

# **TEST REPORT**

Report No.:	BCTC2106483915E
Applicant:	Innovative Technology Electronics LLC
Product Name:	Music Center with Bluetooth
Model/Type reference:	VTA-80-ESP, VTA-80, VTA80
Tested Date:	2021-06-23 to 2021-07-06
Issued Date:	2021-07-27
She	enzhen Burectesting Co., Ltd.
No. : BCTC/RF-EMC-007	Page: 1 of 68 Edition : A.3



## FCC ID: 2AFHW-VTA80ESP

Product Name:	Music Center with Bluetooth			
Trademark:	N/A			
Model/Type reference:	VTA-80-ESP, VTA-80, VTA80 VTA-80xxxx (xxxx can be digit 0 to 9, A-Z or blank to indicate			
Prepared For:	Innovative Technology Electronics LLC			
Address:	1979 Marcus Ave., Suite 210 Lake Success NY 11042 United States			
Manufacturer:	Amega Electronic(HZ) Limited			
Address:	3/F., Hengfengyuan Industrial Building, Huangshi Industrail Park, Baishi Villiage, Qiuchang Town, Huiyang District, Huizhou City, Guangdong Province, China			
Prepared By:	Shenzhen BCTC Testing Co., Ltd.			
Address:	1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Tangwei, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China			
Sample Received Date:	2021-06-23			
Sample tested Date:	2021-06-23 to 2021-07-06			
Issue Date:	2021-07-27			
Report No.:	BCTC2106483915E			
Test Standards	FCC Part15.247 ANSI C63.10-2013			
Test Results	PASS			
Remark:	This is Bluetooth Classic radio test report.			

Tested by:

Eric Yang/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
BCTC2106483915E	2021-07-27	Original	Valid



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## 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	<b>U=0.59℃</b>



## 4. PRODUCT INFORMATION AND TEST SETUP

#### 4.1 Product Information

Model differences: All the model are the same circuit and RF module, except model names.
Bluetooth Version: BT 4.2
Operation Frequency: Bluetooth: 2402-2480MHz
Type of Modulation: Bluetooth: GFSK, Pi/4 DQPSK, 8DPSK
Number Of Channel 79CH
Antenna installation: PCB antenna
Antenna Gain: 0dBi
Ratings: AC120V/60Hz

## 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/Radiated Spurious Emission





## 4.3 Support Equipment

No.	Device Type	Brand	Model	Series No.	Note

	Item	Shielded Type	Ferrite Core	Length	Note
Ī					

#### 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(Pi/4DQPSK)	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

Test software Version		FCC_Test	
Frequency	2402 MHz	2441 MHz	2480 MHz
Parameters	DEF	DEF	DEF



## 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, Tangwei, 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 28, 2021	May 27, 2022				
LISN	R&S	ENV216	101375	May 28, 2021	May 27, 2022				
ISN	HPX	ISN T800	S1509001	May 28, 2021	May 27, 2022				
Software	Frad	EZ-EMC	EMC-CON 3A1	١	$\Lambda_{/}$				

RF Conducted Test					
Equipment	Manufacturer	Model#	Serial#	Last Cal.	Next Cal.
Signal Analyzer 20kHz-26.5GHz	KEYSIGHT	N9020A	MY49100060	May 28, 2021	May 27, 2022



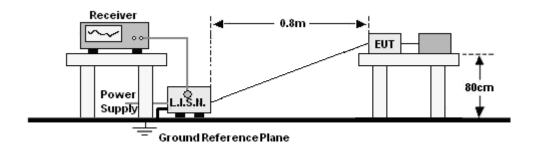
	Radiated	d emissions	Test (966 cha	amber)	
Equipment	Manufacturer	Model#	Serial#	Last Cal.	Next Cal.
966 chamber	ChengYu	966 Room	966	Jun. 06. 2020	Jun. 05, 2023
Receiver	R&S	ESR3	102075	May 28, 2021	May 27, 2022
Receiver	R&S	ESRP	101154	May 28, 2021	May 27, 2022
Amplifier	SKET	LAPA_01G 18G-45dB	١	May 28, 2021	May 27, 2022
Amplifier	Schwarzbeck	BBV9744	9744-0037	May 28, 2021	May 27, 2022
TRILOG Broadband Antenna	schwarzbeck	VULB 9163	VULB9163- 942	Jun. 01, 2021	May 31, 2022
Horn Antenna	SCHWARZBE CK	BBHA9120 D	1541	Jun. 02, 2021	Jun. 01, 2022
Horn Antenna (18GHz-40 GHz)	SCHWARZBE CK	BBHA9170	822	May 28, 2021	May 27, 2022
Amplifier (18GHz-40 GHz)	MITEQ	TTA1840-3 5-HG	2034381	May 28, 2021	May 27, 2022
Loop Antenna (9KHz-30M Hz)	SCHWARZBE CK	FMZB1519 B	014	Jun. 02, 2021	Jun. 01, 2022
RF cables1 (9kHz-30MH z)	Huber+Suhnar	9kHz-30M Hz	B1702988- 0008	May 28, 2021	May 27, 2022
RF cables2 (30MHz-1G Hz)	Huber+Suhnar	30MHz-1G Hz	1486150	May 28, 2021	May 27, 2022
RF cables3 (1GHz-40G Hz)	Huber+Suhnar	1GHz-40G Hz	1607106	May 28, 2021	May 27, 2022
Power Metter	Keysight	E4419B		May 28, 2021	May 27, 2022
Power Sensor (AV)	Keysight	E9 300A	J	May 28, 2021	May 27, 2022
Signal Analyzer 20kHz-26.5 GHz	KEYSIGHT	N9020A	MY491000 60	May 28, 2021	May 27, 2022
Spectrum Analyzer 9kHz-40G Hz	R&S	FSP40	100363	May 28, 2021	May 27, 2022
Software	Frad	EZ-EMC	FA-03A2 RE		

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## 6. CONDUCTED EMISSIONS

6.1 Block Diagram Of Test Setup



#### 6.2 Limit

FREQUENCY (MHz)	Limit (	dBuV)	
FREQUENCI (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.

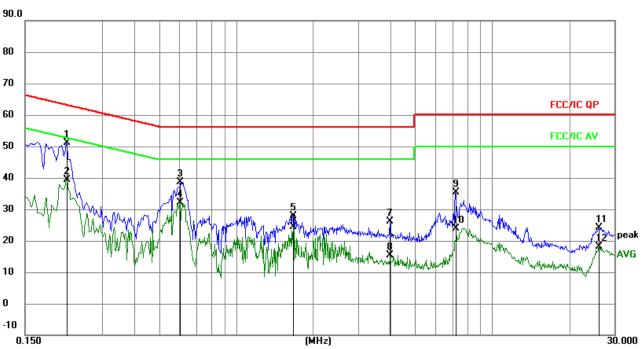
#### 6.4 EUT operating Conditions

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 Voltage :	AC 120V/60Hz	Test Mode :	Mode 4



#### Remark:

<sup>1.</sup> All readings are Quasi-Peak and Average values.

5	
2. Factor = Insertion	Loss + Cable Loss.

