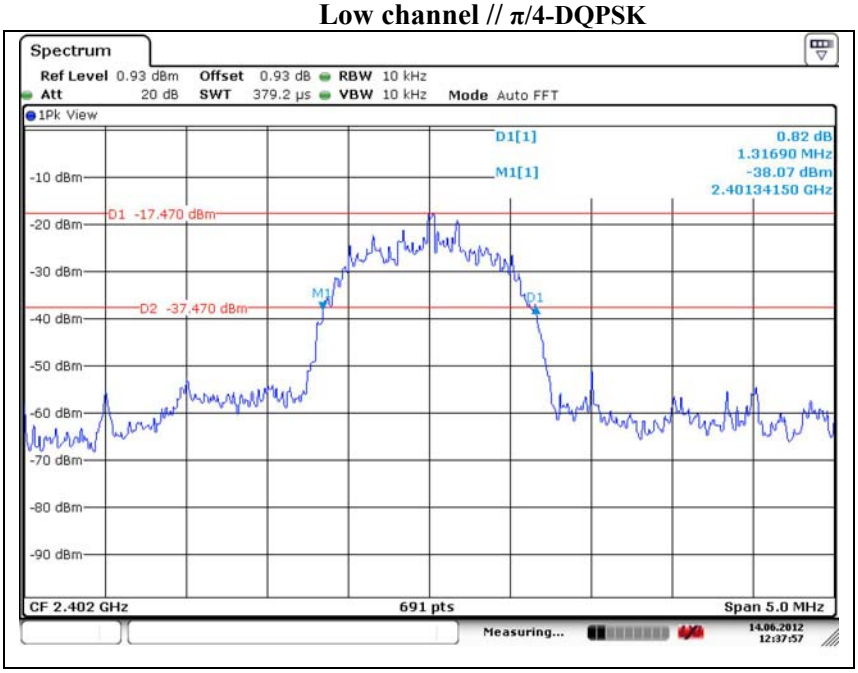
High channel(GFSK)



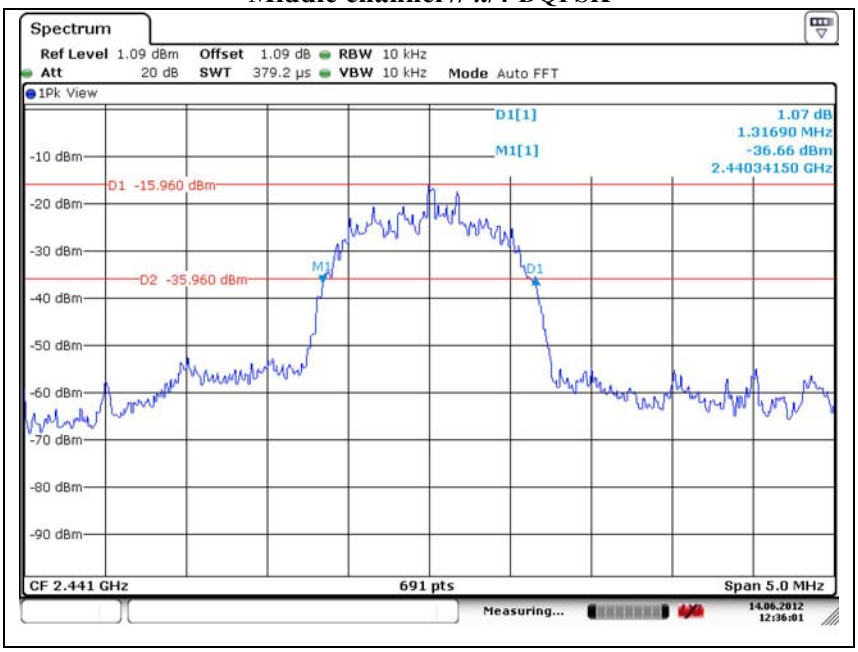
Test results

Operation mode	Frequency(㎒)	20 ㏈ bandwidth(㎒)
π/4-DQPSK(2Mbps)	2 402	1.316
	2 441	1.316
	2 480	1.309

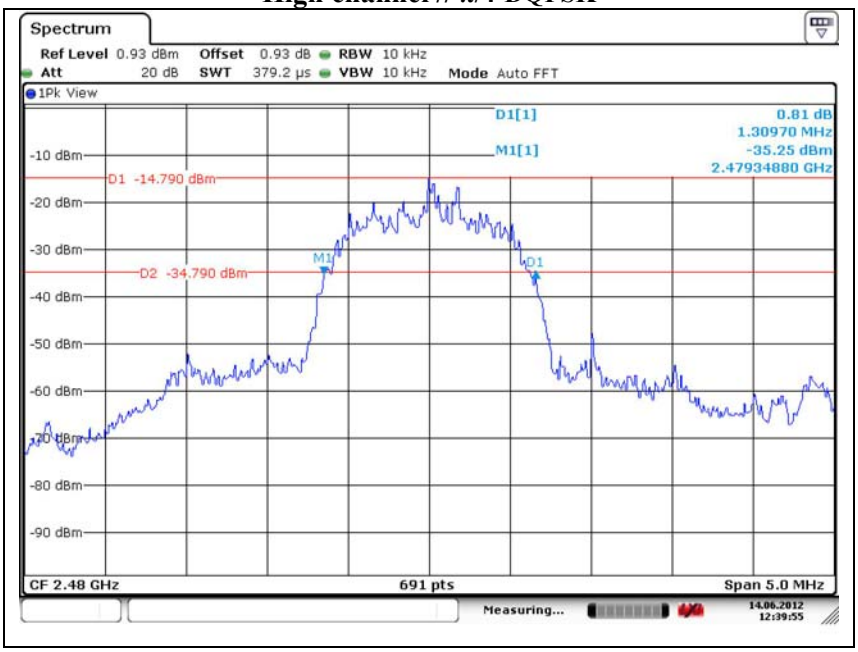
Low channel // π/4-DQPSK



Middle channel // π/4-DQPSK



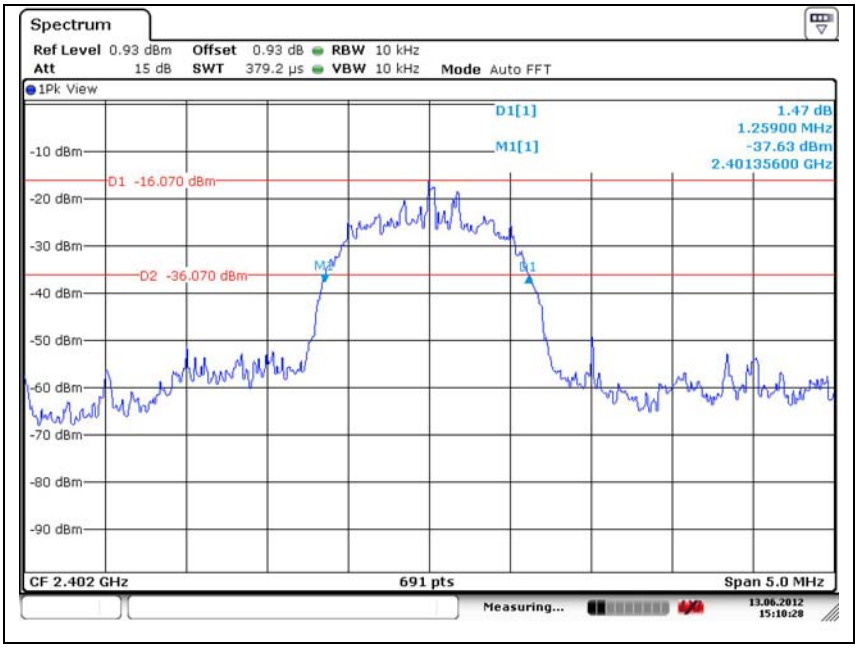
High channel // π/4-DQPSK



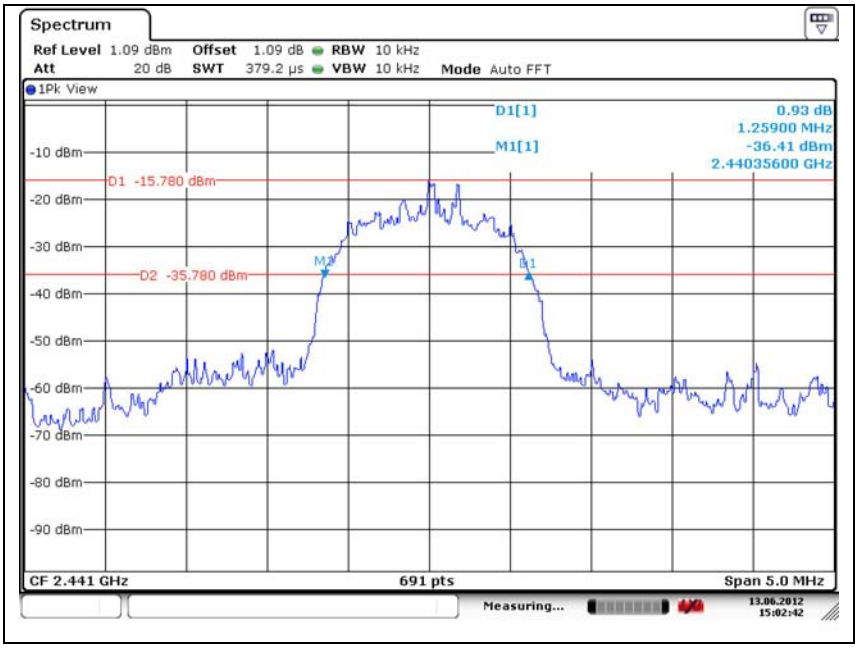
Test results

Operation mode	Frequency(㎒)	20 ㏈ bandwidth(㎒)
8DPSK(3Mbps)	2 402	1.259
	2 441	1.259
	2 480	1.273

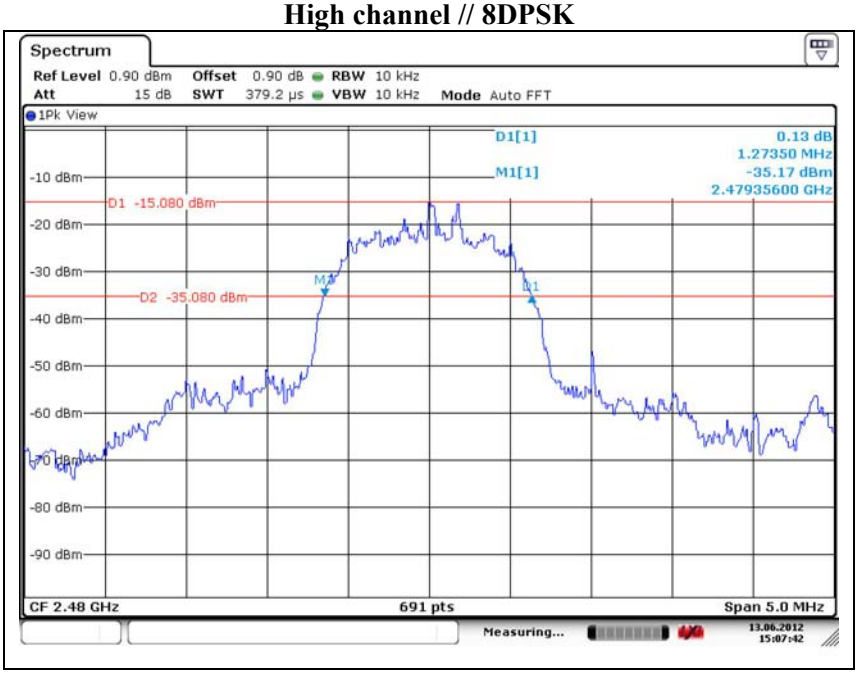
Low channel // 8DPSK



Middle channel // 8DPSK

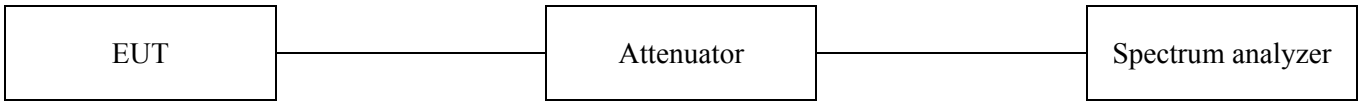


High channel // 8DPSK



2.1.4 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

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

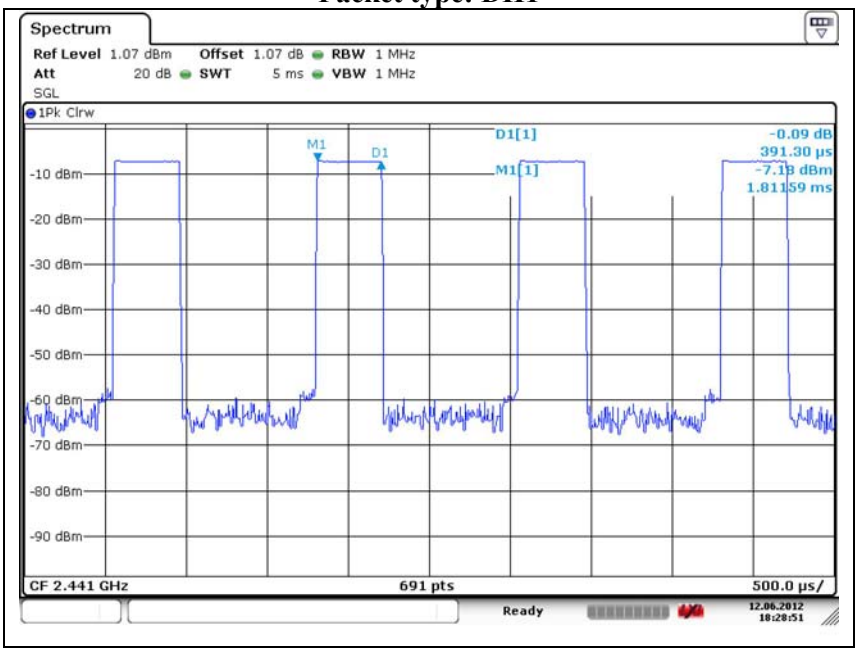
Operation mode: GFSK(1Mbps)

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	0.391	125.12	400
DH3	2 441	1.652	264.32	400
DH5	2 441	2.898	309.12	400

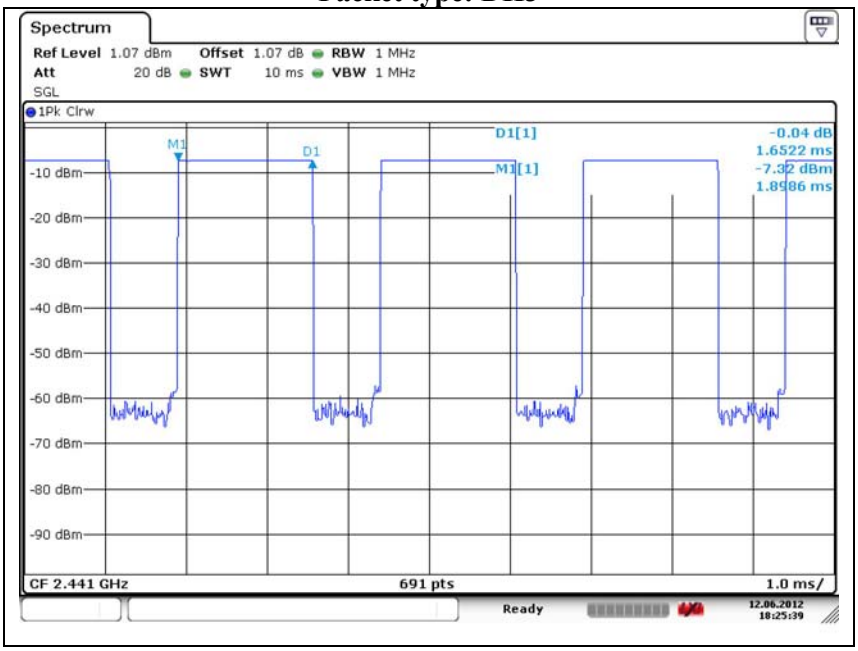
※ Remark:

DH1: Dwell time (ms) × [(1 600 ÷ 2) ÷ 79] × 31.6(s) = 125.12 (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) = 309.12 (ms)

