

# **TEST REPORT**

Report No.:	eport No.: BCTC2211741781-1E					
Applicant:	SUZHOU AUDITORYWORKS CO.,LTD					
Product Name:	Bluetooth Wireless Headset					
Model/Type reference:	AW-HP30					
Tested Date:	2022-11-29 to 2022-12-13					
Issued Date:	2022-12-13	er anderer anderer anderer				
S	nenzhen BCTC Testing Co., Ltd.					
No.: BCTC/RF-EMC-0	D7 Page: 1 of 68 Edition: A.5	· · · · · · · · · · · · · · · · · · ·				



## FCC ID: 2AU5G-AWHP30

Product Name:	Bluetooth Wireless Headset
Trademark:	N/A
Model/Type reference:	AW-HP30 AW-HP3XXXXX("X" can be 0-9, A-Z, A-Z, or blank, indicating A different case color, sales area, or customer)
Prepared For:	SUZHOU AUDITORYWORKS CO.,LTD
Address:	Unit 2-B504, Creative Industry Park, No.328, Xinghu St., Suzhou Industrial Park, Suzhou 215000, China
Manufacturer:	SUZHOU AUDITORYWORKS CO.,LTD
Address:	Unit 2-B504, Creative Industry Park, No.328, Xinghu St., Suzhou Industrial Park, Suzhou 215000, China
Prepared By:	Shenzhen BCTC Testing Co., Ltd.
Address:	1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Zhancheng, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China
Sample Received Date:	2022-11-29
Sample tested Date:	2022-11-29 to 2022-12-13
Issue Date:	2022-12-13
Report No.:	BCTC2211741781-1E
Test Standards:	FCC Part15.247 ANSI C63.10-2013
Test Results:	PASS
Remark:	This is Bluetooth Classic radio test report.

Tested by:

Brave .

Brave Zeng/ Project Handler

Approved by

Zero Zhou/Reviewer

The test report is effective only with both signature and specialized stamp. This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen BCTC Testing Co., Ltd, this report can't be reproduced except in full. The tested sample(s) and the sample information are provided by the client.



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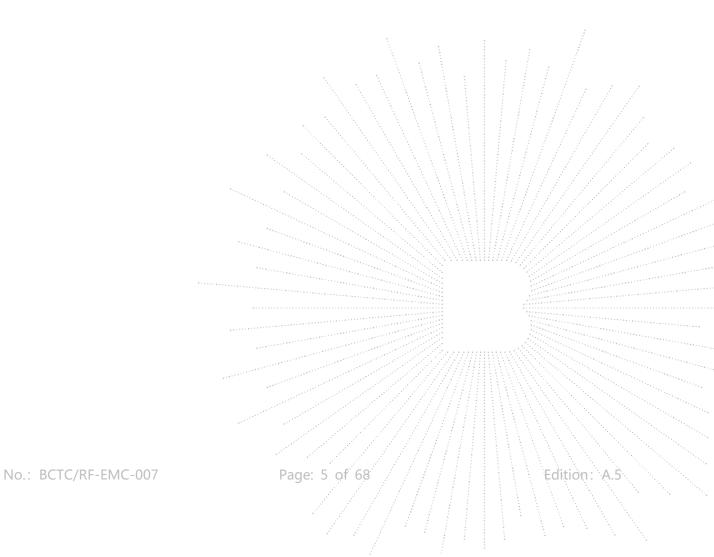
(Note: N/A Means Not Applicable)

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## 1. Version

Report No.	Issue Date	Description	Approved
BCTC2211741781-1E	2022-12-13	Original	Valid





## 2. Test Summary

The Product has been tested according to the following specifications:

No.	Test Parameter	Clause No.	Results
1	Conducted emission AC power port	§15.207	PASS
2	Conducted peak output power for FHSS	§15.247(b)(1)	PASS
3	20dB Occupied bandwidth	§15.247(a)(1)	PASS
4	Number of hoppingfrequencies	§15.247(a)(1)(iii)	PASS
5	Dwell Time	§15.247(a)(1)(iii)	PASS
6	Spurious RF conducted emissions	§15.247(d)	PASS
7	Band edge	§15.247(d)	PASS
8	Spurious radiated emissions for transmitter	§15.247(d) & §15.209 & §15.205	PASS
9	Antenna Requirement	15.203	PASS



## 3. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Uncertainty
1	3m chamber Radiated spurious emission(30MHz-1GHz)	U=4.3dB
2	3m chamber Radiated spurious emission(9KHz-30MHz)	U=3.7dB
3	3m chamber Radiated spurious emission(1GHz-18GHz)	U=4.5dB
4	3m chamber Radiated spurious emission(18GHz-40GHz)	U=3.34dB
5	Conducted Emission (150kHz-30MHz)	U=3.20dB
6	Conducted Adjacent channel power	U=1.38dB
7	Conducted output power uncertainty Above 1G	U=1.576dB
8	Conducted output power uncertainty below 1G	U=1.28dB
9	humidity uncertainty	U=5.3%
10	Temperature uncertainty	U=0.59°C



## 4. Product Information And Test Setup

#### 4.1 Product Information

Model/Type reference:	AW-HP30 AW-HP3XXXXX("X" can be 0-9, A-Z, A-Z, or blank, indicating A different case color, sales area, or customer)
Model differences:	All models are the same circuit and RF module except for the model name and color.
Bluetooth Version:	5.0
Hardware Version:	2.1
Software Version:	4.0
Operation Frequency:	Bluetooth: 2402-2480MHz
Type of Modulation:	Bluetooth: GFSK, π/ 4 DQPSK, 8DPSK
Number Of Channel	79CH
Antenna installation:	Internal antenna
Antenna Gain:	2.95 dBi
Ratings:	DC 5V from adapter/DC 3.7V from battery

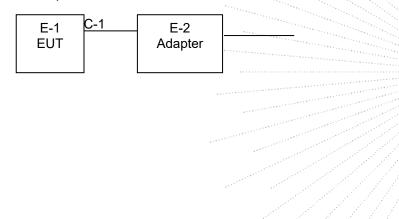
## 4.2 Test Setup Configuration

See test photographs attached in *EUT TEST SETUP PHOTOGRAPHS* for the actual connections between Product and support equipment.

Conducted Emission:

E-1	C-1	E-2	AC
EUT		Adapter	
			54.

Radiated Spurious Emission





## 4.3 Support Equipment

No.	Device Type	Brand	Model	Series No.	Note
E-1	Bluetooth Wireless Headset	N/A	AW-HP30	AW-HP31, AW-HP32, AW-HP33, AW-HP34, AW-HP35	EUT
E-2	Adapter	N/A	BCTC001	N/A	Auxiliary

ltem	Shielded Type	Ferrite Core	Length	Note
C-1	N/A	N/A	0.3M	DC cable unshielded

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.

2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

#### 4.4 Channel List

СН	Frequency (MHz)	СН	Frequency (MHz)	СН	Frequency (MHz)	СН	Frequency (MHz)
0	2402	1	2403	2	2404	3	2405
4	2406	5	2407	6	2408	7	2409
8	2410	9	2411	10	2412	: 11	2413
12	2414	13	2415	14	2416	15	2417
16	2418	17	2419	18	2420	19	2421
20	2422	21	2423	22	2424	23	2425
24	2426	25	2427	26	2428	27	2429
28	2430	29	2431	30	2432	31	2433
32	2434	33	2435	34	2436	35	2437
36	2438	37	2439	38	2440	39	2441
40	2442	41	2443	42	2444	43	2445
44	2446	45	2447	46	2448	47	2449
48	2450	49	2451	50	2452	51	2453
52	2454	53	2455	54	2456	55	2457
56	2458	57	2459	58	2460	59	2461
60	2462	61	2463	62	2464	63	2465
64	2466	65 …	2467	66	2468	67	2469
68	2470	69	2471	70	2472	71	2473
72	2474	73	2475	74	2476	75	2477
76	2478	77	2479	. 78	2480	79	· · · · · · · · · · · · · · · · · · ·



#### 4.5 Test Mode

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Test Mode	Test mode	Low channel	Middle channel	High channel	
1	Transmitting(GFSK)	2402MHz	2441MHz	2480MHz	
2	Transmitting(π/ 4 DQPSK)	2402MHz	2441MHz	2480MHz	
3	Transmitting(8DPSK)	2402MHz	2441MHz	2480MHz	
4	Transmitting (Conducted emission & Radiated emission)				

Note:

- (1) The measurements are performed at the highest, middle, lowest available channels.
- (2) Fully-charged battery is used during the test

#### 4.6 Table Of Parameters Of Text Software Setting

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters

Frequency Parameters	2402 MHz	2441 MHz	2480 MHz
Parameters			
	DEF	DEF	DEF
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#### 5. Test Facility And Test Instrument Used

#### 5.1 Test Facility

All measurement facilities used to collect the measurement data are located at Shenzhen BCTC Testing Co., Ltd. Address: 1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Zhancheng, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards. FCC Test Firm Registration Number: 712850 IC Registered No.: 23583

