



8. Maximum Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(1)
Test Method:	ANSI C63.10:2013

8.1 Block Diagram Of Test Setup



8.2 Limit

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.

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W.

8.3 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: RBW = 2MHz. VBW =6MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

8.4 DEVIATION FROM STANDARD

No deviation.

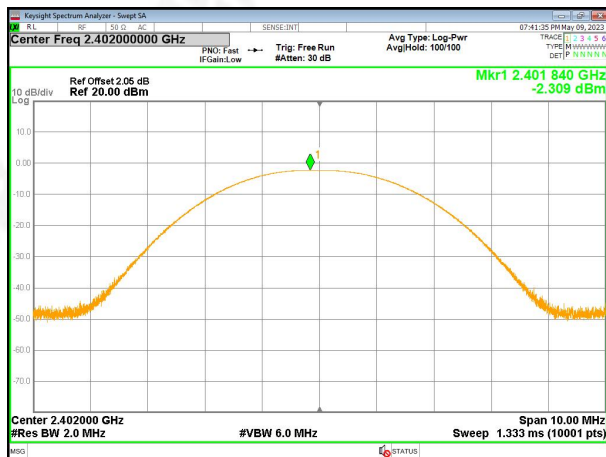
8.5 Test Result

Mode	Test channel	Peak Output Power (dBm)	FCC Limit (dBm)	Result
GFSK	Lowest	-2.31	21.00	Pass
	Middle	-3.64		
	Highest	-5.42		
$\pi/4$ DQPSK	Lowest	-2.37	21.00	Pass
	Middle	-3.79		
	Highest	-5.54		
8DPSK	Lowest	-2.12	21.00	Pass
	Middle	-3.48		
	Highest	-5.85		

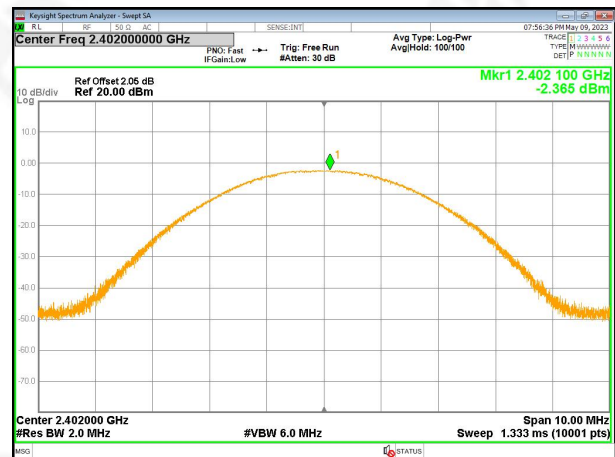


Test plots

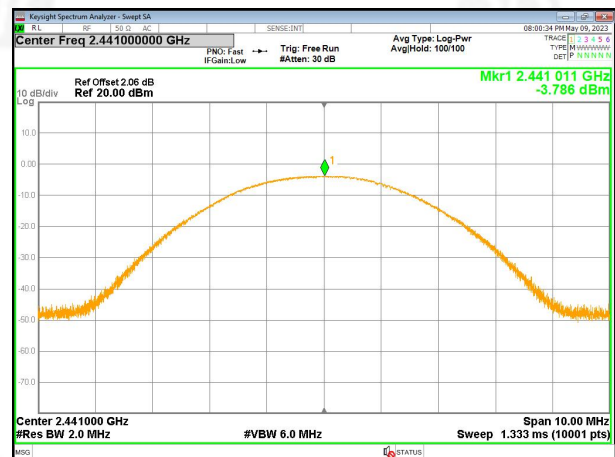
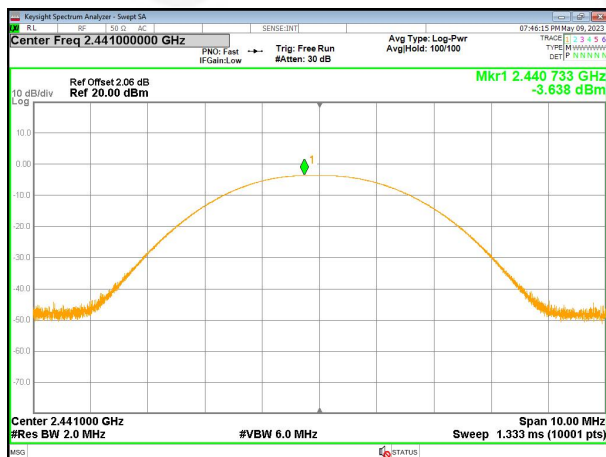
GFSK



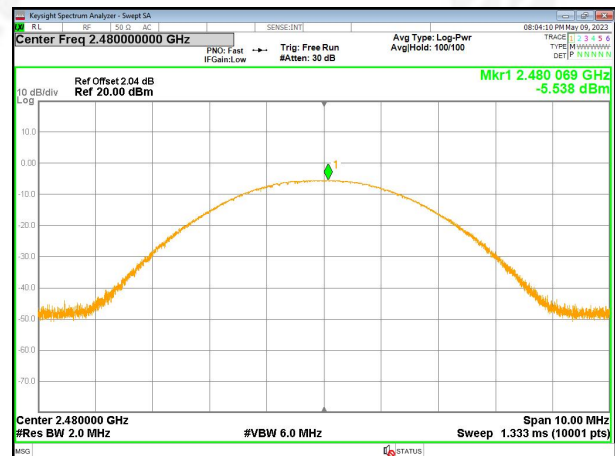
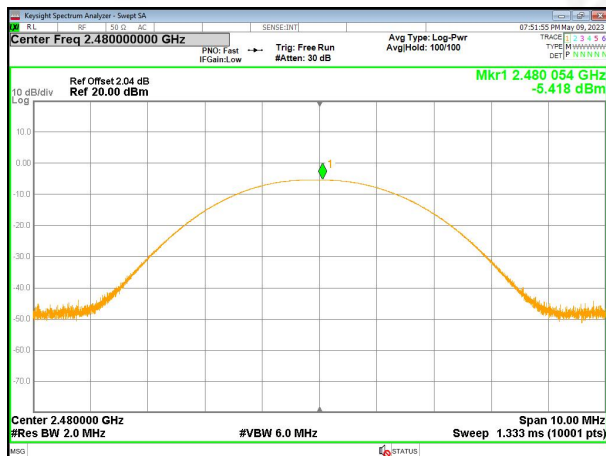
π /4DQPSK



