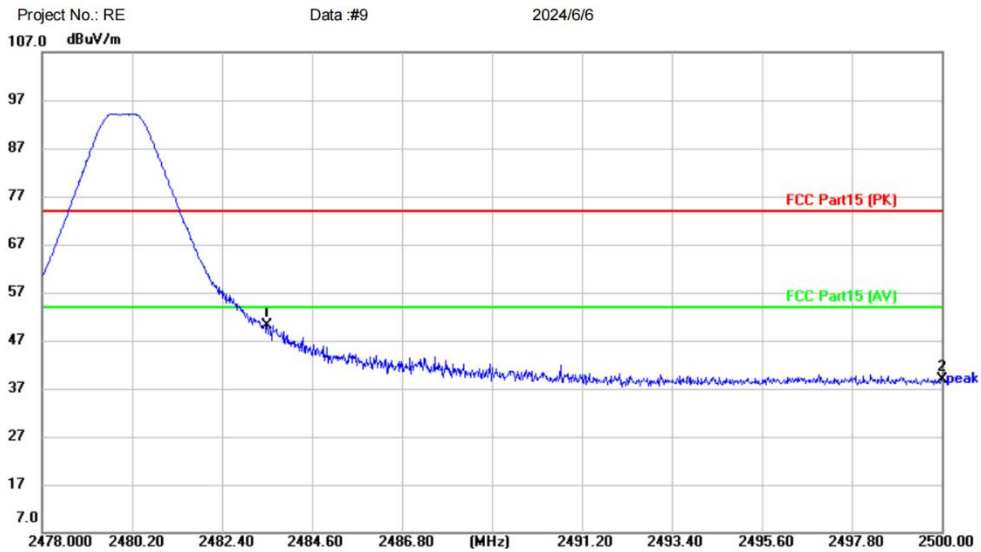


[Test mode: TX High channel]; [Polarity: Horizontal]

Radiated Emission Measurement



Site Polarization: **Horizontal** Temperature: (C)
Limit: FCC Part15 (PK) Power: Humidity: %RH
EUT: Bluetooth low energy module
M/N: MS88SF3
Mode: BLE1M TX 2480
Note:

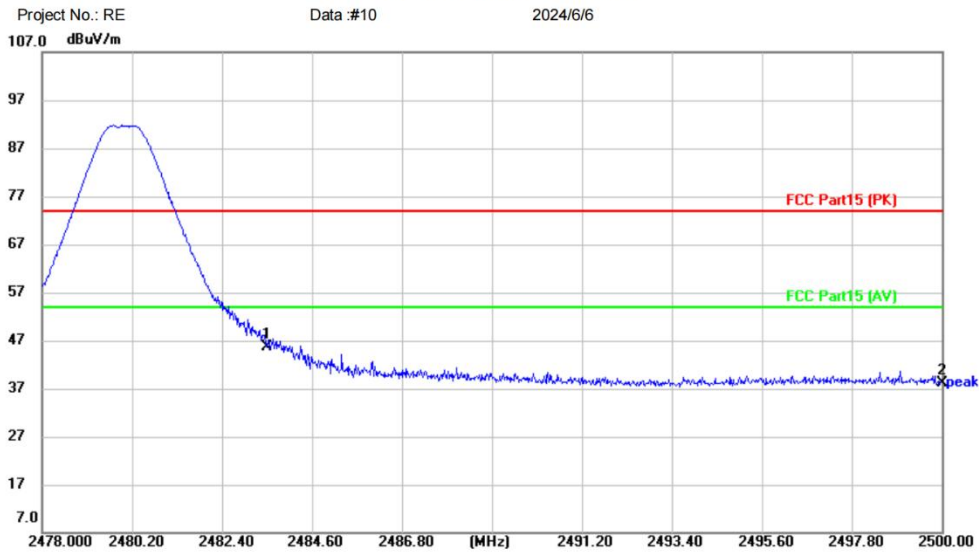
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	2483.500	53.12	-2.91	50.21	74.00	-23.79	peak	
2		2500.000	41.94	-3.00	38.94	74.00	-35.06	peak	

*:Maximum data x:Over limit !:over margin <Reference Only
Receiver: ESR_1 Spectrum Analyzer: FSP40

Test Result: Pass

[Test mode:TX High channel]; [Polarity: Vertical]

Radiated Emission Measurement



Site Polarization: **Vertical** Temperature: (C)
Limit: FCC Part15 (PK) Power: Humidity: %RH
EUT: Bluetooth low energy module
M/N: MS88SF3
Mode: BLE1M TX 2480
Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	2483.500	48.47	-2.91	45.56	74.00	-28.44	peak	
2		2500.000	41.16	-3.00	38.16	74.00	-35.84	peak	

*:Maximum data x:Over limit !:over margin <Reference Only
Receiver: ESR_1 Spectrum Analyzer: FSP40

Test Result: Pass

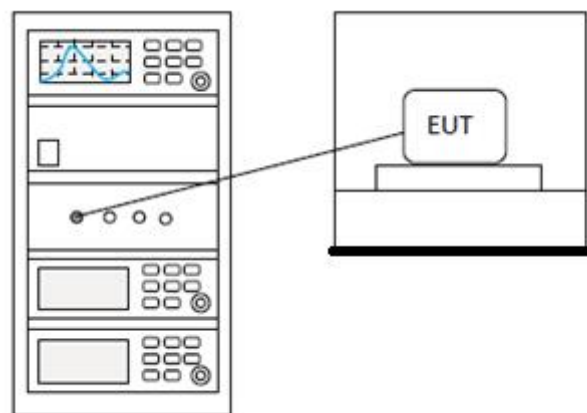
16 CONDUCTED SPURIOUS EMISSIONS

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	56%

16.1 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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16.2 BLOCK DIAGRAM OF TEST SETUP



16.3 TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

BlueAsia

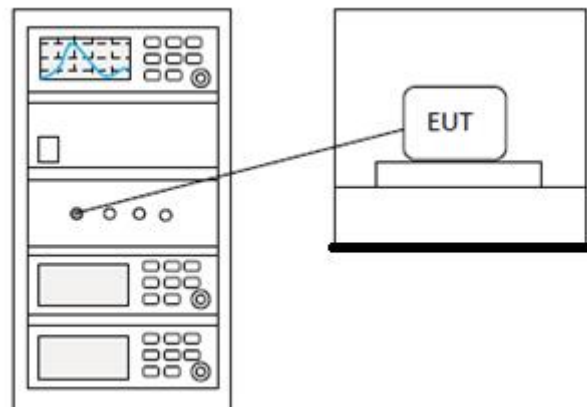
17 POWER SPECTRUM DENSITY

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%

17.1 LIMITS

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

17.2 BLOCK DIAGRAM OF TEST SETUP



17.3 TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

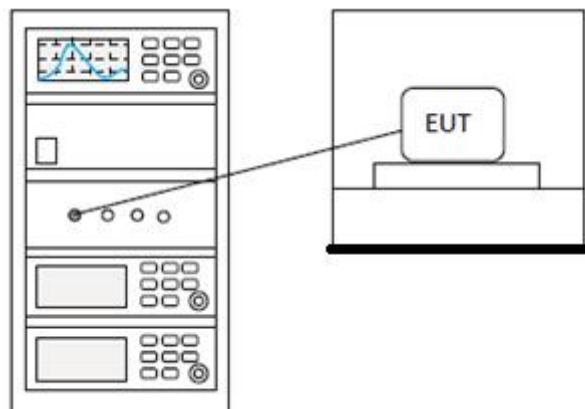
18 CONDUCTED PEAK OUTPUT POWER

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%

18.1 LIMITS

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for ≥ 50 hopping channels
	0.25 for $25 \leq \text{hopping channels} < 50$
	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

