FCC RADIO TEST REPORT

FCC ID	**:**	**MMATRP150**
Equipment	**:**	**Midland Wireless Audio System - Repeater**
Brand Name	**:**	**Midland TeamComm®**
Model Name	**:**	**TRP150**
Marketing Name	**:**	**Midland TeamComm® Repeater**
Applicant	**:**	**Midland Radio** **5900 Parretta Drive Kansas City, MO 64120**
Manufacturer	**:**	**Midland Radio** **5900 Parretta Drive Kansas City, MO 64120**
Standard	**:**	**FCC Part 15 Subpart C §15.247**

The product was received on Apr. 21, 2021 and testing was started from Apr. 21, 2021 and completed on Jul. 04, 2021. We, Sporton International (USA) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (USA) Inc., the test report shall not be reproduced except in full.

Neil Kao

Approved by: Neil Kao

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

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History of this test report

Report No.	Version	Description	Issued Date
FR210420003B	01	Initial issue of report	Jul. 29, 2021

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	Under limit 3.79 dB at 2483.760 MHz
3.6	15.207	AC Conducted Emission	Pass	Under limit 23.22 dB at 1.966 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	Pass	-

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

1 General Description

1.1 Product Feature of Equipment Under Test

2.4GHz Proprietary Radio

Product Specification subjective to this standard	
Antenna Type	Patch Antenna

Antenna information		
2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	5.0

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

1.2 Modification of EUT

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

1.3 Testing Location

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

1.4 Applicable Standards

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

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

Remark:

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

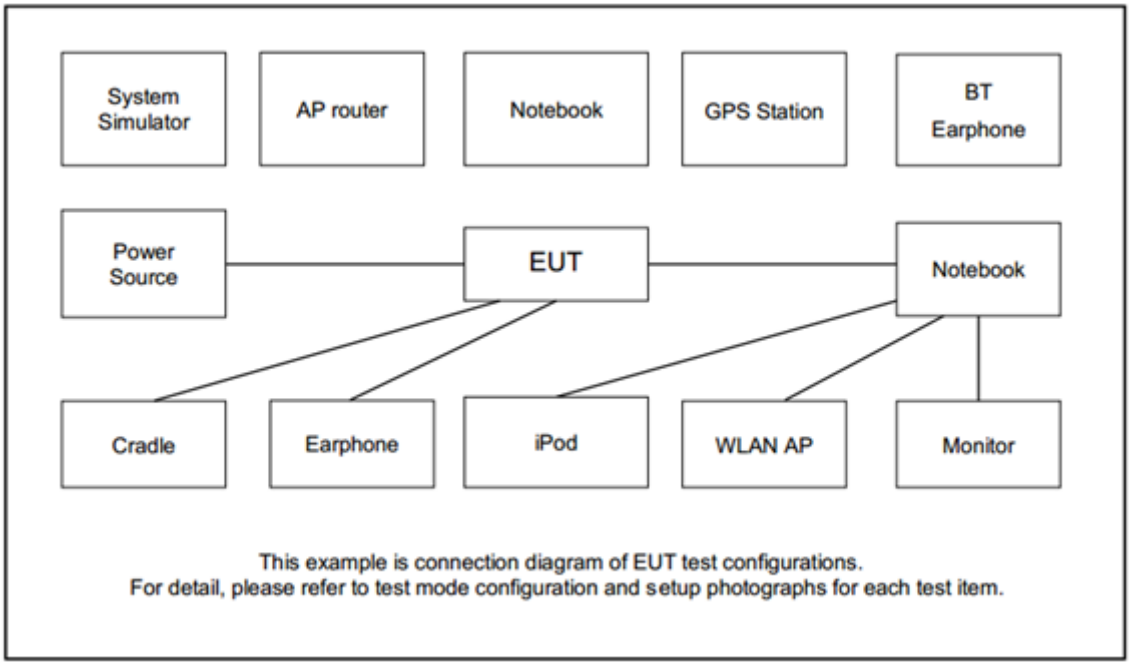
a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). 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 Y plane for 1Mbps, Z plane for 2Mbps 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	**2.4GHz Proprietary Radio / FHSS**
	Mode 1: 2.4GHz Proprietary Radio Tx CH00_2402 MHz_1Mbps
	Mode 2: 2.4GHz Proprietary Radio Tx CH19_2440 MHz_1Mbps
	Mode 3: 2.4GHz Proprietary Radio Tx CH39_2480 MHz_1Mbps
	Mode 4: 2.4GHz Proprietary Radio Tx CH00_2402 MHz_2Mbps
	Mode 5: 2.4GHz Proprietary Radio Tx CH19_2440 MHz_2Mbps
	Mode 6: 2.4GHz Proprietary Radio Tx CH39_2480 MHz_2Mbps
Radiated Test Cases	Mode 1: 2.4GHz Proprietary Radio Tx CH00_2402 MHz_1Mbps
	Mode 2: 2.4GHz Proprietary Radio Tx CH19_2440 MHz_1Mbps
	Mode 3: 2.4GHz Proprietary Radio Tx CH39_2480 MHz_1Mbps
	Mode 4: 2.4GHz Proprietary Radio Tx CH00_2402 MHz_2Mbps
	Mode 5: 2.4GHz Proprietary Radio Tx CH19_2440 MHz_2Mbps
	Mode 6: 2.4GHz Proprietary Radio Tx CH39_2480 MHz_2Mbps
AC Conducted Emission	Mode 1 :Earbud Link + 2.4GHz Proprietary Radio Link + 6-Earbud Charge with AC Adapter
	Mode 2 :Earbud Link + 2.4GHz Proprietary Radio Link + 2-Earbud Charge with AC Adapter
Remark: The worst case of conducted emission is mode 1; only the test data of it was reported.	

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.	6-earbud charge	Midland Radio	TGC150	MMATGC150	N/A	N/A
2.	2-earbud charge	Midland Radio	TGC150	MMATDC150	N/A	N/A
3.	Earbud	Midland Radio	TC150	MMATC150	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “JLink_Windows_V700a.exe V7.00a” was installed in EUT 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.

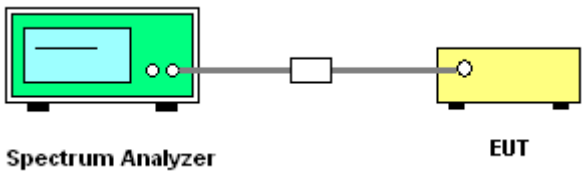
3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW) ≥ 3 * RBW.
6. Measure and record the results in the test report.

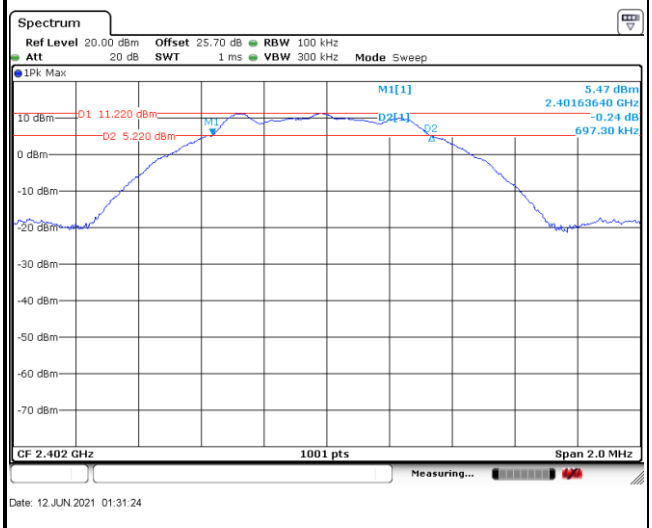
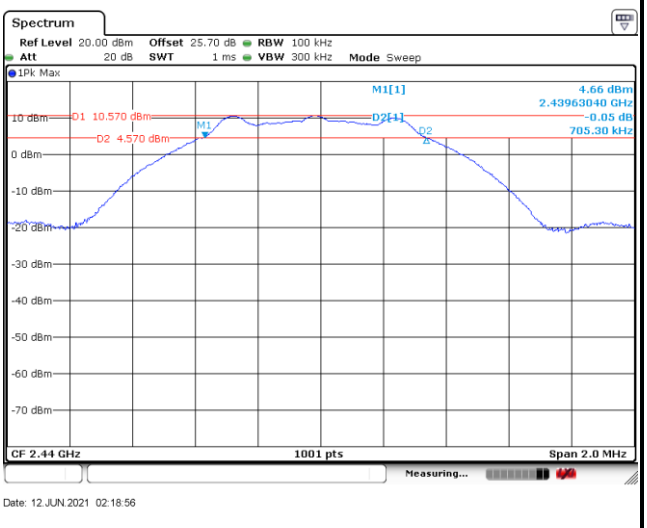
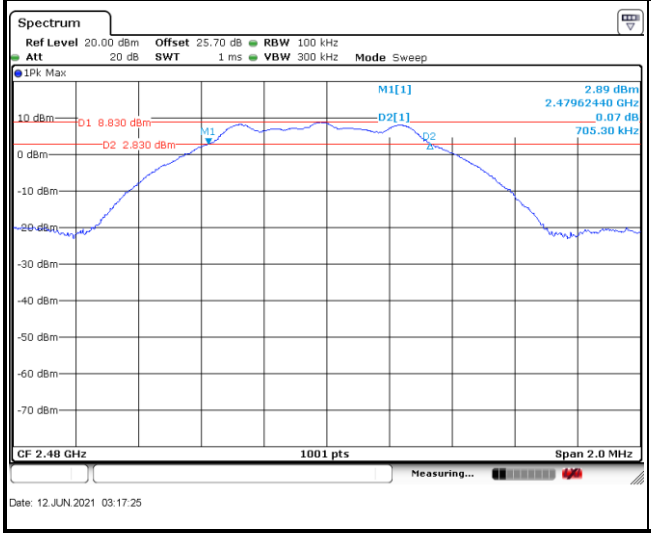
3.1.4 Test Setup



3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

<1Mbps>

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

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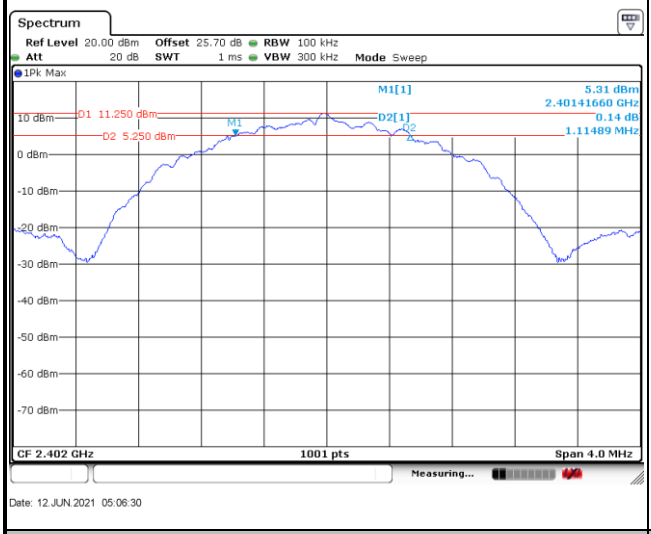
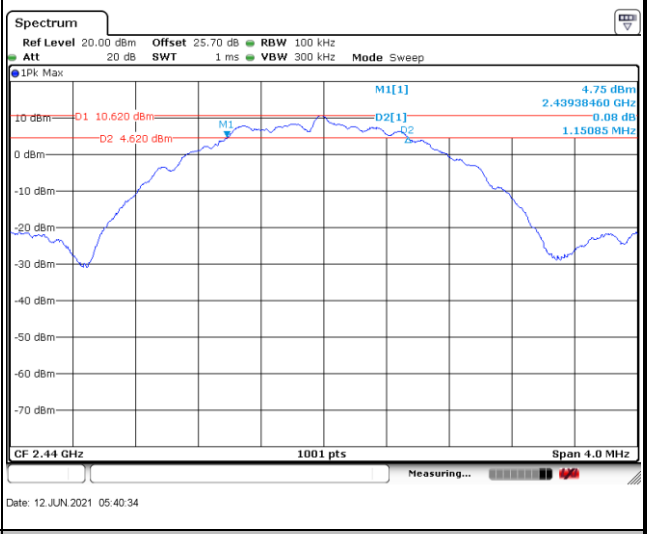
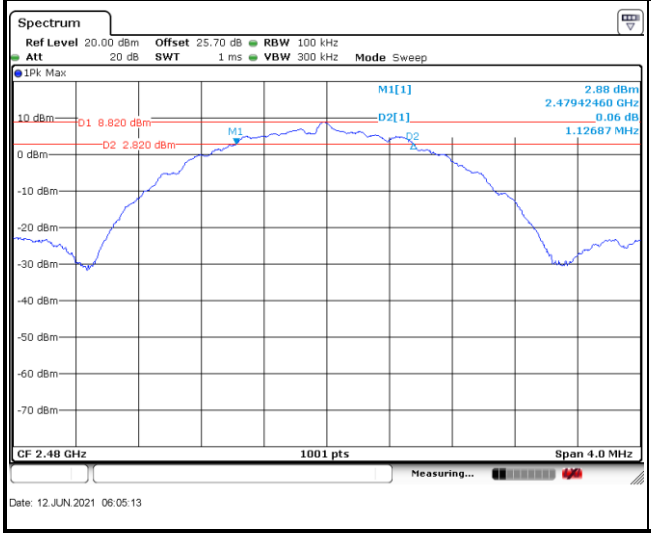
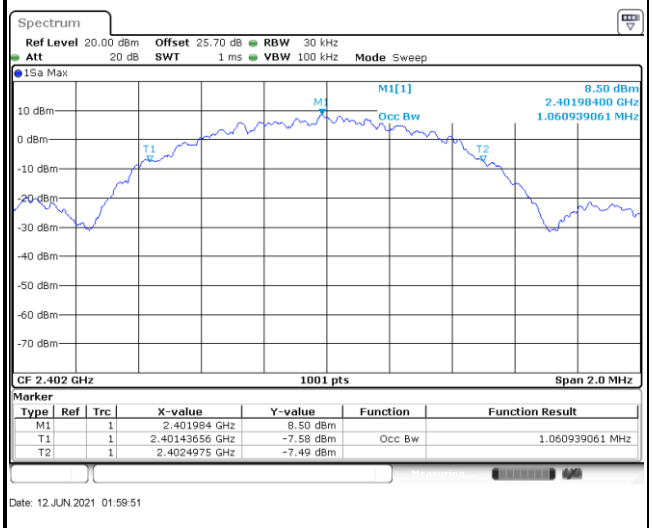
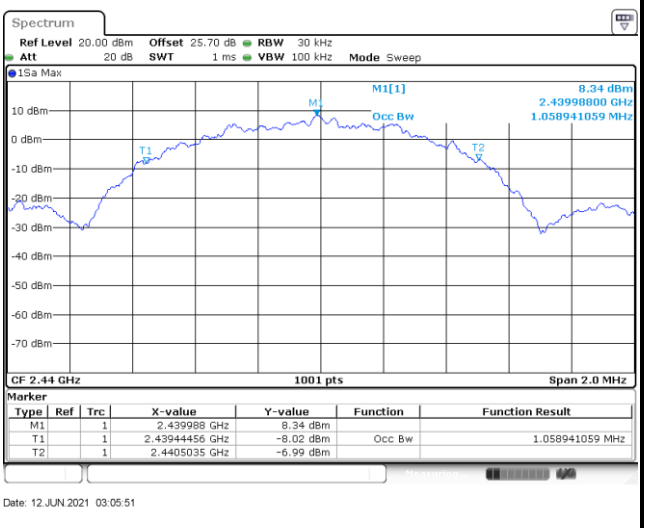
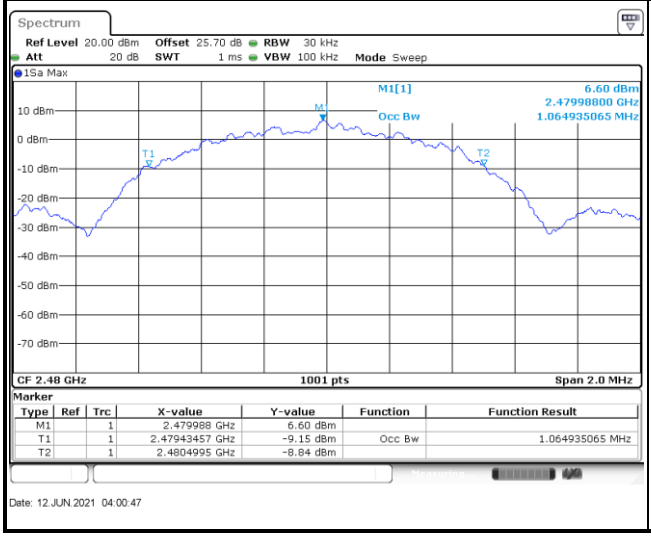
6 dB Bandwidth Plot on Channel 00	6 dB Bandwidth Plot on Channel 19
	