Lowest



Middle

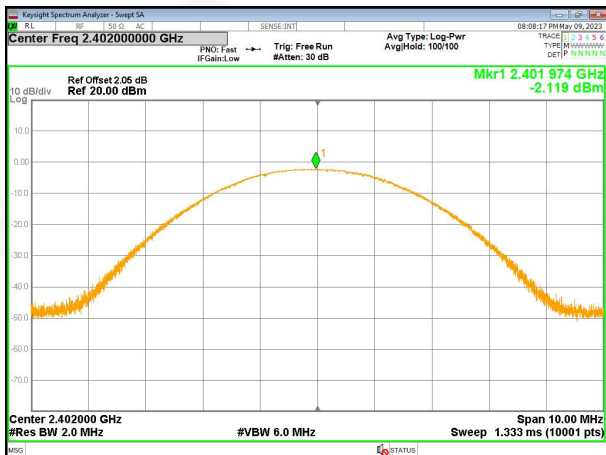


Highest

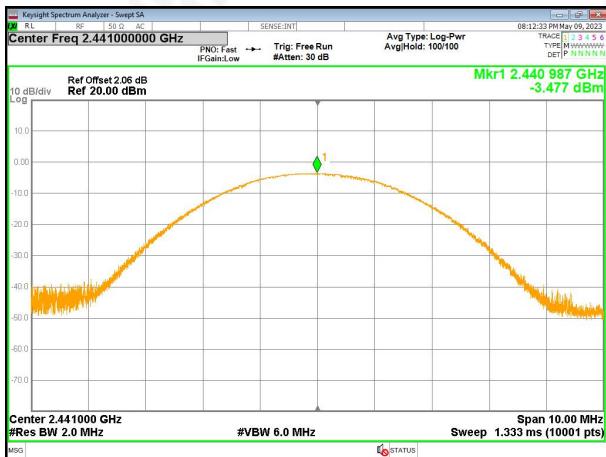


Test plots

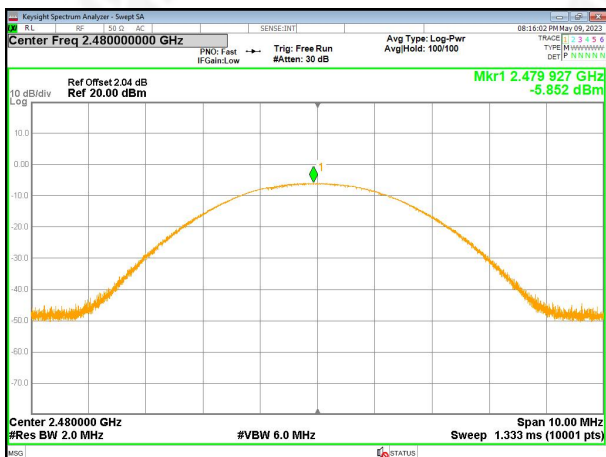
8DPSK



Lowest



Middle



Highest



9. HOPPING CHANNEL SEPARATION

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=30KHz, VBW=100KHz, detector=Peak
Limit:	GFSK: 20dB bandwidth $\pi/4$ -DQPSK & 8DSK: 0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)

9.1 Test Setup



9.2 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: RBW = 30kHz. VBW = 100kHz , Span = 2.0MHz. 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.

9.3 DEVIATION FROM STANDARD

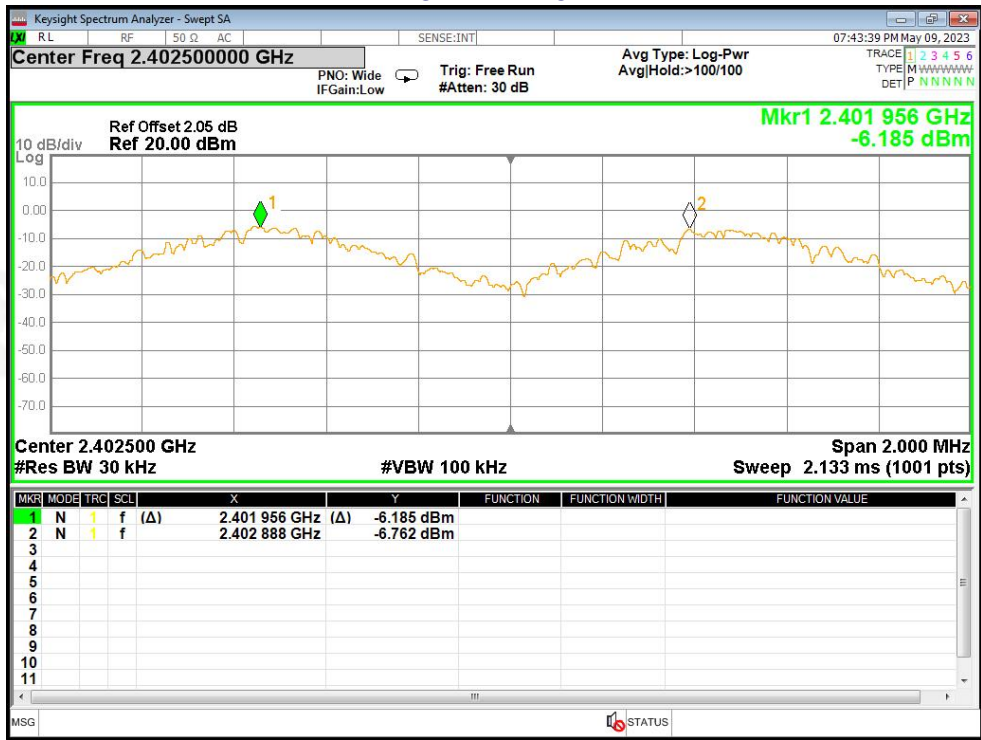
No deviation.



