

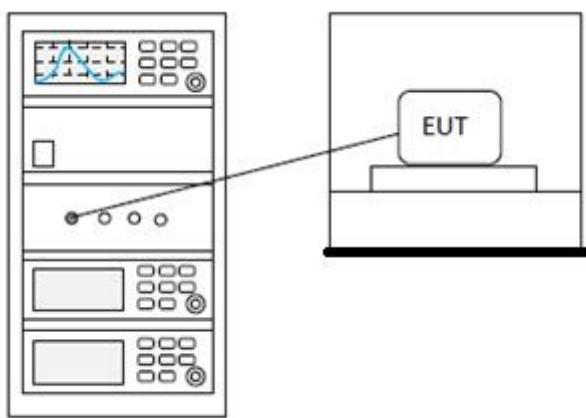
13 CONDUCTED SPURIOUS EMISSIONS

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.6 & Section 11.11
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Jozu
Temperature	25 °C
Humidity	60%

13.1 LIMITS

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)).
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13.2 BLOCK DIAGRAM OF TEST SETUP



13.3 TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

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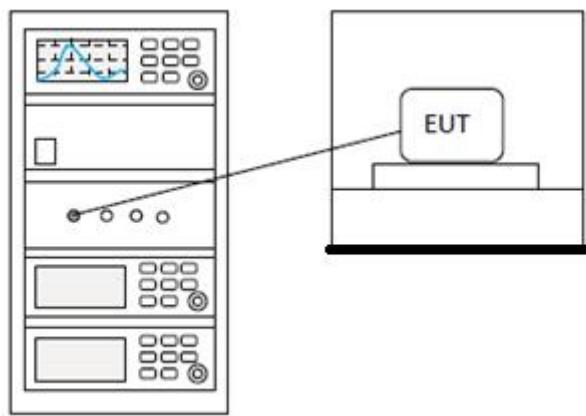
14 POWER SPECTRUM DENSITY

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 11.10.2
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Jozu
Temperature	25 °C
Humidity	60%

14.1 LIMITS

Limit: $\leq 8\text{dBm}$ in any 3 kHz band during any time interval of continuous transmission

14.2 BLOCK DIAGRAM OF TEST SETUP



14.3 TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

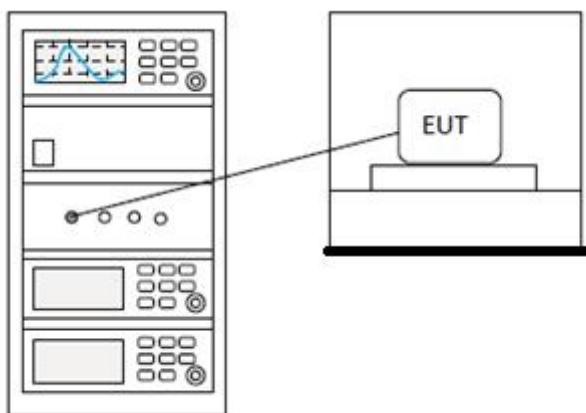
15 CONDUCTED PEAK OUTPUT POWER

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.5
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Jozu
Temperature	25 °C
Humidity	60%

15.1 LIMITS

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

15.2 BLOCK DIAGRAM OF TEST SETUP



15.3 TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

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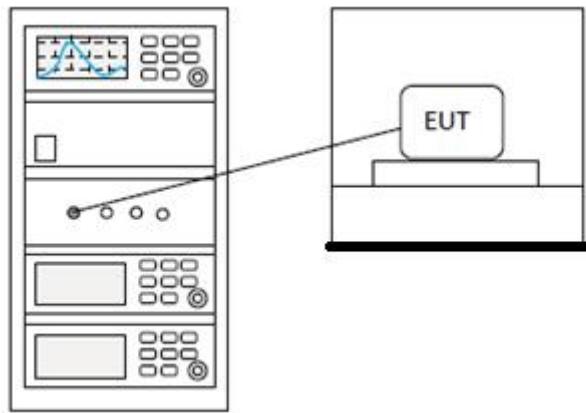
16 MINIMUM 6DB BANDWIDTH

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 11.8.1
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Jozu
Temperature	25 °C
Humidity	60%

16.1 LIMITS

Limit: ≥ 500 kHz

16.2 BLOCK DIAGRAM OF TEST SETUP



16.3 TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

17 ANTENNA REQUIREMENT

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	N/A

17.1 CONCLUSION

Standard Requirement:

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

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -0.6dBi.

18 CONDUCTED EMISSIONS AT AC POWER LINE (150KHZ-30MHZ)

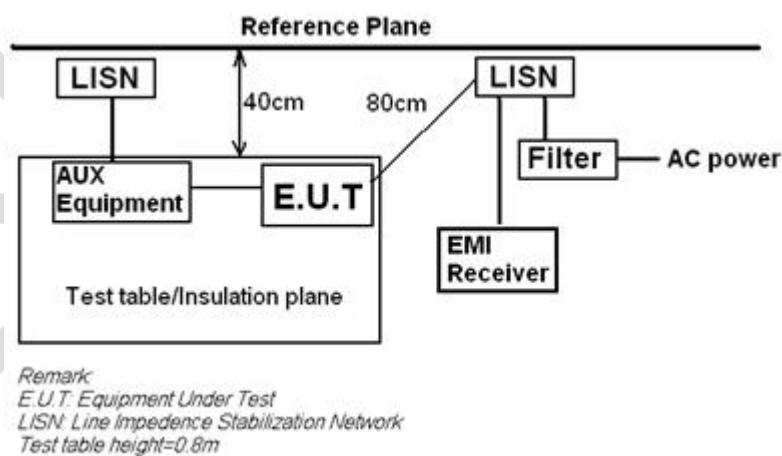
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.2
Test Mode (Pre-Scan)	Transmitting mode
Test Mode (Final Test)	Transmitting mode
Tester	Jozu
Temperature	25°C
Humidity	60%

18.1 LIMITS

Frequency of emission(MHz)	Conducted limit(dB μ V)	
	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.

18.2 BLOCK DIAGRAM OF TEST SETUP



18.3 PROCEDURE

- 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/50H + 50hm 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.

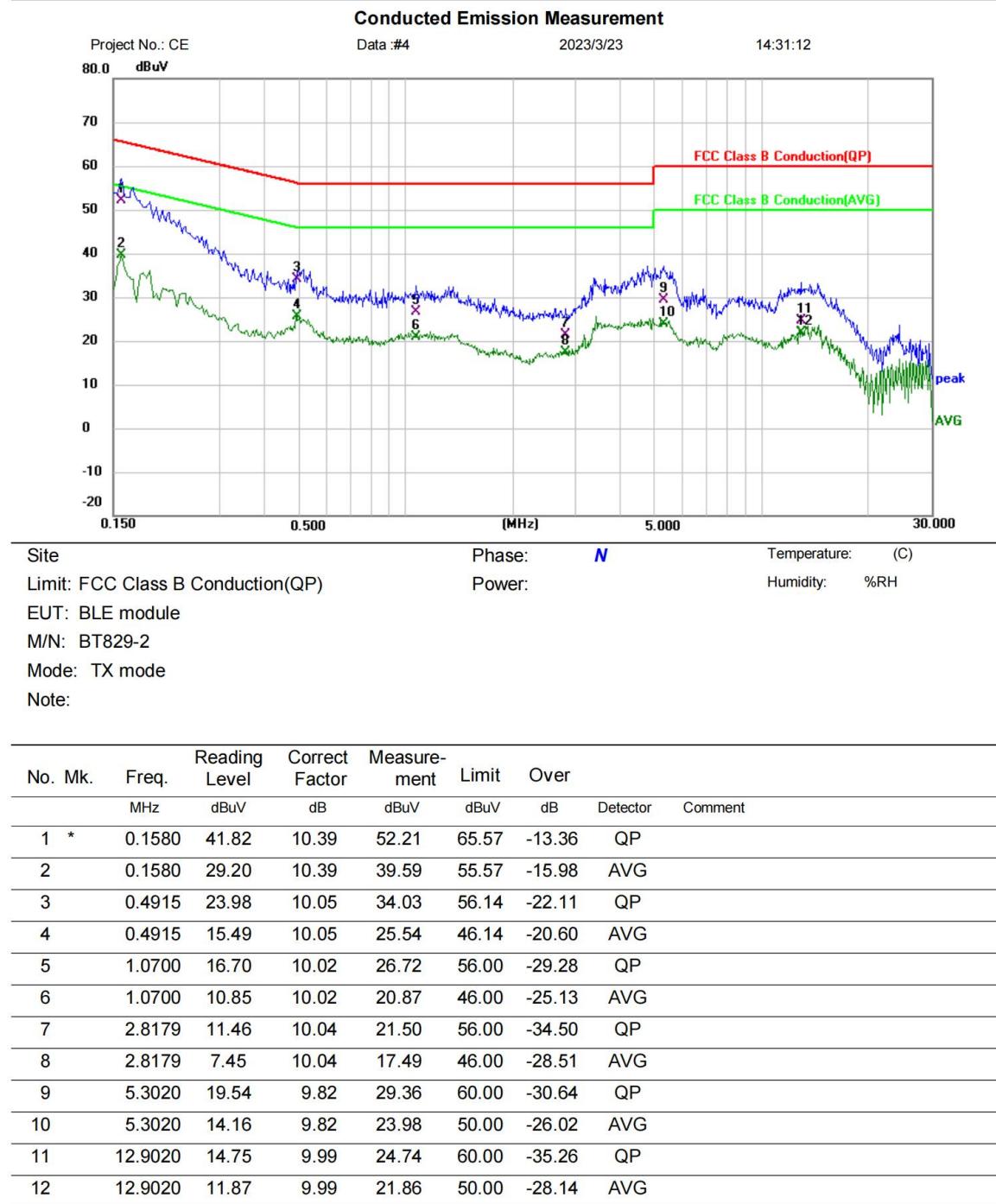
- 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
- 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from 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

