

FCC RF Test Report

APPLICANT	:	Nauto
EQUIPMENT	:	In-vehicle camera
BRAND NAME	:	Nauto
MODEL NAME	:	N4
FCC ID	:	2AKJ5-N4
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	(DTS) Digital Transmission System
TEST DATE(S)	:	Mar. 28, 2024 ~ Mar. 31, 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
FR3D2618B	Rev. 01	Initial issue of report	May 14, 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	99% Bandwidth - Report of		-
3.2	15.247(b)(3)	Peak Output Power	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 13.40 dB at 2494.66 MHz
-	15.207	AC Conducted Emission 15.207(a) Not Applicable		-	
3.6	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

Nauto

1259 Reamwood Ave, Sunnyvale, CA 94089, USA

1.2 Manufacturer

Nauto

1259 Reamwood Ave, Sunnyvale, CA 94089, USA

1.3 Product Feature of Equipment Under Test

Product Feature			
Equipment	In-vehicle camera		
Brand Name	Nauto		
Model Name	N4		
FCC ID	2AKJ5-N4		
SN Code	Conducted: N40HTV6E1000E5L Radiation: N40HTV6E10011BS		
HW Version	V4		
SW Version	NautoN4		
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: 6.51 dBm (0.0045 W)			
Maximum Output Power to Antenna	BLE 2Mbps: 6.62 dBm (0.0046 W)			
99% Occupied Bandwidth	BLE 1Mbps: 1.023 MHz			
39 % Occupied Baildwidth	BLE 2Mbps: 2.010 MHz			
Antenna Type / Gain	monopole Antenna with gain -0.4 dBi			
Type of Modulation	Bluetooth LE : GFSK			

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)				
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China				
	TEL:+86-512-579001	TEL : +86-512-57900158			
	Sporton Site No.	FCC Designation No.	FCC Test Firm		
Test Site No.	oporton one no.	T CC Designation No.	Registration No.		
	03CH05-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.	03CH05-KS	AUDIX	E3	210616

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:, 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 (Y plane) were recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

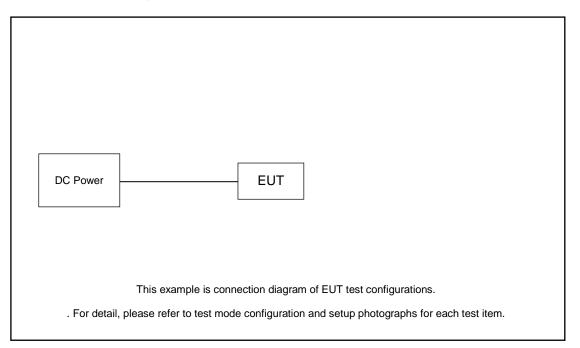
The following summary table is showing all test modes to demonstrate in compliance with the standard.

	Summary table of Test Cases					
Toot Kom	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 CH00_2402 MHz _BLE 2Mbps					
	Mode 5: Bluetooth Tx CH19_2440 MHz _BLE 2Mbps					
	Mode 6: Bluetooth Tx CH39_2480 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 CH00_2402 MHz _BLE 2Mbps					
	Mode 5: Bluetooth Tx CH19_2440 MHz _BLE 2Mbps					
	Mode 6: Bluetooth Tx CH39_2480 MHz _BLE 2Mbps					

RSE Co-location
Bluetooth LE(2 Mbps) CH39_TX + LTE Band 13 link



2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

ltem	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	DC Power	TIANNENG	A6-DZF-12V	N/A	N/A	N/A



2.5 EUT Operation Test Setup

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

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 2.19 dB and 10dB attenuator.

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

= 2.19 + 10 = 12.19 (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.

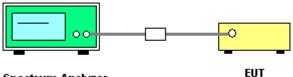
3.1.2 Measuring Instruments

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



Spectrum Analyzer

3.1.5 Test Result of 6dB & 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 6 dBi.

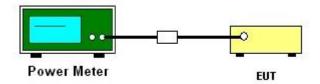
3.2.2 Measuring Instruments

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.

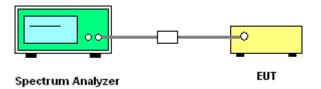
3.3.2 Measuring Instruments

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.

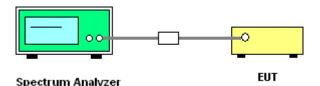
3.4.2 Measuring Instruments

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



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.



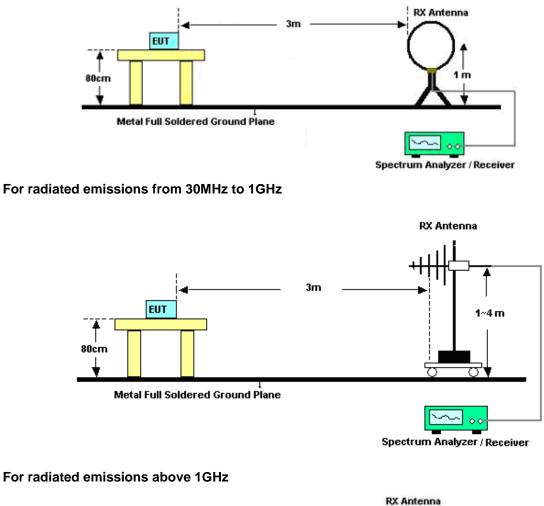
3.5.3 Test Procedures

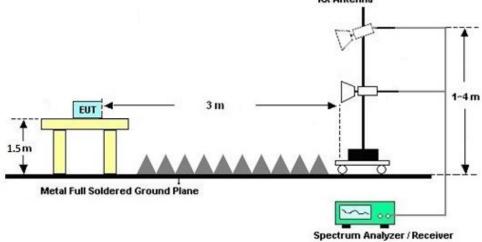
- 1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
- 2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get 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 B.

3.5.7 Duty Cycle

Please refer to Appendix C.

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



3.6 Antenna Requirements

3.6.1 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.

3.6.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.6.3 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;Ma x 30dBm	Oct. 10, 2023	Mar. 28, 2024	Oct. 09, 2024	Radiation (03CH05-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY551502 44	10Hz-44G,MAX 30dB	Mar. 24, 2024	Mar. 28, 2024	Mar. 23, 2025	Radiation (03CH05-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 10, 2023	Mar. 28, 2024	Oct. 09, 2024	Radiation (03CH05-KS)
Bilog Antenna	TeseQ	CBL6111D	49922	30MHz-1GHz	Apr. 09, 2023	Mar. 28, 2024	Apr. 08, 2024	Radiation (03CH05-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218642	1GHz~18GHz	Apr. 06, 2023	Mar. 28, 2024	Apr. 05, 2024	Radiation (03CH05-KS)
SHF-EHF Horn	Com-power	AH-840	101093	18GHz~40GHz	Jan. 05, 2024	Mar. 28, 2024	Jan. 04, 2025	Radiation (03CH05-KS)
Amplifier	SONOMA	310N	380826	9KHz-1GHz	Jul. 06, 2023	Mar. 28, 2024	Jul. 05, 2024	Radiation (03CH05-KS)
Amplifier	EM	EM18G40GA	060852	18~40GHz	Jan. 05, 2024	Mar. 28, 2024	Jan. 04, 2025	Radiation (03CH05-KS)
high gain Amplifier	EM	EM01G18GA	060839	1Ghz-18Ghz	Oct. 10, 2023	Mar. 28, 2024	Oct. 09, 2024	Radiation (03CH05-KS)
Amplifier	EM	EM01G18GA	060833	1Ghz-18Ghz	Jan. 03, 2024	Mar. 28, 2024	Jan. 02, 2025	Radiation (03CH05-KS)
AC Power Source	Chroma	61601	F1040900 04	N/A	NCR	Mar. 28, 2024	NCR	Radiation (03CH05-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Mar. 28, 2024	NCR	Radiation (03CH05-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Mar. 28, 2024	NCR	Radiation (03CH05-KS)
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Oct. 11, 2023	Mar. 31, 2024	Oct. 10, 2024	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 02, 2024	Mar. 31, 2024	Jan. 01, 2025	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 02, 2024	Mar. 31, 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	±2.26 dB
Occupied Channel Bandwidth	±0.1%
Conducted Power	±0.46 dB
Conducted Power Spectral Density	±0.88 dB
Frequency	±0.4 Hz

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

Measuring Uncertainty for a Level of Confidence	2 20 dP
of 95% (U = 2Uc(y))	3.30 dB

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

Measuring Uncertainty for a Level of Confidence	6.28 dB
of 95% (U = 2Uc(y))	0.20 UB

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

Measuring Uncertainty for a Level of Confidence	4.88 dB
of 95% (U = 2Uc(y))	4.00 UB

