FCC Part 15 Subpart C

EMI TEST REPORT

(CLASS II PERMISSIVE CHANGE)

of

E.U.T. : WIRELESS RECEIVER
FCC ID. : DMOEMXSW1D
Model No. : EM-XSW1 DUAL, EM-XSW1, EM-XSW2
Working Frequency : 2433 MHz ~ 2473 MHz

for

APPLICANT : Sennheiser Electronic Corp
ADDRESS : 1 Enterprise Drive, Old Lyme, CT 06371, USA

Test Performed by

TAIWAN TESTING AND CERTIFICATION CENTER
NO. 34. LIN 5, DINGFU VIL., LINKOU DIST.,
NEW TAIPEI CITY, TAIWAN, 24442, R.O.C.
TEL : (02)26023052 FAX : (02)26010910
http:// www.etc.org.tw ; e-mail:emc@etc.org.tw

Report Number : 22-12-RBF-009-06

Table of Contents *Page*

1.Report Version History：

The following revisions have been made to ETC report No. 19-10-RBF-028-01/19-10-RBF-028-01-A

Report No.	Date of issue	Description
19-10-RBF-028-01	Oct. 29, 2019	First Version.
19-10-RBF-028-01-A	Mar. 25, 2020	Second Version.
22-12-RBF-009-06	Jul. 27, 2023	1.Reference Test Report (Data from ETC Report No.19-10-RBF-028-01/19-10-RBF-028-01-A) Class II Change Description: To change the PIN with the same VCO and Components. Does not change the part of RF for the 2.4GHz SYNC. The changes filed to this application as following the KDB Publication 178919 D01 (C2PC) which describes general permissive change policies.

2.TEST REPORT CERTIFICATION

Applicant	:	Sennheiser Electronic Corp 1 Enterprise Drive, Old Lyme, CT 06371, USA
Manufacturer	:	Sennheiser electronic GmbH & Co. KG Am Labor 1 30900 Wedemark, Germany
Factory	:	MASCOT ELECTRIC CO., LTD NO. 85, CHANGXING 1ST ST., RENDE DIST., TAINAN CITY 717, TAIWAN
Description of EUT	:	
a) Type of EUT	:	WIRELESS RECEIVER
b) Trade Name	:	SENNHEISER
c) Model No.	:	EM-XSW1 DUAL, EM-XSW1, EM-XSW2
d) FCC ID	:	DMOEMXSW1D
e) Working Frequency	:	2433 MHz ~ 2473 MHz
f) Power Supply	:	AC/DC Adapter Type: NT12-5CW Model: SSC-5WVI-12 120050 I/P: AC100-240V, 50-60Hz, 0.2A O/P: 12Vdc, 500mA

Regulation Applied: FCC Rules and Regulations Part 15 Subpart C

I HEREBY CERTIFY THAT; The data shown in this report were made in accordance with the procedures given in ANSI C63.10-2013 and the energy emitted by the device was founded to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these data.

Summary of Tests

Test	Results
Radiated Emission	**Pass**
Conducted Emission	**Pass**

Issued Date : Jul. 27, 2023

Brian Huang

Test Engineer : _____

(Brian Huang, Engineer)

:

Approve & Authorized

Kevin Lee

Kevin Lee, Section Manager
EMC Dept. II of TAIWAN
TESTING AND CERTIFICATION
CENTER

3. GENERAL INFORMATION

3.1 Product Description

a) Type of EUT : WIRELESS RECEIVER
b) Trade Name : SENNHEISER
c) Model No. : EM-XSW1 DUAL, EM-XSW1, EM-XSW2
d) Power Supply : Model: SSC-5WVI-12 120050 (Type: NT12-5CW)
I/P: AC100-240V, 50-60Hz,0.2A；O/P: 12Vdc, 500mA
e) Frequency Range : 2433 MHz ~ 2473 MHz

3.2 Characteristics of Device

The EUT is a Wireless Microphone Receiver with 2.4GHz SYNC function.

3.3 Test Methodology

Both conducted and radiated emissions were performed according to the procedures illustrated in ANSI C63.10-2013. Other required measurements were illustrated in separate sections of this test report for details.

Measurement Software

Software	Version	Note
e3	Version 6.100618f	Radiated Emission Test
e3	Version 6.100421	Conducted Emission Test

3.4 Test Facility

Location of the Test site: No.34, Lin 5, Dingfu Vil., Linkou Dist., New Taipei City, Taiwan 24442, R.O.C.

Designation Number: TW2628.

4. PROVISIONS APPLICABLE

4.1 Definition

Unintentional radiator:

A device that intentionally generates and radio frequency energy for use within the device, or that sends radio frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction.

Class A Digital Device:

A digital device which is marketed for use in commercial or business environment; exclusive of a device which is market for use by the general public, or which is intended to be used in the home.

Class B Digital Device :

A digital device which is marketed for use in a residential environment notwithstanding use in a commercial, business of industrial environment. Example of such devices that are marketed for the general public.

Note : A manufacturer may also qualify a device intended to be marketed in a commercial, business, or industrial environment as a Class B digital device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B Digital Device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B Digital Device, Regardless of its intended use.

Intentional radiator:

A device that intentionally generates and emits radio frequency energy by radiation or induction.

4.2 Requirement for Compliance

(1) Conducted Emission Requirement

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50MH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency MHz	Quasi Peak dB μ V	Average dB μ V
0.15 - 0.5	66-56	56-46
0.5 - 5.0	56	46
5.0 - 30.0	60	50

(2) Radiated Emission Requirement

For unintentional device, according to §15.109(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency MHz	**Distance Meters**	**Radiated dB μ V/m**	**Radiated μ V/m**
30 - 88	3	40.0	100
88 - 216	3	43.5	150
216 - 960	3	46.0	200
Above 960	3	54.0	500

For intentional device, according to §15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

For intentional radiator device, per §15.249(a), the field strength of emissions shall comply with the following :

Frequency MHz	**Distance Meters**	**Fundamental**		**Harmonic**	
		dB μV/m	**mV/m**	**dB μV/m**	**μV/m**
902 - 928	3	94	50	54	500
2400 - 2483.5	3	94	50	54	500
5725 - 5875	3	94	50	54	500
24000 - 24250	3	108	250	68	2500

In accordance with §15.249(e), limits shown in above table are based on average limits for frequencies above 1000 MHz, and frequencies below 1000 MHz are based on quasi peak. However, the peak field strength of any emission shall not exceed the maximum permitted average limits by more than 20 dB.

(3) Spurious in Out Band Requirement

For intentional device, according to §15.249 (d), emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits in §15.209.

(4) Antenna Requirement

For intentional device, according to §15.203, 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.

4.3 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below :

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.25
0.495 - 0.505 **	16.69475 - 16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425 - 16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475 - 156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3360-4400	Above 38.6
13.36-13.41			

** : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

4.4 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

4.5 User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual.

The Federal Communications Commission Radio Frequency Interference Statement includes the following paragraph.

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna.

-- Increase the separation between the equipment and receiver.

-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-- Consult the dealer or an experienced radio / TV technician for help.

5. SYSTEM TEST CONFIGURATION

5.1 Justification

For both radiated and conducted emissions, the system was configured for testing in a typical fashion as a customer would normally use it. The peripherals other than EUT were connected in normally standing by situation.

All measurement were intentional to maximum the emissions from EUT by varying the connection cables(if applicable), therefore, the test result is sure to meet the applicable requirement.

5.2 Devices for Tested System

Device	Manufacturer	Model / FCC ID	Description
WIRELESS RECEIVER*	Sennheiser electronic GmbH & Co. KG	EM-XSW1 DUAL, EM-XSW1, EM-XSW2 / DMOEMXSW1D	1.5m Unshielded AC Adapter

Remark "*" means equipment under test.

6. RADIATED EMISSION MEASUREMENT

6.1 Applicable Standard

For intentional radiators, according to §15.249 (a), the fundamental field strength shall not exceed 94 dBμV/m and the harmonics shall not exceed 54 dBμV/m. For out band emission except for harmonics shall be comply with §15.209 or at least attenuated by 50 dB below the level of the fundamental.

6.2 Measurement Procedure

1. Setup the configuration per figure 1 and 2 for frequencies measured below and above 1 GHz respectively.

2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.

3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.

4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0 ° to 360 ° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.

5. Repeat step 4 until all frequencies need to be measured were complete.

6. Repeat step 5 with search antenna in vertical polarized orientations.

7. Check the three frequencies of highest emission with varying the placement of cables associated with EUT to obtain the worse case and record the result.