#### 5.2 Test Instrument Used

Conducted Emissions Test						
Equipment	Manufacturer	Model#	Serial#	Last Cal.	Next Cal.	
Receiver	R&S	ESR3	102075	May 24, 2022	May 23, 2023	
LISN	R&S	ENV216	101375	May 24, 2022	May 23, 2023	
Software	Frad	EZ-EMC	EMC-CON 3A1	1	/	
Attenuator	١	10dB DC-6GHz	1650	May 24, 2022	May 23, 2023	

RF Conducted Test						
Equipment	Manufacturer	Model#	Serial#	Last Cal.	Next Cal.	
Power Metter	Keysight	E4419		May 24, 2022	May 23, 2023	
Power Sensor (AV)	Keysight	E9300A	$\sum_{i=1}^{n} \sum_{j=1}^{n} \prod_{i=1}^{n} \sum_{j=1}^{n} \sum_{j$	May 24, 2022	May 23, 2023	
Signal Analyzer 20kHz-26.5G Hz	Keysight	N9020A	MY49100060	May 24, 2022	May 23, 2023	
Spectrum Analyzer 9kHz-40GHz	R&S	FSP 40		May 24, 2022	May 23, 2023	

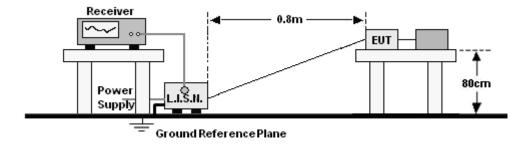


Radiated Emissions Test (966 Chamber01)						
Equipment	Manufacturer	Model#	Serial#	Last Cal.	Next Cal.	
966 chamber	ChengYu	966 Room	966	Jun. 06. 2020	Jun. 05, 2023	
Receiver	R&S	ESR3	102075	May 24, 2022	May 23, 2023	
Receiver	R&S	ESRP	101154	May 24, 2022	May 23, 2023	
Amplifier	Schwarzbeck	BBV9744	9744-0037	May 24, 2022	May 23, 2023	
TRILOG Broadband Antenna	Schwarzbeck	VULB9163	942	May 26, 2022	May 25, 2023	
Loop Antenna(9KHz -30MHz)	Schwarzbeck	FMZB1519B	00014	May 26, 2022	May 25, 2023	
Amplifier	SKET	LAPA_01G18 G-45dB	١	May 24, 2022	May 23, 2023	
Horn Antenna	Schwarzbeck	BBHA9120D	1541	Jun. 06, 2022	Jun. 05, 2023	
Amplifier(18G Hz-40GHz)	MITEQ	TTA1840-35- HG	2034381	May 26, 2022	May 25, 2023	
Horn Antenn(18GH z-40GHz)	Schwarzbeck	BBHA9170	00822	Jun. 06, 2022	Jun. 05, 2023	
Spectrum Analyzer9kHz- 40GHz	R&S	FSP40	100363	May 24, 2022	May 23, 2023	
Software	Frad	EZ-EMC	FA-03A2 RE	1	$\Lambda_{j}$	



#### 6. Conducted Emissions

#### 6.1 Block Diagram Of Test Setup



#### 6.2 Limit

	Limit (dBuV)		
Frequency (MHz)	Quas-peak	Average	
0.15 -0.5	66 - 56 *	56 - 46 *	
0.50 -5.0	56.00	46.00	
5.0 -30.0	60.00	50.00	

Notes:

1. \*Decreasing linearly with logarithm of frequency.

2. The lower limit shall apply at the transition frequencies.

#### 6.3 Test procedure

Receiver Parameters		Setting
Attenuation		10 dB
Start Frequency		0.15 MHz
Stop Frequency		30 MHz
IF Bandwidth		9 kHz

a. The Product was placed on a nonconductive table 0.8 m above the horizontal ground reference plane, and 0.4 m from the vertical ground reference plane, and connected to the main through Line Impedance Stability Network (L.I.S.N).

b. The RBW of the receiver was set at 9 kHz in 150 kHz ~ 30MHz with Peak and AVG detector in Max Hold mode. Run the receiver's pre-scan to record the maximum disturbance generated from Product in all power lines in the full band.

c. For each frequency whose maximum record was higher or close to limit, measure its QP and AVG values and record.

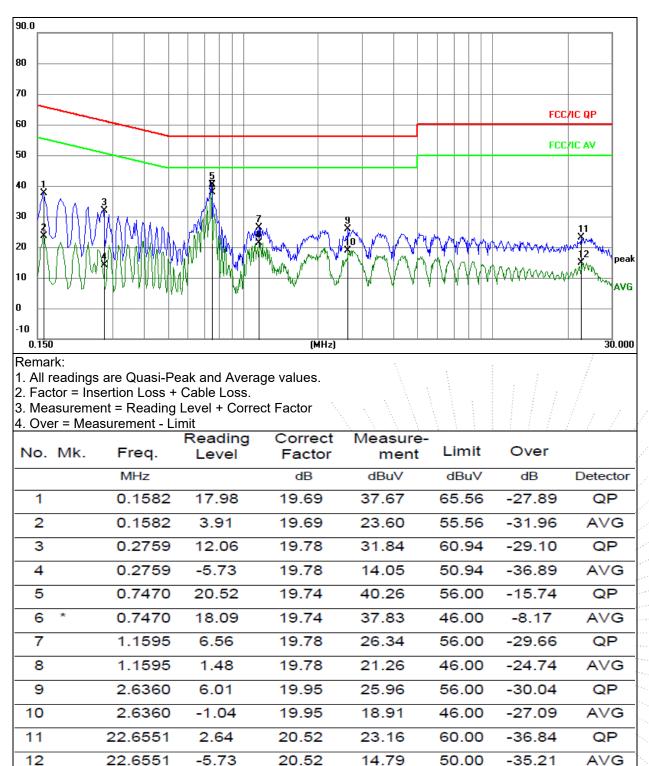
#### 6.4 EUT operating Conditions

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.



#### 6.5 Test Result

Temperature:	<b>26</b> ℃	Relative Humidity:	54%
Pressure:	101KPa	Phase :	L
Test Mode:	Mode 4	Test Voltage :	AC 120V/60Hz

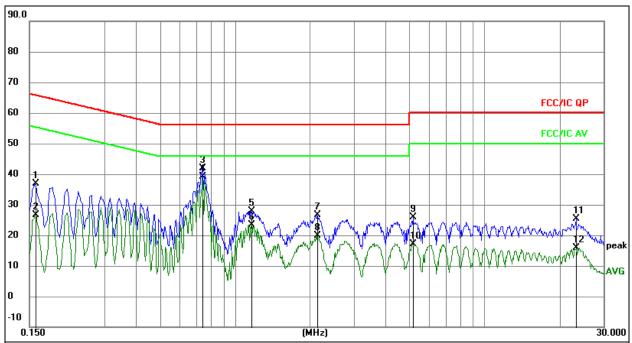


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Temperature:	<b>26</b> ℃	Relative Humidity:	54%
Pressure:	101KPa	Phase :	Ν
Test Mode:	Mode 4	Test Voltage :	AC 120V/60Hz



Remark:

All readings are Quasi-Peak and Average values.
 Factor = Insertion Loss + Cable Loss.
 Measurement = Reading Level + Correct Factor
 Over = Measurement - Limit

4. OVCI 101CU	Surement En	THC .					- i
No. Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
	MHz		dB	dBuV	dBuV	dB	Detector
1	0.1590	17.22	19.69	36.91	65.52	-28.61	QP
2	0.1590	7.06	19.69	26.75	55.52	-28.77	AVG
3	0.7395	22.02	19.74	41.76	56.00	-14.24	QP
4 *	0.7395	19.51	19.74	39.25	46.00	-6.75	AVG
5	1.1625	8.21	19.78	27.99	56.00	-28.01	QP
6	1.1625	3.56	19.78	23.34	46.00	-22.66	AVG
7	2.1390	6.81	19.90	26.71	56.00	-29.29	QP
8	2.1390	-0.13	19.90	19.77	46.00	-26.23	AVG
9	5.1855	5.74	20.13	25.87	60.00	-34.13	QP
10	5.1855	-3.01	20.13	17.12	50.00	-32.88	AVG
11	23.2890	4.74	20.52	25.26	60.00	-34.74	QP
12	23.2890	-4.72	20.52	15.80	50.00	-34.20	AVG
				- 18 - 18 - 18 - 18 - 18			A STATE AND A STATE

