



FCC EMI TEST REPORT

FCC ID : GKRRMLN2X
Equipment : LGA Module
Brand Name : COMPAL
Model Name : RML-N2x
Marketing Name : RML-N2x
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 Aug. 29, 2024 and testing was performed from Sep. 11, 2024 to Sep. 20, 2024. 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 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
FC482804-01	01	Initial issue of report	Oct. 24, 2024
FC482804-01	02	Revise Appendix C This report is an updated version, replacing the report issued on Oct. 24, 2024.	Oct. 29, 2024



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.107	AC Conducted Emission	Pass	18.14 dB under the limit at 0.40 MHz
3.2	15.109	Radiated Emission	Pass	11.40 dB under the limit at 953.1 MHz

Conformity Assessment Condition:

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/manufacture 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".

Disclaimer:

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: Emma Hsiao



1. General Description

1.1. Product Feature of Equipment Under Test

Product Feature
General Specs LTE/5G NR and GNSS.
Antenna Type 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

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

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	Sporton Site No.
	03CH10-HY (TAF Code: 3786)
Remark	The Radiated Emission test item subcontracted to Sporton International Inc. Wensan Laboratory

FCC designation No.: TW1093 and TW1132

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
- ♦ ANSI C63.4a-2017

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

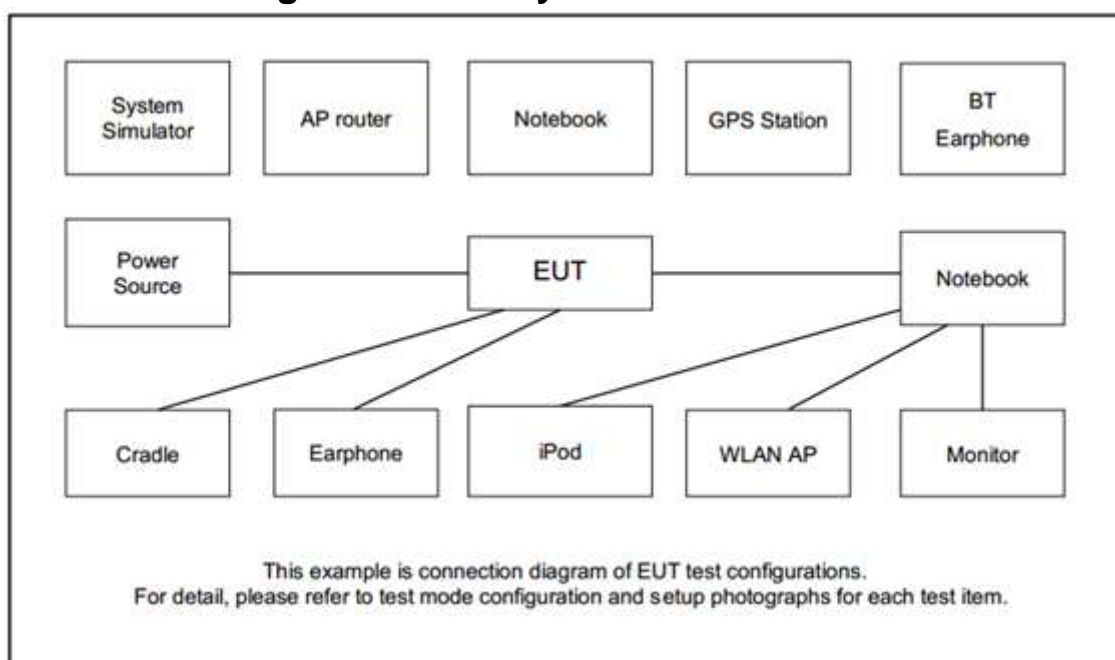
2. Test Configuration of Equipment Under Test

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 5th harmonics of the highest fundamental frequency or to 40 GHz, whichever is lower).

Test Items	Functions Enabled
AC Conducted Emission	Mode 1: 5G NR n71 Idle + GPS Rx + USB Cable (Charging form Adapter)
Radiated Emissions	Mode 1: 5G NR n71 Idle + GPS Rx + DC Power
Remark: For Radiation Emission after pre-scanned the cellular band between 30MHz ~ 960MHz (5G NR n71); only the worst case for cellular band test data of this mode was reported.	

