RF TEST REPORT

Product Name: PEPS ECU

Model Name: CM04-A01

FCC ID: 2BFHR-CM04-A01

IC: 32210-CM04A01

Issued For : Chongging XF Intelligent Technology Co.Ltd.

5th Floor, Production Building, No.2, Hualong Road, Jiulongpo District, Chongging

Issued By : Shenzhen LGT Test Service Co., Ltd.

Room 205, Building 13, Zone B, Zhenxiong Industrial Park, No.177, Renmin West Road, Jinsha, Kengzi Street, Pingshan District, Shenzhen, Guangdong, China

Report Number:	LGT24C088RF02
Sample Received Date:	Mar. 19, 2024
Date of Test:	Mar. 19, 2024 – Mar. 28, 2024
Date of Issue:	Mar. 28, 2024

TEST REPORT CERTIFICATION

Applicant:	Chongging XF Intelligent Technology Co.Ltd.
Address:	5th Floor, Production Building, No.2, Hualong Road, Jiulongpo District, Chongging
Manufacturer:	Chongging XF Intelligent Technology Co.Ltd.
Address:	5th Floor, Production Building, No.2, Hualong Road, Jiulongpo District, Chongging
Product Name:	PEPS ECU
Trademark:	先锋智科 XF INTELLIGENT TECH
Model Name:	CM04-A01
Sample Status:	Normal

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC Part 15.247, Subpart C RSS-247 Issue 3, August 2023 RSS-Gen Issue 5, February 2021 ANSI C63.10-2013	PASS

Prepared by:

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Zane Shan
Engineer

Approved by:

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Technical Director

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Revision History

Rev.	Issue Date	Contents
00	Mar. 28, 2024	Initial Issue

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:
KDB 558074 D01 15.247 Meas Guidance v05r02.

FCC Part 15.247, Subpart C RSS-247 Issue 3			
Standard Section	Test Item	Judgment	Remark
15.207 RSS-Gen 8.8	Conducted Emission	N/A	--
15.247 (a)(2) RSS-Gen 6.7 RSS-247 5.2 (a)	6dB&99% Bandwidth	PASS	--
15.247 (b)(3) RSS-247 5.4 (d)	Output Power	PASS	--
15.209 RSS-Gen 8.9/8.10	Radiated Spurious Emission	PASS	--
15.247 (d) RSS-Gen 8.9/8.10	Conducted Spurious & Band Edge Emission	PASS	--
15.247 (e) RSS-247 5.2 (b)	Power Spectral Density	PASS	--
15.205 RSS-Gen 8.9/8.10	Restricted Band Edge Emission	PASS	--
Part 15.247(d)/ Part 15.209(a) RSS-247 5.5 RSS-Gen 8.9/8.10	Band Edge Emission	PASS	--
15.203 RSS-Gen 6.8	Antenna Requirement	PASS	--
RSS-Gen 6.11/8.11	Frequency Stability	PASS	--

NOTE:

(1) 'N/A' denotes test is not applicable in this Test Report.

(2) All tests are according to ANSI C63.10-2013.

1.1 TEST FACTORY

Company Name:	Shenzhen LGT Test Service Co., Ltd.
Address:	Room 205, Building 13, Zone B, Zhenxiong Industrial Park, No.177, Renmin West Road, Jinsha, Kengzi Street, Pingshan District, Shenzhen, Guangdong, China
Accreditation Certificate	A2LA Certificate No.: 6727.01
	FCC Registration No.: 746540
	CAB ID: CN0136

1.2 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** %.

No.	Item	Uncertainty
1	RF output power, conducted	±0.68dB
2	Unwanted Emissions, conducted	±2.988dB
3	All emissions, radiated 9K-30MHz	±2.84dB
4	All emissions, radiated 30M-1GHz	±4.39dB
5	All emissions, radiated 1G-6GHz	±5.10dB
6	All emissions, radiated>6G	±5.48dB
7	Conducted Emission (9KHz-150KHz)	±2.79dB
8	Conducted Emission (150KHz-30MHz)	±2.80dB
9	Emission Bandwidth	±3.2 %

Note: The measurement uncertainty is not included in the test result.

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name:	PEPS ECU
Trademark:	先锋智科 XF INTELLIGENT TECH
Model Name:	CM04-A01
Series Model:	N/A
Model Difference:	N/A
Product Description:	Operation Frequency: 2402~2480 MHz Modulation Type: GFSK Radio Technology: BLE Bluetooth Configuration: BLE (1M PHY, 2M PHY) Number Of Channel: 40 Antenna Type: PCB Antenna Gain (dBi): -0.66
Channel List:	Please refer to the Note 3.
Rating:	Input: DC 12V
Hardware Version:	CM04-A01-HVX.X
Software Version:	CM04-A01_SVX.X
Connecting I/O Port(s):	Please refer to the Note 1.

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User Manual.
2. The antenna information refers to the manufacturer provide report, applicable only to the tested sample identified in the report. Due to the incorrect antenna information, a series of problems such as the accuracy of the test results will be borne by the customer.

3.

Channel List							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	10	2422	20	2442	30	2462
01	2404	11	2424	21	2444	31	2464
02	2406	12	2426	22	2446	32	2466
03	2408	13	2428	23	2448	33	2468
04	2410	14	2430	24	2450	34	2470
05	2412	15	2432	25	2452	35	2472
06	2414	16	2434	26	2454	36	2474
07	2416	17	2436	27	2456	37	2476
08	2418	18	2438	28	2458	38	2478
09	2420	19	2440	29	2460	39	2480

2.2 DESCRIPTION OF THE TEST MODES

For conducted test items and radiated spurious emissions
Each of these EUT operation mode(s) or test configuration mode(s) mentioned below was evaluated respectively.

Worst Mode	Description	Data/Modulation
Mode 1	TX CH00(2402MHz)	1 MHz/GFSK
Mode 2	TX CH19(2440MHz)	1 MHz/GFSK
Mode 3	TX CH39(2480MHz)	1 MHz/GFSK
Mode 4	TX CH00(2402MHz)	2 MHz/GFSK
Mode 5	TX CH19(2440MHz)	2 MHz/GFSK
Mode 6	TX CH39(2480MHz)	2 MHz/GFSK

Note:
(1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported.
(2) The battery is fully-charged during the radited and RF conducted test.

2.3 TEST SOFTWARE AND POWER LEVEL

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level.

Test software Version	Test program: BLE	
SmartRF_2.24.0.0	Mode Or Modulation type	Power setting
	1M	5
	2M	5

2.4 DESCRIPTION OF NECESSARY ACCESSORIES AND 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.

Accessories Equipment

Description	Manufacturer	Model	S/N	Rating

Auxiliary Equipment

Description	Manufacturer	Model	S/N	Rating

Note:

(1) For detachable type I/O cable should be specified the length in cm in『Length』column.

(2) “YES” is means “with core”; “NO” is means “without core”.

2.5 EQUIPMENTS LIST

Radiated Test equipment					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date**	**Cal. Until**
EMI Test Receiver	R&S	ESU8	100372	2023.04.13	2024.04.12
Active loop Antenna	ETS	6502	00049544	2022.06.02	2025.06.01
Spectrum Analyzer	Keysight	N9010B	MY60242508	2023.04.10	2024.04.09
Bilog Antenna(30M-1G)	SCHWARZBECK	VULB 9168	2705	2022.06.05	2025.06.04
Horn Antenna(1-18G)	SCHWARZBECK	3115	10SL0060	2022.06.02	2025.06.01
Horn Antenna(18-40G)	A-INFO	LB-180400-KF	J211060273	2022.06.08	2025.06.07
Pre-amplifier(30M-1G)	EMtrace	RP01A	02019	2023.04.07	2024.04.06
Pre-amplifier(1-26.5G)	Agilent	8449B	3008A4722	2023.04.07	2024.04.06
Pre-amplifier(18-40G)	com-mw	LNPA_18-40-01	18050003	2023.04.07	2024.04.06
Wireless Communications Test Set	R&S	CMW 500	137737	2023.04.13	2024.04.12
Temperature & Humidity	KTJ	TA218B	N.A	2023.04.24	2024.04.23
Temperature& Humidity test chamber	AISRY	LX-1000L	171200018	2023.08.14	2024.08.13
Antenna Tower	SAEMC	BK-4AT-BS-D	SK2021093008	N.A	N.A
Testing Software	EMC-I_V1.4.0.3_SKET				

Conducted Test equipment					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date**	**Cal. Until**
Signal Analyzer	Keysight	N9010B	MY60242508	2023.04.10	2024.04.09
Wireless Communications Test Set	R&S	CMW 500	137737	2023.04.13	2024.04.12
MXG Vector Signal Generator	Keysight	N5182B	MY59100717	2023.04.07	2024.04.06
Power Sensor	MW	MW100-RFCB	MW220324LG-33	2023.04.13	2024.04.12
Temperature & Humidity	KTJ	TA218B	N.A	2023.04.24	2024.04.23
Temperature& Humidity test chamber	AISRY	LX-1000L	171200018	2023.05.10	2024.05.09
Attenuator	eastsheep	90db	N.A	2023.04.10	2024.04.09
Testing Software	MTS8200_ V2.0.0.0_MW				

3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table.

FREQUENCY (MHz)	Conducted Emission limit (dBuV)	
	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

Note:

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

(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

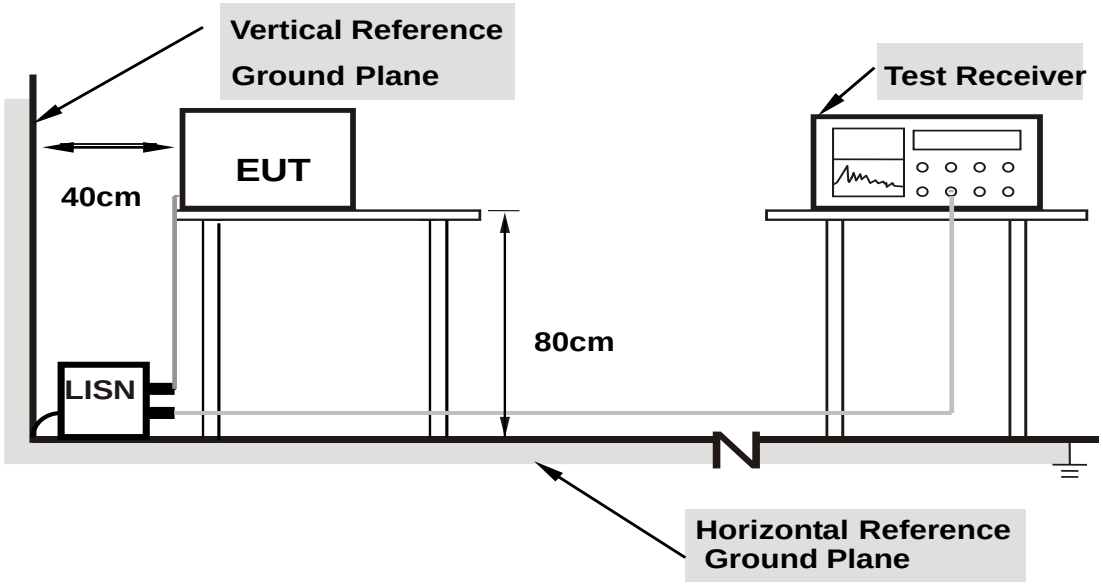
The following table is the setting of the receiver

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

3.2 TEST PROCEDURE

a. The EUT is 0.8 m from the horizontal ground plane and 0.4 m from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments are powered from additional LISN(s). The LISN provides 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. 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.
c. 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.
d. LISN is at least 80 cm from the nearest part of EUT chassis.
e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.3 TEST SETUP



Note: 1. Support units were connected to second LISN.

2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes support units.

3.4 EUT OPERATING CONDITIONS

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

3.5 TEST RESULTS

The product only supports DC power supply, test is not applicable.

4. RADIATED EMISSION MEASUREMENT

4.1 RADIATED EMISSION LIMITS

In case the emission fall within the Restricted band specified on Part15.205 (a)&209(a), RSS-Gen and RSS-247 (5.5) limit in the table and according to ANSI C63.10-2013 below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009MHz - 1000MHz)

Frequencies (MHz)	Field Strength (micorvolts/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

LIMITS OF RADIATED EMISSION MEASUREMENT (1GHz-25 GHz)

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

Notes:

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

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

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

LIMITS OF RESTRICTED FREQUENCY BANDS

FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (GHz)
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

For Radiated Emission

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/QP/AV
Start Frequency	9 KHz/150KHz (Peak/QP/AV)
Stop Frequency	150KHz/30MHz (Peak/QP/AV)
RB / VB (emission in restricted band)	200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz); 200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz)

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/QP
Start Frequency	30 MHz (Peak/QP)
Stop Frequency	1000 MHz (Peak/QP)
RB / VB (emission in restricted band)	120 KHz / 300 KHz

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak
Start Frequency	1000 MHz (Peak/AV)
Stop Frequency	10th carrier hamonic (Peak/AV)
RB / VB (emission in restricted band)	1 MHz / 3 MHz(Peak) 1 MHz/1/T MHz(AVG)

For Restricted band

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 2310 to 2410 MHz Upper Band Edge: 2475 to 2500 MHz
RB / VB	1 MHz / 3 MHz(Peak) 1 MHz/1/T MHz(AVG)

Receiver Parameter	**Setting**
Start ~ Stop Frequency	9kHz~90kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	90kHz~110kHz / RB 200Hz for QP
Start ~ Stop Frequency	110kHz~490kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	490kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

4.2 TEST PROCEDURE

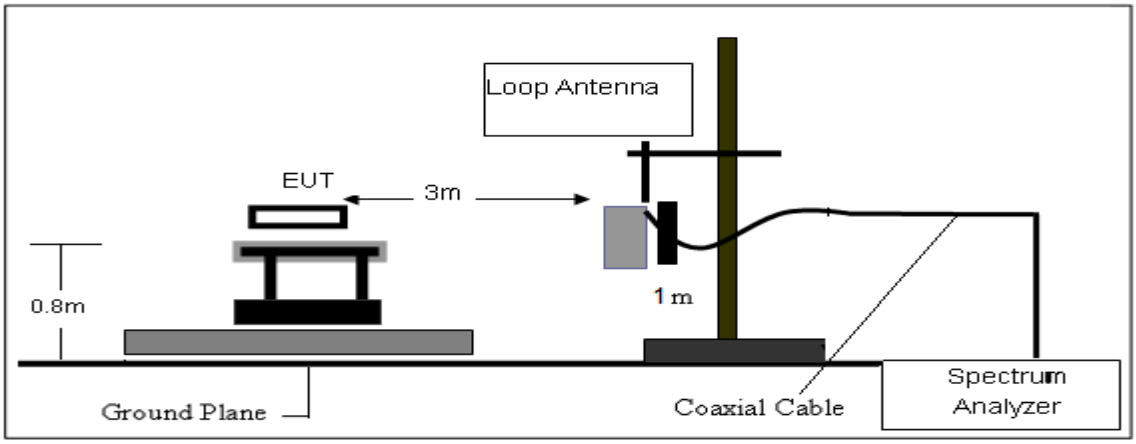
a. The measuring distance at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz, and above 1GHz.
b. The EUT was placed on the top of a rotating table 0.8 m (above 1GHz is 1.5 m) above the ground at a 3 m anechoic chamber test site. The table was rotated 360 degree to determine the position of the highest radiation.
c. The height of the equipment shall be 0.8 m(above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. Horizontal and vertical polarization of the antenna are set to make the measurement.
d. 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 QuasiPeak detector mode will be re-measured.
e. If the Peak Mode measured value is compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and no additional QP Mode measurement was performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

