



EMI TEST REPORT

FOR

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

MODEL : WNFB-266AXI(BT)

SERIES MODEL : AP12275_M2

REPORT NUMBER : 4789558396A -US-E0-V0

ISSUE DATE : Mar. 16, 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



The results reported herein have been performed in accordance with the laboratory's terms of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory. The results in this report are responsible of the test sample(s) provided by the client only and are not to be used to indicate applicability to other similar products.

Revision History

Rev.	Issue Date	Revisions	Revised By
--	Mar. 16, 2021	Initial Issue	Cindy Hsin

Summary of Test Results			
Standard	Test Item	Limit	Result
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

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	5
2. TEST METHODOLOGY	6
3. FACILITIES AND ACCREDITATION	6
4. CALIBRATION AND UNCERTAINTY	7
4.1. Measuring Instrument Calibration	7
4.2. Measurement Uncertainty	7
5. EQUIPMENT UNDER TEST	8
5.1. Description of EUT	8
5.2. Test Mode	9
5.3. EUT Operation Test Setup	10
5.4. Accessory.....	10
5.5. Block diagram showing the configuration of system tested.....	11
5.6. Description of support units	12
5.7. Measuring Instrument List	13
6. EMISSION TEST	14
6.1. Conducted Disturbance Measurement	14
6.1.1. Limits of conducted disturbance voltage and common mode disturbance	14
6.1.2. Test Procedure	14
6.1.3. Test Setup	15
6.1.4. Test Result	16
6.2. Radiated Disturbance Measurement (below 1G)	18
6.2.1. Limits of radiated disturbance measurement.....	18
6.2.2. Test Procedure	18
6.2.3. Test Setup	19
6.2.4. Test Result	20
6.3. Radiated Disturbance Measurement (above 1G).....	22
6.3.1. Limits of radiated disturbance measurement.....	22
6.3.2. Test Procedure	23
6.3.3. Test Setup	23
6.3.4. Test Result	25
Appendix I: Photographs of Test Configuration.....	29
Appendix II: Photographs of the EUT.....	30

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-266AXI(BT)

SERIES MODEL: AP12275_M2

DATE TESTED: Feb. 8, 2021 ~ Mar. 3, 2021

APPLICABLE STANDARDS	
STANDARDS	TEST RESULTS
FCC Part 15 Subpart B: Class B ANSI C63.4:2014 ICES-003 issue 6	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 : Mar. 16, 2021

Approved and Authorized By:



Roy Chen
Operations Manager

Date : Mar. 16, 2021

2. TEST METHODOLOGY

All tests were performed in accordance with the procedures documented FCC Part 15 Subpart B and ANSI C63.4, ICES-003..

3. FACILITIES AND ACCREDITATION

Test Location	Underwriters Laboratories Taiwan Co., Ltd.,
Address	Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
Description	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

EUT Name:	IEEE 802.11ax/ac/a/b/g/n 2x2 WiFi with Bluetooth5.0 Combo Module
Model:	WNFB-266AXI(BT)
Series Model:	AP12275_M2
Power Rating:	From host system
Highest Frequency within EUT:	5850MHz
Condition of EUT:	Identical Prototype
Date Of Receipt Of Sample:	Dec. 2, 2020

Note:

1. The models difference table as below:

Brand	Model	Difference
SparkLAN	WNFB-266AXI(BT)	-
Ampak	AP12275_M2	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 802.11ax20(OFDM) channel 6_X axis	v	v
Mode 2	BT operation mode 8DPSK channel 78_X axis	v	v
Mode 3	WiFi 5G operation mode 802.11a channel 44_X axis	v	v
Mode 4	WiFi 5G operation mode 802.11a channel 44_Y axis	-	v
Mode 5	WiFi 5G operation mode 802.11a channel 44_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 "4789558396-US-R0-V0、4789558396-US-R1-V0、4789558396-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
Emission	Conducted Emission	Mode 3
	Radiated Emission	Mode 3

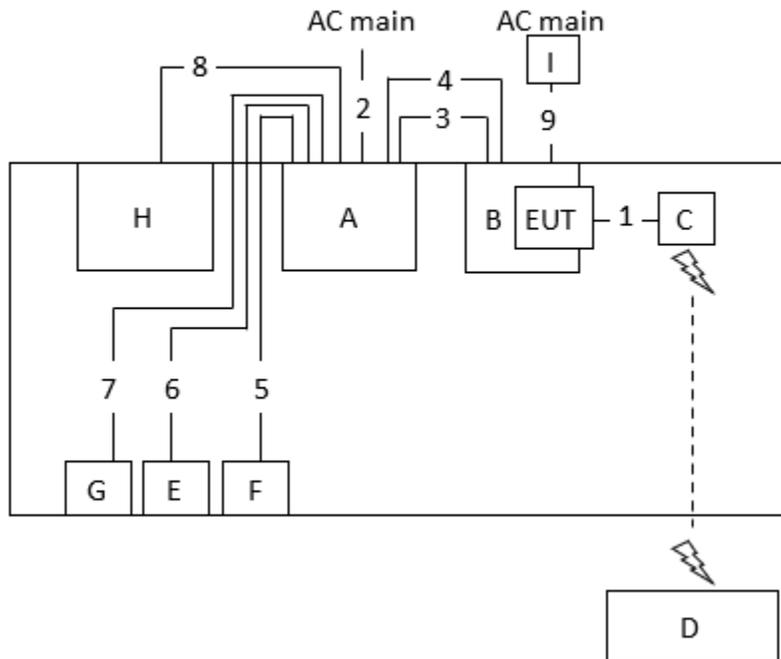
5.3. EUT Operation Test Setup

- a. Connect the EUT to a fixture, then connect it to PC via Flat Cable and USB cable.
- b. 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	PC	ASUS	BM5342	N/A	N/A	N/A
B	Fixture	N/A	N/A	N/A	N/A	N/A
C	Dipole Antenna 3 *2	SparkLAN	AD-303N	N/A	N/A	N/A
D	Wireless-AX6000 Dual Band Gigabit Router	ASUS	RT-AX88U	L4ITHP000110	N/A	N/A
E	Mouse	Microsoft	1113	N/A	N/A	N/A
F	Earphone	TECO	XYFSE005	N/A	N/A	N/A
G	Keyboard	DELL	KB4021	N/A	N/A	N/A
H	Monitor	DELL	SE2417HG	N/A	N/A	N/A
I	AC adapter	AOEM	ADS012PM-W 050200	N/A	N/A	Provide from customer

Item	Connection	Shielded Type	Length	Note
1	Signal cable *2	Non-shielded	0.1 m	Provide from customer
2	Power cable	Non-shielded	1.8 m	N/A
3	USB cable	Shielded	0.5 m	N/A
4	Flat cable	Non-shielded	0.5 m	N/A
5	Audio cable	Non-shielded	1.5 m	N/A
6	USB cable	Shielded	1.8 m	N/A
7	USB cable	Shielded	1.8 m	N/A
8	VGA cable	Shielded	1.2 m	N/A
9	DC power cable	Non-shielded	1.5 m	Provide from customer

5.7. Measuring Instrument List

Instrument					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Expired date
Conducted Disturbance					
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	TITAN	CFD200	T0732ACFD20020A300-1	2020/9/1	2021/8/31
Measurement Software	Farad	EZ-EMC Ver: UL-3A1.2	N/A	N/A	N/A
Radiated Disturbance					
966-1					
EMI Test Receiver	Rohde & Schwarz	ESR7	101755	2020/12/4	2021/12/3
Trilog-Broadband Antenna 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	2021/1/20	2022/1/19
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	2021/2/3	2022/2/2
Cables	UltraPhase / Taitan	K1K50-UP0264-K1K50-500/2500/T0712AT340A12 A400	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

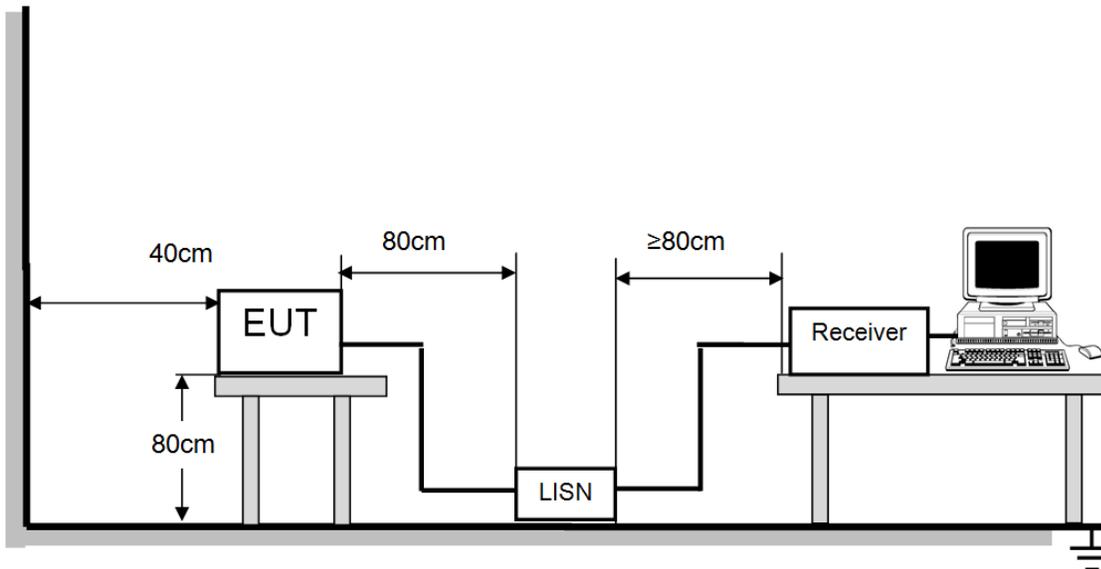
The following table is the setting of the receiver

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.

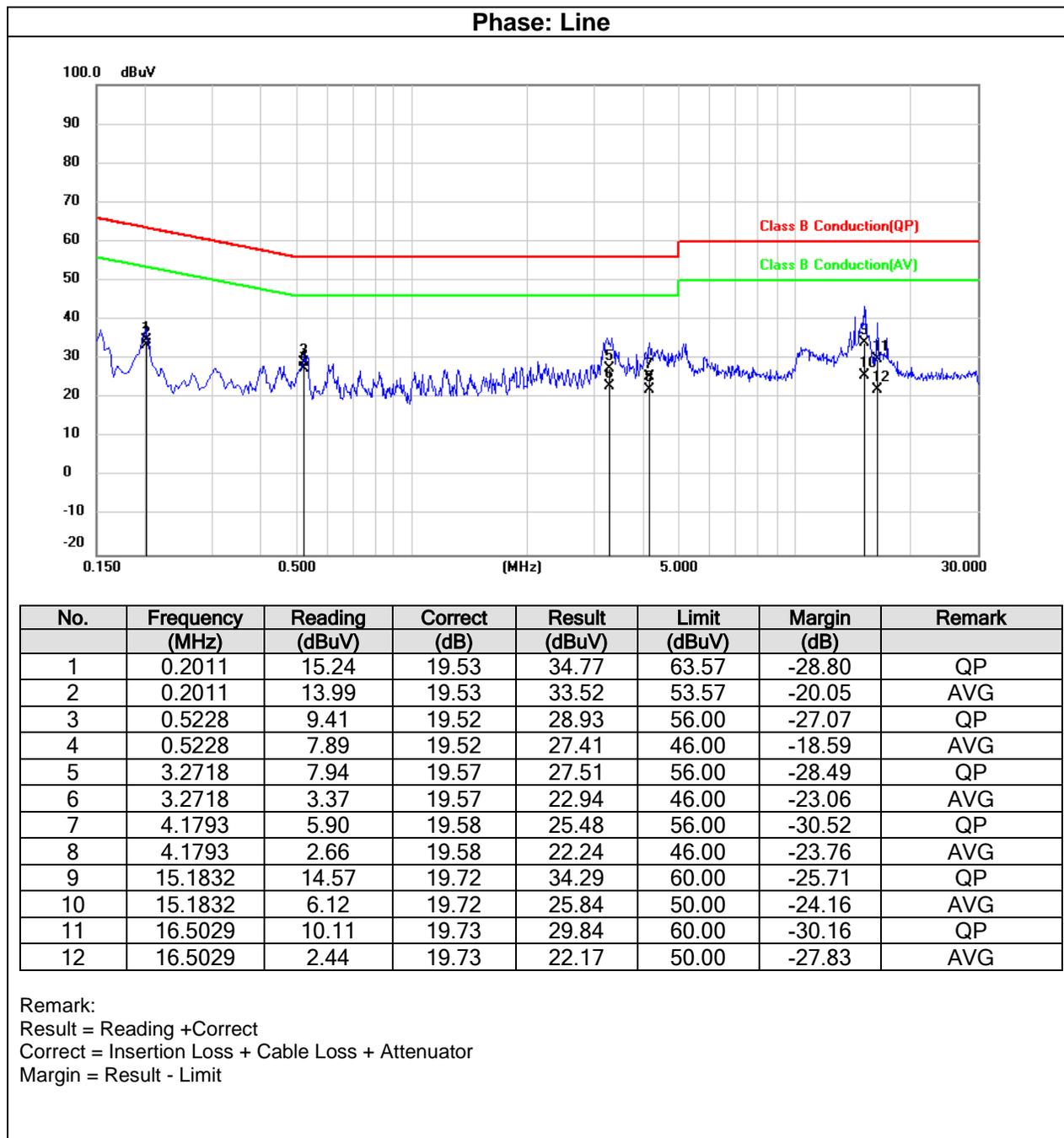
6.1.3. Test Setup



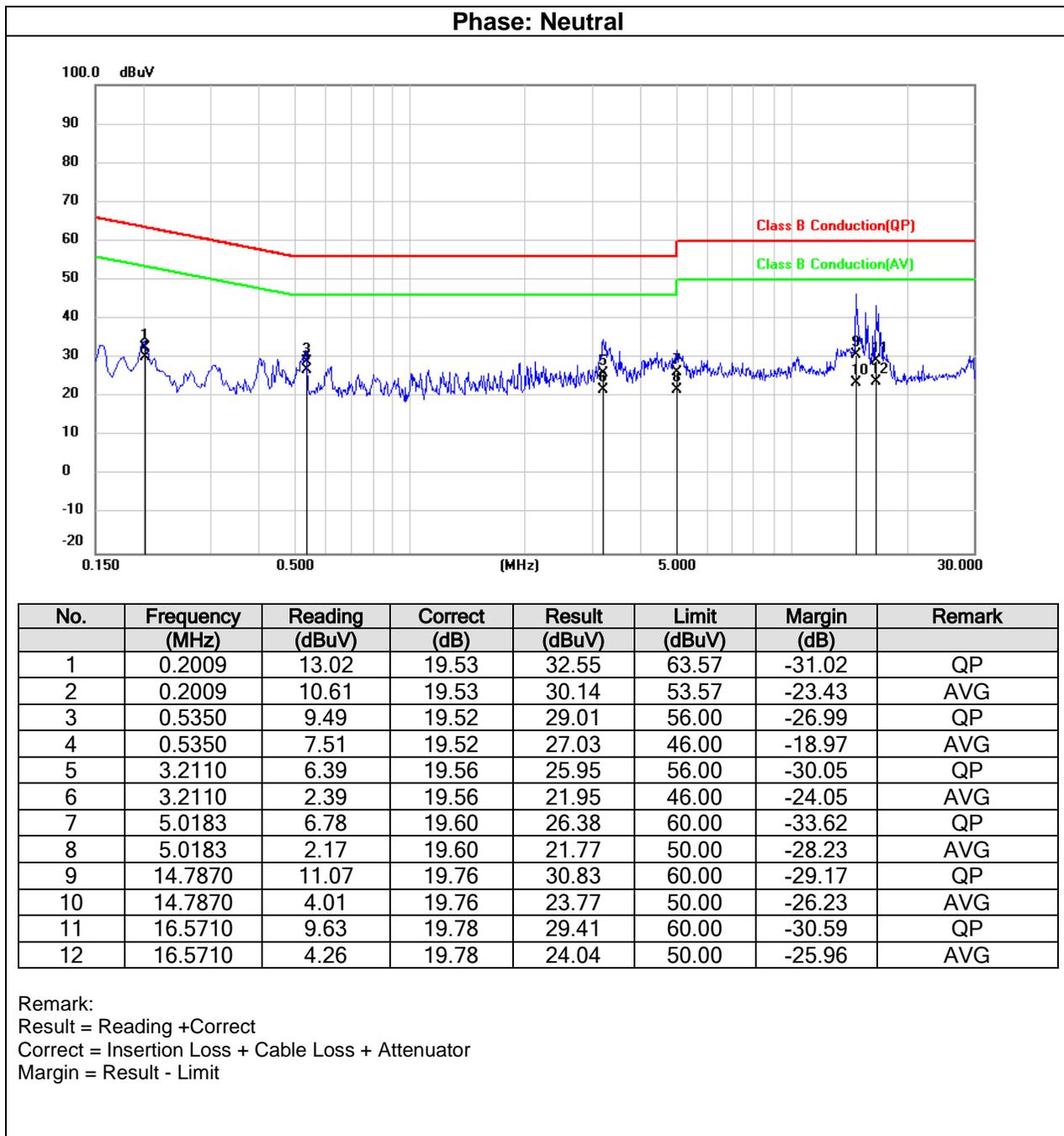
For the actual test configuration, please refer to Appendix I: Photographs of the Test Configuration.

6.1.4. Test Result

Test Mode:	Mode 3	Temperature:	23°C
Test Voltage:	AC 120V/60Hz	Humidity:	53%RH
Tested By:	Edison Lin	Test Date:	Mar. 3, 2021



Test Mode:	Mode 3	Temperature:	23°C
Test Voltage:	AC 120V/60Hz	Humidity:	53%RH
Tested By:	Edison Lin	Test Date:	Mar. 3, 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:

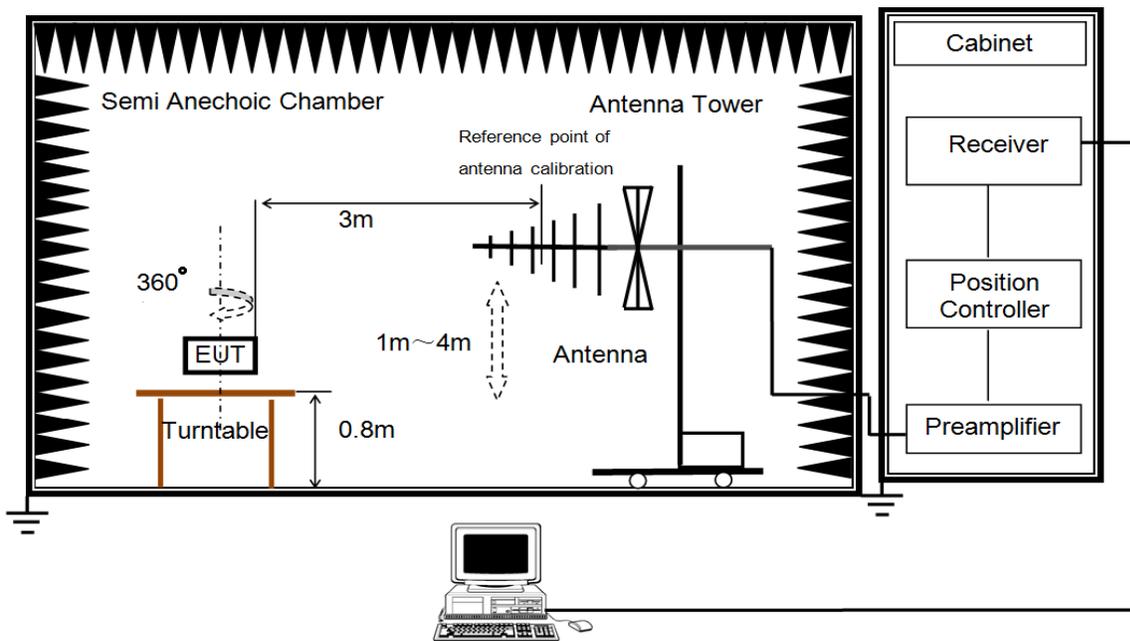
- (1) The tighter limit applies at the band edges.
- (2) Emission level (dB μ V/m)=20*log Emission level (uV/m).
- (3) The test result calculated as following:
 Measurement Value = Reading Level + Correct Factor,
 Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use),
 Margin Level =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

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

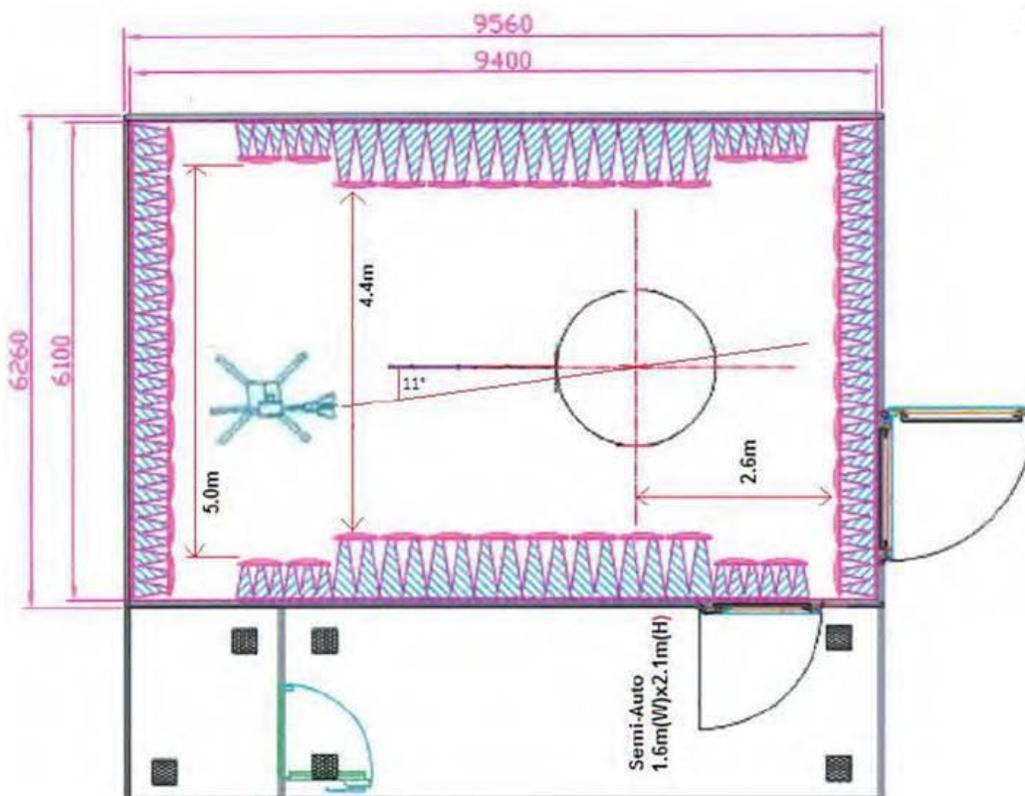
6.2.2. Test Procedure

- 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



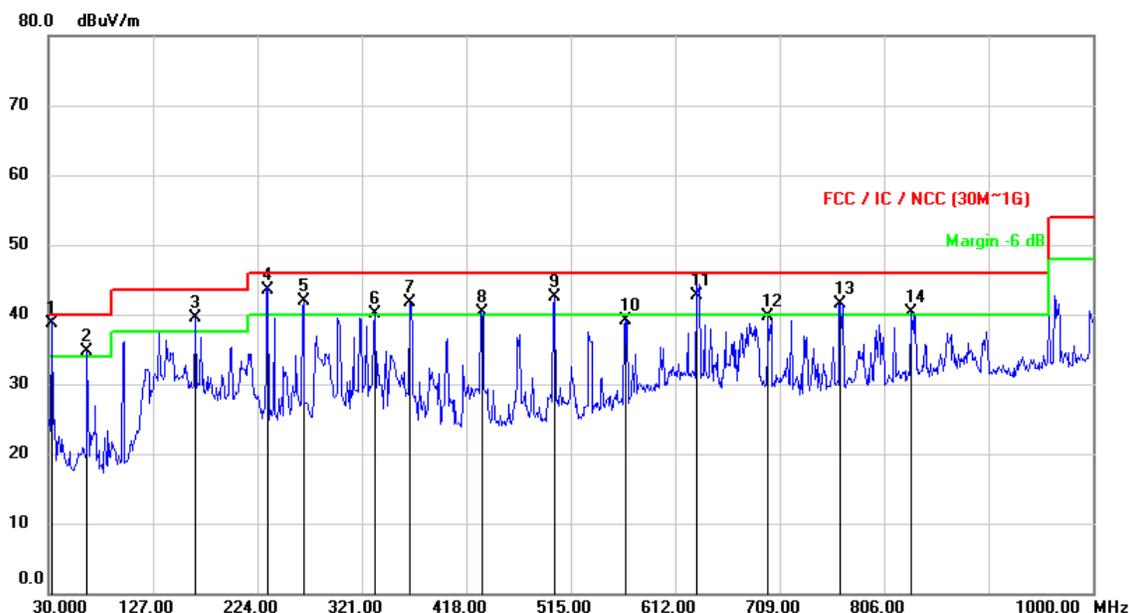
For the actual test configuration, please refer to Appendix I: Photographs of the Test Configuration.



6.2.4. Test Result

Test Mode:	Mode 3	Temperature:	25°C
Test Voltage:	AC 120V/60Hz	Humidity:	59%RH
Tested By:	Edison Lin	Test Date:	Feb. 9, 2021

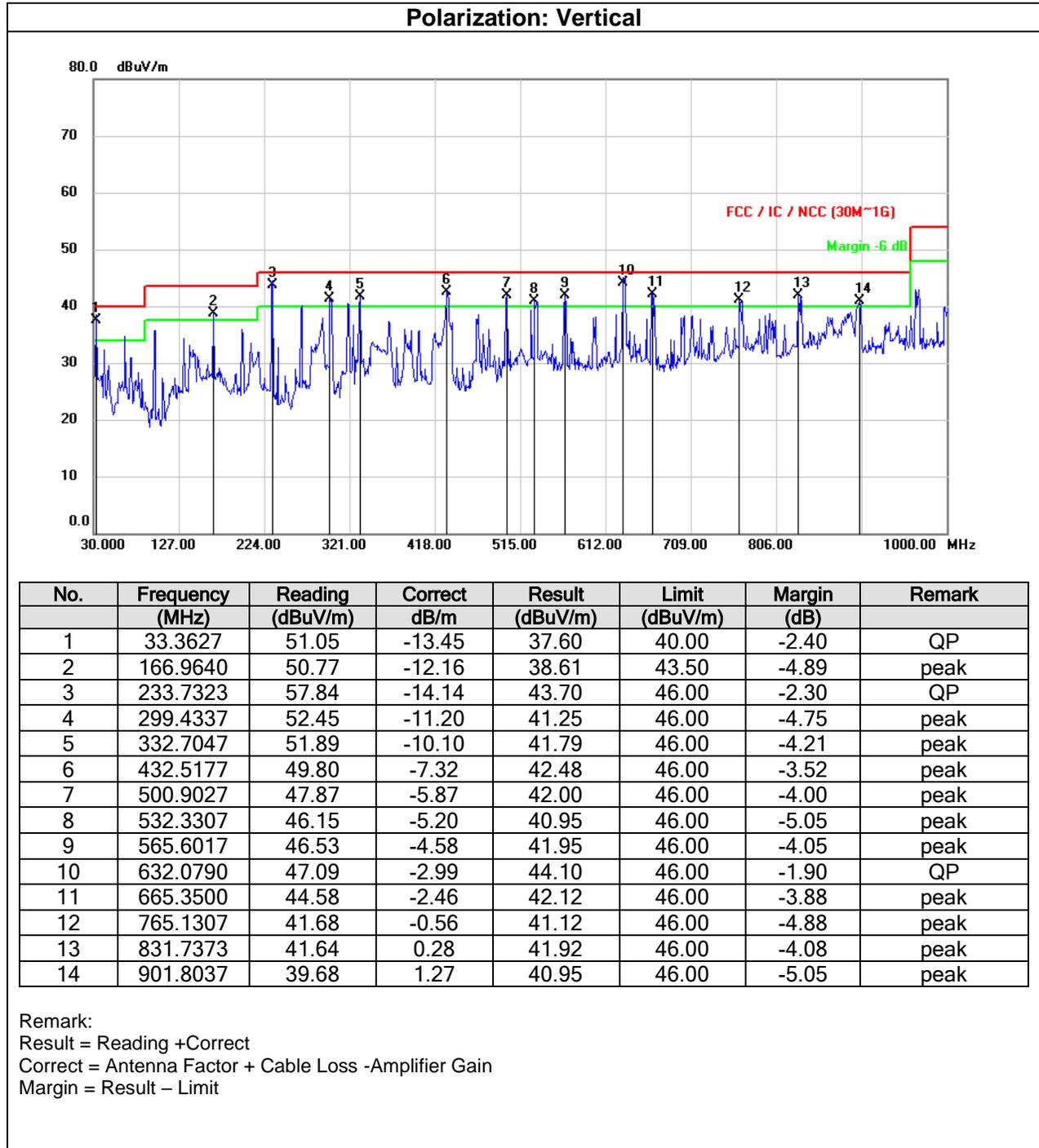
Polarization: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	33.2657	52.27	-13.47	38.80	40.00	-1.20	QP
2	66.5367	48.58	-13.88	34.70	40.00	-5.30	peak
3	166.9640	51.63	-12.16	39.47	43.50	-4.03	peak
4	233.7647	57.63	-14.13	43.50	46.00	-2.50	QP
5	267.1650	54.42	-12.45	41.97	46.00	-4.03	peak
6	333.9333	50.18	-10.06	40.12	46.00	-5.88	peak
7	366.0080	51.11	-9.36	41.75	46.00	-4.25	peak
8	432.5500	47.72	-7.32	40.40	46.00	-5.60	peak
9	500.9997	48.31	-5.87	42.44	46.00	-3.56	peak
10	565.5692	43.68	-4.58	39.10	46.00	-6.90	peak
11	632.2083	45.68	-2.98	42.70	46.00	-3.30	QP
12	698.6210	41.62	-1.90	39.72	46.00	-6.28	peak
13	765.2600	42.10	-0.56	41.54	46.00	-4.46	peak
14	831.7373	40.10	0.28	40.38	46.00	-5.62	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:	Edison Lin	Test Date:	Feb. 9, 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:

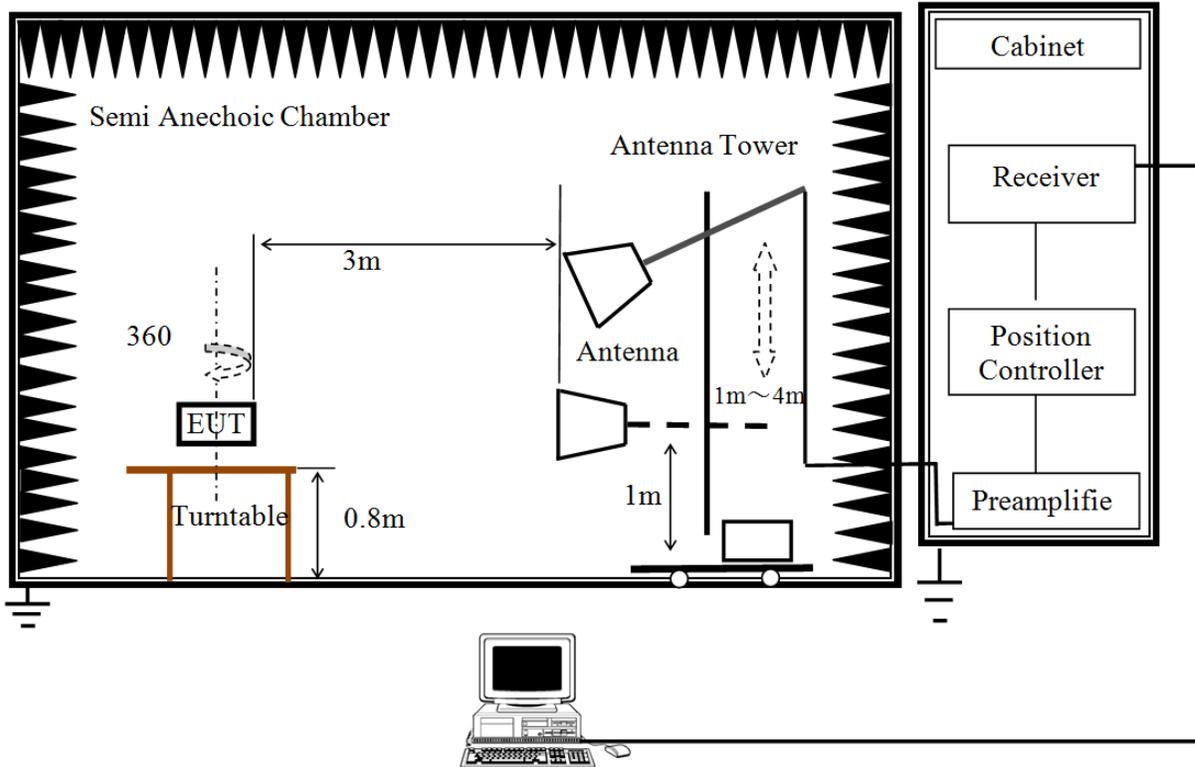
- (1) The tighter limit applies at the band edges.
- (2) Emission level (dBμV/m)=20log Emission level (uV/m).
- (3) If the highest frequency of the internal sources of the EUT is less than 108 MHz, the measurement shall only be made up to 1 GHz. If the highest frequency of the internal sources of the 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 :

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

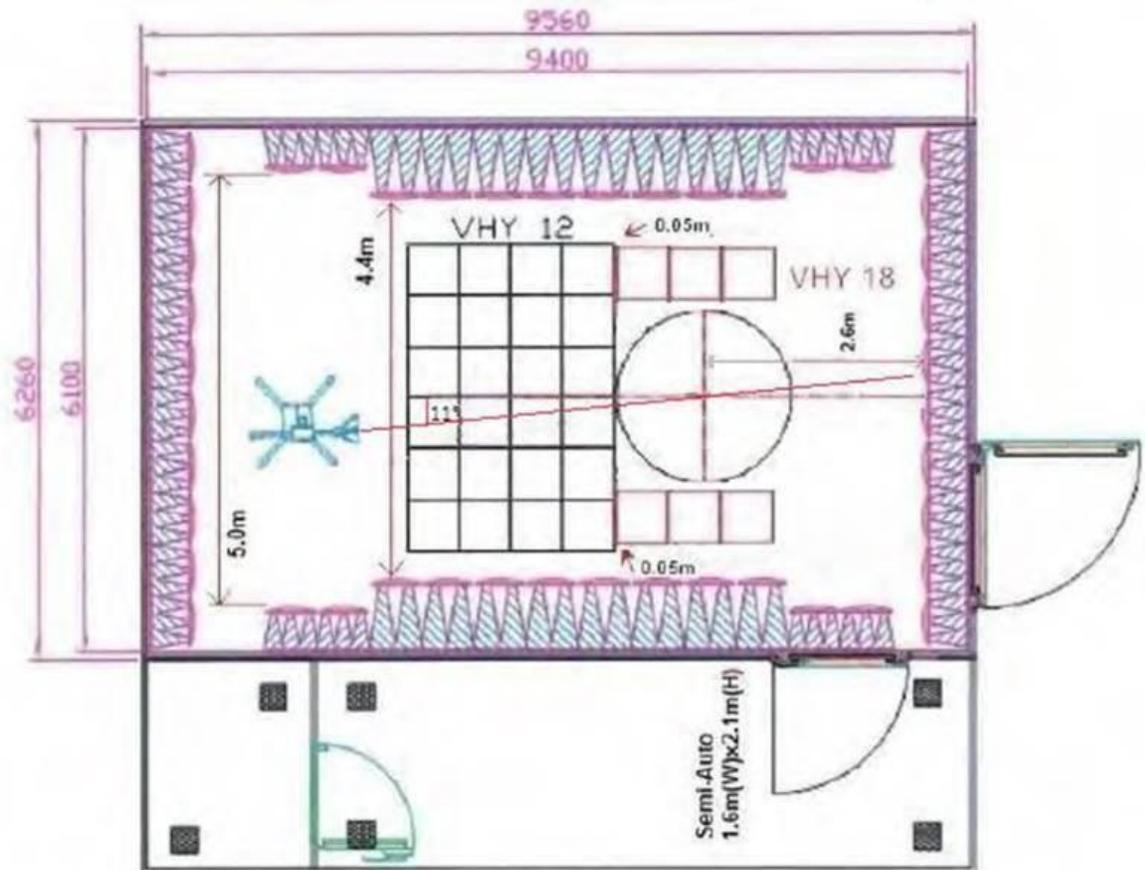
6.3.2. Test Procedure

- 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

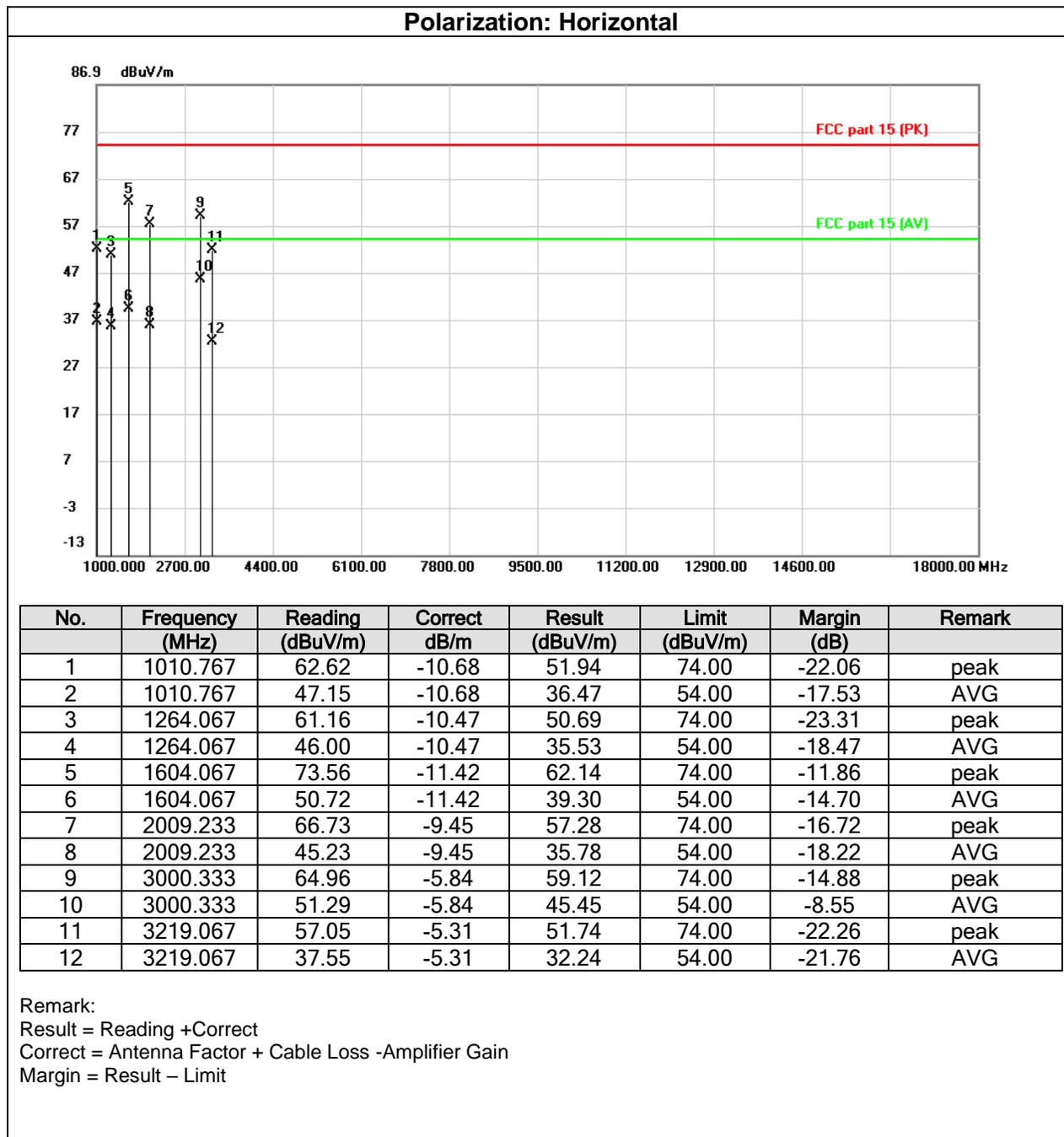


For the actual test configuration, please refer to Appendix I : Photographs of the Test Configuration.

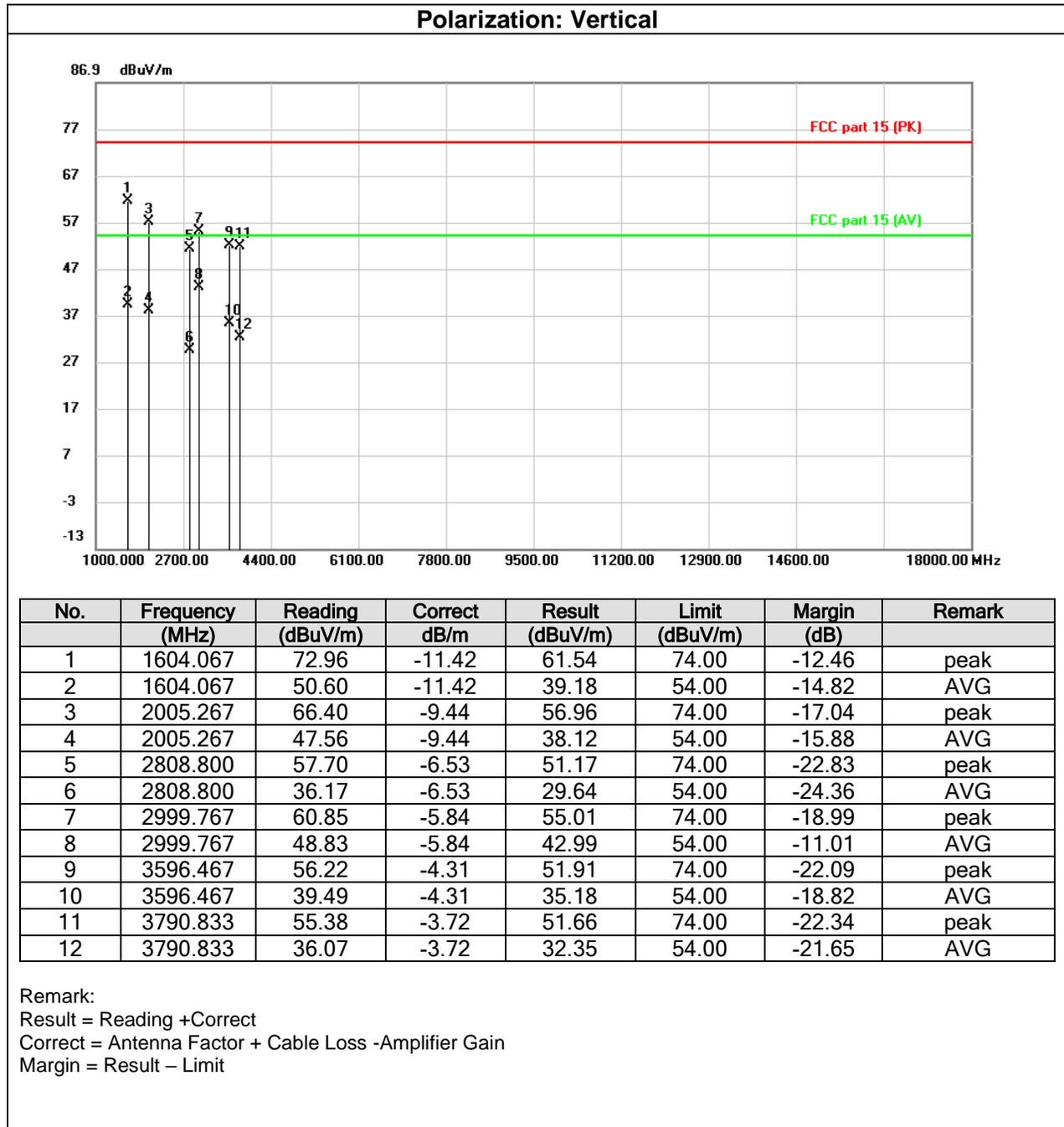


6.3.4. Test Result

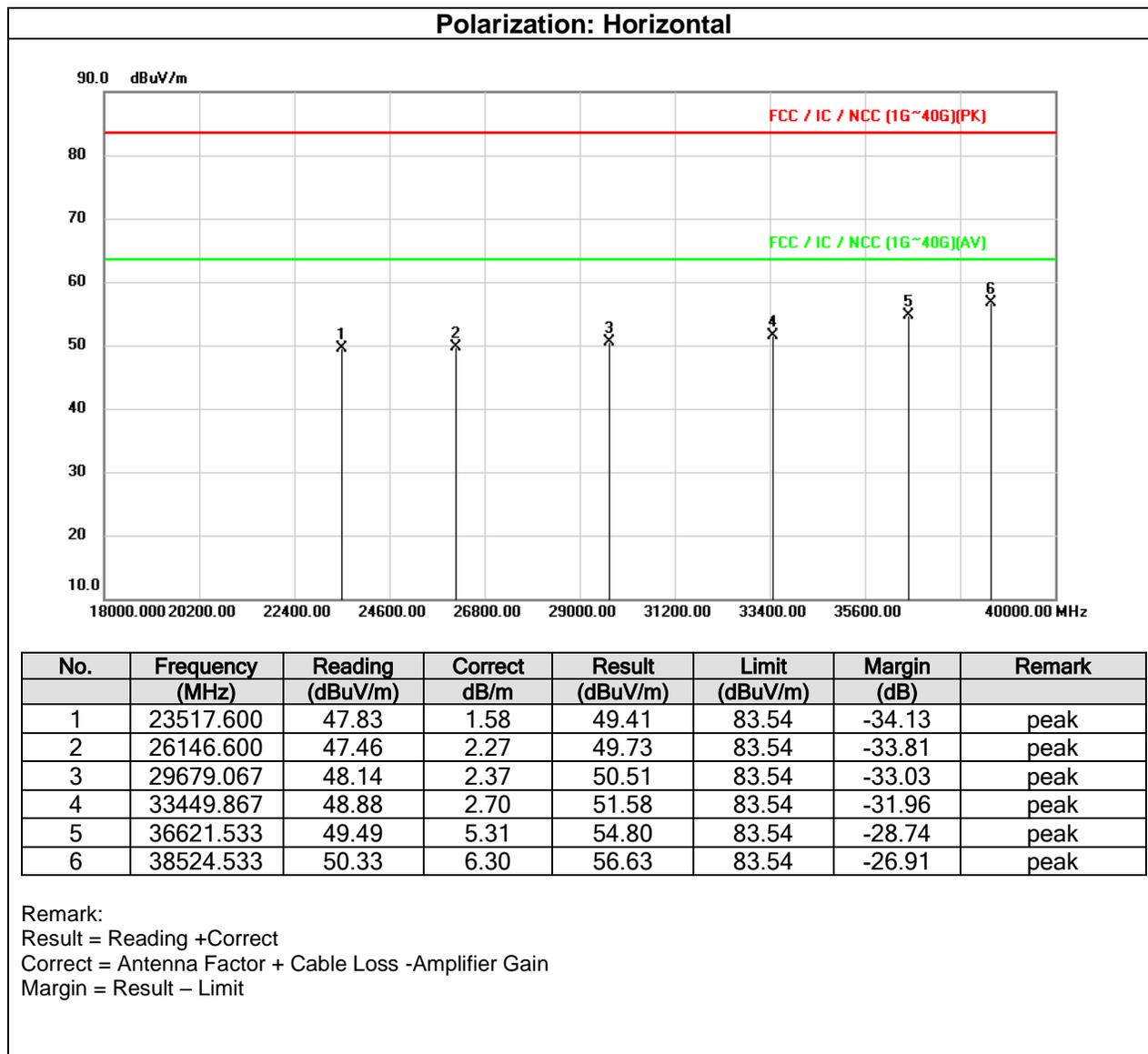
Test Mode:	Mode 3	Temperature:	25°C
Test Voltage:	AC 120V/60Hz	Humidity:	59%RH
Tested By:	Edison Lin	Test Date:	Feb. 8, 2021
Frequency range:	1GHz~18GHz		



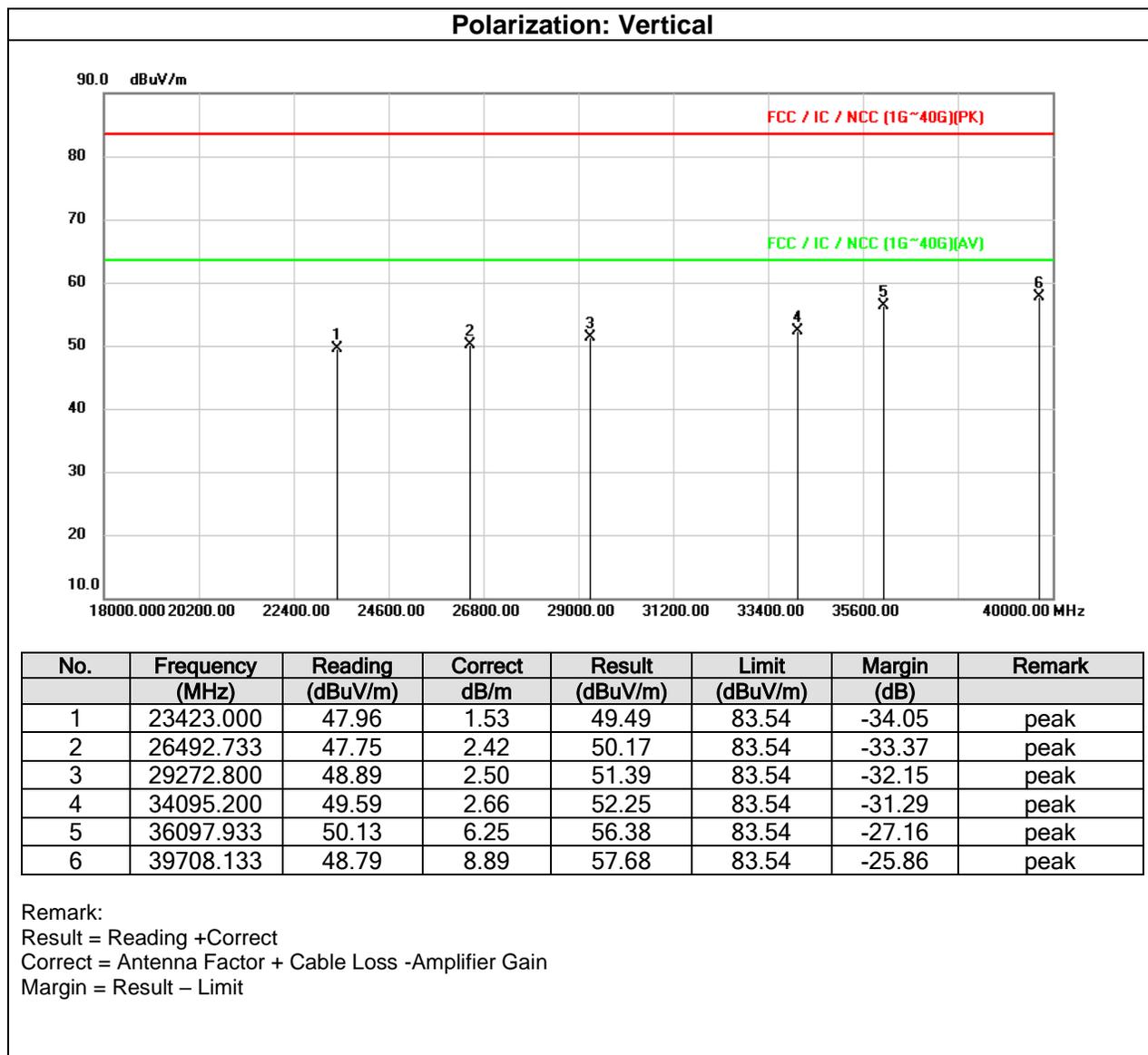
Test Mode:	Mode 3	Temperature:	25°C
Test Voltage:	AC 120V/60Hz	Humidity:	59%RH
Tested By:	Edison Lin	Test Date:	Feb. 8, 2021
Frequency range:	1GHz~18GHz		



Test Mode:	Mode 3	Temperature:	25°C
Test Voltage:	AC 120V/60Hz	Humidity:	52%RH
Tested By:	Edison Lin	Test Date:	Feb. 8, 2021
Frequency range:	18GHz~40GHz		



Test Mode:	Mode 3	Temperature:	25°C
Test Voltage:	AC 120V/60Hz	Humidity:	52%RH
Tested By:	Edison Lin	Test Date:	Feb. 8, 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.: 4789558396-EP.

END OF REPORT