



FCC RADIO TEST REPORT

FCC ID : MMATDC150
Equipment : Midland Wireless Audio System - Charger
Brand Name : Midland TeamComm®
Model Name : TDC150
Marketing Name : Midland TeamComm® Desktop Charger
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 Jun. 03, 2021 and testing was started from Jun. 17, 2021 and completed on Jul. 12, 2021. We, Sporton International (USA) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

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

Approved by: Neil Kao

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
FR210525003	01	Initial issue of report	Jul. 29, 2021
FR210525003	02	Add test site number	Aug. 26, 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 2.39 dB at 19520.000 MHz
3.6	15.207	AC Conducted Emission	Pass	Under limit 18.88 dB at 0.152 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	Monopole Antenna	
Antenna information		
2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	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

FCC designation No.: US1250

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 A2LA 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	-	-

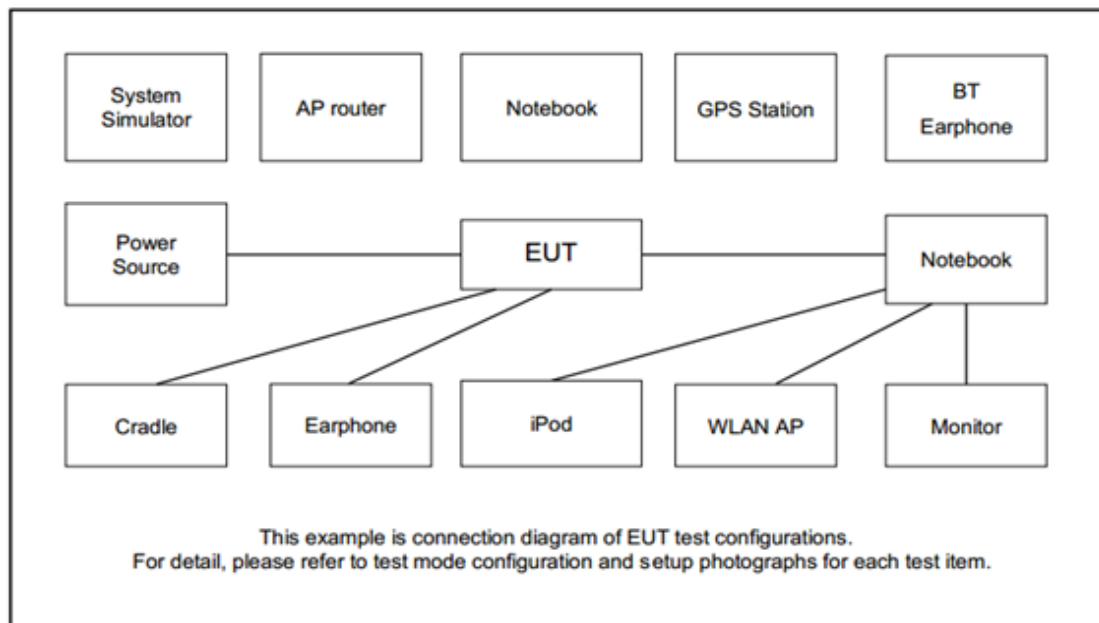
2.2 Test Mode

- 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 Z 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	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 :EUT with 6-Earbud Charge + 2.4GHz Proprietary Radio Link with Repeater + AC Adapter
	Mode 2 :EUT with 2-Earbud Charge + 2.4GHz Proprietary Radio Link with Repeater + 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.	Repeater	Midland Radio	TRP-150	MMATRP150	3690A-TRP150	N/A
2.	Earbud Charger	Midland Radio	TC150	MMATC150	3690A-TC150	N/A
3.	AC adapter	Midland Radio	HT-0051500R00 USH	N/A	N/A	1 meter, non-shielded cable, w/o ferrite core

2.5 Measurement Results Explanation Example

For all conducted test items:

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

Example :

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

Offset = RF cable loss + attenuator factor.

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

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 4.2 + 10 = 14.2 \text{ (dB)}\end{aligned}$$

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedures

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

3.1.4 Test Setup

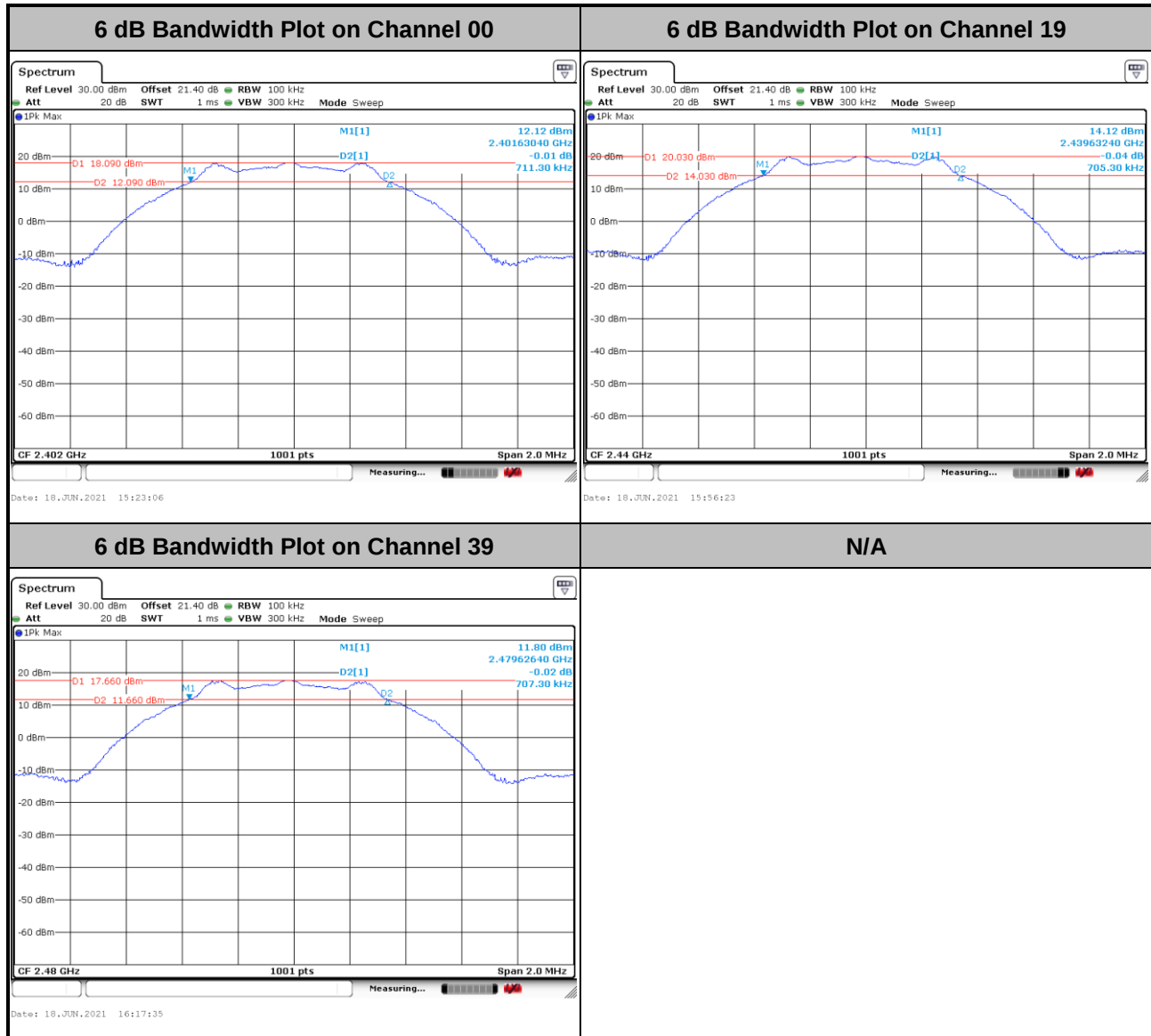




3.1.5 Test Result of 6dB Bandwidth

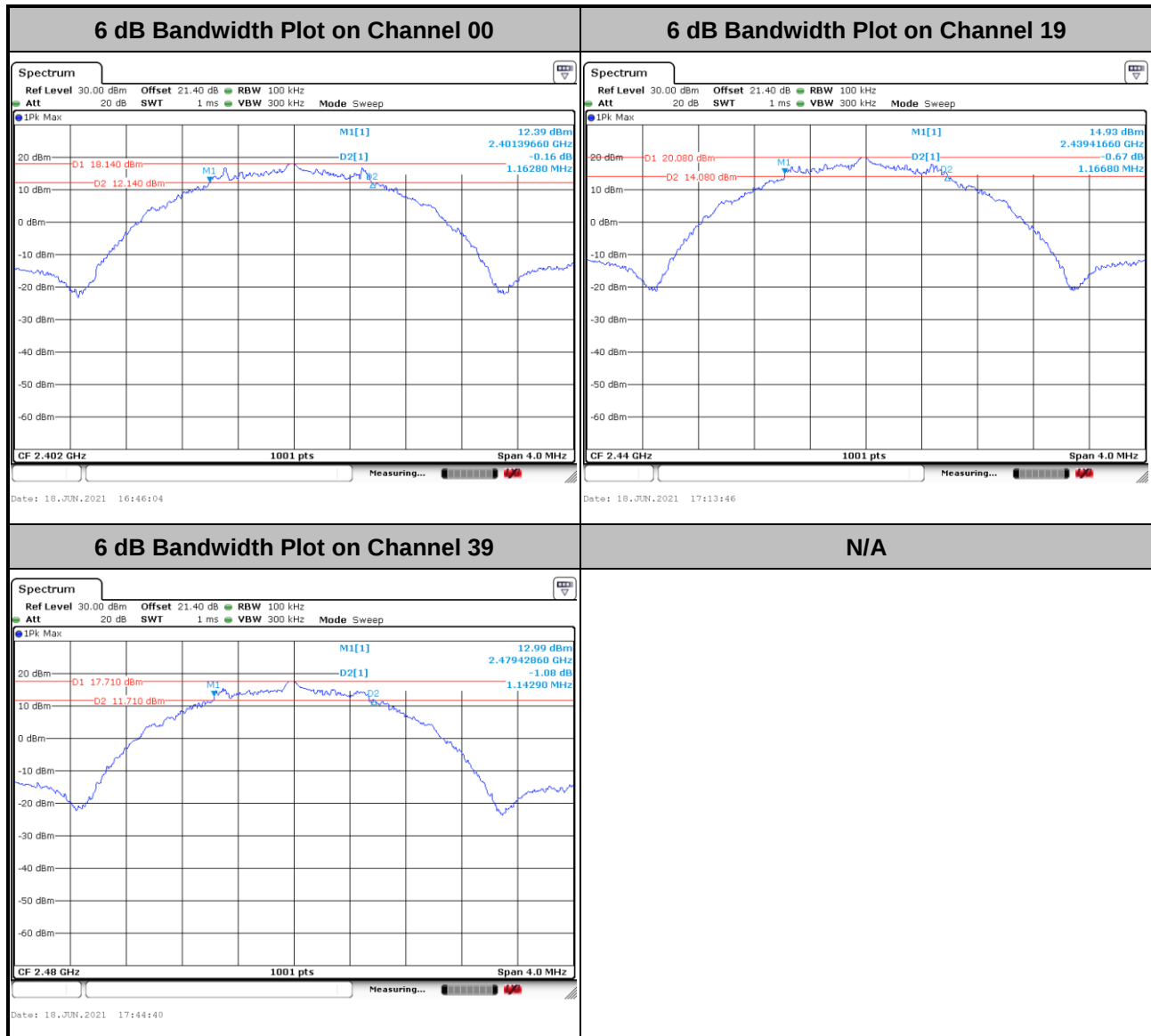
Please refer to Appendix A.

