

FCC RF Test Report

APPLICANT :	Xiaomi Communications Co., Ltd.
EQUIPMENT :	Mobile Phone
BRAND NAME :	Redmi
MODEL NAME :	24090RA29G
FCC ID :	2AFZZRA29G
STANDARD :	FCC Part 15 Subpart C §15.247
CLASSIFICATION :	(DTS) Digital Transmission System
TEST DATE(S) :	Jul. 18, 2024 ~ Jul. 28, 2024

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

JasonJia

Approved by: Jason Jia



Sporton International Inc. (Kunshan) No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR471506B	Rev. 01	Initial issue of report	Aug. 19, 2024



SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	≥ 0.5MHz	Pass	-
3.1	-	99% Bandwidth	-	Report only	-
3.2	15.247(b)(3)	Peak Output Power	≤ 30dBm	Pass	-
3.3	15.247(e)	Power Spectral Density	≤ 8dBm/3kHz	Pass	-
3.4	15.247(d)	Conducted Band Edges and Spurious Emission	≤ 20dBc	Pass	-
3.5	15.247(d)	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 13.80 dB at 2495.32 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 15.07 dB at 15.146 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	15.203 & 15.247(b)	Pass	-

Conformity Assessment Condition:

 The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.

2. The measurement uncertainty please refer to each test result in the section "Measurement Uncertainty"

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.



1 General Description

1.1 Applicant

Xiaomi Communications Co., Ltd.

#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085

1.2 Manufacturer

Xiaomi Communications Co., Ltd.

#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085

1.3 Product Feature of Equipment Under Test

Product Feature			
Equipment Mobile Phone			
Brand Name	Redmi		
Model Name	24090RA29G		
FCC ID 2AFZZRA29G			
IMEI Code Conducted: 861793070040843/8617930700408 IMEI Code Conduction: 861793070038664/86179307003860 Radiation: 861793070038607 Rediation: 861793070038607			
HW Version	135300O16		
SW Version Xiaomi HyperOS 1.0			
EUT Stage	Identical Prototype		

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification			
Tx/Rx Frequency Range	2402 MHz ~ 2480 MHz		
Number of Channels	40		
Carrier Frequency of Each Channel	40 Channel (37 hopping + 3 advertising channel)		
Maximum Output Power to Antenna	BLE 1Mbps: 7.33 dBm (0.0054 W)		
Maximum Output Fower to Antenna	BLE 2Mbps: 7.37 dBm (0.0055 W)		
99% Occupied Bandwidth	BLE 1Mbps: 1.035 MHz		
	BLE 2Mbps: 2.054 MHz		
Antenna Type / Gain	PIFA Antenna type with gain -1.6 dBi		
Type of Modulation	Bluetooth LE : GFSK		

Note: BLE 2M does not support CH00/CH12/CH39.

1.5 Modification of EUT

No modifications are made to the EUT during all test items.



1.6 Testing Location

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International Inc. (Kunshan)			
	No. 1098, Pengxi North Road, Kunshan Economic Development Zone			
Test Site Location	Jiangsu Province 215300 People's Republic of China			
	TEL : +86-512-57900158			
	Sporton Site No.	FCC Designation No.	FCC Test Firm	
Test Site No.	Sporton Site No.	FCC Designation No.	Registration No.	
Test one NU.	CO01-KS 03CH03-KS TH01-KS	CN1257	314309	

1.7 Test Software

ltem	Site	Manufacturer	Name	Version
1.	TH01-KS	Tonscend	JS1120-3 test system China_210602	3.3.10
2.	03CH03-KS	AUDIX	E3	210616
3.	CO01-KS	AUDIX	E3	6.2009-8-24

1.8 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 15 Subpart C §15.247
- FCC KDB 558074 D01 15.247 Meas Guidance v05r02
- ANSI C63.10-2013

Remark:

- 1. All test items were verified and recorded according to the standards and without any deviation during the test.
- 2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.



2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
	0	2402	21	2444
	1	2404	22	2446
	2	2406	23	2448
	3	2408	24	2450
	4	2410	25	2452
	5	2412	26	2454
	6	2414	27	2456
	7	2416	28	2458
	8	2418	29	2460
	9	2420	30	2462
2400-2483.5 MHz	10	2422	31	2464
	11	2424	32	2466
	12	2426	33	2468
	13	2428	34	2470
	14	2430	35	2472
	15	2432	36	2474
	16	2434	37	2476
	17	2436	38	2478
	18	2438	39	2480
	19	2440	-	-
	20	2442	-	-



2.2 Test Mode

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

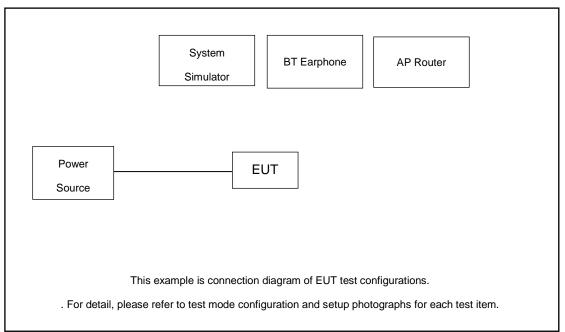
The following summary table is showing all test modes to demonstrate in compliance with the standard.

	Summary table of Test Cases
Toot Itom	Data Rate / Modulation
Test Item	Bluetooth – LE / GFSK
	Mode 1: Bluetooth Tx CH00_2402 MHz_BLE 1Mbps
	Mode 2: Bluetooth Tx CH19_2440 MHz_BLE 1Mbps
Conducted	Mode 3: Bluetooth Tx CH39_2480 MHz_BLE 1Mbps
TCs	Mode 4: Bluetooth Tx CH01_2404 MHz_BLE 2Mbps
	Mode 5: Bluetooth Tx CH19_2440 MHz_BLE 2Mbps
	Mode 6: Bluetooth Tx CH38_2478 MHz_BLE 2Mbps
	Mode 1: Bluetooth Tx CH00_2402 MHz_BLE 1Mbps
	Mode 2: Bluetooth Tx CH19_2440 MHz_BLE 1Mbps
Radiated	Mode 3: Bluetooth Tx CH39_2480 MHz_BLE 1Mbps
TCs	Mode 4: Bluetooth Tx CH01_2404 MHz_BLE 2Mbps
	Mode 5: Bluetooth Tx CH19_2440 MHz_BLE 2Mbps
	Mode 6: Bluetooth Tx CH38_2478 MHz_BLE 2Mbps
AC	
Conducted	Mode 1: GSM 850 Idle + Bluetooth Link + WLAN Link (2.4G) + USB Cable 3 + Adapter 3
Emission	
Remark: For R	Radiated Test Cases, The tests were performance with Adapter and USB Cable.

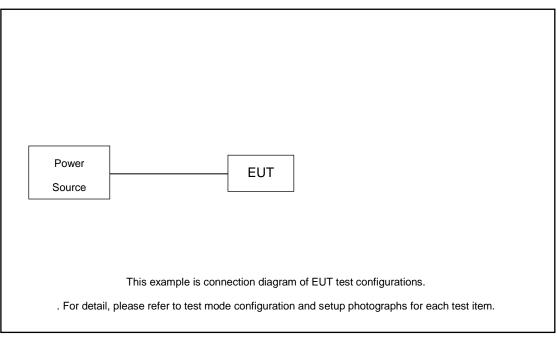


2.3 Connection Diagram of Test System

AC Conducted Emission:



Radiated Emission:



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Earphone	Lenovo	thinkplus-BH3	N/A	N/A	N/A
2.	LTE Base Station	Anritus	MT8821C	N/A	N/A	Unshielded,1.8m
3.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	shielded cable DC O/P 1.8m , Unshielded AC I/P cable 1.8m
4.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded,1.8m

2.5 EUT Operation Test Setup

For BLE function, the engineering test program was provided and enabled to make EUT continuous transmit.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 12.26 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 12.26 + 10 = 22.26 (dB)



3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

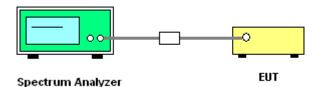
3.1.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.1.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 11.8
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
- 5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1% to 5% of the 99% OBW and the VBW is set to 3 times of the RBW.
- 6. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of 6dB and 99% Occupied Bandwidth



3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna of directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

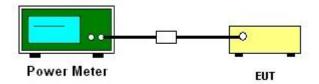
3.2.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.2.3 Test Procedures

- The testing follows the Measurement Procedure of ANSI C63.10-2013 clause 11.9.1.3 PKPM1 Peak power meter or ANSI C63.10-2013 clause 11.9.2.3.1 Method AVGPM method.
- 2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Peak Output Power

Please refer to Appendix A.

3.2.6 Test Result of Average Output Power (Reporting Only)



3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

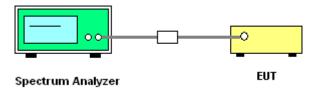
3.3.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.3.3 Test Procedures

- 1. The testing follows Measurement Procedure of ANSI C63.10-2013 clause 11.10.2 Method PKPSD.
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz.
 Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
- 5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
- 6. Measure and record the results in the test report.
- 7. The Measured power density (dBm)/ 100kHz is a reference level and used as 20dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density



3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission

All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band.

