FCC RADIO TEST REPORT

FCC ID	:	**ZAT-CC2652PSIP**
Equipment	:	**CC2652PSIPMOT**
Brand Name	:	**Texas Instruments**
Model Name	:	**CC2652PSIPMOT**
Marketing Name	:	**CC2652PSIP SimpleLink™ Multiprotocol 2.4-GHz Wireless System-in-Package With Integrated Power Amplifier**
Applicant	:	**Texas Instruments Incorporated 12500 TI BLVD., Dallas, Texas, 75243**
Manufacturer	:	**Texas Instruments Incorporated 12500 TI BLVD., Dallas, Texas, 75243**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on Mar. 21, 2022 and testing was performed from Apr. 14, 2022 to May 11, 2022. We, Sporton International Inc. EMC & Wireless Communications 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. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issue Date
FR232118A	01	Initial issue of report	Jul. 15, 2022
FR232118A	02	1. Revise remark of test mode 2. Revise description of section 3.5.3 3. Revise appendix C and appendix D	Jul. 29, 2022

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)	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	0.69 dB under the limit at 4880.000 MHz
3.6	15.207	AC Conducted Emission	Pass	10.15 dB under the limit at 0.188 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	Pass	-

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 this 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: Danny Lee

Report Producer: Clio Lo

1 General Description

1.1 Product Feature of Equipment Under Test

Bluetooth LE (125 kbps, 500 kbps, 1Mbps, 2Mbps) and Zigbee (OQPSK DSSS1:8, 250 kbps)

	Brand	Antenna type	Model	2.4 GHz Gain
1	Texas Instruments	Inverted F - PCB	Custom Antenna	3.3dBi
2			Custom Antenna	5.3dBi
3	Ethertronics	Dipole	1000423	-0.6dBi
4	LSR	Rubber Whip / Dipole	001-0012	2dBi
5			080-0013	2dBi
6			080-0014	2dBi
7		PIFA	001-0016	2.5dBi
8			001-0021	2.5dBi
9	Laird	PCB	CAF94504	2dBi
10			CAF9405	2dBi
11	Pulse	Ceramic Chip	W3006	3.2dBi
12	ACX	Multilayer Chip	AT3216-BR2R7HAA	0.5dBi
13			AT312-T2R4PAA	1.5dBi
14	TDK	Multilayer Ceramic Chip Antenna	ANT016008LCD2442MA1	1.6dBi
15			ANT016008LCD2442MA2	2.5dBi
16	Mitsubishi Material	Chip Antenna	AM03DP-ST01	1.6dBi
17		Antenna Unit	UB18CP-100ST01	-1.0dBi
18	Taiyo Yuden	Chip Antenna / Helical Monopole	AF216M245001	1.5dBi
19		Chip Antenna /Monopole Type	AH212M245001	1.3dBi
20			AH316M245001	1.9dBi
21	Antenna Technology	Dipole	AA2402SPU	2.0dBi
22			AA2402RSPU	2.0dBi
23			AA2402A-UFLLP	2.0dBi
24			AA2402AU-UFLLP	2.0dBi
25	Staf	Mono-pole	1019-016	2.14dBi
26			1019-017	2.14dBi
27			1019-018	2.14dBi
28			1019-019	2.14dBi

	Brand	Antenna type	Model	2.4 GHz Gain
29	Map Electronics	Rubber Whip	MEIWX-2411SAXX-2400	2.0dBi
30			MEIWX-2411RSXX-2400	2.0dBi
31			MEIWX-1511RSXX-2400	5.0dBi
32			MEIWX-151XSAXX-2400	5.0dBi
33			MEIWX-1451RSXX-2400	4.0dBi
34			MEIWX-282XSAXX-2400	2.0dBi
35			MEIWX-282XRSXX-2400	2.0dBi
36			MEIWF-HP01RS2X-2400	2.0dBi
37	Yageo	Chip	ANT3216A063R2400A	1.69dBi
38	Mag Layers Scientific	Chip	LTA-3216-2G4S3-A1	1dBi
39			LTA-3216-2G4S3-A3	2dBi
40	Advantech	Rubber Whip / Dipole	AN2450-5706RS	2.38dBi
41			AN2450-5010BRS	5.03dBi
42			AN2450-92K01BRS	5.03dBi
43			R-AN2400-5701RS	3.3dBi

Remark:

1. The EUT uses the PCB antenna from Texas Instruments (Antenna #1)
2. 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. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	**Sporton Site No.**
	CO05-HY, 03CH07-HY

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

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 (TAF Code: 3786)
Remark	The Conducted test item subcontracted to Sporton International Inc. Wensan Laboratory

FCC designation No.: TW1190 and 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: conduction emission (150 kHz to 30 MHz)radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and find X plane as worst plane.

b. AC power line Conducted Emission was tested under maximum output power.

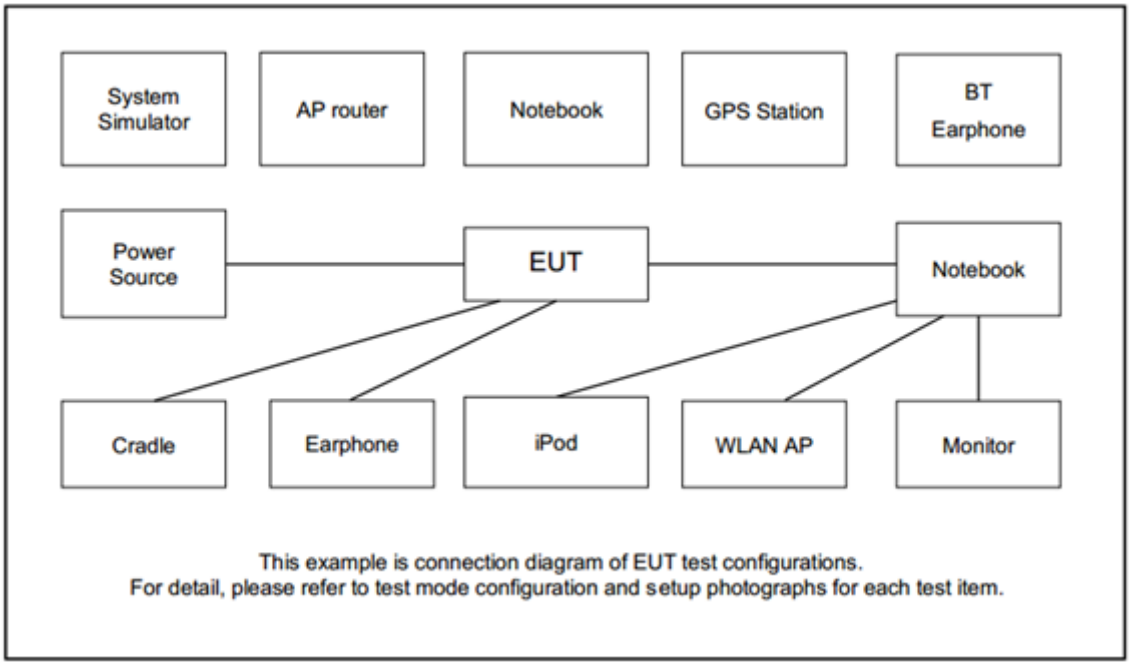
The following summary table is showing all test modes to demonstrate in compliance with the standard.

Summary table of Test Cases	
Test Item	**Data Rate / Modulation**
Conducted Test Cases	**Bluetooth – LE / GFSK**
	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps
	Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps
	Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
	Mode 4: Bluetooth Tx CH00_2402 MHz_2Mbps
	Mode 5: Bluetooth Tx CH19_2440 MHz_2Mbps
	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 CH00_2402 MHz_2Mbps
	Mode 5: Bluetooth Tx CH19_2440 MHz_2Mbps
	Mode 6: Bluetooth Tx CH39_2480 MHz_2Mbps
AC Conducted Emission	Mode 1: Bluetooth - LE TX + USB Cable (Charging from Notebook)
	Mode 2: Zigbee TX + USB Cable (Charging from Notebook)

Remark:

1. Setting 10 and Setting 5 power setting is used for conducted test items and cabinet radiated spurious emission test items for high-power PA and low-power PA respectively.
2. The max allowable power setting is limited according to max antenna gain of each antenna reported in this applicaiton. Setting 10 is limited to using antenna gain 1.9 dBi, setting 9 is limited to using antenna gain 3.3 dBi, setting 5 is limited to using antenna gain 5.3 dBi. Hence the setting 10, 9, and 5 is choosen to test conducted spurious emission.
3. The measured power in Setting 0 is for reporting only.
4. The worst case of Conducted Emission is mode 1; only the test data of it was reported.
5. For Radiated Spurious Emission test on 18 GHz-40 GHz, only test BLE 1 Mbps which with highest output power and power spectral density(worst-case mode).

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.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	Unshielded, 1.0m	Unshielded, 1.8m
2.	iPod	Apple	A1285	FCC DoC	Shielded, 1.0m	N/A
3.	Notebook	Dell	Latitude 3400	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
4.	Notebook	Dell	E3340	FCC DoC	Shielded, 0.3m	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m

2.5 EUT Operation Test Setup

The RF test items, utility “SmartRF Studio 7 v2.23.0” 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.

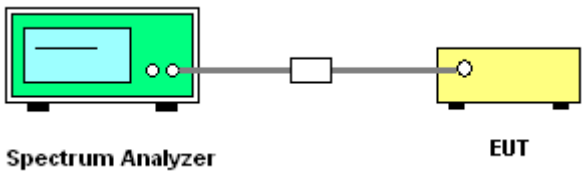
3.1.2 Measuring Instruments

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

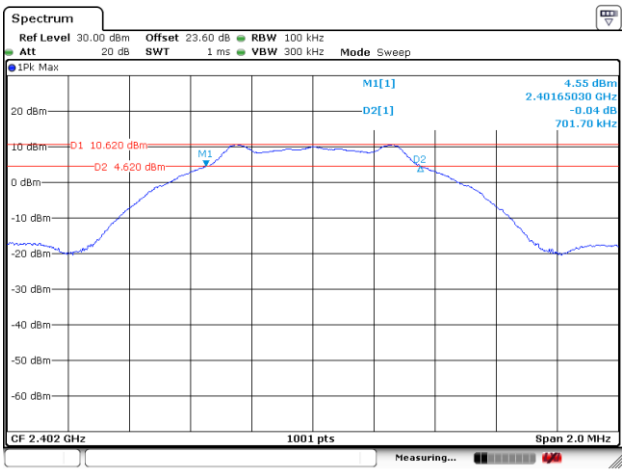
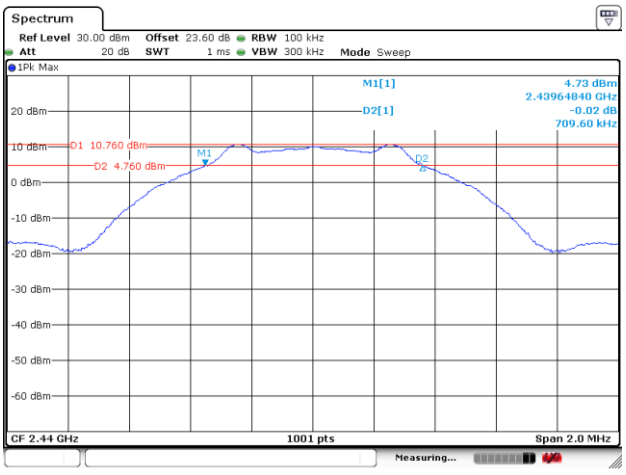


3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

<Setting 10>

<1Mbps>

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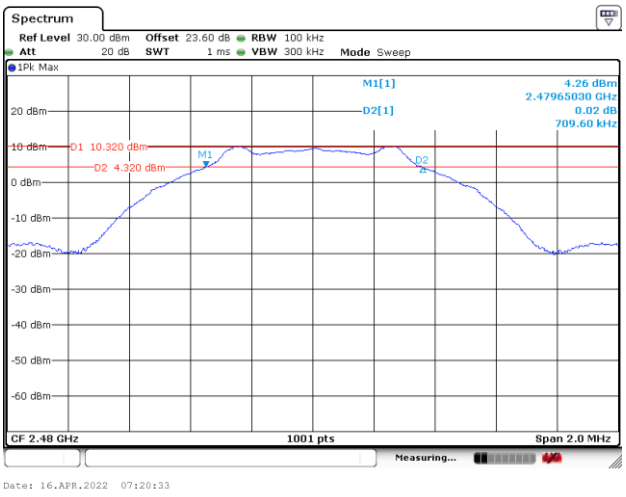	

<2Mbps>

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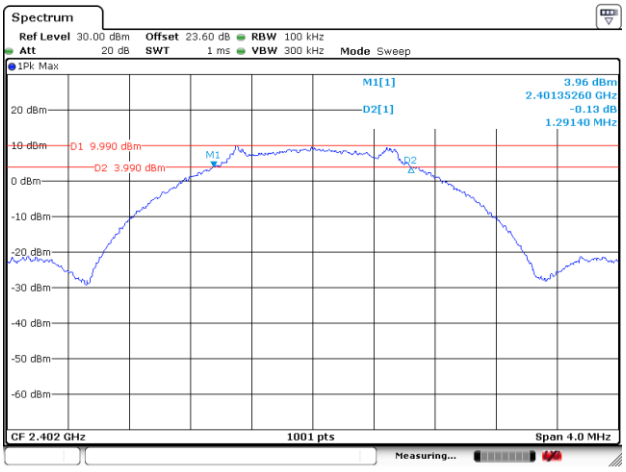	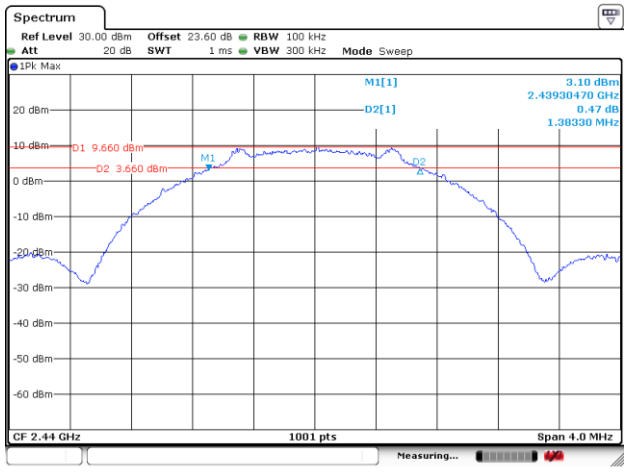
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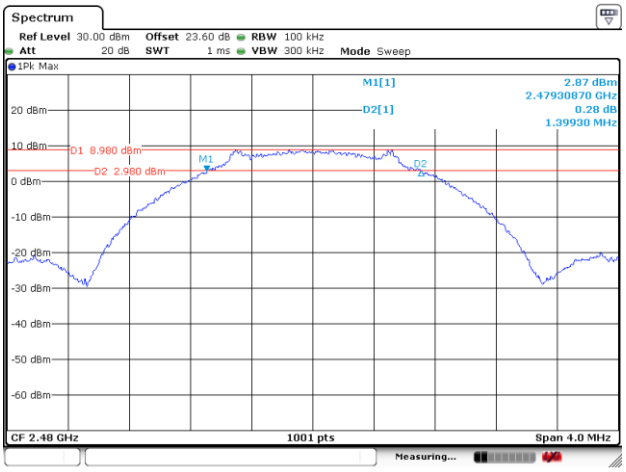
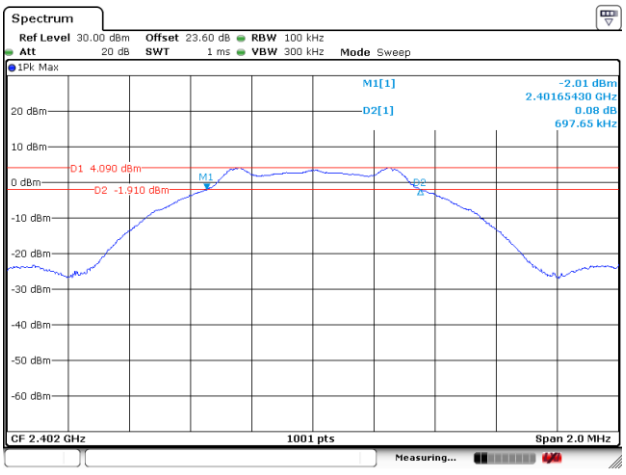
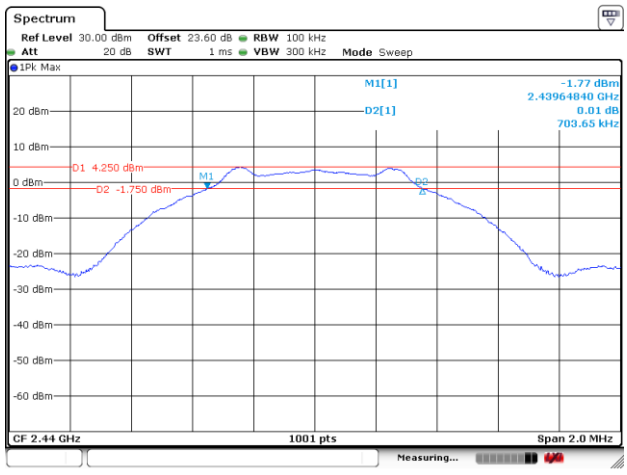
	

<Setting 5>

<1Mbps>

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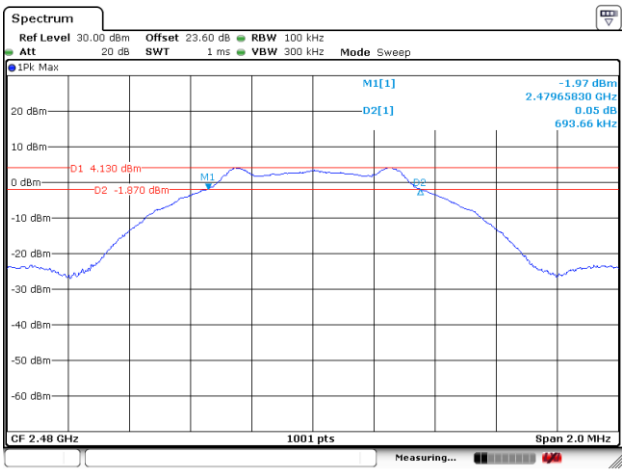
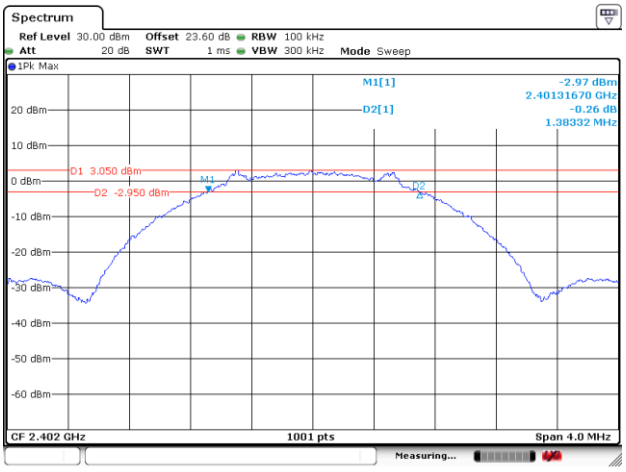
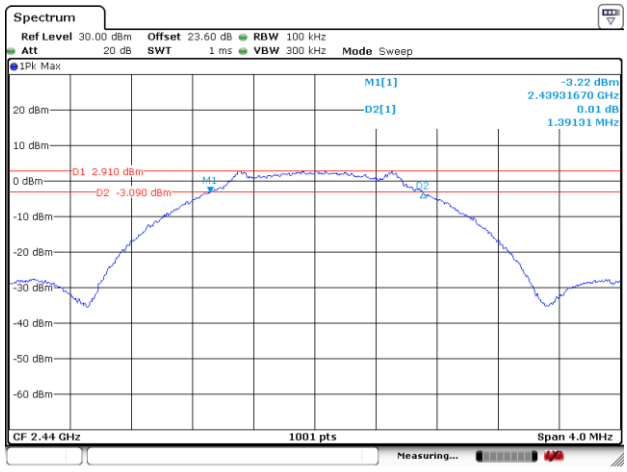
	

<2Mbps>

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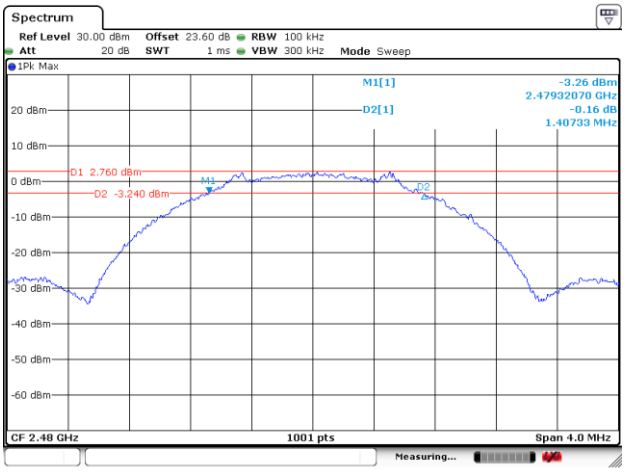
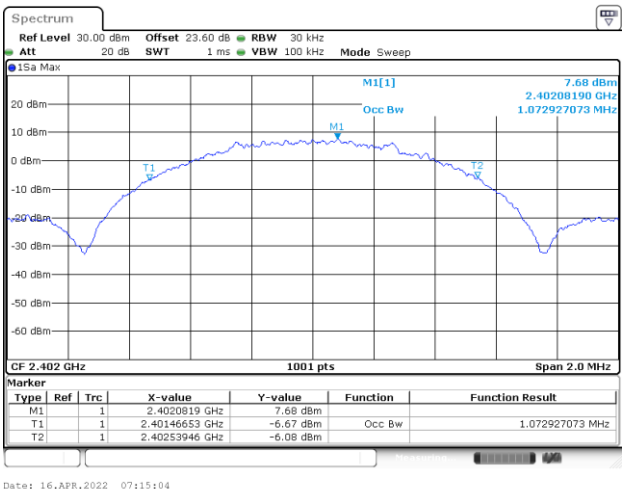
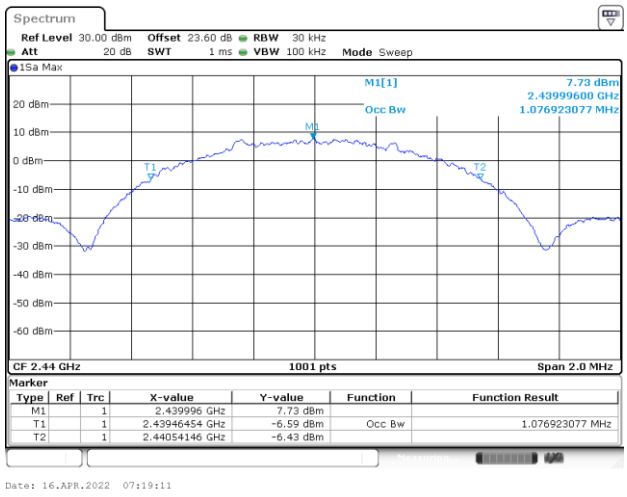
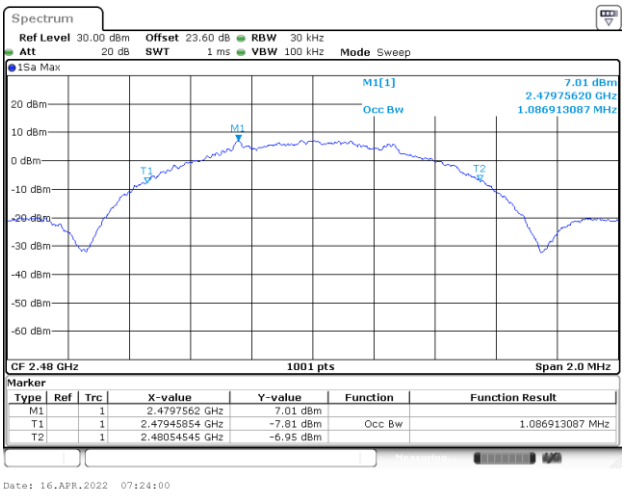
	

3.1.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

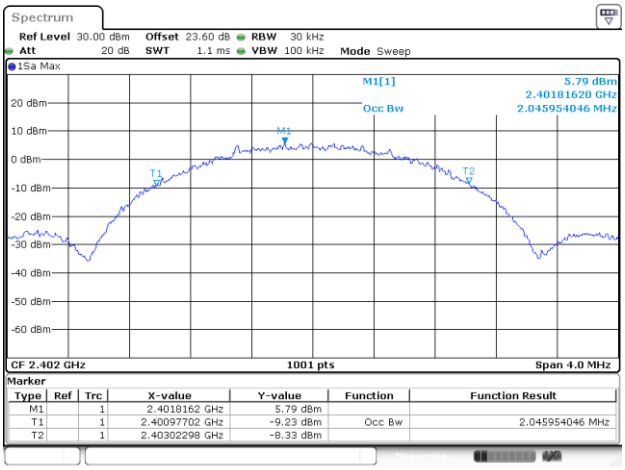
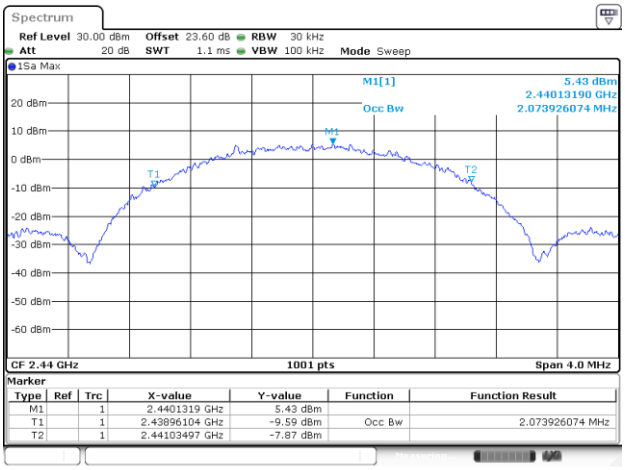
<Setting 10>

<1Mbps>

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.

