



TEST REPORT

Application No.: BTEK230808004AE
Applicant: SHENZHEN ECARE ELECTRONICS CO., LTD
Address of Applicant: 5-6/F., Block B, Huali Industrial Building District 28, Bao An, Shenzhen, Guang Dong, China
Manufacturer: SHENZHEN ECARE ELECTRONICS CO., LTD
Address of Manufacturer: B201/B401/B501/B601, Hua Li Industrial Building, 404 Yu An Road, Bao An, Shenzhen, Guang Dong, China
Factory: SHENZHEN ECARE ELECTRONICS CO., LTD
Address of Factory: B201/B401/B501/B601, Hua Li Industrial Building, 404 Yu An Road, Bao An, Shenzhen, Guang Dong, China
Equipment Under Test (EUT):
EUT Name: Bluetooth Temperature Monitor
Model No.: TP970, TP970W, I70
Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.
Trade Mark: NA
Standard(s) : 47 CFR Part 15, Subpart C 15.247
KDB 558074 D01 15.247 Meas Guidance v05r02
Date of Receipt: 2023-08-08
Date of Test: 2023-08-09 to 2023-10-08
Date of Issue: 2023-10-08

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.

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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2023-10-08		Original

Authorized for issue by:				
				
		<hr/>		
		Carl Yang /Project Engineer		
				
		<hr/>		
		Keven Tan /Reviewer		



2 Test Summary

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)	Pass

Radio Spectrum Matter Part				
Item	Standard	Method	Requirement	Result
Conducted Emissions at AC Power Line (150kHz-30MHz)	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart C 15.207	Pass
Conducted Peak Output Power		ANSI C63.10 (2013) Section 11.9.1.3	47 CFR Part 15, Subpart C 15.247(b)(3)	Pass
Minimum 6dB Bandwidth		ANSI C63.10 (2013) Section 11.8.1	47 CFR Part 15, Subpart C 15.247a(2)	Pass
Power Spectrum Density		ANSI C63.10 (2013) Section 11.10.2	47 CFR Part 15, Subpart C 15.247(e)	Pass
Conducted Band Edges Measurement		ANSI C63.10 (2013) Section 11.13.3.2	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Spurious Emissions		ANSI C63.10 (2013) Section 11.11	47 CFR Part 15, Subpart C 15.247(d)	Pass
Radiated Emissions which fall in the restricted bands		ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions (Below 1GHz)		ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions (Above 1GHz)		ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass

Note:

E.U.T./EUT means Equipment Under Test.

Pass means the test result passed the test standard requirement, please find the detailed decision rule in the report relative section.

Declaration of EUT Family Grouping:

Model No.: TP970, TP970W, I70

Only the model TP970 was tested. According to the declaration from the applicant, the electrical circuit design, layout, components used, internal wiring and functions of other models are identical for the above models, with only difference on model No.and colour.



3 Contents

	Page
1 Cover Page	1
2 Test Summary	3
3 Contents	4
4 General Information	6
4.1 Details of E.U.T.	6
4.2 Description of Support Units	6
4.3 Measurement Uncertainty	6
4.4 Test Location	7
4.5 Deviation from Standards	7
4.6 Abnormalities from Standard Conditions	7
5 Equipment List	8
6 Radio Spectrum Technical Requirement	10
6.1 Antenna Requirement	10
6.1.1 Test Requirement:	10
6.1.2 Conclusion	10
7 Radio Spectrum Matter Test Results	11
7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)	11
7.1.1 E.U.T. Operation	11
7.1.2 Test Mode Description	11
7.1.3 Test Setup Diagram	11
7.1.4 Measurement Procedure and Data	12
7.2 Conducted Peak Output Power	15
7.2.1 E.U.T. Operation	15
7.2.2 Test Mode Description	15
7.2.3 Test Setup Diagram	15
7.2.4 Measurement Procedure and Data	15
7.3 Minimum 6dB Bandwidth	16
7.3.1 E.U.T. Operation	16
7.3.2 Test Mode Description	16
7.3.3 Test Setup Diagram	16
7.3.4 Measurement Procedure and Data	16
7.4 Power Spectrum Density	17
7.4.1 E.U.T. Operation	17
7.4.2 Test Mode Description	17
7.4.3 Test Setup Diagram	17
7.4.4 Measurement Procedure and Data	17
7.5 Conducted Band Edges Measurement	18
7.5.1 E.U.T. Operation	18
7.5.2 Test Mode Description	18
7.5.3 Test Setup Diagram	18
7.5.4 Measurement Procedure and Data	18
7.6 Conducted Spurious Emissions	19
7.6.1 E.U.T. Operation	19
7.6.2 Test Mode Description	19
7.6.3 Test Setup Diagram	19
7.6.4 Measurement Procedure and Data	19
7.7 Radiated Emissions which fall in the restricted bands	20



7.7.1 E.U.T. Operation20

7.7.2 Test Mode Description20

7.7.3 Test Setup Diagram20

7.7.4 Measurement Procedure and Data.....21

7.8 Radiated Spurious Emissions (Below 1GHz).....23

7.8.1 E.U.T. Operation23

7.8.2 Test Mode Description23

7.8.3 Test Setup Diagram23

7.8.4 Measurement Procedure and Data.....24

7.9 Radiated Spurious Emissions (Above 1GHz)27

7.9.1 E.U.T. Operation27

7.9.2 Test Mode Description27

7.9.3 Test Setup Diagram28

7.9.4 Measurement Procedure and Data.....29

8 Test Setup Photo32

9 EUT Constructional Details (EUT Photos)32

10 Appendix.....33

4 General Information

4.1 Details of E.U.T.

Power supply:	DC 3.7V from battery or DC 5V from adapter
Test Voltage:	AC 120V, 60Hz
Cable(s):	/
Frequency Range:	2402MHz to 2480MHz
Bluetooth Version:	Bluetooth 5.3
Modulation Type:	GFSK
Number of Channels:	40
Antenna Type:	PCB Antenna
Antenna Gain:	-2.67dBi

Remark: The information in this section is provided by the applicant or manufacturer, BANTEK is not liable to the accuracy, suitability, reliability or/and integrity of the information.

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Adapter	Mirip	ED1-050200UC	--

4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Emissions at AC Power Line (150kHz-30MHz)	±3.12dB
Conducted Peak Output Power	± 0.75dB
Minimum 6dB Bandwidth	± 3%
Power Spectrum Density	± 2.84dB
Conducted Band Edges Measurement	± 0.75dB
Conducted Spurious Emissions	± 0.75dB
Radiated Emissions which fall in the restricted bands	±5.08dB (1GHz-6GHz);±5.14dB(above 6GHz)
Radiated Spurious Emissions (Below 1GHz)	±5.06dB (3m); ±4.46dB (10m)
Radiated Spurious Emissions (Above 1GHz)	±5.08dB (1GHz-6GHz);±5.14dB(above 6GHz)



4.4 Test Location

All tests were performed at:

Shenzhen BANTEK Testing Co., Ltd.

A5&A6, Building B1&B2, No.45 Gangtou Road, Bogang Community, Shajing Street, Bao'an District, Shenzhen, Guangdong, China 518103

Tel: +86 0755-2334 4200 Fax: +86 0755-2334 4200

FCC Registration Number: 264293

Designation Number: CN1356

No tests were sub-contracted.

4.5 Deviation from Standards

None

4.6 Abnormalities from Standard Conditions

None



5 Equipment List

Conducted Emissions at AC Mains Power Port					
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Shielding Room	YIHENG ENECTRONIC	9*5*3.3	YH-BT-220304-04	2022-03-03	2025-03-02
EMI Test Receiver	Rohde&Schwarz	ESCI	101021	2023-06-12	2024-06-11
Measurement Software	Fara	EZ EMC Ver. FA-03A2	N/A	N/A	N/A
LISN	Rohde&Schwarz	ENV216	101472	2023-06-12	2024-06-11
LISN	Schwarzbeck	NSLK 8128	05127	2023-06-12	2024-06-11

RF Conducted					
Equipment	Manufacturer	Model No	Serial No	Cal Date	Cal Due Date
Shielding Room	YIHENG ENECTRONIC	5.5*3.1*3	YH-BT-220304-03	2022-03-03	2025-03-02
EXA Signal Analyzer	KEYSIGHT	N9020A	MY54230486	2023-06-12	2024-06-11
DC Power Supply	E3632A	E3642A	KR75304416	2023-06-12	2024-06-11
Attenuator	RswTech	SMA-JK-6dB	N/A	2023-06-12	2024-06-11
Attenuator	RswTech	SMA-JK-3dB	N/A	2023-06-12	2024-06-11
RF Control Unit	Techy	TR1029-1	N/A	2023-06-12	2024-06-11
RF Sensor Unit	Techy	TR1029-2	N/A	2023-06-12	2024-06-11
WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	141258	2023-06-12	2024-06-11
MXG Vector Signal Generator	Agilent	N5182A	US46240522	2023-06-12	2024-06-11
Programmable Temperature&Humidity Chamber	GRT	GR-HWX1000	GR22051001	2023-06-12	2024-06-11
Measurement Software	TACHOY	RF TestSoft	N/A	N/A	N/A

RSE					
Equipment	Manufacturer	Model No	Serial No	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	YIHENG ENECTRONIC	966	YH-BT-220304-01	2022-05-06	2025-05-05
EMI Test Receiver	Rohde&Schwarz	ESCI	100694	2023-06-12	2024-06-11
TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	01324	2022-06-15	2025-06-14
Pre-Amplifier	Schwarzbeck	BBV 9745	#180	2023-06-12	2024-06-11
Measurement Software	Fara	EZ EMC Ver. FA-03A2	N/A	2023-06-12	2024-06-11
EXA Signal Analyzer	Keysight	N9020A	MY54440290	2023-06-12	2024-06-11
Horn Antenna	Schwarzbeck	BBHA 9120D	02695	2022-06-15	2025-06-14
Pre-Amplifier	Tonscend	TAP0118045	AP20K806109	2023-06-12	2024-06-11
Horn Antenna	SCHWARZBECK	BBHA9170	1157	2022-06-15	2025-06-14
Low Noise Pre-amplifier	SKET	LNPA-1840G-50	SK2022032902	2023-06-12	2024-06-11



Signal analyzer	ROHDE&SCHWARZ	FSQ40	100010	2023-06-12	2024-06-11
Loop Antenna	ETS	6502	00201177	2022-06-15	2025-06-14

General used equipment					
Equipment	Manufacturer	Model No	Serial No	Cal Date	Cal Due Date
Humidity/Temperature/B arometric Pressure Indicator	KUMAR	F132	N/A	2023-06-12	2024-06-11
Humidity/Temperature/B arometric Pressure Indicator	KUMAR	F132	N/A	2023-06-12	2024-06-11

6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)

6.1.2 Conclusion

Standard Requirement:

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

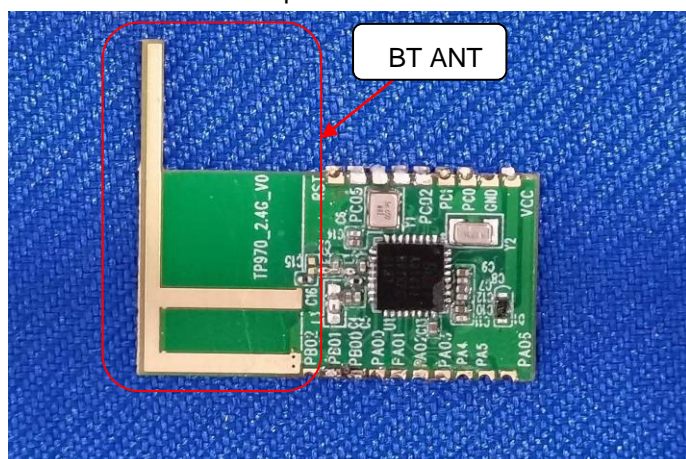
15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -2.67dBi.

Please refer to internal photos.



7 Radio Spectrum Matter Test Results

7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.207
 Test Method: ANSI C63.10 (2013) Section 6.2
 Limit:

Frequency of emission(MHz)	Conducted limit(dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

Detector: Peak for pre-scan (9kHz resolution bandwidth) 0.15M to 30MHz

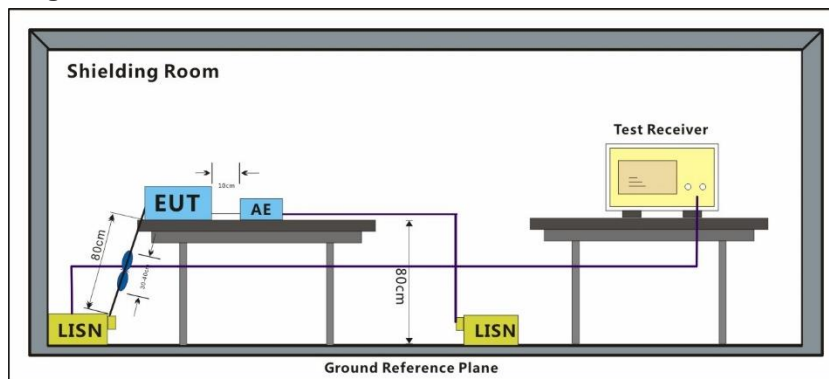
7.1.1 E.U.T. Operation

Operating Environment:
 Temperature: 22.2 °C Humidity: 60.5 % RH Atmospheric Pressure: 1010 mbar

7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	Charge+TX mode_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.