9.4 Test Result

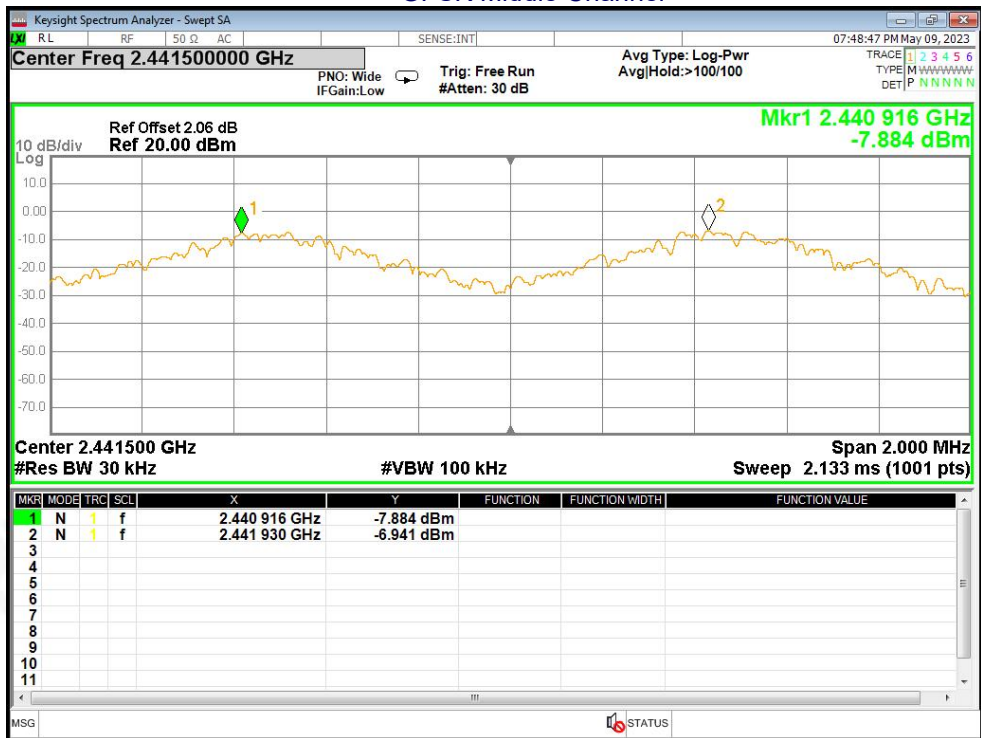
Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	0.932	0.634	PASS
GFSK	Middle	1.014	0.653	PASS
GFSK	High	1.004	0.614	PASS
$\pi/4$ DQPSK	Low	0.99	0.853	PASS
$\pi/4$ DQPSK	Middle	1.032	0.893	PASS
$\pi/4$ DQPSK	High	0.998	0.879	PASS
8DPSK	Low	1.14	0.863	PASS
8DPSK	Middle	1	0.833	PASS
8DPSK	High	1.308	0.817	PASS