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

Measuring Uncertainty for a Level of Confidence	5.26 dB
of 95% (U = 2Uc(y))	5.20 UB

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



Appendix A. Conducted Test Results



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

Test Date: 2024.3.31

Test Engineer: Jiang Jun

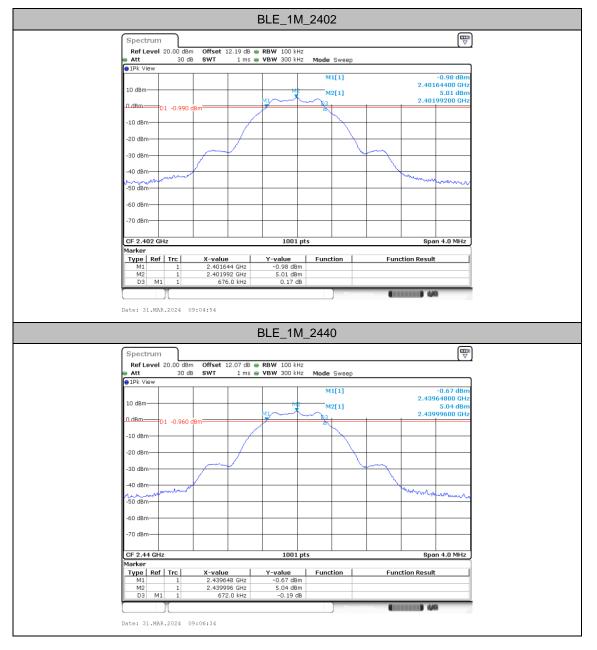
DTS Bandwidth

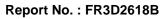
Test Result

TestMode	Freq(MHz)	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
	2402	0.68	2401.64	2402.32	0.5	PASS
BLE_1M	2440	0.67	2439.65	2440.32	0.5	PASS
	2480	0.67	2479.65	2480.32	0.5	PASS
	2402	1.15	2401.42	2402.56	0.5	PASS
BLE_2M	2440	1.14	2439.42	2440.56	0.5	PASS
	2480	1.14	2479.42	2480.56	0.5	PASS



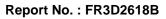
Test Graphs



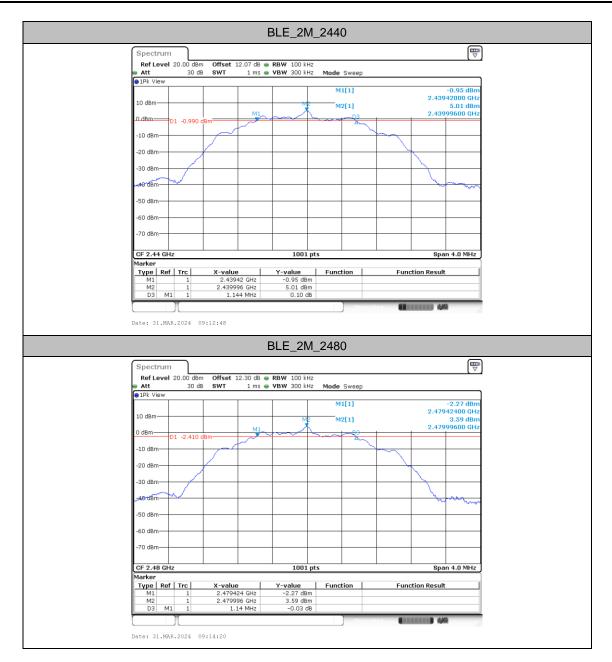














Occupied Channel Bandwidth

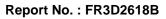
Test Result

TestMode	Freq(MHz)	OCB [MHz]	FL[MHz]	FH[MHz]
	2402	1.023	2401.4805	2402.5035
BLE_1M	2440	1.019	2439.4845	2440.5035
	2480	1.019	2479.4845	2480.5035
	2402	2.006	2400.9970	2403.0030
BLE_2M	2440	2.006	2439.0010	2441.0070
	2480	2.01	2478.9970	2481.0070



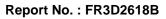
Test Graphs



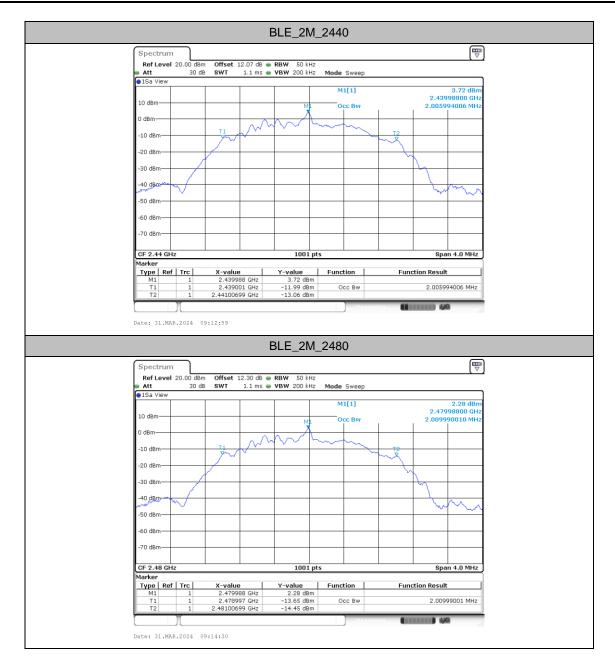














Maximum conducted output power

Test Result Peak

TestMode	CH.	Peak Conducted Power (dBm)	Conducted Power Limit	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit	Pass/Fail
	0	6.49	30.00	-0.4	6.09	36.00	Pass
BLE1M	19	6.51	30.00	-0.4	6.11	36.00	Pass
	39	4.85	30.00	-0.4	4.45	36.00	Pass
	0	6.62	30.00	-0.4	6.22	36.00	Pass
BLE2M	19	6.59	30.00	-0.4	6.19	36.00	Pass
	39	4.92	30.00	-0.4	4.52	36.00	Pass

Test Result Average

TestMode	CH.	Duty Factor (dB)	Average Conducted Power (dBm)
	0	2.04	6.05
BLE1M	19	2.04	6.07
	39	2.04	4.38
	0	4.83	6.22
BLE2M	19	4.83	6.19
	39	4.83	4.40

Remark : Power setting is the AUTO(AUTO is the default).



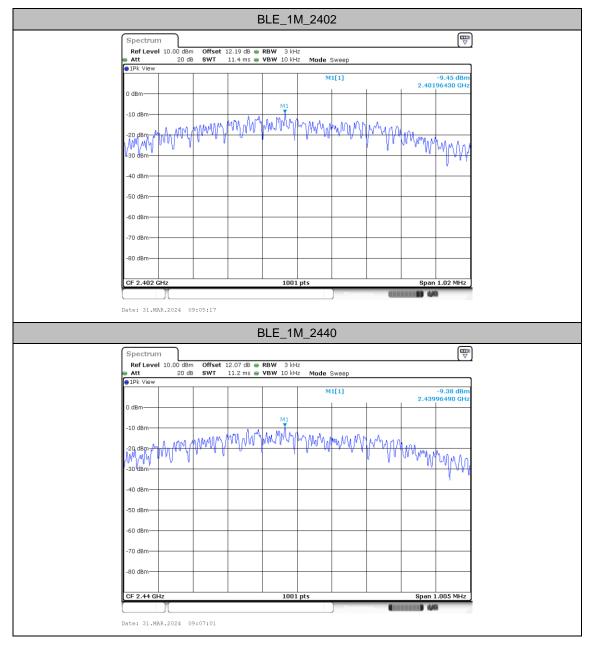
Maximum power spectral density

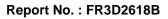
Test Result

TestMode	Freq(MHz)	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
	2402	-9.45	≤8.00	PASS
BLE_1M	2440	-9.38	≤8.00	PASS
	2480	-10.93	≤8.00	PASS
	2402	-12.28	≤8.00	PASS
BLE_2M	2440	-12.22	≤8.00	PASS
	2480	-13.70	≤8.00	PASS