18.2 BLOCK DIAGRAM OF TEST SETUP



18.3 TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

BlueAsia

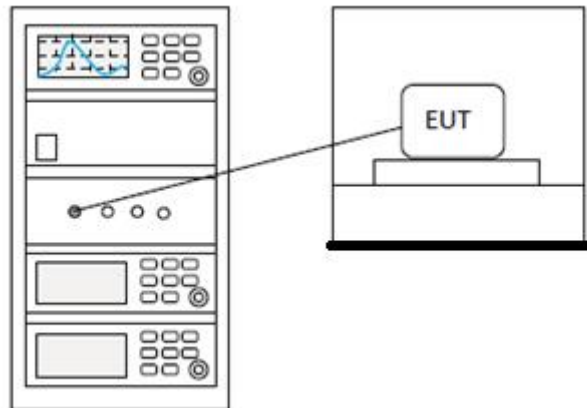
19 MINIMUM 6DB BANDWIDTH

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%

19.1 LIMITS

Limit:	≥ 500 kHz
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19.2 BLOCK DIAGRAM OF TEST SETUP



19.3 TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

20 ANTENNA REQUIREMENT

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

20.1 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 an 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 3.06dBi.

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

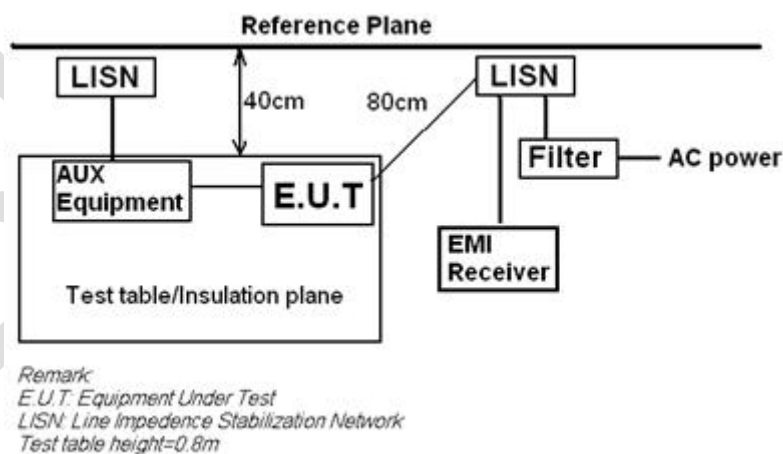
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.2
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Jozu
Temperature	24℃
Humidity	55%

21.1 LIMITS

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.

21.2 BLOCK DIAGRAM OF TEST SETUP



21.3 PROCEDURE

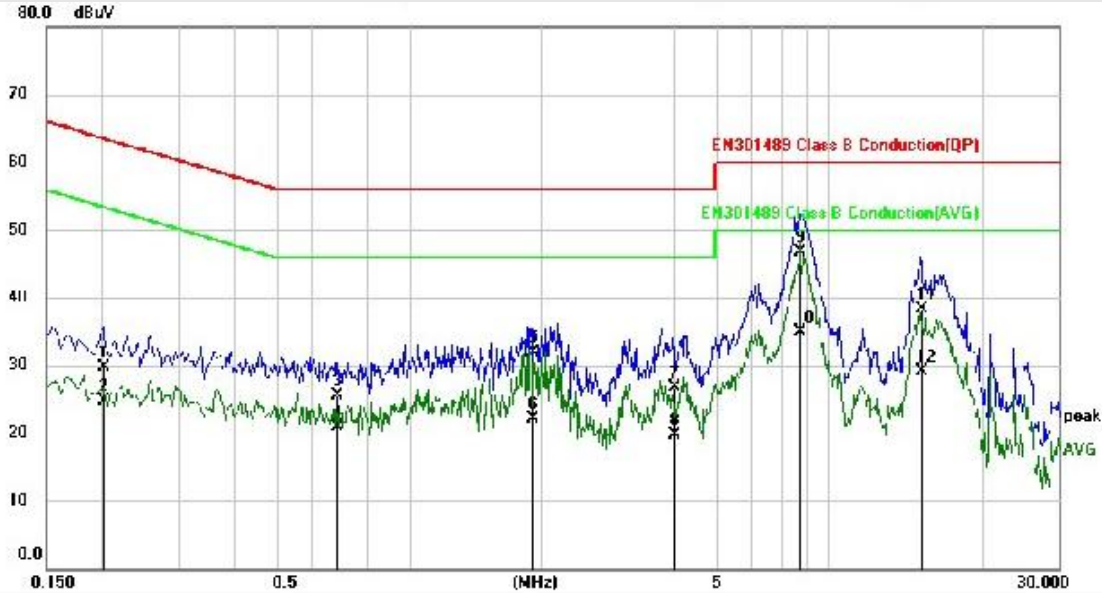
- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to 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: $LISN = Read\ Level + Cable\ Loss + LISN\ Factor$

21.4 TEST DATA

[TestMode: TX]; [Line: Line]

Power: AC120V/60Hz



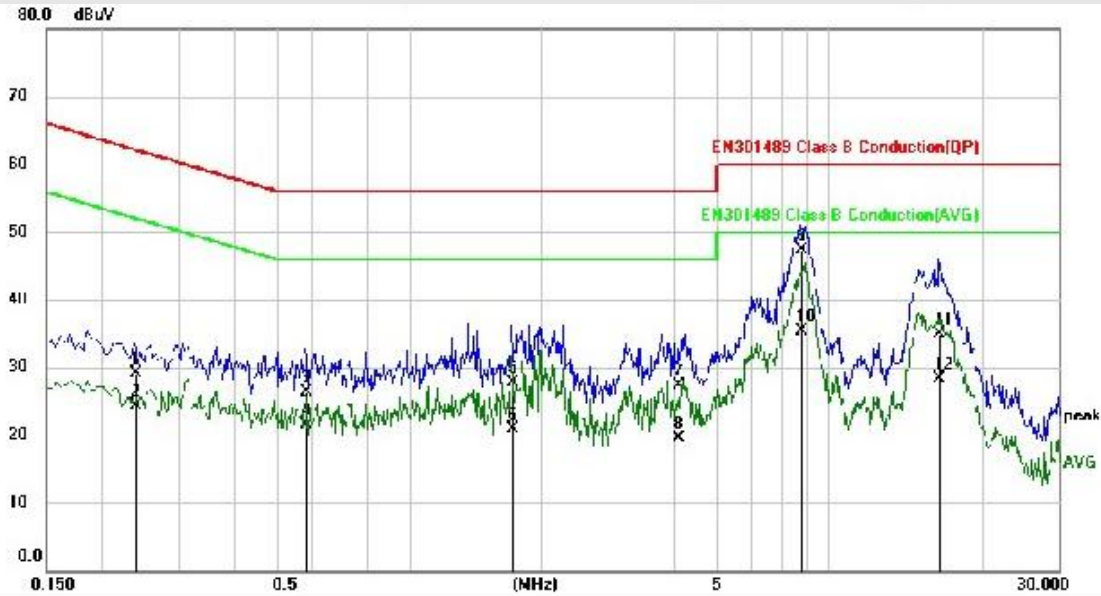
Site: Phase: **L1** Temperature: 26
Limit: EN301489 Class B Conduction(QP) Power: Humidity: 60 %
EUT: Bluetooth low energy module
M/N: MS88SF3
Mode: BT mode
Note:

No.	Mk.	Freq. MHz	Reading Level dBμV	Correct Factor dB	Measure- ment dBμV	Limit dBμV	Over dB	Detector	Comment
1		0.2020	19.89	9.87	29.76	63.53	-33.77	QP	
2		0.2020	14.92	9.87	24.79	53.53	-28.74	AVG	
3		0.6860	15.82	9.68	25.50	56.00	-30.50	QP	
4		0.6860	11.14	9.68	20.82	46.00	-25.18	AVG	
5		1.9060	22.16	9.82	31.98	56.00	-24.02	QP	
6		1.9060	12.32	9.82	22.14	46.00	-23.86	AVG	
7		4.0020	16.85	9.83	26.68	56.00	-29.32	QP	
8		4.0020	9.90	9.83	19.73	46.00	-26.27	AVG	
9	*	7.7420	36.84	9.87	46.71	60.00	-13.29	QP	
10		7.7420	24.96	9.87	34.83	50.00	-15.17	AVG	
11		14.5260	28.25	9.97	38.22	60.00	-21.78	QP	
12		14.5260	19.23	9.97	29.20	50.00	-20.80	AVG	

Test Result: Pass

[TestMode: TX]; [Line: Nutral]

Power: AC120V/60Hz



Site

Phase: **N**

Temperature: 26

Limit: EN301489 Class B Conduction(QP)

Power:

Humidity: 60 %

EUT: Bluetooth low energy module

M/N: MS88SF3

Mode: BT mode

Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.2380	19.34	9.85	29.19	62.17	-32.98	QP	
2		0.2380	14.40	9.85	24.25	52.17	-27.92	AVG	
3		0.5820	16.59	9.74	26.33	56.00	-29.67	QP	
4		0.5820	11.77	9.74	21.51	46.00	-24.49	AVG	
5		1.7140	17.84	9.84	27.68	56.00	-28.32	QP	
6		1.7140	11.16	9.84	21.00	46.00	-25.00	AVG	
7		4.1100	17.38	9.84	27.22	56.00	-28.78	QP	
8		4.1100	9.66	9.84	19.50	46.00	-26.50	AVG	
9	*	7.8020	37.54	9.86	47.40	60.00	-12.60	QP	
10		7.8020	25.35	9.86	35.21	50.00	-14.79	AVG	
11		16.0419	24.91	10.00	34.91	60.00	-25.09	QP	
12		16.0419	18.39	10.00	28.39	50.00	-21.61	AVG	

