

	TEST REPOR	RT				
FCC ID:	2AQRM-O1					
Test Report No::	TCT240904E004					
Date of issue::	Sep. 10, 2024					
Testing laboratory:	SHENZHEN TONGCE TESTIN	G LAB				
Testing location/ address:	2101 & 2201, Zhenchang Factory Renshan Industrial Zone, F Subdistrict, Bao'an District, Shenzhen, Guangdong, 518103, People's Republic of China					
Applicant's name::	FOXX Development Inc.					
Address::	3480 Preston Ridge Road, Suit United States	e500, Alpharetta, Georgia	a 30005,			
Manufacturer's name:	FOXX Development Inc.					
Address:	3480 Preston Ridge Road, Suit United States	e500, Alpharetta, Georgia	a, 30005,			
Standard(s):	FCC CFR Title 47 Part 15 Subp FCC KDB 558074 D01 15.247 ANSI C63.10:2013					
Product Name::	OWS Bluetooth Headphones					
Trade Mark:	N/A					
Model/Type reference:	O1, G11-TWS					
Rating(s)::	Rechargeable Li-ion Battery DC	C 3.7V				
Date of receipt of test item ::	Sep. 04, 2024					
Date (s) of performance of test:	Sep. 04, 2024 ~ Sep. 10, 2024					
Tested by (+signature) :	: Yannie ZHONG					
Check by (+signature):	Beryl ZHAO	Boyl 16 TCT	SUIL			
Approved by (+signature):	Tomsin	Tomsin 43				

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## 1. General Product Information

## 1.1. EUT description

Product Name:	OWS Bluetooth Headphones	(25)
Model/Type reference:	01	
Sample Number:	TCT240904E004-0101	
Bluetooth Version:	V5.0 (This report is for BDR+EDR)	
Operation Frequency:	2402MHz~2480MHz	
Transfer Rate:	1/2 Mbits/s	
Number of Channel:	79	
Modulation Type:	GFSK, π/4-DQPSK	
Modulation Technology:	FHSS	
Antenna Type:	Chip Antenna	
Antenna Gain:	2.78dBi	
Rating(s):	Rechargeable Li-ion Battery DC 3.7V	-

Note: The antenna gain listed in this report is provided by applicant, and the test laboratory is not responsible for this parameter.

# 1.2. Model(s) list

No.	Model No.	Tested with
1	01	
Other models	G11-TWS	

Note: O1 is tested model, other models are derivative models. The models are identical in circuit and PCB layout, only different on the model names. So the test data of O1 can represent the remaining models.



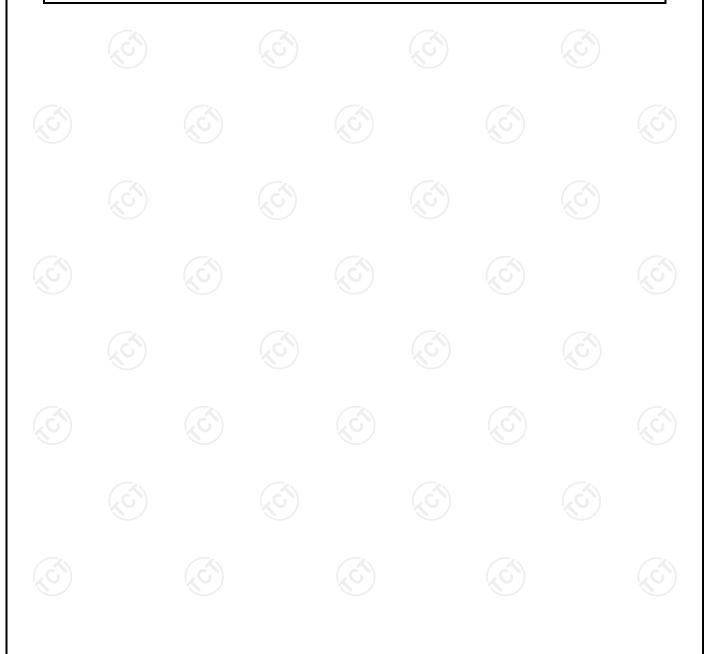
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# 1.3. Operation Frequency

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
_ 0	2402MHz	20	2422MHz	40	2442MHz	60	2462MHz
(6))1	2403MHz	21	2423MHz	41	2443MHz	61	2463MHz
·		<i></i>		<b>/</b>		·	
10	2412MHz	30	2432MHz	50	2452MHz	70	2472MHz
11	2413MHz	31	2433MHz	51	2453MHz	71	2473MHz
	<b></b>						
18	2420MHz	38	2440MHz	58	2460MHz	78	2480MHz
19	2421MHz	39	2441MHz	- 59	2461MHz	741	-

Remark: Channel 0, 39 & 78 have been tested for GFSK, π/4-DQPSK modulation mode.





# 2. Test Result Summary

Requirement	CFR 47 Section	Result	
Antenna Requirement	§15.203/§15.247 (c)	PASS	
AC Power Line Conducted Emission	§15.207	PASS	
Conducted Peak Output Power	§15.247 (b)(1)	PASS	
20dB Occupied Bandwidth	§15.247 (a)(1)	PASS	
Carrier Frequencies Separation			
Hopping Channel Number	§15.247 (a)(1)	PASS	
Dwell Time	§15.247 (a)(1)	PASS	
Radiated Emission	§15.205/§15.209	PASS	
Band Edge	§15.247(d)	PASS	

#### Note:

- 1. PASS: Test item meets the requirement.
- 2. Fail: Test item does not meet the requirement.
- 3. N/A: Test case does not apply to the test object.
- 4. The test result judgment is decided by the limit of test standard.





### 3. General Information

### 3.1. Test environment and mode

Operating Environment:						
Condition	Conducted Emission	Radiated Emission				
Temperature:	24.3 °C	25.3 °C				
Humidity:	52 % RH	52 % RH				
Atmospheric Pressure:	1010 mbar	1010 mbar				
Test Software:						
Software Information:	FCC Assist 1.0.1.1					
Power Level:	10					
Test Mode:						
Engineer mode: Keep the EUT in continuous transmitting by select channel and modulations with Fully-charged battery						

The sample was placed 0.8m & 1.5m for the measurement below & above 1GHz above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case( Z axis) are shown in Test Results of the following pages. DH1 DH3 DH5 all have been tested, only worse case DH1 is reported.

## 3.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
Adapter	QL010-0502000UU	1	/	Qingliu

#### Note:

- 1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
- Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.
- 3. For conducted measurements (Output Power, 20dB Occupied Bandwidth, Carrier Frequencies Separation, Hopping Channel Number, Dwell Time, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.

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### 4. Facilities and Accreditations

#### 4.1. Facilities

The test facility is recognized, certified, or accredited by the following organizations:

• FCC - Registration No.: 645098

SHENZHEN TONGCE TESTING LAB

**Designation Number: CN1205** 

The testing lab has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

IC - Registration No.: 10668A

SHENZHEN TONGCE TESTING LAB

CAB identifier: CN0031

The testing lab has been registered by Innovation, Science and Economic

Development Canada for radio equipment testing.

### 4.2. Location

SHENZHEN TONGCE TESTING LAB

Address: 2101 & 2201, Zhenchang Factory Renshan Industrial Zone, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, 518103, People's Republic of China

TEL: +86-755-27673339

### 4.3. Measurement Uncertainty

The reported uncertainty of measurement  $y \pm U$ , where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	± 3.10 dB
2	RF power, conducted	± 0.12 dB
3	Spurious emissions, conducted	± 0.11 dB
4	All emissions, radiated(<1 GHz)	± 4.56 dB
5	All emissions, radiated(1 GHz - 18 GHz)	± 4.22 dB
6	All emissions, radiated(18 GHz- 40 GHz)	± 4.36 dB



### 5. Test Results and Measurement Data

## 5.1. Antenna requirement

## Standard requirement: FCC Part15 C Section 15.203 /247(c)

15.203 requirement:

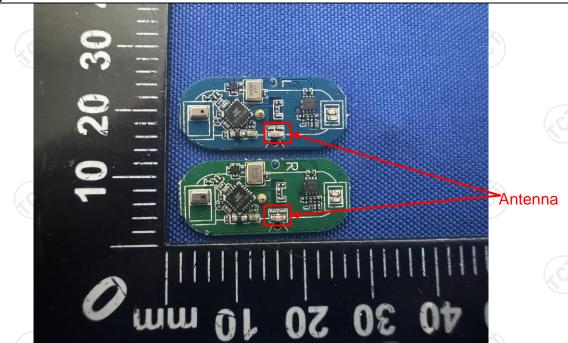
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(c) (1)(i) requirement:

(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

#### **E.U.T Antenna:**

The Bluetooth antenna is Chip antenna which permanently attached, and the best case gain of the antenna is 2.78dBi.





## 5.2. Conducted Emission

## 5.2.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.207						
Test Method:	ANSI C63.10:2013						
Frequency Range:	150 kHz to 30 MHz						
Receiver setup:	RBW=9 kHz, VBW=30 kHz, Sweep time=auto						
Limits:	Frequency range (MHz) 0.15-0.5 0.5-5 5-30	Limit ( Quasi-peak 66 to 56* 56 60	(dBuV) Average 56 to 46* 46 50				
Test Setup:	Remark E.U.T   AC power   Filter   AC power    Remark E.U.T   Equipment Under Test LISN: Line Impedence Stabilization Network Test table height=0.8m						
Test Mode:	Charging + Transmittir	ng Mode					
Test Procedure:	<ol> <li>The E.U.T is connected to an adapter through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.</li> <li>The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).</li> <li>Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement.</li> </ol>						
Test Result:	PASS						



5.2.2. Test Instruments

Report No.: TCT240904E004

Conducted Emission Shielding Room Test Site (843)									
Equipment	Manufacturer	Model	Serial Number	<b>Calibration Due</b>					
EMI Test Receiver	R&S	ESCI3	100898	Jun. 26, 2025					
LISN	Schwarzbeck	NSLK 8126	8126453	Jan. 31, 2025					
Attenuator	N/A	10dB	164080	Jun. 26, 2025					
Line-5	тст	CE-05	1	Jun. 26, 2025					
EMI Test Software	EZ_EMC	EMEC-3A1	1.1.4.2	1 6					



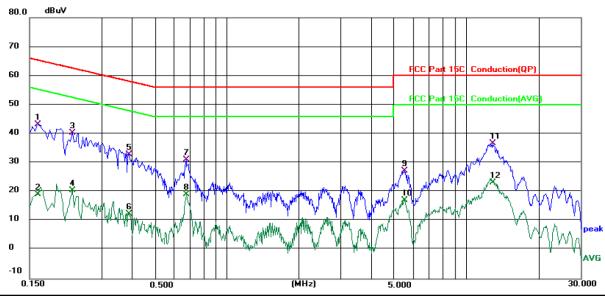




#### 5.2.3. Test data

### Please refer to following diagram for individual

### Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)



