

TEST REPORT

Report No.: BCTC2107520392E

Applicant: Shenzhen Targetever Technology Co., Ltd

Product Name: Wireless Controller for NS

Model/Type reference:

EG09E

Tested Date: 2021-07-28 to 2021-08-25

Issued Date: 2021-08-26



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FCC ID: 2AB5B-EG09E

Product Name: Wireless Controller for NS

Trademark: N/A

EG09E

EG09A, EG09B, EG09C, EG09D, B746, EG103, B254,

Model/Type reference: MTJC-C01, MTJC-C02, B747, B75, B76, EG08, FG02,

DG078, EG13A, EG13B, EG13C, KPAD-THORIUM SW,

SOG-BTGPS2, SOG-BTGPS3, MTNSPC-C01, MTNSPC-C02

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Sample Received Date: 2021-07-28

Sample tested Date: 2021-07-28 to 2021-08-25

Issue Date: 2021-08-26

Report No.: BCTC2107520392E

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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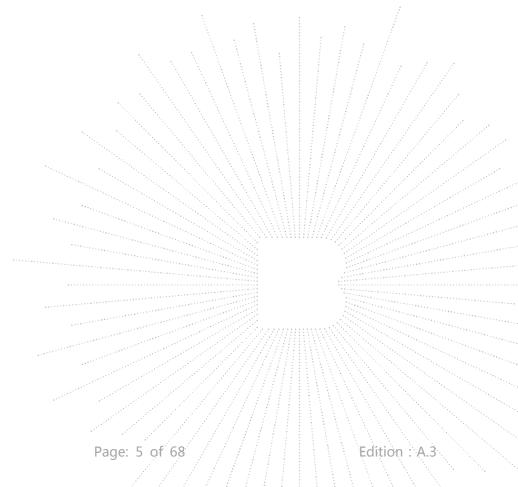
(Note: N/A means not applicable)

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1. VERSION

Report No.	Issue Date	Description	Approved
BCTC2107520392E	2021-08-26	Original	Valid



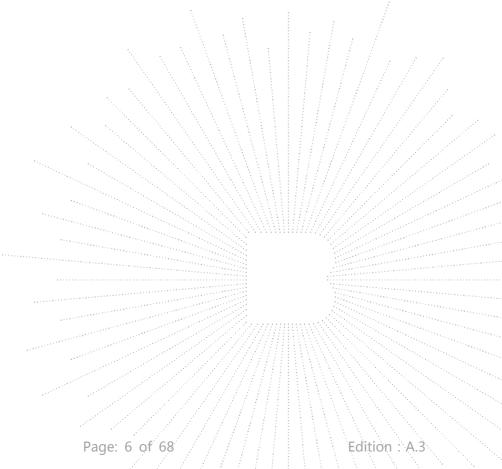
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2. TEST SUMMARY

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



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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℃

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4. PRODUCT INFORMATION AND TEST SETUP

4.1 Product Information

Model/Type reference: EG09E

EG09A, EG09B, EG09C, EG09D, B746, EG103, B254, MTJC-C01, MTJC-C02, B747, B75, B76, EG08, FG02, DG078, EG13A, EG13B, EG13C, KPAD-THORIUM SW, SOG-BTGPS2, SOG-BTGPS3,

MTNSPC-C01, MTNSPC-C02

Model differences: All the model are the same circuit and RF module, except model

names.

Bluetooth Version: BT 5.0

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: DC 3.7V From Battery, DC 5V From adapter

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

E-1 EUT

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4.3 Support Equipment

No.	Device Type	Brand	Model	Series No.	Note
E-2	Adapter	N/A	BCTC001	N/A	Auxiliary

Item	Shielded Type	Ferrite Core	Length	Note
C-1	N/A	N/A	0.5M	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

Chambo Liet							
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	

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4.5 Test Mode

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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		1\ \ /	
Frequency	2402 MHz	2441 MHz	2480 MHz
Parameters	DEF	DEF	DEF /

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5. TEST FACILITY AND TEST INSTRUMENT USED

5.1 Test Facility

All measurement facilities used to collect the measurement data are located at Shenzhen BCTC Testing Co., Ltd. Address: 1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, 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	\	_/		

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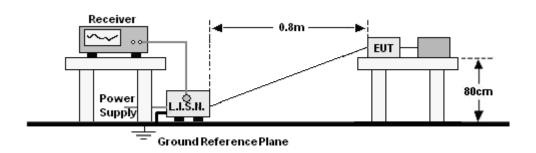
Radiated emissions Test (966 chamber)							
Equipment	Manufacturer	Model#	Serial#	Last Cal.	Next Cal.		
966 chamber	ChengYu	966 Room	966	Jun. 06. 2020	Jun. 05, 2023		
Receiver	R&S	ESR3	102075	May 28, 2021	May 27, 2022		
Receiver	R&S	ESRP	101154	May 28, 2021	May 27, 2022		
Amplifier	SKET	LAPA_01G 18G-45dB	\	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	Jun. 15, 2021	Jun. 14, 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	1	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)		
FREQUENCY (WINZ)	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	

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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

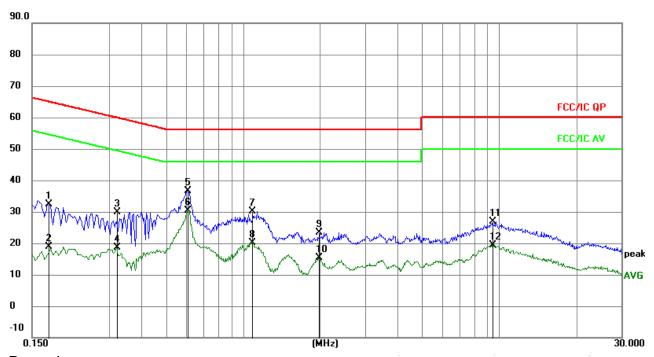
The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

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Test Result 6.5

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



Remark:

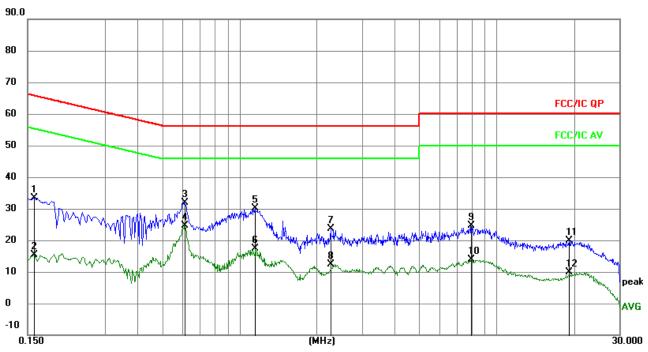
All readings are Quasi-Peak and Average values.
 Factor = Insertion Loss + Cable Loss.

No. Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
	MHz		dB	dBu∀	dBu∀	dB	Detector
1	0.1731	22.81	9.49	32.30	64.81	-32.51	QP
2	0.1731	9.31	9.49	18.80	54.81	-36.01	AVG
3	0.3209	20.36	9.56	29.92	59.68	-29.76	QP
4	0.3209	8.96	9.56	18.52	49.68	-31.16	AVG
5	0.6090	26.74	9.97	36.71	56.00	-19.29	QP
6 *	0.6090	20.48	9.97	30.45	46.00	-15.55	AVG
7	1.0859	20.52	9.57	30.09	56.00	-25.91	QP
8	1.0859	10.68	9.57	20.25	46.00	-25.75	AVG
9	1.9770	13.71	9.59	23.30	56.00	-32.70	QP
10	1.9770	5.76	9.59	15.35	46.00	-30.65	AVG
11	9.4110	17.09	9.70	26.79	60.00	-33.21	QP
12	9.4110	9.57	9.70	19.27	50.00	-30.73	AVG

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



Remark:

- All readings are Quasi-Peak and Average values.
 Factor = Insertion Loss + Cable Loss.

No. Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
	MHz		dB	dBu∀	dBu∀	dB	Detector
1	0.1582	23.91	9.51	33.42	65.56	-32.14	QP
2	0.1582	5.94	9.51	15.45	55.56	-40.11	AVG
3	0.6108	22.02	9.96	31.98	56.00	-24.02	QP
4 *	0.6108	14.66	9.96	24.62	46.00	-21.38	AVG
5	1.1473	20.65	9.57	30.22	56.00	-25.78	QP
6	1.1473	7.78	9.57	17.35	46.00	-28.65	AVG
7	2.2606	14.14	9.61	23.75	56.00	-32.25	QP
8	2.2606	2.65	9.61	12.26	46.00	-33.74	AVG
9	7.9353	14.95	9.71	24.66	60.00	-35.34	QP
10	7.9353	4.14	9.71	13.85	50.00	-36.15	AVG
11	19.1220	10.11	9.77	19.88	60.00	-40.12	QP
12	19.1220	0.08	9.77	9.85	50.00	-40.15	AVG

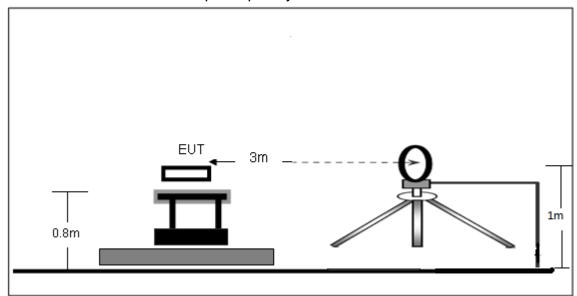
No.: BCTC/RF-EMC-007



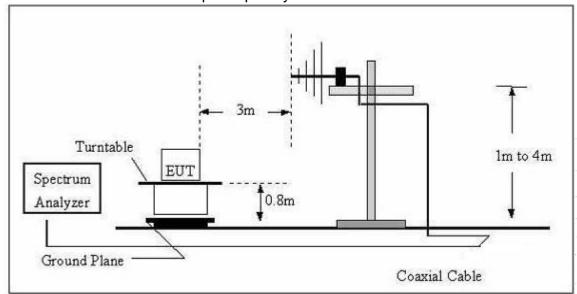
7. RADIATED EMISSIONS

7.1 Block Diagram Of Test Setup

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



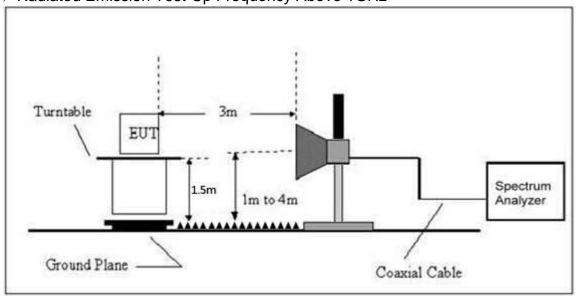
(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



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(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 ^{(2400/F(kHz))} + 80		
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	20log ^{(24000/F(kHz))} + 40		
1.705 ~ 30	30	30	100 * 30	20log ⁽³⁰⁾ + 40		
30 ~ 88	100	3	100	20log ⁽¹⁰⁰⁾		
88 ~ 216	150	3	150	20log ⁽¹⁵⁰⁾		
216 ~ 960	200	3	200	20log ⁽²⁰⁰⁾		
Above 960	500	3	500	20log ⁽⁵⁰⁰⁾		

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).

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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.

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Above 1GHz test procedure as below:

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

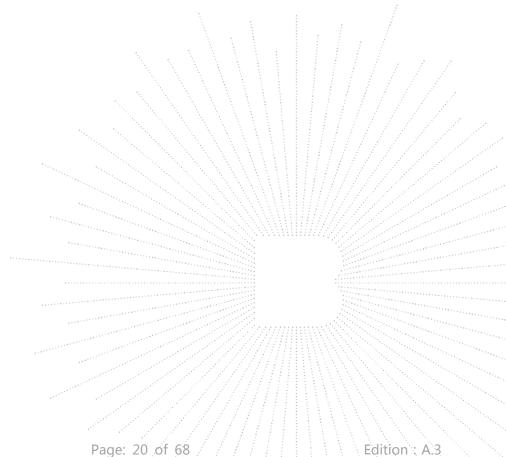
Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
				PASS
				PASS

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.

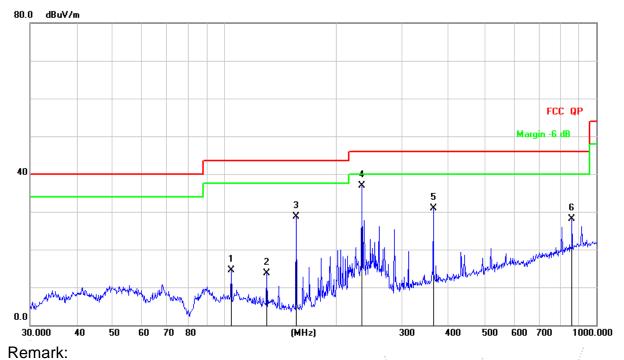


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Between 30MHz - 1GHz

Temperature:	26℃	Relative Humidtity:	54%
Pressure:	101 kPa	Test Voltage:	AC 120V/60Hz
Test Mode:	Mode 4	Polarization :	Horizontal