6 dB Bandwidth Plot on Channel 39	**N/A**
	

3.1.6 Test Result of 99% Occupied Bandwidth

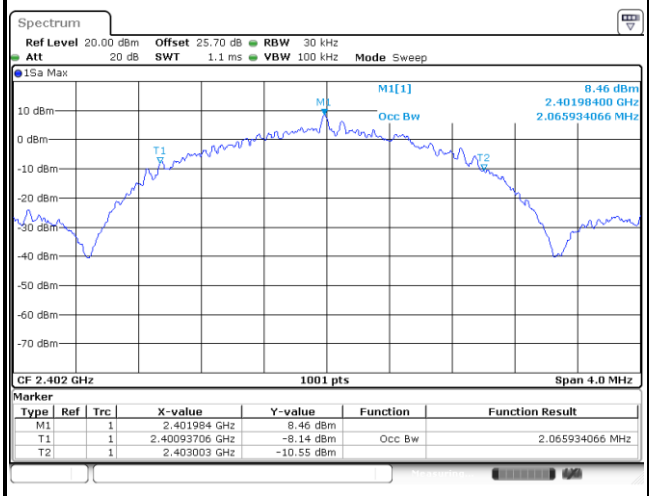
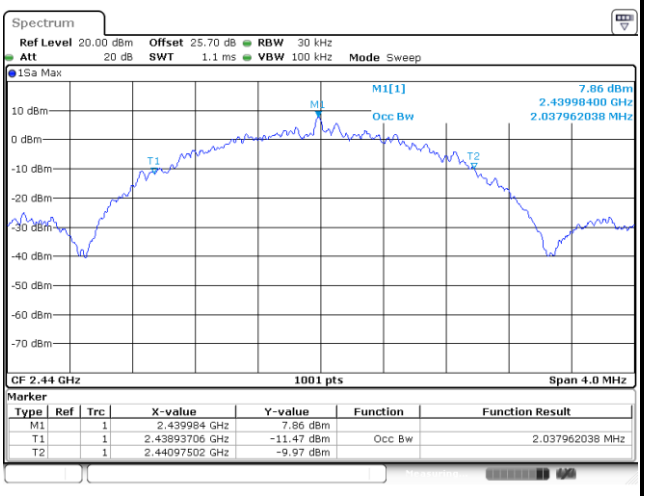
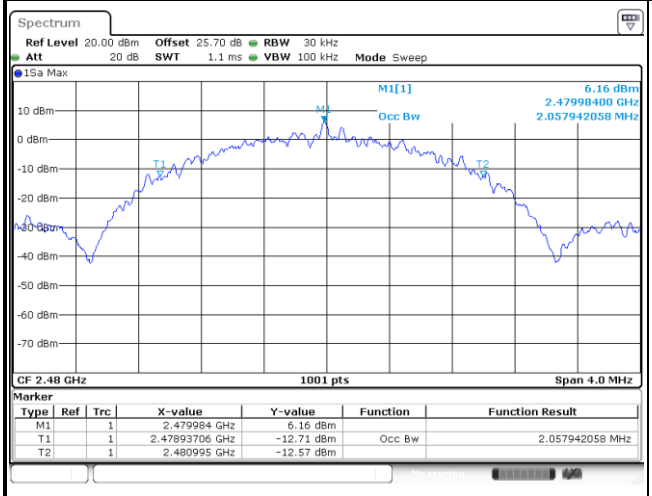
Please refer to Appendix A.

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

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

3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5 MHz, the limit for output power is 30 dBm. If transmitting antenna of directional gain greater than 6 dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

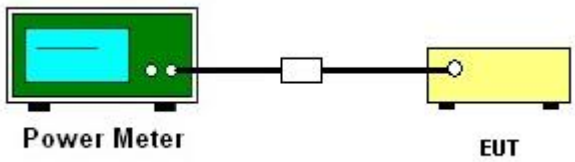
3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

3.2.3 Test Procedures

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

3.2.4 Test Setup



3.2.5 Test Result of Average Output Power

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

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

3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

3.3.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.10.2 Method PKPSD.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz. In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.
7. The Measured power density (dBm)/ 100 kHz is a reference level and is used as 20 dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

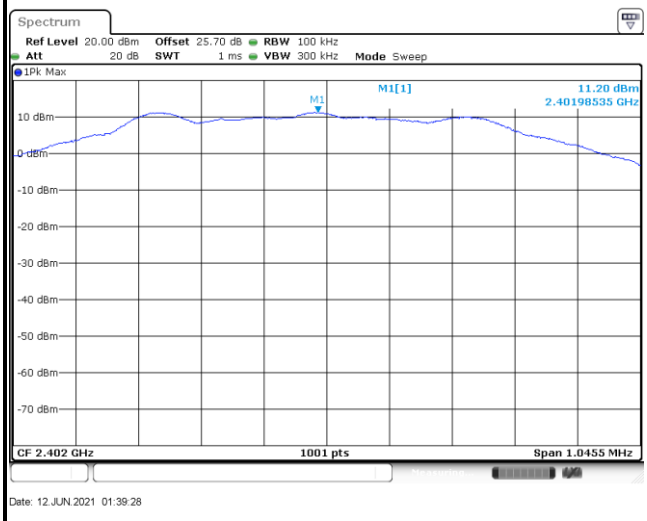
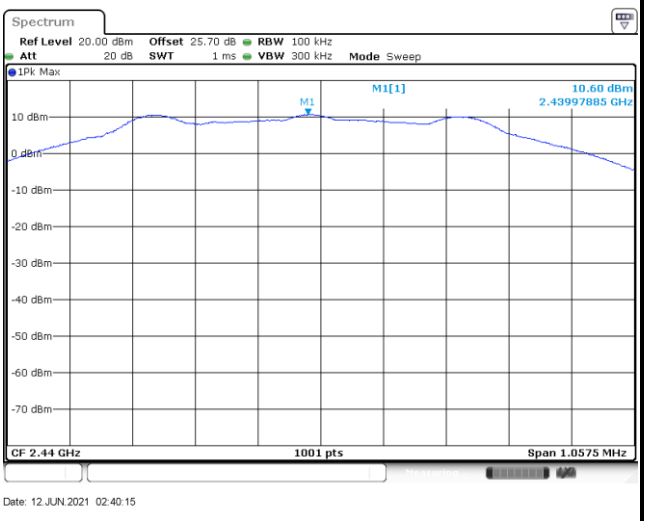
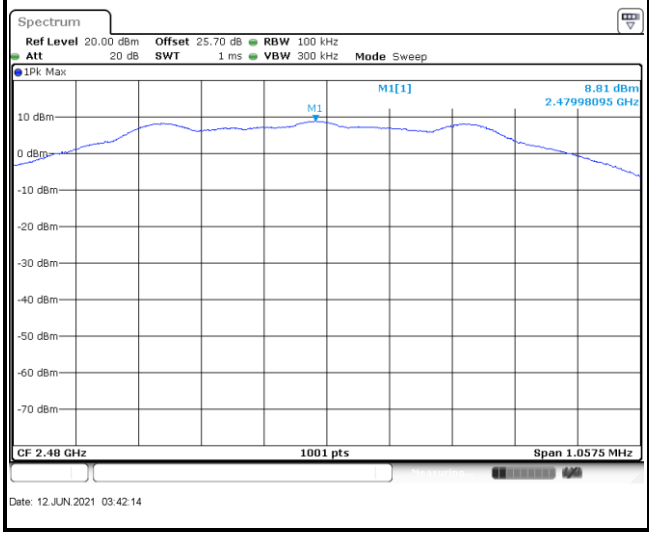
3.3.4 Test Setup

3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

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

<1Mbps>

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

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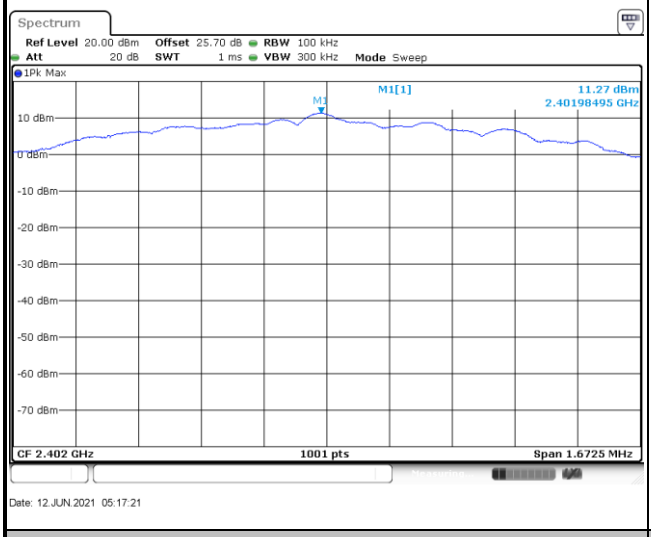
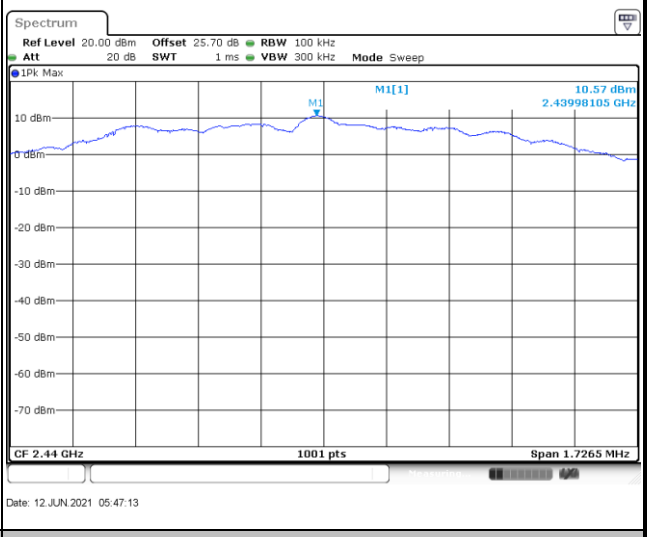
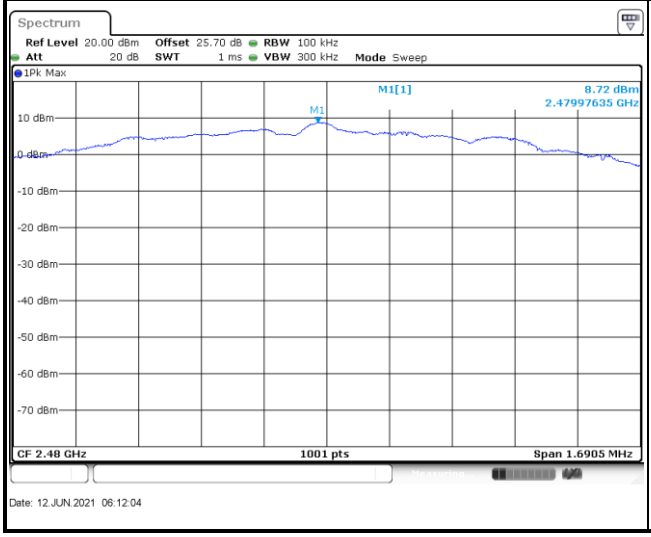
PSD 100kHz Plot on Channel 00	PSD 100kHz Plot on Channel 19
	
