RF Test Report

For

Applicant Name:	**MCAKOREA**
Address:	NO.712 HANGMYEONG-RI DONGMYEONG-MYEON CHILGOK-GUN GYEONGBUK KOREA
EUT Name:	Bluetooth Audio
Brand Name:	ETL MCA
Model Number:	TD25-0162A

Issued By

Company Name:	**BTF Testing Lab (Shenzhen) Co., Ltd.**
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Report Number:	BTF230526R00601
Test Standards:	47 CFR Part 15.247
Test Conclusion:	Pass
FCC ID:	2BB2J-TD25
Test Date:	2023-06-01 to 2023-07-11
Date of Issue:	2023-07-11

Prepared By:

Chris Liu / Project Engineer

Date: 2023-07-11

Approved By:

Ryan.CJ / EMC Manager

Date: 2023-07-11

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Revision History		
Version	Issue Date	Revisions Content
R_V0	2023-07-11	Original
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1 Introduction

1.1 Identification of Testing Laboratory

Company Name:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Phone Number:	+86-0755-23146130
Fax Number:	+86-0755-23146130

1.2 Identification of the Responsible Testing Location

Company Name:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Phone Number:	+86-0755-23146130
Fax Number:	+86-0755-23146130
FCC Registration Number:	518915
Designation Number:	CN1330

1.3 Announcement

(1) The test report reference to the report template version v0.
(2) The test report is invalid if not marked with the signatures of the persons responsible for preparing, reviewing and approving the test report.
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2 Product Information

2.1 Application Information

Company Name:	MCAKOREA
Address:	NO.712 HANGMYEONG-RI DONGMYEONG-MYEON CHILGOK-GUN GYEONGBUK KOREA

2.2 Manufacturer Information

Company Name:	Weihai AUC International Trade CO.,LTD
Address:	Middle Zone Nantong Road Economic Development Wendengqu Weihai City Shandong Province China

2.3 Factory Information

Company Name:	ETL Machinery CO.,LTD
Address:	No.3 east nantong Road economic development wendengqu weihai city Shandong province china

2.4 General Description of Equipment under Test (EUT)

EUT Name:	Bluetooth Audio
Test Model Number:	TD25-0162A

2.5 Technical Information

Power Supply:	DC 12V
Operation Frequency:	2402MHz to 2480MHz
Number of Channels:	79
Modulation Type:	GFSK, π/4 DQPSK, 8DPSK
Antenna Type:	PCB ANT
Antenna Gain#:	3.3dBi
Note: #: The antenna gain provided by the applicant, and the laboratory will not be responsible for the accumulated calculation results which covers the information provided by the applicant.	

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3 Summary of Test Results

3.1 Test Standards

The tests were performed according to following standards:
47 CFR Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

3.2 Summary of Test Result

Item	Standard	Requirement	Result
Antenna requirement	47 CFR Part 15.247	Part 15.203	Pass
Occupied Bandwidth	47 CFR Part 15.247	47 CFR 15.215(c)	Pass
Maximum Conducted Output Power	47 CFR Part 15.247	47 CFR 15.247(b)(1)	Pass
Channel Separation	47 CFR Part 15.247	47 CFR 15.247(a)(1)	Pass
Number of Hopping Frequencies	47 CFR Part 15.247	47 CFR 15.247(a)(1)(iii)	Pass
Dwell Time	47 CFR Part 15.247	47 CFR 15.247(a)(1)(iii)	Pass
Emissions in non-restricted frequency bands	47 CFR Part 15.247	47 CFR 15.247(d)	Pass
Band edge emissions (Radiated)	47 CFR Part 15.247	47 CFR 15.247(d)	Pass
Emissions in restricted frequency bands (below 1GHz)	47 CFR Part 15.247	47 CFR 15.247(d)	Pass
Emissions in restricted frequency bands (above 1GHz)	47 CFR Part 15.247	47 CFR 15.247(d)	Pass

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4 Test Configuration

4.1 Test Equipment List

Occupied Bandwidth					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
RFTest software	/	V1.00	/	/	/
RF Control Unit	Techy	TR1029-1	/	2022-11-24	2023-11-23
RF Sensor Unit	Techy	TR1029-2	/	2022-11-24	2023-11-23
Programmable constant temperature and humidity box	ZZCKONG	ZZ-K02A	20210928007	2022-11-24	2023-11-23
Adjustable Direct Current Regulated Power Supply	Dongguan Tongmen Electronic Technology Co., LTD	etm-6050c	20211026123	2022-11-24	2023-11-23
WIDEBAND RADIO COMMNUNICATION TESTER	Rohde & Schwarz	CMW500	161997	2022-11-24	2023-11-23
MXA Signal Analyzer	KEYSIGHT	N9020A	MY50410020	2022-11-24	2023-11-23

Maximum Conducted Output Power					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
RFTest software	/	V1.00	/	/	/
RF Control Unit	Techy	TR1029-1	/	2022-11-24	2023-11-23
RF Sensor Unit	Techy	TR1029-2	/	2022-11-24	2023-11-23
Programmable constant temperature and humidity box	ZZCKONG	ZZ-K02A	20210928007	2022-11-24	2023-11-23
Adjustable Direct Current Regulated Power Supply	Dongguan Tongmen Electronic Technology Co., LTD	etm-6050c	20211026123	2022-11-24	2023-11-23
WIDEBAND RADIO COMMNUNICATION TESTER	Rohde & Schwarz	CMW500	161997	2022-11-24	2023-11-23
MXA Signal Analyzer	KEYSIGHT	N9020A	MY50410020	2022-11-24	2023-11-23

Channel Separation					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
RFTest software	/	V1.00	/	/	/
RF Control Unit	Techy	TR1029-1	/	2022-11-24	2023-11-23
RF Sensor Unit	Techy	TR1029-2	/	2022-11-24	2023-11-23
Programmable constant temperature and humidity box	ZZCKONG	ZZ-K02A	20210928007	2022-11-24	2023-11-23
Adjustable Direct Current Regulated Power Supply	Dongguan Tongmen Electronic Technology Co.,	etm-6050c	20211026123	2022-11-24	2023-11-23

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	LTD				
WIDEBAND RADIO COMMNUNICATION TESTER	Rohde & Schwarz	CMW500	161997	2022-11-24	2023-11-23
MXA Signal Analyzer	KEYSIGHT	N9020A	MY50410020	2022-11-24	2023-11-23

Number of Hopping Frequencies					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
RFTest software	/	V1.00	/	/	/
RF Control Unit	Techy	TR1029-1	/	2022-11-24	2023-11-23
RF Sensor Unit	Techy	TR1029-2	/	2022-11-24	2023-11-23
Programmable constant temperature and humidity box	ZZCKONG	ZZ-K02A	20210928007	2022-11-24	2023-11-23
Adjustable Direct Current Regulated Power Supply	Dongguan Tongmen Electronic Technology Co., LTD	etm-6050c	20211026123	2022-11-24	2023-11-23
WIDEBAND RADIO COMMNUNICATION TESTER	Rohde & Schwarz	CMW500	161997	2022-11-24	2023-11-23
MXA Signal Analyzer	KEYSIGHT	N9020A	MY50410020	2022-11-24	2023-11-23

Dwell Time					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
RFTest software	/	V1.00	/	/	/
RF Control Unit	Techy	TR1029-1	/	2022-11-24	2023-11-23
RF Sensor Unit	Techy	TR1029-2	/	2022-11-24	2023-11-23
Programmable constant temperature and humidity box	ZZCKONG	ZZ-K02A	20210928007	2022-11-24	2023-11-23
Adjustable Direct Current Regulated Power Supply	Dongguan Tongmen Electronic Technology Co., LTD	etm-6050c	20211026123	2022-11-24	2023-11-23
WIDEBAND RADIO COMMNUNICATION TESTER	Rohde & Schwarz	CMW500	161997	2022-11-24	2023-11-23
MXA Signal Analyzer	KEYSIGHT	N9020A	MY50410020	2022-11-24	2023-11-23

Emissions in non-restricted frequency bands					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
RFTest software	/	V1.00	/	/	/
RF Control Unit	Techy	TR1029-1	/	2022-11-24	2023-11-23
RF Sensor Unit	Techy	TR1029-2	/	2022-11-24	2023-11-23
Programmable constant temperature and humidity box	ZZCKONG	ZZ-K02A	20210928007	2022-11-24	2023-11-23
Adjustable Direct	Dongguan	etm-6050c	20211026123	2022-11-24	2023-11-23

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Current Regulated Power Supply	Tongmen Electronic Technology Co., LTD				
WIDEBAND RADIO COMMNUNICATION TESTER	Rohde & Schwarz	CMW500	161997	2022-11-24	2023-11-23
MXA Signal Analyzer	KEYSIGHT	N9020A	MY50410020	2022-11-24	2023-11-23

Band edge emissions (Radiated)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Coaxial cable Multiflex 141	Schwarzbeck	N/SMA 0.5m	517386	2023-03-24	2024-03-23
Preamplifier	SCHWARZBECK	BBV9744	00246	2022-11-24	2023-11-23
RE Cable	REBES Talent	UF1-SMASMAM-10m	21101566	2022-11-24	2023-11-23
RE Cable	REBES Talent	UF2-NMNM-10m	21101570	2022-11-24	2023-11-23
RE Cable	REBES Talent	UF1-SMASMAM-1m	21101568	2022-11-24	2023-11-23
RE Cable	REBES Talent	UF2-NMNM-1m	21101576	2022-11-24	2023-11-23
RE Cable	REBES Talent	UF2-NMNM-2.5m	21101573	2022-11-24	2023-11-23
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	/	/
Horn Antenna	SCHWARZBECK	BBHA9170	01157	2021-11-28	2023-11-27
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI7	101032	2022-11-24	2023-11-23
SIGNAL ANALYZER	ROHDE&SCHWARZ	FSQ40	100010	2022-11-24	2023-11-23
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	/	/
Broadband Preamplilifier	SCHWARZBECK	BBV9718D	00008	2023-03-24	2024-03-23
Horn Antenna	SCHWARZBECK	BBHA9120D	2597	2022-05-22	2024-05-21
EZ_EMC	Frad	FA-03A2 RE+	/	/	/
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	/	/
Log periodic antenna	SCHWARZBECK	VULB 9168	01328	2021-11-28	2023-11-27

Emissions in restricted frequency bands (below 1GHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Coaxial cable Multiflex 141	Schwarzbeck	N/SMA 0.5m	517386	2023-03-24	2024-03-23
Preamplifier	SCHWARZBECK	BBV9744	00246	2022-11-24	2023-11-23
RE Cable	REBES Talent	UF1-SMASMAM-10m	21101566	2022-11-24	2023-11-23
RE Cable	REBES Talent	UF2-NMNM-10m	21101570	2022-11-24	2023-11-23
RE Cable	REBES Talent	UF1-SMASMAM-1m	21101568	2022-11-24	2023-11-23
RE Cable	REBES Talent	UF2-NMNM-1m	21101576	2022-11-24	2023-11-23
RE Cable	REBES Talent	UF2-NMNM-2.5m	21101573	2022-11-24	2023-11-23
POSITIONAL	SKET	PCI-GPIB	/	/	/

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CONTROLLER					
Horn Antenna	SCHWARZBECK	BBHA9170	01157	2021-11-28	2023-11-27
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI7	101032	2022-11-24	2023-11-23
SIGNAL ANALYZER	ROHDE&SCHWARZ	FSQ40	100010	2022-11-24	2023-11-23
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	/	/
Broadband Preamplilifier	SCHWARZBECK	BBV9718D	00008	2023-03-24	2024-03-23
Horn Antenna	SCHWARZBECK	BBHA9120D	2597	2022-05-22	2024-05-21
EZ_EMC	Frad	FA-03A2 RE+	/	/	/
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	/	/
Log periodic antenna	SCHWARZBECK	VULB 9168	01328	2021-11-28	2023-11-27