Test plots
GFSK Low Channel

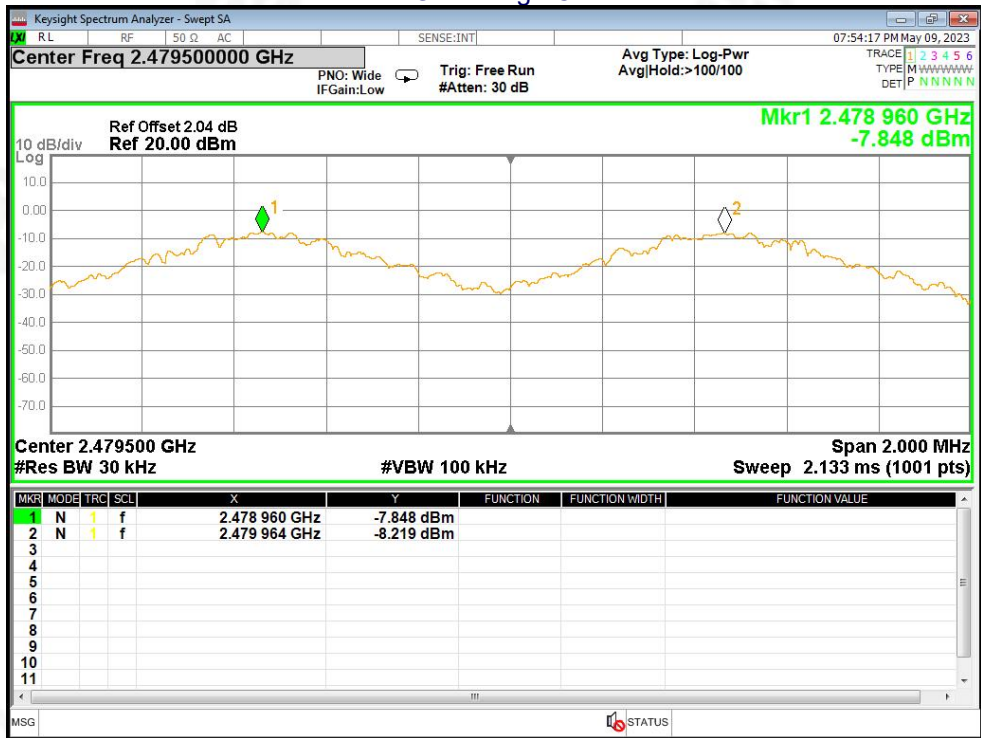




GFSK Middle Channel

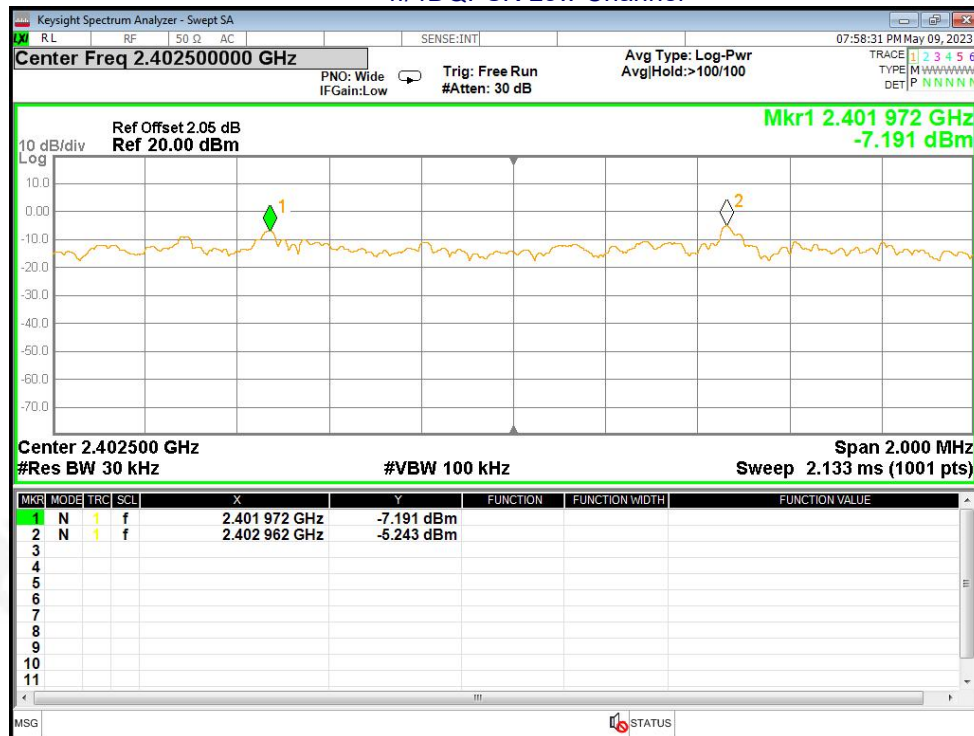


GFSK High Channel

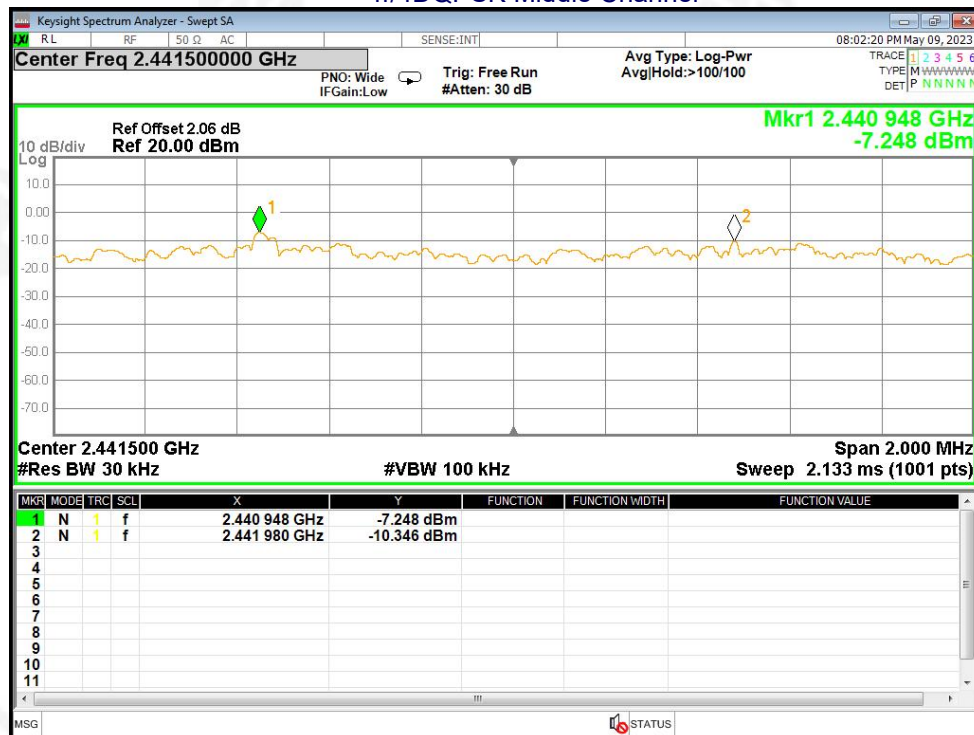




$\pi/4$ DQPSK Low Channel

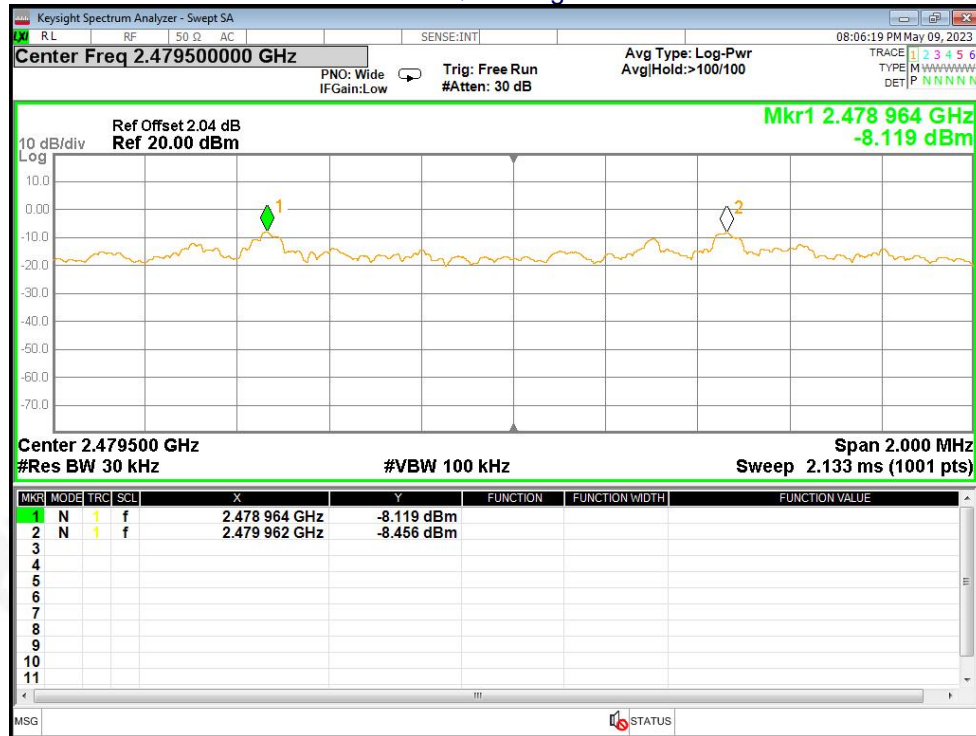


$\pi/4$ DQPSK Middle Channel

