FCC RADIO TEST REPORT

FCC ID	:	**J9CQCARD7280P**
Equipment	:	**QCARD7280P**
Brand Name	:	**Qualcomm**
Model Name	:	**QCARD7280P-3**
Applicant	:	**Qualcomm Technologies, Inc. 5775 Morehouse Drive, San Diego, California 92121, United State**
Manufacturer	:	**Qualcomm Technologies, Inc. 5775 Morehouse Drive, San Diego, California 92121, United State**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on Jun. 29, 2022 and testing was performed from Aug. 23, 2022 to Nov. 05, 2022. We, Sporton International Inc. Wensan Laboratory, 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 from Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. Wensan Laboratory
No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issue Date
FR1N1011-01B	01	Initial issue of report	Nov. 24, 2022
FR1N1011-01B	02	Revise Appendix D and Appendix E	Feb. 06, 2023

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(a)(2)	6dB Bandwidth	Pass	-
3.1	2.1049	99% Occupied Bandwidth	Reporting only	-
3.2	15.247(b)(3) 15.247(b)(4)	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	0.47 dB under the limit at 30.970 MHz
-	15.207	AC Conducted Emission	Not Required	-
3.6	15.203	Antenna Requirement	Pass	-

Note: Not required means after assessing, test items are not necessary to carry out.

Declaration of Conformity:
1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results. 2. The measurement uncertainty please refer to report "Uncertainty of Evaluation".
Comments and Explanations:
The product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Avis Chuang

Report Producer: Lucy Wu

1 General Description

1.1 Product Feature of Equipment Under Test

Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n/ac/ax, Wi-Fi 5GHz 802.11a/n/ac/ax, and Wi-Fi 6GHz 802.11a/n/ac/ax.

Antenna Information								
Antenna Set	RF Chain No.	Brand	Model	Antenna Net Gain (dBi)	Frequency Range (MHz)	Ant. Type	Connector Type	Cable Length (mm)
A	Chain0/1	HONG BO	260-25094	3.53	2.4~2.4835 GHz	PIFA	i-pex (MHF 4L)	300mm
				3.06	5.15~5.25 GHz			
				3.07	5.25~5.35 GHz			
				4.81	5.47~5.725 GHz			
				4.2	5.725~5.850 GHz			
B	Chain0/1	HONG BO	260-25083	5.09	5.850~5.895 GHz	PIFA	i-pex (MHF 4L)	300mm
				5.14	5.925~6.425 GHz			
				5.09	6.425~6.525 GHz			
				5.16	6.525~6.875 GHz			
				5.12	6.875~7.125 GHz			
C	Chain0/1	HONG BO	260-25084	3.22	2.4~2.4835 GHz	Monopole	i-pex (MHF 4L)	200mm
				3.35	5.15~5.25 GHz			
				3.42	5.25~5.35 GHz			
				4.77	5.47~5.725 GHz			
				4.72	5.725~5.850 GHz			
				4.71	5.850~5.895 GHz			
				4.75	5.925~6.425 GHz			
				4.29	6.425~6.525 GHz			
				4.81	6.525~6.875 GHz			
				4.74	6.875~7.125 GHz			

Remark:

1. Ant. 5 means Chain 0 and Ant. 4 means Chain 1.
2. The maximum gain was chosen for test.
3. The EUT's information above is declared by manufacturer. Please refer to Comments and Explanations in report summary.

1.2 Modification of EUT

No modifications made to the EUT during the testing.

1.3 Testing Location

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	**Sporton Site No.**
	TH05-HY, 03CH15-HY

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC designation No.: TW3786

1.4 Applicable Standards

According to the specifications declared by 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:

1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. The TAF code is not including all the FCC KDB listed without accreditation.
3. 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)
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	-	-

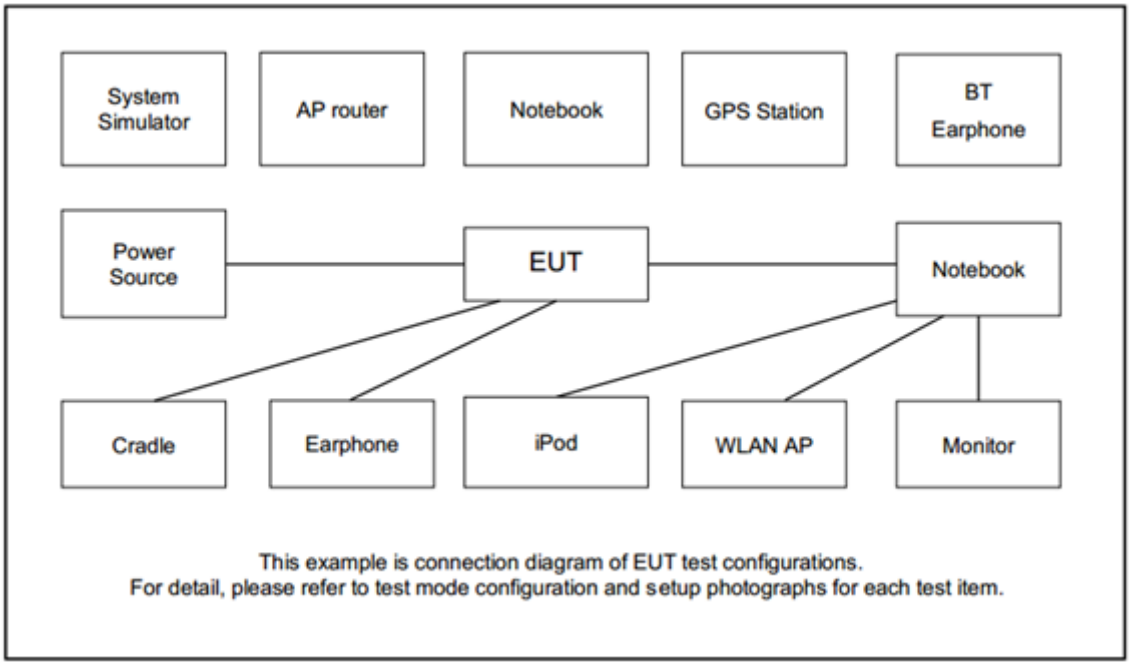
2.2 Test Mode

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: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

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
	Mode 6: Bluetooth Tx CH39_2480 MHz_2Mbps
Radiated Test Cases	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 CH19_2440 MHz_2Mbps

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	Dell	Latitude 3400	N/A	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
2.	Power Supply	GW Instek	GPE-2323	N/A	N/A	Unshielded, 1.8 m
3.	Fixture	Qualcomm	20-33568-H1	N/A	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “QRCT Ver.4.0.00206.0” 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.

2.6 Measurement Results Explanation Example

For all conducted test items:

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

Example :

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

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10 dB attenuator.

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

= 4.2 + 10 = 14.2 (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.

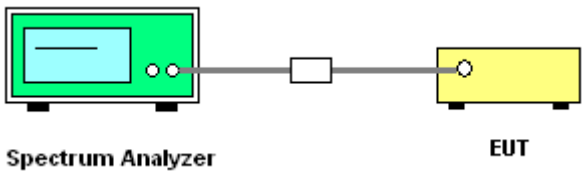
3.1.2 Measuring Instruments

Please refer to the measuring equipment list in 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 is connected to the spectrum analyzer by RF cable and attenuator. The path loss is 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) ≥ 3 * RBW.
6. Measure and record the results in the test report.

3.1.4 Test Setup

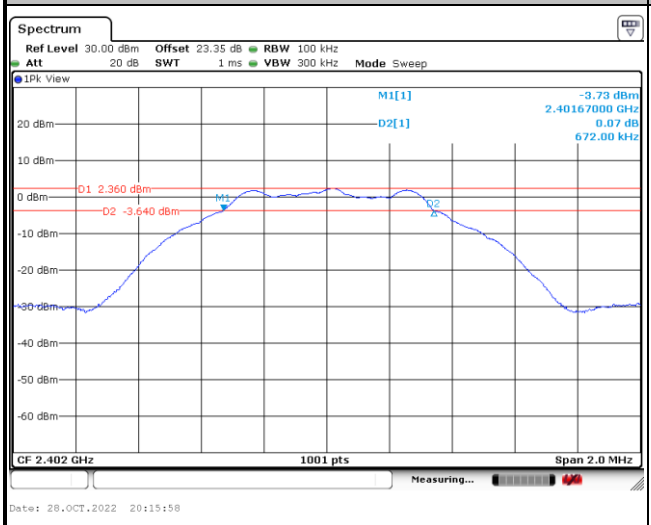
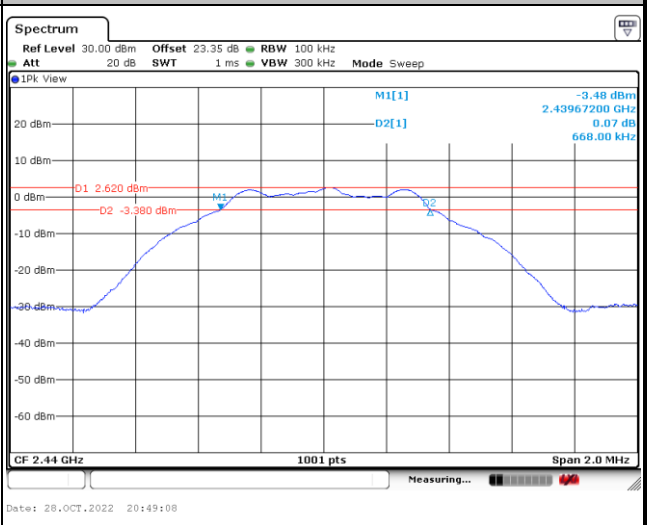


3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

<Ant. 4>

<1Mbps>

6 dB Bandwidth Plot on Channel 00	6 dB Bandwidth Plot on Channel 19
	
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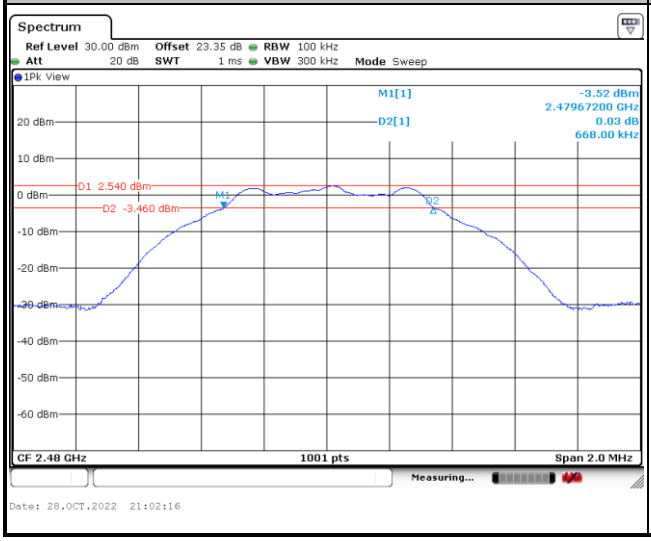	

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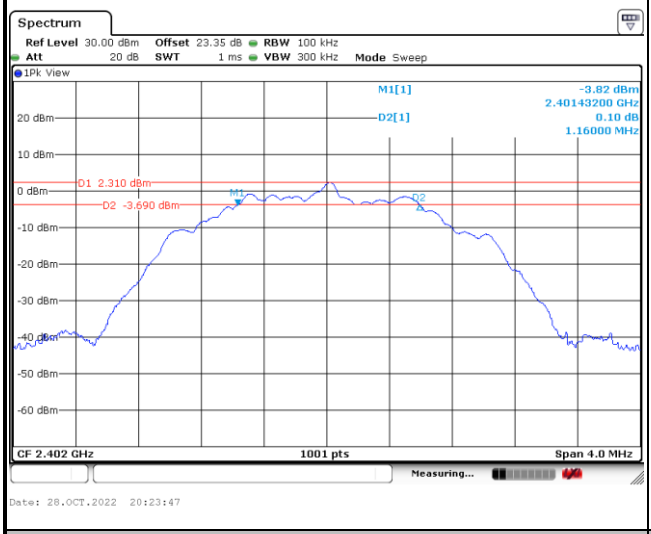
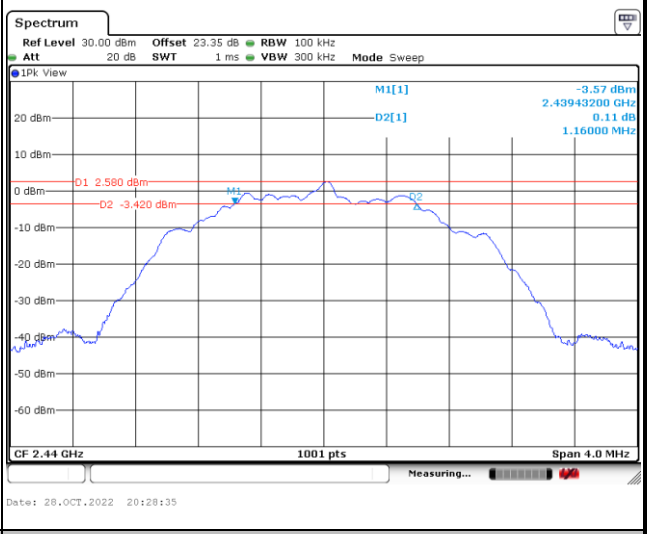
6 dB Bandwidth Plot on Channel 00	6 dB Bandwidth Plot on Channel 19
	
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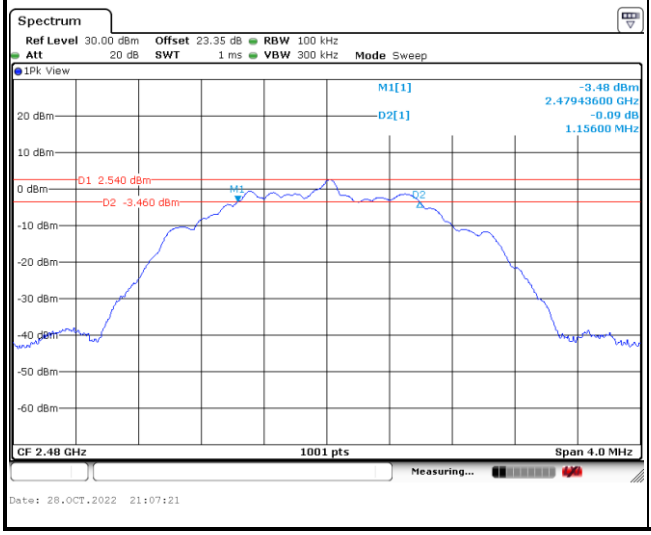	

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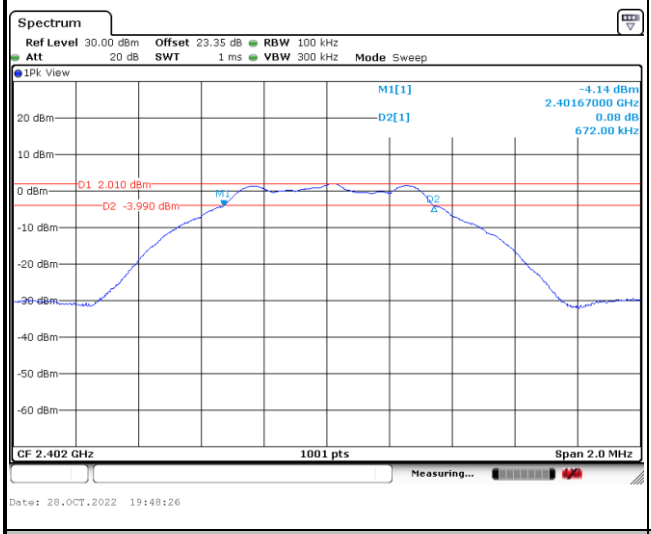
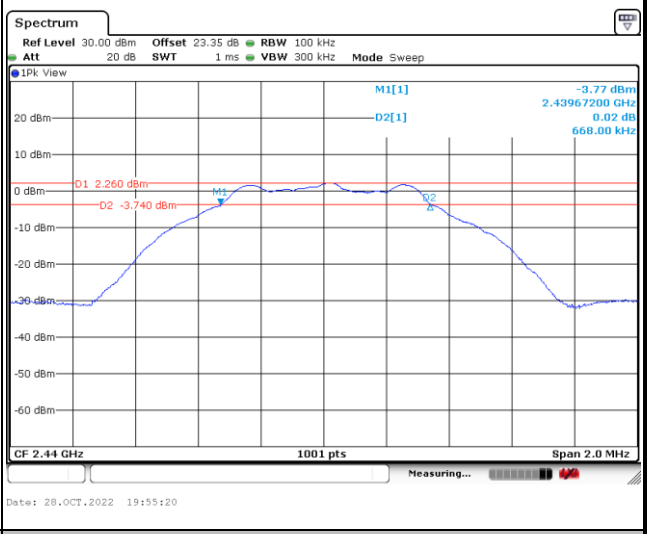
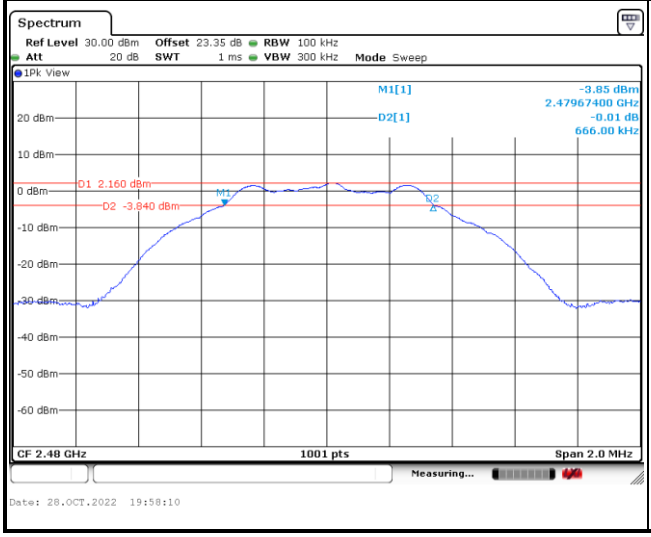
6 dB Bandwidth Plot on Channel 00	6 dB Bandwidth Plot on Channel 19
	
6 dB Bandwidth Plot on Channel 39	**N/A**
	

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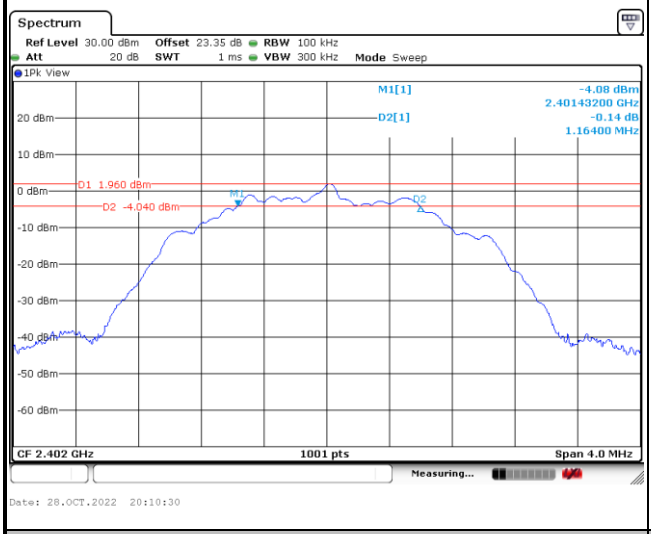
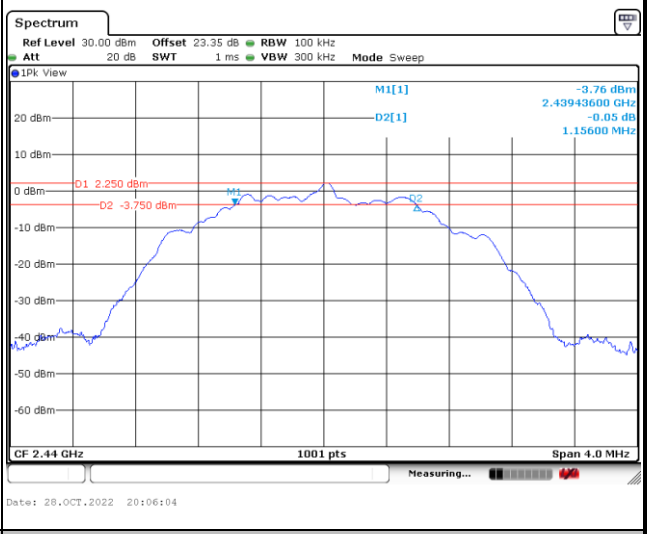
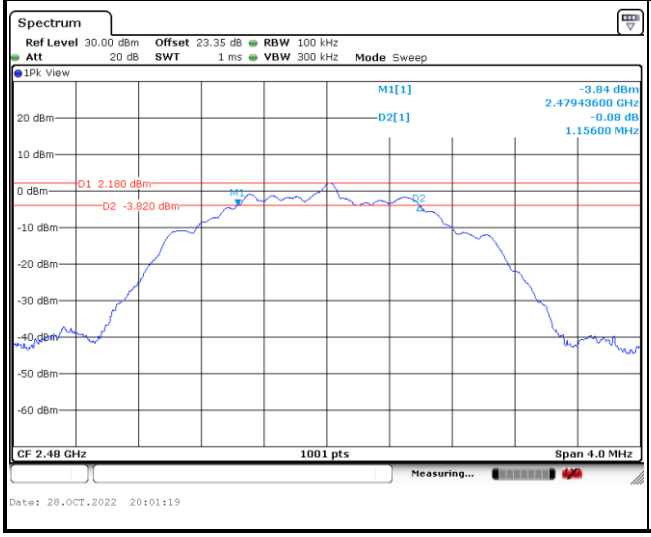
6 dB Bandwidth Plot on Channel 00	6 dB Bandwidth Plot on Channel 19
	
6 dB Bandwidth Plot on Channel 39	**N/A**
	

3.1.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

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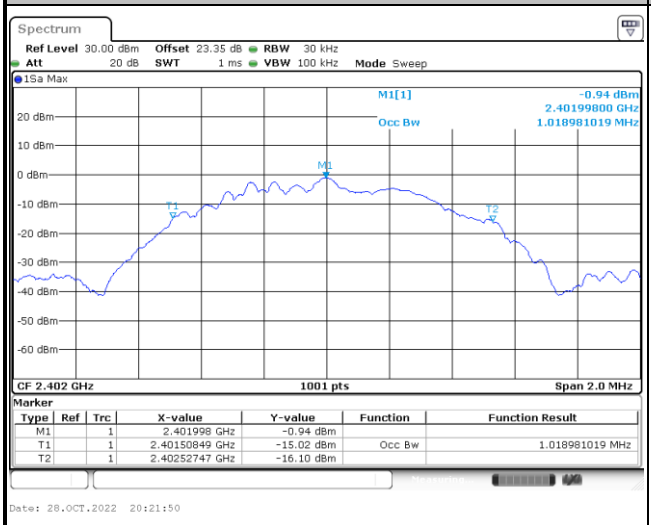
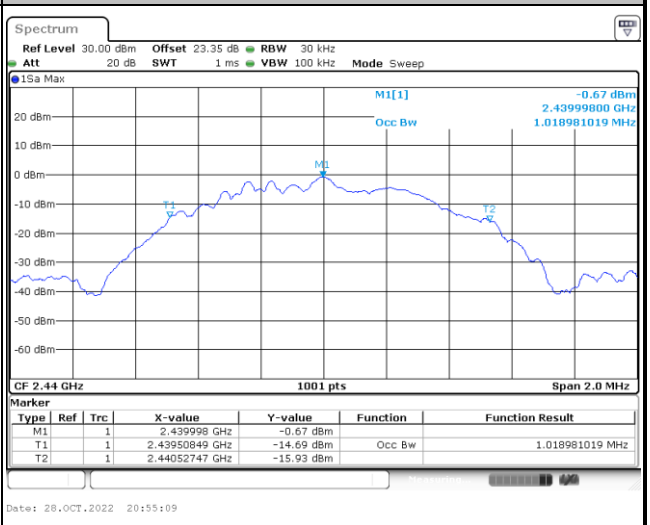
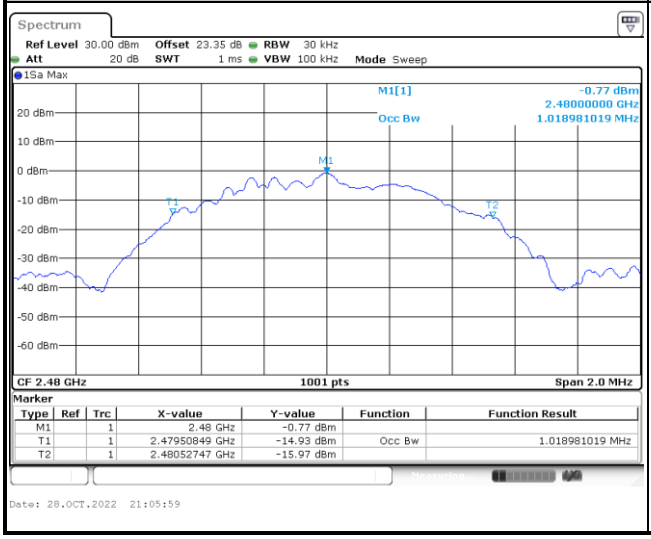
99% Bandwidth Plot on Channel 00	99% Occupied Bandwidth Plot on Channel 19
	