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18.4 TEST DATA

[TestMode: Transmitting mode]; [Line: Neutral];[Power:AC120V/60Hz]



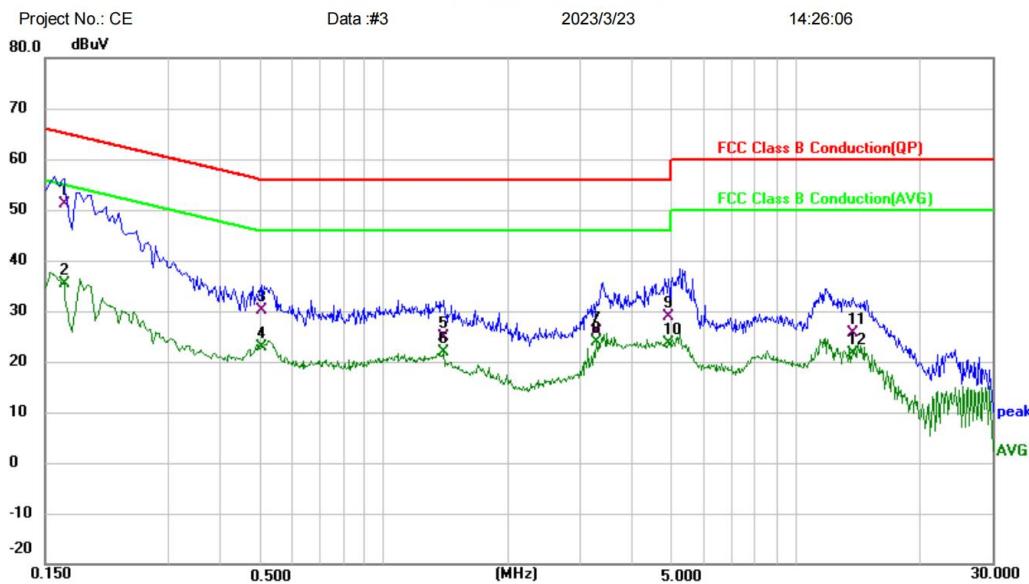
*:Maximum data x:Over limit !:over margin

(Reference Only)

Test Result: Pass

[TestMethod: BT]; [Line: Line] [Power: AC120V/60Hz]

Conducted Emission Measurement



Site

Phase: **L1**

Temperature: (C)

Limit: FCC Class B Conduction(QP)

Power:

Humidity: %RH

EUT: BLE module

M/N: BT829-2

Mode: TX mode

Note:

No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1 *	0.1660	40.74	10.50	51.24	65.16	-13.92	QP	
2	0.1660	24.88	10.50	35.38	55.16	-19.78	AVG	
3	0.5020	19.98	10.08	30.06	56.00	-25.94	QP	
4	0.5020	12.92	10.08	23.00	46.00	-23.00	AVG	
5	1.3980	14.57	10.19	24.76	56.00	-31.24	QP	
6	1.3980	11.74	10.19	21.93	46.00	-24.07	AVG	
7	3.2900	15.64	10.18	25.82	56.00	-30.18	QP	
8	3.2900	13.62	10.18	23.80	46.00	-22.20	AVG	
9	4.9220	18.86	10.02	28.88	56.00	-27.12	QP	
10	4.9220	13.65	10.02	23.67	46.00	-22.33	AVG	
11	13.7180	15.63	9.99	25.62	60.00	-34.38	QP	
12	13.7180	11.60	9.99	21.59	50.00	-28.41	AVG	

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

⟨ Reference Only

Test Result: Pass

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Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss.

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19 APPENDIX

Appendix1

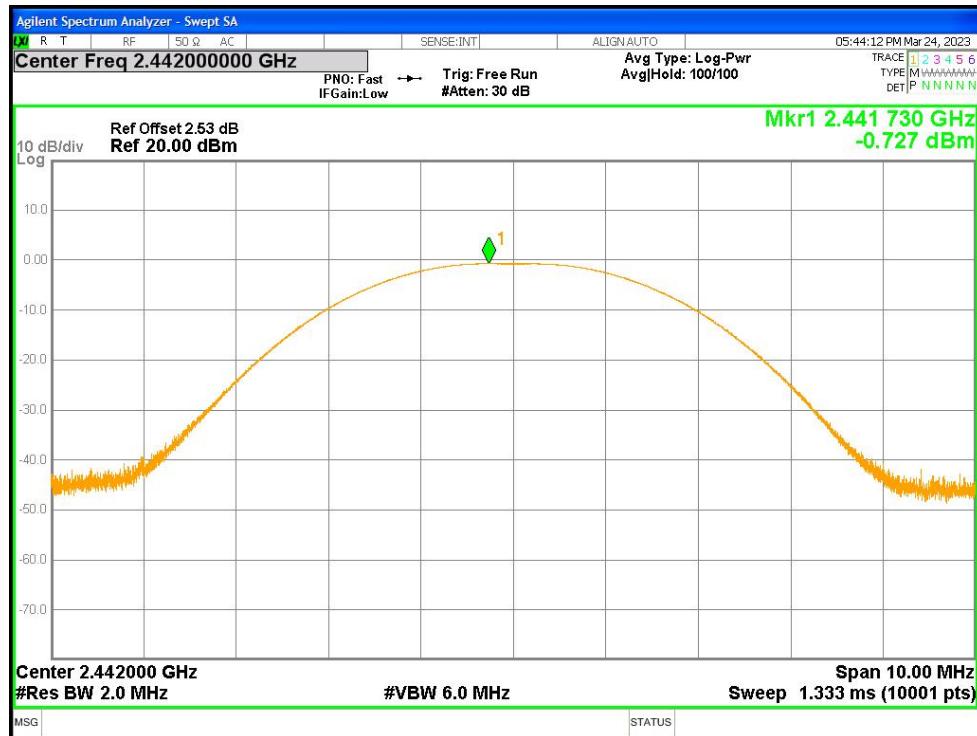
Maximum Conducted Output Power

Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	BLE	2402	Ant1	-0.605	30	Pass
NVNT	BLE	2442	Ant1	-0.727	30	Pass
NVNT	BLE	2480	Ant1	-0.75	30	Pass