Test Result: Pass

22 APPENDIX

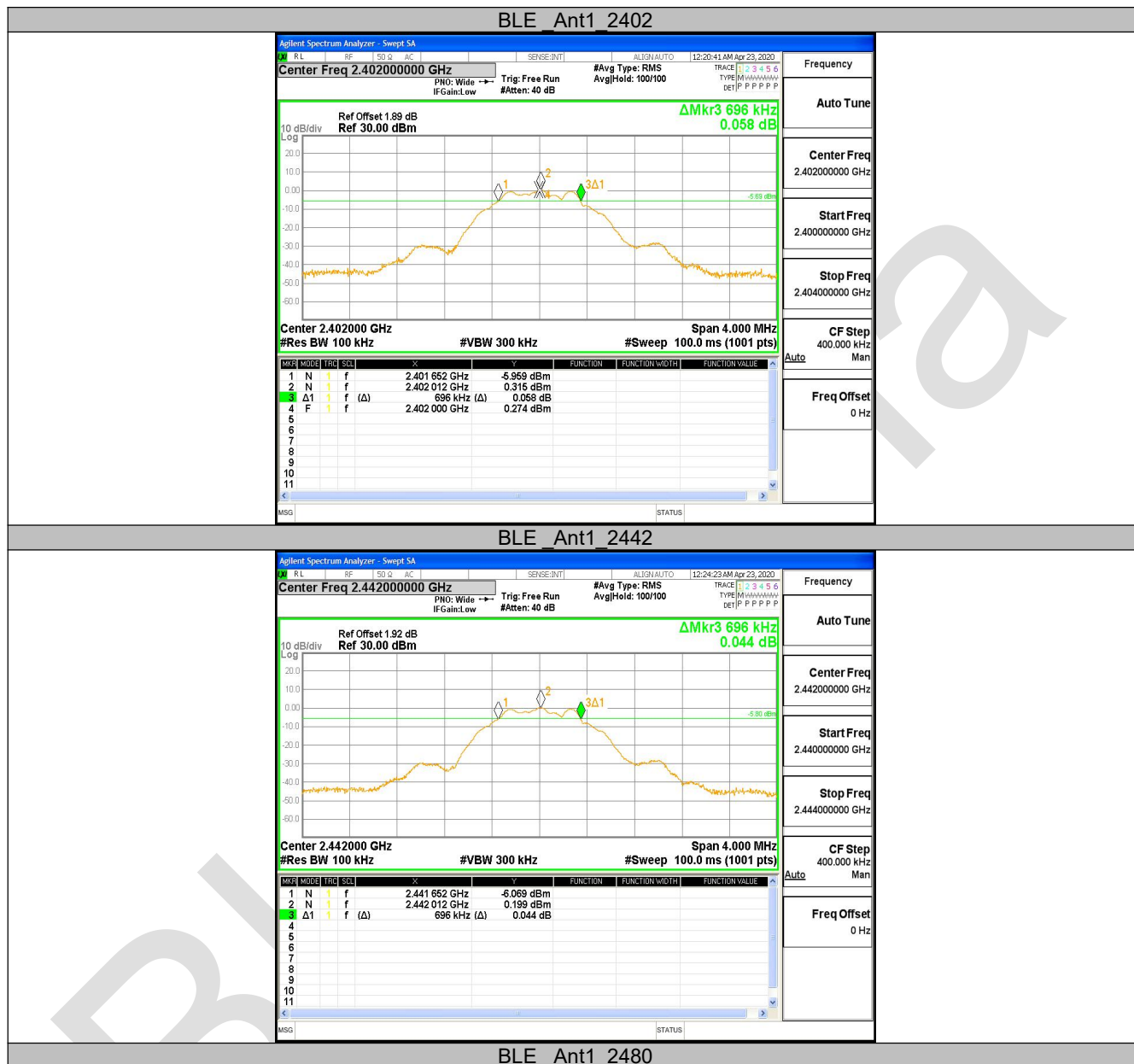
Appendix1

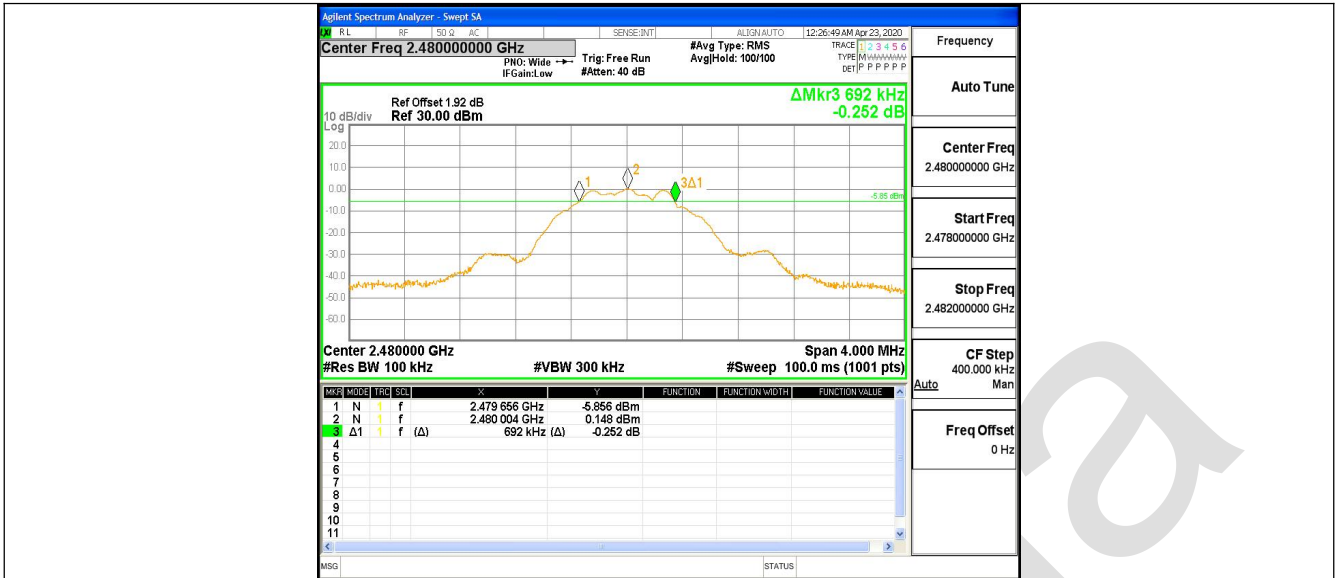
22.1 APPENDIXA: DTS BANDWIDTH

22.1.1 Test Result

TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE	Ant1	2402	0.696	2401.652	2402.348	≥ 0.5	PASS
		2442	0.696	2441.652	2442.348	≥ 0.5	PASS
		2480	0.692	2479.656	2480.348	≥ 0.5	PASS

22.1.2 Test Graphs





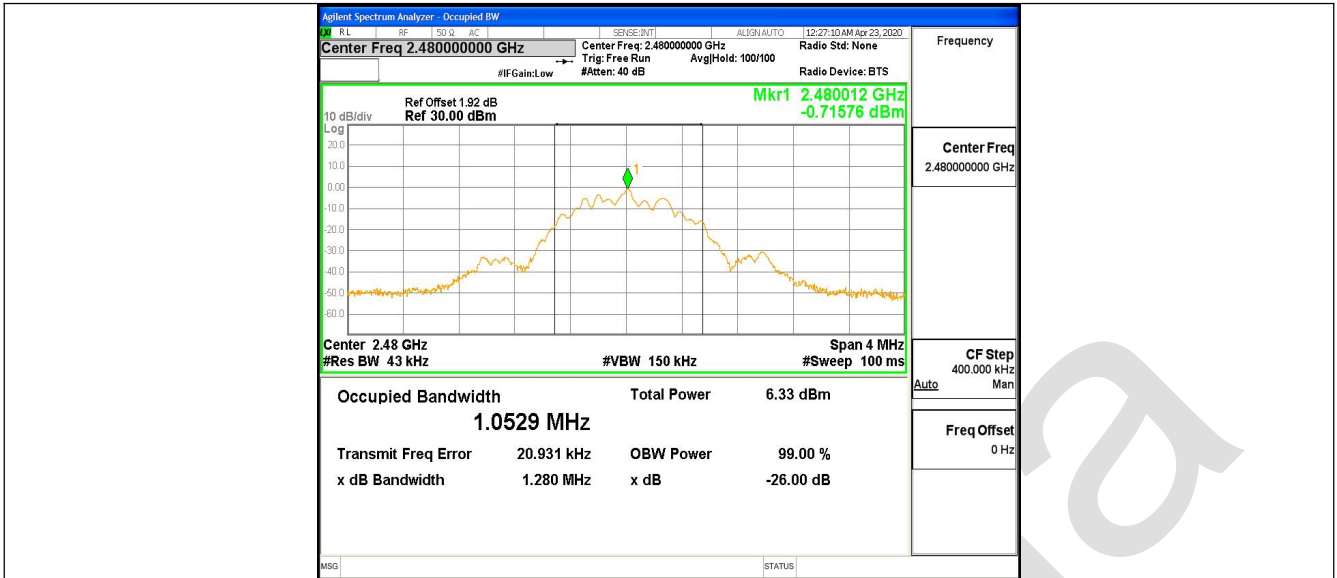
22.2 APPENDIXB: OCCUPIED CHANNEL BANDWIDTH

22.2.1 Test Result

TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE	Ant1	2402	1.0482	2401.497	2402.545	---	PASS
		2442	1.0512	2441.495	2442.546	---	PASS
		2480	1.0529	2479.494	2480.547	---	PASS

