

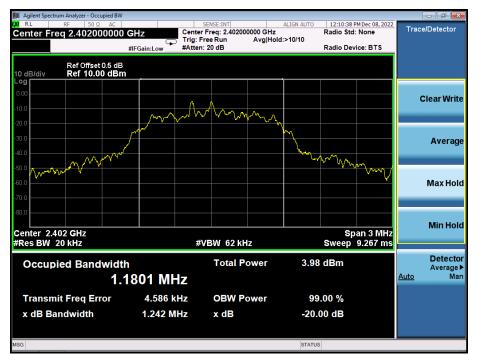
#### GFSK Middle Channel

## **GFSK High Channel**









#### $\pi$ / 4 DQPSK Low Channel

#### $\pi$ / 4 DQPSK Middle Channel







#### $\pi$ / 4 DQPSK High Channel

#### 8DPSK Low Channel





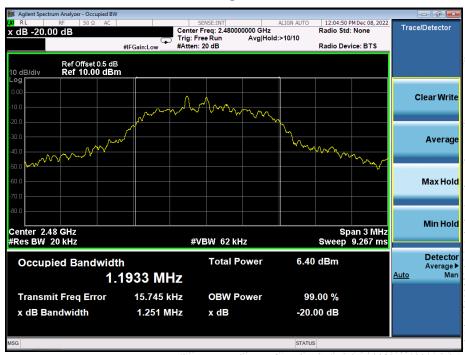






#### **8DPSK Middle Channel**

#### **8DPSK High Channel**





No.: BCTC/RF-EMC-007



# 11. Maximum Peak Output Power

# 11.1 Block Diagram Of Test Setup

EUT	SPECTRUM
	ANALYZER

# 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 = 10MHz. Sweep = auto; Detector Function = Peak.

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

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# 11.4 Test Result

Temperature:	<b>26</b> ℃	Relative Humidity:	54%
Pressure:	101KPa	Test Voltage :	DC 3.7V

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	-1.408	21
GFSK	Middle	0.153	21
GFSK	High	1.140	21
π/ 4 DQPSK	Low	-0.643	21
π/ 4 DQPSK	Middle	0.861	21
π/ 4 DQPSK	High	1.843	21
8DPSK	Low	-0.158	21
8DPSK	Middle	1.316	21
8DPSK	High	2.177	21

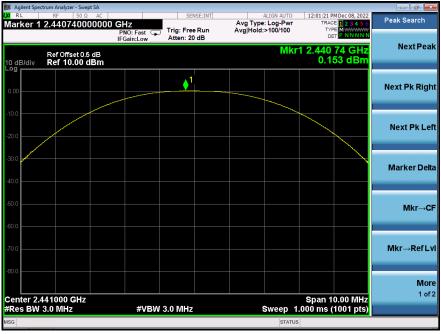
## Test plots GFSK Low Channel



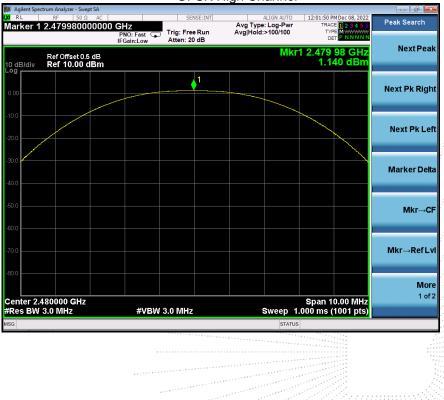
. 00.,175



GFSK Middle Channel



## GFSK High Channel









NextPea	1 71 GHz 643 dBm	1 2.401	Mkr		IFGain:Low	Ref Offset 0.5 dB	
	.643 dBm	-0.6	1			Ref 10.00 dBm	dB/div
Next Pk Righ				<b>↓</b> <sup>1</sup>			00
Next Pk Lei							).0
						A	0.0
Marker Delt							0.0
							).0
Mkr→Cl							).0
							).0
Mkr→RefLv							
Mon							

