



Pi/4 DQPSK High Channel

8DPSK Low Channel

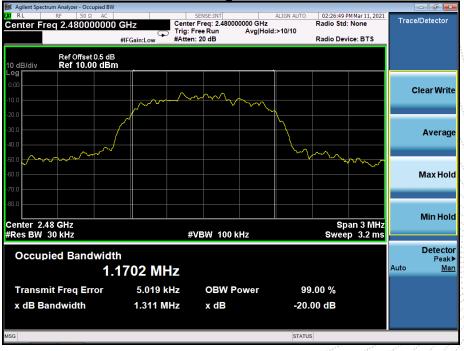






8DPSK Middle Channel

8DPSK High Channel





11. MAXIMUM PEAK OUTPUT POWER

11.1 Block Diagram Of Test Setup



11.2 Limit

FCC Part15 (15.247), Subpart C											
Section	Test Item	Limit	Frequency Range (MHz)	Result							
15.247(b)(1)	Peak Output Power	0.125 watt or 21dBm	2400-2483.5	PASS							

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 = 3MHz. VBW = 3MHz. Sweep = auto; Detector Function = Peak.

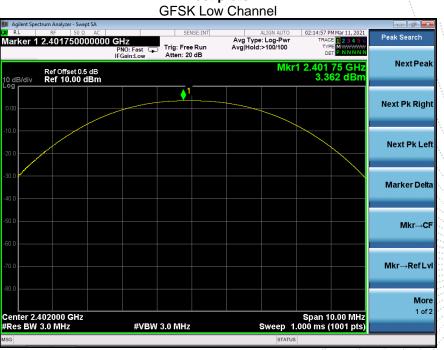
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.



11.4 Test Result

Temperature :	26°C	Relative Humidity:	54%		
Test Voltage :	DC 3.7V	Remark:	N/A		

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	3.362	21
GFSK	Middle	2.720	21
GFSK	High	3.147	21
Pi/4 DQPSK	Low	1.556	21
Pi/4 DQPSK	Middle	0.851	21
Pi/4 DQPSK	High	1.243	21
8DPSK	Low	2.043	21
8DPSK	Middle	1.427	21
8DPSK	High	1.868	21



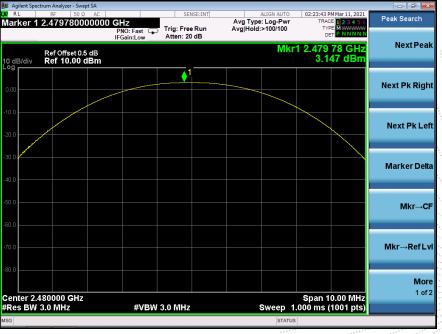
Test plots



📕 Agilent Spectrum Analyzer - Swept SA 🚽					
			ALIGN AUTO		
α RL RF 50 Ω AC Marker 1 2.44076000000	PNO: Fast 😱 Tri	SENSE:INT	Avg Type: Log-Pwr Avg Hold:>100/100	02:23:09 PM Mar 11, 2021 TRACE 1 2 3 4 5 6 TYPE M	Peak Search
	IFGain:Low At	ten: 20 dB	NUL		NextPea
Ref Offset 0.5 dB 0 dB/div Ref 10.00 dBm			IVIKI	1 2.440 76 GHz 2.720 dBm	
		↓ ¹			Next Dis Disch
D.00					Next Pk Righ
10.0					
					Next Pk Le
20.0					
80.0					
40.0					Marker Delf
+0.0					
50.0					Mkr→C
50.0					
70.0					Mkr→RefL
30.0					
					Mor
enter 2.441000 GHz	<i>"</i> "			Span 10.00 MHz .000 ms (1001 pts)	1 of
Res BW 3.0 MHz	#VBW 3.0	WHZ	Sweep 1	.000 ms (1001 pts)	