Site 844 Shielding Room

Phase: L1

Temperature: 24.3 (℃)

Humidity: 52 %

Limit: FCC Part 15C Conduction(QP)

Power: DC 5 V(Adapter Input AC 120 V/60 Hz)

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
		MHz	dBu∀	dB	dBu∀	dBu∀	dB	Detector	Comment
1	*	0.1620	33.56	9.67	43.23	65.36	-22.13	QP	
2		0.1620	9.44	9.67	19.11	55.36	-36.25	AVG	
3		0.2260	30.65	9.65	40.30	62.60	-22.30	QP	
4		0.2260	10.73	9.65	20.38	52.60	-32.22	AVG	
5		0.3892	22.82	10.04	32.86	58.08	-25.22	QP	
6		0.3892	2.26	10.04	12.30	48.08	-35.78	AVG	
7		0.6780	20.60	10.37	30.97	56.00	-25.03	QP	
8		0.6780	8.79	10.37	19.16	46.00	-26.84	AVG	
9		5.4859	17.08	10.21	27.29	60.00	-32.71	QP	
10		5.4859	6.92	10.21	17.13	50.00	-32.87	AVG	
11		12.8859	26.45	10.29	36.74	60.00	-23.26	QP	
12		12.8859	12.83	10.29	23.12	50.00	-26.88	AVG	

#### Note:

Freq. = Emission frequency in MHz

Reading level  $(dB\mu V)$  = Receiver reading

Corr. Factor (dB) = LISN factor + Cable loss

Measurement ( $dB\mu V$ ) = Reading level ( $dB\mu V$ ) + Corr. Factor (dB)

Limit (dBµV) = Limit stated in standard

 $Margin (dB) = Measurement (dB\mu V) - Limits (dB\mu V)$ 

Q.P. =Quasi-Peak

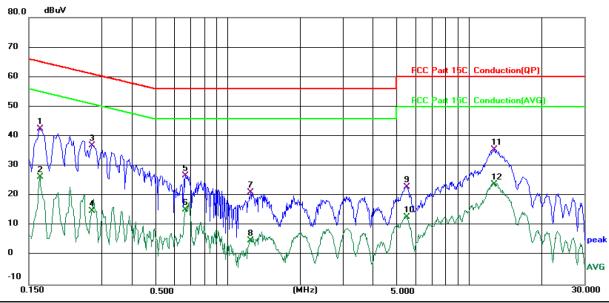
AVG =average

<sup>\*</sup> is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz





### Conducted Emission on Neutral Terminal of the power line (150 kHz to 30MHz)



Site 844 Shielding Room Phase: N Temperature: 24.3 (°C) Humidity: 52 %

Power: DC 5 V(Adapter Input AC 120 V/60 Hz)

Limit: FCC Part 15C Conduction(QP)

				. ,					
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
		MHz	dBu∀	dB	dBu∀	dBu∨	dB	Detector	Comment
1	*	0.1660	32.91	9.64	42.55	65.16	-22.61	QP	
2		0.1660	16.59	9.64	26.23	55.16	-28.93	AVG	
3		0.2740	27.37	9.64	37.01	61.00	-23.99	QP	
4		0.2740	5.28	9.64	14.92	51.00	-36.08	AVG	
5		0.6700	16.37	10.33	26.70	56.00	-29.30	QP	
6		0.6700	4.92	10.33	15.25	46.00	-30.75	AVG	
7		1.2459	11.43	9.72	21.15	56.00	-34.85	QP	
8		1.2459	-4.85	9.72	4.87	46.00	-41.13	AVG	
9		5.5060	12.93	10.14	23.07	60.00	-36.93	QP	
10		5.5060	2.60	10.14	12.74	50.00	-37.26	AVG	
11		12.7299	25.20	10.28	35.48	60.00	-24.52	QP	
12		12.7299	13.55	10.28	23.83	50.00	-26.17	AVG	

#### Note1:

Freq. = Emission frequency in MHz

Reading level  $(dB\mu V)$  = Receiver reading

Corr. Factor (dB) = LISN factor + Cable loss

Measurement ( $dB\mu V$ ) = Reading level ( $dB\mu V$ ) + Corr. Factor (dB)

Limit (dBµV) = Limit stated in standard

 $Margin (dB) = Measurement (dB\mu V) - Limits (dB\mu V)$ 

Q.P. =Quasi-Peak AVG =average

\* is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.

#### Note2:

Measurements were conducted in all three channels (high, middle, low) and three modulation (GFSK, Pi/4 DQPSK), and the worst case Mode (Lowest channel and GFSK) was submitted only.

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# 5.3. Conducted Output Power

# 5.3.1. Test Specification

A) / A)		
Test Requirement:	FCC Part15 C Section 15.247 (b)(1)	
Test Method:	KDB 558074 D01 v05r02	
Limit:	Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.	
Test Setup:	Spectrum Analyzer EUT	
Test Mode:	Transmitting mode with modulation	
Test Procedure:	Use the following spectrum analyzer settings: Span = approximately 5 times the 20 dB bandwidth centered on a hopping channel RBW > the 20 dB bandwidth of the emission being measured VBW ≥ RBW Sweep = auto Detector function = peak Trace = max hold Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission.	
Test Result:	PASS	

### 5.3.2. Test Instruments

Name	Manufacturer	Model No.	Serial Number	<b>Calibration Due</b>
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jun. 26, 2025
Combiner Box	Ascentest	AT890-RFB		1

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# 5.4. 20dB Occupy Bandwidth

# 5.4.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)		
Test Method:	KDB 558074 D01 v05r02		
Limit:	N/A (S)		
Test Setup:	Spectrum Analyzer EUT		
Test Mode:	Transmitting mode with modulation		
Test Procedure:	<ol> <li>The RF output of EUT was connected to the spectrur analyzer by RF cable. The path loss was compensated to the results for each measurement.</li> <li>Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>Use the following spectrum analyzer settings for 20dl Bandwidth measurement.         Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel; 1%≤RBW≤5% of the 20 dB bandwidth; VBW≥3RBW Sweep = auto; Detector function = peak; Trace = mahold.     </li> <li>Measure and record the results in the test report.</li> </ol>		
Test Result:	PASS		

# 5.4.2. Test Instruments

Name	Manufacturer	Model No.	Serial Number	<b>Calibration Due</b>
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jun. 26, 2025
Combiner Box	Ascentest	AT890-RFB	1	1





# 5.5. Carrier Frequencies Separation

## 5.5.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)		
Test Method:	KDB 558074 D01 v05r02		
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 125 mW.		
Test Setup:	Spectrum Analyzer EUT		
Test Mode:	Hopping mode		
Test Procedure:	<ol> <li>The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.</li> <li>Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>Enable the EUT hopping function.</li> <li>Use the following spectrum analyzer settings: Span = wide enough to capture the peaks of two adjacent channels; RBW is set to approximately 30% of the channel spacing, adjust as necessary to best identify the center of each individual channel; VBW≥RBW; Sweep = auto; Detector function = peak; Trace = max hold.</li> <li>Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Record the value in report.</li> </ol>		
Test Result:	PASS		

### 5.5.2. Test Instruments

Name	Manufacturer	Model No.	Serial Number	<b>Calibration Due</b>
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jun. 26, 2025
Combiner Box	Ascentest	AT890-RFB	1	1





# 5.6. Hopping Channel Number

# 5.6.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)		
Test Method:	KDB 558074 D01 v05r02		
Limit:	Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.		
Test Setup:	Spectrum Analyzer EUT		
Test Mode:	Hopping mode		
Test Procedure:	<ol> <li>The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.</li> <li>Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>Enable the EUT hopping function.</li> <li>Use the following spectrum analyzer settings: Span = the frequency band of operation; set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller; VBW≥RBW; Sweep = auto; Detector function = peak; Trace = max hold.</li> <li>The number of hopping frequency used is defined as the number of total channel.</li> <li>Record the measurement data in report.</li> </ol>		
Test Result:	PASS		

## 5.6.2. Test Instruments

Name	Manufacturer	Model No.	Serial Number	<b>Calibration Due</b>
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jun. 26, 2025
Combiner Box	Ascentest	AT890-RFB	/	/



### 5.7. Dwell Time

## 5.7.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	KDB 558074 D01 v05r02
Limit:	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.
Test Setup:	Spectrum Application EUT
	Spectrum Analyzer
Test Mode:	Hopping mode
Test Procedure:	<ol> <li>The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.</li> <li>Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>Enable the EUT hopping function.</li> <li>Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW shall be ≤ channel spacing and where possible RBW should be set &gt;&gt; 1 / T, where T is the expected dwell time per channel; VBW≥RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.</li> <li>Measure and record the results in the test report.</li> </ol>
Test Result:	PASS

### 5.7.2. Test Instruments

Name	Manufacturer	Model No.	Serial Number	<b>Calibration Due</b>
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jun. 26, 2025
Combiner Box	Ascentest	AT890-RFB		

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## 5.8. Pseudorandom Frequency Hopping Sequence

### Test Requirement: FCC Part15 C Section 15.247 (a)(1) requirement:

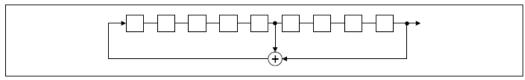
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

### **EUT Pseudorandom Frequency Hopping Sequence**

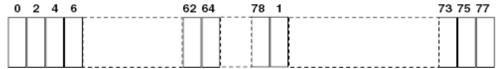
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence: 29-1 = 511 bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter. The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

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# 5.9. Conducted Band Edge Measurement

## 5.9.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (d)			
Test Method:	KDB 558074 D01 v05r02			
Limit:	In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.			
Test Setup:	Spectrum Analyzer EUT			
Test Mode:	Transmitting mode with modulation			
Test Procedure:	<ol> <li>Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>Set RBW = 100 kHz (≥1% span=10MHz), VBW = 300 kHz (≥RBW). Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.</li> <li>Enable hopping function of the EUT and then repeat step 2 and 3.</li> <li>Measure and record the results in the test report.</li> </ol>			
Test Result:	PASS (C)			

### 5.9.2. Test Instruments

Name	Manufacturer	Model No.	Serial Number	<b>Calibration Due</b>
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jun. 26, 2025
Combiner Box	Ascentest	AT890-RFB	3 1	(3)

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# **5.10. Conducted Spurious Emission Measurement**

