

# **TEST REPORT**

Report No.:	BCTC2212819965E					
Applicant:	SUZHOU AUDITORYWORKS CO.,LTD					
Product Name:	Bluetooth Adapter					
Model/Type reference:	AW-L10					
Tested Date:	2022-12-08 to 2022-12-15					
Issued Date:	2022-12-15					
SI	nenzhen BCTC Testing Co., Ltd.					
No.: BCTC/RF-EMC-0	07 Page: 1 of 68 Edition: A,5					



# FCC ID: 2AU5G-AWL10

Product Name:	Bluetooth Adapter
Trademark:	N/A
Model/Type reference:	AW-L10 AW-L1XXXXX("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:	2022-12-08
Sample tested Date:	2022-12-08 to 2022-12-15
Issue Date:	2022-12-15
Report No.:	BCTC2212819965E
Test Standards:	FCC Part15.247 ANSI C63.10-2013
Test Results:	PASS
Remark:	This is Bluetooth Classic radio test report.

Tested by:

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)

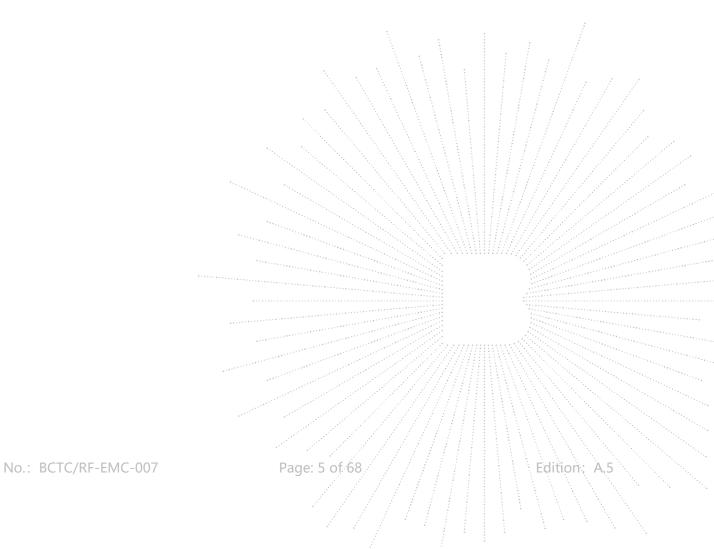
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# 1. Version

Report No.	Issue Date	Description	Approved
BCTC2212819965E	2022-12-15	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-L10 AW-L1XXXXX("X" can be 0-9, A-Z, A-Z, or blank, indicating A different case color, sales area, or customer)
Model differences:	All the model are the same circuit and RF module, except model names.
Hardware Version:	N/A
Software Version:	N/A
Operation Frequency:	Bluetooth: 2402-2480MHz
Type of Modulation:	Bluetooth: GFSK, π/ 4 DQPSK, 8DPSK
Number Of Channel	79CH
Antenna installation:	Internal antenna
Antenna Gain:	1.9 dBi
Ratings:	DC 5V from PC

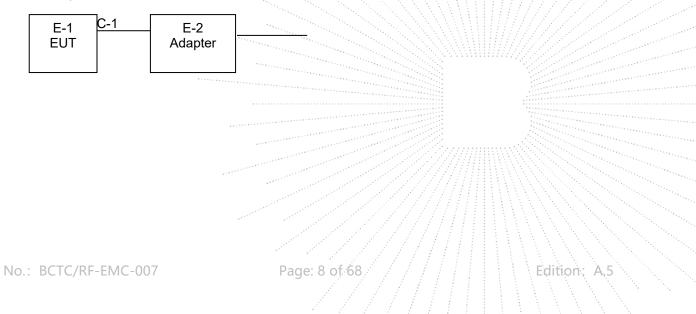
# 4.2 Test Setup Configuration

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	
			1999 - S.

Radiated Spurious Emission





# 4.3 Support Equipment

No.	Device Type	Brand	Model	Series No.	Note
E-1	Bluetooth Wireless Headset		AW-HP30		auxiliary
E-2	Adapter	N/A	BCTC001	N/A	Auxiliary
E-3	PC	N/A	N/A	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 <sup>:</sup>	



# 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



# 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	/	/	
Attenuator	1	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		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	an a	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	$\Lambda_{j}$	

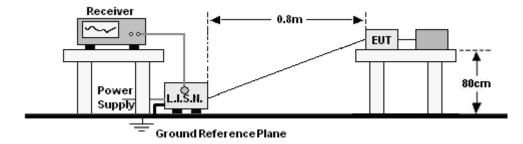
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# 6. Conducted Emissions

# 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

	1. Contract of the second seco		1
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.

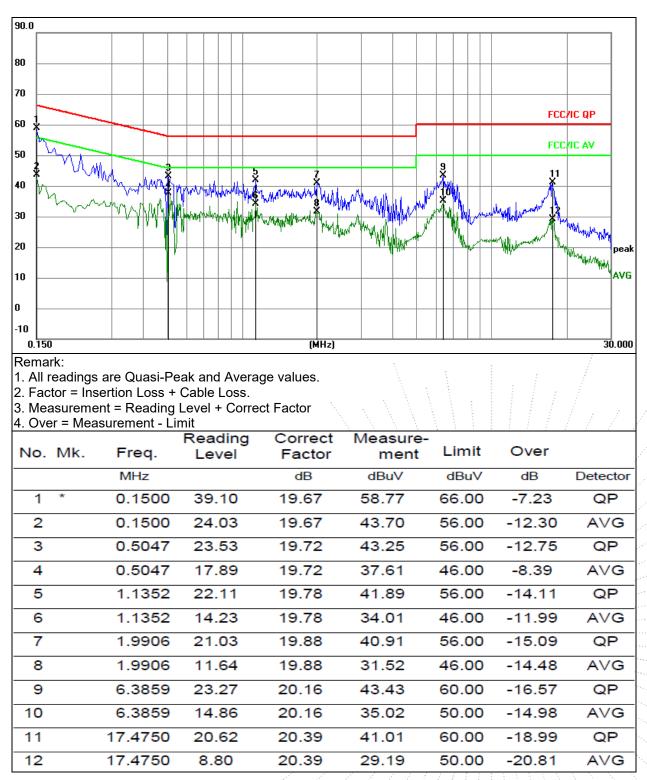
# 6.4 EUT operating Conditions

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 :	DC 5V from PC



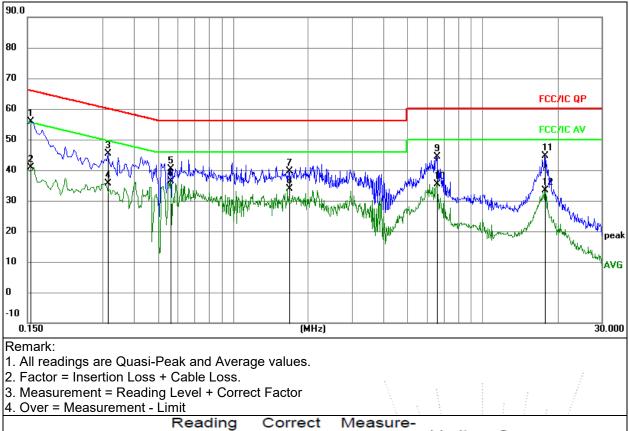
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Temperature:	<b>26</b> ℃	Relative Humidity:	54%
Pressure:	101KPa	Phase :	Ν
Test Mode:	Mode 4	Test Voltage :	DC 5V from PC



