

8DPSK Low Channel



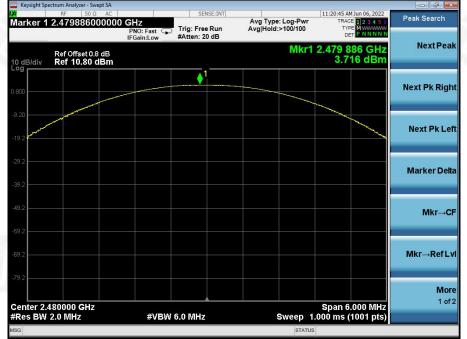
8DPSK Middle Channel







8DPSK High Channel



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

9.1 Test Setup

EUT	SPECTRUM
	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 = 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.





Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	1.160	0.960	PASS
GFSK	Middle	0.998	0.879	PASS
GFSK	High	0.950	0.933	PASS
π/4DQPSK	Low	0.972	0.907	PASS
π/4DQPSK	Middle	1.096	0.910	PASS
π/4DQPSK	High	0.972	0.897	PASS
8DPSK	Low	1.024	0.872	PASS
8DPSK	Middle	1.036	0.899	PASS
8DPSK	High	0.996	0.853	PASS

Test plots GFSK Low Channel

NO: Wide Gain:Low	Atten: 30 dE		1∆2	Mkr1 1.	160 MHz 0.087 dB	Marker T
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						Mari
#VBV	V 300 kHz		Sweep	Span 1.000 ms	2.000 MHz (1001 pts)	
60 MHz (Δ) 10 GHz	∨ 0.087 dB -0.024 dBm	FUNCTION	FUNCTION WIDT	FUNC	TION VALUE	All Markers
						N
	m					2
	0 MHz (Δ)	0 MHz (Δ) 0.087 dB 0 GHz -0.024 dBm	0 MHz (Δ) 0.087 dB 0 GHz -0.024 dBm	Y FUNCTION FUNCTION WIDT 0 MHz (Δ) 0.087 dB -0.024 dBm -0.024 dBm -0.024 dBm -0.024 dBm	#VBW 300 kHz Sweep 1.000 ms 0 MHz Y FUNCTION FUNCTION FUNCTION FUNCTION 0 GHz -0.024 dBm -0.024 dBm -0.024 dBm -0.024 dBm -0.024 dBm	Y FUNCTION FUNCTION WIDTH FUNCTION VALUE 0 MHz (Δ) 0.087 dB - - 0 GHz -0.024 dBm - - -





GFSK Middle Channel



GFSK High Channel







π/4DQPSK Low Channel



π/4DQPSK Middle Channel

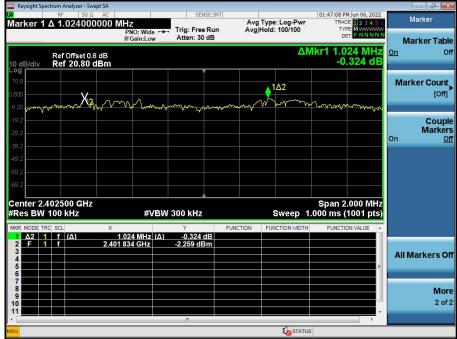
Keysight Spe	ctrum Analyzer - Swept SA						
XI.	RF 50 Ω AC		SENSE:IN	Avg	Type: Log-Pwr Iold: 100/100	01:39:11 PM Jun 06, 2022 TRACE 1 2 3 4 5 TYPE MWWWW	6 Marker
		PNO: Wide ↔ IFGain:Low	Atten: 30 dB	Avgir		DET P NNNN	Select Marker
10 dB/div	Ref Offset 0.8 dB Ref 20.80 dBm				Mkr2	2.440 860 GH -2.416 dBn	
10.8					1Δ2		Norma
9.20 -9.20	mpm m X2m	man	mon	harry	man	an Marina	
-9.20							
-29.2							Delta
-39.2							
-59.2							Fixed
-69.2							
	41500 GHz	-#) (P)			0	Span 2.000 MH	
#Res BW			/ 300 kHz	FUNCTION	Sweep 1	.000 ms (1001 pts	
1 Δ2 1 2 F 1	f (Δ)	1.096 MHz (Δ) 40 860 GHz	1.758 dB -2.416 dBm	TONCTION	TONCHONTMOTH	TONCHOIL VALUE	
3 4							Properties
6							
8							Mor
10							1 of 2
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π/4DQPSK High Channel