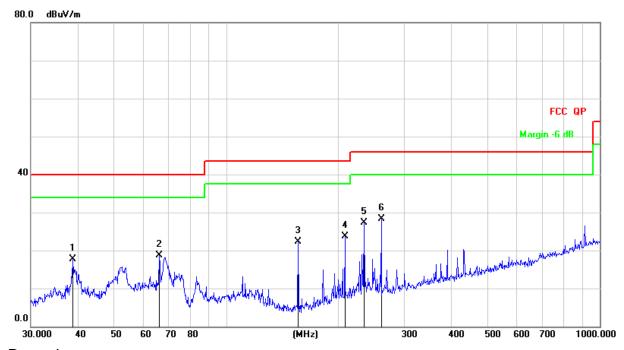
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBu∀	dB	dBuV/m	dB/m	dB	Detector
1	1	04.1701	31.10	-16.55	14.55	43.50	-28.95	QP
2	1	29.9226	31.85	-18.21	13.64	43.50	-29.86	QP
3	1	55.9101	47.77	-19.12	28.65	43.50	-14.85	QP
4	* 2	234.1684	52.42	-15.51	36.91	46.00	-9.09	QP
5	3	864.2595	42.84	-11.90	30.94	46.00	-15.06	QP
6	8	860.0352	30.51	-2.32	28.19	46.00	-17.81	QP

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Temperature:	26℃	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	dBu∀	dB	dBuV/m	dB/m	dB	Detector
1		38.8878	33.35	-15.62	17.73	40.00	-22.27	QP
2		66.2662	35.97	-17.34	18.63	40.00	-21.37	QP
3		155.9101	41.47	-19.12	22.35	43.50	-21.15	QP
4		207.8501	39.91	-16.12	23.79	43.50	-19.71	QP
5		234.1684	42.88	-15.51	27.37	46.00	-18.63	QP
6	*	260.1444	43.22	-14.84	28.38	46.00	-17.62	QP

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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
		G	FSK Low cl	nannel			
V	4804.00	54.26	-0.43	53.83	74.00	-20.17	PK
V	4804.00	44.90	-0.43	44.47	54.00	-9.53	AV
V	7206.00	43.96	8.31	52.27	74.00	-21.73	PK
V	7206.00	33.83	8.31	42.14	54.00	-11.86	AV
Н	4804.00	51.62	-0.43	51.19	74.00	-22.81	PK
Н	4804.00	42.53	-0.43	42.10	54.00	-11.90	AV
Н	7206.00	41.76	8.31	50.07	74.00	-23.93	PK
Н	7206.00	34.33	8.31	42.64	54.00	-11.36	AV
	•	GF:	SK Middle	channel			
V	4882.00	51.59	-0.38	51.21	74.00	-22.79	PK
V	4882.00	42.63	-0.38	42.25	54.00	-11.75	AV
V	7323.00	41.09	8.83	49.92	74.00	-24.08	PK
V	7323.00	31.16	8.83	39.99	54.00	-14.01	AV
Н	4882.00	49.33	-0.38	48.95	74.00	-25.05	PK
Н	4882.00	40.27	-0.38	39.89	54.00	-14.11	AV
Н	7323.00	39.32	8.83	48.15	74.00	-25.85	PK
Н	7323.00	30.84	8.83	39,67	54.00	-14.33	AV
		Gl	FSK High c	hannel			
V	4960.00	53.45	-0.32	53.13	74.00	-20.87	PK
V	4960.00	43.35	-0.32	43.03	54.00	-10.97	AV
V	7440.00	44.92	9.35	54.27	74.00	-19.73	/ PK/
V	7440.00	34.17	9.35	43.52	54.00	-10.48	AV
Н	4960.00	51.13	-0.32	50.81	74.00	-23.19	PK
Н	4960.00	40.27	-0.32	39.95	54.00	-14.05	AV
Н	7440.00	42.82	9.35	52.17	74.00	-21.83	PK
Н	7440.00	35.71	9.35	45.06	54.00	-8.94	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.

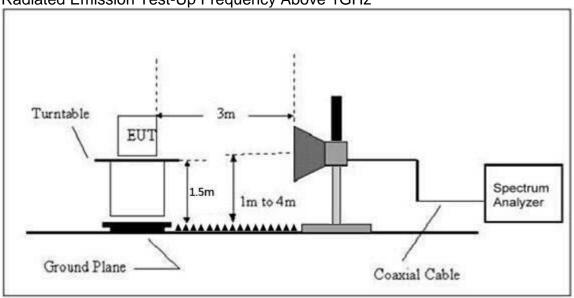
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8. RADIATED BAND EMISSION MEASUREMENT AND RESTRICTED BANDS OF OPERATION

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
¹ 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	(²)
13.36-13.41			

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).

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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.

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8.5 Test Result

Report No.: BCTC2107520392E

	Polar (H/V)	Frequency (MHz)	Reading Level	Correct	Measure- ment (dBuV/m)		nits V/m)	Result	
	()	((dBuV/m)	(dB)	PK	PK	AV		
Low Channel 2402MHz									
	Н	2390.00	57.10	-6.70	50.40	74.00	54.00	PASS	
	Η	2400.00	48.68	-6.71	41.97	74.00	54.00	PASS	
	V	2390.00	56.96	-6.70	50.26	74.00	54.00	PASS	
GFSK	V	2400.00	49.76	-6.71	43.05	74.00	54.00	PASS	
GFSK			High	Channel 2	2480MHz				
	Η	2483.50	56.61	-6.79	49.82	74.00	54.00	PASS	
	Н	2485.00	48.20	-6.81	41.39	74.00	54.00	PASS	
	V	2483.50	55.66	- 6.79	48.87	74.00	54.00	PASS	
	V	2485.00	47.26	-6.81	40.45	74.00	54.00	PASS	
			Low	Channel 2	402MHz				
	Н	2390.00	56.26	-6.70	49.56	74.00	54.00	PASS	
	Н	2400.00	48.97	-6.71	42.26	74.00	54.00	PASS	
	V	2390.00	56.04	-6.70	49.34	74.00	54.00	PASS	
Pi/4DQPSK	V	2400.00	48.03	-6.71	41.32	74.00	54.00	PASS	
FIJADQFSK		High Channel 2480MHz							
	Н	2483.50	54.69	-6.79	47.90	74.00	54.00	PASS	
	Н	2485.00	48.91	-6.81	42.10	74.00	54.00	PASS	
	V	2483.50	55.99	- 6.79	49.20	74.00	54.00	PASS	
	V	2485.00	48.60	-6.81	41.79	74.00	54.00	PASS	
			Low	Channel 2	402MHz				
	Н	2390.00	56.71	-6.70	50.01	74.00	54.00	PASS	
	Н	2400.00	49.58	-6.71	42.87	74.00	54.00	PASS	
	V	2390.00	56.99	-6.70	50.29	74.00	54.00	PASS	
8DPSK	V	2400.00	48.92	-6.71	42.21	74.00	54.00	PASS	
ODPSK		,		Channel 2			<u>////</u>		
	Н	2483.50	55.04	-6.79	48.25	74.00	54.00	PASS	
	Н	2485.00	47.93	-6.81	41.12	74.00	54.00	PASS	
	V	2483.50	56.45	-6.79	49.66	74.00	54.00	PASS	
	V	2485.00	47.50	-6.81	40.69	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.