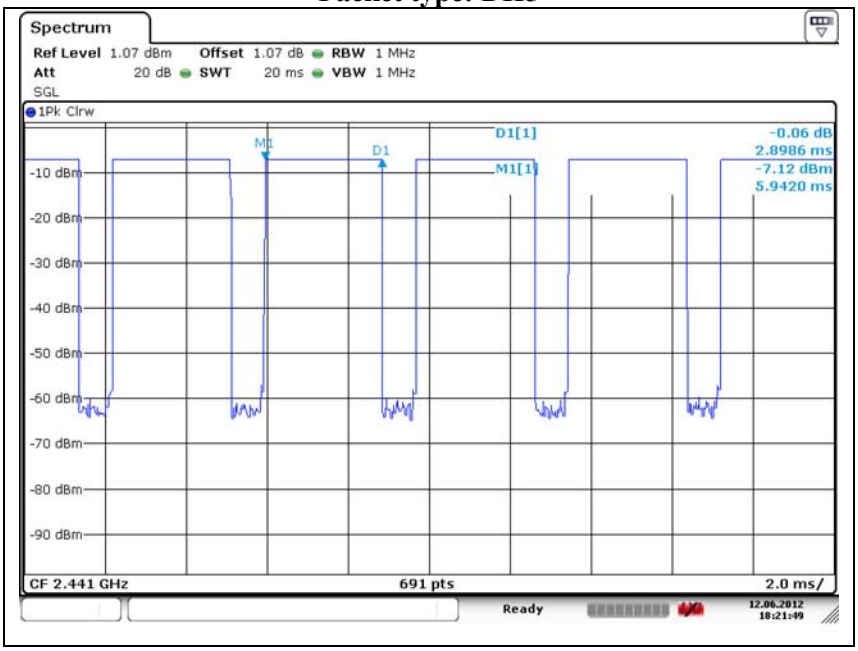
Packet type: DH1



Packet type: DH3



Packet type: DH5



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

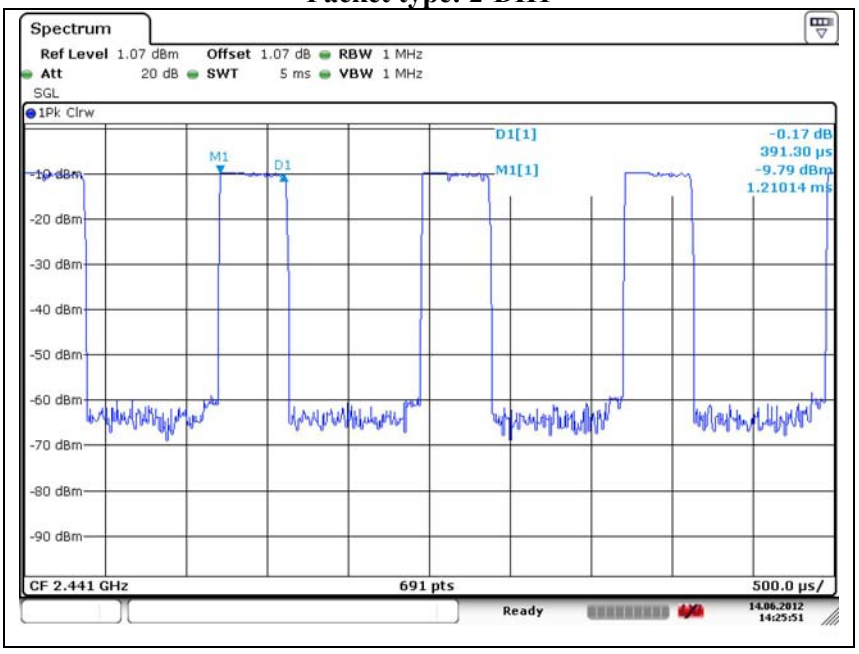
Operation mode: π/4-DQPSK(2Mbps)

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)
2-DH1	2 441	0.391	125.12	400
2-DH3	2 441	1.645	263.20	400
2-DH5	2 441	2.891	308.37	400

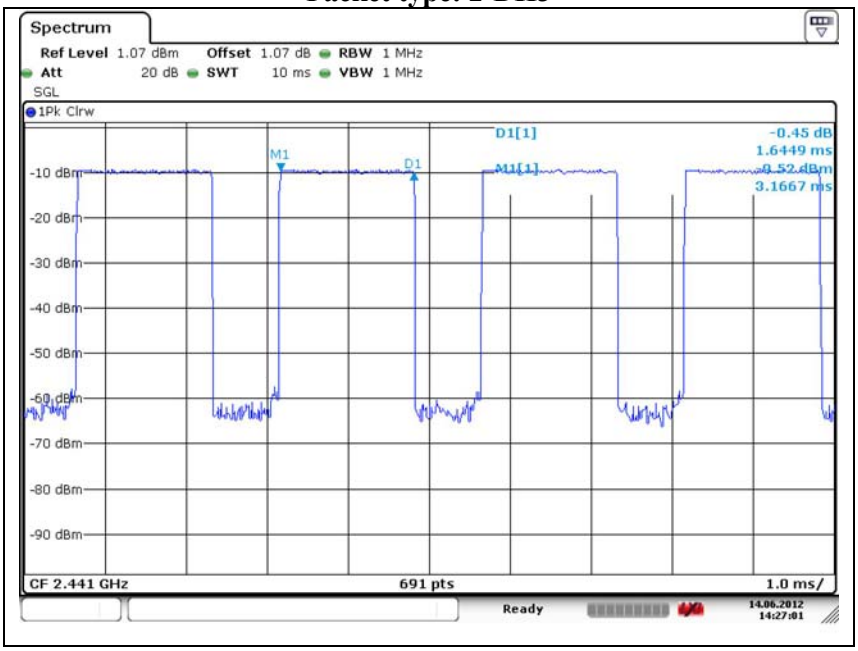
※ Remark:

2-DH1: Dwell time (ms) × [(1 600 ÷ 2) ÷ 79] × 31.6(s) = 125.12 (ms)
2-DH3: Dwell time (ms) × [(1 600 ÷ 4) ÷ 79] × 31.6(s) = 263.20 (ms)
2-DH5: Dwell time (ms) × [(1 600 ÷ 6) ÷ 79] × 31.6(s) = 308.37 (ms)

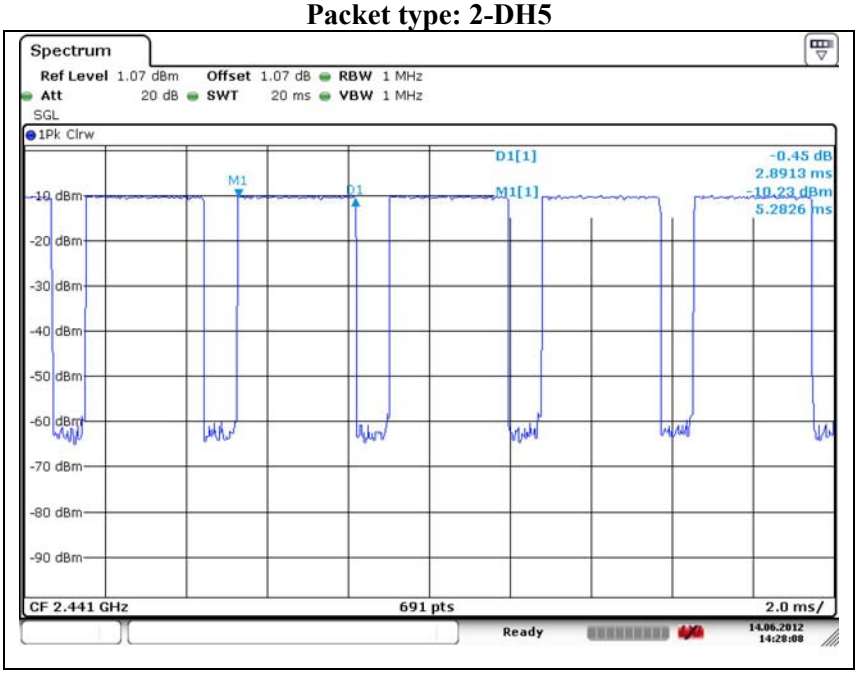
Packet type: 2-DH1



Packet type: 2-DH3



Packet type: 2-DH5



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

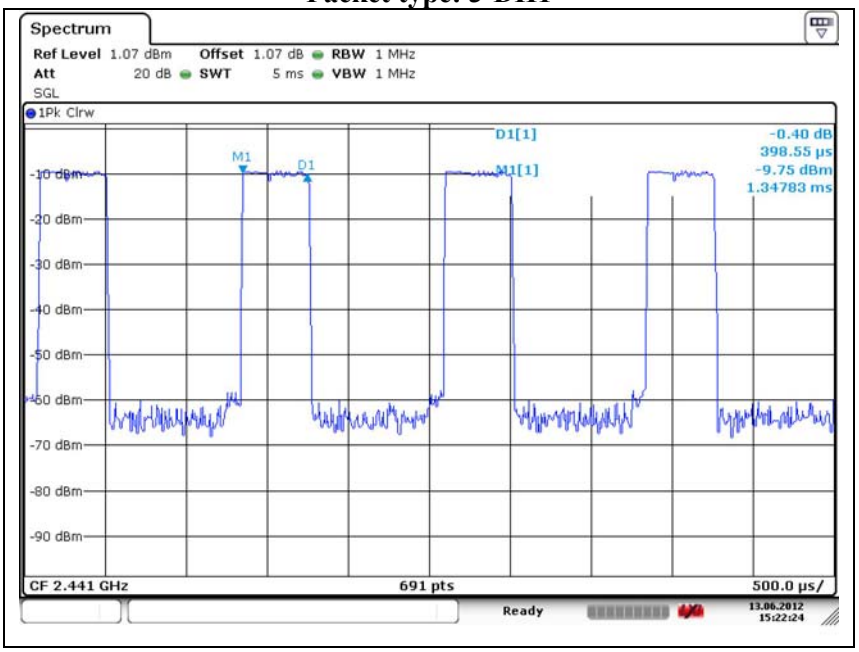
Operation mode: 8DPSK(3Mbps)

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)
3-DH1	2 441	0.398	127.36	400
3-DH3	2 441	1.652	264.32	400
3-DH5	2 441	2.899	309.23	400

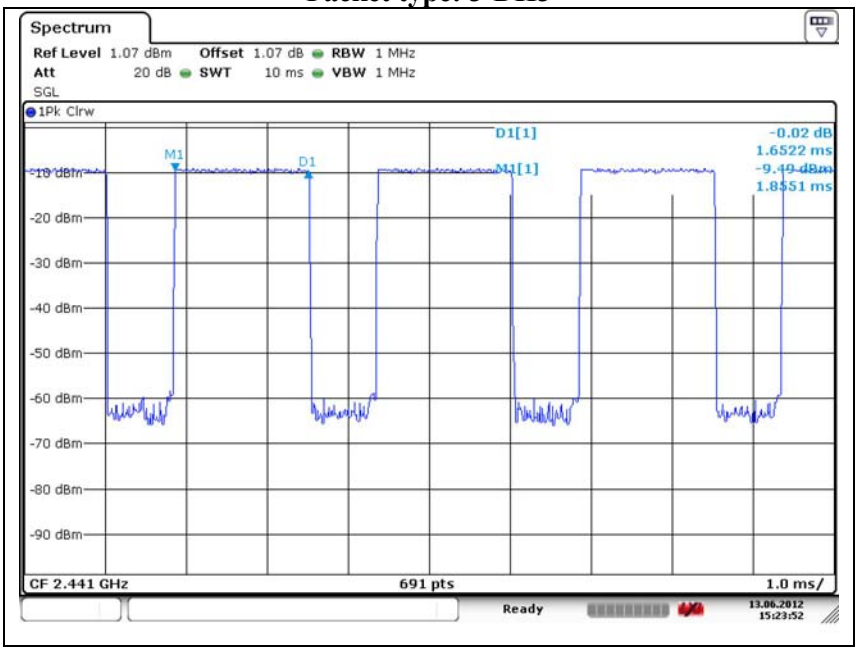
※ Remark:

3-DH1: Dwell time (ms) × [(1 600 ÷ 2) ÷ 79] × 31.6(s) = 127.36 (ms)
3-DH3: Dwell time (ms) × [(1 600 ÷ 4) ÷ 79] × 31.6(s) = 264.32(ms)
3-DH5: Dwell time (ms) × [(1 600 ÷ 6) ÷ 79] × 31.6(s) = 309.23 (ms)

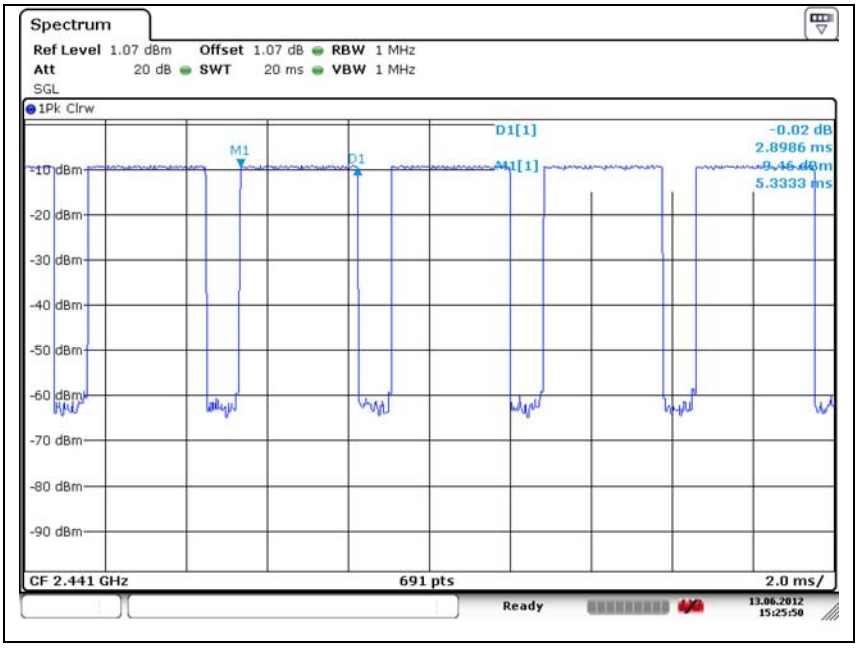
Packet type: 3-DH1



Packet type: 3-DH3

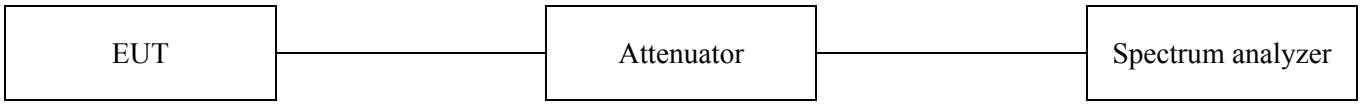


Packet type: 3-DH5



2.1.5 Maximum 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 = 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.

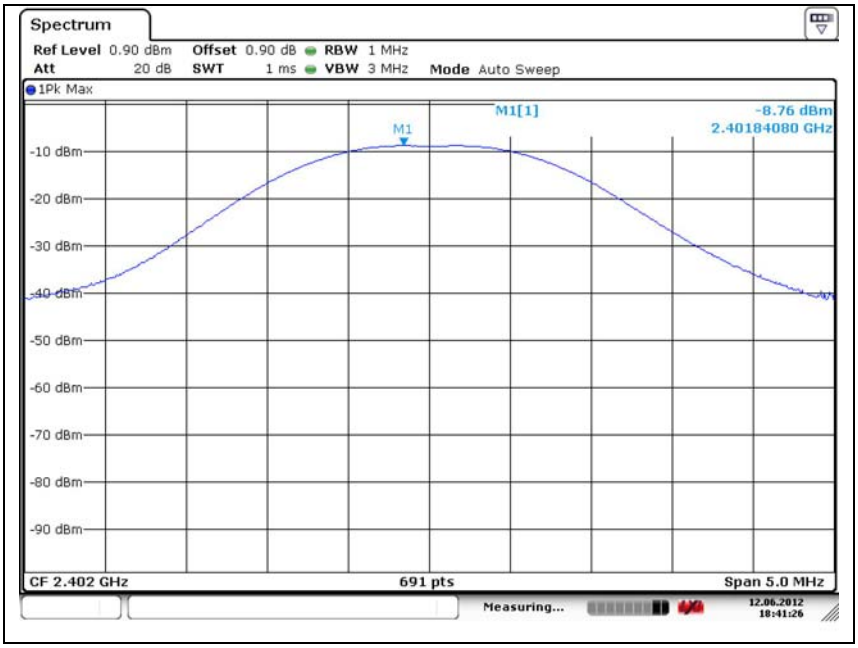
Limit

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.