GFSK Middle Channel

GFSK High Channel





	FI/4 DQF3	SK Low Channe	EI	
Agilent Spectrum Analyzer - Swept SA				
RL RF 50 Ω AC Iarker 1 2.40194000000	O GHZ PNO: Fast Trig: Free Run IFGain:Low Atten: 20 dB	ALIGN AUTO I Avg Type: Log-Pwr Avg Hold:>100/100	D2:16:23 PM Mar 11, 2021 TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N	Peak Search
Ref Offset 0.5 dB 0 dB/div Ref 10.00 dBm	iroan.Low man. Lo up	Mkr1 2	2.401 94 GHz 1.556 dBm	Next Peak
0.00	1			Next Pk Right
				Next Pk Left
30.0				Marker Delta
40.0				
50.0				Mkr→CF
30.0				Mkr→RefLvl
Center 2.402000 GHz	4V/DW/ 2 0 MU-	Succes 1.00	Span 10.00 MHz 0 ms (1001 pts)	More 1 of 2
Res BW 3.0 MHz	#VBW 3.0 MHz	Sweep 1.00	o ms (1001 pts)	

Pi/4 DQPSK Low Channel

Pi/4 DQPSK Middle Channel

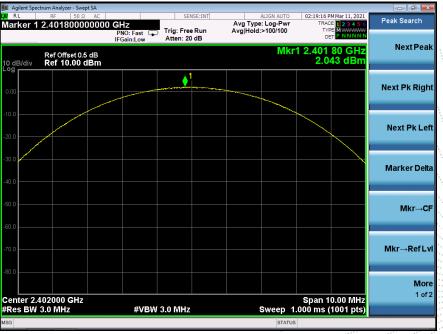




🎉 Agilent Spectrum Ana				it ngn onan		
^ø RL RF Marker 1 2.480	50 Ω AC	GH7	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	02:24:40 PM Mar 11, 2021 TRACE 1 2 3 4 5 6	Peak Search
		PNO: Fast IFGain:Low	Trig: Free Run Atten: 20 dB	Avg Hold:>100/100	TYPE N NNNN DET P NNNNN 1 2.480 08 GHz	Next Peal
Ref C 0 dB/div Ref	offset 0.5 dB 10.00 dBm			WIKI	1.243 dBm	
.og			▲1			
D.00						Next Pk Righ
10.0						
						Next Pk Lei
20.0						
30.0						
40.0						Marker Delt
+0.0						
50.0						Mkr→C
50.0						
70.0						Mkr→RefL
80.0						
						Mor
enter 2.48000					Span 10.00 MHz	1 of:
Res BW 3.0 M	Hz	#VBW	3.0 MHz		.000 ms (1001 pts)	
SG				STATUS		

Pi/4 DQPSK High Channel

8DPSK Low Channel

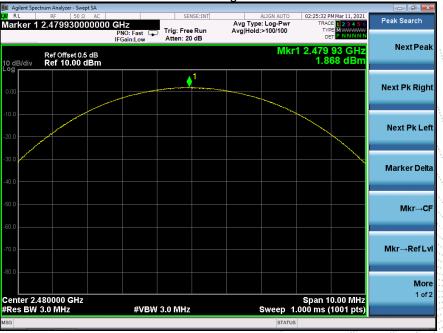




				001						
	um Analyzer - Swept SA									
RL	RF 50 Ω A			SEN	ISE:INT		ALIGN AUTO		M Mar 11, 2021	Peak Search
larker 12	2.4409400000	000 GHZ PNO: I IFGain:	Fast 😱 :Low	Trig: Free Atten: 20		Avg Type Avg Hold:	: Log-Pwr >100/100	TYP	DE 123456 PE MWWWWW ET P NNNNN	
	Ref Offset 0.5 dB Ref 10.00 dBn						Mkr	1 2.440 1.4	94 GHz 27 dBm	Next Pea
				¢	1					Next Pk Righ
10.0										
20.0										Next Pk Le
0.0										
10.0										Marker Delf
60.0										Mkr→C
60.0										WIKI→C
′0.0										Mkr→RefL
.0.0										
Lantar 2.4	44000 CH2							Enon 1		Mor 1 of
enter 2.44 Res BW 3	41000 GHz .0 MHz		#VBW :	3.0 MHz			Sweep 1	- span 1 .000 ms (0.00 MHz (1001 pts)	
SG							STATUS			

8DPSK Middle Channel

8DPSK High Channel





12. HOPPING CHANNEL SEPARATION

12.1 Block Diagram Of Test Setup



12.2 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.