<2Mbps>

99% Bandwidth Plot on Channel 00	99% Occupied Bandwidth Plot on Channel 19
	
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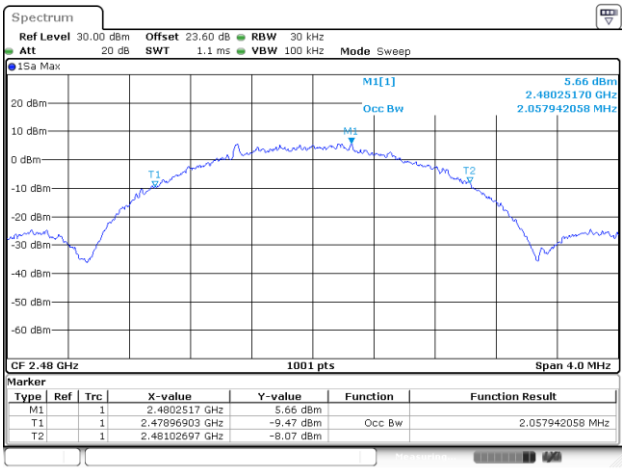
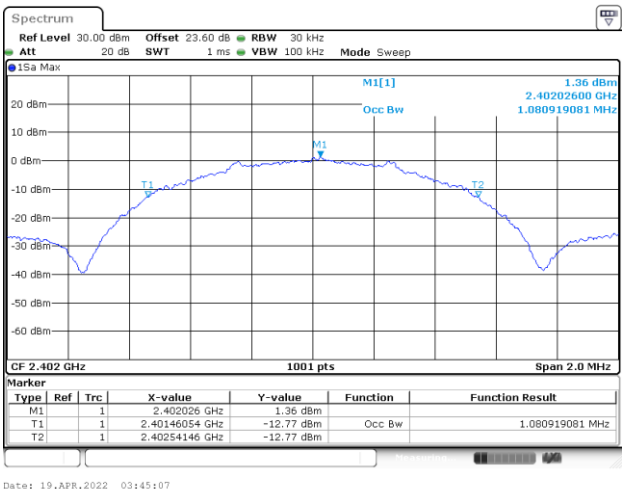
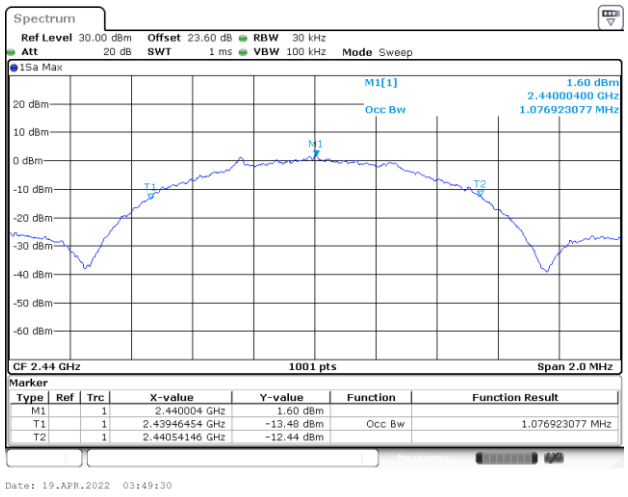
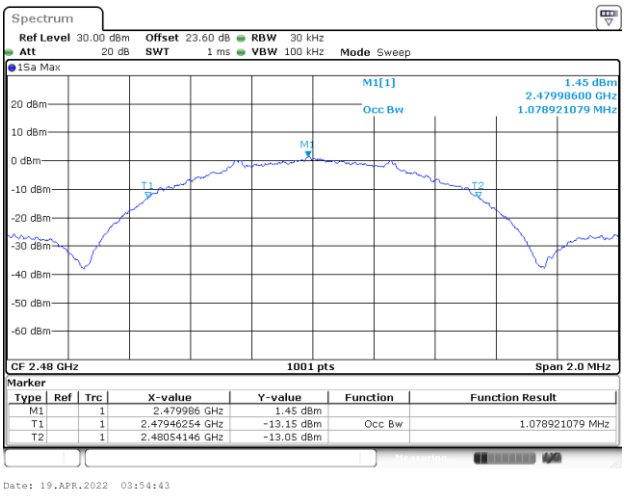
	

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

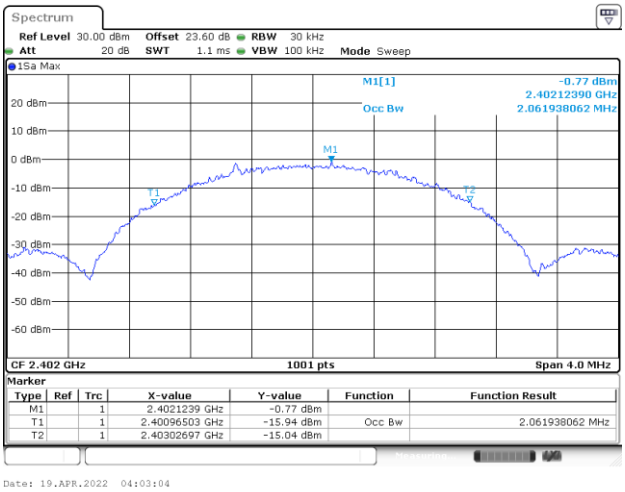
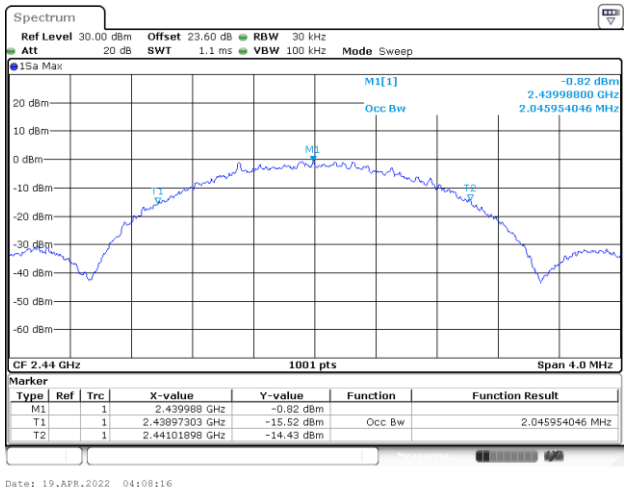
<Setting 5>

<1Mbps>

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.

<2Mbps>

99% Bandwidth Plot on Channel 00	99% Occupied Bandwidth Plot on Channel 19
	
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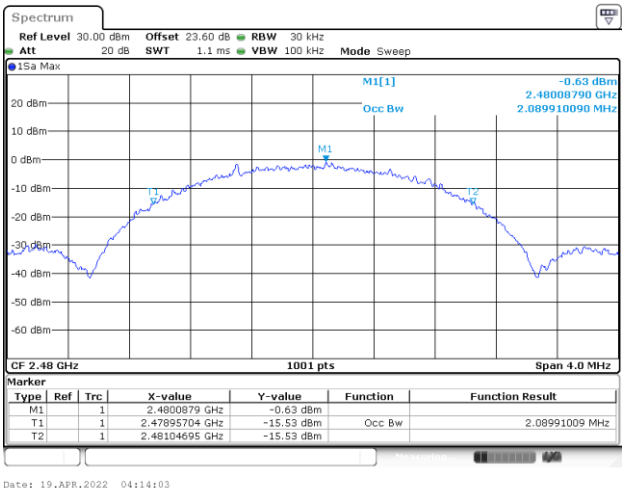
	

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

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.

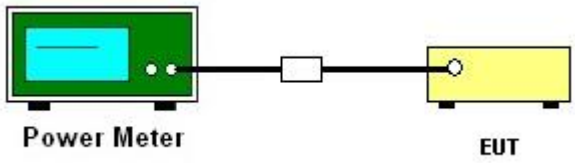
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

1. For Peak Power, the testing follows ANSI C63.10 Section 11.9.1.3 PKPM1.
2. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
3. The RF output of EUT is connected to the power meter by RF cable and attenuator.
4. The path loss is compensated to the results for each measurement.
5. Set the maximum power setting and enable the EUT to transmit continuously.
6. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Peak Output Power

Please refer to Appendix A.

3.2.6 Test Result of Average Output Power (Reporting Only)

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

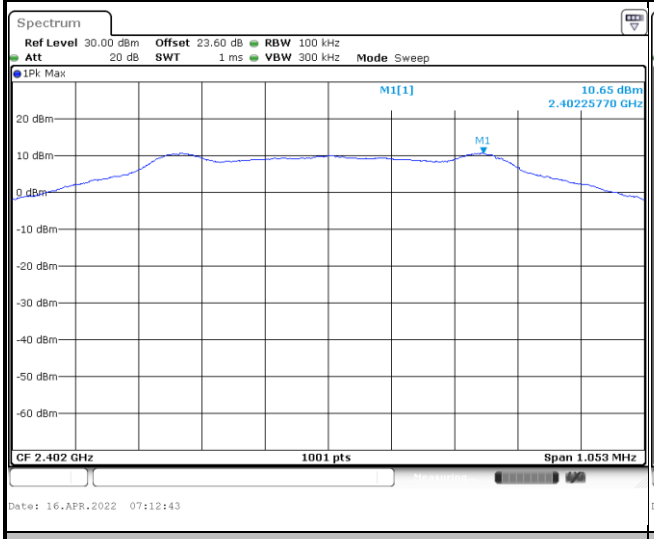
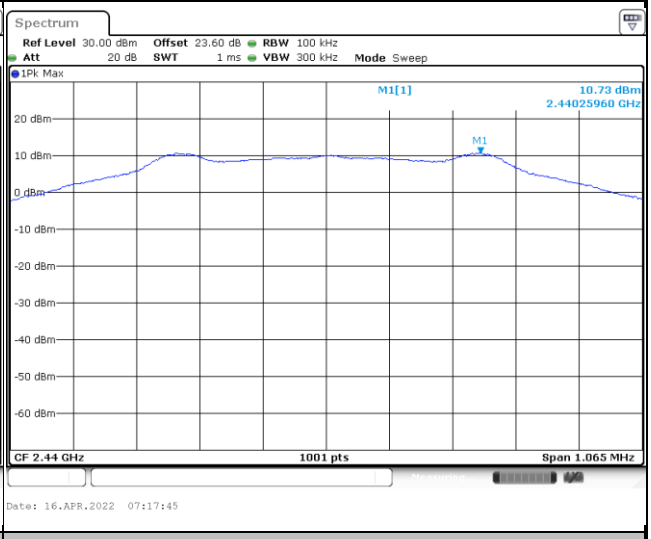
3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

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

<Setting 10>

<1Mbps>

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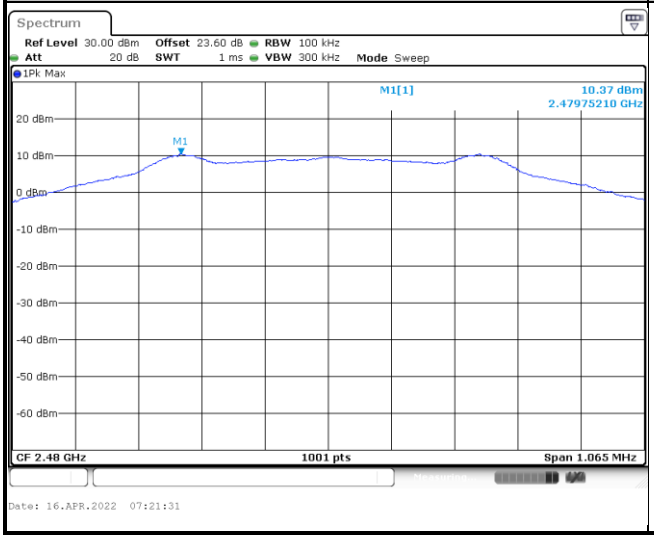	

<2Mbps>

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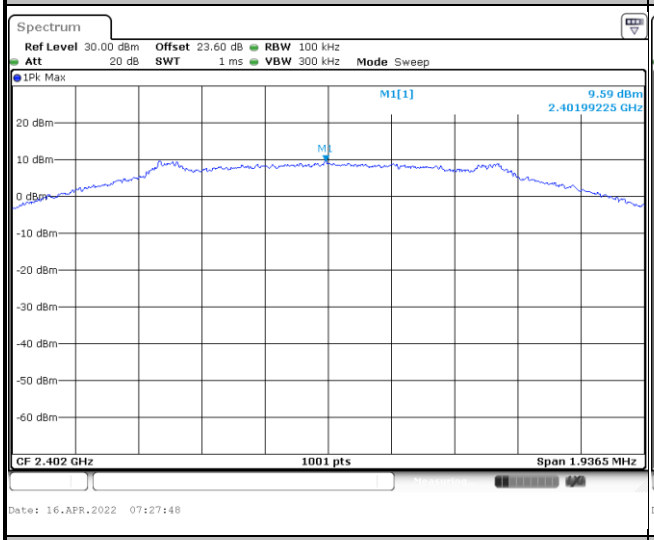	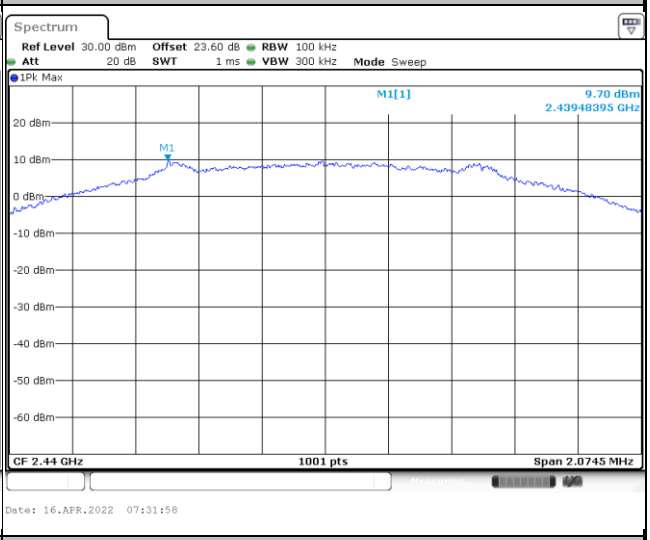
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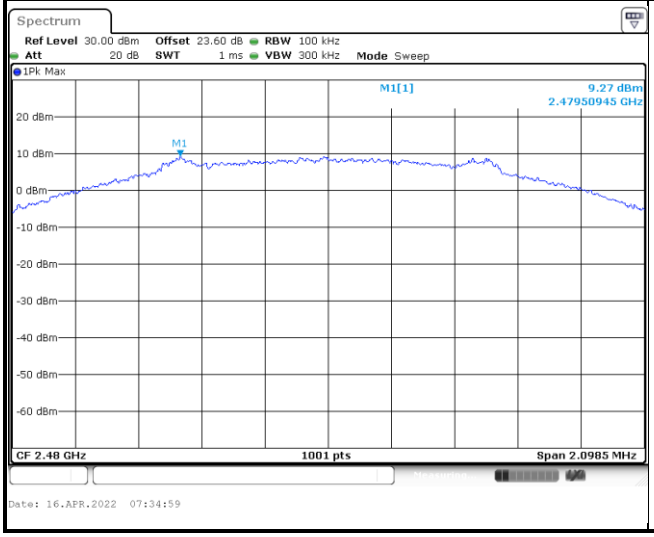	

<Setting 5>

<1Mbps>

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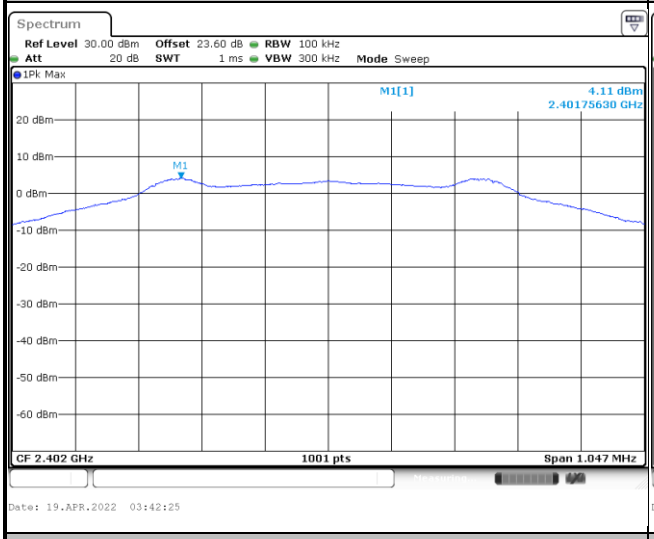	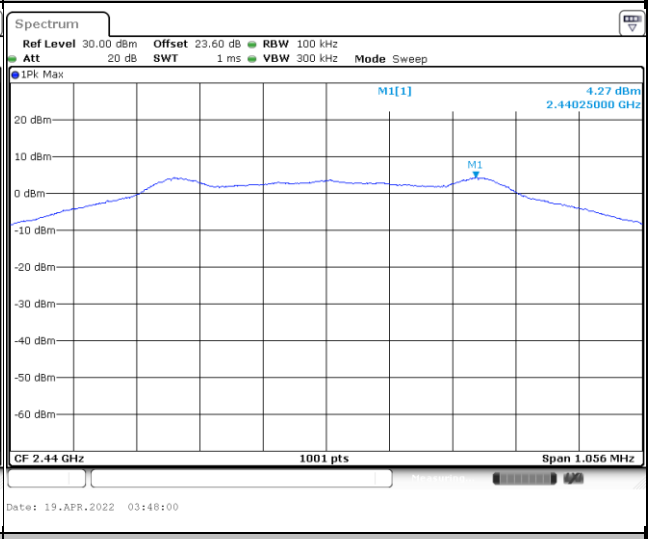
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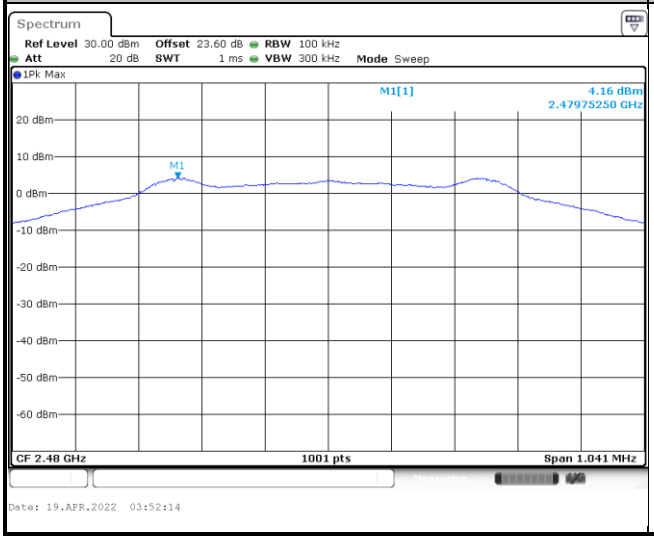	