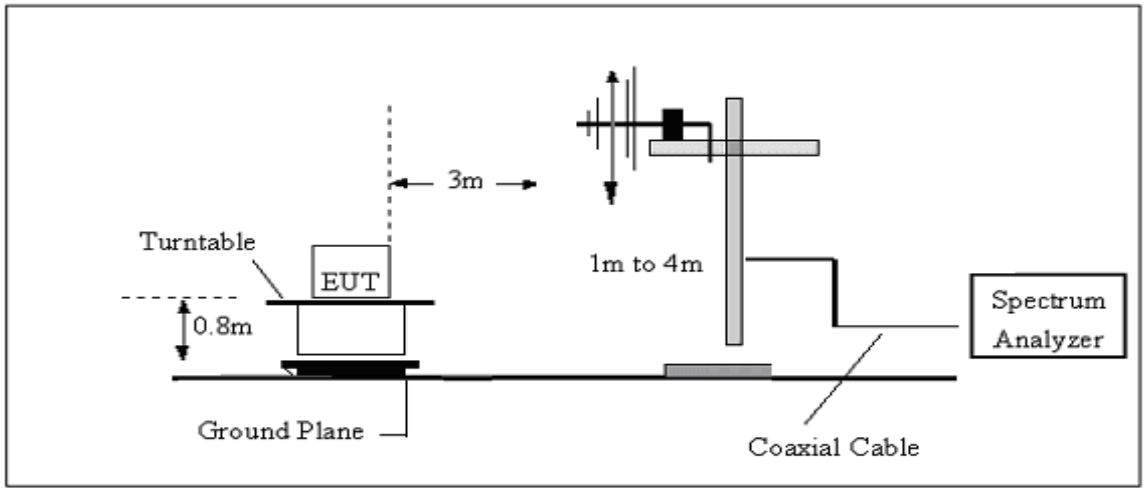
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

4.3 TEST SETUP

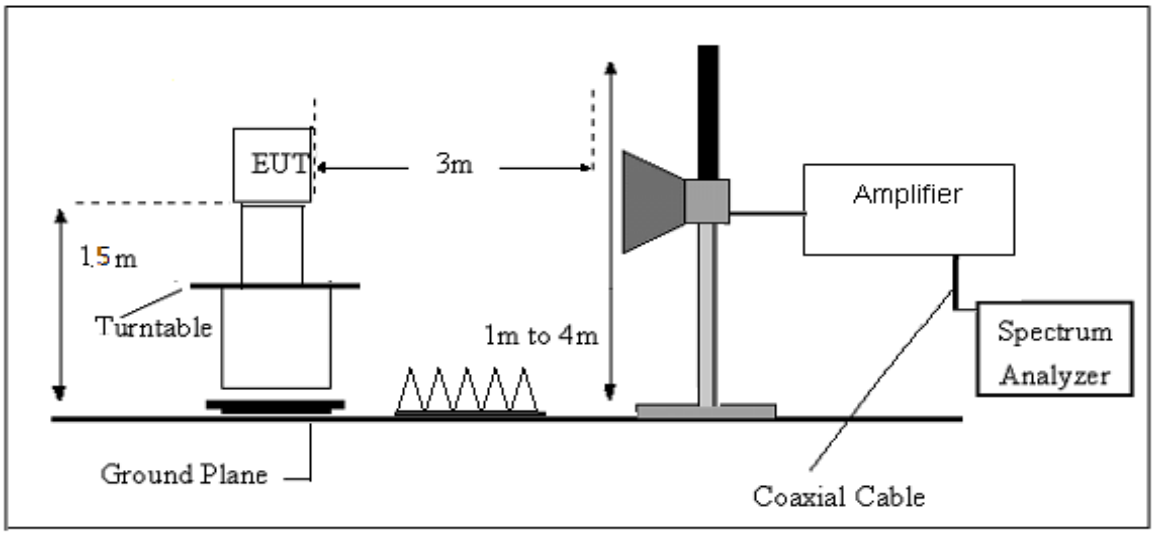
(A) Radiated Emission Test-Up Frequency Below 30MHz



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



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



4.4 EUT OPERATING CONDITIONS

Please refer to section 3.4 of this report.

Notch filter was used for blocking out the carrier.

4.5 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where

FS = Field Strength

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

For example

Frequency	FS	RA	AF	CL	AG	Factor
(MHz)	(dBμV/m)	(dBμV/m)	(dB)	(dB)	(dB)	(dB)
300	40	58.1	12.2	1.6	31.9	-18.1

Factor=AF+CL-AG

4.6 TEST RESULTS

Results of Radiated Emissions (9 KHz~30MHz)

No.	Frequency	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Remark
1*	-	-	-	-	-	-	-	See Note

Note:

The emission from 9 kHz to 30MHz was pre-tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.

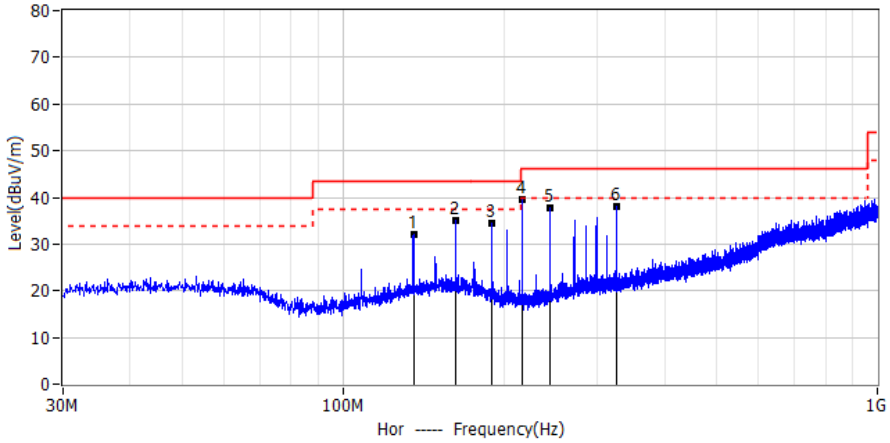
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

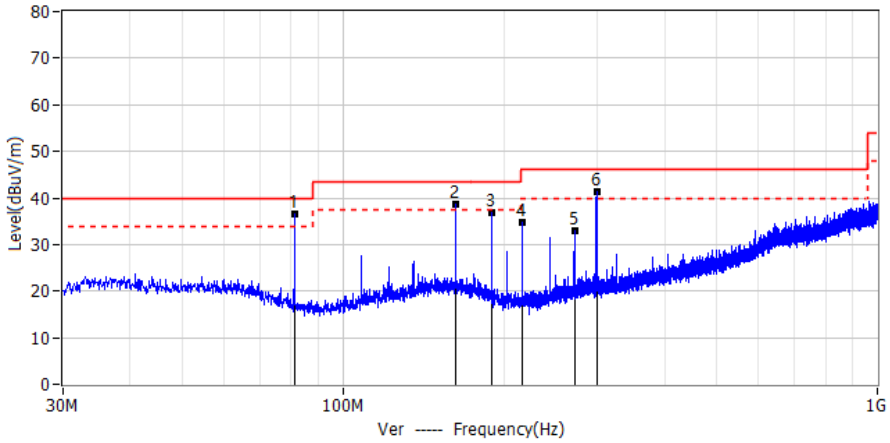
Results of Radiated Emissions (30MHz~1000MHz)

Note: The peak value is less than the AV limit, so no AV data is displayed.

Project: LGT24C088	Test Engineer: Xiangdong Ma
EUT: PEPS ECU	Temperature: 22℃
M/N: CM04-A01	Humidity: 45%RH
Test Voltage: DC 12V	Test Data: 2024-03-25
Test Mode: TX BLE 2402	
Note:	



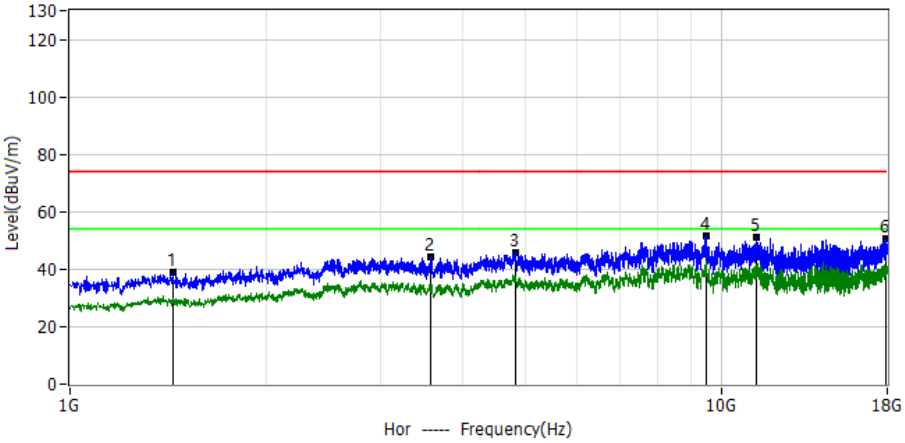
No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	135.609	13.38	18.81	32.19	43.50	-11.31	QP	Hor
2*	162.648	15.21	19.82	35.03	43.50	-8.47	QP	Hor
3*	189.808	16.75	17.70	34.45	43.50	-9.05	QP	Hor
4*	216.968	22.59	16.93	39.52	46.00	-6.48	QP	Hor
5*	244.006	19.72	17.90	37.62	46.00	-8.38	QP	Hor
6*	325.486	17.29	20.71	38.00	46.00	-8.00	QP	Hor



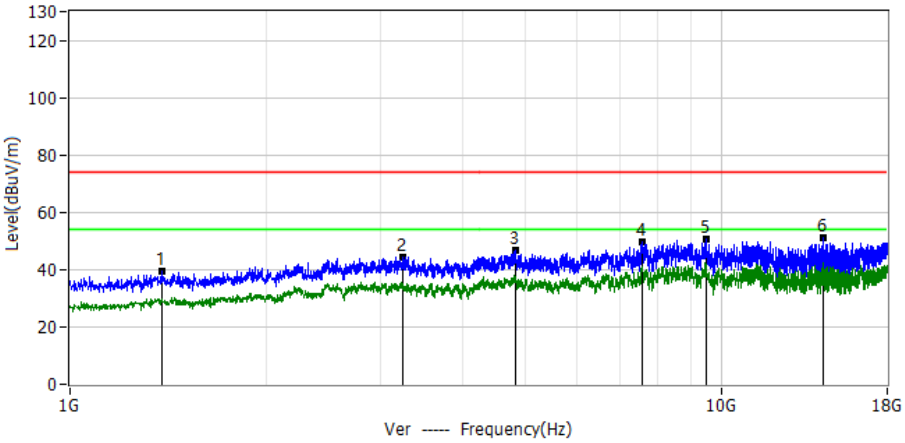
No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	81.289	21.44	15.18	36.62	40.00	-3.38	QP	Ver
2*	162.648	18.89	19.82	38.71	43.50	-4.79	QP	Ver
3*	189.808	19.26	17.70	36.96	43.50	-6.54	QP	Ver
4*	216.968	17.79	16.93	34.72	46.00	-11.28	QP	Ver
5*	271.166	13.74	19.24	32.98	46.00	-13.02	QP	Ver
6*	298.326	21.41	19.88	41.29	46.00	-4.71	QP	Ver

Results of Radiated Emissions (Above 1000MHz)

Project: LGT24C088	Test Engineer: Xiangdong Ma
EUT: PEPS ECU	Temperature: 22℃
M/N: CM04-A01	Humidity: 45%RH
Test Voltage: DC 12V	Test Data: 2024-03-25
Test Mode: BLE 1M 2402	
Note: Worst Case	

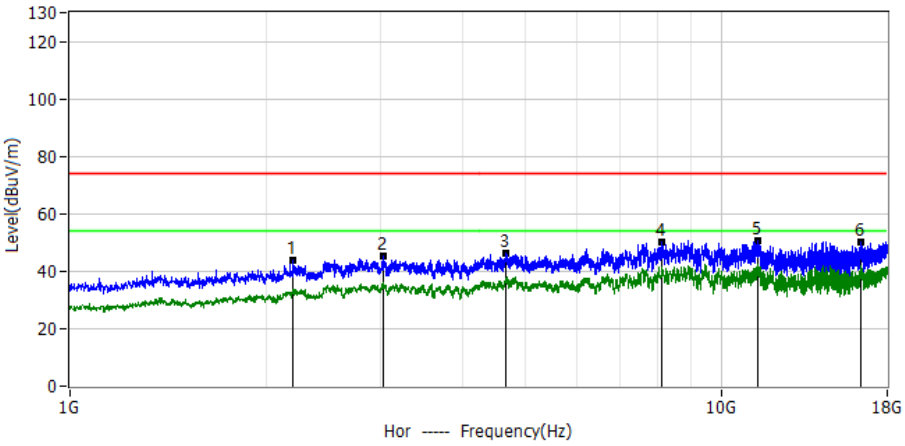


No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	1439.9000	60.22	-21.26	38.96	74.00	-35.04	PK	Hor
2*	3588.2000	53.10	-8.95	44.15	74.00	-29.85	PK	Hor
3*	4842.0000	52.50	-6.84	45.66	74.00	-28.34	PK	Hor
4*	9468.1000	55.63	-3.91	51.72	74.00	-22.28	PK	Hor
5*	11353.0000	52.96	-1.84	51.12	74.00	-22.88	PK	Hor
6*	17936.2000	48.48	1.99	50.47	74.00	-23.53	PK	Hor

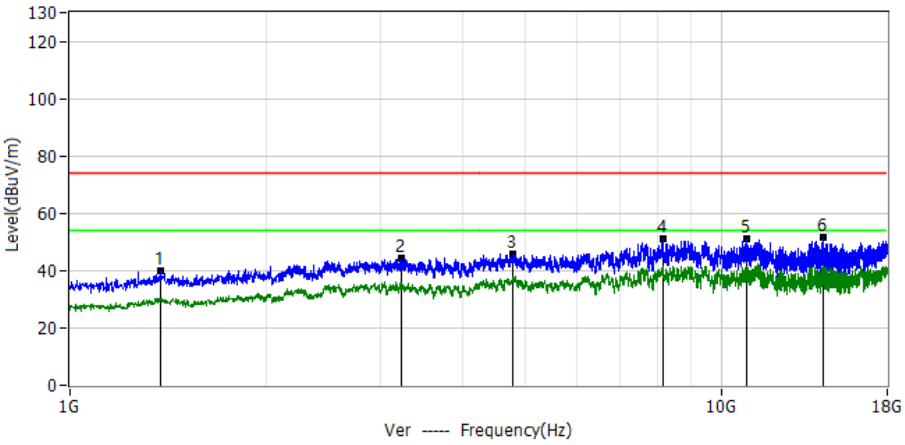


No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	1386.7000	60.92	-21.57	39.35	74.00	-34.65	PK	Ver
2*	3237.6000	53.45	-8.90	44.55	74.00	-29.45	PK	Ver
3*	4831.4000	53.54	-6.83	46.71	74.00	-27.29	PK	Ver
4*	7562.0000	55.25	-5.66	49.59	74.00	-24.41	PK	Ver
5*	9478.7000	54.41	-3.91	50.50	74.00	-23.50	PK	Ver
6*	14366.2000	50.21	0.72	50.93	74.00	-23.07	PK	Ver

Project: LGT24C088	Test Engineer: Xiangdong Ma
EUT: PEPS ECU	Temperature: 22℃
M/N: CM04-A01	Humidity: 45%RH
Test Voltage: DC 12V	Test Data: 2024-03-25
Test Mode: BLE 1M 2440	
Note: Worst Case	

