TEST REPORT

Client Information:

Applicant:	Shenzhen wei bo technology co., LTD
Applicant add.:	Room 601, Tower A, Yousuowei Building, No. 2000, Jiaxian Road, Bantian street, Longgang District, Shenzhen
Manufacturer:	Dongguan Huawei Technology Co., Ltd
Manufacturer add.:	Room 101, Building 1, No. 39 Yongping Lane, Dongshan, Qishi Town, Dongguan City, Guangdong Province

Product Information:

Product Name:	Wireless Gaming Headset
Model No.:	HW20
Series Model:	HW10,HW11,HW12,HW13,HW21,HW22,W1000,W2000,W3000,W4000,W5000,DH10,DH20,DH30,DH40,DH11,HD12,DH13,X1,X2,X3,X4,X5,NYH1,NYH2,NYH3,NYH4,NYH5,WH600,WH610,WH620,WH630,WH640,B10,B11,B12,B13,B14
Brand Name:	N/A
Test samples.:	AiTDG-240717012-1
FCC ID:	2BATE-FC-200

Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247

Prepared By:

Guangdong Asia Hongke Test Technology Limited

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Date of Receipt:	July 15, 2024	Date of Test:	July 15, 2024 ~ July 16, 2024
Date of Issue:	July 17, 2024	Test Result:	Pass

This device described above has been tested by Guangdong Asia Hongke Test Technology Limited and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Reviewed by: Leon Yi

Leon.yi

Approved by: Sean She

Sean She

Guangdong Asia Hongke Test Techno
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Revision History

Revision	Issue Date	Revisions	Revised By
01	July 17, 2024	Initial Issue	Sean She

2 Test Summary

FCC PART 15.247		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 15.247(a)(2)	6dB Bandwidth	PASS
FCC Part 15.247(d)	Spurious RF Conducted Emission	PASS
FCC Part 15.247(b)	Maximum Conducted Output Power	PASS
FCC Part 15.247(e)	Power Spectral Density	PASS
FCC Part 15.205/ 15.209	Radiated Emissions	PASS
FCC Part 15.247(d)	Band Edge	PASS
FCC Part 15.203/15.247 (b)	Antenna Requirement	PASS

Note

1. *Test according to ANSI C63.10:2013 and RSS-Gen.*
2. *The measurement uncertainty is not included in the test result.*
3. *Test results in other test report (RF Exposure Evaluation Report)*

2.1 Statement of the Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the AiT quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

2.2 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	0.009MHz-30MHz	3.10dB	(1)
Radiated Emission	30MHz-1GHz	3.75dB	(1)
Radiated Emission	1GHz-18GHz	3.88dB	(1)
Radiated Emission	18GHz-40GHz	3.88dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	1.20dB	(1)
Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.			

3 Test Facility

The test facility is recognized, certified or accredited by the following organizations:

FCC-Registration No.: 251906 Designation Number: CN1376

Guangdong Asia Hongke Test Technology Limited has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

IC —Registration No.: 31737 CAB identifier: CN0165

The 3m Semi-anechoic chamber of Guangdong Asia Hongke Test Technology Limited has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 31737

A2LA-Lab Cert. No.: 7133.01

Guangdong Asia Hongke Test Technology Limited has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

3.1 Deviation from standard

None

3.2 Abnormalities from standard conditions

None

3.3 Test Location

Guangdong Asia Hongke Test Technology Limited

Address: B1/F, Building 11, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Tel.: +86 0755-230967639 Fax.: +86 0755-230967639

4 General Information

EUT Name:	Wireless Gaming Headset
Model No:	HW20
Serial Model:	HW10,HW11,HW12,HW13,HW21,HW22,W1000,W2000,W3000,W4000,W5000,DH10,DH20,DH30,DH40,DH11,HD12,DH13,X1,X2,X3,X4,X5,NYH1,NYH2,NYH3,NYH4,NYH5,WH600,WH610,WH620,WH630,WH640,B10,B11,B12,B13,B14
Sample(s) Status:	Engineer sample
Operation frequency:	2402MHz-2480MHz
Channel Number:	40 Channels
Channel separation:	2MHz
Modulation Technology:	GFSK
Antenna Type:	PCB antenna
Antenna gain:	0dBi
Hardware version.:	N/A
Software version.:	N/A
Power supply:	DC 3.7V From battery and DC 5.0V From external circuit
Model different:	PCB board, structure and internal of these model(s) are the same, So no additional models were tested.
Note:	For a more detailed features description, please refer to the manufacturer’s specifications or the User's Manual.

4.1 Test frequencies

EUT channels and frequencies list:

Channel	Frequency (MHz)
00	**2402**
01	2404
02	2406
⋮	⋮
19	**2440**
⋮	⋮
37	2476
38	2478
39	**2480**

4.2 EUT Peripheral List

No.	Equipment	Manufacturer	EMC Compliance	Model No.	Serial No.	Power cord	Signal cord
1	N/A	N/A	N/A	N/A	N/A	N/A	N/A

4.3 Test Peripheral List

No.	Equipment	Mfr/Brand	EMC Compliance	Model No.	Serial No.	Power cord	Signal cord
1	Notebook	DELL	CE	VOSTRO.3800	N/A	N/A	N/A
2	USB Cable	N/A	CE	100cm	N/A	N/A	N/A

4.4 TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR PART 15C 15.207, 15.209, 15.247 and DA 00-705.

EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

EUT Exercise

The EUT was operated in continuous transmits mode for the tests.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209, 15.247, ANSI C63.10-2013 under the FCC Rules Part 15 Subpart C

General Test Procedures

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013.