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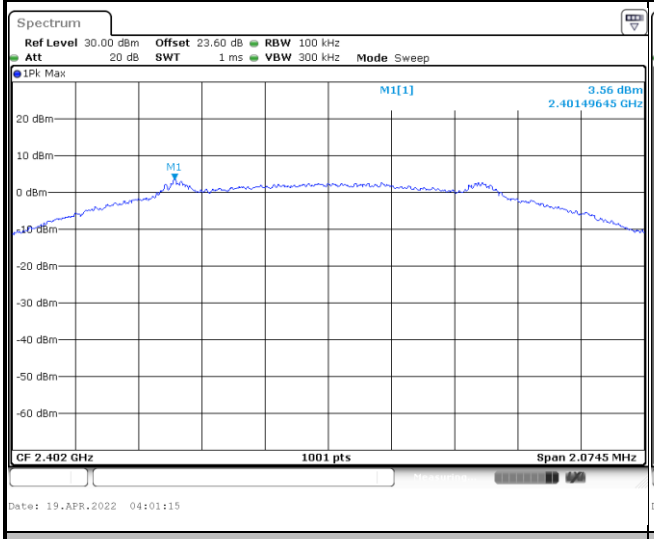
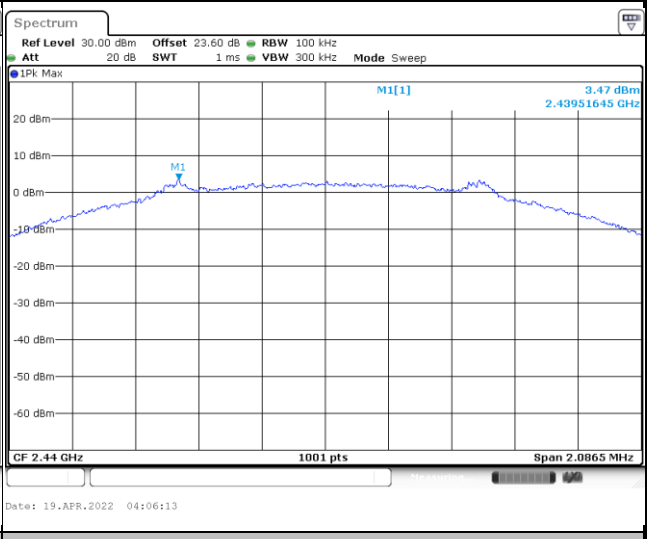
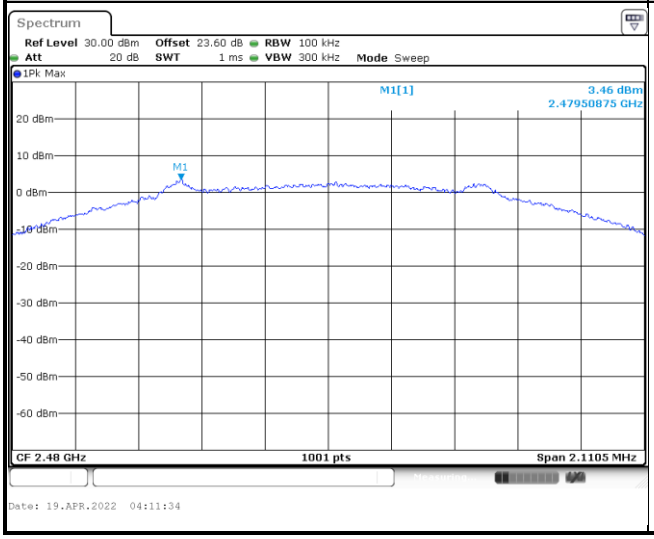
	
PSD 100kHz Plot on Channel 39	**N/A**
	

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

<Setting 10>

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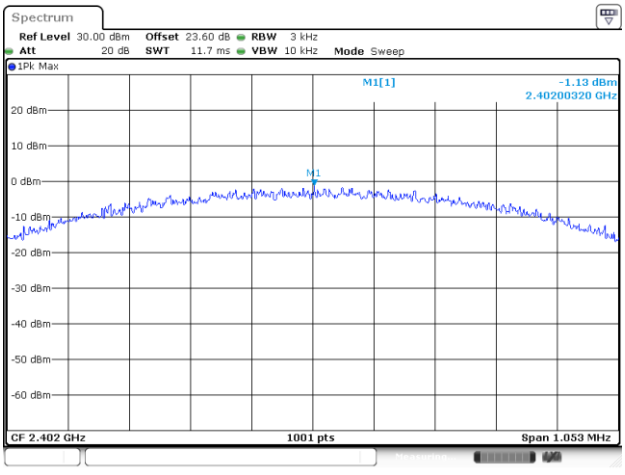	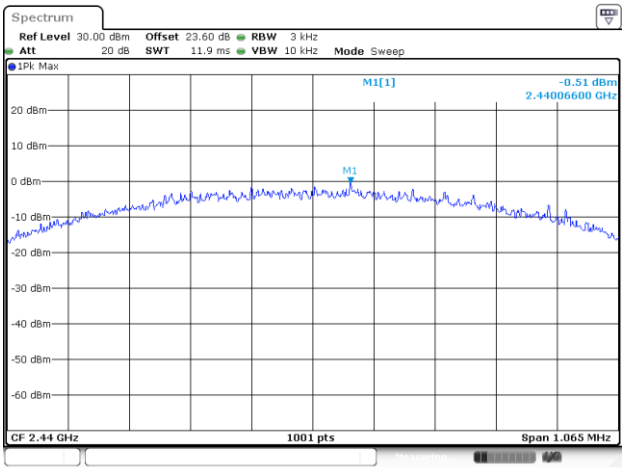
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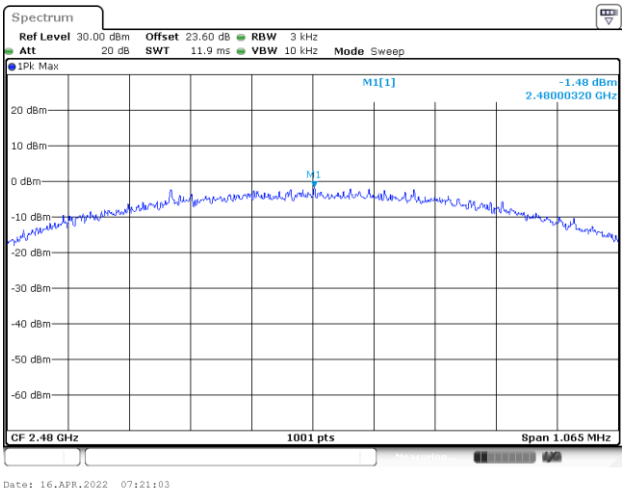	

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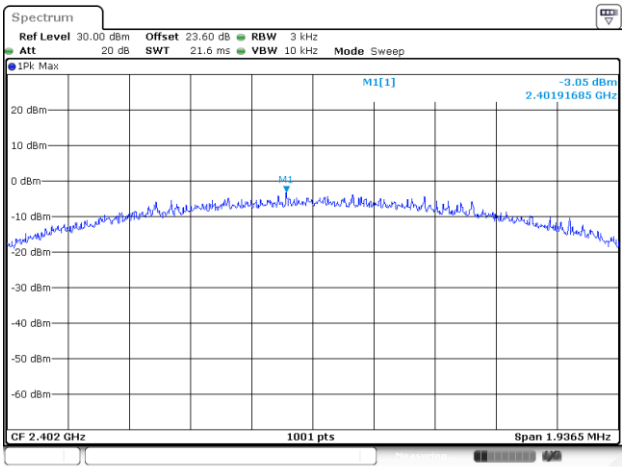
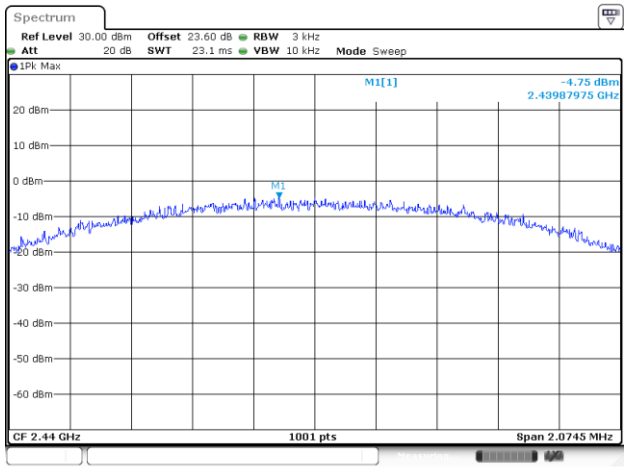
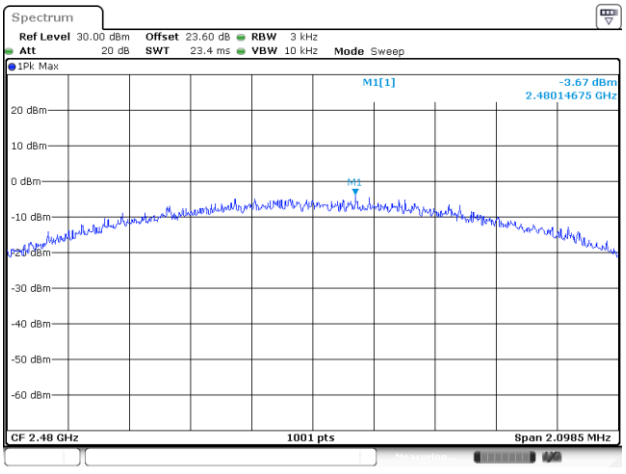
	
PSD 3kHz Plot on Channel 39	**N/A**
	

<Setting 5>

<1Mbps>

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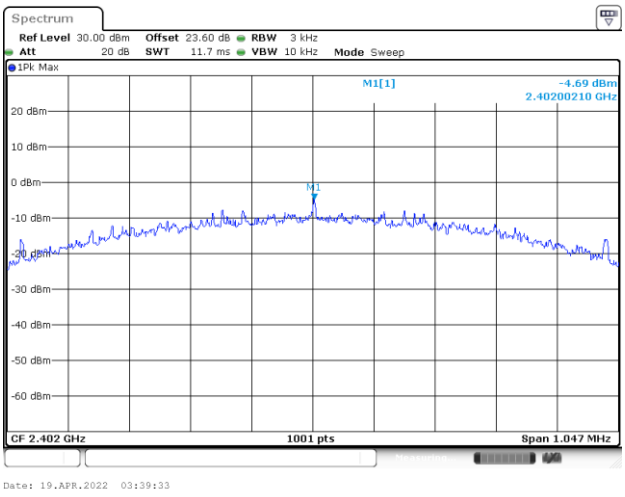	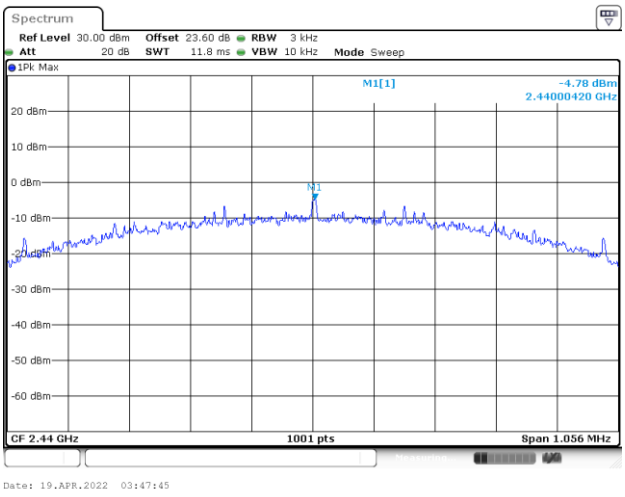
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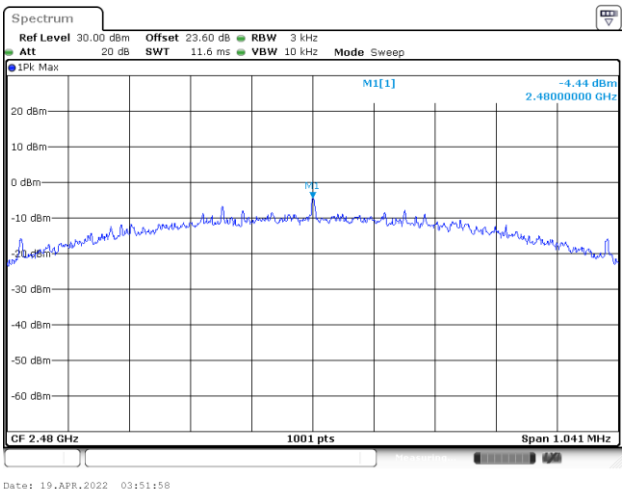	

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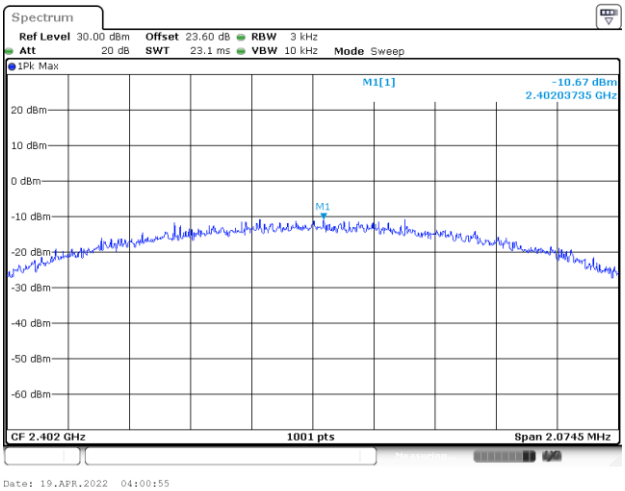
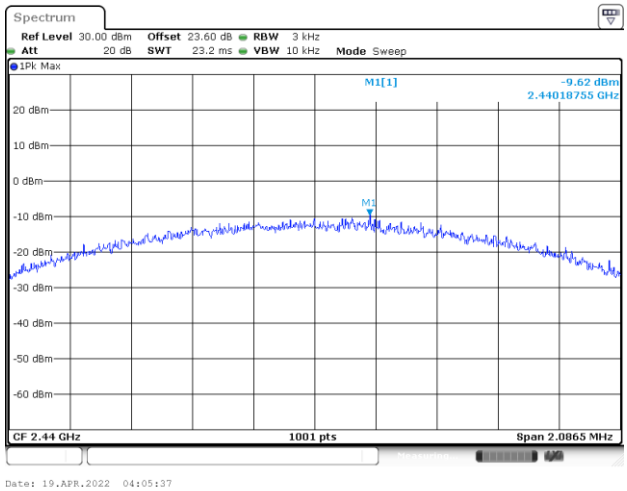
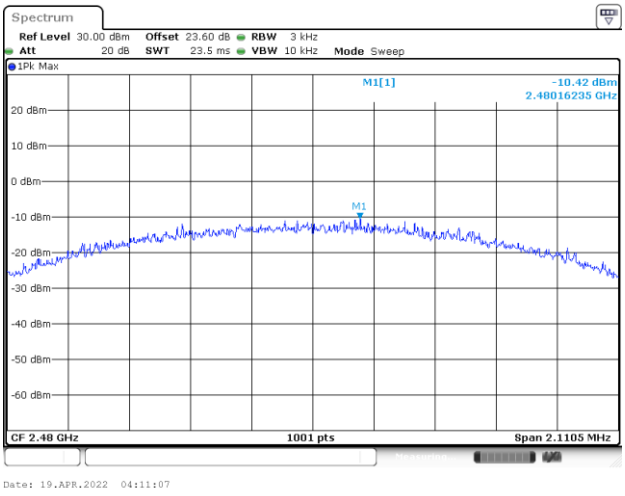
	
PSD 3kHz Plot on Channel 39	**N/A**
	

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 20 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

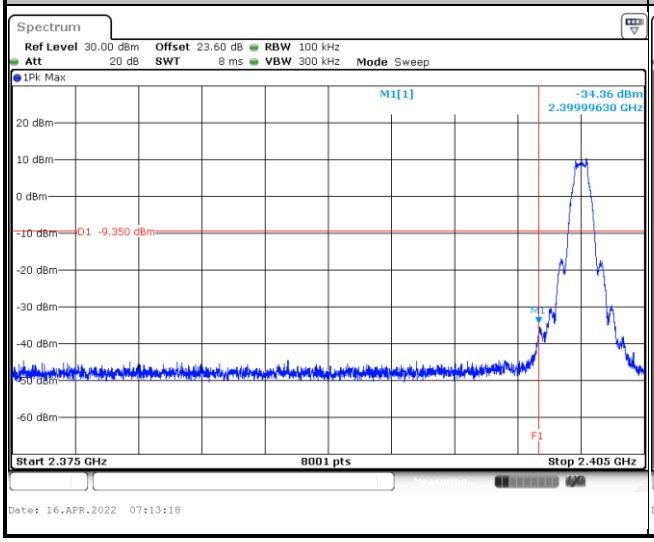
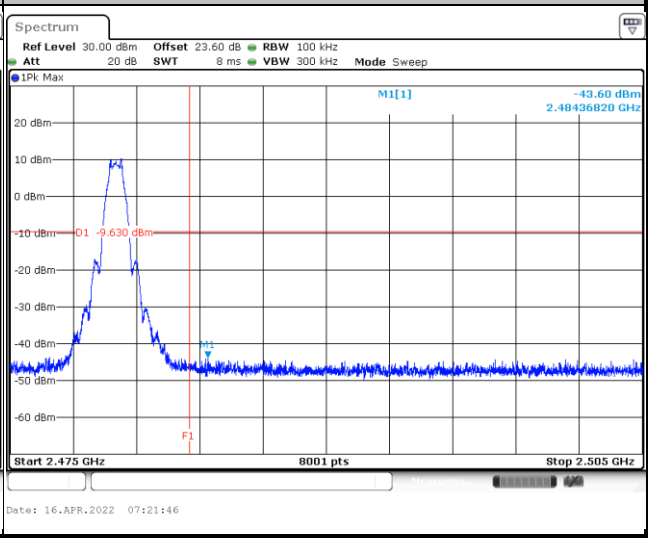
1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit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

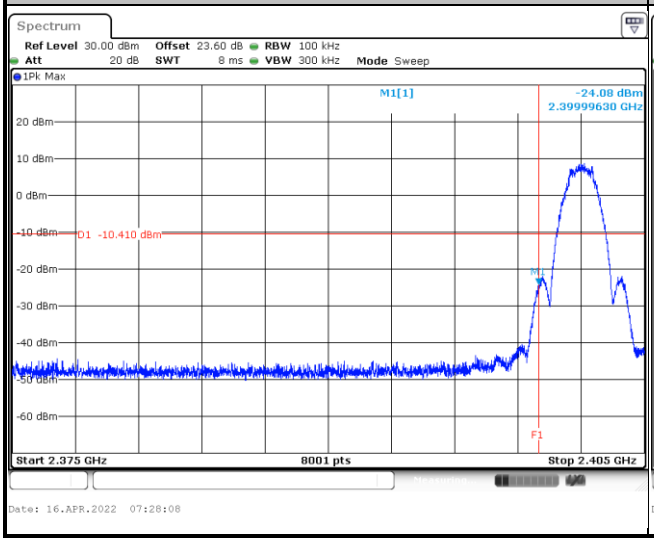
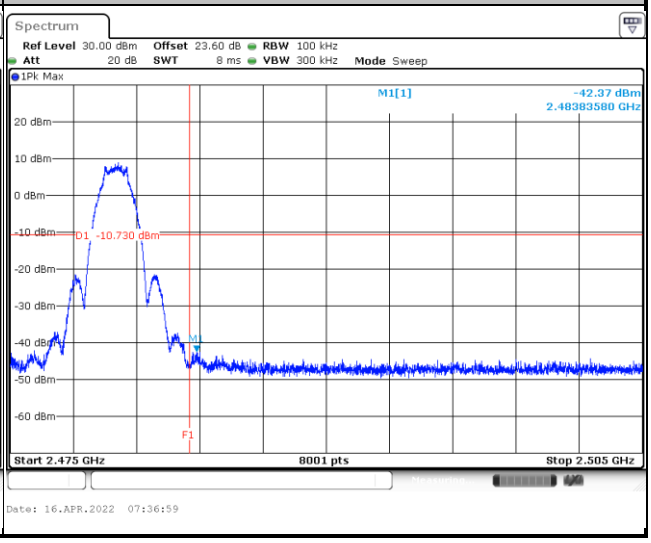
3.4.5 Test Result of Conducted Band Edges Plots

<Setting 10>

<1Mbps>

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

<2Mbps>

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

<Setting 5>

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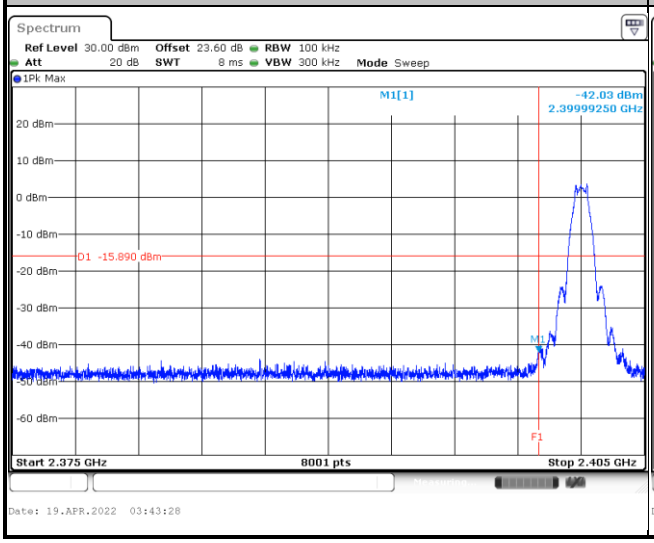
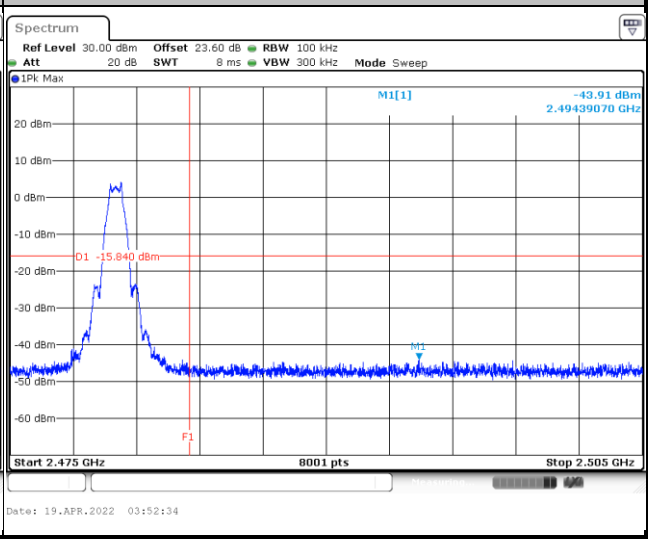
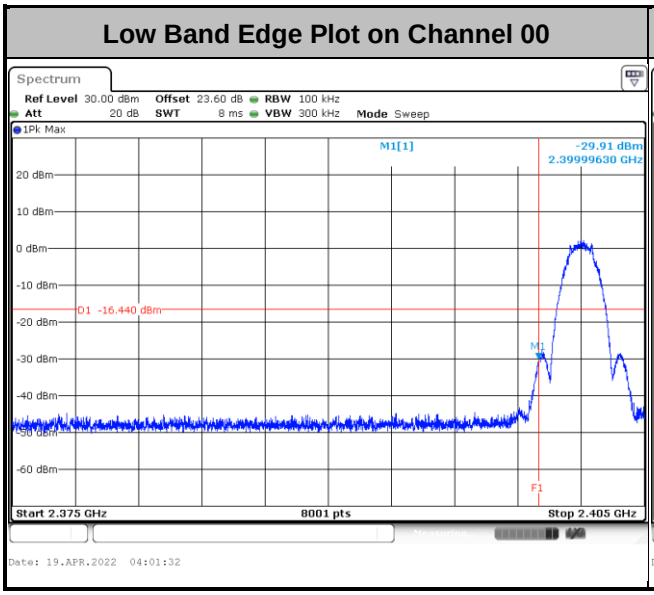
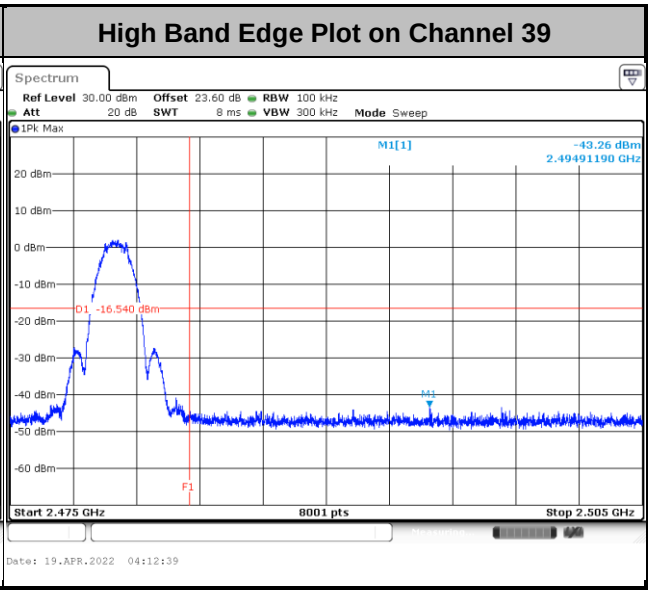
Low Band Edge Plot on Channel 00	High Band Edge Plot on Channel 39
	

