



FCC RADIO TEST REPORT

FCC ID : 2AVC9-7448
Equipment : Digital Media Receiver
Model Name : V5S83A
Applicant : BROOKLYN EAST LLC
41 University Drive, Suite 400
Newtown, PA 18940
Standard : FCC Part 15 Subpart C §15.247

The product was received on Feb. 24, 2021 and testing was started from Mar. 01, 2021 and completed on Mar. 26, 2021. We, Sporton International (USA) Inc., 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 (USA) Inc., the test report shall not be reproduced except in full.

Approved by: Neil Kao

Sportun International (USA) Inc.
1175 Montague Expressway, Milpitas, CA 95035



Table of Contents

History of this test report.....	3
Summary of Test Result.....	4
1 General Description.....	5
1.1 Product Feature of Equipment Under Test.....	5
1.2 Product Specification of Equipment Under Test.....	5
1.3 Modification of EUT	5
1.4 Testing Location	6
1.5 Applicable Standards.....	6
2 Test Configuration of Equipment Under Test.....	7
2.1 Carrier Frequency Channel	7
2.2 Test Mode	8
2.3 Connection Diagram of Test System.....	9
2.4 EUT Operation Test Setup	10
2.5 Measurement Results Explanation Example.....	10
3 Test Result.....	11
3.1 6dB and 99% Bandwidth Measurement	11
3.2 Output Power Measurement.....	16
3.3 Power Spectral Density Measurement	17
3.4 Conducted Band Edges and Spurious Emission Measurement	22
3.5 Radiated Band Edges and Spurious Emission Measurement	28
3.6 AC Conducted Emission Measurement.....	32
3.7 Antenna Requirements.....	34
4 List of Measuring Equipment	35
5 Uncertainty of Evaluation.....	37
Appendix A. Conducted Test Results	
Appendix B. AC Conducted Emission Test Result	
Appendix C. Radiated Spurious Emission	
Appendix D. Radiated Spurious Emission Plots	
Appendix E. Duty Cycle Plots	



History of this test report



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)
3.1	15.247(a)(2)	6dB Bandwidth	Pass
3.1	2.1049	99% Occupied Bandwidth	Reporting only
3.2	15.247(b)(3)	Output Power	Pass
3.3	15.247(e)	Power Spectral Density	Pass
3.4	15.247(d)	Conducted Band Edges and Spurious Emission	Pass
3.5	15.247(d)	Radiated Band Edges and Spurious Emission	Pass
3.6	15.207	AC Conducted Emission	Pass
3.7	15.203 & 15.247(b)	Antenna Requirement	Pass

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.



1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Digital Media Receiver
Model Name	V5S83A
FCC ID	2AVC9-7448
EUT supports Radios application	WLAN 11b/g/n HT20 WLAN 11a/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE

Remark: The above EUT's information was declared by manufacturer.

1.2 Product Specification of Equipment Under Test

Product Specification subjective to this standard	
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	9.02 dBm (0.0080 W) for 1Mbps 9.02 dBm (0.0080 W) for 2Mbps
99% Occupied Bandwidth	1.027 MHz for 1Mbps 2.046 MHz for 2Mbps
Antenna Type / Gain	Dipole Antenna type with gain 2.8 dBi
Type of Modulation	Bluetooth LE : GFSK

Remark: The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.

1.3 Modification of EUT

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



1.4 Testing Location

Test Site	Sportun International (USA) Inc
Test Site Location	1175 Montague Expressway, Milpitas, CA 95035 TEL : 408 9043300
Test Site No.	Sportun Site No.
	TH01-CA, CO01-CA, 03CH02-CA

1.5 Applicable Standards

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

- ♦ FCC Part 15 Subpart C §15.247
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01
- ♦ ANSI C63.10-2013

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.



2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 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
	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

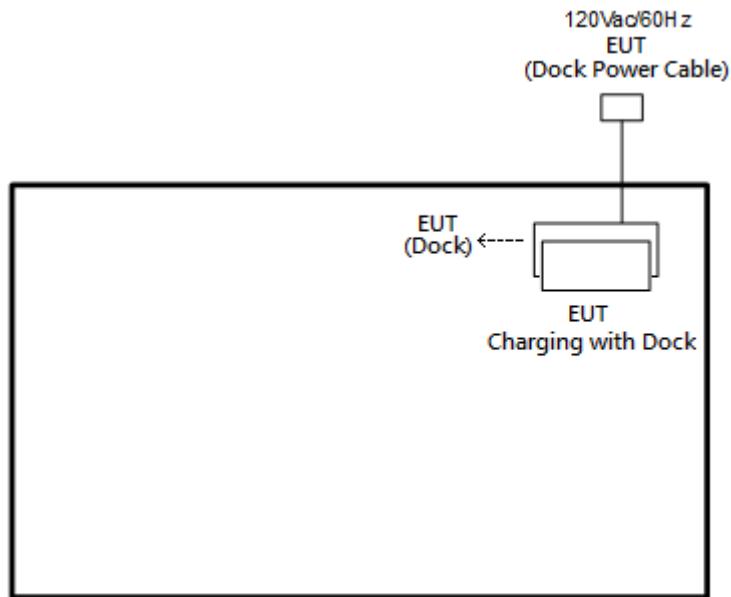
- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental 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.

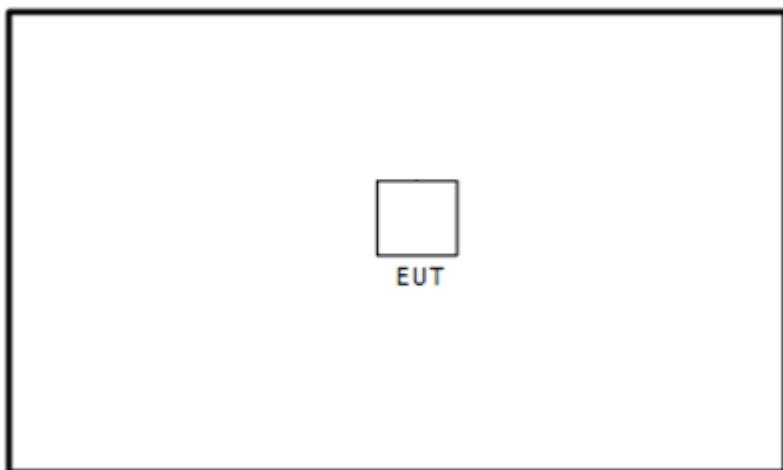
Summary table of Test Cases	
Test Item	Data Rate / Modulation
Conducted Test Cases	Bluetooth – LE / GFSK
	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps
	Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps
	Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
	Mode 4: Bluetooth Tx CH00_2402 MHz_2Mbps
	Mode 5: Bluetooth Tx CH19_2440 MHz_2Mbps
Radiated Test Cases	Mode 6: Bluetooth Tx CH39_2480 MHz_2Mbps
	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps
	Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps
	Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
	Mode 4: Bluetooth Tx CH00_2402 MHz_2Mbps
	Mode 5: Bluetooth Tx CH19_2440 MHz_2Mbps
AC Conducted Emission	Mode 6: Bluetooth Tx CH39_2480 MHz_2Mbps
	Mode 1: WLAN (2.4GHz) Tx + Bluetooth Tx + Dock (Charging from Adapter)

2.3 Connection Diagram of Test System

<AC Conducted Emission Mode>



<Bluetooth - LE Tx Mode>





2.4 EUT Operation Test Setup

The RF test items, utility “Compliance WiFi-BT-Zigbee V1.0.0.97” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

2.5 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 4.2 dB and 10 dB attenuator.

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

$$= 4.2 + 10 = 14.2 \text{ (dB)}$$

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.

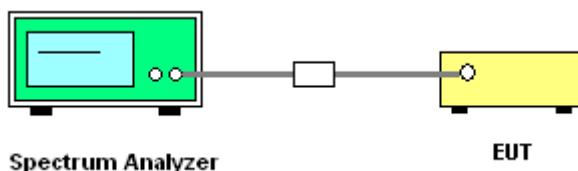
3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).
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 the maximum power setting and enable the EUT to transmit continuously.
4. 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 6dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW) $\geq 3 * \text{RBW}$.
6. Measure and record the results in the test report.

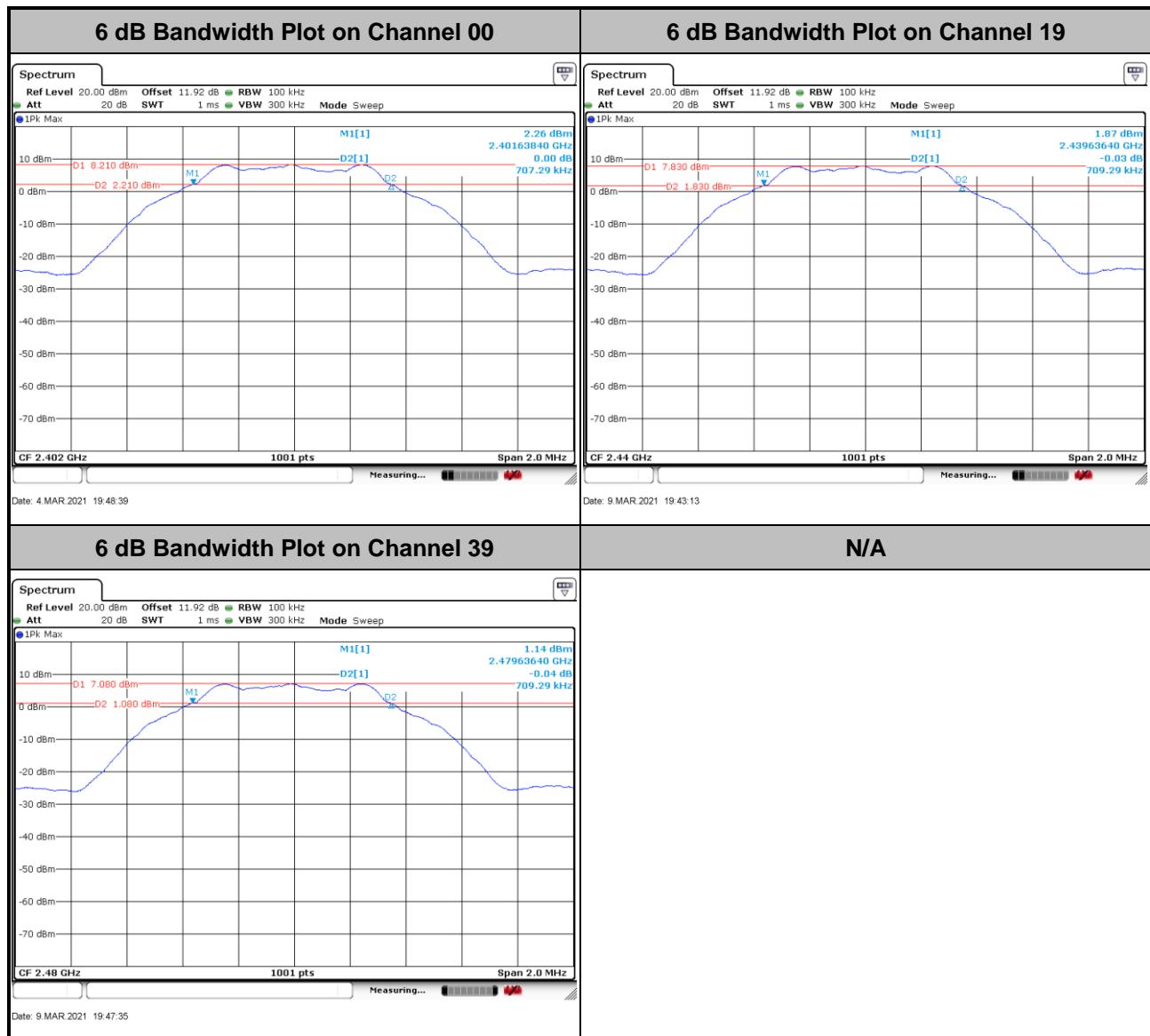
3.1.4 Test Setup



3.1.5 Test Result of 6dB Bandwidth

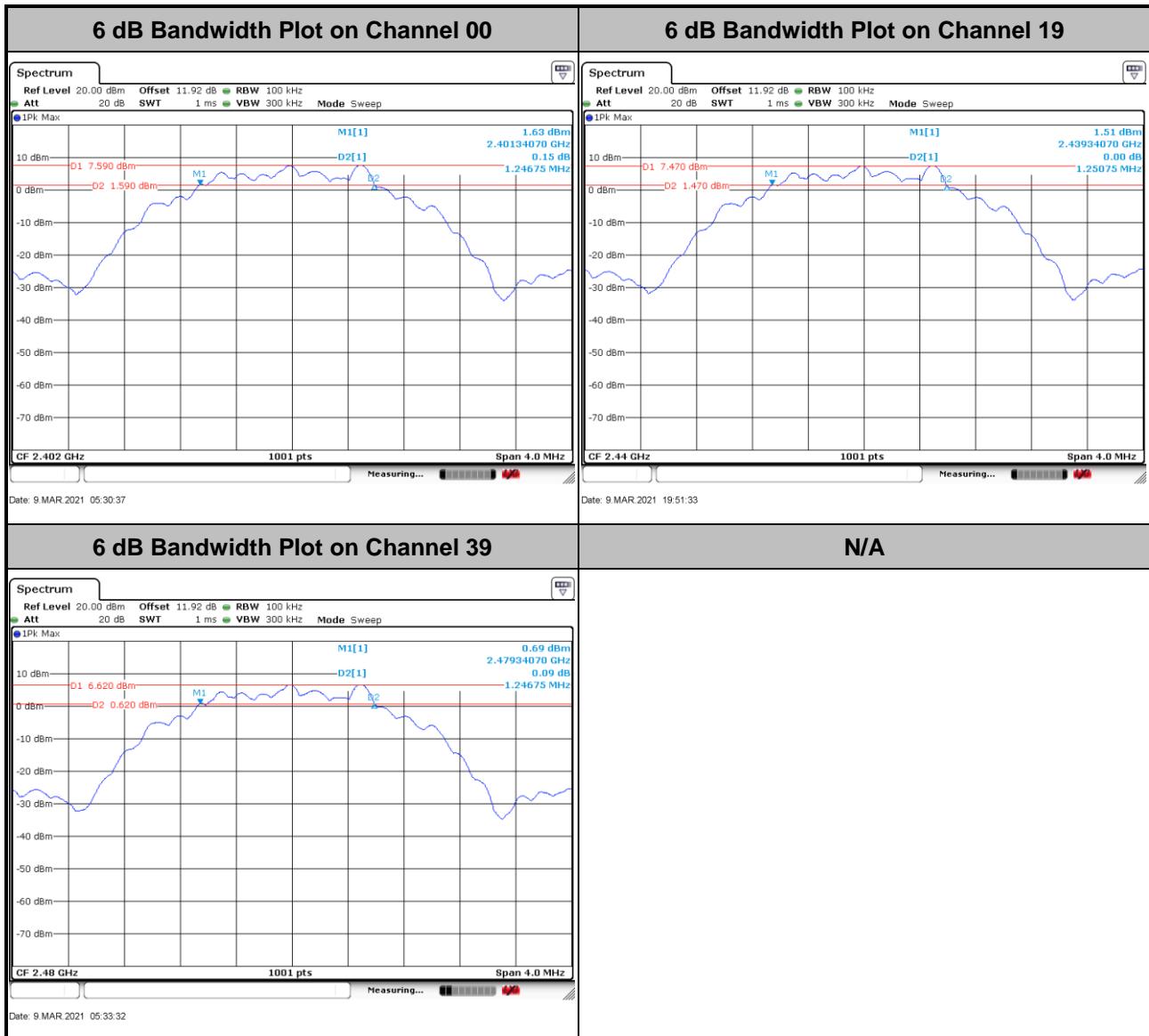
Please refer to Appendix A.

<1Mbps>





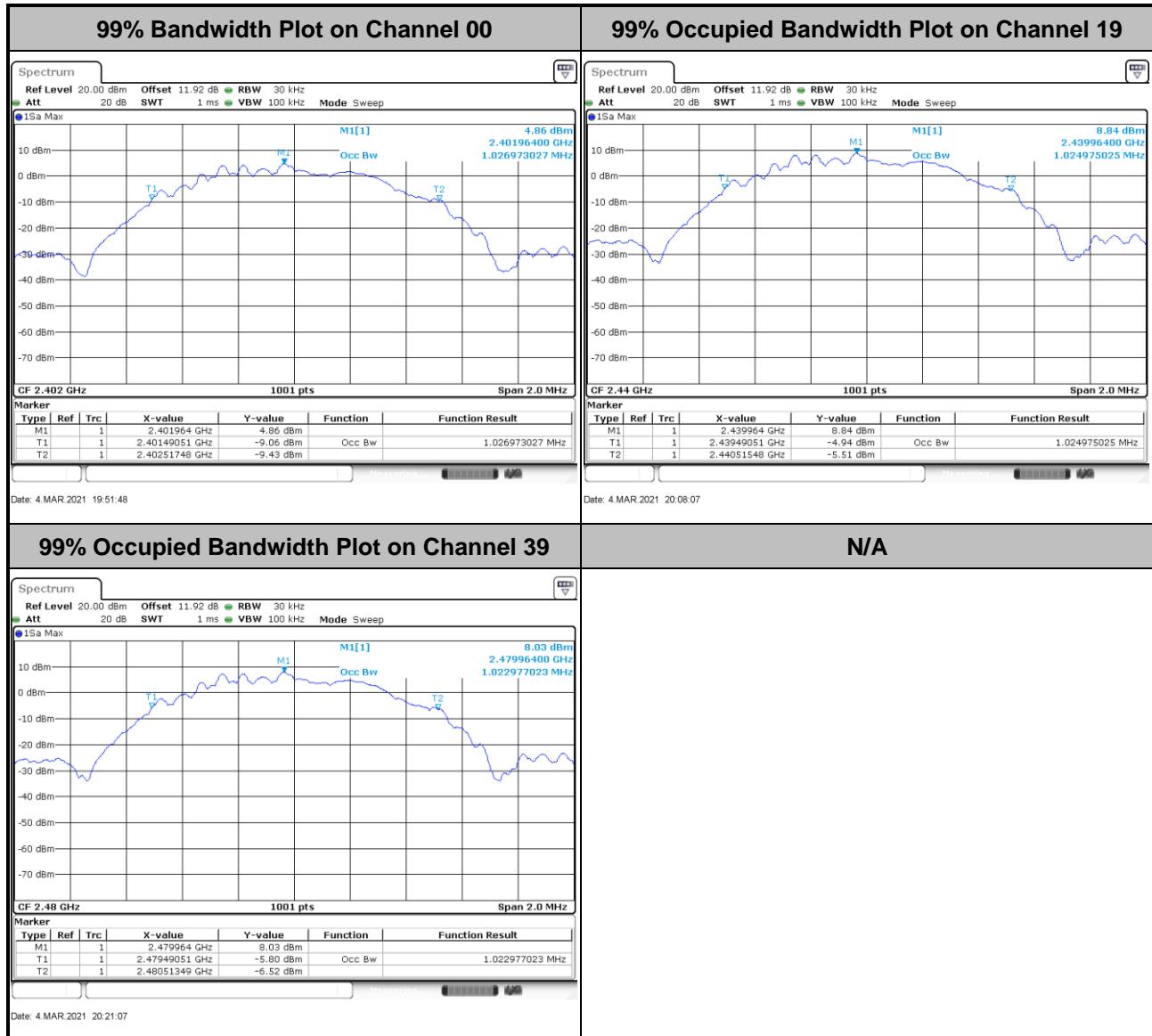
<2Mbps>



3.1.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

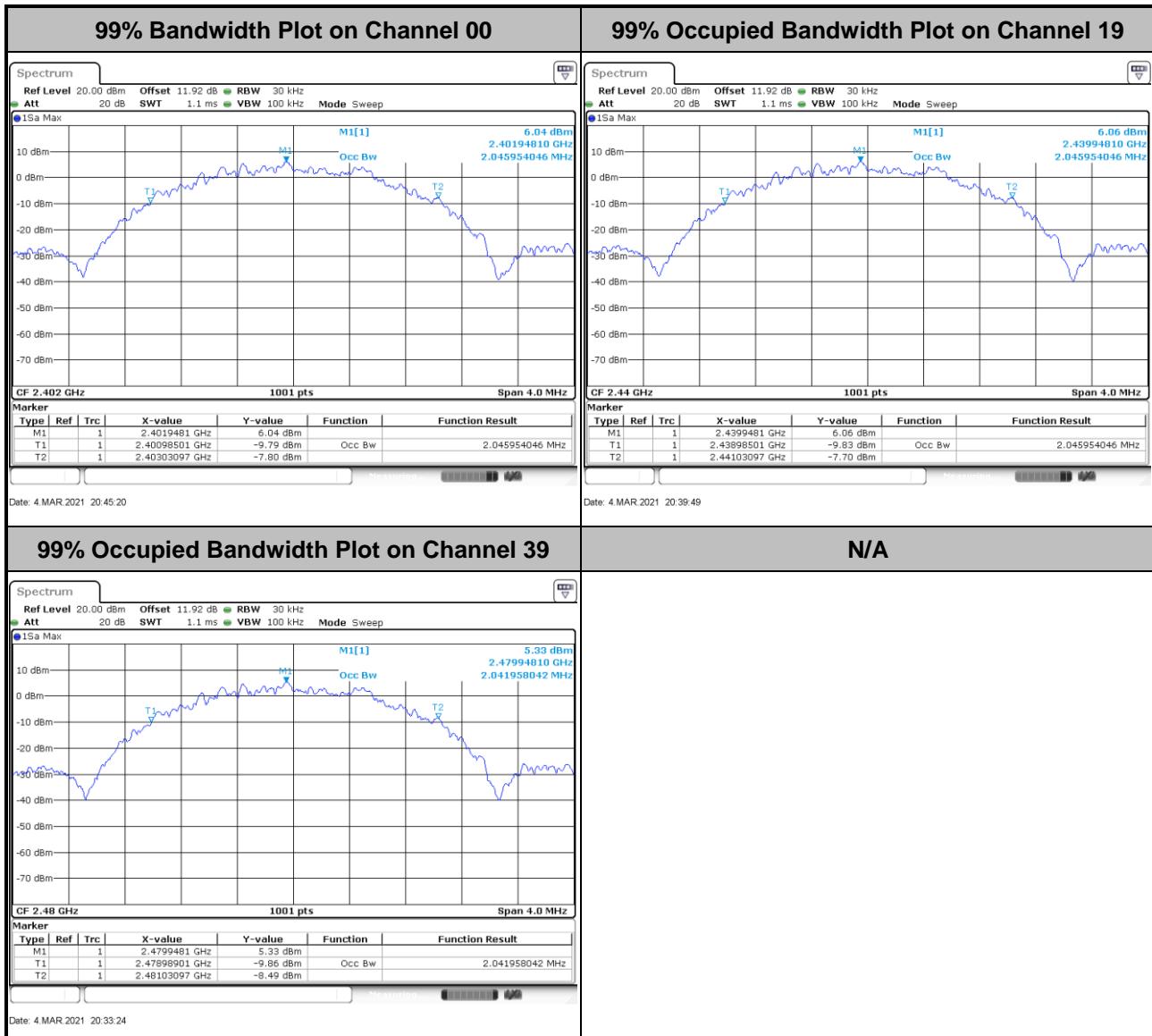
<1Mbps>



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



<2Mbps>



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 2400-2483.5 MHz, the limit for output power is 30 dBm. If transmitting antenna of directional gain greater than 6 dBi 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 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