PSD 100kHz Plot on Channel 39	**N/A**
	

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

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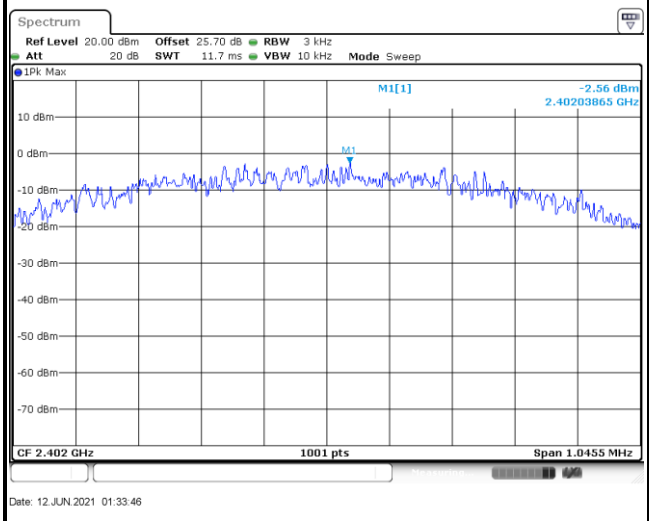
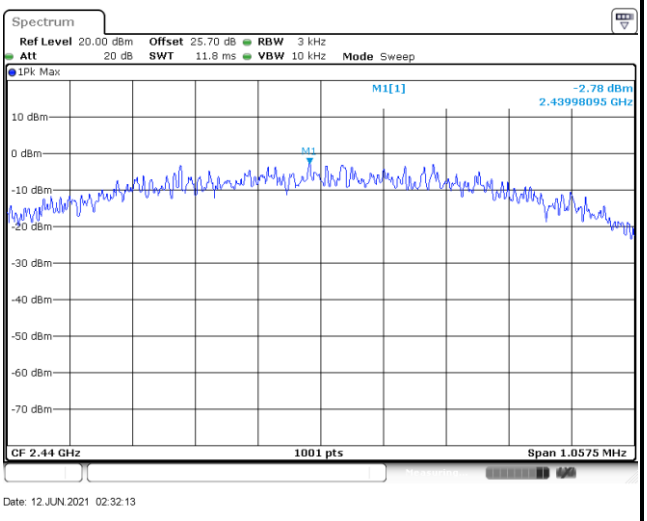
PSD 3kHz Plot on Channel 00	PSD 3kHz Plot on Channel 19
	
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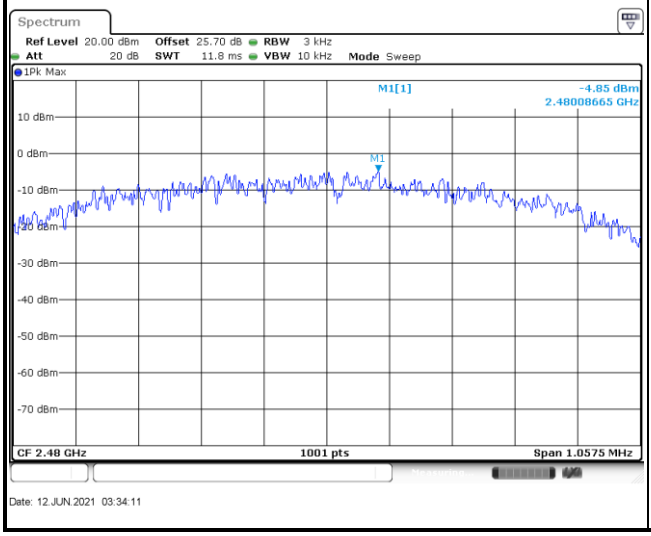	

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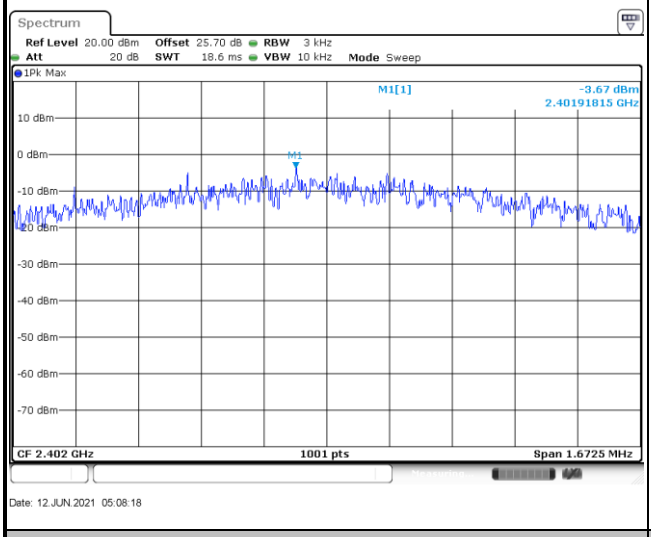
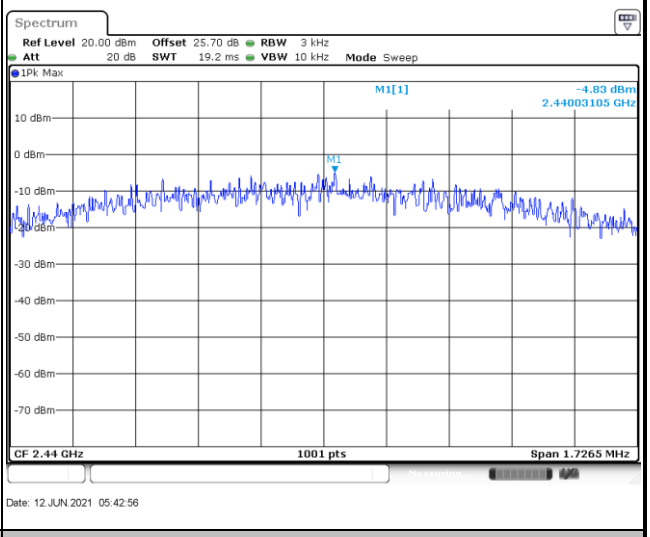
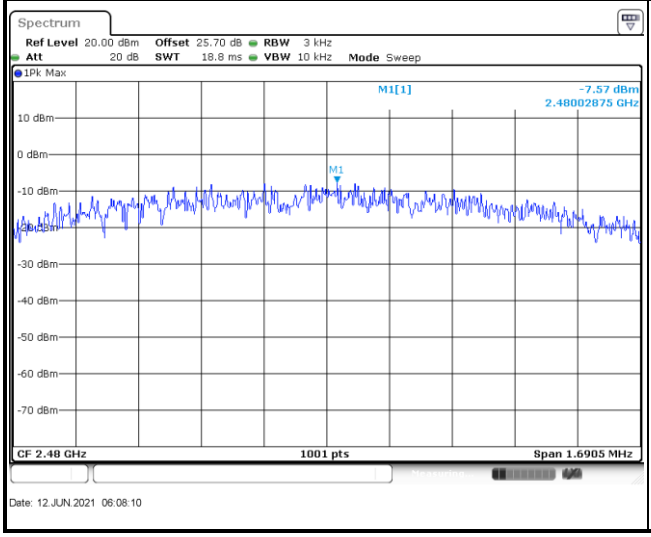
PSD 3kHz Plot on Channel 00	PSD 3kHz Plot on Channel 19
	
PSD 3kHz Plot on Channel 39	**N/A**
	

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.

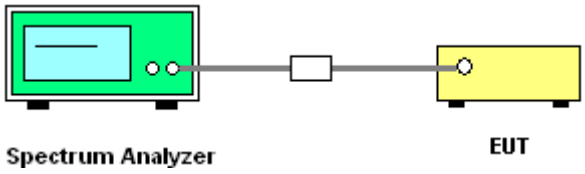
3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

3.4.3 Test Procedure

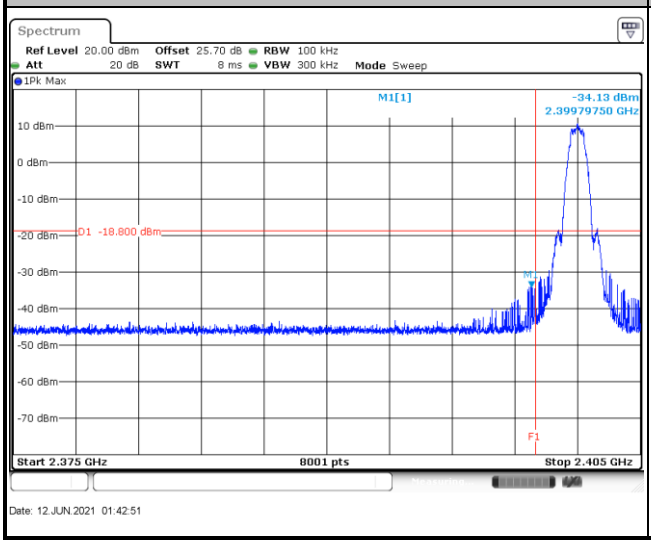
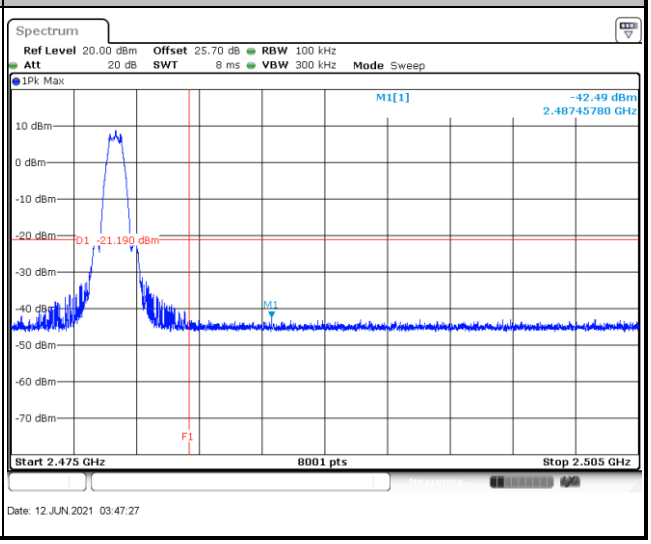
1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Set RBW = 100 kHz, VBW = 300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup

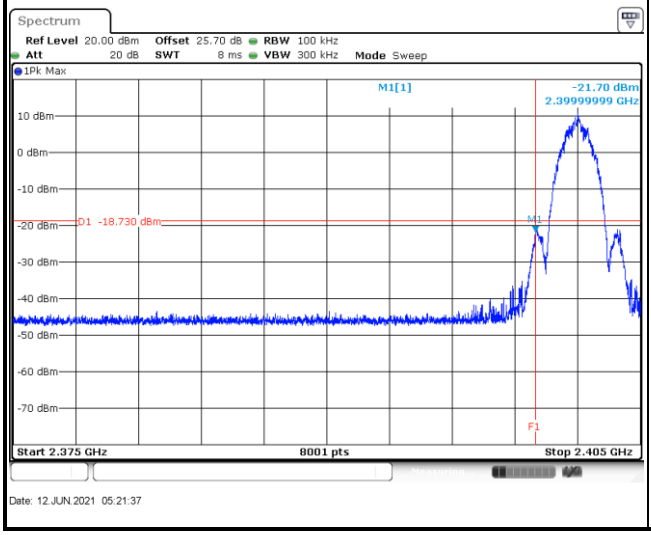
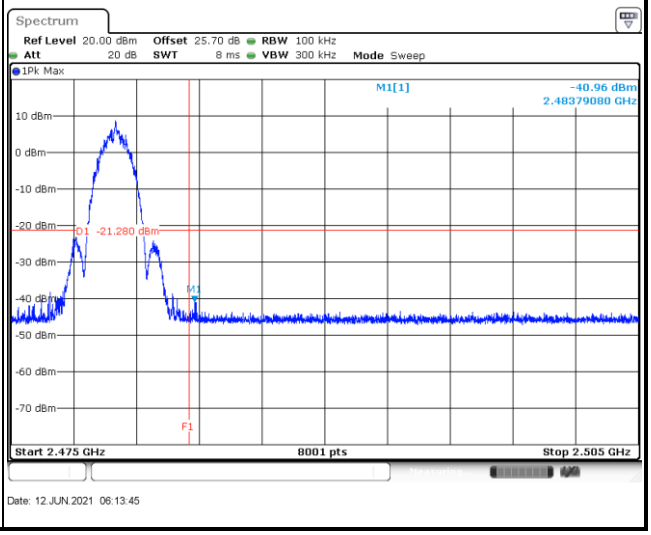