Figure 1 : Frequencies measured below 1 GHz configuration

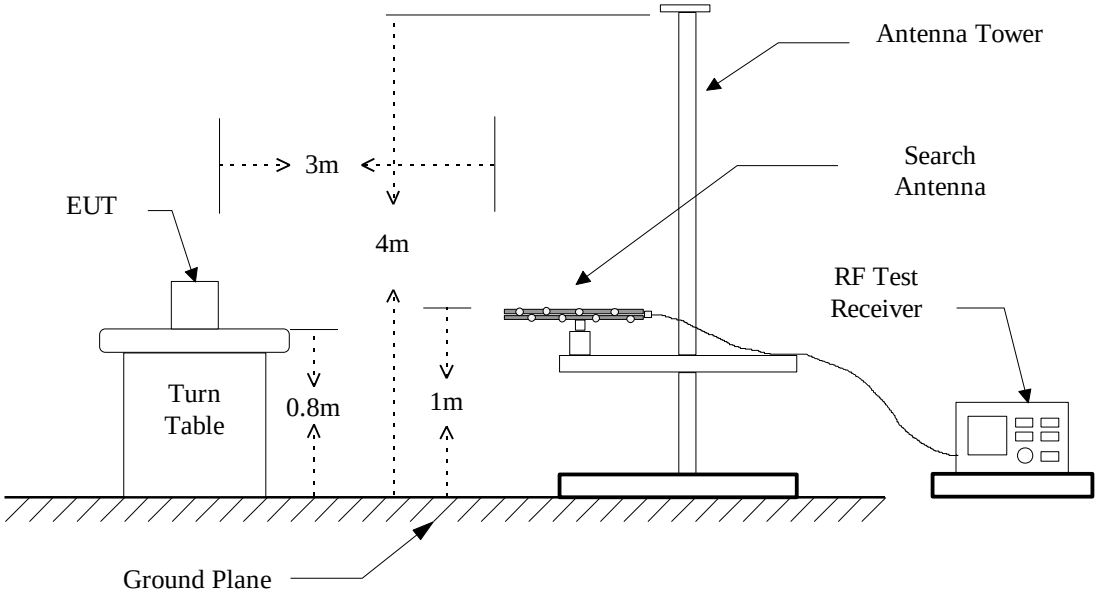
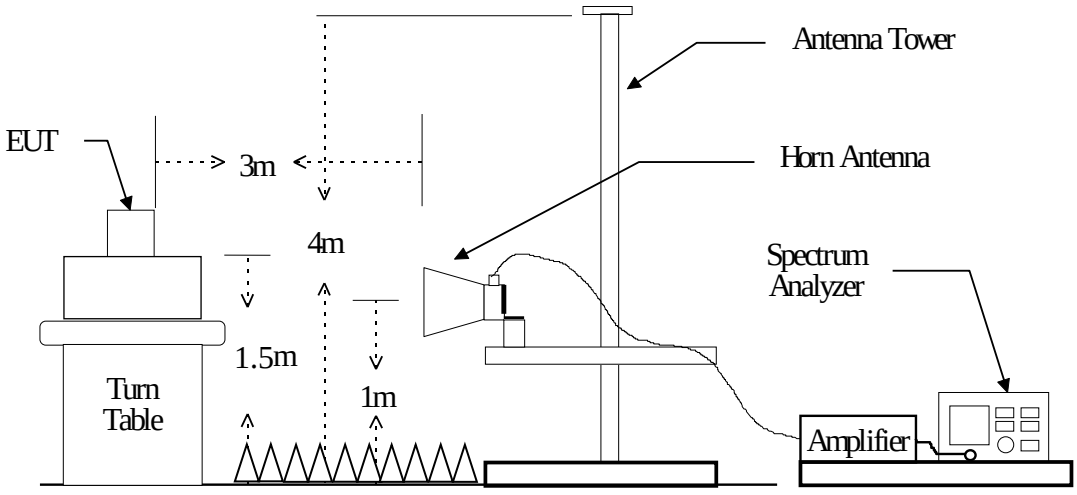


Figure 2 : Frequencies measured above 1 GHz configuration



6.3 Measuring Instrument

The following instrument are used for radiated emissions measurement:

Equipment	**Manufacturer**	**Model No.**	**Assets No.**	**Calibration Date**	**Next Cal. Date**
EMI Test Receiver	Rohde & Schwarz	ESU 40	13054416-001	2023/03/03	2024/03/02
Amplifier	HP	8447D	13040711-001	2022/09/06	2023/09/05
Bilog Antenna with 6dB Pad	ETC & JYEBAO	MCTD 2786 & FAT-NM5NF5T3G2W6	13057618-002&RF-002 (BL13J03015&RF-002)	2022/09/20	2023/09/19

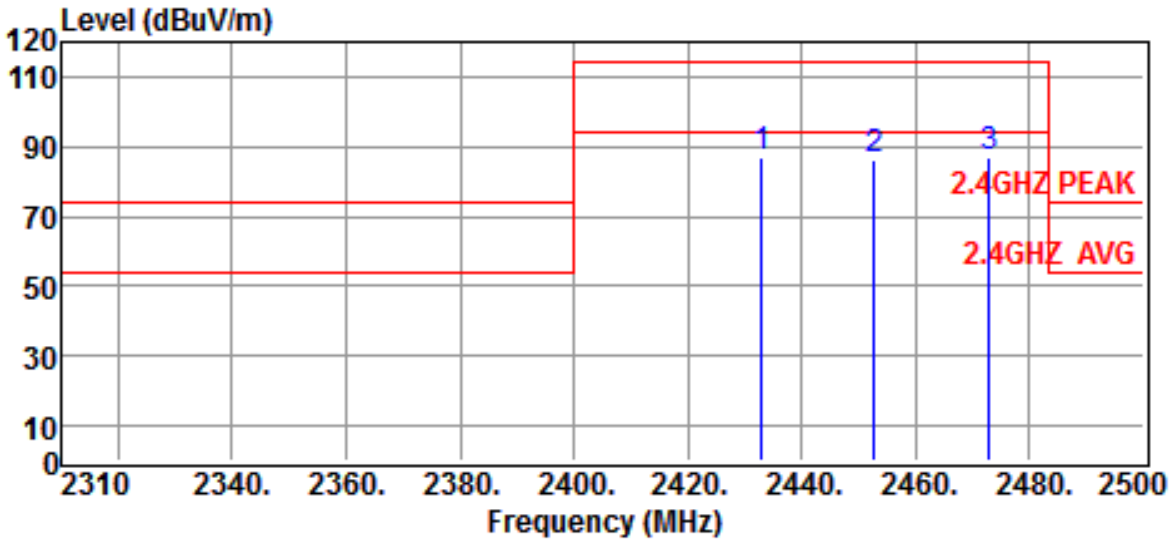
Measuring instrument setup in measured frequency band when specified detector function is used :

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	RF Test Receiver	Quasi-Peak	120 kHz	N/A
	Spectrum Analyzer	Peak	100 kHz	100 kHz
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	10 Hz or ≥ 1/T (Note 1)

Note 1:
VBW = 10 Hz, when the duty cycle is no less than 98%.
VBW ≥ 1/T, when duty cycle is less than 98% where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

6.4 Radiated Emission Data

Refer to the original report (No. 19-10-RBF-028-01/19-10-RBF-028-01-A) that the worst-case test case on the selected frequency and mode has been tested. The chosen worst-case depend on the maximum output power level in the testing.

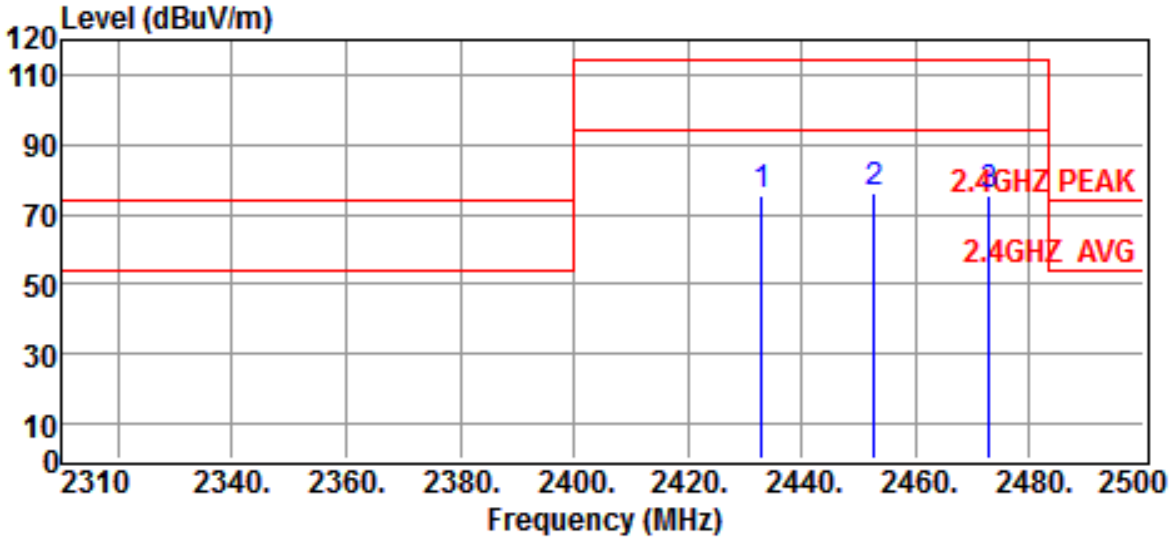


Site	:Chamber #2	Date	:2023-07-27
Limit	:2.4GHZ PEAK	Ant. Pol.	:VERTICAL
EUT	:EM-XSW1 DAUL	Model	:EM-XSW1 DAUL
Power Rating	:120Vac60Hz	Temp.	:22°C
Engineer	:Brian Huang	Humi.	:60 %
Test Mode	:TX Mode (2433MHz-2452MHz-2472MHz)		

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	2433.0000	86.61	0.01	86.62	114.00	-27.38	Peak
	2452.8000	86.47	-0.14	86.33	114.00	-27.67	Peak
*	2472.8000	86.85	-0.14	86.71	114.00	-27.29	Peak

Note :
1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. ” * ” mean this data is the worst emission level.

Refer to the original report (No. 19-10-RBF-028-01/19-10-RBF-028-01-A) that the worst-case test case on the selected frequency and mode has been tested. The chosen worst-case depend on the maximum output power level in the testing.

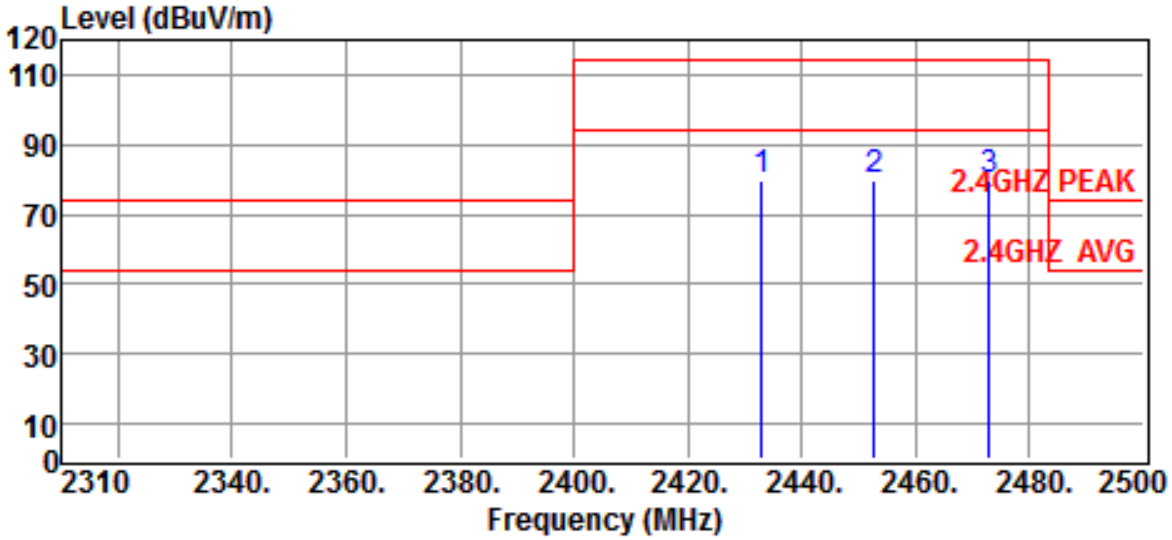


Site	:Chamber #2	Date	:2023-07-27
Limit	:2.4GHZ PEAK	Ant. Pol.	:VERTICAL
EUT	:EM-XSW1	Model	:EM-XSW1
Power Rating	:120Vac60Hz	Temp.	:22°C
Engineer	:Brian Huang	Humi.	:60 %
Test Mode	:TX Mode (2433MHz-2452MHz-2472MHz)		

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	2433.0000	75.48	0.01	75.49	114.00	-38.51	Peak
*	2452.8000	76.19	-0.14	76.05	114.00	-37.95	Peak
	2472.8000	75.81	-0.14	75.67	114.00	-38.33	Peak

Note :
1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. ” * ” mean this data is the worst emission level.

Refer to the original report (No. 19-10-RBF-028-01/19-10-RBF-028-01-A) that the worst-case test case on the selected frequency and mode has been tested. The chosen worst-case depend on the maximum output power level in the testing.



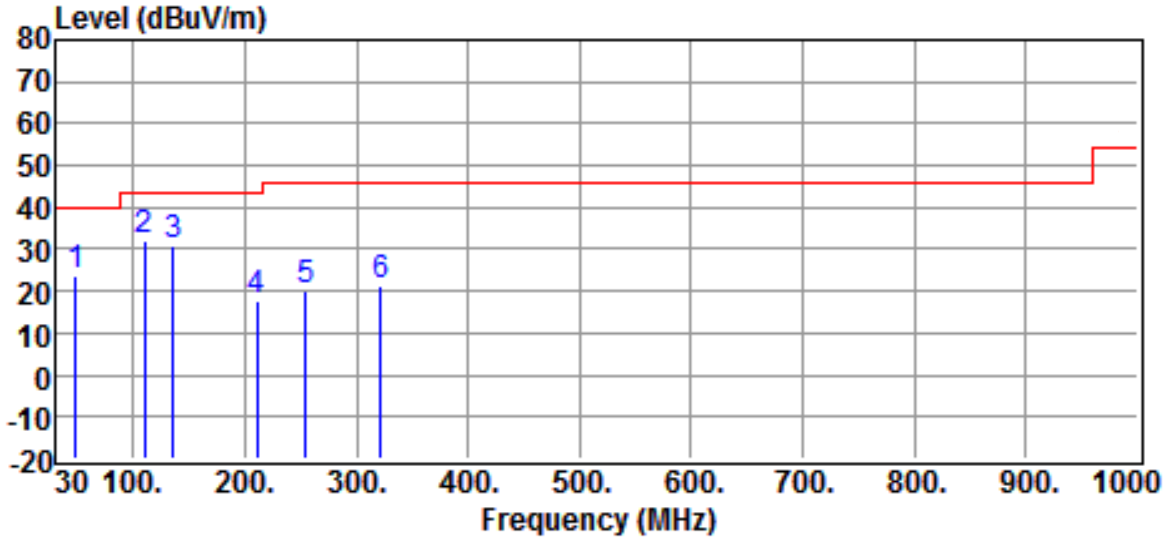
Site	:Chamber #2	Date	:2023-07-27
Limit	:2.4GHZ PEAK	Ant. Pol.	:VERTICAL
EUT	:EM-XSW2	Model	:EM-XSW2
Power Rating	:120Vac60Hz	Temp.	:22°C
Engineer	:Brian Huang	Humi.	:60 %
Test Mode	:TX Mode (2433MHz-2452MHz-2472MHz)		

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	2433.0000	79.65	0.01	79.66	114.00	-34.34	Peak
	2452.8000	80.08	-0.14	79.94	114.00	-34.06	Peak
*	2472.8000	80.19	-0.14	80.05	114.00	-33.95	Peak

Note :
1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. ” * ” mean this data is the worst emission level.

6.4.1 Other Emissions

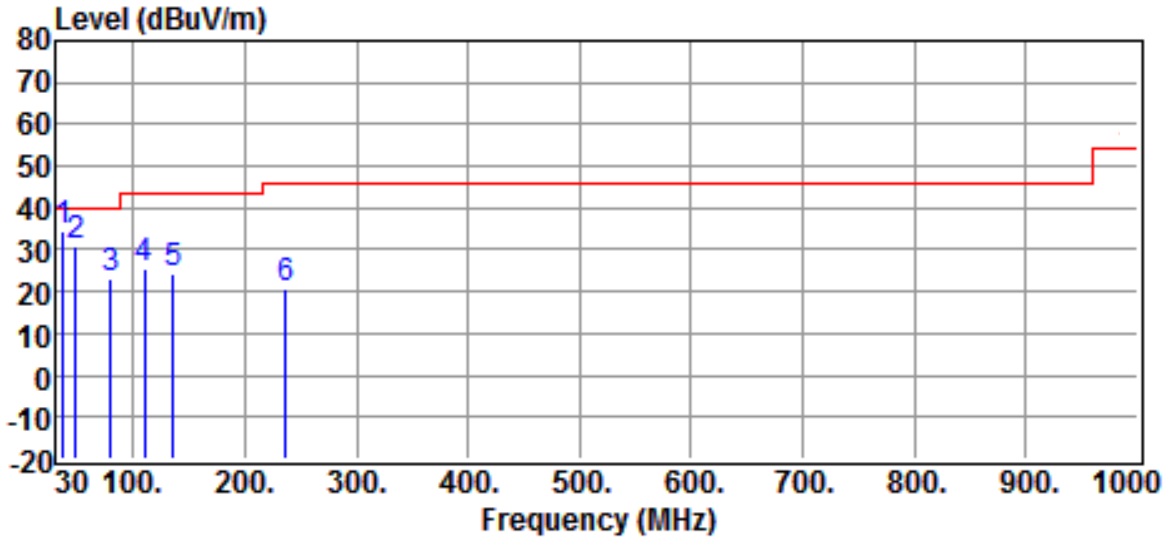
a) Emission frequencies below 1 GHz (worst-case test case)



Site	:Chamber#2	Date	:2023-03-16
Limit	:FCC 15.209	Ant. Pol.	:HORIZONTAL
EUT	: WIRELESS RECEIVER	Model	:EM-XSW1 DUAL
Power Rating	:120Vac60Hz(5116)	Temp.	:22˚C
Engineer	:Brian Huang	Humi.	:60 %
Test Mode	:Operation Mode (2472.8MHz)		

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	48.4300	37.73	-13.84	23.89	40.00	-16.11	QP
*	109.5400	44.32	-12.00	32.32	43.50	-11.18	QP
	135.7300	41.57	-10.87	30.70	43.50	-12.80	QP
	210.4200	27.59	-9.90	17.69	43.50	-25.81	QP
	254.0700	28.17	-8.32	19.85	46.00	-26.15	QP
	321.9700	27.57	-6.37	21.20	46.00	-24.80	QP

Note :
1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. ” * ” mean this data is the worst emission level.

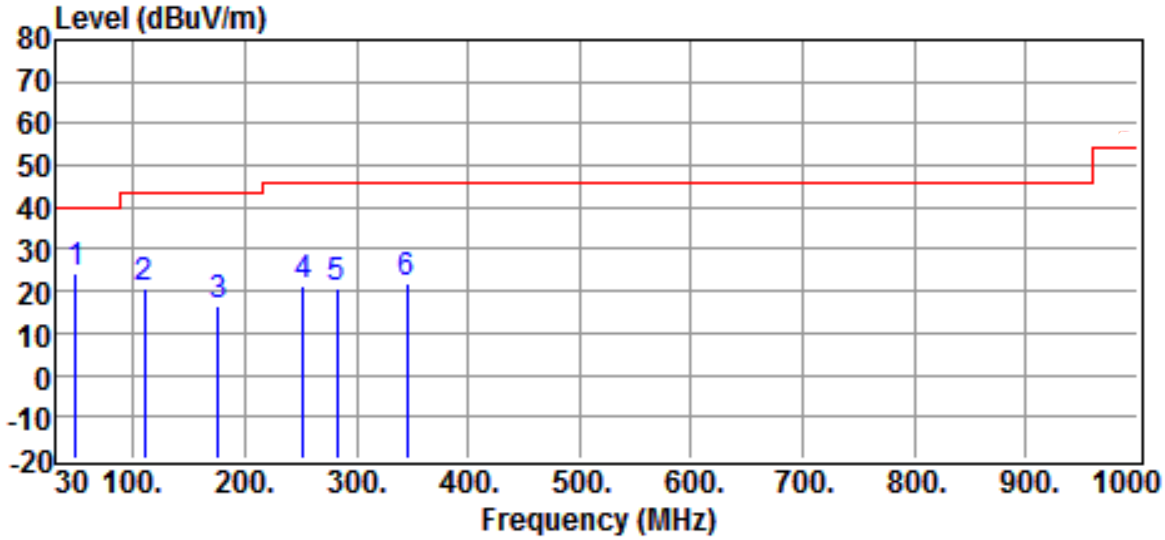


Site	:Chamber#2	Date	:2023-03-16
Limit	:FCC 15.209	Ant. Pol.	:VERTICAL
EUT	: WIRELESS RECEIVER	Model	:EM-XSW1 DUAL
Power Rating	:120Vac60Hz(5116)	Temp.	:22 ˚C
Engineer	:Brian Huang	Humi.	:60 %
Test Mode	:Operation Mode (2472.8MHz)		

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
*	37.7600	42.42	-7.95	34.47	40.00	-5.53	QP
	48.4300	44.68	-13.84	30.84	40.00	-9.16	QP
	79.4700	38.56	-15.68	22.88	40.00	-17.12	QP
	110.5100	37.81	-12.08	25.73	43.50	-17.77	QP
	135.7300	35.00	-10.87	24.13	43.50	-19.37	QP
	236.6100	30.92	-10.41	20.51	46.00	-25.49	QP

Note :
1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. ” * ” mean this data is the worst emission level.

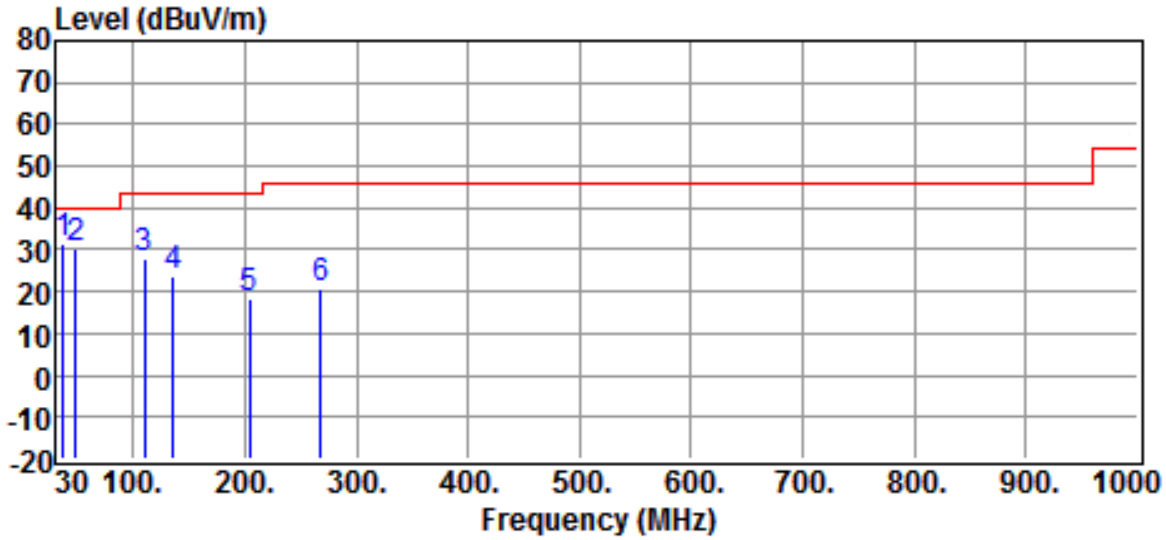
a) Emission frequencies below 1 GHz (worst-case test case)



Site	:Chamber#2	Date	:2023-03-16
Limit	:FCC 15.209	Ant. Pol.	:HORIZONTAL
EUT	: WIRELESS RECEIVER	Model	:EM-XSW1
Power Rating	:120Vac60Hz(5116)	Temp.	:22 ˚C
Engineer	:Brian Huang	Humi.	:60 %
Test Mode	:Operation Mode (2452.8MHz)		

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
*	48.4300	38.09	-13.84	24.25	40.00	-15.75	QP
	109.5400	32.45	-12.00	20.45	43.50	-23.05	QP
	176.4700	29.07	-12.27	16.80	43.50	-26.70	QP
	252.1300	29.64	-8.50	21.14	46.00	-24.86	QP
	282.2000	28.18	-7.62	20.56	46.00	-25.44	QP
	345.2500	27.69	-5.91	21.78	46.00	-24.22	QP

Note :
1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. ” * ” mean this data is the worst emission level.

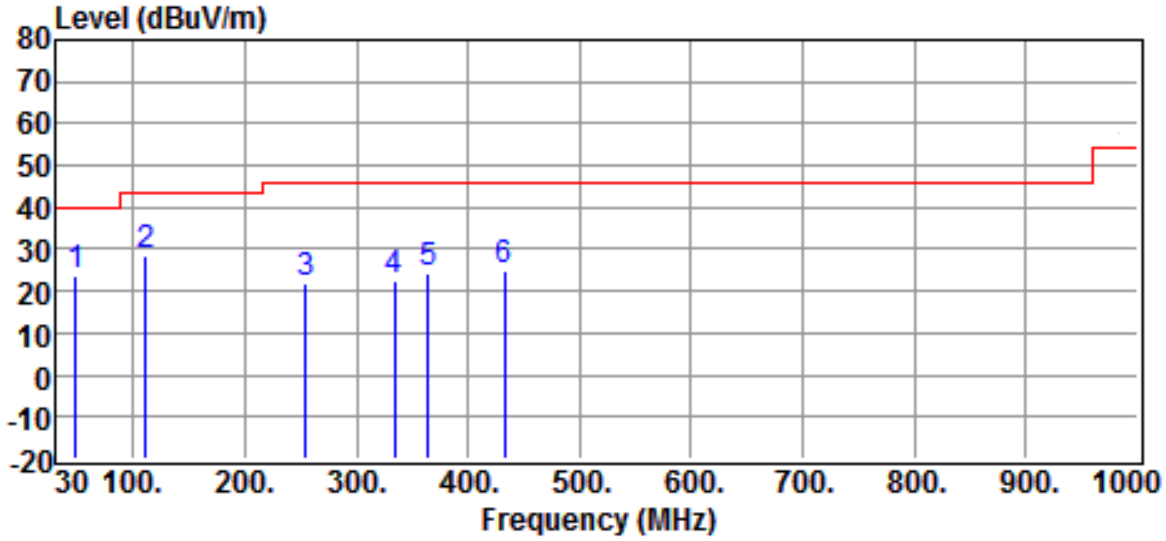


Site	:Chamber#2	Date	:2023-03-16
Limit	:FCC 15.209	Ant. Pol.	:VERTICAL
EUT	: WIRELESS RECEIVER	Model	:EM-XSW1
Power Rating	:120Vac60Hz(5116)	Temp.	:22 ˚C
Engineer	:Brian Huang	Humi.	:60 %
Test Mode	:Operation Mode (2452.8MHz)		

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
*	37.7600	39.49	-7.95	31.54	40.00	-8.46	QP
	48.4300	44.29	-13.84	30.45	40.00	-9.55	QP
	109.5400	39.94	-12.00	27.94	43.50	-15.56	QP
	135.7300	34.68	-10.87	23.81	43.50	-19.69	QP
	203.6300	29.00	-10.80	18.20	43.50	-25.30	QP
	267.6500	28.90	-8.20	20.70	46.00	-25.30	QP

Note :
1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. ” * ” mean this data is the worst emission level.

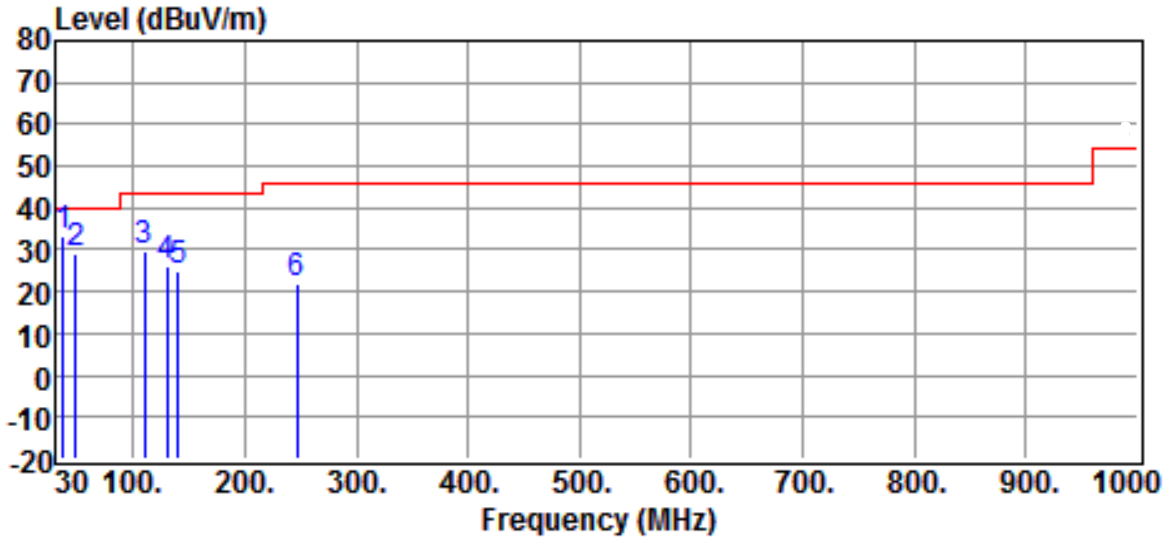
a) Emission frequencies below 1 GHz (worst-case test case)



Site	:Chamber#2	Date	:2023-03-16
Limit	:FCC 15.209	Ant. Pol.	:HORIZONTAL
EUT	: WIRELESS RECEIVER	Model	:EM-XSW2
Power Rating	:120Vac60Hz(5116)	Temp.	:22 ˚C
Engineer	:Brian Huang	Humi.	:60 %
Test Mode	:Operation Mode (2472.8MHz)		

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	48.4300	37.26	-13.84	23.42	40.00	-16.58	QP
*	111.4800	40.53	-11.99	28.54	43.50	-14.96	QP
	255.0400	30.03	-8.24	21.79	46.00	-24.21	QP
	334.5800	28.95	-6.19	22.76	46.00	-23.24	QP
	364.6500	29.48	-5.36	24.12	46.00	-21.88	QP
	432.5500	29.26	-4.23	25.03	46.00	-20.97	QP

Note :
1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. ” * ” mean this data is the worst emission level.



Site	:Chamber#2	Date	:2023-03-16
Limit	:FCC 15.209	Ant. Pol.	:VERTICAL
EUT	: WIRELESS RECEIVER	Model	:EM-XSW2
Power Rating	:120Vac60Hz(5116)	Temp.	:22 ˚C
Engineer	:Brian Huang	Humi.	:60 %
Test Mode	:Operation Mode (2472.8MHz)		

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
*	37.7600	41.43	-7.95	33.48	40.00	-6.52	QP
	48.4300	43.16	-13.84	29.32	40.00	-10.68	QP
	109.5400	41.75	-12.00	29.75	43.50	-13.75	QP
	129.9100	37.39	-11.10	26.29	43.50	-17.21	QP
	140.5800	35.90	-10.74	25.16	43.50	-18.34	QP
	247.2800	31.28	-9.24	22.04	46.00	-23.96	QP

Note :
1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. ” * ” mean this data is the worst emission level.

b) Emission frequencies above 1 GHz

Radiated emission frequencies above 1 GHz to 26.5 GHz were too low to be measured with a pre-amplifier of 35 dB and only the worst case has been presented in this report.

c) Emission frequencies below 30MHz (9kHz - 30MHz)

According to 15.31, (o) The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators that are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.

6.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss(if used) and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

Result = Reading + Corrected Factor

where Corrected Factor

= Antenna FACTOR + Cable Loss + High Pass Filter Loss - Amplifier Gain

6.6 Photos of Radiation Measuring Setup

1)Test model： EM-XSW1 DUAL

2)Test model： EM-XSW1

3)Test model： EM-XSW2

7. CONDUCTED EMISSION MEASUREMENT

7.1 Standard Applicable

For unintentional and intentional device, Line Conducted Emission Limits are in accordance to § 15.107(a) and § 15.207(a) respectively. Both Limits are identical specification.

7.2 Measurement Procedure

1. Setup the configuration per figure 3.

2. A preliminary scan with a spectrum monitor is performed to identify the frequency of emission that has the highest amplitude relative to the limit by operating the EUT in selected modes of operation, typical cable positions, and with a typical system configuration.

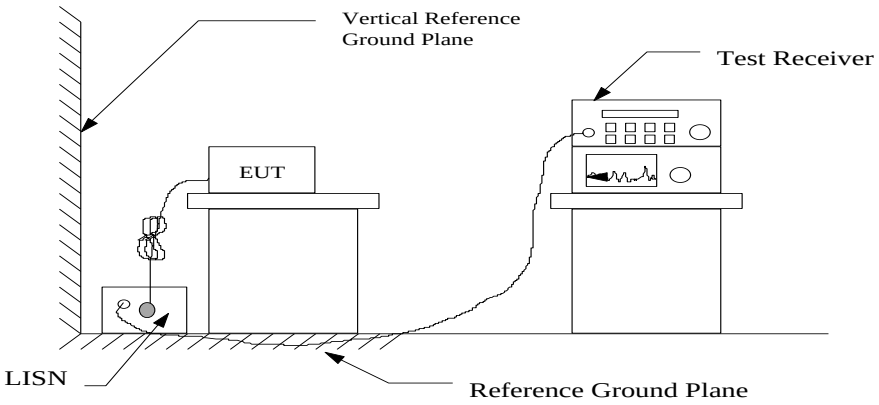
3. Record the 6 or 8 highest emissions relative to the limit.

4. Measure each frequency obtained from step 3 by a test receiver set on quasi peak detector function, and then record the accuracy frequency and emission level. If all emissions measured in the specified band are attenuated more than 20 dB from the limit, this step would be ignored, and the peak detector function would be used.

5. Confirm the highest three emissions with variation of the EUT cable configuration and record the final data.

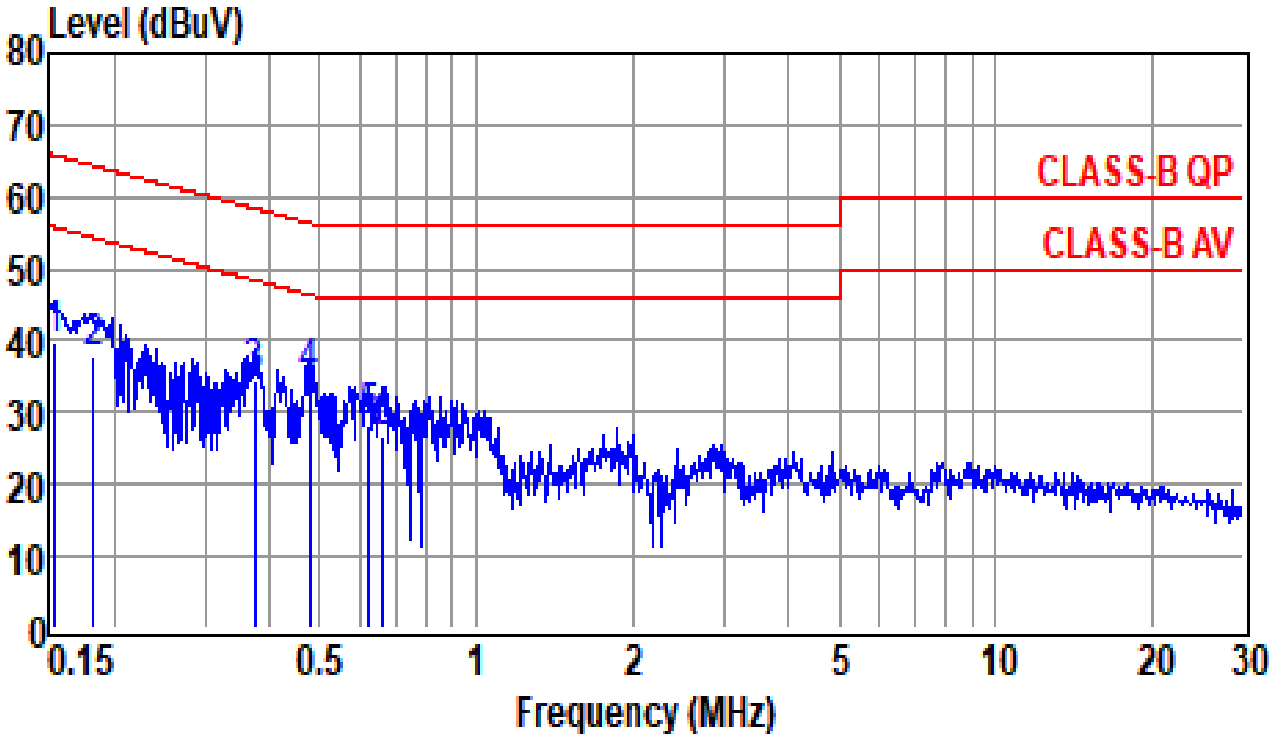
6. Repeat all above procedures on measuring each operation mode of EUT.

Figure 3 : Conducted emissions measurement configuration



7.3 Conducted Emission Data

(worst-case test case)



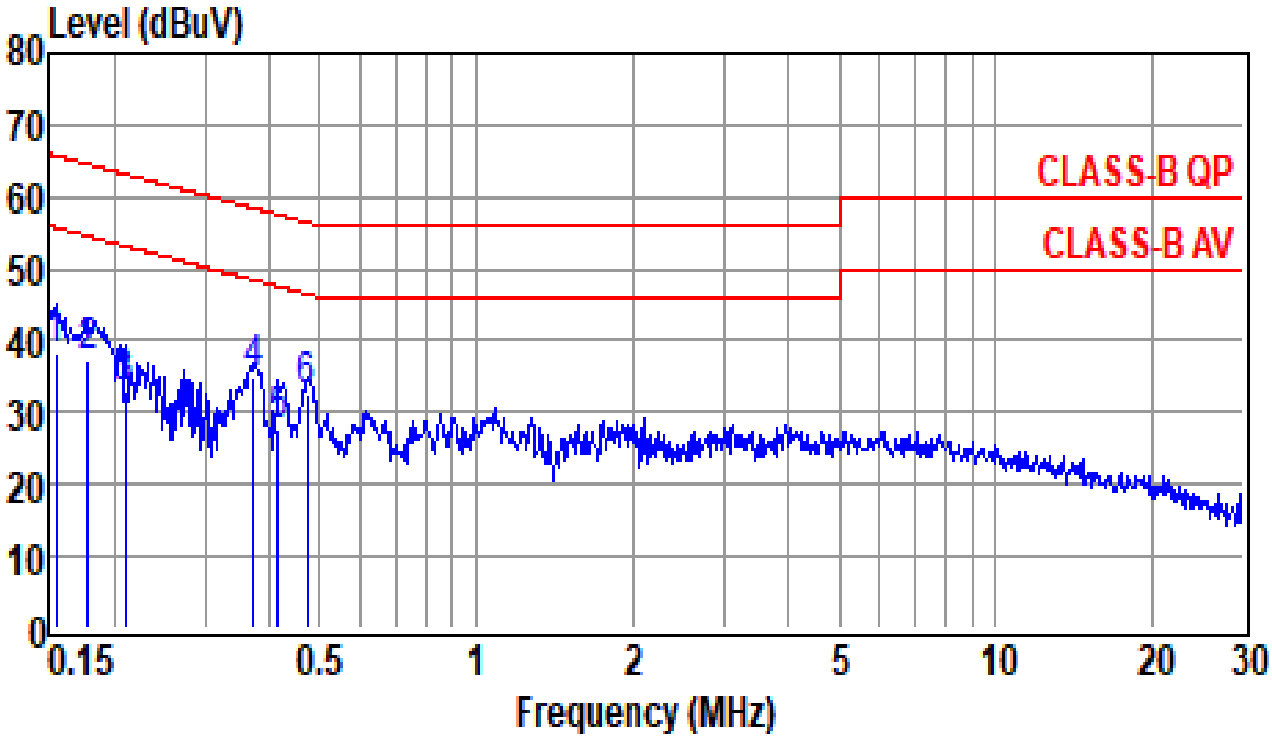
Site : conducted #1
Condition : CLASS-B QP
Tem / Hum : 22 ℃ / 60%
EUT : WIRELESS RECEIVER
Power Rating : 120Vac60Hz
Engineer : Brian Huang

Date : 2023-03-17
LISN : NEUTRAL
Test Mode : Operation Mode (2472.8MHz)

Model :EM-XSW1 DUAL

	Freq (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV)	Limit Line (dBuV)	Over Limit (dB)	Remark
	0.1540	29.88	10.03	39.91	65.78	-25.87	QP
	0.1835	27.61	10.03	37.64	64.33	-26.69	QP
	0.3751	24.67	10.04	34.71	58.39	-23.68	QP
*	0.4787	24.47	10.04	34.51	56.36	-21.85	QP
	0.6205	18.31	10.04	28.35	56.00	-27.65	QP
	0.6613	16.75	10.05	26.80	56.00	-29.20	QP

Note :
1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss+ Pulse Limiter Factor
3. ” * ” mean this data is the worst emission level



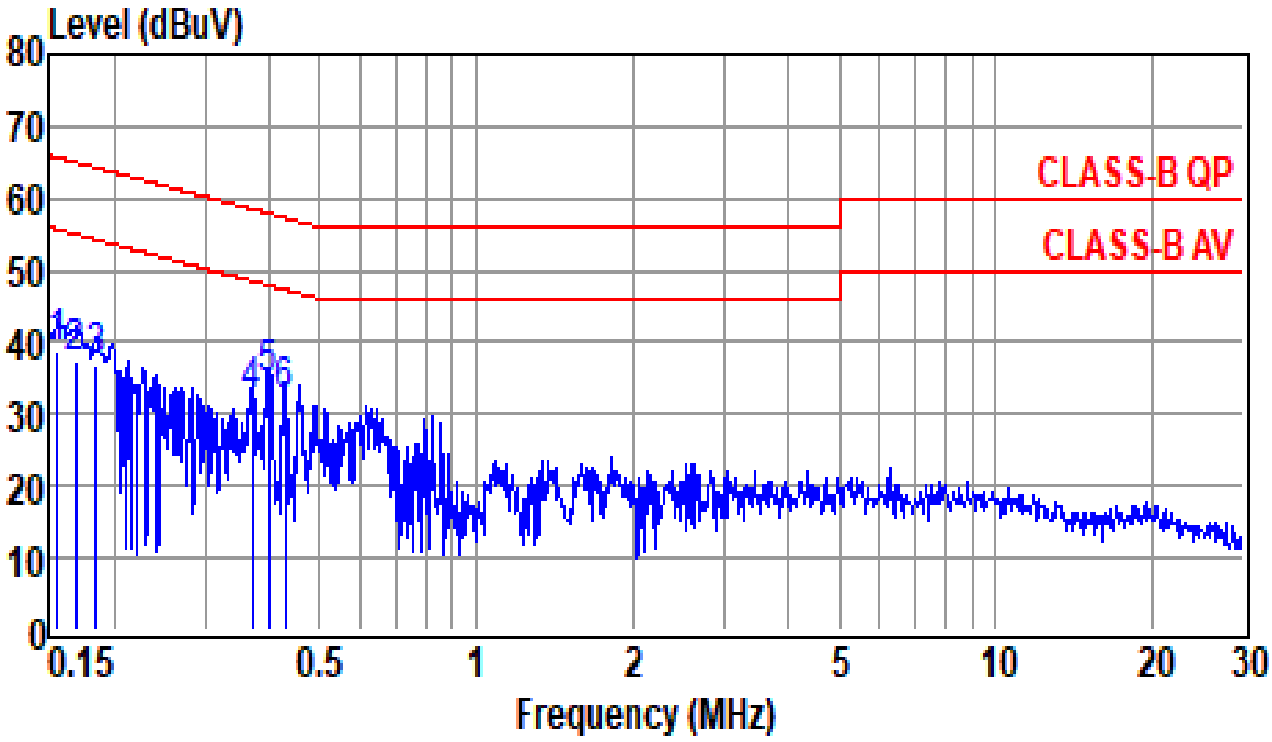
Site : conducted #1
Condition : CLASS-B QP
Tem / Hum : 22 ℃ / 60%
EUT : WIRELESS RECEIVER
Power Rating: 120Vac60Hz
Engineer : Brian Huang

Date : 2023-03-17
LISN : LINE
Test Mode : Operation Mode (2472.8MHz)
Model :EM-XSW1 DUAL

	Freq (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV)	Limit Line (dBuV)	Over Limit (dB)	Remark
	0.1549	28.50	10.03	38.53	65.74	-27.21	QP
	0.1787	27.29	10.03	37.32	64.55	-27.23	QP
	0.2106	22.93	10.03	32.96	63.18	-30.22	QP
*	0.3731	24.72	10.04	34.76	58.43	-23.67	QP
	0.4149	17.78	10.04	27.82	57.55	-29.73	QP
	0.4736	22.69	10.04	32.73	56.45	-23.72	QP

Note :
1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss+ Pulse Limiter Factor
3. ” * ” mean this data is the worst emission level

(worst-case test case)



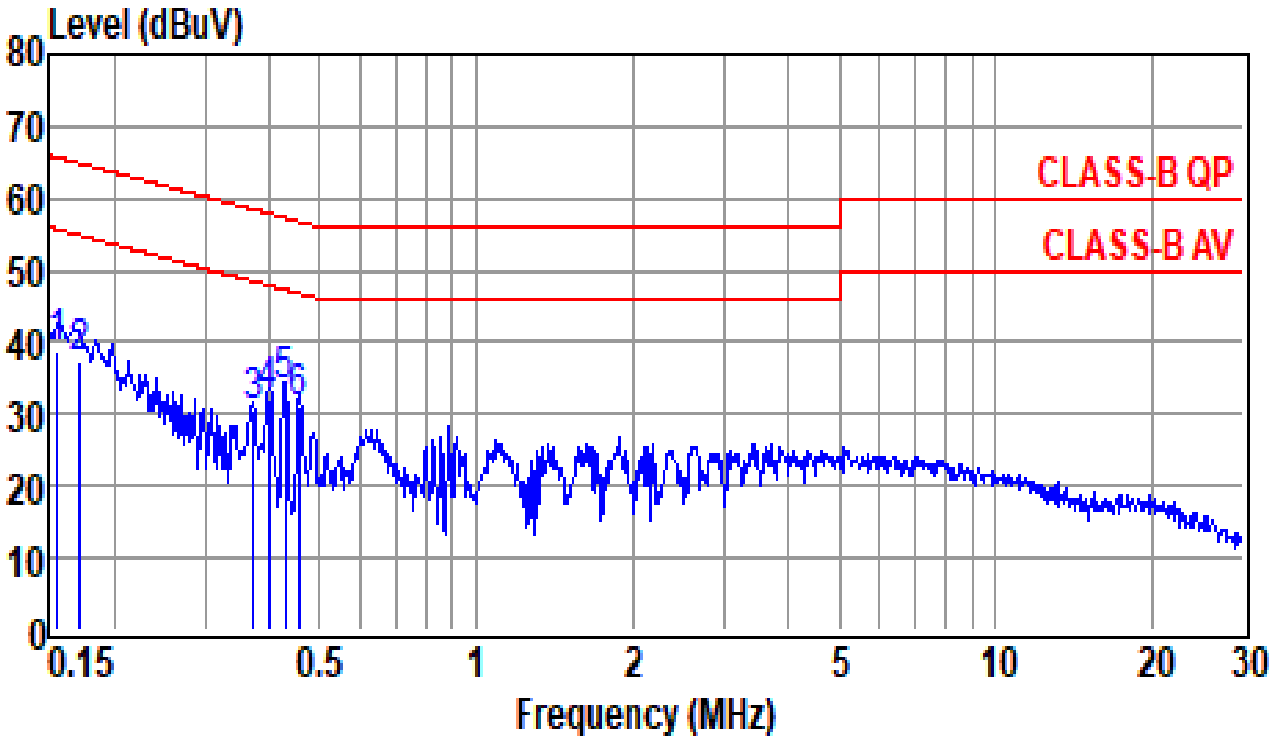
Site : conducted #1
Condition : CLASS-B QP
Tem / Hum : 22 ℃ / 60%
EUT : WIRELESS RECEIVER
Power Rating: 120Vac60Hz
Engineer : Brian Huang

Date : 2023-03-17
LISN : NEUTRAL
Test Mode : Operation Mode (2452.8MHz)
Model : EM-XSW1

	Freq (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV)	Limit Line (dBuV)	Over Limit (dB)	Remark
	0.1565	28.67	10.03	38.70	65.65	-26.95	QP
	0.1685	27.52	10.03	37.55	65.03	-27.48	QP
	0.1854	26.66	10.03	36.69	64.24	-27.55	QP
	0.3692	22.01	10.04	32.05	58.52	-26.47	QP
*	0.3976	24.35	10.04	34.39	57.90	-23.51	QP
	0.4283	21.94	10.04	31.98	57.29	-25.31	QP

Note :
1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss+ Pulse Limiter Factor
3. ” * ” mean this data is the worst emission level

(worst-case test case)



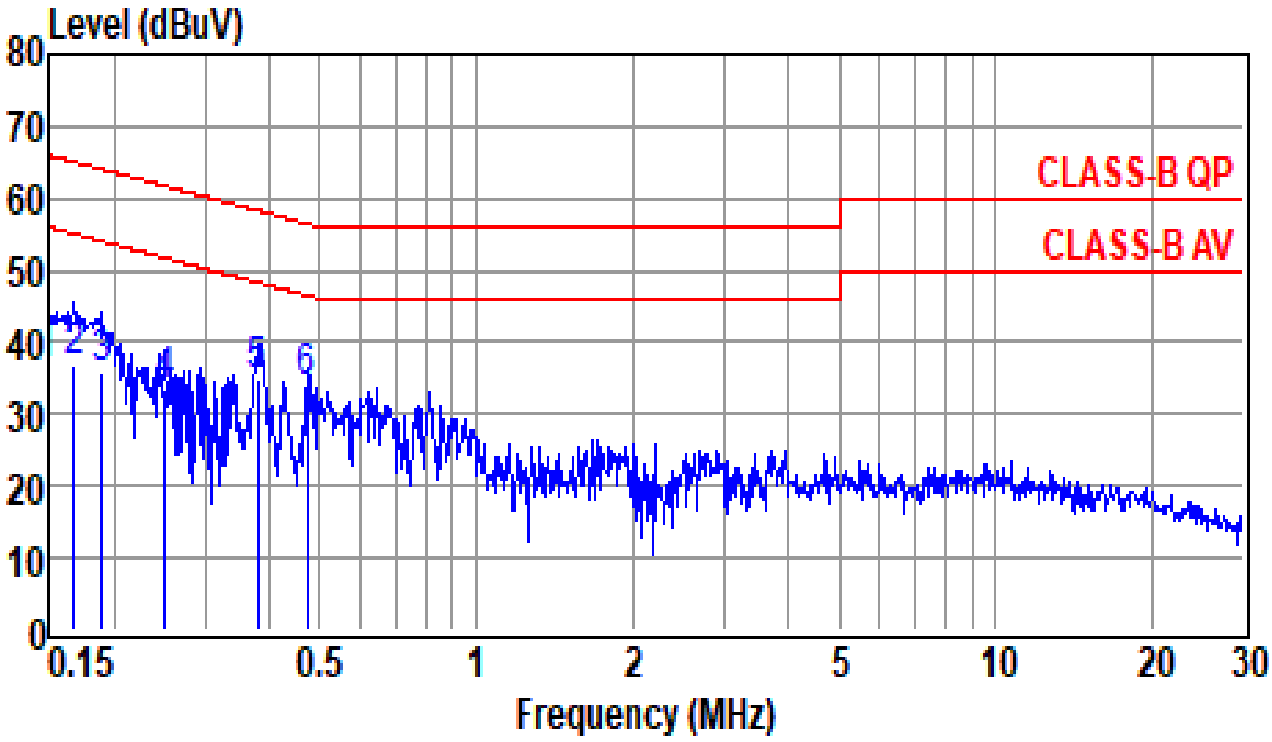
Site : conducted #1
Condition : CLASS-B QP
Tem / Hum : 22 ℃ / 60%
EUT : WIRELESS RECEIVER
Power Rating: 120Vac60Hz
Engineer : Brian Huang

Date : 2023-03-17
LISN : LINE
Test Mode : Operation Mode (2452.8MHz)
Model : EM-XSW1

	Freq (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV)	Limit Line (dBuV)	Over Limit (dB)	Remark
	0.1565	28.60	10.03	38.63	65.65	-27.02	QP
	0.1722	27.20	10.03	37.23	64.86	-27.63	QP
	0.3712	20.62	10.04	30.66	58.47	-27.81	QP
	0.3976	22.25	10.04	32.29	57.90	-25.61	QP
*	0.4283	23.66	10.04	33.70	57.29	-23.59	QP
	0.4564	21.33	10.04	31.37	56.76	-25.39	QP

Note :
1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss+ Pulse Limiter Factor
3. ” * ” mean this data is the worst emission level

(worst-case test case)



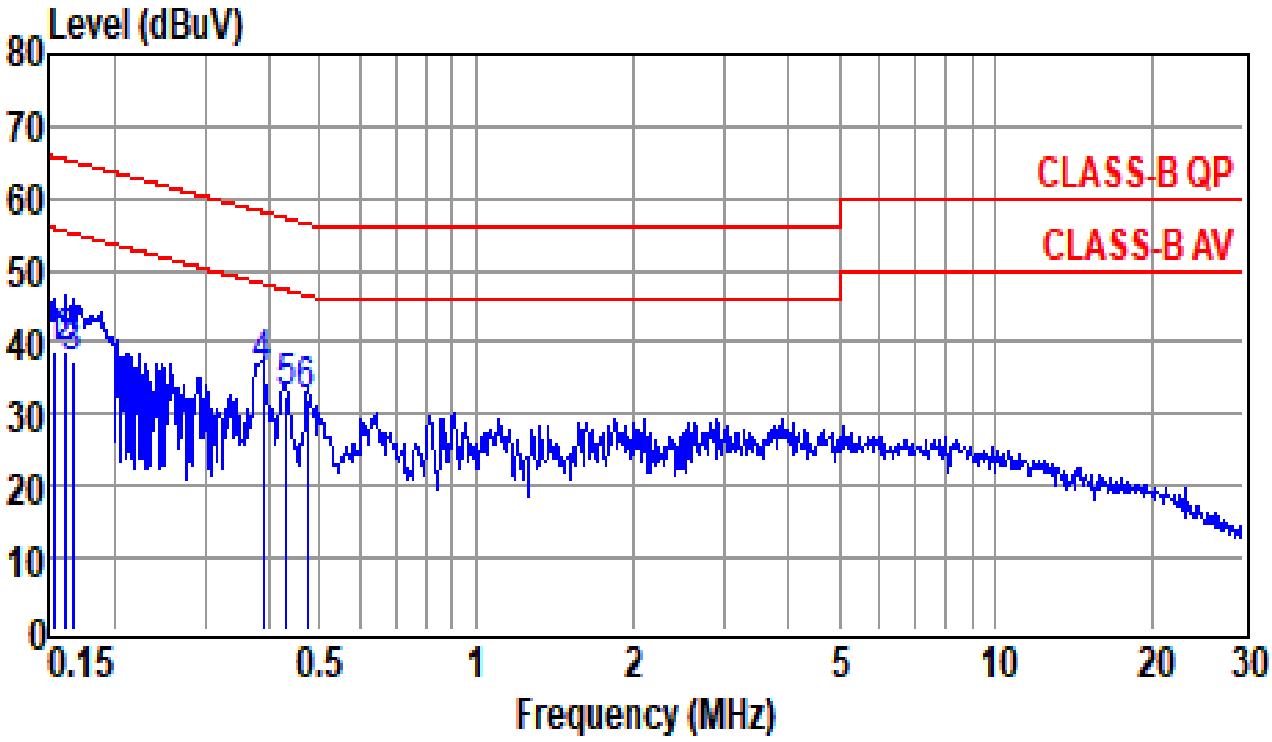
Site : conducted #1
Condition : CLASS-B QP
Tem / Hum : 22 ℃ / 60%
EUT : WIRELESS RECEIVER
Power Rating: 120Vac60Hz
Engineer : Brian Huang

Date : 2023-03-17
LISN : NEUTRAL
Test Mode : Operation Mode (2472.8MHz)
Model : EM-XSW2

	Freq (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV)	Limit Line (dBuV)	Over Limit (dB)	Remark
	0.1500	26.25	10.01	36.26	66.00	-29.74	QP
	0.1677	26.84	10.03	36.87	65.08	-28.21	QP
	0.1894	25.77	10.03	35.80	64.06	-28.26	QP
	0.2521	23.36	10.03	33.39	61.69	-28.30	QP
	0.3791	25.00	10.04	35.04	58.30	-23.26	QP
*	0.4736	23.94	10.04	33.98	56.45	-22.47	QP

Note :
1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss+ Pulse Limiter Factor
3. ” * ” mean this data is the worst emission level

(worst-case test case)



Site : conducted #1
Condition : CLASS-B QP
Tem / Hum : 22 ℃ / 60%
EUT : WIRELESS RECEIVER
Power Rating: 120Vac60Hz
Engineer : Brian Huang

Date : 2023-03-17
LISN : LINE
Test Mode : Operation Mode (2472.8MHz)
Model : EM-XSW2

	Freq (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV)	Limit Line (dBuV)	Over Limit (dB)	Remark
	0.1540	28.59	10.03	38.62	65.78	-27.16	QP
	0.1616	28.95	10.03	38.98	65.38	-26.40	QP
	0.1668	27.48	10.03	37.51	65.12	-27.61	QP
*	0.3872	25.75	10.04	35.79	58.12	-22.33	QP
	0.4305	22.48	10.04	32.52	57.24	-24.72	QP
	0.4711	22.29	10.04	32.33	56.49	-24.16	QP

Note :
1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss+ Pulse Limiter Factor
3. ” * ” mean this data is the worst emission level

7.4 Result Data Calculation

The result data is calculated by adding the LISN Factor to the measured reading. The basic equation with a sample calculation is as follows:

RESULT = READING + LISN FACTOR

Assume a receiver reading of 22.5 dB μV is obtained, and LISN Factor is 0.1 dB, then the total of disturbance voltage is 22.6 dB μV.

RESULT = 22.5 + 0.1 = 22.6 dB μV
Level in μV = Common Antilogarithm[(22.6 dB μV)/20]
= 13.48 μV

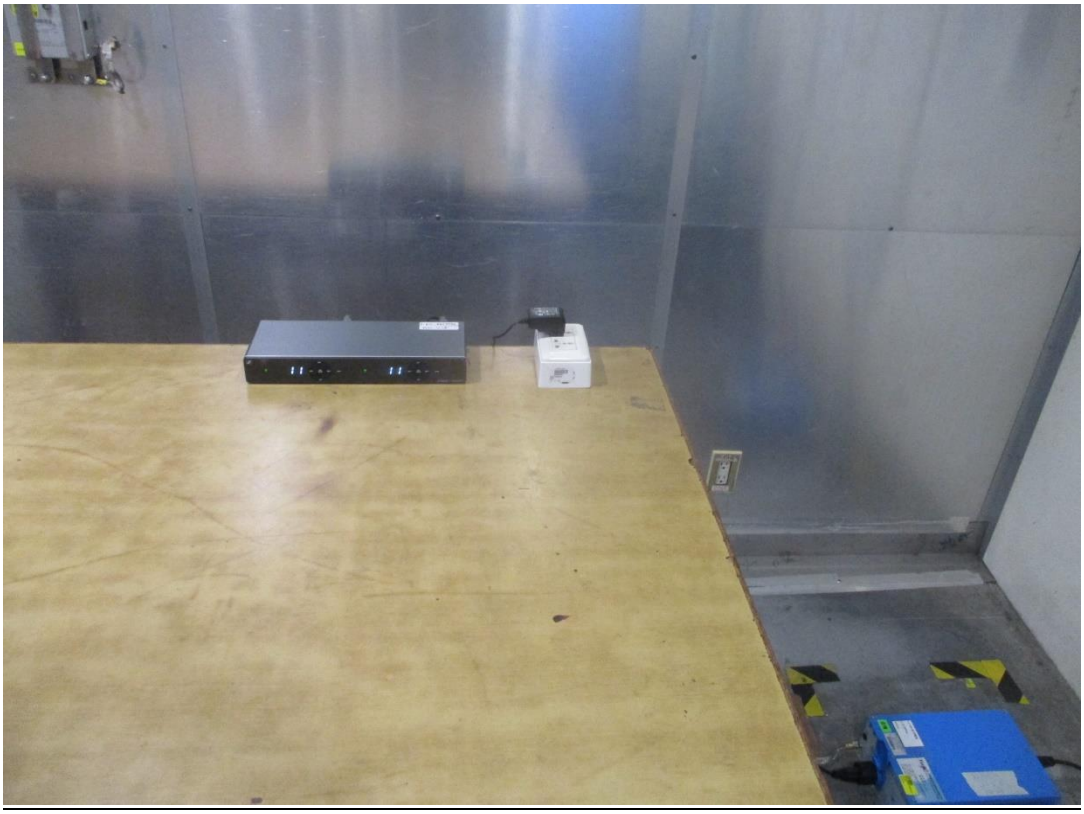
7.5 Conducted Measurement Equipment

The following test equipment are used during the conducted test.

Equipment	Manufacturer	Model No.	Assets No.	Calibration Date	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	ESCI	13054420-001 (101209)	2022/11/23	2023/11/22
PULSE LIMITER	Schwarzbeck	VTSD 9561 F-N	13056701-003 (00335)	2022/04/13	2023/04/12
LISN	Narda(PMM)	L2-16B	13035912-001 (000WT61017)	2022/05/30	2023/05/29

7.6 Photos of Conduction Measuring Setup

1)Test model： EM-XSW1 DUAL



2)Test model： EM-XSW1

3)Test model： EM-XSW2