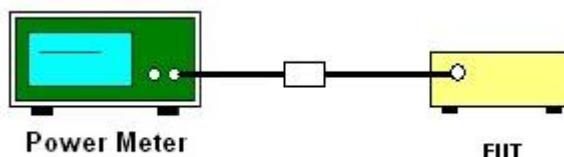
3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

3.2.3 Test Procedures

1. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
2. The RF output of EUT was connected to the power meter by RF cable and attenuator.
3. The path loss was compensated to the results for each measurement.
4. Set the maximum power setting and enable the EUT to transmit continuously.
5. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Average Output Power

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

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

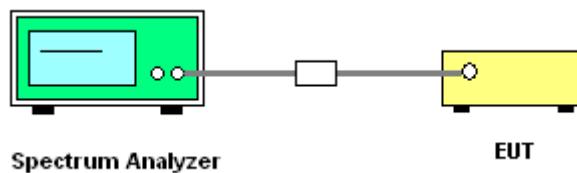
3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

3.3.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 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 the maximum power setting and enable the EUT to transmit continuously.
4. 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)/ 100 kHz is a reference level and is used as 20 dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

3.3.4 Test Setup



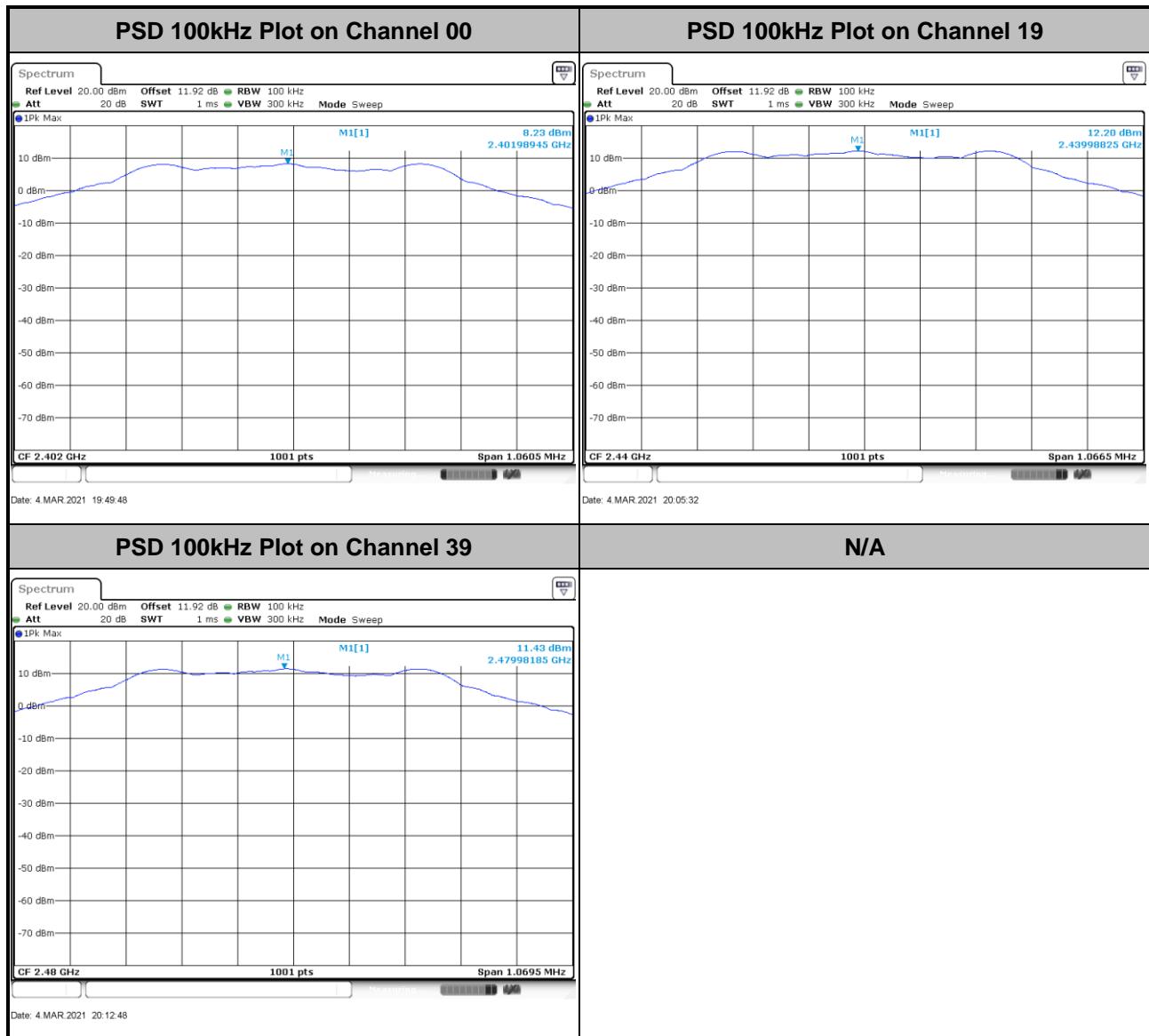
3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.



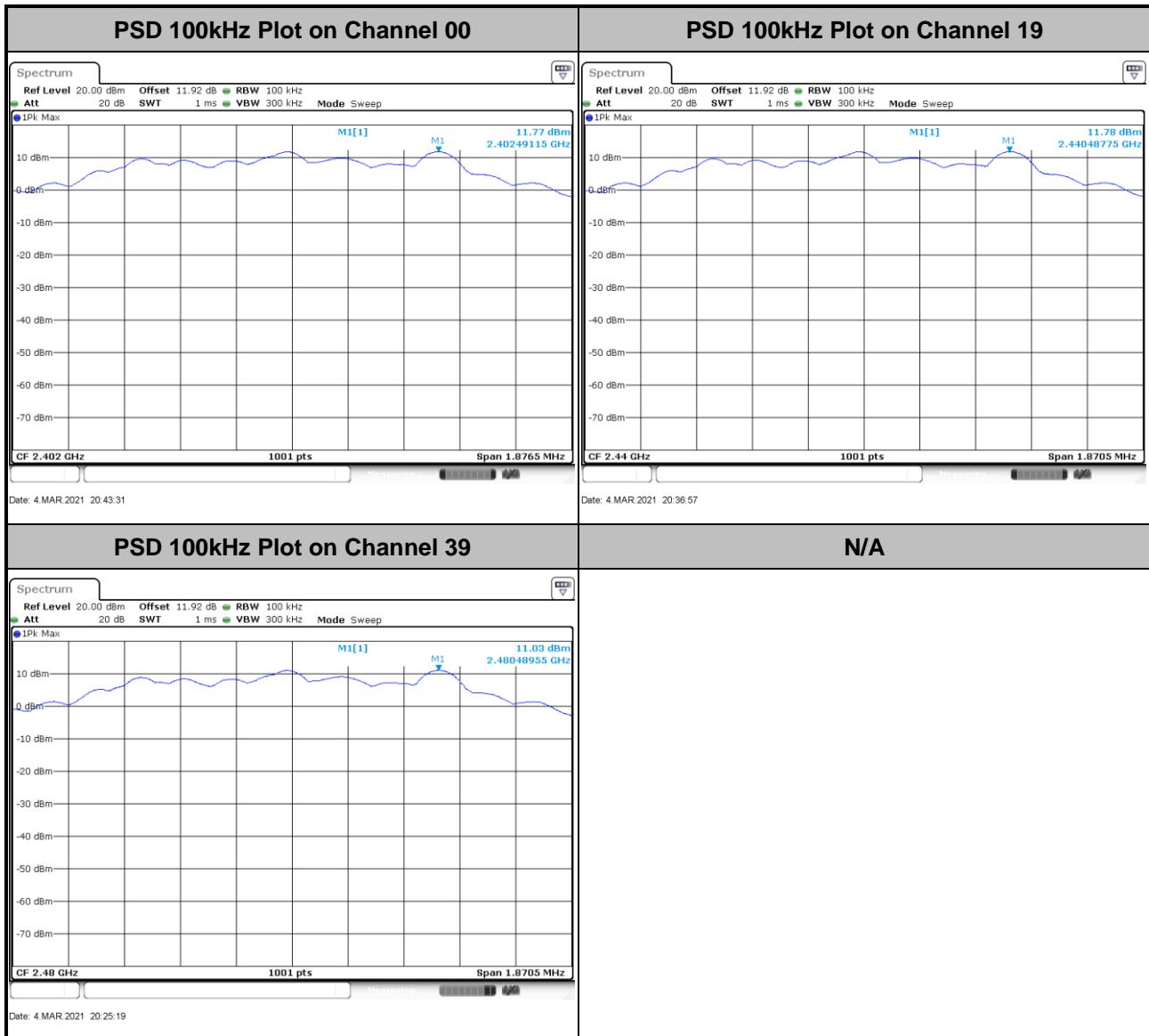
3.3.6 Test Result of Power Spectral Density Plots (100kHz)

<1Mbps>





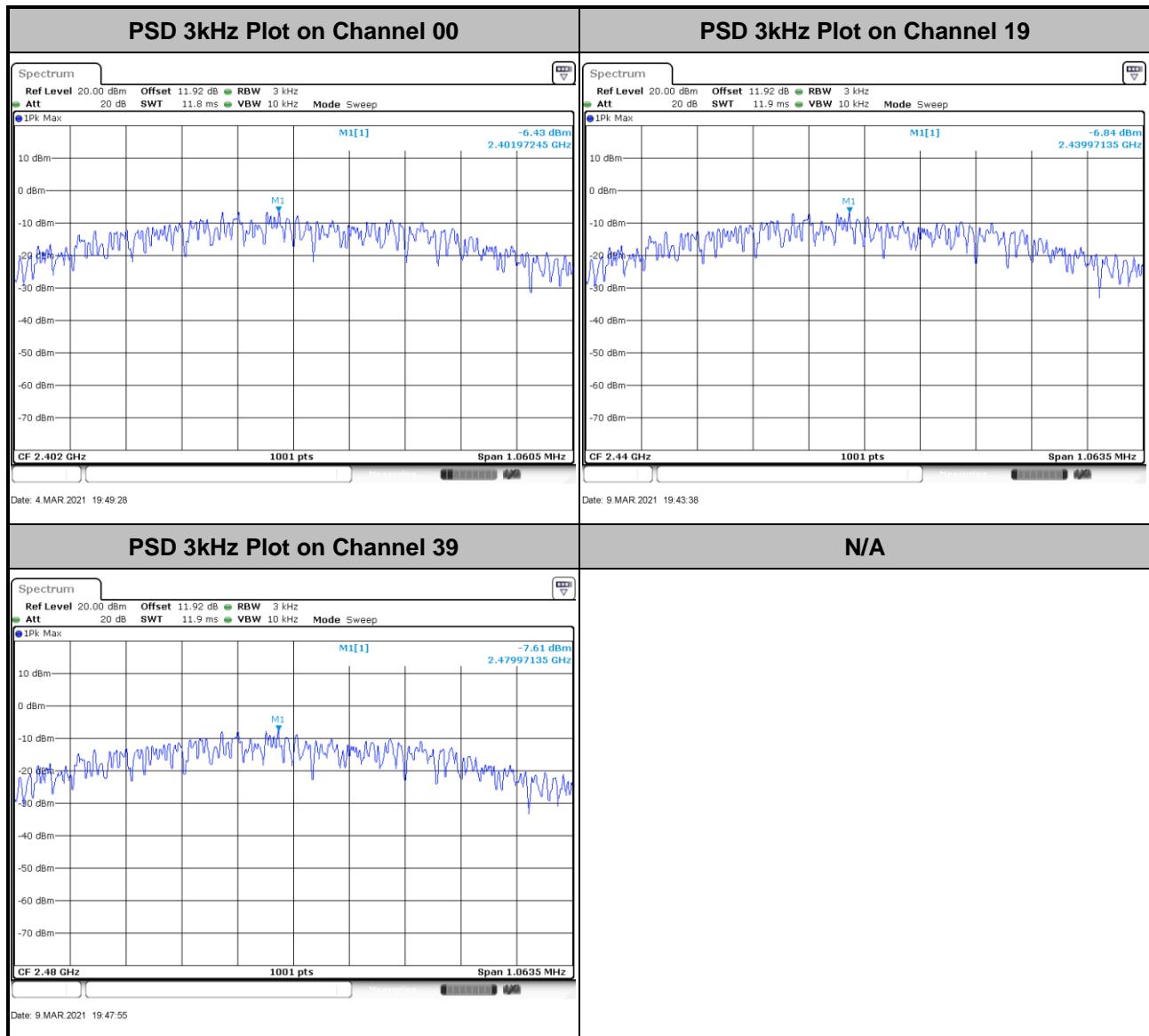
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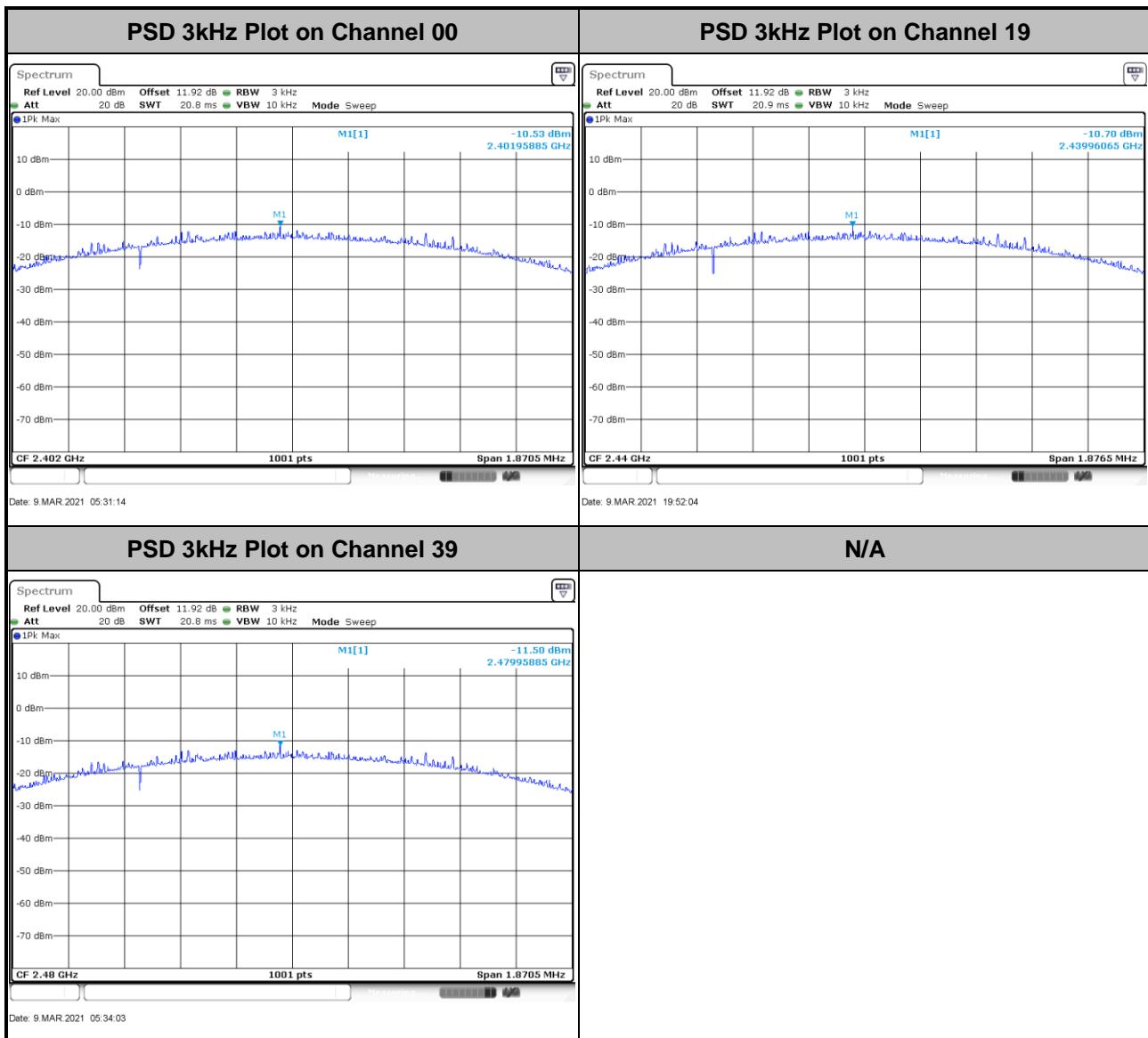
3.3.7 Test Result of Power Spectral Density Plots (3kHz)

<1Mbps>





<2Mbps>





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.

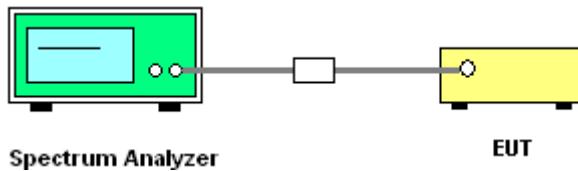
3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

3.4.3 Test Procedure

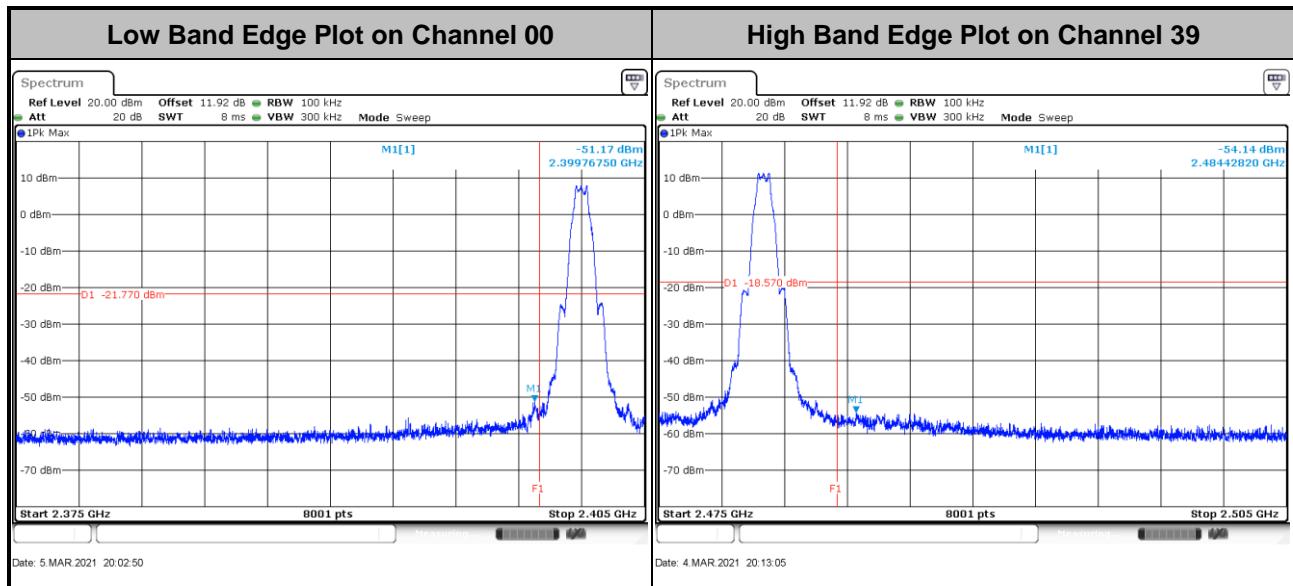
1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit 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