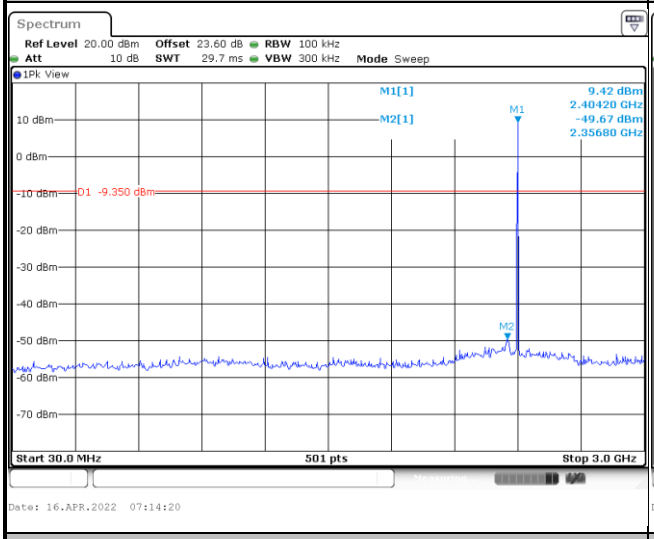
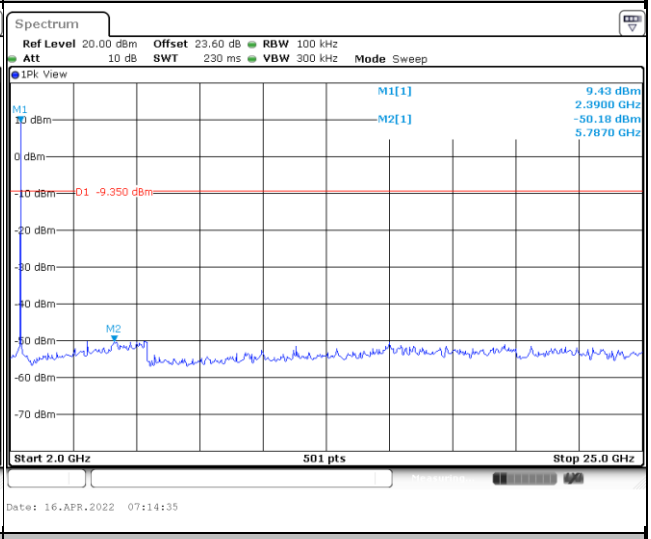
<2Mbps>

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

3.4.6 Test Result of Conducted Spurious Emission Plots

<Setting 10>

<1Mbps>

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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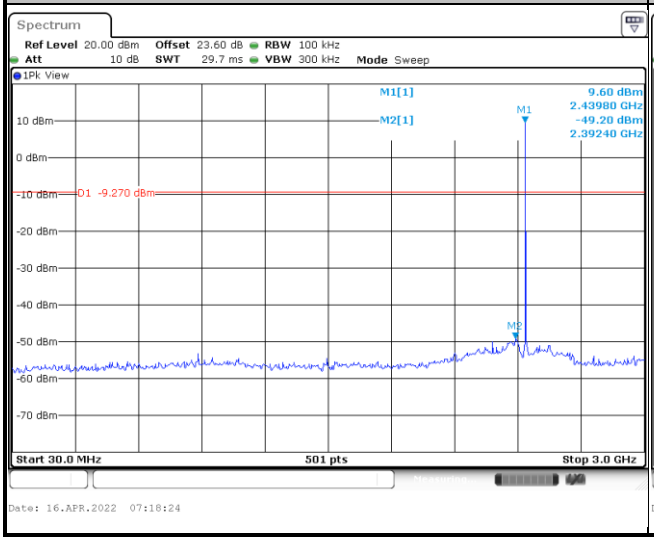
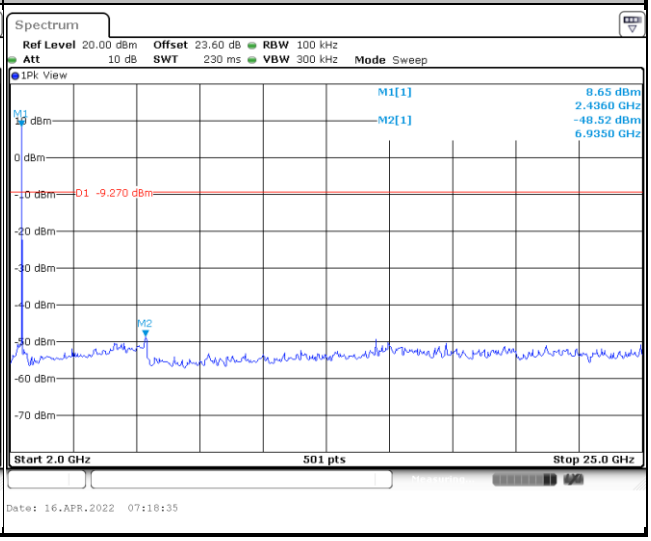
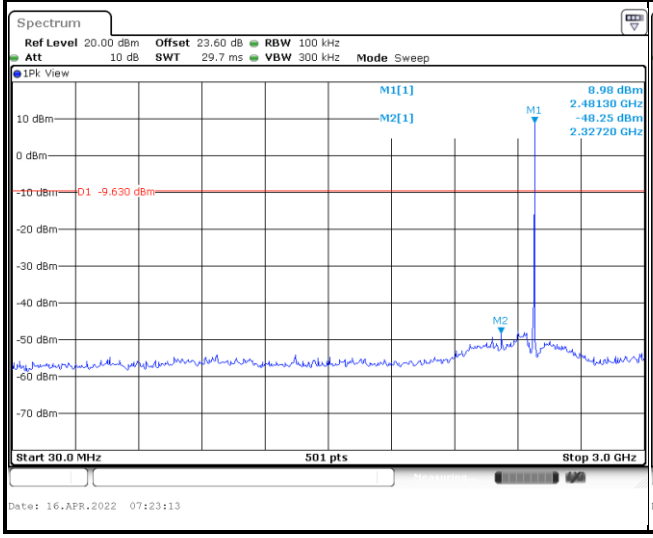
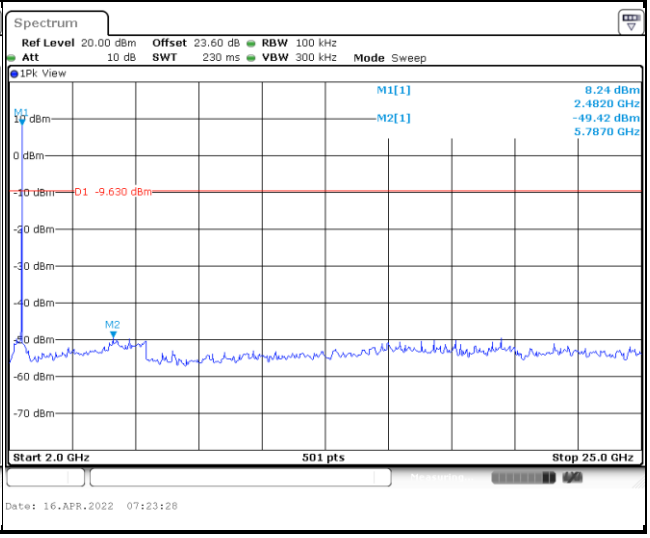
	

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39	Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39
	

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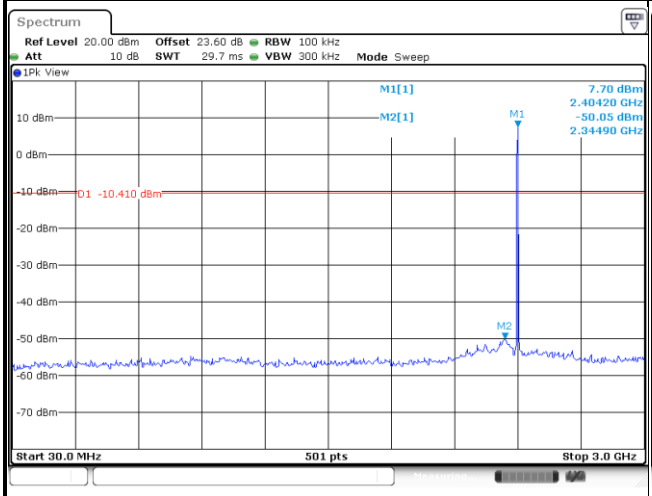	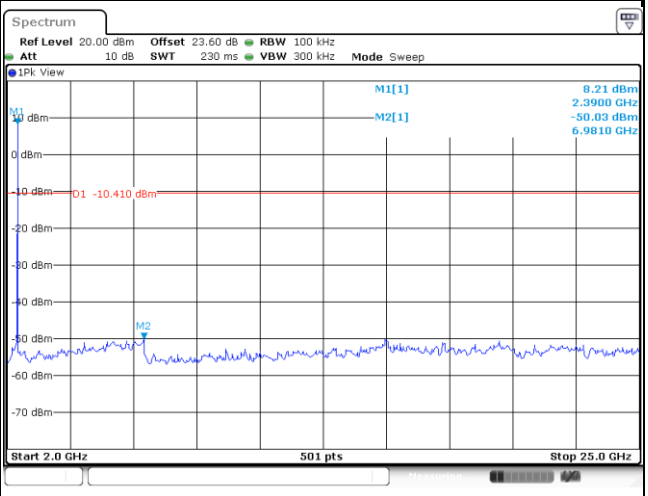
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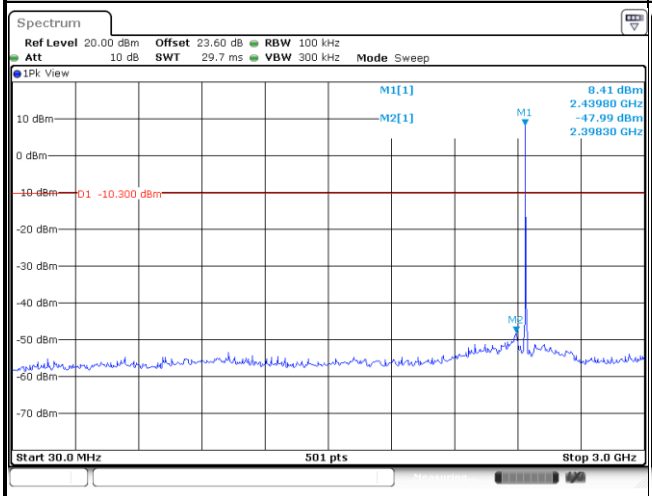
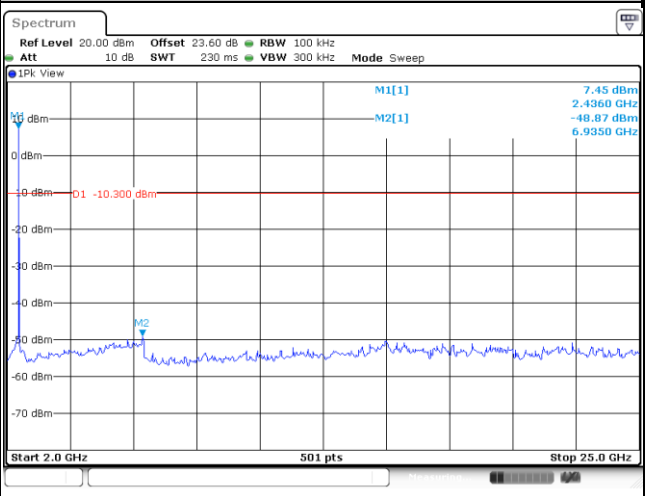
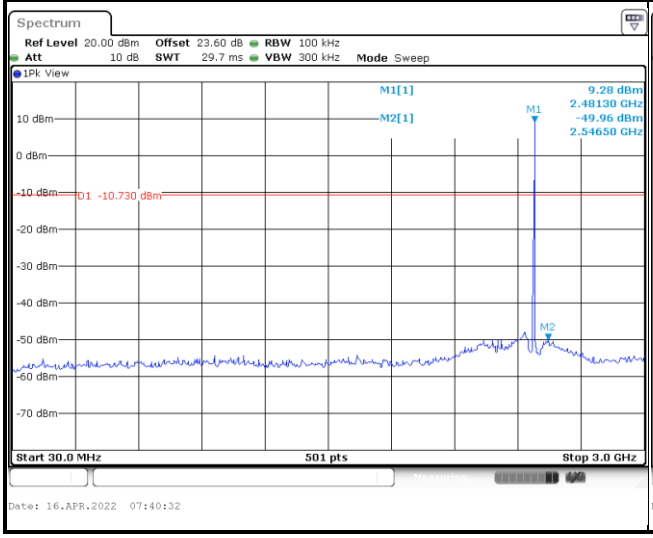
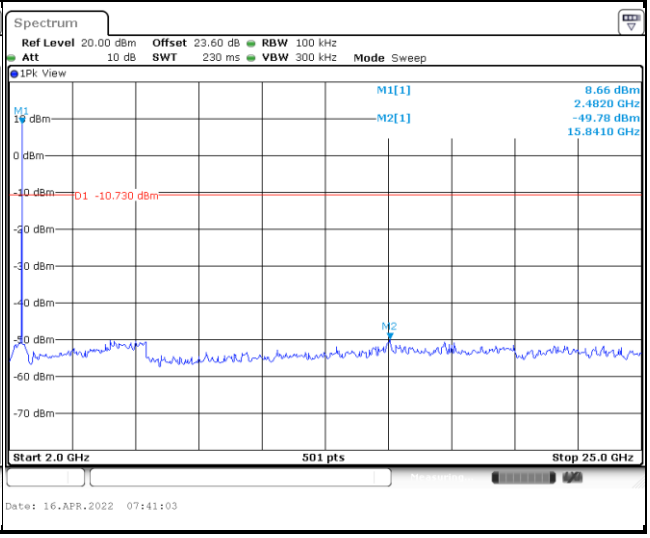
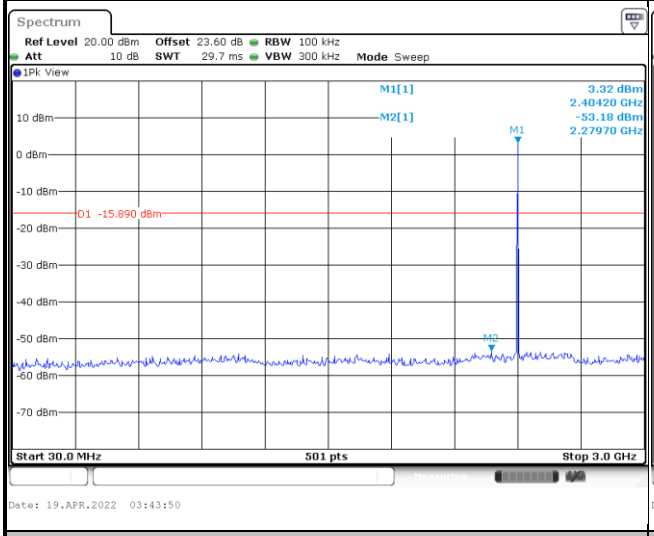
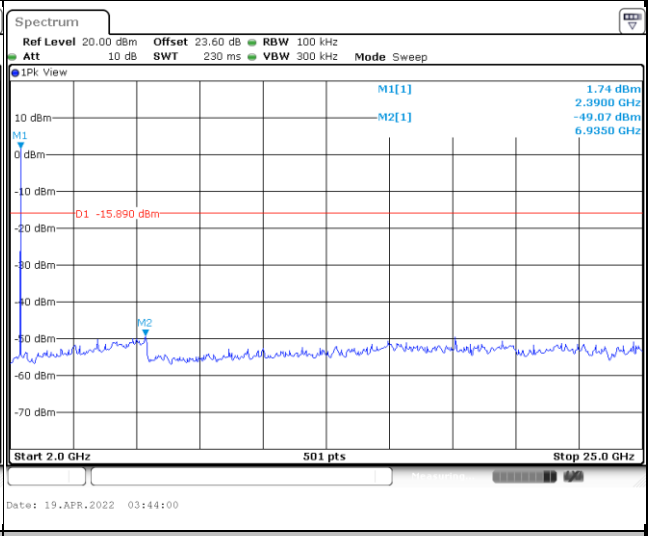
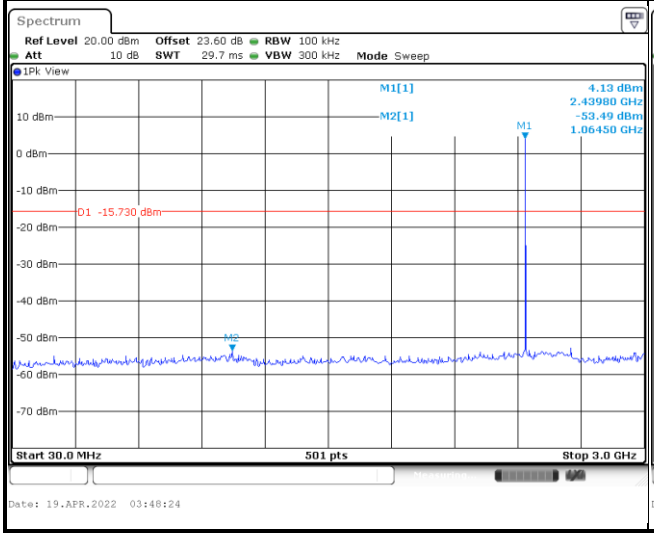
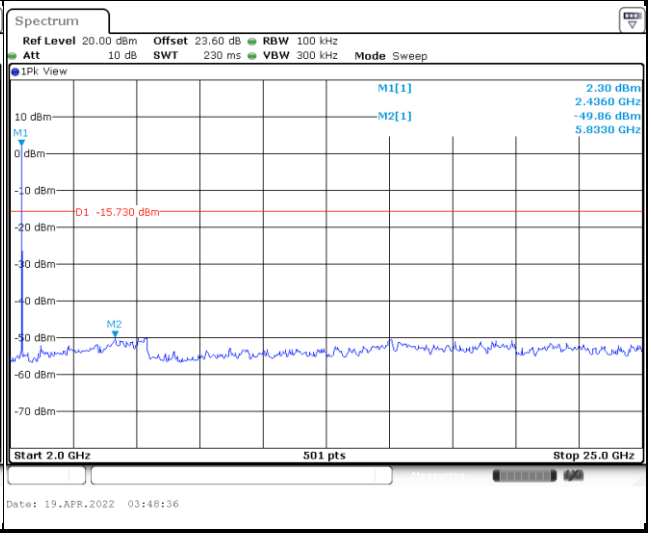
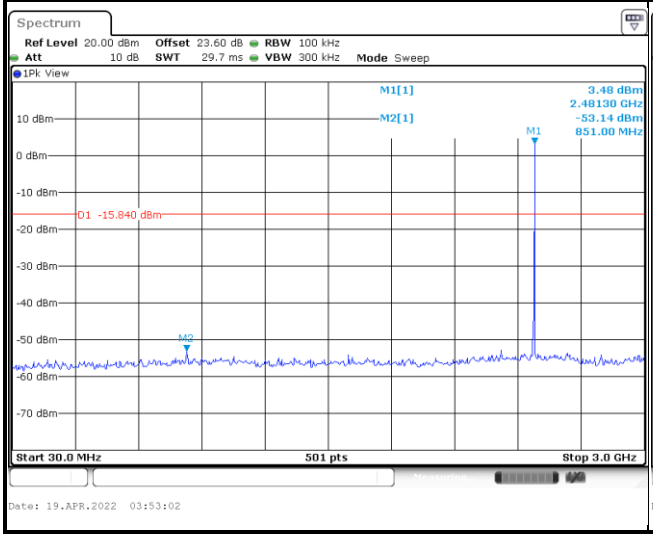
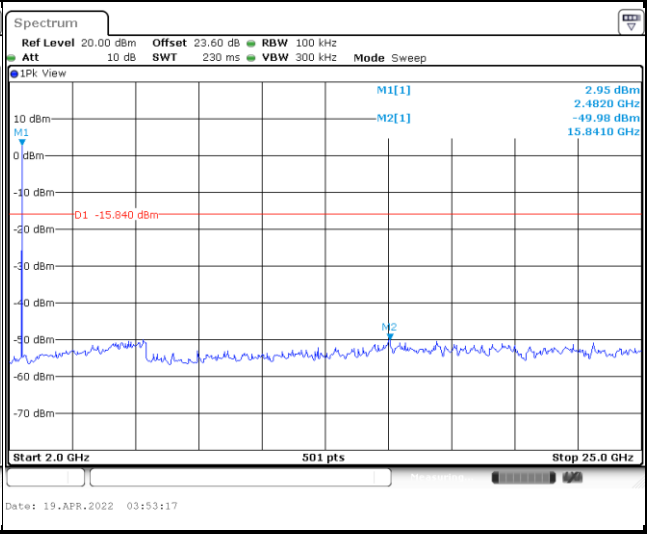
	

Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 39	Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 39
	