<1Mbps>





<2Mbps>

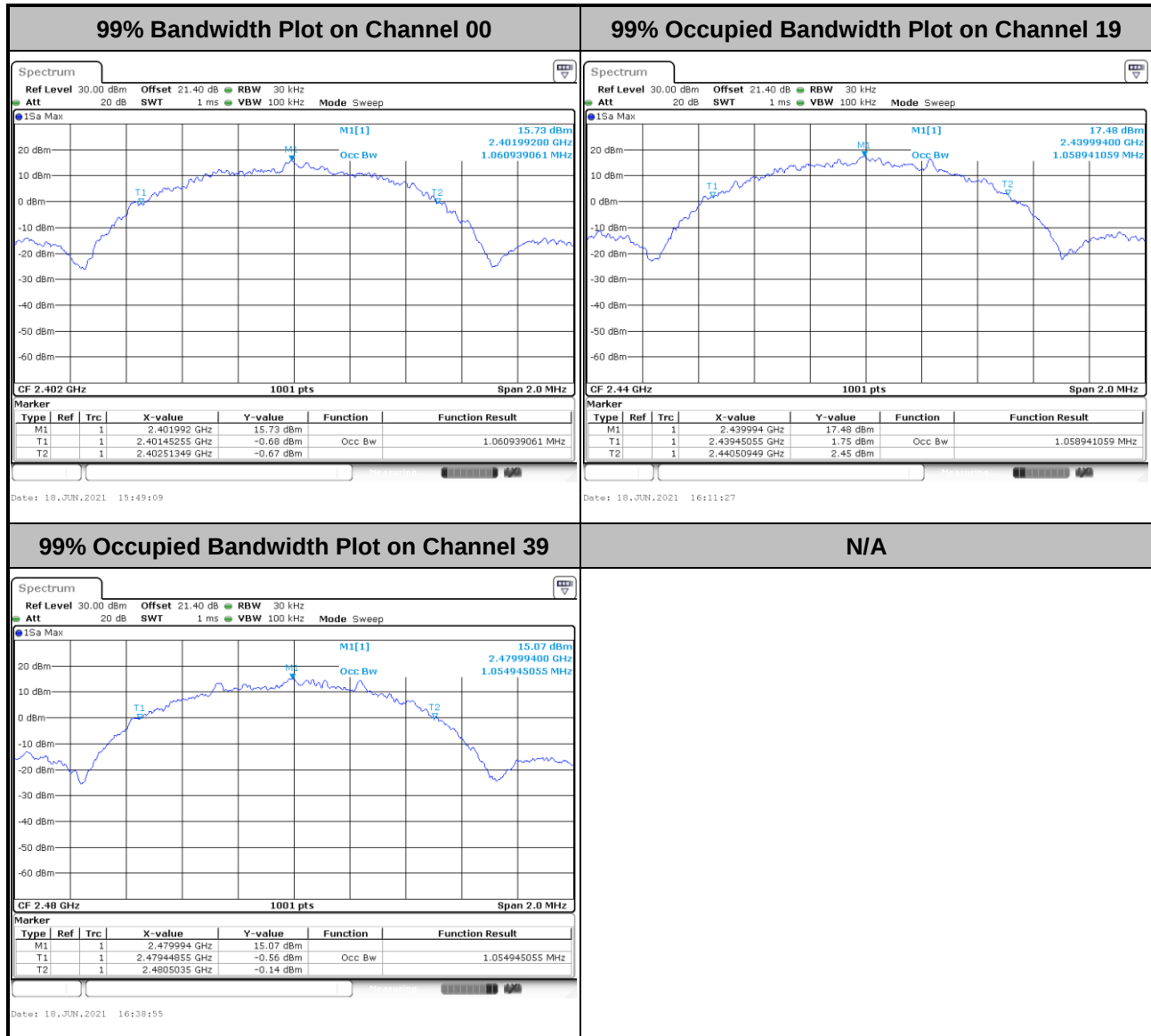




3.1.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

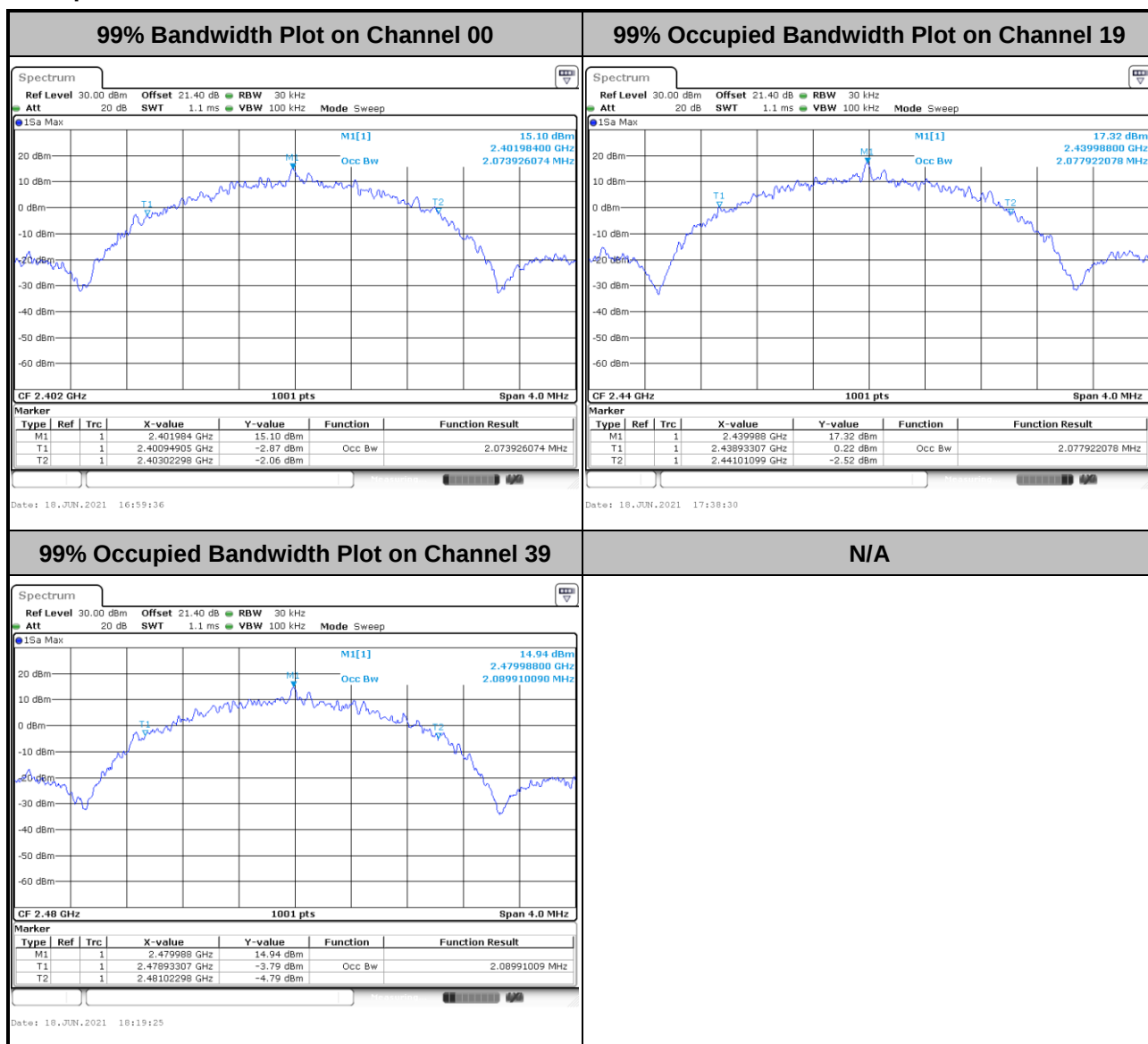
<1Mbps>



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



<2Mbps>



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

3.2 Output Power Measurement

3.2.1 Limit of Output Power

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

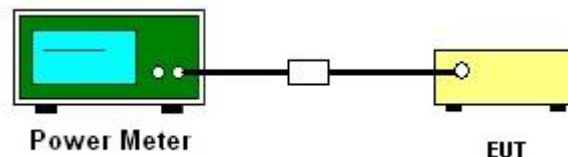
3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

3.2.3 Test Procedures

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

3.2.4 Test Setup



3.2.5 Test Result of Average Output Power

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

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

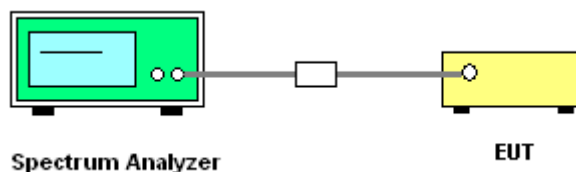
3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

3.3.3 Test Procedures

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

3.3.4 Test Setup



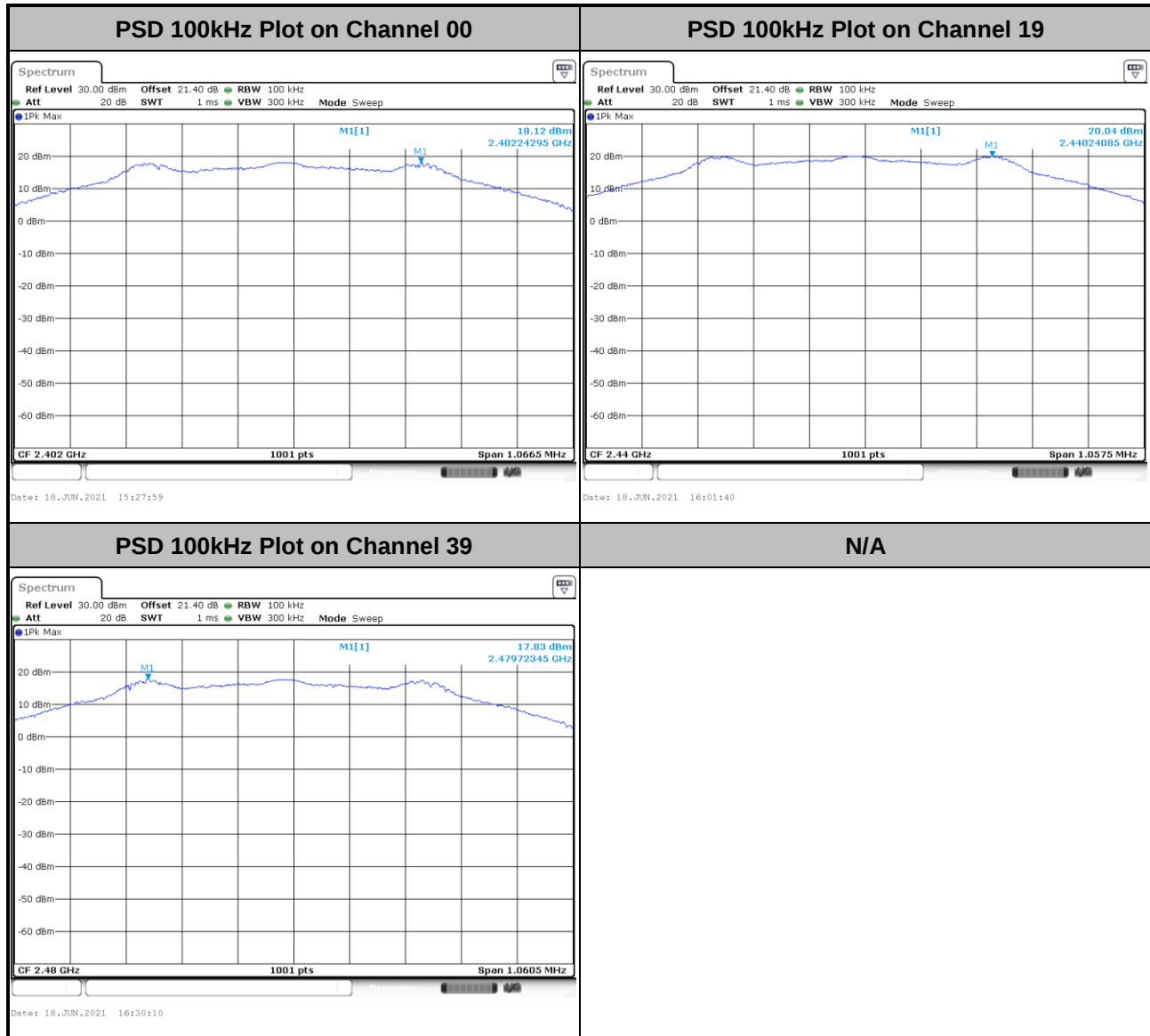
3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.



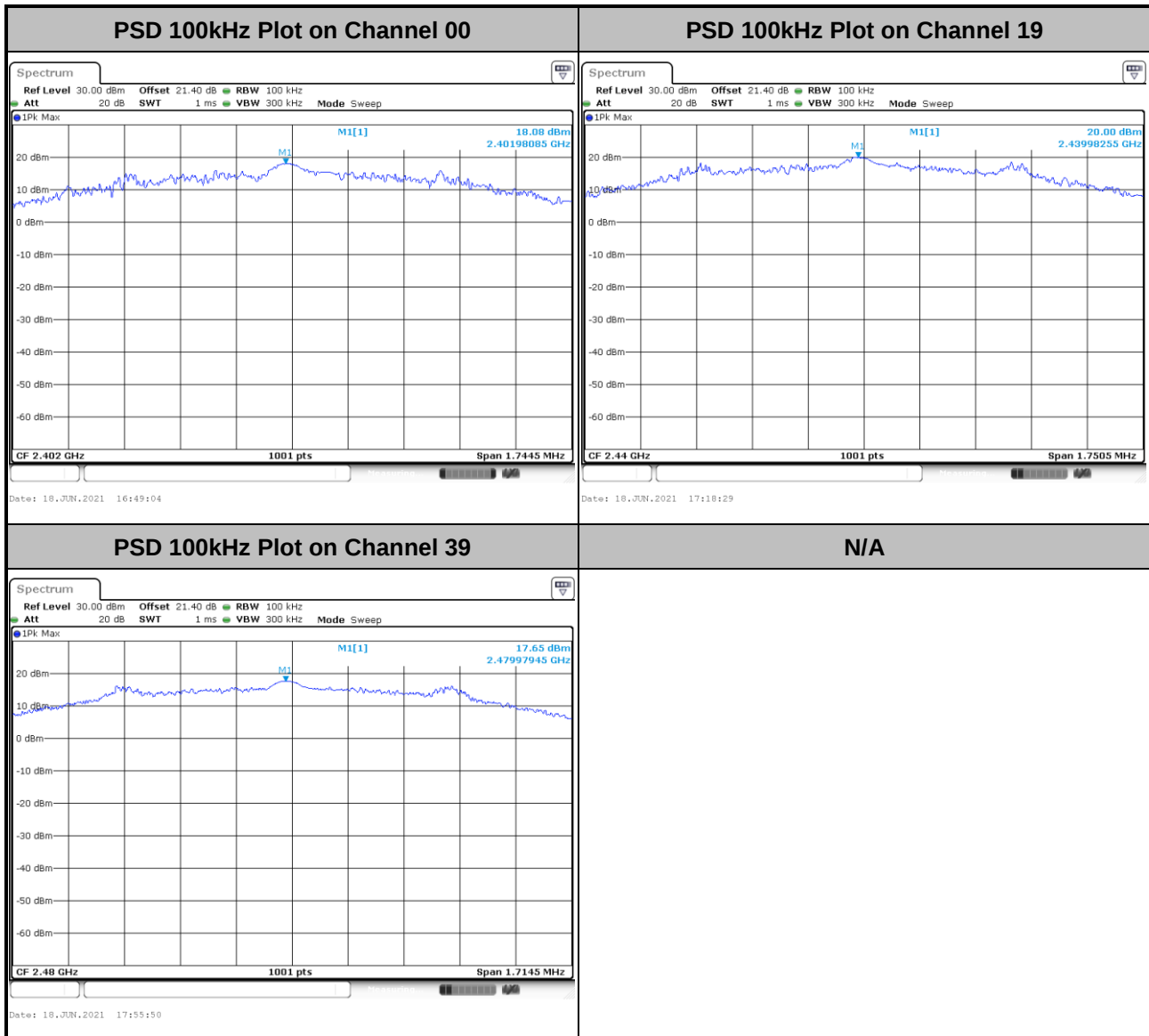
3.3.6 Test Result of Power Spectral Density Plots (100kHz)