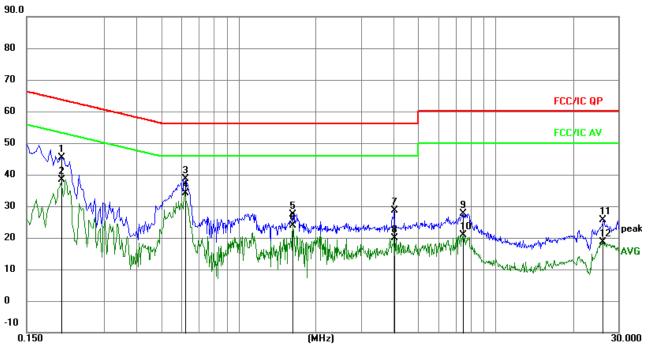
No. Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
	MHz		dB	dBuV	dBuV	dB	Detector
1 *	0.2174	41.54	9.48	51.02	62.92	-11.90	QP
2	0.2174	29.92	9.48	39.40	52.92	-13.52	AVG
3	0.6043	28.72	9.98	38.70	56.00	-17.30	QP
4	0.6043	22.16	9.98	32.14	46.00	-13.86	AVG
5	1.6713	18.32	9.58	27.90	56.00	-28.10	QP
6	1.6713	14.78	9.58	24.36	46.00	-21.64	AVG
7	3.9850	16.30	9.73	26.03	56.00	-29.97	QP
8	3.9850	5.60	9.73	15.33	46.00	-30.67	AVG
9	7.1754	25.69	9.72	35.41	60.00	-24.59	QP
10	7.1754	14.28	9.72	24.00	50.00	-26.00	AVG
11	26.1393	14.42	9.73	24.15	60.00	-35.85	QP
12	26.1393	8.52	9.73	18.25	50.00	-31.75	AVG

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



#### Remark:

1. All readings are Quasi-Peak and Average values.

2. Factor = Ins	sertion Lo	ss + Cable Lo	OSS.	۰.			
	-	Reading	Correct	Me	eas	ure	<u>)</u> -

No. Mk.	Freq.	Level	Factor	ment	Limit	Over	
	MHz		dB	dBuV	dBuV	dB	Detector
1	0.2040	36.01	9.46	45.47	63.45	-17.98	QP
2	0.2040	28.91	9.46	38.37	53.45	-15.08	AVG
3	0.6173	28.67	9.94	38.61	56.00	-17.39	QP
4 *	0.6173	24.27	9.94	34.21	46.00	-11.79	AVG
5	1.6276	17.77	9.58	27.35	56.00	-28.65	QP
6	1.6276	14.30	9.58	23.88	46.00	-22.12	AVG
7	4.0275	18.83	9.73	28.56	56.00	-27.44	QP
8	4.0275	10.26	9.73	19.99	46.00	-26.01	AVG
9	7.4860	17.96	9.72	27.68	60.00	-32.32	QP
10	7.4860	11.22	9.72	20.94	50.00	-29.06	AVG
11	26.1393	15.99	9.73	25.72	60.00	-34.28	QP
12	26.1393	8.96	9.73	18.69	50.00	-31.31	AVG

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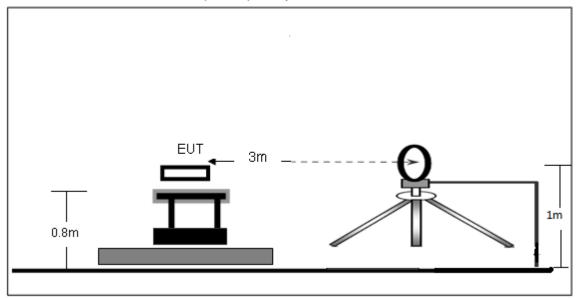
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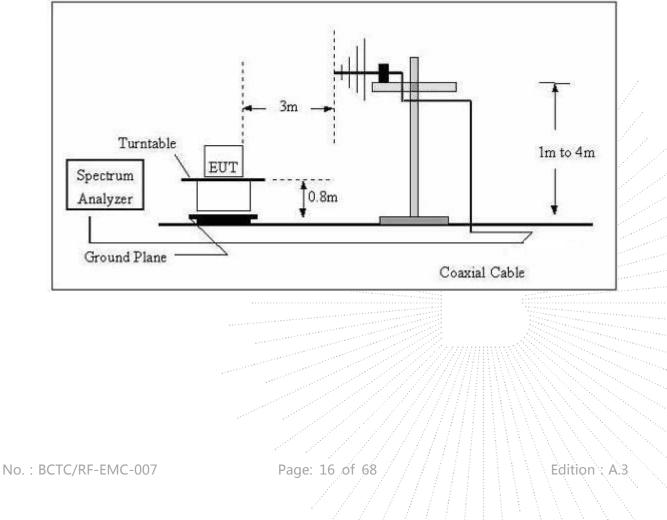


## 7. RADIATED EMISSIONS

- 7.1 Block Diagram Of Test Setup
  - (A) Radiated Emission Test-Up Frequency Below 30MHz



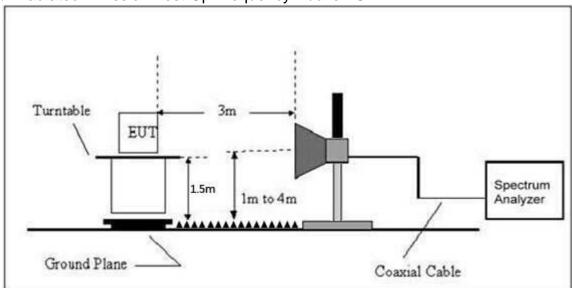
(B) Radiated Emission Test-Up Frequency 30MHz~1GHz





Report No.: BCTC2106483915E





## 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)

FREQUENC	Limit (dBuV/	′m) (at 3M)	
Y (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).



#### 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:

g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 metre to 1.5 metre( Above 18GHz the distance is 1 meter and table is 1.5 metre).

h. Test the EUT in the lowest channel ,the middle 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.





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.

#### 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.

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#### 7.5 Test Result

Below 30MHz

Temperature:	<b>26</b> ℃	Relative Humidtity:	24%
Pressure:	101 kPa	Test Voltage :	AC 120V/60Hz
Test Mode :	Mode 4	Polarization :	

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

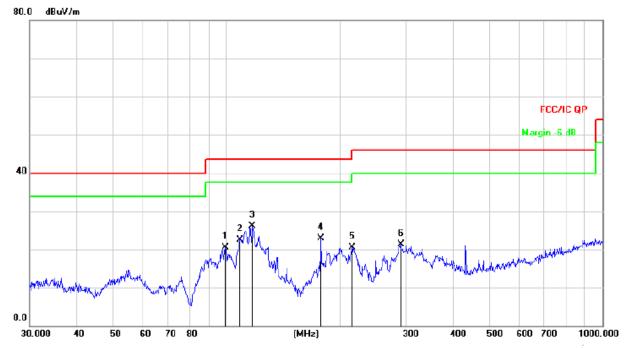
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	Between 30MHz – 1GHz					
Temperature:26°CRelative Humidtity:54%						
Pressure:	101 kPa	Test Voltage :	AC 120V/60Hz			
Test Mode :	Mode 4	Polarization :	Horizontal			





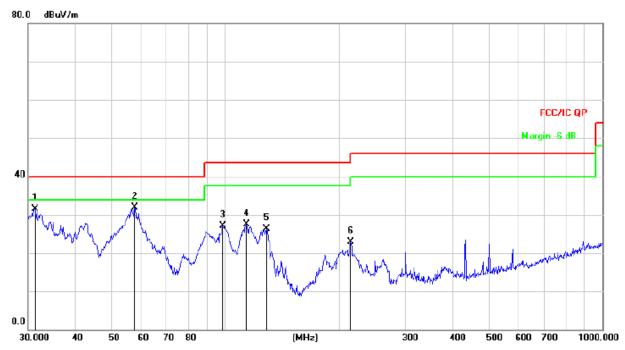
Remark:

Factor =	Antenna	Factor	+ Cable	Loss -	Pre-ami	olifier.
	/			2000		

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	/
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		99.5281	36.78	-16.37	20.41	43.50	-23.09	QP
2		108.6470	39.27	-16.84	22.43	43.50	-21.07	QP
3	*	117.3603	43.49	-17.40	26.09	43.50	-17.41	QP
4		178.7584	40.47	-17.66	22.81	43.50	-20.69	QP
5		216.0240	36.51	-15.93	20.58	46.00	-25.42	QP
6		291.0360	35.23	-13.88	21.35	46.00	-24.65	QP



Temperature:	<b>26</b> ℃	Relative Humidtity:	54%
Pressure:	101 kpa	Test Voltage :	AC 120V/60Hz
Test Mode :	Mode 4	Polarization :	Vertical