# π/ 4 DQPSK Low Channel

 $\pi$ / 4 DQPSK Middle Channel





No.: BCTC/RF-EMC-007

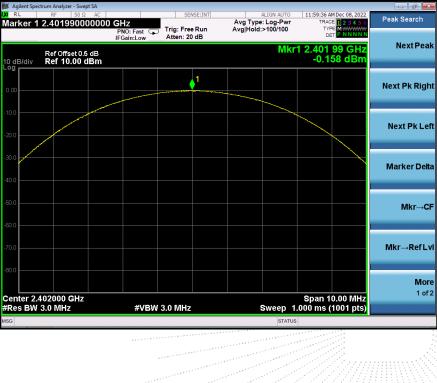




		N High Channel	
📕 Agilent Spectrum Analyzer - Swept SA			
α RL RF 50Ω AC Marker 1 2.479670000000 G	HZ NO: Fast C Trig: Free Run	ALIGN AUTO     12:02:12 PM Dec 08, 2       Avg Type: Log-Pwr     TRACE     1 2 3 4       Avg Hold:>100/100     TYPE     MWWW	5 6 AW
Ref Offset 0.5 dB 0 dB/div Ref 10.00 dBm	Gain:Low Atten: 20 dB	Mkr1 2.479 67 GF 1.843 dB	Next Peak
og 0.00	<u>↓</u> 1		Next Pk Right
			Next Pk Lef
			Marker Delta
0.0			Mkr→Ci
0.0			Mkr→RefLv
enter 2.480000 GHz		Span 10.00 Mi	More 1 of 2
Res BW 3.0 MHz	#VBW 3.0 MHz	Sweep 1.000 ms (1001 p	ts)

#### $\pi$ / 4 DQPSK High Channel

#### 8DPSK Low Channel





Edition: A.5

No.: BCTC/RF-EMC-007





Bill Aglent Spectrum Analyzer - Swept SA     QN RL   RF   50 0 AC   SENSE:INT   ALIGN AUT     Marker 1 2.441030000000 GHz   PNO: Fast   Trig: Free Run   Avg Type: Log-Pr     PNO: Fast   PNO: Fast   Trig: Free Run   Avg Type: Log-Pr     Avg Type: Log-Pr   Avg Type: Log-Pr   Avg Type: Log-Pr     Avg Hold:>100/10   Ref Offset 0.5 dB   N     Log   Avg Hold:>100 dBm   N     000   Image: Avg Type: Log-Pr   Avg Type: Log-Pr     000   Image: Avg Type: Log-Pr   Avg Type: Log-Pr     10 dE/div   Ref Offset 0.5 dB   N     10 dE/div   Ref 0.00 dBm   Image: Avg Type: Log-Pr     100   Image: Avg Type: Log-Pr   Avg Type: Log-Pr     100   Image: Avg Type: Log-Pr   Avg Type: Log-Pr     100   Ref 0.00 dBm   Image: Avg Type: Log-Pr     100   Image: Avg Type: Log-Pr   Avg Type: Log-Pr     100   Ref 0.00 dBm   Image: Avg Type: Log-Pr     100   Image: Avg Type: Log-Pr   Avg Type: Log-Pr     100   Image: Avg Type: Log-Pr   Avg Type: Log-Pr     100   Ref 0.00 dBm   Image: Avg Typ	Wr D0 TRACE II 2 84 56 TYPE Peak Search   Alkr1 2.441 03 GHz 1.316 dBm Next Peak
Marker 1 2.441030000000 GHz PN0: Fast PN0: Fast Trig: Free Run Avg Type: Log-P. Avg Hold:>100/10 Avg Hold:>100/10 Av	Wr D00 TRACE II 2 34 36 DET VIEW MARKEN Search   Alkr1 2.441 03 GHz 1.316 dBm Next Per
	1.316 dBm Next Pk Rig
.10.0	
	Next Pk Le
20.0	
40.0	Marker De
50 0	Mkr→C
70.0	Mkr→RefL
800	Mo Span 10.00 MHz
#Res BW 3.0 MHz #VBW 3.0 MHz Sweep	p 1.000 ms (1001 pts)

# 8DPSK Middle Channel

#### 8DPSK High Channel



TE OVE



# 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.

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## 12.4 Test Result

Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	1.002	0.992	PASS
GFSK	Middle	0.994	0.681	PASS
GFSK	High	1.000	0.684	PASS
π/ 4 DQPSK	Low	1.002	0.828	PASS
π/ 4 DQPSK	Middle	0.998	0.843	PASS
π/ 4 DQPSK	High	0.998	0.851	PASS
8DPSK	Low	1.002	0.806	PASS
8DPSK	Middle	1.000	0.807	PASS
8DPSK	High	1.002	0.834	PASS

