

## **TEST REPORT**

Report No.:	BCTC2212640433E
Applicant:	Hoco technology development (SHENZHEN) co.,Ltd
Product Name:	Wireless Speaker
Model/Type Ref.:	BS31
Tested Date:	2022-12-01 to 2022-12-07
Issued Date:	2022-12-07

### Shenzhen BCTC Testing Co., Ltd.



No.: BCTC/RF-EMC-005

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## FCC ID: 2AX2T-BS31

Product Name:

Trademark:

Wireless Speaker

# hoco.

Model/Type Ref.:	BS31 BS30, BS33, BS40, BS45, BS47, BS49, BS51, BS55, BS56, HC1, HC2, HC3, HC4, HC8, HC9, HC10, HC11, HC12, HC13			
Prepared For:	Hoco technology development (SHENZHEN) co.,Ltd			
Address:	Rm 408, Block A, Weidonglong Business Building, 2125 Meilong Road, Tsinghua Community, Longhua Street, Longhua District, Shenzhen, China			
Manufacturer:	Hoco technology development (SHENZHEN) co.,Ltd			
Address:	Rm 408, Block A, Weidonglong Business Building, 2125 Meilong Road, Tsinghua Community, Longhua Street, Longhua District, Shenzhen, China			
Prepared By:	Shenzhen BCTC Testing Co., Ltd.			
Address:	1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Zhancheng, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China			
Sample Received Date:	2022-12-01			
Sample tested Date:	2022-12-01 to 2022-12-07			
Issue Date:	2022-12-07			
Report No.:	BCTC2212640433E			
Test Standards:	FCC Part15.247 ANSI C63.10-2013			
Test Results:	PASS			
Remark:	This is Bluetooth Classic radio test report.			

Tested by:

Chen

Lei Chen/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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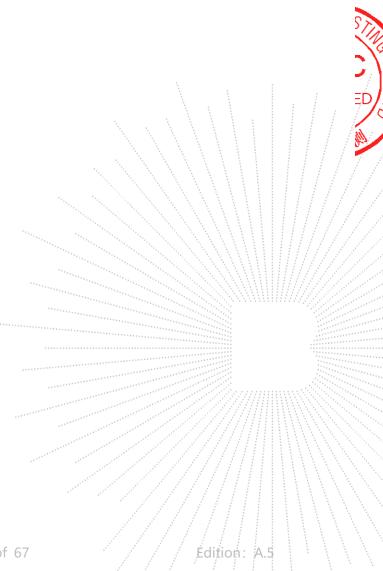
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#### 1. Version

Report No.	Issue Date	Description	Approved
BCTC2212640433E	2022-12-07	Original	Valid



No.: BCTC/RF-EMC-005



#### 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	Hopping channel separation	§15.247(a)(1)	PASS
5	Number of hopping frequencies	§15.247(a)(1)(iii)	PASS
6	Dwell Time	§15.247(a)(1)(iii)	PASS
7	Spurious RF conducted emissions	§15.247(d)	PASS
8	Band edge	§15.247(d)	PASS
9	Spurious radiated emissions for transmitter	§15.247(d) & §15.209 & §15.205	PASS
10	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(9kHz-30MHz)	U=3.7dB
2	3m chamber Radiated spurious emission(30MHz-1GHz)	U=4.3dB
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:	BS31 BS30, BS33, BS40, BS45, BS47, BS49, BS51, BS55, BS56, HC1, HC2, HC3, HC4, HC8, HC9, HC10, HC11, HC12, HC13
Model differences:	All the model are the same circuit and RF module, except model names and color.
Bluetooth version:	BT5.0
Operation Frequency:	2402-2480MHz
Type of Modulation:	GFSK, π/4DQPSK
Number Of Channel	79CH
Antenna installation:	PCB antenna
Antenna Gain:	1.7dBi
Ratings:	DC 5V from USB, DC 3.7V from battery

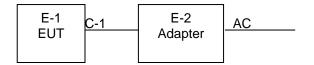
#### 4.2 Test Setup Configuration

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

Conducted Emission:



Radiated Spurious Emission





#### 4.3 Support Equipment

No.	Device Type	Brand	Model	Series No.	Note
E-1	Wireless Speaker	hoco.	BS31	N/A	EUT
E-2	Adapter	N/A	BCTC001	N/A	Auxiliary

ltem	Shielded Type	Ferrite Core	Length	Note
C-1	NO	NO	0.3M	USB cable unshielded

#### Notes:

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

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

#### 4.4 Channel List

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

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#### 4.5 Test Mode

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

Test Mode	Test mode	Low channel	Middle channel	High channel		
1	Transmitting(GFSK)	2402MHz	2441MHz	2480MHz		
2	Transmitting(π/4DQPSK)	2402MHz	2441MHz	2480MHz		
3	Charging(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_assist 1.0.1.1				
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, Zhancheng, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards. FCC Test Firm Registration Number: 712850 IC Registered No.: 23583

#### 5.2 Test Instrument Used

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

		RF Con	ducted Test		
Equipment	Manufacturer	Model#	Serial#	Last Cal.	Next Cal.
Power Metter	Keysight	E4419	λ	May 24, 2022	May 23, 2023
Power Sensor (AV)	Keysight	E9300A	λ	May 24, 2022	May 23, 2023
Signal Analyzer20kH z-26.5GHz	Keysight	N9020A	MY49100060	May 24, 2022	May 23, 2023
Spectrum Analyzer9kHz- 40GHz	R&S	FSP40	N	May 24, 2022	May 23, 2023



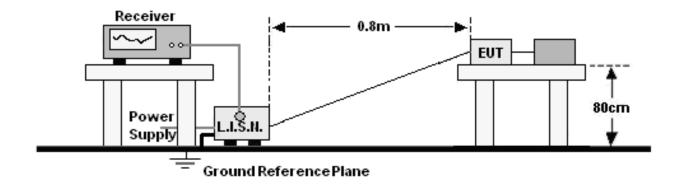
Radiated Emissions Test (966 Chamber01)							
Equipment	Manufacturer	Model#	Serial#	Last Cal.	Next Cal.		
966 chamber	ChengYu	966 Room	966	Jun. 06. 2020	Jun. 05, 2023		
Receiver	R&S	ESR3	102075	May 24, 2022	May 23, 2023		
Receiver	R&S	ESRP	101154	May 24, 2022	May 23, 2023		
Amplifier	SKET	LAPA_01G18 G-45dB	١	May 24, 2022	May 23, 2023		
Amplifier	Schwarzbeck	BBV9744	9744-0037	May 24, 2022	May 23, 2023		
TRILOG Broadband Antenna	Schwarzbeck	VULB9163	942	May 26, 2022	May 25, 2023		
Horn Antenna	Schwarzbeck	BBHA9120D	1541	Jun. 06, 2022	Jun. 05, 2023		
Horn Antenna(18G Hz-40GHz)	Schwarzbeck	BBHA9170	00822	Jun. 06, 2022	Jun. 05, 2023		
Amplifier(18G Hz-40GHz)	MITEQ	TTA1840-35- HG	2034381	May 26, 2022	May 25, 2023		
Loop Antenna(9KHz -30MHz)	Schwarzbeck	FMZB1519B	00014	May 26, 2022	May 25, 2023		
Power Metter	Keysight	E4419	١	May 26, 2022	May 25, 2023		
Power Sensor (AV)	Keysight	E9300A	\	May 26, 2022	May 25, 2023		
Signal Analyzer20kH z-26.5GHz	Keysight	N9020A	MY49100060	May 26, 2022	May 25, 2023		
Spectrum Analyzer9kHz- 40GHz	R&S	FSP40	١	May 26, 2022	May 25, 2023		
Software	Frad	EZ-EMC	FA-03A2 RE	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1			

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#### 6. Conducted Emissions

#### 6.1 Block Diagram Of Test Setup



#### 6.2 Limit

FREQUENCY (MHz)	Limit (	dBuV)
	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.