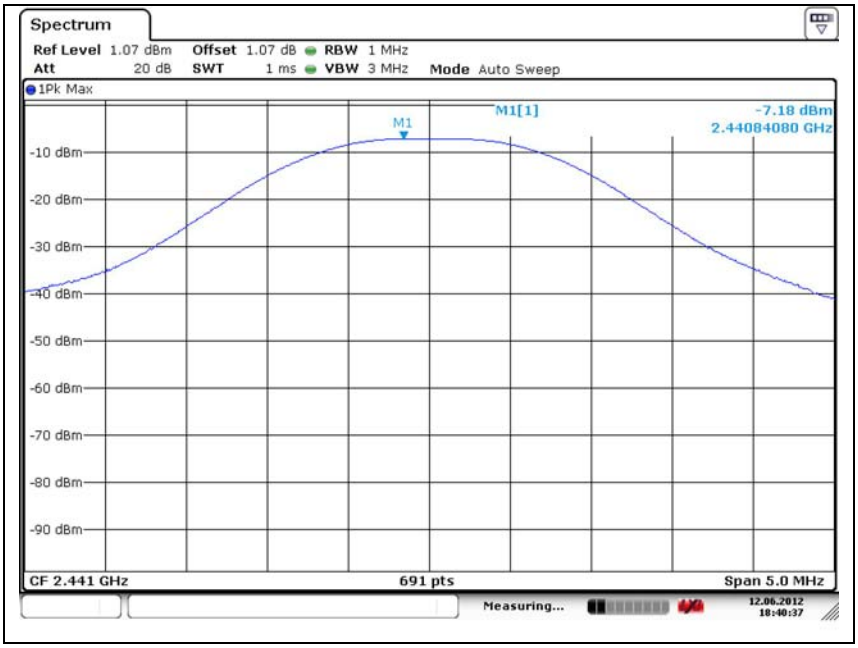
Test results

Operation mode	Frequency(㎒)	Output power (㏈m)	Limit (㏈m)
GFSK(1Mbps)	2 402	-8.76	30
	2 441	-7.18	30
	2 480	-6.30	30

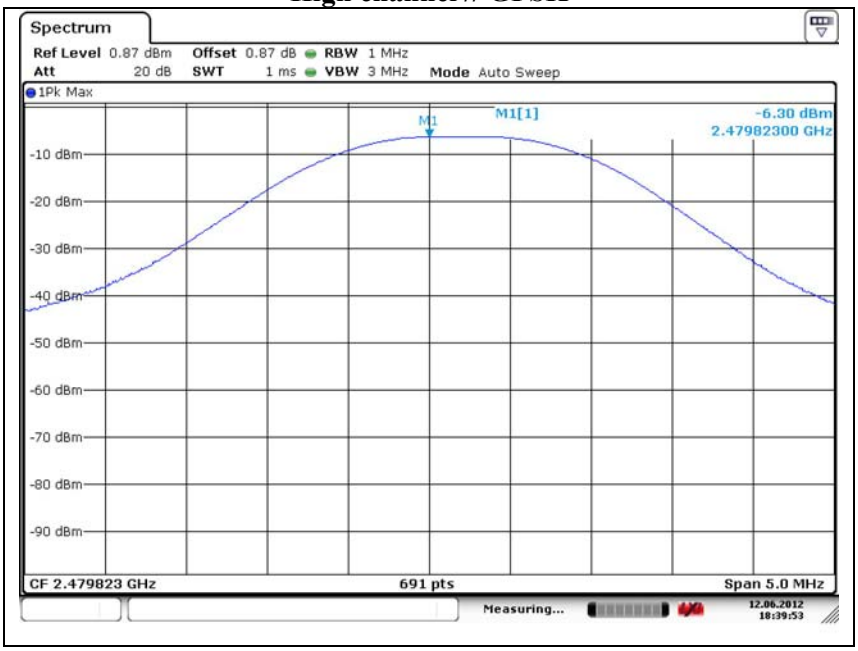
Low channel // GFSK



Middle channel // GFSK



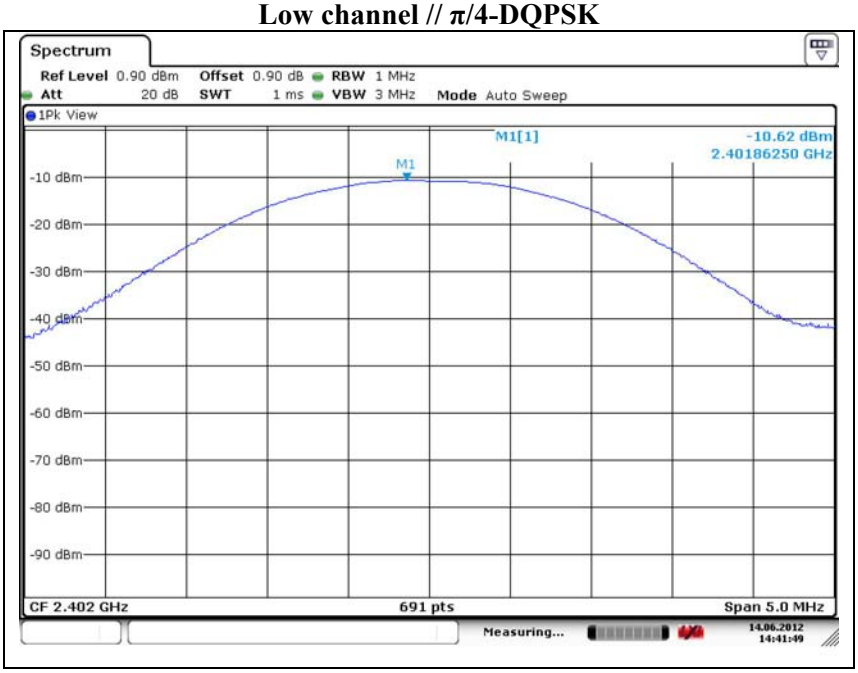
High channel // GFSK



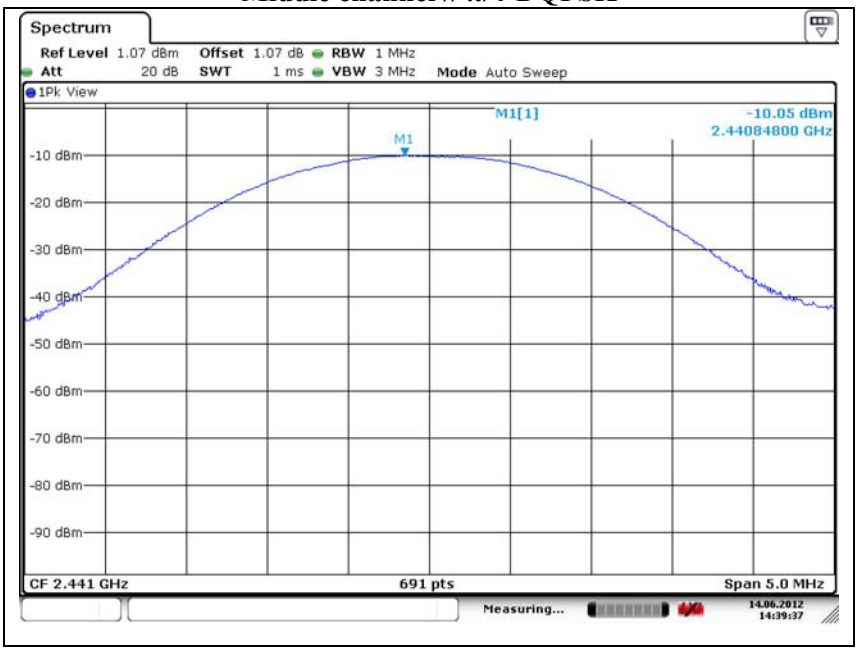
Test results

Operation mode	Frequency(㎒)	Output power (㏈m)	Limit (㏈m)
π/4-DQPSK(2Mbps)	2 402	-10.62	30
	2 441	-10.05	30
	2 480	-9.40	30

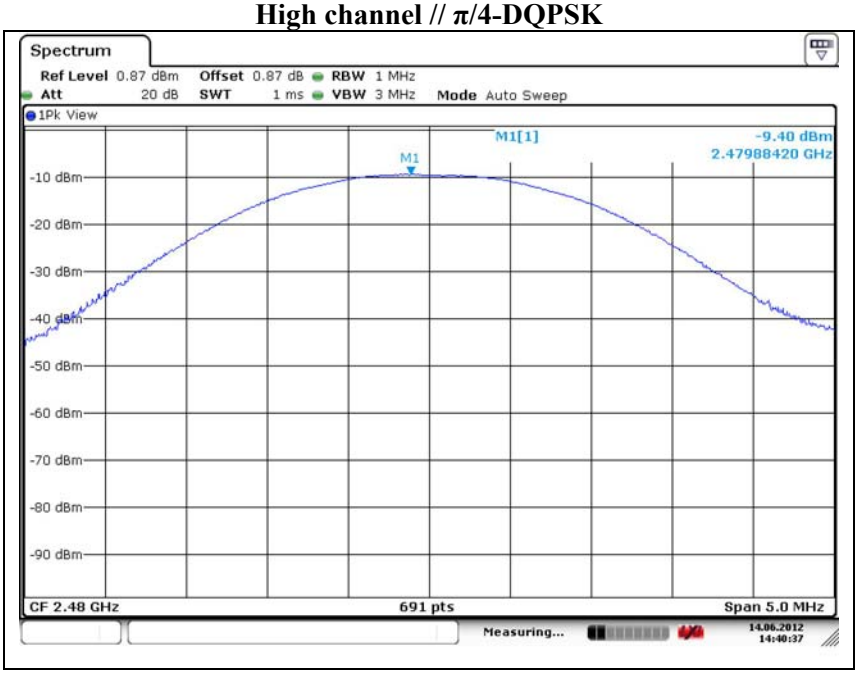
Low channel // π/4-DQPSK



Middle channel // π/4-DQPSK



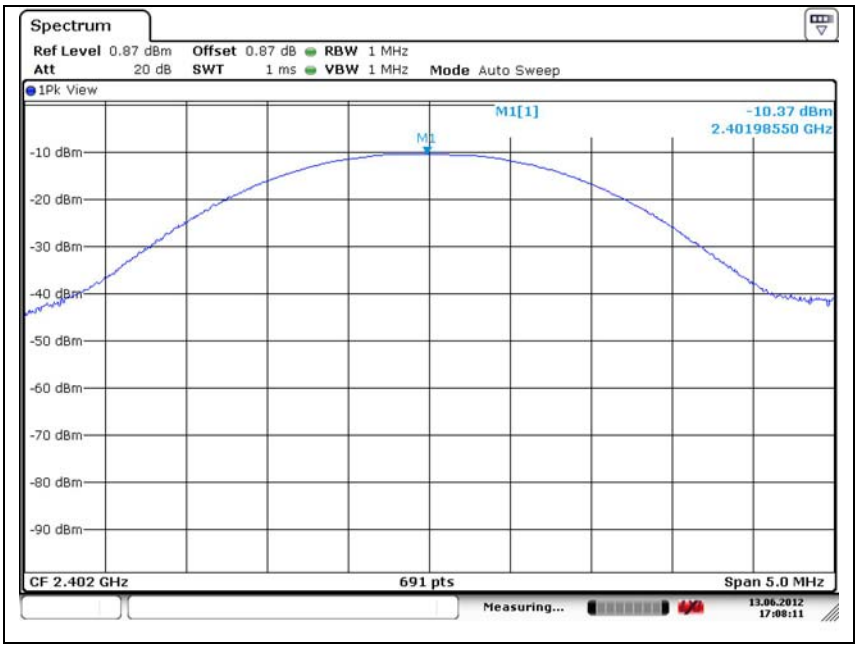
High channel // π/4-DQPSK



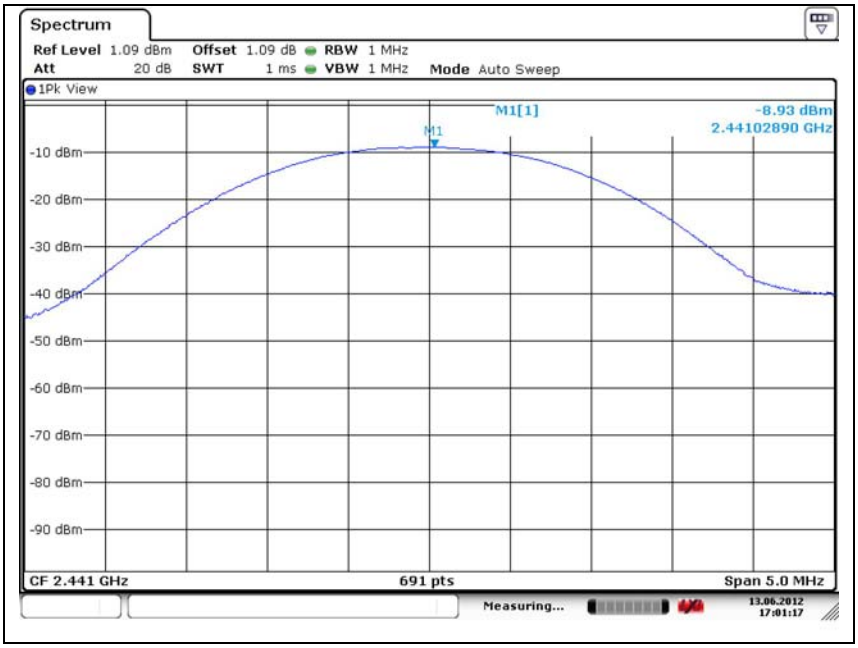
Test results

Operation mode	Frequency(㎒)	Output power (㏈m)	Limit (㏈m)
8DPSK(3Mbps)	2 402	-10.37	30
	2 441	-8.93	30
	2 480	-8.53	30

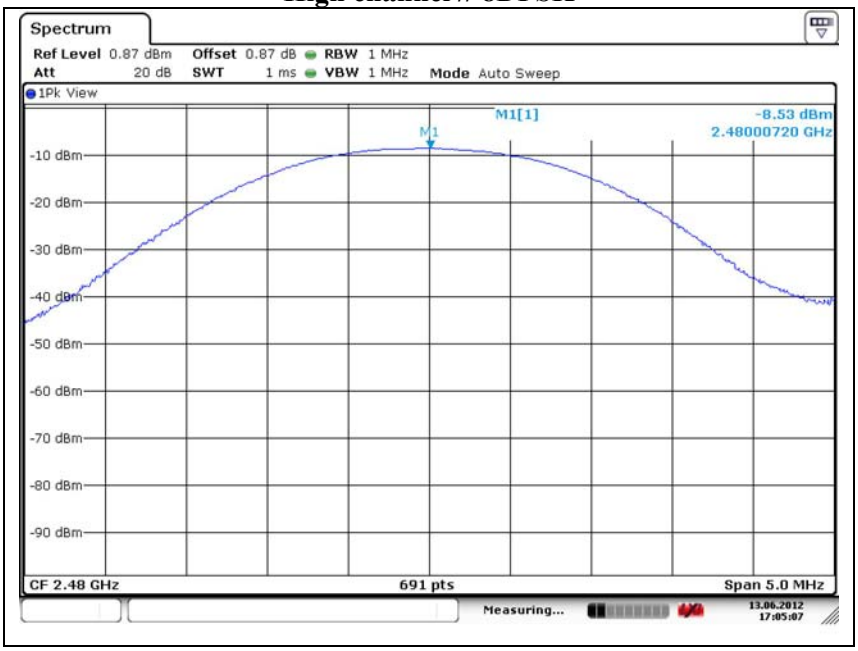
Low channel // 8DPSK



Middle channel // 8DPSK

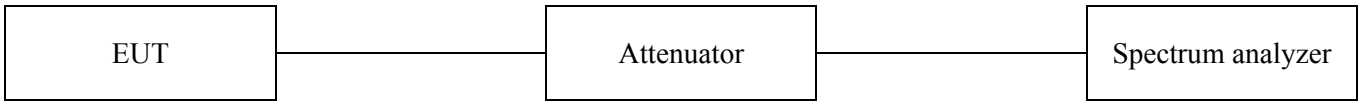


High channel // 8DPSK



2.1.6 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

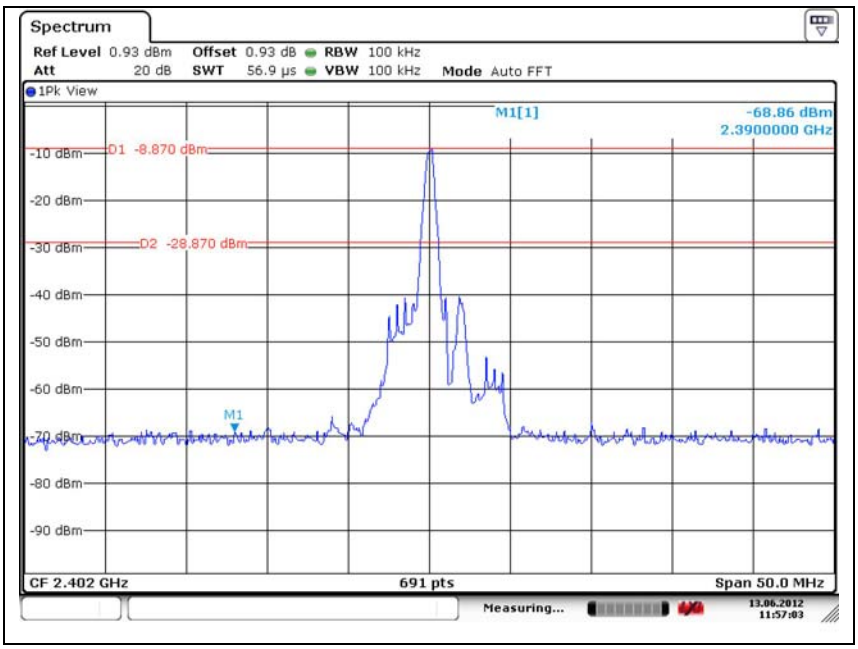
1. Use the following spectrum analyzer setting
   Center frequency: Low, middle and high channel.
   Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.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

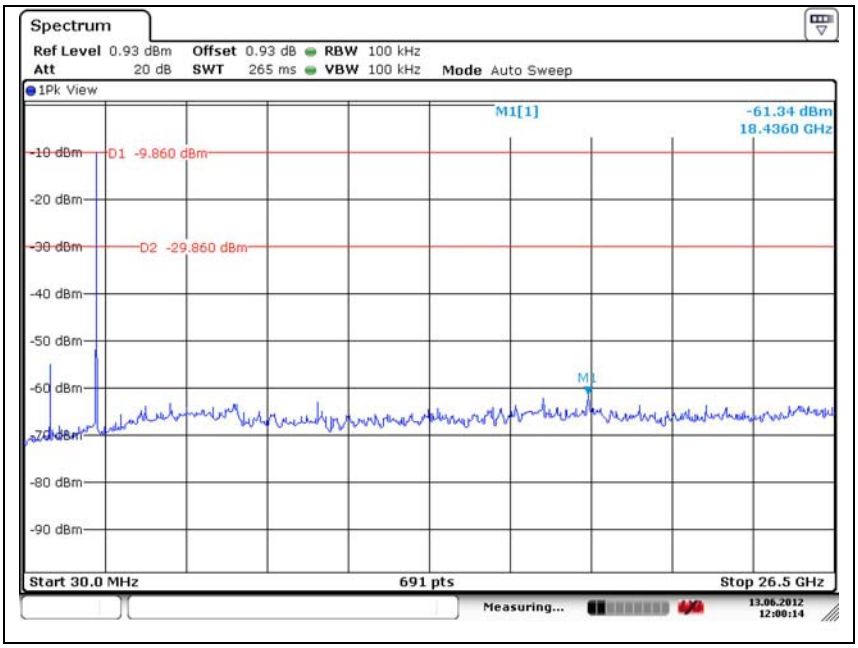
Limit

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))

