

TEST REPORT

Report No.:	BCTC2409018935-1E					
Applicant:	Radxa Computer (Shenzhen) Co.,Ltd.					
Product Name:	Radxa ROCK 5B+					
Test Model:	Radxa ROCK 5B+ D16E0					
Tested Date:	2024-09-20 to 2024-10-10					
Issued Date:	2024-10-10					
She	nzhen BCTC Testing Co., Ltd.					
No.: BCTC/RF-EMC-005	Page: 1 of 86					



FCC ID: 2BC6T-ROCK5B

Product Name:	Radxa ROCK 5B+
Product Name.	Rauxa ROCK 3D+
Trademark:	radxa®
	Radxa ROCK 5B+ D16E0
Model/Type Reference:	Radxa ROCK 5B+ D4E0, Radxa ROCK 5B+ D8E0, Radxa ROCK 5B+ D24E0, Radxa ROCK 5B+ D32E0, Radxa ROCK 5B+ D4E16, Radxa ROCK 5B+ D8E32,
Model/Type Reference.	Radxa ROCK 5B+ D16E64, Radxa ROCK 5B+ D24E128,
	Radxa ROCK 5B+ D32E256
Prepared For:	Radxa Computer (Shenzhen) Co.,Ltd.
Address:	1602, Smart Valley, tiezai Road, Gongle community, Xixiang, Baoan, Shenzhen
Manufacturer:	Radxa Computer (Shenzhen) Co.,Ltd.
Address:	1602, Smart Valley, tiezai Road, Gongle community, Xixiang, Baoan, Shenzhen
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:	2024-09-20
Sample tested Date:	2024-09-20 to 2024-10-10
Issue Date:	2024-10-10
Report No.:	BCTC2409018935-1E
Test Standards	FCC Part15.247 ANSI C63.10-2013
Test Results	PASS
Remark:	This is Bluetooth Classic radio test report.
	\sim

Tested by:

Brave Zeng/ Project Handler

Approved by:

Zero Zhou/Reviewer

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

Page: 2 of 86



Table Of Content

Test	Report Declaration F	'age
1.	Version	5
2.	Test Summary	6
3.	Measurement Uncertainty	7
4.	Product Information And Test Setup	
4.1	Product Information	
4.2	Test Setup Configuration	
4.3	Support Equipment	
4.4	Channel List	-
4.5	Test Mode	
4.6	Table Of Parameters Of Text Software Setting	
5.	Test Facility And Test Instrument Used	
5.1	Test Facility	
5.2	Test Instrument Used	
6.	Conducted Emissions.	
6.1 6.2	Block Diagram Of Test Setup	
0.2 6.3	Test procedure	
6.4	EUT operating Conditions	
6.5	Test Result	
7.	Radiated emissions	
7.1	Block Diagram Of Test Setup	
7.2	Limit	
7.3	Test procedure	
7.4	EUT operating Conditions	
7.5	Test Result	
8.	Radiated Band Emission Measurement And Restricted Bands Of Operation	on26
8.1	Block Diagram Of Test Setup	
8.2	Limit	
8.3	Test procedure	
8.4	EUT operating Conditions	27
8.5	Test Result	
9.	Spurious RF Conducted Emissions	
9.1	Block Diagram Of Test Setup	29
9.2	Limit Test procedure Test Result	
9.3	Test procedure	29
9.4		
10.	20 dB Bandwidth	
10.1	Block Diagram Of Test Setup	
10.2	LIIIII	
10.3		51 E4
10.4 11.	Maximum Peak Output Power	
11.1		
11.2		
11.2	Limit	



11.3 Test procedure	57
11.4 Test Result	57
12. Hopping Channel Separation	63
12.1 Block Diagram Of Test Setup	63
12.2 Limit	63
12.3 Test procedure	63
12.4 Test Result	63
13. Number Of Hopping Frequency	69
13.1 Block Diagram Of Test Setup	69
13.2 Limit	69
13.3 Test procedure	69
13.4 Test Result	69
14. Dwell Time	72
14.1 Block Diagram Of Test Setup	72
14.2 Limit	
14.3 Test procedure	72
14.4 Test Result	72
15. Antenna Requirement	82
15.1 Limit	82
15.2 Test Result	82
16. EUT Photographs	83
17. EUT Test Setup Photographs	84

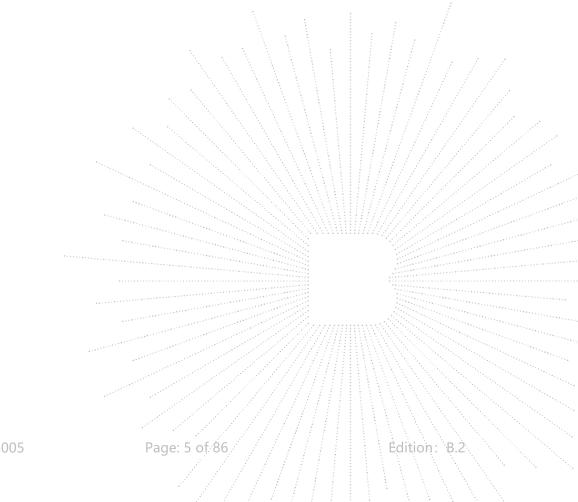
(Note: N/A Means Not Applicable)

Page: 4 of 86



1. Version

Report No.	Issue Date	Description	Approved
BCTC2409018935-1E	2024-10-10	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

No.: BCTC/RF-EMC-005

Page: 6 of 86



3. Measurement Uncertainty

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

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



4. Product Information And Test Setup

4.1 Product Information

Model/Type reference:	Radxa ROCK 5B+ D16E0 Radxa ROCK 5B+ D4E0, Radxa ROCK 5B+ D8E0, Radxa ROCK 5B+ D24E0, Radxa ROCK 5B+ D32E0, Radxa ROCK 5B+ D4E16, Radxa ROCK 5B+ D8E32, Radxa ROCK 5B+ D16E64, Radxa ROCK 5B+ D24E128, Radxa ROCK 5B+ D32E256
Model differences:	All models are the same circuit and RF module, only the model name and memory size are different.
Bluetooth Version:	5.2
Hardware Version:	N/A
Software Version:	N/A
Operation Frequency:	2402-2480MHz
Type of Modulation:	GFSK, π/ 4 DQPSK, 8DPSK
Number Of Channel	79CH
Antenna installation:	FPC antenna
	2.1 dBi
Antenna Gain:	Remark: The antenna gain of the product comes from the antenna report provided by the customer, and the test data is affected by the customer information. The antenna gain of the product is provided by the customer, and the test data is affected by the customer information.
Ratings:	DC 12V 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.



4.3 Support Equipment

No.	Device Type	Brand	Model	Series No.	Note
1.	Adapter	HP	TPN-LA22		
2.	keyboard	Logitech	1641MG01DLZ8		
3.	Mouse	Logitech	M-U0026		
4.	Earphone	IHIP	SBGE1		
5.	U disk	SanDisk	32G		
6.	Router	HUAWEI	WS318		
7.	HDMI Cable	Belkin	HDMI2.0		
8.	Display	ChangHong	55DBK		
9.	PC	Lenovo	TP00117D		

ltem	Shielded Type	Ferrite Core	Length	Note
C-1	NO	NO	OM	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.

No.: BCTC/RF-EMC-005

Page: 9 of 86

Edition: B.2



4.4 Channel List

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

No.: BCTC/RF-EMC-005

Page: 10 of 86

Edition: B.2



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	Test mode Low channel Middle channel		High channel			
1	Transmitting(GFSK)	2402MHz	2441MHz	2480MHz			
2	Transmitting(π/ 4 DQPSK)	2402MHz	2441MHz	2480MHz			
3	Transmitting(8DPSK)	2402MHz	2441MHz	2480MHz			
4	BT+WIFI+HDMI (Output)+RJ45+keyboard+Mouse+USB+Earphone						
5.	BT+WIF	BT+WIFI+HDMI (Output)+HDMI (IN)+PC					

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		ÇMD	
Frequency	2402 MHz	2441 MHz	2480 MHz
Parameters	DEF	DEF	DEF
lo.: BCTC/RF-EMC-005		je: 11 of 86 📝 🏑 🖊 👘	Edition: B.2



Test Facility And Test Instrument Used 5.

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

A2LA certificate registration number is: CN1212

ISED Registered No.: 23583

ISED CAB identifier: CN0017

Conducted Emissions Test								
Equipment Manufacturer Model# Serial# Last Cal. No								
Receiver	R&S	ESR3	102075	May 16, 2024	May 15, 2025			
LISN	R&S	ENV216	101375	May 16, 2024	May 15, 2025			
Software	Frad	EZ-EMC	EMC-CON 3A1	/	١			
Pulse limiter	Schwarzbeck	VTSD9561-F	01323	May 16, 2024	May 15, 2025			

5.2 Test Instrument Used

RF Conducted Test								
Equipment	Manufacturer	Model#	Serial#	Last Cal.	Next Cal.			
Power meter	Keysight	E4419	1	May 16, 2024	May 15, 2025			
Power Sensor (AV)	Keysight	E9300A		May 16, 2024	May 15, 2025			
Signal Analyzer20kH z-26.5GHz	Keysight	N9020A	MY49100060	May 16, 2024	May 15, 2025			
Spectrum Analyzer9kHz- 40GHz	R&S	FSP40	100363	May 16, 2024	May 15, 2025			
Radio frequency control box	MAIWEI	MW100-RFC B						
Software	MAIWEI	MTS 8310			la l			



Radiated Emissions Test (966 Chamber01)								
Equipment	Manufacturer	Model#	Serial#	Last Cal.	Next Cal.			
966 chamber	ChengYu	966 Room	966	May 16, 2024	May 15, 2025			
Receiver	R&S	ESR3	102075	May 16, 2024	May 15, 2025			
Receiver	R&S	ESRP	101154	May 16, 2024	May 15, 2025			
Amplifier	Schwarzbeck	BBV9744	9744-0037	May 16, 2024	May 15, 2025			
TRILOG Broadband Antenna	Schwarzbeck	VULB9163	942	May 21, 2024	May 20, 2025			
Loop Antenna(9KHz -30MHz)	Schwarzbeck	FMZB1519B	00014	May 21, 2024	May 20, 2025			
Amplifier	SKET	LAPA_01G18 G-45dB	SK202104090 1	May 16, 2024	May 15, 2025			
Horn Antenna	Schwarzbeck	BBHA9120D	1541	May 21, 2024	May 20, 2025			
Amplifier(18G Hz-40GHz)	MITEQ	TTA1840-35- HG	2034381	May 16, 2024	May 15, 2025			
Horn Antenna(18G Hz-40GHz)	Schwarzbeck	BBHA9170	00822	May 21, 2024	May 20, 2025			
Spectrum Analyzer9kHz- 40GHz	R&S	FSP40	100363	May 16, 2024	May 15, 2025			
Software	Frad	EZ-EMC	FA-03A2 RE	\	\			

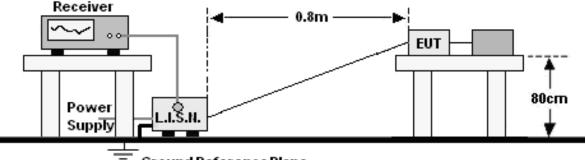
Page: 13 of 86

Edition: B.2



6. Conducted Emissions

6.1 Block Diagram Of Test Setup



Ground Reference Plane

6.2 Limit

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

Notes:

1. *Decreasing linearly with logarithm of frequency.

