

# FCC Co-Location Test Report

**FCC ID** : I8803935  
**Equipment** : 802.11be (WiFi 7) Triple-Radio Unified Pro  
Access Point  
**Model No.** : WBE660S  
**Brand Name** : ZYXEL  
**Applicant** : Zyxel Communications Corporation  
**Address** : No.2 Industry East RD. IX, Hsinchu Science  
Park, Hsinchu 30075, Taiwan, R.O.C  
**Standard** : 47 CFR FCC Part 15.247  
47 CFR FCC Part 15.407  
**Received Date** : Jul. 17, 2023  
**Tested Date** : Aug. 12 ~ Aug. 17, 2023

We, International Certification Corporation, would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by:

Approved by:

  
\_\_\_\_\_  
Along Chen / Assistant Manager

  
\_\_\_\_\_  
Gary Chang / Manager

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### Appendix A. Unwanted Emissions Into Restricted Frequency Bands

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## Release Record

Report No.	Version	Description	Issued Date
FR371702CO	Rev. 01	Initial issue	Sep. 22, 2023

## Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.247(d) 15.407(b) 15.209	Radiated Emissions	[dBuV/m at 3m]: 48.43MHz 36.49 (Margin -3.51dB) - PK	Pass

**Declaration of Conformity:**

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

**Comments and Explanations:**

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.

# 1 General Description

## 1.1 Information

### 1.1.1 Specification of the Equipment under Test (EUT)

WLAN	
<b>Operating Frequency</b>	802.11b/g/n/ax/be: 2412 MHz ~ 2462 MHz 802.11a/n/ac/ax/be: 5180 MHz ~ 5240 MHz; 5260 MHz ~ 5320 MHz; 5500 MHz ~ 5720 MHz; 5745 MHz ~ 5825 MHz; 5925 MHz ~ 6425MHz; 6425 MHz ~ 6525 MHz; 6525 MHz ~ 6875 MHz; 6875 MHz ~ 7125 MHz
<b>Modulation Type</b>	802.11b: DSSS (DBPSK / DQPSK / CCK) 802.11a/g/n/ac/ax/be: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM / 1024QAM / 4096QAM)
BT	
<b>Operating Frequency</b>	2402 MHz ~ 2480 MHz
<b>Modulation Type</b>	Bluetooth LE: GFSK

### 1.1.2 Antenna Details

For WLAN

Brand	Model	Type	Connector	Operating Frequencies (MHz) / Antenna Gain (dBi)				
				2400~2483.5	5150~5250	5250~5350	5470~5725	5725~5850
M.gear	D047	Antenna 1	PIFA	0.82	--	--	--	--
M.gear	D047	Antenna 2	PIFA	4.34	--	--	--	--
M.gear	D047	Antenna 3	PIFA	2.58	--	--	--	--
M.gear	D047	Antenna 4	PIFA	1.61	--	--	--	--
M.gear	D047	Antenna 5	PIFA	--	7.92	8	7.57	6.63
M.gear	D047	Antenna 6	PIFA	--	5.7	6.51	6.67	7.73
M.gear	D047	Antenna 7	PIFA	--	7.11	8.12	8.25	9.18
M.gear	D047	Antenna 8	PIFA	--	6.01	6.94	6.47	7.31
M.gear	D047	Antenna 9	PIFA	--	8.02	7.45	6.82	6.44
M.gear	D047	Antenna 10	PIFA	--	8.13	8.14	8.2	7.74

For BT

Brand	Model	Type	Connector	Gain (dBi)
M.gear	D047	PIFA	UFL	0.97

For 6G

Brand	Model	Type	Connector	Operating Frequencies (MHz) / Gain (dBi)			
				5925-6425	6425-6525	6525-6875	6875-7125
D047	Antenna 11	PIFA	UFL	6.47	7.53	7.53	6.4
D047	Antenna 12	PIFA	UFL	6.19	5.7	5.7	5.73
D047	Antenna 13	PIFA	UFL	7.37	6.86	6.86	6.75
D047	Antenna 14	PIFA	UFL	7.9	7.64	7.64	6.91
D047	Antenna 15	PIFA	UFL	9.01	7.16	7.16	7.8
D047	Antenna 16	PIFA	UFL	7.16	6.89	6.89	7.85

### 1.1.3 Power Supply Type of Equipment under Test (EUT)

<b>Power Supply Type</b>	15Vdc from adapter 56Vdc from PoE injector
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Note: The above power supplies are not bundled in market.

