



# FCC EMI TEST REPORT

**FCC ID** : GKRRMLN1  
**Equipment** : 5G LGA Module  
**Brand Name** : COMPAL  
**Model Name** : RML-N1  
**Marketing Name** : 5G LGA Module  
**Applicant** : Compal Electronics, Inc.  
No.581 & 581-1, Ruiguang Rd., Neihu District,  
Taipei, (114) Taiwan  
**Manufacturer** : Compal Electronics, Inc.  
No.581 & 581-1, Ruiguang Rd., Neihu District,  
Taipei, (114) Taiwan  
**Standard** : FCC 47 CFR FCC Part 15 Subpart B Class B

The product was received on Jun. 13, 2023 and testing was performed from Jun. 16, 2023 to Jun. 28, 2023. We, Sporton International Inc. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI C63.4-2014 and has been in compliance with the applicable technical standards.

The test results in this variant report apply exclusively to the tested model / sample. Without written approval from Sporton International Inc. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

*Louis Wu*

Approved by: Louis Wu

**Sporton International Inc. EMC & Wireless Communications Laboratory**

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)



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### History of this test report

Report No.	Version	Description	Issue Date
FC133040-05	01	Initial issue of report	Aug. 10, 2023



### Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.107	AC Conducted Emission	Pass	14.61 dB under the limit at 0.45 MHz
3.2	15.109	Radiated Emission	Pass	12.00 dB under the limit at 955.20 MHz

**Note:** This is a variant report by adding WWAN Band (5G NR n48) via software. All the test cases were performed on original report which can be referred to Sporton Report Number FC133040-04.

<b>Conformity Assessment Condition:</b>
1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the section "Measurement Uncertainty".
<b>Disclaimer:</b>
The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

**Reviewed by: Keven Cheng**

**Report Producer: Lea Yu**



# 1. General Description

## 1.1. Product Feature of Equipment Under Test

Product Feature	
<b>General Specs</b>	LTE/5G NR and GNSS.
<b>Antenna Type</b>	WWAN: Monopole Antenna GPS / Glonass / BDS / Galileo: Monopole Antenna

**Remark:** The EUT's information above is declared by manufacturer. Please refer to Disclaimer in report summary.

## 1.2. Modification of EUT

No modifications made to the EUT during the testing.

## 1.3. Test Location

<b>Test Site</b>	Sporton International Inc. EMC & Wireless Communications Laboratory
<b>Test Site Location</b>	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
<b>Test Site No.</b>	<b>Sporton Site No.</b>
	CO05-HY, 03CH06-HY

FCC designation No.: TW1093

## 1.4. Applicable Standards

According to the specifications declared by the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC 47 CFR FCC Part 15 Subpart B Class B
- ♦ ANSI C63.4-2014

**Remark:** All test items were verified and recorded according to the standards and without any deviation during the test.

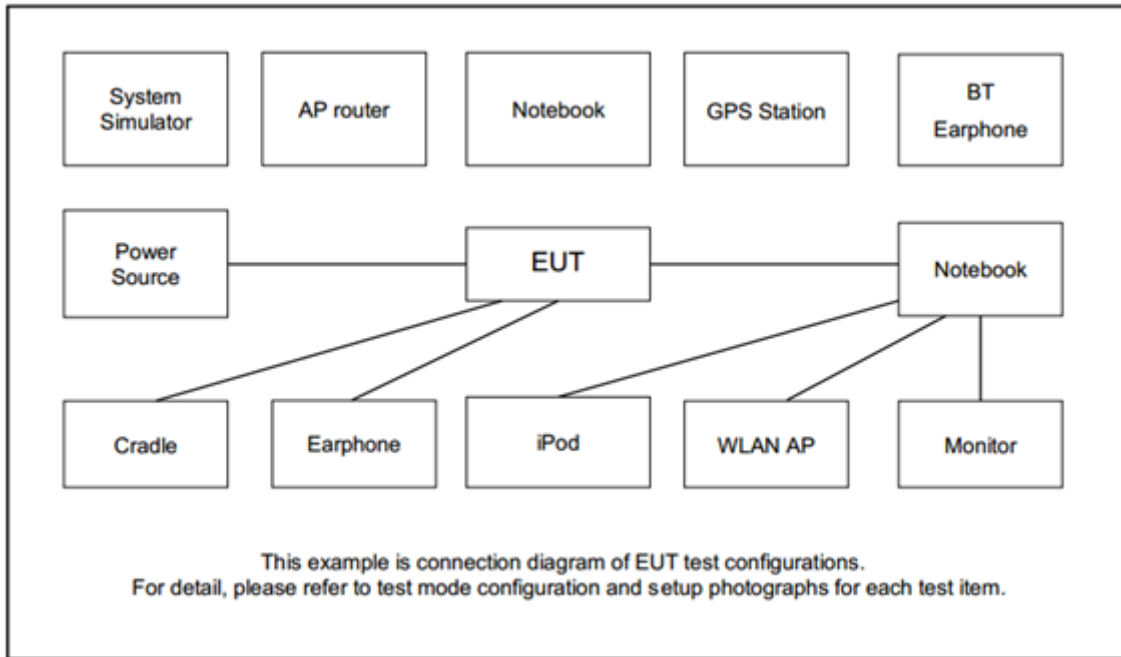
## 2. Test Configuration of Equipment Under Test

### 2.1. Test Mode

The EUT is tested along with the peripherals, operating under possible configurations in compliant with normal operation. The maximum emissions can be identified by a pre-scan carried out in different orientations of placement pursuant to ANSI C63.4-2014. Frequency range covered: Conduction Emission (150 kHz to 30 MHz), Radiation Emission (30 MHz to the 5<sup>th</sup> harmonics of the highest fundamental frequency or to 40 GHz, whichever is lower).

Test Items	Functions Enabled
AC Conducted Emission	Mode 1 : 5G NR n48(M) Idle + Adapter
Radiated Emissions	Mode 1 : 5G NR n48(M) Idle + DC 4V/2A

### 2.2. Connection Diagram of Test System



### 2.3. Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	5G Wireless Test Platform	Anritsu	MT8000A	N/A	N/A	Unshielded, 1.8 m
2.	Adapter	Compal	F24L3-120200SPAU	N/A	N/A	N/A
3.	DC Power Supply	GW Instek	GEU810960	FCC DoC	N/A	N/A
4.	Fixture	COMPAL	ZM52	N/A	N/A	N/A

### 2.4. EUT Operation Test Setup

The EUT is in 5G NR idle mode during the test. The EUT is synchronized with the BCCH, and has been continuous receiving mode by setting paging reorganization of the system simulator.



### 3. Test Result

#### 3.1. Test of AC Conducted Emission Measurement

##### 3.1.1. Limits of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

<Class B>

Frequency of emission (MHz)	Conducted limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

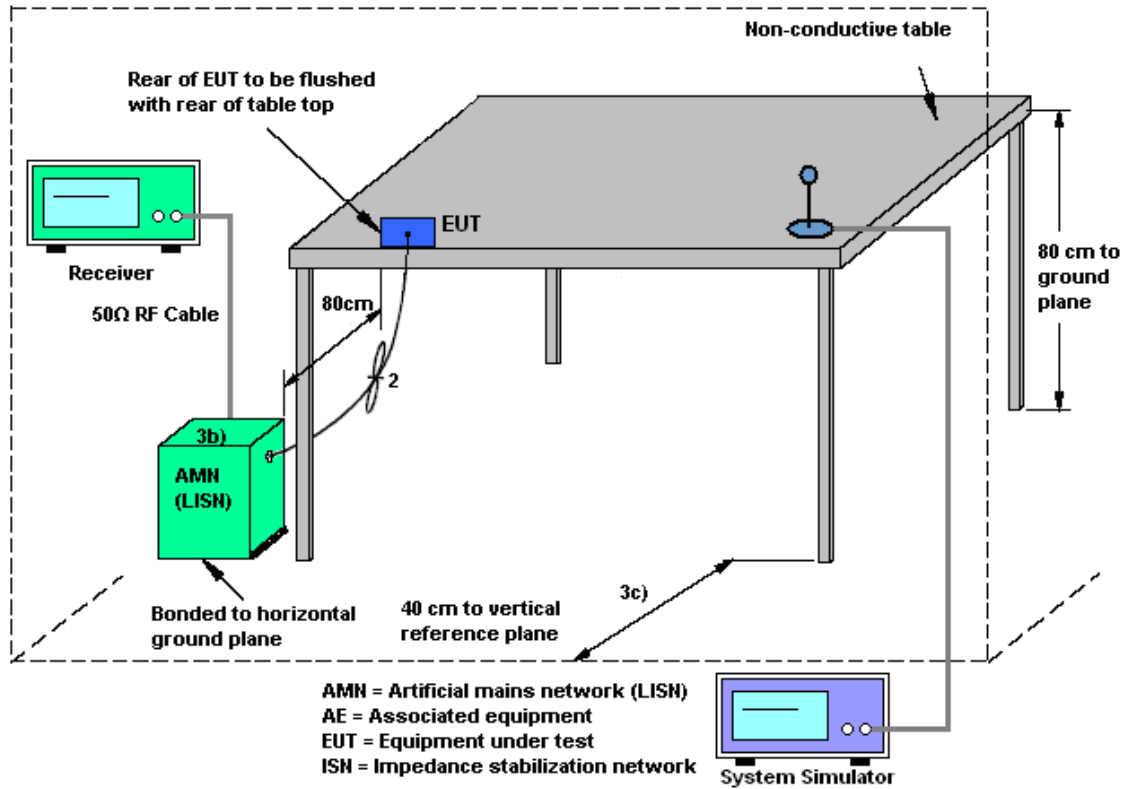
##### 3.1.2. Measuring Instruments

Please refer to the measuring equipment list in this test report.

##### 3.1.3. Test Procedure

1. The EUT is placed 0.4 meter away from the conducting wall of the shielding room, and is kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN shall be used.
6. Both Line and Neutral shall be tested in order to find out the maximum conducted emission.
7. The frequency range from 150 kHz to 30 MHz is scanned.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (If Bandwidth = 9 kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

### 3.1.4. Test Setup



### 3.1.5. Test Result of AC Conducted Emission

Please refer to Appendix A.





### 3.2. Test of Radiated Emission Measurement

#### 3.2.1. Limit of Radiated Emission

The emissions from an unintentional radiator shall not exceed the field strength levels specified in the following table:

<Class B>

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

#### 3.2.2. Measuring Instruments

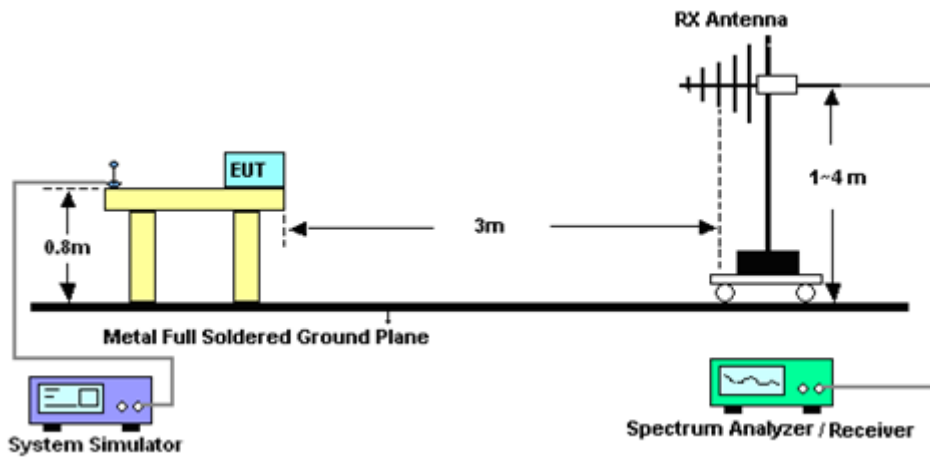
Please refer to the measuring equipment list in this test report.

#### 3.2.3. Test Procedures

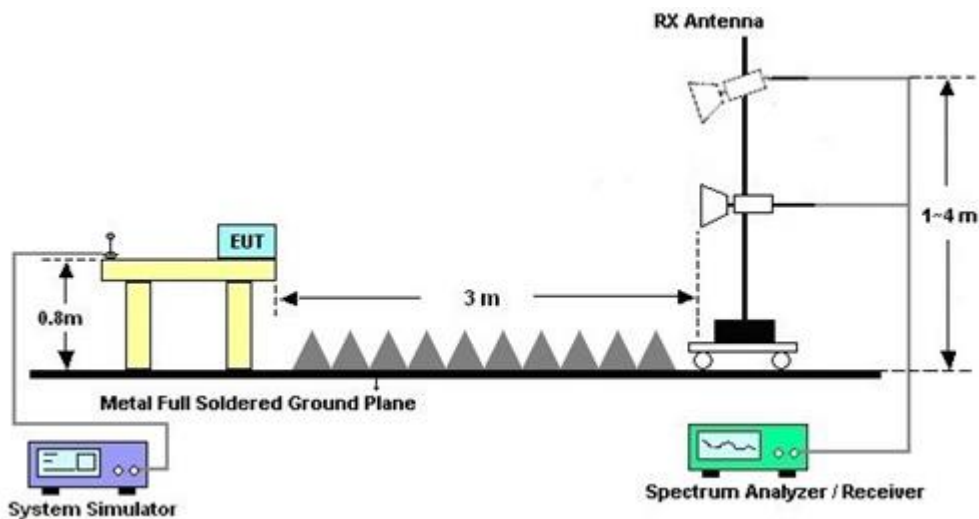
1. The EUT is placed on a turntable with 0.8 meter above ground.
2. The EUT is set 3 meters from the interference receiving antenna, which is mounted on the top of a variable height antenna tower.
3. The table is rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is a Bi-Log antenna and its height is adjusted between one to four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT is arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode (RBW=120 kHz/VBW=300 kHz for frequency below 1 GHz; RBW=1 MHz VBW=3 MHz (Peak), RBW=1 MHz/VBW=10 Hz (Average) for frequency above 1 GHz).
7. If the emission level of the EUT in peak mode is 3 dB lower than the limit specified, peak values of EUT will be reported. Otherwise, the emission will be repeated by using the quasi-peak method and reported.

### 3.2.4. Test Setup of Radiated Emission

For Radiated Emissions from 30 MHz to 1 GHz



For Radiated Emissions above 1GHz



### 3.2.5. Test Result of Radiated Emission

Please refer to Appendix B.



### 4. List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Jun. 28, 2023	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Dec. 01, 2022	Jun. 28, 2023	Nov. 30, 2023	Conduction (CO05-HY)
Hygrometer	Testo	608-H1	34913912	N/A	Nov. 17, 2022	Jun. 28, 2023	Nov. 16, 2023	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Nov. 17, 2022	Jun. 28, 2023	Nov. 16, 2023	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32	N/A	N/A	N/A	Jun. 28, 2023	N/A	Conduction (CO05-HY)
Pulse Limiter	SCHWARZBECK	VTSD 9561-F N	00691	N/A	Aug. 01, 2022	Jun. 28, 2023	Jul. 31, 2023	Conduction (CO05-HY)
LISN Cable	MVE	RG-400	260260	N/A	Dec. 29, 2022	Jun. 28, 2023	Dec. 28, 2023	Conduction (CO05-HY)
Amplifier	SONOMA	310N	186713	9kHz~1GHz	Apr. 17, 2023	Jun. 16, 2023	Apr. 16, 2024	Radiation (03CH06-HY)
Bilog Antenna	Schaffner	CBL 6111C & N-6-06	2725 & AT-N0601	30MHz~1GHz	Nov. 06, 2022	Jun. 16, 2023	Nov. 05, 2023	Radiation (03CH06-HY)
EMI Test Receiver	Rohde & Schwarz	ESU26	100472	20Hz~26.5GHz	Feb. 13, 2023	Jun. 16, 2023	Feb. 12, 2024	Radiation (03CH06-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-02037	1GHz~18GHz	Dec. 30, 2022	Jun. 16, 2023	Dec. 29, 2023	Radiation (03CH06-HY)
Preamplifier	Jet-Power	JPA00101800-30-10P	1601180001	1GHz~18GHz	Jul. 18, 2022	Jun. 16, 2023	Jul. 17, 2023	Radiation (03CH06-HY)
RF Cable	HUBER + SUHNER	SF102_7000mm	532299/2	30MHz to 40GHz	Jul. 04, 2022	Jun. 16, 2023	Jul. 03, 2023	Radiation (03CH06-HY)
RF Cable	HUBER + SUHNER	SF102_3000mm	532422/2	30MHz to 40GHz	Jul. 04, 2022	Jun. 16, 2023	Jul. 03, 2023	Radiation (03CH06-HY)
RF Cable	HUBER + SUHNER	SF102_2000mm	532421/2	30MHz to 40GHz	Jul. 04, 2022	Jun. 16, 2023	Jul. 03, 2023	Radiation (03CH06-HY)
RF Cable	HUBER + SUHNER	SF104	802433/4	30Mhz to 18Ghz	Aug. 18, 2022	Jun. 16, 2023	Aug. 17, 2023	Radiation (03CH06-HY)
Hygrometer	TECPEL	DTM-303B	TP210018	N/A	Oct. 27, 2022	Jun. 16, 2023	Oct. 26, 2023	Radiation (03CH06-HY)
Controller	INN-CO	EM1000	060782	Control Turn table & Ant Mast	N/A	Jun. 16, 2023	N/A	Radiation (03CH06-HY)
Antenna Mast	MF	MF-7802	MF780208212	1m~4m	N/A	Jun. 16, 2023	N/A	Radiation (03CH06-HY)
Turn Table	INN-CO	DS2000	420/650/00	0-360 degree	N/A	Jun. 16, 2023	N/A	Radiation (03CH06-HY)
Software	Audix	E3 6.2009-8-24(k5)	N/A	N/A	N/A	Jun. 16, 2023	N/A	Radiation (03CH06-HY)



## 5. Measurement Uncertainty

### Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	3.5 dB
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### Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	6.3 dB
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### Uncertainty of Radiated Emission Measurement (1000 MHz ~ 6000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	4.6 dB
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### Uncertainty of Radiated Emission Measurement (6000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	4.5 dB
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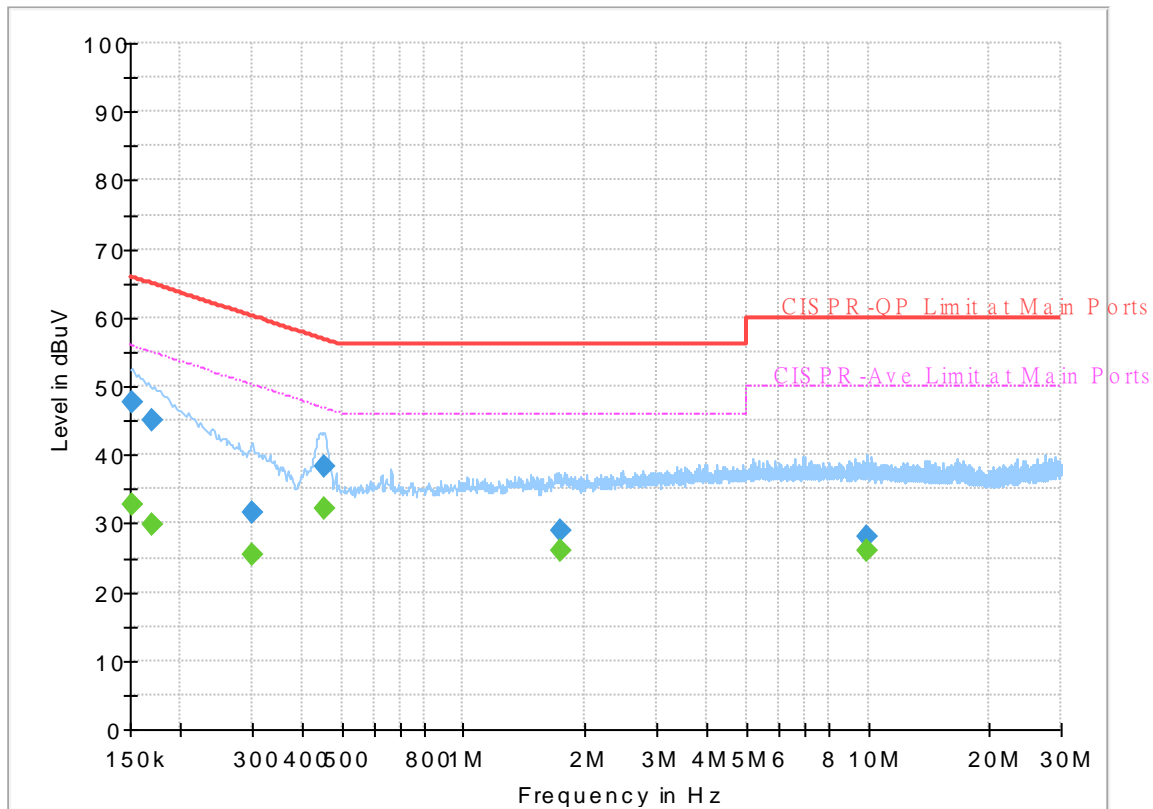
## Appendix A. AC Conducted Emission Test Results

Test Engineer :	Calivn Wang	Temperature :	23~26°C
		Relative Humidity :	45~55%

# EUT Information

Report NO : 133040-05  
 Test Mode : Mode 1  
 Test Voltage : 120Vac/60Hz  
 Phase : Line

Full Spectrum



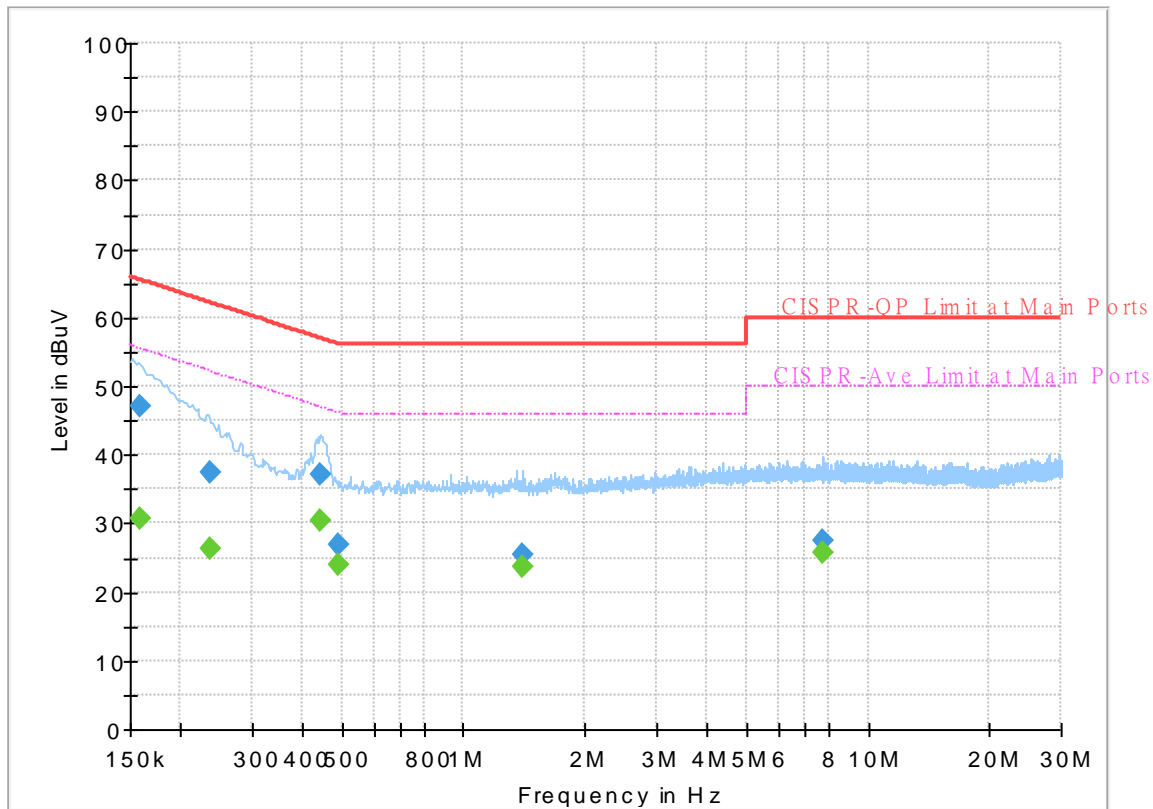
## Final\_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	32.76	55.88	23.12	L1	OFF	19.9
0.152250	47.67	---	65.88	18.21	L1	OFF	19.9
0.170250	---	29.68	54.95	25.27	L1	OFF	19.9
0.170250	45.02	---	64.95	19.93	L1	OFF	19.9
0.300750	---	25.48	50.22	24.74	L1	OFF	19.9
0.300750	31.58	---	60.22	28.64	L1	OFF	19.9
0.451500	---	32.24	46.85	14.61	L1	OFF	19.9
0.451500	38.17	---	56.85	18.68	L1	OFF	19.9
1.740750	---	26.00	46.00	20.00	L1	OFF	19.9
1.740750	29.06	---	56.00	26.94	L1	OFF	19.9
9.928500	---	26.08	50.00	23.92	L1	OFF	20.2
9.928500	28.13	---	60.00	31.87	L1	OFF	20.2

# EUT Information

Report NO : 133040-05  
 Test Mode : Mode 1  
 Test Voltage : 120Vac/60Hz  
 Phase : Neutral

Full Spectrum

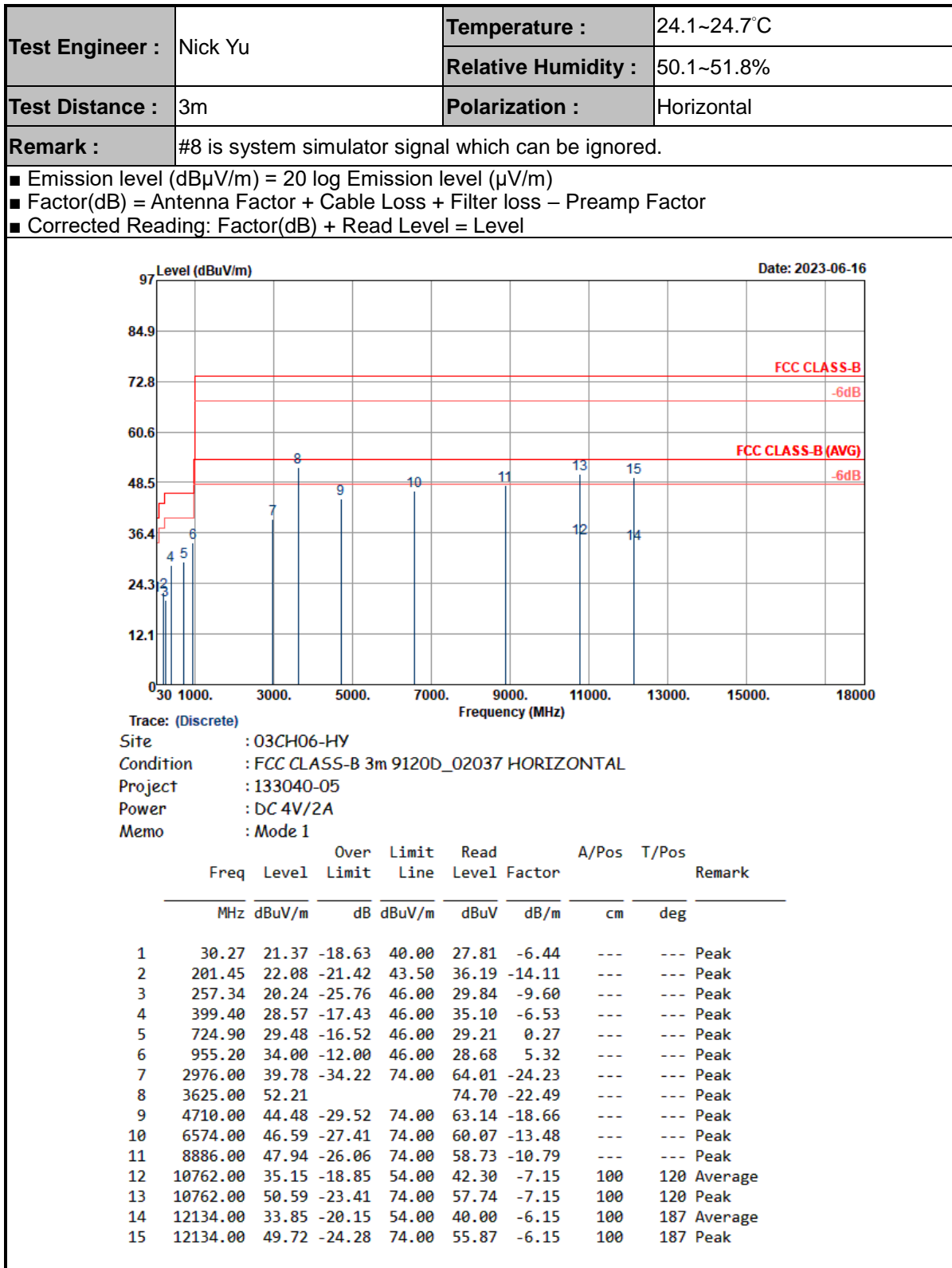


## Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.159000	---	30.84	55.52	24.68	N	OFF	19.9
0.159000	47.10	---	65.52	18.42	N	OFF	19.9
0.235500	---	26.33	52.25	25.92	N	OFF	19.9
0.235500	37.30	---	62.25	24.95	N	OFF	19.9
0.442500	---	30.49	47.02	16.53	N	OFF	19.9
0.442500	37.03	---	57.02	19.99	N	OFF	19.9
0.492000	---	24.08	46.13	22.05	N	OFF	19.9
0.492000	26.76	---	56.13	29.37	N	OFF	19.9
1.403250	---	23.68	46.00	22.32	N	OFF	19.9
1.403250	25.55	---	56.00	30.45	N	OFF	19.9
7.730250	---	25.60	50.00	24.40	N	OFF	20.2
7.730250	27.35	---	60.00	32.65	N	OFF	20.2



## Appendix B. Radiated Emission Test Result

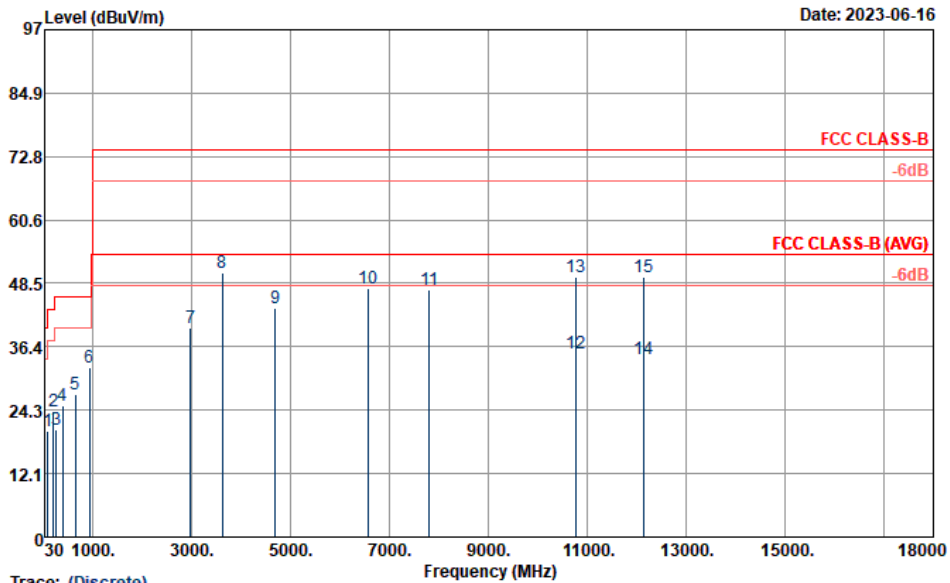






Test Engineer :	Nick Yu	Temperature :	24.1~24.7°C
		Relative Humidity :	50.1~51.8%
Test Distance :	3m	Polarization :	Vertical
Remark :	#8 is system simulator signal which can be ignored.		

- Emission level (dBμV/m) = 20 log Emission level (μV/m)
- Factor(dB) = Antenna Factor + Cable Loss + Filter loss – Preamp Factor
- Corrected Reading: Factor(dB) + Read Level = Level



Trace: (Discrete)

Site : 03CH06-HY  
 Condition : FCC CLASS-B 3m 9120D\_02037 VERTICAL  
 Project : 133040-05  
 Power : DC 4V/2A  
 Memo : Mode 1

	Freq	Level	Over	Limit	Read	Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	cm	deg	
1	91.02	20.29	-23.21	43.50	35.50	-15.21	---	---	Peak
2	201.99	24.03	-19.47	43.50	38.12	-14.09	---	---	Peak
3	264.36	20.60	-25.40	46.00	29.74	-9.14	---	---	Peak
4	398.00	25.12	-20.88	46.00	31.69	-6.57	---	---	Peak
5	645.10	27.31	-18.69	46.00	28.58	-1.27	---	---	Peak
6	930.00	32.55	-13.45	46.00	28.17	4.38	---	---	Peak
7	2980.00	39.86	-34.14	74.00	64.02	-24.16	---	---	Peak
8	3625.00	50.50			72.99	-22.49	---	---	Peak
9	4692.00	43.76	-30.24	74.00	62.53	-18.77	---	---	Peak
10	6580.00	47.51	-26.49	74.00	60.95	-13.44	---	---	Peak
11	7810.00	47.37	-26.63	74.00	59.94	-12.57	---	---	Peak
12	10774.00	35.03	-18.97	54.00	42.10	-7.07	100	307	Average
13	10774.00	49.78	-24.22	74.00	56.85	-7.07	100	307	Peak
14	12140.00	33.95	-20.05	54.00	40.10	-6.15	100	339	Average
15	12140.00	49.60	-24.40	74.00	55.75	-6.15	100	339	Peak