Emissions in restricted frequency bands (above 1GHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Coaxial cable Multiflex 141	Schwarzbeck	N/SMA 0.5m	517386	2023-03-24	2024-03-23
Preamplifier	SCHWARZBECK	BBV9744	00246	2022-11-24	2023-11-23
RE Cable	REBES Talent	UF1-SMASMAM-10m	21101566	2022-11-24	2023-11-23
RE Cable	REBES Talent	UF2-NMNM-10m	21101570	2022-11-24	2023-11-23
RE Cable	REBES Talent	UF1-SMASMAM-1m	21101568	2022-11-24	2023-11-23
RE Cable	REBES Talent	UF2-NMNM-1m	21101576	2022-11-24	2023-11-23
RE Cable	REBES Talent	UF2-NMNM-2.5m	21101573	2022-11-24	2023-11-23
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	/	/
Horn Antenna	SCHWARZBECK	BBHA9170	01157	2021-11-28	2023-11-27
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI7	101032	2022-11-24	2023-11-23
SIGNAL ANALYZER	ROHDE&SCHWARZ	FSQ40	100010	2022-11-24	2023-11-23
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	/	/
Broadband Preamplilifier	SCHWARZBECK	BBV9718D	00008	2023-03-24	2024-03-23
Horn Antenna	SCHWARZBECK	BBHA9120D	2597	2022-05-22	2024-05-21
EZ_EMC	Frad	FA-03A2 RE+	/	/	/
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	/	/
Log periodic antenna	SCHWARZBECK	VULB 9168	01328	2021-11-28	2023-11-27

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4.2 Test Auxiliary Equipment

Title	Manufacturer	Model No.	Serial No.
DC power supply	ITECH	IT6721	800104030767710436

4.3 Test Modes

No.	Test Modes	Description
TM1	TX-GFSK (Non-Hopping)	Keep the EUT in continuously transmitting mode (non-hopping) with GFSK modulation.
TM2	TX-Pi/4DQPSK (Non-Hopping)	Keep the EUT in continuously transmitting mode (non-hopping) with Pi/4DQPSK modulation.
TM3	TX-8DPSK (Non-Hopping)	Keep the EUT in continuously transmitting mode (non-hopping) with 8DPSK modulation.
TM4	TX-GFSK (Hopping)	Keep the EUT in continuously transmitting mode (hopping) with GFSK modulation,.
TM5	TX-Pi/4DQPSK (Hopping)	Keep the EUT in continuously transmitting mode (hopping) with Pi/4DQPSK modulation.
TM6	TX-8DPSK (Hopping)	Keep the EUT in continuously transmitting mode (hopping) with 8DPSK modulation.

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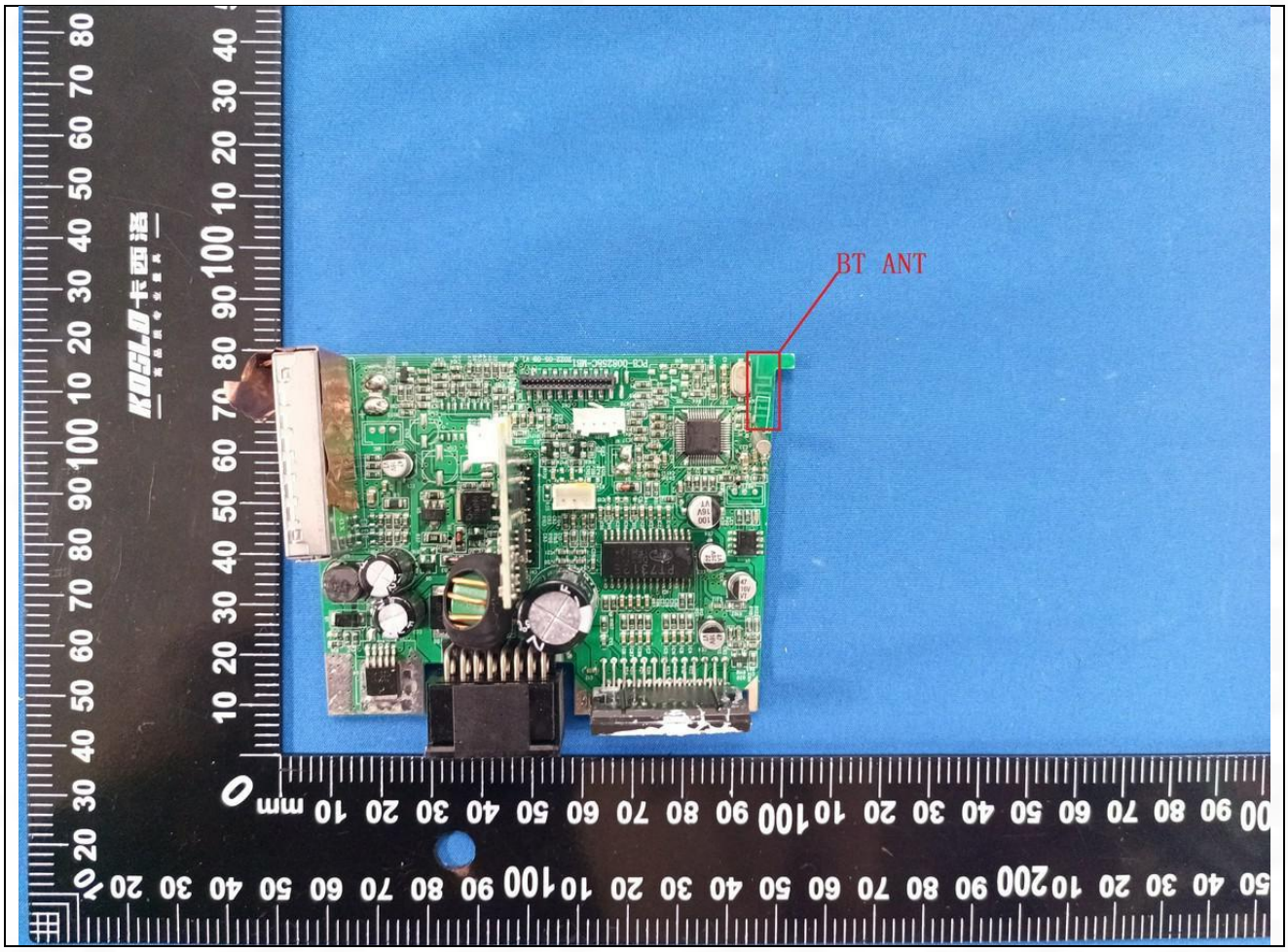
5 Evaluation Results (Evaluation)

5.1 Antenna requirement

Test Requirement:	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. 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 provisions of this section.

5.1.1 Conclusion:



6 Radio Spectrum Matter Test Results (RF)

6.1 Occupied Bandwidth

Test Requirement:	Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.
Test Method:	Occupied bandwidth—relative measurement procedure
Test Limit:	Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.
Procedure:	a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and five times the OBW. b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW, unless otherwise specified by the applicable requirement. c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2. d) Steps a) through c) might require iteration to adjust within the specified tolerances. e) The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target “−xx dB down” requirement; that is, if the requirement calls for measuring the −20 dB OBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value. f) Set detection mode to peak and trace mode to max hold. g) Determine the reference value: Set the EUT to transmit an unmodulated carrier or modulated signal, as applicable. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value). h) Determine the “−xx dB down amplitude” using [(reference value) − xx]. Alternatively, this calculation may be made by using the marker-delta function of the instrument. i) If the reference value is determined by an unmodulated carrier, then turn the EUT modulation ON, and either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise, the trace from step g) shall be used for step j). j) Place two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the “-xx dB down amplitude” determined in step h). If a marker is below this “−xx dB down amplitude” value, then it shall be as close as possible to this value. The occupied bandwidth is the frequency difference between the two markers. Alternatively, set a marker at the lowest frequency of the envelope of the spectral display, such that the marker is at or slightly below the “-xx dB down amplitude” determined in step h). Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the

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	same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth. k) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

6.1.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.9 °C
Humidity:	52.8 %
Atmospheric Pressure:	1010 mbar

6.1.2 Test Data:

Please Refer to Appendix for Details.

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6.2 Maximum Conducted Output Power

Test Requirement:	For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
Test Method:	Output power test procedure for frequency-hopping spread-spectrum (FHSS) devices
Test Limit:	For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
Procedure:	This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test: a) Use the following spectrum analyzer settings: 1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel. 2) RBW > 20 dB bandwidth of the emission being measured. 3) VBW >= RBW. 4) Sweep: Auto. 5) Detector function: Peak. 6) Trace: Max hold. b) Allow trace to stabilize. c) Use the marker-to-peak function to set the marker to the peak of the emission. d) The indicated level is the peak output power, after any corrections for external attenuators and cables. e) A plot of the test results and setup description shall be included in the test report. NOTE—A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.

6.2.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.9 °C
Humidity:	52.8 %
Atmospheric Pressure:	1010 mbar

6.2.2 Test Data:

Please Refer to Appendix for Details.

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6.3 Channel Separation

Test Requirement:	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.
Test Method:	Carrier frequency separation
Test Limit:	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.
Procedure:	The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings: a) Span: Wide enough to capture the peaks of two adjacent channels. b) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel. c) Video (or average) bandwidth (VBW) ≥ RBW. d) Sweep: Auto. e) Detector function: Peak. f) Trace: Max hold. g) Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Compliance of an EUT with the appropriate regulatory limit shall be determined. A plot of the data shall be included in the test report.

6.3.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.9 °C
Humidity:	52.8 %
Atmospheric Pressure:	1010 mbar

6.3.2 Test Data:

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6.4 Number of Hopping Frequencies

Test Requirement:	Fequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
Test Method:	Number of hopping frequencies
Test Limit:	Fequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
Procedure:	The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings: a) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen. b) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller. c) VBW ≥ RBW. d) Sweep: Auto. e) Detector function: Peak. f) Trace: Max hold. g) Allow the trace to stabilize. It might prove necessary to break the span up into subranges to show clearly all of the hopping frequencies. Compliance of an EUT with the appropriate regulatory limit shall be determined for the number of hopping channels. A plot of the data shall be included in the test report.

6.4.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.9 °C
Humidity:	52.8 %
Atmospheric Pressure:	1010 mbar

6.4.2 Test Data:

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6.5 Dwell Time

Test Requirement:	Fequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
Test Method:	Time of occupancy (dwell time)
Test Limit:	Fequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
Procedure:	The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings: a) Span: Zero span, centered on a hopping channel. b) RBW shall be <= channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel. c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel. d) Detector function: Peak. e) Trace: Max hold. Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time. Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation: (Number of hops in the period specified in the requirements) = (number of hops on spectrum analyzer) × (period specified in the requirements / analyzer sweep time) The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation. The measured transmit time and time between hops shall be consistent with the values described in the operational description for the EUT.

6.5.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.9 °C
Humidity:	52.8 %
Atmospheric Pressure:	1010 mbar

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6.5.2 Test Data:

Please Refer to Appendix for Details.

6.6 Emissions in non-restricted frequency bands

Test Requirement:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required.
Test Method:	Conducted spurious emissions test methodology
Test Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required.
Procedure:	Conducted spurious emissions shall be measured for the transmit frequency, per 5.5 and 5.6, and at the maximum transmit powers. Connect the primary antenna port through an attenuator to the spectrum analyzer input; in the results, account for all losses between the unlicensed wireless device output and the spectrum analyzer. The instrument shall span 30 MHz to 10 times the operating frequency in GHz, with a resolution bandwidth of 100 kHz, video bandwidth of 300 kHz, and a coupled sweep time with a peak detector. The band 30 MHz to the highest frequency may be split into smaller spans, as long as the entire spectrum is covered.

