



8. Maximum Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(1)
Test Method:	ANSI C63.10:2013
Limit:	Please see the 8.2

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 = 1MHz. VBW =3MHz. 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.

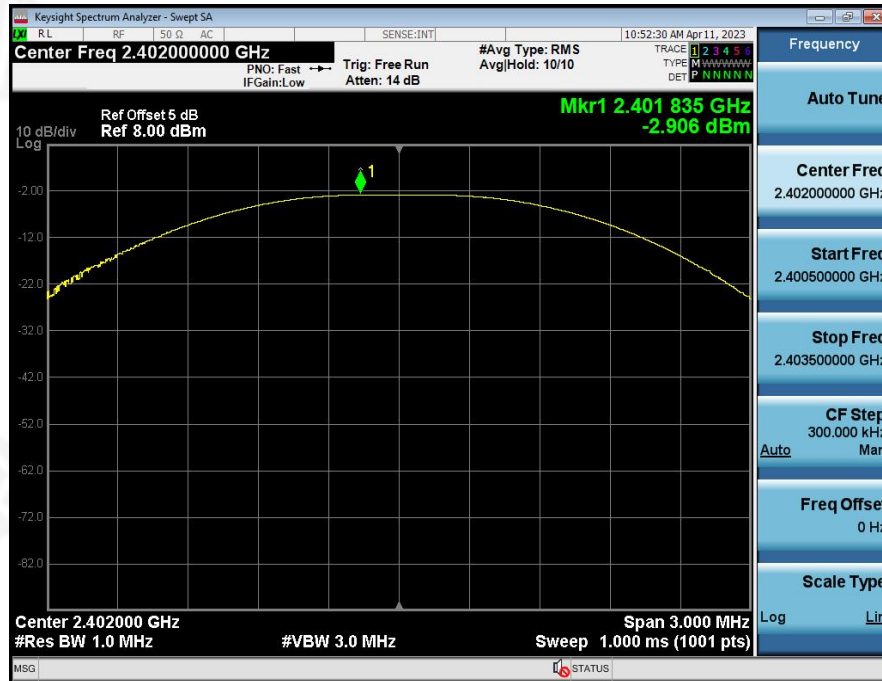
8.5 Test Result

Mode	Test channel	Peak Output Power (dBm)	FCC Limit (dBm)	Result
GFSK	Lowest	-2.906	30	Pass
	Middle	-2.836		
	Highest	-2.286		
$\pi/4$ -DQPSK	Lowest	-2.020	20.97	Pass
	Middle	-1.904		
	Highest	-1.350		
8-DPSK	Lowest	-1.390	20.97	Pass
	Middle	-1.298		
	Highest	-0.766		