99% Occupied Bandwidth Plot on Channel 39	**N/A**
	

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

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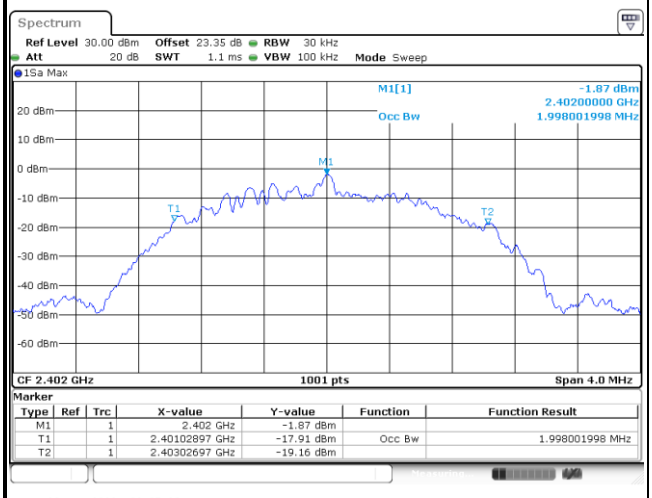
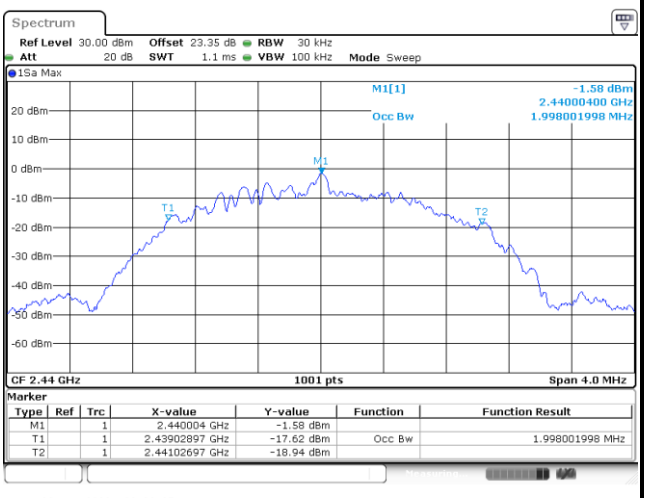
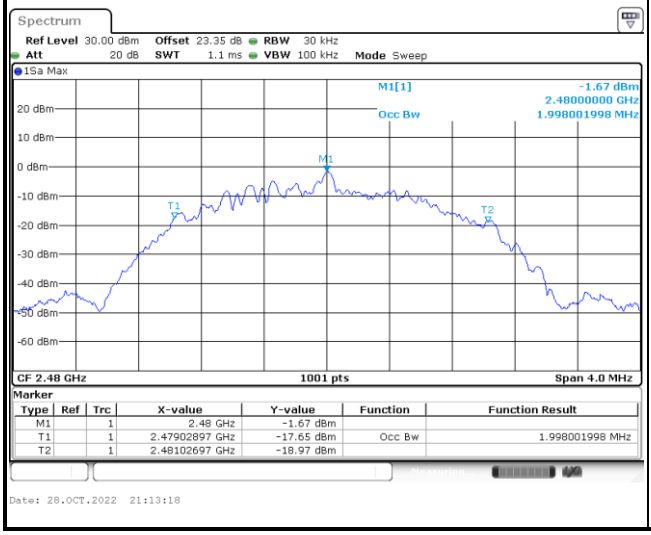
99% Bandwidth Plot on Channel 00	99% Occupied Bandwidth Plot on Channel 19
	
99% Occupied Bandwidth Plot on Channel 39	**N/A**
	

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

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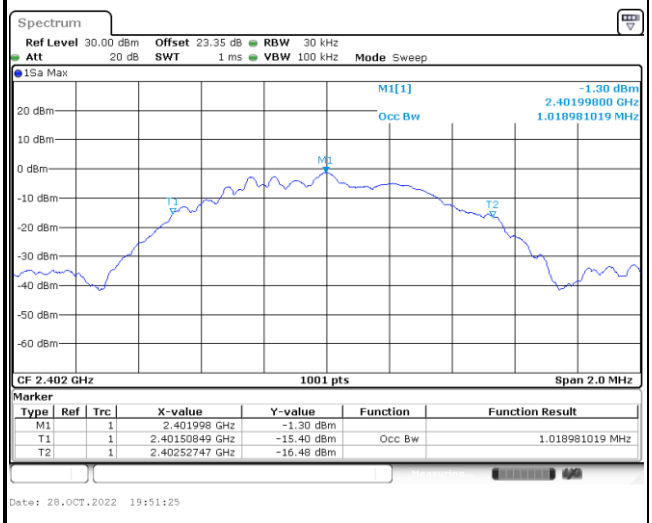
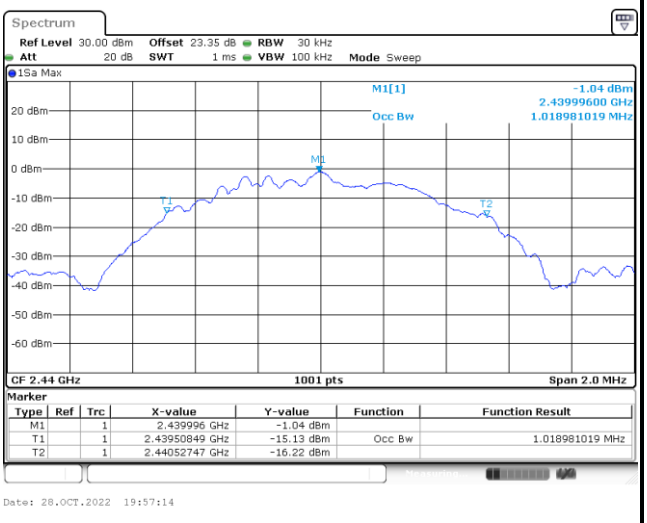
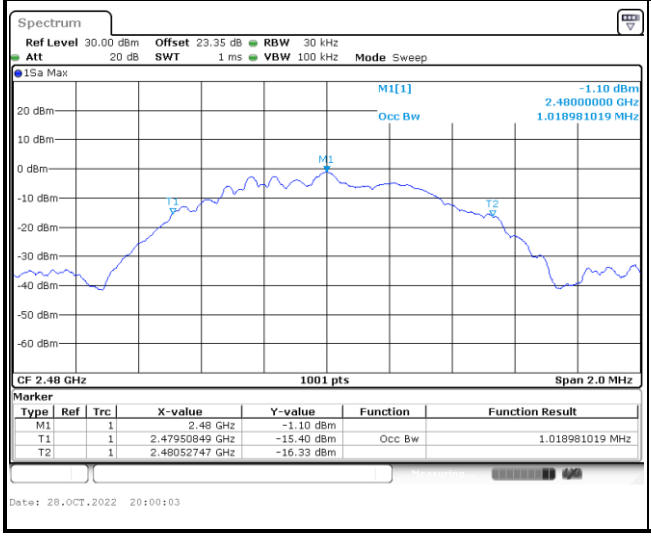
99% Bandwidth Plot on Channel 00	99% Occupied Bandwidth Plot on Channel 19
	
99% Occupied Bandwidth Plot on Channel 39	**N/A**
	

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

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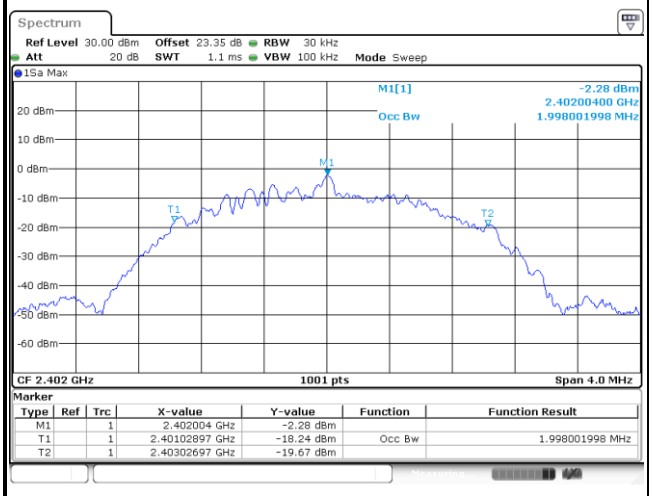
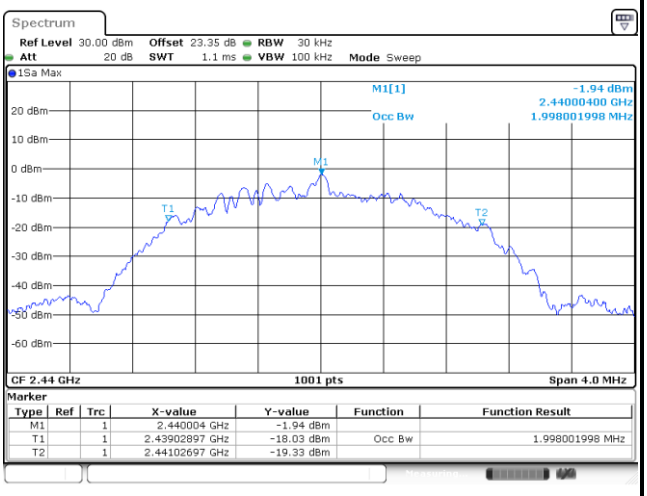
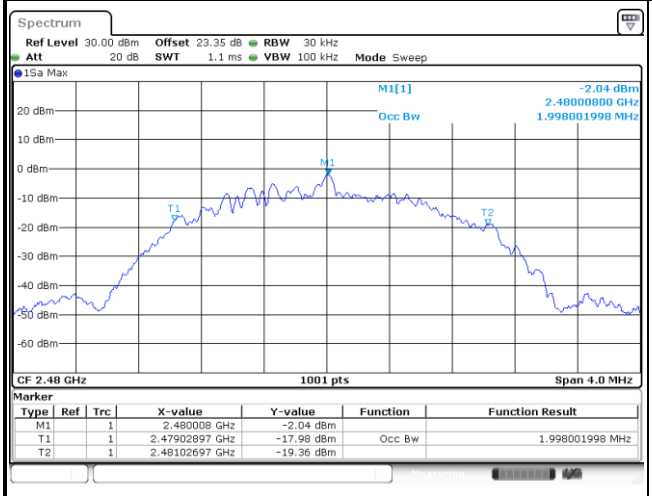
99% Bandwidth Plot on Channel 00	99% Occupied Bandwidth Plot on Channel 19
	
99% Occupied Bandwidth Plot on Channel 39	**N/A**
	

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.

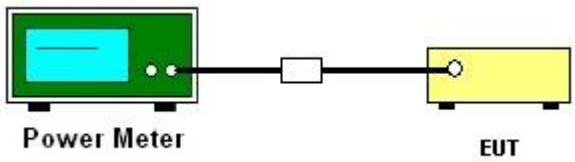
3.2.2 Measuring Instruments

Please refer to the measuring equipment list in 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 is connected to the power meter by RF cable and attenuator.
3. The path loss is 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

Please refer to the measuring equipment list in 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 is connected to the spectrum analyzer by RF cable and attenuator. The path loss is 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. (6 dB 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

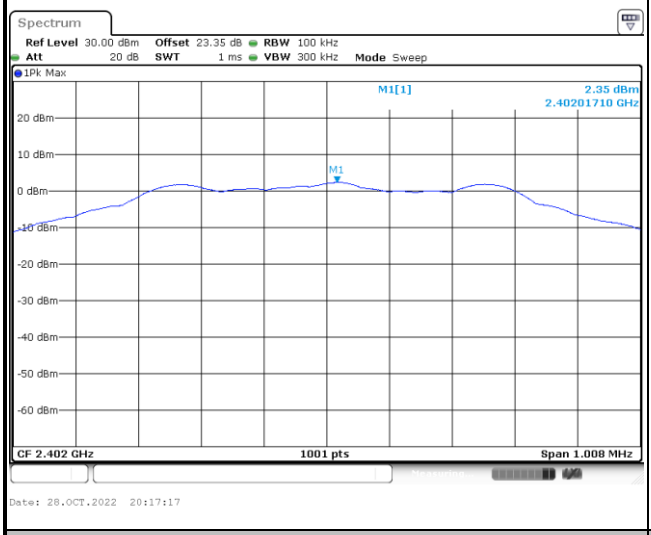
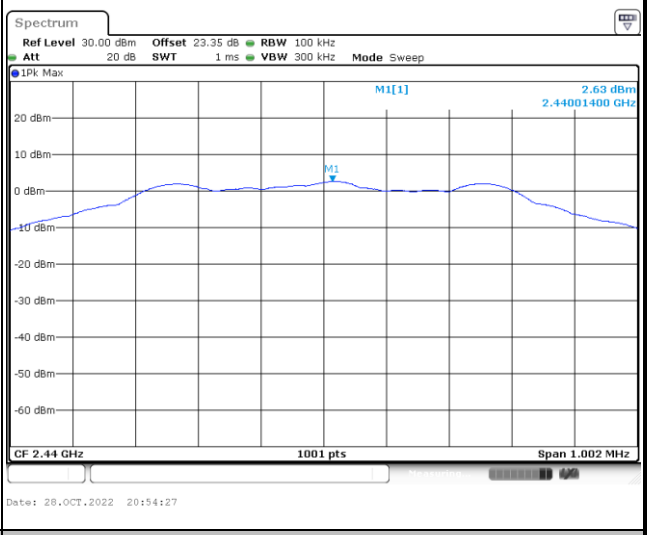
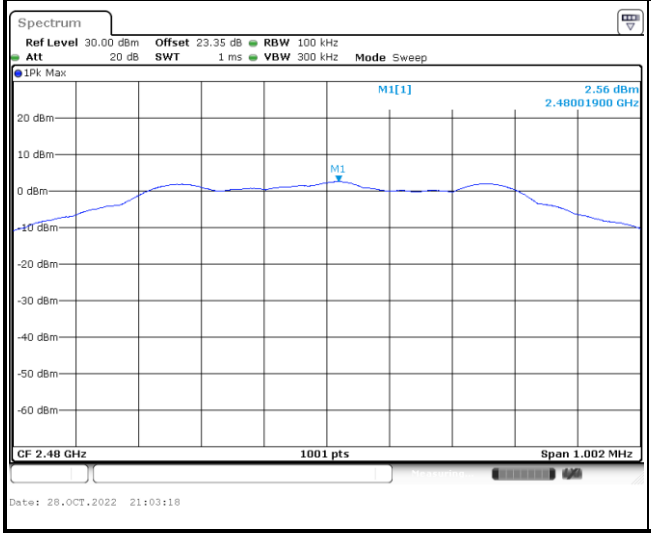
3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

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

<Ant. 4>

<1Mbps>

PSD 100kHz Plot on Channel 00	PSD 100kHz Plot on Channel 19
	
PSD 100kHz Plot on Channel 39	**N/A**
	

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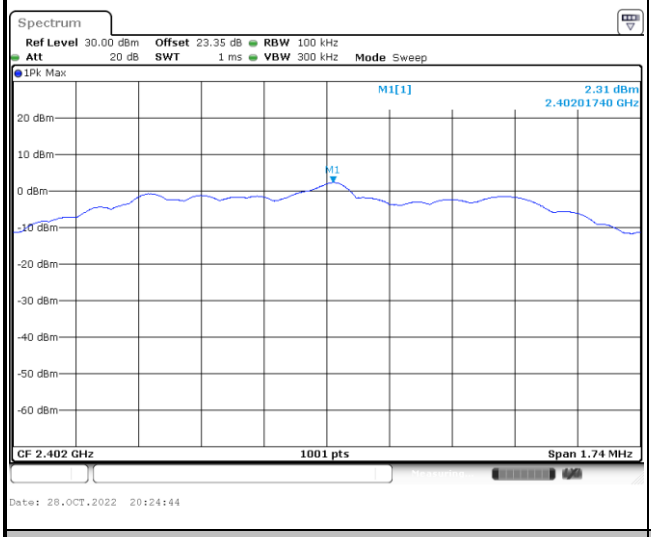
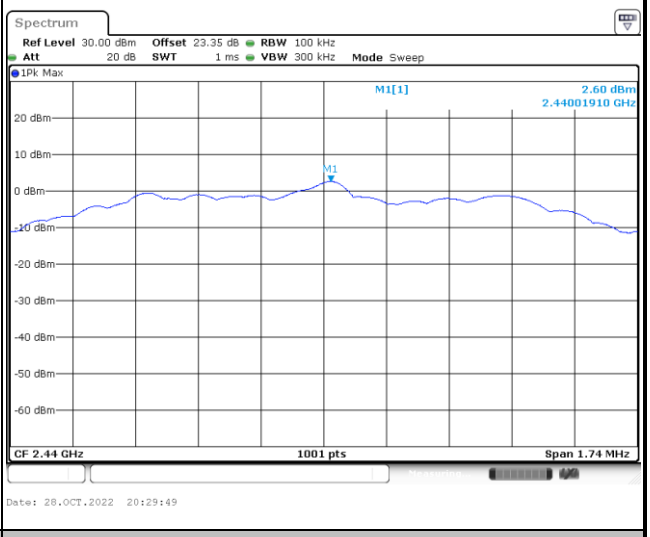
PSD 100kHz Plot on Channel 00	PSD 100kHz Plot on Channel 19
	
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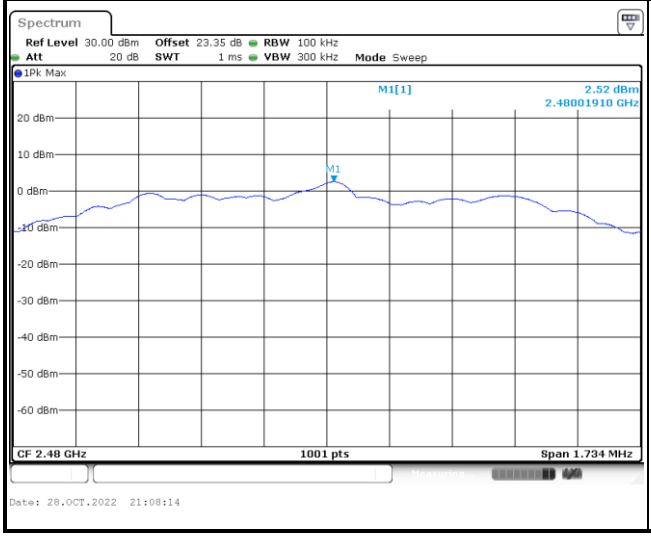	

<Ant. 5>

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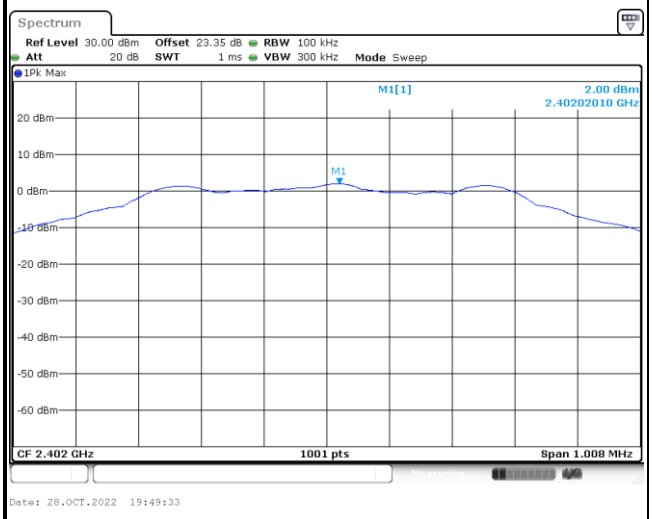
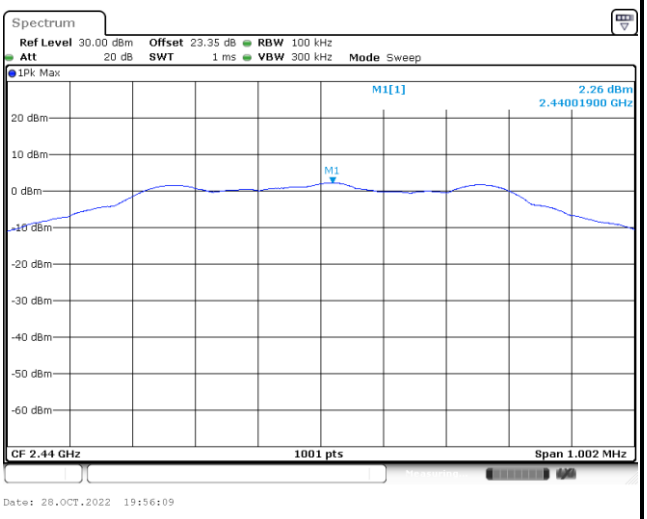
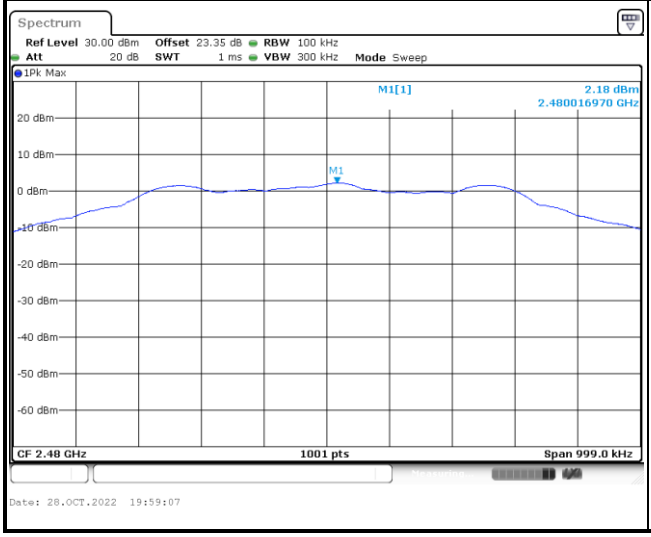
	
