Radio Test Report

FCC ID: 2AXLH-C882

Original Grant

Report No.	:	TBR-C-202206-0121-1
Applicant	:	Shenzhen Xiantaistar Technology Co., Ltd
Equipment Under Test (EUT)		
EUT Name	:	wireless mouse
Model No.	:	C882
Series Model No.	:	C881, C883, C885, C886, C887, C889
Brand Name	:	----
Sample ID	:	RW-C-202206-0121-1-1# RW-C-202206-0121-1-2#
Receipt Date	:	2022-06-27
Test Date	:	2022-06-27 to 2022-08-01
Issue Date	:	2022-08-02
Standards	:	FCC Part 15, Subpart C 15.247
Test Method	:	ANSI C63.10: 2013
Conclusions	:	**PASS**

In the configuration tested, the EUT complied with the standards specified above.

Test/Witness Engineer	:	Wade. Lv
Engineer Supervisor	:	Ivan Su
Engineer Manager	:	Ray Lai

Wade. Lv

Ivan Su

Ray Lai

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in the report.

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Contents

Revision History

Report No.	Version	Description	Issued Date
TBR-C-202206-0121-1	Rev.01	Initial issue of report	2022-08-02

1. General Information about EUT

1.1 Client Information

Applicant	:	Shenzhen Xiantaistar Technology Co., Ltd
Address	:	201&401, No.528 Pinglong East Rd, Pinghu Street, Longgang District Shenzhen, China
Manufacturer	:	Shenzhen Xiantaistar Technology Co., Ltd
Address	:	201&401, No.528 Pinglong East Rd, Pinghu Street, Longgang District Shenzhen, China

1.2 General Description of EUT (Equipment Under Test)

EUT Name	:	wireless mouse	
Models No.	:	C882, C881, C883, C885, C886, C887, C889	
Model Difference	:	All these models are identical in the same PCB, layout and electrical circuit, the only difference is appearance and color.	
Product Description	:	Operation Frequency:	2402MHz~2479MHz
		Number of Channel:	16 Channels See Note 2
		Antenna Gain:	2.58dBi PCB Antenna
		Modulation Type:	GFSK
Power Rating	:	USB Input: DC 5V DC 3.7V by 1200mAh Rechargeable Li-ion battery	
Software Version	:	----	
Hardware Version	:	----	
Remark	:	The adapter and antenna gain provided by the applicant, the verified for the RF conduction test provided by TOBY test lab.	

Note:

(1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

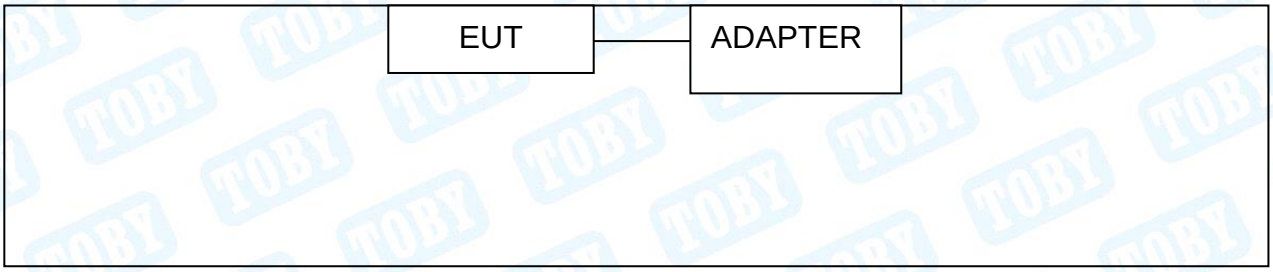
(2) Channel List:

Channel List			
Channel	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**
01	**2402**	09	2446
02	2408	10	2451
03	2417	11	2456
04	2419	12	2460
05	2421	13	2468
06	2423	14	2474
07	2428	15	2478
08	**2437**	**16**	2479
Note: Test frequencies are lowest channel: 2402MHz, middle channel: 2437MHz and highest channel: 2479MHz.			

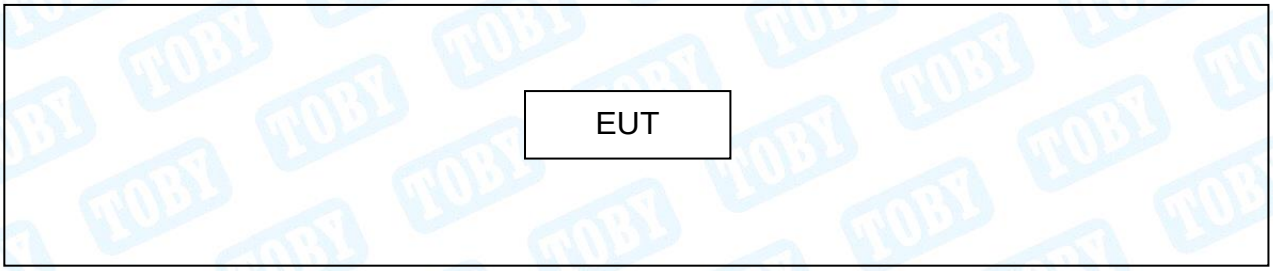
(3) The Antenna information about the equipment is provided by the applicant.

1.3 Block Diagram Showing the Configuration of System Tested

Conducted Test



Radiated Test



1.4 Description of Support Units

The EUT has been tested as an independent unit.

1.5 Description of 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 follow was evaluated respectively.

For Conducted Test	
Final Test Mode	**Description**
Mode 1	TX Mode

For Radiated Test	
Final Test Mode	**Description**
Mode 2	TX Mode(GFSK) Channel 01/08/16
Mode 3	Hopping TX Mode

Note:

(1) For all test, we have verified the construction and function in typical operation. And all the test modes were carried out with the EUT in transmitting operation in maximum power with all kinds of data rate. We have pretested all the test modes above.
According to ANSI C63.10 standards, the measurements are performed at the highest, middle, lowest available channels, and the worst case data rate as follows:
TX Mode: GFSK (1Mbps)

(2) The EUT is considered a portable unit; it was pre-tested on the positioned of each 3 axis, X-plane, Y-plane and Z-plane. The worst case was found positioned on X-plane as the normal use. Therefore only the test data of this X-plane was used for radiated emission measurement test.

1.6 Description of Test 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 of Bluetooth mode.

Test Software Version	**Adjust and control the corresponding transmission frequency through the EUT entity key.**		
Frequency	2402MHz	2437MHz	2479MHz
GFSK	DEF	DEF	DEF

1.7 Measurement Uncertainty

The reported uncertainty of measurement y ± 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 %.

Test Item	**Parameters**	**Expanded Uncertainty (U_{Lab})**
Conducted Emission	Level Accuracy: 9kHz~150kHz 150kHz to 30MHz	±3.50 dB ±3.10 dB
Radiated Emission	Level Accuracy: 9kHz to 30 MHz	±4.60 dB
Radiated Emission	Level Accuracy: 30MHz to 1000 MHz	±4.20 dB
Radiated Emission	Level Accuracy: Above 1000MHz	±4.20 dB

1.8 Test Facility

The testing report were performed by the Shenzhen Toby Technology Co., Ltd., in their facilities located at 1/F., Building 6, Rundongsheng Industrial Zone, Longzhu, Xixiang, Bao'an District, Shenzhen, Guangdong, China. At the time of testing, the following bodies accredited the Laboratory:

CNAS (L5813)
The Laboratory has been accredited by CNAS to ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories for the competence in the field of testing. And the Registration No.: CNAS L5813.

A2LA Certificate No.: 4750.01
The laboratory has been accredited by American Association for Laboratory Accreditation(A2LA) to ISO/IEC 17025：2017 General Requirements for the Competence of Testing and Calibration Laboratories for the technical competence in the field of Electrical Testing. And the A2LA Certificate No.: 4750.01.FCC Accredited Test Site Number: 854351. Designation Number: CN1223.

IC Registration No.: (11950A)
The Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing. The site registration: Site# 11950A. CAB identifier: CN0056.

2. Test Summary

Standard Section FCC	Test Item	Test Sample(s)	Judgment	Remark
FCC 15.207(a)	Conducted Emission	RW-C-202206-0121-1-1#	PASS	N/A
FCC 15.209 & 15.247(d)	Radiated Unwanted Emissions	RW-C-202206-0121-1-1#	PASS	N/A
FCC 15.203	Antenna Requirement	RW-C-202206-0121-1-2#	PASS	N/A
FCC 15.247(a)	99% Occupied Bandwidth & 20dB Bandwidth	RW-C-202206-0121-1-2#	PASS	N/A
FCC 15.247(b)(1)	Peak Output Power	RW-C-202206-0121-1-2#	PASS	N/A
FCC 15.247(a)(1)	Carrier frequency separation	RW-C-202206-0121-1-2#	PASS	N/A
FCC 15.247(a)(1)	Time of occupancy	RW-C-202206-0121-1-2#	PASS	N/A
FCC 15.247(b)(1)	Number of Hopping Frequency	RW-C-202206-0121-1-2#	PASS	N/A
FCC 15.247(d)	Band Edge	RW-C-202206-0121-1-2#	PASS	N/A
FCC 15.207	Conducted Unwanted Emissions	RW-C-202206-0121-1-2#	PASS	N/A
FCC 15.205	Emissions in Restricted Bands	RW-C-202206-0121-1-2#	PASS	N/A

Note: N/A is an abbreviation for Not Applicable.

3. Test Software

Test Item	Test Software	Manufacturer	Version No.
Conducted Emission	EZ-EMC	EZ	CDI-03A2
Radiation Emission	EZ-EMC	EZ	FA-03A2RE
Radiation Emission	EZ-EMC	EZ	FA-03A2RE+
RF Conducted Measurement	MTS-8310	MWRFtest	V2.0.0.0
RF Test System	JS1120	Tonscend	V2.6.88.0336

4. Test Equipment

Conducted Emission Test					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
EMI Test Receiver	Rohde & Schwarz	ESCI	100321	Jun. 23, 2022	Jun. 22, 2023
RF Switching Unit	Compliance Direction Systems Inc	RSU-A4	34403	Jun. 23, 2022	Jun. 22, 2023
AMN	SCHWARZBECK	NNBL 8226-2	8226-2/164	Jun. 22, 2022	Jun. 21, 2023
LISN	Rohde & Schwarz	ENV216	101131	Jun. 22, 2022	Jun. 21, 2023
Radiation Emission Test (A Site)					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Spectrum Analyzer	Rohde & Schwarz	FSV40-N	102197	Jun. 23, 2022	Jun. 22, 2023
EMI Test Receiver	Rohde & Schwarz	ESPI	100010/007	Jun. 23, 2022	Jun. 22, 2023
Bilog Antenna	ETS-LINDGREN	3142E	00117537	Feb. 27, 2022	Feb.26, 2024
Horn Antenna	ETS-LINDGREN	3117	00143207	Feb. 26, 2022	Feb.25, 2024
Horn Antenna	SCHWARZBECK	BBHA 9170	1118	Feb. 26, 2022	Feb.25, 2024
Loop Antenna	SCHWARZBECK	FMZB 1519 B	1519B-059	Feb. 26, 2022	Feb.25, 2024
Pre-amplifier	SONOMA	310N	185903	Feb. 26, 2022	Feb.25, 2023
Pre-amplifier	HP	8449B	3008A00849	Feb. 26, 2022	Feb.25, 2023
HF Amplifier	Tonscend	TAP0184050	AP21C806129	Sep. 03, 2021	Sep. 02, 2022
Radiation Emission Test (B Site)					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Spectrum Analyzer	Rohde & Schwarz	FSV40-N	102197	Jun. 23, 2022	Jun. 22, 2023
MXA Signal Analyzer	Agilent	N9020A	MY47380425	Sep. 03, 2021	Sep. 02, 2022
EMI Test Receiver	Rohde & Schwarz	ESU-8	100472	Feb. 26, 2022	Feb.25, 2023
Bilog Antenna	SCHWARZBECK	VULB 9168	1225	Dec. 05, 2021	Dec. 04, 2023
Horn Antenna	SCHWARZBECK	BBHA 9120 D	2463	Feb. 26, 2022	Feb.25, 2024
Horn Antenna	SCHWARZBECK	BBHA 9170	1118	Jun. 26, 2022	Jun.25, 2024
Loop Antenna	SCHWARZBECK	FMZB 1519 B	1519B-059	Jun. 26, 2022	Jun.25, 2024
HF Amplifier	Tonscend	TAP9E6343	AP21C806117	Sep. 03, 2021	Sep. 02, 2022
HF Amplifier	Tonscend	TAP051845	AP21C806141	Sep. 03, 2021	Sep. 02, 2022
HF Amplifier	Tonscend	TAP0184050	AP21C806129	Sep. 03, 2021	Sep. 02, 2022
Antenna Conducted Emission					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jun. 23, 2022	Jun. 22, 2023
Spectrum Analyzer	Rohde & Schwarz	FSV40-N	102197	Jun. 23, 2022	Jun. 22, 2023
MXA Signal Analyzer	Agilent	N9020A	MY49100060	Sep. 03, 2021	Sep. 02, 2022
Spectrum Analyzer	KEYSIGT	N9020B	MY60110172	Sep. 03, 2021	Sep. 02, 2022
RF Power Sensor	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO26	Sep. 03, 2021	Sep. 02, 2022
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO29	Sep. 03, 2021	Sep. 02, 2022
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO31	Sep. 03, 2021	Sep. 02, 2022
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO33	Sep. 03, 2021	Sep. 02, 2022
RF Control Unit	Tonsced	JS0806-2	21F8060439	Sep. 03, 2021	Sep. 02, 2022

5.Conducted Emission Test

5.1 Test Standard and Limit

5.1.1Test Standard

FCC Part 15.207

5.1.2 Test Limit

Conducted Emission Test Limit

Frequency	Maximum RF Line Voltage (dBμV)	
	Quasi-peak Level	Average Level
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
500kHz~5MHz	56	46
5MHz~30MHz	60	50

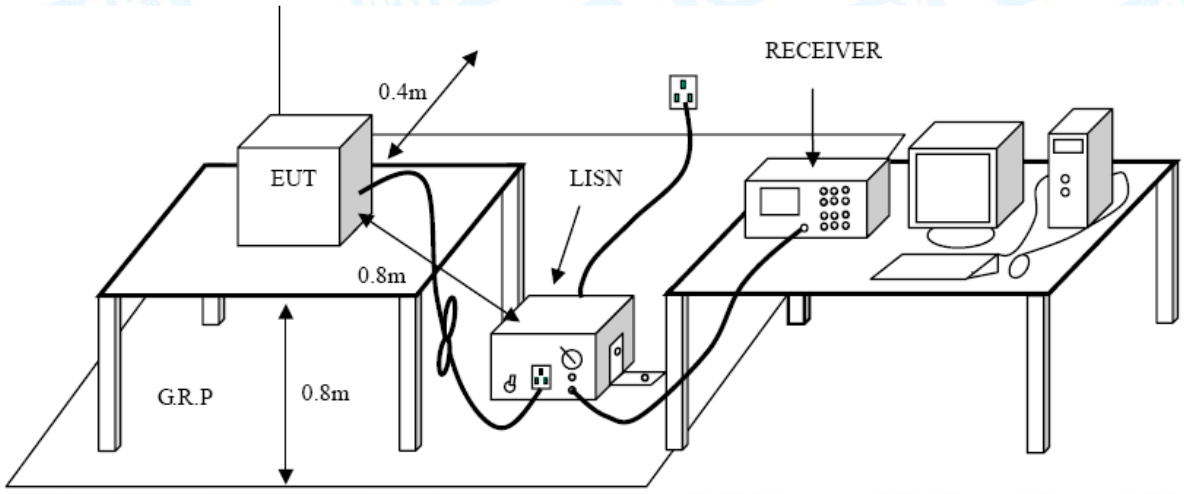
Notes:

(1) *Decreasing linearly with logarithm of the frequency.

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

(3) The limit decrease in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

5.2 Test Setup



5.3 Test Procedure

The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

LISN at least 80 cm from nearest part of EUT chassis

The bandwidth of EMI test receiver is set at 9kHz, and the test frequency band is from 0.15MHz to 30MHz.