#### Remark:

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

No.     Mk.     Freq.     Reading Level     Correct Factor     Measure- ment     Limit     Over       MHz     dBuV     dB     dBuV/m     dB/m     dB     Detector       1     31.2893     48.53     -17.04     31.49     40.00     -8.51     QP       2     *     57.5939     47.58     -15.65     31.93     40.00     -8.07     QP       3     98.4866     43.68     -16.56     27.12     43.50     -16.38     QP       4     113.7143     44.60     -17.16     27.44     43.50     -16.06     QP       5     128.5630     44.35     -18.12     26.23     43.50     -17.27     QP       6     215.2678     38.86     -15.95     22.91     43.50     -20.59     QP									
1   31.2893   48.53   -17.04   31.49   40.00   -8.51   QP     2   *   57.5939   47.58   -15.65   31.93   40.00   -8.07   QP     3   98.4866   43.68   -16.56   27.12   43.50   -16.38   QP     4   113.7143   44.60   -17.16   27.44   43.50   -16.06   QP     5   128.5630   44.35   -18.12   26.23   43.50   -17.27   QP	No.	Mk.	Freq.	~ ~			Limit	Over	
2 *   57.5939   47.58   -15.65   31.93   40.00   -8.07   QP     3   98.4866   43.68   -16.56   27.12   43.50   -16.38   QP     4   113.7143   44.60   -17.16   27.44   43.50   -16.06   QP     5   128.5630   44.35   -18.12   26.23   43.50   -17.27   QP			MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
3   98.4866   43.68   -16.56   27.12   43.50   -16.38   QP     4   113.7143   44.60   -17.16   27.44   43.50   -16.06   QP     5   128.5630   44.35   -18.12   26.23   43.50   -17.27   QP	1		31.2893	48.53	-17.04	31.49	40.00	-8.51	QP
4   113.7143   44.60   -17.16   27.44   43.50   -16.06   QP     5   128.5630   44.35   -18.12   26.23   43.50   -17.27   QP	2	*	57.5939	47.58	-15.65	31.93	40.00	-8.07	QP
5 128.5630 44.35 -18.12 26.23 43.50 -17.27 QP	3		98.4866	43.68	-16.56	27.12	43.50	-16.38	QP
	4		113.7143	44.60	-17.16	27.44	43.50	-16.06	QP
6 215.2678 38.86 -15.95 22.91 43.50 -20.59 QP	5		128.5630	44.35	-18.12	26.23	43.50	-17.27	QP
	6		215.2678	38.86	-15.95	22.91	43.50	-20.59	QP



Between 1GHz – 25GHz

Polar	Frequency	Reading Level	Correct Factor	Measure- ment	Limits	Over	Detector				
(H/V)	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dBuV/ m)	(dB)	Туре				
GFSK Low channel											
V	4804.00	54.48	-0.43	54.05	74.00	-19.95	PK				
V	4804.00	43.62	-0.43	43.19	54.00	-10.81	AV				
V	7206.00	43.69	8.31	52.00	74.00	-22.00	PK				
V	7206.00	33.72	8.31	42.03	54.00	-11.97	AV				
Н	4804.00	51.13	-0.43	50.70	74.00	-23.30	PK				
Н	4804.00	41.32	-0.43	40.89	54.00	-13.11	AV				
Н	7206.00	40.74	8.31	49.05	74.00	-24.95	PK				
H	7206.00	32.49	8.31	40.80	54.00	-13.20	AV				
			SK Middle o	channel	-						
V	4882.00	52.11	-0.38	51.73	74.00	-22.27	PK				
V	4882.00	45.34	-0.38	44.96	54.00	-9.04	AV				
V	7323.00	42.71	8.83	51.54	74.00	-22.46	PK				
V	7323.00	34.22	8.83	43.05	54.00	-10.95	AV				
Н	4882.00	49.05	-0.38	48.67	74.00	-25.33	PK				
Н	4882.00	39.13	-0.38	38.75	54.00	-15.25	AV				
Н	7323.00	40.30	8.83	49.13	74.00	-24.87	PK				
Н	7323.00	32.13	8.83	40.96	54.00	-13.04	AV				
	-	GI	SK High c	hannel			/				
V	4960.00	54.45	-0.32	54.13	74.00	-19.87	PK				
V	4960.00	45.68	-0.32	45.36	54.00	-8.64	AV				
V	7440.00	47.57	9.35	56.92	74.00	-17.08	PK				
V	7440.00	37.79	9.35	47.14	54.00	-6.86	AV				
Н	4960.00	52.26	-0.32	51.94	74.00	-22.06	PK				
Н	4960.00	42.71	-0.32	42.39	54.00	-11.61	AV				
Н	7440.00	45.67	9.35	55.02	74.00	-18.98	PK				
Н	7440.00	37.71	9.35	47.06	54.00	-6.94	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.

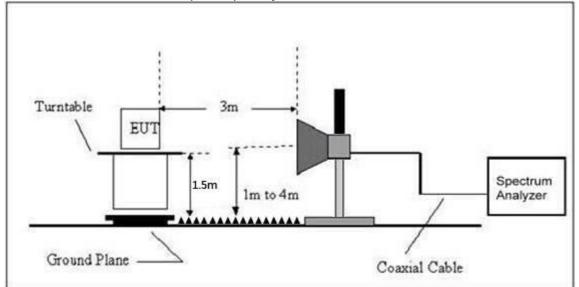
5.All the Modulation are test, the worst mode is GFSK, the data recording in the report.



## 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)

FREQUENC Y (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

	Polar (H/V)	Frequency (MHz)	Reading Level	Correct Factor	Measure- ment (dBuV/m)	Limits (dBuV/m)		Result		
	(1	(	(dBuV/m)	(dB)	PK	РК РК				
		402MHz								
	Н	2390.00	56.30	-6.70	49.60	74.00	54.00	PASS		
	Н	2400.00	49.21	-6.71	42.50	74.00	54.00	PASS		
	V	2390.00	55.76	-6.70	49.06	74.00	54.00	PASS		
0501	V	2400.00	47.22	-6.71	40.51	74.00	54.00	PASS		
GFSK			High	Channel 2	480MHz					
	Н	2483.50	56.55	-6.79	49.76	74.00	54.00	PASS		
	Н	2485.00	48.54	-6.81	41.73	74.00	54.00	PASS		
	V	2483.50	54.71	-6.79	47.92	74.00	54.00	PASS		
	V	2485.00	46.24	-6.81	39.43	74.00	54.00	PASS		
	Low Channel 2402MHz									
	Н	2390.00	57.69	-6.70	50.99	74.00	54.00	PASS		
	Н	2400.00	50.34	-6.71	43.63	74.00	54.00	PASS		
	V	2390.00	57.00	-6.70	50.30	74.00	54.00	PASS		
Pi/4DQPSK	V	2400.00	49.09	-6.71	42.38	74.00	54.00	PASS		
FI/4DQF3N	High Channel 2480MHz									
	Н	2483.50	57.94	-6.79	51.15	74.00	54.00	PASS		
	Н	2485.00	49.80	-6.81	42.99	74.00	54.00	PASS		
	V	2483.50	57.03	-6.79	50.24	74.00	54.00	PASS		
	V	2485.00	49.37	-6.81	42.56	74.00	54.00	PASS		
				Channel 2						
	Н	2390.00	56.48	-6.70	49.78	74.00	54.00	PASS		
	Н	2400.00	48.92	-6.71	42.21	74.00	54.00	PASS		
	V	2390.00	56.62	-6.70	49.92	74.00	54.00	PASS		
8DPSK	V	2400.00	49.11	-6.71	42.40	74.00	54.00	PASS		
				Channel 2						
	Н	2483.50	56.96	-6.79	50.17	74.00	54.00	PASS		
	Н	2485.00	48.19	-6.81	41.38	74.00	54.00	PASS		
	V	2483.50	55.10	-6.79	48.31	74.00	54.00	PASS		
Remark:	V	2485.00	47.16	-6.81	40.35	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. CONDUCTED EMISSION