22.2.2 Test Graphs



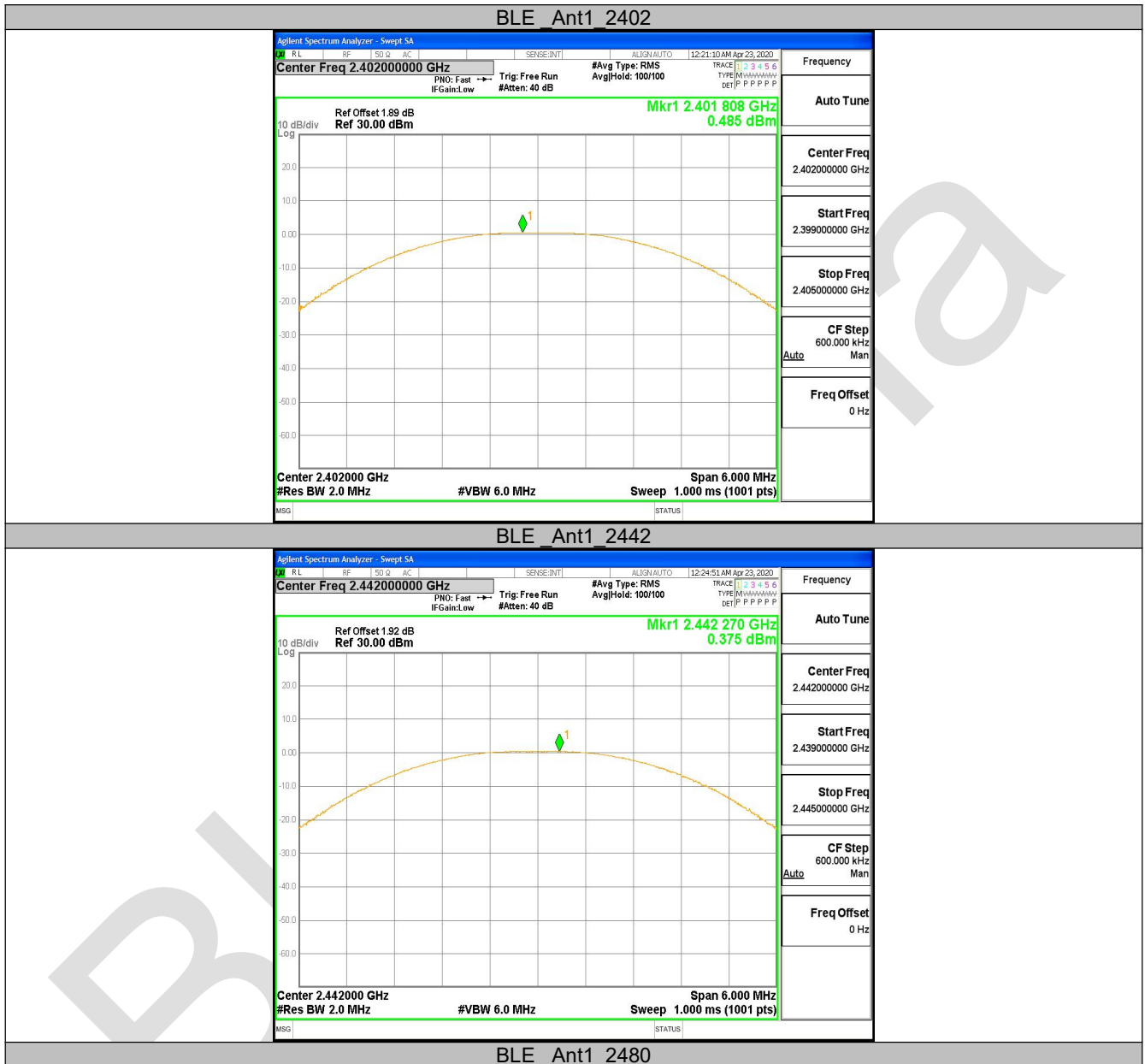


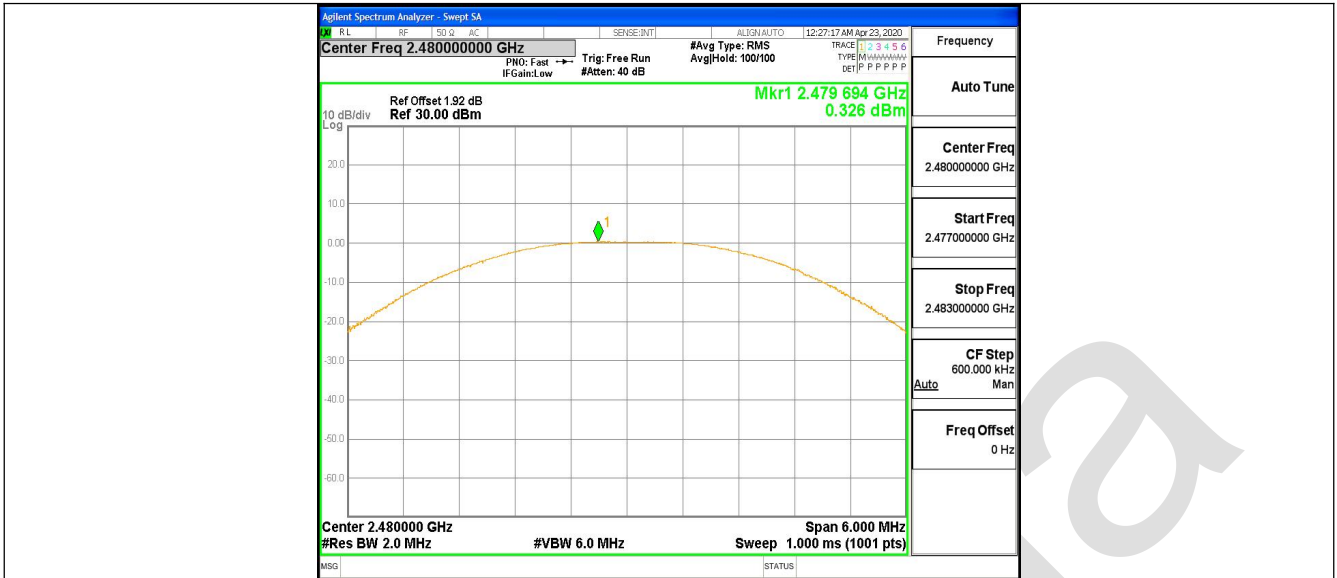
22.3 APPENDIXC: MAXIMUM CONDUCTED OUTPUT POWER

22.3.1 Test Result

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE	Ant1	2402	0.49	<=30	PASS
		2442	0.38	<=30	PASS
		2480	0.33	<=30	PASS

22.3.2 Test Graphs





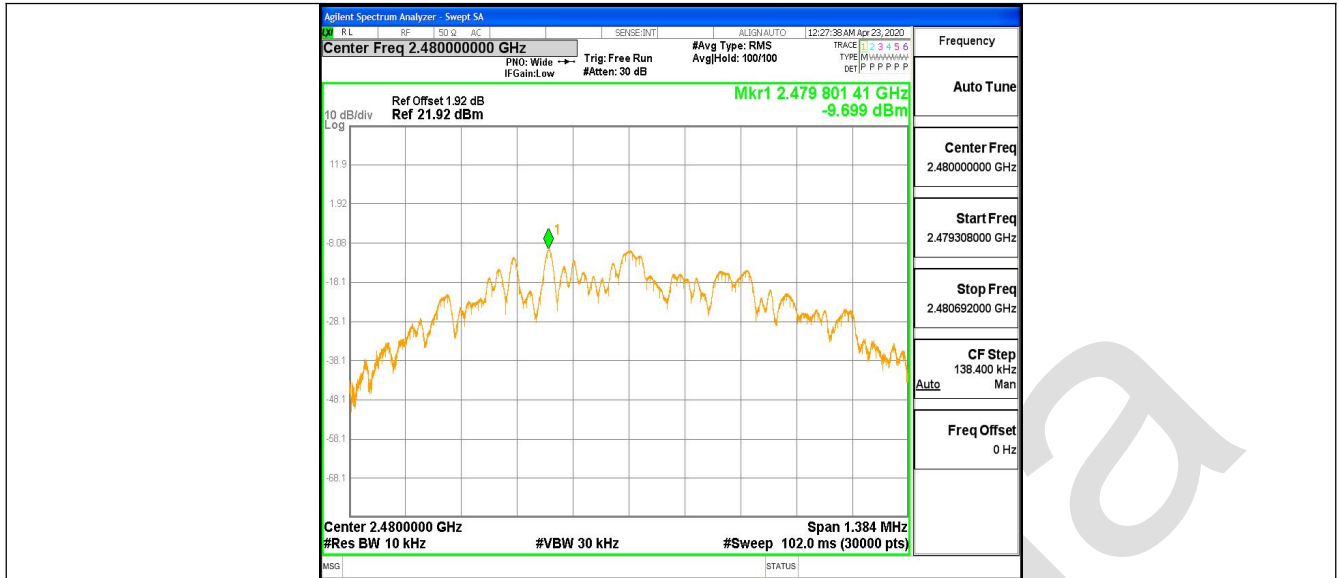
22.4 APPENDIXD: MAXIMUM POWER SPECTRAL DENSITY