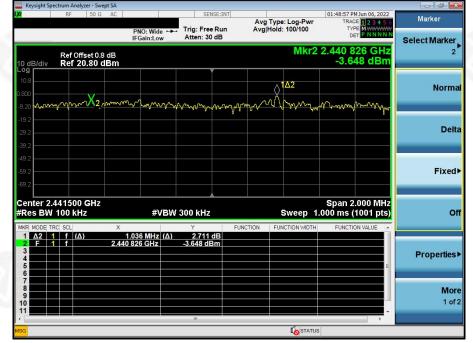


8DPSK Low Channel

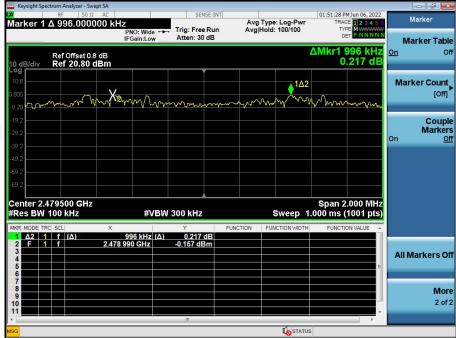




8DPSK Middle Channel



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

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

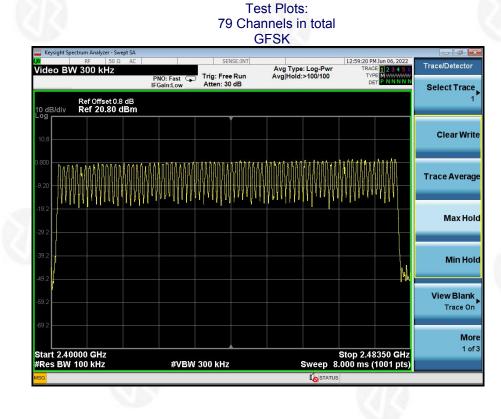
No deviation.



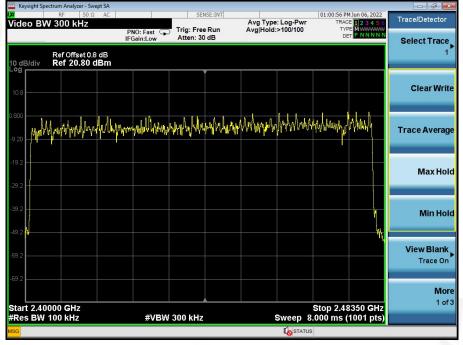


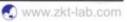
10.4 Test Result





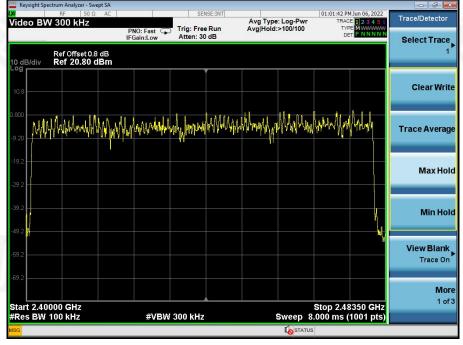
π/4DQPSK







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

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	123.84	400	Pass
2441MHz	DH3	262.08	400	Pass
2441MHz	DH5	307.63	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=0.380(ms)*(1600/ (2*79))*31.6=123.84ms

CH:2441MHz time slot=1.632(ms)*(1600/ (4*79))*31.6=262.08ms

CH:2441MHz time slot=2.860(ms)*(1600/ (6*79))*31.6=307.63ms

π/4-DQPSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	2DH1	123.84	400	Pass
2441MHz	2DH3	262.08	400	Pass
2441MHz	2DH5	307.63	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=0.387(ms)*(1600/ (2*79))*31.6=123.84ms CH:2441MHz time slot=1.638(ms)*(1600/ (4*79))*31.6=262.08ms CH:2441MHz time slot=2.884(ms)*(1600/ (6*79))*31.6=307.63ms

8-DPSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	3DH1	124.16	400	Pass
2441MHz	3DH3	261.76	400	Pass
2441MHz	3DH5	307.84	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=0.388(ms)*(1600/ (2*79))*31.6=124.16ms CH:2441MHz time slot=1.636(ms)*(1600/ (4*79))*31.6=261.76ms CH:2441MHz time slot=2.886(ms)*(1600/ (6*79))*31.6=307.84ms

