



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	
	Lowest	-2.906			
GFSK	Middle	-2.836	30	Pass	
	Highest	-2.286			
	Lowest	-2.020			
π/4-DQPSK	Middle	-1.904	20.97	Pass	
	Highest	-1.350		100	
	Lowest	-1.390			
8-DPSK	Middle	-1.298	20.97	Pass	
	Highest	-0.766			

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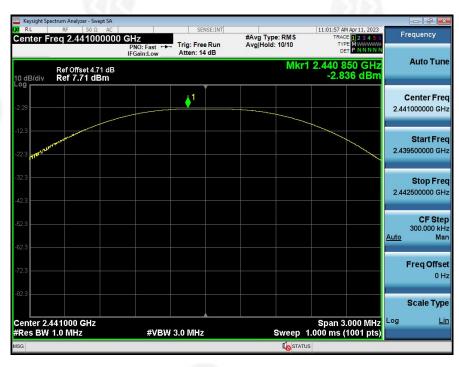


Test plots

GFSK Low Channel

	pectrum Analyzer - Swept SA					
XI RL Center F	RF 50 Ω AC Freq 2.402000000	PNO: Fast ↔	Trig: Free Run Atten: 14 dB	#Avg Type: RMS Avg Hold: 10/10	10:52:30 AM Apr 11, 2023 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P NNNNN	Frequency
10 dB/div	Ref Offset 5 dB Ref 8.00 dBm	I Guilleow		Mkr	1 2.401 835 GHz -2.906 dBm	Auto Tun
-2.00			↓ 1			Center Fre 2.402000000 G⊦
-12.0	Arrow and a second s					Start Fre 2.400500000 G⊦
-32.0						Stop Fre 2.403500000 G⊦
-52.0						CF Ste 300.000 kH <u>Auto</u> Ma
-72.0						Freq Offs 0 F
-82.0						Scale Typ
	402000 GHz 1.0 MHz	#VBW	/ 3.0 MHz	Sweep	Span 3.000 MHz 1.000 ms (1001 pts)	Log <u>Li</u>
MSG				I STAT	US	

GFSK Middle Channel



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GFSK High Channel



$\pi/4\text{-}DQPSK$ Low Channel

3 4 5 6 NNN N GHz Auto Tune	11:11:39 AM Apr11, 2023 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P NNNN	#Avg Type: RMS Avg Hold: 10/10	SENSE:INT	CH2	ectrum Analyzer - Swept SA RF 50 Ω AC	Keysight Sp
3 4 5 5 NNN N GHz Auto Tune	TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P N N N N N			CH2		KL KL
SHZ	0.400.005.000		n: 14 dB	PNO: Fast +++ Irig	req 2.402000000	Center F
	2.402 095 GHz -2.020 dBm	Mkr1			Ref Offset 5 dB Ref 8.00 dBm	10 dB/div
Center Freq 2.402000000 GHz			∳ ¹			-2.00
Start Freq 2.399500000 GHz						-12.0
Stop Freq 2.404500000 GHz						-32.0
CF Step 500.000 kHz <u>Auto</u> Mar						-52.0
Freq Offset 0 Hz						-72.0
Scale Type						-82.0
MHz ^{Log Lin} pts)	Span 5.000 MHz I.000 ms (1001 pts)	Sweep 1	/Hz	#VBW 8.0	402000 GHz 3.0 MHz	Center 2. #Res BW
		STATU:				MSG

