FCC Test Report

Report No: FCS202502081W01

Issued for

Applicant:	Invanti (Beijing) Technology Co., Ltd.
Address:	2004, Building 1, Yard 2, Ronghua South Road, Beijing Economic&Technological Development Zone, Beijing, China
Product Name:	Electric Scooter
Brand Name:	N/A
Model Name:	ES15
Series Model:	N/A
FCC ID:	2BG9J-ES15

Issued By: Flux Compliance Service Laboratory
Add: Room 105 Floor Bao hao Technology Building 1 NO.15 Gong ye West Road Hi-Tech Industrial, Song shan lake Dongguan
Tel: 769-27280901 Fax:769-27280901 http://www.FCS-lab.com

TEST RESULT CERTIFICATION

Applicant's Name .....:	Invanti (Beijing) Technology Co., Ltd.
Address.....:	2004, Building 1, Yard 2, Ronghua South Road, Beijing Economic&Technological Development Zone, Beijing, China
Manufacture's Name .....:	Invanti (Beijing) Technology Co., Ltd.
Address.....:	2004, Building 1, Yard 2, Ronghua South Road, Beijing Economic&Technological Development Zone, Beijing, China

Product Description

Product Name .....:	Electric Scooter
Brand Name.....:	N/A
Model Name.....:	ES15
Series Model .....:	N/A
Test Standards .....:	FCC Part15.247
Test Procedure .....:	ANSI C63.10-2013

This device described above has been tested by Flux Compliance Service Laboratory, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.
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Date of Test.....:

Date (s) of performance of tests.:	Feb. 10, 2025 ~ Feb. 17, 2025
Date of Issue .....:	Feb. 17, 2025
Test Result .....:	Pass

Tested by : Scott Shen

(Scott Shen)

Reviewed by : Duke Qian

(Duke Qian)

Approved by : Jack Wang

(Jack Wang)

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Revision History

Rev.	Issue Date	Contents
00	Feb.17, 2025	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			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	PASS	--
15.247 (a)(2)	6dB Bandwidth	PASS	--
15.247 (b)(3)	Output Power	PASS	--
15.209	Radiated Spurious Emission	PASS	--
15.247 (d)	Conducted Spurious & Band Edge Emission	PASS	--
15.247 (e)	Power Spectral Density	PASS	--
15.205	Restricted Band Edge Emission	PASS	--
Part 15.247(d)/ Part 15.209(a)	Band Edge Emission	PASS	--
15.203	Antenna Requirement	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:	Flux Compliance Service Laboratory
Address:	Room 105 Floor Bao hao Technology Building 1 NO.15 Gong ye West Road Hi-Tech Industrial, Song shan lake Dongguan
Telephone:	+86-769-27280901
Fax:	+86-769-27280901
FCC Test Firm Registration Number: 514908 Designation number: CN0127 A2LA accreditation number：5545.01 ISED Number：25801 CAB ID ：CN0097	

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	±0.71dB
2	Unwanted Emissions, conducted	±2.988 dB
3	Conducted Emission (9KHz-150KHz)	±4.13 dB
4	All emissions radiated (9KHz -30MHz)	±3.1 dB
5	Conducted Emission (150KHz-30MHz)	±4.74 dB
6	All emissions,radiated(<1G) 30MHz-1000MHz	±5.2 dB
7	All emissions,radiated 1GHz -18GHz	±4.66 dB
8	All emissions,radiated 18GHz -40GHz	±4.31 dB
9	PSD	±0.70dB
10	Bandwidth	±2.5 %

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Electric Scooter
Trade Mark	N/A
Model Name	ES15
Series Model	N/A
Model Difference	N/A
Product Description	The EUT is Electric Scooter Operation Frequency: 2402~2480 MHz Modulation Type: GFSK Radio Technology: BLE Bluetooth Version: 5.0 Bluetooth Configuration: BLE (1M PHY) Number Of Channel: 40 Antenna Designation: Please refer to the Note 3. Antenna Gain (dBi) 0 dBi
Channel List	Please refer to the Note 2.
Power Supply	Input: AC 120V/60Hz
Battery	Rated Voltage: 48V 13Ah Capacity: 624Wh
Hardware version number	V1.0
Software version number	V1.0
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.

Channel List							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequenc y (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

3.

Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	N/A	ES15	PCB	N/A	0	BLE ANT

Note: The antenna information refere the manufacturer provide report, applicable only to the tested sample identified in the report.

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

Note:
(1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported.

For AC Conducted Emission

Test Case	
AC Conducted Emission	Mode 4: Keeping BT TX

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.

RF Function	Type	Mode Or Modulation type	Power Class	Software For Testing
BLE	BLE	GFSK	0	RF_TOOL_1.0

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
N/A	N/A	N/A	N/A	N/A

Auxiliary Equipment

Description	Manufacturer	Model	S/N	Rating
N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A

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

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESRP 3	FCS-E001	2024.08.28	2025.08.27
Signal Analyzer	R&S	FSV40-N	FCS-E012	2024.08.28	2025.08.27
Active loop Antenna	ZHINAN	ZN30900C	FCS-E013	2024.08.28	2025.08.27
Bilog Antenna	SCHWARZBECK	VULB 9168	FCS-E002	2024.08.28	2025.08.27
Horn Antenna	SCHWARZBECK	BBHA 9120D	FCS-E003	2024.08.28	2025.08.27
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	FCS-E018	2024.08.28	2025.08.27
Pre-Amplifier(0.1M-3GHz)	EMCI	EM330N	FCS-E004	2024.08.28	2025.08.27
Pre-Amplifier (1G-18GHz)	N/A	TSAMP-0518SE	FCS-E014	2024.08.28	2025.08.27
Pre-Amplifier (18G-40GHz)	TERA-MW	TRLA-0400	FCS-E019	2024.08.28	2025.08.27
Temperature & Humidity	HTC-1	victor	FCS-E005	2024.08.28	2025.08.27
Low frequency cable（9k-1GHz)	Gemma Technology	R03	FCS-E031	2024.08.28	2025.08.27
Low frequency cable（1-18GHz)	Gemma Technology	R04	FCS-E032	2024.08.28	2025.08.27
Low frequency cable（18-40GHz)	Gemma Technology	R05	FCS-E033	2024.08.28	2025.08.27
Testing Software	EZ-EMC(Ver.STSLAB 03A1 RE)				

Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESPI	FCS-E020	2024.08.28	2025.08.27
LISN	R&S	ENV216	FCS-E007	2024.08.28	2025.08.27
LISN	ETS	3810/2NM	FCS-E009	2024.08.28	2025.08.27
Temperature & Humidity	HTC-1	victor	FCS-E008	2024.08.28	2025.08.27
Testing Software	EZ-EMC(Ver.EMC-CON 3A1.1)				

RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
MXA SIGNAL Analyzer	Keysight	N9020A	FCS-E015	2024.08.28	2025.08.27
Spectrum Analyzer	Agilent	E4447A	MY50180039	2024.08.28	2025.08.27
Spectrum Analyzer	R&S	FSV-40	101499	2024.08.28	2025.08.27
Power Sensor	Agilent	UX2021XA	FCS-E021	2024.08.28	2025.08.27
Testing Software	EZ-EMC(Ver.STSLAB 03A1 RE)				

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.

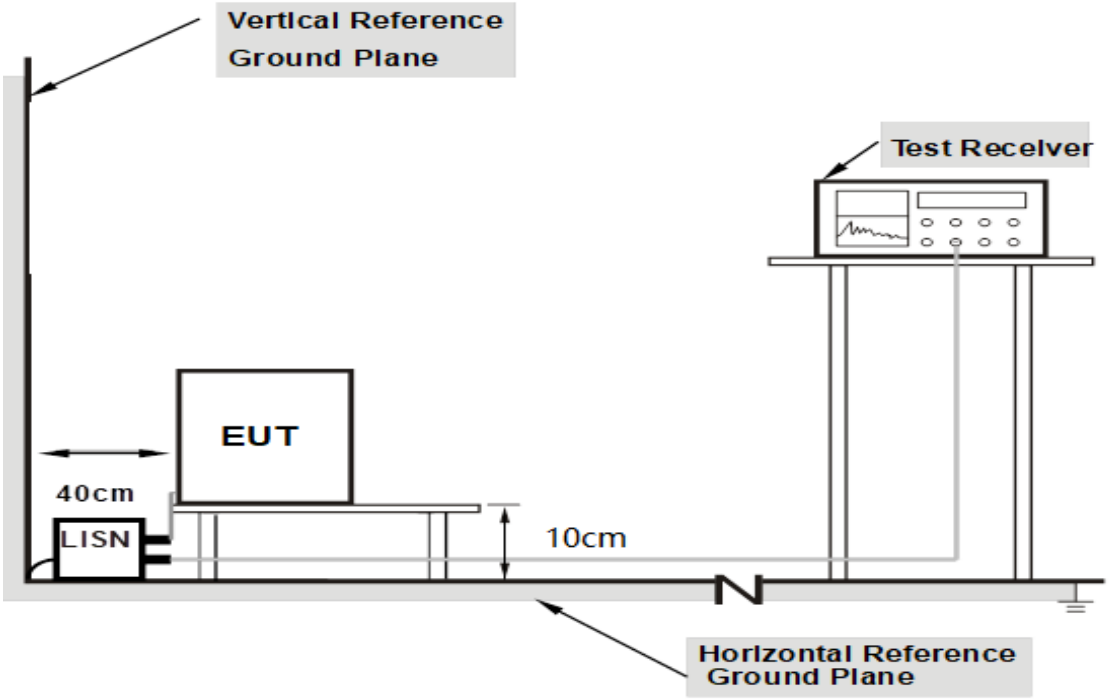
The following table is the setting of the receiver

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 0.1 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



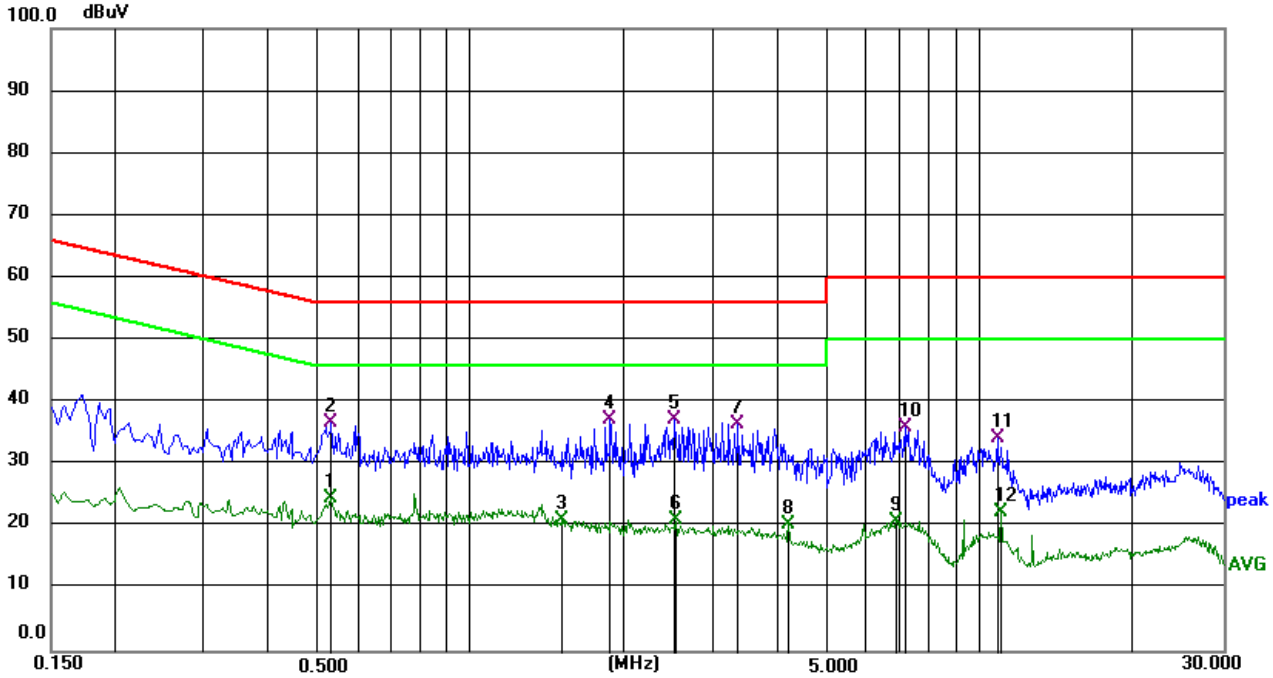
Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes support units.