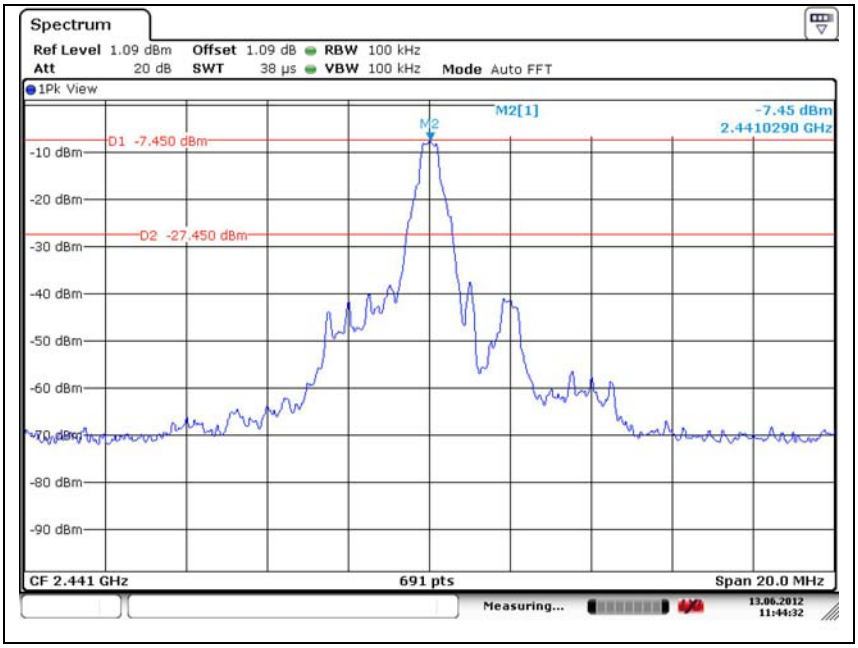
Test results

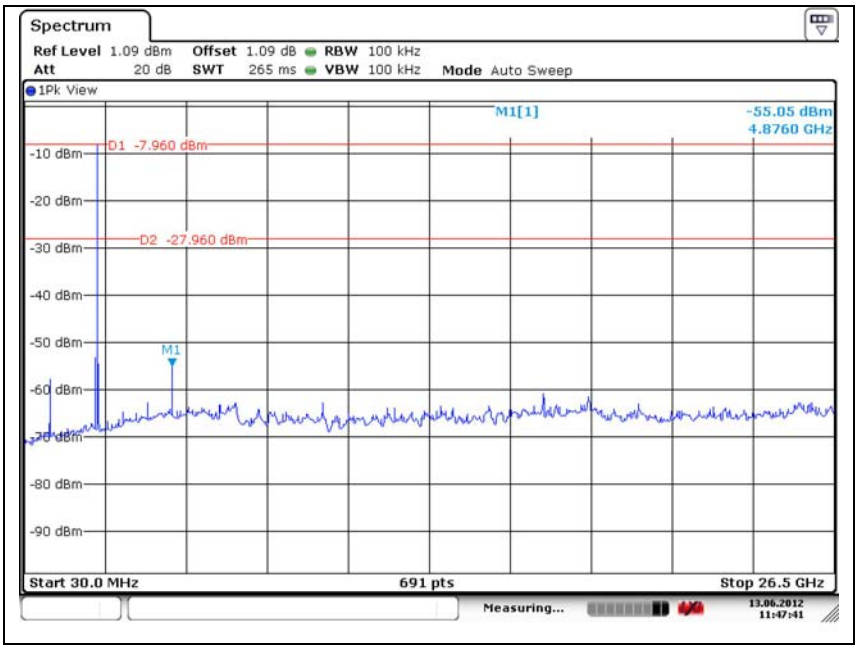
Low channel // GFSK



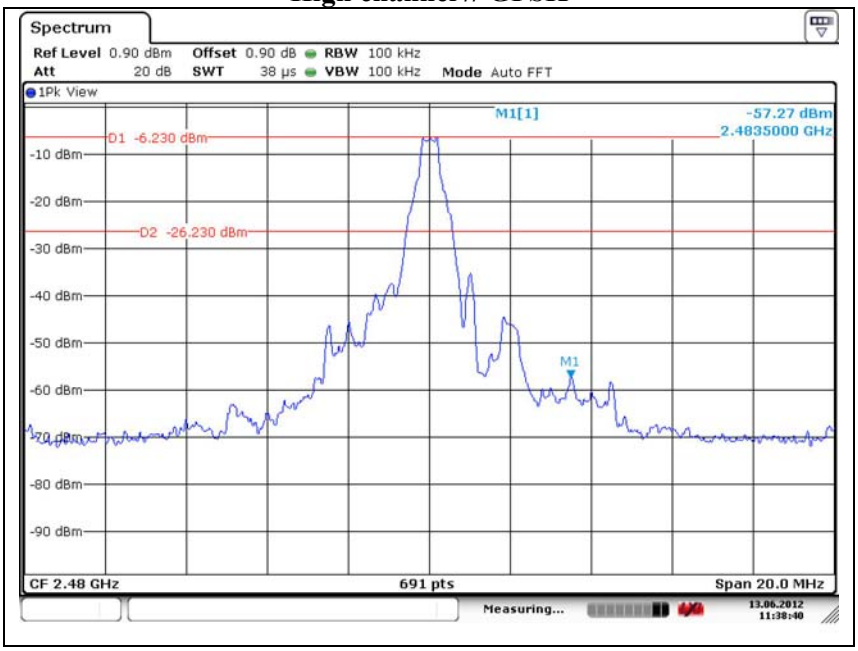


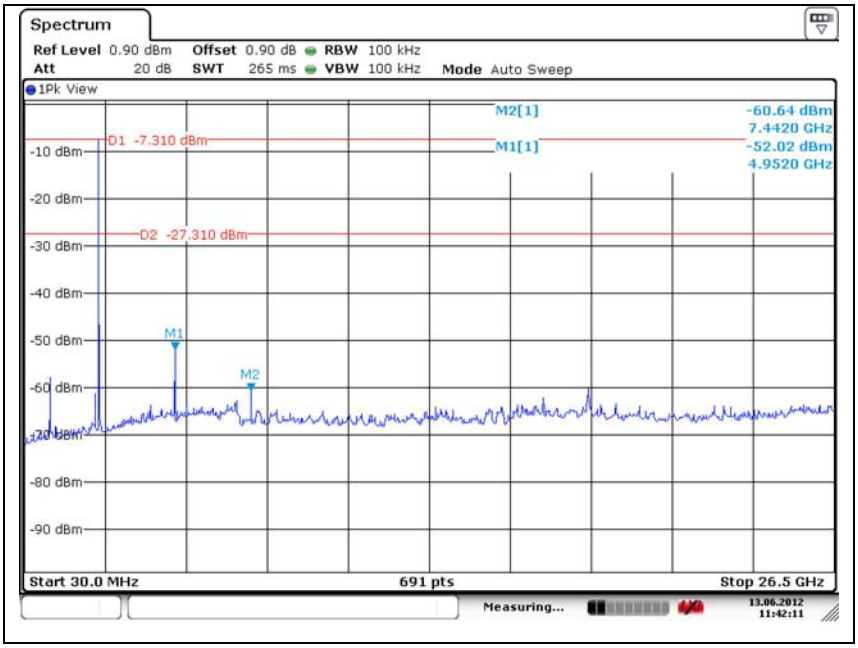
Middle channel // GFSK



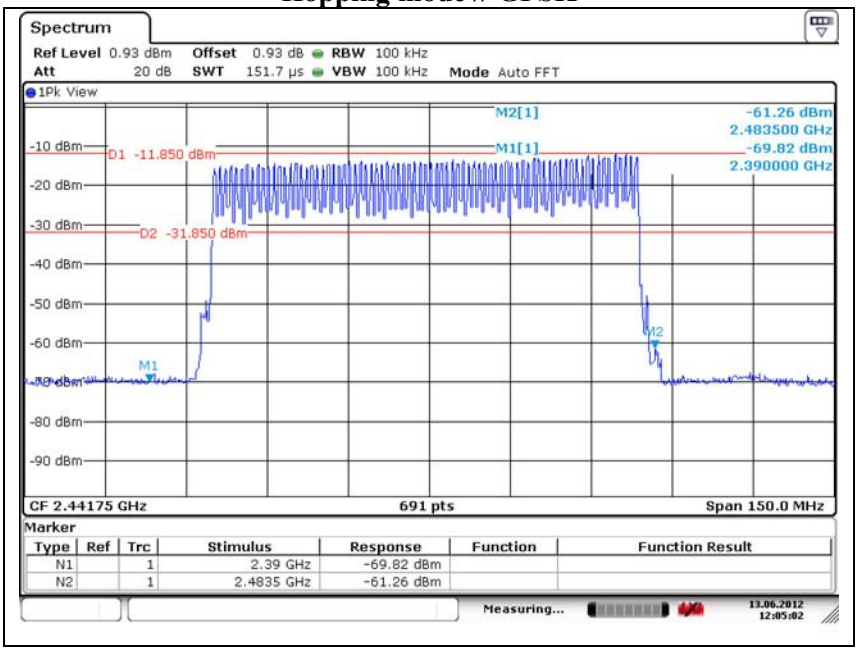


High channel // GFSK

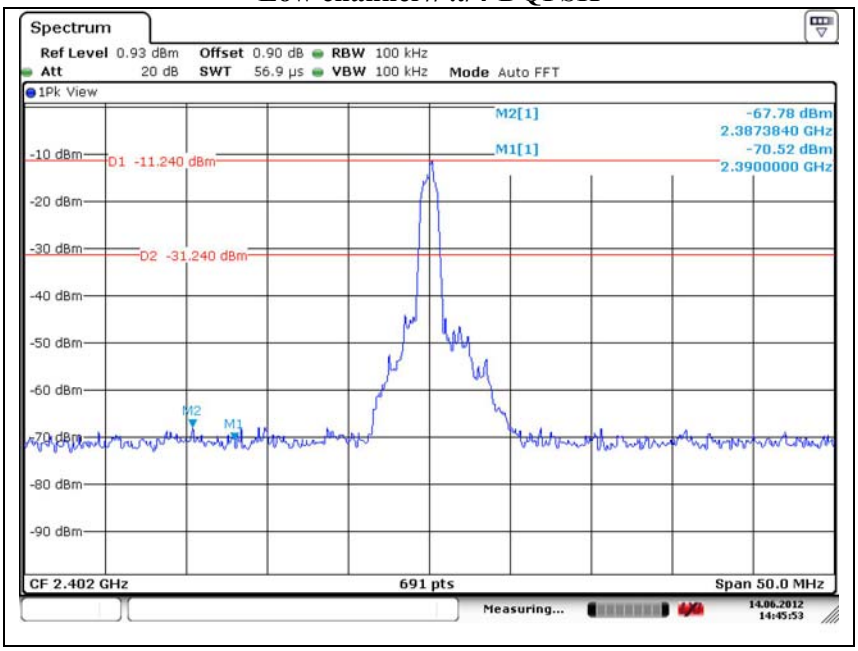


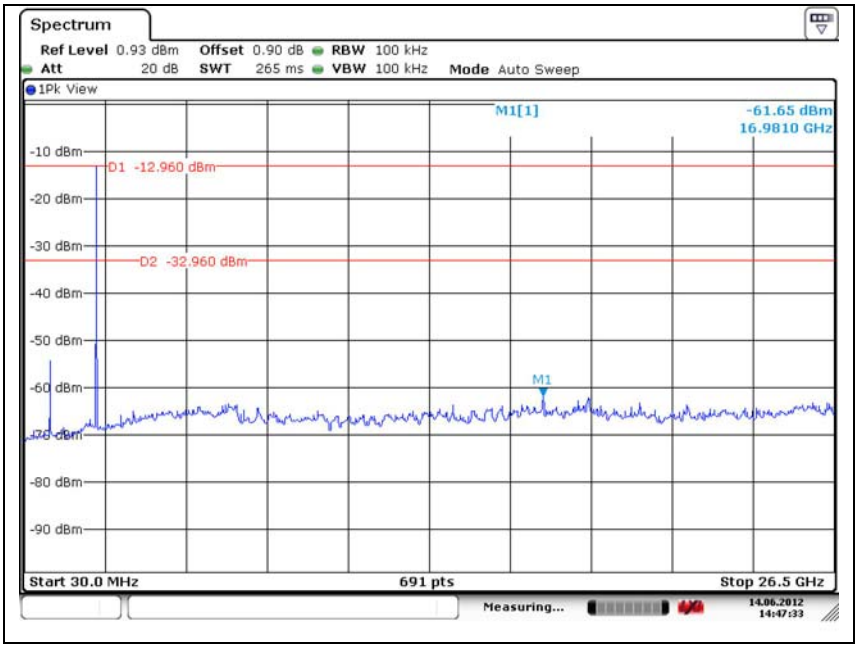


Hopping mode // GFSK

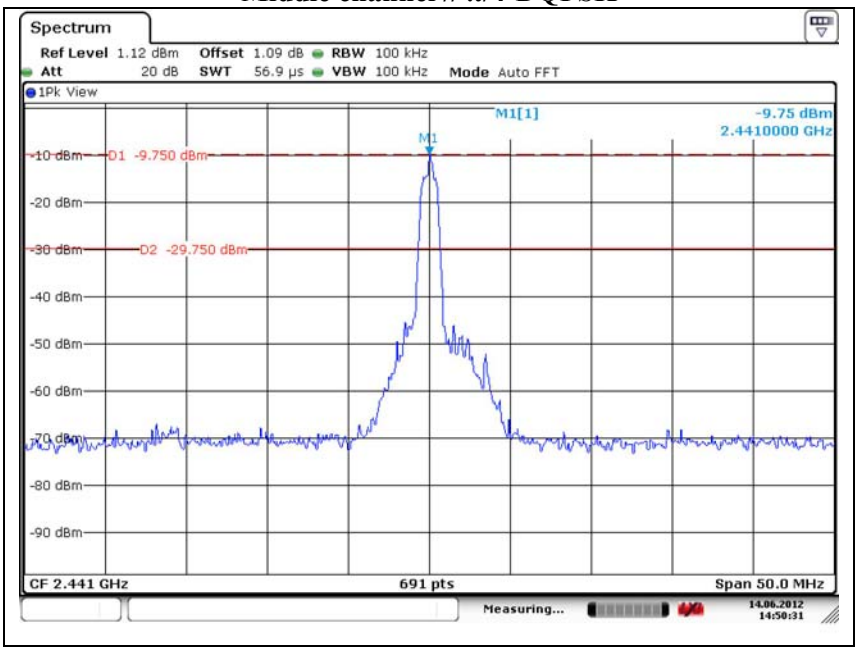


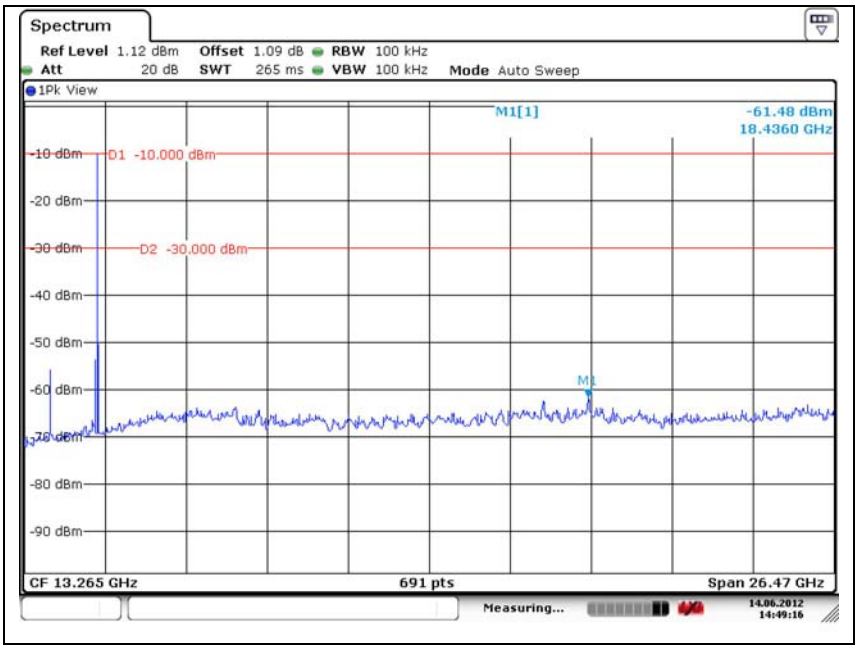
Low channel // π/4-DQPSK



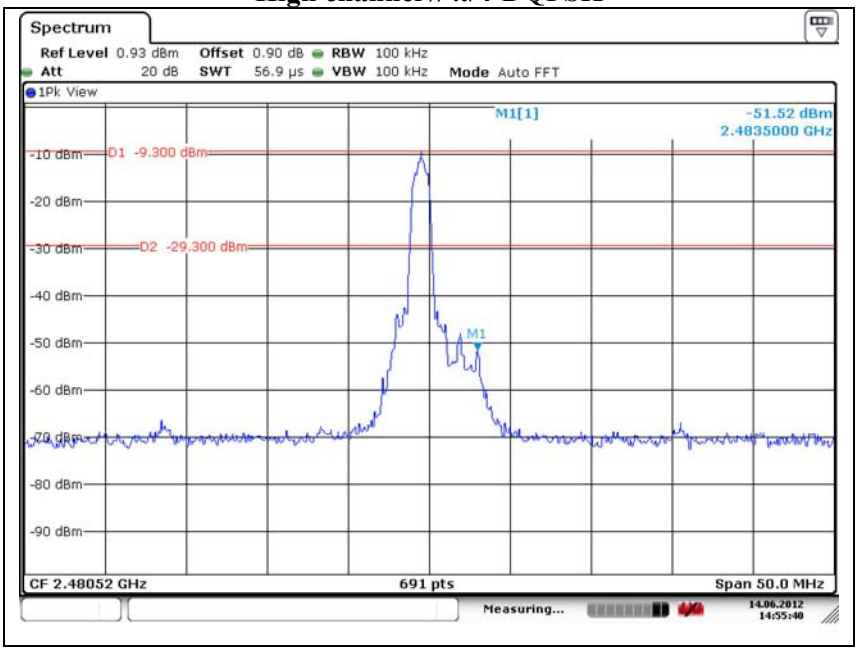


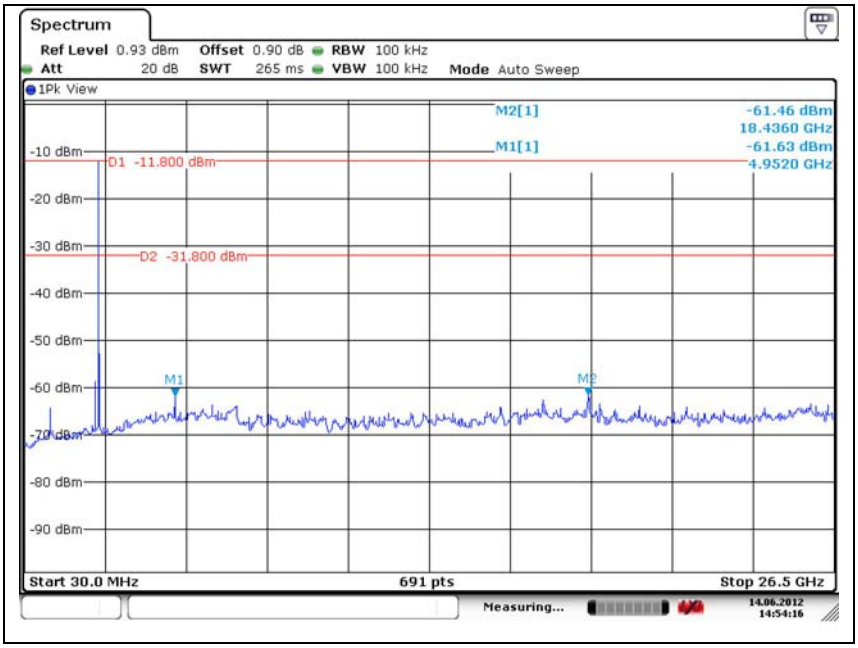
Middle channel // π/4-DQPSK



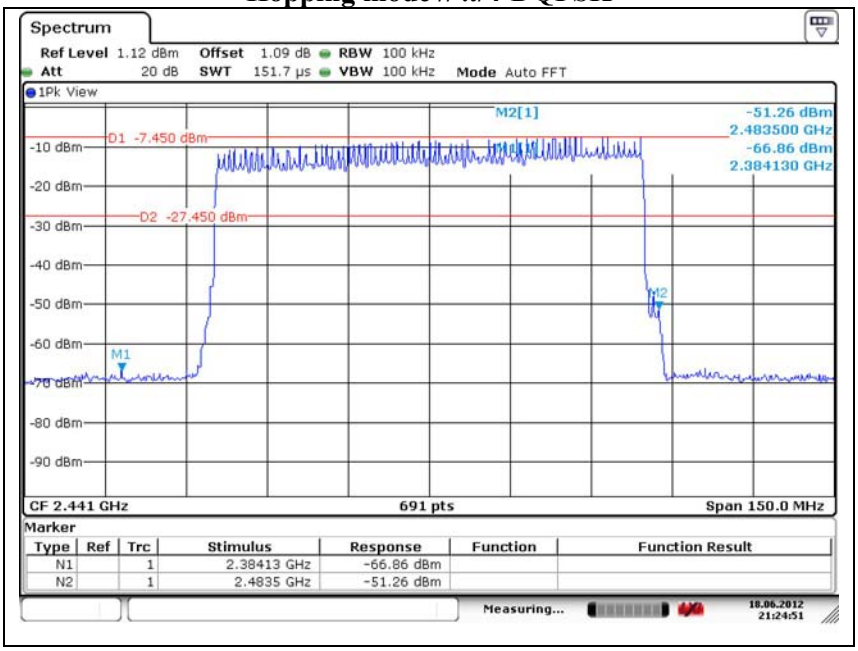


High channel // π/4-DQPSK

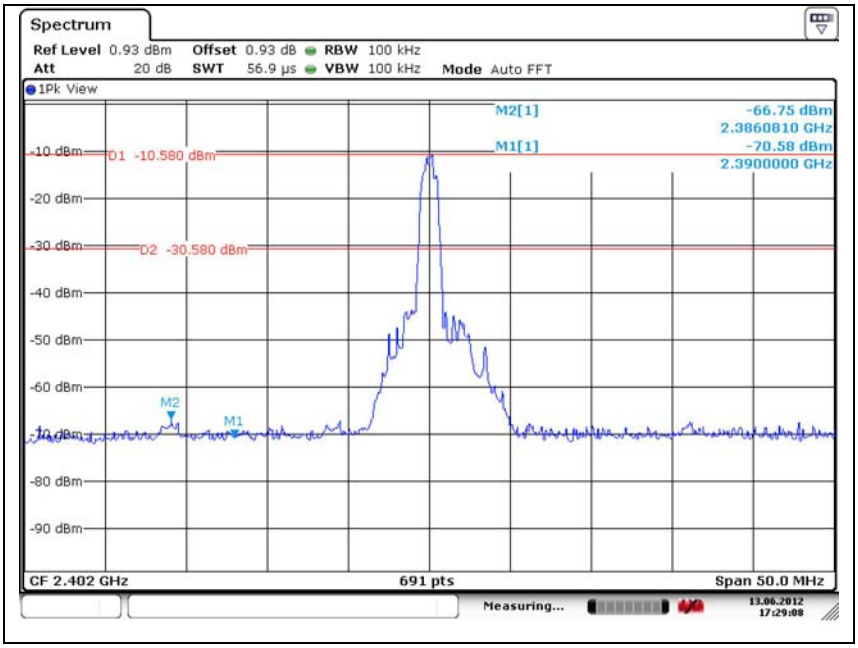


