



**EMI TEST REPORT**

**FOR**

**IEEE 802.11ax/ac/a/b/g/n 2x2 WiFi with Bluetooth5.0 Combo Module**

**MODEL : WNFB-265AXI(BT)**

**SERIES MODEL : AP12275\_M2P**

**REPORT NUMBER : 4789558390A -US-E0-V0**

**ISSUE DATE : Feb. 24, 2021**

**Prepared for**

**SparkLAN Communications, Inc.**

**8F., No.257, Sec. 2, Tiding Blvd., Neihu District, Taipei City 11493, Taiwan (R.O.C.)**

**Prepared by**

**Underwriters Laboratories Taiwan Co., Ltd.**

**Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township,  
Hsinchu County, Taiwan**

**Tel: +886.2.2896.7790**

**Fax: +886.3.583.7948**

**Website: [www.ul.com](http://www.ul.com)**



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## Revision History

<b>Rev.</b>	<b>Issue Date</b>	<b>Revisions</b>	<b>Revised By</b>
--	Feb. 24, 2021	Initial Issue	Cindy Hsin

<b>Summary of Test Results</b>			
<b>Standard</b>	<b>Test Item</b>	<b>Limit</b>	<b>Result</b>
FCC Part 15 Subpart B Class B ANSI C63.4:2014 ICES-003 issue 6	Conducted emission	Class B	PASS
	Radiated emission (Below 1 GHz)	Class B	PASS
	Radiated emission (Above 1 GHz)	Class B	PASS

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SparkLAN Communications, Inc.  
8F., No.257, Sec. 2, Tiding Blvd., Neihu District, Taipei City  
11493, Taiwan

**MANUFACTURER:** SparkLAN Communications, Inc.  
8F., No.257, Sec. 2, Tiding Blvd., Neihu District, Taipei City  
11493, Taiwan

**EUT DESCRIPTION:** IEEE 802.11ax/ac/a/b/g/n 2x2 WiFi with Bluetooth5.0 Combo  
Module

**MODEL:** WNFB-265AXI(BT)

**SERIES MODEL :** AP12275\_M2P

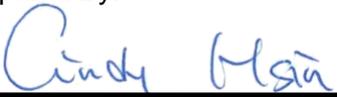
**DATE TESTED:** Jan. 13, 2021 ~ Jan. 14, 2021

APPLICABLE STANDARDS	
STANDARDS	TEST RESULTS
FCC Part 15 Subpart B: Class B ANSI C63.4:2014	PASS

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:



Cindy Hsin  
Project Handler

Date : Feb. 24, 2021

Approved and Authorized By:



Roy Chen  
Operations Manager

Date : Feb. 24, 2021

## 2. TEST METHODOLOGY

All tests were performed in accordance with the procedures documented FCC Part 15 Subpart B and ANSI C63.4.

## 3. FACILITIES AND ACCREDITATION

<b>Test Location</b>	Underwriters Laboratories Taiwan Co., Ltd.,
<b>Address</b>	Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
<b>Description</b>	All measurement facilities use to collect the measurement data are located at Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. Measuring Instrument Calibration

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor  $k=2$ .

Test Item	Measurement Frequency Range	K	U(dB)
Conducted disturbance at mains terminals ports	0.15MHz ~ 30MHz	2	1.5
966-1 Test Site			
Radiated disturbance below 1 GHz	30MHz ~ 1000MHz	2	5.7
Radiated disturbance above 1 GHz	1000MHz ~ 18000MHz	2	4.9
	18000-40000MHz	2	4.9

## 5. EQUIPMENT UNDER TEST

### 5.1. Description of EUT

<b>EUT Name:</b>	IEEE 802.11ax/ac/a/b/g/n 2x2 WiFi with Bluetooth5.0 Combo Module
<b>Model:</b>	WNFB-265AXI(BT)
<b>Series Model:</b>	AP12275_M2P
<b>Power Rating:</b>	From host system
<b>Highest Frequency within EUT:</b>	5850MHz
<b>Condition of EUT:</b>	Identical Prototype
<b>Date Of Receipt Of Sample:</b>	Dec. 2, 2020

Note:

1. The models difference table as below:

Brand	Model	Difference
SparkLAN	WNFB-265AXI(BT)	-
Ampak	AP12275_M2P	Same as WNFB-265AXI(BT), marketing purpose only.

Except above change, there are no change to technical construction that is included circuit diagram, PCB Layout, components and component layout, all electrical construction and mechanical construction.

## 5.2. Test Mode

The pre-test mode:

Mode	Description	Conducted Emission	Radiated Emission
Mode 1	WiFi 2.4G operation mode 802.11ax channel 6_X axis	v	v
Mode 2	BT operation mode BT5-LE-2M channel 39_X axis	v	v
Mode 3	WiFi 5G operation mode 802.11a channel 48_X axis	v	v
Mode 4	WiFi 5G operation mode 802.11a channel 48_Y axis	-	v
Mode 5	WiFi 5G operation mode 802.11a channel 48_Z axis	-	v

Note :

1. The EUT has been fully verify as above modes, the report only shows the worst mode data.
2. The evaluation method is to test the channel with the highest power in the power table in the report number "4789558390-US-R0-V0、4789558390-US-R1-V0、4789558390-US-R4-V0".
3. Since the gain value of dipole antenna 3 is the largest in all frequency bands, All the test uses dipole antenna 3 as a representative.

After pre-testing, the final test mode was displayed as below table.

Test Items		Test Mode
<b>Emission</b>	Conducted Emission	Mode 1
	Radiated Emission	Mode 3

### 5.3. EUT Operation Test Setup

Mode 1:

- a. Place the EUT as X axis
- b. Connect the EUT to fixture 2 and connect the fixture 2 to fixture 1, then insert it into Notebook.
- c. Connect the EUT to a wireless router and transmitted packages via Wi-Fi 2.4G.

Mode 2:

- a. Place the EUT as X axis
- b. Connect the EUT to fixture 2 and connect the fixture 2 to fixture 1, then insert it into Notebook.
- c. Connect the EUT to a smart phone and transmitted audio via Bluetooth.

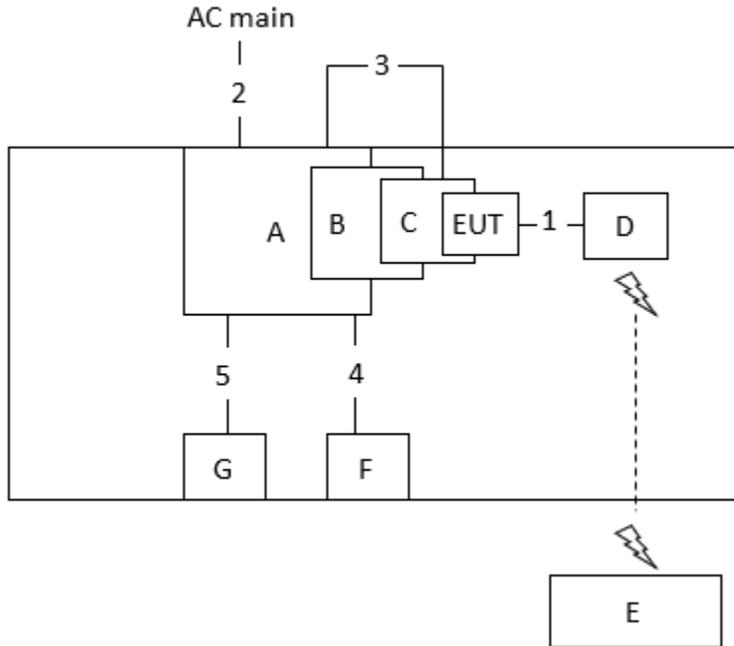
Mode 3:

- a. Place the EUT as X axis
- b. Connect the EUT to fixture 2 and connect the fixture 2 to fixture 1, then insert it into Notebook.
- c. Connect the EUT to a wireless router and transmitted packages via Wi-Fi 5G.

### 5.4. Accessory

Item	Accessory	Brand Name	Model Name	Note
-	Dipole Antenna 1	SparkLAN	AD-103AG	2.4GHz: 2.02dBi 5GHz: 2.03dBi RP-SMA
-	Dipole Antenna 2	SparkLAN	AD-302N	2.4GHz: 3.14dBi 5GHz: 2.73dBi RP-SMA
-	Dipole Antenna 3	SparkLAN	AD-303N	2.4GHz: 3.14dBi 5GHz: 3.24dBi RP-SMA

### 5.5. Block diagram showing the configuration of system tested



## 5.6. Description of support units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	FCC ID	Note
A	Notebook	Lenovo	T430	N/A	N/A	N/A
B	Fixture 1	N/A	N/A	N/A	N/A	N/A
C	Fixture 2	N/A	N/A	N/A	N/A	N/A
D	Dipole Antenna 3 *2	SparkLAN	AD-303N	N/A	N/A	N/A
E	Wireless-AX6000 Dual Band Gigabit Router	ASUS	RT-AX88U	L4ITHP000110	N/A	N/A
F	Mouse	DELL	MS116t	0DV0RH-71616-71B-0ZU2	N/A	N/A
G	Earphone	TECO	XYFSE005	N/A	N/A	N/A

Item	Connection	Shielded Type	Length	Note
1	Signal cable *2	Non-shielded	0.1 m	Provide from customer
2	Power cable	Non-shielded	3 m	N/A
3	USB cable*2	Shielded	0.5 m	N/A
4	USB cable	Shielded	1.5m	N/A
5	Audio cable	Non-shielded	1.5m	N/A

## 5.7. Measuring Instrument List

Instrument					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Expired date
<b>Conducted Disturbance</b>					
EMI Test Receiver	Rohde & Schwarz	ESR7	101753	2020/11/17	2021/11/16
Two-Line V-Network	Rohde & Schwarz	ENV216	102136	2020/8/19	2021/8/18
Two-Path V-LISN	SCHWARZBECK	NSLK 8127	8127-946	2020/11/3	2021/11/2
Impuls-Begrenzer Pulse Limiter	Rohde & Schwarz	ESH3-Z2	102219-Qt	2020/8/12	2021/8/11
Cable	HARBOUR INDUSTRIES	LL142	170205-5000-1	2020/2/5	2021/2/3
Measurement Software	Farad	EZ-EMC Ver: UL-3A1.2	N/A	N/A	N/A
<b>Radiated Disturbance</b>					
<b>966-1</b>					
EMI Test Receiver	Rohde & Schwarz	ESR7	101755	2020/12/4	2021/12/3
Trilog-Broadband Antena with 5dB Attenuator	SCHWARZBECK	VULB 9168 & N-6-05	9168-773 & AT-N0539	2020/2/11	2021/2/9
Double Ridged Guide Horn Antenna	SCHWARZBECK	BBHA 9120 D	1686	2020/12/23	2021/12/22
Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	759	2020/11/30	2021/11/29
Preamplifier	EMC Instrument	EMC330E	980404	2020/6/4	2021/6/3
Preamplifier	EMC Instrument	EMC051835BE	980407	2020/1/15	2021/1/13
Preamplifier	EMC Instrument	EMC184045SE	980408	2020/3/24	2021/3/23
EXA Spectrum Analyzer	Keysight Technologies	N9010A	MY56070821	2020/12/15	2021/12/14
Cables	UltraPhase&EMC Instrument	A1K50-UP0358-A1K50-1500&EMC106-NM-SM-2500/8000	170111-3&170104/170223	2020/2/5	2021/2/3
Cables	UltraPhase / Taitan	K1K50-UP0264-K1K50-500/2500/T0712AT340A12A400	1701214-3/170214-3/J09004	2020/3/25	2021/3/24
Measurement Software	Farad	EZ-EMC Ver: UL-3A1	N/A	N/A	N/A

## 6. EMISSION TEST

### 6.1. Conducted Disturbance Measurement

#### 6.1.1. Limits of conducted disturbance voltage and common mode disturbance

FREQUENCY (MHz)	□ Class A (dBμV)		☒ Class B (dBμV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 -0.5	79.00	66.00	66 - 56 *	56 – 46 *
0.50 -5.0	73.00	60.00	56.00	46.00
5.0 -30.0	73.00	60.00	60.00	50.00

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " \* " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.
- (3) The test result calculated as following:  
 Measurement Value = Reading Level + Correct Factor  
 Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor(if use)  
 Margin Level = Measurement Value - Limit Value

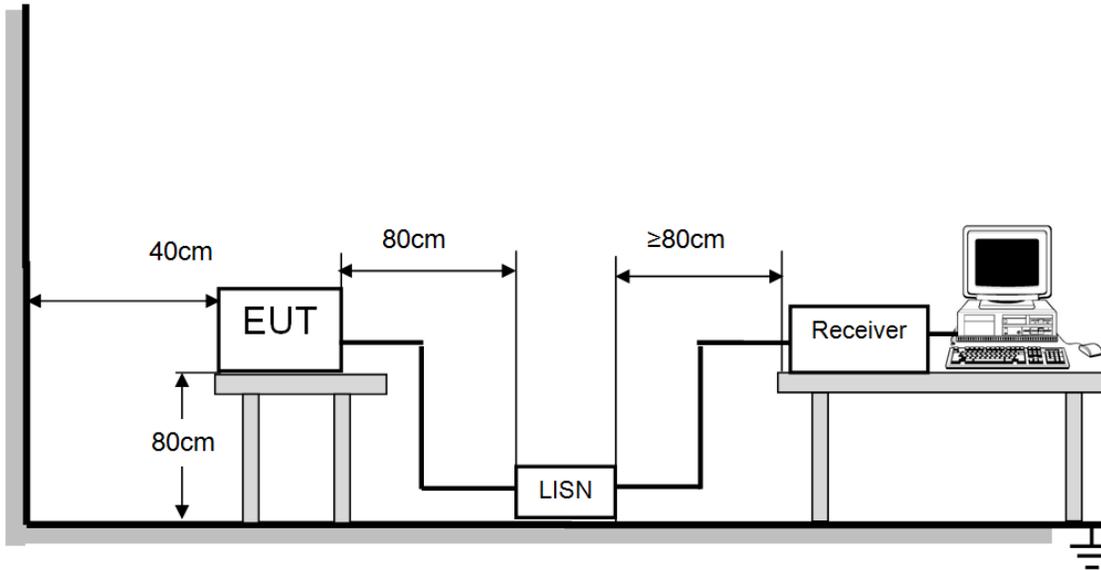
The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

#### 6.1.2. Test Procedure

- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall at least 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item: EUT Test Photos.

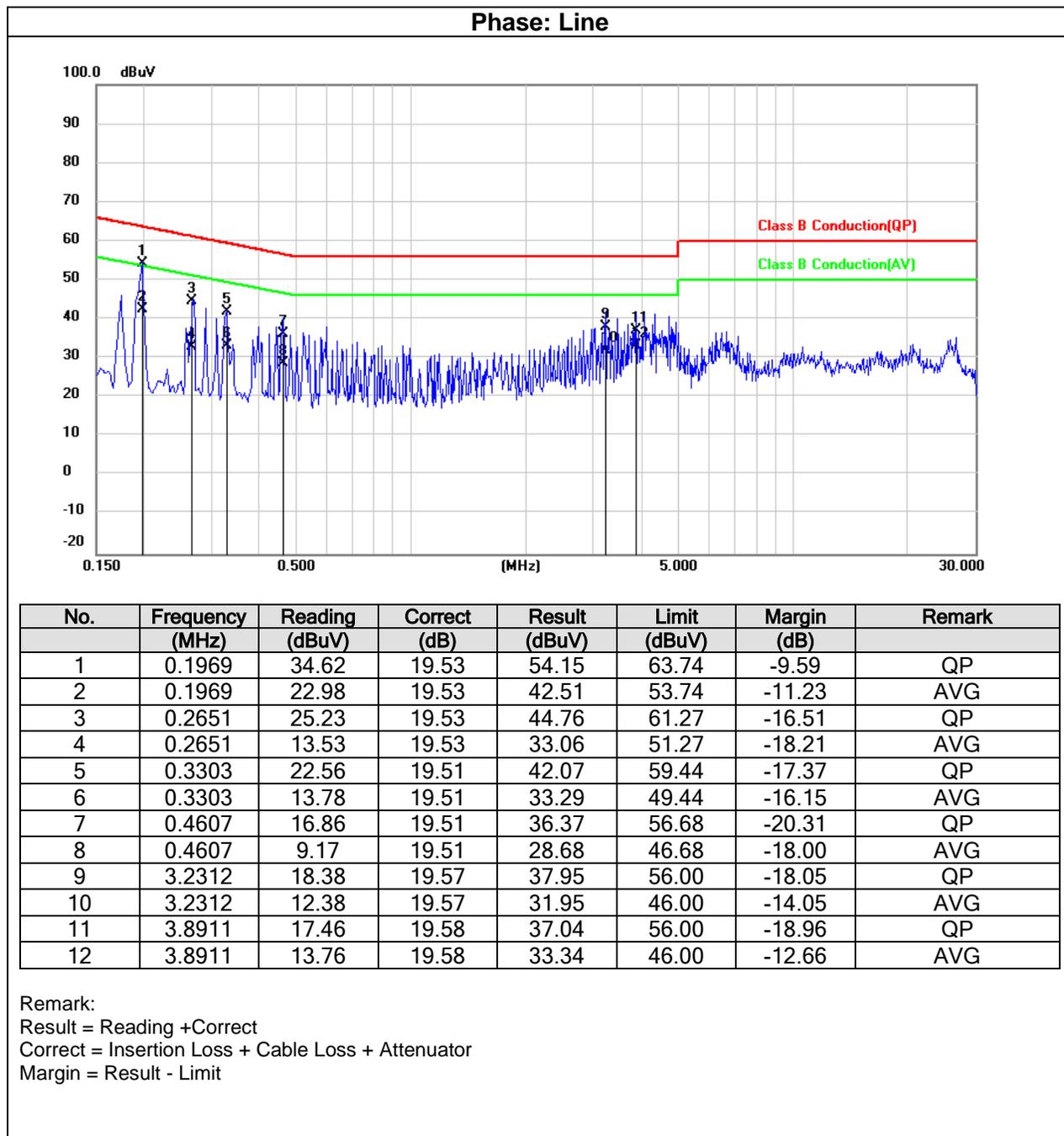
### 6.1.3. Test Setup



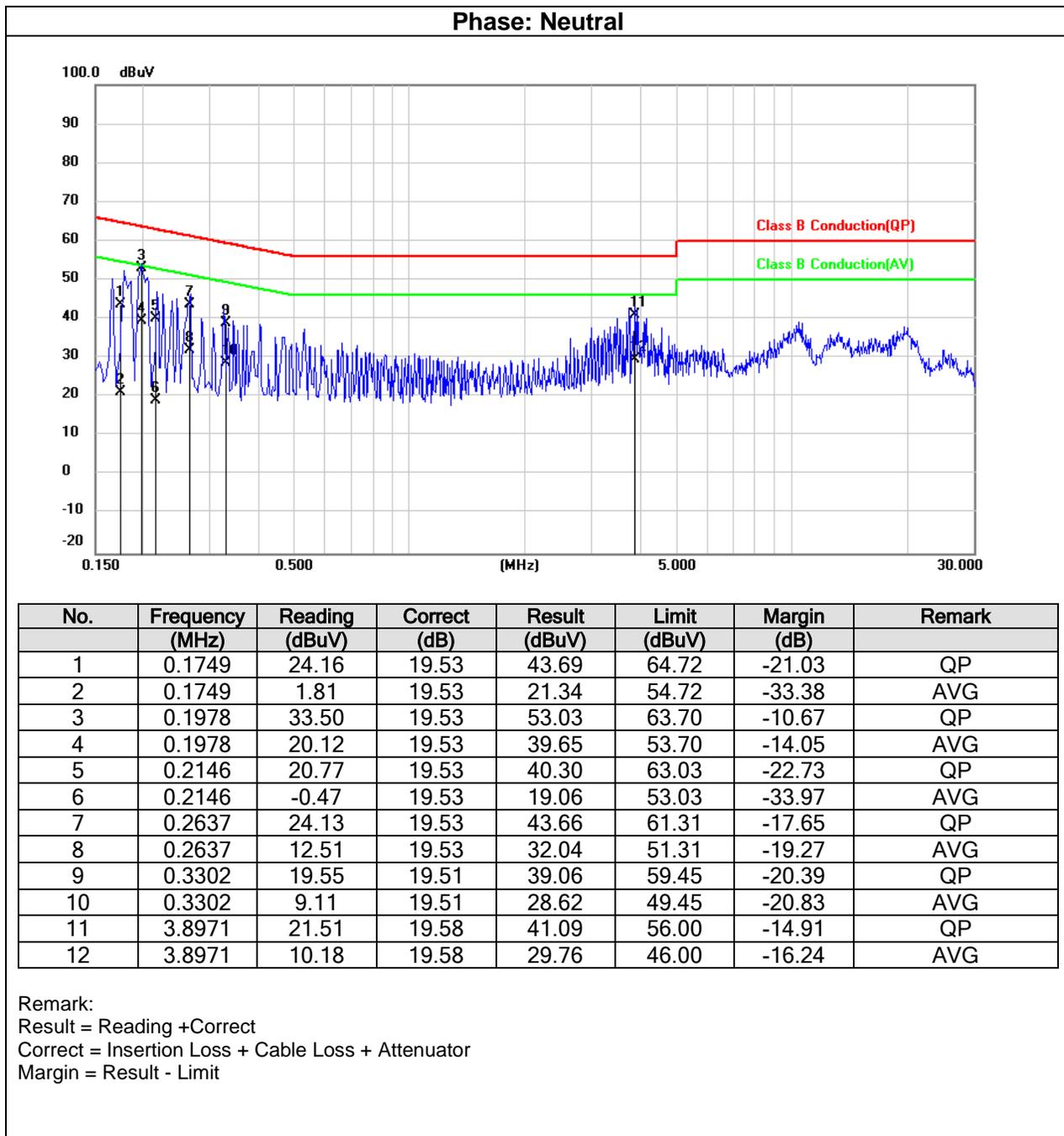
For the actual test configuration, please refer to Appendix I: Photographs of the Test Configuration.

### 6.1.4. Test Result

Test Mode:	Mode 1	Temperature:	23°C
Test Voltage:	AC 120V/60Hz	Humidity:	53%RH
Tested By:	Rupert Huang	Test Date:	Jan. 14, 2021



Test Mode:	Mode 1	Temperature:	23°C
Test Voltage:	AC 120V/60Hz	Humidity:	53%RH
Tested By:	Rupert Huang	Test Date:	Jan. 14, 2021



## 6.2. Radiated Disturbance Measurement (below 1G)

### 6.2.1. Limits of radiated disturbance measurement

FREQUENCY (MHz)	<input type="checkbox"/> Class A	<input checked="" type="checkbox"/> Class B
	<input type="checkbox"/> At 3m	<input checked="" type="checkbox"/> At 3m
	(dBuV/m)	
30 – 88	49.5	40
88 – 216	53.9	43.5
216 – 960	56.9	46
960 – 1000	60	54

**NOTE:**

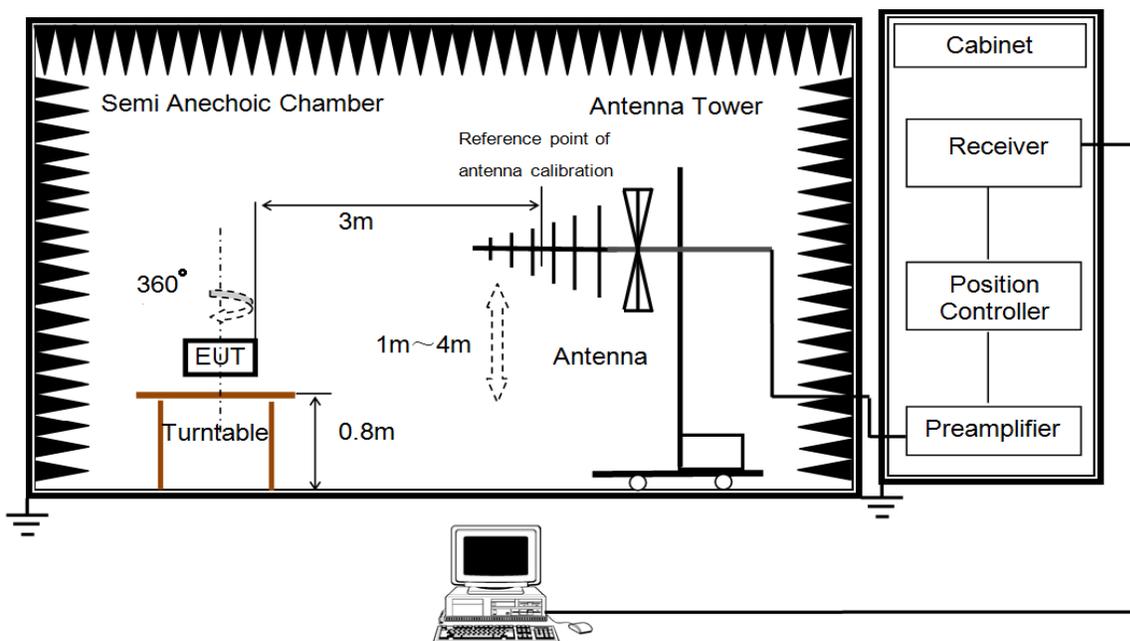
- (1) The tighter limit applies at the band edges.
- (2) Emission level (dB $\mu$ V/m)=20\*log Emission level (uV/m).
- (3) The test result calculated as following:  
 Measurement Value = Reading Level + Correct Factor,  
 Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use),  
 Margin Level = Measurement Value - Limit Value.
- (4) For class A equipment test distance from 10m translate to 3m, the limit shall be relax by following formula :  

$$L_3 = L_{10} + 20 \log (d_{10}/d_3)$$

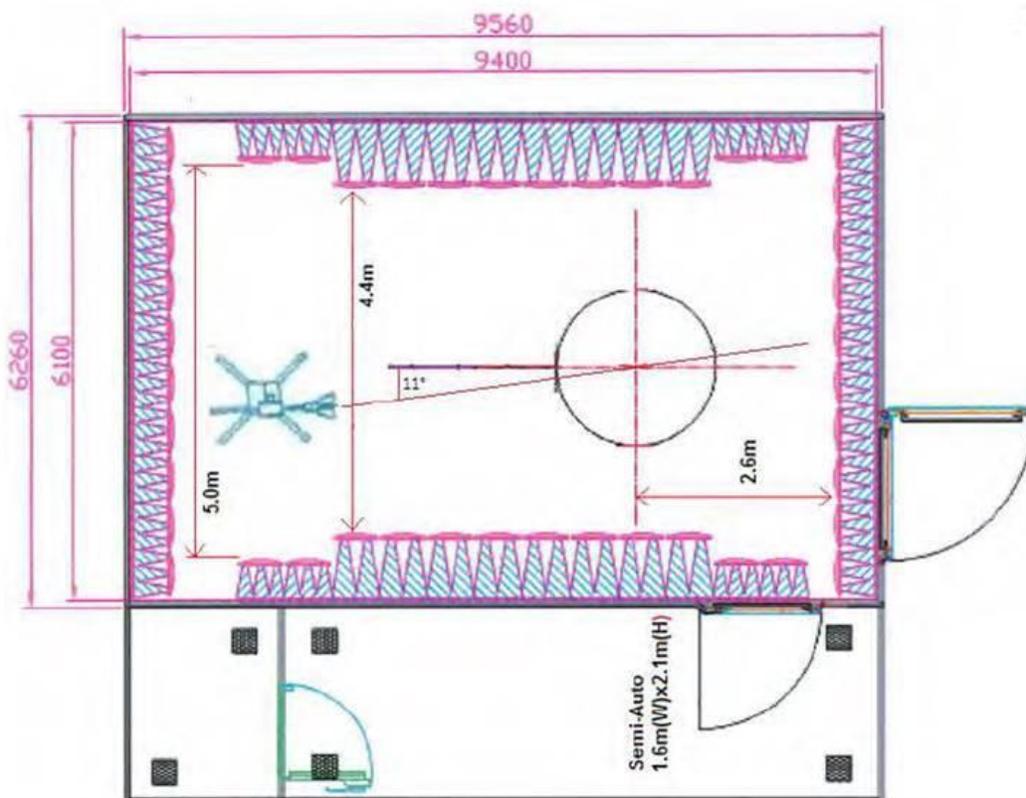
### 6.2.2. Test Procedure

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- c. The initial step in collecting radiated emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- d. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- e. For the actual test configuration, please refer to the related Item: EUT Test Photos.

### 6.2.3. Test Setup

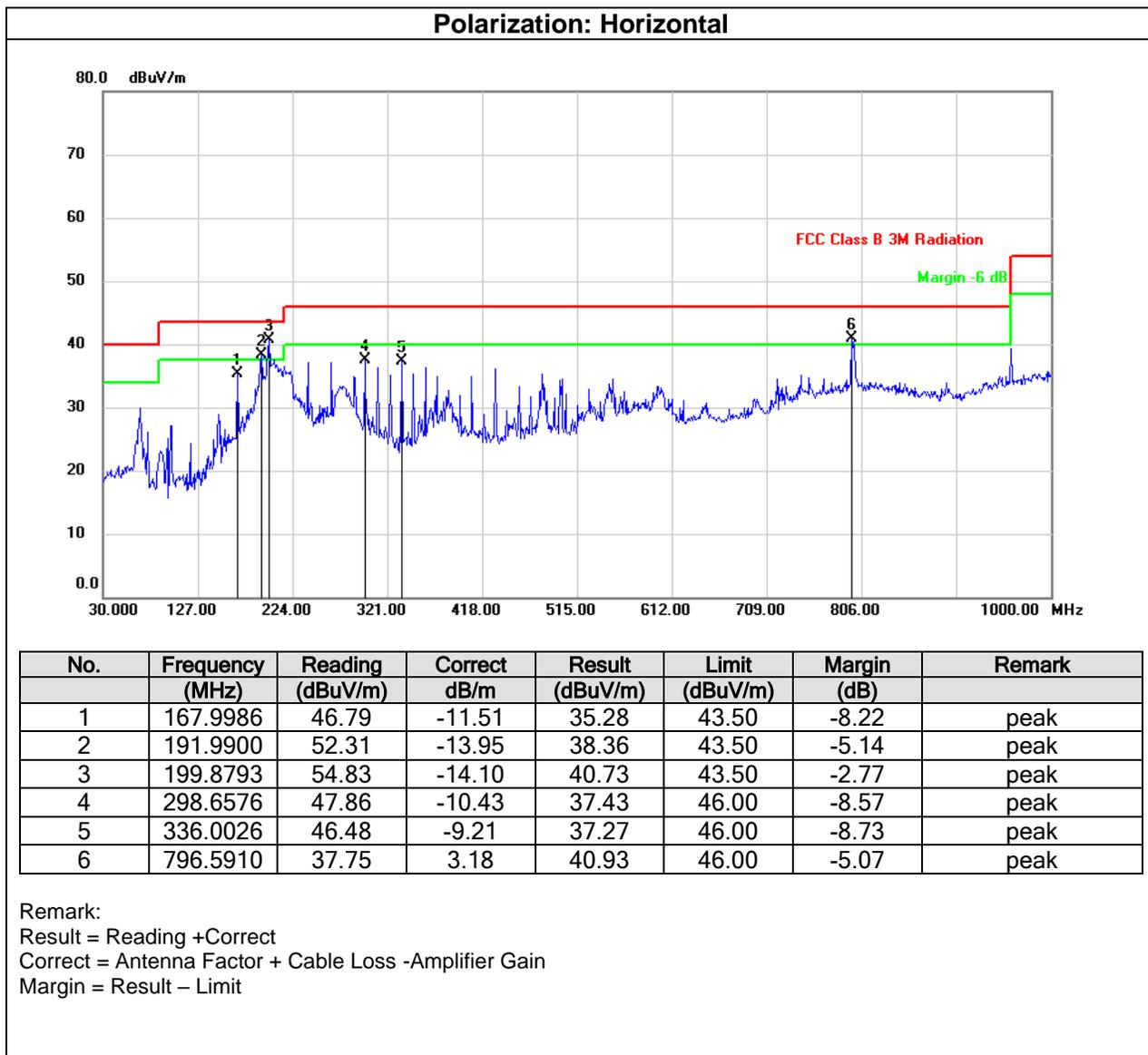


For the actual test configuration, please refer to Appendix I: Photographs of the Test Configuration.

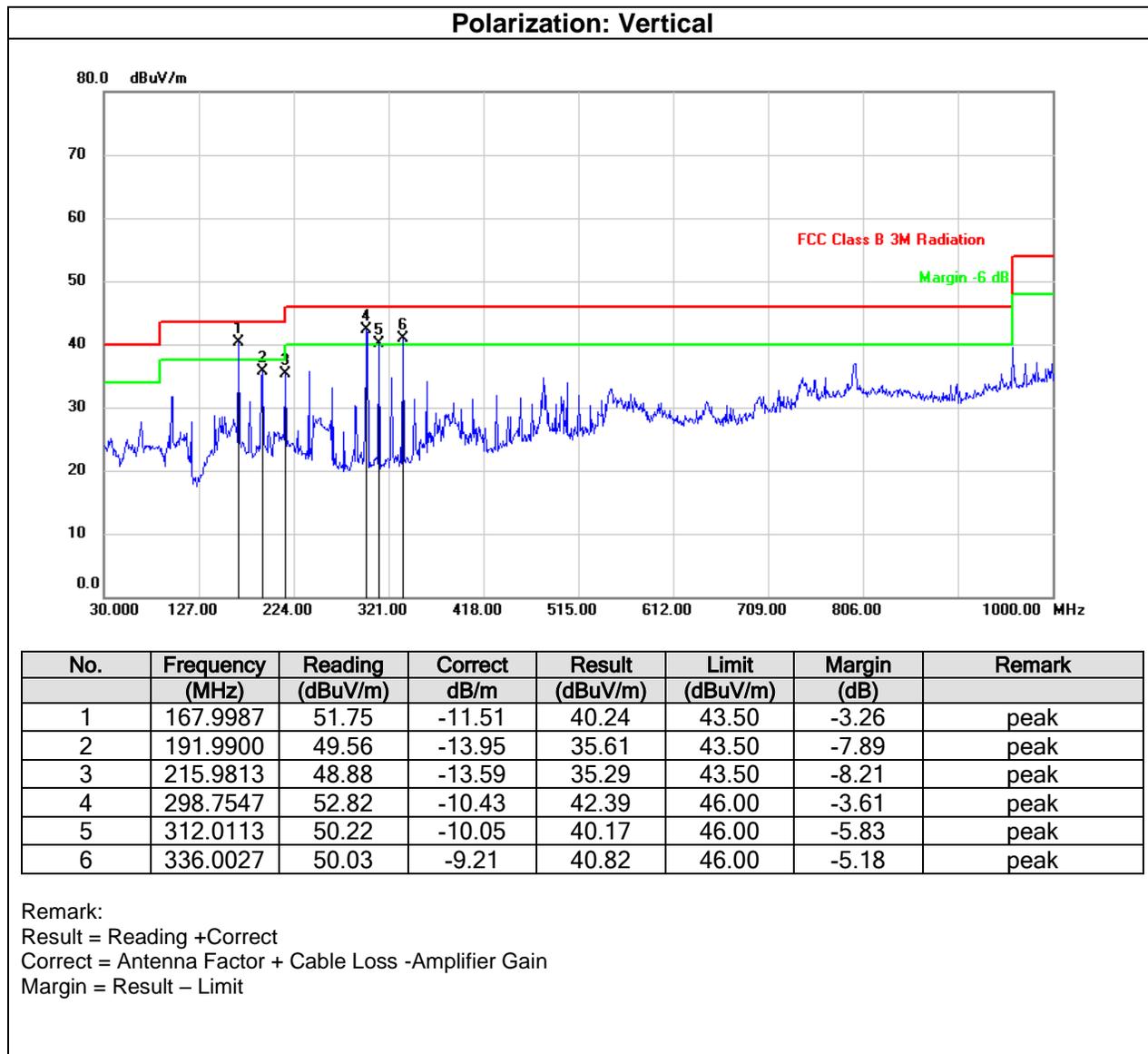


### 6.2.4. Test Result

Test Mode:	Mode 3	Temperature:	23°C
Test Voltage:	AC 120V/60Hz	Humidity:	53%RH
Tested By:	Rupert Huang	Test Date:	Jan. 13, 2021



Test Mode:	Mode 3	Temperature:	23°C
Test Voltage:	AC 120V/60Hz	Humidity:	53%RH
Tested By:	Rupert Huang	Test Date:	Jan. 13, 2021



### 6.3. Radiated Disturbance Measurement (above 1G)

#### 6.3.1. Limits of radiated disturbance measurement

FREQUENCY (MHz)	<input type="checkbox"/> Class A		<input checked="" type="checkbox"/> Class B	
	<input type="checkbox"/> At 3m; <input type="checkbox"/> At 1m		<input checked="" type="checkbox"/> At 3m; <input checked="" type="checkbox"/> At 1m	
	Average limit dB(μV/m)	Peak limit dB(μV/m)	Average limit dB(μV/m)	Peak limit dB(μV/m)
1000-18000	60	80	54	74
18000-40000	69.54	89.54	63.54	83.54

**NOTE:**

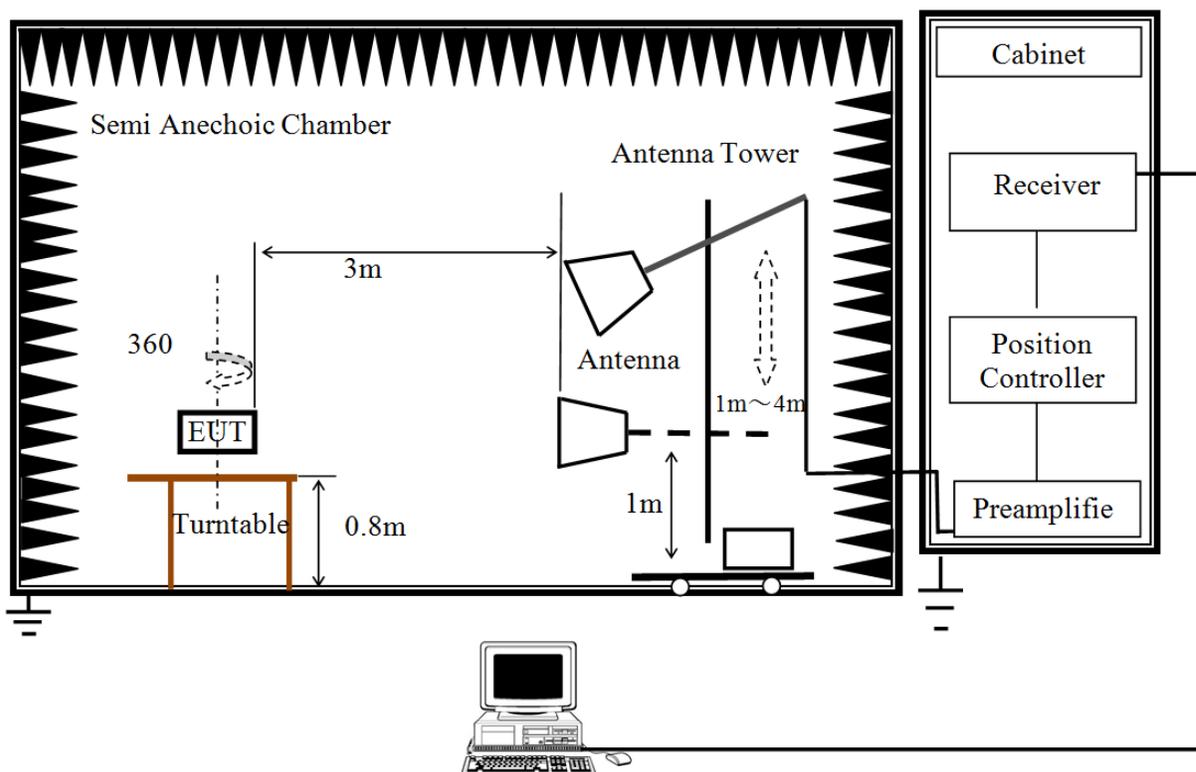
- (1) The tighter limit applies at the band edges.
- (2) Emission level (dBμV/m)=20log Emission level (uV/m).
- (3) If the highest frequency of the internal sources of the EUT is less than 108 MHz, the measurement shall only be made up to 1 GHz. If the highest frequency of the internal sources of the EUT is between 108 MHz and 500 MHz, the measurement shall only be made up to 2 GHz. If the highest frequency of the internal sources of the EUT is between 500 MHz and 1 GHz, measurement shall only be made up to 5GHz. If the highest frequency of the internal sources of the EUT is above 1 GHz, the measurement shall be made up to 5 times the highest frequency or 40 GHz, whichever is less.
- (4) The test result calculated as following:  
 Measurement Value = Reading Level + Correct Factor,  
 Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use),  
 Margin Level = Measurement Value - Limit Value.
- (5) For 1-18GHz, the test distance is 3m, for 18 to 40G, the test distance will be move from 3m to 1m. the limit shall be relax by following formula :  

$$L_1 = L_3 + 20 \log (d_3/d_1)$$

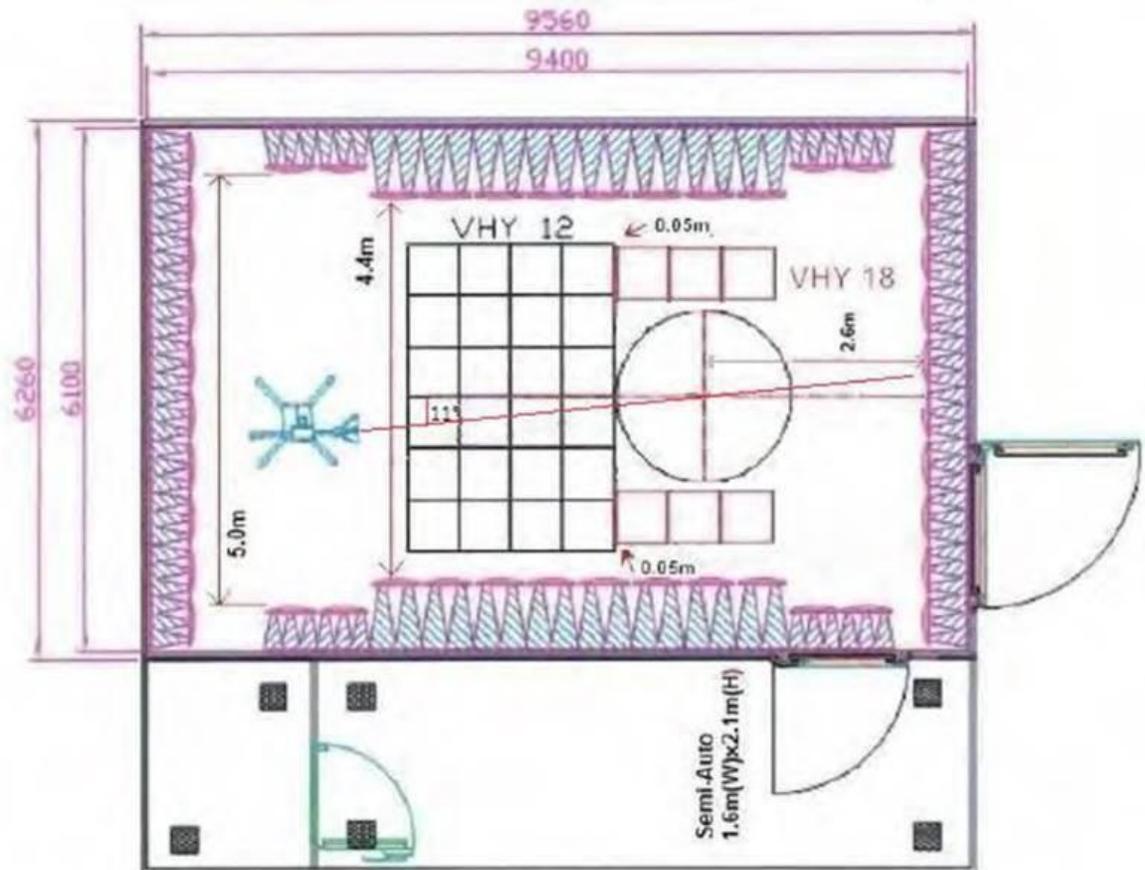
### 6.3.2. Test Procedure

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- c. The initial step in collecting radiated emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Average detector mode re-measured.
- d. For the actual test configuration, please refer to the related Item:EUT Test Photos.

### 6.3.3. Test Setup

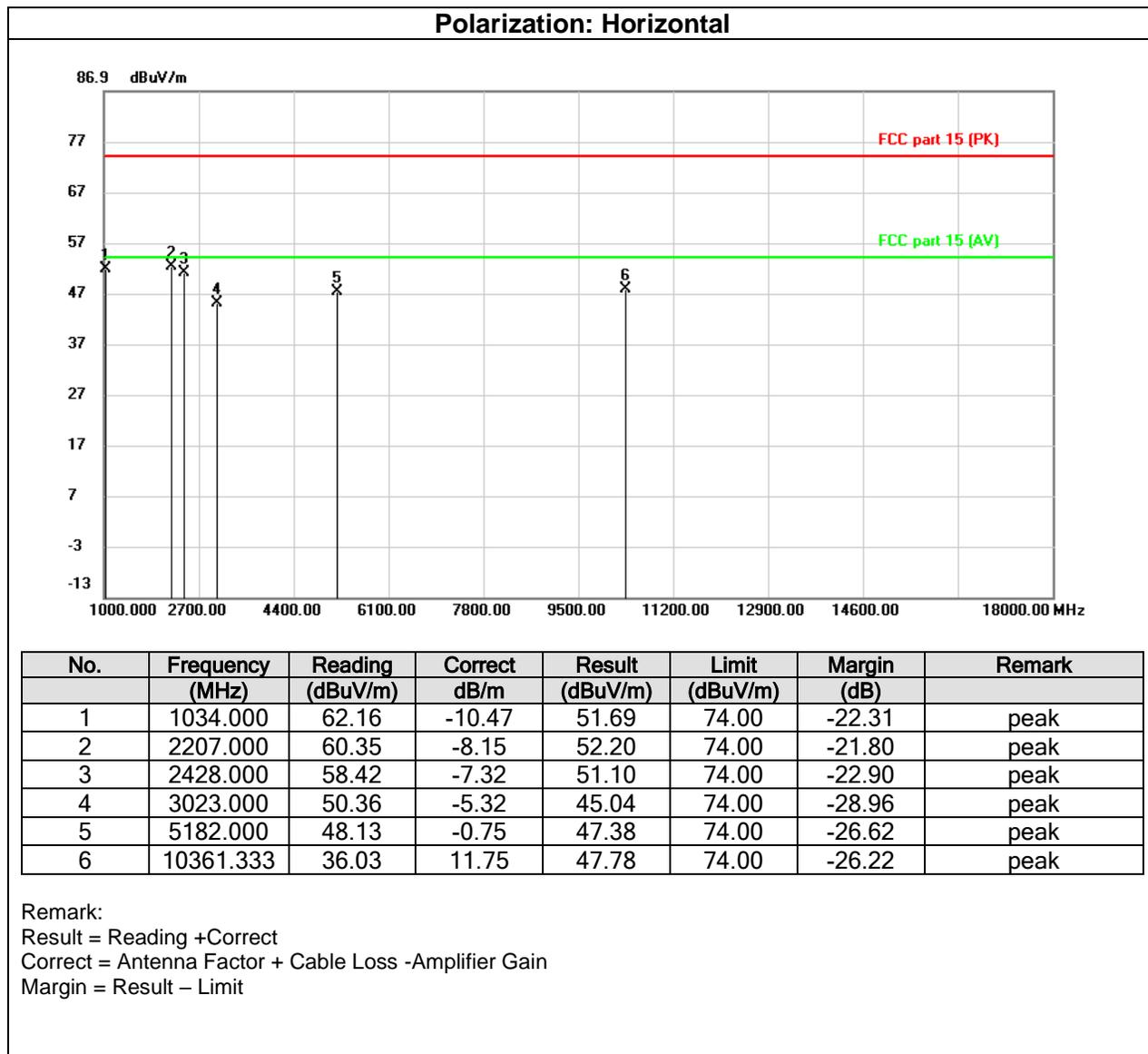


For the actual test configuration, please refer to Appendix I : Photographs of the Test Configuration.

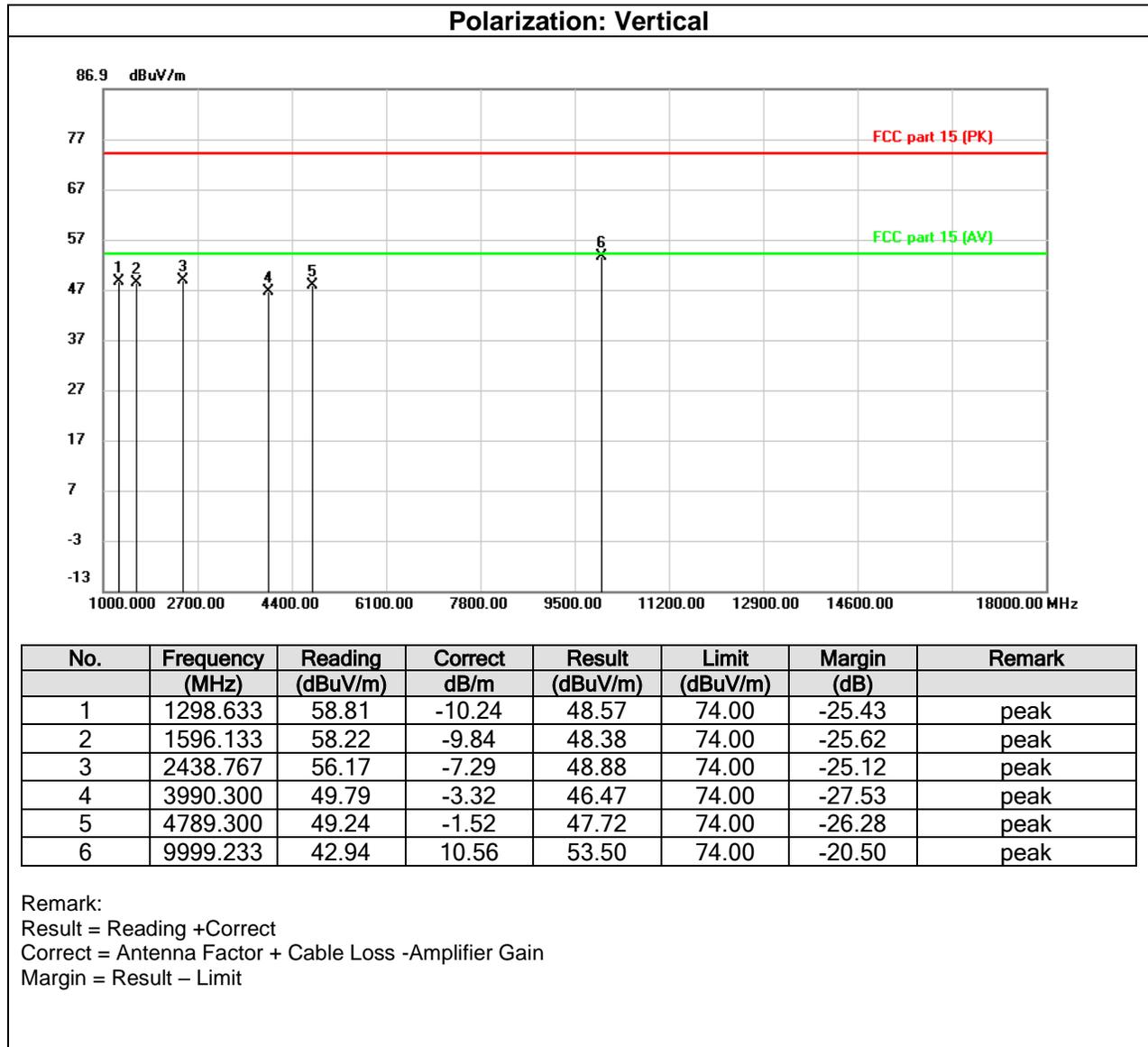


### 6.3.4. Test Result

Test Mode:	Mode 3	Temperature:	25°C
Test Voltage:	AC 120V/60Hz	Humidity:	59%RH
Tested By:	Rupert Huang	Test Date:	Jan. 14, 2021
Frequency range:	1GHz~18GHz		

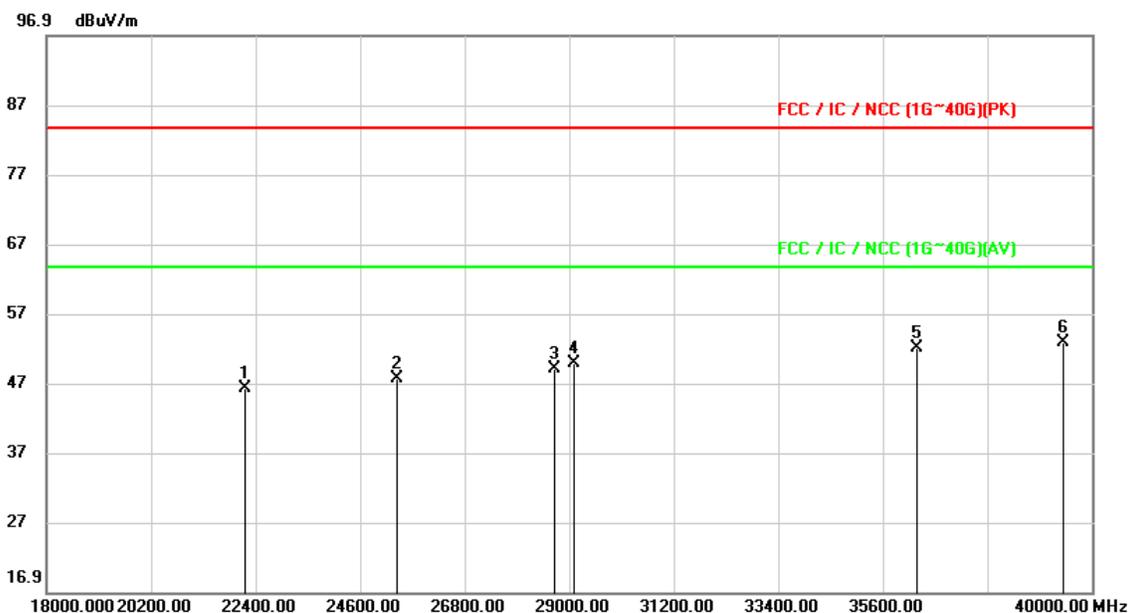


Test Mode:	Mode 3	Temperature:	25°C
Test Voltage:	AC 120V/60Hz	Humidity:	59%RH
Tested By:	Rupert Huang	Test Date:	Jan. 14, 2021
Frequency range:	1GHz~18GHz		



Test Mode:	Mode 3	Temperature:	25°C
Test Voltage:	AC 120V/60Hz	Humidity:	59%RH
Tested By:	Rupert Huang	Test Date:	Jan. 14, 2021
Frequency range:	18GHz~40GHz		

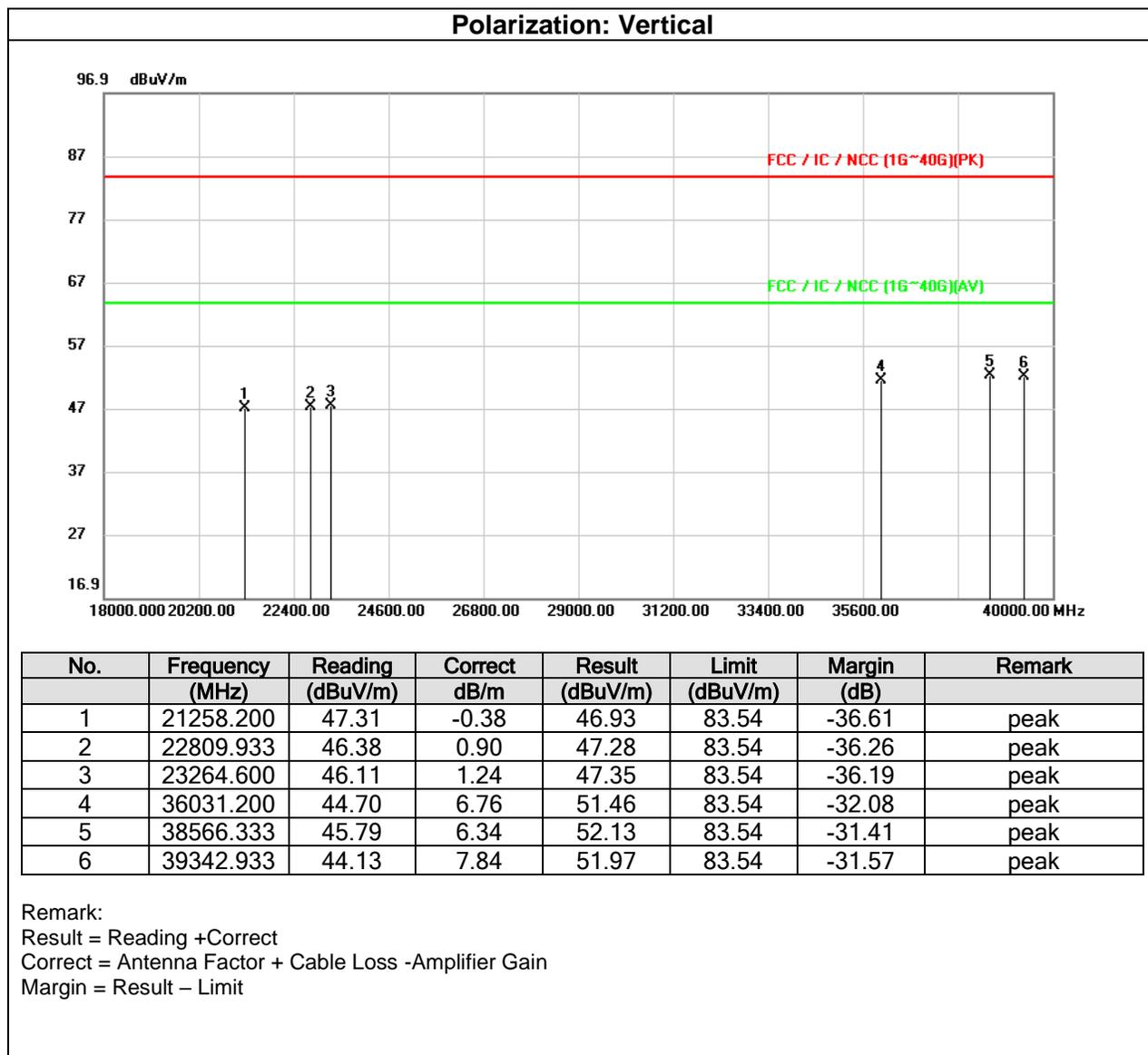
**Polarization: Horizontal**



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	22180.000	46.02	0.09	46.11	83.54	-37.43	peak
2	25379.533	45.30	2.23	47.53	83.54	-36.01	peak
3	28707.400	46.63	2.36	48.99	83.54	-34.55	peak
4	29088.000	47.38	2.44	49.82	83.54	-33.72	peak
5	36310.600	46.20	5.73	51.93	83.54	-31.61	peak
6	39402.333	44.92	7.96	52.88	83.54	-30.66	peak

Remark:  
 Result = Reading +Correct  
 Correct = Antenna Factor + Cable Loss -Amplifier Gain  
 Margin = Result – Limit

Test Mode:	Mode 3	Temperature:	25°C
Test Voltage:	AC 120V/60Hz	Humidity:	59%RH
Tested By:	Rupert Huang	Test Date:	Jan. 14, 2021
Frequency range:	18GHz~40GHz		



## **Appendix I: Photographs of Test Configuration**

Please refer to Test Configuration.

## **Appendix II: Photographs of the EUT**

Please see the photographs of EUT in the test report no.: 4789558390-EP.

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**END OF REPORT**