<1Mbps>





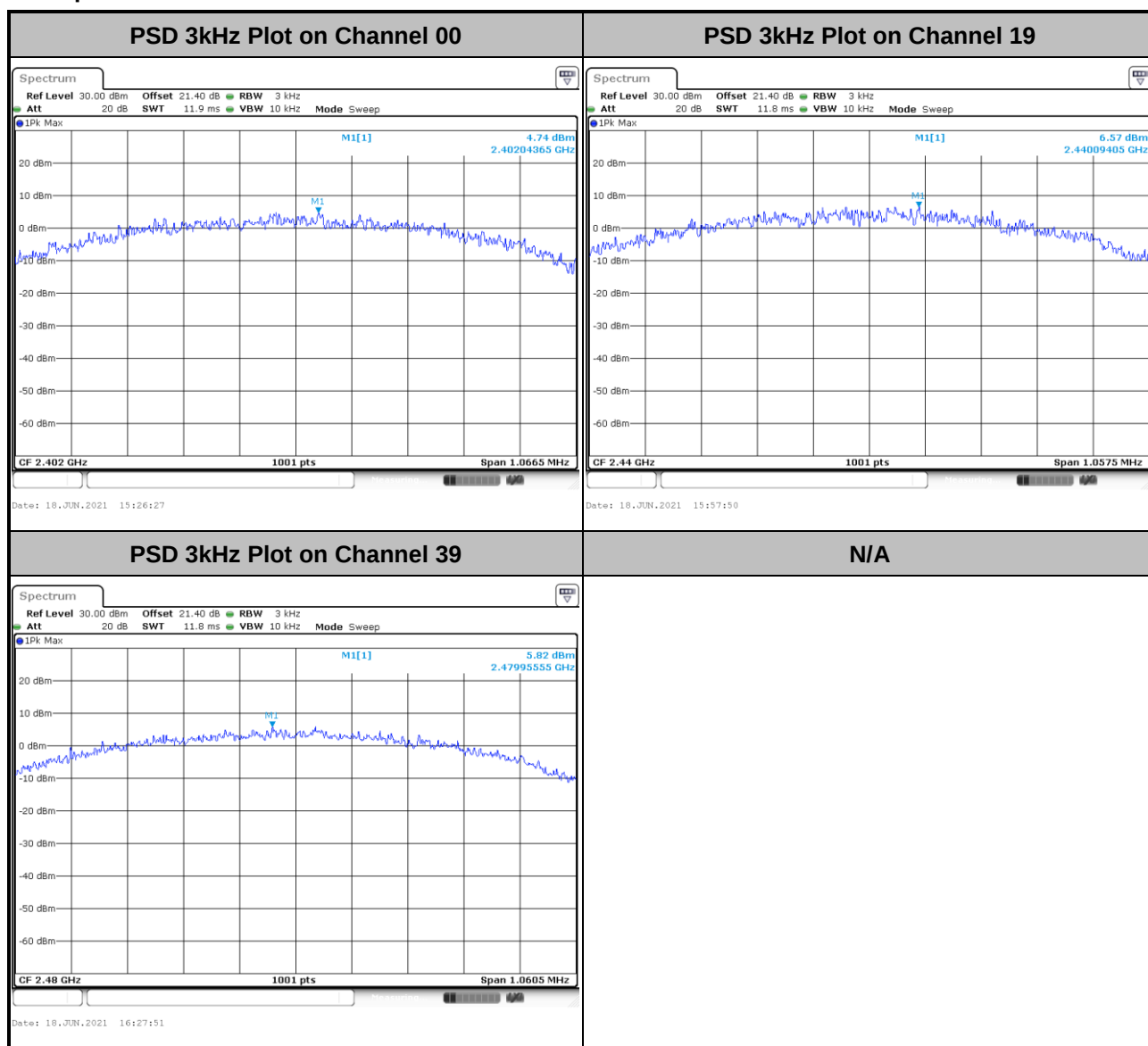
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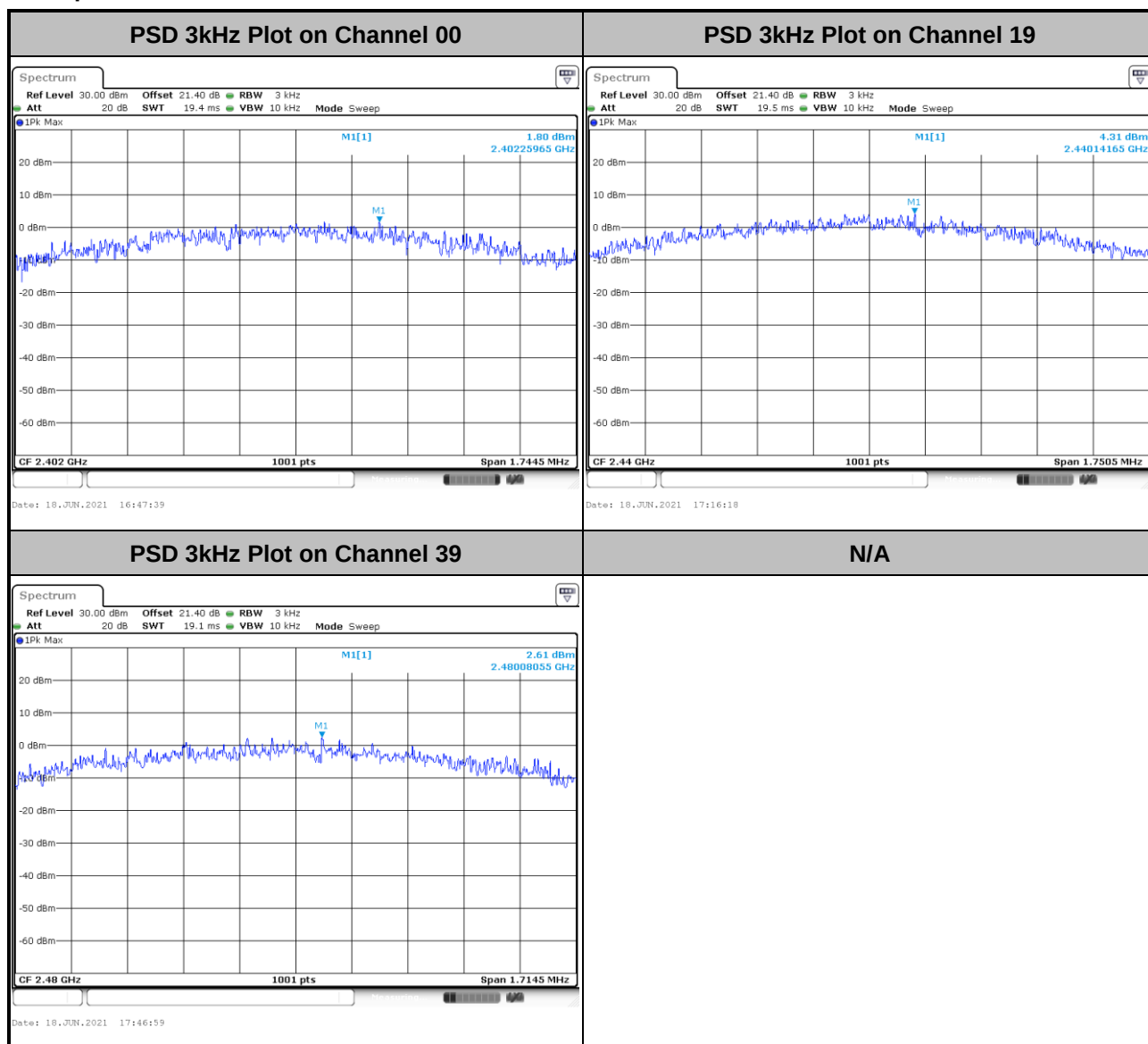
3.3.7 Test Result of Power Spectral Density Plots (3kHz)

<1Mbps>





<2Mbps>



3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission

All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band.

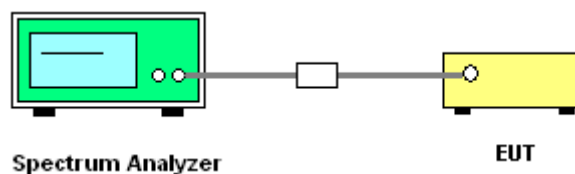
3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

3.4.3 Test Procedure

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

3.4.4 Test Setup

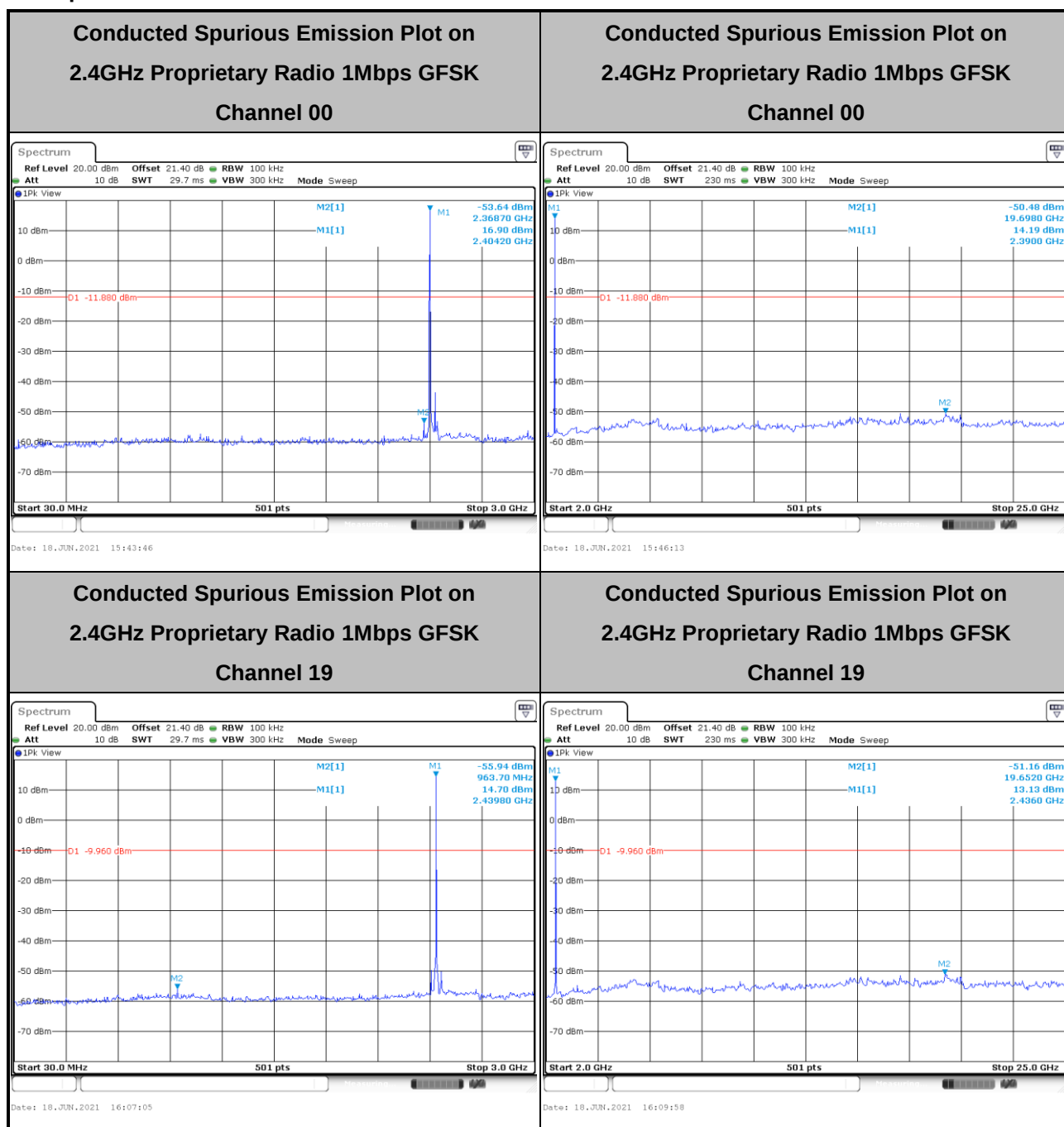






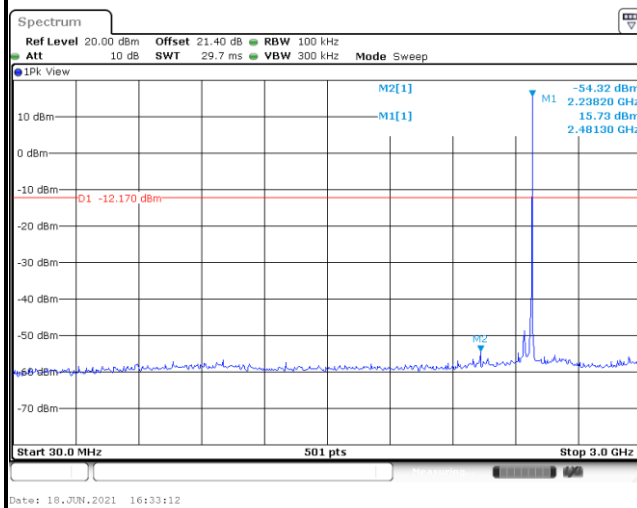
3.4.6 Test Result of Conducted Spurious Emission Plots