# 5.10.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB 558074 D01 v05r02
Limit:	In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.
Test Setup:	Spectrum Analyzer EUT
Test Mode:	Transmitting mode with modulation
Test Procedure:	<ol> <li>The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.</li> <li>Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.</li> <li>Measure and record the results in the test report.</li> <li>The RF fundamental frequency should be excluded against the limit line in the operating frequency band.</li> </ol>
Test Result:	PASS

### 5.10.2. Test Instruments

Name	Manufacturer	Model No.	Serial Number	<b>Calibration Due</b>
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jun. 26, 2025
Combiner Box	Ascentest	AT890-RFB		

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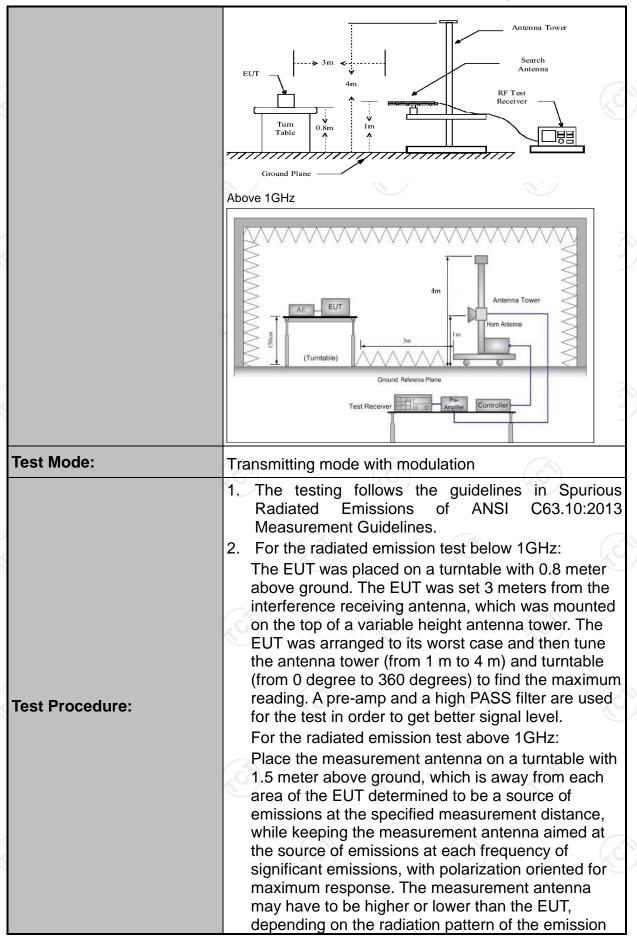
# **5.11. Radiated Spurious Emission Measurement**

# 5.11.1. Test Specification

			/						
Test Requirement:	FCC Part15	C Sectio	n 15.209			180			
Test Method:	ANSI C63.10	0:2013							
Frequency Range:	9 kHz to 25 (	GHz							
Measurement Distance:	3 m				10	)			
Antenna Polarization:	Horizontal &	Vertical							
	Frequency 9kHz- 150kHz	Detector Quasi-pea		VBW 1kHz	_	Remark si-peak Value			
Receiver Setup:	150kHz- 30MHz	Quasi-pea		30kHz		si-peak Value			
	30MHz-1GHz	Quasi-pea		300KHz		si-peak Value			
	Above 1GHz	Peak	1MHz	3MHz		eak Value			
		Peak	1MHz	10Hz	Ave	erage Value			
	Frequen	ісу	Field Stre (microvolts	-		asurement nce (meters)			
	0.009-0.4	490	2400/F(I	(Hz)		300			
	0.490-1.7	705	24000/F(	KHz)		30			
	1.705-3	30	30			30			
	30-88		100			3			
	88-216		150		(c	3			
Limit:	216-96		200			3			
	Above 9	60	500			3			
	Frequency		eld Strength rovolts/meter)	Measure Distan (mete	ice	Detector			
	Above 4CU		500	3		Average			
	Above 1GH	2	5000	3		Peak			
	For radiated emis	ssions below	w 30MHz						
	*	Computer							
Test setup:	C.Sm Turn table Pre -Amplifier  Receiver  Ground Plane								
	30MHz to 1GHz								
\(\lambda\)		<b>X</b> \							









maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.  3. Set to the maximum power setting and enable to EUT transmit continuously.  4. Use the following spectrum analyzer settings:  (1) Span shall wide enough to fully capture the emission being measured;  (2) Set RBW=120 kHz for f < 1 GHz, RBW=1MH for f>1GHz; VBW≥RBW;  Sweep = auto; Detector function = peak; Trate = max hold for peak  (3) For average measurement: use duty cycle correction factor method per  15.35(c). Duty cycle = On time/100 millisecond	TESTING CENTRE TECHNOLOGY	кероп No.: ТСТ240904Е0
<ul> <li>4. Use the following spectrum analyzer settings: <ul> <li>(1) Span shall wide enough to fully capture the emission being measured;</li> <li>(2) Set RBW=120 kHz for f &lt; 1 GHz, RBW=1MH for f&gt;1GHz; VBW≥RBW;</li> <li>Sweep = auto; Detector function = peak; Tra = max hold for peak</li> <li>(3) For average measurement: use duty cycle correction factor method per</li> <li>15.35(c). Duty cycle = On time/100 millisecon On time =N1*L1+N2*L2++Nn-1*LNn-1+Nn* Where N1 is number of type 1 pulses, L1 is length of type 1 pulses, etc. <ul> <li>Average Emission Level = Peak Emission Level + 20*log(Duty cycle)</li> <li>Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level</li> </ul> </li> </ul></li></ul>		receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.  3. Set to the maximum power setting and enable the
(3) For average measurement: use duty cycle correction factor method per 15.35(c). Duty cycle = On time/100 millisecon On time =N1*L1+N2*L2++Nn-1*LNn-1+Nn* Where N1 is number of type 1 pulses, L1 is length of type 1 pulses, etc.  Average Emission Level = Peak Emission Level + 20*log(Duty cycle)  Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level		<ul> <li>4. Use the following spectrum analyzer settings: <ol> <li>Span shall wide enough to fully capture the emission being measured;</li> <li>Set RBW=120 kHz for f &lt; 1 GHz, RBW=1MHz for f&gt;1GHz; VBW≥RBW;</li> <li>Sweep = auto; Detector function = peak; Trace</li> </ol> </li></ul>
Loss + Read Level - Preamp Factor = Level		(3) For average measurement: use duty cycle correction factor method per 15.35(c). Duty cycle = On time/100 milliseconds On time =N1*L1+N2*L2++Nn-1*LNn-1+Nn*Ln Where N1 is number of type 1 pulses, L1 is length of type 1 pulses, etc.  Average Emission Level = Peak Emission
Test results: PASS		
	Test results:	PASS





### 5.11.2. Test Instruments

	Radiated Er	nission Test Sit	e (966)	
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESCI7	100529	Jan. 31, 2025
Spectrum Analyzer	R&S	FSQ40	200061	Jun. 26, 2025
Pre-amplifier	HP	8447D	2727A05017	Jun. 26, 2025
Pre-amplifier	SKET	LNPA_0118G- 45	SK202101210 2	Jan. 31, 2025
Pre-amplifier	SKET	LNPA_1840G- 50	SK202109203 500	Jan. 31, 2025
Loop antenna	Schwarzbeck	FMZB1519B	00191	Jun. 26, 2025
Broadband Antenna	Schwarzbeck	VULB9163	340	Jun. 28, 2025
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Jun. 28, 2025
Horn Antenna	Schwarzbeck	BBHA 9170	00956	Feb. 02, 2025
Coaxial cable	SKET	RE-03-D	/	Jun. 26, 2025
Coaxial cable	SKET	RE-03-M	) /	Jun. 26, 2025
Coaxial cable	SKET	RE-03-L	/	Jun. 26, 2025
Coaxial cable	SKET	RE-04-D	(3)	Jun. 26, 2025
Coaxial cable	SKET	RE-04-M		Jun. 26, 2025
Coaxial cable	SKET	RE-04-L	/	Jun. 26, 2025
Antenna Mast	Keleto	RE-AM	) ,	(6)
EMI Test Software	EZ_EMC	FA-03A2 RE+	1.1.4.2	/

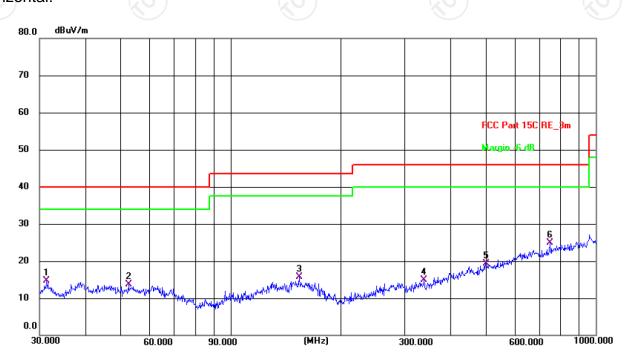


#### 5.11.3. Test Data

### Please refer to following diagram for individual

Horizontal:

**Below 1GHz** 



Site 3m Anechoic Chamber2 Polarization: Horizontal Temperature: 25.3(C) Humidity: 52 %

Power: DC 3.7 V

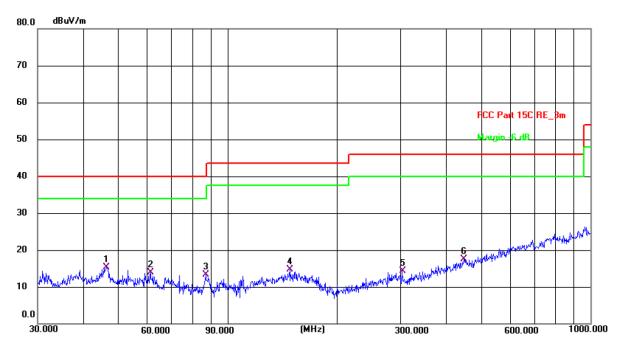
Limit: FCC Part 15C RE\_3m

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1	31.3992	34.08	-19.46	14.62	40.00	-25.38	QP	Р	
2	52.5753	32.70	-18.95	13.75	40.00	-26.25	QP	Р	
3	154.2785	32.75	-16.99	15.76	43.50	-27.74	QP	Р	
4	338.4000	31.93	-17.12	14.81	46.00	-31.19	QP	Р	
5	499.4246	31.43	-12.22	19.21	46.00	-26.79	QP	Р	
6 *	750.1082	32.61	-7.61	25.00	46.00	-21.00	QP	Р	





#### Vertical:



Site 3m Anechoic Chamber2 Polarization: Vertical Temperature: 25.3(C) Humidity: 52 %

Limit: FCC Part 15C RE\_3m

Power: DC 3.7 V

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1 *	46.3402	34.05	-18.67	15.38	40.00	-24.62	QP	Р	
2	61.3463	32.96	-19.01	13.95	40.00	-26.05	QP	Р	
3	87.1117	35.54	-22.30	13.24	40.00	-26.76	QP	Р	
4	148.4410	32.09	-17.47	14.62	43.50	-28.88	QP	Р	
5	302.4812	32.09	-17.80	14.29	46.00	-31.71	QP	Р	
6	447.9822	31.15	-13.58	17.57	46.00	-28.43	QP	Р	

**Note:** 1.The low frequency, which started from 9KHz~30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

2. Measurements were conducted in all three channels (high, middle, low) and three modulation (GFSK, Pi/4 DQPSK), and the worst case Mode (Lowest channel and GFSK) was submitted only.