6.6.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.9 °C
Humidity:	52.8 %
Atmospheric Pressure:	1010 mbar

6.6.2 Test Data:

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6.7 Band edge emissions (Radiated)

Test Requirement:	In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).`
Test Method:	Radiated emissions tests
Test Limit:	

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

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.

Procedure:	ANSI C63.10-2013 section 6.10.5.2

6.7.1 E.U.T. Operation:

Operating Environment:	
Temperature:	23 °C
Humidity:	46.3 %
Atmospheric Pressure:	1010 mbar

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6.7.2 Test Data:

TM1 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH: L

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	2310.000	70.92	-30.59	40.33	74.00	-33.67	peak	P
2	2390.000	70.15	-30.49	39.66	74.00	-34.34	peak	P
3 *	2400.000	75.14	-30.48	44.66	74.00	-29.34	peak	P

TM1 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH: L

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	2310.000	67.38	-30.59	36.79	74.00	-37.21	peak	P
2	2390.000	68.53	-30.49	38.04	74.00	-35.96	peak	P
3 *	2400.000	80.02	-30.48	49.54	74.00	-24.46	peak	P

TM1 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH: H

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 *	2483.500	69.90	-30.39	39.51	74.00	-34.49	peak	P
2	2500.000	69.84	-30.37	39.47	74.00	-34.53	peak	P

TM1 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH: H

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	2483.500	70.40	-30.39	40.01	74.00	-33.99	peak	P
2 *	2500.000	70.84	-30.37	40.47	74.00	-33.53	peak	P

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TM2 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH: L

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	2310.000	68.75	-30.59	38.16	74.00	-35.84	peak	P
2	2390.000	68.63	-30.49	38.14	74.00	-35.86	peak	P
3 *	2400.000	78.21	-30.48	47.73	74.00	-26.27	peak	P

TM2 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH: L

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	2310.000	68.16	-30.59	37.57	74.00	-36.43	peak	P
2	2390.000	68.83	-30.49	38.34	74.00	-35.66	peak	P
3 *	2400.000	74.49	-30.48	44.01	74.00	-29.99	peak	P

TM2 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH: H

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 *	2483.500	75.30	-30.39	44.91	74.00	-29.09	peak	P
2	2500.000	67.90	-30.37	37.53	74.00	-36.47	peak	P

TM2 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH: H

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	2483.500	69.75	-30.39	39.36	74.00	-34.64	peak	P
2 *	2500.000	69.76	-30.37	39.39	74.00	-34.61	peak	P

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TM3 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH: L

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	2310.000	66.16	-30.59	35.57	74.00	-38.43	peak	P
2	2390.000	68.82	-30.49	38.33	74.00	-35.67	peak	P
3 *	2400.000	75.90	-30.48	45.42	74.00	-28.58	peak	P

TM3 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH: L

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	2310.000	66.61	-30.59	36.02	74.00	-37.98	peak	P
2	2390.000	68.18	-30.49	37.69	74.00	-36.31	peak	P
3 *	2400.000	68.56	-30.48	38.08	74.00	-35.92	peak	P

TM3 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH: H

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 *	2483.500	77.49	-30.39	47.10	74.00	-26.90	peak	P
2	2500.000	71.62	-30.37	41.25	74.00	-32.75	peak	P

TM3 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH: H

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	2483.500	69.23	-30.39	38.84	74.00	-35.16	peak	P
2 *	2500.000	70.91	-30.37	40.54	74.00	-33.46	peak	P

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6.8 Emissions in restricted frequency bands (below 1GHz)

Test Requirement:	In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).`
Test Method:	Radiated emissions tests
Test Limit:	

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

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.

Procedure:	ANSI C63.10-2013 section 6.6.4

6.8.1 E.U.T. Operation:

Operating Environment:	
Temperature:	23.1 °C
Humidity:	49.4 %
Atmospheric Pressure:	1010 mbar

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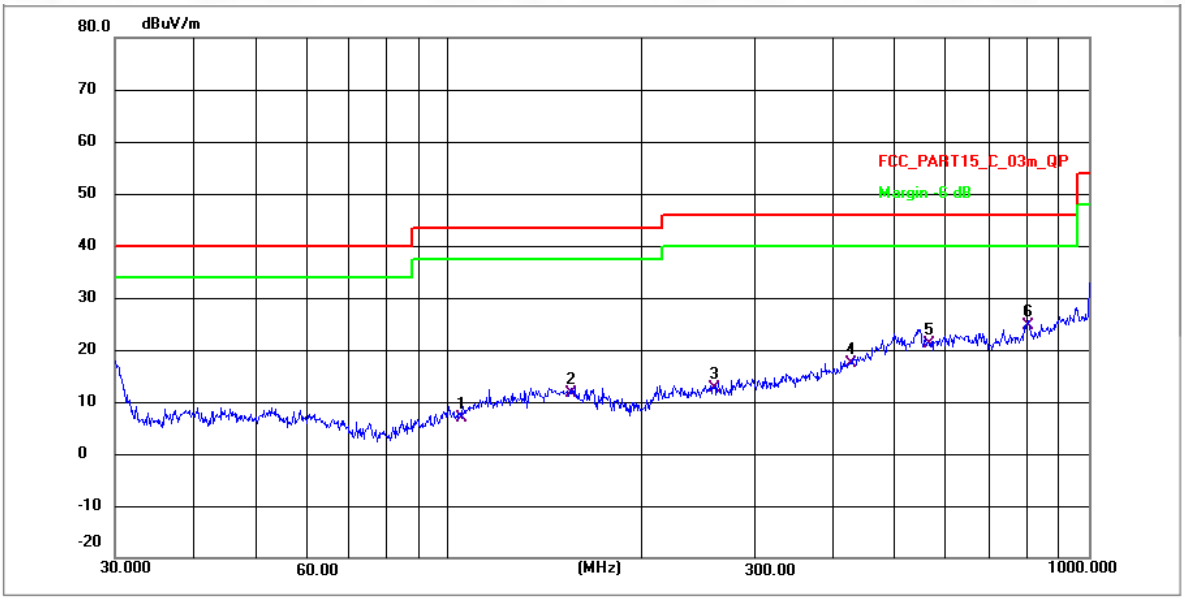
6.8.2 Test Data:

TM1 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH: M



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	104.7195	35.18	-28.19	6.99	43.50	-36.51	QP	P
2	155.6370	39.36	-27.73	11.63	43.50	-31.87	QP	P
3	259.6887	38.42	-25.77	12.65	46.00	-33.35	QP	P
4	424.2835	40.83	-23.49	17.34	46.00	-28.66	QP	P
5	562.6624	43.01	-21.80	21.21	46.00	-24.79	QP	P
6 *	808.8459	48.29	-23.57	24.72	46.00	-21.28	QP	P

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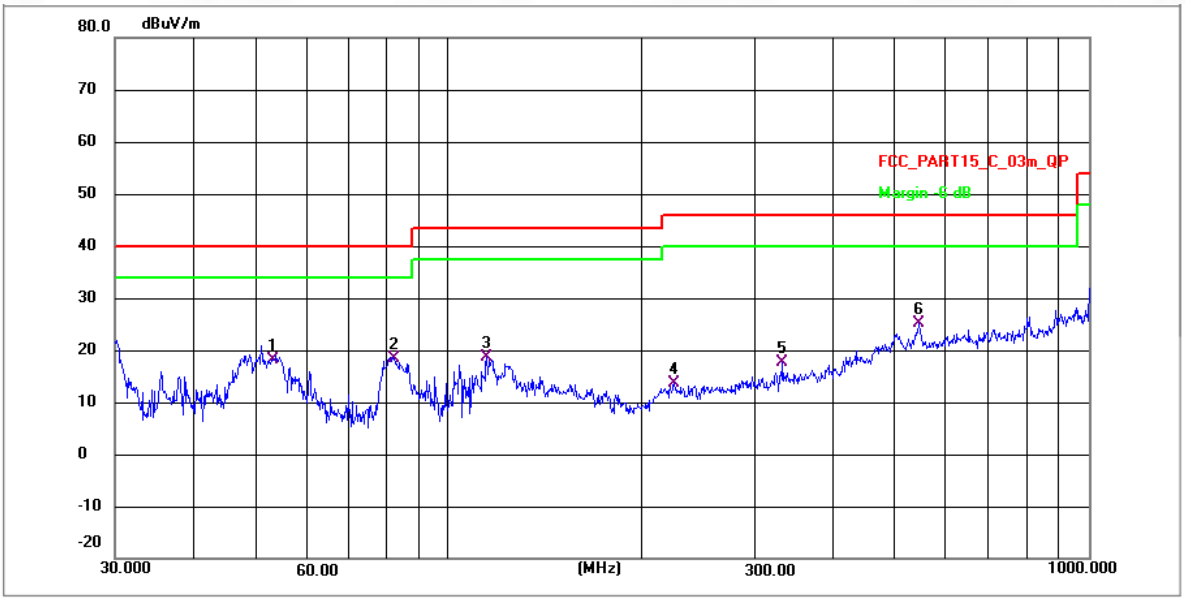
TM1 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH: M



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	52.9453	38.40	-20.28	18.12	40.00	-21.88	QP	P
2	82.0706	49.62	-31.18	18.44	40.00	-21.56	QP	P
3	114.7156	46.62	-28.10	18.52	43.50	-24.98	QP	P
4	225.3080	39.90	-26.22	13.68	46.00	-32.32	QP	P
5	331.9362	42.76	-25.18	17.58	46.00	-28.42	QP	P
6 *	545.1826	46.67	-21.61	25.06	46.00	-20.94	QP	P

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6.9 Emissions in restricted frequency bands (above 1GHz)

Test Requirement:	In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).`
Test Method:	Radiated emissions tests
Test Limit:	

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

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.