Test plots GFSK Low Channel



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#### **GFSK Middle Channel**

## **GFSK High Channel**









	π/ 4 DQF	SK Low Chan	nel	
Agilent Spectrum Analyzer - Swept SA RL RF 50 Ω AC	SENSE:INT	ALIGN AUTO	02:16:09 PM Dec 08, 2022	
larker 1 ∆ 1.002000000 I	PNO: Wide IFGain:Low Atten: 20 dB	Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 1 2 3 4 5 6 TYPE M WWWW DET P NNNNN	Peak Search
Ref Offset 0.5 dB D dB/div Ref 10.00 dBm		ΔΝ	kr1 1.002 MHz 0.094 dB	NextPeal
		<u>1Δ2</u>		Next Pk Righ
20.0			. Mart	Next Pk Lef
0.0				
0.0				Marker Delt
0.0				Mkr→Ci
0.0				
0.0				Mkr→RefLv
00.0				
enter 2.402500 GHz			Span 2.000 MHz	Mor 1 of 2
Res BW 30 kHz	#VBW 100 kHz	Sweep 2.	133 ms (1001 pts)	
6G		STATUS		

π/ 4 DQPSK Low Channel

 $\pi$ / 4 DQPSK Middle Channel





No.: BCTC/RF-EMC-007





Agilent Spectrum Analyzer - Swept SA       R L     RF     50 Ω     AC		SENSE:INT	ALIGN AUTO	02:19:47 PM Dec 08, 2022	Peak Search
arker 1 ∆ 998.000000 k	PNO: Wide	rig: Free Run tten: 20 dB	Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 1 2 3 4 5 6 TYPE MWWWW DET P NNNNN	
Ref Offset 0.5 dB			,	∆Mkr1 998 kHz 0.086 dB	Next Peak
					Next Pk Righ
		$\sim \sim $		$\sim$	Next Pk Le
0.0					Marker Delt
0.0					Mkr→C
0.0					Mkr→RefL
0.0					Mor
enter 2.479500 GHz Res BW 30 kHz	#VBW 10	0 kHz	Sweep 2	Span 2.000 MHz 133 ms (1001 pts)	1 of

#### π/ 4 DQPSK High Channel

#### **8DPSK Low Channel**











8DPSK Middle Channel

#### **8DPSK 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

				G	FSK				
Agilent Spectrum Analy	zer - Swept SA								
RL RF	50 Ω AC		SEN	SE:INT		ALIGN AUTO		PM Dec 08, 2022	Marker
larker 1 ∆ 78.	156000000	PNO: Fast	Trig: Free	Run	Avg Type Avg Hold:	: Log-Pwr :>100/100	TY	CE 1 2 3 4 5 6 PE M ********* ET P N N N N N	
		IFGain:Low	Atten: 20				D	ET P N N N N N	Select Marker
						ΛMk	1 78 15	6 0 MHz	
DdB/div Ref 1	fset 0.5 dB 0.00 dBm							.643 dB	•
	0.00 0.011								
								<u>1</u> ∆2	
				hart				B & L = N Å	Norma
1100664 PM	านสงสถาสถาสถาสไปได้	ነበልል ከበልል በበላ	httanaßt	KAAAAAA	KRADADAAN	140.0	TIMUAAAAA	INARA/	
0.0 4 411 414	A PARA ANA ANA ANA ANA ANA ANA ANA ANA ANA	I AAAYDUU	e fa privere.	ի չի յերեւ	U A A A A A A A A A A A A A A A A A A A	YRYRY (L	YUUYIUYI	1401101	
	U KAU VY KATA	YNUUUUUU	ITTY TURY.	A FLAMA LA	WWWWW	1111111	ALLA RUL	U Y Y Y Y Y	
	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	181811111	1.11.1	100.0	a ha	11	I STARKS		Delta
0.0									
									Fixed
0.0									
0.0								V I	Of
1									
0.0									
0.0									Properties
									•
0.0									
0.0									
									More
tart 2.40000 GI	17						Ston 24	8350 GHz	1 of 2
Res BW 100 kl		#VBW	300 kHz			Sweep_{	8.000 ms	8350 GHz (1001 pts)	
						STATU			