3. Freq. = Emission frequency in MHz

Measurement  $(dB\mu V/m)$  = Reading level  $(dB\mu V)$  + Corr. Factor (dB) Correction Factor= Antenna Factor + Cable loss - Pre-amplifier

Limit (dBμV/m) = Limit stated in standard

Over (dB) = Measurement  $(dB\mu V/m)$  – Limits  $(dB\mu V/m)$ 

\* is meaning the worst frequency has been tested in the test frequency range.

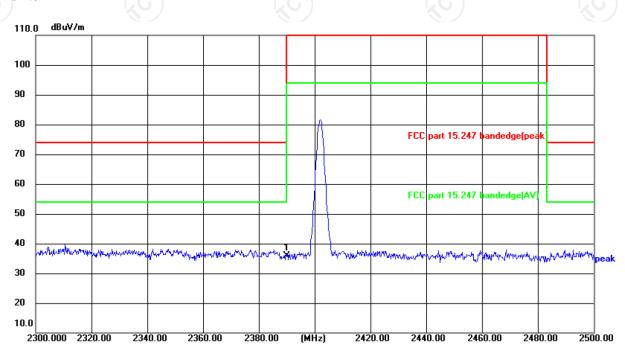
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### Test Result of Radiated Spurious at Band edges

#### Lowest channel 2402:

Horizontal:



Site: 3m Anechoic Chamber Polarization: Horizontal Temperature: 25.8(°C) Humidity: 54 %

Limit: FCC part 15.247 bandedge(peak)

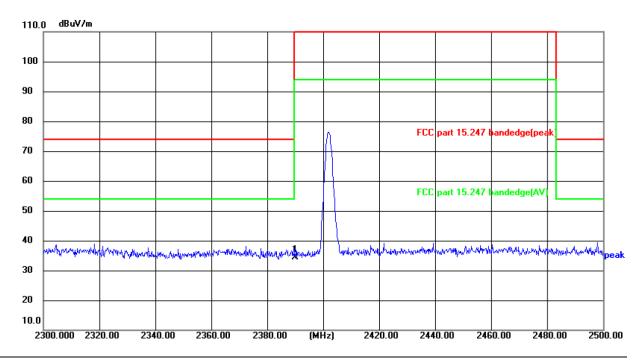
Power: DC 3.7 V

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1 *	2390.000	52.99	-17.10	35.89	74.00	-38.11	peak	Р	





### Vertical:



Site: 3m Anechoic Chamber Polarization: Vertical Temperature: 25.8(°C) Humidity: 54 %

Limit: FCC part 15.247 bandedge(peak)

No.	Frequency (MHz)	Reading (dBuV)		Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1 *	2390.000	51.37	-17.10	34.27	74.00	-39.73	peak	Р	

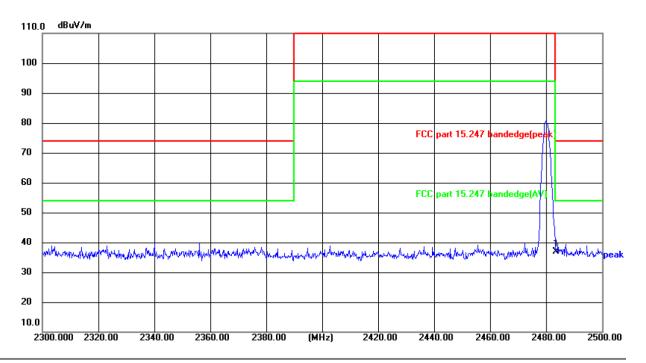
Power: DC 3.7 V





## Highest channel 2480:

#### Horizontal:



Site: 3m Anechoic Chamber

Polarization: Horizontal

Temperature: 25.8(°C)

Humidity: 54 %

Limit: FCC part 15.247 bandedge(peak)

Power: DC 3.7 V

No.	Frequency (MHz)	Reading (dBuV)		Level (dBuV/m)		Margin (dB)	Detector	P/F	Remark
1 *	2483.500	53.79	-16.88	36.91	74.00	-37.09	peak	Р	































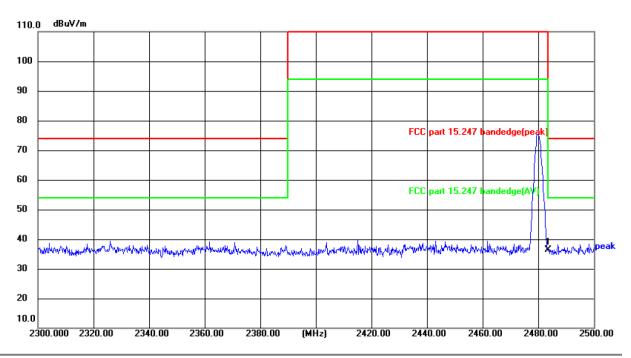








#### Vertical:



Site: 3m Anechoic Chamber

Polarization: Vertical

Temperature: 25.8(°C)

Humidity: 54 %

Limit: FCC part 15.247 bandedge(peak)

Power:DC 3.7 V

No.	Frequency (MHz)	Reading (dBuV)		Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1 *	2483.500	53.26	-16.88	36.38	74.00	-37.62	peak	Р	

**Note:** Measurements were conducted in all three modulation (GFSK, Pi/4 DQPSK), and the worst case Mode (GFSK) was submitted only.







































#### **Above 1GHz**

Modulation Type: GFSK									
Low channel: 2402 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBuV)	Correction Factor (dB/m)	Peak	n Level AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)
4804	Н	55.36		-9.51	45.85		74	54	-8.15
7206	Н	46.81	-	-1.41	45.40		74	54	-8.60
	Н						-	7-7	
(									
4804	V	56.86		-9.51	47.35	<u></u>	74	54	-6.65
7206	V	47.25	-	-1.41	45.84		74	54	-8.16
	V								

Middle cha	nnel: 2441	MHz		1/20	5)		((0))		KC
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBµV)	Correction Factor (dB/m)	Emissic Peak (dBµV/m)	n Level AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)
4882	H	55.12	/	-9.36	45.76	<b></b>	74	54	-8.24
7323	(OH)	47.99	-120	-1.14	46.85	(C) 1/2	74	54	-7.15
	H					<u> </u>			
4882	V	56.57		-9.36	47.21		74	54	-6.79
7323	V	46.36		-1.14	45.22		74	54	-8.78
)	V	\ <u></u>			)		\\ <u></u>		

High channel: 2480 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBµV)	Correction Factor (dB/m)	Emissic Peak (dBµV/m)	AV	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)
4960	Н	54.18		-9.20	44.98		74	54	-9.02
7440	Н	45.65		-0.96	44.69		74	54	-9.31
	Н				7				
(6)									
4960	V	54.99		-9.20	45.79		74	54	-8.21
7440	V	46.45		-0.96	45.49		74	54	-8.51
	V								

#### Note:

- 1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss Pre-amplifier
- 2.  $Margin (dB) = Emission Level (Peak) (dB\mu V/m)-Average limit (dB\mu V/m)$
- 3. The emission levels of other frequencies are very lower than the limit and not show in test report.
- 4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency.
- 5. Data of measurement shown "---"in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.
- 6. Measurements were conducted in all three modulation (GFSK, Pi/4 DQPSK), and the worst case Mode (GFSK) was submitted only.
- 7. All the restriction bands are compliance with the limit of 15.209.





# **Appendix A: Test Result of Conducted Test**

**Maximum Conducted Output Power** 

Condition	Mode	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	1-DH1	2402	6.77	30	Pass
NVNT	1-DH1	2441	6.76	30	Pass
NVNT	1-DH1	2480	6.07	30	Pass
NVNT	2-DH1	2402	6.63	21	Pass
NVNT	2-DH1	2441	6.53	21	Pass
NVNT	2-DH1	2480	5.84	21	Pass