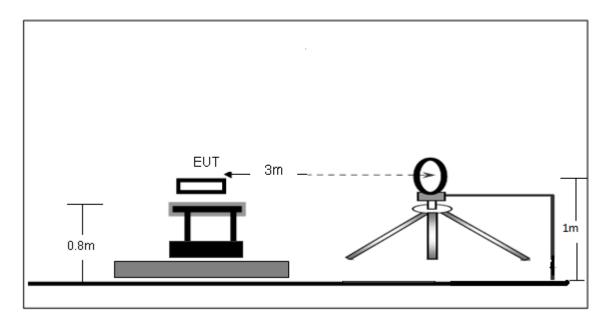
No.	Mk.	Freq.	Level	Correct Factor	Measure- ment	Limit	Over	
		MHz		dB	dBuV	dBuV	dB	Detector
1		0.1548	36.11	19.68	55.79	65.74	-9.95	QP
2		0.1548	21.23	19.68	40.91	55.74	-14.83	AVG
3		0.3165	25.71	19.77	45.48	59.80	-14.32	QP
4		0.3165	15.90	19.77	35.67	49.80	-14.13	AVG
5		0.5639	20.71	19.73	40.44	56.00	-15.56	QP
6	*	0.5639	16.62	19.73	36.35	46.00	-9.65	AVG
7		1.6755	19.71	19.84	39.55	56.00	-16.45	QP
8		1.6755	13.92	19.84	33.76	46.00	-12.24	AVG
9		6.5580	24.12	20.17	44.29	60.00	-15.71	QP
10		6.5580	15.26	20.17	35.43	50.00	-14.57	AVG
11		17.8395	24.27	20.41	44.68	60.00	-15.32	QP
12		17.8395	13.00	20.41	33.41	50.00	-16.59	AVG
				25 (24) (24)				



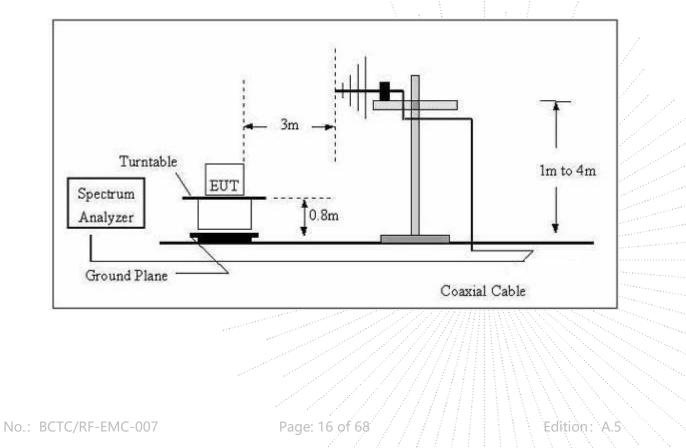
# 7. Radiated Emissions

# 7.1 Block Diagram Of Test Setup

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

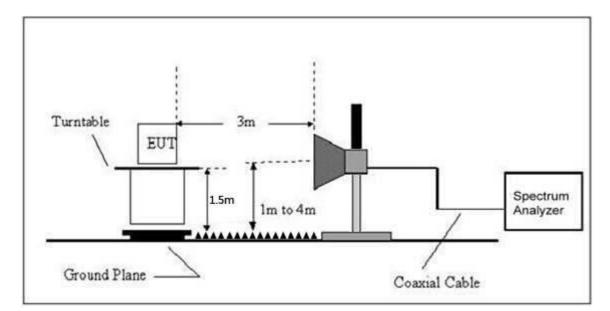


(B) Radiated Emission Test-Up Frequency 30MHz~1GHz





(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

Setting			
Auto			
RBW 200Hz for QP			
RBW 9kHz for QP			
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	Teet Voltage :	DC 5V from PC	
Test Mode:	Mode 4	Test Voltage :		

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.

No.: BCTC/RF-EMC-007

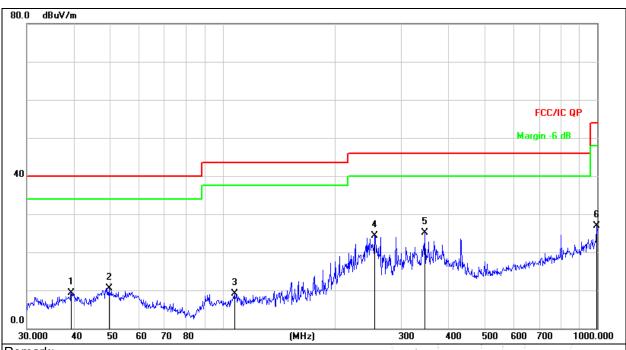
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#### Between 30MHz - 1GHz

Temperature:	<b>26</b> ℃	Relative Humidity:	54%
Pressure:	101KPa	Phase :	Horizontal
Test Mode:	Mode 4	Test Voltage :	DC 5V from PC



Remark:

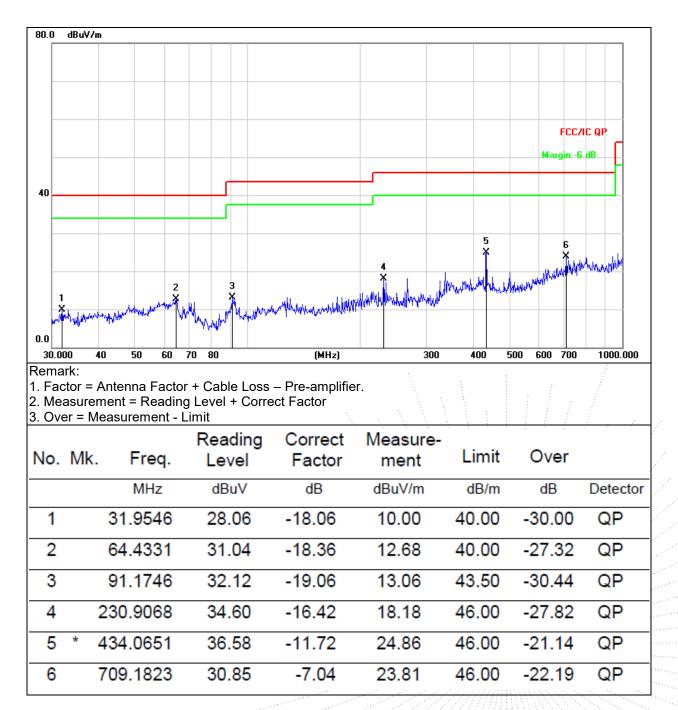
1. Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Measurement = Reading Level + Correct Factor
 Over = Measurement - Limit

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		39.4371	26.17	-16.81	9.36	40.00	-30.64	QP
2		49.7068	26.06	-15.62	10.44	40.00	-29.56	QP
3		107.5101	27.42	-18.25	9.17	43.50	-34.33	QP
4	2	254.7284	40.03	-15.71	24.32	46.00	-21.68	QP
5	*	346.8092	38.03	-12.90	25.13	46.00	-20.87	QP
6	ç	996.4996	30.60	-3.78	26.82	54.00	-27.18	QP



Temperature:	<b>26</b> ℃	Relative Humidity:	54%
Pressure:	101KPa	Phase :	Vertical
Test Mode:	Mode 4	Test Voltage :	DC 5V from PC