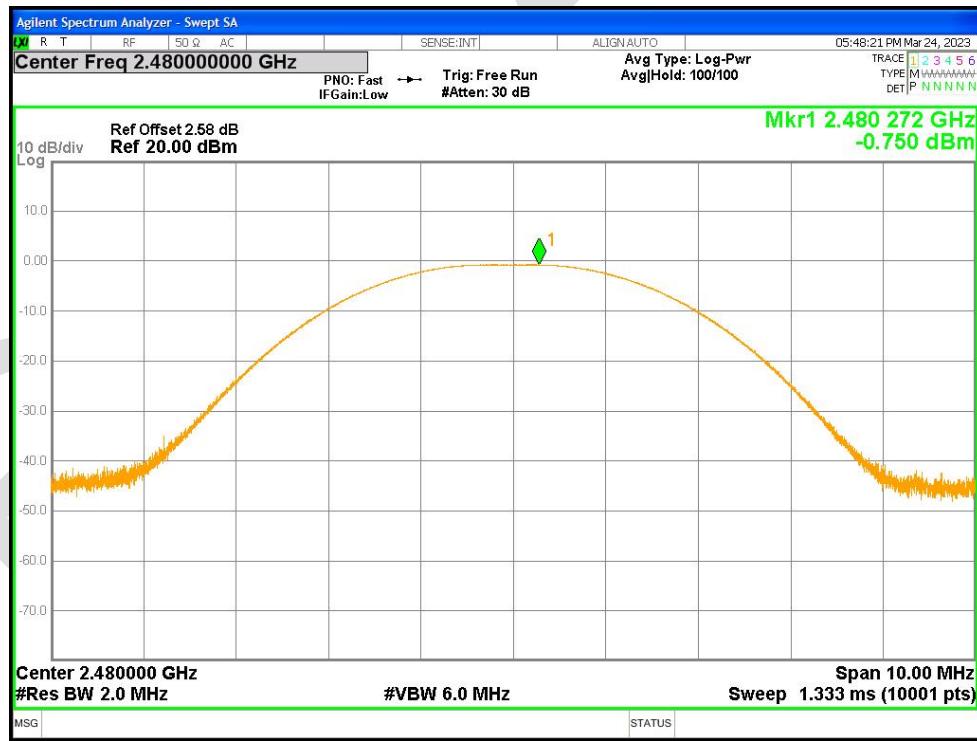
Power NVNT BLE 2402MHz Ant1



Power NVNT BLE 2442MHz Ant1

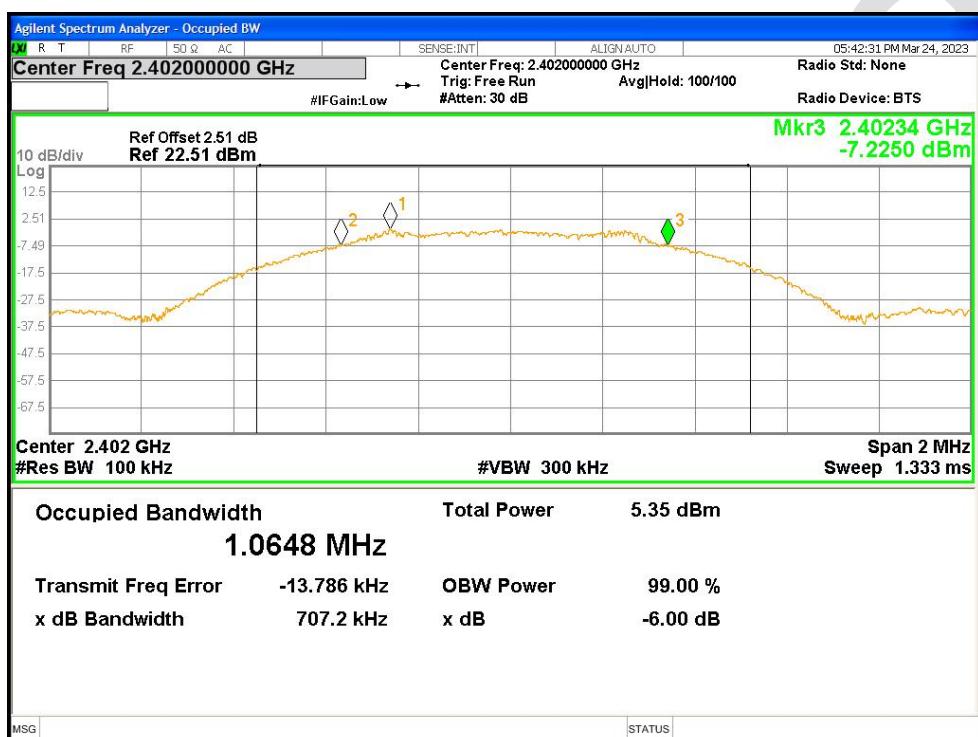


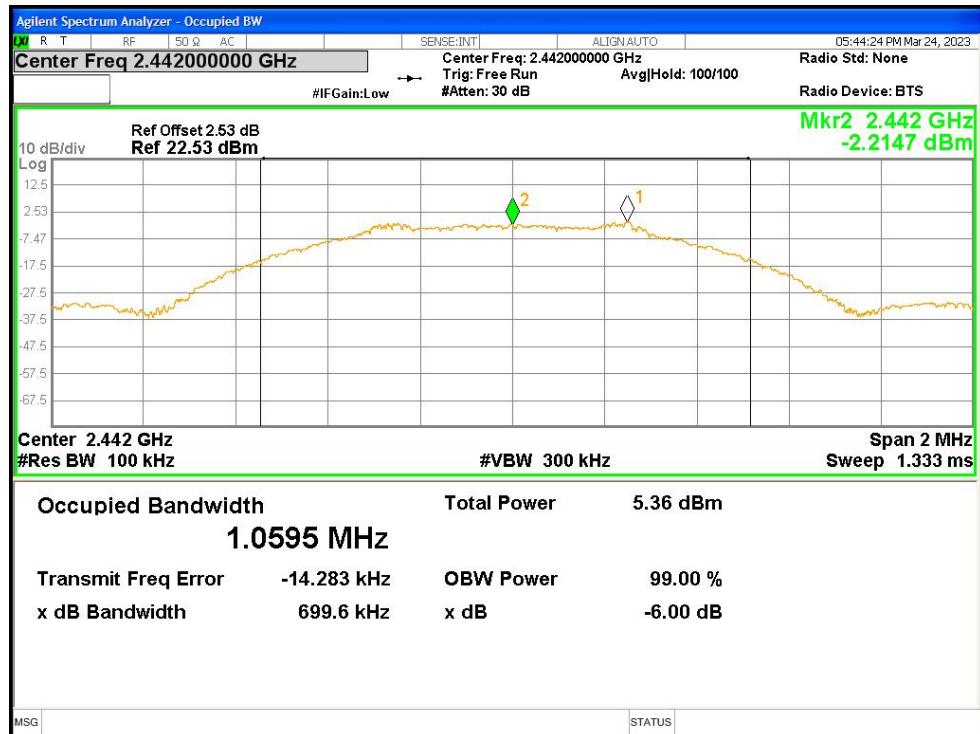
Power NVNT BLE 2480MHz Ant1



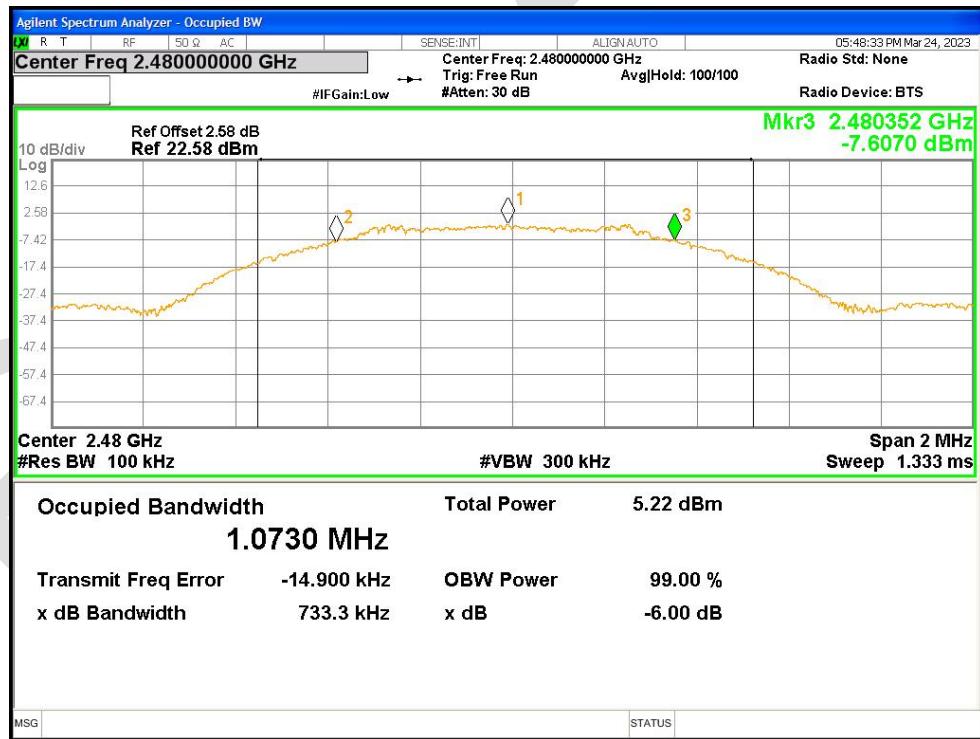
-6dB Bandwidth

Condition	Mode	Frequency (MHz)	Antenna	-6 dB Bandwidth (MHz)	Limit -6 dB Bandwidth (MHz)	Verdict
NVNT	BLE	2402	Ant1	0.707	0.5	Pass
NVNT	BLE	2442	Ant1	0.7	0.5	Pass
NVNT	BLE	2480	Ant1	0.733	0.5	Pass