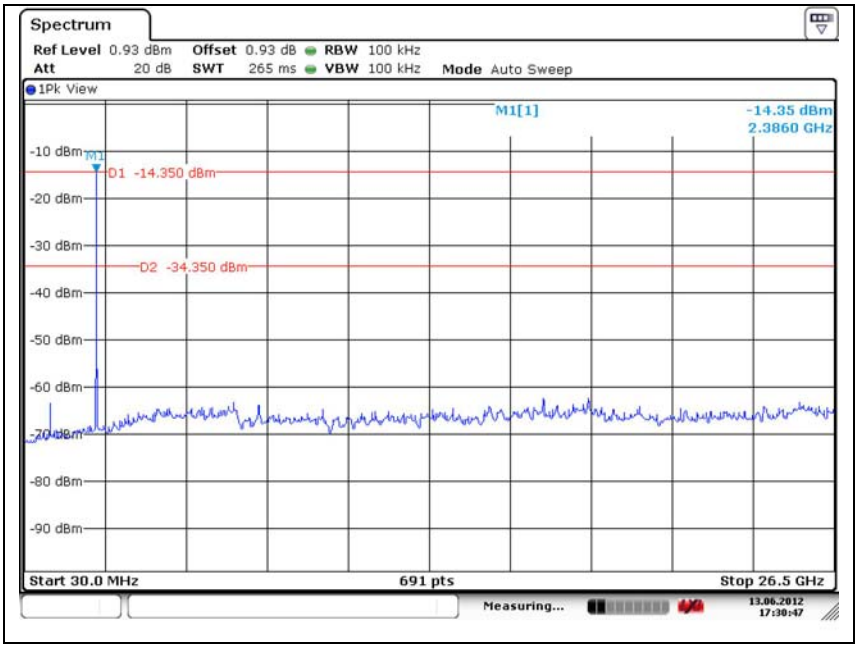


Hopping mode // π/4-DQPSK

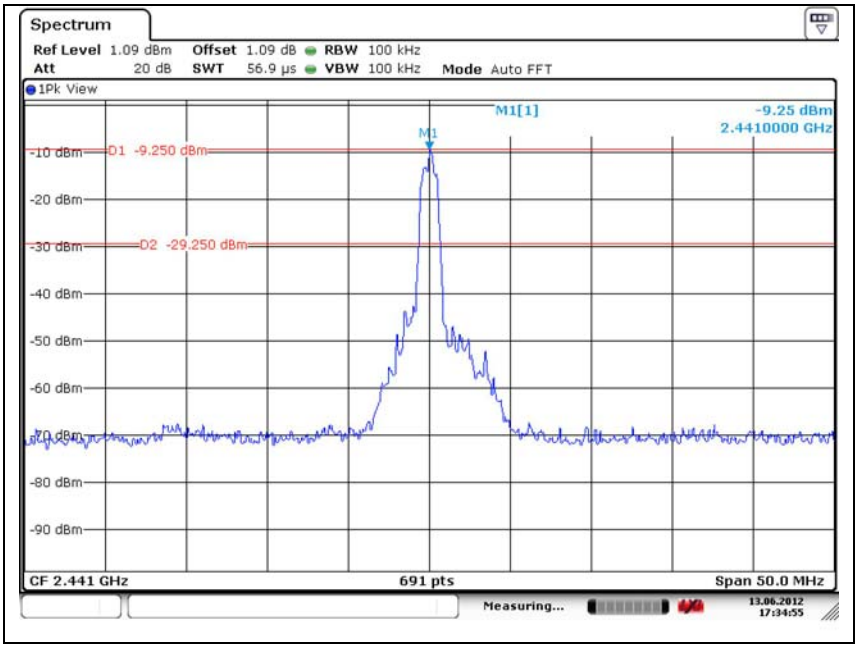


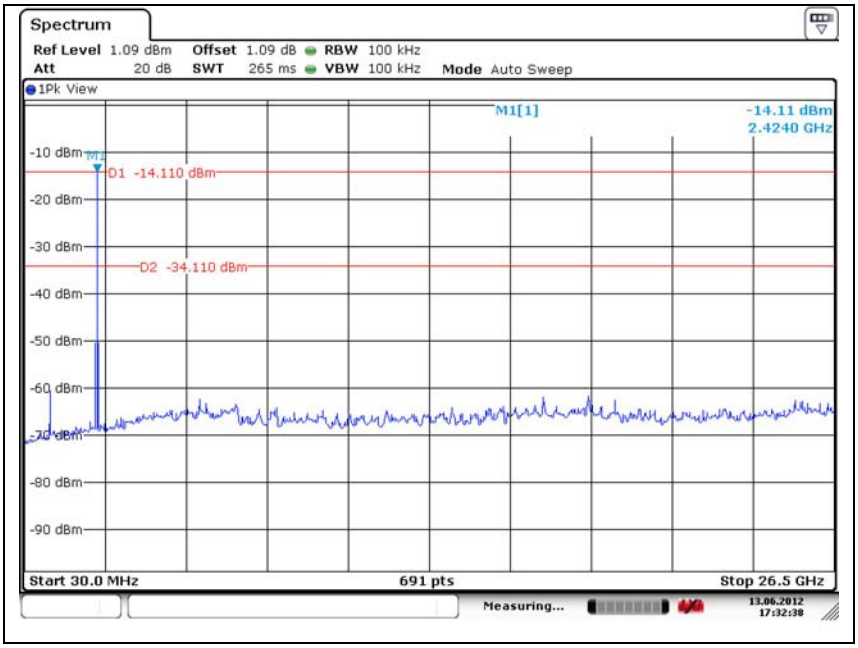
Low channel // 8DPSK



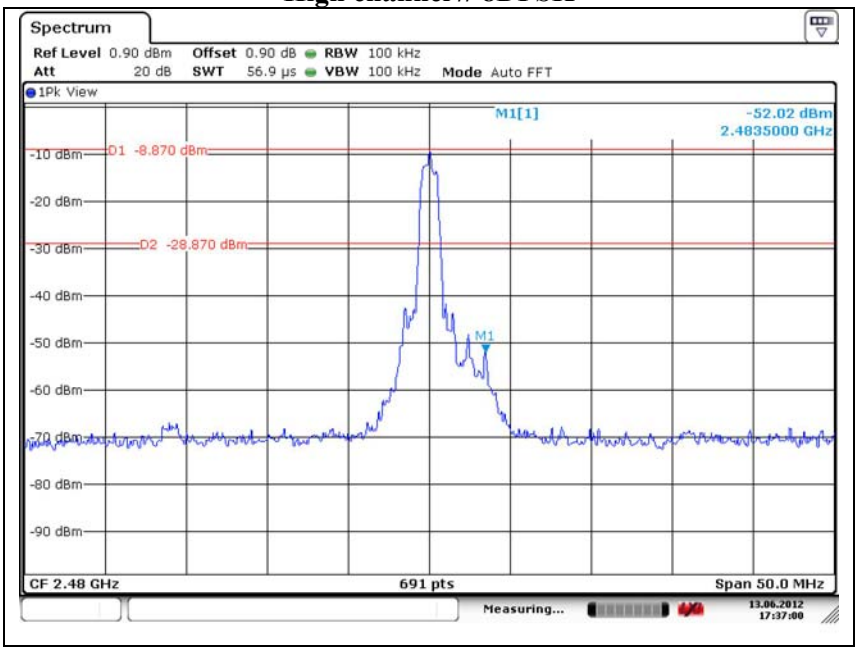


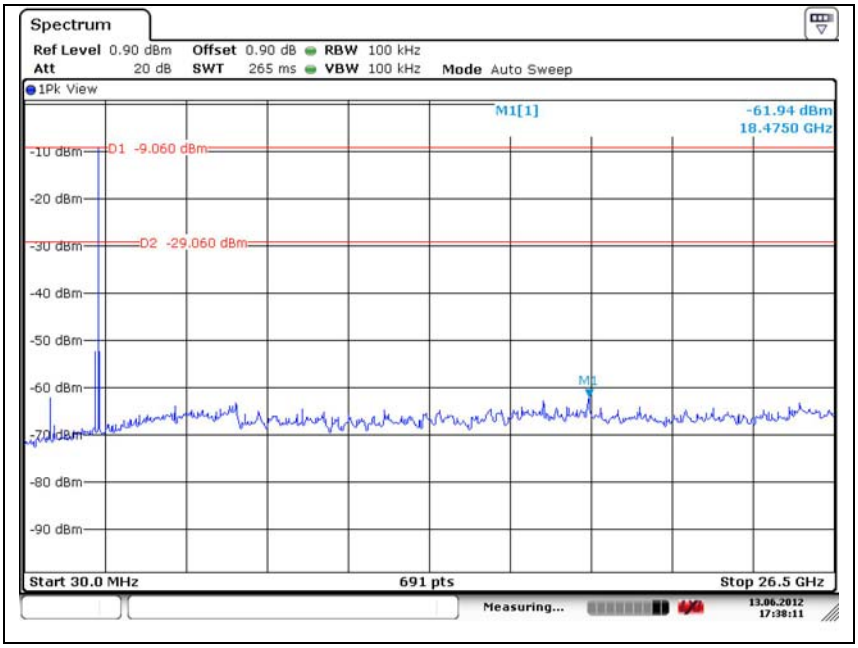
Middle channel // 8DPSK



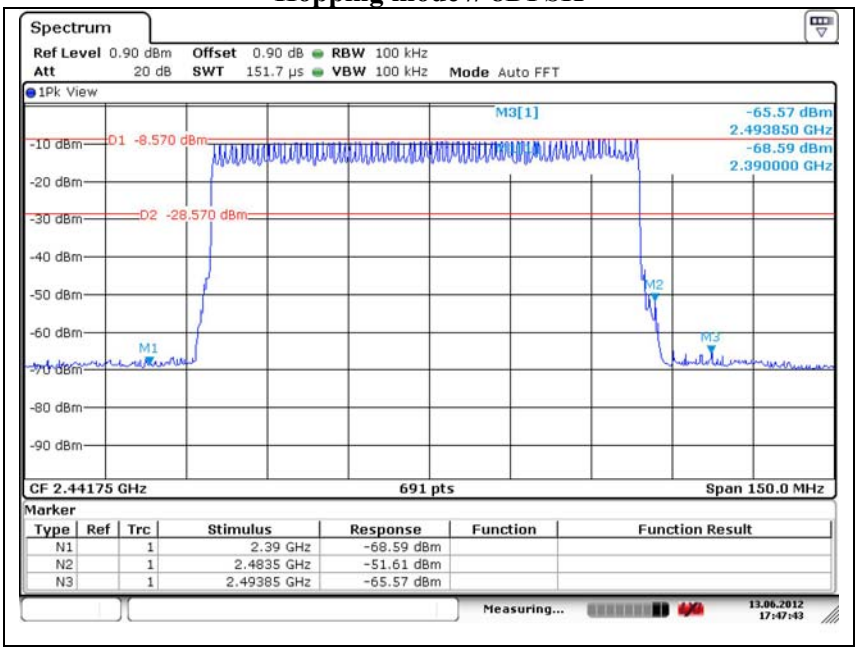


High channel // 8DPSK





Hopping mode // 8DPSK



2.1.7 Radiated spurious emission & band edge

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

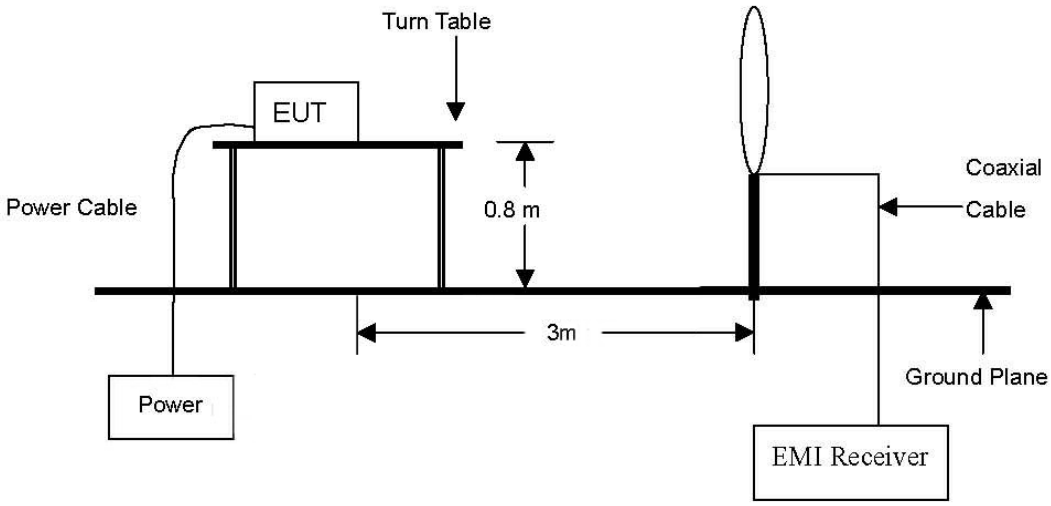
Test procedures
[9 ㎑ to 30 ㎒]
The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation. Then antenna is a loop antenna is fixed at one meter above the ground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