4.5 Description of Test Modes

The EUT has been tested under operating condition.

AC main conducted emission pre-test voltage at both AC 120V/60Hz and AC 240V/50Hz, recorded worst case;

AC main conducted emission pre-test at charge from power adapter modes, recorded worst case;

Worst-case mode and channel used for 150 KHz-30 MHz power line conducted emissions was the mode and channel with the highest output power that was determined to be TX(middle Channel).

Worst-case mode and channel used for 9 KHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be TX(middle Channel).

This test was performed with EUT in X, Y, Z position and the worst case was found when EUT in X position.

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Transmitting mode	Keep the EUT in continuously transmitting mode.		
Test software:	FCC_assist_1.0.2.2		
Frequency	2402 MHz	2440 MHz	2480 MHz
Parameters(1Mbps)	Default	Default	Default

5 Equipment Used during Test

No	Test Equipment	Manufacturer	Model No	Serial No	Cal. Date	Cal. Due Date
1	Spectrum Analyzer	R&S	FSV40	101470	2023.09.08	2024.09.07
2	Spectrum Analyzer	Keysight	N9020A	MY51280643	2023.09.08	2024.09.07
3	EMI Measuring Receiver	R&S	ESR	101660	2023.09.08	2024.09.07
4	Low Noise Pre-Amplifier	HP	HP8447E	1937A01855	2023.09.08	2024.09.07
5	Low Noise Pre-Amplifier	Tsj	MLA-0120-A02-34	2648A04738	2023.09.08	2024.09.07
6	Passive Loop	ETS	6512	00165355	2022.09.04	2024.09.03
7	TRILOG Super Broadband test Antenna	SCHWARZBECK	VULB9160	9160-3206	2021.08.29	2024.08.28
8	Broadband Horn Antenna	SCHWARZBECK	BBHA9120D	452	2021.08.29	2024.08.28
9	SHF-EHF Horn Antenna 15-40GHz	SCHWARZBECK	BBHA9170	BBHA9170367d	2021.08.29	2024.08.28
10	EMI Measuring Receiver	R&S	ESR	101160	2023.09.13	2024.09.12
11	LISN	SCHWARZBECK	NNLK 8129	8130179	2023.10.29	2024.10.28
12	Pulse Limiter	R&S	ESH3-Z2	102789	2023.09.13	2024.09.12
13	Pro.Temp&Humi.chamber	MENTEK	MHP-150-1C	MAA08112501	2023.09.08	2024.09.07
14	RF Automatic Test system	MW	MW100-RFCB	21033016	2023.09.08	2024.09.07
15	Signal Generator	Agilent	N5182A	MY50143009	2023.09.08	2024.09.07
16	Wideband Radio communication tester	R&S	CMW500	1201.0002K50	2023.09.08	2024.09.07
17	RF Automatic Test system	MW	MW100-RFCB	21033016	2023.09.08	2024.09.07
18	DC power supply	ZHAOXIN	RXN-305D-2	28070002559	N/A	N/A
19	RE Software	EZ	EZ-EMC_RE	Ver.AIT-03A	N/A	N/A
20	CE Software	EZ	EZ-EMC_CE	Ver.AIT-03A	N/A	N/A
21	RF Software	MW	MTS 8310	2.0.0.0	N/A	N/A
22	temporary antenna connector(Note)	NTS	R001	N/A	N/A	N/A
Note: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.						

6 Test results and Measurement Data

6.1 Antenna requirement

6.1.1 Standard 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. The manufacturer may design the unit so that a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded. And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.
6.1.2 EUT Antenna:
The antenna is Chip antenna, the best case gain of the antenna is 0dBi reference to the Internal photos for details

6.2 Peak Power Measurement

6.2.1 Standard requirement:

The Maximum Peak Output Power Measurement is 30dBm.

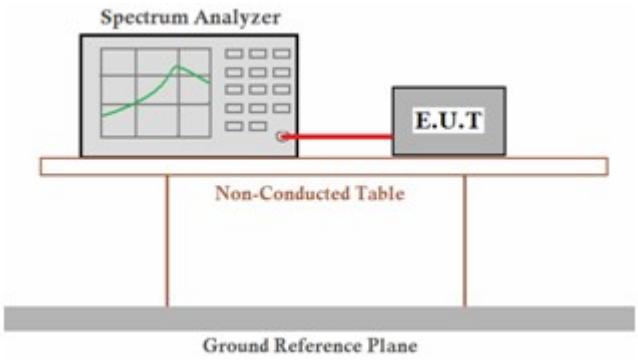
6.2.2 Measuring Instruments:

Please refer to equipment's list in this report.