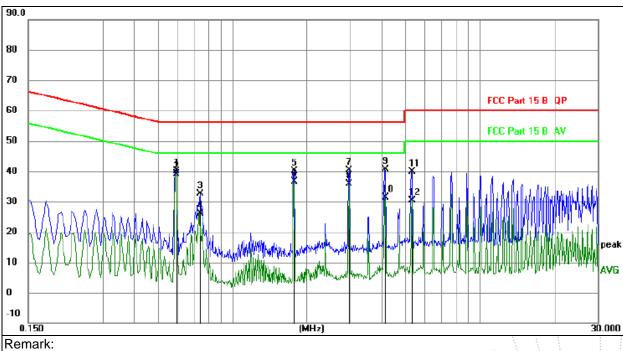
#### 6.4 EUT Operating Conditions

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 :	Line
Test Voltage :	AC120V/60Hz	Test Mode:	Mode 3



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

3. Measurement=Reading Level+ Correct Factor

4. Over=Measurement-Limit

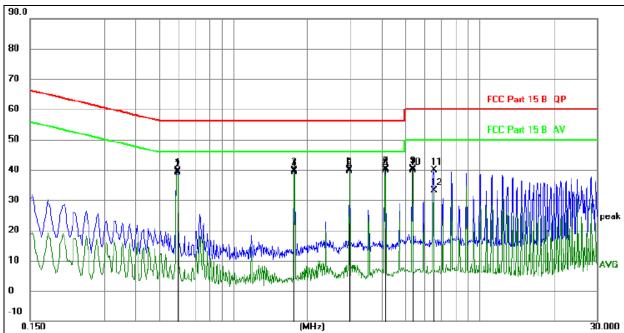
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No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz		dB	dBuV	dBuV	dB	Detector
1		0.5948	20.50	19.73	40.23	56.00	-15.77	QP
2	*	0.5948	19.45	19.73	39.18	46.00	-6.82	AVG
3		0.7430	12.90	19.74	32.64	56.00	-23.36	QP
4		0.7430	6.51	19.74	26.25	46.00	-19.75	AVG
5		1.7810	20.36	19.85	40.21	56.00	-15.79	QP
6		1.7810	16.79	19.85	36.64	46.00	-9.36	AVG
7		2.9619	20.30	19.99	40.29	56.00	-15.71	QP
8		2.9619	15.92	19.99	35.91	46.00	-10.09	AVG
9		4.1356	20.42	20.10	40.52	56.00	-15.48	QP
10		4.1356	11.40	20.10	31.50	46.00	-14.50	AVG
11		5.3050	19.83	20.13	39.96	60.00	-20.04	QP
12		5.3050	10.25	20.13	30.38	50.00	-19.62	AVG
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No.: BCTC/RF-EMC-005

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Temperature:	<b>26</b> ℃	Relative Humidity:	54%
Pressure:	101kPa	Phase :	Neutral
Test Voltage :	AC120V/60Hz	Test Mode:	Mode 3



Remark:

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

2. Factor = Insertion Loss + Cable Loss.

3. Measurement=Reading Level+ Correct Factor

4.	Over=Measurement-Limit	

No. Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
	MHz		dB	dBuV	dBuV	dB	Detector
1	0.5948	19.80	19.73	39.53	56.00	-16.47	QP
2	0.5948	19.46	19.73	39.19	46.00	-6.81	AVG
3	1.7716	20.02	19.85	39.87	56.00	-16.13	QP
4	1.7716	19.50	19.85	39.35	46.00	-6.65	AVG
5	2.9619	20.21	19.99	40.20	56.00	-15.80	QP
6	2.9619	19.76	19.99	39.75	46.00	-6.25	AVG
7	4.1356	20.25	20.10	40.35	56.00	-15.65	QP
8 *	4.1356	19.87	20.10	39.97	46.00	-6.03	AVG
9	5.3332	20.15	20.14	40.29	60.00	-19.71	QP
10	5.3332	19.64	20.14	39.78	50.00	-10.22	AVG
11	6.5227	19.70	20.17	39.87	60.00	-20.13	QP
12	6.5227	13.07	20.17	33.24	50.00	-16.76	AVG

No.: BCTC/RF-EMC-005



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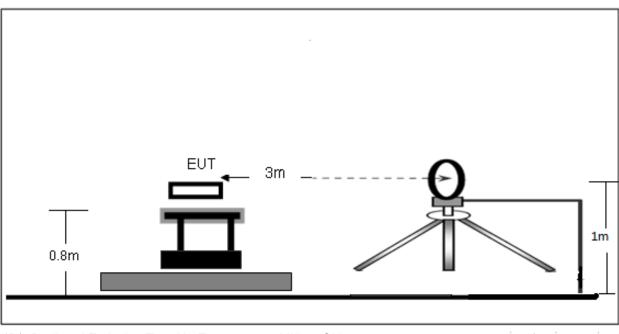
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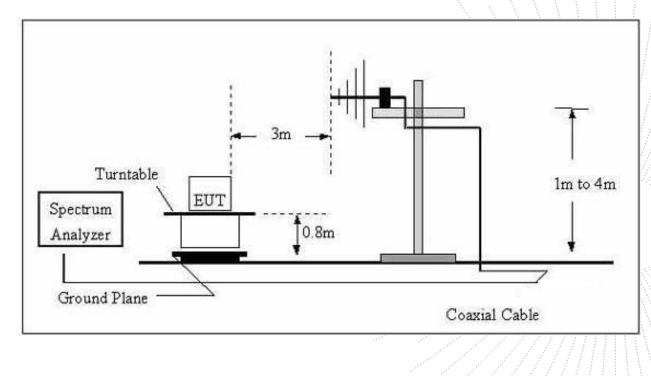
#### 7. Radiated Emissions

#### 7.1 Block Diagram Of Test Setup

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







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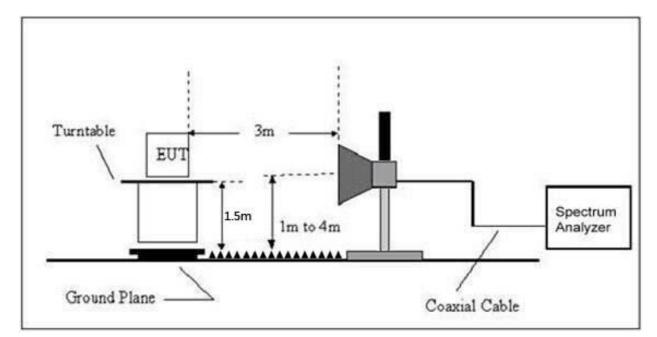
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#### (C) Radiated Emission Test-Up Frequency Above 1GHz



#### 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 <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)

FREQUENCY		Limit (dBuV/m) (at 3M)
(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 chamber. 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 chamber. 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.

#### 7.5 Test Result

#### Below 30MHz

				PASS
				PASS
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
Freq.	Reading	Limit	Margin	State
Test Mode :	Mode 3	Polariza	tion ·	\
Pressure:	101 kPa	Test Vol	Itage:	AC 120V/60Hz
Temperature:	<b>26</b> ℃	Relative	Humidity	24%

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.



#### Between 30MHz – 1GHz

Temperature:	<b>26</b> ℃	Relative Humidity:	54%
Pressure:	101KPa	Phase :	Horizontal
Test Mode:	Mode 3	Remark:	N/A



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

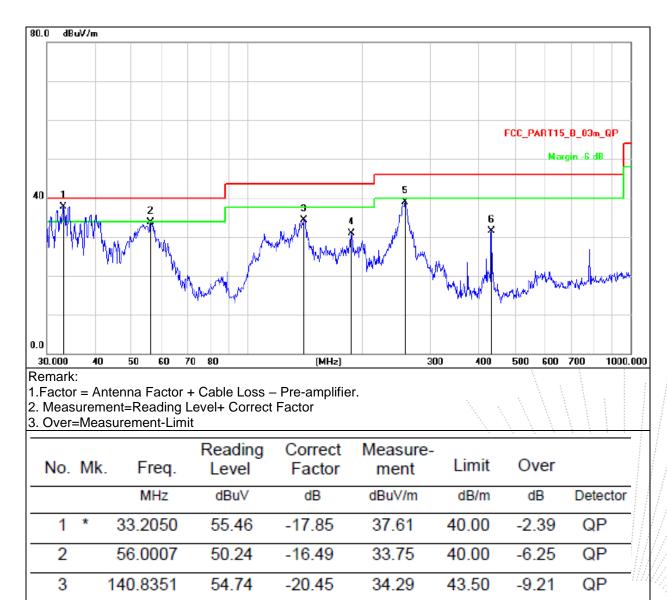
2. Measurement=Reading Level+ Correct Factor

3. Over=Measurement-Limit

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		41.4215	37.57	-16.56	21.01	40.00	-18.99	QP
2		52.2079	34.12	-15.92	18.20	40.00	-21.80	QP
3		140.3421	51.60	-20.41	31.19	43.50	-12.31	QP
4	*	251.1804	52.15	-15.80	36.35	46.00	-9.65	QP
5		316.5890	46.88	-13.99	32.89	46.00	-13.11	QP
6		420.5803	42.22	-11.91	30.31	46.00	-15.69	QP



Temperature:	<b>26</b> ℃	Relative Humidity:	54%
Pressure:	101KPa	Phase :	Vertical
Test Mode:	Mode 3	Remark:	N/A