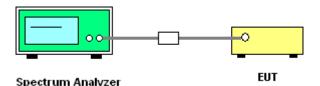
3.4.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.4.3 Test Procedure

- 1. The testing follows ANSI C63.10-2013 clause 11.13
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
- 5. Measure and record the results in the test report.
- 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup



3.4.5 Test Result of Conducted Band Edges Plots

Please refer to Appendix A.

3.4.6 Test Result of Conducted Spurious Emission Plots



3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

Frequency	Field Strength	Measurement Distance
(MHz)	(microvolts/meter)	(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

3.5.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.



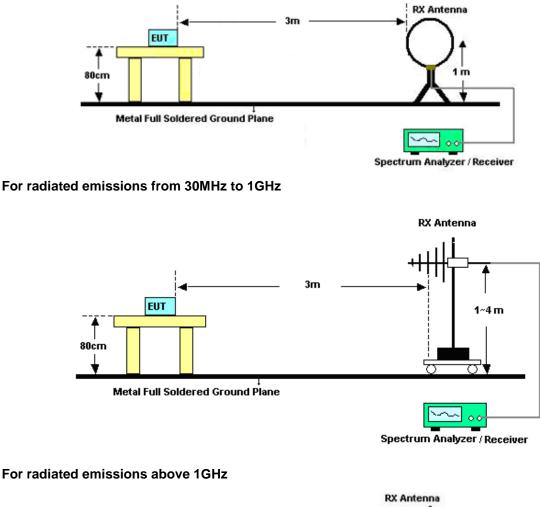
3.5.3 Test Procedures

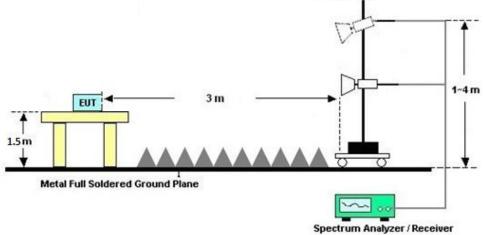
- 1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
- 2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
- 3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
- 4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- 5. Corrected Reading: Antenna Factor + Cable Loss + Read Level Preamp Factor = Level
- 6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
- 7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- 8. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $f \ge 1$ GHz for peak measurement. For average measurement:
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.



3.5.4 Test Setup

For radiated emissions below 30MHz





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3.5.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

3.5.7 Duty Cycle

Please refer to Appendix D.

3.5.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)



3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, 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 of emission (MHz)	Conducted limit (dBµV)				
Frequency of emission (MHZ)	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.

3.6.2 Measuring Instruments

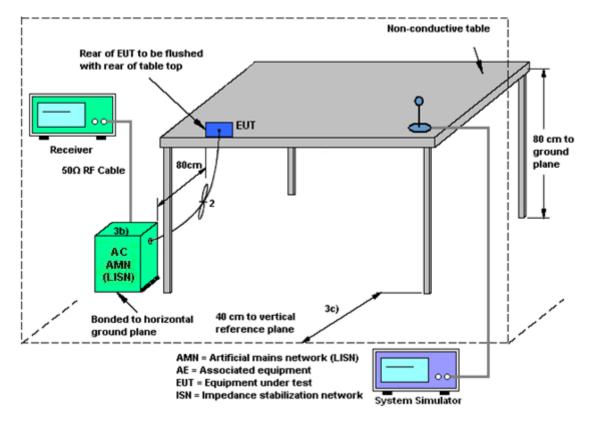
The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.6.3 Test Procedures

- 1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- 2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- 3. All the support units are connecting to the other LISN.
- 4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- 5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
- 6. Both sides of AC line were checked for maximum conducted interference.
- 7. The frequency range from 150 kHz to 30 MHz was searched.
- Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.



3.6.4 Test Setup



3.6.5 Test Result of AC Conducted Emission



3.7 Antenna Requirements

3.7.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EMI Test Receiver	Keysight	N9038A	MY564000 04	3Hz~8.5GHz;M ax 30dBm	Oct. 11, 2023	Jul. 18, 2024	Oct. 10, 2024	Radiation (03CH03-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY553705 28	10Hz-44GHz	Oct. 11, 2023	Jul. 18, 2024	Oct. 10, 2024	Radiation (03CH03-KS)
Loop Antenna	R&S	HFH2-Z2E	101125	9kHz~30MHz	Sep. 11, 2023	Jul. 18, 2024	Sep. 10, 2024	Radiation (03CH03-KS)
Bilog Antenna	TeseQ	CBL6112D	23182	30MHz-1GHz	Dec. 06, 2023	Jul. 18, 2024	Dec. 05, 2024	Radiation (03CH03-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	75957	1GHz~18GHz	Oct. 23, 2023	Jul. 18, 2024	Oct. 22, 2024	Radiation (03CH03-KS)
SHF-EHF Horn	com-power	AH-840	101115	18GHz~40GHz	Oct. 15, 2023	Jul. 18, 2024	Oct. 14, 2024	Radiation (03CH03-KS)
Amplifier	SONOMA	310N	413740	30MHz ~1000MHz	Jan. 03, 2024	Jul. 18, 2024	Jan. 02, 2025	Radiation (03CH03-KS)
Amplifier	EM	EM18G40GA	060851	18~40GHz	Jan. 03, 2024	Jul. 18, 2024	Jan. 02, 2025	Radiation (03CH03-KS)
high gain Amplifier	MITEQ	AMF-7D-0010 1800-30-10P	2082394	1Ghz-18Ghz	Jan. 03, 2024	Jul. 18, 2024	Jan. 02, 2025	Radiation (03CH03-KS)
Amplifier	Keysight	83017A	MY532703 19	1GHz~26.5GHz	Oct. 11, 2023	Jul. 18, 2024	Oct. 10, 2024	Radiation (03CH03-KS)
AC Power Source	Chroma	61601	F1040900 04	N/A	NCR	Jul. 18, 2024	NCR	Radiation (03CH03-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Jul. 18, 2024	NCR	Radiation (03CH03-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Jul. 18, 2024	NCR	Radiation (03CH03-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr 18, 2024	Jul. 28, 2024	Apr 17, 2025	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 11, 2023	Jul. 28, 2024	Oct. 10, 2024	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	Apr 18, 2024	Jul. 28, 2024	Apr 17, 2025	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP00000 0811	AC 0V~300V, 45Hz~1000Hz	Oct. 11, 2023	Jul. 28, 2024	Oct. 10, 2024	Conduction (CO01-KS)
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Oct. 11, 2023	Jul. 19, 2024	Oct. 10, 2024	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GH z	Jan. 02, 2024	Jul. 19, 2024	Jan. 01, 2025	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 02, 2024	Jul. 19, 2024	Jan. 01, 2025	Conducted (TH01-KS)

NCR: No Calibration Required



5 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Measurement

Conducted Spurious Emission & Bandedge	±2.22 dB
Occupied Channel Bandwidth	±0.1%
Conducted Power	±0.50 dB
Conducted Power Spectral Density	±0.90 dB
Frequency	0.04ppm

Uncertainty of AC Conducted Emission Measurement (0.15 MHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence	2.84 dB
of 95% (U = 2Uc(y))	2.04 UB

Uncertainty of Radiated Emission Measurement (9 KHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence	3.30 dB
of 95% (U = 2Uc(y))	3.30 dB

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence	6.08 dB
of 95% (U = 2Uc(y))	0.08 UB

Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.18 dB
--	---------

Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence	5.22 dB
of 95% (U = 2Uc(y))	5.22 UB

----- THE END ------



Appendix A. Conducted Test Results



Ambient Condition: <u>25</u> ℃, <u>45</u> %RH

Test Date: 2024/7/19

Test Engineer: _albert shi

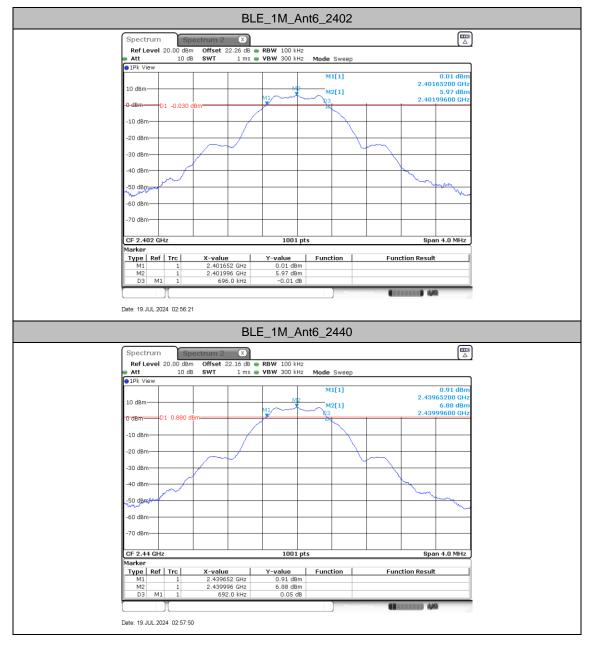
DTS Bandwidth

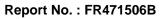
Test Result

TestMode	Antenna	Freq(MHz)	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
		2402	0.70	2401.65	2402.35	0.5	PASS
BLE_1M Ant6	2440	0.69	2439.65	2440.34	0.5	PASS	
	2480	0.69	2479.66	2480.34	0.5	PASS	
		2404	1.18	2403.42	2404.59	0.5	PASS
BLE_2M Ant6	Ant6	2440	1.18	2439.41	2440.59	0.5	PASS
		2478	1.18	2477.42	2478.59	0.5	PASS