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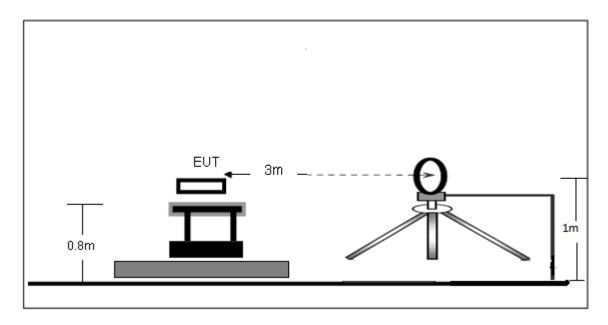
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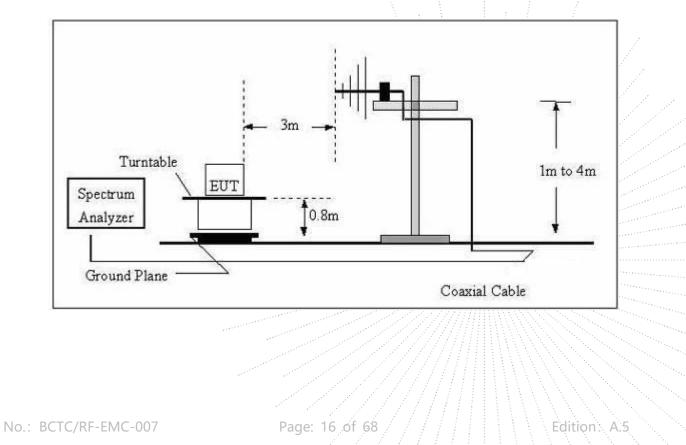
#### 7. Radiated Emissions

## 7.1 Block Diagram Of Test Setup

#### (A) Radiated Emission Test-Up Frequency Below 30MHz

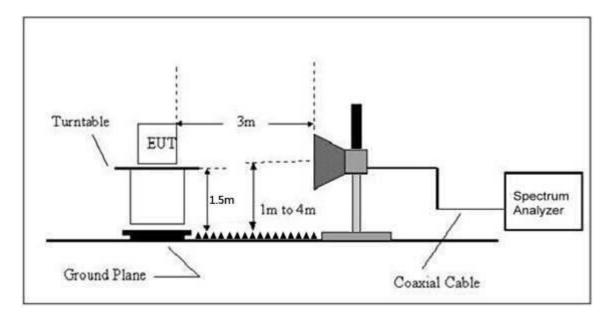


(B) Radiated Emission Test-Up Frequency 30MHz~1GHz





(C) Radiated Emission Test-Up Frequency Above 1GHz



#### 7.2 Limit

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency	Field Strength	Distance	Field Strength Limit at 3m Distance		
(MHz)	uV/m	(m)	uV/m	dBuV/m	
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	20log <sup>(2400/F(kHz))</sup> + 80	
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	20log <sup>(24000/F(kHz))</sup> + 40	
1.705 ~ 30	30	30	100 * 30	20log <sup>(30)</sup> + 40	
30 ~ 88	100	3	100	20log <sup>(100)</sup>	
88 ~ 216	150	3	150	20log <sup>(150)</sup>	
216 ~ 960	200	3	200	20log <sup>(200)</sup>	
Above 960	500	3	500	20log <sup>(500)</sup>	

Limits Of Radiated Emission Measurement (Above 1000MHz)

	Limit (dBuV/m)	) (at 3M)
Frequency (MHz)	Peak	Average
Above 1000	74	54

Notes:

(1)The limit for radiated test was performed according to FCC PART 15C.

(2)The tighter limit applies at the band edges.

(3) Emission level (dBuV/m)=20log Emission level (uV/m).



Frequency Range Of Radiated Measurement

(a) For an intentional radiator the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph:

(1) If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(2) If the intentional radiator operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

(3) If the intentional radiator operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower, unless specified otherwise elsewhere in the rules.

(4) If the intentional radiator operates at or above 95 GHz: To the third harmonic of the highest fundamental frequency or to 750 GHz, whichever is lower, unless specified otherwise elsewhere in the rules.

(5) If the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to the range specified in paragraphs (a) (1)through (4) of this section or the range applicable to the digital device, as shown in paragraph (b)(1) of this section, whichever is the higher frequency range of investigation.

#### 7.3 Test procedure

Receiver Parameter	Setting				
Attenuation	Auto				
9kHz~150kHz	RBW 200Hz for QP				
150kHz~30MHz	RBW 9kHz for QP				
30MHz~1000MHz	RBW 120kHz for QP				

Spectrum Parameter	Setting
1-25GHz	RBW 1 MHz /VBW 1 MHz for Peak, RBW 1 MHz / VBW 10Hz for Average

Below 1GHz test procedure as below:

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.



d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Above 1GHz test procedure as below:

a. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.

b.The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c.The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d.For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.

e.The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. Test the EUT in the lowest channel, the middlest channel, the Highest channel.

Note:

Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

#### 7.4 EUT operating Conditions

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.



## 7.5 Test Result

#### Below 30MHz

Temperature:	<b>26</b> ℃	Relative Humidity:	54%	
Pressure:	101KPa	Toot Voltago :	DC 3.7V	
Test Mode:	Mode 4	Test Voltage :	DC 3.7 V	

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
				PASS
				PASS

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the

permissible value has no need to be reported.

Distance extrapolation factor =40 log (specific distance/test distance)(dB);

Limit line = specific limits(dBuv) + distance extrapolation factor.

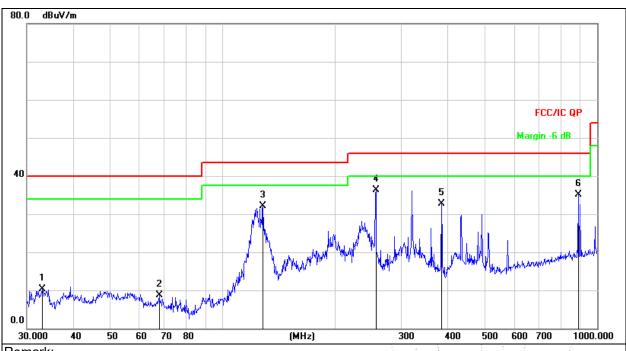
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#### Between 30MHz - 1GHz

Temperature:	<b>26</b> ℃	Relative Humidity:	54%
Pressure:	101KPa	Phase :	Horizontal
Test Mode:	Mode 4	Test Voltage :	DC 3.7V



Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier.

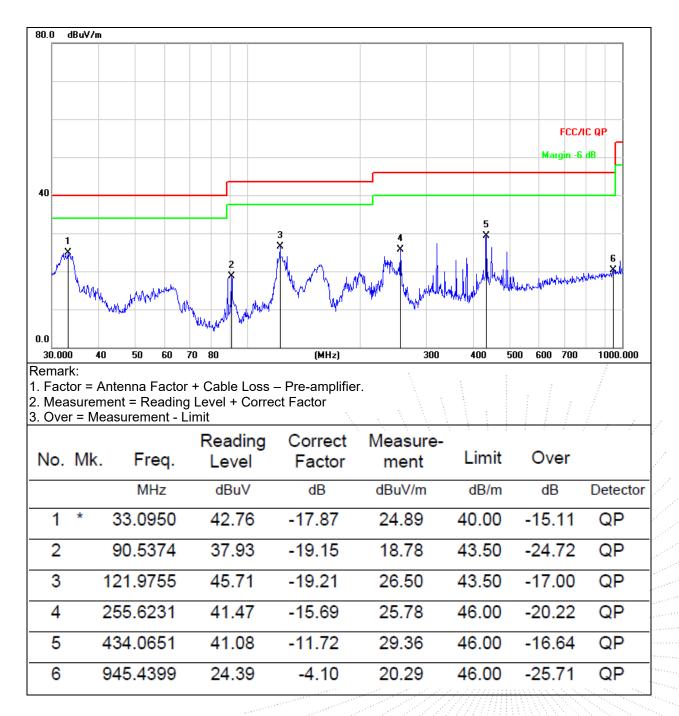
2. Measurement = Reading Level + Correct Factor 3. Over = Measurement - Limit

0.0.0	1 1010							
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		32.9791	28.22	-17.89	10.33	40.00	-29.67	QP
2		67.6751	27.89	-19.28	8.61	40.00	-31.39	QP
3	1	28.1130	51.76	-19.61	32.15	43.50	-11.35	QP
4	* 2	256.5211	52.03	-15.67	36.36	46.00	-9.64	QP
5	3	83.9318	45.08	-12.40	32.68	46.00	-13.32	QP
6	8	390.7278	39.89	-4.69	35.20	46.00	-10.80	QP

Edition:



Temperature:	<b>26</b> ℃	Relative Humidity:	54%
Pressure:	101KPa	Phase :	Vertical
Test Mode:	Mode 4	Test Voltage :	DC 3.7V