187.0956

258.3264

434.0650

49.14

54.44

43.32

4

5

6

-18.32

-15.62

-11.72

30.82

38.82

31.60

43.50

46.00

46.00

-12.68

-7.18

-14.40

QP

QP

QP

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Polar	Frequency	Reading Level	Correct Factor	Measure- ment	Limits	Over	Detector	
(H/V)	(MHz)	(dBuV/m)	(dBuV/m) (dB) (dBuV/m)		(dBuV/ m)	(dB)	Туре	
			GFSK Low ch	annel				
V	4804.00	54.80	-0.43	-0.43 54.37		-19.63	PK	
V	4804.00	43.87	-0.43	43.44	54.00	-10.56	AV	
V	7206.00	44.92	8.31	53.23	74.00	-20.77	PK	
V	7206.00	34.14	8.31	42.45	54.00	-11.55	AV	
Н	4804.00	51.42	-0.43	50.99	74.00	-23.01	PK	
Н	4804.00	40.73	-0.43	40.30	54.00	-13.70	AV	
Н	7206.00	43.59	8.31	51.90	74.00	-22.10	PK	
Н	7206.00	36.36	8.31	44.67	54.00	-9.33	AV	
		G	FSK Middle o	hannel				
V	4882.00	52.00	-0.38	51.62	74.00	-22.38	PK	
V	4882.00	45.24	-0.38	44.86	54.00	-9.14	AV	
V	7323.00	43.03	8.83	51.86	74.00	-22.14	PK	
V	7323.00	33.30	8.83	42.13	54.00	-11.87	AV	
Н	4882.00	48.69	-0.38	48.31	74.00	-25.69	PK	
Н	4882.00	38.54	-0.38	38.16	54.00	-15.84	AV	
Н	7323.00	40.90	8.83	49.73	74.00	-24.27	PK	
Н	7323.00	32.47	8.83	41.30	54.00	-12.70	AV	
		(	GFSK High ch	annel				
V	4960.00	53.54	-0.32	53.22	74.00	-20.78	PK	
V	4960.00	43.81	-0.32	43.49	54.00	-10.51	AV	
V	7440.00	45.80	9.35	55.15	74.00	-18.85	PK	
V	7440.00	36.66	9.35	46.01	54.00	-7.99	AV	
Н	4960.00	52.03	-0.32	51.71	74.00	-22.29	PK	
Н	4960.00	41.83	-0.32	41.51	54.00	-12.49	AV	
Н	7440.00	43.53	9.35	52.88	74.00	-21.12	PK	
Н	7440.00	36.35	9.35	45.70	54.00	-8.30	AV	

#### Between 1GHz – 25GHz

Remark:

1.Emission Level = Meter Reading + Factor,

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

Over= Emission Level - Limit

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

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

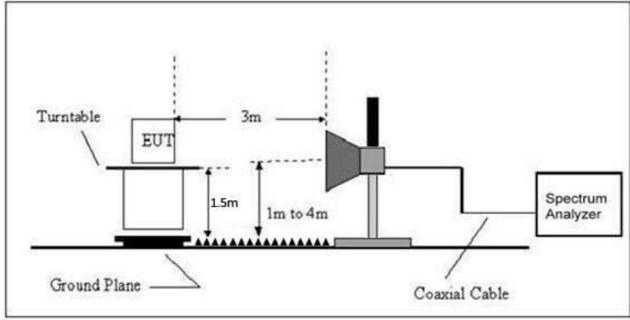
5.All the Modulation are test, the worst mode is GFSK, the data recording in the report.



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

#### 8.1 Block Diagram Of Test Setup

#### Radiated Emission Test-Up Frequency Above 1GHz



#### 8.2 Limit

FCC Part15 C Section 15.209 and 15.205

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

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





#### LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Limit (dBuV/m) (at 3M)		
	PEAK	AVERAGE	
Above 1000	74	54	

Notes:

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

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

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

#### 8.3 Test Procedure

Receiver Parameter	Setting
Attenuation	Auto
Start Frequency	2300MHz
Stop Frequency	2520
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 1/T Hz 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 chamber. 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 Frequency (H/V) (MHz)	Level F	Correct Factor	Measure- ment (dBuV/m)	Limits (dBuV/m)		Result	
	(177)	(11112)	(dBuV/m)	n) (dB)	РК	PK	AV	
			Low	Channel 24	402MHz		l	
	Н	2390.00	53.74	-6.70	47.04	74.00	54.00	PASS
	Н	2400.00	57.75	-6.71	51.04	74.00	54.00	PASS
	V	2390.00	53.24	-6.70	46.54	74.00	54.00	PASS
GFSK	V	2400.00	58.17	-6.71	51.46	74.00	54.00	PASS
GISK			High	Channel 2	480MHz			
	Н	2483.50	56.70	-6.79	49.91	74.00	54.00	PASS
	Н	2500.00	52.74	-6.81	45.93	74.00	54.00	PASS
	V	2483.50	56.55	-6.79	49.76	74.00	54.00	PASS
	V	2500.00	51.56	-6.81	44.75	74.00	54.00	PASS
			Low	Channel 24	402MHz			
	Н	2390.00	54.43	-6.70	47.73	74.00	54.00	PASS
	Н	2400.00	58.10	-6.71	51.39	74.00	54.00	PASS
	V	2390.00	54.14	-6.70	47.44	74.00	54.00	PASS
π/4DQPSK	V	2400.00	57.41	-6.71	50.70	74.00	54.00	PASS
		1	High	Channel 2	480MHz			
	Н	2483.50	56.73	-6.79	49.94	74.00	54.00	PASS
	Н	2500.00	51.78	-6.81	44.97	74.00	54.00	PASS
	V	2483.50	58.52	-6.79	51.73	74.00	54.00	PASS
	V	2500.00	55.38	-6.81	48.57	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 §15.205(c))

#### 9.3 Test Procedure

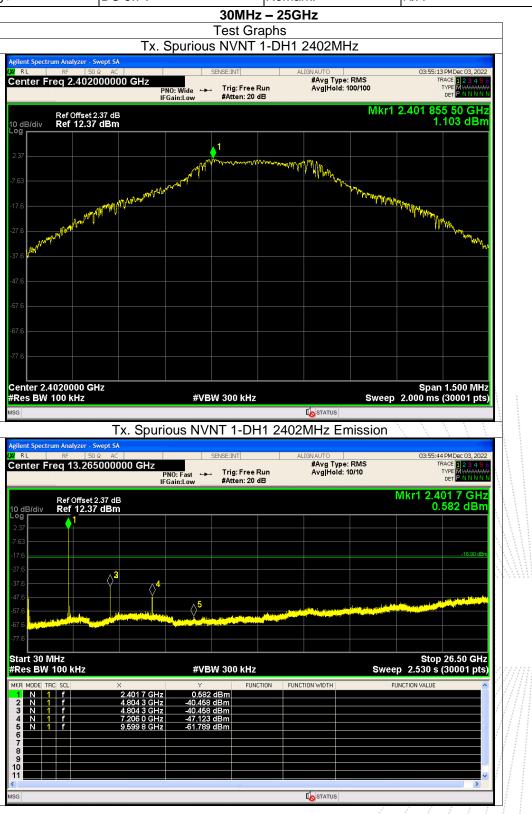
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;

2. Set the spectrum analyzer: Below 1GHz: RBW = 100kHz, VBW = 300kHz, Sweep = auto Detector function = peak, Trace = max hold Above 1GHz: RBW = 100kHz, VBW = 300kHz, Sweep = auto Detector function = peak, Trace = max hold



#### 9.4 Test Result

Temperature :	<b>26</b> ℃	Relative Humidity:	54%
Test Voltage :	DC 3.7V	Remark:	N/A



