

FCC RF Test Report

APPLICANT	:	Nokia Shanghai Bell Co., Ltd.
EQUIPMENT	:	Nokia FastMile 5G Receiver
BRAND NAME	:	Nokia
MODEL NAME	:	5G16-B
FCC ID	:	2ADZR5G16B
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	(DTS) Digital Transmission System
TEST DATE(S)	:	Jun. 17, 2024 ~ Jul. 07, 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
FR341901-02	Rev. 01	Initial issue of report	Jul. 26, 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 4.58 dB at 59.100 MHz for Quasi-Peak
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 9.15 dB at 0.330 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

Nokia Shanghai Bell Co., Ltd. 388#, Ningqiao Road, China (Shanghai) Pilot Free Trade Zone, Shanghai 201206, China

1.2 Manufacturer

Nokia Solutions and Networks Oy Karakaari 7, 02610 Espoo, Finland

1.3 Product Feature of Equipment Under Test

Product Feature				
Equipment Nokia FastMile 5G Receiver				
Brand Name Nokia				
Model Name 5G16-B				
FCC ID	2ADZR5G16B			
IMEI / SN Code	Conducted: KLT242100002 Conduction: 358937920000263 Radiation: KLT242100023			
HW Version	3TG02508Axxx(x:A~Z)			
SW Version 5GReceiver-HG-2_D240200BieT0001E0643				
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 2Mbps: 5.81 dBm (0.0038 W)			
99% Occupied Bandwidth	BLE 2Mbps: 2.09MHz			
Antenna Type / Gain	PCB Antenna type with gain 3.62 dBi			
Type of Modulation	Bluetooth LE : GFSK			

Note: The device supports data rate 2Mbps only.

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	n Road, Kunshan Econom	ic Development Zone			
Test Site Location	Jiangsu Province 215300 People's Republic of China					
	TEL : +86-512-57900158					
	Sporton Sito No	FCC Designation No.	FCC Test Firm			
Test Site No.	Sporton Site No.	FCC Designation No.	Registration No.			
Test one NO.	CO01-KS 03CH05-KS TH01-KS	CN1257	314309			

1.7 Test Software

ltem	Site	Manufacturer	Name	Version
1.	TH01-KS	SPORTON	FCC 15C-15E Test Tools Ver10.0_210607	10.0
2.	03CH05-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 10 11 12	2420	30	2462
2400-2483.5 MHz		2422	31	2464
		2424	32	2466
		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 (Z plane) were recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

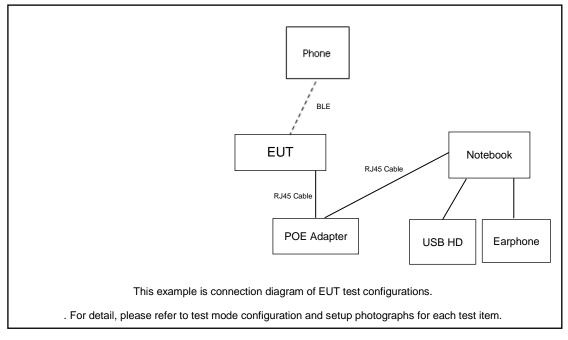
The following summary table is showing all test modes to demonstrate in compliance with the standard.

	Summary table of Test Cases						
Test Item	Data Rate / Modulation						
Test item	Bluetooth – LE / GFSK						
Conducted	Mode 1: Bluetooth Tx CH00_2402 MHz_BLE 2Mbps						
TCs	Mode 2: Bluetooth Tx CH19_2440 MHz_BLE 2Mbps						
ICS	Mode 3: Bluetooth Tx CH39_2480 MHz_BLE 2Mbps						
	Mode 1: Bluetooth Tx CH00_2402 MHz_BLE 2Mbps						
Radiated	Mode 2: Bluetooth Tx CH19_2440 MHz_BLE 2Mbps						
TCs	Mode 3: Bluetooth Tx CH39_2480 MHz_BLE 2Mbps						
	Mode 4: Bluetooth Tx CH39_2480 MHz_2Mbps + LTE 48A_2A BW20M Link (Co-location)						
AC	Made 4. Blueteeth Link + DOE Len Bert Link With NB + DOE edenter unshielded D 145						
Conducted	Mode 1: Bluetooth Link + POE Lan Port Link With NB + POE adapter unshielded RJ45						
Emission	Cable						
Remark: For	Radiated Test Cases, the tests were performed with POE Adapter.						

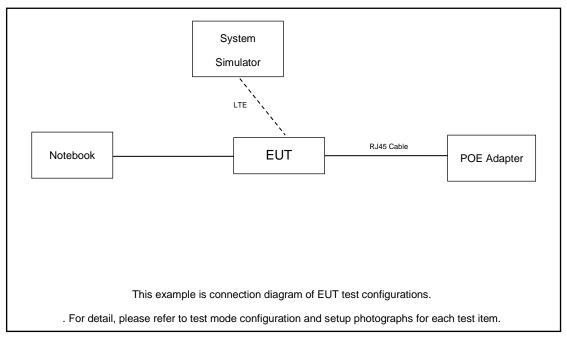


2.3 Connection Diagram of Test System

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.	Base Station	R&S	CMW500	N/A	N/A	Unshielded,1.8m
2.	Phone	мото	XT1952-1	N/A	N/A	N/A
3.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	shielded cable DC O/P 1.8m , Unshielded AC I/P cable 1.8m
4.	Hard Disk	Lenovo	F310	DoC	Shielded, 1.2m	N/A
5.	Earphone	Lenovo	P121	N/A	Unshielded,1.2m	N/A

2.5 EUT Operation Test Setup

For BLE function, the engineering test program "QRCT" 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 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.

Offset = RF cable loss.

Following shows an offset computation example with cable loss 5.8 dB.

 $Offset(dB) = RF \ cable \ loss(dB).$ = 5.8 (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 and 99% Bandwidth

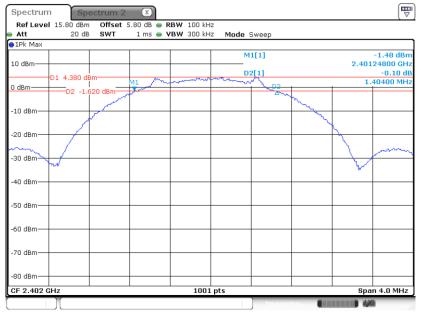
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE	2Mbps	1	0	1000	2.09	1.41	0.50	Pass
BLE	2Mbps	1	19	2440	2.09	1.40	0.50	Pass
BLE	2Mbps	1	39	2480	2.08	1.39	0.50	Pass



3.1.6 Test Plots of 6dB Bandwidth

BLE 2Mbps

6 dB Bandwidth Plot on Channel 00



Date: 7.JUL.2024 18:48:16

6 dB Bandwidth Plot on Channel 19



Date: 7.JUL.2024 18:51:02



Spectrum ctrum 2 X Sp Offset 5.80 dB ● RBW 100 kHz SWT 1 ms ● VBW 300 kHz RefLevel 15.80 dBm Att 20 dB Mode Sweep 🛛 Att 1Pk Max M1[1] -1.62 dBn 2.47926800 GHa 10 dBm D2[1] -0.11 di 1.38800 MH D1 4.230 dB 0 dBm--D2 -1. -10 dBm -20 dBm--30 dBm 40 dBm -50 dBm--60 dBm -70 dBm -80 dBm-Span 4.0 MHz 1001 pts CF 2.48 GH Date: 7.JUL.2024 18:53:16