Between 1GHz - 25GHz

Polar	Frequency Reading Correct Level Factor		Measure- ment	Limits	Over	Detector		
(H/V)	(MHz)	(dBuV/m) (dB)	(dB)	(dBuV/m)	(dBuV/ m)	(dB)	Туре	
			GFSK Low ch	annel				
V	4804.00	52.35	-0.43	51.92	74.00	-22.08	PK	
V	4804.00	44.20	-0.43	43.77	54.00	-10.23	AV	
V	7206.00	45.25	8.31	53.56	74.00	-20.44	PK	
V	7206.00	35.99	8.31	44.30	54.00	-9.70	AV	
Н	4804.00	49.45	-0.43	49.02	74.00	-24.98	PK	
Н	4804.00	38.72	-0.43	38.29	54.00	-15.71	AV	
Н	7206.00	43.55	8.31	51.86	74.00	-22.14	PK	
Н	7206.00	36.39	8.31	44.70	54.00	-9.30	AV	
		G	FSK Middle c	hannel		•	•	
V	4882.00	50.72	-0.38	50.34	74.00	-23.66	PK	
V	4882.00	41.76	-0.38	41.38	54.00	-12.62	AV	
V	7323.00	41.73	8.83	50.56	74.00	-23.44	PK	
V	7323.00	33.38	8.83	42.21	54.00	-11.79	AV	
Н	4882.00	48.07	-0.38	47.69	74.00	-26.31	PK	
Н	4882.00	38.05	-0.38	37.67	54.00	-16.33	AV	
Н	7323.00	39.30	8.83	48.13	74.00	-25.87	PK	
Н	7323.00	30.55	8.83	39.38	54.00	-14.62	AV	
			GFSK High ch	annel				
V	4960.00	52.95	-0.32	52.63	74.00	-21.37	PK	
V	4960.00	43.23	-0.32	42.91	54.00	-11.09	AV	
V	7440.00	44.77	9.35	54.12	74.00	-19.88	PK	
V	7440.00	33.86	9.35	43.21	54.00	-10.79	AV	
Н	4960.00	50.70	-0.32	50.38	74.00	-23.62	PK	
Н	4960.00	40.39	-0.32	40.07	54.00	-13.93	AV	
Н	7440.00	43.18	9.35	52.53	74.00	-21.47	PK	
Н	7440.00	35.72	9.35	45.07	54.00	-8.93	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.

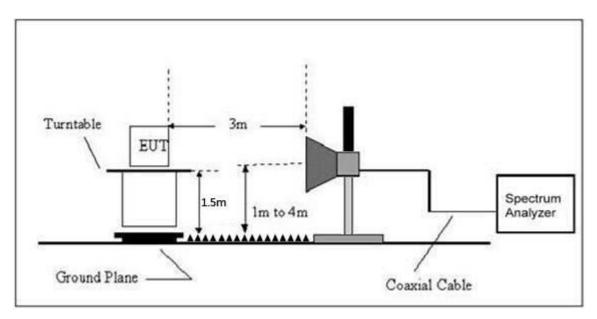
5.All the Modulation are test, the worst mode is GFSK, the data recording in the report.



# 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)			
Frequency (MIRZ)	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)	Frequency (MHz)	Reading Level	Correct Factor	Measure- ment (dBuV/m)		nits IV/m)	Result	
	(,	()	(dBuV/m)	(dB)	РК	РК	AV		
Low Channel 2402MHz									
	Н	2390.00	52.22	-6.70	45.52	74.00	54.00	PASS	
	Н	2400.00	55.84	-6.71	49.13	74.00	54.00	PASS	
	V	2390.00	52.98	-6.70	46.28	74.00	54.00	PASS	
GFSK	V	2400.00	53.14	-6.71	46.43	74.00	54.00	PASS	
GFSK				n Channel 2	480MHz				
	Н	2483.50	52.28	-6.79	45.49	74.00	54.00	PASS	
	Н	2500.00	47.59	-6.81	40.78	74.00	54.00	PASS	
	V	2483.50	52.92	-6.79	46.13	74.00	54.00	PASS	
	V	2500.00	48.10	-6.81	41.29	74.00	54.00	PASS	
	Low Channel 2402MHz								
	Н	2390.00	52.58	-6.70	45.88	74.00	54.00	PASS	
	Н	2400.00	57.14	-6.71	50.43	74.00	54.00	PASS	
	V	2390.00	52.99	-6.70	46.29	74.00	54.00	PASS	
π/4DQPSK	V	2400.00	54.51	-6.71	47.80	74.00	54.00	PASS	
II/4DQF SN		High Channel 2480MHz							
	Н	2483.50	50.84	-6.79	44.05	74.00	54.00	PASS	
	Н	2500.00	49.11	-6.81	42.30	74.00	54.00	PASS	
	V	2483.50	52.36	-6.79	45.57	74.00	54.00	PASS	
	V	2500.00	48.75	-6.81	41.94	74.00	54.00	PASS	
				/ Channel 2	402MHz				
	Н	2390.00	53.48	-6.70	46.78	74.00	54.00	PASS	
	Н	2400.00	57.28	-6.71	50.57	74.00	54.00	PASS	
	V	2390.00	53.09	6.70 ·	46.39	74.00	54.00	PASS	
8DPSK	V	2400.00	53.50	-6.71	46.79	74.00	54.00	PASS	
ODFSN			High	n Channel 2					
	Н	2483.50	52.05	-6.79	45.26	74.00	54.00	PASS	
	Н	2500.00	50.45	-6.81	43.64	74.00	54.00	PASS	
	V	2483.50	53.38	-6.79	46.59	74.00	54.00	PASS	
	V	2500.00	48.68	-6.81	41.87	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

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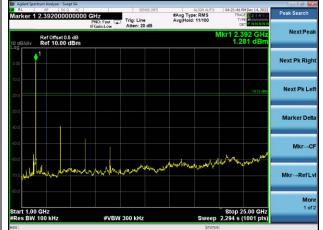
Edition: A.5



# 9.4 Test Result

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





arker 1	988.360000001	PNO: East	Trig: Line Atten: 20 dB	#Avg Type: RM Avg Hold: 36/10	S TRA	PMDec 14,2022 CE 23450 PE MWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW	Peak Search
) dB/div	Ref Offset 0.5 dB Ref 10.00 dBm				Mkr1 988 -69.3	.36 MHz 370 dBm	NextPea
							Next Pk Righ
10						-20.52 sBm	Next Pk Le
10							Marker Delt
10							Mkr→C
10 14 10	hainally villible that in the beau	ni-sime.Herbellshi	ilife.hrythjabhtywska	nerdenen mannerer et	the the second of the second of the second	contraction	Mkr→RefL
art 30.0	MHz 100 kHz	#VBW 3			Stop 1.	0000 GHz	Mor 1 of

# GFSK Middle Channel

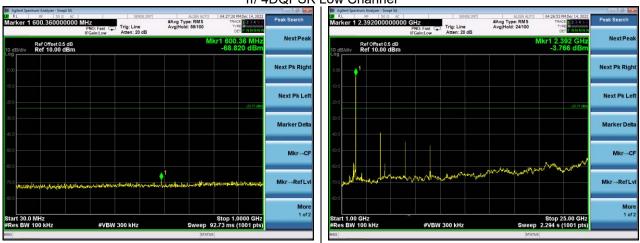


#### Agilent Spectrum Many RL RF S Marker 1 2.488000 #Avg Type: RMS AvgiHold: 37/100 1 623 640 Trig: Line NextPe 1 623.64 -68.532 c Ref Offset 0.5 dB Ref 10.00 dBm Next Pk Righ Next Pk Lef Marker Del Mkr→Ref Lvi More 1 of 2 es BW 100 kH 30.0 MHz BW 100 kH Stop 1.0000 GF Sweep 92.73 ms (1001 pt #VBW 300 kHz