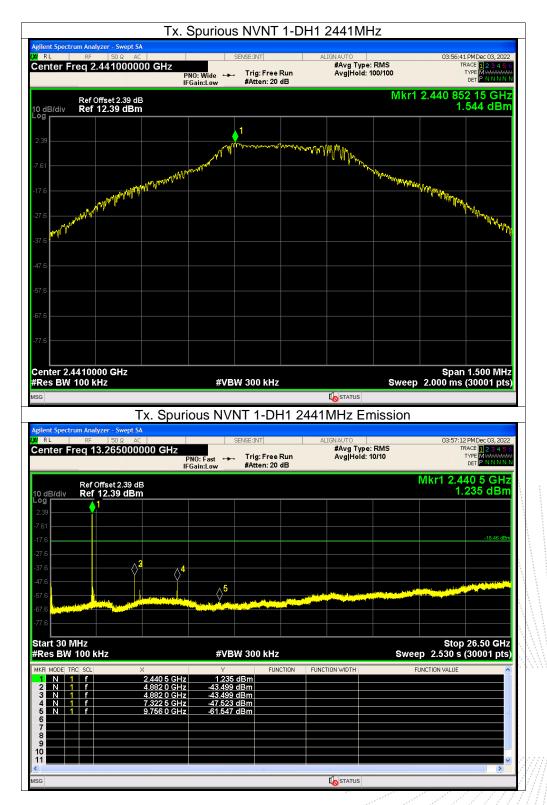
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ilent Spectrum Analy RL RF	zer - Swept SA 50 Ω AC	SENS	E:INT	ALIGNAUTO		03:58:22 PMDec 03, 2022
	402000000 GHz	PNO: Wide +++ 1	rig: Free Run Atten: 20 dB	#Avg Type: Avg Hold: 1	RMS 00/100	TRACE 12345 TYPE MWWWW DET PNNNN
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ilent Spectrum Analy R L RF	zer - Swept SA 50 Ω AC		2-DH1 2	2402MHz Em		03:58:54 PM Dec 03, 2022
ilent Spectrum Analy R L RF	zer - Swept SA   50 Ω AC   1.265000000 GHz	PNO: Fast ++ 1		2402MHz Em	RMS	03:58:54 PMDec 03, 202 TRACE 123:4 5 TYPE MWWW DET PNNNN
ilent Spectrum Analy RL RF enter Freq 13 Ref O	zer - Swept SA 50 Ω AC 5.265000000 GHz ffset 2.37 dB	PNO: Fast +++ 1	E:INT	2402MHz Em	RMS 0/10	TRACE 12345 TYPE MWWWW DET PNNNN
Ilent Spectrum Analy RL RF enter Freq 13 Ref 01 0 dB/div Ref 1 09	zer - Swept SA   50 Ω AC   5.265000000 GHz	PNO: Fast +++ 1	E:INT	2402MHz Em	RMS 0/10	TRACE 12345 TYPE MWWWW DET PNNNN
Ilent Spectrum Analy RL RF enter Freq 13 Ref 0 0 dB/div Ref 1 0 g 137 63	zer - Swept SA 50 Ω AC 5.265000000 GHz ffset 2.37 dB	PNO: Fast +++ 1	E:INT	2402MHz Em	RMS 0/10	IRACE DI 2: 4 5 TYPE MYMMU DET PINNIN Ikr1 2:401 7 GH; -4.835 dBm
Ilent Spectrum Analy RL RF enter Freq 13 Ref 0 0 dB/div Ref 1 0 g 137 63 7 6	zer - Swept SA 50 0 aC 5.265000000 GHz ffset 2.37 dB 12.37 dBm	PNO: Fast +++ 1	E:INT	2402MHz Em	RMS 0/10	IRACE DI 2: 4 5 TYPE MYMMU DET PINNIN Ikr1 2:401 7 GH; -4.835 dBm
ilent Spectrum Analy RL RF enter Freq 13 Ref 0 0 dB/div Ref 1 0 g 37 63 7 6 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 7 7 7 7 7 7 7 7 7 7 7	zer - Swept SA 50 Ω AC 5.265000000 GHz ffset 2.37 dB	PNO: Fast 1 IFGain:Low #	E:INT	2402MHz Em	RMS 0/10	IRACE DI 2: 4 5 TYPE MYMMU DET PINNIN Ikr1 2:401 7 GH; -4.835 dBm
ilent Spectrum Analy RL RF enter Freq 13 Ref 0 0 dB/div Ref 1 0 g 37 63 7 6 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 7 7 7 7 7 7 7 7 7 7 7	zer - Swept SA 50 0 aC 265000000 GHz ffset 2.37 dB 12.37 dBm	PNO: Fast 1 IFGain:Low #	E:INT	2402MHz Em	RMS 0/10	IRACE DI 2: 4 5 TYPE MYMMU DET PINNIN Ikr1 2:401 7 GH; -4.835 dBm
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Ilent Spectrum Analy RL RF enter Freq 13 Ref O D dB/div Ref 1 9 137 137 14 15 15 15 15 15 15 15 15 15 15	zer - Swept SA 50 0 aC 265000000 GHz ffset 2.37 dB 12.37 dBm	PNO: Fast 1 IFGain:Low #	E:INT	2402MHz Em	RMS 0/10	IRACE DI 29 4 5 TYPE MYMMUN DET PINNIN Ikr1 2.4017 GH2 -4.835 dBm -18.85 dBm
Ref Of     Ref Of       0 dB/div     Ref Of       1 dB/div     Ref Of	zer - Swept SA 50 Q AC 265000000 GHz ffset 2.37 dB 2.37 dBm 4 4 4 4 4 4 4 4 4	PNO: Fast 1 IFGain:Low #	EINT Trig: Free Run Atten: 20 dB	2402MHz Em	RMS 0/10 W	Ikr1 2.401 7 GH2 -4.835 dBm -1885 dBm Stop 26.50 GH2 2.530 s (30001 pts
ilent Spectrum Analy RL RF enter Freq 13 Ref 0 0 dB/div Ref 1 0 dB/div Re	zer - Swept SA 50 0 AC 5265000000 GHz ffset 2.37 dB 12.37 dBm 4 4 4 4 4 4 4 4 4 4 4 4 4	PNO: Fast → 1 IFGain:Low → 1 # 5 # VBW 3 # VBW 3 2 - - - - - - - - - - - - -	E:INT rig: Free Run Atten: 20 dB	2402MHz Em	RMS 0/10 W	IRACE DI 29 4 5 TYPE MANAGEMENT DET PININN Ikr1 2.4017 GH2 -4.835 dBm -1865 dB -1865
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RL     RF       RL     RF       enter Freq 13       0 dB/div     Ref 0       0 dB/div     Ref 1       0 dB/div     Ref 0       1 dB/div     Ref 0       1 dB/div     Ref 0       1 dB/div     Ref 0       2 N 1 f     1       3 N 1 f     1       4 N 1 f     1	zer - Swept SA 50 0 AC 5265000000 GHz ffset 2.37 dB 2.37 dBm 4 4 4 4 4 4 4 4 4 4 4 4 4	PNO: Fast → 1 IFGain:Low → 1 #	EIINT Trig: Free Run Atten: 20 dB	2402MHz Em	RMS 0/10 W	Itrace 10:23 4 5 Trace 10:23 4 5 Oper Devices 10:000 
Ilent Spectrum Analy       RL     RF       enter Freq 13       Ref O       0 dB/div     Ref O       0 dB/div     Ref O       1 dB     1       63     1       7.6     1       7.7     1       7.8     1       8     1     1       9     1     1	2er - Swept SA 50 Q AC 265000000 GHz ffset 2.37 dB 2.37 dBm 4 2.37 dBm 4 4 4 4 4 4 4 4 4 4 4 4 4	PNO: Fast → 1 IFGain:Low → 1 #	EIINT Trig: Free Run Atten: 20 dB	2402MHz Em	RMS 0/10 W	03:58:54 PMDec 03, 2022 TRACE 12 3 4 5 TYPE [12 3 4 5 TYPE [21 7 GH2 -4.835 dBm -18.85 dBm -18.8

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	5000000 GHz	PNO: Fast 🛶 Tri	g: Free Run	#Avg Type: Avg Hold: 1		TRACE 1 2 3 4 5 TYPE MWWWW
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Ref Offset dB/div Ref 12.39	5000000 GHz 2.39 dB	PNO: Fast 🛶 Tri		#Avg Type:	0/10	TRACE 12345 TYPE MWWWW DET PNNNN
Ref Offset dB/div Ref 12.39	5000000 GHz 2.39 dB	PNO: Fast 🛶 Tri		#Avg Type:	0/10	TRACE 12345 TYPE MWWWW DET PNNNN
Ref Offset dB/div Ref 12.39	5000000 GHz 2.39 dB	PNO: Fast 🛶 Tri		#Avg Type:	0/10	r1 2.440 5 GH: 1.555 dBn
Ref Offset	5000000 GHz 2.39 dB	PNO: Fast 🛶 Tri		#Avg Type:	0/10	TRACE 12345 TYPE MWWWW DET PNNNN
Ref Offset	5000000 GHz 2.39 dB 9 dBm	PNO: Fast →→ Tri IFGain:Low #At		#Avg Type:	0/10	r1 2.440 5 GH: 1.555 dBn
Ref Offset dB/div Ref 12.39	5000000 GHz 2.39 dB	PNO: Fast → Tri IFGain:Low #At		#Avg Type:	0/10	r1 2.440 5 GH: 1.555 dBr
Ref Offset dB/div Ref 12.34 0 0 0 0 0 0 0 0 0 0 0 0 0	5000000 GHz 2.39 dB 9 dBm	PNO: Fast →→ Tri IFGain:Low #At		#Avg Type:	0/10	r1 2.440 5 GH: 1.555 dBn
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Ref Offset dB/div Ref 12.3: 1 1 1 1 1 1 1 1 1 1 1 1 1	5000000 GHz 2.39 dB 9 dBm	PNO: Fast $\rightarrow$ Tri IFGain:Low #At	Renering methods	#Avg Type:		TRACE II 2 3 4 5 Type M WWWW Det P N NNN 1.555 dBn 
Ref Offset Ref Offset Ref 12.34 Ref 13.34 Ref 13.34	5000000 GHz 2.39 dB 9 dBm 0 dBm	PNO: Fast I Tri IFGain:Low #At	tten: 20 dB	#Avg Type:	o/10 Mk	TRACE 12 3 4 5 Type M WWWW Det P N NNN 1.555 dBn 
Ref Offset dB/div Ref 12.34	5000000 GHz 2.39 dB 9 dBm 0 dBm	PNO: Fast $\rightarrow$ Tri #At FGain:Low #At	tten: 20 dB	#Avg Type: Avg Hold: 1	o/10 Mk	rtace 12 3 4 5 Type Mymouth r1 2.440 5 GH2 1.555 dBm -1870 @ -1870 @ Stop 26.50 GH2 2.530 s (30001 pts
Ref Offset dB/div Ref 12.34	5000000 GHz 2.39 dB 9 dBm 2.440 5 GHz 4.882 0 GHz	PNO: Fast $\rightarrow$ Tri #At FGain:Low #At	tten: 20 dB	#Avg Type: Avg Hold: 1	o/10 Mk	rtace II 2 3 4 5 The Manager Manager int 2.440 5 GH: 1.555 dBn -1870 @ -1870 @ Stop 26.50 GH: 2.530 s (30001 pts
Ref Offset       dB/div     Ref 12.34       9     1       100     1       100     1       100     1       100     1       100     1       100     1       100     1       100     1       100     1       100     1       100     1       100     1       100     1       100     1       100     1	5000000 GHz	PN0: Fast - Tri IFGain:Low #A	tten: 20 dB	#Avg Type: Avg Hold: 1	o/10 Mk	rtace II 2 3 4 5 The Manager Manager int 2.440 5 GH: 1.555 dBn -1870 @ -1870 @ Stop 26.50 GH: 2.530 s (30001 pts
Ref Offset B/div Ref 13.263 B/div Ref 12.34 1 1 1 1 1 1 1 1 1 1 1 1 1	5000000 GHz 2.39 dB 9 dBm 2.440 5 GHz 4.882 0 GHz	PNO: Fast $\rightarrow$ Tri #At Sain:Low #At Sain:Low	tten: 20 dB	#Avg Type: Avg Hold: 1	o/10 Mk	rtace II 2 3 4 5 The Manager Manager int 2.440 5 GH: 1.555 dBn -1870 @ -1870 @ Stop 26.50 GH: 2.530 s (30001 pts
Ref Offset       dB/div     Ref 0ffset       dB/div     Ref 12.34       33     1       34     1       35     1       36     1       37     1       38     1       39     1       39     1       30     1       31     1       36     1       36     1       36     1       37     1       38     1       38     1       38     1	5000000 GHz 2.39 dB 9 dBm 2.440 5 GHz 4.882 0 GHz	PNO: Fast $\rightarrow$ Tri #At Sain:Low #At Sain:Low	tten: 20 dB	#Avg Type: Avg Hold: 1	o/10 Mk	rtace II 2 3 4 5 The Manager Manager int 2.440 5 GH: 1.555 dBn -1870 @ -1870 @ Stop 26.50 GH: 2.530 s (30001 pts
Nter Freq 13.263       B/div     Ref Offset       B/div     Ref 12.31       Image: State of the stat	5000000 GHz 2.39 dB 9 dBm 2.440 5 GHz 4.882 0 GHz	PNO: Fast $\rightarrow$ Tri #At Sain:Low #At Sain:Low	tten: 20 dB	#Avg Type: Avg Hold: 1	o/10 Mk	rtace 12 3 4 5 Tree 12 3 4 5 Per P NNNN r1 2.440 5 GH: 1.555 dBn 