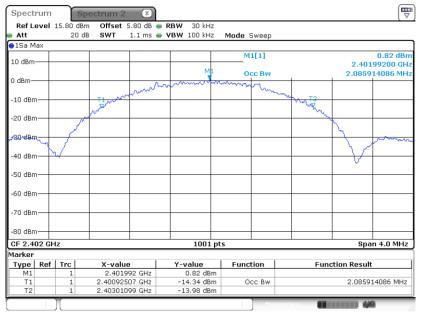
6 dB Bandwidth Plot on Channel 39



3.1.7 Test Plots of 99% Occupied Bandwidth

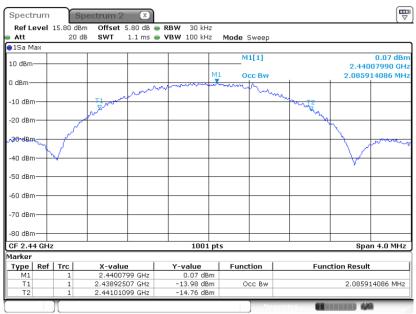
BLE 2Mbps

99% Occupied Bandwidth Plot on Channel 00



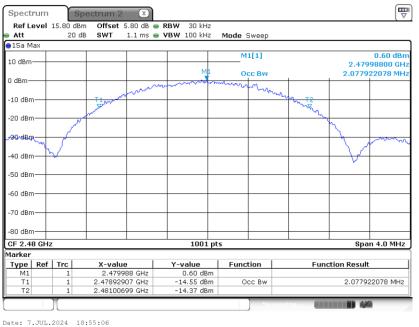
Date: 7.JUL.2024 18:50:05

99% Occupied Bandwidth Plot on Channel 19



Date: 7.JUL.2024 18:52:32





99% Occupied Bandwidth Plot on Channel 39

Note : The occupied channel bandwidth is maintained within the band of operation for all of the modulations.



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.

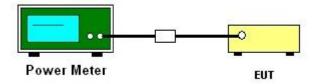
3.2.2 Measuring Instruments

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

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	2Mbps	1	0	2402	5.81	30.00	3.62	9.43	36.00	Pass
BLE	2Mbps	1	19	2440	5.74	30.00	3.62	9.36	36.00	Pass
BLE	2Mbps	1	39	2480	5.80	30.00	3.62	9.42	36.00	Pass

3.2.6 Test Result of Average Output Power (Reporting Only)

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
BLE	2Mbps	1	0	2402	0.00	5.69
BLE	2Mbps	1	19	2440	0.00	5.63
BLE	2Mbps	1	39	2480	0.00	5.68



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.

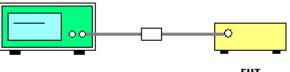
3.3.2 Measuring Instruments

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



Spectrum Analyzer

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3.3.5 Test Result of Power Spectral Density

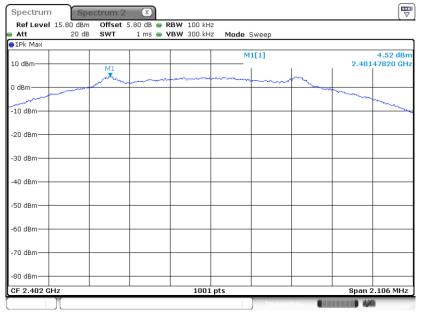
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm /100kHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
BLE	2Mbps	1	0	2402	4.52	-8.71	3.62	8.00	Pass
BLE	2Mbps	1	19	2440	4.59	-9.01	3.62	8.00	Pass
BLE	2Mbps	1	39	2480	4.36	-9.19	3.62	8.00	Pass



3.3.6 Test Result of Power Spectral Density Plots (100kHz)

BLE 2Mbps

PSD 100kHz Plot on Channel 00



Date: 7.JUL.2024 18:48:55

PSD 100kHz Plot on Channel 19



Date: 7.JUL.2024 18:51:40



PSD 100kHz Plot on Channel 39

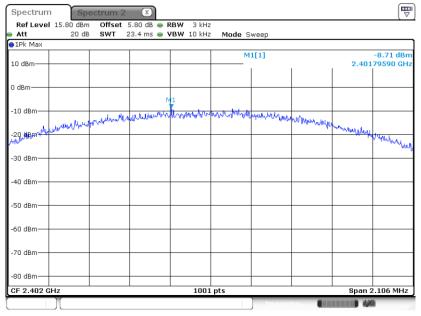
Ref Level 15.80 d		0 dB 🥃 RBW 100 kH			
Att 20	dB SWT	1 ms 👄 VBW 300 kH	z Mode Sweep		
∋1Pk Max			-		
10 dBm	M1		M1[1]		4.36 dBr 2.47947380 GH
0 dBm	Mun			mon	
and the second s					man and a second
-10 dBm					
-20 dBm					
-30 dBm					
-40 dBm					
-50 dBm					
-60 dBm					
-70 dBm					
-80 dBm					
CF 2.48 GHz	I	1001	pts		Span 2.082 MHz

Date: 7.JUL.2024 18:53:55

3.3.7 Test Result of Power Spectral Density Plots (3kHz)

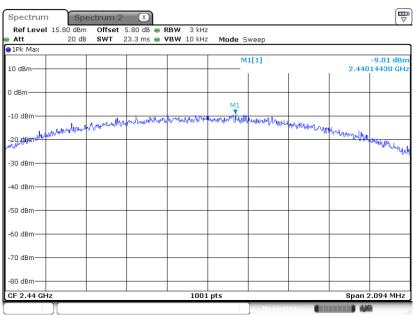
BLE 2Mbps

PSD 3kHz Plot on Channel 00



Date: 7.JUL.2024 18:48:35

PSD 3kHz Plot on Channel 19



Date: 7.JUL.2024 18:51:21

PSD 3kHz Plot on Channel 39

	ctrum 2 🛛 🗵		
Att 20 dBm	Offset 5.80 dB	3 kHz 10 kHz Mode Sweep	
1Pk Max	3W1 23.2 IIIS - YBW	TO KHZ MIDUE Sweep	
10 dBm		M1[1]	-9.19 dBn 2.48014350 GH
0 dBm			
-10 dBm		M1	
-2010Brallynumbrund	A Ample A augura and an an	and a second and they	within and when the weather when the
-30 dBm			
-40 dBm			
-50 dBm			
-60 dBm			
-70 dBm			
-80 dBm			
CF 2.48 GHz		1001 pts	Span 2.082 MHz

Date: 7.JUL.2024 18:53:36



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.