22.4.1 Test Result

TestMode	Antenna	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
BLE	Ant1	2402	-9.44	<=8	PASS
		2442	-9.63	<=8	PASS
		2480	-9.7	<=8	PASS

22.4.2 Test Graphs





22.5 APPENDIXE: BAND EDGE MEASUREMENTS

22.5.1 Test Result

TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE	Ant1	Low	2402	0.23	-53.66	≤ -19.77	PASS
		High	2480	0.13	-53.64	≤ -19.87	PASS

22.5.2 Test Graphs



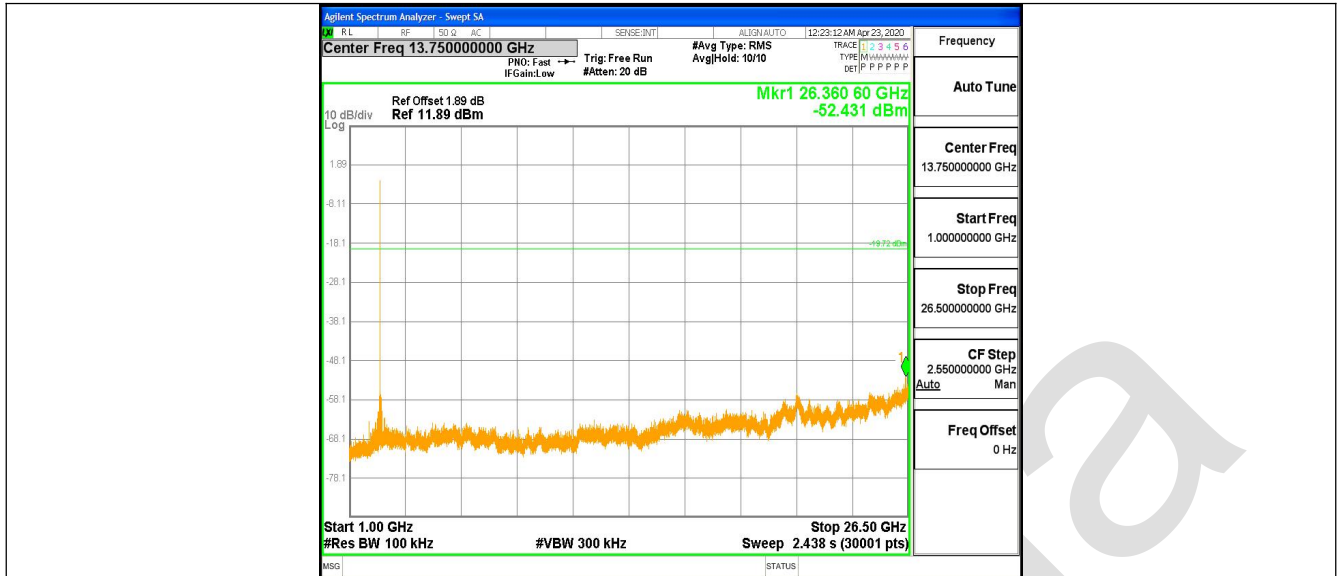
22.6 APPENDIXF:CONDUCTED SPURIOUSEMISSION

22.6.1 Test Result

TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE	Ant1	2402	Reference	0.28	0.28	---	PASS
			30~1000	30~1000	-67.171	<=-19.724	PASS
			1000~26500	1000~26500	-52.431	<=-19.724	PASS
		2442	Reference	0.16	0.16	---	PASS
			30~1000	30~1000	-67.437	<=-19.843	PASS
			1000~26500	1000~26500	-53.327	<=-19.843	PASS
		2480	Reference	-0.43	-0.43	---	PASS
			30~1000	30~1000	-67.706	<=-20.43	PASS
			1000~26500	1000~26500	-53.502	<=-20.43	PASS