PSD 100kHz Plot on Channel 39	**N/A**
	

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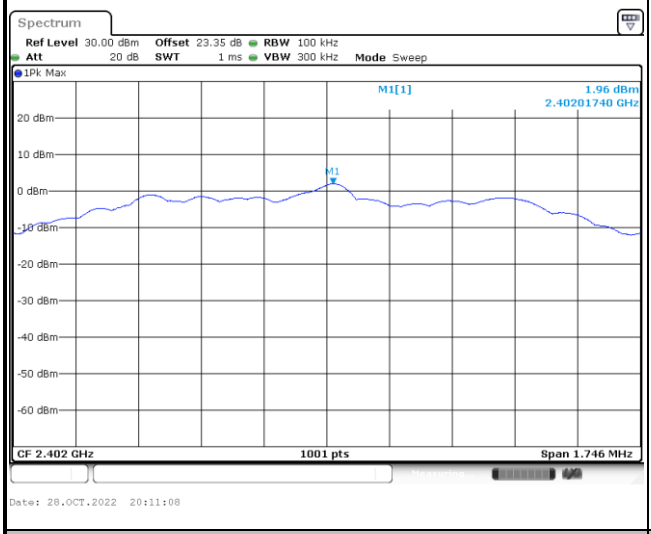	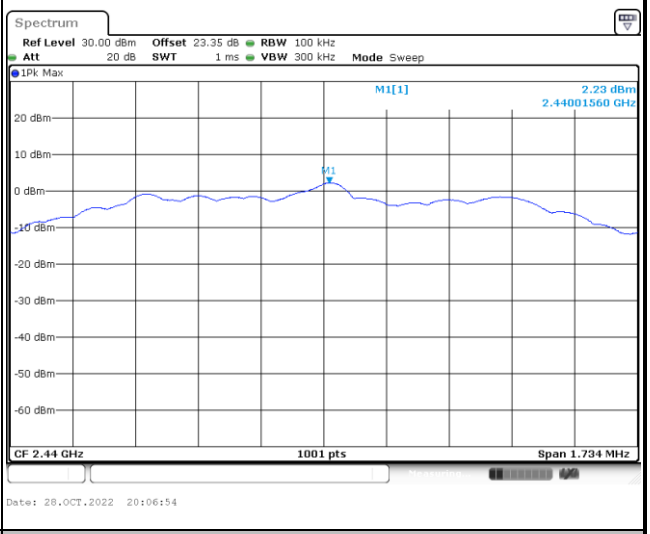
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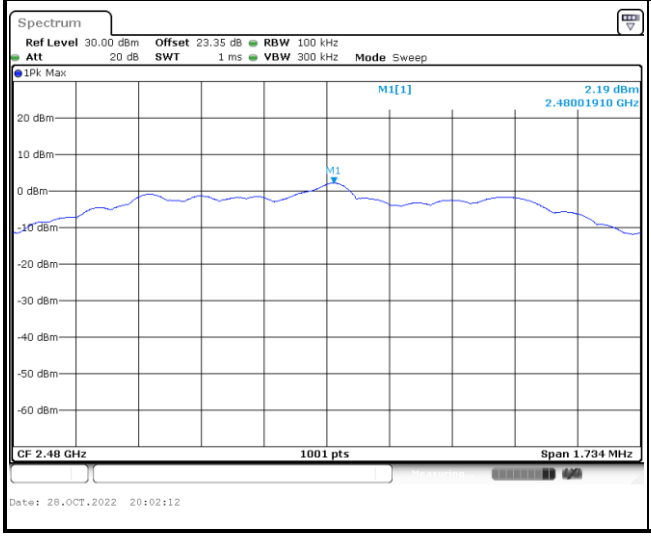	

3.3.7 Test Result of Power Spectral Density Plots (3kHz)

<Ant. 4>

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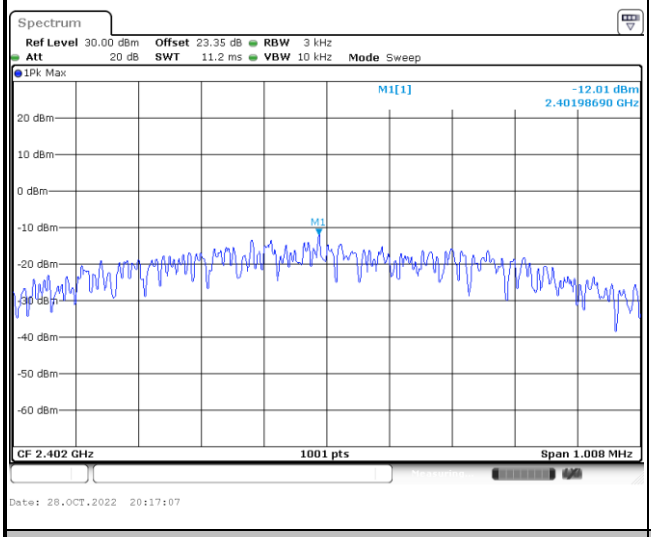	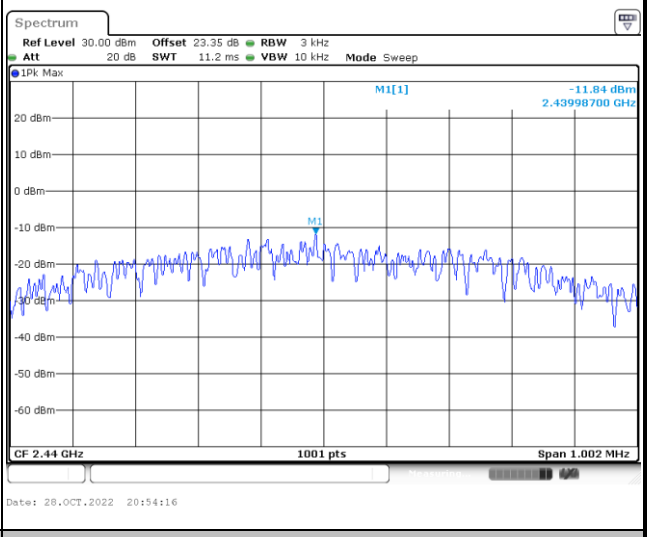
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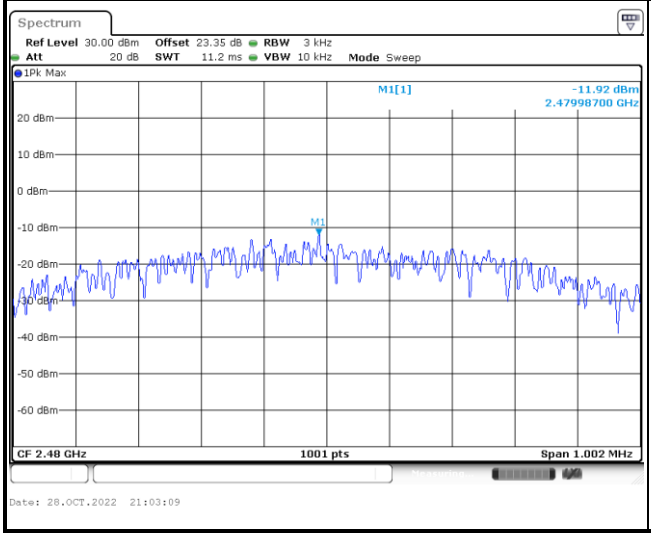	

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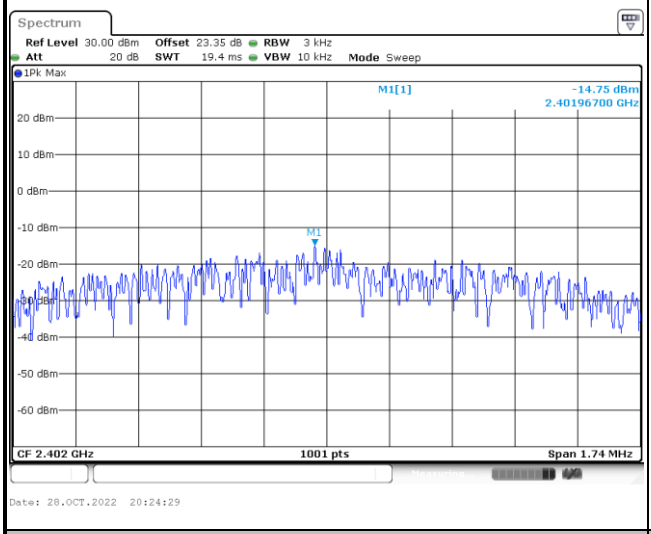	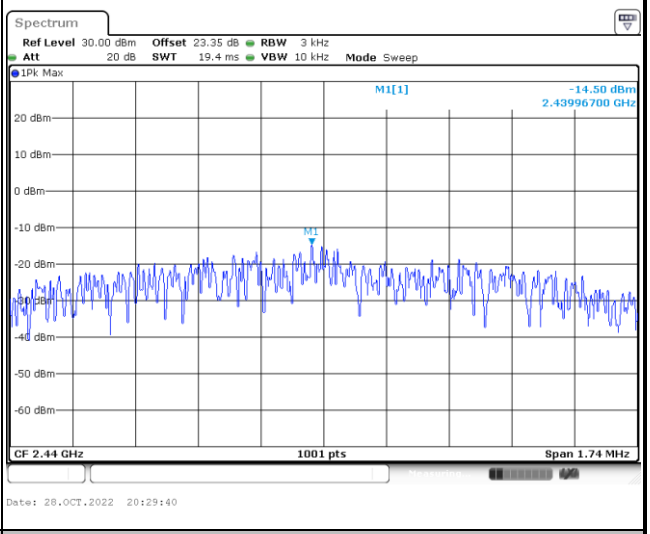
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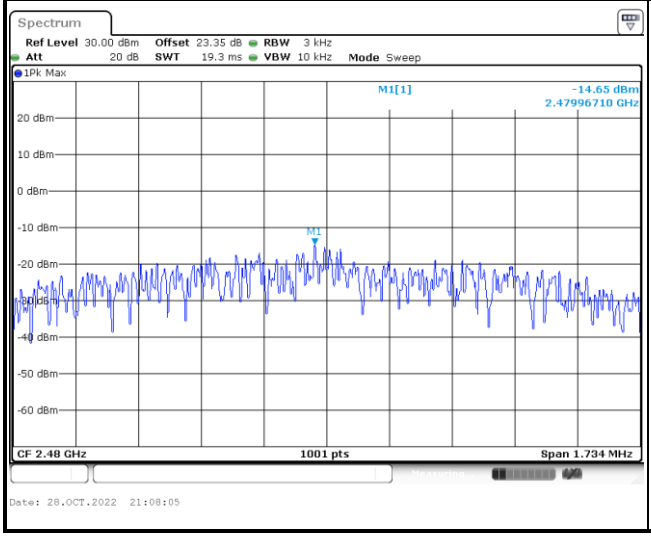	

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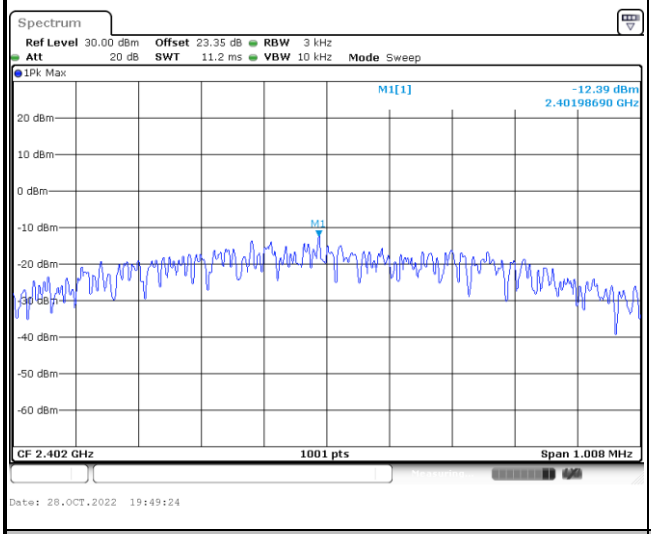	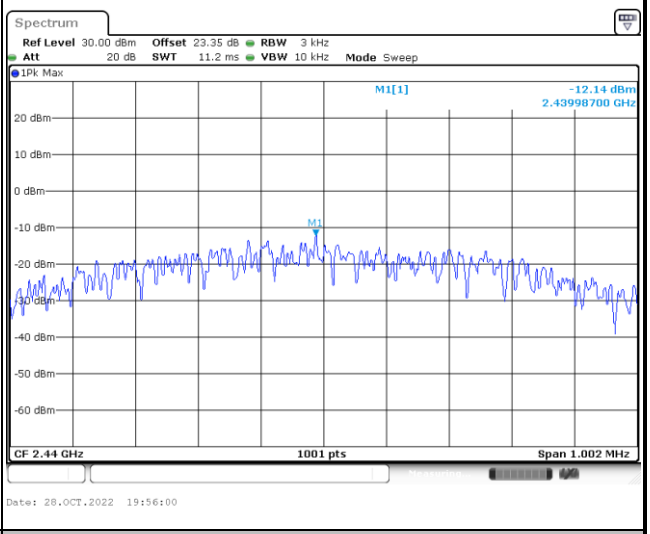
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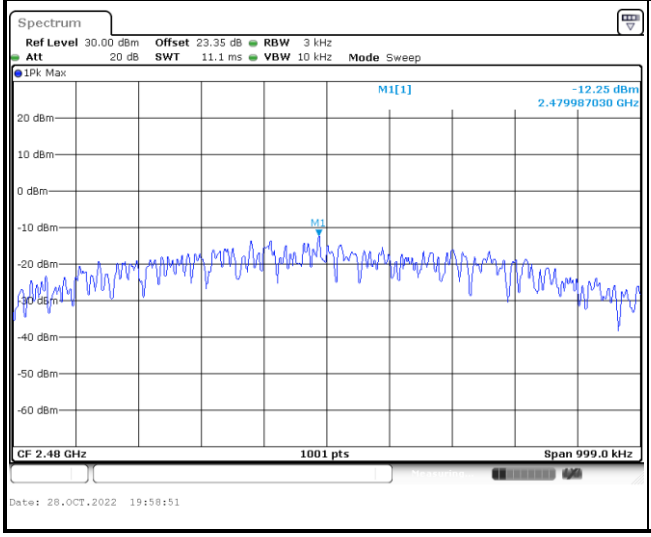	

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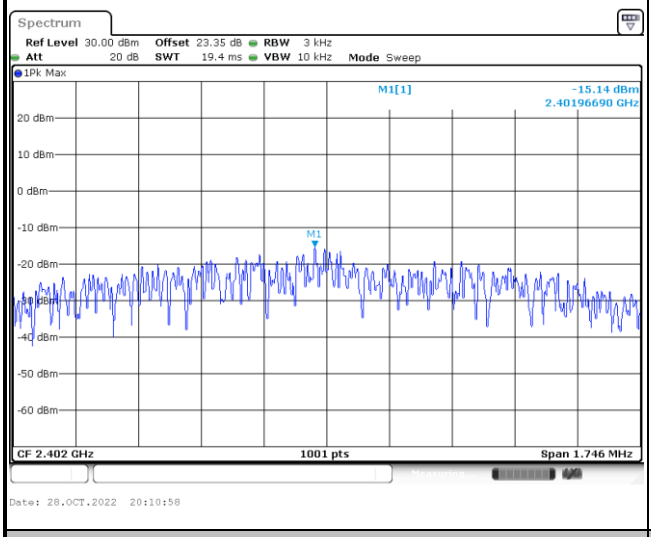
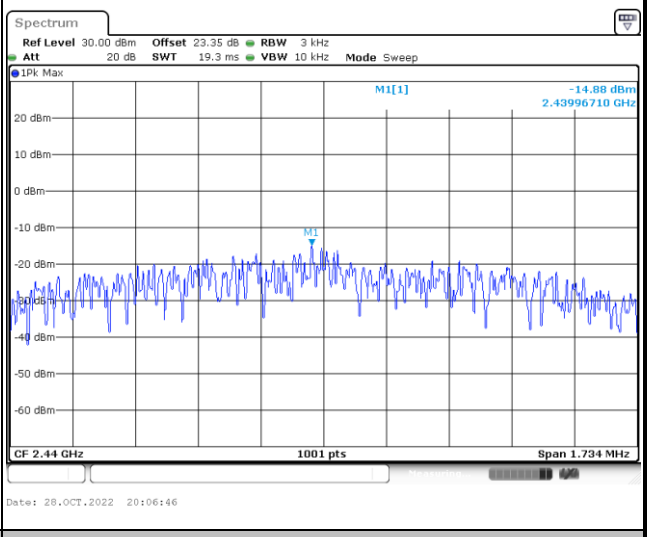
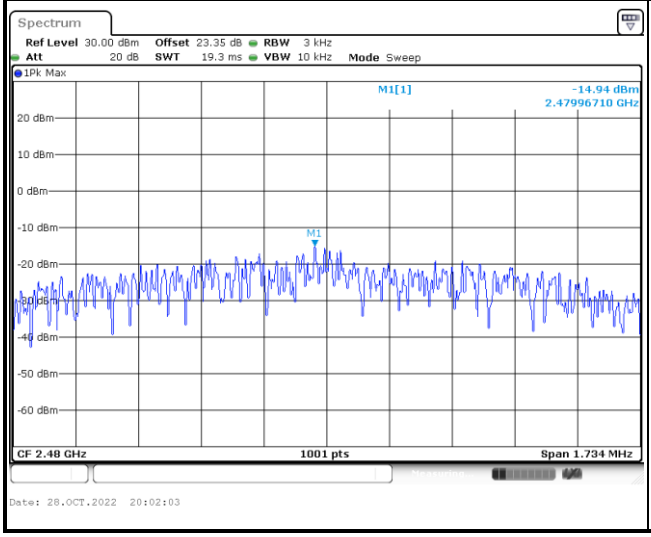
	
PSD 3kHz Plot on Channel 39	**N/A**
	

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 30 dB down from the highest emission level within the authorized band.

3.4.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.4.3 Test Procedure

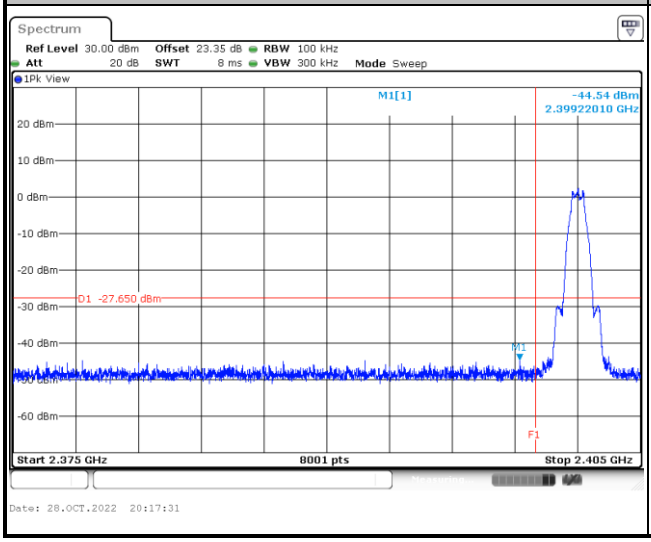
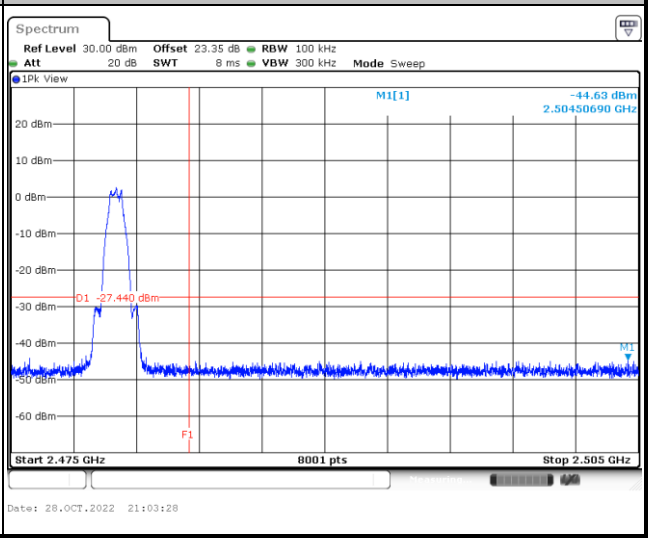
1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit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

<Ant. 4>

<1Mbps>

Low Band Edge Plot on Channel 00	High Band Edge Plot on Channel 39
	

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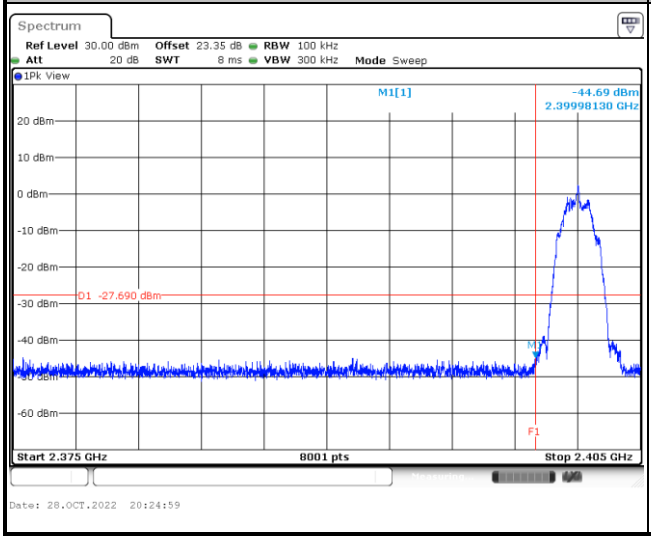
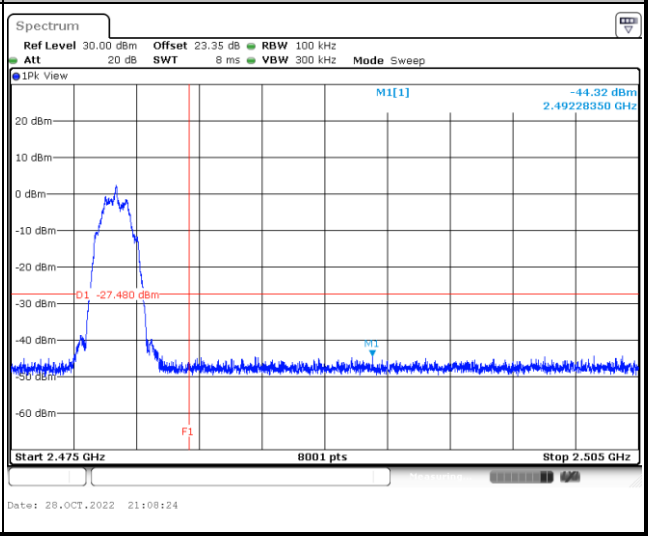
Low Band Edge Plot on Channel 00	High Band Edge Plot on Channel 39
	