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

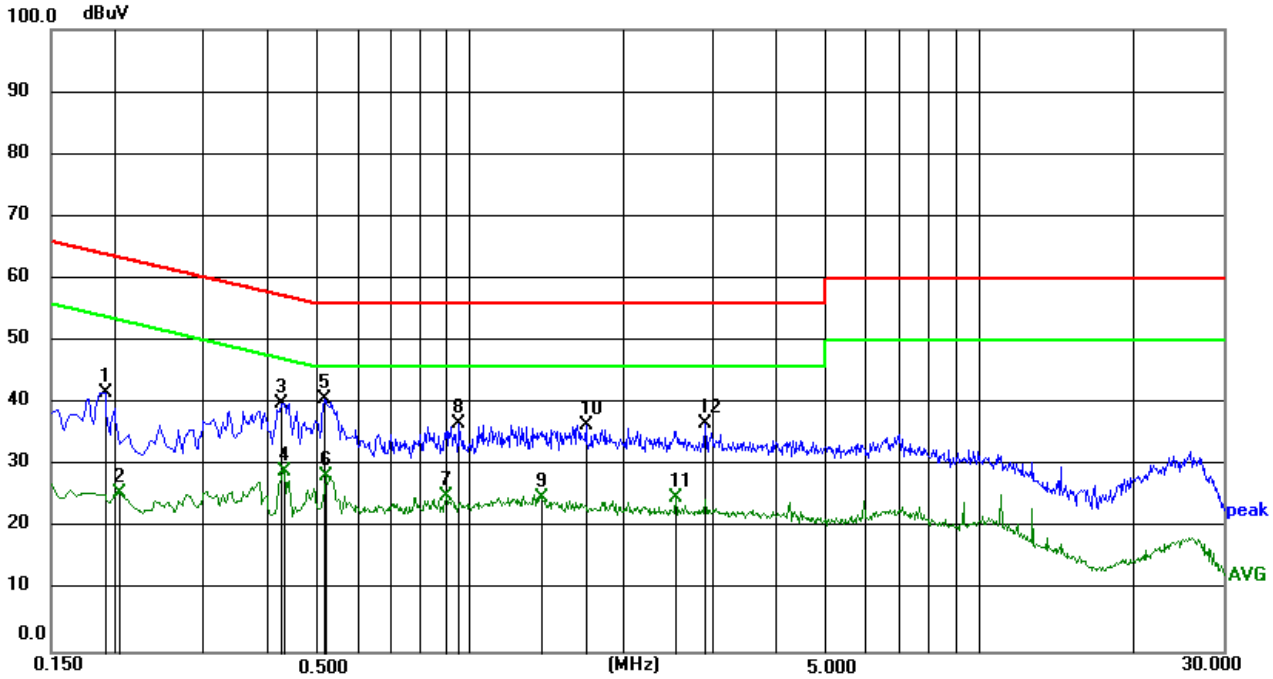
Temperature:	25C	Relative Humidity:	56%
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	Mode 4		



No.	Frequency (MHz)	Reading Level(dBuV)	Factor (dB)	Measure-ment(dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.5324	13.76	10.84	24.60	46.00	-21.40	AVG
2	0.5325	25.84	10.84	36.68	56.00	-19.32	QP
3	1.5090	10.41	10.86	21.27	46.00	-24.73	AVG
4 *	1.8825	26.40	10.86	37.26	56.00	-18.74	QP
5	2.5215	26.39	10.87	37.26	56.00	-18.74	QP
6	2.5304	10.17	10.87	21.04	46.00	-24.96	AVG
7	3.3540	25.46	11.02	36.48	56.00	-19.52	QP
8	4.2180	9.20	11.10	20.30	46.00	-25.70	AVG
9	6.8550	9.71	11.15	20.86	50.00	-29.14	AVG
10	7.1204	24.76	11.15	35.91	60.00	-24.09	QP
11	10.8194	23.13	11.21	34.34	60.00	-25.66	QP
12	10.9634	11.27	11.23	22.50	50.00	-27.50	AVG

Remark:
1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result =Reading + Factor)–Limit
3. Factor=LISN factor+Cable loss+Limiter (10dB)

Temperature:	25C	Relative Humidity:	56%
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	Mode 4		



No.	Frequency (MHz)	Reading Level(dBuV)	Factor (dB)	Measure-ment(dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1905	30.83	10.84	41.67	64.01	-22.34	peak
2	0.2040	14.90	10.84	25.74	53.45	-27.71	AVG
3	0.4244	29.13	10.84	39.97	57.36	-17.39	peak
4	0.4290	18.31	10.84	29.15	47.27	-18.12	AVG
5 *	0.5144	29.89	10.84	40.73	56.00	-15.27	peak
6	0.5190	17.50	10.84	28.34	46.00	-17.66	AVG
7	0.8970	14.25	10.85	25.10	46.00	-20.90	AVG
8	0.9510	25.97	10.85	36.82	56.00	-19.18	peak
9	1.3829	13.94	10.86	24.80	46.00	-21.20	AVG
10	1.6890	25.61	10.87	36.48	56.00	-19.52	peak
11	2.5350	13.96	10.88	24.84	46.00	-21.16	AVG
12	2.8860	25.87	10.90	36.77	56.00	-19.23	peak

Remark:
1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result =Reading + Factor)–Limit
3. Factor=LISN factor+Cable loss+Limiter (10dB)

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) 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/AV
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/AV
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

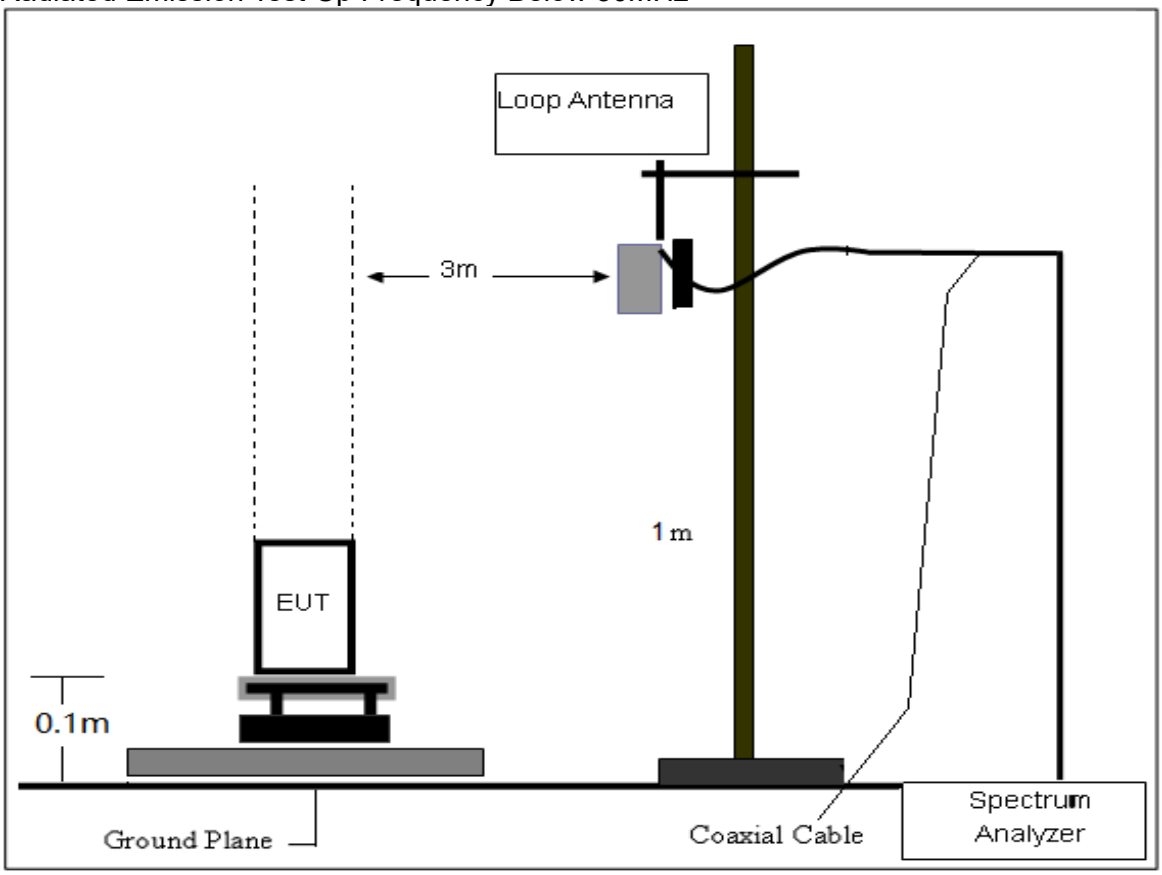
a. The measuring distance at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz, and above 1GHz.
b. The EUT was placed on the top of a rotating table 0.1 m (above 1GHz is 0.1 m) above the ground at a 3 m anechoic chamber test site. The table was rotated 360 degree to determine the position of the highest radiation.
c. The height of the equipment shall be 0.1 m(above 1GHz is 0.1 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:

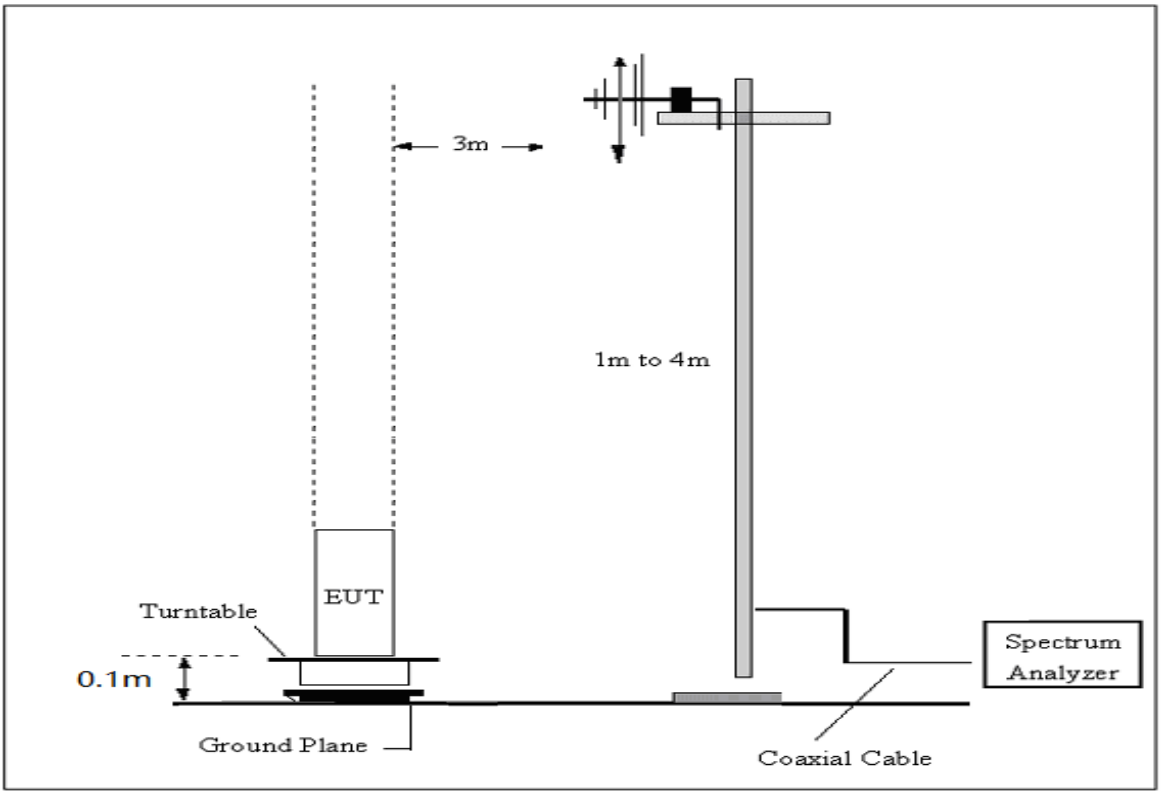
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