5.4 Deviation From Test Standard

No deviation

5.5 EUT Operating Mode

Please refer to the description of test mode.

5.6 Test Data

Please refer to the Attachment A.

5. Radiated Emission Test

6.1 Test Standard and Limit

6.1.1 Test Standard

FCC Part 15.209 & FCC Part 15.247(d)

6.1.2 Test Limit

Radiated Emission Limit (9 kHz~1000MHz)

Frequency (MHz	Field Strength (microvolt/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Radiated Emission Limit (Above 1000MHz)

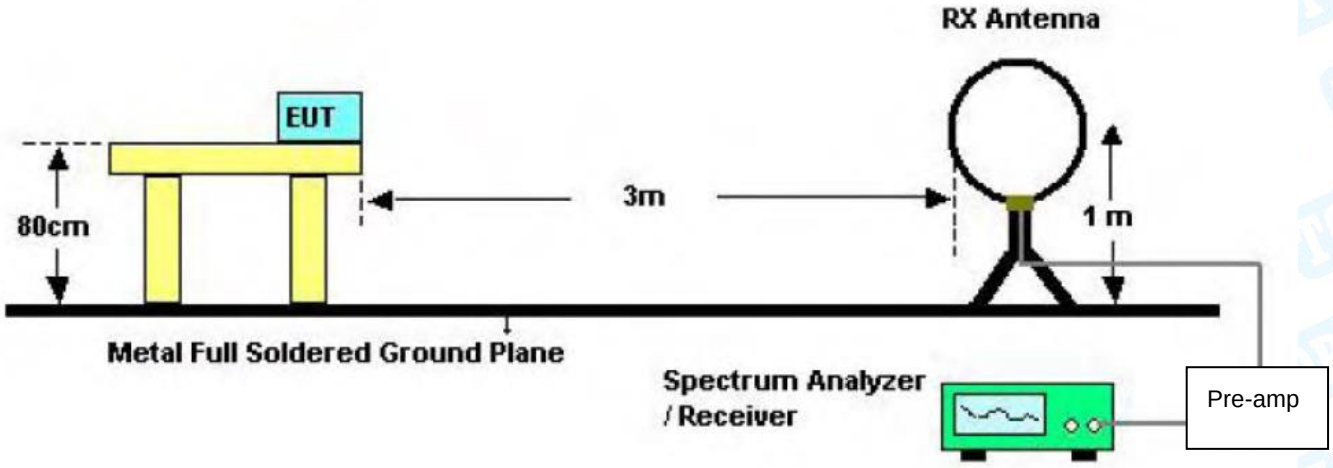
Frequency (MHz)	Distance Meters(at 3m)	
	Peak	Average
Above 1000	74	54

Note:

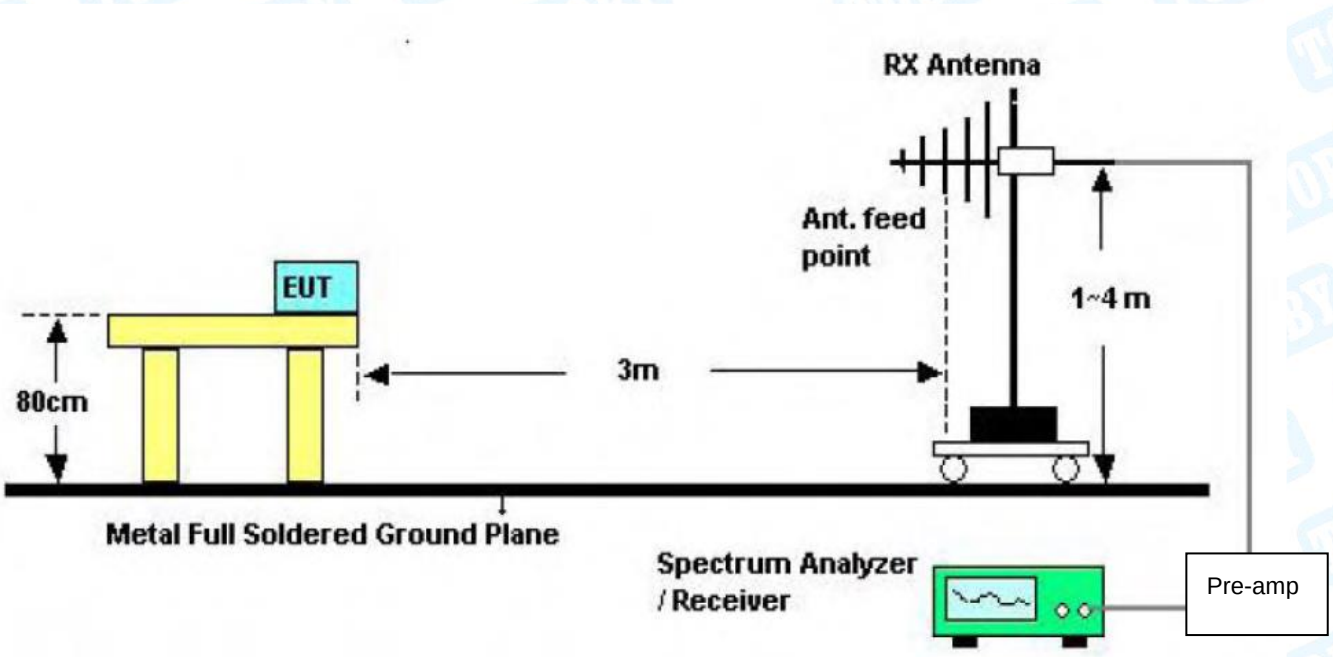
(1) The tighter limit applies at the band edges.

(2) Emission Level (dBuV/m)=20log Emission Level (uV/m)

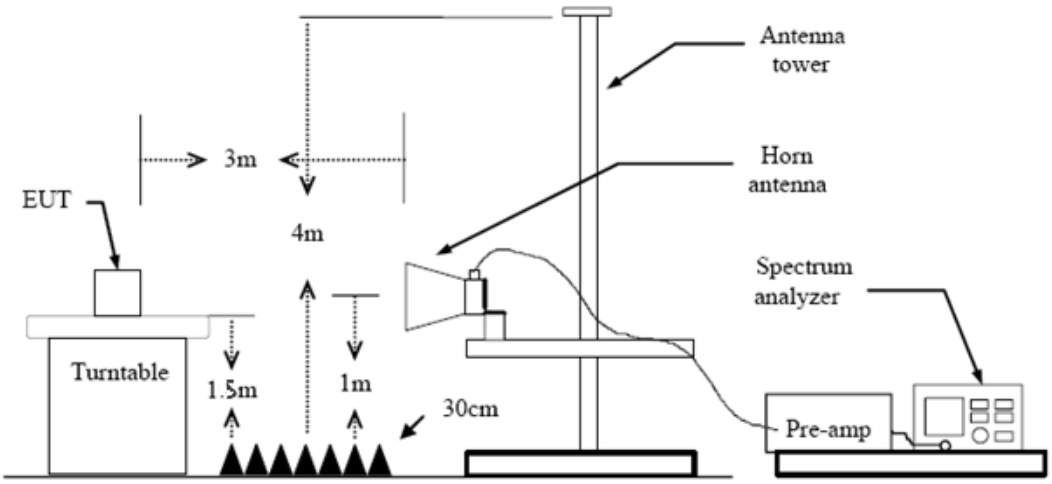
6.2 Test Setup



Below 30MHz Test Setup



Below 1000MHz Test Setup



Above 1GHz Test Setup

6.3 Test Procedure

(1) Measurements at frequency above 1GHz. The EUT was placed on a rotating 1.5m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.

(2) Measurements at frequency Below 1GHz. The EUT was placed on a rotating 0.8m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.

(3) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.

(4) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.

(5) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Bellow 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.

(6) Testing frequency range below 1GHz the measuring instrument use VBW=120 kHz with Quasi-peak detection.

(7) Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.

(8) For the actual test configuration, please see the test setup photo.

6.4 Deviation From Test Standard

No deviation

6.5 EUT Operating Condition

The Equipment Under Test was set to Continual Transmitting in maximum power.

6.6 Test Data

Remark: During testing above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.

Please refer to the Attachment B.

6. Restricted Bands and Band-edge test

7.1 Test Standard and Limit

7.1.1 Test Standard

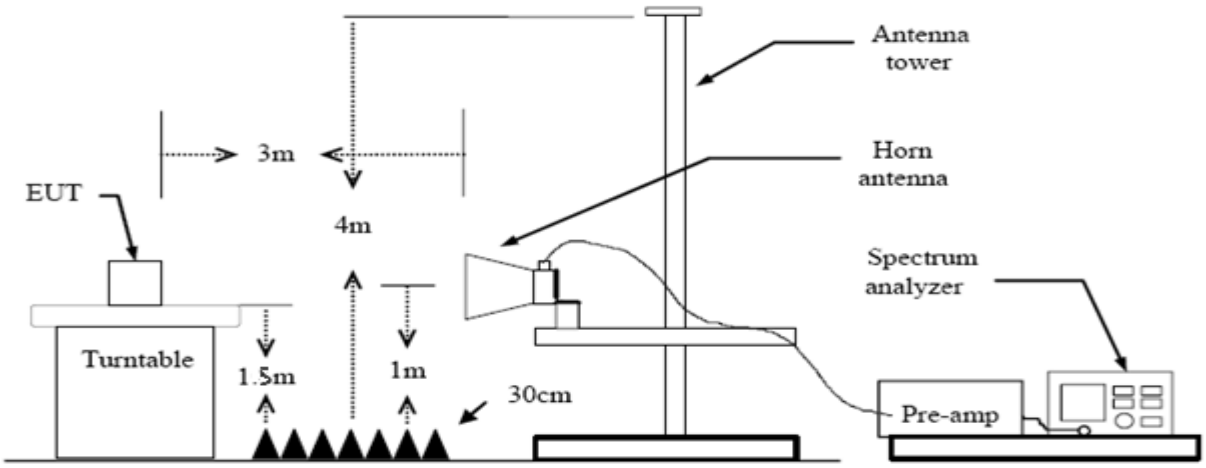
FCC Part 15.205 & FCC Part 15.247(d)

7.1.2 Test Limit

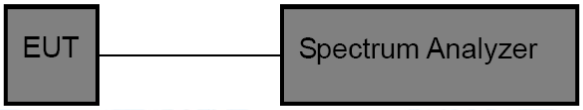
Radiated measurement		
Restricted Frequency Band (MHz)	**Distance Meters(at 3m)**	
	Peak (dBuV/m)	**Average (dBuV/m)**
2310 ~2390	74	54
2483.5 ~2500	74	54
Conducted measurement		
	Peak (dBm)see 7.3 e)	**Average (dBm)** see 7.3 e)
2310 ~2390	-41.20	-21.20
2483.5 ~2500	-41.20	-21.20
Note: According the ANSI C63.10 11.12.2 antenna-port conducted measurements may also be used as an alternative to radiated measurements for determining compliance in the restricted frequency bands requirements. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test forcabinet/case emissions is required.		

7.2 Test Setup

Radiated measurement



Conducted measurement



7.3 Test Procedure

---Radiated measurement

(1) The measuring distance of 3m shall be used for measurements at frequency up to 1GHz and above 1 GHz. The EUT was placed on a rotating 0.8m high above ground, the table was rotated 360 degrees to determine the position of the highest radiation.

(2) Measurements at frequency above 1GHz. The EUT was placed on a rotating 1.5m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.

(3) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.

(4) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.

(5) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Below 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.

(6) Testing frequency range below 1GHz the measuring instrument use VBW=120 kHz with Quasi-peak detection.

(7) Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.

(8) For the actual test configuration, please see the test setup photo.

---Conducted measurement

a) Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency (see 11.12.2.3 through 11.12.2.5 for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).

b) Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP (see 11.12.2.6 for guidance on determining the applicable antenna gain).

c) Add the appropriate maximum ground reflection factor to the EIRP (6 dB for frequencies ≤30 MHz; 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive; and 0 dB for frequencies > 1000 MHz).

d) For MIMO devices, measure the power of each chain and sum the EIRP of all chains in linear terms (i.e., watts and mW).

e) Convert the resultant EIRP to an equivalen t electric field strength using the following

relationship:

$$E = \text{EIRP} - 20 \log d + 104.8$$

where

E is the electric field strength in dBuV/m

EIRP is the equivalent isotropically radiated power in dBm

d is the specified measurement distance in m

f) Compare the resultant electric field strength level with the applicable regulatory limit.

g) Perform the radiated spurious emission test.

7.4 Deviation From Test Standard

No deviation

7.5 EUT Operating Condition

The Equipment Under Test was set to Continual Transmitting in maximum power.

7.6 Test Data

Remark: The test uses antenna-port conducted measurements as an alternative to radiated measurements for determining compliance in the restricted frequency bands requirements.

Please refer to the Attachment C.

7. Number of Hopping Channel

8.1 Test Standard and Limit

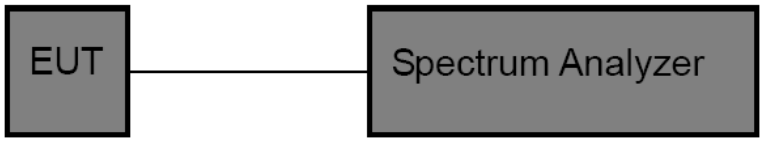
8.1.1 Test Standard

FCC Part 15.247 (a)(1)

8.1.2 Test Limit

Section	Test Item	Limit
15.247	Number of Hopping Channel	>15

8.2 Test Setup



8.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
(2) Spectrum Setting: RBW=100 KHz, VBW=100 KHz, Sweep time= Auto.

8.4 Deviation From Test Standard

No deviation

8.5 EUT Operating Condition

The EUT was set to the Hopping Mode by the Customer.

8.6 Test Data

Please refer to the Attachment D.

8. Average Time of Occupancy

9.1 Test Standard and Limit

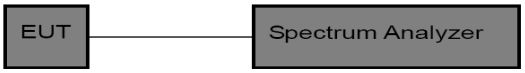
9.1.1 Test Standard

FCC Part 15.247 (a)(1)

9.1.2 Test Limit

Test Item	Limit
Average Time of Occupancy	0.4 sec

9.2 Test Setup



9.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
(2) Spectrum Setting: RBW=100KHz, VBW=300KHz.
(3) Use video trigger with the trigger level set to enable triggering only on full pulses.
(4) Sweep Time is more than once pulse time.
(5) Set the center frequency on any frequency would be measure and set the frequency span to zero.
(6) Measure the maximum time duration of one single pulse.
(7) Set the EUT for packet transmitting.
(8) Measure the maximum time duration of one single pulse.

9.4 EUT Operating Condition

The average time of occupancy on any channel within the Period can be calculated with formulas:
The Dwell Time = Burst Width * Total Hops. The detailed calculations are showed as follows:
The duration for dwell time calculation: 0.4 [s] * hopping number = 0.4 [s] * 20 [ch] = 8.0 [s*ch];
The burst width, which is directly measured, refers to the duration on one channel hop.
The maximum number of hopping channels in 8.0s =3*(8.0/0.24) =100
The lowest, middle and highest channels are selected to perform testing to record the dwell time of each occupation measured in this channel, which is called Pulse Time here.

The EUT was set to the Hopping Mode by the Customer.

9.4 Deviation From Test Standard

No deviation

9.5 Test Data

Please refer to the Attachment E.

9. Channel Separation and Bandwidth Test

10.1 Test Standard and Limit

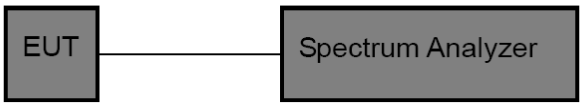
10.1.1 Test Standard

FCC Part 15.247

10.1.2 Test Limit

Test Item	Limit	Frequency Range(MHz)
Bandwidth	<=1 MHz (20dB bandwidth)	2400~2483.5
Channel Separation	>25KHz or >two-thirds of the 20 dB bandwidth Which is greater	2400~2483.5

10.2 Test Setup



10.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.