## 9.1 Block Diagram Of Test Setup



#### 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 §15.209(a) (see §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:

Below 30MHz:

RBW = 100kHz, VBW = 300kHz, Sweep = auto

Detector function = peak, Trace = max hold

Above 30MHz:

RBW = 100KHz, VBW = 300KHz, Sweep = auto

Detector function = peak, Trace = max hold

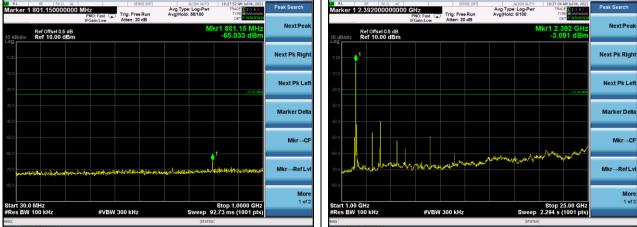
Page: 27 of 68

Edition: A.3

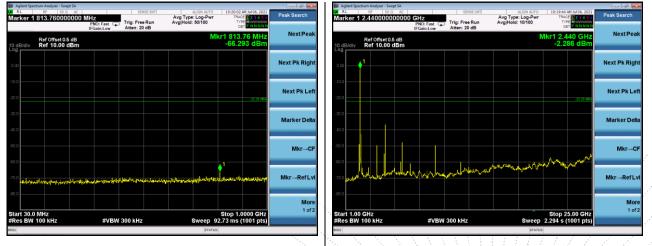


## 9.4 Test Result

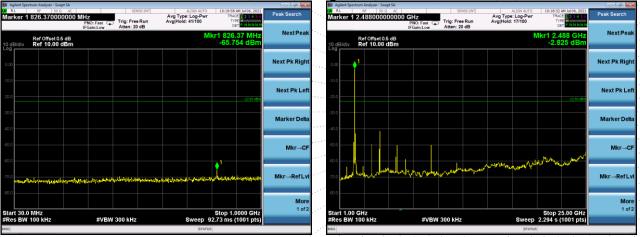
Temperature :	<b>26</b> ℃	Relative Humidity :	54%							
Test Voltage :	AC 120V/60Hz	Remark:	N/A							
30MHz – 25GHz										
GFSK Low Channel										
Mi Agilent Spectrum Analyzer - Swept SA DI RL RF 50 Ω AC	SENSE:JNT ALIGN AUTO 10:27:52 AM Jul 06, 2021	Image: Agilent Spectrum Analyzer - Swept SA       Peak Search     RL     RF     S0 QL     AC     S	SENSE:INT ALIGN AUTO 10:27:34 AM Jul 06, 2021 Auro Tures Lee Pare Table 10:27:34 AM Jul 06, 2021 Peak Search							



#### GFSK Middle Channel



#### **GFSK High Channel**

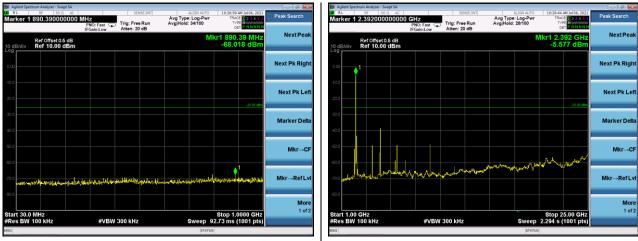


No. : BCTC/RF-EMC-007

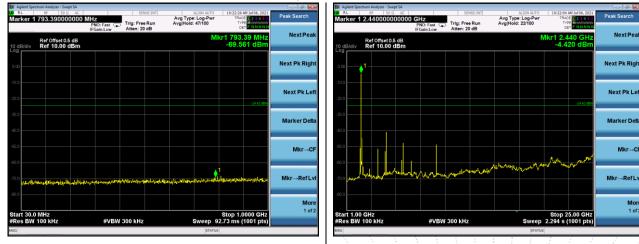
Edition : A.3



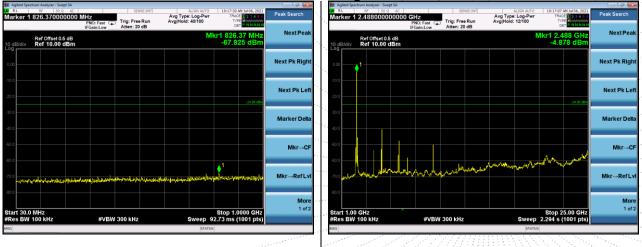
#### Pi/4 DQPSK Low Channel



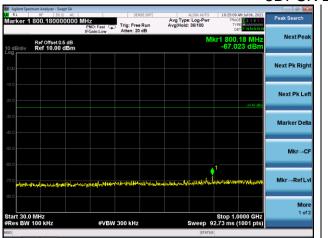
#### Pi/4 DQPSK Middle Channel



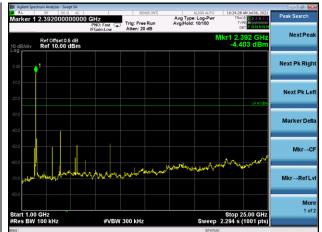
#### Pi/4 DQPSK High Channel



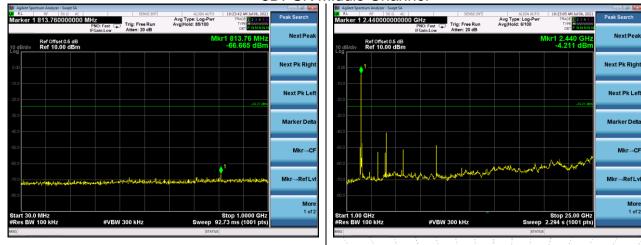




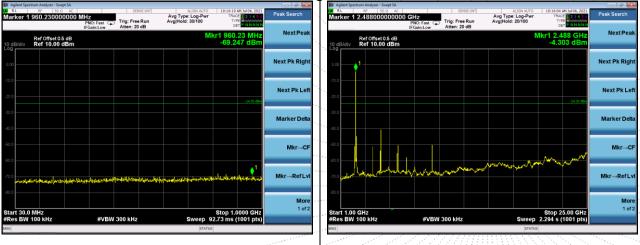
#### **8DPSK Low Channel**



#### 8DPSK Middle Channel



#### 8DPSK High Channel

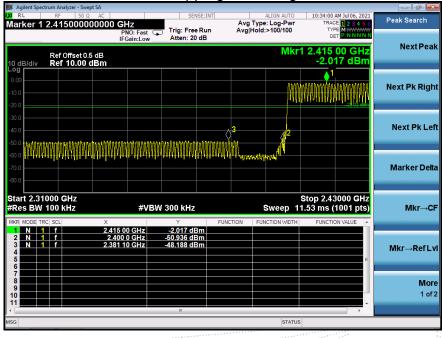




鱦 Agilent Spectrum Analyzer - Swep			_ ē ×
RL RF 50 Ω Marker 1 2.40200000	00000 GHz	ALIGN AUTO 10:29:49 AM Jul 06, 202 Avg Type: Log-Pwr TRACE 12 3 4 5	Peak Search
Ref Offset 0.5	PNO: Fast Trig: Free Run IFGain:Low Atten: 20 dB	Avg Hoid:>100/100 TVPE WWWW Det WNNN Mkr1 2.402 0 GHz -2.017 dBm	Next Peak
10.00		1	Next Pk Right
-30.0 -40.0 -50.0		2	Next Pk Left
-60.0 -70.0	the man and the set of	Monor Marine Ma	Marker Delta
Start 2.31000 GHz #Res BW 100 kHz		Stop 2.41000 GHz Sweep 9.600 ms (1001 pts)	
1 N 1 f 2 N 1 f 3 N 1 f 4 5 6	2.402 0 GHz -2.017 dBm 2.400 0 GHz -44.086 dBm 2.398 5 GHz -52.887 dBm		Mkr→RefLv
7 8 9 9 10 11 11 1 1 1 1 1 1 1 1 1 1 1 1 1			More 1 of 2
MSG	III	STATUS	

