TEST REPORT

1. Applicant
   - Name : Samsin Innotec Co., Ltd.
   - Brand Name : N/A
   - Address : 252-23, Sarihyun-Dong, Ilsandong-Gu, Goyang-City, Kyonggi-Do, 411-530 Korea
   - FCC ID : QJ8-BPA-9005
2. Products
   - Name : BioStrive
   - Model No. : BPA-9005
   - Variant Model No. : BPA-9003W
   - Manufacturer : Samsin Innotec Co., Ltd.
   - Address : 252-23, Sarihyun-Dong, Ilsandong-Gu, Goyang-City, Kyonggi-Do, 411-530 Korea
3. Test Standard : FCC CFR 47 Part 15.247 Subpart C
4. Test Method : ANSI C63.10-2009
5. Test Result : PASS
6. Dates of Test : July 11, 2014 to July 15, 2014
7. Date of Issue : July 16, 2014
8. Test Laboratory : Korea Standard Quality Laboratories
   FCC Designation Number : 100384

Tested by	Approved by
KwangMin, Lee	SuWook, Chae
Test Engineer:	Compliance Engineer:

Korea Standard Quality Laboratories
Testing Laboratories for EMC and Safety Compliance
www.ksqlab.com
#102, Jangduk-Dong, Hwasung-City, Kyunggi-Do, KOREA

Revision History

Rev.	Issue Date	Revisions	Revised By
-	2014.07.16	Initial Issue	K.M. Lee
Rev 1	2014.08.04	Pseudorandom Frequency Hopping Sequence is added.	K.M. Lee

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1. Test Summary

Test	Test Requirement	Result
Antenna Requirement	FCC PART 15 C section 15.247 (c) and Section 15.203	PASS
20 dB Bandwidth	FCC PART 15 C section 15.247 (a)(1)	PASS
Maximum peak power	FCC PART 15 C section 15.247(b)(1)	PASS
Carrier Frequency Separation	FCC PART 15 C section 15.247(a)(1)	PASS
Number of Hopping Channels	FCC PART 15 C section 15.247(a)(1)(iii)	PASS
Time of Occupancy (Dwell Time)	FCC PART 15 C section 15.247(a)(1)(iii)	PASS
Conducted spurious emissions & Band edge	FCC PART 15 C section 15.247(d)	PASS
Radiated Spurious Emission & Band edge	FCC PART 15 C section 15.209(a)	PASS
AC Power Line Conducted Emissions	FCC PART 15 C section 15.207(a)	PASS

2. General Information

2.1 Client Information

Applicant	:	Samsin Innotec Co., Ltd.
Address of Applicant	:	252-23, Sarihyun-Dong, Ilsandong-Gu, Goyang-City, Kyonggi-Do, 411-530 Korea

2.2 General Description of E.U.T.

Product Name	:	BioStrive
Model No.	:	BPA-9005
Variant Model No.	:	BPA-9003W

2.3 Details of E.U.T.

Operating Frequency	:	2 402 MHz to 2 480 MHz
Type of Modulation	:	FHSS
Number of Channels	:	79 Channels
Channel Separation	:	1 MHz
Antenna Type	:	FIFA Antenna
Antenna gain	:	-4.01 dBi
Normal Test Voltage	:	DC 3.7 V (Li-Polymer Battery)

3. Test Location

#102, Jangduk Dong, Hwasung City, Kyunggi Do, South Korea
(FCC Designation Number : 100384)

This test site is in compliance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.

4. Equipment Used during Test

No.	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration interval	Next Cal. Data	Used equipment
1	EMI Test Receiver	LIG Nex1	LSA-265	L07098033	1 Year	2014.12.19	■
2	Bi-log Antenna	Schwarzbeck	VULB9160	3311	2 Year	2015.11.21	■
3	Loop ANT.	Com-Power	AL-130	121010	2 Year	2015.04.25	■
4	Spectrum Analyzer	Agilent	E4440A	MY45304715	1 Year	2015.02.13	■
5	Function Generator	Agilent	33120A	US36026465	1 Year	2015.04.29	□
6	Frequency Counter	HP	5350B	3049A05530	1 Year	2015.06.02	□
7	Modulation Analyzer	Agilent	8901B	3438A05099	1 Year	2015.06.02	□
8	Audio Analyaer	Agilent	8903B	3729A18576	1 Year	2015.06.02	□
9	Attenuator	Agilent	8494B	MY41110204	1 Year	2015.06.01	□
10	Attenuator	Agilent	8496B	US40152183	1 Year	2015.06.01	□
11	Attenuator	Agilent	8495B	3308A17660	1 Year	2015.06.01	□
12	Attenuator	TAE SUNG	SMA-2	N/A	1 Year	2015.06.01	□
13	Power Meter	Agilent	E4418B	GB43312894	1 Year	2015.06.01	□
14	Power Sensor	HP	8485A	3316A14708	1 Year	2015.06.27	□
15	Vibration Tester	Gana	GNV-400	C114	1 Year	2015.06.19	□
16	Temp & Humidity Chamber	Seoksan Tech	SE-CT-02	S7400JD5340618	1 Year	2015.06.02	□
17	Signal Generator	Leader Electronics	3220	0137231	1 Year	2015.06.01	■
18	SYNTHESIZED SWEEPER	HP	8340B	2804A00830	1 Year	2015.05.07	■
19	Drop Tester	Self-made	KSQ-01	N/A	1 Year	N/A	□
20	Pre Amplifier	GTC	GA-1825A	GT0929/003	1 Year	2015.06.01	■
21	Continuous operation tester	GTC	CT-100	GT0929/001	1 Year	N/A	□
22	CW Generator	HP	83711B	US34490158	1 Year	2015.06.01	■
23	POWER DIVIDER	Agilent	11636B	54381	1 Year	2015.06.19	□
24	Power Sensor	Agilent	8482B	N/A	1 Year	2015.06.29	□
25	Attenuator	Winswell	53-30-33	N/A	1 Year	2015.04.17	□
26	Termination	Kwang Yeok	KYTE-NJ-150 W	2040004	1 Year	2015.06.01	□
27	Horn ANT.	SCHWARZBECK	BBHA 9120D	831	2 Year	2015.11.28	■
28	Horn ANT.	A.H. SYSTEMS	SAS-572	100284	2 Year	2015.09.07	■
29	DC Power Supply	ALINCO	DM-340MW	F001015	1 Year	2015.06.02	■
30	TEST RECEIVER	ROHDE & SCHWARZ	ESPI	101014	1 Year	2014.08.05	■
31	LISN	ROHDE & SCHWARZ	ENV216	101732	1 Year	2015.03.13	■
32	LISN	Kyoritsu	KNW-407	8-1010-14	1 Year	2015.06.09	■

5. Measurement conditions

5.1 Description of test modes

- The EUT had been tested under the operating condition.
- There are three channels have been tested as following:
- Channel Low and Channel High with higher data rate were chosen for full testing.

Channel	Frequency (MHz)
Lowest	2 402
Middle	2 441
Highest	2 480

5.2 Setup of equipmet under test

5.2.1 Description of support units

- The EUT has beel tested as an independent unit along with the following necessary accessories or support units, which are adopted to form a representative test configuration.

No.	Equipment	Manufacturer	Model
1	Desktop Computer	Dell Inc.	VOSTRO
2	Monitor	LG Electronics Nanjing Display Co., Ltd.	W2261VT
3	Keyboard	COSY	KB956
4	Mouse	Dell Inc.	MS111-T

6. Test data

6.1 Antenna Requirement

6.1.1 Regulation

According to 15.203. an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

According to 15.247(c) (1)(i) Systems operating in the 2 400-2 483.5 MHz bands that are used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

6.1.2 EUT Antenna PASS

The transmitter has an Integrated FIFA antenna. The directional gain of the antenna is -4.01 dBi.

6.2 20 dB Bandwidth

6.2.1 Regulation

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

6.2.2 Test procedure

Use the following spectrum analyzer setting

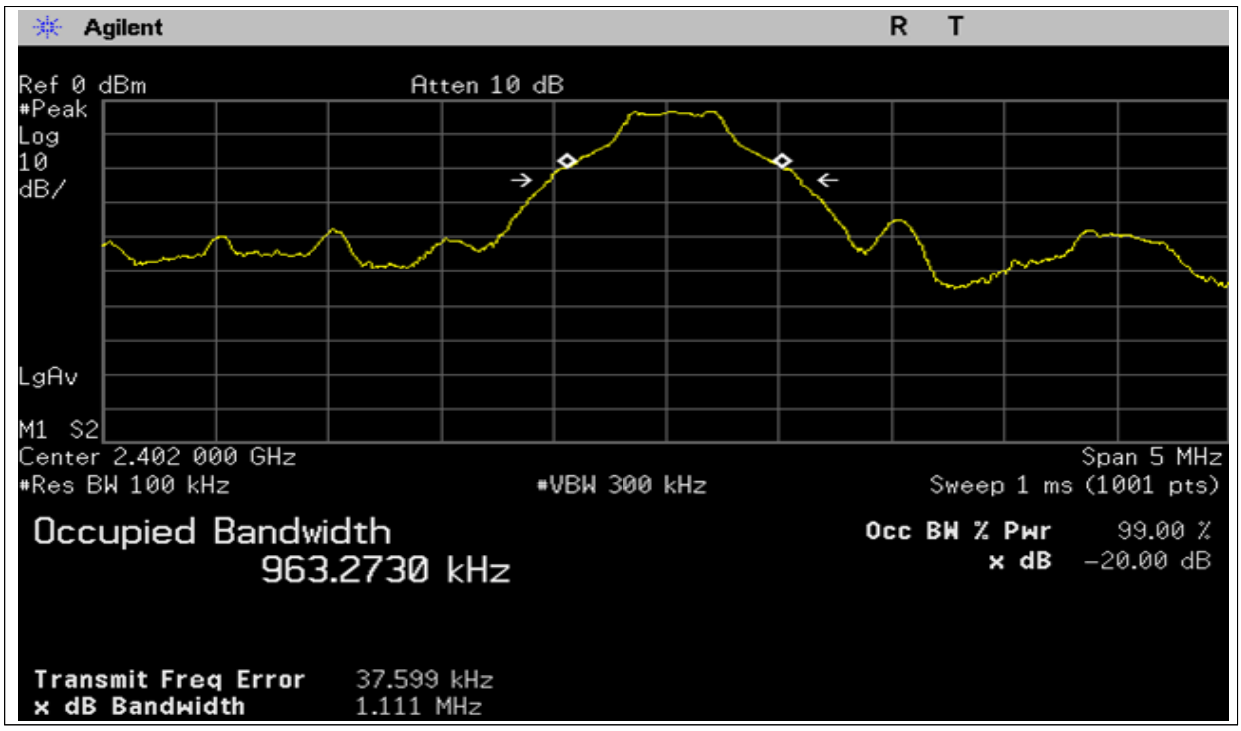
- Center frequency : Lowest, middle and highest channels
- Spen = 5 MHz
- RBW = 100 kHz
- VBW = 300 kHz
- Sweep = Auto
- Detector function = Peak
- Trace = Max hold

6.2.3 Test Result

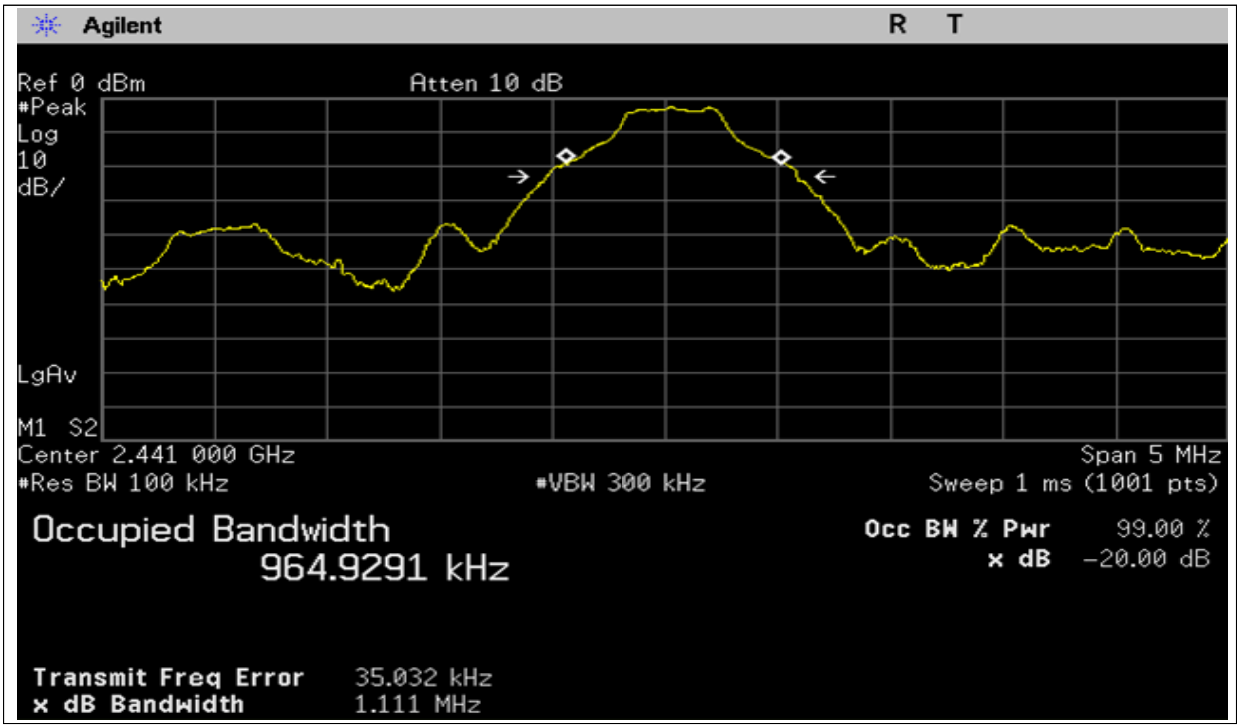
Operation mode	Frequency (MHz)	20 dB Bandwidth (kHz)	Limit (kHz)	Verdict
GFSK	2 402	963.27	> 25	Pass
	2 441	964.93	> 25	Pass
	2 480	963.56	> 25	Pass
8DPSK	2 402	1 222.70	> 25	Pass
	2 441	1 226.90	> 25	Pass
	2 480	1 231.30	> 25	Pass