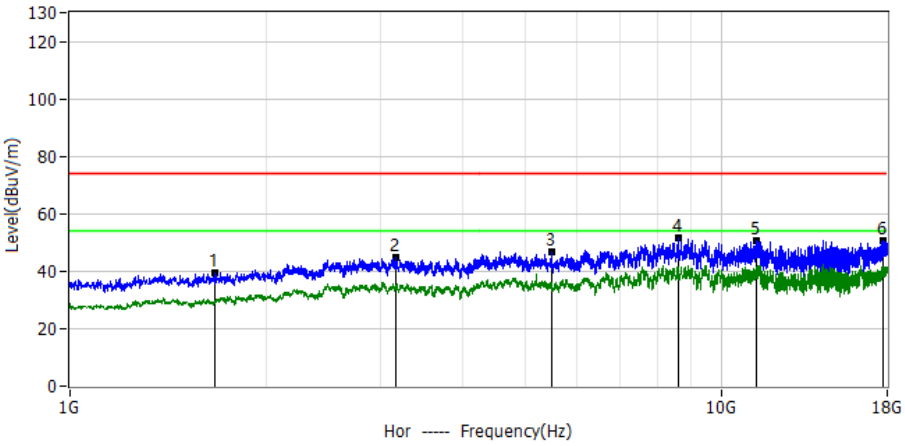


No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	2198.5000	58.32	-14.40	43.92	74.00	-30.08	PK	Hor
2*	3023.0000	54.26	-8.78	45.48	74.00	-28.52	PK	Hor
3*	4680.5000	52.85	-6.68	46.17	74.00	-27.83	PK	Hor
4*	8114.5000	55.54	-5.29	50.25	74.00	-23.75	PK	Hor
5*	11359.4000	52.42	-1.84	50.58	74.00	-23.42	PK	Hor
6*	16393.5000	49.51	0.78	50.29	74.00	-23.71	PK	Hor

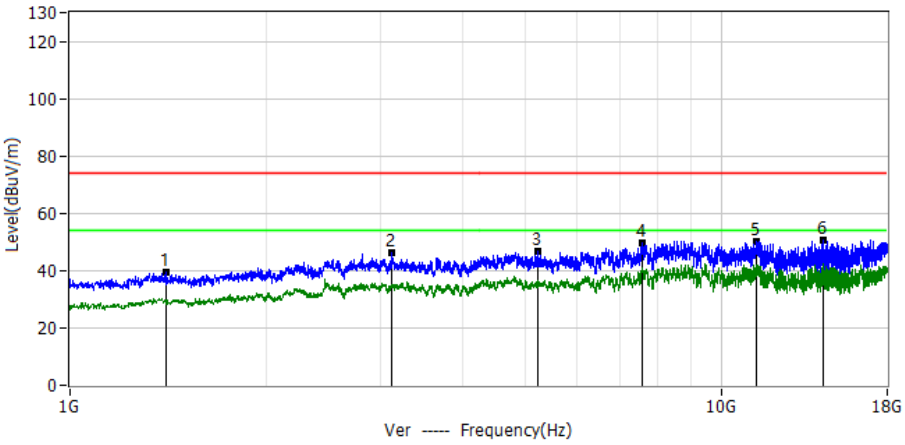


No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	1380.4000	61.43	-21.62	39.81	74.00	-34.19	PK	Ver
2*	3233.4000	52.98	-8.90	44.08	74.00	-29.92	PK	Ver
3*	4788.9000	52.50	-6.79	45.71	74.00	-28.29	PK	Ver
4*	8133.6000	56.26	-5.26	51.00	74.00	-23.00	PK	Ver
5*	10923.7000	53.22	-2.05	51.17	74.00	-22.83	PK	Ver
6*	14368.4000	50.85	0.72	51.57	74.00	-22.43	PK	Ver

Project: LGT24C088	Test Engineer: Xiangdong Ma
EUT: PEPS ECU	Temperature: 22℃
M/N: CM04-A01	Humidity: 45%RH
Test Voltage: DC 12V	Test Data: 2024-03-25
Test Mode: BLE 1M 2480	
Note: Worst Case	



No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	1667.2000	59.24	-19.67	39.57	74.00	-34.43	PK	Hor
2*	3171.7000	53.89	-8.86	45.03	74.00	-28.97	PK	Hor
3*	5488.0000	55.24	-8.66	46.58	74.00	-27.42	PK	Hor
4*	8579.9000	55.81	-4.44	51.37	74.00	-22.63	PK	Hor
5*	11336.0000	52.26	-1.84	50.42	74.00	-23.58	PK	Hor
6*	17766.2000	48.66	1.91	50.57	74.00	-23.43	PK	Hor



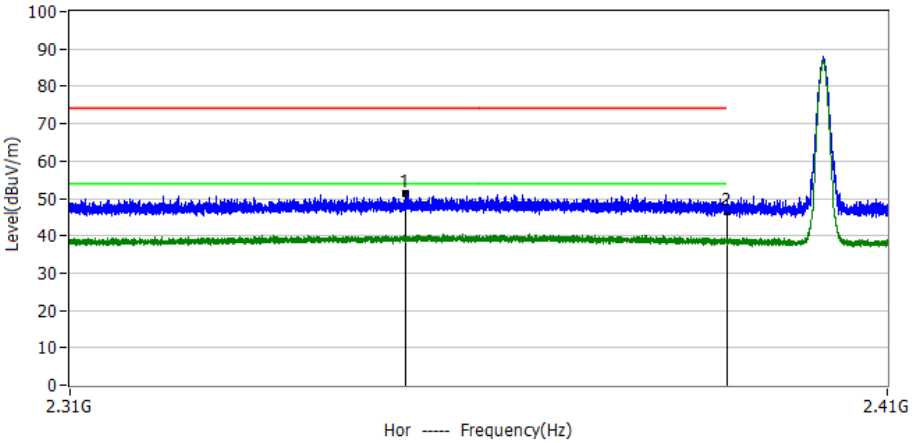
No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	1408.0000	60.66	-21.43	39.23	74.00	-34.77	PK	Ver
2*	3125.0000	55.31	-8.84	46.47	74.00	-27.53	PK	Ver
3*	5224.5000	54.46	-7.76	46.70	74.00	-27.30	PK	Ver
4*	7572.6000	55.51	-5.66	49.85	74.00	-24.15	PK	Ver
5*	11346.6000	52.19	-1.84	50.35	74.00	-23.65	PK	Ver
6*	14364.1000	49.90	0.72	50.62	74.00	-23.38	PK	Ver

Remark:
In frequency ranges 18~25GHz no any other harmonic emissions detected which are tested to compliance with the limit. No recording in the test report. No any other emissions level which are attenuated less than 20dB below the limit. No recording in the test report.

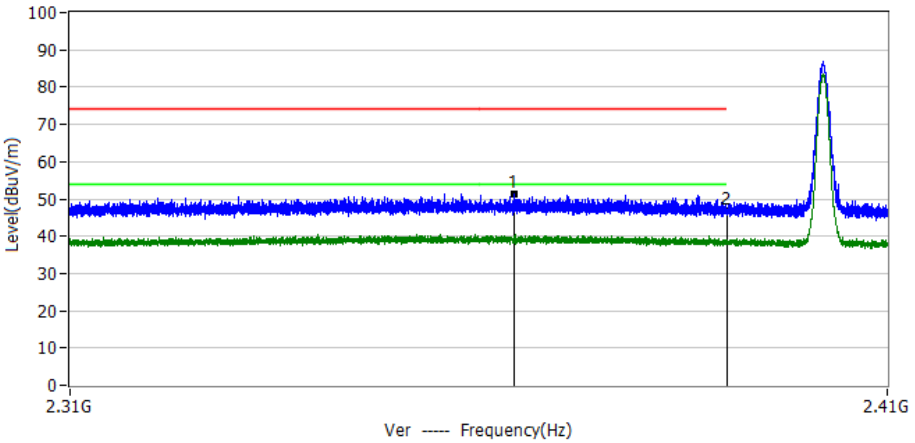
4.7 TEST RESULTS (BAND EDGE REQUIREMENTS)

Note: The peak value is less than the AV limit, so no AV data is displayed.

Project: LGT24C088	Test Engineer: Xiangdong Ma
EUT: PEPS ECU	Temperature: 22℃
M/N: CM04-A01	Humidity: 45%RH
Test Voltage: DC 12V	Test Data: 2024-03-25
Test Mode: BLE 1M 2402	
Note:	

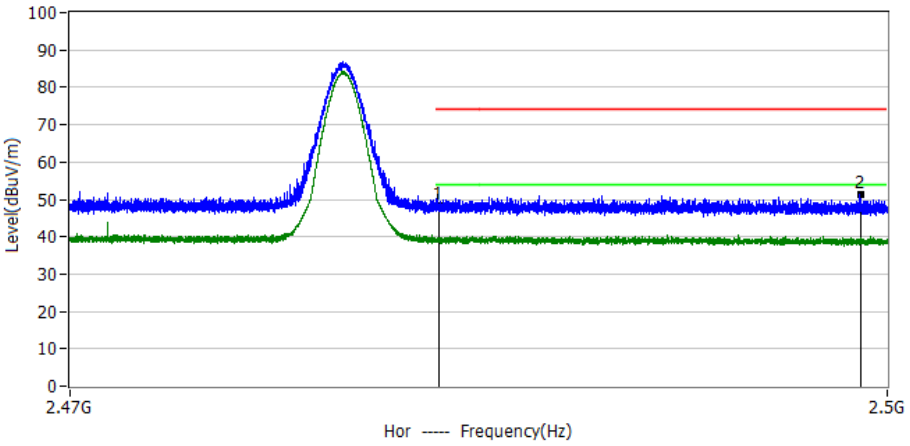


No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	2350.6000	17.20	34.05	51.25	74.00	-22.75	PK	Hor
2*	2390.0000	12.35	33.95	46.30	74.00	-27.70	PK	Hor

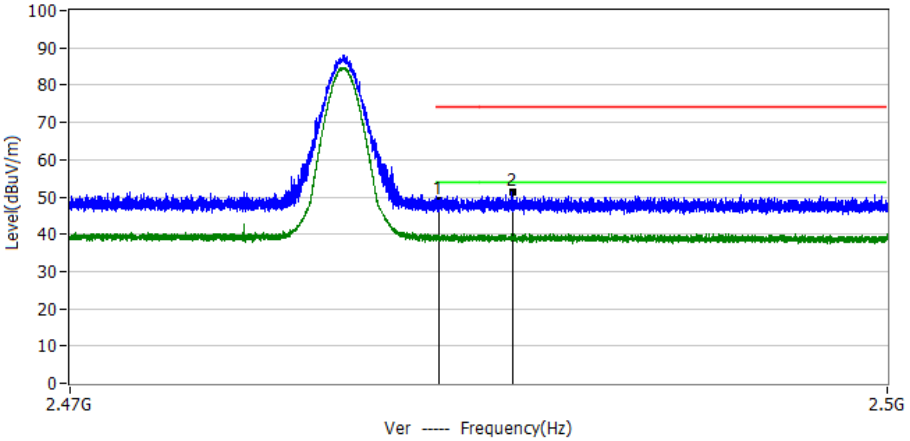


No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	2363.9000	17.27	34.01	51.28	74.00	-22.72	PK	Ver
2*	2390.0000	12.95	33.95	46.90	74.00	-27.10	PK	Ver

Project: LGT24C088	Test Engineer: Xiangdong Ma
EUT: PEPS ECU	Temperature: 22℃
M/N: CM04-A01	Humidity: 45%RH
Test Voltage: DC 12V	Test Data: 2024-03-25
Test Mode: BLE 1M 2480	
Note:	



No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	2483.5000	14.27	34.13	48.40	74.00	-25.60	PK	Hor
2*	2499.0000	17.11	34.16	51.27	74.00	-22.73	PK	Hor



No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	2483.5000	15.07	34.13	49.20	74.00	-24.80	PK	Ver
2*	2486.2000	17.17	34.13	51.30	74.00	-22.70	PK	Ver

5. CONDUCTED SPURIOUS & BAND EDGE EMISSION

5.1 LIMIT

According to FCC section 15.247(d)&RSS-247, in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

5.2 TEST PROCEDURE

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	30 MHz to 10th carrier harmonic
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

For Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 2300 – 2407 MHz Upper Band Edge: 2475 – 2500 MHz
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

5.3 TEST SETUP

The EUT which is powered by the battery, is connected to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50 Ohm; the path loss as the factor is calibrated to correct the reading. Make the measurement with the spectrum analyzer's resolution bandwidth(RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

5.4 EUT OPERATION CONDITIONS

Please refer to section 3.4 of this report.

5.5 TEST RESULTS

For the measurement records, refer to the appendix I.

6. POWER SPECTRAL DENSITY TEST

6.1 LIMIT

Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(e) RSS-247	Power Spectral Density	≤8 dBm (RBW≥3KHz)	2400-2483.5	PASS

6.2 TEST PROCEDURE

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the RBW to: 100 kHz ≥ RBW ≥ 3 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

6.3 TEST SETUP

6.4 EUT OPERATION CONDITIONS

Please refer to section 3.4 of this report.

6.5 TEST RESULTS

For the measurement records, refer to the appendix I.

7. BANDWIDTH TEST

7.1 LIMIT

Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2) RSS-247 5.2 (a)	Bandwidth	>= 500KHz (6dB bandwidth)	2400-2483.5	PASS
RSS-Gen Clause 6.7	99% Bandwidth	For reporting purposes only.	2400-2483.5	PASS

7.2 TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	For 6 dB Bandwidth :100KHz For 99% Bandwidth :1% to 5% of the occupied bandwidth
VBW	For 6dB Bandwidth : ≥3 × RBW For 99% Bandwidth : approximately 3×RBW
Trace	Max hold
Sweep	Auto

Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB and 99% relative to the maximum level measured in the fundamental emission.

7.3 TEST SETUP

7.4 EUT OPERATION CONDITIONS

Please refer to section 3.4 of this report.

7.5 TEST RESULTS

For the measurement records, refer to the appendix I.

8. PEAK OUTPUT POWER TEST

8.1 LIMIT

Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3) RSS-247	Output Power	1 watt or 30dBm	2400-2483.5	PASS
RSS-247	EIRP	4W	2400-2483.5	PASS

8.2 TEST PROCEDURE

One of the following procedures may be used to determine the maximum peak conducted output power of a DTS EUT.

RBW ≥ DTS bandwidth

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:

a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ [3 × RBW].
c) Set span ≥ [3 × RBW].
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

Integrated band power method:

The following procedure can be used when the maximum available RBW of the instrument is less than the
DTS bandwidth:

a) Set the RBW = 1 MHz.
b) Set the VBW ≥ [3 × RBW].
c) Set the span ≥ [1.5 × DTS bandwidth].
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select the peak detector). If the instrument does not have a band power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS channel bandwidth.

PKPM1 Peak power meter method:

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall use a fast-responding diode detector.

8.3 TEST SETUP

8.4 EUT OPERATION CONDITIONS

Please refer to section 3.4 of this report.

8.5 TEST RESULTS

For the measurement records, refer to the appendix I.

9. ANTENNA REQUIREMENT

9.1 STANDARD REQUIREMENT

15.203&RSS Gen requirement: For intentional device, according to 15.203&RSS Gen: 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.

9.2 EUT ANTENNA

The EUT antenna is PCB Antenna. It comply with the standard requirement.