## GFSK Transmitting Band edge-left side

GFSK Hopping Band edge-left side

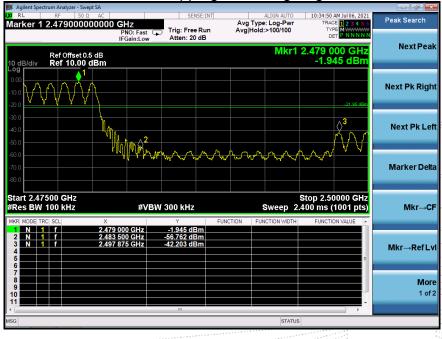




Agilent Spectrum Analyzer - Swept S	SA			
	AC SENSE:IN		10:48:58 AM Jul 06, 2021	Peak Search
Marker 1 2.480002000		Avg Type: Log-Pwr	TRACE 1 2 3 4 5 6	Feak Search
	PNO: Fast Trig: Free Run	Avg Hold:>100/100	DET P N N N N	
	IFGain:Low Atten: 20 dB			New Beat
		Mkr1	2.480 002 GHz	Next Peak
Ref Offset 0.5 c			-2.027 dBm	
10 dB/div Ref 10.00 dE	3m		-2.027 0011	
0.00				Next Pk Right
-10.0				NEXT FR RIGHT
-20.0			-22.05 dBm	
-20.0			-22.05 dBm	
-30.0				
				Next Pk Left
-40.0				MOXIT IN LON
-50.0	~~~{\?}°			
	and the second sec			
-60.0	and a second and a second and a second		.00	
-70.0	A A A A A A A A A A A A A A A A A A A	the share with the second	m. hermal good and and and and and and and and and an	Marker Delta
-80.0				
Start 2.47800 GHz			Stop 2.50000 GHz	
#Res BW 100 kHz	#VBW 300 kHz	Sweep 2.	133 ms (1001 pts)	Mkr→CF
	X Y			
MKR MODE TRC SCL		FUNCTION FUNCTION WIDTH	FUNCTION VALUE	
	2.480 002 GHz -2.027 dBm 2.483 500 GHz -52.185 dBm			
3 N 1 f	2.483 960 GHz -52.185 dBm			
4	2.400 500 CH2 -04.007 aBill			Mkr→RefLvl
5				
6				
7				
8				More
9				1 of 2
11				1012
MSG		STATUS		

## GFSK Transmitting Band edge-right side

GFSK Hopping Band edge-right side

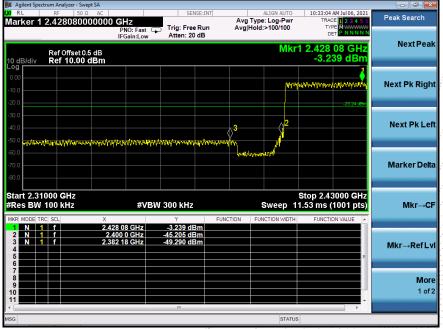




SILLE	a eage-left	іў Бапс	SIIIIIII	\ man	<u>iur sr</u>	-1/4 D	Г	
Peak Search	10:29:13 AM Jul 06, 2021 TRACE 2 3 4 5 6 TYPE MW////////////////////////////////////	ALIGN AUTO Type: Log-Pwr Hold:>100/100	Avg	SENSE: Trig: Free Ru Atten: 20 dE	SHZ PNO: Fast Gain: Low	Ω AC 000000	trum Analyzer - Sw RF 50 <b>2.4020000</b>	XI RL
Next Peak	r1 2.402 0 GHz -3.368 dBm	Mk		Atten: 20 de	FGam:Low	0.5 dB	Ref Offset 0 Ref 10.00	10 dB/div
Next Pk Right	-23 37 dBm							-10.0
Next Pk Left	2 ) <sup>2</sup>							-30.0
Marker Delta		What have a share way and a share way and a share way a share w	What was a fair	hatman	میرید. میرید رویده میرود.	nig Anna anna	person and the sea	-60.0
Mkr→CF	Stop 2.41000 GHz 600 ms (1001 pts)	Sweep 9.	FUNCTION	300 kHz Y	#VBW	×	100 kHz	Start 2.31 #Res BW
Mkr→RefLvl	E			-3.368 dBm -43.087 dBm -50.787 dBm	2 0 GHz 0 0 GHz 8 5 GHz	2.40		1 N 1 2 N 1 3 N 1 4 5 6
More 1 of 2								7 8 9 10 11
		STATUS						ISG

Pi/4 DQPSK Transmitting Band edge-left side

#### Pi/4 DQPSK Hopping Band edge-left side







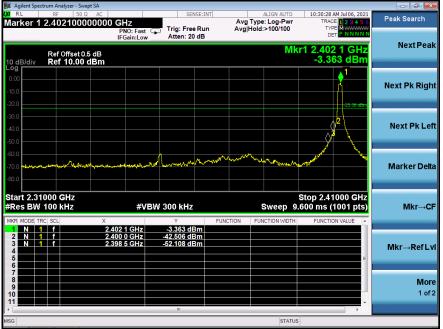
				g Bana	euge-n	9.10	
[ Agilent Spectrum Analyzer - Swept SA RL RF 50.Ω AC [arker 1 2.480090000000	I GHz PNO: Fast G IFGain:Low	SENSE:IN Trig: Free Run Atten: 20 dB	Avg	ALIGN AUTO Type: Log-Pwr Hold:>100/100	10:48:26 AM Jul 0 TRACE 1 2 TYPE MW DET P N	3456	- ☞ × Peak Search
Ref Offset 0.5 dB 0 dB/div Ref 10.00 dBm				Mkr1	2.480 090 0 -3.229 d		Next Peak
						23 dBm	Next Pk Right
	23						Next Pk Lef
0.0		and the second second	within the former	anna Sala agus ma		<b>wy</b>	Marker Delta
tart 2.47800 GHz Res BW 100 kHz		7 300 kHz	FUNCTION		Stop 2.50000 .133 ms (1001	pts)	Mkr→CF
2 N 1 f 2.48	0 090 GHz 3 500 GHz 3 850 GHz	-3.229 dBm -50.484 dBm -51.881 dBm					Mkr→RefLv
7 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9		11					More 1 of 2
G				STATUS	\$		

#### Pi/4 DQPSK Transmitting Band edge-right side

Pi/4 DQPSK Hopping Band edge-right side

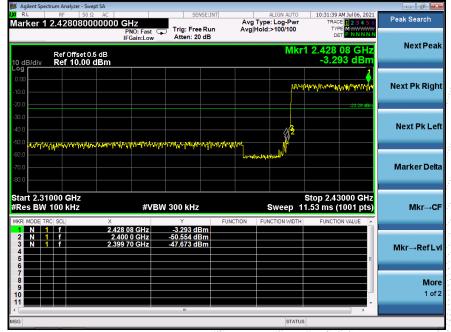






#### 8DPSK Transmitting Band edge-left side

8DPSK Hopping Band edge-left side



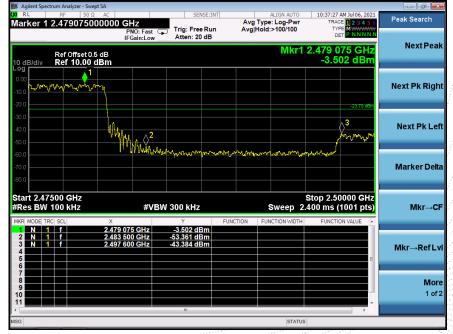




	m Analyzer - Swept SA							
	RF 50 Ω AC 480090000000	GHz PNO: Fast C IFGain:Low	Trig: Free Ru Atten: 20 dB	Avg	ALIGN AUTO Type: Log-Pwr Hold:>100/100	TYPE	UI 06, 2021 2 3 4 5 6 NNNNN	Peak Search
	Ref Offset 0.5 dB Ref 10.00 dBm				Mkr1	2.480 090 -3.303		Next Peak
								Next Pk Right
20.0 20.0 40.0 50.0	- man - d	23					-23.30 dBm	Next Pk Lef
80.0 70.0 80.0			www.weenser	ሎፕቶ <mark>Γ</mark> ናዮትራትና ተለያለግለል	ulaman_un	Mar	an and an	Marker Delta
tart 2.4780 Res BW 10	00 kHz	#VB	W 300 kHz		Sweep 2	Stop 2.500 .133 ms (10	01 pts)	Mkr→CF
2 N 1 3 N 1 4 5 6 9	f 2.480 f 2.483	090 GHz 500 GHz 850 GHz	Y -3.303 dBm -50.973 dBm -51.718 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION	ALUE	Mkr→RefLv
7 8 9 10 11								More 1 of 2
3G			m		STATUS	3	•	

