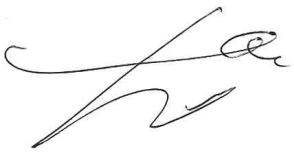
TEST REPORT

1. Applicant		
Name	:	M.I.J
Brand Name	:	N/A
Address	:	Womem Enterprise Supporting Center 301, 366, Huseok-ro, cuuncheon, Gangwon-do, Korea
FCC ID	:	2AL5DBBCT2017-S2
2. Products		
Name	:	ETEREO S2
Model No.	:	BBCT2017-S2
Variant Model No.	:	BBCT2017-S2-A
Manufacturer		M.I.J
Address		Womem Enterprise Supporting Center 301, 366, Huseok-ro, cuuncheon, Gangwon-do, Korea
3. Test Standard	:	47 CFR Part 15, Subpart C
4. Test Method	:	ANSI C63.10:2013
5. Test Result	:	PASS
6. Dates of Test	:	May 08, 2017 to May 16, 2017
7. Date of Issue	:	May 19, 2017
8. Test Laboratory	:	Standard Engineering Co. Ltd. FCC Designation Number : 624439

Tested by	Approved by
	
SoonHo, Kim / Test Engineer	SeongSeok, Seo / Compliance Engineer

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377-11, Sinjang-ri, Eumam-myeon, Seosan-si, ChoongNam 356-844, South Korea
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1. Test Summary

Test	Test Requirement	Test method	Result
Antenna Requirement	FCC PART 15 C section 15.247 (c) and Section 15.203	FCC PART 15 C section 15.247 (c) and Section 15.203	PASS
Occupied Bandwidth	FCC PART 15 C section 15.247 (a)(1)	ANSI C63.10: Clause 6.9.1	PASS
Carrier Frequencies Separated	FCC PART 15 C section 15.247(a)(1)	ANSI C63.10: Clause 7.7.2	PASS
Hopping Channel Number	FCC PART 15 C section 15.247(a)(1)(iii)	ANSI C63.10: Clause 7.7.3	PASS
Dwell Time	FCC PART 15 C section 15.247(a)(1)(iii)	ANSI C63.10: Clause 7.7.4	PASS
Pseudorandom frequency-hopping sequence	FCC PART 15 C section 15.247(a)(1)	ANSI C63.10: Clause 7.7.5	PASS
Maximum Peak Output Power	FCC PART 15 C section 15.247(b)(1)	ANSI C63.10: Clause 6.10.1	PASS
Conducted Spurious Emission	FCC PART 15 C section 15.247(d)	ANSI C63.10: Clause 6.7	PASS
Radiated Spurious Emission	FCC PART 15 C section 15.247(d)	ANSI C63.10: Clause 6.4, 6.5 and 6.6	PASS
Band Edges Measurement	FCC PART 15 C section 15.247 (d) &15.205	ANSI C63.10: Clause 6.9.1	PASS
Conducted Emissions at Mains Terminals	FCC PART 15 C section 15.207	ANSI C63.10: Clause 6.2	PASS
Radio Frequency Exposure Procedures	FCC PART 15 C section 15.247 (i) &1.1307(b)	-	PASS

Remark:

N/A: not applicable. Refer to the relative section for the details.

EUT: In this whole report EUT means Equipment Under Test.

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radio Frequency.

ANSI C63.10: the detail version is ANSI C63.10:2013 in the whole report.

DA 00-705 was used as a guideline in preparing this Test Report.

2. TABLE OF CONTENTS

3. General Information

3.1. Client Information

Applicant : M.I.J
Address of Applicant : Womem Enterprise Supporting Center 301, 366, Huseok-ro, cuuncheon, Gangwon-do, Korea

3.2. General Description of E.U.T.

Product Name : ETEREO S2
Model No. : BBCT2017-S2
Variant Model No. : BBCT2017-S2-A

3.3. Details of E.U.T.

Operating Frequency	:	2402 MHz to 2480 MHz
Type of Modulation	:	GFSK, π/4DQPSK, 8DPSK
Number of Channels	:	79 Channels
Channel Separation	:	1 MHz
Antenna Type	:	Integral (Pattern Antenna)
Antenna gain	:	2.0 dBi
Speciality	:	BDR/EDR
Power Supply	:	Rechargeable battery : DC 4.2 V, 170 mAh
Normal Test Voltage	:	DC 4.2V

Remark:

- The device meets the requirements stated within Parts 15.247(g) & (h) in that they were developed under the Bluetooth protocol and operate as a true frequency hopping system. The device does not have the ability to be coordinated with other FHSS systems in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

3.4. Modulation configure

Modulation	Packet	Packet Type	Packet Size
GFSK	DH1	4	24
	DH3	11	183
	DH5	15	339
π/4DQPSK	2DH1	20	54
	2DH3	26	367
	2DH5	30	379
8DPSK	3DH1	24	83
	3DH3	27	552
	3DH5	31	1021

Remark:

- In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
Lowest channel	2402 ㎒
Middle channel	2441 ㎒
Highest channel	2480 ㎒

3.5. Description of Support Units

The EUT has been tested with corresponding accessories as below:

Supplied by Standard Engineering Laboratory.:

Description	Manufacturer	Model No.	Serial No.
NoteBook	COMPAQ	PP2140	1V2CKSBZ52C0
USB To SPI Jig	CSR	USB-SPI-TOOLS	-

3.6. Abnormalities from Standard Conditions

None.

3.7. Other Information Requested by the Customer

None.

3.8. Test Location

377-11, Sinjang-ri, Eumam-myeon, Seosan-si, ChoongNam 356-844, South Korea
(FCC Designation Number : 624439)

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.	Cal. Date	Next Cal. Data	Used equipment
1	EMI Test Receiver	LIG	ER-265	L1009B016	03/02/2017	03/02/2018	■
2	EMI Test Receiver	Rhode & Schwarz	ESIB7	3311	09/02/2016	09/02/2017	■
3	Bi-log Antenna	Schwarzbeck	VULB9163	163	09/15/2015	09/30/2017	■
4	Loop Antenna	EMCO	6502	9206-2769	01/28/2016	01/28/2018	■
5	Spectrum Analyzer	Agilent	E4440A	US45303130	01/24/2017	01/24/2018	■
6	Power Meter	Agilent	E4418B	MY40511165 5	01/23/2017	01/23/2018	□
7	Power Sensor	HP	8485A	2347A02746	01/23/2017	01/23/2018	□
8	Signal Generator	HP	83630A	3420A00728	01/24/2017	01/24/2018	□
9	Pre Amplifier	Agilent	8449B	3008A02105	01/24/2017	01/24/2018	■
10	Signal Generator	Rhode & Schwarz	SML03	102330	01/23/2017	01/23/2018	□
11	POWER DIVIDER	Agilent	11636B	50309	01/23/2017	01/23/2018	□
12	Power Sensor	Agilent	8482B	3318A05111	01/23/2017	01/23/2018	□
13	DC Power Supply	HP	6032A	US35420383	01/23/2017	01/23/2018	■
14	Bandreject Filter	K&L Microwave	50140	555	01/23/2017	01/23/2018	□
15	Horn Antenna	Schwarzbeck	BBHA9120A	346	02/05/2016	02/05/2018	■
16	Horn Antenna	A.H. SYSTEMS	SAS-572	269	09/03/2015	09/03/2017	■
16	DC Power Supply	Provice	PWS-5005D	205051	01/23/2017	01/23/2018	■
17	LISN	Rhode & Schwarz	ESH2-Z5	100204	11/10/2016	11/10/2017	■
18	Pulse Limiter	Rhode & Schwarz	ESH3-Z2	100137	11/10/2016	11/10/2017	■
19	Digital Multimeter	DONG HWA	DM-1010	A323665	01/23/2017	01/23/2018	■

5. Test Results

5.1. E.U.T. test conditions

Test Voltage:	DC 4.2V
Temperature:	20.0 -25.0 °C
Humidity:	38-50 % RH
Atmospheric Pressure:	1000 -1010 mbar
Test frequencies and frequency range:	According to the 15.31(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table: According to the 15.33 (a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in the following table:

Number of fundamental frequencies to be tested in EUT transmit band

Frequency range in which device operates	Number of frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

Frequency range of radiated emission measurements

Lowest frequency generated in the device	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified

EUT channels and frequencies list:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	27	2429	54	2456
1	2403	28	2430	55	2457
2	2404	29	2431	56	2458
3	2405	30	2432	57	2459
4	2406	31	2433	58	2460
5	2407	32	2434	59	2461
6	2408	33	2435	60	2462
7	2409	34	2436	61	2463
8	2410	35	2437	62	2464
9	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454	/	/
26	2428	53	2455	/	/

Remark:

Test frequencies are the lowest channel: 0 channel(2402 MHz), middle channel: 39 channel(2441 MHz) and highest channel: 78 channel(2480 MHz)

5.2. Antenna Requirement

Standard requirement

15.203 requirement::

For intentional device. 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.

15.247(c) (1)(i) requirement:

(i) Systems operating in the 2400-2483.5 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.

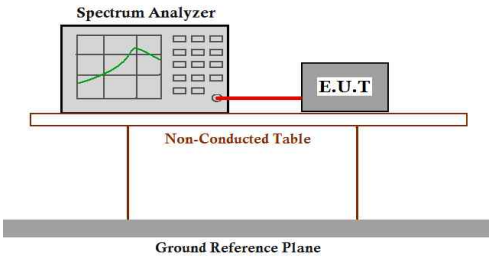
EUT Antenna **PASS**

The transmitter has an Integrated Pattern antenna. The directional gain of the antenna is 2.0 dBi. please refer to the EUT internal photos.

5.3. Occupied Bandwidth

Test Requirement:	FCC Part 15 C section 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.
Test Method:	ANSI C63.10: Clause 6.9.1
Test Status:	Pre-test the EUT in continuous transmitting mode at the lowest (2402 MHz), middle (2441 MHz) and highest (2480 MHz) channel with different data package. Compliance test in normal mode (DH5) as the worst case was found.
Final Test model :	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of π/4DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: Span = approximately 2 to 3 times the 20dB bandwidth, centring on a hopping channel;
3. Set the spectrum analyzer: RBW >= 1% of the 20dB bandwidth VBW >= RBW. Sweep = auto; Detector Function = Peak. Trace = Max Hold.
4. Mark the peak frequency and -20 dB points bandwidth.

Test result:

DH5:

Test Channel	Bandwidth(MHz)	2/3 bandwidth(MHz)
Lowest	1.131	0.754
Middle	1.129	0.752
Highest	1.093	0.728

2DH5:

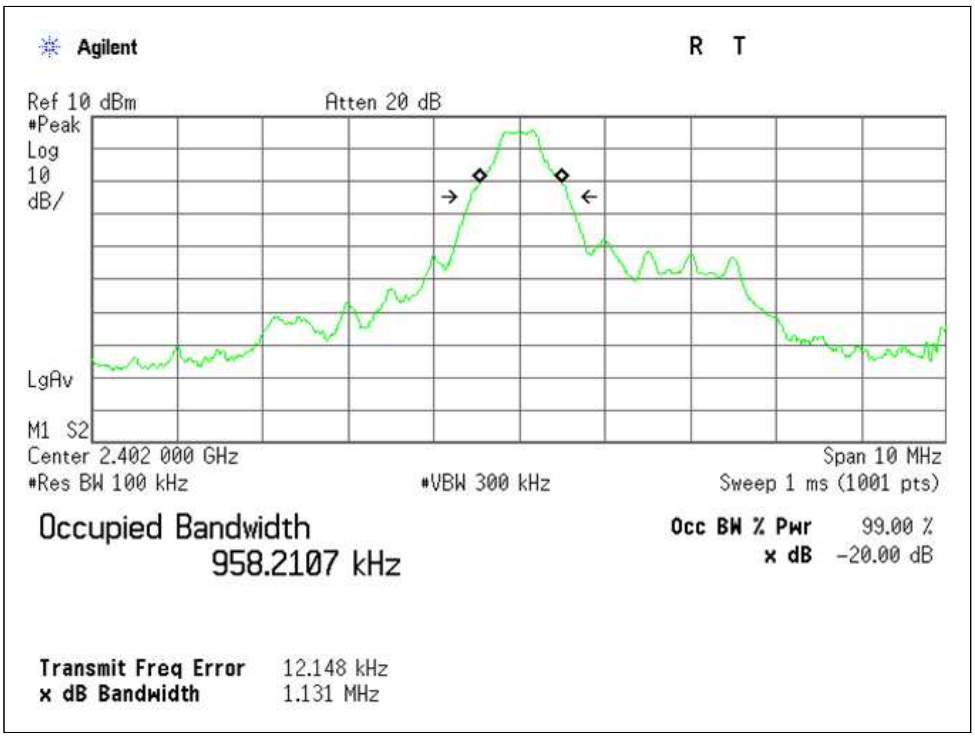
Test Channel	Bandwidth(MHz)	2/3 bandwidth(MHz)
Lowest	1.389	0.926
Middle	1.382	0.921
Highest	1.380	0.920

3DH5:

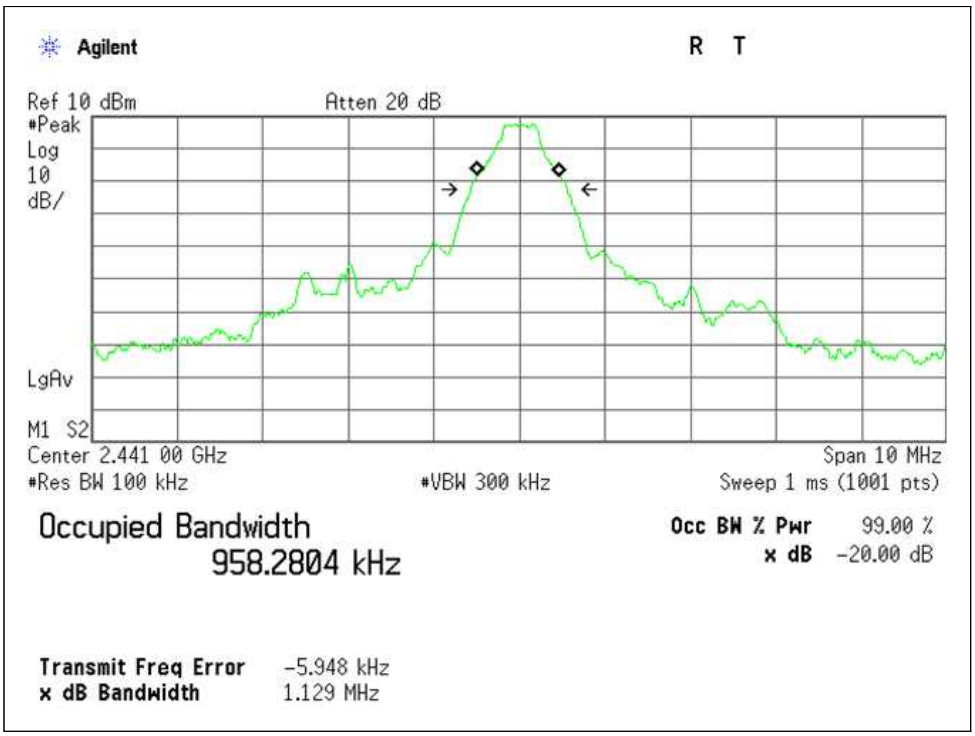
Test Channel	Bandwidth(MHz)	2/3 bandwidth(MHz)
Lowest	1.386	0.924
Middle	1.389	0.926
Highest	1.380	0.920

Result plot as follows:

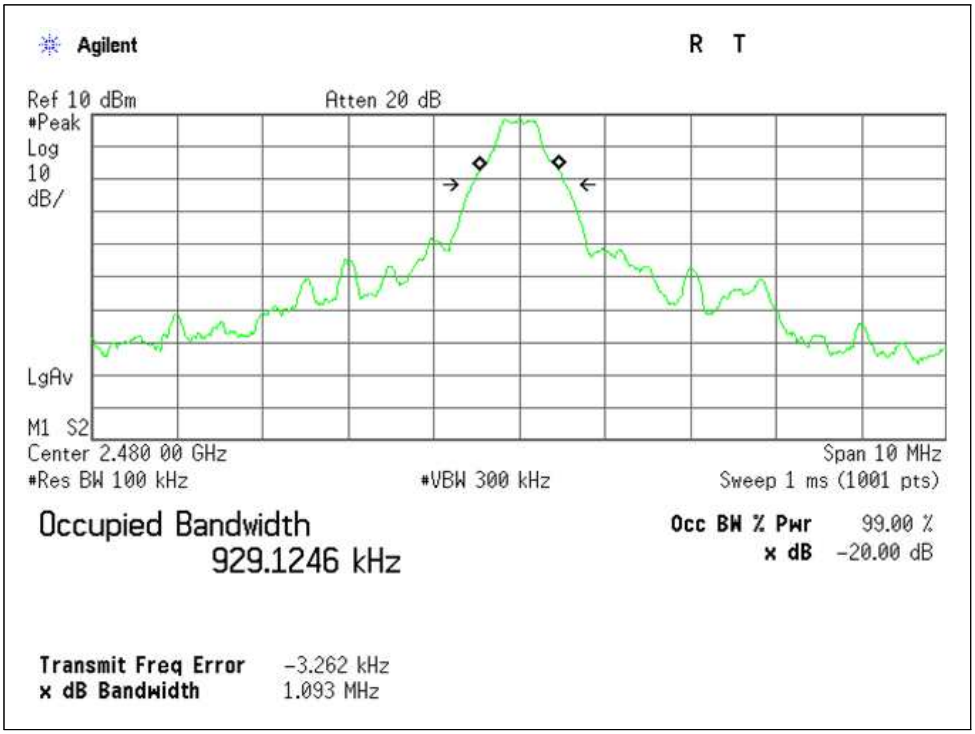
Test mode:	GFSK	Test chanel:	Lowest



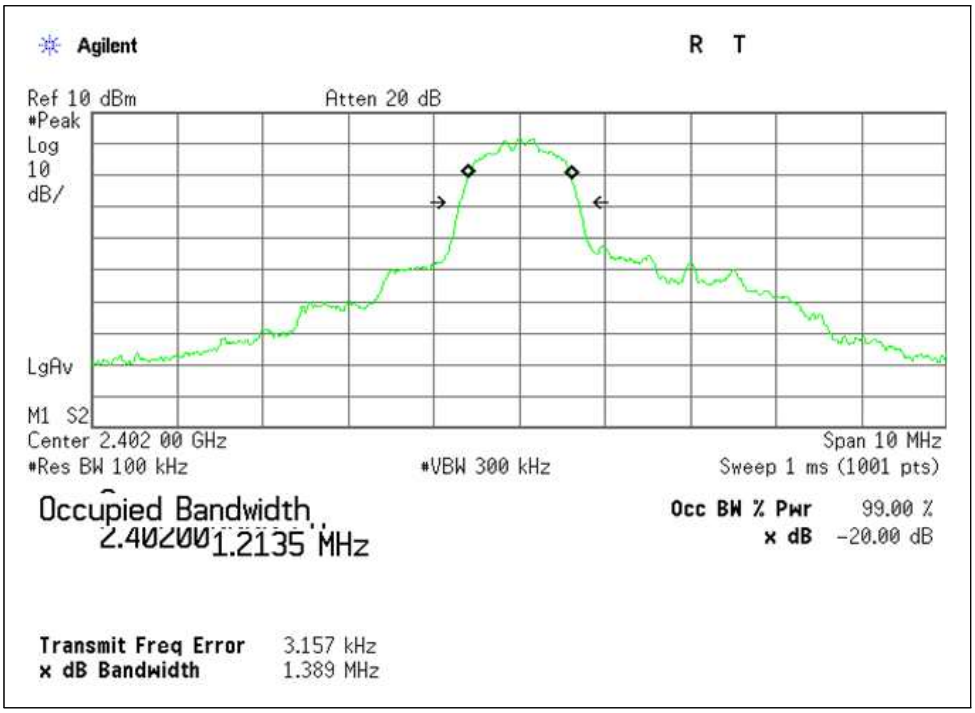
Test mode:	GFSK	Test chanel:	Middle



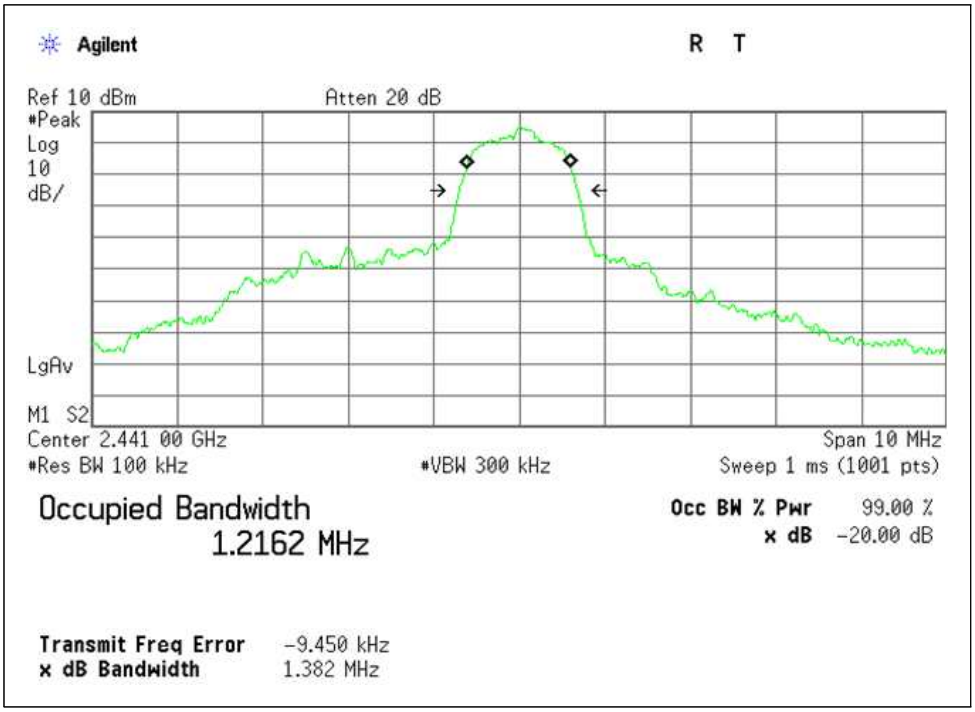
Test mode:	GFSK	Test chanel:	Highest



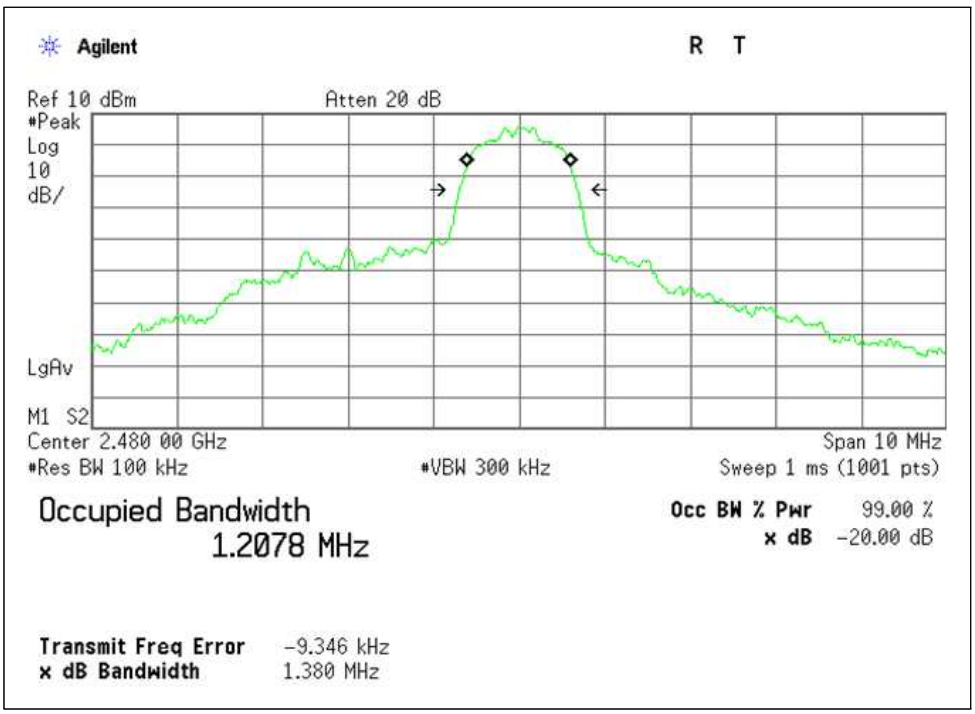
Test mode:	π/4DQPSK	Test chanel:	Lowest



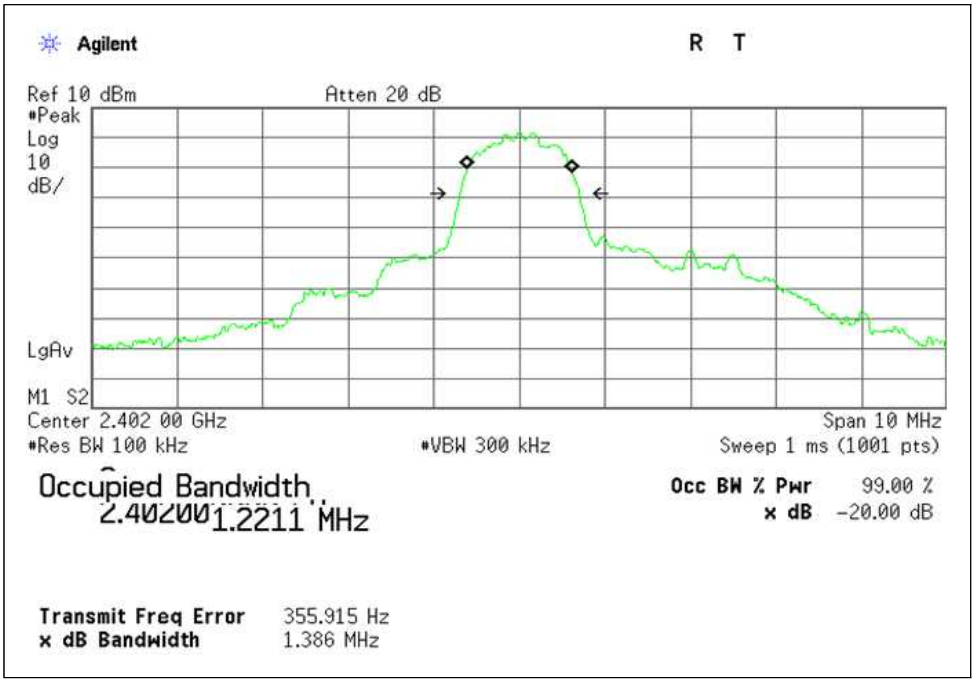
Test mode:	π/4DQPSK	Test chanel:	Middle



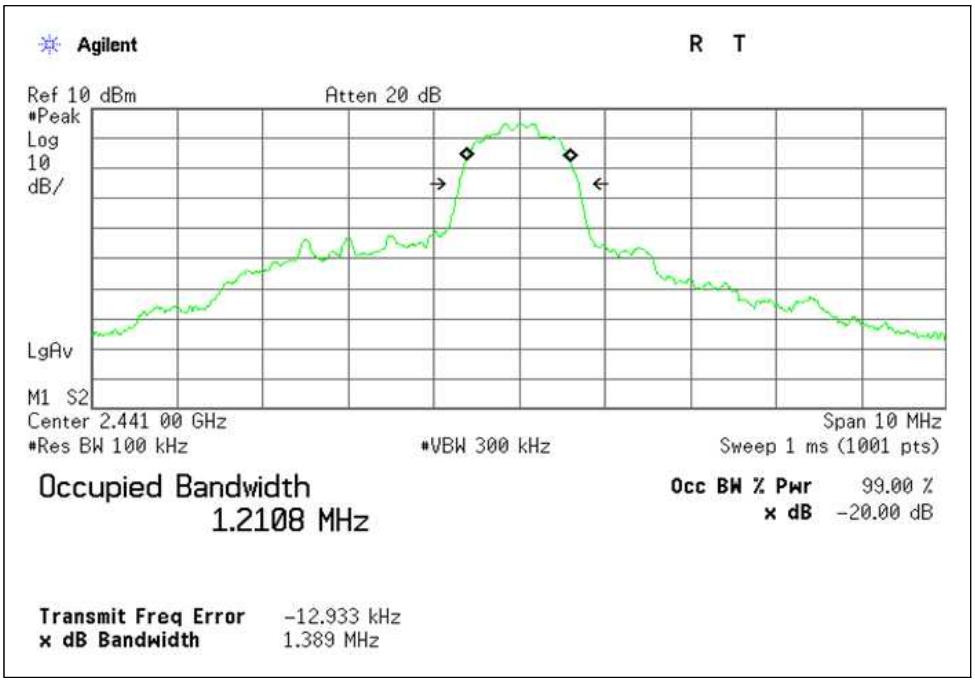
Test mode:	π/4DQPSK	Test chanel:	Highest



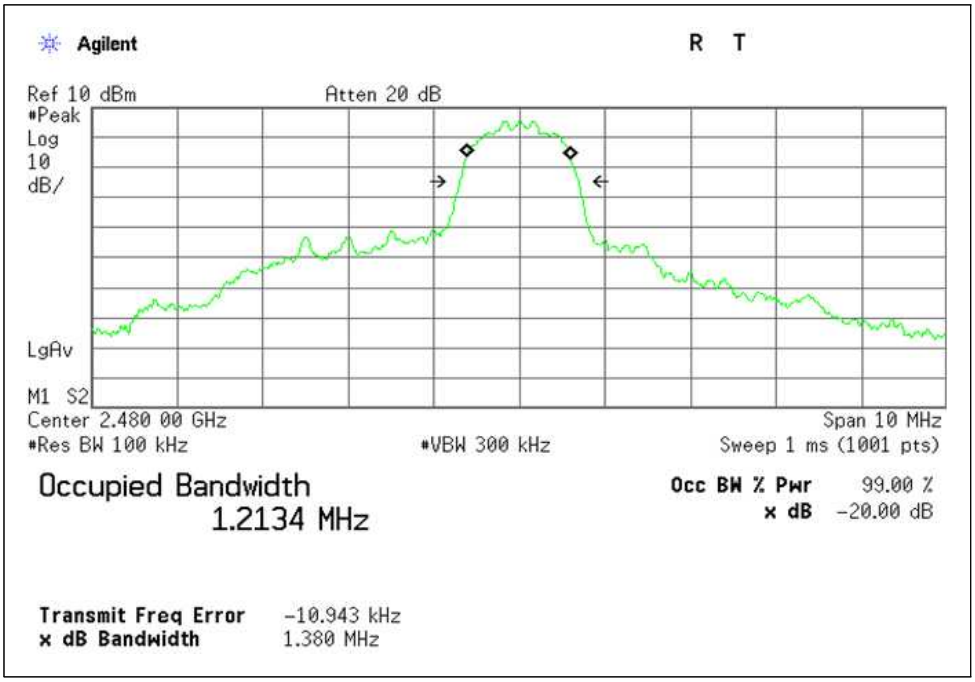
Test mode:	8DPSK	Test chanel:	Lowest



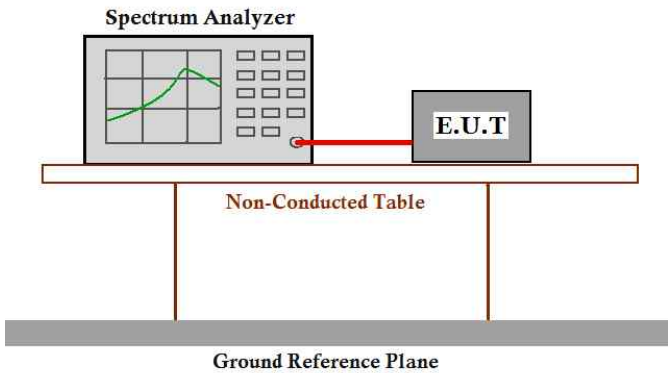
Test mode:	8DPSK	Test chanel:	Middle



Test mode:	8DPSK	Test chanel:	Highest



5.4. Carrier Frequencies Separated

Test Requirement:	FCC Part 15 C section 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.
Test Method:	ANSI C63.10: Clause 7.7.2
Test Status:	Pre-test the EUT in continuous transmitting mode at the lowest (2402 MHz), middle (2441 MHz) and highest (2480 MHz) channel with different data package. Compliance test in normal mode (DH5) as the worst case was found.
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of π/4DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Test Configuration:	
Test Procedure: 1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum. 2. Set the spectrum analyzer: RBW >= 1% of the span, VBW >= RBW,. Sweep = auto; Detector Function = Peak. Trace = Max, hold.	

3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

Test result:

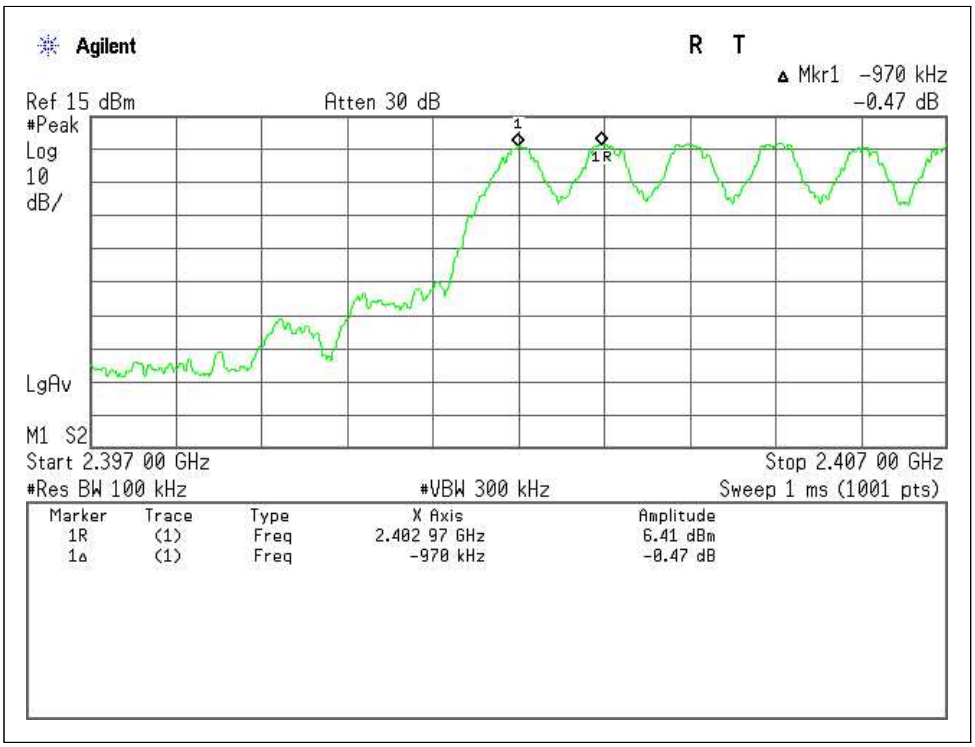
GFSK mode		
Test Channel	Carrier Frequencies Separated	Pass/Fail
Lower Channels (channel 0 and channel 1)	0.970 MHz	Pass
Middle Channels (channel 39 and channel 40)	0.970 MHz	Pass
Upper Channels (channel 77 and channel 78)	0.970 MHz	Pass
π/4DQPSK		
Test Channel	Carrier Frequencies Separated	Pass/Fail
Lower Channels (channel 0 and channel 1)	1.00 MHz	Pass
Middle Channels (channel 39 and channel 40)	1.03 MHz	Pass
Upper Channels (channel 77 and channel 78)	1.02 MHz	Pass
8DPSK mode		
Test Channel	Carrier Frequencies Separated	Pass/Fail
Lower Channels (channel 0 and channel 1)	1.00 MHz	Pass
Middle Channels (channel 39 and channel 40)	1.17 MHz	Pass
Upper Channels (channel 77 and channel 78)	1.14 MHz	Pass

Remark:

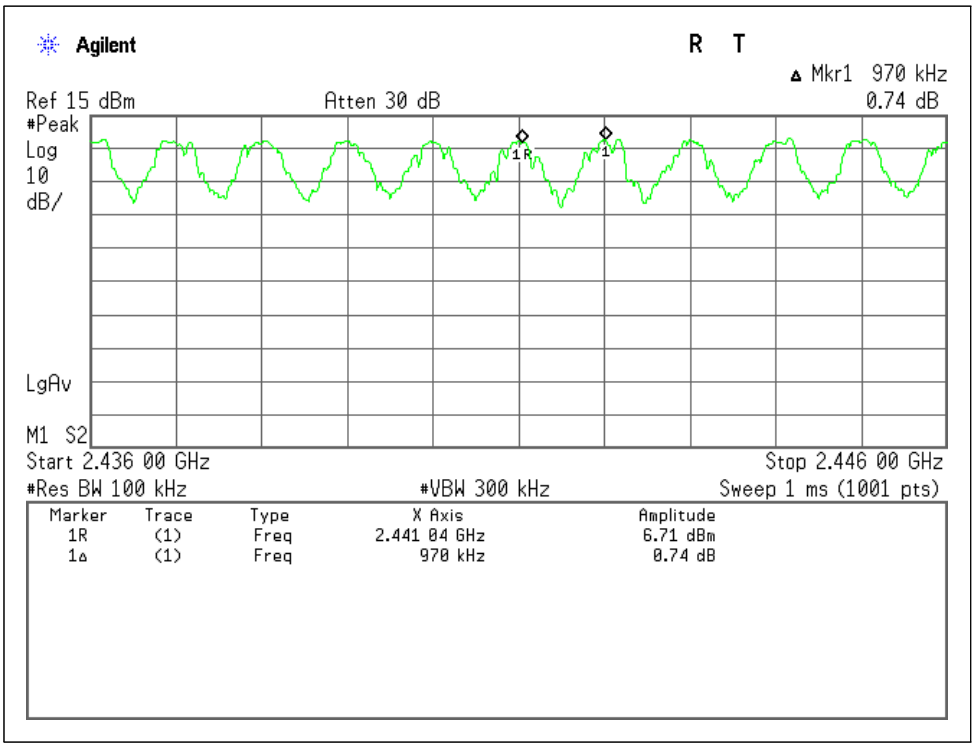
The limit is maximum two-thirds of the 20 dB bandwidth: 0.926 MHz.