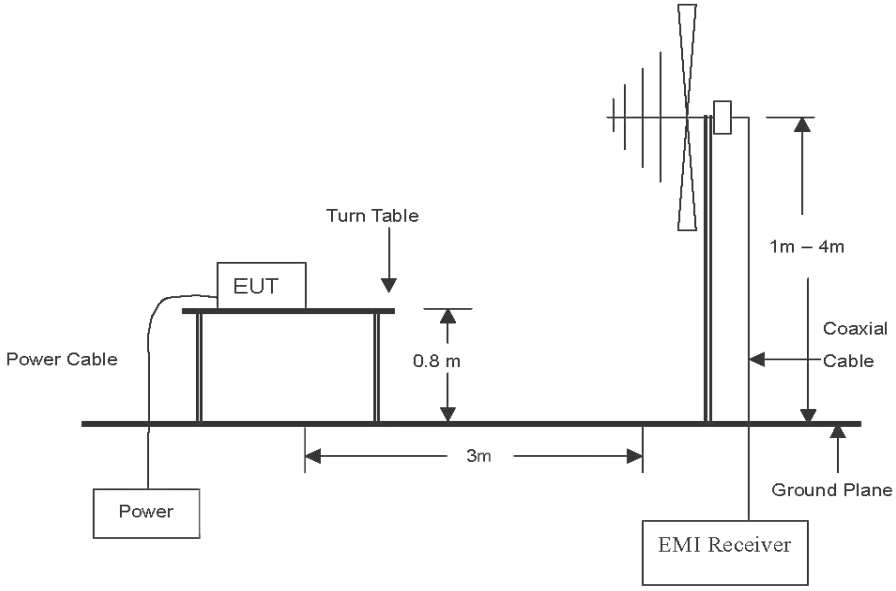
[30 ㎒ to 1 ㎓ and 1 ㎓ to 24 ㎓]
The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity.
The measurement was made in both the vertical and horizontal polarization, and the maximum value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

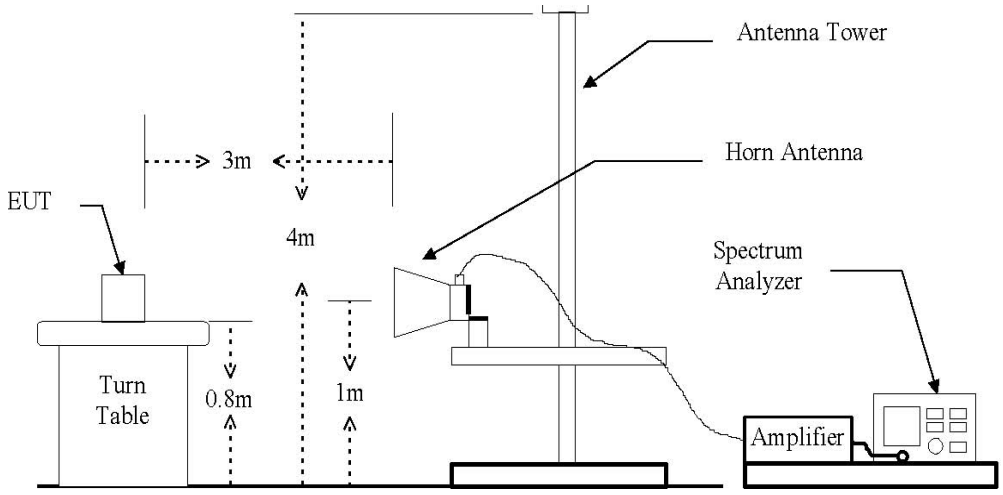
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



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 ~ 30.00	30	30
30 ~ 88	3	100
88 ~ 216	3	150
216 ~ 960	3	200
Above 960	3	500

Test results (Below 30 ㎒)

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 ㏈.

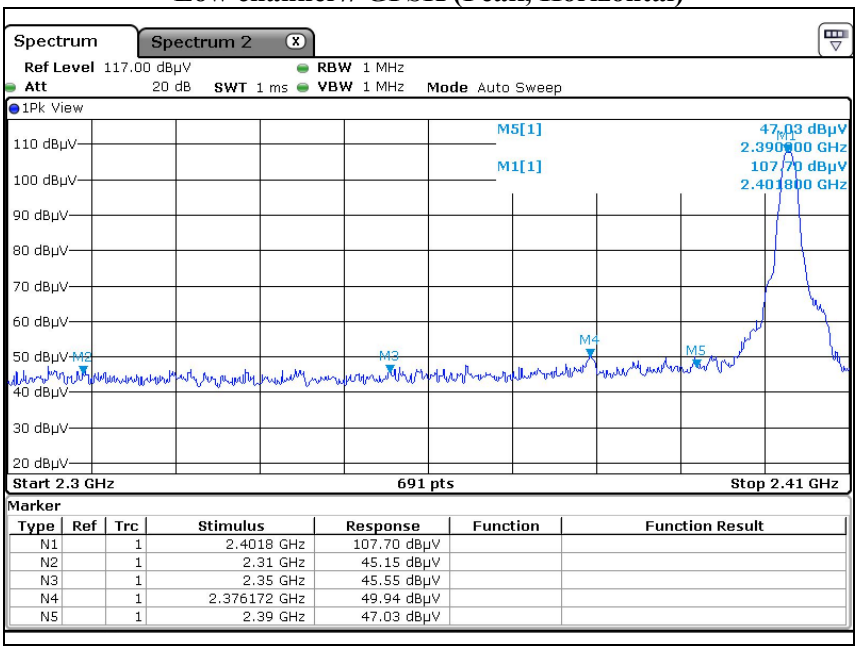
Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (㏈㎶)	Pol.	Ant. factor (㏈/m)	Cable loss (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
163.400	22.46	H	13.03	1.61	37.10	43.50	6.4
216.700	20.43	H	10.52	1.81	32.76	46.00	13.24
393.800	18.23	H	15.47	2.18	35.88	46.00	10.12
393.800	17.03	V	15.47	2.18	34.68	46.00	11.32
561.500	14.85	H	18.96	2.74	36.55	46.00	9.45

※ Remark

1. All spurious emission at channels are almost the same below 1 ㎓, so that high 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 ㎒)

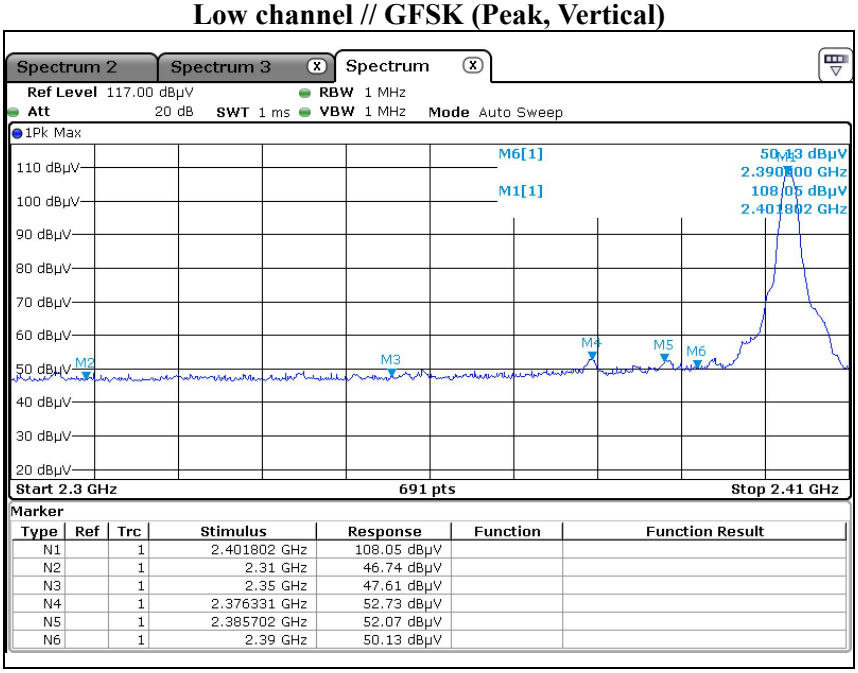
Low channel // GFSK (Peak, Horizontal)



Marker

Type	Ref	Trc	Stimulus	Response	Function	Function Result
N1		1	2.4018 GHz	107.70 dBµV		
N2		1	2.31 GHz	45.15 dBµV		
N3		1	2.35 GHz	45.55 dBµV		
N4		1	2.376172 GHz	49.94 dBµV		
N5		1	2.39 GHz	47.03 dBµV		

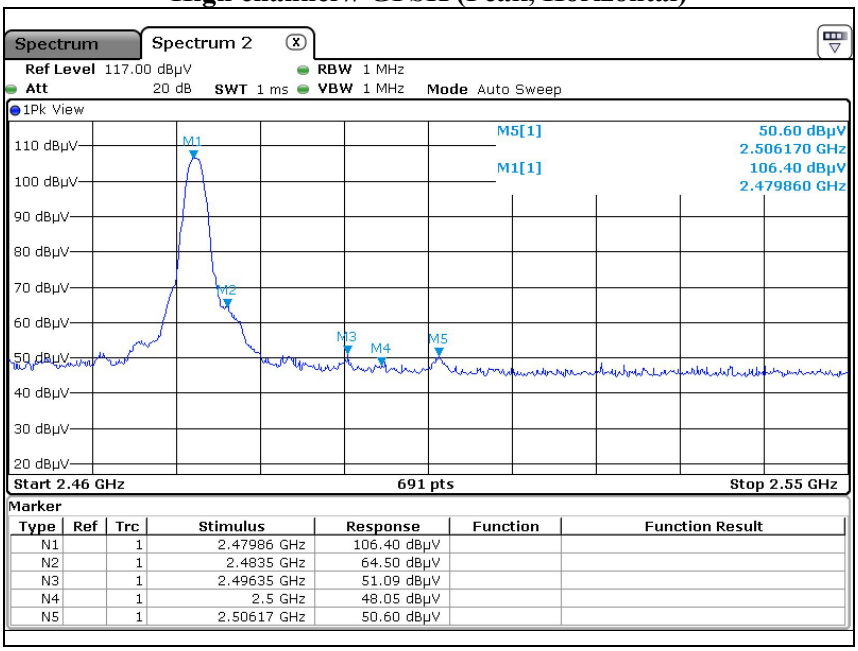
Low channel // GFSK (Peak, Vertical)



Marker

Type	Ref	Trc	Stimulus	Response	Function	Function Result
N1		1	2.401802 GHz	108.05 dBµV		
N2		1	2.31 GHz	46.74 dBµV		
N3		1	2.35 GHz	47.61 dBµV		
N4		1	2.376331 GHz	52.73 dBµV		
N5		1	2.385702 GHz	52.07 dBµV		
N6		1	2.39 GHz	50.13 dBµV		

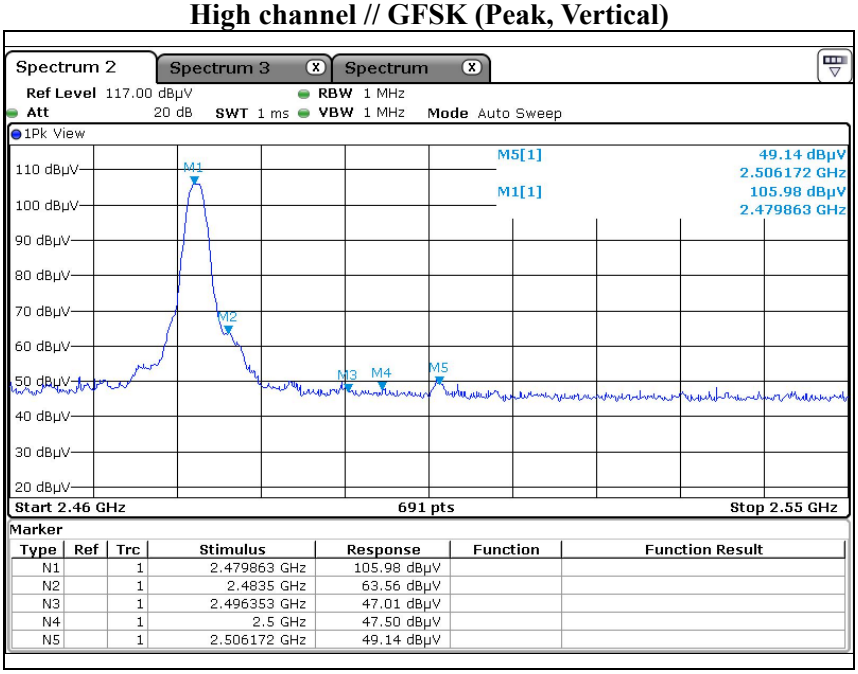
High channel // GFSK (Peak, Horizontal)



Marker

Type	Ref	Trc	Stimulus	Response	Function	Function Result
N1		1	2.47986 GHz	106.40 dBµV		
N2		1	2.4835 GHz	64.50 dBµV		
N3		1	2.49635 GHz	51.09 dBµV		
N4		1	2.5 GHz	48.05 dBµV		
N5		1	2.50617 GHz	50.60 dBµV		

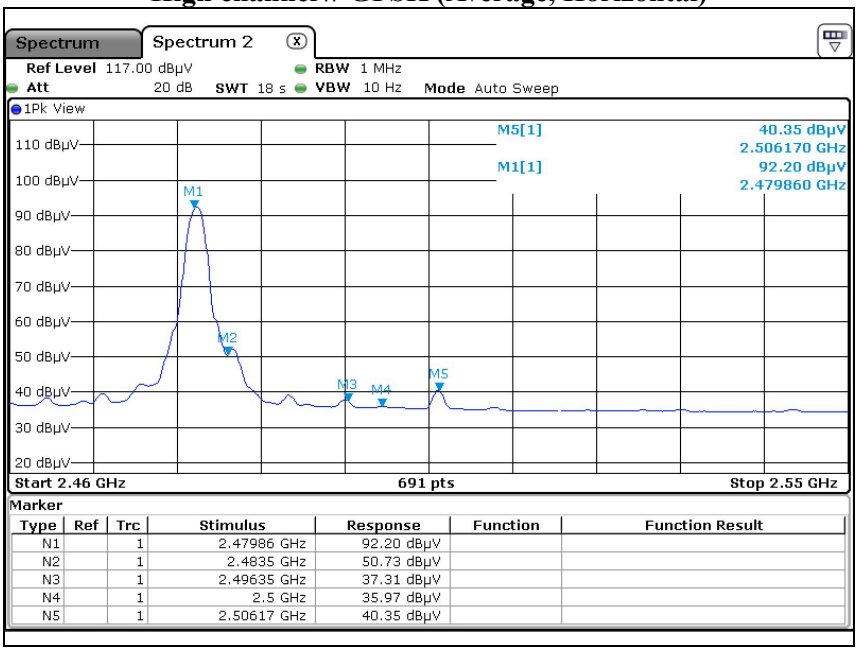
High channel // GFSK (Peak, Vertical)