6.2.3.1 Operation mode : GFSK

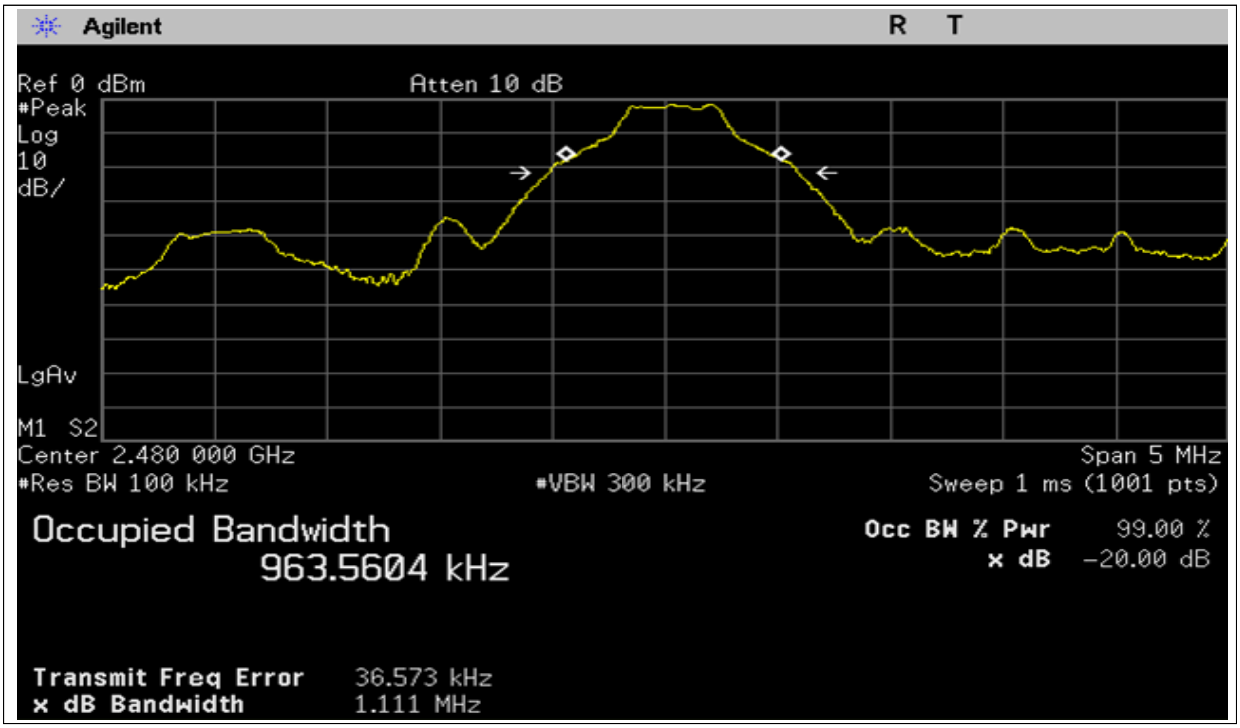
Lowest channel



Middle channel

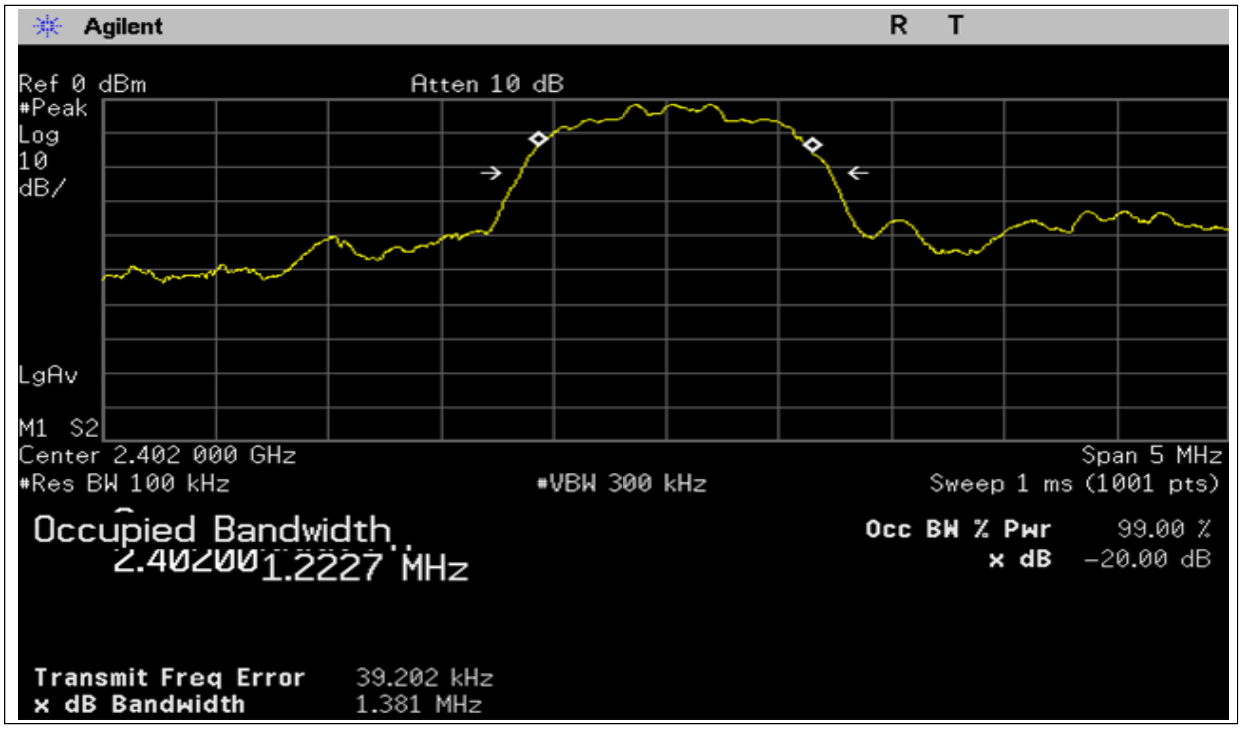


Highest channel

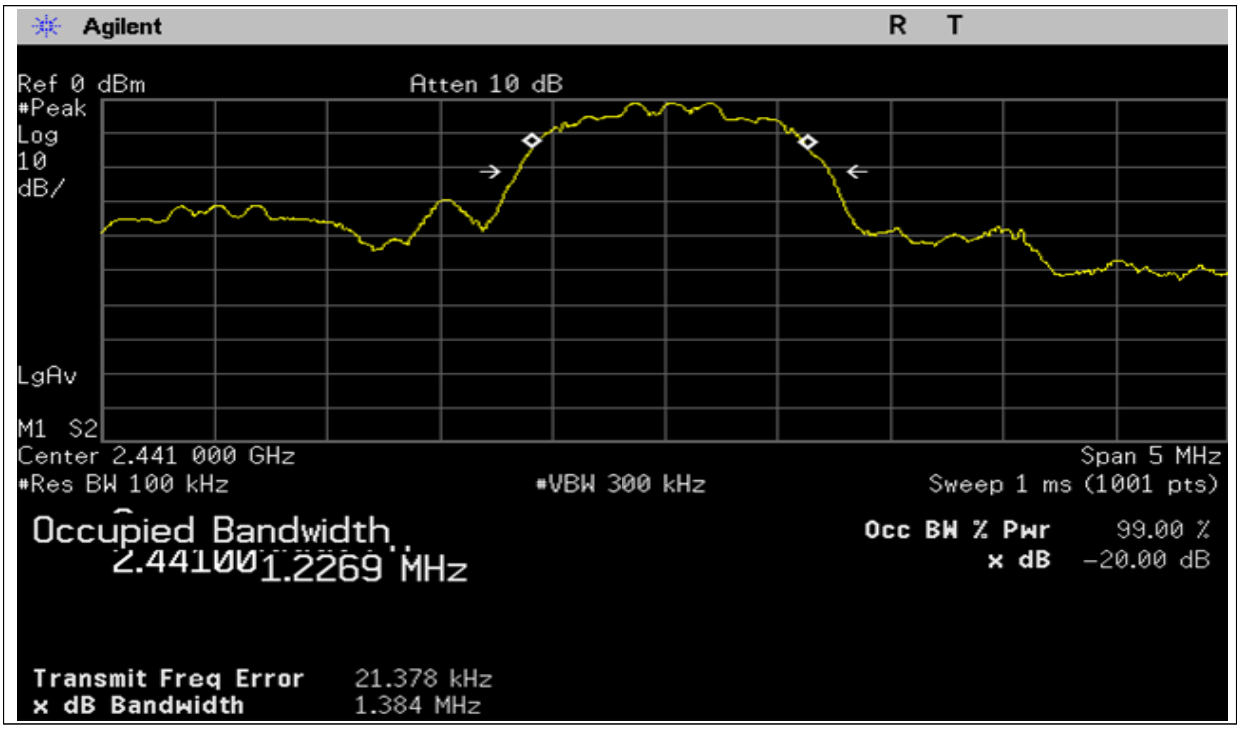


6.2.3.2 Operation mode : 8DPSK

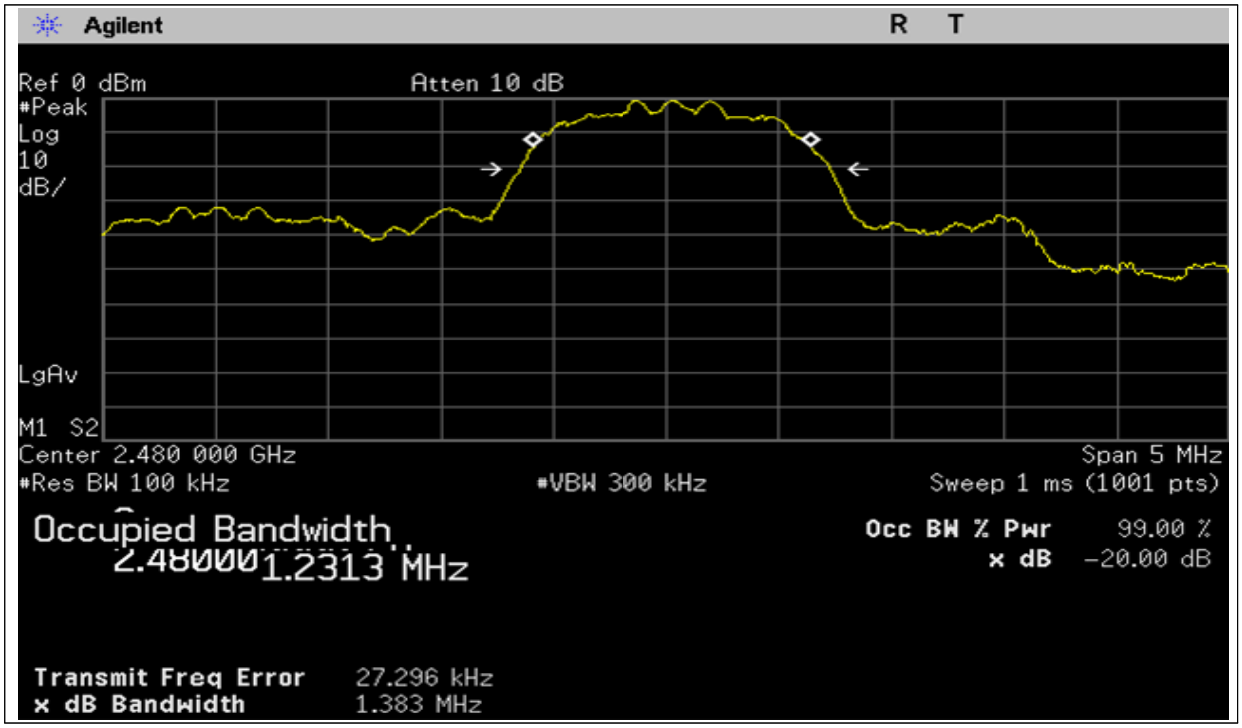
Lowest channel



Middle channel



Highest channel



6.3 Maximum peak power

6.3.1 Regulation

According to §15.247(b)(1), for frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.3.2 Test procedure

Use the following spectrum analyzer setting

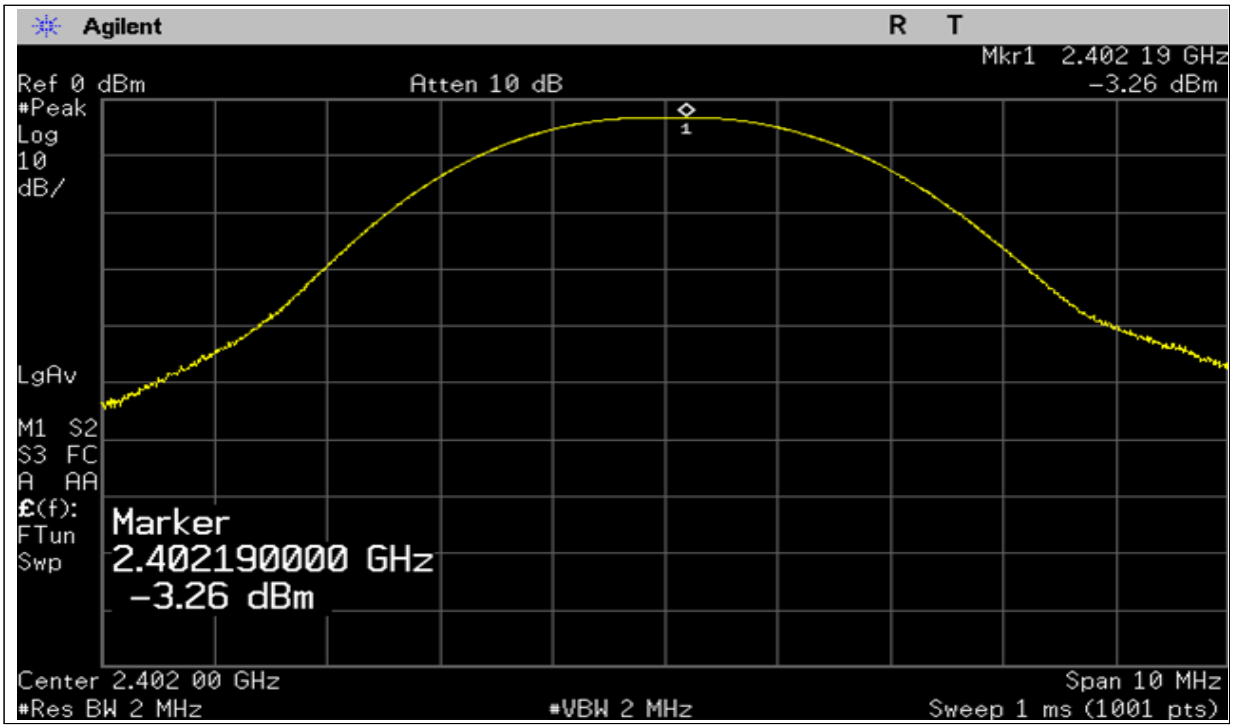
- Center frequency : Lowest, middle and highest channels
- Spen = 10 MHz
- RBW = 2 MHz
- VBW = 2 MHz
- Sweep = Auto
- Detector function = Peak
- Trace = Max hold

6.3.3 Test Result

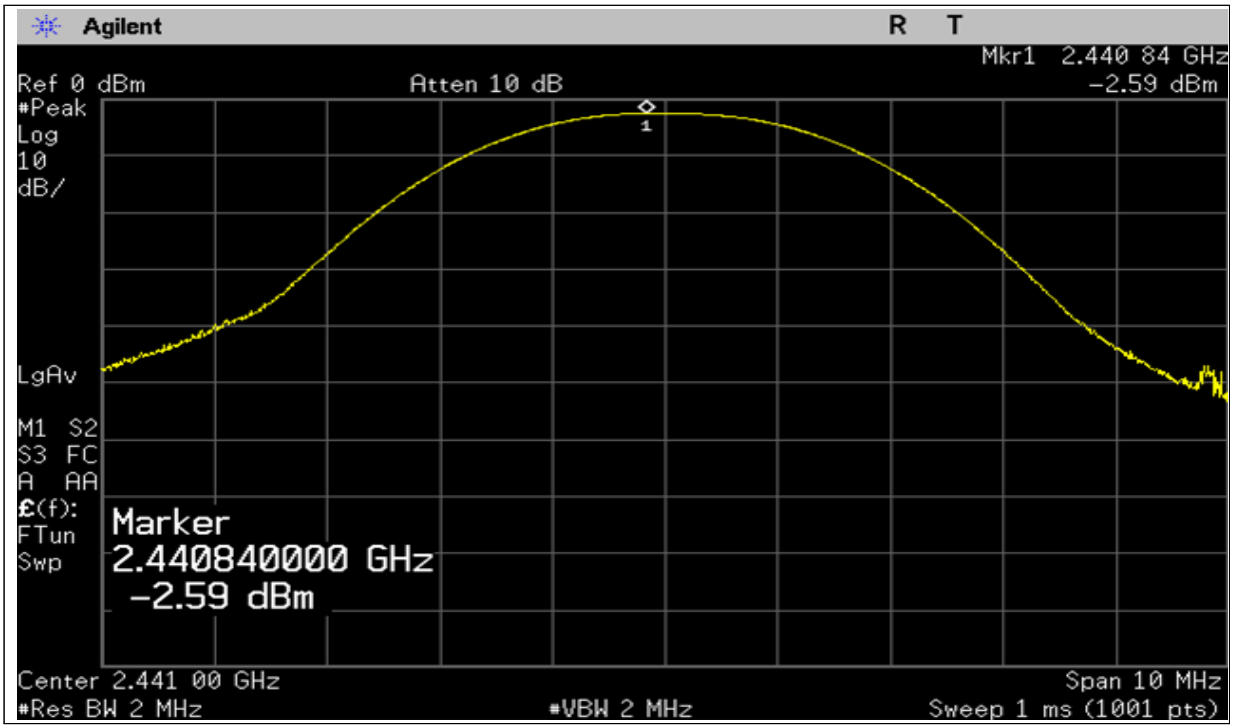
Operation mode	Frequency (MHz)	Maximum peak power		Limit (W)	Verdict
		(dBm)	(W)		
GFSK	2 402	-3.26	0.000 5	1	Pass
	2 441	-2.59	0.000 6	1	Pass
	2 480	-1.60	0.000 7	1	Pass
8DPSK	2 402	-0.60	0.000 9	1	Pass
	2 441	-0.04	0.009 9	1	Pass
	2 480	0.06	0.001 0	1	Pass

6.3.3.1 Operation mode : GFSK

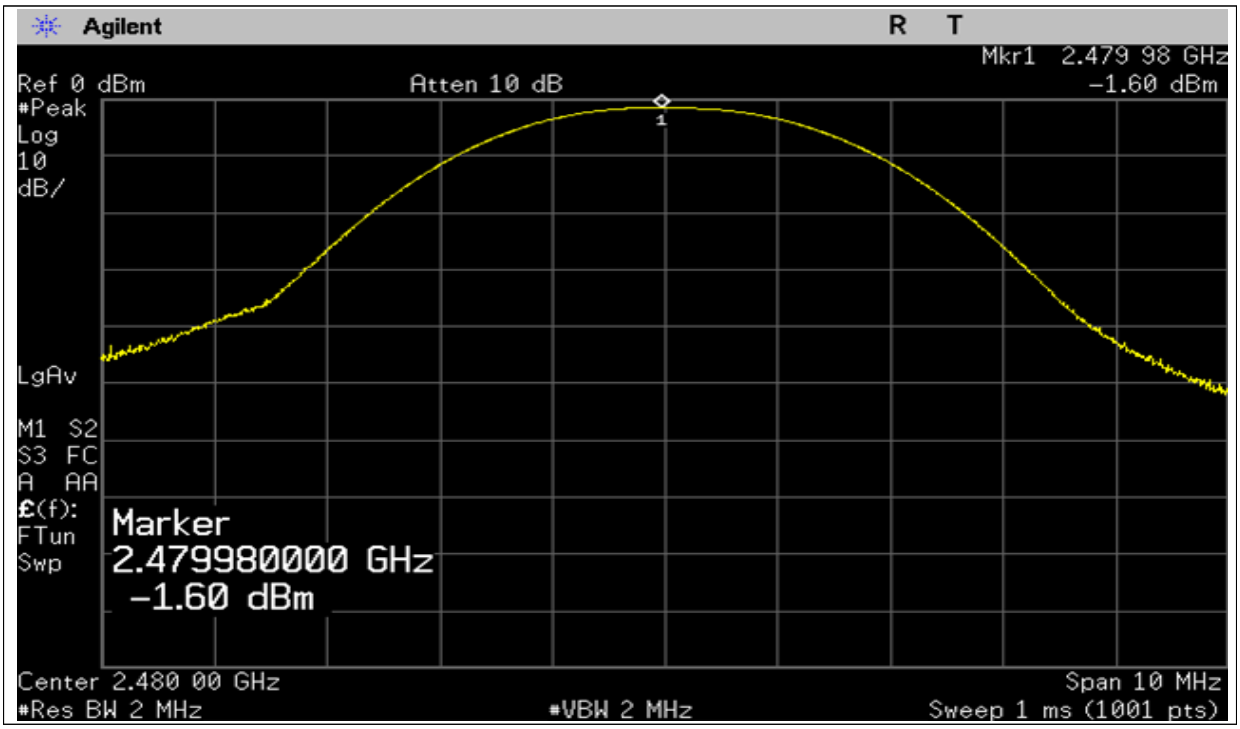
Lowest channel



Middle channel

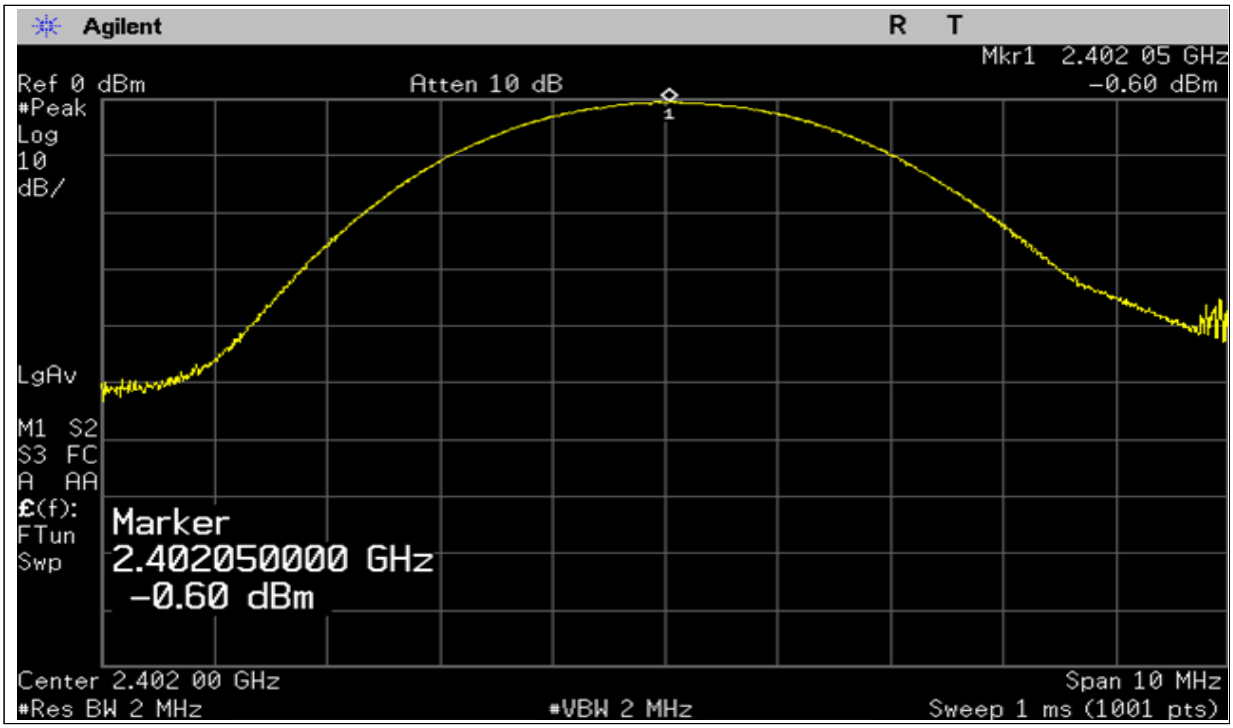


Highest channel

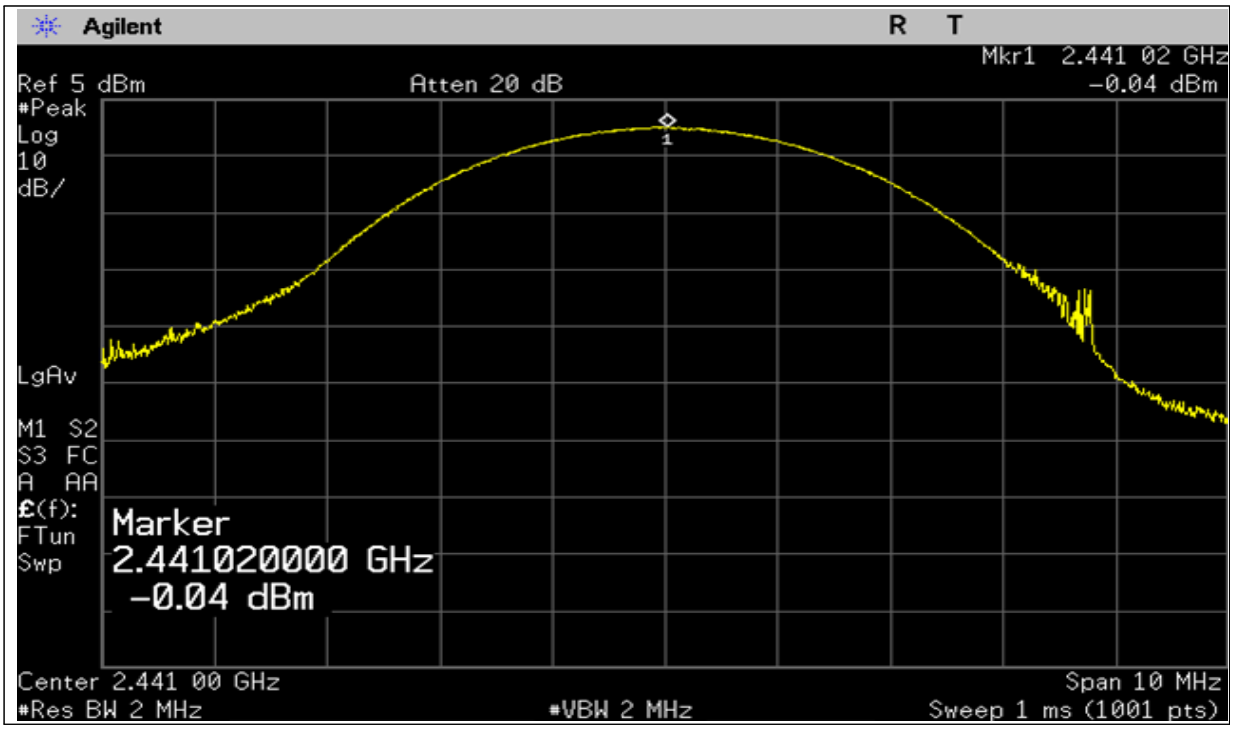


6.3.3.2 Operation mode : 8DPSK

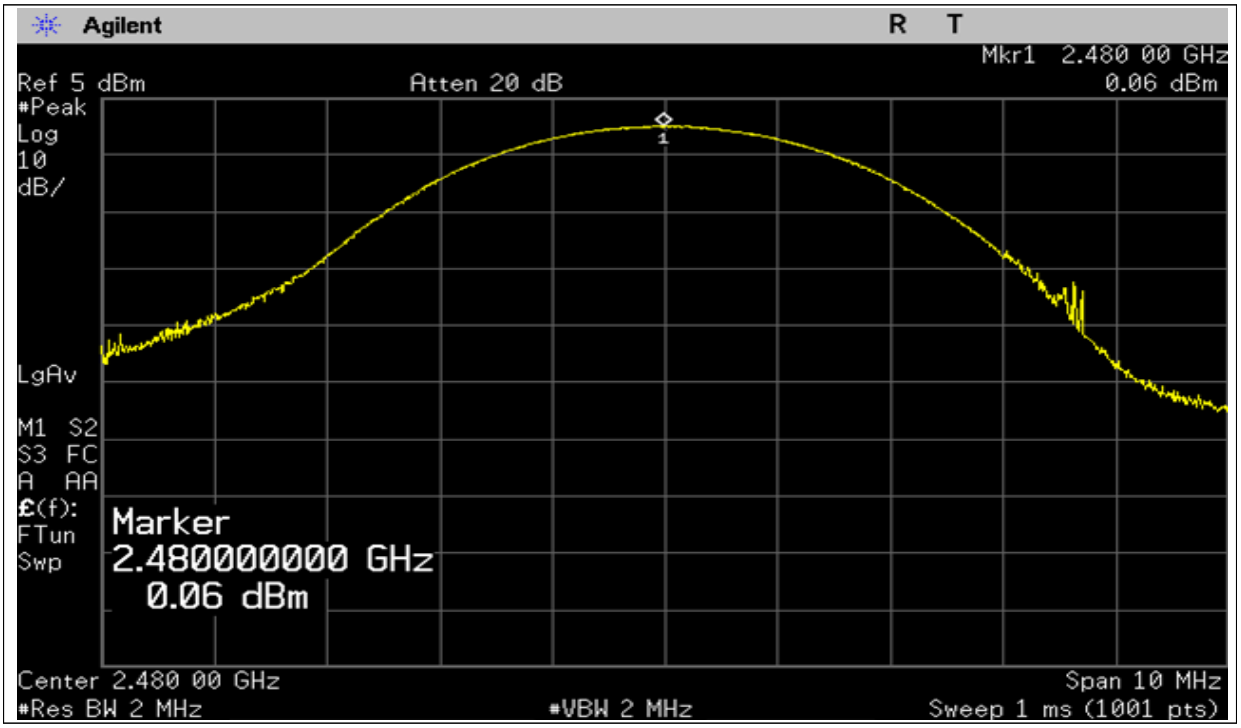
Lowest channel



Middle channel



Highest channel



6.4 Carrier Frequency Separation

6.4.1 Regulation

According to §15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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