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 = 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.



12.4 Test Result

Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	1.006	0.638	PASS
GFSK	Middle	0.998	0.639	PASS
GFSK	High	1.004	0.629	PASS
Pi/4 DQPSK	Low	1.006	0.896	PASS
Pi/4 DQPSK	Middle	1.000	0.898	PASS
Pi/4 DQPSK	High	0.998	0.898	PASS
8DPSK	Low	0.998	0.872	PASS
8DPSK	Middle	1.004	0.873	PASS
8DPSK	High	1.002	0.874	PASS

Test plots GFSK Low Channel







GFSK Middle Channel

GFSK High Channel







Pi/4 DQPSK Low Channel

Pi/4 DQPSK Middle Channel

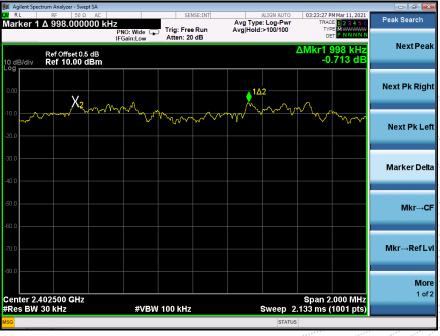






Pi/4 DQPSK High Channel

8DPSK Low Channel

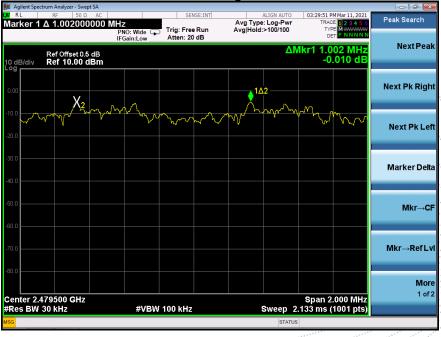






8DPSK Middle Channel

8DPSK High Channel





13. NUMBER OF HOPPING FREQUENCY

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.

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 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.

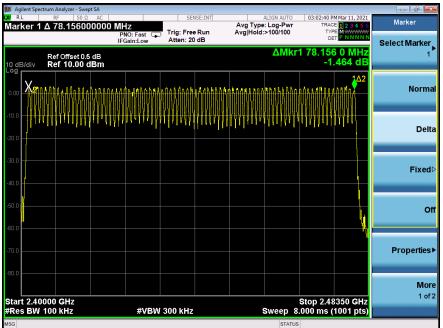
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;



13.4 Test Result

Test Plots:

79 Channels in total GFSK

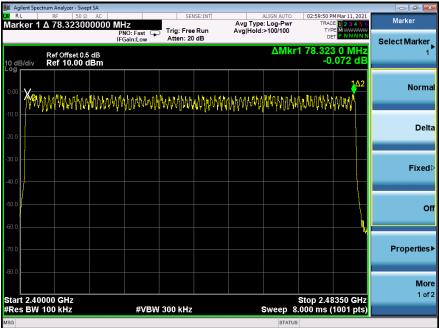


Pi/4 DQPSK

🊺 Agi	ilent Spect	trum Ana	lyzer - Swe	ept SA																		×
LXI RI		RF	ء _{50 (} 0725.			1			SE	NSE:INT		Ava		LIGN AU		03:		PM Mar I CE <mark>1</mark> 2			Marker	
Wan	Ker I	Δ70	.0725	0000	Р		ist 🖵 ow		g: Fre ten: 20			Avg Ho					TY	PE MH ET P N	www	₩	Select Marke	er
10 dE Log	3/div		offset 0. 10.00											ΔN	lkr	1 78		2 5 .53(1
0.00	Y	- 14 - 4	h = 1 / 1																\ ∆2	2	Norr	mal
-10.0	INAN	ΛŴΨ	MMM	μW	WW	ANN.	Mu	WW	WW	MA	WW	VIMVYY	WI,	WWW	U4	Wh	N/M	NW	M_			
-20.0																					De	elta
-30.0	ľ																					
-40.0																					Fixe	ed⊳
-50.0	ļ																		Ì			
																						Off
-60.0																			h	Î.		
-70.0																					Propertie	₽5₽
-80.0																						ore
	t 2.40 s BW					#	VBW	/ 300) kHz				ş	Sweep	5 8 C	Stop .000	o 2.4 ms	8350 (100 ⁷	GH: i pts	z s)	10	of 2
MSG															ATUS	_						_









14. DWELL TIME

14.1 Block Diagram Of Test Setup



14.2 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.

14.3 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).



14.4 Test Result

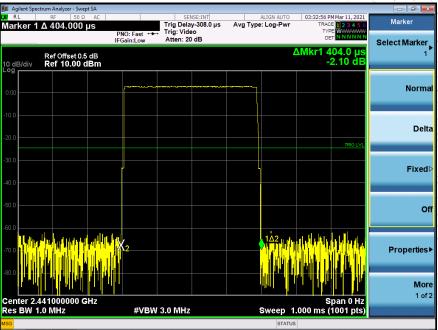
DH5 Packet permit maximum 1600 / 79 / 6 hops per second in each channel (5 time slots RX, 1 time slot TX).

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:

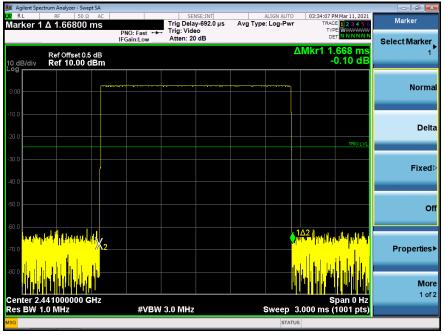
DH5:1600/79/6*0.4*79*(MkrDelta)/1000 DH3:1600/79/4*0.4*79*(MkrDelta)/1000 DH1:1600/79/2*0.4*79*(MkrDelta)/1000 Remark: Mkr Delta is once pulse time.

Modulation	Channel Data	Packet	pulse time(ms)	Dwell Time(s)	Limits(s)
		DH1	0.404	0.129	0.4
GFSK	Middle	DH3	1.668	0.267	0.4
		DH5	2.930	0.313	0.4
		2DH1	0.406	0.130	0.4
Pi/4DQPSK	Middle	2DH3	1.668	0.267	0.4
		2DH5	2.930	0.313	0.4
		3DH1	0.406	0.130	0.4
8DPSK	Middle	3DH3	1.668	0.267	0.4
		3DH5	2.930	0.313	0.4