10. FREQUENCY STABILITY

10.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

The frequency tolerance of the carrier signal shall be maintained within +/-0.02% of the operating frequency over a temperature variation of -30 degrees to 50 degrees C at normal supply voltage and for a variation in primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees.

10.2 TEST PROCEDURE

1. The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
2. Turn the EUT on and couple its output to spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2,5 and 10 minutes.
5. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

10.3 TEST RESULT

For the measurement records, refer to the appendix I.

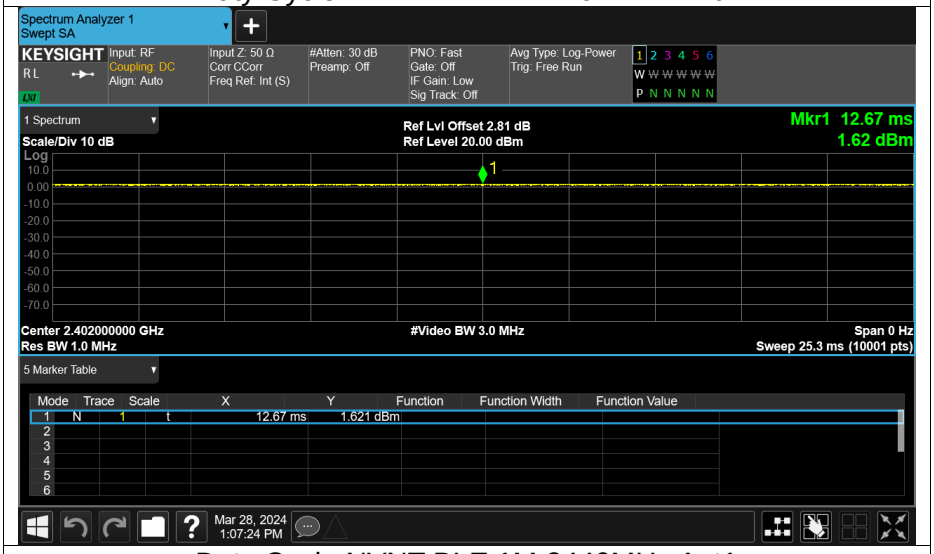
APPENDIX I:TEST RESULTS

Duty Cycle

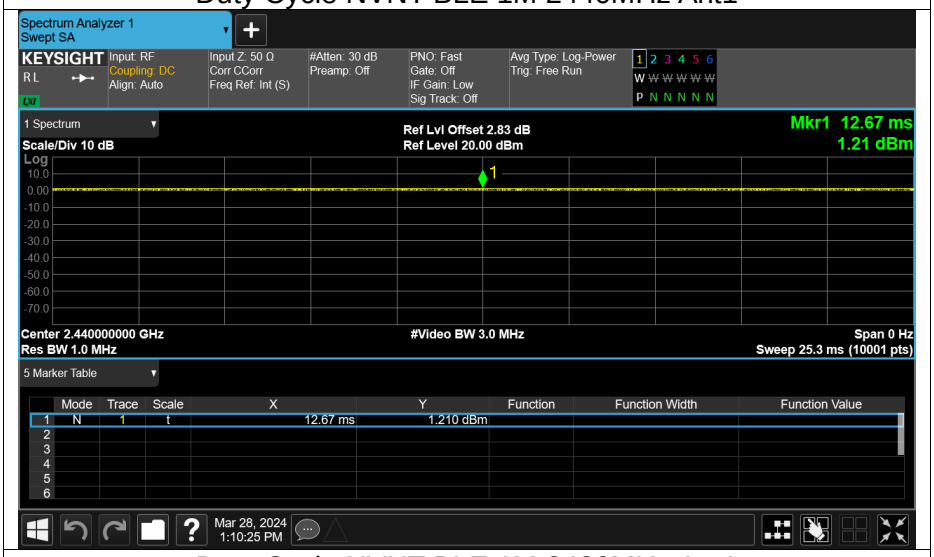
Condition	Mode	Frequency (MHz)	Antenna	Duty Cycle (%)	Correction Factor (dB)	1/T (kHz)
NVNT	BLE 1M	2402	Ant1	100	0	0
NVNT	BLE 1M	2440	Ant1	100	0	0
NVNT	BLE 1M	2480	Ant1	100	0	0
NVNT	BLE 2M	2402	Ant1	100	0	0
NVNT	BLE 2M	2440	Ant1	100	0	0
NVNT	BLE 2M	2480	Ant1	100	0	0

Test Graphs

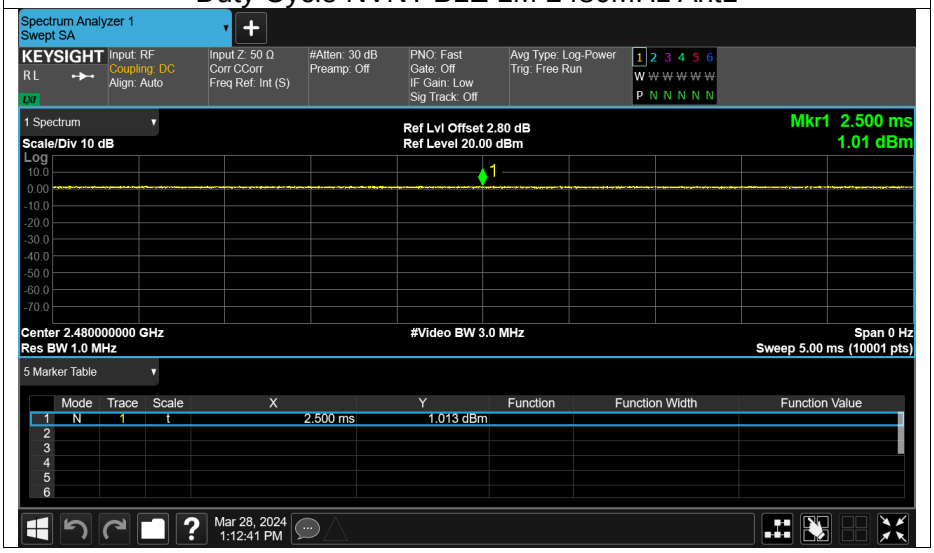
Duty Cycle NVNT BLE 1M 2402MHz Ant1



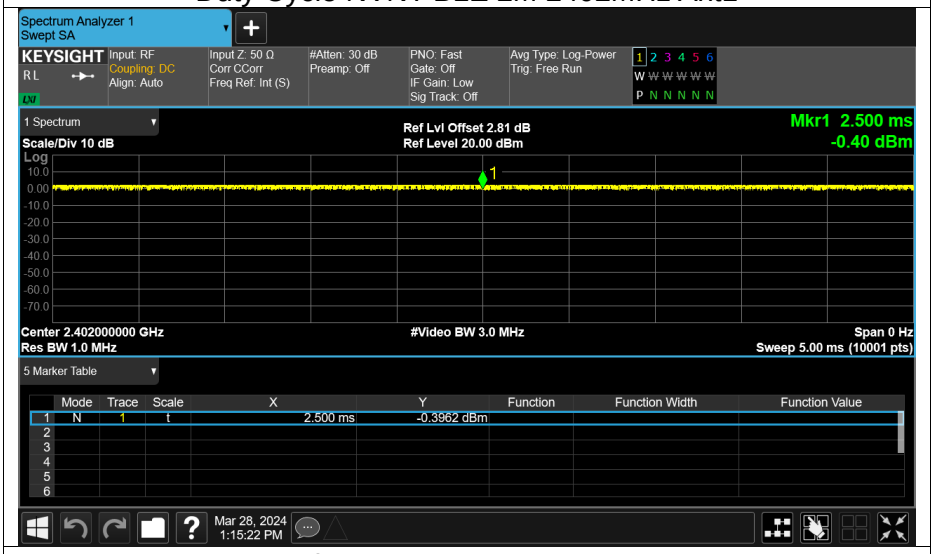
Duty Cycle NVNT BLE 1M 2440MHz Ant1



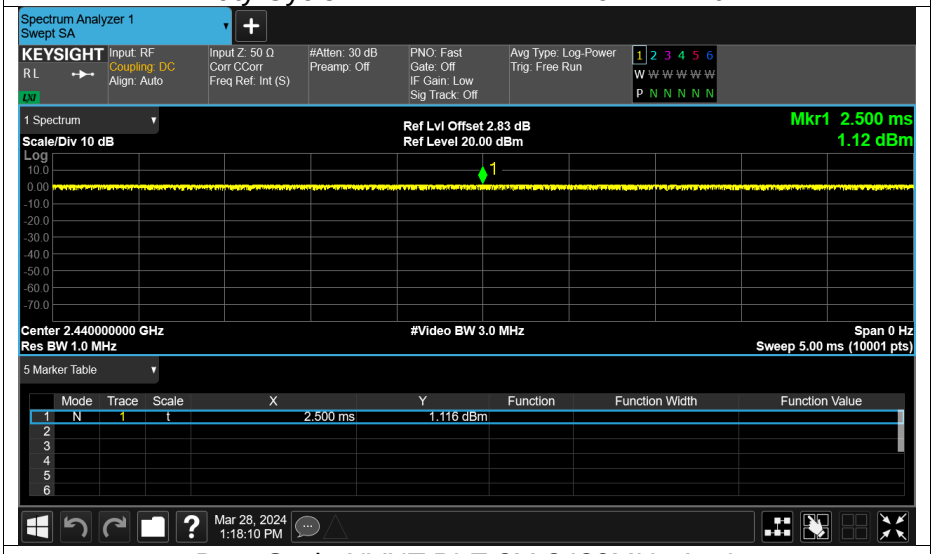
Duty Cycle NVNT BLE 1M 2480MHz Ant1



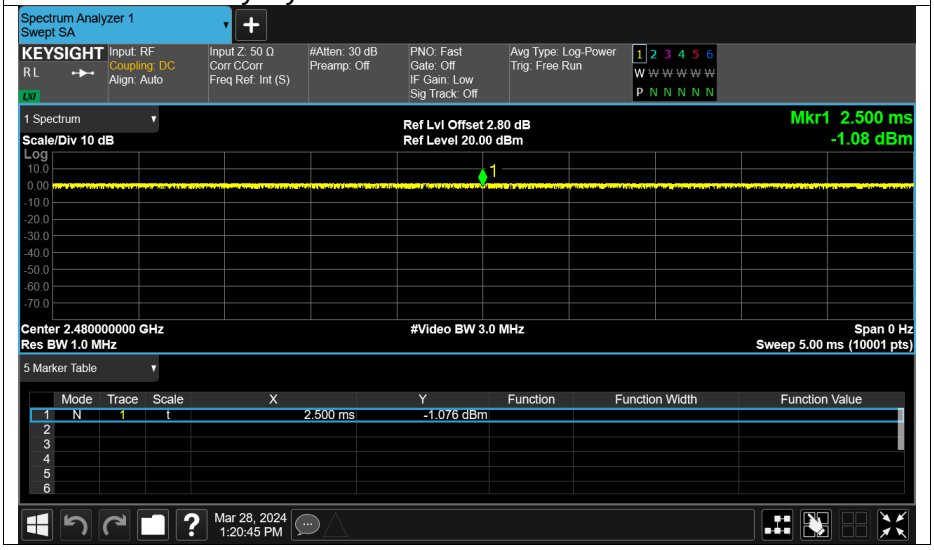
Duty Cycle NVNT BLE 2M 2402MHz Ant1



Duty Cycle NVNT BLE 2M 2440MHz Ant1



Duty Cycle NVNT BLE 2M 2480MHz Ant1



Maximum Average Conducted Output Power

Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Duty Factor (dB)	Total Power (dBm)	Limit (dBm)	Verdict
NVNT	BLE 1M	2402	Ant1	2.18	0	2.18	30	Pass
NVNT	BLE 1M	2440	Ant1	1.28	0	1.28	30	Pass
NVNT	BLE 1M	2480	Ant1	1.41	0	1.41	30	Pass
NVNT	BLE 2M	2402	Ant1	2.09	0	2.09	30	Pass
NVNT	BLE 2M	2440	Ant1	1.06	0	1.06	30	Pass
NVNT	BLE 2M	2480	Ant1	1.09	0	1.09	30	Pass

Maximum Peak Conducted Output Power

Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	BLE 1M	2402	Ant1	2.42	30	Pass
NVNT	BLE 1M	2440	Ant1	1.5	30	Pass
NVNT	BLE 1M	2480	Ant1	1.63	30	Pass
NVNT	BLE 2M	2402	Ant1	2.63	30	Pass
NVNT	BLE 2M	2440	Ant1	1.57	30	Pass
NVNT	BLE 2M	2480	Ant1	1.6	30	Pass

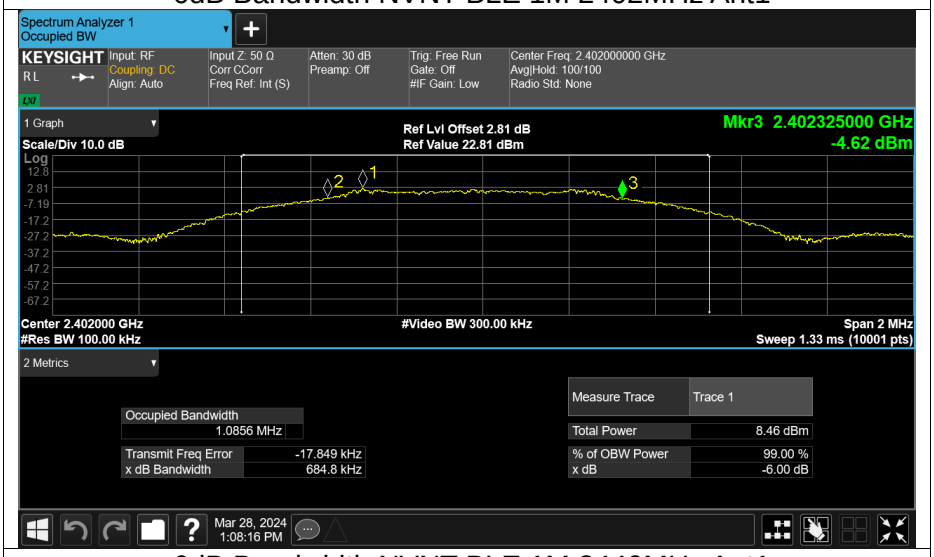
Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	ANT GAIN (dBi)	EIRP (dBm)	EIRP LIMIT(dBm)	Verdict
NVNT	BLE 1M	2402	Ant1	2.42	-0.66	1.76	36.02	Pass
NVNT	BLE 1M	2441	Ant1	1.5	-0.66	0.84	36.02	Pass
NVNT	BLE 1M	2480	Ant1	1.63	-0.66	0.97	36.02	Pass
NVNT	BLE 2M	2402	Ant1	2.63	-0.66	1.97	36.02	Pass
NVNT	BLE 2M	2440	Ant1	1.57	-0.66	0.91	36.02	Pass
NVNT	BLE 2M	2480	Ant1	1.6	-0.66	0.94	36.02	Pass