6.4.2 Test procedure

Use the following spectrum analyzer setting

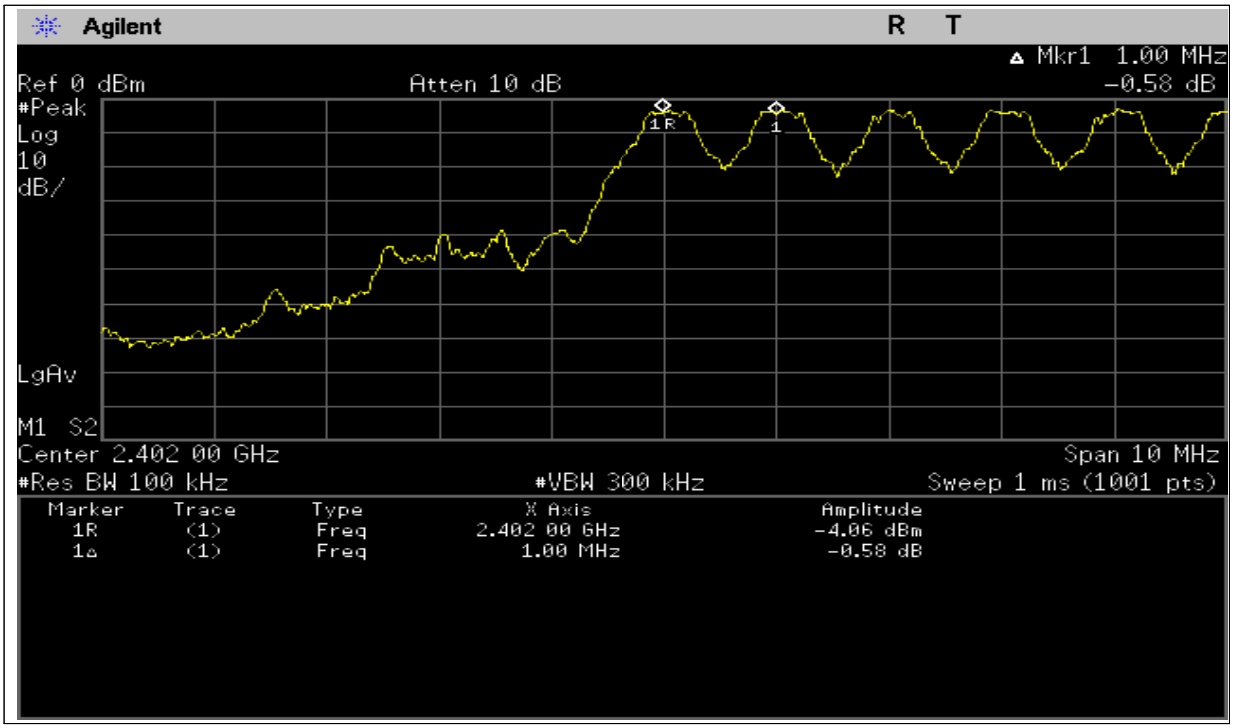
- Center frequency : Lowest, middle and highest channels
- Spen = 3 MHz
- RBW = 30 kHz
- VBW = 30 kHz
- Sweep = Auto
- Detector function = Peak
- Trace = Max hold

6.4.3 Test Result

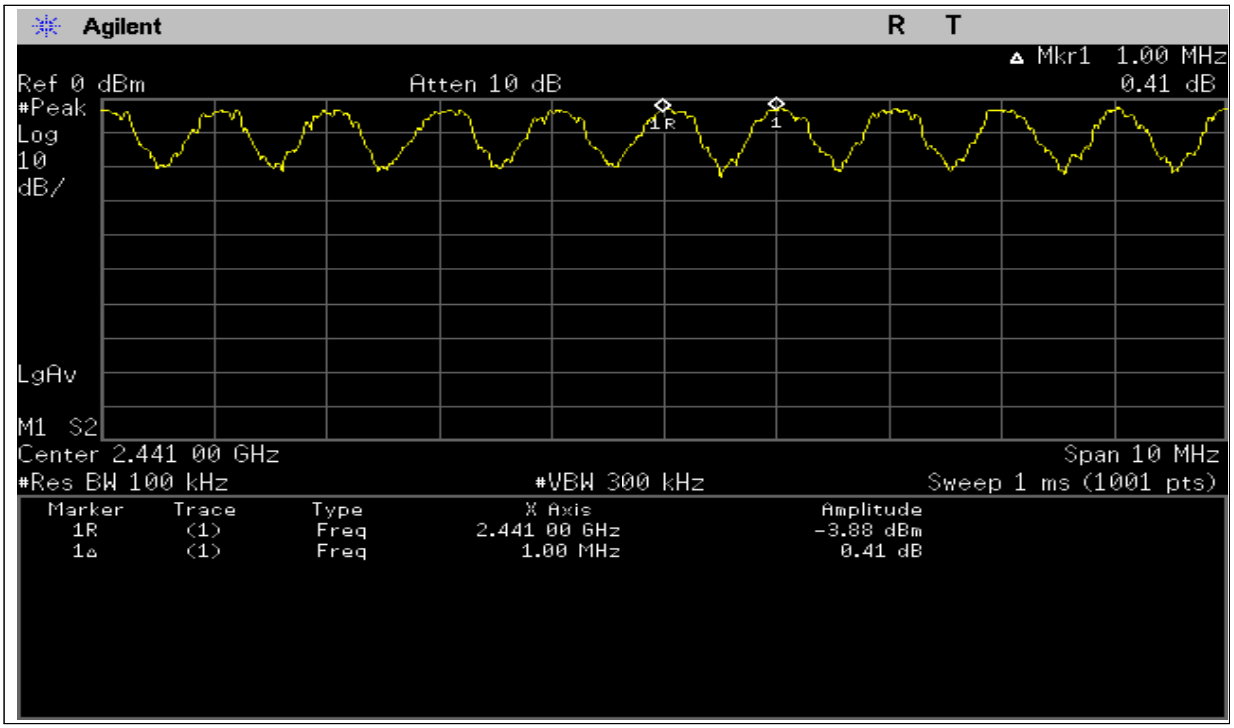
Operation mode	Frequency (MHz)	Frequency separation (MHz)	Limit (dBm)	Verdict
GFSK	2 402	1.00	>25 kHz	Pass
	2 441	1.00	>25 kHz	Pass
	2 480	1.00	>25 kHz	Pass
8DPSK	2 402	1.00	>25 kHz	Pass
	2 441	1.03	>25 kHz	Pass
	2 480	1.10	>25 kHz	Pass

6.4.3.1 Operation mode : GFSK

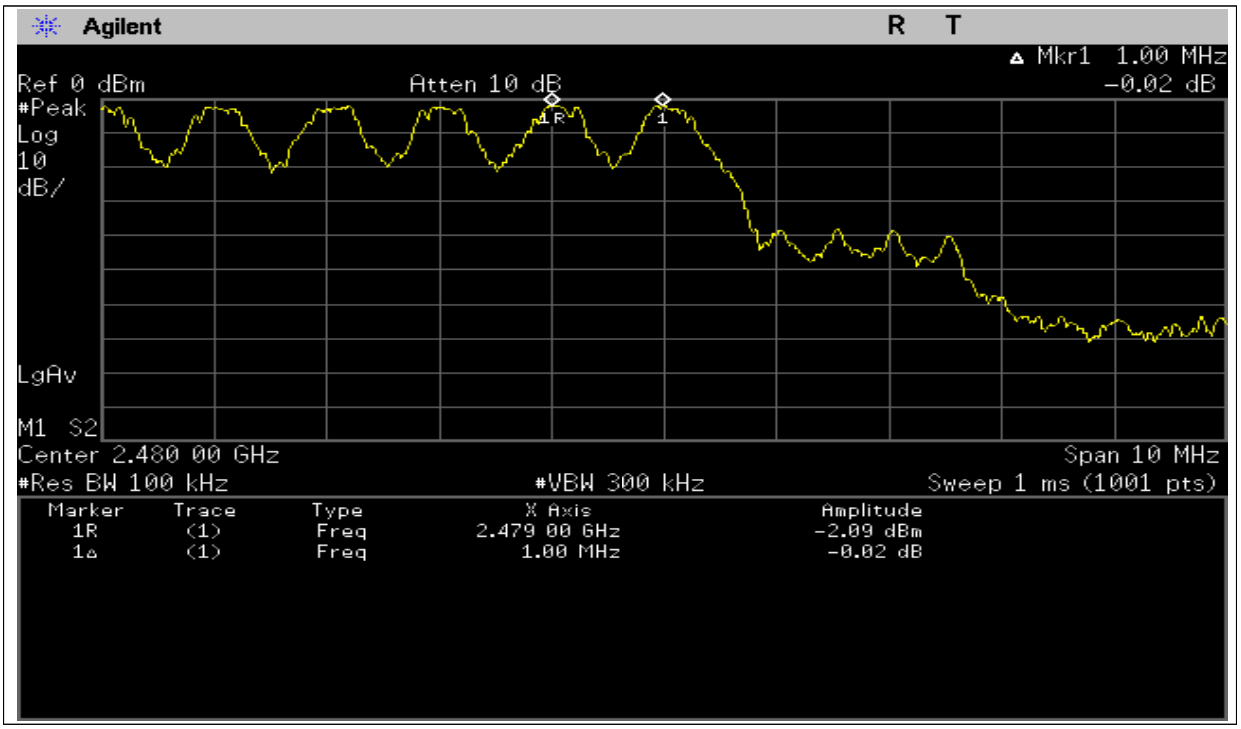
Lowest channel



Middle channel

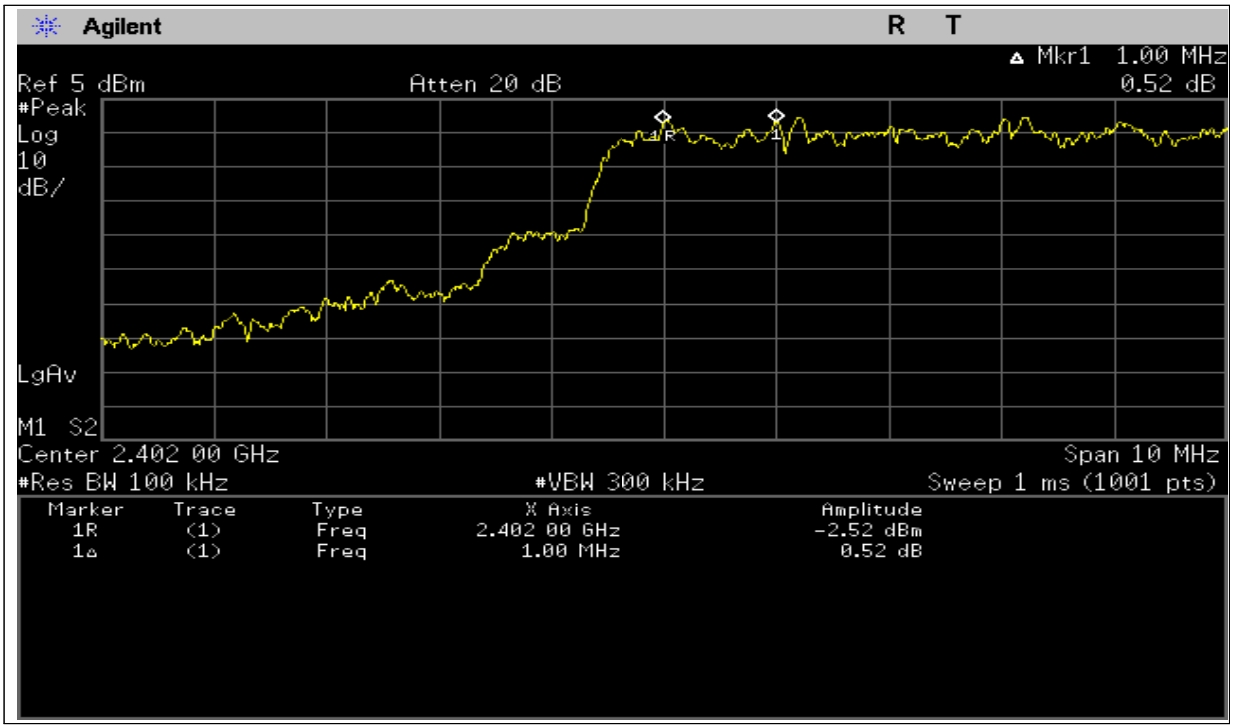


Highest channel

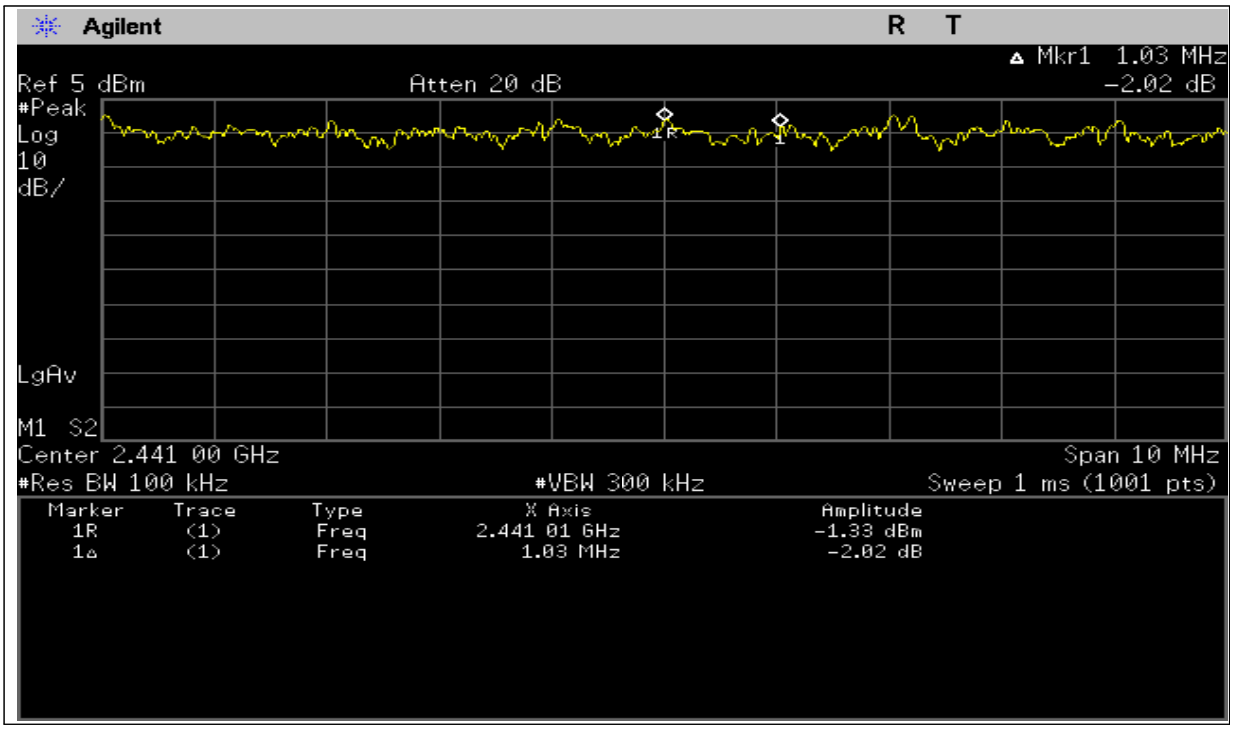


6.4.3.2 Operation mode : 8DPSK

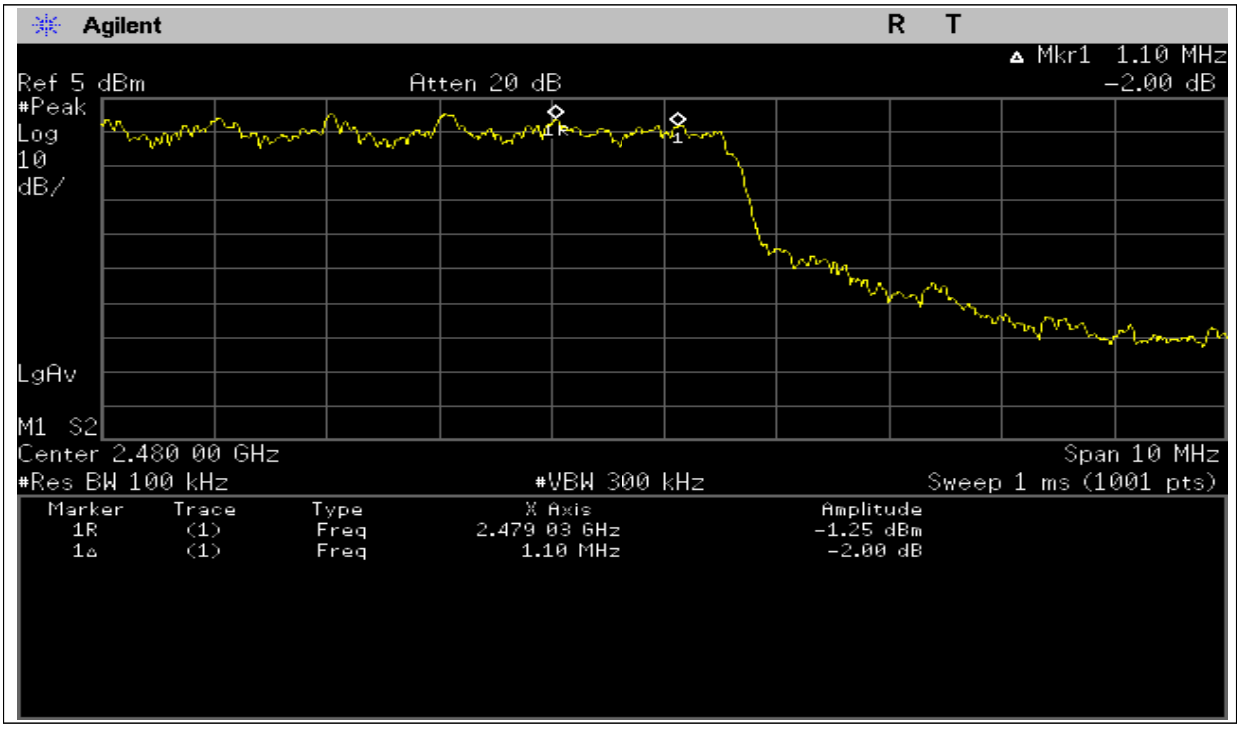
Lowest channel



Middle channel



Highest channel



6.5 Number of Hopping Channels

6.5.1 Regulation

According to §15.247(a)(1)(iii), frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

6.5.2 Test procedure

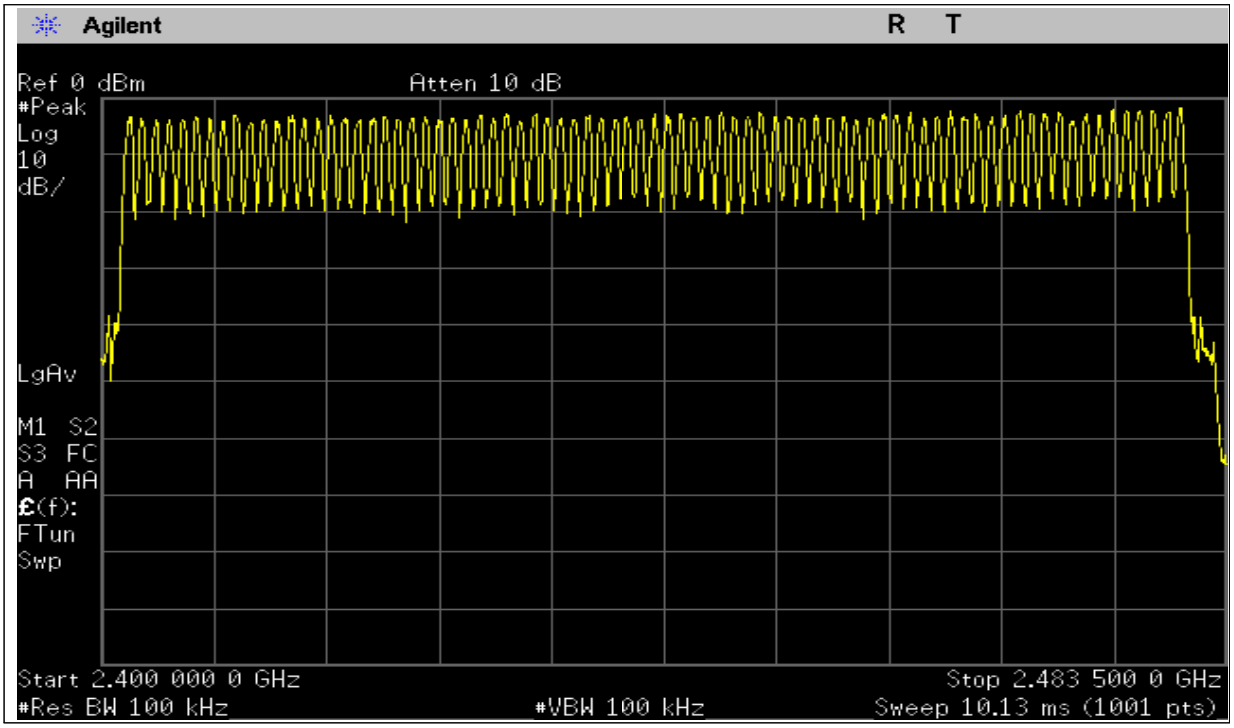
Use the following spectrum analyzer setting

- Center frequency : Lowest, middle and highest channels
- Frequency rage = 2400 - 2483.5 MHz
- RBW = 100 kHz
- VBW = 100 kHz
- Sweep = Auto
- Detector function = Peak
- Trace = Max hold