### 1.1.4 Accessories

N/A

## 1.2 The Equipment List

Test Item	Radiated Emission				
Test Site	966 chamber3 / (03CH03-WS)				
Tested Date	Aug. 12 ~ Aug. 17, 2023				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101657	Mar. 03, 2023	Mar. 02, 2024
Spectrum Analyzer	R&S	FSV40	101499	Mar. 16, 2023	Mar. 15, 2024
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 01, 2022	Oct. 31, 2023
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-685	Jul. 04, 2023	Jul. 03, 2024
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1206	Dec. 15, 2022	Dec. 14, 2023
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Oct. 27, 2022	Oct. 26, 2023
Preamplifier	EMC	EMC02325	980187	Jul. 10, 2023	Jul. 09, 2024
Preamplifier	EMC	EMC184045SE	980897	Aug. 01, 2023	Jul. 31, 2024
Preamplifier	EMC	EMC184045SE	980903	Jul. 17, 2023	Jul. 16, 2024
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 04, 2022	Oct. 03, 2023
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800-001	Sep. 23, 2022	Sep. 22, 2023
LF cable-3M	EMC	EMC8D-NM-NM-3000	131103	Sep. 23, 2022	Sep. 22, 2023
LF cable-13M	EMC	EMC8D-NM-NM-13000	131104	Sep. 23, 2022	Sep. 22, 2023
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22620/4	Sep. 23, 2022	Sep. 22, 2023
RF cable-8M	EMC	EMC104-SM-SM-8000	181107	Sep. 23, 2022	Sep. 22, 2023
HIGHPASS FILTER	WI	WHK3.1-18G-10SS	43	Sep. 28, 2022	Sep. 27, 2023
HIGHPASS FILTER	K&L	11SH10-7000/T1800 0-O/OP	21	Sep. 28, 2022	Sep. 27, 2023
HIGHPASS FILTER 7.5-18G	STI	STI15-9722	STI-HP7.5G-B	Dec. 08, 2022	Dec. 07, 2023
Attenuator	Pasternack	PE7005-10	10-3	Oct. 14, 2022	Oct. 13, 2023
Measurement Software	AUDIX	e3	6.120210g	NA	NA

Note: Calibration Interval of instruments listed above is one year.

## 1.3 Test Standards

47 CFR FCC Part 15.247

47 CFR FCC Part 15.407

ANSI C63.10-2013

## 1.4 Reference Guidance

FCC KDB 558074 D01 15.247 Meas Guidance v05r02  
FCC KDB 662911 D01 Multiple Transmitter Output v02r01  
FCC KDB 412172 D01 Determining ERP and EIRP v01r01  
FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01

## 1.5 Deviation from Test Standard and Measurement Procedure

None

## 1.6 Measurement Uncertainty

The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor ( $k=2$ )).

Measurement Uncertainty	
Parameters	Uncertainty
Unwanted Emission $\leq$ 1GHz	$\pm 3.96$ dB
Unwanted Emission $>$ 1GHz	$\pm 4.51$ dB



## 2 Test Configuration

### 2.1 Testing Facility

<b>Test Laboratory</b>	International Certification Corporation
<b>Test Site</b>	03CH03-WS
<b>Address of Test Site</b>	No.14-1, Lane 19, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 33381, Taiwan (R.O.C.)