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π /4-DQPSK Middle Channel



π /4-DQPSK High Channel





8-DPSK Low Channel

Ref Offset5 dB Mkr1 2.401 925 GHz 200 1	MSG				STATU	IS	4
Ref Offset5 dB Mkr1 2.401 925 GHz 200 -1.390 dBm -200 -1.390 dBm			#VBV	8.0 MHz		1.000 ms (1001 pts)	
Ref Offset 5 dB Mkr1 2.401 925 GHz 200 1	Contor 2	402000 CH2				Spap 5 000 MHz	Loa Li
Center Pred 2.40200000 GH2 PNO: Fast billion Program Avgram Avg	-82.0						Scale Typ
Ref Offset 5 dB Mkr1 2.401 925 GHz 200 1							
Ref Offset5 dB Mkr1 2.401 925 GHz 200 1 <	-72.0						E contractor
Ref Offset 5 dB Mkr1 2.401 925 GHz 200 1	-62.0						
Ref Offset 5 dB Mkr1 2.401 925 GHz 200 1 420 1 420 1							
Ref Offset 5 dB Mkr1 2.401 925 GHz 200 1 320 1	-52.0						
Ref Offset 5 dB Mkr1 2.401 925 GHz 200 1	-42.0						
Ref Offset5 dB Mkr1 2.401 925 GHz 200 1 220 1							
Ref Offset 5 dB Mkr1 2.401 925 GHz 200 1	22.0						
Ref Offset5 dB Mkr1 2.401 925 GHz 2.00 2.00	-22.0						2.399500000 GH
Ref Offset 5 dB Mkr1 2.401 925 GHz 10 dB/div Ref 8.00 dBm	-12.0						Start Fre
Ref Offset 5 dB Mkr1 2.401 925 GHz Log 1							6
Ref Offset 5 dB 0 dB/div Ref Offset 5 dB Ref State Mkr1 2.401 925 GHz -1.390 dBm Auto Tur	-2.00				Mary Mary Mary Mary South Street Stre		
PNC: Fast →→ IFGain:Low Argin Jpe: Nin's Argin Jpe: Nin's Trig: Free Run Argin Jpe: Nin's Trig: Free Run Argin Jpe: Nin's Trig: Pre- Nin Fast →→ Rtten: 14 dB Argin Jpe: Nin's Argin Jpe: Nin's Trig: Pre- Argin Jpe: Nin's Argin Jpe: Nin's Trig: Pre- Nin's Argin Jpe: Nin's Argin Jpe: Nin's Trig: Pre- Bargin Jpe: Nin's Argin Jpe: Nin's Trig: Pre- Bargin Jpe: Nin's Argin Jpe: Nin's	Log			* 1			O sustain Free
PNO: Fast ++ Trig: Free Run Avg Hold: 10/10 Trie PNNNNN IFGain:Low Atten: 14 dB	10 dB/div	Ref Offset 5 dB Ref 8 00 dBm			MKr	-1.390 dBm	Auto Tuli
							Auto Tun
Frequency	Center F	req 2.40200000	0 GHz	Trig: Free Run	#Avg Type: RMS Avg/Hold: 10/10	TRACE 1 2 3 4 5 6 TYPE MWWWWW	Frequency

8-DPSK Middle Channel

	-					
	ectrum Analyzer - Swept SA					
Center F	RF 50 Ω AC Treq 2.441000000) GHz PNO: Fast ↔ IFGain:Low	Trig: Free Run Atten: 20 dB	#Avg Type: RMS Avg Hold: 10/10	11:32:59 AM Apr 11, 2023 TRACE 1 2 3 4 5 0 TYPE MWWWW DET P N N N N N	Frequency
10 dB/div	Ref Offset 4.71 dB Ref 13.71 dBm	I Gam. Low		Mkr	1 2.440 930 GHz -1.298 dBm	Auto Tune
3.71			<u>1</u>			Center Freq 2.441000000 GHz
-6.29						Start Freq 2.438500000 GHz
-26.3						Stop Freq 2.443500000 GHz
-46.3						CF Step 500.000 kHz <u>Auto</u> Man
-66.3						Freq Offset 0 Hz
-76.3						Scale Type
#Res BW	441000 GHz 3.0 MHz	#VBV	/ 8.0 MHz		1.000 ms (1001 pts)	
MSG				I o STAT	US	

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8-DPSK High Channel









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 & π/4-DQPSK & 8DSK: 0.025MHz or 2/3 of the 20dB bandwidth
	(whichever is greater)

9.1 Test Setup

EUT	SPECTRUM
1010607010100 s	ANALYZER

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.





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
π/4-DQPSK	Low	0.999	0.8380	PASS
π/4-DQPSK	Middle	0.996	0.8400	PASS
π/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





GFSK Low Channel



GFSK Middle Channel



GFSK High Channel



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π/4-DQPSK Low Channel



π /4-DQPSK Middle Channel





π/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

EUT	SPECTRUM
	ANALYZER

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

					G	FSK					
	Spectrum Analyzer - Sw					-					×
enter	RF 50 Ω Freq 2.4417	50000 GH	Z NO: Fast ↔ Gain:Low			#Avg Type Avg Hold:	e: RMS 10/10	TRAC TYP	Apr 11, 2023	Frequenc	
dB/div	Ref Offset 4. Ref 7.71 d						ΔMkr	1 78.240 0.	0 MHz 720 dB	Auto	Tune
° X,	ሳ ለ የሌ ለ የ ለ የ ለ ስ ስ ብ ነ	180200646	ሰበብለተሰኑኩ	01.06048	וגווזיייין	አከለተለከብለ	ኮሀዋህበታ	በፈስታልታከብል	102 101	Center 2.441750000	
3										Start	
3										Stop	
3									1.	2.483500000	
									YŲY	8.350000 <u>Auto</u>	Step MH: Mar
										Freq O	o ffse 0 Hi
-										Scale	Туре
	10000 GHz N 100 kHz		#VBW	300 kHz		ę	Sweep 8	Stop 2.48 .000 ms (350 GHz 1001 pts)	Log	Lir
6							I STATUS				