(2) Spectrum Setting:
Channel Separation: RBW=100 kHz, VBW=100 kHz.
Bandwidth: RBW=30 kHz, VBW=100 kHz.

(3) The bandwidth is measured at an amplitude level reduced 20dB from the reference level. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst –case (i.e the widest) bandwidth.

(4) Measure the channel separation the spectrum analyzer was set to Resolution Bandwidth:30 kHz, and Video Bandwidth:100 kHz. Sweep Time set auto.

10.4 Deviation From Test Standard

No deviation

10.5 EUT Operating Condition

The EUT was set to the Hopping Mode for Channel Separation Test and continuously transmitting for the Bandwidth Test.

10.6 Test Data

Please refer to the Attachment F.

10. Peak Output Power Test

11.1 Test Standard and Limit

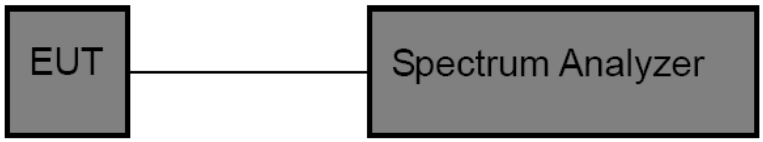
11.1.1 Test Standard

FCC Part 15.247 (b) (1)

11.1.2 Test Limit

Test Item	Limit	Frequency Range(MHz)
Peak Output Power	Hopping Channels>75 Power<1W(30dBm) Other <125 mW(21dBm)	2400~2483.5

11.2 Test Setup



11.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.

(2) Spectrum Setting:

Peak Detector: RBW=1 MHz, VBW=3 MHz for bandwidth less than 1MHz.

RBW=3 MHz, VBW=3 MHz for bandwidth more than 1MHz.

11.4 Deviation From Test Standard

No deviation

11.5 EUT Operating Condition

The EUT was set to continuously transmitting in the max power during the test.

11.6 Test Data

Please refer to the Attachment G.

11. Antenna Requirement

12.1 Standard Requirement

12.1.1 Standard

FCC Part 15.203

12.1.2 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 shall be considered sufficient to comply with the provisions of this Section. 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.

12.2 Deviation From Test Standard

No deviation

12.3 Antenna Connected Construction

The gains of the antenna used for transmitting is 2.58dBi, and the antenna connector is de-signed with permanent attachment and no consideration of replacement. Please see the EUT photo for details.

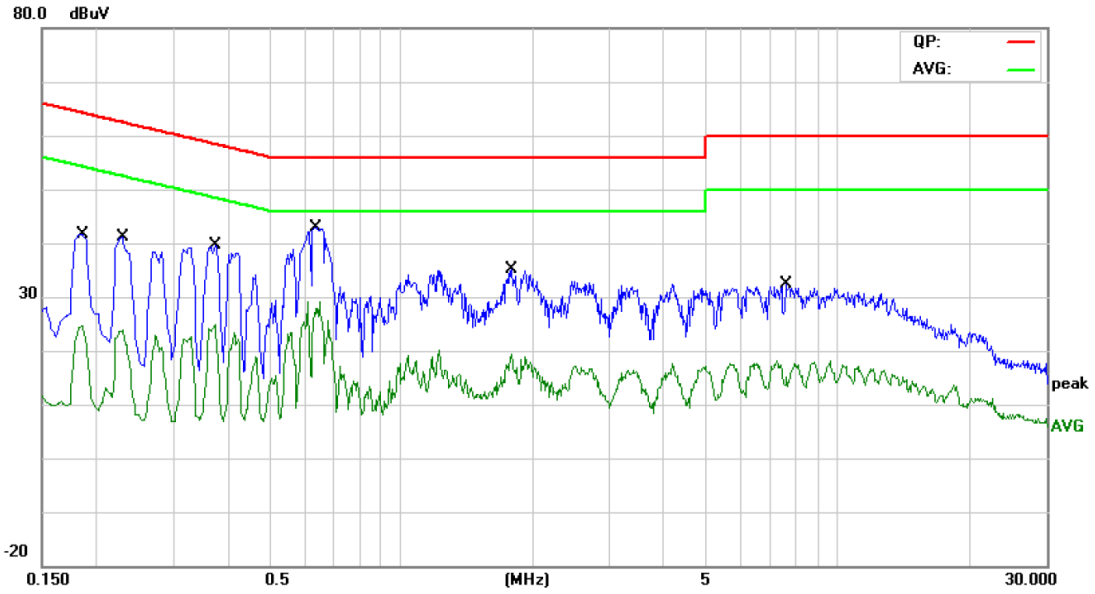
12.4 Result

The EUT antenna is a Internal Antenna. It complies with the standard requirement.

Antenna Type
☒Permanent attached antenna
☐Unique connector antenna
☐Professional installation antenna

Attachment A-- Conducted Emission Test Data

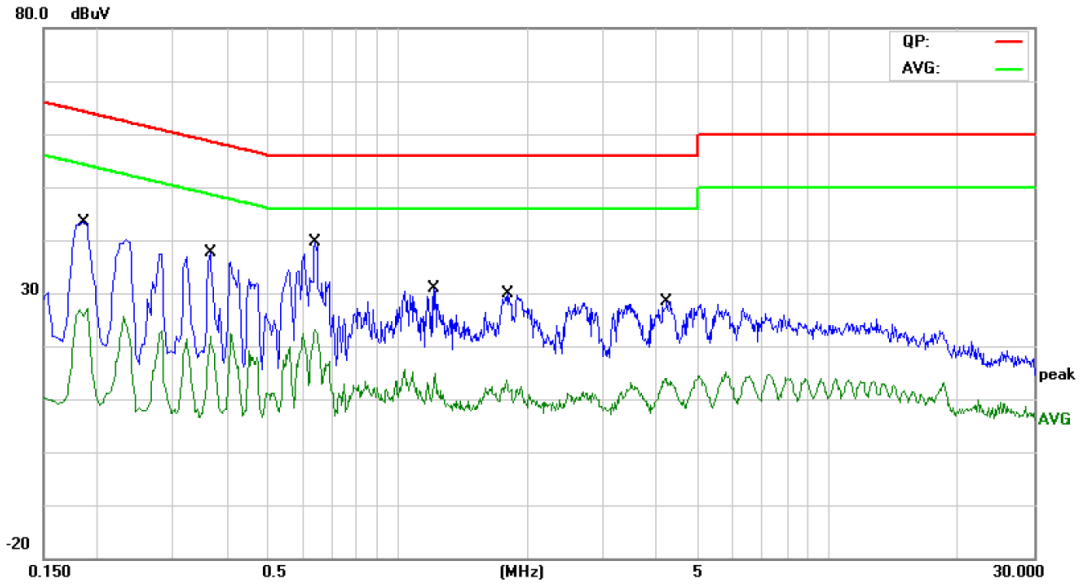
Temperature:	24.4℃	**Relative Humidity:**	44%
Test Voltage:	AC 120V/60Hz		
Terminal:	Line		
Test Mode:	Mode 1		
Remark:	All channels have been tested and Shows only the worst channels.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1860	29.86	11.03	40.89	64.21	-23.32	QP
2		0.1860	13.76	11.03	24.79	54.21	-29.42	AVG
3		0.2300	27.25	10.96	38.21	62.45	-24.24	QP
4		0.2300	11.83	10.96	22.79	52.45	-29.66	AVG
5		0.3740	25.00	10.89	35.89	58.41	-22.52	QP
6		0.3740	10.36	10.89	21.25	48.41	-27.16	AVG
7	*	0.6380	29.12	10.90	40.02	56.00	-15.98	QP
8		0.6380	15.65	10.90	26.55	46.00	-19.45	AVG
9		1.7900	19.58	10.54	30.12	56.00	-25.88	QP
10		1.7900	7.77	10.54	18.31	46.00	-27.69	AVG
11		7.5860	11.96	10.05	22.01	60.00	-37.99	QP
12		7.5860	2.69	10.05	12.74	50.00	-37.26	AVG

Emission Level= Read Level+ Correct Factor

Temperature:	24.4℃	**Relative Humidity:**	44%
Test Voltage:	AC 120V/60Hz		
Terminal:	Neutral		
Test Mode:	Mode 1		
Remark:	All channels have been tested and Shows only the worst channels.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1860	29.53	11.03	40.56	64.21	-23.65	QP
2		0.1860	13.84	11.03	24.87	54.21	-29.34	AVG
3		0.3660	23.31	10.89	34.20	58.59	-24.39	QP
4		0.3660	9.70	10.89	20.59	48.59	-28.00	AVG
5	*	0.6419	26.35	10.90	37.25	56.00	-18.75	QP
6		0.6419	12.32	10.90	23.22	46.00	-22.78	AVG
7		1.2100	13.90	10.64	24.54	56.00	-31.46	QP
8		1.2100	1.06	10.64	11.70	46.00	-34.30	AVG
9		1.8020	12.16	10.53	22.69	56.00	-33.31	QP
10		1.8020	0.73	10.53	11.26	46.00	-34.74	AVG
11		4.2180	10.60	10.07	20.67	56.00	-35.33	QP
12		4.2180	2.12	10.07	12.19	46.00	-33.81	AVG

Emission Level= Read Level+ Correct Factor

Attachment B-- Radiated Emission Test Data

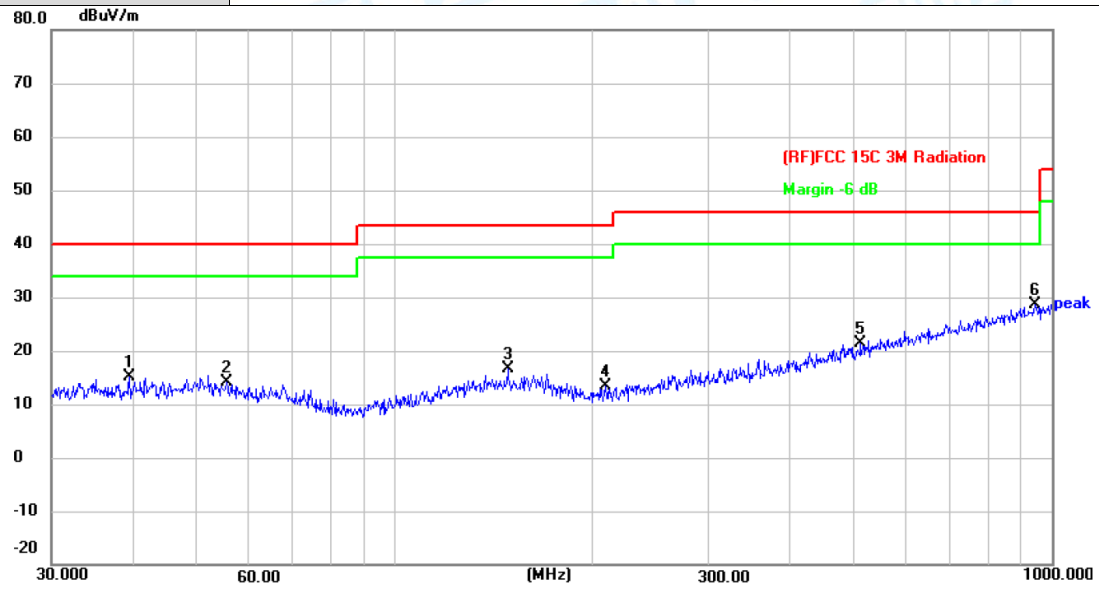
9KHz~30MHz

From 9KHz to 30MHz: Conclusion: PASS

Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

30MHz~1GHz

Temperature:	24.3℃	**Relative Humidity:**	45%
Test Voltage:	DC 5V		
Ant. Pol.	Horizontal		
Test Mode:	Mode 2 TX Mode(GFSK) Channel 01		
Remark:	Only worse case is reported		

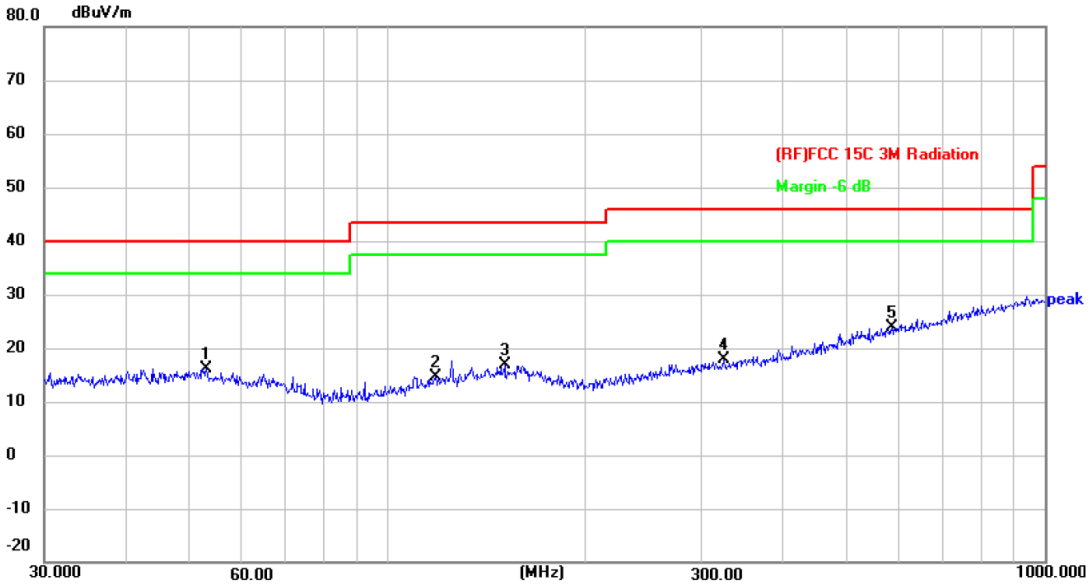


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	39.4371	38.14	-23.04	15.10	40.00	-24.90	peak	P
2	55.4147	37.14	-23.13	14.01	40.00	-25.99	peak	P
3	148.4410	38.33	-21.79	16.54	43.50	-26.96	peak	P
4	209.3129	37.03	-23.77	13.26	43.50	-30.24	peak	P
5	511.8352	36.70	-15.28	21.42	46.00	-24.58	peak	P
6 *	942.1305	36.75	-8.09	28.66	46.00	-17.34	peak	P

*:Maximum data x:Over limit !:over margin

Emission Level= Read Level+ Correct Factor

Temperature:	24.3℃	**Relative Humidity:**	45%
Test Voltage:	DC 5V		
Ant. Pol.	Vertical		
Test Mode:	Mode 2 TX Mode(GFSK) Channel 01		
Remark:	Only worse case is reported		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	52.9453	38.99	-22.86	16.13	40.00	-23.87	peak	P
2	118.1862	38.09	-23.46	14.63	43.50	-28.87	peak	P
3	150.5378	38.49	-21.73	16.76	43.50	-26.74	peak	P
4	324.4561	38.02	-20.26	17.76	46.00	-28.24	peak	P
5 *	584.7895	37.54	-13.68	23.86	46.00	-22.14	peak	P

*:Maximum data x:Over limit !:over margin

Emission Level= Read Level+ Correct Factor

Above 1GHz (Only worse case is reported)

Temperature:	26℃	Relative Humidity:	54%
Test Voltage:	DC 5V		
Ant. Pol.	Horizontal		
Test Mode:	TX GFSK Mode 2402MHz		

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	10945.000	43.30	8.19	51.49	74.00	-22.51	peak	P
2 *	14948.500	41.45	11.27	52.72	74.00	-21.28	peak	P

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)
4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.
5. No report for the emission which more than 20dB below the prescribed limit.
6. The peak value＜average limit, So only show the peak value.

Temperature:	26℃	Relative Humidity:	54%
Test Voltage:	DC 5V		
Ant. Pol.	Vertical		
Test Mode:	TX GFSK Mode 2402MHz		

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	12602.500	42.71	9.75	52.46	74.00	-21.54	peak	P
2 *	17167.000	40.42	12.78	53.20	74.00	-20.80	peak	P

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)
4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.
5. No report for the emission which more than 20dB below the prescribed limit.
6. The peak value＜average limit, So only show the peak value.