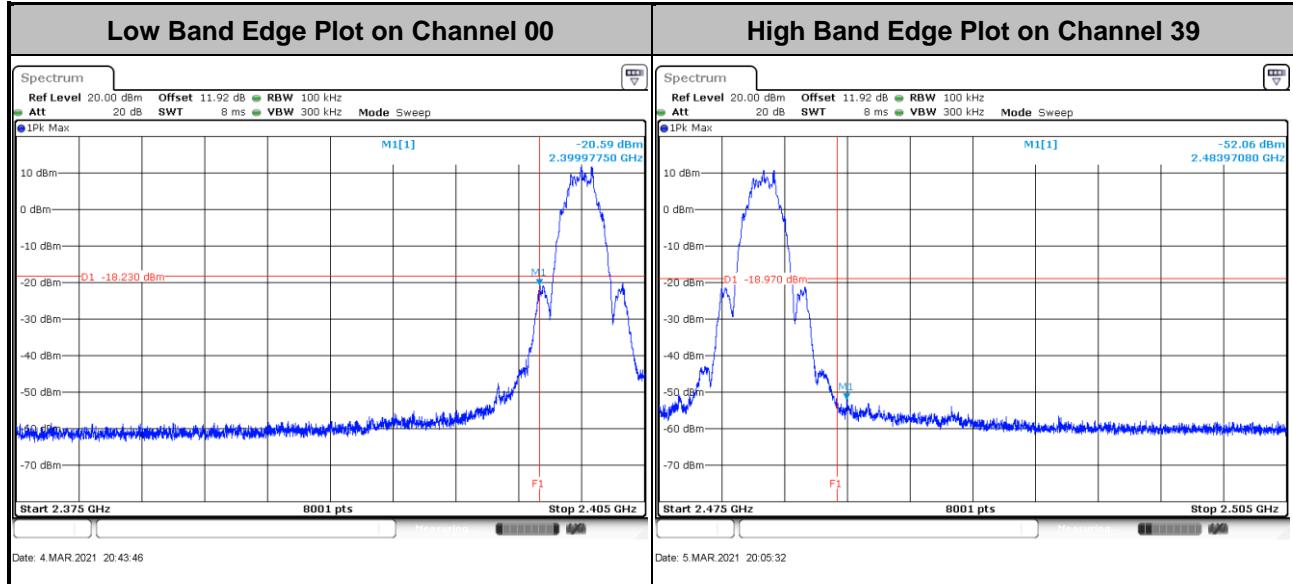


3.4.5 Test Result of Conducted Band Edges Plots

<1Mbps>

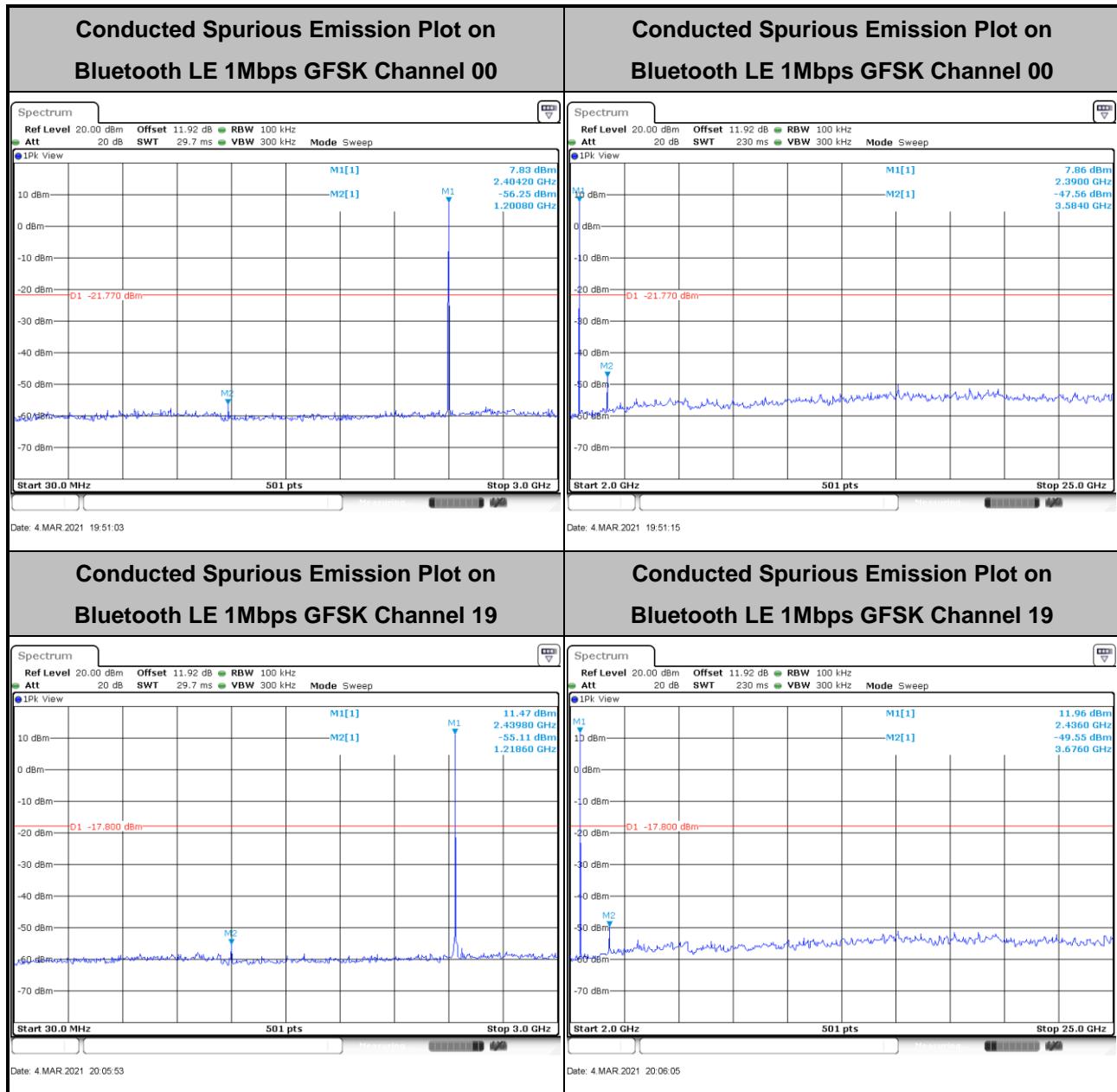


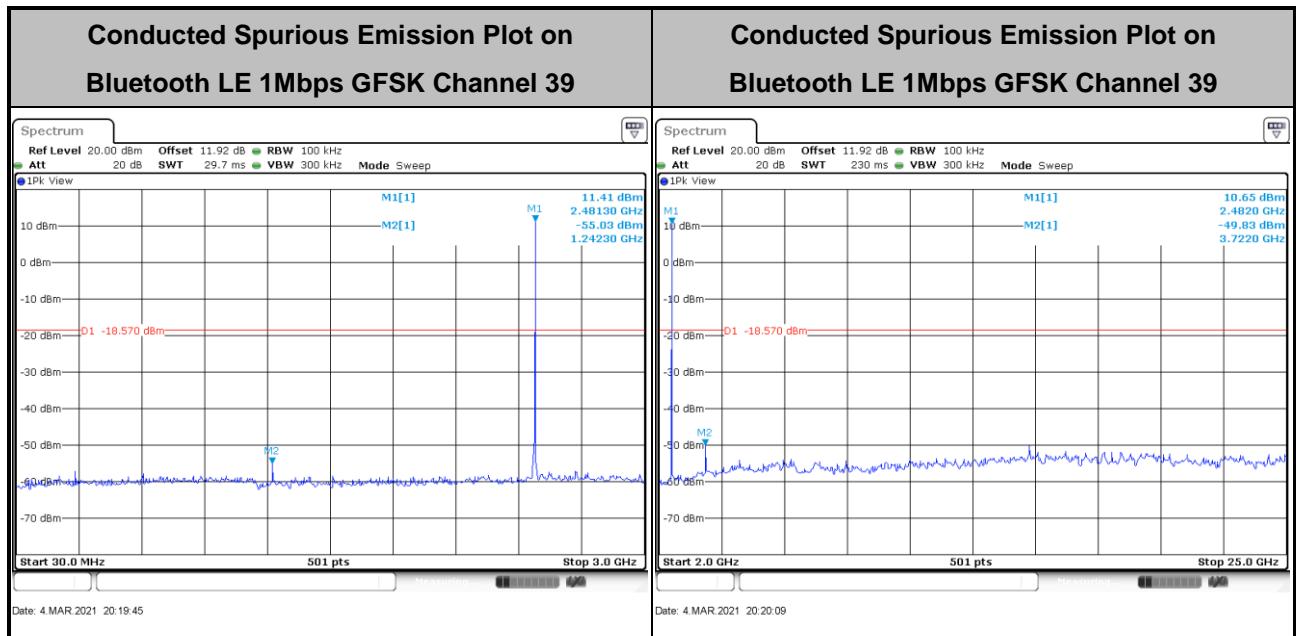
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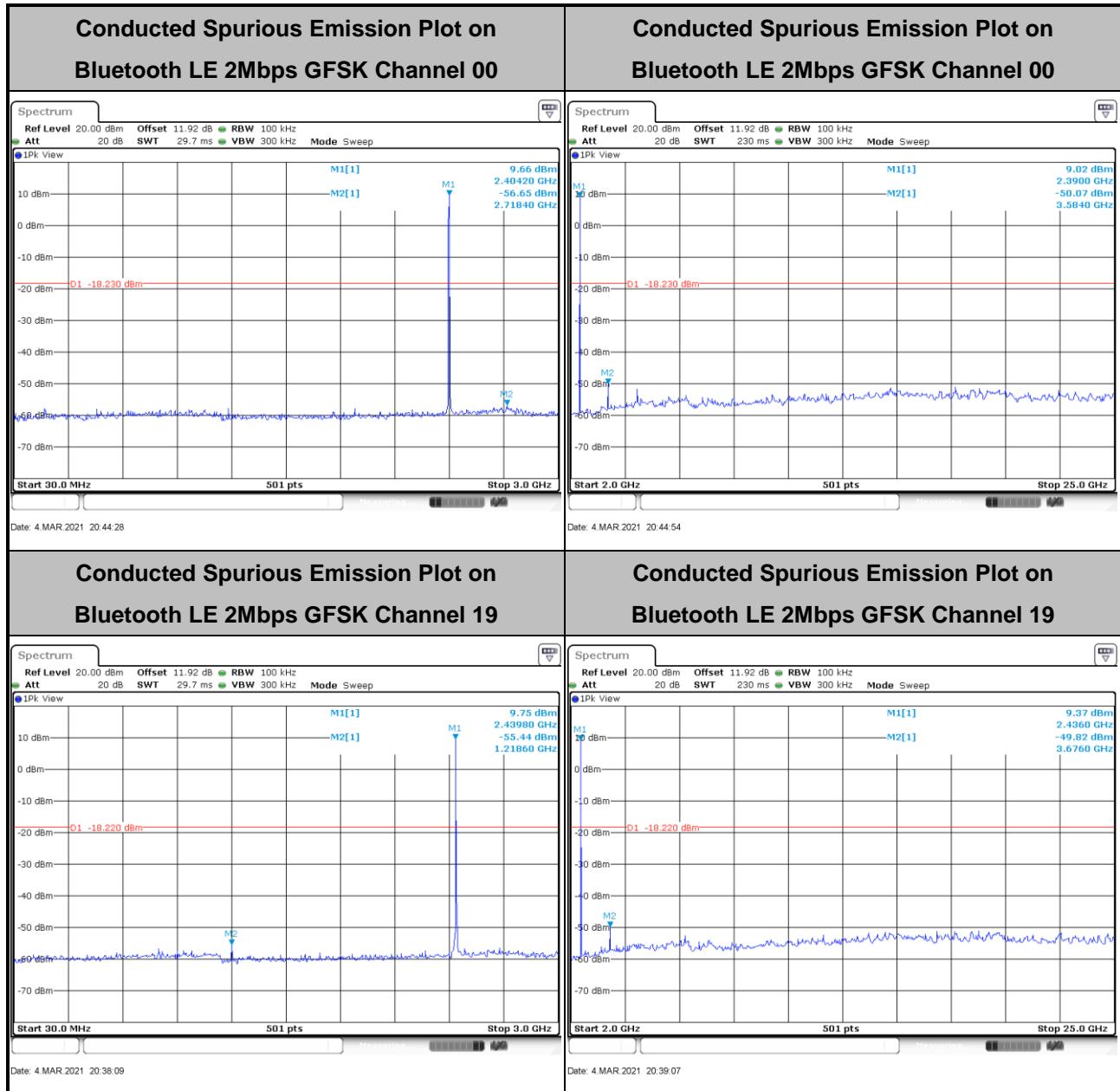


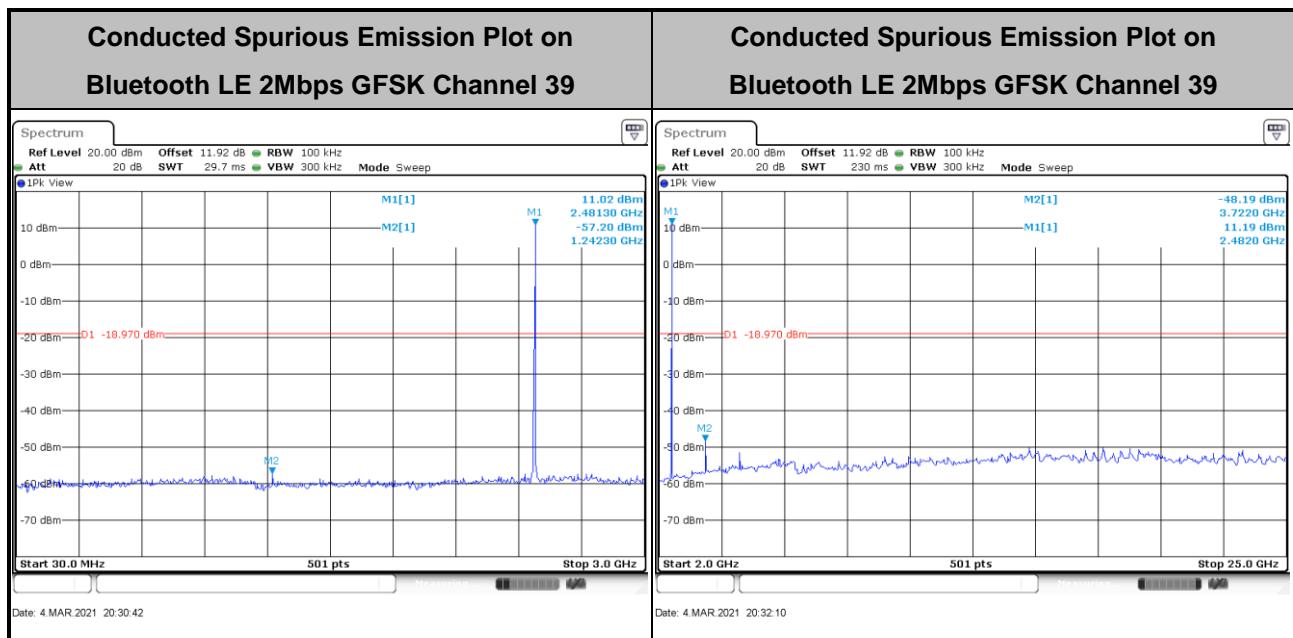


3.4.6 Test Result of Conducted Spurious Emission Plots











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

See list of measuring equipment of this test report.



3.5.3 Test Procedures

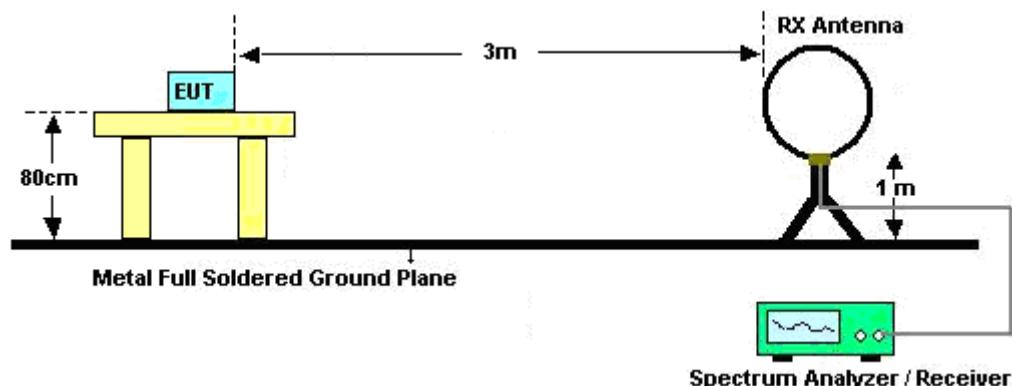
1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz 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 1 GHz, 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 be reported.
7. For testing above 1 GHz, the emission level of the EUT in peak mode was 20 dB lower than average 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 be 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 \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW = 3 MHz for $f \geq 1$ GHz for peak measurement.

For average measurement:

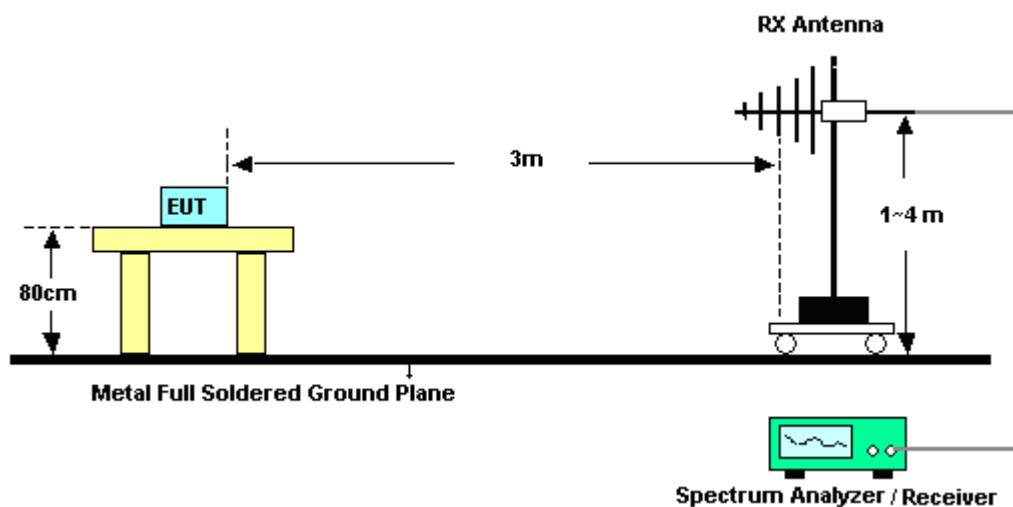
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

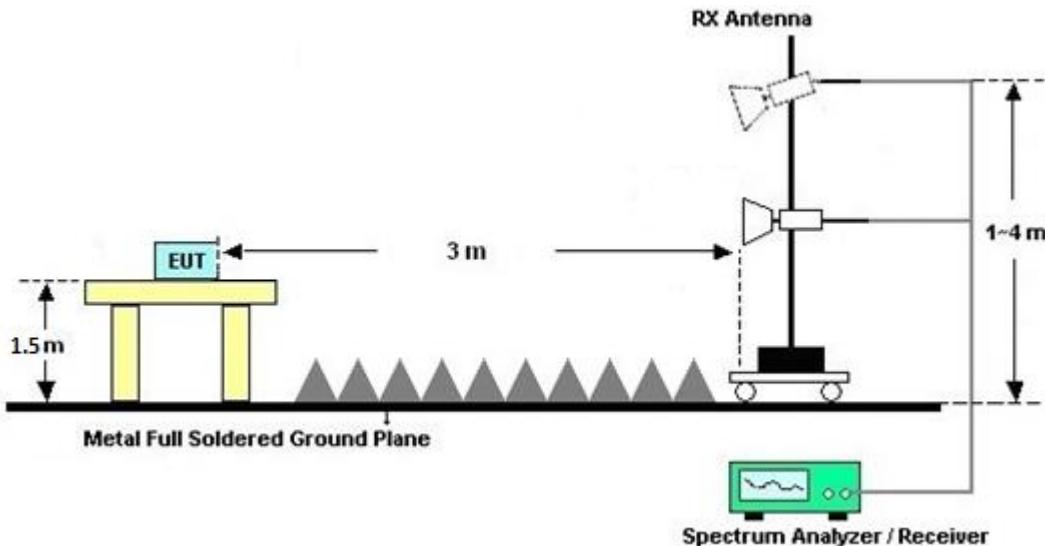
For radiated test below 30MHz



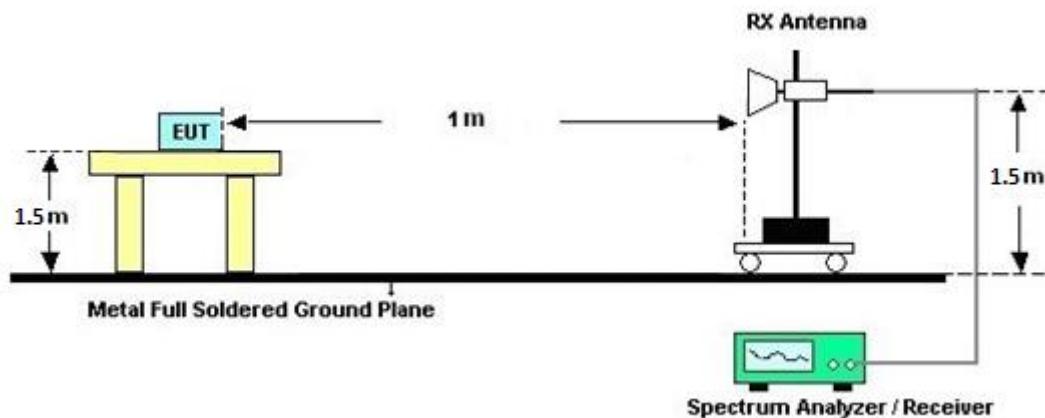
For radiated test from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



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 alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.5.7 Duty Cycle

Please refer to Appendix E.

3.5.8 Test Result of Radiated Spurious Emission (30 MHz ~ 10th Harmonic)

Please refer to Appendix C and D.



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 (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

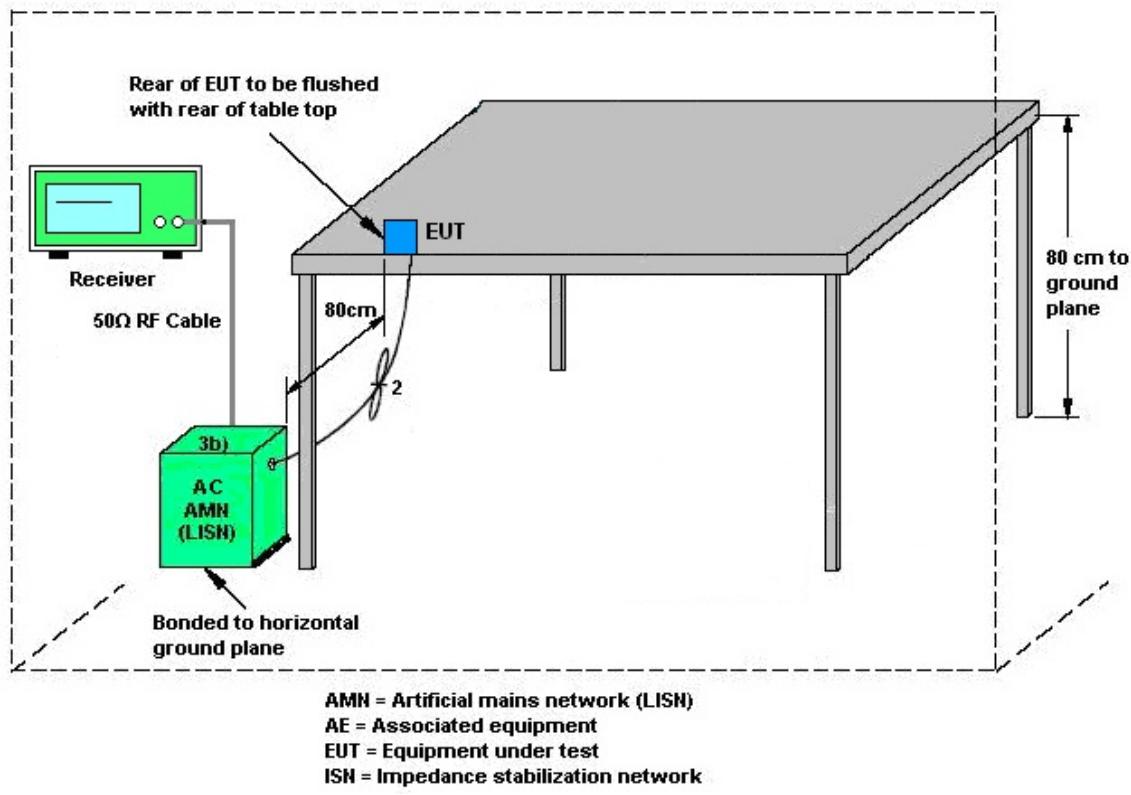
3.6.2 Measuring Instruments

See list of measuring equipment of this test report.

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 shall 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.
8. 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 B.



