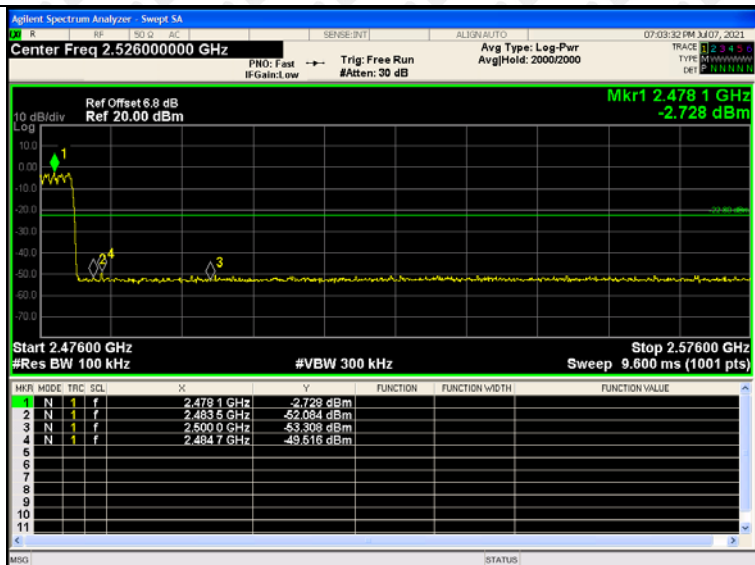
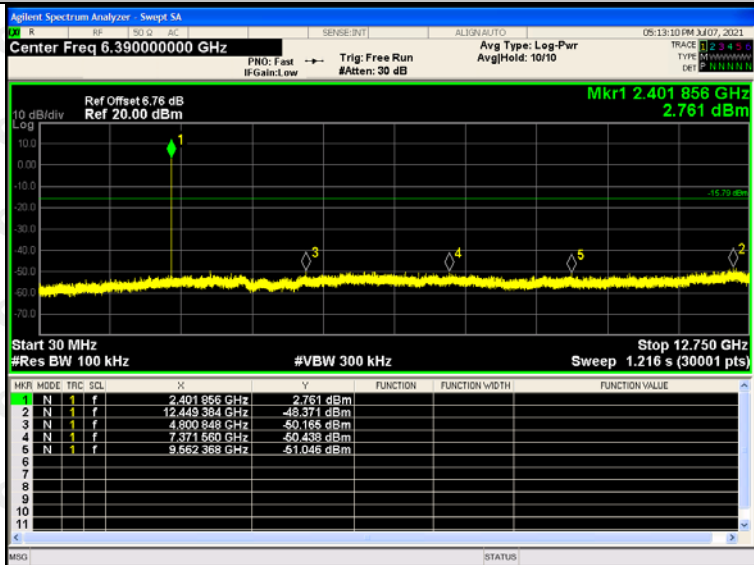


8DPSK
/HCH/Hop

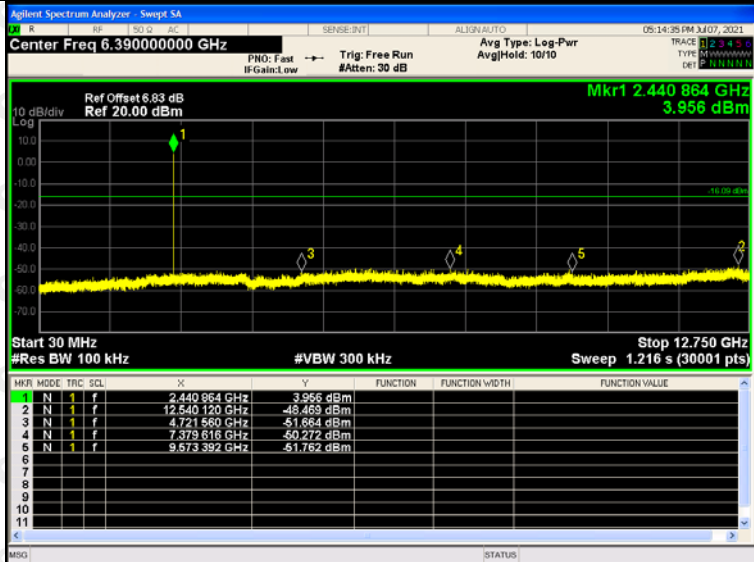


RF Conducted Spurious Emissions Graphs

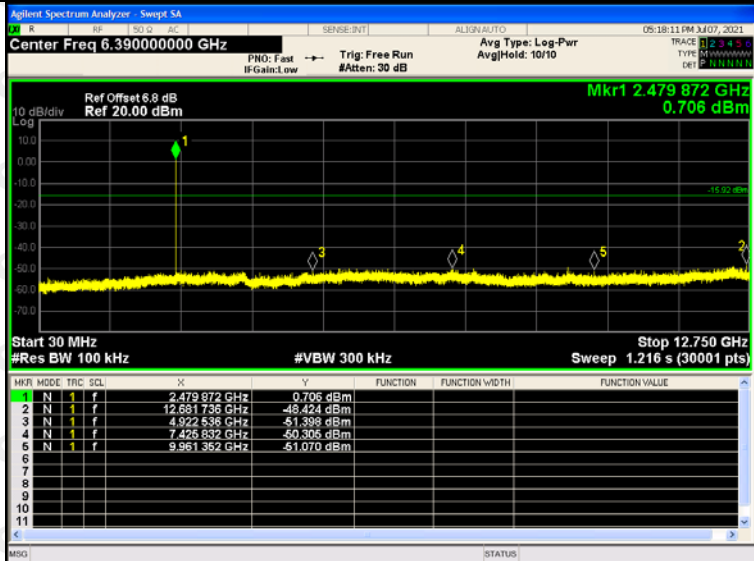
GFSK/LCH

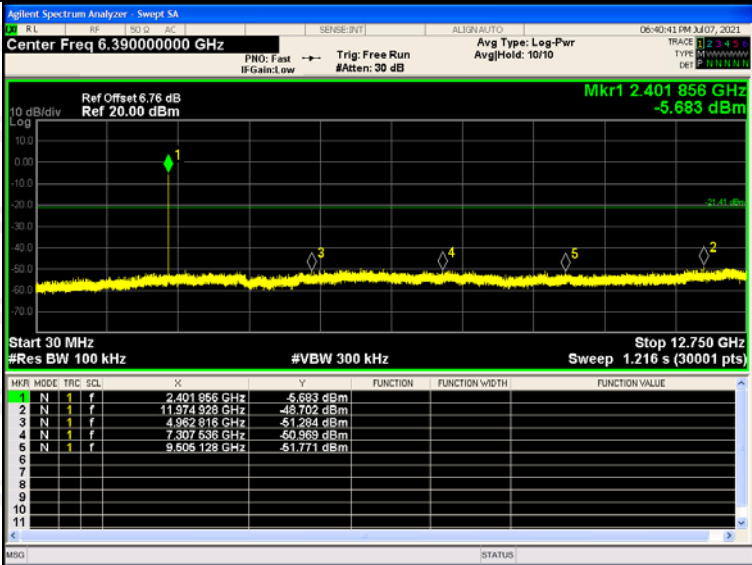
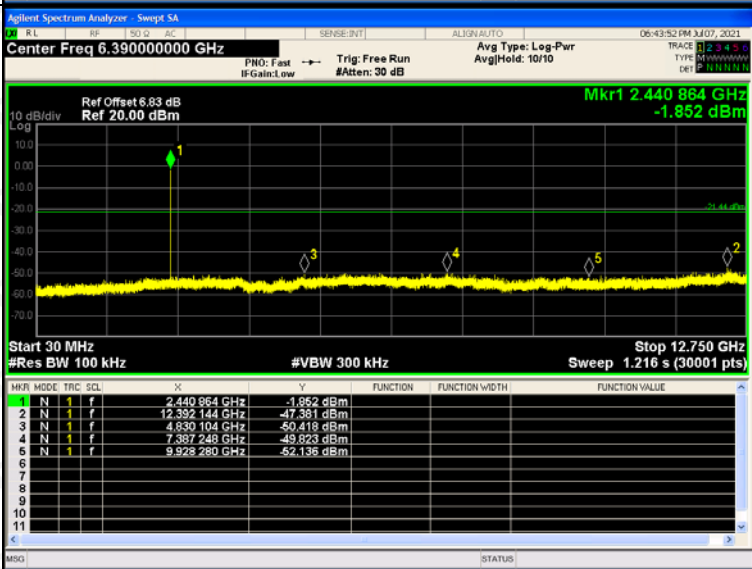
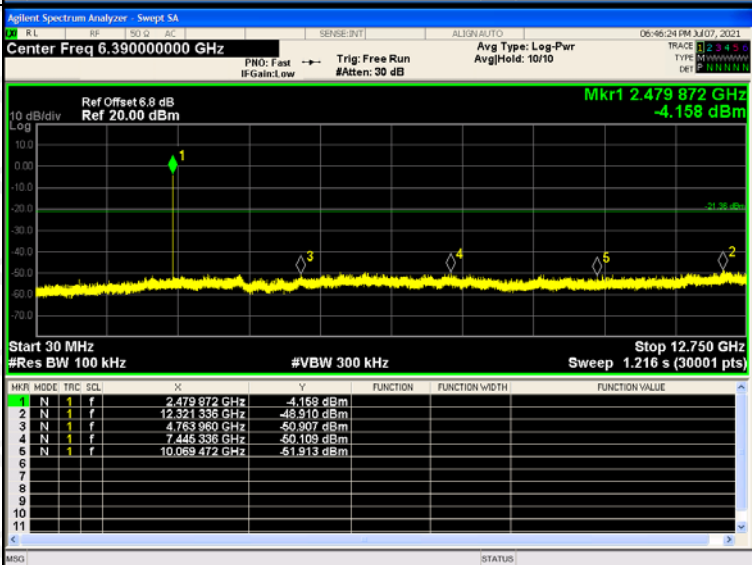