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,1.8m
2.	System Simulator	Anritsu	MT8821C	N/A	N/A	Unshielded,1.8m
3.	GPS Station	Pendulum	GSG-54	N/A	N/A	Unshielded,1.8m
4.	Adapter	Frecom	F24L15-120200SPAU	N/A	N/A	N/A
5.	Fixture	Compal	ZLN1	N/A	N/A	N/A
6.	Power Supply	GWINSTEK	GPE-2323	N/A	N/A	Unshielded,1.8m

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.

At the same time, the following programs installed in the EUT are programmed during the test:

1. Execute "GPS Test" to turn on GPS, make the EUT search continuous signals from GPS station.



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.

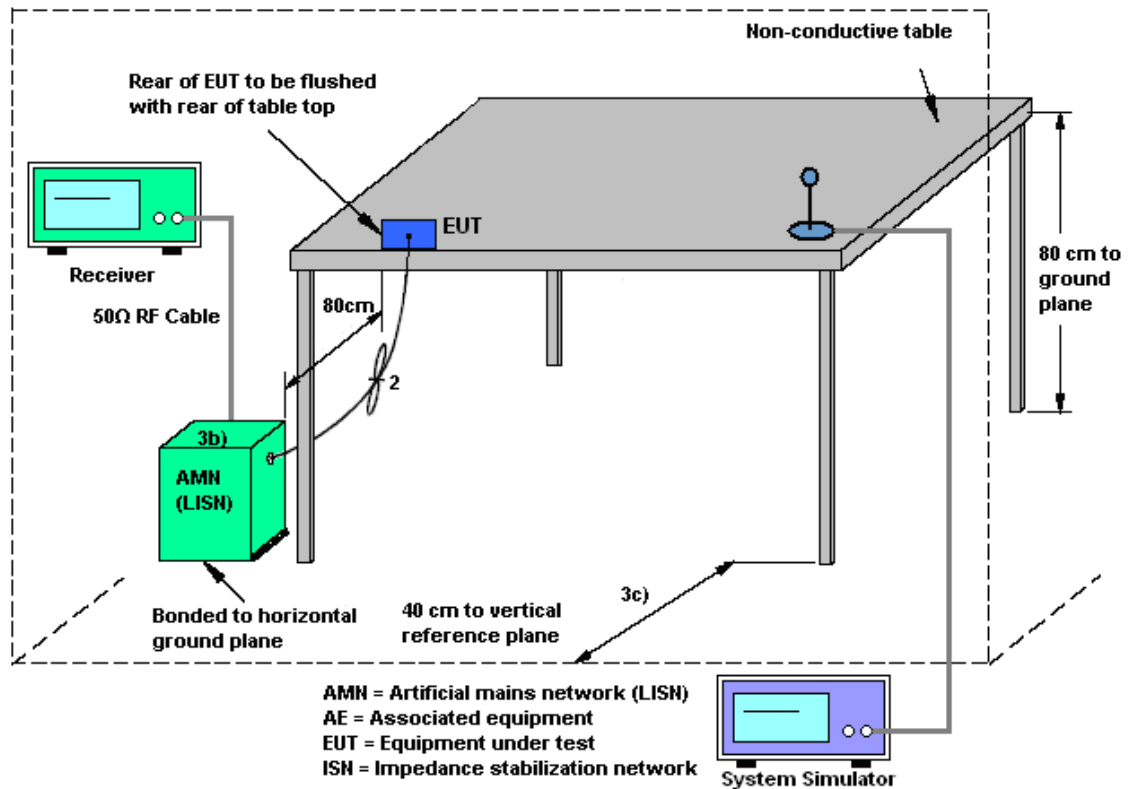
3.1.2. Measuring Instruments

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

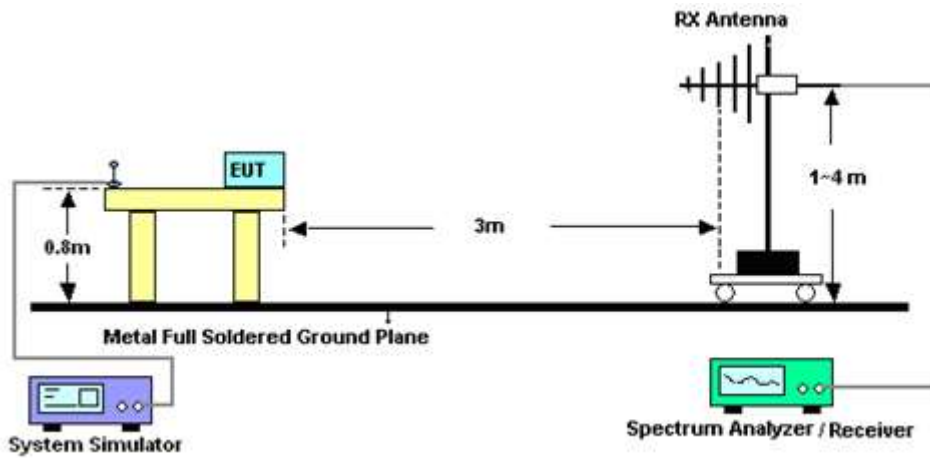
Please refer to the measuring equipment list in this test report.

3.2.3. Test Procedures

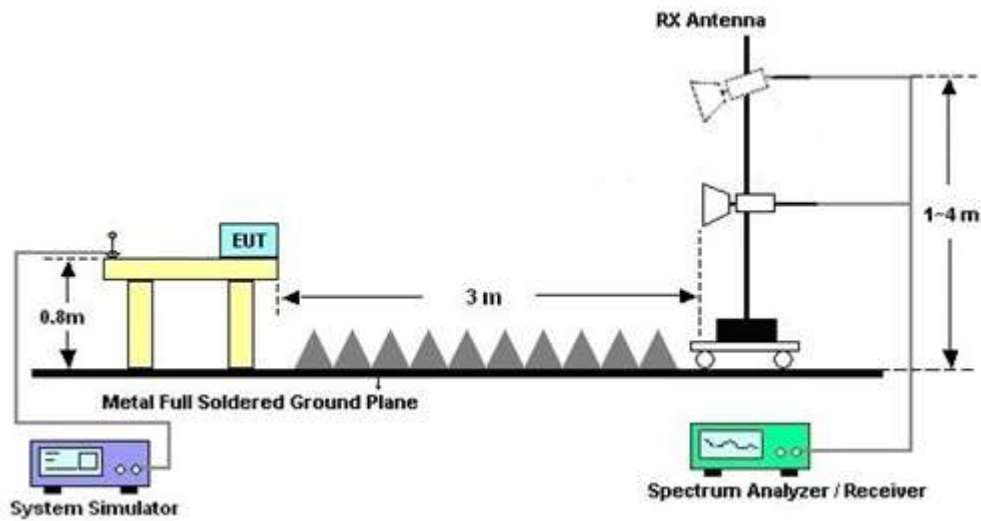
1. The EUT is placed on a turntable with 0.8 meter above ground.
2. The EUT is set 3 meters(30 M~18 G) and 1 meters (18 G~40 G) from the interference receiving antenna, which is mounted on the top of a variable height antenna tower.
3. The table is rotated 360 degrees to determine the position of the 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