3.4.5 Test Result of Conducted Band Edges Plots

<1Mbps>

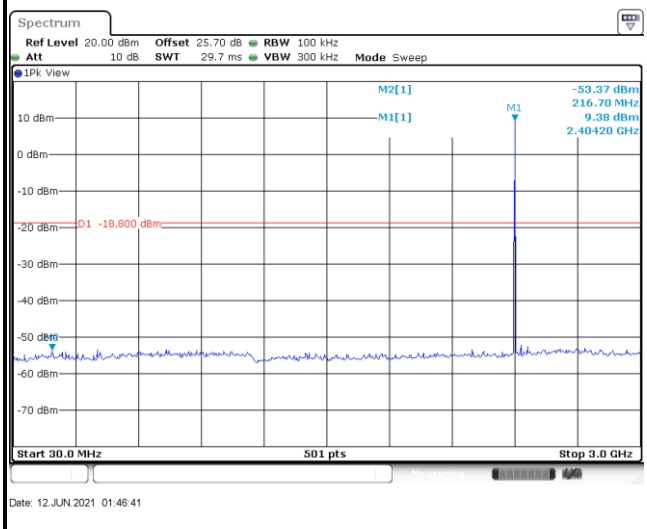
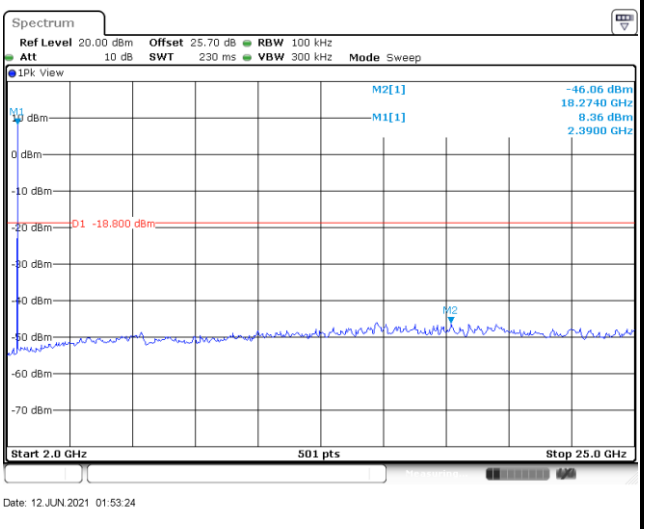
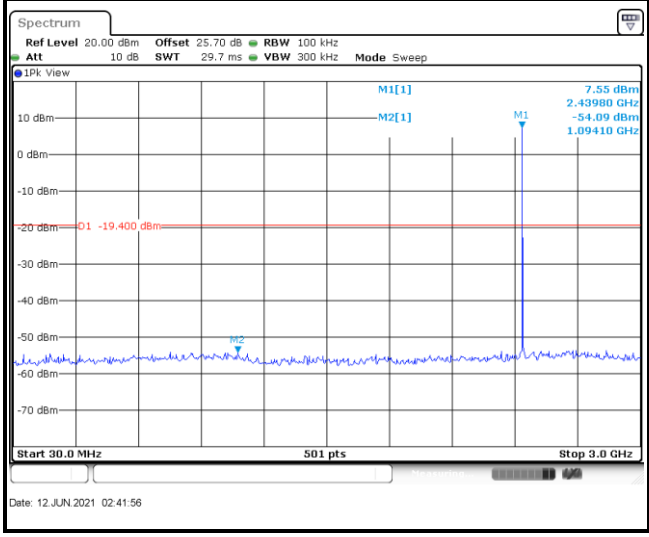
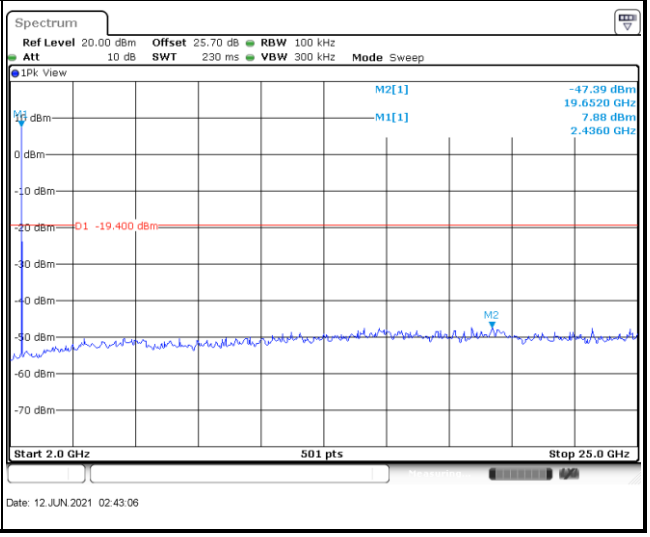
Low Band Edge Plot on Channel 00	High Band Edge Plot on Channel 39
	

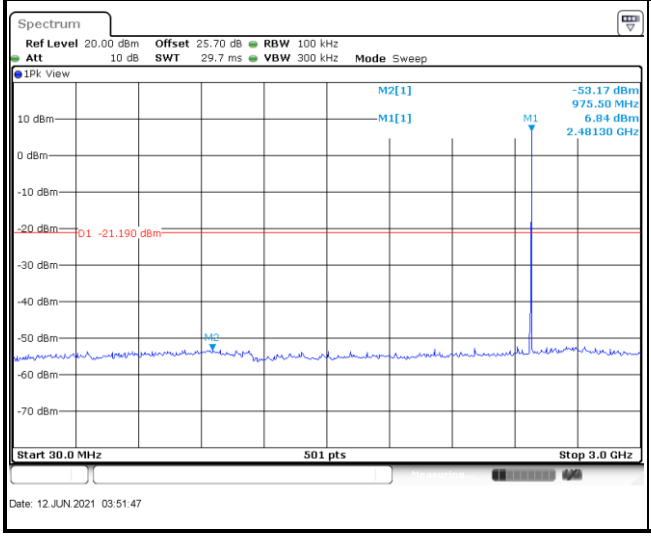
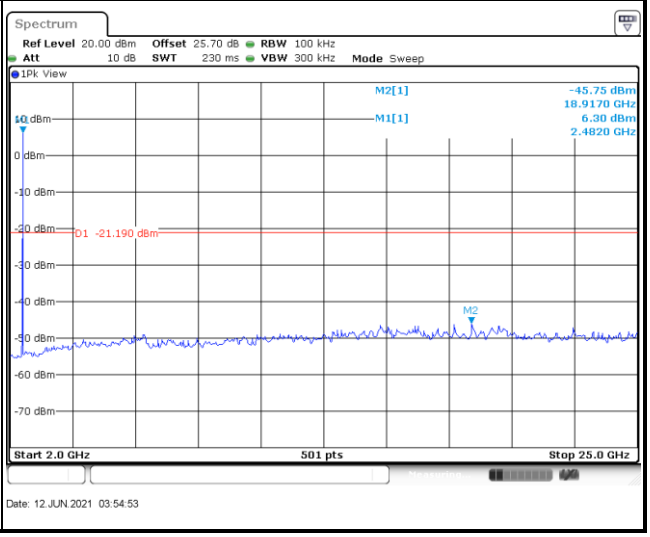
<2Mbps>

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

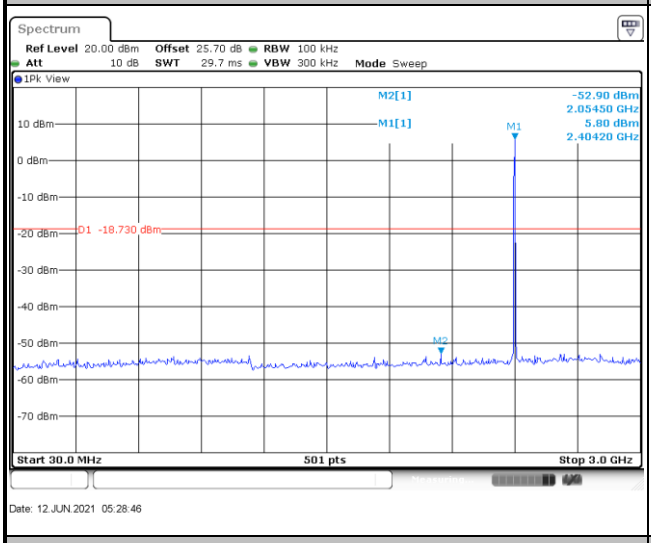
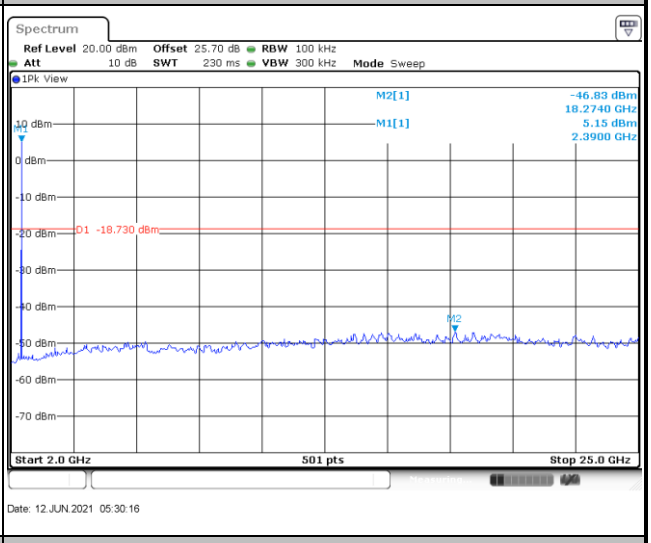
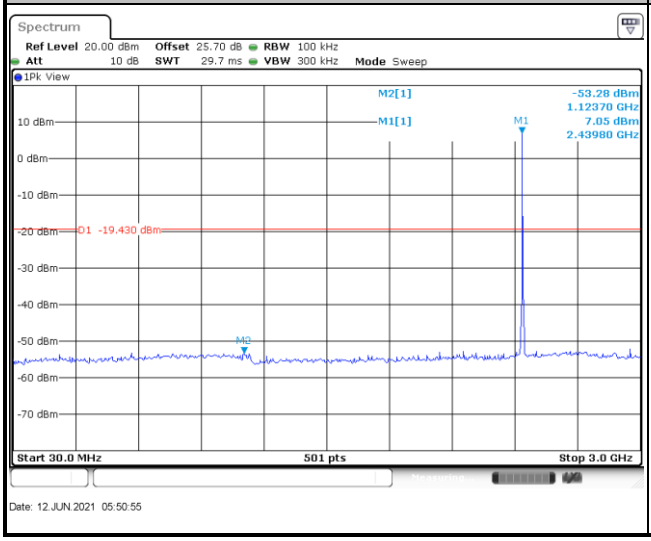
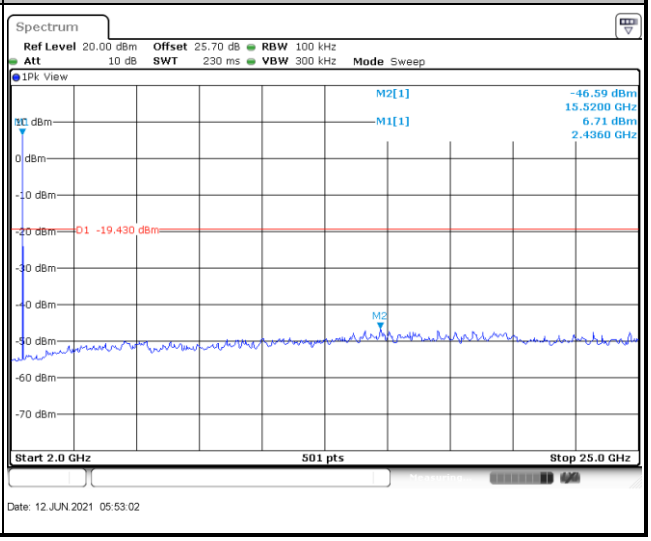
3.4.6 Test Result of Conducted Spurious Emission Plots

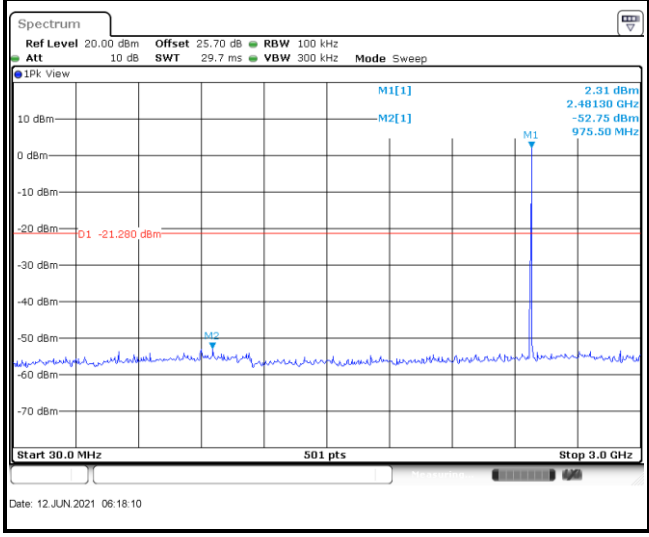
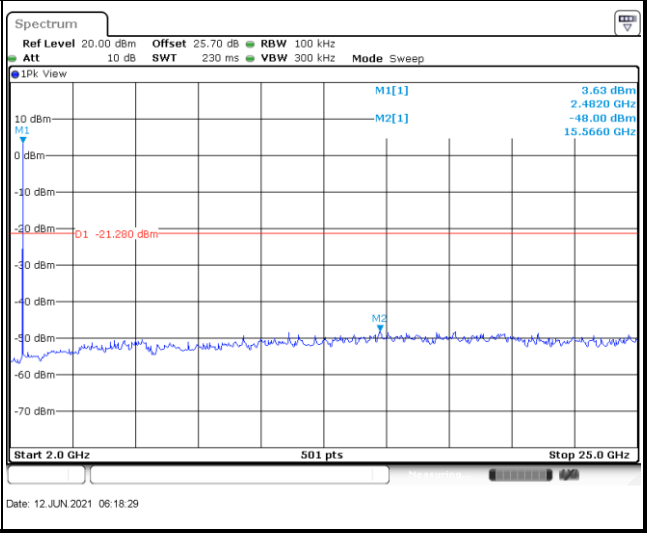
<1Mbps>

Conducted Spurious Emission Plot on 2.4GHz Proprietary Radio 1Mbps GFSK Channel 00	Conducted Spurious Emission Plot on 2.4GHz Proprietary Radio 1Mbps GFSK Channel 00
	
Conducted Spurious Emission Plot on 2.4GHz Proprietary Radio 1Mbps GFSK Channel 19	**Conducted Spurious Emission Plot on 2.4GHz Proprietary Radio 1Mbps GFSK Channel 19**
	

Conducted Spurious Emission Plot on 2.4GHz Proprietary Radio 1Mbps GFSK Channel 39	Conducted Spurious Emission Plot on 2.4GHz Proprietary Radio 1Mbps GFSK Channel 39
	

<2Mbps>

Conducted Spurious Emission Plot on 2.4GHz Proprietary Radio 2Mbps GFSK Channel 00	Conducted Spurious Emission Plot on 2.4GHz Proprietary Radio 2Mbps GFSK Channel 00
	
Conducted Spurious Emission Plot on 2.4GHz Proprietary Radio 2Mbps GFSK Channel 19	**Conducted Spurious Emission Plot on 2.4GHz Proprietary Radio 2Mbps GFSK Channel 19**
	

Conducted Spurious Emission Plot on 2.4GHz Proprietary Radio 2Mbps GFSK Channel 39	Conducted Spurious Emission Plot on 2.4GHz Proprietary Radio 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 was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.5.2 Measuring Instruments

See list of measuring equipment of this test report.