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9. CONDUCTED EMISSION

Report No.: BCTC2107520392E

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 §15.209(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

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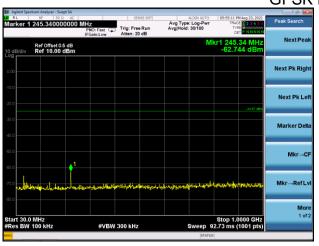


9.4 Test Result

Report No.: BCTC2107520392E

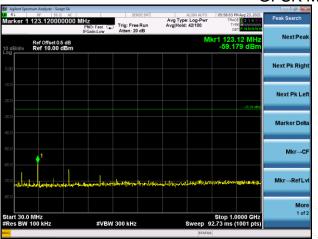
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Test Voltage :	AC 120V/60Hz	Remark:	N/A

30MHz – 25GHz GFSK Low Channel



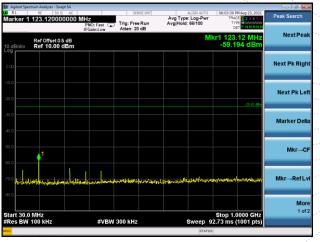


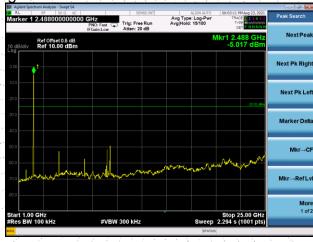
GFSK Middle Channel







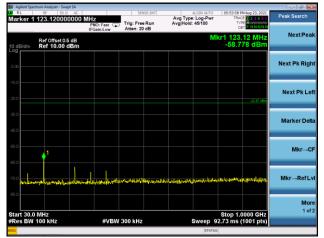




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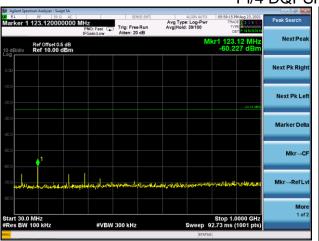


Pi/4 DQPSK Low Channel



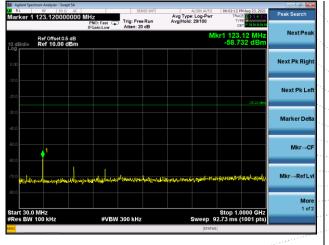


Pi/4 DQPSK Middle Channel







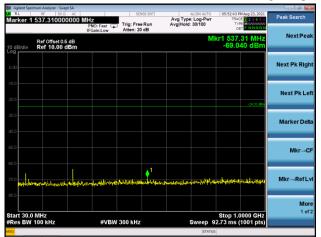




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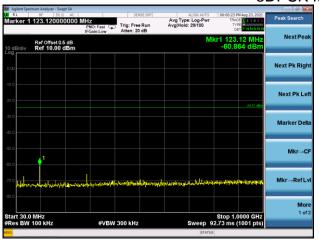


8DPSK Low Channel



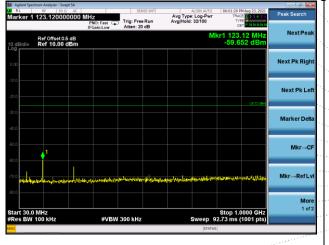


8DPSK Middle Channel





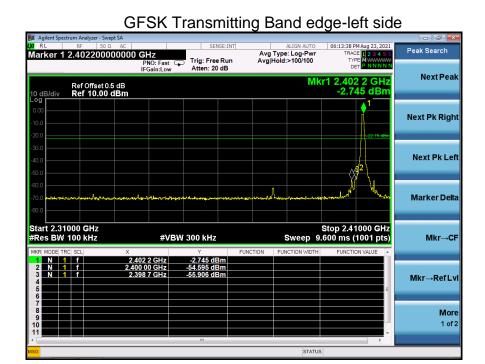
8DPSK High Channel

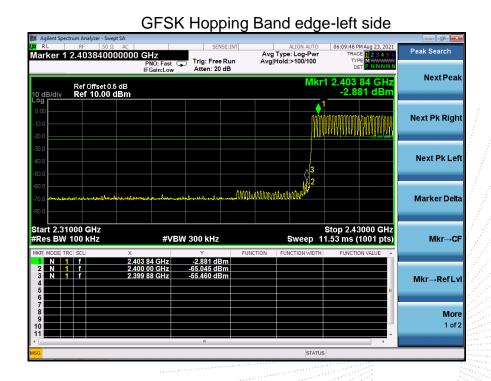




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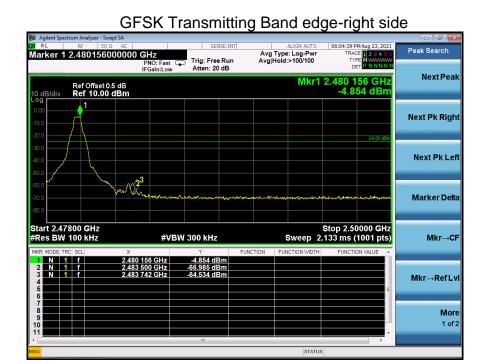


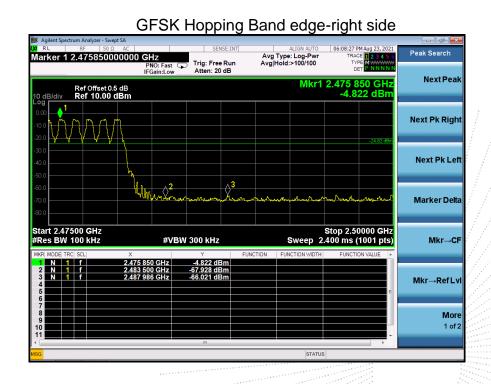




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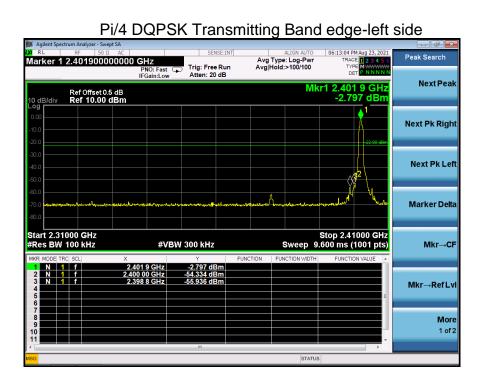