Temperature:	26℃	Relative Humidity:	54%
Test Voltage:	DC 5V		
Ant. Pol.	Horizontal		
Test Mode:	TX GFSK Mode 2437MHz		

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	13469.500	42.39	10.19	52.58	74.00	-21.42	peak	P
2 *	17957.500	34.92	17.67	52.59	74.00	-21.41	peak	P

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)
4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.
5. No report for the emission which more than 20dB below the prescribed limit.
6. The peak value＜average limit, So only show the peak value.

Temperature:	26℃	Relative Humidity:	54%
Test Voltage:	DC 5V		
Ant. Pol.	Vertical		
Test Mode:	TX GFSK Mode 2437MHz		

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	10460.500	45.63	6.32	51.95	74.00	-22.05	peak	P
2 *	15025.000	41.70	11.34	53.04	74.00	-20.96	peak	P

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)
4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.
5. No report for the emission which more than 20dB below the prescribed limit.
6. The peak value＜average limit, So only show the peak value.

Temperature:	26℃	Relative Humidity:	54%
Test Voltage:	DC 5V		
Ant. Pol.	Horizontal		
Test Mode:	TX GFSK Mode 2479MHz		

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	10409.500	44.90	6.22	51.12	74.00	-22.88	peak	P
2 *	13903.000	41.88	10.94	52.82	74.00	-21.18	peak	P

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)
4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.
5. No report for the emission which more than 20dB below the prescribed limit.
6. The peak value＜average limit, So only show the peak value.

Temperature:	26℃	Relative Humidity:	54%
Test Voltage:	DC 5V		
Ant. Pol.	Vertical		
Test Mode:	TX GFSK Mode 2479MHz		

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	11863.000	43.79	8.94	52.73	74.00	-21.27	peak	P
2 *	14948.500	41.80	11.27	53.07	74.00	-20.93	peak	P

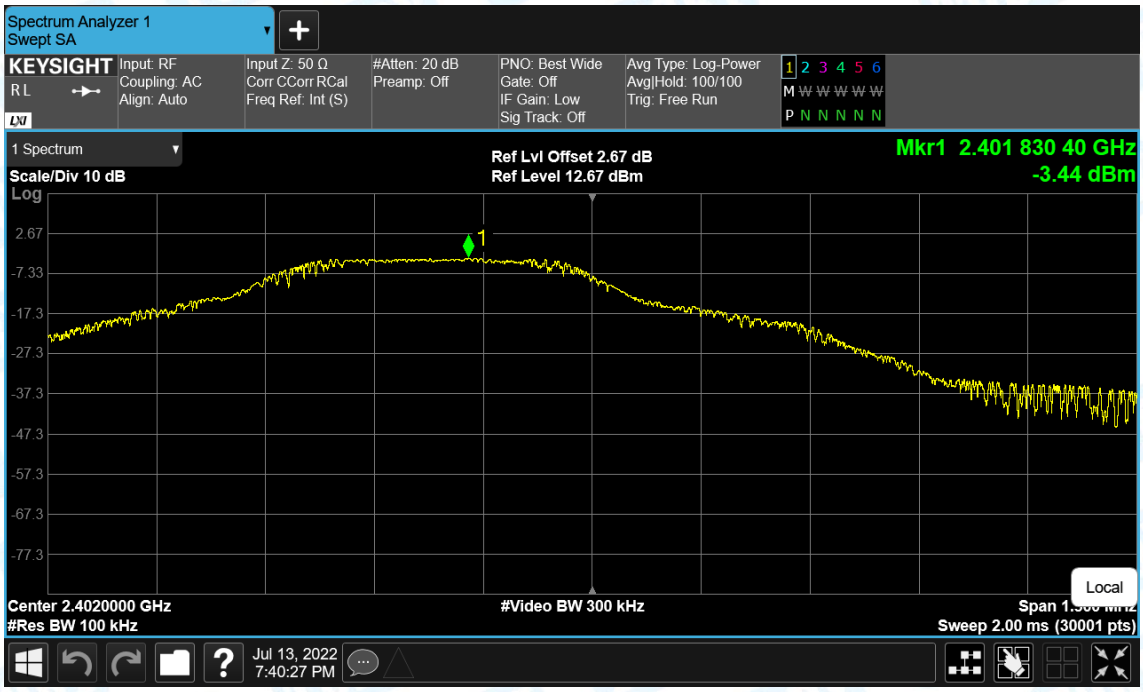
Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)
4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.
5. No report for the emission which more than 20dB below the prescribed limit.
6. The peak value＜average limit, So only show the peak value.

Conducted Emission Test Data

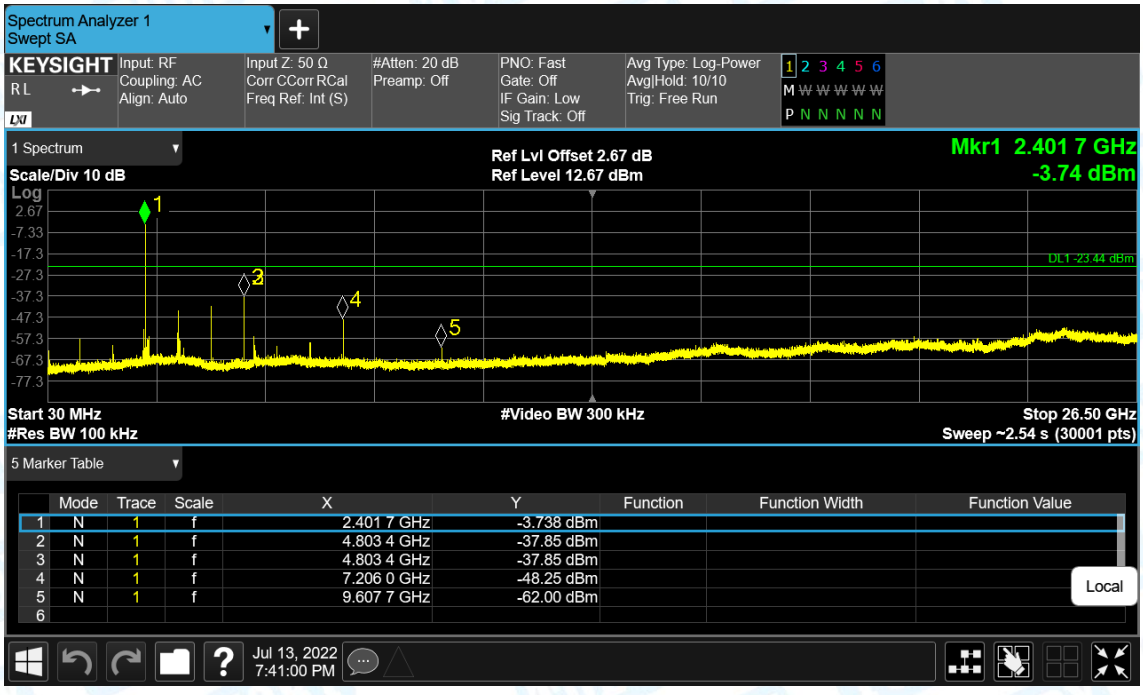
Condition	Mode	Frequency (MHz)	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	user	2402	-34.41	-20	Pass
NVNT	user	2437	-38.11	-20	Pass
NVNT	user	2479	-35.92	-20	Pass

Test Graphs

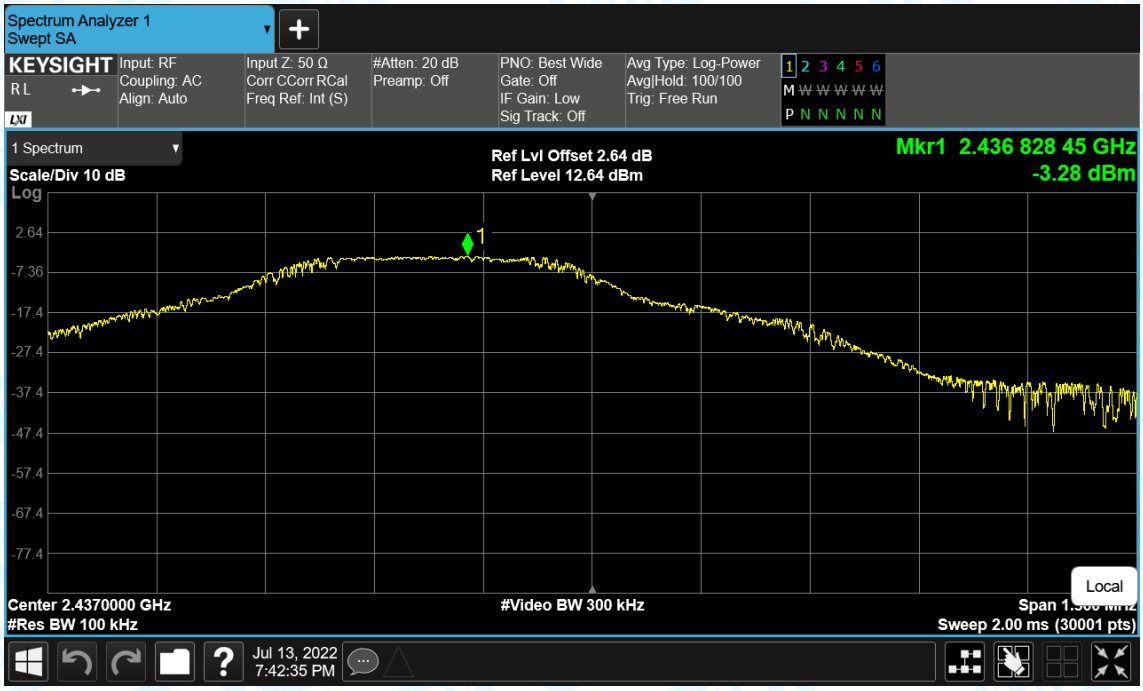
Tx. Spurious NVNT user 2402MHz Ant1 Ref



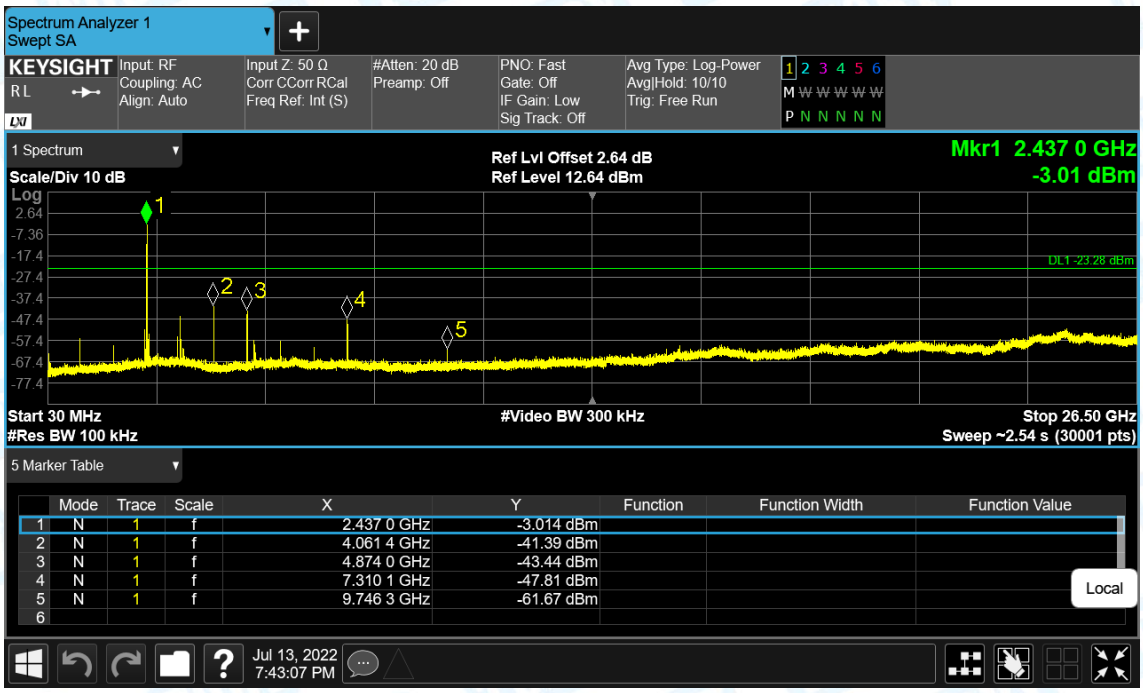
Tx. Spurious NVNT user 2402MHz Ant1 Emission



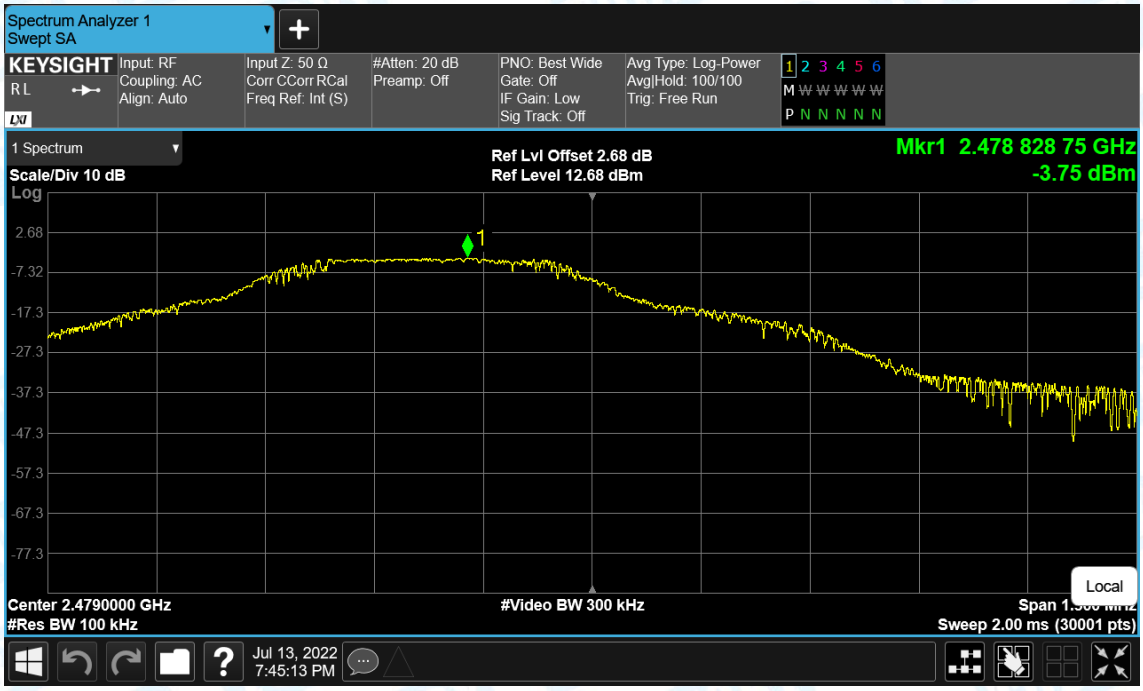
Tx. Spurious NVNT user 2437MHz Ant1 Ref



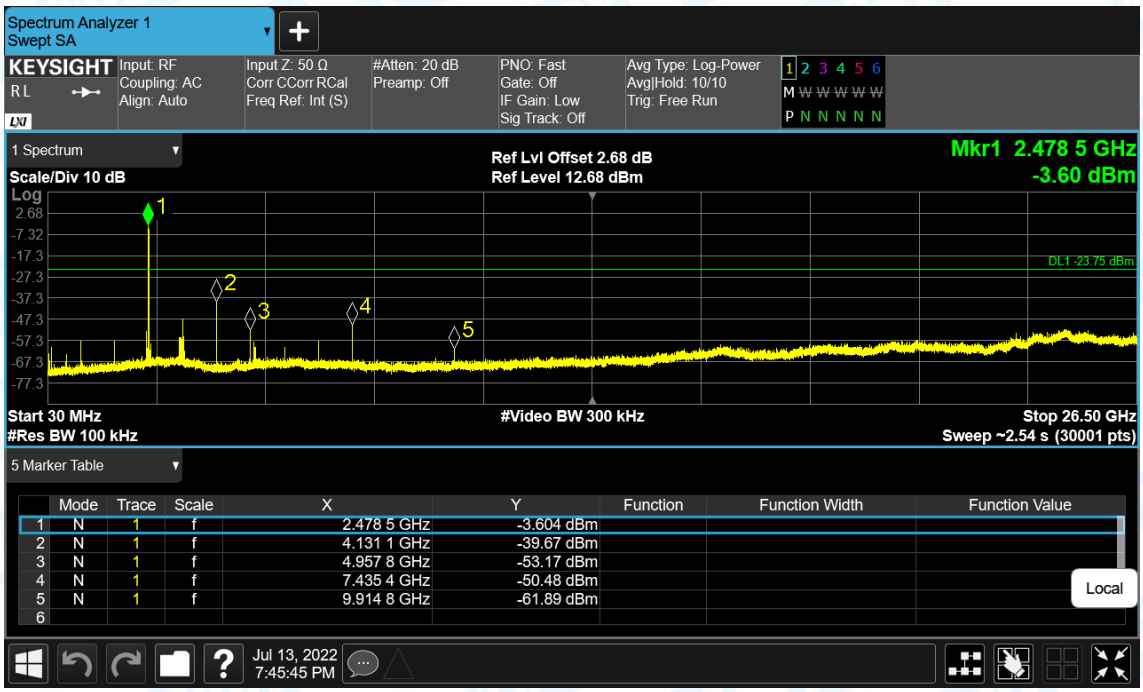
Tx. Spurious NVNT user 2437MHz Ant1 Emission