<1Mbps>

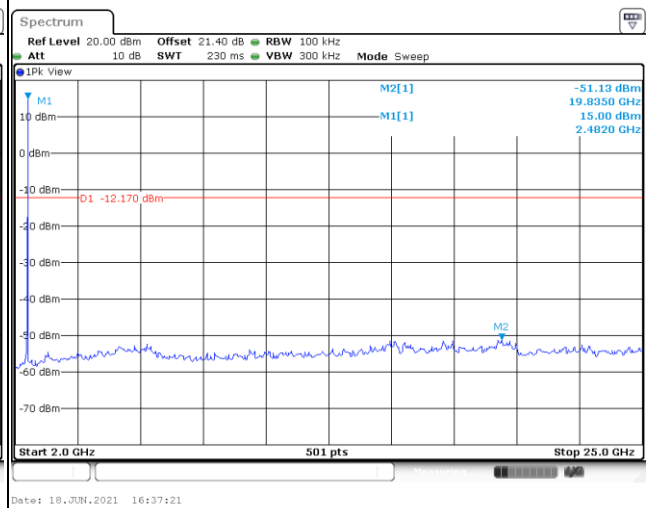




Conducted Spurious Emission Plot on
2.4GHz Proprietary Radio 1Mbps GFSK
Channel 39



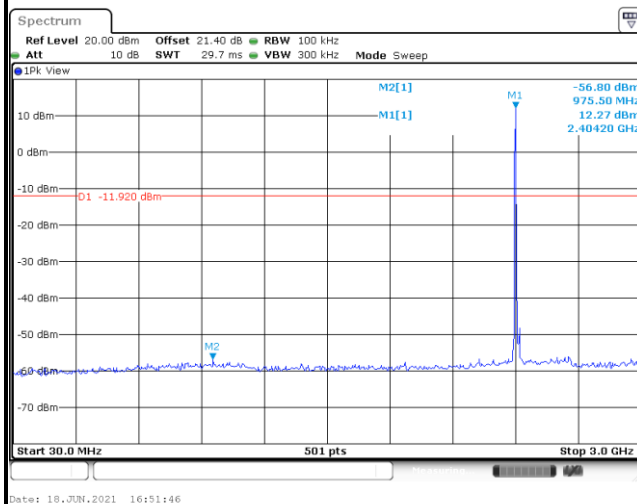
Conducted Spurious Emission Plot on
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Channel 39



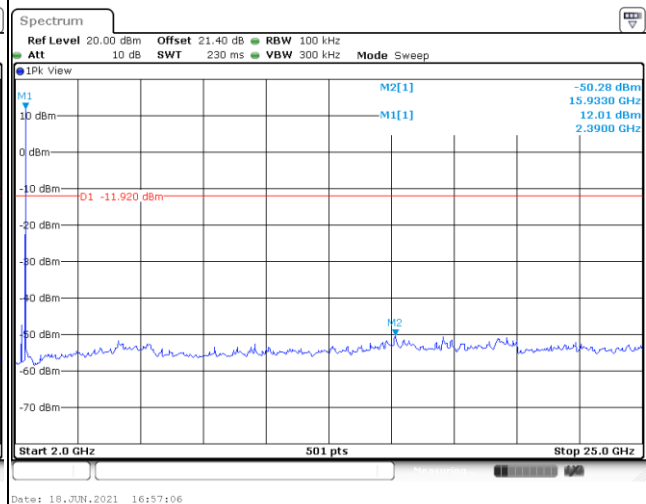


<2Mbps>

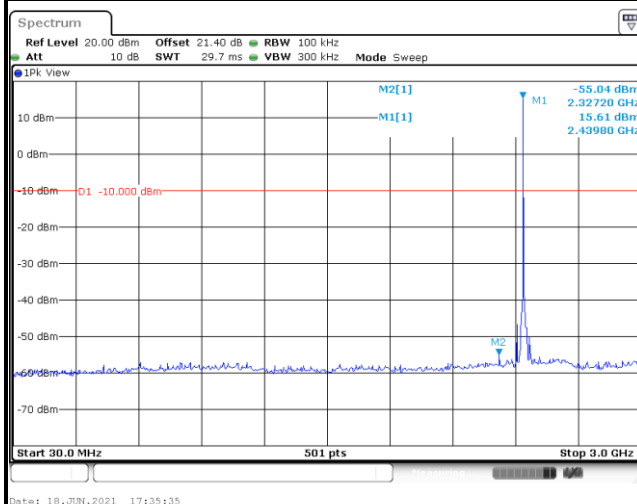
Conducted Spurious Emission Plot on
2.4GHz Proprietary Radio 2Mbps GFSK
Channel 00



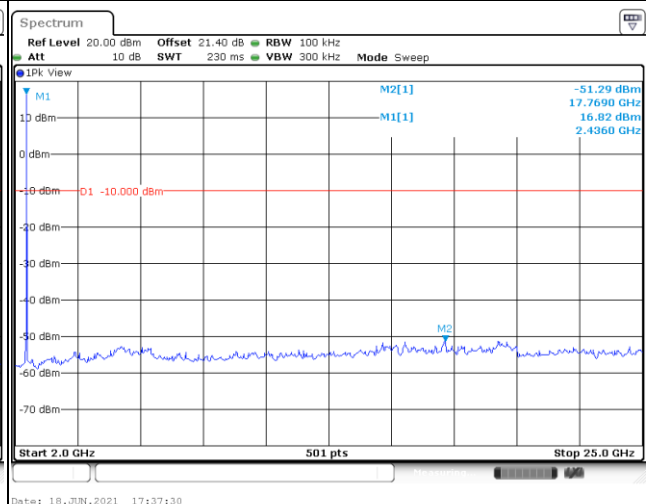
Conducted Spurious Emission Plot on
2.4GHz Proprietary Radio 2Mbps GFSK
Channel 00



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

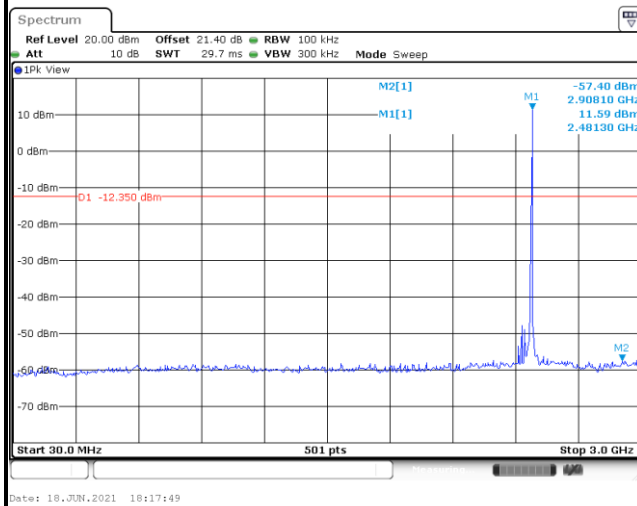


Conducted Spurious Emission Plot on
2.4GHz Proprietary Radio 2Mbps GFSK
Channel 19

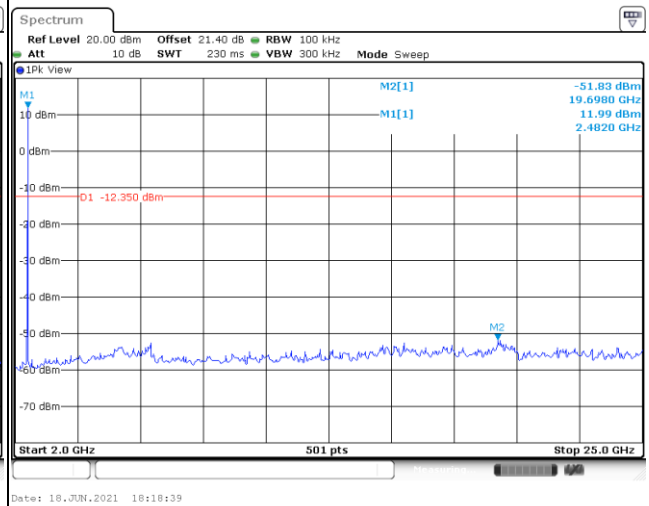




Conducted Spurious Emission Plot on
2.4GHz Proprietary Radio 2Mbps GFSK
Channel 39



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.

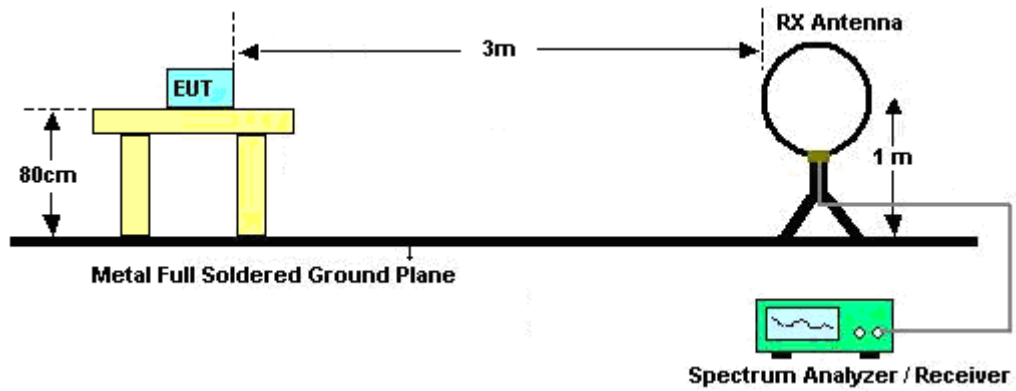
3.5.3 Test Procedures

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.