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

6.3 Test procedure

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

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

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

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

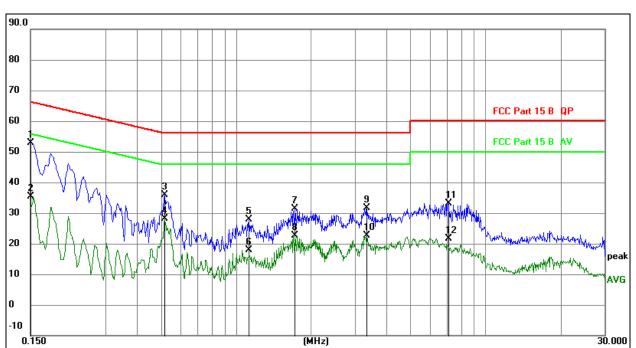
6.4 EUT operating Conditions

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



6.5 Test Result

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



Remark:

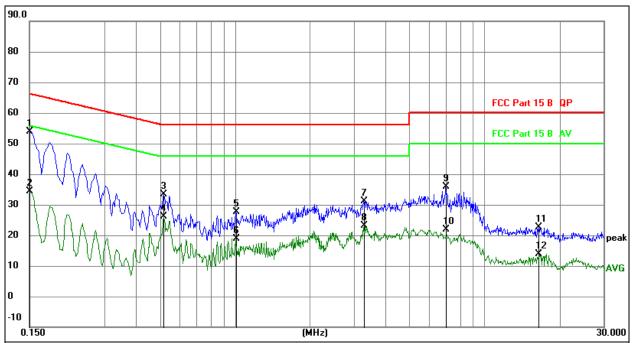
- All readings are Quasi-Peak and Average values.
 Factor = Insertion Loss + Cable Loss.
 Measurement = Reading Level + Correct Factor
 Over = Measurement Limit

								1
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz		dB	dBu∨	dBuV	dB	Detector
1	*	0.1500	32.87	20.07	52.94	66.00	-13.06	QP
2		0.1500	15.21	20.07	35.28	56.00	-20.72	AVG
3		0.5181	15.78	20.08	35.86	56.00	-20.14	QP
4		0.5181	8.08	20.08	28.16	46.00	-17.84	AVG
5		1.1292	7.81	20.09	27.90	56.00	-28.10	QP
6		1.1292	-2.24	20.09	17.85	46.00	-28.15	AVG
7		1.7253	11.29	20.10	31.39	56.00	-24.61	QP
8		1.7253	2.46	20.10	22.56	46.00	-23.44	AVG
9		3.3281	11.57	20.13	31.70	56.00	-24.30	QP
10		3.3281	2.46	20.13	22.59	46.00	-23.41	AVG
11		7.0997	13.00	20.16	33.16	60.00	-26.84	QP
12		7.0997	1.46	20.16	21.62	50.00	-28.38	AVG

No.: BCTC/RF-EMC-005



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



Remark:

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

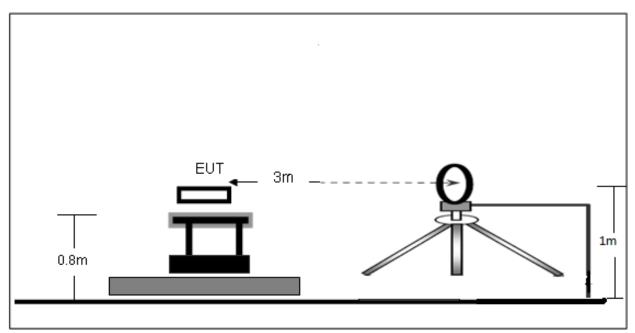
			tion Loss + (5			1
3. N	Measu	urement	= Reading L	evel + Correc	t Factor				1
4. (Over =	= Meası	irement - Lim	nit					
_				Reading	Correct	Measure-			
	No.	Mk.	Freq.	Level	Factor	ment	Limit	Over	
			MHz		dB	dBuV	dBuV	dB	Detector
	1	*	0.1500	33.76	20.07	53.83	66.00	-12.17	QP
	2		0.1500	14.27	20.07	34.34	56.00	-21.66	AVG
	3		0.5181	13.40	20.08	33.48	56.00	-22.52	QP
	4		0.5181	6.09	20.08	26.17	46.00	-19.83	AVG
	5		1.0050	7.57	20.09	27.66	56.00	-28.34	QP
	6		1.0050	-1.14	20.09	18.95	46.00	-27.05	AVG
	7		3.2756	11.10	20.13	31.23	56.00	-24.77	QP
	8		3.2756	2.95	20.13	23.08	46.00	-22.92	AVG
	9		6.9878	15.60	20.16	35.76	60.00	-24.24	QP
	10		6.9878	1.61	20.16	21.77	50.00	-28.23	AVG
	11		16.4856	2.42	20.32	22.74	60.00	-37.26	QP
	12		16.4856	-6.50	20.32	13.82	50.00	-36.18	AVG



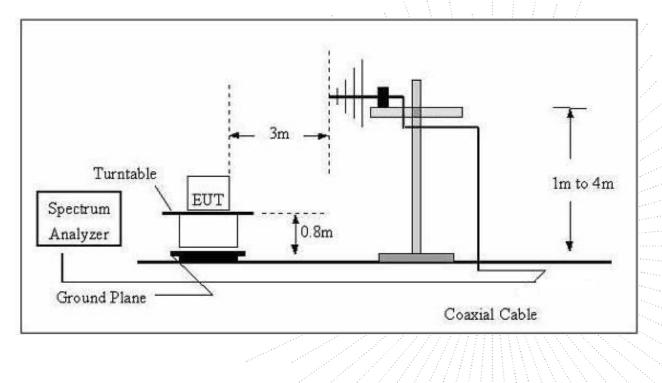
7. Radiated emissions

7.1 Block Diagram Of Test Setup

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

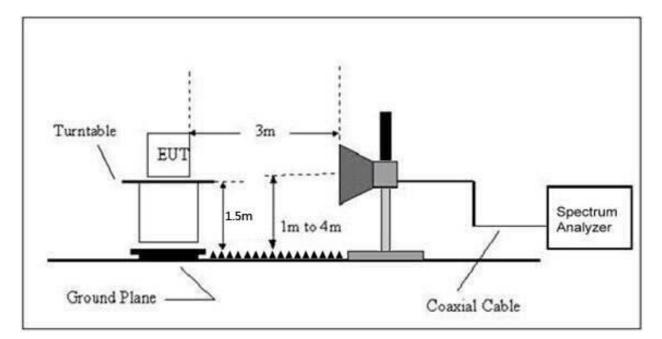


(B) Radiated Emission Test-Up Frequency 30MHz~1GHz





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



7.2 Limit

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

Frequency	Field Strength	Distance	Field Strength Limit at 3m Distance						
(MHz)	uV/m	(m)	uV/m	dBuV/m					
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	20log ^{(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)

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

Notes:

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

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

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



Frequency Range Of Radiated Measurement

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

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

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

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

(4) If the intentional radiator operates at or above 95 GHz: To the third harmonic of the highest fundamental frequency or to 750 GHz, whichever is lower, unless specified otherwise elsewhere in the rules.
 (5) If the intentional radiator contains a digital device, regardless of whether this digital device controls the

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

7.3 Test procedure

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

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

Below 1GHz test procedure as below:

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

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

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

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

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

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



Above 1GHz test procedure as below:

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

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

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

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

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

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

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

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

7.4 EUT operating Conditions

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

7.5 Test Result

Below 30MHz

Temperature:	26 ℃	 Relative Humidity:	54%
Pressure:	101KPa	Test Voltage :	AC 120V/60Hz
Test Mode:	Mode 4	Polarization :	NH / / / / / / / / / / /

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.



80.0 dBuV/m

Report No.: BCTC2409018935-1E

Between 30MHZ – TGHZ Temperature: 26 °C Relative Humidity: 54%						
Pressure:	101KPa	Phase :	Horizontal			
Test Mode:	Mode 4	Test Voltage :	AC 120V/60Hz			



						FCI	C_PART15_8_0	3m_QP
							Margin -6	ав
						5		
40					4	Ť		
			2	3 X	×.		NY James	man
Number	ates added	WWW ware	himme	Warmin Warming	www.www.www.www.www.www.www.www.www.ww	und ^k ayahang	414 ⁷⁰ 447	
1.46	aliyiya waa daladha	dille.						
0.0 30.000	40	50 60 70	80	(MHz)	300	400 50	00 600 700	1000.000
Remark 1. Facto 2. Meas	: r = Anter urement	nna Factor +	· Cable Loss – _evel + Correc	Pre-amplifier				
			Reading	Correct	Measure-			
No.	Mk.	Freq.	Level	Factor	ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1	7	7.0505	43.28	-19.23	24.05	40.00	-15.95	QP
2	11	9.8556	47.60	-17.32	30.28	43.50	-13.22	QP
3	17	4.4241	47.56	-17.62	29.94	43.50	-13.56	QP
4	29	8.2681	47.73	-13.28	34.45	46.00	-11.55	QP