22.6.2 Test Graphs

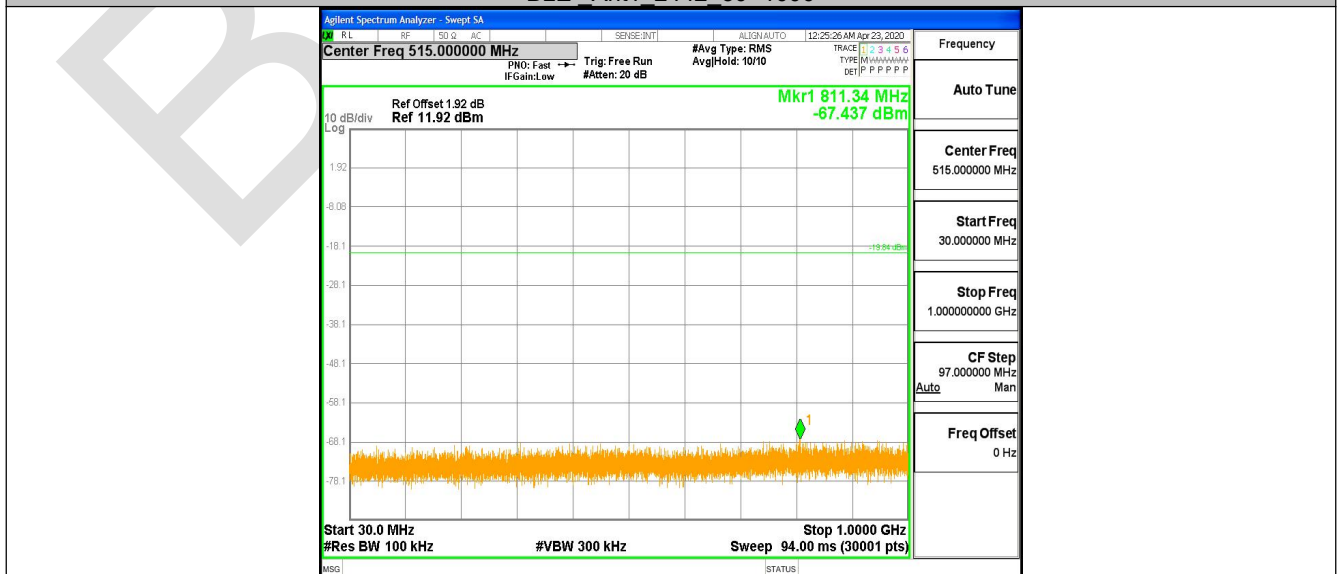




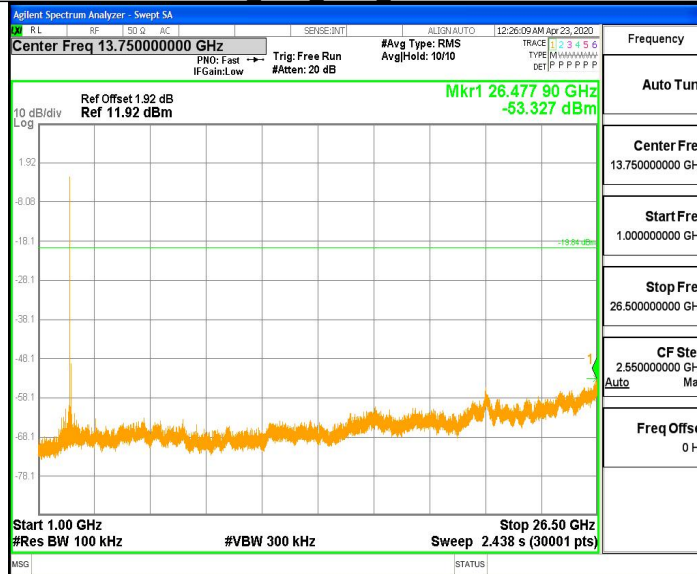
BLE_Ant1 2442 0~Reference



BLE_Ant1 2442 30~1000



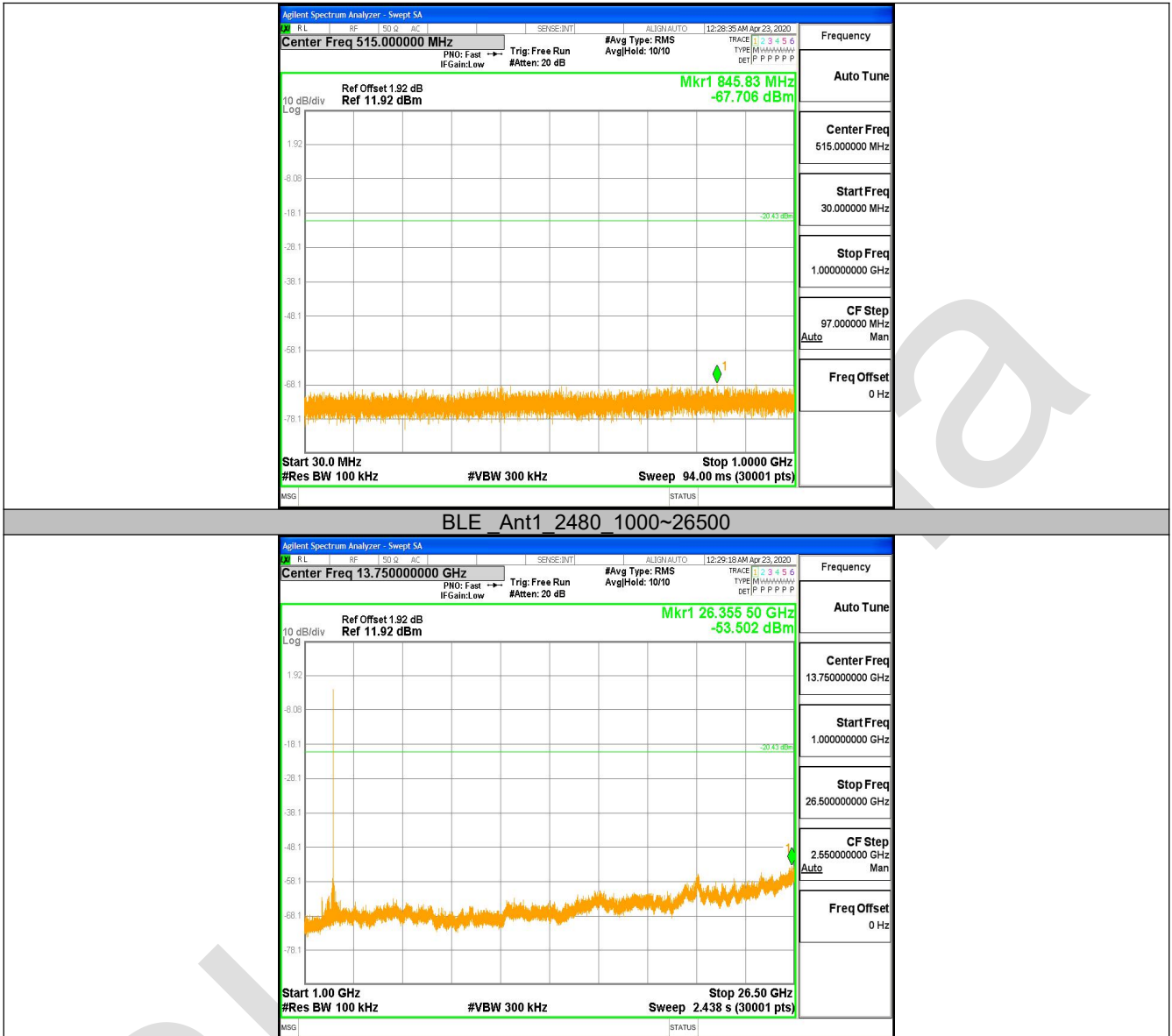
BLE_Ant1_2442_1000~26500



BLE_Ant1_2480_0~Reference

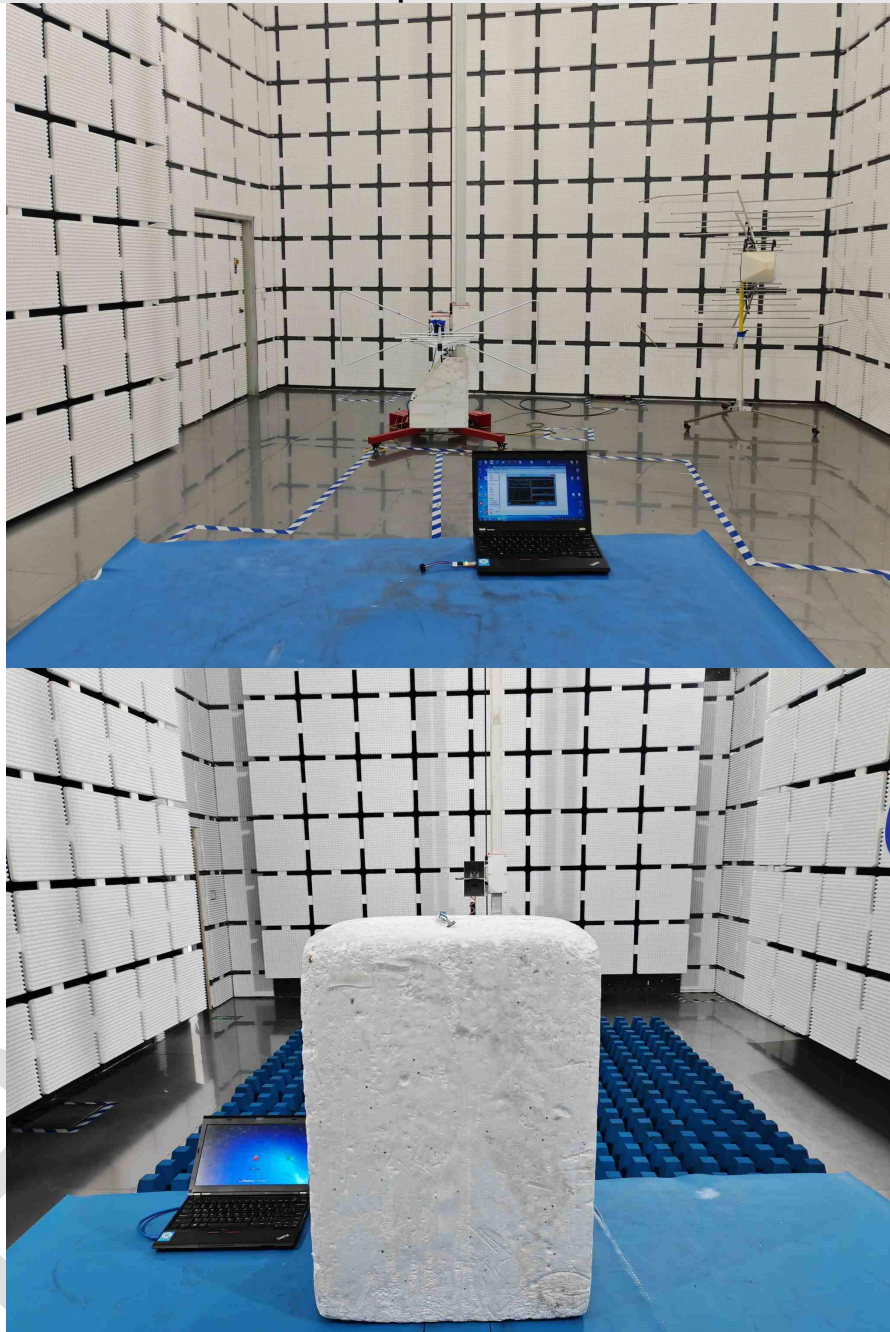


BLE_Ant1_2480_30~1000