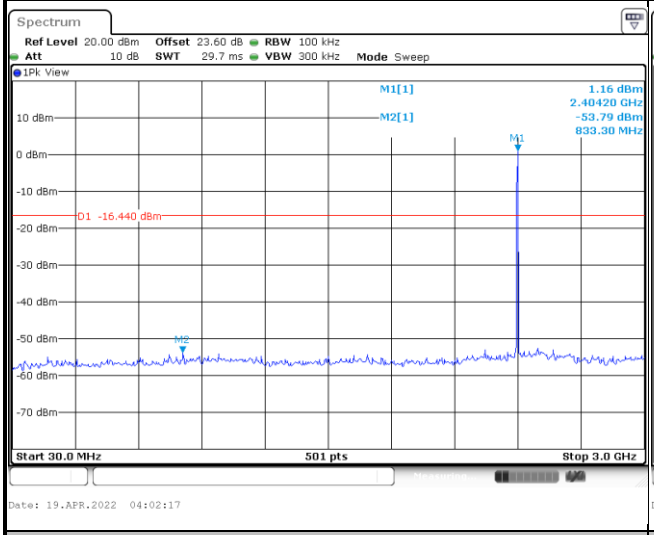
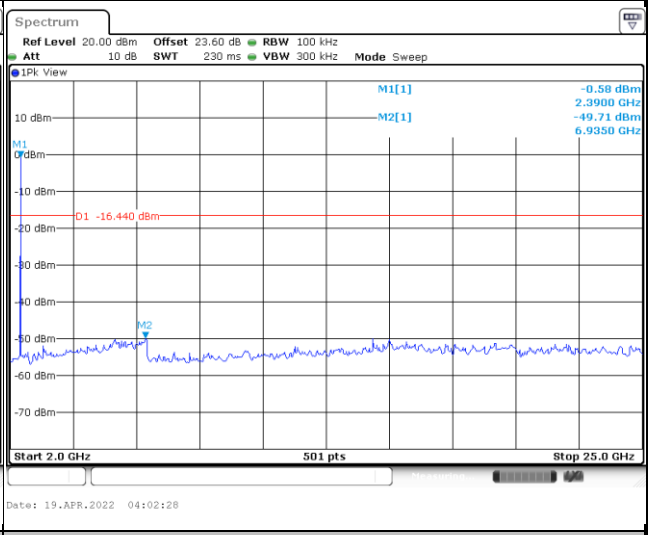
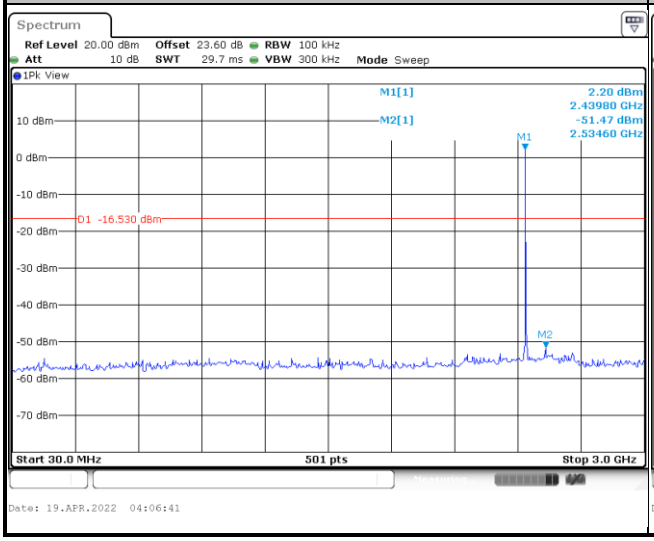
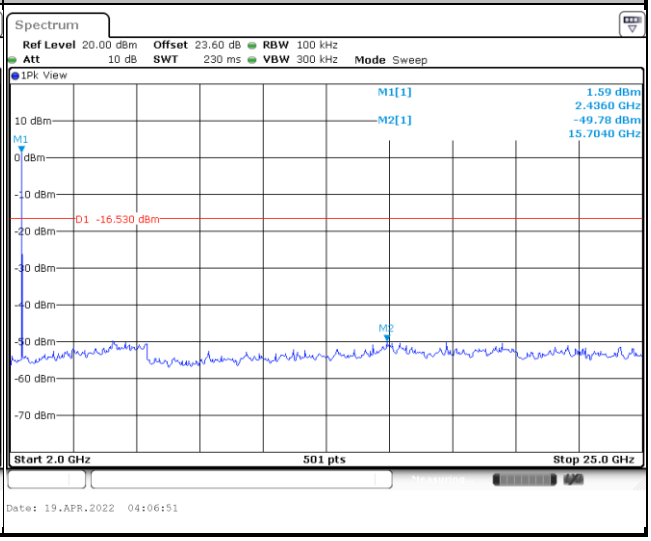
<Setting 5>

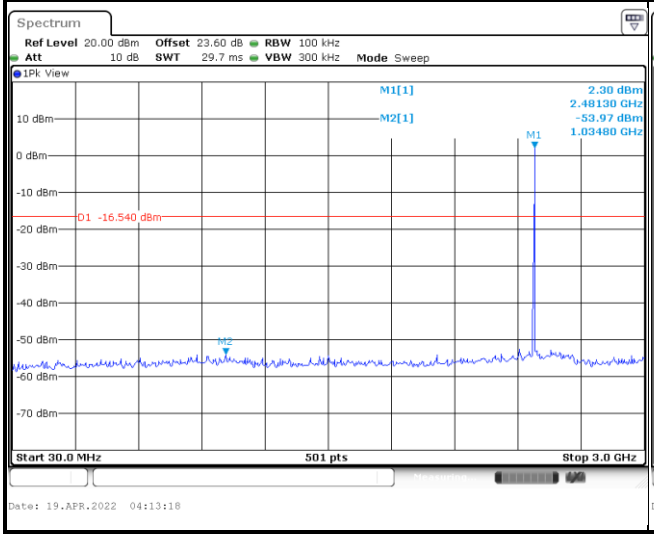
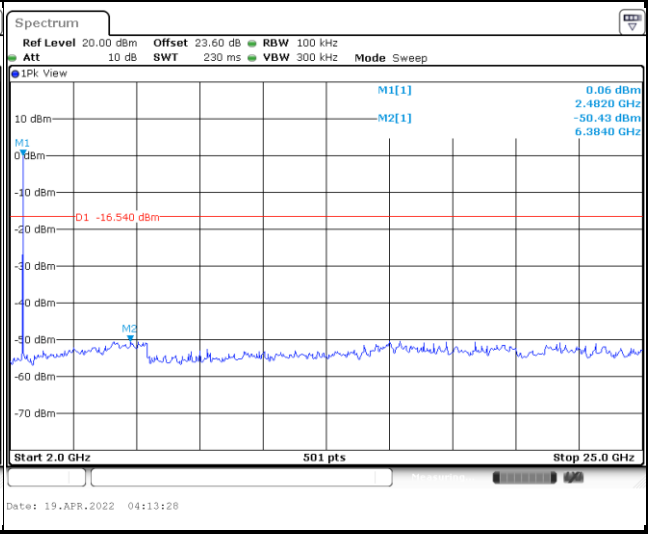
<1Mbps>

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 00	Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 00
	
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 19	**Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 19**
	

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

<2Mbps>

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

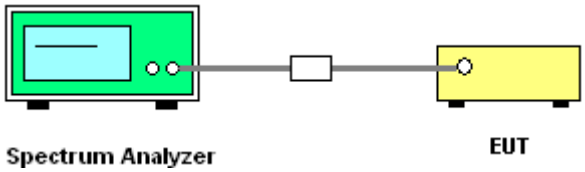
   EIRP is the equivalent isotropically radiated power in dBm

   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 “-“.

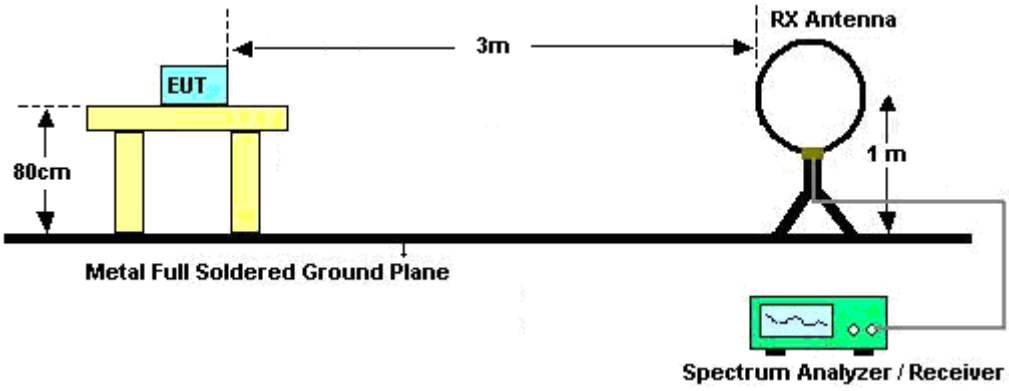
15. Use the following spectrum analyzer settings:
    (1) Span shall wide enough to fully capture the emission being measured;
    (2) Set RBW = 100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
    (3) Set RBW = 1 MHz, VBW = 3 MHz for f ≥ 1 GHz for peak measurement.
    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

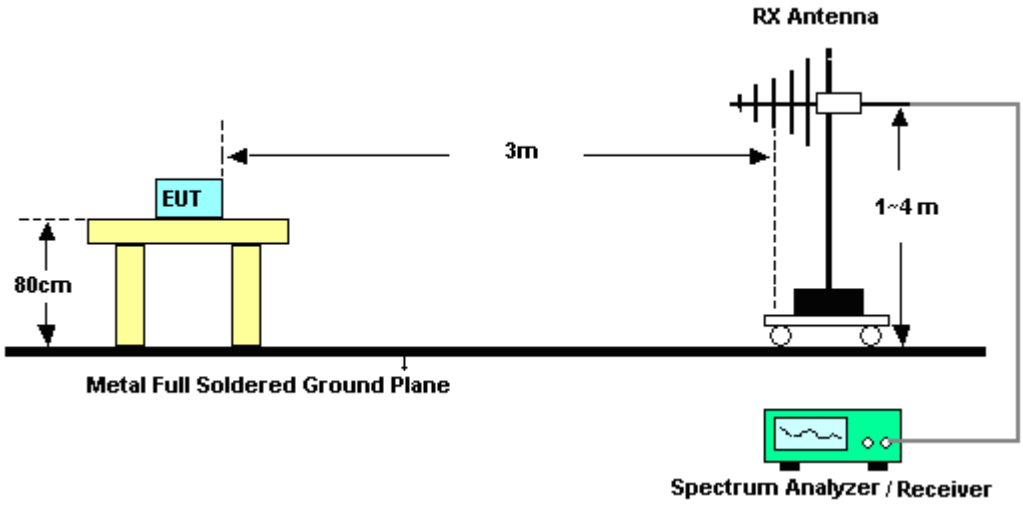
For Conducted Measurement Setup:



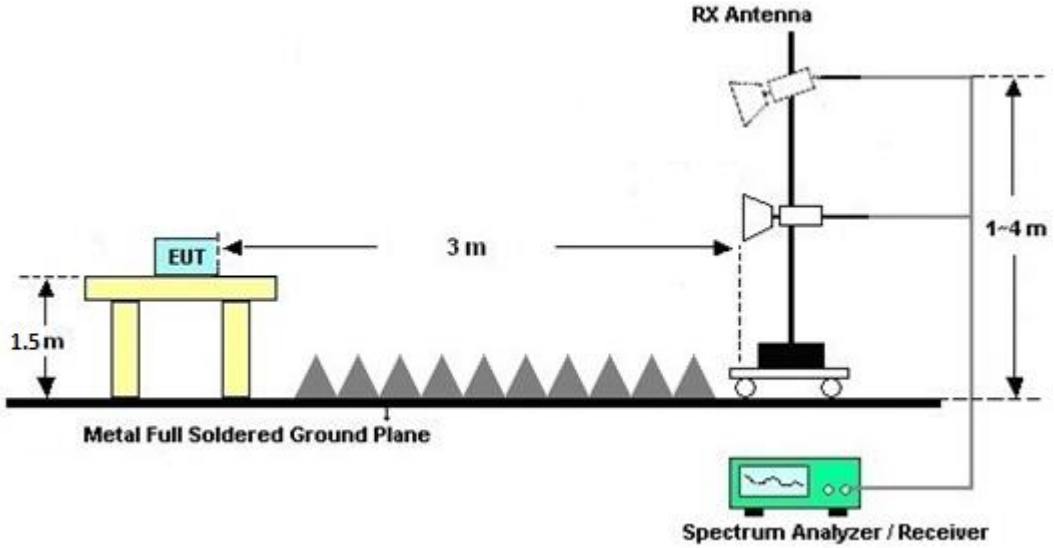
For radiated test below 30MHz



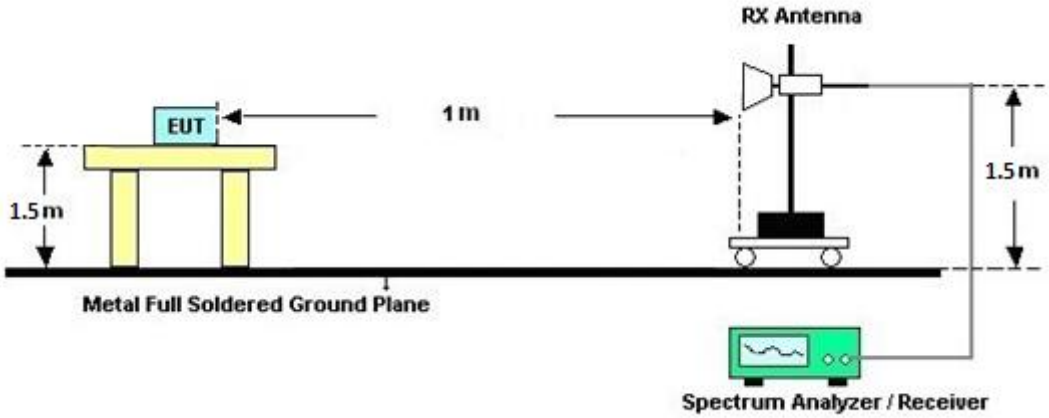
For radiated test from 30MHz to 1GHz



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 C and D.

3.5.7 Test Result of Conduced Spurious Emission in the Restricted Band

Please refer to Appendix C and D.

3.5.8 Test Result of Cabinet Radiated Spurious at Band Edges

Please refer to Appendix E and F.

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

Please refer to Appendix E and F.

3.5.10 Duty Cycle

Please refer to Appendix G.

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

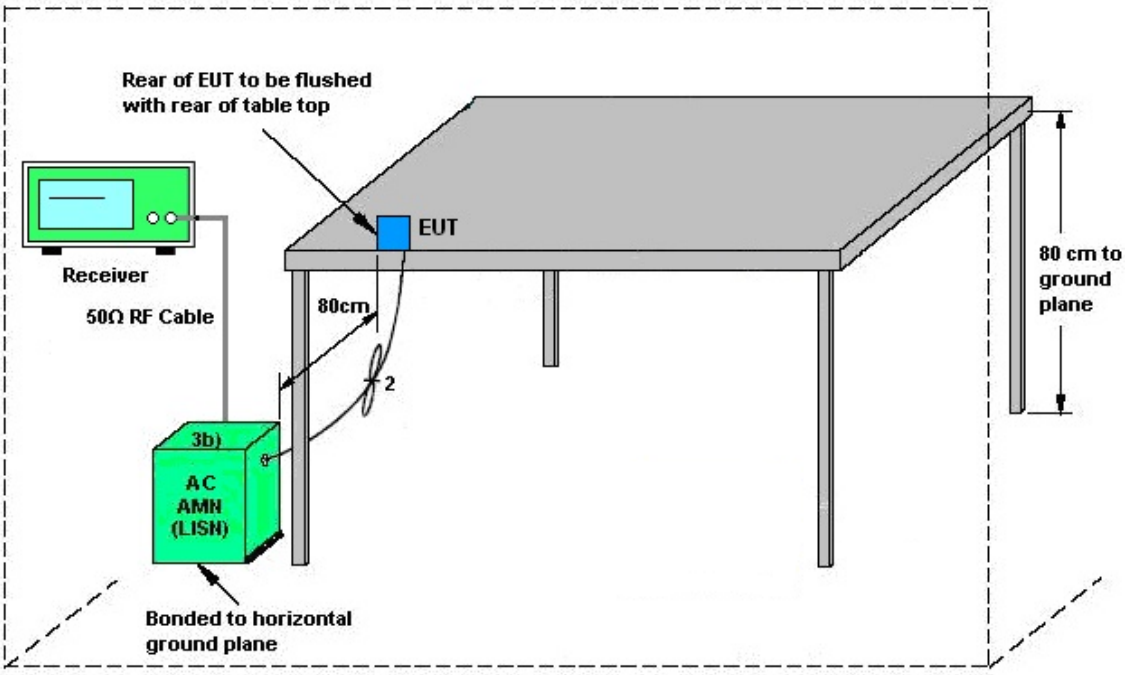
3.6.2 Measuring Instruments

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

3.6.3 Test Procedures

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

3.6.4 Test Setup



AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.7 Antenna Requirements

3.7.1 Standard Applicable

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

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

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

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Apr. 14, 2022	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Dec. 01, 2021	Apr. 14, 2022	Nov. 30, 2022	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Dec. 03, 2021	Apr. 14, 2022	Dec. 02, 2022	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Nov. 16, 2021	Apr. 14, 2022	Nov. 15, 2022	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32	N/A	N/A	N/A	Apr. 14, 2022	N/A	Conduction (CO05-HY)
Pulse Limiter	SCHWARZBECK	VTSD 9561-F N	00691	N/A	Jul. 28, 2021	Apr. 14, 2022	Jul. 27, 2022	Conduction (CO05-HY)
LISN Cable	MVE	RG-400	260260	N/A	Dec. 30, 2021	Apr. 14, 2022	Dec. 29, 2022	Conduction (CO05-HY)
Spectrum Analyzer	ROHDE & SCHWARZ	FSV40	101565	10Hz~40GHz	Dec. 29, 2021	Apr. 25, 2022~ May 11, 2022	Dec. 28, 2022	CSE (TH05-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	9kHz~30MHz	Mar. 10, 2022	Apr. 25, 2022~ May 11, 2022	Mar. 09, 2023	CSE (TH05-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0058/126E	30MHz~18GHz	Dec. 10, 2021	Apr. 25, 2022~ May 11, 2022	Dec. 09, 2022	CSE (TH05-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz~40GHz	Feb. 21, 2022	Apr. 25, 2022~ May 11, 2022	Feb. 20, 2023	CSE (TH05-HY)
Filter	Wainwright	WLKS1200-12 SS	SN2	1.2GHz Low Pass Filter	Mar. 15, 2022	Apr. 25, 2022~ May 11, 2022	Mar. 14, 2023	CSE (TH05-HY)
Filter	Wainwright	WHKX12-2700 -3000-18000-6 0ST	SN2	3GHz High Pass Filter	Jul. 12, 2021	Apr. 25, 2022~ May 11, 2022	Jul. 11, 2022	CSE (TH05-HY)
Power Meter	Anritsu	ML2495A	1036004	N/A	Aug. 01, 2021	Apr. 08, 2022~ May 07, 2022	Jul. 31, 2022	Conducted (TH05-HY)
Power Sensor	Anritsu	MA2411B	1027253	300MHz~40GHz	Aug. 01, 2021	Apr. 08, 2022~ May 07, 2022	Jul. 31, 2022	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101566	10Hz~40GHz	Aug. 30, 2021	Apr. 08, 2022~ May 07, 2022	Aug. 29, 2022	Conducted (TH05-HY)
Switch Control Mainframe	E-IUSTRUMENT	ETF-1405-0	EC1900067 (BOX7)	N/A	Aug. 12, 2021	Apr. 08, 2022~ May 07, 2022	Aug. 11, 2022	Conducted (TH05-HY)

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jan. 07, 2022	Apr. 26, 2022 ~ Apr. 27, 2022	Jan. 06, 2023	Radiation (03CH07-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N -06	35419 & 03	30MHz~1GHz	Apr. 28, 2021	Apr. 26, 2022 ~ Apr. 27, 2022	Apr. 27, 2022	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Dec. 03, 2021	Apr. 26, 2022 ~ Apr. 27, 2022	Dec. 02, 2022	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	18GHz~40GHz	Nov. 30, 2021	Apr. 26, 2022 ~ Apr. 27, 2022	Nov. 29, 2022	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1590075	1GHz~18GHz	Apr. 21, 2022	Apr. 26, 2022 ~ Apr. 27, 2022	Apr. 20, 2023	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz~1GHz	Oct. 04, 2021	Apr. 26, 2022 ~ Apr. 27, 2022	Oct. 03, 2022	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A02362	1GHz~26.5GHz	Oct. 04, 2021	Apr. 26, 2022 ~ Apr. 27, 2022	Oct. 03, 2022	Radiation (03CH07-HY)
Preamplifier	EMEC	EM18G40G	0600789	18-40GHz	Jul. 23, 2021	Apr. 26, 2022 ~ Apr. 27, 2022	Jul. 22, 2022	Radiation (03CH07-HY)
Spectrum Analyzer	Agilent	N9030A	MY52350276	3Hz~44GHz	Jul. 22, 2021	Apr. 26, 2022 ~ Apr. 27, 2022	Jul. 21, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY15682/4	30MHz to 18GHz	Feb. 23, 2022	Apr. 26, 2022 ~ Apr. 27, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24971/4	9kHz to 18GHz	Feb. 23, 2022	Apr. 26, 2022 ~ Apr. 27, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY28655/4	9kHz to 18GHz	Feb. 23, 2022	Apr. 26, 2022 ~ Apr. 27, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126	532078/126E	30MHz~18GHz	Sep. 17, 2021	Apr. 26, 2022 ~ Apr. 27, 2022	Sep. 16, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2858/2	18GHz~40GHz	Feb. 23, 2022	Apr. 26, 2022 ~ Apr. 27, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	801606/2	9KHz ~ 40GHz	Apr. 14, 2022	Apr. 26, 2022 ~ Apr. 27, 2022	Apr. 13, 2023	Radiation (03CH07-HY)
Antenna Mast	EMEC	AM-BS-4500E	N/A	Boresight mast 1M~4M	N/A	Apr. 26, 2022 ~ Apr. 27, 2022	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Apr. 26, 2022 ~ Apr. 27, 2022	N/A	Radiation (03CH07-HY)
Software	Audix	E3	N/A	N/A	N/A	Apr. 26, 2022 ~ Apr. 27, 2022	N/A	Radiation (03CH07-HY)
USB Data Logger	TECPEL	TR-32	HE17XB2495	N/A	Mar. 07, 2022	Apr. 26, 2022 ~ Apr. 27, 2022	Mar. 06, 2023	Radiation (03CH07-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.1 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.1 dB**

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.8 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.0 dB**

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Shiming Liu and Kai Liao	Temperature:	21~25	°C
Test Date:	2022/4/8~2022/5/7	Relative Humidity:	51~54	%

<Setting 10>

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	1.073	0.702	0.50	Pass
BLE	1Mbps	1	19	2440	1.077	0.710	0.50	Pass
BLE	1Mbps	1	39	2480	1.087	0.710	0.50	Pass

TEST RESULTS DATA
Peak Power Table

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	1Mbps	1	0	2402	10.89	30.00	1.90	12.79	36.00	Pass
BLE	1Mbps	1	19	2440	10.95	30.00	1.90	12.85	36.00	Pass
BLE	1Mbps	1	39	2480	10.56	30.00	1.90	12.46	36.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

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	10.83	30.00	1.90	12.73	36.00	Pass
BLE	1Mbps	1	19	2440	10.87	30.00	1.90	12.77	36.00	Pass
BLE	1Mbps	1	39	2480	10.48	30.00	1.90	12.38	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	10.65	-1.13	1.90	8.00	Pass
BLE	1Mbps	1	19	2440	10.73	-0.51	1.90	8.00	Pass
BLE	1Mbps	1	39	2480	10.37	-1.48	1.90	8.00	Pass

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 20dBc 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	2.046	1.291	0.50	Pass
BLE	2Mbps	1	19	2440	2.074	1.383	0.50	Pass
BLE	2Mbps	1	39	2480	2.058	1.399	0.50	Pass

TEST RESULTS DATA
Peak Power Table

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	2Mbps	1	0	2402	10.92	30.00	1.90	12.82	36.00	Pass
BLE	2Mbps	1	19	2440	10.93	30.00	1.90	12.83	36.00	Pass
BLE	2Mbps	1	39	2480	10.67	30.00	1.90	12.57	36.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

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	10.84	30.00	1.90	12.74	36.00	Pass
BLE	2Mbps	1	19	2440	10.85	30.00	1.90	12.75	36.00	Pass
BLE	2Mbps	1	39	2480	10.49	30.00	1.90	12.39	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	9.59	-3.05	1.90	8.00	Pass
BLE	2Mbps	1	19	2440	9.70	-4.75	1.90	8.00	Pass
BLE	2Mbps	1	39	2480	9.27	-3.67	1.90	8.00	Pass

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 20dBc limit.