No.: BCTC/RF-EMC-005

5 *

6

400.4319

790.6188

50.79

43.18

-10.83

-4.51

39.96

38.67

46.00

46.00

-6.04

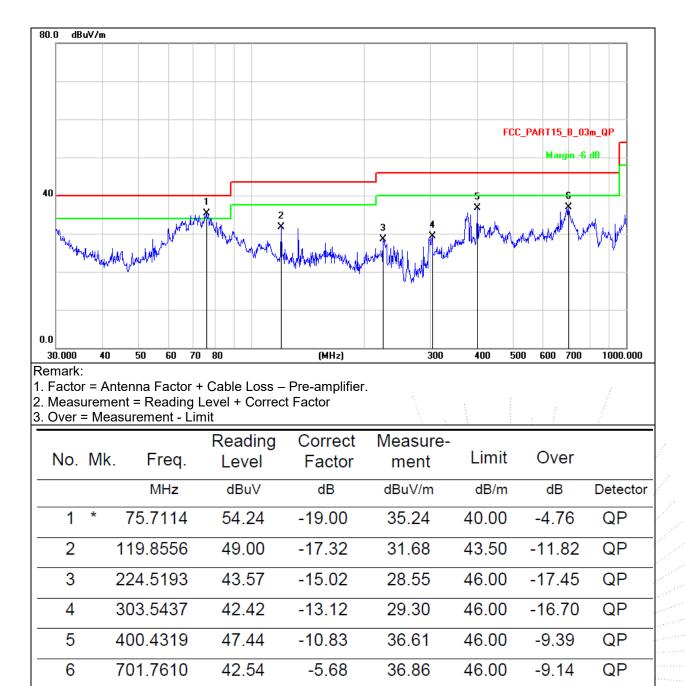
-7.33

QP

QP



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





Between 1GHz – 25GHz									
Polar	Fre- quency	Reading Level	Correct Factor	Measure- ment	Limits	Over	Detector		
(H/V)	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	Туре		
	GFSK Low channel								
V	4804.00	74.44	-19.99	54.45	74.00	-19.55	PK		
V	4804.00	66.15	-19.99	46.16	54.00	-7.84	AV		
V	7206.00	66.95	-14.22	52.73	74.00	-21.27	PK		
V	7206.00	57.86	-14.22	43.64	54.00	-10.36	AV		
Н	4804.00	69.65	-19.99	49.66	74.00	-24.34	PK		
Н	4804.00	59.15	-19.99	39.16	54.00	-14.84	AV		
Н	7206.00	65.59	-14.22	51.37	74.00	-22.63	PK		
Н	7206.00	58.22	-14.22	44.00	54.00	-10.00	AV		
			GFSK Mide	dle channel					
V	4882.00	72.68	-19.84	52.84	74.00	-21.16	PK		
V	4882.00	65.84	-19.84	46.00	54.00	-8.00	AV		
V	7323.00	63.34	-13.90	49.44	74.00	-24.56	PK		
V	7323.00	54.08	-13.90	40.18	54.00	-13.82	AV		
Н	4882.00	69.14	-19.84	49.30	74.00	-24.70	PK		
Н	4882.00	58.77	-19.84	38.93	54.00	-15.07	AV		
Н	7323.00	61.99	-13.90	48.09	74.00	-25.91	PK		
Н	7323.00	54.20	-13.90	40.30	54.00	-13.70	AV		
			GFSK Hig	h channel					
V	4960.00	74.55	-19.68	54.87	74.00	-19.13	PK		
V	4960.00	64.58	-19.68	44.90	54.00	-9.10	AV		
V	7440.00	66.06	-13.57	52.49	74.00	-21.51	PK		
V	7440.00	55.60	-13.57	42.03	54.00	-11.97	AV		
Н	4960.00	73.24	-19.68	53.56	74.00	-20.44	PK		
Н	4960.00	63.13	-19.68	43.45	54.00	-10.55	AV		
Н	7440.00	64.34	-13.57	50.77	74.00	-23.23	PK		
Н	7440.00	56.04	-13.57	42.47	54.00	-11.53	AV		

Remark:

1. Measurement = Reading Level + Correct Factor,

Correct Factor = Antenna Factor + Cable Loss Pre-amplifier,

Over= Measurement - 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.



Polar	Fre- quency	Reading Level	Correct Factor	Measure- ment	Limits	Over	Detector
(H/V)	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	Туре
			π /4DQPSK	Low channel	· · · · · · · · · · · · · · · · · · ·		
V	4804.00	74.92	-19.99	54.93	74.00	-19.07	PK
V	4804.00	64.35	-19.99	44.36	54.00	-9.64	AV
V	7206.00	65.34	-14.22	51.12	74.00	-22.88	PK
V	7206.00	55.74	-14.22	41.52	54.00	-12.48	AV
Н	4804.00	73.33	-19.99	53.34	74.00	-20.66	PK
Н	4804.00	64.19	-19.99	44.20	54.00	-9.80	AV
Н	7206.00	63.35	-14.22	49.13	74.00	-24.87	PK
Н	7206.00	54.90	-14.22	40.68	54.00	-13.32	AV
			π /4DQPSK N	liddle channe	1		
V	4882.00	71.25	-19.84	51.41	74.00	-22.59	PK
V	4882.00	62.28	-19.84	42.44	54.00	-11.56	AV
V	7323.00	61.96	-13.90	48.06	74.00	-25.94	PK
V	7323.00	53.94	-13.90	40.04	54.00	-13.96	AV
Н	4882.00	67.00	-19.84	47.16	74.00	-26.84	PK
Н	4882.00	57.90	-19.84	38.06	54.00	-15.94	AV
Н	7323.00	59.75	-13.90	45.85	74.00	-28.15	PK
Н	7323.00	51.74	-13.90	37.84	54.00	-16.16	AV
			π /4DQPSK	High channel	· · · · · · · · · · · · · · · · · · ·		
V	4960.00	73.54	-19.68	53.86	74.00	-20.14	PK
V	4960.00	65.32	-19.68	45.64	54.00	-8.36	AV
V	7440.00	64.87	-13.57	51.30	74.00	-22.70	PK
V	7440.00	55.37	-13.57	41.80	54.00	-12.20	AV
Н	4960.00	72.00	-19.68	52.32	74.00	-21.68	PK
Н	4960.00	62.68	-19.68	43.00	54.00	-11.00	AV
Н	7440.00	63.00	-13.57	49.43	74.00	-24.57	PK
Н	7440.00	55.14	-13.57	41.57	54.00	-12.43	AV

Remark:

1. Measurement = Reading Level + Correct Factor,

Correct Factor = Antenna Factor + Cable Loss - Pre-amplifier,

Over= Measurement - 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.



Polar	Fre- quency	Reading Level	Correct Factor	Measure- ment	Limits	Over	Detector		
(H/V)	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	Туре		
	8DPSK Low channel								
V	4804.00	75.05	-19.99	55.06	74.00	-18.94	PK		
V	4804.00	64.81	-19.99	44.82	54.00	-9.18	AV		
V	7206.00	66.39	-14.22	52.17	74.00	-21.83	PK		
V	7206.00	56.79	-14.22	42.57	54.00	-11.43	AV		
Н	4804.00	70.60	-19.99	50.61	74.00	-23.39	PK		
Н	4804.00	59.71	-19.99	39.72	54.00	-14.28	AV		
Н	7206.00	64.50	-14.22	50.28	74.00	-23.72	PK		
Н	7206.00	56.67	-14.22	42.45	54.00	-11.55	AV		
			8DPSK Mic	ldle channel					
V	4882.00	73.67	-19.84	53.83	74.00	-20.17	PK		
V	4882.00	67.62	-19.84	47.78	54.00	-6.22	AV		
V	7323.00	64.50	-13.90	50.60	74.00	-23.40	PK		
V	7323.00	55.39	-13.90	41.49	54.00	-12.51	AV		
Н	4882.00	69.12	-19.84	49.28	74.00	-24.72	PK		
Н	4882.00	58.54	-19.84	38.70	54.00	-15.30	AV		
Н	7323.00	61.59	-13.90	47.69	74.00	-26.31	PK		
Н	7323.00	53.42	-13.90	39.52	54.00	-14.48	AV		
			8DPSK Hi	gh channel					
V	4960.00	76.49	-19.68	56.81	74.00	-17.19	PK		
V	4960.00	67.29	-19.68	47.61	54.00	-6.39	AV		
V	7440.00	67.98	-13.57	54.41	74.00	-19.59	PK		
V	7440.00	58.86	-13.57	45.29	54.00	-8.71	AV		
Н	4960.00	73.81	-19.68	54.13	74.00	-19.87	PK		
Н	4960.00	63.59	-19.68	43.91	54.00	-10.09	AV		
Н	7440.00	66.06	-13.57	52.49	74.00	-21.51	PK		
Н	7440.00	58.78	-13.57	45.21	54.00	-8.79	AV		

Remark:

1. Measurement = Reading Level + Correct Factor,

Correct Factor = Antenna Factor + Cable Loss - Pre-amplifier,

Over= Measurement - Limit

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

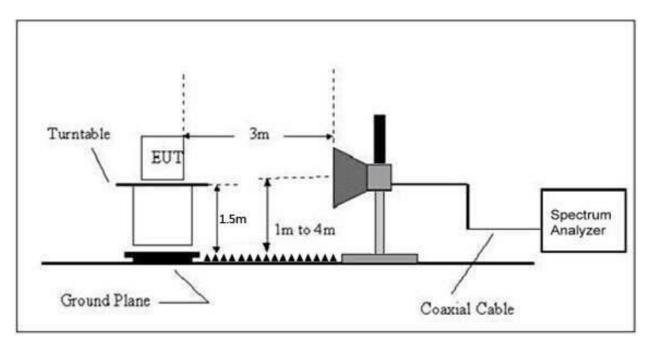
In restricted bands of operation, The spurious emissions below the permissible value more than 20dB
 The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.



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)

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

Notes:

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

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

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

8.3 Test procedure

Receiver Parameter	Setting			
Attenuation	Auto			
Start Frequency	2300MHz			
Stop Frequency	2520			
RB / VB (Emission In Restricted Band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average			

Above 1GHz test procedure as below:

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

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

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

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

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

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

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

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

8.4 EUT operating Conditions

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



8.5 Test Result

Test mode	Polar (H/V)	Fre- quency	Reading Level (dBuV/m)	Correct Factor (dB)	Measure- ment (dBuV/m) PK	Limits (dBuV/m)		Result		
	()	(MHz)				PK	AV	1		
	Low Channel 2402MHz									
GFSK	Н	2390.00	71.88	-25.43	46.45	74.00	54.00	PASS		
	Н	2400.00	75.90	-25.40	50.50	74.00	54.00	PASS		
	V	2390.00	72.37	-25.43	46.94	74.00	54.00	PASS		
	V	2400.00	77.34	-25.40	51.94	74.00	54.00	PASS		
	High Channel 2480MHz									
	Н	2483.50	75.16	-25.15	50.01	74.00	54.00	PASS		
	Н	2500.00	71.08	-25.10	45.98	74.00	54.00	PASS		
	V	2483.50	76.44	-25.15	51.29	74.00	54.00	PASS		
	V	2500.00	73.84	-25.10	48.74	74.00	54.00	PASS		
	Low Channel 2402MHz									
	Н	2390.00	72.15	-25.43	46.72	74.00	54.00	PASS		
π/4DQPSK	Н	2400.00	76.10	-25.40	50.70	74.00	54.00	PASS		
	V	2390.00	71.63	-25.43	46.20	74.00	54.00	PASS		
	V	2400.00	75.01	-25.40	49.61	74.00	54.00	PASS		
	High Channel 2480MHz									
	Н	2483.50	75.41	-25.15	50.26	74.00	54.00	PASS		
	Н	2500.00	71.31	-25.10	46.21	74.00	54.00	PASS		
	V	2483.50	73.83	-25.15	48.68	74.00	54.00	PASS		
	V	2500.00	70.03	-25.10	44.93	74.00	54.00	PASS		
	Low Channel 2402MHz									
8DPSK	Н	2390.00	71.98	-25.43	46.55	74.00	54.00	PASS		
	Н	2400.00	76.33	-25.40	50.93	74.00	54.00	PASS		
	V	2390.00	72.21	-25.43	46.78	74.00	54.00	PASS		
	V	2400.00	75.30	-25.40	49.90	74.00	54.00	PASS		
ODFSK	High Channel 2480MHz									
	Н	2483.50	75.52	-25.15	50.37	74.00	54.00	PASS		
	Н	2500.00	70.71	-25.10	45.61	74.00	54.00	PASS		
	V	2483.50	75.36	-25.15	50.21	74.00	54.00	PASS		
	V	2500.00	70.63	-25.10	45.53	74.00	54.00	PASS		

