

Prüfbericht-Nr.: Test report no.:	CN21ETLW 001	Auftrags-Nr.: Order no.:	244373581	Seite 1 von 114 Page 1 of 114
Kunden-Referenz-Nr.: Client reference no.:	P00490748	Auftragsdatum: Order date:	2021-11-11	
Auftraggeber: Client:	Beijing Roborock Technology Co., Ltd. Floor 6, Suite 6016, 6017, 6018, Building C, Kangjian Baosheng Plaza, No. 8 Heiquan Road, Haidian District, 100192 Beijing, P. R. China			
Prüfgegenstand: Test item:	Robotic Vacuum Cleaner			
Bezeichnung / Typ-Nr.: Identification / Type no.:	Q340RR 2AN2O-Q340RR01 23317-Q340RR01			
Auftrags-Inhalt: Order content:	Complete test			
Prüfgrundlage: Test specification:	FCC CFR47 Part 15, Subpart C Section 15.247 RSS-Gen Issue 5, Amendment 2, February 2021 RSS-247 Issue 2, February 2017 ANSI C63.10: 2013			
Wareneingangsdatum: Date of sample receipt:	2021-11-18			
Prüfmuster-Nr.: Test sample no.:	A003167138-001			
Prüfzeitraum: Testing period:	Refer to test report			
Ort der Prüfung: Place of testing:	TÜV Rheinland (Shanghai) Co., Ltd.			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland (Shanghai) Co., Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von: tested by:	X <u>Yanli Fan</u>		genehmigt von: authorized by:	X <u>Hongfei Wu</u>
Datum: Date: 2021-12-24	Signed by: Yanli Fan		Ausstellungsdatum: Issue date: 2021-12-24	Signed by: Hongfei Wu
Stellung / Position:	PE/Yanli Fan		Stellung / Position:	Reviewer/Hongfei Wu
Sonstiges / Other:	HVIN: Q340RR-FN31			
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:	Prüfmuster vollständig und unbeschädigt Test item complete and undamaged			
* Legende: P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet * Legend: P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT

RESULT: Pass

5.1.2 6dB & 99% BANDWIDTH

RESULT: Pass

5.1.3 PEAK OUTPUT POWER

RESULT: Pass

5.1.4 POWER SPECTRAL DENSITY

RESULT: Pass

5.1.5 CONDUCTED BAND EDGE AND OUT-OF BAND EMISSIONS

RESULT: Pass

5.2.1 CONDUCTED EMISSION

RESULT: Pass

5.3.1 RADIATED BAND-EDGE

RESULT: Pass

5.3.2 RADIATED SPURIOUS EMISSION

RESULT: Pass

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1. General Remarks

1.1 Complementary Materials

Null.

2. Test Sites

2.1 Test Facilities

TÜV Rheinland (Shanghai) Co., Ltd.

Shanghai TÜV Rheinland Building No. 177, 178 Lane 777, West Guangzhong Rd, Jing'an District, Shanghai, China

The used test equipment is in accordance with CISPR 16 for measurement of radio interference.

The Federal Communications Commission has reviewed the technical characteristics of the radiated and conducted emission facility, and has found these test facilities to be in compliance with the requirements of section 2.948 of the FCC rules. The description of the test facility is listed under FCC registration number 958801.

The Innovation, Science and Economic Development Canada has reviewed the technical characteristics of the radiated and conducted emission facility, and has found these test facilities to be in compliance. The description of the test facility is listed under chambers filing number 2932F.

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Instrument	Manufacturer	Type No.	Asset No.	Cali. Due Date
3m modified semi-anechoic chamber	Frankonia	SAC3	G1811378	2022-06-27
Bilog antenna	Teseq	CBL 6112D	G1811425	2023-03-10
EMI test receiver	Rohde & Schwarz	ESCI	G1811402	2022-09-01
Spectrum analyser	Rohde & Schwarz	FSV40	G1822702	2023-03-10
Preamplifier	Taiwan EMCI	EMC184045SE	G1825372	2023-05-14
Log periodic antenna	Rohde & Schwarz	HL050	G1811417	2023-03-10
Broadband Horn Antenna	Schwarzbeck	BBHA 9170	9170-305	2023-07-10
Preamplifier	Taiwan EMCI	EMC051845SE	G1825371	2023-05-14
Spectrum Analyzer	Keysight	N9020A	MY54500180	2023-09-07
Thermohygrometer	Testo	608-H1	1241320614	2023-10-12
EMI test receiver	R&S	ESIB26	G1811380	2023-03-06
Artificial main network	R&S	ENV432	G1830003	2022-11-01
Spectrum Analyzer	Keysight	N9020A	MY54500180	2022-09-07
EMC measurement software	R&S	EMC32 (Ver 10.20.01)	G1824845	N/A

2.3 Traceability

All measurement equipment calibrations are traceable to NIST or where calibration is performed outside the United States, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

Table 2: Measurement Uncertainty

Measurement Type	Frequency	Uncertainty
Antenna Port Conducted Emission	< 1GHz	±0.39dB
	> 1GHz	±0.68dB
Conducted Emission	150kHz - 30MHz	±3.39dB
Radiated Emission	9kHz - 30MHz	±2.93dB
	30MHz - 1GHz	±5.34dB
	> 1GHz	±5.40dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT (Equipment Under Test) is a Robotic Vacuum Cleaner which supports Wi-Fi.

The aim of this report is to evaluate the RF characteristic of the Wi-Fi Part of this EUT.

For details refer to the User Manual and Circuit Diagram.

3.2 Ratings and System Details

Table 3: Technical Specification of EUT

General Description of EUT	
Product Name:	Robotic Vacuum Cleaner
Model No.:	Q340RR
Rated Voltage:	DC 20V, 1.2A
Technical Specification of W-LAN	
Frequency Range:	2412~2462MHz
Modulation Type:	DSSS (CCK, DQPSK, DBPSK) OFDM (QPSK/BPSK/16QAM/64QAM)
Antenna Type:	Internal antenna
Antenna Gain:	3.87 dBi
Receiver Category:	1

3.3 Independent Operation Modes

Table 4: Independent Operation Modes

Test Mode Tx	Operating Mode	Channel Number	Channel Frequency [MHz]
TM1	802.11b	1	2412
TM2	802.11b	6	2437
TM3	802.11b	11	2462
TM4	802.11g	1	2412
TM5	802.11g	6	2437
TM6	802.11g	11	2462
TM7	802.11n-HT20	1	2412
TM8	802.11n-HT20	6	2437
TM9	802.11n-HT20	11	2462
Test Mode			
TM10	Normal		

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.5 Submitted Documents

- Bill of Material
- PCB Layout
- Photo Document
- Circuit Diagram
- Instruction Manual
- Rating Label

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum power level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All testing were performed according to the procedures in ANSI C63.10: 2013.