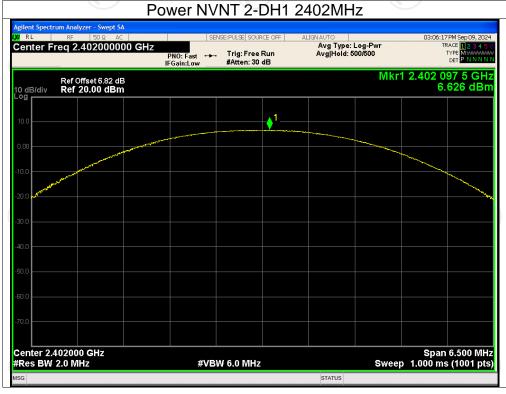
### Power NVNT 1-DH1 2441MHz







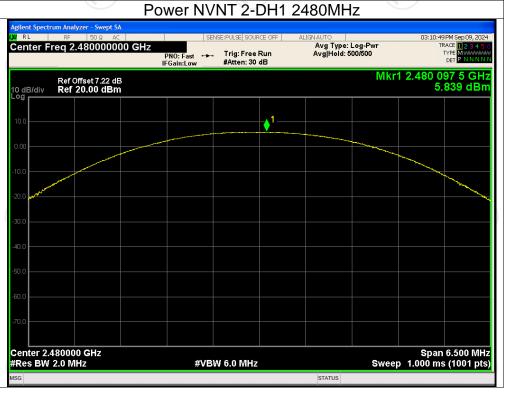








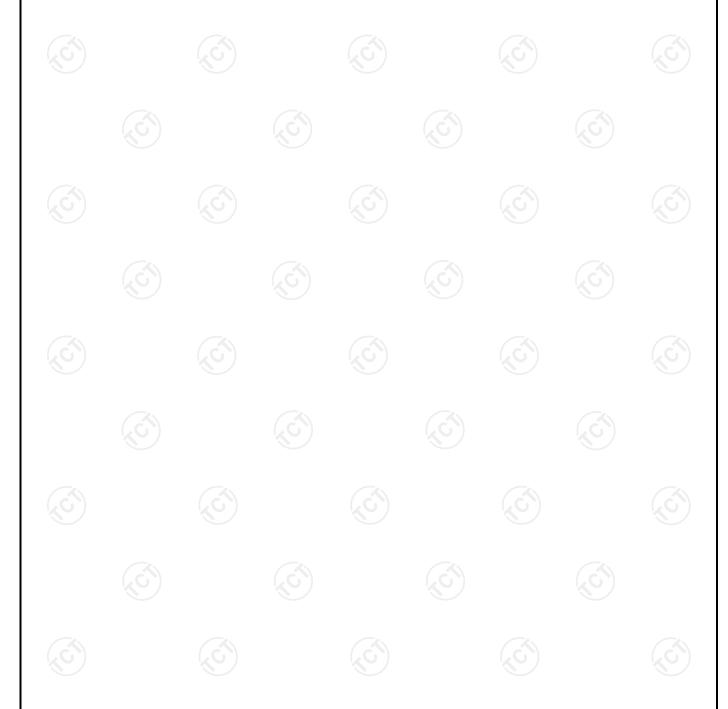






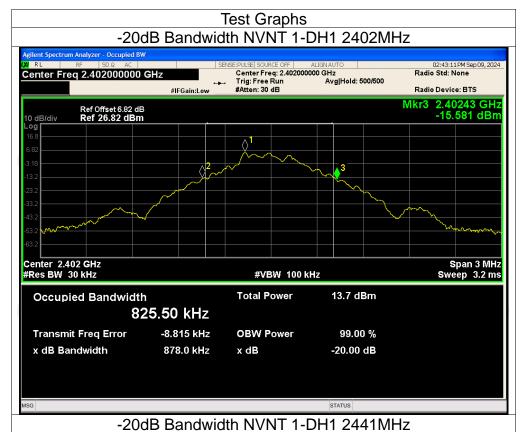
### -20dB Bandwidth

Condition	Mode	Frequency (MHz)	-20 dB Bandwidth (MHz)	Verdict
NVNT	1-DH1	2402	0.878	Pass
NVNT	1-DH1	2441	0.878	Pass
NVNT	1-DH1	2480	0.926	Pass
NVNT	2-DH1	2402	1.273	Pass
NVNT	2-DH1/	2441	1.265	Pass
NVNT	2-DH1	2480	1.254	Pass









#### 02:47:17 PM Sep 09, 2024 | ALIGNAUTO | Center Freq: 2.441000000 GHz | Trig: Free Run | Avg|Hold: 500/500 #Atten: 30 dB Center Freq 2.441000000 GHz Radio Std: None #IFGain:Low Mkr3 2.44143 GHz -15.208 dBm Ref Offset 7.14 dB Ref 27.14 dBm Center 2.441 GHz #Res BW 30 kHz Span 3 MHz Sweep 3.2 ms #VBW 100 kHz **Total Power** 13.7 dBm Occupied Bandwidth 838.11 kHz -8.768 kHz **OBW Power** 99.00 % Transmit Freq Error 877.9 kHz x dB -20.00 dB x dB Bandwidth

STATUS











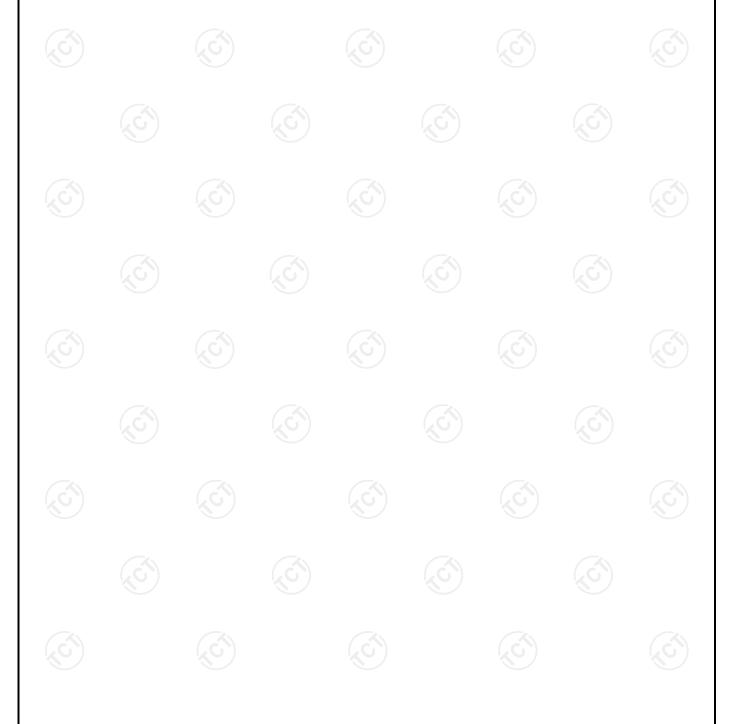






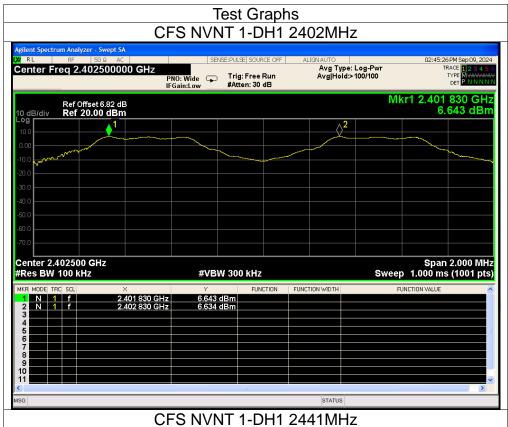
**Carrier Frequencies Separation** 

			1			
Condition	Mode	Hopping Freq1	Hopping Freq2	HFS	Limit	Verdict
		(MHz)	(MHz)	(MHz)	(MHz)	
NVNT	1-DH1	2401.83	2402.830	1.000	0.926	Pass
NVNT	1-DH1	2440.83	2441.836	1.006	0.926	Pass
NVNT	1-DH1	2478.83	2479.832	1.002	0.926	Pass
NVNT	2-DH1	2401.826	2402.830	1.004	0.849	Pass
NVNT	2-DH1	2440.99	2441.986	0.996	0.849	Pass
NVNT	2-DH1	2478.988	2479.982	0.994	0.849	Pass





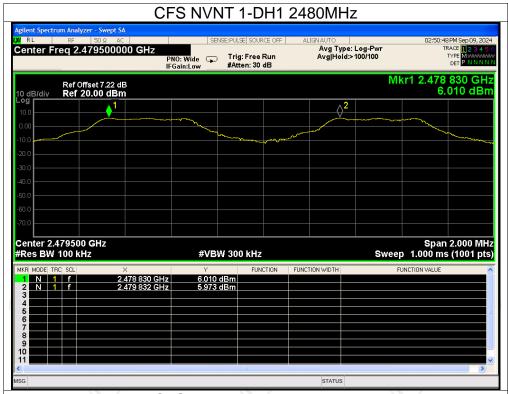


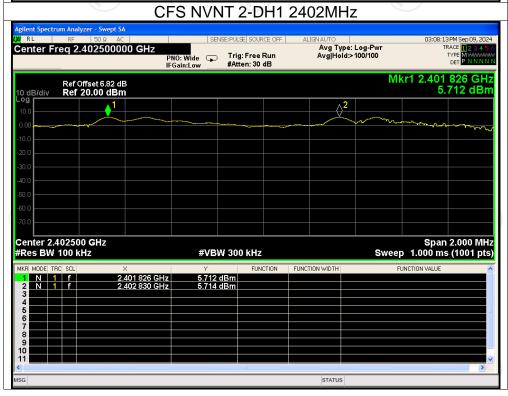


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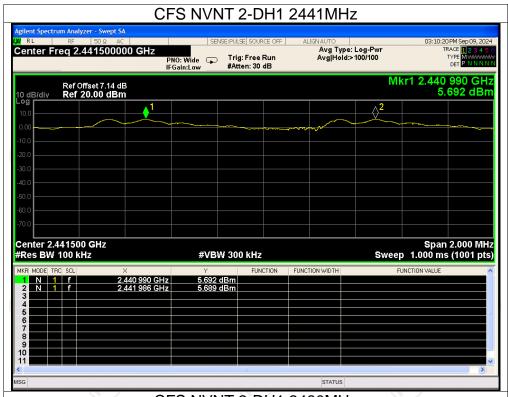