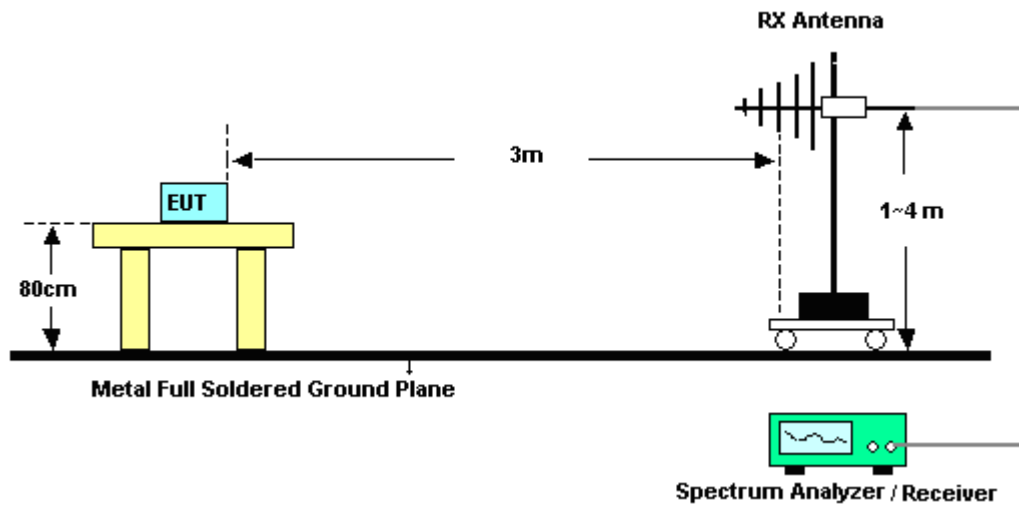
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-39.58dB for 1Mbps; -44.44dB for 2Mbps) derived from $20\log(\text{dwell time}/100\text{ms})$. This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

3.5.4 Test Setup

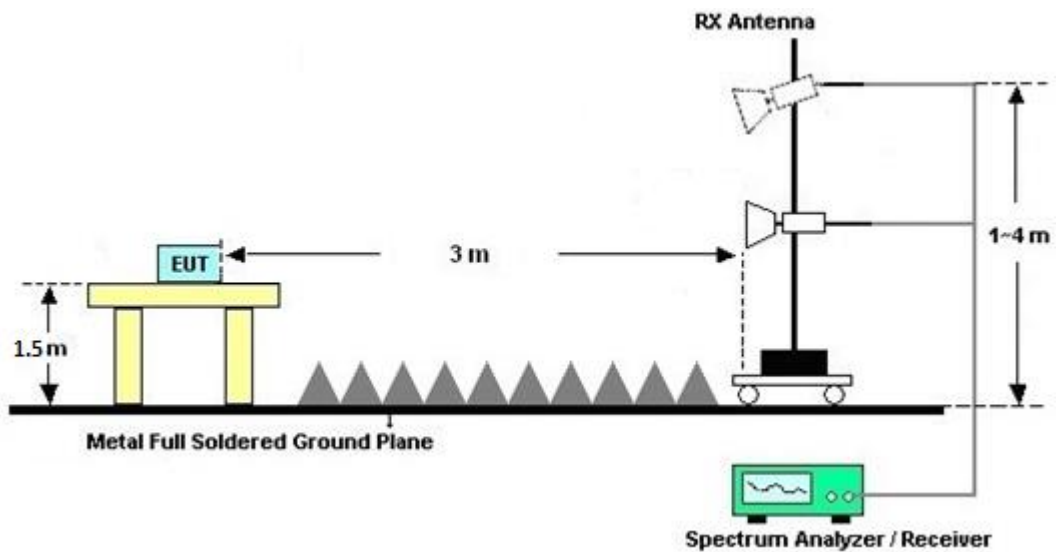
For radiated test below 30MHz



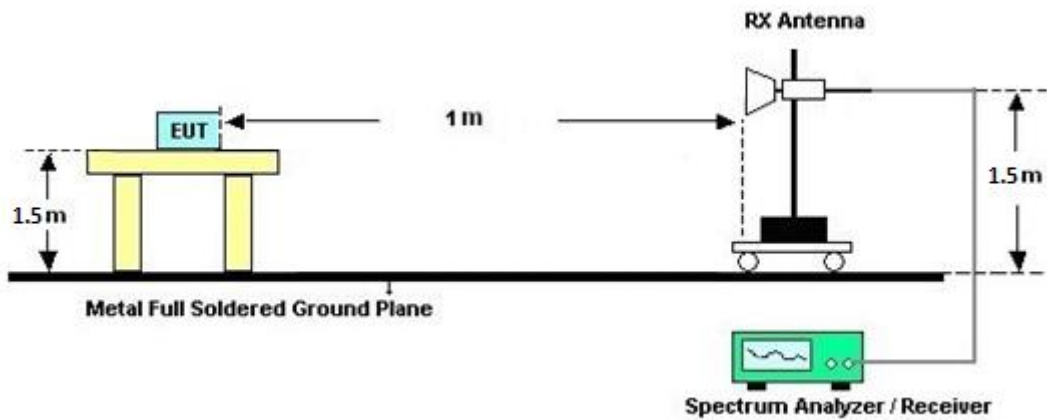
For radiated test from 30MHz to 1GHz



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

*Decreases with the logarithm of the frequency.

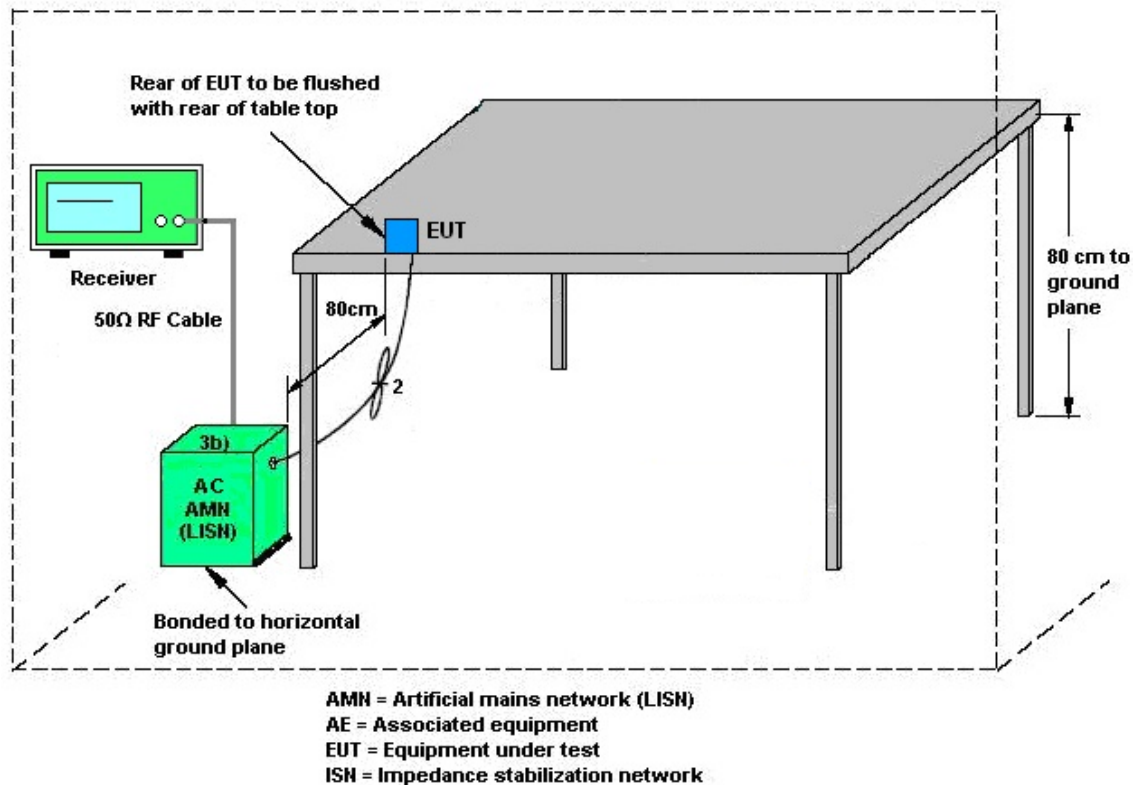
3.6.2 Measuring Instruments

See list of measuring equipment of this test report.

3.6.3 Test Procedures

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

3.6.4 Test Setup



3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



3.7 Antenna Requirements

3.7.1 Standard Applicable

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

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

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



4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Hygrometer	Testo	608-H1	45142595	N/A	Aug. 05, 2020	Jun. 17, 2021~ Jun. 25, 2021	Aug. 04, 2021	Conducted (TH01-CA)
Power Sensor	DARE!!	RPR3006W	RPR6W-1 901026	10MHz-6GHz	Jun. 24, 2020	Jun. 17, 2021~ Jun. 23, 2021	Jun. 23, 2021	Conducted (TH01-CA)
Power Sensor	DARE!!	RPR3006W	15I00041S NO09	10MHz-6GHz	Jan. 06, 2021	Jun. 23, 2021~ Jun. 25, 2021	Jan. 05, 2022	Conducted (TH01-CA)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101089	10Hz-40GHz	Sep. 14, 2020	Jun. 17, 2021~ Jun. 25, 2021	Sep. 13, 2021	Conducted (TH01-CA)
Switch Box & RF Cable	EM Electronics	EMSW26	1090304	N/A	Dec. 30, 2020	Jun. 17, 2021~ Jun. 25, 2021	Dec. 29, 2021	Conducted (TH01-CA)
LISN	TESEQ	NNB51	47407	N/A	Jul. 06, 2020	Jul. 02, 2021 ~ Jul. 04, 2021	Jul. 05, 2021	Conduction (CO01-CA)
EMI Test Receiver	R&S	ESR7	102177	9KHz~7GHz	Jul. 16, 2020	Jul. 02, 2021 ~ 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. 02, 2021 ~ Jul. 04, 2021	Jul. 07, 2021	Conduction (CO01-CA)
Test Software	R&S	EMC32 V10.30.0	N/A	N/A	N/A	Jul. 02, 2021 ~ Jul. 04, 2021	N/A	Conduction (CO01-CA)



Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Bilog Antenna	TESEQ	6111D	50391	30MHz~1GHz	Jul. 06, 2020	Jun. 22, 2021~ Jun. 24, 2021	Jul. 05, 2021	Radiation (03CH02-CA)
Bilog Antenna	TESEQ	6111D	50392	30MHz~1GHz	Jul. 29, 2020	Jun. 24, 2021~ Jul. 12, 2021	Jul. 28, 2021	Radiation (03CH02-CA)
Horn Antenna	SCHWARZBE CK	BBHA 9120D	01895	1GHz~18GHz	Aug. 28, 2020	Jun. 22, 2021~ Jul. 12, 2021	Aug. 27, 2021	Radiation (03CH02-CA)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA9170	00842	18GHz~40GHz	Jul. 27, 2020	Jun. 22, 2021~ Jul. 12, 2021	Jul. 26, 2021	Radiation (03CH02-CA)
Preamplifier	SONOMA	310N	372240	N/A	Aug. 12, 2020	Jun. 22, 2021~ Jul. 12, 2021	Aug. 11, 2021	Radiation (03CH02-CA)
Preamplifier	Keysight	83017A	MY532703 23	1GHz~26.5GHz	Jul. 28, 2020	Jun. 22, 2021~ Jul. 12, 2021	Jul. 27, 2021	Radiation (03CH02-CA)
Preamplifier	E-instrument	ERA-100M-18 G-56-01-A70	EC190025 1	N/A	Mar. 30, 2021	Jun. 22, 2021~ Jul. 12, 2021	Mar. 29, 2022	Radiation (03CH02-CA)
Preamplifier	EMEC	EMC18G40G	060725	18G-40G	Aug. 07, 2020	Jun. 22, 2021~ Jul. 12, 2021	Aug. 06, 2021	Radiation (03CH02-CA)
Spectrum Analyzer	Keysight	N9010A	MY574202 21	10Hz~44GHz	Sep. 11, 2020	Jun. 22, 2021~ Jul. 12, 2021	Sep. 10, 2021	Radiation (03CH02-CA)
Filter	Wainwright	WHKX12-270 0-3000-18000 -60ST	SN10	3G High Pass	Jul. 24, 2020	Jun. 22, 2021~ Jul. 12, 2021	Jul. 23, 2021	Radiation (03CH02-CA)
Filter	Wainwright	WLK12-1200- 1272-11000-4 0SS	SN2	1.2G Low Pass	Jul. 24, 2020	Jun. 22, 2021~ Jul. 12, 2021	Jul. 23, 2021	Radiation (03CH02-CA)
Hygrometer	TESEO	608-H1	45142602	N/A	Aug. 05, 2020	Jun. 22, 2021~ Jul. 12, 2021	Aug. 04, 2021	Radiation (03CH02-CA)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	Jun. 22, 2021~ Jul. 12, 2021	N/A	Radiation (03CH02-CA)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Jun. 22, 2021~ Jul. 12, 2021	N/A	Radiation (03CH02-CA)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Jun. 22, 2021~ Jul. 12, 2021	N/A	Radiation (03CH02-CA)
Software	Audix	E3	N/A	N/A	N/A	Jun. 22, 2021~ Jul. 12, 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
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

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

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

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

Test Engineer:	Andy Kao	Temperature:	20.4~23.9	°C
Test Date:	2021/06/17~2021/06/25	Relative Humidity:	43.2~47.1	%

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	0.711	0.50	Pass
2.4GHz	1Mbps	1	19	2440	1.059	0.705	0.50	Pass
2.4GHz	1Mbps	1	39	2480	1.055	0.707	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	17.92	30.00	0.00	17.92	36.00	Pass
2.4GHz	1Mbps	1	19	2440	19.80	30.00	0.00	19.80	36.00	Pass
2.4GHz	1Mbps	1	39	2480	17.47	30.00	0.00	17.47	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	18.12	4.74	0.00	8.00	Pass
2.4GHz	1Mbps	1	19	2440	20.04	6.57	0.00	8.00	Pass
2.4GHz	1Mbps	1	39	2480	17.83	5.82	0.00	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	2.074	1.163	0.50	Pass
2.4GHz	2Mbps	1	19	2440	2.078	1.167	0.50	Pass
2.4GHz	2Mbps	1	39	2480	2.090	1.143	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	17.91	30.00	0.00	17.91	36.00	Pass
2.4GHz	2Mbps	1	19	2440	19.82	30.00	0.00	19.82	36.00	Pass
2.4GHz	2Mbps	1	39	2480	17.49	30.00	0.00	17.49	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	18.08	1.80	0.00	8.00	Pass
2.4GHz	2Mbps	1	19	2440	20.00	4.31	0.00	8.00	Pass
2.4GHz	2Mbps	1	39	2480	17.65	2.61	0.00	8.00	Pass