GFSK/MCH

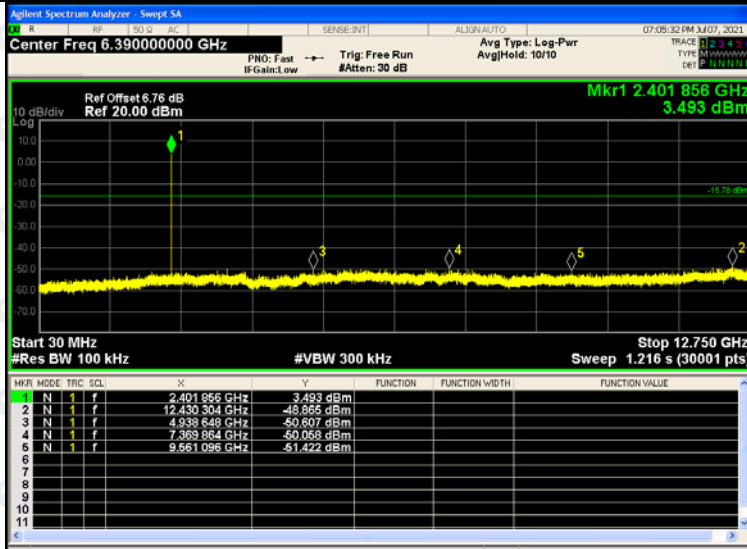


GFSK/HCH

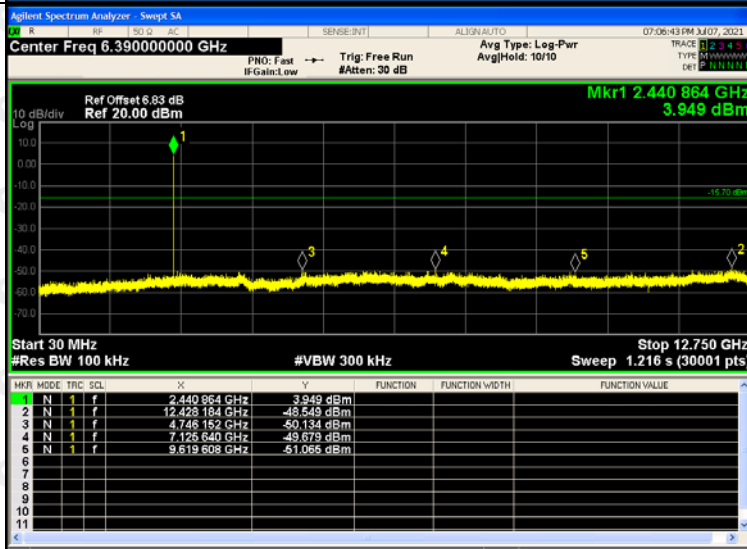


$\pi/4$ DQPSK /LCH	 Agilent Spectrum Analyzer - Sweep SA Center Freq 6.390000000 GHz Ref Offset 6.76 dB Ref 20.00 dBm Mkr1 2.401856 GHz -5.683 dBm Start 30 MHz #Res BW 100 kHz #VBW 300 kHz Stop 12.750 GHz Sweep 1.216 s (30001 pts) <table><tr><th>MKR MODE</th><th>TRC</th><th>SCL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>N</td><td>1</td><td>f</td><td>2.401856 GHz</td><td>-5.683 dBm</td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>f</td><td>11.974528 GHz</td><td>-46.702 dBm</td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>f</td><td>4.962816 GHz</td><td>-51.284 dBm</td><td></td><td></td></tr><tr><td>4</td><td>N</td><td>1</td><td>f</td><td>7.307536 GHz</td><td>-60.969 dBm</td><td></td><td></td></tr><tr><td>5</td><td>N</td><td>1</td><td>f</td><td>9.505128 GHz</td><td>-51.771 dBm</td><td></td><td></td></tr></table>	MKR MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	f	2.401856 GHz	-5.683 dBm			2	N	1	f	11.974528 GHz	-46.702 dBm			3	N	1	f	4.962816 GHz	-51.284 dBm			4	N	1	f	7.307536 GHz	-60.969 dBm			5	N	1	f	9.505128 GHz	-51.771 dBm		
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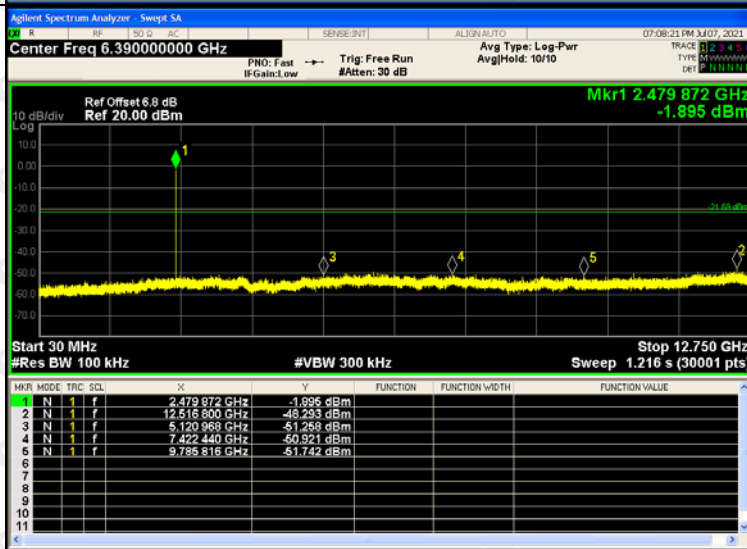
8DPSK /LCH



8DPSK /MCH

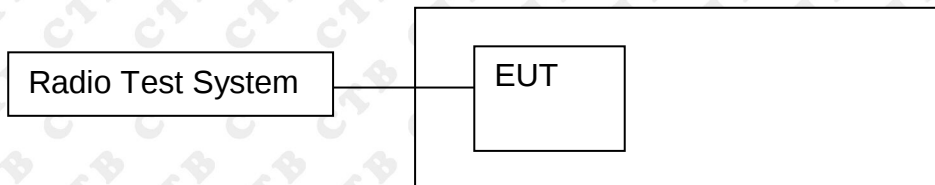


8DPSK /HCH



9. COUDUCTED PEAK OUTPUT POWER

9.1 Block Diagram Of Test Setup



9.2 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.