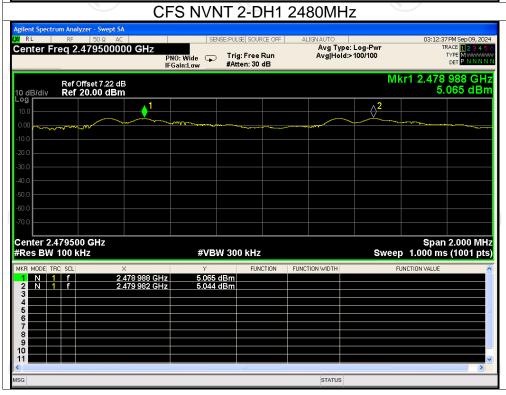








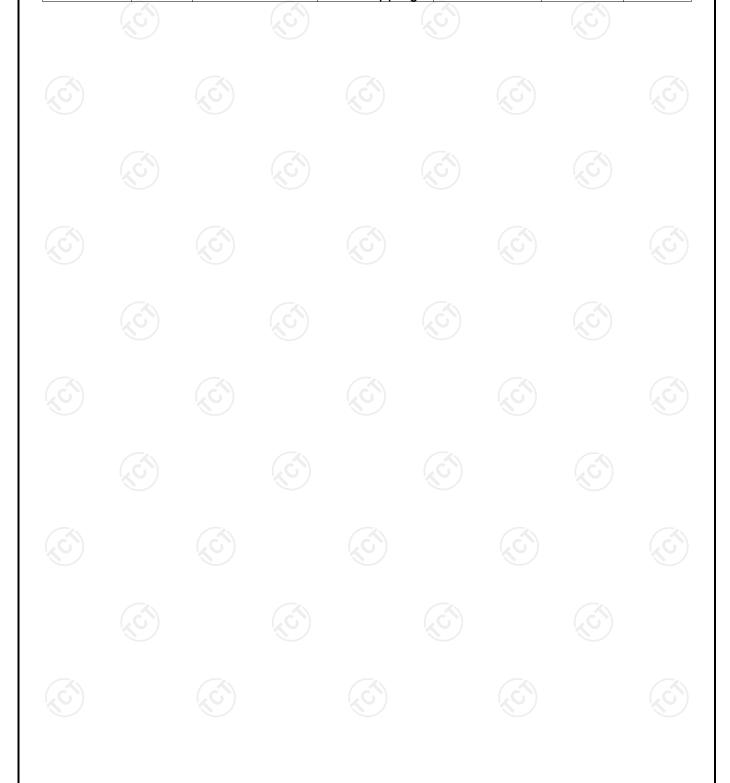




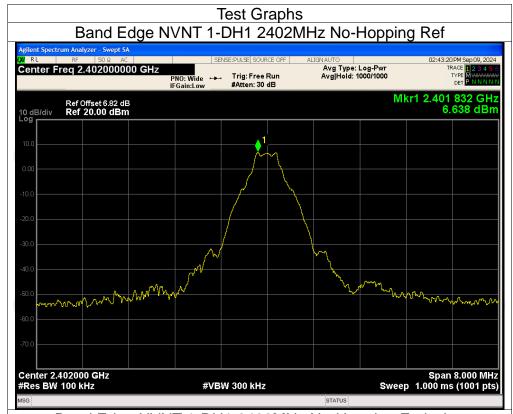


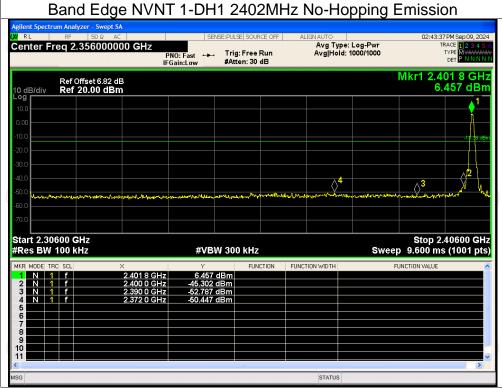
**Band Edge** 

Condition	Mode	Frequency (MHz)	Hopping Mode	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	1-DH1	2402	No-Hopping	-57.08	-20	Pass
NVNT	1-DH1	2480	No-Hopping	-56.26	-20	Pass
NVNT	2-DH1	2402	No-Hopping	-56.51	-20	Pass
NVNT	2-DH1	2480	No-Hopping	-55.72	-20	Pass

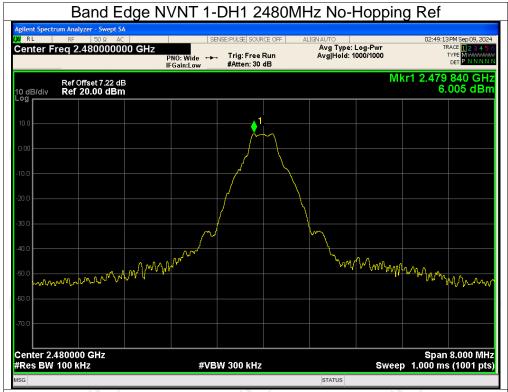


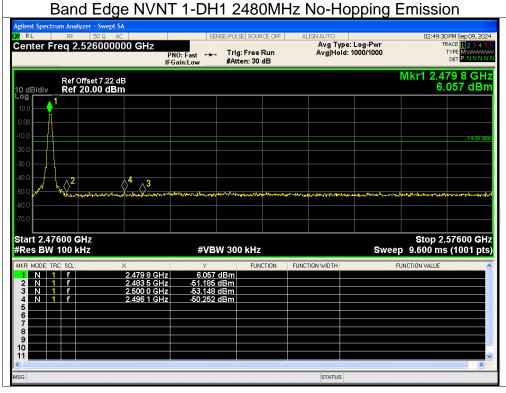




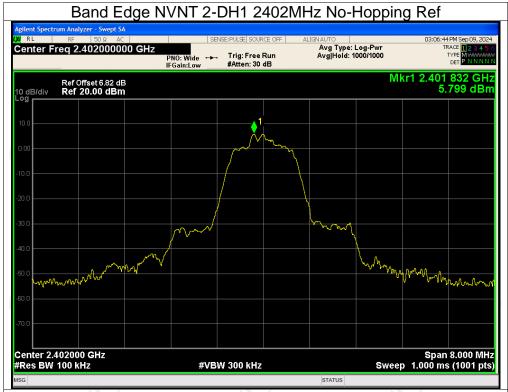


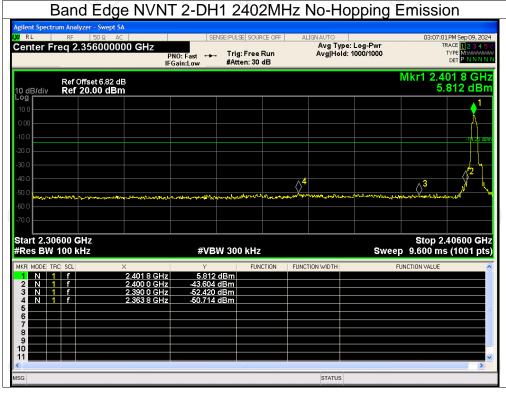




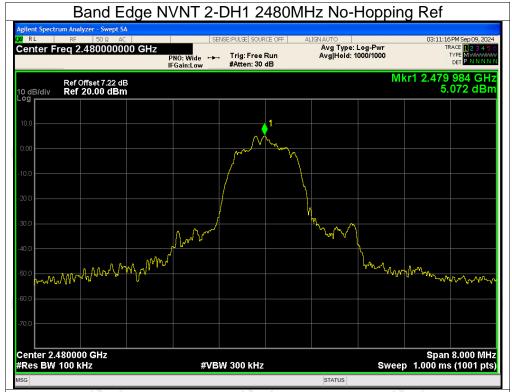


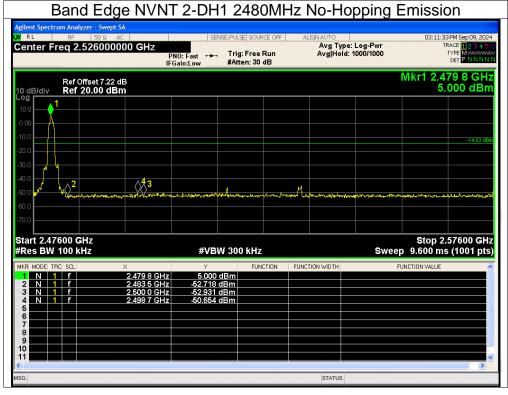








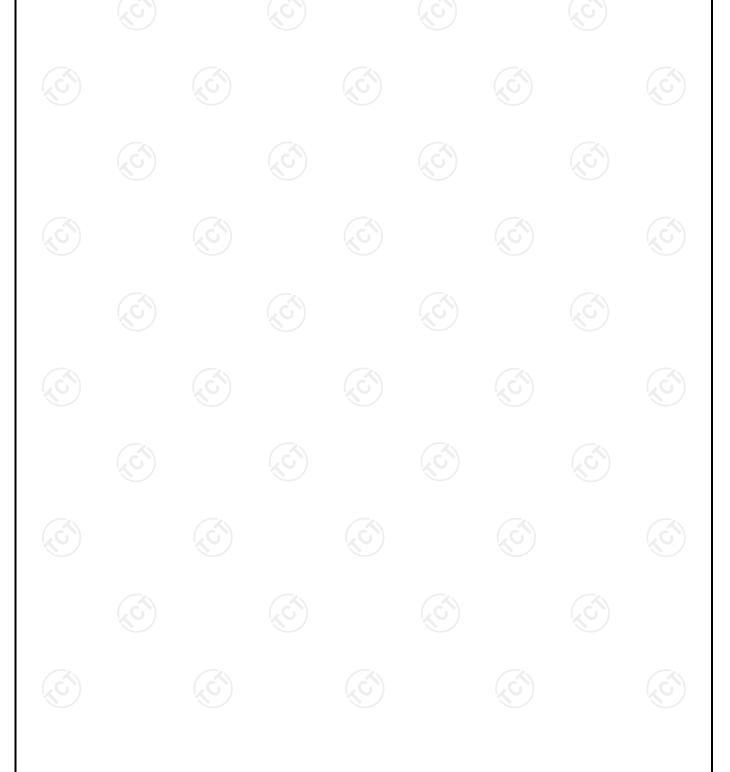






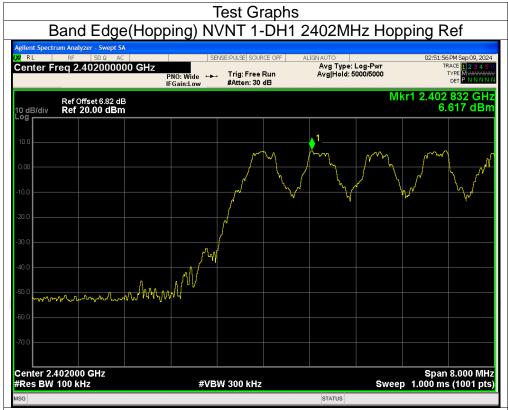
**Band Edge(Hopping)** 

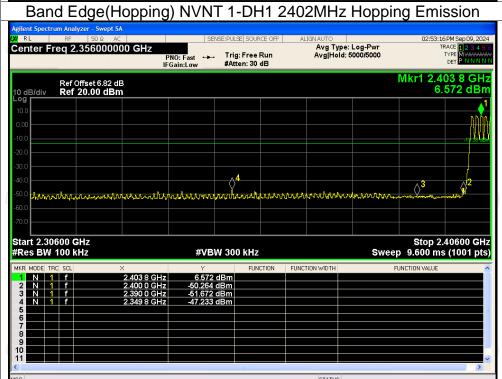
Condition	Mode	Frequency (MHz)	Hopping Mode	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	1-DH1	2402	Hopping	-53.85	-20	Pass
NVNT	1-DH1	2480	Hopping	-55.76	-20	Pass
NVNT	2-DH1	2402	Hopping	-52.22	-20	Pass
NVNT	2-DH1	2480	Hopping	-53.23	-20	Pass