7.1.3 Test Setup Diagram





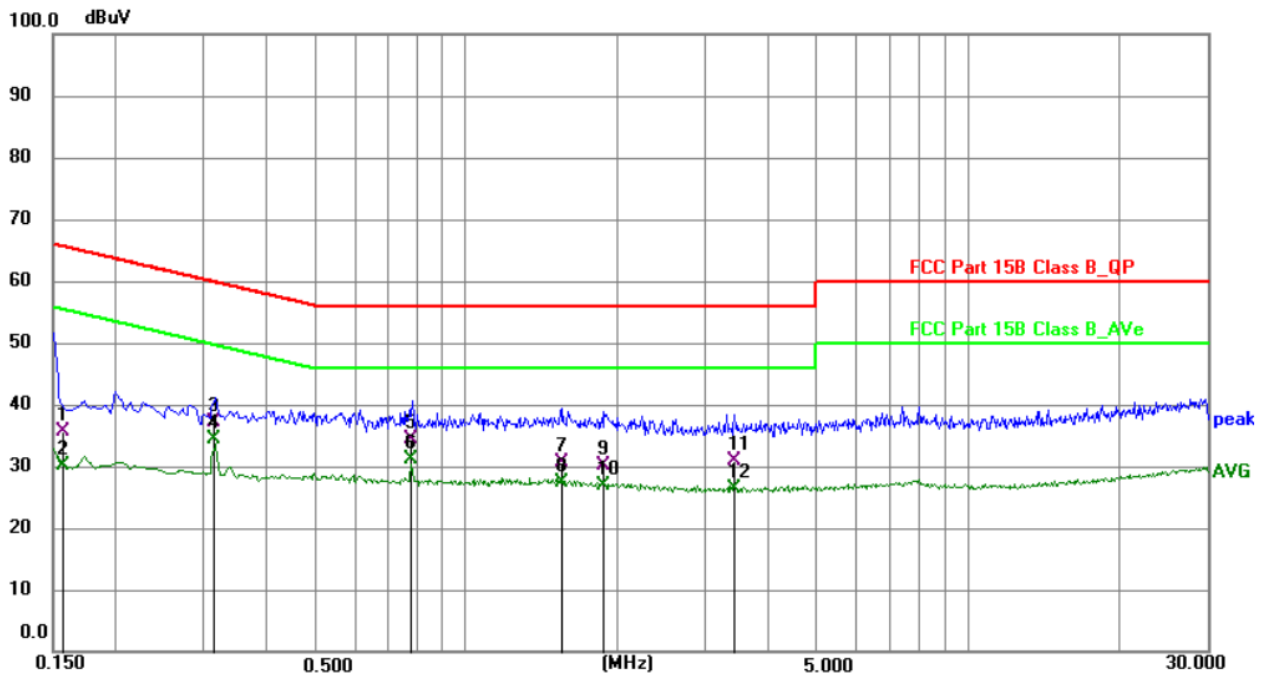
7.1.4 Measurement Procedure and Data

- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
- 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane.
- 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
- 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Remark: LISN=Read Level+ Cable Loss+ LISN Factor



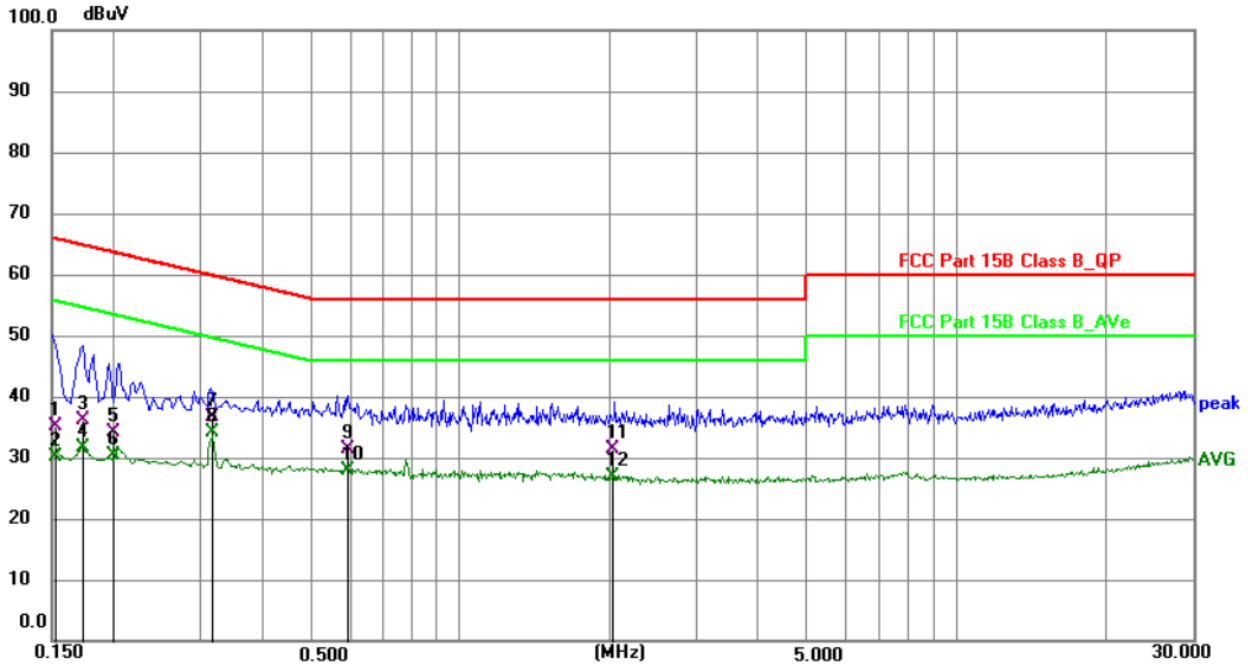
Test Mode: 01; Line: Live line; Modulation:GFSK; Channel:Low



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.1566	15.98	19.75	35.73	65.64	-29.91	QP	P	
2	0.1566	10.44	19.75	30.19	55.64	-25.45	AVG	P	
3	0.3143	17.35	19.82	37.17	59.86	-22.69	QP	P	
4	0.3143	14.57	19.82	34.39	49.86	-15.47	AVG	P	
5	0.7776	14.43	19.94	34.37	56.00	-21.63	QP	P	
6 *	0.7776	11.27	19.94	31.21	46.00	-14.79	AVG	P	
7	1.5586	10.52	20.05	30.57	56.00	-25.43	QP	P	
8	1.5586	7.24	20.05	27.29	46.00	-18.71	AVG	P	
9	1.8837	10.01	20.07	30.08	56.00	-25.92	QP	P	
10	1.8837	6.89	20.07	26.96	46.00	-19.04	AVG	P	
11	3.4458	10.64	20.20	30.84	56.00	-25.16	QP	P	
12	3.4458	6.15	20.20	26.35	46.00	-19.65	AVG	P	



Test Mode: 01; Line: Neutral Line; Modulation:GFSK; Channel:Low



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.1531	15.40	19.77	35.17	65.83	-30.66	QP	P	
2	0.1531	10.43	19.77	30.20	55.83	-25.63	AVG	P	
3	0.1730	16.31	19.79	36.10	64.82	-28.72	QP	P	
4	0.1730	11.95	19.79	31.74	54.82	-23.08	AVG	P	
5	0.2004	14.39	19.81	34.20	63.59	-29.39	QP	P	
6	0.2004	10.47	19.81	30.28	53.59	-23.31	AVG	P	
7	0.3156	16.90	19.83	36.73	59.82	-23.09	QP	P	
8 *	0.3156	14.34	19.83	34.17	49.82	-15.65	AVG	P	
9	0.5919	11.51	19.88	31.39	56.00	-24.61	QP	P	
10	0.5919	8.03	19.88	27.91	46.00	-18.09	AVG	P	
11	2.0331	11.22	20.08	31.30	56.00	-24.70	QP	P	
12	2.0331	6.86	20.08	26.94	46.00	-19.06	AVG	P	

7.2 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(3)

Test Method: ANSI C63.10 (2013) Section 11.9.1.3

Limit:

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for ≥ 50 hopping channels
	0.25 for $25 \leq$ hopping channels < 50
	1 for digital modulation
2400-2483.5	1 for ≥ 75 non-overlapping hopping channels
	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

7.2.1 E.U.T. Operation

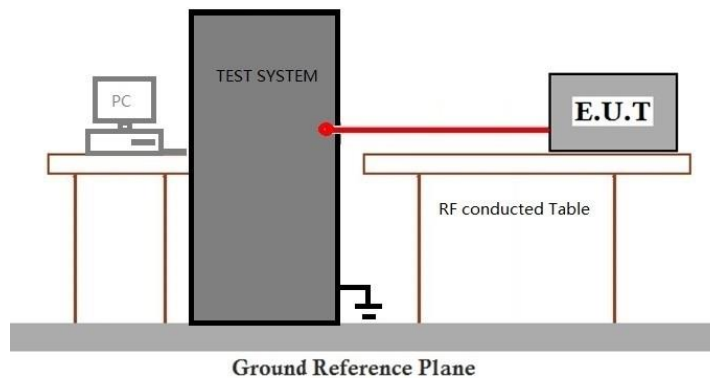
Operating Environment:

Temperature: 20.5 °C Humidity: 50.0 % RH Atmospheric Pressure: 1010 mbar

7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.
Pre-scan	01	Charge+ TX mode_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.

7.2.3 Test Setup Diagram



7.2.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details

7.3 Minimum 6dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247a(2)
 Test Method: ANSI C63.10 (2013) Section 11.8.1
 Limit: ≥ 500 kHz

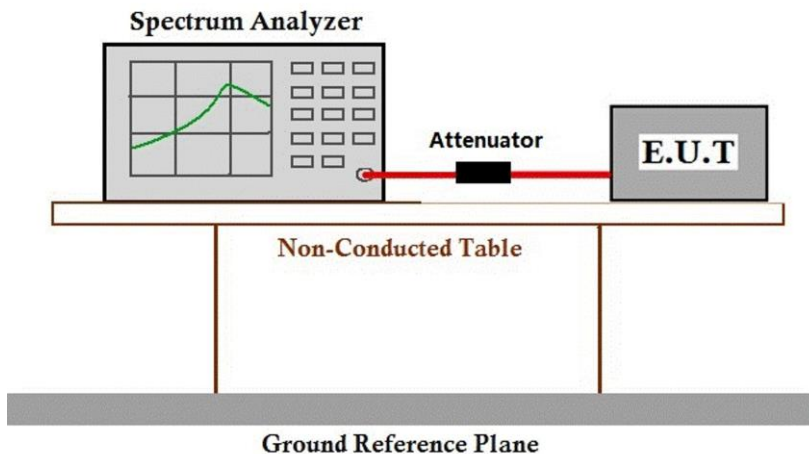
7.3.1 E.U.T. Operation

Operating Environment:
 Temperature: 20.5 °C Humidity: 50.0 % RH Atmospheric Pressure: 1010 mbar

7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.
Pre-scan	01	Charge+ TX mode_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.

7.3.3 Test Setup Diagram



7.3.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details

7.4 Power Spectrum Density

Test Requirement 47 CFR Part 15, Subpart C 15.247(e)

Test Method: ANSI C63.10 (2013) Section 11.10.2

Limit:

≤8dBm in any 3 kHz band during any time interval of continuous transmission

7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 20.5 °C

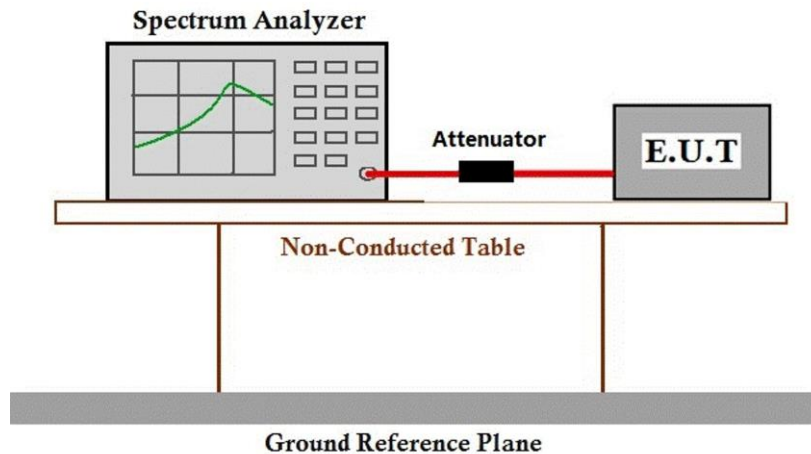
Humidity: 50.0 % RH

Atmospheric Pressure: 1010 mbar

7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.
Pre-scan	01	Charge+ TX mode_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.