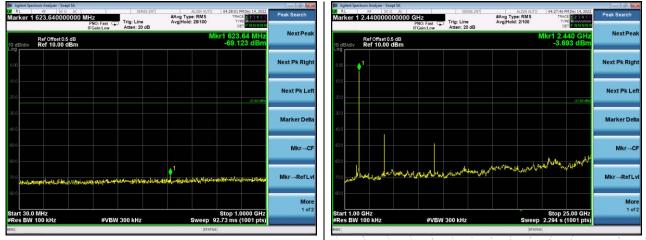
GFSK High Channel



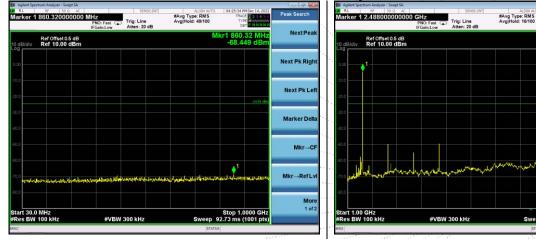


#### π/ 4DQPSK Low Channel









No.: BCTC/RF-EMC-007

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NextPea

Next Pk Righ

Next Pk Le

Marker De

Mkr→RefL

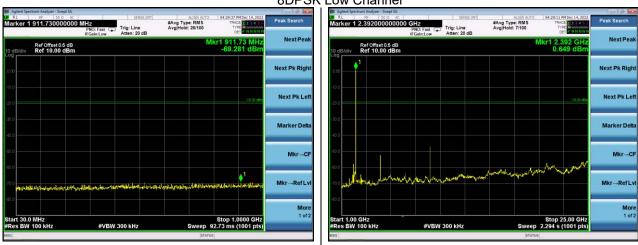
Mkr→C

Mor 1 of

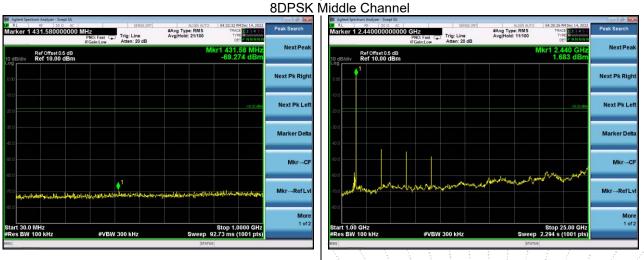
1 2.488 ( -4.648 c

Stop 25.00 GHz eep 2.294 s (1001 pts)



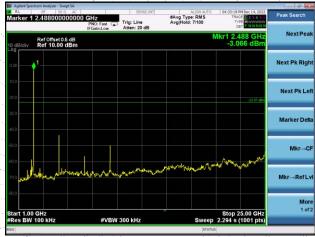


8DPSK Low Channel











Agrienta LXI RL	F	RF	50 Ω A0			SEI	SE:INT			LIGN AUTO		PM Dec 14, 20		Peak Search
Marker	12.4	10180	00000	PN	lZ NO:Fast ⊂ Gain:Low	Trig: Free Atten: 20			) Type Hold:>	: RMS 100/100	TY	DE 1234 PE MWWW ET P N N N	WW -	
10 dB/div			t 0.5 dB 00 dBn							M	(r1 2.40 1.9	1 8 GH 54 dBi		Next Peak
Log 0.00												1 1		Next Pk Right
-10.0												-18.05 dl	3.0	Next PK Right
-30.0												$\mathbb{H}^{-}$		Next Pk Left
-40.0 -50.0												2		Next FR Leit
-60.0 -70.0	nolum	madama	inger and and	weenstra	egentual horan	han and managed	يهيناسمانيو	موہلولدور واس	up man	and an address of the	adaman the	a h	~	Marker Delta
-80.0														
Start 2. #Res B					#VB	W 300 kHz			s	weep 9	Stop 2.4 .600 ms			Mkr→CF
MKR MODE	TRC S			× 2.401 8		Y 1.954 di		UNCTION	FUNC	TION WIDTH	FUNCT	ON VALUE		
2 N 3 N				2.401 0	0 GHz	-51.030 dE -58.983 dE	3m							Mkr→RefLvi
4 5 6													E	WIRT ARCTEV
7 8 9														More
10 11													-	1 of 2
MSG										STATU	5	•		

# GFSK Transmitting Band edge-left side

#### GFSK Hopping Band edge-left side

	ter - Swept SA							
RL RF RF 1 2.4028		PNO: Fast C	Trig: Free Run	#Avg Type Avg Hold::		TRACE	Dec 14, 2022 1 2 3 4 5 6 M WWWWWW P N N N N N	Peak Search
dB/div Ref 1	fset 0.5 dB 0.00 dBm	IFGain:Low	Atten: 20 dB		Mkr	1 2.402 8		NextPe
9 .00 .0								Next Pk Rig
.0					2			Next Pk L
.0 .0 .0	MUUUUUUUUUU	MMMMarri			***			Marker De
art 2.31000 GH es BW 100 kH	z	#VB	W 300 kHz		weep 1	Stop 2.430 1.53 ms (1	001 pts)	Mkr→
N         1         f           N         1         f           N         1         f           N         1         f	2.400	2 88 GHz 0 00 GHz 8 12 GHz	1.926 dBm -54.446 dBm -60.305 dBm	UNCTION FUN	CTION WIDTH	FUNCTION	N VALUE	Mkr→Refl
							=	
								<b>Мс</b> 1 с
			m		STATUS		•	

Edition: A.5



RF 50 Ω AC		SENSE:INT	ALIGN AUTO	03:37:31 PM Dec 14, 2022	
	0 GHz		#Avg Type: RMS	TRACE 1 2 3 4 5 6	Peak Search
	PNO: Fast C	Trig: Free Run	Avg Hold:>100/100	TYPE MWWWWW DET P NNNNN	
	IFGain:Low	Atten: 20 dB	Mkr4	2 470 949 CH7	Next Pe
Ref Offset 0.5 dB				2.479 646 GHZ	
				nour abii	
<b>A</b>					
					Next Pk Rig
				-18.36 dBm	
5					Next Pk L
hun (	$^2$ $^3$				
	haven	~ Antonio and an	- man And - And de David		
				an a	Marker De
				Oton 3 50000 CH-	
	#VB	W 300 kHz	Sween 2	133 ms (1001 pts)	Mkr→
f 2.4	79 848 GHz	1.641 dBm		TONCTION VALUE	
2.4	84 514 GHZ	-59.7 17 UBIII			Mkr→RefL
				Ξ	
					Mo
					1 c
				-	
				F	
	Ref Offset 0.5 dB Ref 10.00 dBm 1 00 GHz 00 GHz 00 KHz SCL X f 2.4 2	IFGain:Low Ref Offset 0.5 dB Ref 10.00 dBm	PRO: Fast IFGsin:Low Trig: Free Run Atten: 20 dB Ref 0fiset 0.5 dB Ref 10.00 dBm 0 GHz 00 GHz 00 GHz 1 2.479 848 GHz 1 2.407 848 GHz 1 3.411 dBm 1 4.41 dBm 1 4.41 dBm	PRO: Fest         Trig: Free Run Atten: 20 dB         Avg Hold:>100/100           Ref Offiset 0.5 dB         Mkr1           Ref 10.00 dBm         Image: Comparison of the second	PHO: Fast Trig: Free Run Atten: 20 dB Ref Offiset 0.5 dB Ref 10.00 dBm