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



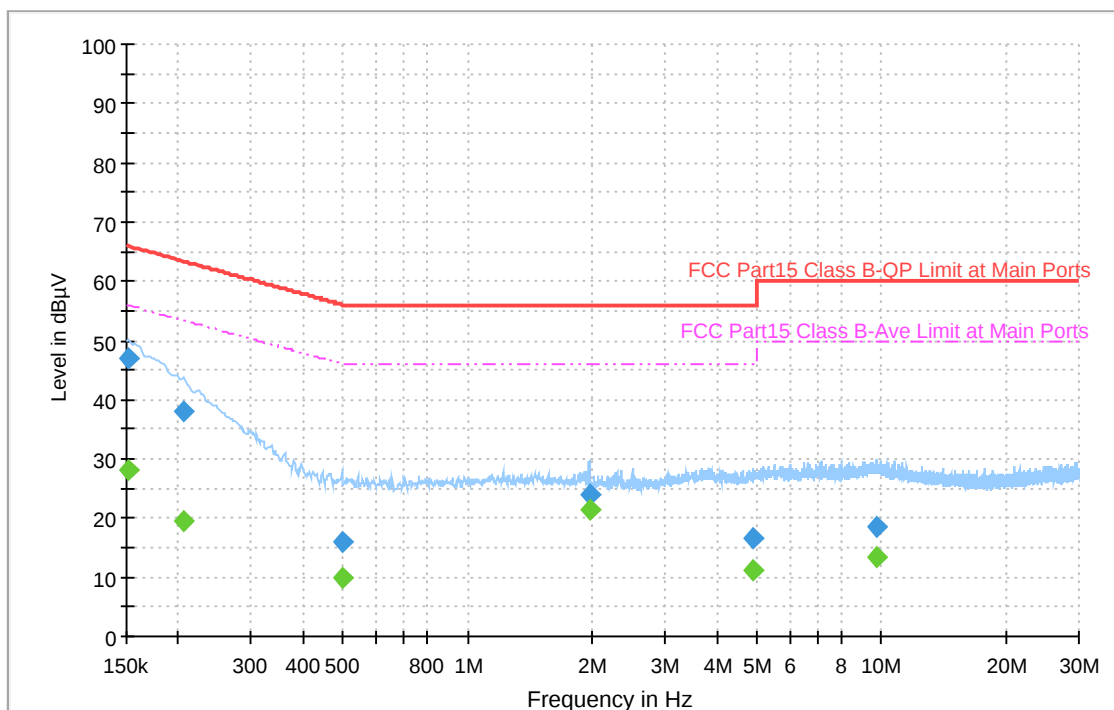
Appendix B. AC Conducted Emission Test Results

Test Engineer :	Jordan Huang	Temperature :	24°C
		Relative Humidity :	45%

EUT Information

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

Full Spectrum



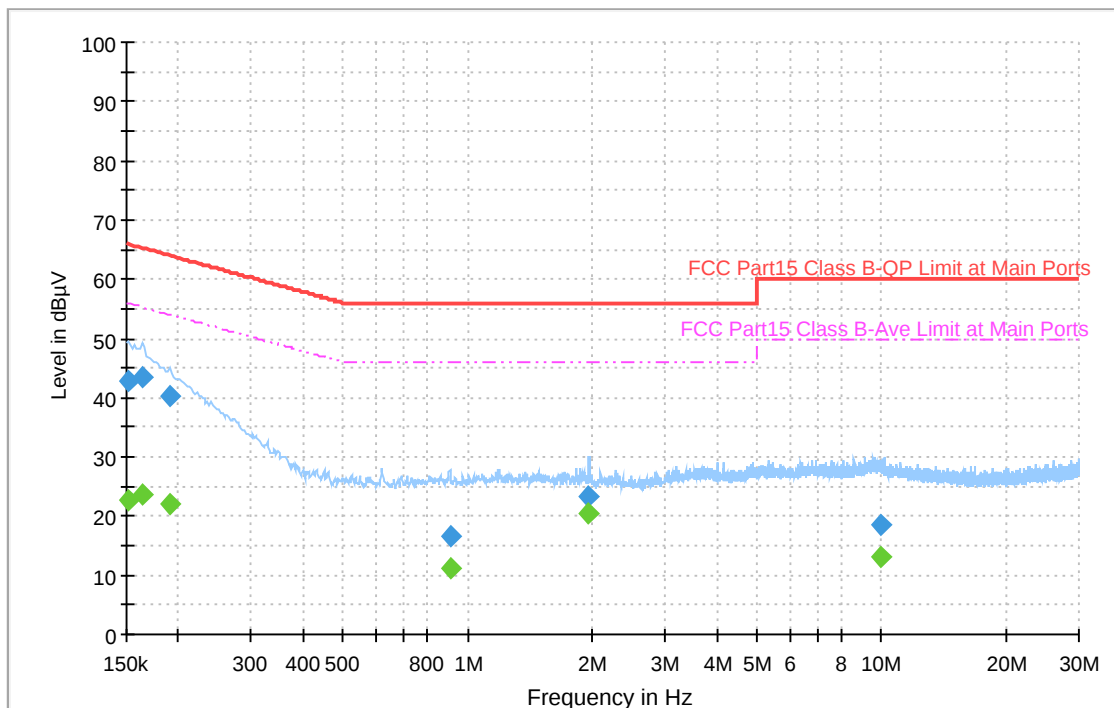
Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	28.18	55.88	27.70	L1	OFF	20.3
0.152250	47.00	---	65.88	18.88	L1	OFF	20.3
0.206250	---	19.57	53.36	33.79	L1	OFF	20.3
0.206250	38.10	---	63.36	25.26	L1	OFF	20.3
0.496500	---	9.84	46.06	36.22	L1	OFF	20.3
0.496500	16.00	---	56.06	40.06	L1	OFF	20.3
1.965750	---	21.42	46.00	24.58	L1	OFF	20.3
1.965750	24.11	---	56.00	31.89	L1	OFF	20.3
4.890750	---	11.24	46.00	34.76	L1	OFF	20.4
4.890750	16.63	---	56.00	39.37	L1	OFF	20.4
9.784500	---	13.45	50.00	36.55	L1	OFF	20.4
9.784500	18.65	---	60.00	41.35	L1	OFF	20.4

EUT Information

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

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	22.56	55.88	33.32	N	OFF	20.3
0.152250	42.93	---	65.88	22.95	N	OFF	20.3
0.163500	---	23.71	55.28	31.57	N	OFF	20.3
0.163500	43.49	---	65.28	21.79	N	OFF	20.3
0.190500	---	22.12	54.02	31.89	N	OFF	20.3
0.190500	40.11	---	64.02	23.90	N	OFF	20.3
0.906000	---	11.26	46.00	34.74	N	OFF	20.4
0.906000	16.52	---	56.00	39.48	N	OFF	20.4
1.963500	---	20.33	46.00	25.67	N	OFF	20.3
1.963500	23.26	---	56.00	32.74	N	OFF	20.3
9.924000	---	13.23	50.00	36.77	N	OFF	20.5
9.924000	18.55	---	60.00	41.45	N	OFF	20.5



Appendix C. Radiated Spurious Emission

Test Engineer :	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	Preampl 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)
Proprietary 2.4G CH 00 2402MHz		2380.56	60.02	-13.98	74	46.29	27.65	27.44	31.38	100	132	P	H
		2380.56	20.44	-33.55	54	-	-	-	-	-	-	A	H
	*	2402	116.8	-	-	103.06	27.61	27.47	31.36	100	132	P	H
	*	2402	77.22	-	-	-	-	-	-	-	-	A	H
												P	H
												A	H
		2387.76	57.01	-16.99	74	43.28	27.63	27.45	31.37	104	208	P	V
		2387.76	17.43	-36.57	54	-	-	-	-	-	-	A	V
	*	2402	112.3	-	-	98.6	27.57	27.47	31.36	104	208	P	V
	*	2402	72.72	-	-	-	-	-	-	-	-	A	V
												P	V
												A	V
Proprietary 2.4G CH 19 2440MHz		2315.76	55.72	-18.28	74	41.92	27.87	27.32	31.42	110	124	P	H
		2315.76	16.14	-37.85	54	-	-	-	-	-	-	A	H
	*	2440	115.42	-	-	101.64	27.59	27.53	31.36	110	124	P	H
	*	2440	75.84	-	-	-	-	-	-	-	-	A	H
		2488.08	56.09	-17.91	74	42.23	27.56	27.63	31.34	110	124	P	H
		2488.08	16.51	-37.48	54	-	-	-	-	-	-	A	H
		2382.64	55.41	-18.59	74	41.67	27.66	27.44	31.38	361	3	P	V
		2382.64	15.83	-38.17	54	-	-	-	-	-	-	A	V
	*	2440	112.23	-	-	98.59	27.45	27.53	31.36	361	3	P	V
	*	2440	72.65	-	-	-	-	-	-	-	-	A	V
		2487.6	55.03	-18.97	74	41.34	27.39	27.63	31.34	361	3	P	V
		2487.6	15.45	-38.55	54	-	-	-	-	-	-	A	V



Proprietary 2.4G CH 39 2480MHz												P	H
												A	H
	*	2480	114.39	-	-	100.54	27.57	27.62	31.35	128	129	P	H
	*	2480	74.81	-	-	-	-	-	-	-	-	A	H
		2483.76	62.51	-11.49	74	48.66	27.57	27.62	31.35	128	129		H
		2483.76	22.93	-31.07	54	-	-	-	-	-	-		H
												P	V
												A	V
	*	2480	109.8	-	-	96.12	27.4	27.62	31.35	400	2	P	V
	*	2480	70.22	-	-	-	-	-	-	-	-	A	V
		2483.76	58.71	-15.29	74	45.04	27.39	27.62	31.35	400			V
		2483.76	19.13	-34.87	54	-	-	-	-	-			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)
Proprietary 2.4G CH 00 2402MHz		4804	60.02	-13.98	74	85.49	31.38	11.99	68.21	140	32	P	H
		4804	20.44	-33.56	54	-	-	-	-	-	-	A	H
		7206	66.69	-7.31	74	83.08	36.25	14.7	66.81	254	23	P	H
		9608	57.61	-16.39	74	71.76	38.48	16.67	68.84	100	0	P	H
		12010	59.51	-14.49	74	69.63	39.29	18.94	67.78	220	329	P	H
		12010	19.93	-34.07	54	-	-	-	-	-	-	A	H
		14412	56.84	-17.16	74	62.64	41.97	20.65	67.82	100	0	P	H
		16814	65.86	-8.14	74	72.28	40.23	22.37	68.44	195	63	P	H
		4804	56.03	-17.97	74	81.49	31.39	11.99	68.21	292	357	P	V
		4804	16.45	-37.55	54	-	-	-	-	-	-	A	V
		7206	66.11	-7.89	74	82.53	36.22	14.7	66.81	100	8	P	V
		9608	52.37	-21.63	74	66.49	38.51	16.67	68.84	100	0	P	V
		12010	59.52	-14.48	74	69.55	39.38	18.94	67.78	214	27	P	V
		12010	19.94	-34.06	54	-	-	-	-	-	-	A	V
		16814	62.25	-11.75	74	68.57	40.33	22.37	68.44	376	15	P	V
Proprietary 2.4G CH 19 2440MHz		4880	56.11	-17.89	74	81.22	31.35	11.69	68.15	168	2	P	H
		4880	16.53	-37.47	54	-	-	-	-	-	-	A	H
		7320	68.12	-5.88	74	84.69	36.36	13.89	66.82	101	37	P	H
		7320	28.54	-25.46	54	-	-	-	-	-	-	A	H
		9760	58.34	-15.66	74	72.29	39.03	15.9	68.88	100	0	P	H
		12200	58.84	-15.16	74	68.75	39.45	18.12	67.48	192	281	P	H
		12200	19.26	-34.74	54	-	-	-	-	-	-	A	H
		14640	58.5	-15.5	74	64.02	42.35	20.04	67.91	100	0	P	H
		17080	64.08	-9.92	74	70.72	40.33	21.91	68.88	100	0	P	H
		4880	52.38	-21.62	74	77.56	31.28	11.69	68.15	398	348	P	V
		4880	12.8	-41.2	54	-	-	-	-	-	-	A	V
		7320	67.88	-6.12	74	84.39	36.42	13.89	66.82	231	350	P	V
		7320	28.3	-25.7	54	-	-	-	-	-	-	A	V
		9760	56.99	-17.01	74	70.93	39.04	15.9	68.88	100	0	P	V
		12200	57.72	-16.28	74	67.61	39.47	18.12	67.48	195	309	P	V
		12200	18.14	-35.86	54	-	-	-	-	-	-	A	V
		14640	57.18	-16.82	74	62.79	42.26	20.04	67.91	100	0	P	V
		17080	60.37	-13.63	74	67.02	40.32	21.91	68.88	100	0	P	V