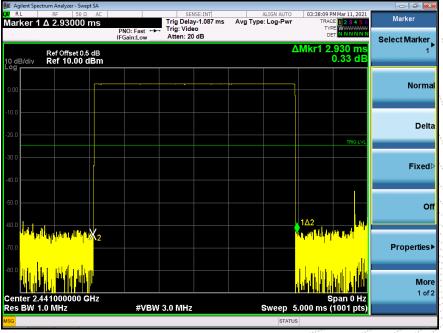
Test Plots GFSK DH1 Middle Channel



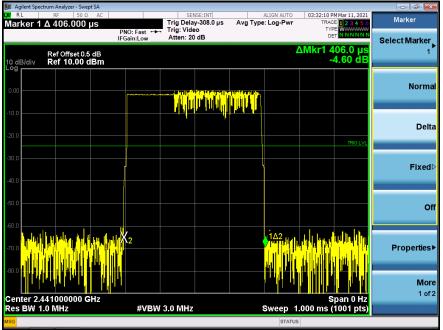


GFSK DH3 Middle Channel

GFSK DH5 High Middle Channel

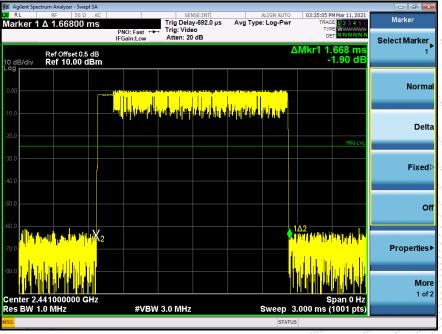




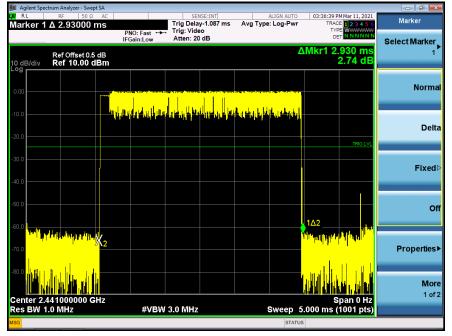


Pi/4DQPSK DH1 Middle Channel

Pi/4DQPSK DH3 Middle Channel

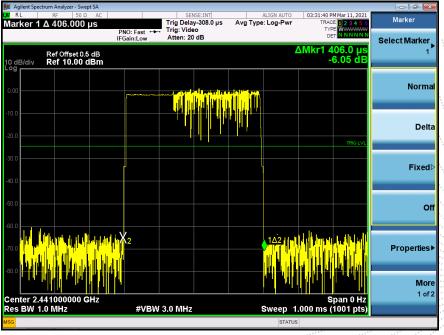




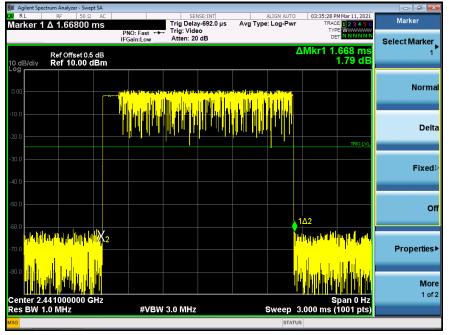


Pi/4DQPSK DH5 Middle Channel

8DPSK DH1 Middle Channel

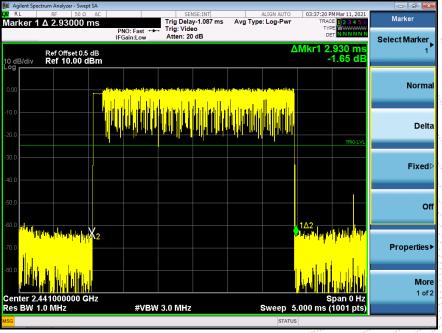






8DPSK DH3 Middle Channel

8DPSK DH5 Middle Channel





15. ANTENNA REQUIREMENT

15.1 Limit

15.203 requirement: For intentional device, according to 15.203: 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.

15.2 Test Result

The EUT antenna is Internal antenna, antenna Gain is -0.38dBi, fulfill the requirement of this section.



16. EUT PHOTOGRAPHS

EUT Photo 1





Page: 65 of 69



EUT Photo 3



EUT Photo 4





17. EUT TEST SETUP PHOTOGRAPHS

Conducted emissions



Radiated Measurement Photos











STATEMENT

1. The equipment lists are traceable to the national reference standards.

2. The test report can not be partially copied unless prior written approval is issued from our lab.

3. The test report is invalid without stamp of laboratory.

4. The test report is invalid without signature of person(s) testing and authorizing.

5. The test process and test result is only related to the Unit Under Test.

6. The quality system of our laboratory is in accordance with ISO/IEC17025.

7.If there is any objection to report, the client should inform issuing laboratory within 15 days from the date of receiving test report.

Address:

1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Tangwei, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China

TEL: 400-788-9558

P.C.: 518103

FAX: 0755-33229357

Website : http://www.bctc-lab.com

E-Mail : <u>bctc@bctc-lab.com.cn</u>

******** END ******

No. : BCTC/RF-EMC-005