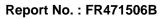
Test Graphs



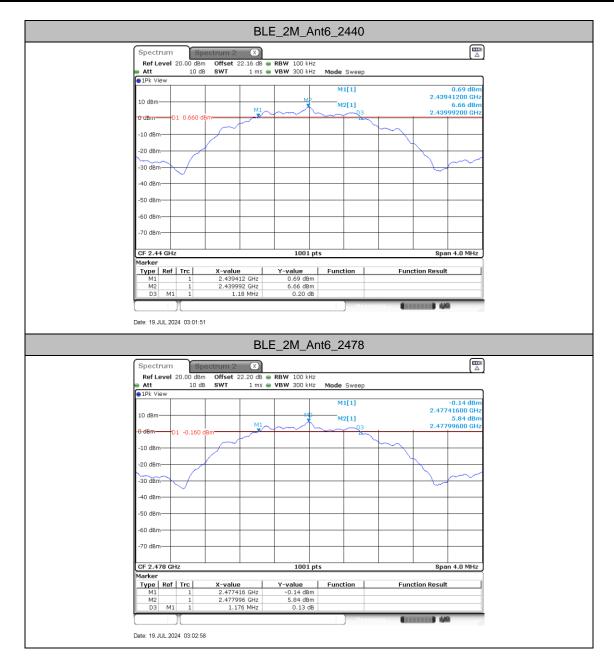














Occupied Channel Bandwidth

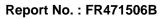
Test Result

TestMode	Antenna	Freq(MHz)	OCB [MHz]	FL[MHz]	FH[MHz]
		2402	1.035	2401.4925	2402.5275
BLE_1M	Ant6	2440	1.035	2439.4925	2440.5275
		2480	1.035	2479.4925	2480.5275
		2404	2.054	2402.9930	2405.0470
BLE_2M Ant6	Ant6	2440	2.054	2438.9930	2441.0470
		2478	2.05	2476.9970	2479.0470



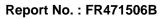
Test Graphs



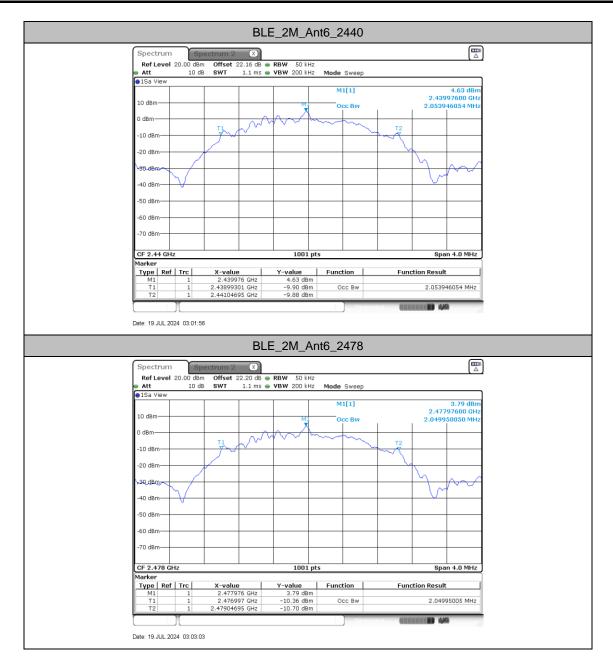














Maximum conducted output power

Test Result Peak

TestMode	Antenna	CH.	Peak Conducted Power (dBm)	Conducted Power Limit	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit	Pass/Fail
		0	6.49	30.00	-1.6	4.89	36.00	Pass
BLE1M	Ant6	19	7.33	30.00	-1.6	5.73	36.00	Pass
		39	6.31	30.00	-1.6	4.71	36.00	Pass
		01	6.55	30.00	-1.6	4.95	36.00	Pass
BLE2M	Ant6	19	7.37	30.00	-1.6	5.77	36.00	Pass
		38	6.49	30.00	-1.6	4.89	36.00	Pass

Test Result Average (Reference only)

TestMode	Antenna	CH.	Duty Factor (dB)	Average Conducted Power (dBm)
		0	2.17	6.25
BLE1M	Ant6	19	2.17	6.91
		39	2.17	6.06
		01	5.02	6.09
BLE2M	Ant6	19	5.02	7.06
		38	5.02	6.04



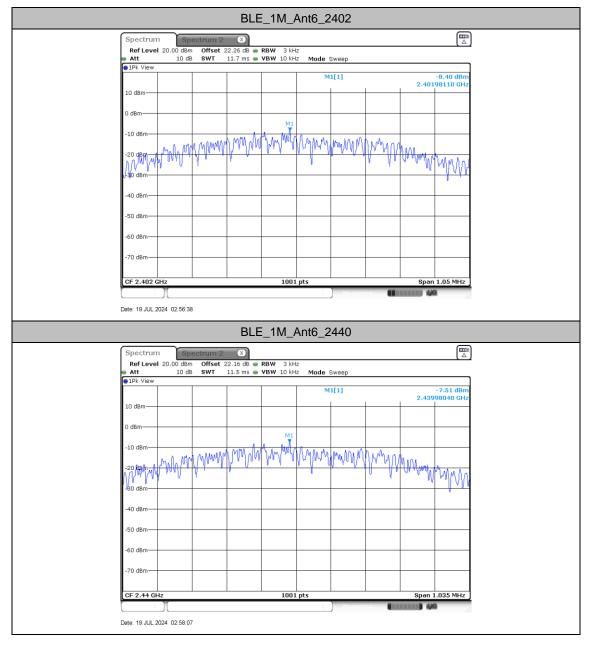
Maximum power spectral density

Test Result

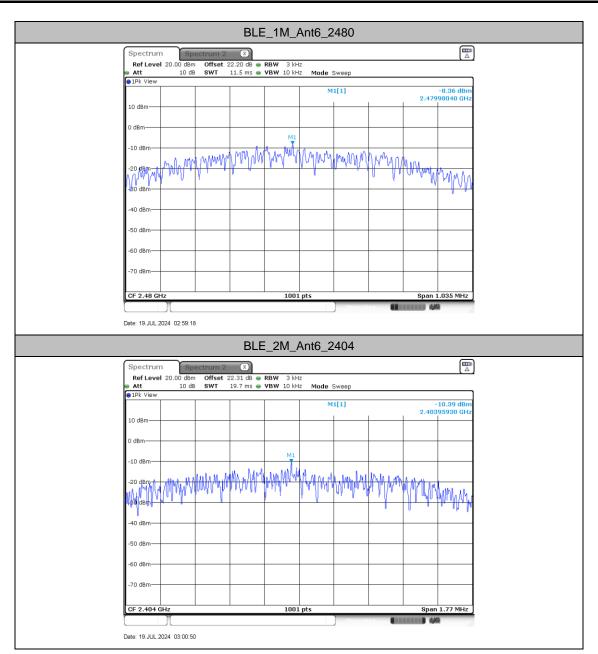
TestMode	Antenna	Freq(MHz)	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant6	2402	-8.4	≤8.00	PASS
		2440	-7.51	≤8.00	PASS
		2480	-8.36	≤8.00	PASS
BLE_2M	Ant6	2404	-10.39	≤8.00	PASS
		2440	-9.66	≤8.00	PASS
		2478	-10.51	≤8.00	PASS



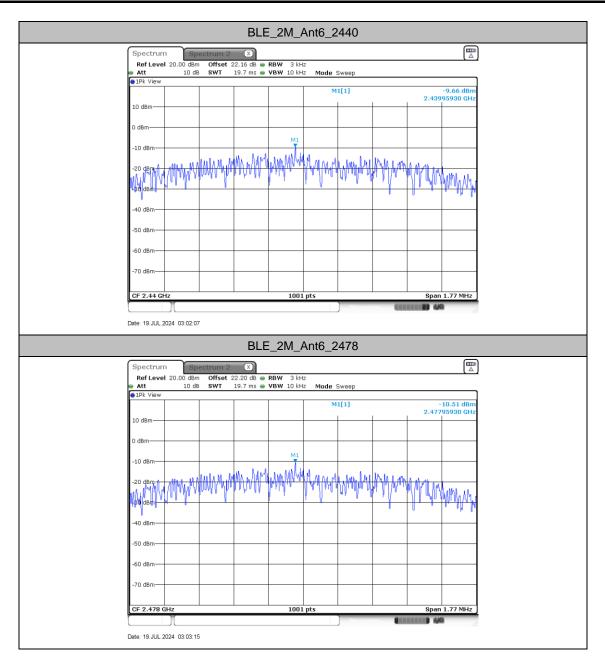
Test Graphs













Reference level measurement

Test Result

TestMode	Antenna	Freq(MHz)	Max.Point[MHz]	Result[dBm/100KHz]
		2402	2402.00	5.96
BLE_1M	Ant6	2440	2440.00	6.85
		2480	2480.00	5.98
		2404	2403.99	5.91
BLE_2M	Ant6	2440	2439.99	6.64
		2478	2477.99	5.81