Table 5: Power parameter value

Operating Mode	Power Parameter Value
802.11b	-50
802.11g	-50
802.11n-HT20	-50

4.3 Special Accessories and Auxiliary Equipment

Table 6: Auxiliary Equipment

Product Name	Model Name	Manufactory
Laptop	TP00001A	Lenovo

4.4 Countermeasures to achieve EMC Compliance

Null.

5. Test Results

5.1 Conducted Testing at Antenna Port

5.1.1 Antenna Requirement

RESULT:**Pass**

According to the manufacturer declared, the EUT has one internal antenna, the directional gain of antenna is 3.87 dBi and the antenna is designed with permanent attachment and no consideration of replacement. Therefore the EUT is considered sufficient to comply with the provision.

Table 7: Antenna Requirement**FCC 15.203 – Antenna Requirement 1**

Requirement:	No antenna other than that furnished by the responsible party shall be used with the device	
Results:	Antenna type:	Internal antenna
Verdict:	Pass	

FCC 15.204 – Antenna Requirement 2

Requirement:	An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator.	
Results:	Only one internal antenna can be used	
Verdict:	Pass	

RSS-Gen 6.4 – External Control

Requirement:	The device shall not have any external controls accessible to the user that enable it to be adjusted, selected or programmed to operate in violation of the regulatory requirements, including RSS-Gen and the applicable RSSs	
Results:	The device does not have any transmitter external controls accessible to the user that can be adjusted and operated in violation of the limits of this standard.	
Verdict:	PASS	

RSS-Gen 6.8 – Antenna Requirement

Requirement: When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

Results:

a) Antenna Type:	Internal antenna
b) Manufacture:	N/A
c) Model No.:	N/A
d) Gain with reference to an isotropic radiator:	3.87 dBi

Verdict: PASS

Test Mode	Data rate/ MCS	CH.	Freq. [MHz]	6dB Bandwidth [MHz]	6dB Bandwidth limit [kHz]	99% Bandwidth [MHz]
TM1	1Mbps	1	2412	9.129	≥500	11.391
TM2	1Mbps	6	2437	9.130	≥500	11.413
TM3	1Mbps	11	2462	9.131	≥500	11.397
TM4	6Mbps	1	2412	16.41	≥500	16.705
TM5	6Mbps	6	2437	16.41	≥500	16.705
TM6	6Mbps	11	2462	16.41	≥500	16.692
TM7	MCS0	1	2412	17.62	≥500	17.716
TM8	MCS0	6	2437	17.62	≥500	17.707
TM9	MCS0	11	2462	17.63	≥500	17.712

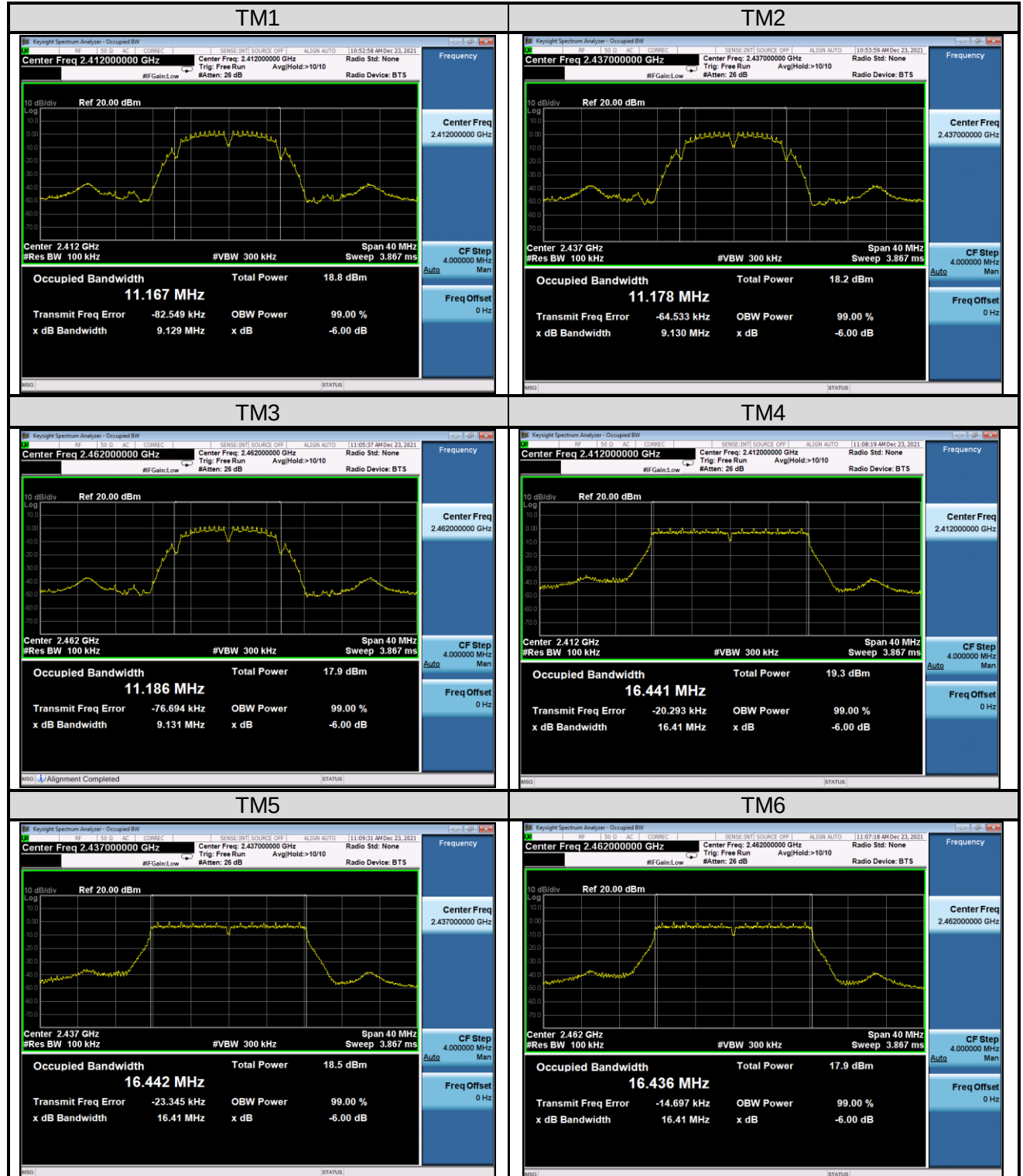
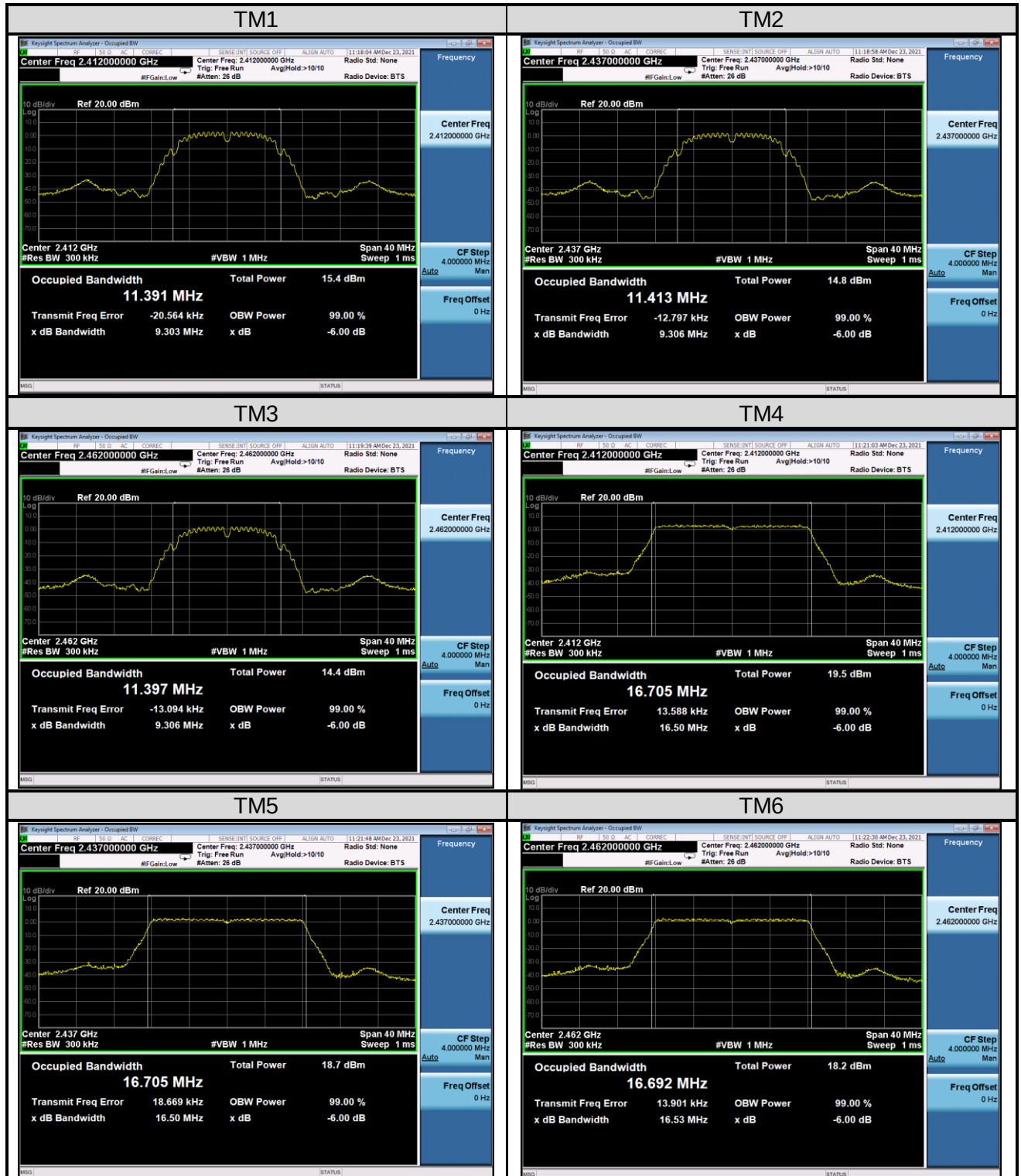
Figure 1: 6dB Bandwidth