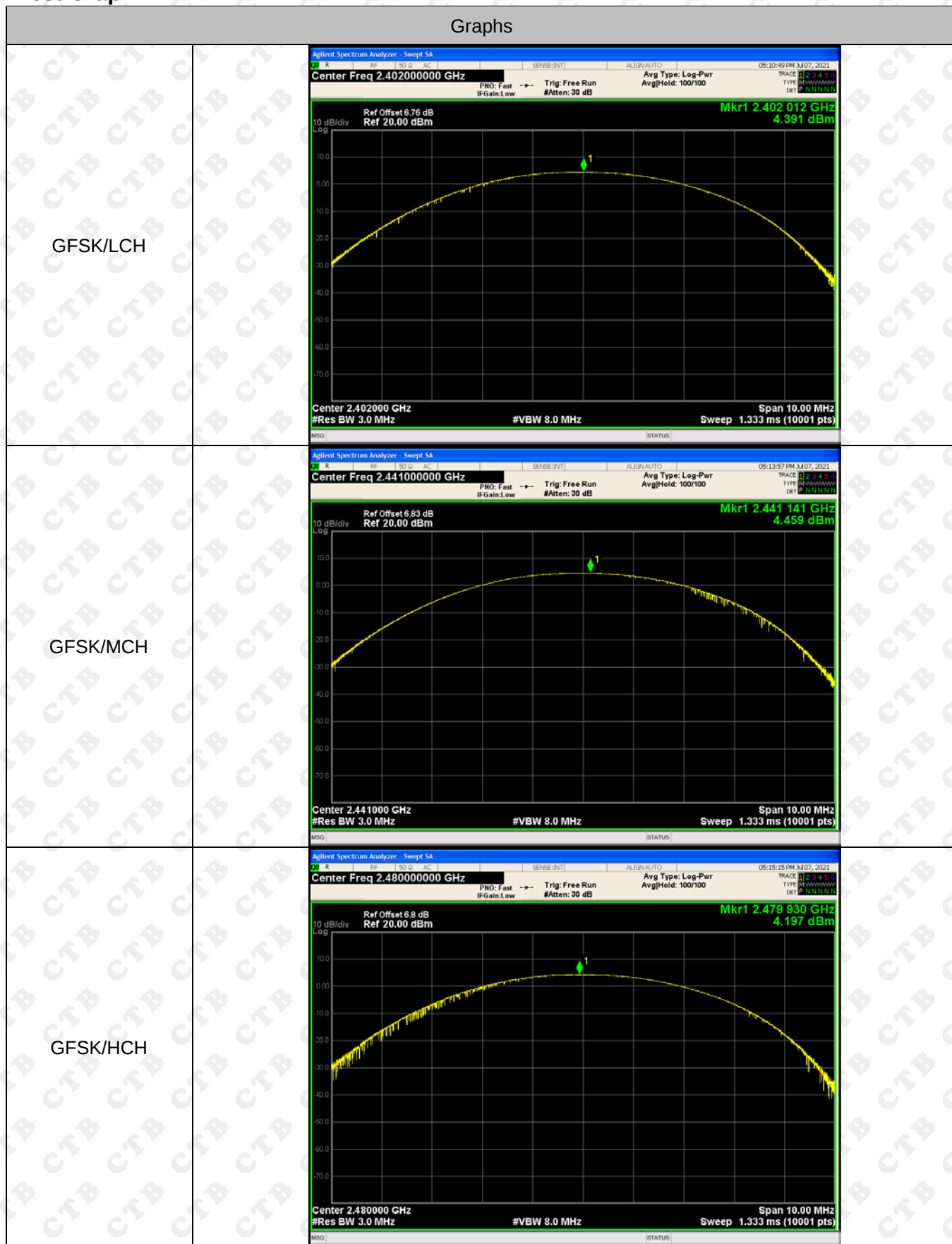
9.3 Test procedure

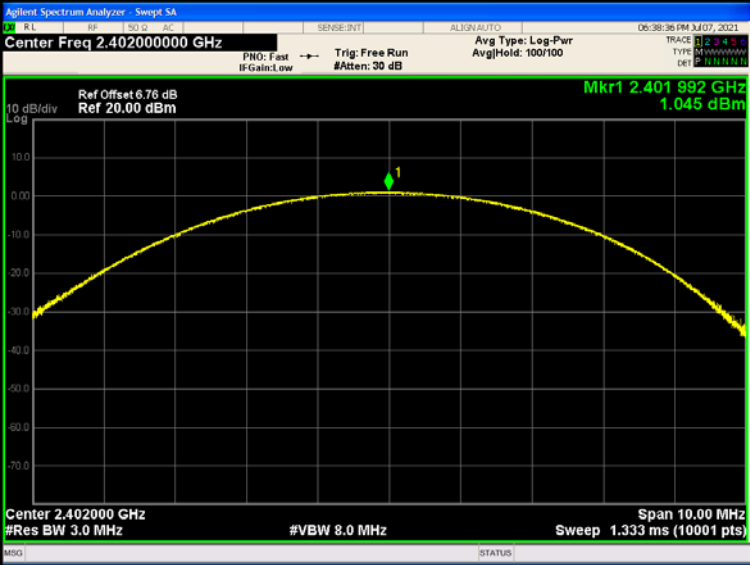
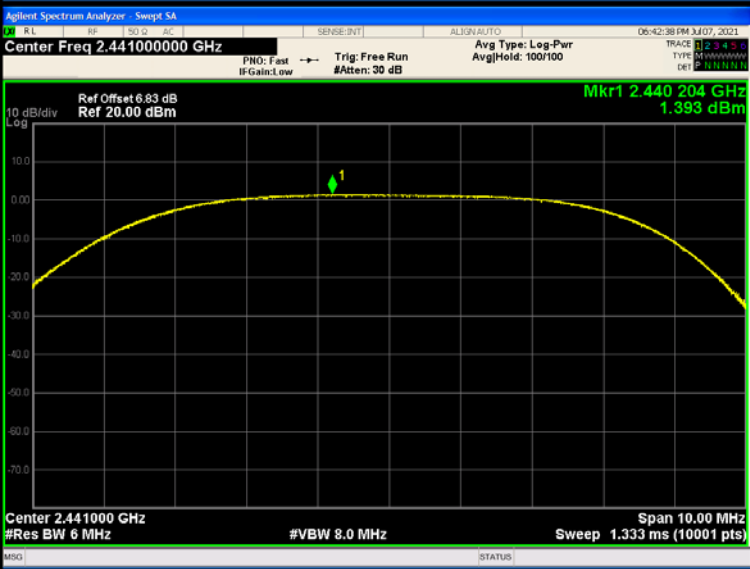
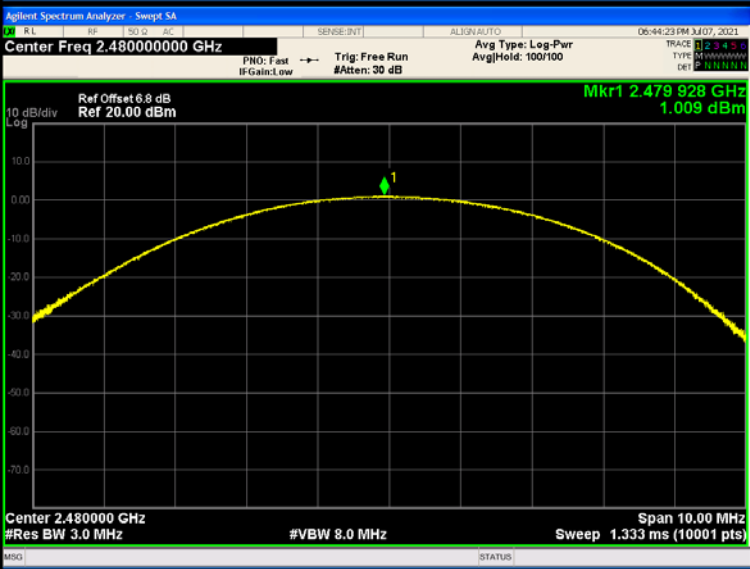
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3MHz. VBW = 8MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, middle and highest channel individually. Record the max value.