Procedure:	ANSI C63.10-2013 section 6.6.4

6.9.1 E.U.T. Operation:

Operating Environment:	
Temperature:	23 °C
Humidity:	46.3 %
Atmospheric Pressure:	1010 mbar

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6.9.2 Test Data:

TM1 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH: L

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	3066.685	65.92	-29.45	36.47	74.00	-37.53	peak	P
2	3767.424	66.93	-29.03	37.90	74.00	-36.10	peak	P
3	5578.412	65.92	-26.70	39.22	74.00	-34.78	peak	P
4	7657.525	68.41	-25.01	43.40	74.00	-30.60	peak	P
5	10520.657	71.21	-24.47	46.74	74.00	-27.26	peak	P
6 *	12534.655	68.88	-21.60	47.28	74.00	-26.72	peak	P

TM1 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH: L

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	4163.676	56.50	-28.93	27.57	74.00	-46.43	peak	P
2	5768.617	59.48	-26.08	33.40	74.00	-40.60	peak	P
3	8122.617	66.31	-25.48	40.83	74.00	-33.17	peak	P
4	9494.688	66.30	-23.21	43.09	74.00	-30.91	peak	P
5	11596.997	69.24	-22.89	46.35	74.00	-27.65	peak	P
6 *	14496.147	69.18	-21.20	47.98	74.00	-26.02	peak	P

TM1 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH: M

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	4509.439	60.82	-28.76	32.06	74.00	-41.94	peak	P
2	5982.575	62.23	-25.38	36.85	74.00	-37.15	peak	P
3	7780.230	67.56	-25.20	42.36	74.00	-31.64	peak	P
4	10348.748	67.91	-24.45	43.46	74.00	-30.54	peak	P
5	14496.147	71.68	-21.20	50.48	74.00	-23.52	peak	P
6 *	16629.456	71.21	-18.95	52.26	74.00	-21.74	peak	P

TM1 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH: M

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	3685.568	57.93	-29.03	28.90	74.00	-45.10	peak	P
2	4855.763	61.72	-27.78	33.94	74.00	-40.06	peak	P
3	7948.431	64.81	-25.46	39.35	74.00	-34.65	peak	P
4	9160.419	68.00	-23.95	44.05	74.00	-29.95	peak	P
5	11742.031	70.70	-22.64	48.06	74.00	-25.94	peak	P
6 *	15213.027	71.61	-20.86	50.75	74.00	-23.25	peak	P

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TM1 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH: H

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	3842.204	59.12	-29.02	30.10	74.00	-43.90	peak	P
2	4798.559	61.79	-27.94	33.85	74.00	-40.15	peak	P
3	6700.309	65.58	-25.20	40.38	74.00	-33.62	peak	P
4	9115.518	67.28	-24.05	43.23	74.00	-30.77	peak	P
5	11830.604	70.64	-22.48	48.16	74.00	-25.84	peak	P
6 *	14736.951	69.06	-20.82	48.24	74.00	-25.76	peak	P

TM1 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH: H

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	3522.060	64.32	-29.05	35.27	74.00	-38.73	peak	P
2	5069.452	65.54	-27.32	38.22	74.00	-35.78	peak	P
3	9396.405	69.97	-23.43	46.54	74.00	-27.46	peak	P
4	10051.007	72.23	-24.31	47.92	74.00	-26.08	peak	P
5	13326.747	72.40	-21.09	51.31	74.00	-22.69	peak	P
6 *	16211.815	72.00	-20.57	51.43	74.00	-22.57	peak	P

TM2 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH: L

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	3583.673	62.44	-29.05	33.39	74.00	-40.61	peak	P
2	4960.740	64.76	-27.48	37.28	74.00	-36.72	peak	P
3	6866.962	67.60	-25.05	42.55	74.00	-31.45	peak	P
4	8480.072	68.80	-25.33	43.47	74.00	-30.53	peak	P
5	11079.298	71.63	-23.38	48.25	74.00	-25.75	peak	P
6 *	15003.422	72.71	-20.41	52.30	74.00	-21.70	peak	P

TM2 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH: L

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	3482.580	66.22	-29.07	37.15	74.00	-36.85	peak	P
2	4962.174	66.43	-27.47	38.96	74.00	-35.04	peak	P
3	8157.909	73.46	-25.46	48.00	74.00	-26.00	peak	P
4	9688.747	71.19	-23.61	47.58	74.00	-26.42	peak	P
5	14238.686	68.90	-21.14	47.76	74.00	-26.24	peak	P
6 *	17047.998	69.66	-18.10	51.56	74.00	-22.44	peak	P

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TM2 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH: M

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	3640.045	61.09	-29.04	32.05	74.00	-41.95	peak	P
2	4794.400	63.95	-27.95	36.00	74.00	-38.00	peak	P
3	5727.084	65.54	-26.21	39.33	74.00	-34.67	peak	P
4	7227.415	68.48	-24.86	43.62	74.00	-30.38	peak	P
5	9388.261	70.06	-23.45	46.61	74.00	-27.39	peak	P
6 *	11012.253	71.50	-23.43	48.07	74.00	-25.93	peak	P

TM2 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH: M

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	3814.540	60.68	-29.02	31.66	74.00	-42.34	peak	P
2	5425.752	64.45	-27.01	37.44	74.00	-36.56	peak	P
3	7473.846	66.29	-24.79	41.50	74.00	-32.50	peak	P
4	9248.211	66.30	-23.76	42.54	74.00	-31.46	peak	P
5	11573.557	69.00	-22.93	46.07	74.00	-27.93	peak	P
6 *	12509.320	69.32	-21.61	47.71	74.00	-26.29	peak	P

TM2 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH: H

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	3380.429	60.27	-29.16	31.11	74.00	-42.89	peak	P
2	4373.374	67.38	-28.83	38.55	74.00	-35.45	peak	P
3	6936.783	67.91	-24.99	42.92	74.00	-31.08	peak	P
4	9993.072	69.45	-24.27	45.18	74.00	-28.82	peak	P
5	13400.135	70.45	-21.04	49.41	74.00	-24.59	peak	P
6 *	17813.675	69.68	-16.66	53.02	74.00	-20.98	peak	P

TM2 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH: H

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	3326.154	61.82	-29.21	32.61	74.00	-41.39	peak	P
2	4162.473	66.17	-28.93	37.24	74.00	-36.76	peak	P
3	5727.084	66.04	-26.21	39.83	74.00	-34.17	peak	P
4	7764.504	71.96	-25.18	46.78	74.00	-27.22	peak	P
5	8761.614	71.70	-24.79	46.91	74.00	-27.09	peak	P
6 *	13877.076	71.64	-21.06	50.58	74.00	-23.42	peak	P

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TM3 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH: L

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	3090.711	59.89	-29.43	30.46	74.00	-43.54	peak	P
2	4398.729	64.43	-28.83	35.60	74.00	-38.40	peak	P
3	6115.447	61.35	-25.35	36.00	74.00	-38.00	peak	P
4	8129.663	70.68	-25.48	45.20	74.00	-28.80	peak	P
5	12205.733	70.73	-21.95	48.78	74.00	-25.22	peak	P
6 *	15199.842	71.41	-20.84	50.57	74.00	-23.43	peak	P

TM3 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH: L

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	3294.579	61.70	-29.24	32.46	74.00	-41.54	peak	P
2	4350.680	67.30	-28.85	38.45	74.00	-35.55	peak	P
3	5689.137	66.84	-26.34	40.50	74.00	-33.50	peak	P
4	7820.813	70.11	-25.26	44.85	74.00	-29.15	peak	P
5	11012.253	71.50	-23.43	48.07	74.00	-25.93	peak	P
6 *	14308.822	72.58	-21.16	51.42	74.00	-22.58	peak	P

TM3 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH: M

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	3814.540	60.68	-29.02	31.66	74.00	-42.34	peak	P
2	4649.737	61.68	-28.36	33.32	74.00	-40.68	peak	P
3	5912.097	64.12	-25.62	38.50	74.00	-35.50	peak	P
4	7078.561	67.33	-24.91	42.42	74.00	-31.58	peak	P
5	9660.783	70.04	-23.55	46.49	74.00	-27.51	peak	P
6 *	12950.811	71.01	-21.37	49.64	74.00	-24.36	peak	P

TM3 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH: M

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	4059.108	65.09	-28.97	36.12	74.00	-37.88	peak	P
2	5441.457	68.09	-27.00	41.09	74.00	-32.91	peak	P
3	7210.722	67.82	-24.87	42.95	74.00	-31.05	peak	P
4	8529.235	70.39	-25.26	45.13	74.00	-28.87	peak	P
5	10532.828	70.95	-24.45	46.50	74.00	-27.50	peak	P
6 *	15064.257	68.56	-20.54	48.02	74.00	-25.98	peak	P

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TM3 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH: H

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	3854.439	64.75	-29.01	35.74	74.00	-38.26	peak	P
2	5194.040	67.13	-27.21	39.92	74.00	-34.08	peak	P
3	7760.017	68.62	-25.17	43.45	74.00	-30.55	peak	P
4	9208.201	69.25	-23.85	45.40	74.00	-28.60	peak	P
5	11906.073	70.37	-22.35	48.02	74.00	-25.98	peak	P
6 *	13977.714	70.79	-21.08	49.71	74.00	-24.29	peak	P

TM3 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH: H

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	4417.841	62.45	-28.82	33.63	74.00	-40.37	peak	P
2	5588.094	64.39	-26.66	37.73	74.00	-36.27	peak	P
3	7015.420	66.90	-24.93	41.97	74.00	-32.03	peak	P
4	8307.820	71.88	-25.40	46.48	74.00	-27.52	peak	P
5	11391.026	71.94	-23.14	48.80	74.00	-25.20	peak	P
6 *	17844.595	67.36	-16.69	50.67	74.00	-23.33	peak	P

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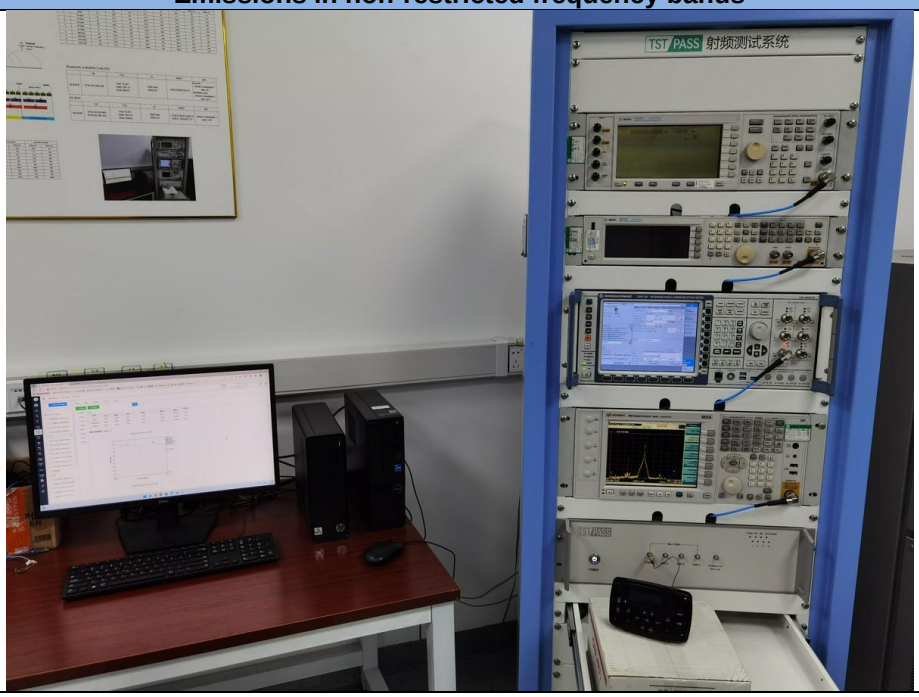
7 Test Setup Photos

Occupied Bandwidth Maximum Conducted Output Power Channel Separation Number of Hopping Frequencies Dwell Time Emissions in non-restricted frequency bands