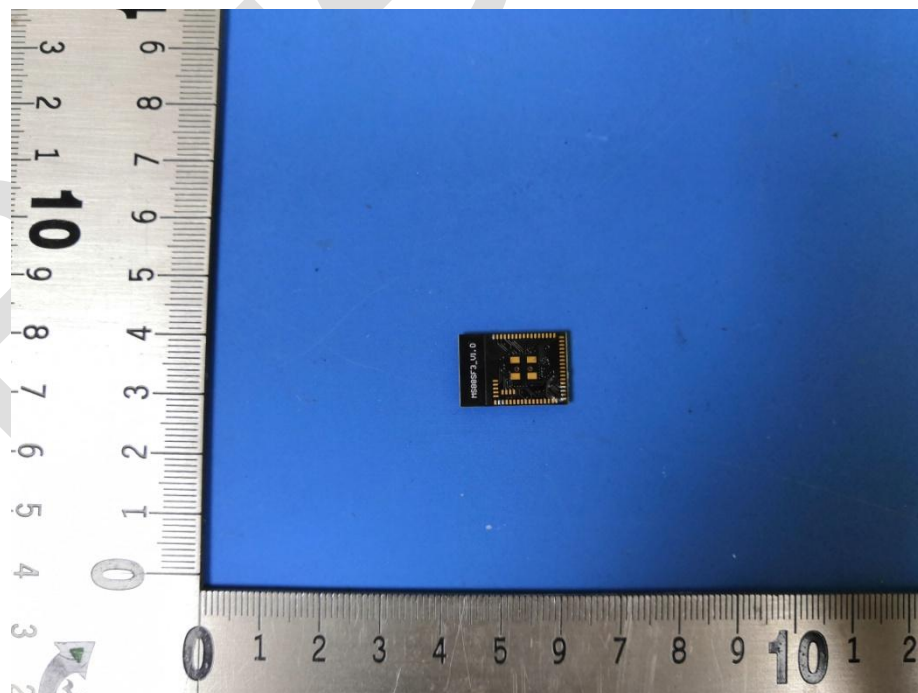
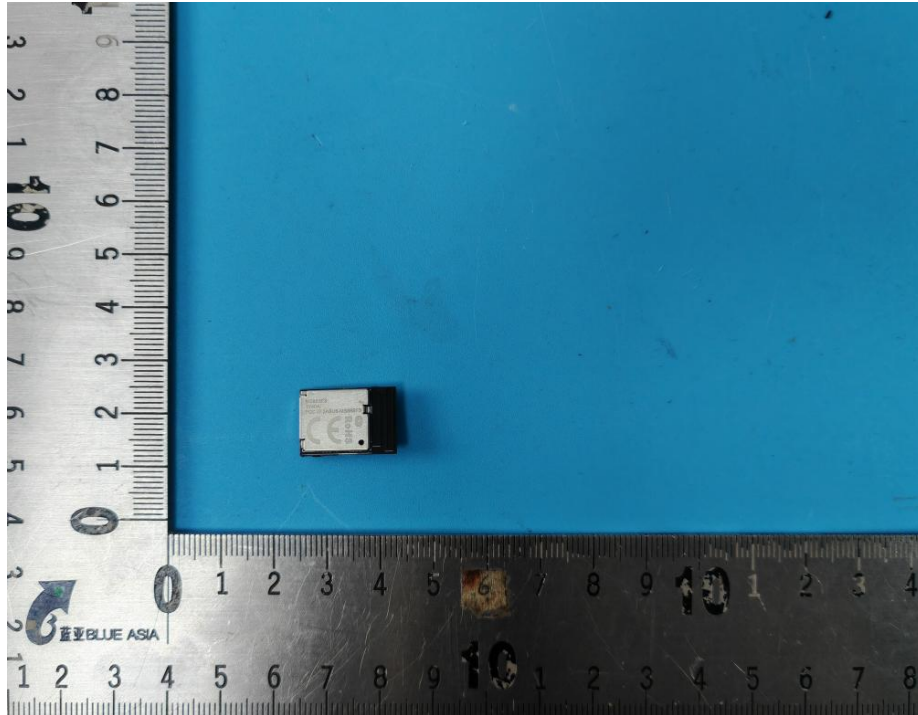


APPENDIX A: PHOTOGRAPHS OF TEST SETUP

Radiated Spurious Emissions

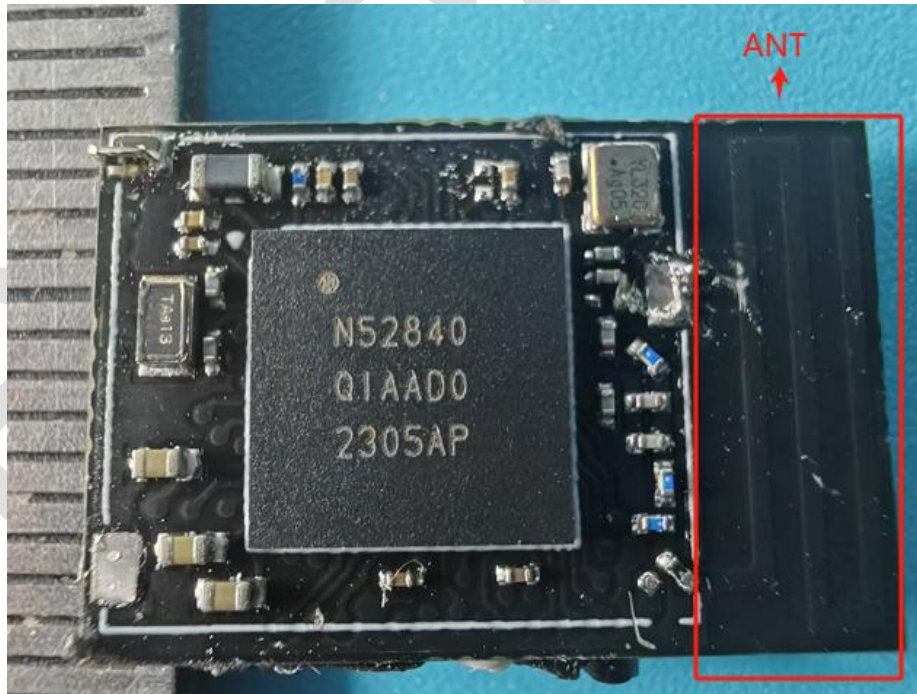


APPENDIX B: PHOTOGRAPHS OF EUT





ANT



----END OF REPORT----

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