-6dB Bandwidth

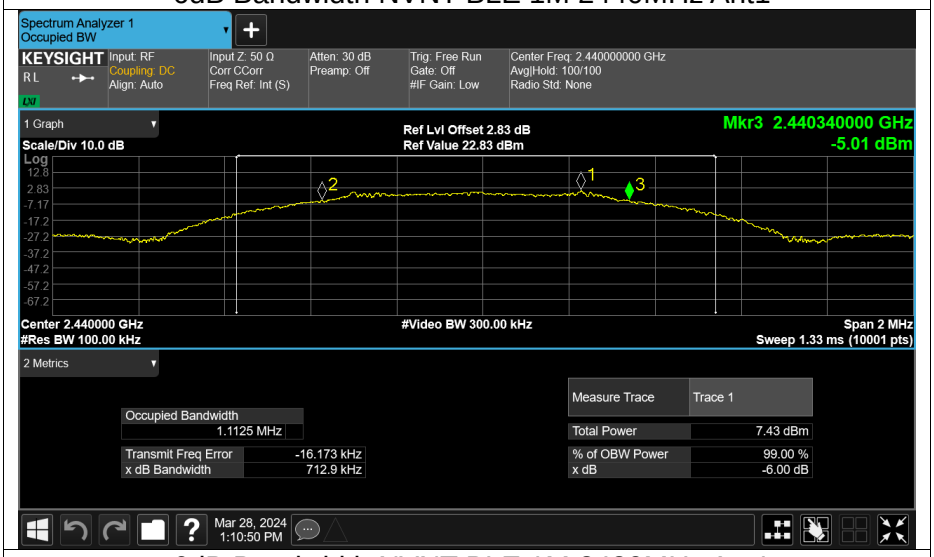
Condition	Mode	Frequency (MHz)	Antenna	-6 dB Bandwidth (MHz)	Limit -6 dB Bandwidth (MHz)	Verdict
NVNT	BLE 1M	2402	Ant1	0.685	0.5	Pass
NVNT	BLE 1M	2440	Ant1	0.713	0.5	Pass
NVNT	BLE 1M	2480	Ant1	0.687	0.5	Pass
NVNT	BLE 2M	2402	Ant1	1.311	0.5	Pass
NVNT	BLE 2M	2440	Ant1	1.337	0.5	Pass
NVNT	BLE 2M	2480	Ant1	1.216	0.5	Pass

Test Graphs

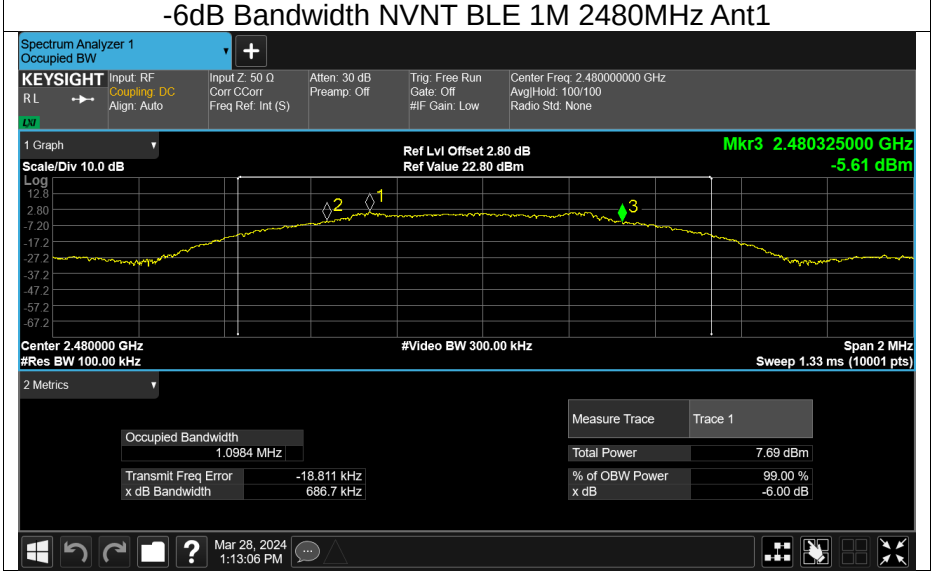
-6dB Bandwidth NVNT BLE 1M 2402MHz Ant1



-6dB Bandwidth NVNT BLE 1M 2440MHz Ant1

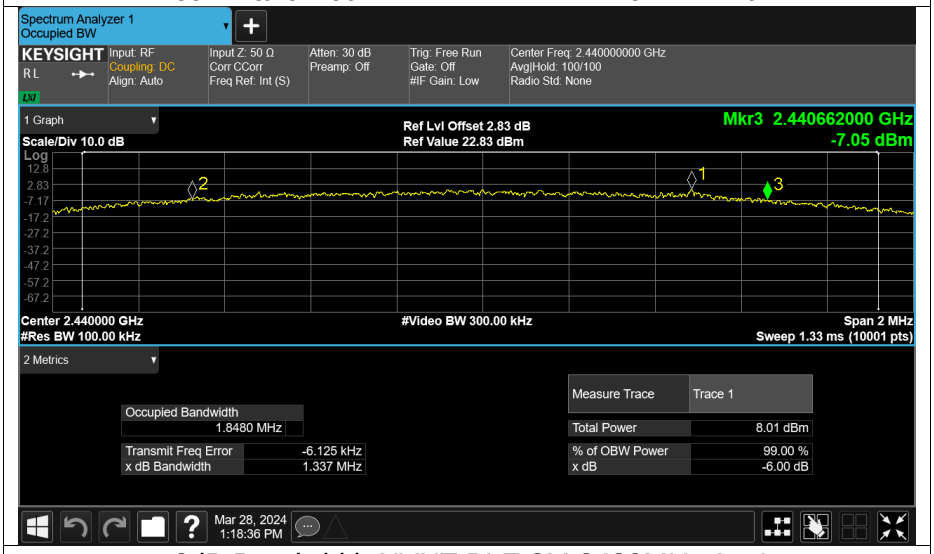


-6dB Bandwidth NVNT BLE 1M 2480MHz Ant1

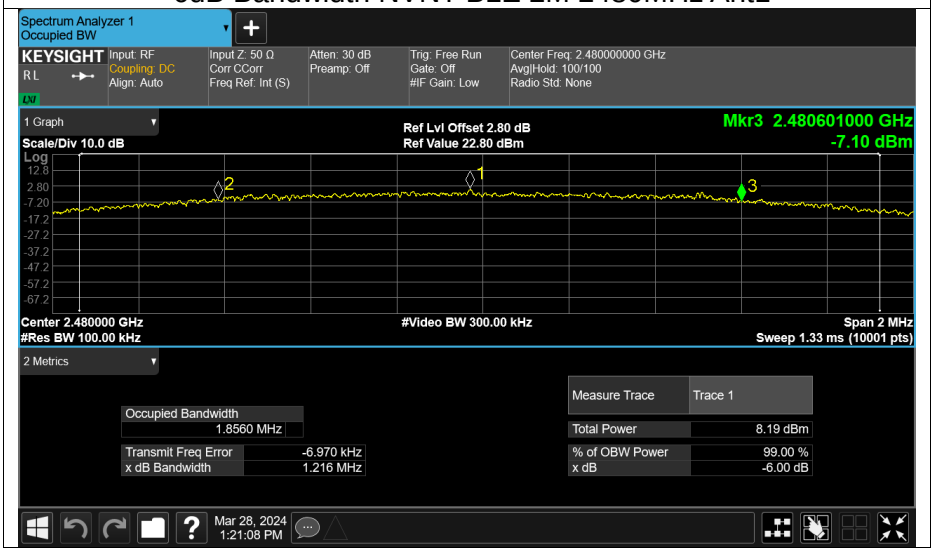


-6dB Bandwidth NVNT BLE 2M 2402MHz Ant1

-6dB Bandwidth NVNT BLE 2M 2440MHz Ant1



-6dB Bandwidth NVNT BLE 2M 2480MHz Ant1



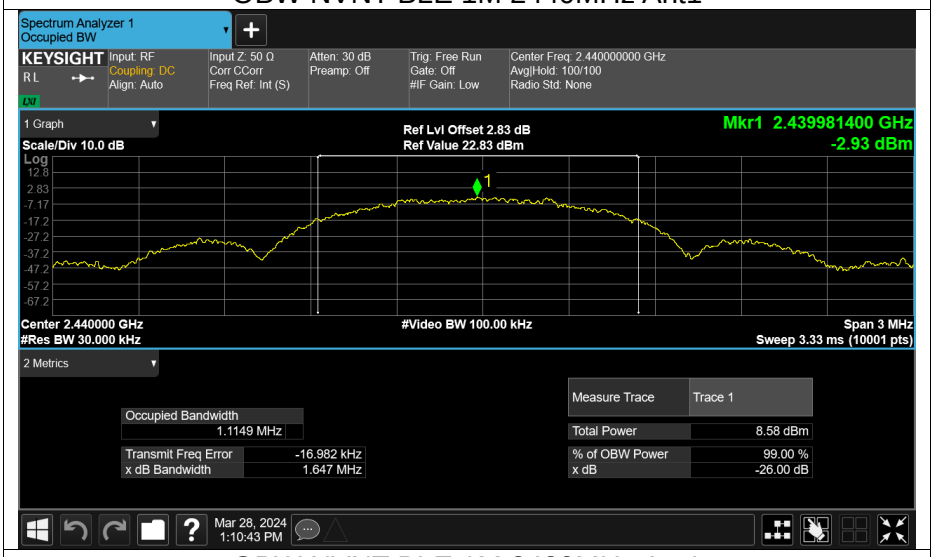
Occupied Channel Bandwidth

Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)
NVNT	BLE 1M	2402	Ant1	1.09
NVNT	BLE 1M	2440	Ant1	1.115
NVNT	BLE 1M	2480	Ant1	1.097
NVNT	BLE 2M	2402	Ant1	2.061
NVNT	BLE 2M	2440	Ant1	2.041
NVNT	BLE 2M	2480	Ant1	2.062