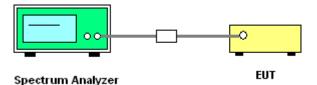
3.4.2 Measuring Instruments

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

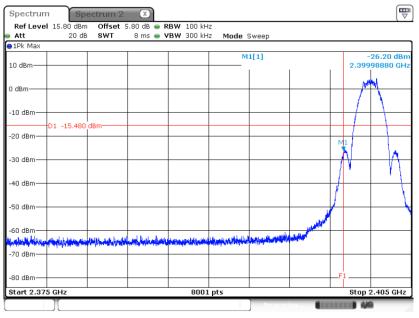




3.4.5 Test Result of Conducted Band Edges Plots

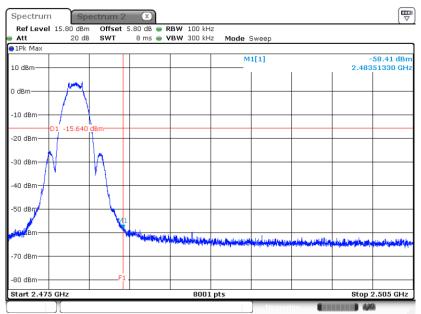
BLE 2Mbps

Low Band Edge Plot on Channel 00



Date: 7.JUL.2024 18:49:14

High Band Edge Plot on Channel 39



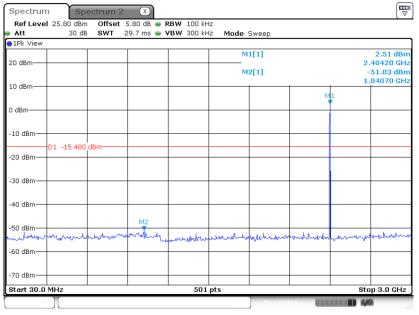
Date: 7.JUL.2024 18:54:15



3.4.6 Test Result of Conducted Spurious Emission Plots

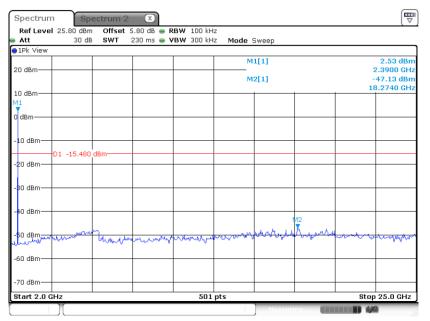
Conducted Spurious Emission Plot on Bluetooth LE 2Mbps

GFSK Channel 00



Date: 7.JUL.2024 18:49:35

Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 00



Date: 7.JUL.2024 18:49:56



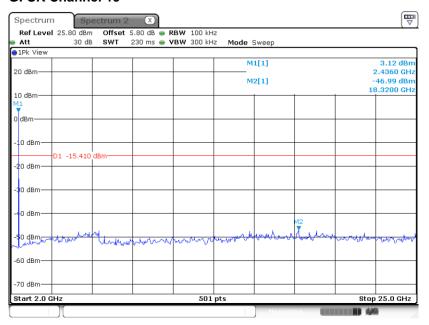
Conducted Spurious Emission Plot on Bluetooth LE 2Mbps

GFSK Channel 19

Ref Level 25.8		et 5.80 dB 👄						
Att	30 dB SW1	F 29.7 ms 👄	VBW 300 kH;	2 Mode 9	Gweep			
1Pk View								
				MI	l[1]			3.69 dBn
20 dBm								43980 GH: 51.73 dBn
				IVE2	2[1]			51.73 dBn 80.70 MH;
LO dBm							M1	00110 1111
							▼ I	
) dBm			+					
10 dBm								
	L5.410 dBm							
20 dBm	13.410 UBIII							
20 0011								
-30 dBm								
40 dBm			+ +					
50 dBm		M2	++					
SU UBIII	Amagan	ana mark	month	mound	munum	manul	Monthebre	Munun
60 dBm			+					
70 dBm								
				-+			01-	
Start 30.0 MHz			501	ots			Sto	p 3.0 GHz

Date: 7.JUL.2024 18:52:02

Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 19



Date: 7.JUL.2024 18:52:22



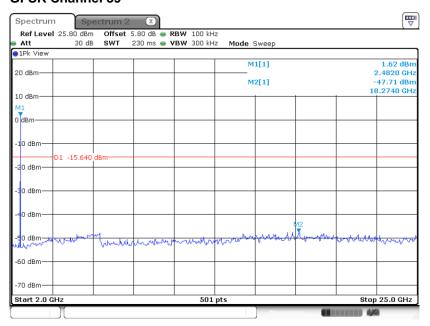
Conducted Spurious Emission Plot on Bluetooth LE 2Mbps

GFSK Channel 39

Att 30 dB SWT	29.7 ms 👄 VBW 300) kHz Mode Sweep			
20 dBm		M1[1]		2.	2.58 dBr 48130 GH
		M2[1]			51.80 dBr 04070 GH
10 dBm			1		04070 GH
				M1	
) dBm					
10 dBm					
D1 -15.640 dBm					
20 dBm				_	
30 dBm					
40 - 40					
40 dBm					
50 dBm	M2				
Methodown maller de	moment why have have	monormulto	mondener	Mahmun	really
60 dBm					
70 dBm					

Date: 7.JUL.2024 18:54:36

Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 39



Date: 7.JUL.2024 18:54:56



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.



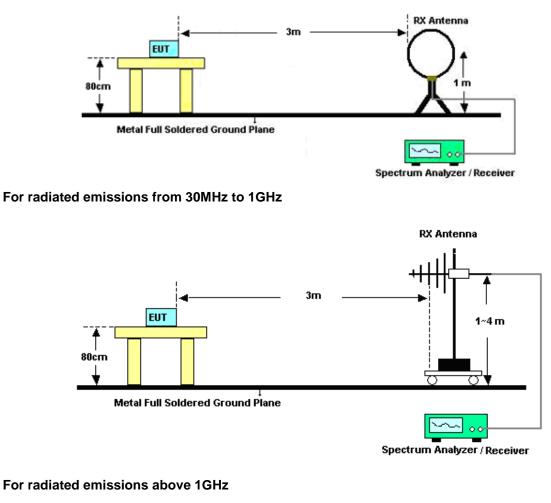
3.5.3 Test Procedures

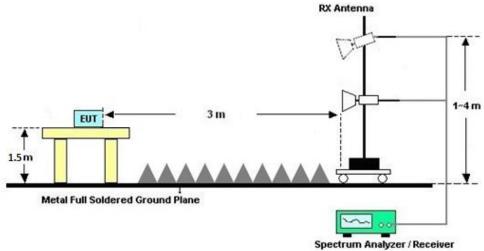
- 1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
- 2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get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





Sporton International Inc. (Kunshan) TEL : +86-512-57900158 FCC ID: 2ADZR5G16B



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)

Please refer to Appendix B.



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

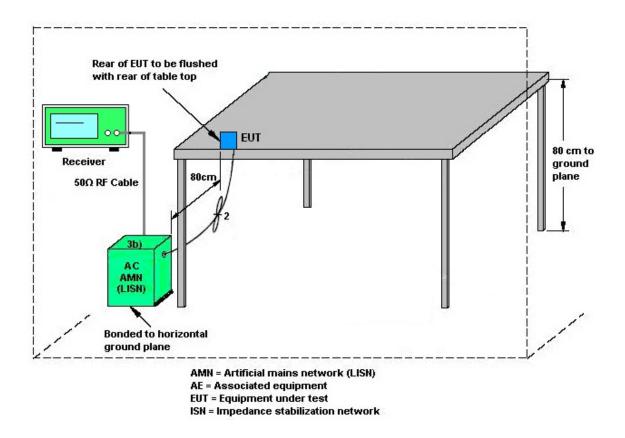
The section 4.0 of List of Measuring Equipment of this test report is used for test.

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

Please refer to Appendix A.