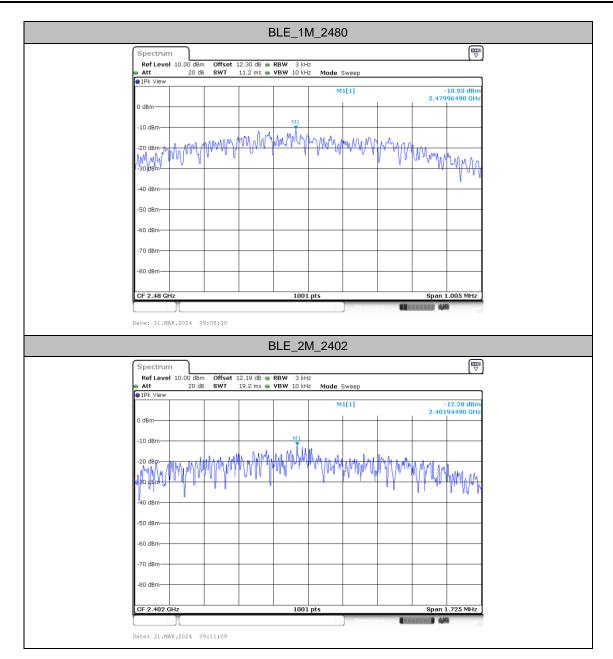


Test Graphs

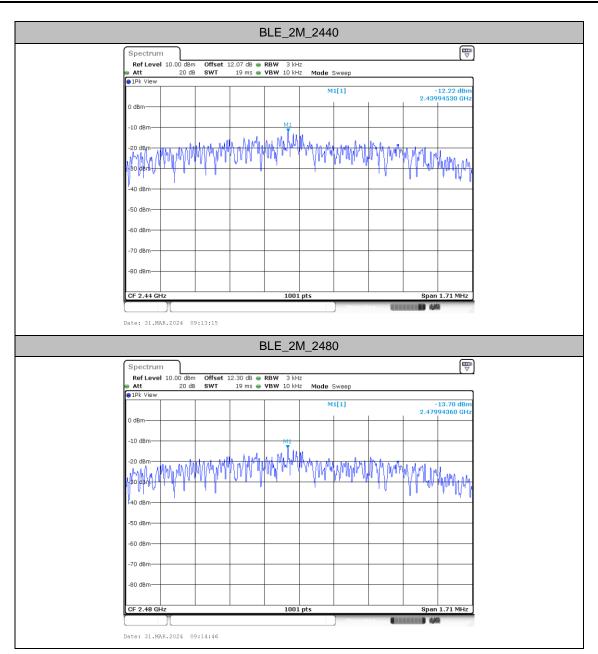














Reference level measurement

Test Result

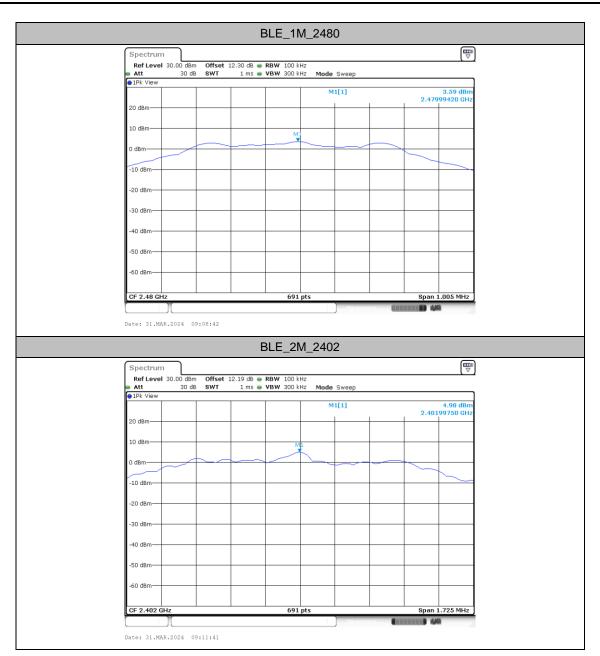
TestMode	Freq(MHz)	Max.Point[MHz]	Result[dBm/100KHz]
BLE_1M	2402	2401.99	5.00
	2440	2439.99	5.03
	2480	2479.99	3.59
BLE_2M	2402	2402.00	4.98
	2440	2440.00	4.99
	2480	2480.00	3.56



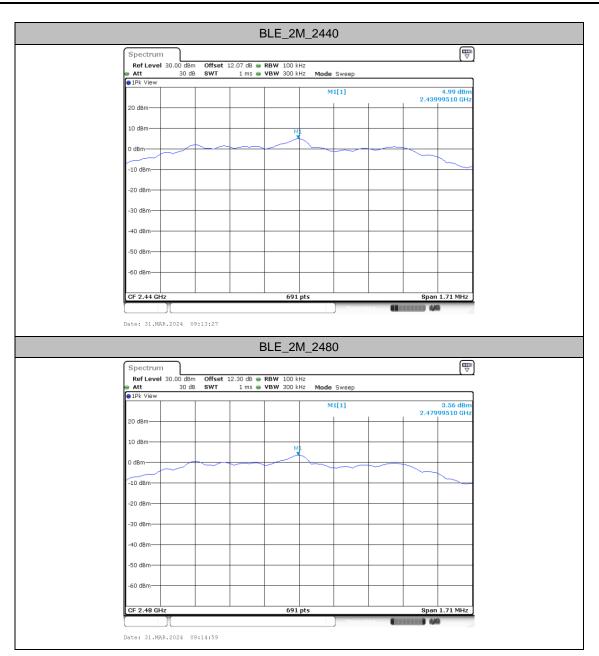
Test Graphs













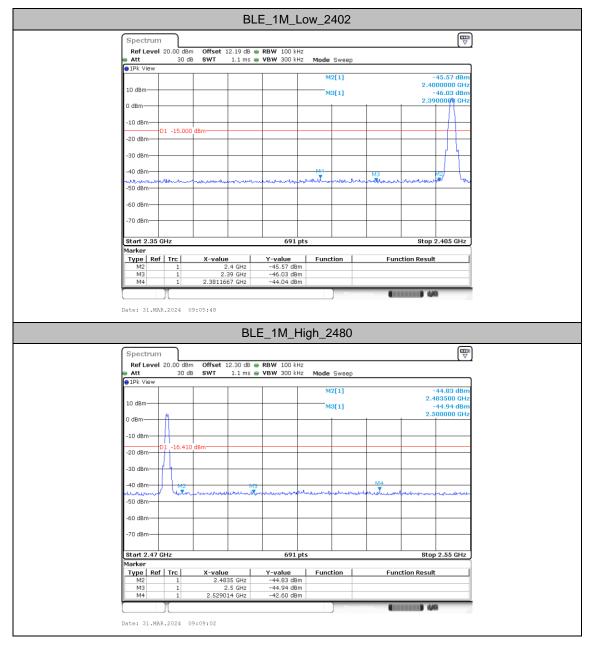
Band edge measurements

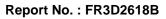
Test Result

TestMode	ChNome	Freq(MHz)	RefLevel[dBm	Result[dBm	Limit[dBm	Verdict
restiniode	ChName		/100KHz]	/100KHz]	/100KHz]	verdict
BLE_1M	Low	2402	5.00	-44.04	≤-15	PASS
	High	2480	3.59	-42.6	≤-16.41	PASS
BLE_2M	Low	2402	4.98	-39.78	≤-15.02	PASS
	High	2480	3.56	-43.01	≤-16.44	PASS



Test Graphs











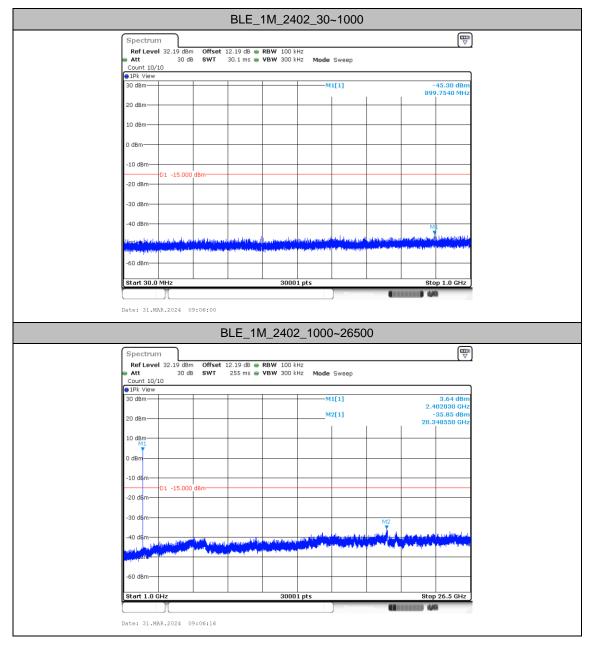
Conducted Spurious Emission

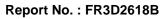
Test Result

TestMode		FreqRange	RefLevel	Result	Limit	Verdict	
TESTINOUE	Freq(MHz)	[MHz]	[dBm/100KHz]	[dBm/100KHz]	[dBm/100KHz]	Veruiet	
	2402	30~1000	5.00	-45.3	≤-15	PASS	
	2402	1000~26500	5.00	-35.85	≤-15	PASS	
BLE 1M	2440	30~1000	5.03	-45.74	≤-14.97	PASS	
DLE_11VI	2440	1000~26500	5.03	-36.1	≤-14.97	PASS	
	2480	30~1000	3.59	-44.46	≤-16.41	PASS	
		1000~26500	3.59	-36.63	≤-16.41	PASS	
BLE_2M	2402	30~1000	4.98	-45.58	≤-15.02	PASS	
		1000~26500	4.98	-36.59	≤-15.02	PASS	
	2440	30~1000	4.99	-45.52	≤-15.01	PASS	
		1000~26500	4.99	-37.16	≤-15.01	PASS	
	2480	30~1000	3.56	-45.22	≤-16.44	PASS	
	2400	1000~26500	3.56	-36.22	≤-16.44	PASS	