Result plot as follows:

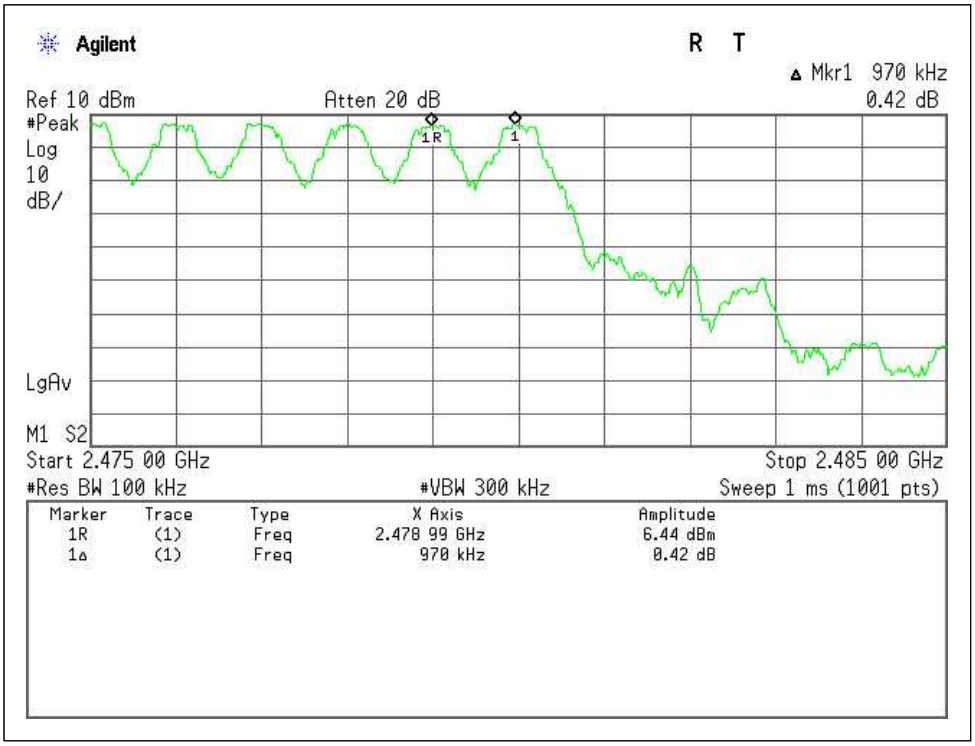
Test mode:	GFSK	Test chanel:	Lowest



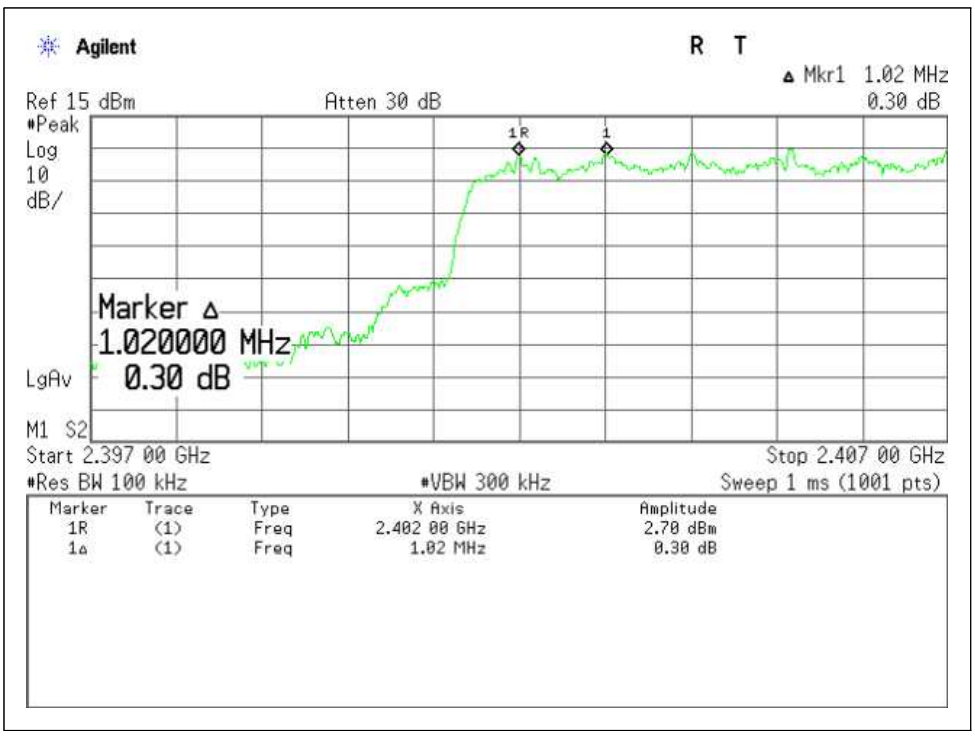
Test mode:	GFSK	Test chanel:	Middle



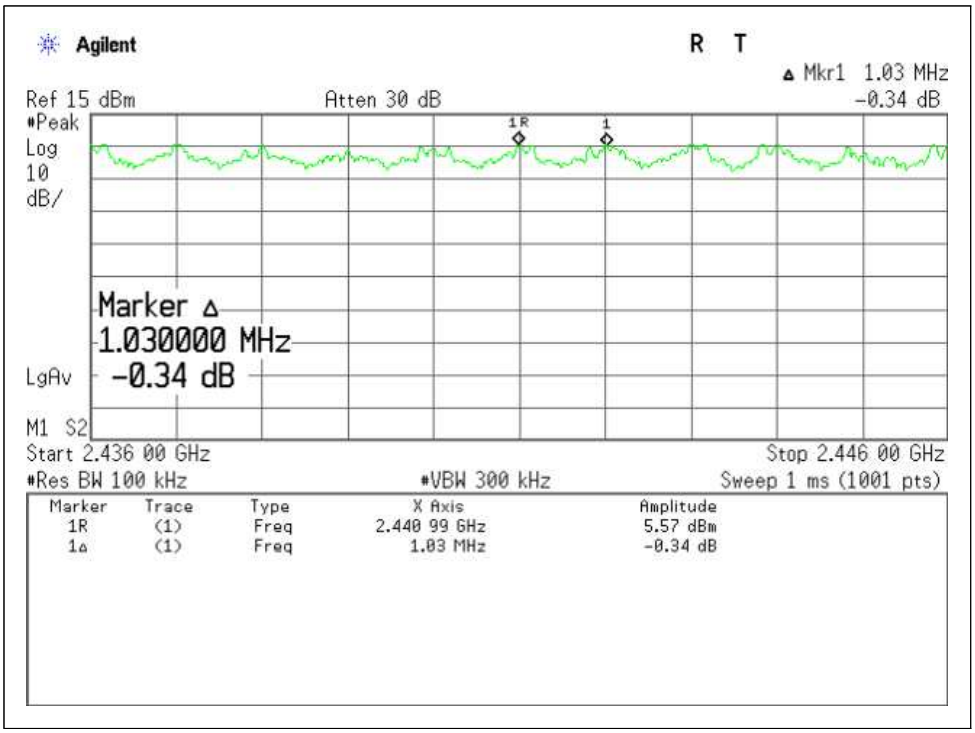
Test mode:	GFSK	Test chanel:	Highest



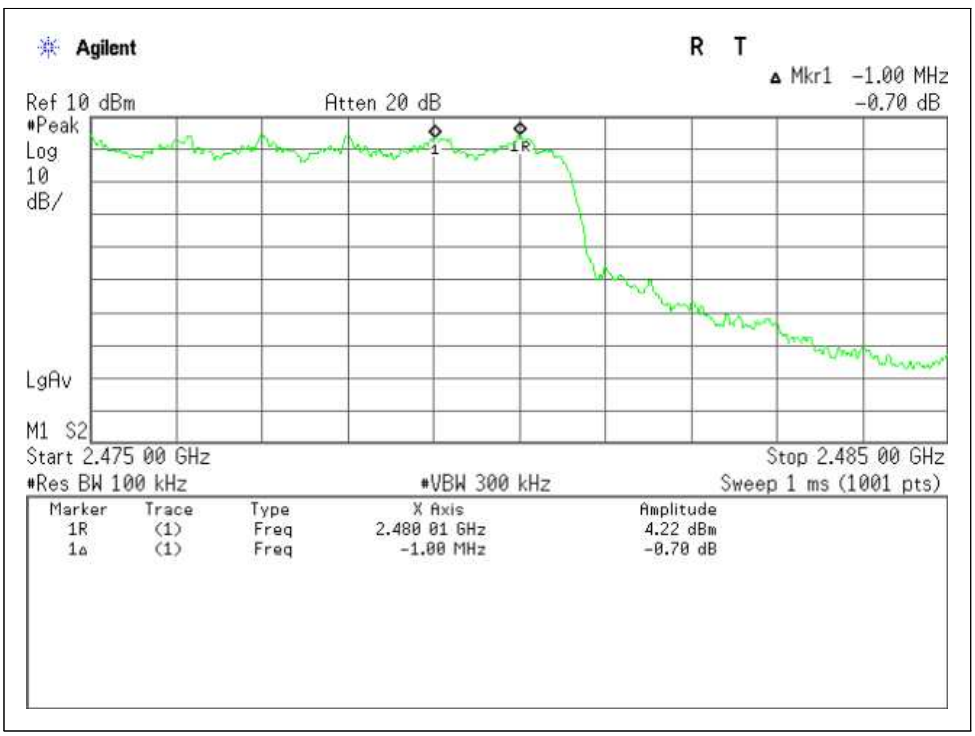
Test mode:	π/4DQPSK	Test chanel:	Lowest



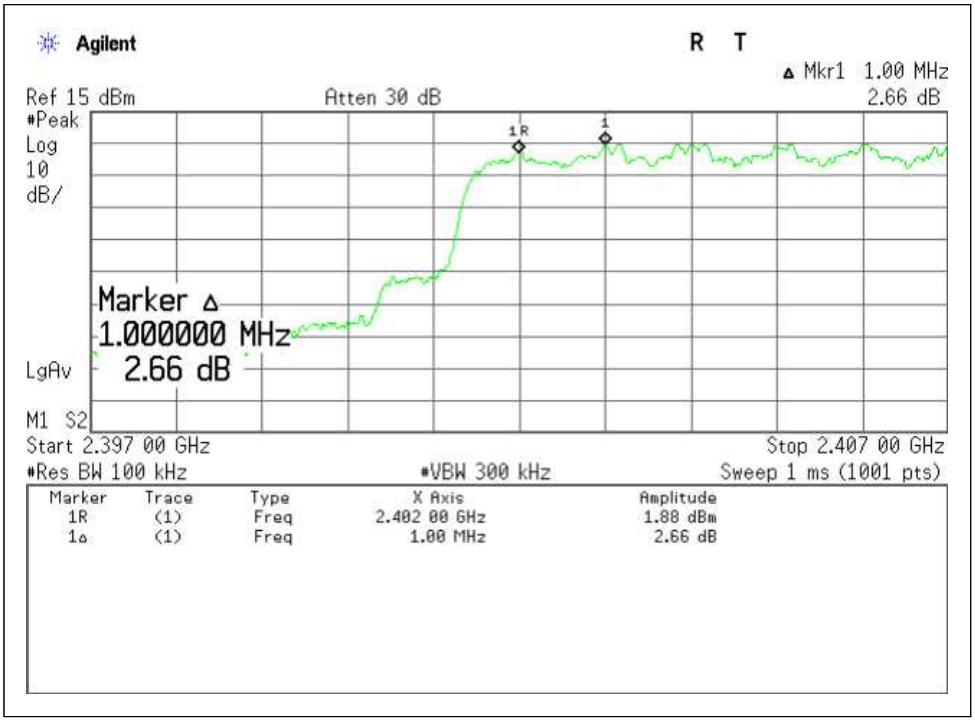
Test mode:	π/4DQPSK	Test chanel:	Middle



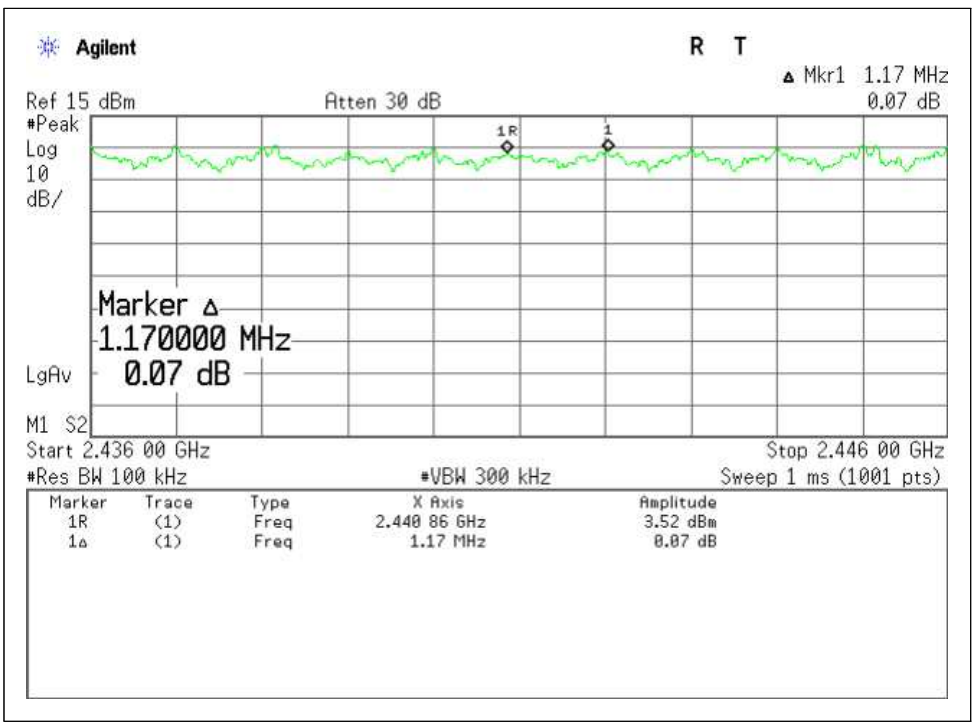
Test mode:	π/4DQPSK	Test chanel:	Highest



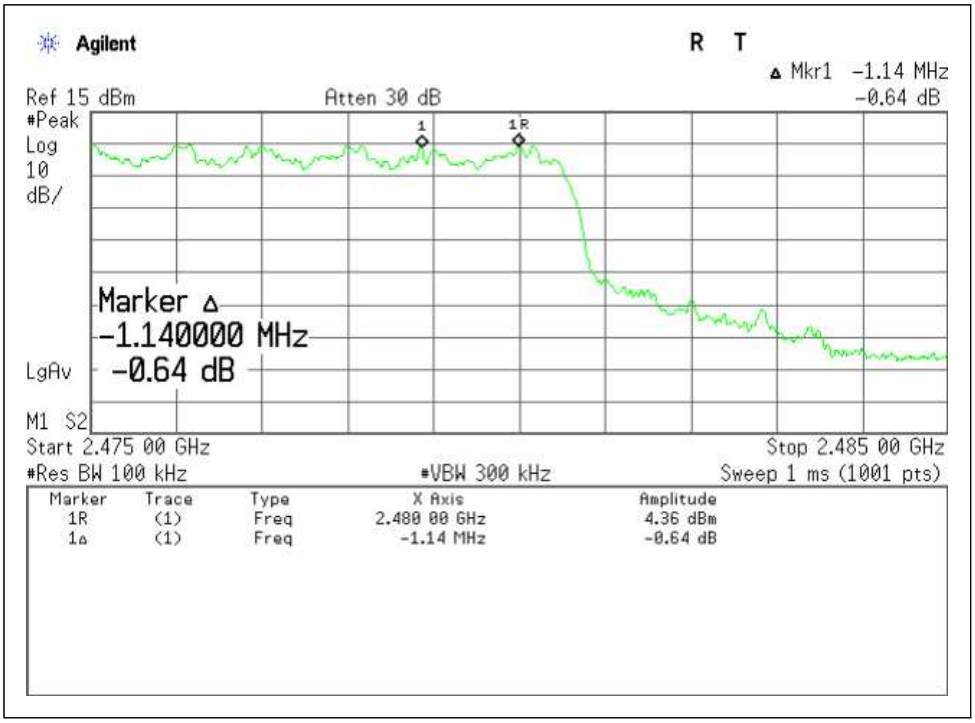
Test mode:	8DPSK	Test chanel:	Lowest



Test mode:	8DPSK	Test chanel:	Middle



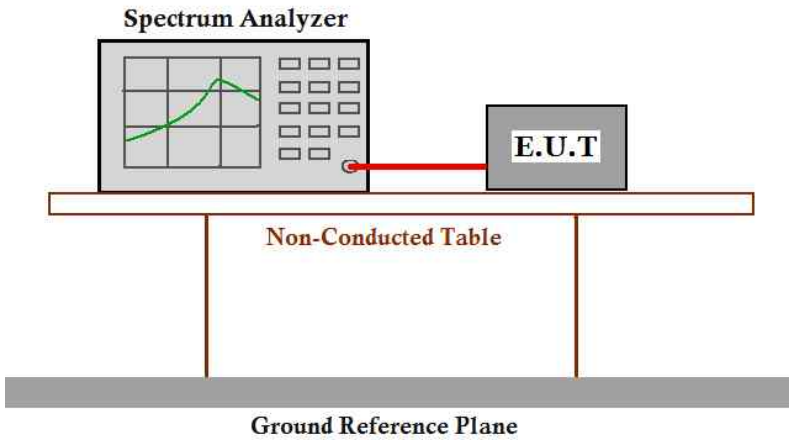
Test mode:	8DPSK	Test chanel:	Highest



5.5. Hopping Channel Number

Test Requirement:	FCC Part15 C section 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Method:	ANSI C63.10: Clause 7.7.3
Test Status:	Pre-test the EUT in continuous transmitting mode at the lowest (2402 MHz), middle (2441 MHz) and highest (2480 MHz) channel with different data package. Compliance test in normal mode (DH5) as the worst case was found.

Test Configuration:



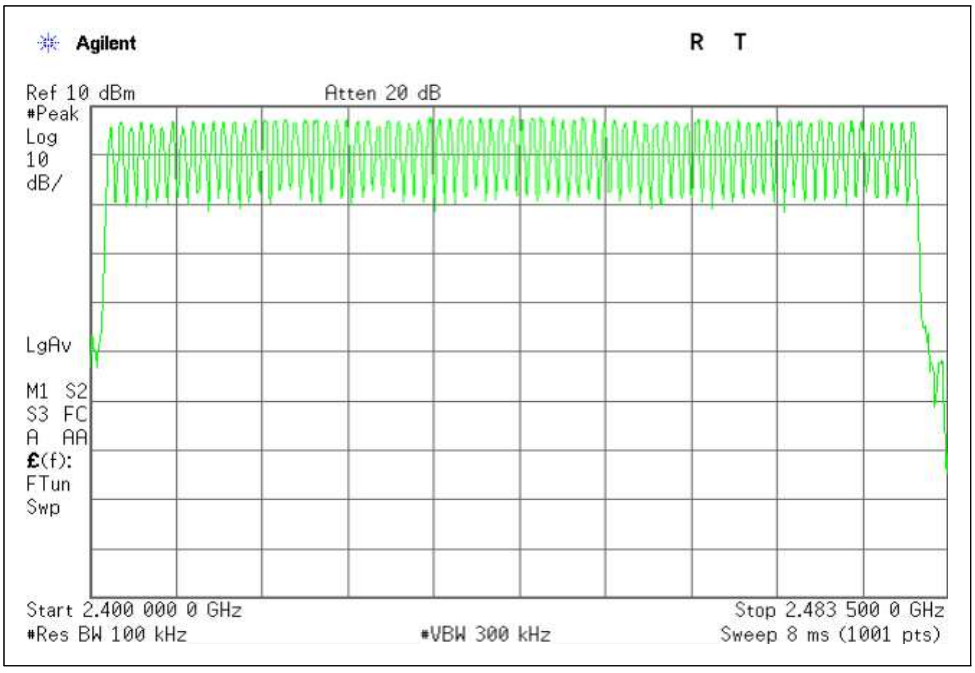
Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100 kHz. VBW = 100 kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: start frequency = 2400 MHz. stop frequency = 2483.5 MHz. Submit the test result graph.

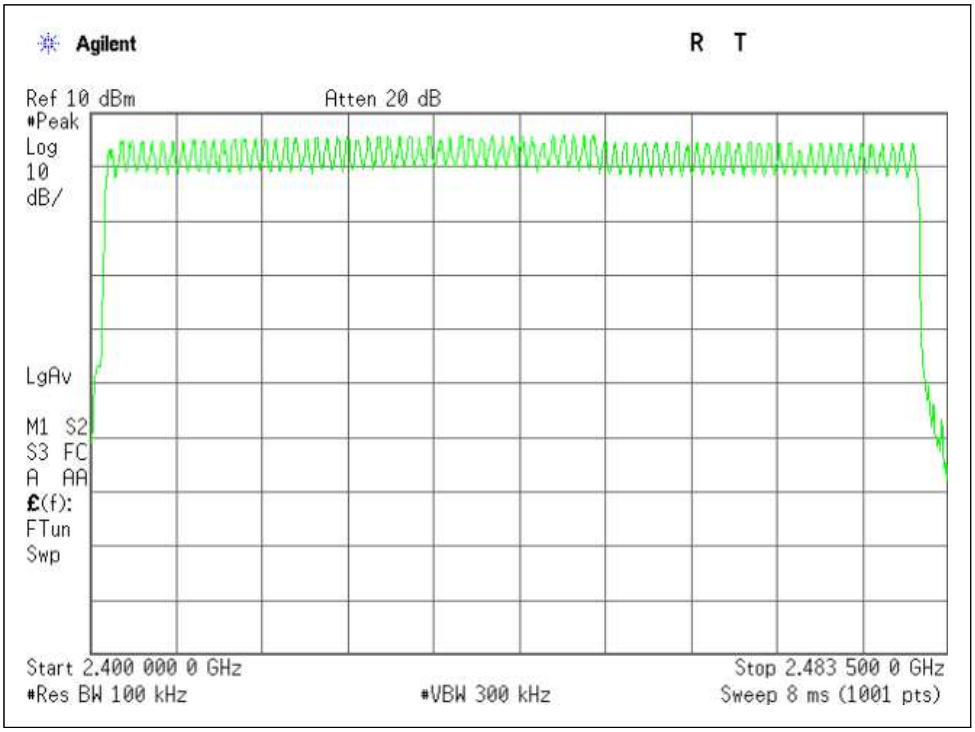
Test result: :

Mode	Hopping channel numbers	Limit
GFSK	79	≥15
π/4DQPSK	79	≥15
8DPSK	79	≥15

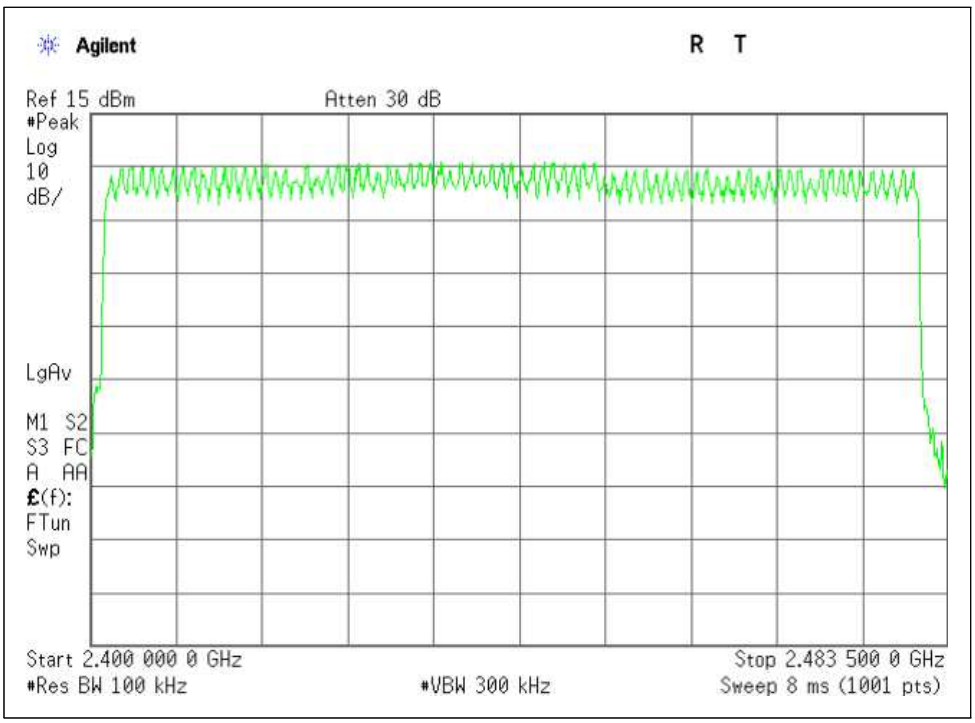
Test mode:	GFSK



Test mode:	π/4DQPSK



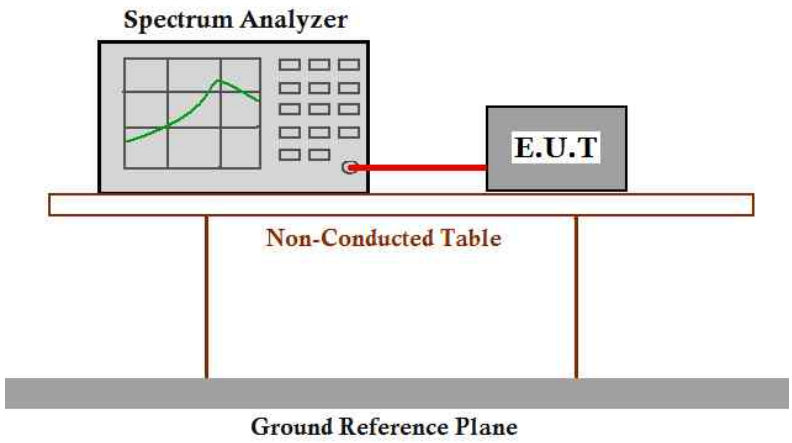
Test mode:	8DPSK



5.6. Dwell Time

Test Requirement:	FCC Part15 C section 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.
Test Method:	ANSI C63.10: Clause 7.7.4
Test Status:	Test the EUT in hopping mode at the lowest (2402 MHz), middle (2441 MHz) and highest (2480 MHz) channel with different data packet. Compliance test in hopping mode with BDR mode (DH1, DH3 and DH5) as the worst case was found.

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. centered on a hopping channel;
3. Set RBW = 1 MHz and VBW = 1 MHz. Sweep = as necessary to capture the entire dwell time per hopping channel. Detector Function = Peak. Trace = Max hold;
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). Repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s). An oscilloscope may be used instead of a spectrum analyzer.

Test Result :

Test mode:	GFSK

1. Channel 0: 2.402GHz

DH1 time slot = 0.352 (ms) * 32 * (31.6/3.16) = 112.64 ms

DH3 time slot = 1.634 (ms) * 16 * (31.6/3.16) = 261.44 ms

DH5 time slot = 2.876 (ms) * 11 * (31.6/3.16) = 316.36 ms

2. Channel 39: 2.441GHz

DH1 time slot = 0.355 (ms) * 32 * (31.6/3.16) = 113.60 ms

DH3 time slot = 1.627 (ms) * 16 * (31.6/3.16) = 260.32 ms

DH5 time slot = 2..881 (ms) * 11 * (31.6/3.16) = 316.91 ms

3. Channel 78: 2.480GHz

DH1 time slot = 0.352 (ms) * 32 * (31.6/3.16) = 112.64 ms

DH3 time slot = 1.634 (ms) * 16 * (31.6/3.16) = 261.44 ms

DH5 time slot = 2.881 (ms) * 11 * (31.6/3.16) = 316.91ms

The average time of occupancy in the specified 31.6 second period is equal to pulse width* (# of pulse in observation period)*(test period / observation period)

Test mode:	π/4DQPSK

1. Channel 0: 2.402GHz

DH1 time slot = 0.380 (ms) * 32 * (31.6/3.16) = 121.60 ms

DH3 time slot = 1.642 (ms) * 16 * (31.6/3.16) = 262.72 ms

DH5 time slot = 1.686 (ms) * 11 * (31.6/3.16) = 185.46 ms

2. Channel 39: 2.441GHz

DH1 time slot = 0.393 (ms) * 32 * (31.6/3.16) = 125.76 ms

DH3 time slot = 1.642 (ms) * 16 * (31.6/3.16) = 262.72 ms

DH5 time slot = 1.693 (ms) * 11 * (31.6/3.16) = 186.23 ms

3. Channel 78: 2.480GHz

DH1 time slot = 0.396 (ms) * 32 * (31.6/3.16) = 126.72 ms

DH3 time slot = 1.628 (ms) * 16 * (31.6/3.16) = 260.48 ms

DH5 time slot = 1.686 (ms) * 11 * (31.6/3.16) = 185.46 ms

The average time of occupancy in the specified 31.6 second period is equal to pulse width* (# of pulse in observation period)*(test period / observation period)

Test mode:	8DPSK

1. Channel 0: 2.402GHz

DH1 time slot = 0.394 (ms) * 32 * (31.6/3.16) = 126.08 ms

DH3 time slot = 1.621 (ms) * 16 * (31.6/3.16) = 286.52 ms

DH5 time slot = 2.884 (ms) * 11 * (31.6/3.16) = 317.24 ms

2. Channel 39: 2.441GHz

DH1 time slot = 0.394 (ms) * 32 * (31.6/3.16) = 126.08 ms

DH3 time slot = 1.628 (ms) * 16 * (31.6/3.16) = 286.52 ms

DH5 time slot = 2.884 (ms) * 11 * (31.6/3.16) = 317.24 ms

3. Channel 78: 2.480GHz

DH1 time slot = 0.397 (ms) * 32 * (31.6/3.16) = 127.04 ms

DH3 time slot = 1.628 (ms) * 16 * (31.6/3.16) = 286.52 ms

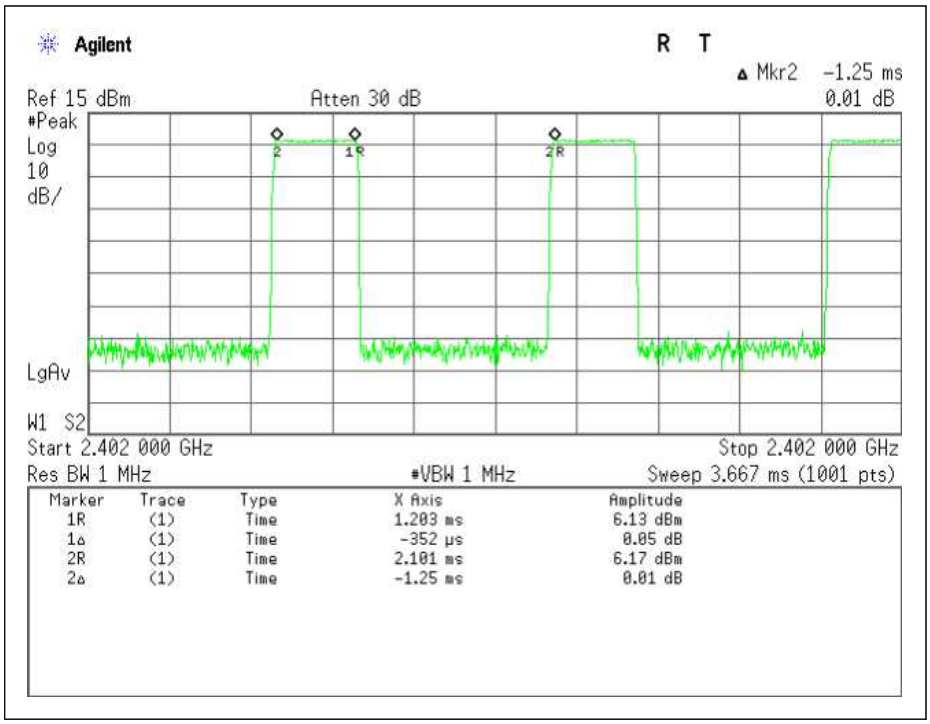
DH5 time slot = 2.894 (ms) * 11 * (31.6/3.16) = 318.34 ms

The average time of occupancy in the specified 31.6 second period is equal to pulse width* (# of pulse in observation period)*(test period / observation period)

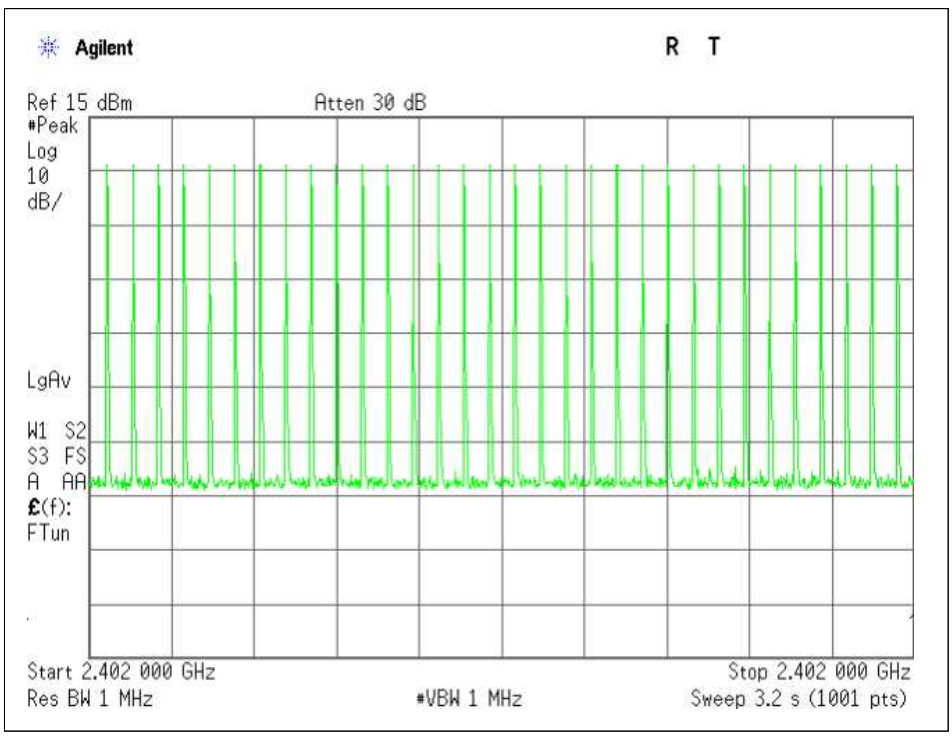
Result plot as follows :

Test mode:	GFSK	Test chanel:	Lowerst(DH1)

Pulse Width:

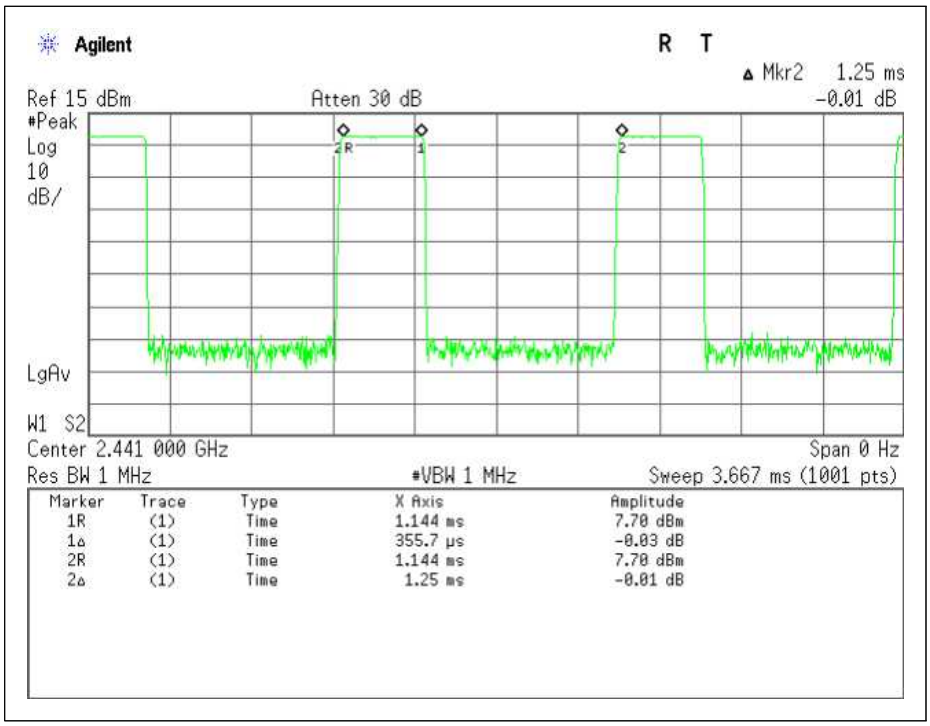


Number of Pulses in 3.16 S observation period:

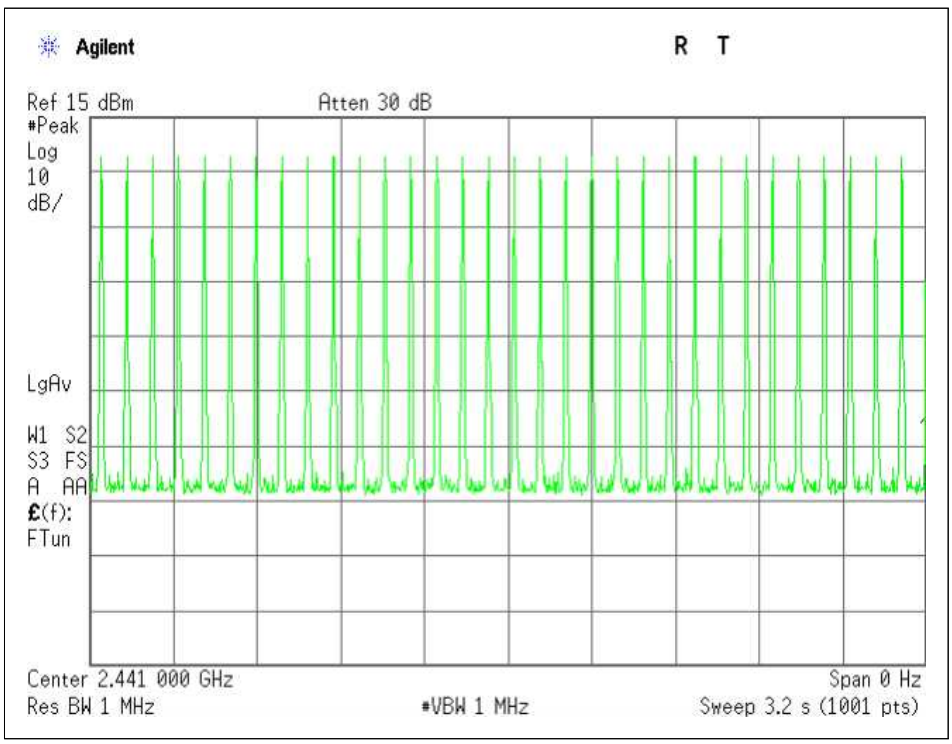


Test mode:	GFSK	Test chanel:	Midde(DH1)

Pulse Width:

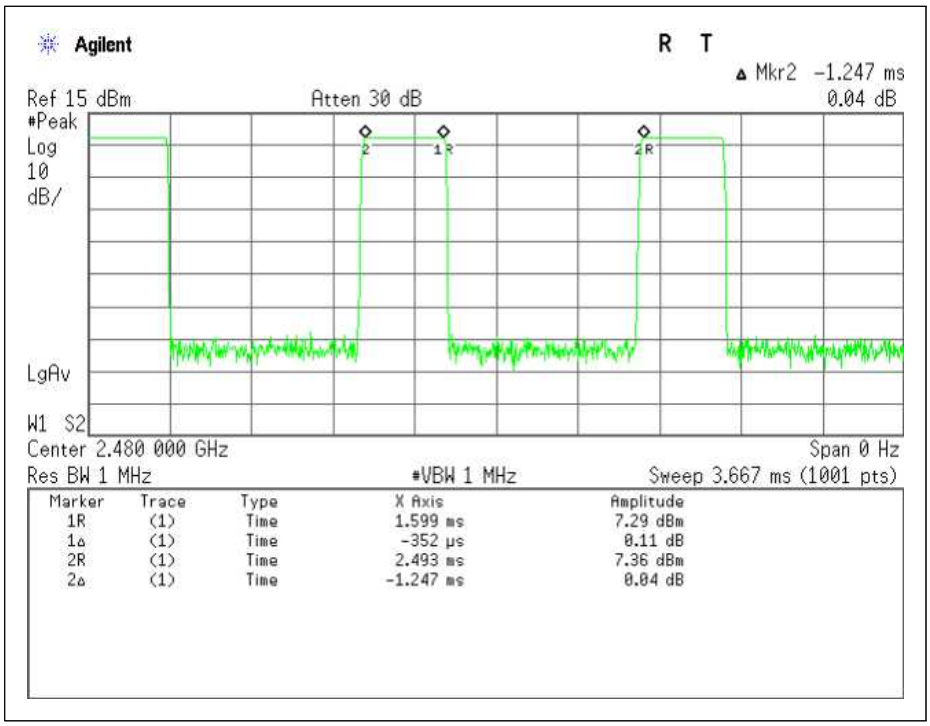


Number of Pulses in 3.16 S observation period:

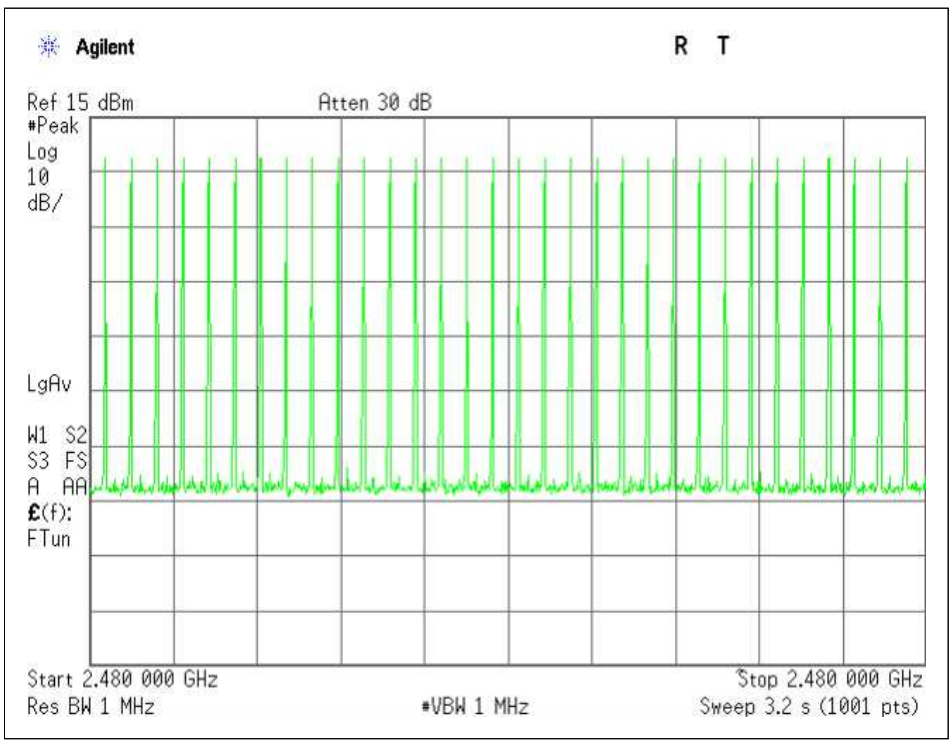


Test mode:	GFSK	Test chanel:	Highest(DH1)

Pulse Width:

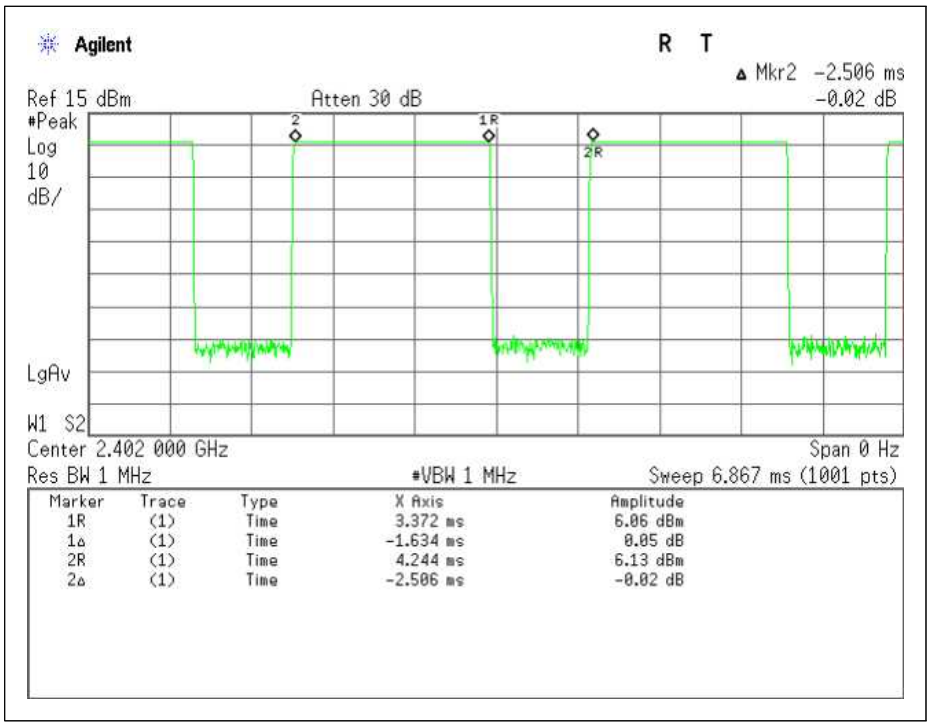


Number of Pulses in 3.16 S observation period:

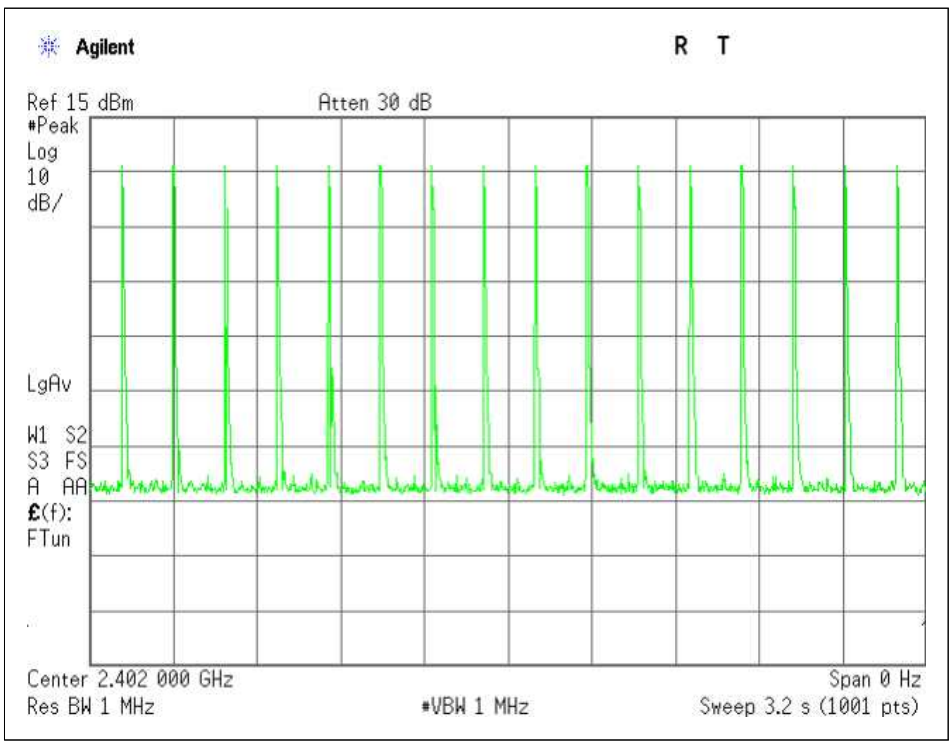


Test mode:	GFSK	Test chanel:	Lowest(DH3)

Pulse Width:

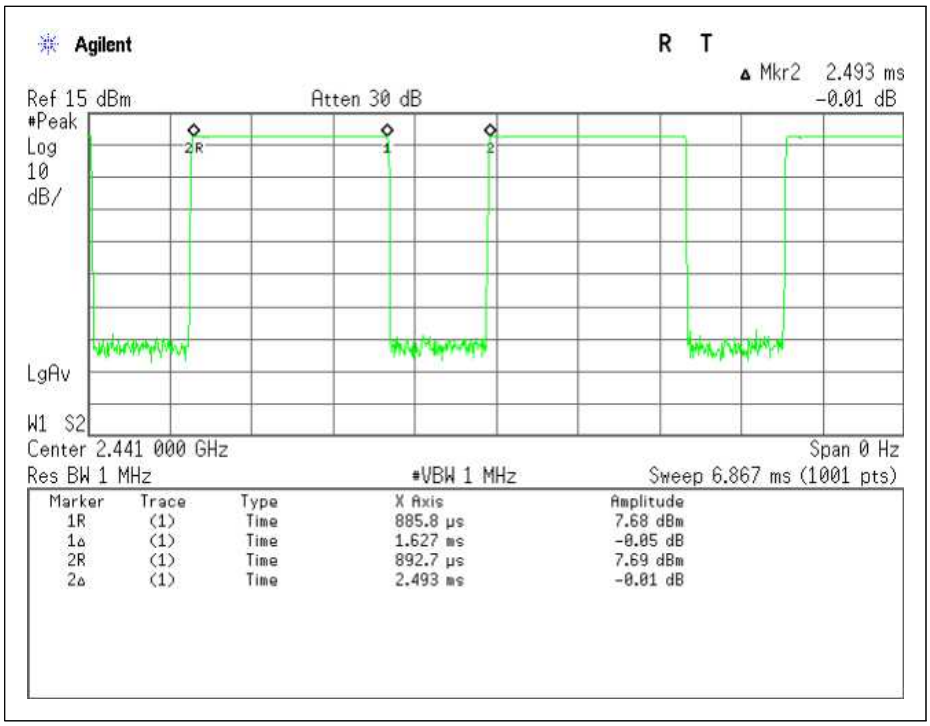


Number of Pulses in 3.16 S observation period:

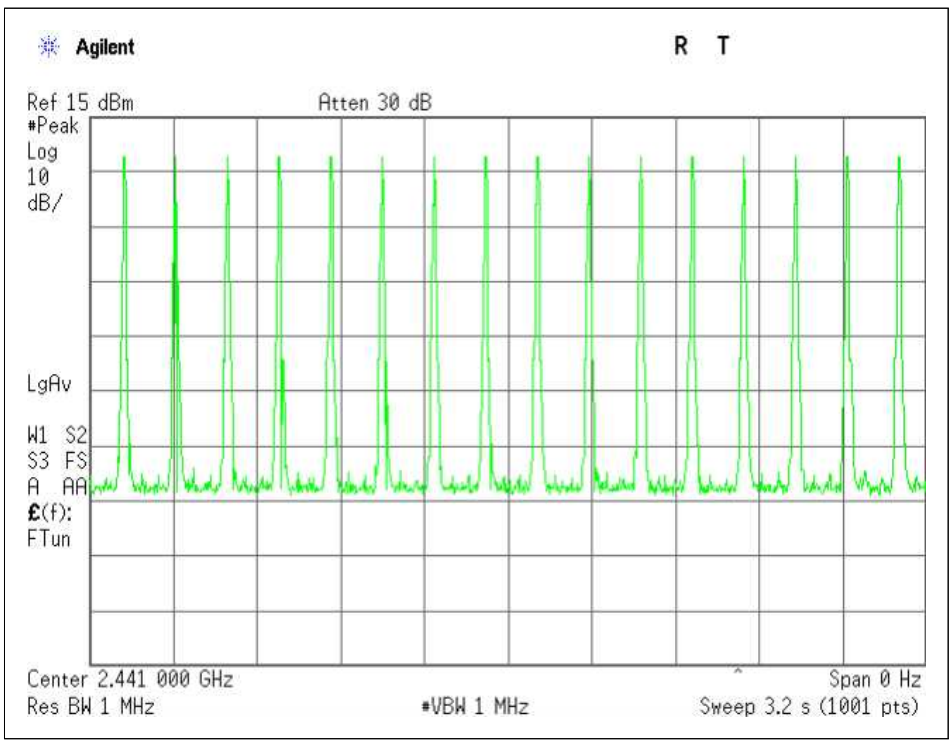


Test mode:	GFSK	Test chanel:	Middle(DH3)

Pulse Width:

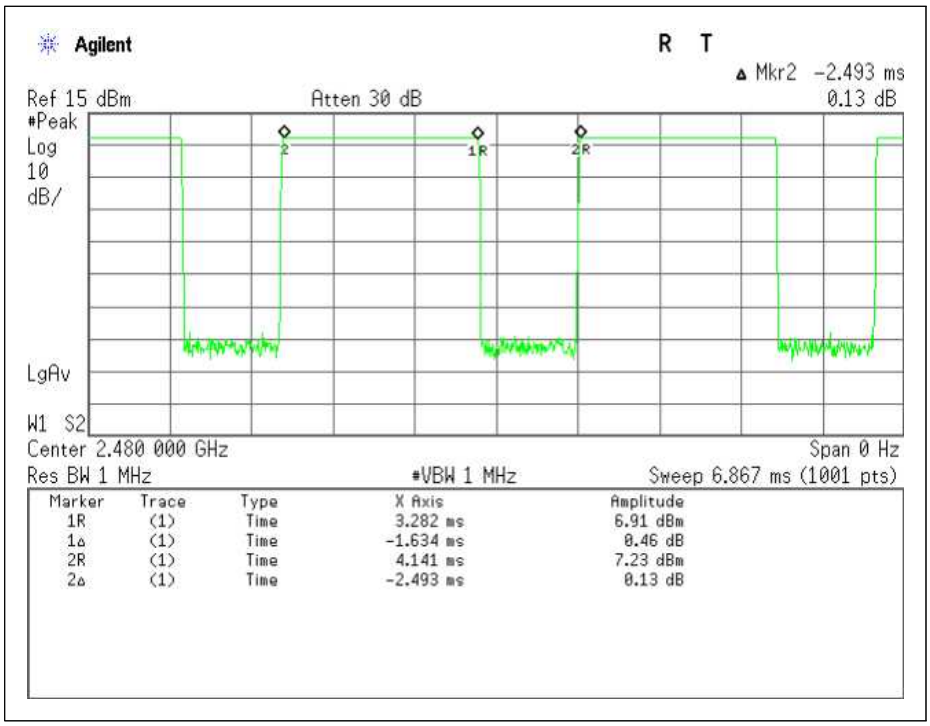


Number of Pulses in 3.16 S observation period:

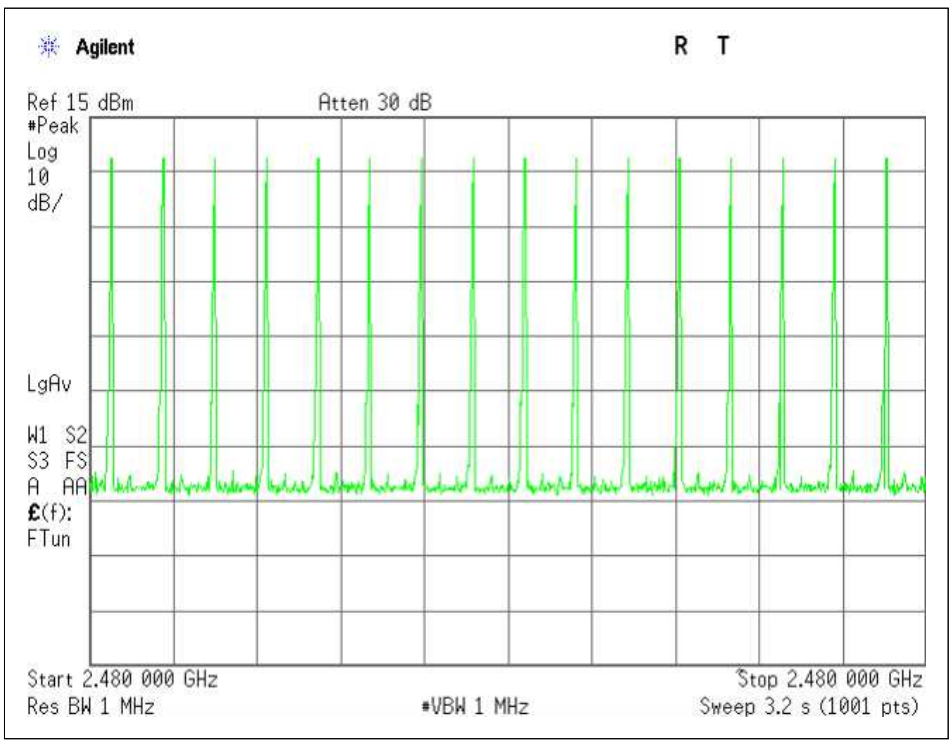


Test mode:	GFSK	Test chanel:	Highest(DH3)

Pulse Width:

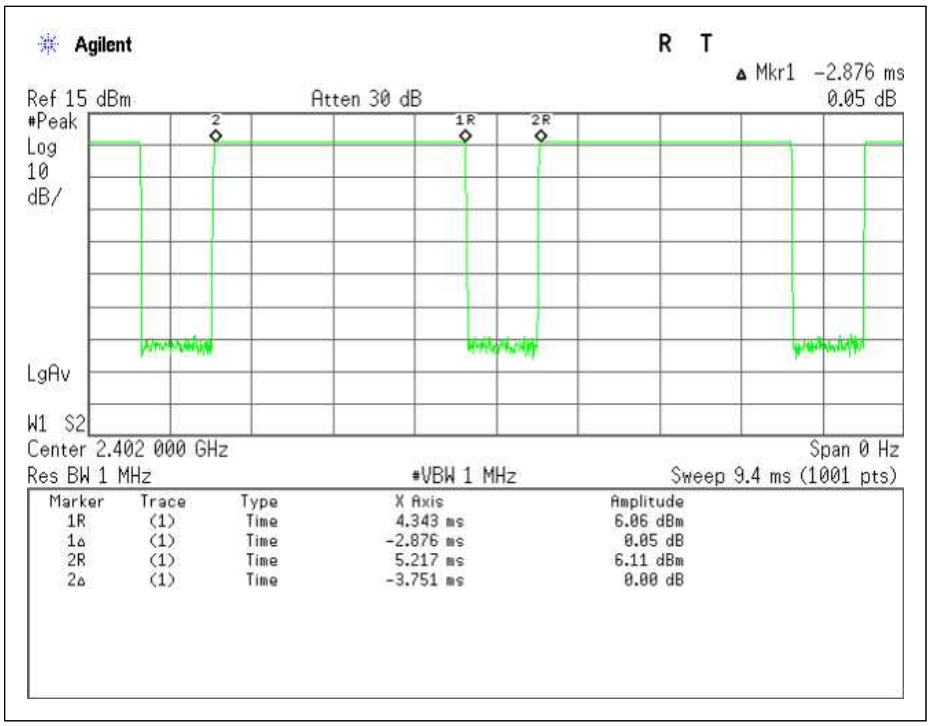


Number of Pulses in 3.16 S observation period:

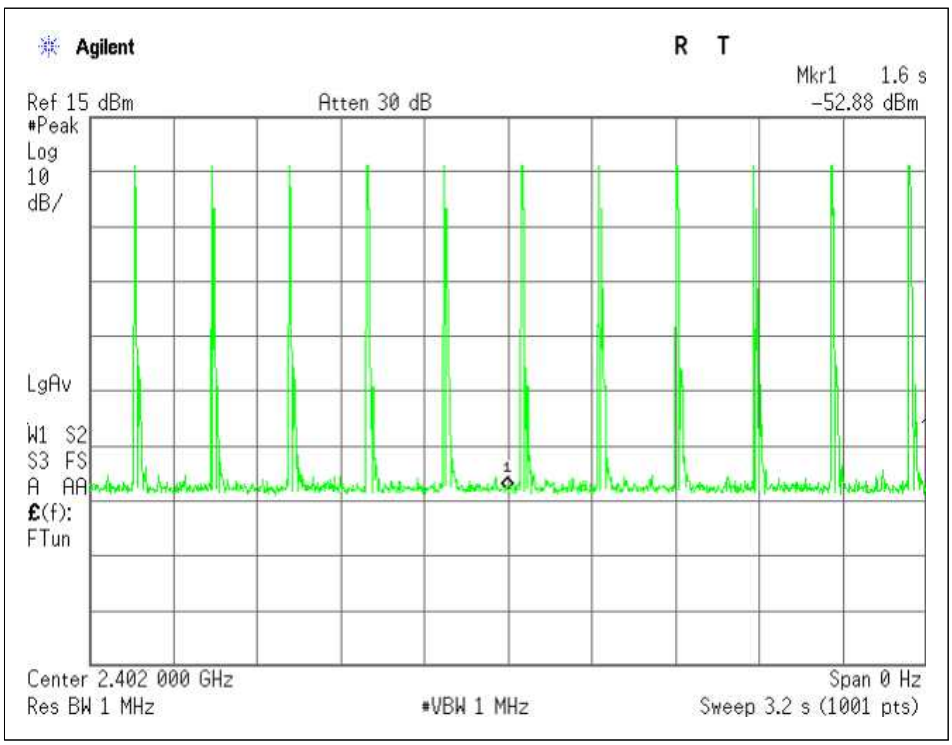


Test mode:	GFSK	Test chanel:	Lowest(DH5)

Pulse Width:

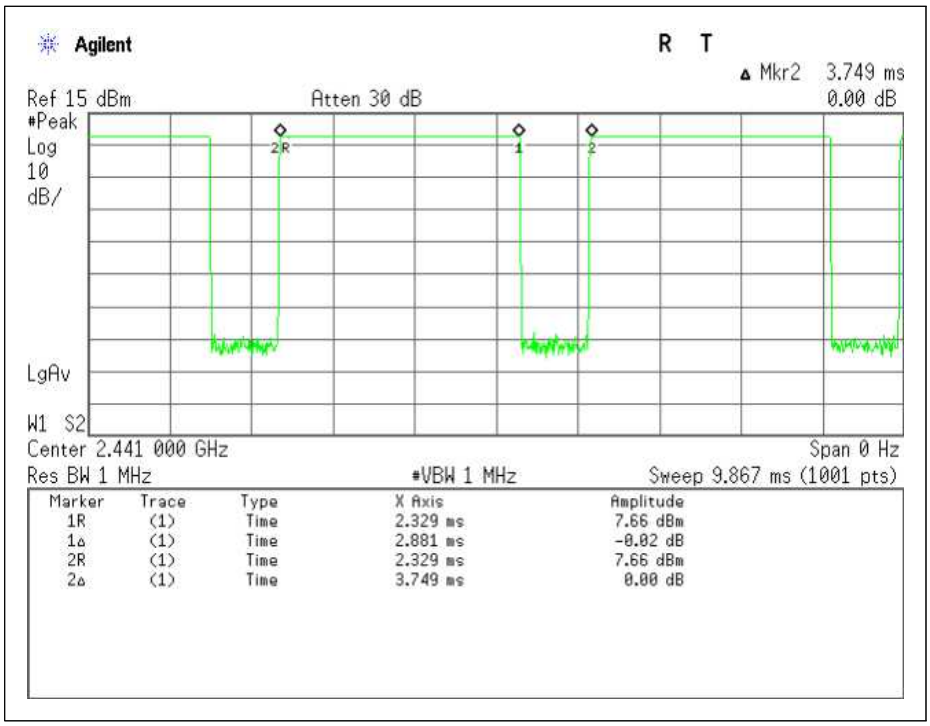


Number of Pulses in 3.16 S observation period:

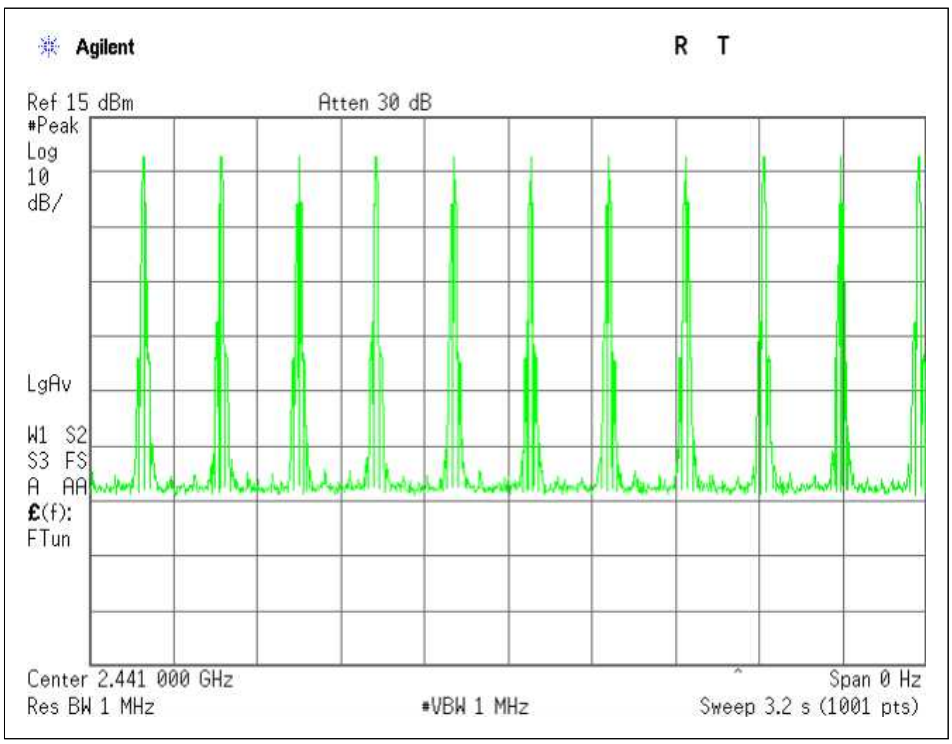


Test mode:	GFSK	Test chanel:	Middle(DH5)

Pulse Width:

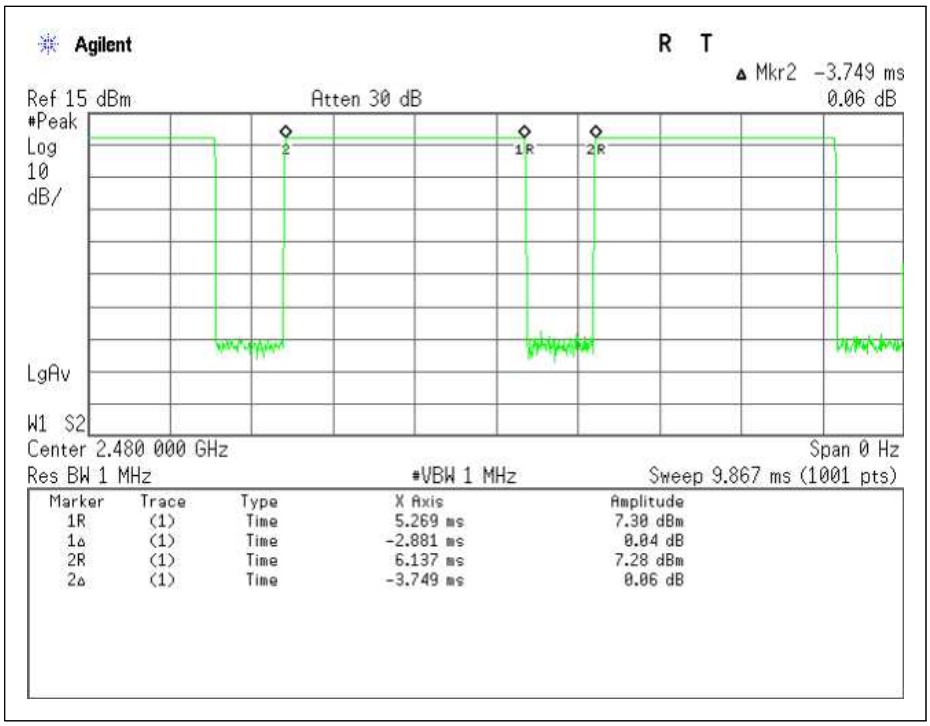


Number of Pulses in 3.16 S observation period:

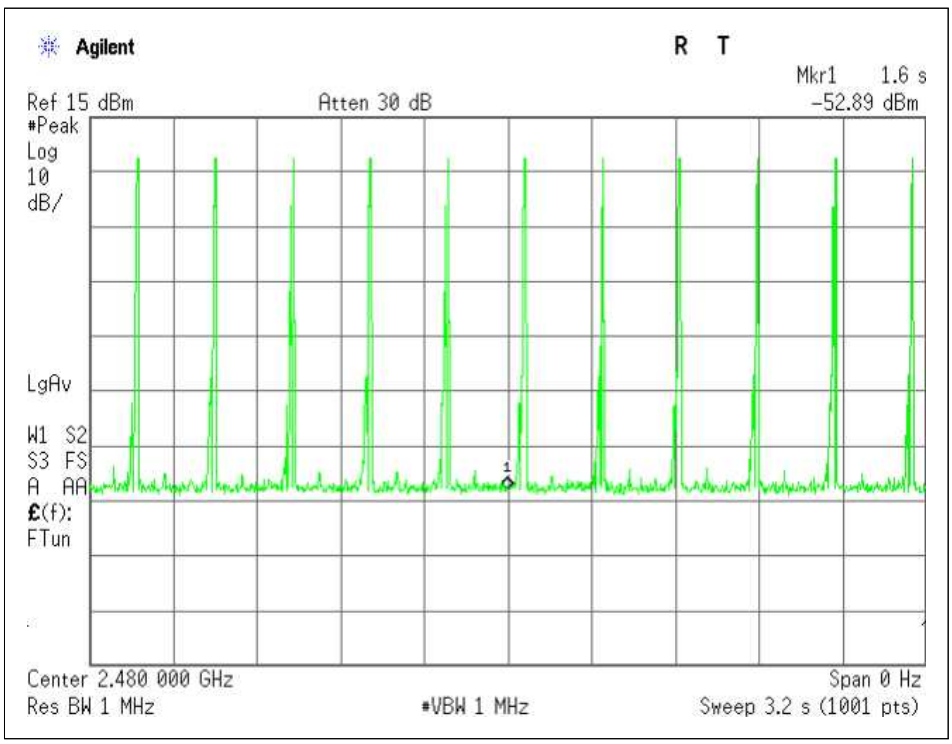


Test mode:	GFSK	Test chanel:	Highest(DH5)

Pulse Width:

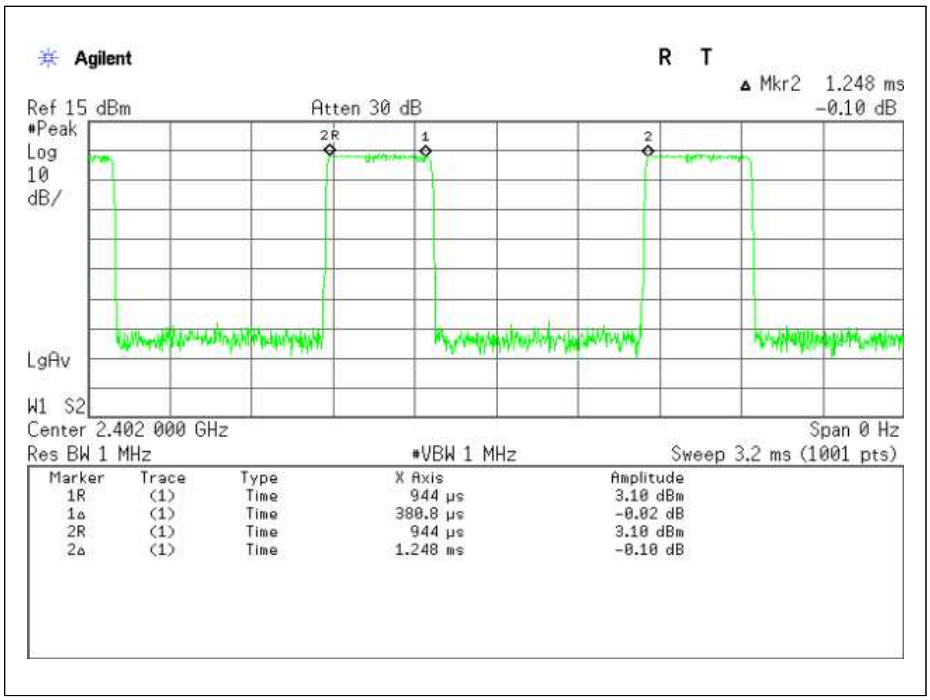


Number of Pulses in 3.16 S observation period:

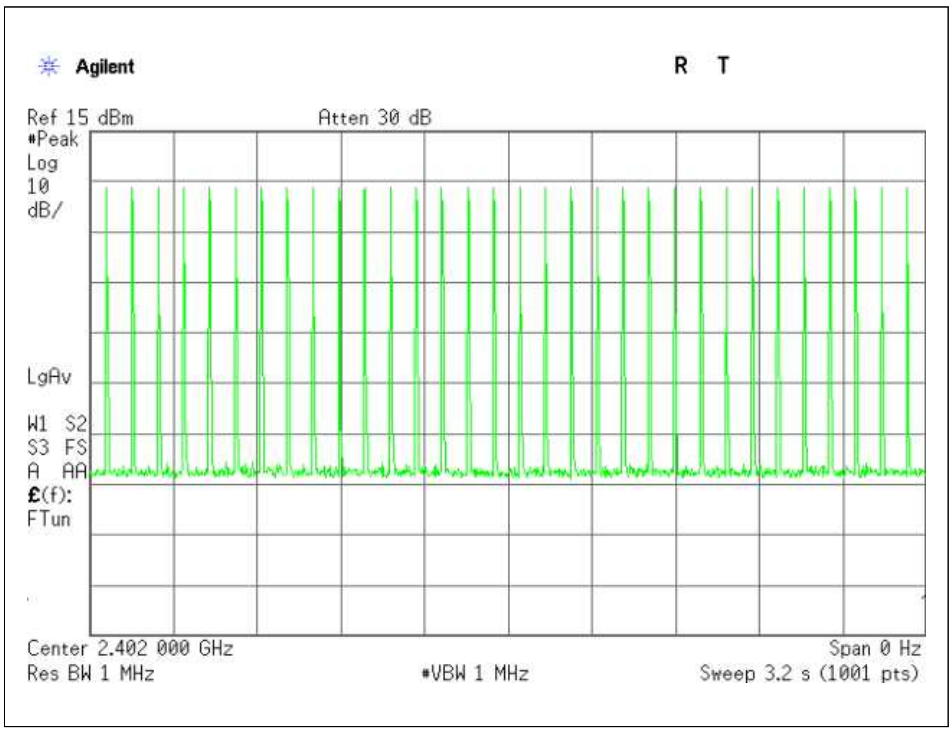


Test mode:	π/4DQPSK	Test chanel:	Lowest(DH1)

Pulse Width:

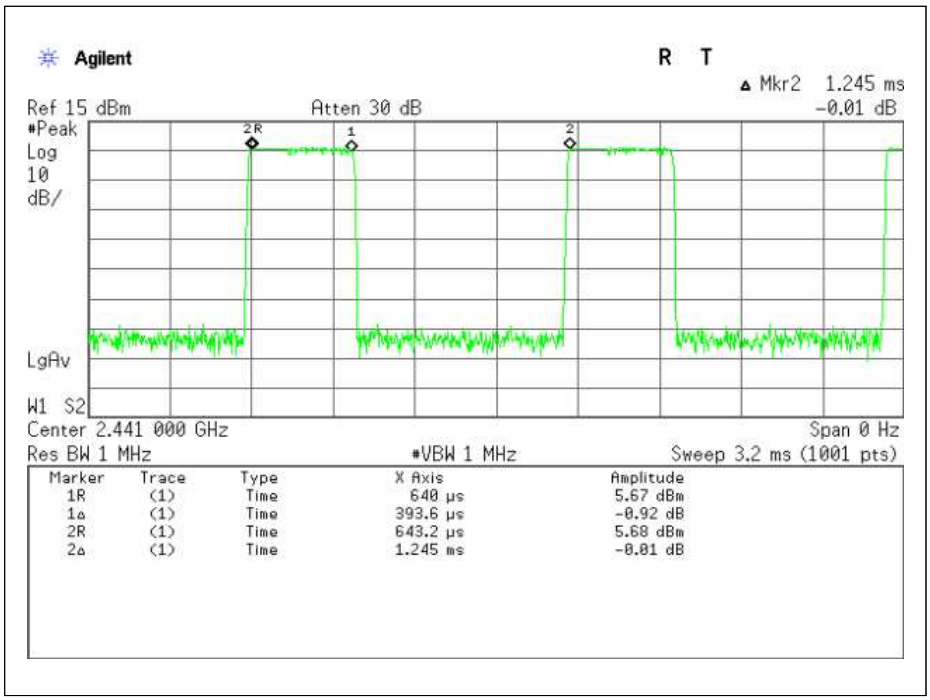


Number of Pulses in 3.16 S observation period:

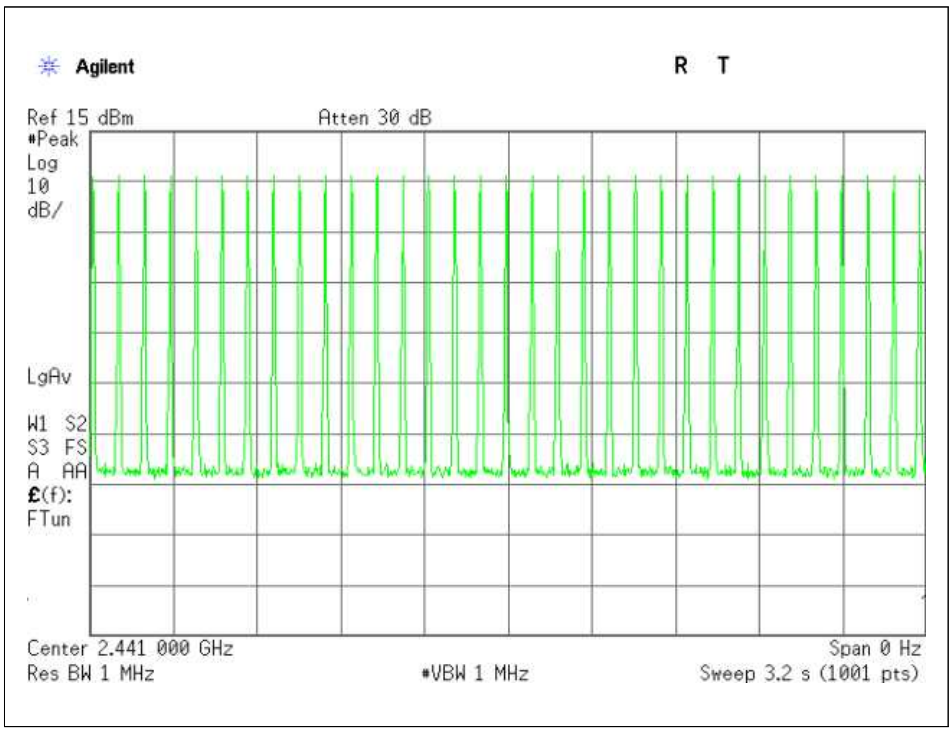


Test mode:	π/4DQPSK	Test chanel:	Middle(DH1)

Pulse Width:

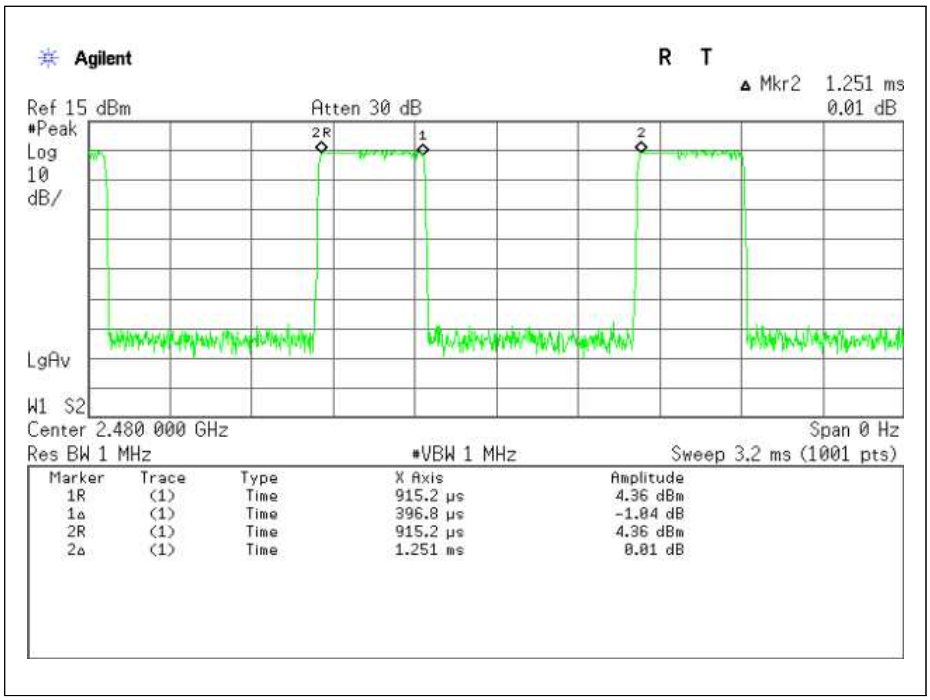


Number of Pulses in 3.16 S observation period:

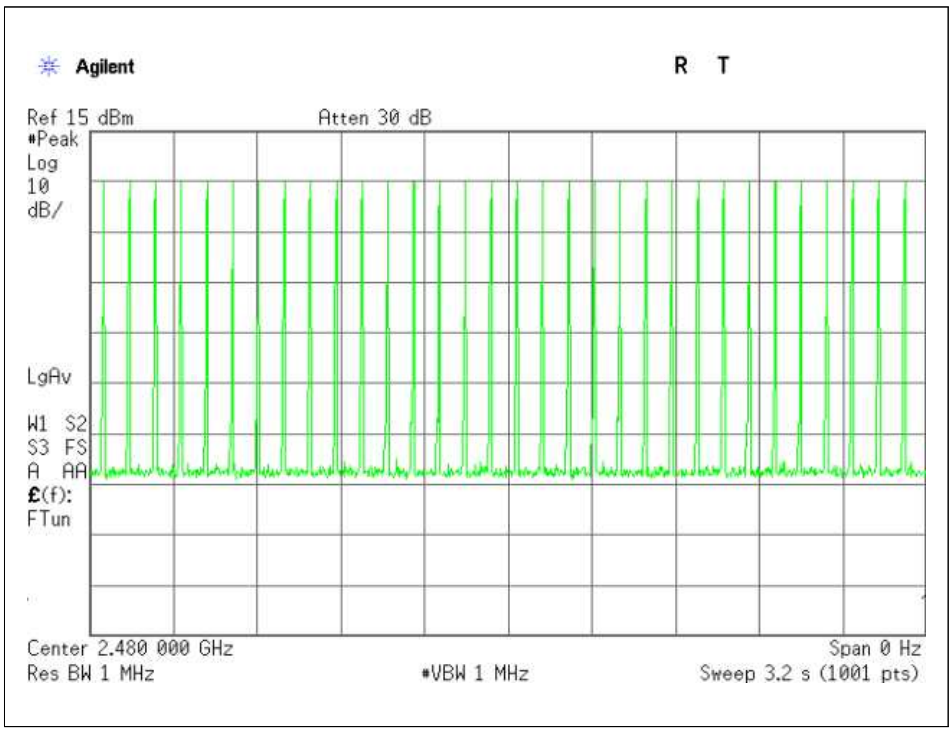


Test mode:	π/4DQPSK	Test chanel:	Highest(DH1)

Pulse Width:

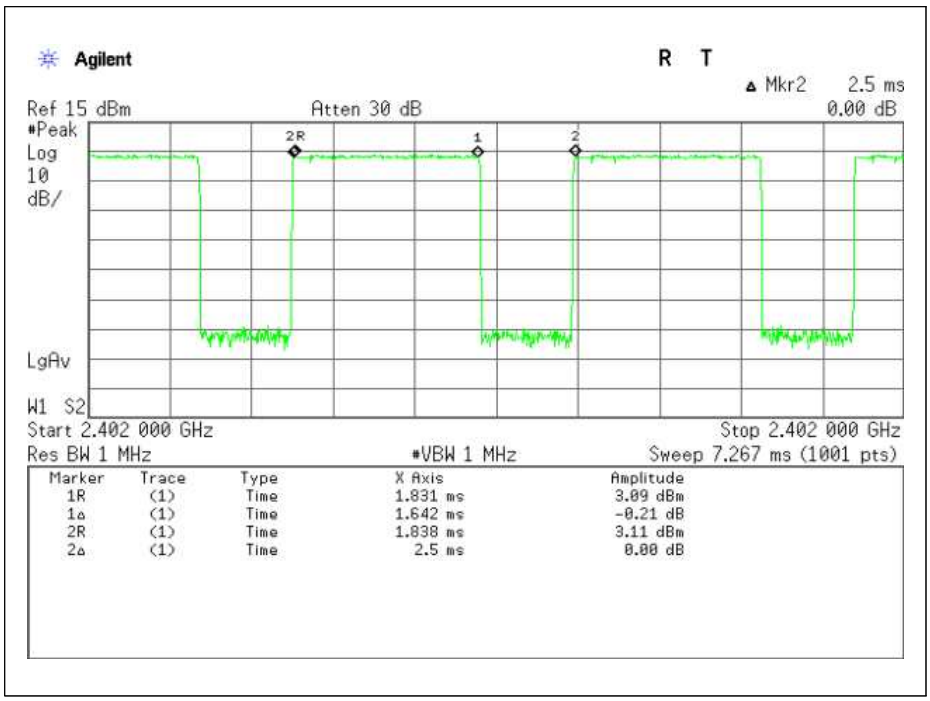


Number of Pulses in 3.16 S observation period:

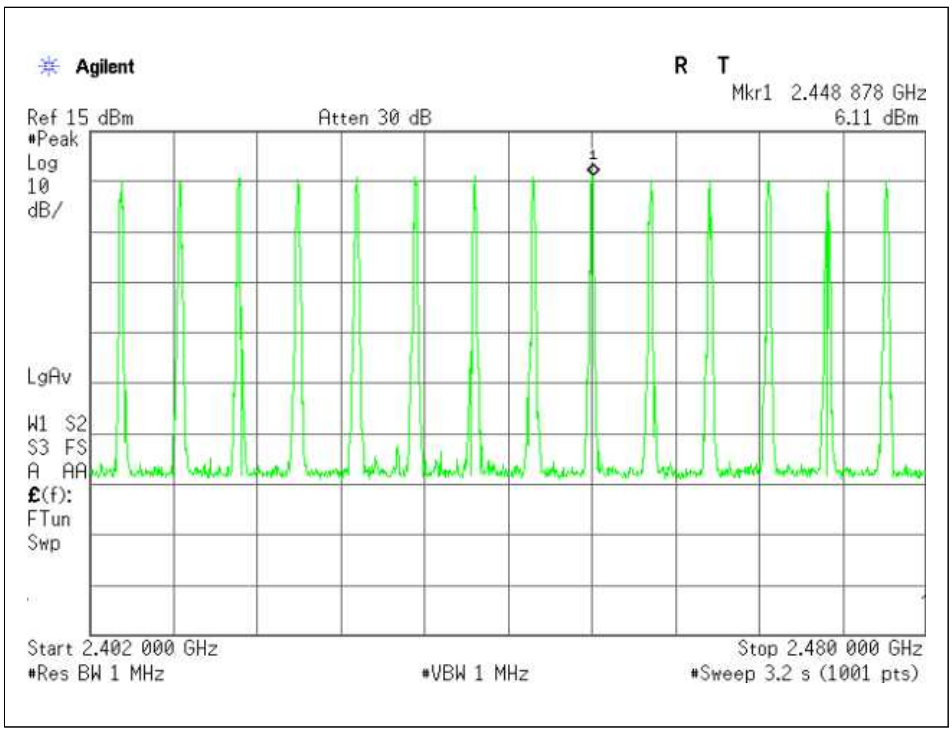


Test mode:	π/4DQPSK	Test chanel:	Lowest(DH3)