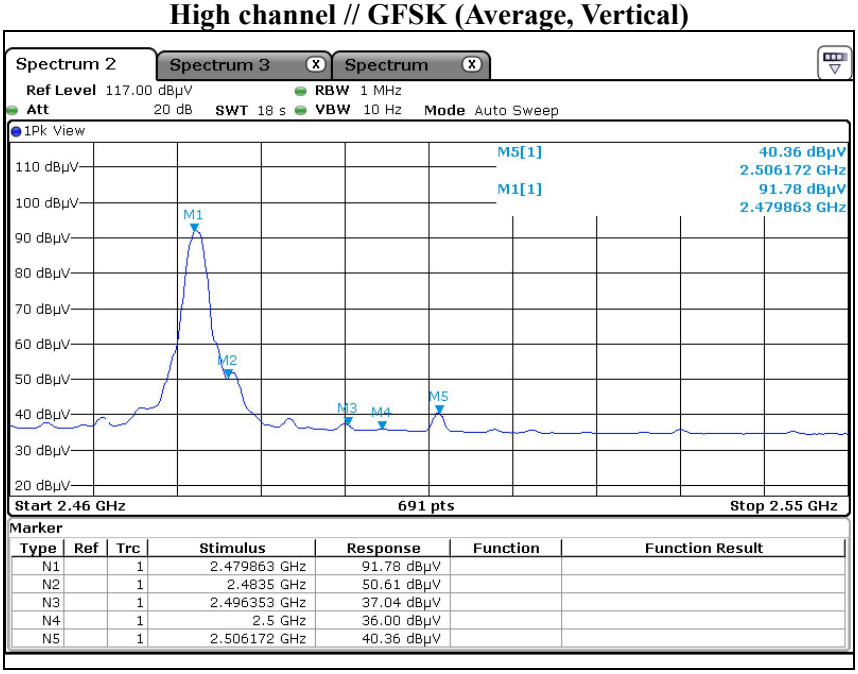
Marker

Type	Ref	Trc	Stimulus	Response	Function	Function Result
N1		1	2.479863 GHz	105.98 dBµV		
N2		1	2.4835 GHz	63.56 dBµV		
N3		1	2.496353 GHz	47.01 dBµV		
N4		1	2.5 GHz	47.50 dBµV		
N5		1	2.506172 GHz	49.14 dBµV		

High channel // GFSK (Average, Horizontal)



High channel // GFSK (Average, 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)
2 390.0	47.03	Peak	H	28.31	-38.88	36.46	74.00	37.54
2 390.0	50.13	Peak	V	28.31	-38.88	39.56	74.00	34.44
4 809.0	46.94	Peak	H	33.92	-33.32	47.54	74.00	26.46
4 089.0	46.40	Peak	V	33.92	-33.32	47.00	74.00	27.00

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)
4 882.0	47.18	Peak	H	34.16	-31.08	50.26	74.00	23.74
4 882.0	45.22	Peak	V	34.16	-31.08	48.30	74.00	25.70

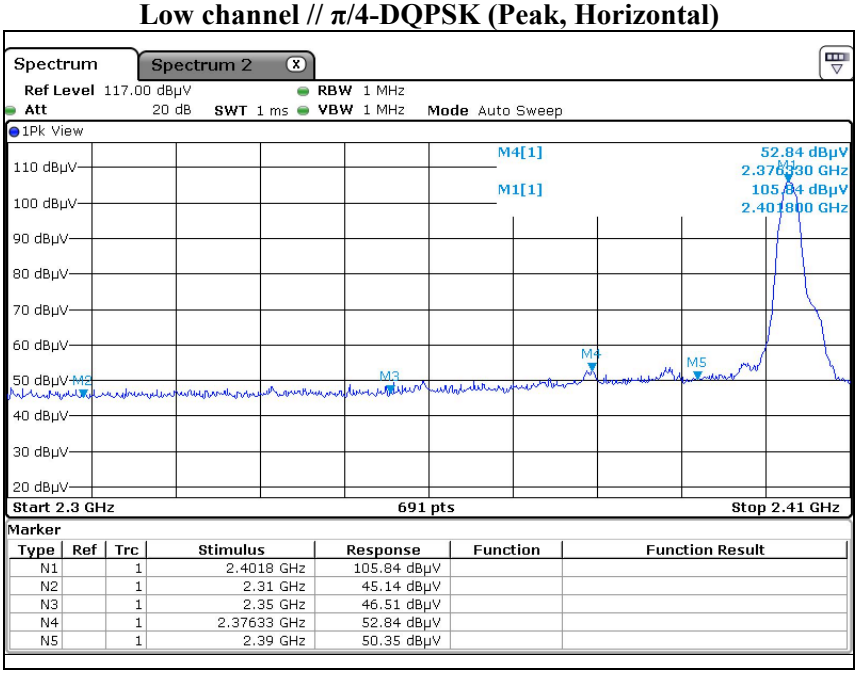
High channel // GFSK

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)
2 483.5	64.50	Peak	H	28.50	-38.73	54.27	74.00	19.73
2 483.5	50.73	Average	H	28.50	-38.73	40.50	54.00	13.50
2 483.5	63.56	Peak	V	28.50	-38.73	53.33	74.00	20.67
2 483.5	50.61	Average	V	28.50	-38.73	40.38	54.00	13.62
4 964.0	49.38	Peak	H	34.43	-30.44	53.37	74.00	20.63
4 964.0	46.00	Peak	V	34.43	-30.44	49.99	74.00	24.01

※ 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.

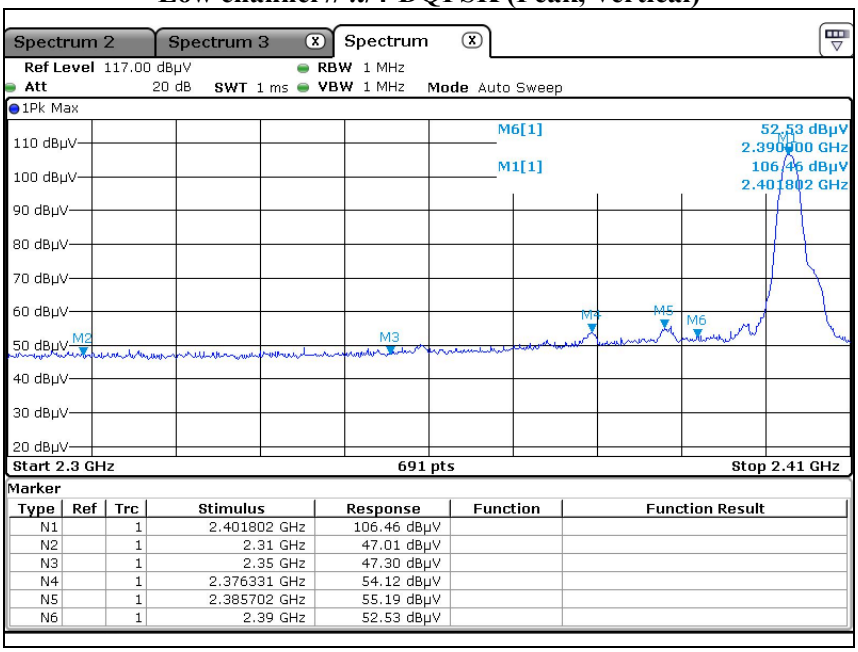
Low channel // π/4-DQPSK (Peak, Horizontal)



Marker

Type	Ref	Trc	Stimulus	Response	Function	Function Result
N1		1	2.4018 GHz	105.84 dBµV		
N2		1	2.31 GHz	45.14 dBµV		
N3		1	2.35 GHz	46.51 dBµV		
N4		1	2.37633 GHz	52.84 dBµV		
N5		1	2.39 GHz	50.35 dBµV		

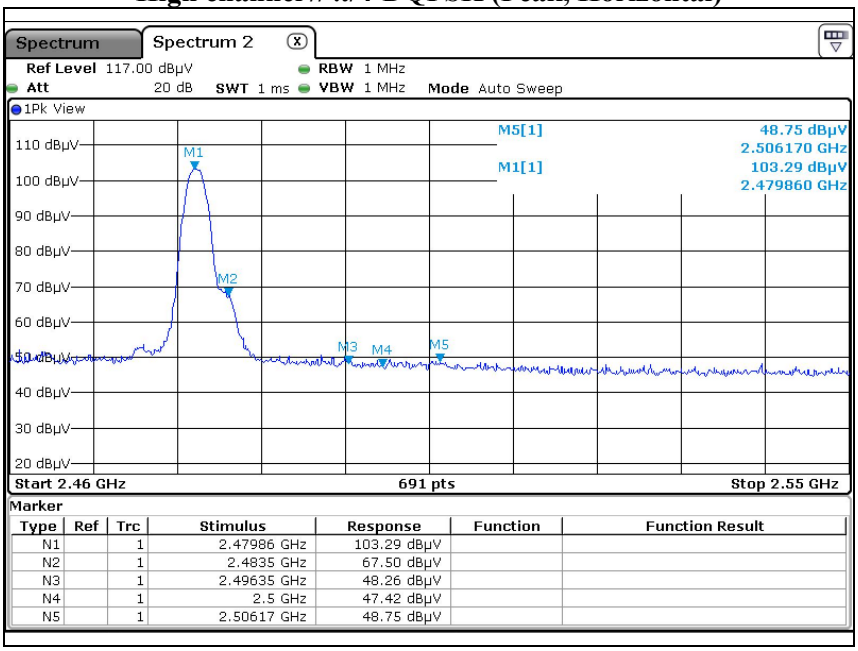
Low channel // π/4-DQPSK (Peak, Vertical)



Marker

Type	Ref	Trc	Stimulus	Response	Function	Function Result
N1		1	2.401802 GHz	106.46 dBµV		
N2		1	2.31 GHz	47.01 dBµV		
N3		1	2.35 GHz	47.30 dBµV		
N4		1	2.376331 GHz	54.12 dBµV		
N5		1	2.385702 GHz	55.19 dBµV		
N6		1	2.39 GHz	52.53 dBµV		

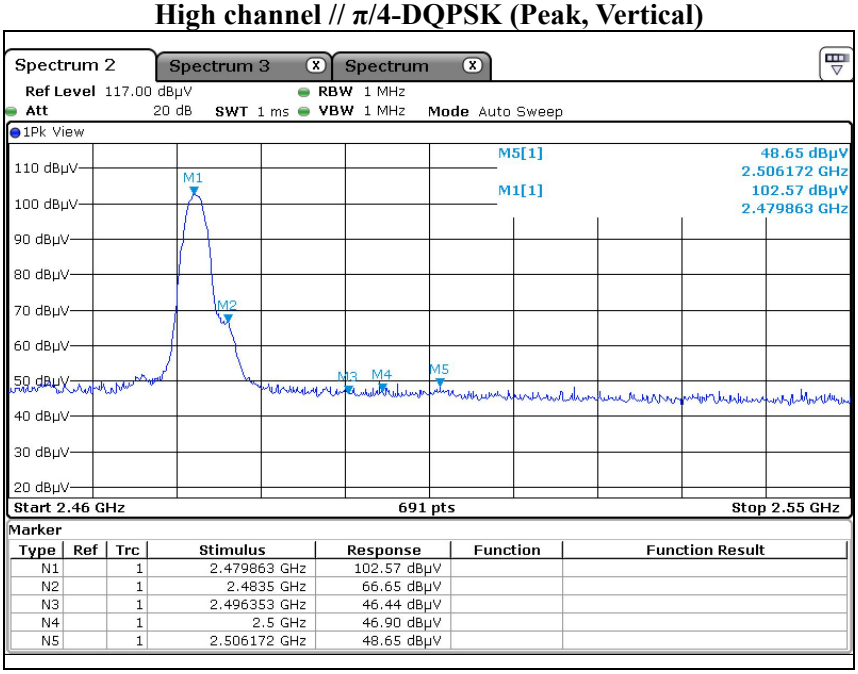
High channel // π/4-DQPSK (Peak, Horizontal)



Marker

Type	Ref	Trc	Stimulus	Response	Function	Function Result
N1		1	2.47986 GHz	103.29 dBµV		
N2		1	2.4835 GHz	67.50 dBµV		
N3		1	2.49635 GHz	48.26 dBµV		
N4		1	2.5 GHz	47.42 dBµV		
N5		1	2.50617 GHz	48.75 dBµV		

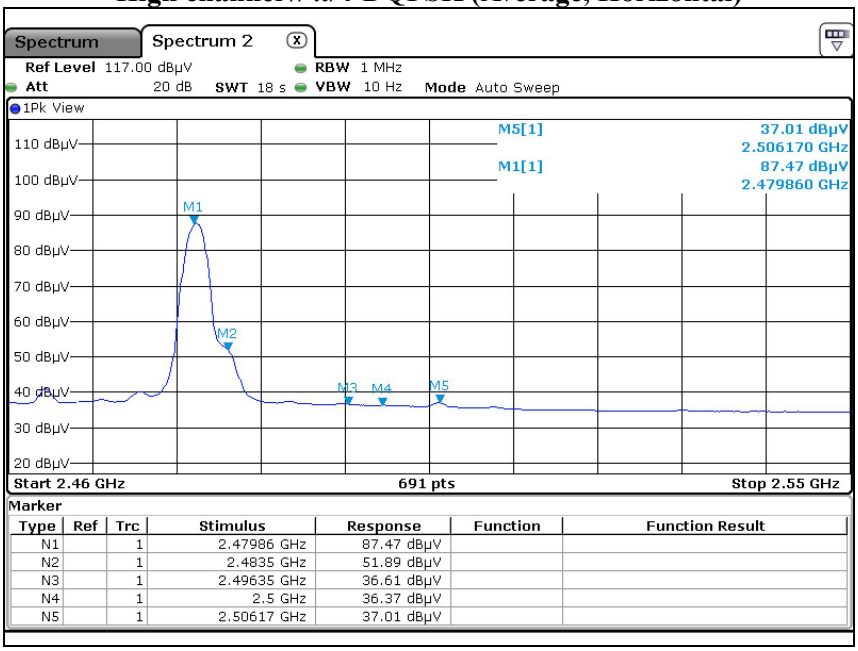
High channel // π/4-DQPSK (Peak, Vertical)



Marker

Type	Ref	Trc	Stimulus	Response	Function	Function Result
N1		1	2.479863 GHz	102.57 dBµV		
N2		1	2.4835 GHz	66.65 dBµV		
N3		1	2.496353 GHz	46.44 dBµV		
N4		1	2.5 GHz	46.90 dBµV		
N5		1	2.506172 GHz	48.65 dBµV		

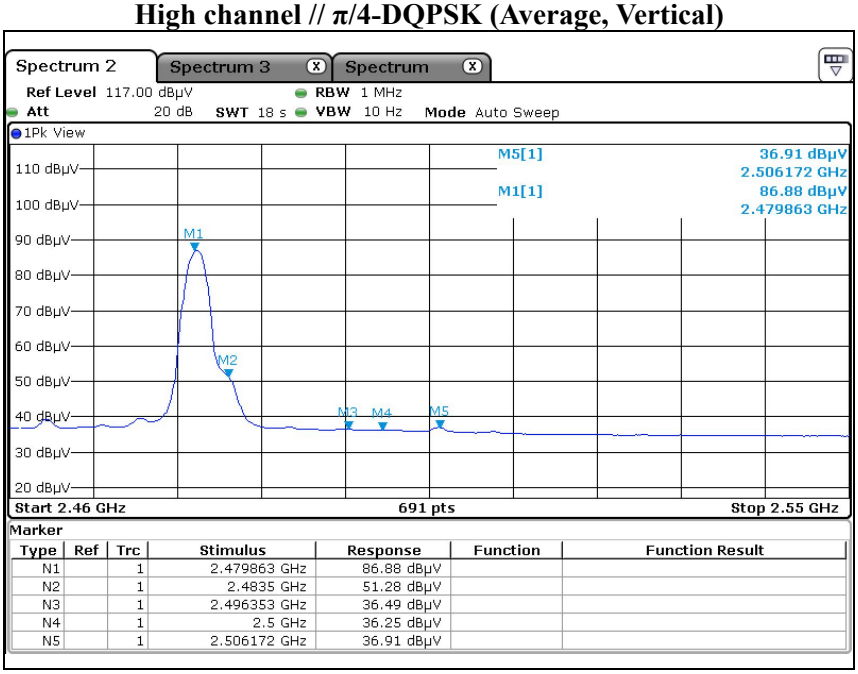
High channel // π/4-DQPSK (Average, Horizontal)



Marker

Type	Ref	Trc	Stimulus	Response	Function	Function Result
N1		1	2.47986 GHz	87.47 dBµV		
N2		1	2.4835 GHz	51.89 dBµV		
N3		1	2.49635 GHz	36.61 dBµV		
N4		1	2.5 GHz	36.37 dBµV		
N5		1	2.50617 GHz	37.01 dBµV		

High channel // π/4-DQPSK (Average, Vertical)



Marker

Type	Ref	Trc	Stimulus	Response	Function	Function Result
N1		1	2.479863 GHz	86.88 dBµV		
N2		1	2.4835 GHz	51.28 dBµV		
N3		1	2.496353 GHz	36.49 dBµV		
N4		1	2.5 GHz	36.25 dBµV		
N5		1	2.506172 GHz	36.91 dBµV		

Low channel // π/4-DQPSK

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)
2 390.0	50.35	Peak	H	28.31	-38.88	39.78	74.00	34.22
2 390.0	52.53	Peak	V	28.31	-38.88	41.96	74.00	32.04
4 809.0	47.49	Peak	H	33.92	-31.65	49.76	74.00	24.24
4 089.0	46.05	Peak	V	33.92	-31.65	48.32	74.00	25.68

Middle channel // π/4-DQPSK

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)
4 882.0	48.15	Peak	H	34.16	-31.08	51.23	74.00	22.77
4 882.0	46.72	Peak	V	34.16	-31.08	49.80	74.00	24.20

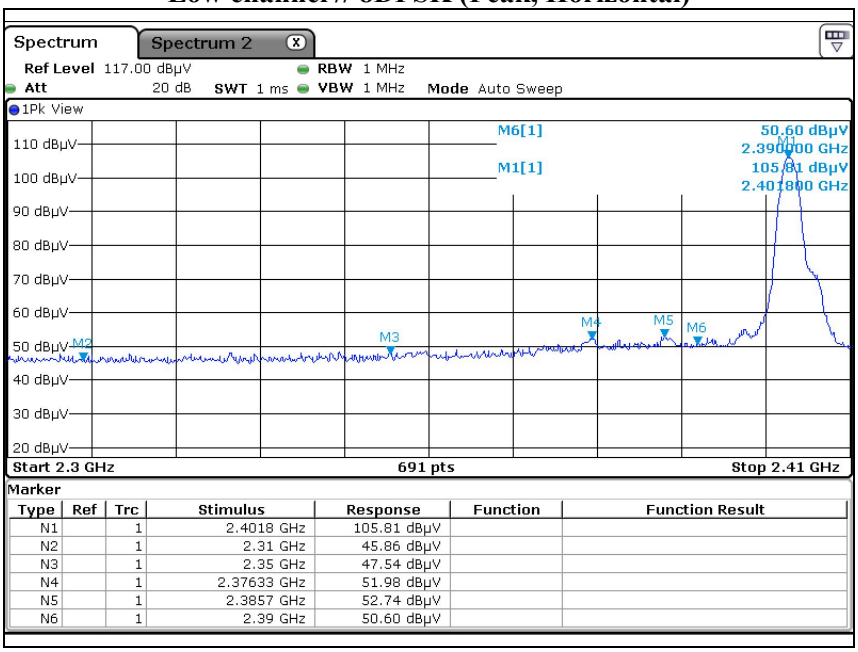
High channel // π/4-DQPSK

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)
2 483.5	67.50	Peak	H	28.50	-38.73	57.27	74.00	16.73
2 483.5	51.89	Average	H	28.50	-38.73	41.66	54.00	12.34
2 483.5	66.65	Peak	V	28.50	-38.73	56.42	74.00	17.58
2 483.5	51.28	Average	V	28.50	-38.73	41.05	54.00	12.95
4 964.0	44.88	Peak	H	34.43	-30.44	48.87	74.00	25.13
4 964.0	51.14	Peak	V	34.43	-30.44	55.43	74.00	18.57

※ 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.