Figure 2: 99% Bandwidth




EIRP=Peak Conducted Output Power + Antenna Gain

Figure 3: Peak Output Power



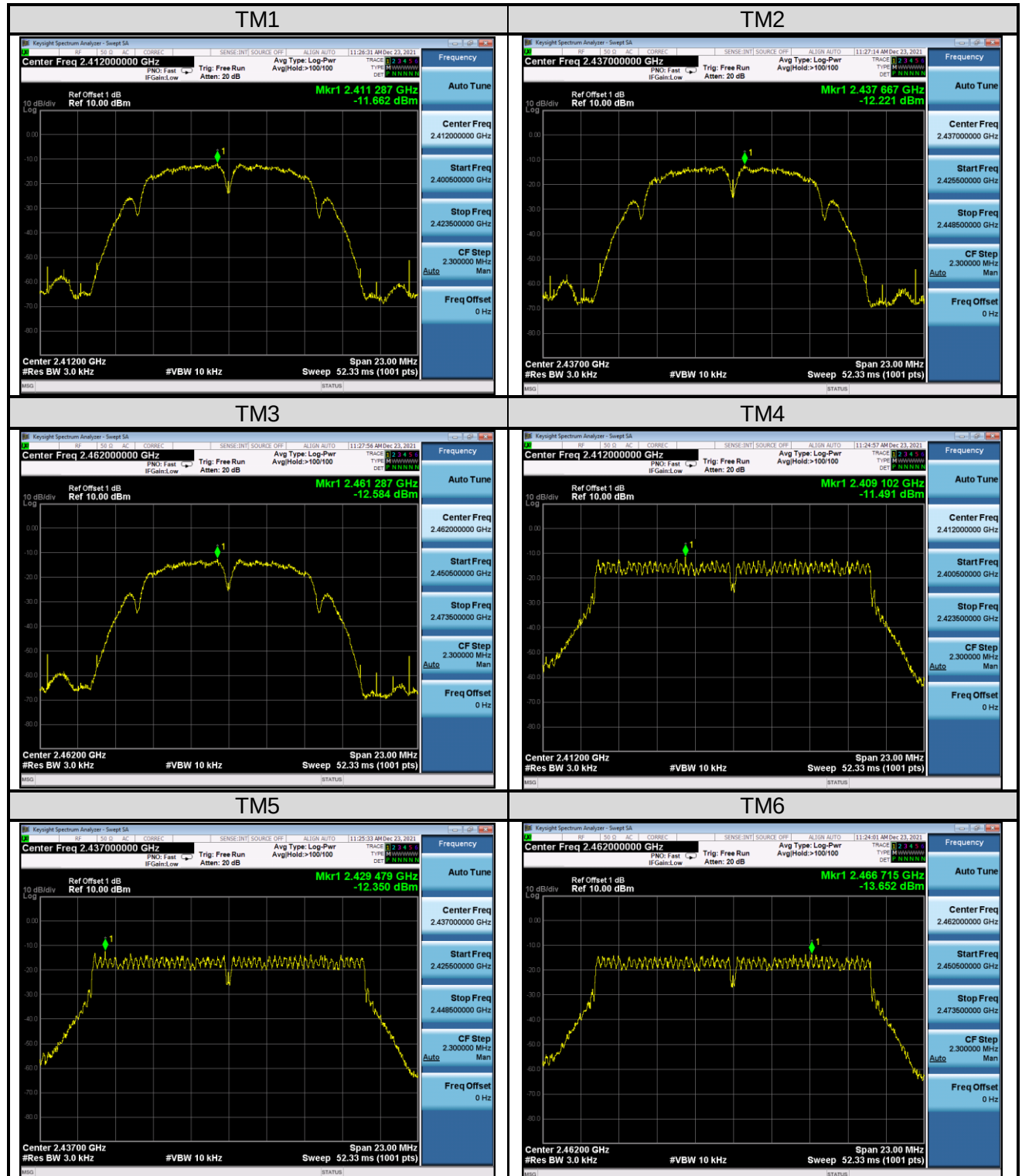

5.1.4 Power Spectral Density

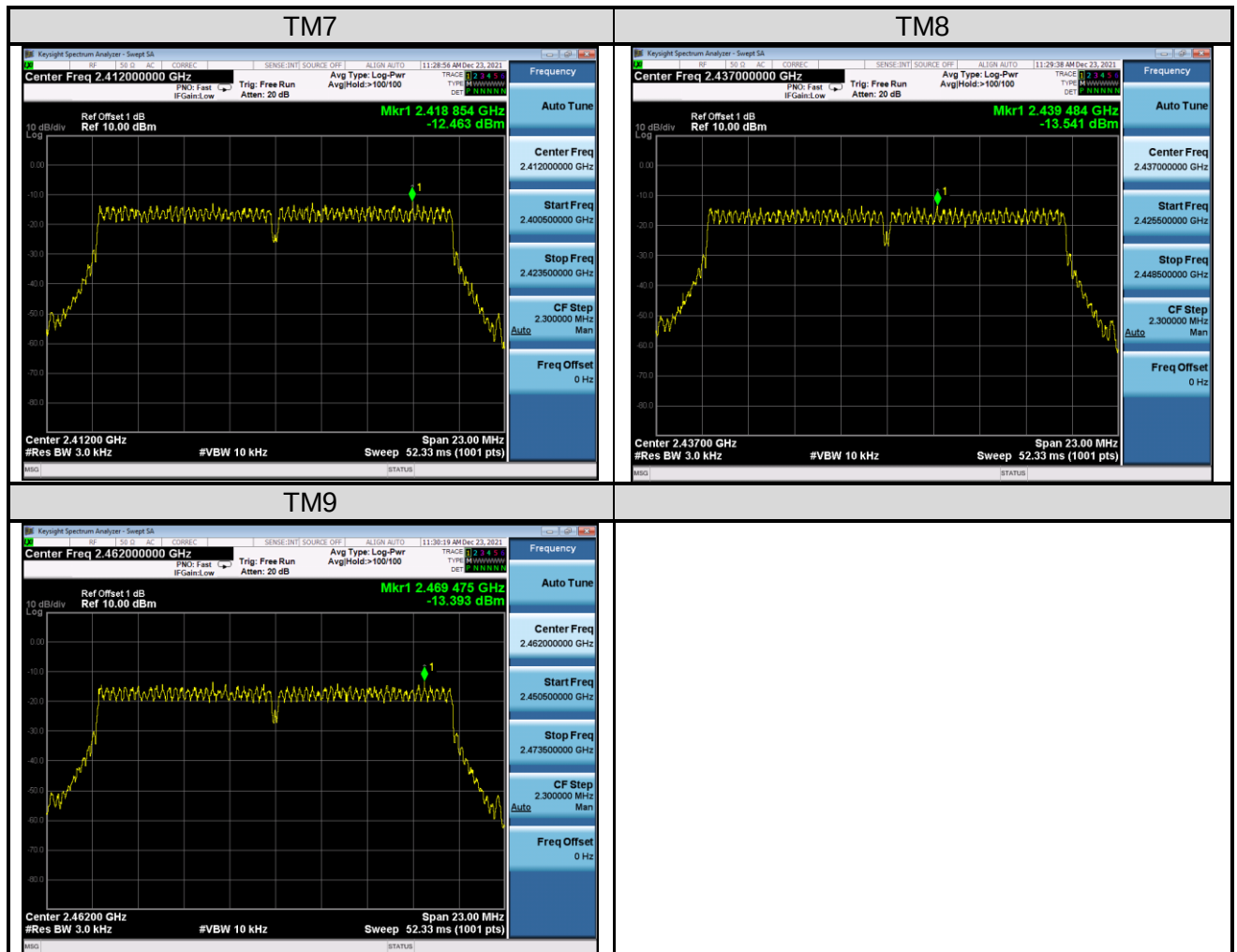
RESULT:**Pass**

Date of testing : 2021-12-23
Ambient temperature : 21.4°C
Relative humidity : 56.1%
Atmospheric pressure : 101kPa
Test requirement : FCC Part 15.247(e)
RSS-247 Issue 2, February 2017, Clause 5.2(b)
Test procedure : ANSI C63.10: 2013
Test voltage : DC 20V
Test modes applied : TM1 to TM9

Table 10: Power Spectral Density

Mode	Data rate/ MCS	CH.	Frequency [MHz]	Result [dBm/3kHz]	Limit [dBm/3kHz]
TM1	1Mbps	1	2412	-11.662	8
TM2	1Mbps	6	2437	-12.221	8
TM3	1Mbps	11	2462	-12.584	8
TM4	6Mbps	1	2412	-11.491	8
TM5	6Mbps	6	2437	-12.350	8
TM6	6Mbps	11	2462	-13.653	8
TM7	MCS0	1	2412	-12.463	8
TM8	MCS0	6	2437	-13.541	8
TM9	MCS0	11	2462	-13.393	8

Figure 4: Power Spectral Density




5.1.5 Conducted Band Edge and out-of Band Emissions

RESULT:**Pass**

Date of testing	:	2021-12-23
Ambient temperature	:	21.4°C
Relative humidity	:	56.1%
Atmospheric pressure	:	101kPa
Test requirement	:	FCC Part 15.247(d) RSS-247 Issue 2, February 2017, Clause 5.5
Test procedure	:	ANSI C63.10: 2013
Test voltage	:	DC 20V
Test modes applied	:	TM1 to TM9