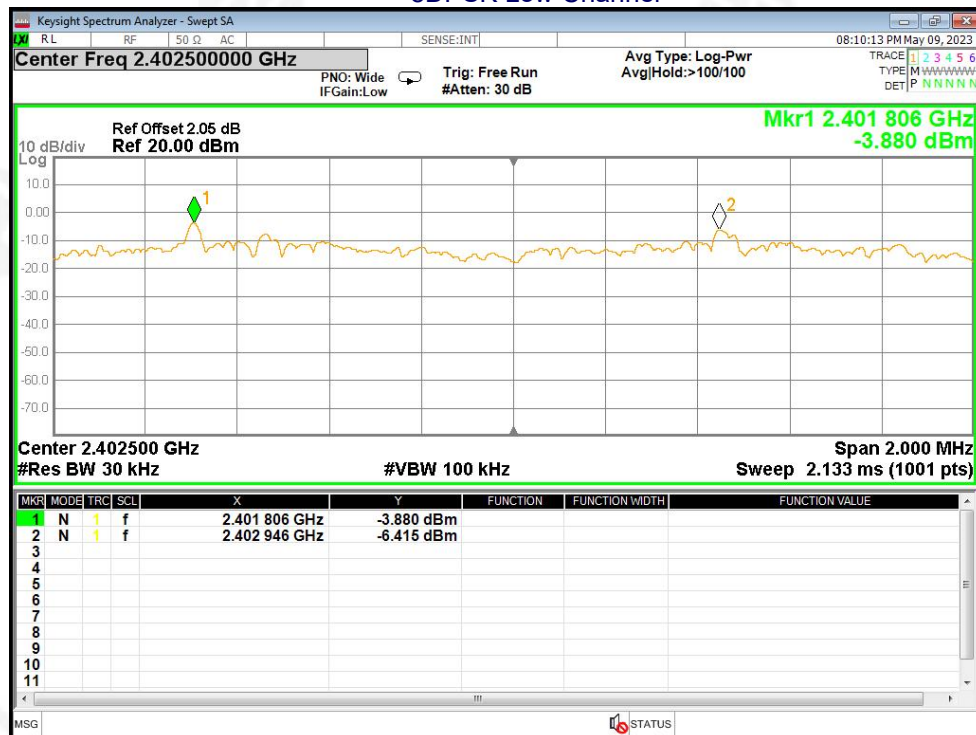




$\pi/4$ DQPSK High Channel

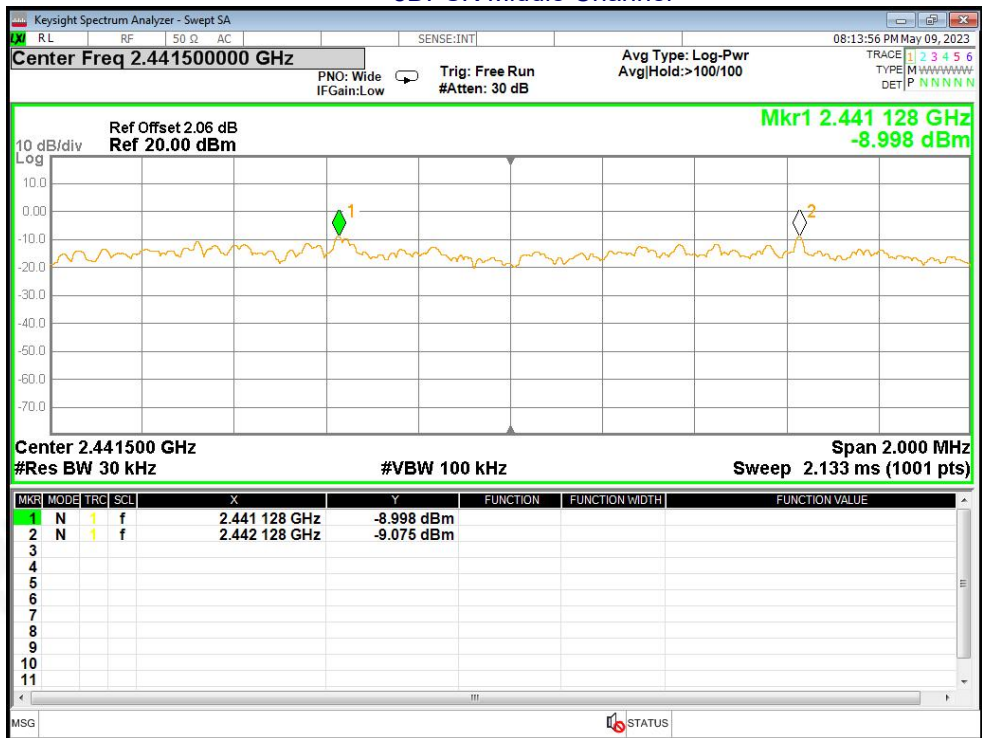


8DPSK Low Channel

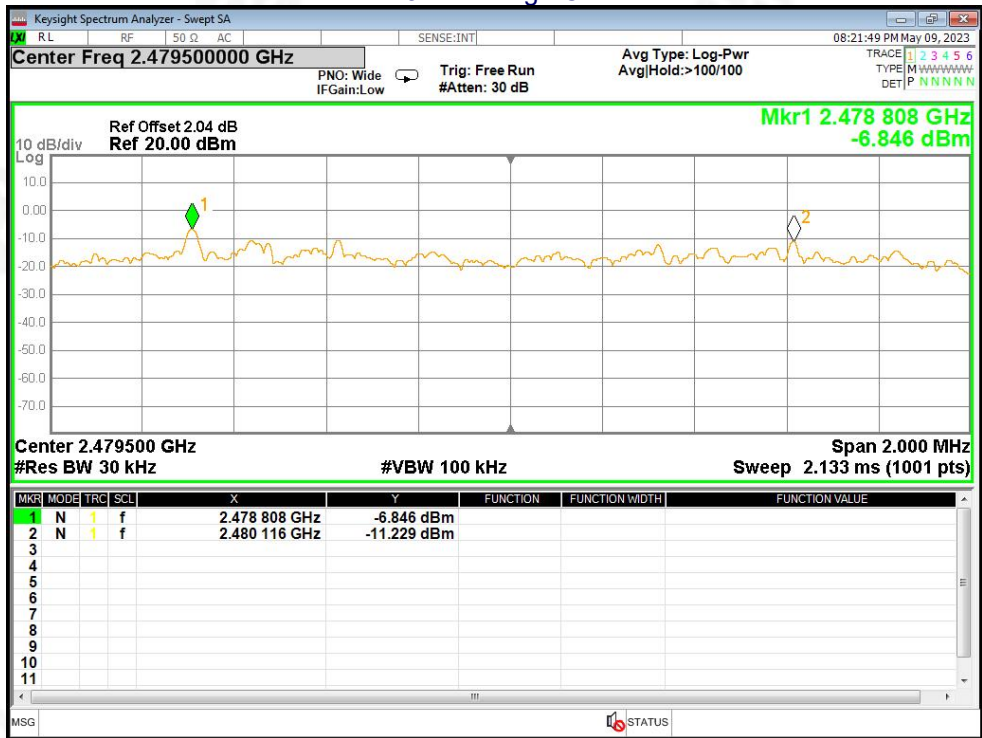




8DPSK Middle Channel



8DPSK High Channel





10.NUMBER OF HOPPING FREQUENCY

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak
Limit:	15 channels

10.1 Test Setup



10.2 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: RBW = 100kHz. VBW = 300kHz. 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 = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;

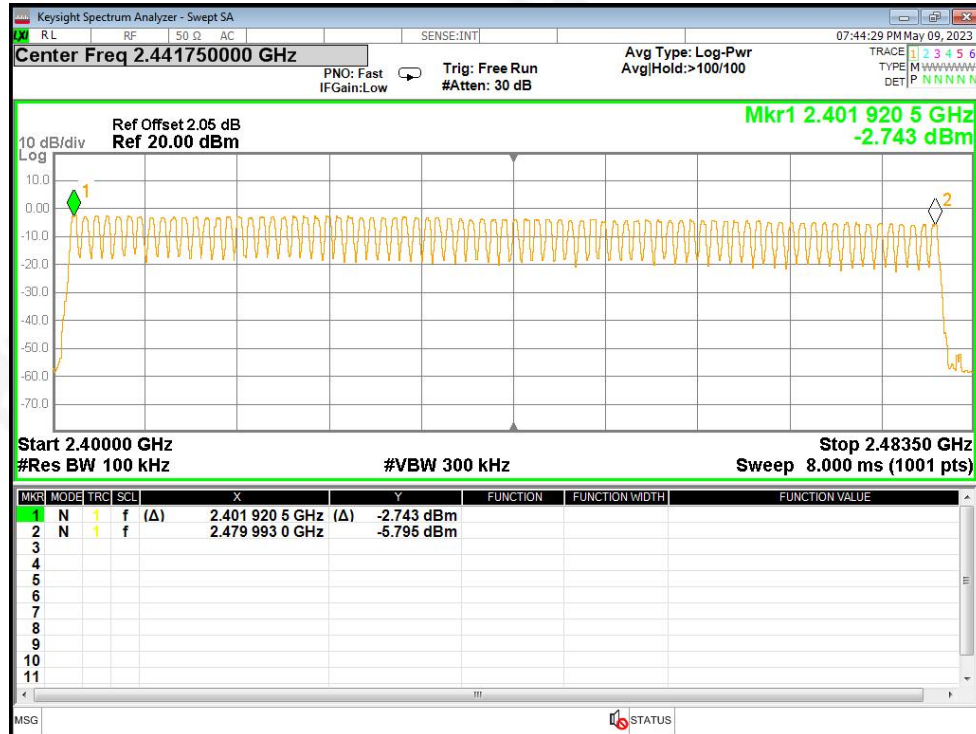
10.3 DEVIATION FROM STANDARD

No deviation.