1. Measurement = Reading Level + Correct Factor,

Correct Factor = Antenna Factor + Cable Loss - Pre-amplifier,

Over= Measurement - Limit

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

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



9. Spurious RF Conducted Emissions

9.1 Block Diagram Of Test Setup



9.2 Limit

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

9.3 Test procedure

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

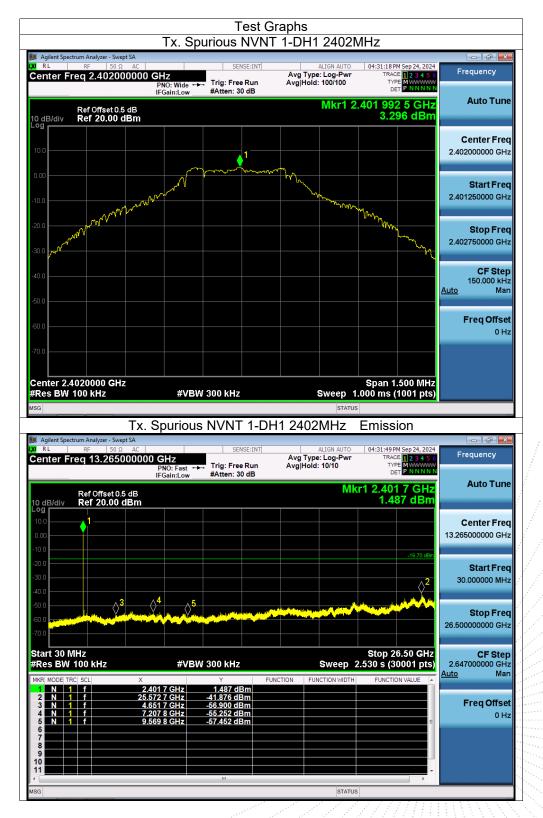
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto Detector function = peak, Trace = max hold