Test Plots: 79 Channels in total

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Lin



Keyaight Spectrum Jenney RL RF 50 Ω AC Center Freq 2.441750000 GHz PNO: Fast → IFGaint.ow 37 AM Apr 11, 2023 TRACE 1 2 3 4 5 #Avg Type: RMS Avg|Hold: 10/10 Frequency Trig: Free Run Atten: 14 dB TYP Auto Tun ΔMkr1 78.240 0 MHz -0.437 dB Ref Offset 4.71 dB Ref 7.71 dBm 0 dB/div **Center Freq** <u>1</u>Δ2 2.441750000 GHz Astronomication and a second water and a second s Start Freq 2.40000000 GHz Stop Free 2.483500000 GHz CF Step 8.350000 MHz Man Auto Freq Offset 0 Hz Scale Type Stop 2.48350 GHz Sweep 8.000 ms (1001 pts) Start 2.40000 GHz #Res BW 100 kHz Log #VBW 300 kHz

8-DPSK

I ST/

	n Analyzer - Swept SA RF 50 Ω AC		SENSE:INT	T	11:36:13 AM Apr 11, 2023	- 7 ×
	2.441750000 G	PNO: Fast	Trig: Free Run Atten: 14 dB	#Avg Type: RMS Avg Hold: 10/10	TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P NNNNN	Frequency
Re 10 dB/div Re	ef Offset 4.71 dB ef 7.71 dBm			ΔMk	r1 78.156 0 MHz 2.110 dB	Auto Tune
-2.29					102 MANNAMM	Center Fred 2.441750000 GH
-12.3						Start Fre 2.400000000 GH
-32.3						Stop Fre 2.483500000 GH
-52.3 					<u>. </u>	CF Ste 8.350000 MH <u>Auto</u> Ma
72.3						Freq Offse 0 H
-82.3						Scale Typ
Start 2.40000 #Res BW 100		#VBW :	300 kHz	Sweep	Stop 2.48350 GHz 8.000 ms (1001 pts)	Log <u>Li</u>

π/4-DQPSK



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

EUT	SPECTRUM
	ANALYZER

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

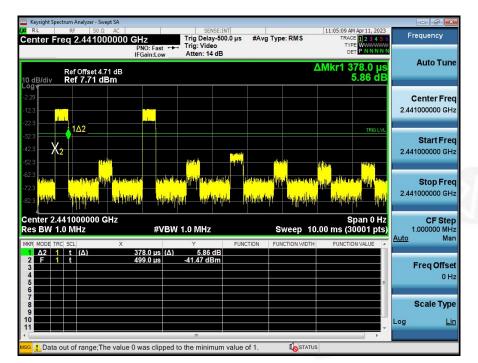
Remarks:

- The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s Test channel: as blow CH:2441MHz time slot=0.378(ms)*(1600/ (2*79))*31.6
 - CH:2441MHz time slot=1.633(ms)*(1600/ (4*79))*31.6
 - CH:2441MHz time slot=2.882(ms)*(1600/ (6*79))*31.6
- 2. We tested all modes and recorded the worst in the report.

Test Plots



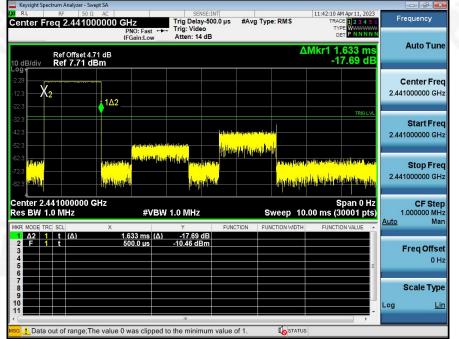
GFSK DH1 2441MHz



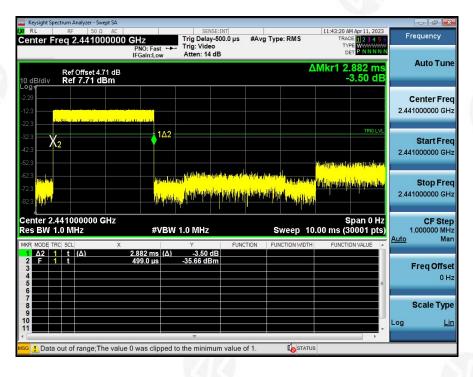




GFSK DH3 2441MHz



GFSK DH5 2441MHz



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12. Antenna Requirement

EUT Antenna:		every 3 dB that the dire		
The antenna is Internal a	antenna, the best c	ase gain of the antennas	s is -0.58 dBi, reference t	o the appendix II for detail:







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 *****