Tx. Spurious NVNT user 2479MHz Ant1 Ref



Tx. Spurious NVNT user 2479MHz Ant1 Emission

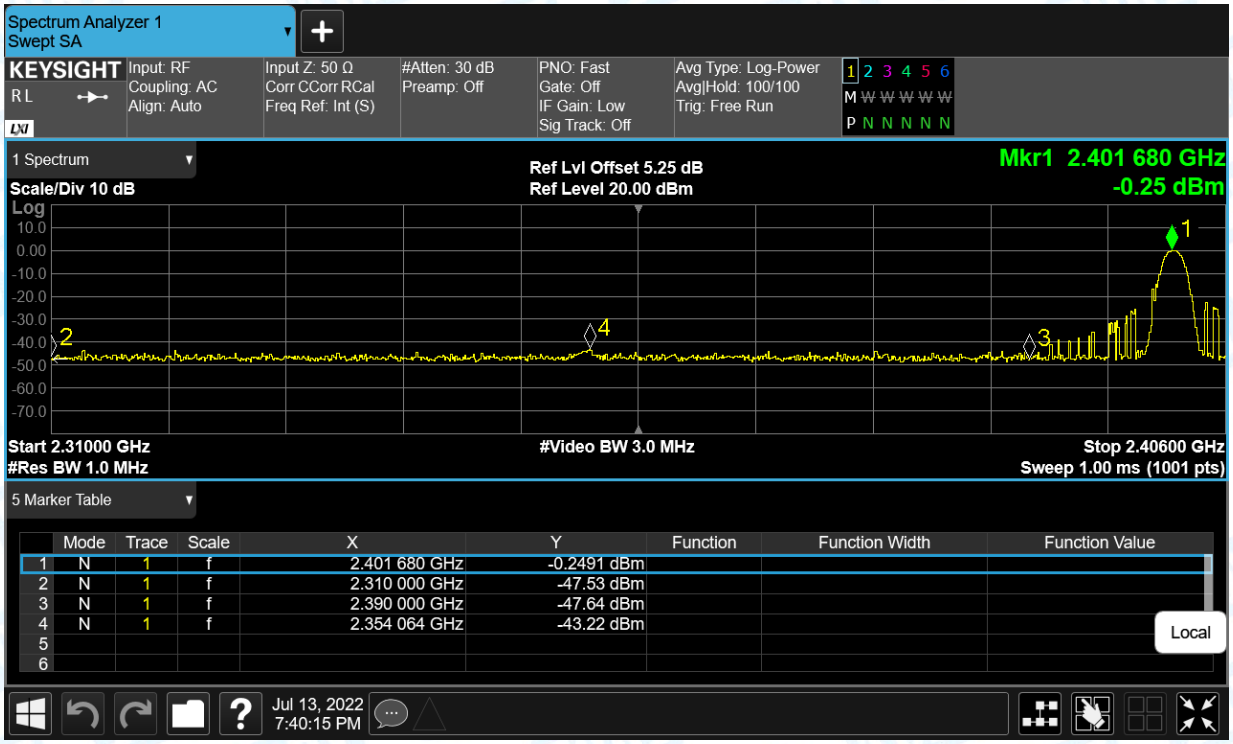


Attachment C-- Restricted Bands Requirement Test Data

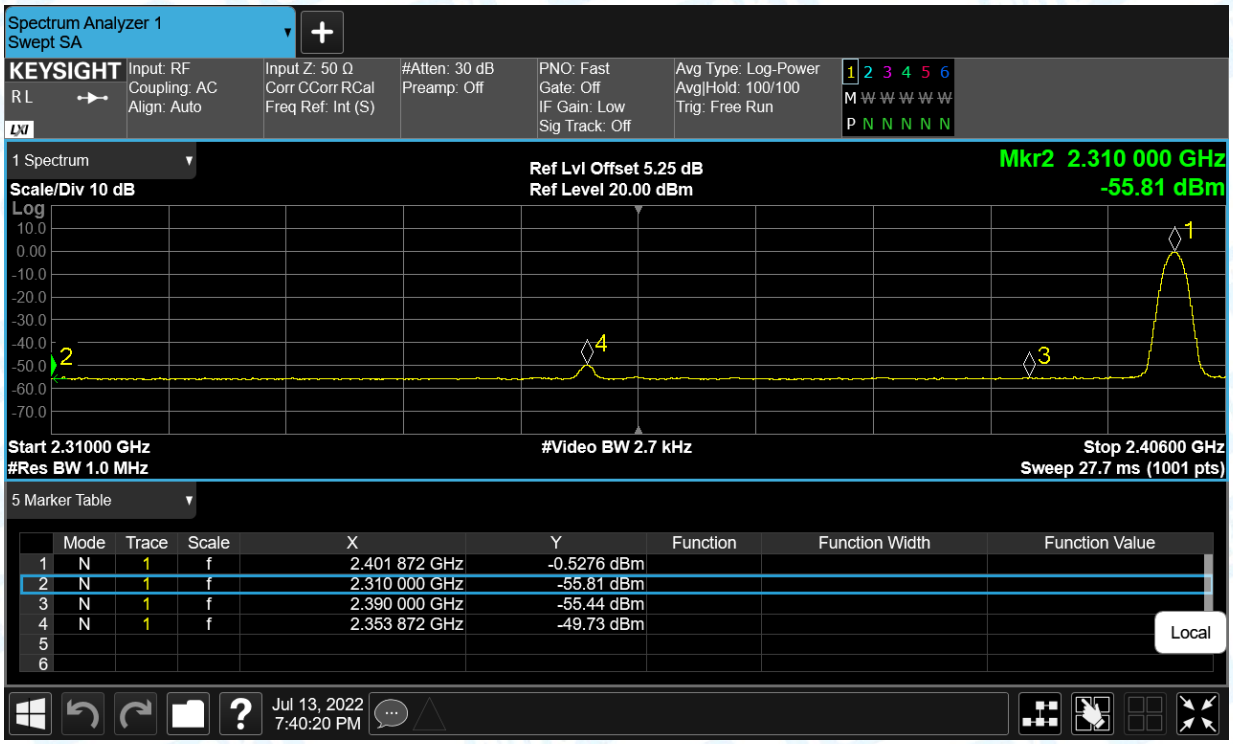
(1) Radiation Test

Frequency (MHz)	Antenna	Hopping Mode	Spur Freq (MHz)	Power (dBm)	Gain (dBi)	E (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
2402	Ant1	No-Hopping	2310	-47.53	2.58	50.31	Peak	74	Pass
2402	Ant1	No-Hopping	2310	-55.81	2.58	42.03	Average	54	Pass
2402	Ant1	No-Hopping	2354.064	-43.22	2.58	54.62	Peak	74	Pass
2402	Ant1	No-Hopping	2353.872	-49.73	2.58	48.11	Average	54	Pass
2402	Ant1	No-Hopping	2390	-47.21	2.58	50.63	Peak	74	Pass
2402	Ant1	No-Hopping	2390	-55.46	2.58	42.38	Average	54	Pass
2479	Ant1	No-Hopping	2483.5	-30.74	2.58	67.1	Peak	74	Pass
2479	Ant1	No-Hopping	2483.5	-55.38	2.58	42.46	Average	54	Pass
2479	Ant1	No-Hopping	2483.875	-54.84	2.58	43	Average	54	Pass
2479	Ant1	No-Hopping	2500	-46.51	2.58	51.33	Peak	74	Pass
2479	Ant1	No-Hopping	2500	-55.69	2.58	42.15	Average	54	Pass

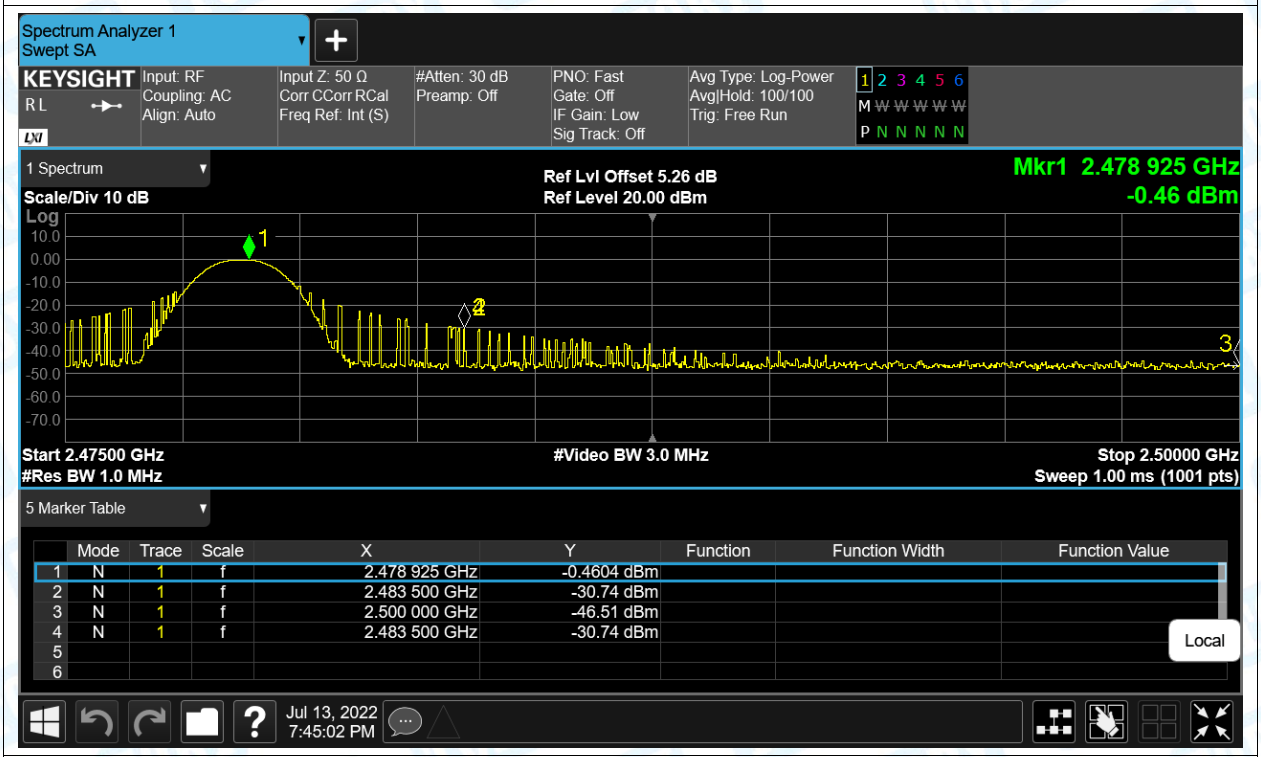
Test Graphs
Restrict Band NVNT user 2402MHz Ant1 No-Hopping Peak



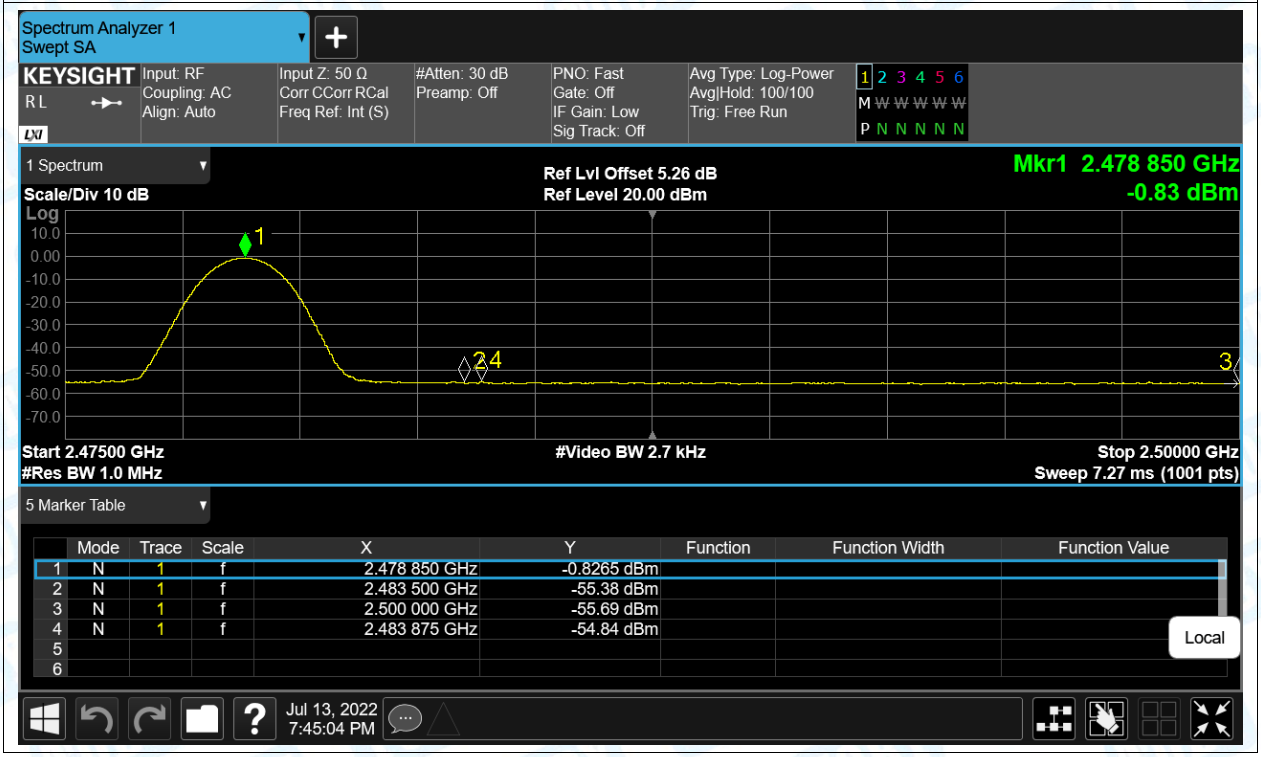
Restrict Band NVNT user 2402MHz Ant1 No-Hopping Average