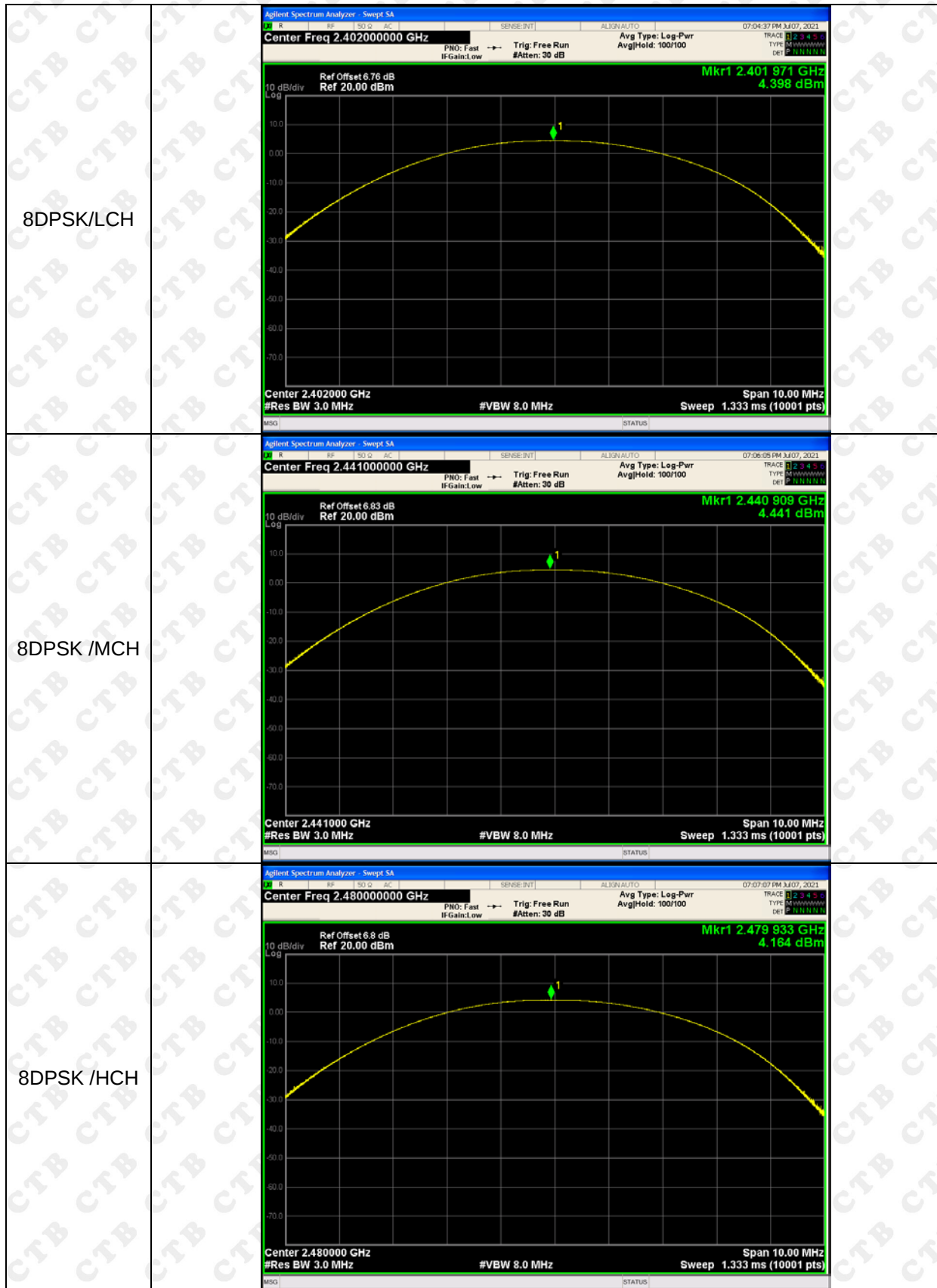
9.4 Test Result

Mode	Channel.	Maximum Peak Output Power [dBm]	Verdict
EDR mode (GFSK)	LCH	4.391	PASS
	MCH	4.459	PASS
	HCH	4.197	PASS
EDR mode ($\pi/4$ DQPSK)	LCH	1.045	PASS
	MCH	1.393	PASS
	HCH	1.009	PASS
EDR mode (8DPSK)	LCH	4.398	PASS
	MCH	4.441	PASS
	HCH	4.164	PASS

Test Graph:

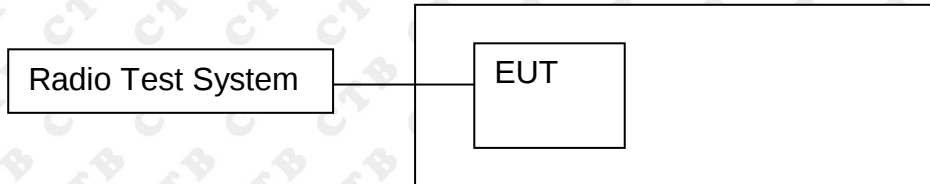


$\pi/4$ DQPSK/LCH	 Agilent Spectrum Analyzer - Swept SA Center Freq 2.40200000 GHz Ref Offset 6.76 dB Ref 20.00 dBm Mkr1 2.401 992 GHz 1.045 dBm Center 2.402000 GHz #Res BW 3.0 MHz #VBW 8.0 MHz Sweep 1.333 ms (10001 pts)
$1/4$ DQPSK/MCH	 Agilent Spectrum Analyzer - Swept SA Center Freq 2.44100000 GHz Ref Offset 6.83 dB Ref 20.00 dBm Mkr1 2.440 204 GHz 1.393 dBm Center 2.441000 GHz #Res BW 6 MHz #VBW 8.0 MHz Sweep 1.333 ms (10001 pts)
$\pi/4$ DQPSK/HCH	 Agilent Spectrum Analyzer - Swept SA Center Freq 2.48000000 GHz Ref Offset 6.8 dB Ref 20.00 dBm Mkr1 2.479 928 GHz 1.009 dBm Center 2.480000 GHz #Res BW 3.0 MHz #VBW 8.0 MHz Sweep 1.333 ms (10001 pts)



10. 20DB OCCUPIED BANDWIDTH

10.1 Block Diagram Of Test Setup



10.2 Limit

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

10.3 Test procedure

1. Rem1. Set RBW = 30 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

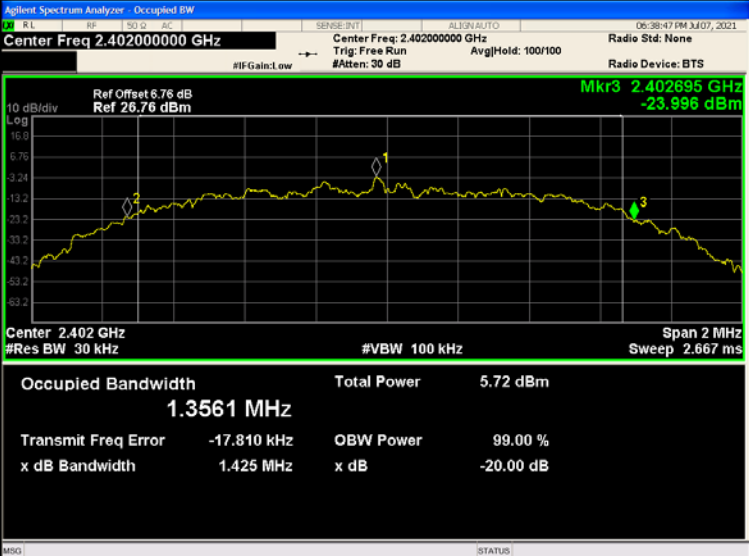
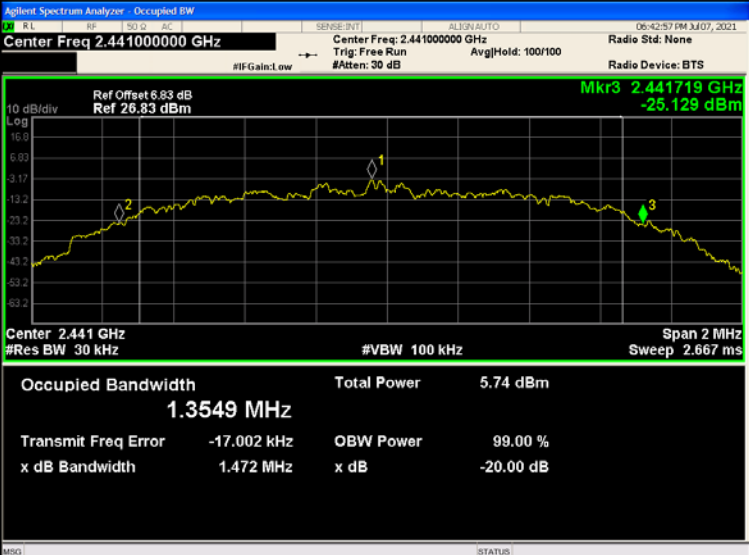
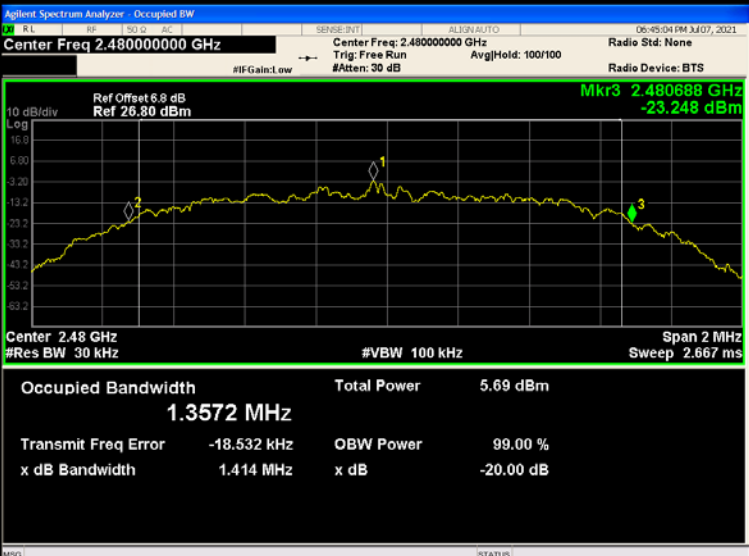
10.4 Test Result