**Test Plots:** 79 Channels in total

			ĸ	DQPS	π/ 4						
Marker	PM Dec 08, 2022 CE 1 2 3 4 5 6 (PE M ***********************************	02:13:34 P TRAC TYF DE	ALIGN AUTO : Log-Pwr >100/100				HZ PNO: Fast ⊊ Gain:Low	AC   DOOOO MI	um Analyzer - Swe RF 50 Ω <b>78.0725</b>	L	XI RI
Select Marker	2 5 MHz I.697 dB	1 78.07: 1	ΔMkr					5 dB	Ref Offset 0. Ref 10.00	B/div	10 dE
Norma	102 WMM	WWW.N	MMM	ANNAN	MANN	AAAAAA	Inanuana (	IARAANNI I	0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0	X	og 0.00
Delt		le le le		1 P. 14		10 ° 1 10 ° 1	Act II ward	aftan Jû AN.	103994944444 1	9   V	10.0 20.0
Fixed										 	30.0 40.0
o										/ 	50.0
Properties											0.0 0.0
Mor 1 of	8350 GHz	Stop 2,41							00 GHz	t 2.4 <u>0</u>	:0.0 tar
	(1001 pts)	000 ms (	Sweep 8. STATUS			300 kHz	#VBW		00 kHz		
				and the second sec	المعنى المعنى						



8DPSK X RL RF 50 Ω2 AC Marker 1 Δ 78.156000000 MHz ALIGN AUTO Avg Type: Log-Pwr Avg|Hold:>100/100 Marker PNO: Fast IFGain:Low Trig: Free Run Atten: 20 dB Select Marker ΔMkr1 78.156 0 MHz 0.665 dE Ref Offset 0.5 dB Ref 10.00 dBm 0 dB/div Normal MANAN Delta **Fixed**▷ Off Properties► More 1 of 2 Stop 2.48350 GHz Sweep 8.000 ms (1001 pts) Start 2.40000 GHz #Res BW 100 kHz #VBW 300 kHz



No.: BCTC/RF-EMC-007

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# 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

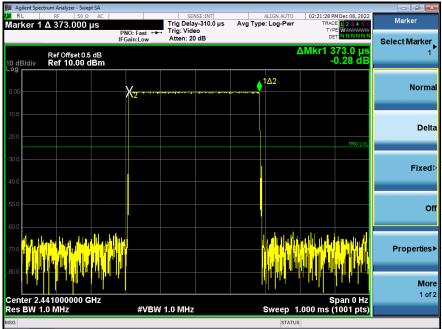
DH3:1600/79/4\*0.4\*79\*(MkrDelta)/1000

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)
GFSK	Middle	1DH1	0.373	0.119	0.4
		1DH3	1.620	0.259	0.4
		1DH5	2.870	0.306	0.4
π/ 4 DQPSK	Middle	2DH1	0.384	0.123	0.4
		2DH3	1.632	0.261	0.4
		2DH5	2.880	0.307	0.4
8DPSK	Middle	3DH1	0.385	0.123	0.4
		3DH3	1.623	0.260	0.4
		3DH5	2.885	0.308	0.4

Test Plots GFSK DH1 Middle Channel



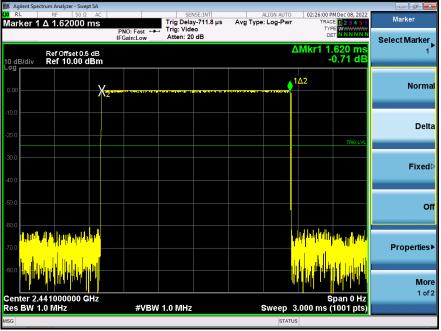
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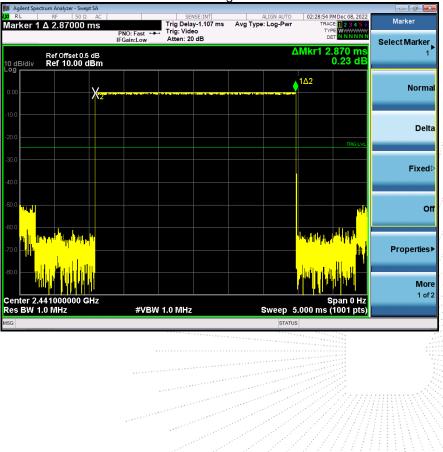
No.: BCTC/RF-EMC-007