Test Graphs













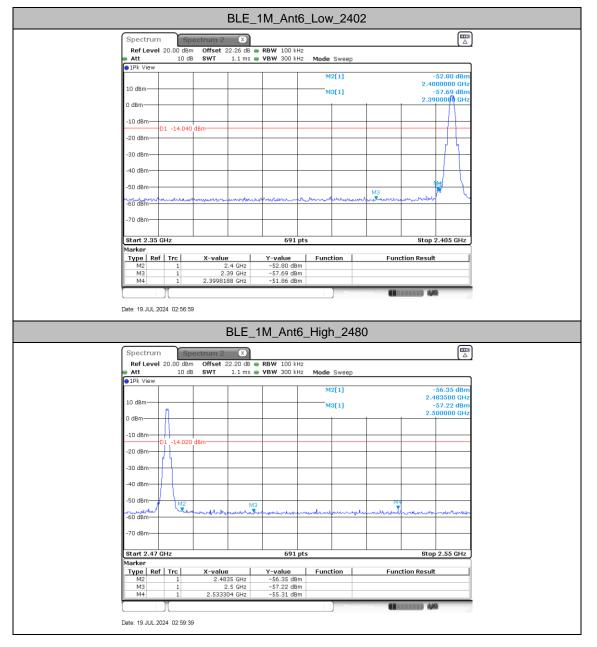
Band edge measurements

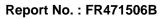
Test Result

TootModo	Antonno	Chlome		RefLevel	Result	Limit	Verdict	
TestMode Antenn	Antenna	a ChName	Freq(MHz)	[dBm/100KHz]	[dBm/100KHz]	[dBm/100KHz]	verdict	
	Ant6	Low	2402	5.96	-51.86	≤-14.04	PASS	
BLE_1M	Anto	High	2480	5.98	-55.31	≤-14.02	PASS	
BLE_2M Ant6	Ante	Low	2404	5.91	-52.4	≤-14.09	PASS	
	Anto	High	2478	5.81	-55.76	≤-14.19	PASS	

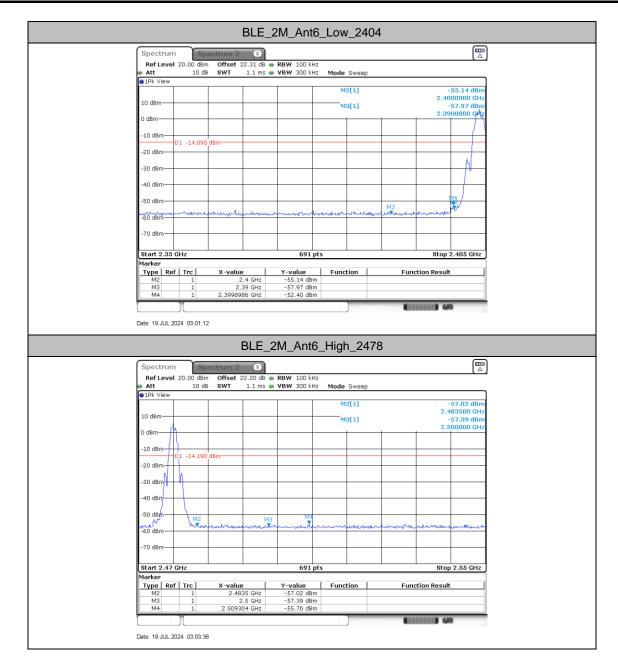


Test Graphs











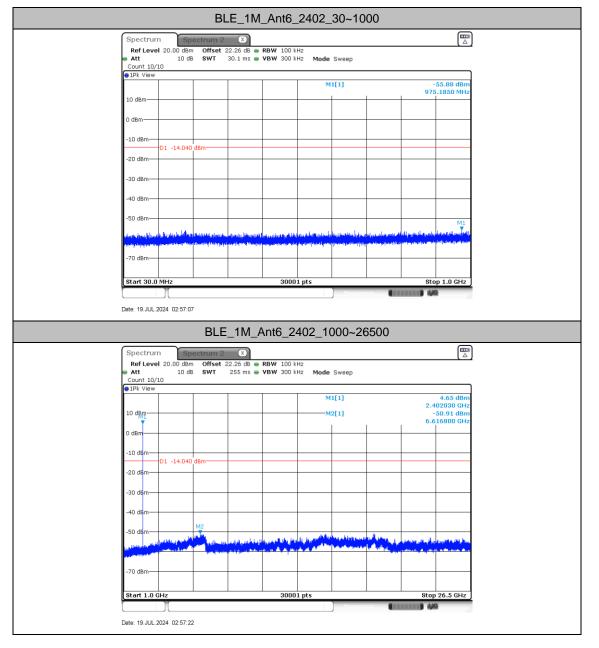
Conducted Spurious Emission

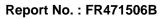
Test Result

TaatMada	Antonno		FreqRange	RefLevel	Result	Limit	Verdict	
TestMode	Antenna	Freq(MHz)	[MHz]	[dBm/100KHz]	[dBm/100KHz]	[dBm/100KHz]	verdict	
		2402	30~1000	5.96	-55.88	≤-14.04	PASS	
		2402	1000~26500	5.96	-50.91	≤-14.04	PASS	
BLE 1M	Ant6	2440	30~1000	6.85	-55.2	≤-13.15	PASS	
	Anto	2440	1000~26500	6.85	-49.34	≤-13.15	PASS	
		2480	30~1000	5.98	-55.91	≤-14.02	PASS	
		2400	1000~26500	5.98	-49.05	≤-14.02	PASS	
		2404	30~1000	5.91	-55.88	≤-14.09	PASS	
		2404	1000~26500	5.91	-49.51	≤-14.09	PASS	
BLE 2M	Ant6	2440	30~1000	6.64	-56.23	≤-13.36	PASS	
DLC_2IVI	Anto	2440	1000~26500	6.64	-50.55	≤-13.36	PASS	
		2478	30~1000	5.81	-55.78	≤-14.19	PASS	
		2470	1000~26500	5.81	-50.79	≤-14.19	PASS	