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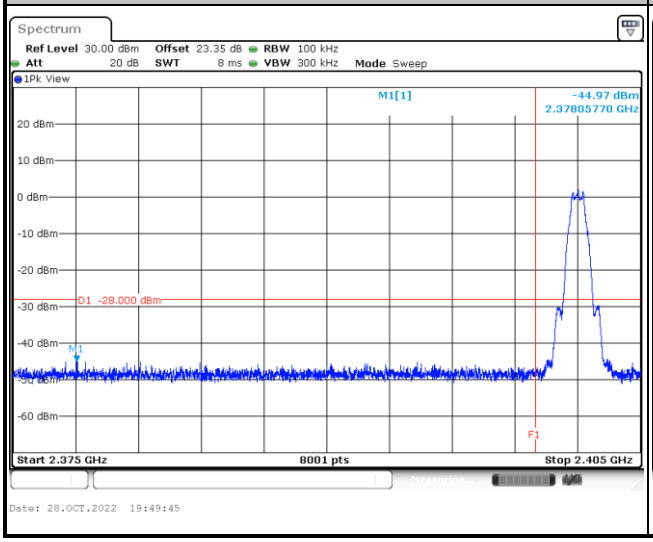
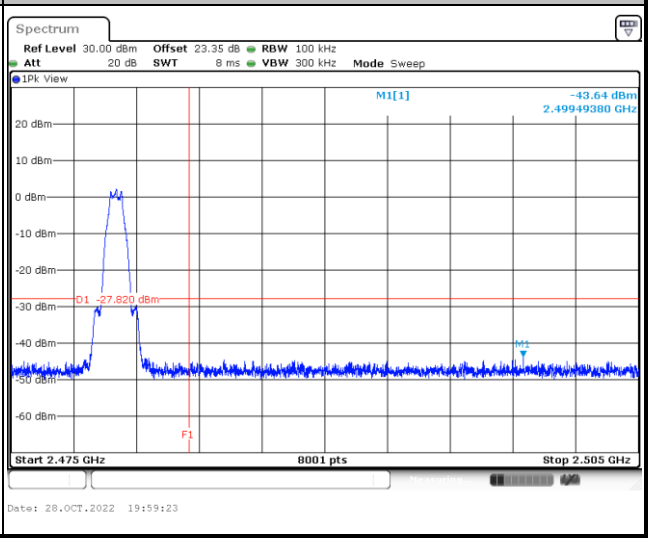
Low Band Edge Plot on Channel 00	High Band Edge Plot on Channel 39
	

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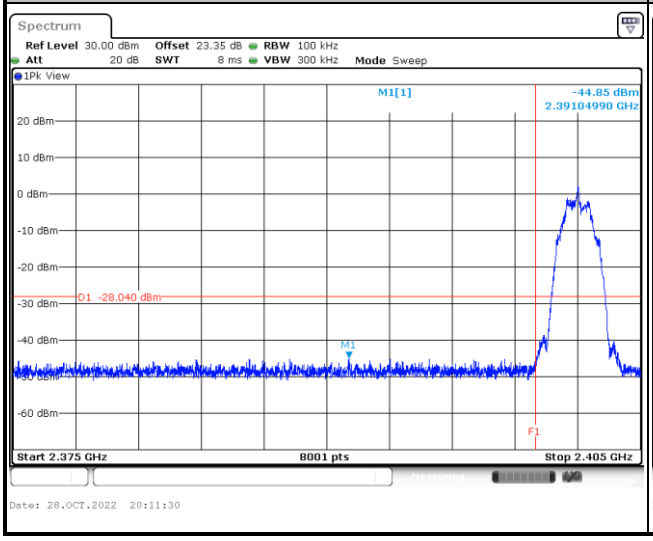
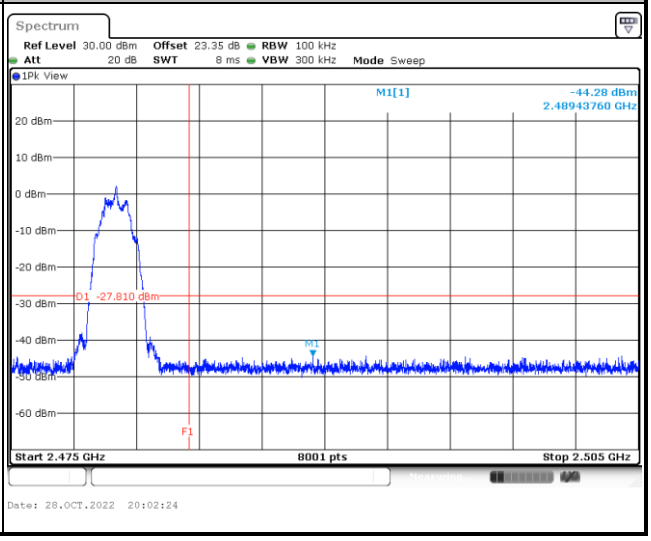
Low Band Edge Plot on Channel 00	High Band Edge Plot on Channel 39
	

3.4.6 Test Result of Conducted Spurious Emission Plots

<Ant. 4>

<1Mbps>

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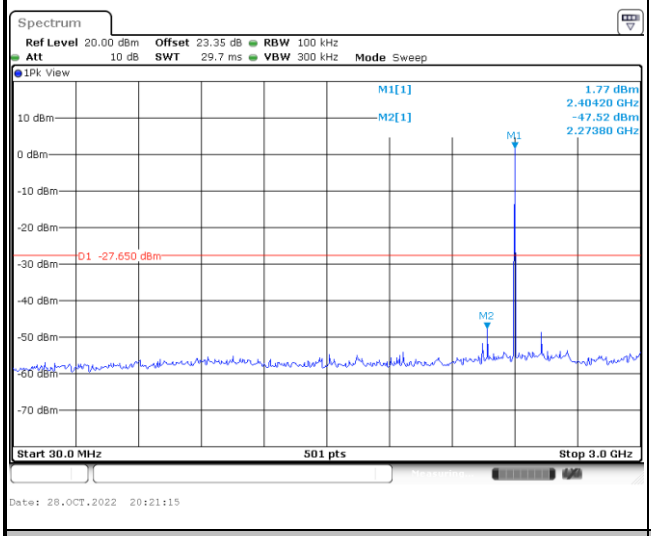	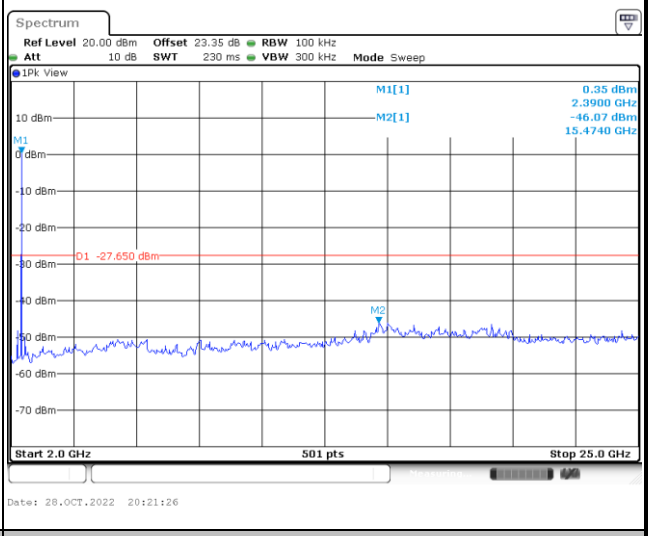
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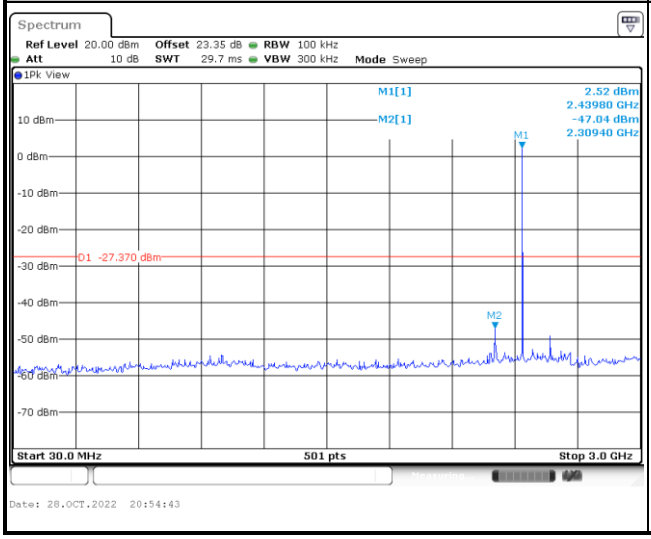
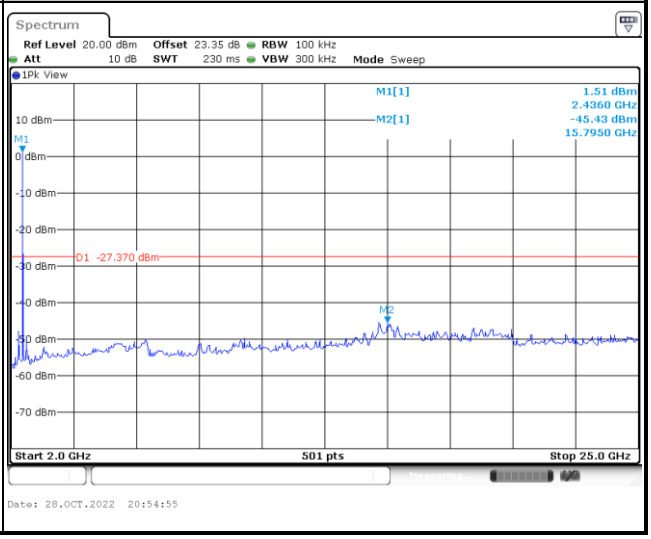
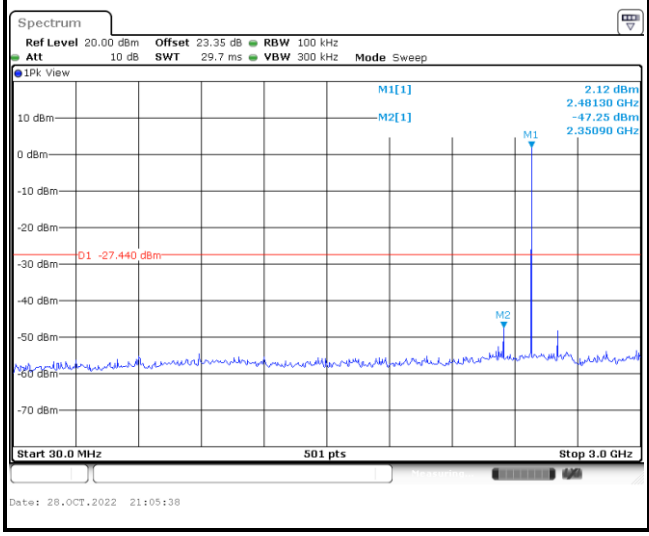
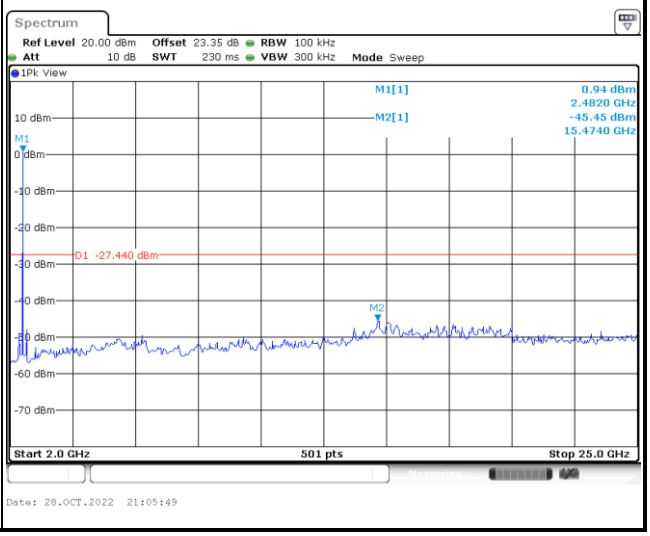
	

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39	Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39
	

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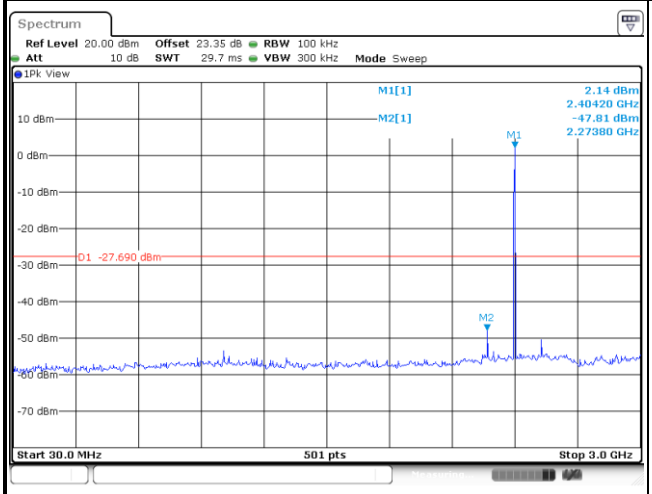	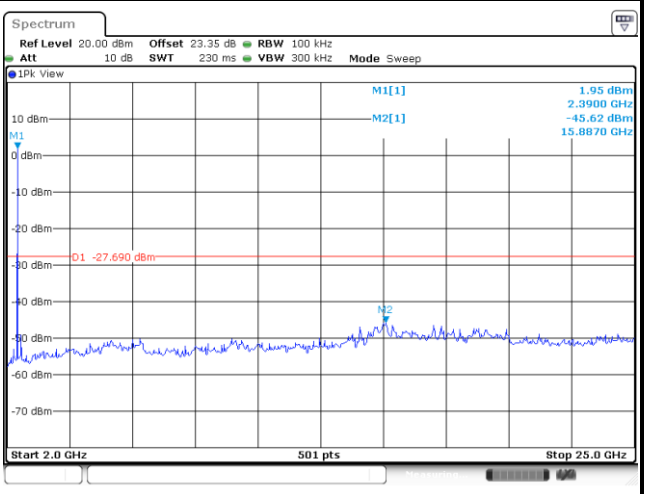
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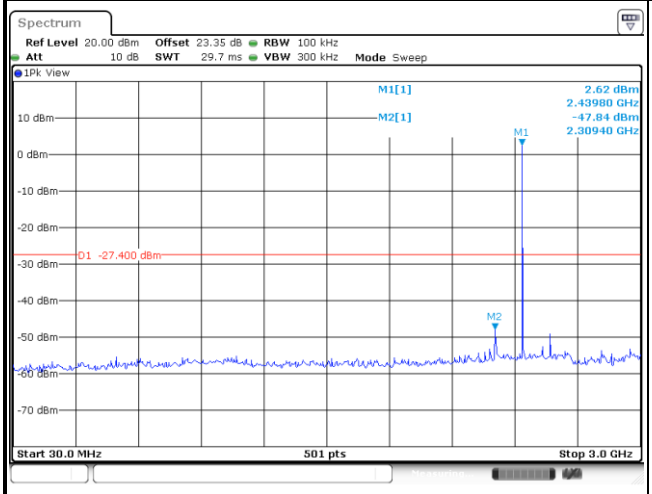
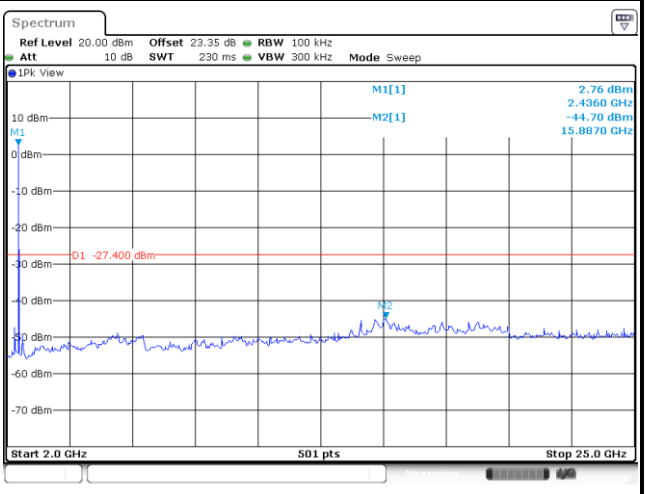
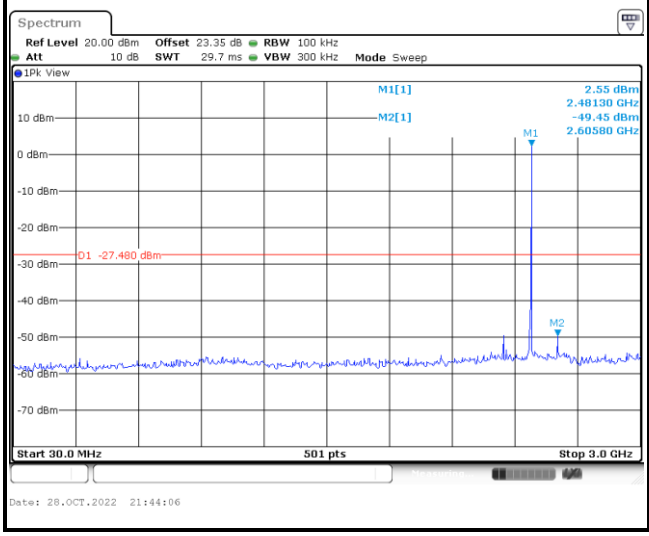
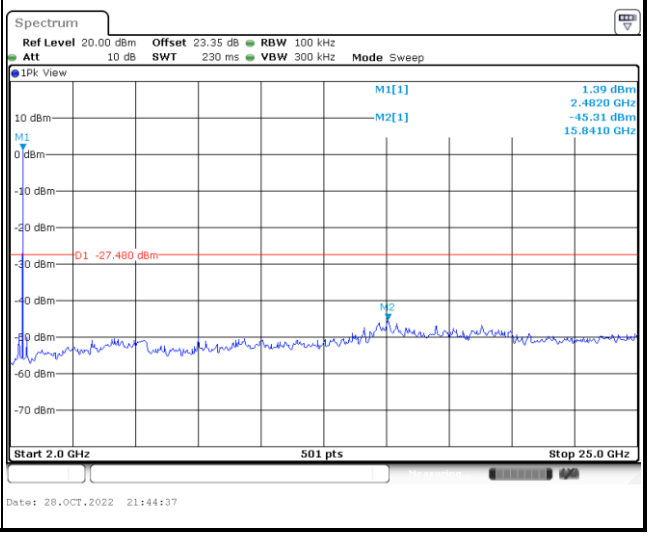
	

Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 39	Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 39
	

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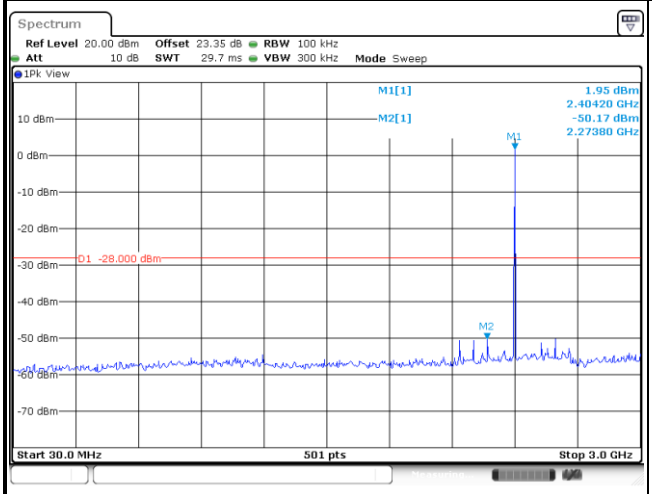
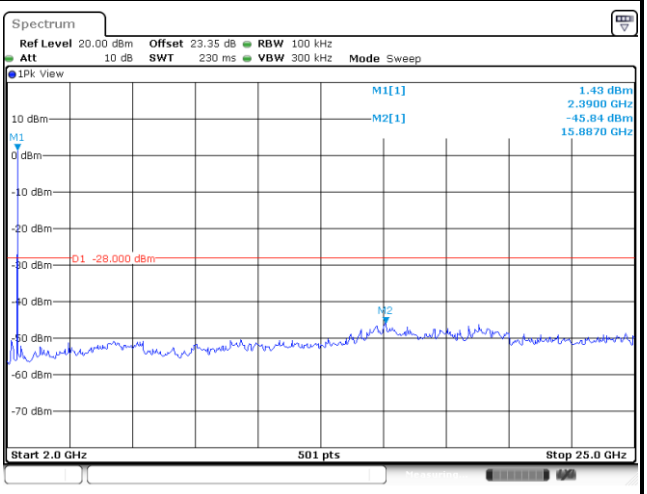
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 00	Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 00
	
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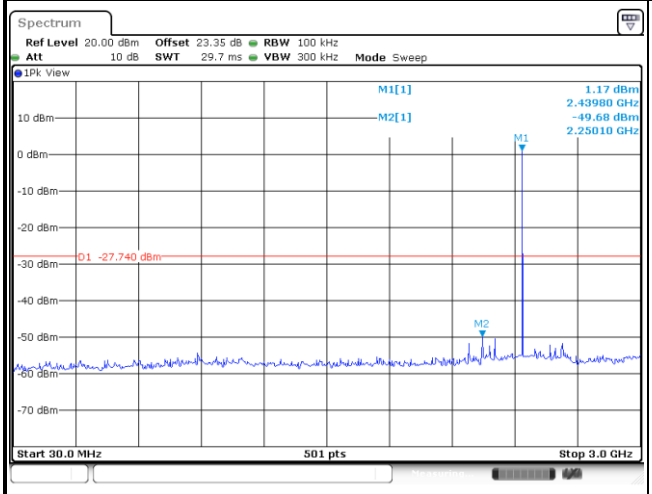
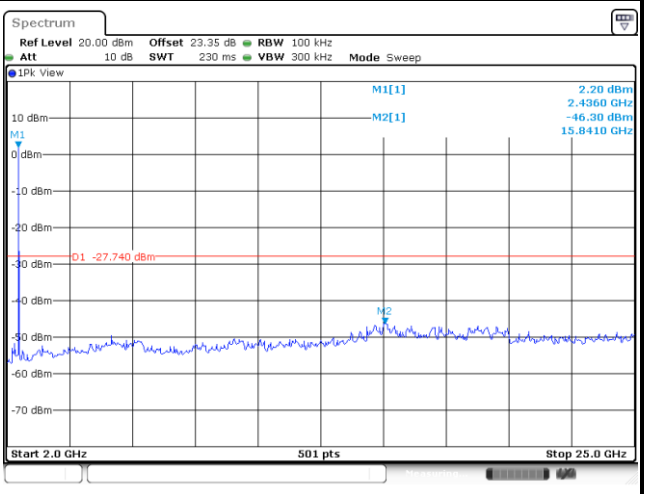
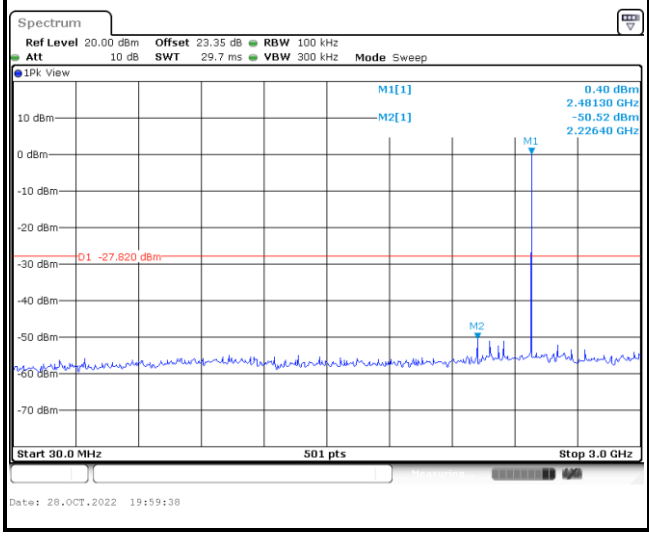
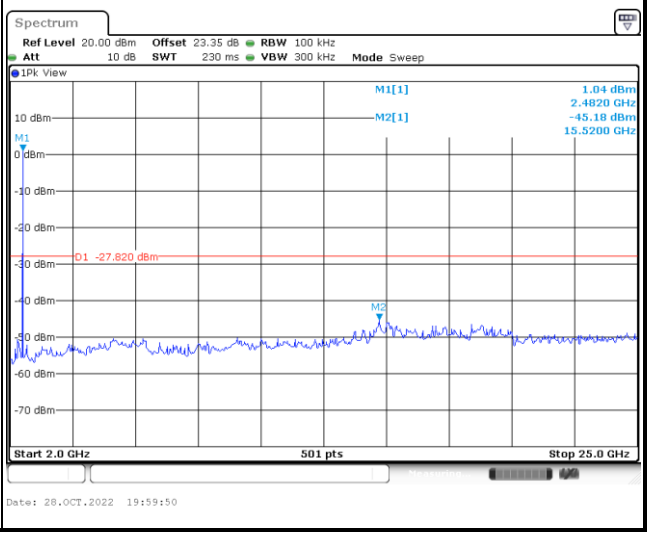
	