3.7 Antenna Requirements

3.7.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. 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	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	R&S	HFH2-Z2E	100840	9kHz~30MHz	Jun. 16, 2020	Mar. 04, 2021~Mar. 26, 2021	Jun. 15, 2021	Radiation (03CH02-CA)
Bilog Antenna	TESEQ	6111D	50392	30MHz~1GHz	Jul. 29, 2020	Mar. 04, 2021~Mar. 26, 2021	Jul. 28, 2021	Radiation (03CH02-CA)
Horn Antenna	SCHWARZBECK	BBHA 9120D	01895	1GHz~18GHz	Aug. 28, 2020	Mar. 04, 2021~Mar. 26, 2021	Aug. 27, 2021	Radiation (03CH02-CA)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA9170	00842	18GHz~40GHz	Jul. 27, 2020	Mar. 04, 2021~Mar. 26, 2021	Jul. 26, 2021	Radiation (03CH02-CA)
Amplifier	SONOMA	310N	372240	N/A	Aug. 12, 2020	Mar. 04, 2021~Mar. 26, 2021	Aug. 11, 2021	Radiation (03CH02-CA)
Preamplifier	Keysight	83017A	MY53270321	1GHz~26.5GHz	Jul. 28, 2020	Mar. 04, 2021~Mar. 26, 2021	Jul. 27, 2021	Radiation (03CH02-CA)
Preamplifier	EMEC	EMC18G40G	060725	18G-40G	Aug. 07, 2020	Mar. 04, 2021~Mar. 26, 2021	Aug. 06, 2021	Radiation (03CH02-CA)
Preamplifier	E-instrument	ERA-100M-18G-56-01-A70	EC1900251	1GHz~18GHz	Nov. 26, 2019	Mar. 04, 2021~Mar. 26, 2021	Nov. 25, 2021	Radiation (03CH02-CA)
EMI Test Receiver	Rohde & Schwarz	ESR7	102177	9kHz~7GHz	Jul. 16, 2020	Mar. 04, 2021~Mar. 26, 2021	Jul. 15, 2021	Radiation (03CH02-CA)
Spectrum Analyzer	Keysight	N9010A	MY57420221	10Hz~44GHz	Sep. 11, 2020	Mar. 04, 2021~Mar. 26, 2021	Sep. 10, 2021	Radiation (03CH02-CA)
Filter	Wainwright	Whkx8-5872 .5-6750-180 00-40ST	SN8	6.75G Highpass	Jul. 24, 2020	Mar. 04, 2021~Mar. 26, 2021	Jul. 23, 2021	Radiation (03CH02-CA)
Filter	Wainwright	WHKX12-27 00-3000-180 00-60ST	SN10	3G Highpass	Jul. 24, 2020	Mar. 04, 2021~Mar. 26, 2021	Jul. 23, 2021	Radiation (03CH02-CA)
Filter	Wainwright	WLK12-1200 -1272-11000 -40SS	SN2	1.2G Low Pass	Jul. 24, 2020	Mar. 04, 2021~Mar. 26, 2021	Jul. 23, 2021	Radiation (03CH02-CA)
Hygrometer	TESEO	608-H1	45142602	N/A	Aug. 05, 2020	Mar. 04, 2021~Mar. 26, 2021	Aug. 04, 2021	Radiation (03CH02-CA)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	Mar. 04, 2021~Mar. 26, 2021	N/A	Radiation (03CH02-CA)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Mar. 04, 2021~Mar. 26, 2021	N/A	Radiation (03CH02-CA)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Mar. 04, 2021~Mar. 26, 2021	N/A	Radiation (03CH02-CA)
Software	Audix	E3	N/A	N/A	N/A	Mar. 04, 2021~Mar. 26, 2021	N/A	Radiation (03CH02-CA)
Hygrometer	Testo	608-H1	45142595	N/A	Aug. 05, 2020	Mar. 01, 2021~Mar. 10, 2021	Aug. 04, 2021	Conducted (TH01-CA)
Power Sensor	DARE!!	RPR3006W	RPR6W-190 1026	10MHz-6GHz	Jun. 24, 2020	Mar. 01, 2021~Mar. 10, 2021	Jun. 23, 2021	Conducted (TH01-CA)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101089	10Hz-40GHz	Sep. 14, 2020	Mar. 01, 2021~Mar. 10, 2021	Sep. 13, 2021	Conducted (TH01-CA)
Coupler	WOKEN	20dB 30W Coupler	CAT7AKW1A 1	0.5-18GHz	Calibration from System	Mar. 01, 2021~Mar. 10, 2021	Calibration from System	Conducted (TH01-CA)



Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
LISN	TESEQ	NNB51	47407	N/A	Jul. 06, 2020	Mar. 12, 2021	Jul. 05, 2021	Conduction (CO01-CA)
EMI Test Receiver	R&S	ESR7	102177	9KHz~7GHz	Jul. 16, 2020	Mar. 12, 2021	Jul. 15, 2021	Conduction (CO01-CA)
Pulse limiter with 10dB attenuation	R&S	VTSD 9561-F N	9561-F-N00412	N/A	Jul. 08, 2020	Mar. 12, 2021	Jul. 07, 2021	Conduction (CO01-CA)
Test Software	R&S	EMC32 V10.30.0	N/A	N/A	N/A	Mar. 12, 2021	N/A	Conduction (CO01-CA)



5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$)	2.2
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$)	4.5
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$)	6.1
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$)	6.5
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Appendix A. Test Result of Conducted Test Items

Test Engineer:	Andy Kao/Kaying Xiong	Temperature:	17~22.2	°C
Test Date:	2021/3/1~2021/3/10	Relative Humidity:	31~47.5	%

<u>TEST RESULTS DATA</u> <u>6dB and 99% Occupied Bandwidth</u>								
Mod.	Data Rate	N _{TX}	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE	1Mbps	1	0	2402	1.027	0.707	0.50	Pass
BLE	1Mbps	1	19	2440	1.025	0.709	0.50	Pass
BLE	1Mbps	1	39	2480	1.023	0.709	0.50	Pass

<u>TEST RESULTS DATA</u> <u>Average Power Table</u>										
Mod.	Data Rate	N _{TX}	CH.	Freq. (MHz)	Average Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	1Mbps	1	0	2402	9.02	30.00	2.80	11.82	36.00	Pass
BLE	1Mbps	1	19	2440	8.82	30.00	2.80	11.62	36.00	Pass
BLE	1Mbps	1	39	2480	8.12	30.00	2.80	10.92	36.00	Pass

<u>TEST RESULTS DATA</u> <u>Peak Power Density</u>									
Mod.	Data Rate	N _{TX}	CH.	Freq. (MHz)	Peak PSD (dBm /100kHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
BLE	1Mbps	1	0	2402	8.23	-6.43	2.80	8.00	Pass
BLE	1Mbps	1	19	2440	12.20	-6.84	2.80	8.00	Pass
BLE	1Mbps	1	39	2480	11.43	-7.61	2.80	8.00	Pass

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 30dBc limit.

<u>TEST RESULTS DATA</u> <u>6dB and 99% Occupied Bandwidth</u>								
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE	2Mbps	1	0	2402	2.046	1.247	0.50	Pass
BLE	2Mbps	1	19	2440	2.046	1.251	0.50	Pass
BLE	2Mbps	1	39	2480	2.042	1.247	0.50	Pass

<u>TEST RESULTS DATA</u> <u>Average Power Table</u>									
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)
BLE	2Mbps	1	0	2402	9.02	30.00	2.80	11.82	36.00
BLE	2Mbps	1	19	2440	8.82	30.00	2.80	11.62	36.00
BLE	2Mbps	1	39	2480	8.02	30.00	2.80	10.82	36.00

<u>TEST RESULTS DATA</u> <u>Peak Power Density</u>									
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	11.77	-10.53	2.80	8.00	Pass
BLE	2Mbps	1	19	2440	11.78	-10.70	2.80	8.00	Pass
BLE	2Mbps	1	39	2480	11.03	-11.50	2.80	8.00	Pass

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 30dBc limit.



Appendix B. AC Conducted Emission Test Results

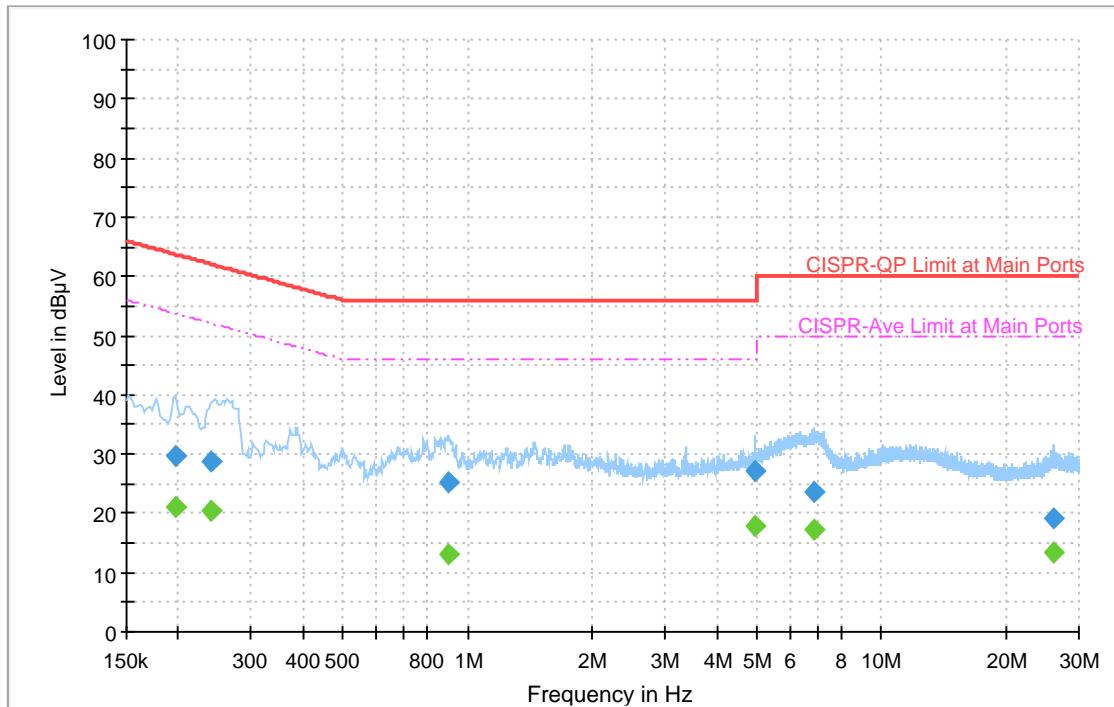
Test Engineer :	Janssen Wongso	Temperature :	18~21°C
		Relative Humidity :	40.6~44.8%

EUT Information

Site: CO01-CA

Power: 120Vac/60Hz
Model: Vesta
Mode: 1

Full Spectrum



Final Result

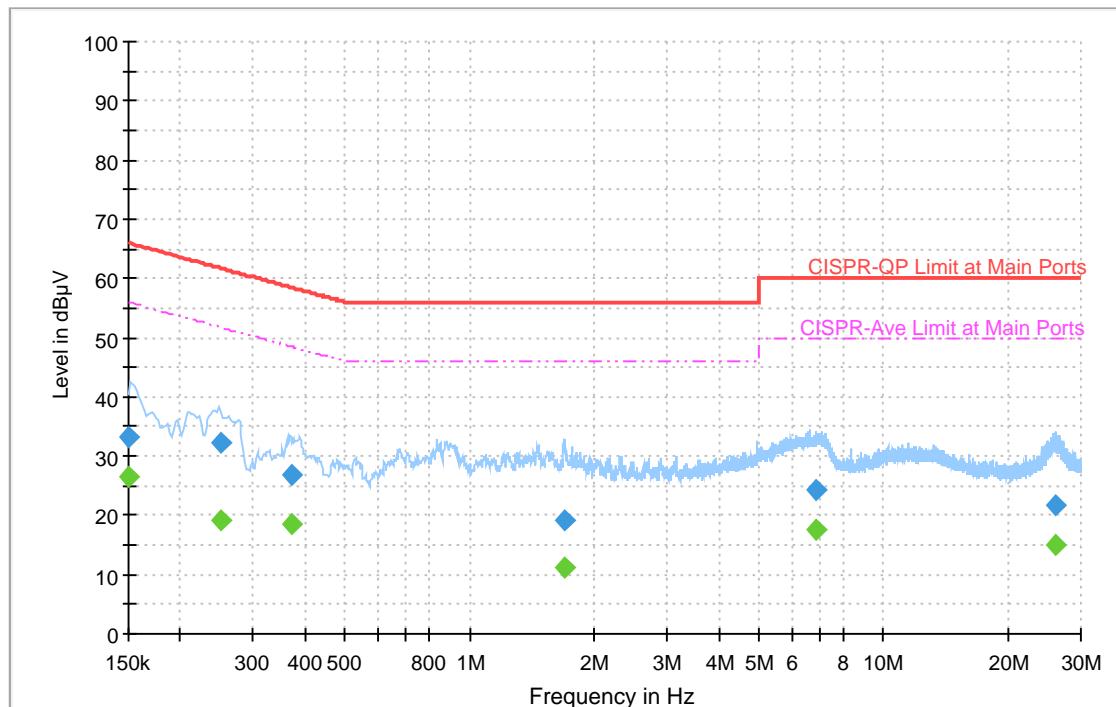
Frequency (MHz)	QuasiPeak (dB μ V)	CAverage (dB μ V)	Limit (dB μ V)	Margin (dB)	Line	Filter	Corr. (dB)
0.197700	29.64	---	63.71	34.07	L1	OFF	20.0
0.197700	---	21.02	53.71	32.69	L1	OFF	20.0
0.240000	28.79	---	62.10	33.31	L1	OFF	20.0
0.240000	---	20.53	52.10	31.57	L1	OFF	20.0
0.904290	25.30	---	56.00	30.70	L1	OFF	20.0
0.904290	---	12.96	46.00	33.04	L1	OFF	20.0
4.933590	27.16	---	56.00	28.84	L1	OFF	20.1
4.933590	---	17.85	46.00	28.15	L1	OFF	20.1
6.859500	23.66	---	60.00	36.34	L1	OFF	20.1
6.859500	---	17.37	50.00	32.63	L1	OFF	20.1
26.133000	19.24	---	60.00	40.76	L1	OFF	20.6
26.133000	---	13.52	50.00	36.48	L1	OFF	20.6

EUT Information

Site: CO01-CA

Power: 120Vac/60Hz
Model: Vesta
Mode: 1

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dB μ V)	CAverage (dB μ V)	Limit (dB μ V)	Margin (dB)	Line	Filter	Corr. (dB)
0.150203	---	26.37	55.99	29.62	N	OFF	20.0
0.150203	33.38	---	65.99	32.61	N	OFF	20.0
0.251250	---	19.09	51.72	32.63	N	OFF	20.0
0.251250	32.38	---	61.72	29.34	N	OFF	20.0
0.372750	---	18.69	48.44	29.75	N	OFF	20.0
0.372750	26.77	---	58.44	31.67	N	OFF	20.0
1.693860	---	11.32	46.00	34.68	N	OFF	20.0
1.693860	19.06	---	56.00	36.94	N	OFF	20.0
6.852210	---	17.68	50.00	32.32	N	OFF	20.1
6.852210	24.19	---	60.00	35.81	N	OFF	20.1
26.142000	---	15.07	50.00	34.93	N	OFF	20.6
26.142000	21.79	---	60.00	38.21	N	OFF	20.6



Appendix C. Radiated Spurious Emission

Test Engineer :	Calvin Wu and Michael Bui	Temperature :	19 – 24°C
		Relative Humidity :	40~46%

<1Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dB μ V/m)	(dB)	(dB μ V/m)	(dB μ V)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 00 2402MHz		2336.46	55.11	-18.89	74	41.44	27.78	17.31	31.42	223	355	P	H
		2314.725	46.1	-7.9	54	32.38	27.87	17.27	31.42	223	355	A	H
	*	2402	107.25	-	-	93.58	27.61	17.42	31.36	223	355	P	H
	*	2402	106.94	-	-	93.27	27.61	17.42	31.36	223	355	A	H
		2384.55	54.94	-19.06	74	41.27	27.65	17.4	31.38	100	244	P	V
		2314.83	46.05	-7.95	54	32.36	27.84	17.27	31.42	100	244	A	V
	*	2402	98.27	-	-	84.64	27.57	17.42	31.36	100	244	P	V
	*	2402	97.89	-	-	84.26	27.57	17.42	31.36	100	244	A	V
BLE CH 19 2440MHz		2341.5	55.42	-18.58	74	41.76	27.75	17.32	31.41	216	348	P	H
		2357.25	45.73	-8.27	54	32.08	27.7	17.35	31.4	216	348	A	H
	*	2440	110.99	-	-	97.28	27.59	17.48	31.36	216	348	P	H
	*	2440	110.54	-	-	96.83	27.59	17.48	31.36	216	348	A	H
		2490.88	54.37	-19.63	74	40.58	27.56	17.57	31.34	216	348	P	H
		2485.2	45.41	-8.59	54	31.64	27.56	17.56	31.35	216	348	A	H
		2362.95	55.33	-18.67	74	41.62	27.75	17.36	31.4	400	276	P	V
		2337.9	45.52	-8.48	54	31.8	27.82	17.31	31.41	400	276	A	V
	*	2440	102.37	-	-	88.8	27.45	17.48	31.36	400	276	P	V
	*	2440	101.91	-	-	88.34	27.45	17.48	31.36	400	276	A	V
		2499.44	54.39	-19.61	74	40.77	27.38	17.58	31.34	400	276	P	V
		2499.44	45.23	-8.77	54	31.61	27.38	17.58	31.34	400	276	A	V



BLE CH 39 2480MHz	*	2480	109.89	-	-	96.12	27.57	17.55	31.35	233	346	P	H
	*	2480	109.5	-	-	95.73	27.57	17.55	31.35	233	346	A	H
	2486.88	56.74	-17.26	74	42.97	27.56	17.56	31.35	233	346	P	H	
	2484.28	47.88	-6.12	54	34.11	27.56	17.56	31.35	233	346	A	H	
	*	2480	100.75	-	-	87.15	27.4	17.55	31.35	100	93	P	V
	*	2480	100.35	-	-	86.75	27.4	17.55	31.35	100	93	A	V
	2499.84	55.02	-18.98	74	41.4	27.38	17.58	31.34	100	93	P	V	
	2484.88	45.73	-8.27	54	32.13	27.39	17.56	31.35	100	93	A	V	
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	Note	Frequency (MHz)	Level (dB μ V/m)	Over Limit (dB)	Limit Line (dB μ V/m)	Read Level (dB μ V)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 00 2402MHz		3603	56.4	-17.6	74	82.69	29.26	10.92	65.6	302	327	P	H
		3603	53.33	-0.67	54	79.62	29.26	10.92	65.6	302	327	A	H
		4804	48.94	-25.06	74	72.57	31.38	11.91	66.29	100	0	P	H
		11760	57.28	-16.72	74	66.91	39.35	18.27	66.7	253	258	P	H
		11760	48.07	-5.93	54	57.7	39.35	18.27	66.7	253	258	A	H
		18000	62.33	-11.67	74	59.73	48.43	22.59	67.8	226	143	P	H
		18000	50.86	-3.14	54	48.26	48.43	22.59	67.8	226	143	A	H
		3603	51.44	-22.56	74	77.83	29.16	10.05	65.6	103	237	P	V
		3603	47.23	-6.77	54	73.62	29.16	10.05	65.6	103	237	A	V
		4804	45.23	-28.77	74	68.85	31.39	11.28	66.29	100	0	P	V
		11760	57.04	-16.96	74	66.63	39.39	17.72	66.7	315	338	P	V
		11760	47.47	-6.53	54	57.06	39.39	17.72	66.7	315	338	A	V
		18000	62.35	-11.65	74	59.7	48.48	21.97	67.8	400	14	P	V
		18000	50.81	-3.19	54	48.16	48.48	21.97	67.8	400	14	A	V
BLE CH 19 2440MHz		3660	46.55	-27.45	74	72.89	29.25	10.07	65.66	100	0	P	H
		4880	42.23	-31.77	74	65.59	31.35	11.43	66.14	100	0	P	H
		7320	45.36	-28.64	74	60.97	36.36	13.89	65.86	100	0	P	H
		11760	56.47	-17.53	74	66.1	39.35	17.72	66.7	249	262	P	H
		11760	47.91	-6.09	54	57.54	39.35	17.72	66.7	249	262	A	H
		18000	63.49	-10.51	74	60.89	48.43	21.97	67.8	305	221	P	H
		18000	51.41	-2.59	54	48.81	48.43	21.97	67.8	305	221	A	H
		3660	40.84	-33.16	74	67.18	29.25	10.07	65.66	100	0	P	V
		4880	40.38	-33.62	74	63.81	31.28	11.43	66.14	100	0	P	V
		7320	44.64	-29.36	74	60.19	36.42	13.89	65.86	100	0	P	V
		11760	55.62	-18.38	74	65.21	39.39	17.72	66.7	196	72	P	V
		11760	46.24	-7.76	54	55.83	39.39	17.72	66.7	196	72	A	V
		18000	63.2	-10.8	74	60.55	48.48	21.97	67.8	255	58	P	V
		18000	51.16	-2.84	54	48.51	48.48	21.97	67.8	255	58	A	V



2480MHz	BLE	3720	46.2	-27.8	74	72.41	29.41	9.32	65.72	100	0	P	H
	CH 39	4960	42.66	-31.34	74	65.58	31.47	10.84	65.98	100	0	P	H
		7440	46.56	-27.44	74	61.91	36.51	13.46	65.89	100	0	P	H
		11760	55.99	-18.01	74	65.62	39.35	17.17	66.7	294	10	P	H
		11760	47.23	-6.77	54	56.86	39.35	17.17	66.7	294	10	A	H
		18000	62.82	-11.18	74	60.22	48.43	21.35	67.8	321	2	P	H
		18000	51.42	-2.58	54	48.82	48.43	21.35	67.8	321	2	A	H
		4960	42.83	-31.17	74	65.8	31.42	10.84	65.98	100	0	P	V
		7440	46.38	-27.62	74	61.76	36.48	13.46	65.89	100	0	P	V
		11760	55.87	-18.13	74	65.46	39.39	17.17	66.7	194	38	P	V
		11760	46.44	-7.56	54	56.03	39.39	17.17	66.7	194	38	A	V
		18000	62.73	-11.27	74	60.08	48.48	21.35	67.8	181	291	P	V
		18000	51.5	-2.5	54	48.85	48.48	21.35	67.8	181	291	A	V



Emission above 18GHz

2.4GHz BLE (SHF)

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dB μ V/m)	(dB)	(dB μ V/m)	(dB μ V)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BLE SHF		24937	39.51	-34.49	74	35.96	39.16	15.89	51.5	150	0	P	H
		22921	39.65	-34.35	74	37.88	38.78	14.67	51.68	150	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.	
2.4GHz BLE LF		30.97	21.75	-18.25	40	28.58	24.71	0.9	32.44	-	-	P	H	
		120	38.62	-4.88	43.5	51.7	17.6	1.73	32.41	288	85	Q	H	
		120	40.48	-3.02	43.5	53.56	17.6	1.73	32.41	288	85	P	H	
		136.7	35.21	-8.29	43.5	48.1	17.6	1.92	32.41	-	-	P	H	
		167.74	36.71	-6.79	43.5	51.09	15.93	2.1	32.41	-	-	P	H	
		359.8	31.7	-14.3	46	40.33	20.7	3.14	32.47	-	-	P	H	
		623.64	36.14	-9.86	46	38.55	26.15	4.06	32.62	-	-	P	H	
		33.88	21.86	-18.14	40	30.29	23.06	0.95	32.44	-	-	P	V	
		94.02	32.06	-11.44	43.5	47.4	15.4	1.68	32.42	-	-	P	V	
		120	35.53	-7.97	43.5	48.61	17.6	1.73	32.41	100	0	P	V	
		136.7	34.01	-9.49	43.5	46.9	17.6	1.92	32.41	-	-	P	V	
		251.16	30.17	-15.83	46	41.27	18.72	2.59	32.41	-	-	P	V	
		512.09	31.74	-14.26	46	36.68	24	3.66	32.6	-	-	P	V	
Remark	1. No other spurious found. 2. All results are PASS against limit line.													