<Setting 9 >

TEST RESULTS DATA
Peak Power Table

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	1Mbps	1	0	2402	9.81	30.00	3.30	13.11	36.00	Pass
BLE	1Mbps	1	19	2440	9.67	30.00	3.30	12.97	36.00	Pass
BLE	1Mbps	1	39	2480	9.35	30.00	3.30	12.65	36.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

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	9.72	30.00	3.30	13.02	36.00	Pass
BLE	1Mbps	1	19	2440	9.44	30.00	3.30	12.74	36.00	Pass
BLE	1Mbps	1	39	2480	9.14	30.00	3.30	12.44	36.00	Pass

TEST RESULTS DATA
Peak Power Table

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	2Mbps	1	0	2402	9.80	30.00	3.30	13.10	36.00	Pass
BLE	2Mbps	1	19	2440	9.56	30.00	3.30	12.86	36.00	Pass
BLE	2Mbps	1	39	2480	9.28	30.00	3.30	12.58	36.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

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	9.70	30.00	3.30	13.00	36.00	Pass
BLE	2Mbps	1	19	2440	9.40	30.00	3.30	12.70	36.00	Pass
BLE	2Mbps	1	39	2480	9.12	30.00	3.30	12.42	36.00	Pass

<Setting 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	1.081	0.698	0.50	Pass
BLE	1Mbps	1	19	2440	1.077	0.704	0.50	Pass
BLE	1Mbps	1	39	2480	1.079	0.694	0.50	Pass

TEST RESULTS DATA
Peak Power Table

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	1Mbps	1	0	2402	4.30	30.00	5.30	9.60	36.00	Pass
BLE	1Mbps	1	19	2440	4.47	30.00	5.30	9.77	36.00	Pass
BLE	1Mbps	1	39	2480	4.29	30.00	5.30	9.59	36.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

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	4.06	30.00	5.30	9.36	36.00	Pass
BLE	1Mbps	1	19	2440	4.23	30.00	5.30	9.53	36.00	Pass
BLE	1Mbps	1	39	2480	4.05	30.00	5.30	9.35	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	4.11	-4.69	5.30	8.00	Pass
BLE	1Mbps	1	19	2440	4.27	-4.78	5.30	8.00	Pass
BLE	1Mbps	1	39	2480	4.16	-4.44	5.30	8.00	Pass

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 20dBc 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	2.062	1.383	0.50	Pass
BLE	2Mbps	1	19	2440	2.046	1.391	0.50	Pass
BLE	2Mbps	1	39	2480	2.090	1.407	0.50	Pass

TEST RESULTS DATA
Peak Power Table

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	2Mbps	1	0	2402	4.27	30.00	5.30	9.57	36.00	Pass
BLE	2Mbps	1	19	2440	4.44	30.00	5.30	9.74	36.00	Pass
BLE	2Mbps	1	39	2480	4.26	30.00	5.30	9.56	36.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

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	4.04	30.00	5.30	9.34	36.00	Pass
BLE	2Mbps	1	19	2440	4.20	30.00	5.30	9.50	36.00	Pass
BLE	2Mbps	1	39	2480	4.03	30.00	5.30	9.33	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	3.56	-10.67	5.30	8.00	Pass
BLE	2Mbps	1	19	2440	3.47	-9.62	5.30	8.00	Pass
BLE	2Mbps	1	39	2480	3.46	-10.42	5.30	8.00	Pass

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 20dBc limit.

<Setting 0 >

TEST RESULTS DATA
Peak Power Table

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	1Mbps	1	0	2402	1.04	30.00	5.30	6.34	36.00	Pass
BLE	1Mbps	1	19	2440	0.72	30.00	5.30	6.02	36.00	Pass
BLE	1Mbps	1	39	2480	0.21	30.00	5.30	5.51	36.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

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	0.53	30.00	5.30	5.83	36.00	Pass
BLE	1Mbps	1	19	2440	0.10	30.00	5.30	5.40	36.00	Pass
BLE	1Mbps	1	39	2480	-0.47	30.00	5.30	4.83	36.00	Pass

TEST RESULTS DATA
Peak Power Table

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	2Mbps	1	0	2402	1.00	30.00	5.30	6.30	36.00	Pass
BLE	2Mbps	1	19	2440	0.71	30.00	5.30	6.01	36.00	Pass
BLE	2Mbps	1	39	2480	0.20	30.00	5.30	5.50	36.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

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	0.51	30.00	5.30	5.81	36.00	Pass
BLE	2Mbps	1	19	2440	0.09	30.00	5.30	5.39	36.00	Pass
BLE	2Mbps	1	39	2480	-0.48	30.00	5.30	4.82	36.00	Pass

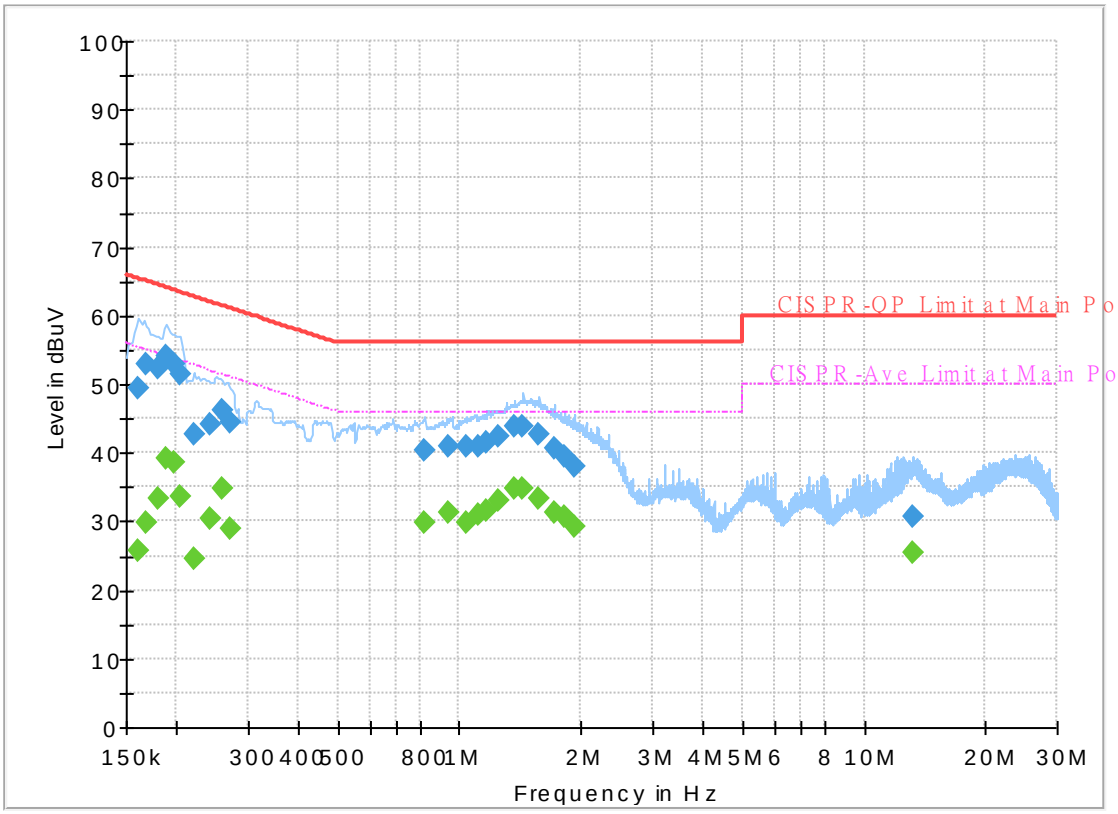
Appendix B. AC Conducted Emission Test Results

Test Engineer :	Calvin Wang	**Temperature :**	23~26℃
		Relative Humidity :	45~55%

EUT Information

Report NO :	232118
Test Mode :	Mode 1
Test Voltage :	Power From System
Phase :	Line

Full Spectrum



Final_Result

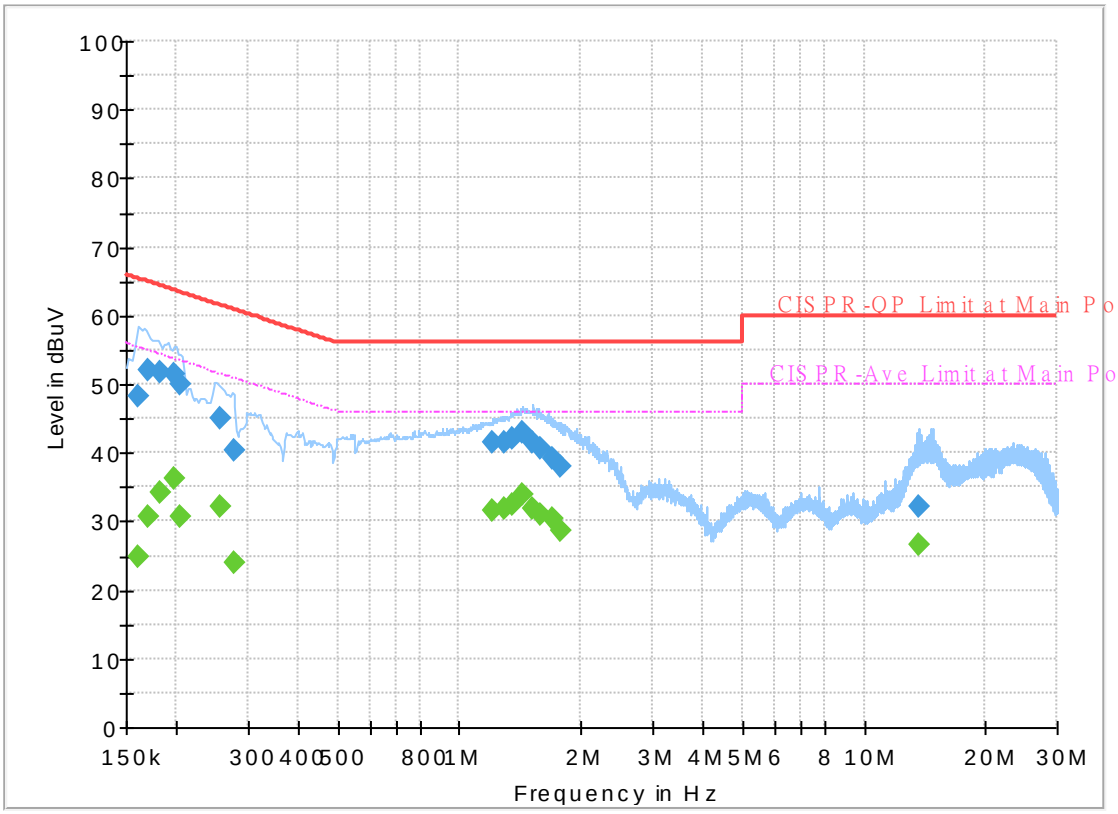
Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.161250	---	25.74	55.40	29.66	L1	OFF	19.6
0.161250	49.50	---	65.40	15.90	L1	OFF	19.6
0.168000	---	29.81	55.06	25.25	L1	OFF	19.6
0.168000	52.79	---	65.06	12.27	L1	OFF	19.6
0.179250	---	33.20	54.52	21.32	L1	OFF	19.6
0.179250	52.44	---	64.52	12.08	L1	OFF	19.6
0.188250	---	39.27	54.11	14.84	L1	OFF	19.6
0.188250	53.96	---	64.11	10.15	L1	OFF	19.6
0.197250	---	38.45	53.73	15.28	L1	OFF	19.6
0.197250	52.97	---	63.73	10.76	L1	OFF	19.6
0.204000	---	33.67	53.45	19.78	L1	OFF	19.6
0.204000	51.47	---	63.45	11.98	L1	OFF	19.6
0.222000	---	24.58	52.74	28.16	L1	OFF	19.6
0.222000	42.57	---	62.74	20.17	L1	OFF	19.6
0.242250	---	30.30	52.02	21.72	L1	OFF	19.6
0.242250	44.11	---	62.02	17.91	L1	OFF	19.6
0.258000	---	34.89	51.50	16.61	L1	OFF	19.6
0.258000	46.23	---	61.50	15.27	L1	OFF	19.6
0.271500	---	28.87	51.07	22.20	L1	OFF	19.6
0.271500	44.56	---	61.07	16.51	L1	OFF	19.6
0.820500	---	29.77	46.00	16.23	L1	OFF	19.6

0.820500	40.44	---	56.00	15.56	L1	OFF	19.6
0.944250	---	31.17	46.00	14.83	L1	OFF	19.6
0.944250	40.82	---	56.00	15.18	L1	OFF	19.6
1.043250	---	29.94	46.00	16.06	L1	OFF	19.6
1.043250	40.87	---	56.00	15.13	L1	OFF	19.6
1.115250	---	31.11	46.00	14.89	L1	OFF	19.6
1.115250	41.07	---	56.00	14.93	L1	OFF	19.6
1.164750	---	31.44	46.00	14.56	L1	OFF	19.6
1.164750	41.61	---	56.00	14.39	L1	OFF	19.6
1.252500	---	33.10	46.00	12.90	L1	OFF	19.6
1.252500	42.54	---	56.00	13.46	L1	OFF	19.6
1.371750	---	34.70	46.00	11.30	L1	OFF	19.6
1.371750	43.81	---	56.00	12.19	L1	OFF	19.6
1.439250	---	34.90	46.00	11.10	L1	OFF	19.6
1.439250	43.90	---	56.00	12.10	L1	OFF	19.6
1.576500	---	33.30	46.00	12.70	L1	OFF	19.6
1.576500	42.65	---	56.00	13.35	L1	OFF	19.6
1.713750	---	31.23	46.00	14.77	L1	OFF	19.6
1.713750	40.55	---	56.00	15.45	L1	OFF	19.6
1.826250	---	30.58	46.00	15.42	L1	OFF	19.6
1.826250	39.44	---	56.00	16.56	L1	OFF	19.6
1.918500	---	29.37	46.00	16.63	L1	OFF	19.6
1.918500	38.11	---	56.00	17.89	L1	OFF	19.6
13.166250	---	25.44	50.00	24.56	L1	OFF	19.8
13.166250	30.70	---	60.00	29.30	L1	OFF	19.8

EUT Information

Report NO :	232118
Test Mode :	Mode 1
Test Voltage :	Power From System
Phase :	Neutral

Full Spectrum



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.161250	---	24.97	55.40	30.43	N	OFF	19.6
0.161250	48.14	---	65.40	17.26	N	OFF	19.6
0.170250	---	30.66	54.95	24.29	N	OFF	19.6
0.170250	52.19	---	64.95	12.76	N	OFF	19.6
0.181500	---	34.17	54.42	20.25	N	OFF	19.6
0.181500	51.67	---	64.42	12.75	N	OFF	19.6
0.197250	---	36.13	53.73	17.60	N	OFF	19.6
0.197250	51.35	---	63.73	12.38	N	OFF	19.6
0.204000	---	30.71	53.45	22.74	N	OFF	19.6
0.204000	49.97	---	63.45	13.48	N	OFF	19.6
0.255750	---	32.29	51.57	19.28	N	OFF	19.6
0.255750	45.02	---	61.57	16.55	N	OFF	19.6
0.276000	---	23.84	50.94	27.10	N	OFF	19.6
0.276000	40.49	---	60.94	20.45	N	OFF	19.6
1.212000	---	31.65	46.00	14.35	N	OFF	19.6
1.212000	41.42	---	56.00	14.58	N	OFF	19.6
1.290750	---	31.80	46.00	14.20	N	OFF	19.6
1.290750	41.39	---	56.00	14.61	N	OFF	19.6
1.356000	---	32.58	46.00	13.42	N	OFF	19.6
1.356000	42.06	---	56.00	13.94	N	OFF	19.6
1.432500	---	33.97	46.00	12.03	N	OFF	19.6

1.432500	42.85	---	56.00	13.15	N	OFF	19.6
1.520250	---	31.97	46.00	14.03	N	OFF	19.6
1.520250	41.47	---	56.00	14.53	N	OFF	19.6
1.592250	---	30.89	46.00	15.11	N	OFF	19.6
1.592250	40.54	---	56.00	15.46	N	OFF	19.6
1.704750	---	30.27	46.00	15.73	N	OFF	19.6
1.704750	39.30	---	56.00	16.70	N	OFF	19.6
1.785750	---	28.75	46.00	17.25	N	OFF	19.6
1.785750	37.99	---	56.00	18.01	N	OFF	19.6
13.715250	---	26.46	50.00	23.54	N	OFF	19.9
13.715250	32.02	---	60.00	27.98	N	OFF	19.9

Appendix C. Conducted Spurious Emission

Test Engineer :	Kal Liao	Temperature :	20~24.5°C
		Relative Humidity :	47~68%

<Setting 10>

<1Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	MIMO	Grounding	Peak
				Limit	Line	Level	Gain	Loss	Factor	Factor	Avg.
		(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dBi)	(dB)	(dB)	(dB)	(P/A)
BLE CH 00 2402MHz		2364.6	-37.72	-16.52	-21.2	-41.25	2	1.53	0	0	P
		2353.995	-50.02	-8.82	-41.2	-53.55	2	1.53	0	0	A
	*	2402	13.64	-	-	10.14	2	1.5	0	0	P
	*	2402	12.1	-	-	8.6	2	1.5	0	0	A
BLE CH 19 2440MHz		2364.18	-36.53	-15.33	-21.2	-40.06	2	1.53	0	0	P
		2389.8	-52.26	-11.06	-41.2	-55.76	2	1.5	0	0	A
	*	2440	13.43	-	-	9.85	2	1.58	0	0	P
	*	2440	11.81	-	-	8.23	2	1.58	0	0	A
		2487.33	-40.75	-19.55	-21.2	-44.22	2	1.47	0	0	P
		2488.03	-52.55	-11.35	-41.2	-56.02	2	1.47	0	0	A
BLE CH 39 2480MHz	*	2480	13.35	-	-	9.88	2	1.47	0	0	P
	*	2480	11.81	-	-	8.34	2	1.47	0	0	A
		2483.76	-39.99	-18.79	-21.2	-43.46	2	1.47	0	0	P
		2483.48	-51.59	-10.39	-41.2	-55.06	2	1.47	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	Note	Frequency (MHz)	Level (dBm)	Margin 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		4804	-38.14	-16.94	-21.2	-43.11	2	2.97	0	0	P
		4804	-45.47	-4.27	-41.2	-50.44	2	2.97	0	0	A
		7206	-59.55	-38.35	-21.2	-65.04	2	3.49	0	0	P
BLE CH 19 2440MHz		4880	-34.58	-13.38	-21.2	-39.3	2	2.72	0	0	P
		4880	-41.89	-0.69	-41.2	-46.61	2	2.72	0	0	A
		7320	-45.12	-23.92	-21.2	-50.59	2	3.47	0	0	P
BLE CH 39 2480MHz		4960	-37.2	-16	-21.2	-41.85	2	2.65	0	0	P
		4960	-44.07	-2.87	-41.2	-48.72	2	2.65	0	0	A
		7440	-60.31	-39.11	-21.2	-65.8	2	3.49	0	0	P
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.										

Emission below 1GHz

BLE (LF)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	MIMO	Grounding	Peak
				Limit	Line	Level	Factor	Loss	Factor	Factor	Avg.
		(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dBi)	(dB)	(dB)	(dB)	(P/A)
2.4GHz BLE LF		78.06	-83.78	-28.58	-55.2	-90.83	2	0.35	0	4.7	P
		212.79	-81.16	-29.46	-51.7	-88.54	2	0.68	0	4.7	P
		272.19	-80.2	-31	-49.2	-87.58	2	0.68	0	4.7	P
		871.9	-73.8	-24.6	-49.2	-81.9	2	1.4	0	4.7	P
		937.7	-72.61	-23.41	-49.2	-80.81	2	1.5	0	4.7	P
		998.6	-72.14	-30.94	-41.2	-80.48	2	1.64	0	4.7	P
Remark	1. No other spurious found. 2. All results are PASS against limit line.										

<2Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	MIMO	Grounding	Peak
		(MHz)	(dBm)	Limit (dB)	Line (dBm)	Level (dBm)	Gain (dBi)	Loss (dB)	Factor (dB)	Factor (dB)	Avg. (P/A)
BLE CH 00 2402MHz		2365.125	-36.91	-15.71	-21.2	-40.44	2	1.53	0	0	P
		2353.89	-52.6	-11.4	-41.2	-56.13	2	1.53	0	0	A
	*	2402	13.52	-	-	10.02	2	1.5	0	0	P
	*	2402	10.3	-	-	6.8	2	1.5	0	0	A
BLE CH 19 2440MHz		2383.5	-37.71	-16.51	-21.2	-41.21	2	1.5	0	0	P
		2382.66	-51.64	-10.44	-41.2	-55.13	2	1.49	0	0	A
	*	2440	13.27	-	-	9.69	2	1.58	0	0	P
	*	2440	10.26	-	-	6.68	2	1.58	0	0	A
		2487.61	-40.36	-19.16	-21.2	-43.83	2	1.47	0	0	P
		2487.96	-53.01	-11.81	-41.2	-56.48	2	1.47	0	0	A
BLE CH 39 2480MHz	*	2480	13.11	-	-	9.64	2	1.47	0	0	P
	*	2480	10.15	-	-	6.68	2	1.47	0	0	A
		2483.48	-34.62	-13.42	-21.2	-38.09	2	1.47	0	0	P
		2483.48	-45.58	-4.38	-41.2	-49.05	2	1.47	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	Note	Frequency (MHz)	Level (dBm)	Margin 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		4804	-38.43	-17.23	-21.2	-43.4	2	2.97	0	0	P
		4804	-50.35	-9.15	-41.2	-55.32	2	2.97	0	0	A
		7206	-60.32	-39.12	-21.2	-65.81	2	3.49	0	0	P
BLE CH 19 2440MHz		4880	-34.58	-13.38	-21.2	-39.3	2	2.72	0	0	P
		4880	-46.5	-5.3	-41.2	-51.22	2	2.72	0	0	A
		7320	-44.95	-23.75	-21.2	-50.42	2	3.47	0	0	P
BLE CH 39 2480MHz		4958.1	-37.14	-15.94	-21.2	-41.79	2	2.65	0	0	P
		4960	-48.65	-7.45	-41.2	-53.3	2	2.65	0	0	A
		7440	-61.71	-40.51	-21.2	-67.2	2	3.49	0	0	P
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.										