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39	Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39
	

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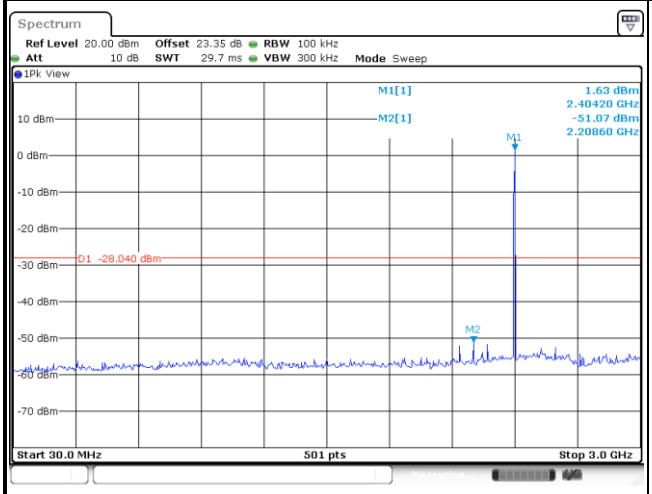
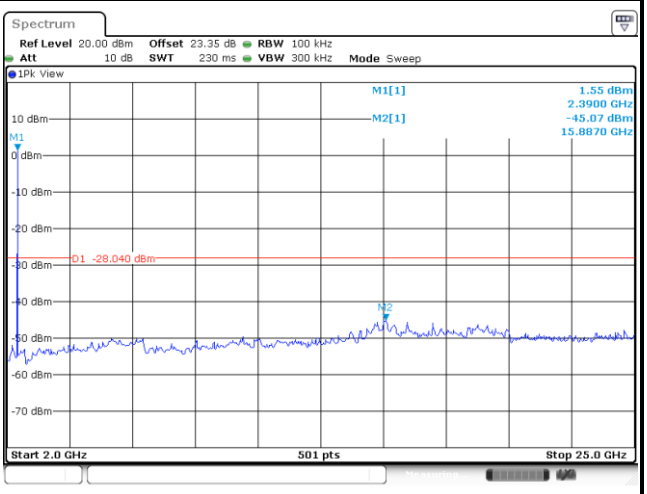
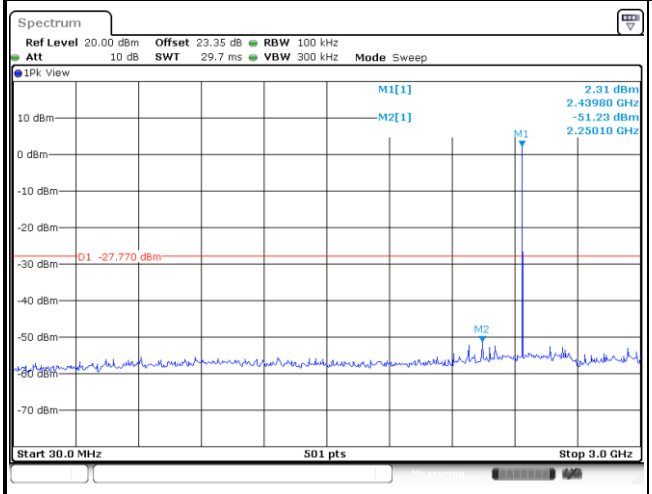
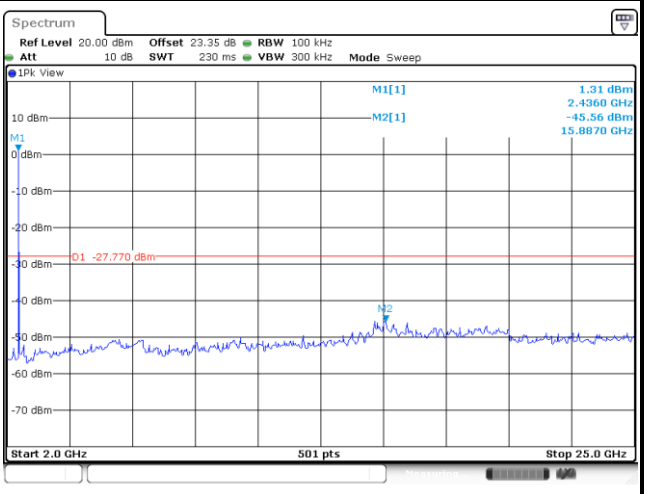
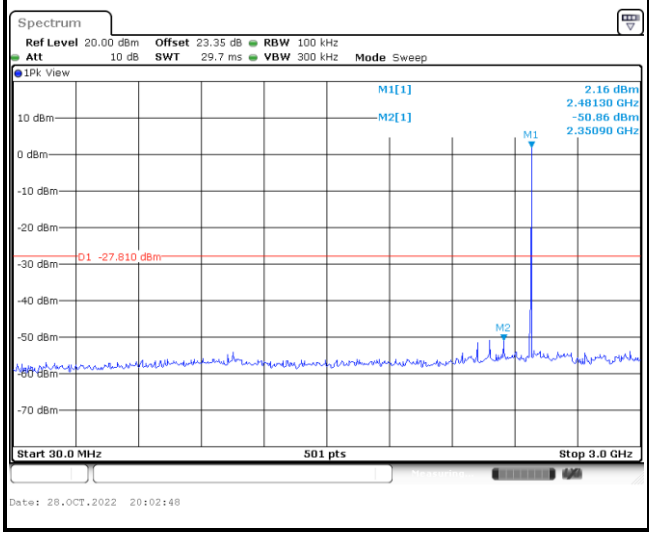
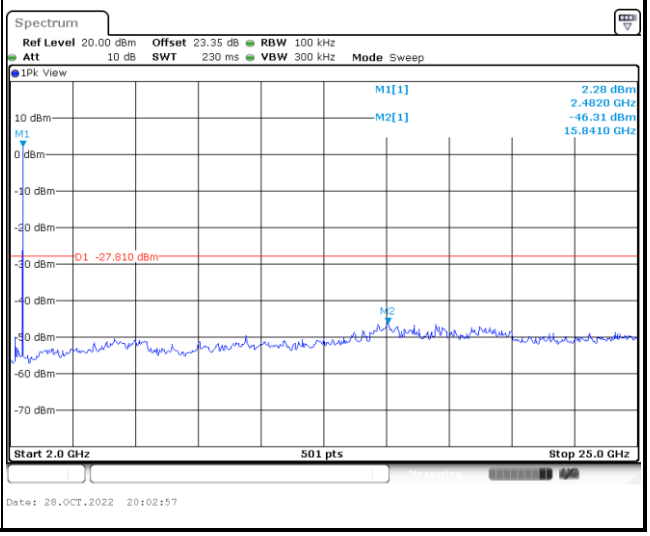
	
Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 19	**Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 19**
	

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

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 is 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

Please refer to the measuring equipment list in this test report.

3.5.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.12.2 Antenna-port conducted measurements.
2. Measure the conducted output power (in dBm) using the peak detector.
3. Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP.
4. Add the appropriate maximum ground reflection factor to the EIRP (6 dB for frequencies ≤ 30 MHz; 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive; and 0 dB for frequencies > 1000 MHz).
5. Convert the resultant EIRP to an equivalent electric field strength using the following relationship:

   E = EIRP − 20 log d + 104.8,

   where

   E is the electric field strength in dBμV/m

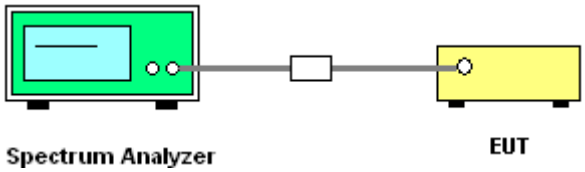
   EIRP is the equivalent isotropically radiated power in dBm

   d is the specified measurement distance in 3m
6. Compare the resultant electric field strength level with the applicable regulatory limit.
7. Corrected Reading for conducted spurious emission: Antenna Factor + Cable Loss + Read Level = Level
8. Perform the cabinet radiated spurious emission test.
9. The EUT is 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.
10. The EUT is 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.
11. The EUT is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
12. Corrected Reading for cabinet radiated spurious emission: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
13. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as “-“.

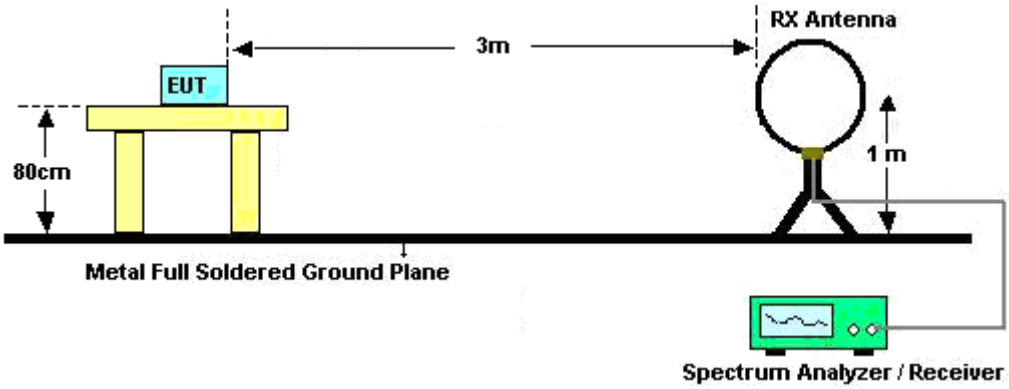
14. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as "-".
15. 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 = 3 MHz for f ≥ 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

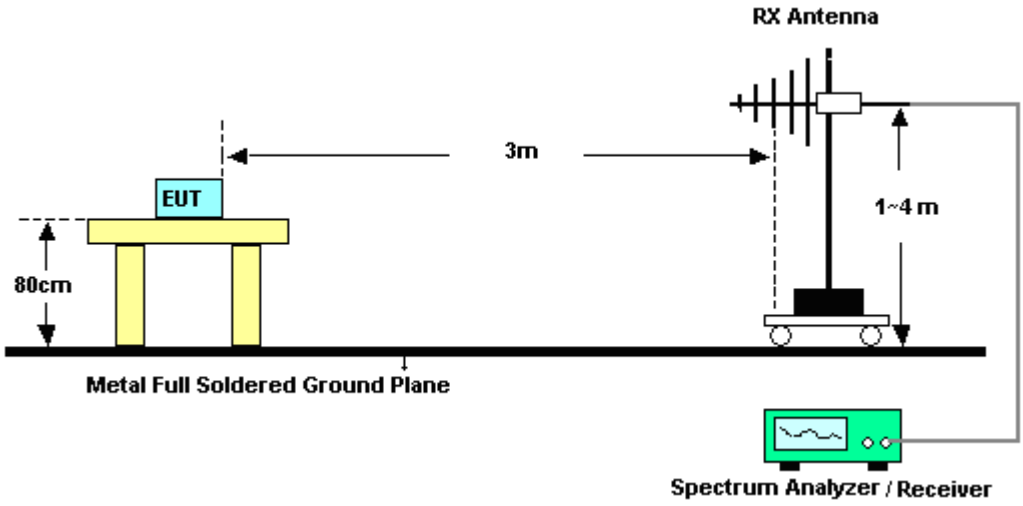
For Conducted Measurement Setup:



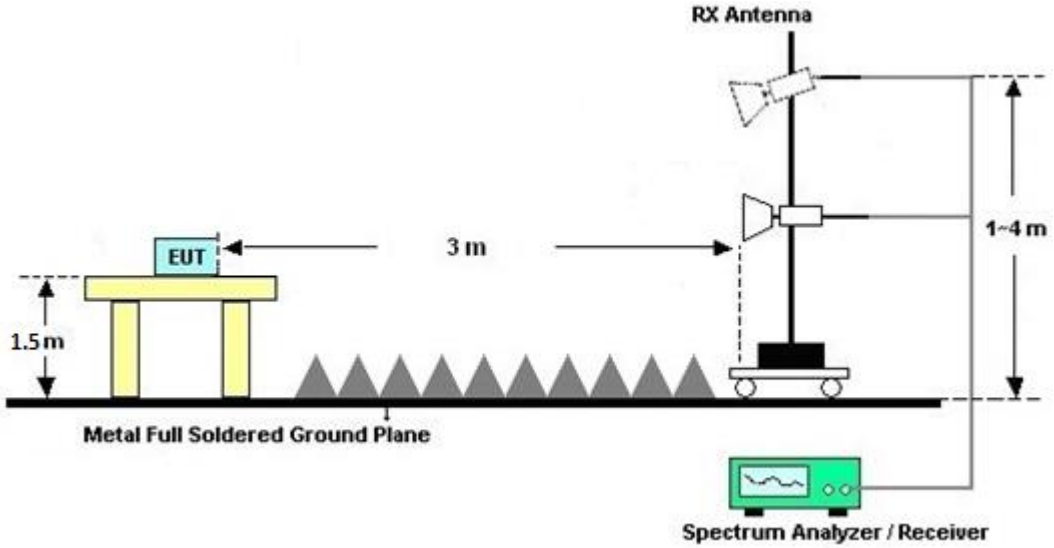
For radiated test below 30MHz



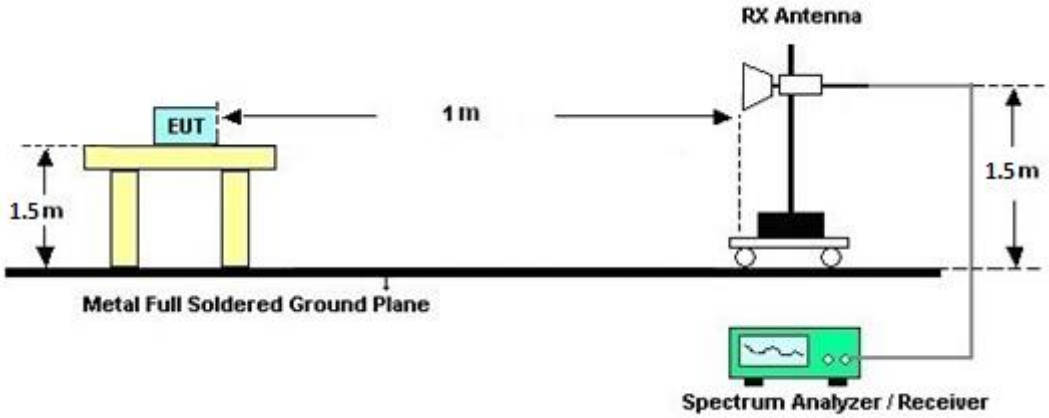
For radiated test from 30MHz to 1GHz



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 starts from 9 kHz to 30 MHz, is pre-scanned and the result which is 20 dB lower than the limit line is not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result comes out very similar.

3.5.6 Test Result of Conduced Spurious at Band Edges in the Restricted Band

Please refer to Appendix B and C.

3.5.7 Test Result of Conduced Spurious Emission in the Restricted Band

Please refer to Appendix B and C.

3.5.8 Test Result of Cabinet Radiated Spurious at Band Edges

Please refer to Appendix D and E.

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

Please refer to Appendix D and E.

3.5.10 Duty Cycle

Please refer to Appendix F.

3.6 Antenna Requirements

3.6.1 Standard Applicable

The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.6.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	TESEQ	HLA 6120	31244	9 kHz~30 MHz	Mar. 18, 2022	Oct. 15, 2022~ Nov. 02, 2022	Mar. 17, 2023	Radiation (03CH15-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N-06	41912 & 05	30MHz~1GHz	Feb. 06, 2022	Oct. 15, 2022~ Nov. 02, 2022	Feb. 05, 2023	Radiation (03CH15-HY)
Amplifier	SONOMA	310N	363440	9kHz~1GHz	Dec. 27, 2021	Oct. 15, 2022~ Nov. 02, 2022	Dec. 26, 2022	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-02294	1GHz~18GHz	Jun. 23, 2022	Oct. 15, 2022~ Nov. 02, 2022	Jun. 22, 2023	Radiation (03CH15-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	00993	18GHz~40GHz	Nov. 30, 2021	Oct. 15, 2022~ Nov. 02, 2022	Nov. 29, 2022	Radiation (03CH15-HY)
Amplifier	EMEC	EM1G18G	060837	1GHz~18GHz	Sep. 01, 2022	Oct. 15, 2022~ Nov. 02, 2022	Aug. 31, 2023	Radiation (03CH15-HY)
Preamplifier	EM Electronics	EM01G18G	060803	1GHz-18GHz	Dec. 16, 2021	Oct. 15, 2022~ Nov. 02, 2022	Dec. 15, 2022	Radiation (03CH15-HY)
Preamplifier	EMEC	EM18G40G	060802	18-40GHz	Mar. 08, 2022	Oct. 15, 2022~ Nov. 02, 2022	Mar. 07, 2023	Radiation (03CH15-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY54130085	20MHz~8.4GHz	Oct. 21, 2021	Oct. 15, 2022~ Oct. 17, 2022	Oct. 20, 2022	Radiation (03CH15-HY
EMI Test Receiver	Keysight	N9038A(MXE)	MY54130085	20MHz~8.4GHz	Oct. 18, 2022	Oct. 18, 2022~ Oct. 31, 2022	Oct. 20, 2023	Radiation (03CH15-HY
Spectrum Analyzer	Keysight	N9010	MY54200485	10Hz~44GHz	May 07, 2022	Oct. 15, 2022~ Nov. 02, 2022	May 06, 2023	Radiation (03CH15-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Oct. 15, 2022~ Nov. 02, 2022	N/A	Radiation (03CH15-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Oct. 15, 2022~ Nov. 02, 2022	N/A	Radiation (03CH15-HY)
Software	Audix	E3 6.2009-8-24(k5)	RK-000451	N/A	N/A	Oct. 15, 2022~ Nov. 02, 2022	N/A	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104, 102E	MY36980/4, MY9838/4PE,508405/2E	30MHz~18G	Nov. 15, 2021	Oct. 15, 2022~ Nov. 02, 2022	Nov. 14, 2022	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	804011/2,804012/2	30MHz-40GHz	Jan. 04, 2022	Oct. 15, 2022~ Nov. 02, 2022	Jan. 03, 2023	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	9kHz~30MHz	Mar. 10, 2022	Oct. 15, 2022~ Nov. 02, 2022	Mar. 09, 2023	Radiation (03CH15-HY)
Hygrometer	TECPEL	DTM-303A	TP201996	N/A	Nov. 16, 2021	Oct. 28, 2022	Nov. 15, 2022	Conducted (TH05-HY)
Power Sensor	DARE	RPR3006W	15I00041SNO10 (NO:248)	10MHz~6GHz	Dec. 29, 2021	Oct. 28, 2022	Dec. 28, 2022	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101905	10Hz - 40GHz(amp)	Aug. 03, 2022	Oct. 28, 2022	Aug. 02, 2023	Conducted (TH05-HY)
Spectrum Analyzer	ROHDE & SCHWARZ	FSV40	101565	10Hz~40GHz	Dec. 29, 2021	Aug. 23, 2022~ Nov. 05, 2022	Dec. 28, 2022	CSE (TH05-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	9kHz~30MHz	Mar. 10, 2022	Aug. 23, 2022~ Nov. 05, 2022	Mar. 09, 2023	CSE (TH05-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0058/126E	30MHz~18GHz	Dec. 10, 2021	Aug. 23, 2022~ Nov. 05, 2022	Dec. 09, 2022	CSE (TH05-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz~40GHz	Feb. 21, 2022	Aug. 23, 2022~ Nov. 05, 2022	Feb. 20, 2023	CSE (TH05-HY)
Filter	Wainwright	WLKS1200-12SS	SN2	1.2GHz Low Pass Filter	Mar. 15, 2022	Aug. 23, 2022~ Nov. 05, 2022	Mar. 14, 2023	CSE (TH05-HY)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN15	3GHz High Pass Filter	May 24, 2022	Aug. 23, 2022~ Nov. 05, 2022	May 23, 2023	CSE (TH05-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**6.3 dB**

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 6000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.2 dB**

Uncertainty of Radiated Emission Measurement (6000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.4 dB**

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.2 dB**

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Derek Hsu	Temperature:	21~25	°C
Test Date:	2022/10/28	Relative Humidity:	51~54	%

<Ant. 4>

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE	1Mbps	1	0	2402	1.019	0.672	0.50	Pass
BLE	1Mbps	1	19	2440	1.019	0.668	0.50	Pass
BLE	1Mbps	1	39	2480	1.019	0.668	0.50	Pass

TEST RESULTS DATA
Average Power Table

Mod.	Data Rate	NTX	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	3.35	30.00	3.53	6.88	36.00	Pass
BLE	1Mbps	1	19	2440	3.45	30.00	3.53	6.98	36.00	Pass
BLE	1Mbps	1	39	2480	3.25	30.00	3.53	6.78	36.00	Pass

TEST RESULTS DATA
Peak Power 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	1Mbps	1	0	2402	2.35	-12.01	3.53	8.00	Pass
BLE	1Mbps	1	19	2440	2.63	-11.84	3.53	8.00	Pass
BLE	1Mbps	1	39	2480	2.56	-11.92	3.53	8.00	Pass

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

TEST RESULTS DATA
6dB and 99% Occupied 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	2402	1.998	1.160	0.50	Pass
BLE	2Mbps	1	19	2440	1.998	1.160	0.50	Pass
BLE	2Mbps	1	39	2480	1.998	1.156	0.50	Pass

TEST RESULTS DATA
Average Power Table

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	2Mbps	1	0	2402	3.25	30.00	3.53	6.78	36.00	Pass
BLE	2Mbps	1	19	2440	3.35	30.00	3.53	6.88	36.00	Pass
BLE	2Mbps	1	39	2480	3.15	30.00	3.53	6.68	36.00	Pass

TEST RESULTS DATA
Peak Power 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	2.31	-14.75	3.53	8.00	Pass
BLE	2Mbps	1	19	2440	2.60	-14.50	3.53	8.00	Pass
BLE	2Mbps	1	39	2480	2.52	-14.65	3.53	8.00	Pass

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

<Ant. 5>

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE	1Mbps	1	0	2402	1.019	0.672	0.50	Pass
BLE	1Mbps	1	19	2440	1.019	0.668	0.50	Pass
BLE	1Mbps	1	39	2480	1.019	0.666	0.50	Pass

TEST RESULTS DATA
Average Power Table

Mod.	Data Rate	NTX	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	3.05	30.00	3.53	6.58	36.00	Pass
BLE	1Mbps	1	19	2440	3.15	30.00	3.53	6.68	36.00	Pass
BLE	1Mbps	1	39	2480	2.95	30.00	3.53	6.48	36.00	Pass

TEST RESULTS DATA
Peak Power 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	1Mbps	1	0	2402	2.00	-12.39	3.53	8.00	Pass
BLE	1Mbps	1	19	2440	2.26	-12.14	3.53	8.00	Pass
BLE	1Mbps	1	39	2480	2.18	-12.25	3.53	8.00	Pass

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

TEST RESULTS DATA
6dB and 99% Occupied 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	2402	1.998	1.164	0.50	Pass
BLE	2Mbps	1	19	2440	1.998	1.156	0.50	Pass
BLE	2Mbps	1	39	2480	1.998	1.156	0.50	Pass

TEST RESULTS DATA
Average Power Table

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	2Mbps	1	0	2402	2.95	30.00	3.53	6.48	36.00	Pass
BLE	2Mbps	1	19	2440	3.05	30.00	3.53	6.58	36.00	Pass
BLE	2Mbps	1	39	2480	2.95	30.00	3.53	6.48	36.00	Pass

TEST RESULTS DATA
Peak Power 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	1.96	-15.14	3.53	8.00	Pass
BLE	2Mbps	1	19	2440	2.23	-14.88	3.53	8.00	Pass
BLE	2Mbps	1	39	2480	2.19	-14.94	3.53	8.00	Pass

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

Appendix B. Conducted Spurious Emission

Test Engineer :	Kai Liao and Nick Yu	Temperature :	22.7~24.8°C
		Relative Humidity :	52~59%

<1Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	MIMO	Grounding	Peak
Ant. 4		(MHz)	(dBm)	Limit (dB)	Line (dBm)	Level (dBm)	Gain (dBi)	Loss (dB)	Factor (dB)	Factor (dB)	Avg. (P/A)
BLE CH 00 2402MHz		2325.225	-51.55	-30.35	-21.2	-56.17	3.53	1.09	0	0	P
		2325.12	-58.24	-17.04	-41.2	-62.86	3.53	1.09	0	0	A
	*	2402	8.34	-	-	3.64	3.53	1.17	0	0	P
	*	2402	6.54	-	-	1.84	3.53	1.17	0	0	A
BLE CH 19 2440MHz		2313.78	-40.47	-19.27	-21.2	-45.08	3.53	1.08	0	0	P
		2313.92	-42.73	-1.53	-41.2	-47.34	3.53	1.08	0	0	A
	*	2440	8.82	-	-	4.09	3.53	1.2	0	0	P
	*	2440	6.06	-	-	1.33	3.53	1.2	0	0	A
		2484.32	-53.43	-32.23	-21.2	-58.19	3.53	1.23	0	0	P
		2494.89	-65.88	-24.68	-41.2	-70.65	3.53	1.24	0	0	A
BLE CH 39 2480MHz	*	2480	8.4	-	-	3.64	3.53	1.23	0	0	P
	*	2480	7.42	-	-	2.66	3.53	1.23	0	0	A
		2483.52	-45.68	-24.48	-21.2	-50.44	3.53	1.23	0	0	P
		2483.52	-64.11	-22.91	-41.2	-68.87	3.53	1.23	0	0	A
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.										