Proprietary 2.4G CH 39 2480MHz		4960	50.77	-23.23	74	75.8	31.47	11.6	68.1	100	340	P	H
		4960	11.19	-42.81	54	-	-	-	-	-	-	A	H
		7440	65.65	-8.35	74	82.02	36.51	13.96	66.84	291	38	P	H
		7440	26.07	-27.93	54	-	-	-	-	-	-	A	H
		9920	51.88	-22.12	74	65.79	39.01	16.01	68.93	100	0	P	H
		12400	54.91	-19.09	74	65.16	38.61	18.31	67.17	101	280	P	H
		12400	15.33	-38.67	54	-	-	-	-	-	-	A	H
		14880	54.75	-19.25	74	61.15	41.63	20.19	68.22	100	0	P	H
		17360	63.25	-10.75	74	68.83	41.42	22.22	69.22	100	0	P	H
		4960	50.43	-23.57	74	75.51	31.42	11.6	68.1	272	340	P	V
		4960	10.85	-43.15	54	-	-	-	-	-	-	A	V
		7440	65.68	-8.32	74	82.08	36.48	13.96	66.84	109	357	P	V
		7440	26.1	-27.9	54	-	-	-	-	-	-	A	V
		9920	53.39	-20.61	74	67.24	39.07	16.01	68.93	100	0	P	V
		12400	53.85	-20.15	74	64.03	38.68	18.31	67.17	109	242	P	V
		12400	14.27	-39.73	54	-	-	-	-	-	-	A	V
		14880	52.54	-21.46	74	59.04	41.53	20.19	68.22	100	0	P	V
		17360	59.74	-14.26	74	65.36	41.38	22.22	69.22	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average 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)
Proprietary 2.4G CH 00 2402MHz		2385.84	59.82	-14.18	74	46.08	27.64	17.47	31.37	100	133	P	H
		2385.84	15.38	-38.62	54	-	-	-	-	-	-	A	H
	*	2402	116.72	-	-	102.98	27.61	17.49	31.36	100	133	P	H
	*	2402	72.28	-	-	-	-	-	-	-	-	A	H
		2488.16	55.06	-18.94	74	41.2	27.56	17.64	31.34	100	133	P	H
		2488.16	10.62	-43.38	54	-	-	-	-	-	-	A	H
		2384.88	58.1	-15.9	74	44.36	27.65	17.47	31.38	106	208	P	V
		2384.88	13.66	-40.34	54	-	-	-	-	-	-	A	V
	*	2402	112.2	-	-	98.5	27.57	17.49	31.36	106	208	P	V
	*	2402	67.76	-	-	-	-	-	-	-	-	A	V
		2497.84	54.81	-19.19	74	41.11	27.38	17.66	31.34	106	208	P	V
		2497.84	10.37	-43.63	54	-	-	-	-	-	-	A	V
Proprietary 2.4G CH 19 2440MHz		2347.76	54.82	-19.18	74	41.11	27.72	17.4	31.41	109	124	P	H
		2347.76	10.38	-43.62	54	-	-	-	-	-	-	A	H
	*	2440	115.32	-	-	101.54	27.59	17.55	31.36	109	124	P	H
	*	2440	70.88	-	-	-	-	-	-	-	-	A	H
		2485.04	57.15	-16.85	74	43.3	27.56	17.64	31.35	109	124	P	H
		2485.04	12.71	-41.29	54	-	-	-	-	-	-	A	H
		2335.28	55.01	-18.99	74	41.23	27.82	17.38	31.42	400	12	P	V
		2335.28	10.57	-43.43	54	-	-	-	-	-	-	A	V
	*	2440	111.2	-	-	97.56	27.45	17.55	31.36	400	12	P	V
	*	2440	66.76	-	-	-	-	-	-	-	-	A	V
		2492.72	54.9	-19.1	74	41.2	27.39	17.65	31.34	400	12	P	V
		2492.72	10.46	-43.54	54	-	-	-	-	-	-	A	V



Proprietary 2.4G CH 39 2480MHz		2367.44	54.94	-19.06	74	41.21	27.68	17.44	31.39	127	130	P	H
		2367.44	10.5	-43.5	54	-	-	-	-	-	-	A	H
	*	2480	114.5	-	-	100.65	27.57	17.63	31.35	127	130	P	H
	*	2480	70.06	-	-	-	-	-	-	-	-	A	H
		2483.6	68.46	-5.54	74	54.61	27.57	17.63	31.35	127	130	P	H
		2483.6	24.02	-29.98	54	-	-	-	-	-	-	A	H
		2373.68	55.13	-18.87	74	41.37	27.7	7.47	31.39	100	166	P	V
		2373.68	10.69	-43.31	54	-	-	-	-	-	-	A	V
	*	2480	109.85	35.85	74	96.17	27.4	7.64	31.35	100	166	P	V
	*	2480	65.41	11.41	54	-	-	-	-	-	-	A	V
		2483.6	62.92	-11.08	74	49.25	27.39	7.64	31.35	100	166	P	V
		2483.6	18.48	-35.52	54	-	-	-	-	-	-	A	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)
Proprietary 2.4G CH 00 2402MHz		4804	60.12	-13.88	74	85.46	31.38	11.49	68.21	100	303	P	H
		4804	15.68	-38.32	54	-	-	-	-	-	-	A	H
		7206	66.95	-7.05	74	83.78	36.25	13.73	66.81	100	0	P	H
		9608	55.6	-18.4	74	70.19	38.48	15.77	68.84	100	0	P	H
		12010	58.43	-15.57	74	68.96	39.29	17.96	67.78	101	326	P	H
		12010	13.99	-40.01	54	-	-	-	-	-	-	A	H
		14412	57.04	-16.96	74	62.97	41.97	19.92	67.82	100	0	P	H
		16814	63.62	-10.38	74	70.18	40.23	21.65	68.44	100	0	P	H
		4804	55.64	-18.36	74	80.97	31.39	11.49	68.21	305	331	P	V
		4804	11.2	-42.8	54	-	-	-	-	-	-	A	V
		7206	66.67	-7.33	74	83.53	36.22	13.73	66.81	100	0	P	V
		9608	52.1	-21.9	74	66.66	38.51	15.77	68.84	100	0	P	V
		12010	59.78	-14.22	74	70.22	39.38	17.96	67.78	217	8	P	V
		12010	15.34	-38.66	54	-	-	-	-	-	-	A	V
		14412	52.94	-21.06	74	58.75	42.09	19.92	67.82	100	0	P	V
		16814	58.73	-15.27	74	65.19	40.33	21.65	68.44	100	0	P	V
Proprietary 2.4G CH 19 2440MHz		4880	56.39	-17.61	74	81.5	31.35	11.69	68.15	100	342	P	H
		4880	11.95	-42.05	54	-	-	-	-	-	-	A	H
		7320	69.55	-4.45	74	86.12	36.36	13.89	66.82	237	10	P	H
		7320	25.11	-28.89	54	-	-	-	-	-	-	A	H
		9760	53.41	-20.59	74	67.36	39.03	15.9	68.88	100	0	P	H
		12200	58.32	-15.68	74	68.23	39.45	18.12	67.48	188	283	P	H
		12200	13.88	-40.12	54	-	-	-	-	-	-	A	H
		14640	55.28	-18.72	74	60.8	42.35	20.04	67.91	100	0	P	H
		17080	61.05	-12.95	74	67.69	40.33	21.91	68.88	100	0	P	H
		4880	52.92	-21.08	74	78.1	31.28	11.69	68.15	400	339	P	V
		4880	8.48	-45.52	54	-	-	-	-	-	-	A	V
		7320	68.17	-5.83	74	84.68	36.42	13.89	66.82	231	2	P	V
		7320	23.73	-30.27	54	-	-	-	-	-	-	A	V
		9760	52.69	-21.31	74	66.63	39.04	15.9	68.88	100	0	P	V
		12200	56.54	-17.46	74	66.43	39.47	18.12	67.48	195	310	P	V
		12200	12.1	-41.9	54	-	-	-	-	-	-	A	V
		14640	52.35	-21.65	74	57.96	42.26	20.04	67.91	100	0	P	V
		17080	56.76	-17.24	74	63.41	40.32	21.91	68.88	100	0	P	V



Proprietary 2.4G CH 39 2480MHz		4960	50.72	-23.28	74	75.75	31.47	11.6	68.1	116	340	P	H
		4960	6.28	-47.72	54	-	-	-	-	-	-	A	H
		7440	65.84	-8.16	74	82.21	36.51	13.96	66.84	284	38	P	H
		7440	21.4	-32.6	54	-	-	-	-	-	-	A	H
		9920	50.71	-23.29	74	64.62	39.01	16.01	68.93	100	0	P	H
		12400	54.16	-19.84	74	64.41	38.61	18.31	67.17	100	281	P	H
		12400	9.72	-44.28	54	-	-	-	-	-	-	A	H
		14880	54.89	-19.11	74	61.29	41.63	20.19	68.22	100	0	P	H
		17360	63.09	-10.91	74	68.67	41.42	22.22	69.22	100	0	P	H
		4960	49.8	-24.2	74	74.88	31.42	11.6	68.1	273	332	P	V
		4960	5.36	-48.64	54	-	-	-	-	-	-	A	V
		7440	65.75	-8.25	74	82.15	36.48	13.96	66.84	362	343	P	V
		7440	21.31	-32.69	54	-	-	-	-	-	-	A	V
		9920	51.6	-22.4	74	65.45	39.07	16.01	68.93	100	0	P	V
		12400	53.3	-20.7	74	63.48	38.68	18.31	67.17	101	245	P	V
		12400	8.86	-45.14	54	-	-	-	-	-	-	A	V
		14880	52.05	-21.95	74	58.55	41.53	20.19	68.22	100	0	P	V
		17360	57.66	-16.34	74	63.28	41.38	22.22	69.22	100	0	P	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		19520	71.61	-2.39	74	73.34	37.57	13.48	52.78	100	0	P	H	
		19520	27.17	-26.83	54	-	-	-	-	-	-	A	H	
		21960	63.08	-10.92	74	61.92	38.19	14.96	51.99	100	0	P	H	
		24400	45.43	-28.57	74	41.89	38.93	16.04	51.43	100	0	P	H	
													H	
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		19520	60.3	-13.7	74	61.93	37.67	13.48	52.78	100	0	P	V	
		19520	15.86	-38.14	54	-	-	-	-	-	-	-	A	V
		21960	55.68	-18.32	74	54.56	38.15	14.96	51.99	100	0	P	V	
		24400	42.32	-31.68	74	38.71	39	16.04	51.43	100	0	P	V	
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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		30.97	21.89	-18.11	40	28.98	24.42	0.93	32.44	-	-	P	H
		70.74	19.86	-20.14	40	38.43	12.37	1.49	32.43	-	-	P	H
		105.66	19.87	-23.63	43.5	33.89	16.67	1.73	32.42	-	-	P	H
		947.62	33.83	-12.17	46	29.14	30.75	5.22	31.28	100	0	P	H
		979.63	33.95	-20.05	54	28.77	30.81	5.34	30.97	-	-	P	H
													H
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		30	23.54	-16.46	40	30.08	25	0.9	32.44	-	-	P	V
		45.52	21.33	-18.67	40	35.96	16.64	1.17	32.44	-	-	P	V
		59.1	19.71	-20.29	40	39.2	11.6	1.34	32.43	-	-	P	V
		70.74	20.22	-19.78	40	38.79	12.37	1.49	32.43	-	-	P	V
		105.66	22.78	-20.72	43.5	36.8	16.67	1.73	32.42	-	-	P	V
		944.71	33.66	-12.34	46	29.08	30.69	5.2	31.31	100	0	P	V
		968.96	33.57	-20.43	54	28.42	30.92	5.3	31.07	-	-	P	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 :	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

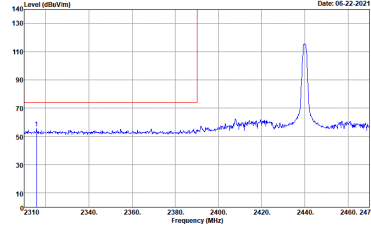
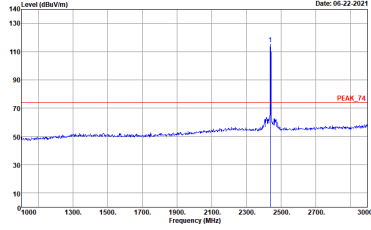
Proprietary 2.4G (Band Edge @ 3m)

2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH00 2402MHz	
	Horizontal	Fundamental
Peak	Level (dBuV/m) Date: 06-22-2021 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 HORIZONTAL	Level (dBuV/m) Date: 06-22-2021 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 HORIZONTAL

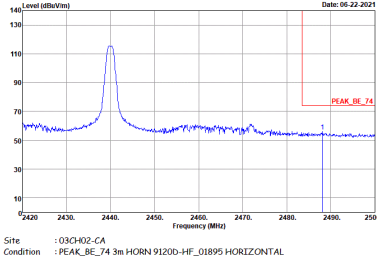


2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH00 2402MHz	
	Vertical	Fundamental
Peak	Level (dBu/Vm) Date: 06-22-2021 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 91200-HF_01895 VERTICAL	Level (dBu/Vm) Date: 06-22-2021 Site : 03CH02-CA Condition : PEAK_74 3m HORN 91200-HF_01895 VERTICAL



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	 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 HORIZONTAL