Restrict Band NVNT user 2479MHz Ant1 No-Hopping Peak



Restrict Band NVNT user 2479MHz Ant1 No-Hopping Average

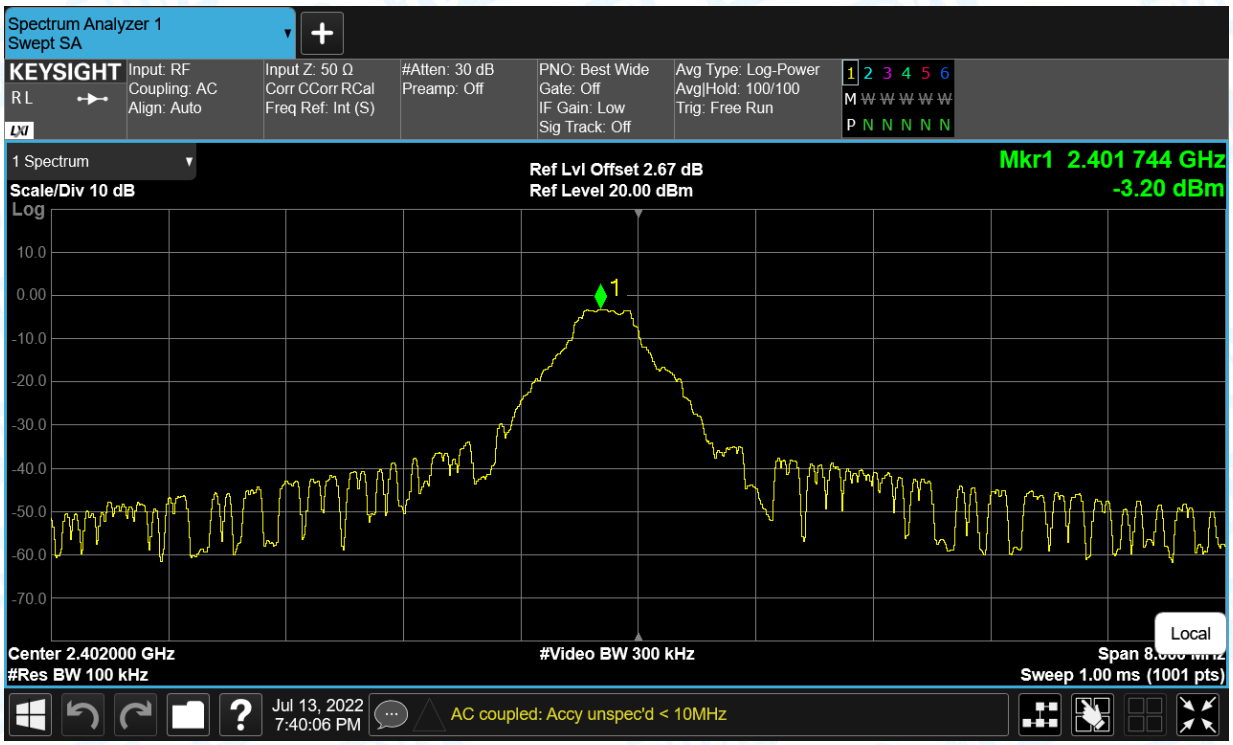


(2) Conducted Band Edge Test

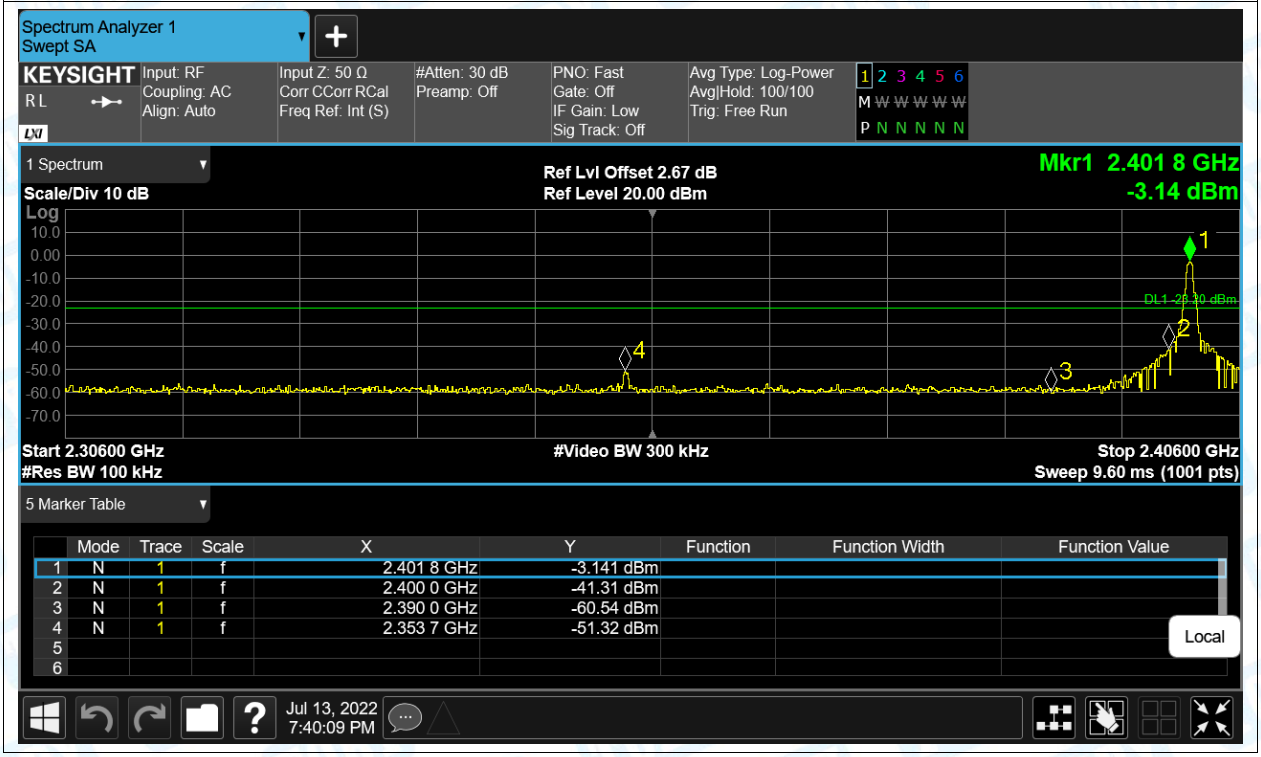
Condition	Mode	Frequency (MHz)	Antenna	Hopping Mode	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	user	2402	Ant1	No-Hopping	-48.12	-20	Pass
NVNT	user	2479	Ant1	No-Hopping	-48.12	-20	Pass

Test Graphs

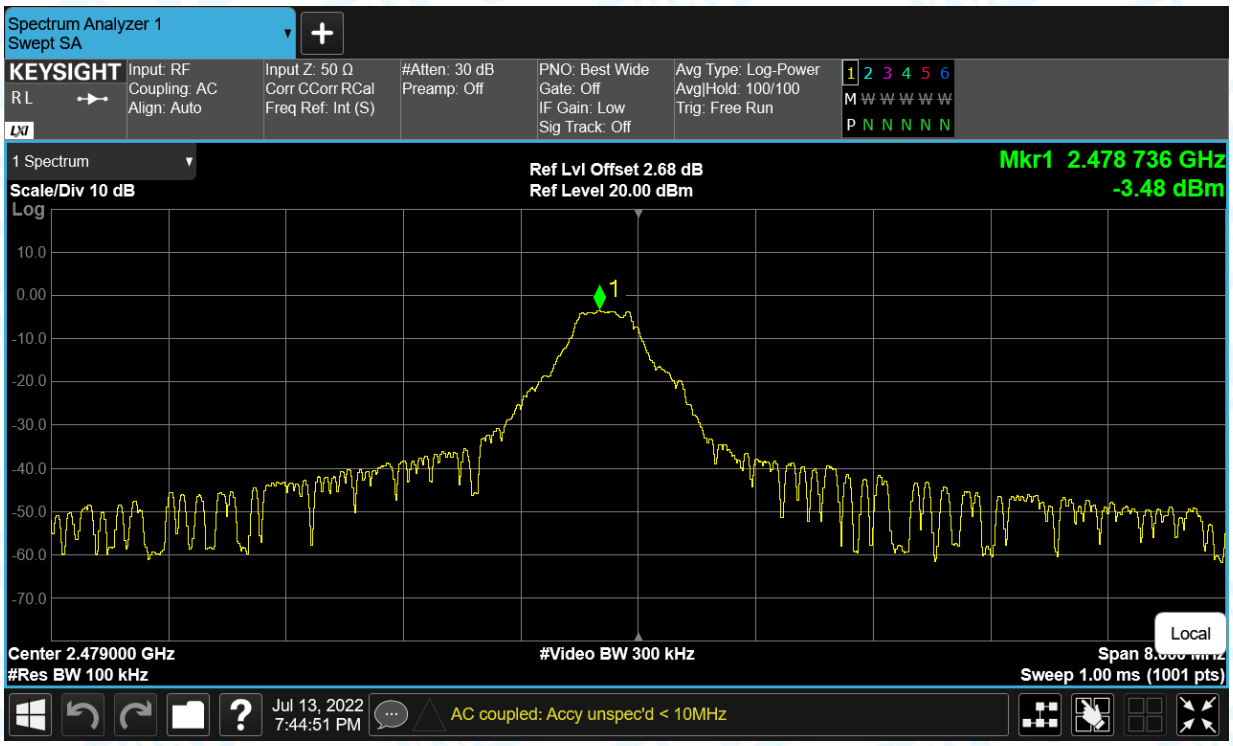
Band Edge NVNT user 2402MHz Ant1 No-Hopping Ref



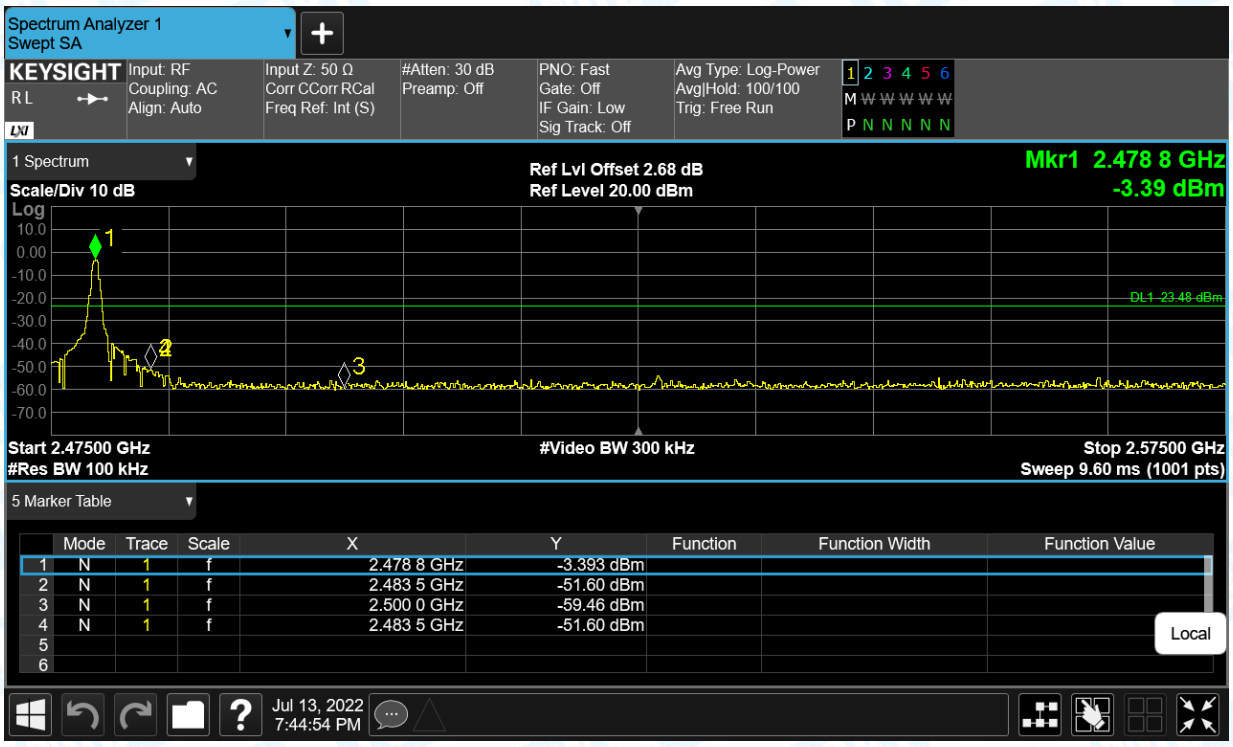
Band Edge NVNT user 2402MHz Ant1 No-Hopping Emission



Band Edge NVNT user 2479MHz Ant1 No-Hopping Ref



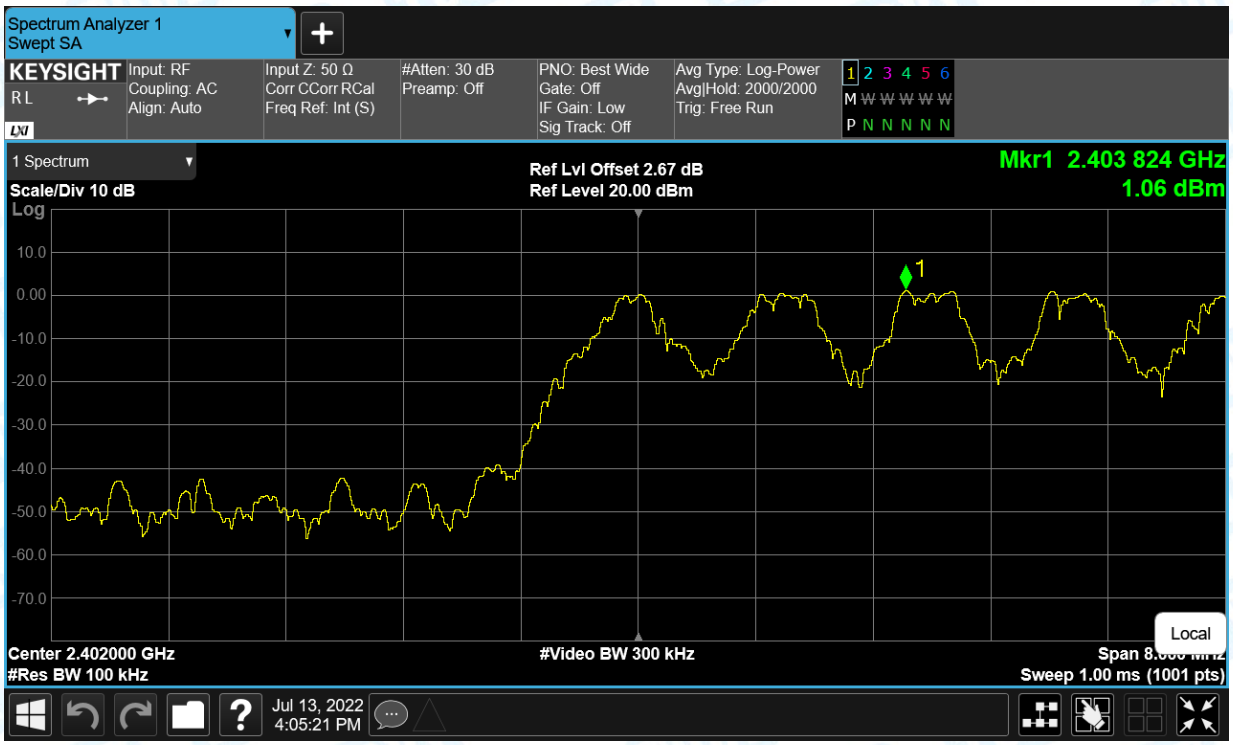
Band Edge NVNT user 2479MHz Ant1 No-Hopping Emission