<2Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dB μ V/m)	(dB)	(dB μ V/m)	(dB μ V)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 00 2402MHz		2369.22	56.25	-17.75	74	42.6	27.67	17.37	31.39	222	352	P	H
		2389.065	45.5	-8.5	54	31.84	27.63	17.4	31.37	222	352	A	H
	*	2402	108.96	-	-	95.29	27.61	17.42	31.36	222	352	P	H
	*	2402	107.6	-	-	93.93	27.61	17.42	31.36	222	352	A	H
		2367.225	55.73	-18.27	74	42.02	27.73	17.37	31.39	100	246	P	V
		2331.525	45.43	-8.57	54	31.73	27.82	17.3	31.42	100	246	A	V
	*	2402	99.59	-	-	85.96	27.57	17.42	31.36	100	246	P	V
	*	2402	98.24	-	-	84.61	27.57	17.42	31.36	100	246	A	V
BLE CH 19 2440MHz		2373.84	54.61	-19.39	74	40.96	27.66	17.38	31.39	218	349	P	H
		2346.48	44.74	-9.26	54	31.1	27.73	17.32	31.41	218	349	A	H
	*	2440	111.15	-	-	97.44	27.59	17.48	31.36	218	349	P	H
	*	2440	109.86	-	-	96.15	27.59	17.48	31.36	218	349	A	H
		2484.8	55.12	-18.88	74	41.35	27.56	17.56	31.35	218	349	P	H
		2495.68	45.01	-8.99	54	31.21	27.56	17.58	31.34	218	349	A	H
		2319.92	55.51	-18.49	74	41.82	27.83	17.28	31.42	400	275	P	V
		2348.4	44.71	-9.29	54	30.98	27.81	17.33	31.41	400	275	A	V
	*	2440	102.71	-	-	89.14	27.45	17.48	31.36	400	275	P	V
	*	2440	101.36	-	-	87.79	27.45	17.48	31.36	400	275	A	V
		2489.68	54.66	-19.34	74	41.04	27.39	17.57	31.34	400	275	P	V
		2494.88	44.79	-9.21	54	31.16	27.39	17.58	31.34	400	275	A	V



BLE CH 39 2480MHz	*	2480	110.9	-	-	97.13	27.57	17.55	31.35	210	347	P	H
	*	2480	109.55	-	-	95.78	27.57	17.55	31.35	210	347	A	H
		2483.88	59.07	-14.93	74	45.3	27.56	17.56	31.35	210	347	P	H
		2483.52	50.34	-3.66	54	36.56	27.57	17.56	31.35	210	347	A	H
	*	2480	101.84	-	-	88.24	27.4	17.55	31.35	115	92	P	V
	*	2480	100.42	-	-	86.82	27.4	17.55	31.35	115	92	A	V
		2490.32	54.97	-19.03	74	41.35	27.39	17.57	31.34	115	92	P	V
		2483.52	45.76	-8.24	54	32.16	27.39	17.56	31.35	115	92	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	Note	Frequency (MHz)	Level (dB μ V/m)	Over Limit (dB)	Limit Line (dB μ V/m)	Read Level (dB μ V)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 00 2402MHz		3603	56.68	-17.32	74	82.97	29.26	10.05	65.6	301	327	P	H
		3603	53.14	-0.86	54	79.43	29.26	10.05	65.6	301	327	A	H
		4804	45.99	-28.01	74	69.62	31.38	11.28	66.29	100	0	P	H
		11760	56.3	-17.7	74	65.93	39.35	17.72	66.7	203	14	P	H
		11760	47.28	-6.72	54	56.91	39.35	17.72	66.7	203	14	A	H
		18000	62.79	-11.21	74	60.19	48.43	21.97	67.8	189	1	P	H
		18000	51.48	-2.52	54	48.88	48.43	21.97	67.8	189	1	A	H
		3603	51.87	-22.13	74	78.26	29.16	10.05	65.6	183	237	P	V
		3603	47.28	-6.72	54	73.67	29.16	10.05	65.6	183	237	A	V
		4804	44.06	-29.94	74	67.68	31.39	11.28	66.29	100	0	P	V
		11760	57.17	-16.83	74	66.76	39.39	17.72	66.7	315	337	P	V
		11760	47.52	-6.48	54	57.11	39.39	17.72	66.7	315	337	A	V
		18000	62.74	-11.26	74	60.09	48.48	21.97	67.8	281	336	P	V
		18000	51.43	-2.57	54	48.78	48.48	21.97	67.8	281	336	A	V
BLE CH 19 2440MHz		3660	51.39	-22.61	74	77.73	29.25	10.07	65.66	100	8	P	H
		3660	46.79	-7.21	54	73.13	29.25	10.07	65.66	100	8	A	H
		4880	43.6	-30.4	74	66.96	31.35	11.43	66.14	100	0	P	H
		7320	46.3	-27.7	74	61.91	36.36	13.89	65.86	100	0	P	H
		11760	56.48	-17.52	74	66.11	39.35	17.72	66.7	290	9	P	H
		11760	47.31	-6.69	54	56.94	39.35	17.72	66.7	290	9	A	H
		18000	62.57	-11.43	74	59.97	48.43	21.97	67.8	301	12	P	H
		18000	51.38	-2.62	54	48.78	48.43	21.97	67.8	301	12	A	H
		3660	43.23	-30.77	74	69.57	29.25	10.07	65.66	100	0	P	V
		4880	41.42	-32.58	74	64.85	31.28	11.43	66.14	100	0	P	V
		7320	45.13	-28.87	74	60.68	36.42	13.89	65.86	100	0	P	V
		11760	56.63	-17.37	74	66.22	39.39	17.72	66.7	314	337	P	V
		11760	47.77	-6.23	54	57.36	39.39	17.72	66.7	314	337	A	V
		18000	62.64	-11.36	74	59.99	48.48	21.97	67.8	338	259	P	V
		18000	51.31	-2.69	54	48.66	48.48	21.97	67.8	338	259	A	V



2480MHz	BLE	3720	45.66	-28.34	74	71.87	29.41	10.1	65.72	100	0	P	H
	CH 39	4960	42.76	-31.24	74	65.68	31.47	11.59	65.98	100	0	P	H
		7440	46.62	-27.38	74	61.97	36.51	14.03	65.89	100	0	P	H
		11760	56.34	-17.66	74	65.97	39.35	17.72	66.7	281	9	P	H
		11760	47.22	-6.78	54	56.85	39.35	17.72	66.7	281	9	A	H
		18000	63.18	-10.82	74	60.58	48.43	21.97	67.8	281	42	P	H
		18000	51.37	-2.63	54	48.77	48.43	21.97	67.8	281	42	A	H
		4960	42.1	-31.9	74	65.07	31.42	11.59	65.98	100	0	P	V
		7440	45.59	-28.41	74	60.97	36.48	14.03	65.89	100	0	P	V
		11760	56.2	-17.8	74	65.79	39.39	17.72	66.7	315	337	P	V
		11760	47.49	-6.51	54	57.08	39.39	17.72	66.7	315	337	A	V
		18000	62.77	-11.23	74	60.12	48.48	21.97	67.8	361	188	P	V
	Remark		1. No other spurious found. 2. All results are PASS against Peak and Average limit line.										



Emission above 18GHz

2.4GHz BLE (SHF)

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dB μ V/m)	(dB)	(dB μ V/m)	(dB μ V)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BLE SHF		24930	39.2	-34.8	74	35.65	39.16	15.89	51.5	150	0	P	H
		23635	39.98	-34.02	74	37.55	38.74	15.09	51.4	150	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.	
2.4GHz BLE LF		30.97	21.58	-18.42	40	28.41	24.71	0.9	32.44	-	-	P	H	
		120.21	38.16	-5.34	43.5	51.24	17.6	1.73	32.41	100	0	P	H	
		136.7	35.11	-8.39	43.5	48	17.6	1.92	32.41	-	-	P	H	
		167.74	36.8	-6.7	43.5	51.18	15.93	2.1	32.41	-	-	P	H	
		400.54	31.6	-14.4	46	38.76	21.85	3.49	32.5	-	-	P	H	
		630.43	35.88	-10.12	46	38.02	26.4	4.08	32.62	-	-	P	H	
		31.94	22.36	-17.64	40	29.94	23.95	0.91	32.44	-	-	P	V	
		94.02	31.88	-11.62	43.5	47.22	15.4	1.68	32.42	-	-	P	V	
		120.21	34.08	-9.42	43.5	47.16	17.6	1.73	32.41	-	-	P	V	
		136.7	34.45	-9.05	43.5	47.34	17.6	1.92	32.41	100	0	P	V	
		586.78	31.77	-14.23	46	34.66	25.8	3.94	32.63	-	-	P	V	
		860.32	33.08	-12.92	46	31.08	29.1	4.82	31.92	-	-	P	V	
Remark	1. No other spurious found. 2. All results are PASS against limit line.													

**Note symbol**

*	Fundamental Frequency which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is over limit line.
P/A	Peak or Average
H/V	Horizontal or Vertical



A calculation example for radiated spurious emission is shown as below:

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
			Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.		
		(MHz)	(dB μ V/m)	(dB)	(dB μ V/m)	(dB μ V)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 00 2402MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)

2. Level(dB μ V/m) =

Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dB μ V) - Preamp Factor(dB)

3. Over Limit(dB) = Level(dB μ V/m) – Limit Line(dB μ V/m)

For Peak Limit @ 2390MHz:

1. Level(dB μ V/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dB μ V) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dB μ V) – 35.86 (dB)

= 55.45 (dB μ V/m)

2. Over Limit(dB)

= Level(dB μ V/m) – Limit Line(dB μ V/m)

= 55.45(dB μ V/m) – 74(dB μ V/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dB μ V/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dB μ V) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dB μ V) – 35.86 (dB)

= 43.54 (dB μ V/m)

2. Over Limit(dB)

= Level(dB μ V/m) – Limit Line(dB μ V/m)

= 43.54(dB μ V/m) – 54(dB μ V/m)

= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is “PASS”.



Appendix D. Radiated Spurious Emission Plots

Test Engineer :	Calvin Wu and Michael Bui	Temperature :	19 – 24°C
		Relative Humidity :	40~46%

Note symbol

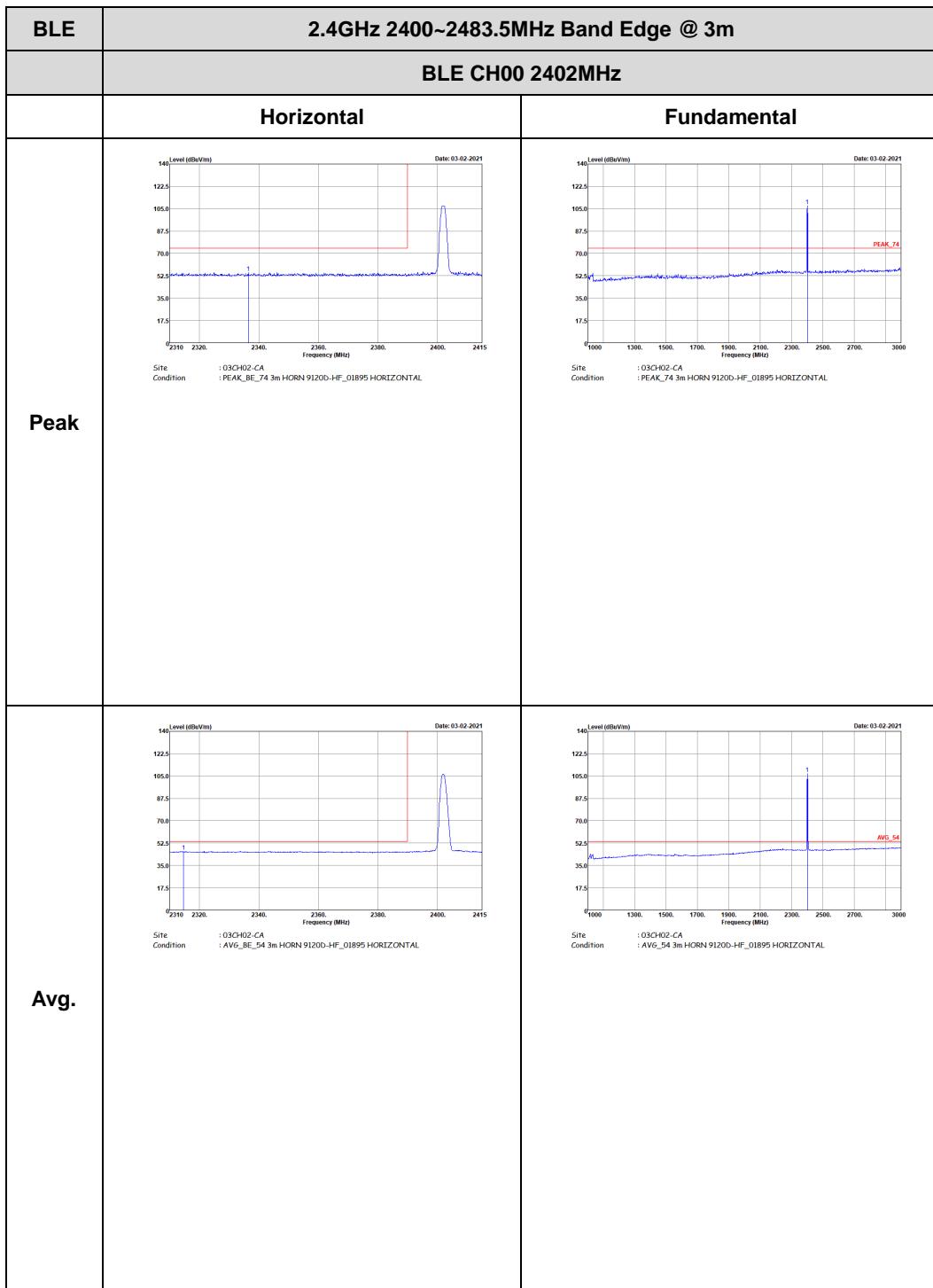
-L	Low channel location
-R	High channel location

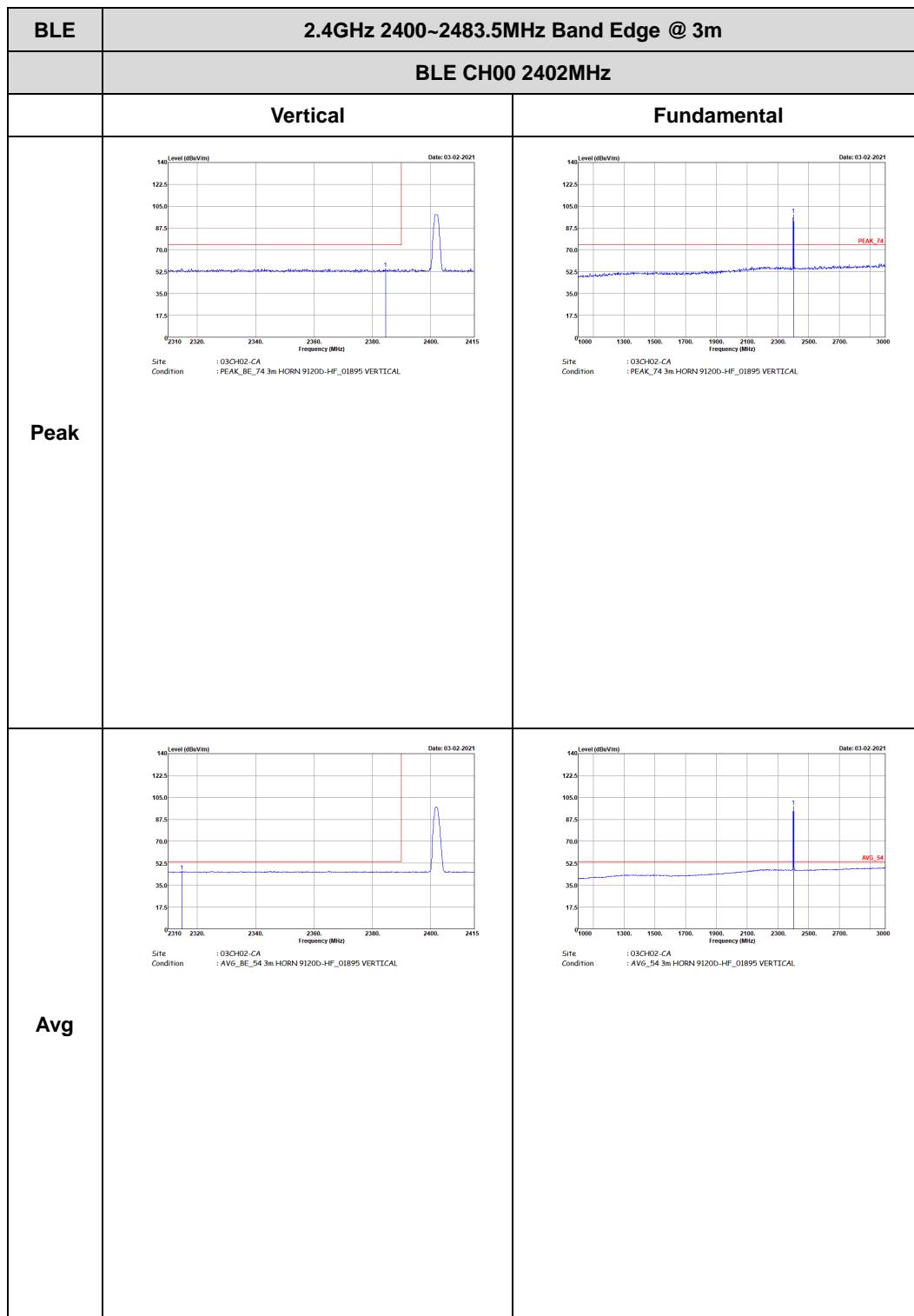


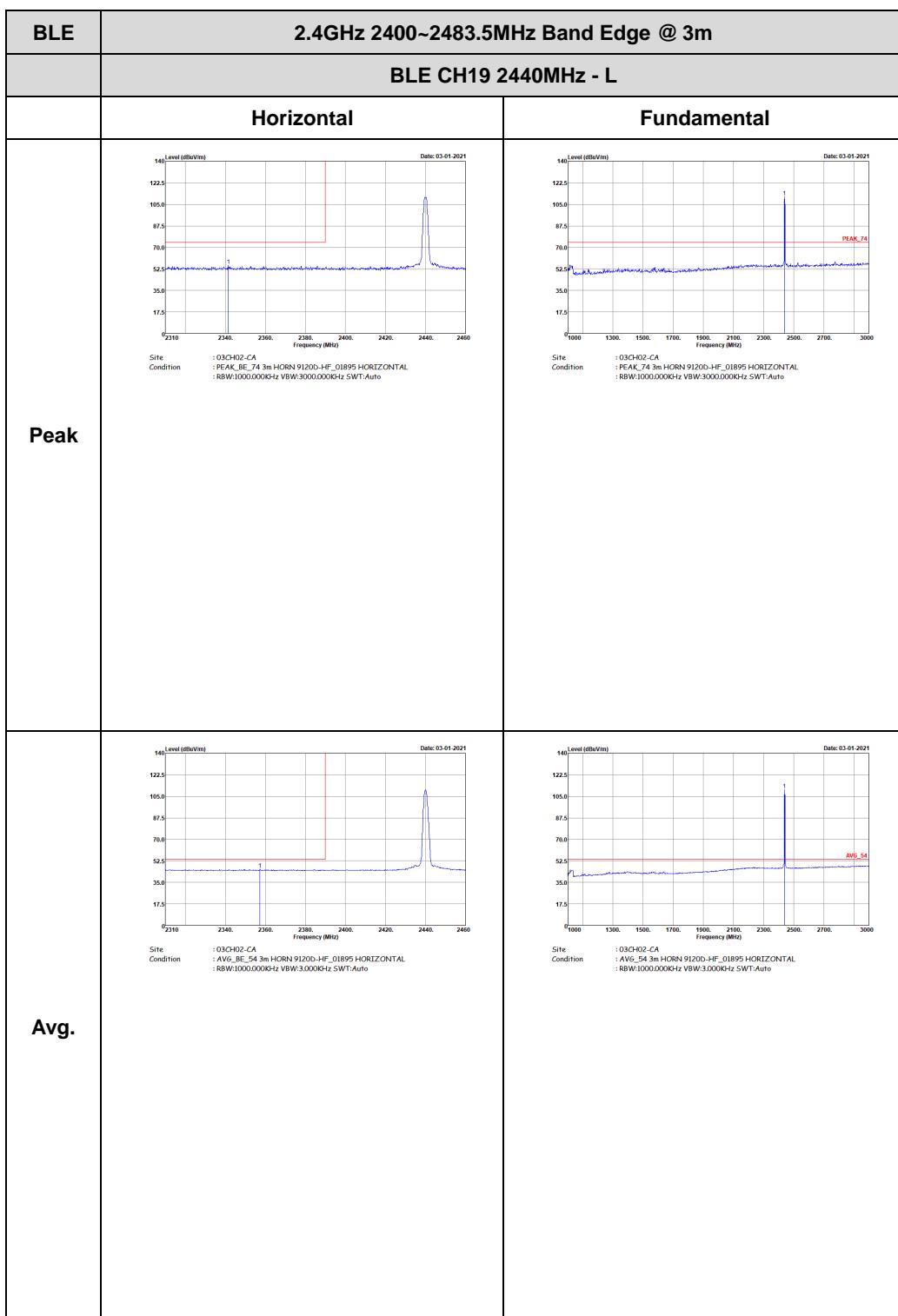
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2.4GHz 2400~2483.5MHz