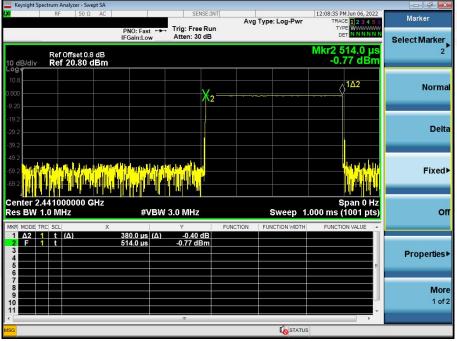






Test Plots

GFSK DH1 2441MHz



GFSK DH3 2441MHz

Keysight Spectrum Analyzer - Swept SA	1 I I I I I I I I I I I I I I I I I I I		1	
Marker 1 Δ 1.63200 ms	SENSE:IN	Avg Type: Log-Pwr	12:14:41 PM Jun 06, 2022 TRACE 1 2 3 4 5 6	Marker
	PNO: Fast +++ Trig: Free Run IFGain:Low Atten: 30 dB		TYPE WWWWW DET NNNNNN	Select Marker
Ref Offset 0.8 dB 10 dB/div Ref 20.80 dBm Log		L	Mkr1 1.632 ms -0.32 dB	1
0.800	X2		1Δ2	Norma
-9.20 -19.2 -29.2				Delta
-39.2 -49.2 -59.2 			dete broattel andere a 1991 - Dete for det andere a	Fixed▷
Center 2.441000000 GHz Res BW 1.0 MHz	#VBW 3.0 MHz	Sweep 3	Span 0 Hz .000 ms (1001 pts)	Of
1 Δ2 1 t (Δ) 2 F 1 t 3 3 4 5 5 6	1.632 ms (Δ) -0.32 dB 744.0 μs -0.74 dBm	FUNCTION		Properties
7 8 9 10				Mor 1 of:
MSG	m	STATU	6	





GFSK DH5 2441MHz

larker 1	AC 2.86000 ms	PNO: Fast ←	SENSE:IN		Type: Log-Pwr	TYPE	1 2 3 4 5 6 WWWWWW N N N N N N	Marker
0 dB/div	Ref Offset 0.8 dB Ref 20.80 dBm	IFGain:Low	Atten: 30 dB		Δ	Mkr1 2.8		Marker Table
0g	X ₂					•1∆2	*	Marker Count [Off]
19.2				9				Couple Markers
39.2 49.2 59.2	terestation in the second s					t deter detter	tipelettett	
^{69.2} Center 2.4 Res BW 1	<mark>LLN , LLN</mark> 441000000 GHz .0 MHz	#VBI	N 3.0 MHz		Sweep 4	Sp .400 ms (1	an 0 Hz 001 pts)	
IKR MODE TR		2.860 ms (Δ	Ƴ -0.06 dB	FUNCTION	FUNCTION WIDTH	FUNCTION	V VALUE	
2 F 1 3 4		717.2 µs	1.64 dBm					All Markers Of
5 6 7 8								Mor
9							-	2 of 2
			m					

π/4DQPSK 2DH1 2441MHz

Keysight Spectrum Analyzer - Swept SA				
Marker 1 Δ 387.000 μs	PNO: Fast +++ Trig: Free Rur	Avg Type: Log-Pwr	12:27:27 PM Jun 06, 2022 TRACE 1 2 3 4 5 6 TYPE WWWWWW	Marker
	IFGain:Low Atten: 30 dB		DET NNNNN	Marker Table
Ref Offset 0.8 dB 10 dB/div Ref 20.80 dBn		Z	Mkr1 387.0 µs -1.62 dB	<u>On</u> Of
10.8		N/	1Δ2	Marker Count
0.800		X2	a na hana a na si	[Off]
-19.2				Coupl
-29.2				On <u>Oi</u>
-49.2	energy of a solution of a second state		and a	
-69.2			<mark>IIII</mark>	
Center 2.441000000 GHz Res BW 1.0 MHz	: #VBW 3.0 MHz	Sweep 1.	Span 0 Hz 000 ms (1001 pts)	
MKR MODE TRC SCL	X Y 387.0 μs (Δ) -1.62 dB	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	
2 F 1 t	559.0 µs 1.65 dBm			All Markers O
4 5 6			E	
7				Mor
10 11				2 of:
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Shenzhen ZKT Technology Co., Ltd. 1/F, No. 101, Building B, No. 6, Tangwei Community Industrial Avenue, Fuhai Street, Bao'an District, Shenzhen, China