- FCC Designation No.: TW0009
- FCC site registration No.: 207696
- ISED#: 10807C
- CAB identifier: TW2732

### 2.2 The Worst Test Modes and Channel Details

<b>Test item</b>	<b>Modulation Mode</b>
Unwanted Emissions	ax20 2437MHz + ax40 5230 MHz + EHT320 6905 MHz
<b>NOTE:</b> The selected channel is the maximum power channel of Wi-Fi mode.	

### 3 Transmitter Test Results

#### 3.1 Unwanted Emissions into Restricted Frequency Bands

##### 3.1.1 Limit of Unwanted Emissions into Restricted Frequency Bands

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

**Note 1:**  
Qusai-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit

**Note 2:**  
Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

Un-restricted band emissions above 1GHz Limit	
Operating Band	Limit
5.15 - 5.25 GHz	e.i.r.p. -27 dBm [68.2 dBuV/m@3m]
5.25 - 5.35 GHz	e.i.r.p. -27 dBm [68.2 dBuV/m@3m]
5.47 - 5.725 GHz	e.i.r.p. -27 dBm [68.2 dBuV/m@3m]
5.725 - 5.850 GHz	All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

**Note 1:** Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

### 3.1.2 Test Procedures

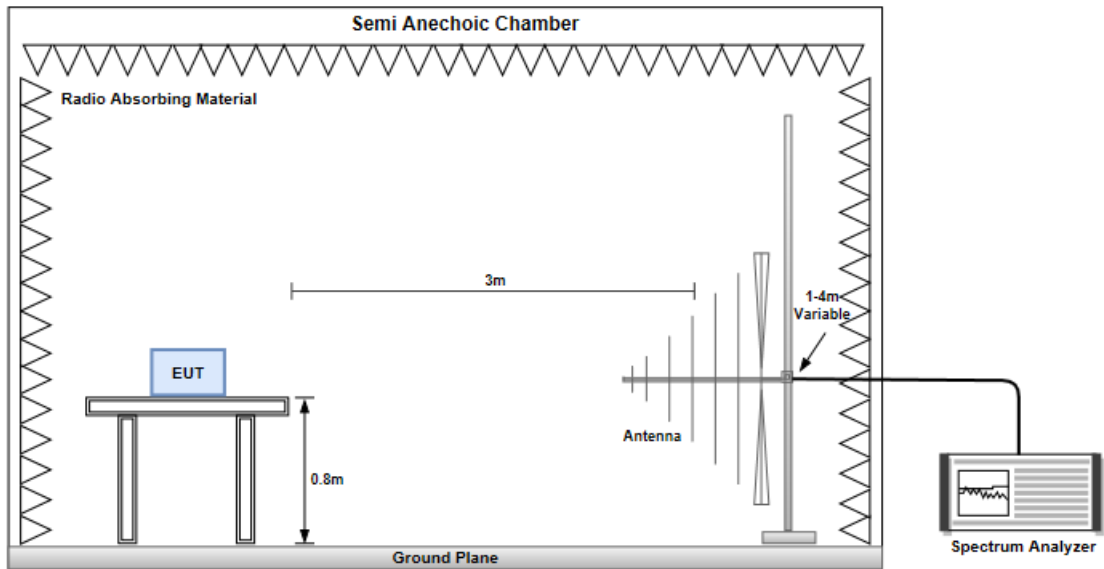
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m.
2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Note:

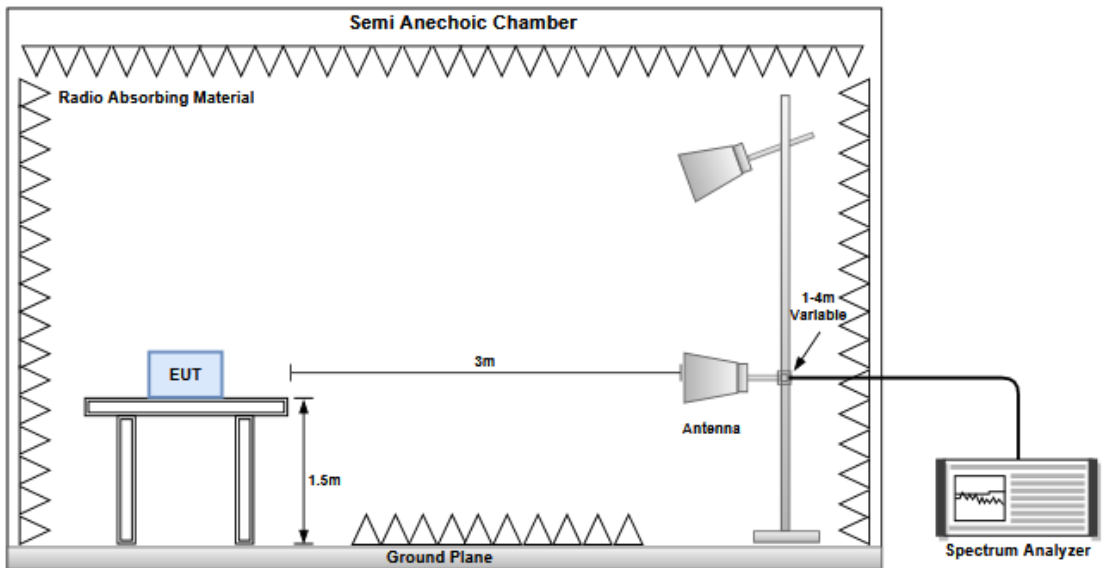
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above 1GHz.

### 3.1.3 Test Setup

#### Radiated Emissions below 1 GHz



#### Radiated Emissions above 1 GHz



### 3.1.4 Test Results

Refer to Appendix A.

## 4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corporation (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website <http://www.icertifi.com.tw>.

### **Linkou**

Tel: 886-2-2601-1640

No.30-2, Ding Fwu Tsuen, Lin Kou  
District, New Taipei City, Taiwan  
(R.O.C.)

### **Kwei Shan**

Tel: 886-3-271-8666

No.3-1, Lane 6, Wen San 3rd  
St., Kwei Shan Dist., Tao Yuan  
City 33381, Taiwan (R.O.C.)  
No.2-1, Lane 6, Wen San 3rd  
St., Kwei Shan Dist., Tao Yuan  
City 33381, Taiwan (R.O.C.)

### **Kwei Shan Site II**

Tel: 886-3-271-8640

No.14-1, Lane 19, Wen San 3rd  
St., Kwei Shan Dist., Tao Yuan  
City 33381, Taiwan (R.O.C.)

If you have any suggestion, please feel free to contact us as below information.

Tel: 886-3-271-8666

Fax: 886-3-318-0345

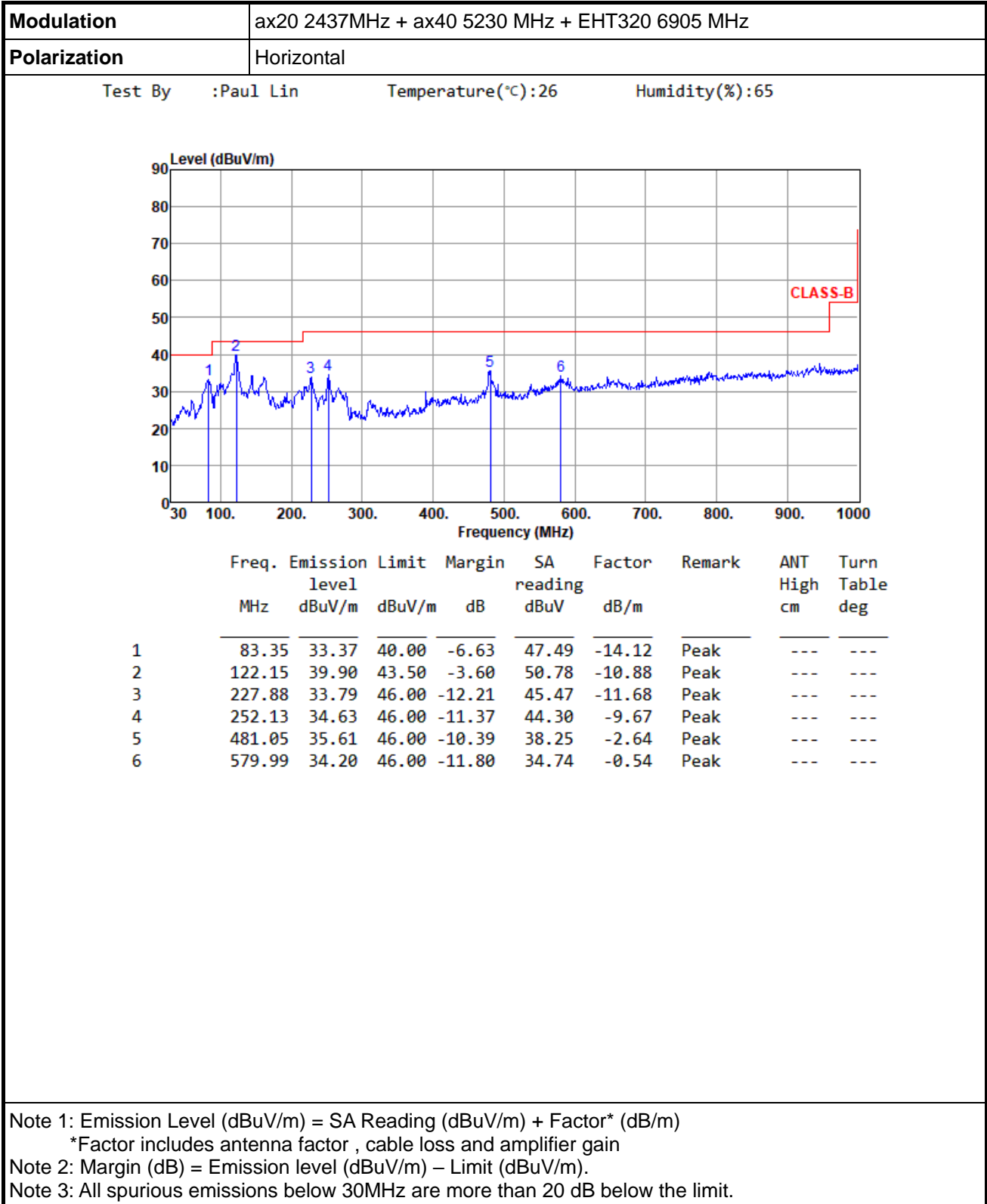
Email: ICC\_Service@icertifi.com.tw

==END==



PoE mode

Unwanted Emissions (Below 1GHz)



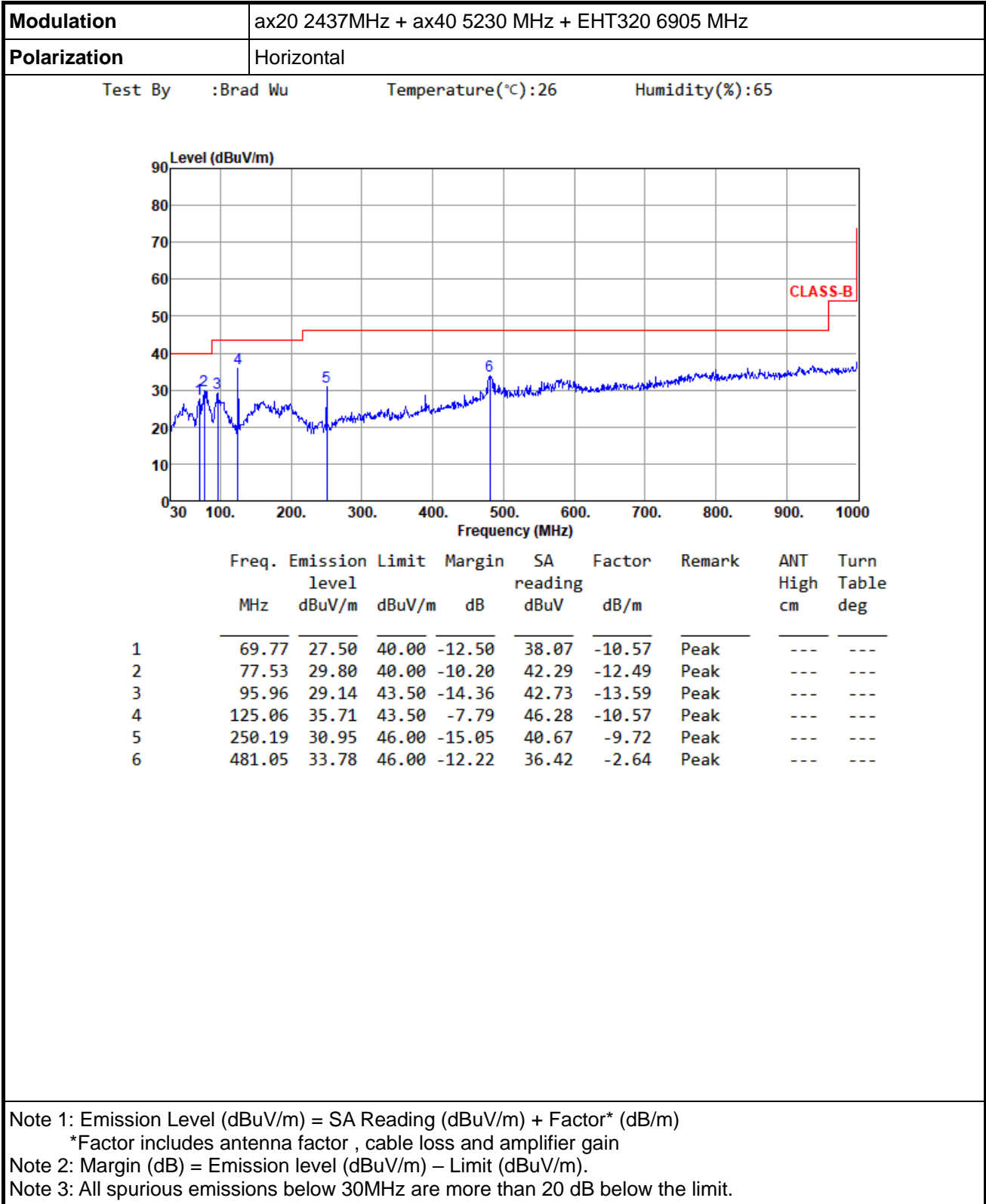


<b>Modulation</b>	ax20 2437MHz + ax40 5230 MHz + EHT320 6905 MHz									
<b>Polarization</b>	Vertical									
Test By : Paul Lin			Temperature(°C): 26			Humidity(%): 65				
<p>The plot shows a blue signal line with several peaks. A red step-like line represents the CLASS-B emission limit. Six peaks are marked with vertical blue lines and numbered 1 through 6. The y-axis ranges from 0 to 90 dBuV/m, and the x-axis ranges from 30 to 1000 MHz.</p>										
	Freq.	Emission	Limit	Margin	SA	Factor	Remark	ANT	Turn	
	MHz	level	dBuV/m	dB	reading	dB/m		High	Table	
								cm	deg	
	1	48.43	36.49	40.00	-3.51	44.36	-7.87	Peak	---	---
	2	78.50	36.43	40.00	-3.57	49.32	-12.89	Peak	---	---
	3	125.06	39.61	43.50	-3.89	50.18	-10.57	Peak	---	---
	4	253.10	32.45	46.00	-13.55	42.10	-9.65	Peak	---	---
	5	478.14	36.03	46.00	-9.97	38.73	-2.70	Peak	---	---
	6	555.74	41.33	46.00	-4.67	42.49	-1.16	Peak	---	---
<p>Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB/m)            *Factor includes antenna factor , cable loss and amplifier gain            Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).            Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.</p>										



Adapter mode

Unwanted Emissions (Below 1GHz)







<b>Modulation</b>	ax20 2437MHz + ax40 5230 MHz + EHT320 6905 MHz									
<b>Polarization</b>	Vertical									
Test By :Brad Wu			Temperature(°C):26			Humidity(%):65				
	Freq.	Emission	Limit	Margin	SA	Factor	Remark	ANT	Turn	
	MHz	level	dBuV/m	dB	reading	dB/m		High	Table	
					dBuV			cm	deg	
1	48.43	36.28	40.00	-3.72	44.15	-7.87	Peak	---	---	
2	59.10	33.44	40.00	-6.56	42.01	-8.57	Peak	---	---	
3	125.06	32.20	43.50	-11.30	42.77	-10.57	Peak	---	---	
4	250.19	28.07	46.00	-17.93	37.79	-9.72	Peak	---	---	
5	479.11	36.82	46.00	-9.18	39.49	-2.67	Peak	---	---	
6	559.62	38.52	46.00	-7.48	39.58	-1.06	Peak	---	---	
<p>Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB/m)            *Factor includes antenna factor , cable loss and amplifier gain            Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).            Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.</p>										



Unwanted Emissions (Above 1GHz)

<b>Modulation</b>	ax20 2437MHz + ax40 5230 MHz + EHT320 6905 MHz									
<b>Polarization</b>	Horizontal									
Test By :Brad Wu			Temperature(°C):23			Humidity(%):65				
<p>The graph plots Level (dBuV/m) on the y-axis (0 to 90) against Frequency (MHz) on the x-axis (1000 to 40000). Two horizontal red lines represent limits: CLASS-B at approximately 74 dBuV/m and CLASS-B (AVG) at approximately 54 dBuV/m. Four vertical blue lines indicate emission peaks labeled 1, 2, 3, and 4. Peak 1 is at 2793 MHz (33.49 dBuV/m), peak 2 is at 2793 MHz (46.51 dBuV/m), peak 3 is at 7667 MHz (39.59 dBuV/m), and peak 4 is at 7667 MHz (53.03 dBuV/m).</p>										
	Freq.	Emission	Limit	Margin	SA	Factor	Remark	ANT	Turn	
	MHz	level	dBuV/m	dB	reading	dB/m		High	Table	
		dBuV/m			dBuV			cm	deg	
1	2793.00	33.49	54.00	-20.51	36.40	-2.91	Average	100	15	
2	2793.00	46.51	74.00	-27.49	49.42	-2.91	Peak	100	15	
3	7667.00	39.59	54.00	-14.41	33.93	5.66	Average	100	46	
4	7667.00	53.03	74.00	-20.97	47.37	5.66	Peak	100	46	
<p>Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB/m)            *Factor includes antenna factor , cable loss and amplifier gain            Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).</p>										



<b>Modulation</b>	ax20 2437MHz + ax40 5230 MHz + EHT320 6905 MHz									
<b>Polarization</b>	Vertical									
Test By :Brad Wu			Temperature(°C):23			Humidity(%):65				
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table	
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		cm	deg	
1	2793.00	33.58	54.00	-20.42	36.49	-2.91	Average	100	42	
2	2793.00	46.92	74.00	-27.08	49.83	-2.91	Peak	100	42	
3	7667.00	39.89	54.00	-14.11	34.23	5.66	Average	100	29	
4	7667.00	52.93	74.00	-21.07	47.27	5.66	Peak	100	29	
<p>Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB/m)            *Factor includes antenna factor , cable loss and amplifier gain            Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).</p>										