Between 1GHz – 25GHz

Polar (H/V)	Frequency	Reading Level	Correct Factor	Measure- ment	Limits	Over	Detector
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dBuV/ m)	(dB)	Туре
			GFSK Low ch	annel			
V	4804.00	53.88	-0.43	53.45	74.00	-20.55	PK
V	4804.00	43.49	-0.43	43.06	54.00	-10.94	AV
V	7206.00	43.08	8.31	51.39	74.00	-22.61	PK
V	7206.00	33.89	8.31	42.20	54.00	-11.80	AV
Н	4804.00	51.94	-0.43	51.51	74.00	-22.49	PK
Н	4804.00	42.21	-0.43	41.78	54.00	-12.22	AV
Н	7206.00	41.68	8.31	49.99	74.00	-24.01	PK
Н	7206.00	34.47	8.31	42.78	54.00	-11.22	AV
		G	FSK Middle c	hannel		•	•
V	4882.00	51.74	-0.38	51.36	74.00	-22.64	PK
V	4882.00	44.56	-0.38	44.18	54.00	-9.82	AV
V	7323.00	44.36	8.83	53.19	74.00	-20.81	PK
V	7323.00	35.06	8.83	43.89	54.00	-10.11	AV
Н	4882.00	48.20	-0.38	47.82	74.00	-26.18	PK
Н	4882.00	38.30	-0.38	37.92	54.00	-16.08	AV
Н	7323.00	43.24	8.83	52.07	74.00	-21.93	PK
Н	7323.00	35.39	8.83	44.22	54.00	-9.78	AV
			GFSK High ch	annel			
V	4960.00	54.48	-0.32	54.16	74.00	-19.84	PK
V	4960.00	45.61	-0.32	45.29	54.00	-8.71	AV
V	7440.00	45.86	9.35	55.21	74.00	-18.79	PK
V	7440.00	35.66	9.35	45.01	54.00	-8.99	AV
Н	4960.00	52.67	-0.32	52.35	74.00	-21.65	PK
Н	4960.00	42.58	-0.32	42.26	54.00	-11.74	AV
Н	7440.00	43.58	9.35	52.93	74.00	-21.07	PK
Н	7440.00	34.62	9.35	43.97	54.00	-10.03	AV

Remark:

1.Emission Level = Meter Reading + Factor, Factor = Antenna Factor + Cable Loss – Pre-amplifier. Over= Emission Level - Limit

2.If peak below the average limit, the average emission was no test.

3. In restricted bands of operation, The spurious emissions below the permissible value more than 20dB

4. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

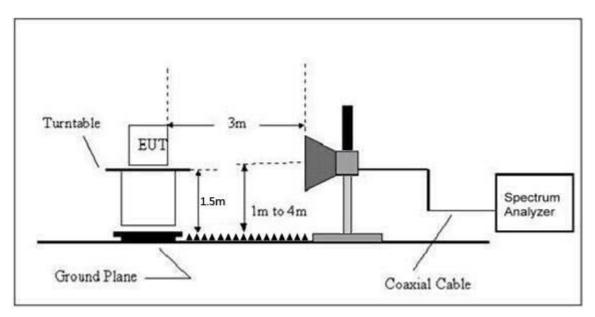
5.All the Modulation are test, the worst mode is GFSK, the data recording in the report.



## 8. Radiated Band Emission Measurement And Restricted Bands Of Operation

#### 8.1 Block Diagram Of Test Setup

Radiated Emission Test-Up Frequency Above 1GHz



#### 8.2 Limit

FCC Part15 C Section 15.209 and 15.205

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
<sup>1</sup> 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	( <sup>2</sup> )
13.36-13.41			



Limits Of Radiated Emission Measurement (Above 1000MHz)

Frequency (MHz)	Limit (dBuV/m) (at 3M)		
	Peak	Average	
Above 1000	74	54	

Notes:

(1)The limit for radiated test was performed according to FCC PART 15C.

(2)The tighter limit applies at the band edges.

(3)Emission level (dBuV/m)=20log Emission level (uV/m).

#### 8.3 Test procedure

Receiver Parameter	Setting			
Attenuation	Auto			
Start Frequency	2300MHz			
Stop Frequency	2520			
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average			

Above 1GHz test procedure as below:

a. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.

b.The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c.The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d.For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.

e.The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. Test the EUT in the lowest channel, the Highest channel.

Note:

Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

#### 8.4 EUT operating Conditions

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.



#### 8.5 Test Result

Test mode	Polar (H/V)			Correct Factor	Measure- ment (dBuV/m)	Limits (dBuV/m)		Result	
	(1	(11112)	(dBuV/m)	(dB)	РК	РК	AV		
	Low Channel 2402MHz								
OFOK	Н	2390.00	53.87	-6.70	47.17	74.00	54.00	PASS	
	Н	2400.00	57.48	-6.71	50.77	74.00	54.00	PASS	
	V	2390.00	53.32	-6.70	46.62	74.00	54.00	PASS	
	V	2400.00	53.39	-6.71	46.68	74.00	54.00	PASS	
GFSK			High	n Channel 2	480MHz		•		
	Н	2483.50	53.38	-6.79	46.59	74.00	54.00	PASS	
	Н	2500.00	50.47	-6.81	43.66	74.00	54.00	PASS	
	V	2483.50	53.03	-6.79	46.24	74.00	54.00	PASS	
	V	2500.00	50.00	-6.81	43.19	74.00	54.00	PASS	
	Low Channel 2402MHz								
	Н	2390.00	52.53	-6.70	45.83	74.00	54.00	PASS	
	Н	2400.00	56.94	-6.71	50.23	74.00	54.00	PASS	
	V	2390.00	52.70	-6.70	46.00	74.00	54.00	PASS	
	V	2400.00	53.58	-6.71	46.87	74.00	54.00	PASS	
π/4DQPSK		High Channel 2480MHz							
	Н	2483.50	52.72	-6.79	45.93	74.00	54.00	PASS	
	Н	2500.00	48.79	-6.81	41.98	74.00	54.00	PASS	
	V	2483.50	52.78	-6.79	45.99	74.00	54.00	PASS	
	V	2500.00	49.33	-6.81	42.52	74.00	54.00	PASS	
			Low	Channel 2	402MHz				
	Н	2390.00	52.35	-6.70	45.65	:74.00	54.00	PASS	
	Н	2400.00	55.35	-6.71	48.64	74.00	54.00	PASS	
	V	2390.00	52.35	-6.70	45.65	74.00	54.00	PASS	
	V	2400.00	53.75	-6.71	47.04	74.00	54.00	PASS	
8DPSK		L		n Channel 2					
	Н	2483.50	50.60	-6.79	43.81	74.00	54.00	PASS	
	Н	2500.00	48.41	-6.81	41.60	74.00	54.00	PASS	
	V	2483.50	50.64	-6.79	43.85	74.00	54.00	PASS	
	V	2500.00	47.33	-6.81	40.52	74.00	54.00	PASS	

#### Remark:

1. Emission Level = Meter Reading + Factor, Factor = Antenna Factor + Cable Loss – Pre-amplifier. Over= Emission Level - Limit

2. If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

3 In restricted bands of operation, The spurious emissions below the permissible value more than 20dB

4. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.



#### 9. Spurious RF Conducted Emissions

#### 9.1 Block Diagram Of Test Setup

EUT	SPECTRUM
	ANALYZER

#### 9.2 Limit

Regulation 15.247 (d),In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.205(c))

#### 9.3 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

Page: 27 of (



Peak Search

NextPea

Next Pk Righ

Next Pk Le

Marker De

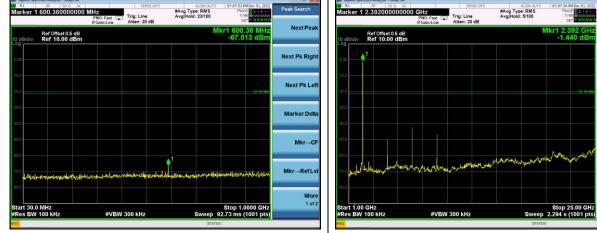
Mkr→C

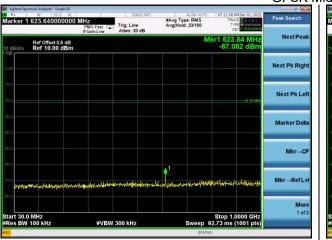
Mkr→RefL

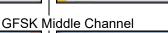
More 1 of 2

## 9.4 Test Result

#### **30MHz – 25GHz** GFSK Low Channel











#### **GFSK High Channel**

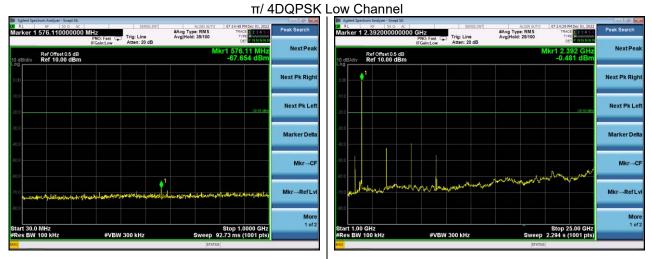




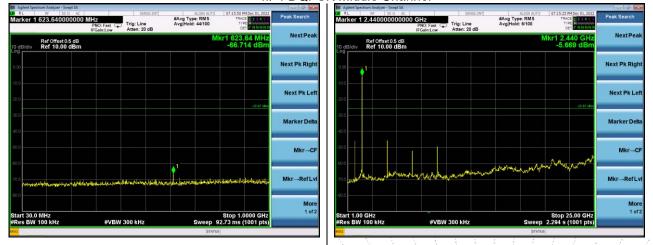
ALIGN AU #Avg Type: RMS Avg|Hold: 2/100

> 1 2.488 ( -5.338 c

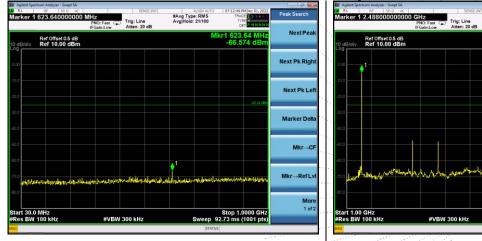
Stop 25.00 GHz eep 2.294 s (1001 pts)