-6dB Bandwidth NVNT BLE 2402MHz Ant1

-6dB Bandwidth NVNT BLE 2442MHz Ant1

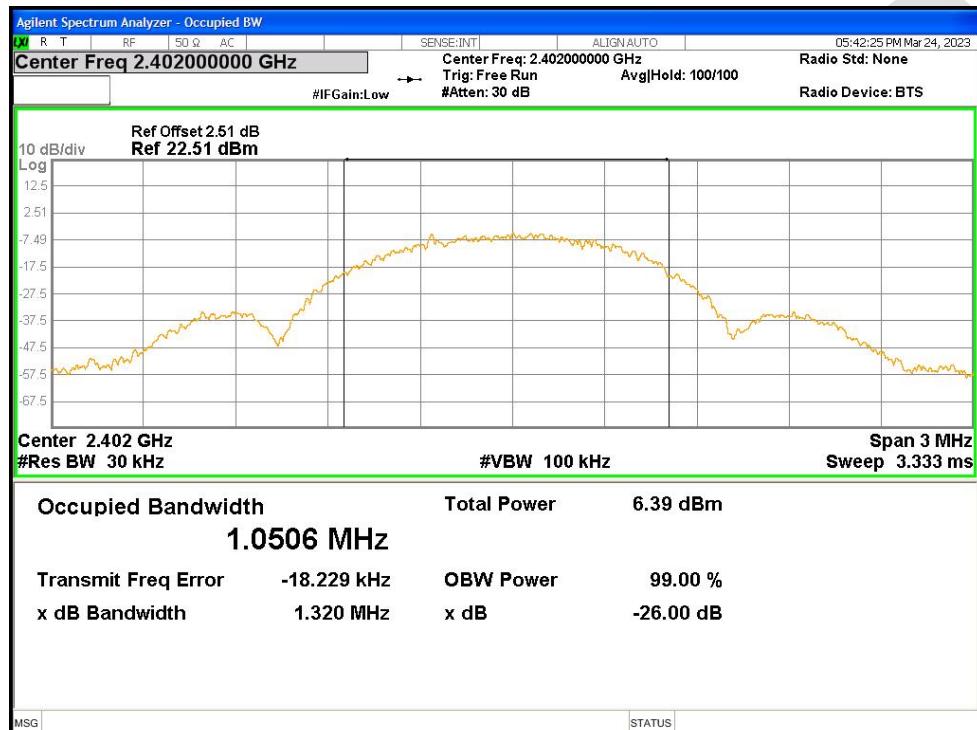


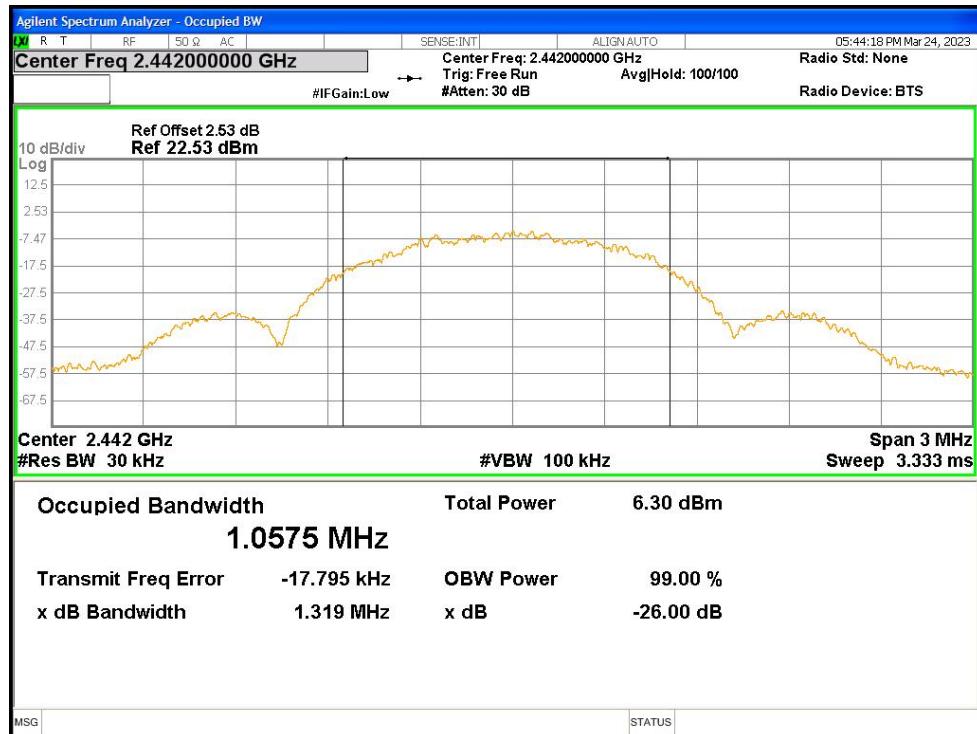
-6dB Bandwidth NVNT BLE 2480MHz Ant1



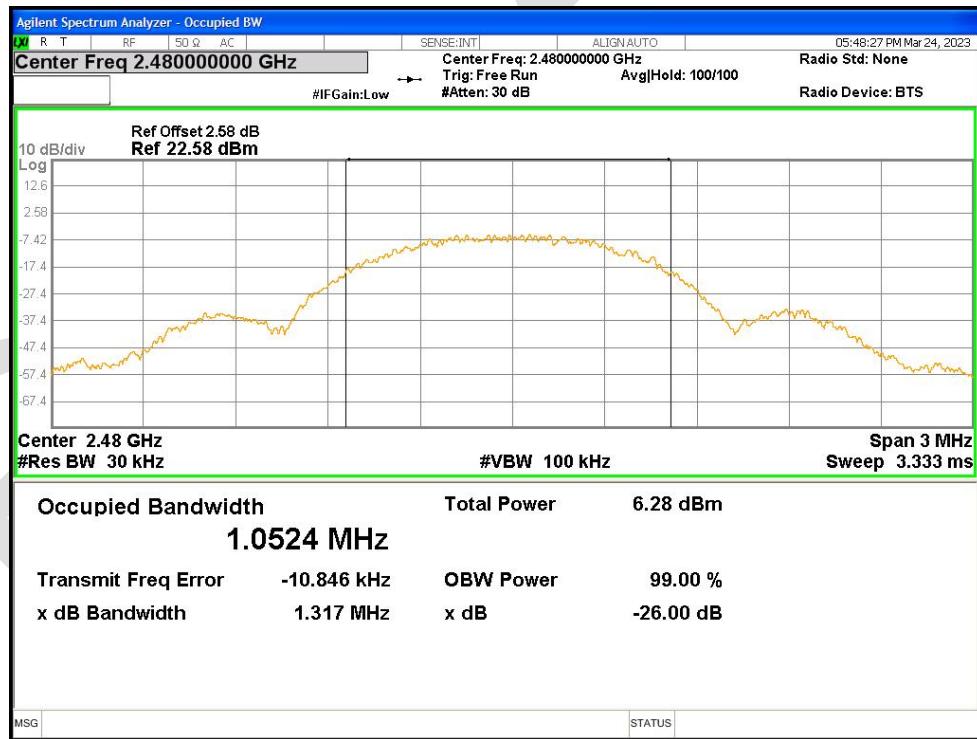
Occupied Channel Bandwidth

Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)
NVNT	BLE	2402	Ant1	1.0506
NVNT	BLE	2442	Ant1	1.0575
NVNT	BLE	2480	Ant1	1.0524