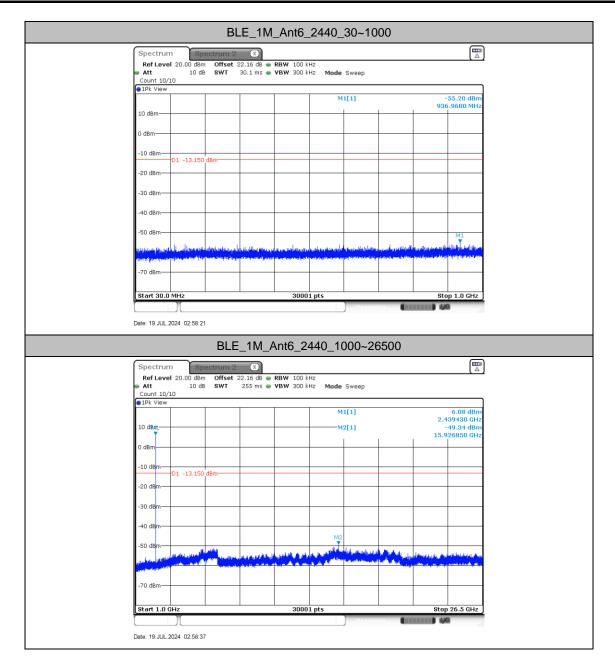


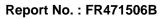
Test Graphs



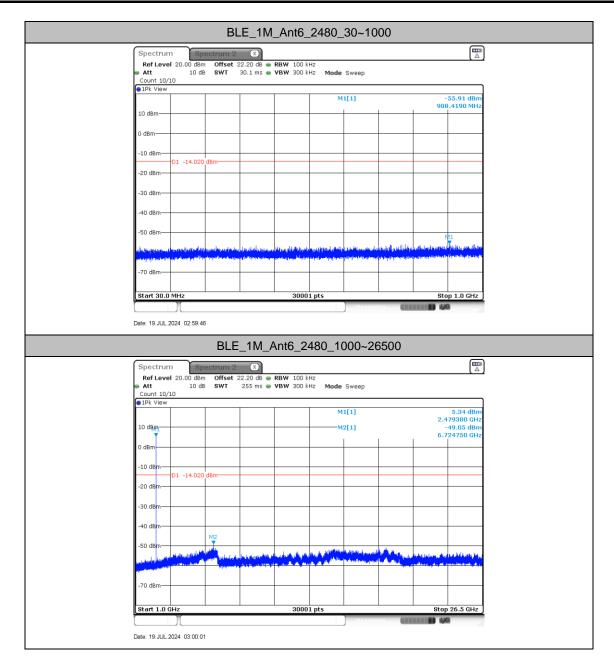


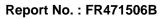




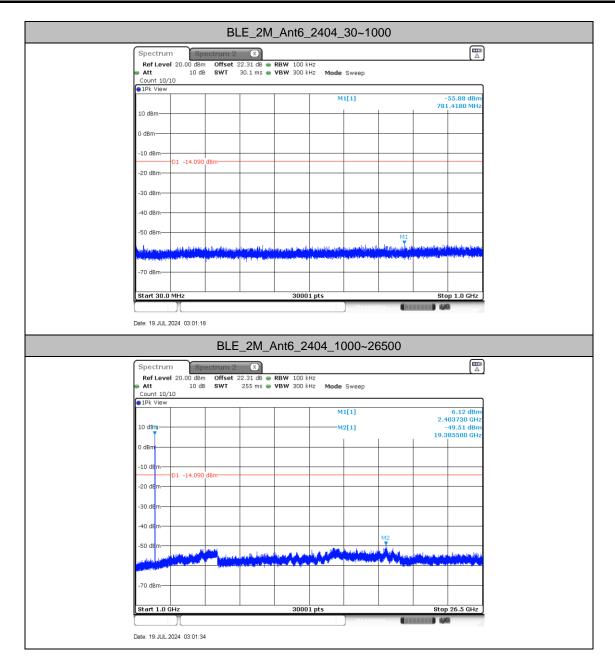


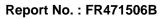




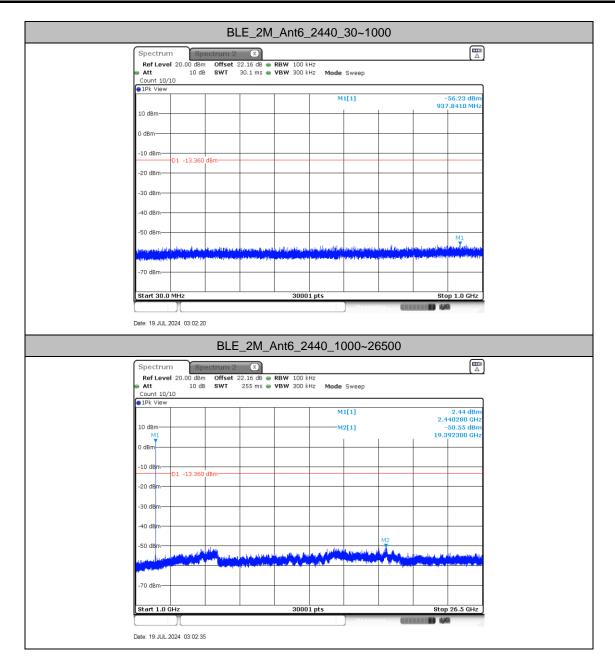


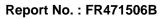




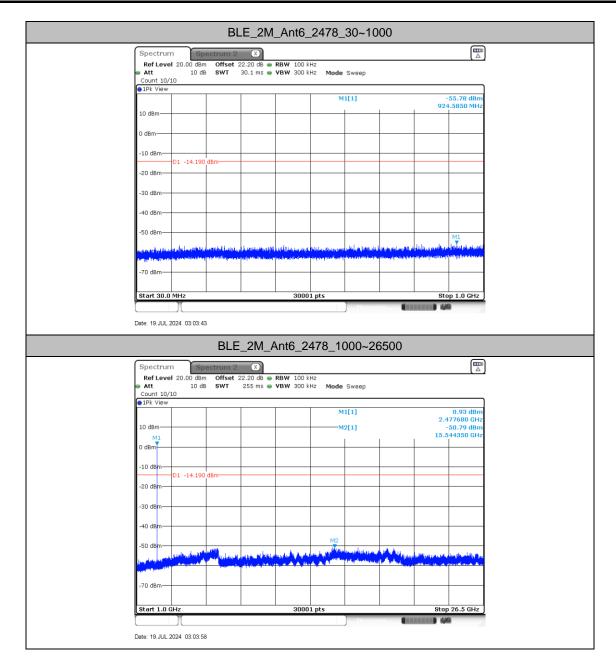










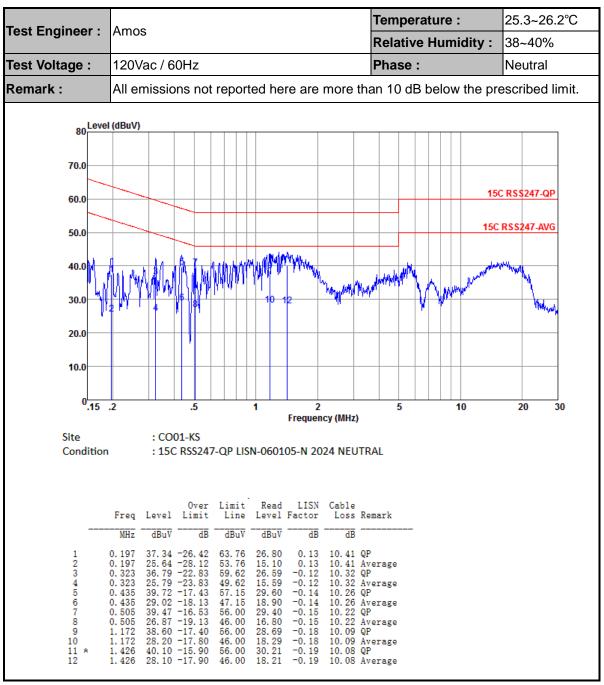




Appendix B. AC Conducted Emission Test Results

Toot Engineer .	Amon	Temperature :	25.3~26.2°C	
Test Engineer :	Amos	Relative Humidity :	38~40%	
Test Voltage :	120Vac / 60Hz	Phase :	Line	
Remark :	All emissions not reported here are more th	an 10 dB below the pre	escribed limit.	
80 Level	(dBuV)			
70.0				
60.0			CRS\$247-QP	
50.0			RSS247-AVG	
40.0	A N N MARAMANA MANAGAMANA	And Mary Marking and Ma	2	
30.0		r Duri H.	- hund	
20.0				
10.0				
0.15	2 .5 1 2 Frequency (MHz)	5 10	20 30	
Site Condition	: CO01-KS			
	Over Limit Read LISN Cable Freq Level Limit Line Level Factor Loss R	emark		
	MHz dBuV dB dBuV dBuV dB dB			
2 3 5 6 7 8 9 10	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	verage p p verage p verage p verage p		





Note:

- 1. Level(dB μ V) = Read Level(dB μ V) + LISN Factor(dB) + Cable Loss(dB)
- 2. Over $Limit(dB) = Level(dB\mu V) Limit Line(dB\mu V)$





Appendix C. Radiated Spurious Emission Test Data

Test Engineer : Jake zhou	lake zhou	Relative Humidity :	52~56%
		Temperature :	22~25 ℃

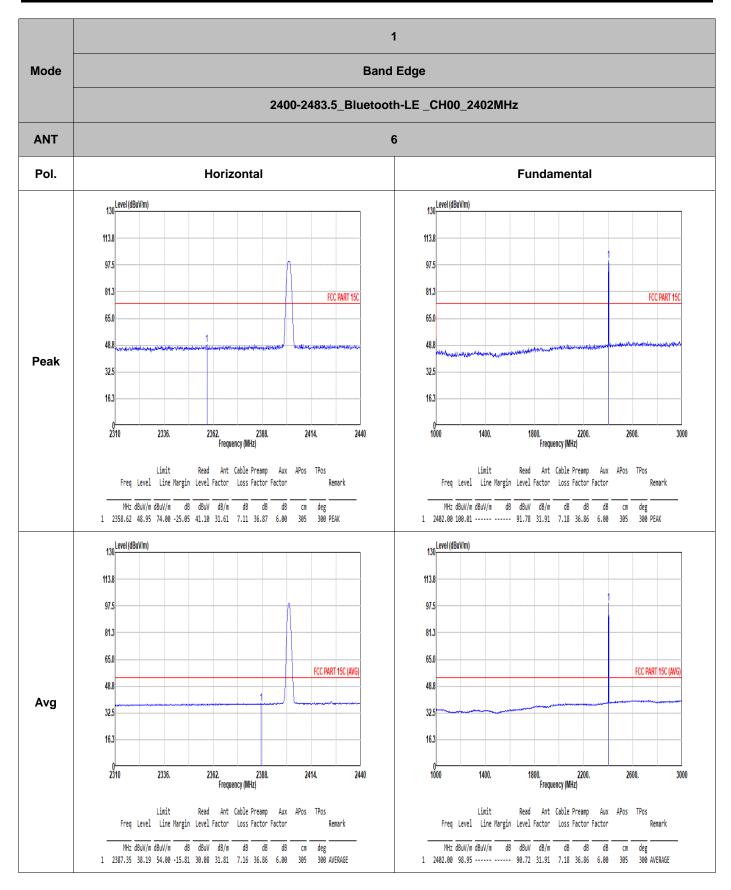
Radiated Spurious Emission Test Modes

Mode	Band (MHz)	Antenna	Modulation	Channel	Frequency	Data Rate	RU	Remark
Mode 1	2400-2483.5	6	Bluetooth-LE	00	2402	1Mbps	-	-
Mode 2	2400-2483.5	6	Bluetooth-LE	19	2440	1Mbps	-	-
Mode 3	2400-2483.5	6	Bluetooth-LE	39	2480	1Mbps	-	-
Mode 4	2400-2483.5	6	Bluetooth-LE	01	2404	2Mbps	-	-
Mode 5	2400-2483.5	6	Bluetooth-LE	19	2440	2Mbps	-	-
Mode 6	2400-2483.5	6	Bluetooth-LE	38	2478	2Mbps	-	-