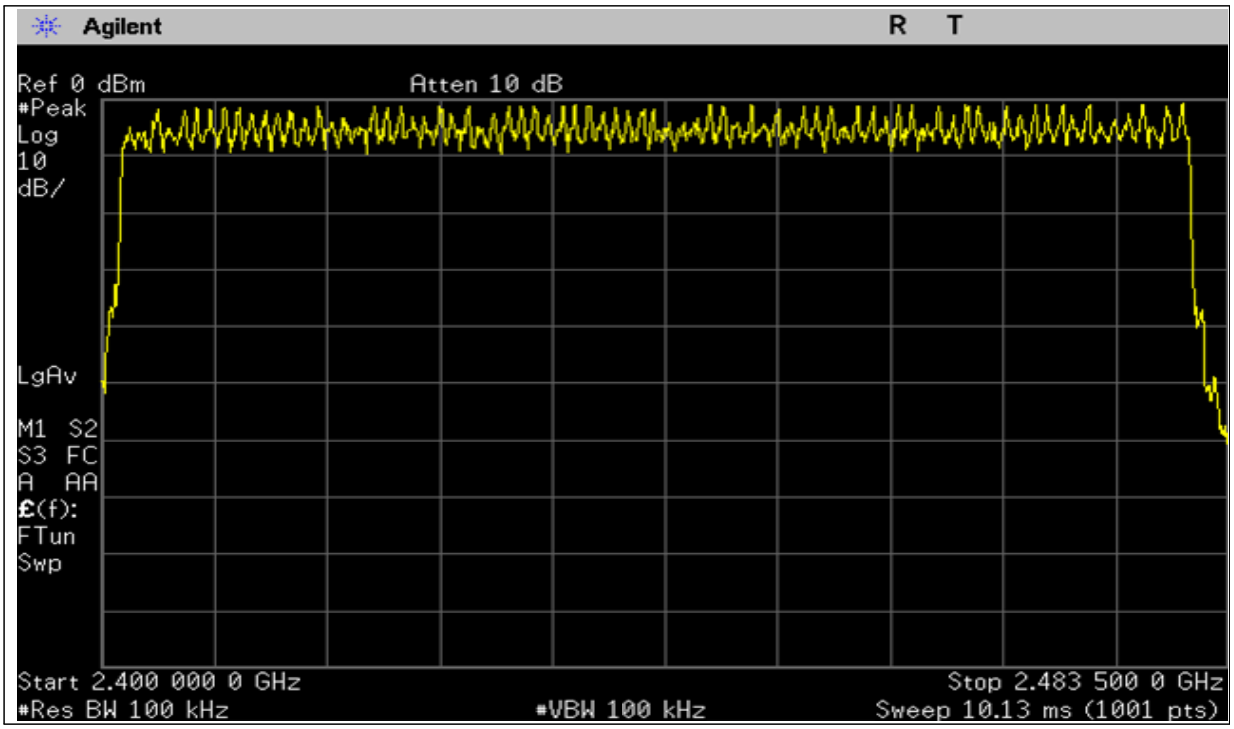
6.5.3 Test Result

Operation mode	Number of Hopping Channels	Limit	Verdict
GFSK	79	>15	Pass
8DPSK	79	>15	Pass

6.5.3.1 Operation mode : GFSK



6.5.3.2 Operation mode : 8DPSK



6.6 Time of occupancy (Dwell time)

6.6.1 Regulation

According to §15.247(a)(1)(iii), frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

6.6.2 Test procedure

Use the following spectrum analyzer setting

- Center frequency : Lowest, middle and highest channels
- Spen = 0 Hz
- RBW = 1 MHz
- VBW = 1 MHz
- Sweep = Auto
- Detector function = Peak
- Trace = Max hold

6.6.3 Test Result

Operation mode	Frequency (MHz)	On Time (ms)	Hop rate (hops/s)	Number of hopping Channels	Period Time (s)	Dwell time (ms)	Limits (ms)	Verdict
GFSK	2 402	2.89	266.67	79	31.6	308	≤ 400	Pass
	2 441	2.90	266.67	79	31.6	309	≤ 400	Pass
	2 480	2.90	266.67	79	31.6	309	≤ 400	Pass
8DPSK	2 402	2.90	266.67	79	31.6	309	≤ 400	Pass
	2 441	2.91	266.67	79	31.6	310	≤ 400	Pass
	2 480	2.90	266.67	79	31.6	309	≤ 400	Pass

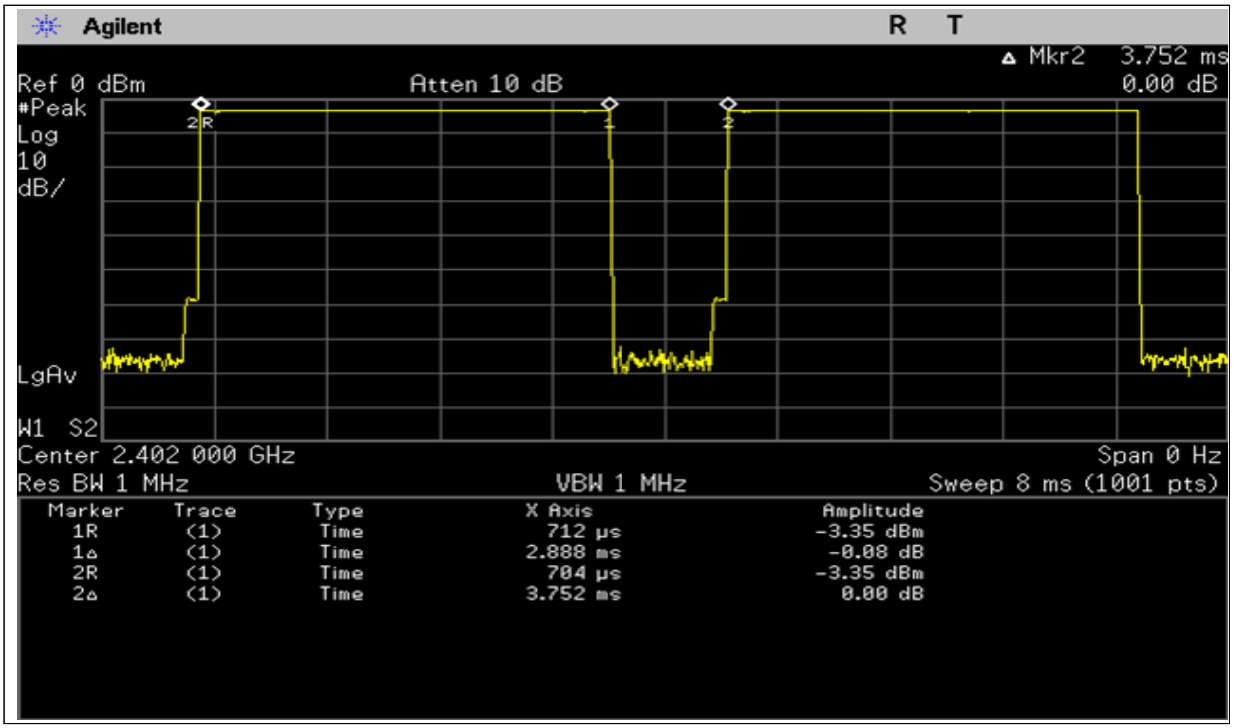
Dwell time = Reading × (Hop rate / Number of hopping Channels) × Period Time

Period Time = 0.4 [seconds / channel] × 79 [channel] = 31.6 [seconds]

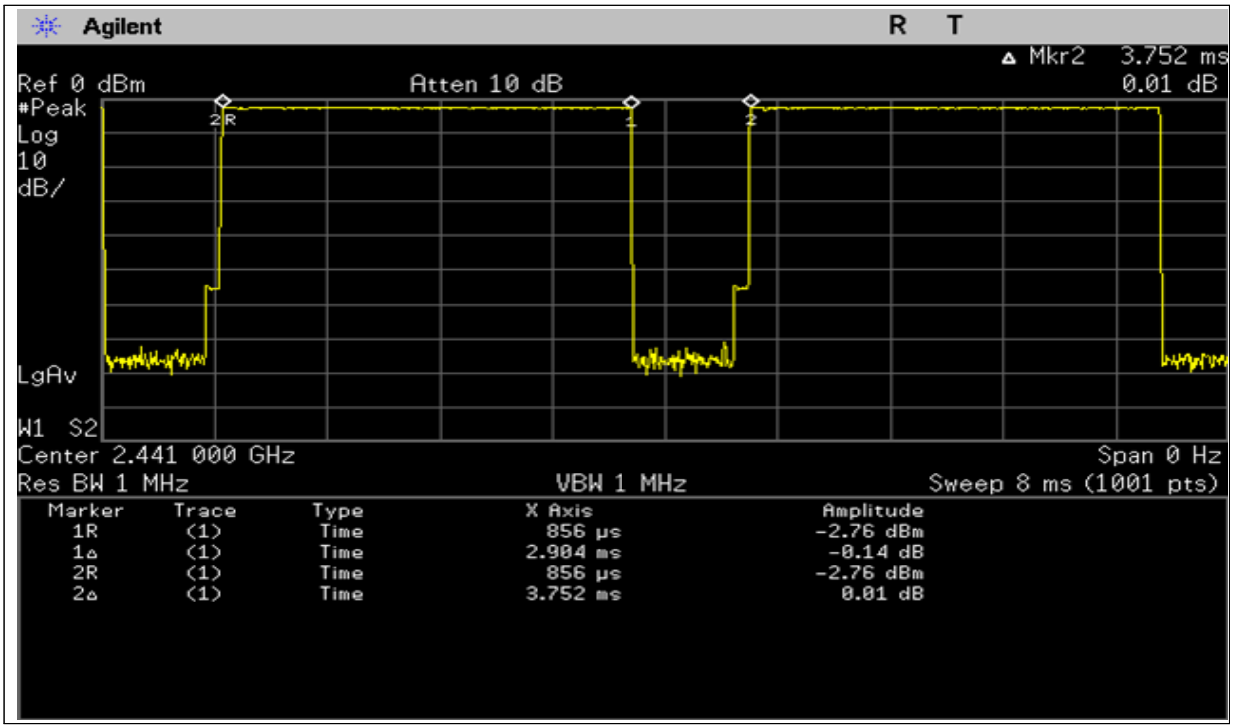
Note : The EUT makes worst case 1 600 hops second or 1time slot has a length of 625us with 79 chanels. Then the EUT makes worst case 266.67 hops per second with 79 channels.

6.6.3.1 Operation mode : GFSK

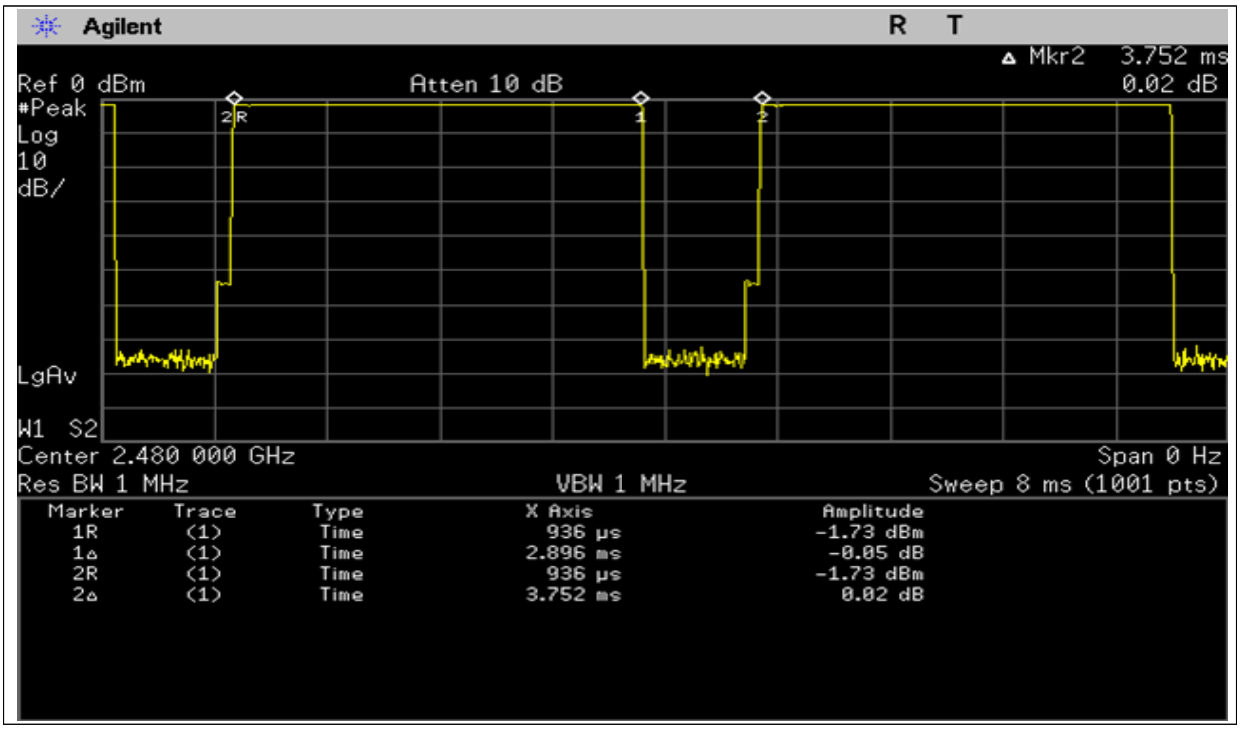
Lowest channel



Middle channel

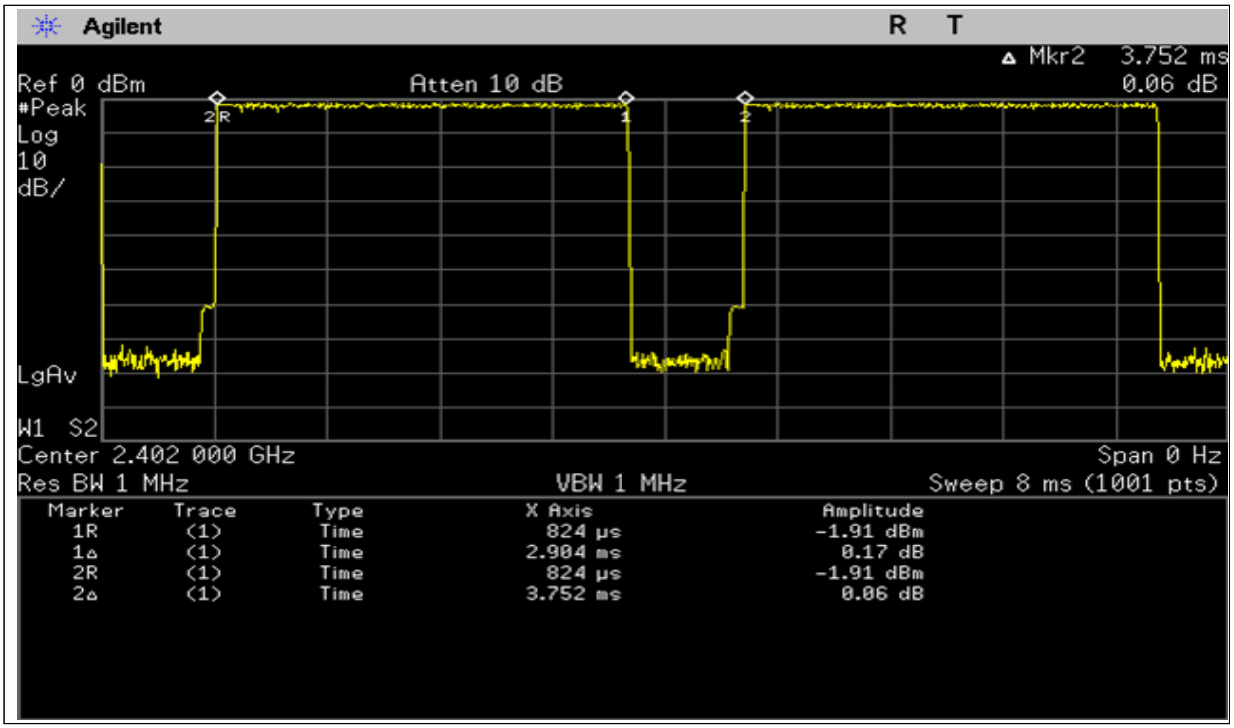


Highest channel

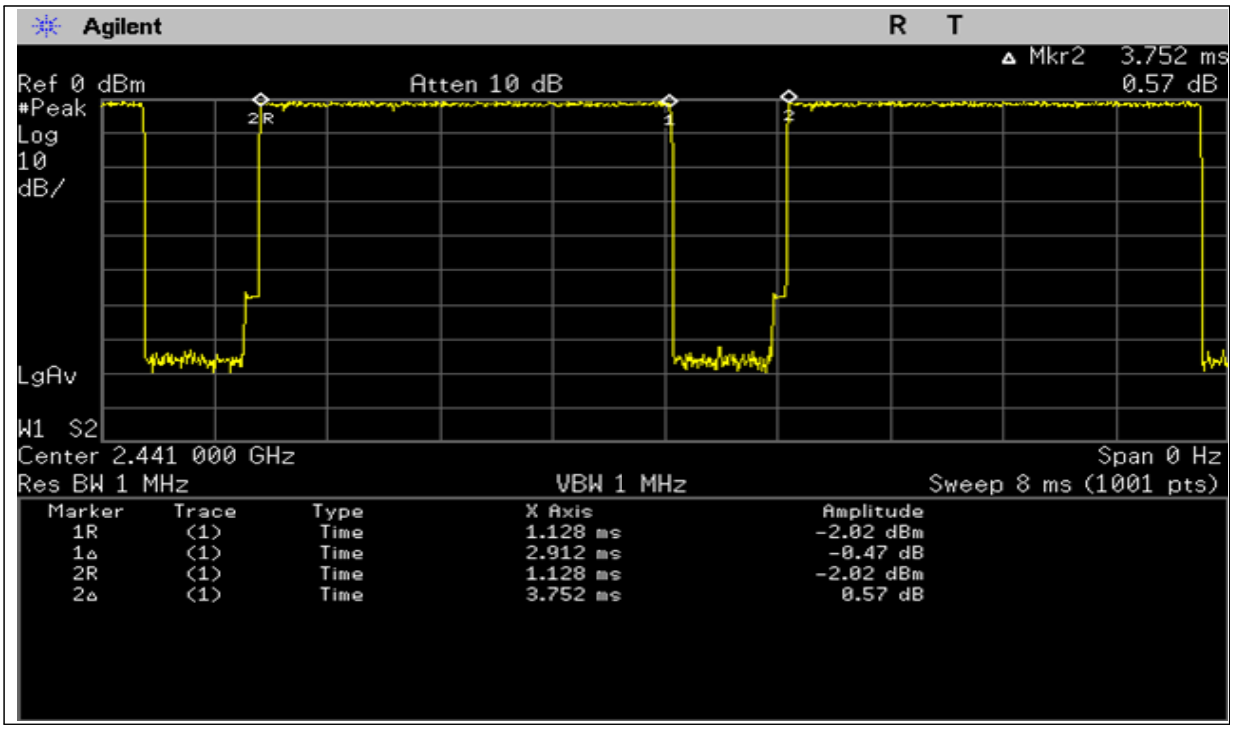


6.6.3.2 Operation mode : 8DPSK

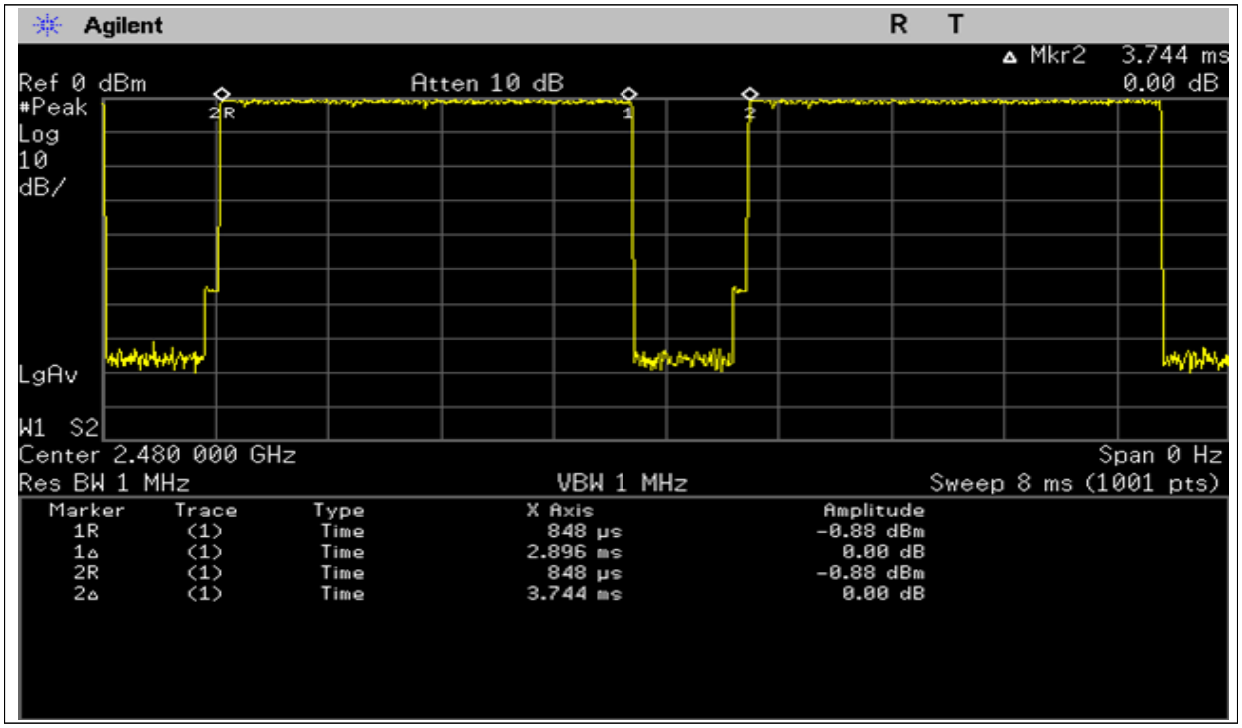
Lowest channel



Middle channel



Highest channel



6.7 Pseudorandom Frequency Hopping Sequence

6.7.1 Standard requirement

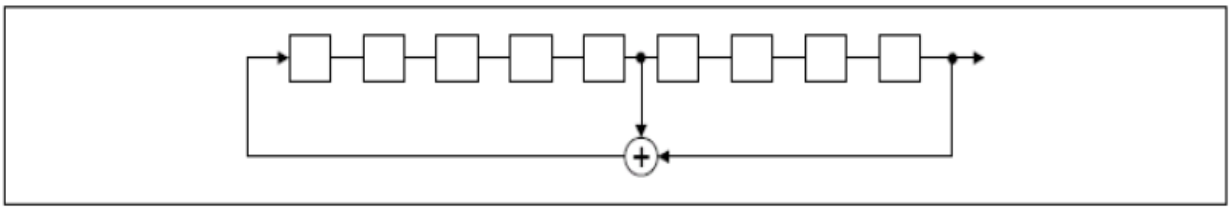
According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively. Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

6.7.2 EUT Pseudorandom Frequency Hopping Sequence

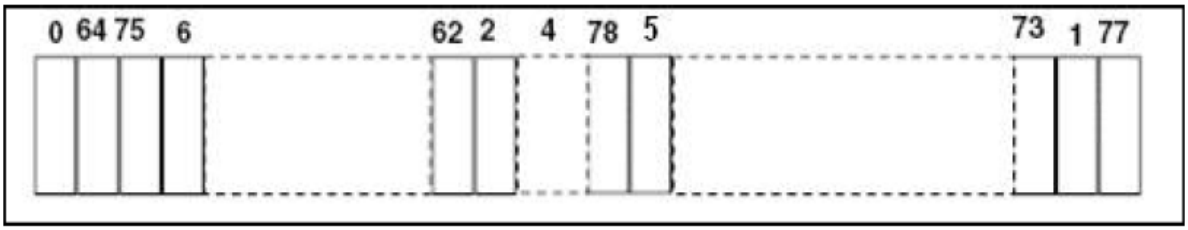
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence: 29 -1 = 511 bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



6.7.3 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, 53, 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

Each Frequency used equally on the average by each transmitter

6.7.4 System Receiver Input Bandwidth

Each channel bandwidth is 1 MHz.