Test Mode	Frequency	20dB Bandwidth (MHz)	Result
GFSK	Low channel	0.936	PASS
	Mid channel	0.858	PASS
	High channel	0.854	PASS
$\pi/4$ DQPSK	Low channel	1.425	PASS
	Mid channel	1.472	PASS
	High channel	1.414	PASS
8DPSK	Low channel	0.971	PASS
	Mid channel	0.958	PASS
	High channel	0.94	PASS

Note: All modes of operation were Pre-scan and the worst-case emissions are reported.

Test Graph:

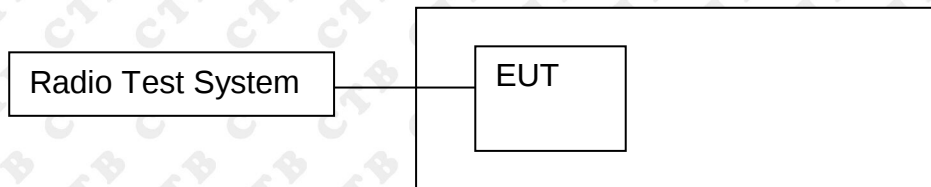
GFSK Low channel	
GFSK Mid channel	
GFSK High channel	

$\pi/4$ -DQPSK Low channel	
$\pi/4$ -DQPSK Mid channel	
$\pi/4$ -DQPSK High channel	

8DPSK Low channel	Agilent Spectrum Analyzer - Occupied BW Center Freq: 2.40200000 GHz Ref Offset: 6.76 dB Ref: 26.76 dBm Mkr3: 2.402469 GHz -17.594 dBm Center: 2.402 GHz #Res BW: 30 kHz #VBW: 100 kHz Span: 2 MHz Sweep: 2.667 ms <table><tr><td>Occupied Bandwidth</td><td>868.30 kHz</td><td>Total Power</td><td>11.0 dBm</td></tr><tr><td>Transmit Freq Error</td><td>-16.596 kHz</td><td>OBW Power</td><td>99.00 %</td></tr><tr><td>x dB Bandwidth</td><td>971.4 kHz</td><td>x dB</td><td>-20.00 dB</td></tr></table>	Occupied Bandwidth	868.30 kHz	Total Power	11.0 dBm	Transmit Freq Error	-16.596 kHz	OBW Power	99.00 %	x dB Bandwidth	971.4 kHz	x dB	-20.00 dB
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x dB Bandwidth	971.4 kHz	x dB	-20.00 dB										
8DPSK Mid channel	Agilent Spectrum Analyzer - Occupied BW Center Freq: 2.44100000 GHz Ref Offset: 6.83 dB Ref: 26.83 dBm Mkr3: 2.441465 GHz -16.875 dBm Center: 2.441 GHz #Res BW: 30 kHz #VBW: 100 kHz Span: 2 MHz Sweep: 2.667 ms <table><tr><td>Occupied Bandwidth</td><td>883.71 kHz</td><td>Total Power</td><td>10.8 dBm</td></tr><tr><td>Transmit Freq Error</td><td>-14.470 kHz</td><td>OBW Power</td><td>99.00 %</td></tr><tr><td>x dB Bandwidth</td><td>958.0 kHz</td><td>x dB</td><td>-20.00 dB</td></tr></table>	Occupied Bandwidth	883.71 kHz	Total Power	10.8 dBm	Transmit Freq Error	-14.470 kHz	OBW Power	99.00 %	x dB Bandwidth	958.0 kHz	x dB	-20.00 dB
Occupied Bandwidth	883.71 kHz	Total Power	10.8 dBm										
Transmit Freq Error	-14.470 kHz	OBW Power	99.00 %										
x dB Bandwidth	958.0 kHz	x dB	-20.00 dB										
8DPSK High channel	Agilent Spectrum Analyzer - Occupied BW Center Freq: 2.48000000 GHz Ref Offset: 6.8 dB Ref: 26.80 dBm Mkr3: 2.480453 GHz -18.218 dBm Center: 2.48 GHz #Res BW: 30 kHz #VBW: 100 kHz Span: 2 MHz Sweep: 2.667 ms <table><tr><td>Occupied Bandwidth</td><td>886.34 kHz</td><td>Total Power</td><td>10.5 dBm</td></tr><tr><td>Transmit Freq Error</td><td>-17.255 kHz</td><td>OBW Power</td><td>99.00 %</td></tr><tr><td>x dB Bandwidth</td><td>940.3 kHz</td><td>x dB</td><td>-20.00 dB</td></tr></table>	Occupied Bandwidth	886.34 kHz	Total Power	10.5 dBm	Transmit Freq Error	-17.255 kHz	OBW Power	99.00 %	x dB Bandwidth	940.3 kHz	x dB	-20.00 dB
Occupied Bandwidth	886.34 kHz	Total Power	10.5 dBm										
Transmit Freq Error	-17.255 kHz	OBW Power	99.00 %										
x dB Bandwidth	940.3 kHz	x dB	-20.00 dB										

11. CARRIER FREQUENCIES SEPARATION

11.1 Block Diagram Of Test Setup



11.2 Limit

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 0.125W.

11.3 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 = 30kHz. VBW = 100kHz , 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.

11.4 Test Result

Mode	Channel.	Carrier Frequency Separation [MHz]	Verdict
GFSK	LCH	0.999	PASS
GFSK	MCH	1.002	PASS
GFSK	HCH	0.999	PASS
$\pi/4$ DQPSK	LCH	1.002	PASS
$\pi/4$ DQPSK	MCH	1.002	PASS
$\pi/4$ DQPSK	HCH	0.999	PASS
8DPSK	LCH	1.002	PASS
8DPSK	MCH	1.002	PASS
8DPSK	HCH	0.999	PASS