6.2.3 Test Procedures:

a) Set the RBW ≥ *DTS bandwidth*.
b) Set VBW ≥ 3 RBW.
c) Set span ≥ 3 x RBW
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

6.2.4 Test Setup Layout



6.2.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

6.2.6 Test result

Please refer to Appendix B

Remark:

1. *Test results including cable loss;*

6.3 Power Spectral Density

6.3.1 Standard requirement:

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

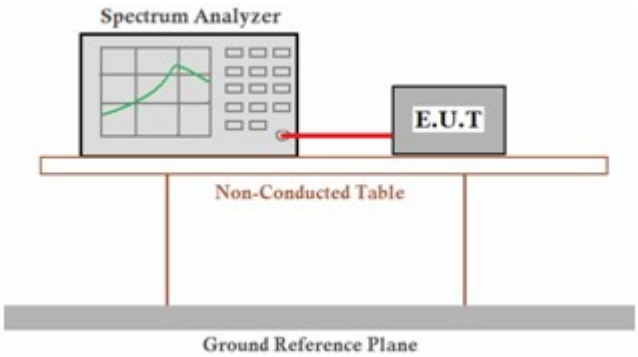
6.3.2 Measuring Instruments:

Please refer to equipment's list in this report.

6.3.3 Test Procedures

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW ≥ 3 kHz.
3. Set the VBW ≥ 3× RBW.
4. Set the span to 1.5 times the DTS channel bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

6.3.4 Test Setup Layout



6.3.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

6.3.6 Test result

PASS

Please refer to Appendix B

Remark:

1). Test results including cable loss;

6.4 6dB Bandwidth

6.4.1 Standard requirement:

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz

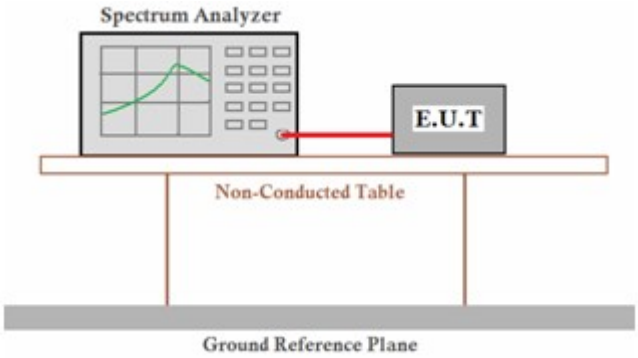
6.4.2 Measuring Instruments and Setting:

Please refer to equipment's list in this report.

6.4.3 Test Procedures

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

6.4.4 Test Setup Layout



6.4.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

6.4.6 Test result

PASS

Please refer to Appendix B

Remark:

1). Test results including cable loss;

6.5 Conducted Spurious Emissions and Band Edges Test

6.6.1 Standard 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. Attenuation below the general limits specified in Section 15.209(a) is not required.

6.6.2 Measuring Instruments and Setting:

Please refer to equipment list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Detector	Peak
Attenuation	Auto
RB / VB (Emission in restricted band)	100KHz/300KHz
RB / VB (Emission in non-restricted band)	100KHz/300KHz

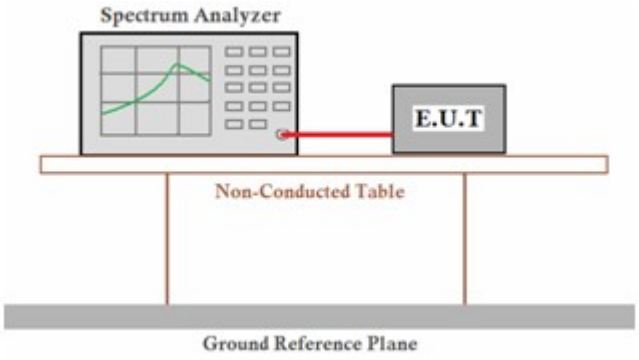
6.6.3 Test Procedures

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 KHz. The video bandwidth is set to 300 KHz.

Measurements are made over the 9kHz to 25GHz range with the transmitter set to the lowest, middle, and highest channels.

6.6.4 Test Setup Layout



6.6.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

6.6.6 Test result

PASS

No non-compliance noted. Only record the worst test result in this report. The test data refer to the following page.

PASS

Please refer to Appendix B for conducted spurious emission.

Please refer to Appendix B for conducted band edge.