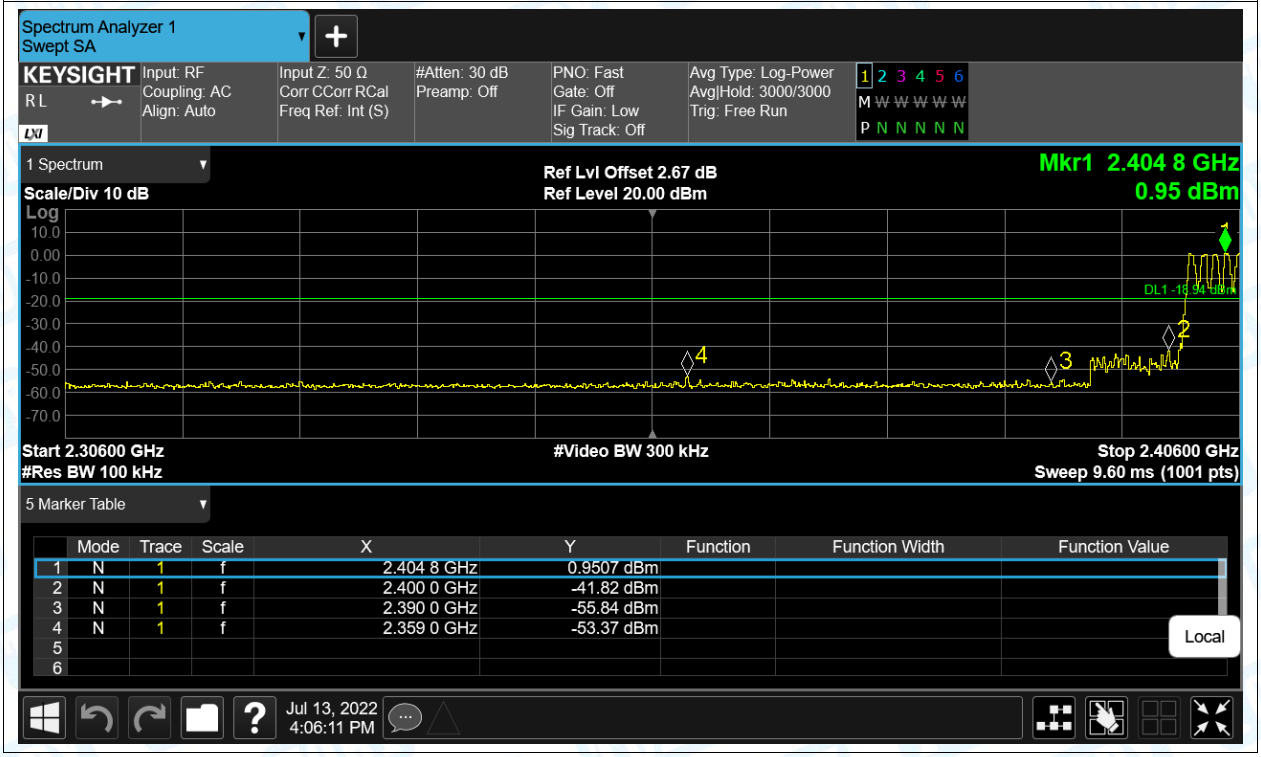
Condition	Mode	Frequency (MHz)	Antenna	Hopping Mode	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	user	2402	Ant1	Hopping	-54.43	-20	Pass
NVN	user	2479	Ant1	Hopping	-51.32	-20	Pass

Test Graphs

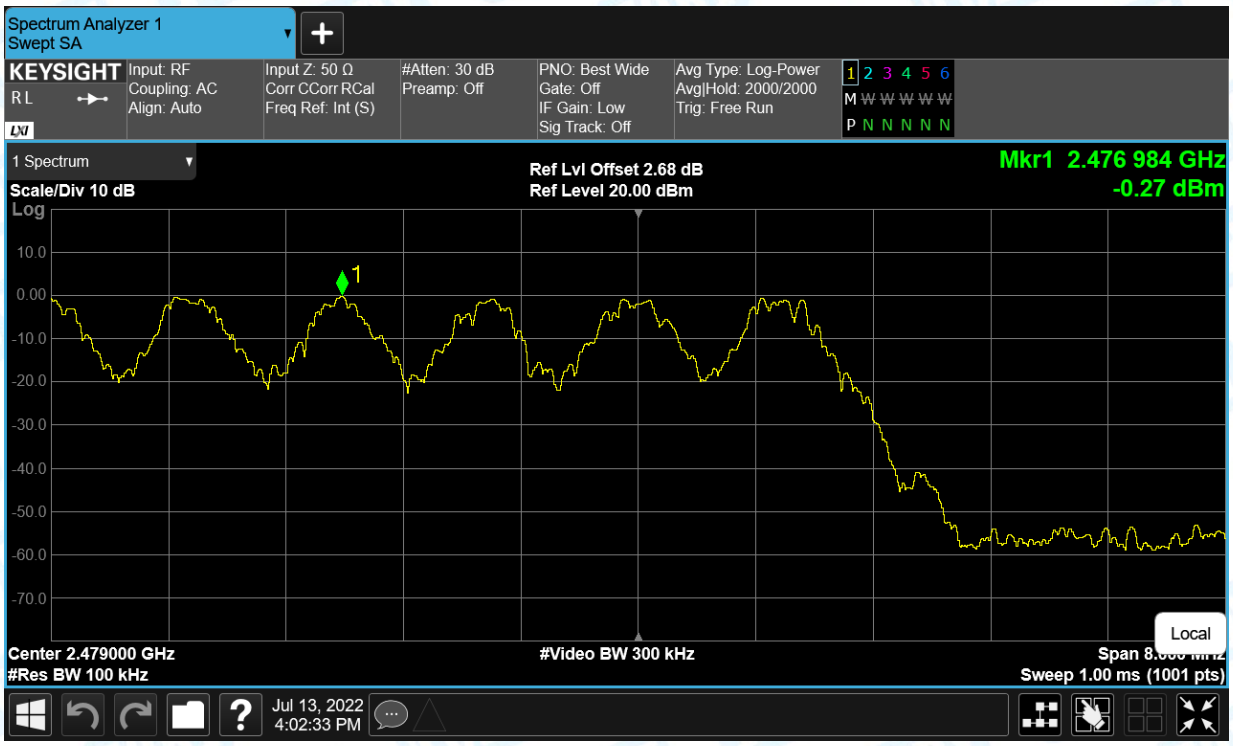
Band Edge(Hopping) NVNT user 2402MHz Ant1 Hopping Ref



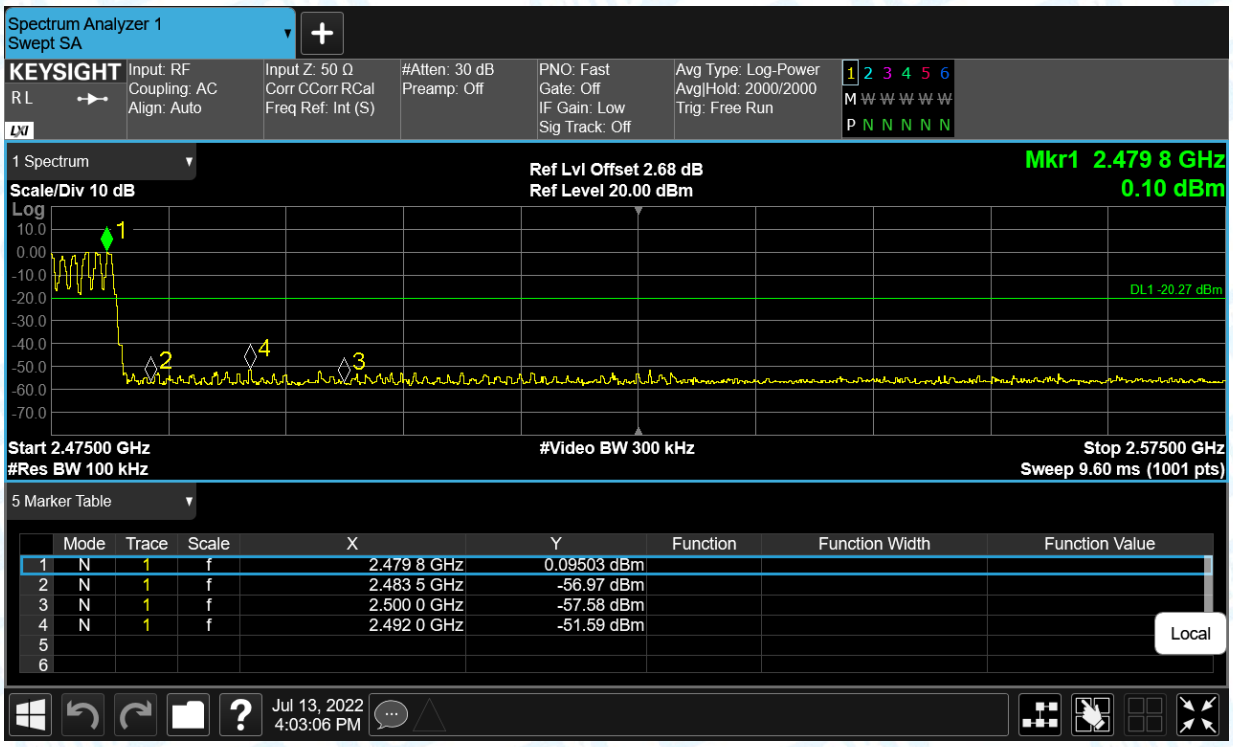
Band Edge(Hopping) NVNT user 2402MHz Ant1 Hopping Emission



Band Edge(Hopping) NVNT user 2479MHz Ant1 Hopping Ref

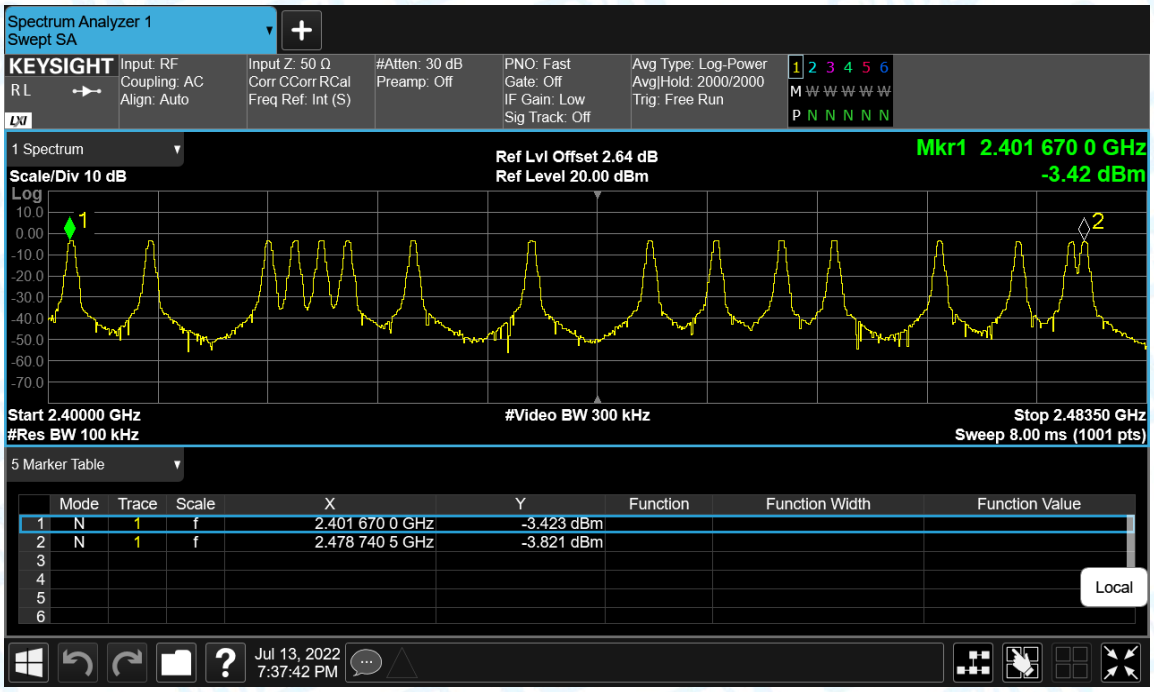


Band Edge(Hopping) NVNT user 2479MHz Ant1 Hopping Emission



Attachment D-- Number of Hopping Channel Test Data

Condition	Antenna	Hopping Number	Limit	Verdict
NVNT	Ant1	16	15	Pass



Attachment E-- Average Time of Occupancy Test Data

Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	DC 5V		
Test Mode:	Hopping Mode (GFSK)		
Remark:	The number of total hopping frequencies up to 16.		

Test Mode	Channel (MHz)	Reading Time (ms)	Total hops	Test Result (ms)	Limit (ms)	Result
GFSK	2437	0.39	15	5.85	**400**	**PASS**

The Dwell Time = Burst Width * Total Hops. The detailed calculations are showed as follows:

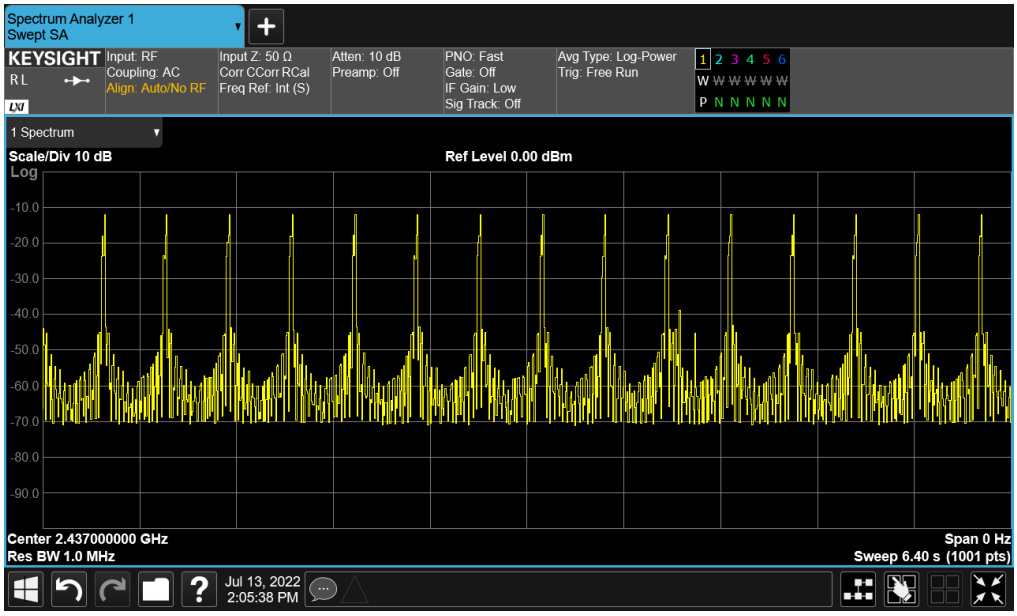
The duration for dwell time calculation: 0.4 [s] * hopping number = 0.4 [s] * 16 [ch] =6.4 [s*ch];

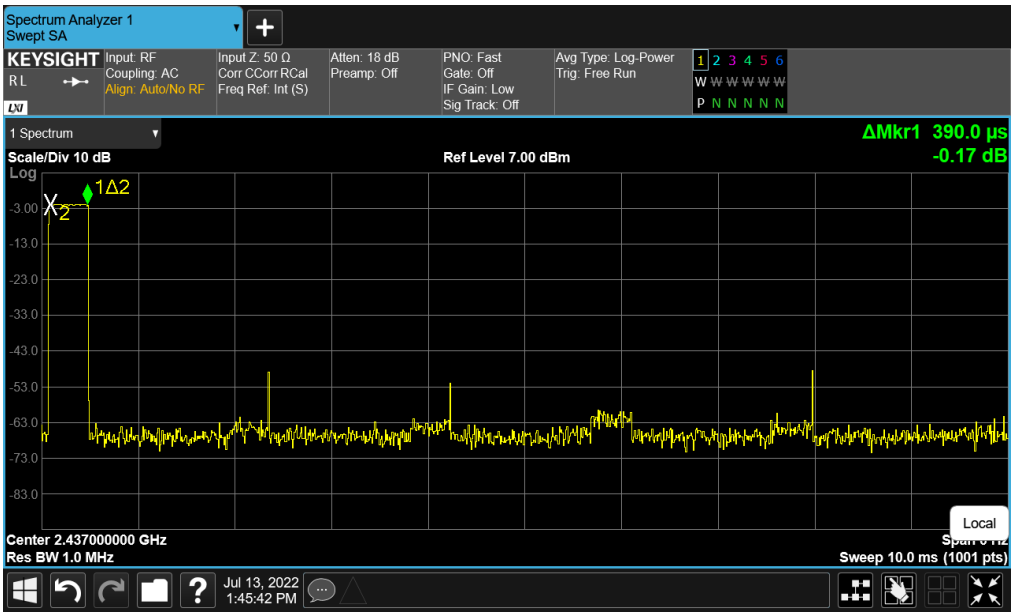
The burst width, which is directly measured, refers to the duration on one channel hop.