The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

6.7.5 Equipment Description

15.247(a)(1) that 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)

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

6.8 Conducted spurious emissions & Band edge

6.8.1 Regulation

According to §15.247(d), in any 100 kHz 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 dB below that in the 100 kHz 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 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

6.8.2 Test procedure

1) Test procedure for band edge

Use the following spectrum analyzer setting

- Center frequency : Lowest and highest channels
- Spen = 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 kHz
- VBW = 300 kHz
- Sweep = Auto
- Detector function = Peak
- Trace = Max hold
- Allow the trace to stabilize. Set the marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is greater than that at the band-edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.
- Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit.

2) Test procedure for spurious emission

Use the following spectrum analyzer setting

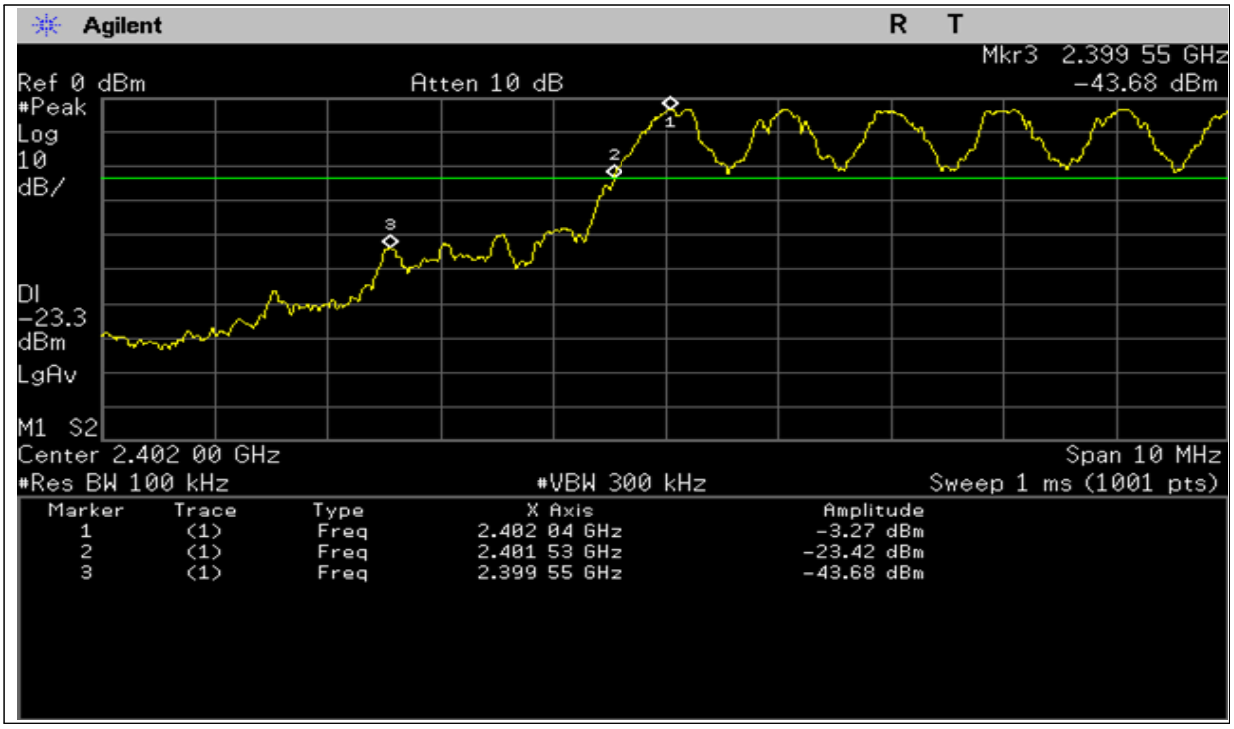
- Center frequency : Lowest, middle and highest channels
- Spen = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
- RBW = 100 kHz
- VBW = 300 kHz
- Sweep = Auto
- Detector function = Peak
- Trace = Max hold
- Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.