π/ 4 DQPSK Middle Channel







NextPea

Next Pk Rigi

Next Pk Le

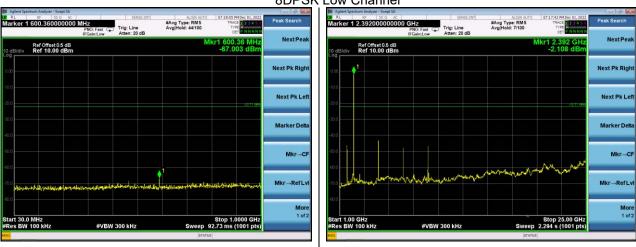
Marker De

Mkr→RefL

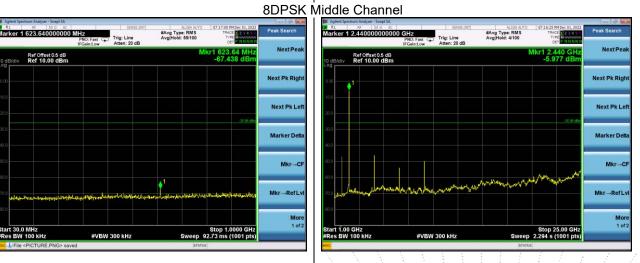
Mkr→C

Mor 1 of

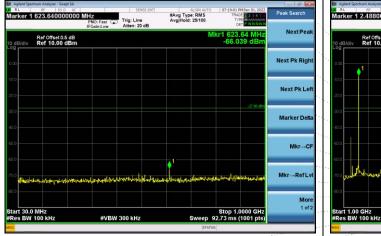




#### 8DPSK Low Channel











	ctrum Analyzer - Swep					
L <mark>XI</mark> RL	RF 50 Ω	AC	SENSE:INT	ALIGN AUTO	06:38:37 PM Dec 01, 2022	Peak Search
Marker 1	2.40190000	DOOOO GHZ PNO:Fast C IFGain:Low	Trig: Free Run Atten: 20 dB	#Avg Type: RMS Avg Hold:>100/100	TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P NNNNN	
	Ref Offset 0.5			Mk	r1 2.401 9 GHz	NextPeak
10 dB/div	Ref 10.00 c				-1.263 dBm	
					<u>↓</u> 1	
						Next Pk Right
-10.0						Ŭ
-20.0					-21.26 dBm	
-30.0						
-40.0						Next Pk Left
-50.0					2	
-60.0			where have a starter		$\rightarrow^3$	
-70.0	Yorlay/Yorlyv/WW/W	ት <sub>በ</sub> / እቀም አዲማትም ነው። በብት ወቅት ነውን ነውን	Phi and die bei and all all and and	1 Marthall and a start and a strategy and the start and th	Under Waren	Marker Delta
-80.0						
Start 2.3 #Res BW	1000 GHz	#\/B	W 300 kHz		Stop 2.41000 GHz .600 ms (1001 pts)	Mkr→CF
						IVIKI→CF
MKR MODE T	RC SCL	× 2.401 9 GHz	Y FU -1.263 dBm	JNCTION FUNCTION WIDTH	FUNCTION VALUE	
2 N	1 f	2.400 00 GHz	-57.088 dBm			
3 N ·	1 f	2.395 9 GHz	-63.717 dBm			Mkr→RefLvl
5					E	
7						
8						More
10						1 of 2
11						
MSG				STATUS		

## GFSK Transmitting Band edge-left side

GFSK Hopping Band edge-left side

RL RF 50Ω AC arker 1 2.417880000000		ALIGN AUTO #Avg Type: RMS	06:36:46 PM Dec 01, 2022 TRACE 1 2 3 4 5 6	Peak Search
	PNO: Fast C Trig: Free Ru		TYPE M WWWWW	r our oouron
Ref Offset 0.5 dB dB/div Ref 10.00 dBm	IFGain:Low Atten: 20 dE	•	r1 2.417 88 GHz -1.310 dBm	Next Pea
9 00 .0		M		Next Pk Rig
.0		A3 (2		Next Pk Le
0.0 0.0 0.0	who and a stand and a standard			Marker De
art 2.31000 GHz tes BW 100 kHz	#VBW 300 kHz		Stop 2.43000 GHz 11.53 ms (1001 pts)	Mkr→0
2 N 1 f 2.40	Y 17 88 GHz 00 00 GHz -58.675 dBm 95 20 GHz -61.241 dBm	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	Mkr→RefL
				<b>Mo</b> 1 o
	III	STATU	JS	



	trum Analyzer - Sw									
RL	RF 50		CH7	SENS	E:INT	#Avg Typ	ALIGN AUTO e: RMS		PM Dec 01, 2022	Peak Search
	2.4750400		PNO: Fast (	Trig: Free	Run	Avg Hold		TY		
			IFGain:Low	Atten: 20	B					NextPe
	Ref Offset 0	15 dB					Mkr1		848 GHz	NEALFE
) dB/div	Ref 10.00	dBm						-1.5	80 dBm	
.00	<b>↓</b> 1									
	h									Next Pk Ric
0.0										-
0.0	$\vdash$			-					-21.58 dBm	
0.0										
0.0	\									Next Pk L
0.0										
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	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	mont	monolomora		an a strollars.	Annon	-	mun		
0.0								Ç 00000 9000	1. Augusta 1999 (199	Marker De
0.0										
Lart 2.47	800 GHz							Stop 2.5	0000 GHz	
Res BW			#VB	W 300 kHz		9	Sween 2		1000 GH2	Mkr⊸
KR MODE TR		X		Y	FUNCTI		ICTION WIDTH		ON VALUE	
1 N 1	f		848 GHz	-1.580 dBi		JN FUN	ICTION WIDTH	FUNCT	UN VALUE	
2 N 1	f	2.483	500 GHz	-65.153 dB	n					
3 N 1	f	2.485	084 GHz	-64.139 dB	n					Mkr→Refl
5									E	
7										
8										Mo
9										1 0
									-	
1										
									•	

#### GFSK Transmitting Band edge-right side

GFSK Hopping Band edge-right side





RL	RF 50 Ω A	A	SENSE:II	NT	ALIGN AUTO	06:39:23 PM Dec	01 2022	
	2.401900000			#Avg	ype: RMS	TRACE 12	3456	Peak Search
		PNO: Fast C IFGain:Low	Trig: Free Rui Atten: 20 dB	n Avg H	old:>100/100	DET P N	NNNN	
					Mk	r1 2.401 9	215	NextPea
0 dB/div	Ref Offset 0.5 dE Ref 10.00 dB					-1.246 c		
og 🔤						1		
1.00								Next Pk Rig
0.0								NEXTERNING
0.0						-2	.25 dBm	
0.0								
10.0 <b></b>						ہا لم		Next Pk L
0.0						2		
						A3 2 4		
A A D	www.www.	www.hohn	www.	Western the standards	month	3 4 4	man	
0.0								Marker De
0.0								
tart 231							CH 7	
	1000 GHz 100 kHz	#VB	W 300 kHz		Sweep 9.	Stop 2.41000 600 ms (1001	GHz pts)	Mkr→0
Res BW	100 kHz	#VB	W 300 kHz	FUNCTION	Sweep 9.	500 2.41000 600 ms (1001	pts)	Mkr⊸0
Res BW	100 kHz	× 2.401 9 GHz	۲ -1.246 dBm	FUNCTION	Sweep 9.	600 ms (1001	pts)	Mkr⊸(
Res BW	100 kHz	× 2.401 9 GHz 2.400 00 GHz	Ƴ -1.246 dBm -58.392 dBm	FUNCTION	Sweep 9.	600 ms (1001	pts)	
Res BW	100 kHz	× 2.401 9 GHz	۲ -1.246 dBm	FUNCTION	Sweep 9.	600 ms (1001	pts)	
Res BW	100 kHz	× 2.401 9 GHz 2.400 00 GHz	Ƴ -1.246 dBm -58.392 dBm	FUNCTION	Sweep 9.	600 ms (1001	pts)	
Res         BW           KR         MODE         TF           1         N         1           2         N         1           3         N         1           4         5         6           6         7	100 kHz	× 2.401 9 GHz 2.400 00 GHz	Ƴ -1.246 dBm -58.392 dBm	FUNCTION	Sweep 9.	600 ms (1001	pts)	Mkr→Refl
	100 kHz	× 2.401 9 GHz 2.400 00 GHz	Ƴ -1.246 dBm -58.392 dBm	FUNCTION	Sweep 9.	600 ms (1001	pts)	Mkr→Refi Mo
Res         BW           KR         MODE         TF           1         N         1           2         N         1           3         N         1           4         5         5           6         7         7           8         9         9           0         0         1	100 kHz	× 2.401 9 GHz 2.400 00 GHz	Ƴ -1.246 dBm -58.392 dBm	FUNCTION	Sweep 9.	600 ms (1001	pts)	Mkr→Refi Mo
Res         BW           R         MODE         TF           1         N         1           2         N         1           3         N         1           4	100 kHz	× 2.401 9 GHz 2.400 00 GHz	Ƴ -1.246 dBm -58.392 dBm	FUNCTION	Sweep 9.	600 ms (1001	pts)	Mkr→d Mkr→RefL Ma 1 o