Page: 29 of 86

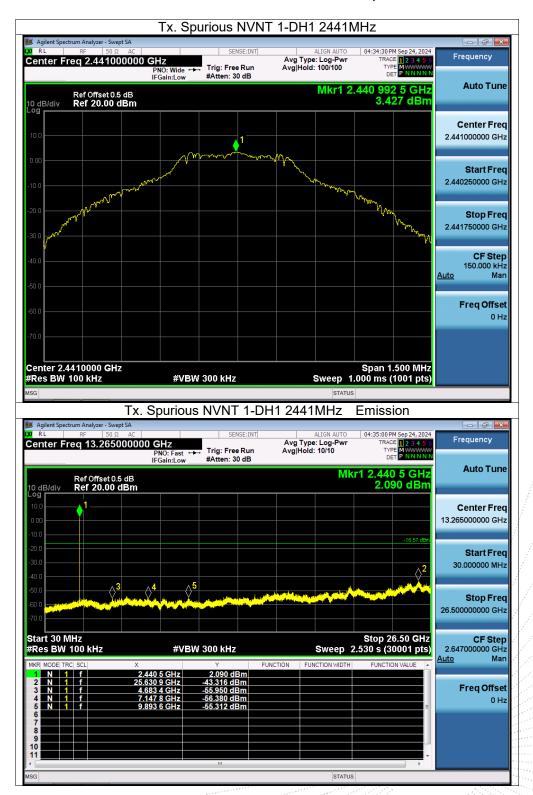
Edition: B.2



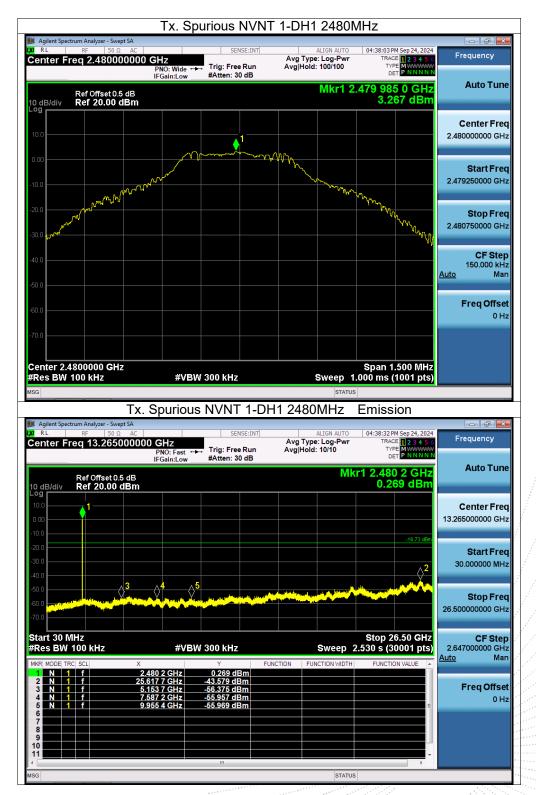
9.4 Test Result











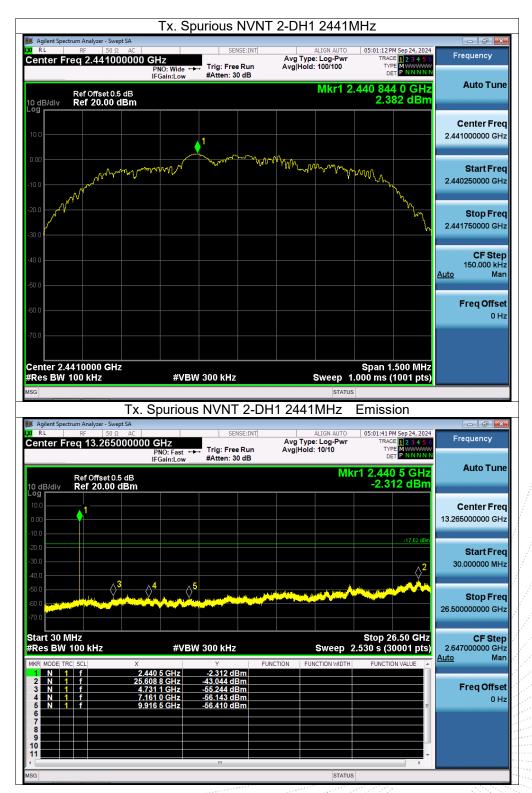
No.: BCTC/RF-EMC-005



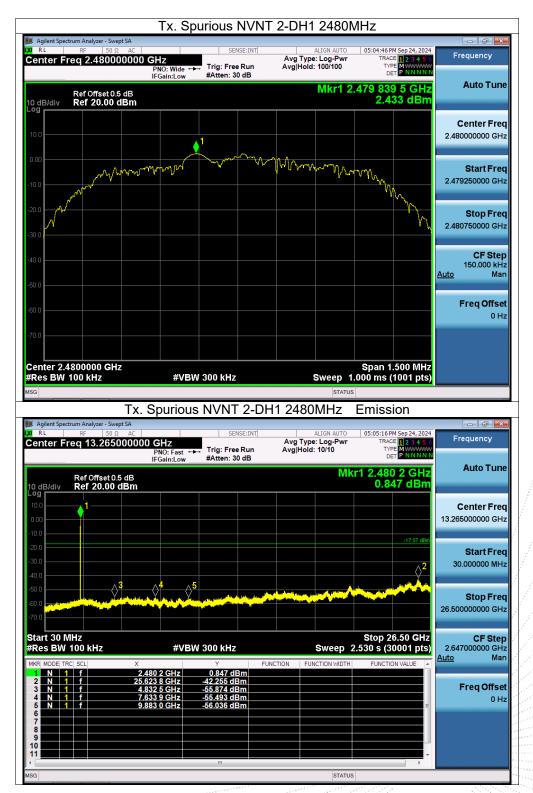


No.: BCTC/RF-EMC-005

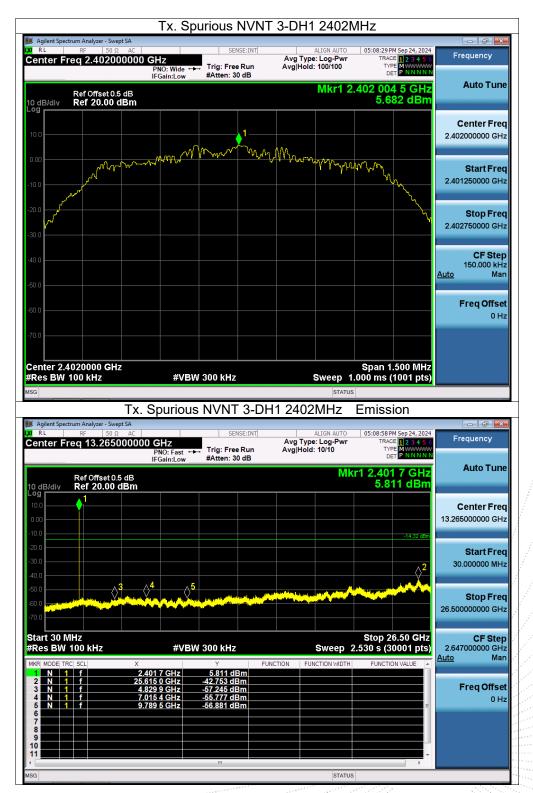




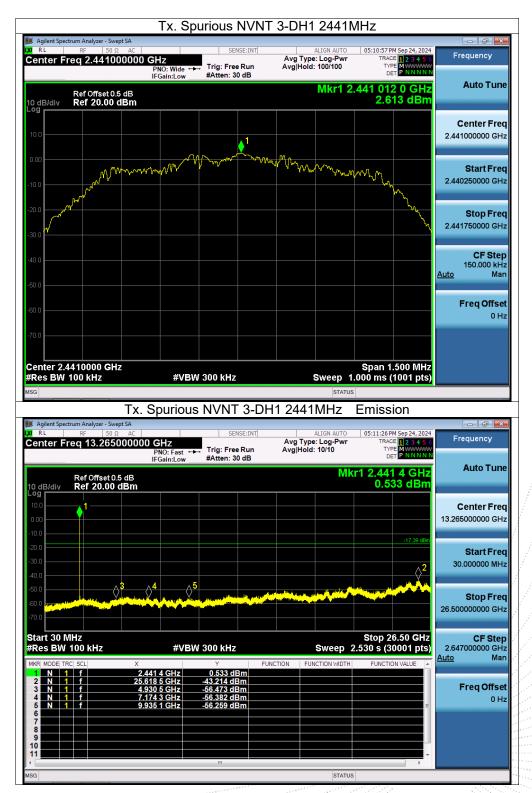




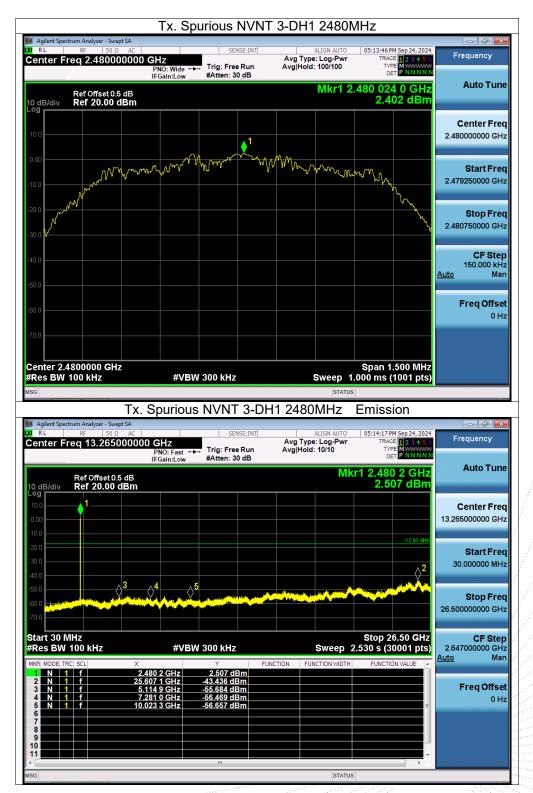




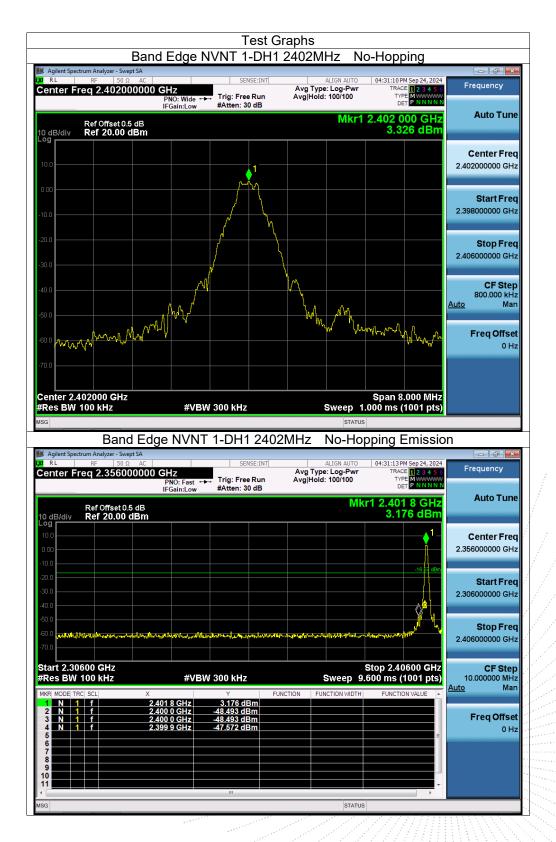




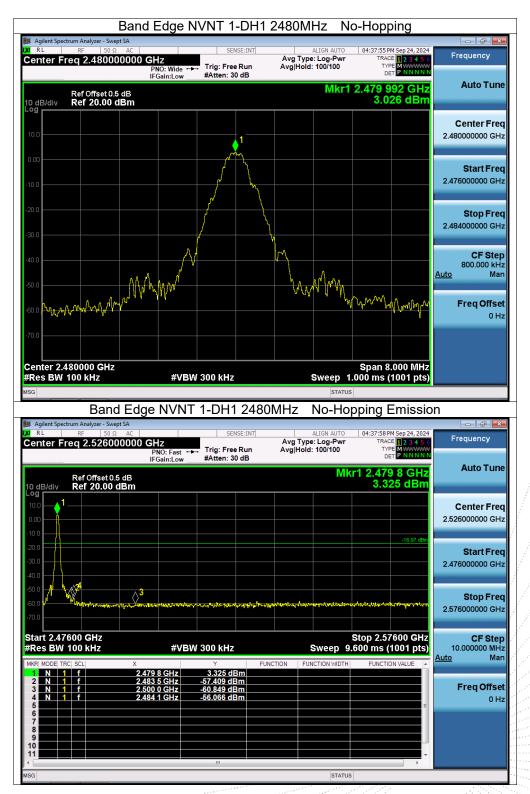






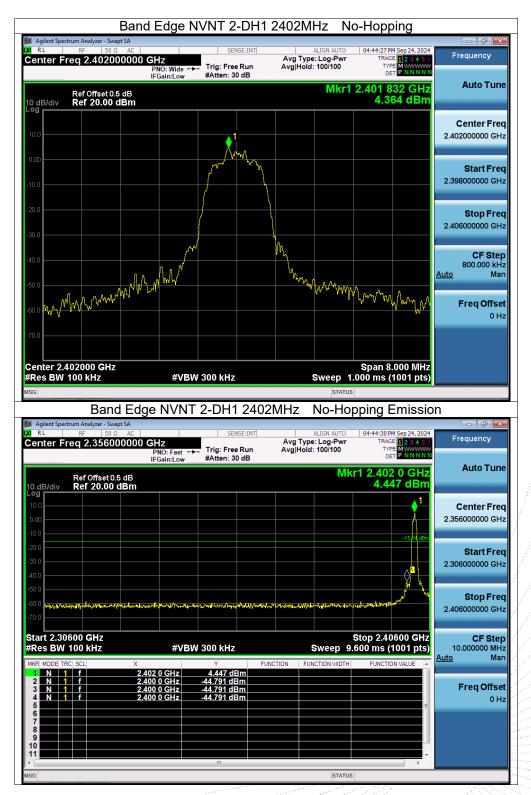




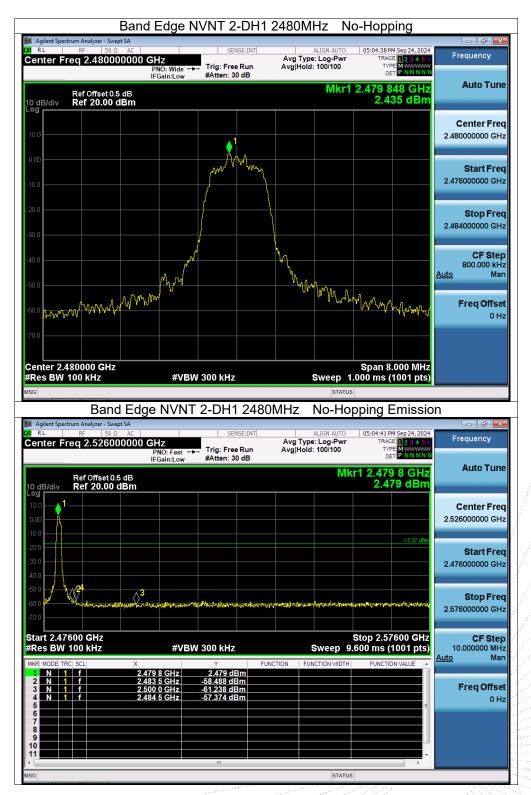


Edition: B.2

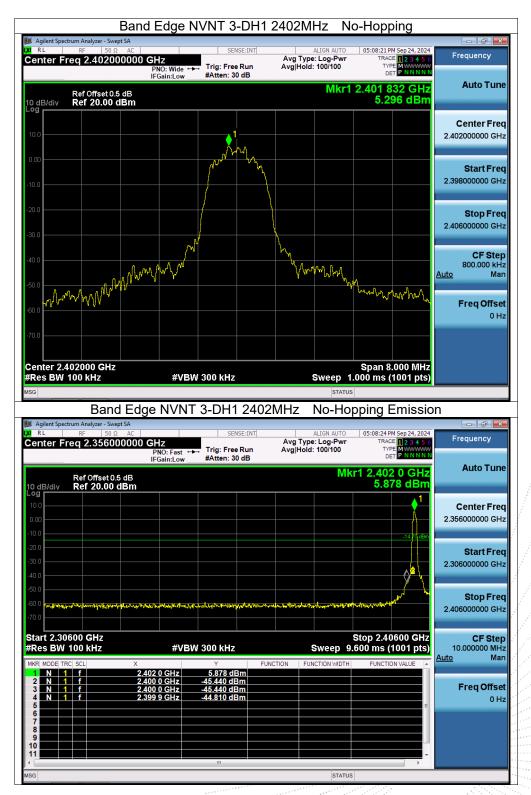




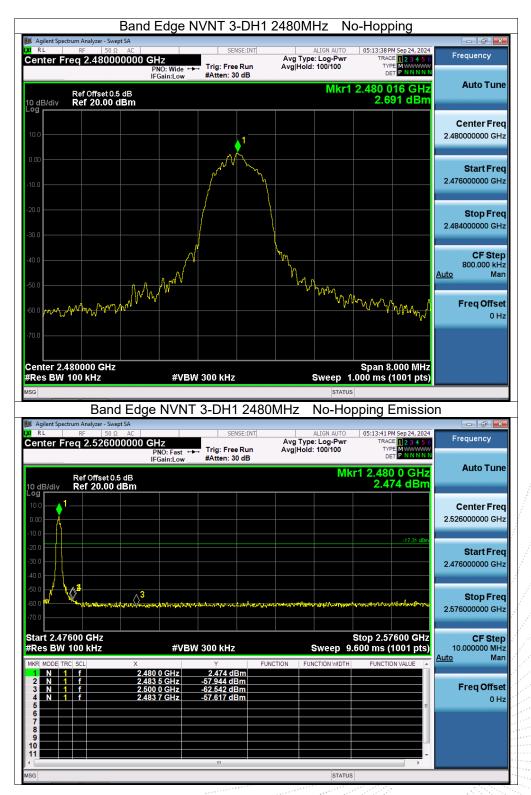






































10. 20 dB Bandwidth

10.1 Block Diagram Of Test Setup



10.2 Limit

N/A

10.3 Test procedure

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

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

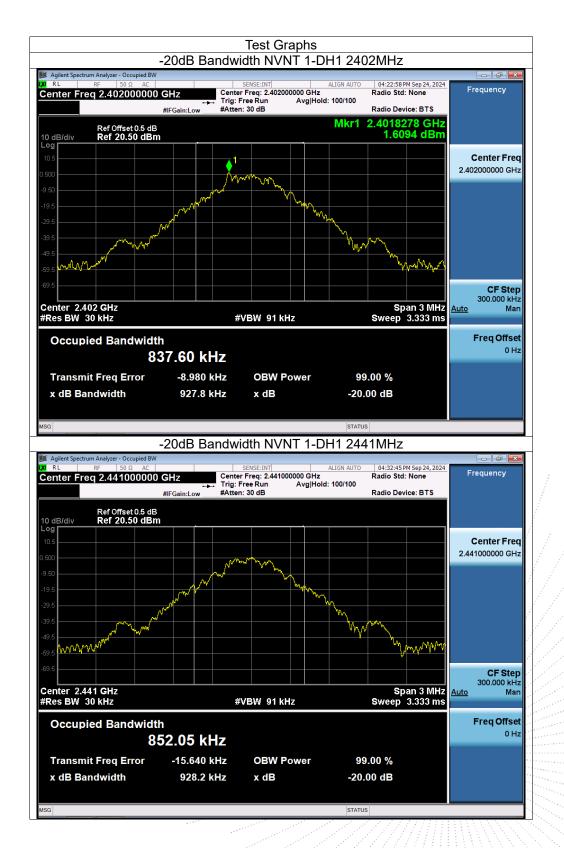
10.4 Test Result

Temperature:	26 ℃	Relative Humidity: 54%
Test Voltage:	DC 12V	Remark: N/A
		\sim

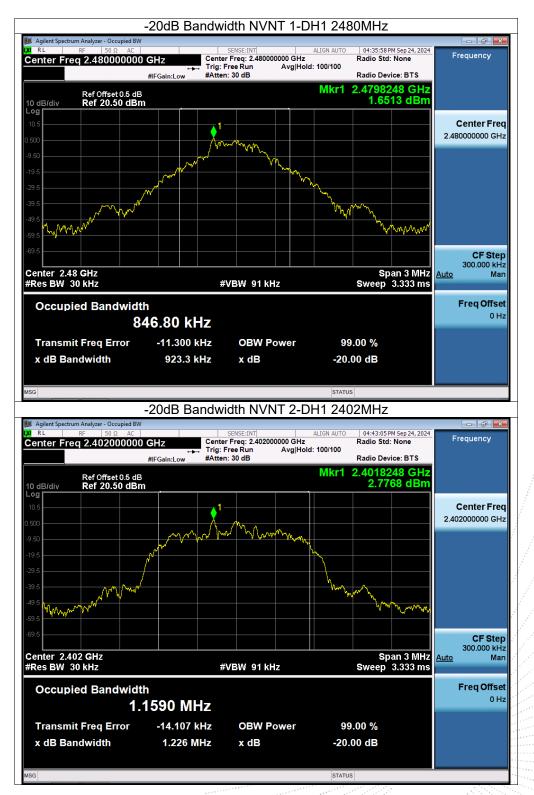