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

8DPSK Hopping Band edge-right side



Edition : A.3



## 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 :	26%	Relative Humidity:	54%
Test Voltage :	AC 120V/60Hz	Remark	N/A

Modulation	Test Channel	Bandwidth(MHz)
GFSK	Low	1.023
GFSK	Middle	1.027
GFSK	High	1.025
Pi/4 DQPSK	Low	1.353
Pi/4 DQPSK	Middle	1.358
Pi/4 DQPSK	High	1.355
8DPSK	Low	1.344
8DPSK	Middle	1.345
8DPSK	High	1.347

#### Test plots GFSK Low Channel







#### **GFSK Middle Channel**

## **GFSK High Channel**







## **Pi/4 DQPSK Low Channel**

#### **Pi/4 DQPSK Middle Channel**







## **Pi/4 DQPSK High Channel**

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

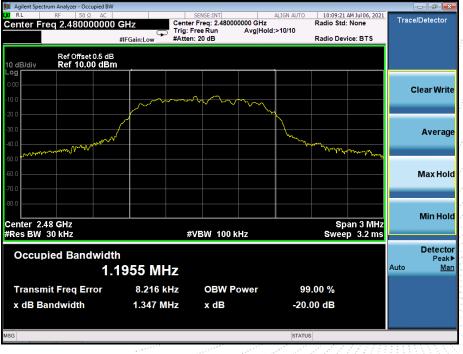






#### **8DPSK Middle Channel**

## 8DPSK High Channel





## 11. MAXIMUM PEAK OUTPUT POWER

## 11.1 Block Diagram Of Test Setup



## 11.2 Limit

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

## 11.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

2. Set the spectrum analyzer: RBW = 3MHz. VBW = 3MHz. Sweep = auto; Detector Function = Peak.

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



## 11.4 Test Result

Temperature :	260	Relative Humidity:	54%
Test Voltage :	AC 120V/60Hz	Remark:	N/A

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	-1.689	21
GFSK	Middle	-1.820	21
GFSK	High	-1.771	21
Pi/4 DQPSK	Low	0.604	21
Pi/4 DQPSK	Middle	0.507	21
Pi/4 DQPSK	High	0.566	21
8DPSK	Low	0.998	21
8DPSK	Middle	0.899	21
8DPSK	High	0.985	21

## Test plots GFSK Low Channel





		<u> </u>		ddie Chani		
	ctrum Analyzer - Swept SA					
Marker 1	RF 50 Ω AC 2.440880000000	PNO: Fast	Trig: Free Run Atten: 20 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100	10:05:31 AM Jul 06, 2021 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P N N N N N	Peak Search
10 dB/div	Ref Offset 0.5 dB Ref 10.00 dBm			Mkr	1 2.440 88 GHz -1.820 dBm	Next Peak
0.00			1			Next Pk Right
-10.0	WW www.					Next Pk Left
-30.0						Marker Delta
50.0						Mkr→CF
70.0						Mkr→RefLvl
-80.0	441000 GHz				Span 10.00 MHz	More 1 of 2
#Res BW		#VBW	3.0 MHz	Sweep 1	.000 ms (1001 pts)	
/ISG				STATUS		

GFSK Middle Channel

**GFSK High Channel** 





📕 Agilent Spectrum Analyzer - Swept SA			
X RL RF 50Ω AC	SENSE:INT	ALIGN AUTO 10:04:01 AM Jul 06, 202	
Marker 1 2.40208000000	PNO: Fast IFGain:Low Atten: 20 dB	Avg Type: Log-Pwr     TRACE     2 3 4 5       Avg Hold:>100/100     TYPE     Mutanian       DET     P N N N	o ₩ N
Ref Offset 0.5 dB 10 dB/div Ref 10.00 dBm		Mkr1 2.402 08 GH 0.604 dBn	2 Next Peak
0.00	<b>↓</b> <sup>1</sup>		Next Pk Right
-10.0			
-20.0			Next Pk Left
-30.0		<u> </u>	Marker Delta
-40.0			
60.0			Mkr→CF
70.0			Mkr→RefLvl
80.0			
Center 2.402000 GHz		Span 10.00 MH	More 1 of 2
#Res BW 3.0 MHz	#VBW 3.0 MHz	Span 10.00 MH Sweep 1.000 ms (1001 pts	
NSG		STATUS	

#### Pi/4 DQPSK Low Channel

Pi/4 DQPSK Middle Channel

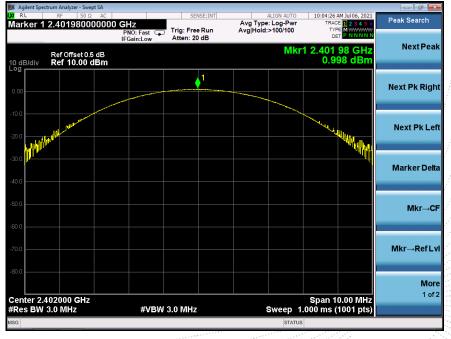




ent Spectrum Analyzer - Swept SA RF   50 Ω AC SENSE:INT ALIGN AUTO 10:06:08 AM Jul 06, 2021 PNO: Fast IFGain:Low Trig: Free Run Atten: 20 dB Avg Hold:>100/100 Trace 2.2.3.5 G NUT 0.2.5 AVg Hold:>100/100 DEC ULL NEXT Performance 2.2.5 G NUT 0.2.5 AVg Hold:>100/100 DEC ULL NEXT Performance 2.2.5 G NUT 0.2.5 AVg Hold:>100/100 DEC ULL NEXT Performance 2.2.5 G NUT 0.2.5 AVg Hold:>100/100 DEC ULL NEXT Performance 2.2.5 G NUT 0.2.5 AVg Hold:>100/100 DEC ULL NEXT PERFORMANCE 2.2.5 AVg Hold:>100/100 DEC ULL NEXT PERFORMANCE 2.5 AVg Hold:>100/100 DEC ULL NEXT PERFO
Avg Type: Log-Pwr     Trace     Page State     Peak Search       PN0: Fast     Trig: Free Run     Avg Hold:>100/100     Tree Mage State     Peak Search       IFGain: Low     Atten: 20 dB     Det Mage State     Det Mage State     Det Mage State
CETT 2.47 SS50000000 GHz Free Run Avg Hpie. Log+wi Note Figure State   PNO: Fast Trig: Free Run Avg Hoid:>100/100 Three With State   IFGain:Low Atten: 20 dB DET PNNNN
Ref Offset 0.5 dB Mkr1 2.479 95 GHz NextPer
Next Pk Rig
Next Pk Lo
Marker De
Mkr→RefL
er 2.480000 GHz Span 10.00 MHz Sweep 1.000 ms (1001 pts)
STATUS