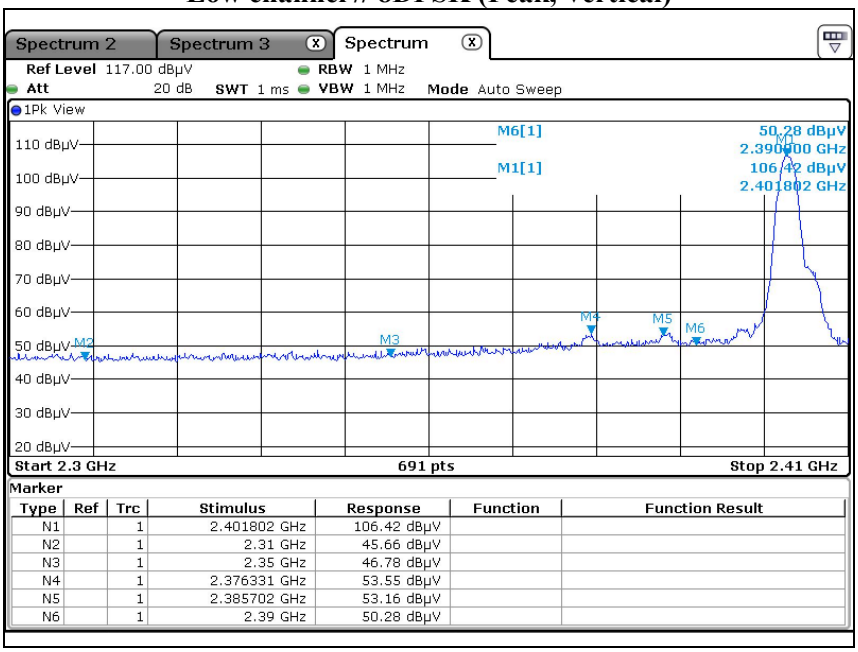
Low channel // 8DPSK (Peak, Horizontal)



Marker

Type	Ref	Trc	Stimulus	Response	Function	Function Result
N1		1	2.4018 GHz	105.81 dBµV		
N2		1	2.31 GHz	45.86 dBµV		
N3		1	2.35 GHz	47.54 dBµV		
N4		1	2.37633 GHz	51.98 dBµV		
N5		1	2.3857 GHz	52.74 dBµV		
N6		1	2.39 GHz	50.60 dBµV		

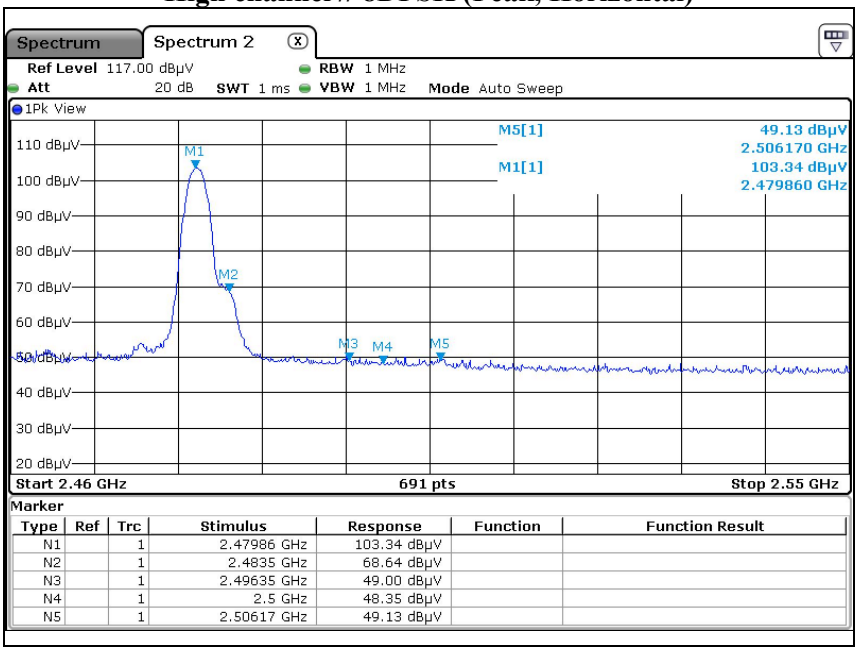
Low channel // 8DPSK (Peak, Vertical)



Marker

Type	Ref	Trc	Stimulus	Response	Function	Function Result
N1		1	2.401802 GHz	106.42 dBµV		
N2		1	2.31 GHz	45.66 dBµV		
N3		1	2.35 GHz	46.78 dBµV		
N4		1	2.376331 GHz	53.55 dBµV		
N5		1	2.385702 GHz	53.16 dBµV		
N6		1	2.39 GHz	50.28 dBµV		

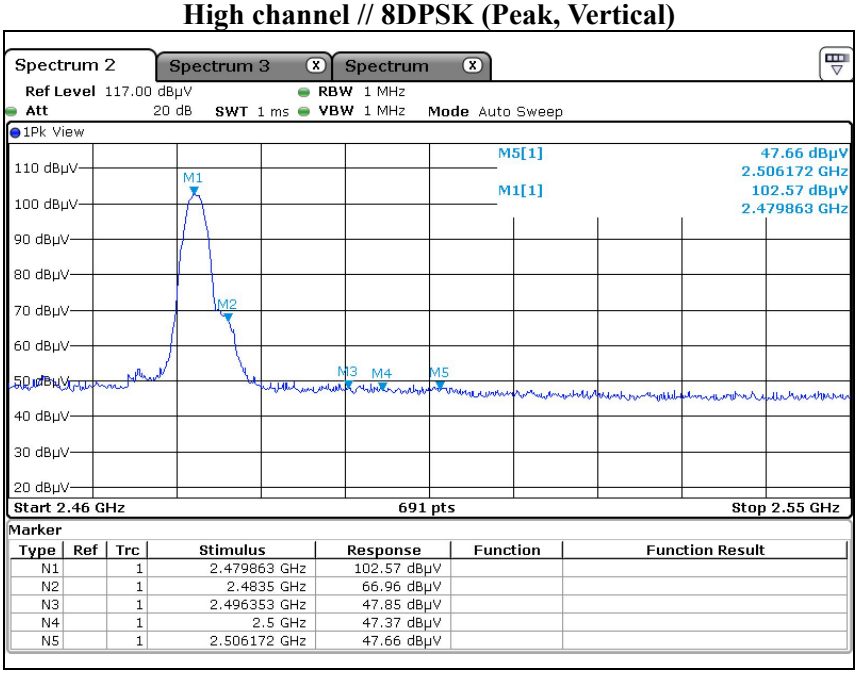
High channel // 8DPSK (Peak, Horizontal)



Marker

Type	Ref	Trc	Stimulus	Response	Function	Function Result
N1		1	2.47986 GHz	103.34 dBµV		
N2		1	2.4835 GHz	68.64 dBµV		
N3		1	2.49635 GHz	49.00 dBµV		
N4		1	2.5 GHz	48.35 dBµV		
N5		1	2.50617 GHz	49.13 dBµV		

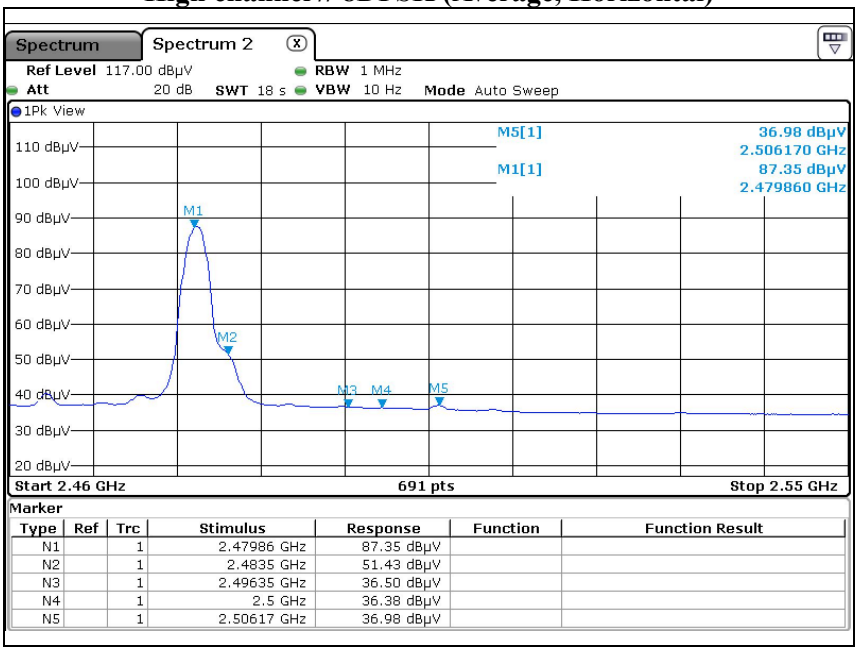
High channel // 8DPSK (Peak, Vertical)



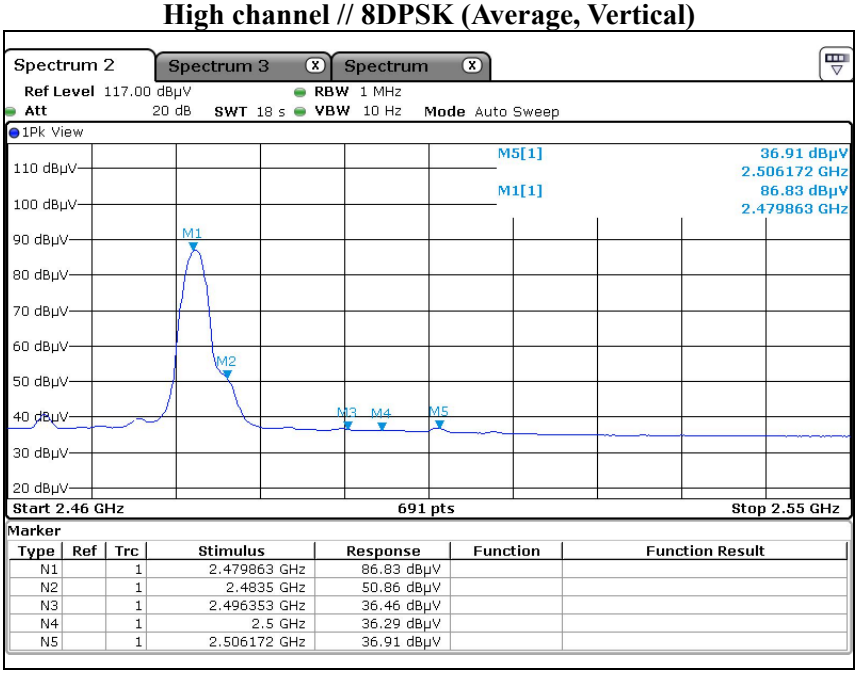
Marker

Type	Ref	Trc	Stimulus	Response	Function	Function Result
N1		1	2.479863 GHz	102.57 dBµV		
N2		1	2.4835 GHz	66.96 dBµV		
N3		1	2.496353 GHz	47.85 dBµV		
N4		1	2.5 GHz	47.37 dBµV		
N5		1	2.506172 GHz	47.66 dBµV		

High channel // 8DPSK (Average, Horizontal)



High channel // 8DPSK (Average, 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)
2 390.0	50.60	Peak	H	28.31	-38.62	40.29	74.00	33.71
2 390.0	50.28	Peak	V	28.31	-38.62	39.97	74.00	34.03
4 809.0	49.67	Peak	H	33.92	-31.65	51.94	74.00	22.06
4 089.0	36.49	Peak	V	33.92	-31.65	38.76	74.00	35.24

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)
4 882.0	47.88	Peak	V	34.16	-31.08	50.96	74.00	23.04
4 882.0	46.17	Peak	V	34.16	-31.08	49.25	74.00	24.75

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)
2 483.5	68.64	Peak	H	28.50	-38.73	58.41	74.00	15.59
2 483.5	51.43	Average	H	28.50	-38.73	41.20	54.00	12.80
2 483.5	66.96	Peak	V	28.50	-38.73	56.73	74.00	17.27
2 483.5	50.86	Average	V	28.50	-38.73	40.63	54.00	13.37
4 964.0	40.36	Peak	H	34.43	-30.44	44.35	74.00	29.65
4 964.0	37.87	Peak	V	34.43	-30.44	41.86	74.00	32.14

※ 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.

2.1.8 AC conducted emissions

Frequency range of measurement
150 ㎑ to 30 ㎒

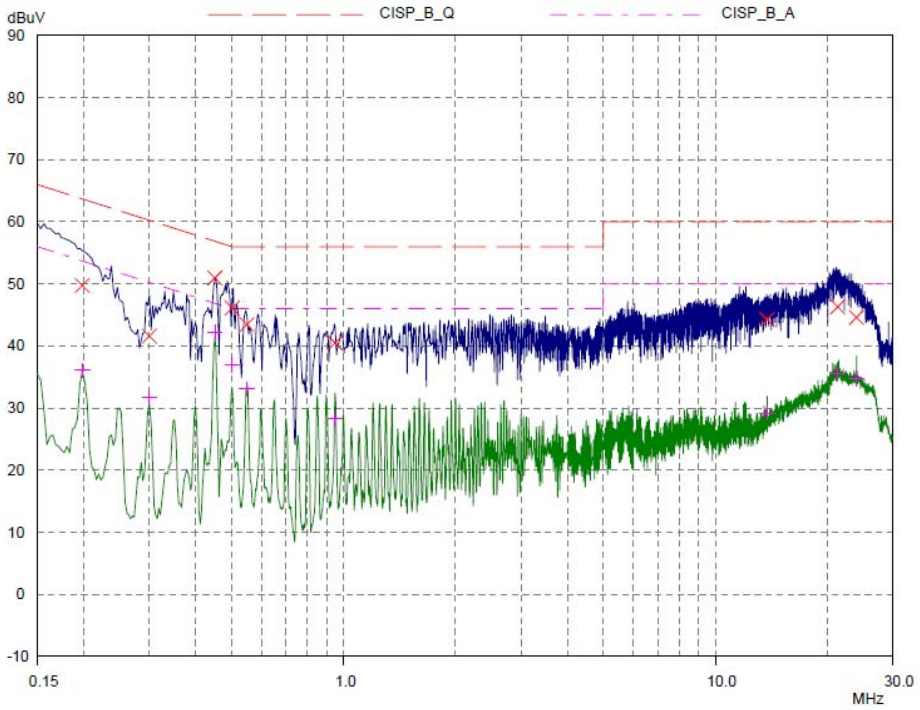
Instrument settings
IF Band Width: 9 ㎑

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.



Frequency MHz	QP Level dBuV	QP Limit dBuV	QP Delta dB
0.198	49.76	63.69	13.93
0.3	41.58	60.24	18.66
0.45	50.95	56.88	5.93
0.501	46.12	56.00	9.88
0.549	43.44	56.00	12.56
0.948	40.50	56.00	15.50
13.791	44.25	60.00	15.75
21.351	46.31	60.00	13.69
23.979	44.60	60.00	15.40

Frequency MHz	AV Level dBuV	AV Limit dBuV	AV Delta dB
0.198	36.06	53.69	17.63
0.3	31.67	50.24	18.57
0.45	42.15	46.88	4.73
0.501	36.94	46.00	9.06
0.549	33.05	46.00	12.95
0.948	28.31	46.00	17.69
13.791	29.18	50.00	20.82
21.351	35.50	50.00	14.50
23.979	34.71	50.00	15.29

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
DC Power Supply	HP	6674A	2012.12.05
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	2012.08.22
EMI Test Receiver	LIG Nex1	ISA-80	2012.08.05
LISN	R&S	ENV216	2013.02.27

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
Netbook	Lenovo	S10-2	2957N5K

Appendix B. Test setup photo

Radiated field emissions