RL RF 50 Ω enter Freq 2.48000	F		SE:INT Trig: Free Run #Atten: 20 dB	ALIGNAUTO #Avg Typ Avg Hold	e: RMS : 100/100	03:53:26 PM Dec 03, 20 TRACE 1 2 3 4 TYPE MWWW DET P N N N
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G ilent Spectrum Analyzer - Sw RL RF 50 Ω	AC 00000 GHz	ious NVN <sup>-</sup>			mission e: RMS	2.000 ms (30001 pt
G Ilent Spectrum Analyzer - Sw RL RF 50 Ω enter Freq 13.265(	ept SA AC       D000000 GHz II	ious NVN	T 2-DH1 2	2480MHz E Alignauto #Avg Typ	mission e: RMS : 10/10	2.000 ms (30001 pt 03:53:57 PMDec 03, 20 TRACE 12 23 4 TVP 12 34 VPF 14 VPF 14
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G RL RF 50 Ω enter Freq 13.2650 Ref Offset 2. 0 dB/div Ref 12.44	ept SA AC 0000000 GHz 11 44 dB		T 2-DH1 2 ISE:INT Trig: Free Run	2480MHz E Alignauto #Avg Typ	mission e: RMS : 10/10	2.000 ms (30001 pt 03:53:57 PMDec 03,20 TRACE 12 23 4 TYPE MMAN 0ET P NNN Mkr1 2.480 2 GH
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G Ilent Spectrum Analyzer _ Sw RL RF 50 % enter Freq 13.2650 C C C C C C C C C C C C C	ept SA AC D000000 GHz 44 dB dBm	ious NVN	T 2-DH1 2	2480MHz E	e: RMS 10/10	2.000 ms (30001 pt 03:53:57 PMDec 03, 20 TRACE 12 34 TYPE 12 34 TY
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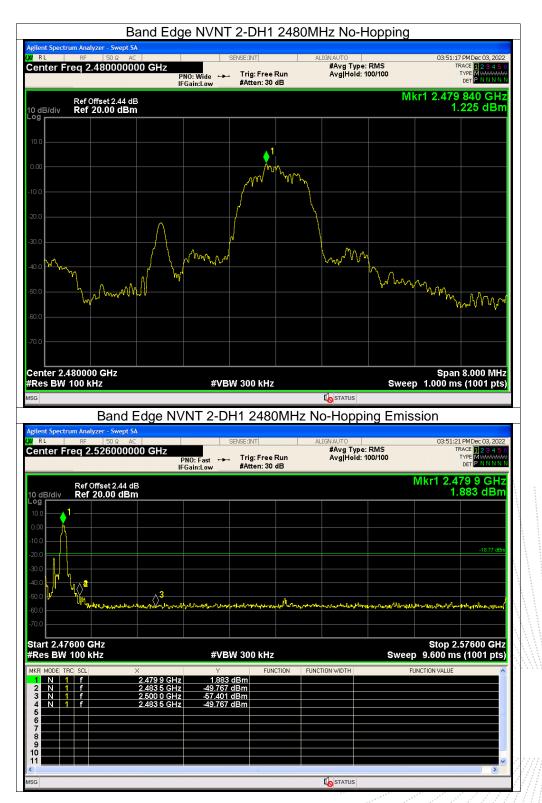












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### 10. 20 dB Bandwidth

#### 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 20 dB relative to the maximum level measured in the fundamental emission.

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## 10.4 Test Result

Temperature :	<b>26</b> °C		Relative Humidit	ty :	54%
Test Voltage :	DC 3.7	V	Remark:		N/A
Modulation		Test Cha	innel		Bandwidth(MHz)
GFSK		Low			0.869
GFSK		Middl	e		0.876
GFSK		High	1		0.866
π/4DQPSK		Low			1.285
π/4DQPSK		Middl	e		1.282
π/4DQPSK		High			1.238





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#### 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 = 2MHz. VBW = 6MHz. Sweep = auto; Detector Function = Peak.
- 3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

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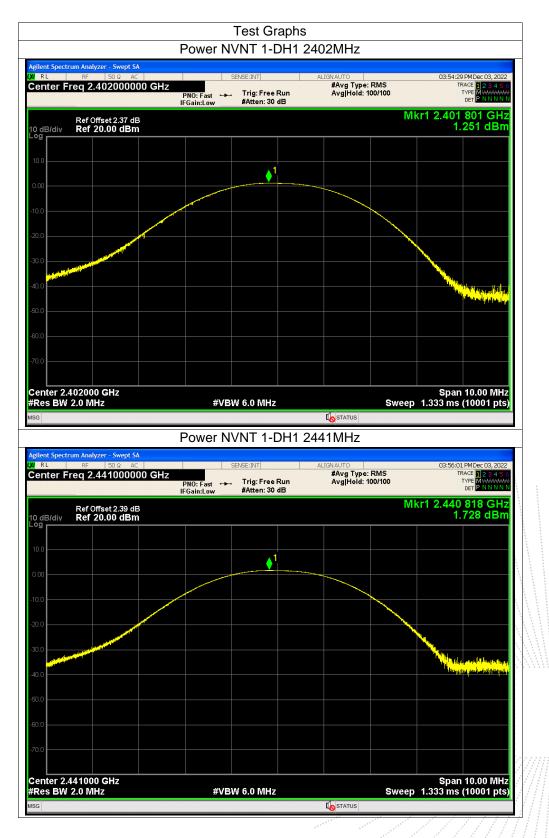
## 11.4 Test Result

Temperature :	<b>26</b> ℃	Relative Humidity :	54%
Test Voltage :	DC 3.7V	Remark:	N/A
Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	1.25	21
GFSK	Middle	1.73	21
GFSK	High	2.24	21
π/4DQPSK	Low	1.9	21
π/4DQPSK	Middle	2.3	21
π/4DQPSK	High	2.82	21