Pulse Width:

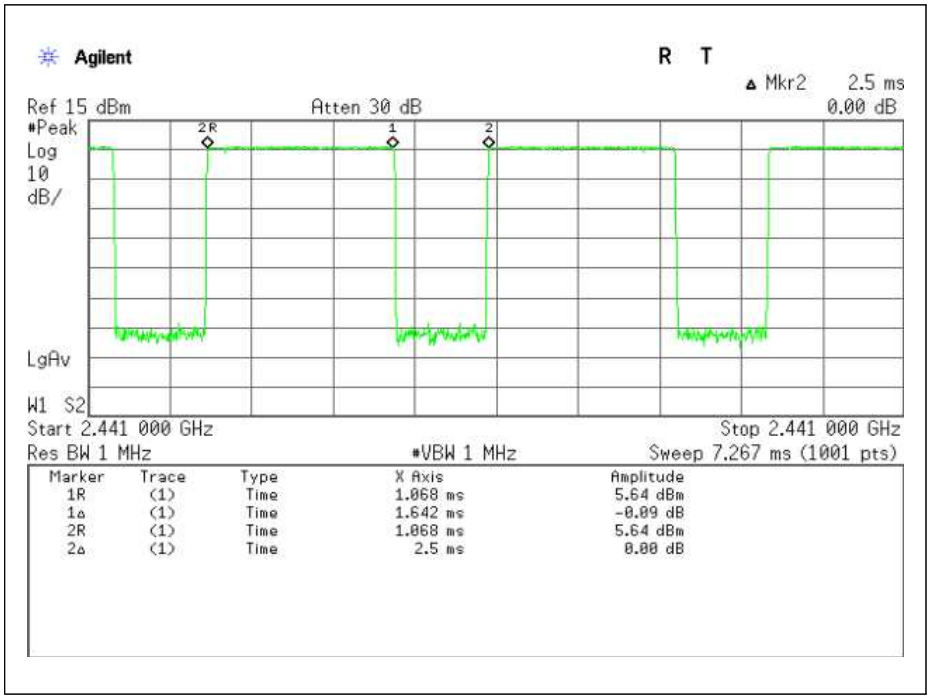


Number of Pulses in 3.16 S observation period:

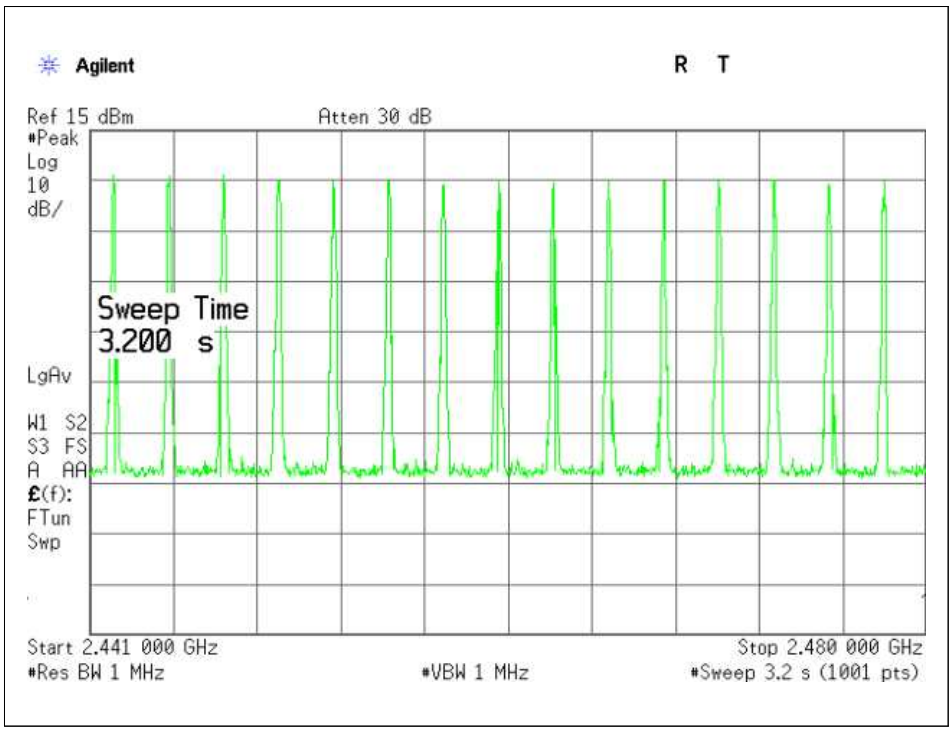


Test mode:	π/4DQPSK	Test chanel:	Middle(DH3)

Pulse Width:

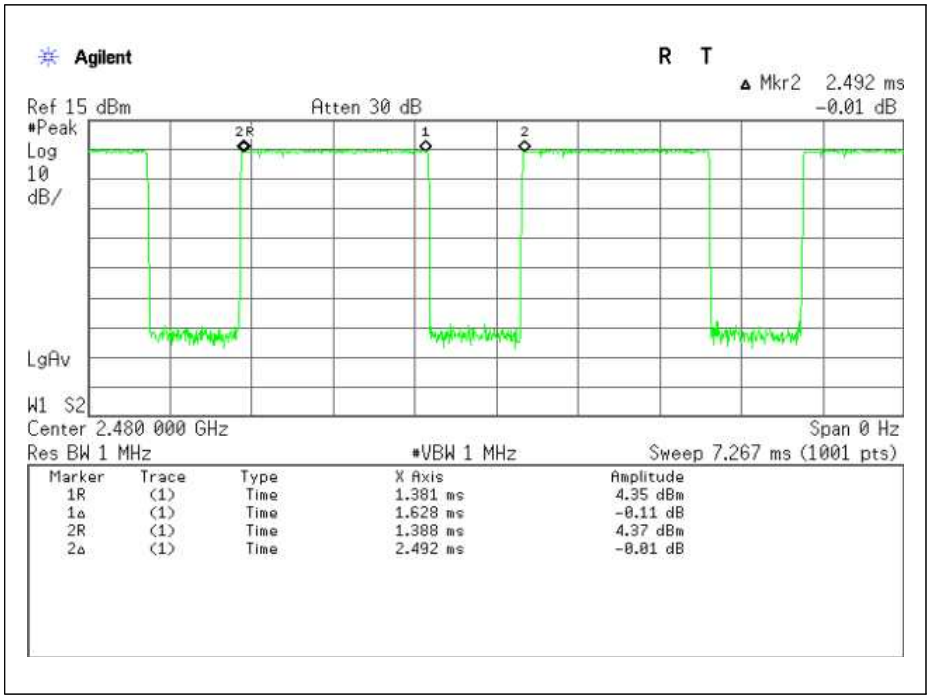


Number of Pulses in 3.16 S observation period:

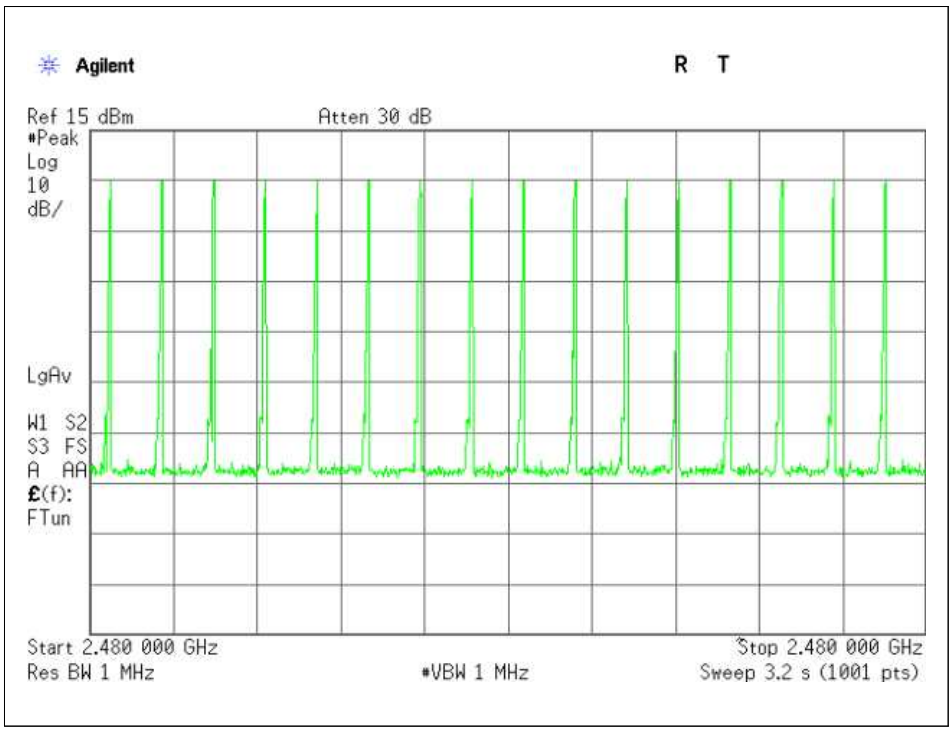


Test mode:	π/4DQPSK	Test chanel:	Highest(DH3)

Pulse Width:

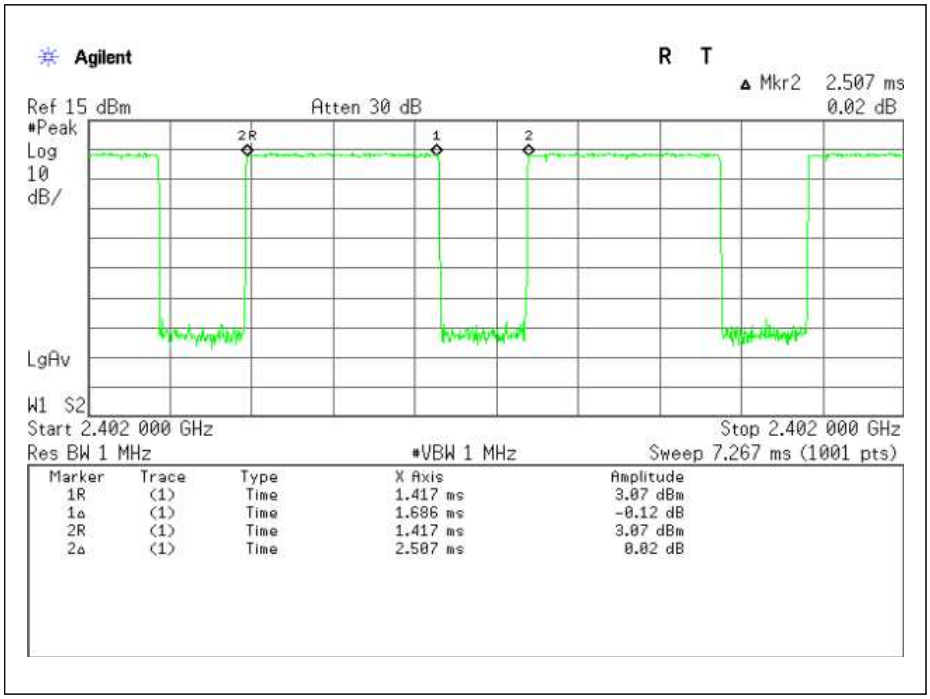


Number of Pulses in 3.16 S observation period:

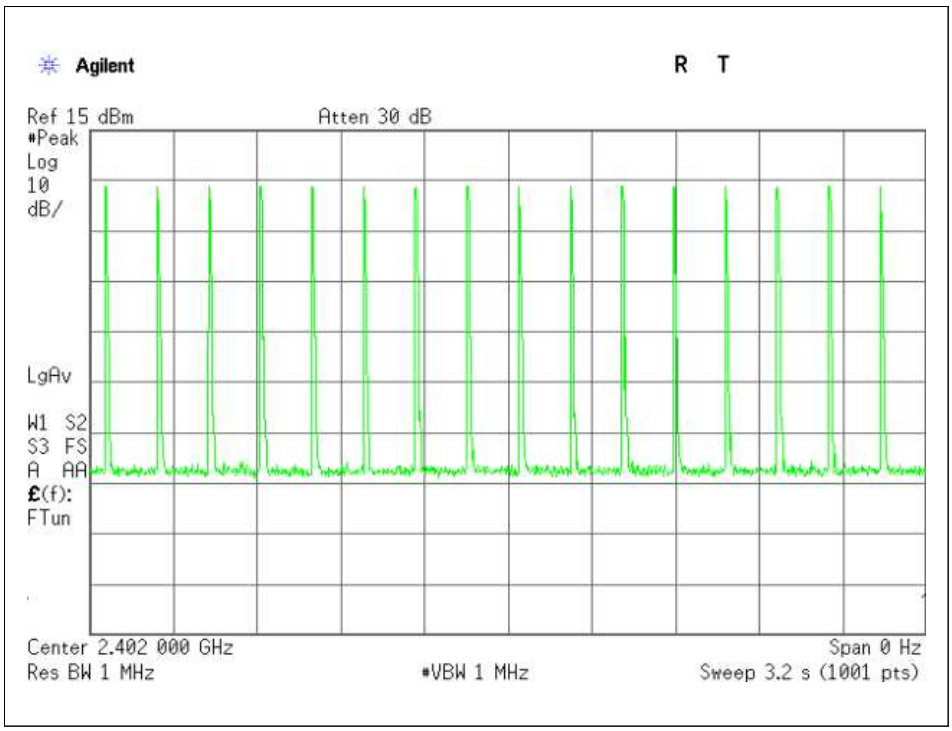


Test mode:	π/4DQPSK	Test chanel:	Lowest(DH5)

Pulse Width:

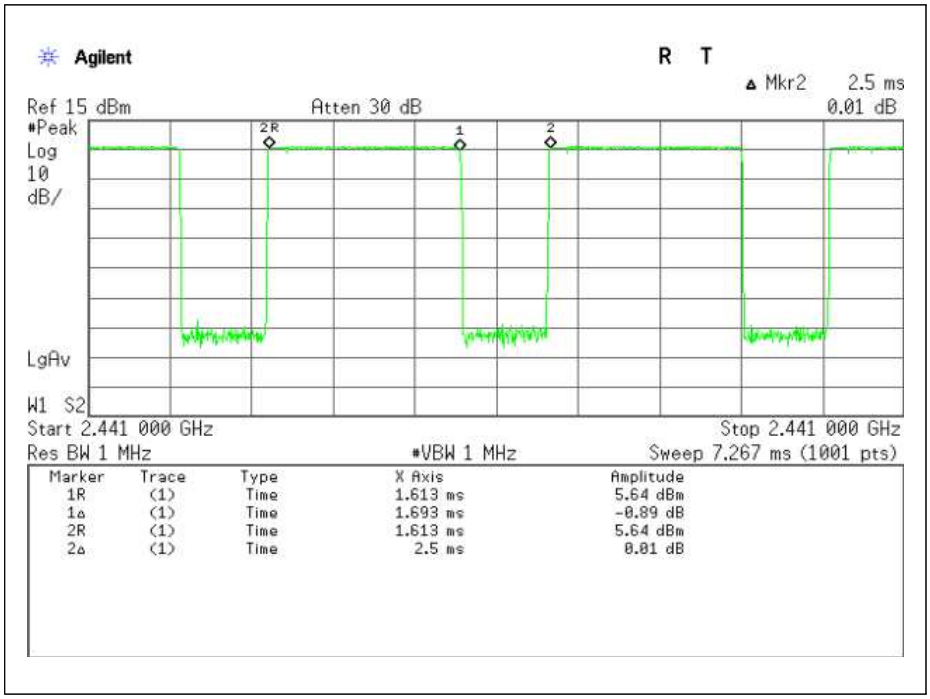


Number of Pulses in 3.16 S observation period:

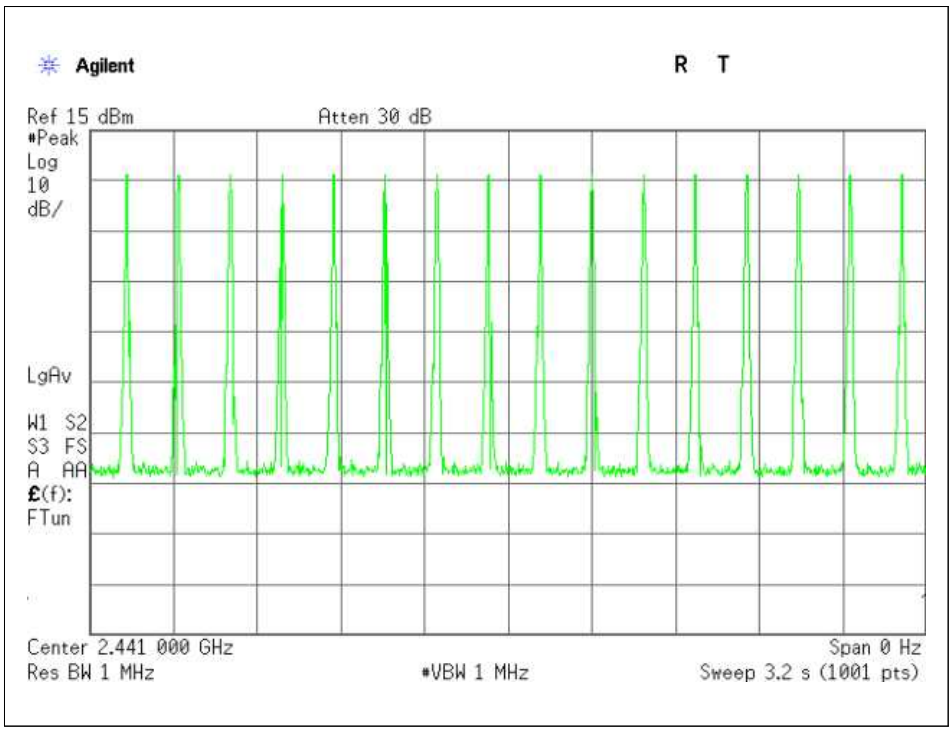


Test mode:	π/4DQPSK	Test chanel:	Middle(DH5)

Pulse Width:

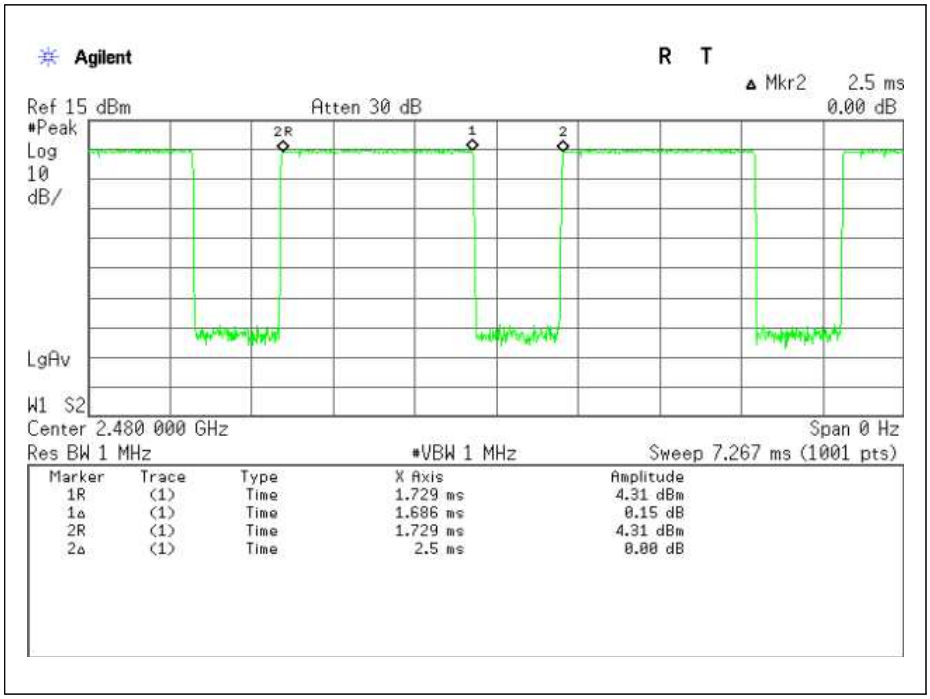


Number of Pulses in 3.16 S observation period:

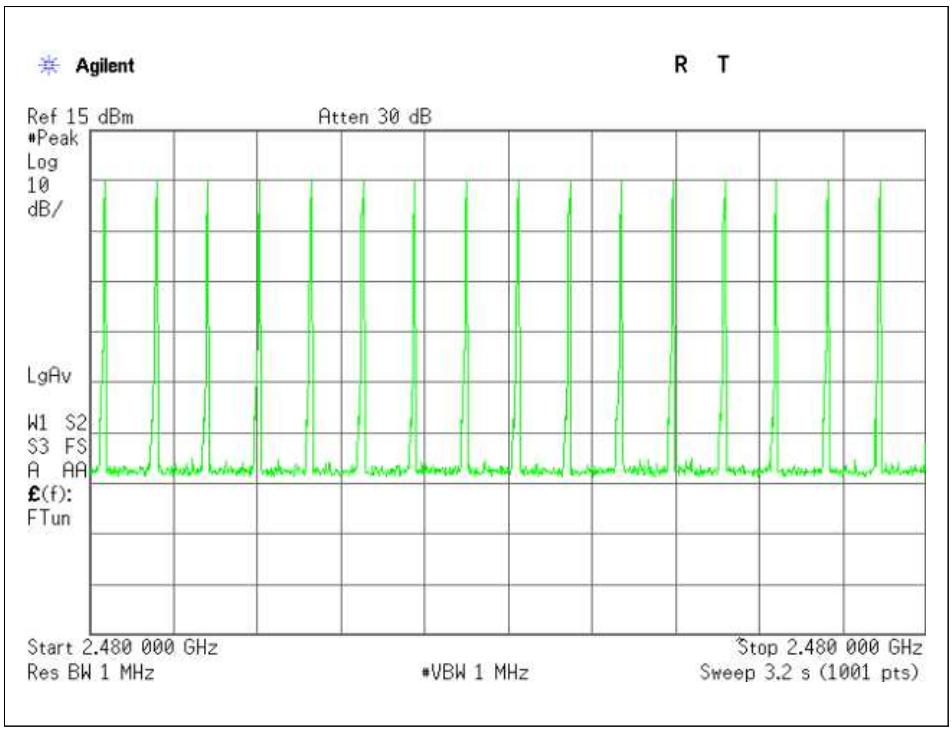


Test mode:	π/4DQPSK	Test chanel:	Highest(DH5)

Pulse Width:

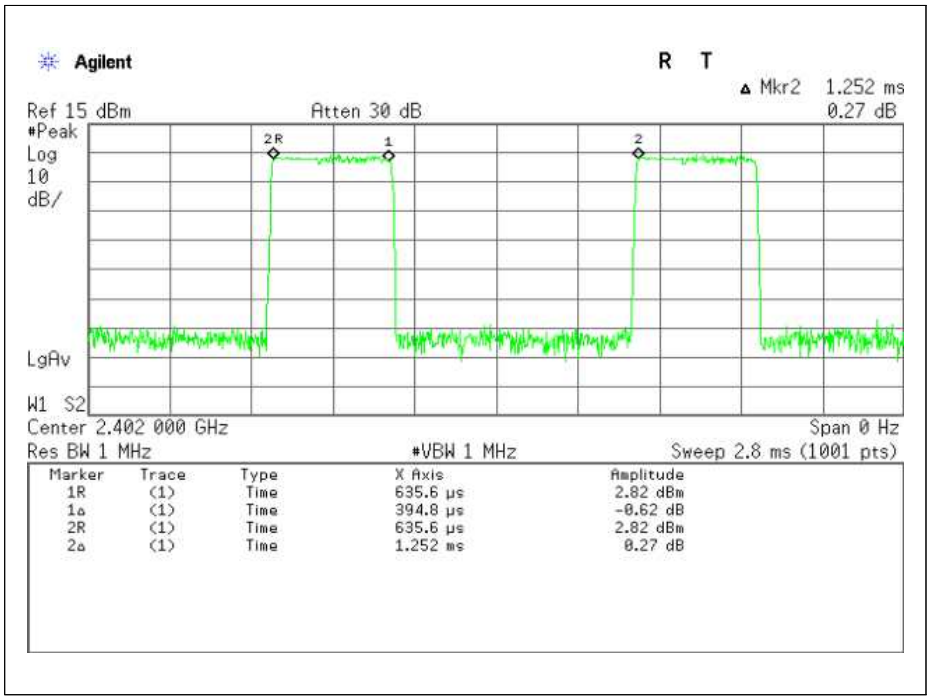


Number of Pulses in 3.16 S observation period:

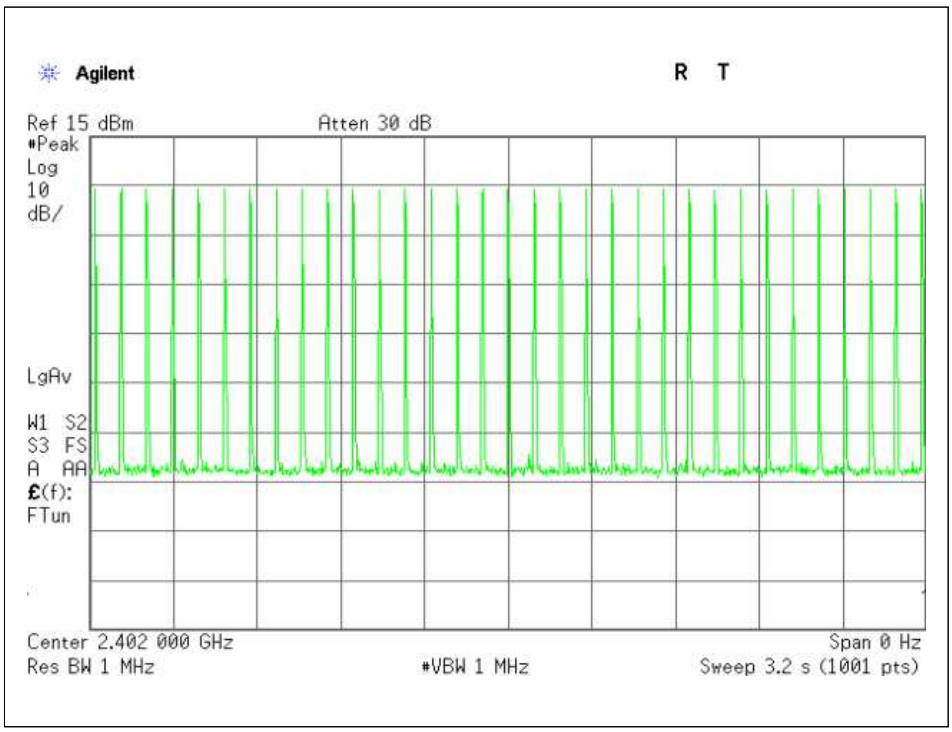


Test mode:	8DPSK	Test chanel:	Lowerst(DH1)

Pulse Width:

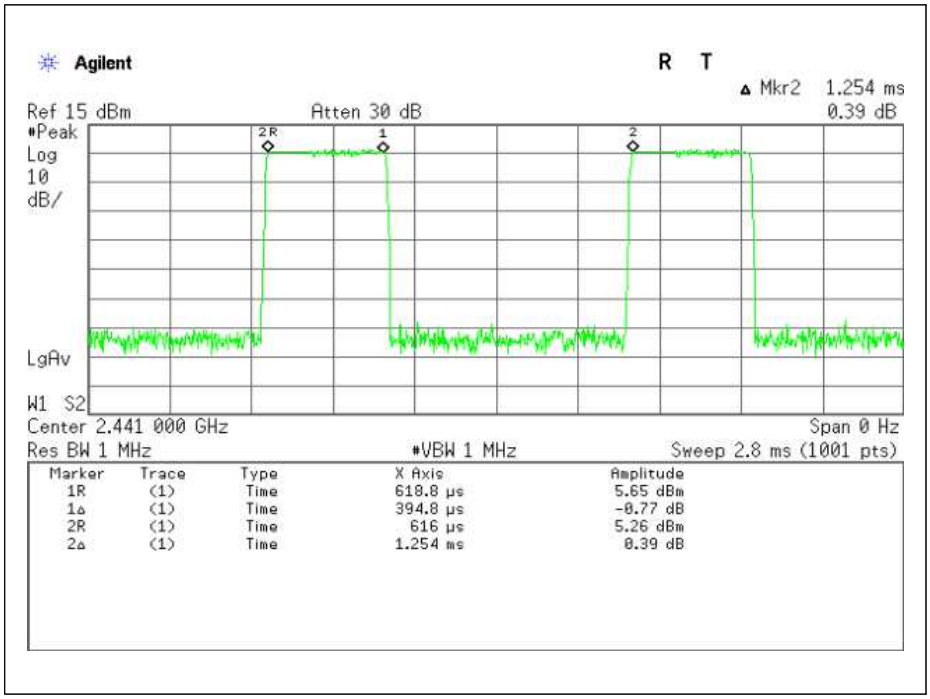


Number of Pulses in 3.16 S observation period:

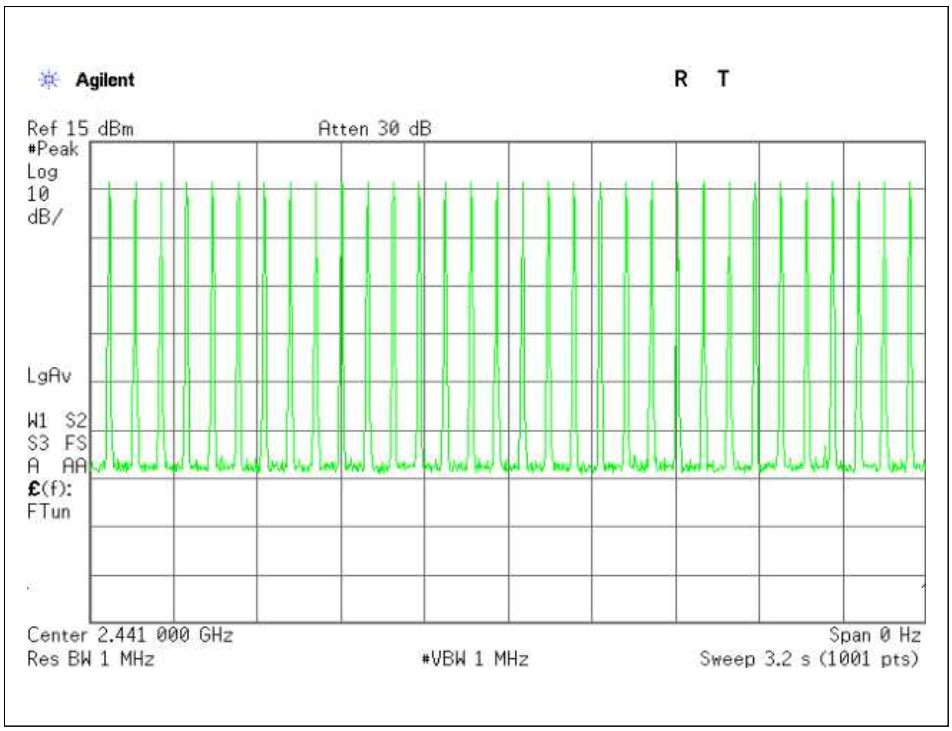


Test mode:	8DPSK	Test chanel:	Midde(DH1)

Pulse Width:

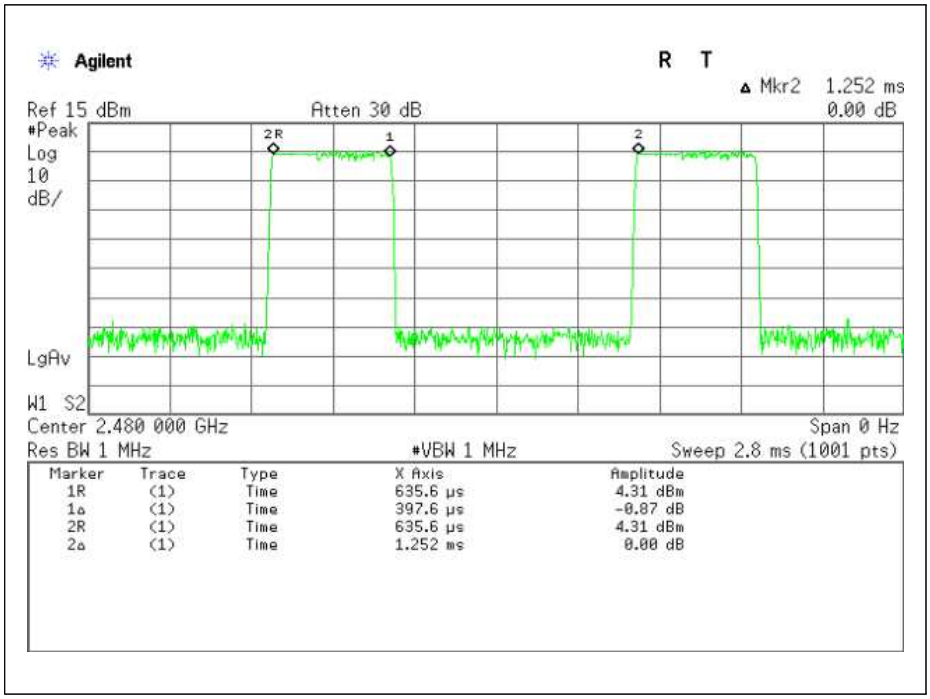


Number of Pulses in 3.16 S observation period:

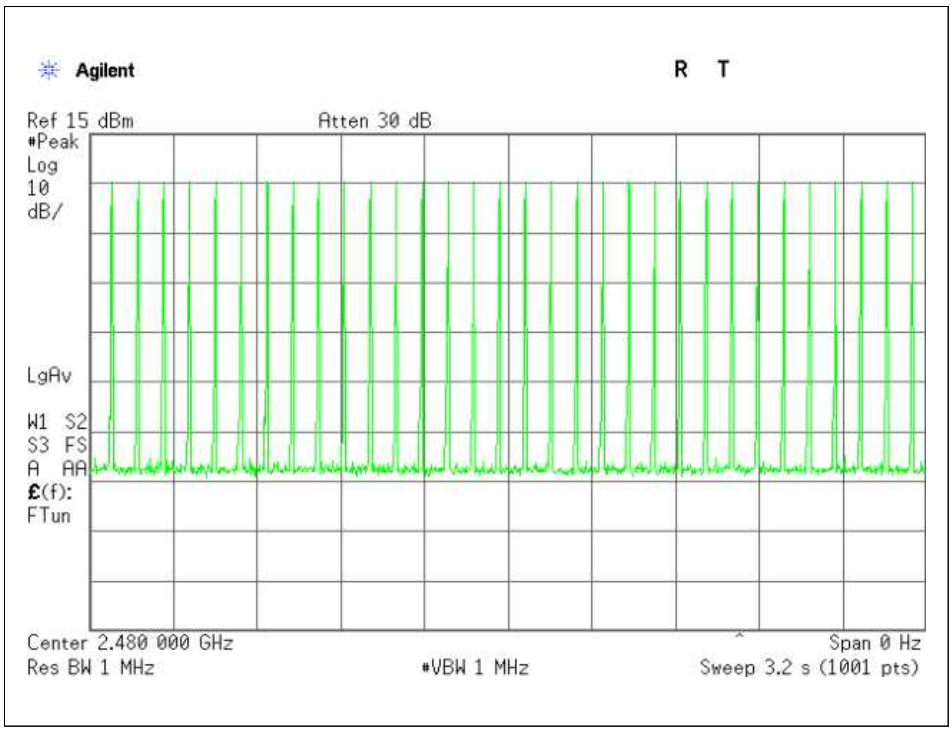


Test mode:	8DPSK	Test chanel:	Highest(DH1)

Pulse Width:

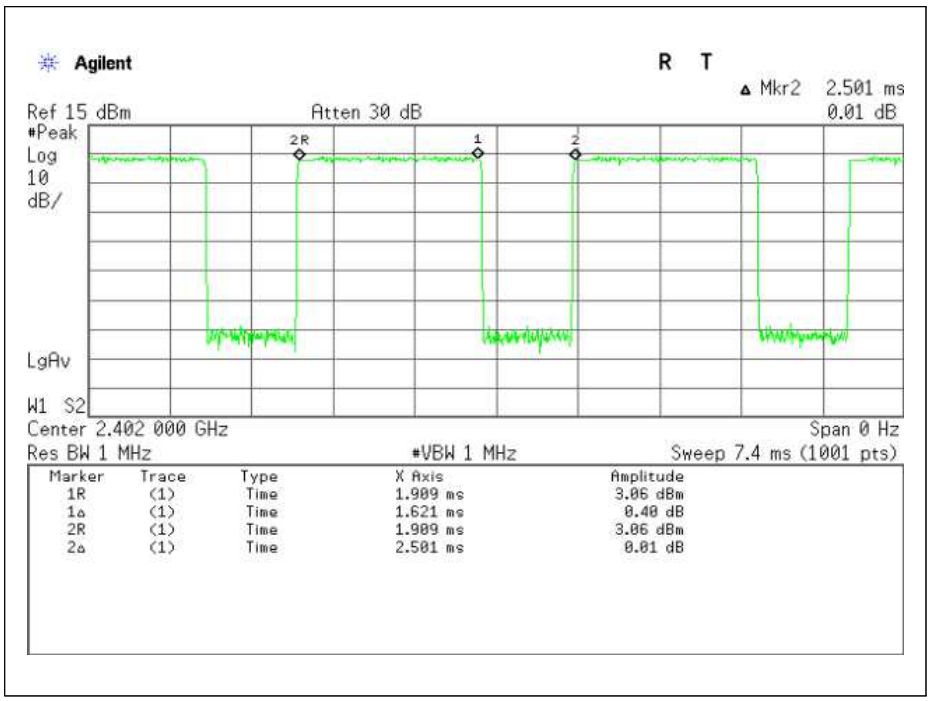


Number of Pulses in 3.16 S observation period:

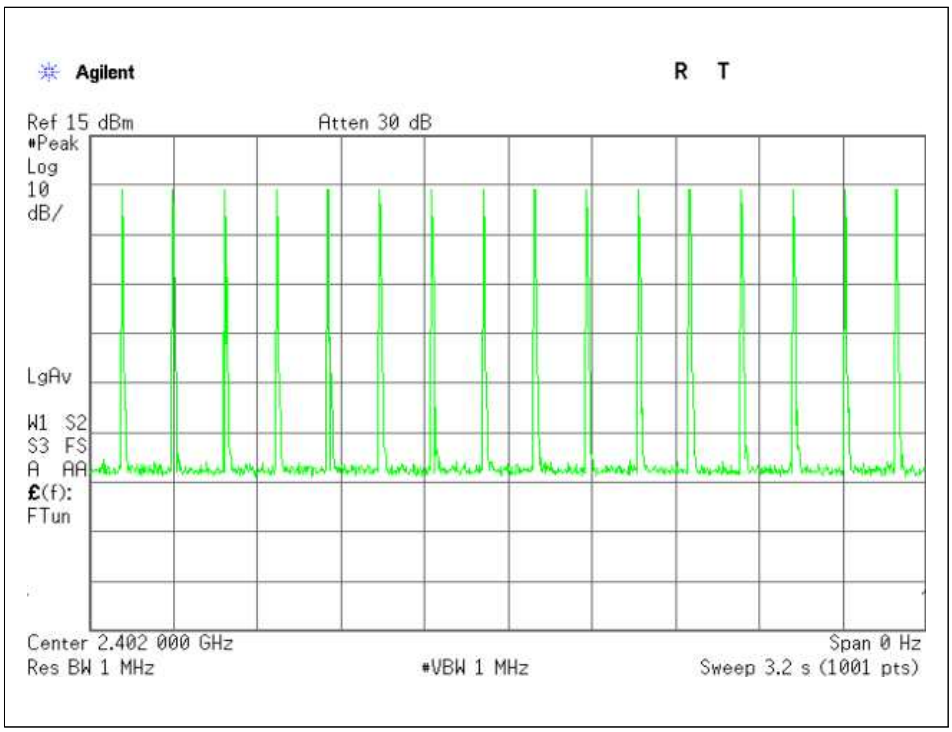


Test mode:	8DPSK	Test chanel:	Lowest(DH3)

Pulse Width:

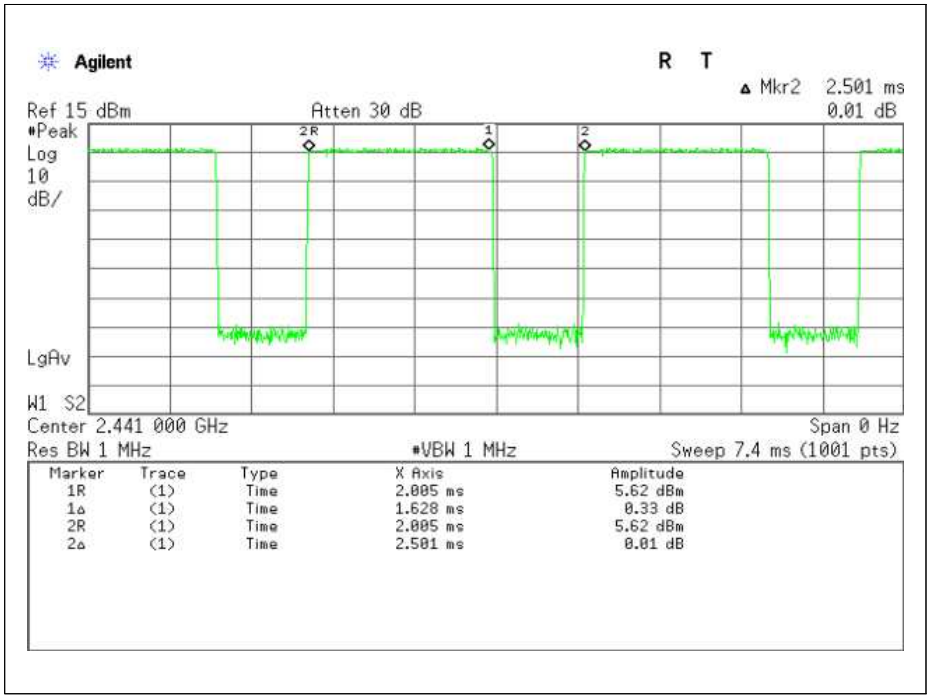


Number of Pulses in 3.16 S observation period:

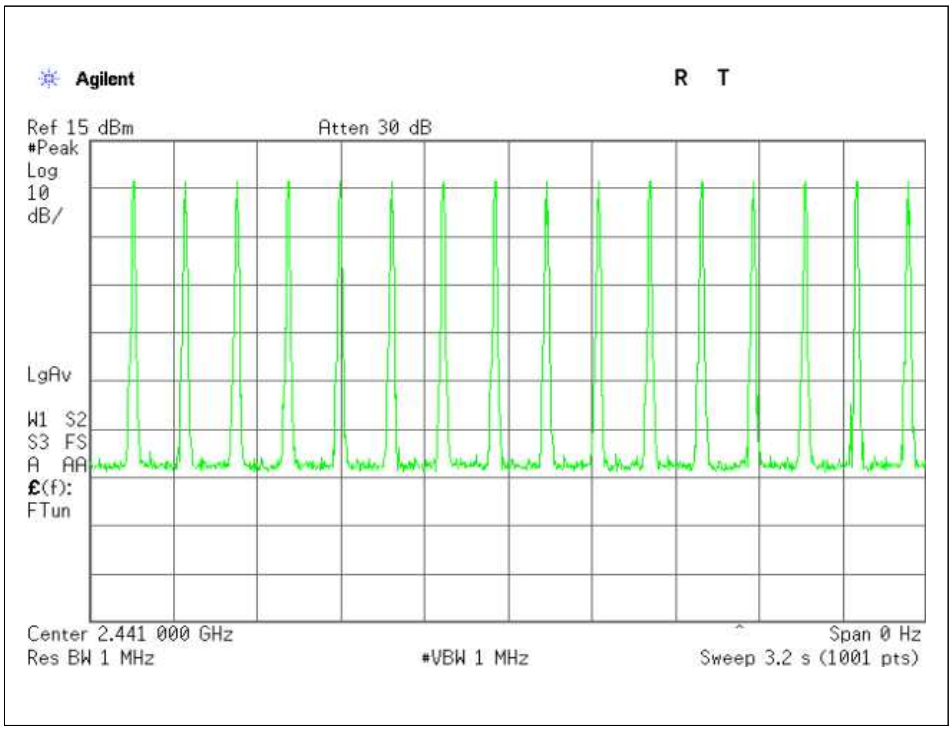


Test mode:	8DPSK	Test chanel:	Middle(DH3)

PPulse Width:

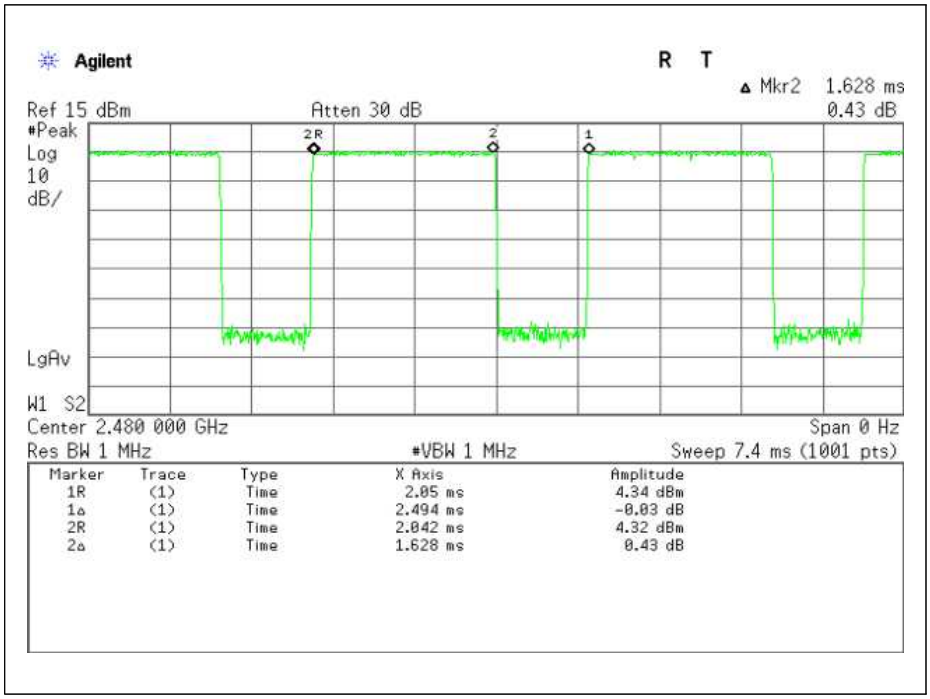


Number of Pulses in 3.16 S observation period:

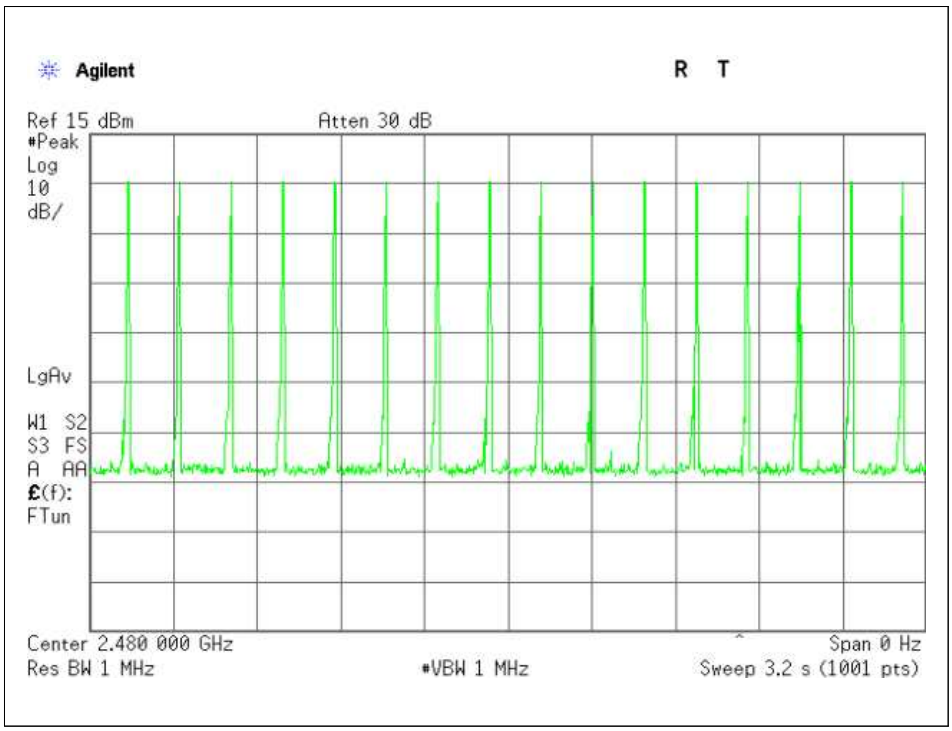


Test mode:	8DPSK	Test chanel:	Highest(DH3)

Pulse Width:

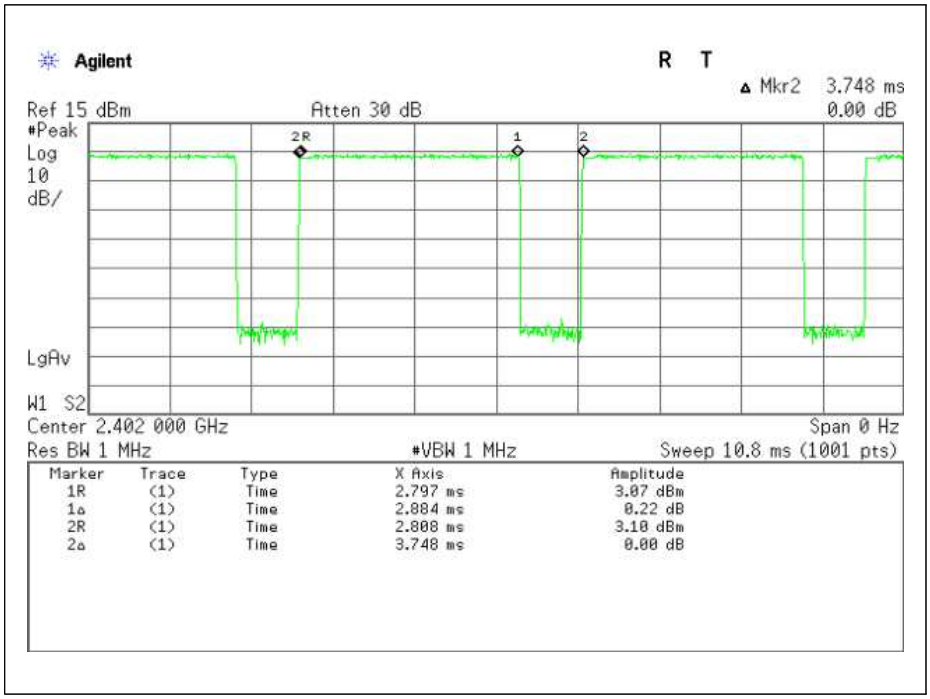


Number of Pulses in 3.16 S observation period:

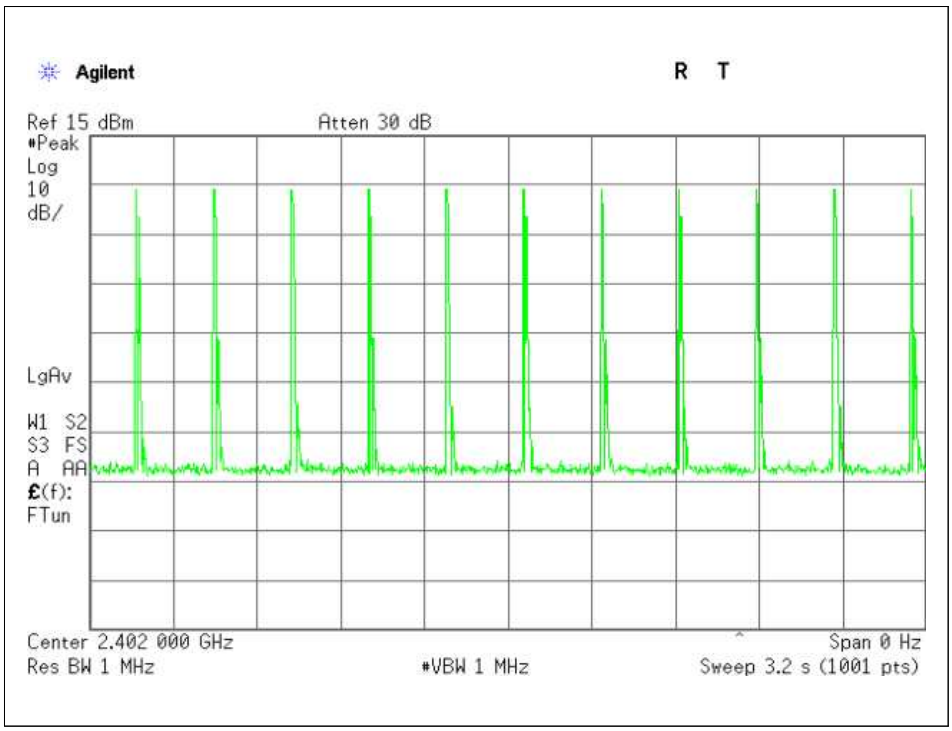


Test mode:	8DPSK	Test chanel:	Lowest(DH5)

Pulse Width:

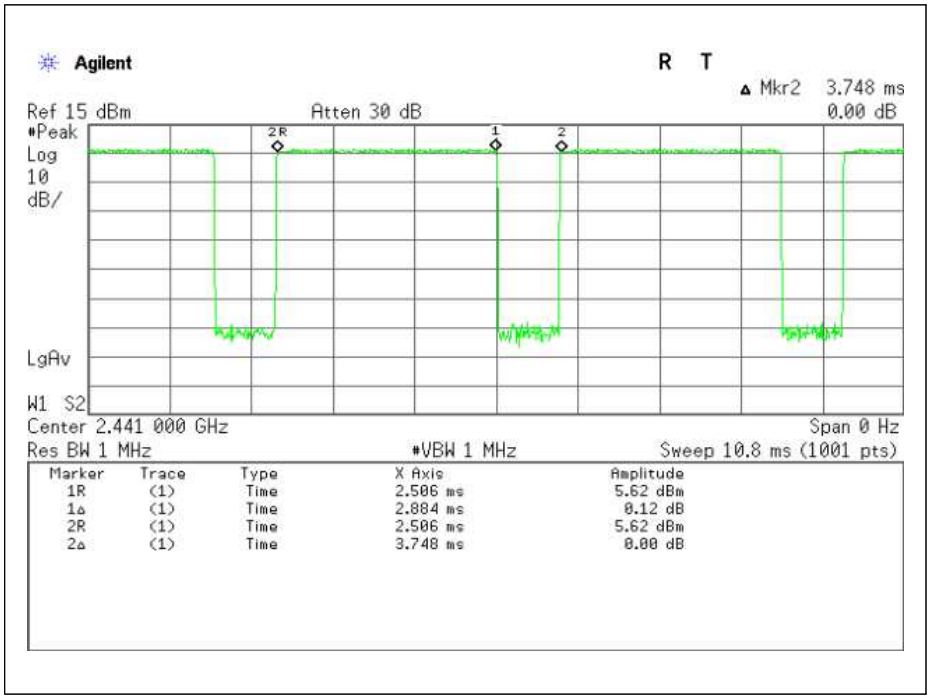


Number of Pulses in 3.16 S observation period:

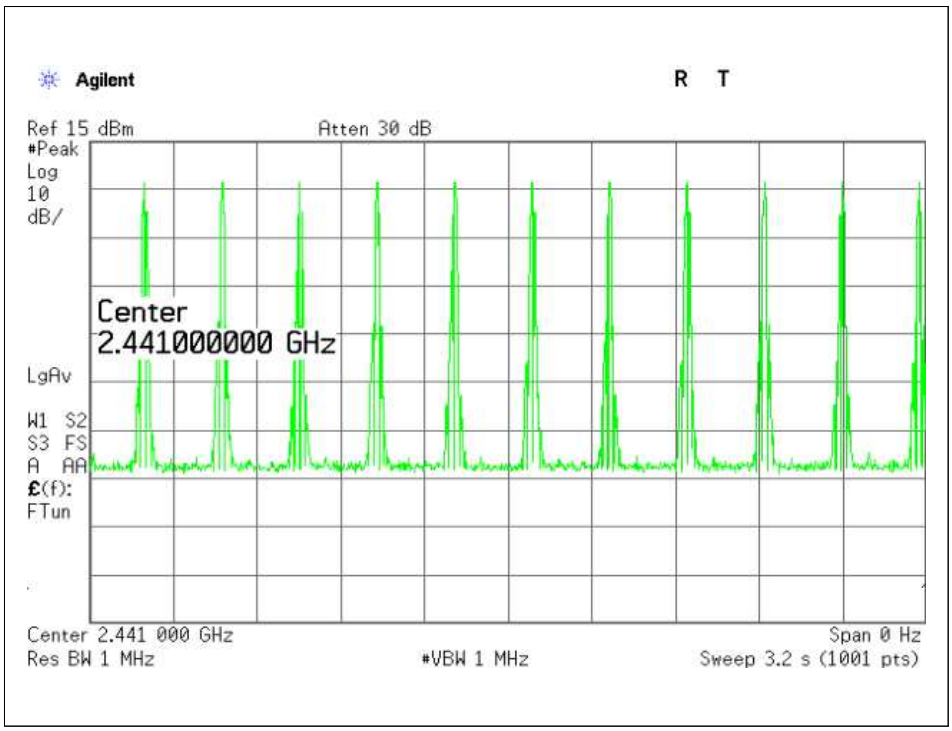


Test mode:	8DPSK	Test chanel:	Middle(DH5)

Pulse Width:

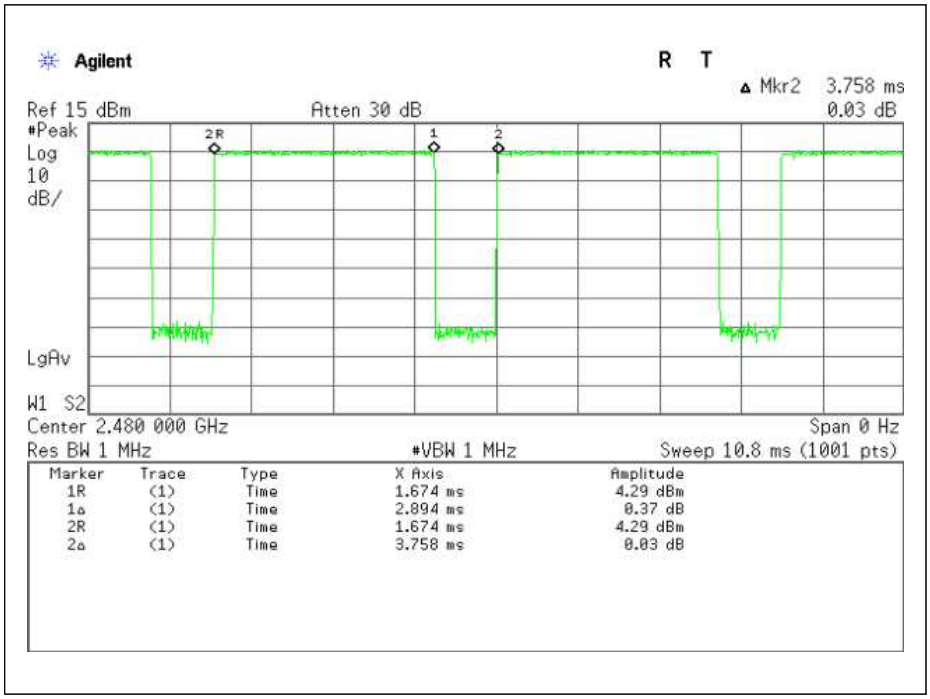


Number of Pulses in 3.16 S observation period:

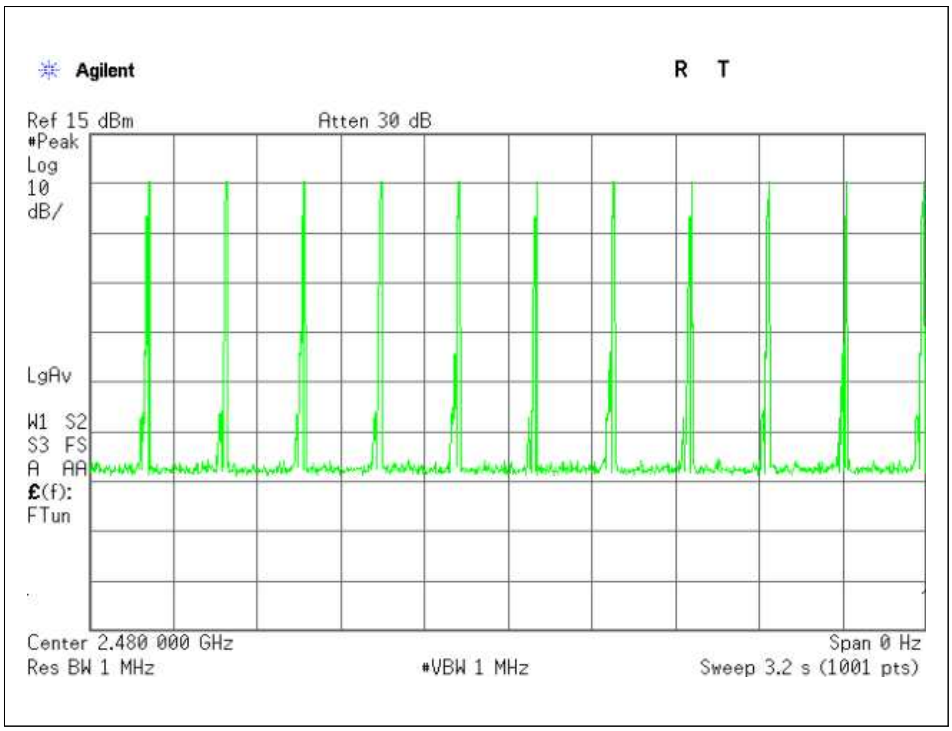


Test mode:	8DPSK	Test chanel:	Highest(DH5)

Pulse Width:



Number of Pulses in 3.16 S observation period:



5.7. Pseudorandom Frequency Hopping Sequence

5.7.1. Standard requirement

15.247(a)(1) requirement:

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.

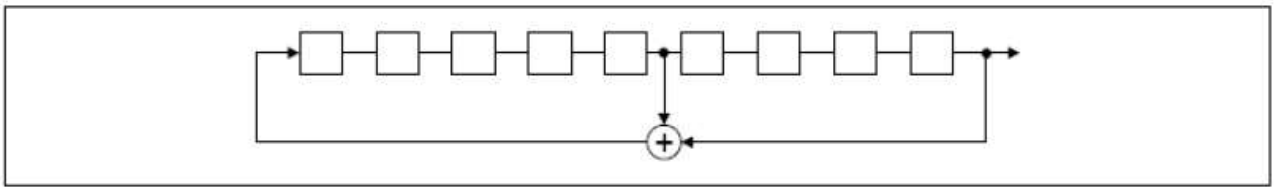
Alternatively. Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

5.7.2. EUT Pseudorandom Frequency Hopping Sequence

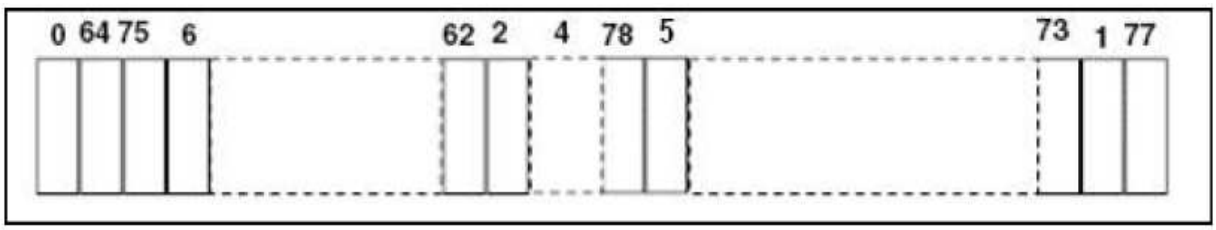
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized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

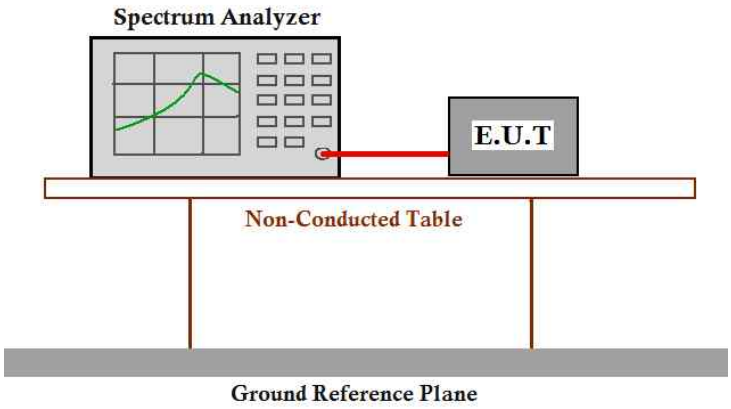
An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.

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.

5.8. Maximum Peak Output Power

Test Requirement:	FCC Part 15 C section 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. Refer to the result "opping channel number"of this document. The 1 watt (30.0 dBm) limit applies.
Test Method:	ANSI C63.10: Clause 6.10.1
Test Status:	Pre-test the EUT in continuous transmitting mode at the lowest (2402 MHz), middle (2441 MHz) and highest (2480 MHz) channel with different data packet.
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of π/4DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Test Configuration:	
Test Procedure: 1 . Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum. 2 . Set the spectrum analyzer: RBW = 2 MHz. VBW = 2 MHz. Sweep = auto; Detector Function = Peak. 3 . Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.	

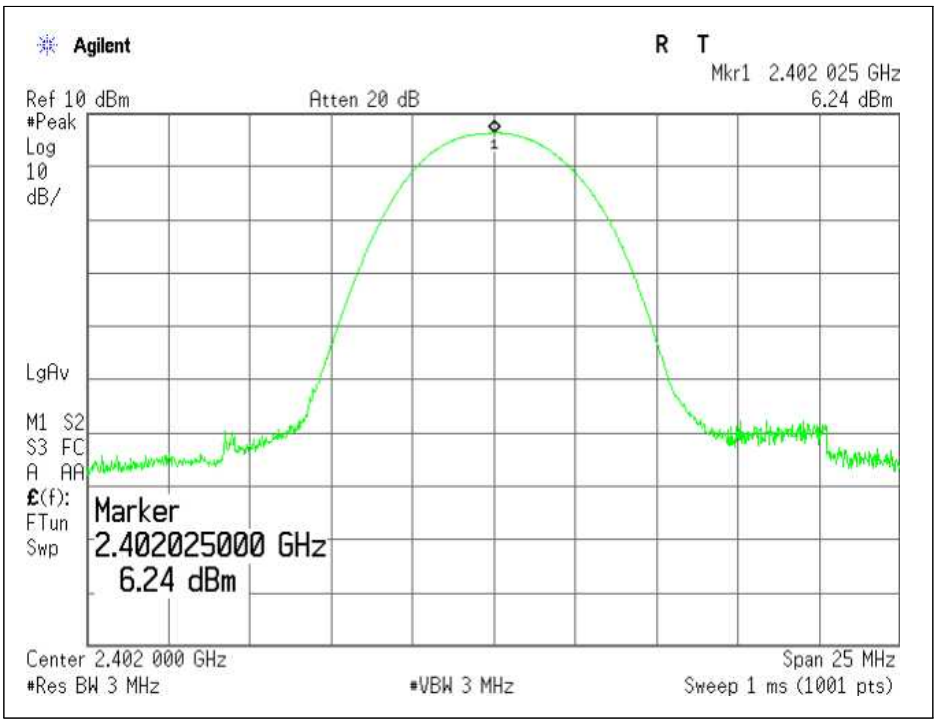
Test result :

Normal mode:

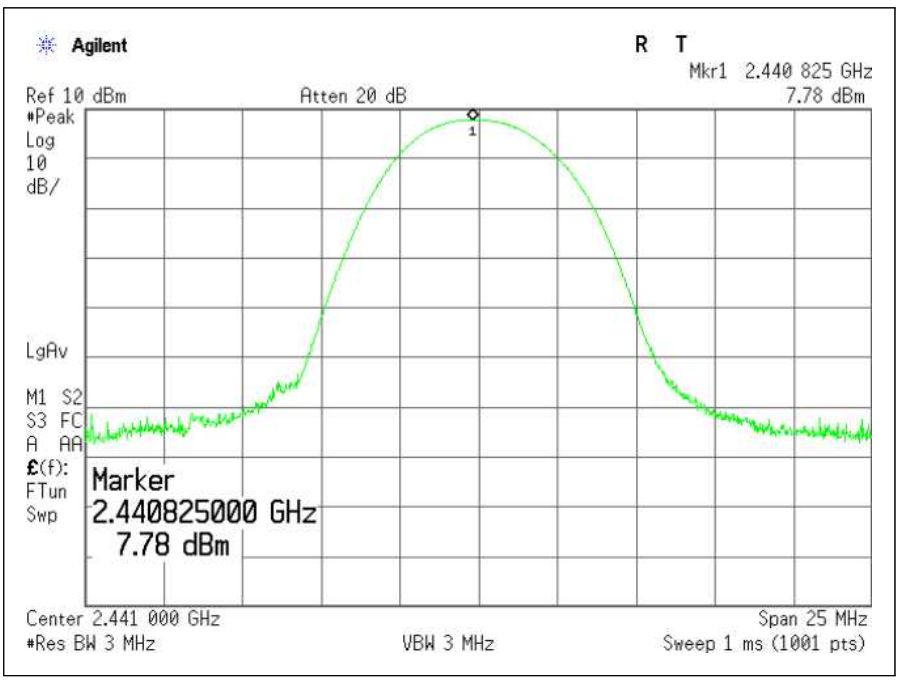
GFSK mode				
Test Channel	Fundamental Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
Lowest	2402	6.24	30.0	Pass
Middle	2441	7.78	30.0	Pass
Highest	2480	7.51	30.0	Pass
π/4DQPSK mode				
Test Channel	Fundamental Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
Lowest	2402	4.62	30.0	Pass
Middle	2441	6.76	30.0	Pass
Highest	2480	5.70	30.0	Pass
8DPSK mode				
Test Channel	Fundamental Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
Lowest	2402	4.96	30.0	Pass
Middle	2441	7.07	30.0	Pass
Highest	2480	6.02	30.0	Pass

Result plot as follows :

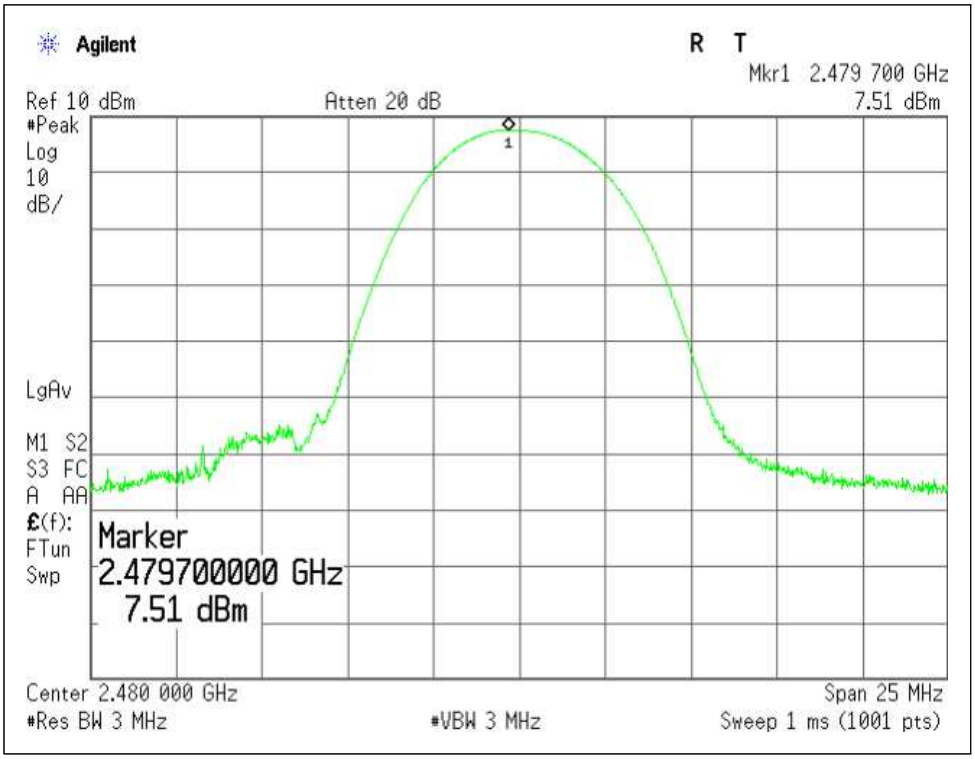
Test mode:	GFSK	Test chanel:	Lowest



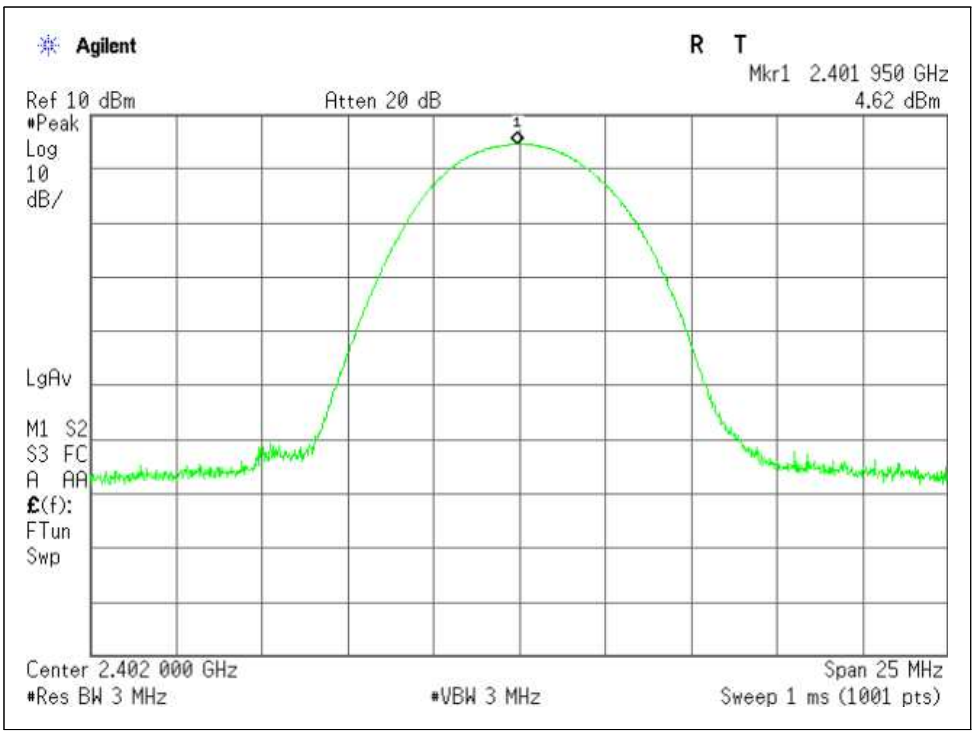
Test mode:	GFSK	Test chanel:	Middle



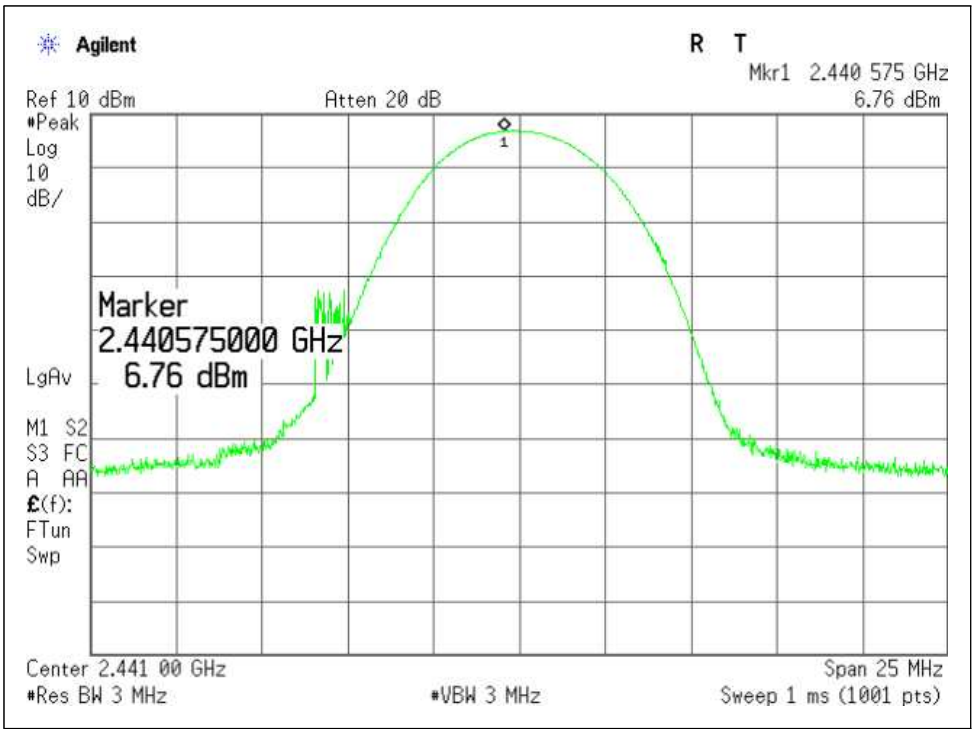
Test mode:	GFSK	Test chanel:	Highest



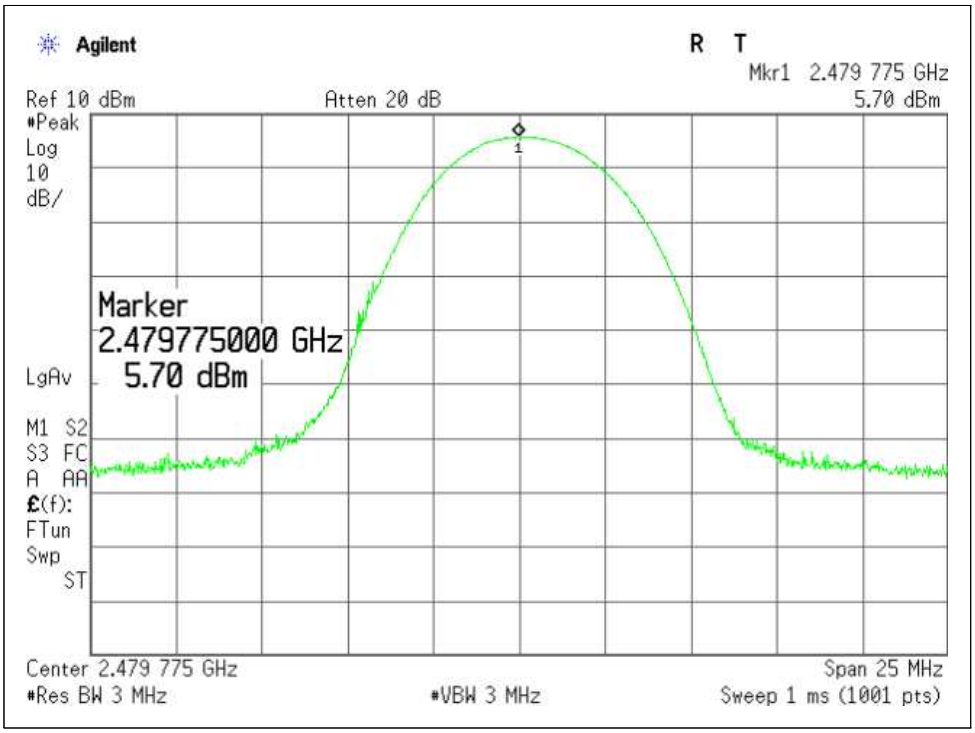
Test mode:	π/4DQPSK	Test chanel:	Lowest



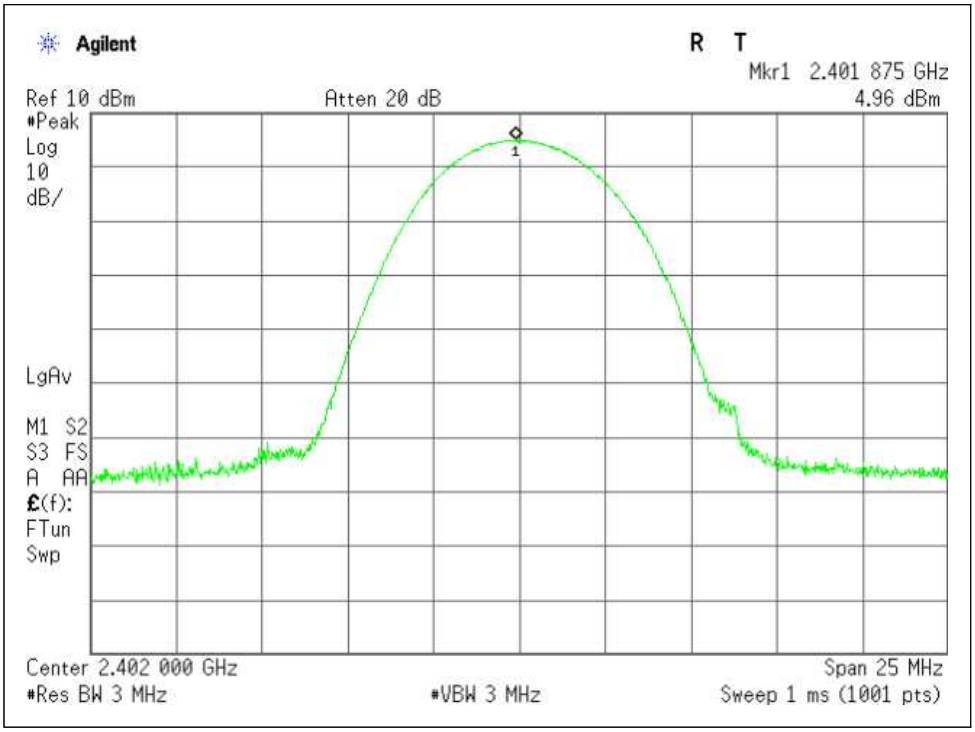
Test mode:	π/4DQPSK	Test chanel:	Middle



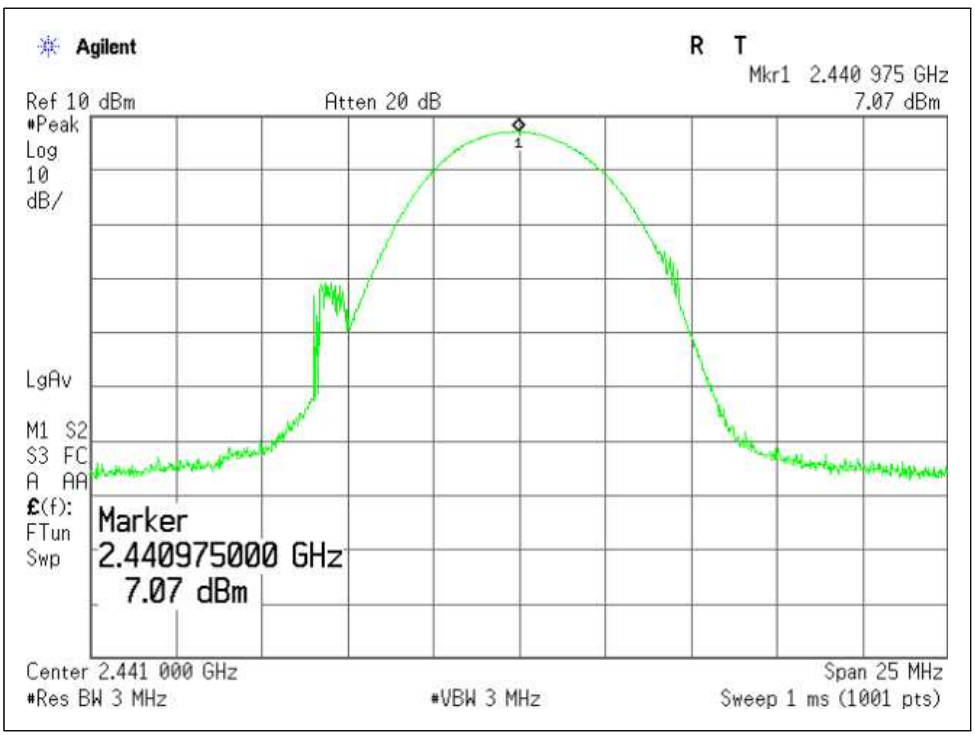
Test mode:	π/4DQPSK	Test chanel:	Highest