2.4GHz 2400~2483.5MHz

BLE (Harmonic)

BLE Ant. 4	Note	Frequency (MHz)	Level (dBm)	Over Limit (dB)	Limit Line (dBm)	Read Level (dBm)	Antenna Gain (dBi)	Path Loss (dB)	MIMO Factor (dB)	Grounding Factor (dB)	Peak Avg. (P/A)
BLE CH 00 2402MHz		2274	-40.7	-19.5	-21.2	-45.28	3.53	1.05	0	0	P
		2274	-42.61	-1.41	-41.2	-47.19	3.53	1.05	0	0	A
		2532	-41.52	-20.32	-21.2	-46.29	3.53	1.24	0	0	P
		2532	-43.61	-2.41	-41.2	-48.38	3.53	1.24	0	0	A
		4804	-66.4	-45.2	-21.2	-71.28	3.53	1.35	0	0	P
		6905.2	-62.86	-41.66	-21.2	-67.89	3.53	1.5	0	0	P
		7206	-68.94	-47.74	-21.2	-74.06	3.53	1.59	0	0	P
		9608	-62.83	-41.63	-21.2	-68.12	3.53	1.76	0	0	P
BLE CH 19 2440MHz		2314	-40.42	-19.22	-21.2	-45.03	3.53	1.08	0	0	P
		2314	-42.26	-1.06	-41.2	-46.87	3.53	1.08	0	0	A
		2572	-41.62	-20.42	-21.2	-46.39	3.53	1.24	0	0	P
		2572	-43.54	-2.34	-41.2	-48.31	3.53	1.24	0	0	A
		4880	-63.28	-42.08	-21.2	-68.15	3.53	1.34	0	0	P
		6905.2	-64.02	-42.82	-21.2	-69.05	3.53	1.5	0	0	P
		7320	-71.14	-49.94	-21.2	-76.29	3.53	1.62	0	0	P
		9760	-61.9	-40.7	-21.2	-67.17	3.53	1.74	0	0	P
BLE CH 39 2480MHz		2354	-40.84	-19.64	-21.2	-45.49	3.53	1.12	0	0	P
		2354	-42.84	-1.64	-41.2	-47.49	3.53	1.12	0	0	A
		2610	-41.6	-20.4	-21.2	-46.34	3.53	1.21	0	0	P
		2610	-44.16	-2.96	-41.2	-48.9	3.53	1.21	0	0	A
		4960	-63.3	-42.1	-21.2	-68.17	3.53	1.34	0	0	P
		6905.2	-63.85	-42.65	-21.2	-68.88	3.53	1.5	0	0	P
		7440	-68.87	-47.67	-21.2	-74.07	3.53	1.67	0	0	P
		9920	-58.69	-37.49	-21.2	-63.93	3.53	1.71	0	0	P
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.										

Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	MIMO	Grounding	Peak
Ant.				Limit	Line	Level	Gain	Loss	Factor	Factor	Avg.
4		(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dBi)	(dB)	(dB)	(dB)	(P/A)
2.4GHz BLE LF		87.51	-82.28	-27.08	-55.2	-90.76	3.53	0.25	0	4.7	P
		172.02	-81.51	-29.81	-51.7	-90.11	3.53	0.37	0	4.7	P
		297.3	-81.58	-32.38	-49.2	-90.32	3.53	0.51	0	4.7	P
		480.6	-81.71	-32.51	-49.2	-90.56	3.53	0.62	0	4.7	P
		715.8	-66.41	-17.21	-49.2	-75.5	3.53	0.86	0	4.7	P
		944.7	-78.88	-29.68	-49.2	-88.26	3.53	1.15	0	4.7	P
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.										

2.4GHz 2400~2483.5MHz

BLE (Band Edge)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	MIMO	Grounding	Peak
Ant.				Limit	Line	Level	Gain	Loss	Factor	Factor	Avg.
5		(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dBi)	(dB)	(dB)	(dB)	(P/A)
BLE CH 00 2402MHz		2325.015	-52.01	-30.81	-21.2	-56.63	3.53	1.09	0	0	P
		2325.015	-59.04	-17.84	-41.2	-63.66	3.53	1.09	0	0	A
	*	2402	7.64	-	-	2.94	3.53	1.17	0	0	P
	*	2402	6.72	-	-	2.02	3.53	1.17	0	0	A
BLE CH 19 2440MHz		2311.68	-43.69	-22.49	-21.2	-48.3	3.53	1.08	0	0	P
		2311.96	-46.46	-5.26	-41.2	-51.07	3.53	1.08	0	0	A
	*	2440	7.97	-	-	3.24	3.53	1.2	0	0	P
	*	2440	6.7	-	-	1.97	3.53	1.2	0	0	A
		2497.48	-53.56	-32.36	-21.2	-58.33	3.53	1.24	0	0	P
		2488.8	-65.93	-24.73	-41.2	-70.7	3.53	1.24	0	0	A
BLE CH 39 2480MHz	*	2480	7.93	-	-	3.17	3.53	1.23	0	0	P
	*	2480	6.84	-	-	2.08	3.53	1.23	0	0	A
		2483.64	-46.01	-24.81	-21.2	-50.77	3.53	1.23	0	0	P
		2483.84	-64.27	-23.07	-41.2	-69.03	3.53	1.23	0	0	A
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.										

2.4GHz 2400~2483.5MHz

BLE (Harmonic)

BLE Ant. 5	Note	Frequency (MHz)	Level (dBm)	Over Limit (dB)	Limit Line (dBm)	Read Level (dBm)	Antenna Gain (dBi)	Path Loss (dB)	MIMO Factor (dB)	Grounding Factor (dB)	Peak Avg. (P/A)
BLE CH 00 2402MHz		2148	-43.17	-21.97	-21.2	-47.72	3.53	1.02	0	0	P
		2532	-44.83	-23.63	-21.2	-49.6	3.53	1.24	0	0	P
		4804	-63.78	-42.58	-21.2	-68.66	3.53	1.35	0	0	P
		6905.2	-54.59	-33.39	-21.2	-59.62	3.53	1.5	0	0	P
		7206	-63.36	-42.16	-21.2	-68.48	3.53	1.59	0	0	P
BLE CH 19 2440MHz		2312	-43.3	-22.1	-21.2	-47.91	3.53	1.08	0	0	P
		2570	-45.38	-24.18	-21.2	-50.15	3.53	1.24	0	0	P
		4880	-63.21	-42.01	-21.2	-68.08	3.53	1.34	0	0	P
		6905.2	-54.82	-33.62	-21.2	-59.85	3.53	1.5	0	0	P
		7320	-69.15	-47.95	-21.2	-74.3	3.53	1.62	0	0	P
BLE CH 39 2480MHz		2224	-42.22	-21.02	-21.2	-46.77	3.53	1.02	0	0	P
		2738	-45.52	-24.32	-21.2	-50.22	3.53	1.17	0	0	P
		4960	-61.01	-39.81	-21.2	-65.88	3.53	1.34	0	0	P
		6905.2	-54.72	-33.52	-21.2	-59.75	3.53	1.5	0	0	P
		7440	-64.17	-42.97	-21.2	-69.37	3.53	1.67	0	0	P
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.										

Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	MIMO	Grounding	Peak
Ant.				Limit	Line	Level	Gain	Loss	Factor	Factor	Avg.
5		(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dBi)	(dB)	(dB)	(dB)	(P/A)
2.4GHz BLE LF		73.74	-82.7	-27.5	-55.2	-91.17	3.53	0.24	0	4.7	P
		163.11	-81.18	-29.48	-51.7	-89.79	3.53	0.38	0	4.7	P
		244.65	-81.69	-32.49	-49.2	-90.39	3.53	0.47	0	4.7	P
		479.2	-80.86	-31.66	-49.2	-89.71	3.53	0.62	0	4.7	P
		587	-80.46	-31.26	-49.2	-89.47	3.53	0.78	0	4.7	P
		916.7	-80.06	-30.86	-49.2	-89.35	3.53	1.06	0	4.7	P
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.										

<2Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	MIMO	Grounding	Peak
Ant. 4		(MHz)	(dBm)	Limit (dB)	Line (dBm)	Level (dBm)	Gain (dBi)	Loss (dB)	Factor (dB)	Factor (dB)	Avg. (P/A)
BLE CH 00 2402MHz		2324.49	-44.16	-22.96	-21.2	-48.78	3.53	1.09	0	0	P
		2325.225	-54.12	-12.92	-41.2	-58.74	3.53	1.09	0	0	A
	*	2402	8.12	-	-	3.42	3.53	1.17	0	0	P
	*	2402	6.22	-	-	1.52	3.53	1.17	0	0	A
BLE CH 19 2440MHz		2312.94	-38.28	-17.08	-21.2	-42.89	3.53	1.08	0	0	P
		2311.82	-43.34	-2.14	-41.2	-47.95	3.53	1.08	0	0	A
	*	2442	8.45	-	-	3.72	3.53	1.2	0	0	P
	*	2440	6.55	-	-	1.82	3.53	1.2	0	0	A
		2487.26	-44.15	-22.95	-21.2	-48.92	3.53	1.24	0	0	P
		2493.56	-54.71	-13.51	-41.2	-59.48	3.53	1.24	0	0	A
BLE CH 39 2480MHz	*	2480	8.4	-	-	3.64	3.53	1.23	0	0	P
	*	2480	6.5	-	-	1.74	3.53	1.23	0	0	A
		2484.84	-43.57	-22.37	-21.2	-48.33	3.53	1.23	0	0	P
		2499	-54.34	-13.14	-41.2	-59.12	3.53	1.25	0	0	A
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.										

2.4GHz 2400~2483.5MHz

BLE (Harmonic)

BLE Ant. 4	Note	Frequency (MHz)	Level (dBm)	Over Limit (dB)	Limit Line (dBm)	Read Level (dBm)	Antenna Gain (dBi)	Path Loss (dB)	MIMO Factor (dB)	Grounding Factor (dB)	Peak Avg. (P/A)
BLE CH 00 2402MHz		2274	-38.99	-17.79	-21.2	-43.57	3.53	1.05	0	0	P
		2274	-43.02	-1.82	-41.2	-47.6	3.53	1.05	0	0	A
		2532	-39.7	-18.5	-21.2	-44.47	3.53	1.24	0	0	P
		2532	-43.58	-2.38	-41.2	-48.35	3.53	1.24	0	0	A
		4804	-66.33	-45.13	-21.2	-71.21	3.53	1.35	0	0	P
		6905.2	-64.41	-43.21	-21.2	-69.44	3.53	1.5	0	0	P
		7206	-70.62	-49.42	-21.2	-75.74	3.53	1.59	0	0	P
		9608	-64.07	-42.87	-21.2	-69.36	3.53	1.76	0	0	P
BLE CH 19 2440MHz		2312	-38.04	-16.84	-21.2	-42.65	3.53	1.08	0	0	P
		2312	-42.96	-1.76	-41.2	-47.57	3.53	1.08	0	0	A
		2568	-39.21	-18.01	-21.2	-43.98	3.53	1.24	0	0	P
		2568	-43.93	-2.73	-41.2	-48.7	3.53	1.24	0	0	A
		4880	-64.28	-43.08	-21.2	-69.15	3.53	1.34	0	0	P
		6905.2	-63.52	-42.32	-21.2	-68.55	3.53	1.5	0	0	P
		7320	-70.77	-49.57	-21.2	-75.92	3.53	1.62	0	0	P
		9760	-62.04	-40.84	-21.2	-67.31	3.53	1.74	0	0	P
BLE CH 39 2480MHz		2352	-38.93	-17.73	-21.2	-43.58	3.53	1.12	0	0	P
		2352	-42.93	-1.73	-41.2	-47.58	3.53	1.12	0	0	A
		2608	-40	-18.8	-21.2	-44.75	3.53	1.22	0	0	P
		2608	-44.32	-3.12	-41.2	-49.07	3.53	1.22	0	0	A
		4960	-63.11	-41.91	-21.2	-67.98	3.53	1.34	0	0	P
		6905.2	-62.51	-41.31	-21.2	-67.54	3.53	1.5	0	0	P
		7440	-70	-48.8	-21.2	-75.2	3.53	1.67	0	0	P
		9920	-59.73	-38.53	-21.2	-64.97	3.53	1.71	0	0	P
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.										

2.4GHz 2400~2483.5MHz

BLE (Band Edge)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	MIMO	Grounding	Peak
Ant.				Limit	Line	Level	Gain	Loss	Factor	Factor	Avg.
5		(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dBi)	(dB)	(dB)	(dB)	(P/A)
BLE CH 00 2402MHz		2371.32	-44.46	-23.26	-21.2	-49.13	3.53	1.14	0	0	P
		2325.645	-54.26	-13.06	-41.2	-58.88	3.53	1.09	0	0	A
	*	2402	7.64	-	-	2.94	3.53	1.17	0	0	P
	*	2402	5.88	-	-	1.18	3.53	1.17	0	0	A
BLE CH 19 2440MHz		2311.54	-40.86	-19.66	-21.2	-45.47	3.53	1.08	0	0	P
		2311.54	-46.96	-5.76	-41.2	-51.57	3.53	1.08	0	0	A
	*	2440	7.95	-	-	3.22	3.53	1.2	0	0	P
	*	2440	6.28	-	-	1.55	3.53	1.2	0	0	A
		2483.69	-44.59	-23.39	-21.2	-49.35	3.53	1.23	0	0	P
		2499.37	-54.62	-13.42	-41.2	-59.4	3.53	1.25	0	0	A
BLE CH 39 2480MHz	*	2480	7.91	-	-	3.15	3.53	1.23	0	0	P
	*	2480	6.22	-	-	1.46	3.53	1.23	0	0	A
		2483.6	-42.71	-21.51	-21.2	-47.47	3.53	1.23	0	0	P
		2494.6	-54.43	-13.23	-41.2	-59.2	3.53	1.24	0	0	A
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.										

2.4GHz 2400~2483.5MHz

BLE (Harmonic)

BLE Ant. 5	Note	Frequency (MHz)	Level (dBm)	Over Limit (dB)	Limit Line (dBm)	Read Level (dBm)	Antenna Gain (dBi)	Path Loss (dB)	MIMO Factor (dB)	Grounding Factor (dB)	Peak Avg. (P/A)
BLE CH 00 2402MHz		2212	-39.34	-18.14	-21.2	-43.88	3.53	1.01	0	0	P
		2212	-45.79	-4.59	-41.2	-50.33	3.53	1.01	0	0	A
		2274	-40.39	-19.19	-21.2	-44.97	3.53	1.05	0	0	P
		2274	-46.58	-5.38	-41.2	-51.16	3.53	1.05	0	0	A
		2532	-40.91	-19.71	-21.2	-45.68	3.53	1.24	0	0	P
		2532	-47.1	-5.9	-41.2	-51.87	3.53	1.24	0	0	A
		4804	-63.79	-42.59	-21.2	-68.67	3.53	1.35	0	0	P
		6905.2	-54.26	-33.06	-21.2	-59.29	3.53	1.5	0	0	P
		7206	-64.96	-43.76	-21.2	-70.08	3.53	1.59	0	0	P
BLE CH 19 2440MHz		2250	-39.56	-18.36	-21.2	-44.13	3.53	1.04	0	0	P
		2250	-45.16	-3.96	-41.2	-49.73	3.53	1.04	0	0	A
		2312	-40.64	-19.44	-21.2	-45.25	3.53	1.08	0	0	P
		2312	-45.73	-4.53	-41.2	-50.34	3.53	1.08	0	0	A
		2632	-42.21	-21.01	-21.2	-46.93	3.53	1.19	0	0	P
		2632	-47.6	-6.4	-41.2	-52.32	3.53	1.19	0	0	A
		4880	-64.98	-43.78	-21.2	-69.85	3.53	1.34	0	0	P
		6905.2	-55	-33.8	-21.2	-60.03	3.53	1.5	0	0	P
		7320	-69.77	-48.57	-21.2	-74.92	3.53	1.62	0	0	P
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.										

BLE Ant. 5	Note	Frequency (MHz)	Level (dBm)	Over Limit (dB)	Limit Line (dBm)	Read Level (dBm)	Antenna Gain (dBi)	Path Loss (dB)	MIMO Factor (dB)	Grounding Factor (dB)	Peak Avg. (P/A)
BLE CH 39 2480MHz		2224	-41.33	-20.13	-21.2	-45.88	3.53	1.02	0	0	P
		2224	-45.54	-4.34	-41.2	-50.09	3.53	1.02	0	0	A
		2288	-40.27	-19.07	-21.2	-44.86	3.53	1.06	0	0	P
		2288	-45.06	-3.86	-41.2	-49.65	3.53	1.06	0	0	A
		2352	-40.62	-19.42	-21.2	-45.27	3.53	1.12	0	0	P
		2352	-46.03	-4.83	-41.2	-50.68	3.53	1.12	0	0	A
		2610	-40.32	-19.12	-21.2	-45.06	3.53	1.21	0	0	P
		2610	-47.4	-6.2	-41.2	-52.14	3.53	1.21	0	0	A
		4960	-61.41	-40.21	-21.2	-66.28	3.53	1.34	0	0	P
		6905.2	-54.92	-33.72	-21.2	-59.95	3.53	1.5	0	0	P
		7440	-65.32	-44.12	-21.2	-70.52	3.53	1.67	0	0	P
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average 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	**P**eak or **A**verage

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

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	MIMO	Grounding	Peak
Ant.				Limit	Line	Level	Gain	Loss	Factor	Factor	Avg.
4		(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dBi)	(dB)	(dB)	(dB)	(P/A)
BLE CH 00 2402MHz		2388.54	-54.45	-33.25	-21.2	-58.88	3.53	0.9	0	0	P
		2390	-65.81	-24.61	-41.2	-70.24	3.53	0.9	0	0	A
	*	2404	13.81	-	-	9.38	3.53	0.9	0	0	P
	*	2402	12.8	-	-	8.37	3.53	0.9	0	0	A

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. MIMO Factor(dB) = 10 log (*N*ANT) , where *N*ANT is the number of outputs
3. Grounding Factor(dB) = Ground reflection factor (i.e., 6 dB for f ≤ 30 MHz and 4.7 dB for 30 MHz < f ≤ 960 MHz)
4. Level(dBμV/m) = Antenna Gain(dBi) + Path Loss(dB) + Read Level(dBm) + MIMO Factor(dB) + Grounding Factor(dB)
5. Over Limit(dB) = Level(dBm) – Limit Line(dBm)

For Peak Limit @ 2388.54MHz:

1. Level(dBm)

= Antenna Gain(dBi) + Path Loss(dB) + MIMO Factor(dB) + Grounding Factor(dB) + Read Level(dBm)
= 3.53(dB) + 0.9(dB) – 58.88(dBm)
= -54.45(dBm)

2. Over Limit(dB)

= Level(dBm) – Limit Line(dBm)
= -54.45(dBm) + 21.2(dBm)
= -33.25(dB)

For Average Limit @ 2390MHz:

1. Level(dBm)

= Antenna Gain(dBi) + Path Loss(dB) + MIMO Factor(dB) + Grounding Factor(dB) + Read Level(dBm)
= 3.53(dBi) + 0.9(dB) – 70.24(dBm)
= -65.81(dBm)

2. Over Limit(dB)

= Level(dBm) – Limit Line(dBm)
= -68.81(dBm) + 41.2(dBm)
= -24.61(dB)

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

Appendix C. Conducted Spurious Emission Plots

Test Engineer :	Kai Liao and Nick Yu	**Temperature :**	22.7~24.8°C
		Relative Humidity :	52~59%

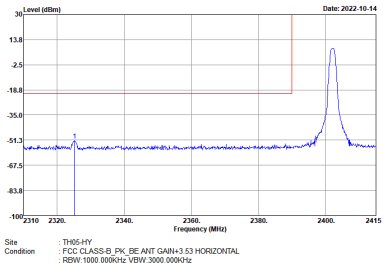
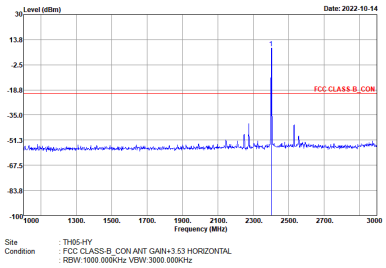
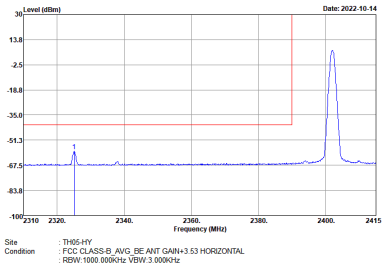
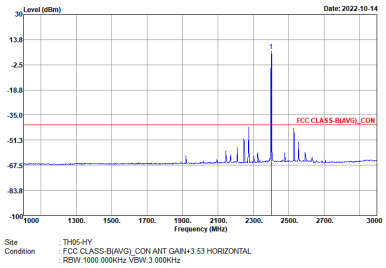
Note symbol