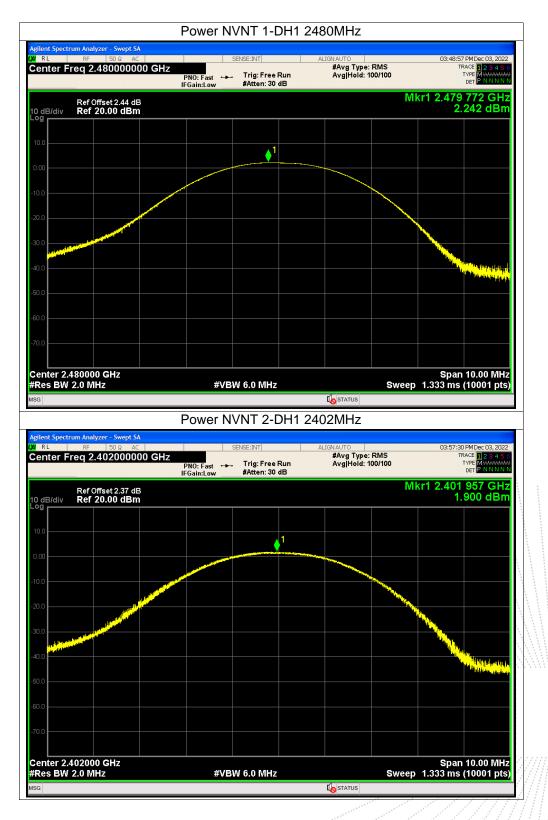
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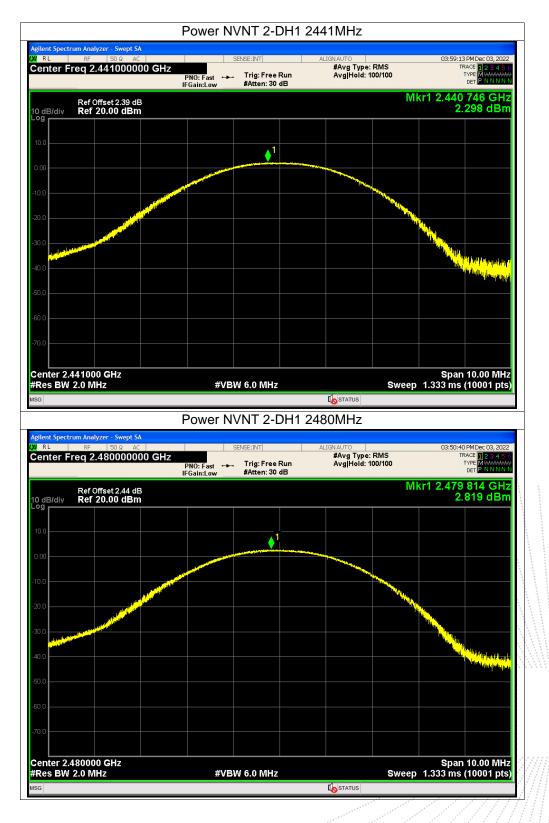






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### 12. Hopping Channel Separation

#### 12.1 Block Diagram Of Test Setup



#### 12.2 Limit

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

#### 12.3 Test Procedure

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

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

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

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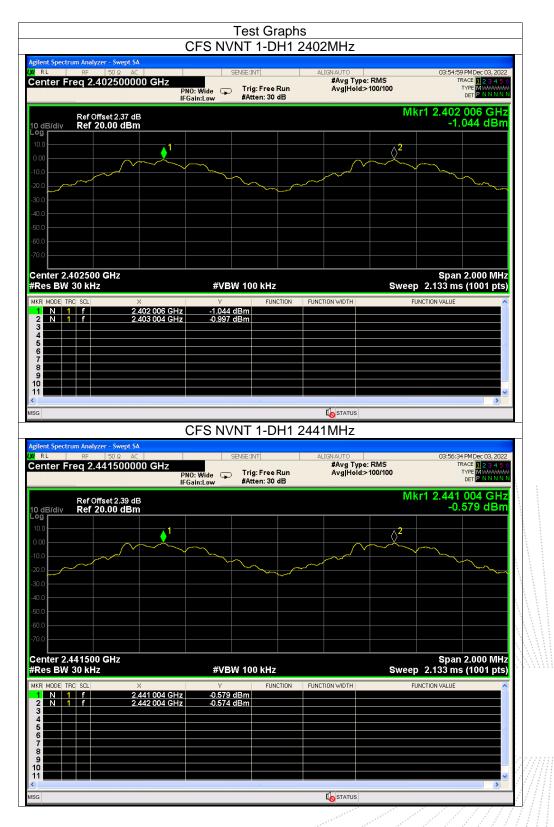
## 12.4 Test Result

Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	0.998	0.869	PASS
GFSK	Middle	1	0.876	PASS
GFSK	High	1	0.866	PASS
π/4DQPSK	Low	1	0.857	PASS
π/4DQPSK	Middle	1.002	0.855	PASS
π/4DQPSK	High	0.998	0.825	PASS

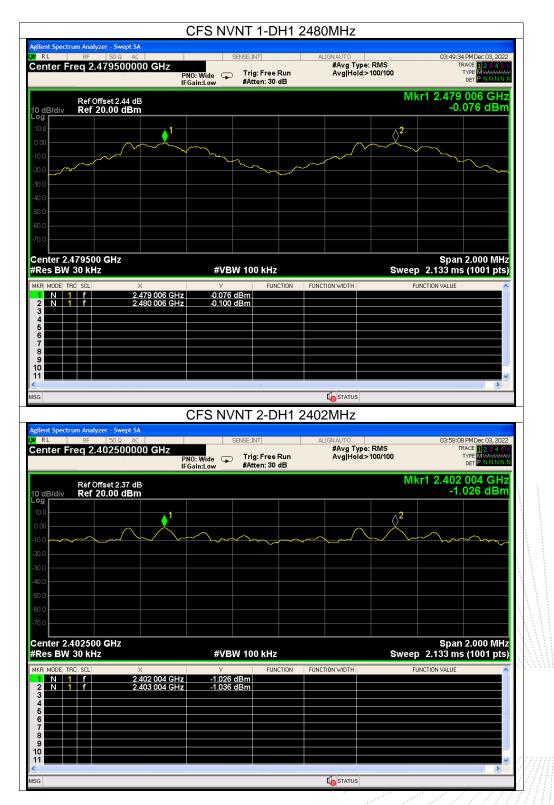
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No.: BCTC/RF-EMC-005

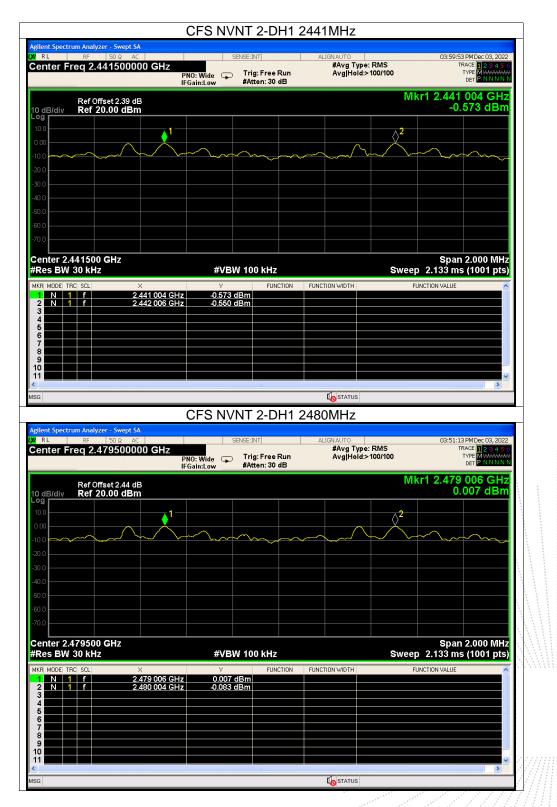














#### **13. Number Of Hopping Frequency**

#### 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.

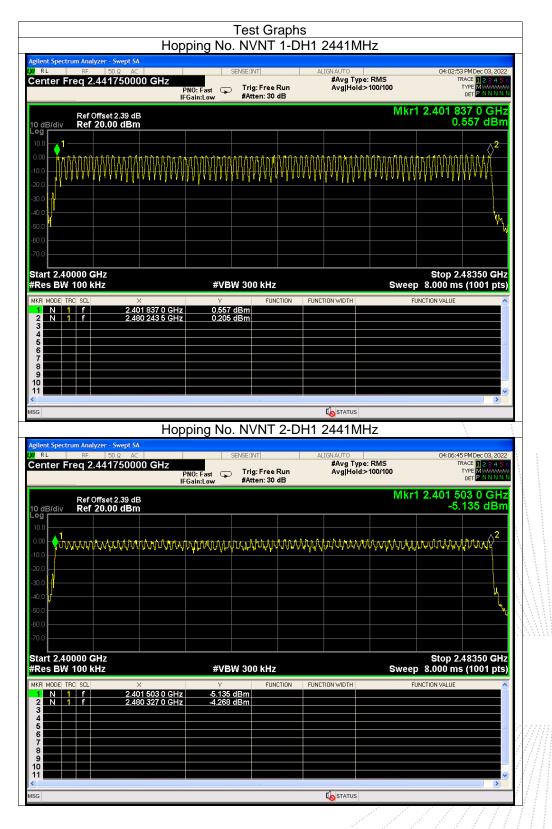
Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;