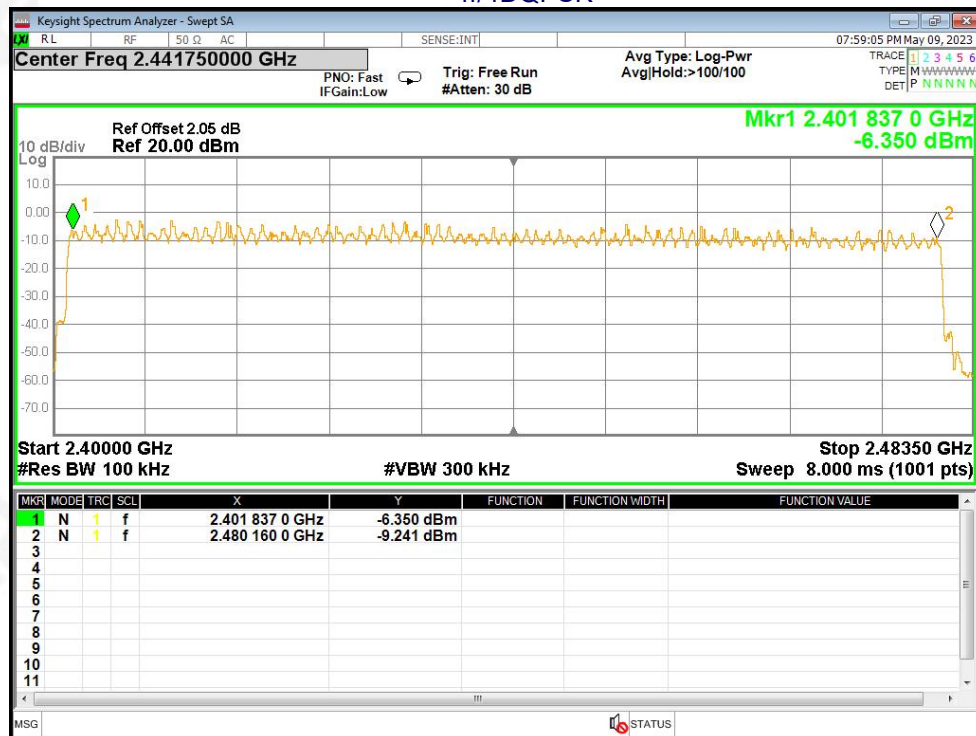


10.4 Test Result

Test Plots:
79 Channels in total
GFSK

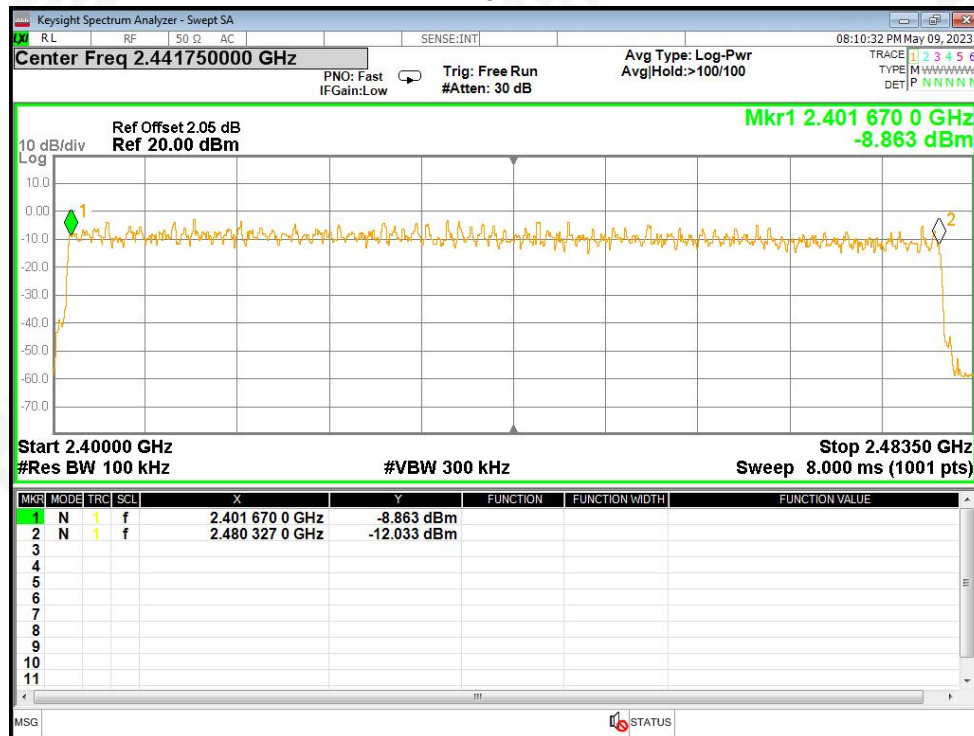


$\pi/4$ DQPSK





8DPSK





11. DWELL TIME

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=1MHz, VBW=3MHz, Span=0Hz, Detector=Peak
Limit:	0.4 Second

11.1 Test Setup



11.2 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 spectrum analyzer span = 0Hz;
3. Set RBW = 1MHz and VBW = 3MHz. Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 and DH1 packet transmitting.
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).

11.3 DEVIATION FROM STANDARD

No deviation.