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
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Oct. 11, 2023	Jul. 07, 2024	Oct. 10, 2024	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GH z	Jan. 02, 2024	Jul. 07, 2024	Jan. 01, 2025	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 02, 2024	Jul. 07, 2024	Jan. 01, 2025	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY564000 04	3Hz~8.5GHz;M ax 30dBm	Oct. 10, 2023	Jun. 25, 2024~ Jun. 26, 2024	Oct. 09, 2024	Radiation (03CH05-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY551502 44	10Hz-44G,MAX 30dB	Apr. 18, 2024	Jun. 25, 2024~ Jun. 26, 2024	Apr. 17, 2025	Radiation (03CH05-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 10, 2023	Jun. 25, 2024~ Jun. 26, 2024	Oct. 09, 2024	Radiation (03CH05-KS)
Bilog Antenna	TeseQ	CBL6111D	59913	30MHz-1GHz	Aug. 19, 2023	Jun. 25, 2024~ Jun. 26, 2024	Aug. 18, 2024	Radiation (03CH05-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	75957	1GHz~18GHz	Oct. 23, 2023	Jun. 25, 2024~ Jun. 26, 2024	Oct. 22, 2024	Radiation (03CH05-KS)
SHF-EHF Horn	Com-power	AH-840	101093	18GHz~40GHz	Jan. 05, 2024	Jun. 25, 2024~ Jun. 26, 2024	Jan. 04, 2025	Radiation (03CH05-KS)
Amplifier	SONOMA	310N	380826	9KHz-1GHz	Jul. 06, 2023	Jun. 25, 2024~ Jun. 26, 2024	Jul. 05, 2024	Radiation (03CH05-KS)
Amplifier	EM	EM18G40GA	060852	18~40GHz	Jan. 05, 2024	Jun. 25, 2024~ Jun. 26, 2024	Jan. 04, 2025	Radiation (03CH05-KS)
high gain Amplifier	EM	EM01G18GA	060839	1Ghz-18Ghz	Oct. 10, 2023	Jun. 25, 2024~ Jun. 26, 2024	Oct. 09, 2024	Radiation (03CH05-KS)
Amplifier	EM	EM01G18GA	060833	1Ghz-18Ghz	Jan. 03, 2024	Jun. 25, 2024~ Jun. 26, 2024	Jan. 02, 2025	Radiation (03CH05-KS)
AC Power Source	Chroma	61601	F1040900 04	N/A	NCR	Jun. 25, 2024~ Jun. 26, 2024	NCR	Radiation (03CH05-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Jun. 25, 2024~ Jun. 26, 2024	NCR	Radiation (03CH05-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Jun. 25, 2024~ Jun. 26, 2024	NCR	Radiation (03CH05-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr. 18, 2024	Jun. 17, 2024	Apr. 17, 2025	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 11, 2023	Jun. 17, 2024	Oct. 10, 2024	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	Apr. 18, 2024	Jun. 17, 2024	Apr. 17, 2025	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP00000 0811	AC 0V~300V, 45Hz~1000Hz	Oct. 11, 2023	Jun. 17, 2024	Oct. 10, 2024	Conduction (CO01-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	±0.4 ppm

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))	2.64 dB

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

Measuring Uncertainty for a Level of Confidence	3.30 dB
of 95% (U = 2Uc(y))	5.30 dB

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

Measuring Uncertainty for a Level of Confidence	6.02 dB
of 95% (U = 2Uc(y))	0.02 dB

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

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

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

Measuring Uncertainty for a Level of Confidence	5.34 dB
of 95% (U = 2Uc(y))	5.54 UB

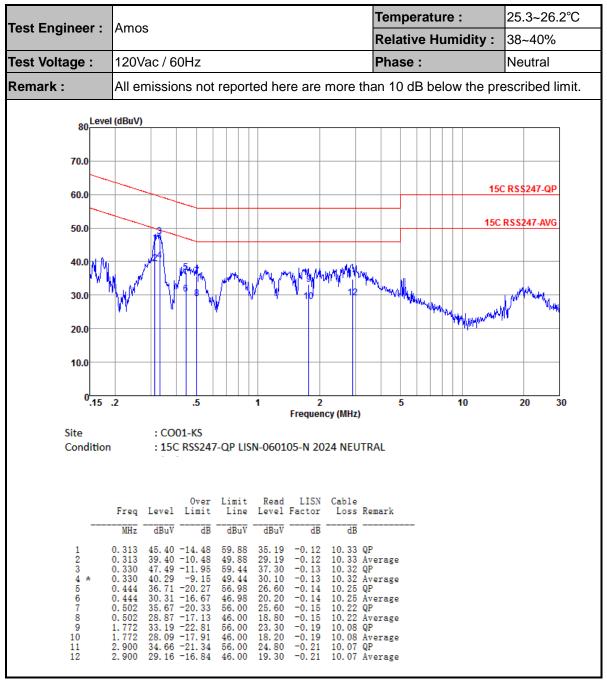
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Appendix A. AC Conducted Emission Test Results

Toot Engineer	Amos		Temperature :	25.3~26.2°C	
Test Engineer :	Amos			Relative Humidity :	38~40%
Test Voltage :	120Vac / 60Hz			Phase :	Line
Remark :	All emissions no	ot reported he	nan 10 dB below the p	rescribed limit.	
80	l (dBuV)				
80					
70.0					
60.0				15	SC RSS247-QP
					C RSS247-AVG
50.0					
40.0			an an an the		
30.0	No Marin	MAN	1012	MA HANNE AND	
0010	''' Y	Y' ['		March Marganese Harapanese	Alter Sty
20.0					
10.0					
0 ^L .15	.2 .5	1	2 Frequency (MHz)	5 10	20 30
Site	: CO01-KS				
Condition	15C RSS2	17-QP LISN-0601	105-L 2024 LINE		
	Ove Freq Level Limi		LISN Cable Factor Loss R	emark	
	MHz dBuV d	3 dBuV dBuV	dB dB		
$^{1}_{2}$ *	0.329 47.57 -11.9 0.329 39.87 -9.6	2 49.49 29.50	0.05 10.32 A	verage	
2 * 3 4 5 6 7 8	0.474 36.74 -19.7 0.474 30.34 -16.1 1.088 35.40 -20.6	46.45 20.20	-0.09 10.23 A	verage	
6 7	1.088 29.50 -16.5 1.707 34.07 -21.9	0 46.00 19.59 3 56.00 24.20	-0.18 10.09 A -0.21 10.08 Q	verage P	
8 9 10	1.707 30.07 -15.9 2.608 34.09 -21.9 2.608 28.49 -17.5	3 46.00 20.20 1 56.00 24.20	-0.18 10.07 Q	P	
10 11 12	2.884 35.10 -20.9 2.884 29.50 -16.5	0 56.00 25.20	-0.17 10.07 Q	P	





Note:

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





Appendix B. Radiated Spurious Emission Test Data

Test Engineer :	levi zhao	Relative Humidity :	41~ 42%
		Temperature :	22 ~ 23 ℃

Radiated Spurious Emission Test Modes

Mode	Band (MHz)	Modulation	Channel	Frequency	Data Rate	RU	Remark
Mode 1	2400-2483.5	Bluetooth-LE_GSFK	0	2402	2Mbps	-	-
Mode 2	2400-2483.5	Bluetooth-LE_GSFK	19	2440	2Mbps	-	-
Mode 3	2400-2483.5	Bluetooth-LE_GSFK	39	2480	2Mbps	-	-

Co-location

Mode	Band (MHz)	Antenna	Modulation	Channel	Frequency	Data Rate	RU	Remark		
Mode 4	2400-2483.5	-	Bluetooth-LE_GSFK	39	2480	2Mbps	-	-		
	Ant 0+5 48A-2A QPSK,20MHz BW 1RB0									