#### Pi/4 DQPSK High Channel

**8DPSK Low Channel** 



No. : BCTC/RF-EMC-007



Ref Offset0.5 dB MKT 2.441 F00 GHz   10 dB/div 0.899 dBm   000 1   -100 1 </th <th colspan="6"></th>							
Marker 1 2.441060000000 GHz   Trig: Free Run Atten: 20 dB   Avg Type: Log-Pwr AvgHold:>100/100   Trig: Free Run Atten: 20 dB   Avg Type: Log-Pwr AvgHold:>100/100   Trig: Free Run Atten: 20 dB   Avg Type: Log-Pwr AvgHold:>100/100   Trig: Free Run Atten: 20 dB   Next Pk Ri     10 dEXdiv   Ref Offset 0.5 dB   Mkr1 2.441 06 GHz   Next Pk Ri   Next Pk Ri     0 dEXdiv   Ref 10.00 dBm   1   Next Pk Ri   Next Pk Ri     -000   1   1   1   Next Pk Ri     -000   1   1   1   Next Pk Ri     -000   1   1   1   1   Next Pk Ri     -000   1   1   1   1   1   Next Pk Ri     -000   1   1   1   1   1   Next Pk Ri     -000   1   1   1   1   1   1   1     -000   1   1   1   1   1   1   1   1     -000   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1							
Marker 1 2.44106000000 GHZ     Trig: Free Run Arten: 20 dB     Arg (19): 100/100     Comparison of the compariso				SENSE:INT			Peak Search
Ref offset0 5 dB     MKT 2.441 100 GHz       0.00     0.899 dBm	Marker 1 2.4410	P	NO: Fast 🗔 Tri			TYPE M WWWWWW	
0000   1   0000   1   0000   0	10 dB/div Ref 10	set 0.5 dB 0.00 dBm			Mkr		Next Peak
200				•1			Next Pk Right
200   1	-10.0						
.400	-20.0						Next Pk Left
.50.0							Marker Delta
600 Mkr→Ref							
80.0	-60.0						MKr→CF
	70.0						Mkr→RefLvi
	-80.0						More
Center 2.441000 GHz Span 10.00 MHz 1 #Res BW 3.0 MHz #VBW 3.0 MHz Sweep 1.000 ms (1001 pts)			#VBW 3.0	MHz	Sweep 1	Span 10.00 MHz .000 ms (1001 pts)	1 of 2
MSG STATUS	ISG				STATUS		

8DPSK Middle Channel

8DPSK High Channel



No. : BCTC/RF-EMC-007



## 12. HOPPING CHANNEL SEPARATION

12.1 Block Diagram Of Test Setup



## 12.2 Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 0.125W.

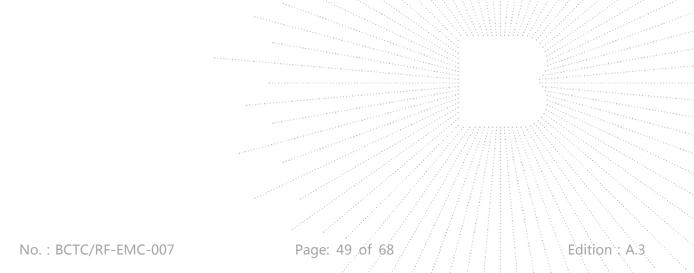
## 12.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port

to the spectrum.

2. Set the spectrum analyzer: RBW = 30kHz. VBW = 100kHz, Span = 2.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.





## 12.4 Test Result

Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	1.000	0.682	PASS
GFSK	Middle	1.002	0.685	PASS
GFSK	High	0.998	0.683	PASS
Pi/4 DQPSK	Low	1.000	0.902	PASS
Pi/4 DQPSK	Middle	1.000	0.905	PASS
Pi/4 DQPSK	High	1.000	0.903	PASS
8DPSK	Low	1.000	0.896	PASS
8DPSK	Middle	1.000	0.897	PASS
8DPSK	High	1.004	0.898	PASS

Test plots GFSK Low Channel



No. : BCTC/RF-EMC-007





**GFSK Middle Channel** 

GFSK High Channel





📕 Agilent Spectrum Analyzer - Swe					
RL RF 50 Ω Marker 1 Δ 1.000000		SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	11:20:13 AM Jul 06, 2021 TRACE 1 2 3 4 5 6	Peak Search
	PNO: Wide IFGain:Low	Trig: Free Run Atten: 20 dB	Avg Hold:>100/100	DET PNNNN	NextBack
Ref Offset 0.5			ΔΜ	kr1 1.000 MHz 0.286 dB	Next Peak
0.00			140		Next Pk Right
10.0	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	1Δ2	~~~~~	Next Pk Lef
20.0					NEXT PR Len
40.0					Marker Delta
50.0					Mkr→Ci
70.0					Mkr→RefLv
80.0					More
Center 2.402500 GHz Res BW 30 kHz	#VBW	100 kHz	Sweep 2.	Span 2.000 MHz 133 ms (1001 pts)	1 of 2
SG .			STATUS		

#### Pi/4 DQPSK Low Channel

Pi/4 DQPSK Middle Channel





📕 Agilent Spectrum Ar						
« <sup>RL</sup> RF Marker 1 Δ 1.	50 Ω AC		SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	11:13:00 AM Jul 06, 2021 TRACE 1 2 3 4 5 6	Peak Search
	000000000	PNO: Wide IFGain:Low	Trig: Free Run Atten: 20 dB	Avg Hold:>100/100	TYPE M WWWWW DET P NNNNN	
Ref 0 dB/div Ref	Offset 0.5 dB 10.00 dBm			ΔN	kr1 1.000 MHz -0.277 dB	NextPeak
0.00				1Δ2		Next Pk Righ
20.0	Xann	$\sim$		man my		Next Pk Lef
10.0						Marker Delta
50.0						Mkr→Cl
10.0						Mkr→RefL
30.0						Mon 1 of:
enter 2.4795 Res BW 30 kl		#VBW	100 kHz	Sweep 2.	Span 2.000 MHz 133 ms (1001 pts)	1 01.
ss 🔀 No Peak Fo	ound			STATUS		

#### Pi/4 DQPSK High Channel

**8DPSK Low Channel** 



No. : BCTC/RF-EMC-007



			0			ladie	Unai	IIICI		
Agilent Spect	rum Analyzer - Swept S RF 50 Ω	AC AC		SEN	SE:INT		ALIGN AUTO	11:00:22.0	M Jul 06, 2021	
	∆ 1.0000000					Avg Type	: Log-Pwr	TRACE	122456	Peak Search
		PNO: V IEGain	Nide 🖵	Trig: Free Atten: 20		Avg Hold:	>100/100	TYP DE		
								/kr1 1.0	00 MHZ	NextPea
0 dB/div	Ref Offset 0.5 c Ref 10.00 dE	IB 3m					-		125 dB	
<sup>,</sup> g										
.00										Next Pk Rig
								<mark>≜</mark> 1∆2		
	1 mmm	$\Lambda $	2	<u></u>	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	- marra	An r		~	
$\sim$	¥ - • •			$\sim$	$\sim$		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		$\sim$	Next Pk Le
0.0										
0.0										
										Marker Del
0.0										
).0										Mkr→C
0.0										
										Mkr→RefL
0.0										
										Mor
	44500 011-							0	000 8411	1 of
enter 2.4 Res BW 3	41500 GHz 30 kHz		#VBW '	100 kHz			Sween 2	Span 2. .133 ms (′	000 MHz	
3				100-111Z			STATUS			
							STATUS			

## 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

## Test Plots:

79 Channels in total GFSK



				SK	DQPS	Pi/4 [					
Marker			10:52:05	ALIGN AUTO		ISE:INT	SEI		AC	Analyzer - Swep F 50 Ω	R
Select Mark	NN	E 1 2 3 4 E M WWW T P N N I	DE	>100/100	Avg Type Avg Hold:		Trig: Free Atten: 20	IZ NO:Fast ⊊ Gain:Low	10000 MF PN IFC	7.90550	er 1 Δ 7
	Hz dB	5 5 M .073	1 77.908 0	ΔMkr						f Offset 0.5 ef 10.00 d	
Nor	∆2										
		NWN	YYYYWYY	MAMAN	undulan	ኊቚኯኯኯ	~~~~~	MANYAMAN	YWWYW	NYANAMIAN	Xizvivyv
D											
Fix											
	h										
Properti											
<b>M</b> 1	Hz	350 G	Stop 2.48								2.40000
	ots)	1001	000 ms (	Sweep 8			300 kHz	#VBW		kHz	BW 100



RL RF RL RF RKer 1 ∆ 78.07	50 Ω AC 2500000 MHz PNO: Fast	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100	10:54:50 AM Jul 06, 2021 TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P N N N N N	Marker
Ref Offs 0 dB/div Ref 10.	IFGain:Low et 0.5 dB 00 dBm	, Atten: 20 dB	ΔMkr1	-0.921 dB	Select Marker 1
0.00	\$9.4~{\$9.5~{\$^5}}	<i>ብረግ</i> ተሉላዋናታሳቀ <u>ወ</u> ላውንይሁክ	MANHAMAN MANYAN	102 201/10101/101/101/101	Norm
					Del
0.0					Fixe
					c
0.0					Propertie
tart 2.40000 GHz				Stop 2.48350 GHz	<b>Mo</b> 1 o

## onder

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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.