#### GFSK Transmitting Band edge-right side

GFSK Hopping Band edge-right side



No.: BCTC/RF-EMC-007



Agilent Spect	rum Analyzer - S RF 50	wept SA ) Ω AC	SENSE	INT	ALIGN AUTO		1Dec 14, 2022	
arker 1	2.401800	000000 GHz PNO: Fas	Trig: Free R	#Avg Typ	be:RMS l:>100/100	TRACE	123456 MWWWW	Peak Search
		IFGain:Lo				DE	PNNNN	
) dB/div	Ref Offset Ref 10.0				Mk	r1 2.401 1.95	8 GHz 3 dBm	Next Pe
.00							<b>0</b> 1	
0.0							Å –	Next Pk Rig
0.0							-18.05 dBm	
0.0								
0.0								Next Pk L
0.0						^	2	
0.0						3/	1	
a south and	hand an all the state of the	had many of which and when the		workerst had been been been so and	stan, manager age	man	hanner	Marker De
0.0								MarkerDe
0.0								
tart 2.310						Stop 2.41		
Res BW '	100 kHz	#	VBW 300 kHz		Sweep 9	.600 ms (1	001 pts)	Mkr→
KR MODE TRO	SCL	X	Y		NCTION WIDTH	FUNCTIO	N VALUE	
1 N 1 2 N 1	f	2.401 80 GHz 2.400 00 GHz	-53.348 dBm					
3 N 1	f	2.393 1 GHz	-63.528 dBm					Mkr→RefL
5							E	
6 7								
8	$\vdash$						_	Mo
0								1 c
							-	
							- F	

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

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





📕 Agilent Spectrum Analyzer - Swept SA				
Marker 1 2.479826000000		ALIGN AUTO 0: #Avg Type: RMS Avg Hold:>100/100	3:38:30 PM Dec 14, 2022 TRACE 1 2 3 4 5 6 TYPE MWWWWW	Peak Search
Ref Offset 0.5 dB 10 dB/div Ref 10.00 dBm	PNO: Fast Trg: Free Run IFGain:Low Atten: 20 dB		1.582 dBm	Next Peak
Log 0.00 -10.0 -20.0			-18.48 dBm	Next Pk Right
-30.0	2,3			Next Pk Lef
-60.0		m han an a	www.www.	Marker Delta
Start 2.47800 GHz #Res BW 100 kHz MKR MODE TRC SCL X			p 2.50000 GHz ms (1001 pts)	Mkr→CF
2 N 1 f 2.483	9 826 GHz 1,582 dBm 500 GHz -63.069 dBm 1 204 GHz -61.920 dBm			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



No.: BCTC/RF-EMC-007

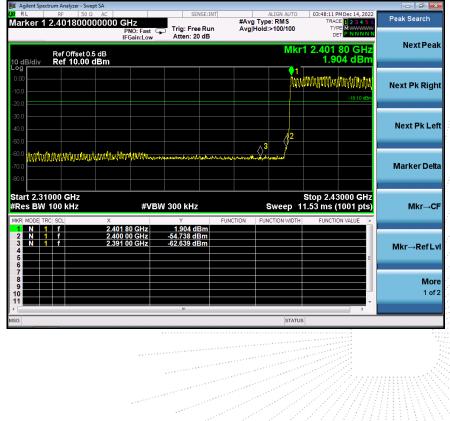
Edition: A.5



Agilent Spectrum Analyzer - Swept SA RL RF 50 Ω AC					
RL RF 50 Ω AC arker 1 2.401800000000			ALIGN AUTO vg Type: RMS g Hold:>100/100	03:49:06 PM Dec 14, 2022 TRACE 1 2 3 4 5 6 TYPE M	Peak Search
Ref Offset 0.5 dB 0 dB/div Ref 10.00 dBm		ten: 20 dB		r1 2.401 8 GHz 1.960 dBm	Next Pea
				↓ 1 -18.04 dBm	Next Pk Rig
40.0 50.0 50.0				2 2	Next Pk Le
0.0 0.0 0.0	waanayaadalaataa dawa	when the Permit consideration the second	htman have a	3 Manual Andrew	Marker Del
tart 2.31000 GHz Res BW 100 kHz	#VBW 300	KHZ		Stop 2.41000 GHz .600 ms (1001 pts)	Mkr→0
1 N 1 f 2.40 2 N 1 f 2.40	01 80 GHz 1.9	260 dBm 276 dBm 241 dBm			Mkr→RefL
7 8 9 0 1				· .	<b>Мо</b> 1 о
G					

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

8DPSK Hopping Band edge-left side



No.: BCTC/RF-EMC-007



🎉 Agilent Spectrum Analyzer - Swept SA					
ເ₩ RL RF 50Ω AC Marker 1 2.480178000000	GHz	ENSE:INT #Avg Ty		9:15 PM Dec 14, 2022 TRACE 1 2 3 4 5 6 TYPE M	Peak Search
D.COSCUDE ID	PNO: Fast Trig: Fr IFGain:Low Atten:			0 178 GHz	Next Peak
Ref Offset 0.5 dB 10 dB/div Ref 10.00 dBm				1.576 dBm	
-10.0					Next Pk Right
-20.0				-18.42 dBm	
-40.0					Next Pk Left
-60.0	2 <sup>3</sup>				
-70.0		and a construction of the second s	W-Proprietor	<u>``madadhaanka</u>	Marker Delta
Start 2.47800 GHz #Res BW 100 kHz	#\/D\// 000 LU	<u> </u>		2.50000 GHz	Min. of
MKR MODE TRC SCL X	#VBW 300 kH	FUNCTION FU	Sweep 2.133 I		Mkr→CF
2 N 1 f 2.483	0 178 GHz 1.576 3 500 GHz -62.842 4 006 GHz -60.942	dBm			Mkr→RefLvl
				E	Wiki →Kei Evi
7 8 9 9					More
					1 of 2
MSG			STATUS		

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

8DPSK Hopping Band edge-right side



No.: BCTC/RF-EMC-007



## 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.

No.: BCTC/RF-EMC-007

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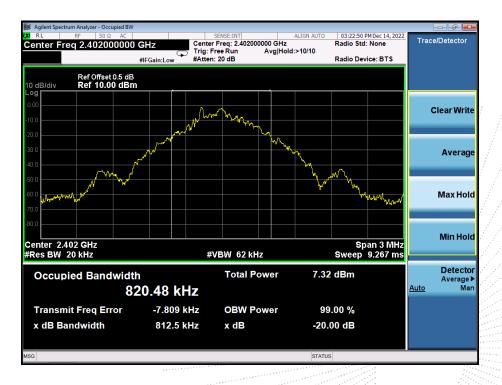


# 10.4 Test Result

Temperature:	<b>26</b> ℃	Relative Humidity:	54%
Pressure:	101KPa	Test Voltage :	DC 5V
		root voltago :	2007

Modulation	Test Channel Bandwidth(MHz)	
GFSK	Low 0.813	
GFSK	Middle 0.817	
GFSK	High	0.818
π/ 4 DQPSK	Low	1.201
π/ 4 DQPSK	Middle	1.199
π/ 4 DQPSK	High	1.200
8DPSK	Low	1.200
8DPSK	Middle	1.200
8DPSK	High	1.202