7.4.3 Test Setup Diagram



7.4.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details

7.5 Conducted Band Edges Measurement

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)
 Test Method: ANSI C63.10 (2013) Section 11.13.3.2

Limit:

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

7.5.1 E.U.T. Operation

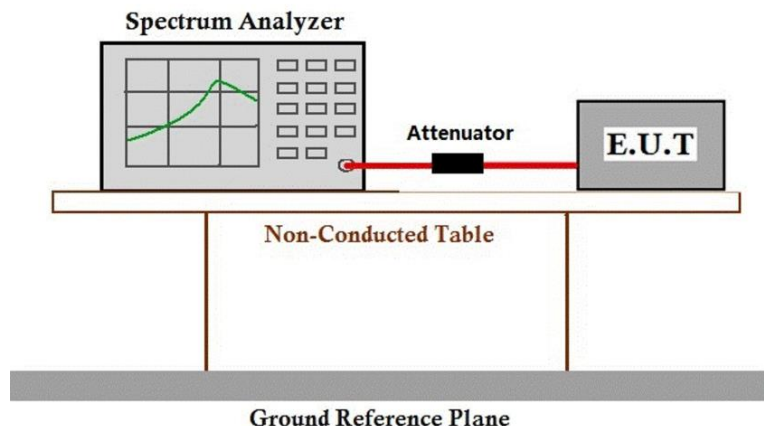
Operating Environment:

Temperature: 20.5 °C Humidity: 50.0 % RH Atmospheric Pressure: 1010 mbar

7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.
Pre-scan	01	Charge+ TX mode_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.

7.5.3 Test Setup Diagram



7.5.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details

7.6 Conducted Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)

Test Method: ANSI C63.10 (2013) Section 11.11

Limit:

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

7.6.1 E.U.T. Operation

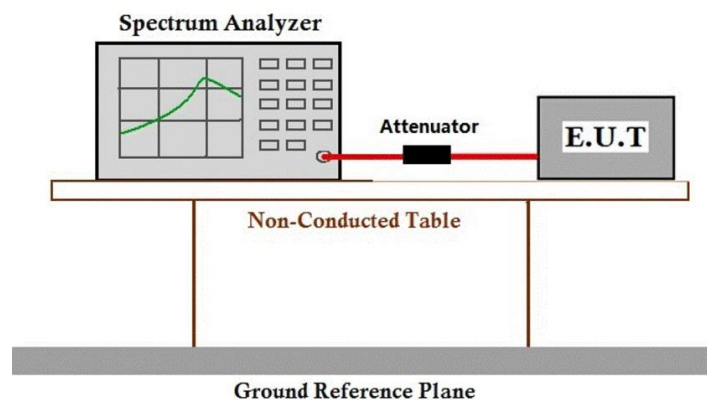
Operating Environment:

Temperature: 20.5 °C Humidity: 50.0 % RH Atmospheric Pressure: 1010 mbar

7.6.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.
Pre-scan	01	Charge+ TX mode_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.

7.6.3 Test Setup Diagram



7.6.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details

7.7 Radiated Emissions which fall in the restricted bands

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

Test Method: ANSI C63.10 (2013) Section 6.10.5

Limit:

Frequency(MHz)	Field strength(microvolts/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

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

7.7.1 E.U.T. Operation

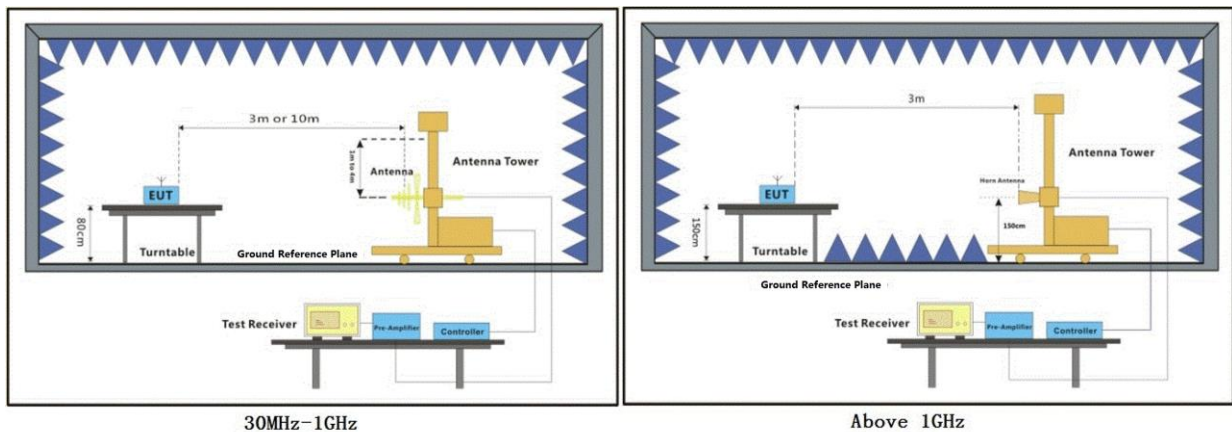
Operating Environment:

Temperature: 21.4 °C Humidity: 54.3 % RH Atmospheric Pressure: 1010 mbar

7.7.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.
Pre-scan	01	Charge+ TX mode_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.

7.7.3 Test Setup Diagram





7.7.4 Measurement Procedure and Data

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h. Test the EUT in the lowest channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

Remark 1: $Level = Read\ Level + Cable\ Loss + Antenna\ Factor - Preamp\ Factor$

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.



Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; ; Channel:Low

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	2310.000	67.44	-30.59	36.85	74.00	-37.15	peak	P
2	2390.000	70.00	-30.49	39.51	74.00	-34.49	peak	P
3	2400.000	77.94	-30.48	47.46	74.00	-26.54	peak	P

Test Mode: 00; Polarity: Vertical; Modulation:GFSK; ; Channel:Low

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	2310.000	67.42	-30.59	36.83	74.00	-37.17	peak	P
2	2390.000	69.00	-30.49	38.51	74.00	-35.49	peak	P
3	2400.000	78.83	-30.48	48.35	74.00	-25.65	peak	P

Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; ; Channel:High

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	2483.500	79.20	-30.39	48.81	74.00	-25.19	peak	P
2	2500.000	71.48	-30.37	41.11	74.00	-32.89	peak	P

Test Mode: 00; Polarity: Vertical; Modulation:GFSK; ; Channel:High

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	2483.500	80.77	-30.39	50.38	74.00	-23.62	peak	P
2	2500.000	70.92	-30.37	40.55	74.00	-33.45	peak	P

7.8 Radiated Spurious Emissions (Below 1GHz)

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
 Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6
 Limit:

Frequency(MHz)	Field strength(microvolts/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

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

7.8.1 E.U.T. Operation

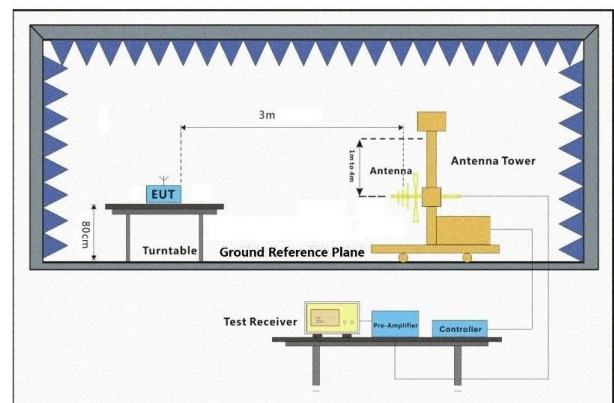
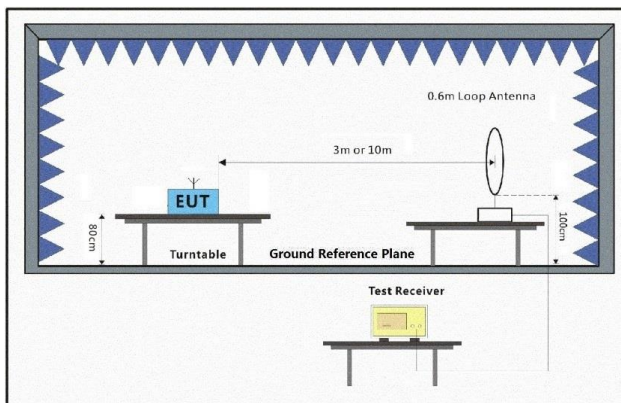
Operating Environment:

Temperature: 25.5 °C Humidity: 68.6 % RH Atmospheric Pressure: 1010 mbar

7.8.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Pre-scan	00	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.
Final test	01	Charge+ TX mode_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.

7.8.3 Test Setup Diagram





7.8.4 Measurement Procedure and Data

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- g. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- i. Repeat above procedures until all frequencies measured was complete.

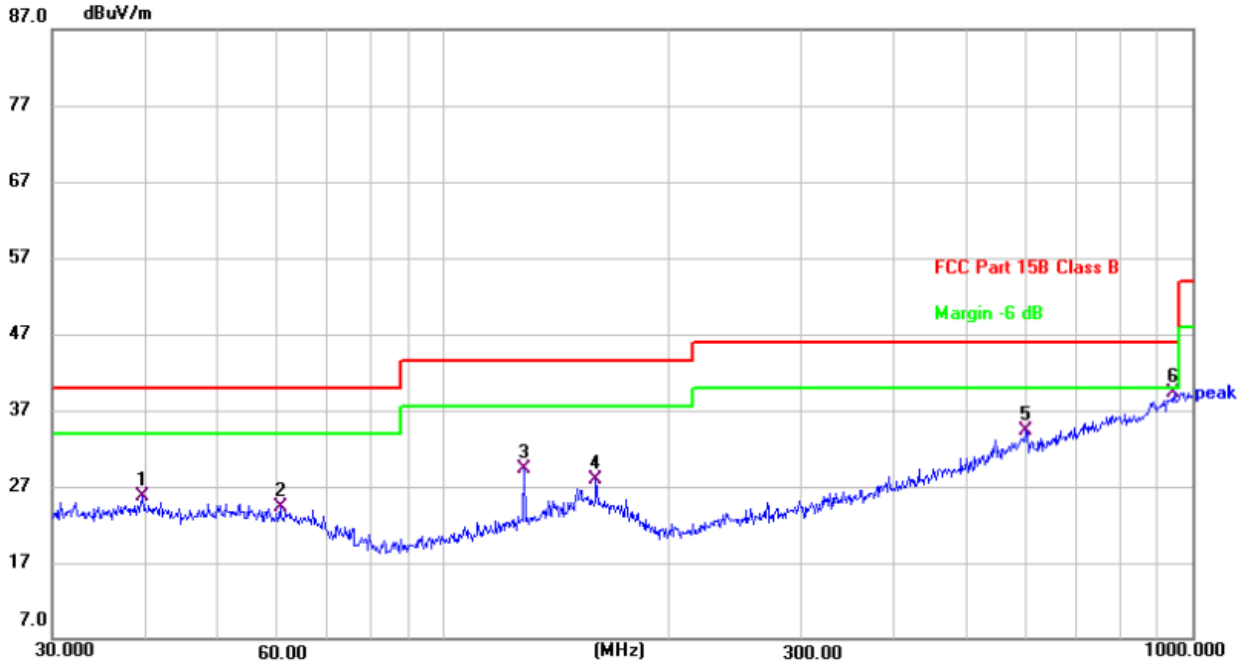
Remark:

- 1) Through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.
- 2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor
- 3) Scan from 9kHz to 1 GHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.



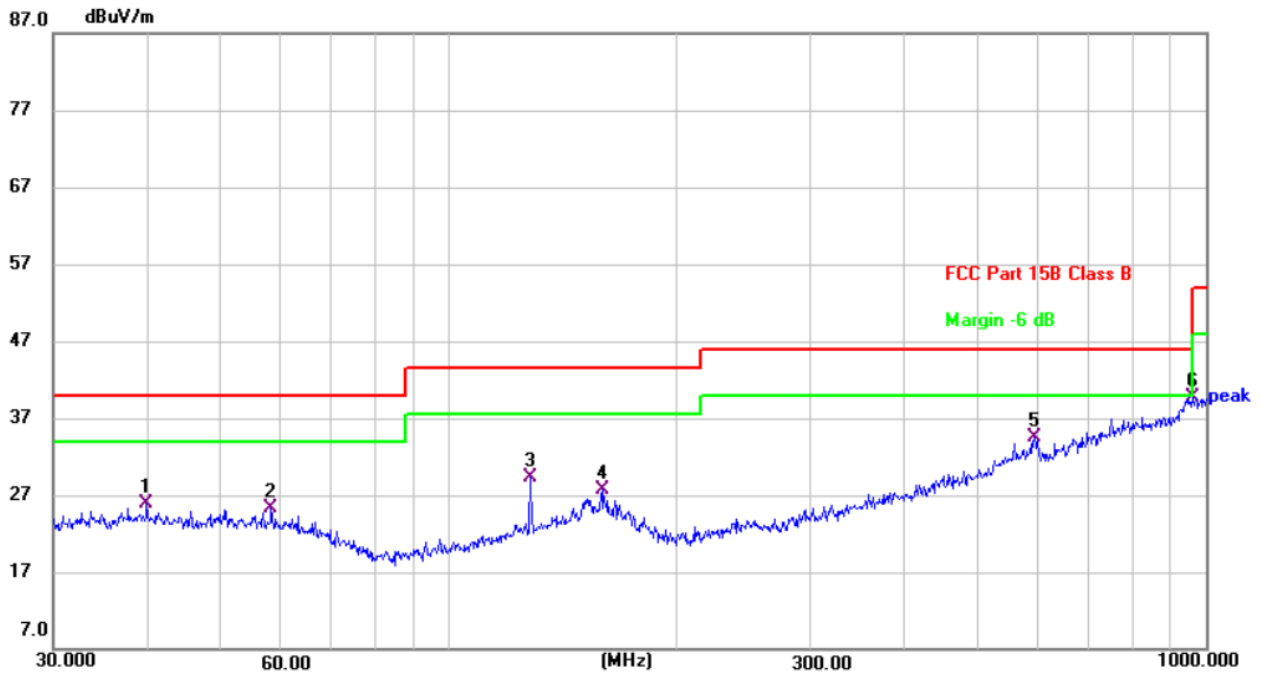
Note: All the mode have been tested, and only the worst case of GFSK mode are in the report
Only the worst data was recorded.