6.8.3 Test Result

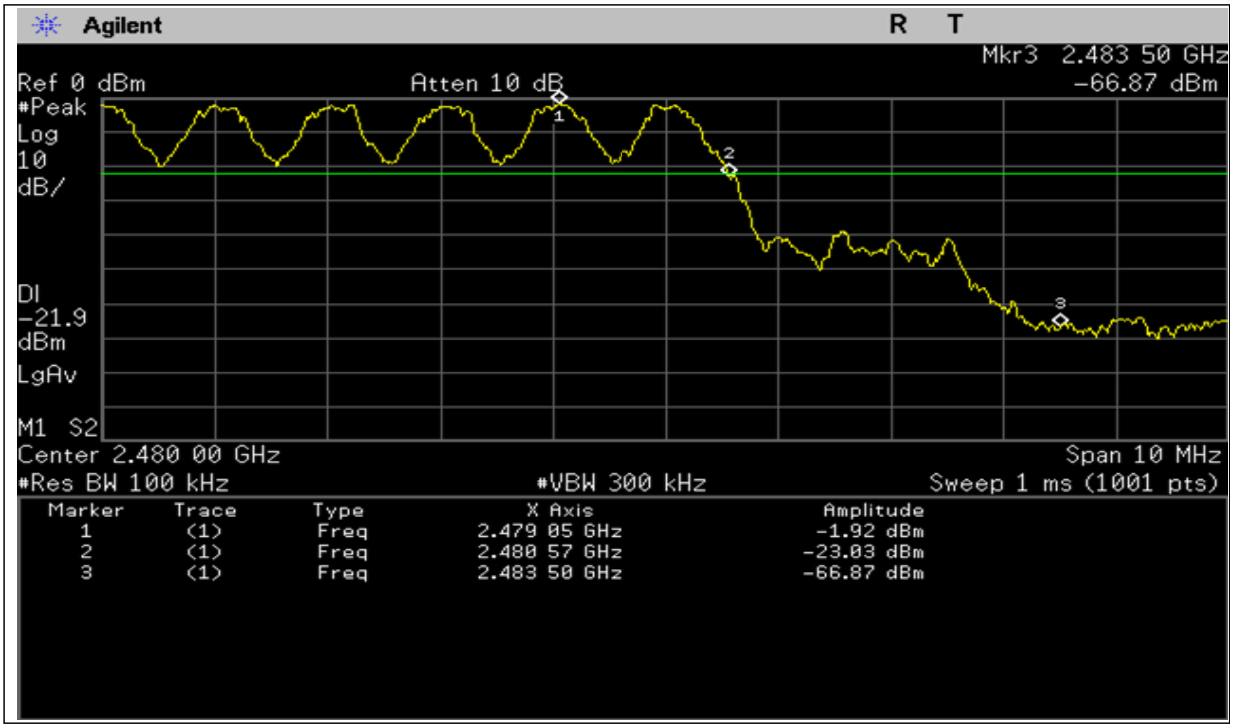
6.8.3.1 band edge

Operation mode : GFSK

Lowest channel

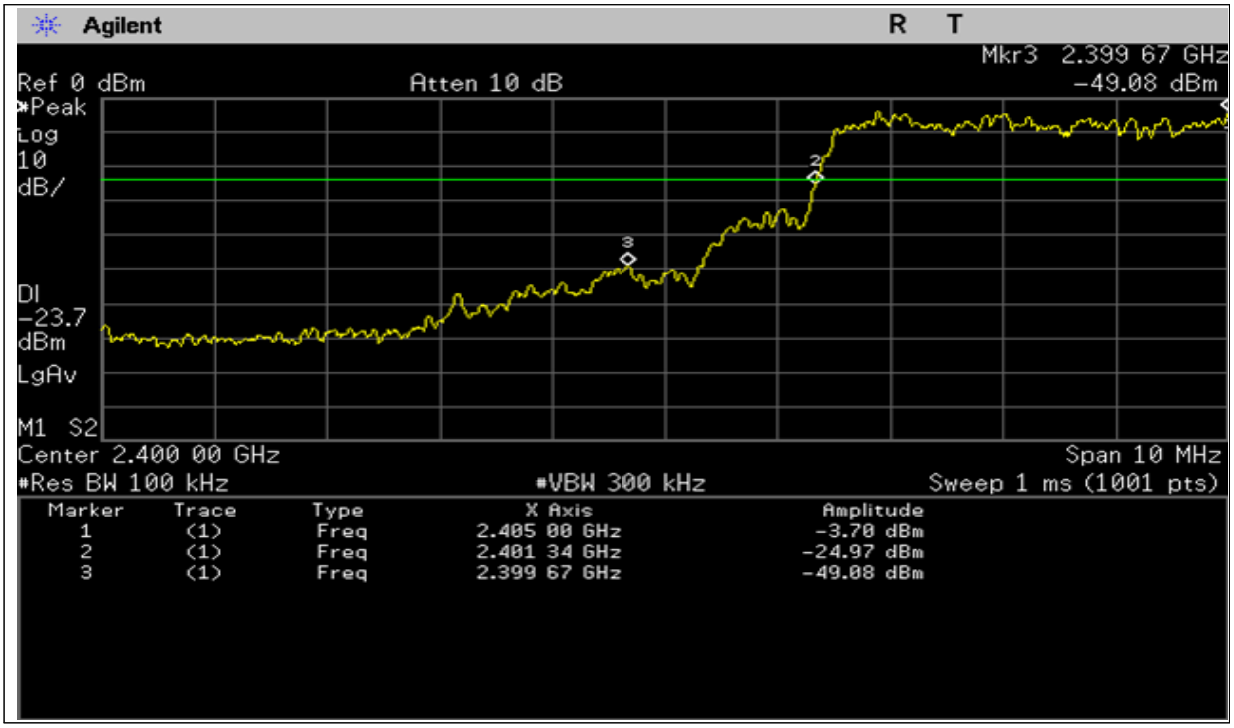


Highest channel



Operation mode : 8DPSK

Lowest channel

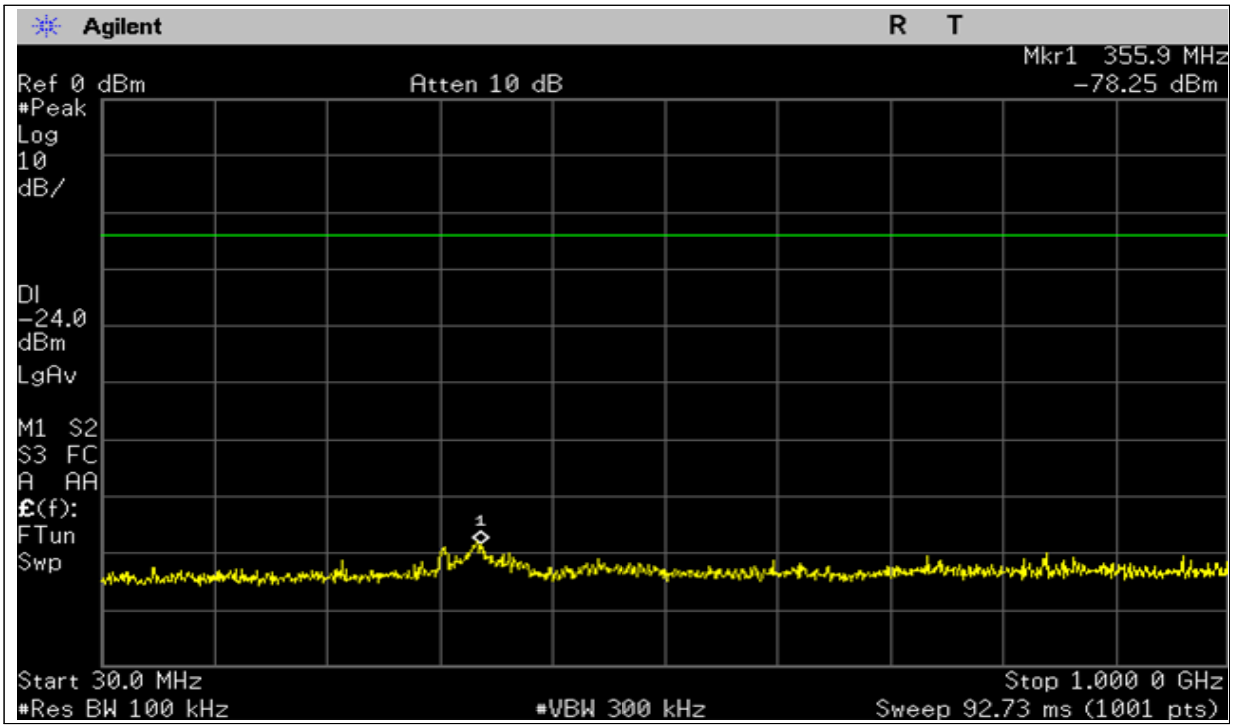


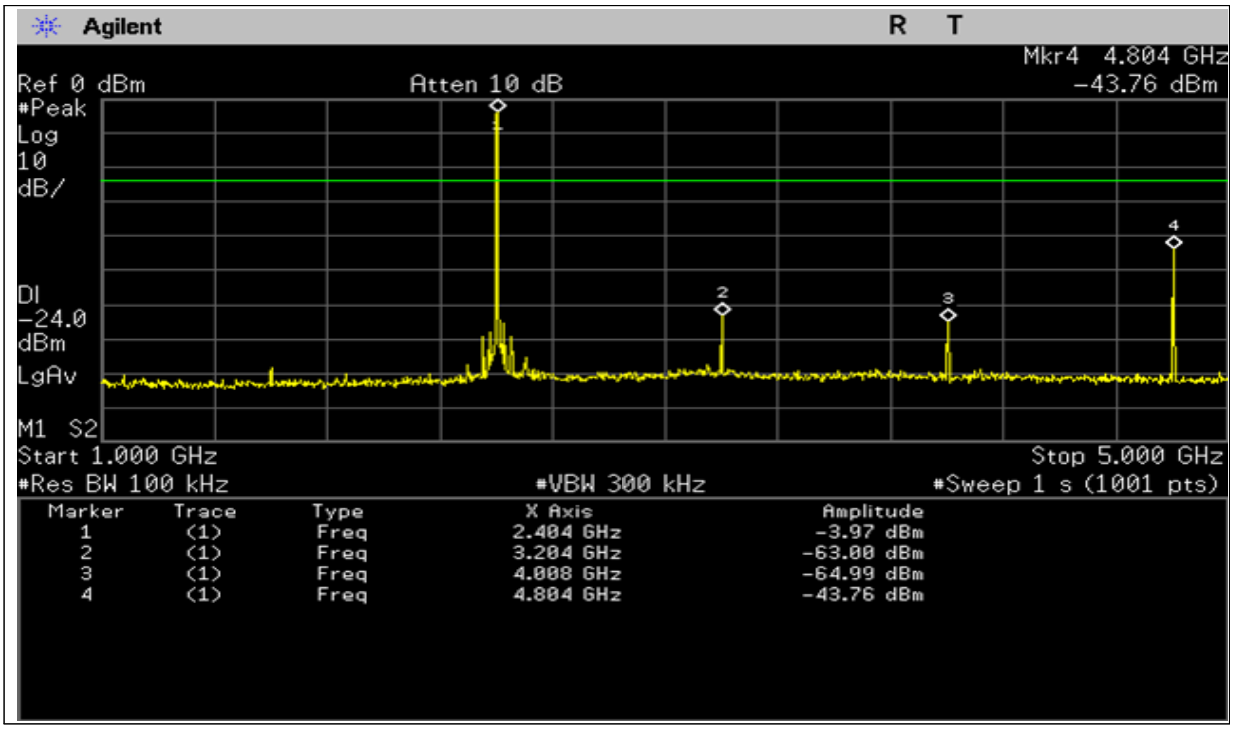
Highest channel

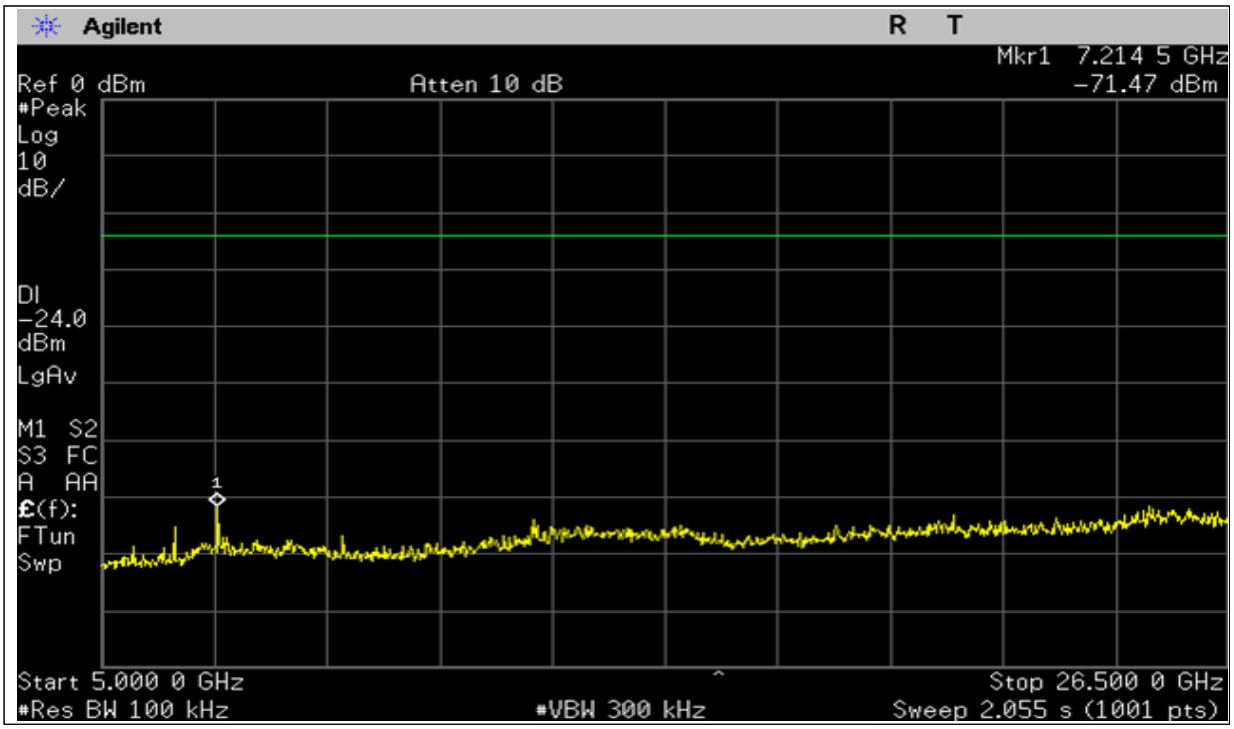
6.8.3.2 spurious emission

Operation mode : GFSK

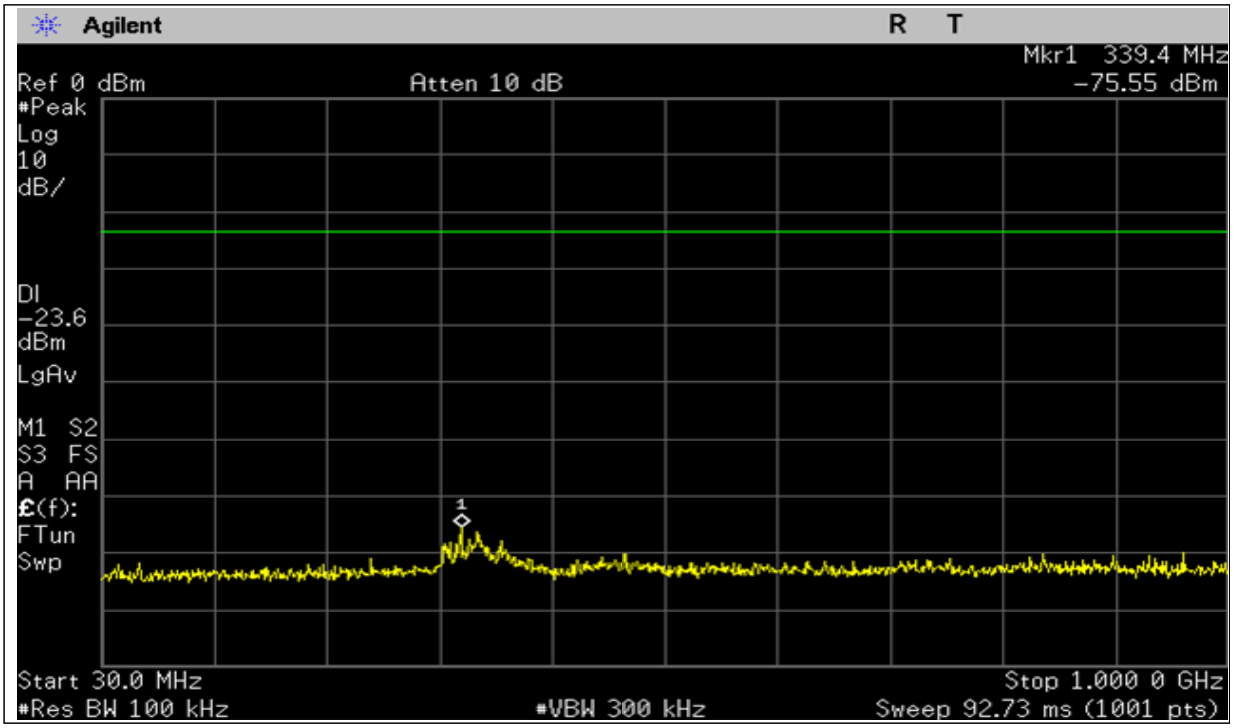
Lowest channel

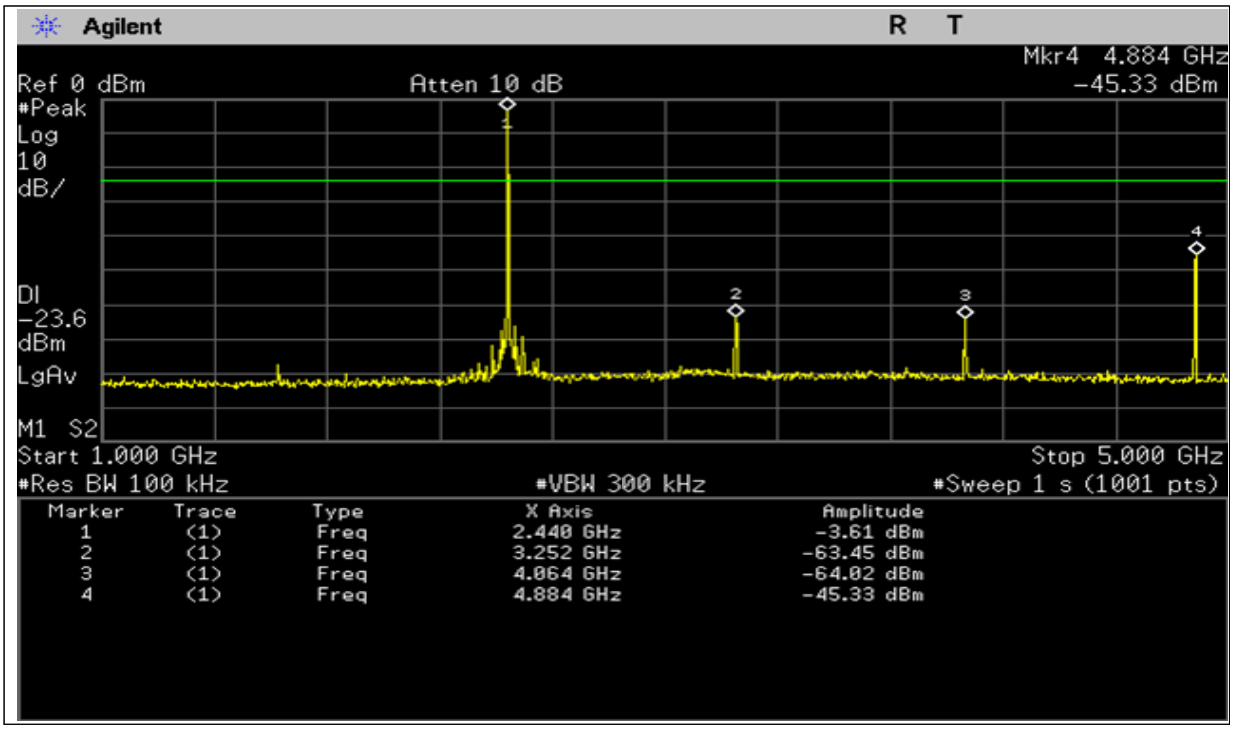


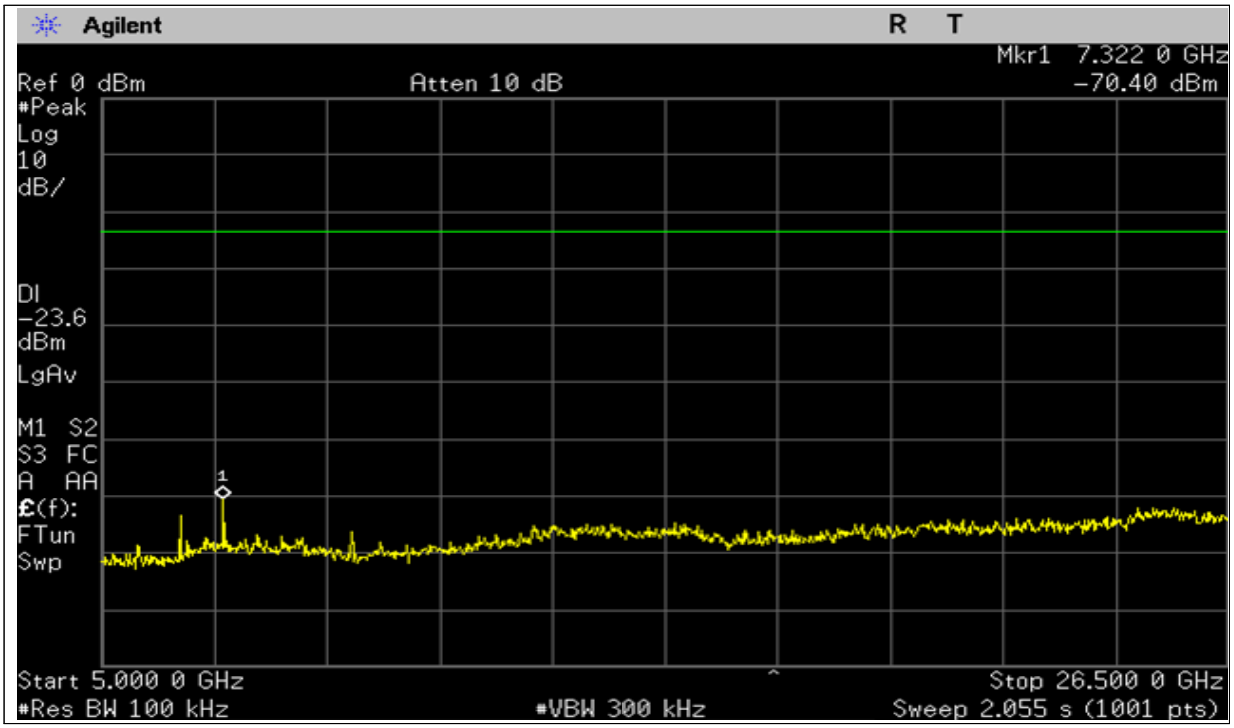




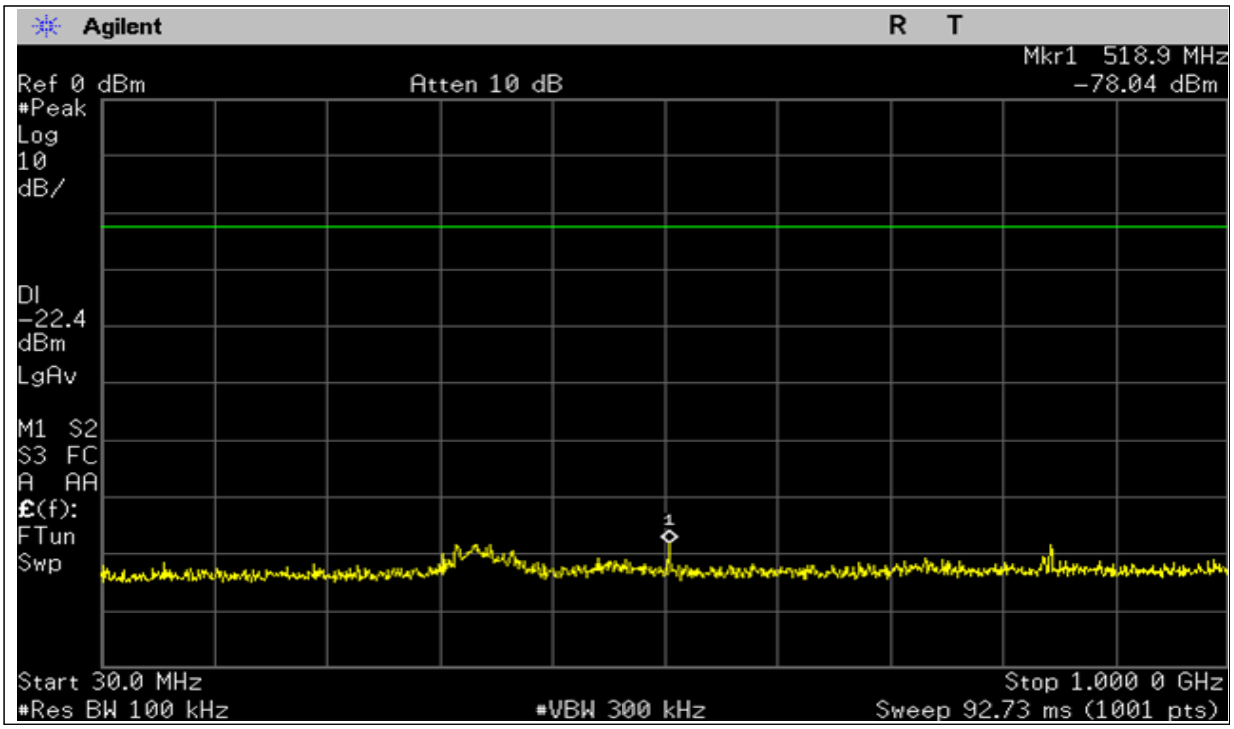
Middle channel

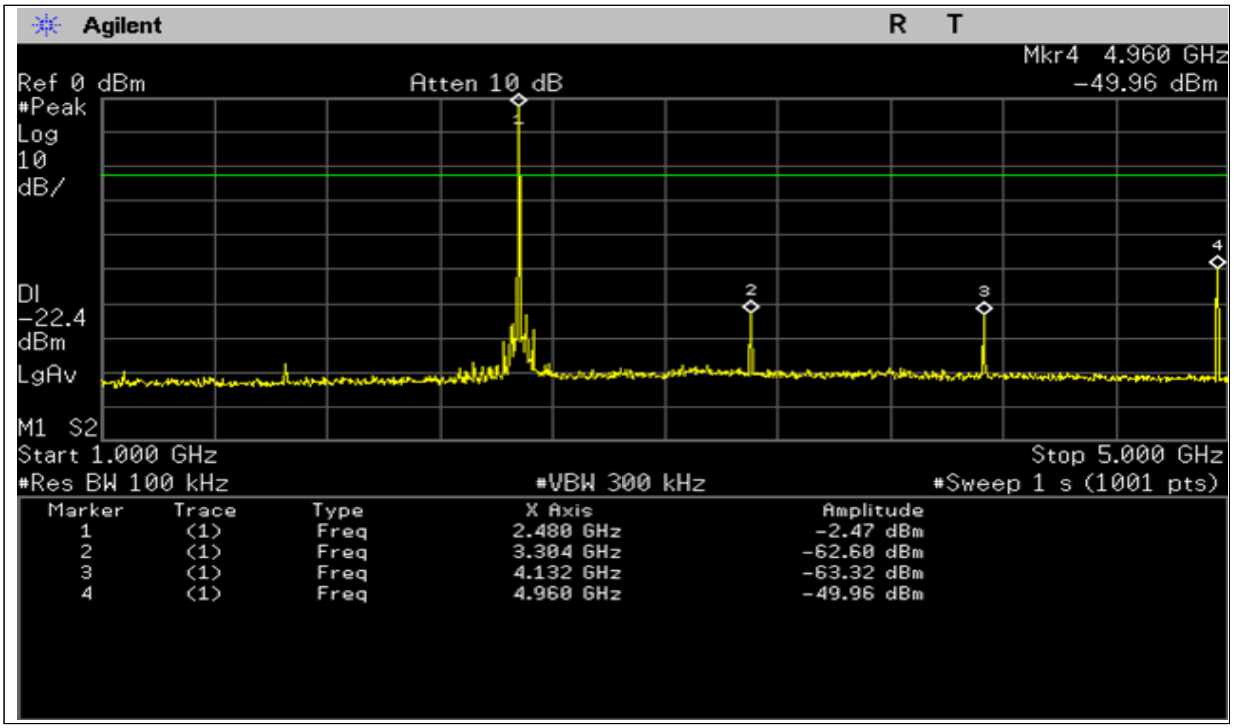


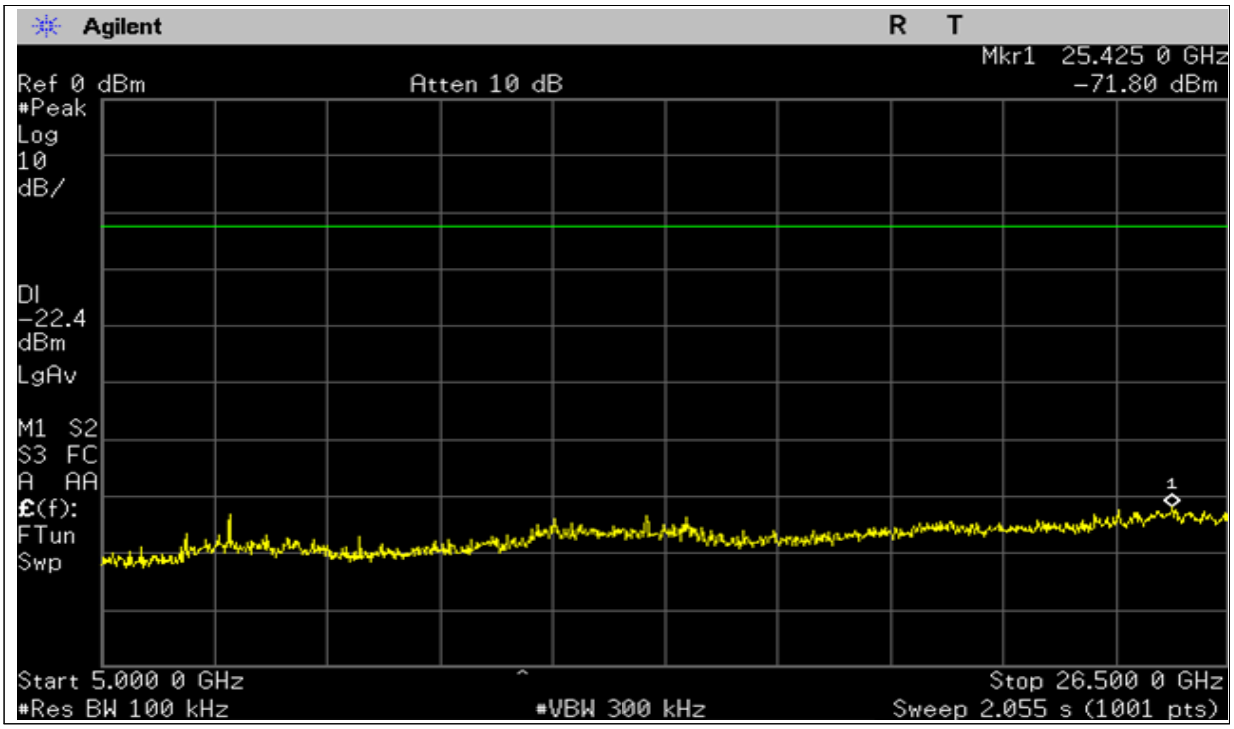

Agilent
R T
Mkr4 4.884 GHz
-45.33 dBm
Ref 0 dBm
Atten 10 dB
#Peak
Log
10
dB/
Dl
-23.6
dBm
LgAv
M1 S2
Start 1.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 5.000 GHz
#Sweep 1 s (1001 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.440 GHz -3.61 dBm
2 (1) Freq 3.252 GHz -63.45 dBm
3 (1) Freq 4.064 GHz -64.02 dBm
4 (1) Freq 4.884 GHz -45.33 dBm


Agilent
R T
Mkr1 7.322 0 GHz
-70.40 dBm
Ref 0 dBm
Atten 10 dB
#Peak
Log
10
dB/
Dl
-23.6
dBm
LgAv
M1 S2
S3 FC
A AA
£(f):
FTun
Swp
Start 5.000 0 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 26.500 0 GHz
Sweep 2.055 s (1001 pts)