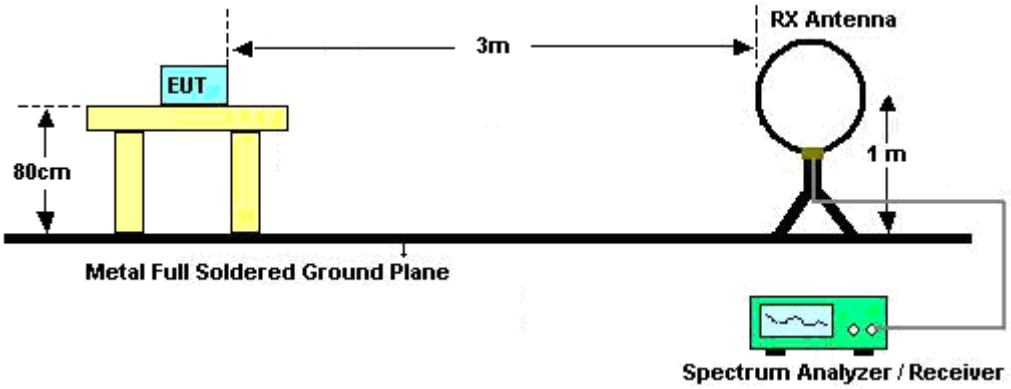
3.5.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For testing below 1 GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and be reported.
7. For testing above 1 GHz, the emission level of the EUT in peak mode was 20 dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and be reported.

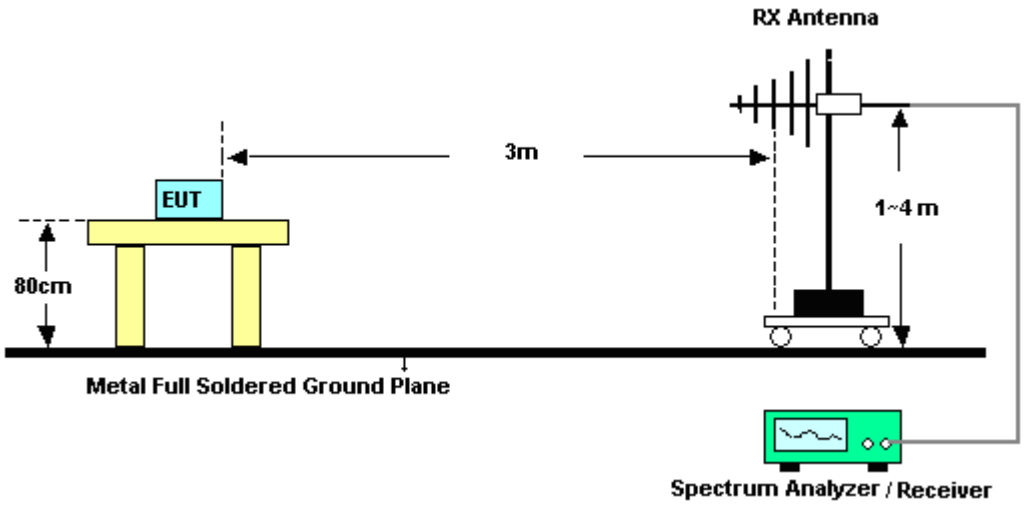
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-33.98dB for 1Mbps; -39.58dB for 2Mbps) derived from 20log (dwell time/100ms). This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

3.5.4 Test Setup

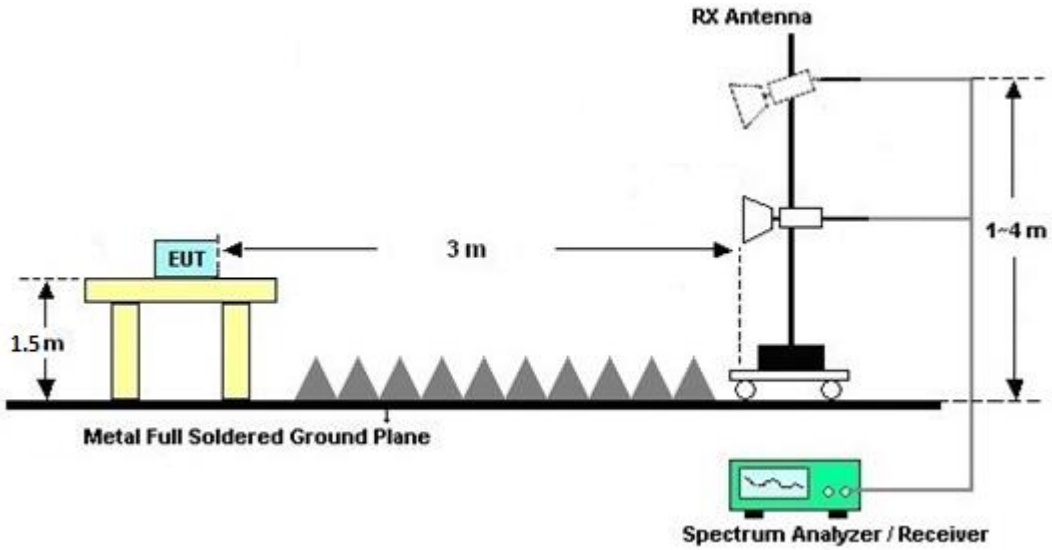
For radiated test below 30MHz



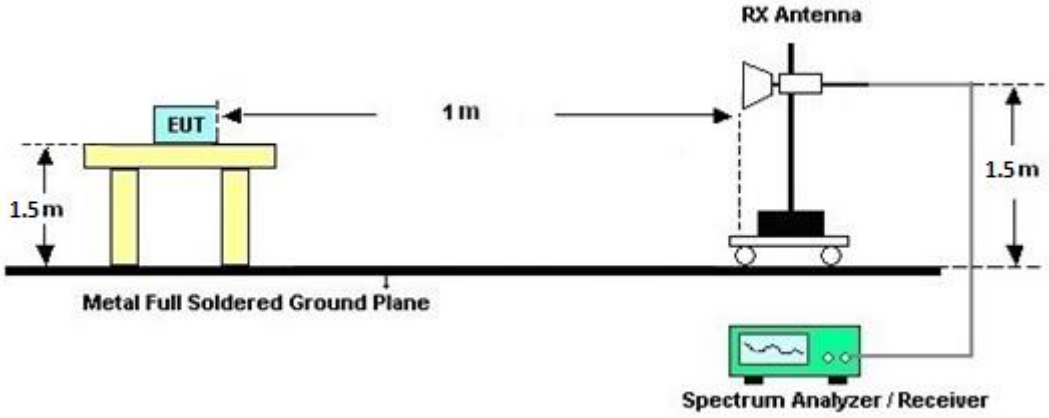
For radiated test from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



3.5.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is 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 came out very similar.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.5.7 Duty Cycle

Please refer to Appendix E.

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

Please refer to Appendix C and D.

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

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

Frequency of emission (MHz)	Conducted limit (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.

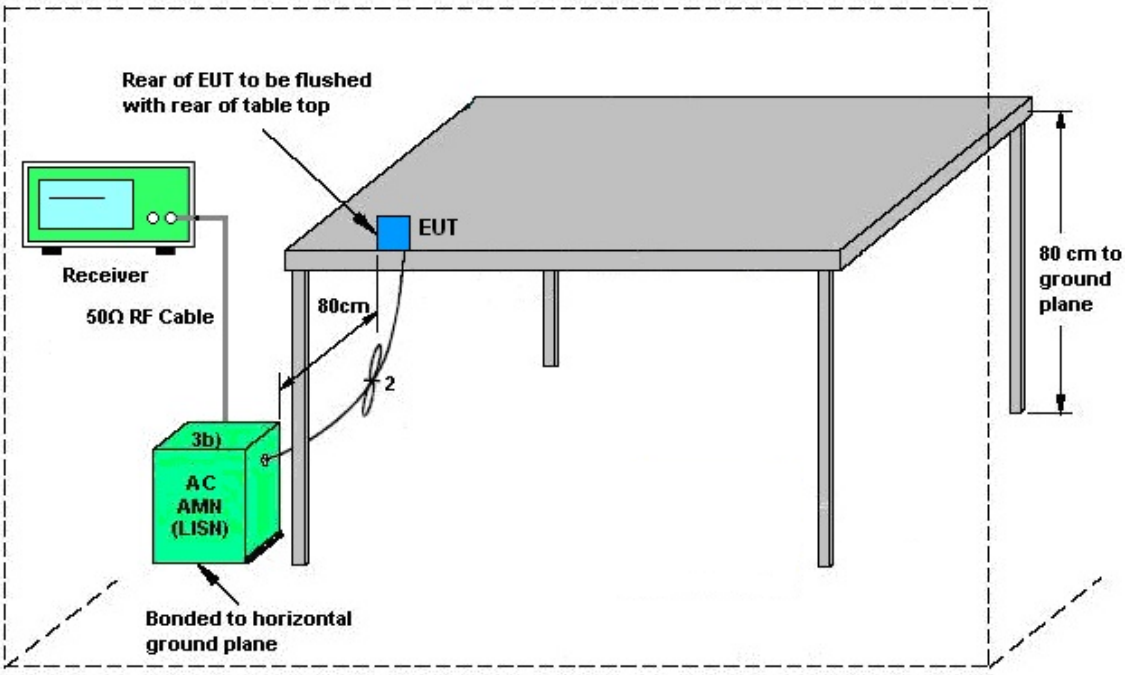
3.6.2 Measuring Instruments

See list of measuring equipment of this test report.

3.6.3 Test Procedures

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

3.6.4 Test Setup



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
Hygrometer	Testo	608-H1	45142595	N/A	Aug. 05, 2020	Apr. 21, 2021~ Jun. 29, 2021	Aug. 04, 2021	Conducted (TH01-CA)
USB Power Sensor	DARE	RPR3006W	15I00041SNO09	10MHz-6GHz	Jan. 06, 2021	Apr. 21, 2021~ Jun. 29, 2021	Jan. 05, 2022	Conducted (TH01-CA)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101089	10Hz-40GHz	Sep. 14, 2020	Apr. 21, 2021~ Jun. 29, 2021	Sep. 13, 2021	Conducted (TH01-CA)
LISN	TESEQ	NNB51	47407	N/A	Jul. 06, 2020	Jul. 04, 2021	Jul. 05, 2021	Conduction (CO01-CA)
EMI Test Receiver	R&S	ESR7	102177	9KHz~7GHz	Jul. 16, 2020	Jul. 04, 2021	Jul. 15, 2021	Conduction (CO01-CA)
Pulse limiter with 10dB attenuation	R&S	VTSD 9561-F N	9561-F-N00412	N/A	Jul. 08, 2020	Jul. 04, 2021	Jul. 07, 2021	Conduction (CO01-CA)
Test Software	R&S	EMC32 V10.30.0	N/A	N/A	N/A	Jul. 04, 2021	N/A	Conduction (CO01-CA)
Bilog Antenna	TESEQ	6111D	50391	30MHz~1GHz	Jul. 06, 2020	May 25, 2021~ Jun. 10, 2021	Jul. 05, 2021	Radiation (03CH02-CA)
Horn Antenna	SCHWARZBECK	BBHA 9120D	01895	1GHz~18GHz	Aug. 28, 2020	May 25, 2021~ Jun. 10, 2021	Aug. 27, 2021	Radiation (03CH02-CA)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA9170	00842	18GHz~40GHz	Jul. 27, 2020	May 25, 2021~ Jun. 10, 2021	Jul. 26, 2021	Radiation (03CH02-CA)
Amplifier	SONOMA	310N	372240	N/A	Aug. 12, 2020	May 25, 2021~ Jun. 10, 2021	Aug. 11, 2021	Radiation (03CH02-CA)
Preamplifier	Keysight	83017A	MY53270323	1GHz~26.5GHz	Jul. 28, 2020	May 25, 2021~ Jun. 10, 2021	Jul. 27, 2021	Radiation (03CH02-CA)
Preamplifier	E-instrument	ERA-100M-18G-56-01-A70	EC1900251	N/A	Mar. 30, 2021	May 25, 2021~ Jun. 10, 2021	Mar. 29, 2022	Radiation (03CH02-CA)
Preamplifier	EMEC	EMC18G40G	060725	18G-40G	Aug. 07, 2020	May 25, 2021~ Jun. 10, 2021	Aug. 06, 2021	Radiation (03CH02-CA)
EMI Test Receiver	Rohde & Schwarz	ESU26	100049	20Hz~26.5GHz	Aug. 11, 2020	May 25, 2021~ Jun. 10, 2021	Aug. 10, 2021	Radiation (03CH02-CA)
Spectrum Analyzer	Keysight	N9010A	MY57420221	10Hz~44GHz	Sep. 11, 2020	May 25, 2021~ Jun. 10, 2021	Sep. 10, 2021	Radiation (03CH02-CA)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN10	3G High Pass	Jul. 24, 2020	May 25, 2021~ Jun. 10, 2021	Jul. 23, 2021	Radiation (03CH02-CA)
Filter	Wainwright	WLK12-1200-1272-11000-40SS	SN2	1.2G Low Pass	Jul. 24, 2020	May 25, 2021~ Jun. 10, 2021	Jul. 23, 2021	Radiation (03CH02-CA)
Hygrometer	TESEO	608-H1	45142602	N/A	Aug. 05, 2020	May 25, 2021~ Jun. 10, 2021	Aug. 04, 2021	Radiation (03CH02-CA)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	May 25, 2021~ Jun. 10, 2021	N/A	Radiation (03CH02-CA)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	May 25, 2021~ Jun. 10, 2021	N/A	Radiation (03CH02-CA)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	May 25, 2021~ Jun. 10, 2021	N/A	Radiation (03CH02-CA)
Software	Audix	E3	N/A	N/A	N/A	May 25, 2021~ Jun. 10, 2021	N/A	Radiation (03CH02-CA)

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))	**2.2 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.5 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**6.1 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**6.5 dB**

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Andy Kao	Temperature:	18.1-25.1	°C
Test Date:	2021/04/21~2021/06/29	Relative Humidity:	31.5-52.9	%

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
2.4GHz	1Mbps	1	0	2402	1.061	0.697	0.50	Pass
2.4GHz	1Mbps	1	19	2440	1.059	0.705	0.50	Pass
2.4GHz	1Mbps	1	39	2480	1.065	0.705	0.50	Pass

TEST RESULTS DATA
Average Power Table

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	Average Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
2.4GHz	1Mbps	1	0	2402	11.40	30.00	5.00	16.40	36.00	Pass
2.4GHz	1Mbps	1	19	2440	10.70	30.00	5.00	15.70	36.00	Pass
2.4GHz	1Mbps	1	39	2480	8.90	30.00	5.00	13.90	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
2.4GHz	1Mbps	1	0	2402	11.20	-2.56	5.00	8.00	Pass
2.4GHz	1Mbps	1	19	2440	10.60	-2.78	5.00	8.00	Pass
2.4GHz	1Mbps	1	39	2480	8.81	-4.85	5.00	8.00	Pass