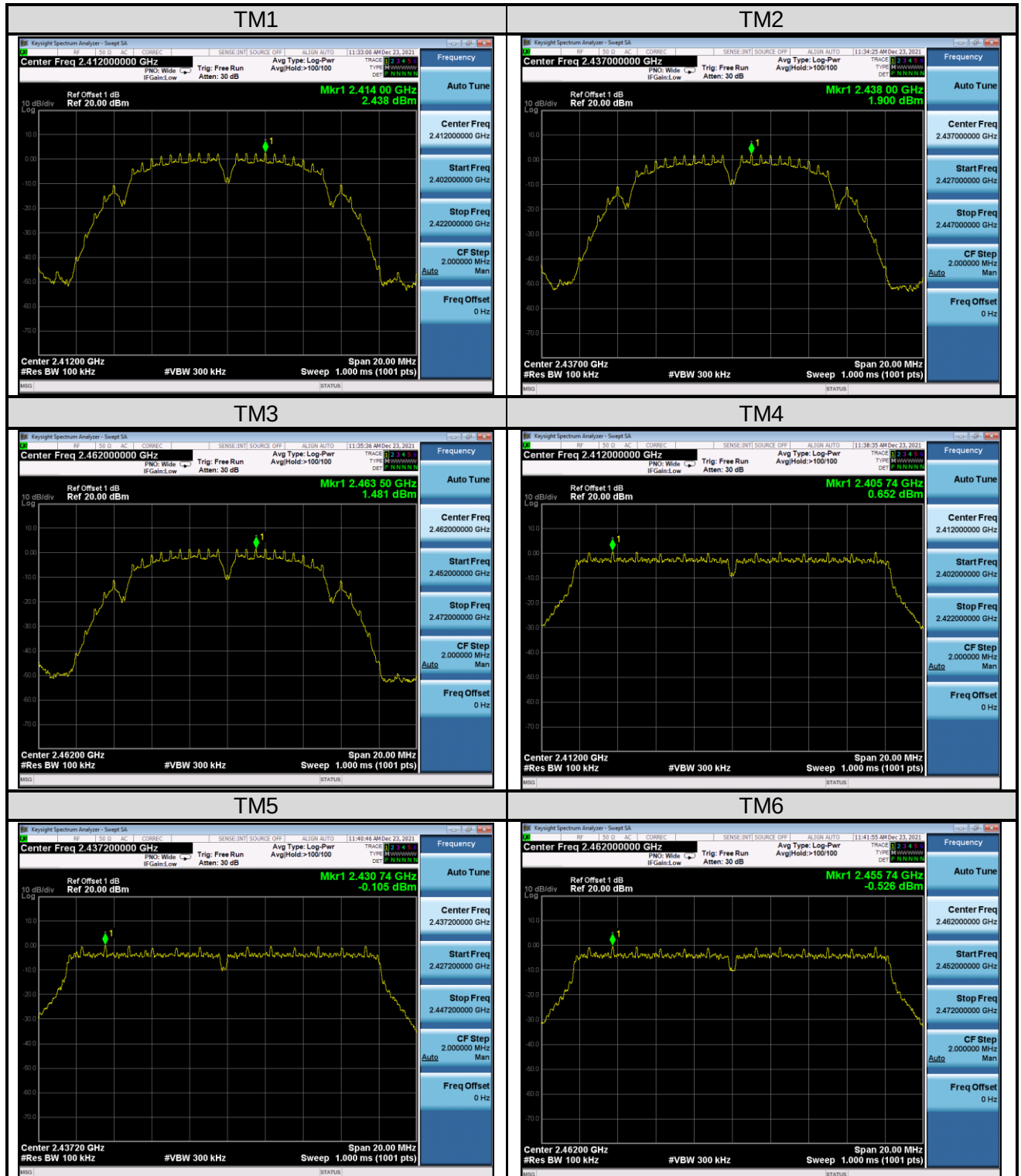




Figure 6: Conducted Spurious Emission

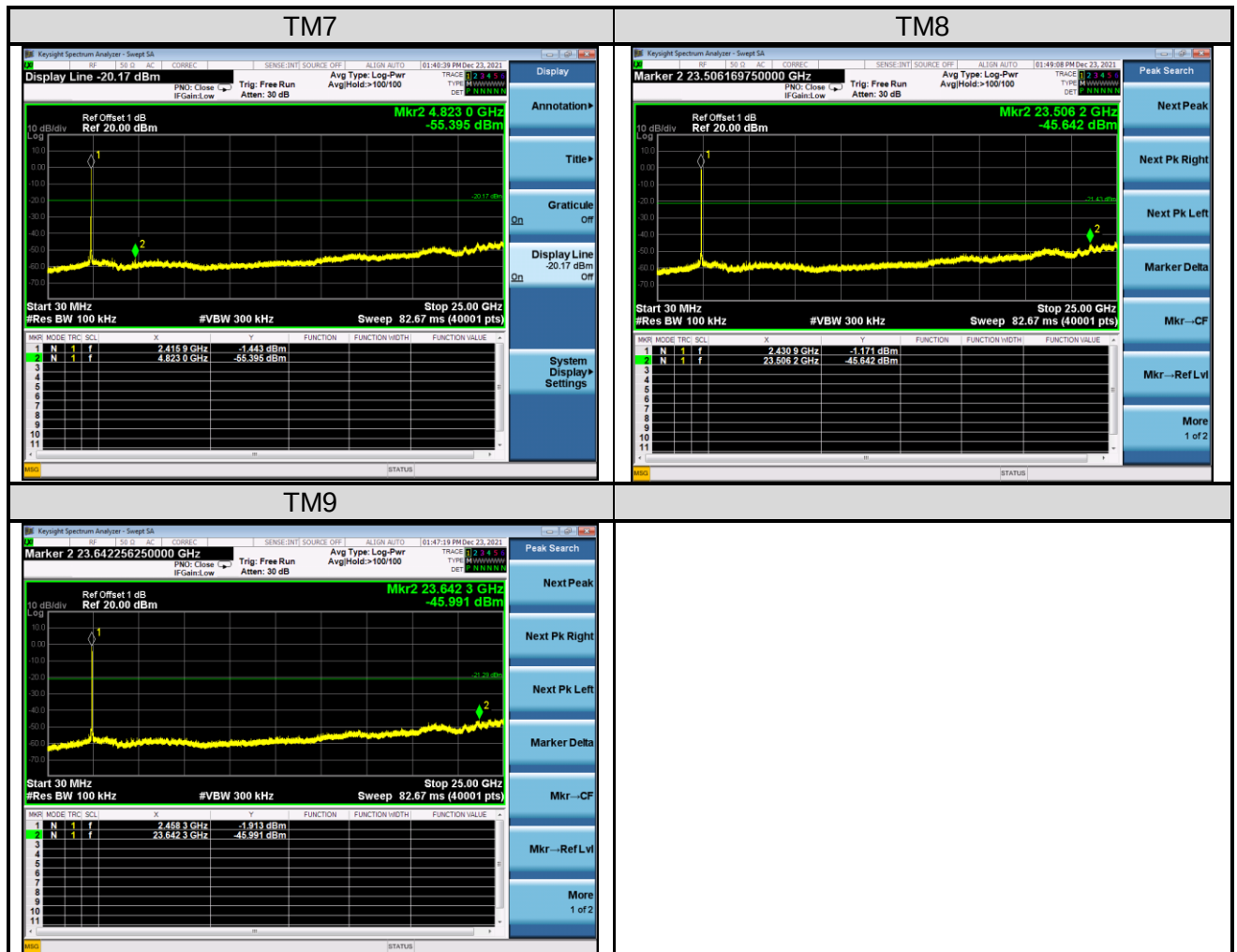



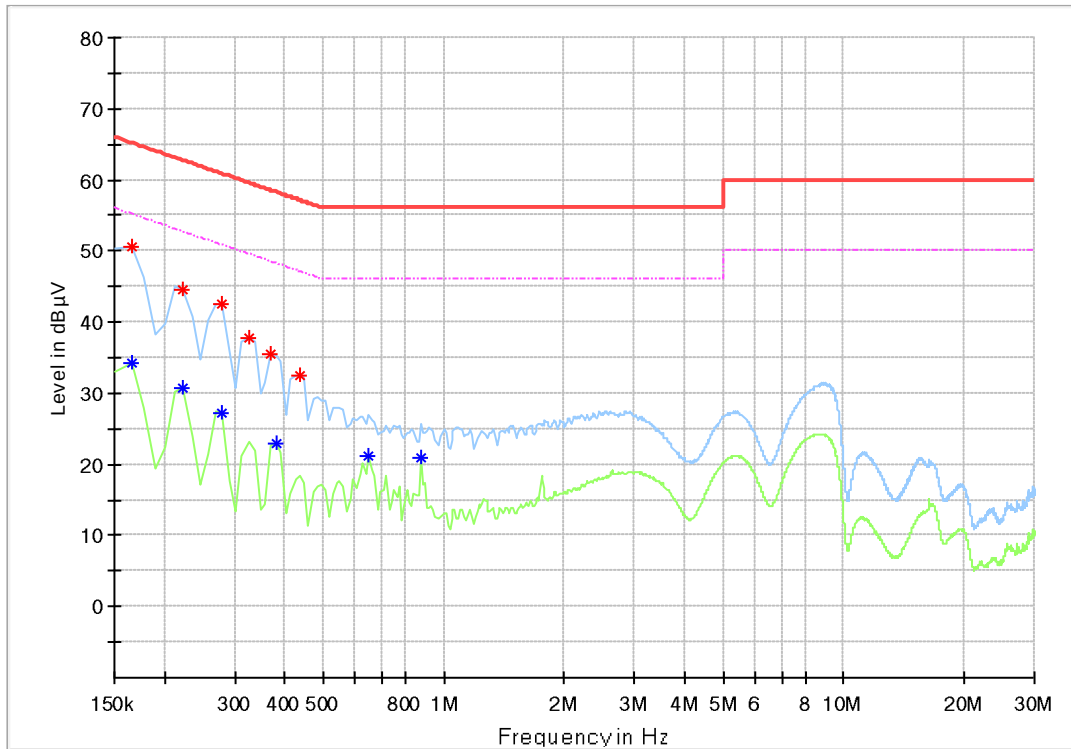
Figure 7: Conducted Band Edge


5.2 Emission in the Frequency Range up to 30MHz

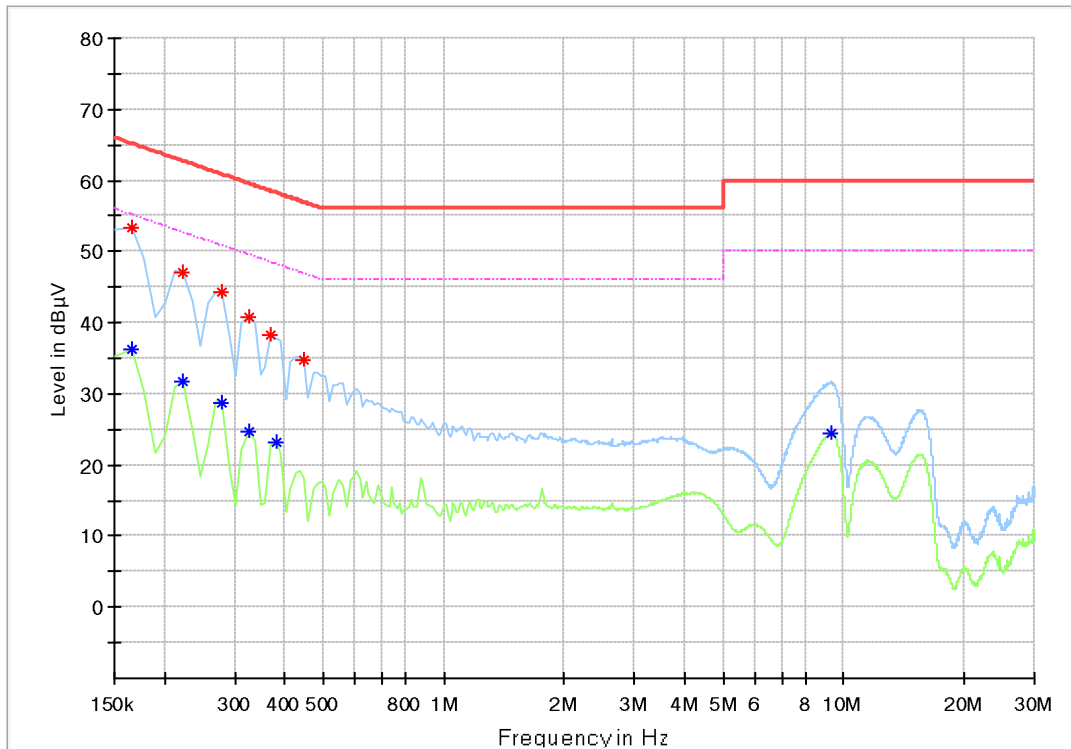
5.2.1 Conducted Emission

RESULT:**Pass**

Date of testing	:	2021-12-01
Ambient temperature	:	26.1°C
Relative humidity	:	32.7%
Atmospheric pressure	:	101kPa
Test requirement	:	FCC Part 15.207 (a) RSS-Gen Issue 5, Amendment 2, February 2021, Clause 8.8
Test procedure	:	ANSI C63.10: 2013
Test voltage	:	AC 120V/60Hz
Test modes applied	:	TM10

Figure 8: Conducted Emission, L

Critical_Freqs

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line
0.875625	---	20.93	46.00	25.07	L1
0.650625	---	21.19	46.00	24.81	L1
0.380625	---	22.92	48.27	25.35	L1
0.279375	---	27.12	50.83	23.72	L1
0.223125	---	30.78	52.70	21.92	L1
0.166875	---	34.24	55.12	20.87	L1
0.166875	50.61	---	65.12	14.51	L1
0.223125	44.67	---	62.70	18.03	L1
0.279375	42.43	---	60.83	18.41	L1
0.324375	37.74	---	59.59	21.85	L1
0.369375	35.51	---	58.52	23.00	L1
0.436875	32.46	---	57.12	24.66	L1