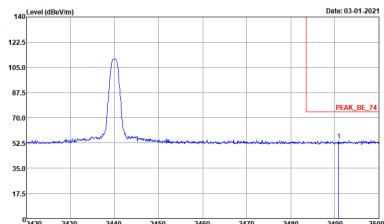
BLE (Band Edge @ 3m)

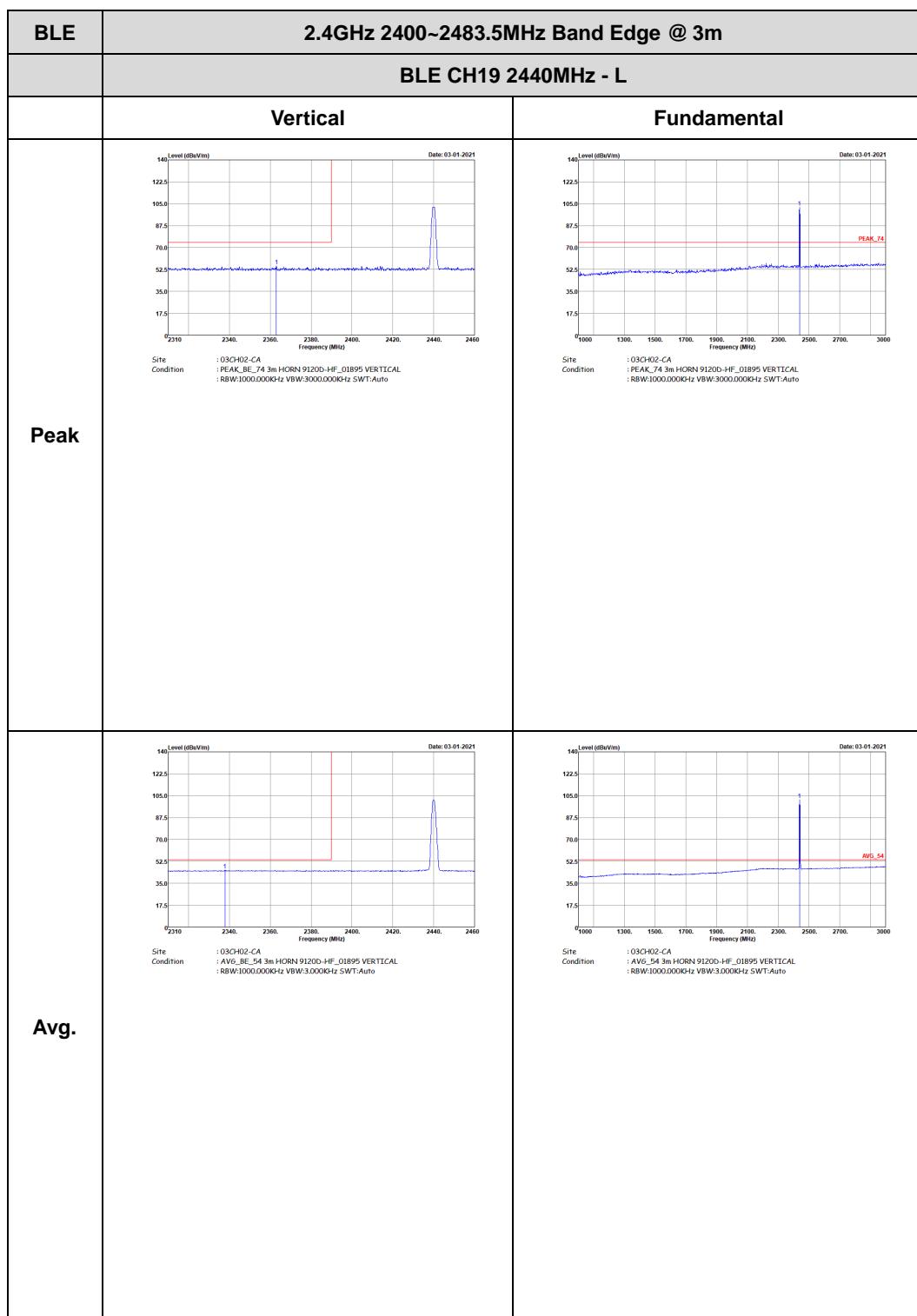




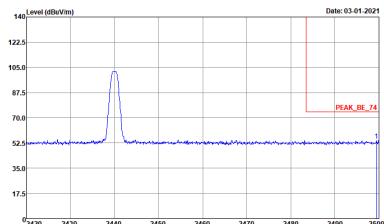


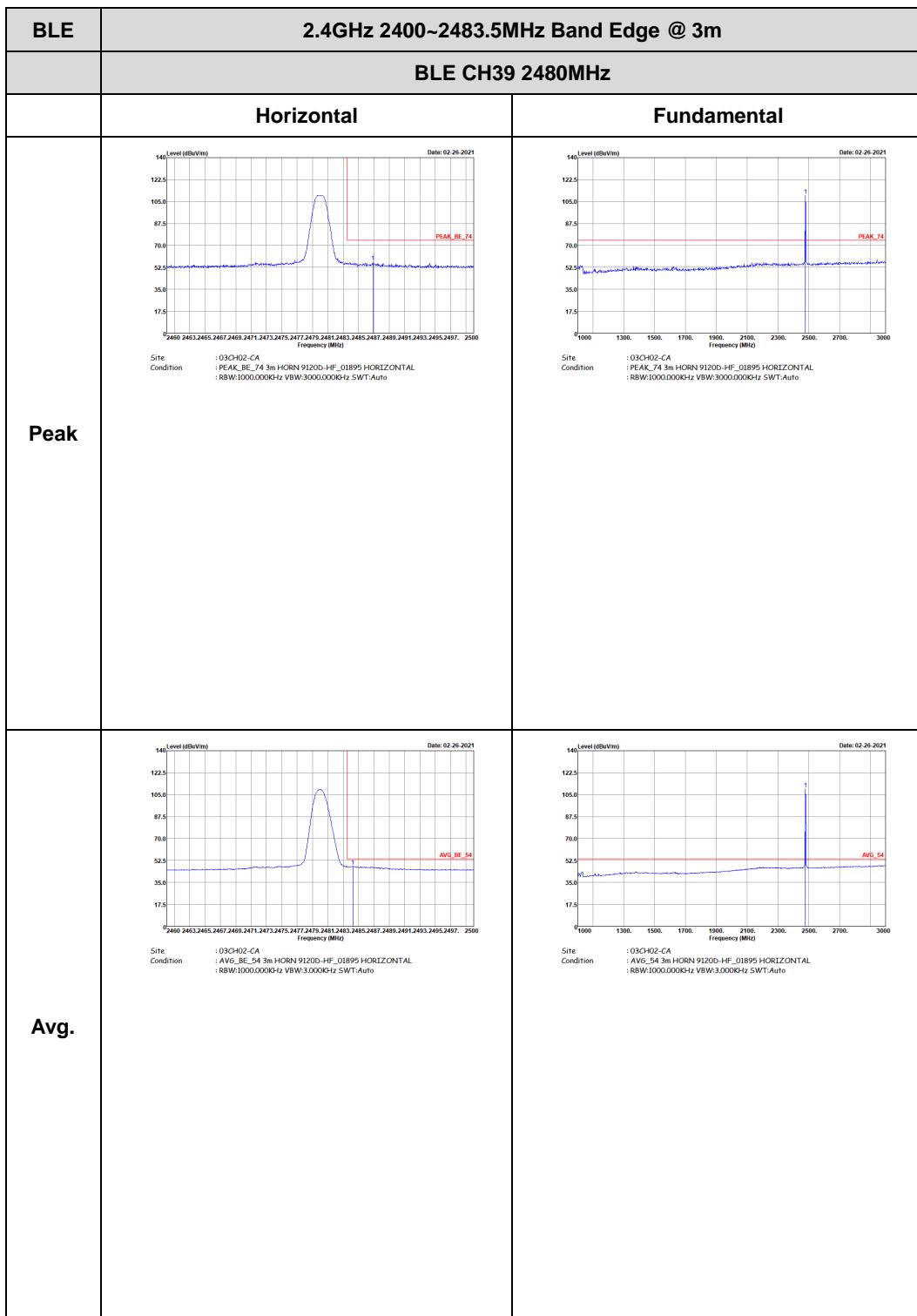


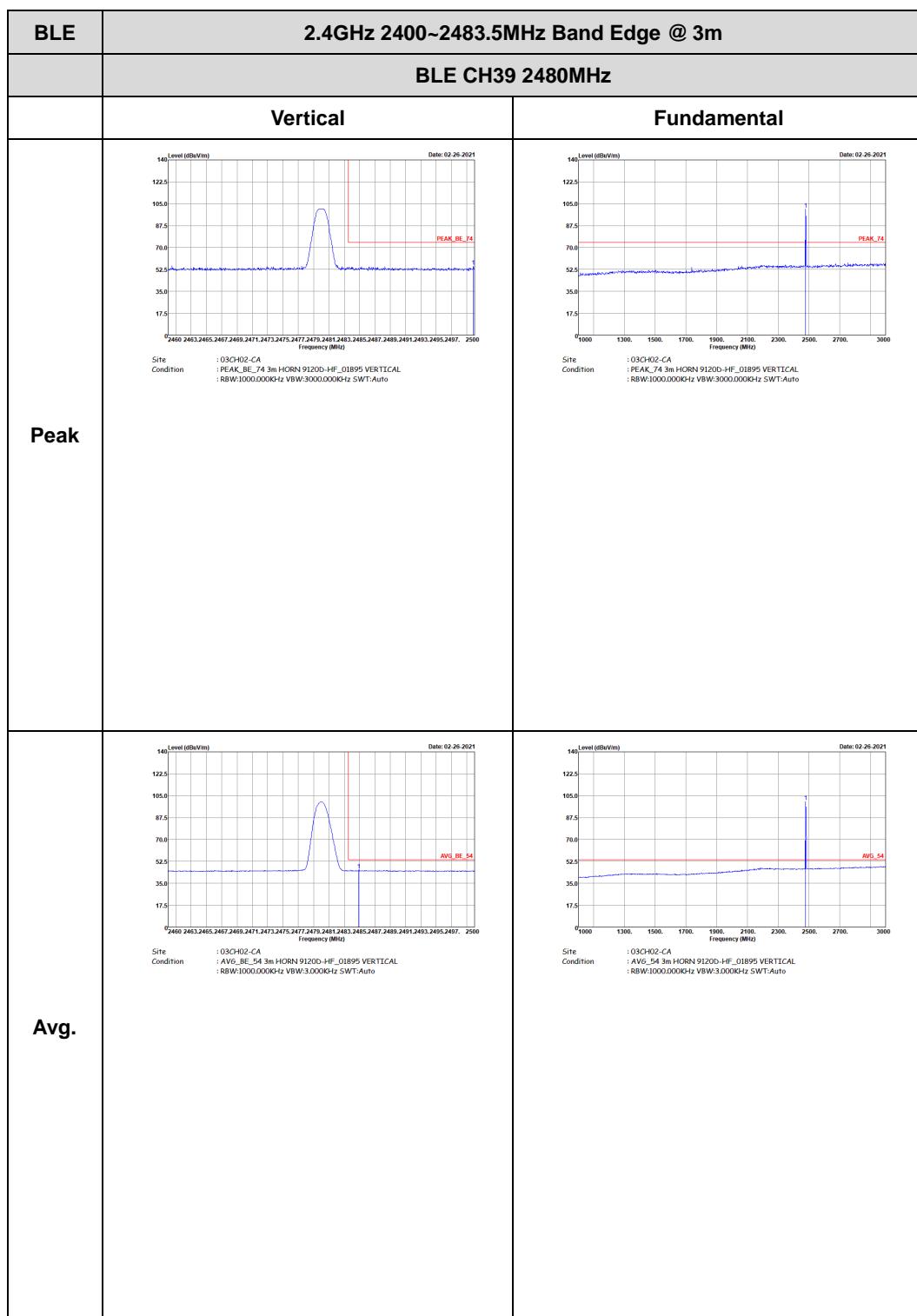
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH19 2440MHz - R		
Horizontal		Fundamental
Peak	 <p>Site : 03C402-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto</p>	Left blank
Avg.	 <p>Site : 03C402-CA Condition : AVG_BE_54 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto</p>	Left blank





BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH19 2440MHz - R		
Vertical		Fundamental
Peak	 <p>Level (dBuV/m)</p> <p>Date: 03-01-2021</p> <p>Site : 03C102-CA</p> <p>Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 VERTICAL</p> <p>: RBW:1000.000KHz VBW:3.000KHz SWT:Auto</p>	Left blank
Avg.	 <p>Level (dBuV/m)</p> <p>Date: 03-01-2021</p> <p>Site : 03C102-CA</p> <p>Condition : AVG_BE_54 3m HORN 9120D-HF_01895 VERTICAL</p> <p>: RBW:1000.000KHz VBW:3.000KHz SWT:Auto</p>	Left blank

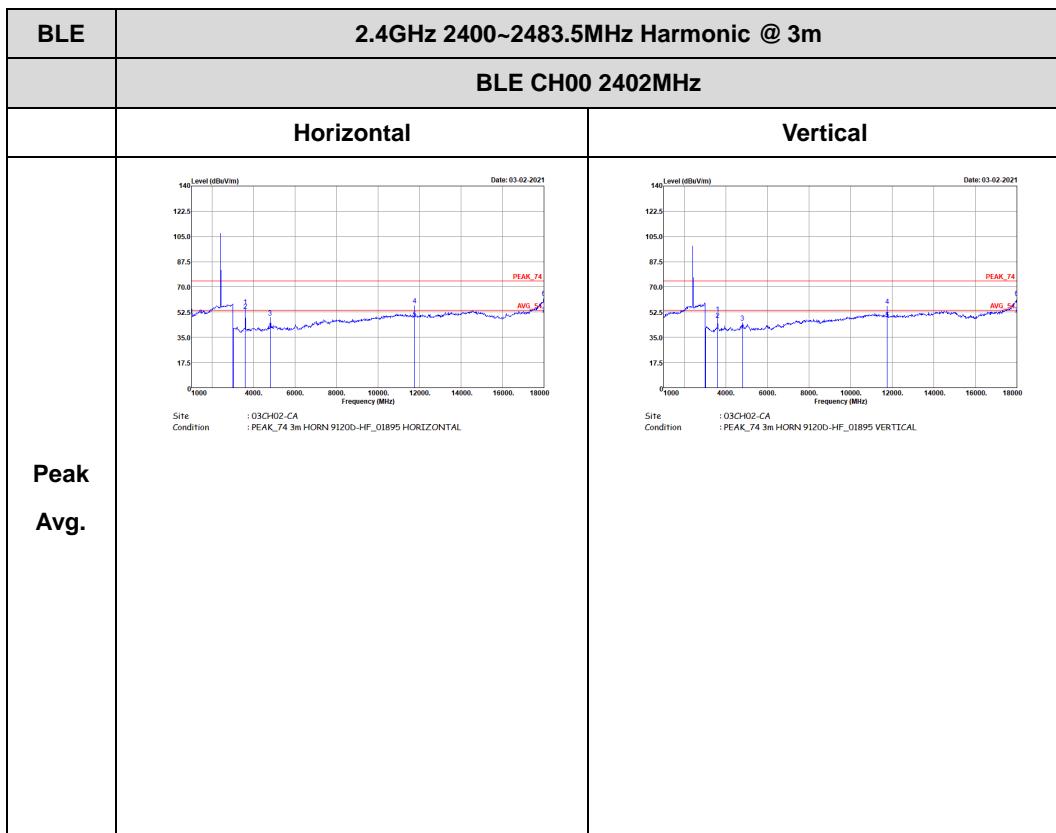


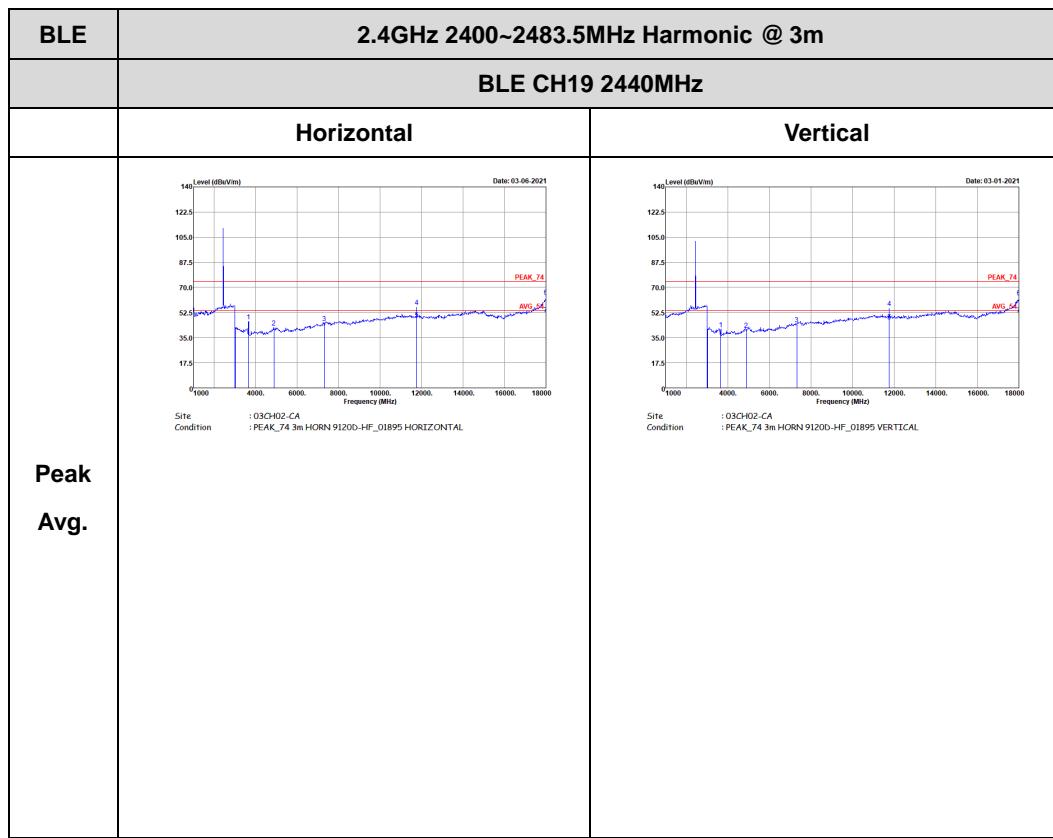


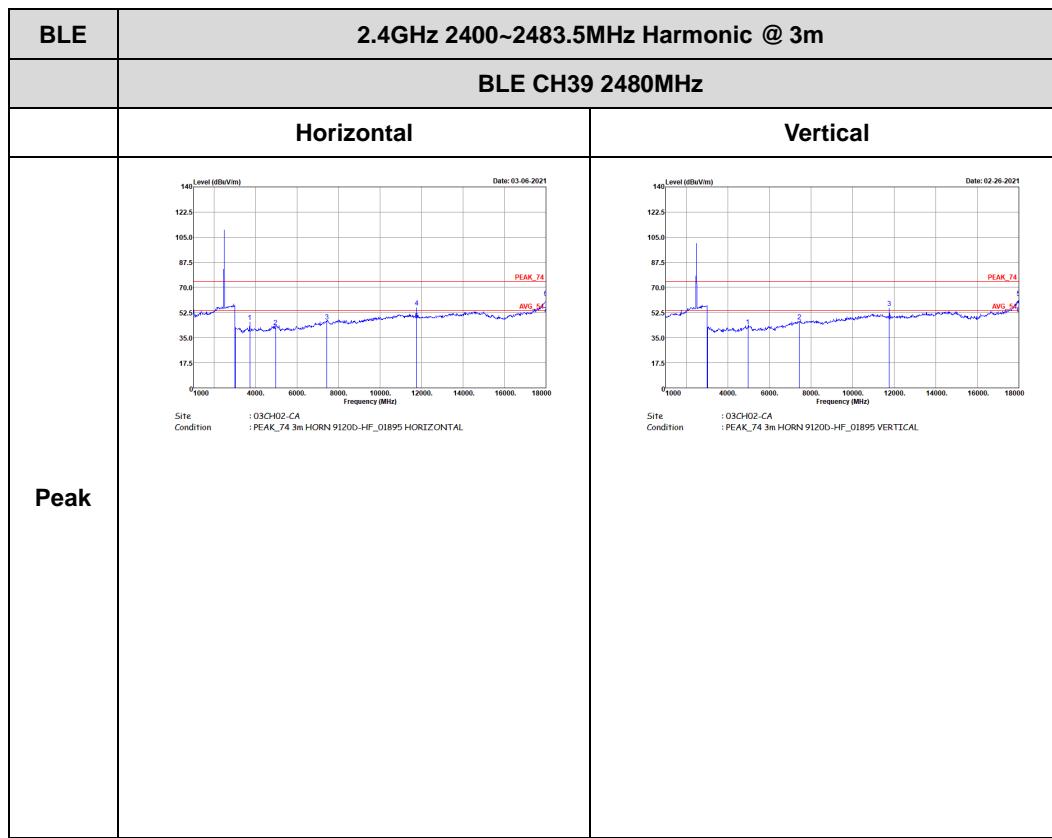


2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)