Highest channel

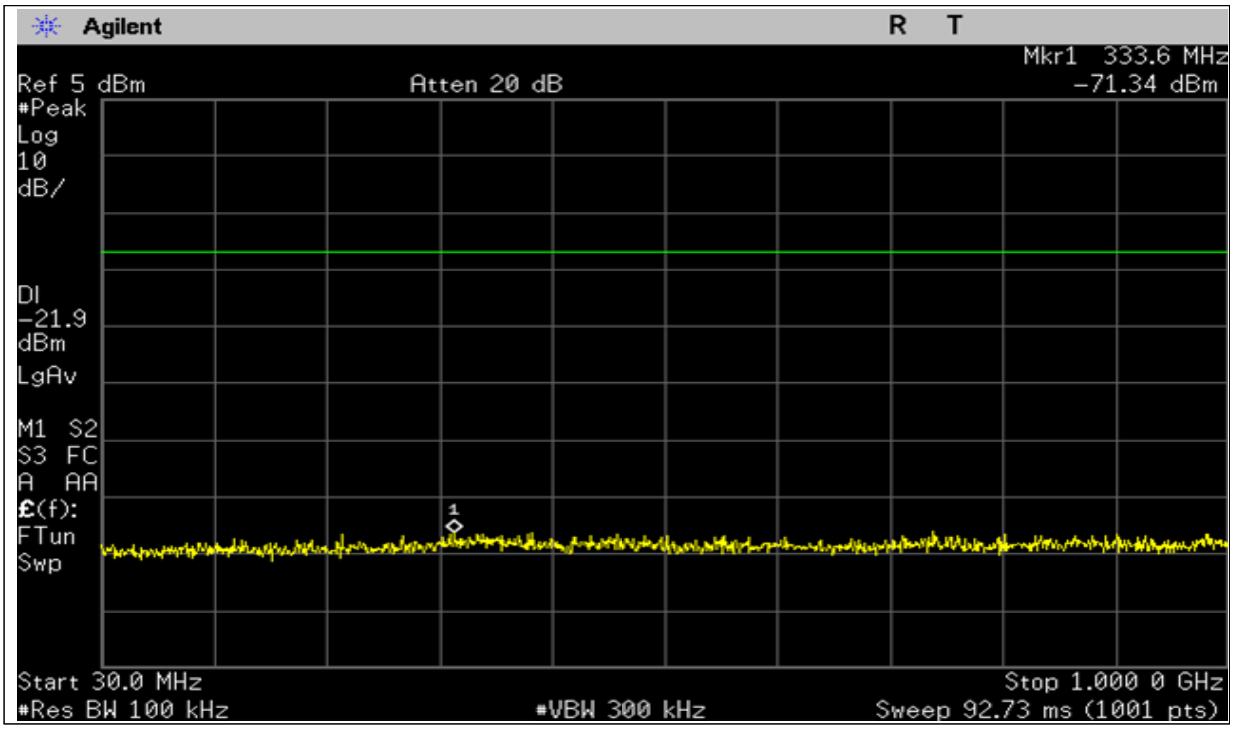


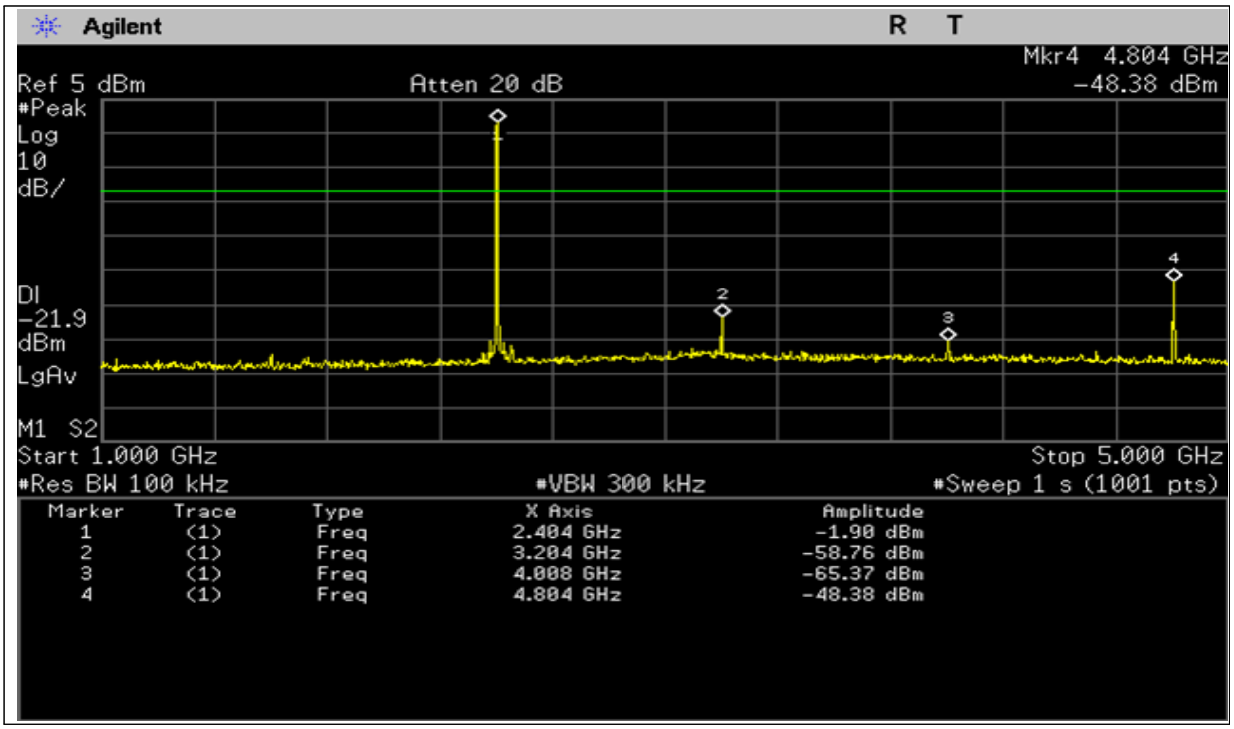


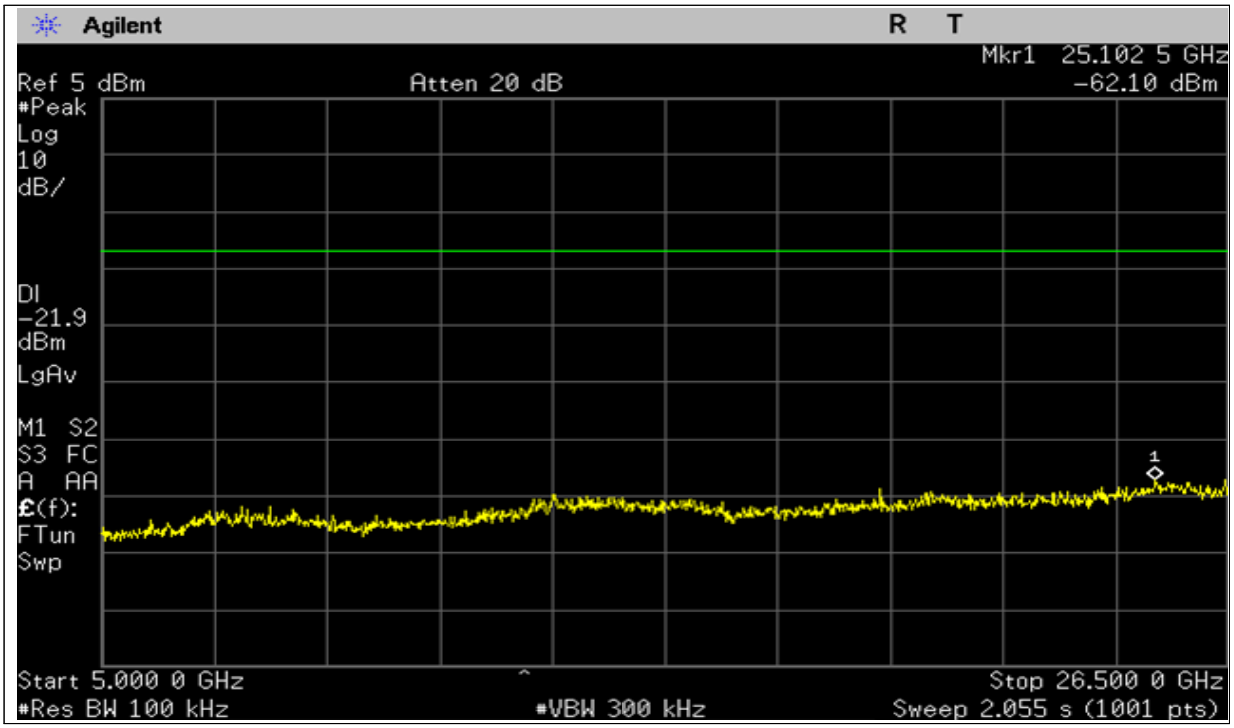


Operation mode : 8DPSK

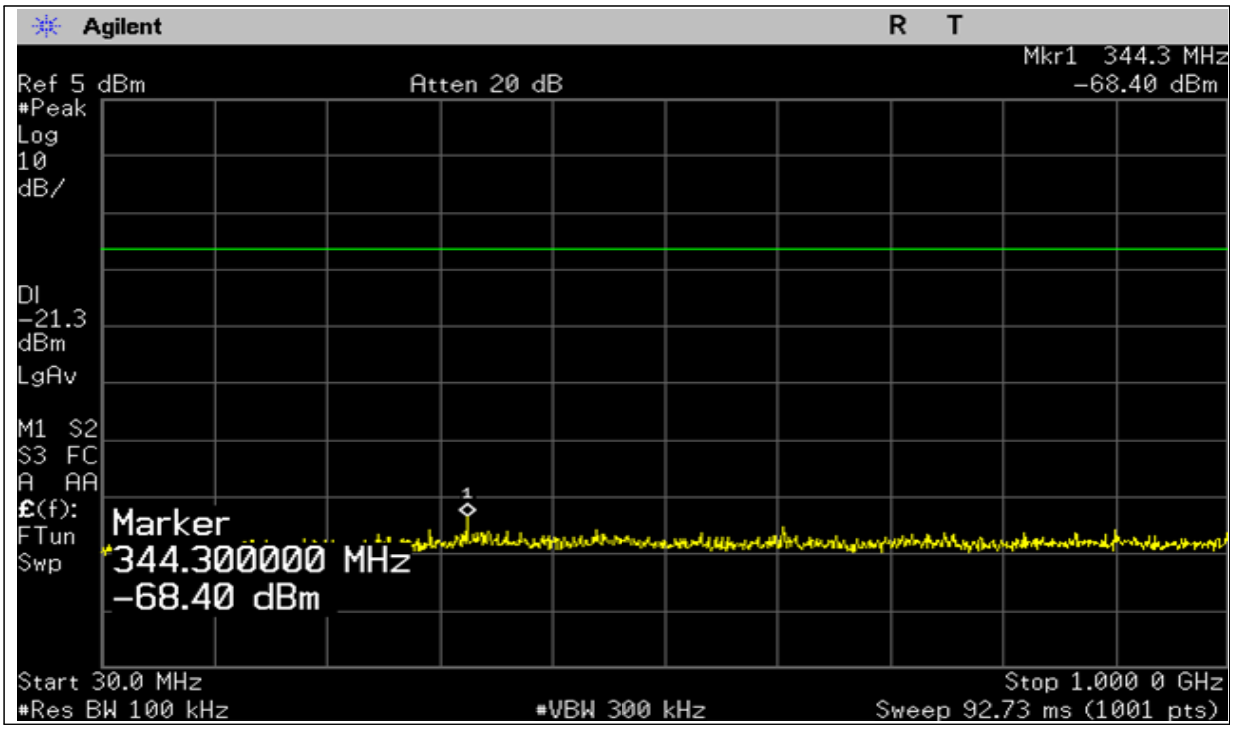
Lowest channel

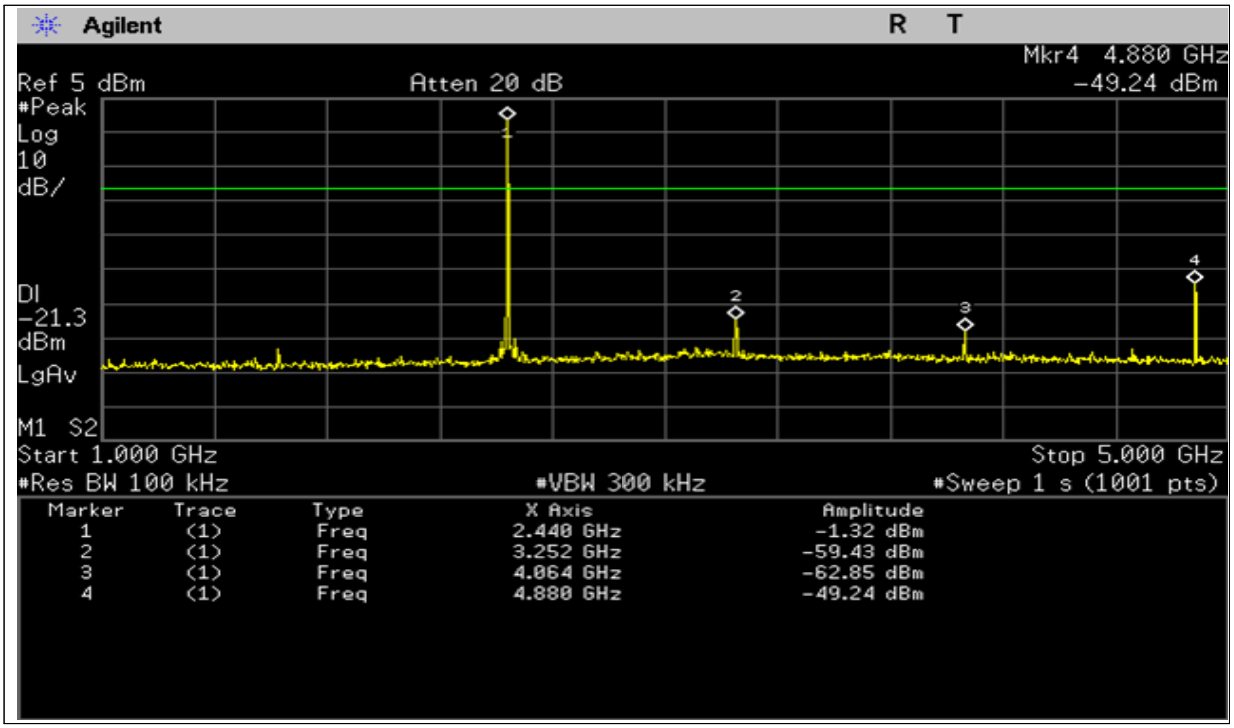


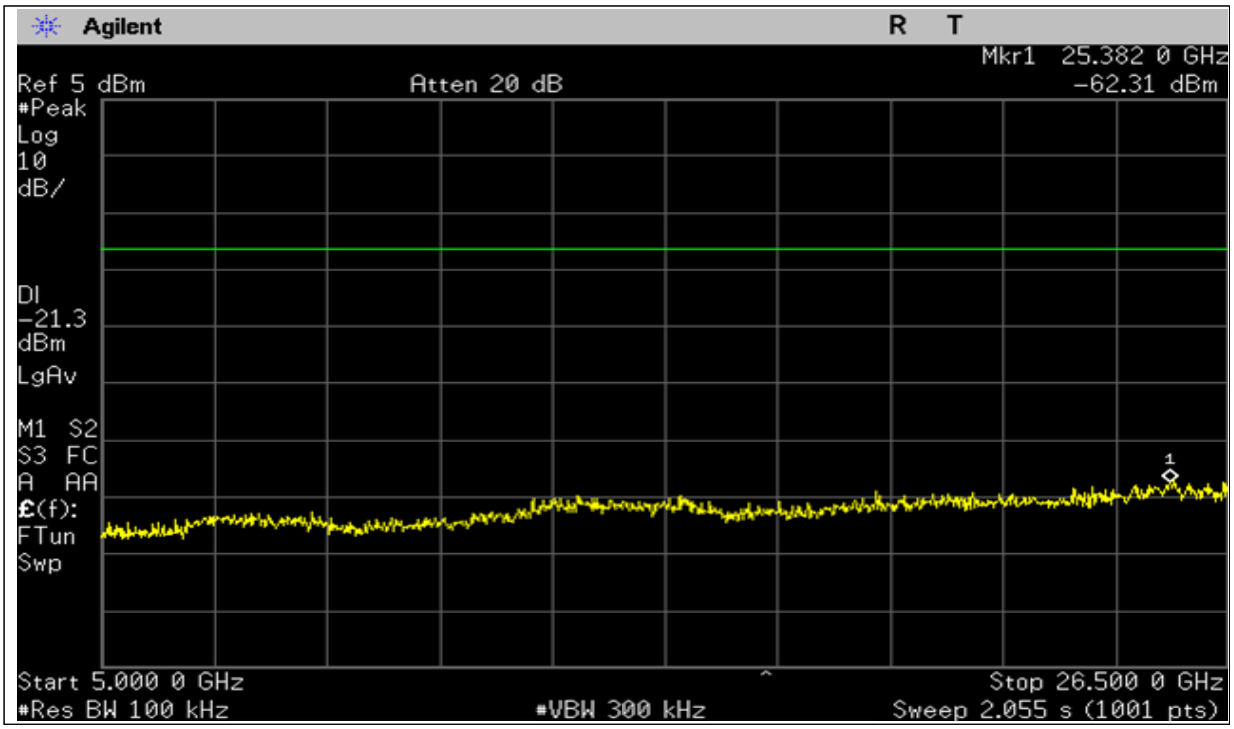

Agilent
R T
Mkr4 4.804 GHz
Ref 5 dBm
Atten 20 dB
-48.38 dBm
#Peak
Log
10
dB/
Dl
-21.9
dBm
LgAv
M1 S2
Start 1.000 GHz
Stop 5.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
#Sweep 1 s (1001 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.404 GHz -1.90 dBm
2 (1) Freq 3.204 GHz -58.76 dBm
3 (1) Freq 4.008 GHz -65.37 dBm
4 (1) Freq 4.804 GHz -48.38 dBm


Agilent
R T
Mkr1 25.102 5 GHz
Ref 5 dBm
Atten 20 dB
-62.10 dBm
#Peak
Log
10
dB/
Dl
-21.9
dBm
LgAv
M1 S2
S3 FC
A AA
£(f):
FTun
Swp
Start 5.000 0 GHz
Stop 26.500 0 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.055 s (1001 pts)

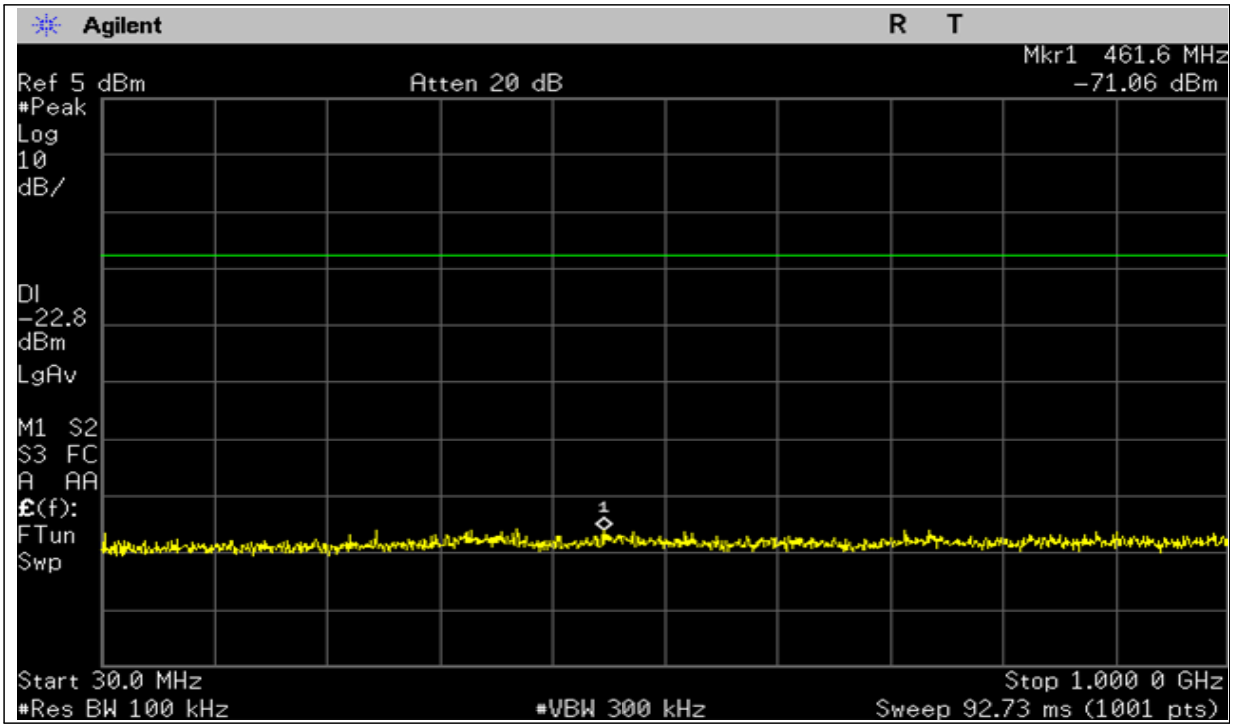
Middle channel

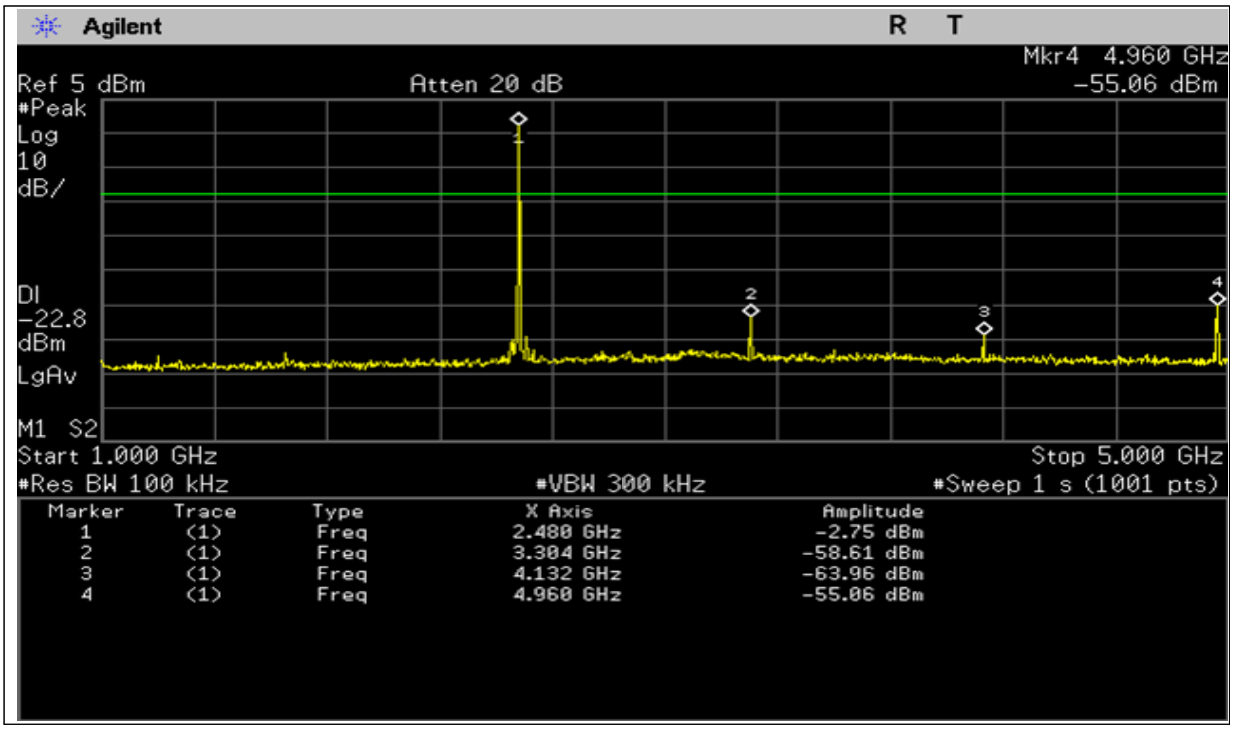


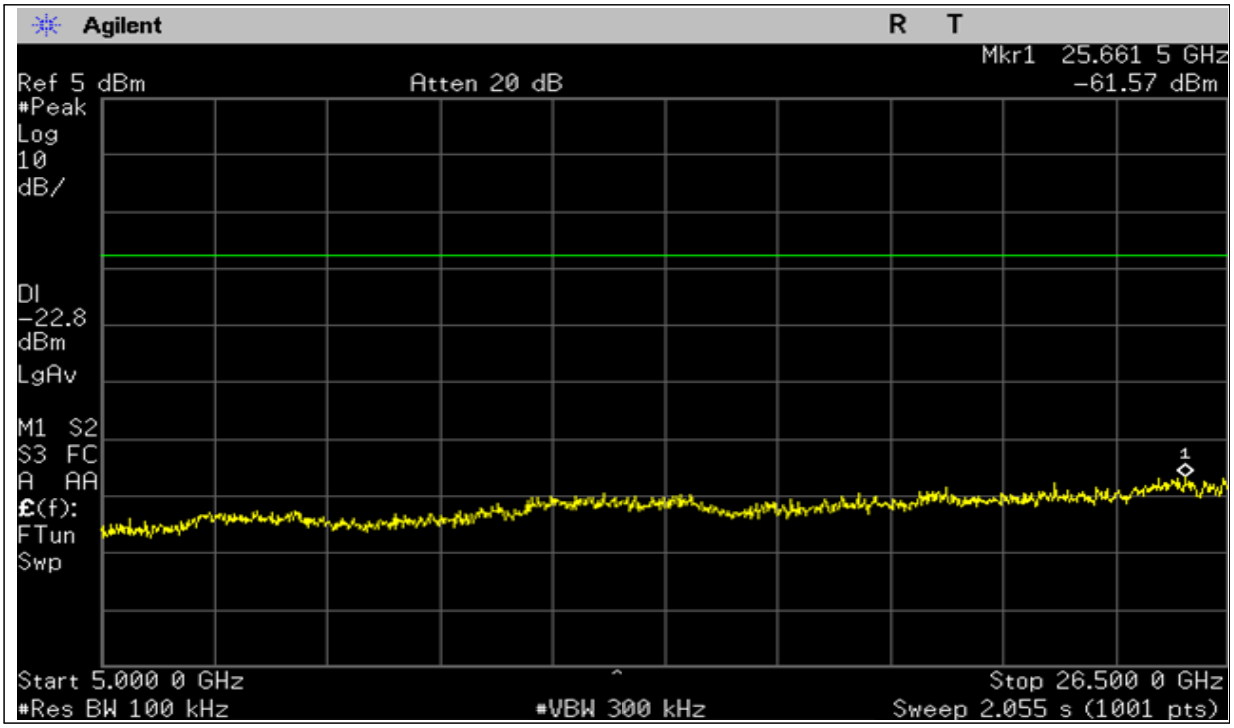




Highest channel




Agilent
R T
Mkr4 4.960 GHz
Ref 5 dBm
Atten 20 dB
-55.06 dBm
#Peak
Log
10
dB/
Dl
-22.8
dBm
LgAv
M1 S2
Start 1.000 GHz
Stop 5.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
#Sweep 1 s (1001 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.480 GHz -2.75 dBm
2 (1) Freq 3.304 GHz -58.61 dBm
3 (1) Freq 4.132 GHz -63.96 dBm
4 (1) Freq 4.960 GHz -55.06 dBm


Agilent
R T
Mkr1 25.661 5 GHz
Ref 5 dBm
Atten 20 dB
-61.57 dBm
#Peak
Log
10
dB/
Dl
-22.8
dBm
LgAv
M1 S2
S3 FC
A AA
£(f):
FTun
Swp
Start 5.000 0 GHz
Stop 26.500 0 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.055 s (1001 pts)