GFSK DH3 Middle Channel



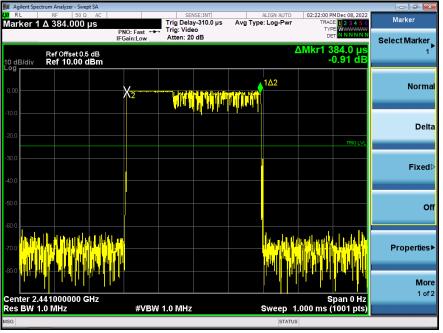
GFSK DH5 High Middle Channel



No.: BCTC/RF-EMC-007

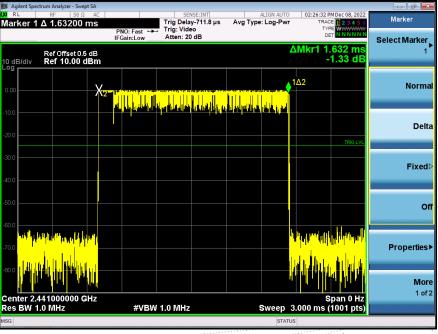
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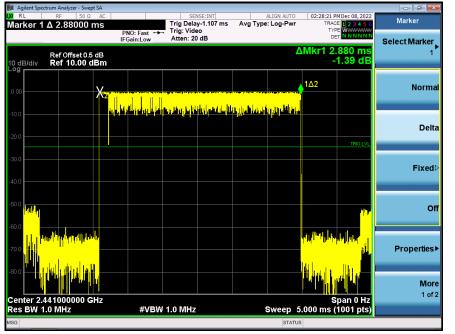
#### π/ 4 DQPSK DH1 Middle Channel

#### $\pi$ / 4 DQPSK DH3 Middle Channel



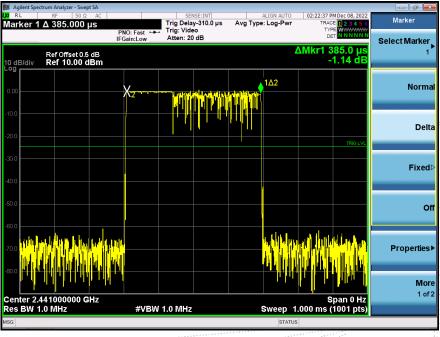
No.: BCTC/RF-EMC-007





#### π/ 4 DQPSK DH5 Middle Channel

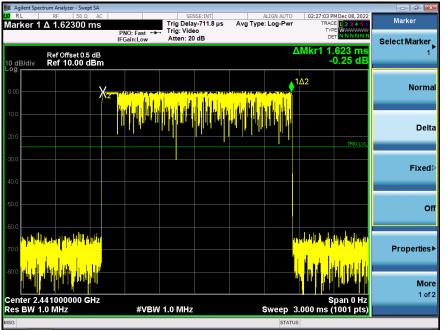
#### 8DPSK DH1 Middle Channel



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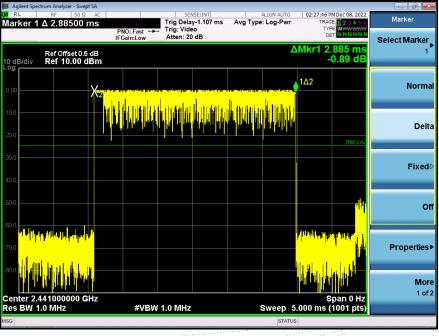
No.: BCTC/RF-EMC-007