Test plots GFSK Low Channel





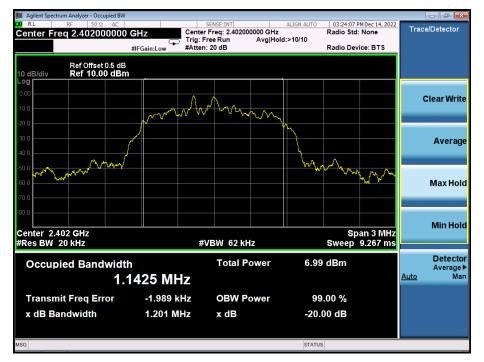


#### **GFSK Middle Channel**

#### **GFSK High Channel**







#### π/ 4 DQPSK Low Channel

#### π/ 4 DQPSK Middle Channel

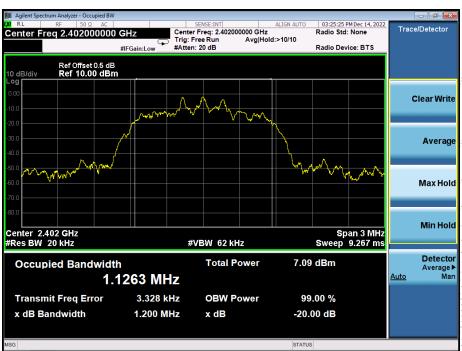






#### π/ 4 DQPSK High Channel

#### 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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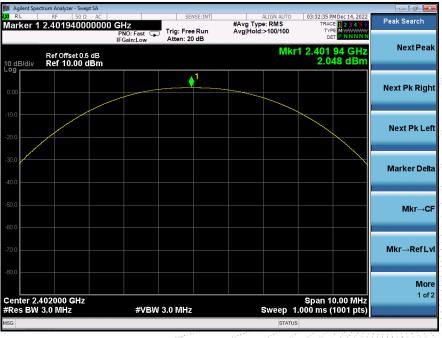


# 11.4 Test Result

Temperature:	<b>26</b> ℃	Relative Humidity:	54%
Pressure:	101KPa	Test Voltage :	DC 5V

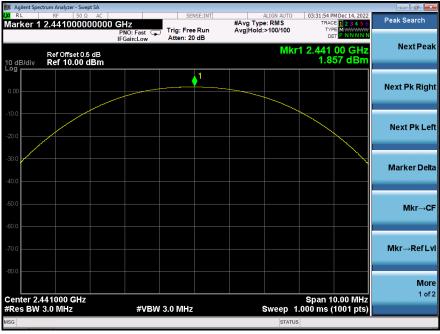
Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	2.048	21
GFSK	Middle	1.857	21
GFSK	High	1.693	21
π/ 4 DQPSK	Low	2.007	21
π/ 4 DQPSK	Middle	1.840	21
π/ 4 DQPSK	High	1.668	21
8DPSK	Low	2.341	21
8DPSK	Middle	2.178	21
8DPSK	High	2.019	21

## Test plots GFSK Low Channel

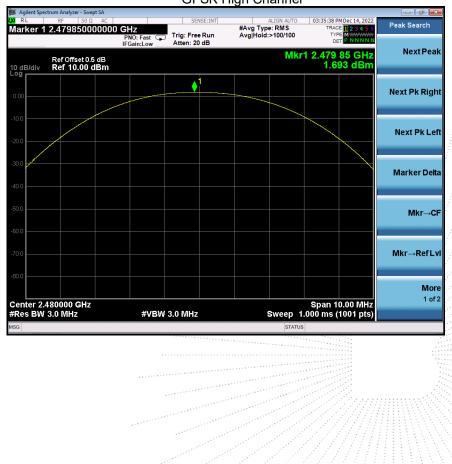




**GFSK Middle Channel** 



#### **GFSK High Channel**





📁 Agilent Spectrum Analyzer - Swept SA			(	
X RL RF 50Ω AC	SENSE:INT		0 PM Dec 14, 2022	k Search
Marker 1 2.401980000000	PNO: Fast → IFGain:Low Trig: Free Run Atten: 20 dB	#Avg Type: RMS ⊤ Avg Hold:>100/100		
Ref Offset 0.5 dB 10 dB/div Ref 10.00 dBm		Mkr1 2.40 2	1 98 GHz 007 dBm	Next Peak
0.00	1		Nex	t Pk Right
-10.0			N	ext Pk Left
-30.0				arker Delta
-40.0				
-60.0				Mkr→CF
-70.0			M	kr→RefLvl
Center 2.402000 GHz	41/D1// 0.0 MUL-	Spar Sweep 1.000 m	10.00 MHz	More 1 of 2
#Res BW 3.0 MHz	#VBW 3.0 MHz		s (1001 pts)	
mou		STATUS		

#### π/ 4 DQPSK Low Channel

 $\pi$ / 4 DQPSK Middle Channel





nalyzer - Swept SA   S0 Q AC   798800000000 Offset 0.5 dB f 10.00 dBm	GHz PNO: Fast ( IFGain:Low	SENSE:INT Trig: Free Run Atten: 20 dB	ALIGN AUTO #Avg Type: RMS Avg Hold:>100/100	03:30:51 PMDec 14, TRACE 0 2 3 4 TYPE MININ DET P NNN tr1 2.479 88 GI 1.668 dE	Peak Search
79880000000 Offset 0.5 dB	PNO: Fast	Trig: Free Run	#Avg Type: RMS Avg Hold:>100/100	TRACE 1 2 3 4 TYPE MWWW DET P NNN	z 6 NN Hz NextPeal
Offset 0.5 dB f 10.00 dBm	IFGain:Low	Atten: 20 dB		r1 2.479 88 GI	HZ Next Peal
		<b>1</b>			Next Pk Righ
					Next Pk Lef
					Marker Delt
					Mkr→C
					Mkr→RefLv
00 GHz	#\/B\A	3 0 MHz	Sween	Span 10.00 M	Mor 1 of:
	00 GHz WHz				

#### π/ 4 DQPSK High Channel

#### 8DPSK Low Channel



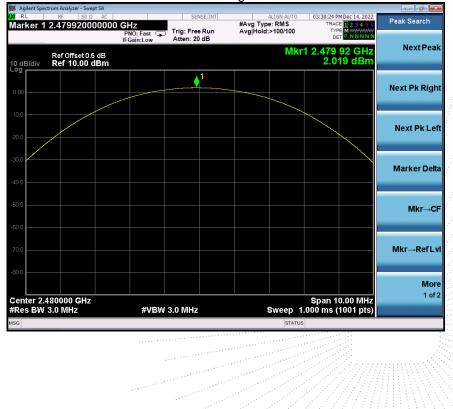
No.: BCTC/RF-EMC-007



			ODF OK IV			
	ctrum Analyzer - Swept SA					
Marker 1	RF 50 Ω AC	0 GHz	SENSE:INT	ALIGN AUTO #Avg Type: RMS	03:26:22 PM Dec 14, 2022 TRACE 1 2 3 4 5 6	Peak Search
marker	2.4400000000	PNO: Fast IFGain:Low	Trig: Free Run Atten: 20 dB	Avg Hold:>100/100	TYPE MWWWWW DET PNNNNN	NextBack
10 dB/div Log	Ref Offset 0.5 dB Ref 10.00 dBm			Mkr	1 2.440 88 GHz 2.178 dBm	Next Peak
0.00						Next Pk Right
-10.0						Next Pk Left
-20.0						Marker B. K.
-40.0						Marker Delta
-50.0						Mkr→CF
-70.0						Mkr→RefLvl
-80.0						More
Center 2. #Res BW	441000 GHz 3.0 MHz	#VBW	3.0 MHz	Sweep 1	Span 10.00 MHz .000 ms (1001 pts)	1 of 2
MSG				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	1.004	0.813	PASS
GFSK	Middle	1.000	0.817	PASS
GFSK	High	0.996	0.818	PASS
π/ 4 DQPSK	Low	1.000	0.801	PASS
π/ 4 DQPSK	Middle	1.004	0.799	PASS
π/ 4 DQPSK	High	0.996	0.800	PASS
8DPSK	Low	1.002	0.800	PASS
8DPSK	Middle	1.000	0.800	PASS
8DPSK	High	0.996	0.801	PASS