Condition	Mode	Frequency (MHz)	-20 dB Bandwidth (MHz)	Verdict
NVNT	1-DH1	2402	0.928	Pass
NVNT	1-DH1	2441	0.928	Pass
NVNT	1-DH1	2480	0.923	Pass
NVNT	2-DH1	2402	1.226	Pass
NVNT	2-DH1	2441	1.262	Pass
NVNT	2-DH1	2480	1.212	Pass
NVNT	3-DH1	2402	1.208	Pass
NVNT	3-DH1	2441	1.215	Pass
NVNT	3-DH1	2480	1.216	Pass



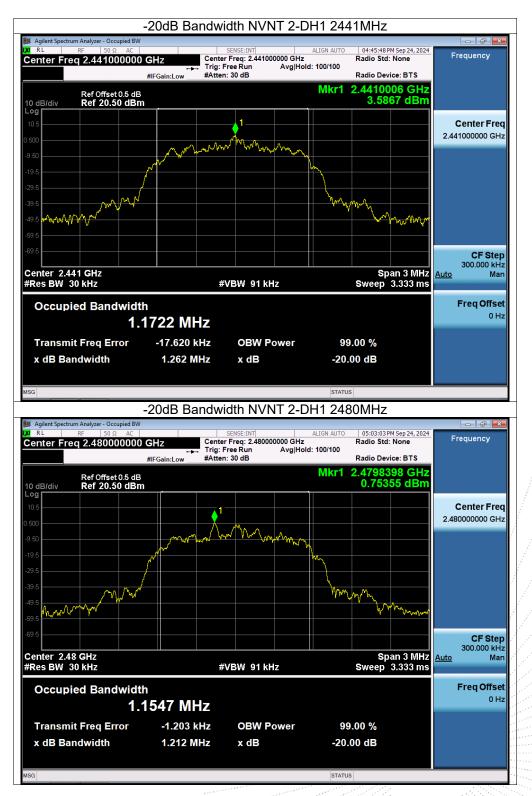




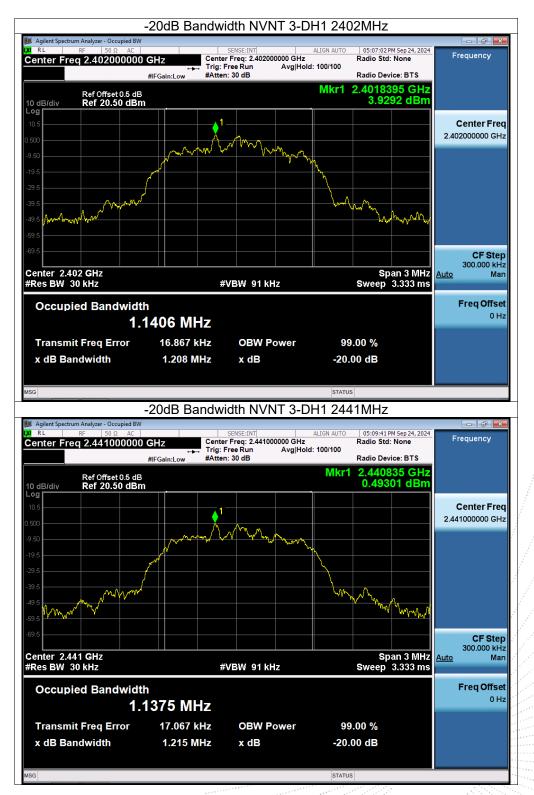




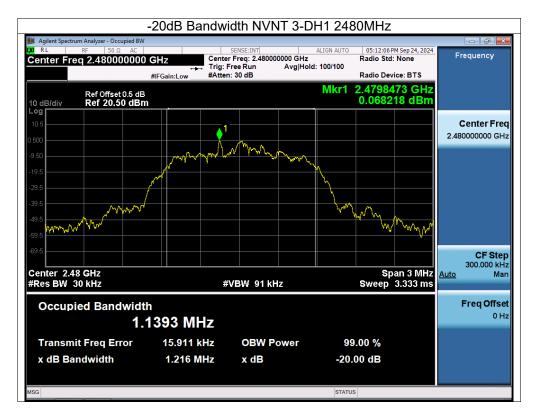












No.: BCTC/RF-EMC-005

Page: 56 of 86



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 = 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.

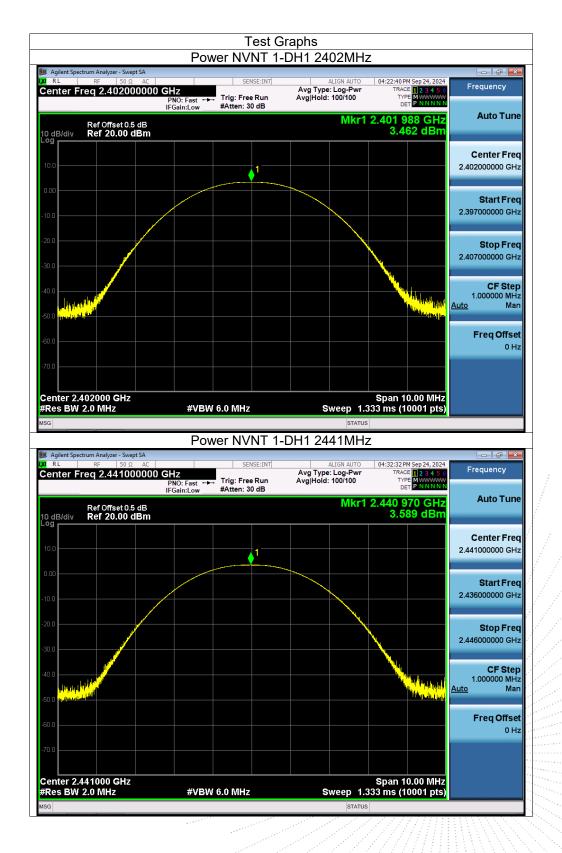
11.4 Test Result

Temperature: 26°C	Relative Humidity:	54%			1 - A.	
Test Voltage: DC 12V	Remark:	N/A				

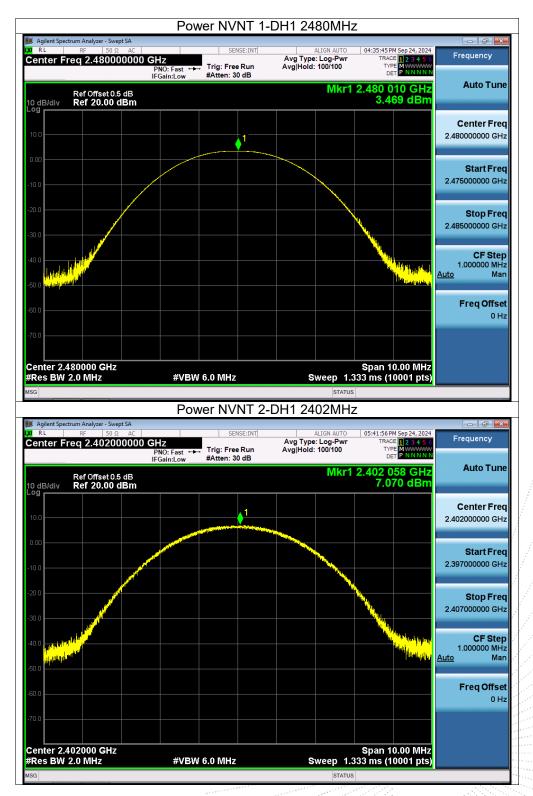
Condition	Mode	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	1-DH1	2402	3.46	21	Pass
NVNT	1-DH1	2441	3.59	21	Pass
NVNT	1-DH1	2480	3.47	21	Pass
NVNT	2-DH1	2402	7.07	21	Pass
NVNT	2-DH1	2441	7.26	21	Pass
NVNT	2-DH1	2480	3.72	21	Pass
NVNT	3-DH1	2402	7.82	21	Pass
NVNT	3-DH1	2441	4.51	21	Pass
NVNT	3-DH1	2480	4.57	21	Pass