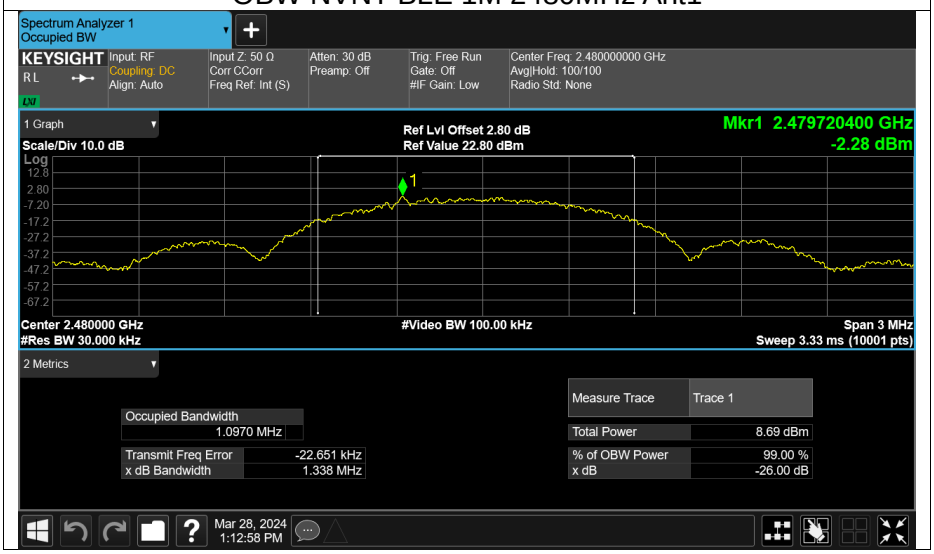
Test Graphs

OBW NVNT BLE 1M 2402MHz Ant1

OBW NVNT BLE 1M 2440MHz Ant1

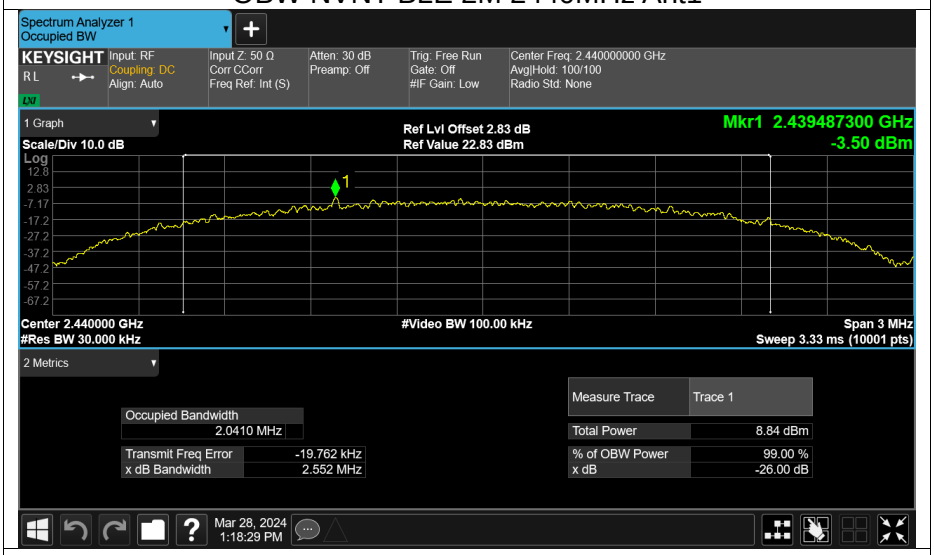


OBW NVNT BLE 1M 2480MHz Ant1

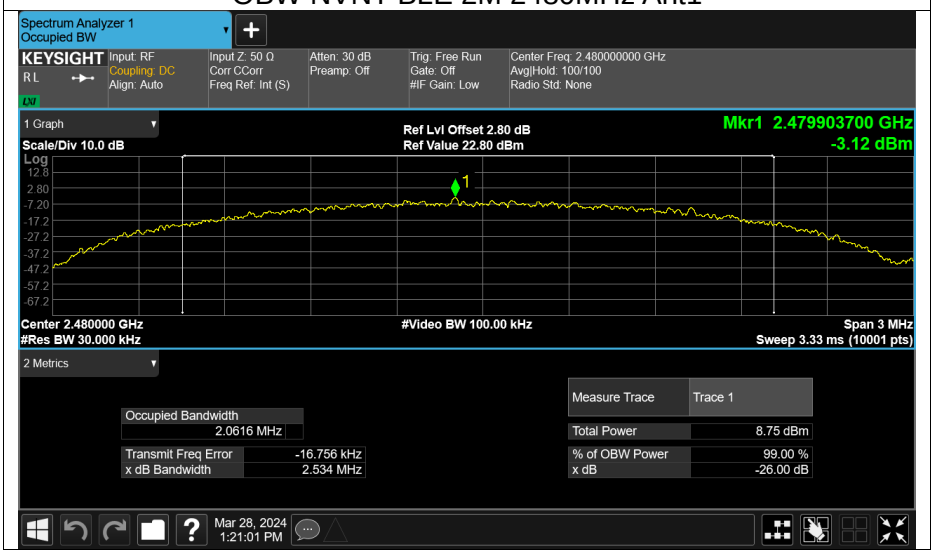


OBW NVNT BLE 2M 2402MHz Ant1

OBW NVNT BLE 2M 2440MHz Ant1

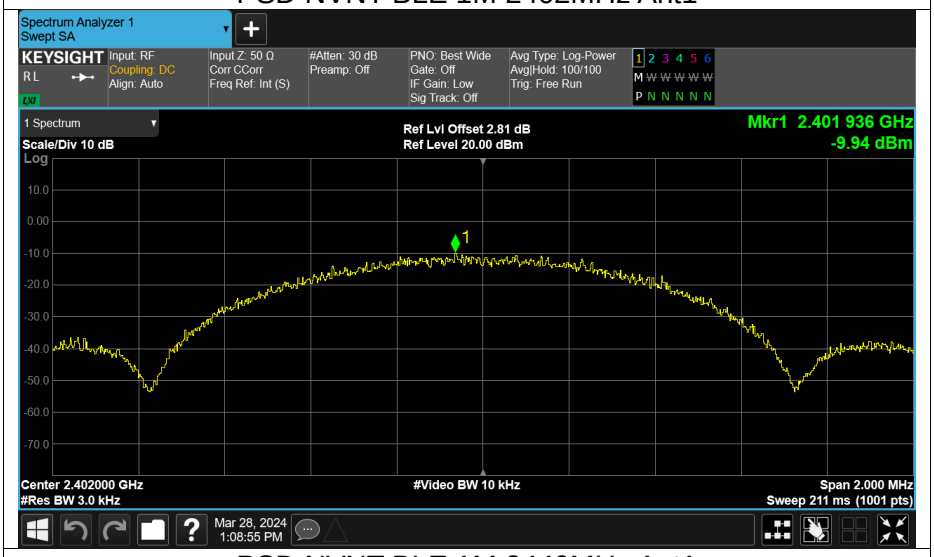
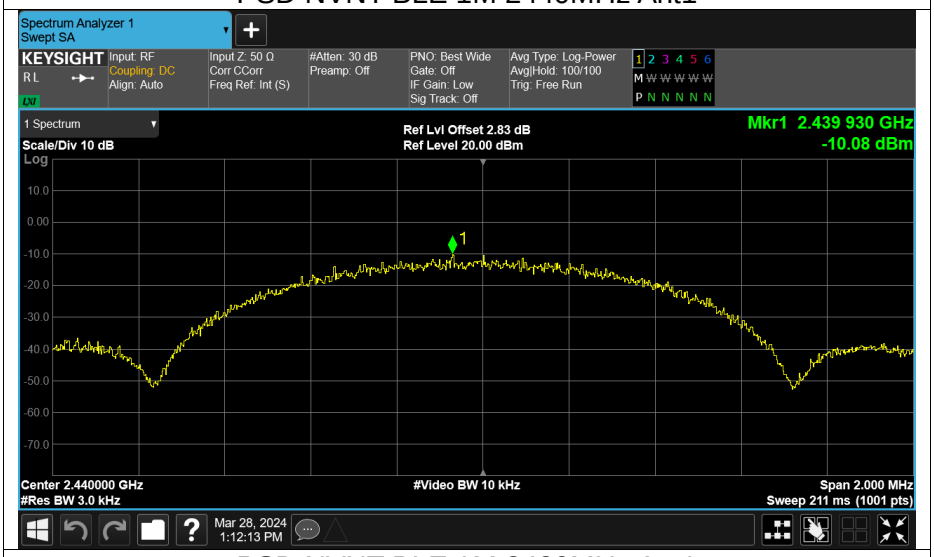
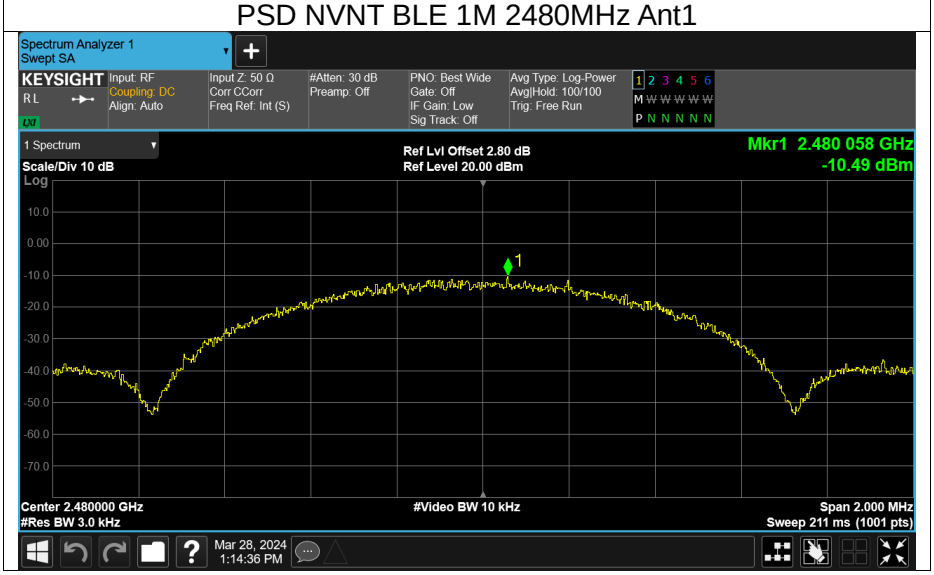


OBW NVNT BLE 2M 2480MHz Ant1

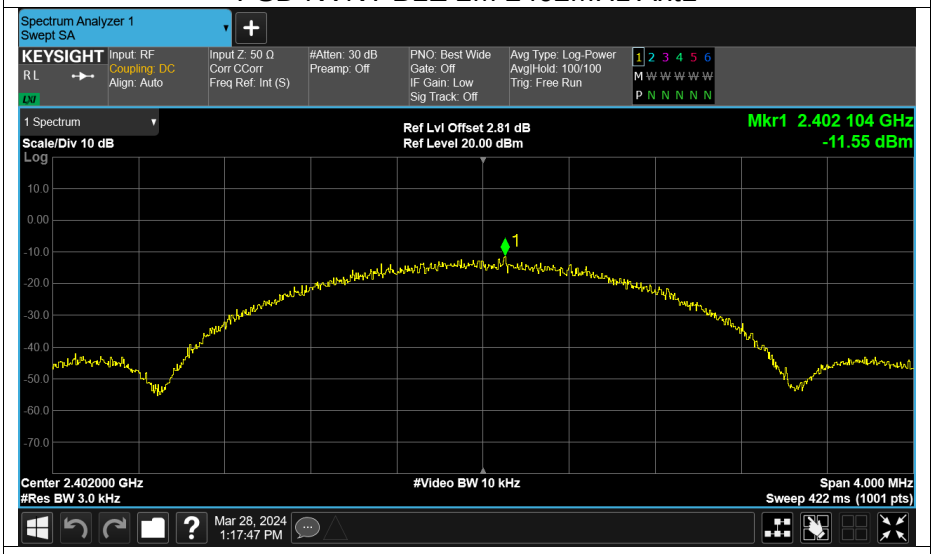


Maximum Power Spectral Density Level

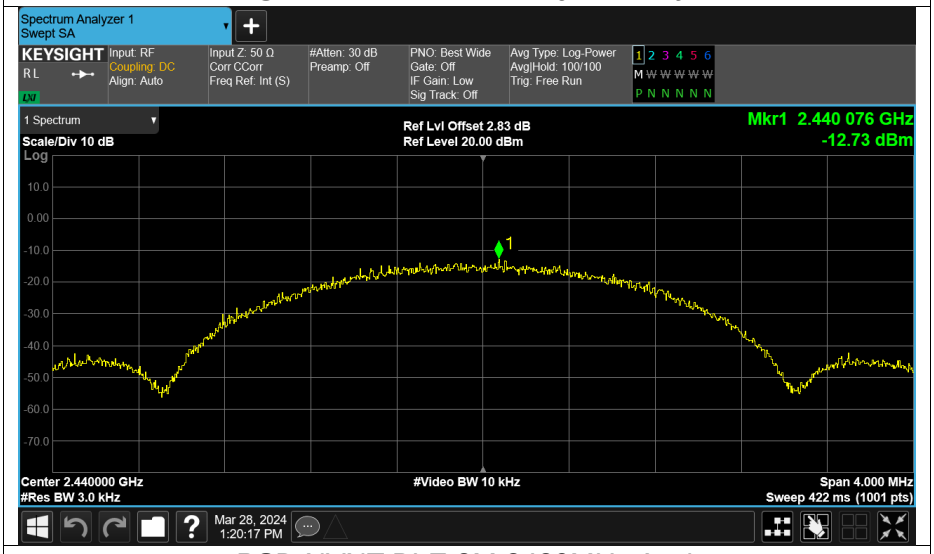
Condition	Mode	Frequency (MHz)	Antenna	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
NVNT	BLE 1M	2402	Ant1	-9.94	8	Pass
NVNT	BLE 1M	2440	Ant1	-10.08	8	Pass
NVNT	BLE 1M	2480	Ant1	-10.49	8	Pass
NVNT	BLE 2M	2402	Ant1	-11.55	8	Pass
NVNT	BLE 2M	2440	Ant1	-12.73	8	Pass
NVNT	BLE 2M	2480	Ant1	-13.12	8	Pass

Test Graphs
PSD NVNT BLE 1M 2402MHz Ant1

PSD NVNT BLE 1M 2440MHz Ant1

PSD NVNT BLE 1M 2480MHz Ant1


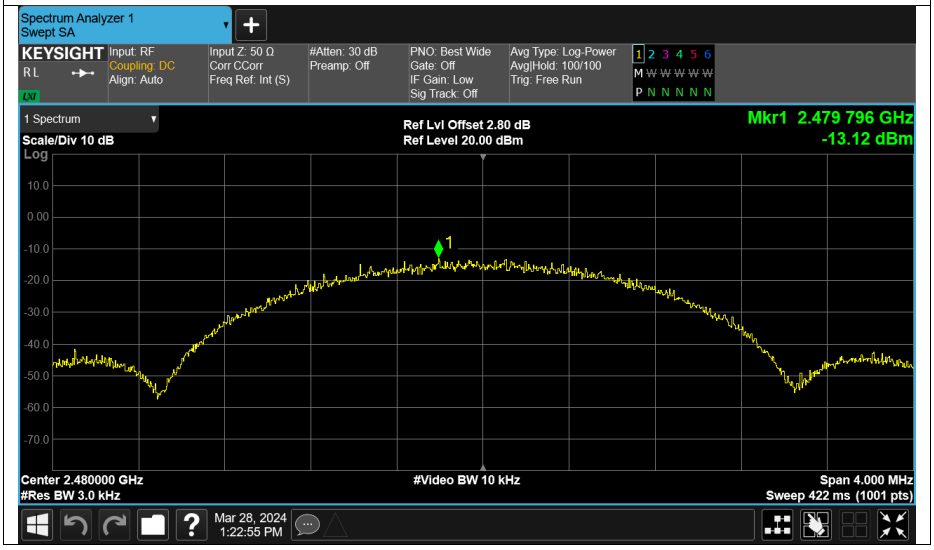
PSD NVNT BLE 2M 2402MHz Ant1



PSD NVNT BLE 2M 2440MHz Ant1



PSD NVNT BLE 2M 2480MHz Ant1

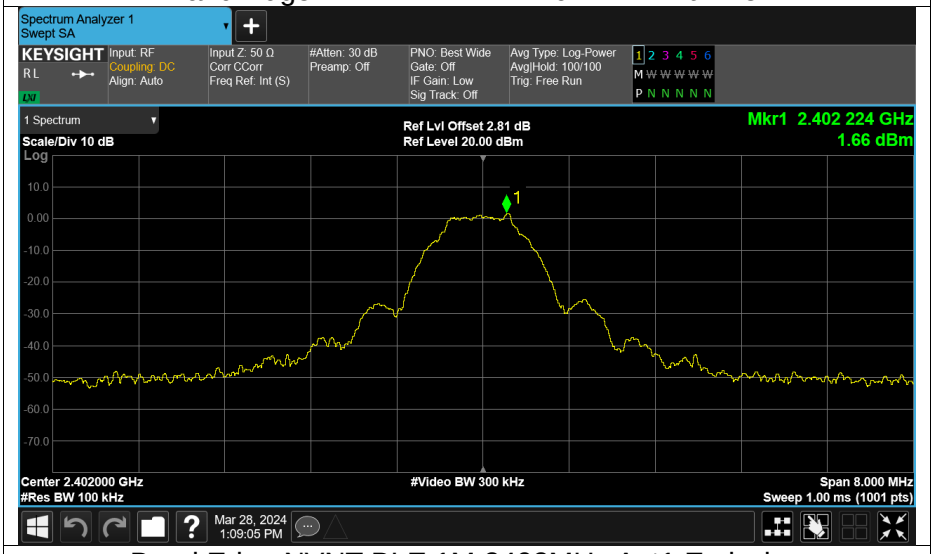


Band Edge

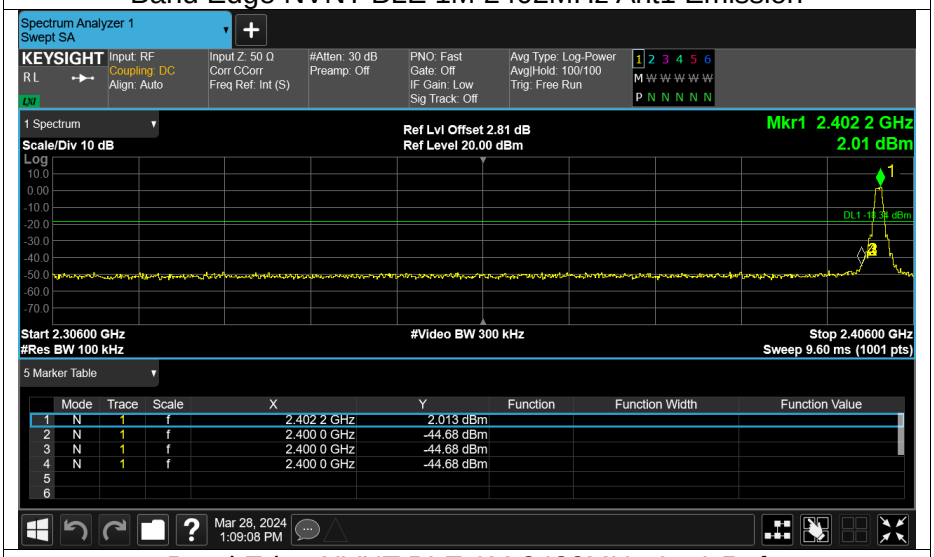
Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	BLE 1M	2402	Ant1	-46.34	-20	Pass
NVNT	BLE 1M	2480	Ant1	-49	-20	Pass
NVNT	BLE 2M	2402	Ant1	-32.05	-20	Pass
NVNT	BLE 2M	2480	Ant1	-46.35	-20	Pass

Test Graphs

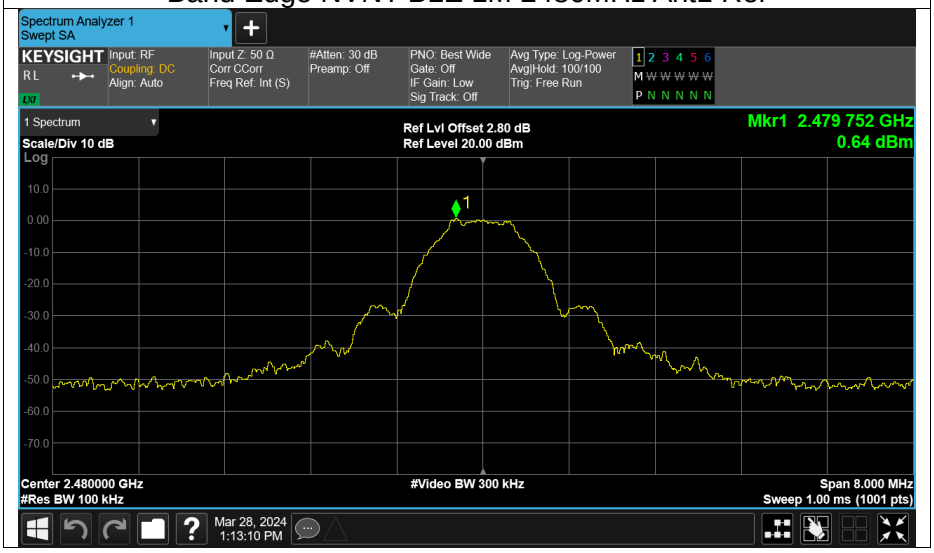
Band Edge NVNT BLE 1M 2402MHz Ant1 Ref



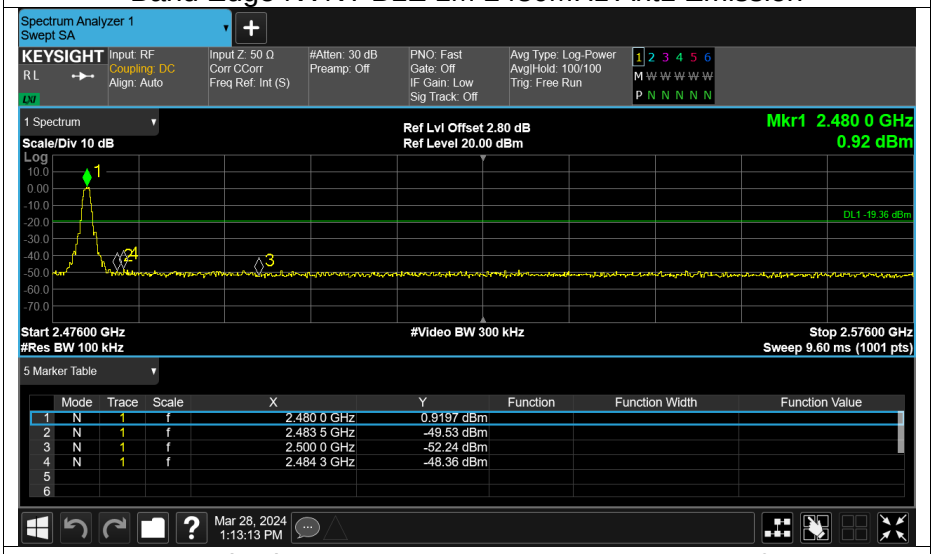
Band Edge NVNT BLE 1M 2402MHz Ant1 Emission