Test Graph

Graphs

GFSK/LCH



GFSK/MCH



GFSK/HCH



$\pi/4$ DQPSK/LCH

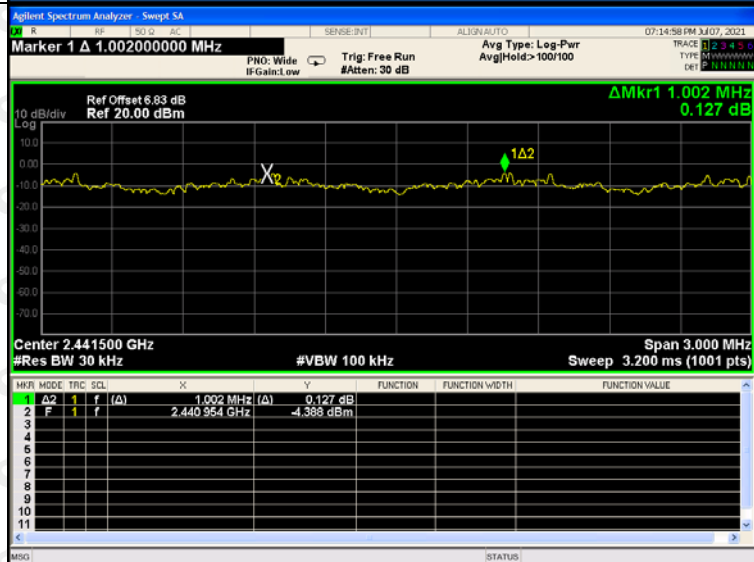
 $\pi/4$ DQPSK/MCH

 $\pi/4$ DQPSK/HCH


8DPSK/LCH



8DPSK /MCH

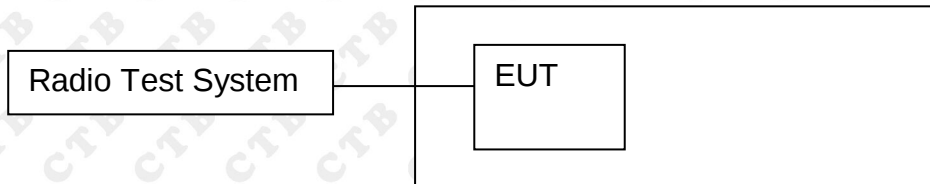


8DPSK /HCH



12. HOPPING CHANNEL NUMBER

12.1 Block Diagram Of Test Setup



12.2 Limit

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

12.3 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 = 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;

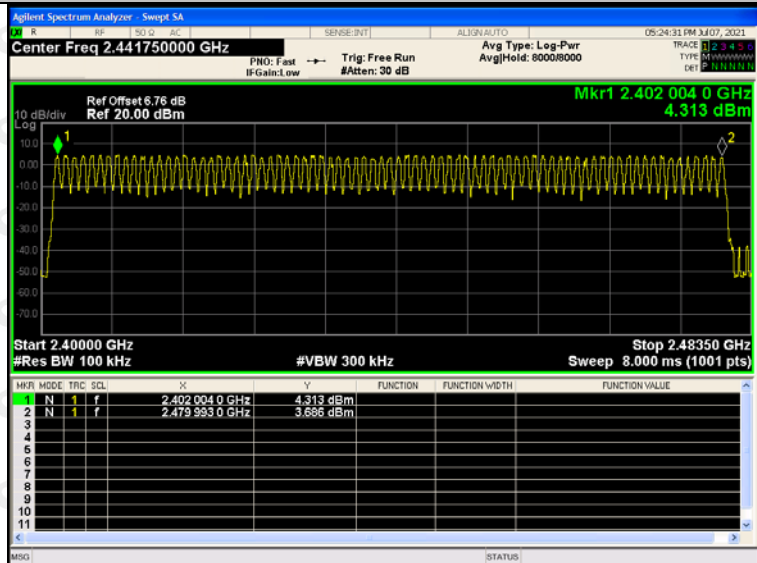
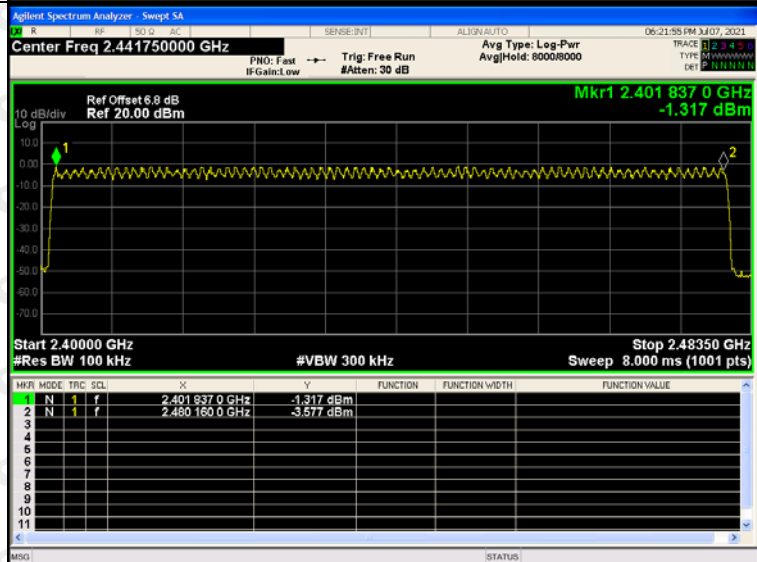
12.4 Test Result

Mode	Channel.	Number of Hopping Channel	Verdict
GFSK	Hop	79	PASS
$\pi/4$ DQPSK	Hop	79	PASS
8DPSK	Hop	79	PASS

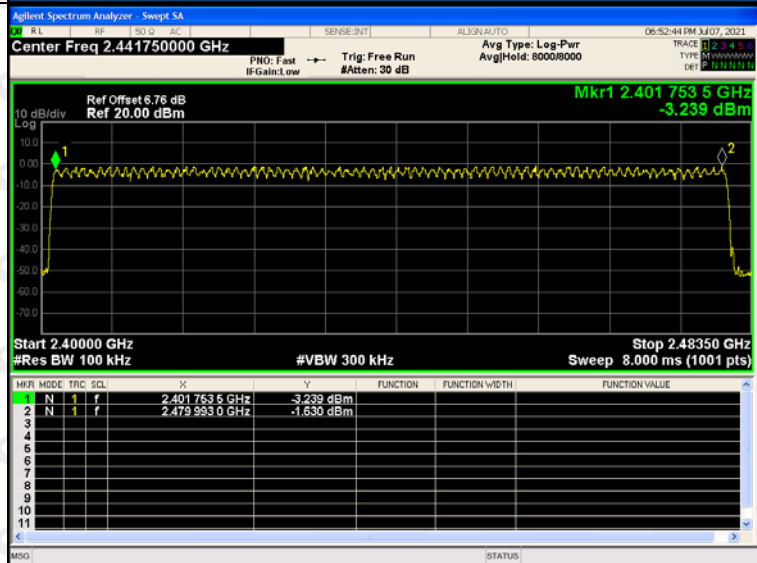
Test Graph

Graphs

GFSK/Hop

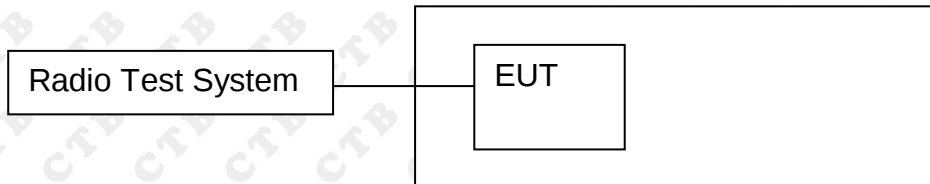
 $\pi/4$ DQPSK/Hop

8DPSK/Hop



13. DWELL TIME

13.1 Block Diagram Of Test Setup



13.2 Limit

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.

13.3 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 spectrum analyzer span = 0. Centred on a hopping channel;
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).

13.4 Test Result

Mode	Packet	Channel	Pulse Time (ms)	Total Dwell Time (ms)	Limit (ms)	Verdict
GFSK	DH1	LCH	0.38	121.6	400	PASS
	DH1	MCH	0.38	121.6	400	PASS
	DH1	HCH	0.379	121.28	400	PASS
	DH3	LCH	1.641	262.56	400	PASS
	DH3	MCH	1.641	262.56	400	PASS
	DH3	HCH	1.641	262.56	400	PASS
	DH5	LCH	2.891	308.373	400	PASS
	DH5	MCH	2.891	308.373	400	PASS
	DH5	HCH	2.892	308.48	400	PASS

Remark: DH5 Packet permit maximum 1600 / 79 / 6 hops per second in each channel (5 time slots RX, 1 time slot TX).

DH3 Packet permit maximum 1600 / 79 / 4 hops per second in each channel (3 time slots RX, 1 time slot TX).