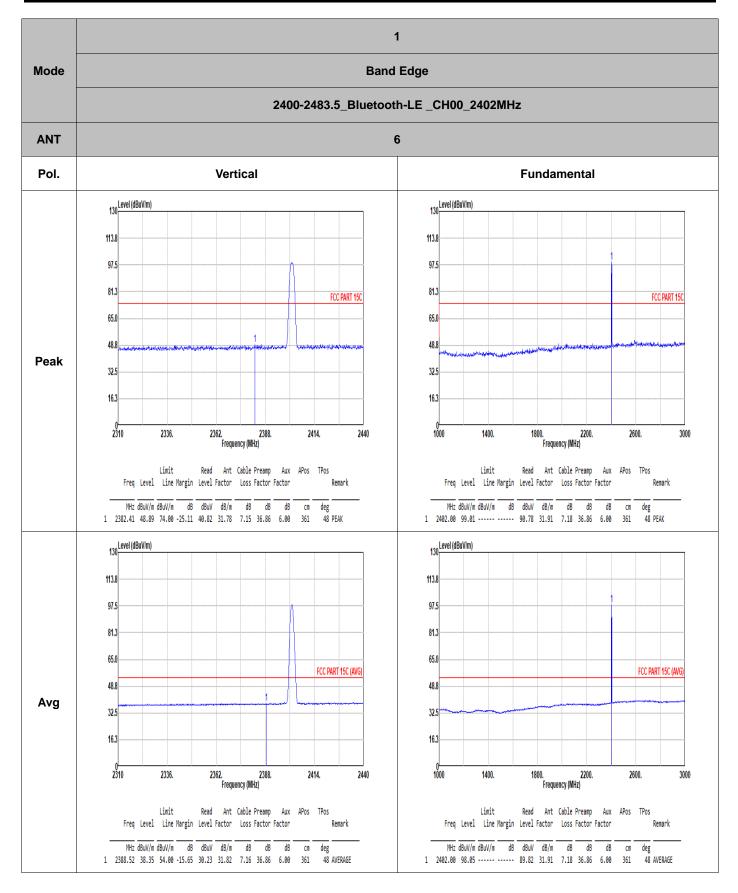
Summary of each worse mode

Mode	Modulation	Ch.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	Remark
1	Bluetooth-LE	00	2388.52	38.35	54.00	-15.65	V	AVERAGE	Pass	Band Edge
1	Bluetooth-LE	00	4804.00	41.20	74.00	-32.80	Н	PEAK	Pass	Harmonic
2	Bluetooth-LE	19	-	-	-	-	-	-	-	Band Edge
2	Bluetooth-LE	19	7320.00	41.89	74.00	-32.11	V	PEAK	Pass	Harmonic
3	Bluetooth-LE	39	2483.56	39.28	54.00	-14.72	Н	AVERAGE	Pass	Band Edge
3	Bluetooth-LE	39	4960.00	42.41	74.00	-31.59	V	PEAK	Pass	Harmonic
4	Bluetooth-LE	01	2383.19	39.24	54.00	-14.76	Н	AVERAGE	Pass	Band Edge
4	Bluetooth-LE	01	4808.00	41.21	74.00	-32.79	Н	PEAK	Pass	Harmonic
5	Bluetooth-LE	19	-	-	-	-	-	-	-	Band Edge
5	Bluetooth-LE	19	7320.00	42.78	74.00	-31.22	Н	PEAK	Pass	Harmonic
6	Bluetooth-LE	38	2495.32	40.20	54.00	-13.80	Н	AVERAGE	Pass	Band Edge
6	Bluetooth-LE	38	4956.00	42.05	74.00	-31.95	Н	PEAK	Pass	Harmonic