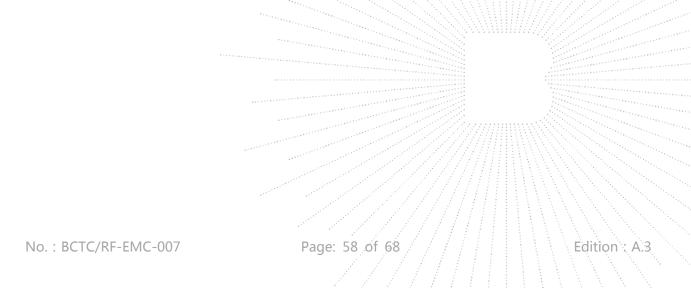
## 14.3 Test procedure

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

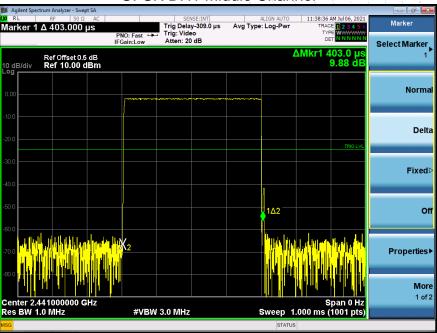
DH5 Packet permit maximum 1600 / 79 / 6 hops per second in each channel (5 time slots RX, 1 time slot TX). DH3 Packet permit maximum 1600 / 79 / 4

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)
		DH1	0.403	0.129	0.4
GFSK	Middle	DH3	1.656	0.265	0.4
		DH5	2.940	0.314	0.4
		2DH1	0.400	0.128	0.4
Pi/4DQPSK	Middle	2DH3	1.674	0.268	0.4
		2DH5	2.960	0.316	0.4
		3DH1	0.400	0.128	0.4
8DPSK	Middle	3DH3	1.668	0.267	0.4
		3DH5	2.960	0.316	0.4

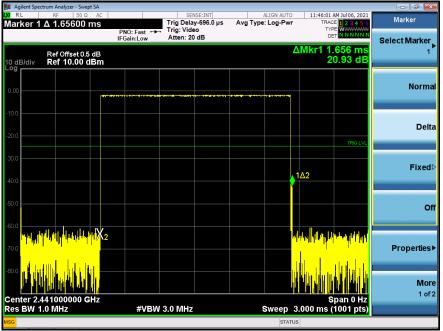


#### **Test Plots** GFSK DH1 Middle Channel

No.: BCTC/RF-EMC-007

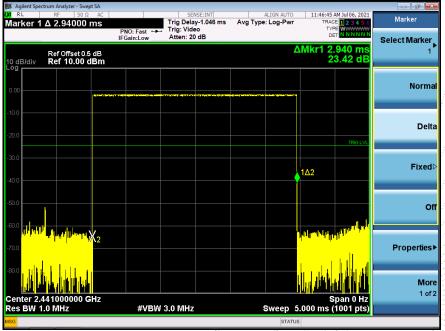
Edition :





#### GFSK DH3 Middle Channel

#### GFSK DH5 High Middle Channel

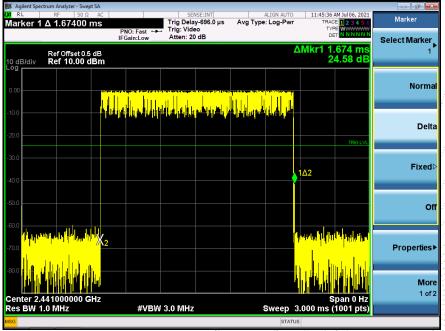






## Pi/4DQPSK DH1 Middle Channel

## Pi/4DQPSK DH3 Middle Channel

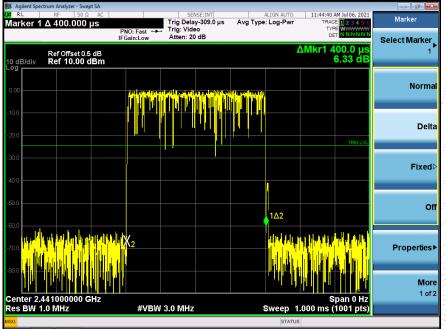




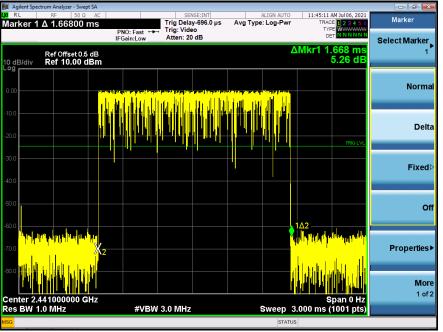
Agilent Spectrum Analyzer - Swept SA					_ <b>_</b>
LX/ RL RF 50 Ω AC		SENSE:INT Trig Delay-1.046 ms	ALIGN AUTO	11:48:09 AM Jul 06, 2021	Marker
Marker 1 <b>Δ</b> 2.96000 ms	PNO: Fast 🕶		Avg Type: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE WWWWWW DET N N N N N N	
	IFGain:Low	Atten: 20 dB		DET NNNNN	Select Marker
Ref Offset 0.5 dB			<i>L</i>	\Mkr1 2.960 ms	1
10 dB/div Ref 10.00 dBm				20.02 dB	
Log					
					Normal
0.00					Norma
	1 1 1 1	ي جان ا	attained attained		
-10.0					
					Delta
-20.0					
				TRIG LVL	
-30.0					
				14.0	Fixed⊳
-40.0				1Δ2	
-50.0					
					Off
-60.0					
				والمتعادية والمانية والتركيل	
-70.0				. 41	Properties►
					Troperacov
				i di <b>di di dana di di di</b>	Mars
No tran V which V					More
Center 2.441000000 GHz				Span 0 Hz	1 of 2
Res BW 1.0 MHz	#VBW	3.0 MHz	Sweep 5	5.000 ms (1001 pts)	
MSG			STATU	S	

#### Pi/4DQPSK DH5 Middle Channel

## 8DPSK DH1 Middle Channel

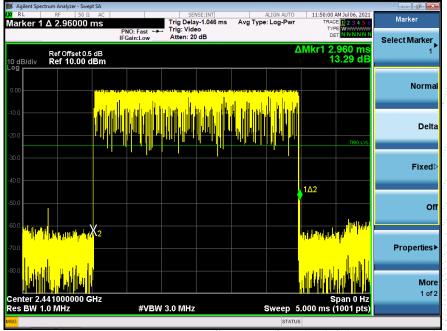






#### 8DPSK DH3 Middle Channel

#### 8DPSK DH5 Middle Channel





## 15. ANTENNA REQUIREMENT

## 15.1 Limit

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall

be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

## 15.2 Test Result

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





## EUT Photo 1



## EUT Photo 2



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## **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 stamp of laboratory.

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

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

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

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

Address:

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