Test plots GFSK Low Channel



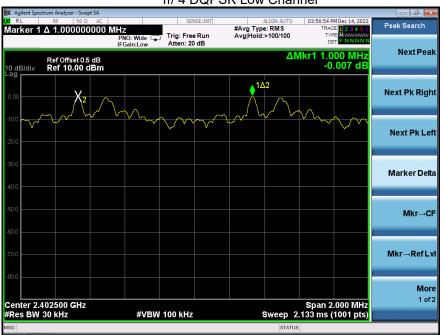




#### **GFSK High Channel**







 $\pi$ / 4 DQPSK Low Channel

π/ 4 DQPSK Middle Channel





Agilent Spectrum Analyzer - Swept SA	117		K High Char		
RL RF 50 Ω AC Iarker 1 Δ 996.000000 kH	PNO: Wide	SENSE:INT	ALIGN AUTO #Avg Type: RMS Avg Hold:>100/100	04:00:53 PM Dec 14, 2022 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P N N N N N	Peak Search
Ref Offset 0.5 dB 0 dB/div Ref 10.00 dBm				ΔMkr1 996 kHz 0.004 dB	Next Pea
			↓1∆2		Next Pk Righ
					Next Pk Le
.0.0					Marker Delf
0.0					Mkr→C
0.0					Mkr→RefL
enter 2.479500 GHz Res BW 30 kHz	#VBW 100	kHz	Sweep 2	Span 2.000 MHz .133 ms (1001 pts)	Mor 1 of
G			STATUS		

π/ 4 DQPSK High Channel

8DPSK Low Channel





			1	
📕 Agilent Spectrum Analyzer - Swept SA				
	D: Wide ain:Low Atten: 20 dB	ALIGN AUTO #Avg Type: RMS Avg Hold:>100/100	03:59:25 PM Dec 14, 2022 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P N N N N N	Peak Search
Ref Offset 0.5 dB 0 dB/div Ref 10.00 dBm	ani.cow	ΔΜk	r1 1.000 MHz -0.004 dB	NextPea
	$\wedge$		$\overline{\gamma}$	Next Pk Righ
				Next Pk Lei
0.0				Marker Delt
0.0				Mkr→C
0.0				Mkr→RefLv
enter 2.441500 GHz Res BW 30 KHz	#VBW 100 kHz	Sweep 2.1	Span 2.000 MHz 33 ms (1001 pts)	<b>Mor</b> 1 of:
SG		STATUS		

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;

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# 13.4 Test Result

Agilent Spectrum Analyzer - Swept SA		GFSK		
RL     RF     50 Ω     AC       arker 1 Δ     77.989000000	MHz PN0: Fast → Trig: Free F IFGain:Low Atten: 20 d	#Avg Type: RMS Avg Hold:>100/100	03:52:26 PM Dec 14, 2022 TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P N N N N N	Marker
Ref Offset 0.5 dB dB/div Ref 10.00 dBm	I Sameon		r1 77.989 0 MHz -0.280 dB	Select Marker 1
				Norma
		<u>Hindian Childian Child</u>		Delt
				Fixed
				o
.0				Properties
				Mo 1 of
art 2.40000 GHz Res BW 100 kHz	#VBW 300 kHz	Sweep	Stop 2.48350 GHz 8.000 ms (1001 pts)	

**Test Plots:** 79 Channels in total

					π/4[	DQPS	K		-	
	trum Analyzer - Swep									
Warker 1	RF 50 Ω Δ 78.23950	AC	lz		ISE:INT	#Avg Typ	ALIGN AUTO e: RMS	TRAC	M Dec 14, 2022	Marker
		PI	NO:Fast 🕞 Gain:Low	Trig: Free Atten: 20		Avg Hold	>100/100	TYP		
			Jame	/110111 20	45		AMkr	1 78 239	5 MHz	Select Marker
10 dB/div Log	Ref Offset 0.5 Ref 10.00 d	dB IBm						-0	.368 dB	1
0.00			MMM	AMMA		MW.Mw	ANNA	MMM.	142 MMM	Norma
-10.0										Delta
-30.0										Fixed▷
-50.0										Of
-70.0									Ĭ,	Properties
-80.0										More 1 of 2
Start 2.40 #Res BW			#VBW	300 kHz			Sweep 8	<del>Stop</del> 2.48 .000 ms (	3350 GHz 1001 pts)	
	ment Complete	d					STATUS			
						1997 - 1999 1997 - 1999			////	



		8DP	SK		
Magilent Spectrum Analyzer - Sw RL RF 50 Marker 1 Δ 77.9890	Ω AC 000000 MHz PN0: Fast		ALIGN AUTO Avg Type: RMS Avg Hold:>100/100	03:54:43 PM Dec 14, 2022 TRACE 2 3 4 5 6 TYPE MWWWW DET P NNNNN	Marker
Ref Offset 0 10 dB/div Ref 10.00	0.5 dB dBm		ΔMkr1	77.989 0 MHz 0.821 dB	1
	WWWWWWWWWW	ANNO ANNO ANN	WWWWWWWW		Norma
-20.0					Delta
-30.0					Fixed
.50.0					Of
.70.0				<b>``</b>	Properties
-80.0 Start 2.40000 GHz				top 2.48350 GHz	Mor 1 of
#Res BW 100 kHz	#VBW 30	UKHZ	Sweep 8.0 STATUS	000 ms (1001 pts)	

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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

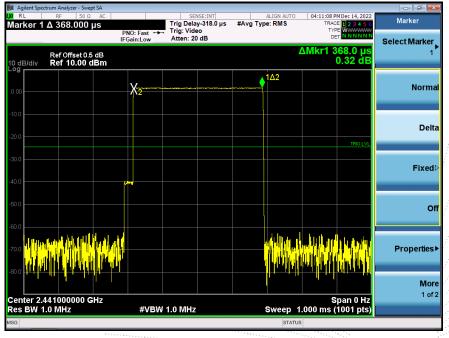
DH3:1600/79/4\*0.4\*79\*(MkrDelta)/1000

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

Remark: Mkr Delta is once pulse time.