OBW NVNT BLE 2402MHz Ant1

OBW NVNT BLE 2442MHz Ant1

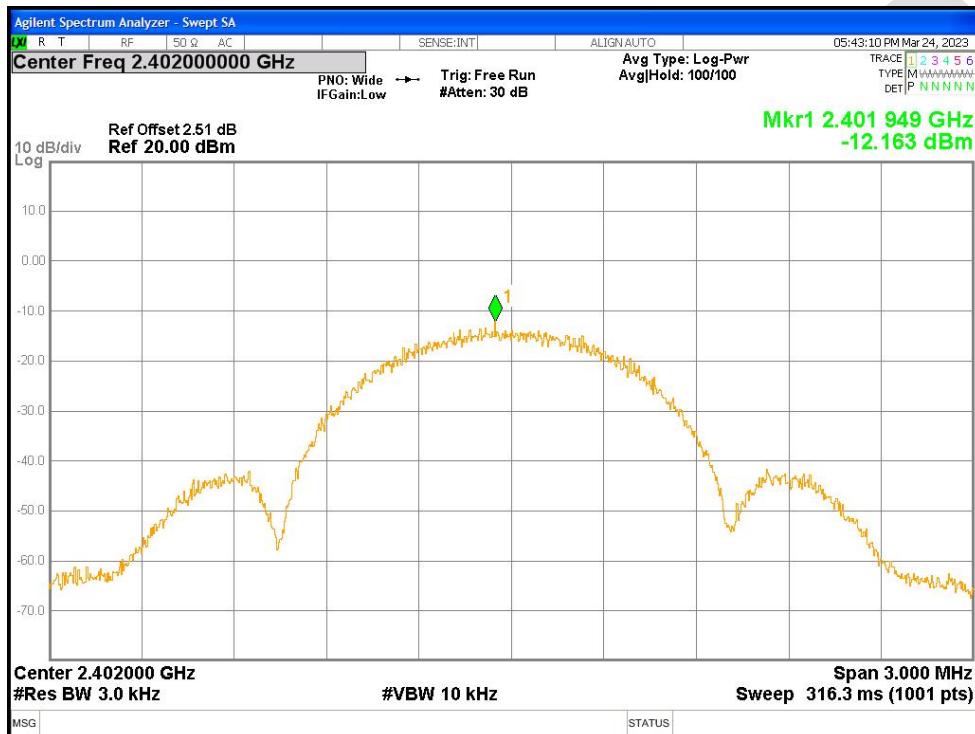


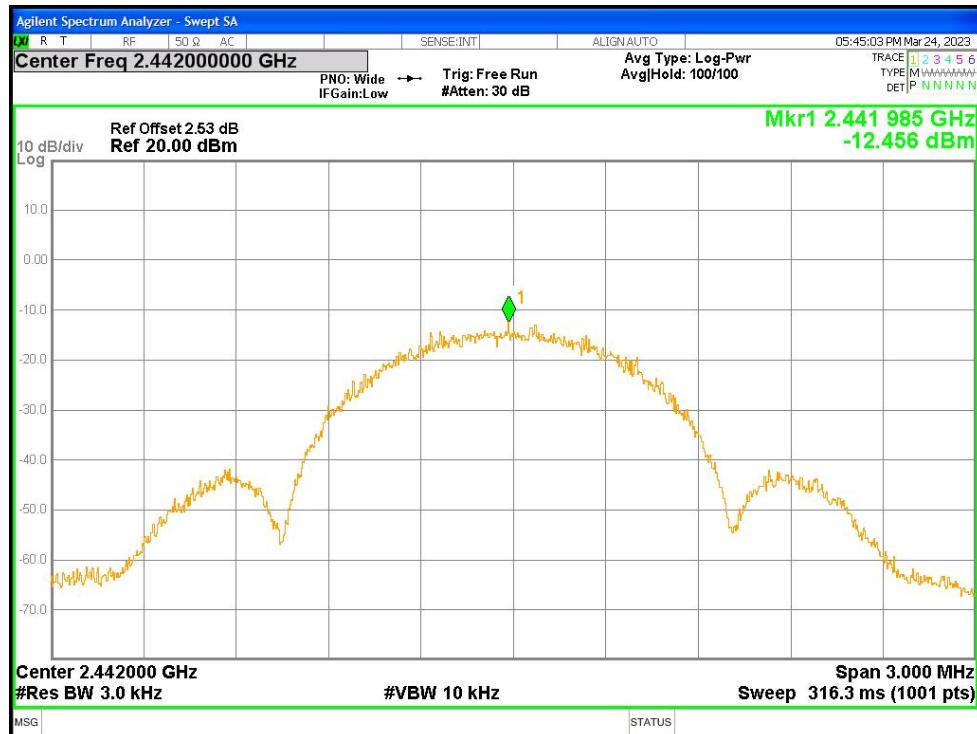
OBW NVNT BLE 2480MHz Ant1



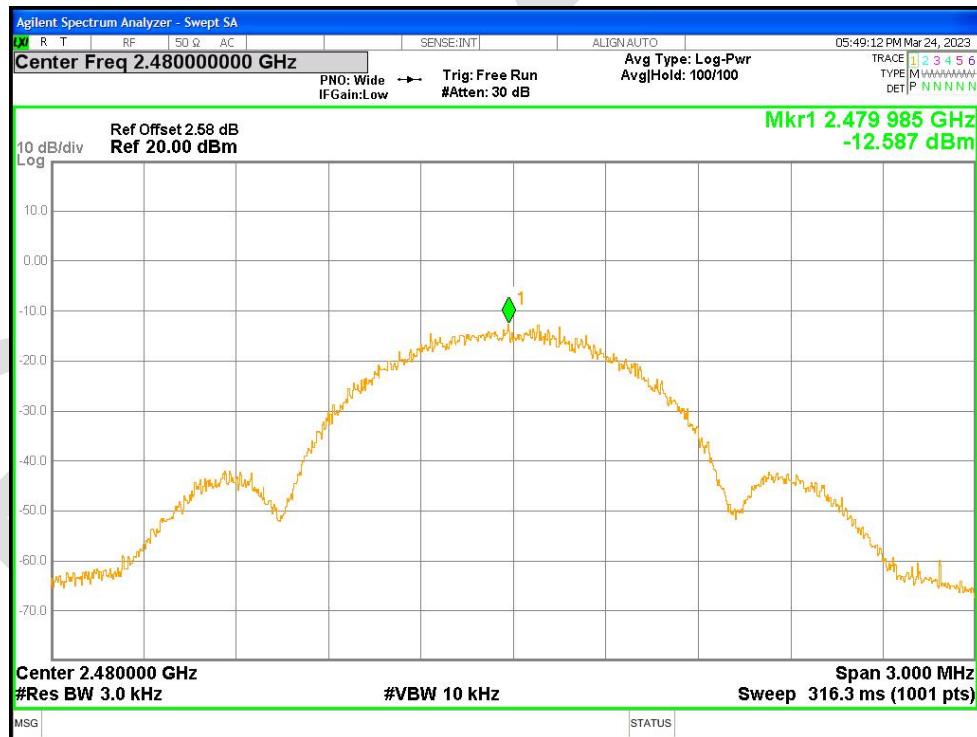
Maximum Power Spectral Density Level

Condition	Mode	Frequency (MHz)	Antenna	Max PSD (dBm)	Limit (dBm)	Verdict
NVNT	BLE	2402	Ant1	-12.163	8	Pass
NVNT	BLE	2442	Ant1	-12.456	8	Pass
NVNT	BLE	2480	Ant1	-12.587	8	Pass