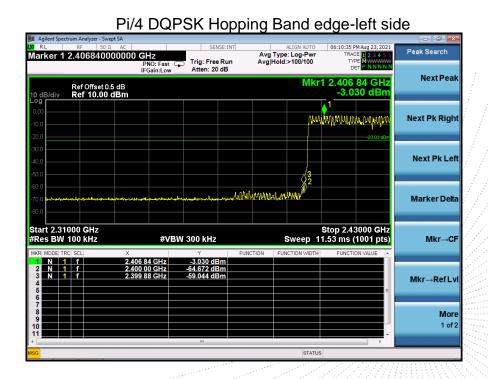


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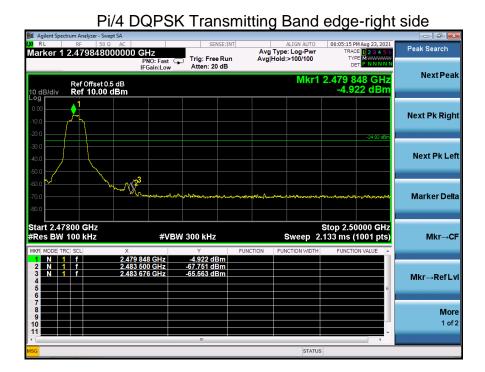


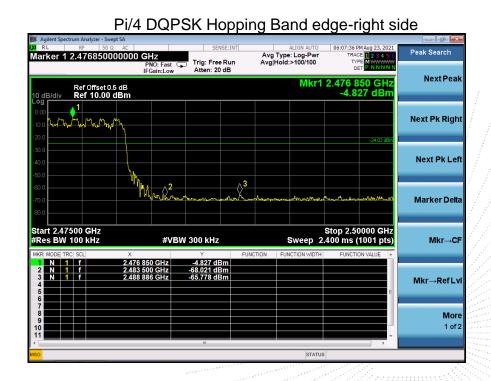




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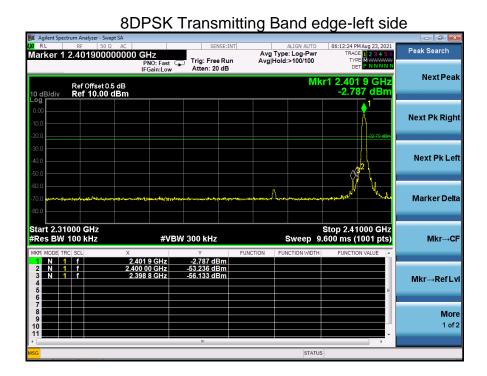


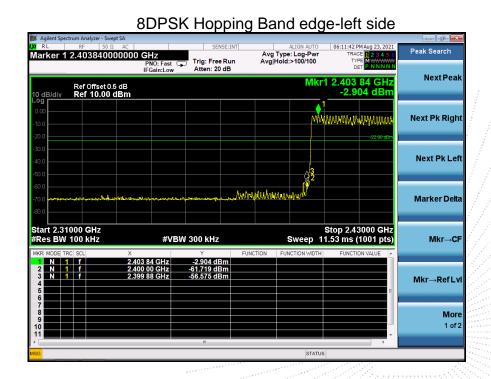




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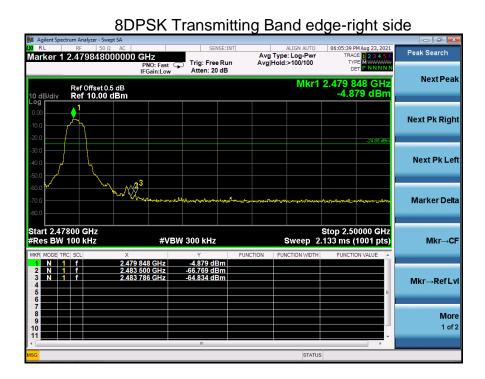


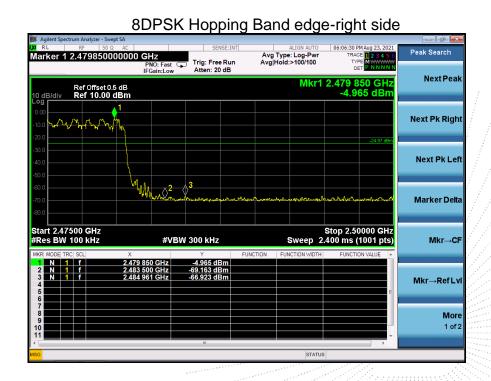




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10. 20 DB BANDWIDTH

10.1 Block Diagram Of Test Setup

EUT	SPECTRUM
	ANALYZER

10.2 Limit

N/A

10.3 Test procedure

- 1. Set RBW = 30kHz.
- 2. Set the video bandwidth (VBW) \geq 3 x RBW.
- 3. Detector = Peak.
- 4. Trace mode = max hold.
- 5. Sweep = auto couple.
- 6. Allow the trace to stabilize.
- 7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

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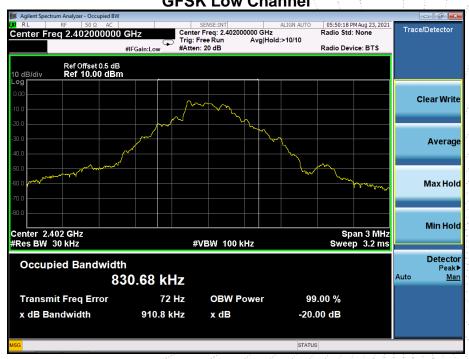


10.4 Test Result

Temperature :	196°C	Relative Humidity:	54%
Test Voltage :	AC 120V/60Hz	Remark	N/A

Modulation	Test Channel	Bandwidth(MHz)
GFSK	Low	0.911
GFSK	Middle	0.910
GFSK	High	0.913
Pi/4 DQPSK	Low	1.250
Pi/4 DQPSK	Middle	1.257
Pi/4 DQPSK	High	1.271
8DPSK	Low	1.251
8DPSK	Middle	1.256
8DPSK	High	1.255

Test plots GFSK Low Channel



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GFSK Middle Channel

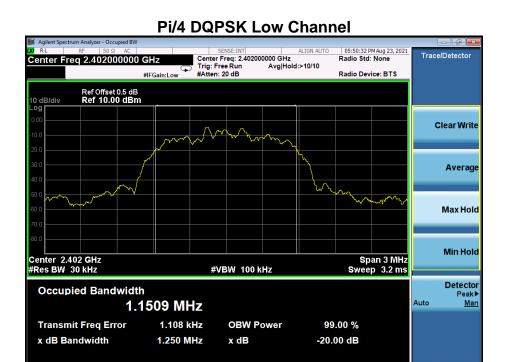


GFSK High Channel



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Pi/4 DQPSK Middle Channel



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Pi/4 DQPSK High Channel 05:49:05 PM Aug 23, 2021 Radio Std: None Trace/Detector Radio Device: BTS Clear Write Average Max Hold Min Hold Span 3 MHz Sweep 3.2 ms Center 2.48 GHz #Res BW 30 kHz **#VBW 100 kHz** Detector Peak► <u>Man</u> Occupied Bandwidth 1.1572 MHz -1.166 kHz **Transmit Freq Error OBW Power** 99.00 % x dB Bandwidth 1.271 MHz x dB -20.00 dB