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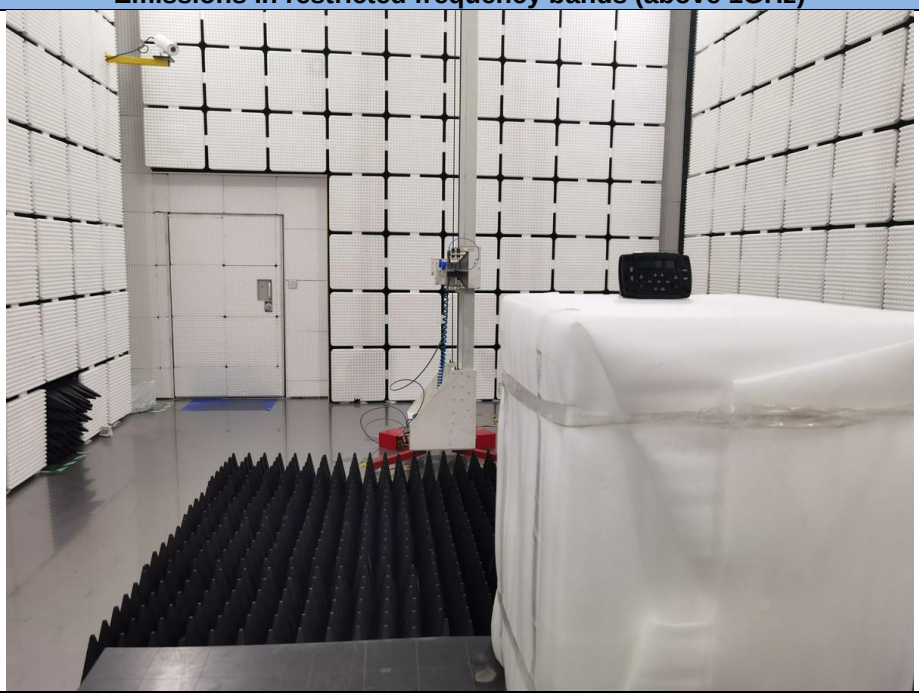
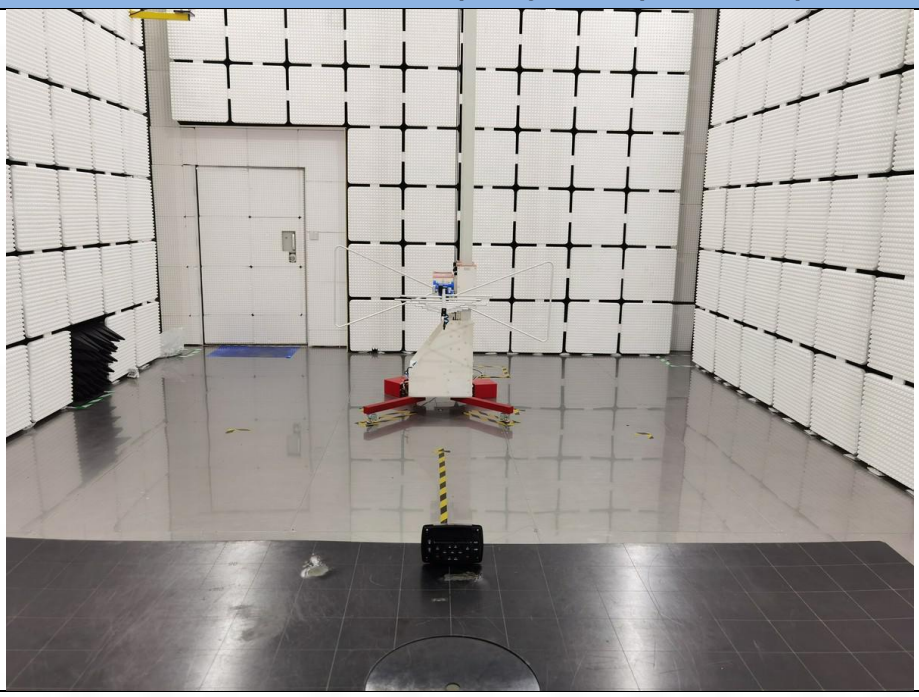
Band edge emissions (Radiated) Emissions in restricted frequency bands (above 1GHz)


Emissions in restricted frequency bands (below 1GHz)


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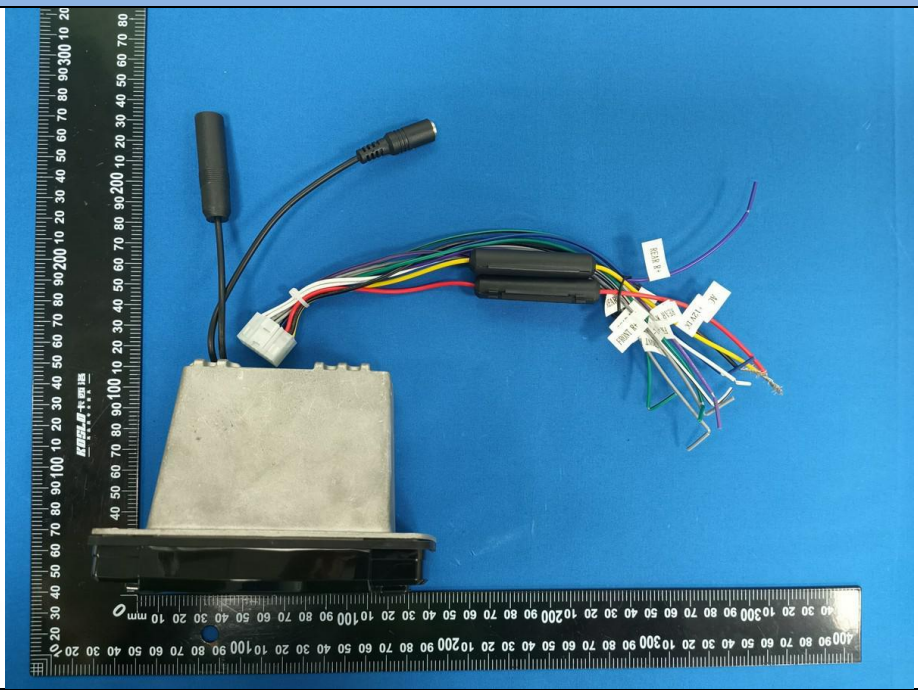
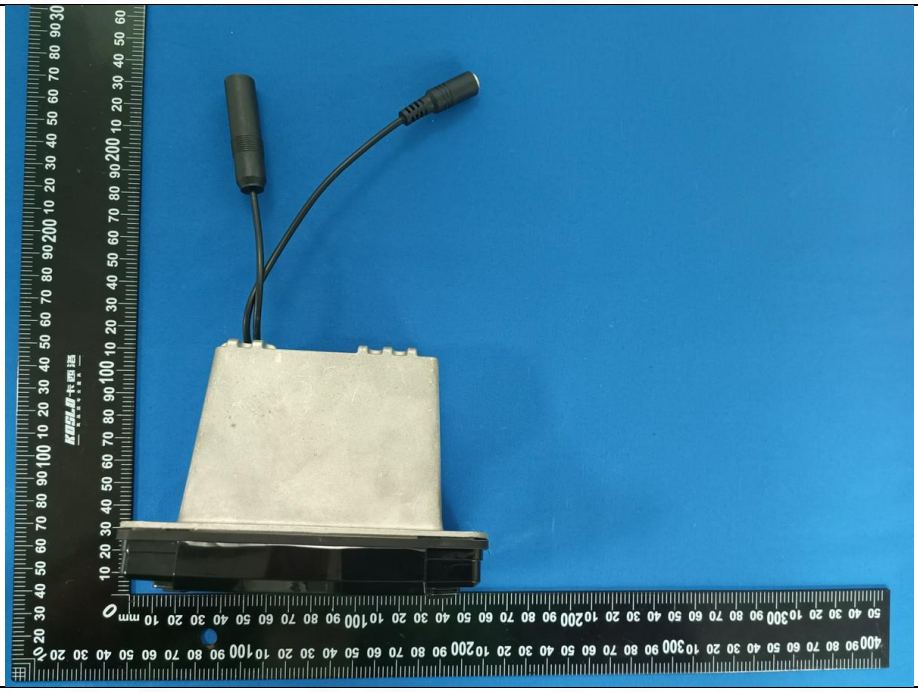
8 EUT Constructional Details (EUT Photos)

External



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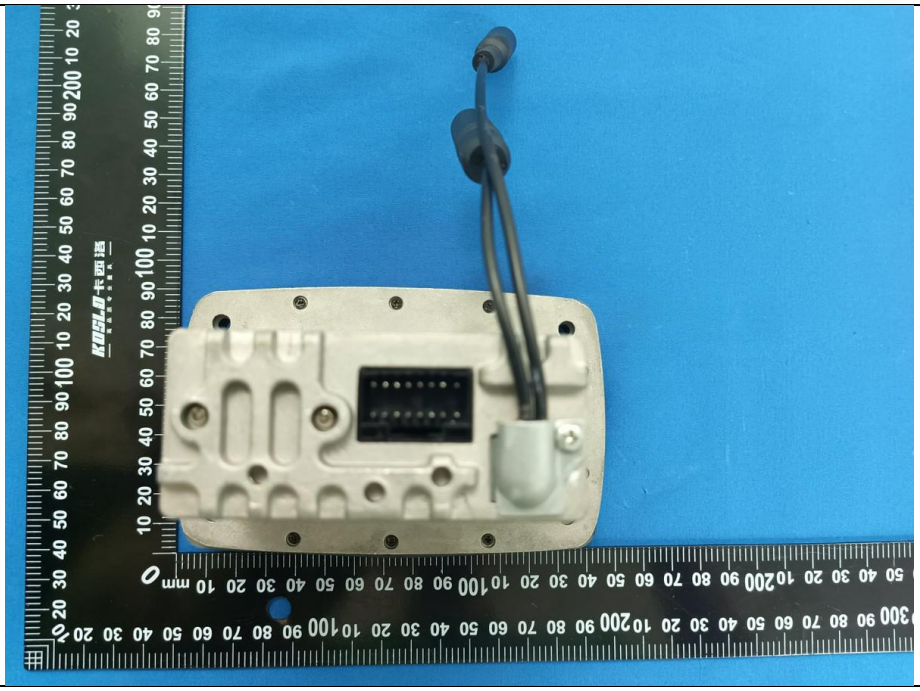
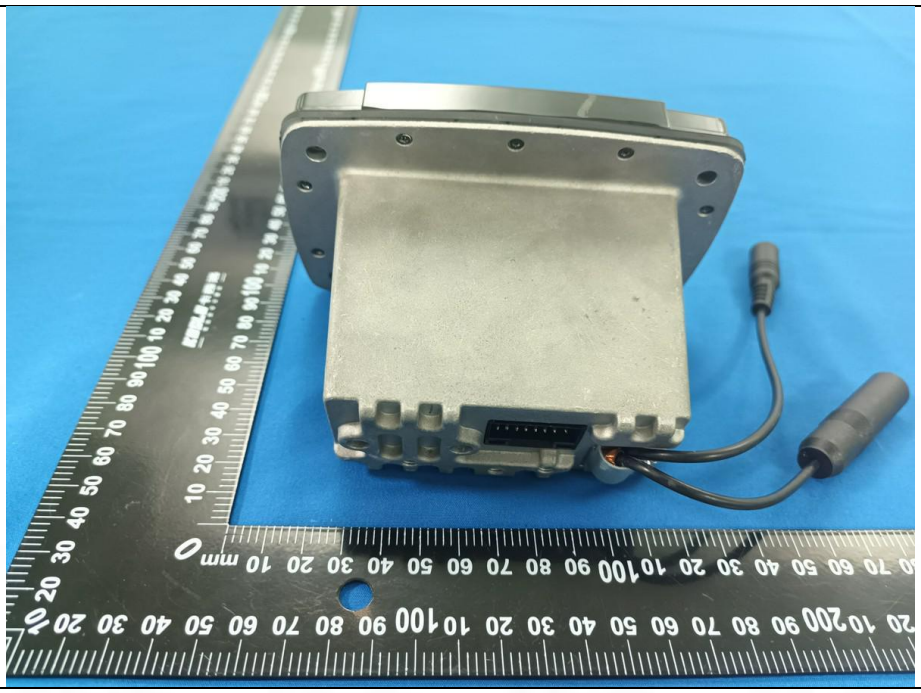
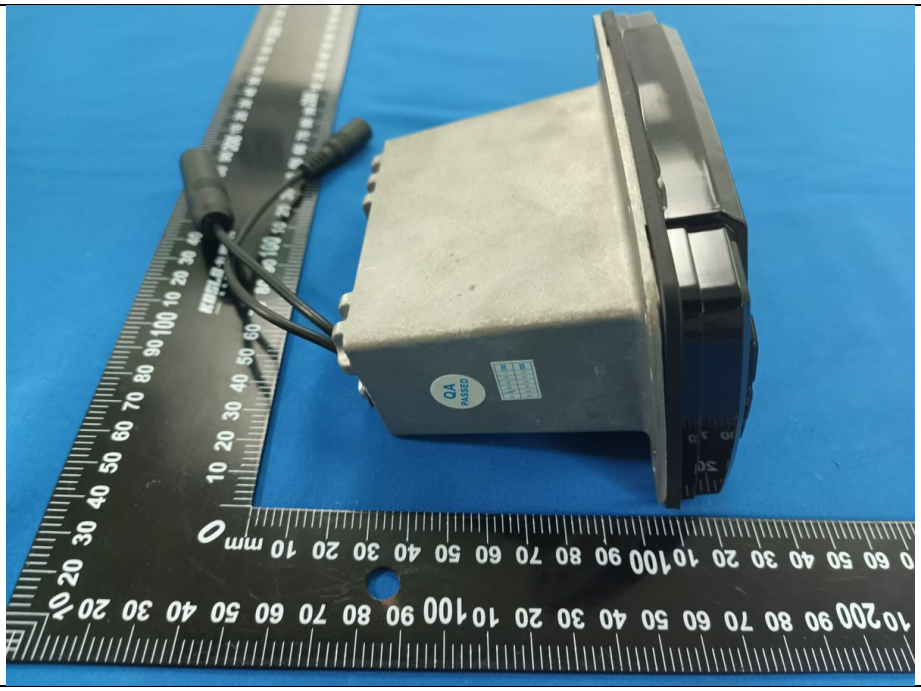
SND AMS
5 CLK
1 INT
2
VOL-
SEL
VOL+
3 RPT
4 RDM
6 MUT
AUX
USB