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### 13.4 Test Result







### 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).

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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	0.376	0.120	0.4
GFSK	Middle	DH3	1.632	0.261	0.4
		DH5	2.881	0.307	0.4
		2DH1	0.381	0.122	0.4
π/4DQPSK	Middle	2DH3	1.638	0.262	0.4
		2DH5	2.886	0.308	0.4



ent Spectrum Analyzer - Swe	ept SA	VNT 1-DH1 2					
RL RF 50Ω nter Freg 2.44100	AC		ay-500.0 μs	IGNAUTO #Avg Type:	RMS	04:02:5 T	9 PMDec 03, 2022 RACE 123456
	PNO	:Fast ↔ Trig:Vide n:Low #Atten:3					DET P N N N N
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F 1 t	498.0 µs	-3.25 dBm					
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RL RF 50 Ω nter Freq 2.44100 	ept SA AC DOOOO GHz PNO IFGai 39 dB	SENSE:INT Trig Dela Fast Trig: Vide	ау-500.0 µs eo	IGNAUTO		Т	RACE 123456 TYPE WWWWWWW DET PNNNNN 1.632 ms
RL RF 50 Ω nter Freq 2.44100 Ref Offset 2.3 dB/div Ref 20.00 c	ept SA AC DOOOO GHz PNO IFGai 39 dB	SENSE:INT Trig Dela Fast Trig: Vide	ау-500.0 µs eo	IGNAUTO		Т	RACE 123456 TYPE WAAAAAA DET PNNNNN
RL RF 150 Ω nter Freq 2.44100 Ref Offset 2.3 dB/div Ref 20.00 c	ept SA AC DOOOO GHz PNO IFGai 39 dB	SENSE:INT Trig Dela Fast Trig: Vide	ау-500.0 µs eo	IGNAUTO		Т	RACE 123456 TYPE WWWWWWW DET PNNNNN 1.632 ms
RL RF 150 Ω nter Freq 2.44100 Ref Offset 2.3 dB/div Ref 20.00 c	AC   AC   PNO IFGai 39 dB IBm	SENSE:INT Trig Dela Fast Trig: Vide	ау-500.0 µs eo	IGNAUTO		Т	RACE 123456 TYPE WWWWWWW DET PNNNNN 1.632 ms
Ref Offset 2.3 B/div Ref 20.00 c	AC   AC   PNO IFGai 39 dB IBm	SENSE:INT Trig Dela Fast Trig: Vide	ау-500.0 µs eo	IGNAUTO		Т	RACE 123456 TYPE WWWWWWW DET PNNNNN 1.632 ms 0.47 dB
RL   RF   50 Ω nter Freq 2.44100 Ref Offset2.3 dB/div Ref 20.00 c	AC   AC   PNO IFGai 39 dB IBm	SENSE:INT Trig Dela Fast Trig: Vide	ау-500.0 µs eo	IGNAUTO		Т	RACE 123456 TYPE WWWWWWW DET PNNNNN 1.632 ms 0.47 dB
RL   RF   50 Ω nter Freq 2.44100 Ref Offset2.3 dB/div Ref 20.00 c	2pt 5A AC AC PRO PRO IFGat 39 dB 1Bm 1Δ2	SENSE:INT Trig Dela Fast Trig: Vid #Atten: 30 #Atten: 30 *Atten: 40 *Atten: 40	Δ4 23/500.0 μs eo 0 dB	IGNAUTO   #Avg Type	RMS	ΔMkr1	RACE 123456 TYPE WWWWWWW DET PNNNNN 1.632 ms 0.47 dB
RL RF Freq 2.44100 Ref Offset 2.3 Ref Offset 2.3 Ref 20.00 c 2 2 2 2 2 2 2 2 2 2 2 2 2	2pt 5A ΔC 100000 GHz PRO IFGat 39 dB dBm 1Δ2 1Δ2 441 mathematics table	SENSE:INT Trig Dela Fast Trig: Vid #Atten: 30 #Atten: 30 ************************************	AL 247-500.0 µs eo 0 dB	IGNAUTO   #Avg Type			RACE 112 3 4 5 6 THE WINNINN NO THE PINNINN NO THE
RL RF 150 2 nter Freq 2.44100 Ref Offset2.3 dB/div Ref 20.00 c 2 2 2 2 2 2 2 2 2 2 2 2 2	2pt 5A AC AC PRO PRO IFGat 39 dB 1Bm 1Δ2	SENSE:INT Trig Dela Fast Trig: Vid #Atten: 30 #Atten: 30 ************************************	Δ4 23/500.0 μs eo 0 dB	IGNAUTO   #Avg Type			RACE 112 3 4 5 6 THE WINNINN NO THE PINNINN NO THE
RL RF 1502 nter Freq 2.44100 Ref Offset2.3 B/div Ref 20.00 d 2 2 2 2 4 4 4 4 4 4 4 4 4 4 4 4 4	ept 5A AC 00000 GHz PRO IBm 1Δ2	SENSE:INT Trig Dela Fast Trig: Vid #Atten: 30 #Atten: 30 ************************************	AL 247-500.0 µs eo 0 dB	IGNAUTO   #Avg Type	RMS	T AMkr1	RACE 012 3 4 5 G TYPE WITH MANNIN DET P NN NN N 1.632 ms 0.47 dB
RL RF 7502 nter Freq 2.44100 Ref Offset2.3 B/div Ref 20.00 d 2 2 2 2 4 4 4 4 4 4 4 4 4 4 4 4 4	ept 5A AC 00000 GHz PRO IBm 1Δ2	SENSE:INT Trig Dela Fast Fast #Atten: 3 #Atten: 4 #Atten: 4	AL 29-500.0 µs eo 0 dB	IGN AUTO	RMS	AMkr1	RACE 112 3 4 5 6 THE WINNINN NO THE PINNINN NO THE
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Ref Offset 2.3 Ref Offset 2.3	ept 5A AC AC PRO PRO PRO PRO PRO PRO PRO PRO	SENSE:INT Trig Dela rast → Trig: Yid #Atten: 30 #Atten: 40 #Atten: 40 #	AL 29-500.0 µs eo 0 dB	IGN AUTO	RMS	AMkr1	RACE 012 3 4 5 G TYPE WITH MANNIN DET P NN NN N 1.632 ms 0.47 dB
RL     RF       50 Ω       nter Freq 2.44100     Ref Offset2.3       dB/div     Ref 20.00 d       V     Ref 20.00 d       Ref 20.00 d     Ref 20.00 d       Ref 20.00 d <td>2pt 5A AC 300000 GHz PRO IFGat 39 dB 1Bm 1Δ2 4 (γ, η, η,</td> <td>SENSE:INT Trig Dela rast → Trig: Yid #Atten: 30 #Atten: 40 #Atten: 40 #</td> <td>AL 29-500.0 µs eo 0 dB</td> <td>IGN AUTO</td> <td>RMS</td> <td>AMkr1</td> <td>RACE 012 3 4 5 G TYPE WITH MANNIN DET P NN NN N 1.632 ms 0.47 dB</td>	2pt 5A AC 300000 GHz PRO IFGat 39 dB 1Bm 1Δ2 4 (γ, η,	SENSE:INT Trig Dela rast → Trig: Yid #Atten: 30 #Atten: 40 #Atten: 40 #	AL 29-500.0 µs eo 0 dB	IGN AUTO	RMS	AMkr1	RACE 012 3 4 5 G TYPE WITH MANNIN DET P NN NN N 1.632 ms 0.47 dB
RL     RF       50 Ω       nter Freq 2.44100     Ref Offset2.3       dB/div     Ref 20.00 d       V     Ref 20.00 d       Ref 20.00 d     Ref 20.00 d       Ref 20.00 d <td>2pt 5A AC 300000 GHz PRO IFGat 39 dB 1Bm 1Δ2 4 (γ, η, η,</td> <td>SENSE:INT Trig Dela rast → Trig: Yid #Atten: 30 #Atten: 40 #Atten: 40 #</td> <td>AL 29-500.0 µs eo 0 dB</td> <td>IGN AUTO</td> <td>RMS</td> <td>AMkr1</td> <td>RACE 012 3 4 5 G TYPE WITH MANNIN DET P NN NN N 1.632 ms 0.47 dB</td>	2pt 5A AC 300000 GHz PRO IFGat 39 dB 1Bm 1Δ2 4 (γ, η,	SENSE:INT Trig Dela rast → Trig: Yid #Atten: 30 #Atten: 40 #Atten: 40 #	AL 29-500.0 µs eo 0 dB	IGN AUTO	RMS	AMkr1	RACE 012 3 4 5 G TYPE WITH MANNIN DET P NN NN N 1.632 ms 0.47 dB
RL RF 1502 nter Freq 2.44100 Ref Offset2.3 B/div Ref 20.00 d 2 2 2 4 4 4 4 4 4 4 4 4 4 4 4 4	2pt 5A AC 300000 GHz PRO IFGat 39 dB 1Bm 1Δ2 4 (γ, η,	SENSE:INT Trig Dela rast → Trig: Yid #Atten: 30 #Atten: 40 #Atten: 40 #	AL 29-500.0 µs eo 0 dB	IGN AUTO	RMS	AMkr1	RACE 012 3 4 5 G TYPE WITH MANNIN DET P NN NN N 1.632 ms 0.47 dB