Test plots

GFSK Low Channel



GFSK Middle Channel





GFSK High Channel



$\pi/4$ -DQPSK Low Channel

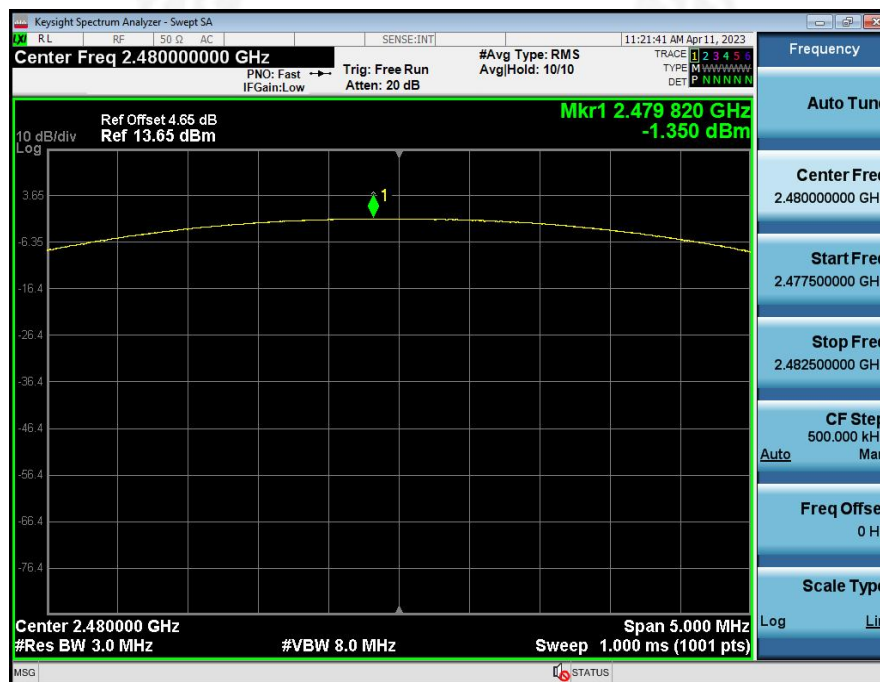




$\pi/4$ -DQPSK Middle Channel



$\pi/4$ -DQPSK High Channel

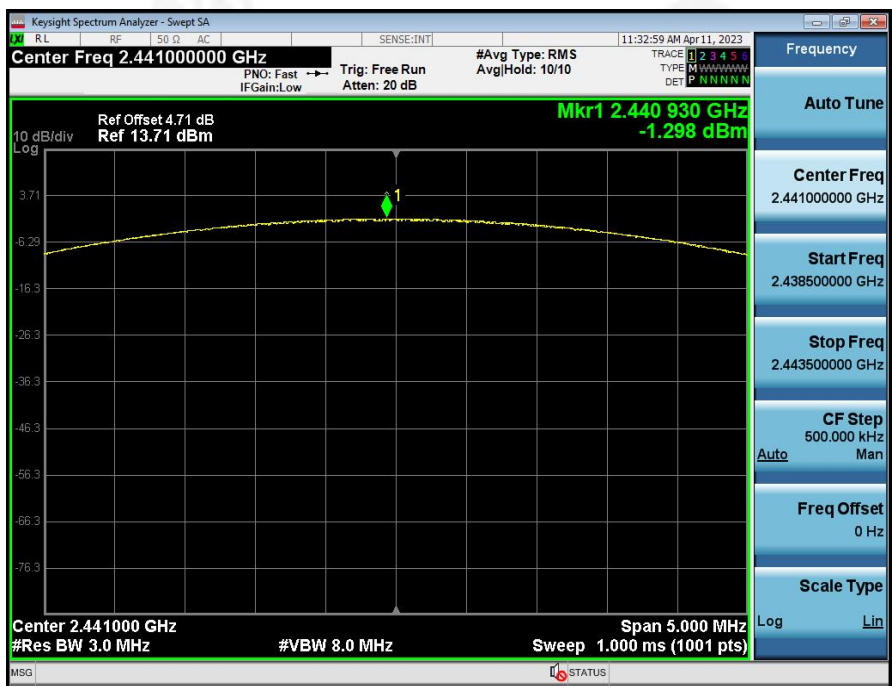




8-DPSK Low Channel



8-DPSK Middle Channel





Keysight Spectrum Analyzer - Swept SA

RL RF 50 Ω AC SENSE:INT 11:37:22 AM Apr 11, 2023

Center Freq 2.48000000 GHz #Avg Type: RMS
PNO: Fast IFGain:Low Trig: Free Run Avg/Hold: 10/10
TRACE 1 2 3 4 5
TYPE 1A 1B 1C 1D 1E 1F 1G 1H 1I 1J 1K 1L 1M 1N 1O 1P 1Q 1R 1S 1T 1U 1V 1W 1X 1Y 1Z
DET 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

Ref Offset 4.65 dB
Ref 13.65 dBm

Mkr1 2.479 970 GHz
-0.766 dBm

10 dB/div
Log

Center 2.480000 GHz
#Res BW 3.0 MHz
#VBW 8.0 MHz
Span 5.000 MHz
Sweep 1.000 ms (1001 pts)

The image shows a Keysight Spectrum Analyzer interface. The main display is a log-scale plot of power versus frequency. A single, sharp peak is visible at a frequency of 2.479970 GHz, with a power level of -0.766 dBm. The peak is labeled with a green '1'. The plot has a grid with major lines every 10 dB on the vertical axis and 100 MHz on the horizontal axis. The vertical axis is labeled '10 dB/div' and 'Log'. The horizontal axis is labeled 'Center 2.480000 GHz'. The plot shows a slight downward slope on either side of the peak, indicating a sweep. The interface includes various control panels and status bars. The top status bar shows the center frequency, span, resolution bandwidth, and video bandwidth. The bottom status bar shows the reference offset, reference power, and other settings. The right side of the interface has a vertical menu with options like 'Frequency', 'Auto Tune', 'Center Freq', 'Start Freq', 'Stop Freq', 'CF Step', 'Auto', 'Freq Offset', 'Scale Type', and 'Log'. The bottom right corner has a 'MSG' button and a 'STATUS' button.