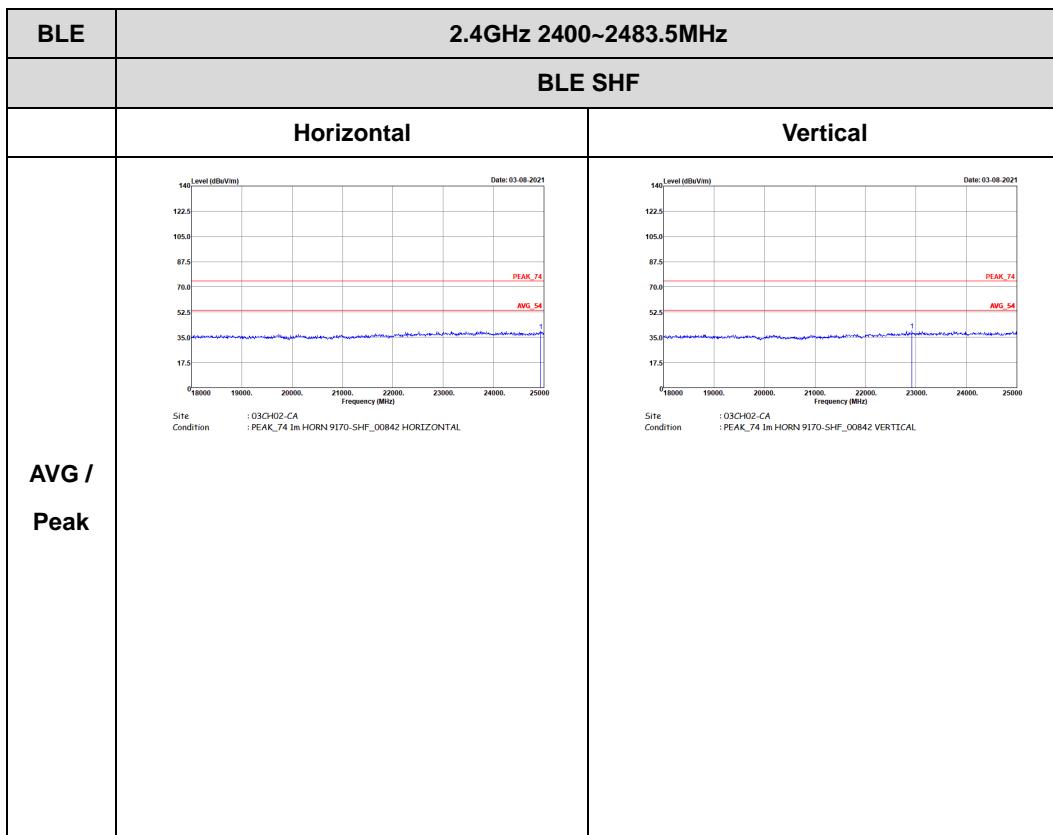






Emission above 18GHz

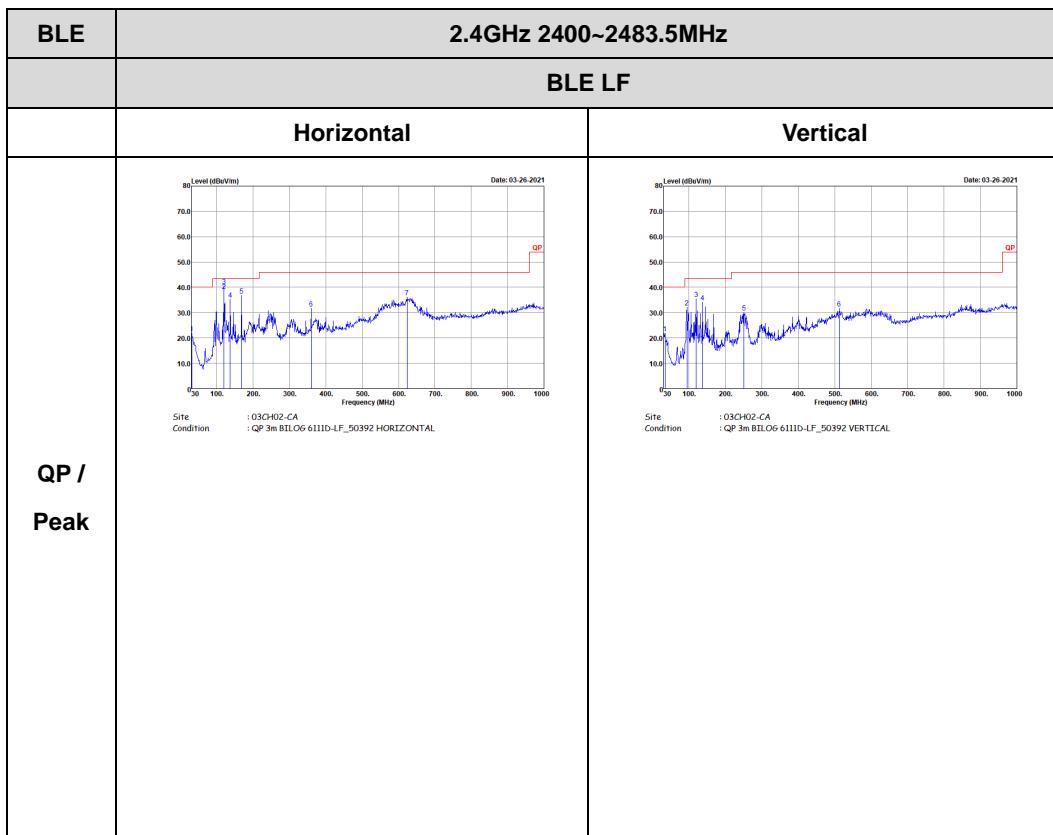
2.4GHz BLE (SHF)





Emission below 1GHz

2.4GHz BLE (LF)

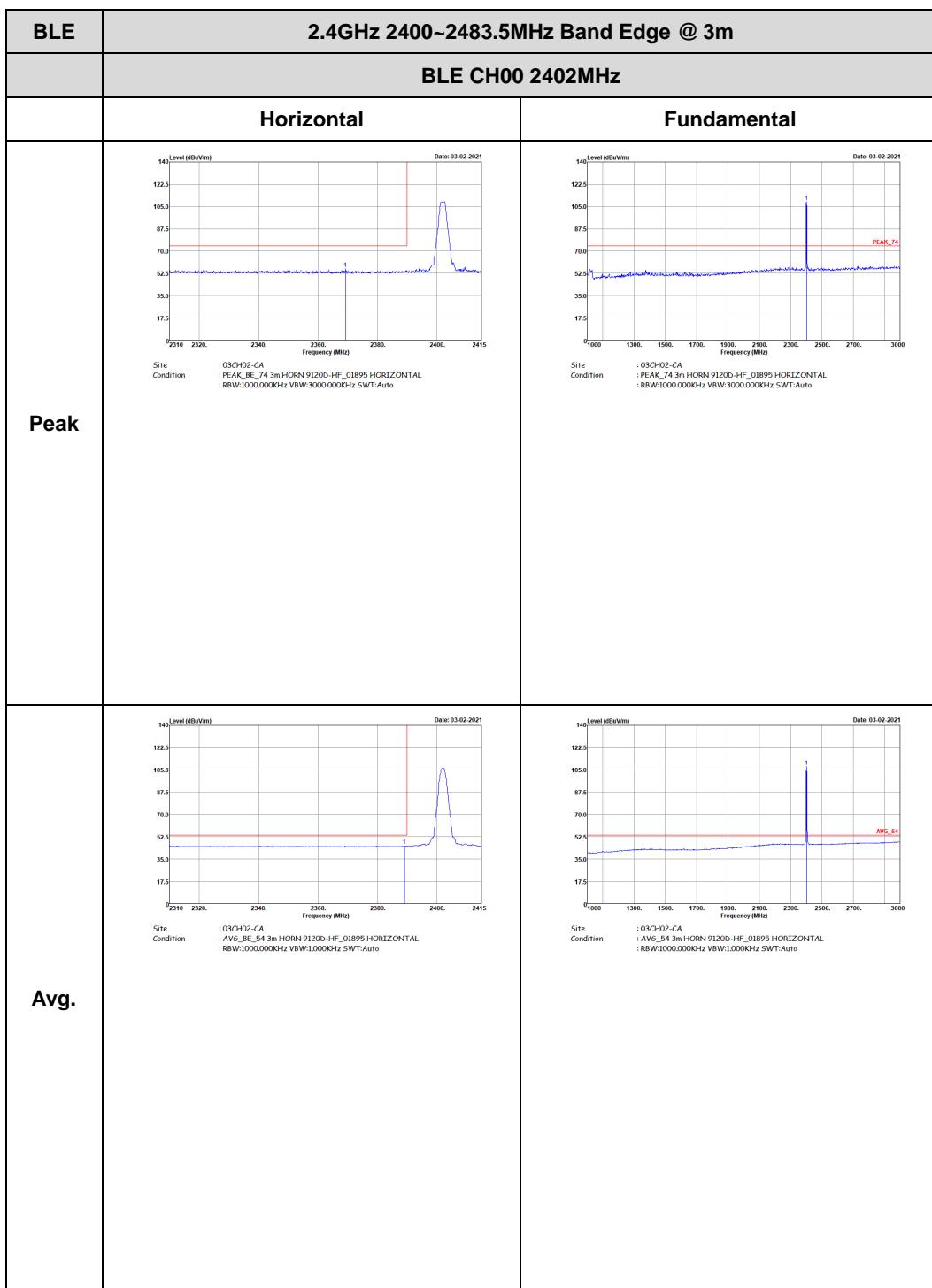


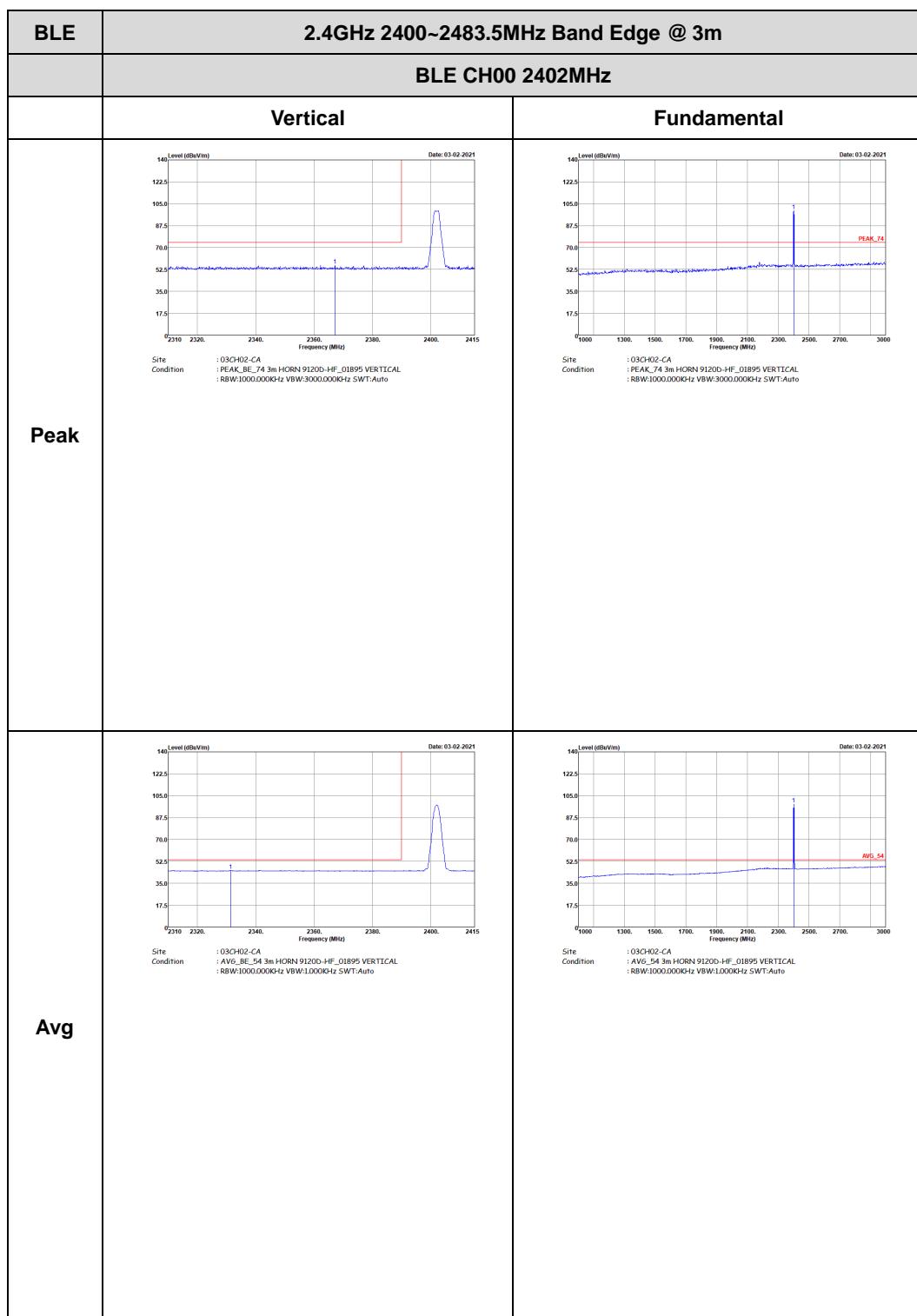


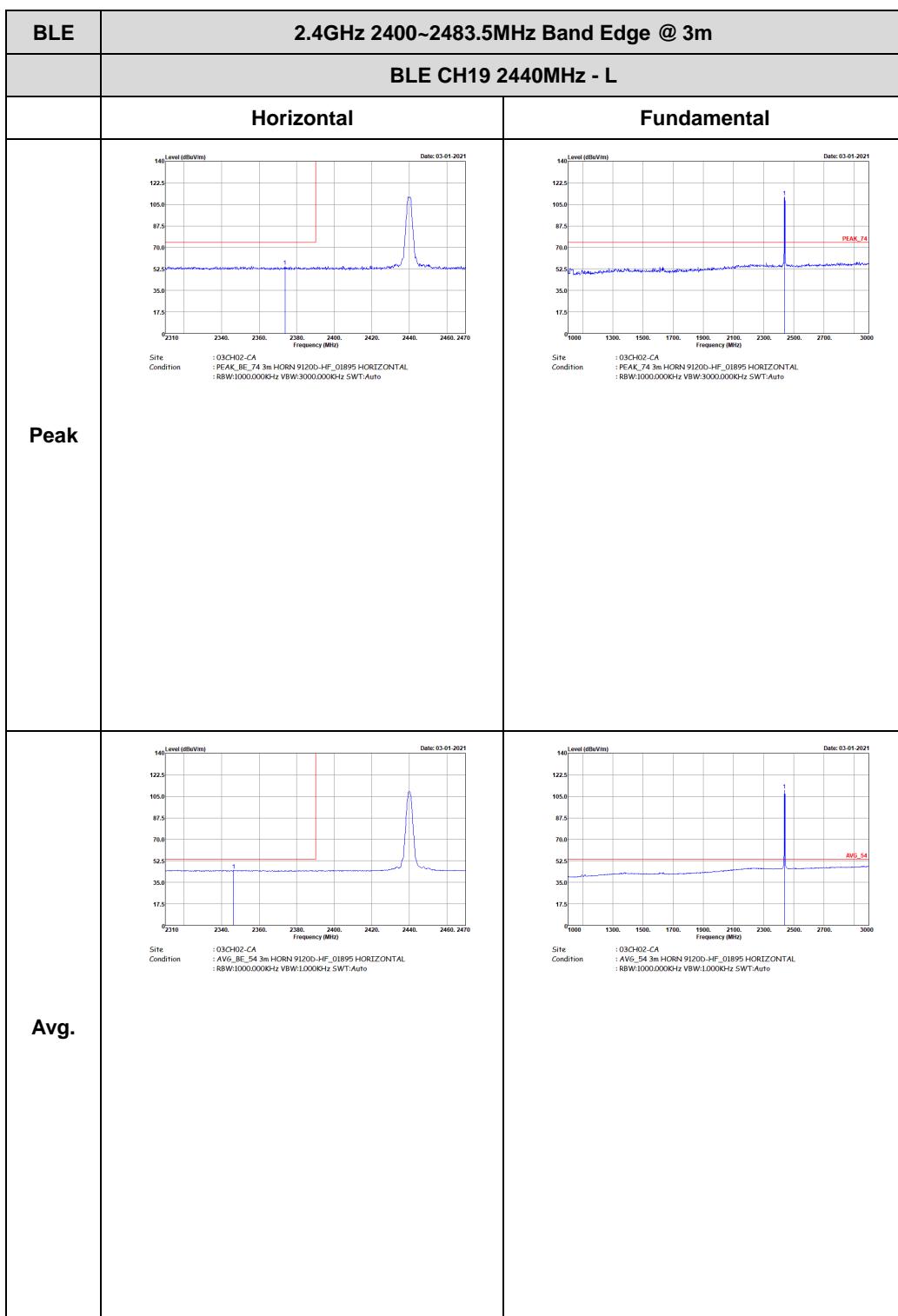
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2.4GHz 2400~2483.5MHz

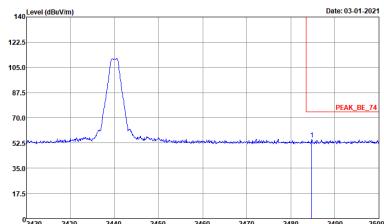
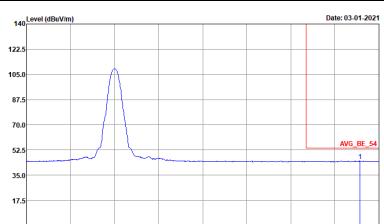
BLE (Band Edge @ 3m)

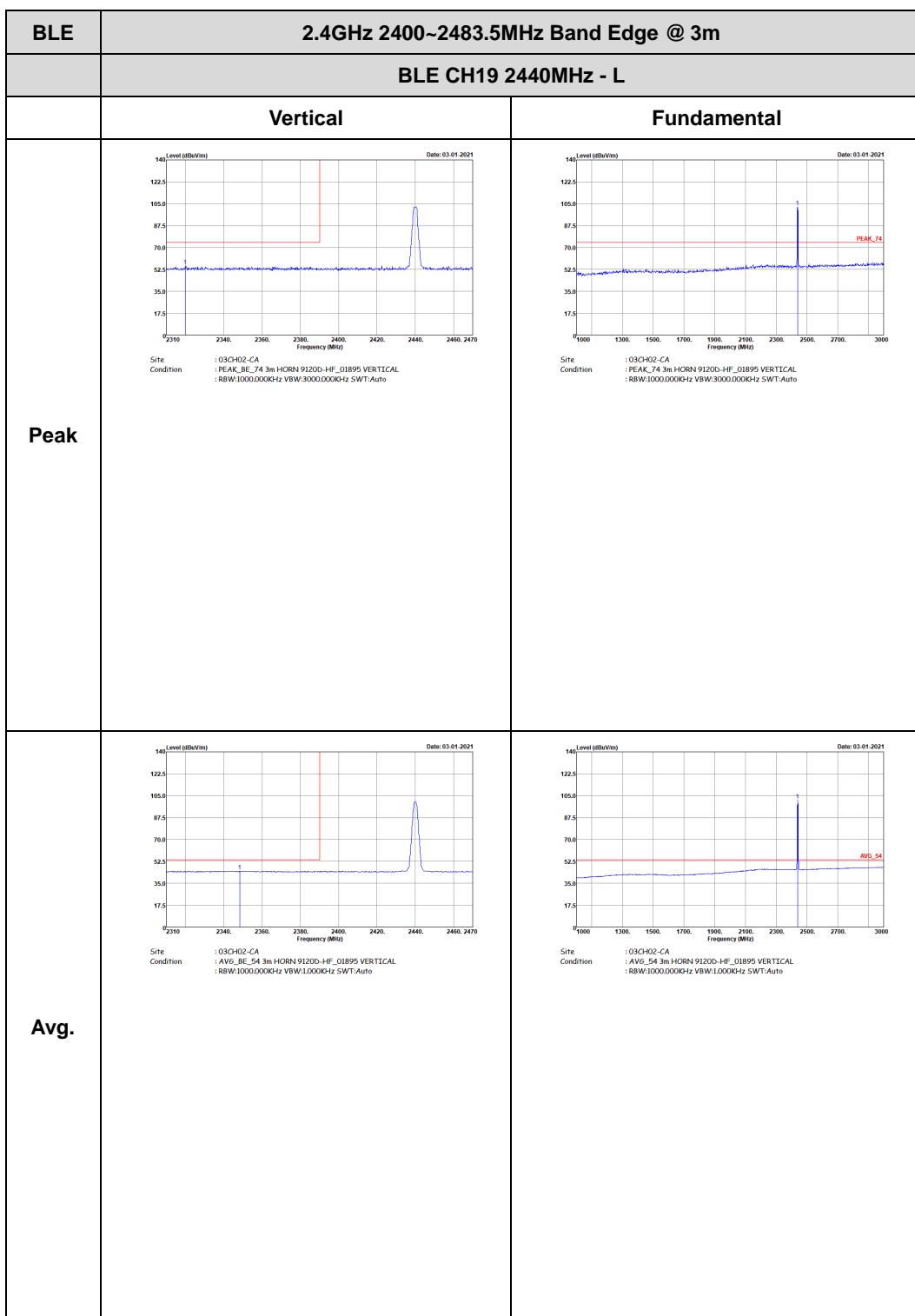




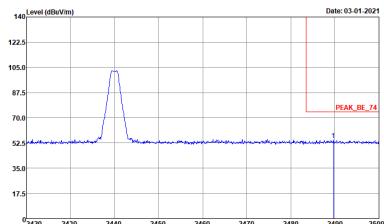
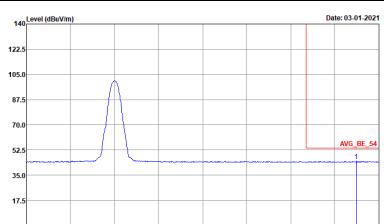