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

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
2.4GHz	2Mbps	1	0	2402	2.066	1.115	0.50	Pass
2.4GHz	2Mbps	1	19	2440	2.038	1.151	0.50	Pass
2.4GHz	2Mbps	1	39	2480	2.058	1.127	0.50	Pass

TEST RESULTS DATA
Average Power Table

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
2.4GHz	2Mbps	1	0	2402	11.40	30.00	5.00	16.40	36.00	Pass
2.4GHz	2Mbps	1	19	2440	10.70	30.00	5.00	15.70	36.00	Pass
2.4GHz	2Mbps	1	39	2480	8.90	30.00	5.00	13.90	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
2.4GHz	2Mbps	1	0	2402	11.27	-3.67	5.00	8.00	Pass
2.4GHz	2Mbps	1	19	2440	10.57	-4.83	5.00	8.00	Pass
2.4GHz	2Mbps	1	39	2480	8.72	-7.57	5.00	8.00	Pass

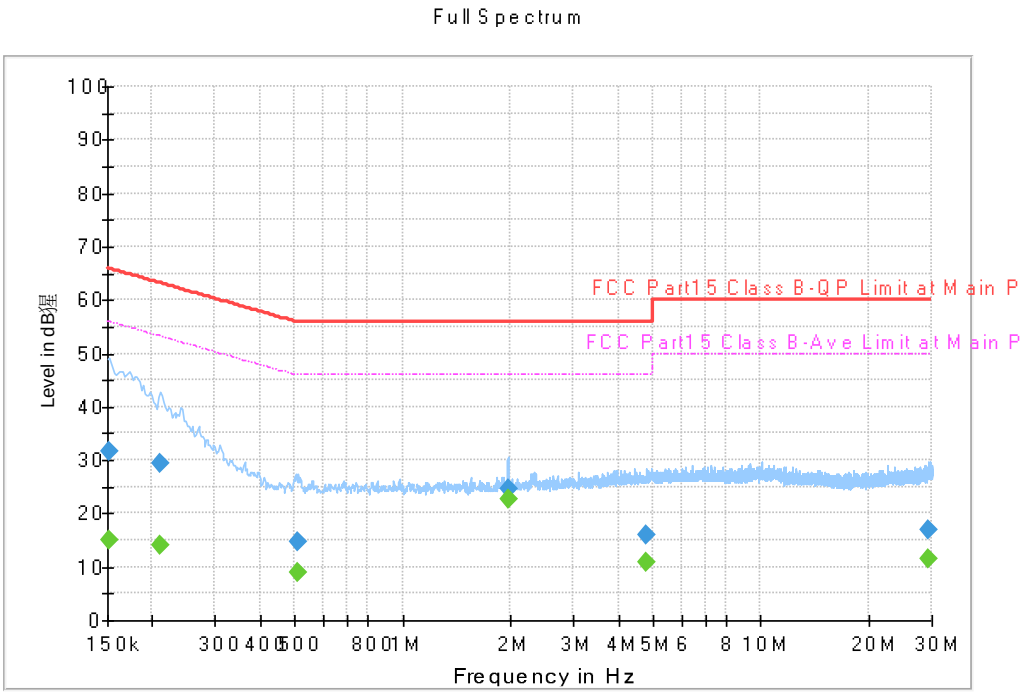
Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 30dBc limit.

Appendix B. AC Conducted Emission Test Results

Test Engineer :	Jordan Huang	**Temperature :**	24℃
		Relative Humidity :	45%

EUT Information

Site:	CO01-CA
Power:	120Vac/60Hz
Mode:	1
	Earbud Link + Repeater Link + 6-earbud charge with AC adapter

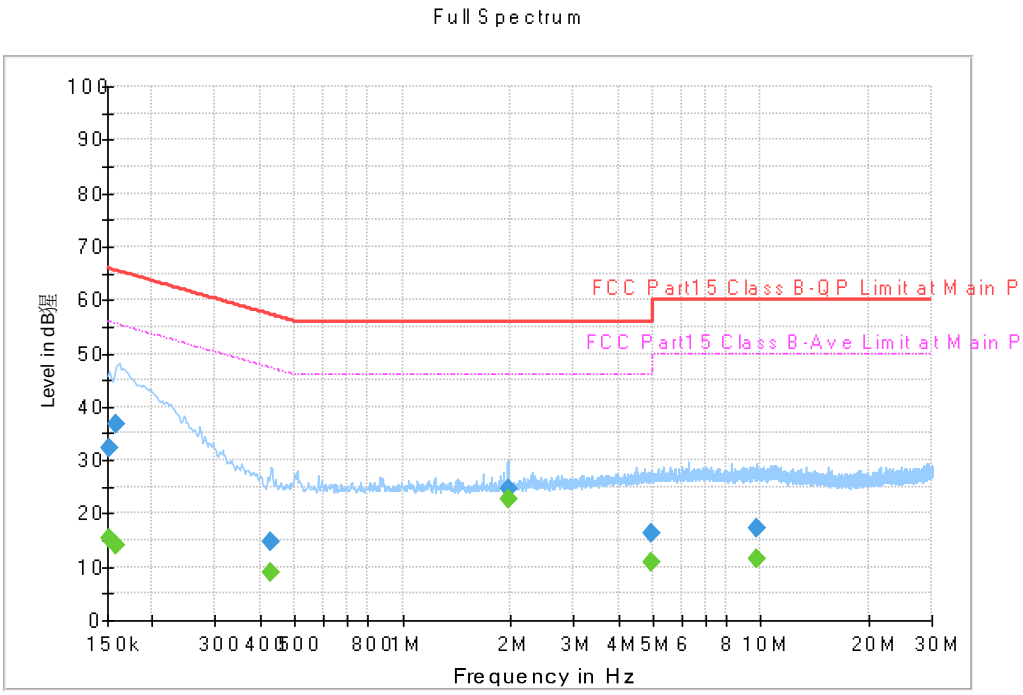


Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	31.61	---	65.88	34.27	L1	OFF	20.3
0.152250	---	15.10	55.88	40.78	L1	OFF	20.3
0.210750	29.55	---	63.18	33.63	L1	OFF	20.3
0.210750	---	14.04	53.18	39.14	L1	OFF	20.3
0.512250	14.81	---	56.00	41.19	L1	OFF	20.3
0.512250	---	9.04	46.00	36.96	L1	OFF	20.3
1.965750	24.58	---	56.00	31.42	L1	OFF	20.3
1.965750	---	22.78	46.00	23.22	L1	OFF	20.3
4.771500	16.13	---	56.00	39.87	L1	OFF	20.4
4.771500	---	10.84	46.00	35.16	L1	OFF	20.4
29.213250	16.85	---	60.00	43.15	L1	OFF	20.7
29.213250	---	11.51	50.00	38.49	L1	OFF	20.7

EUT Information

Site:	CO01-CA
Power:	120Vac/60Hz
Mode:	1
	Earbud Link + Repeater Link + 6-earbud charge with AC adapter



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	15.19	55.88	40.69	N	OFF	20.3
0.152250	32.26	---	65.88	33.62	N	OFF	20.3
0.159000	---	14.20	55.52	41.32	N	OFF	20.3
0.159000	36.66	---	65.52	28.86	N	OFF	20.3
0.429000	---	8.88	47.27	38.39	N	OFF	20.4
0.429000	14.76	---	57.27	42.51	N	OFF	20.4
1.965750	---	22.60	46.00	23.40	N	OFF	20.3
1.965750	24.53	---	56.00	31.47	N	OFF	20.3
4.944750	---	10.82	46.00	35.18	N	OFF	20.4
4.944750	16.16	---	56.00	39.84	N	OFF	20.4
9.719250	---	11.51	50.00	38.49	N	OFF	20.5
9.719250	17.27	---	60.00	42.73	N	OFF	20.5

Appendix C. Radiated Spurious Emission

Test Engineer :	Calvin Wu and Michael Bui	Temperature :	19 ~ 22°C
		Relative Humidity :	36 ~ 45%

<1Mbps>

2.4GHz 2400~2483.5MHz

Proprietary 2.4G (Band Edge @ 3m)

2.4GHz	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
		2321.04	64.95	-9.05	74	41.18	27.85	27.34	31.42	119	310	P	H
		2321.04	30.97	-23.03	54	-	-	-	-	-	-	A	H
	*	2402	102.8	-	-	79.08	27.61	27.47	31.36	119	310	P	H
	*	2402	68.82	-	-	-	-	-	-	-	-	A	H
Proprietary													H
2.4G													H
CH 00		2311.28	64.86	-9.14	74	41.13	27.84	27.32	31.43	154	3	P	V
2402MHz		2311.28	30.88	-23.12	54	-	-	-	-	-	-	A	V
	*	2402	117.05	-	-	93.37	27.57	27.47	31.36	154	3	P	V
	*	2402	83.07	-	-	-	-	-	-	-	-	A	V
													V
													V
		2356.56	65.1	-8.9	74	41.41	27.7	27.39	31.4	118	34	P	H
		2356.56	31.12	-22.88	54	-	-	-	-	-	-	A	H
	*	2440	104.23	-	-	80.47	27.59	27.53	31.36	118	34	P	H
	*	2440	70.25	-	-	-	-	-	-	-	-	A	H
Proprietary		2498.96	65.1	-8.9	74	41.25	27.55	27.64	31.34	118	34	P	H
2.4G		2498.96	31.12	-22.88	54	-	-	-	-	-	-	A	H
CH 19		2315.28	64.92	-9.08	74	41.17	27.84	27.33	31.42	144	1	P	V
2440MHz		2315.28	30.94	-23.06	54	-	-	-	-	-	-	A	V
	*	2440	118	-	-	94.38	27.45	27.53	31.36	144	1	P	V
	*	2440	84.02	-	-	-	-	-	-	-	-	A	V
		2497.44	65.21	-8.79	74	41.53	27.38	27.64	31.34	144	1	P	V
		2497.44	31.23	-22.77	54	-	-	-	-	-	-	A	V

	*	2480	104.51	-	-	80.68	27.57	27.61	31.35	121	313	P	H
	*	2480	70.53	-	-	-	-	-	-	-	-	A	H
		2489.44	64.82	-9.18	74	40.98	27.56	27.62	31.34	121	313	P	H
		2489.44	30.84	-23.16	54	-	-	-	-	-	-	A	H
Proprietary													H
2.4G													H
CH 39	*	2480	117.42	-	-	93.76	27.4	27.61	31.35	124	2	P	V
2480MHz	*	2480	83.44	-	-	-	-	-	-	-	-	A	V
		2484.56	66.35	-7.65	74	42.69	27.39	27.62	31.35	124	2	P	V
		2484.56	32.37	-21.63	54	-	-	-	-	-	-	A	V
													V
													V

Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.

2.4GHz 2400~2483.5MHz

Proprietary 2.4G (Harmonic @ 3m)

2.4GHz	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		4804	49.78	-24.22	74	75.25	31.38	11.36	68.21	100	0	P	H
													H
Proprietary													H
2.4G													H
CH 00		4804	42.59	-31.41	74	68.05	31.39	11.36	68.21	100	0	P	V
2402MHz													V
													V
													V
		4880	48.46	-25.54	74	73.89	31.35	11.37	68.15	100	0	P	H
													H
Proprietary		7320	47.28	-26.72	74	63.38	36.36	14.36	66.82	100	0	P	H
2.4G													H
CH 19		4880	41.93	-32.07	74	67.43	31.28	11.37	68.15	100	0	P	V
2440MHz													V
		7320	44.32	-29.68	74	60.36	36.42	14.36	66.82	100	0	P	V
													V
		4960	49.01	-24.99	74	74.26	31.47	11.38	68.1	100	0	P	H
													H
Proprietary		7440	48.28	-25.72	74	64.13	36.51	14.48	66.84	100	0	P	H
2.4G													H
CH 39		4960	40.4	-33.6	74	65.7	31.42	11.38	68.1	100	0	P	V
2480MHz													V
		7440	46.24	-27.76	74	62.12	36.48	14.48	66.84	100	0	P	V
													V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.

Emission above 18GHz

Proprietary 2.4G (SHF)

2.4GHz	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz Proprietary SHF		19840	43.87	-30.13	74	45.51	37.61	13.6	52.85	150	0	P	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
		19840	41.97	-32.03	74	43.54	37.68	13.6	52.85	150	0	P	V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.

Emission below 1GHz

Proprietary 2.4G (LF)

2.4GHz	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz Proprietary LF		31.94	22.1	-17.9	40	29.71	23.84	0.99	32.44	-	-	P	H
		100.81	19.43	-24.07	43.5	33.91	16.16	1.77	32.41	-	-	P	H
		105.66	22.97	-20.53	43.5	36.94	16.67	1.78	32.42	-	-	P	H
		563.5	26.84	-19.16	46	29.43	26.07	3.97	32.63	-	-	P	H
		948.59	33.35	-12.65	46	28.6	30.77	5.25	31.27	100	0	P	H
		997.09	33.99	-20.01	54	29.02	30.46	5.33	30.82	-	-	P	H
													H
													H
													H
													H
													H
													H
		30	22.55	-17.45	40	29.04	25	0.95	32.44	-	-	P	V
		66.86	17.1	-22.9	40	36.04	11.99	1.5	32.43	-	-	P	V
		100.81	20.81	-22.69	43.5	35.29	16.16	1.77	32.41	-	-	P	V
		105.66	23.43	-20.07	43.5	37.4	16.67	1.78	32.42	-	-	P	V
		943.74	32.61	-13.39	46	28.05	30.65	5.23	31.32	100	0	P	V
		979.63	33.43	-20.57	54	28.29	30.81	5.3	30.97	-	-	P	V
													V
													V
													V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.