Remark:

1. *Test results including cable loss;*
2. *Not recorded emission from 9 KHz to 30 MHz as emission level at least 20dBc lower than emission limit.*

6.6 Radiated Emissions and Radiation Restricted Band Measurement

6.7.1 Standard requirement:

According to §15.247 (d): 20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (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

6.7.2 Measuring Instruments and Setting:

Please refer to equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

6.7.3 Test Procedures

1) Sequence of testing 9 kHz to 30 MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 1.5 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) Sequence of testing 30 MHz to 1 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximizes the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

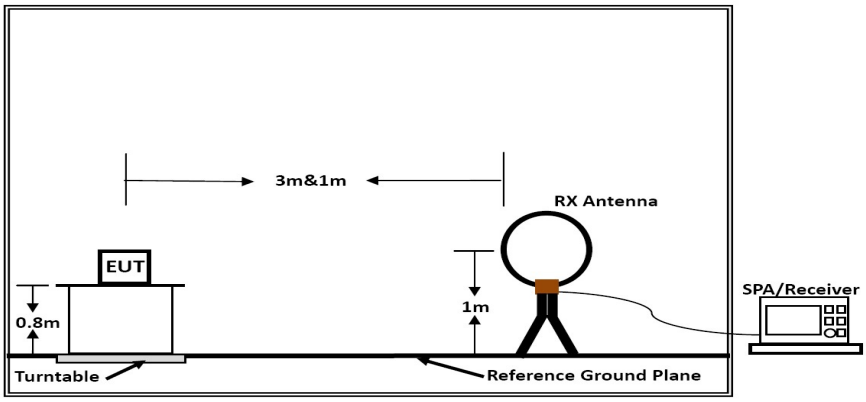
--- The antenna is moved spherical over the EUT in different polarisations of the antenna.

Final measurement:

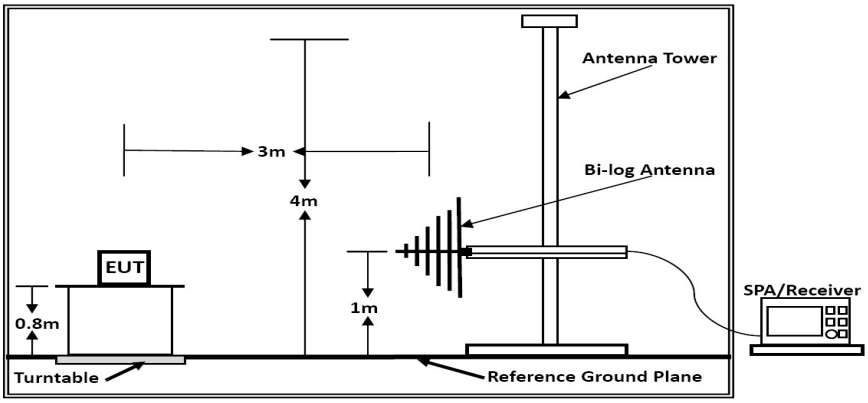
--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

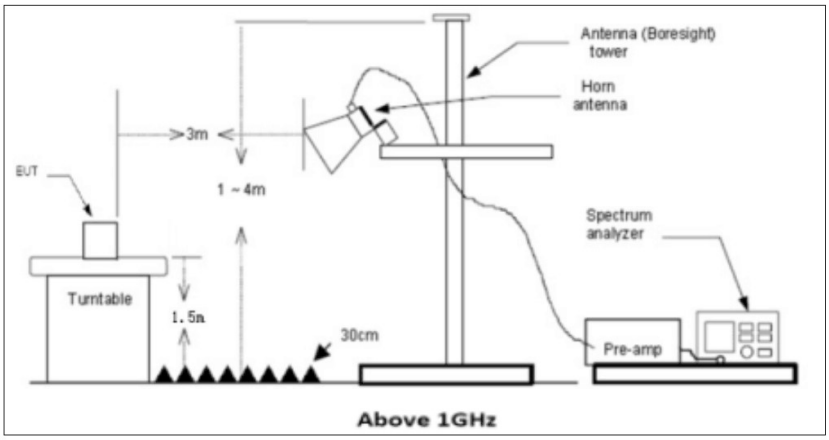
6.7.4 Test Setup Layout



Below 30MHz



Below 1GHz



Above 1GHz

Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1m.

Distance extrapolation factor = 20 log (specific distance [3m] / test distance [1m]) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

6.7.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

6.7.6 Test result

Temperature	26℃	Humidity	54%
Configurations	2.4GHz transmitting		

Remarks:

1. *Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.*

■ **Results of Radiated Emissions (9 KHz~30MHz)**

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:

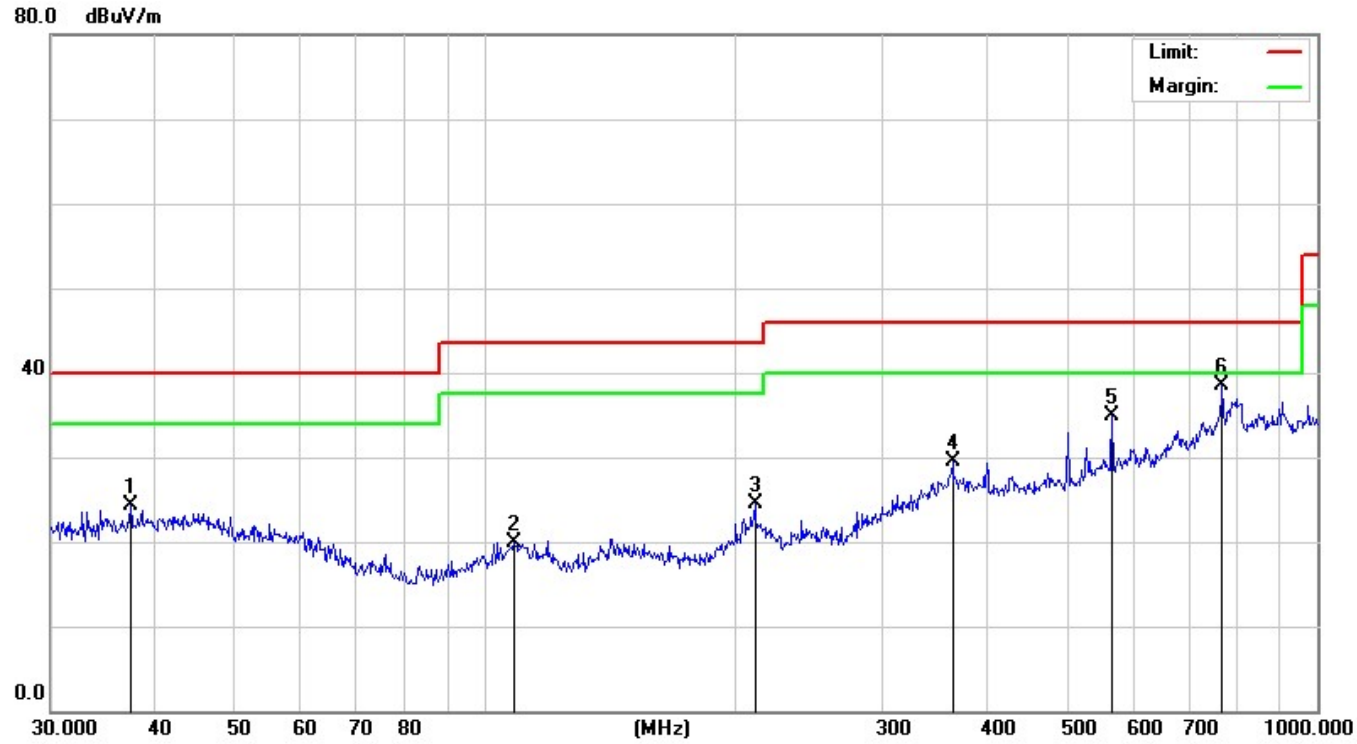
The emission from 9 kHz to 30MHz was pre-tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.

Distance extrapolation factor = 40 log (specific distance / test distance) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor.

■ **Results of Radiated Emissions (30MHz~1GHz)**

Pre-scan tests all L/M/H channels, found worst case at Middle channel, and only show the test result of this channel.

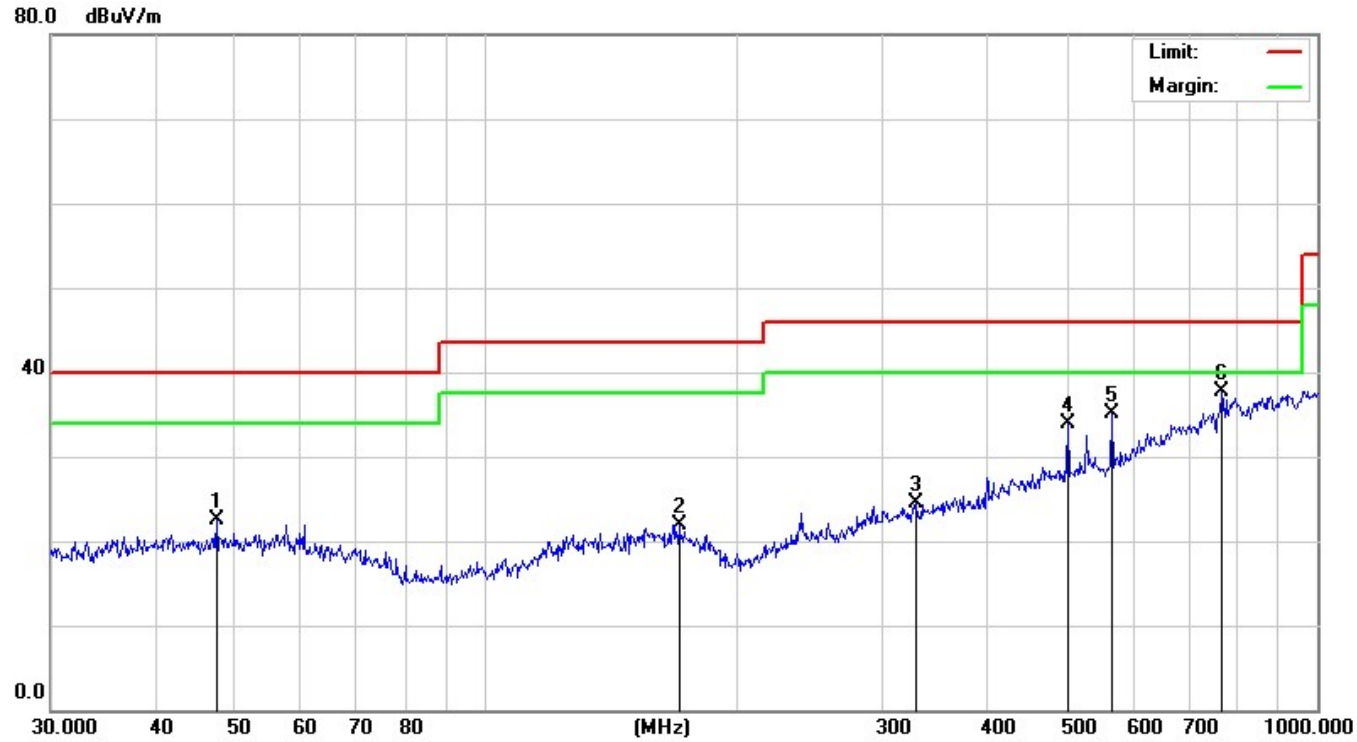
Model name:	HW20	Test Date :	2024-07-16
Polarization :	Vertical	Test Result:	☒ Pass ☐ Fail