#### $\pi$ / 4 DQPSK Transmitting Band edge-left side

 $\pi$ / 4 DQPSK Hopping Band edge-left side

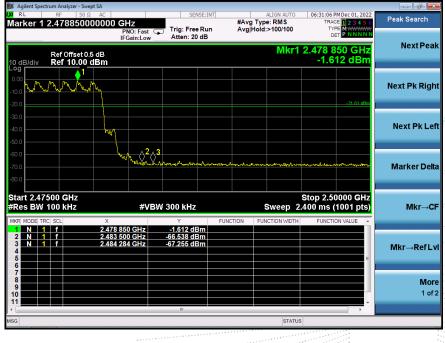




📕 Agilent Spectrum Analyzer - Swept SA				
Marker 1 2.479848000000	GHz PNO: Fast Trig: Free Run	ALIGN AUTO #Avg Type: RMS AvglHold:>100/100	06:26:51 PM Dec 01, 2022 TRACE 1 2 3 4 5 6 TYPE M	Peak Search
Ref Offset 0.5 dB 10 dB/div Ref 10.00 dBm	IFGain:Low Atten: 20 dB		2.479 848 GHz -1.590 dBm	Next Peak
-10.0			-21.59 dBm	Next Pk Right
-30.0				Next Pk Left
-60.0 F	33	al on the second and the second	Mhananghaga liyadarayaya	Marker Delta
Start 2.47800 GHz #Res BW 100 kHz	#VBW 300 kHz		Stop 2.50000 GHz 133 ms (1001 pts)	Mkr→CF
2 N 1 f 2.483	848 GHz -1.590 dBm 500 GHz -66.612 dBm 830 GHz -65.462 dBm		E	Mkr→RefLv
7 8 9 10 11				More 1 of 2
4 MSG		STATUS	•	

#### $\pi$ / 4 DQPSK Transmitting Band edge-right side

 $\pi$ / 4 DQPSK Hopping Band edge-right side





🎉 Agilent Spectrum Analyzer - Swept SA			
RL RF 50 Ω AC Marker 1 2.402200000000	GHz		1 2 3 4 5 6 Peak Search
Ref Offset 0.5 dB 10 dB/div Ref 10.00 dBm	PNO: Fast Trig: Free Run IFGain:Low Atten: 20 dB	Mkr1 2.402	2 GHz NextPeak 1 dBm
-10.0 -20.0			Next Pk Righ
-30.0			Next Pk Let
-60.0 -70.0 -80.0	www.www.www.www.	arter the theory and the physical management of the second s	Marker Delt
Start 2.31000 GHz #Res BW 100 kHz	#VBW 300 kHz	Stop 2.410 Sweep 9.600 ms (1)	001 pts) Mkr→C
2 N 1 f 2.40	102 2 GHz -1.221 dBm 10 00 GHz -56.952 dBm 195 8 GHz -65.966 dBm		Mkr→RefLv
7	11		Mon 1 of:
ISG		STATUS	

#### 8DPSK Transmitting Band edge-left side

8DPSK Hopping Band edge-left side





🎉 Agilent Spectrum Analyzer - Swept SA				- ē 🔀
Marker 1 2.480178000000		#Avg Type: RMS	06:25:41 PM Dec 01, 2022 TRACE 1 2 3 4 5 6 TYPE M WWWWW	Peak Search
Ref Offset 0.5 dB	PNO: Fast Free Run IFGain:Low Atten: 20 dB		2.480 178 GHz -0.305 dBm	NextPeak
			-20.31 dBm	Next Pk Right
-30.0	2,3			Next Pk Left
-60.0	Xone generation and the second	almore and a second and a second and a	<i>ใหญ่ขนายสมเป็น</i> ไทยสมบายไปหมาย เ	Marker Delta
Start 2.47800 GHz #Res BW 100 kHz	#VBW 300 kHz	Sweep 2	Stop 2.50000 GHz .133 ms (1001 pts) FUNCTION VALUE	Mkr→CF
2 N 1 f 2.483 3 N 1 f 2.483 4 5 6 6	0 178 GHz -0.305 dBm 3 500 GHz -63.370 dBm 3 962 GHz -63.497 dBm			Mkr→RefLvl
7 8 8 9 10 11	I		· ·	More 1 of 2
MSG		STATUS	5	

#### 8DPSK Transmitting Band edge-right side

8DPSK Hopping Band edge-right side





## 10. 20 dB Bandwidth

#### 10.1 Block Diagram Of Test Setup



10.2 Limit

N/A

#### 10.3 Test procedure

- 1. Set RBW = 30kHz.
- 2. Set the video bandwidth (VBW)  $\ge$  3 x RBW.
- 3. Detector = Peak.
- 4. Trace mode = max hold.
- 5. Sweep = auto couple.

6. Allow the trace to stabilize.

7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

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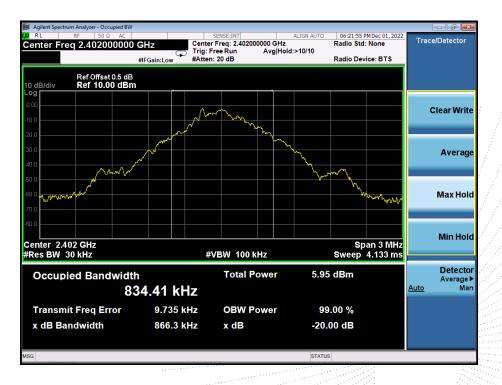


## 10.4 Test Result

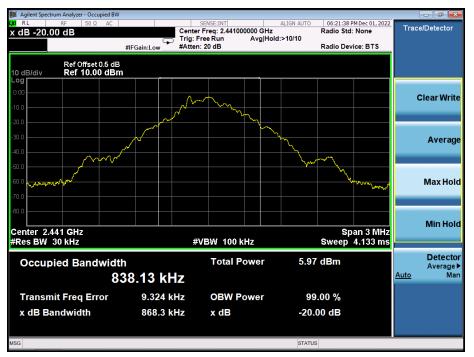
	54%	Relative Humidity:	<b>26</b> ℃	Temperature:
Pressure: 101KPa Test Voltage : DC 3.7V	DC 3.7V	Test Voltage :	101KPa	Pressure:

Modulation	Test Channel	Bandwidth(MHz)
GFSK	Low	0.866
GFSK	Middle	0.868
GFSK	High	0.863
π/ 4 DQPSK	Low	1.214
π/ 4 DQPSK	Middle	1.217
π/ 4 DQPSK	High	1.218
8DPSK	Low	1.220
8DPSK	Middle	1.221
8DPSK	High	1.219

Test plots GFSK Low Channel







#### **GFSK Middle Channel**

#### **GFSK High Channel**







#### π/ 4 DQPSK Low Channel

#### π/ 4 DQPSK Middle Channel







#### $\pi$ / 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

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

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

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	-0.004	21
GFSK	Middle	-0.055	21
GFSK	High	-0.320	21
π/ 4 DQPSK	Low	-0.022	21
π/ 4 DQPSK	Middle	-0.070	21
π/ 4 DQPSK	High	-0.333	21
8DPSK	Low	0.093	21
8DPSK	Middle	0.041	21
8DPSK	High	-0.216	21

#### Test plots GFSK Low Channel

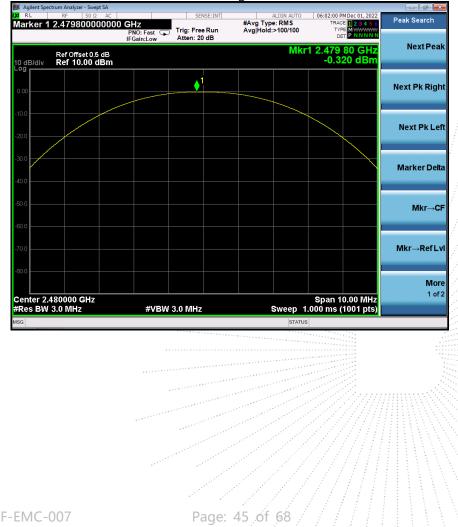




**GFSK Middle Channel** 

								m Analyzer - Swep	
Peak Search	M Dec 01, 2022 E 1 2 3 4 5 6	TRA	ALIGN AUTO	#Avg Ty	SENSE:INT	z	AC	RF 50 Ω	RL arker 1
		D	:>100/100	Avg Hol	ig: Free Run tten: 20 dB				
Next Pe	76 GHz 55 dBm	1 2.440 -0.0	Mkr					Ref Offset 0.5 Ref 10.00 d	dB/div
Next Pk Rig					<b>♦</b> <sup>1</sup>				9 00
Next Pk L									
Marker De									
Mkr→									
Mkr→Refl									
Ma									.0
1 c	0.00 MHz 1001 pts)	Span 1 .000 ms	Sweep 1		MHz	#VBW 3.0		1000 GHz 0 MHz	enter 2.4 tes BW 3
			STATUS						