<2Mbps>

2.4GHz 2400~2483.5MHz

Proprietary 2.4G (Band Edge @ 3m)

2.4GHz	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
		2341.84	65.34	-8.66	74	41.63	27.75	27.37	31.41	110	357	P	H
		2341.84	25.76	-28.24	54	-	-	-	-	-	-	A	H
	*	2402	117.02	-	-	93.3	27.61	27.47	31.36	110	357	P	H
	*	2402	77.44	-	-	-	-	-	-	-	-	A	H
Proprietary													H
2.4G													H
CH 00		2382.32	65.37	-8.63	74	41.65	27.66	27.44	31.38	397	53	P	V
2402MHz		2382.32	25.79	-28.21	54	-	-	-	-	-	-	A	V
	*	2402	103.2	-	-	79.52	27.57	27.47	31.36	397	53	P	V
	*	2402	63.62	-	-	-	-	-	-	-	-	A	V
													V
													V
		2343.12	65.6	-8.4	74	41.89	27.75	27.37	31.41	134	7	P	H
		2343.12	26.02	-27.98	54	-	-	-	-	-	-	A	H
	*	2440	117.58	-	-	93.82	27.59	27.53	31.36	134	7	P	H
	*	2440	78	-	-	-	-	-	-	-	-	A	H
Proprietary		2487.6	66.93	-7.07	74	43.09	27.56	27.62	31.34	134	7	P	H
2.4G		2487.6	27.35	-26.65	54	-	-	-	-	-	-	A	H
CH 19		2365.84	64.99	-9.01	74	41.22	27.74	27.42	31.39	398	52	P	V
2440MHz		2365.84	25.41	-28.59	54	-	-	-	-	-	-	A	V
	*	2440	106.44	-	-	82.82	27.45	27.53	31.36	398	52	P	V
	*	2440	66.86	-	-	-	-	-	-	-	-	A	V
		2488.4	65.42	-8.58	74	41.75	27.39	27.62	31.34	398	52	P	V
		2488.4	25.84	-28.16	54	-	-	-	-	-	-	A	V

	*	2480	117.46	-	-	93.63	27.57	27.61	31.35	179	357	P	H
	*	2480	77.88	-	-	-	-	-	-	-	-	A	H
		2483.76	70.21	-3.79	74	46.38	27.57	27.61	31.35	179	357	P	H
		2483.76	30.63	-23.37	54	-	-	-	-	-	-	A	H
Proprietary													H
2.4G													H
CH 39	*	2480	103.92	-	-	80.26	27.4	27.61	31.35	377	18	P	V
2480MHz	*	2480	64.34	-	-	-	-	-	-	-	-	A	V
		2490.16	65.4	-8.6	74	41.73	27.39	27.62	31.34	377	18	P	V
		2490.16	25.82	-28.18	54	-	-	-	-	-	-	A	V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.

2.4GHz 2400~2483.5MHz

Proprietary 2.4G (Harmonic @ 3m)

2.4GHz	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		4804	44.23	-29.77	74	69.7	31.38	11.36	68.21	100	0	P	H
													H
Proprietary													H
2.4G													H
CH 00		4804	49.04	-24.96	74	74.5	31.39	11.36	68.21	100	0	P	V
2402MHz													V
													V
													V
		4880	43.43	-30.57	74	68.86	31.35	11.37	68.15	100	0	P	H
													H
Proprietary		7320	44.99	-29.01	74	61.09	36.36	14.36	66.82	100	0	P	H
2.4G													H
CH 19		4880	48.37	-25.63	74	73.87	31.28	11.37	68.15	100	0	P	V
2440MHz													V
		7320	45.71	-28.29	74	61.75	36.42	14.36	66.82	100	0	P	V
													V
		4960	41.41	-32.59	74	66.66	31.47	11.38	68.1	100	0	P	H
													H
Proprietary		7440	46.48	-27.52	74	62.33	36.51	14.48	66.84	100	0	P	H
2.4G													H
CH 39		4960	47.25	-26.75	74	72.55	31.42	11.38	68.1	100	0	P	V
2480MHz													V
		7440	45.81	-28.19	74	61.69	36.48	14.48	66.84	100	0	P	V
													V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.

Emission above 18GHz

Proprietary 2.4G (SHF)

2.4GHz	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
Proprietary 2.4G SHF		19840	51.07	-22.93	74	52.71	37.61	13.6	52.85	150	228	P	H
		19840	11.49	-42.51	54	-	-	-	-	-	-	A	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
		19840	37.9	-36.1	74	39.47	37.68	13.6	52.85	150	0	P	V
		19840	-1.68	-55.68	54	-	-	-	-	-	-	A	V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Emission below 1GHz

Proprietary 2.4G (LF)

2.4GHz	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
Proprietary 2.4G LF		32.91	22.01	-17.99	40	30.18	23.25	1.02	32.44	-	-	P	H
		101.78	19.68	-23.82	43.5	34.06	16.28	1.76	32.42	-	-	P	H
		105.66	23.05	-20.45	43.5	37.02	16.67	1.78	32.42	-	-	P	H
		748.77	30.19	-15.81	46	29.79	28.08	4.75	32.43	-	-	P	H
		951.5	33.47	-12.53	46	28.57	30.89	5.25	31.24	100	0	P	H
		993.21	33.53	-20.47	54	28.5	30.57	5.32	30.86	-	-	P	H
													H
													H
													H
													H
													H
													H
		30.97	22.76	-17.24	40	29.8	24.42	0.98	32.44	-	-	P	V
		66.86	18.1	-21.9	40	37.04	11.99	1.5	32.43	-	-	P	V
		100.81	20.9	-22.6	43.5	35.38	16.16	1.77	32.41	-	-	P	V
		105.66	22.76	-20.74	43.5	36.73	16.67	1.78	32.42	-	-	P	V
		958.29	34.23	-11.77	46	29.05	31.1	5.26	31.18	100	0	P	V
		985.45	33.47	-20.53	54	28.3	30.79	5.31	30.93	-	-	P	V
													V
													V
													V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.

Note symbol

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

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

2.4GHz	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
Proprietary 2.4G CH 00 2402MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =

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

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

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

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

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

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

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

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

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

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

Appendix D. Radiated Spurious Emission Plots

Test Engineer :	Calvin Wu and Michael Bui	**Temperature :**	19 ~ 22°C
		Relative Humidity :	36 ~ 45%

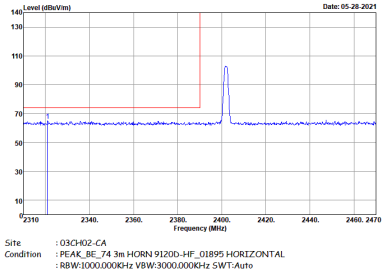
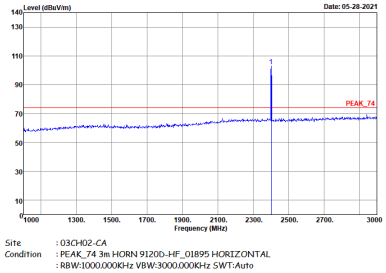
Note symbol

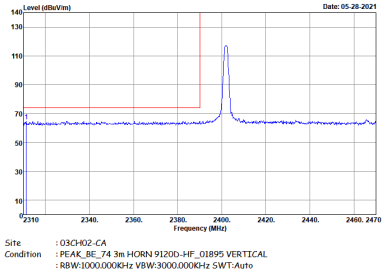
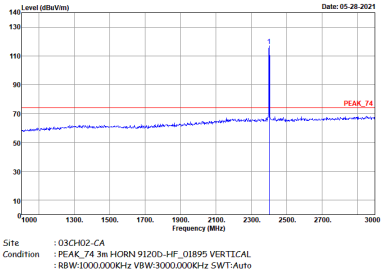
-L	**Low channel location**
-R	**High channel location**

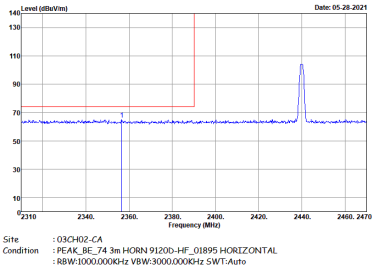
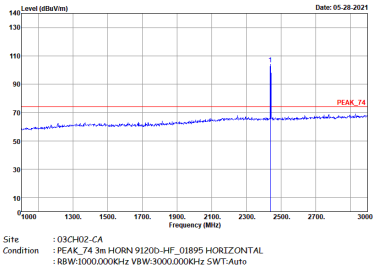
<1Mbps>

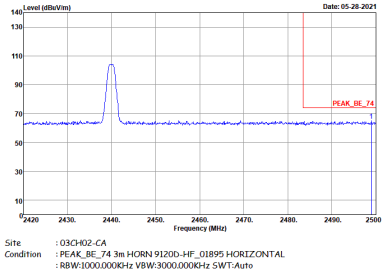
2.4GHz 2400~2483.5MHz

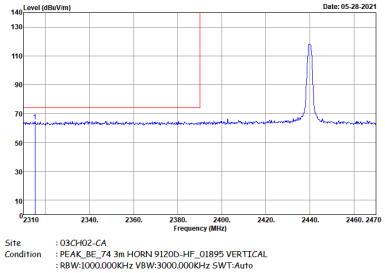
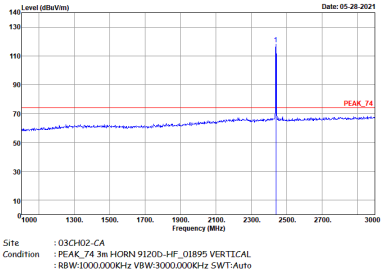
Proprietary 2.4G (Band Edge @ 3m)

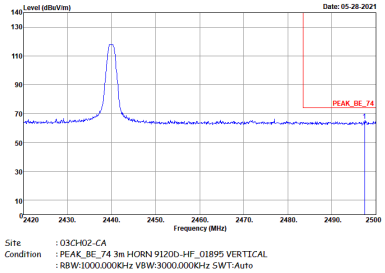
2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH00 2402MHz	
	Horizontal	Fundamental
Peak		

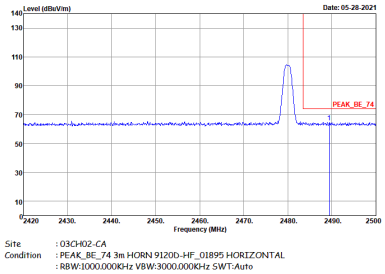
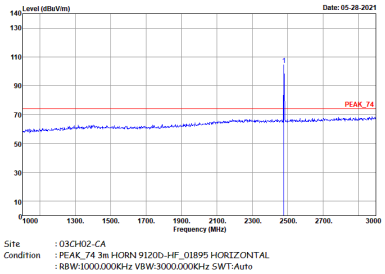
2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH00 2402MHz	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto

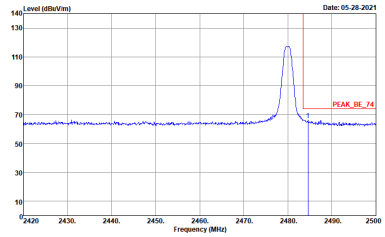
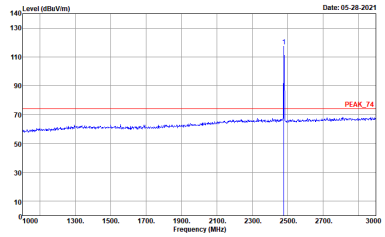
2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH19 2440MHz - L	
	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto

2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH19 2440MHz - R	
	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Left blank

2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH19 2440MHz - L	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto

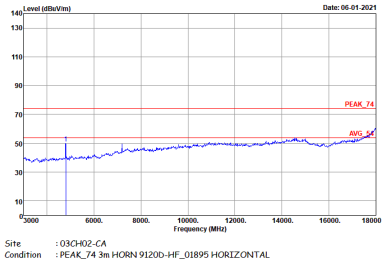
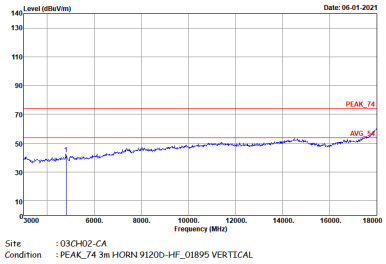
2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH19 2440MHz - R	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Left blank

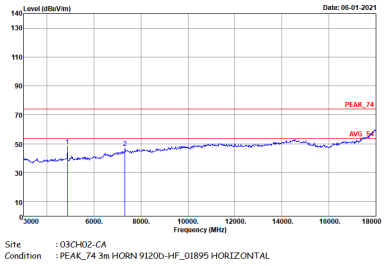
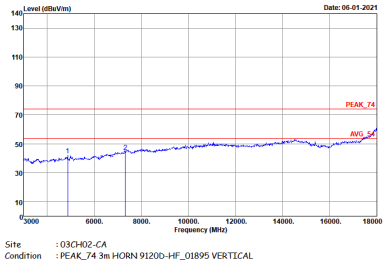
2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH39 2480MHz	
	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto

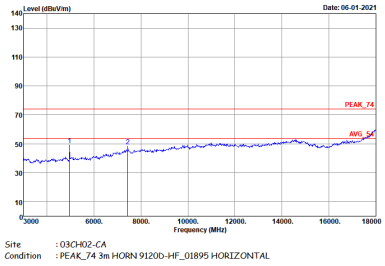
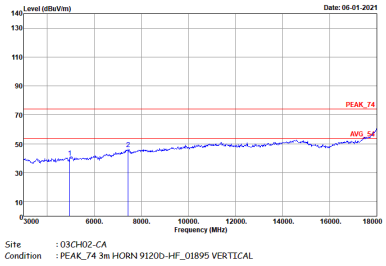
2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH39 2480MHz	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto

2.4GHz 2400~2483.5MHz

Proprietary 2.4G (Harmonic @ 3m)

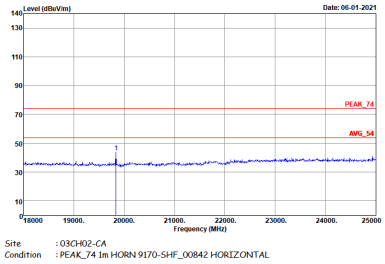
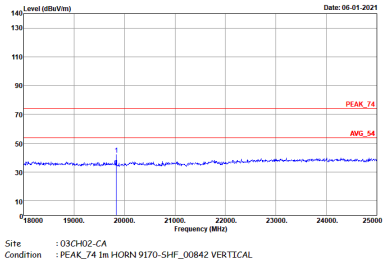
2.4GHz	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	Proprietary 2.4G CH00 2402MHz	
	Horizontal	Vertical
Peak Avg.		