DH1 Packet permit maximum 1600 / 79 / 2 hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

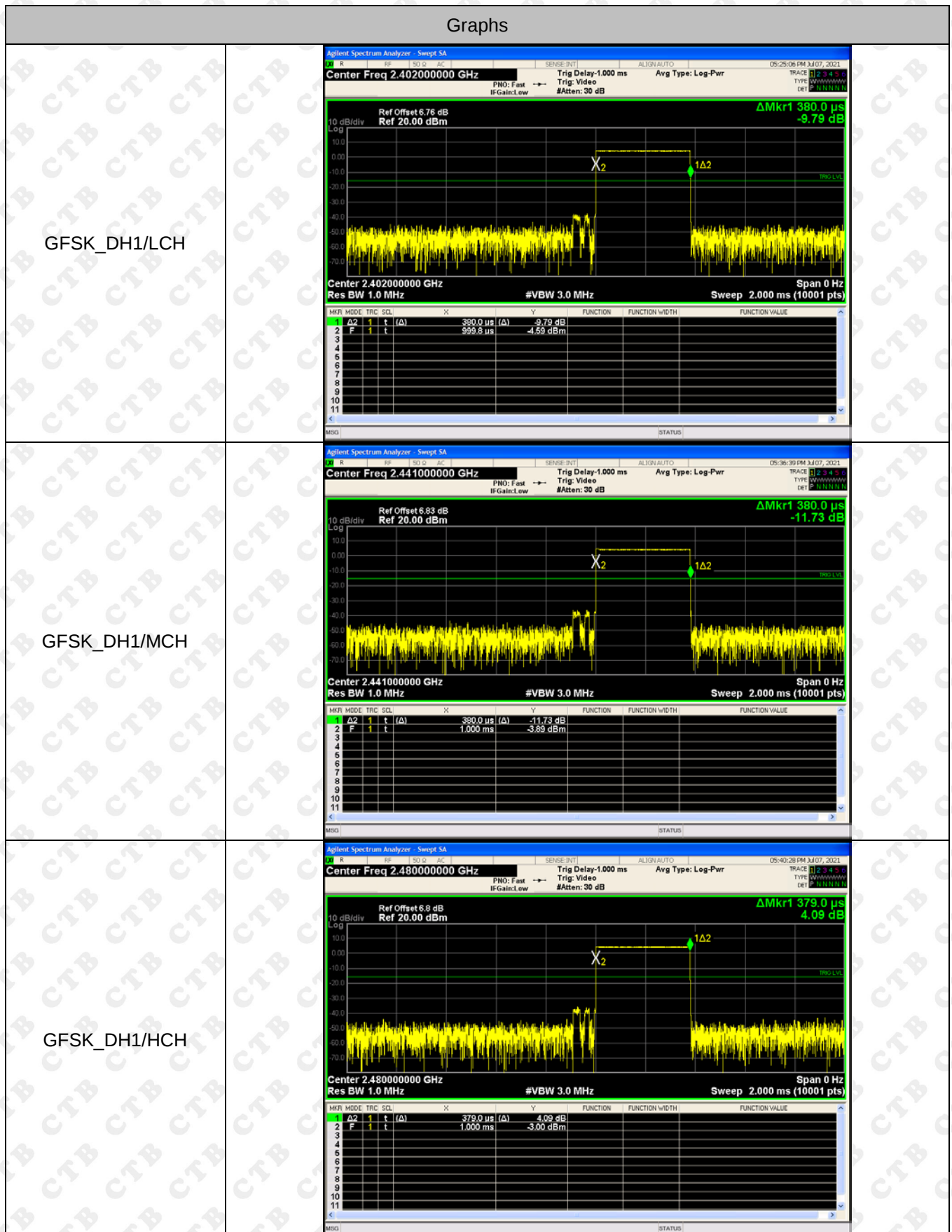
DH5: $1600/79/6*0.4*79*(MkrDelta)/1000$

DH3: $1600/79/4*0.4*79*(MkrDelta)/1000$

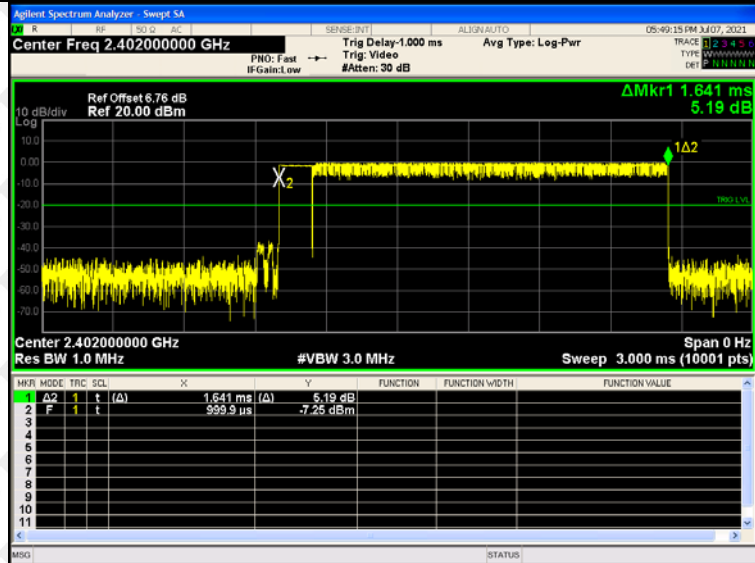
DH1: $1600/79/2*0.4*79*(MkrDelta)/1000$

Remark: Mkr Delta is once pulse time.