#### **GFSK High Channel**



No.: BCTC/RF-EMC-007



				SK LOW Chai		
	trum Analyzer - Swept SA					
XI RL	RF 50 Ω AC		SENSE:INT	ALIGN AUTO	06:02:41 PM Dec 01, 2022	Peak Search
Marker 1	2.40184000000	PNO: Fast IFGain:Low	Trig: Free Run Atten: 20 dB	#Avg Type: RMS Avg Hold:>100/100	TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P N N N N N	
10 dB/div	Ref Offset 0.5 dB Ref 10.00 dBm			Mkr	1 2.401 84 GHz -0.022 dBm	NextPeak
0.00			<b>\</b>			Next Pk Right
10.0						
-10.0	and the second s					Next Pk Left
-30.0	our					
40.0						Marker Delta
50.0						Mkr→CF
60.0						
-70.0						Mkr→RefLv
80.0						
						More 1 of 2
Center 2.4 #Res BW 3	02000 GHz	#\/B)A(	3.0 MHz	Sween	Span 10.00 MHz .000 ms (1001 pts)	1012
ISG		# 4 D V 4		STATUS		
				STATUS		

π/ 4 DQPSK Low Channel

 $\pi$ / 4 DQPSK Middle Channel



No.: BCTC/RF-EMC-007



				ък піўн Спаг		
	trum Analyzer - Swept SA					
arker 1	RF 50 Ω AC 2.47976000000	0 GHz PNO: Fast 🖵	SENSE:INT	#Avg Type: RMS Avg Hold:>100/100	06:02:22 PM Dec 01, 2022 TRACE 1 2 3 4 5 6 TYPE M	Peak Search
		IFGain:Low	Atten: 20 dB		DET P NNNN	NextPeak
0 dB/div	Ref Offset 0.5 dB Ref 10.00 dBm			Mkı	1 2.479 76 GHz -0.333 dBm	Nextreak
0.00			∮ <sup>1</sup>			Next Pk Right
10.0						
20.0	warded and the second					Next Pk Lef
30.0 <b></b>						Marker Delta
0.0						
						Mkr→Cl
0.0						Mkr→RefLv
0.0						
	180000 GHz				Span 10.00 MHz	More 1 of 2
Res BW	3.0 MHz	#VBW	3.0 MHz	Sweep 1	.000 ms (1001 pts)	
SG				STATU	3	

#### π/ 4 DQPSK High Channel

8DPSK Low Channel



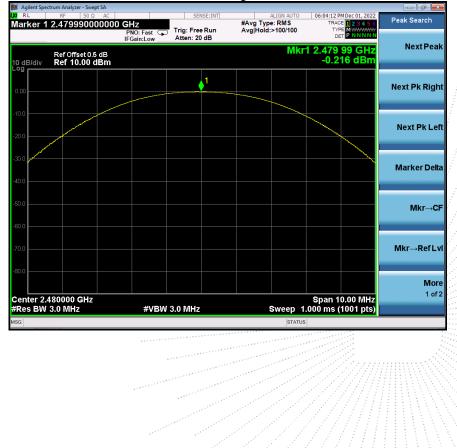
No.: BCTC/RF-EMC-007



		OBI OIL
nalyzer - Swept SA		Agilent Spectrum Analyzer - Swept SA
PN0: Fast Trig: Free Run Avg Hold:>100/100 DFZ	Avg Hold:>100/100	
Offset 0.5 dB MIRT 2.440 89 GHZ	Mkr1 2.440 89 GHz 0.041 dBm	Ref Offset 0.5 dB B/div Ref 10.00 dBm
Next Pk R	Next Pk Right	
Next Pk	Next Pk Left	
Marker	Marker Delta	
	Mkr→CF	
		0
Mkr→Re	Mkr→RefLv	
	More	
00 GHz Span 10.00 MHz	Span 10.00 MHz Sweep 1.000 ms (1001 pts)	nter 2.441000 GHz es BW 3.0 MHz #VBW 3.0 MHz
CTATUS	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.



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#### 12.4 Test Result

Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	1.002	0.866	PASS
GFSK	Middle	1.000	0.868	PASS
GFSK	High	0.996	0.863	PASS
π/ 4 DQPSK	Low	1.000	0.809	PASS
π/ 4 DQPSK	Middle	1.000	0.811	PASS
π/ 4 DQPSK	High	0.996	0.812	PASS
8DPSK	Low	1.002	0.813	PASS
8DPSK	Middle	1.000	0.814	PASS
8DPSK	High	0.998	0.813	PASS

Test plots GFSK Low Channel







**GFSK Middle Channel** 

#### **GFSK High Channel**



No.: BCTC/RF-EMC-007





 $\pi$ / 4 DQPSK Low Channel

π/ 4 DQPSK Middle Channel



No.: BCTC/RF-EMC-007





π/ 4 DQPSK High Channel

8DPSK Low Channel



No.: BCTC/RF-EMC-007



📕 Agilent Spectrum Analyzer - Swept SA			
α RL RF 50 Ω AC Marker 1 Δ 1.000000000 Γ	PNO: Wide 💭 Trig: Free Run	ALIGN AUTO 06:51:02 PM Dec 01, 202 #Avg Type: RMS TRACE 23.4.5 Avg Hold:>100/100 DFT P NNNN	6 Peak Search
Ref Offset 0.5 dB 0 dB/div Ref 10.00 dBm	IFGain:Low Atten: 20 dB	ΔMkr1 1.000 MH -0.026 dE	NextPea
			Next Pk Righ
20.0			Next Pk Le
			Marker Delt
50.0			Mkr→C
0.0			Mkr→RefL
30.0 Center 2.441500 GHz		Span 2.000 MH:	Mor 1 of
Res BW 30 kHz	#VBW 100 kHz	Sweep 2.133 ms (1001 pts	

8DPSK Middle Channel

8DPSK High Channel



No.: BCTC/RF-EMC-007



## 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;

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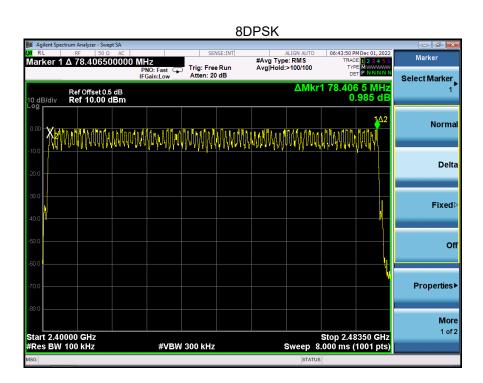
# 13.4 Test Result

					G	FSK				
	ctrum Analyzer - Swept S	A								
XI RL		AC		SEN	SE:INT	#Avg Typ	ALIGN AUTO		M Dec 01, 2022	Marker
Marker 1	Δ / /.905500		Z 0: Fast 🗔	Trig: Free		Avg Hold:		TYP	E 1 2 3 4 5 6 E M WWWWW F P N N N N N	
		IFG	ain:Low	Atten: 20	dB					Select Marker
10 dB/div	Ref Offset 0.5 d Ref 10.00 dB	B Im					ΔMki	1 77.90 -0	5 5 MHz .012 dB	1
									102	Normal
···· <b>X</b>	AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	INAAAAA	naninn	ALANANA	\ NAARAAA	nNaana	AAANAA	LAANTAAN	AMAAA	Norma
-10.0							, A. P. VVI I V			Delta
-20.0	the factor of the	<u>bb.a</u>		L. Luit		mm.	111.11,		1.11.1	Delta
-30.0										Firedb
-40.0										Fixed⊳
50.0										
										Off
-60.0 <mark>/</mark>									ή	
70.0										Properties►
80.0										More
Start 2.40	0000 GHz							Stop 2.48	3350 GHz	1 of 2
#Res BW	100 kHz		#VBW	300 kHz			Sweep 8	8.000 ms (	1001 pts)	
ISG							STATU	s		