Figure 9: Conducted Emission, N

Critical_Freqs

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line
0.380625	---	23.25	48.27	25.01	N
9.313125	---	24.42	50.00	25.58	N
0.324375	---	24.78	49.59	24.81	N
0.279375	---	28.73	50.83	22.10	N
0.223125	---	31.69	52.70	21.01	N
0.166875	---	36.29	55.12	18.82	N
0.166875	53.34	---	65.12	11.78	N
0.223125	47.15	---	62.70	15.55	N
0.279375	44.23	---	60.83	16.60	N
0.324375	40.66	---	59.59	18.94	N
0.369375	38.16	---	58.52	20.35	N
0.448125	34.85	---	56.91	22.06	N

5.3 Emission in the Frequency Range above 30MHz

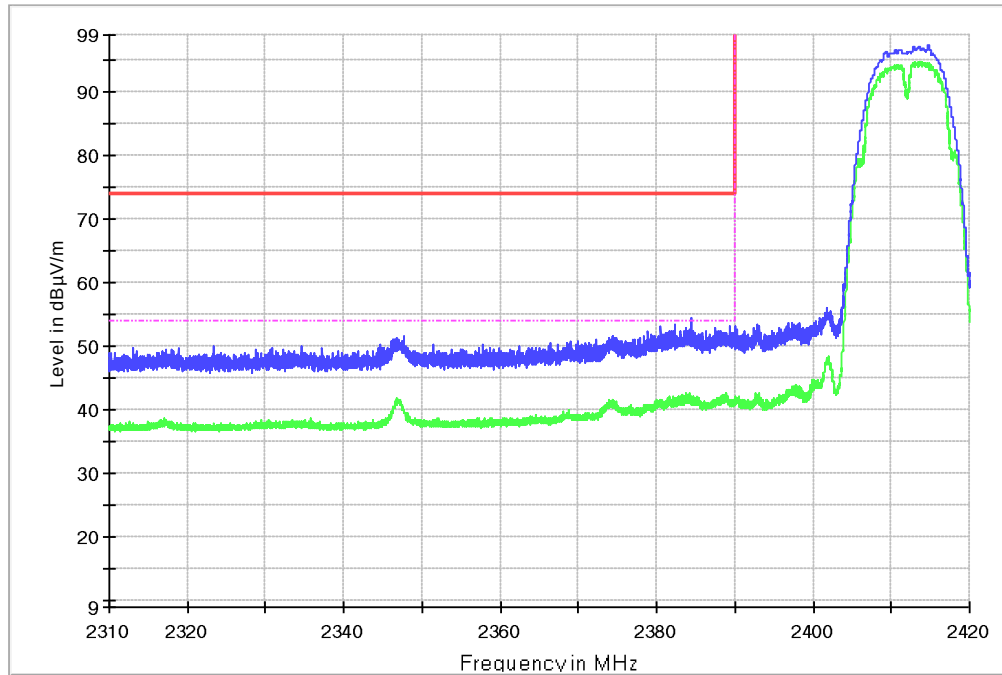
5.3.1 Radiated Band-Edge

RESULT:**Pass**

Date of testing	:	2021-11-23~2021-11-29
Ambient temperature	:	26.1°C
Relative humidity	:	32.7%
Atmospheric pressure	:	101kPa
Test requirement	:	FCC Part 15.247(d) FCC Part 15.205(a) FCC Part 15.209(a) RSS-Gen Issue 5, Amendment 2, February 2021, Clause 8.9 RSS-Gen Issue 5, Amendment 2, February 2021, Clause 8.10 RSS-247 Issue 2, February 2017, Clause 5.5
Test procedure	:	ANSI C63.10: 2013
Test voltage	:	DC 20V
Test modes applied	:	TM1, TM3, TM4, TM6, TM7, TM9

Figure 10: Radiated Band-Edge, TM1, H

RE 1-18GHz HL050 FSV40 Pre


Figure 11: Radiated Band-Edge, TM1, V

RE 1-18GHz HL050 FSV40 Pre

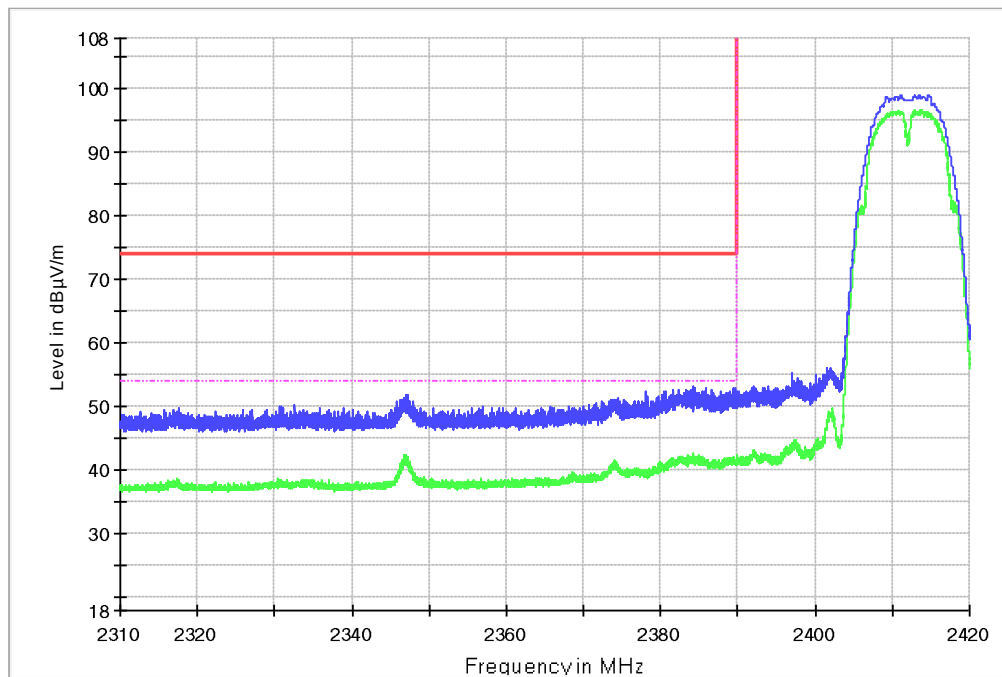
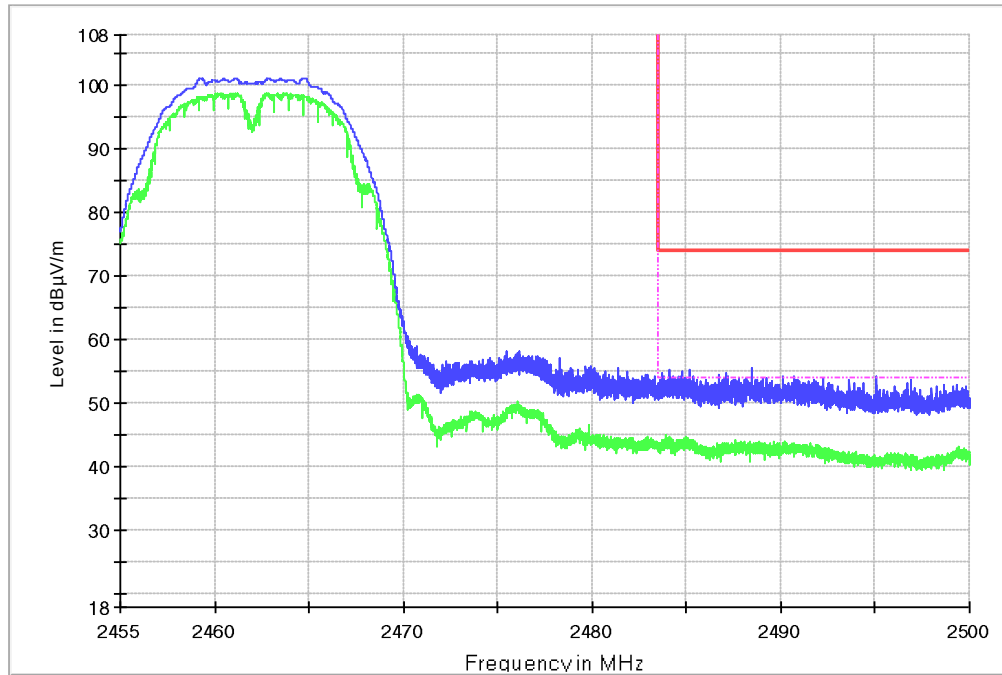


