

## 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

Lemperature ' 126°		Relative Humidity:	54%	
Test Voltage :	DC 3.7V	Remark:	N/A	

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	-4.114	21
GFSK	Middle	-3.780	21
GFSK	High	-3.895	21
Pi/4 DQPSK	Low	-3.298	21
Pi/4 DQPSK	Middle	-2.990	21
Pi/4 DQPSK	High	-3.052	21

Test plots GFSK Low Channel

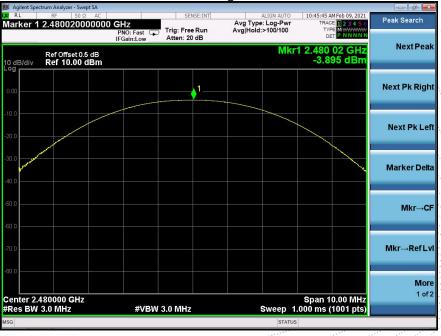




		ddle Channe			
			SENSE:INT	trum Analyzer - Swept SA RF 50 Ω AC	Agilent Spectrun
Peak Search	10:45:16 AM Feb 09, 2021 TRACE 2 3 4 5 6 TYPE M	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100	Trig: Free Run Atten: 20 dB	2.441030000000 GHz PNO: Fast G IFGain:Low	
Next Pea	2.441 03 GHz -3.780 dBm	Mkr		Ref Offset 0.5 dB Ref 10.00 dBm	R DdB/div R
Next Pk Rigi			1		.00
Next Pk Le					0.0
Marker Del					0.0
Mkr→C					).0
Mkr→RefL					
Moi 1 of	Span 10.00 MHz 00 ms (1001 pts)	Sweep 1.	3.0 MHz	141000 GHz 3.0 MHz #VBV	enter 2.447 Res BW 3.0
		STATUS			G

GESK Middle Channel

**GFSK High Channel** 







Pi/4 DQPSK Low Channel

Pi/4 DQPSK Middle Channel





🔰 Agilent Spectrum Analyzer - Swept SA				
α RL RF 50 Ω AC Marker 1 2.479970000000	GHZ PNO: Fast IFGain:Low Atten: 20 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100	10:46:06 AM Feb 09, 2021 TRACE 1 2 3 4 5 0 TYPE M WWWWW DET P N N N N N	Peak Search
Ref Offset 0.5 dB 10 dB/div Ref 10.00 dBm		Mkr	2.479 97 GHz -3.052 dBm	NextPeal
0.00	1			Next Pk Righ
10.0				Next Pk Let
30.0 <b>Martine and Constant</b>				Marker Delt
50.0				Mkr→C
70.0				Mkr→RefL
80.0			Span 10.00 MHz	Mor 1 of
Res BW 3.0 MHz	#VBW 3.0 MHz	Sweep 1.	000 ms (1001 pts)	

Pi/4 DQPSK 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	1.000	0.519	PASS
GFSK	Middle	1.000	0.530	PASS
GFSK	High	1.002	0.521	PASS
Pi/4 DQPSK	Low	1.002	0.821	PASS
Pi/4 DQPSK	Middle	1.000	0.811	PASS
Pi/4 DQPSK	High	1.000	0.807	PASS



### Test plots GFSK Low Channel





#### **GFSK Middle Channel**

**GFSK High Channel** 







#### Pi/4 DQPSK Low Channel

Pi/4 DQPSK Middle Channel





Agilent Spectrum Analyzer - Swept SA				
RL RF 50 Ω AC arker 1 Δ 1.000000000 N		AVG Type:	LIGN AUTO 11:08:44 AM Feb Log-Pwr TRACE	
	PNO: Wide Trig: Free IFGain:Low Atten: 20	Run Avg Hold:>	100/100 TYPE	
Ref Offset 0.5 dB dB/div Ref 10.00 dBm			∆Mkr1 1.000 -0.07	MHz NextPea 6 dB
.00 X	2		1Δ2	Next Pk Rig
	mmmm	www	m purpose	Www. Next Pk Le
.0				Marker De
				Mkr⊸0
				Mkr→RefL
enter 2.479500 GHz Res BW 30 kHz	#VBW 100 kHz		Span 2.00	Mo 0 MHz 1 oto
G G GW JU KHZ	#VOVV TOU KHZ		status	n pisj

### Pi/4 DQPSK High Channel

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## 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

				79		nels FSK	in to	tal		
RL	RF 50 S	2 AC	Ηz				ALIGN AUTO	TRAC	M Feb 09, 2021 E 1 2 3 4 5 6 E M WWWWW	Marker
0 dB/div	Ref Offset 0. Ref 10.00	IF 5 dB	NO: Fast Ģ Gain:Low	Atten: 20		Avginoid.		DE r1 78.15		Select Marker
			C. Mared and						102	Norma
					NADOAN IIIIII				ADADĂ V V V V	Deita
0.0										Fixed
									W	Of
).0 ).0										Properties
	0000 GHz 100 kHz		#VBW	/ 300 kHz			Sweep 8	Stop 2.43 8.000 ms (	8350 GHz 1001 pts)	More 1 of 2
G							STATU	IS		