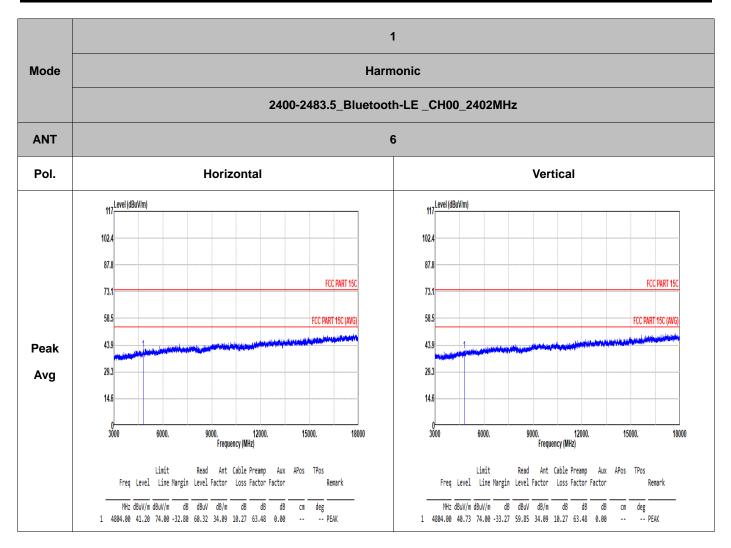




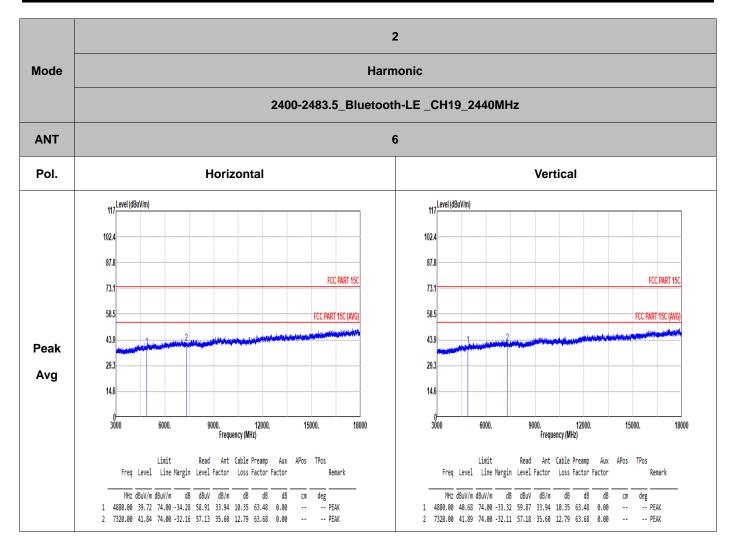




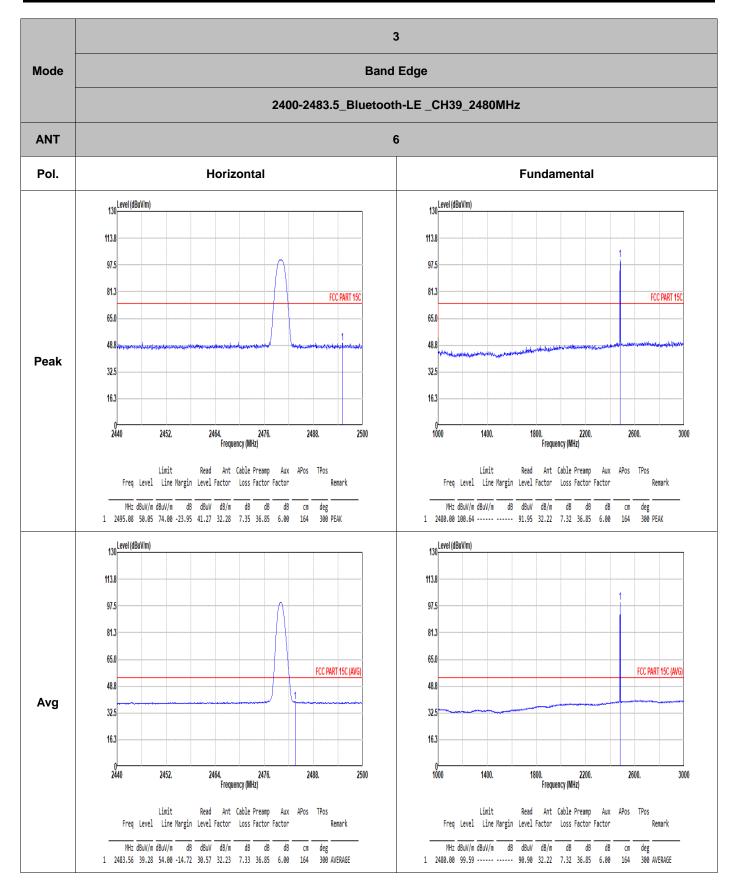




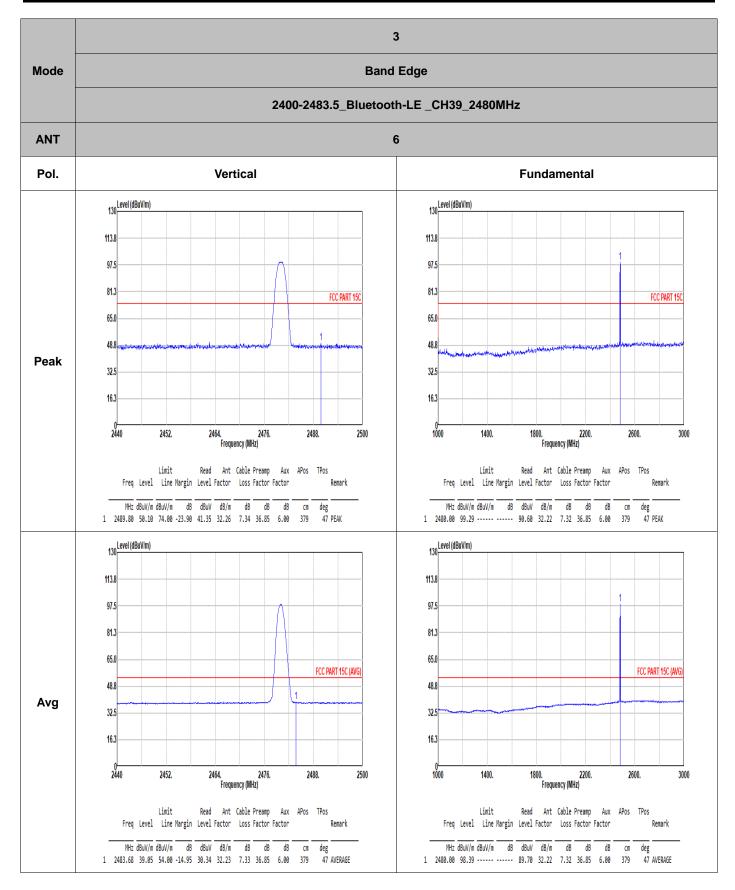




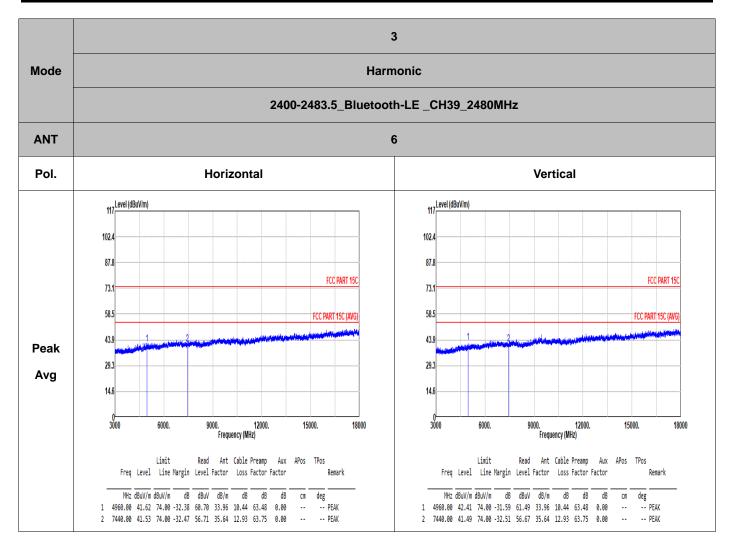




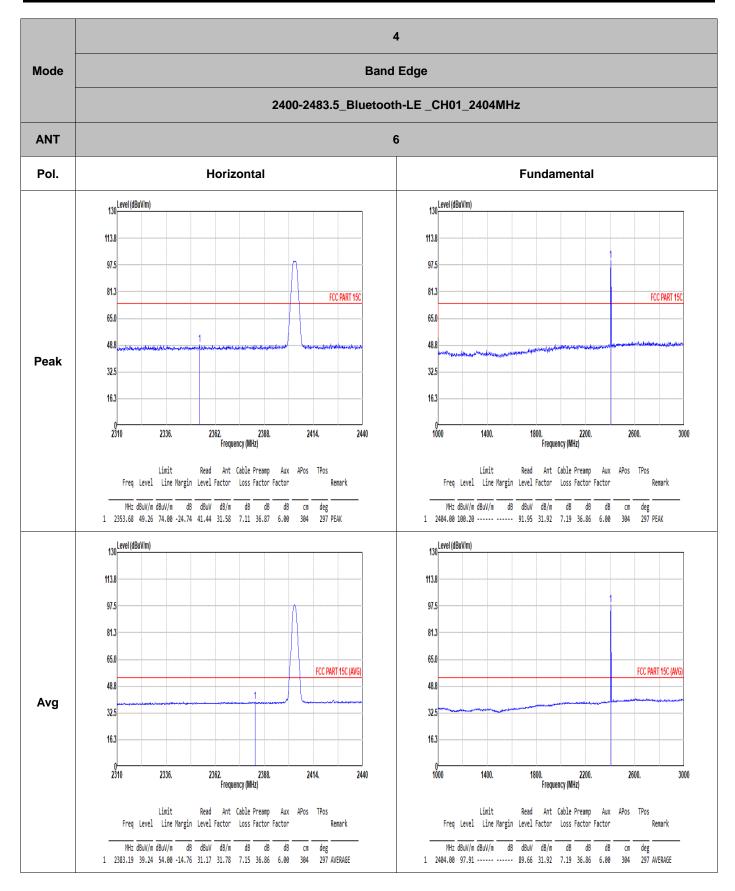




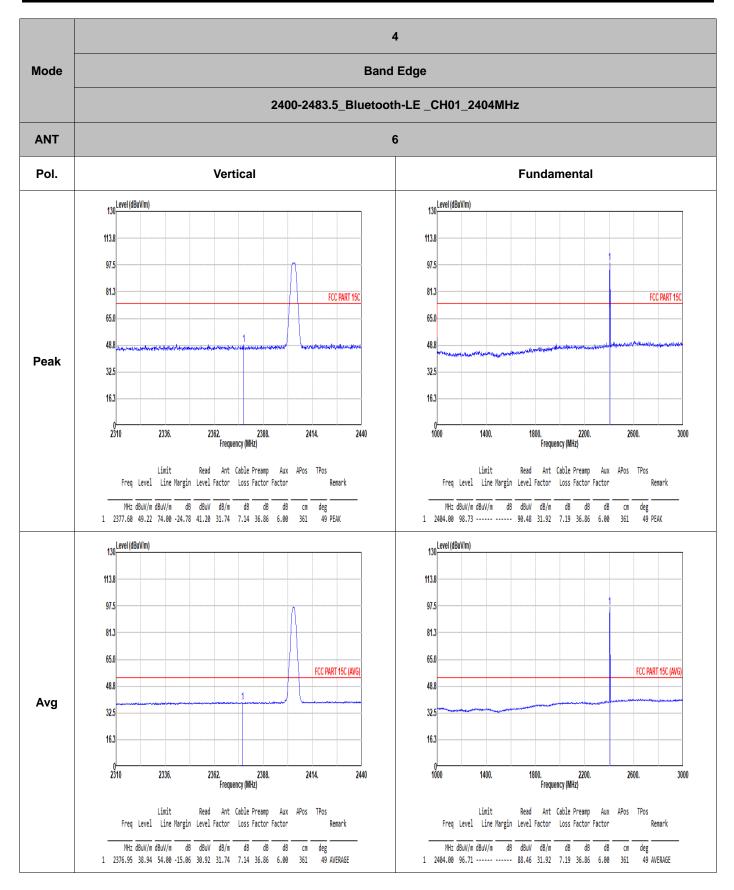




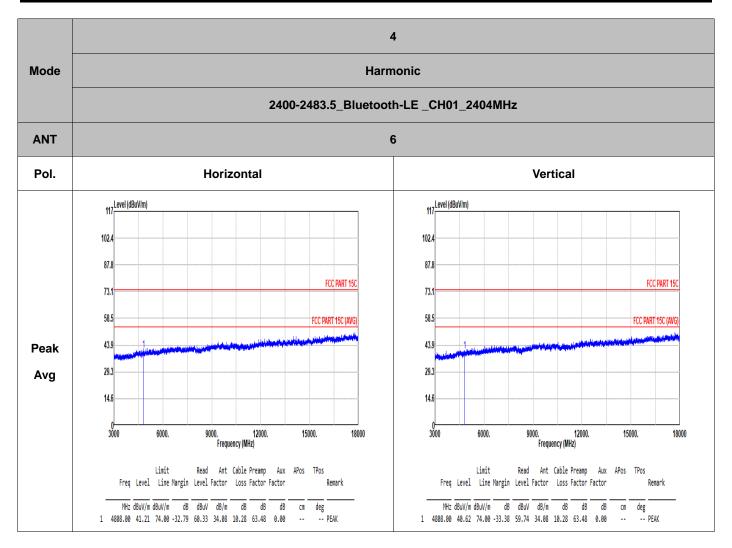




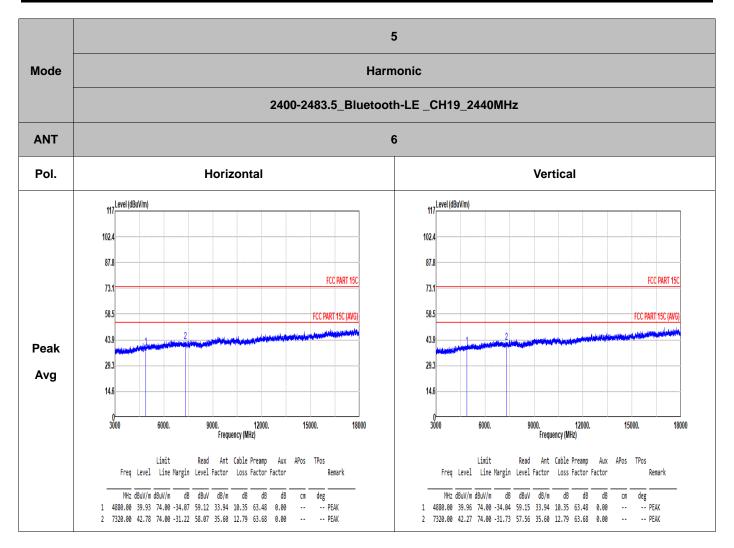




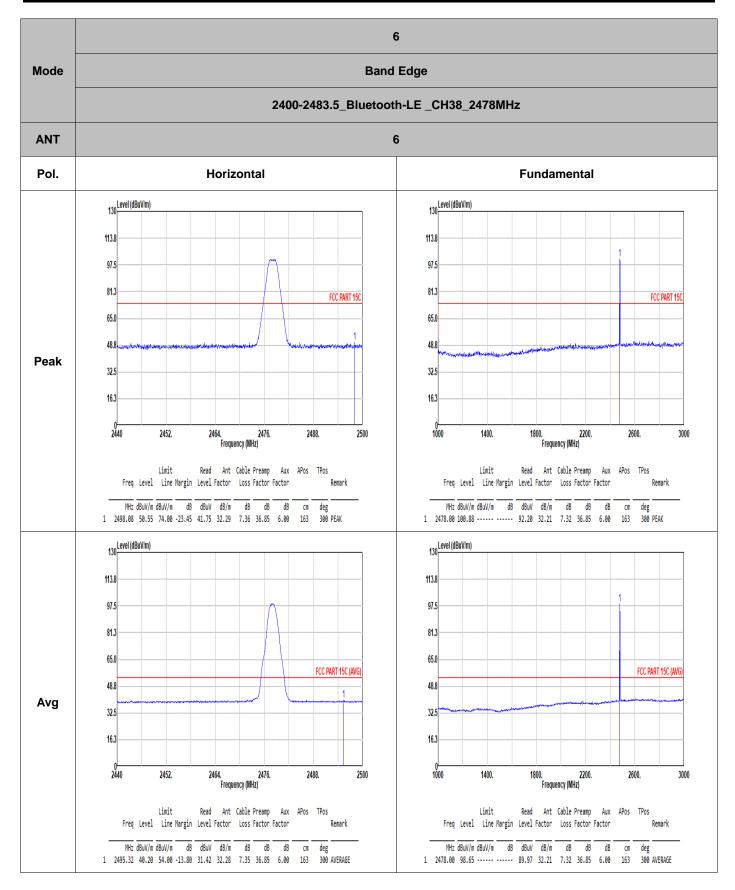




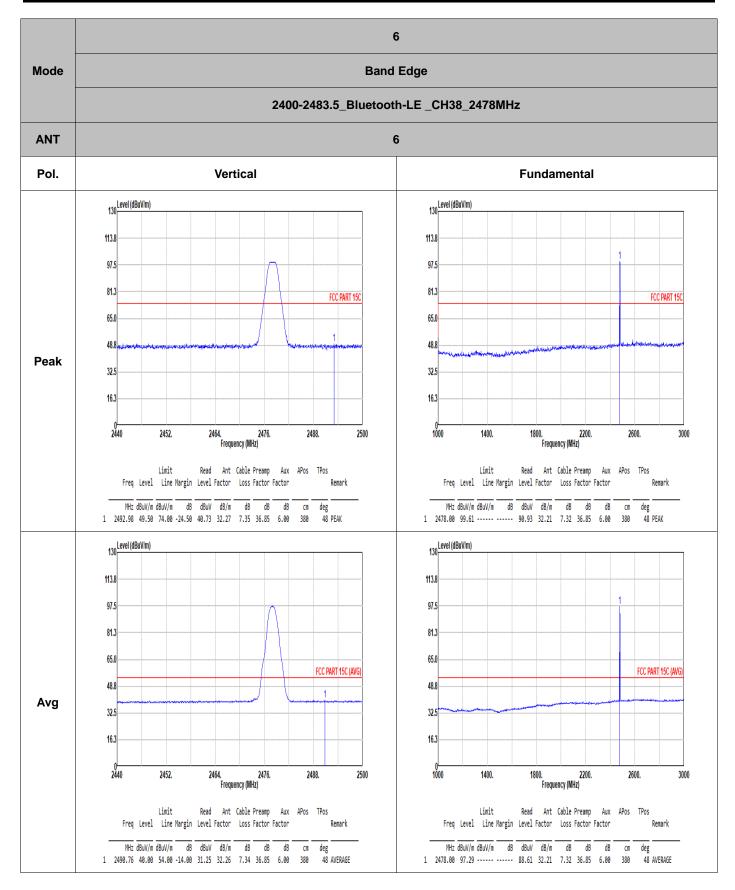