4.3 TEST SETUP

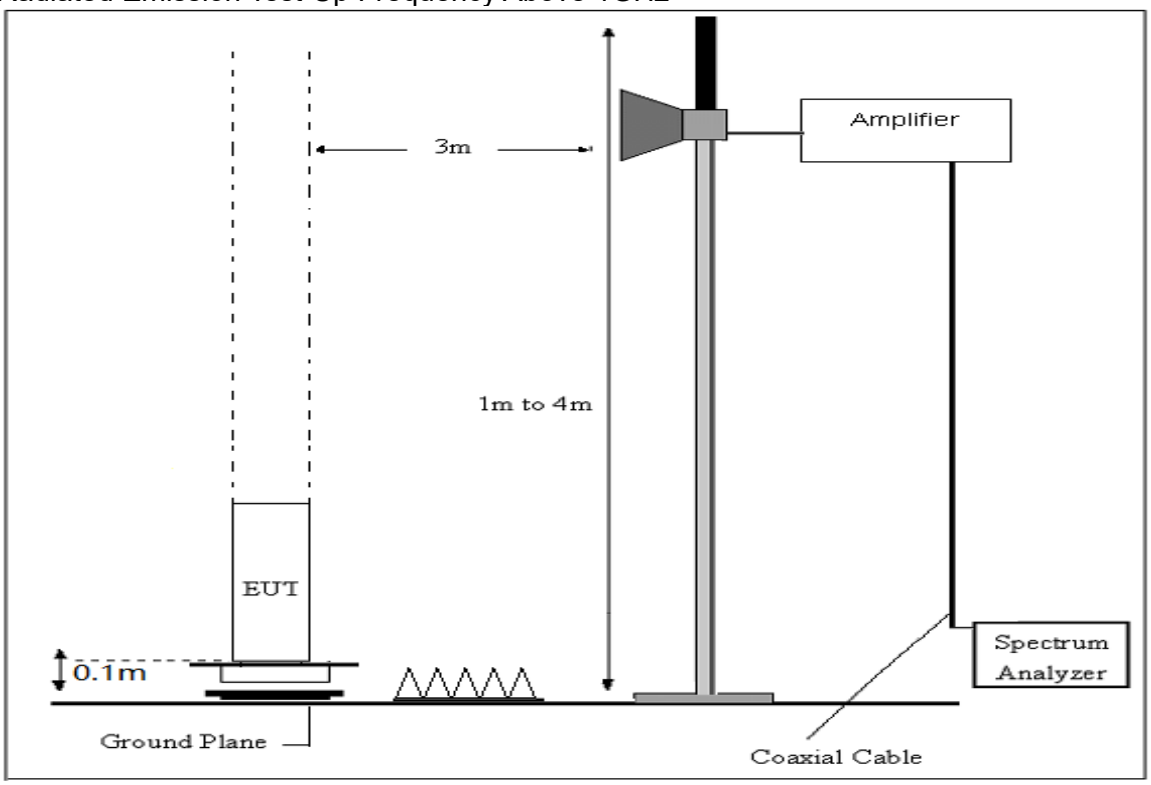
(A) Radiated Emission Test-Up Frequency Below 30MHz



(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.

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

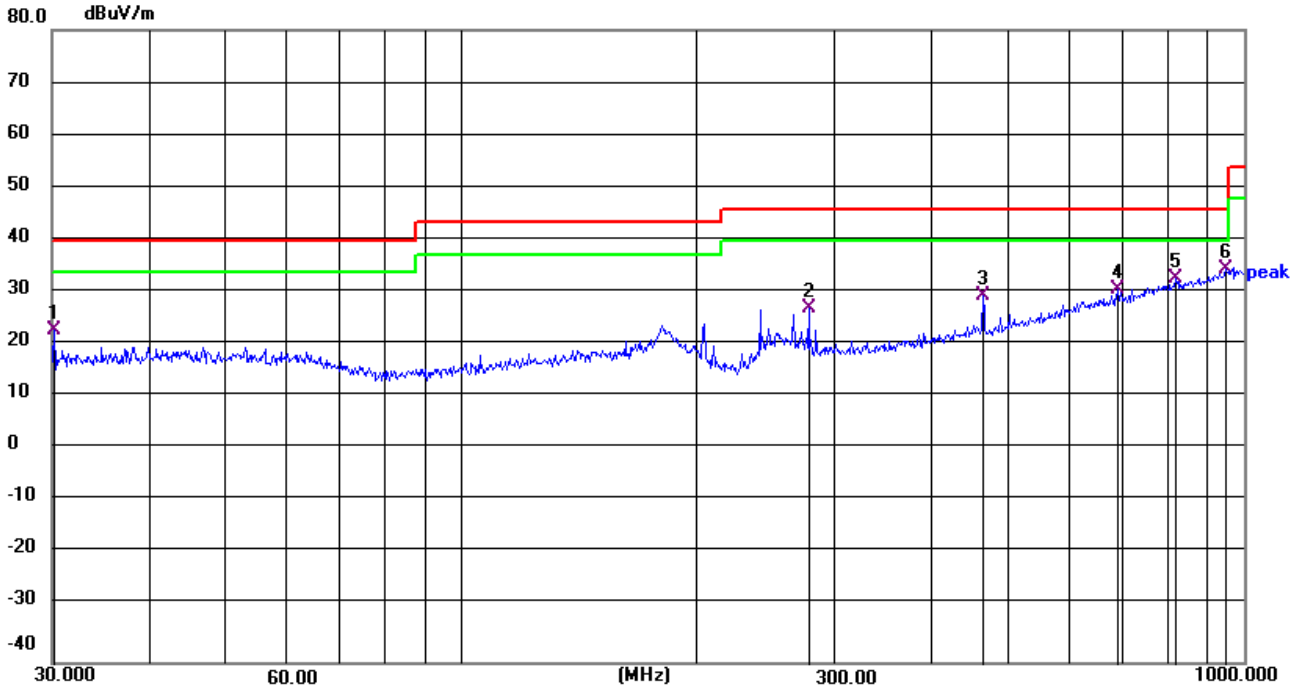
For example

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

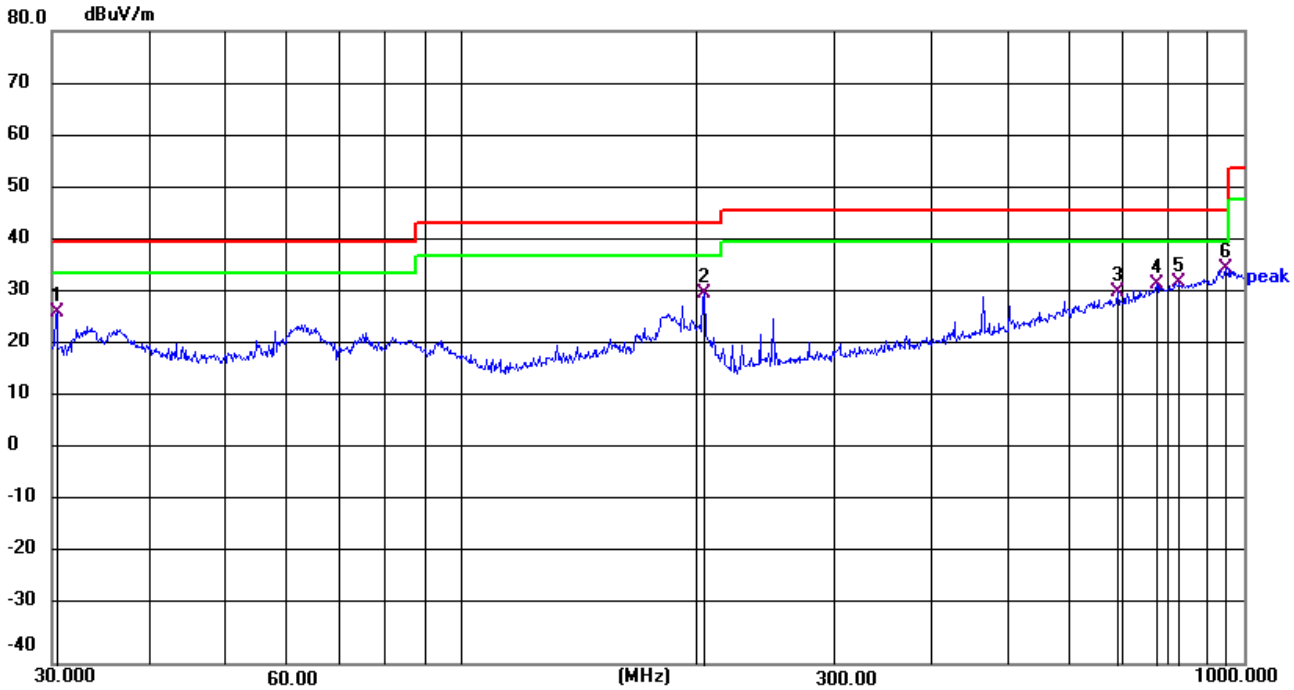
4.6 TEST RESULTS

M/N: ES15	Temperature: 23.7°C
Phase: H	Humidity: 56%RH
Test Mode: Mode 4	Test Voltage: DC 48V



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	30.2111	40.75	-17.56	23.19	40.00	-16.81	QP
2	278.0668	44.76	-17.55	27.21	46.00	-18.79	QP
3	463.9696	42.71	-13.02	29.69	46.00	-16.31	QP
4	689.5644	39.22	-8.39	30.83	46.00	-15.17	QP
5	818.8341	38.66	-5.77	32.89	46.00	-13.11	QP
6 *	948.7610	38.17	-3.55	34.62	46.00	-11.38	QP

M/N: ES15	Temperature: 23.7°C
Phase: V	Humidity: 56%RH
Test Mode: Mode 4	Test Voltage: DC 48V



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	30.4238	44.16	-17.54	26.62	40.00	-13.38	QP
2	204.2377	50.51	-20.16	30.35	43.50	-13.15	QP
3	689.5644	38.97	-8.39	30.58	46.00	-15.42	QP
4	774.1584	38.54	-6.45	32.09	46.00	-13.91	QP
5	827.4934	37.89	-5.67	32.22	46.00	-13.78	QP
6 *	948.7610	38.66	-3.55	35.11	46.00	-10.89	QP

(1GHz-25GHz) Spurious emission Requirements

GFSK

Frequency (MHz)	Meter Reading (dBμV)	Amplifier (dB)	Loss (dB)	Antenna Factor (dB/m)	Corrected Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type	Comment
Low Channel (GFSK/2402 MHz)										
3264.65	61.77	44.70	6.70	28.20	-9.80	51.97	74.00	-22.03	PK	Vertical
3264.65	51.47	44.70	6.70	28.20	-9.80	41.67	54.00	-12.33	AV	Vertical
3264.73	61.01	44.70	6.70	28.20	-9.80	51.21	74.00	-22.79	PK	Horizontal
3264.73	50.34	44.70	6.70	28.20	-9.80	40.54	54.00	-13.46	AV	Horizontal
4804.32	59.56	44.20	9.04	31.60	-3.56	56.00	74.00	-18.00	PK	Vertical
4804.32	49.94	44.20	9.04	31.60	-3.56	46.38	54.00	-7.62	AV	Vertical
4804.36	58.58	44.20	9.04	31.60	-3.56	55.02	74.00	-18.98	PK	Horizontal
4804.36	50.06	44.20	9.04	31.60	-3.56	46.50	54.00	-7.50	AV	Horizontal
5359.75	48.47	44.20	9.86	32.00	-2.34	46.13	74.00	-27.87	PK	Vertical
5359.75	39.54	44.20	9.86	32.00	-2.34	37.20	54.00	-16.80	AV	Vertical
5359.85	48.40	44.20	9.86	32.00	-2.34	46.06	74.00	-27.94	PK	Horizontal
5359.85	39.51	44.20	9.86	32.00	-2.34	37.17	54.00	-16.83	AV	Horizontal
7205.92	54.27	43.50	11.40	35.50	3.40	57.67	74.00	-16.33	PK	Vertical
7205.92	44.91	43.50	11.40	35.50	3.40	48.31	54.00	-5.69	AV	Vertical
7205.79	53.55	43.50	11.40	35.50	3.40	56.95	74.00	-17.05	PK	Horizontal
7205.79	44.79	43.50	11.40	35.50	3.40	48.19	54.00	-5.81	AV	Horizontal
Middle Channel (GFSK/2440 MHz)										
3264.78	61.77	44.70	6.70	28.20	-9.80	51.97	74.00	-22.03	PK	Vertical
3264.78	51.80	44.70	6.70	28.20	-9.80	42.00	54.00	-12.00	AV	Vertical
3264.79	61.89	44.70	6.70	28.20	-9.80	52.09	74.00	-21.91	PK	Horizontal
3264.79	50.09	44.70	6.70	28.20	-9.80	40.29	54.00	-13.71	AV	Horizontal
4882.40	58.68	44.20	9.04	31.60	-3.56	55.12	74.00	-18.88	PK	Vertical
4882.40	50.23	44.20	9.04	31.60	-3.56	46.67	54.00	-7.33	AV	Vertical
4882.41	59.56	44.20	9.04	31.60	-3.56	56.00	74.00	-18.00	PK	Horizontal
4882.41	49.28	44.20	9.04	31.60	-3.56	45.72	54.00	-8.28	AV	Horizontal
5359.71	49.26	44.20	9.86	32.00	-2.34	46.92	74.00	-27.08	PK	Vertical
5359.71	40.17	44.20	9.86	32.00	-2.34	37.83	54.00	-16.17	AV	Vertical
5359.57	48.14	44.20	9.86	32.00	-2.34	45.80	74.00	-28.20	PK	Horizontal
5359.57	38.24	44.20	9.86	32.00	-2.34	35.90	54.00	-18.10	AV	Horizontal
7323.80	53.75	43.50	11.40	35.50	3.40	57.15	74.00	-16.85	PK	Vertical
7323.80	43.78	43.50	11.40	35.50	3.40	47.18	54.00	-6.82	AV	Vertical
7323.71	53.93	43.50	11.40	35.50	3.40	57.33	74.00	-16.67	PK	Horizontal
7323.71	44.65	43.50	11.40	35.50	3.40	48.05	54.00	-5.95	AV	Horizontal