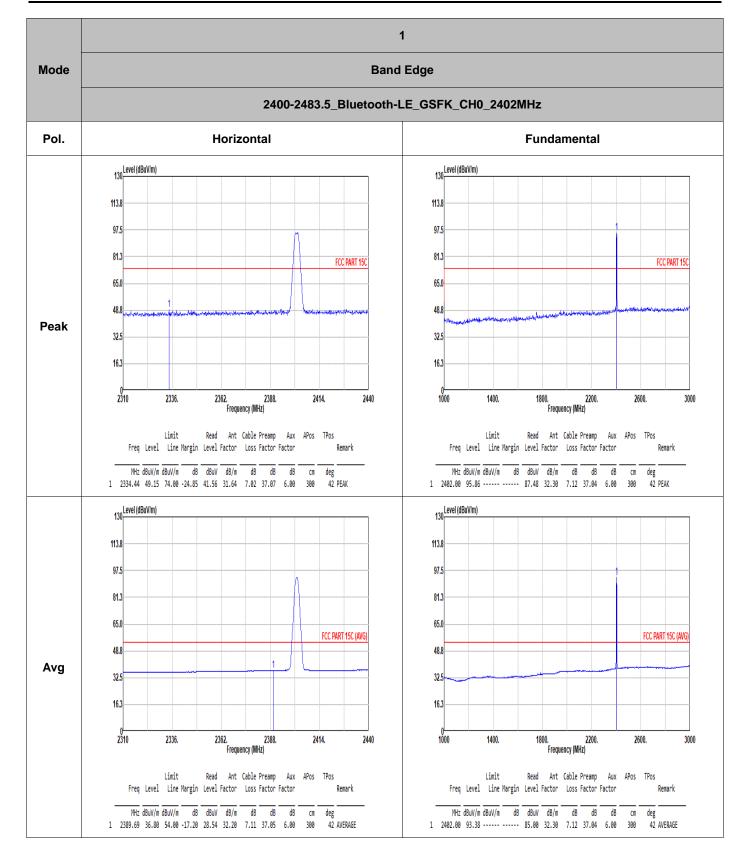
Summary of each worse mode

Mode	Modulation	Ch.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	Remark
1	Bluetooth-LE_GSFK	0	2389.69	36.80	54.00	-17.20	н	AVERAGE	Pass	Band Edge
I	Bluetooth-LE_GSFK	0	4804.00	43.44	74.00	-30.56	V	PEAK	Pass	Harmonic
2	Bluetooth-LE_GSFK	19	2499.88	37.40	54.00	-16.60	Н	AVERAGE	Pass	Band Edge
2	Bluetooth-LE_GSFK	19	7320.00	42.93	74.00	-31.07	н	PEAK	Pass	Harmonic
2	Bluetooth-LE_GSFK	39	2483.50	38.79	54.00	-15.21	Н	AVERAGE	Pass	Band Edge
3	Bluetooth-LE_GSFK	39	4960.00	43.09	74.00	-30.91	Н	PEAK	Pass	Harmonic

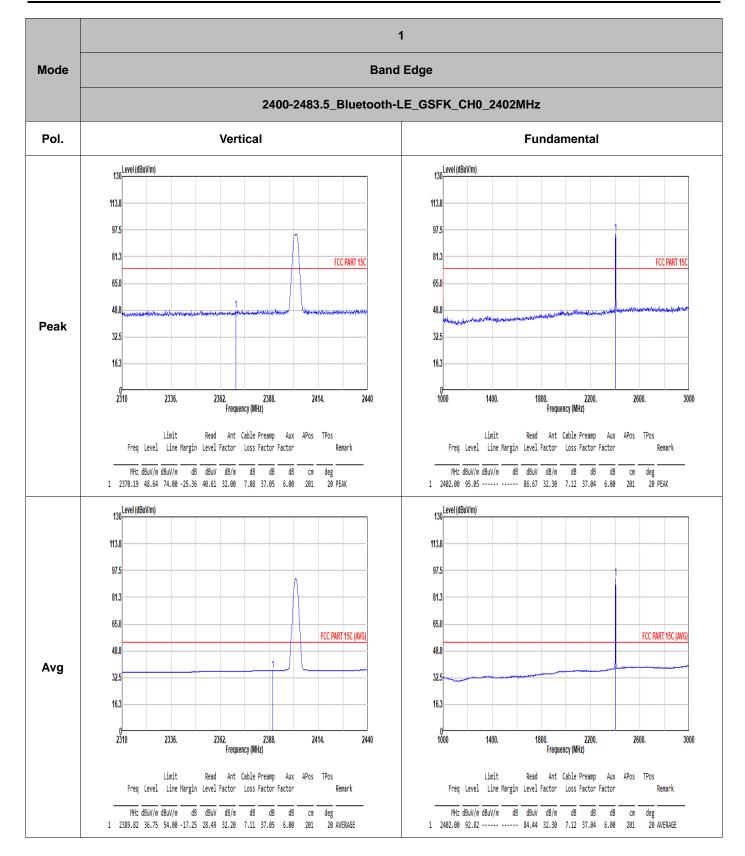
Co-location

Mode	Modulation	Ch.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	Remark
4	Bluetooth-LE_GSFK	39	2483.50	38.75	54.00	-15.25	Н	AVERAGE	Pass	Band Edge
4	Bluetooth-LE_GSFK	39	4960.00	42.01	74.00	-31.99	н	PEAK	Pass	Harmonic