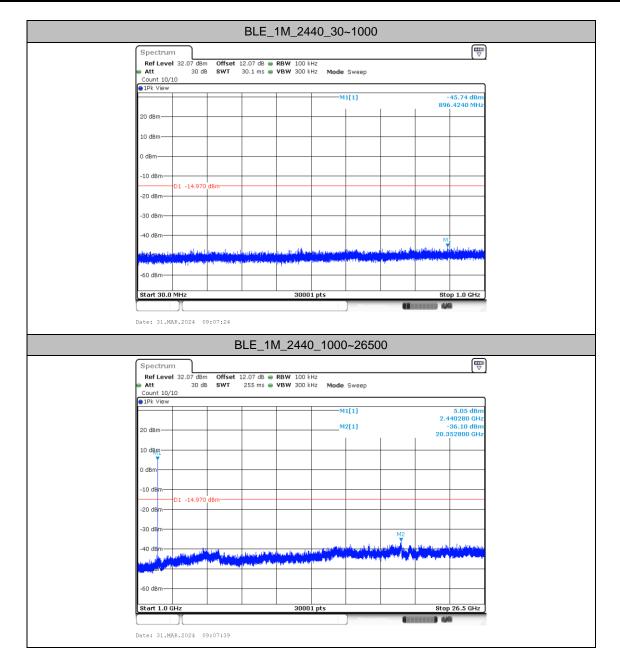


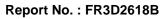
Test Graphs



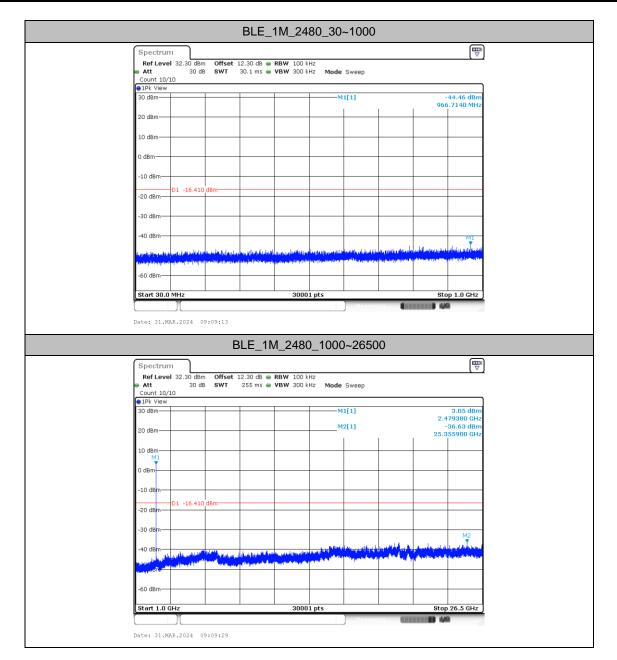


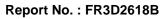




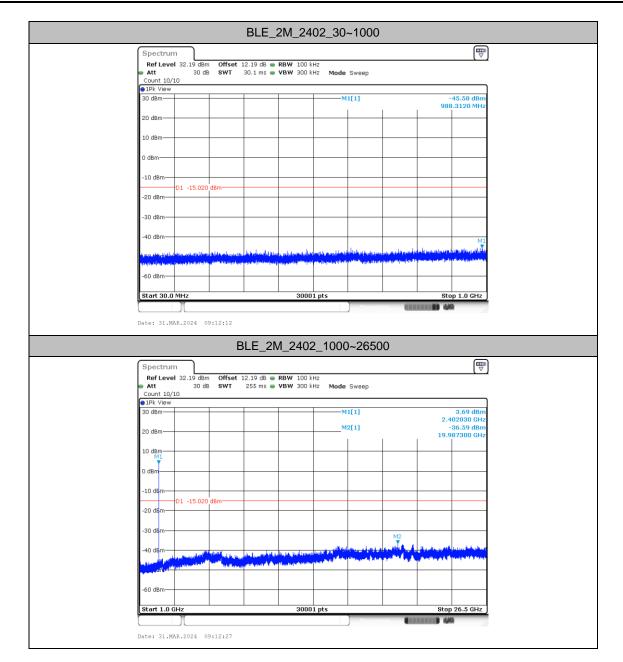


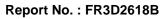




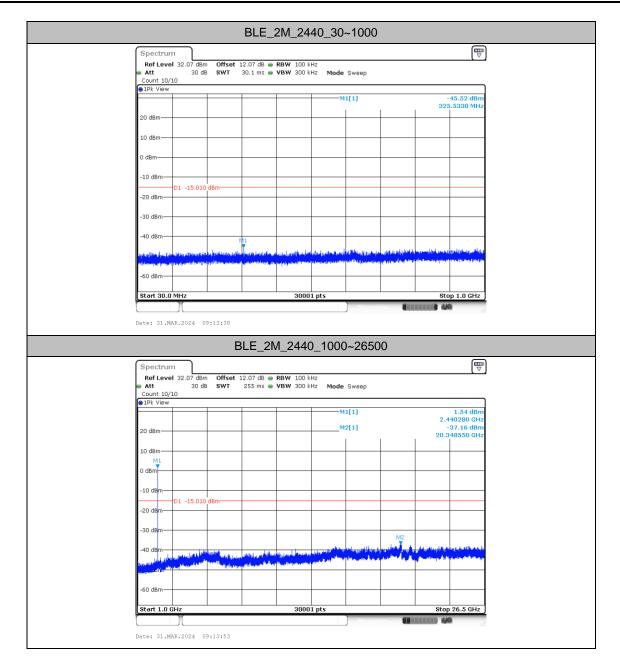


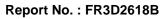




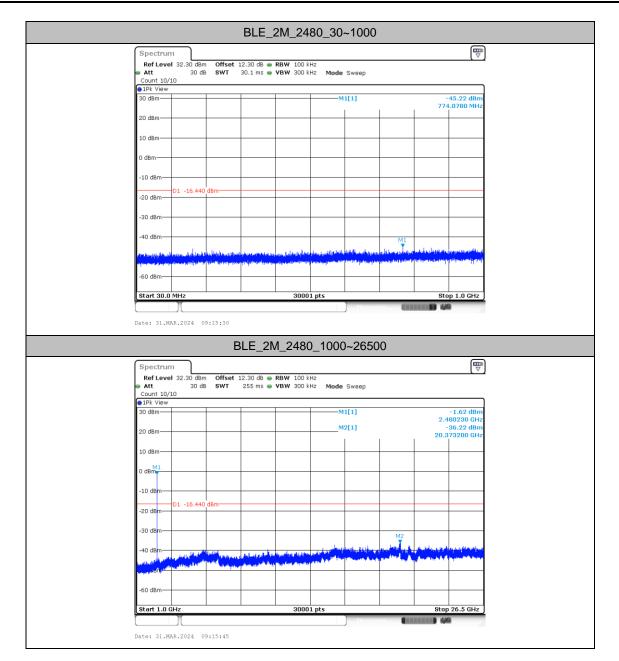














Appendix B. Radiated Spurious Emission Test Data

Test Engineer :	Carry	Relative Humidity :	41~42%	
rest Engineer .	Carry	Temperature :	22~23 ℃	