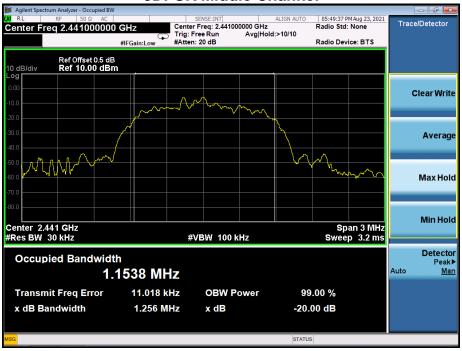
8DPSK Low Channel



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8DPSK Middle Channel



8DPSK High Channel



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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 = 3MHz. 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 :	196°C	Relative Humidity:	54%
Test Voltage :	AC 120V/60Hz	Remark:	N/A

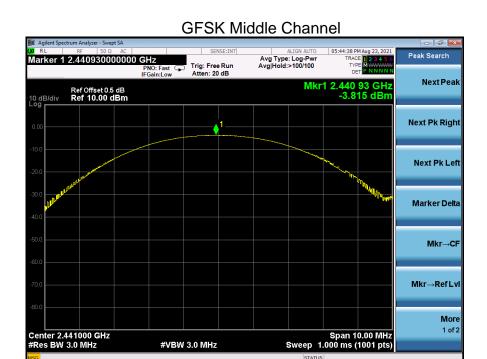
Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	-2.798	21
GFSK	Middle	-3.815	21
GFSK	High	-4.876	21
Pi/4 DQPSK	Low	-0.452	21
Pi/4 DQPSK	Middle	-1.453	21
Pi/4 DQPSK	High	-2.572	21
8DPSK	Low	0.268	21
8DPSK	Middle	-0.752	21
8DPSK	High	-1.849	21

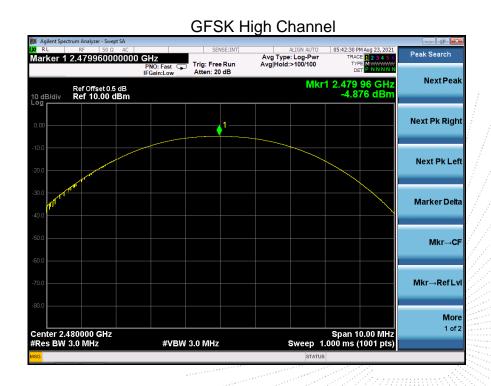
Test plots GFSK Low Channel



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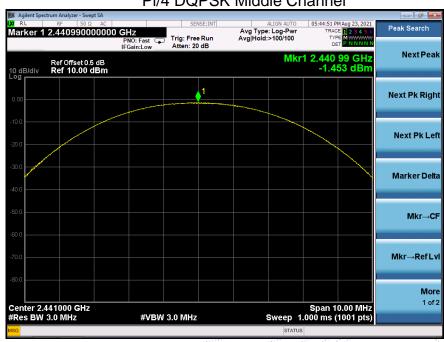
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Pi/4 DQPSK Low Channel

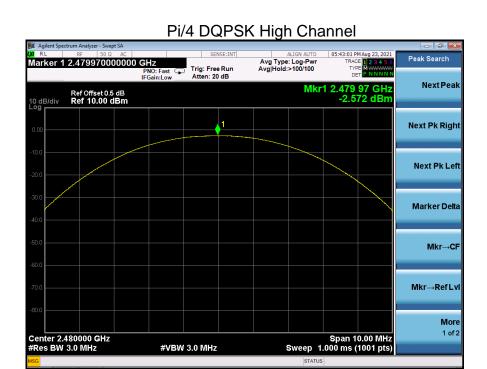


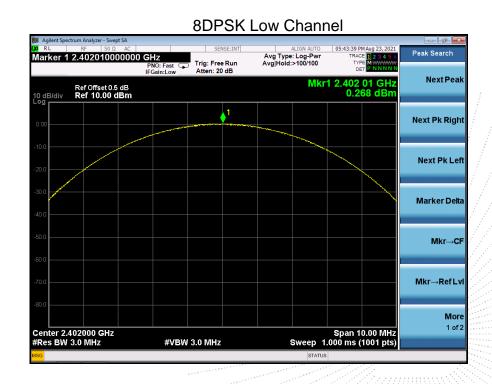
Pi/4 DQPSK Middle Channel



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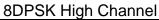


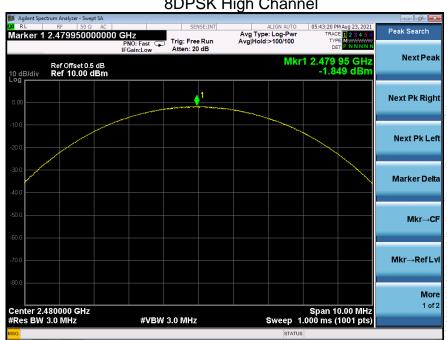
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8DPSK Middle Channel Peak Search PNO: Fast Trig: Free Run IFGain:Low Atten: 20 dB Avg Type: Log-Pwr Avg|Hold:>100/100 2.440 92 GH: -0.752 dBn







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12. HOPPING CHANNEL SEPARATION

12.1 Block Diagram Of Test Setup

EUT	SPECTRUM
	ANALYZER

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	1.000	0.607	PASS
GFSK	Middle	0.998	0.607	PASS
GFSK	High	1.000	0.609	PASS
Pi/4 DQPSK	Low	1.000	0.833	PASS
Pi/4 DQPSK	Middle	0.998	0.838	PASS
Pi/4 DQPSK	High	1.004	0.847	PASS
8DPSK	Low	1.000	0.834	PASS
8DPSK	Middle	0.998	0.837	PASS
8DPSK	High	0.998	0.837	PASS

Test plots GFSK Low Channel



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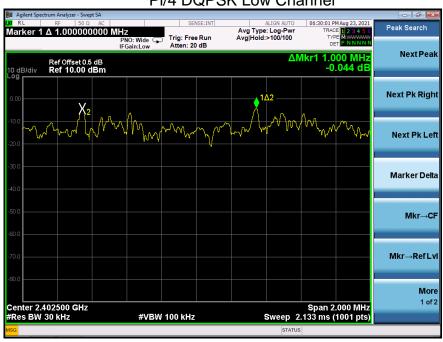