9. HOPPING CHANNEL SEPARATION

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100KHz, VBW=300KHz, detector=Peak
Limit:	GFSK & $\pi/4$ -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 = 100kHz. VBW = 300kHz , Span = 3.0MHz. 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	0.999	0.8789	PASS
GFSK	Middle	0.999	0.8807	PASS
GFSK	High	0.999	0.8792	PASS
$\pi/4$ -DQPSK	Low	0.999	0.8380	PASS
$\pi/4$ -DQPSK	Middle	0.996	0.8400	PASS
$\pi/4$ -DQPSK	High	1.002	0.8393	PASS
8-DPSK	Low	1.002	0.8153	PASS
8-DPSK	Middle	0.999	0.8280	PASS
8-DPSK	High	0.999	0.8153	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



8-DPSK Low Channel

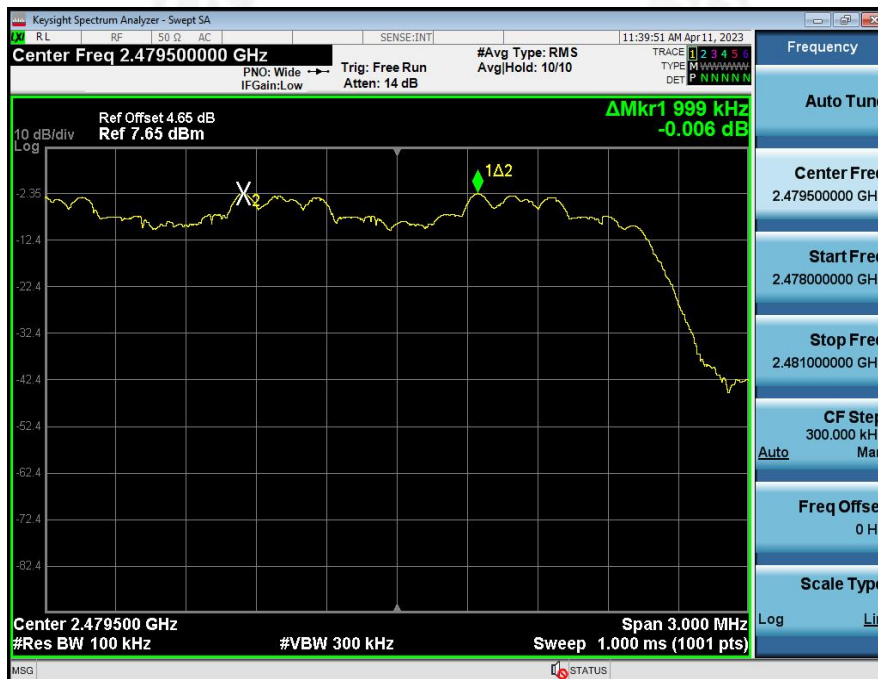




8-DPSK Middle Channel



8-DPSK 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.