8DPSK DH3 Middle Channel

#### 8DPSK DH5 Middle Channel







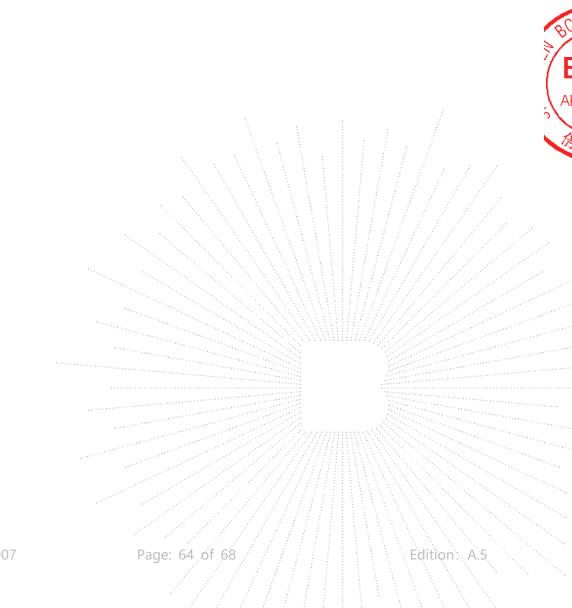
# 15. Antenna Requirement

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





# 16. EUT Photographs





NOTE: Appendix-Photographs Of EUT Constructional Details

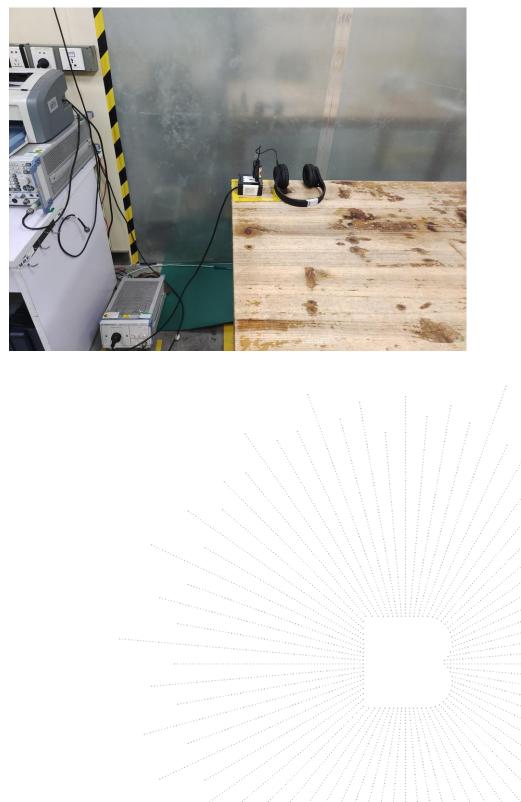






# 17. EUT Test Setup Photographs

Conducted emissions



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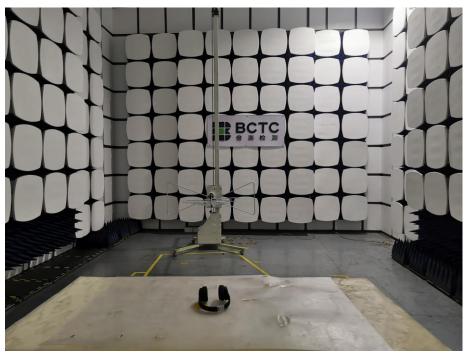
Edition: A.5

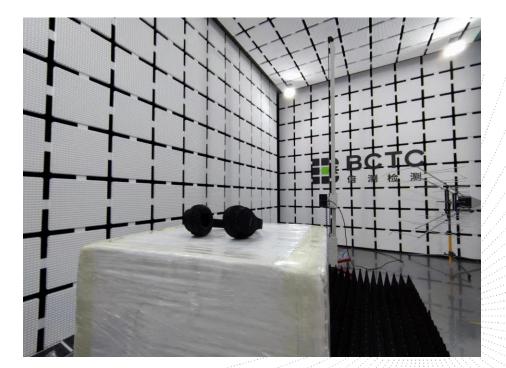
ΤΕ, **Τ**(

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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 the "special seal for inspection and testing".

4. The test report is invalid without the signature of the approver.

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

6. Sample information is provided by the client and the laboratory is not responsible for its authenticity.

7. The test report without CMA mark is only used for scientific research, teaching, enterprise product development and internal quality control purposes.

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

9. If there is any objection to this test 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, Zhancheng, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China

TEL: 400-788-9558

P.C.: 518103

FAX: 0755-33229357

Website: http://www.chnbctc.com

E-Mail: bctc@bctc-lab.com.cn

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

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