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Pi/4 DQPSK Low Channel

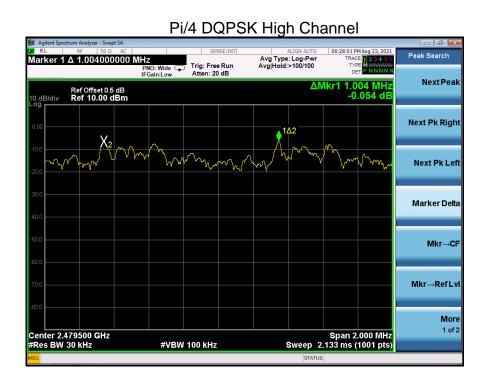


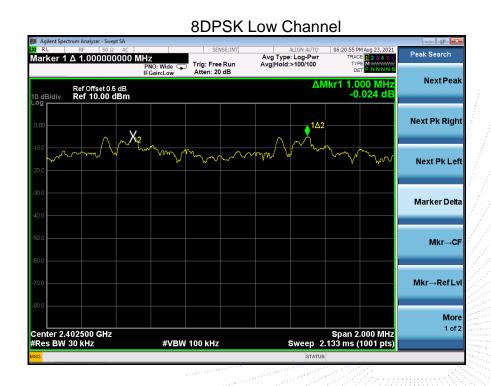
Pi/4 DQPSK Middle Channel



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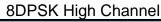


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8DPSK Middle Channel







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13. NUMBER OF HOPPING FREQUENCY

13.1 Block Diagram Of Test Setup

EUT	SPECTRUM
	ANALYZER

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;

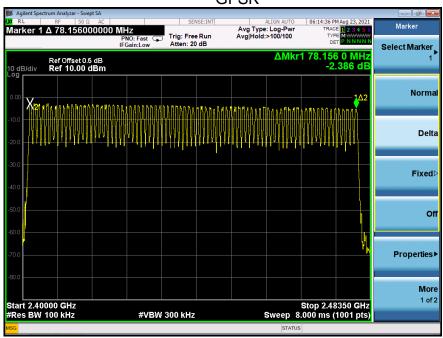
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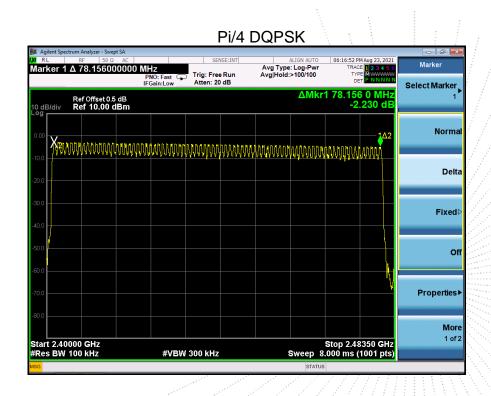


13.4 Test Result

Test Plots:

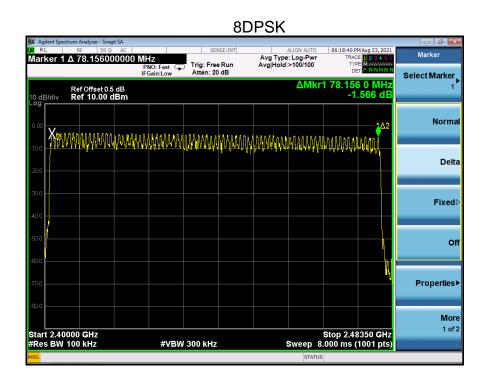
79 Channels in total GFSK

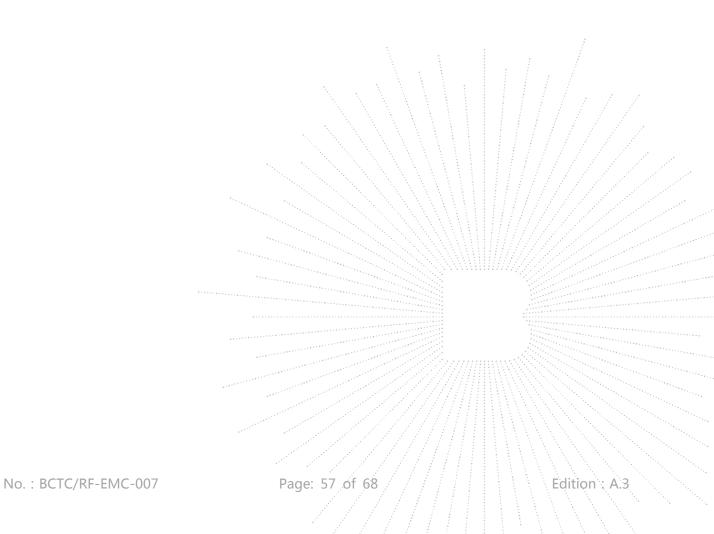




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14. DWELL TIME

14.1 Block Diagram Of Test Setup

EUT	SPECTRUM
	ANALYZER

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).

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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).

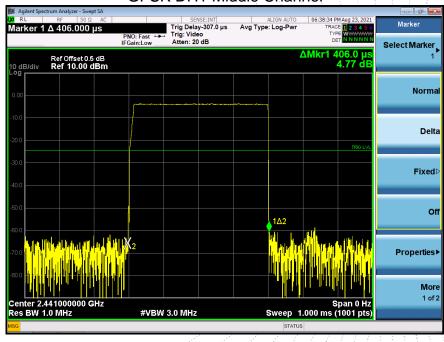
DH3 Packet permit maximum 1600 / 79 / 4 hops per second in each channel (3 time slots RX, 1 time slot TX).