Figure 12: Radiated Band-Edge, TM3, H

RE 1-18GHz HL050 FSV40 Pre


Figure 13: Radiated Band-Edge, TM3, V

RE 1-18GHz HL050 FSV40 Pre

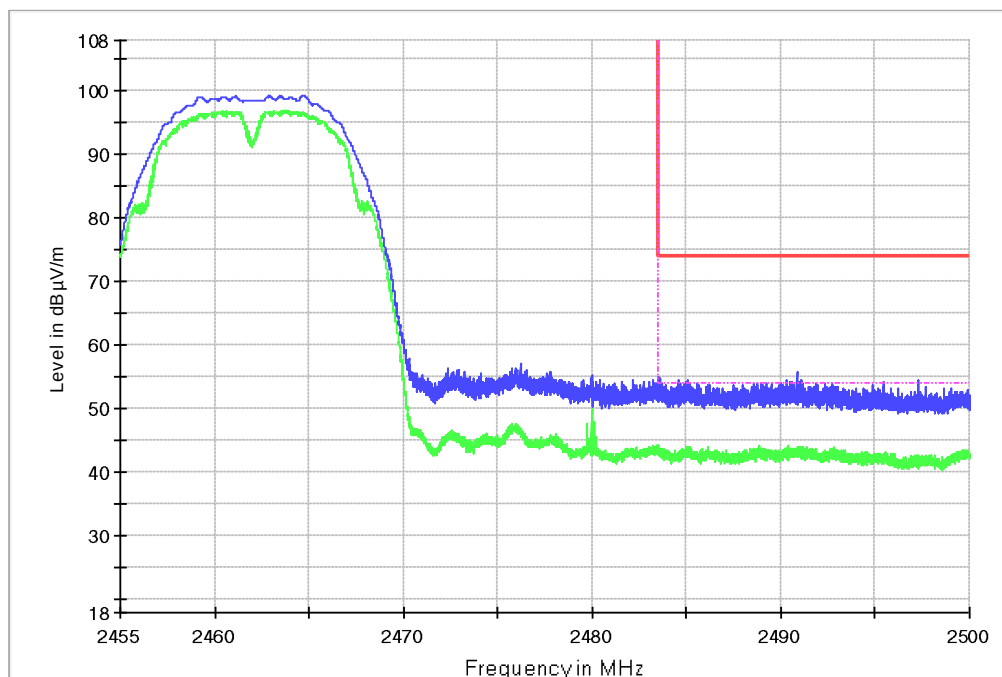
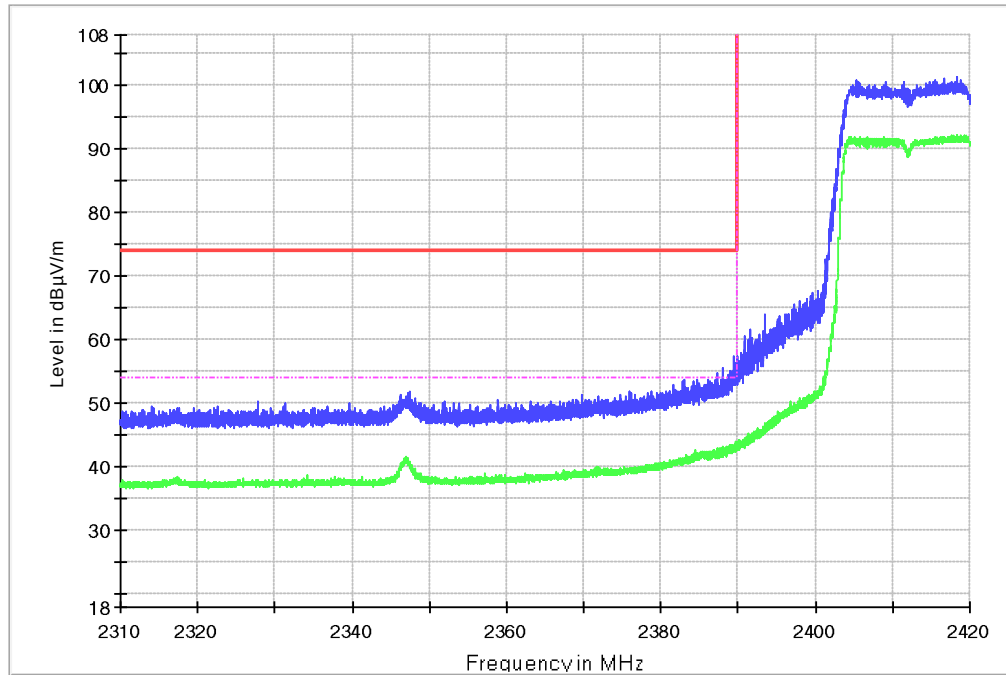


Figure 14: Radiated Band-Edge, TM4, H

RE 1-18GHz HL050 FSV40 Pre


Figure 15: Radiated Band-Edge, TM4, V

RE 1-18GHz HL050 FSV40 Pre