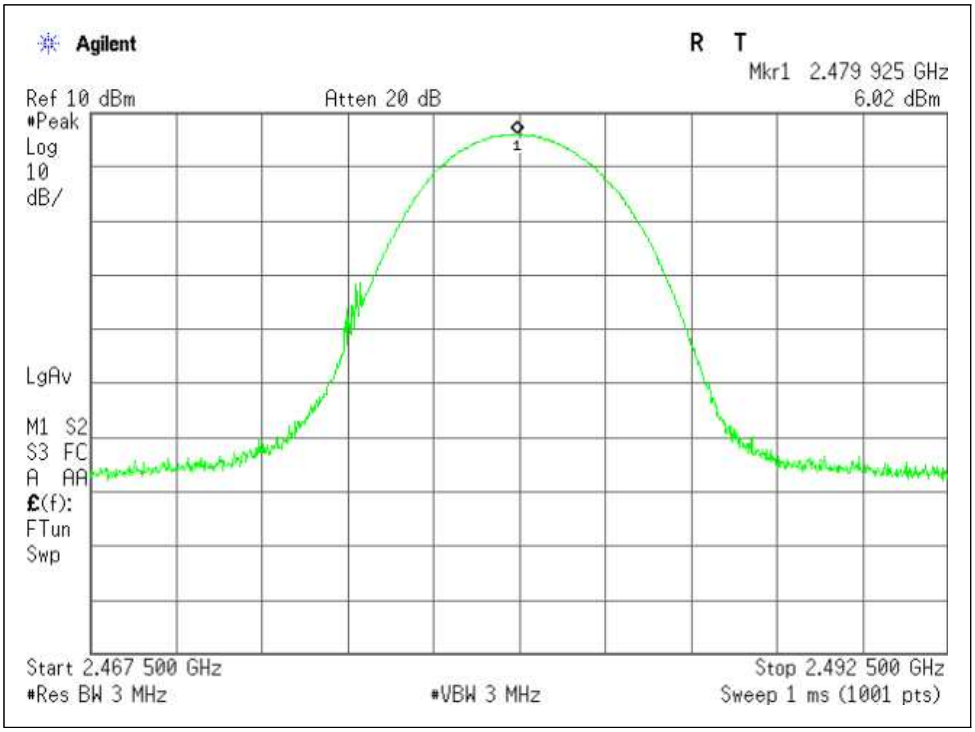
Test mode:	8DPSK	Test chanel:	Lowest



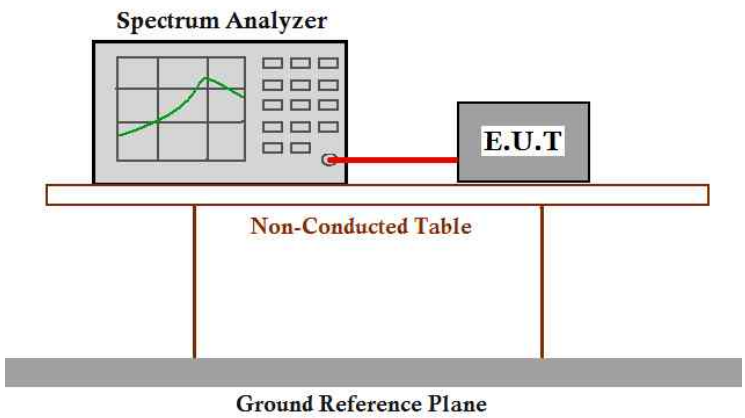
Test mode:	8DPSK	Test chanel:	Middle



Test mode:	8DPSK	Test chanel:	Highest



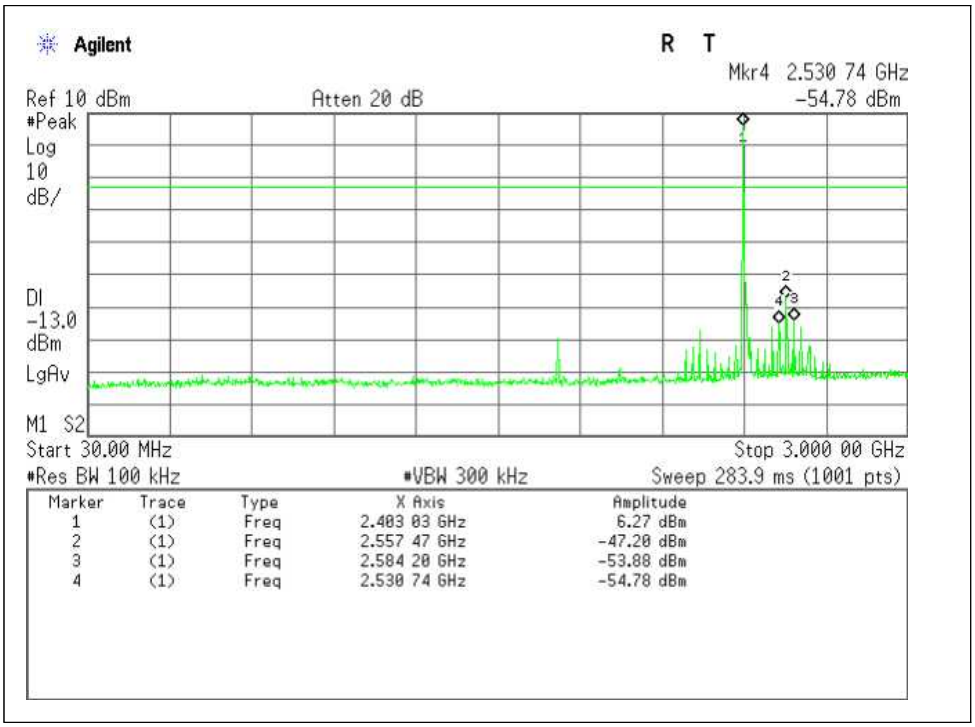
5.9. Conducted Spurious Emissions

Test Requirement:	FCC Part15 C section 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.
Test Method:	ANSI C63.10: Clause 6.7
Test Status:	Pre-test the EUT in continuous transmitting mode at the lowest (2402 MHz), middle (2441 MHz) and highest (2480 MHz) channel with different data packet.
Final Test Mode:	Through Pre-scan, find the DH1 of data type is the worst case of GFSK modulation type, 2-DH1 of data type is the worst case of π/4DQPSK modulation type, 3-DH1 of data type is the worst case of 8DPSK modulationtype.
Test Configuration:	
Test Procedure: 1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum. 2. Set the spectrum analyzer: RBW = 100 kHz. VBW >= RBW. Sweep = auto; Detector Function = Peak (Max. hold).	

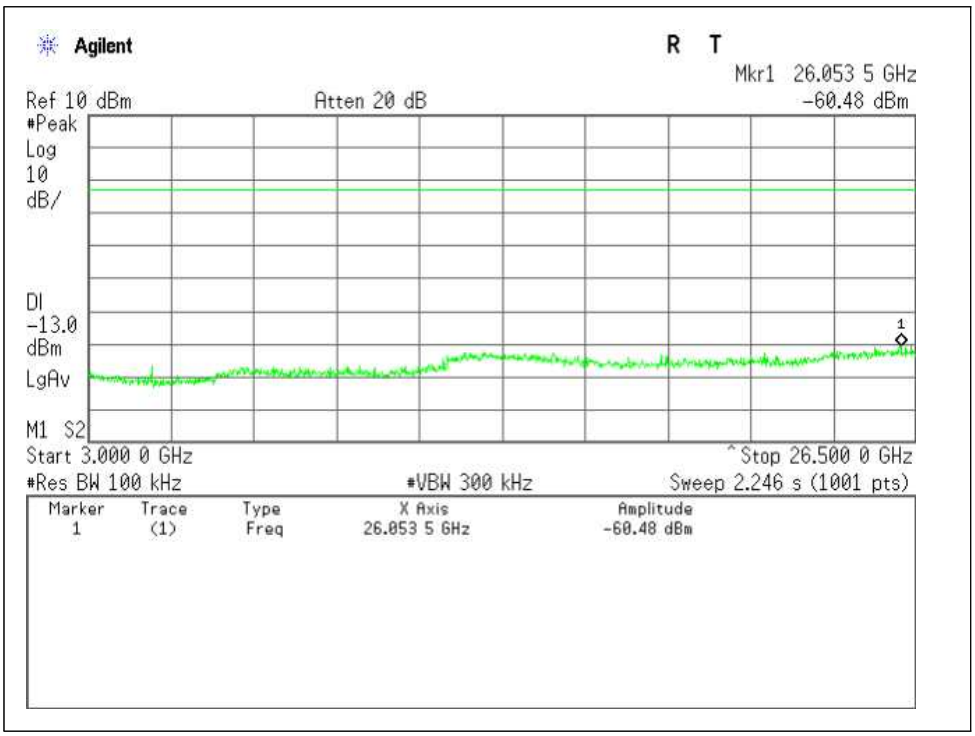
Result plot as follows :