PSD NVNT BLE 2402MHz Ant1

PSD NVNT BLE 2442MHz Ant1

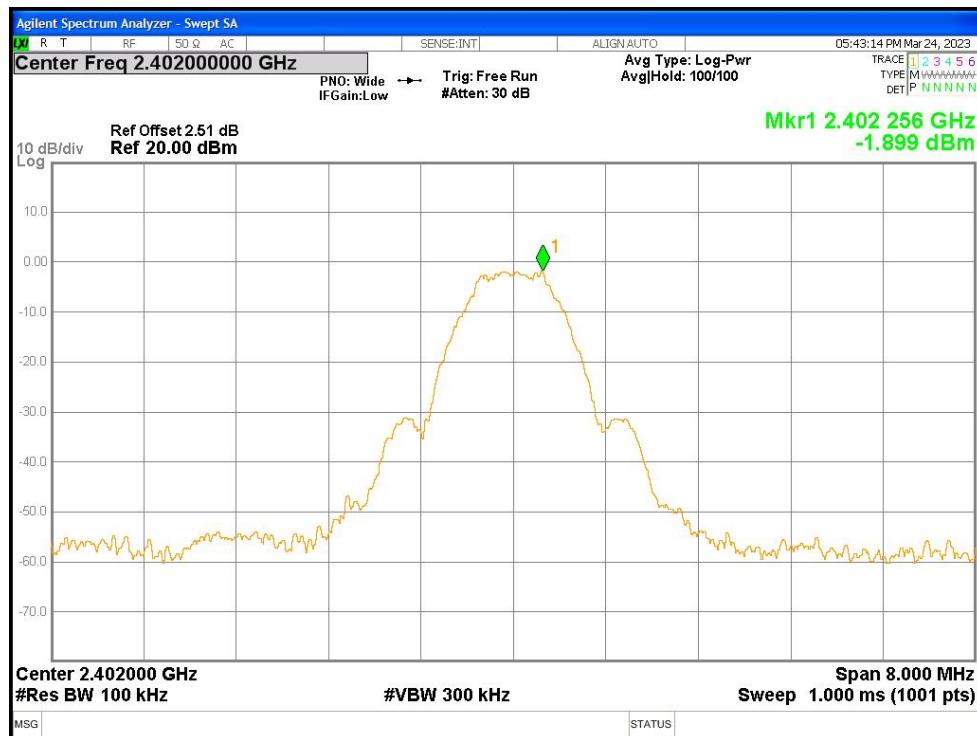


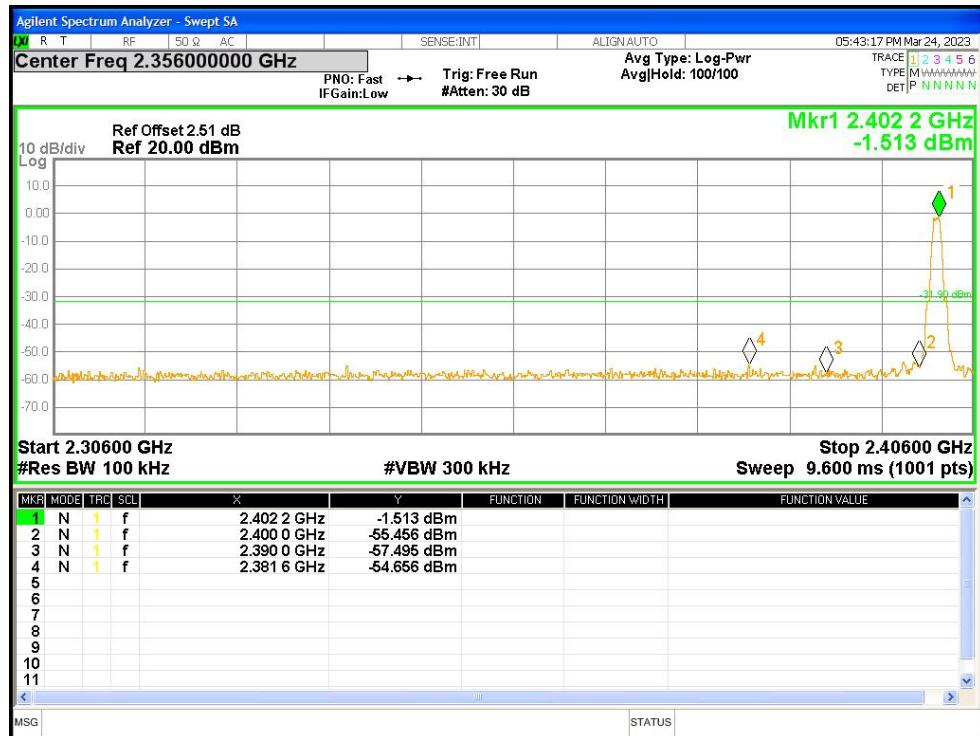
PSD NVNT BLE 2480MHz Ant1



Band Edge

Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	BLE	2402	Ant1	-52.75	-30	Pass
NVNT	BLE	2480	Ant1	-52.35	-30	Pass

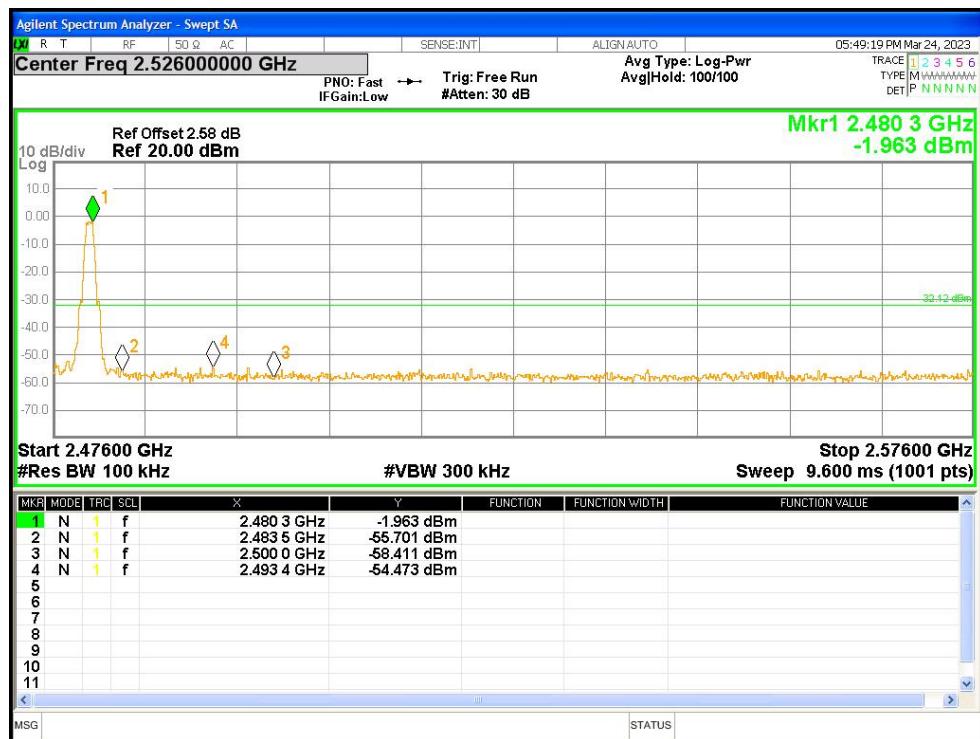
Band Edge NVNT BLE 2402MHz Ant1 Ref

Band Edge NVNT BLE 2402MHz Ant1 Emission



Band Edge NVNT BLE 2480MHz Ant1 Ref



Band Edge NVNT BLE 2480MHz Ant1 Emission



Conducted RF Spurious Emission

Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	BLE	2402	Ant1	-42.99	-30	Pass
NVNT	BLE	2442	Ant1	-43.89	-30	Pass
NVNT	BLE	2480	Ant1	-43.37	-30	Pass