2.4GHz	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	Proprietary 2.4G CH19 2440MHz	
	Horizontal	Vertical
Peak Avg.		

2.4GHz	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	Proprietary 2.4G CH39 2480MHz	
	Horizontal	Vertical
Peak		

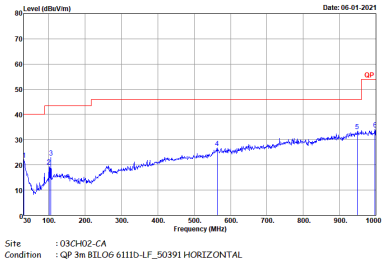
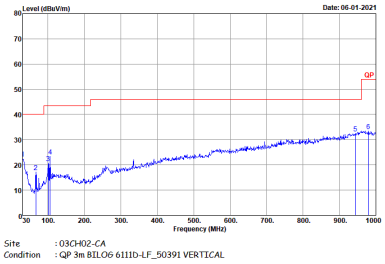
Emission above 18GHz

Proprietary 2.4G (SHF)

2.4GHz	2.4GHz 2400~2483.5MHz	
	Proprietary 2.4G SHF	
	Horizontal	Vertical
Peak		

Emission below 1GHz

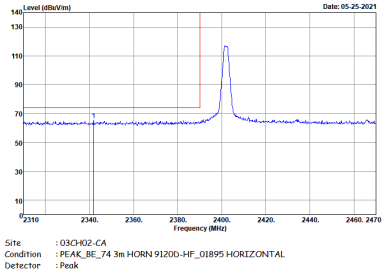
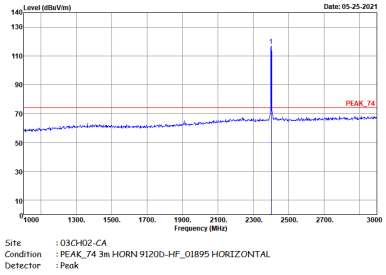
Proprietary 2.4G (LF)

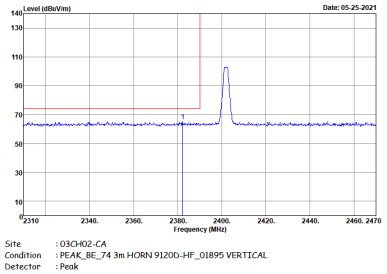
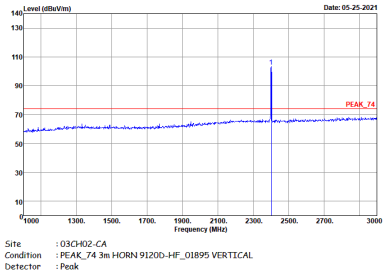
2.4GHz	2.4GHz 2400~2483.5MHz	
	Proprietary 2.4G LF	
	Horizontal	Vertical
QP / Peak		

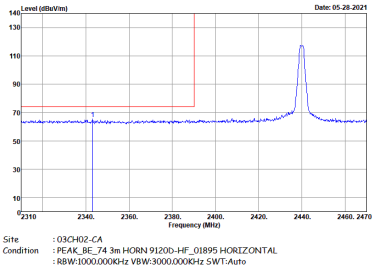
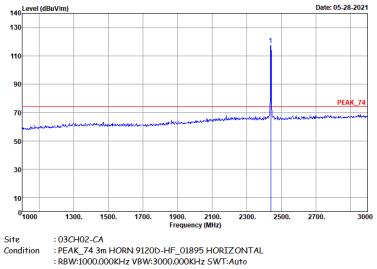
<2Mbps>

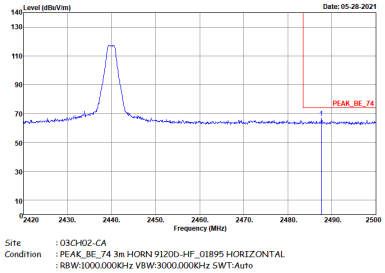
2.4GHz 2400~2483.5MHz

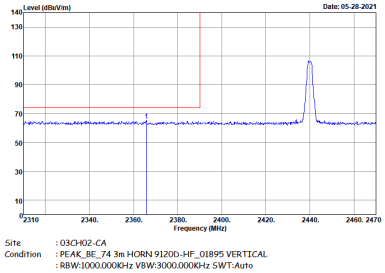
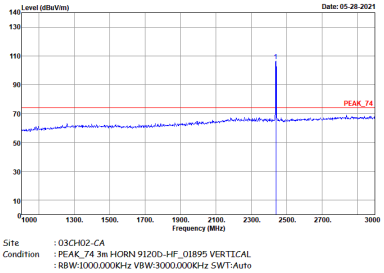
Proprietary 2.4G (Band Edge @ 3m)

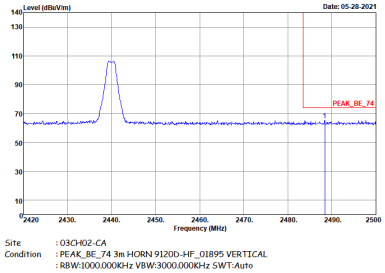
2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH00 2402MHz	
	Horizontal	Fundamental
Peak		

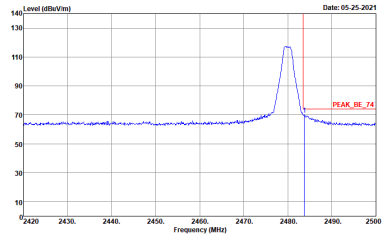
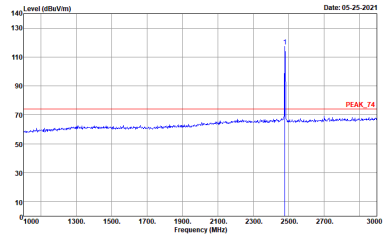
2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH00 2402MHz	
	Vertical	Fundamental
Peak		

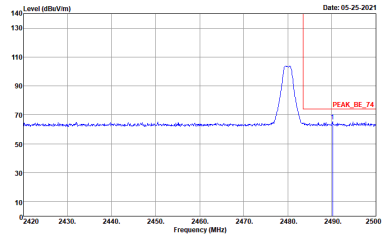
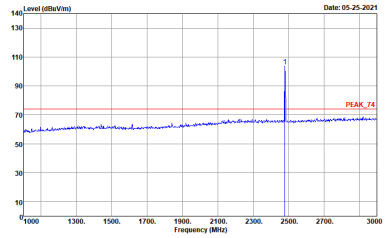
2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH19 2440MHz - L	
	Horizontal	Fundamental
Peak		

2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH19 2440MHz - R	
	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Left blank

2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH19 2440MHz - L	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto

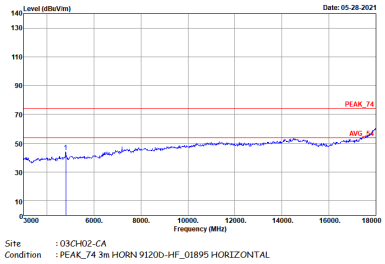
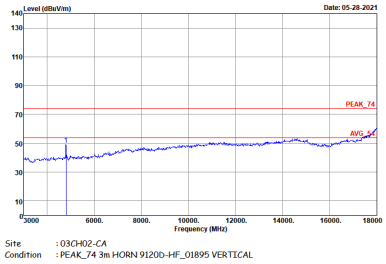
2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH19 2440MHz - R	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Left blank

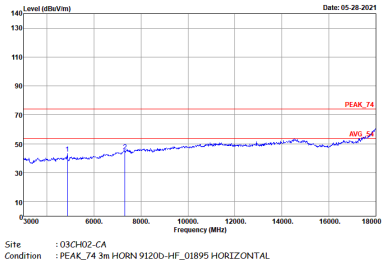
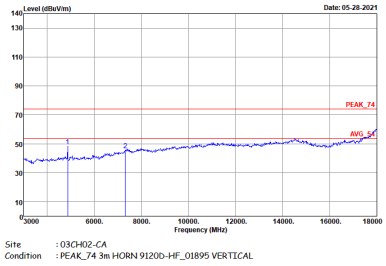
2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH39 2480MHz	
	Horizontal	Fundamental
Peak		

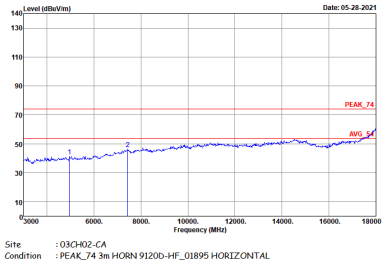
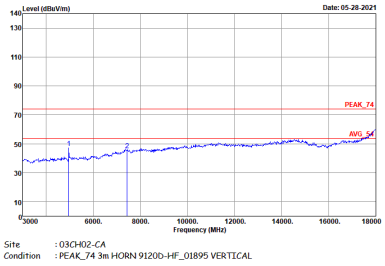
2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH39 2480MHz	
	Vertical	Fundamental
Peak		

2.4GHz 2400~2483.5MHz

Proprietary 2.4G (Harmonic @ 3m)

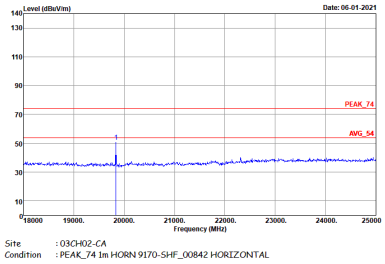
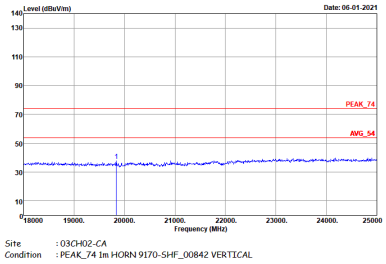
2.4GHz	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	Proprietary 2.4G CH00 2402MHz	
	Horizontal	Vertical
Peak Avg.		

2.4GHz	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	Proprietary 2.4G CH19 2440MHz	
	Horizontal	Vertical
Peak Avg.		

2.4GHz	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	Proprietary 2.4G CH39 2480MHz	
	Horizontal	Vertical
Peak	 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 HORIZONTAL	 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 VERTICAL

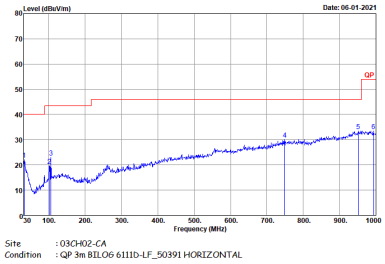
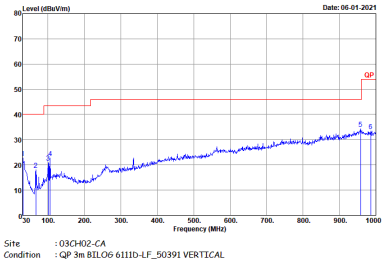
Emission above 18GHz

Proprietary 2.4G (SHF)

2.4GHz	2.4GHz 2400~2483.5MHz	
	Proprietary 2.4G SHF	
	Horizontal	Vertical
Peak		

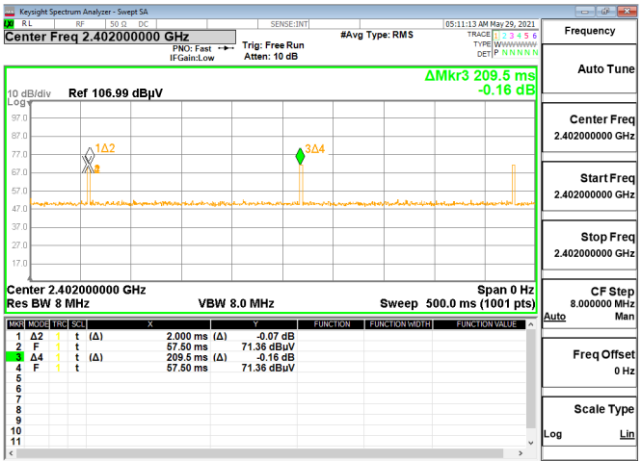
Emission below 1GHz

Proprietary 2.4G (LF)

2.4GHz	2.4GHz 2400~2483.5MHz	
	Proprietary 2.4G LF	
	Horizontal	Vertical
QP /Peak		

Appendix E. Duty Cycle Plots

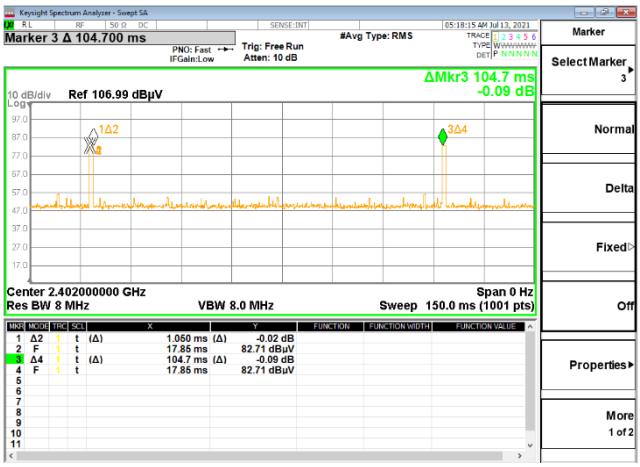
Radio 2 : The duty cycle of BLE fundamental signal (channel 00, and 1Mbps) is 2%



Note:

1. The Radio 2 is duty cycle limited device as detailed in the Operating Discerption.
2. The pulse train (period) of fundamental signal is longer than 100 milliseconds
3. The worst case duty cycle = on time/ pulse train = 2.00 ms / 100 ms = 2.00 %
4. The worst case duty cycle correction factor = 20*log (Duty cycle) = -33.98 dB and this correction is applied to all emissions that demonstrate the same pulse timing characteristics as the fundamental emission (Clause 7.5 of ANSI C63.10 2013).

Radio 2 : The duty cycle of BLE fundamental signal (channel 00, and 2Mbps) is 1.05%



Note:

1. The pulse train (period) of fundamental signal is longer than 100 milliseconds
2. The worst case duty cycle = on time/ pulse chain = 1.05 ms / 100 ms = 1.05 %
3. The worst case duty cycle correction factor = 20*log(Duty cycle) = -39.58 dB
   and this correction is applied to all emissions that demonstrate the same pulse timing characteristics as the fundamental emission (Clause 7.5 of ANSI C63.10 2013).