Test mode:	GFSK	Test chanel:	Lowest

30 MHz to 3 GHz

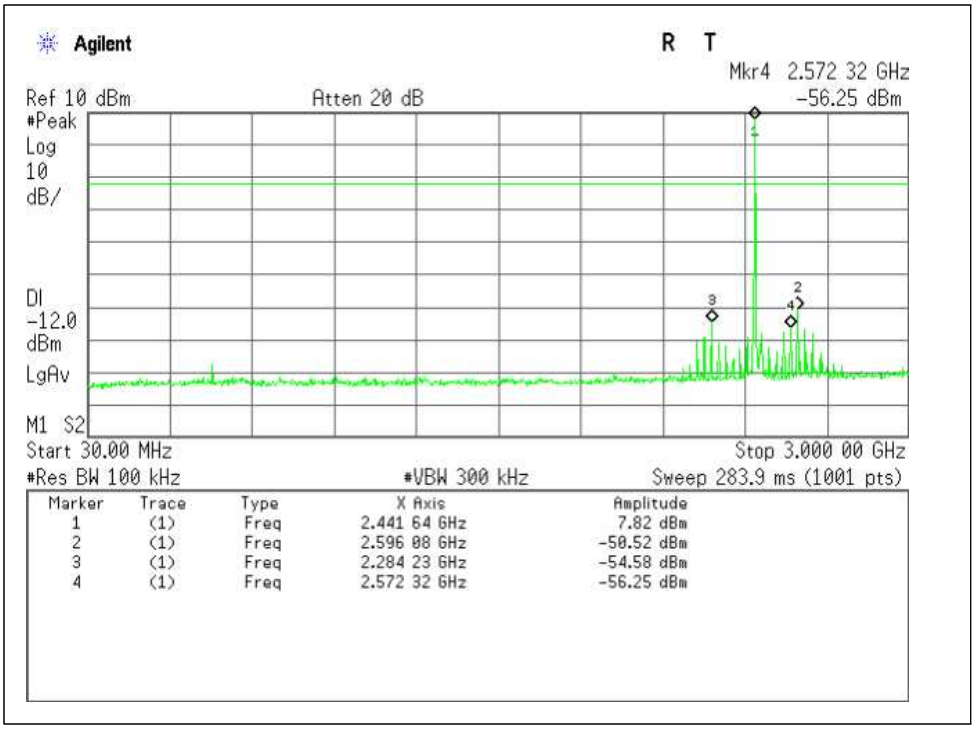


3 GHz to 26.5 GHz

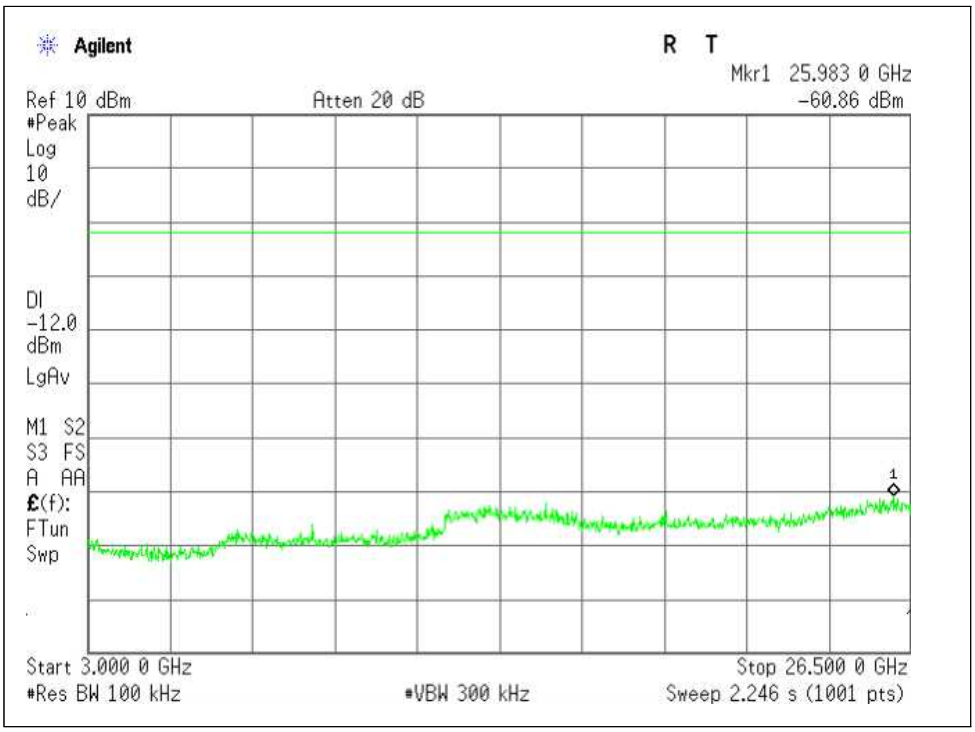


Test mode:	GFSK	Test chanel:	Middle

30 MHz to 3 GHz

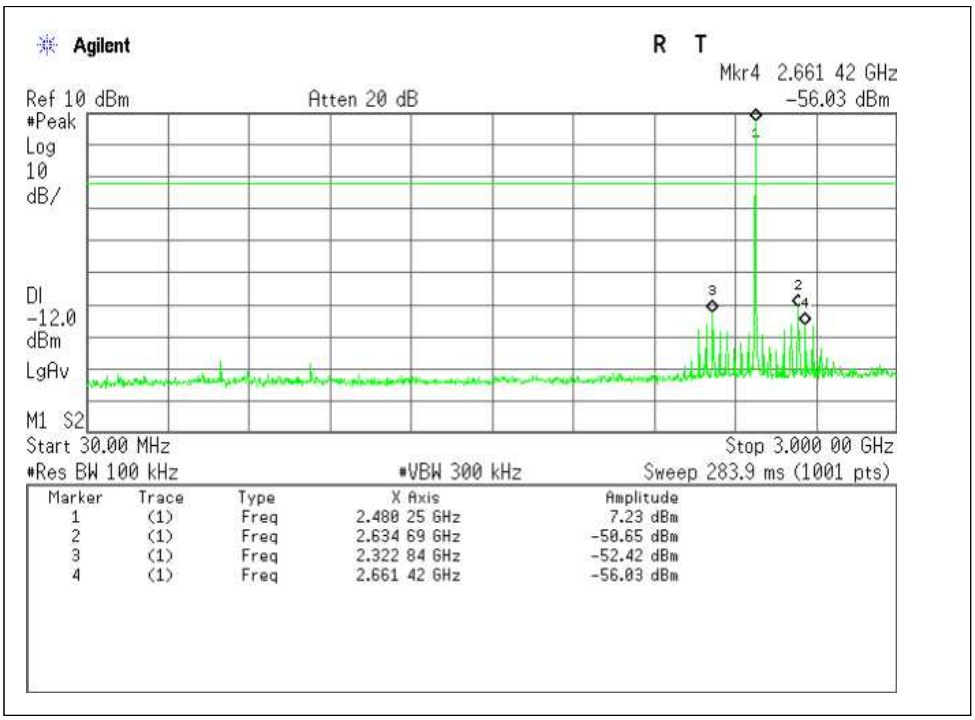


3 GHz to 26.5 GHz

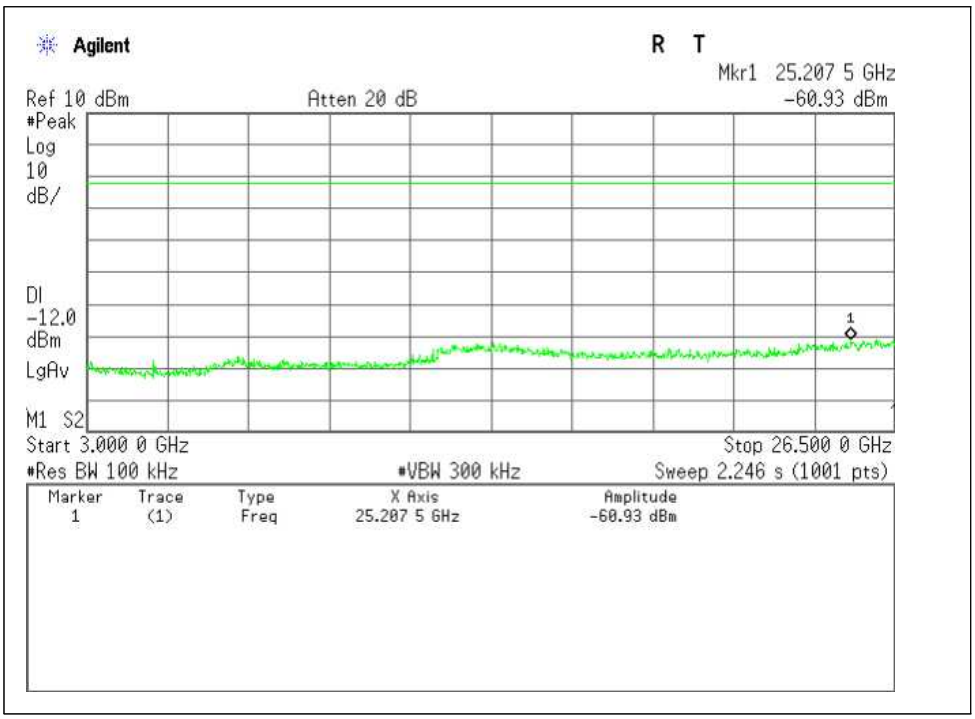


Test mode:	GFSK	Test chanel:	Highest

30 MHz to 3 GHz

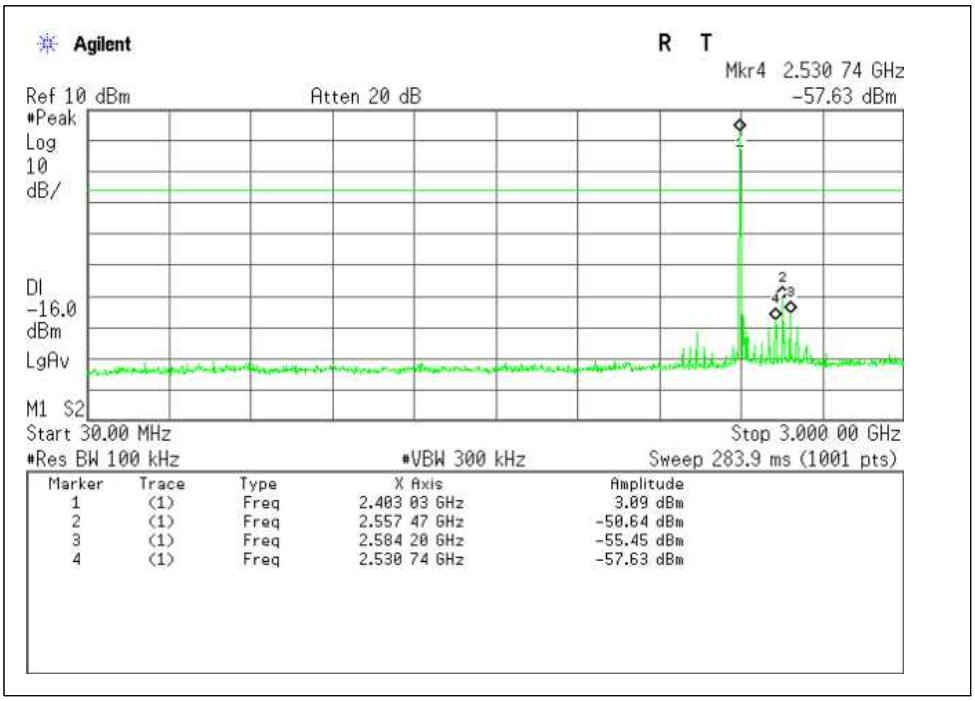


3 GHz to 26.5 GHz

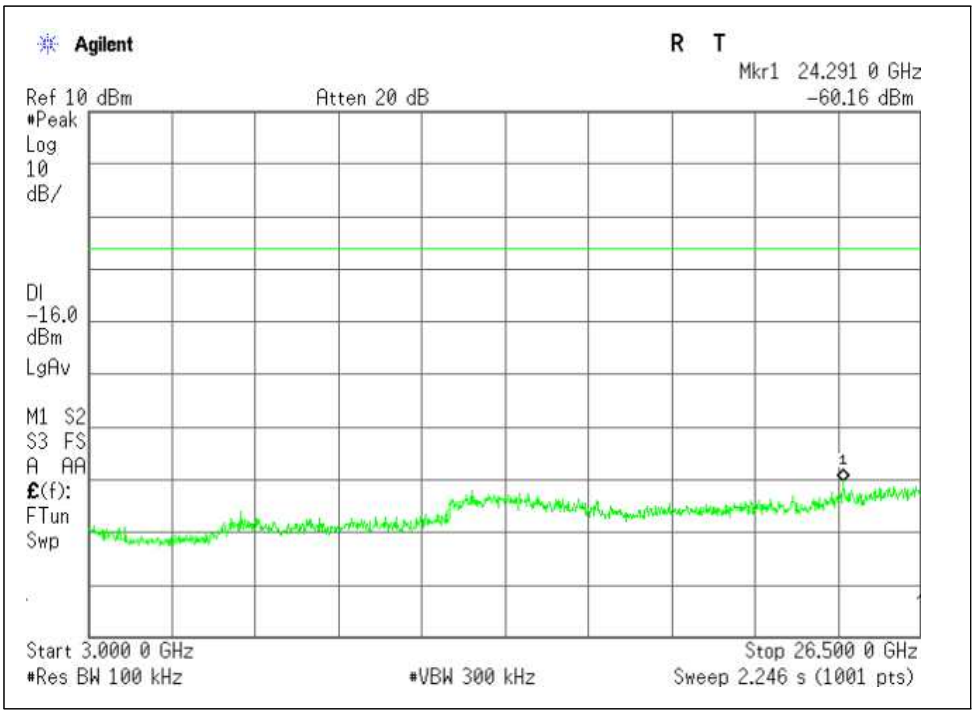


Test mode:	π/4DQPSK	Test chanel:	Lowest

30 MHz to 3 GHz

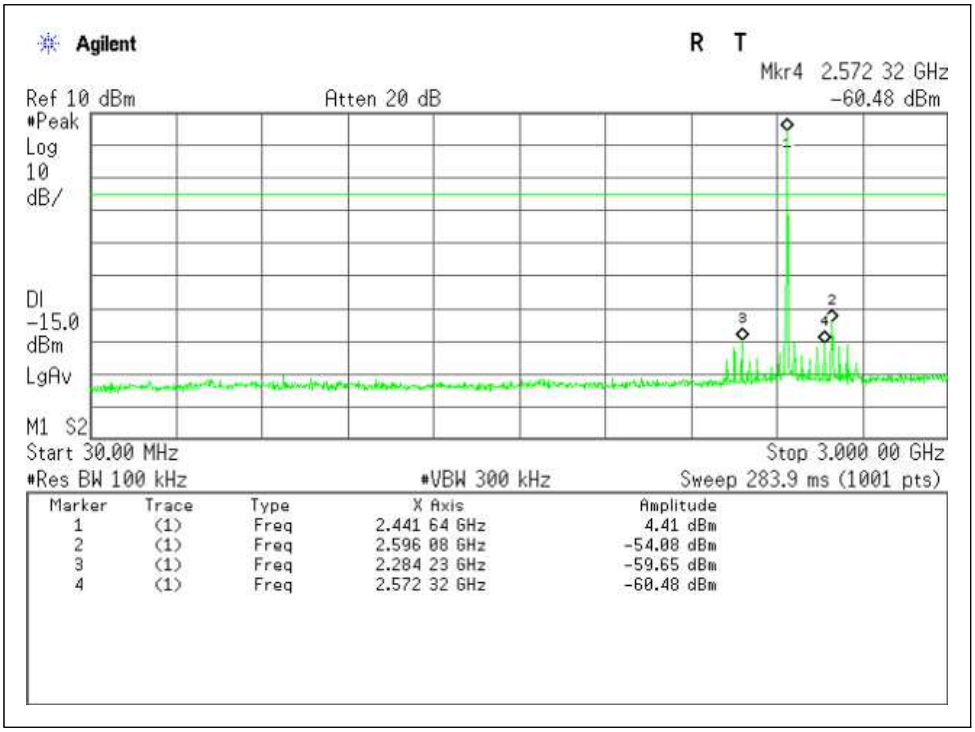


3 GHz to 26.5 GHz

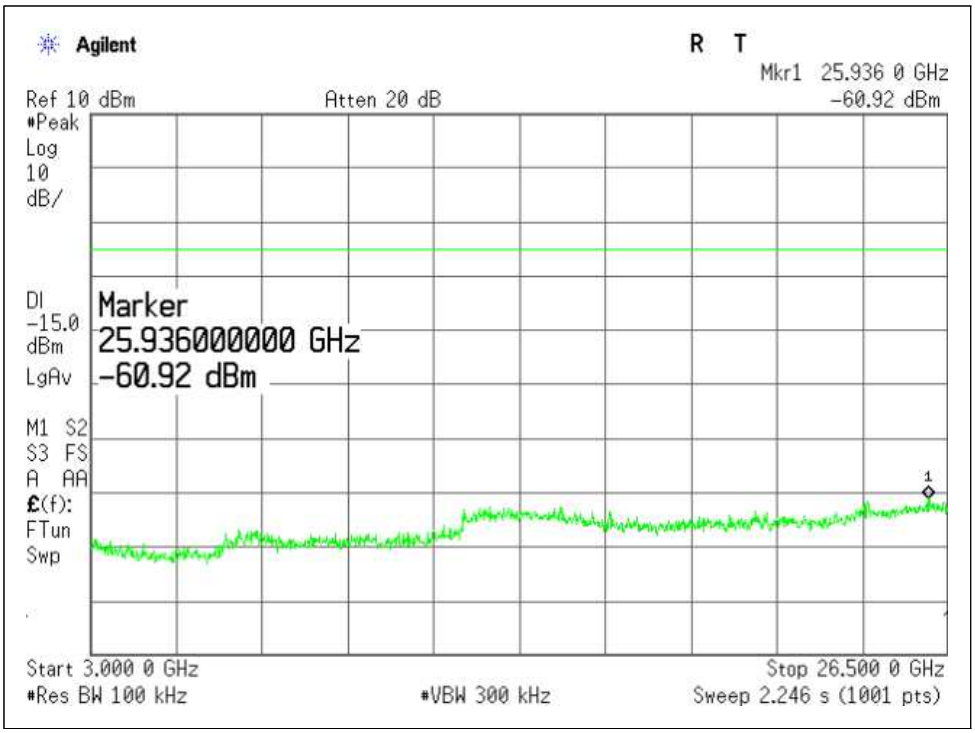


Test mode:	π/4DQPSK	Test chanel:	Middle

30 MHz to 3 GHz

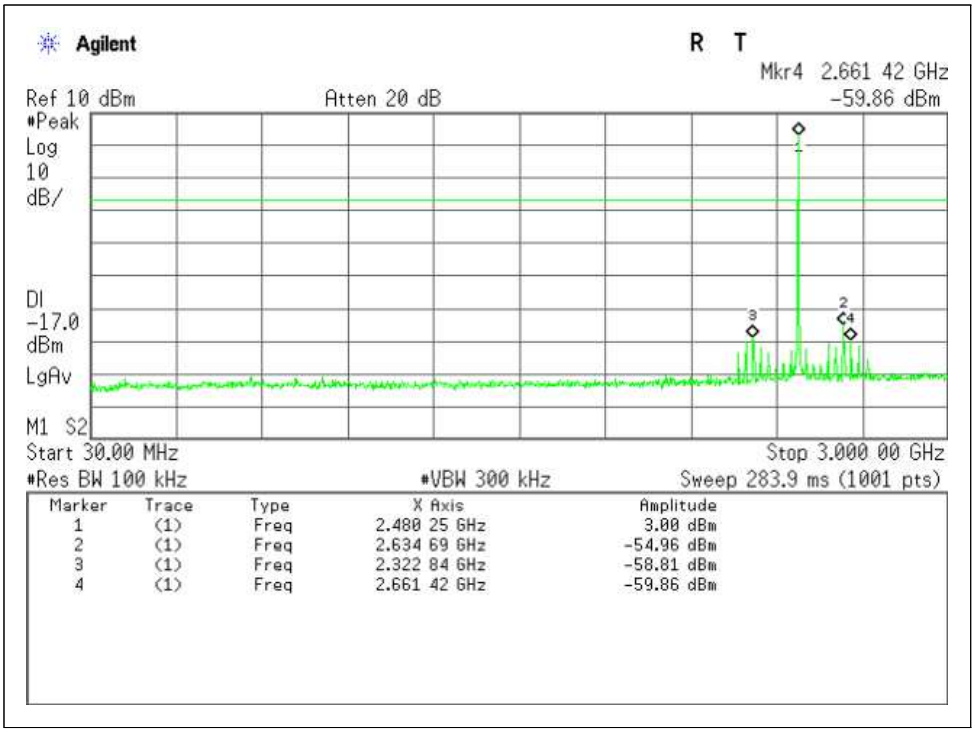


3 GHz to 26.5 GHz

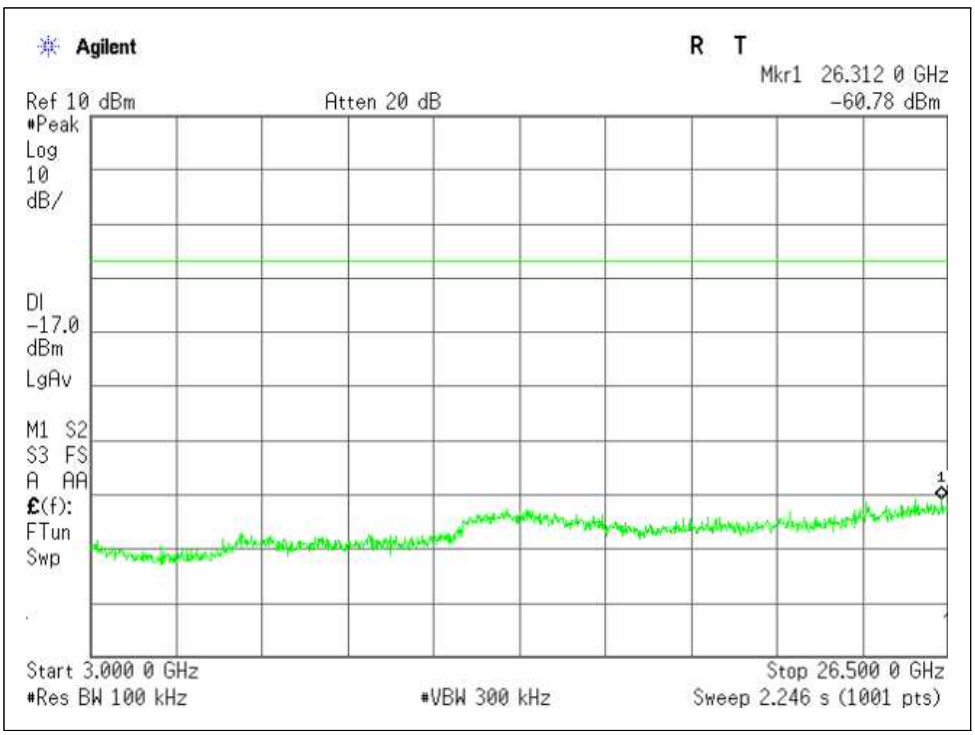


Test mode:	π/4DQPSK	Test chanel:	Highest

30 MHz to 3 GHz

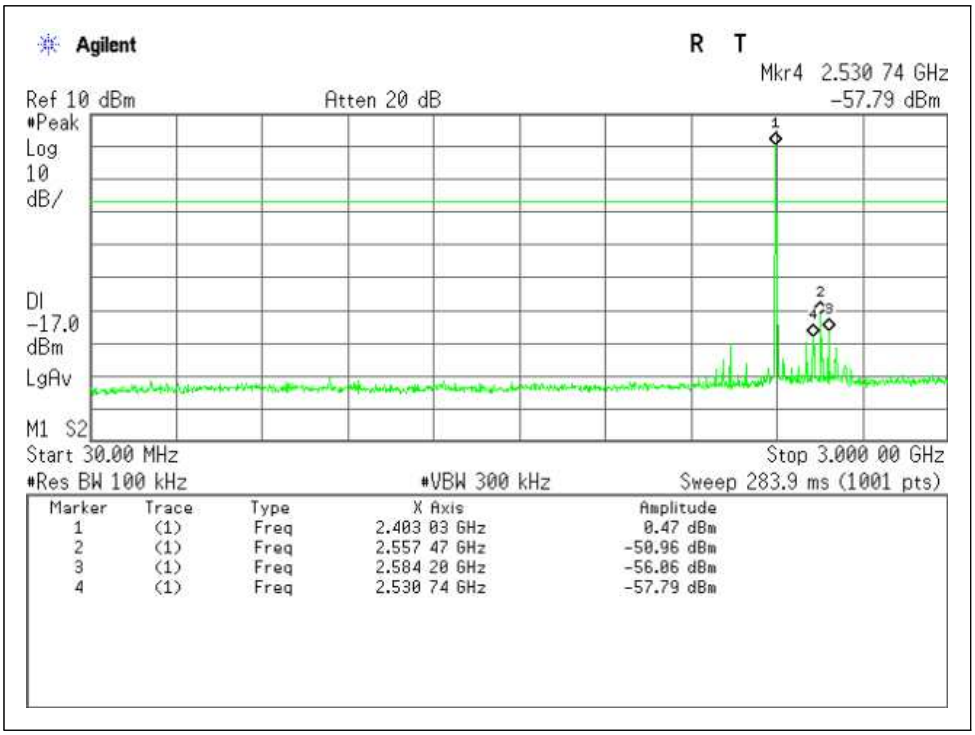


3 GHz to 26.5 GHz

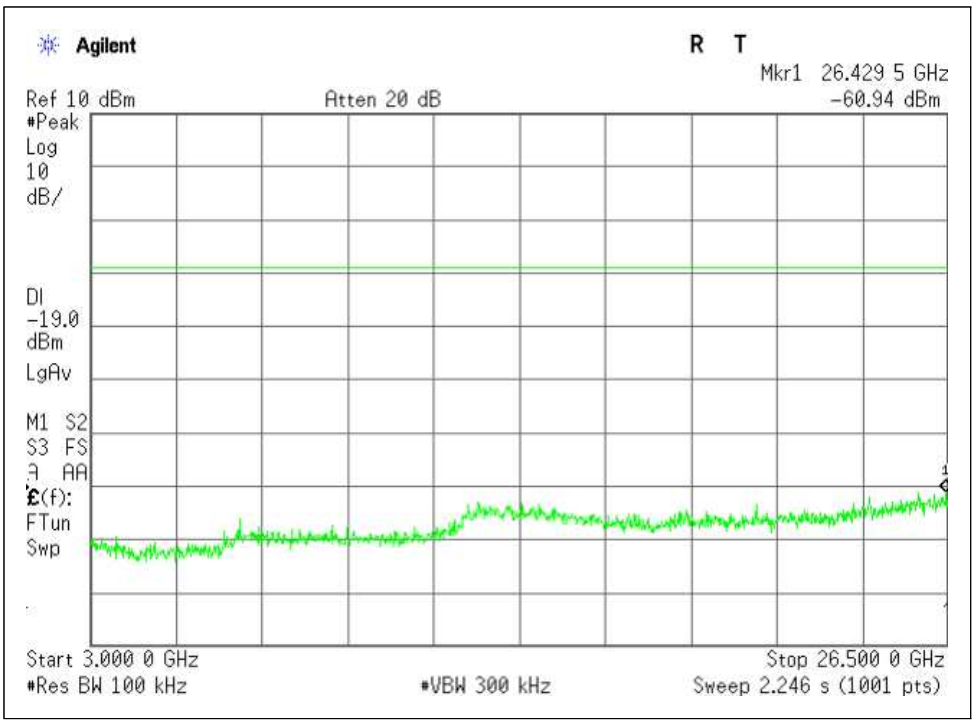


Test mode:	8DPSK	Test chanel:	Lowest

30 MHz to 3 GHz

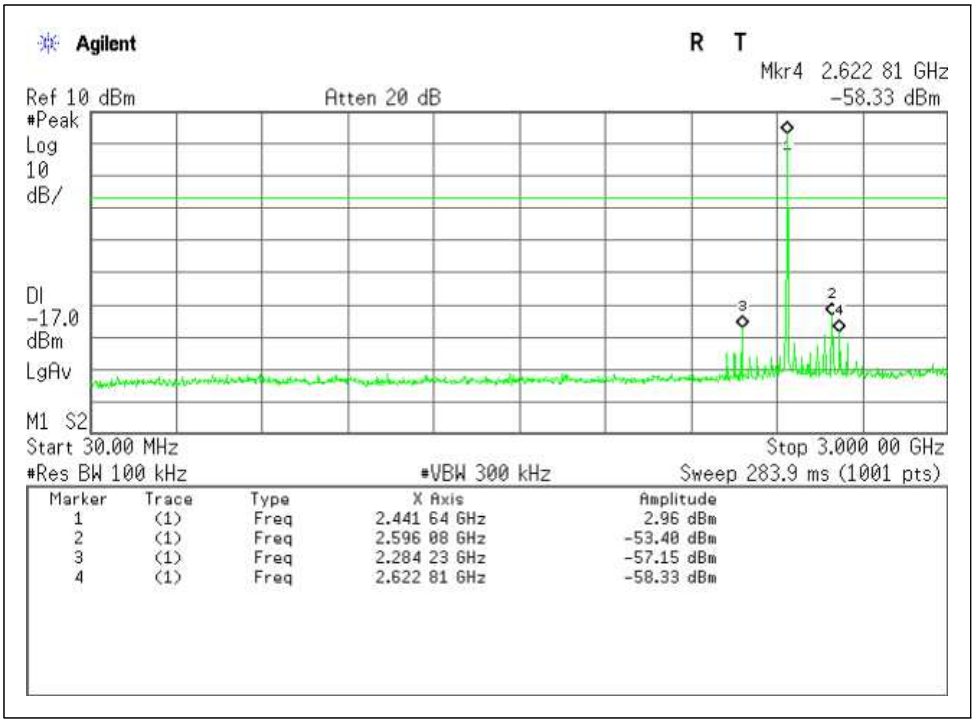


3 GHz to 26.5 GHz

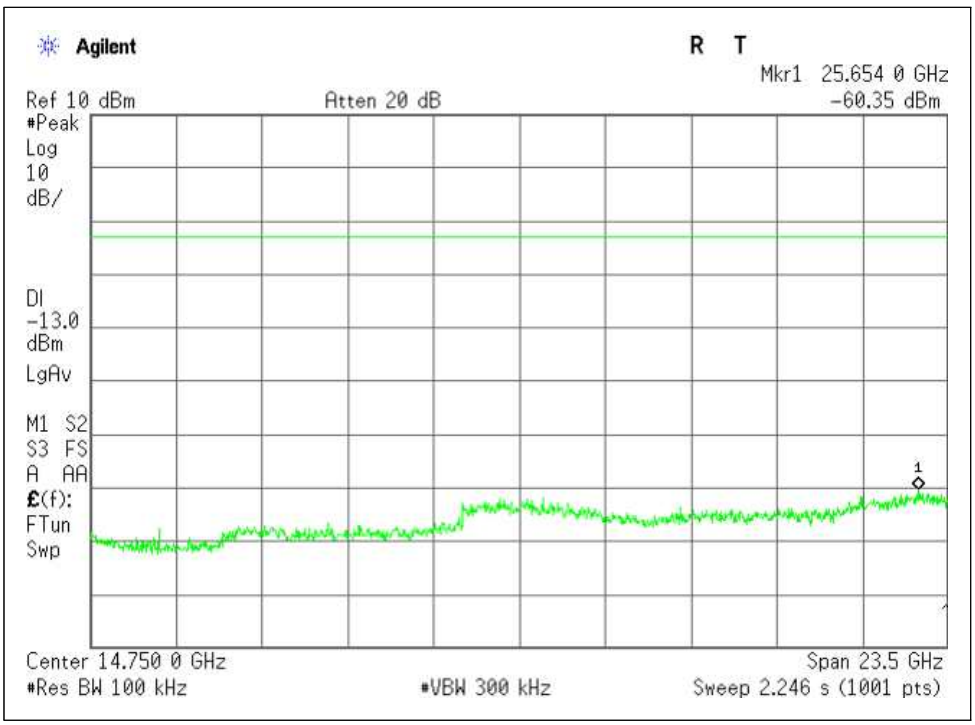


Test mode:	8DPSK	Test chanel:	Middle

30 MHz to 3 GHz

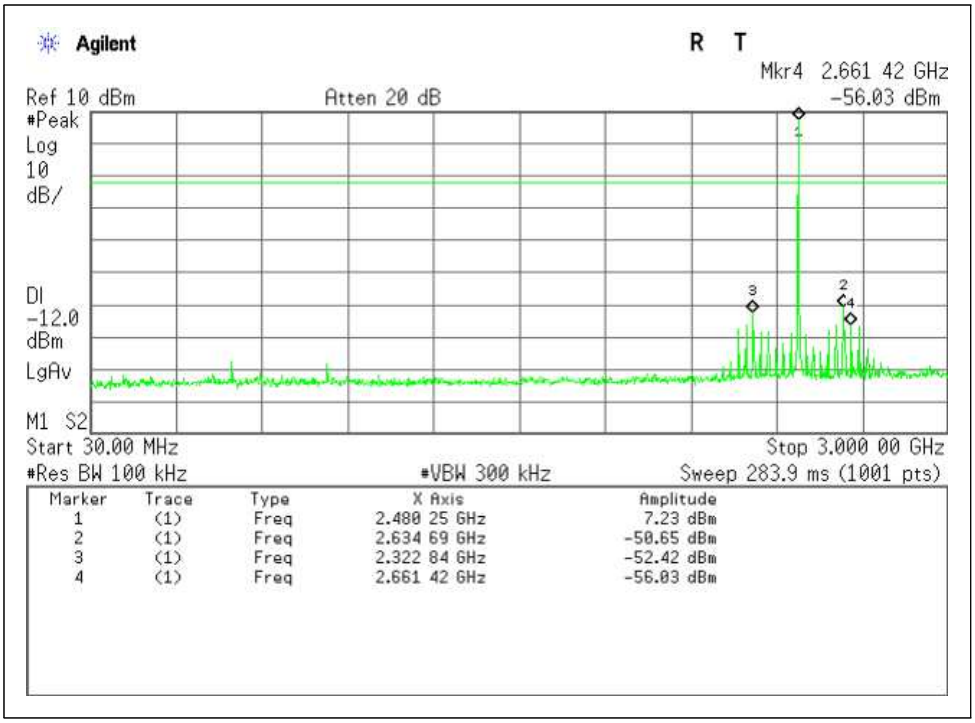


3 GHz to 26.5 GHz

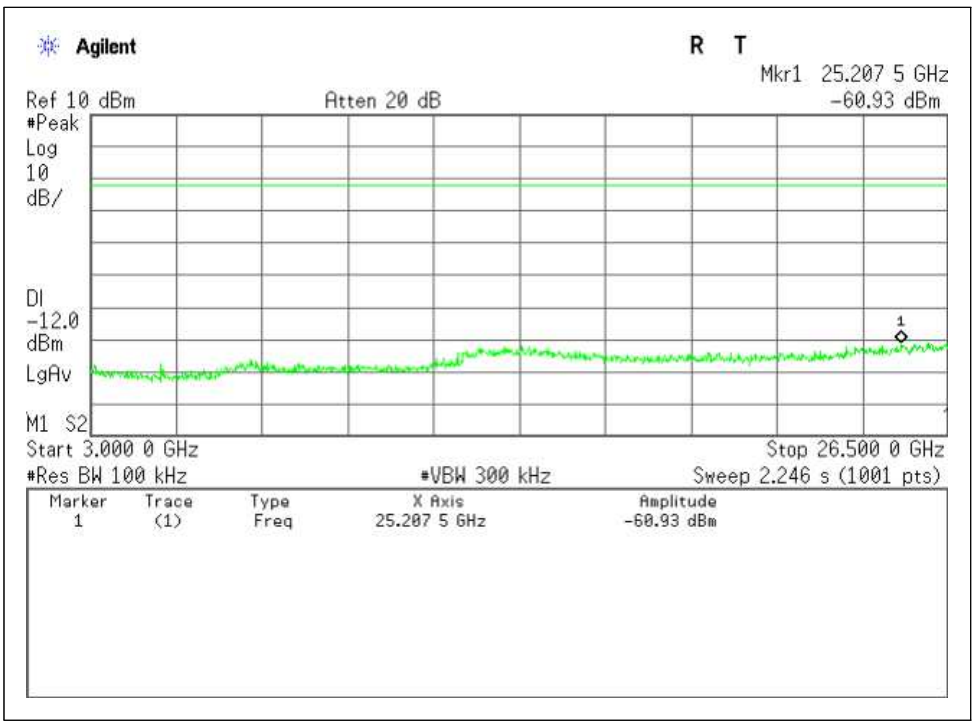


Test mode:	8DPSK	Test chanel:	Highest

30 MHz to 3 GHz



3 GHz to 26.5 GHz

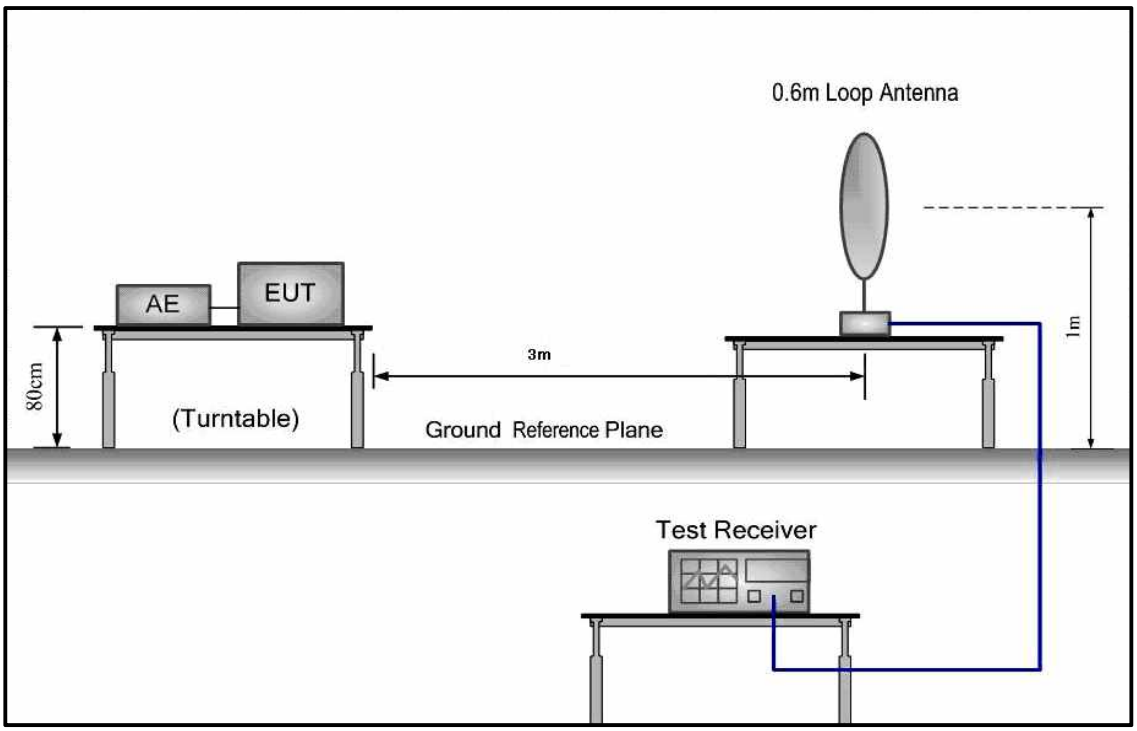


5.10. Radiated Spurious Emissions

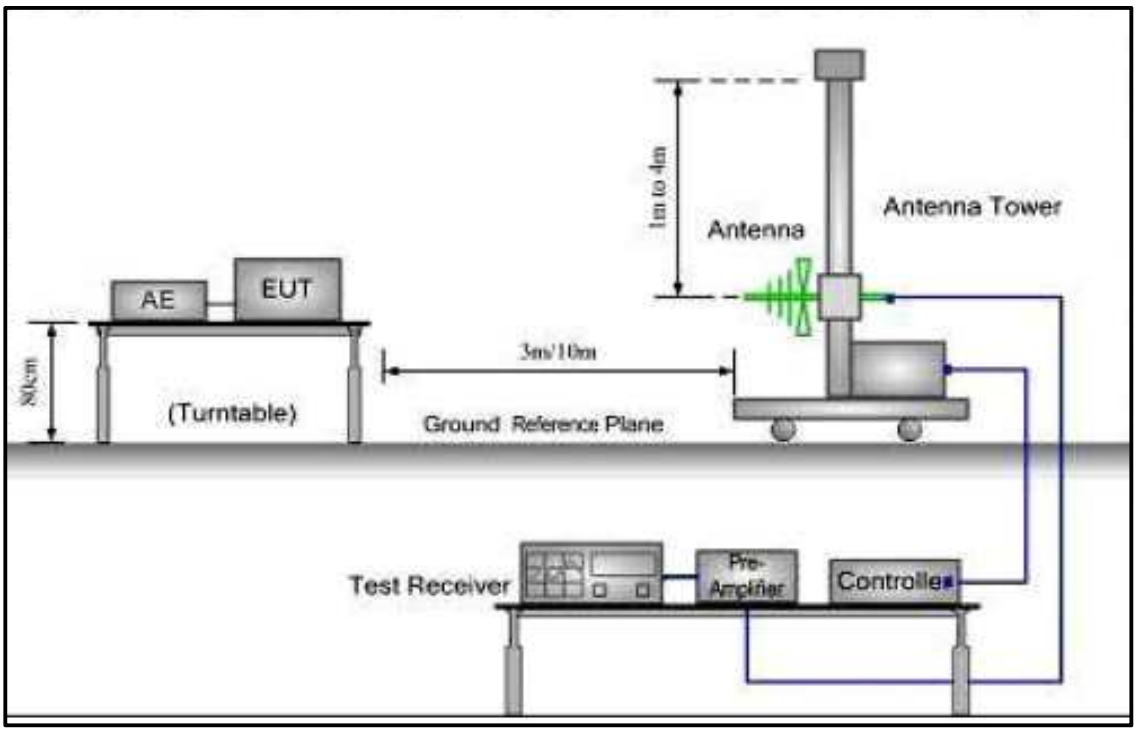
Test Requirement:	FCC Part15 C section 15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating. The radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 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, and provided the transmitter demonstrates compliance with the peak conducted power limits.
Test Method:	ANSI C63.10: Clause 6.4, 6.5 and 6.6
Test Status:	Pre-test the EUT in continuous transmitting mode at the lowest (2402 MHz), middle (2441 MHz) and highest (2480 MHz) channel with different data packet.
Final Test Mode:	Through Pre-scan, find the DH3 of data type and GFSK modulation at the lowest channel is the worst case. Only the worst case is recorded in the report.
Detector:	For PK value: RBW = 1 MHz for f ³ 1 GHz, 100 kHz for f < 1 GHz VBW ³ RBW Sweep = auto Detector function = peak Trace = max hold For AV value: RBW = 1 MHz for f ³ 1 GHz, 100 kHz for f < 1 GHz VBW =10 Hz Sweep = auto Detector function = peak Trace = max hold
15.209 Limit:	40.0 dBμV/m between 30MHz & 88MHz 43.5 dBμV/m between 88MHz & 216MHz 46.0 dBμV/m between 216MHz & 960MHz 54.0 dBμV/m above 960MHz

Test Configuration:

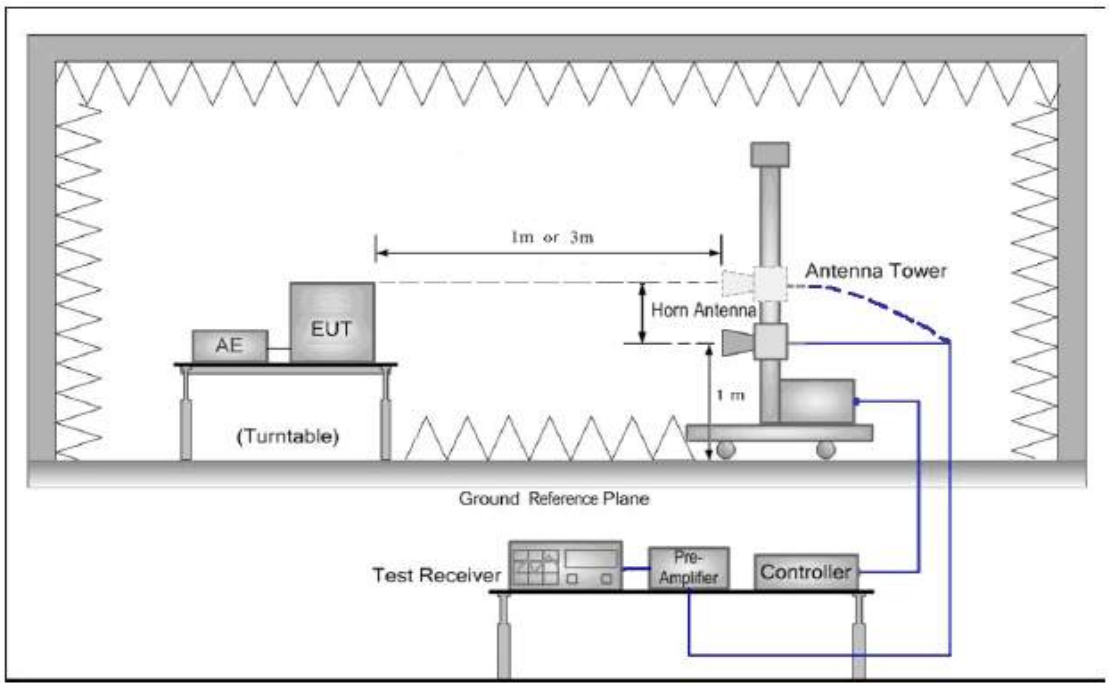
1) 9 kHz to 30 MHz emissions:



2) 30 MHz to 1 GHz emissions:



3) 1 GHz to 25 GHz emissions:



Test Procedure:
Test site with RF absorbing material covering the ground plane that met the site validation criterion called out in CISPR 16-1-4:2007 was used to perform radiated emission test above 1 GHz. The receiver scanned from the lowest frequency generated within the EUT to 25GHz. When an emission was found, the table was rotated to produce the maximum signal strength. An initial pre-scan was performed for in peak detection mode using the receiver. The EUT was measured for both the Horizontal and Vertical polarities and performed a pre-test three orthogonal planes. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. The worst case emissions were reported.
For hand-held or body-worn devices rotated through three orthogonal axes(X,Y,Z) to determine which attitude (orientation) and equipment arrangement produces the highest emission relative to the limit; the attitude and equipment arrangement that produces the highest emission relative to the limit was used in making final radiated emission measurements. Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from 20log(dwell time/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

5.10.1. Harmonic and other spurious emissions

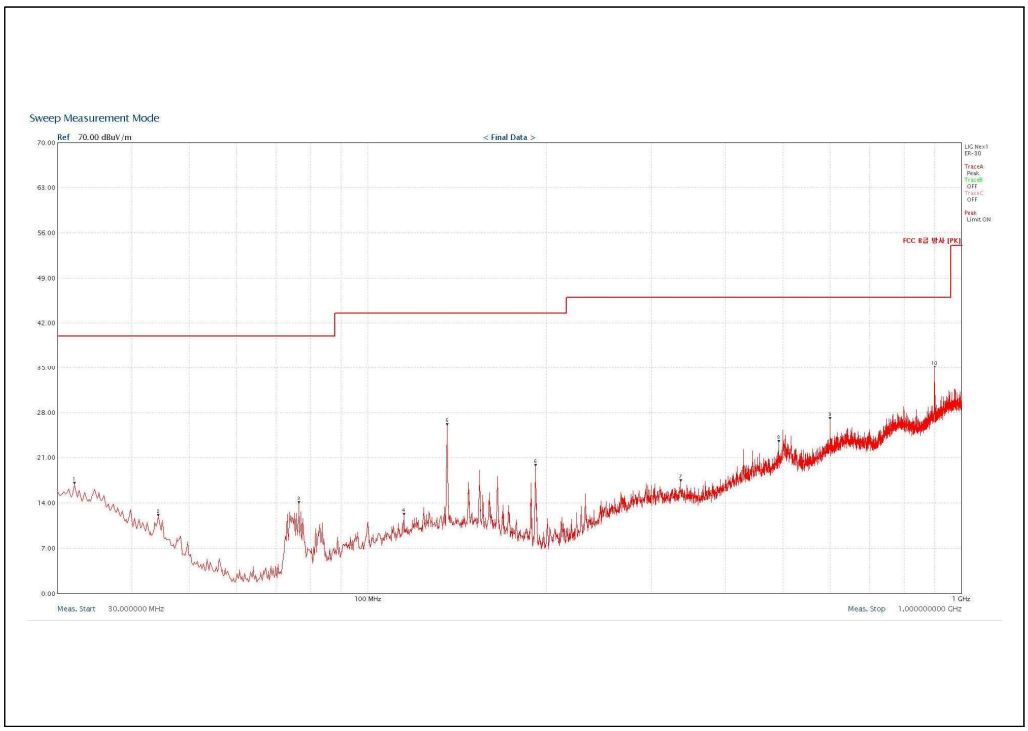
5.10.1.1. Test at low Channel in transmitting status

9 kHz~30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.

30 MHz~1 GHz Spurious Emissions. Quasi-Peak Measurement

Vertical: Level (dBμV/m)

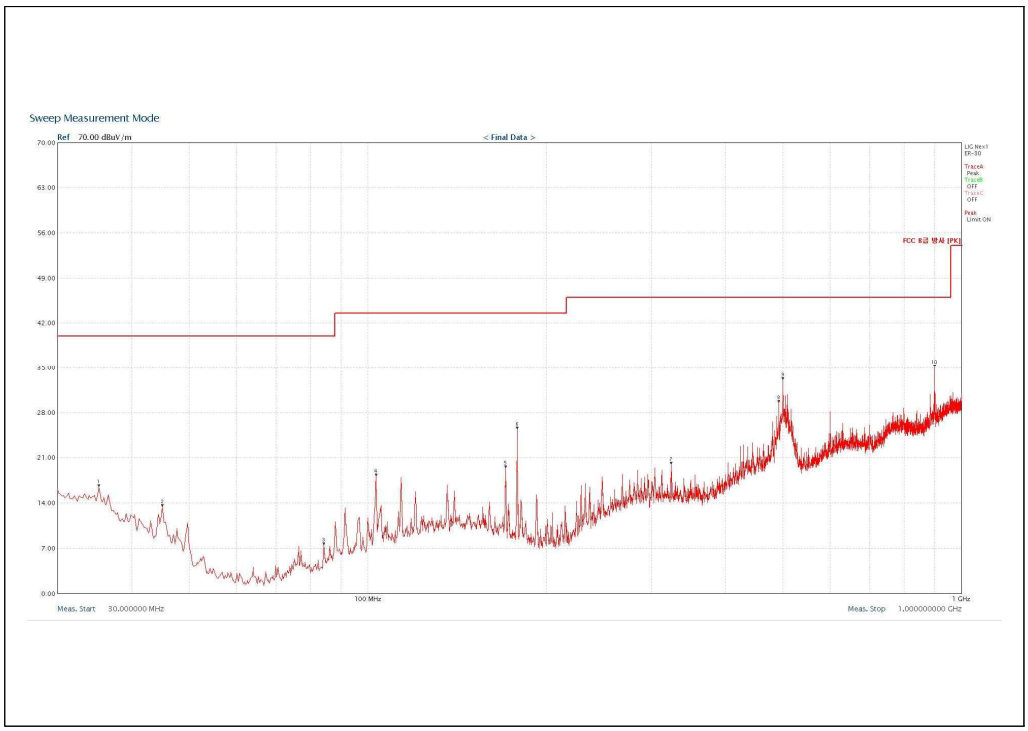


Quasi-peak measurement

Frequency (MHz)	Detect Mode	Polarization (V/H)	Measured Value (dBμV)	Antenna Factor + Cable Loss (dB/m)	Emission Level (dBμV/m)	Limit (dBμV/m)
116.868	QP	V	20.54	7.75	12.79	43.5
135.869	QP	V	26.60	12.47	14.13	43.5
191.987	QP	V	26.90	10.45	16.45	43.5

Horizontal:

Level (dBμV/m)



Quasi-peak measurement

Frequency (MHz)	Detect Mode	Polarization (V/H)	Measured Value (dBμV)	Antenna Factor + Cable Loss (dB/m)	Emission Level (dBμV/m)	Limit (dBμV/m)
35.210	QP	H	26.82	17.66	26.82	17.66
103.587	QP	H	21.87	11.39	21.87	11.39
178.383	QP	H	24.71	10.60	24.71	10.60
499.991	QP	H	39.51	21.16	39.51	21.16

1~25 GHz Harmonics & Spurious Emissions. Peak & Average Measurement

Peak / Average Measurement:

Frequency (MHz)	Polarization (V/H)	Measured Value (dBμV)	Antenna Factor + Cable Loss (dB/m)	Amplifier Gain (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)

The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

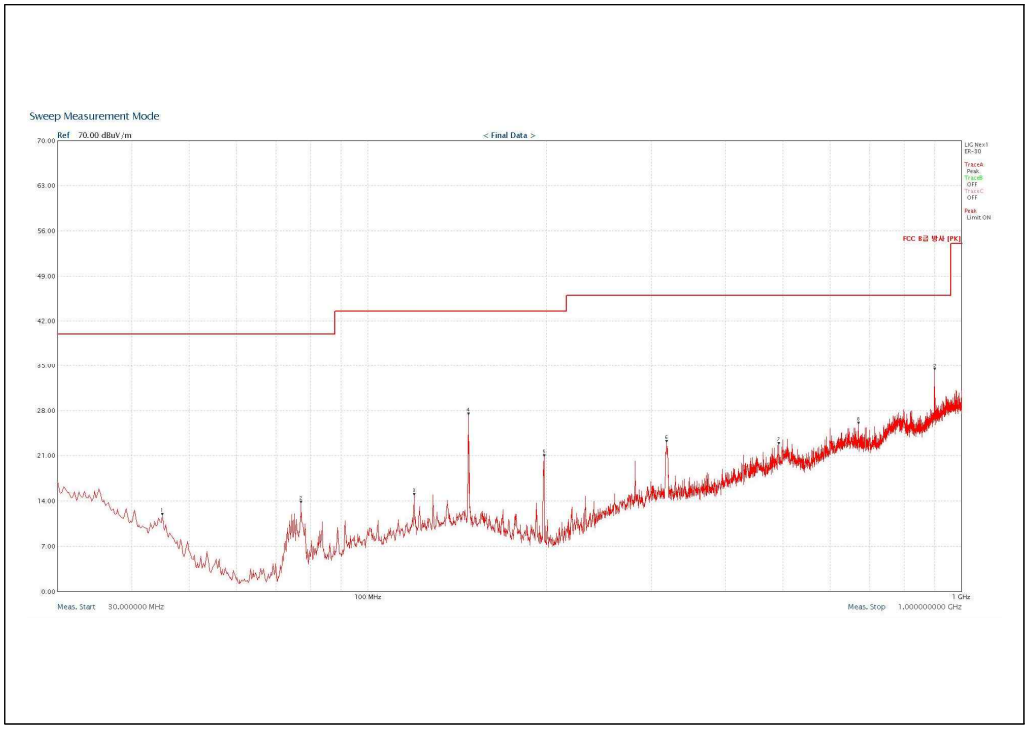
5.10.1.2. Test at middle Channel in transmitting status

9 kHz~30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.

30 MHz~1 GHz Spurious Emissions. Quasi-Peak Measurement

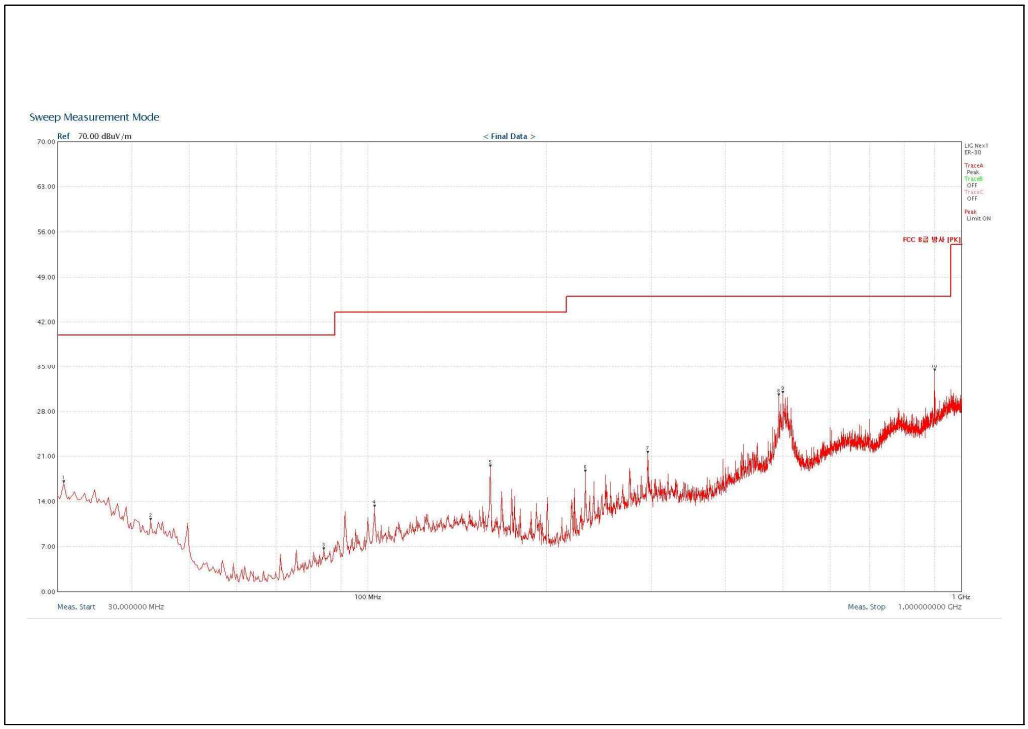
Vertical: Level (dBμV/m)



Quasi-peak measurement

Frequency (MHz)	Detect Mode	Polarization (V/H)	Measured Value (dBμV)	Antenna Factor + Cable Loss (dB/m)	Emission Level (dBμV/m)	Limit (dBμV/m)
76.557	QP	V	20.95	7.70	13.25	40.0
47.528	QP	V	24.33	12.19	12.14	40.0
197.429	QP	V	23.58	10.44	13.14	43.5
318.870	QP	V	30.61	16.21	14.40	46.0

Horizontal: Level (dBμV/m)



Quasi-peak measurement

Frequency (MHz)	Detect Mode	Polarization (V/H)	Measured Value (dBμV)	Antenna Factor + Cable Loss (dB/m)	Emission Level (dBμV/m)	Limit (dBμV/m)
31.081	QP	H	26.86	17.93	8.93	40.0
102.301	QP	H	25.02	11.30	13.72	43.5
160.984	QP	H	23.82	11.70	12.12	43.5
500.002	QP	H	37.96	21.16	16.8	46.0

1~25 GHz Harmonics & Spurious Emissions. Peak & Average Measurement

Peak / Average Measurement:

Frequency (MHz)	Polarization (V/H)	Measured Value (dBμV)	Antenna Factor + Cable Loss (dB/m)	Amplifier Gain (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)

The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

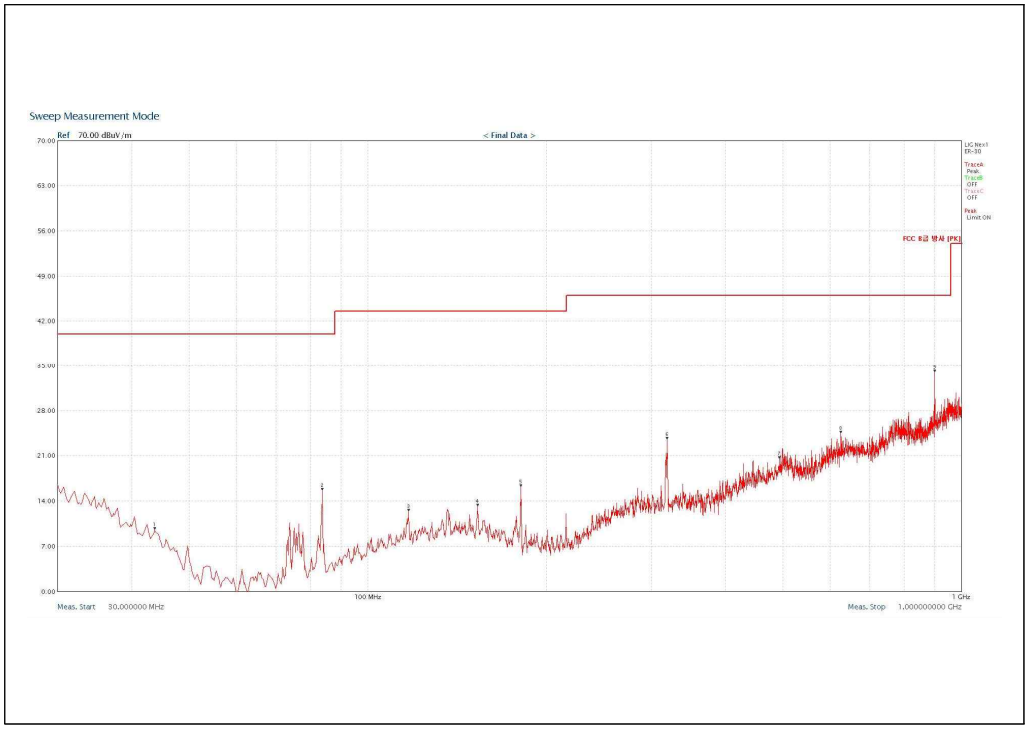
5.10.1.3. Test at high Channel in transmitting status

9 kHz~30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.

30 MHz~1 GHz Spurious Emissions. Quasi-Peak Measurement

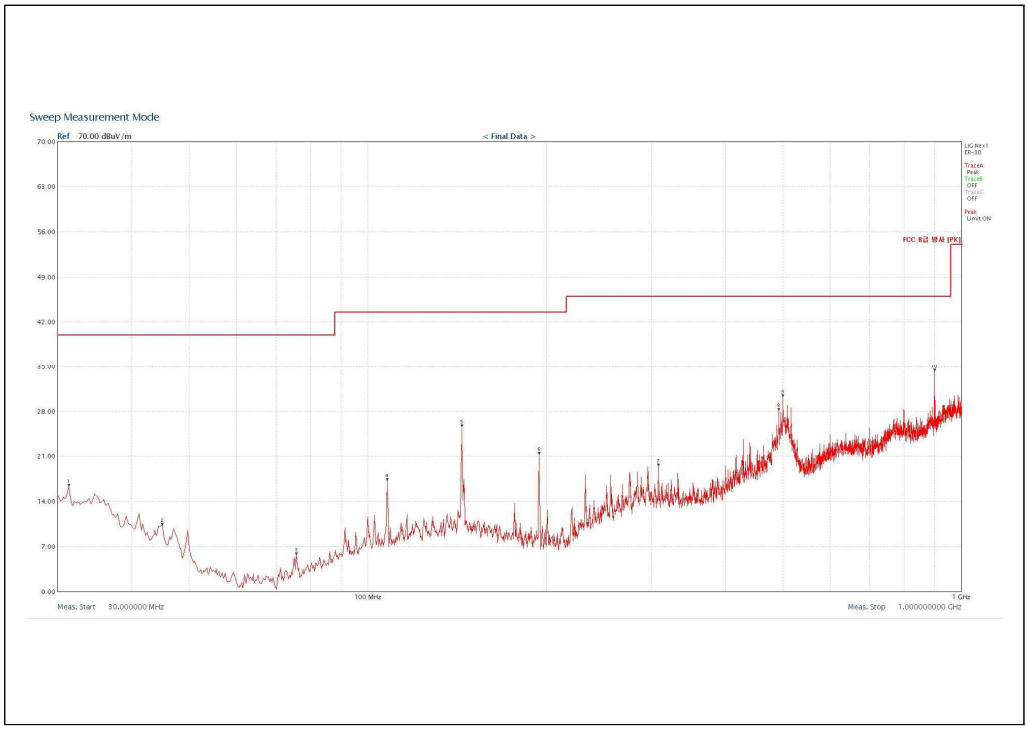
Vertical: Level (dBμV/m)



Quasi-peak measurement

Frequency (MHz)	Detect Mode	Polarization (V/H)	Measured Value (dBμV)	Antenna Factor + Cable Loss (dB/m)	Emission Level (dBμV/m)	Limit (dBμV/m)
83.085	QP	V	19.38	8.89	10.49	40.0
181.272	QP	V	23.06	10.47	12.59	43.5
319.456	QP	V	29.43	16.23	13.2	46.0

Horizontal: Level (dBμV/m)



Quasi-peak measurement

Frequency (MHz)	Detect Mode	Polarization (V/H)	Measured Value (dBμV)	Antenna Factor + Cable Loss (dB/m)	Emission Level (dBμV/m)	Limit (dBμV/m)
108.352	QP	H	22.64	11.73	10.91	40.0
143.994	QP	H	25.40	12.61	12.79	43.5
194.473	QP	H	23.12	10.44	12.68	46.0
499.969	QP	H	42.03	21.16	20.87	46.0

1~25 GHz Harmonics & Spurious Emissions. Peak & Average Measurement

Peak / Average Measurement:

Frequency (MHz)	Polarization (V/H)	Measured Value (dBμV)	Antenna Factor + Cable Loss (dB/m)	Amplifier Gain (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)

The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

Remark:

1). The field strength is calculated by adding the Antenna Factor. Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Measured Value + Antenna Factor + Cable Loss –Amplifier Gain.

2). As shown in Section, for frequencies above 1000 MHz. the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

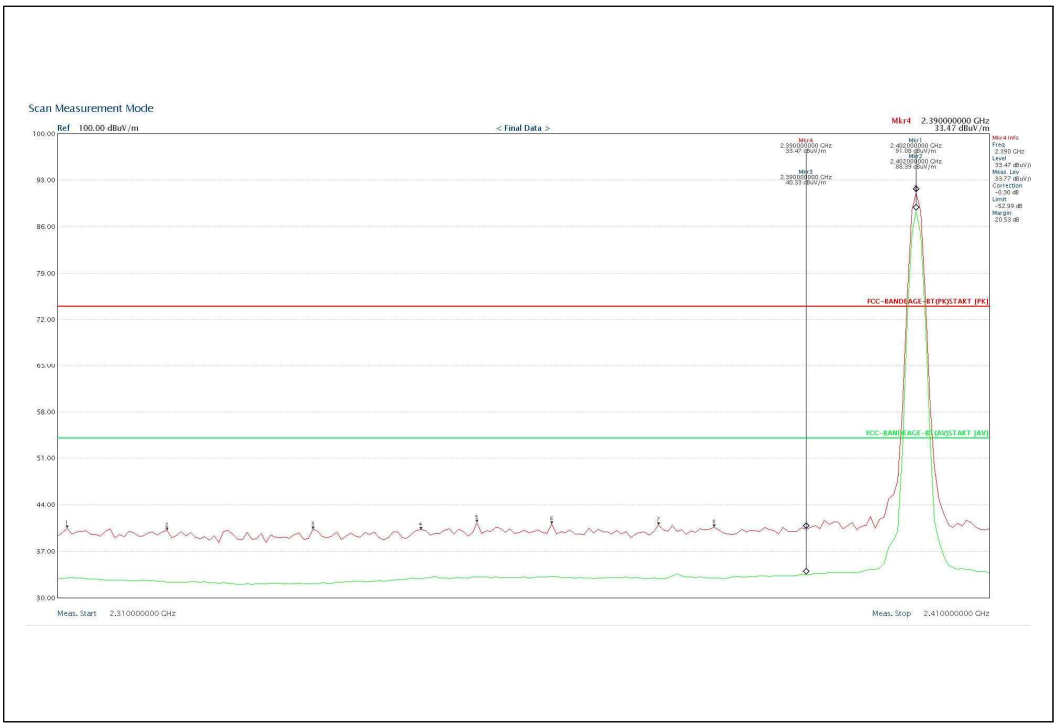
3). The test only perform the EUT in transmitting status since the test frequencies were over 1GHz only required transmitting status.

5.10.2. Radiated Emissions which fall in the restricted bands

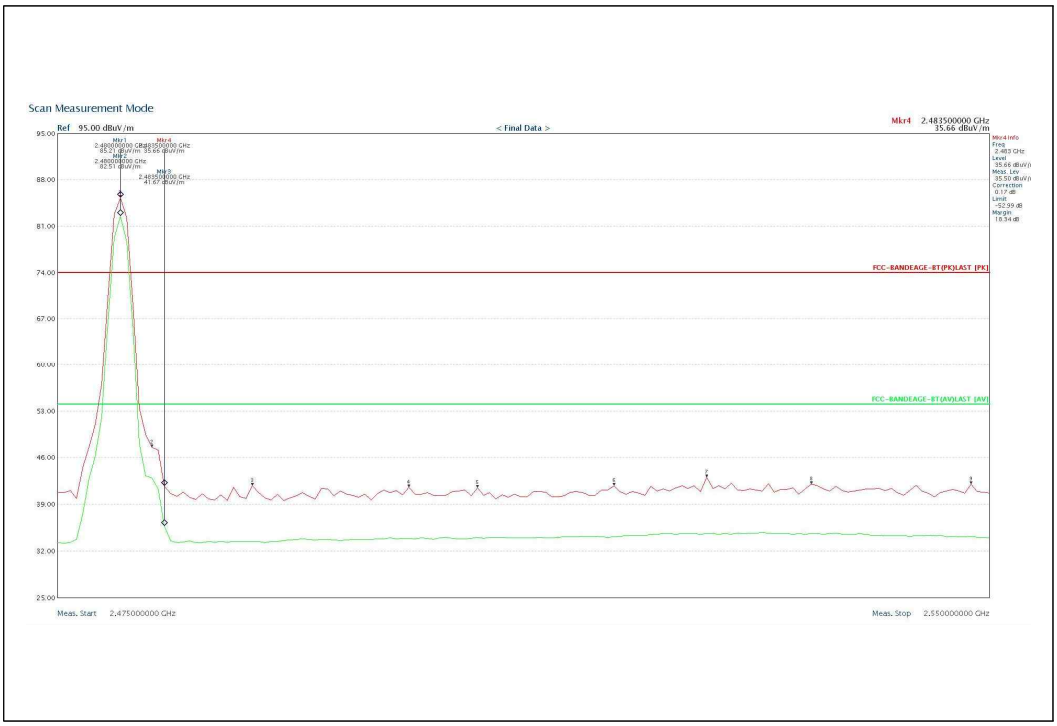
Test Requirement:	FCC Part15 C Section 15.247 (d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method:	ANSI C63.10: Clause 6.4, 6.5 and 6.6
Test Status:	Pre-test the EUT in continuous transmitting mode at the lowest (2402 MHz), and highest (2480 MHz) channel with different data packet.
Final Test Mode:	Through Pre-scan, find the DH5 of data type and GFSK modulation is the worst case. Only the worst case is recorded in the report.
Measurement	3m (Semi-Anechoic Chamber)
Limit:	Section 15.209(a) 40.0 dBμV/m between 30MHz & 88MHz; 43.5 dBμV/m between 88MHz & 216MHz; 46.0 dBμV/m between 216MHz & 960MHz; 54.0 dBμV/m above 960MHz.
Detector:	For PK value: RBW = 1 MHz for f ³ 1 GHz, 100 kHz for f < 1 GHz VBW ³ RBW Sweep = auto Detector function = peak Trace = max hold For AV value: RBW = 1 MHz for f ³ 1 GHz, 100 kHz for f < 1 GHz VBW =10 Hz Sweep = auto Detector function = peak Trace = max hold

Measurement Result :

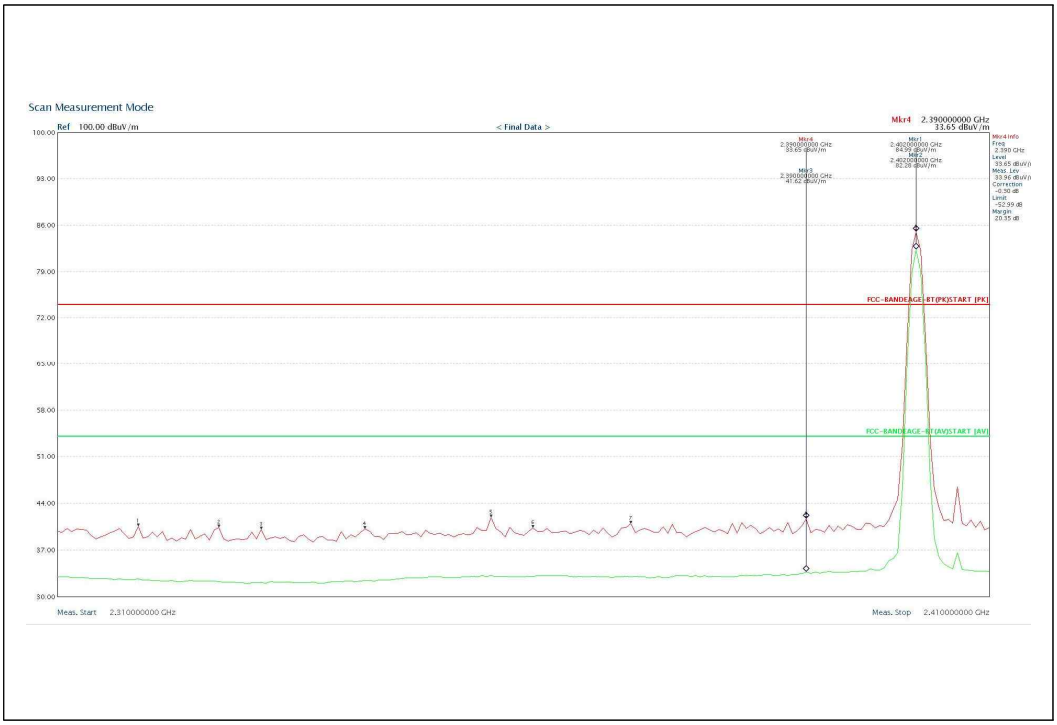
Low Channel (2402 MHz) , Horizontal , Peak/ Average Detector



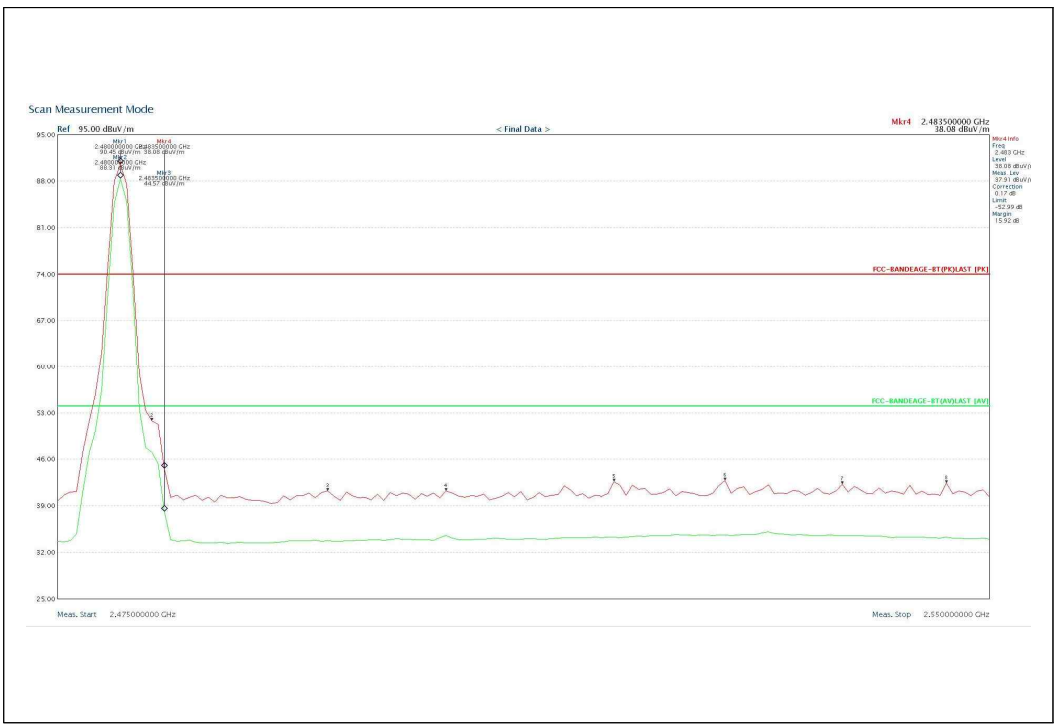
High Channel (2480MHz) , Horizontal , Peak/ Average Detector



Low Channel (2402 MHz) , Vertical , Peak/ Average Detector



High Channel (2480MHz) , Vertical , Peak/ Average Detector

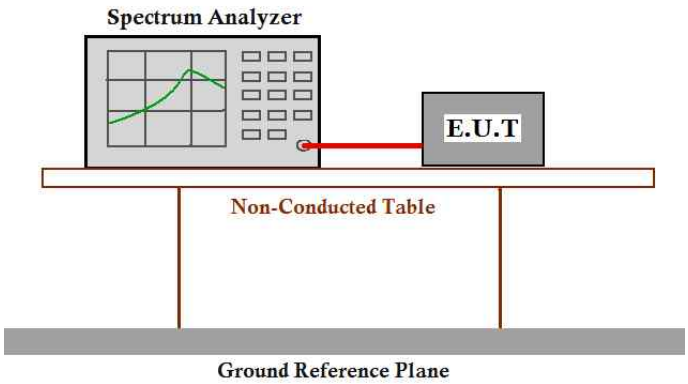


Section 15.205 Restricted bands of operation.