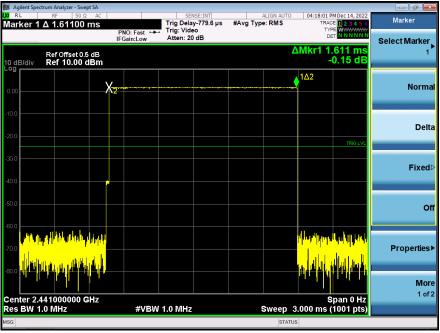
Modulation	Channel Data	Packet	pulse time(ms)	Dwell Time(s)	Limits(s)
GFSK	Middle	1DH1	0.368	0.118	0.4
		1DH3	1.611	0.258	0.4
		1DH5	2.865	0.306	0.4
π/ 4 DQPSK	Middle	2DH1	0.377	0.121	0.4
		2DH3	1.626	0.260	0.4
		2DH5	2.870	0.306	0.4
8DPSK		3DH1	0.377	0.121	0.4
	Middle	3DH3	1.620	0.259	0.4
		3DH5	2.860	0.305	0.4

Test Plots GFSK DH1 Middle Channel

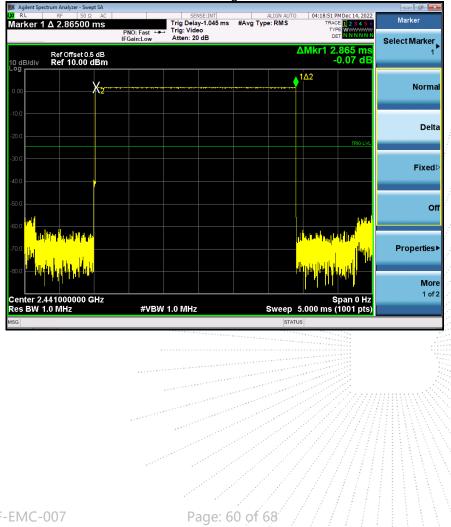




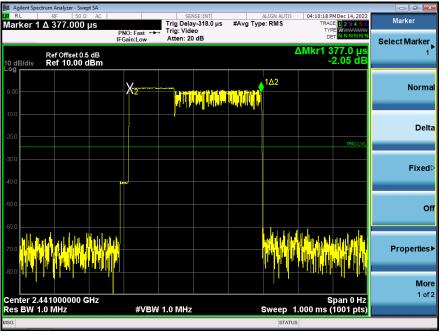
GFSK DH3 Middle Channel



## GFSK DH5 High Middle Channel

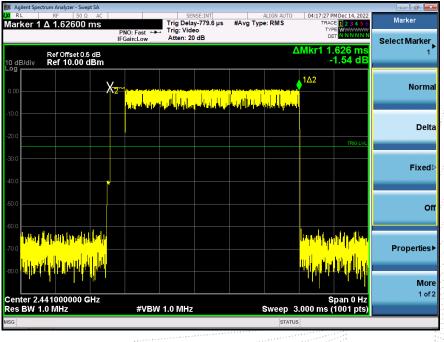




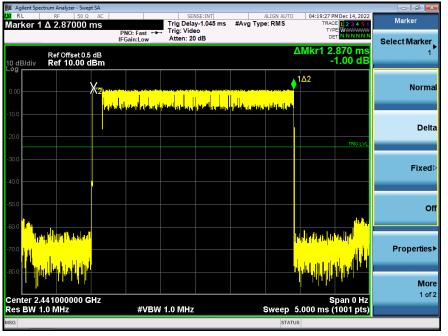


#### π/ 4 DQPSK DH1 Middle Channel

#### π/ 4 DQPSK DH3 Middle Channel

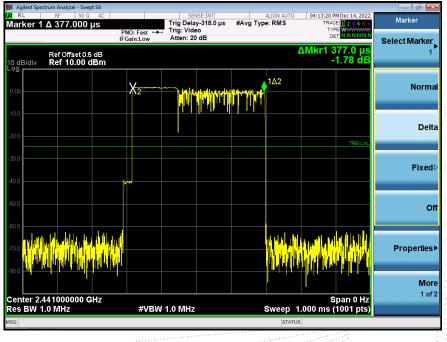




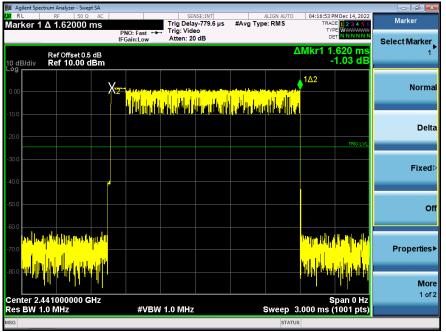


#### π/ 4 DQPSK DH5 Middle Channel

8DPSK DH1 Middle Channel

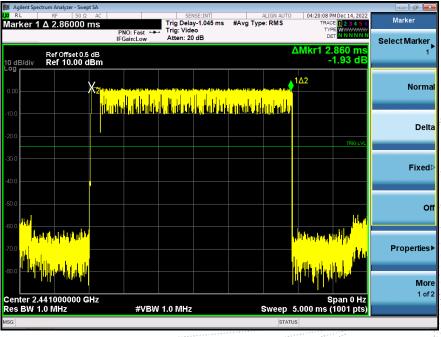






8DPSK DH3 Middle Channel

#### 8DPSK DH5 Middle Channel





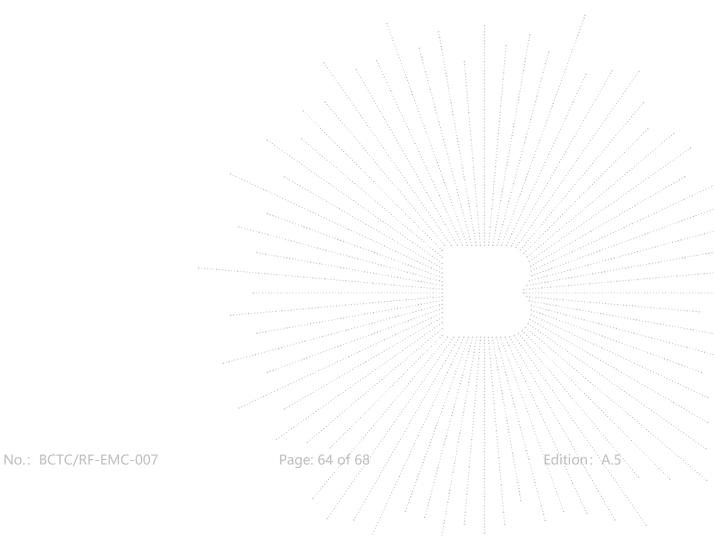
# 15. Antenna Requirement

#### 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

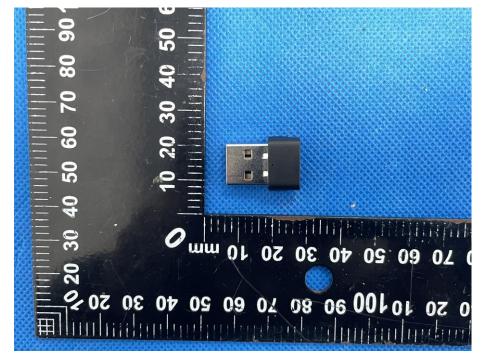
The EUT antenna is Internal antenna, fulfill the requirement of this section.





# 16. EUT Photographs

EUT Photo



NOTE: Appendix-Photographs Of EUT Constructional Details

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# 17. EUT Test Setup Photographs

Conducted emissions

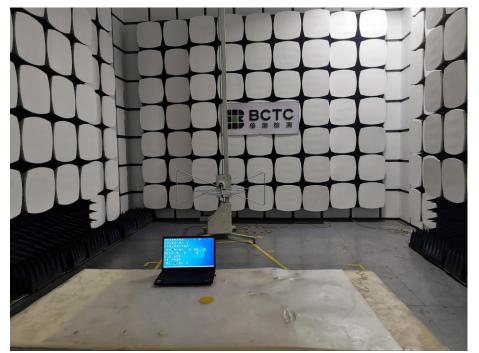


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#### **Radiated Measurement Photos**







# **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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