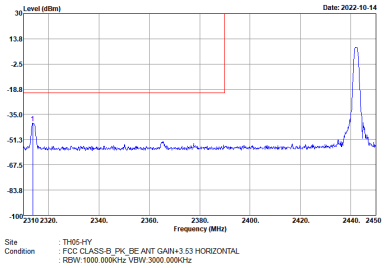
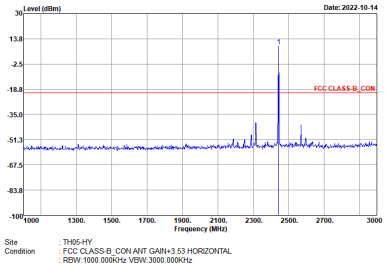
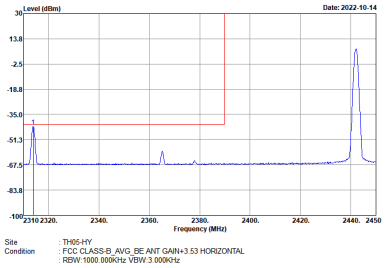
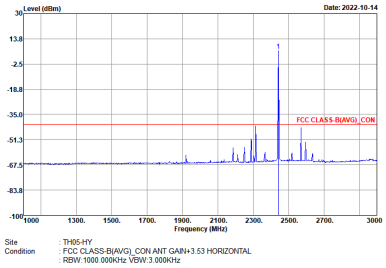
-L	**Low channel location**
-R	**High channel location**

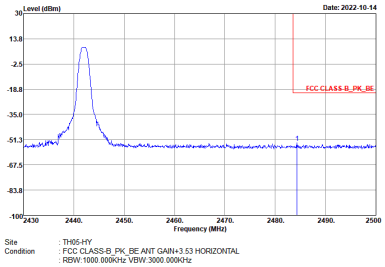
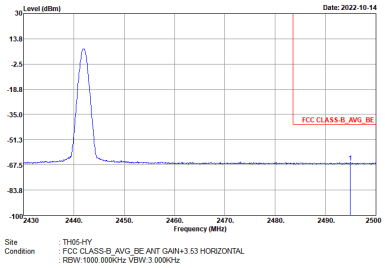
<1Mbps>

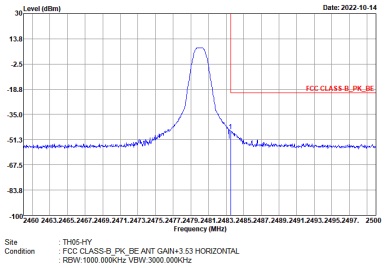
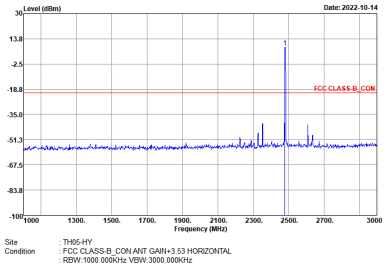
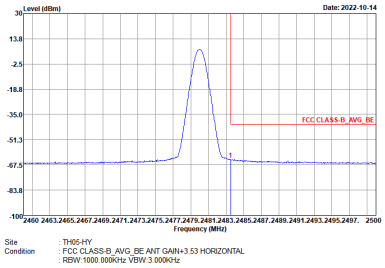
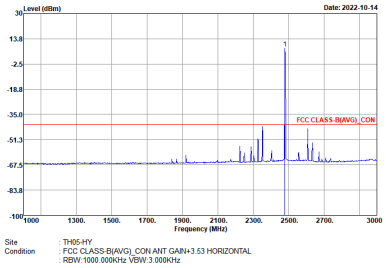
2.4GHz 2400~2483.5MHz

BLE (Band Edge)

BLE	2.4GHz 2400~2483.5MHz Band Edge	
ANT	BLE CH00 2402MHz	
4	CSE	Fundamental
Peak		
Avg.		

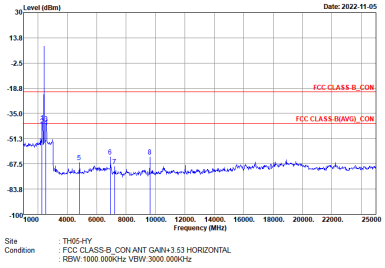
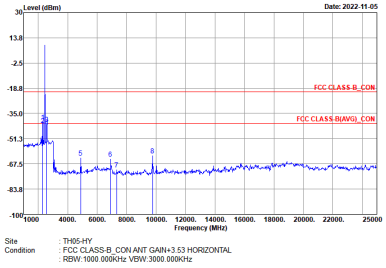
BLE	2.4GHz 2400~2483.5MHz Band Edge	
ANT	BLE CH19 2440MHz - L	
4	CSE	Fundamental
Peak		
Avg.		

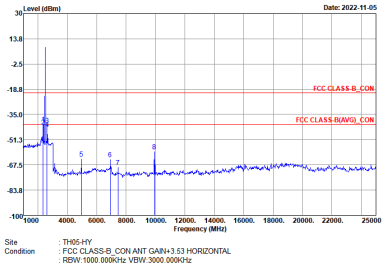
BLE	2.4GHz 2400~2483.5MHz Band Edge	
ANT	BLE CH19 2440MHz - R	
4	CSE	Fundamental
Peak		Left blank
Avg.		Left blank

BLE	2.4GHz 2400~2483.5MHz Band Edge	
ANT	BLE CH39 2480MHz	
4	CSE	Fundamental
Peak		
Avg.		

2.4GHz 2400~2483.5MHz

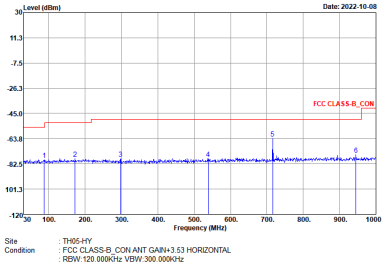
BLE (Harmonic)

BLE	2.4GHz 2400~2483.5MHz Harmonic	
ANT	BLE	
4	BLE CH00 2402MHz	BLE CH19 2440MHz
Peak Avg.		

BLE	2.4GHz 2400~2483.5MHz Harmonic	
ANT	BLE	
4	BLE CH39 2480MHz	-
Peak Avg.		Left blank

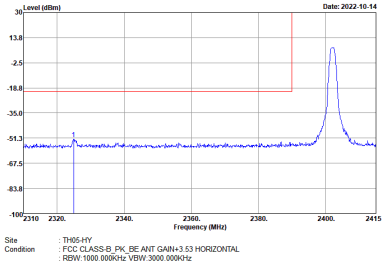
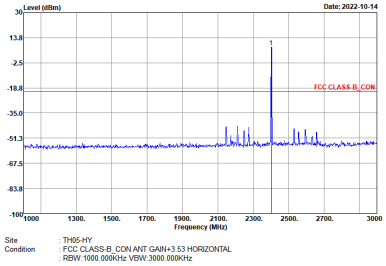
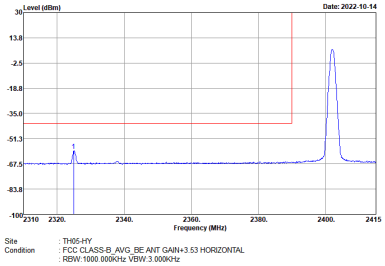
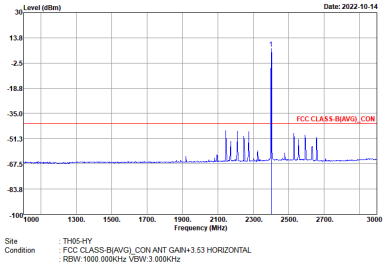
Emission below 1GHz

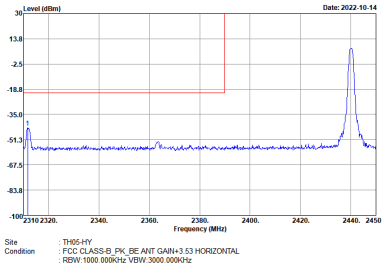
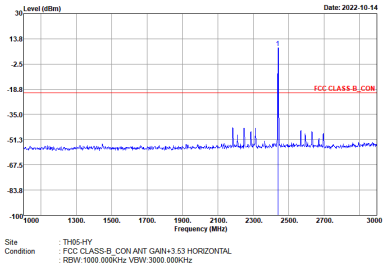
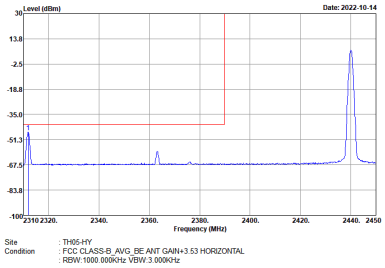
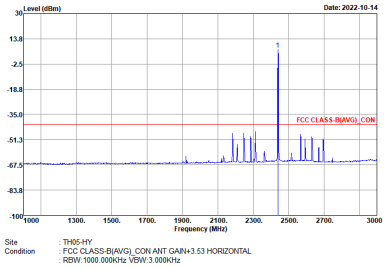
2.4GHz BLE (LF)

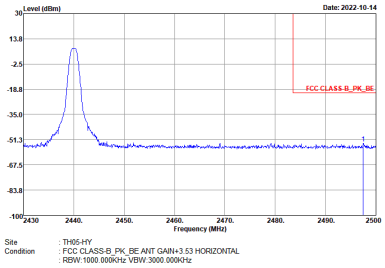
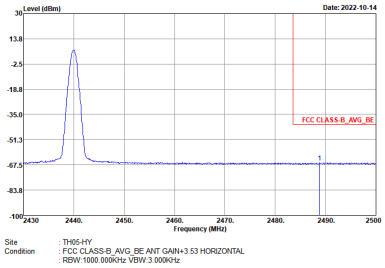
BLE	2.4GHz 2400~2483.5MHz	
ANT	BLE LF	
4		
QP / Peak		Left blank

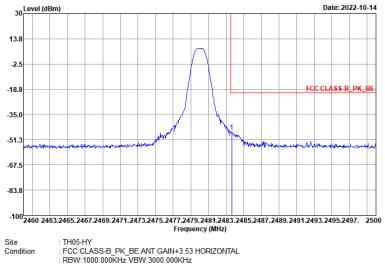
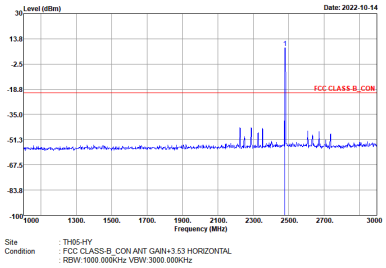
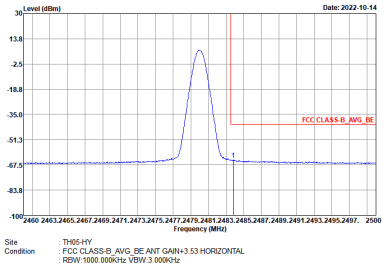
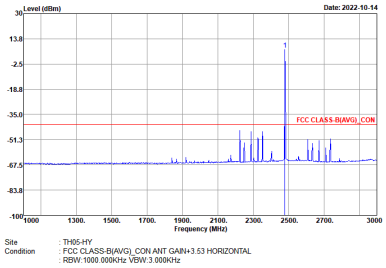
2.4GHz 2400~2483.5MHz

BLE (Band Edge)

BLE	2.4GHz 2400~2483.5MHz Band Edge	
ANT	BLE CH00 2402MHz	
5	CSE	Fundamental
Peak		
Avg.		

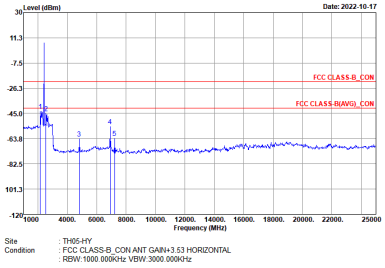
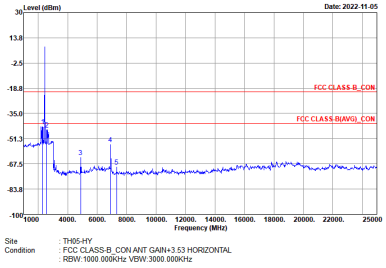
BLE	2.4GHz 2400~2483.5MHz Band Edge	
ANT	BLE CH19 2440MHz - L	
5	CSE	Fundamental
Peak		
Avg.		

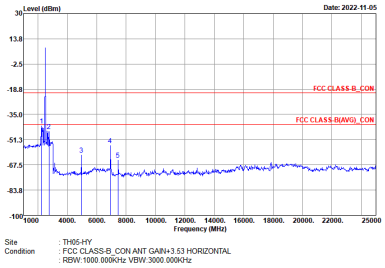
BLE	2.4GHz 2400~2483.5MHz Band Edge	
ANT	BLE CH19 2440MHz - R	
5	CSE	Fundamental
Peak		Left blank
Avg.		Left blank

BLE	2.4GHz 2400~2483.5MHz Band Edge	
ANT	BLE CH39 2480MHz	
5	CSE	Fundamental
Peak		
Avg.		

2.4GHz 2400~2483.5MHz

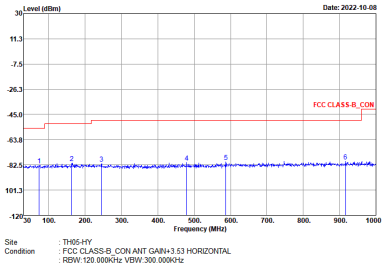
BLE (Harmonic)

BLE	2.4GHz 2400~2483.5MHz Harmonic	
ANT	BLE	
5	BLE CH00 2402MHz	BLE CH19 2440MHz
Peak Avg.		

BLE	2.4GHz 2400~2483.5MHz Harmonic	
ANT	BLE	
5	BLE CH39 2480MHz	-
Peak Avg.		Left blank

Emission below 1GHz

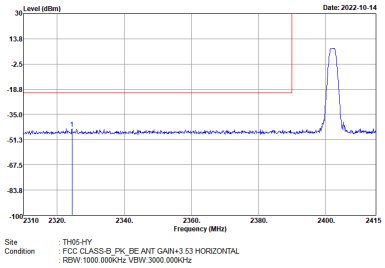
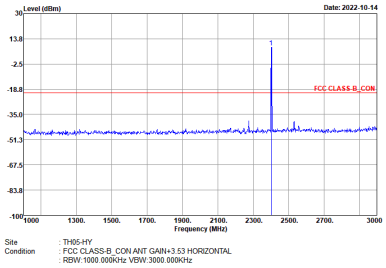
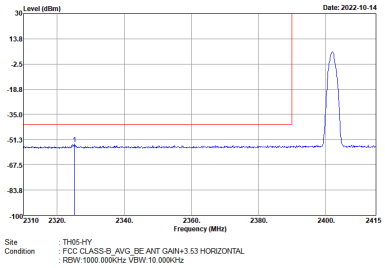
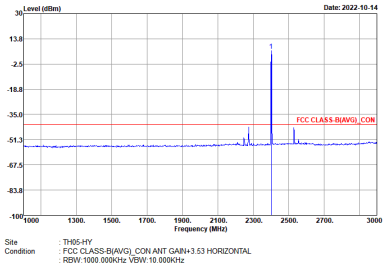
BLE (LF)

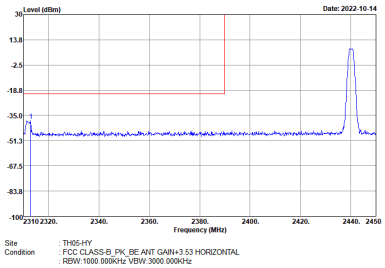
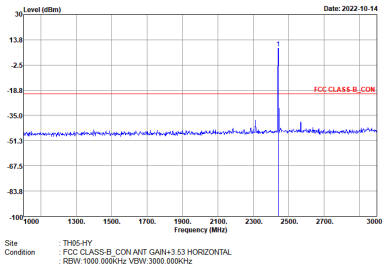
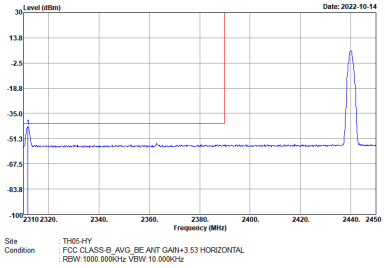
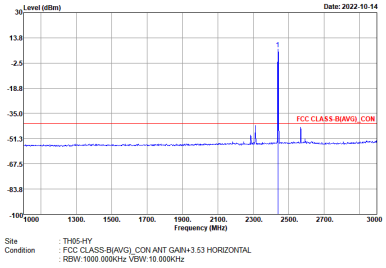
BLE	2.4GHz 2400~2483.5MHz	
ANT	BLE LF	
5		
QP / Peak		Left blank

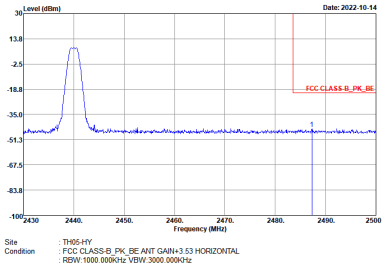
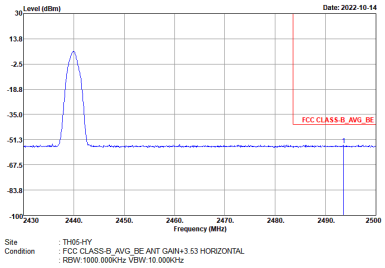
<2Mbps>

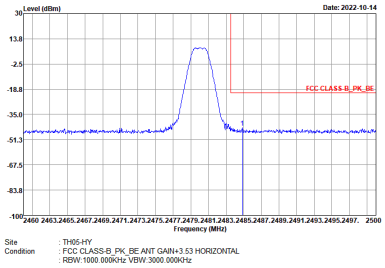
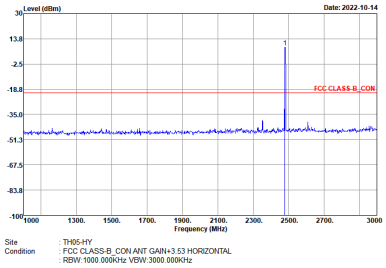
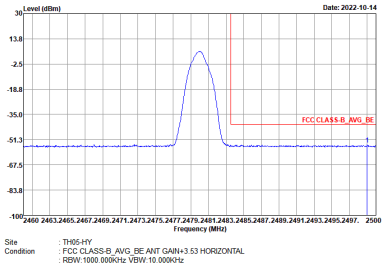
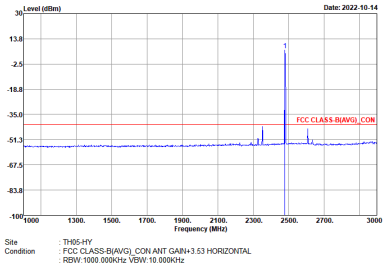
2.4GHz 2400~2483.5MHz

BLE (Band Edge)

BLE	2.4GHz 2400~2483.5MHz Band Edge	
ANT	BLE CH00 2402MHz	
4	CSE	Fundamental
Peak		
Avg.		

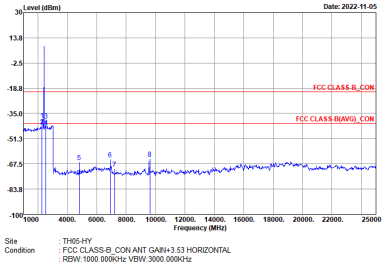
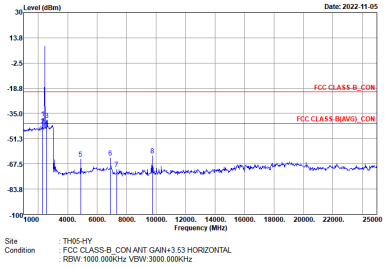
BLE	2.4GHz 2400~2483.5MHz Band Edge	
ANT	BLE CH19 2440MHz - L	
4	CSE	Fundamental
Peak		
Avg.		

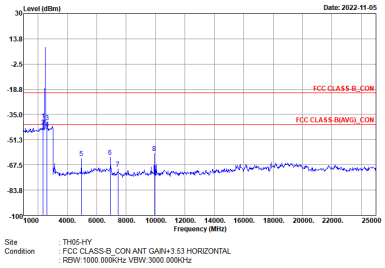
BLE	2.4GHz 2400~2483.5MHz Band Edge	
ANT	BLE CH19 2440MHz - R	
4	CSE	Fundamental
Peak		Left blank
Avg.		Left blank

BLE	2.4GHz 2400~2483.5MHz Band Edge	
ANT	BLE CH39 2480MHz	
4	CSE	Fundamental
Peak		
Avg.		

2.4GHz 2400~2483.5MHz

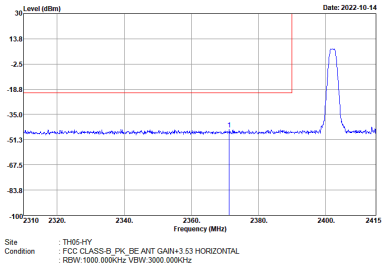
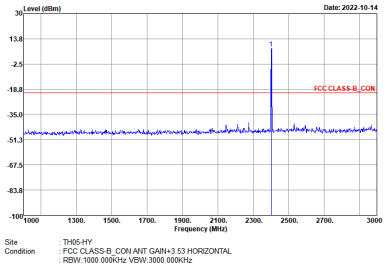
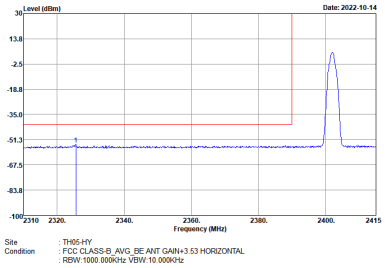
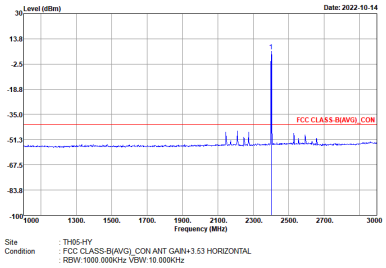
BLE (Harmonic)

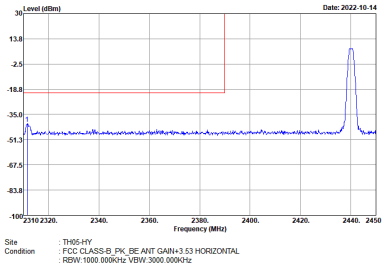
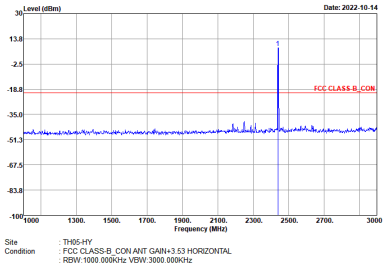
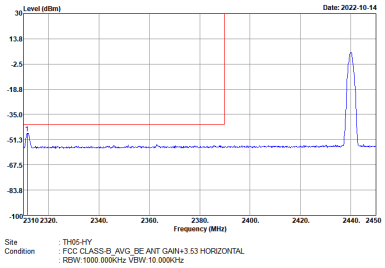
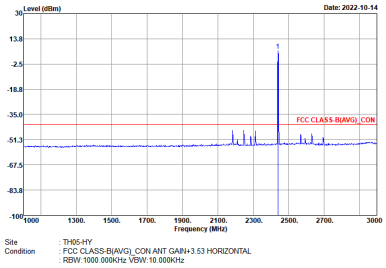
BLE	2.4GHz 2400~2483.5MHz Harmonic	
ANT	BLE	
4	BLE CH00 2402MHz	BLE CH19 2440MHz
Peak Avg.		