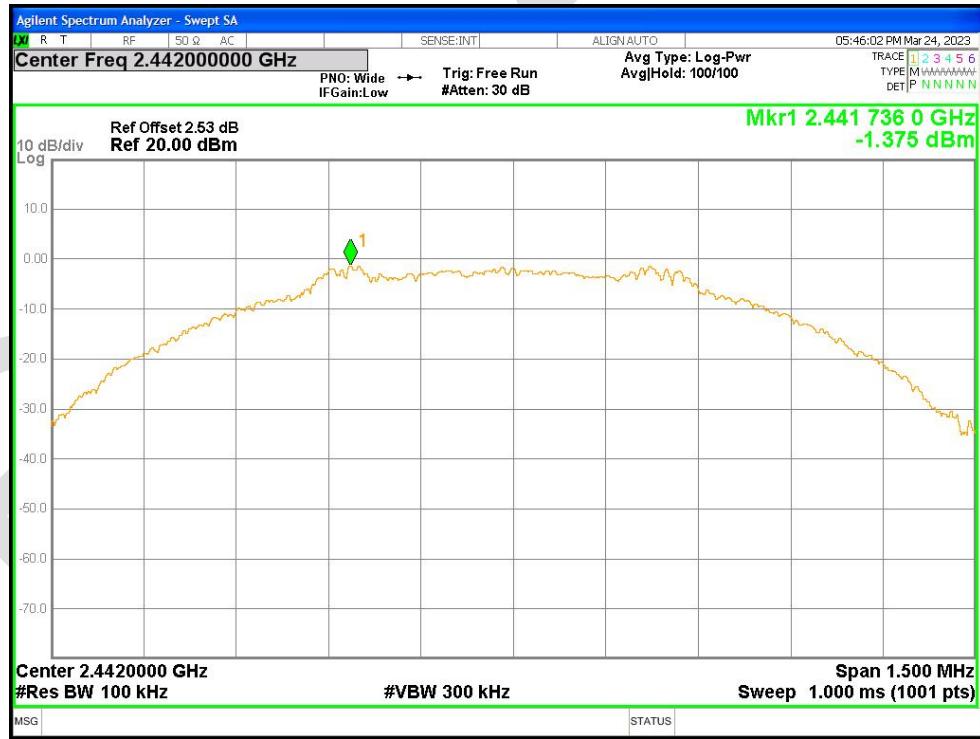
Tx. Spurious NVNT BLE 2402MHz Ant1 Ref



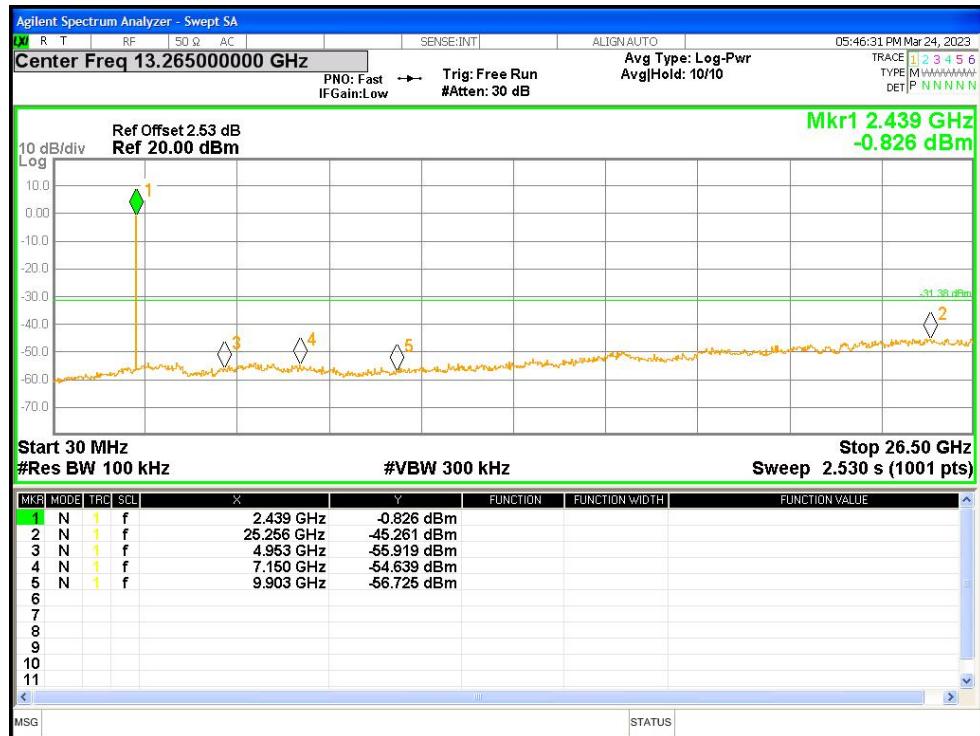
Tx. Spurious NVNT BLE 2402MHz Ant1 Emission



Tx. Spurious NVNT BLE 2442MHz Ant1 Ref



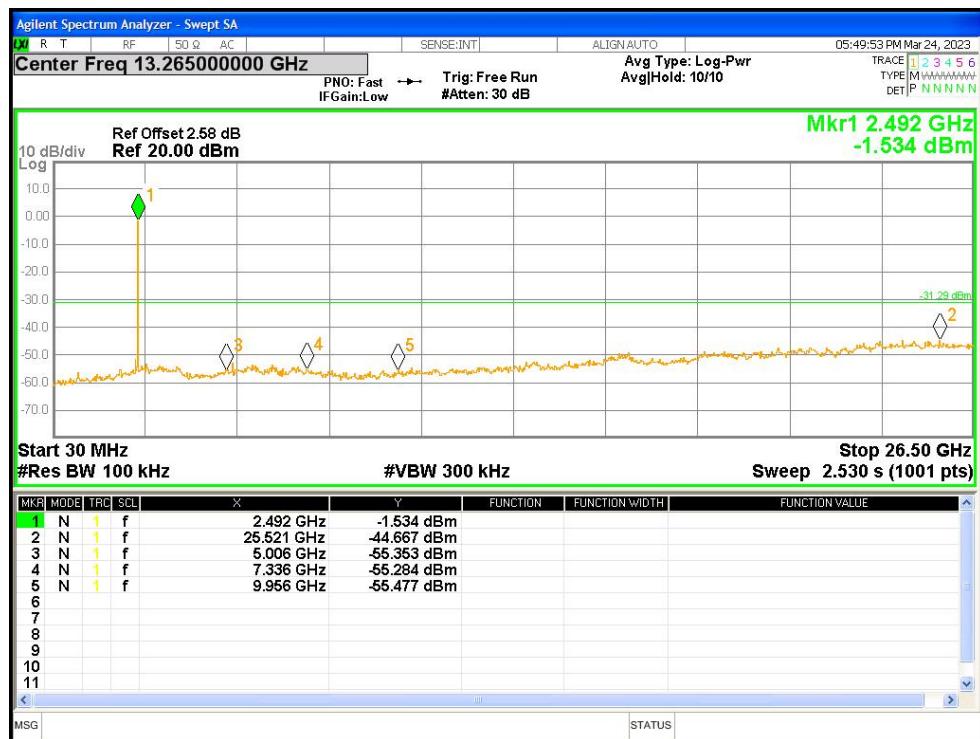
Tx. Spurious NVNT BLE 2442MHz Ant1 Emission