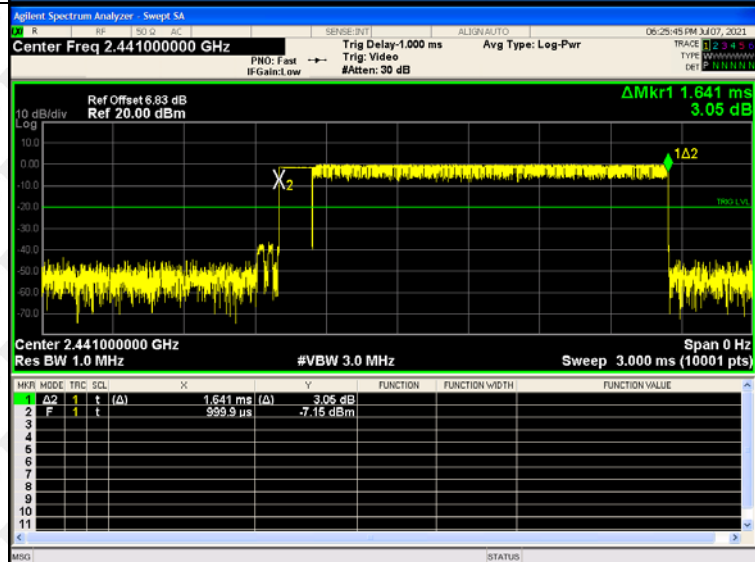
Test Graph



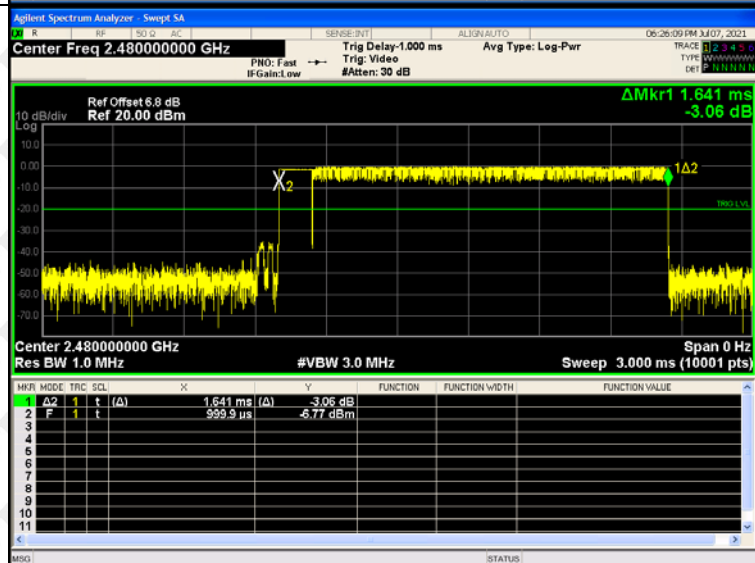
GFSK_DH3/LCH



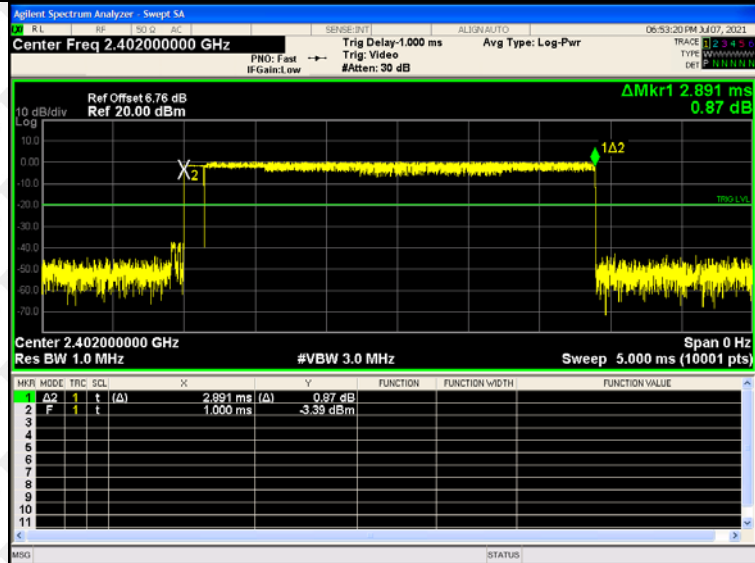
GFSK_DH3/MCH



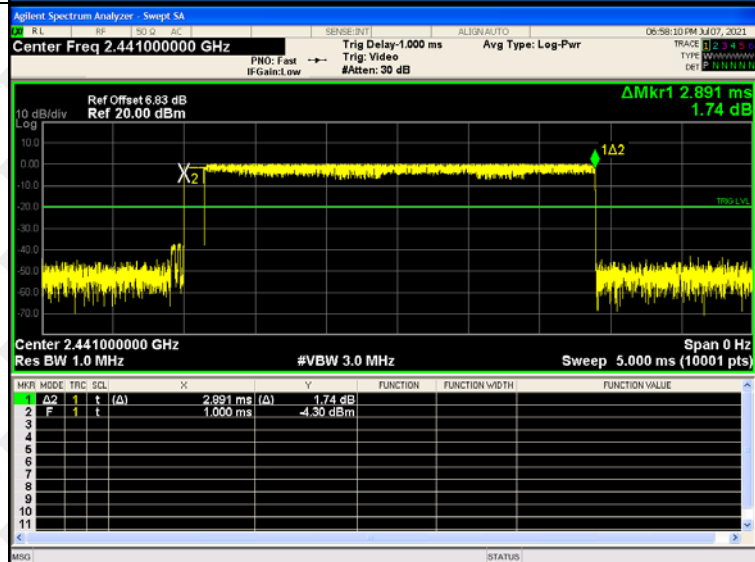
GFSK_DH3/HCH



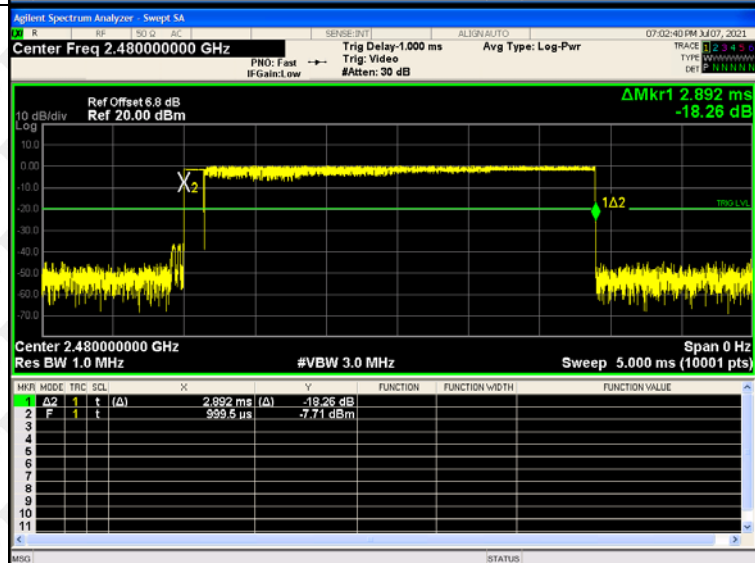
GFSK_DH5/LCH



GFSK_DH5/MCH



GFSK_DH5/HCH



14. PSEUDORANDOM FREQUENCY

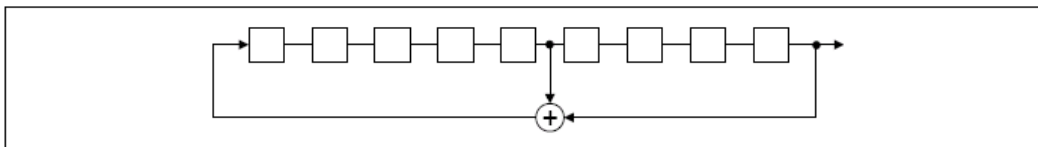
14.1 Limit

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.

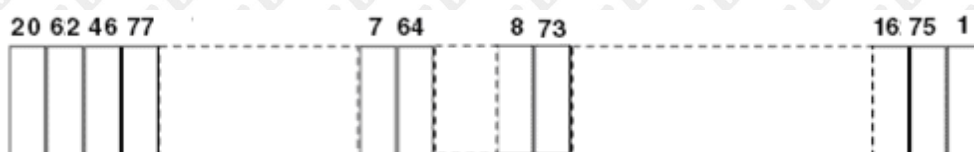
14.2 Test procedure

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: $2^9 - 1 = 511$ bits
- Longest sequence of zeros: 8 (non-inverted signal)



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.

14.3 Test Result

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.

15. ANTENNA REQUIREMENT

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(b) (4) requirement:

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.

EUT Antenna:

The antenna is Internal antenna. The best case gain of the antenna is 1dBi.

16. EUT PHOTOGRAPHS

EUT Photo 1



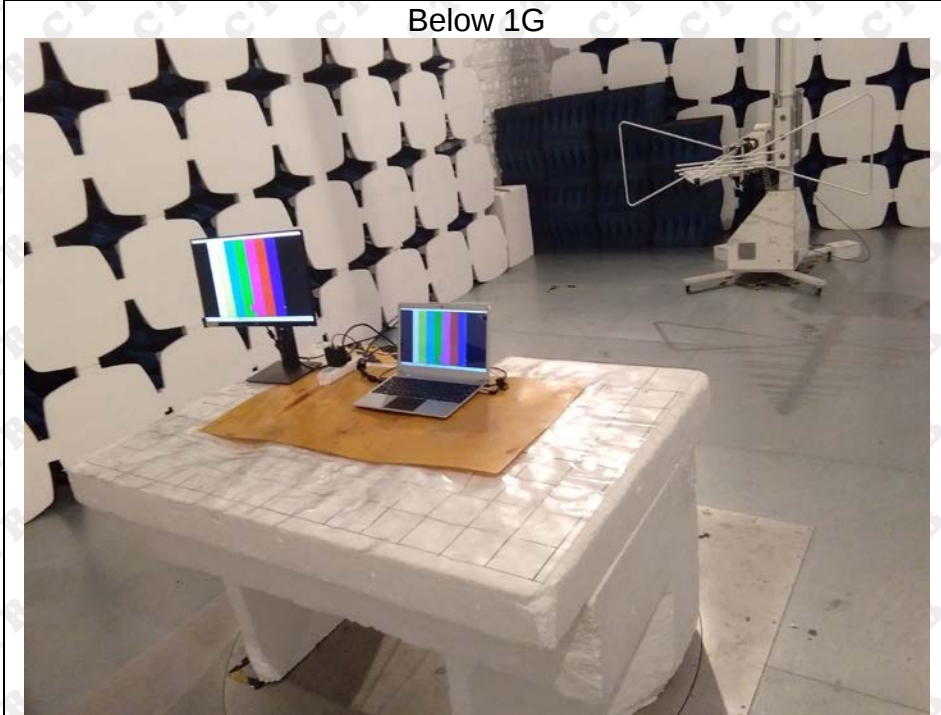
EUT Photo 2



17. EUT TEST SETUP PHOTOGRAPHS

Radiated Emission

Below 1G



Above 1G



Conducted emissions



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