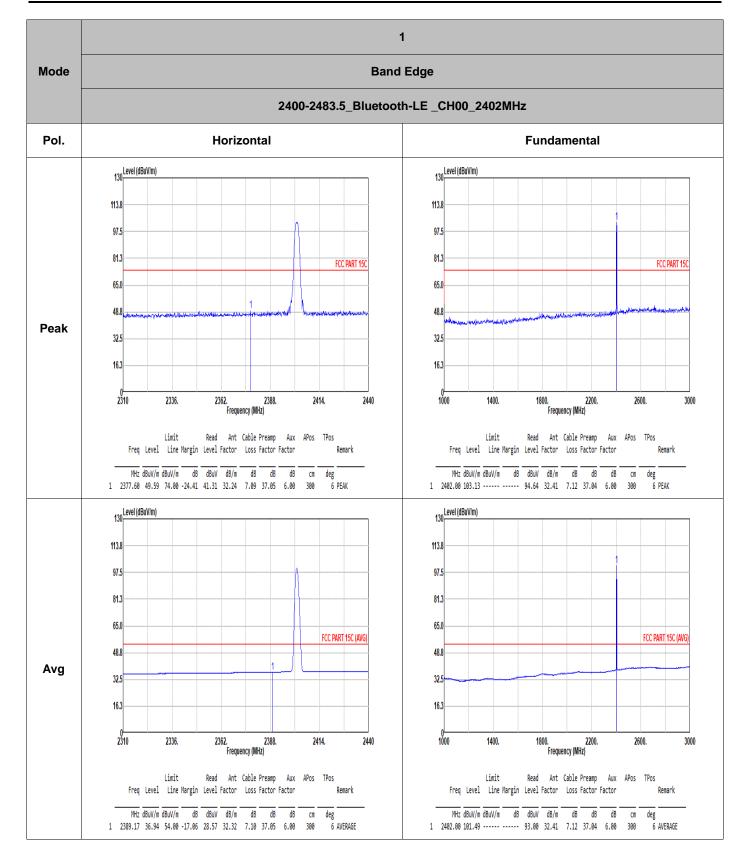
Radiated Spurious Emission Test Modes

Mode	Band (MHz)	Modulation	Channel	Frequency	Data Rate	Remark	
Mode 1	2400-2483.5	Bluetooth-LE	00	2402	1Mbps	-	
Mode 2	2400-2483.5	Bluetooth-LE	19	2440	1Mbps	-	
Mode 3	2400-2483.5	Bluetooth-LE	39	2480	1Mbps	-	
Mode 4	2400-2483.5	Bluetooth-LE	00	2402	2Mbps	-	
Mode 5	2400-2483.5	Bluetooth-LE	19	2440	2Mbps	-	
Mode 6	2400-2483.5	Bluetooth-LE	39	2480	2Mbps	-	
Mode 7	2400-2483.5	Bluetooth-LE	39	2480	2Mbps	-	
	Part 27F LTE Band 13 Link (BW 5M)						

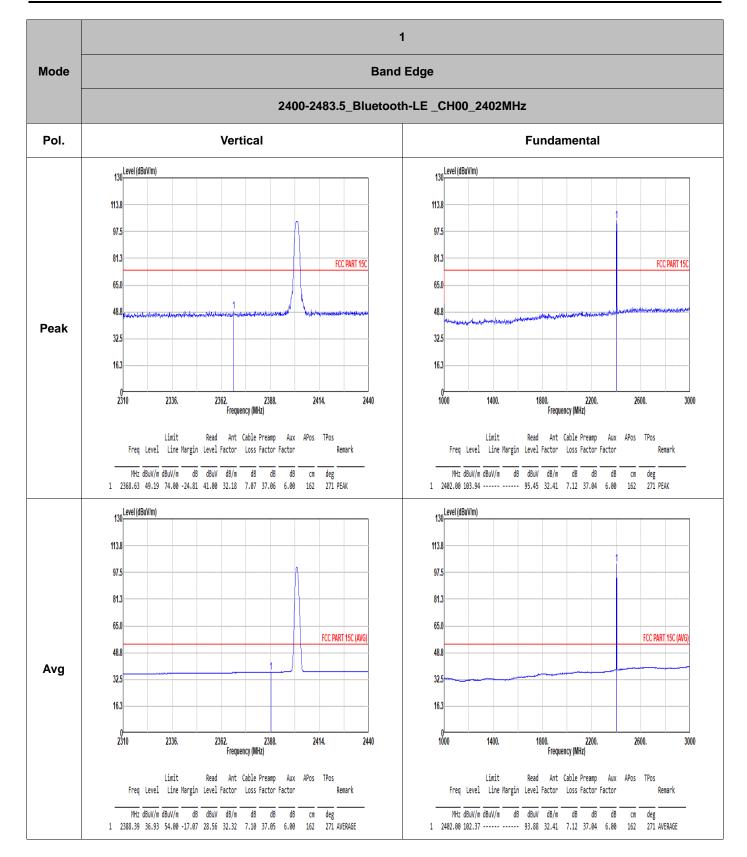
Summary of each worse mode

Mode	Modulation	Ch.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	Remark
1	Bluetooth-LE	00	2389.17	36.94	54.00	-17.06	Н	AVERAGE	Pass	Band Edge
1	Bluetooth-LE	00	4804.00	40.60	74.00	-33.40	V	PEAK	Pass	Harmonic
2	Bluetooth-LE	19	-	-	-	-	-	-	-	Band Edge
2	Bluetooth-LE	19	7320.00	42.27	74.00	-31.73	Н	PEAK	Pass	Harmonic
3	Bluetooth-LE	39	2483.92	39.66	54.00	-14.34	V	AVERAGE	Pass	Band Edge
3	Bluetooth-LE	39	7440.00	42.22	74.00	-31.78	V	PEAK	Pass	Harmonic
4	Bluetooth-LE	00	2367.59	39.34	54.00	-14.66	V	AVERAGE	Pass	Band Edge
4	Bluetooth-LE	00	4804.00	41.47	74.00	-32.53	V	PEAK	Pass	Harmonic
5	Bluetooth-LE	19	-	-	-	-	-	-	-	Band Edge
5	Bluetooth-LE	19	7320.00	42.43	74.00	-31.57	Н	PEAK	Pass	Harmonic
6	Bluetooth-LE	39	2486.98	40.50	54.00	-13.50	Н	AVERAGE	Pass	Band Edge
6	Bluetooth-LE	39	7440.00	43.01	74.00	-30.99	V	PEAK	Pass	Harmonic
7	Bluetooth-LE	39	2494.66	40.60	54.00	-13.40	Н	AVERAGE	Pass	Band Edge
7	Bluetooth-LE	39	7440.00	42.02	74.00	-31.98	Н	PEAK	Pass	Harmonic