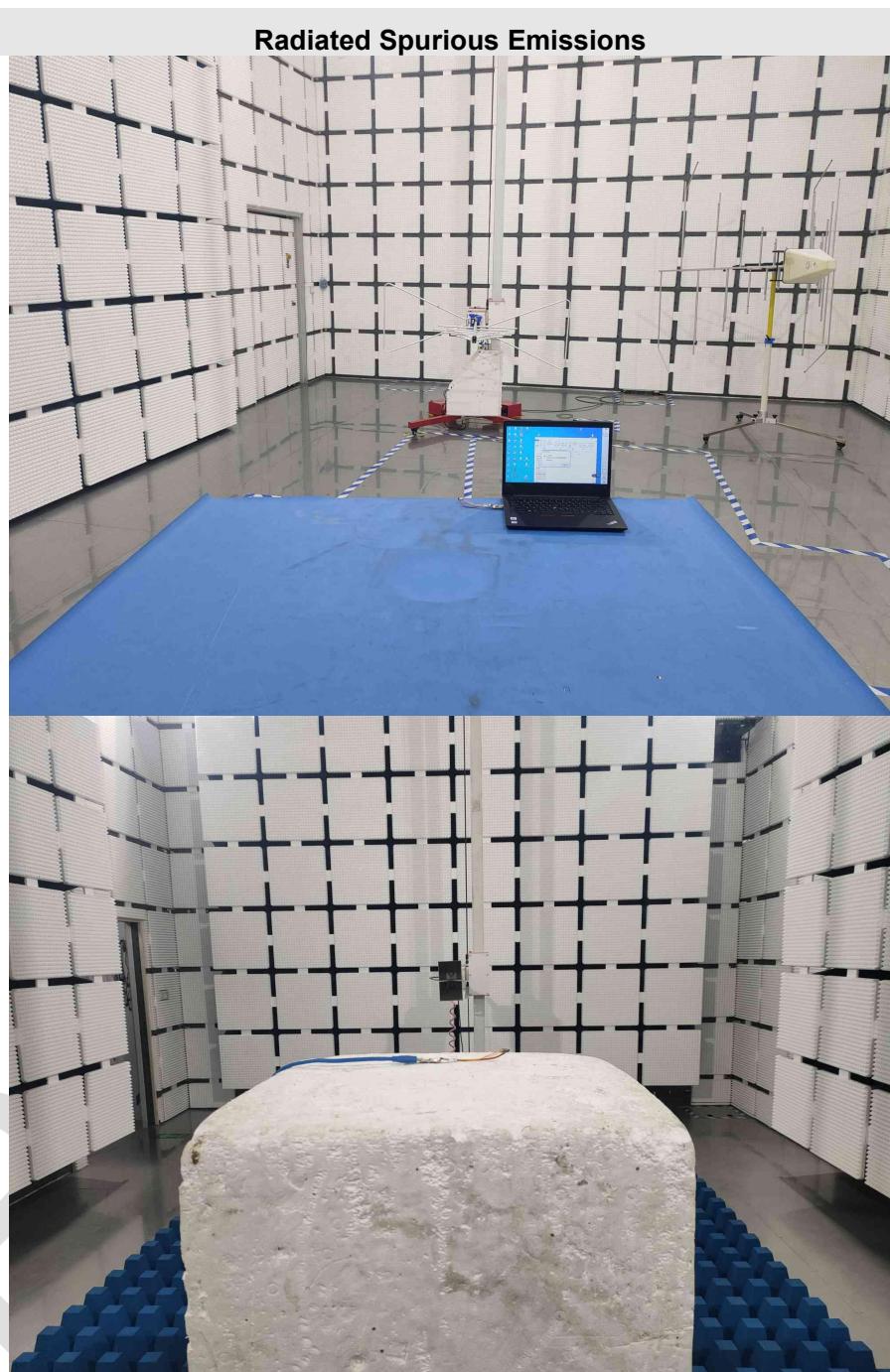
Tx. Spurious NVNT BLE 2480MHz Ant1 Ref



Tx. Spurious NVNT BLE 2480MHz Ant1 Emission



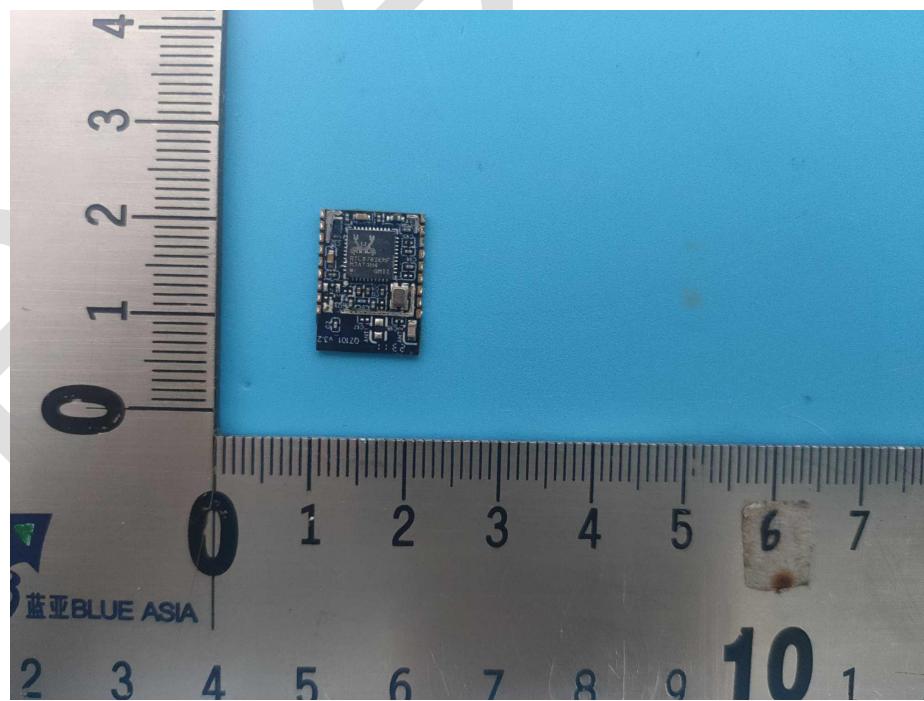
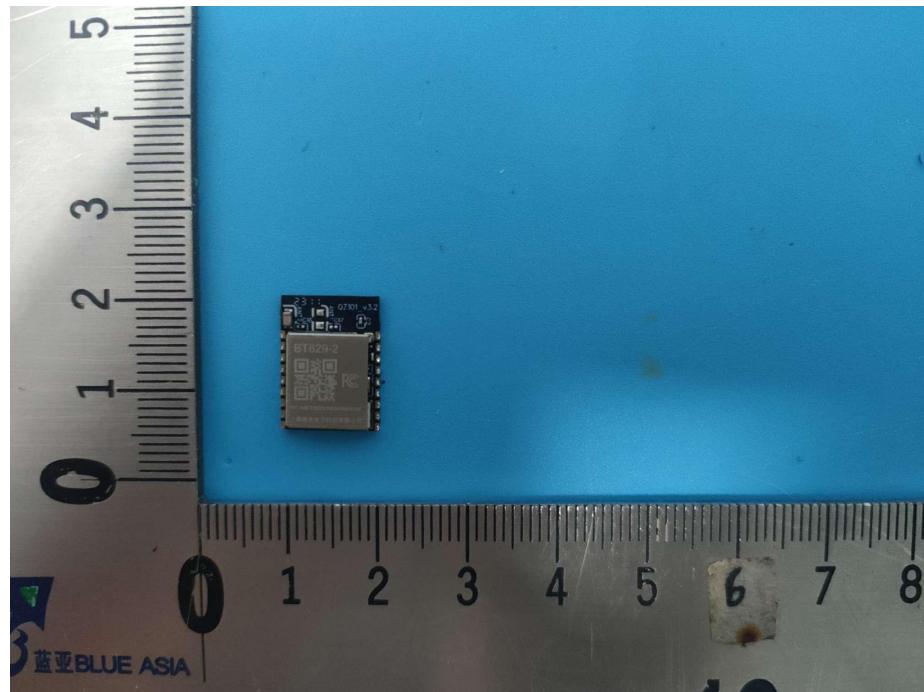
APPENDIX A: PHOTOGRAPHS OF TEST SETUP

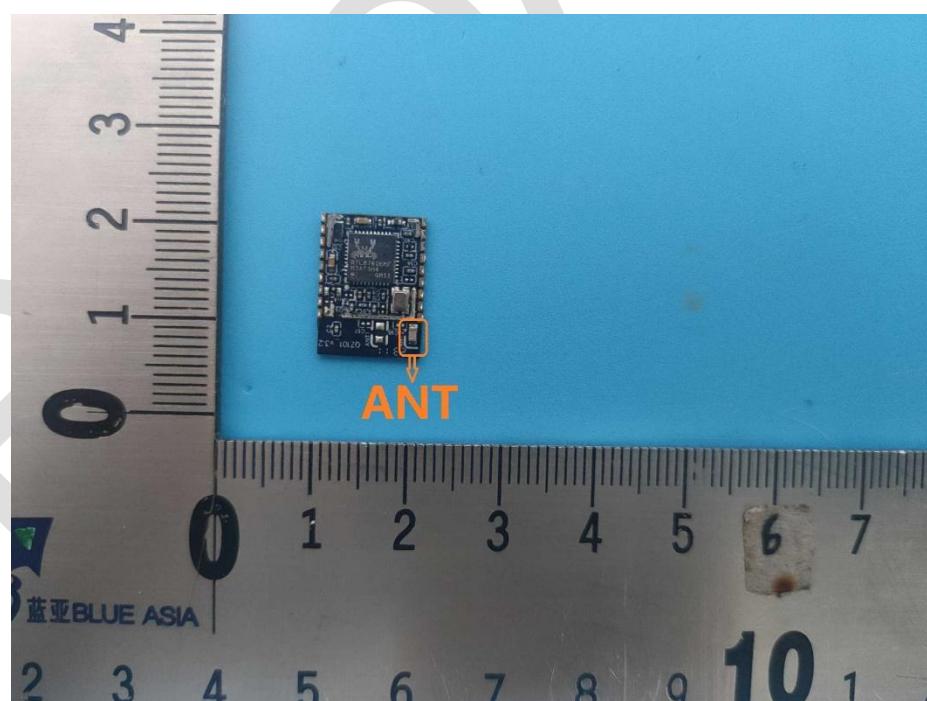
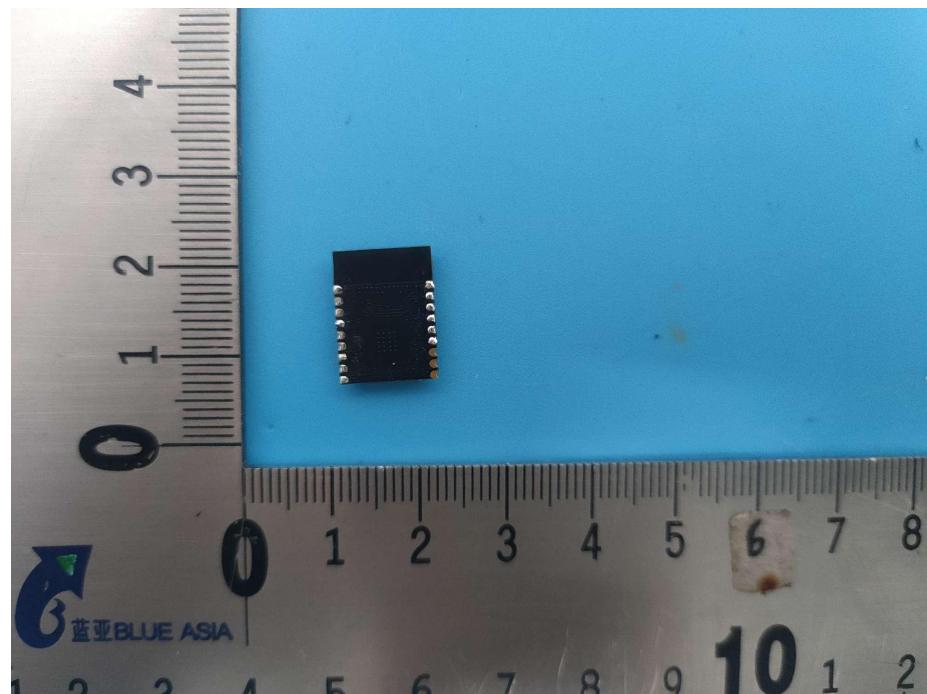


Conducted Emissions at AC Power Line (150kHz-30MHz)



APPENDIX B: PHOTOGRAPHS OF EUT





----END OF REPORT----

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