Remark:
Emission Level = Reading + Factor;
Factor = Antenna Factor + Cable Loss – Pre-amplifier;
Margin= Emission Level - Limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	37.5254	22.96	1.38	24.34	40.00	-15.66	QP
2	108.3265	21.70	-1.79	19.91	43.50	-23.59	QP
3	210.7695	22.59	-1.95	20.64	43.50	-22.86	QP
4	364.2685	23.98	5.48	29.46	46.00	-16.54	QP
5	566.6248	27.91	6.94	34.85	46.00	-11.15	QP
6	768.7585	27.31	11.20	38.51	46.00	-7.49	QP

Model name:	HW20	Test Date :	2024-07-16
Polarization :	Horizontal	Test Result:	☒ Pass ☐ Fail



Remark:
Emission Level = Reading + Factor;
Factor = Antenna Factor + Cable Loss – Pre-amplifier;
Margin= Emission Level - Limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	47.4925	23.68	-1.25	22.43	40.00	-17.57	QP
2	170.7958	22.30	-0.37	21.93	43.50	-21.57	QP
3	329.0412	22.25	2.19	24.44	46.00	-21.56	QP
4	501.1822	27.79	6.17	33.96	46.00	-12.04	QP
5	566.6325	27.97	7.03	35.00	46.00	-11.00	QP
6	768.7505	25.62	12.01	37.63	46.00	-8.37	QP

Results for Radiated Emissions (1- 26 GHz)

Test channel:	Lowest channel

H

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB/m)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4804	49.37	5.06	54.43	74.00	-19.57	PEAK
4804	38.19	5.06	43.25	54.00	-10.75	AVG
7206	45.58	7.03	52.61	74.00	-21.39	PEAK
7206	33.64	7.03	40.67	54.00	-13.33	AVG

V

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB/m)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4804	47.49	5.06	52.55	74.00	-21.45	PEAK
4804	34.25	5.06	39.31	54.00	-14.69	AVG
7206	42.72	7.03	49.75	74.00	-24.25	PEAK
7206	29.23	7.03	36.26	54.00	-17.74	AVG

Test channel:	Middle channel

H

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB/m)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4880	48.17	5.14	53.31	74.00	-20.69	PEAK
4880	35.53	5.14	40.67	54.00	-13.33	AVG
7320	42.23	7.52	49.75	74.00	-24.25	PEAK
7320	31.01	7.52	38.53	54.00	-15.47	AVG

V

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4880	44.38	5.14	49.52	74.00	-24.48	PEAK
4880	33.88	5.14	39.02	54.00	-14.98	AVG
7320	40.71	7.52	48.23	74.00	-25.77	PEAK
7320	28.13	7.52	35.65	54.00	-18.35	AVG

Test channel:	Highest channel

H

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	
4960	47.50	5.22	52.72	74.00	-21.28	PEAK
4960	37.31	5.22	42.53	54.00	-11.47	AVG
7440	41.40	8.06	49.46	74.00	-24.54	PEAK
7440	31.28	8.06	39.34	54.00	-14.66	AVG

V

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4960	46.01	5.22	51.23	74.00	-22.77	PEAK
4960	35.31	5.22	40.53	54.00	-13.47	AVG
7440	41.25	8.06	49.31	74.00	-24.69	PEAK
7440	32.10	8.06	40.16	54.00	-13.84	AVG

Remarks:

1). Measuring frequencies from 9 KHz - 10th harmonic or 26.5GHz (which is less), No emission found between lowest internal used/generated frequency to 30MHz.