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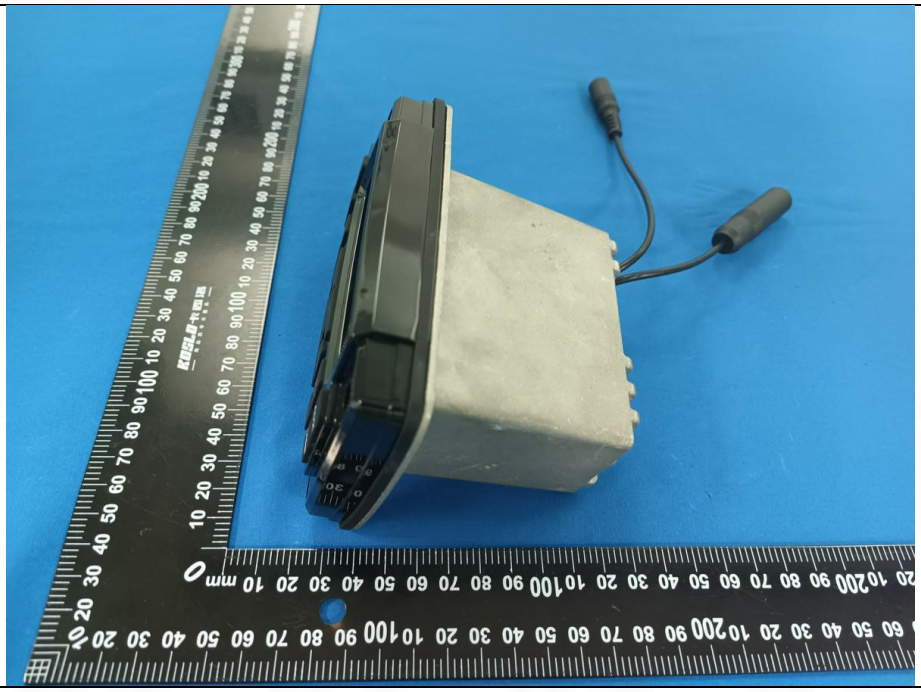
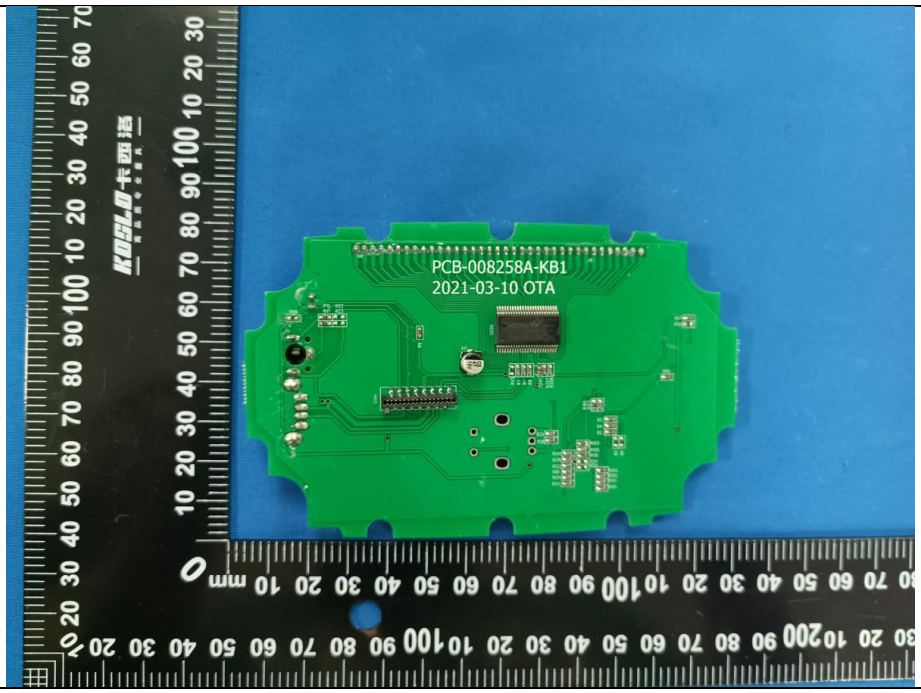


Internal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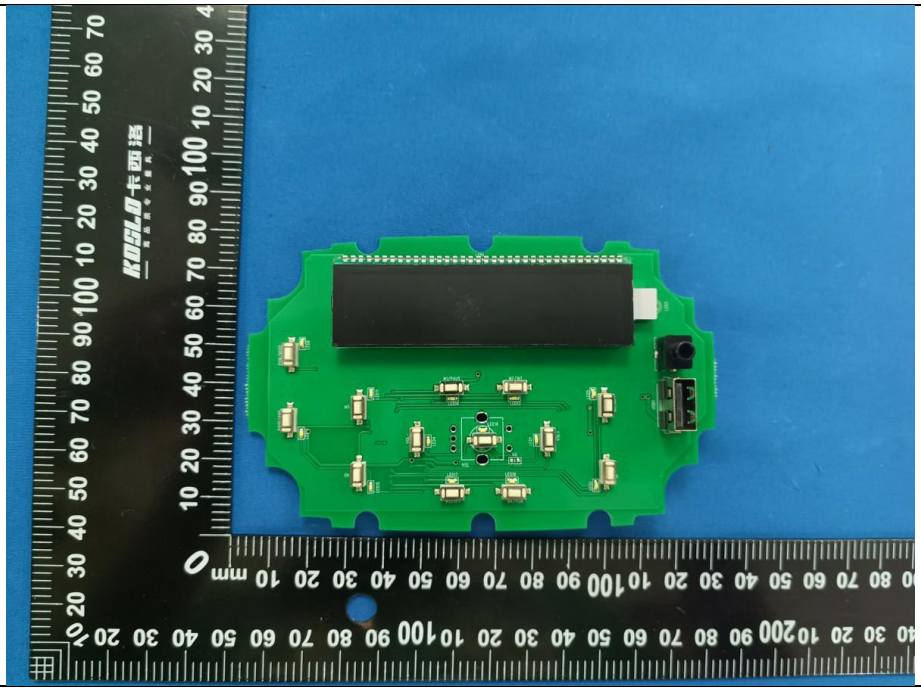
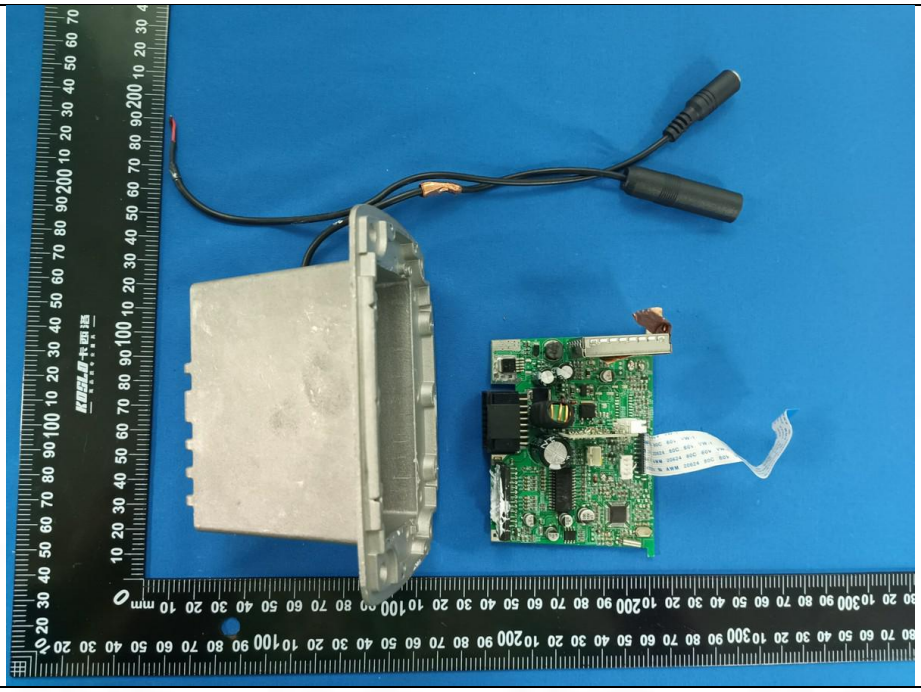
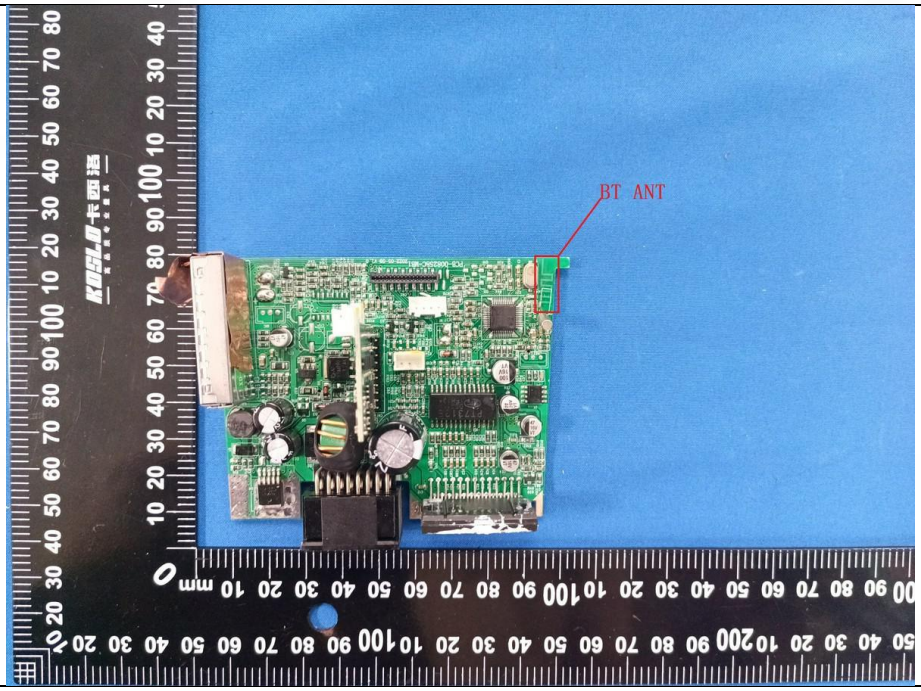
2021-03-10 OTA