Test Mode: 01; Polarity: Horizontal; Modulation:GFSK ; Channel:Low



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	39.5757	42.63	-16.93	25.70	40.00	-14.30	QP	200	348	P	
2	60.4919	42.44	-18.15	24.29	40.00	-15.71	QP	300	11	P	
3	128.1130	47.52	-18.26	29.26	43.50	-14.24	QP	300	11	P	
4	159.7844	45.08	-17.23	27.85	43.50	-15.65	QP	300	11	P	
5	599.3212	45.89	-11.59	34.30	46.00	-11.70	QP	300	293	P	
6 *	945.4399	46.38	-7.04	39.34	46.00	-6.66	QP	300	11	P	

Test Mode: 01; Polarity: Vertical; Modulation:GFSK ; Channel:Low



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	39.8542	42.90	-16.90	26.00	40.00	-14.00	QP	300	348	P	
2	58.2030	43.43	-18.15	25.28	40.00	-14.72	QP	100	27	P	
3	128.1130	47.48	-18.26	29.22	43.50	-14.28	QP	199	12	P	
4	159.7844	45.01	-17.23	27.78	43.50	-15.72	QP	300	10	P	
5	593.0496	46.25	-11.84	34.41	46.00	-11.59	QP	300	348	P	
6 *	958.7943	46.58	-6.83	39.75	46.00	-6.25	QP	199	232	P	



7.9 Radiated Spurious Emissions (Above 1GHz)

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6

Limit:

Frequency(MHz)	Field strength(microvolts/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

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

7.9.1 E.U.T. Operation

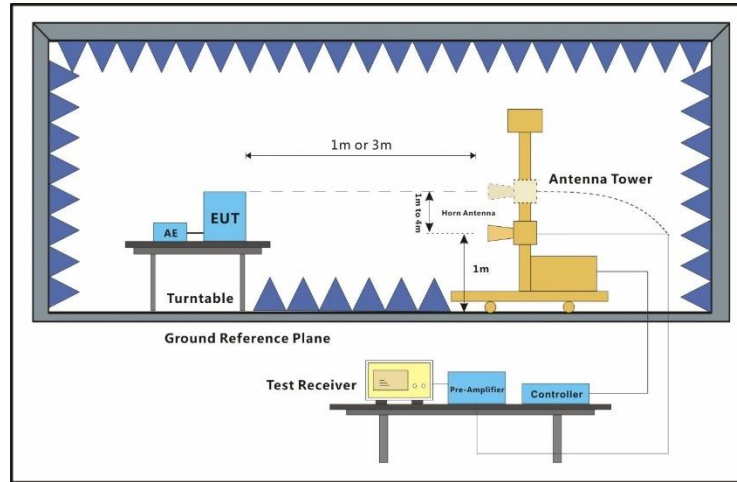
Operating Environment:

Temperature: 21.4 °C Humidity: 54.3 % RH Atmospheric Pressure: 1010 mbar

7.9.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.
Pre-scan	01	Charge+ TX mode_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.

7.9.3 Test Setup Diagram



7.9.4 Measurement Procedure and Data

- a. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- g. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- i. Repeat above procedures until all frequencies measured was complete.

Remark:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor

2) Scan from 1GHz to 25GHz, the disturbance above 18GHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

3) The field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.



Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; Channel:Low

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	2914.445	70.14	-30.16	39.98	74.00	-34.02	peak	P
2	4277.843	68.35	-29.76	38.59	74.00	-35.41	peak	P
3	6084.979	64.03	-25.51	38.52	74.00	-35.48	peak	P
4	8646.315	70.42	-25.53	44.89	74.00	-29.11	peak	P
5	11047.385	68.46	-23.37	45.09	74.00	-28.91	peak	P
6	14218.932	70.31	-21.89	48.42	74.00	-25.58	peak	P

Test Mode: 01; Polarity: Vertical; Modulation:GFSK ; Channel:Low

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	2972.697	66.65	-30.06	36.59	74.00	-37.41	peak	P
2	4314.083	68.22	-28.36	39.86	74.00	-34.14	peak	P
3	6352.787	67.66	-25.66	42.01	74.00	-31.99	peak	P
4	8575.836	69.36	-24.41	44.95	74.00	-29.05	peak	P
5	11286.229	67.34	-23.82	43.51	74.00	-30.49	peak	P
6	14955.548	71.62	-21.24	50.38	74.00	-23.62	peak	P

Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; Channel:middle

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	2915.133	68.98	-30.30	38.69	74.00	-35.31	peak	P
2	4277.397	67.78	-29.88	37.89	74.00	-36.11	peak	P
3	6086.068	64.81	-25.90	38.92	74.00	-35.08	peak	P
4	8645.034	69.71	-25.12	44.59	74.00	-29.41	peak	P
5	11047.503	68.62	-23.36	45.25	74.00	-28.75	peak	P
6	14218.650	70.03	-20.71	49.32	74.00	-24.68	peak	P



Test Mode: 01; Polarity: Vertical; Modulation:GFSK; Channel:middle

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	3119.299	63.85	-28.98	34.86	74.00	-39.14	peak	P
2	4110.142	67.69	-29.66	38.04	74.00	-35.96	peak	P
3	5953.667	68.30	-25.60	42.70	74.00	-31.30	peak	P
4	7572.431	65.17	-24.63	40.54	74.00	-33.46	peak	P
5	9929.540	69.47	-23.27	46.20	74.00	-27.80	peak	P
6	12827.044	70.26	-21.48	48.78	74.00	-25.22	peak	P

Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; Channel:High

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	2914.581	70.66	-30.17	40.50	74.00	-33.50	peak	P
2	4276.483	67.45	-29.32	38.13	74.00	-35.87	peak	P
3	6086.271	64.23	-24.43	39.80	74.00	-34.20	peak	P
4	8646.873	69.91	-24.64	45.27	74.00	-28.73	peak	P
5	11046.596	67.45	-23.82	43.63	74.00	-30.37	peak	P
6	14218.481	69.96	-20.14	49.81	74.00	-24.19	peak	P

Test Mode: 01; Polarity: Vertical; Modulation:GFSK; Channel:High

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	2972.997	66.71	-28.74	37.97	74.00	-36.03	peak	P
2	4312.672	68.00	-29.78	38.22	74.00	-35.78	peak	P
3	6353.800	68.34	-25.09	43.25	74.00	-30.75	peak	P
4	8576.222	69.90	-25.57	44.33	74.00	-29.67	peak	P
5	11285.856	68.22	-23.00	45.22	74.00	-28.78	peak	P
6	14955.507	70.86	-19.80	51.06	74.00	-22.94	peak	P



8 Test Setup Photo

Please refer to the Appendix test setup Photos.

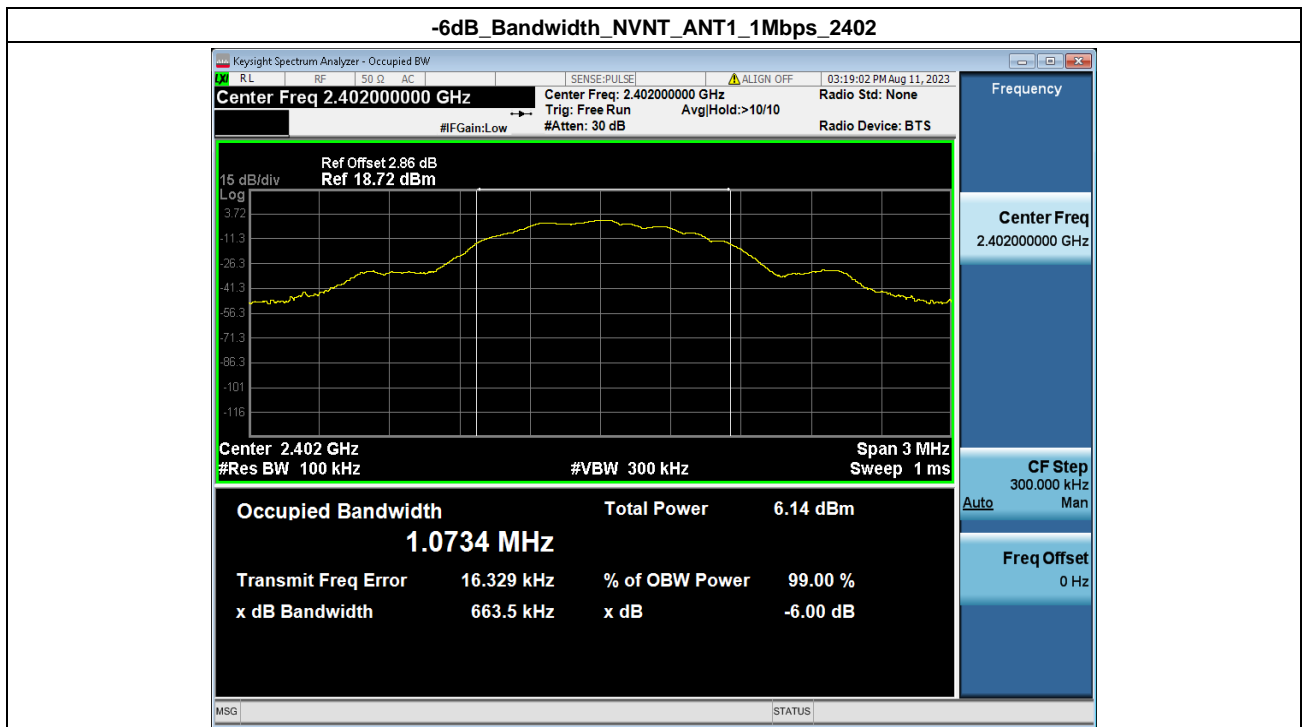
9 EUT Constructional Details (EUT Photos)

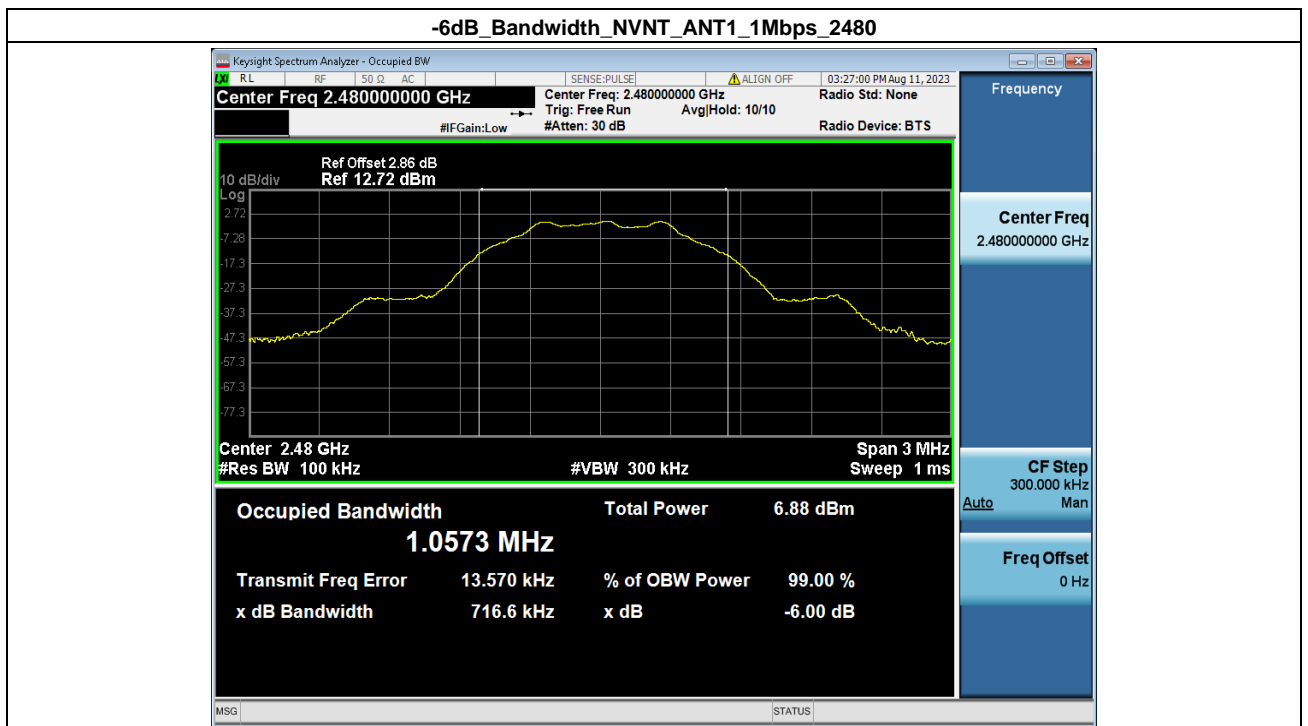
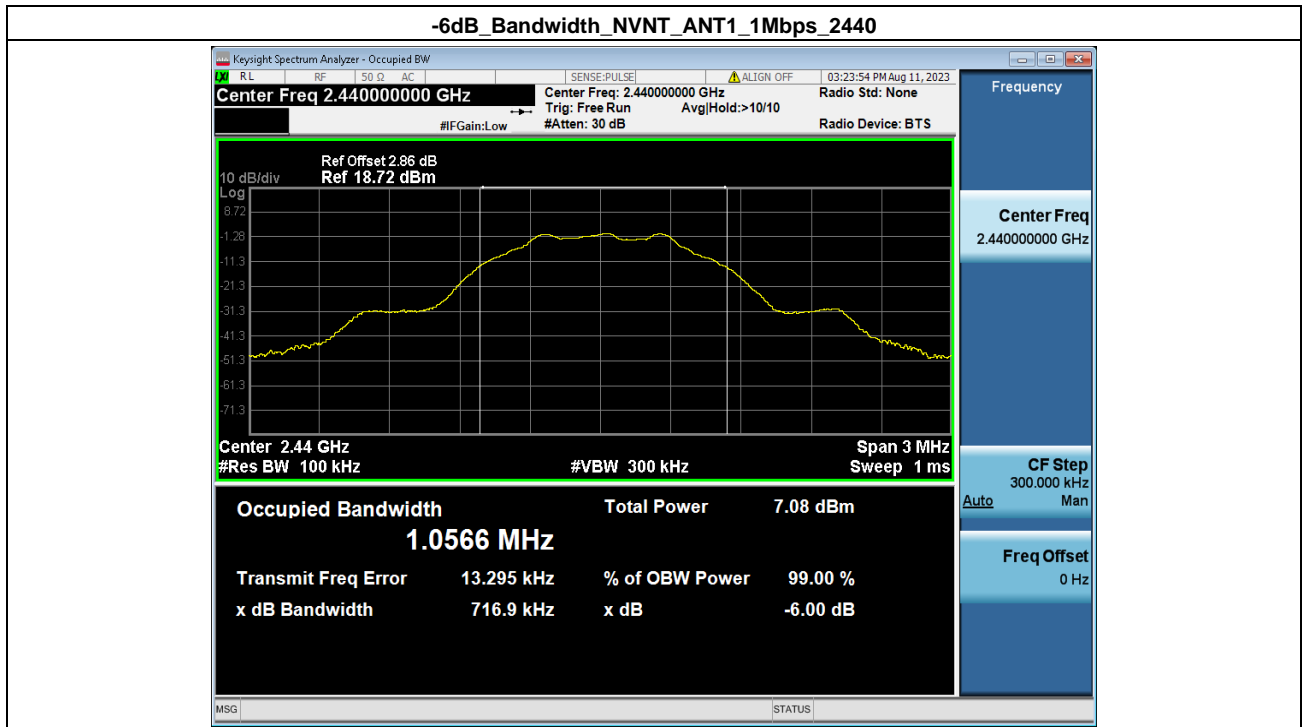
Please refer to the Appendix EUT Photos.

10 Appendix

1. -6dB Bandwidth

Condition	Antenna	Rate	Frequency (MHz)	-6dB BW(kHz)	limit(kHz)	Result
NVNT	ANT1	1Mbps	2402	663.50	500	Pass
NVNT	ANT1	1Mbps	2440.00	716.87	500	Pass
NVNT	ANT1	1Mbps	2480	716.56	500	Pass

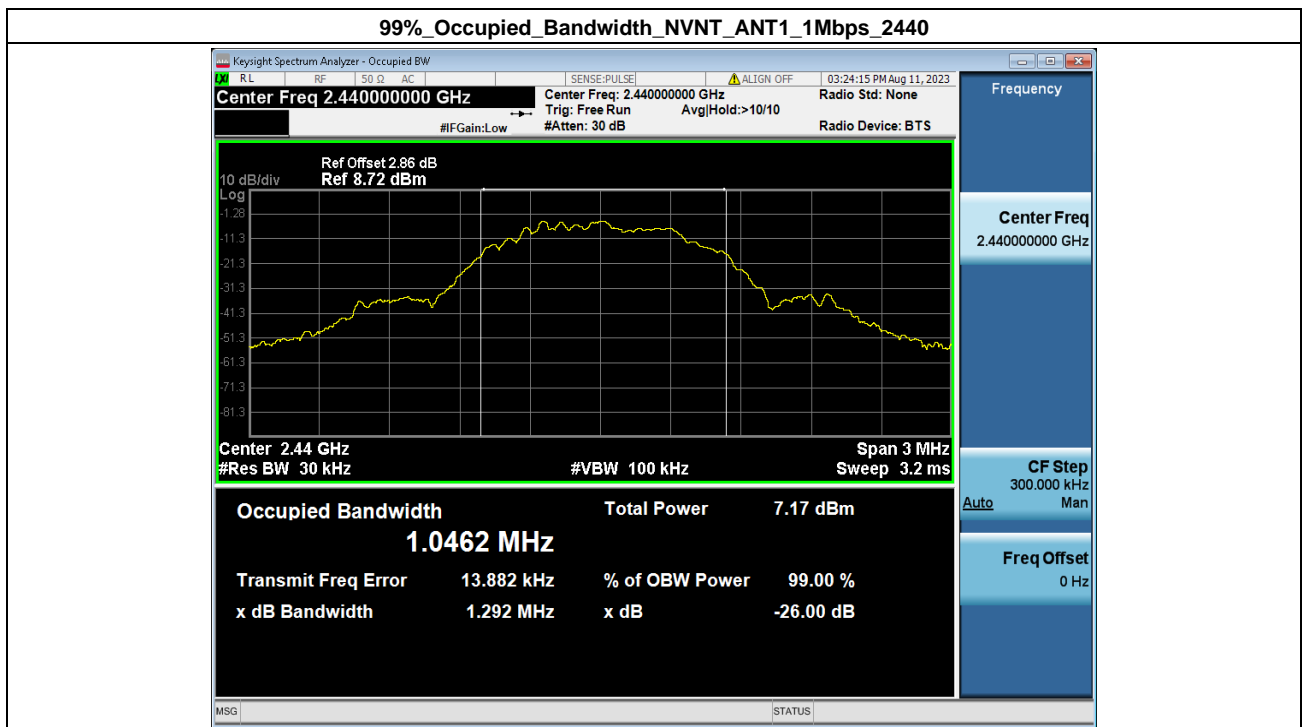
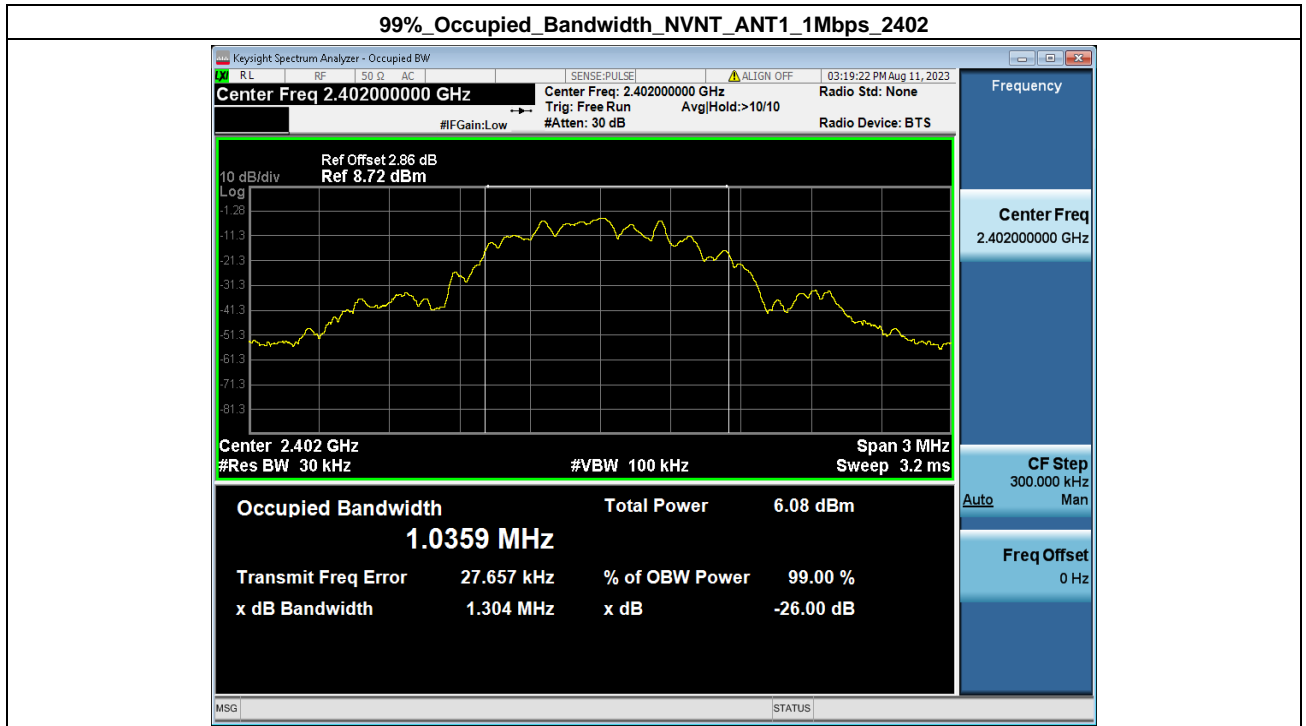


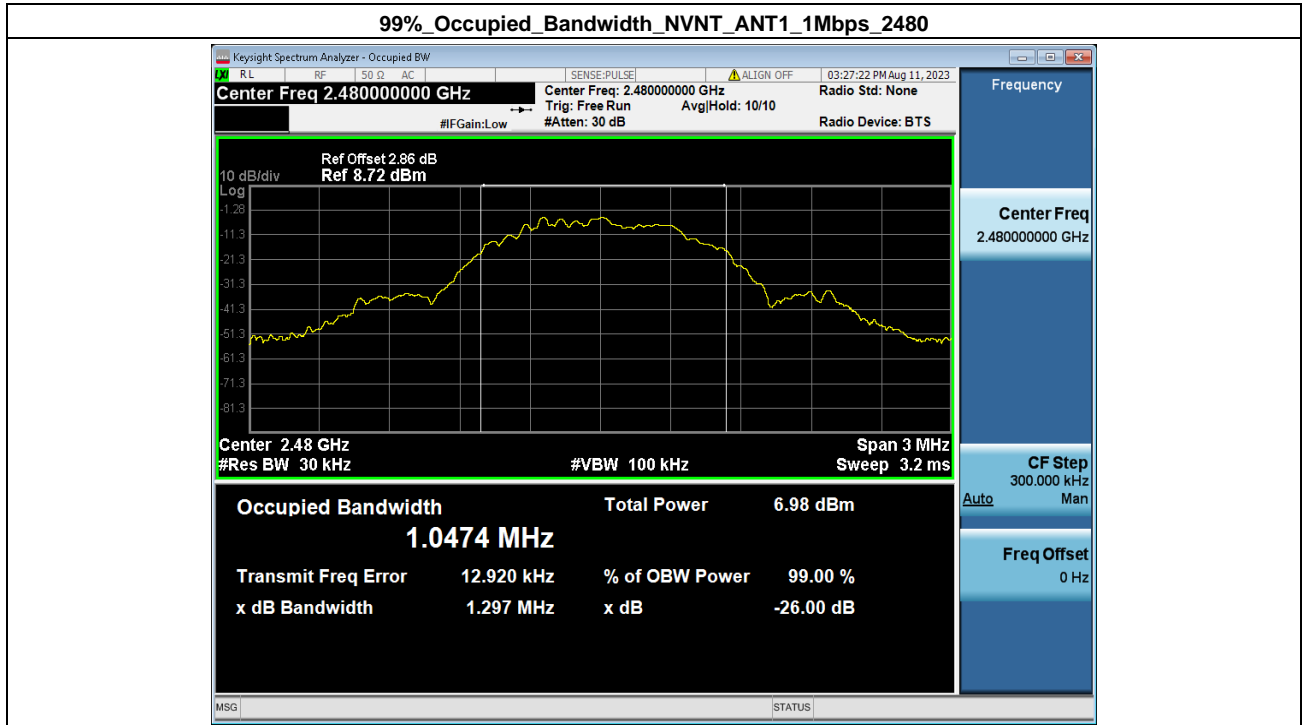




2. 99% Occupied Bandwidth

Condition	Antenna	Rate	Frequency (MHz)	99% BW (MHz)
NVNT	ANT1	1Mbps	2402	1.036
NVNT	ANT1	1Mbps	2440.00	1.046
NVNT	ANT1	1Mbps	2480	1.047

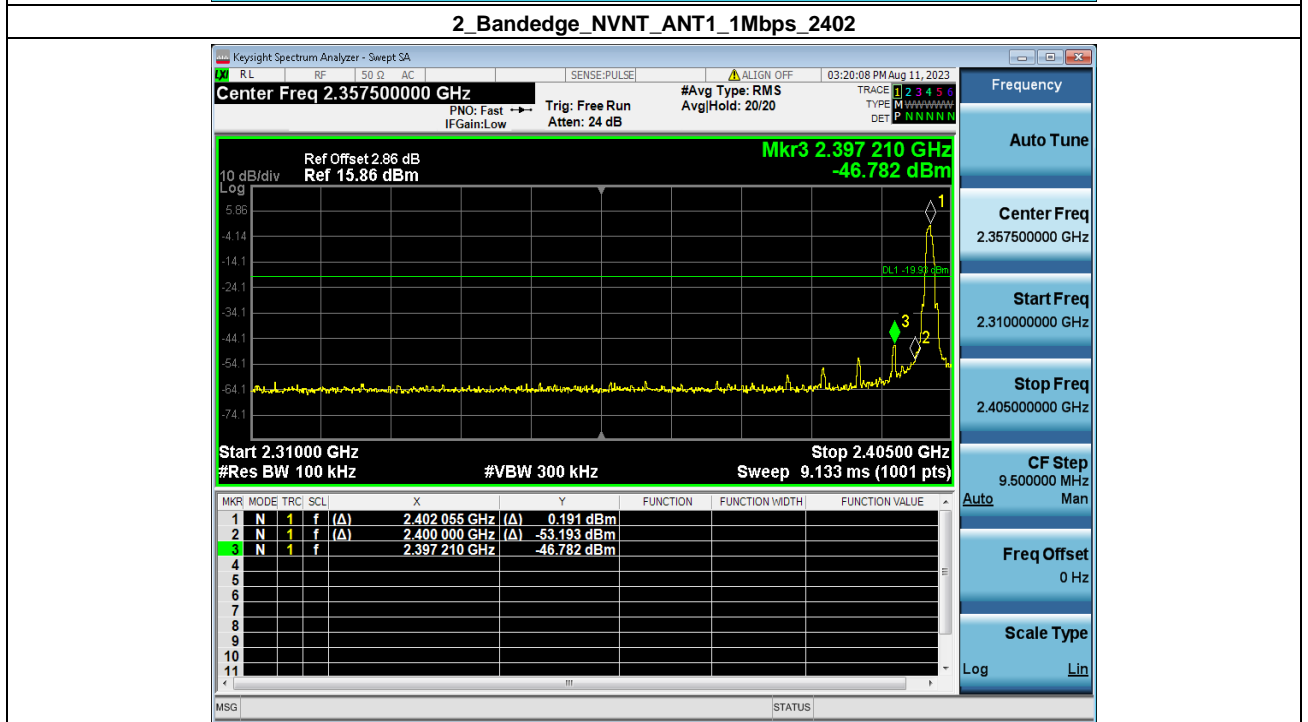
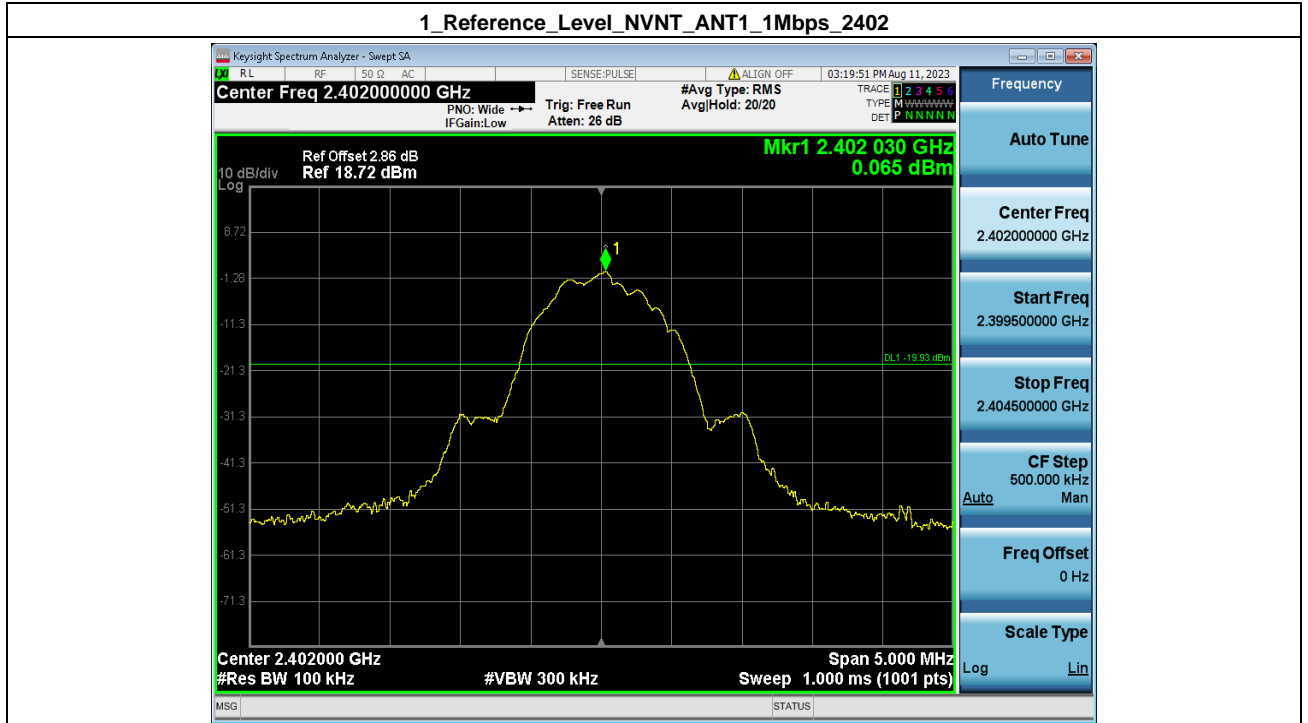






3. Bandedge

Condition	Antenna	Rate	TX_Frequency (MHz)	Max. Mark Frequency (MHz)	Spurious level(dBm)	limit(dBm)	Result
NVNT	ANT1	1Mbps	2402	2397.210	-46.782	-19.935	Pass
NVNT	ANT1	1Mbps	2480	2484.800	-46.294	-20.198	Pass

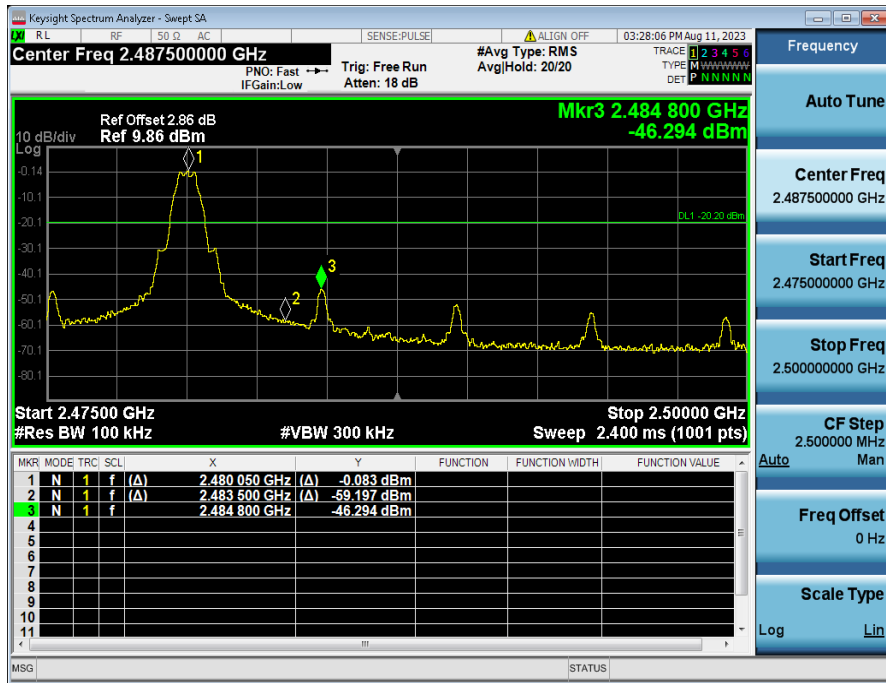




1_Reference_Level_NVNT_ANT1_1Mbps_2480



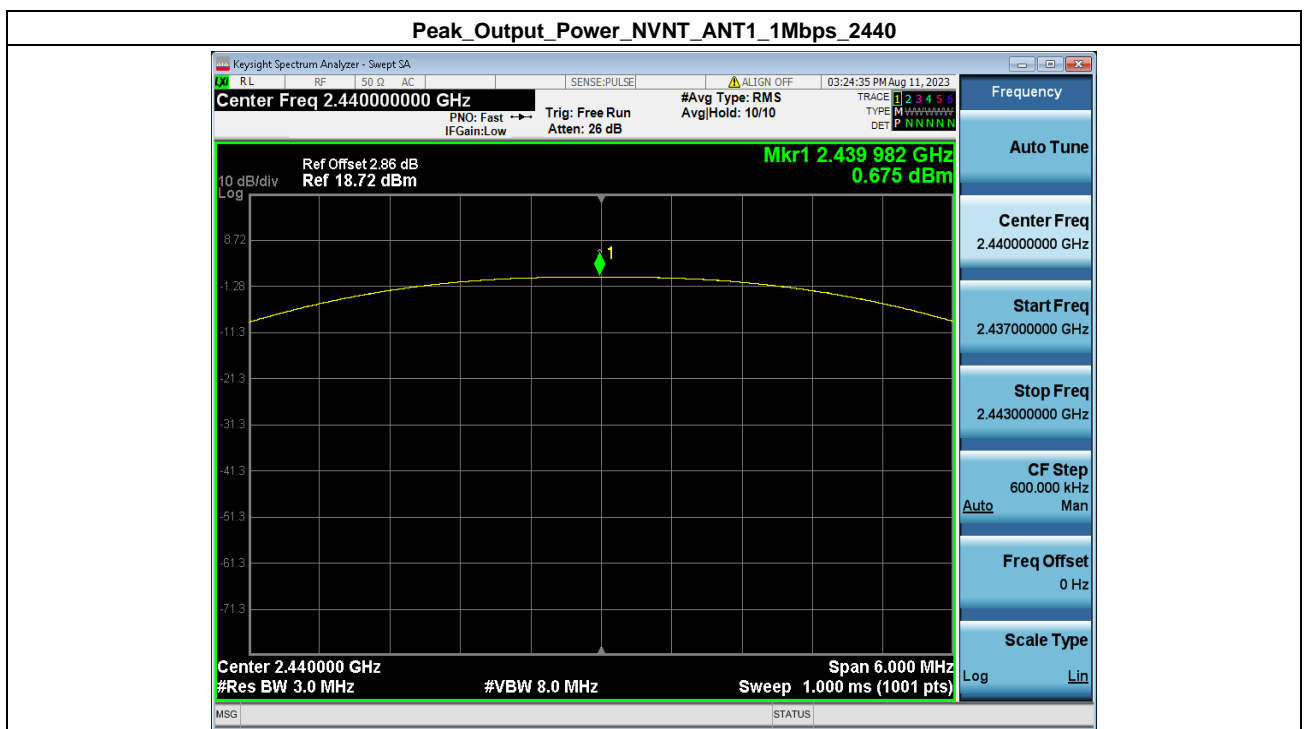
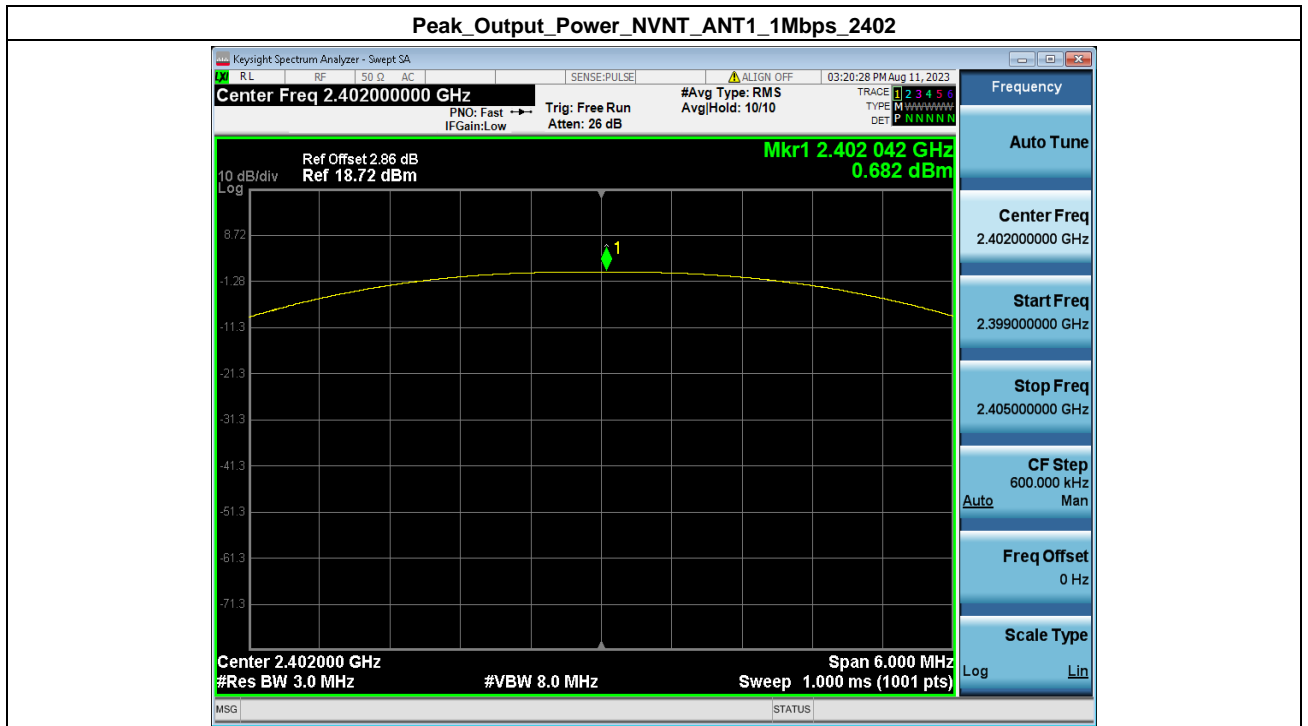
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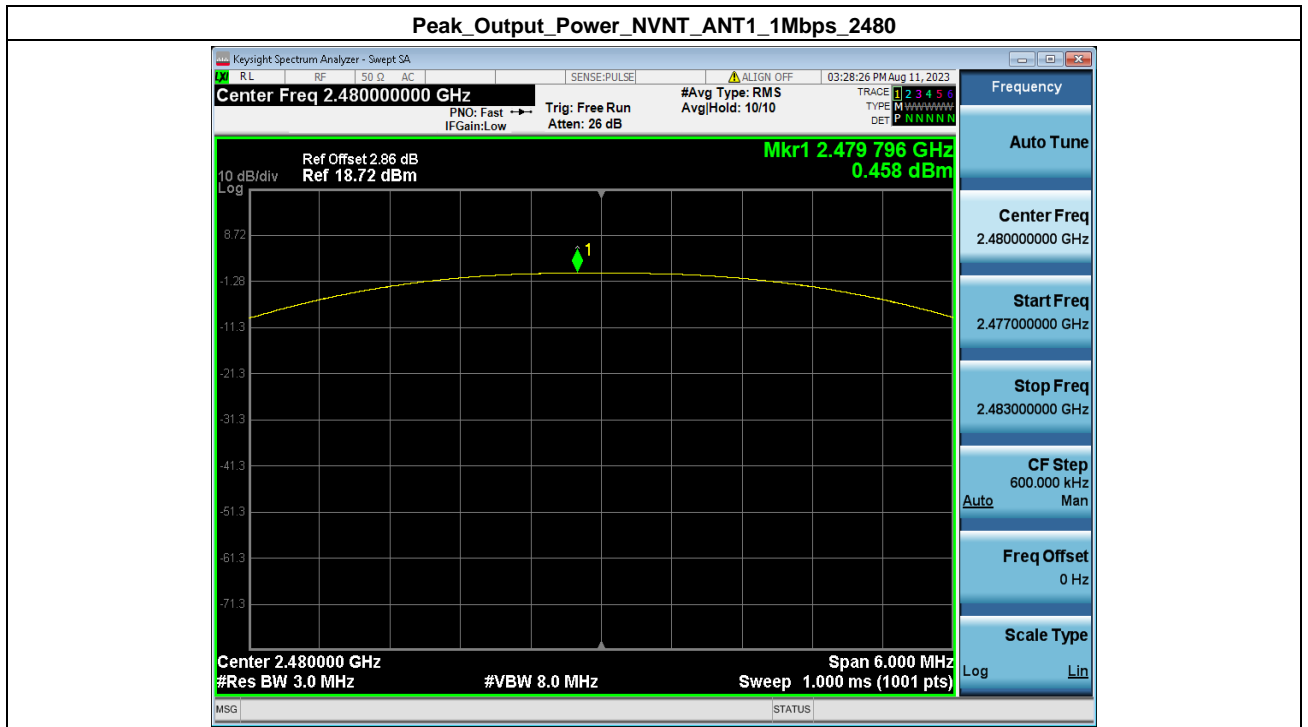