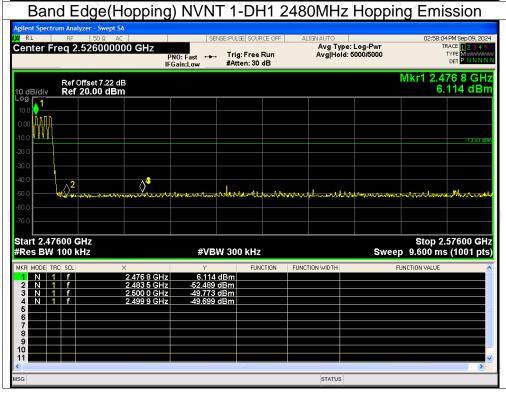








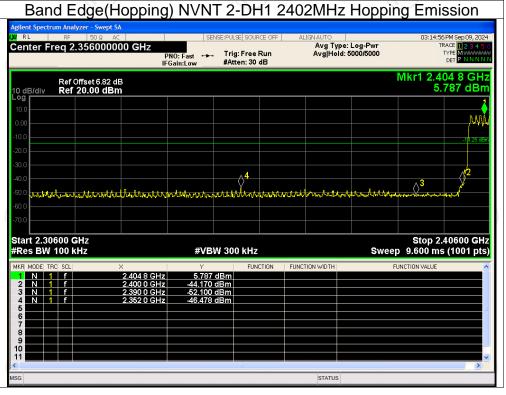








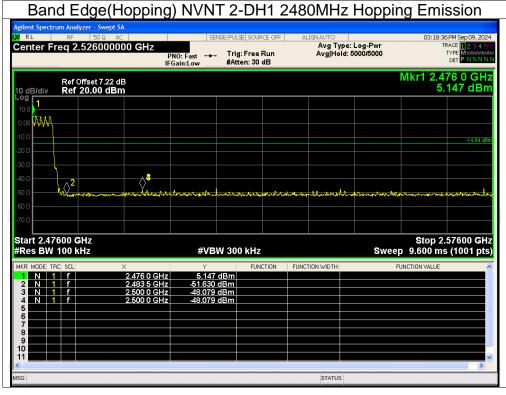








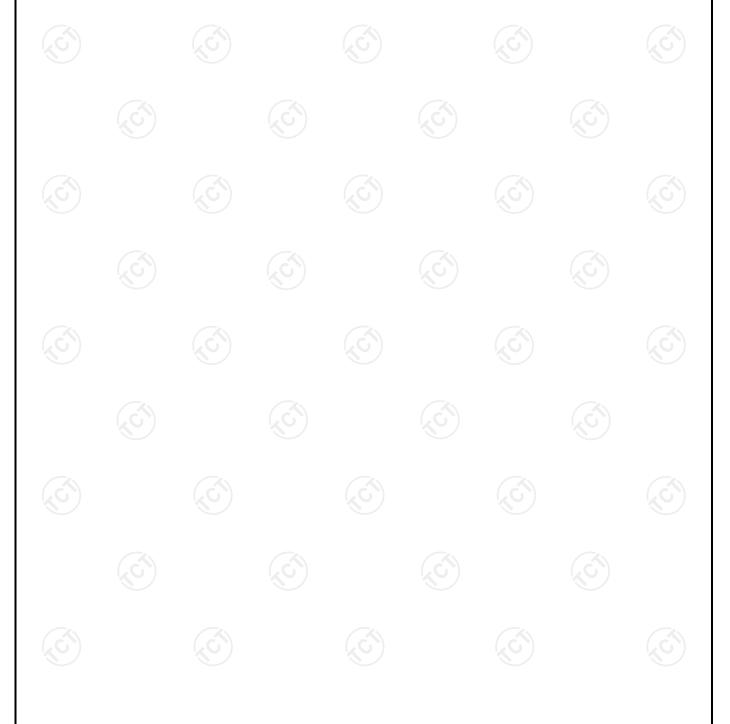




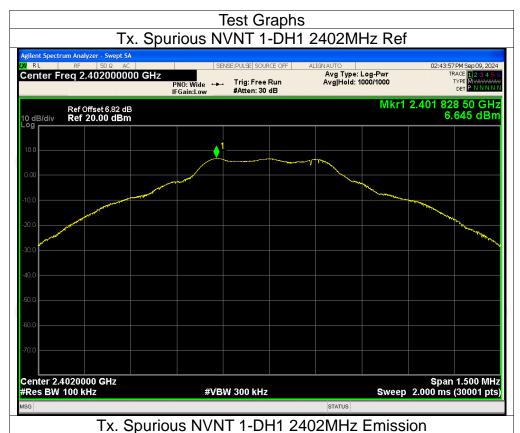


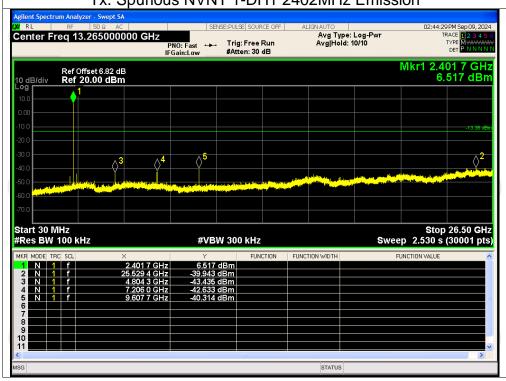
**Conducted RF Spurious Emission** 

Condition	Mode	Frequency (MHz)	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	1-DH1	2402	-46.58	-20	Pass
NVNT	1-DH1	2441	-45.64	-20	Pass
NVNT	1-DH1	2480	-45.06	-20	Pass
NVNT	2-DH1	2402	-45.81	-20	Pass
NVNT	2-DH1	2441	-46.33	-20	Pass
NVNT	2-DH1	2480	-43.92	-20	Pass