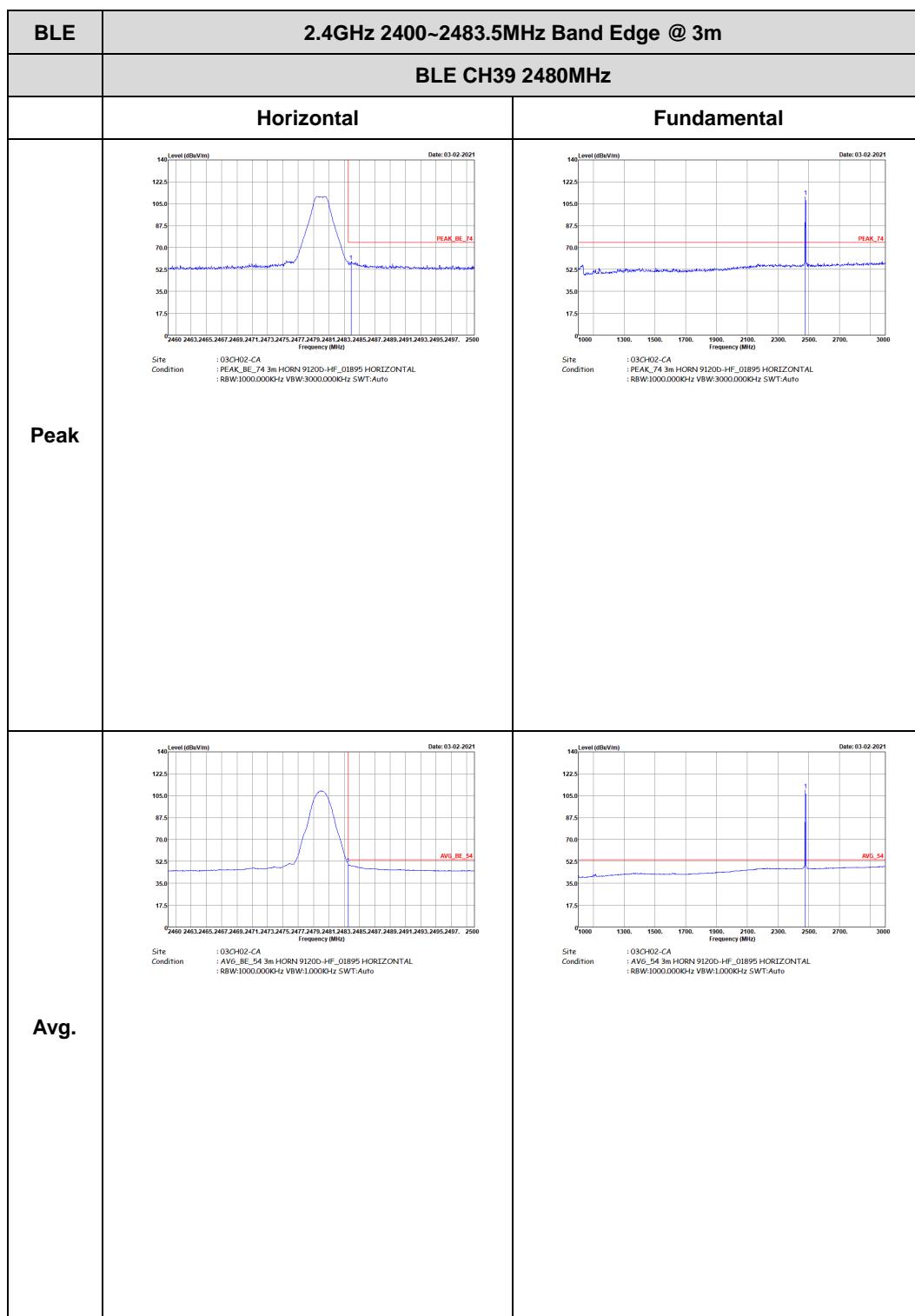


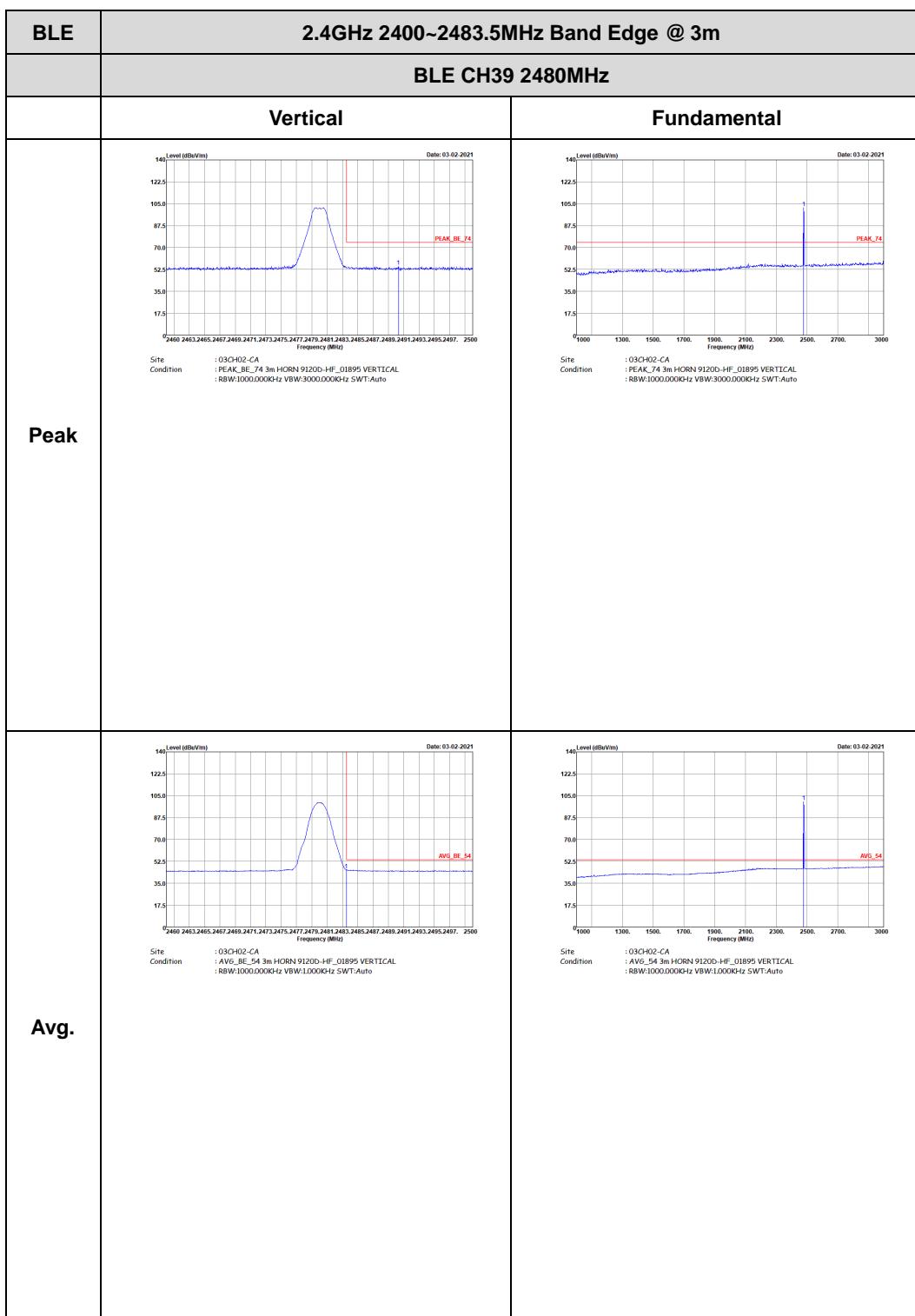
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH19 2440MHz - R		
Horizontal		Fundamental
Peak	 <p>Site : 03C402-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	Left blank
Avg.	 <p>Site : 03C402-CA Condition : AVG_BE_54 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto</p>	Left blank





BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH19 2440MHz - R		
Vertical		Fundamental
Peak	 <p>Site : 03C402-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	Left blank
Avg.	 <p>Site : 03C402-CA Condition : AVG_BE_54 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto</p>	Left blank

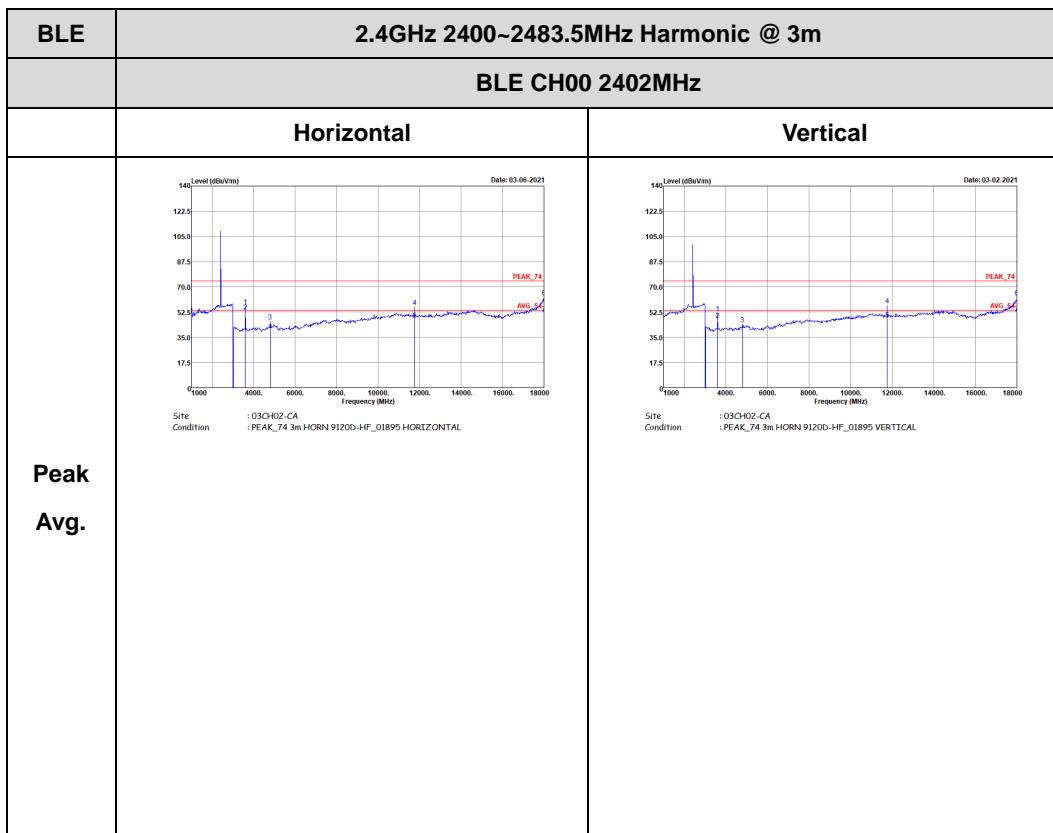


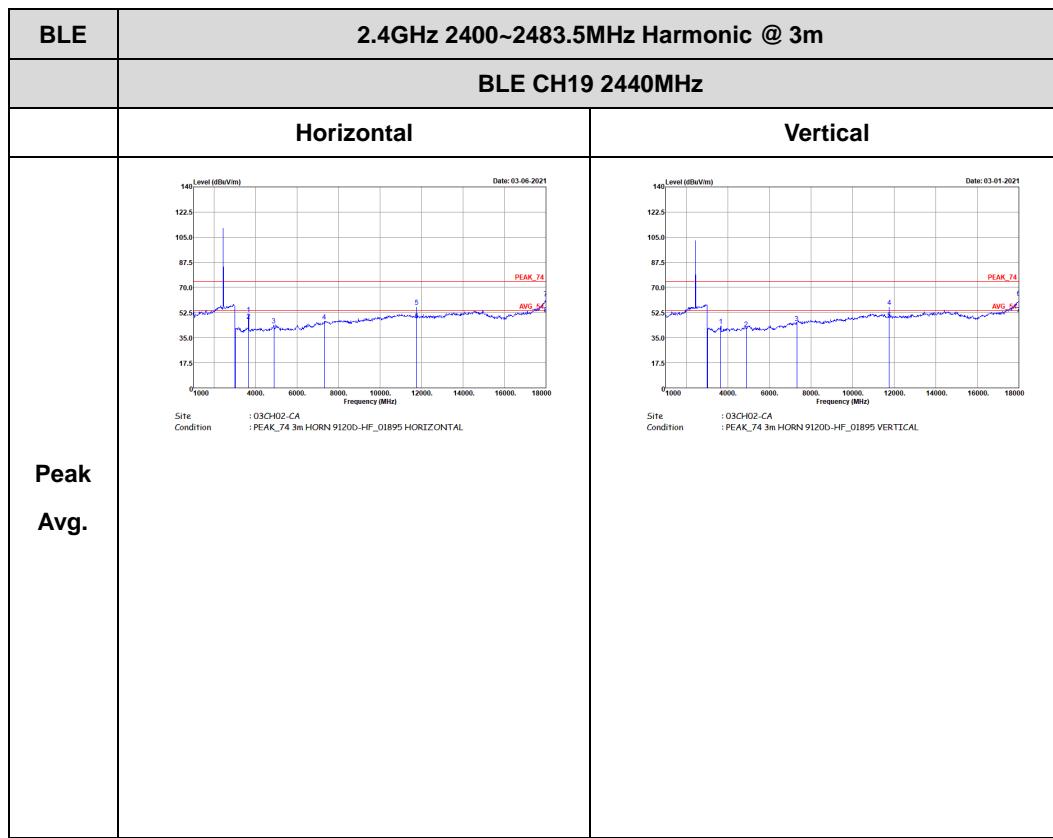


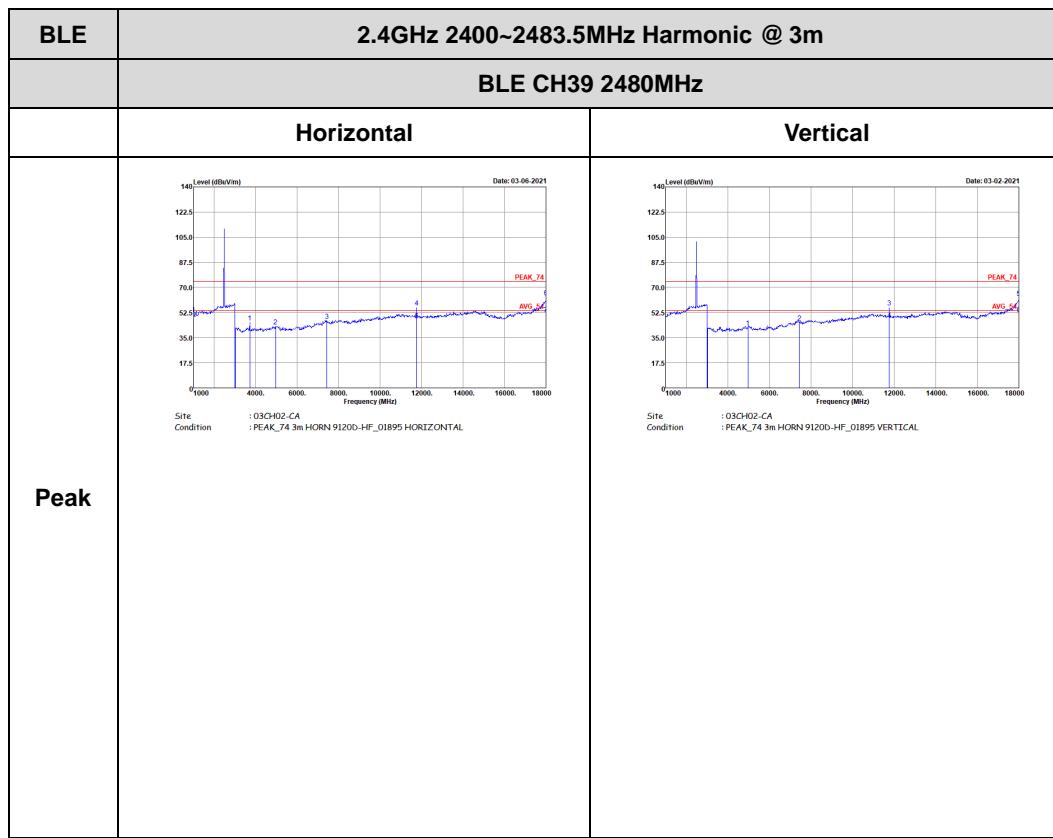


2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)



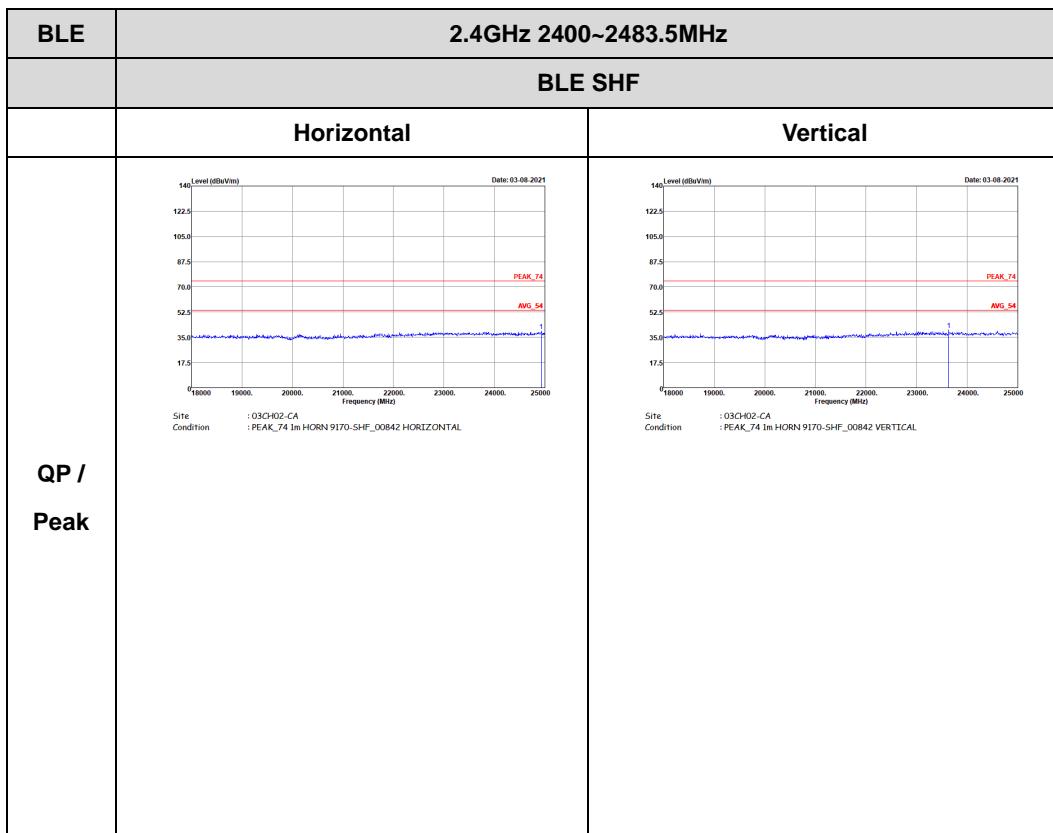






Emission above 18GHz

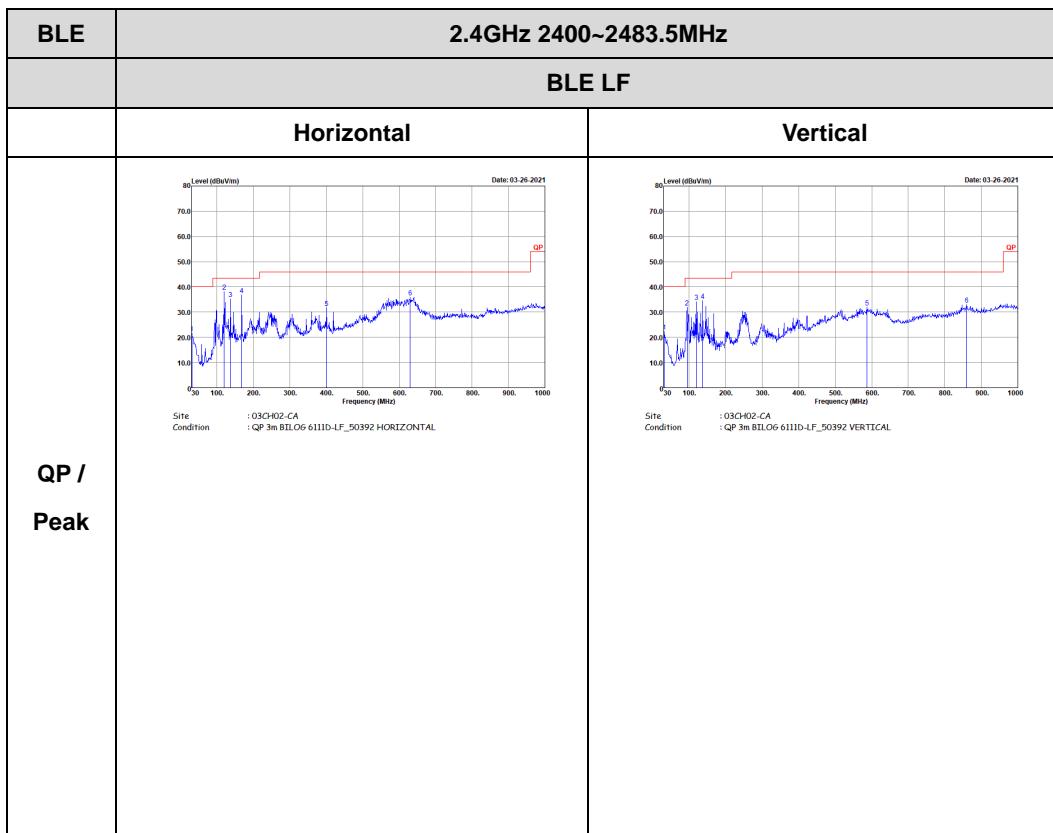
2.4GHz BLE (SHF)





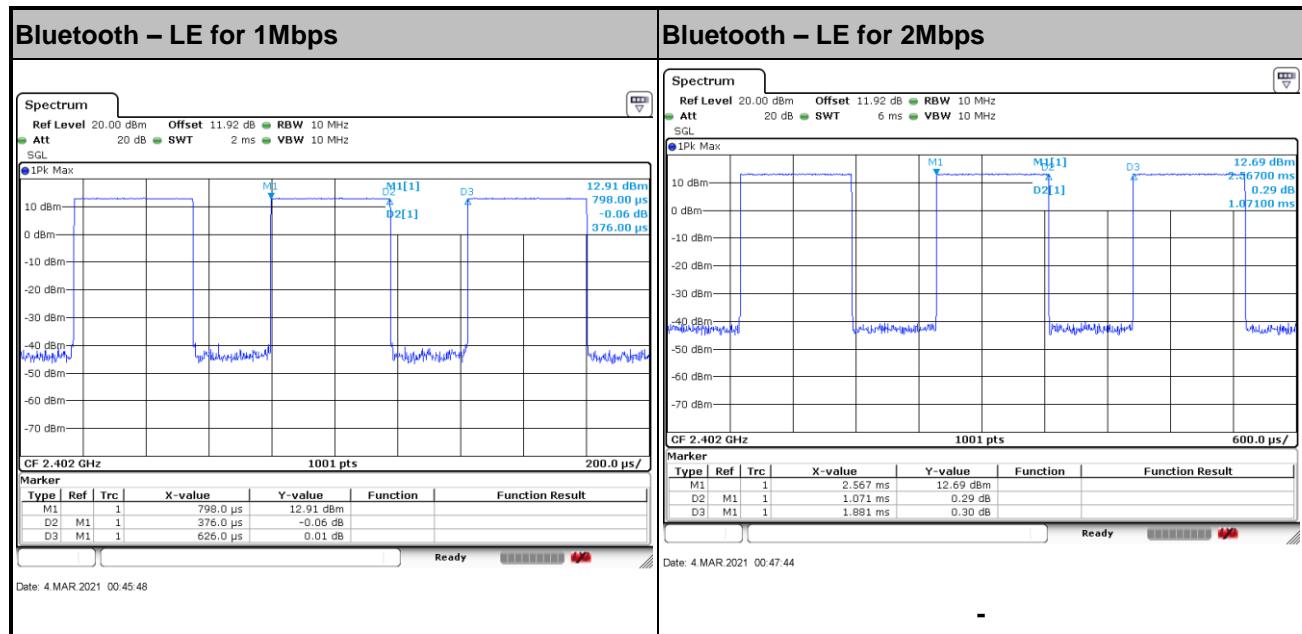
Emission below 1GHz

2.4GHz BLE (LF)



Appendix E. Duty Cycle Plots

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
Bluetooth –LE for 1Mbps	60.06	376	2.66	3kHz	2.21
Bluetooth –LE for 2Mbps	56.94	1071	0.93	1kHz	2.45



—————THE END—————