4. Peak Output Power

Condition	Antenna	Rate	Frequency (MHz)	Max. Conducted Power(dBm)	Max. Conducted Power(mW)	Limit(mW)	Result
NVNT	ANT1	1Mbps	2402	0.68	1.17	1000	Pass
NVNT	ANT1	1Mbps	2440.00	0.68	1.17	1000	Pass
NVNT	ANT1	1Mbps	2480	0.46	1.11	1000	Pass

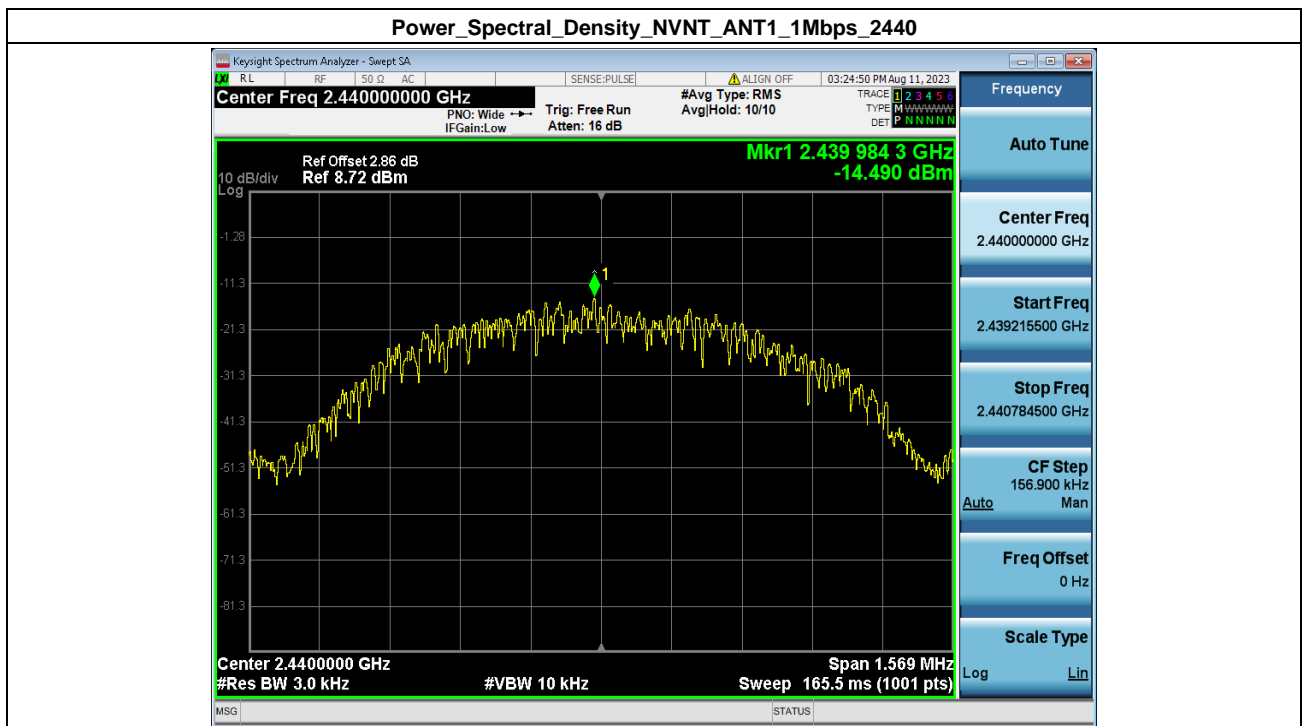
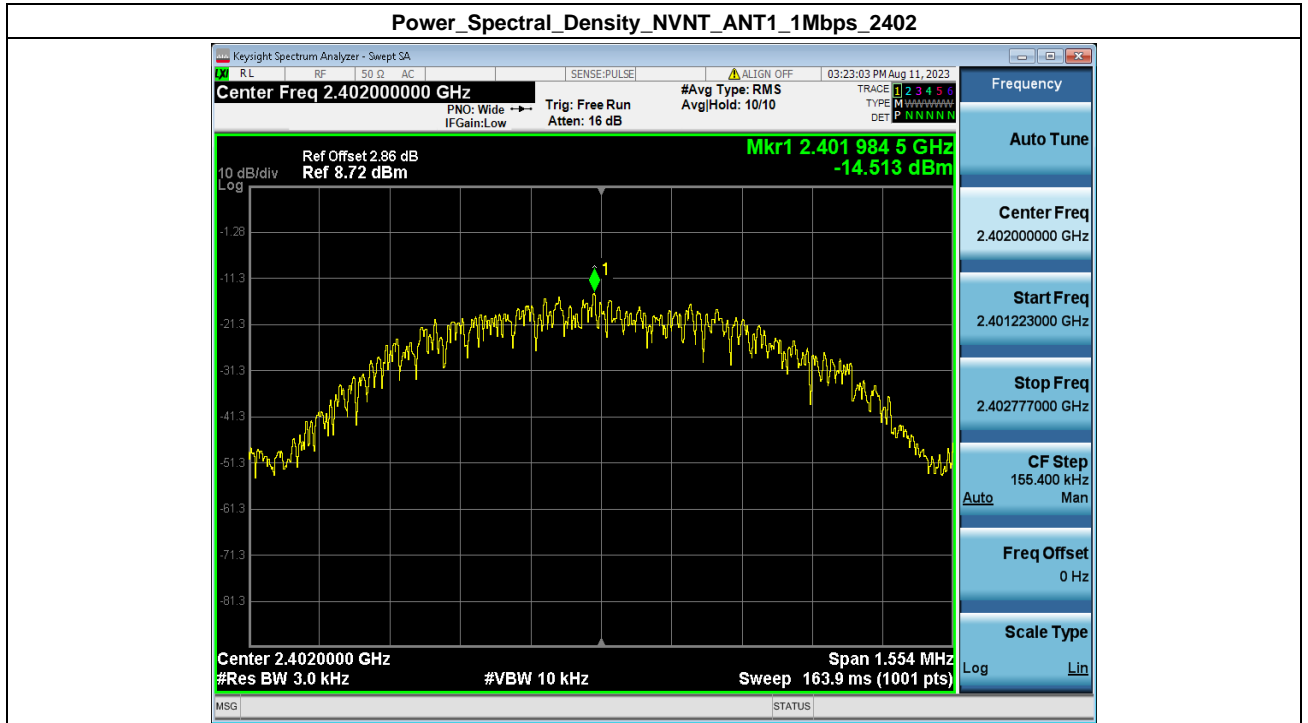


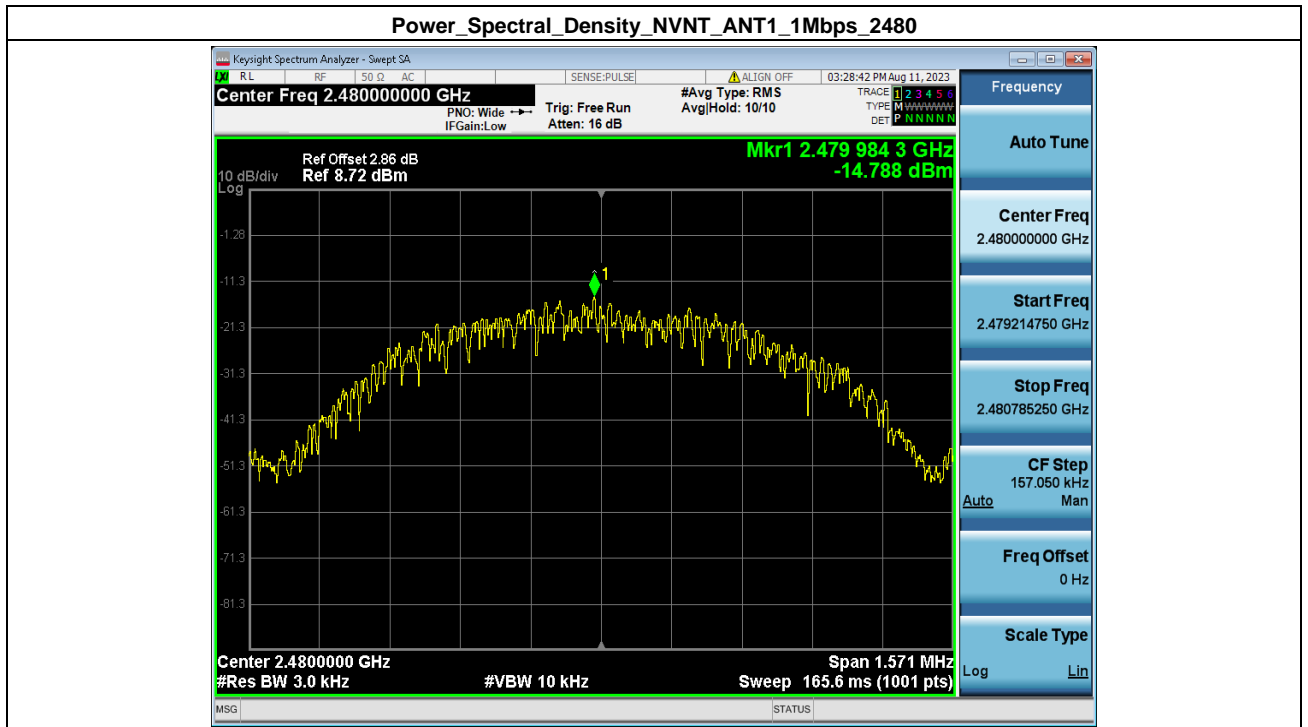




5. Power Spectral Density

Condition	Antenna	Rate	Frequency (MHz)	Power Spectral Density(dBm)	Limit(dBm/3kHz)	Result
NVNT	ANT1	1Mbps	2402	-14.51	8	Pass
NVNT	ANT1	1Mbps	2440.00	-14.49	8	Pass
NVNT	ANT1	1Mbps	2480	-14.79	8	Pass