11.4 Test Result

GFSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	DH1	118.08	400	Pass
2441MHz	DH3	259.2	400	Pass
2441MHz	DH5	305.92	400	Pass

Remarks:

The test period: $T = 0.4 \text{ Second/Channel} \times 79 \text{ Channel} = 31.6 \text{ s}$

Test channel: as blow

CH:2441MHz time slot= $0.369(\text{ms}) \times (1600 / (2 \times 79)) \times 31.6 = 118.08 \text{ms}$

CH:2441MHz time slot= $1.62(\text{ms}) \times (1600 / (4 \times 79)) \times 31.6 = 259.2 \text{ms}$

CH:2441MHz time slot= $2.868(\text{ms}) \times (1600 / (6 \times 79)) \times 31.6 = 305.92 \text{ms}$

$\pi/4$ -DQPSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	2DH1	120.96	400	Pass
2441MHz	2DH3	261.12	400	Pass
2441MHz	2DH5	306.99	400	Pass

Remarks:

The test period: $T = 0.4 \text{ Second/Channel} \times 79 \text{ Channel} = 31.6 \text{ s}$

Test channel: as blow

CH:2441MHz time slot= $0.378(\text{ms}) \times (1600 / (2 \times 79)) \times 31.6 = 120.96 \text{ms}$

CH:2441MHz time slot= $1.632(\text{ms}) \times (1600 / (4 \times 79)) \times 31.6 = 261.12 \text{ms}$

CH:2441MHz time slot= $2.878(\text{ms}) \times (1600 / (6 \times 79)) \times 31.6 = 306.99 \text{ms}$

8-DPSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	3DH1	121.6	400	Pass
2441MHz	3DH3	260.8	400	Pass
2441MHz	3DH5	307.31	400	Pass

Remarks:

The test period: $T = 0.4 \text{ Second/Channel} \times 79 \text{ Channel} = 31.6 \text{ s}$

Test channel: as blow

CH:2441MHz time slot= $0.38(\text{ms}) \times (1600 / (2 \times 79)) \times 31.6 = 121.6 \text{ms}$

CH:2441MHz time slot= $1.63(\text{ms}) \times (1600 / (4 \times 79)) \times 31.6 = 260.8 \text{ms}$

CH:2441MHz time slot= $2.881(\text{ms}) \times (1600 / (6 \times 79)) \times 31.6 = 307.31 \text{ms}$



Test Plots

GFSK DH1 2441MHz



GFSK DH3 2441MHz

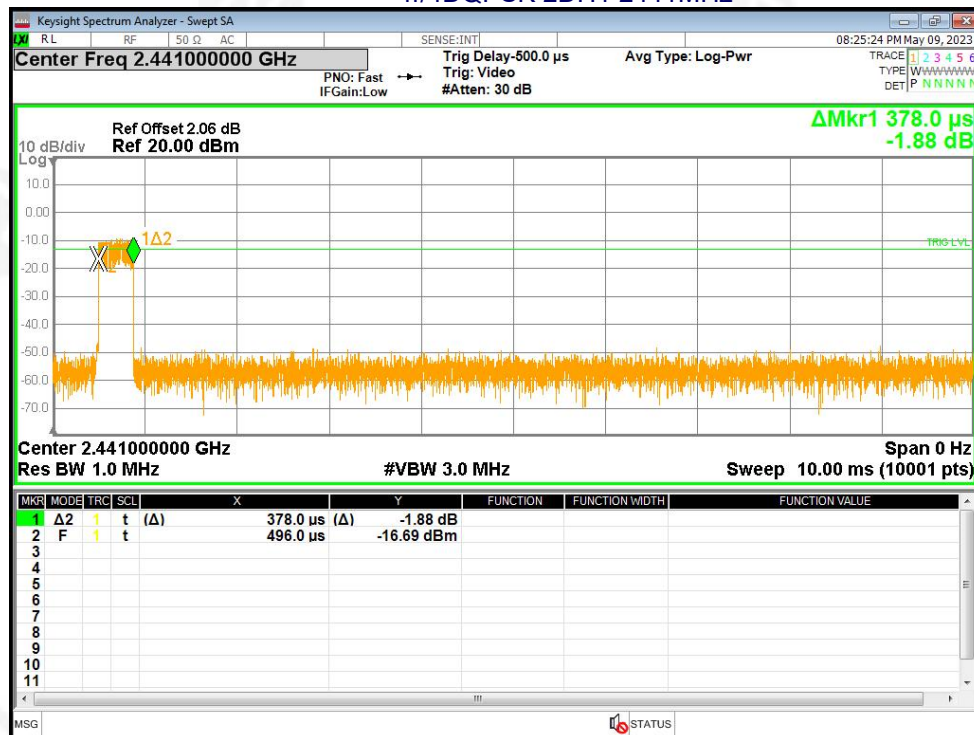




GFSK DH5 2441MHz



π /4DQPSK 2DH1 2441MHz





$\pi/4$ DQPSK 2DH3 2441MHz



$\pi/4$ DQPSK 2DH5 2441MHz



[illegible]

Keysight Spectrum Analyzer - Swept SA

08:28:21 PM May 09, 2023

Center Freq 2.441000000 GHz

Ref Offset 2.06 dB
Ref 20.00 dBm

PNO: Fast
IFGain: Low

Trig Delay 500.0 μ s
Trig: Video
#Atten: 30 dB

Avg Type: Log-Pwr

TRACE 1 2 3 4 5 6
TYPE W W W W W W W W
DET P N N N N N N

Δ Mkr1 1.630 ms
-3.77 dB

10 dB/div
Log

Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Sweep 10.00 ms (10001 pts)
Span 0 Hz

MNR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	Δ 2	1	t	(Δ)	1.630 ms	(Δ)	-3.77 dB	
2	F		t		496.0 μ s		-14.36 dBm	
3								
4								
5								
6								
7								
8								
9								
10								
11								

MSG

STATUS



8DPSK 3DH5 2441MHz





12. Antenna Requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(b)(4)
<p>15.203 requirement: 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p> <p>15.247(b) (4) requirement: (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.</p>	
EUT Antenna:	
The antenna is FPC Antenna, the best case gain of the antennas is -0.58dBi, reference to the appendix II for details	



13. Test Setup Photo

Reference to the appendix I for details.

14. EUT Constructional Details

Reference to the appendix II for details.

***** END OF REPORT *****