6.9 Radiated spurious emissions & Band edge

6.9.1 Regulation

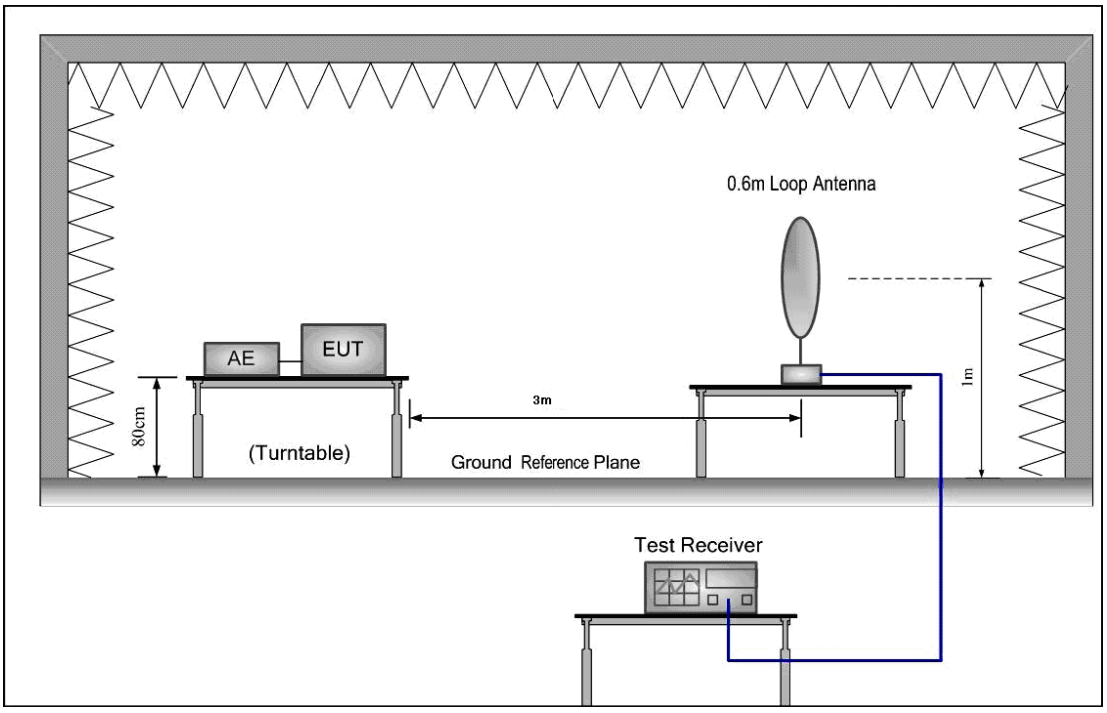
According to §15.209(a), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (meters)
0.009-0.490	2 400/F (kHz)	-	300
0.490-1.705	24 000/F (kHz)	-	30
1.705-30	30	29.5	30
30–88	100**	40.0	3
88–216	150**	43.5	3
216–960	200**	46.0	3
Above 960	300	54.0	3

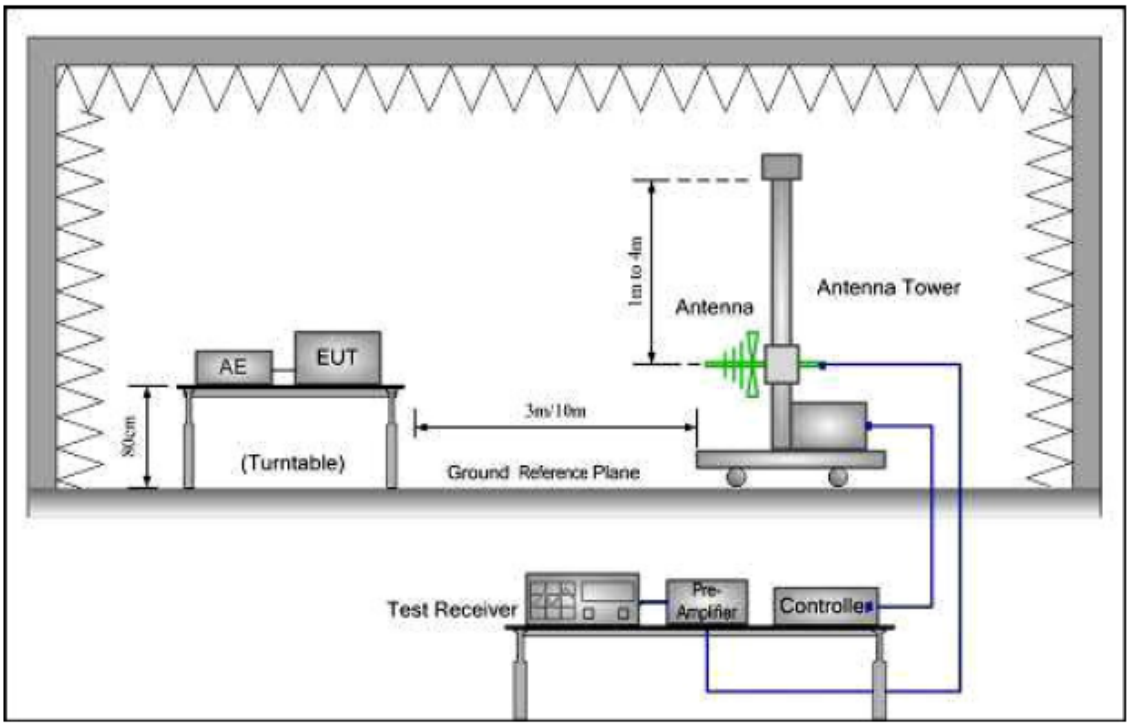
**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permlttted under other sections of this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

6.9.2 Test Setup Layout

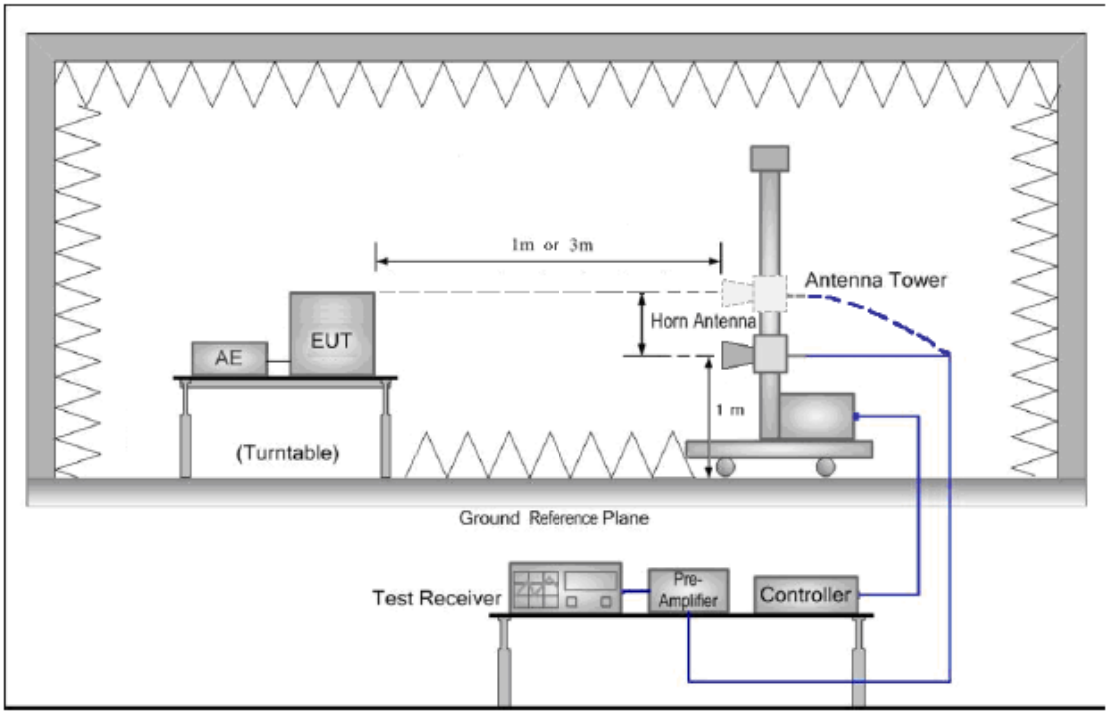
6.9.2.1 Radiated Emission Test Set-Up, Frequency Below 30 MHz



6.9.2.2 Radiated Emission Test Set-Up, Frequency Below 1 000 MHz



6.9.2.3 Radiated Emission Test Set-UP Frequency Over 1 000 MHz



6.9.3 Test procedure

6.9.3.1 Spurious Radiated Emissions:

1) The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters for above 30 MHz, and at 1 meter distance for below 30 MHz.
2) The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.
3) The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, from 30 to 1000 MHz using the Trilog broadband antenna, and from 1 GHz to tenth harmonic of the highest fundamental frequency using the horn antenna.
4) To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 × 4 meter at the Open Area Test Site. The EUT was tested at a distance 3 meters.
5) Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
6) The EUT is situated in three orthogonal planes (if appropriate)
7) The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT.
8) If the emission on which a radiated measurement must be made is located at the edge of the authorized band of operation, then the alternative “arker-delta”method may be employed.

6.5.3.2 Marker-Delta Method at the edge of the authorized band of operation:

1) Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function as the above Spurious Radiated Emissions test procedure.
2) Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 1% of the total span (but never less than 30 kHz) with a video bandwidth equal to or greater than the RBW. Record the peak levels of the fundamental emission and the relevant band-edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not a field strength measurement; it is only a relative measurement to determine the amount by which the emission drops at the band-edge relative to the highest fundamental emission level.
3) Subtract the delta measured in step (2) from the field strengths measured in step (1). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band-edge compliance as required by Section 15.205.
4) The above "delta" measurement technique may be used for measuring emissions that are up to two "standard" bandwidths away from the band-edge, where a "standard" bandwidth is the bandwidth specified by C63.4 for the frequency being measured. For example, for band-edge measurements in the restricted band that begins at 2483.5 MHz, C63.4 specifies a measurement bandwidth of at least 1 MHz. Therefore you may use the "delta" technique for measuring emissions up to 2 MHz removed from the band-edge. Radiated emissions that are removed by more than two “tandard” bandwidths must be measured as the above Spurious Radiated Emissions test procedure.

6.9.4 Test Result

6.9.4.1 band edge

Operation mode	Frequency (MHz)		Detect Mode	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
GFSK	2 402	2 355.0	Peak	55.05	74	18.95
		2 355.0	Average	45.18	54	8.82
	2 480	2 498.5	Peak	48.88	74	25.12
		2 498.5	Average	44.88	54	9.12
8DPSK	2 402	2 352.0	Peak	54.43	74	19.57
		2 352.0	Average	44.82	54	9.18
	2 480	2 498.5	Peak	44.11	74	29.89
		2 498.5	Average	44.03	54	9.97

6.9.4.2 spurious emission

Operation mode	Frequency (MHz)		Detect Mode	Polarization (V/H)	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
GFSK	2 402	50.96	Quasi-Peak	V	32.48	40.00	7.52
		60.08	Quasi-Peak	H	34.02	40.00	5.98
		99.99	Quasi-Peak	H	37.11	43.50	6.39
		300.12	Quasi-Peak	H	36.68	46.00	9.32
		800.22	Quasi-Peak	V	39.18	46.00	6.82
		900.53	Quasi-Peak	H	40.19	46.00	5.81
		1 601.50	Peak	V	56.84	74.00	17.16
			Average	V	47.26	54.00	6.74
		4 804.50	Peak	V	52.66	74.00	21.37
			Average	V	47.44	54.00	6.56
	2 442	50.96	Quasi-Peak	V	32.50	40.00	7.50
		576.88	Quasi-Peak	H	35.06	46.00	10.94
		720.05	Quasi-Peak	H	37.15	46.00	8.85
		799.51	Quasi-Peak	V	39.41	46.00	6.59
		900.53	Quasi-Peak	H	40.49	46.00	5.51
		4 882.50	Peak	V	53.51	74.00	20.49
			Average	V	48.15	54.00	5.85
	2 480	35.92	Quasi-Peak	V	31.51	40.00	8.49
		576.88	Quasi-Peak	H	35.16	46.00	10.84
		720.05	Quasi-Peak	H	37.47	46.00	8.53
		799.51	Quasi-Peak	V	38.52	46.00	7.48
		900.53	Quasi-Peak	H	38.78	46.00	7.22
		1 600.00	Peak	V	52.86	74.00	21.14
			Average	V	46.06	54.00	7.94
		4 960.50	Peak	V	48.84	74.00	25.16
			Average	V	44.49	54.00	9.51

Operation mode	Frequency (MHz)		Detect Mode	Polarization (V/H)	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
8DPSK	2 402	47.65	Quasi-Peak	V	35.39	40.00	4.61
		576.17	Quasi-Peak	H	35.15	46.00	10.85
		799.51	Quasi-Peak	V	40.62	46.00	5.38
		816.56	Quasi-Peak	H	37.61	46.00	8.39
		900.53	Quasi-Peak	H	39.00	46.00	7.00
		1 602.00	Peak	H	50.65	74.00	23.35
			Average	H	44.27	54.00	9.73
	2 441	47.05	Quasi-Peak	V	35.72	40.00	4.28
		576.88	Quasi-Peak	H	35.02	46.00	10.98
		799.51	Quasi-Peak	V	40.23	46.00	5.77
		816.56	Quasi-Peak	H	37.59	46.00	8.41
		900.53	Quasi-Peak	H	39.41	46.00	6.59
		1 998.50	Peak	V	50.70	74.00	23.30
			Average	V	43.97	54.00	10.03
		4 882.00	Peak	V	53.45	74.00	20.55
			Average	V	47.91	54.00	6.09
	2 480	48.36	Quasi-Peak	V	34.38	40.00	5.62
		576.88	Quasi-Peak	H	35.42	46.00	10.58
		830.18	Quasi-Peak	V	40.33	46.00	5.67
		900.53	Quasi-Peak	H	39.17	46.00	6.83
		1 602.00	Peak	V	49.70	74.00	24.30
			Average	V	42.19	54.00	11.81

6.10 AC Power Line Conducted Emissions

6.10.1 Regulation

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 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 Ω line impedance stabilization network (LISN).

Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Qausi-peak	Average
0.15 −0.5	66 to 56 *	56 to 46 *
0.5 −5	56	46
5 −30	60	50

* Decreases with the logarithm of the frequency.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

6.10.2 Test Procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5 m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50 Ω / 50 μH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

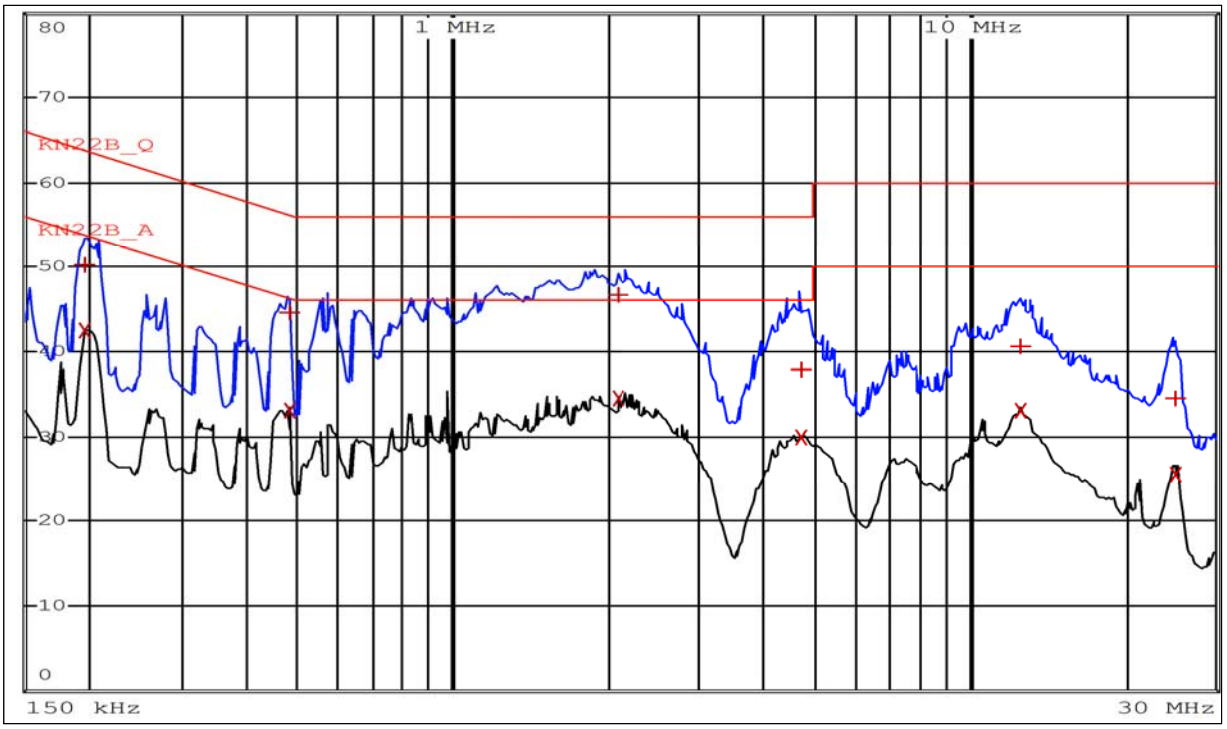
6.10.3 Test Result

Frequency (MHz)	Detect Mode	Hot/Neutral (H/N)	Measured Value (dBµV)	Correction Factor (dB)	Cable Loss (dB)	Emission Level (dBµV)	Limit (dBµV)	Margin (dB)
0.19	Quasi-Peak	H	40.10	9.62	0.53	50.25	64.04	13.79
	Average		32.35			42.50	54.04	11.54
0.19	Quasi-Peak	N	45.76	9.63	0.53	55.92	64.04	8.12
	Average		32.12			42.28	54.04	11.76
0.47	Quasi-Peak	N	32.37	9.64	0.58	42.59	56.51	13.92
	Average		19.05			29.27	46.51	17.24
0.48	Quasi-Peak	H	34.47	9.64	0.58	44.69	56.34	11.65
	Average		22.76			32.98	46.34	13.36
1.91	Quasi-Peak	N	33.09	9.67	0.62	43.38	56.00	12.62
	Average		21.18			31.47	46.00	14.53
2.09	Quasi-Peak	H	36.32	9.67	0.63	46.62	56.00	9.38
	Average		24.30			34.60	46.00	11.40
4.69	Quasi-Peak	N	26.11	9.74	0.63	36.48	56.00	19.52
	Average		15.51			25.88	46.00	20.12
4.73	Quasi-Peak	H	27.46	9.71	0.63	37.80	56.00	18.20
	Average		19.58			29.92	46.00	16.08
12.54	Quasi-Peak	N	31.92	10.17	0.84	42.93	60.00	17.07
	Average		23.78			34.79	50.00	15.21
12.59	Quasi-Peak	H	29.89	9.99	0.84	40.72	60.00	19.28
	Average		22.23			33.06	50.00	16.94
25.06	Quasi-Peak	H	22.32	10.98	1.21	34.51	60.00	25.49
	Average		13.31			25.50	50.00	24.50

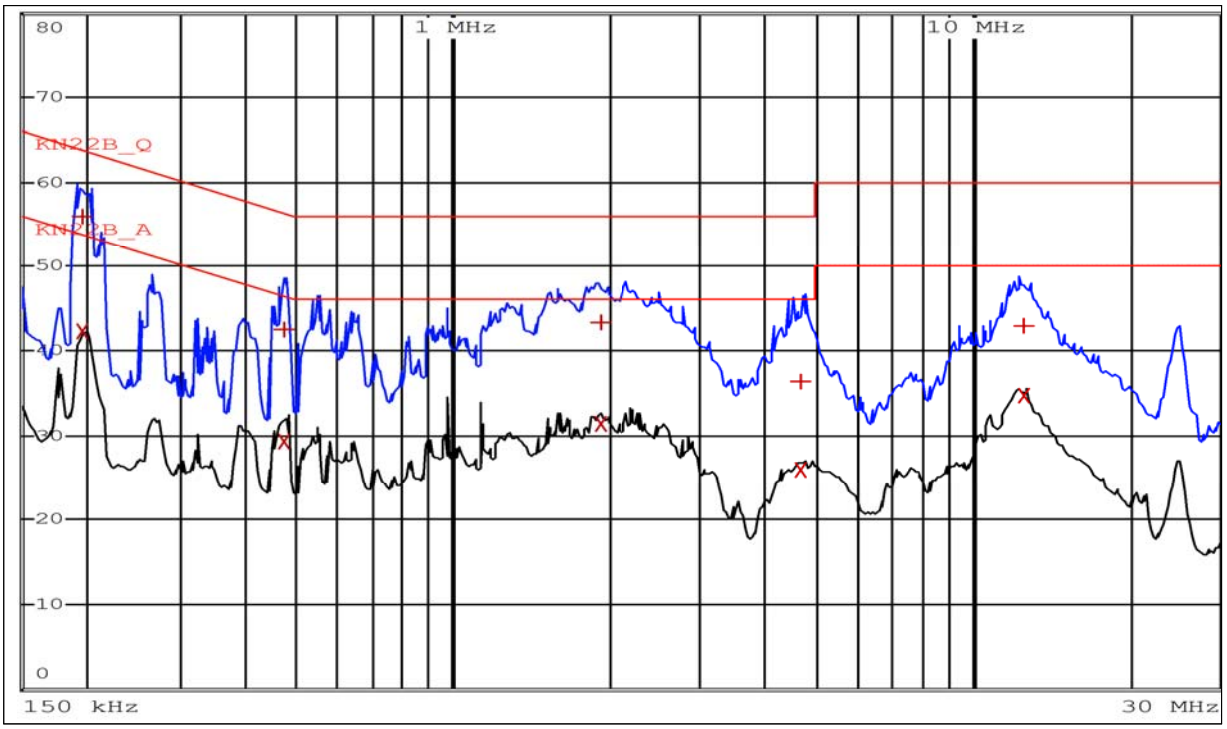
1. Margin (dB) = Limit −Emission Level
2. Emission Level = Measured Value + CF + CL

6.10.4. Graph of the AC Power Line Conducted Emissions

HOT LINE



NEUTRAL LINE



APPENDIX

1. EUT photo