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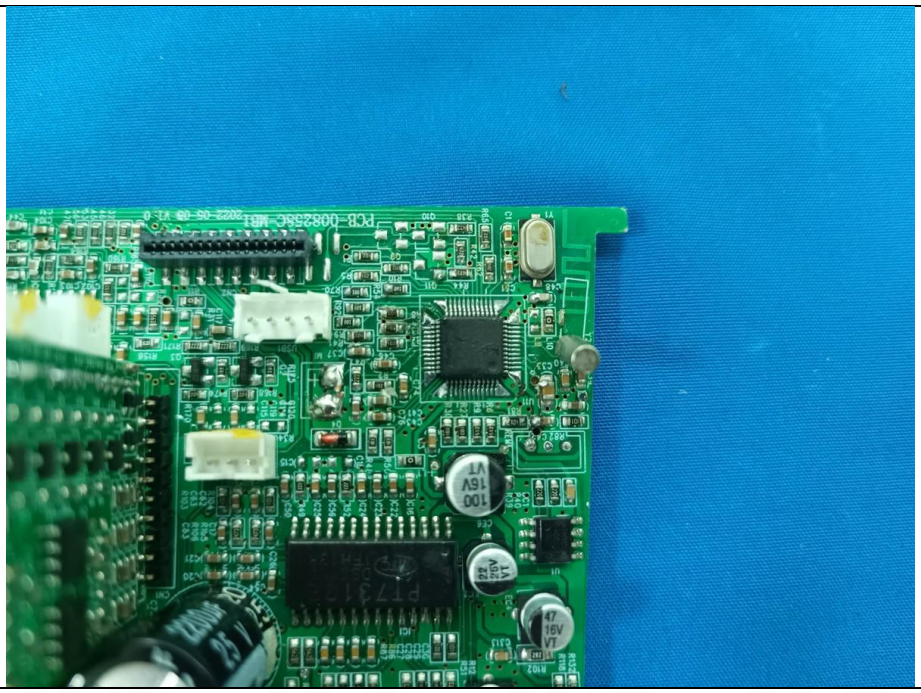

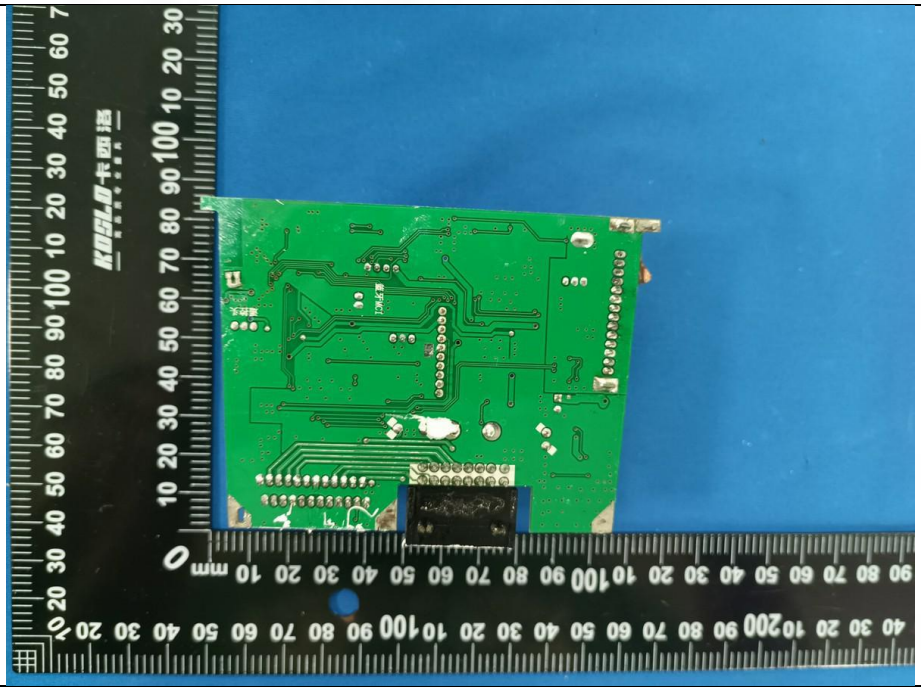

Appendix

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1. Bandwidth

1.1 OBW

1.1.1 Test Result

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	99% Occupied Bandwidth (MHz) Result	Verdict
GFSK	SISO	2402	DH5	1	0.749	Pass
		2441	DH5	1	0.749	Pass
		2480	DH5	1	0.750	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	1.147	Pass
		2441	2DH5	1	1.144	Pass
		2480	2DH5	1	1.146	Pass
8DPSK	SISO	2402	3DH5	1	1.154	Pass
		2441	3DH5	1	1.155	Pass
		2480	3DH5	1	1.154	Pass

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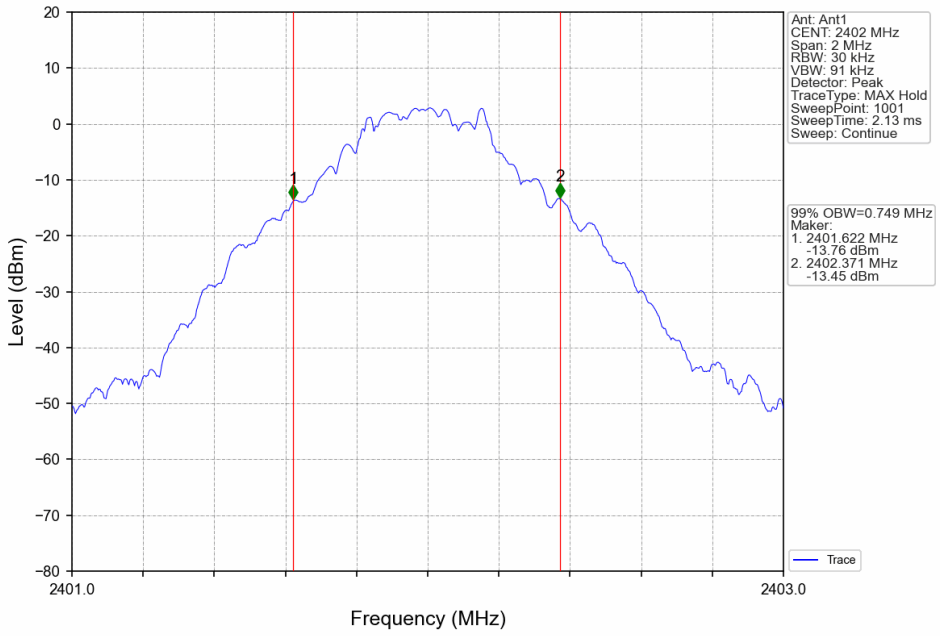
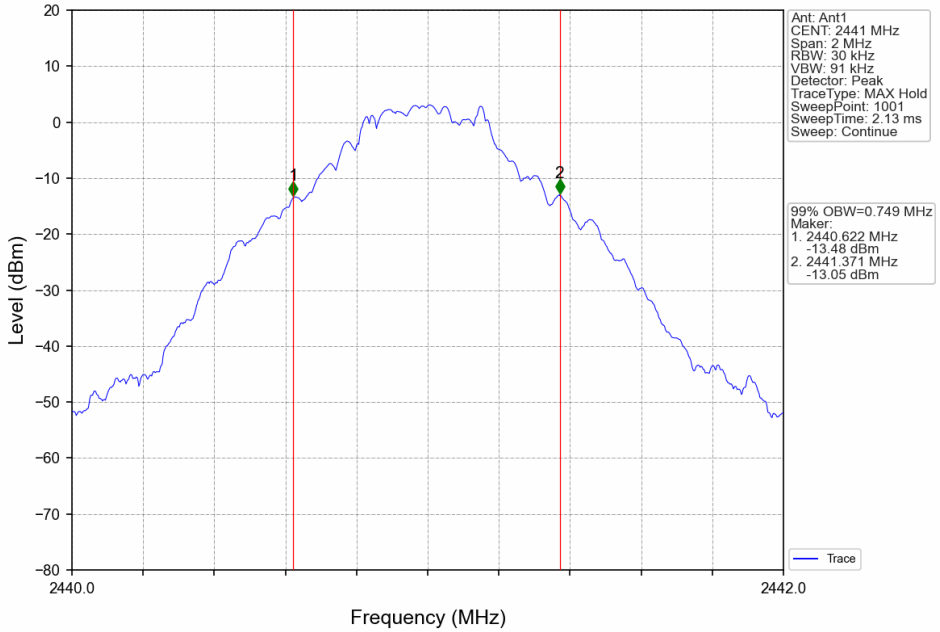
1.1.2 Test Graph

GFSK_DH5_LCH_2402MHz_Ant1_NTNV



GFSK_DH5_MCH_2441MHz_Ant1_NTNV



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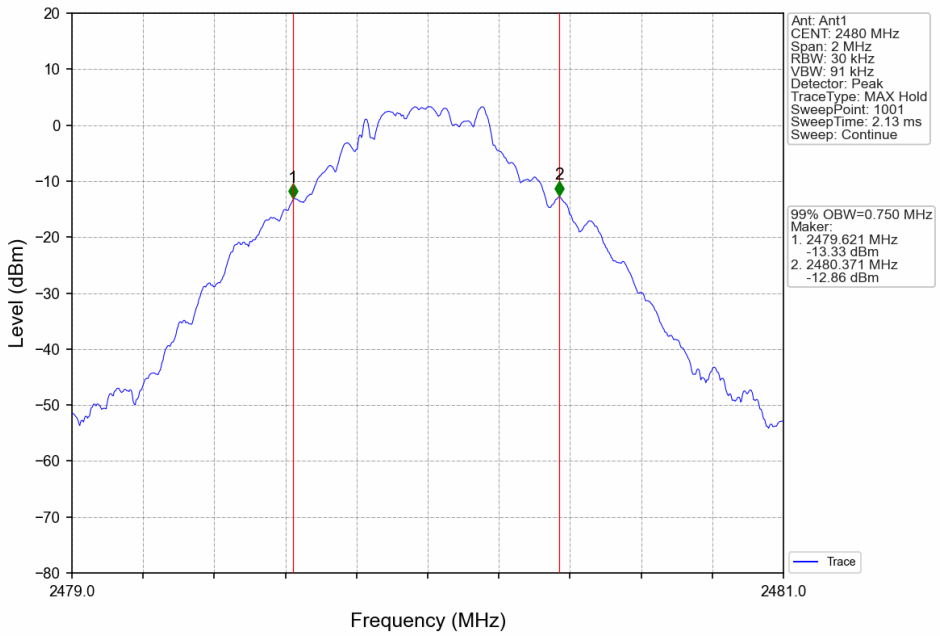
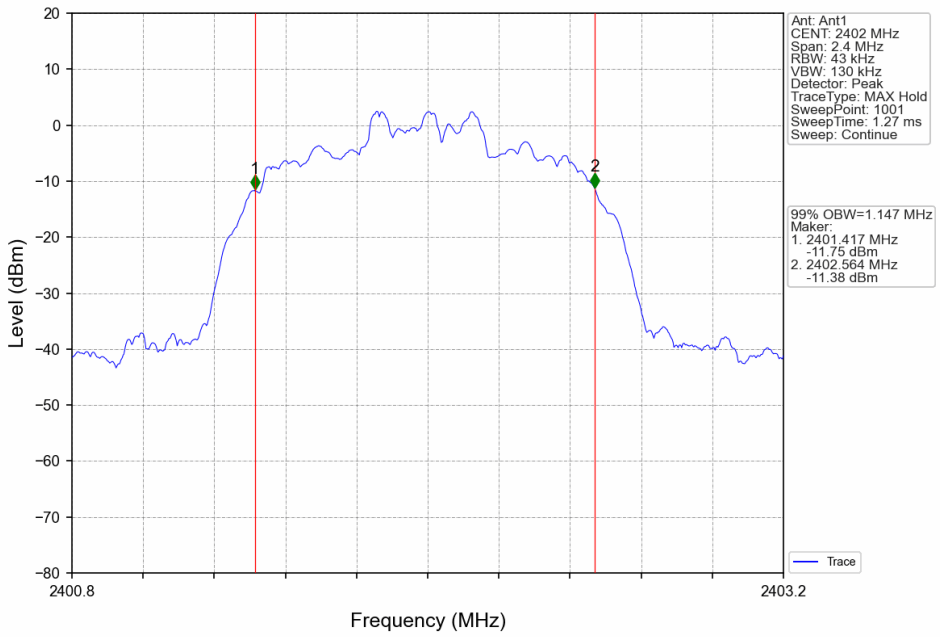
GFSK_DH5_HCH_2480MHz_Ant1_NTNV



Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV



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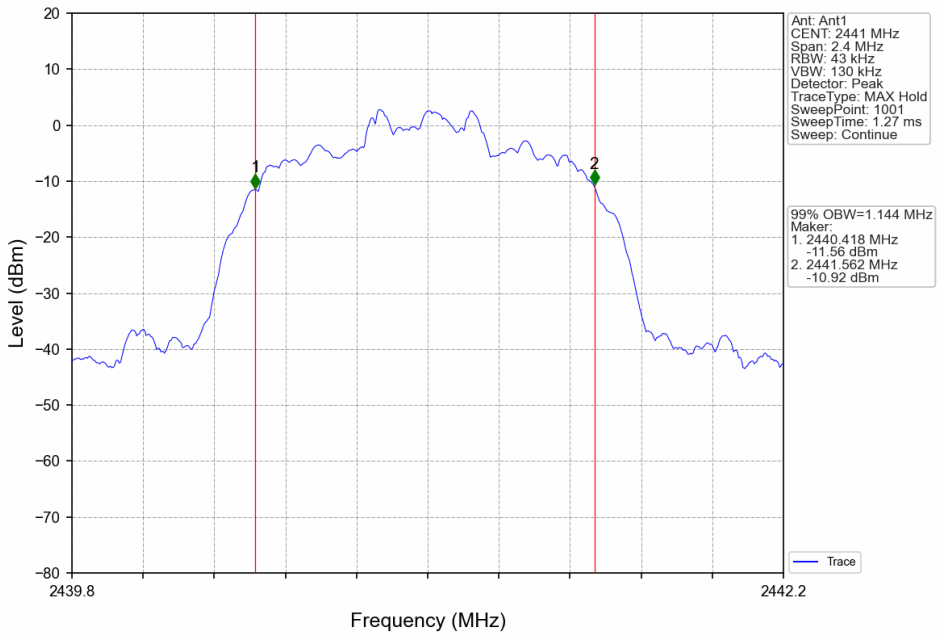
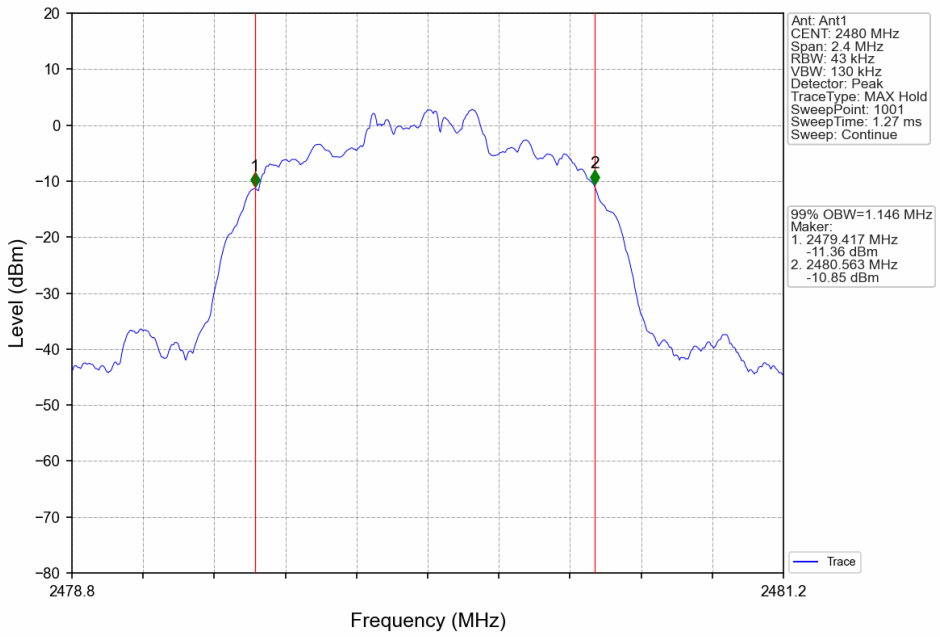
Pi/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV



Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV



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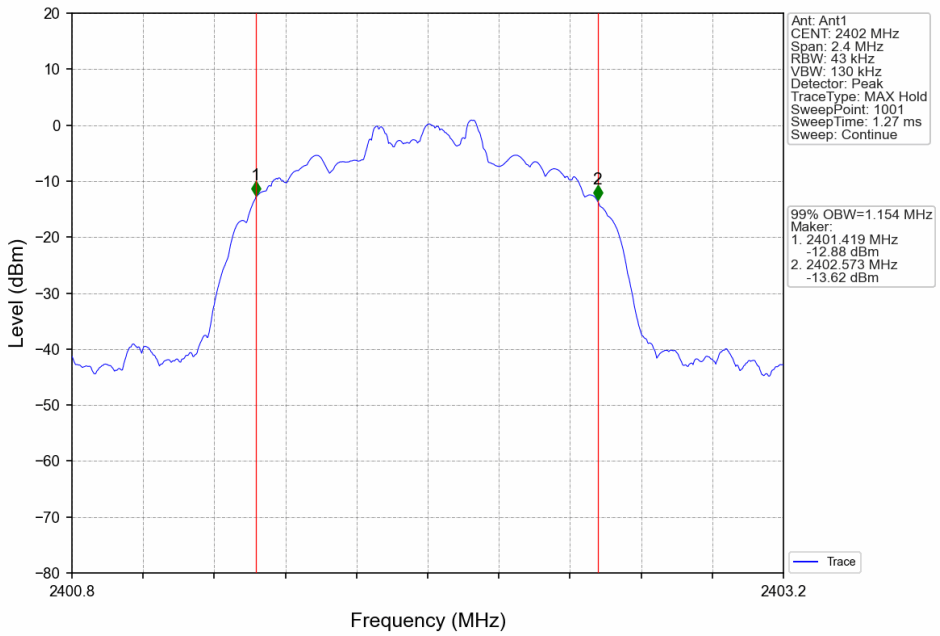
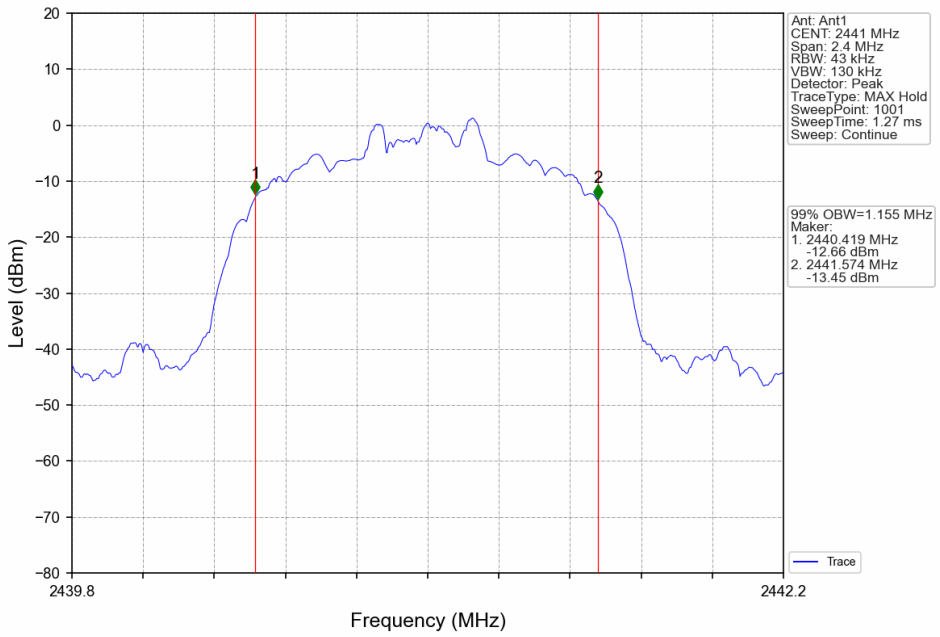
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV



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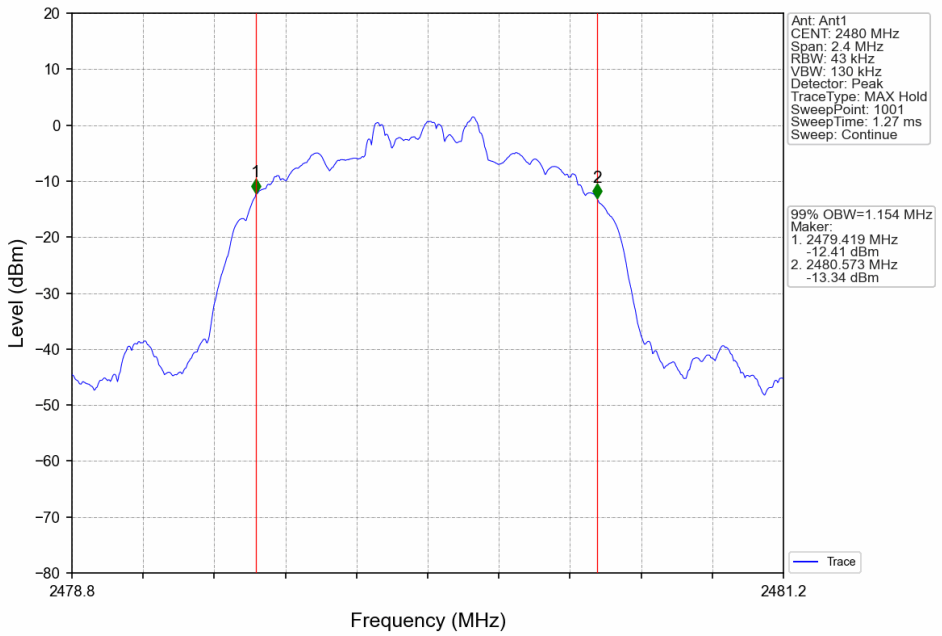
8DPSK_3DH5_HCH_2480MHz_Ant1_NTNV



1.2 20dB BW

1.2.1 Test Result

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	20dB Bandwidth (MHz) Result	Verdict
GFSK	SISO	2402	DH5	1	0.849	Pass
		2441	DH5	1	0.850	Pass
		2480	DH5	1	0.851	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	1.283	Pass
		2441	2DH5	1	1.285	Pass
		2480	2DH5	1	1.281	Pass
8DPSK	SISO	2402	3DH5	1	1.297	Pass
		2441	3DH5	1	1.295	Pass
		2480	3DH5	1	1.301	Pass

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