2). Radiated emissions *measured in frequency range from 9 KHz~10th harmonic or 26.5GHz (which is less) were made with an instrument using Peak detector mode.*

3). Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

4). Margin= Emission Level – Limit

5). Emission Level = Reading + Factor

6). Factor = Antenna Factor + Cable Loss – Pre-amplifier

7). All the modes have been tested and the only shows the worst case 8DPSK mode

Radiation Restricted band

GFSK-Low

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	2385.585	44.11	-5.80	38.31	74	-35.69	peak
2	2390.000	43.94	-5.72	38.22	74	-35.78	peak
3	2400.000	48.36	-5.61	42.75	74	-31.25	peak

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	2385.479	45.07	-5.94	39.13	74.00	-34.87	peak
2	2390.000	46.80	-5.94	40.86	74.00	-33.14	peak
3	2400.000	49.30	-5.65	43.65	74.00	-30.35	peak

GFSK-High

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	2483.500	40.70	-5.14	35.56	74.00	-38.44	peak
2	2483.558	41.76	-5.08	36.68	74.00	-37.32	peak

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	2483.500	41.20	-4.89	36.31	74.00	-37.69	peak
2	2484.785	42.90	-5.02	37.88	74.00	-36.12	peak

Remarks:

1). Margin= Emission Level – Limit

2). Emission Level = Reading + Factor

3). Factor = Antenna Factor + Cable Loss – Pre-amplifie

4). All the modes have been tested and the only shows the worst case 8DPSK mode.

5).The PEAK value is less than the AVG limit, the AVG result no need be show in this report.

6.7 Conducted Emissions

6.8.1 Standard requirement:

According to §15.207 (a): For an intentional radiator which 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

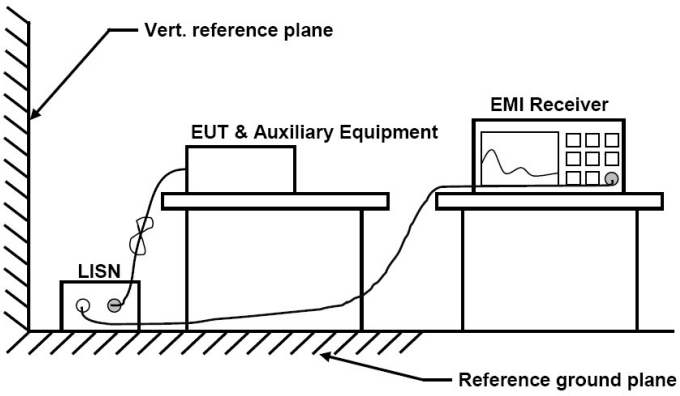
* Decreasing linearly with the logarithm of the frequency

6.8.2 Test Procedures

The transmitter output is connected to EMI receiver. The resolution bandwidth is set to 9 kHz. The video bandwidth is set to 30 kHz, Sweep time=Auto

The spectrum from 150 kHz to 30MHz is investigated with the transmitter set to the lowest, middle, and highest channels.

6.8.3 Test Setup Layout



6.8.4 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

6.8.5 Test result

PASS

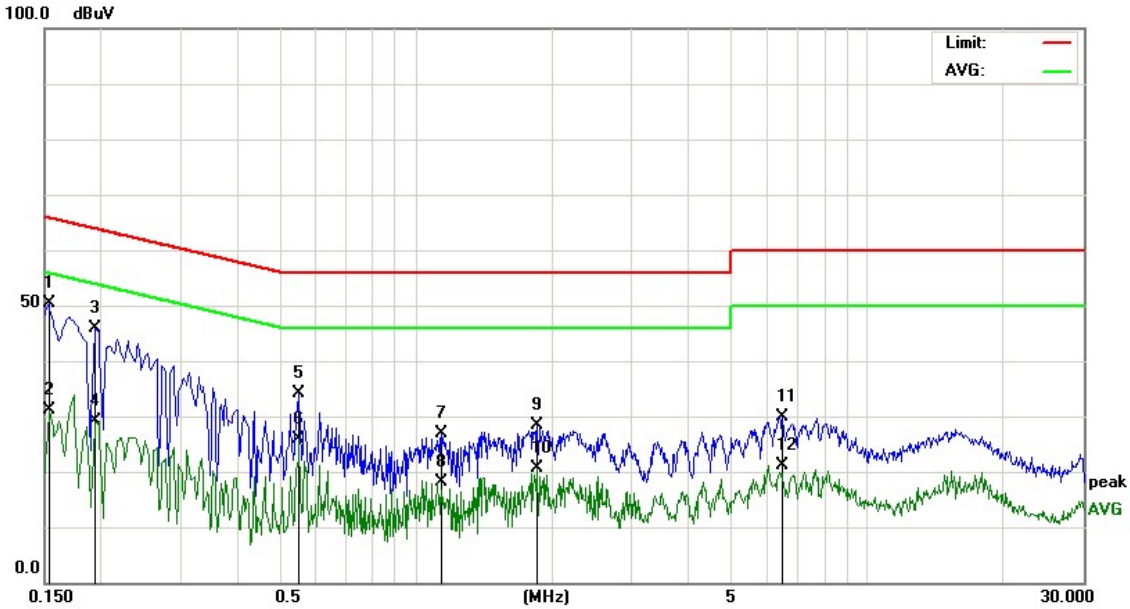
The test data please refer to following page.

Temperature	26℃	Humidity	54%
Configurations	2.4GHz Middle channel		

Measurement data:

Pre-scan tests all L/M/H channels, found worst case at Middle channel, and only show the test result of this channel.