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	0.406	0.130	0.4
GFSK	Middle	DH3	1.662	0.266	0.4
		DH5	2.930	0.313	0.4
		2DH1	0.417	0.133	0.4
Pi/4DQPSK	Middle	2DH3	1.674	0.268	0.4
		2DH5	2.940	0.314	0.4
		3DH1	0.418	0.134	0.4
8DPSK	Middle	3DH3	1.680	0.269	0.4
		3DH5	2.940	0.314	0.4

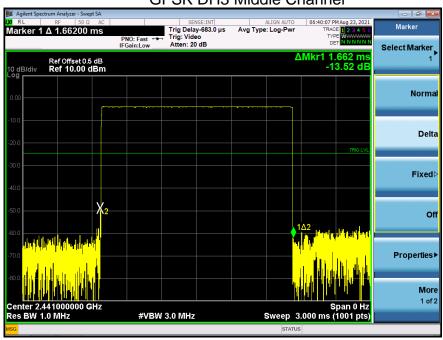
Test Plots
GFSK DH1 Middle Channel



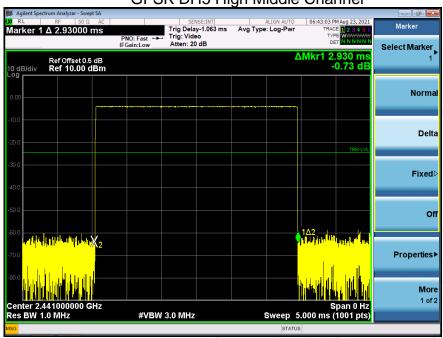
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GFSK DH3 Middle Channel



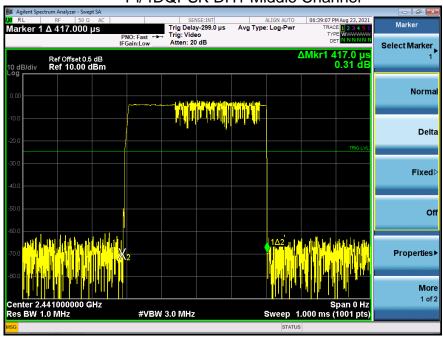




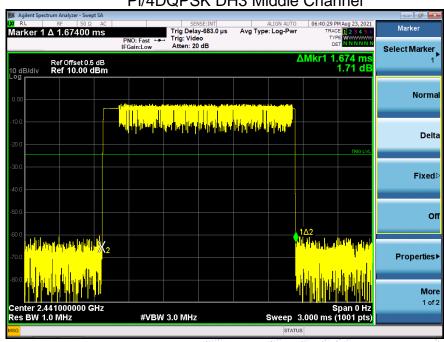
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Pi/4DQPSK DH1 Middle Channel



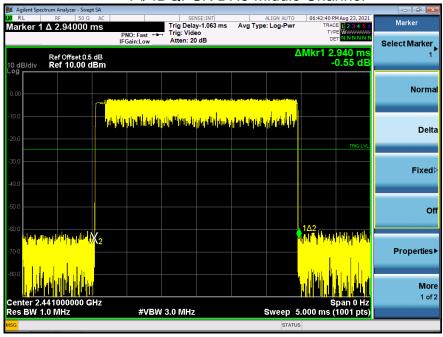
Pi/4DQPSK DH3 Middle Channel



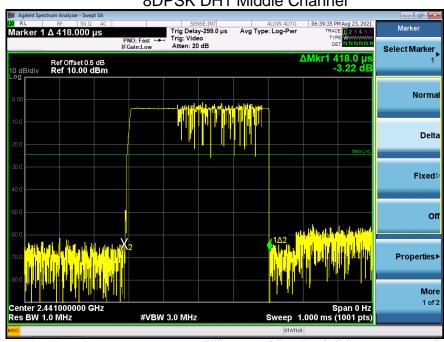
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Pi/4DQPSK DH5 Middle Channel



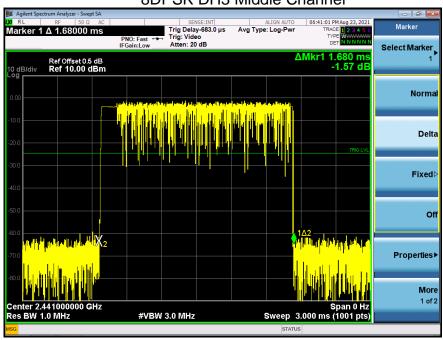
8DPSK DH1 Middle Channel



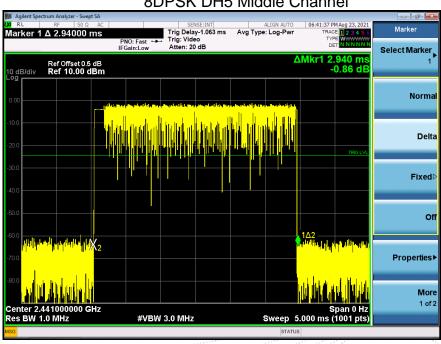
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8DPSK DH3 Middle Channel



8DPSK DH5 Middle Channel



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ANTENNA REQUIREMENT

Report No.: BCTC2107520392E

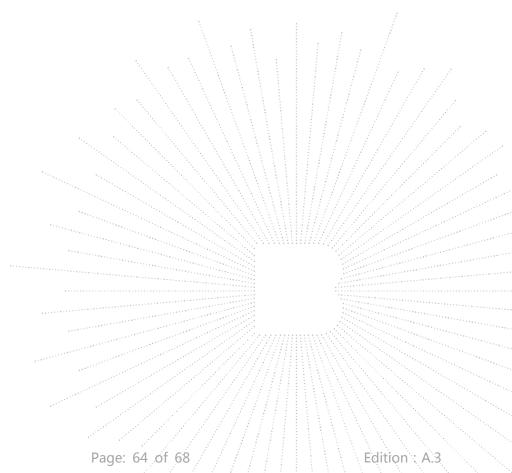
15.1 Limit

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.



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16. EUT PHOTOGRAPHS

Report No.: BCTC2107520392E

EUT Photo 1



EUT Photo 2

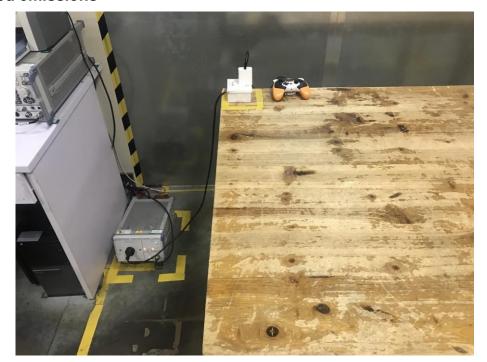


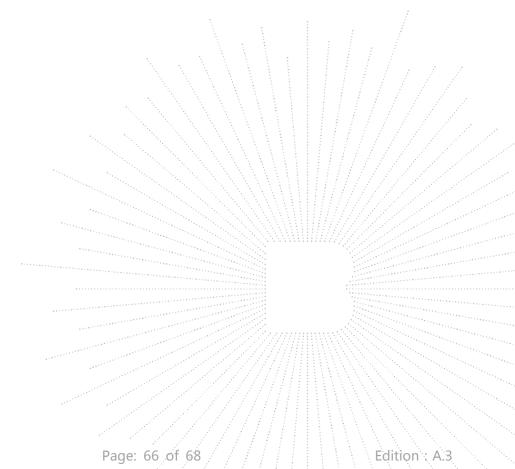
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17. EUT TEST SETUP PHOTOGRAPHS

Conducted emissions





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Radiated Measurement Photos





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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:

1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Tangwei, 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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