**Test Plots:** 79 Channels in total

	6 4 5	K	DQPS	π/ 4 I						
								Analyzer - Swep		
Marker Select Marker	06:44:59 PM Dec 01, 2022 TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P N N N N N	>100/100	#Avg Typ Avg Hold			<b>IZ</b> NO:Fast ⊂ Gain:Low	P	<sup>ε 50 Ω</sup> 77.82200		Marl
1	77.822 0 MHz -0.026 dB	ΔMkr′					dB IBm	of Offset 0.5 ef 10.00 c	Re 3/div <b>R</b> e	I0 dE
Norm	142 MMWMM	MAMA	VANAN	MMM	MMMM		MunA	MMMM	XAM	0.00
Delt										10.0 20.0
Fixed									1	30.0 40.0
o										50.0 50.0
Properties	(									70.0
Mor 1 of	top 2 49250 CH							CHZ	2 40000	80.0
	tart 2.40000 GHz Stop 2.48350 GHz Res BW 100 kHz #VBW 300 kHz Sweep 8.000 ms (1001 pts)									
	27777		1							





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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

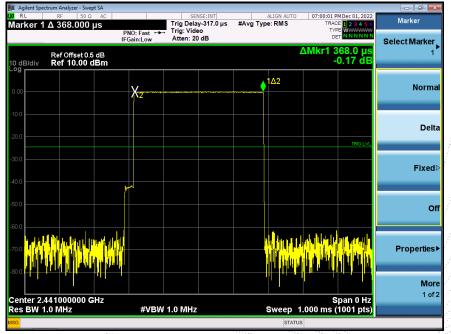
DH3:1600/79/4\*0.4\*79\*(MkrDelta)/1000

DH1:1600/79/2\*0.4\*79\*(MkrDelta)/1000

Remark: Mkr Delta is once pulse time.

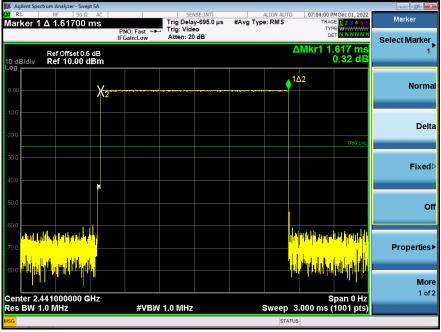
Modulation	Channel Data	Packet	pulse time(ms)	Dwell Time(s)	Limits(s)
	Middle	1DH1	0.368	0.118	0.4
GFSK		1DH3	1.617	0.259	0.4
		1DH5	2.854	0.304	0.4
	Middle	2DH1	0.377	0.121	0.4
π/ 4 DQPSK		2DH3	1.632	0.261	0.4
		2DH5	2.885	0.308	0.4
		3DH1	0.377	0.121	0.4
8DPSK	Middle	3DH3	1.620	0.259	0.4
		3DH5	2.864	0.305	0.4

Test Plots GFSK DH1 Middle Channel

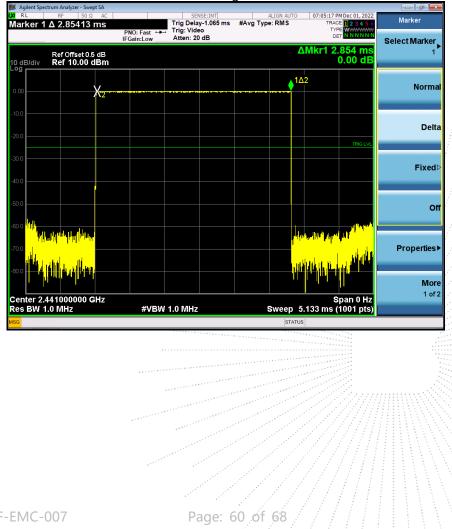




GFSK DH3 Middle Channel

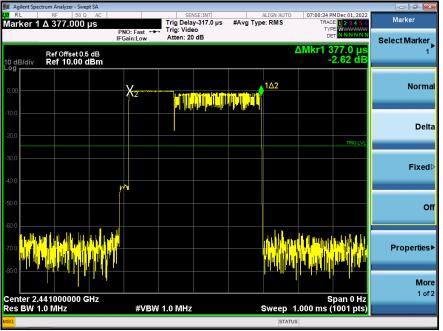


## GFSK DH5 High Middle Channel



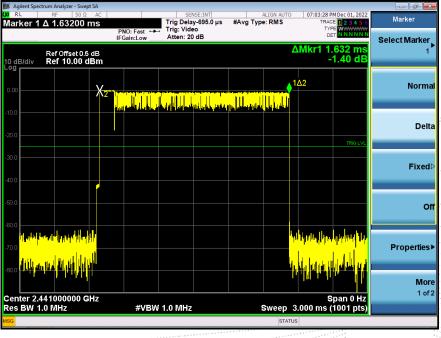
No.: BCTC/RF-EMC-007



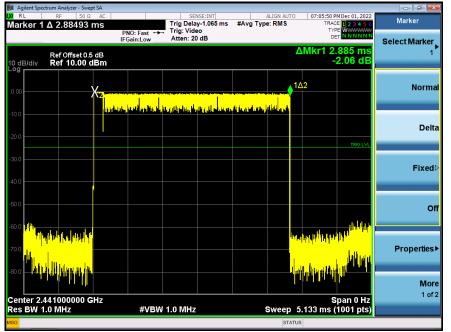


#### π/ 4 DQPSK DH1 Middle Channel

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

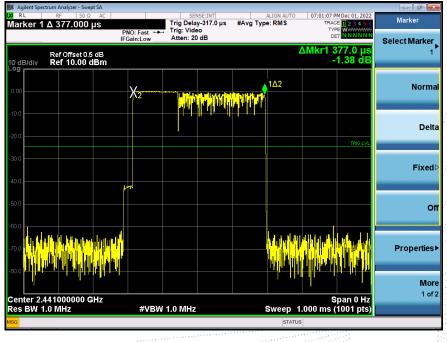




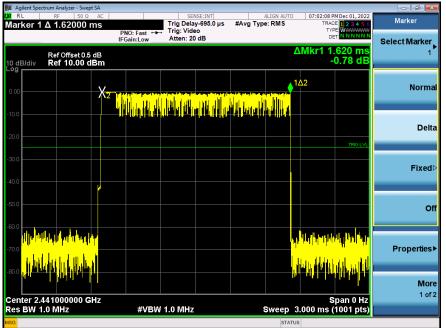


#### π/ 4 DQPSK DH5 Middle Channel

#### 8DPSK DH1 Middle Channel

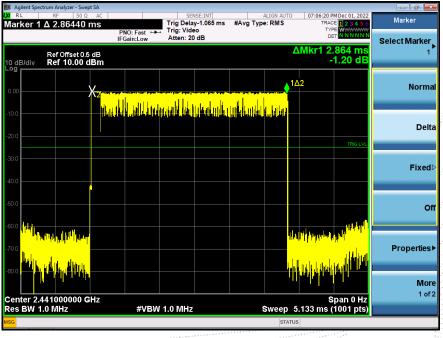






8DPSK DH3 Middle Channel

#### 8DPSK DH5 Middle Channel



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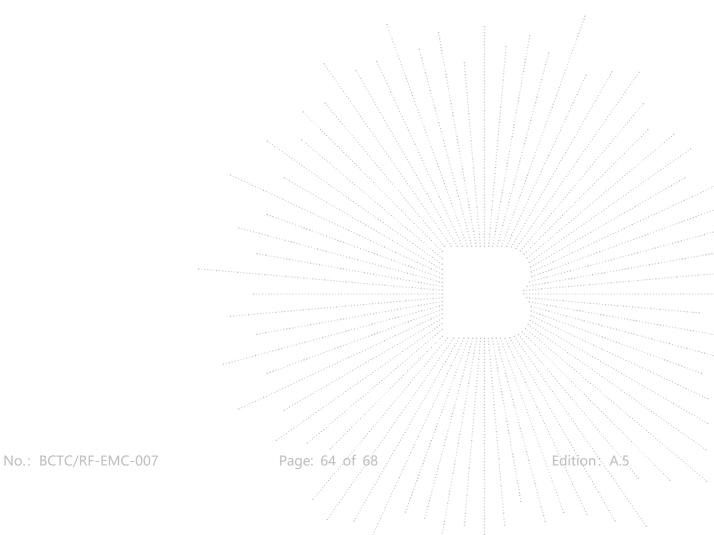
## 15. Antenna Requirement

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





# 16. EUT Photographs

EUT Photo



NOTE: Appendix-Photographs Of EUT Constructional Details



# 17. EUT Test Setup Photographs

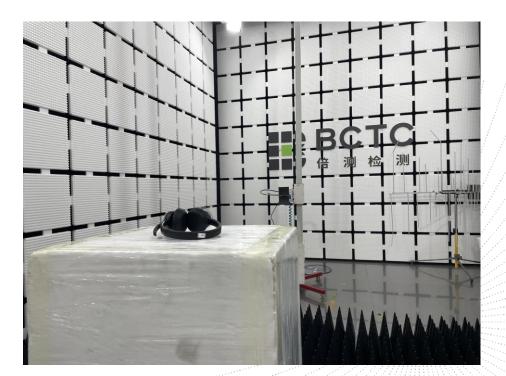
Conducted emissions





#### 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 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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