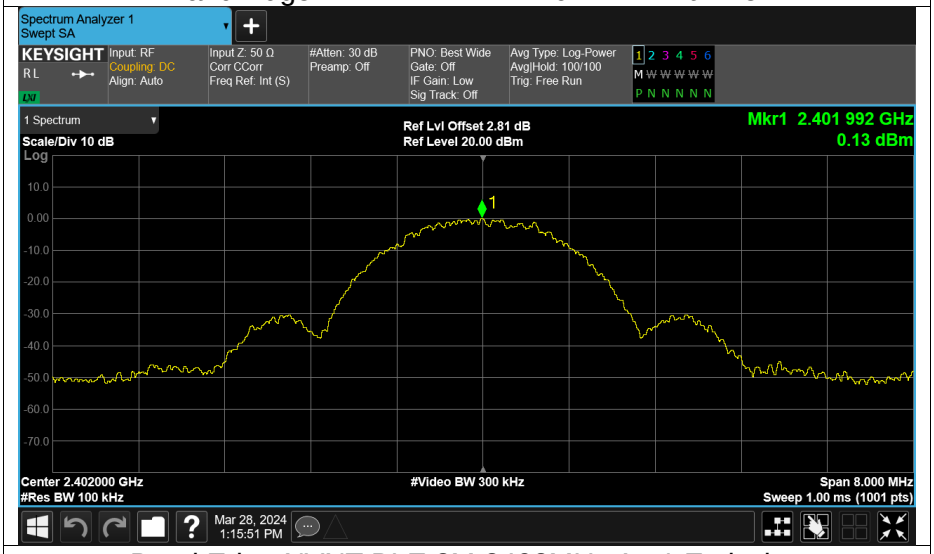
Band Edge NVNT BLE 1M 2480MHz Ant1 Ref



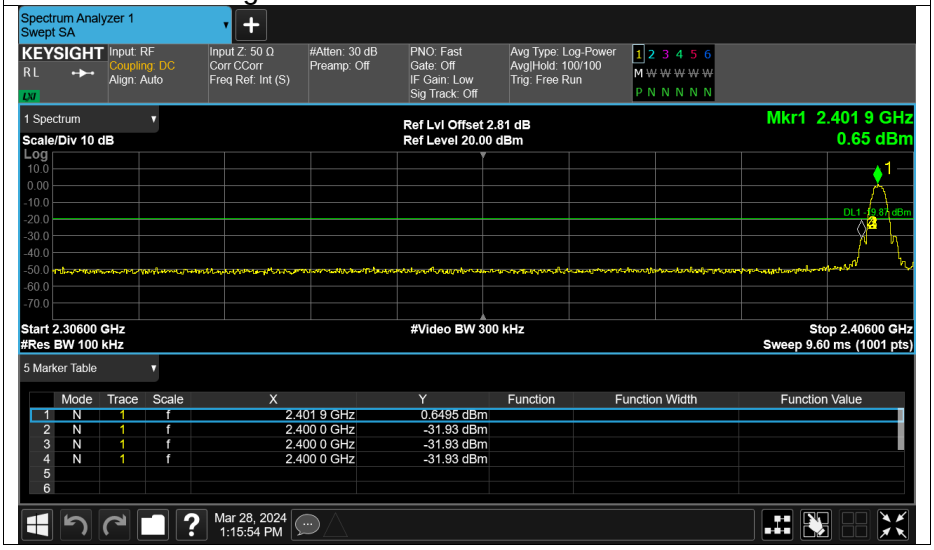
Band Edge NVNT BLE 1M 2480MHz Ant1 Emission



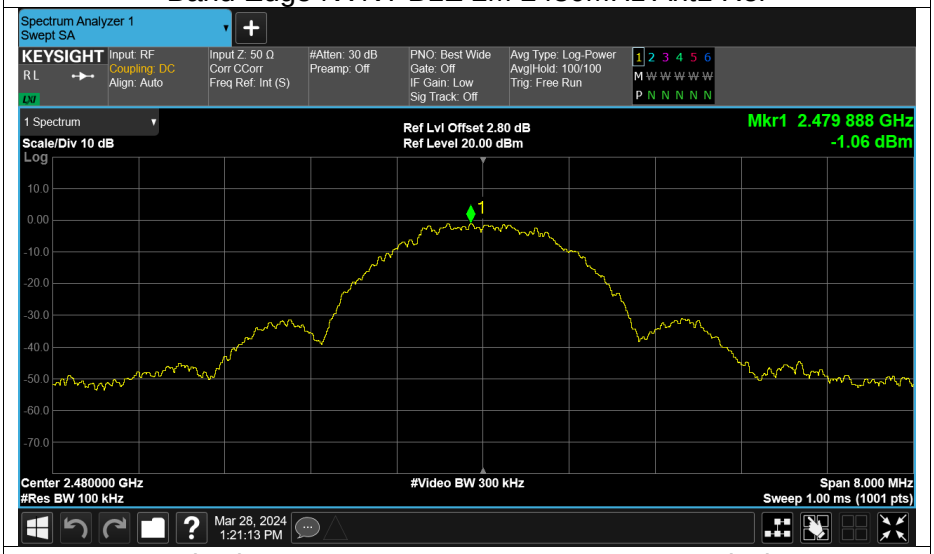
Band Edge NVNT BLE 2M 2402MHz Ant1 Ref



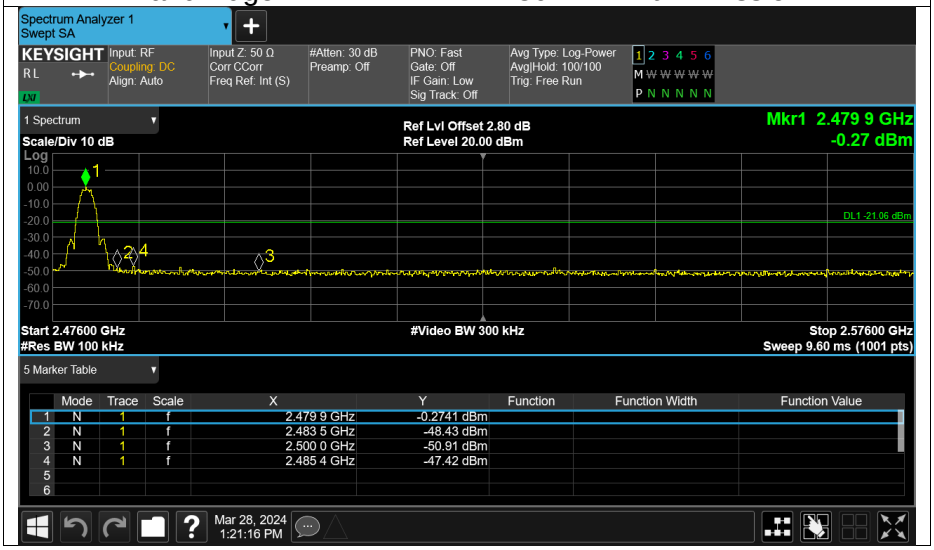
Band Edge NVNT BLE 2M 2402MHz Ant1 Emission



Band Edge NVNT BLE 2M 2480MHz Ant1 Ref



Band Edge NVNT BLE 2M 2480MHz Ant1 Emission

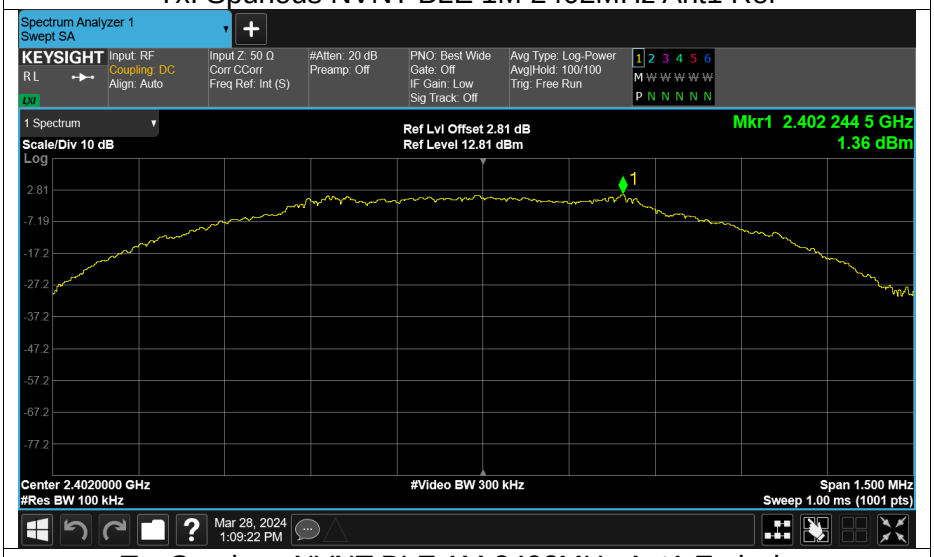


Conducted RF Spurious Emission

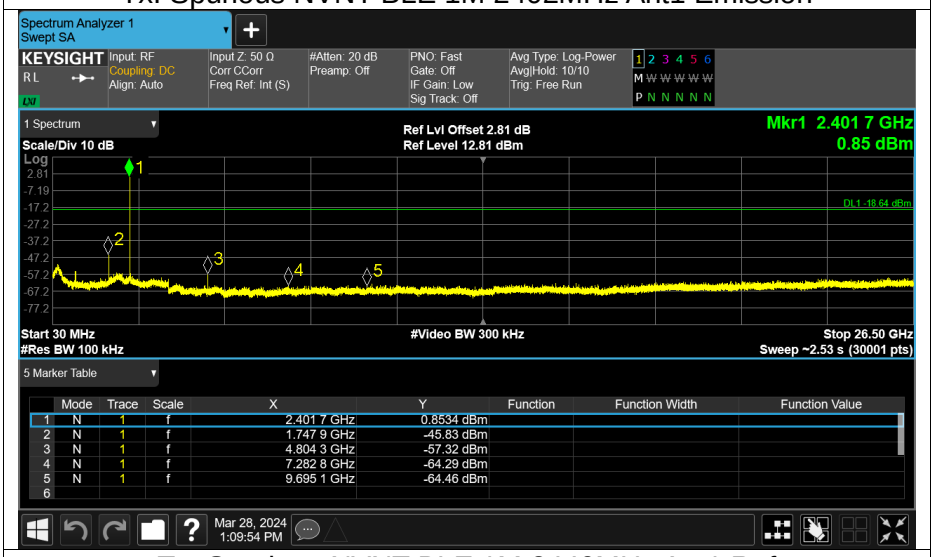
Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	BLE 1M	2402	Ant1	-47.19	-20	Pass
NVNT	BLE 1M	2440	Ant1	-47.41	-20	Pass
NVNT	BLE 1M	2480	Ant1	-48.28	-20	Pass
NVNT	BLE 2M	2402	Ant1	-50.81	-20	Pass
NVNT	BLE 2M	2440	Ant1	-41.79	-20	Pass
NVNT	BLE 2M	2480	Ant1	-50.32	-20	Pass

Test Graphs

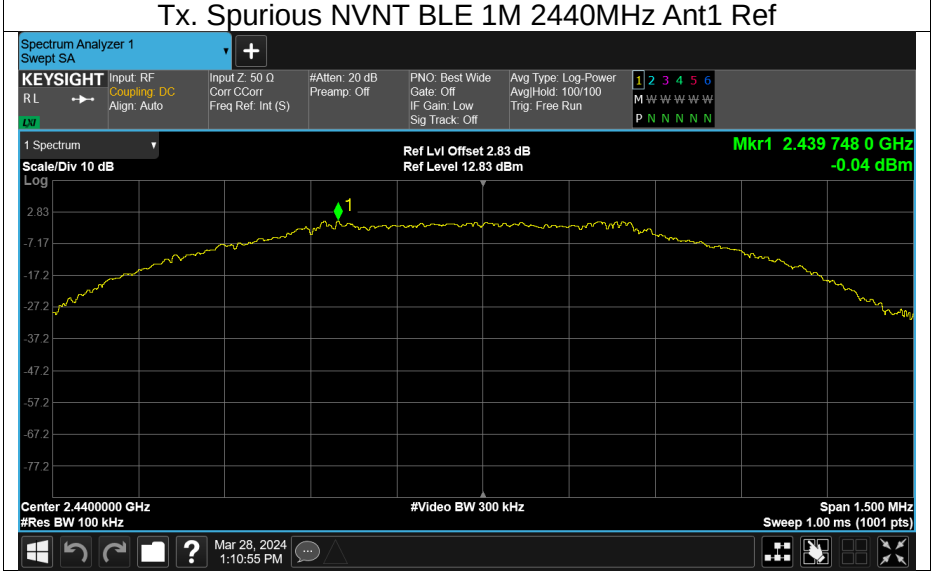
Tx. Spurious NVNT BLE 1M 2402MHz Ant1 Ref



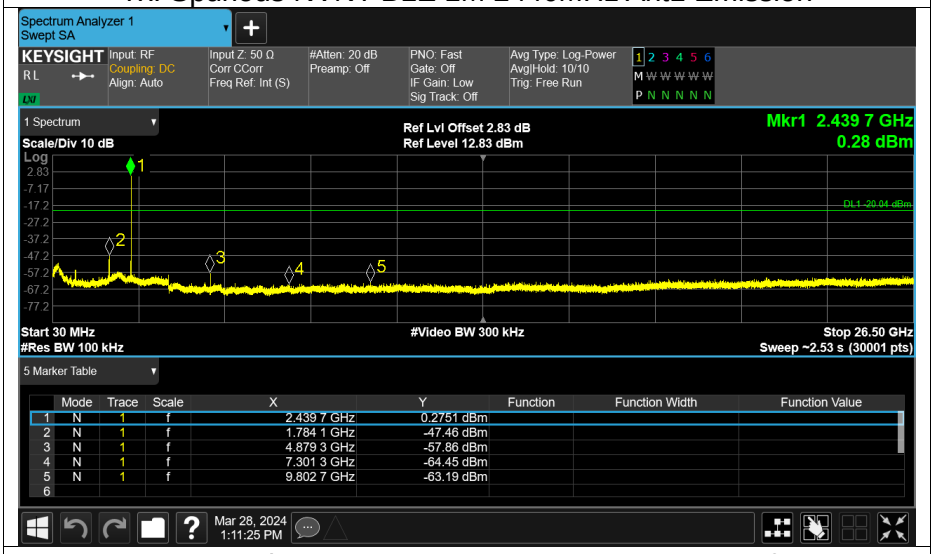
Tx. Spurious NVNT BLE 1M 2402MHz Ant1 Emission