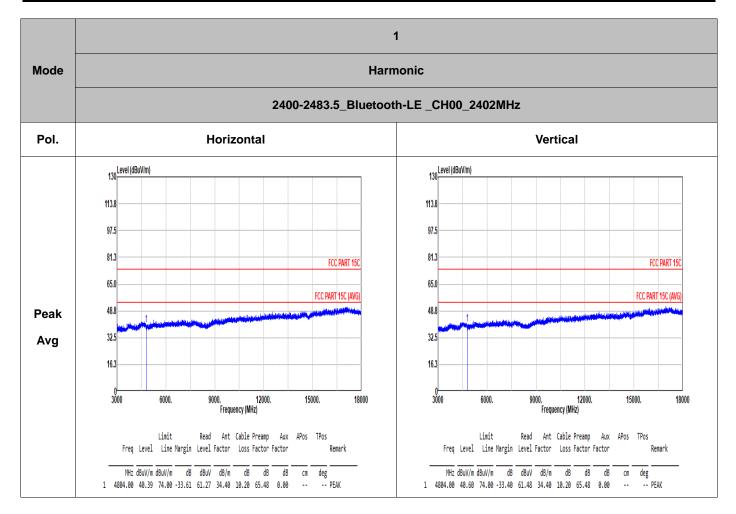




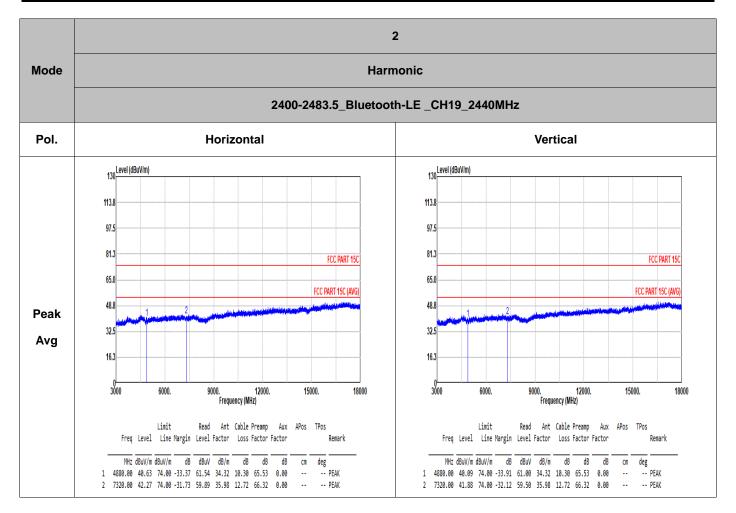




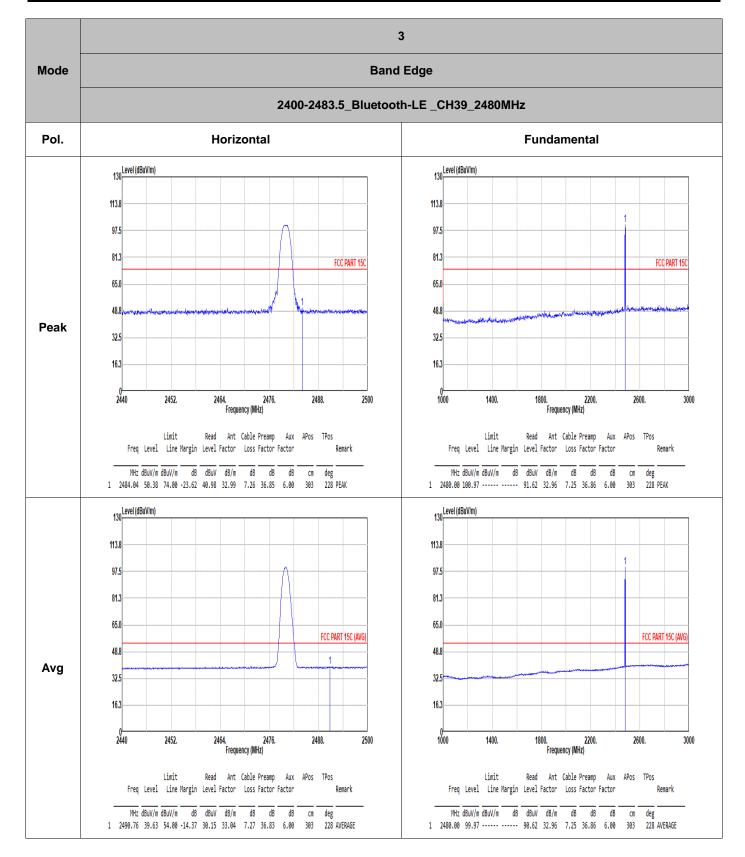




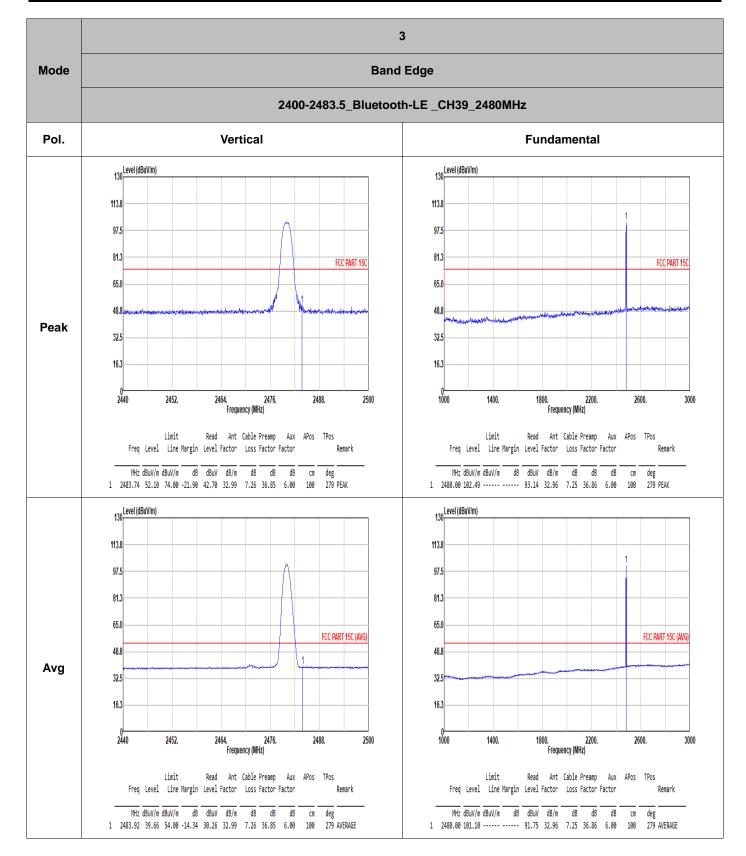




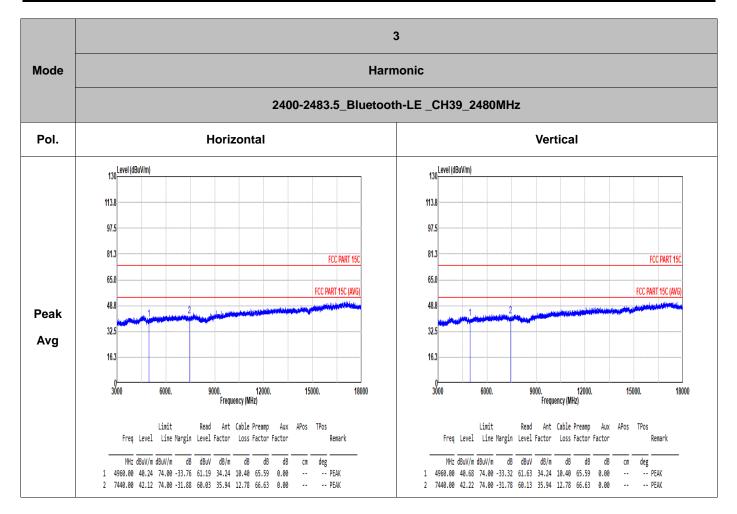




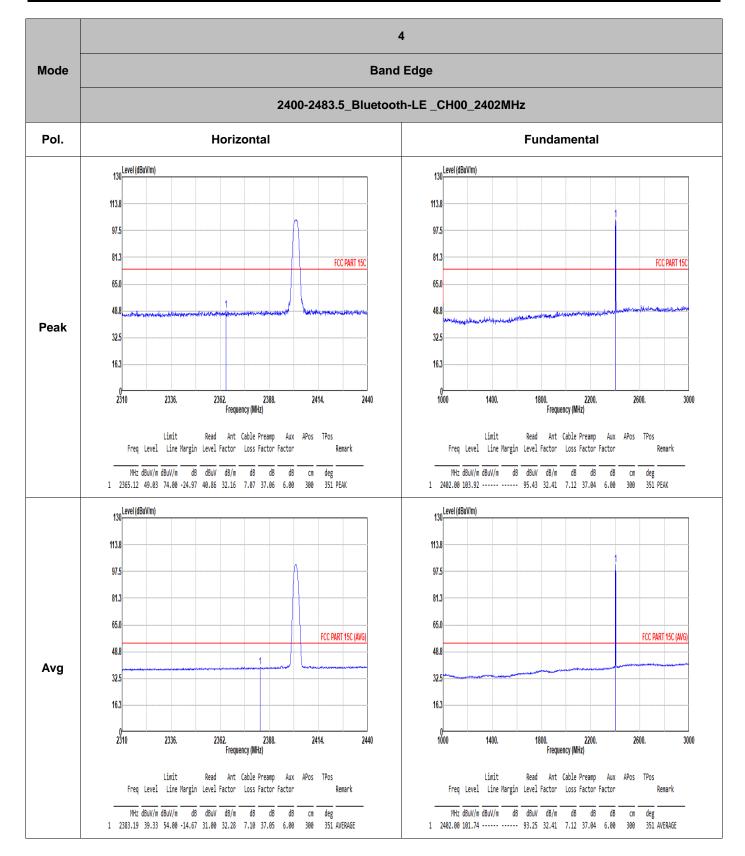




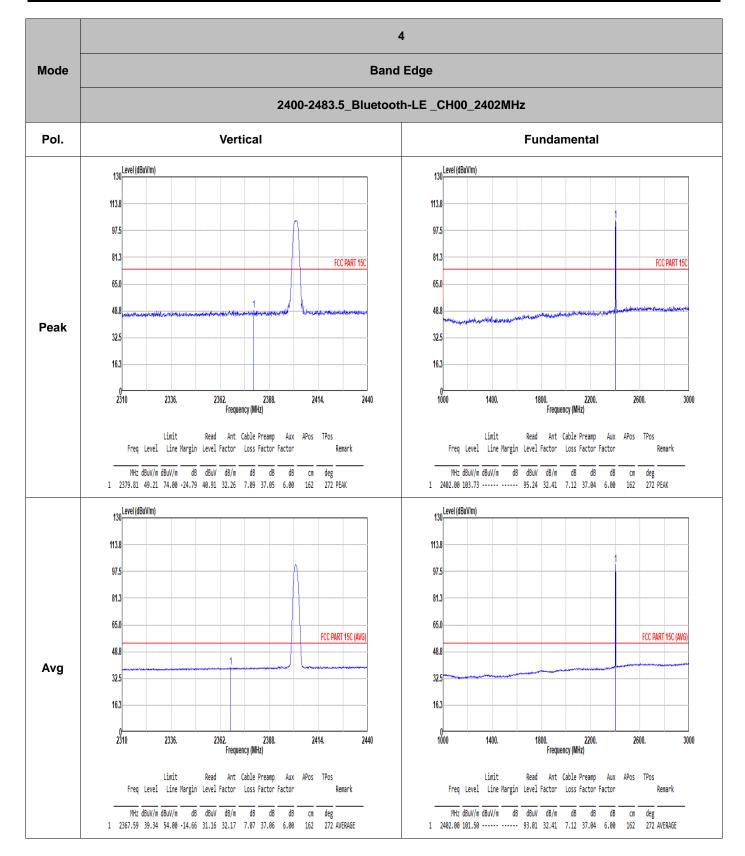




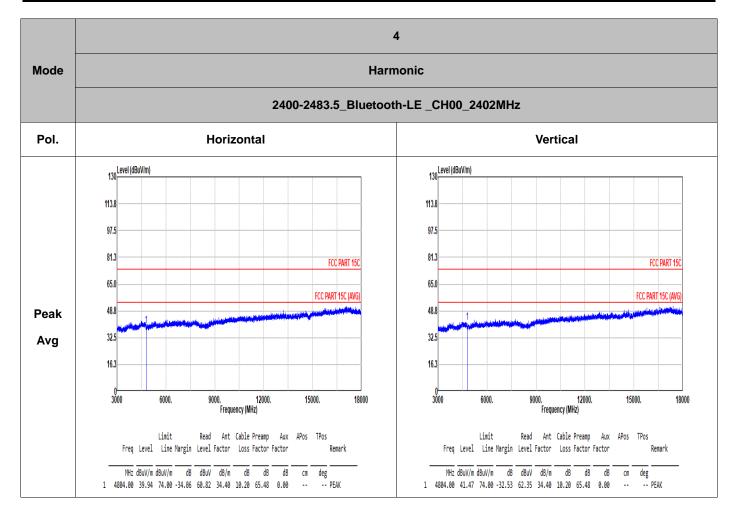