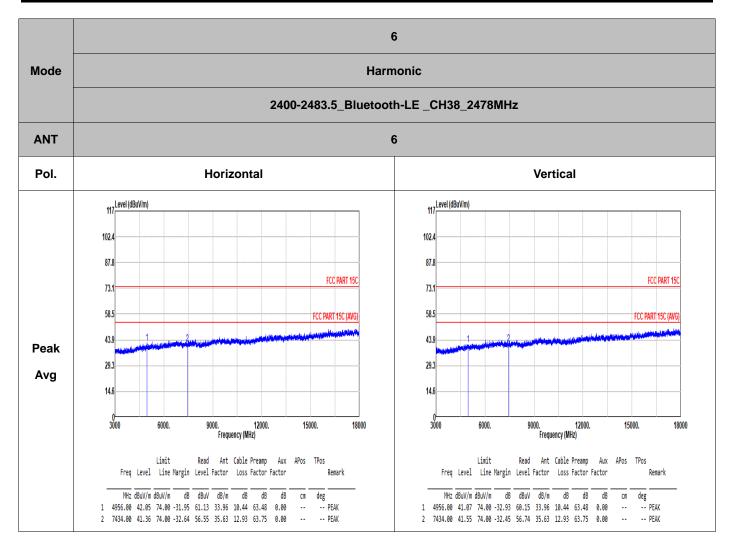




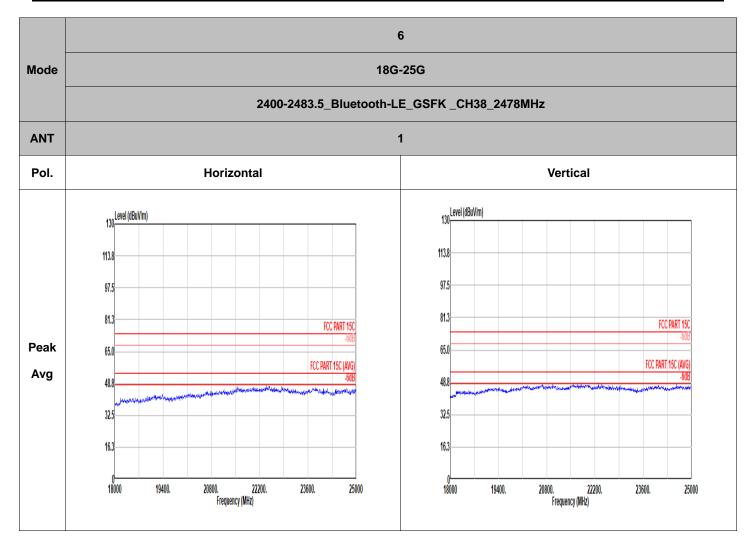




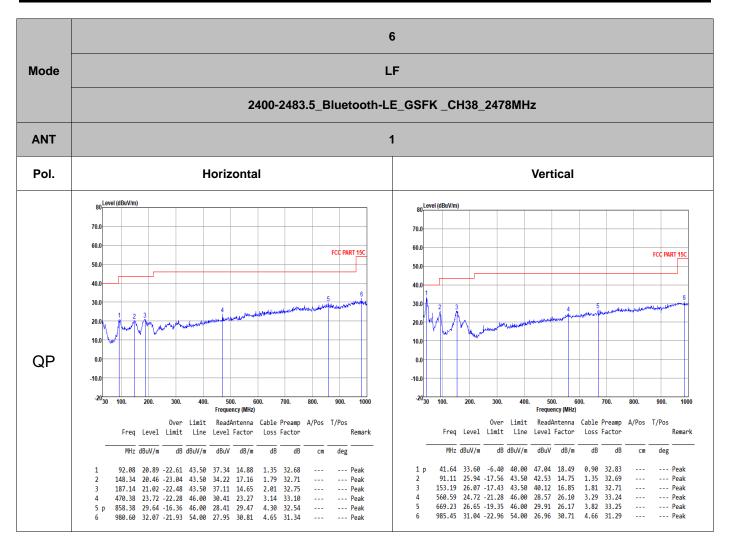










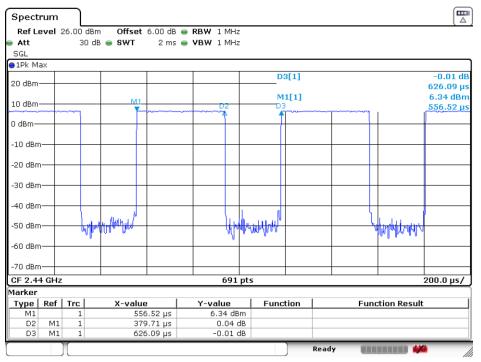




Appendix D. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
Bluetooth LE 1Mbps	60.65	0.380	2.634	2.7KHz
Bluetooth LE 2Mbps	31.48	0.197	5.074	5.1KHz

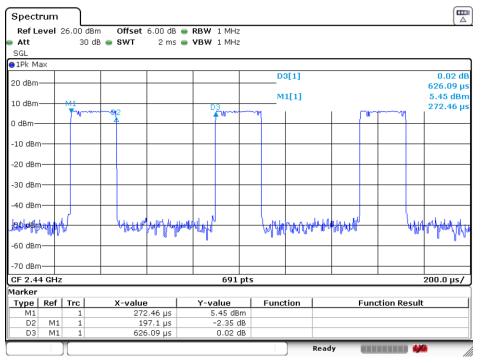
Bluetooth LE 1Mbps



Date: 18.JUL.2024 04:26:19



Bluetooth LE 2Mbps



Date: 18.JUL.2024 04:27:00