**Test Plots:** 

Pi/4	DQ	PSK
PI/4	บน	PSK

			yzer - Swej										
XI RL Mari		<sub>RF</sub> Δ 78.	50 Ω 07250	AC				NSE:INT	Avg Type	ALIGN AUTO	TRAC	M Feb 09, 2021	Marker
						0:Fast 🕞 ain:Low	Trig: Fre Atten: 20	e Run ) dB	Avg Hold:	:>100/100	DE		Select Marker
10 dE	3/div		ffset 0.5 1 <b>0.00</b> c							ΔMkr	1 78.072 -0	2 5 MHz .401 dB	1
-og													
0.00	۷									0.010000		1Δ2	Normal
-10.0	APA A	WWW	WW		ЩΝ	NY YUY	¥¥¥¥¥kVVV	NUUUU	10000	WWWW.			
-20.0									a la companya da companya d				Delta
												ļ	
-30.0													Fixed⊵
-40.0									3				
-50.0	ľ			17			-	_	2				Off
-60.0													
-70.0				2									Properties►
-80.0													
Stor	- 1 4 00										Stop 2.40	250 CH-	More 1 of 2
	t 2.400 s BW 1					#VBW	300 kHz			Sweep 8	Stop 2.48 .000 ms (	1001 pts)	
ISG										STATUS			



## 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.

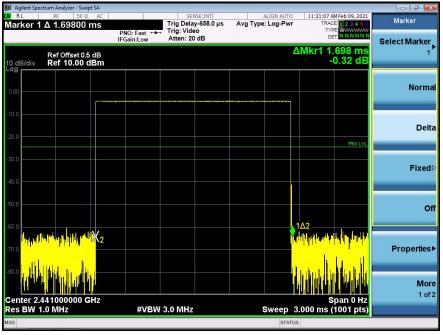
Modulation	Channel Data	Packet	pulse time(ms)	Dwell Time(s)	Limits(s)
		DH1	0.434	0.139	0.4
GFSK	Middle	DH3	1.698	0.272	0.4
		DH5	2.960	0.316	0.4
		2DH1	0.441	0.141	0.4
Pi/4DQPSK	Middle	2DH3	1.704	0.273	0.4
		2DH5	2.950	0.315	0.4



**Test Plots GFSK DH1 Middle Channel** 

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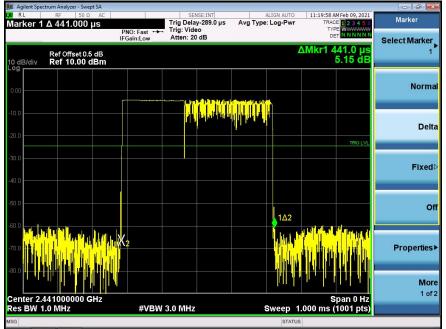


#### GFSK DH3 Middle Channel

#### GFSK DH5 High Middle Channel

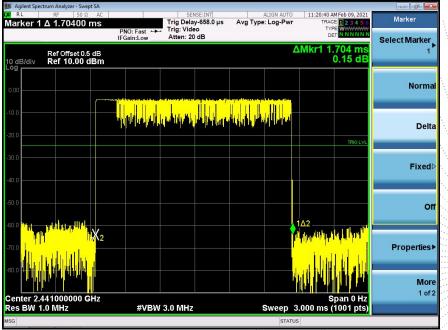




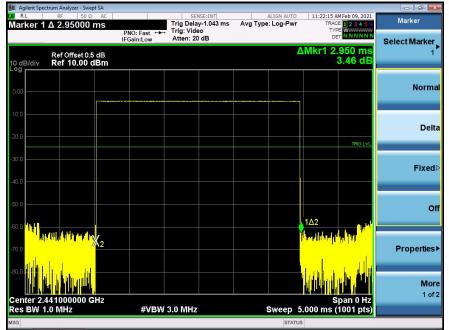


#### Pi/4DQPSK DH1 Middle Channel

### Pi/4DQPSK DH3 Middle Channel







### Pi/4DQPSK DH5 Middle Channel

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## 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 PCB antenna, fulfill the requirement of this section.

Edition: A.3

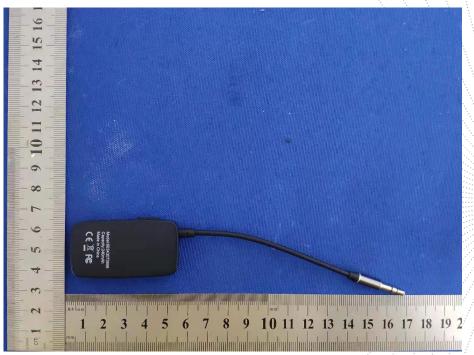


## 16. EUT PHOTOGRAPHS

#### EUT Photo 1



#### **EUT Photo 2**



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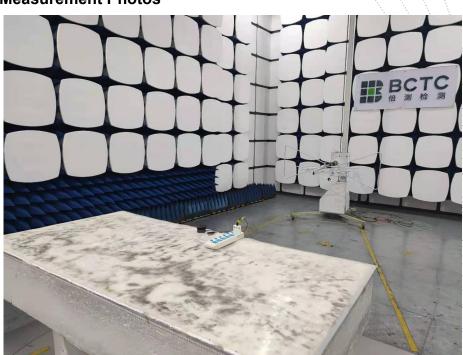


## **17. EUT TEST SETUP PHOTOGRAPHS**

### **Conducted emissions**



**Radiated Measurement Photos** 



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Edition : A.3



# **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.

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

\*\*\*\*\* END \*\*\*\*\*

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