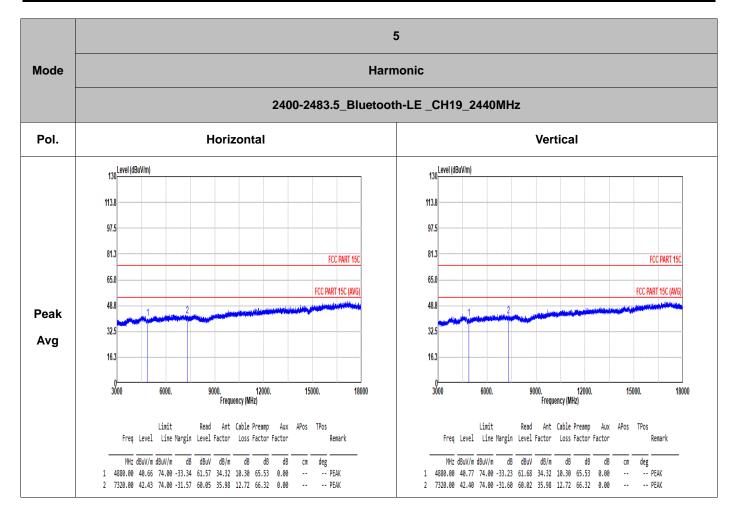




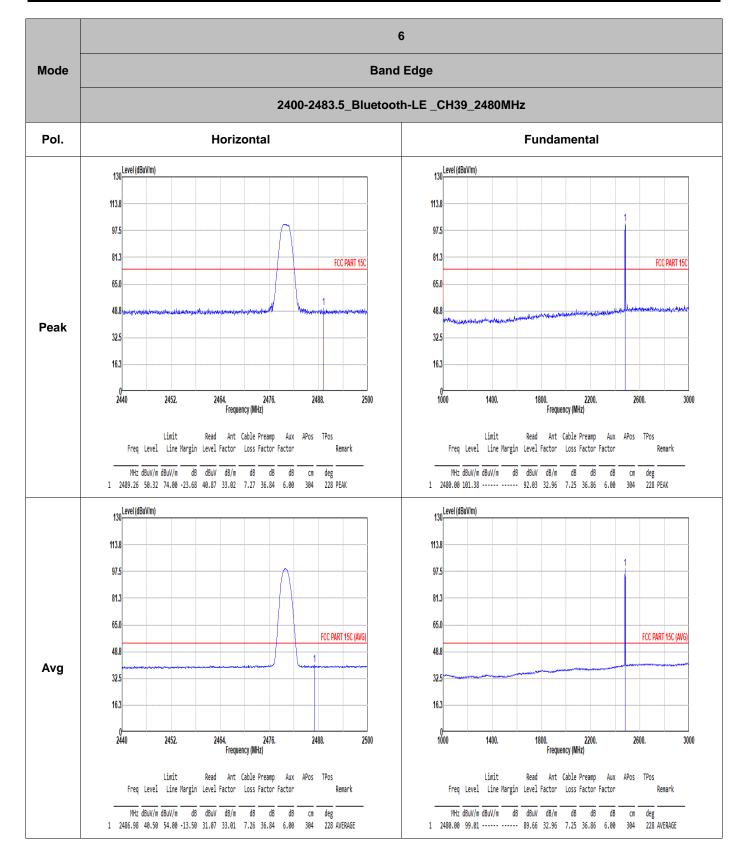




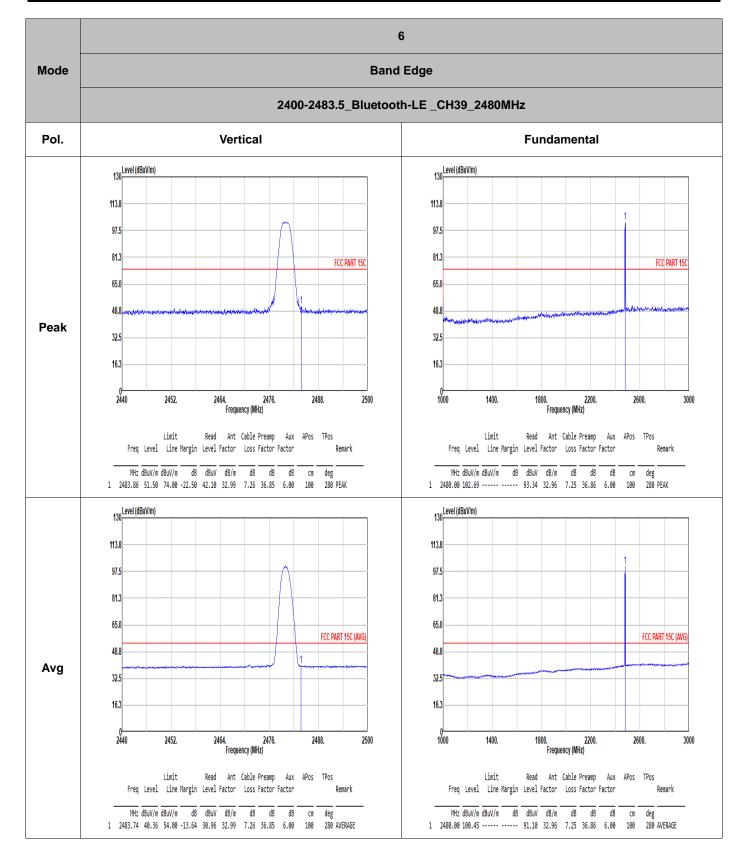




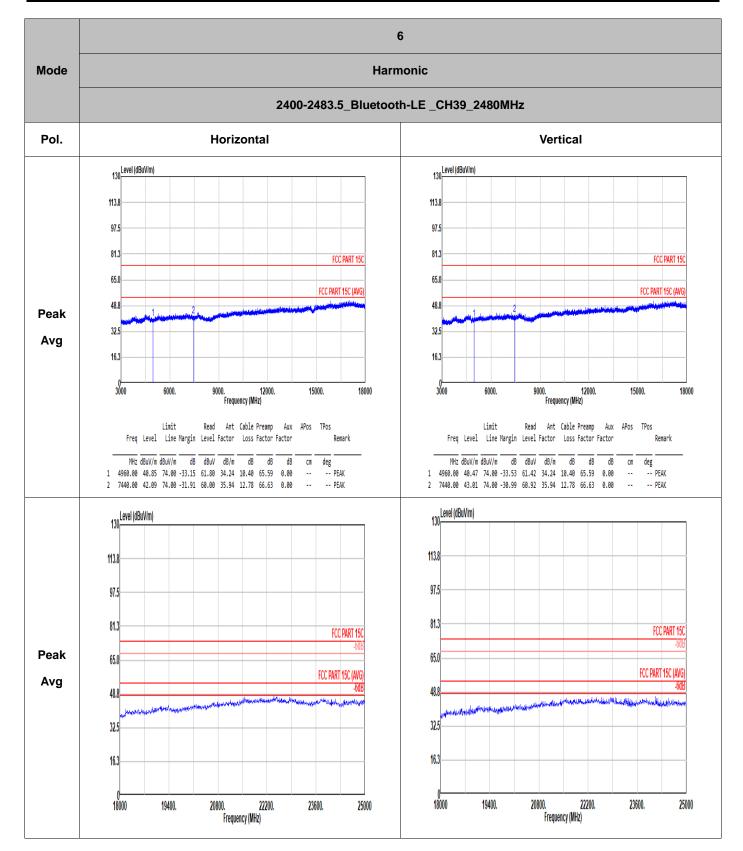




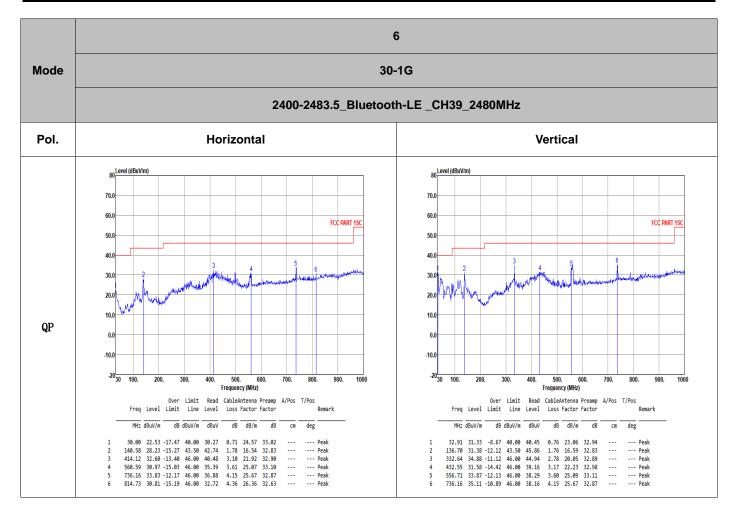






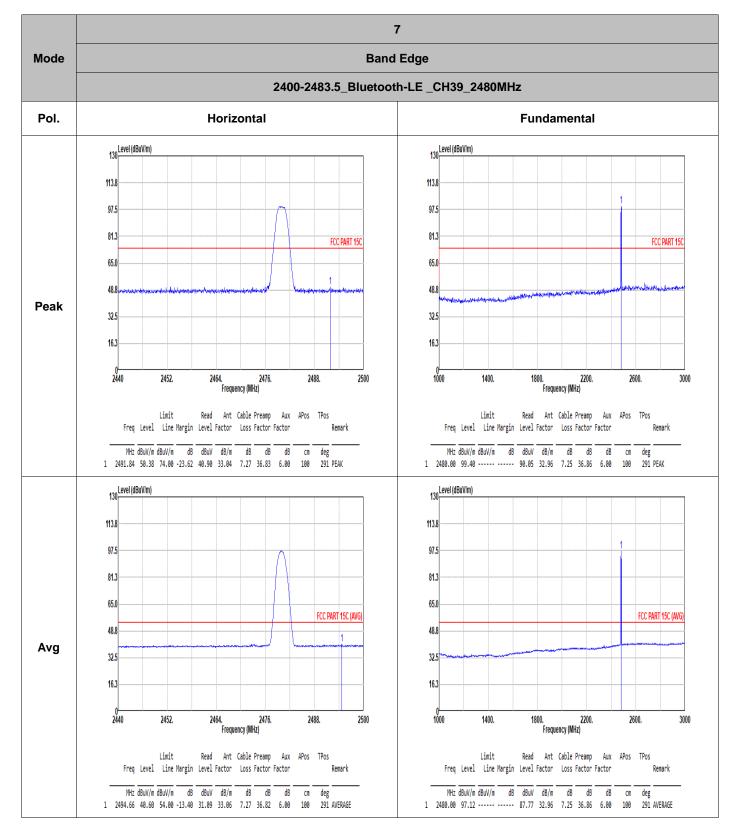




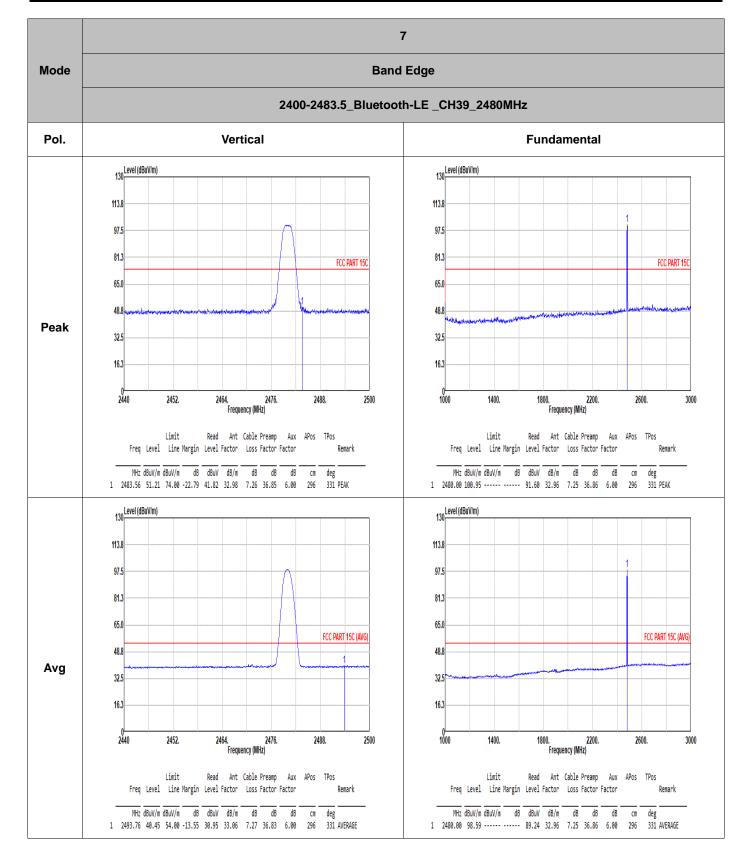