High Channel (GFSK/2480 MHz)										
3264.72	62.08	44.70	6.70	28.20	-9.80	52.28	74.00	-21.72	PK	Vertical
3264.72	50.24	44.70	6.70	28.20	-9.80	40.44	54.00	-13.56	AV	Vertical
3264.66	61.35	44.70	6.70	28.20	-9.80	51.55	74.00	-22.45	PK	Horizontal
3264.66	50.68	44.70	6.70	28.20	-9.80	40.88	54.00	-13.12	AV	Horizontal
4960.33	59.50	44.20	9.04	31.60	-3.56	55.94	74.00	-18.06	PK	Vertical
4960.33	49.92	44.20	9.04	31.60	-3.56	46.36	54.00	-7.64	AV	Vertical
4960.48	59.21	44.20	9.04	31.60	-3.56	55.65	74.00	-18.35	PK	Horizontal
4960.48	49.79	44.20	9.04	31.60	-3.56	46.23	54.00	-7.77	AV	Horizontal
5359.82	48.63	44.20	9.86	32.00	-2.34	46.29	74.00	-27.71	PK	Vertical
5359.82	40.09	44.20	9.86	32.00	-2.34	37.75	54.00	-16.25	AV	Vertical
5359.74	47.62	44.20	9.86	32.00	-2.34	45.28	74.00	-28.72	PK	Horizontal
5359.74	38.84	44.20	9.86	32.00	-2.34	36.50	54.00	-17.50	AV	Horizontal
7439.92	53.59	43.50	11.40	35.50	3.40	56.99	74.00	-17.01	PK	Vertical
7439.92	44.01	43.50	11.40	35.50	3.40	47.41	54.00	-6.59	AV	Vertical
7439.81	53.54	43.50	11.40	35.50	3.40	56.94	74.00	-17.06	PK	Horizontal
7439.81	43.72	43.50	11.40	35.50	3.40	47.12	54.00	-6.88	AV	Horizontal

Note:

1) Factor = Antenna Factor + Cable Loss – Pre-amplifier.
   Emission Level = Reading + Factor

2) The frequency emission of peak points that did not show above the forms are at least 20dB below the limit, the frequency emission is mainly from the environment noise.

Restricted Bands Requirements

BLE_2402MHz

H

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)
1	2386.10	40.94	-6.75	34.19	74	-39.81	peak	100	360
2	2390	40.91	-5.72	35.19	74	-38.81	peak	100	360
3	2400	39.79	-5.61	34.18	74	-39.82	peak	100	360

V

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)
1	2383.39	43.90	-5.32	38.58	74	-35.42	peak	100	360
2	2390	39.79	-5.72	34.07	74	-39.93	peak	100	360
3	2400	41.16	-5.61	35.55	74	-38.45	peak	100	360

BLE_2480MHz

H

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)
1	2483.5	38.20	-5.09	33.11	74	-40.89	peak	100	360
2	2483.57	36.39	-5.27	31.12	74	-42.88	peak	100	360

V

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)
1	2483.5	35.44	-5.09	30.35	74	-43.65	peak	100	360
2	2484.32	38.20	-4.66	33.54	74	-40.46	peak	100	360

Note:

1) Factor = Antenna Factor + Cable Loss – Pre-amplifier.
   Emission Level = Reading + Factor

2) Only show the worst case.

3) The peak volue is less than AV limit, so AV measure is not need.

5. CONDUCTED SPURIOUS & BAND EDGE EMISSION

5.1 LIMIT

According to FCC section 15.247(d), 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 DC 5V, 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

FCC Part 15.247,Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(e)	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

FCC Part 15.247,Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	>= 500KHz (6dB bandwidth)	2400-2483.5	PASS

7.2 TEST PROCEDURE

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW≥3RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be≥6 dB.

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

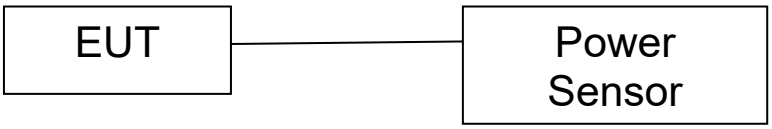
8.1 LIMIT

FCC Part 15.247,Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3)	Output Power	1 watt or 30dBm	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 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

9.2 EUT ANTENNA

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

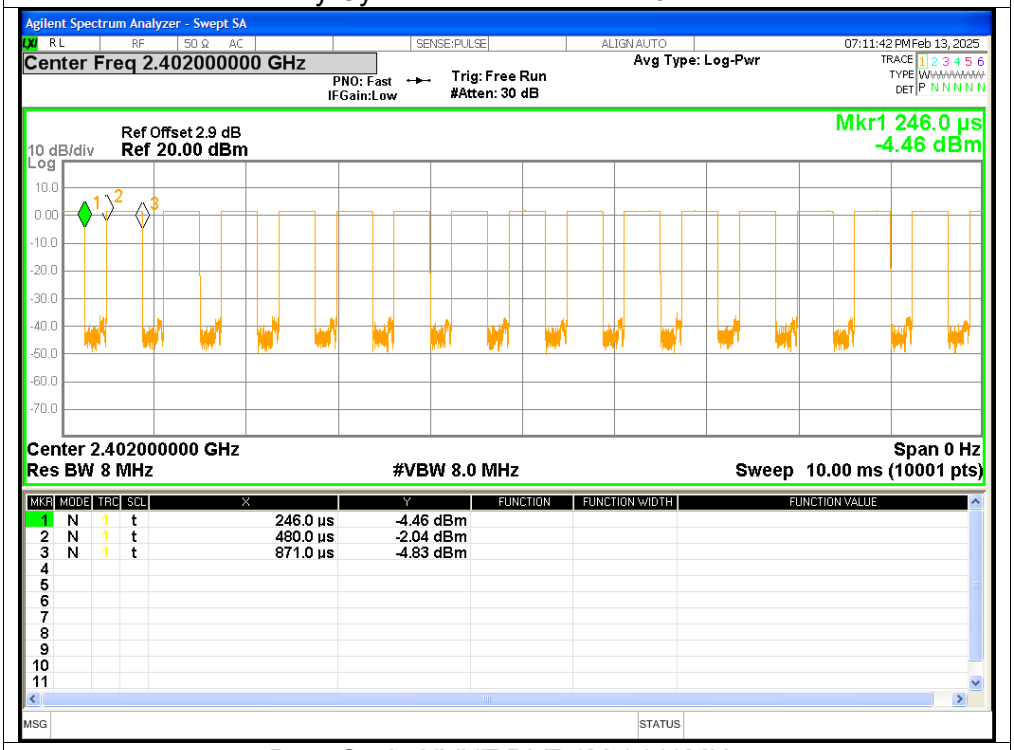
APPENDIX I:TEST RESULTS

1. Duty Cycle

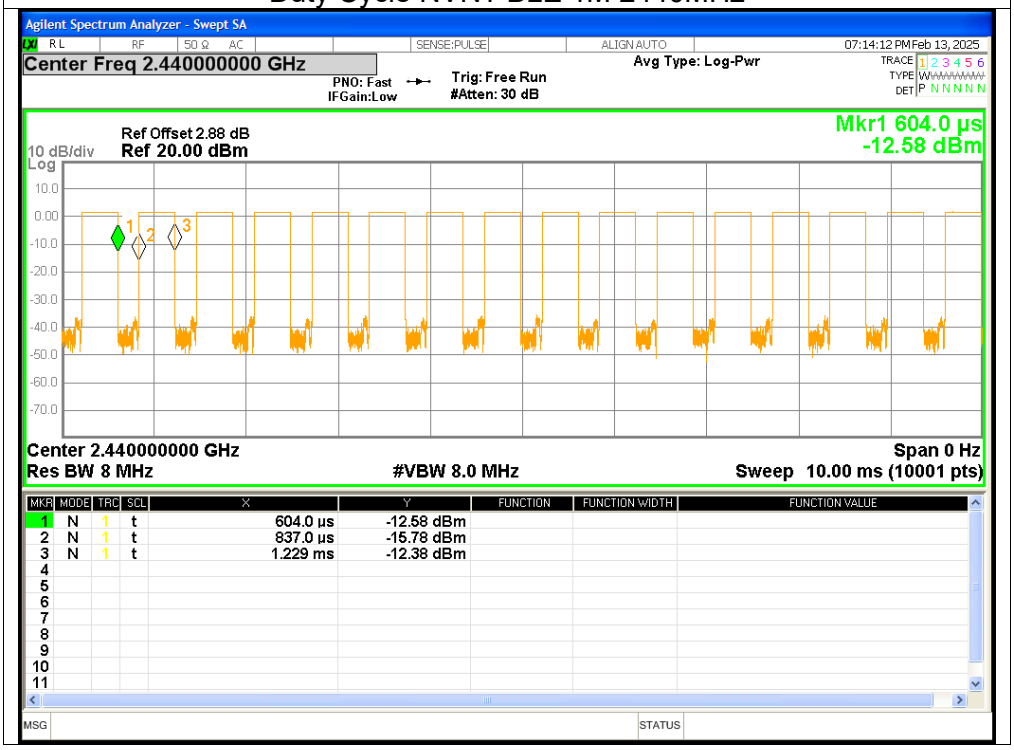
Condition	Mode	Frequency (MHz)	Duty Cycle (%)	Correction Factor (dB)	1/T (kHz)
NVNT	BLE 1M	2402	62.56	2.04	2.56
NVNT	BLE 1M	2440	62.72	2.03	2.55
NVNT	BLE 1M	2480	62.56	2.04	2.56

Test Graphs

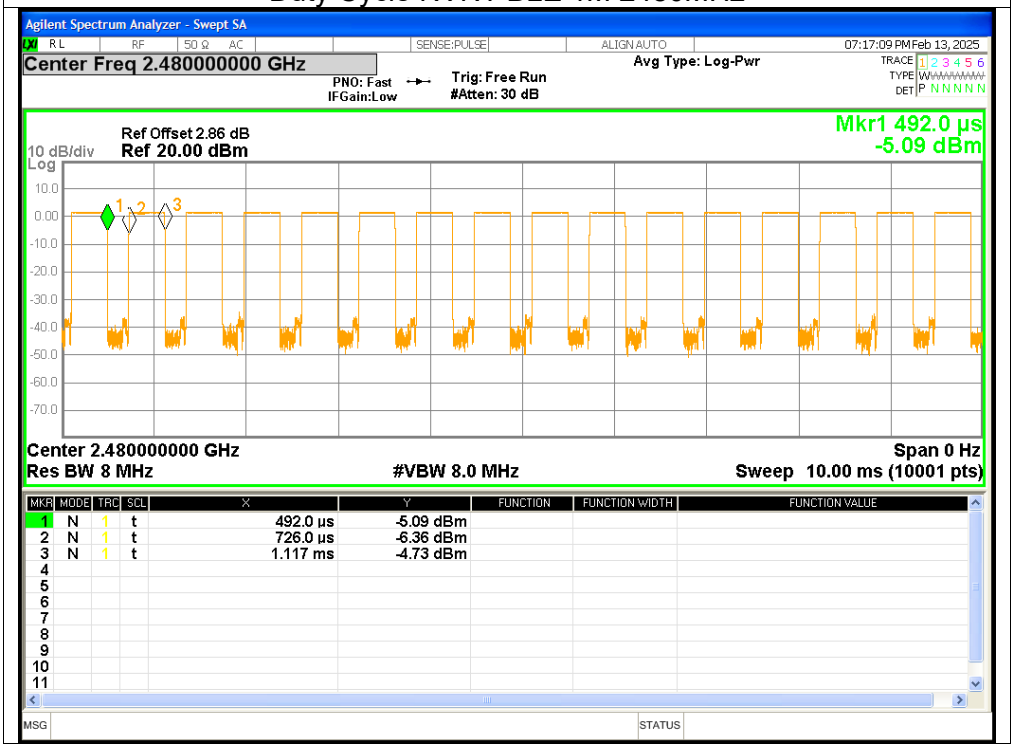
Duty Cycle NVNT BLE 1M 2402MHz



Duty Cycle NVNT BLE 1M 2440MHz



Duty Cycle NVNT BLE 1M 2480MHz

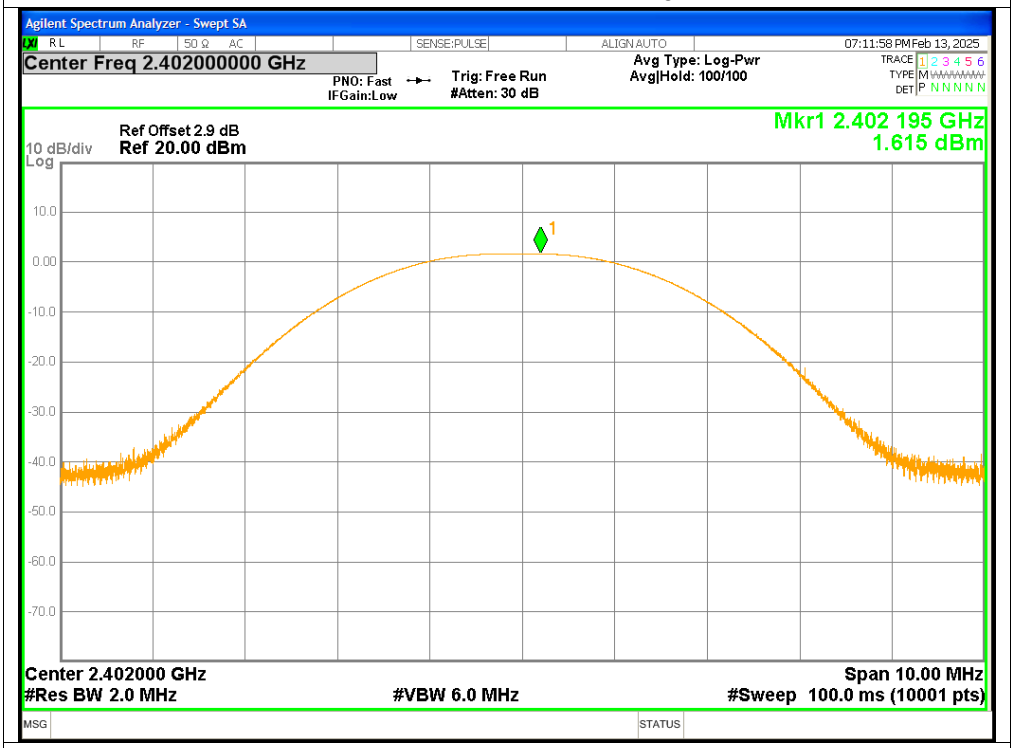


2. Maximum Peak Conducted Output Power

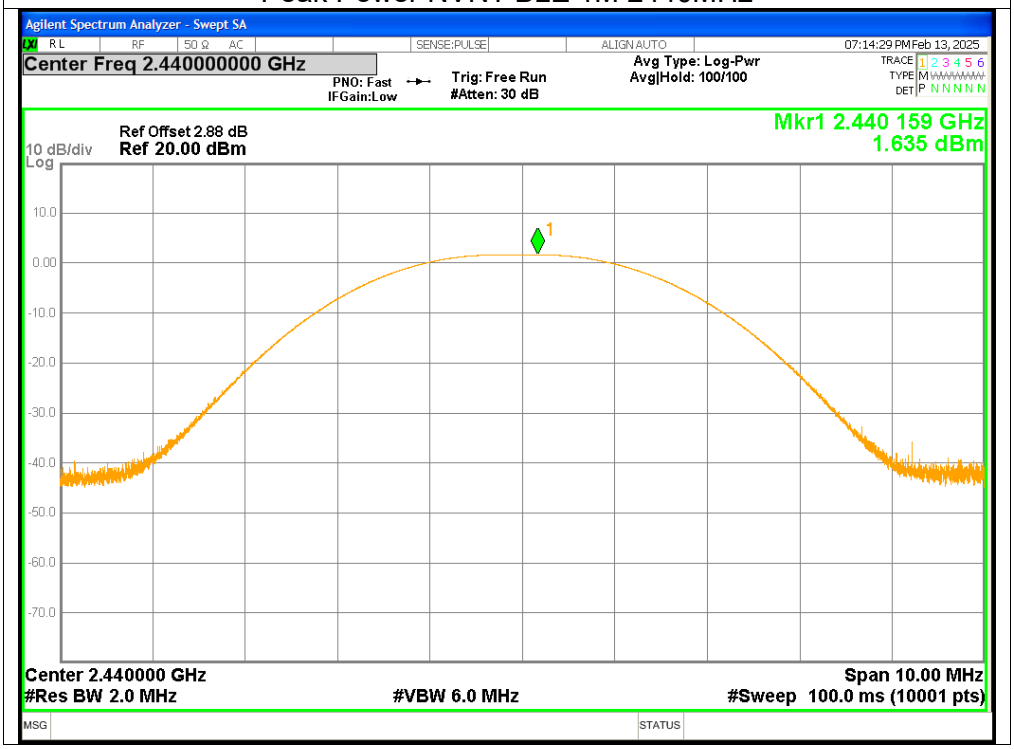
Condition	Mode	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	BLE 1M	2402	1.62	<=30	Pass
NVNT	BLE 1M	2440	1.64	<=30	Pass
NVNT	BLE 1M	2480	1.4	<=30	Pass

Test Graphs

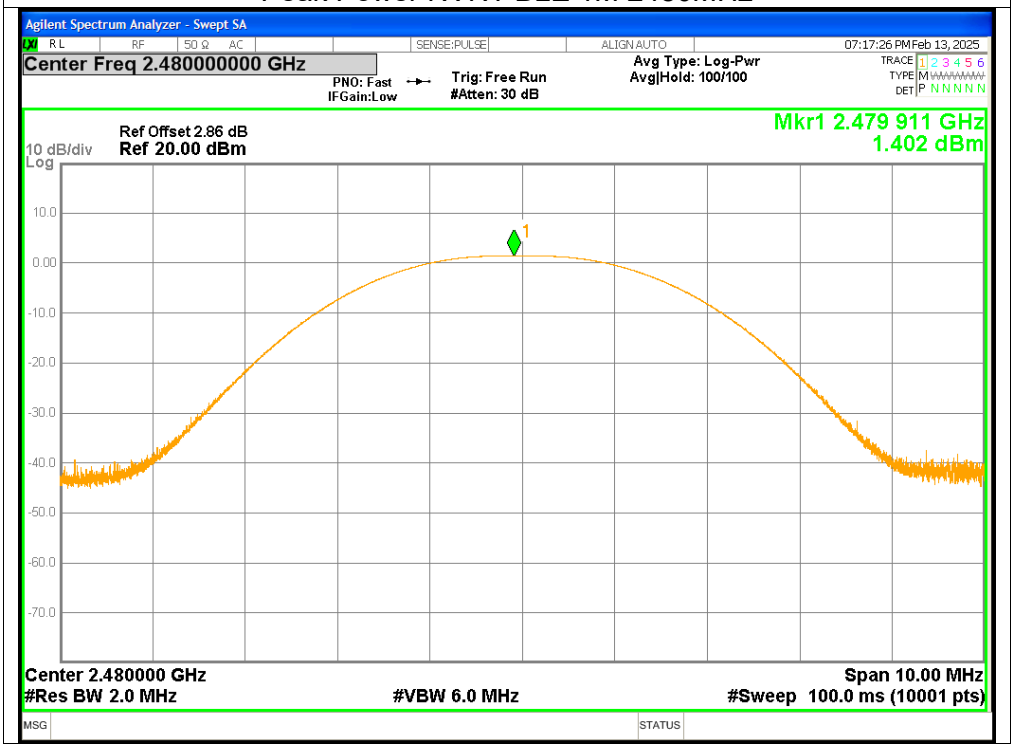
Peak Power NVNT BLE 1M 2402MHz



Peak Power NVNT BLE 1M 2440MHz



Peak Power NVNT BLE 1M 2480MHz

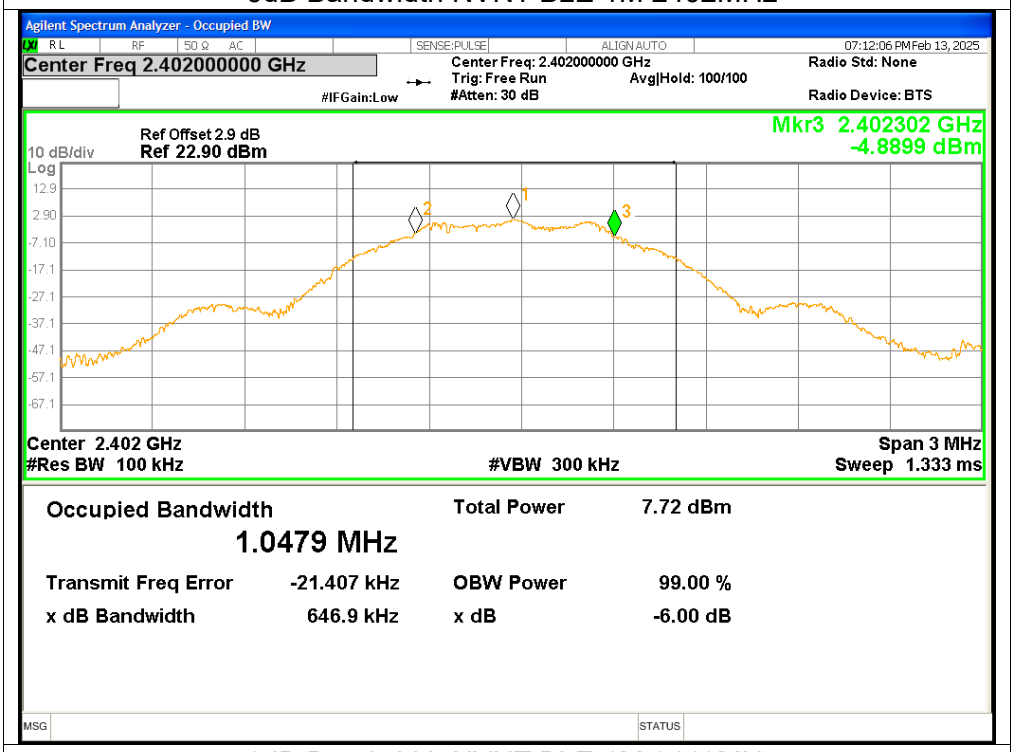


3. -6dB Bandwidth

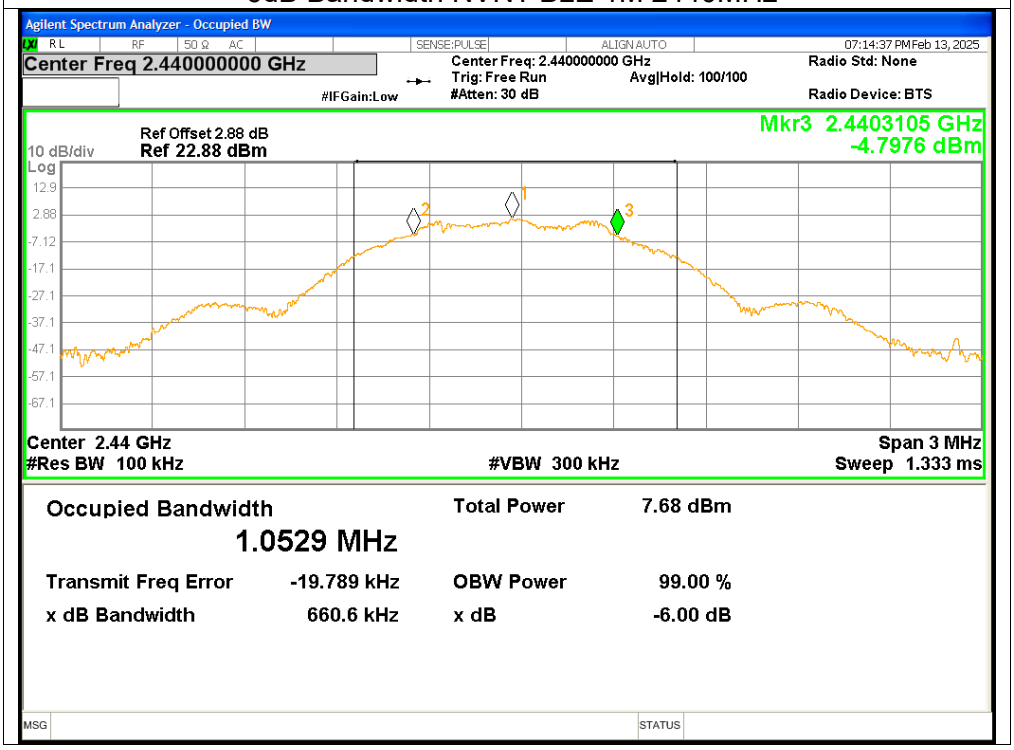
Condition	Mode	Frequency (MHz)	-6 dB Bandwidth (MHz)	Limit -6 dB Bandwidth (MHz)	Verdict
NVNT	BLE 1M	2402	0.6469	>=0.5	Pass
NVNT	BLE 1M	2440	0.6606	>=0.5	Pass
NVNT	BLE 1M	2480	0.6655	>=0.5	Pass

Test Graphs

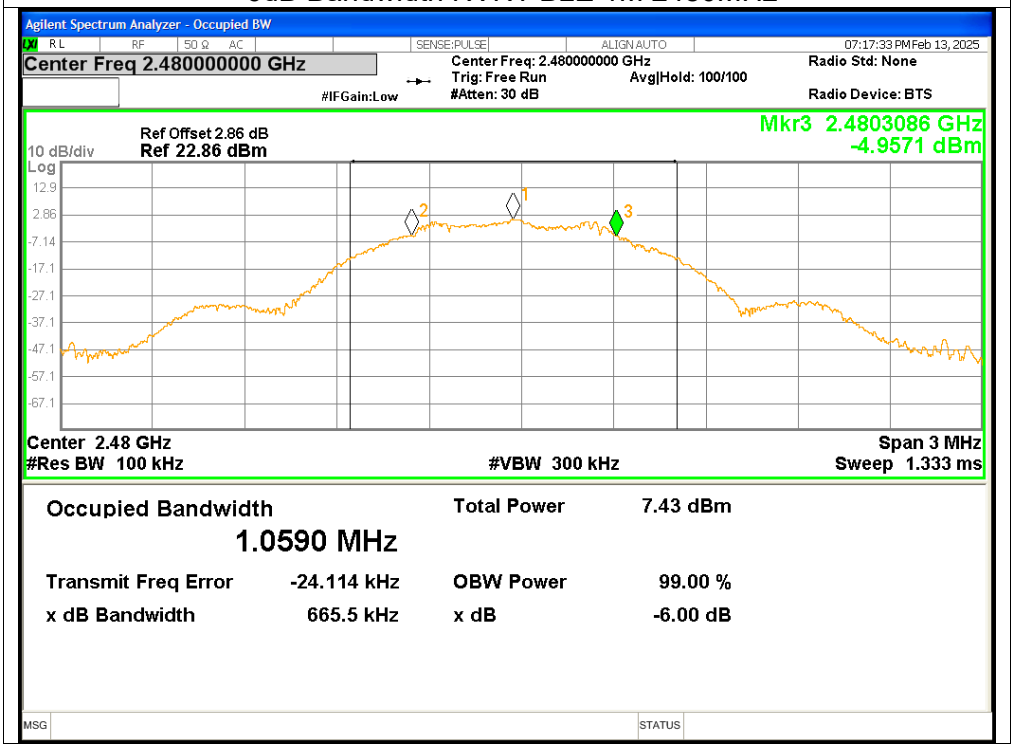
-6dB Bandwidth NVNT BLE 1M 2402MHz



-6dB Bandwidth NVNT BLE 1M 2440MHz



-6dB Bandwidth NVNT BLE 1M 2480MHz

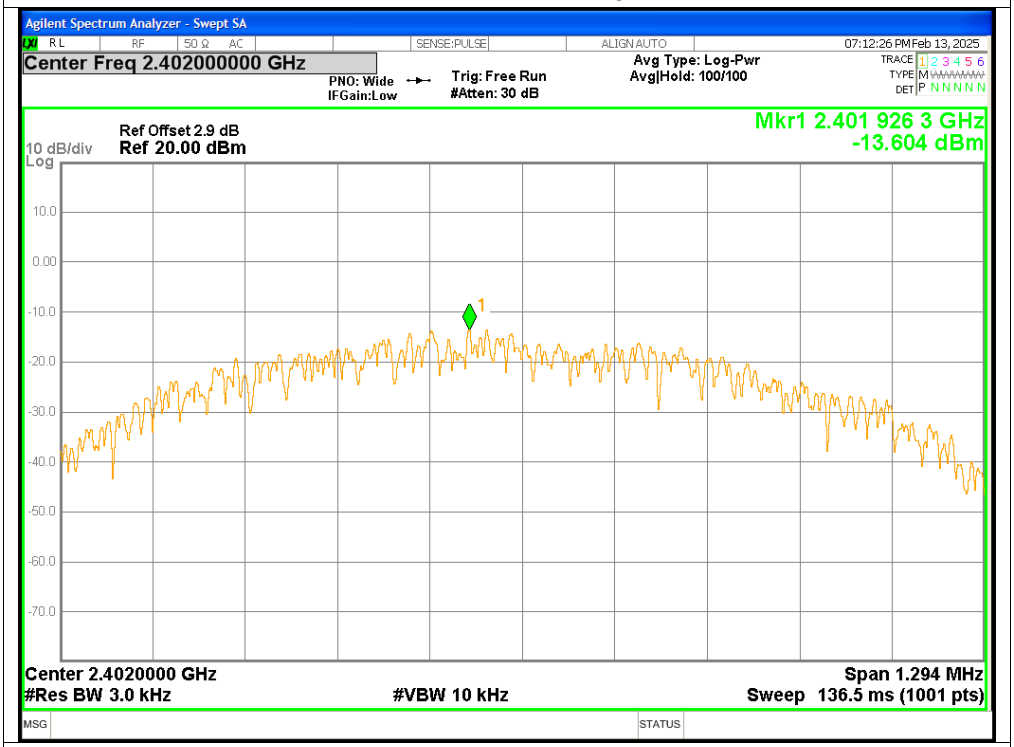


4. Maximum Power Spectral Density Level

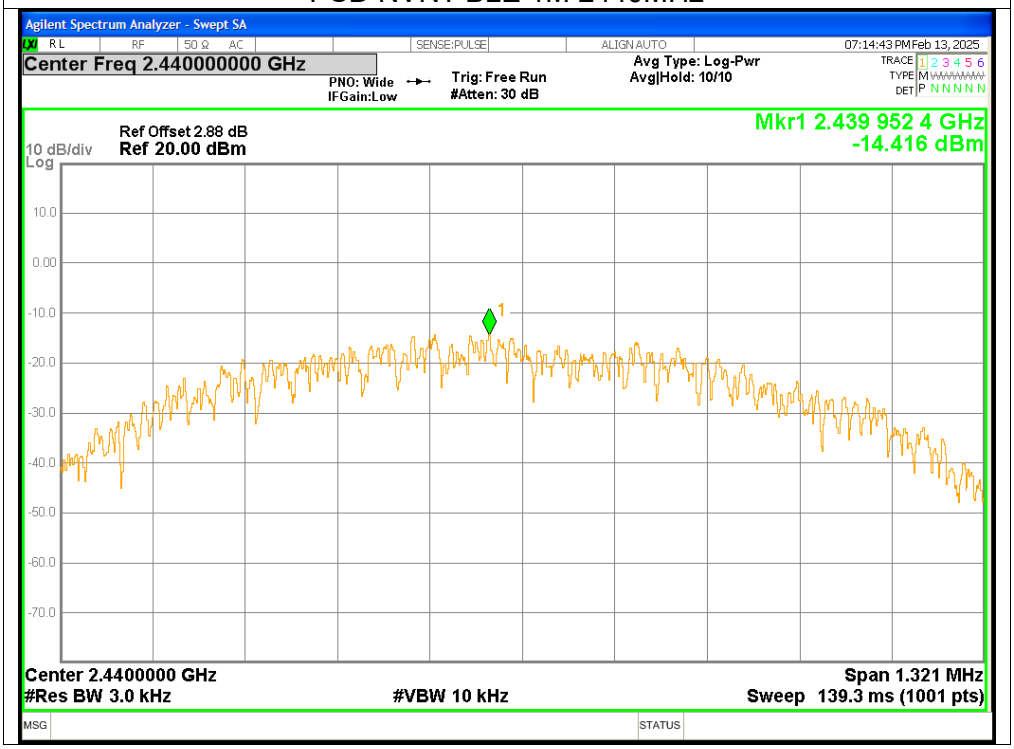
Condition	Mode	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
NVNT	BLE 1M	2402	-13.6	<=8	Pass
NVNT	BLE 1M	2440	-14.42	<=8	Pass
NVNT	BLE 1M	2480	-14.33	<=8	Pass

Test Graphs

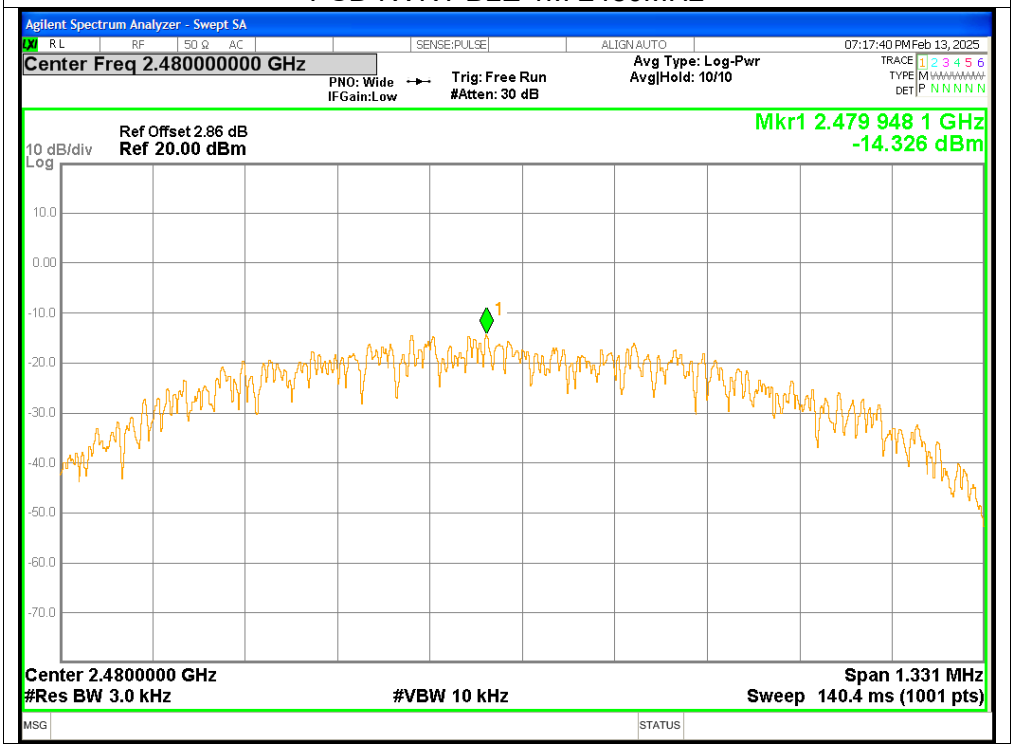
PSD NVNT BLE 1M 2402MHz



PSD NVNT BLE 1M 2440MHz



PSD NVNT BLE 1M 2480MHz

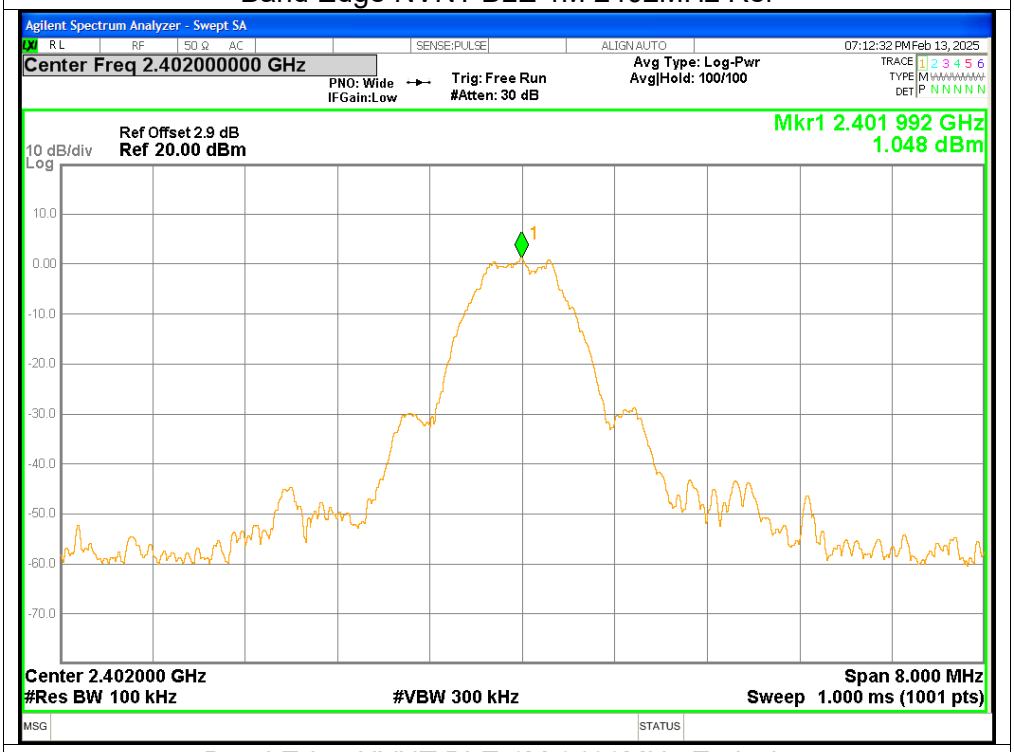


5. Band Edge

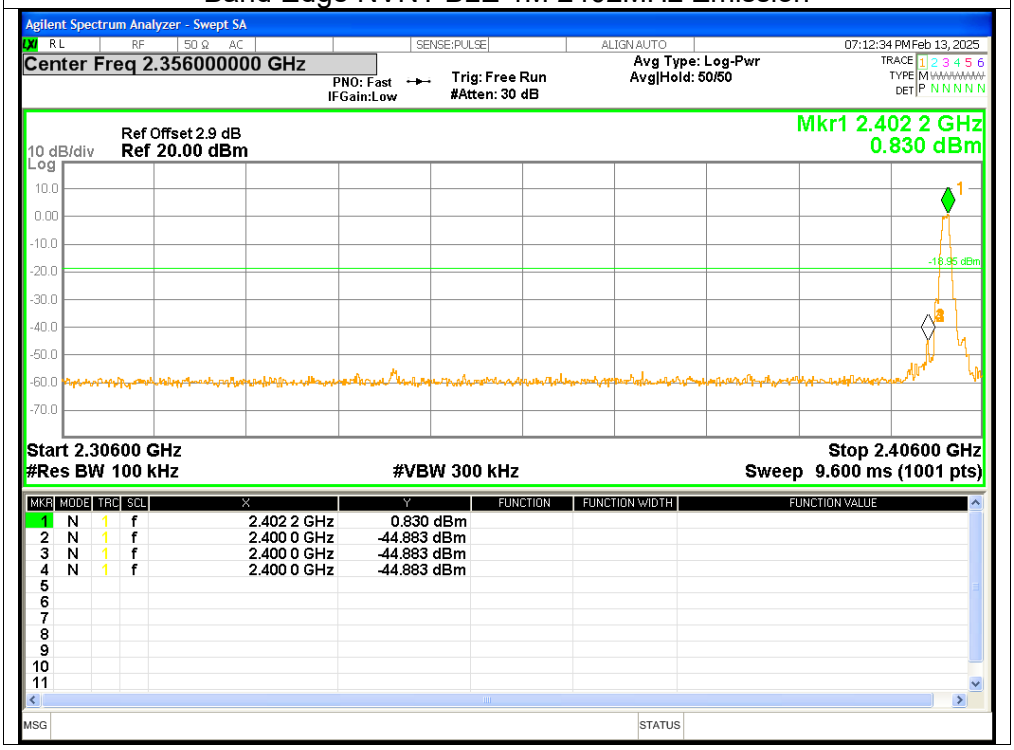
Condition	Mode	Frequency (MHz)	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	BLE 1M	2402	-45.93	<=-20	Pass
NVNT	BLE 1M	2480	-57.36	<=-20	Pass

Test Graphs

Band Edge NVNT BLE 1M 2402MHz Ref

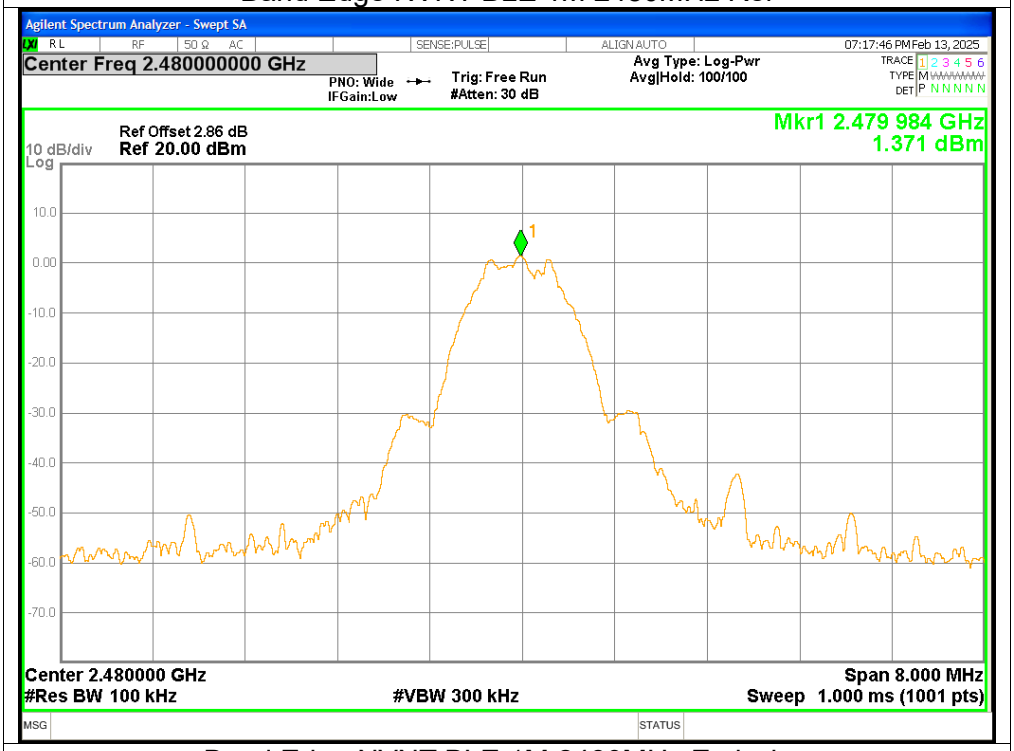


Band Edge NVNT BLE 1M 2402MHz Emission

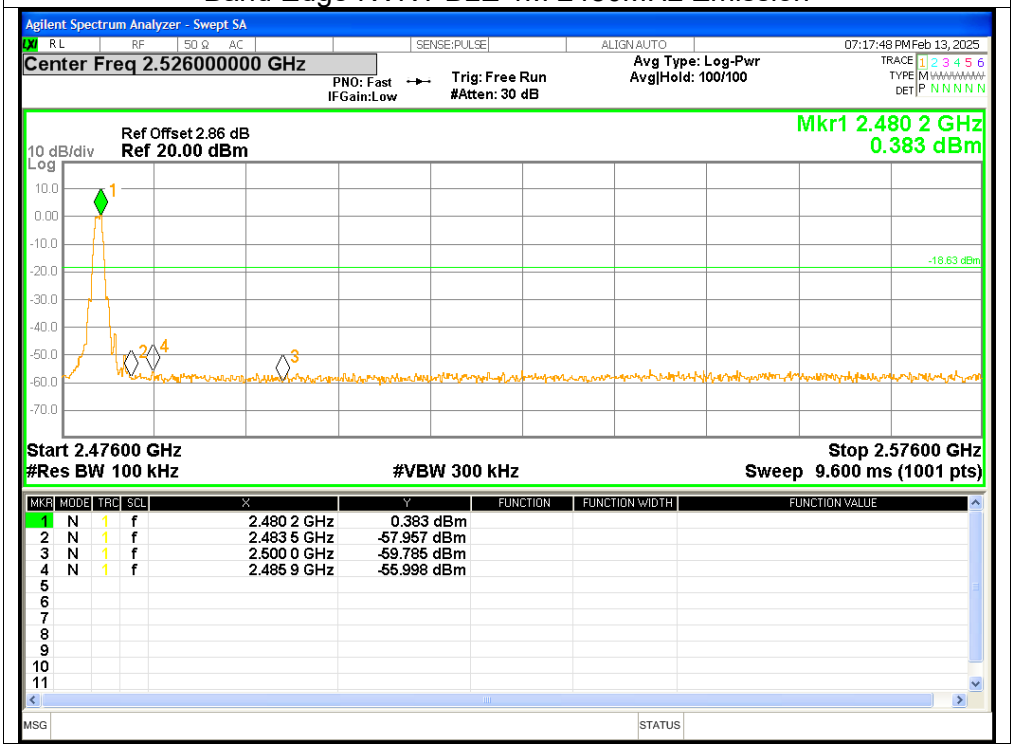


MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.402 2 GHz	0.830 dBm			
2	N	1	f	2.400 0 GHz	-44.883 dBm			
3	N	1	f	2.400 0 GHz	-44.883 dBm			
4	N	1	f	2.400 0 GHz	-44.883 dBm			
5								
6								
7								
8								
9								
10								
11								

Band Edge NVNT BLE 1M 2480MHz Ref



Band Edge NVNT BLE 1M 2480MHz Emission

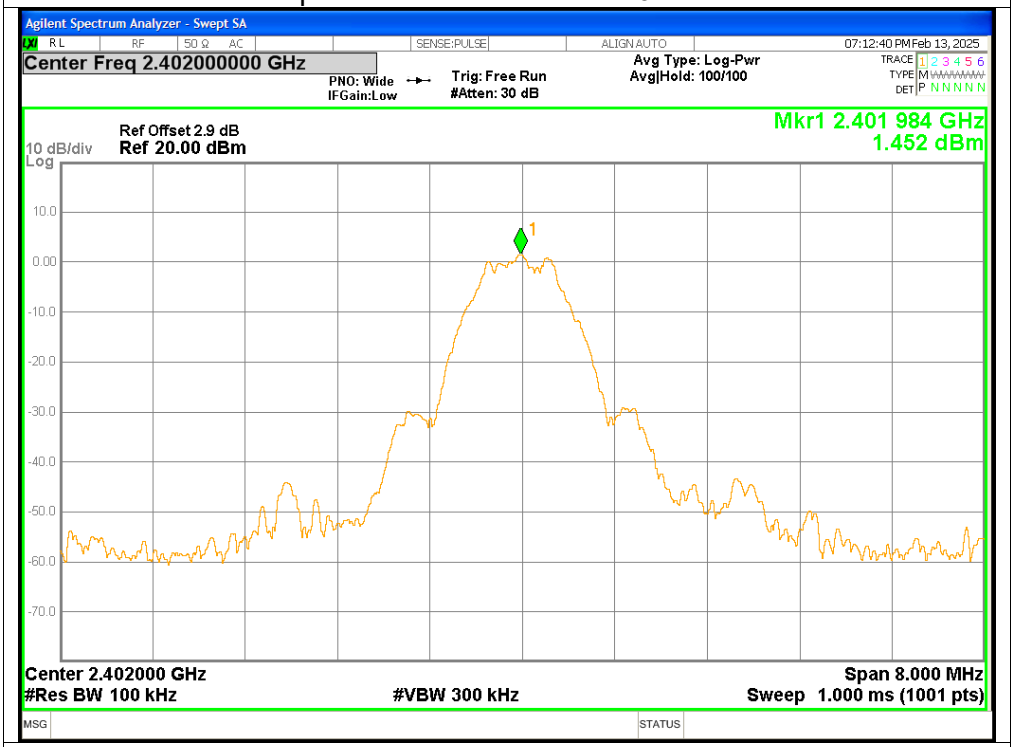


6. Conducted RF Spurious Emission

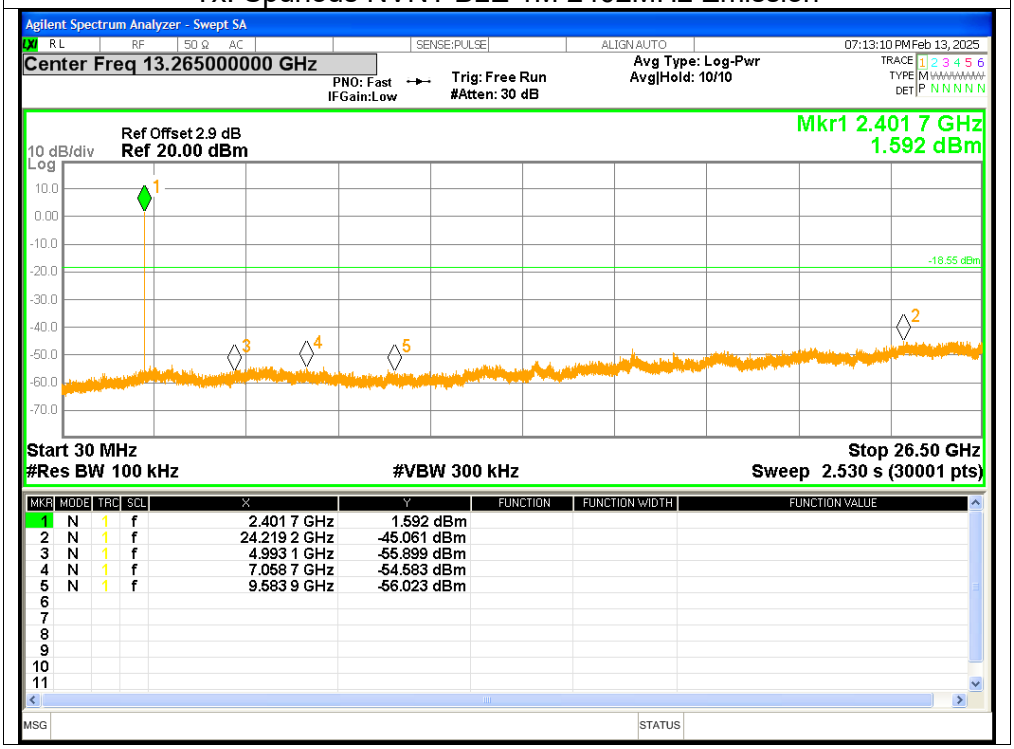
Condition	Mode	Frequency (MHz)	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	BLE 1M	2402	-46.51	<=-20	Pass
NVNT	BLE 1M	2440	-44.21	<=-20	Pass
NVNT	BLE 1M	2480	-44.37	<=-20	Pass

Test Graphs

Tx. Spurious NVNT BLE 1M 2402MHz Ref

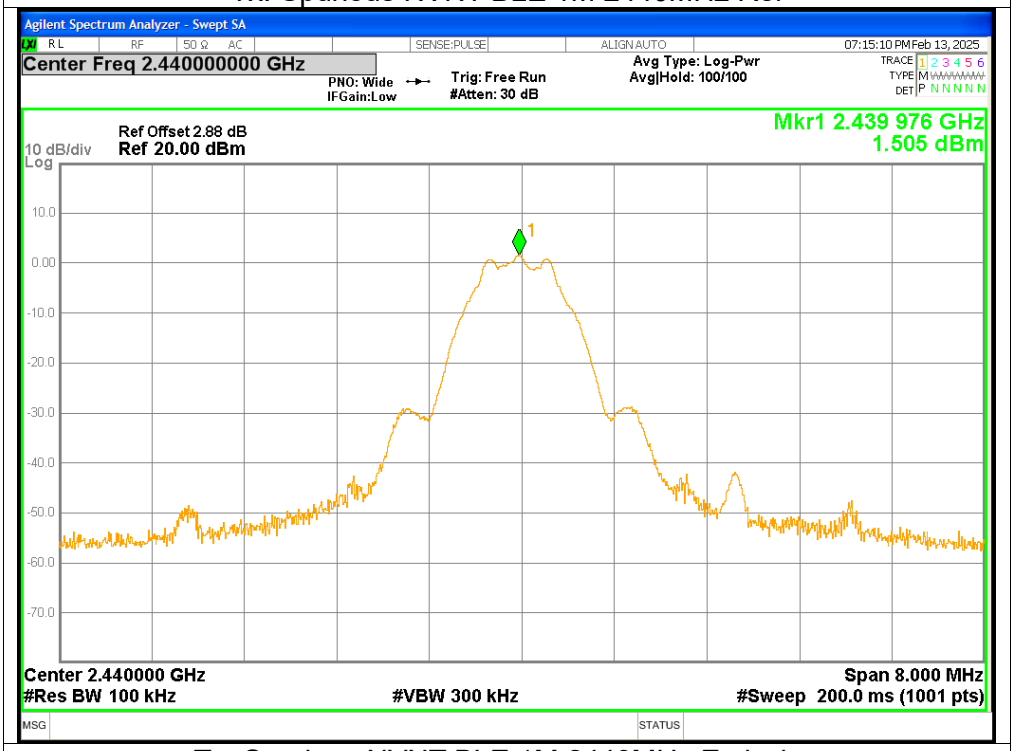


Tx. Spurious NVNT BLE 1M 2402MHz Emission

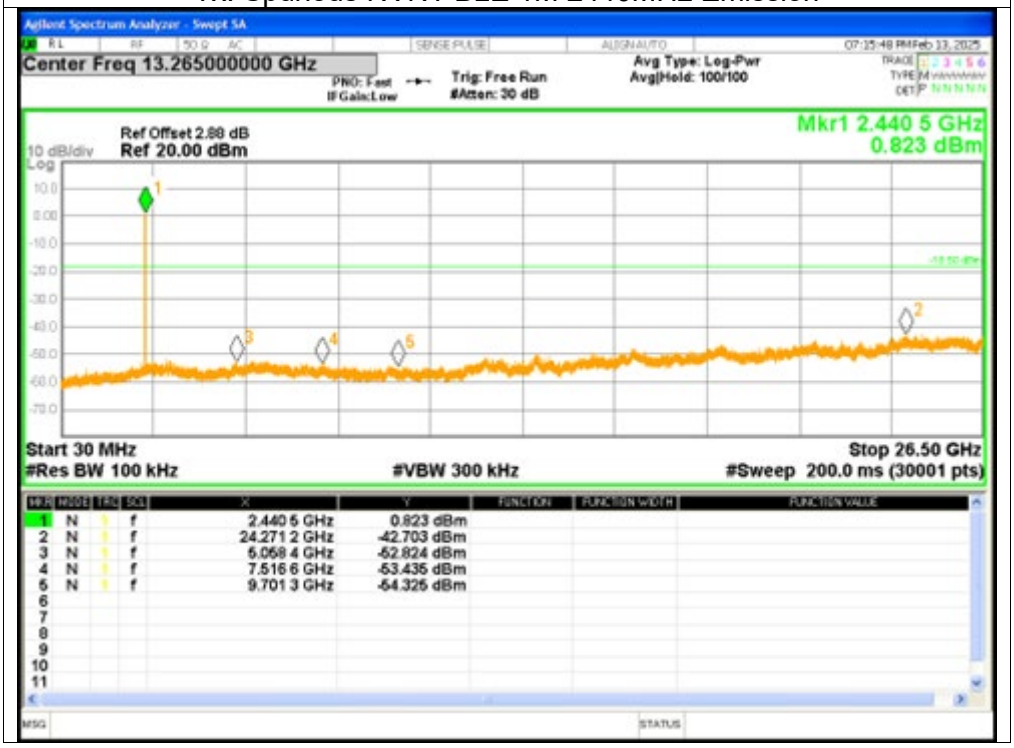


MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.401 7 GHz	1.592 dBm			
2	N	1	f	24.219 2 GHz	-45.061 dBm			
3	N	1	f	4.993 1 GHz	-55.899 dBm			
4	N	1	f	7.058 7 GHz	-54.583 dBm			
5	N	1	f	9.583 9 GHz	-56.023 dBm			
6								
7								
8								
9								
10								
11								

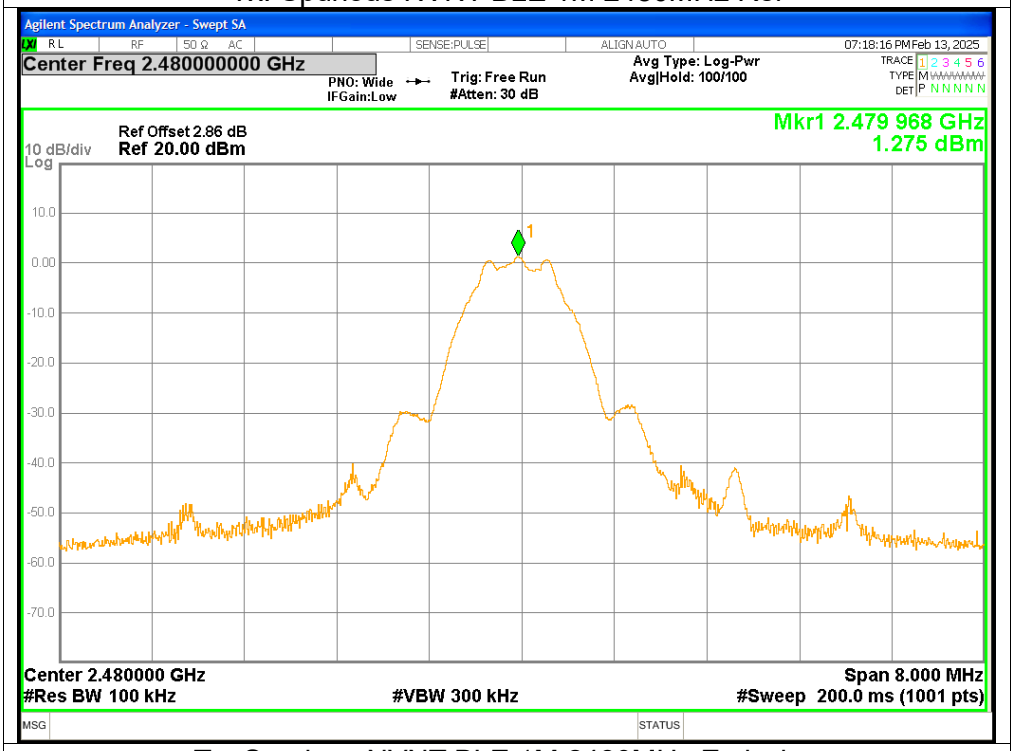
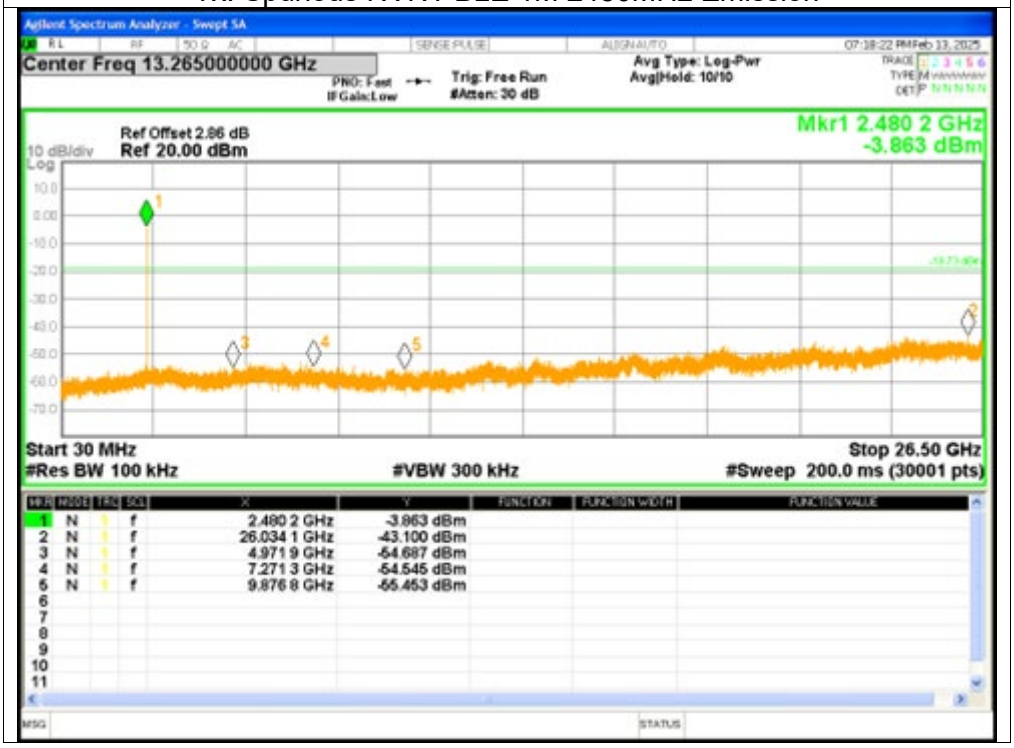
Tx. Spurious NVNT BLE 1M 2440MHz Ref



Tx. Spurious NVNT BLE 1M 2440MHz Emission



Tx. Spurious NVNT BLE 1M 2480MHz Ref



Tx. Spurious NVNT BLE 1M 2480MHz Emission