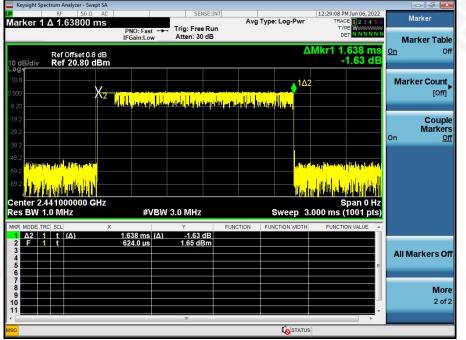
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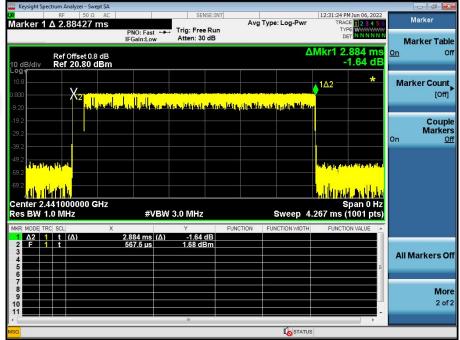




π/4DQPSK 2DH3 2441MHz



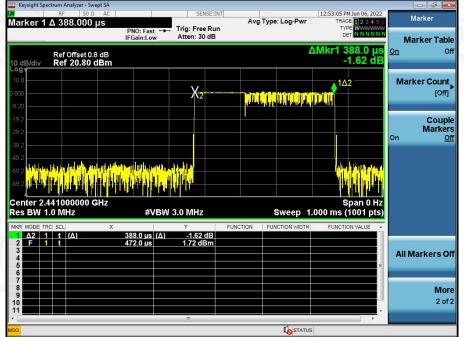
π/4DQPSK 2DH5 2441MHz







8DPSK 3DH1 2441MHz



8DPSK 3DH3 2441MHz

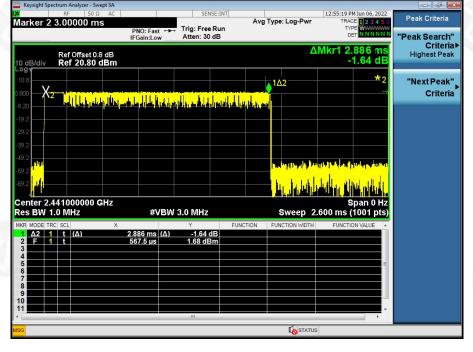
Keysight Spectrum Analyzer - Swept SA						
RF 50 Ω AC	PNO: Fast ↔→ IFGain:Low	Trig: Free Run Atten: 30 dB		Type: Log-Pwr	12:54:53 PM Jun 06, 2022 TRACE 1 2 3 4 5 TYPE WWWWWW DET N N N N N	Marker Marker Table
Ref Offset 0.8 dB 10 dB/div Ref 20.80 dBm					Mkr2 101.0 µs 1.71 dBm	
Logy 10.8 0.800 X2				<u>_</u> 1 <u>∆2</u>	*	Marker Count
-19.2						Couple Markers On <u>Of</u>
-39.2 -49.2 -59.2				n sheath alt be	utititi a tous anim	
-69.2 J Center 2.441000000 GHz Res BW 1.0 MHz	#VBW	3.0 MHz		Sweep 2	Span 0 Hz 600 ms (1001 pts)	
MKR MODE TRC SCL X	1.636 ms (Δ)	Y -1.85 dB	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	
2 F 1 t 3 4 5 5 6 4	101.0 µs	1.71 dBm			E	All Markers O
7 8 9 10 11						Mor 2 of 2
≪ [ш		STATUS		







8DPSK 3DH5 2441MHz











12. Antenna Requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(b)(4)
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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:

(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.

EUT Antenna:

The antenna is SMT Antenna, the best case gain of the antennas is 0dBi, 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 ****