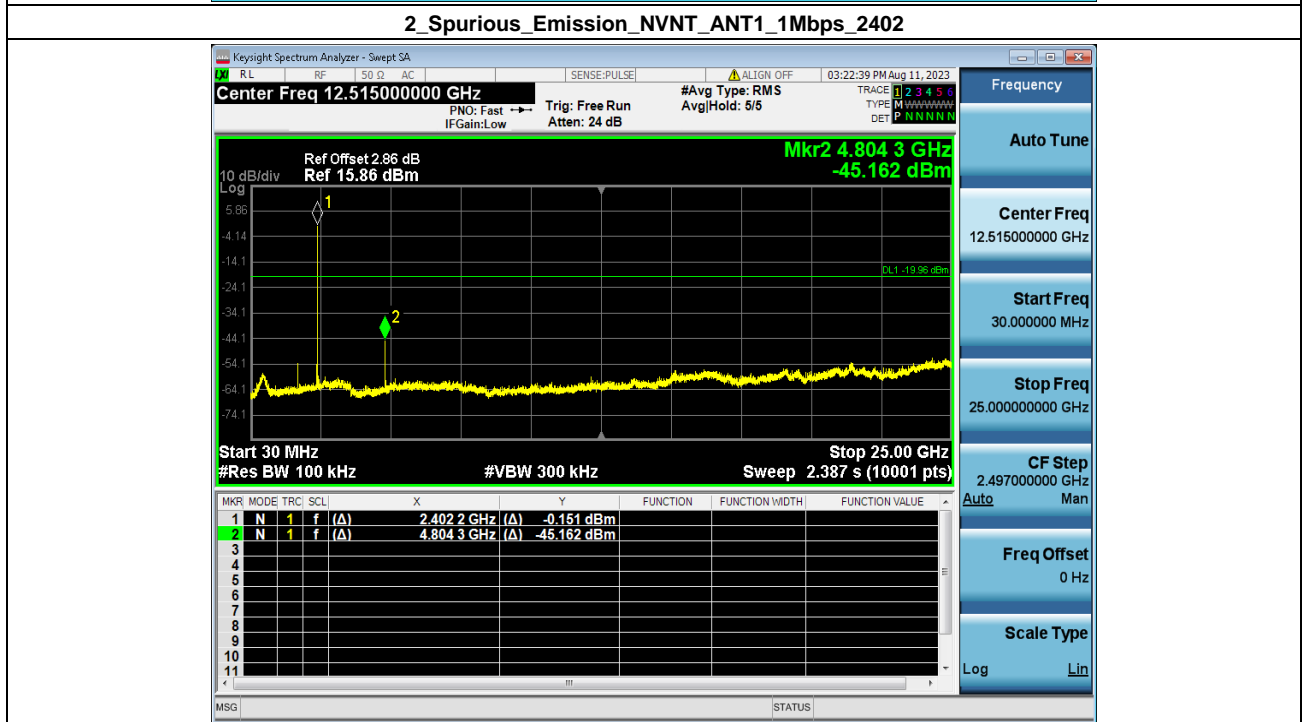
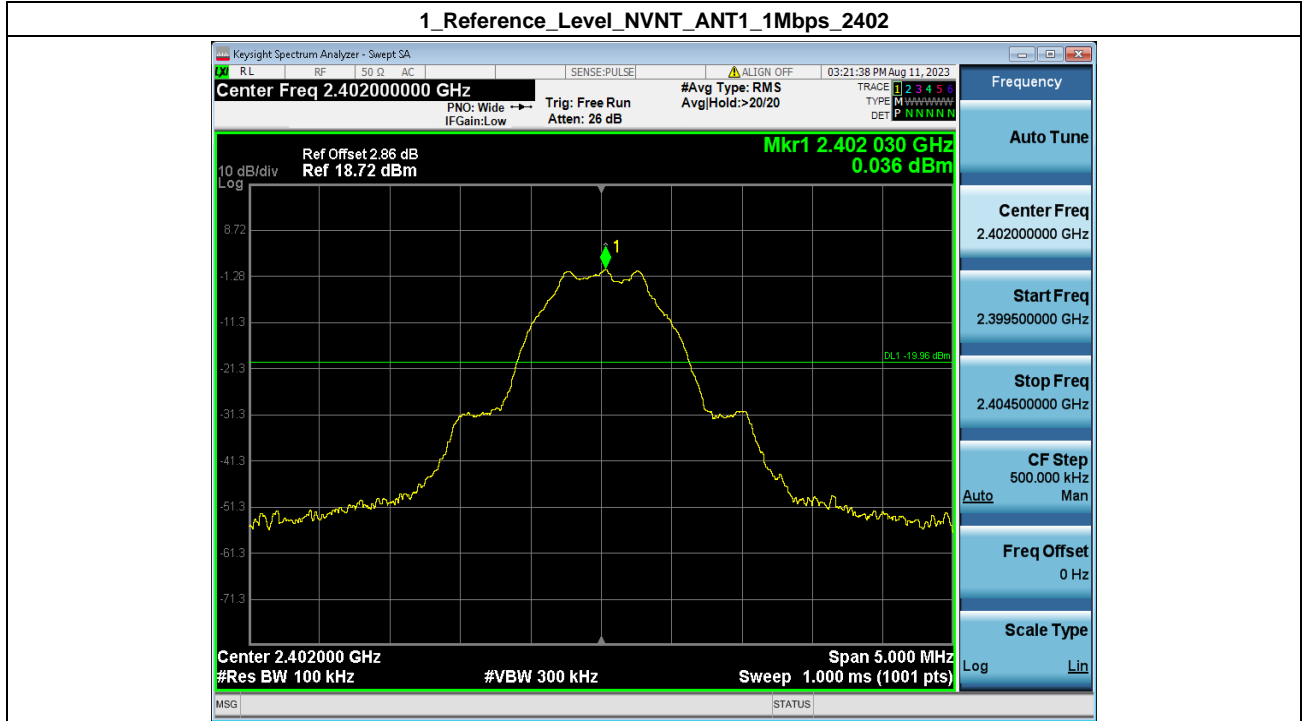






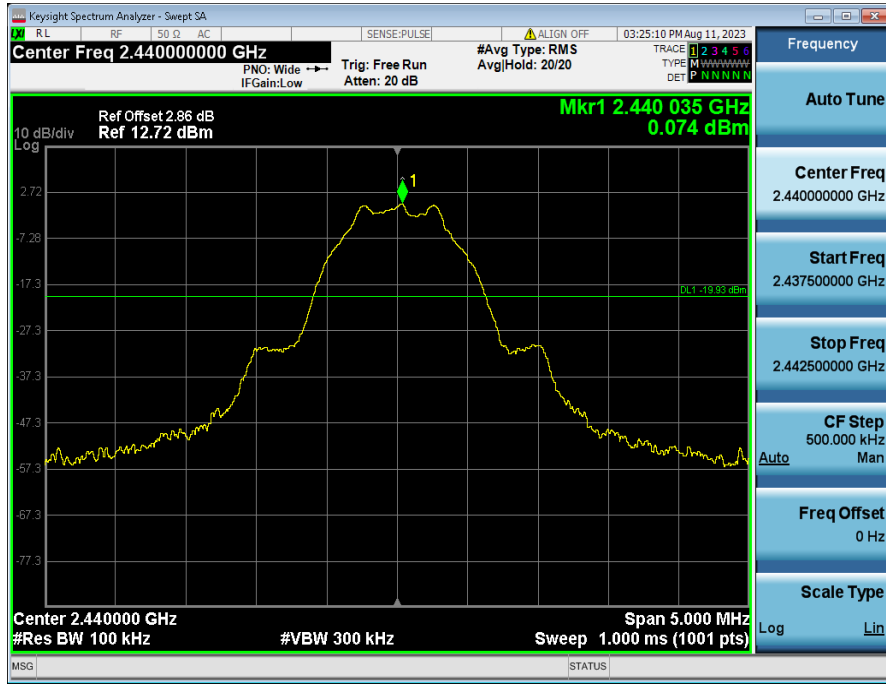
6. Spurious Emission

Condition	Antenna	Rate	TX_Frequency(MHz)	Spurious MAX.Value(dBm)	Limit	Result
NVNT	ANT1	1Mbps	2402	-45.162	-19.964	Pass
NVNT	ANT1	1Mbps	2440.00	-47.133	-19.926	Pass
NVNT	ANT1	1Mbps	2480	-48.611	-20.198	Pass

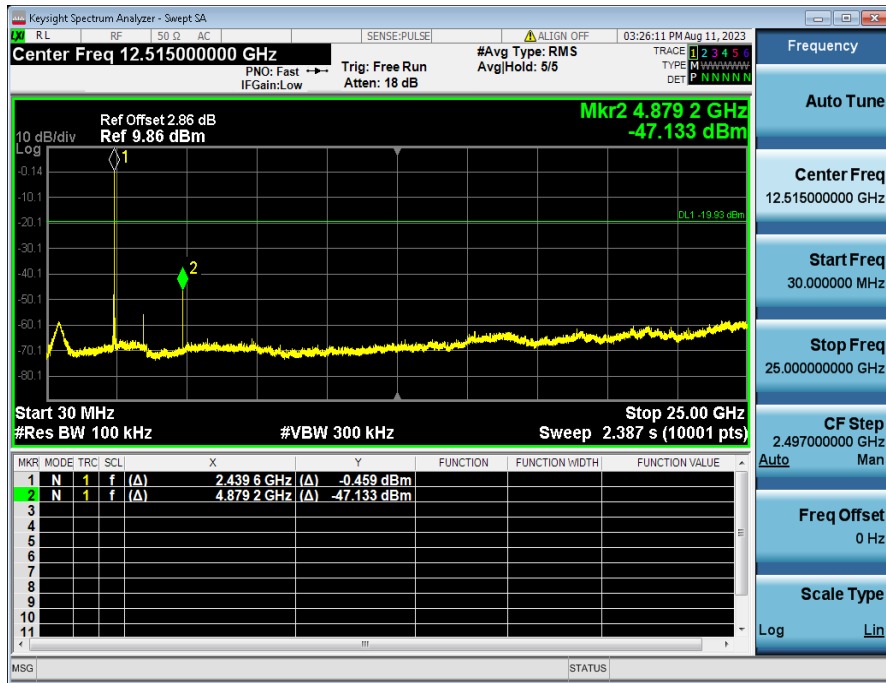




1_Reference_Level_NVNT_ANT1_1Mbps_2440



2_Spurious_Emission_NVNT_ANT1_1Mbps_2440

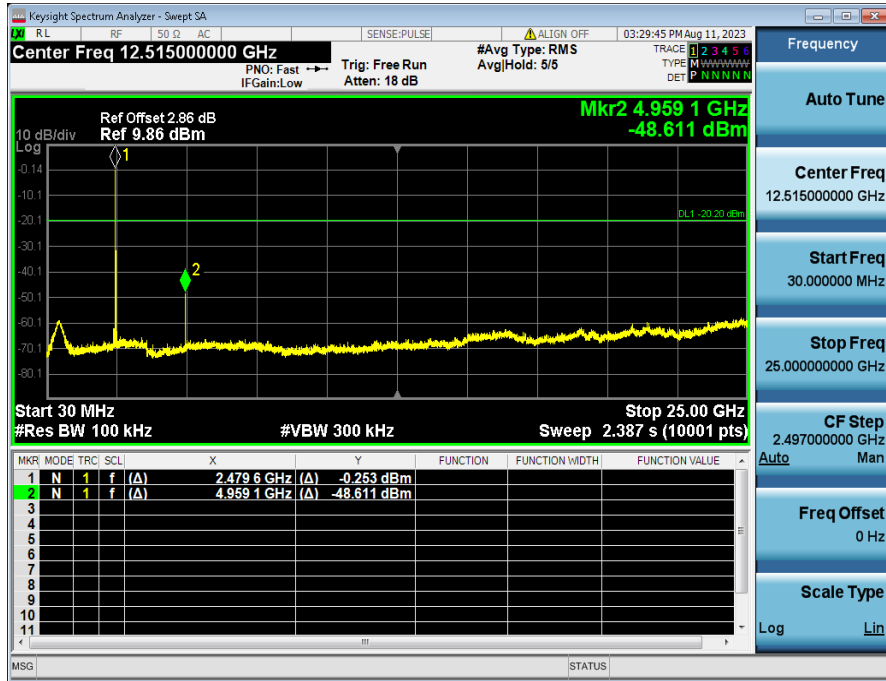




1_Reference_Level_NVNT_ANT1_1Mbps_2480



2_Spurious_Emission_NVNT_ANT1_1Mbps_2480



- End of the Report -