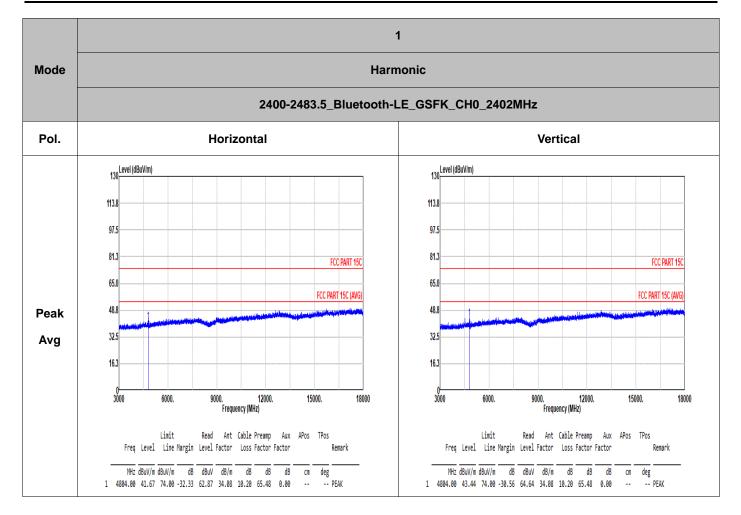




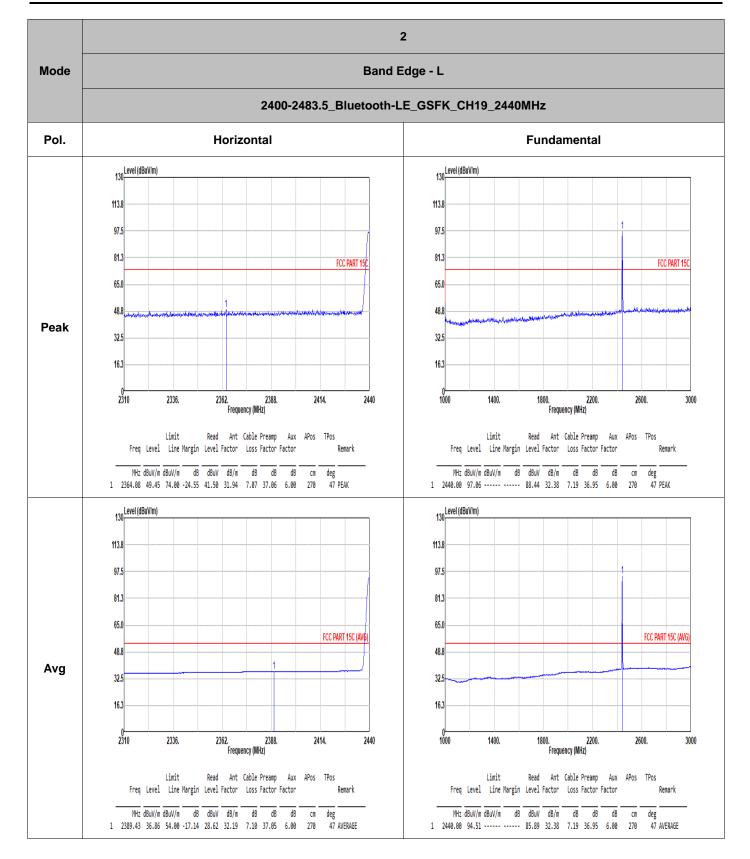




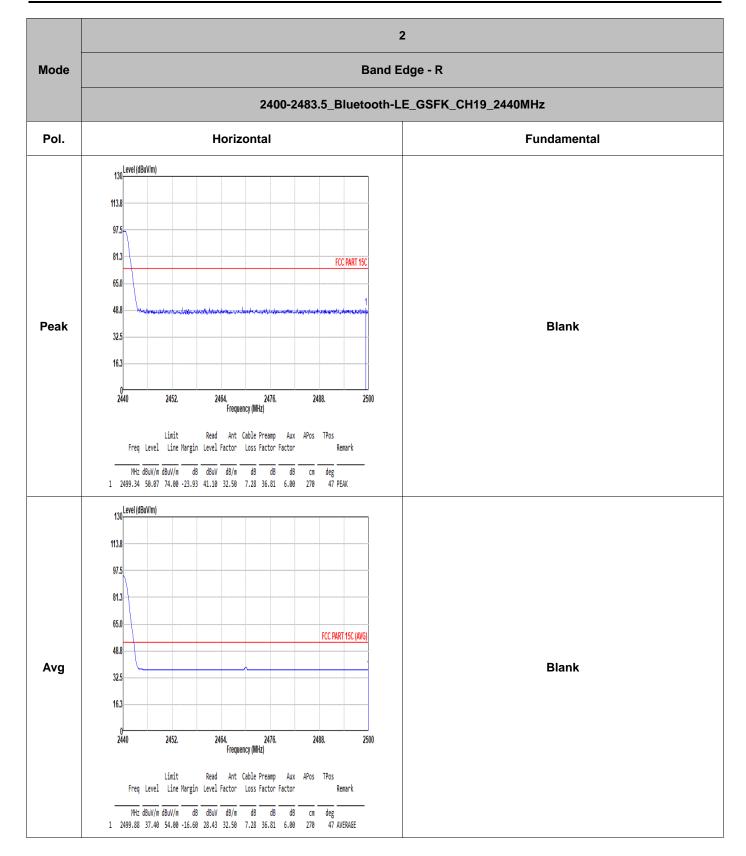




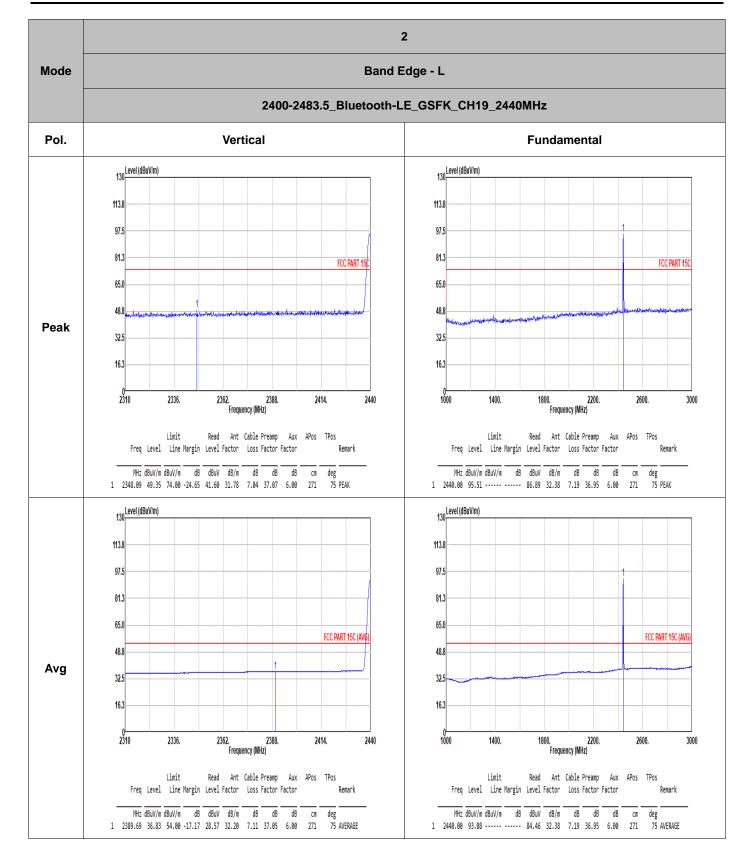




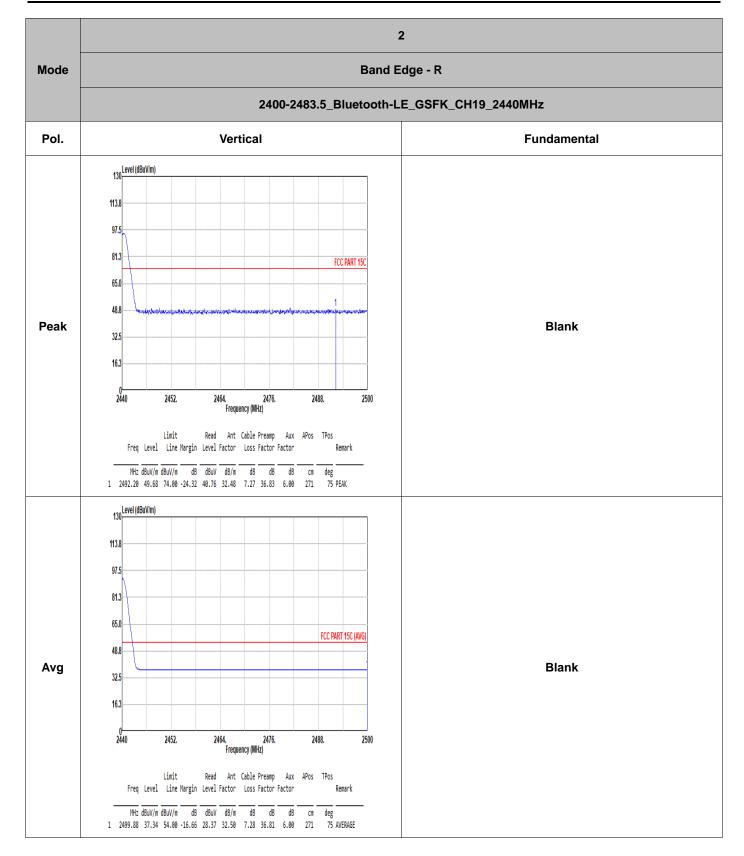




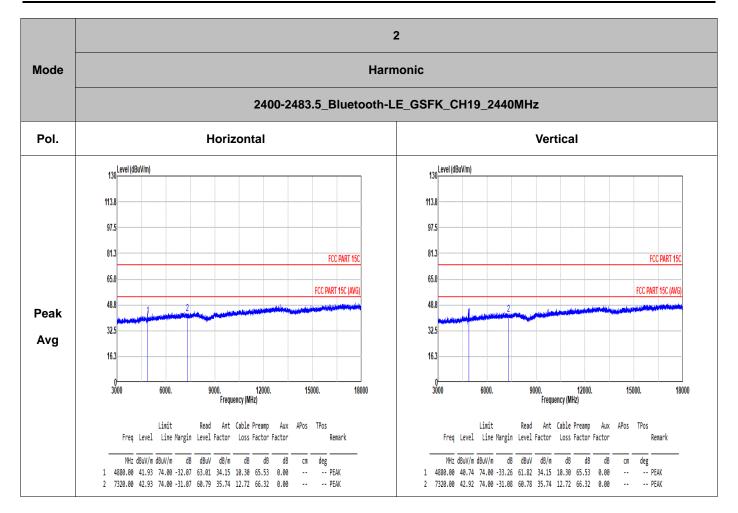




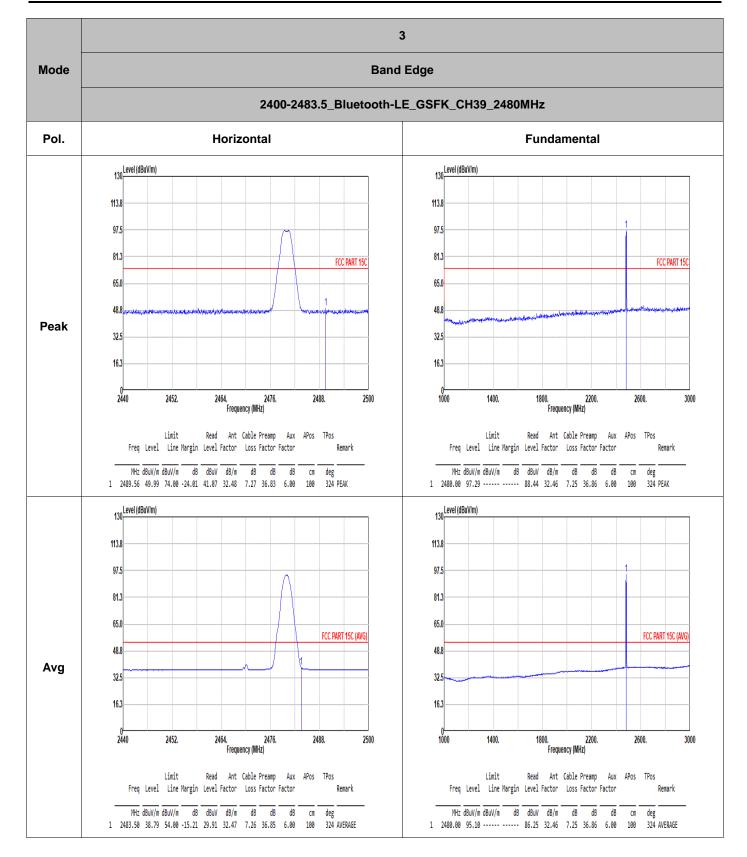




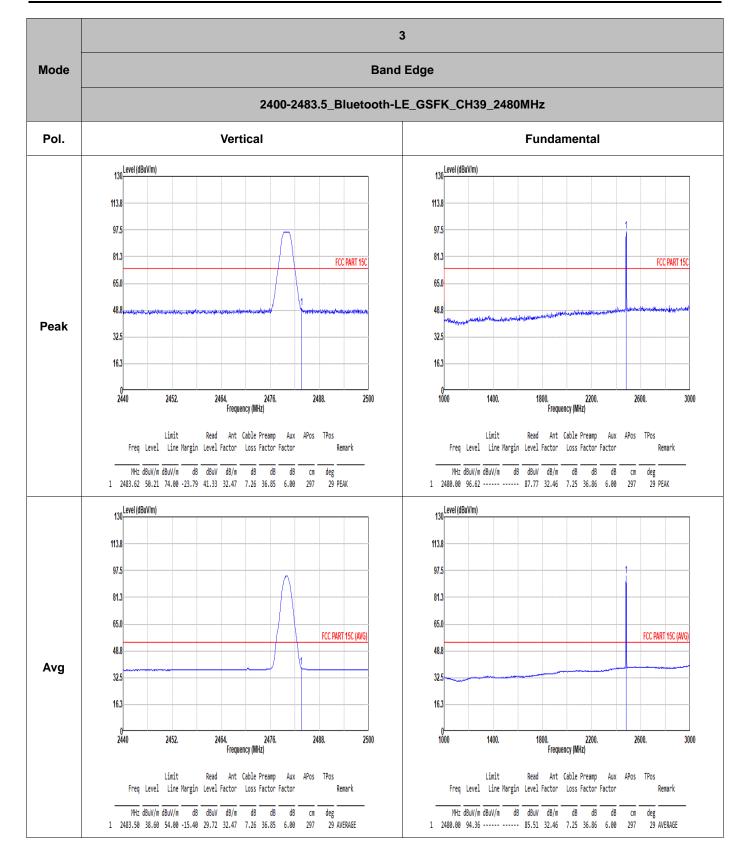




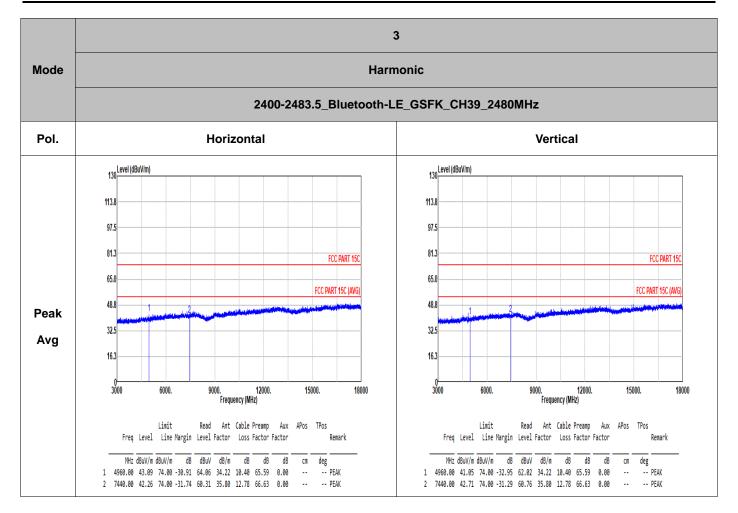