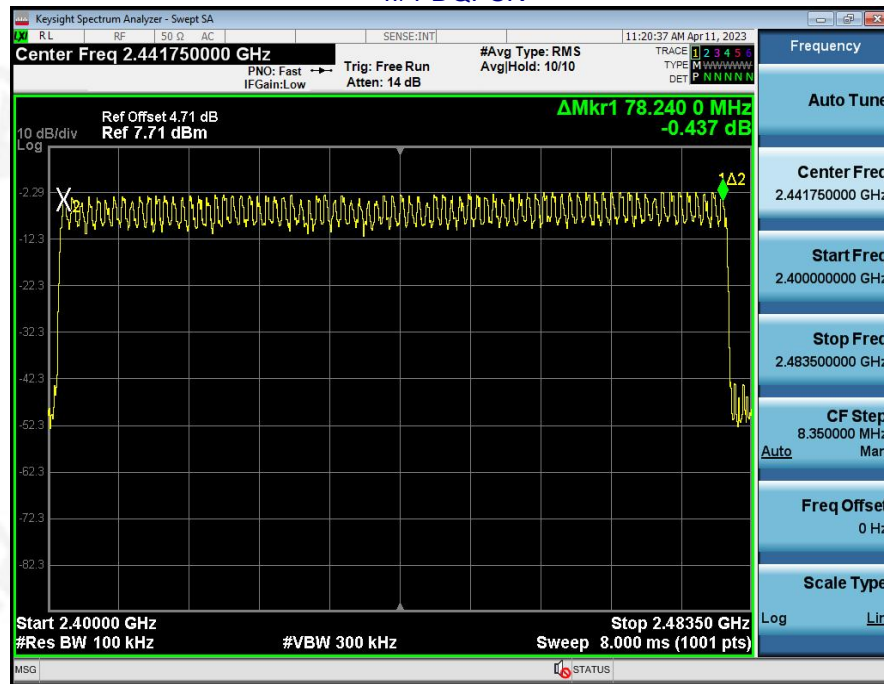
10.4 Test Result

Test Plots:
79 Channels in total
GFSK

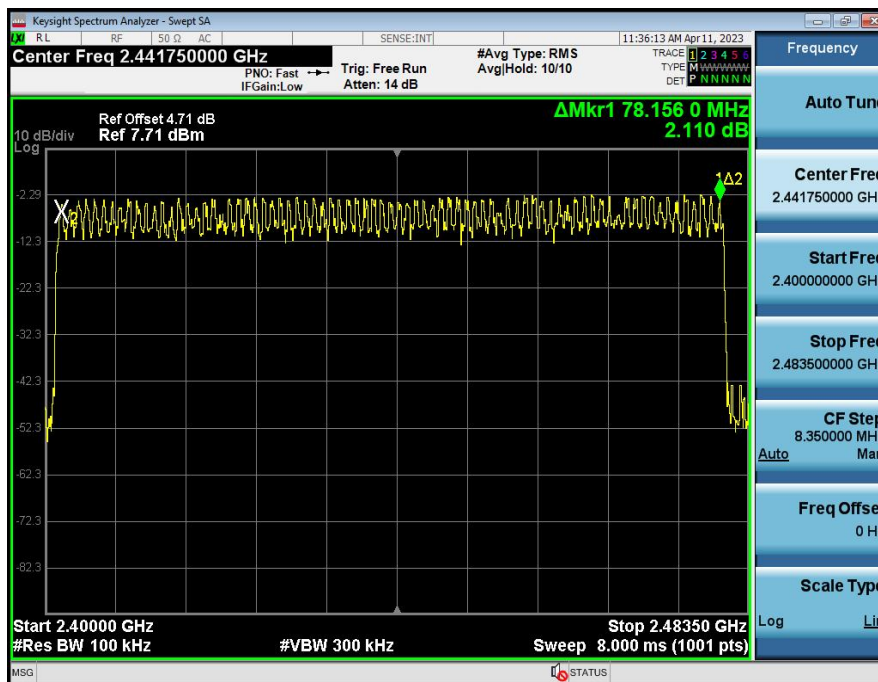




$\pi/4$ -DQPSK



8-DPSK





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:

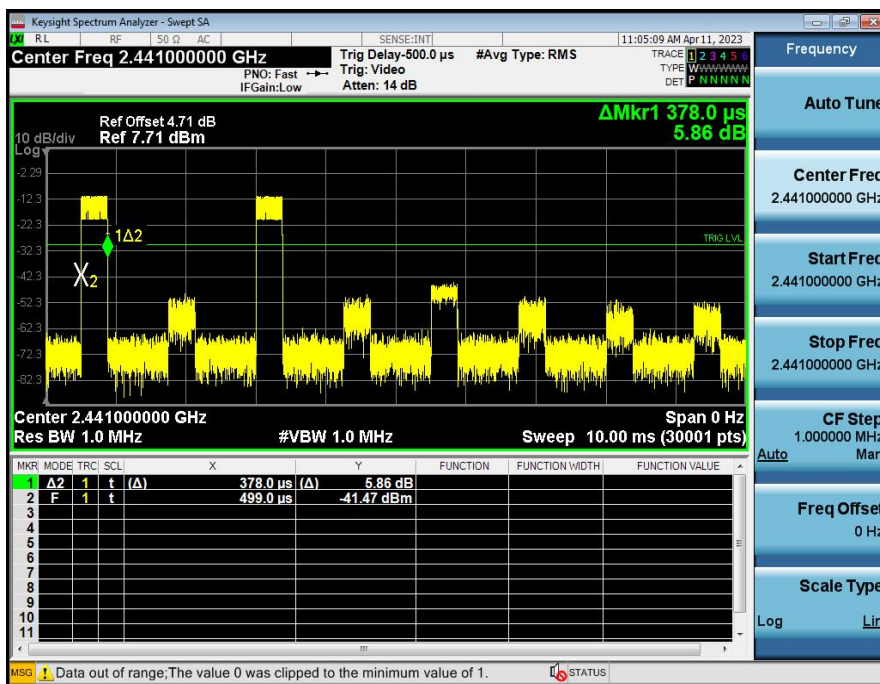
Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	DH1	120.96	400	Pass
2441MHz	DH3	261.28	400	Pass
2441MHz	DH5	307.41	400	Pass

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= $0.378(\text{ms}) \times (1600 / (2 \times 79)) \times 31.6$
CH:2441MHz time slot= $1.633(\text{ms}) \times (1600 / (4 \times 79)) \times 31.6$
CH:2441MHz time slot= $2.882(\text{ms}) \times (1600 / (6 \times 79)) \times 31.6$
- We tested all modes and recorded the worst in the report.