nt Spectrum Analyzer - Swept SA L RF 50 Ω AC Inter Freq 2.441000000	GHZ Trig Delay-5 PNO: Fast → Trig: Video IFGain:Low #Atten: 30 dl			C 03, 2022 2 3 4 5 6 MMMMM N N N N N
Ref Offset 2.39 dB B/div Ref 20.00 dBm			ΔMkr1 2.88 2.5	31 ms 34 dB
	102			
-X <sub>2</sub>				TRIG LVL
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ter 2.441000000 GHz BW 1.0 MHz	#VBW 3.0 MHz		Spa Sweep 10.00 ms (100	n 0 Hz 01 pts)
MODE TRC SCL X	Υ FUNCT 2.881 ms (Δ) 2.84 dB 497.0 μs -8.11 dBm	TION FUNCTION WIDTH	FUNCTION VALUE	~
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t Spectrum Analyzer - Swept SA	Dwell NVNT 2-DH1 24	141MHZ One Burs	st	
er Freq 2.441000000	GHZ PN0: Fast →→ Trig Delay-5 PN0: Fast →→ Trig: Video IFGain:Low #Atten: 30 dl		04:06:50 PMDe TRACE TYPE V DET	23456
Ref Offset 2.39 dB	IFGain:Low whitein so u		ΔMkr1 38 <sup>°</sup>	
B/div Ref 20.00 dBm			0.;	93 dB
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ter 2.441000000 GHz			Spa	n 0 Hz
ter 2.441000000 GHz BW 1.0 MHz	հետարիս իսկային էլ էր գրություններ Ալիս աներին ուսերին էր էր երկային վերինում #VBW 3.0 MHz			n 0 Hz
ter 2.441000000 GHz BW 1.0 MHz	#VBW 3.0 MHz		Spa Sweep 10.00 ms (100	n 0 Hz
Δ     1	#VBW 3.0 MHz 381 0 µs (A) 0.93 dB		Spa Sweep 10.00 ms (100	n 0 Hz
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THENTHE



RL RF 50Ω A nter Freq 2.4410000		ast 🔸	ISE:INT Trig Delay-500.0 Trig: Video #Atten: 30 dB	ALIGNAUTO Dµs #Avg1	ype: RMS		4 PMDec 03, 2022 RACE 123456 TYPE WWWWWW DET PNNNNN
Ref Offset 2.39 d dB/div Ref 20.00 dBr	В					ΔMkr1	1.638 ms 2.02 dB
	142						TRIG LVL
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0 <mark>111 12</mark>	<mark>delphysichter besterette</mark> te	la halistata kilitataa Aana kata kata kata	had the dealership	and the second second	ut la classicatori da considera di Manda francisca di constante di constante di	and the second s	n hat wat night da
0 <mark>4/164<sup>11</sup></mark>	a in provide the second se		, <sup>4</sup> 141, <sup>66</sup> 1, <sup>4</sup> 144, 1, 414, 1, 414, 1	a la fata da angeli da na			and the part of th
nter 2.441000000 GHz s BW 1.0 MHz		#VBW	3.0 MHz		Sween	10.00 ms	Span 0 Hz (10001 pts)
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	Dweil INV	IN I Z-I	DH5 244	1MHz One	Burst		
RL RF 50Ω A			ISE:INT	ALIGNAUTO		04:11:3	5 PMDec 03, 2022
<b>RL</b> RF 50Ω A	A OO GHz PNO: F	SEN ast ↔	/SE:INT Trig Delay-500.0 Trig: Video	ALIGNAUTO	Burst	04:11:3	5 PMDec 03, 2022 RACE 1 2 3 4 5 6 TYPE WMMMMW DET P N N N N N
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nter Freq 2.4410000 Ref Offset 2.39 d Ref 20.00 dBr	A 00 GHz PNO: F IFGain:I B	ast ++-	/SE:INT Trig Delay-500.0 Trig: Video	ALIGNAUTO		1	RACE 123456 TYPE WWWWWW DET P NNNNN 2.886 ms
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RL RF 50 2 Ad nter Freq 2.4410000 Ref Offset2.39 d dB/div Ref 20.00 dBr V2	A 00 GHz PNO: F IFGain:I B	set ast ow 1Δ2	ISEINT  Trig Delay-500.7 Trig: Video #Atten: 30 dB	LIGNAUTO 0 μs #Avg T	ype: RMS	1	RACE 1 2 3 4 5 6 TYPE WWWWWWW DET PINNNIN 2.886 ms -6.29 dB
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RL 1000 RF 50 Q Ad nter Freq 2.4410000 dB/div Ref 20.00 dBr 2 2 4 4 4 4 4 4 4 4 4 4 4 4 4	A OO GHz PRO: F IFGain:1 B m 	set ast ow 1Δ2	ISEIINT  Trig Delay-500.0 #Atten: 30 dB	ALIGNAUTO 0 μs #Avg T	ype: RMS	ΔMkr1	RACE    2 3 4 5 6 Det    2 3
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RL     RF     S0 Ω     Al       nter Freq 2.4410000     Ref Offset 2.39 d     d       dB/div     Ref 20.00 dBr     d       0     X2     d     d       0     X3     d     d       0     X410000000     GHz     d       0     X410     d     d       0     X410     d     d       0     X410     d     d <	A OO GH2 PRO: F IFGain:1	ast ow 1Δ2 	ISEINT Trig Delay-500. Trig: Video #Atten: 30 dB Atten: 40 dB Atten		ype: RMS	ΔMkr1	RACE III 2 3 4 5 6 Det P. N.N.N.N. 2.886 ms -6.29 dB 1000 LVL 1000 LVL
RL     RF     S0 Ω     Al       nter Freq 2.4410000     Ref Offset 2.39 d     d       dB/div     Ref 20.00 dBr     d     d       V     Z     d     d     d       V     Z     d     d     d     d       V     Z     d     d     d     d     d       V     Z     d	A PRO: F IFGain: B m I I I I I I I I I I I I I I I I I I	set ow 1∆2 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	ISEINT Trig Delay-500. Trig: Video #Atten: 30 dB Atten: 40 dB Atten		ype: RMS	ΔMkr1	RACE III 2 3 4 5 6 Det P. N.N.N.N. 2.886 ms -6.29 dB 1000 LVL 1000 LVL
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Normalia



### 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

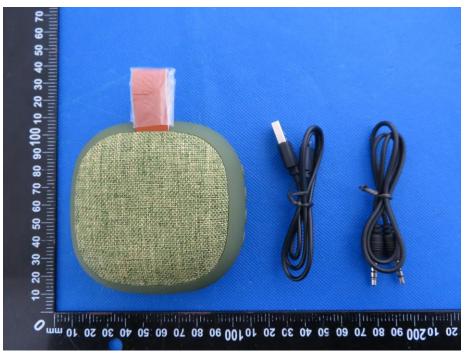
The EUT antenna is PCB antenna, fulfill the requirement of this section.

٩PF Edition: A 5



## 16. EUT Photographs

## EUT Photo

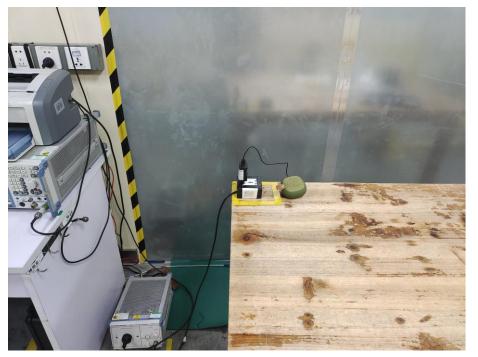


NOTE: Appendix-Photographs Of EUT Constructional Details

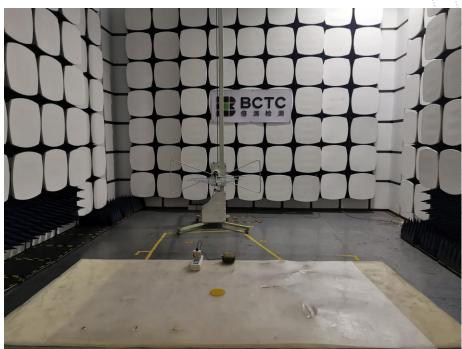


## 17. EUT Test Setup Photographs

## **Conducted Emissions Photo**



Radiated Measurement Photos



ES FC

A W







# **STATEMENT**

1. The equipment lists are traceable to the national reference standards.

2. The test report can not be partially copied unless prior written approval is issued from our lab.

3. The test report is invalid without the "special seal for inspection and testing".

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

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

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

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

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

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

Address:

1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Zhancheng, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China

TEL: 400-788-9558

P.C.: 518103

FAX: 0755-33229357

Website: http://www.chnbctc.com

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

#### **\*\*\*\*\*\* END \*\*\*\*\***

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