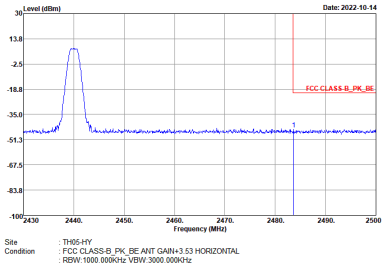
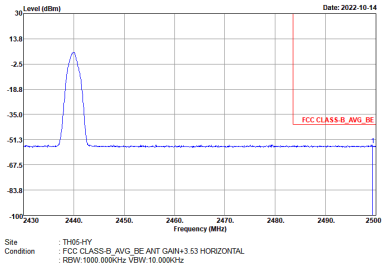
BLE	2.4GHz 2400~2483.5MHz Harmonic	
ANT	BLE	
4	BLE CH39 2480MHz	-
Peak Avg.		Left blank

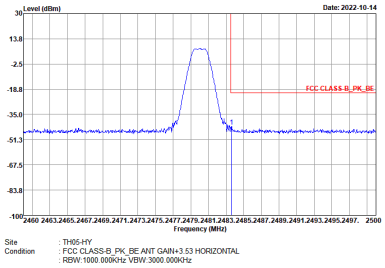
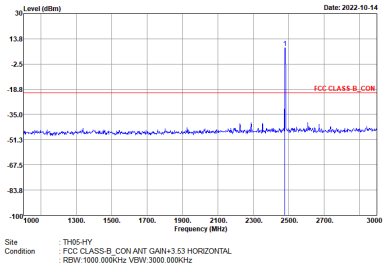
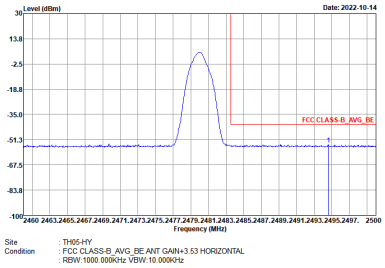
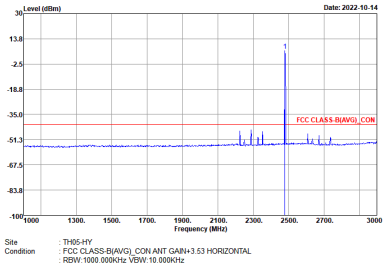
2.4GHz 2400~2483.5MHz

BLE (Band Edge)

BLE	2.4GHz 2400~2483.5MHz Band Edge	
ANT	BLE CH00 2402MHz	
5	CSE	Fundamental
Peak		
Avg.		

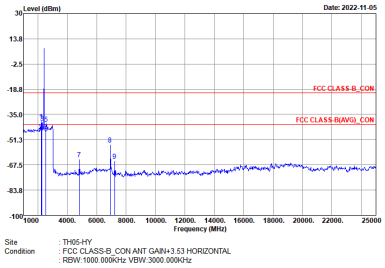
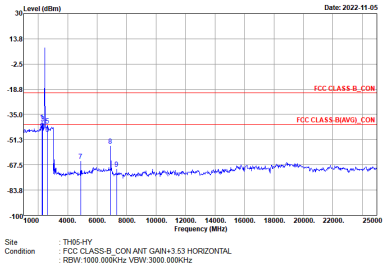
BLE	2.4GHz 2400~2483.5MHz Band Edge	
ANT	BLE CH19 2440MHz - L	
5	CSE	Fundamental
Peak		
Avg.		

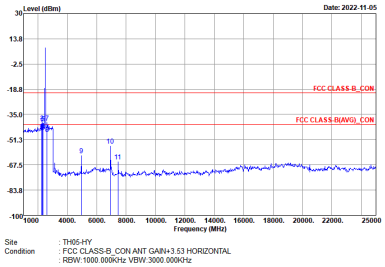
BLE	2.4GHz 2400~2483.5MHz Band Edge	
ANT	BLE CH19 2440MHz - R	
5	CSE	Fundamental
Peak		Left blank
Avg.		Left blank

BLE	2.4GHz 2400~2483.5MHz Band Edge	
ANT	BLE CH39 2480MHz	
5	CSE	Fundamental
Peak		
Avg.		

2.4GHz 2400~2483.5MHz

BLE (Harmonic)

BLE	2.4GHz 2400~2483.5MHz Harmonic	
ANT	BLE	
5	BLE CH00 2402MHz	BLE CH19 2440MHz
Peak Avg.		

BLE	2.4GHz 2400~2483.5MHz Harmonic	
ANT	BLE	
5	BLE CH39 2480MHz	-
Peak Avg.		Left blank

Appendix D. Cabinet Radiated Spurious Emission

Test Engineer :	Bigshow Wang and Quentin Liu	Temperature :	21.1~23.1°C
		Relative Humidity :	49~58%

<1Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
ANT 4		(MHz)	(dBµV/m)	(dB)	Line (dBµV/m)	Level (dBµV)	Factor (dB/m)	Loss (dB)	Factor (dB)	Pos (cm)	Pos (deg)	Avg. (P/A)	(H/V)
BLE CH 00 2402MHz		2349.168	51.59	-22.41	74	45.49	27	15.96	36.86	371	65	P	H
		2385.99	41.11	-12.89	54	34.66	27.29	16.02	36.86	371	65	A	H
	*	2402	65.66	-	-	59.06	27.41	16.05	36.86	371	65	P	H
	*	2402	64.12	-	-	57.52	27.41	16.05	36.86	371	65	A	H
													H
													H
		2338.254	50.54	-23.46	74	44.46	27	15.94	36.86	378	140	P	V
		2387.826	41.03	-12.97	54	34.56	27.3	16.03	36.86	378	140	A	V
	*	2402	68.37	-	-	61.77	27.41	16.05	36.86	378	140	P	V
	*	2402	67.21	-	-	60.61	27.41	16.05	36.86	378	140	A	V
													V
													V
BLE CH 19 2440MHz		2363.2	52.61	-21.39	74	46.38	27.11	15.98	36.86	361	74	P	H
		2385.74	41.2	-12.8	54	34.75	27.29	16.02	36.86	361	74	A	H
	*	2440	65.95	-	-	59.05	27.64	16.11	36.85	361	74	P	H
	*	2440	64.66	-	-	57.76	27.64	16.11	36.85	361	74	A	H
		2486.21	51.2	-22.8	74	44.03	27.84	16.18	36.85	361	74	P	H
		2485.44	42.04	-11.96	54	34.87	27.84	16.18	36.85	361	74	A	H
		2377.06	50.48	-23.52	74	44.11	27.22	16.01	36.86	365	144	P	V
		2385.74	41.06	-12.94	54	34.61	27.29	16.02	36.86	365	144	A	V
	*	2440	68.5	-	-	61.6	27.64	16.11	36.85	365	144	P	V
	*	2440	67.49	-	-	60.59	27.64	16.11	36.85	365	144	A	V
		2490.97	50.98	-23.02	74	43.78	27.86	16.19	36.85	365	144	P	V
		2489.15	42	-12	54	34.8	27.86	16.19	36.85	365	144	A	V

BLE ANT 4	Note	Frequency (MHz)	Level (dBµV/m)	Margin (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	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 39 2480MHz	*	2480	67.26	-	-	60.12	27.82	16.17	36.85	398	76	P	H
	*	2480	65.5	-	-	58.36	27.82	16.17	36.85	398	76	A	H
		2496.82	51.54	-22.46	74	44.3	27.89	16.2	36.85	398	76	P	H
		2497.48	42.19	-11.81	54	34.95	27.89	16.2	36.85	398	76	A	H
													H
													H
	*	2480	68.3	-	-	61.16	27.82	16.17	36.85	400	149	P	V
	*	2480	67.02	-	-	59.88	27.82	16.17	36.85	400	149	A	V
		2486.95	51.64	-22.36	74	44.46	27.85	16.18	36.85	400	149	P	V
		2489.47	42.06	-11.94	54	34.86	27.86	16.19	36.85	400	149	A	V
													V
													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 ANT 4	Note	Frequency (MHz)	Level (dBµV/m)	Margin (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	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		4804	34.05	-39.95	74	53.01	32.32	8.97	60.7	-	-	P	H
													H
													H
													H
		4804	33.63	-40.37	74	52.59	32.32	8.97	60.7	-	-	P	V
													V
													V
													V
BLE CH 19 2440MHz		4880	33.85	-40.15	74	52.56	32.6	8.91	60.71	-	-	P	H
		7320	38.74	-35.26	74	52.19	36.62	10.74	60.92	-	-	P	H
													H
													H
		4880	33.85	-40.15	74	52.56	32.6	8.91	60.71	-	-	P	V
		7320	38.46	-35.54	74	51.91	36.62	10.74	60.92	-	-	P	V
													V
													V
BLE CH 39 2480MHz		4960	34.47	-39.53	74	52.88	32.94	8.84	60.72	-	-	P	H
		7440	37.18	-36.82	74	50.86	36.34	10.86	60.98	-	-	P	H
													H
													H
		4960	34.44	-39.56	74	52.85	32.94	8.84	60.72	-	-	P	V
		7440	37.25	-36.75	74	50.93	36.34	10.86	60.98	-	-	P	V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.
3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.

Emission above 18GHz

2.4GHz BLE (SHF)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
ANT					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
4		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BLE SHF		36491	46.26	-27.74	74	62.57	42.91	-0.81	58.41	-	-	P	H
													H
													H
													H
		36505.5	45.84	-28.16	74	62.15	42.9	-0.81	58.4	-	-	P	V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
ANT					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
4		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BLE LF		30.97	31.15	-8.85	40	38.95	24.01	0.66	32.48	-	-	P	H
		49.4	31	-9	40	48.08	14.6	0.86	32.57	-	-	P	H
		131.85	27.57	-15.93	43.5	41.23	17.48	1.3	32.51	-	-	P	H
		267.65	25.55	-20.45	46	36.61	19.36	1.86	32.43	-	-	P	H
		588.72	26.85	-19.15	46	30.81	25.58	2.81	32.51	-	-	P	H
		741.98	34.87	-11.13	46	36.12	27.75	3.17	32.3	-	-	P	H
		30.97	39.23	-0.77	40	47.03	24.01	0.66	32.48	100	120	Q	V
		54.25	31.65	-8.35	40	50.72	12.58	0.87	32.56	-	-	P	V
		133.79	27.35	-16.15	43.5	41.02	17.46	1.31	32.51	-	-	P	V
		166.77	21.3	-22.2	43.5	36.29	15.83	1.46	32.46	-	-	P	V
		506.27	24.87	-21.13	46	30.71	23.93	2.58	32.47	-	-	P	V
		741.98	33.94	-12.06	46	35.19	27.75	3.17	32.3	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line. 3. The emission position marked as “-” means no suspected emission found and emission level has at least 6dB margin against limit or emission is noise floor only.												

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE ANT 5	Note	Frequency (MHz)	Level (dBµV/m)	Margin (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	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		2375.688	50.64	-23.36	74	44.28	27.21	16.01	36.86	137	78	P	H
		2382.114	41.32	-12.68	54	34.9	27.26	16.02	36.86	137	78	A	H
	*	2402	62.48	-11.52	74	55.88	27.41	16.05	36.86	137	78	P	H
	*	2402	60.36	-	-	53.76	27.41	16.05	36.86	137	78	A	H
													H
													H
		2379.36	50.59	-23.41	74	44.21	27.23	16.01	36.86	382	144	P	V
		2386.092	41.02	-12.98	54	34.57	27.29	16.02	36.86	382	144	A	V
	*	2402	60.32	-13.68	74	53.72	27.41	16.05	36.86	382	144	P	V
	*	2402	57.98	-	-	51.38	27.41	16.05	36.86	382	144	A	V
													V
													V
BLE CH 19 2440MHz		2382.52	50.94	-23.06	74	44.52	27.26	16.02	36.86	114	84	P	H
		2386.16	41.08	-12.92	54	34.62	27.29	16.03	36.86	114	84	A	H
	*	2440	63.25	-10.75	74	56.35	27.64	16.11	36.85	114	84	P	H
	*	2440	60.82	-	-	53.92	27.64	16.11	36.85	114	84	A	H
		2494.54	51.4	-22.6	74	44.17	27.88	16.2	36.85	114	84	P	H
		2490.27	42	-12	54	34.8	27.86	16.19	36.85	114	84	A	H
		2372.58	50.8	-23.2	74	44.48	27.18	16	36.86	368	144	P	V
		2385.18	41.11	-12.89	54	34.67	27.28	16.02	36.86	368	144	A	V
	*	2440	60.69	-13.31	74	53.79	27.64	16.11	36.85	368	144	P	V
	*	2440	58.26	-	-	51.36	27.64	16.11	36.85	368	144	A	V
		2496.43	51.12	-22.88	74	43.88	27.89	16.2	36.85	368	144	P	V
		2493.98	42.26	-11.74	54	35.03	27.88	16.2	36.85	368	144	A	V

BLE ANT 5	Note	Frequency (MHz)	Level (dBµV/m)	Margin (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	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 39 2480MHz	*	2480	63.86	-10.14	74	56.72	27.82	16.17	36.85	100	68	P	H
	*	2480	61.95	-	-	54.81	27.82	16.17	36.85	100	68	A	H
		2495.5	51.52	-22.48	74	44.29	27.88	16.2	36.85	100	68	P	H
		2495.47	42.08	-11.92	54	34.85	27.88	16.2	36.85	100	68	A	H
													H
													H
	*	2480	60.67	-13.33	74	53.53	27.82	16.17	36.85	400	145	P	V
	*	2480	58.36	-	-	51.22	27.82	16.17	36.85	400	145	A	V
		2499.76	51.83	-22.17	74	44.58	27.9	16.2	36.85	400	145	P	V
		2496.58	42.19	-11.81	54	34.95	27.89	16.2	36.85	400	145	A	V
													V
													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 ANT 5	Note	Frequency (MHz)	Level (dBµV/m)	Margin (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	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		4804	32.76	-41.24	74	51.72	32.32	9.42	60.7	-	-	P	H
		7206	37.3	-36.7	74	50.69	36.71	10.76	60.86	-	-	P	H
													H
													H
		4804	34.27	-39.73	74	53.23	32.32	9.42	60.7	-	-	P	V
		7206	36.9	-37.1	74	50.29	36.71	10.76	60.86	-	-	P	V
													V
													V
BLE CH 19 2440MHz		4880	33.85	-40.15	74	52.56	32.6	9.4	60.71	-	-	P	H
		7320	38.74	-35.26	74	52.19	36.62	10.85	60.92	-	-	P	H
													H
													H
		4880	33.85	-40.15	74	52.56	32.6	9.4	60.71	-	-	P	V
		7320	38.46	-35.54	74	51.91	36.62	10.85	60.92	-	-	P	V
													V
													V
BLE CH 39 2480MHz		4960	34.57	-39.43	74	52.98	32.94	9.37	60.72	-	-	P	H
		7440	36.72	-37.28	74	50.4	36.34	10.96	60.98	-	-	P	H
													H
													H
		4960	33.64	-40.36	74	52.05	32.94	9.37	60.72	-	-	P	V
		7440	36.28	-37.72	74	49.96	36.34	10.96	60.98	-	-	P	V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.
3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.

Emission above 18GHz

2.4GHz BLE (SHF)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
ANT					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
5		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BLE SHF		36491	46.26	-27.74	74	62.57	42.91	8.73	58.41	-	-	P	H
													H
													H
													H
		36505.5	45.84	-28.16	74	62.15	42.9	-0.81	58.4	-	-	P	V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
ANT					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
5		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BLE LF		30	31.07	-8.93	40	38.6	24.3	0.63	32.47	-	-	P	H
		49.4	29.41	-10.59	40	46.49	14.6	0.86	32.57	-	-	P	H
		132.82	28.18	-15.32	43.5	41.83	17.48	1.31	32.51	-	-	P	H
		267.65	24.85	-21.15	46	35.91	19.36	1.86	32.43	-	-	P	H
		741.98	33.86	-12.14	46	35.11	27.75	3.17	32.3	-	-	P	H
		838.01	32.53	-13.47	46	32.5	28.52	3.35	32.03	-	-	P	H
		30.97	39.53	-0.47	40	47.33	24.01	0.66	32.48	111	115	Q	V
		50.37	31.35	-8.65	40	48.88	14.14	0.87	32.57	-	-	P	V
		134.76	26.91	-16.59	43.5	40.59	17.44	1.32	32.51	-	-	P	V
		458.74	24.95	-21.05	46	31.61	23.21	2.46	32.42	-	-	P	V
		741.98	35.66	-10.34	46	36.91	27.75	3.17	32.3	-	-	P	V
		920.46	32.1	-13.9	46	30.57	29.18	3.52	31.39	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line. 3. The emission position marked as “-” means no suspected emission found and emission level has at least 6dB margin against limit or emission is noise floor only.												

<2Mbps>

2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE ANT	Note	Frequency	Level	Margin	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
4		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 19 2440MHz		4880	34.98	-39.02	74	53.69	32.6	9.4	60.71	-	-	P	H
		7320	38.34	-35.66	74	51.79	36.62	10.85	60.92	-	-	P	H
													H
													H
		4880	34.55	-39.45	74	53.26	32.6	9.4	60.71	-	-	P	V
		7320	39.1	-34.9	74	52.55	36.62	10.85	60.92	-	-	P	V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.
3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.

2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
ANT					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
5		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 19 2440MHz		4880	34.42	-39.58	74	53.13	32.6	9.4	60.71	-	-	P	H
		7320	38.75	-35.25	74	52.2	36.62	10.85	60.92	-	-	P	H
													H
													H
		4880	34.92	-39.08	74	53.63	32.6	9.4	60.71	-	-	P	V
		7320	39.52	-34.48	74	52.97	36.62	10.85	60.92	-	-	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

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

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
4		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 00 2402MHz		2334.675	51.32	-22.68	74	44.57	27.14	16.47	36.86	138	313	P	H
		2371.11	41.67	-12.33	54	34.7	27.28	16.53	36.84	138	313	A	H
	*	2402	74.02	-	-	66.87	27.4	16.58	36.83	138	313	P	H
	*	2402	73.28	-	-	66.13	27.4	16.58	36.83	138	313	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Margin(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2333.675MHz:

1. Level(dBμV/m)

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

= 27.14(dB/m) + 16.47(dB) + 44.57(dBμV) – 36.86 (dB)

= 51.32 (dBμV/m)

2. Margin(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 51.32(dBμV/m) – 74(dBμV/m)

= -22.68(dB)

For Average Limit @ 2371.11MHz:

1. Level(dBμV/m)

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

= 27.28(dB/m) + 16.53(dB) + 34.7(dBμV) – 36.84 (dB)

= 41.67 (dBμV/m)

2. Margin(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 41.67(dBμV/m) – 54(dBμV/m)

= -12.33(dB)

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

Appendix E. Cabinet Radiated Spurious Emission Plots

Test Engineer :	Bigshow Wang and Quentin Liu	**Temperature :**	21.1~23.1°C
		Relative Humidity :	49~58%

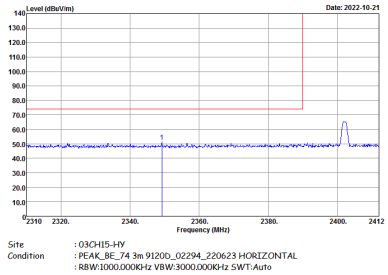
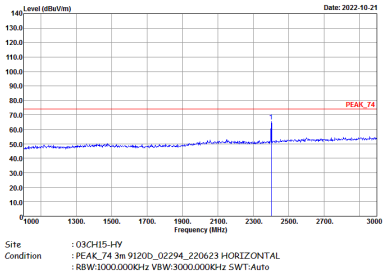
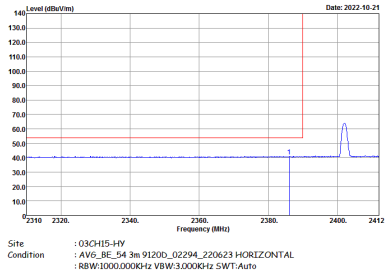
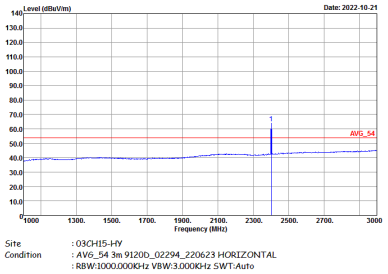
Note symbol

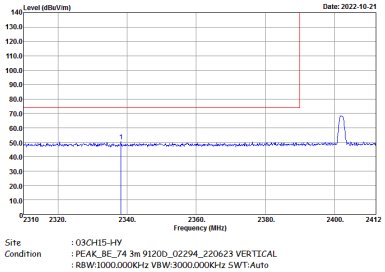
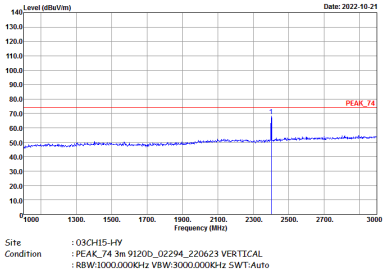
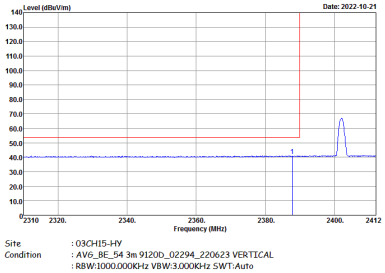
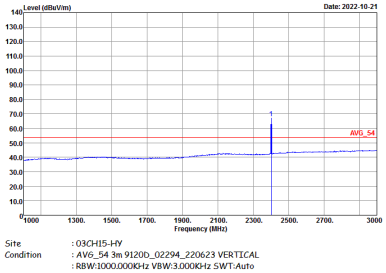
-L	**Low channel location**
-R	**High channel location**

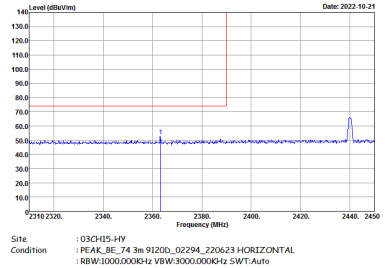
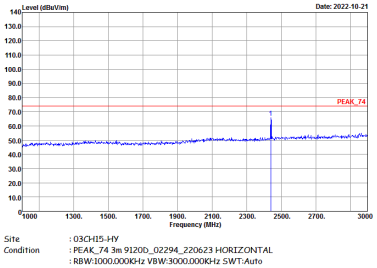
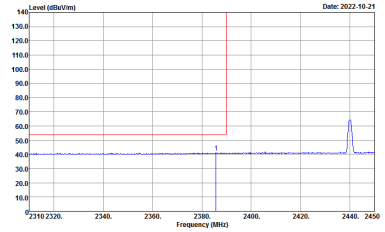
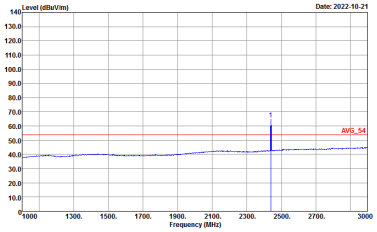
<1Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH00 2402MHz	
4	Horizontal	Fundamental
Peak		
Avg.		

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH00 2402MHz	
4	Vertical	Fundamental
Peak		
Avg.		

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH19 2440MHz - L	
4	Horizontal	Fundamental
Peak	 Site : 03CH15-HY Condition : PEAK_BE_74 3m 9120D_02294_220623 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH15-HY Condition : PEAK_74 3m 9120D_02294_220623 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH15-HY Condition : AVG_BE_54 3m 9120D_02294_220623 HORIZONTAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto	 Site : 03CH15-HY Condition : AVG_54 3m 9120D_02294_220623 HORIZONTAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto