



# EMI TEST REPORT

**Equipment** : WiFi6 11ax 2T2R module 1800Mbps  
**Brand Name** : AsiaRF Co., Ltd.  
**Model Name** : AW7915-NPD  
**Applicant** : AsiaRF Co., Ltd.  
1F., No.2, Lane45, Shuiyuan Street., Yonghe City,  
Taipei County 234, Taiwan  
**Manufacturer** : AsiaRF Co., Ltd.  
1F., No.2, Lane45, Shuiyuan Street., Yonghe City,  
Taipei County 234, Taiwan  
**Standard** : ICES-003 Issue 7, Class B

The product was received on Mar. 28, 2022, and testing was started from Apr. 07, 2022 and completed on Apr. 21, 2022. We, SPORTON INTERNATIONAL INC. Hsinhua Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.4a-2017 standards and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. Hsinhua Laboratory, the test report shall not be reproduced except in full.

Approved by: William Li

**SPORTON INTERNATIONAL INC. Hsinhua Laboratory**  
No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan (R.O.C.)



## Table of Contents

<b>History of this test report.....</b>	<b>3</b>
<b>Summary of Test Result.....</b>	<b>4</b>
<b>1. General Description of Equipment under Test.....</b>	<b>5</b>
1.1. Basic Description of Equipment under Test .....	5
1.2. Feature of Equipment under Test.....	5
1.3. Table for Multiple Listing .....	5
<b>2. Test Configuration of Equipment under Test .....</b>	<b>6</b>
2.1. Details of EUT Test Modes.....	6
2.2. Description of Test System.....	6
2.3. Connection Diagram of Test System .....	7
2.4. Details of EUT Test Setup .....	8
<b>3. General Information of Test.....</b>	<b>9</b>
3.1. Test Facilities .....	9
3.2. Test Standards.....	9
3.3. Test Voltage/Frequencies .....	9
3.4. Test Distance and Frequency Range Investigated .....	10
3.5. Operating Condition .....	10
3.6. ICES Labelling requirements.....	10
<b>4. Conducted Emissions Measurement (AC mains power terminals).....</b>	<b>11</b>
4.1. Limit .....	11
4.2. Test Procedures.....	12
4.3. Measurement Results Calculation .....	12
4.4. Typical Test Setup Layout .....	13
4.5. Test Result.....	15
<b>5. Radiated Emissions Measurement .....</b>	<b>17</b>
5.1. Radiated Emission below 1GHz .....	17
5.2. Radiated Emission above 1GHz.....	24
<b>6. Uncertainty of Test Site .....</b>	<b>30</b>
6.1. Measurement Uncertainty .....	30
<b>7. List of Measuring Equipment Used .....</b>	<b>31</b>
<b>Appendix A. Test Photos</b>	
<b>Photographs of EUT v01</b>	



## History of this test report

Report No.	Version	Description	Issued Date
CI211912	01	Initial issue of report	Jun. 27, 2022

## Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
4	3.2.1	Conducted Emissions of Powerline	PASS	Under limit 11.73 dB at 0.16 MHz
5.1	3.2.2	Radiated Emissions below 1GHz	PASS	Under limit 4.21 dB at 249.600 MHz
5.2	3.2.2	Radiated Emissions above 1GHz	PASS	Under limit 24.4 dB at 4.565 GHz

**Declaration of Conformity:**

1. The Radiated Emission and Conducted Transient Disturbances test result (Pass/Fail) which exclude measurement uncertainty. Note that measurement values may risk exceeding the limit of regulation standard, if measurement uncertainty is included in test results.
2. The Radiated Emission and Conducted Transient Disturbances measurement uncertainty please refer to the "Measurement Uncertainty" section of the report.

**Comments and explanations:**

1. The test configuration and test mode were recorded in this test report are declared by the manufacturer.
2. The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

**Reviewed by: Andrew Yang**

**Report Producer: Debby Hung**

## 1. General Description of Equipment under Test

### 1.1. Basic Description of Equipment under Test

Equipment : WiFi6 11ax 2T2R module 1800Mbps  
 Model No. : AW7915-NPD  
 Power Supply Type : From Host System  
 The maximum operating frequency : 5.85 GHz

### 1.2. Feature of Equipment under Test

Group	Ant.	Brand	Model Name	Antenna Type	Connector	Support	Cable Loss (dBi)
1	1-2	Asiarf	ANT010-DAU	PCB	I-PEX / MMCX	2.4G+5G	0.3
2	3-4	Asiarf	ANT003	PCB	I-PEX / MMCX	2.4G+5G	0.3
3	5-6	Asiarf	A245005N	PCB	I-PEX / MMCX	2.4G+5G	0.3
4	7-8	Asiarf	A2405N	PCB	I-PEX / MMCX	2.4G	0.3
5	9-10	Asiarf	A5005N	PCB	I-PEX / MMCX	5G	0.3
6	11-12	Asiarf	A245004	Dipole	I-PEX / MMCX	2.4G+5G	0.3
7	13-14	Asiarf	A245002	Dipole	I-PEX / MMCX	2.4G+5G	0.3

For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

### 1.3. Table for Multiple Listing

SKU	Ant. Connector	Description
1	I-PEX	There are two SKUs for EUT. The only difference between SKU 1 and SKU 2 is Ant. Connector, but the gain is same.
2	MMCX	

Note 1: The information is provided by manufacturer.

Note 2: After evaluation, only SKU1 is required to be tested.

## 2. Test Configuration of Equipment under Test

### 2.1. Details of EUT Test Modes

Model No.: AW7915-NPD was selected as the main test model and its data was recorded in this report. The equipment under test was performed the following test modes:

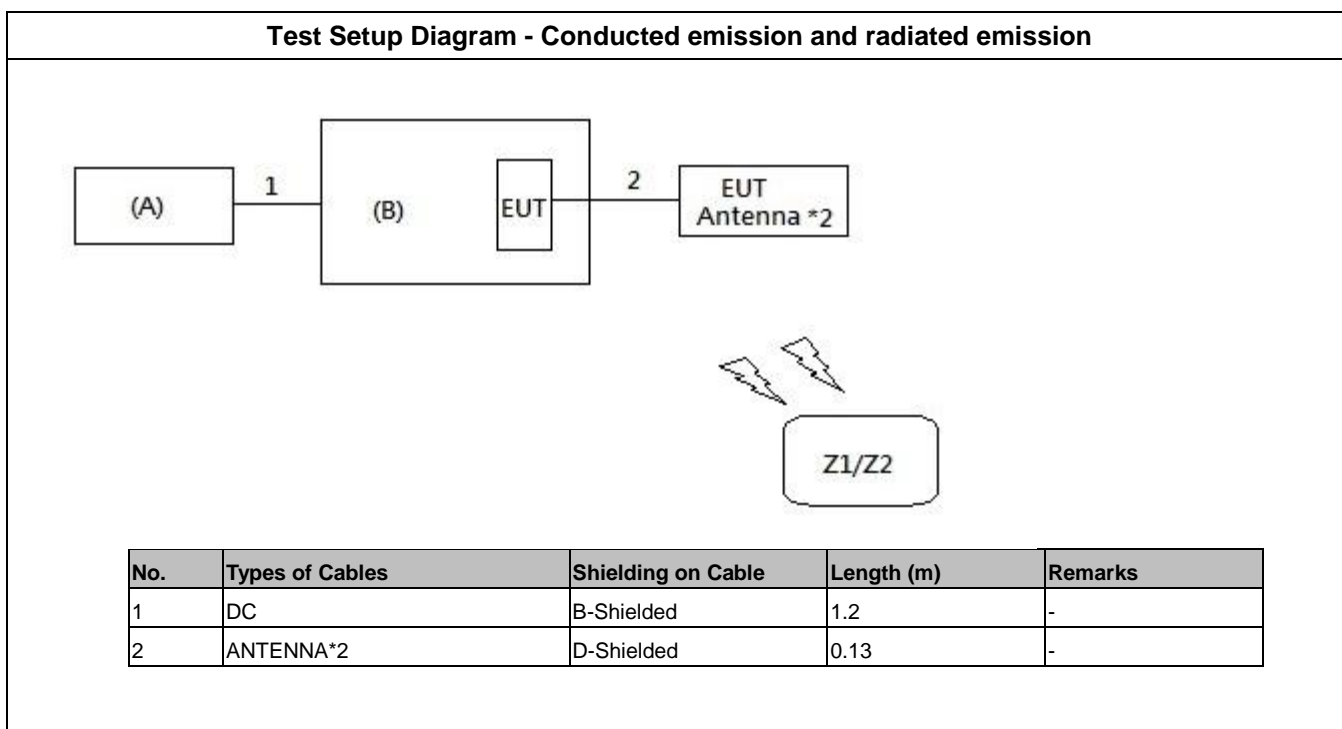
Test Items	Description of test modes
<b>Conducted Emission</b>	Mode 1. PCB antenna(ANT010-DAU),WiFi2.4G&5G/ I-Pex connector Mode 2. Dipole antenna(A245004),WiFi2.4G&5G/ I-Pex connector Mode 3. Dipole antenna(A245002),WiFi2.4G&5G/ I-Pex connector Mode 4. PCB antenna(A245005N),WiFi2.4G&5G/ I-Pex connector Mode 5. PCB antenna(ANT003),WiFi2.4G&5G/ I-Pex connector Mode 6. PCB antenna(A2405N),WiFi2.4G/ I-Pex connector Mode 7. PCB antenna(A5005N),WiFi5G/ I-Pex connector cause "mode 1" generated the worst test result; it was reported as final data.
<b>Radiated Emissions &lt;below 1GHz&gt;</b>	Mode 1. PCB antenna(ANT010-DAU),WiFi2.4G&5G/ I-Pex connector Mode 2. Dipole antenna(A245004),WiFi2.4G&5G/ I-Pex connector Mode 3. Dipole antenna(A245002),WiFi2.4G&5G/ I-Pex connector Mode 4. PCB antenna(A245005N),WiFi2.4G&5G/ I-Pex connector Mode 5. PCB antenna(ANT003),WiFi2.4G&5G/ I-Pex connector Mode 6. PCB antenna(A2405N),WiFi2.4G/ I-Pex connector Mode 7. PCB antenna(A5005N),WiFi5G/ I-Pex connector cause "mode 1" generated the worst test result; it was reported as final data.
<b>Radiated Emissions &lt;above 1GHz&gt;</b>	Mode 1. PCB antenna(ANT010-DAU),WiFi2.4G&5G/ I-Pex connector The measurement of radiated emissions above 1GHz follows the test configuration for the worst test results below 1GHz.

### 2.2. Description of Test System

#### Conducted emission and radiated emission

No.	Peripheral	Manufacturer	Model Number	FCC ID	Remarks
<b>For Local</b>					
A	Adapter	YINGHUIYUAN	YHY-12004000	DoC	-
B	PCB fixture	N/A	N/A	-	-
<b>For Remote</b>					
Z1	Laptop	DELL	Latitude E5520	DoC	-
Z2	Laptop	DELL	Latitude E5520	DoC	-

## 2.3. Connection Diagram of Test System





## **2.4. Details of EUT Test Setup**

During the test, the following program under WIN 7 was executed:

- The remote Laptop executed "ping" to link with the EUT to maintain the connection by WIFI.



### 3. General Information of Test

#### 3.1. Test Facilities

Test Lab : Sporton International Inc. Hsinhua Laboratory							
<input checked="" type="checkbox"/>	Hsinhua (TAF: 3785)	ADD : No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan (R.O.C.)					
		TEL : 886-3-327-3456		FAX : 886-3-327-0973			
<input checked="" type="checkbox"/>		ADD : No.3, Ln. 238, Kangle St., Neihu Dist., Taipei City 114040, Taiwan (R.O.C.)					
		TEL : 886-2-2631-5551		FAX : 886-2-2631-9740			
Test Items		Test Site No.	Test Engineer	Test Environment		Test Date	Remark
				temp °C	humidity %		
Powerline Conducted Emissions		CO01-NH	Willy Lee	23.6~23.7	71~72	11/Apr/2022	-
Radiated Emissions (below 1GHz)		OS03-NH	Louis Lin	24.1~24.2	63.1~63.2	11/Apr/2022	-
Radiated Emissions (above 1GHz)		03CH04-HY	Alan Chen	23.8~23.9	62~63	21/Apr/2022	-

#### 3.2. Test Standards

Test items	Test Standards and Test Procedures
Radiated and Conducted Emissions	Canada Standard ICES-003 Issue 7 , Class B ANSI C63.4a-2017

#### 3.3. Test Voltage/Frequencies

Power Supply Type	Voltage/Frequencies
Host System	120V / 60Hz

### 3.4. Test Distance and Frequency Range Investigated

Test Items	Frequency Range	Remark
Powerline Conducted Emissions	150 kHz to 30 MHz	-
Radiated Emissions (below 1GHz)	30 MHz to 1,000 MHz	Measurement distance is 10 m.
Radiated Emissions (above 1GHz)	1,000 MHz to 18,000 MHz	Measurement distance is 3 m.
	Above 18,000 MHz	Measurement distance is 1 m.

### 3.5. Operating Condition

- Customers request this specification for test plan.

### 3.6. ICES Labelling requirements

The requirements specified in ICES-Gen shall apply. An example ISED compliance label, to be placed on each unit of an equipment model (or in the user manual, if allowed), is given below:

CAN ICES-003(\*) / NMB-003(\*)

\* Insert either “A” or “B”, but not both, to identify the applicable Class of the device used for compliance verification.

The above label is only an example. The specific format is left to the manufacturer to decide, as long as the label includes the required information, in accordance with ICES-Gen.

## 4. Conducted Emissions Measurement (AC mains power terminals)

The EUT is which satisfies the Class B disturbance limits.

### 4.1. Limit

Limits for conducted disturbance at the mains ports of class A			
Frequency range MHz	Coupling device	Detector type / bandwidth	Class A limits dB(μV)
0,15 – 0,5	AMN	Quasi-peak / 9 kHz	79
0,50 – 5			73
5 – 30			73
0,15 – 0,5	AMN	Average / 9 kHz	66
0,50 – 5			60
5 – 30			60
Note : The more stringent limit applies at transition frequencies.			

Limits for conducted disturbance at the mains ports of class B			
Frequency range MHz	Coupling device	Detector type / bandwidth	Class B limits dB(µV)
0,15 – 0,5	AMN	Quasi-peak / 9 kHz	66 to 56
0,50 – 5			56
5 – 30			60
0,15 – 0,5	AMN	Average / 9 kHz	56 to 46
0,50 – 5			46
5 – 30			50
Note : The more stringent limit applies at transition frequencies.			

## 4.2. Test Procedures

Tabletop equipment:

- a). The EUT was warmed up for 15 minutes before testing started.
- b). The EUT was placed on a desk 0.8 meter height from the metal ground plane and 0.4 meter from the conducting wall of the shielding room and it was kept at least 0.8 meter from any other grounded conducting surface.
- c). Connect EUT to the power mains through a line impedance stabilization network (LISN).
- d). All the support units are connect to the other LISN.
- e). The LISN provides 50 ohm, coupling impedance for the measuring instrument.
- f). The CISPR states that a 50 ohm, 50 microhenry LISN should be used.
- g). Both sides of AC line were checked for maximum conducted interference.
- h). The frequency range from 150 kHz to 30 MHz was searched.
- i). Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- j). All emissions not reported here are more than 10 dB below the prescribed limit.

Floor-standing equipment:

- a). The EUT was warmed up for 15 minutes before testing started.
- b). The EUT was placed on the horizontal ground reference plane, 12 mm above ground.
- c). Connect EUT to the power mains through a line impedance stabilization network (LISN).
- d). All the support units are connect to the other LISN.
- e). The LISN provides 50 ohm, coupling impedance for the measuring instrument.
- f). The CISPR states that a 50 ohm, 50 microhenry LISN should be used.
- g). Both sides of AC line were checked for maximum conducted interference.
- h). The frequency range from 150 kHz to 30 MHz was searched.
- i). Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- j). All emissions not reported here are more than 10 dB below the prescribed limit.

## 4.3. Measurement Results Calculation

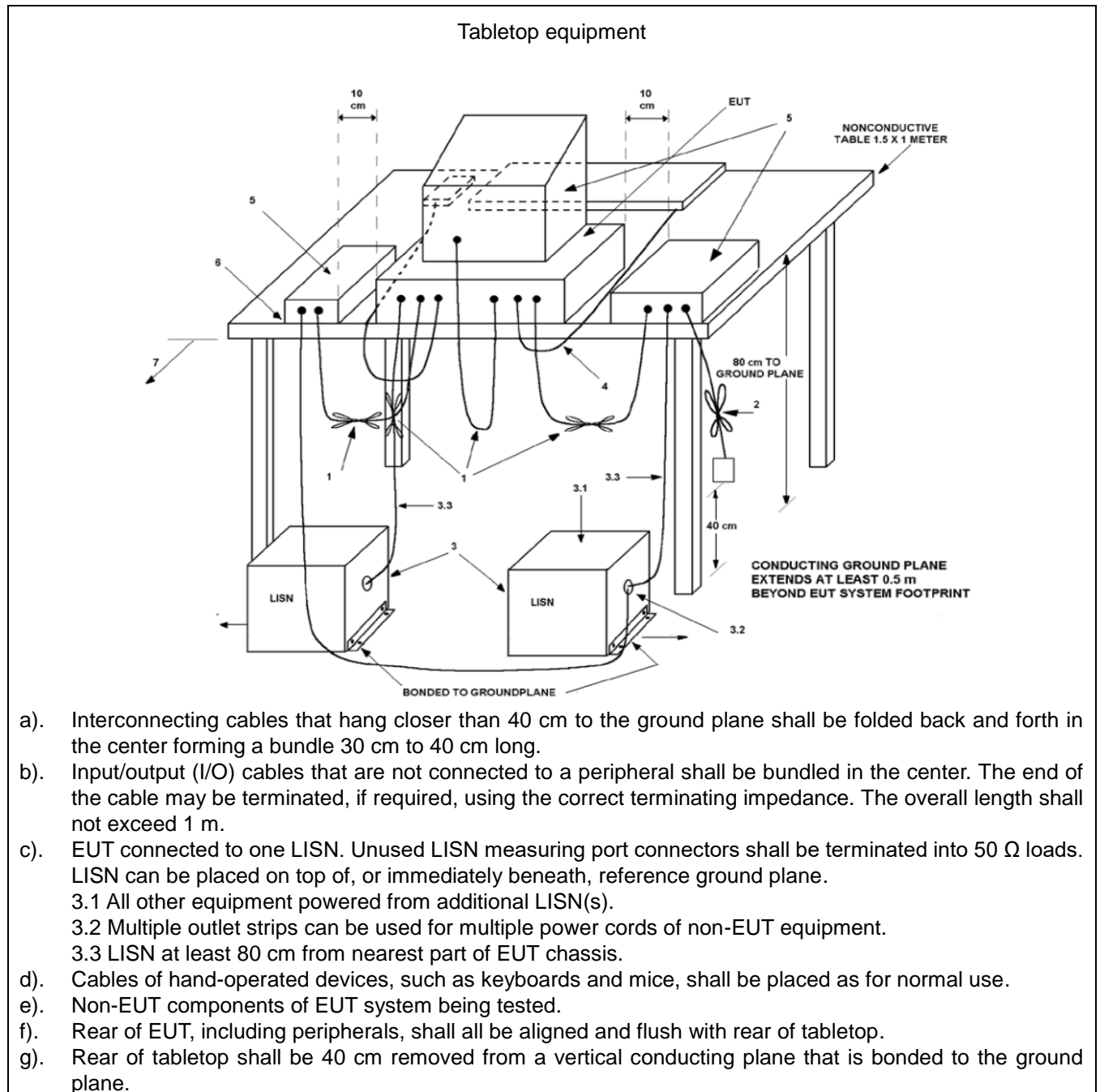
The measured Level is calculated using:

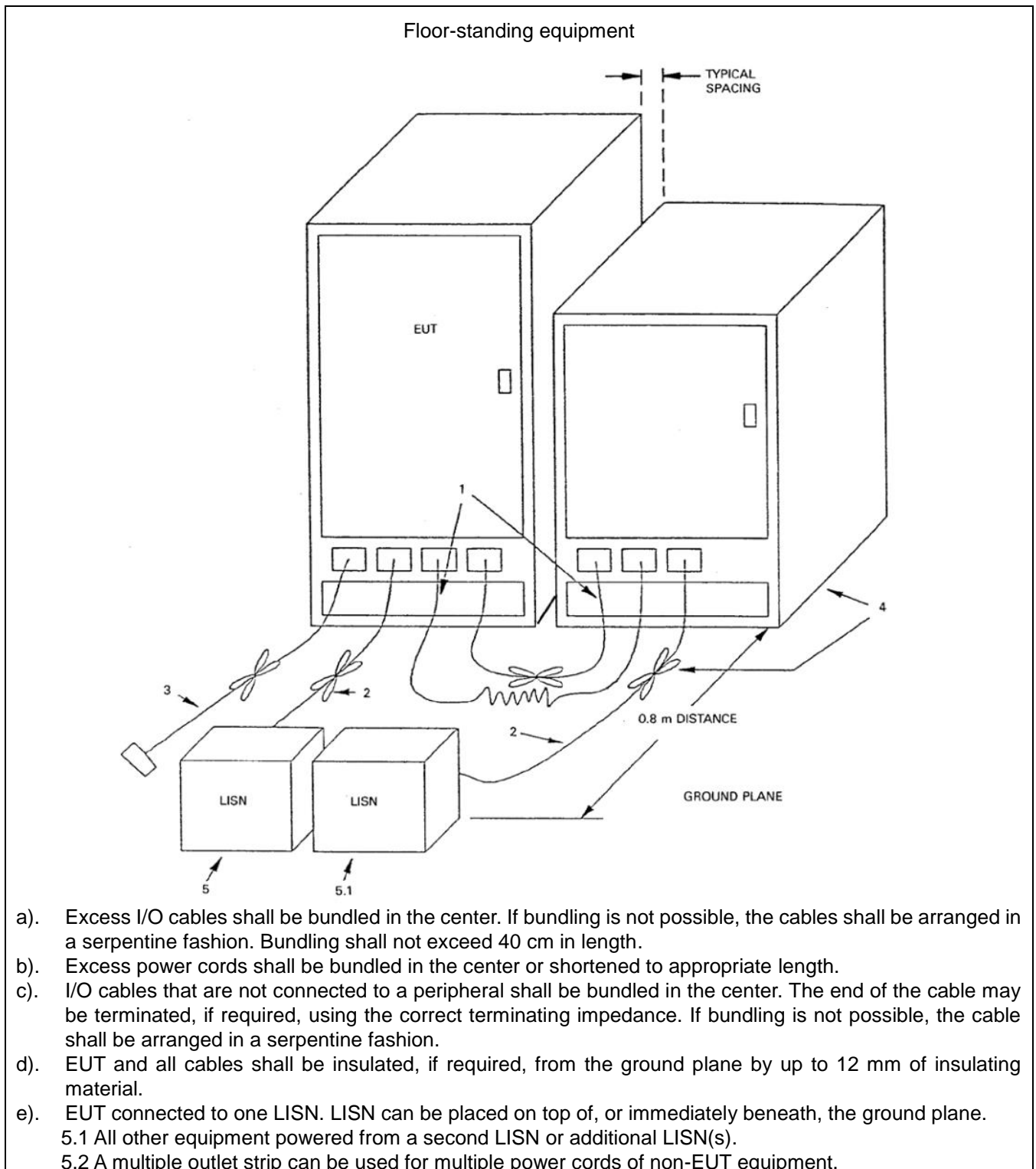
Corrected Reading (dB $\mu$ V) = LISN Factor + Cable Loss + Read Level

For example at 0.3 MHz if the LISN Factor is 10.48 dB, the cable loss is 0.10 dB, the measured voltage is 36.39 dB $\mu$ V, the signal strength would be calculated:

Corrected Reading (dB $\mu$ V) = 10.48 dB + 0.10 dB + 36.39 dB $\mu$ V = 46.97 dB $\mu$ V

#### 4.4. Typical Test Setup Layout

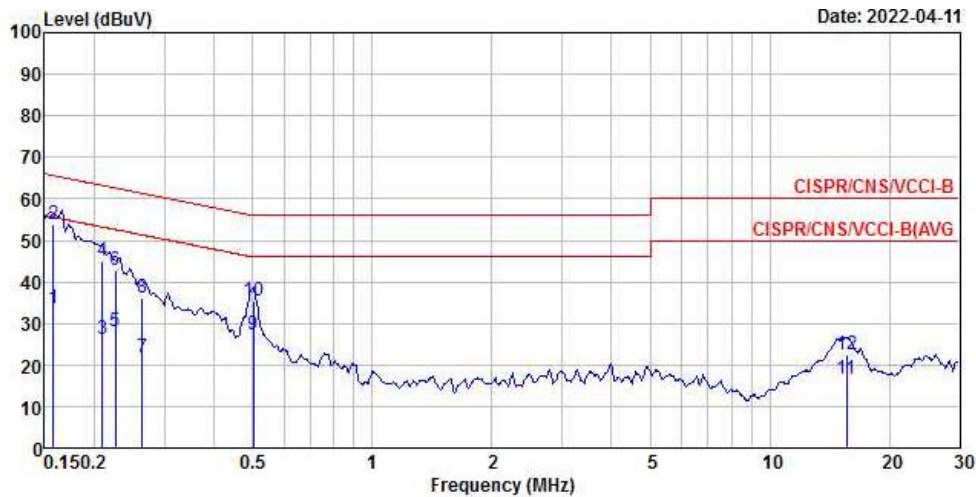




#### 4.5. Test Result

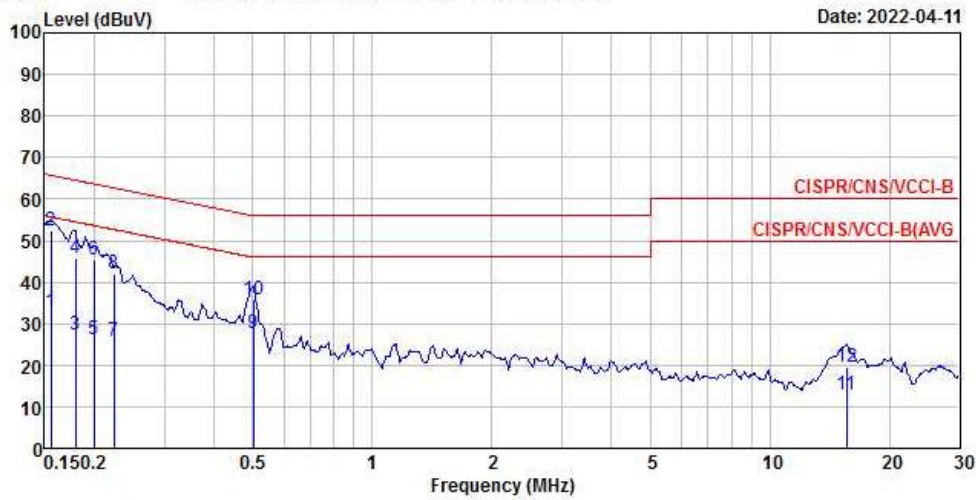
Test Mode	Mode 1		
Test Frequency	0.15 MHz ~ 30 MHz	Test Voltage	AC 120V / 60Hz
■ The test was passed at the minimum margin that marked by the frame in the following data			

##### Line



	Freq	Level	Over	Limit	Read	LISN	Cable	
	MHz	dBuV	Limit	Line	Level	Factor	Loss	Remark
			dB	dBuV	dBuV	dB	dB	
1	0.16	33.53	-22.07	55.60	23.16	10.28	0.09	Average
2 @	0.16	53.87	-11.73	65.60	43.50	10.28	0.09	QP
3	0.21	26.12	-27.11	53.23	15.76	10.27	0.09	Average
4	0.21	45.02	-18.21	63.23	34.66	10.27	0.09	QP
5	0.23	27.91	-24.69	52.60	17.55	10.27	0.09	Average
6	0.23	42.72	-19.88	62.60	32.36	10.27	0.09	QP
7	0.26	21.83	-29.46	51.29	11.47	10.27	0.09	Average
8	0.26	36.28	-25.01	61.29	25.92	10.27	0.09	QP
9	0.50	27.31	-18.69	46.00	16.93	10.27	0.11	Average
10	0.50	35.28	-20.72	56.00	24.90	10.27	0.11	QP
11	15.63	16.62	-33.38	50.00	5.73	10.57	0.32	Average
12	15.63	22.48	-37.52	60.00	11.59	10.57	0.32	QP



**Neutral**


	Freq	Level	Over	Limit	Read	LISN	Cable	
	MHz	dBuV	Limit	Line	Level	Factor	Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.16	32.76	-22.93	55.69	22.43	10.24	0.09	Average
2 @	0.16	52.48	-13.21	65.69	42.15	10.24	0.09	QP
3	0.18	27.17	-27.33	54.50	16.85	10.23	0.09	Average
4	0.18	45.88	-18.62	64.50	35.56	10.23	0.09	QP
5	0.20	26.08	-27.55	53.63	15.76	10.23	0.09	Average
6	0.20	45.30	-18.33	63.63	34.98	10.23	0.09	QP
7	0.22	25.71	-26.98	52.69	15.39	10.23	0.09	Average
8	0.22	41.89	-20.80	62.69	31.57	10.23	0.09	QP
9	0.50	27.67	-18.33	46.00	17.33	10.23	0.11	Average
10	0.50	35.89	-20.11	56.00	25.55	10.23	0.11	QP
11	15.63	13.08	-36.92	50.00	2.20	10.56	0.32	Average
12	15.63	19.59	-40.41	60.00	8.71	10.56	0.32	QP



## 5. Radiated Emissions Measurement

The EUT is which satisfies the Class B disturbance limits.

### 5.1. Radiated Emission below 1GHz

#### 5.1.1. Limit

radiated emissions at frequencies up to 1 GHz for Class A equipment				
Frequency range MHz	Measurement		Class A limits	
	Distance (m)	Detector type / bandwidth	3m(dBμV/m)	10m(dBμV/m)
30 – 88	3 or 10	Quasi Peak / 120 kHz	50.0	40.0
88 – 216			54.0	43.5
216 – 230			56.9	46.4
230 – 960			57.0	47.0
960 – 1000			60.0	49.5
Note: The more stringent limit applies at transition frequencies.				
radiated emissions at frequencies up to 1 GHz for Class B equipment				
Frequency range MHz	Measurement		Class B limits	
	Distance (m)	Detector type / bandwidth	3m(dBμV/m)	10m(dBμV/m)
30 – 88	3 or 10	Quasi Peak / 120 kHz	40.0	30.0
88 – 216			43.5	33.1
216 – 230			46.0	35.6
230 – 960			47.0	37.0
960 – 1000			54.0	43.5
Note: The more stringent limit applies at transition frequencies.				

### 5.1.2. Test Procedures

Tabletop equipment:

- a). The EUT was placed on a rotatable table top 0.8 meter above ground.
- b). The EUT was set 10 meters from the interference-receiving antenna which was mounted on the top of a variable height antenna tower.
- c). The table was rotated 360 degrees to determine the position of the highest radiation.
- d). The antenna is a half wave dipole and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
- e). For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
- f). Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.
- g). If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
- h). If the EUT is having a Wireless modular, can choose to install the filter at the input connector of test-receiver system.

Floor-standing equipment:

- a). The EUT was placed on the horizontal ground reference plane, 12 mm above ground.
- b). The EUT was set 10 meters from the interference-receiving antenna which was mounted on the top of a variable height antenna tower.
- c). The table was rotated 360 degrees to determine the position of the highest radiation.
- d). The antenna is a half wave dipole and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
- e). For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
- f). If the EUT is having a Wireless modular, can choose to install the filter at the input connector of test-receiver system.

### 5.1.3. Measurement Results Calculation

The measured Level is calculated using:

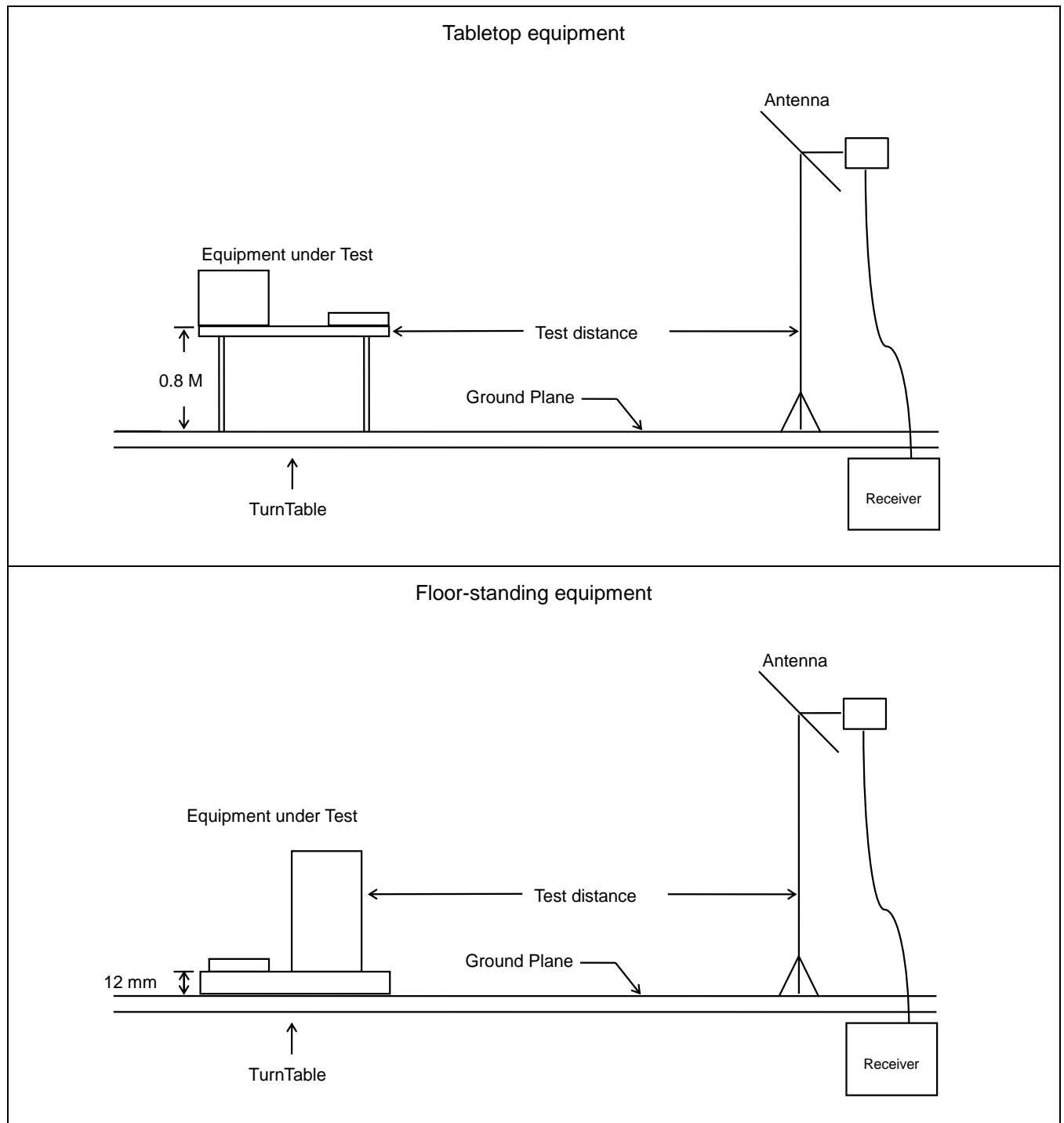
Corrected Reading (dB $\mu$ V/m) = Antenna Factor + Cable Loss + Read Level – Preamp Factor

For example at 125 MHz if the Antenna Factor is 17.24 dB/m, the cable loss is 1.20 dB, the measured voltage is 35.80 dB $\mu$ V and the Preamp Factor is 27.18 dB, the signal strength would be calculated:

Corrected Reading (dB $\mu$ V/m) = 17.24 dB/m + 1.20 dB + 35.80 dB $\mu$ V - 27.18 dB = 27.06 dB $\mu$ V/m

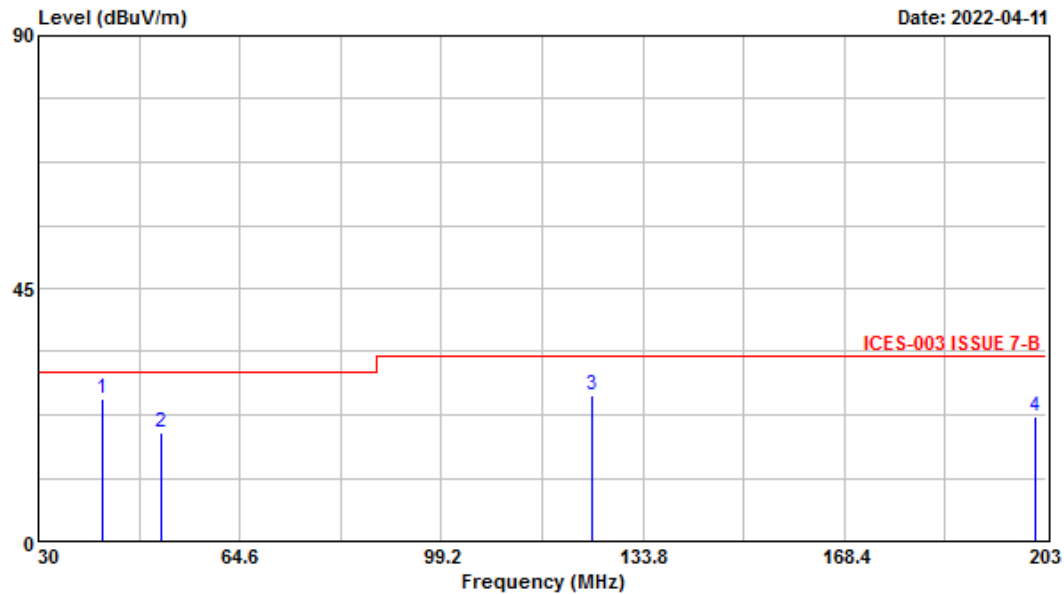
Note: If a hybrid antenna is used, the antenna factor shall be the sum of the Antenna Factor + Attenuator Factor.

#### 5.1.4. Typical Test Setup Layout

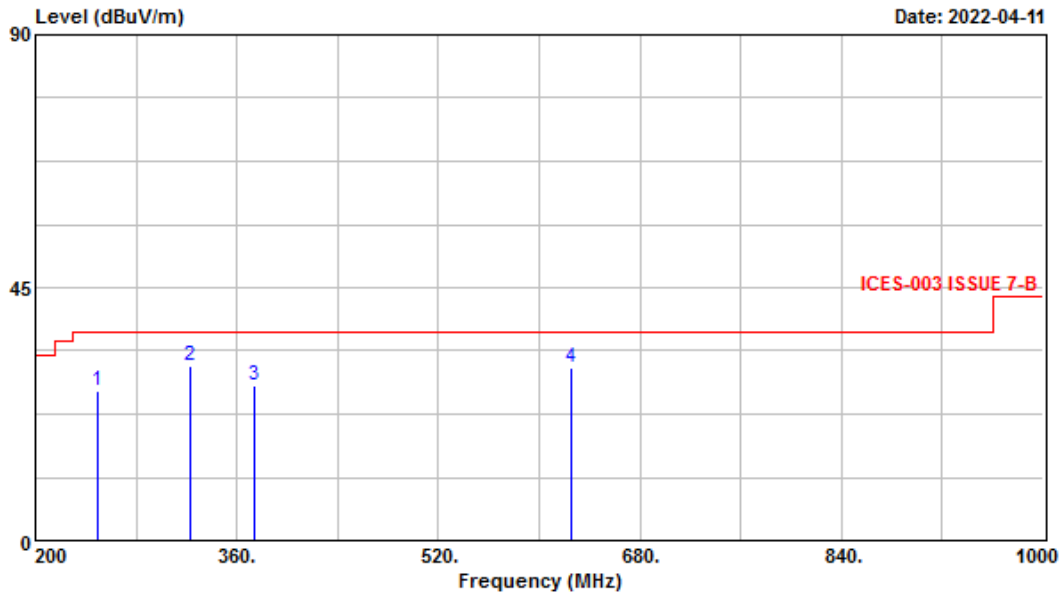


**5.1.5. Test Result**

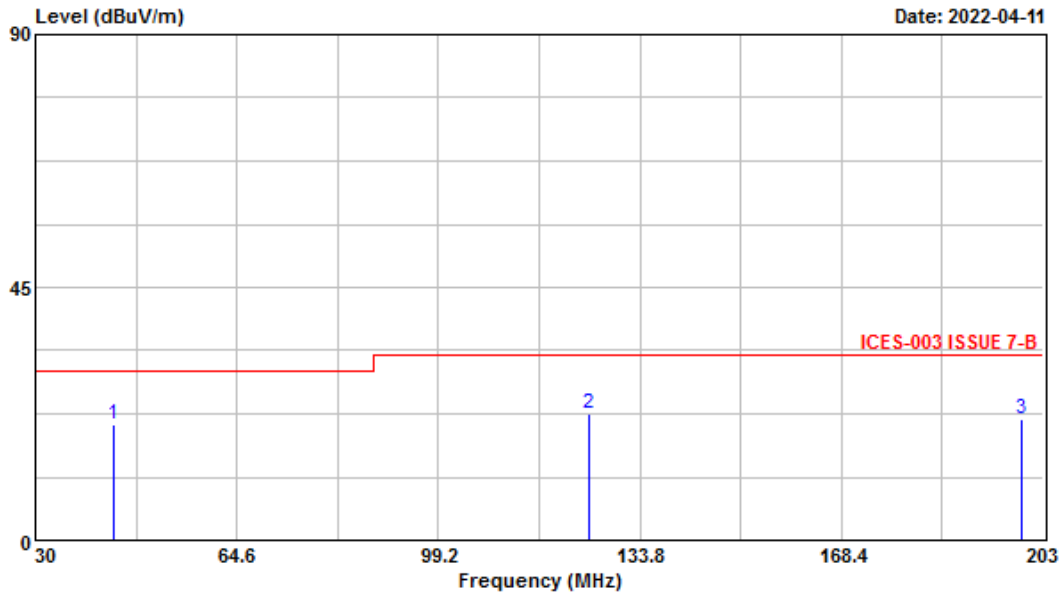
Test mode	Mode 1		
Test frequency	30 MHz ~ 1000 MHz	Test Voltage	AC 120V / 60Hz
■ The test was passed at the minimum margin that marked by the frame in the following data			

**Vertical**

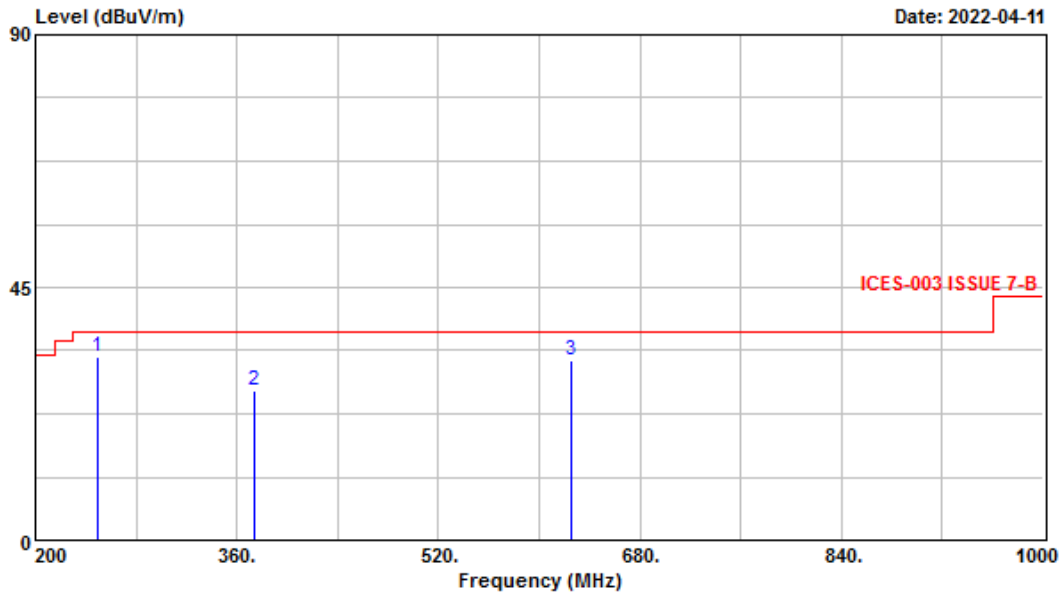
	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
1	41.070	25.30	-4.70	30.00	35.39	17.28	1.10	28.47	Peak	---	---
2	51.110	19.27	-10.73	30.00	33.35	13.14	1.24	28.46	Peak	---	---
3	125.150	25.86	-7.24	33.10	34.39	17.71	2.05	28.29	Peak	100	185
4	201.270	22.29	-10.81	33.10	33.18	14.36	2.72	27.97	Peak	---	---

**Vertical**


	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamplifier Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
1	249.600	26.48	-10.52	37.00	33.77	17.31	3.19	27.79	Peak	---	---
2	323.200	30.93	-6.07	37.00	36.45	18.82	3.62	27.96	Peak	---	---
3	374.400	27.48	-9.52	37.00	31.80	19.99	4.00	28.31	Peak	---	---
4	624.800	30.69	-6.31	37.00	30.52	23.89	5.45	29.17	Peak	---	---

**Horizontal**


	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamplifier Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
1	43.490	20.73	-9.27	30.00	32.27	15.83	1.10	28.47	Peak	---	---
2	125.150	22.59	-10.51	33.10	31.12	17.71	2.05	28.29	Peak	---	---
3	199.370	21.65	-11.45	33.10	32.57	14.36	2.70	27.98	Peak	---	---

**Horizontal**


	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
1	249.600	32.79	-4.21	37.00	40.08	17.31	3.19	27.79	Peak	400	174
2	374.400	26.52	-10.48	37.00	30.84	19.99	4.00	28.31	Peak	---	---
3	624.800	31.89	-5.11	37.00	31.72	23.89	5.45	29.17	Peak	---	---

## 5.2. Radiated Emission above 1GHz

### 5.2.1.Limit

radiated emissions at frequencies above 1 GHz for Class A equipment			
Frequency range GHz	Measurement		Class A limits
	Distance (m)	Detector type / bandwidth	dB(μV/m)
1 – 18	3	Average / 1 MHz	60
1 – 18		Peak / 1 MHz	80
18 – 40	1	Average / 1 MHz	69.54
18 – 40		Peak / 1 MHz	89.54
radiated emissions at frequencies above 1 GHz for Class B equipment			
Frequency range GHz	Measurement		Class B limits
	Distance (m)	Detector type / bandwidth	dB(μV/m)
1 – 18	3	Average / 1 MHz	54
1 – 18		Peak / 1 MHz	74
18 – 40	1	Average / 1 MHz	63.54
18 – 40		Peak / 1 MHz	83.54
<div>1. The measurement bandwidth shall be 1 MHz or greater.</div> <div>2. These limit levels apply for a measurement distance of 3 m. If using a different measurement distance, the measured levels shall be extrapolated to the 3 m limit distance using a factor of 20 dB per decade of distance. The measurement distance shall place the measurement antenna in the far field of the ITE or digital apparatus under test.</div> <div>3. The test site shall have been validated at the distance used for radiated emission measurements on the ITE or digital apparatus under test.</div>			
<div>Remark: It should be noted that the field strength is inversely proportional to distance, so the field strength at 3m is 1/3 the strength at 1m, i.e. <math>L_{3m}/L_x = X/3</math>.</div> <div>Ex. <math>L_{3m}\text{ dB}-L_x\text{ dB} = 20\log(3/x)</math>; <math>L_{1m}\text{ dB} = 60 + 20\log(3/1) = 69.54\text{ dB}(\mu\text{V/m})</math></div> <div>Ex. <math>L_{3m}\text{ dB}-L_x\text{ dB} = 20\log(3/x)</math>; <math>L_{1m}\text{ dB} = 54 + 20\log(3/1) = 63.54\text{ dB}(\mu\text{V/m})</math></div>			

Required highest measurement frequency for radiated emissions	
Highest internal frequency ( $F_x$ )	Highest measured frequency
$F_x \leq 108\text{ MHz}$	1 GHz
$108\text{ MHz} < F_x \leq 500\text{ MHz}$	2 GHz
$500\text{ MHz} < F_x \leq 1\text{ GHz}$	5 GHz
$F_x > 1\text{ GHz}$	$5 \times F_x$ up to a maximum of 40 GHz
Note: $F_x$ is the highest fundamental frequency generated and/or used in the ITE or digital apparatus under test.	



### 5.2.2. Test Procedures

**Tabletop equipment:**

- a). Same test set up as below 1GHz radiated testing.
- b). The EUT was set 3m (1 – 18GHz) / 1m (18 – 40GHz) from the interference-receiving antenna which was mounted on the top of a variable height antenna tower.
- c). There should be absorber placed between the EUT and Antenna and its located size should let the test site meet CISPR16-1-4 requirement.
- d). The table was rotated 360 degrees to determine the position of the highest radiation.
- e). The measured using a test-receiver system with both a peak and CISPR average detector.
- f). If the EUT is having a Wireless or Bluetooth modular, can choose to install the filter at the input connector of test-receiver system.
- g). Set the DRG Horn Antenna at 1M height, then run the turn table to get the maximum noise reading from Horizontal and Vertical polarity separately the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.
- h). When EUT locating on the turn-table, and its height is over 172cm (Antenna's 3dB beam width of 6GHz is 27°), the DRG Horn Antenna must be raised up and descended down, while keeping the antenna in the cone of radiation from that area and pointed at the area both in azimuth and elevation, then turning around the turn-table to get the maximum noise reading of the Horizontal and Vertical polarity separately.
- i). If emission level of the EUT in peak mode was 23dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

**Floor-standing equipment:**

- a). Same test set up as below 1GHz radiated testing.
- b). The EUT was set 3m (1 – 18GHz) / 1m (18 – 40GHz) from the interference-receiving antenna which was mounted on the top of a variable height antenna tower.
- c). There should be absorber placed between the EUT and Antenna and its located size should let the test site meet CISPR16-1-4 requirement.
- d). The table was rotated 360 degrees to determine the position of the highest radiation.
- e). The measured using a test-receiver system with both a peak and CISPR average detector.
- f). If the EUT is having a Wireless or Bluetooth modular, can choose to install the filter at the input connector of test-receiver system.
- g). Set the DRG Horn Antenna at 1M height, then run the turn table to get the maximum noise reading from Horizontal and Vertical polarity separately the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.
- h). When EUT locating on the turn-table, and its height is over 172cm (Antenna's 3dB beam width of 6GHz is 27°), the DRG Horn Antenna must be raised up and descended down, while keeping the antenna in the cone of radiation from that area and pointed at the area both in azimuth and elevation, then turning around the turn-table to get the maximum noise reading of the Horizontal and Vertical polarity separately.
- i). If emission level of the EUT in peak mode was 23dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

### 5.2.3. Measurement Results Calculation

The measured Level is calculated using:

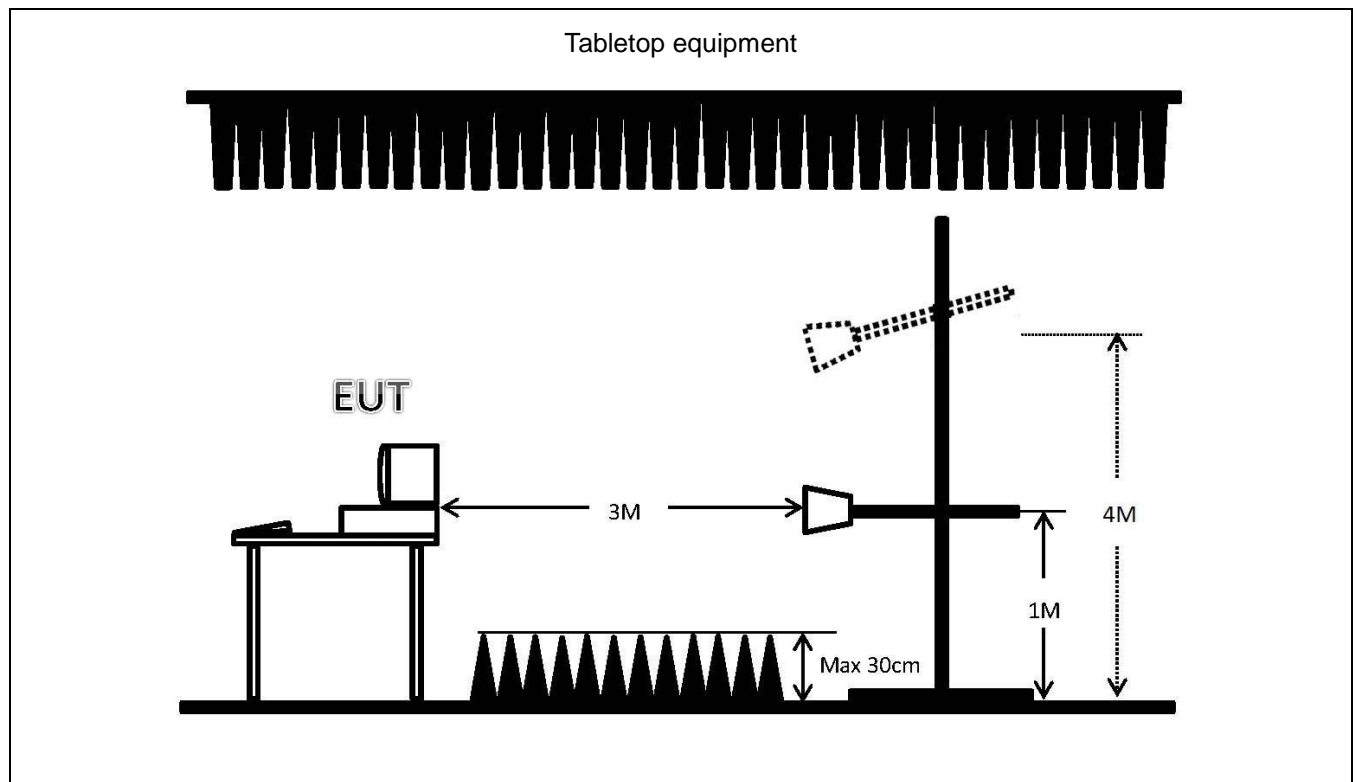
Corrected Reading (dB $\mu$ V/m) = Raw(Read Level)+AF(Antenna Factor)+CL(Cable Loss)-PA( Preamp Factor)

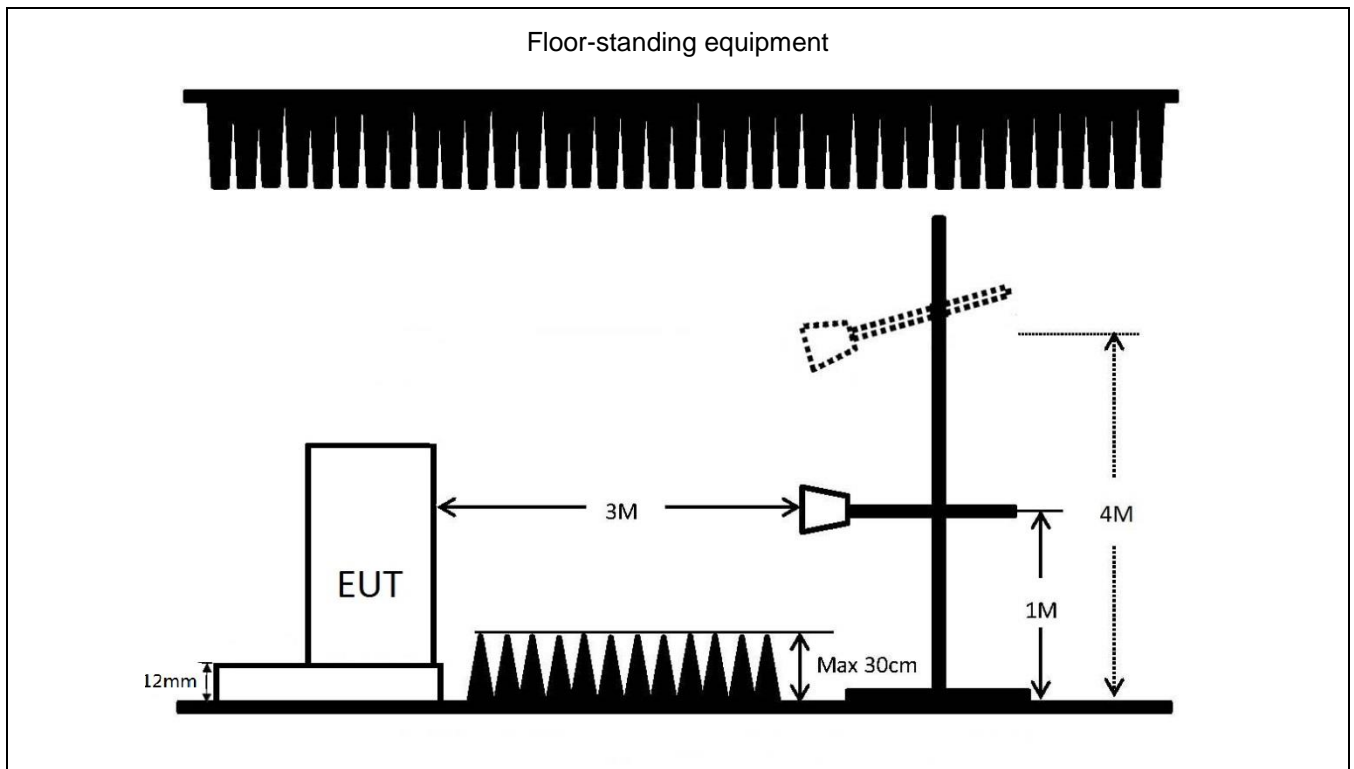
For example at 1980 MHz if the Antenna Factor is 26.19 dB/m, the cable loss is 4.08 dB, the measured voltage is 51.30 dB $\mu$ V and the Preamp Factor is 33.34 dB, the signal strength would be calculated:

Corrected Reading (dB $\mu$ V/m) = 51.30 dB $\mu$ V + 26.19 dB/m + 4.08 dB - 33.34 dB = 48.23 dB $\mu$ V/m

Note: If a Band reject filter is used, this factor will be added to the sum of the factors.

### 5.2.4. Typical Test Setup Layout





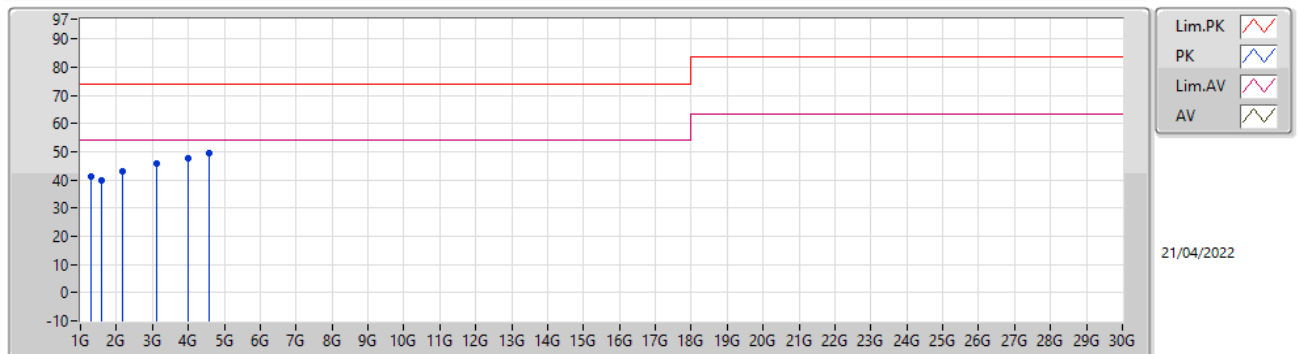


### 5.2.5. Test Result

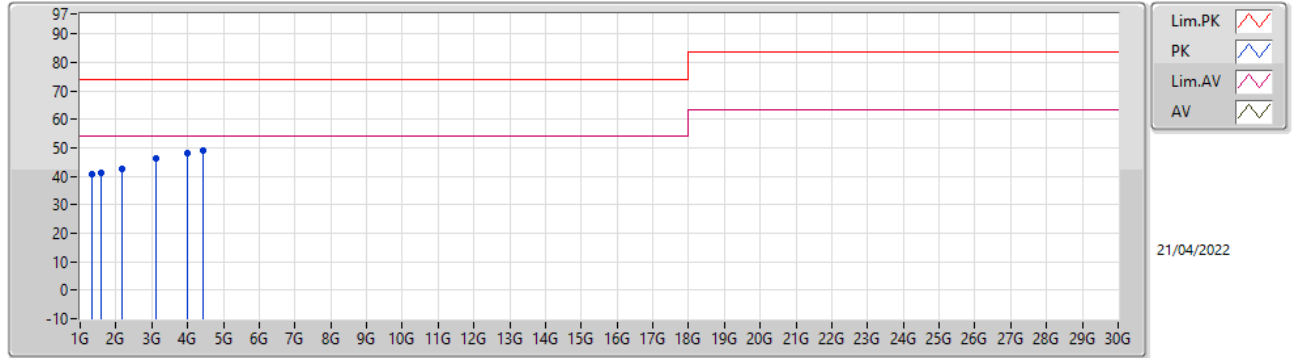
Test mode	Mode 1		
Test frequency	Above 1GHz	Test Voltage	AC 120V / 60Hz
■ The test was passed at the minimum margin that marked by the frame in the following data			

#### Vertical

#### Mode 1



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB/m)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB/m)	CL (dB)	PA (dB)
PK	1.29G	41.13	74.00	-32.87	-5.24	3	Vertical	-	-	-	46.37	26.02	3.36	34.79
PK	1.6G	40.03	74.00	-33.97	-5.15	3	Vertical	-	-	-	45.18	25.30	3.73	34.39
PK	2.165G	42.96	74.00	-31.04	-1.95	3	Vertical	-	-	-	44.91	27.51	4.40	34.15
PK	3.135G	45.77	74.00	-28.23	1.23	3	Vertical	-	-	-	44.54	29.74	5.38	34.23
PK	4.005G	47.62	74.00	-26.38	3.91	3	Vertical	-	-	-	43.71	30.90	6.27	33.84
PK	4.565G	49.60	74.00	-24.40	4.95	3	Vertical	190	1	"Worst"	44.65	31.60	6.71	33.88

**Horizontal**
**Mode 1**


Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB/m)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV)	AF (dB/m)	CL (dB)	PA (dB)
PK	1.32G	40.79	74.00	-33.21	-4.97	3	Horizontal	-	-	-	45.76	26.22	3.38	34.74
PK	1.6G	41.00	74.00	-33.00	-5.15	3	Horizontal	-	-	-	46.15	25.30	3.73	34.39
PK	2.16G	42.71	74.00	-31.29	-1.93	3	Horizontal	-	-	-	44.64	27.54	4.40	34.15
PK	3.115G	46.17	74.00	-27.83	1.14	3	Horizontal	-	-	-	45.03	29.66	5.37	34.24
PK	3.99G	47.90	74.00	-26.10	3.90	3	Horizontal	-	-	-	44.00	30.92	6.26	33.84
PK	4.43G	48.83	74.00	-25.17	4.95	3	Horizontal	188	1	"Worst"	43.88	31.74	6.70	33.87



## 6. Uncertainty of Test Site

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor ( $k=2$ )).

### 6.1. Measurement Uncertainty

Test Items	Test Site No.	$U_{LAB}$
Conducted Emissions	CO01-NH	2.66 dB
Radiated Emissions below 1GHz	OS03-NH	5.07 dB
Radiated Emissions above 1GHz	03CH04-HY	3.53 dB



## 7. List of Measuring Equipment Used

### Conducted Emission - Test Date: 11/Apr/2022

Instrument	Manufacturer/ Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
EMI Receiver	R&S	ESR	102318	9k Hz - 3.6 GHz	26/Jul/2021	25/Jul/2022	Conduction (CO01-NH)
LISN	SCHAFFNER	NNB41	06/10024	9kHz - 30MHz	17/Dec/2021	16/Dec/2022	Conduction (CO01-NH)
Power Filter	CORCOM	MR12030	N/A	30A*2	NCR	NCR	Conduction (CO01-NH)
RF Cable-CON	Suhner Switzerland	RG223/U	CB004	9kHz - 30MHz	27/Dec/2021	26/Dec/2022	Conduction (CO01-NH)
software	Audix	E3	6.12160806	-	NCR	NCR	Conduction (CO01-NH)

NCR: No Calibration Required

### Radiated Emission below 1GHz - Test Date: 11/Apr/2022

Instrument	Manufacturer/ Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Open Area Test Site	SPORTON	OATS-10	OS03-NH	30 MHz - 1 GHz 10m, 3m	16/Oct/2021	15/Oct/2022	Radiation (OS03-NH)
Amplifier	HP	8447D	2944A08292	0.1 MHz - 1.3 GHz	02/Jul/2021	01/Jul/2022	Radiation (OS03-NH)
Spectrum Analyzer	R&S	FSP7	838858/038	9 kHz - 7GHz	21/Jun/2021	20/Jun/2022	Radiation (OS03-NH)
Receiver	R&S	ESCS30	100357	9 kHz - 2.75 GHz	07/May/2021	06/May/2022	Radiation (OS03-NH)
Bilog Antenna With 5dB Attenuator	CHASE	CBL6112D	25234	30 MHz - 2 GHz	24/Apr/2021	23/Apr/2022	Radiation (OS03-NH)
Turn Table	EMCO	2080	9805-2065	0 - 360 degree	NCR	NCR	Radiation (OS03-NH)
Antenna Mast	EMCO	2075	9804-2151	1 m - 4 m	NCR	NCR	Radiation (OS03-NH)
RF Cable-R10m	HSCN	RG213U	2X11N	30 MHz - 1 GHz	13/Jul/2021	12/Jul/2022	Radiation (OS03-NH)
Software	Audix	E3	Ver.4	-	NCR	NCR	Radiation (OS03-NH)

NCR: No Calibration Required

**Radiated Emission above 1GHz - Test Date: 21/Apr/2022**

Instrument	Manufacturer/ Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Turn Table	Chaintek	3000	TT9664	0 ~ 360 degree	NCR	NCR	Radiation (03CH04-HY)
Antenna Mast	MF	MFA-515BSN	MFA-515BSN08 193	1 m ~ 4 m	NCR	NCR	Radiation (03CH04-HY)
3m Semi Anechoic Chamber (Site V.S.W.R)	RIKEN	SAC-3M	03CH04-HY	1 GHz ~ 18 GHz 3m	18/Feb/2022	17/Feb/2023	Radiation (03CH04-HY)
Spectrum Analyzer	R&S	FSP 40	100004	9kHz ~ 40GHz	07/Dec/2021	06/Dec/2022	Radiation (03CH04-HY)
Microwave Preamplifier	Agilent	8449B	3008A02364	1GHz ~ 26.5GHz	08/Mar/2022	07/Mar/2023	Radiation (03CH04-HY)
Preamplifier	MITEQ	TTA1840-35-HG	1864481	18GHz ~ 40GHz	09/Apr/2022	08/Apr/2023	Radiation (03CH04-HY)
Horn Antenna	SCHWARZBEC K	BBHA9120 D	BBHA 9120 D-1130	1 GHz ~ 18 GHz	27/Dec/2021	26/Dec/2022	Radiation (03CH04-HY)
Broadband Horn Antenna	SCHWARZBEC K	BBHA9170	BBHA9170614	15GHz ~ 40GHz	12/May/2021	11/May/2022	Radiation (03CH04-HY)
RF Cable-HIGH	HUBER+SUHN ER	SUCOFLEX 104	SN805197/4+M Y39497	1 GHz ~ 18 GHz	07/Mar/2022	06/Mar/2023	Radiation (03CH04-HY)
RF Cable	HUBER+SUHN ER	SUCOFLEX 102	SN801271/2+SN 80147/2	1 GHz~40 GHz	07/Mar/2022	06/Mar/2023	Radiation (03CH04-HY)
Band Reject Filter	Wi	WRCGV10	41	2382-2402-2480 -2500MHz	30/Apr/2021	29/Apr/2022	Radiation (03CH04-HY)
Band Reject Filter	MTJ	MBR-5150-5250 -45-S1	160413001	5150~5250MHz	30/Apr/2021	29/Apr/2022	Radiation (03CH04-HY)
Software	Sporton	SENSE-EMI	V5.10.7	-	NCR	NCR	Radiation (03CH04-HY)

NCR: No Calibration Required



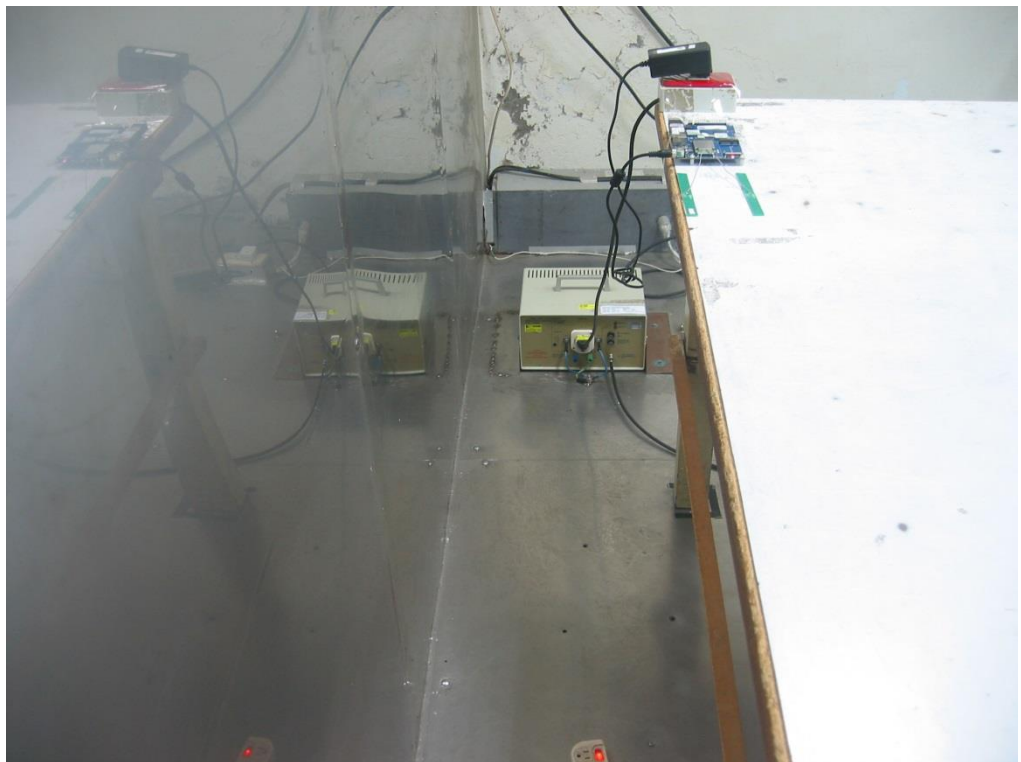
## Appendix A. Test Photos

### 1. Photographs of Conducted Emissions Test Configuration

Front View



Side View



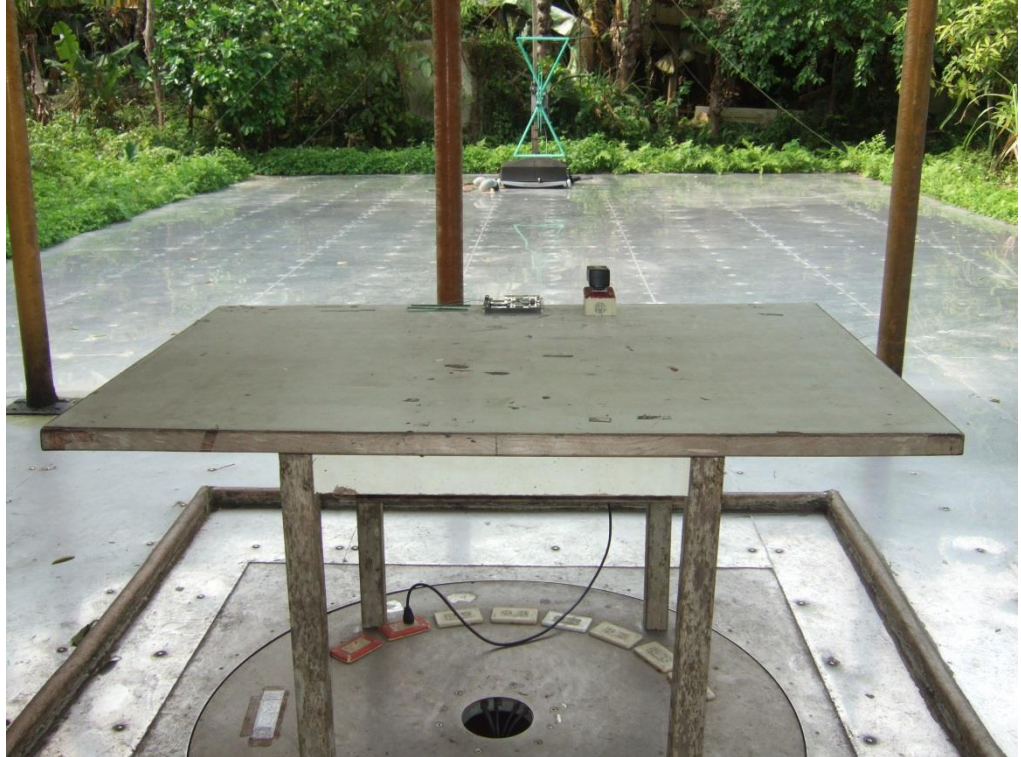
**Under Table View**



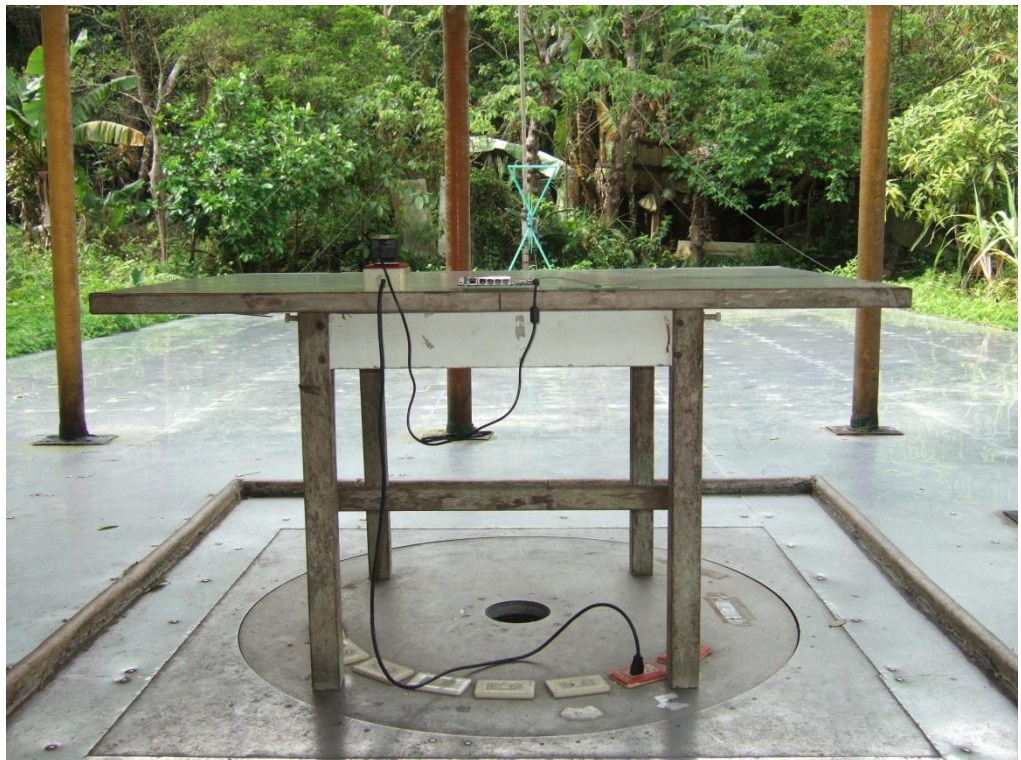
## 2. Photographs of Radiated Emissions Test Configuration

For radiated emissions below 1GHz

Front View



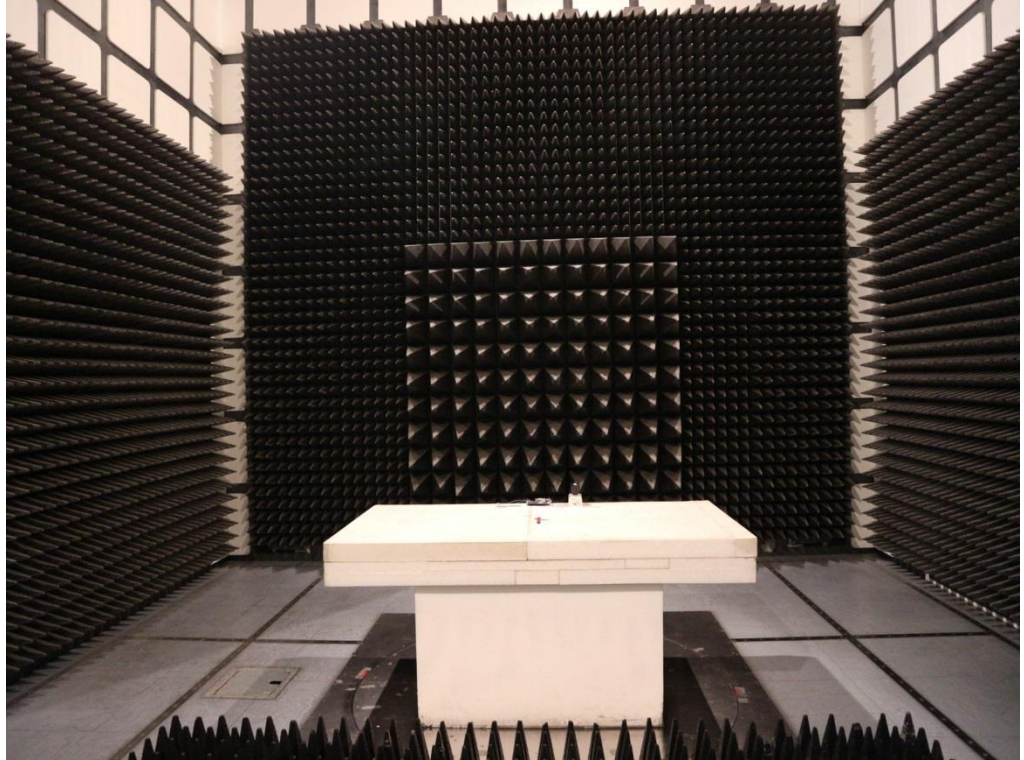
Rear View



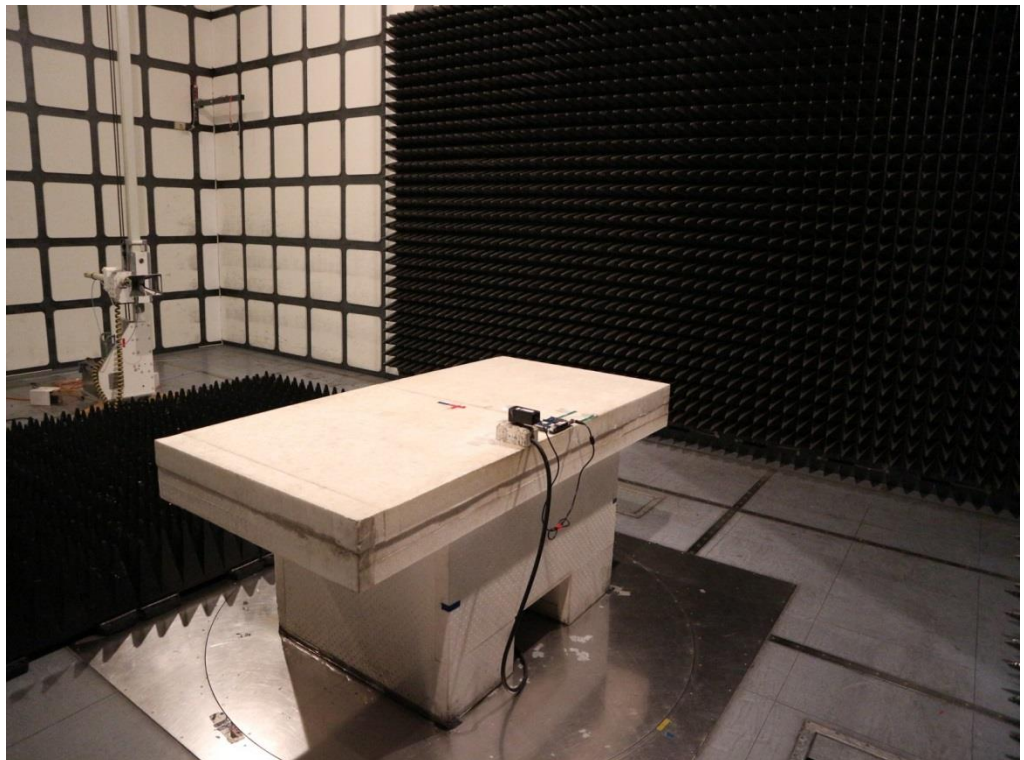


For radiated emissions above 1GHz

**Front View**



**Rear View**



————THE END————