<Setting 9>

<1Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	MIMO	Grounding	Peak
		(MHz)	(dBm)	Limit (dB)	Line (dBm)	Level (dBm)	Gain (dBi)	Loss (dB)	Factor (dB)	Factor (dB)	Avg. (P/A)
BLE CH 00 2402MHz		2342.235	-34.53	-13.33	-21.2	-39.35	3.3	1.52	0	0	P
		2353.995	-48.53	-7.33	-41.2	-53.36	3.3	1.53	0	0	A
	*	2402	13.85	-	-	9.05	3.3	1.5	0	0	P
	*	2402	12.34	-	-	7.54	3.3	1.5	0	0	A
BLE CH 19 2440MHz		2364.46	-35.3	-14.1	-21.2	-40.13	3.3	1.53	0	0	P
		2389.94	-48.33	-7.13	-41.2	-53.13	3.3	1.5	0	0	A
	*	2440	13.32	-	-	8.44	3.3	1.58	0	0	P
	*	2440	11.68	-	-	6.8	3.3	1.58	0	0	A
		2487.96	-36.21	-15.01	-21.2	-40.98	3.3	1.47	0	0	P
		2488.03	-48.07	-6.87	-41.2	-52.84	3.3	1.47	0	0	A
BLE CH 39 2480MHz	*	2480	13.04	-	-	8.27	3.3	1.47	0	0	P
	*	2480	11.41	-	-	6.64	3.3	1.47	0	0	A
		2486.91	-39.93	-18.73	-21.2	-44.7	3.3	1.47	0	0	P
		2483.48	-51.17	-9.97	-41.2	-55.94	3.3	1.47	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	Note	Frequency (MHz)	Level (dBm)	Margin 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		4804	-38.4	-17.2	-21.2	-44.67	3.3	2.97	0	0	P
		4804	-46.86	-5.66	-41.2	-53.13	3.3	2.97	0	0	A
		7206	-58.38	-37.18	-21.2	-65.17	3.3	3.49	0	0	P
BLE CH 19 2440MHz		4880	-34.56	-13.36	-21.2	-40.58	3.3	2.72	0	0	P
		4880	-42.47	-1.27	-41.2	-48.49	3.3	2.72	0	0	A
		7320	-46.37	-25.17	-21.2	-53.14	3.3	3.47	0	0	P
BLE CH 39 2480MHz		4960	-37.61	-16.41	-21.2	-43.56	3.3	2.65	0	0	P
		4960	-45.92	-4.72	-41.2	-51.87	3.3	2.65	0	0	A
		7440	-60.73	-39.53	-21.2	-67.52	3.3	3.49	0	0	P
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.										

Emission below 1GHz

BLE (LF)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	MIMO	Grounding	Peak
				Limit	Line	Level	Factor	Loss	Factor	Factor	Avg.
		(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dBi)	(dB)	(dB)	(dB)	(P/A)
2.4GHz BLE LF		59.97	-78.71	-23.51	-55.2	-87.03	3.3	0.32	0	4.7	P
		214.41	-77.75	-26.05	-51.7	-86.42	3.3	0.67	0	4.7	P
		273	-76.2	-27	-49.2	-84.88	3.3	0.68	0	4.7	P
		952.4	-69.42	-20.22	-49.2	-78.93	3.3	1.51	0	4.7	P
		983.9	-68.49	-27.29	-41.2	-78.1	3.3	1.61	0	4.7	P
		989.5	-68.15	-26.95	-41.2	-77.79	3.3	1.64	0	4.7	P
Remark	1. No other spurious found. 2. All results are PASS against limit line.										

<2Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	MIMO	Grounding	Peak
		(MHz)	(dBm)	Limit (dB)	Line (dBm)	Level (dBm)	Gain (dBi)	Loss (dB)	Factor (dB)	Factor (dB)	Avg. (P/A)
BLE CH 00 2402MHz		2354.73	-34.58	-13.38	-21.2	-39.41	3.3	1.53	0	0	P
		2354.1	-49.11	-7.91	-41.2	-53.94	3.3	1.53	0	0	A
	*	2402	13.65	-	-	8.85	3.3	1.5	0	0	P
	*	2402	10.49	-	-	5.69	3.3	1.5	0	0	A
BLE CH 19 2440MHz		2374.26	-35.08	-13.88	-21.2	-39.87	3.3	1.49	0	0	P
		2382.8	-49.42	-8.22	-41.2	-54.21	3.3	1.49	0	0	A
	*	2440	13.27	-	-	8.39	3.3	1.58	0	0	P
	*	2440	10.21	-	-	5.33	3.3	1.58	0	0	A
		2486.28	-37.84	-16.64	-21.2	-42.61	3.3	1.47	0	0	P
		2488.03	-49.8	-8.6	-41.2	-54.57	3.3	1.47	0	0	A
BLE CH 39 2480MHz	*	2480	12.96	-	-	8.19	3.3	1.47	0	0	P
	*	2480	9.93	-	-	5.16	3.3	1.47	0	0	A
		2483.55	-34.58	-13.38	-21.2	-39.35	3.3	1.47	0	0	P
		2483.48	-45.98	-4.78	-41.2	-50.75	3.3	1.47	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	Note	Frequency (MHz)	Level (dBm)	Margin 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		4804	-38.31	-17.11	-21.2	-44.58	3.3	2.97	0	0	P
		4804	-51.11	-9.91	-41.2	-57.38	3.3	2.97	0	0	A
		7206	-58.74	-37.54	-21.2	-65.53	3.3	3.49	0	0	P
BLE CH 19 2440MHz		4880	-35.66	-14.46	-21.2	-41.68	3.3	2.72	0	0	P
		4880	-48.89	-7.69	-41.2	-54.91	3.3	2.72	0	0	A
		7320	-46.37	-25.17	-21.2	-53.14	3.3	3.47	0	0	P
BLE CH 39 2480MHz		4960	-37.58	-16.38	-21.2	-43.53	3.3	2.65	0	0	P
		4960	-49.86	-8.66	-41.2	-55.81	3.3	2.65	0	0	A
		7440	-60.89	-39.69	-21.2	-67.68	3.3	3.49	0	0	P
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.										

Emission below 1GHz

BLE (LF)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	MIMO	Grounding	Peak
				Limit	Line	Level	Factor	Loss	Factor	Factor	Avg.
		(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dBi)	(dB)	(dB)	(dB)	(P/A)
2.4GHz BLE LF		59.97	-78.71	-23.51	-55.2	-87.03	3.3	0.32	0	4.7	P
		214.41	-77.75	-26.05	-51.7	-86.42	3.3	0.67	0	4.7	P
		273	-76.2	-27	-49.2	-84.88	3.3	0.68	0	4.7	P
		952.4	-69.42	-20.22	-49.2	-78.93	3.3	1.51	0	4.7	P
		983.9	-68.49	-27.29	-41.2	-78.1	3.3	1.61	0	4.7	P
		989.5	-68.15	-26.95	-41.2	-77.79	3.3	1.64	0	4.7	P
Remark	1. No other spurious found. 2. All results are PASS against limit line.										

<Setting 5>

<1Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	MIMO	Grounding	Peak
		(MHz)	(dBm)	Limit (dB)	Line (dBm)	Level (dBm)	Gain (dBi)	Loss (dB)	Factor (dB)	Factor (dB)	Avg. (P/A)
BLE CH 00 2402MHz		2371.95	-42.07	-20.87	-21.2	-48.6	5.3	1.23	0	0	P
		2353.89	-55.91	-14.71	-41.2	-62.43	5.3	1.22	0	0	A
	*	2402	9.96	-	-	3.42	5.3	1.24	0	0	P
	*	2402	8.38	-	-	1.84	5.3	1.24	0	0	A
BLE CH 19 2440MHz		2322.74	-42.76	-21.56	-21.2	-49.25	5.3	1.19	0	0	P
		2389.38	-56.15	-14.95	-41.2	-62.69	5.3	1.24	0	0	A
	*	2440	10.02	-	-	3.48	5.3	1.24	0	0	P
	*	2440	8.45	-	-	1.91	5.3	1.24	0	0	A
		2496.64	-41.59	-20.39	-21.2	-48.13	5.3	1.24	0	0	P
		2487.89	-55.25	-14.05	-41.2	-61.8	5.3	1.25	0	0	A
BLE CH 39 2480MHz	*	2480	10.02	-	-	3.48	5.3	1.24	0	0	P
	*	2480	8.37	-	-	1.83	5.3	1.24	0	0	A
		2487.26	-39.62	-18.42	-21.2	-46.17	5.3	1.25	0	0	P
		2486.84	-53.96	-12.76	-41.2	-60.51	5.3	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	Note	Frequency (MHz)	Level (dBm)	Margin 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		4804	-49.28	-28.08	-21.2	-56.98	5.3	2.4	0	0	P
		7206	-53.29	-32.09	-21.2	-61.15	5.3	2.56	0	0	P
		12010	-51.64	-30.44	-21.2	-60.58	5.3	3.64	0	0	P
BLE CH 19 2440MHz		4880	-40.92	-19.72	-21.2	-48.52	5.3	2.3	0	0	P
		4880	-49.68	-8.48	-41.2	-57.28	5.3	2.3	0	0	A
		7320	-53.23	-32.03	-21.2	-61.21	5.3	2.68	0	0	P
		12200	-45.29	-24.09	-21.2	-54.36	5.3	3.77	0	0	P
BLE CH 39 2480MHz		4960	-43.45	-22.25	-21.2	-50.98	5.3	2.23	0	0	P
		7440	-57.06	-35.86	-21.2	-65.16	5.3	2.8	0	0	P
		12400	-49.67	-28.47	-21.2	-58.87	5.3	3.9	0	0	P
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.										

Emission below 1GHz

BLE (LF)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	MIMO	Grounding	Peak
				Limit	Line	Level	Factor	Loss	Factor	Factor	Avg.
		(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dBi)	(dB)	(dB)	(dB)	(P/A)
2.4GHz BLE LF		68.07	-80.63	-25.43	-55.2	-90.89	5.3	0.45	0	4.7	P
		157.71	-79.98	-28.28	-51.7	-90.27	5.3	0.59	0	4.7	P
		294.33	-79.09	-29.89	-49.2	-89.44	5.3	0.76	0	4.7	P
		613.6	-77.83	-28.63	-49.2	-88.25	5.3	1.09	0	4.7	P
		713.7	-67.87	-18.67	-49.2	-78.34	5.3	1.16	0	4.7	P
		778.8	-77.64	-28.44	-49.2	-88.09	5.3	1.19	0	4.7	P
Remark	1. No other spurious found. 2. All results are PASS against limit line.										

<2Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	MIMO	Grounding	Peak
		(MHz)	(dBm)	Limit (dB)	Line (dBm)	Level (dBm)	Gain (dBi)	Loss (dB)	Factor (dB)	Factor (dB)	Avg. (P/A)
BLE CH 00 2402MHz		2355.36	-42.03	-20.83	-21.2	-48.55	5.3	1.22	0	0	P
		2385.18	-55.79	-14.59	-41.2	-62.33	5.3	1.24	0	0	A
	*	2402	9.81	-	-	3.27	5.3	1.24	0	0	P
	*	2402	6.64	-	-	0.1	5.3	1.24	0	0	A
BLE CH 19 2440MHz		2379.44	-42.83	-21.63	-21.2	-49.36	5.3	1.23	0	0	P
		2386.58	-56.16	-14.96	-41.2	-62.7	5.3	1.24	0	0	A
	*	2440	9.86	-	-	3.32	5.3	1.24	0	0	P
	*	2440	6.76	-	-	0.22	5.3	1.24	0	0	A
		2492.72	-41.7	-20.5	-21.2	-48.24	5.3	1.24	0	0	P
		2487.96	-55.29	-14.09	-41.2	-61.84	5.3	1.25	0	0	A
BLE CH 39 2480MHz	*	2480	9.84	-	-	3.3	5.3	1.24	0	0	P
	*	2480	6.67	-	-	0.13	5.3	1.24	0	0	A
		2483.48	-36.27	-15.07	-21.2	-42.82	5.3	1.25	0	0	P
		2483.48	-47.99	-6.79	-41.2	-54.54	5.3	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	Note	Frequency (MHz)	Level (dBm)	Margin 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		4804	-49.36	-28.16	-21.2	-57.06	5.3	2.4	0	0	P
		7206	-53.26	-32.06	-21.2	-61.12	5.3	2.56	0	0	P
		12010	-51.33	-30.13	-21.2	-60.27	5.3	3.64	0	0	P
BLE CH 19 2440MHz		4880	-40.84	-19.64	-21.2	-48.44	5.3	2.3	0	0	P
		4880	-54.29	-13.09	-41.2	-61.89	5.3	2.3	0	0	A
		7320	-53.55	-32.35	-21.2	-61.53	5.3	2.68	0	0	P
		12200	-45.42	-24.22	-21.2	-54.49	5.3	3.77	0	0	P
BLE CH 39 2480MHz		4960	-43.62	-22.42	-21.2	-51.15	5.3	2.23	0	0	P
		7440	-57	-35.8	-21.2	-65.1	5.3	2.8	0	0	P
		12400	-50.02	-28.82	-21.2	-59.22	5.3	3.9	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 **Margin limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

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

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	MIMO	Grounding	Peak
				Limit	Line	Level	Factor	Loss	Factor	Factor	Avg.
		(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dBi)	(dB)	(dB)	(dB)	(P/A)
BLE CH 00 2402MHz		2390	-45.8	-24.6	-21.2	-48.44	2	0.64	0	0	P
		2390	-59.91	-18.71	-41.2	-62.58	2	0.67	0	0	A

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBm) = Antenna Factor(dBi) + Path Loss(dB) + Read Level(dBm)
3. Margin Limit(dB) = Level(dBm) – Limit Line(dBm)

For Peak Limit @ 2390MHz:

1. Level(dBm)

= Antenna Factor(dBi) + Path Loss(dB) + Read Level(dBm)

= 2(dBi) + 0.64(dB) - 48.44(dBm)

= -45.8 (dBm)

2. Margin Limit(dB)

= Level(dBm) – Limit Line(dBm)

= -45.8(dBm) +21.2(dBm)

= -24.6(dB)

For Average Limit @ 2390MHz:

1. Level(dBm)

= Antenna Factor(dBi) + Path Loss(dB) + Read Level(dBm)

= 2(dBi) + 0.67(dB) - 62.58(dBm)

= -59.91 (dBm)

2. Margin Limit(dB)

= Level(dBm) – Limit Line(dBm)

= -59.91(dBm) + 41.2(dBm)

= -18.71(dB)

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

Appendix D. Conducted Spurious Emission Plots

Test Engineer :	Kal Liao	**Temperature :**	20~24.5°C
		Relative Humidity :	47~68%

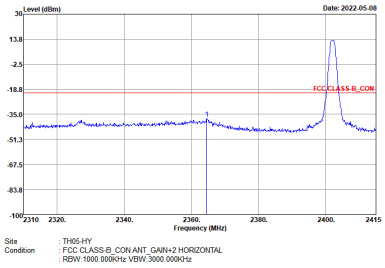
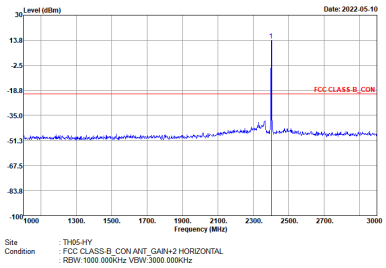
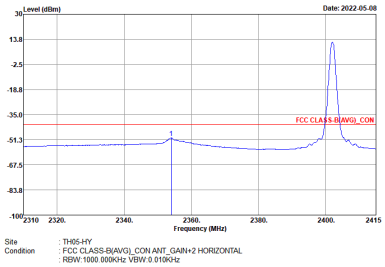
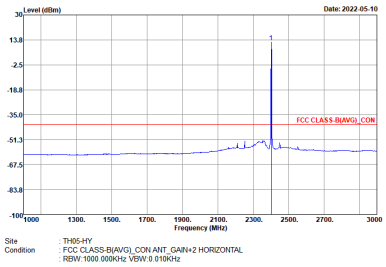
Note symbol

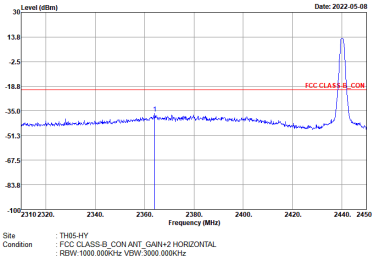
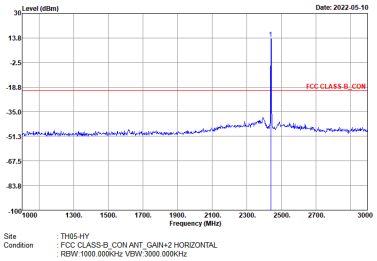
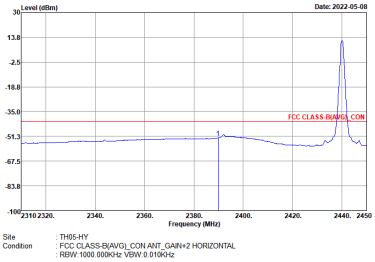
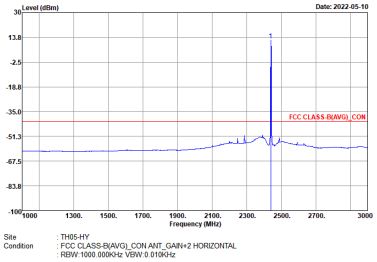
-L	**Low channel location**
-R	**High channel location**

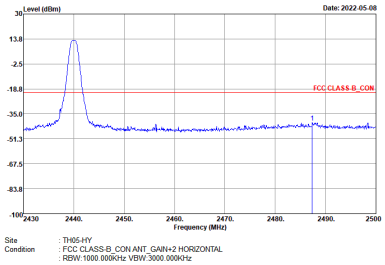
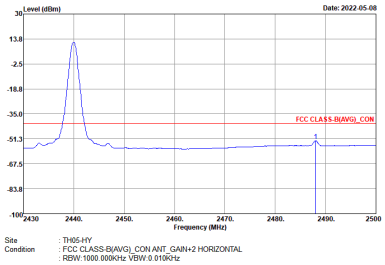
<Setting 10>
<1Mbps>

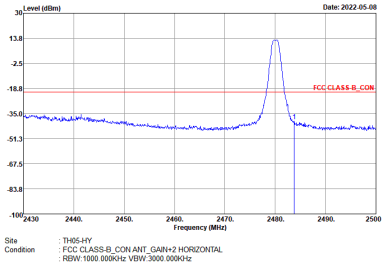
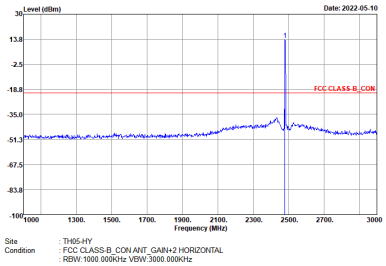
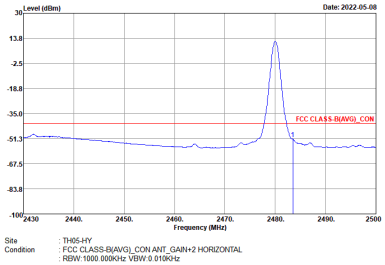
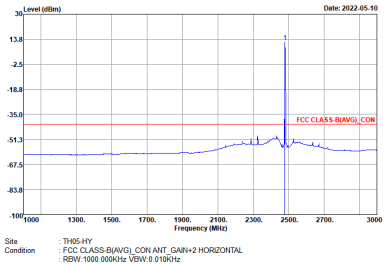
2.4GHz 2400~2483.5MHz

BLE (Band Edge)

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

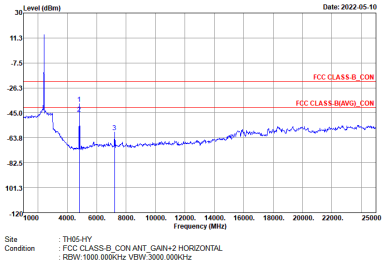
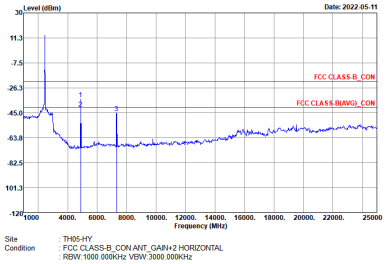
BLE	2.4GHz 2400~2483.5MHz Band Edge	
	BLE CH19 2440MHz - L	
	CSE	Fundamental
Peak		
Avg.		