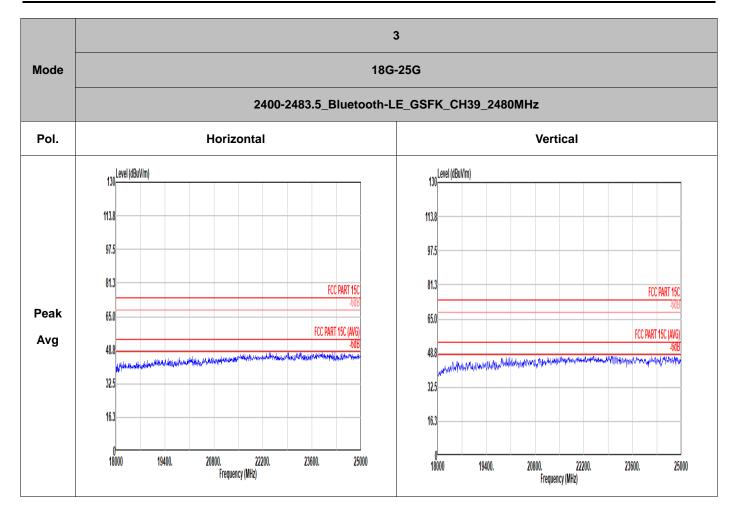




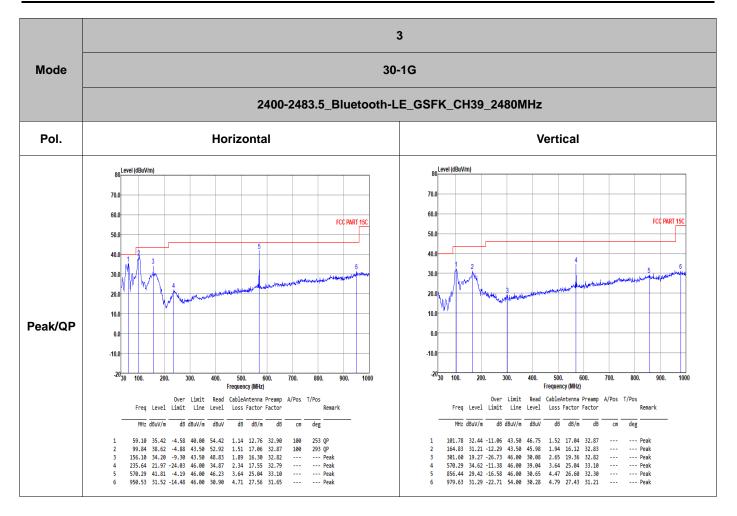


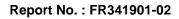




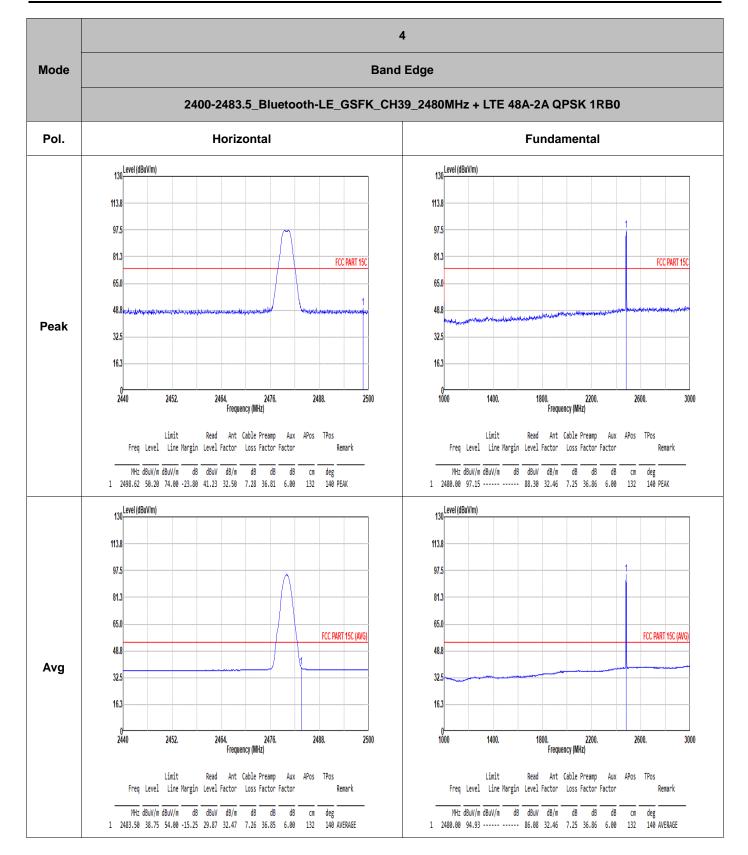


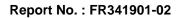




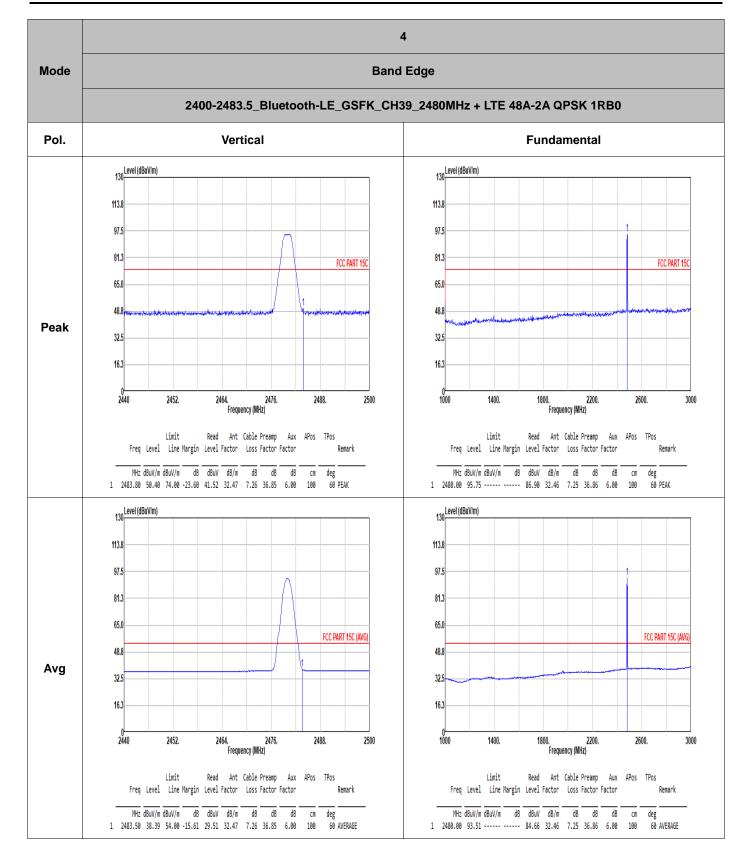




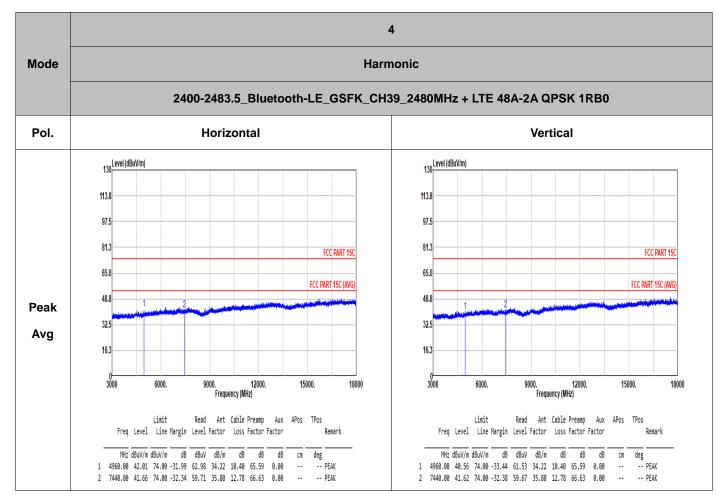














Appendix C. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting	
Bluetooth LE 2Mbps	100%	-	-	10Hz	

Bluetooth LE 2Mbps

Spectrum	Spe	ectrum 2	×						
Ref Level 25				RBW 1 MHz					
Att	30 dB	SWT	10 ms 😑	VBW 1 MH:	2				
SGL									,
●1Pk Max									
20 dBm									
10 dBm									
0 dBm									
-10 dBm									
-20 dBm									
-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									
CF 2.44 GHz				691	pts				1.0 ms/
						Read	y	🗰	