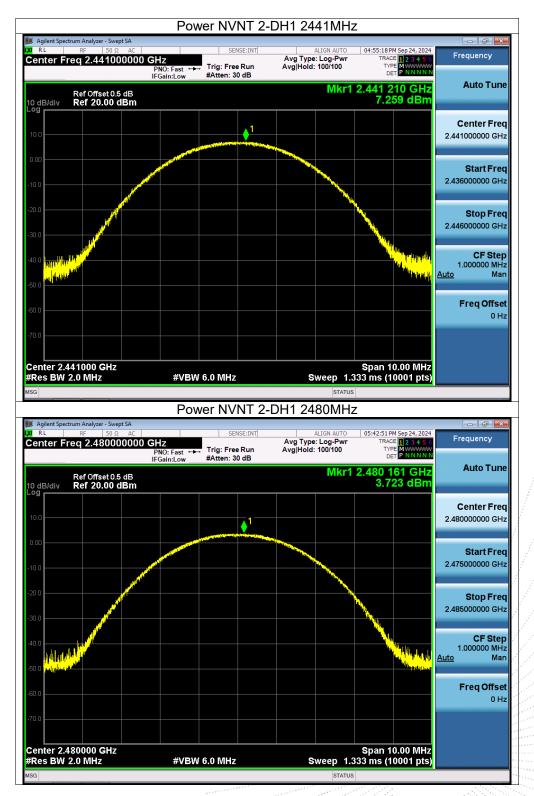




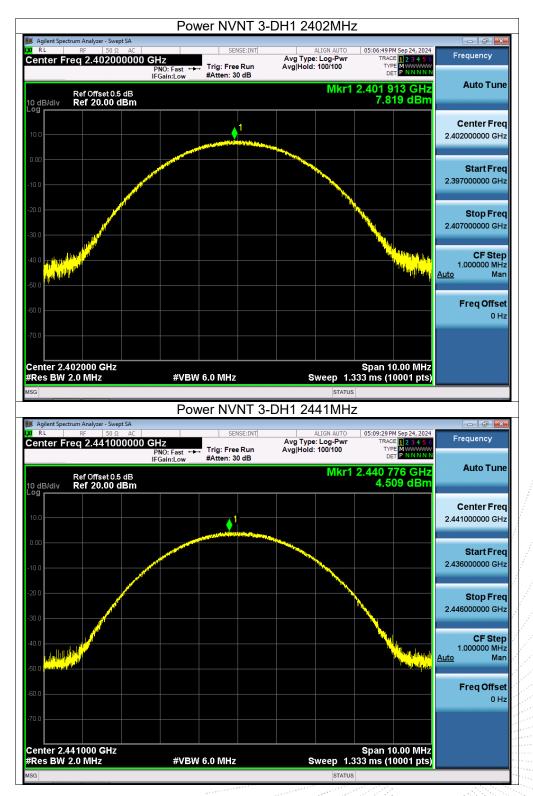




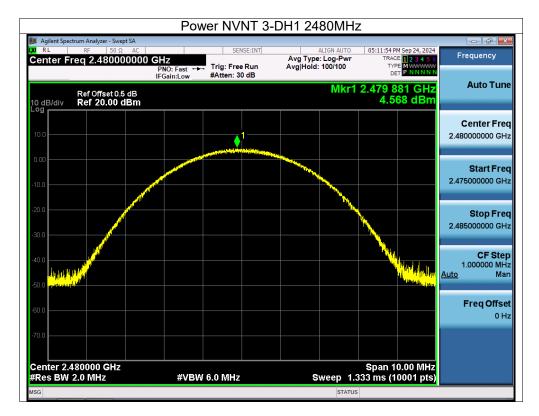












No.: BCTC/RF-EMC-005

Page: 62 of 86



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.

Condition	Mode	Hopping Freq1 (MHz)	Hopping Freq2 (MHz)	HFS (MHz)	Limit (MHz)	Verdict
NVNT	1-DH1	2401.826	2402.824	0.998	0.619	Pass
NVNT	1-DH1	2440.824	2441.824	1	0.619	Pass
NVNT	1-DH1	2478.824	2479.824	1	0.615	Pass
NVNT	2-DH1	2401.824	2402.824	1	0.817	Pass
NVNT	2-DH1	2440.838	2441.84	1.002	0.841	Pass
NVNT	2-DH1	2478.838	2479.84	1.002	0.808	Pass
NVNT	3-DH1	2401.838	2402.838	1	0.805	Pass
NVNT	3-DH1	2440.842	2441.84	0.998	0.81	Pass
NVNT	3-DH1	2478.838	2479.838	1	0.811	Pass

12.4 Test Result









		FS NVNT 1-	DH1 2480MHz		
Agilent Spectrum Analyzer - Swep RL RF 50 Ω		SENSE:INT	ALIGN AUTO	04:37:48 PM Sep 24, 2024	
enter Freq 2.47950	PNO: Wide C	○ Trig: Free Run #Atten: 30 dB	Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 1 2 3 4 5 6 TYPE MWWWW DET PNNNN	Frequency
Ref Offset 0.5 0 dB/div Ref 20.00 (i dB IBm		Mkr1	2.478 824 GHz 1.682 dBm	Auto Tur
og 10.0			<mark>2</mark>		Center Fre
3.00				~	2.479500000 GH
20.0		\sim			Start Fre
80.0					2.478500000 GH
40.0 50.0					
60.0					Stop Fre 2.480500000 Gi
0.0					
enter 2.479500 GHz Res BW 30 kHz	#VB\	N 100 kHz	Sweep 2	Span 2.000 MHz 133 ms (1001 pts)	CF Ste 200.000 ki
KR MODE TRC SCL	× 2.478 824 GHz	Y F	UNCTION FUNCTION WIDTH	FUNCTION VALUE	Auto Ma
2 N 1 f	2.479 824 GHz	1.729 dBm			Freq Offs
4 5 6 1				E	01
7 8 9					
0					
G		III	STATUS		
	C	ES NVNT 2-	DH1 2402MHz		
Agilent Spectrum Analyzer - Swep	ot SA			04:44:20 PM Sep 24, 2024	
enter Freq 2.40250	0000 GHz PNO: Wide	Trig: Free Run #Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N	Frequency
Ref Offset 0.5		#Atten: 30 dB	Mkr1	2.401 824 GHz 2.853 dBm	Auto Tur
0 dB/div Ref 20.00 c	BM		A 2	2.000 0.011	Conton Em
				\wedge	Center Fre 2.402500000 Gi
30.0					Start Fre 2.401500000 G
0.0					
50.0 60.0					Stop Fre
70.0					2.400000000
enter 2.402500 GHz Res BW 30 kHz	#\/B)	№ 100 kHz	Sween 2	Span 2.000 MHz .133 ms (1001 pts)	CF Ste 200.000 kl
IKR MODE TRC SCL	X		UNCTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Ma
1 N 1 f 2 N 1 f	2.401 824 GHz 2.402 824 GHz	2.853 dBm 2.877 dBm			Freq Offs
3					01
4 5				E	
5 6 7				E	
5 6					
5 6 7 8 9		m		F	



	_	S NVNT 2-E	DH1 2441MHz		
Agilent Spectrum Analyzer - Swep R L RF 50 Ω		SENSE:INT	ALIGN AUTO	05:00:16 PM Sep 24, 2024	
enter Freq 2.44150	00000 GHz PNO: Wide G IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P N N N N N	Frequency
Ref Offset 0.5 dB/div Ref 20.00 c			Mkr1	2.440 838 GHz 4.121 dBm	Auto Tur
			<u>2</u>		Center Fre
	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		$\sim$	2.441500000 Gł
					Start Fre
0.0					2.440500000 GI
50.0 50.0					Stop Fre
0.0					2.442500000 GI
enter 2.441500 GHz Res BW 30 kHz	#VBW	V 100 kHz	Sweep 2.	Span 2.000 MHz 133 ms (1001 pts)	CF Ste 200.000 k
KR MODE TRC SCL	× 2.440 838 GHz	Y FU 4.121 dBm	NCTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Mi
2 N 1 f	2.441 840 GHz	2.212 dBm			Freq Offs
4 5 6				=	01
7					
9 0 0					
	<u> </u>	m			
G			STATUS		
		-S NVNT 2-D	DH1 2480MHz		
Agilent Spectrum Analyzer - Swep           R L         RF         50 Ω	AC	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	05:04:31 PM Sep 24, 2024	Frequency
enter Freq 2.47950	PNO: Wide IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Hold:>100/100	TRACE 1 2 3 4 5 6 TYPE M WWWW DET P N N N N N	
Ref Offset 0.5 DdB/div Ref 20.00 c	dB IBm		Mkr1	2.478 838 GHz 2.266 dBm	Auto Tu
og 10.0			2		Center Fre
					2.479500000 GI
30.0					Start Fre 2.478500000 G
0.0					
i0.0					<b>Stop Fr</b> 2.480500000 G
70.0					2.480500000 Gi
enter 2.479500 GHz Res BW 30 kHz	#VBW	V 100 kHz	Sweep 2.	Span 2.000 MHz 133 ms (1001 pts)	CF Ste 200.000 kl
KR MODE TRC SCL	Х		NCTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> M
1 N 1 f 2 N 1 f 3	2.478 838 GHz 2.479 840 GHz	2.266 dBm 2.300 dBm			Freq Offs
				=	01
4					
5 6 7 C					
5 6 7 8 9					
5 6 7 8					



	C	FS NVNT 3-[	JH1 2402MHz		
📕 Agilent Spectrum Analyzer - Swe					
ଅ RL RF 50 ଯ Center Freq 2.4025।		SENSE:INT Trig: Free Run #Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100	05:08:14 PM Sep 24, 2024 TRACE 1 2 3 4 5 6 TYPE M WWWW DET P N N N N N	Frequency
Ref Offset 0. 10 dB/div Ref 20.00	5 dB		Mkr1	2.401 838 GHz 3.957 dBm	Auto Tun
	· · · · · ·		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Center Fre 2.402500000 GH
-20.0					Start Fre 2.401500000 GF
-50.0 -60.0 -70.0					Stop Fre 2.403500000 GH
Center 2.402500 GHz #Res BW 30 kHz		W 100 kHz	Sweep 2.	Span 2.000 MHz 133 ms (1001 pts)	CF Ste 200.000 kH
MKR MODE TRC SCL 1 N 1 f 2 N 1 f 3 4	X 2.401 838 GHz 2.402 838 GHz	Y FU <u>3.957 dBm</u> 3.981 dBm	UNCTION FUNCTION WIDTH	FUNCTION VALUE	Auto Ma
5 6 7 8 9				E E	0 F
		m			
ISG			STATUS		
		FS NVNT 3-[	DH1 2441MHz		
M Agilent Spectrum Analyzer - Swe RL RF 50 ଜ Center Freq 2.4415	2 AC 00000 GHz PNO: Wide	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100	05:10:49 PM Sep 24, 2024 TRACE 1 2 3 4 5 6 TYPE M WWWW DET P N N N N N	Frequency
Ref Offset 0. 10 dB/div <b>Ref 20.00</b>		#Atten: 30 dB	Mkr1	2.440 842 GHz 2.369 dBm	Auto Tur
- <b>og</b> 10.0 0.00			$\wedge^2$		Center Fre 2.441500000 GH
				$\sim$	2.441300000 61
-10.0					Start Fre
-20.0 -30.0 -40.0 -50.0					Start Fre 2.440500000 GH Stop Fre
20.0 -20.0 -40.0 -50.0 -60.0 -70.0 Center 2.441500 GHz				Span 2.000 MHz	Start Fre 2.44050000 GH Stop Fre 2.44250000 GH
200 300 400 500 500 500 500 500 500 5	#VB1	W 100 kHz	-	133 ms (1001 pts)	Start Fre 2.44050000 GH Stop Fre 2.44250000 GH CF Ste 200.00 kH
20.0 30.0 40.0 60.0 70.0 Center 2.441500 GHz #Res BW 30 kHz			Sweep 2.		Start Fre           2.440500000 GF           Stop Fre           2.442500000 GF           2.442500000 GF           CF Ste           200.000 kF           Auto           Kauto           Kauto           Kauto
-20.0	#VB\ X 2.440 842 GHz	Y FU 2.369 dBm	-	133 ms (1001 pts)	Start Fre 2.440500000 GH Stop Fre 2.442500000 GH CF Ste 200.000 kH
20.0 30.0 40.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0	#VB\ X 2.440 842 GHz	Y FU 2.369 dBm	-	133 ms (1001 pts)	Start Fr           2.440500000 Gl           Stop Fr           2.442500000 Gl           CF Ste           200.000 kl           Auto           Market Stop Fr           2.442500000 Gl           CF Ste           200.000 kl           Auto           Market Stop Fr           CF Ste           200.000 kl           Auto           Market Stop Fr           CF Ste           200.000 kl           Auto           Freq Offs



	CFS NVN	T 3-DH1 248	0MHz		
Magilent Spectrum Analyzer - Swept SA					- ¢ ×
KL RF 50 Ω AC     Center Freq 2.479500000		Avg Type: Run Avg Hold:>	Log-Pwr TRA •100/100 T	PM Sep 24, 2024 ACE 1 2 3 4 5 6 APE M WWWWW DET P N N N N N	Frequency
Ref Offset 0.5 dB 10 dB/div Ref 20.00 dBm			Mkr1 2.478	838 GHz 540 dBm	Auto Tune
Log 10.0 0.00 .10.0	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~ ²	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		Center Freq 2.479500000 GHz
-20.0					<b>Start Freq</b> 2.478500000 GHz
-50.0 -60.0 -70.0					<b>Stop Freq</b> 2.480500000 GHz
Center 2.479500 GHz #Res BW 30 kHz	#VBW 100 kHz	s	Span: weep 2.133 ms		CF Step 200.000 kHz uto Man
MKR MODE TRC SCL X	78 838 GHz 2.540 dBi		TION WIDTH FUNCT	ION VALUE	<u>uto</u> Man
2 N 1 f 2.4 3 4 5	79 838 GHz 2.325 dBi	m			<b>Freq Offset</b> 0 Hz
6 7 8 9					
	m				
MSG			STATUS		

No.: BCTC/RF-EMC-005

Page: 68 of 86



# 13. Number Of Hopping Frequency

# 13.1 Block Diagram Of Test Setup



### 13.2 Limit

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

### 13.3 Test procedure

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

2. Set the spectrum analyzer: RBW = 100kHz. VBW = 300kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

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

### 13.4 Test Result

Condition	Mode	Hopping Number	Limit	Verdict
NVNT	1-DH1	79	15	Pass
NVNT	2-DH1	79	15	Pass
NVNT	3-DH1	79	15	Pass



	Hor		Graphs T 1-DH1 2441N		
🗴 Agilent Spectrum Analyzer -					
RL RF 5	0Ω AC	SENSE:INT	ALIGN AUTO	05:17:32 PM Sep 24, 2024	
Center Freq 2.441		Trig: Free Run	Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 1 2 3 4 5 6	Frequency
	PNO: Fas IFGain:Lo		Avginola.>100/100		
Ref Offset			Mkr1 2	.402 004 0 GHz	Auto Tun
10 dB/div Ref 20.0	10.5 dBm			2.975 dBm	
-og 10.0 11				<u>^2</u>	
	444486000044000				Center Free 2.441750000 GH
					2.441750000 GH
੶10.0 <b>                                   </b>	KRAMAAAAAAAAAAAAAAAA	┎╗╅┰╅┯┪╉┿┅╅╢╫┿╢┷╬┨╢	<del>╏║╣╢╕┍┥╝╣╕╕╹╗╢┥</del> ╊┝ <del>┝</del> ┙┥	╏┪╫╖╫┿╫┿╫╅╉╟╫┥┤	
-20.0					Start Fre
-30.0					2.400000000 GH
-40.0					
-50.0 /				hu hu	Stop Fre
-60.0					2.483500000 GH
70.0					
Start 2.40000 GHz				Stop 2.48350 GHz	05.06
Res BW 100 kHz	#	/BW 300 kHz		.000 ms (1001 pts)	CF Stej 8.350000 MH
MKR MODE TRC SCL	X		UNCTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Ma
1 N 1 f	2.402 004 0 GHz	2.975 dBm	Station Fonction wiDTH		
2 N 1 f	2.479 993 0 GHz	2.773 dBm			Freq Offse
4 5					0 H
6					
7 8					
9					
10					
•		m		•	
SG			STATUS		
SG	Нор		status T 2-DH1 2441N		
🗴 Agilent Spectrum Analyzer -	Swept SA	pping No. NVN	T 2-DH1 2441N	ИНz	
Agilent Spectrum Analyzer - RL RF 5	Swept SA i0 Ω AC		T 2-DH1 2441N	MHz 05:21:57 PM Sep 24, 2024	Frequency
Agilent Spectrum Analyzer - RL RF 5	Swept SA 10 Ω AC 1750000 GHz PNO: Fas	Diping No. NVN SENSE:INT	T 2-DH1 2441N	ИНz	
Agilent Spectrum Analyzer - RL RF 5	Swept SA i0 Ω AC 1750000 GHz	Diping No. NVN SENSE:INT	T 2-DH1 2441N ALIGN AUTO Avg Type: Log-Pwr Avg Hoid:>100/100	05:21:57 PM Sep 24, 2024 TRACE 2 3 4 5 6 TYPE DET PNNNNN	Frequency
Agilent Spectrum Analyzer - RL RF 5 Center Freq 2.441 Ref Offset	Swept SA i0 Ω AC PNO: Fas IFGain:Lo t 0.5 dB	Diping No. NVN SENSE:INT	T 2-DH1 2441N ALIGN AUTO Avg Type: Log-Pwr Avg Hoid:>100/100	05:21:57 PM Sep 24, 2024 TRACE 0 2 3 4 5 6 TYPE MWWWW DET P NNNN N 401 837 0 GHz	Frequency
Agilent Spectrum Analyzer - 5 (RL RF 5 Center Freq 2.441 Ref Offset	Swept SA i0 Ω AC PNO: Fas IFGain:Lo t 0.5 dB	Diping No. NVN SENSE:INT	T 2-DH1 2441N ALIGN AUTO Avg Type: Log-Pwr Avg Hoid:>100/100	05:21:57 PM Sep 24, 2024 TRACE 2 3 4 5 6 TYPE DET PNNNNN	Frequency
Agient Spectrum Analyzer - RL RF S Center Freq 2.441 Ref Offset 0 dB/div Ref 20.0 -0 -0 -0 -0 -0 -0 -0 -0 -0 -	Swept SA 1750000 GHz PNO: Fas IFGain:Lo t0.5 dB 10 dBm	t Trig: Free Run #Atten: 30 dB	T 2-DH1 2441N ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100 Mkr1 2	05:21:57 PM Sep 24, 2024 TRACE [] 23 4 5 6 TYPE [] 30 4 5 7 TYPE [] 30	Frequency Auto Tun
Agient Spectrum Analyzer - RL RF S Center Freq 2.441 Ref Offset 0 dB/div Ref 20.0 -0 -0 -0 -0 -0 -0 -0 -0 -0 -	Swept SA 1750000 GHz PNO: Fas IFGain:Lo t0.5 dB 10 dBm	t Trig: Free Run #Atten: 30 dB	T 2-DH1 2441N ALIGN AUTO Avg Type: Log-Pwr Avg Hoid:>100/100	05:21:57 PM Sep 24, 2024 TRACE [] 23 4 5 6 TYPE [] 30 4 5 7 TYPE [] 30	Frequency Auto Tun Center Fre
Agient Spectrum Analyzer - RL RF S Center Freq 2.441 Ref Offset 0 dB/div Ref 20.0 -0 -0 -0 -0 -0 -0 -0 -0 -0 -	Swept SA 1750000 GHz PNO: Fas IFGain:Lo t0.5 dB 10 dBm	t Trig: Free Run #Atten: 30 dB	T 2-DH1 2441N ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100 Mkr1 2	05:21:57 PM Sep 24, 2024 TRACE [] 23 4 5 6 TYPE [] 30 4 5 7 TYPE [] 30	Frequency Auto Tun Center Fre
Aglient Spectrum Analyzer - 5 R RL RF - 5 Center Freq 2.441 Ref Offset 0 dB/div Ref 20.0 - 09 10 0 - 00 -	Swept SA 1750000 GHz PNO: Fas IFGain:Lo t0.5 dB 10 dBm	t Trig: Free Run #Atten: 30 dB	T 2-DH1 2441N ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100 Mkr1 2	05:21:57 PM Sep 24, 2024 TRACE [] 23 4 5 6 TYPE [] 30 4 5 7 TYPE [] 30	Frequency Auto Tun Center Fre 2.441750000 GH
Aglent Spectrum Analyzer - 5           RL         RF           Center Freq 2.441           Ref Offset           0 dB/div           Ref 20.00           0 g           10 dB/div           0 mode           10 dB/div	Swept SA 1750000 GHz PNO: Fas IFGain:Lo t0.5 dB 10 dBm	t Trig: Free Run #Atten: 30 dB	T 2-DH1 2441N ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100 Mkr1 2	05:21:57 PM Sep 24, 2024 TRACE [] 23 4 5 6 TYPE [] 30 4 5 7 TYPE [] 30	Frequency Auto Tun Center Fre 2.441750000 GH Start Fre
R Aglient Spectrum Analyzer - 5 R RL RF - 5 Center Freq 2.441 Ref Offset 0 dB/div Ref 20.0 - 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Swept SA 1750000 GHz PNO: Fas IFGain:Lo t0.5 dB 10 dBm	t Trig: Free Run #Atten: 30 dB	T 2-DH1 2441N ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100 Mkr1 2	05:21:57 PM Sep 24, 2024 TRACE [] 23 4 5 6 TYPE [] 30 4 5 7 TYPE [] 30	Frequency Auto Tun Center Fre 2.441750000 GH Start Fre
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-20.0						Start Free 2.400000000 GHz		
-50.0						Stop Fred 2.483500000 GH:		
Start 2.40000 GHz #Res BW 100 kHz	#VBW	300 kHz			Stop 2.48350 GHz 000 ms (1001 pts)	CF Step 8.350000 MHz		
	× 402 004 0 GHz 480 160 0 GHz	Y 3.943 dBm 1.944 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Mar		
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6 7 8 9								
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MSG				STATUS				

No.: BCTC/RF-EMC-005

Page: 71 of 86



# 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).

Condition	Mode	Frequency (MHz)	Pulse Time (ms)	Total Dwell Time (ms)	Burst Count	Period Time (ms)	Limit (ms)	Verdict
NVNT	1-DH1	2441	0.383	120.645	315	31600	400	Pass
NVNT	1-DH3	2441	1.639	268.796	164	31600	400	Pass
NVNT	1-DH5	2441	2.886	320.346	111	31600	400	Pass
NVNT	2-DH1	2441	0.392	124.656	318	31600	400	Pass
NVNT	2-DH3	2441	1.644	254.82	155	31600	400	Pass
NVNT	2-DH5	2441	2.891	297.773	103	31600	400	Pass
NVNT	3-DH1	2441	0.391	124.729	319	31600	400	Pass
NVNT	3-DH3	2441	1.642	269.288	164	31600	400	Pass
NVNT	3-DH5	2441	2.893	358.732	124	31600	400	Pass

### 14.4 Test Result

Note: Total Dwell Time (ms) = Pulse Time (ms)*Burst Count