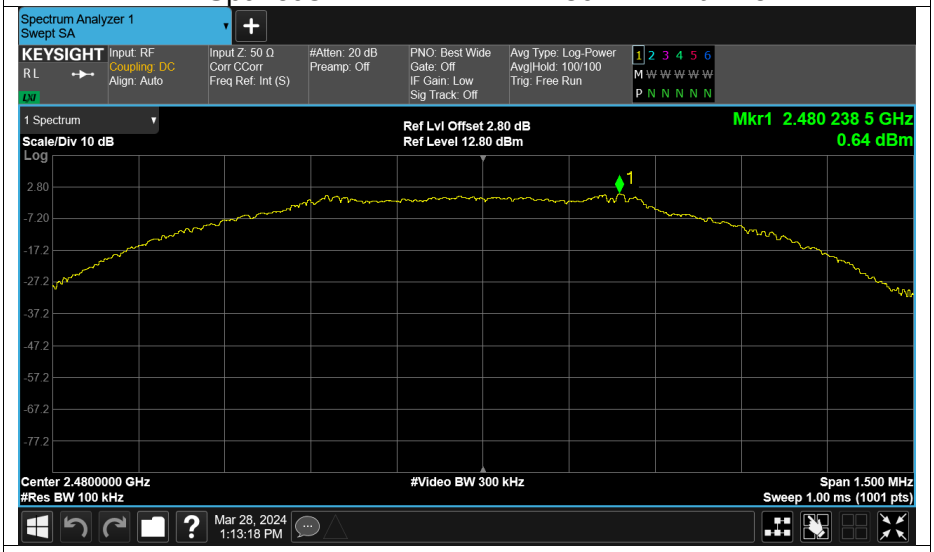
Tx. Spurious NVNT BLE 1M 2440MHz Ant1 Ref



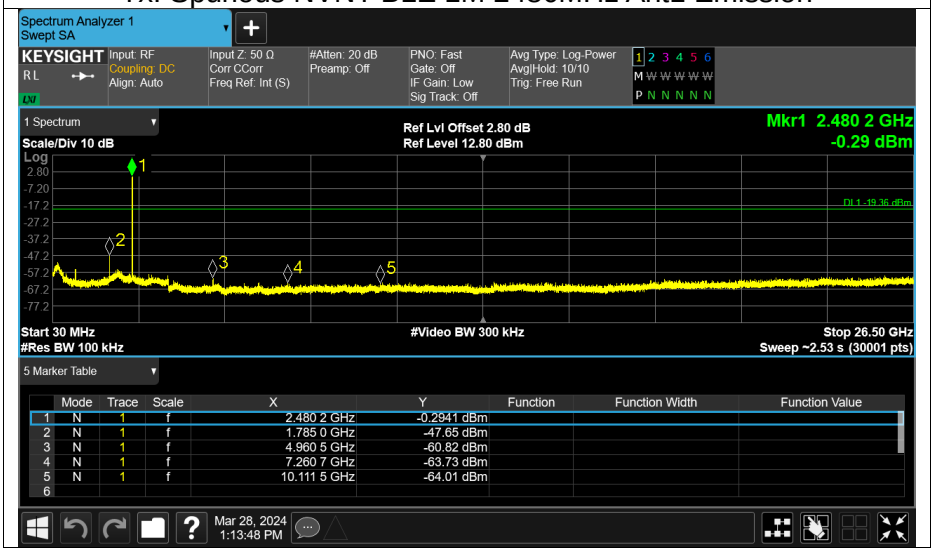
Tx. Spurious NVNT BLE 1M 2440MHz Ant1 Emission



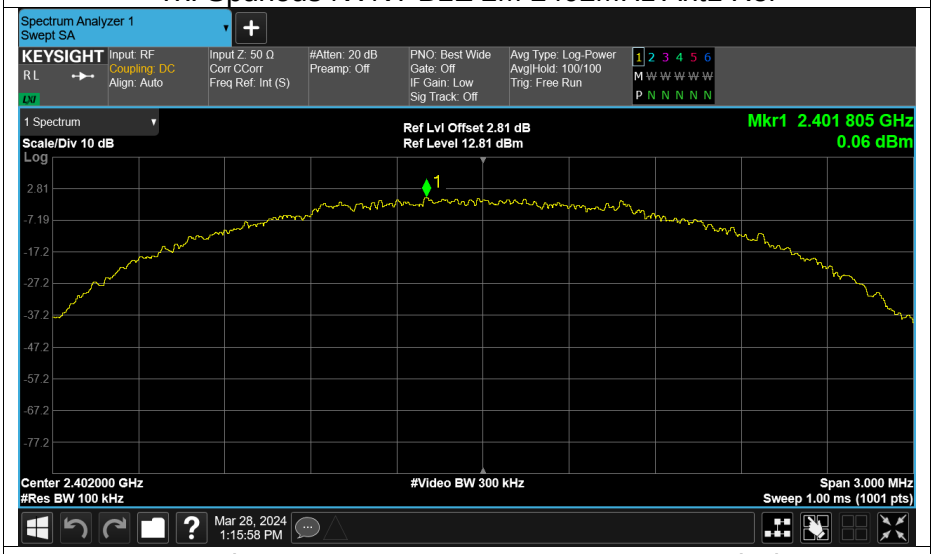
Tx. Spurious NVNT BLE 1M 2480MHz Ant1 Ref



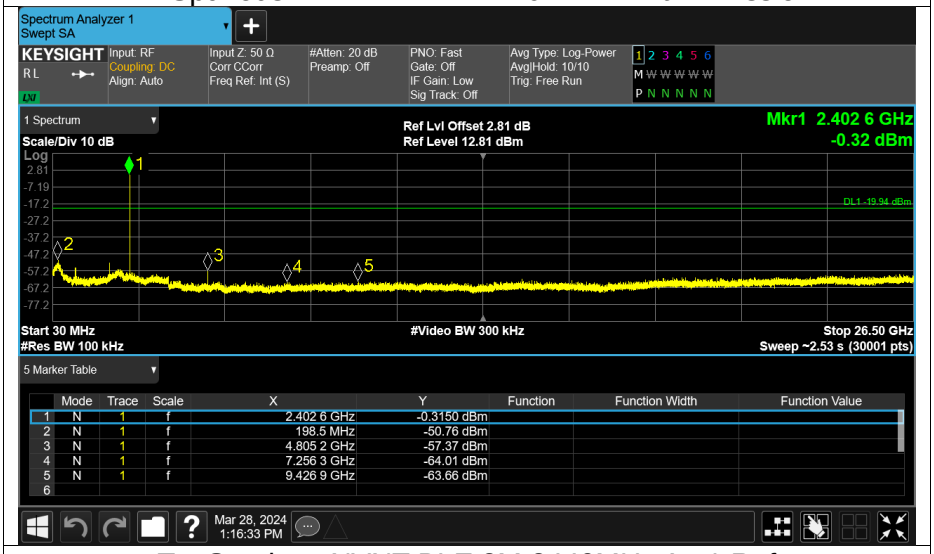
Tx. Spurious NVNT BLE 1M 2480MHz Ant1 Emission



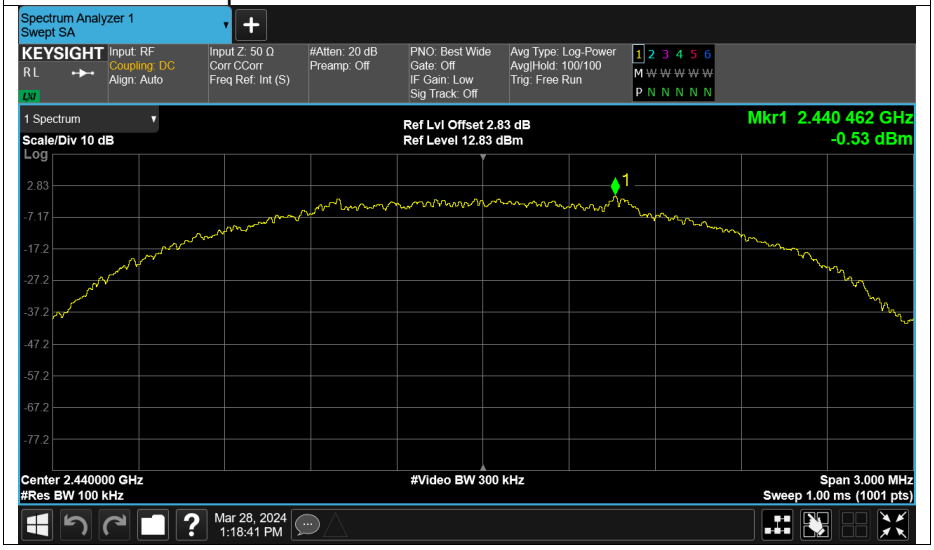
Tx. Spurious NVNT BLE 2M 2402MHz Ant1 Ref



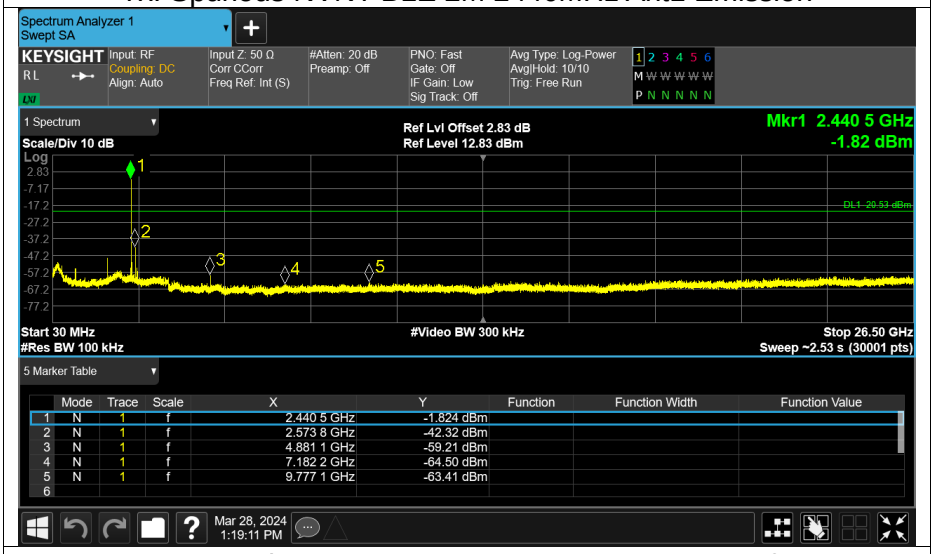
Tx. Spurious NVNT BLE 2M 2402MHz Ant1 Emission



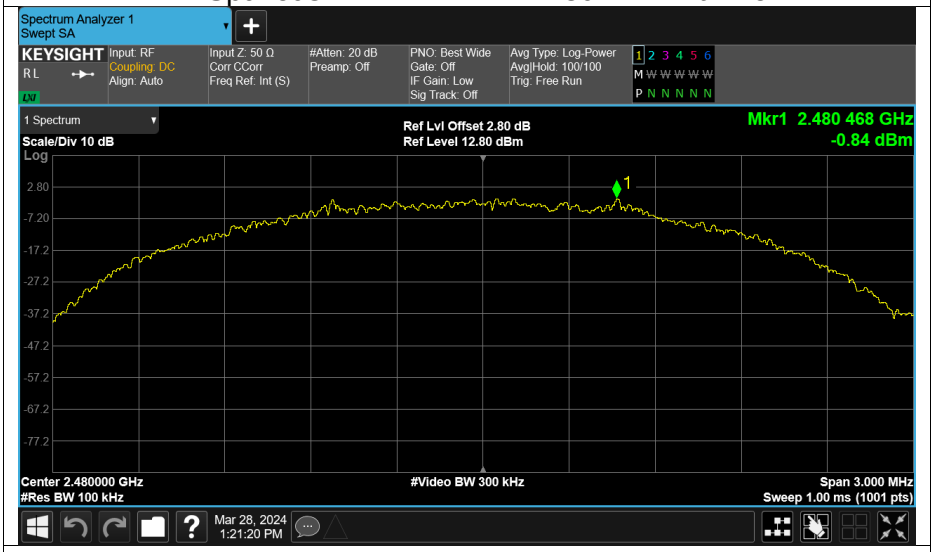
Tx. Spurious NVNT BLE 2M 2440MHz Ant1 Ref



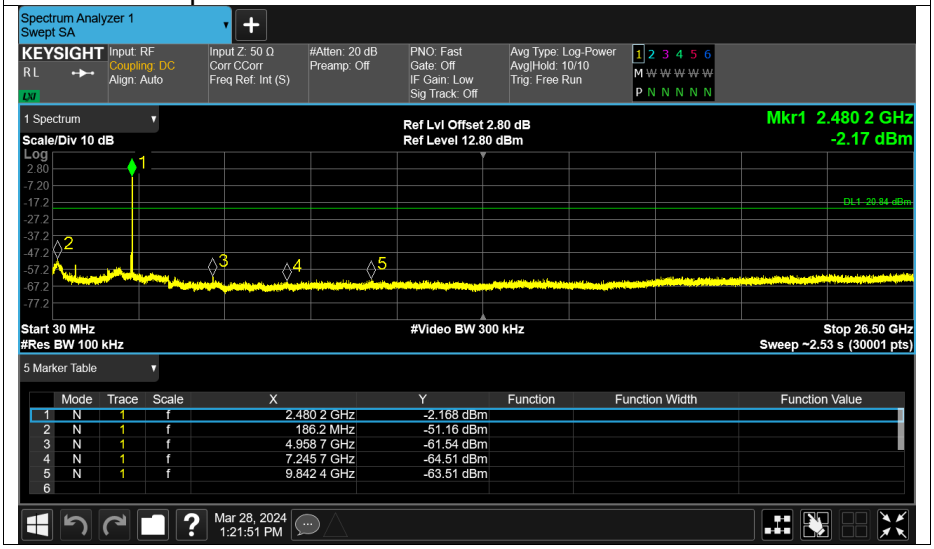
Tx. Spurious NVNT BLE 2M 2440MHz Ant1 Emission



Tx. Spurious NVNT BLE 2M 2480MHz Ant1 Ref



Tx. Spurious NVNT BLE 2M 2480MHz Ant1 Emission



FREQUENCY STABILITY

Channel 19	2440.0000
Voltage(V)	Measurement Frequency(MHz)
13.8	2440.0022
12	2440.0021
10.2	2440.0020
Max.Deviation(MHz)	0.0022
Max.Deviation(ppm)	0.90

Temperature(℃)	Measurement Frequency(MHz)
-30	2440.0036
-20	2440.0034
-10	2440.0030
0	2440.0031
10	2440.0033
20	2440.0030
30	2440.0031
40	2440.0034
50	2440.0031
Max.Deviation(MHz)	0.0036
Max.Deviation(ppm)	1.48

※※※※※END OF THE REPORT※※※※※