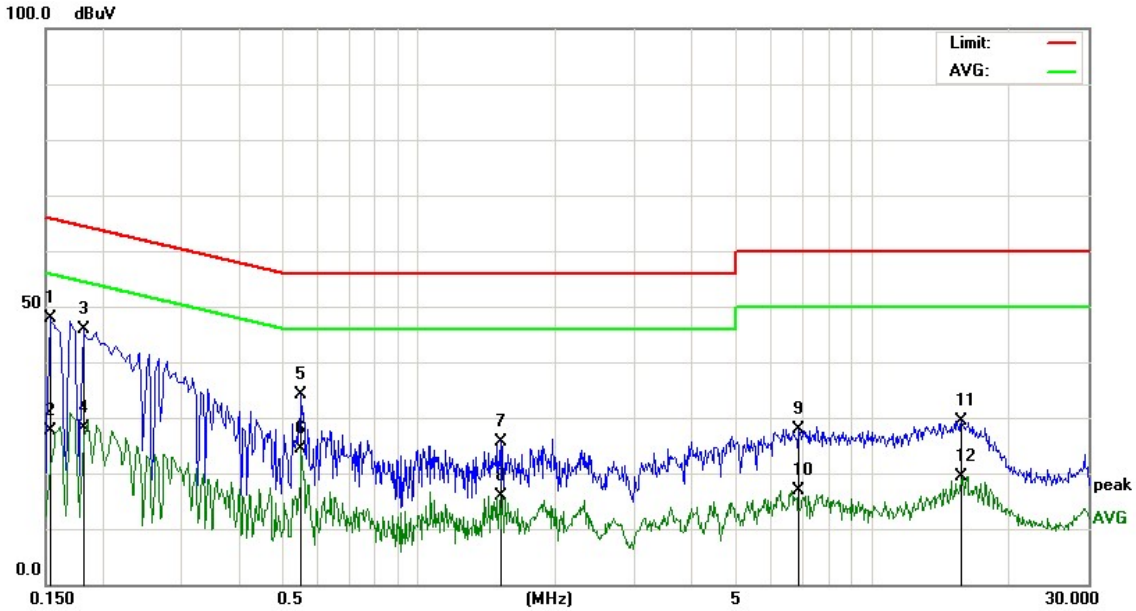
Model name:	HW20	Test Date :	2024-07-16
ATM Pressure:	101 kPa	Test Result:	☒ Pass ☐ Fail
Phase :	Line		



Remark: Correct Factor = Insertion loss of LISN + Cable loss + Insertion loss of Pulse Limiter;
Measurement Result = Reading Level +Correct Factor;
Margin = Measurement Result- Limit;

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1544	38.32	11.83	50.15	65.78	-15.63	QP
2	0.1544	19.15	11.83	30.98	55.78	-24.80	AVG
3	0.1941	34.65	11.20	45.85	63.86	-18.01	QP
4	0.1941	17.48	11.20	28.68	53.86	-25.18	AVG
5	0.5505	24.15	10.01	34.16	56.00	-21.84	QP
6	0.5505	15.66	10.01	25.67	46.00	-20.33	AVG
7	1.1375	16.48	9.93	26.41	56.00	-29.59	QP
8	1.1375	8.10	9.93	18.03	46.00	-27.97	AVG
9	1.8581	18.35	10.00	28.35	56.00	-27.65	QP
10	1.8581	10.41	10.00	20.41	46.00	-25.59	AVG
11	6.4782	19.63	10.13	29.76	60.00	-30.24	QP
12	6.4782	10.89	10.13	21.02	50.00	-28.98	AVG

Model name:	HW20	Test Date :	2024-07-16
ATM Pressure:	101 kPa	Test Result:	☒ Pass ☐ Fail
Phase :	Neutral		



Remark: Correct Factor = Insertion loss of LISN + Cable loss + Insertion loss of Pulse Limiter;
Measurement Result = Reading Level +Correct Factor;
Margin = Measurement Result- Limit;

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1544	36.01	11.83	47.84	65.78	-17.94	QP
2	0.1544	15.82	11.83	27.65	55.78	-28.13	AVG
3	0.1825	34.58	11.35	45.93	64.39	-18.46	QP
4	0.1825	16.82	11.35	28.17	54.39	-26.22	AVG
5	0.5505	24.18	10.01	34.19	56.00	-21.81	QP
6	0.5505	14.39	10.01	24.40	46.00	-21.60	AVG
7	1.5265	15.72	9.98	25.70	56.00	-30.30	QP
8	1.5265	5.84	9.98	15.82	46.00	-30.18	AVG
9	6.8778	17.65	10.16	27.81	60.00	-32.19	QP
10	6.8778	6.62	10.16	16.78	50.00	-33.22	AVG
11	15.7536	18.83	10.55	29.38	60.00	-30.62	QP
12	15.7536	8.76	10.55	19.31	50.00	-30.69	AVG

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.

7 Test Setup Photographs of EUT

Please refer to separated files for Test Setup Photos of the EUT.

8 External Photographs of EUT

Please refer to separated files for External Photos of the EUT.

9 Internal Photographs of EUT

Please refer to separated files for Internal Photos of the EUT.

------End------