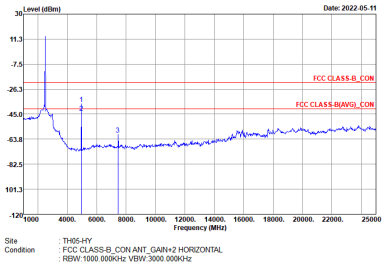
BLE	2.4GHz 2400~2483.5MHz Band Edge	
	BLE CH19 2440MHz - R	
	CSE	Fundamental
Peak		Left blank
Avg.		Left blank

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

2.4GHz 2400~2483.5MHz

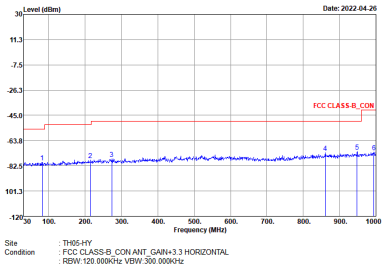
BLE (Harmonic)

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

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

Emission below 1GHz

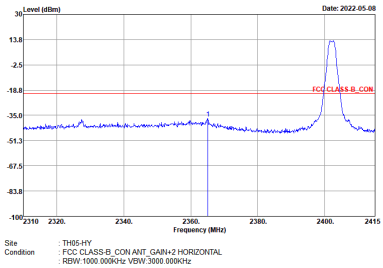
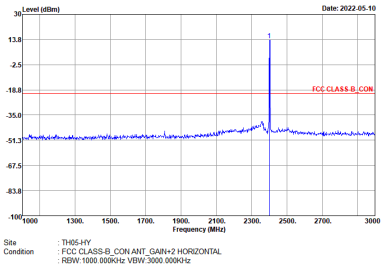
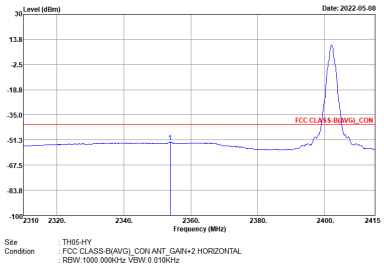
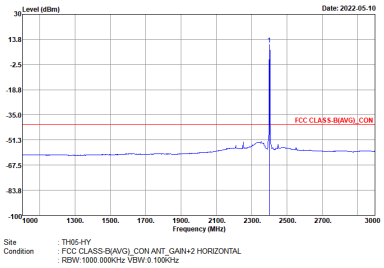
BLE (LF)

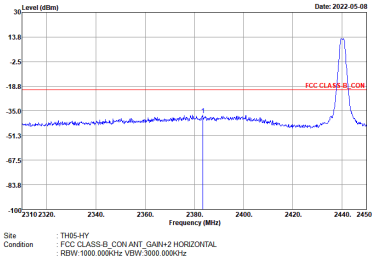
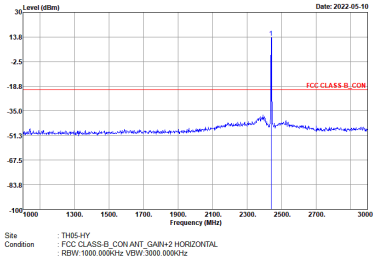
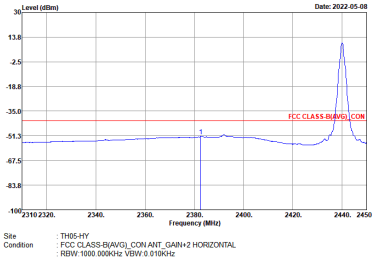
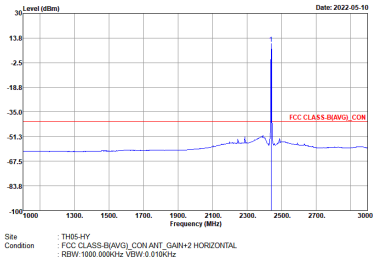
BLE	2.4GHz 2400~2483.5MHz	
	BLE LF	
Peak		Left blank

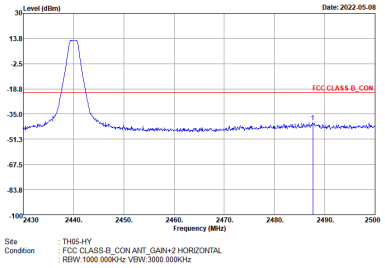
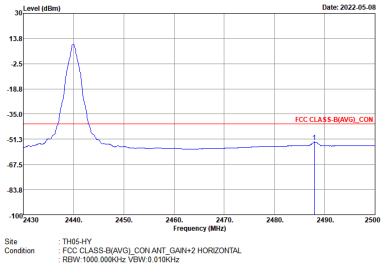
<2Mbps>

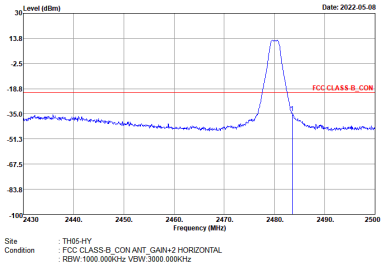
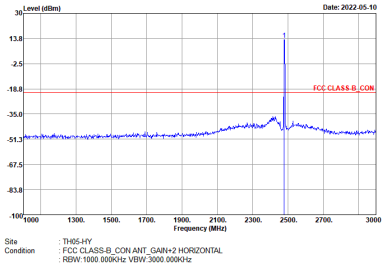
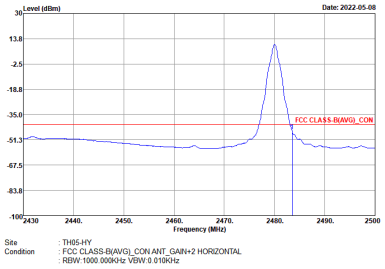
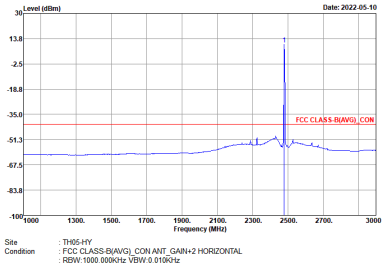
2.4GHz 2400~2483.5MHz

BLE (Band Edge)

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

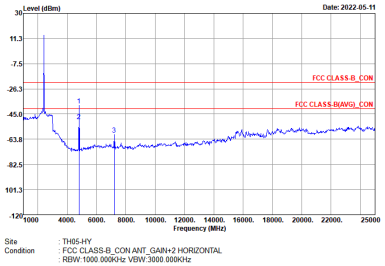
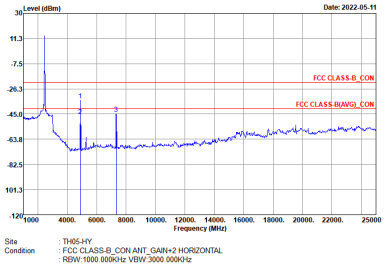
BLE	2.4GHz 2400~2483.5MHz Band Edge	
	BLE CH19 2440MHz - L	
	CSE	Fundamental
Peak		
Avg.		

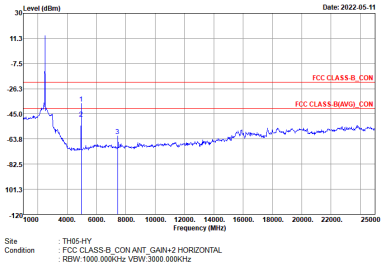
BLE	2.4GHz 2400~2483.5MHz Band Edge	
	BLE CH19 2440MHz - R	
	CSE	Fundamental
Peak		Left blank
Avg.		Left blank

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

2.4GHz 2400~2483.5MHz

BLE (Harmonic)

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

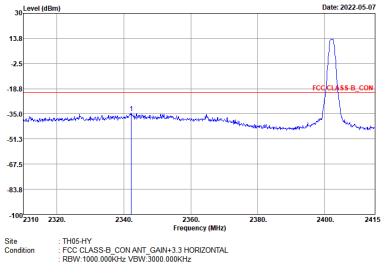
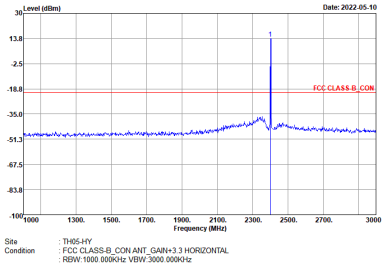
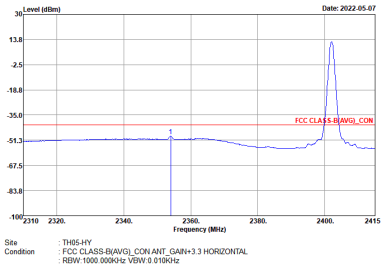
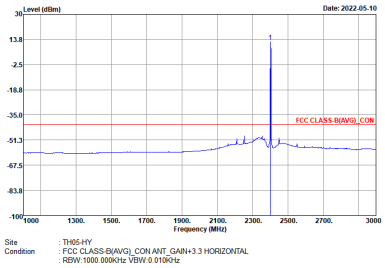
BLE	2.4GHz 2400~2483.5MHz Harmonic	
	BLE	
	CH39 2480MHz	
Peak Avg.		Left blank

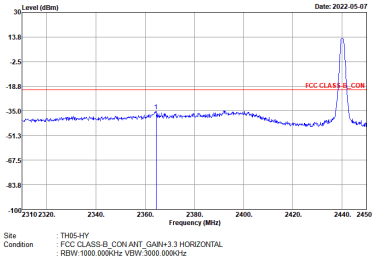
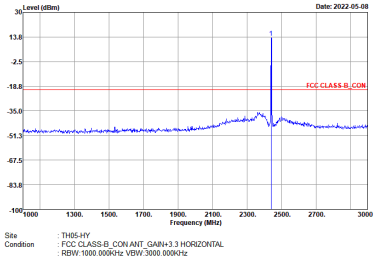
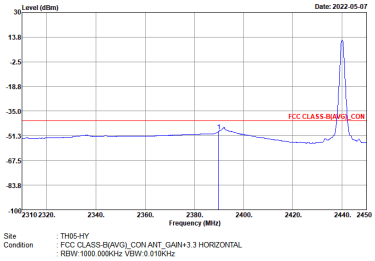
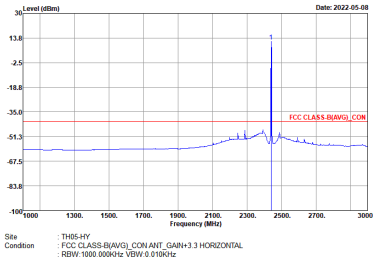
<Setting 9>

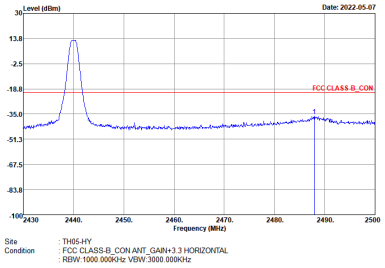
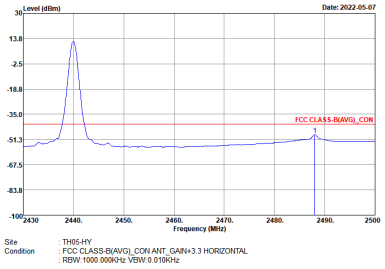
<1Mbps>

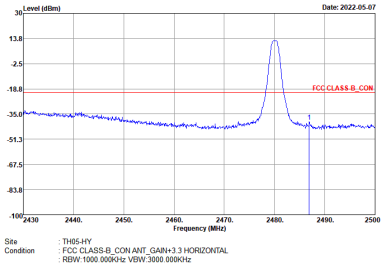
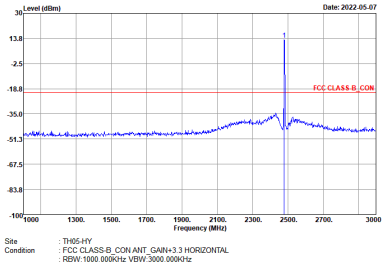
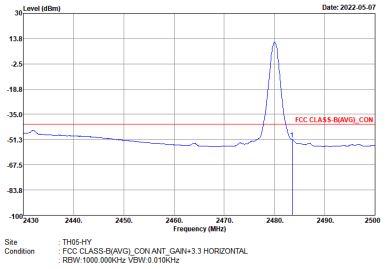
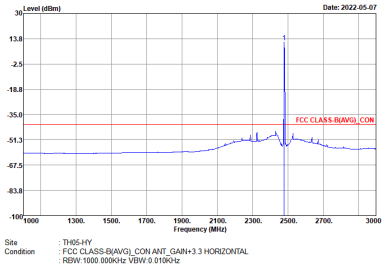
2.4GHz 2400~2483.5MHz

BLE (Band Edge)

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

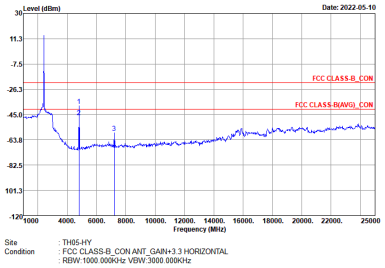
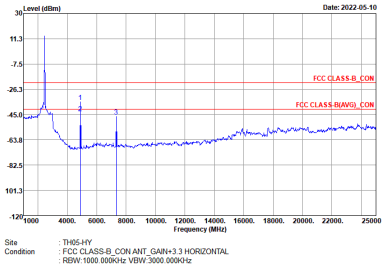
BLE	2.4GHz 2400~2483.5MHz Band Edge	
	BLE CH19 2440MHz - L	
	CSE	Fundamental
Peak		
Avg.		

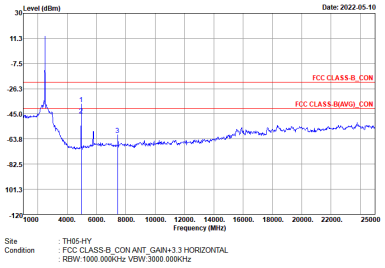
BLE	2.4GHz 2400~2483.5MHz Band Edge	
	BLE CH19 2440MHz - R	
	CSE	Fundamental
Peak		Left blank
Avg.		Left blank

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

2.4GHz 2400~2483.5MHz

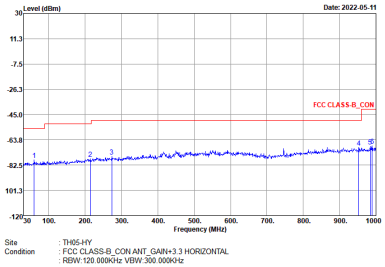
BLE (Harmonic)

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

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

Emission below 1GHz

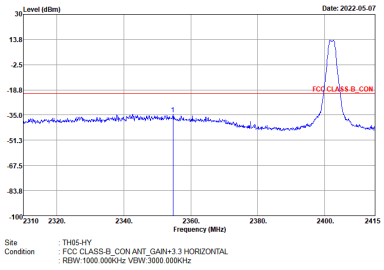
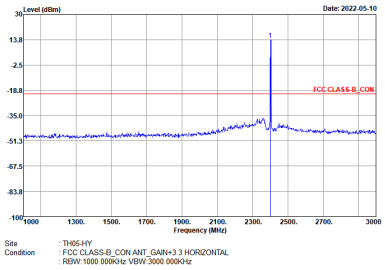
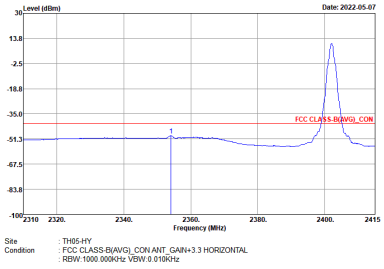
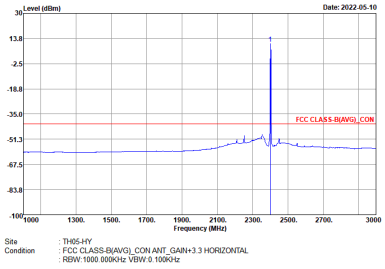
BLE (LF)

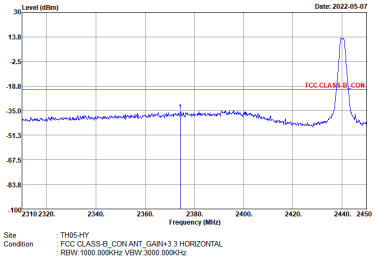
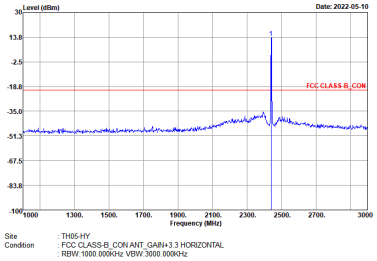
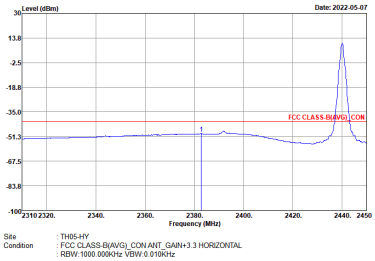
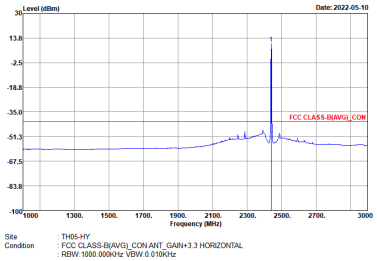
BLE	2.4GHz 2400~2483.5MHz	
	BLE LF	
Peak		Left blank

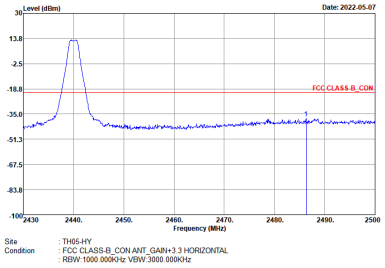
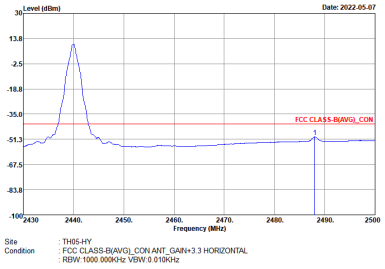
<2Mbps>

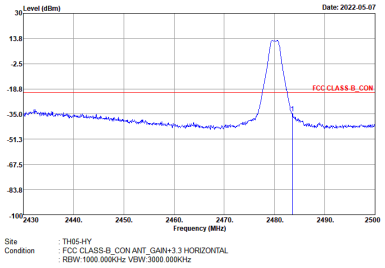
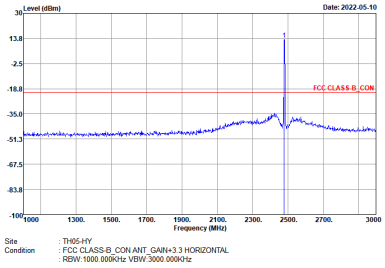
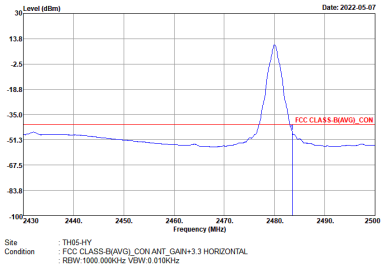
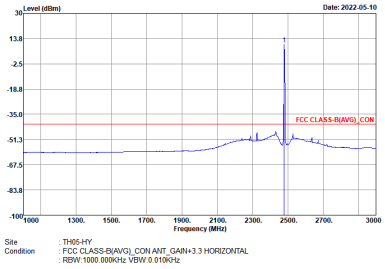
2.4GHz 2400~2483.5MHz

BLE (Band Edge)

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

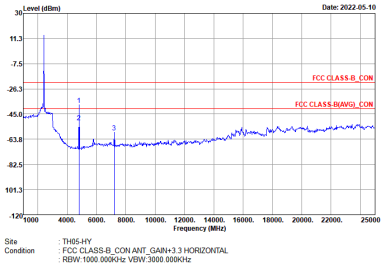
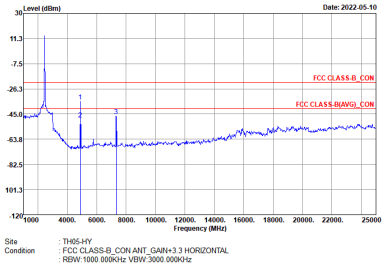
BLE	2.4GHz 2400~2483.5MHz Band Edge	
	BLE CH19 2440MHz - L	
	CSE	Fundamental
Peak		
Avg.		

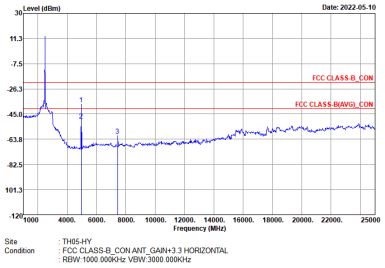
BLE	2.4GHz 2400~2483.5MHz Band Edge	
	BLE CH19 2440MHz - R	
	CSE	Fundamental
Peak		Left blank
Avg.		Left blank

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

2.4GHz 2400~2483.5MHz

BLE (Harmonic)

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

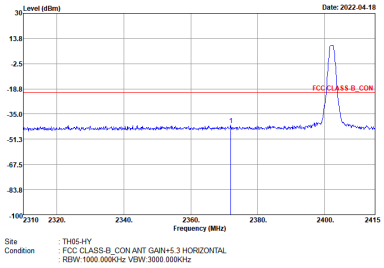
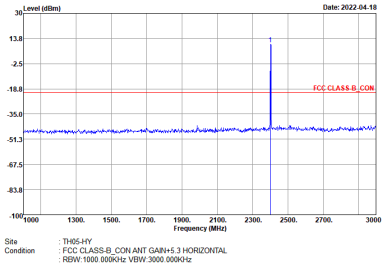
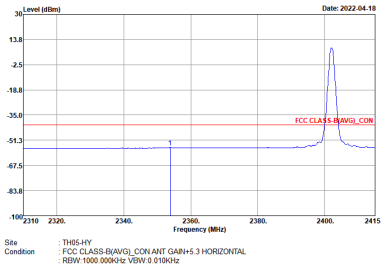
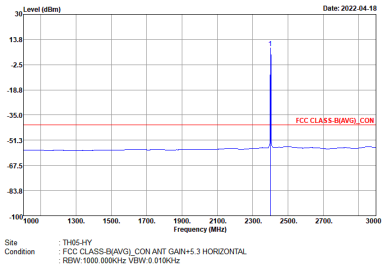
BLE	2.4GHz 2400~2483.5MHz Harmonic	
	BLE	
	CH39 2480MHz	
Peak Avg.		Left blank

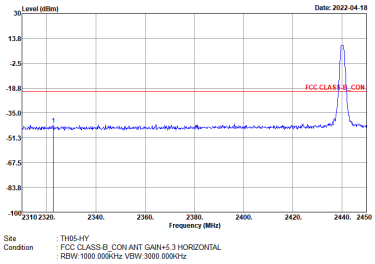
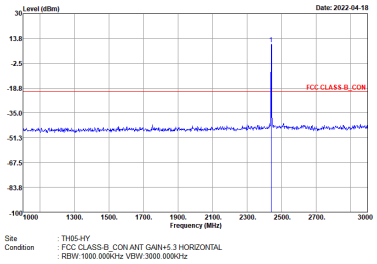
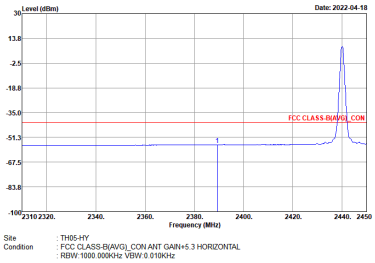
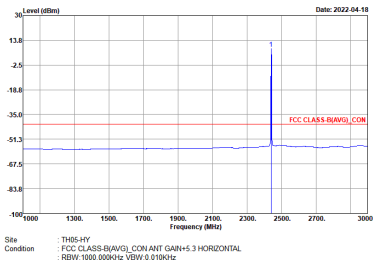
<Setting 5>

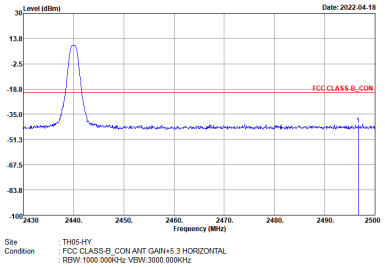
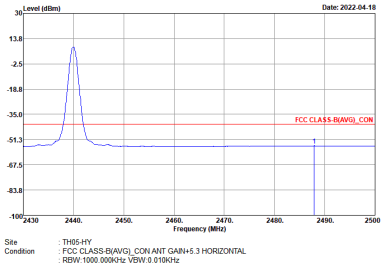
<1Mbps>

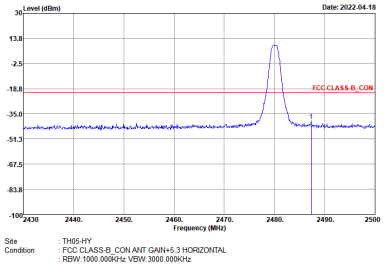
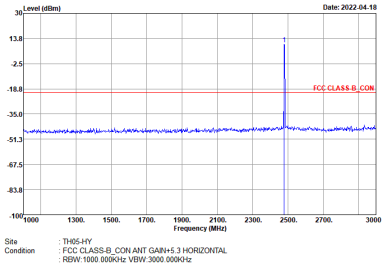
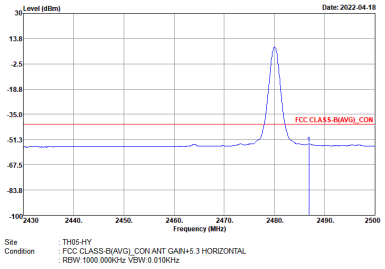
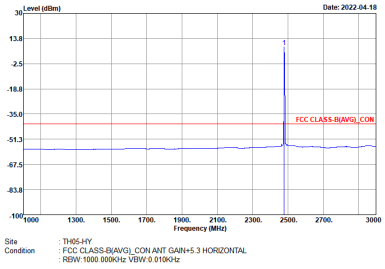
2.4GHz 2400~2483.5MHz

BLE (Band Edge)

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

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

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

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

2.4GHz 2400~2483.5MHz

BLE (Harmonic)

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