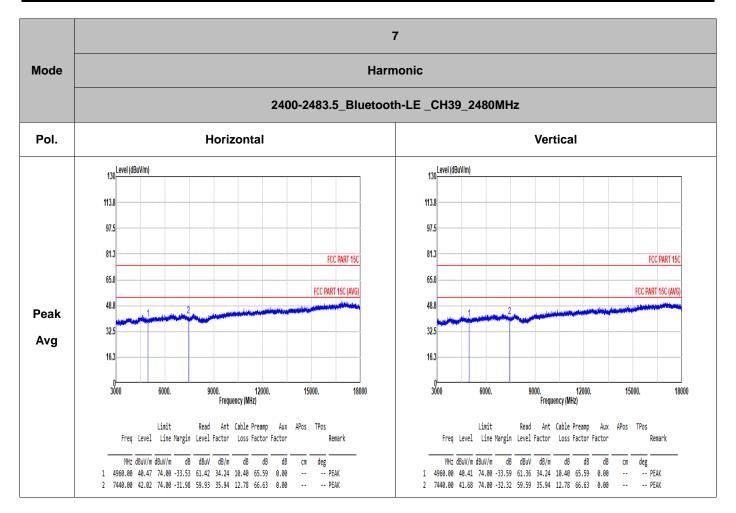
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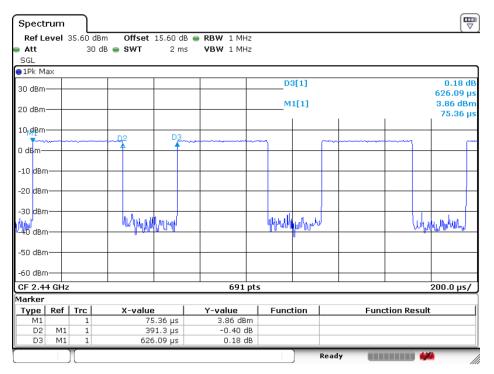




Appendix C. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting	
Bluetooth LE 1Mbps	62.499	0.391	2.556	2.7KHz	
Bluetooth LE 2Mbps	32.871	0.206	4.859	5.1KHz	

Bluetooth LE 1Mbps





Bluetooth LE 2Mbps