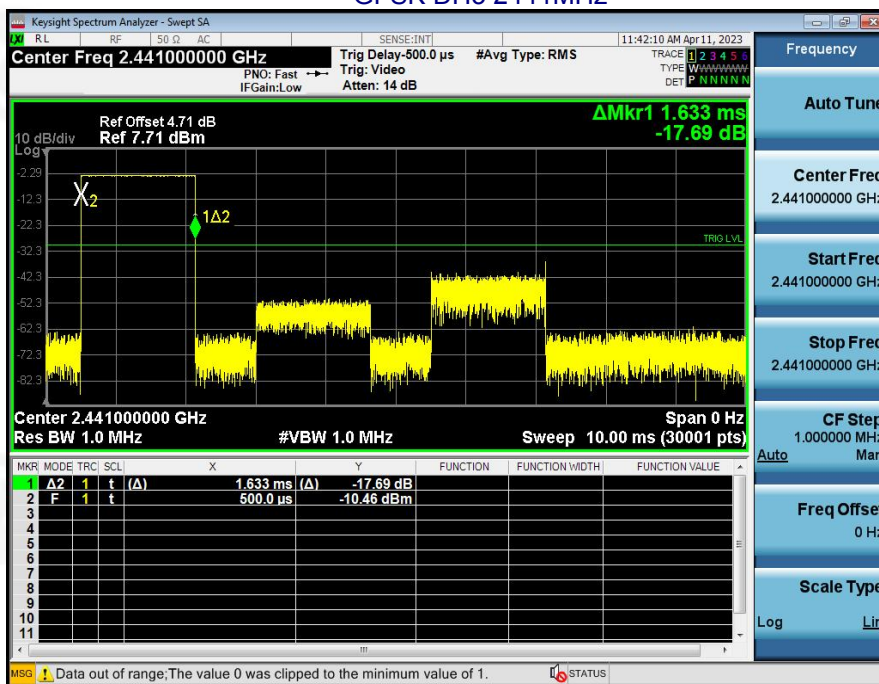
Test Plots

GFSK DH1 2441MHz

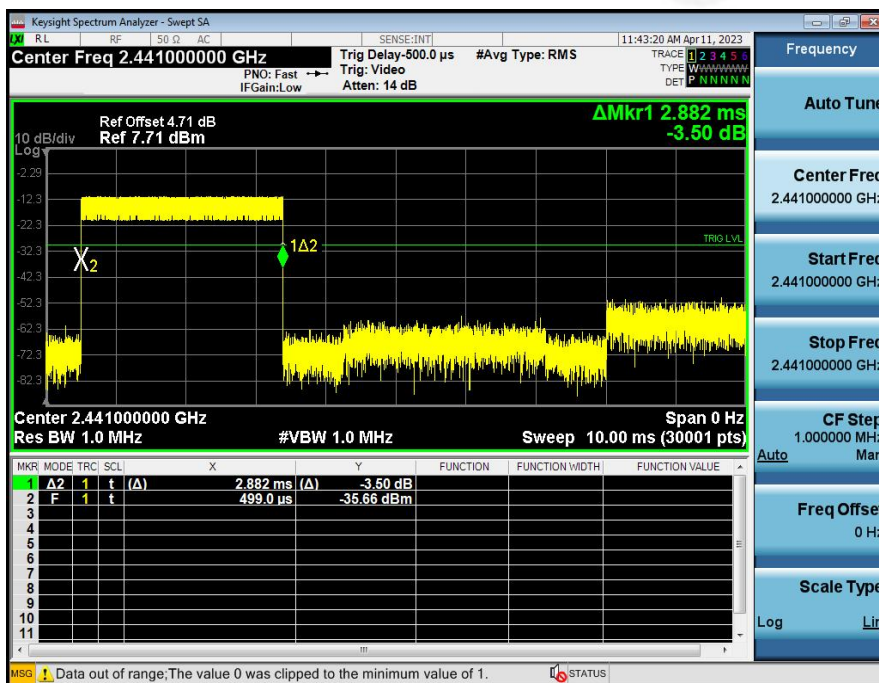




GFSK DH3 2441MHz



GFSK DH5 2441MHz





12. Antenna Requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
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. 15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi 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 6dBi.	
EUT Antenna:	
The antenna is Internal antenna, the best case gain of the antennas is -0.58 dBi, 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 *****