The maximum number of hopping channels in 6.4s is 15.

GFSK Hopping Mode

2437 MHz



GFSK Hopping Mode
2437 MHz


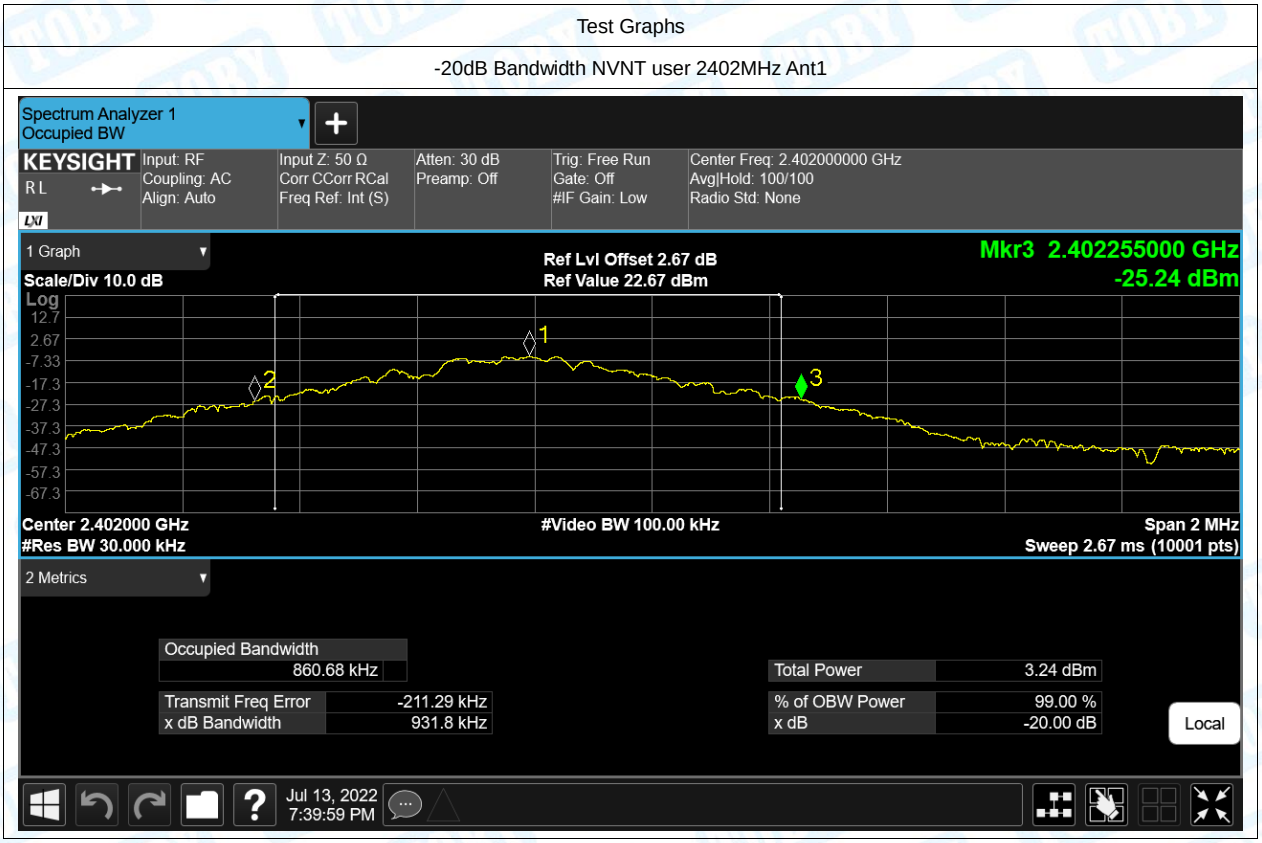
Attachment F-- Channel Separation and Bandwidth Test Data

Bandwidth Test Data:

Condition	Frequency (MHz)	Antenna	20dB BW (MHz)	2/3 *20dB BW (MHz)
NVNT	2402	Ant1	0.9318	0.6212
NVNT	2437	Ant1	0.9340	0.6227
NVNT	2479	Ant1	0.9337	0.6224

Test Graphs

-20dB Bandwidth NVNT user 2402MHz Ant1



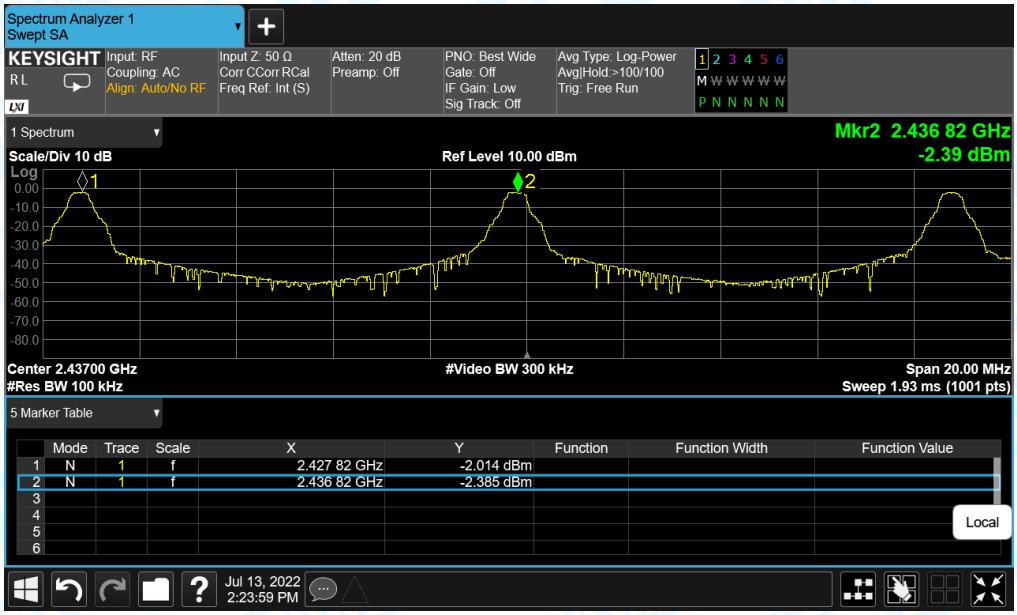
-20dB Bandwidth NVNT user 2437MHz Ant1

-20dB Bandwidth NVNT user 2479MHz Ant1

Channel Separation Test data:

Condition	Antenna	Hopping Freq1 (MHz)	Hopping Freq2 (MHz)	HFS (MHz)	Limit (MHz)	Verdict
NVNT	Ant1	2427.82	2436.82	9.0	0.6227	Pass

Test Graphs
CFS NVNT user 2437MHz Ant1

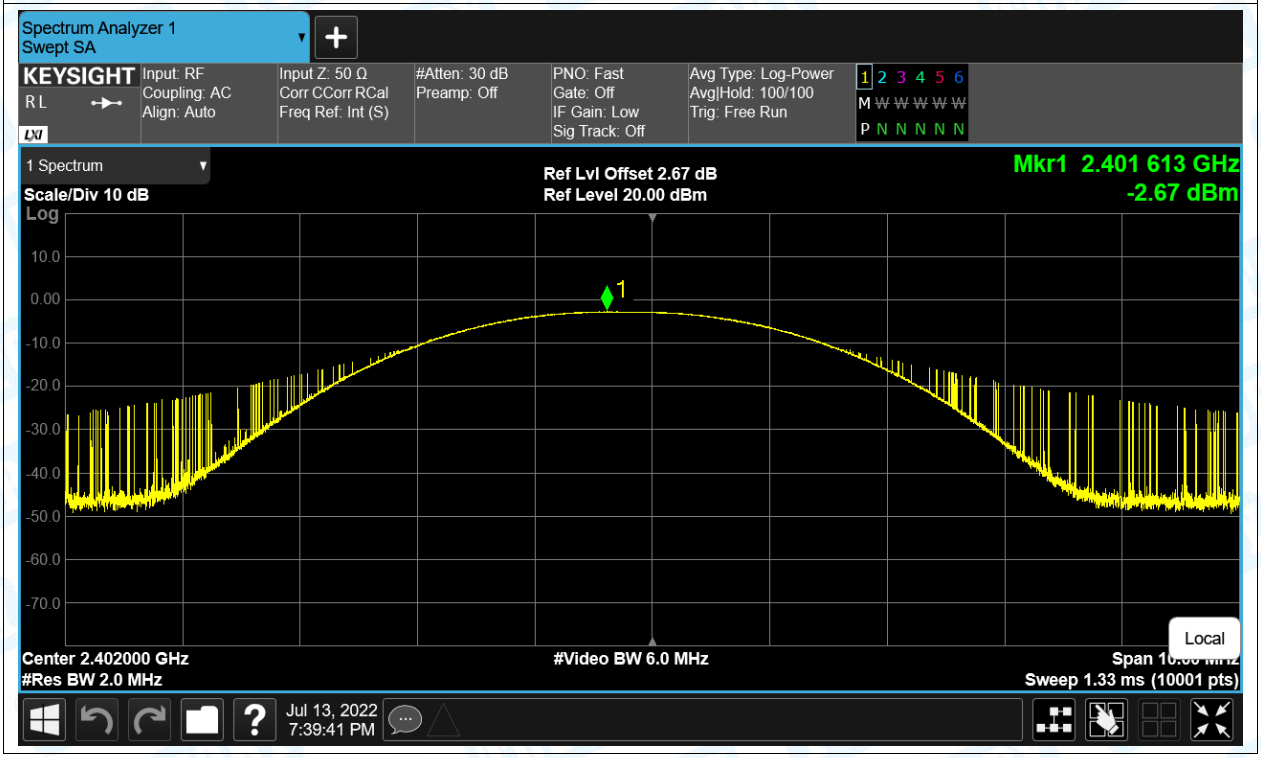


Attachment G-- Peak Output Power Test Data

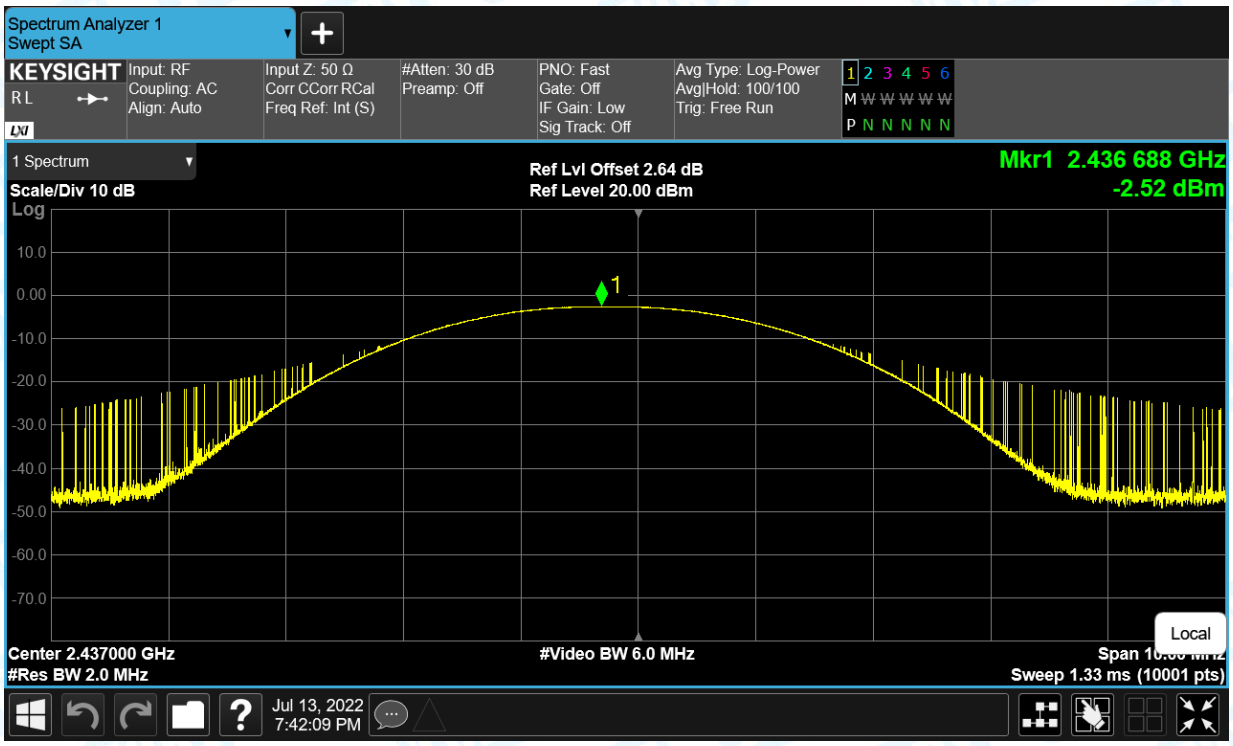
Condition	Frequency (MHz)	Antenna	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	2402	Ant1	-2.67	21	Pass
NVNT	2437	Ant1	-2.52	21	Pass
NVNT	2479	Ant1	-2.92	21	Pass

Test Graphs

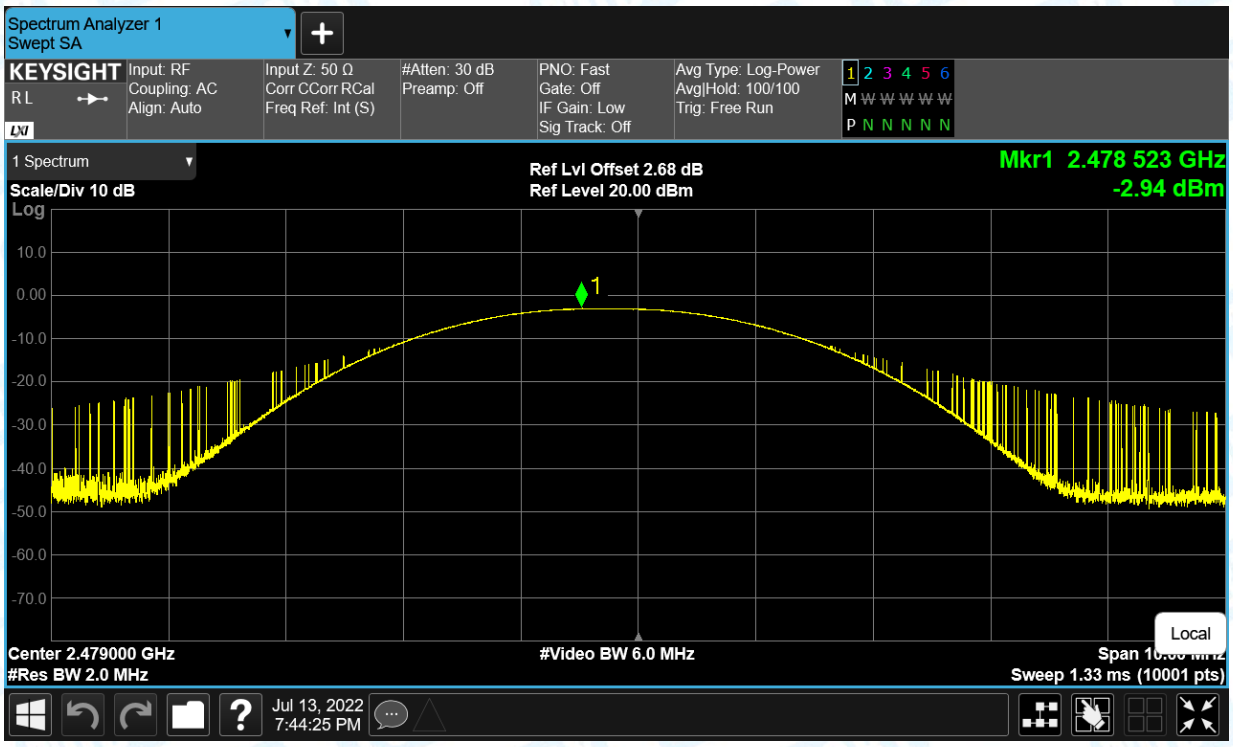
Power NVNT user 2402MHz Ant1



Power NVNT user 2437MHz Ant1



Power NVNT user 2479MHz Ant1



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