(a) Except as shown in paragraph (d) of this section. only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	
13.36 - 13.41			

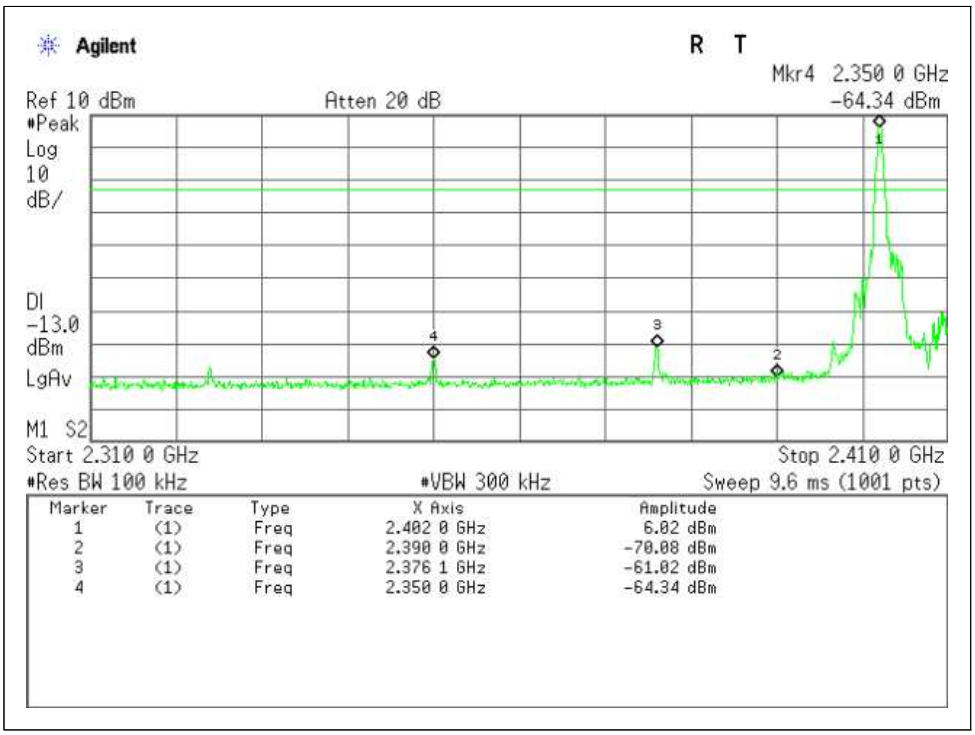
5.11. Band Edges Requirement

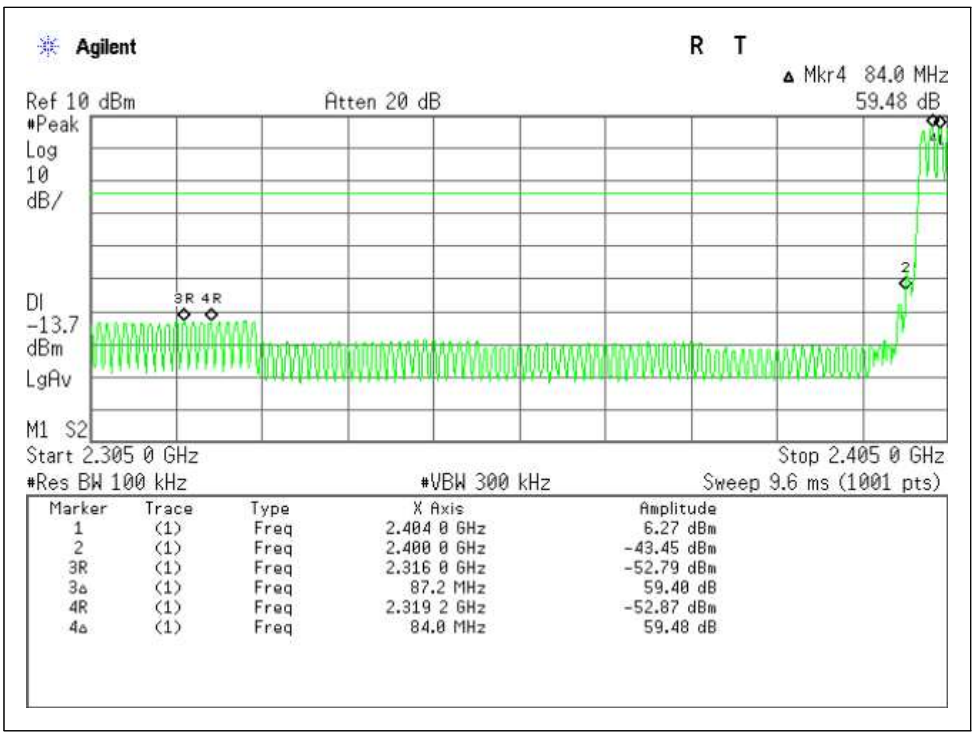
Test Requirement:	FCC Part15 C section 15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 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)).
Frequency Band:	2400 MHz to 2483.5 MHz
Test Method:	ANSI C63.10: Clause 6.9.2
Test Status:	Pre-test the EUT in continuous transmitting mode at the lowest (2402 MHz), and highest (2480 MHz) channel and hopping mode with different data packet.
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of π/4DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Test Configuration:	
Test Procedure:	Set RBW of spectrum analyzer to 100 kHz and VBW of spectrum analyzer to 100 kHz with suitable frequency span including 100 kHz bandwidth from band edge.

The band edges was measured and recorded Result:
The Lower Edges attenuated more than 20dB.
The Upper Edges attenuated more than 20dB.
The graph as below. Represents the emissions take for this device.

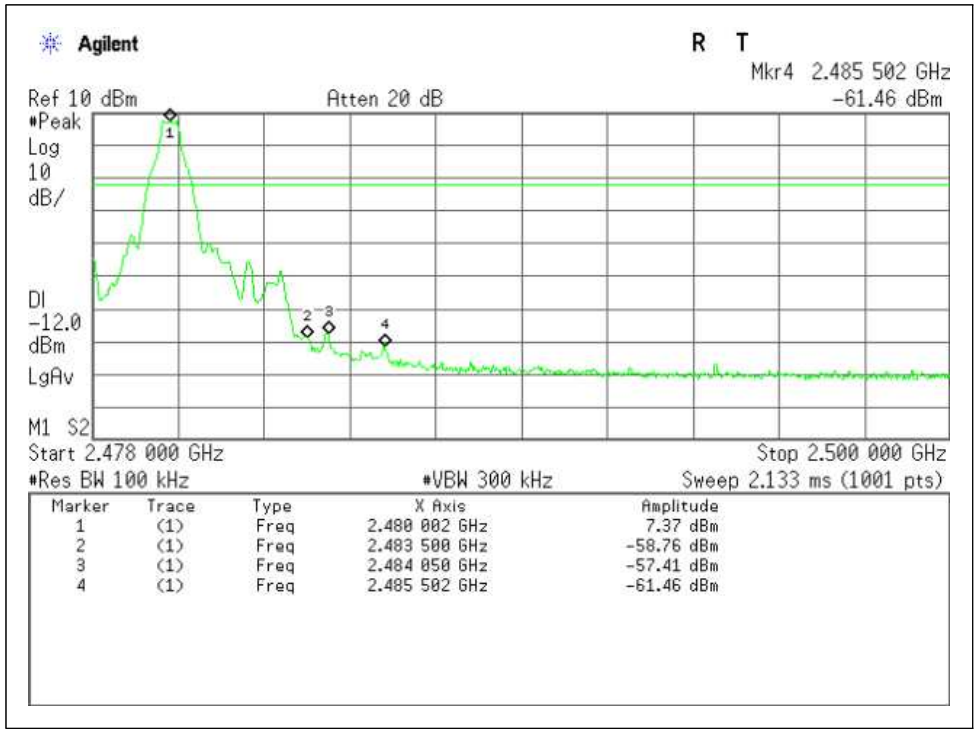
Result plot as follows :

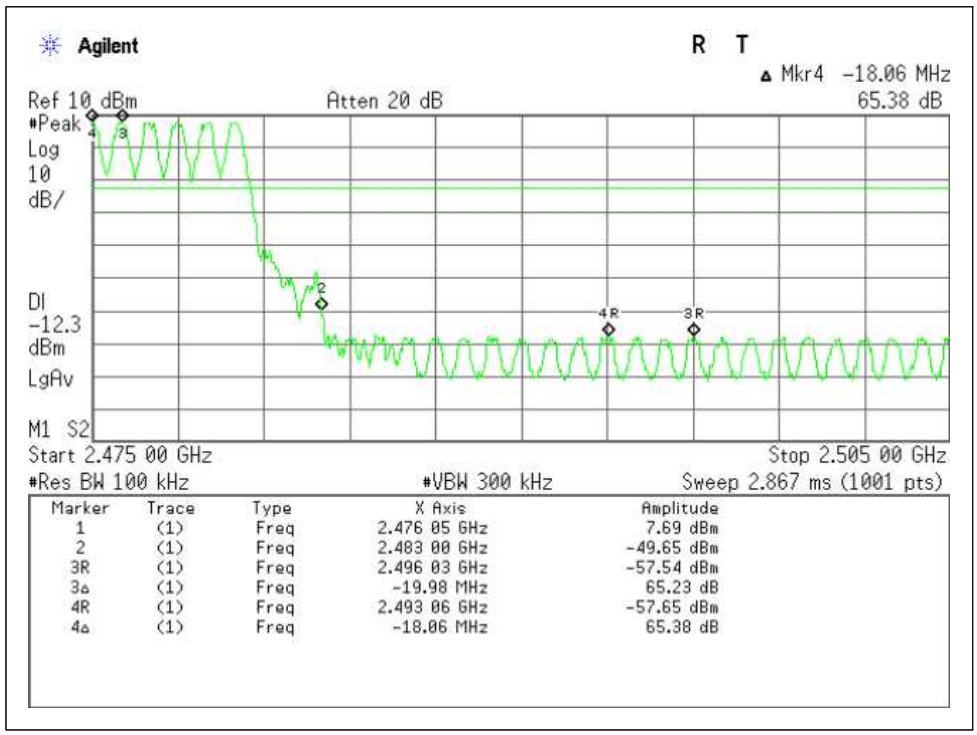
Test mode:	GFSK	Test chanel:	Lowest



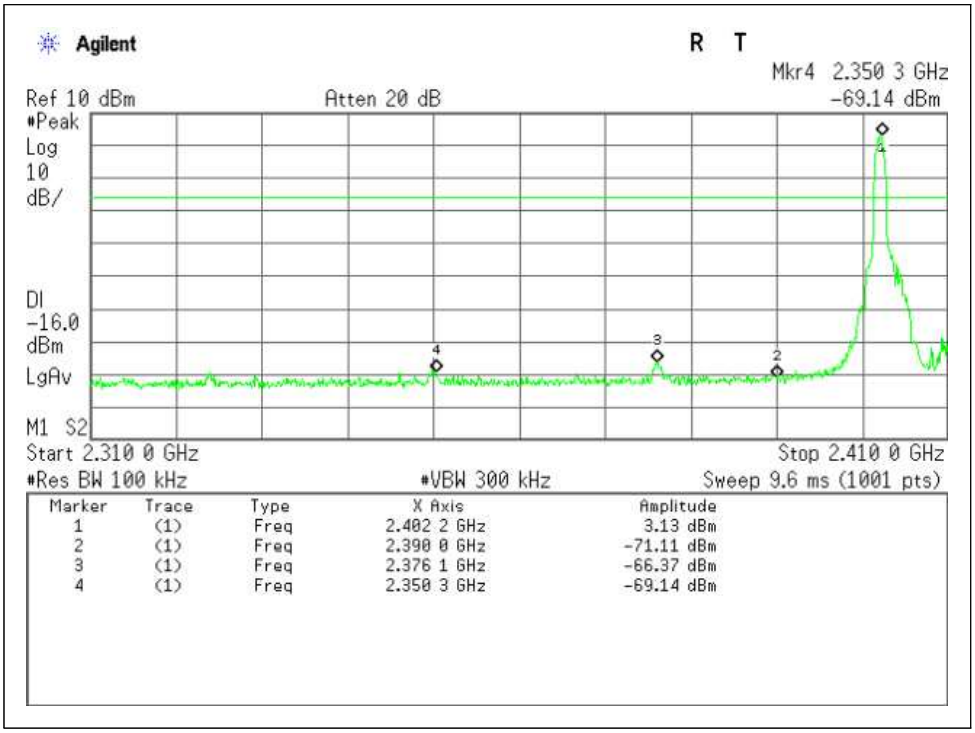


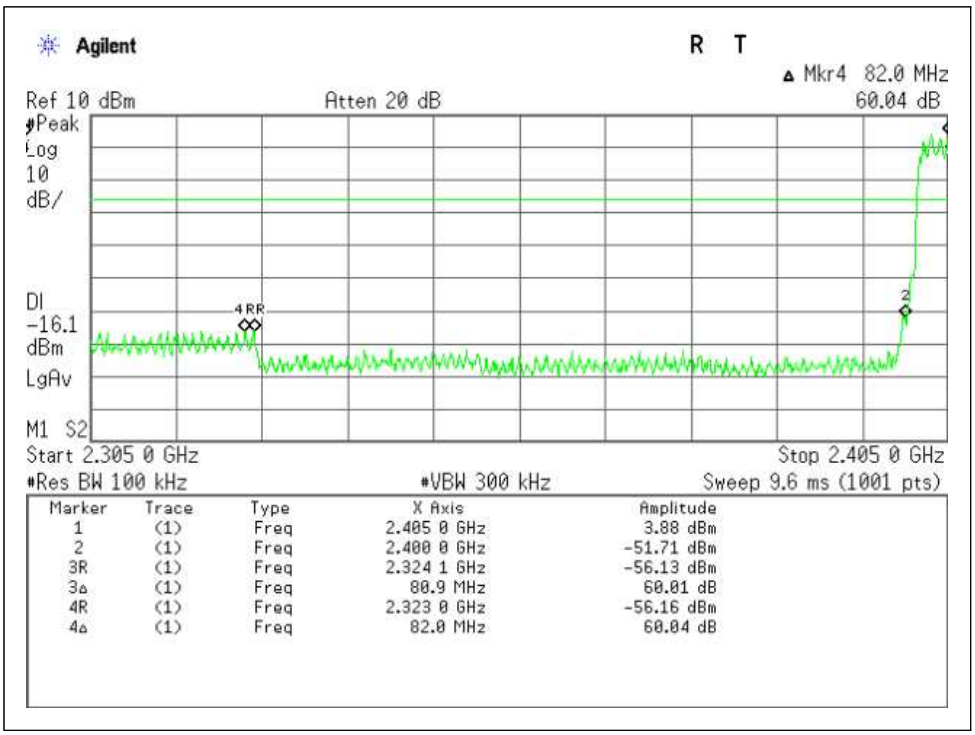
Test mode:	GFSK	Test chanel:	Highest



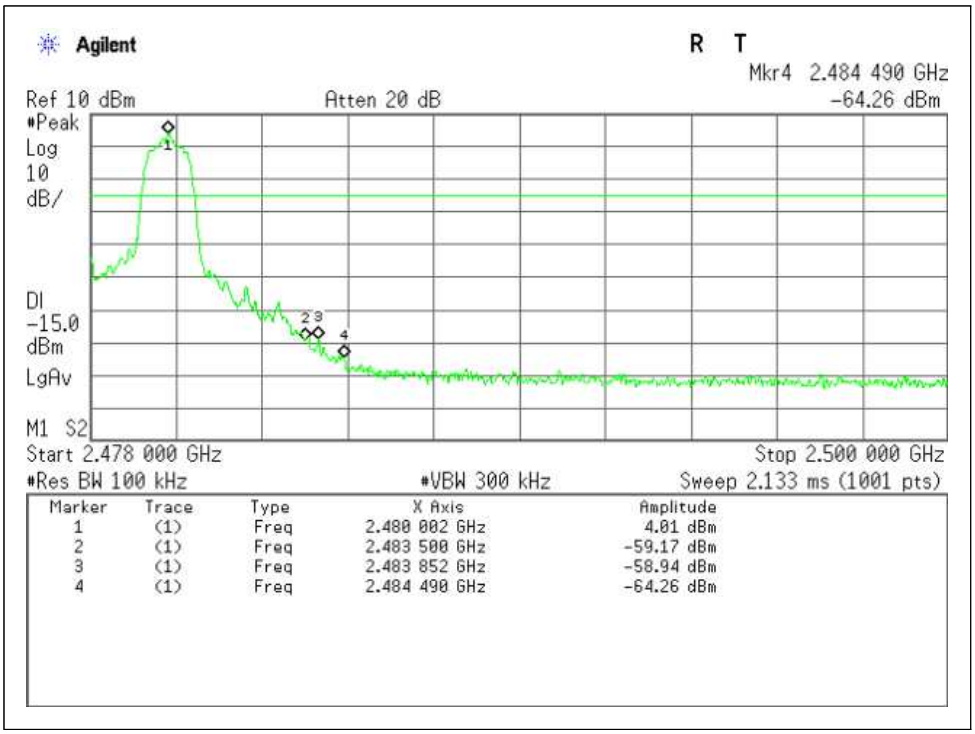


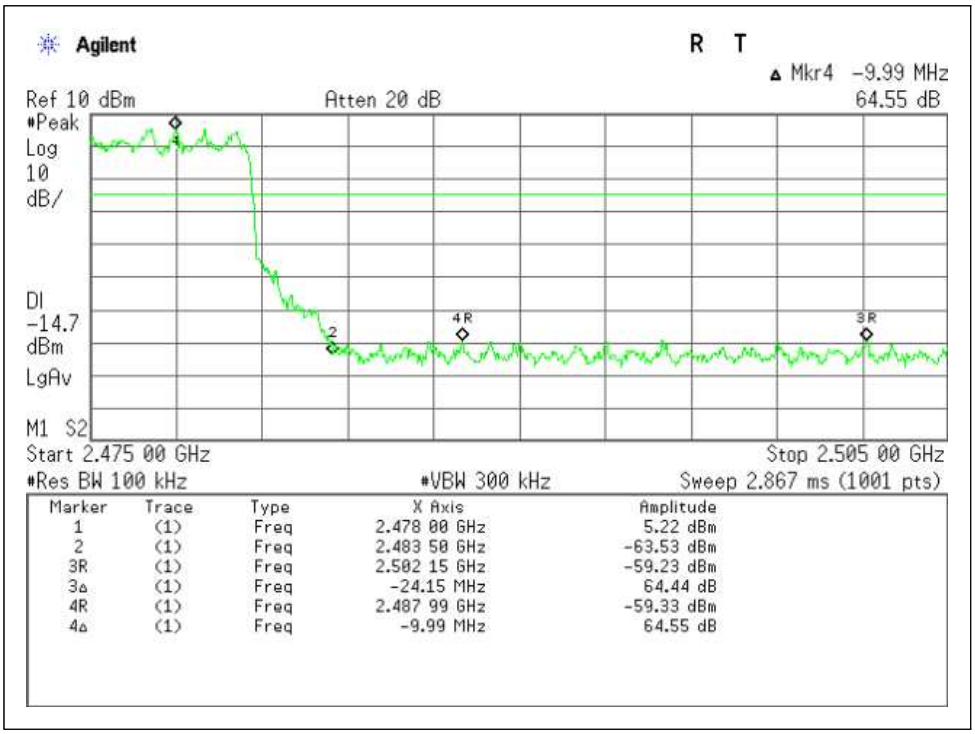
Test mode:	π/4DQPSK	Test chanel:	Lowest



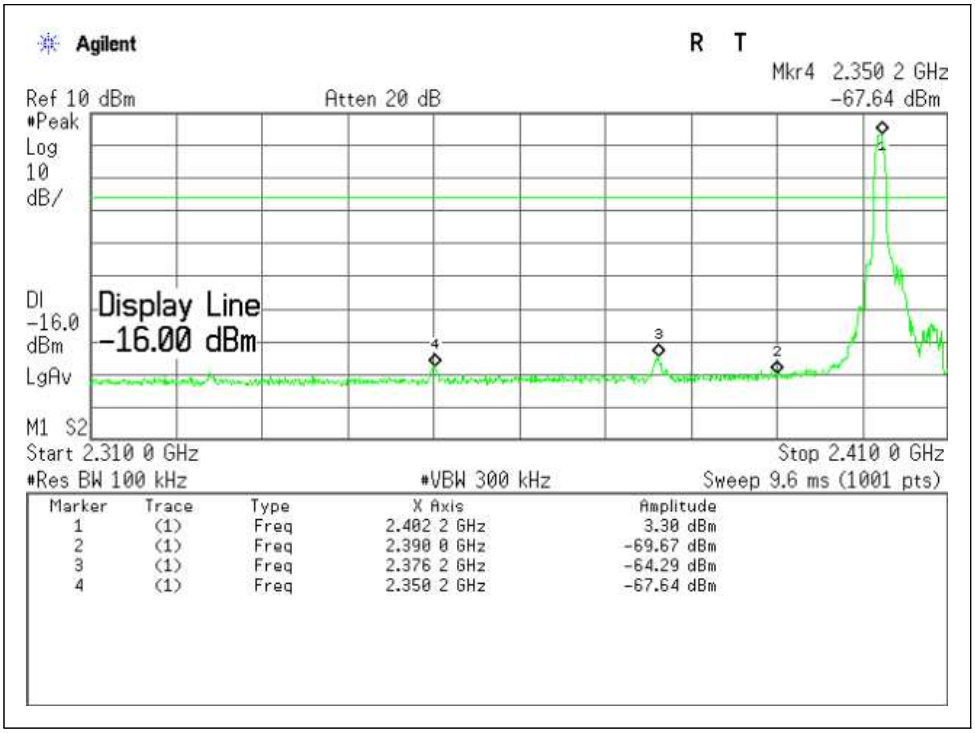


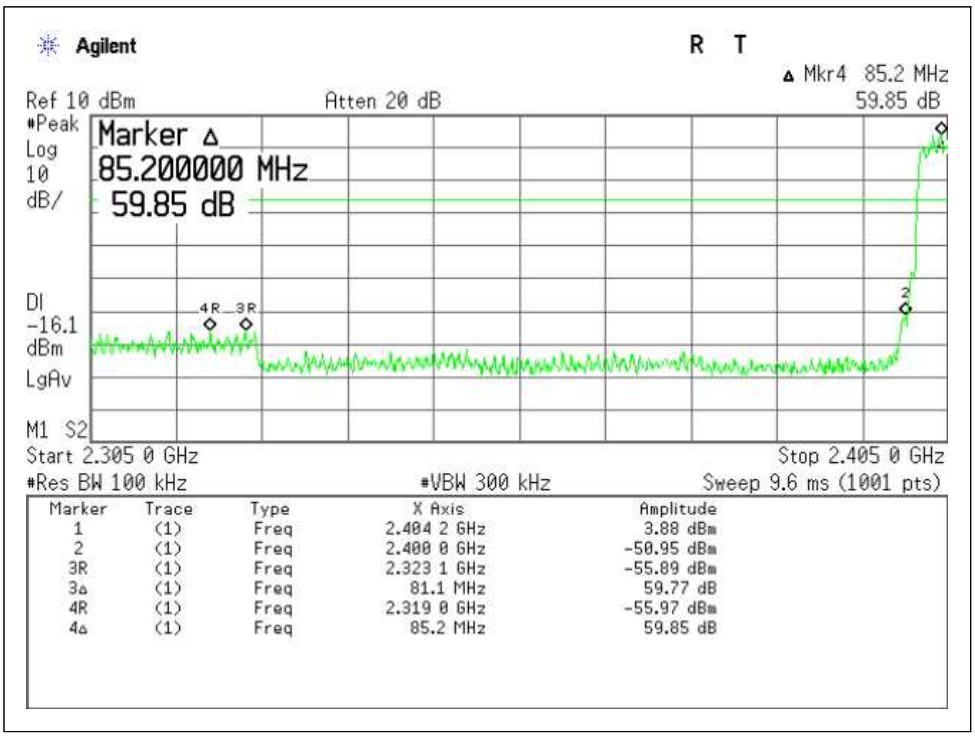
Test mode:	π/4DQPSK	Test chanel:	Highest



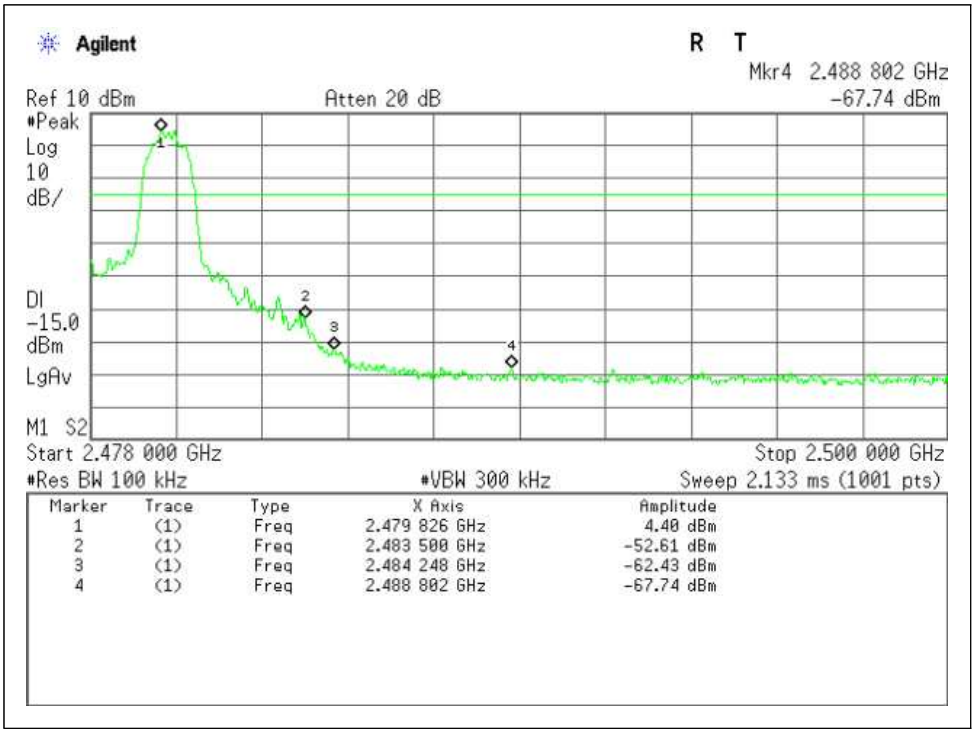


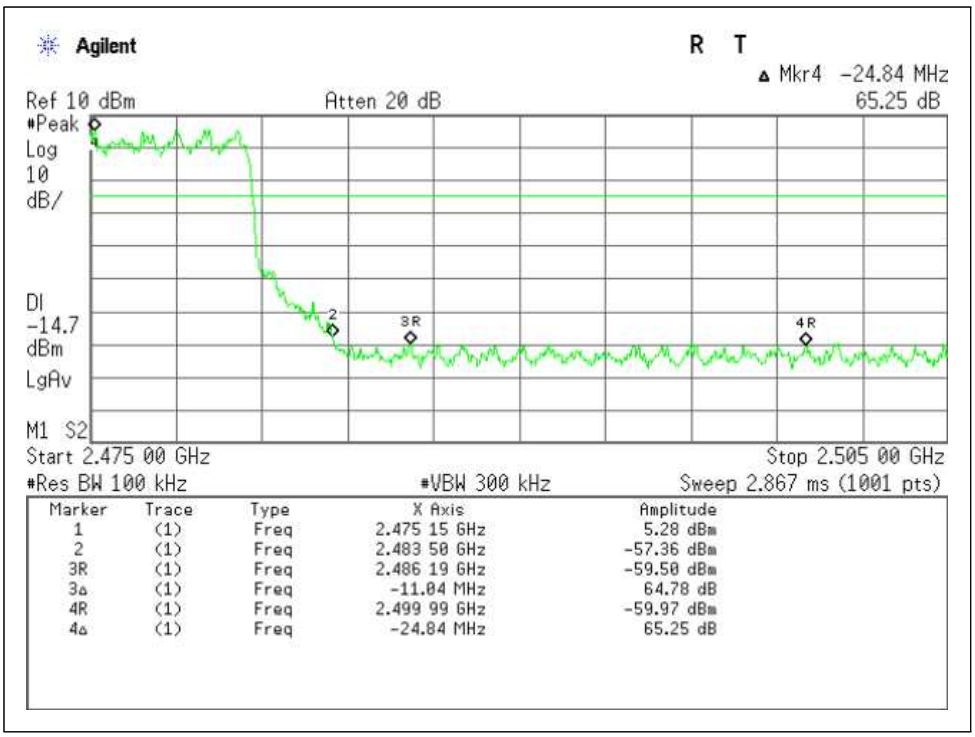
Test mode:	8DPSK	Test chanel:	Lowest





Test mode:	8DPSK	Test chanel:	Highest





5.12. Conducted Emissions at Mains Terminals 150 kHz to 30 MHz

Test Requirement:	FCC Part 15 C section 15.207
Test Method: ANSI C63.10:	Clause 6.2
Frequency Range:	150 kHz to 30 MHz
Detector:	Peak for pre-scan (9 kHz Resolution Bandwidth)

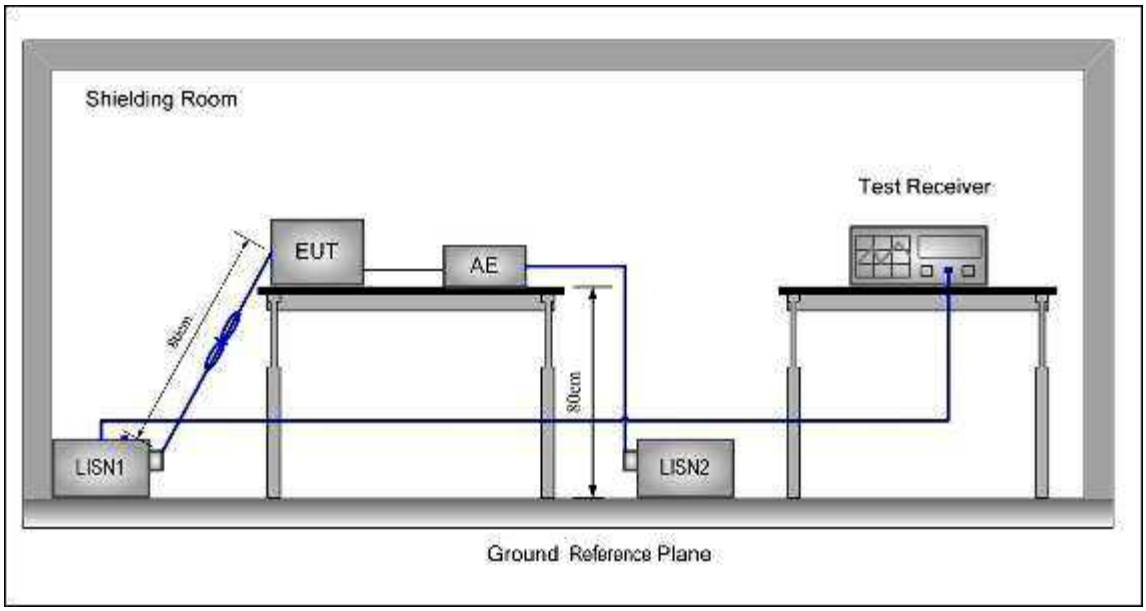
Test Limit

Limits for conducted disturbance at the mains ports of class B

Frequency Range (MHz)	Class B Limit dB(μV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
NOTE 1 The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.		

EUT Operation:	Test in normal operating mode. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
Final Test Mode:	Through Pre-scan, find the DH3 of data type and GFSK modulation at the lowest channel is the worst case. Only the worst case is recorded in the report.

Test Configuration:



Test procedure:

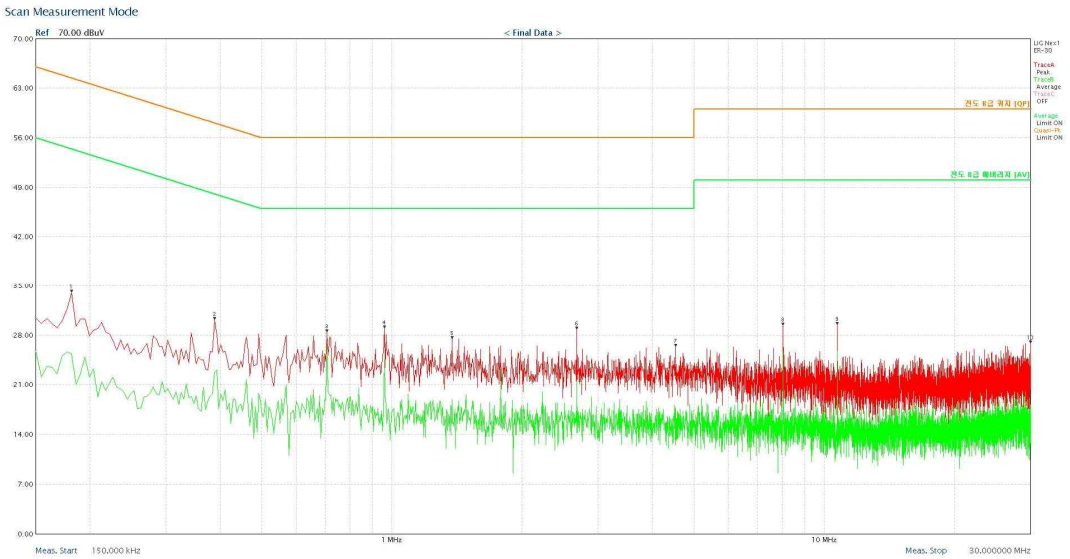
1. The mains terminal disturbance voltage test was conducted in a shielded room.
2. The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50/50μH + 5linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
3. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.
4. The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0,4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane.

This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0,8 m from the LISN 2.

5.12.1. Measurement Data

Pre-scan was performed with peak detected on all ports, Quasi-peak & average measurements were performed at the frequencies at which maximum peak emission level were detected. Please see the attached Quasi-peak and Average test results.

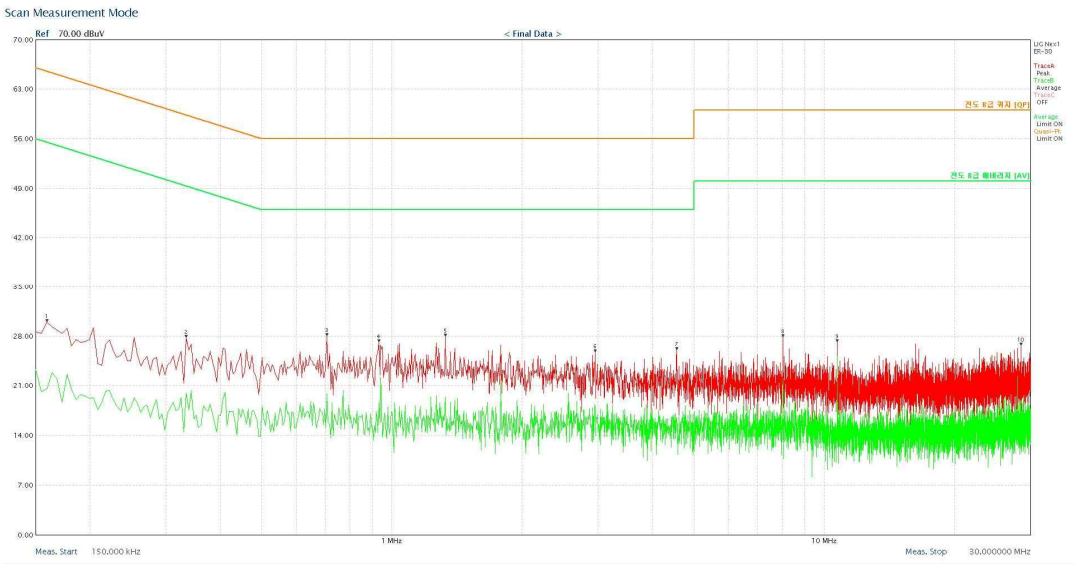
Line - PE(QusiPeak and Average detector used)



REDUCTION TABLE

No	Freq (MHz)	Level (dBuV)	Corr (dB)	Limit (dBuV)	Margin (dB)	State	Reference
1	0.181	16.71	9.98	64.44	37.75	Pass	QP
2	80.050	16.19	10.44	60.00	33.37	Pass	QP
3	0.181	10.65	9.98	54.44	33.81	Pass	AV
4	80.050	12.04	10.44	50.00	27.52	Pass	AV

Neutral – PE(QusiPeak and Average detector used)



REDUCTION TABLE

No	Freq (MHz)	Level (dBuV)	Corr (dB)	Limit (dBuV)	Margin (dB)	State	Reference
1	0.159	17.82	10.03	65.52	37.67	Pass	QP
2	8.025	16.21	10.39	60.00	33.40	Pass	QP
3	0.159	11.81	10.03	55.52	33.68	Pass	AV
4	8.025	12.15	10.39	50.00	27.46	Pass	AV

Measurement data:

* Detector function was set into Quasi-peak & Average mode.

* Corr = LISN Factor + Cable loss + Pulse Limiter

5.13. Radio Frequency Exposure Procedures

Regulation

According to §15.247(i) and § 1.1307(b)(1) , systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

KDB 447498 D01: Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table:

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Maximum Measured Transmitter Power :

Channel Frequency (MHz)	Maximum Peak Conducted Output Power		Max Antenna Gain (dBi)	Numeric antenna gain (mW)
	(dBm)	(mW)		
2440	7.78	5.998	2.0	1.584

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] = 5.998/5*√2.440 = 1.874 ≤ 3.0

Threshold at which no SAR required is 10mW and ≤ 3.0 for 1-g SAR, Separation distance is 5mm.

Conclusion : The SAR measurement is exempt.

Conclusion : The SAR measurement is exempt.

APPENDIX

1. EUT photo