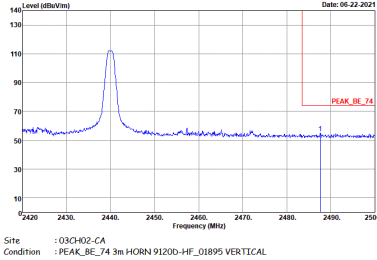


2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH19 2440MHz - R	
	Horizontal	Fundamental
Peak		Left blank

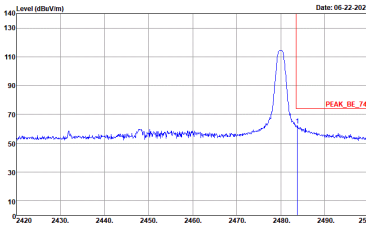
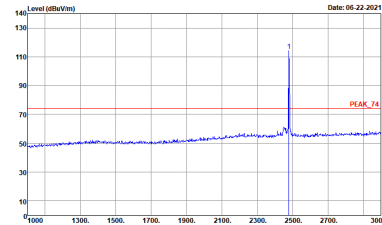


2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH19 2440MHz - L	
	Vertical	Fundamental
Peak	Level (dBu/Vm) Date: 06-22-2021 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 91200-HF_01895 VERTICAL	Level (dBu/Vm) Date: 06-22-2021 Site : 03CH02-CA Condition : PEAK_74 3m HORN 91200-HF_01895 VERTICAL



2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH19 2440MHz - R	
	Vertical	Fundamental
Peak		Left blank



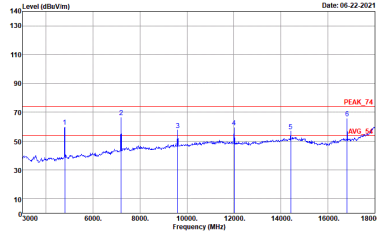
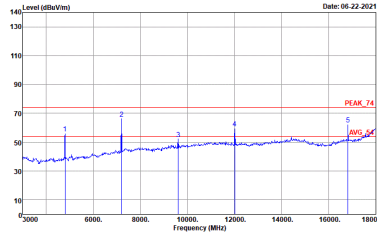
2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH39 2480MHz	
	Horizontal	Fundamental
Peak	Level (dBuV/m) Date: 06-22-2021  Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 91200-HF_01895 HORIZONTAL	Level (dBuV/m) Date: 06-22-2021  Site : 03CH02-CA Condition : PEAK_74 3m HORN 91200-HF_01895 HORIZONTAL



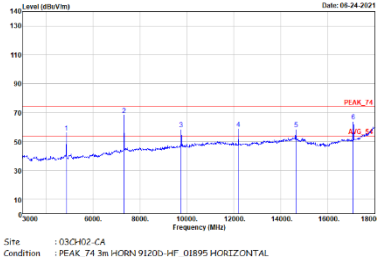
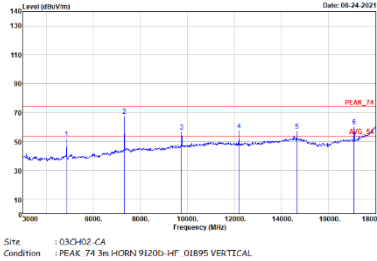
2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH39 2480MHz	
	Vertical	Fundamental
Peak	Level (dBuV/m) Date: 06-22-2021 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 91200-HF_01895 VERTICAL	Level (dBuV/m) Date: 06-22-2021 Site : 03CH02-CA Condition : PEAK_74 3m HORN 91200-HF_01895 VERTICAL



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.	 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 HORIZONTAL	 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 VERTICAL



2.4GHz	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	Proprietary 2.4G CH19 2440MHz	
	Horizontal	Vertical
Peak Avg.	 Site : 03CH02-CA Condition : PEAK 74 3m HORN 91200-HF 01895 HORIZONTAL	 Site : 03CH02-CA Condition : PEAK 74 3m HORN 91200-HF 01895 VERTICAL



2.4GHz	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	Proprietary 2.4G CH39 2480MHz	
	Horizontal	Vertical
Peak	Level (dBuV/m) Date: 06-24-2021 Site : 03CH02-CA Condition : PEAK_74 3m HORN 91200-HF_01895 HORIZONTAL	Level (dBuV/m) Date: 06-24-2021 Site : 03CH02-CA Condition : PEAK_74 3m HORN 91200-HF_01895 VERTICAL



<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	Level (dBuV/m) Date: 06-22-2021 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 HORIZONTAL	Level (dBuV/m) Date: 06-22-2021 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 HORIZONTAL

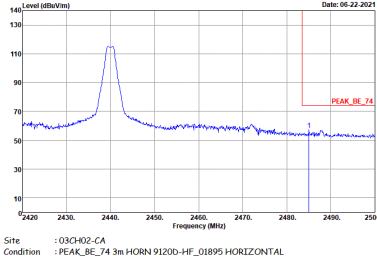


2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH00 2402MHz	
	Vertical	Fundamental
Peak	Level (dBu/Vm) Date: 06-22-2021 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 91200-HF_01895 VERTICAL	Level (dBu/Vm) Date: 06-22-2021 Site : 03CH02-CA Condition : PEAK_74 3m HORN 91200-HF_01895 VERTICAL



2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH19 2440MHz - L	
	Horizontal	Fundamental
Peak	Level (dBm/100kHz) Date: 05-22-2021 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 HORIZONTAL	Level (dBm/100kHz) Date: 05-22-2021 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 HORIZONTAL

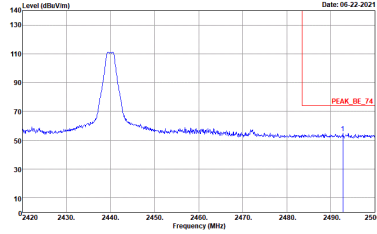


2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH19 2440MHz - R	
	Horizontal	Fundamental
Peak		Left blank



2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH19 2440MHz - L	
	Vertical	Fundamental
Peak	Level (dBuV/m) Date: 06-22-2021 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 91200-HF_01895 VERTICAL	Level (dBuV/m) Date: 06-22-2021 Site : 03CH02-CA Condition : PEAK_74 3m HORN 91200-HF_01895 VERTICAL



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 91200-HF_01895 VERTICAL	Left blank



2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH39 2480MHz	
	Horizontal	Fundamental
Peak	Level (dBuV/m) Date: 06-22-2021 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 91200-HF_01895 HORIZONTAL	Level (dBuV/m) Date: 06-22-2021 Site : 03CH02-CA Condition : PEAK_74 3m HORN 91200-HF_01895 HORIZONTAL



2.4GHz	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	Proprietary 2.4G CH39 2480MHz	
	Vertical	Fundamental
Peak	Level (dBuV/m) Date: 06-22-2021 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 91200-HF_01895 VERTICAL	Level (dBuV/m) Date: 06-22-2021 Site : 03CH02-CA Condition : PEAK_74 3m HORN 91200-HF_01895 VERTICAL



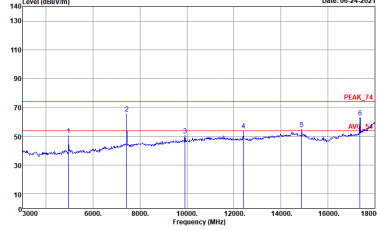
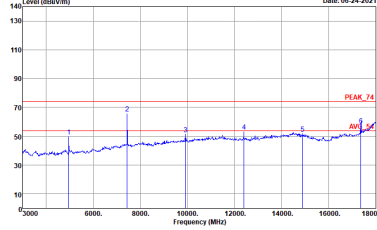
2.4GHz 2400~2483.5MHz
Proprietary 2.4G (Harmonic @ 3m)

2.4GHz	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	Proprietary 2.4G CH00 2402MHz	
	Horizontal	Vertical
Peak Avg.	Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 HORIZONTAL	Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 VERTICAL



2.4GHz	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	Proprietary 2.4G CH19 2440MHz	
	Horizontal	Vertical
Peak Avg.	Level (dBu/V/m) Date: 06-24-2021 Site : 03CH02-CA Condition : PEAK_74 3m HORN 91200-HF_01895 HORIZONTAL	Level (dBu/V/m) Date: 06-24-2021 Site : 03CH02-CA Condition : PEAK_74 3m HORN 91200-HF_01895 VERTICAL



2.4GHz	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	Proprietary 2.4G CH39 2480MHz	
	Horizontal	Vertical
Peak	Level (dBu/Vm) Date: 06-24-2021  Site : 03CH02-CA Condition : PEAK_74 3m HORN 91200-HF_01895 HORIZONTAL	Level (dBu/Vm) Date: 06-24-2021  Site : 03CH02-CA Condition : PEAK_74 3m HORN 91200-HF_01895 VERTICAL

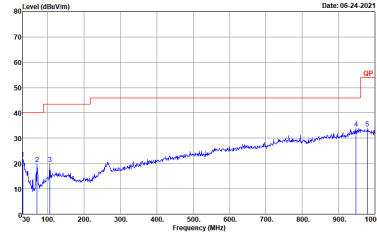
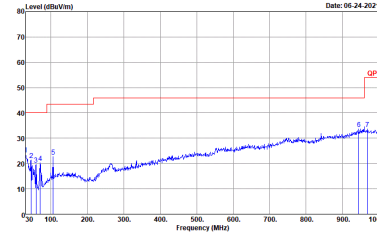


Emission above 18GHz

Proprietary 2.4G (SHF)

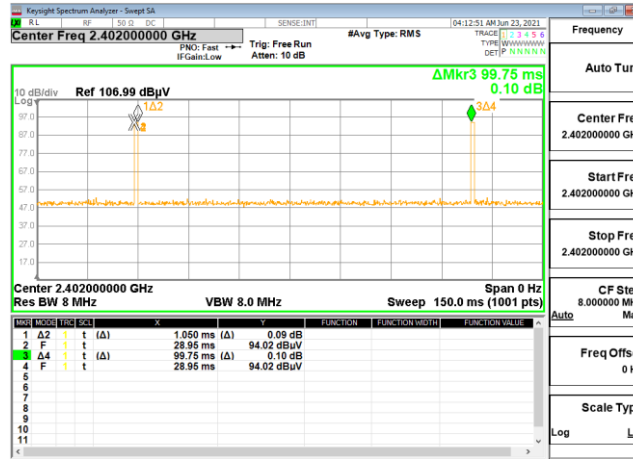
2.4GHz	2.4GHz 2400~2483.5MHz	
	BLE SHF	
	Horizontal	Vertical
Peak	Level (dBuV/m) Date: 07-12-2021 Site : 03CH02-CA Condition : PEAK_74 1m HORN 9170-SHF_0084Z HORIZONTAL	Level (dBuV/m) Date: 07-12-2021 Site : 03CH02-CA Condition : PEAK_74 1m HORN 9170-SHF_0084Z VERTICAL

Emission below 1GHz
Proprietary 2.4G (LF)

2.4GHz	2.4GHz 2400~2483.5MHz	
	Proprietary 2.4G LF	
	Horizontal	Vertical
QP / Peak	 Site : 03CH02-CA Condition : QP 3m BIL06 6111D-LF_50391 HORIZONTAL	 Site : 03CH02-CA Condition : QP 3m BIL06 6111D-LF_50391 VERTICAL

Appendix E. Duty Cycle Plots

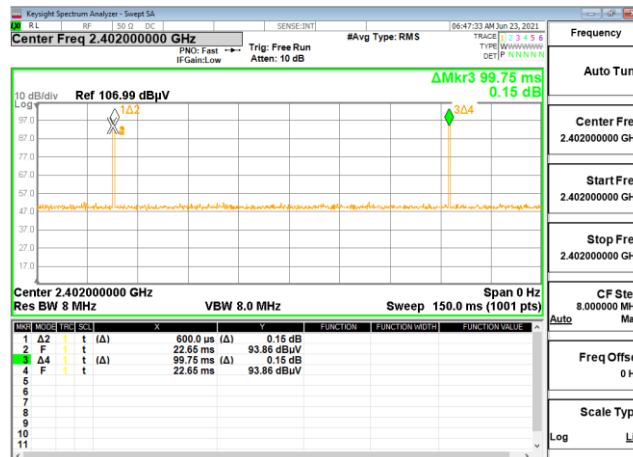
Radio 1 : The duty cycle of Proprietary 2.4G fundamental signal (channel 00, and 1Mbps) is 1.05%



Note:

1. The Radio 1 is duty cycle limited device as detailed in the Operating Discription.
2. The pulse train (period) of fundamental signal is longer than 100 milliseconds
3. The worst case duty cycle = on time/ pulse train = 1.05 ms / 100 ms = 1.05 %
4. The worst case duty cycle correction factor = $20 \cdot \log(\text{Duty cycle}) = -39.58 \text{ dB}$ 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 1 : The duty cycle of Proprietary 2.4G fundamental signal (channel 00, and 2Mbps) is 0.6%



Note:

1. The pulse train (period) of fundamental signal is longer than 100 milliseconds
2. The worst case duty cycle = on time/ pulse chain = 0.60 ms / 100 ms = 0.60 %
3. The worst case duty cycle correction factor = $20 \cdot \log(\text{Duty cycle}) = -44.44 \text{ dB}$ 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).