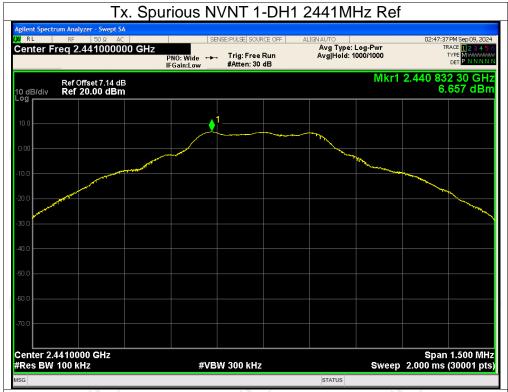


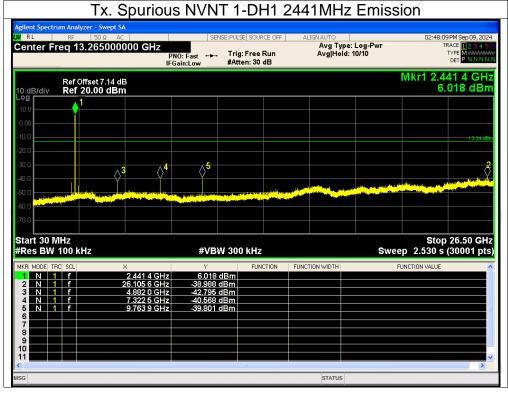






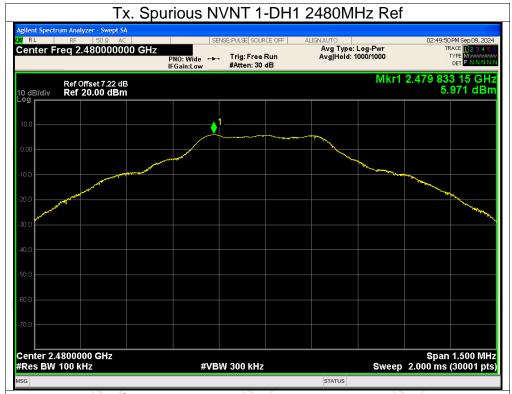


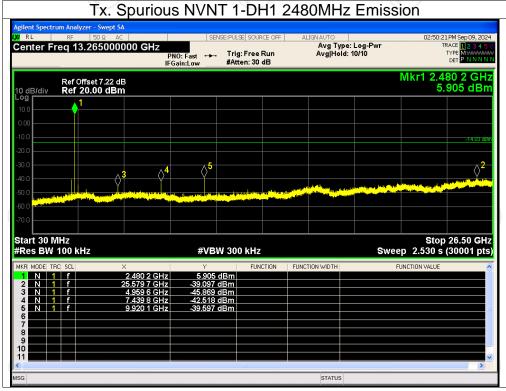








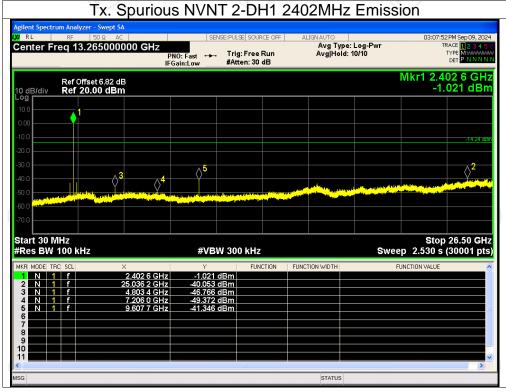








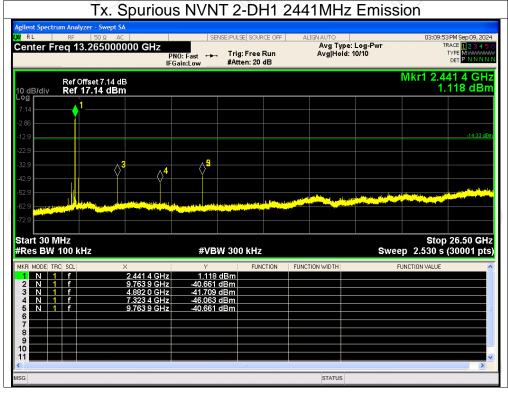








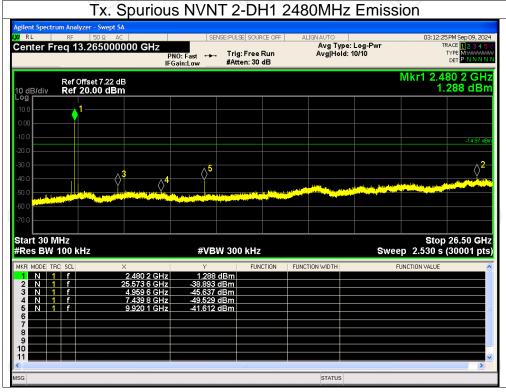








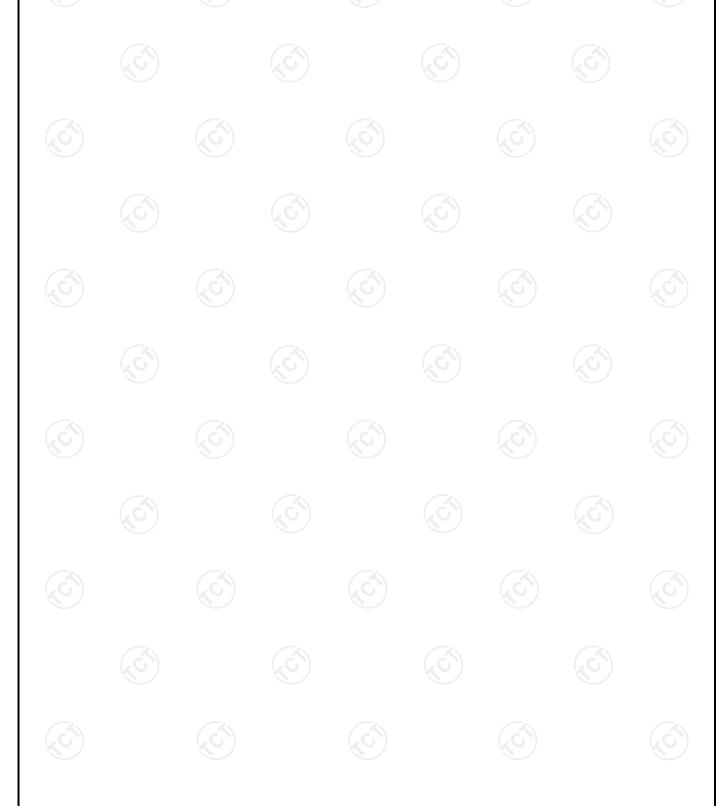






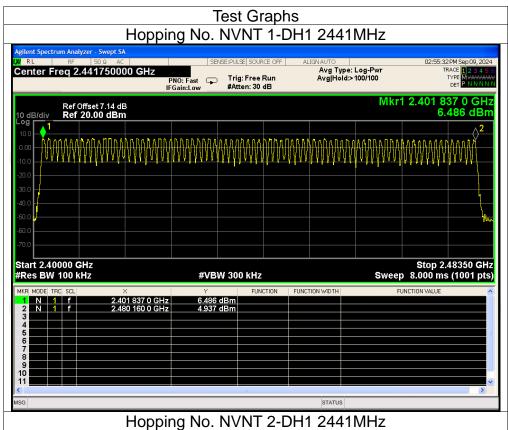
**Number of Hopping Channel** 

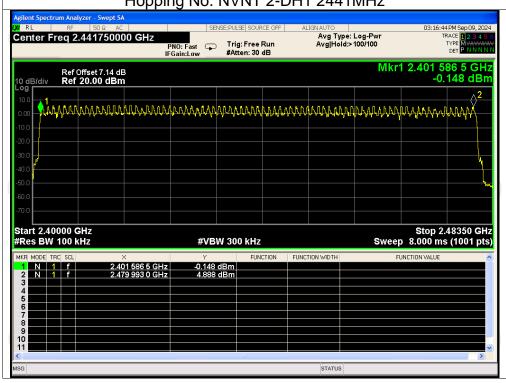
Condition Mode		Hopping Number	Limit	Verdict	
NVNT	1-DH1	79	15	Pass	
NVNT	2-DH1	79	15	Pass	













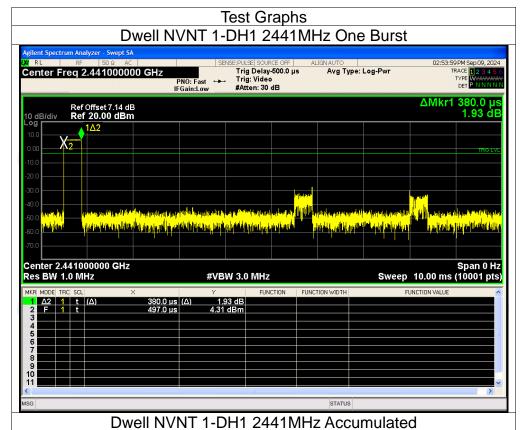
#### **Dwell Time**

Condition	Mode	Frequency (MHz)	Pulse Time (ms)	Total Dwell Time (ms)	Burst Count	Period Time (ms)	Limit (ms)	Verdict
NVNT	1-DH1	2441	0.38	120.46	317	31600	400	Pass
NVNT	1-DH3	2441	1.64	267.32	163	31600	400	Pass
NVNT	1-DH5	2441	2.89	294.78	102	31600	400	Pass
NVNT	2-DH1	2441	0.39	124.41	319	31600	400	Pass
NVNT	2-DH3	2441	1.64	252.56	154	31600	400	Pass
NVNT	2-DH5	2441	2.89	271.66	94	31600	400	Pass





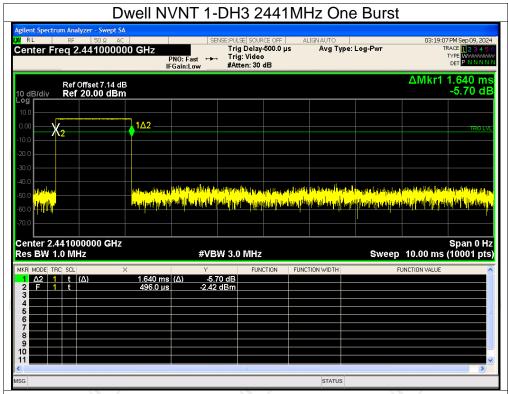


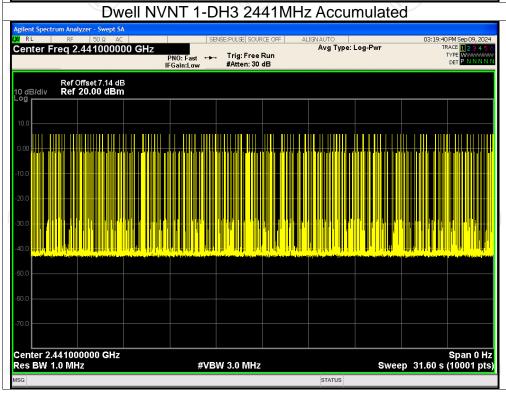


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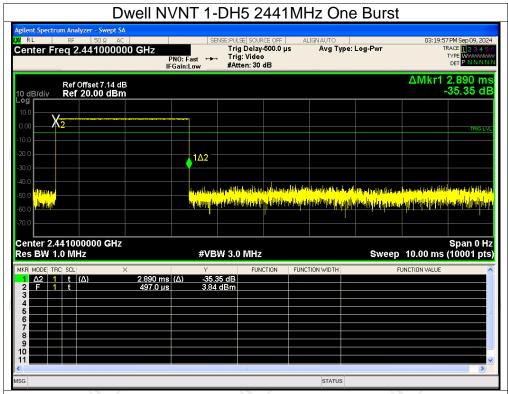


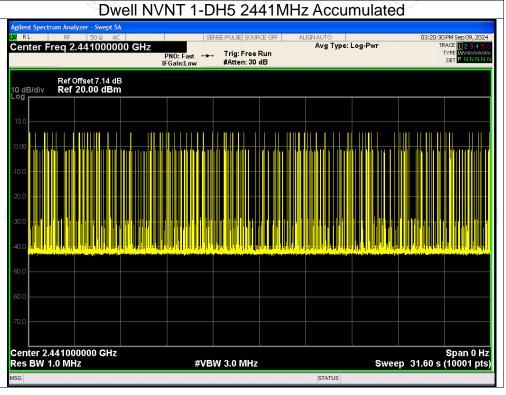






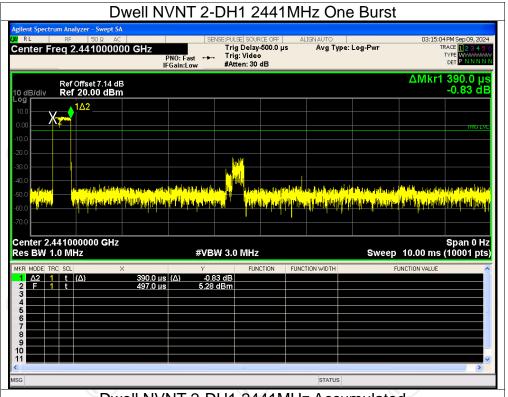


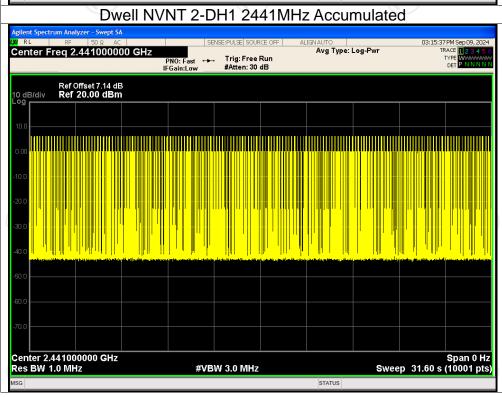






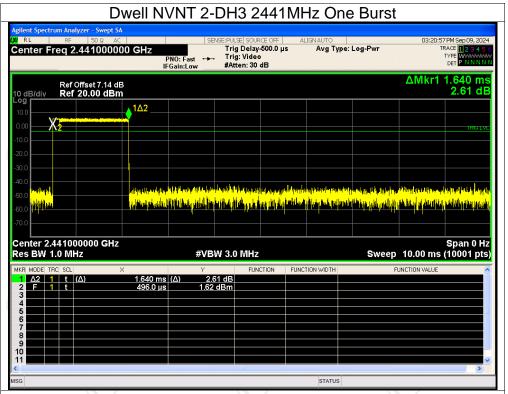


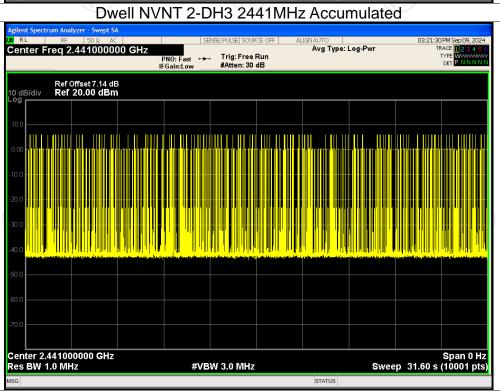






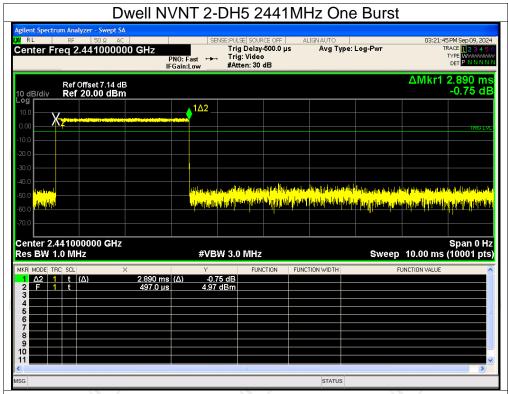


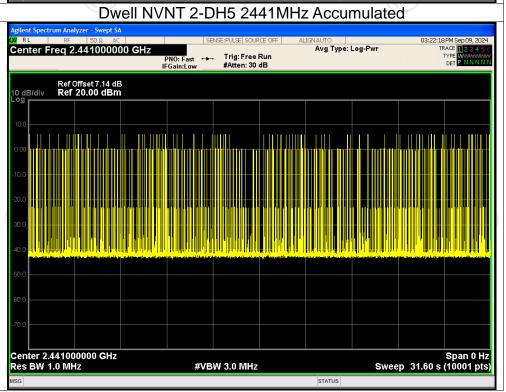














### **Appendix B: Photographs of Test Setup**

Please refer to document Appendix No.: TCT240904E004-A.

## Appendix C: Photographs of EUT

Please refer to document Appendix No.: TCT240904E004-B & TCT240904E004-C.