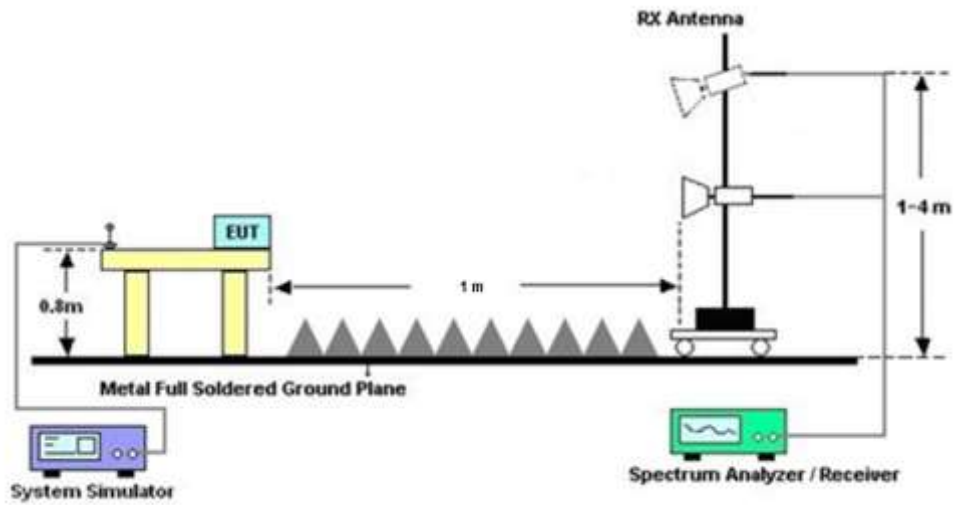
For Radiated Emissions from 30 MHz to 1 GHz



For Radiated Emissions from 1GHz to 18GHz



For Radiated Emissions above 18GHz



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	Sep. 20, 2024	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Dec. 06, 2023	Sep. 20, 2024	Dec. 05, 2024	Conduction (CO05-HY)
Hygrometer	Testo	608-H1	34913912	N/A	Oct. 26, 2023	Sep. 20, 2024	Oct. 25, 2024	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Nov. 22, 2023	Sep. 20, 2024	Nov. 21, 2024	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32	N/A	N/A	N/A	Sep. 20, 2024	N/A	Conduction (CO05-HY)
Pulse Limiter	SCHWARZBECK	VTSD 9561-F N	00691	N/A	Jul. 30, 2024	Sep. 20, 2024	Jul. 29, 2025	Conduction (CO05-HY)
RF Cable	HUBER + SUHNER	RG 214/U	1358175	9kHz~30MHz	Mar. 14, 2024	Sep. 20, 2024	Mar. 13, 2025	Conduction (CO05-HY)
Amplifier	SONOMA	310N	187311	9kHz~1GHz	Oct. 16, 2023	Sep. 11, 2024	Oct. 15, 2024	Radiation (03CH10-HY)
Bilog Antenna	TESEQ	CBL6111D&00802N1D01N-06	55608 & 09	30MHz~1GHz	Oct. 20, 2023	Sep. 11, 2024	Oct. 19, 2024	Radiation (03CH10-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1325	1GHz~18GHz	Oct. 18, 2023	Sep. 11, 2024	Oct. 17, 2024	Radiation (03CH10-HY)
Preamplifier	Jet-Power	JAP00101800-30-10P	160118550004	1GHz~18GHz	Feb. 26, 2024	Sep. 11, 2024	Feb. 25, 2025	Radiation (03CH10-HY)
Controller	EMEC	EM 1000	N/A	Control Turn table & Ant Mast	N/A	Sep. 11, 2024	N/A	Radiation (03CH10-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Sep. 11, 2024	N/A	Radiation (03CH10-HY)
Turn Table	EMEC	TT 2200	N/A	0~360 Degree	N/A	Sep. 11, 2024	N/A	Radiation (03CH10-HY)
Software	Audix	E3 6.2009-8-24	RK-001042	N/A	N/A	Sep. 11, 2024	N/A	Radiation (03CH10-HY)
EMI Test Receiver	Keysight	N9038A	MY59053012	3Hz~26.5GHz	Nov. 08, 2023	Sep. 11, 2024	Nov. 07, 2024	Radiation (03CH10-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	519226/2, 804014/2, 804026/2	30MHz~40GHz	Nov. 01, 2023	Sep. 11, 2024	Oct. 31, 2024	Radiation (03CH10-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA9170	00993	18GHz~40GHz	Nov. 24, 2023	Sep. 11, 2024	Nov. 23, 2024	Radiation (03CH10-HY)
Signal Analyzer	Keysight	N9010B	MY60241055	10Hz~44GHz	Jul. 19, 2024	Sep. 11, 2024	Jul. 18, 2025	Radiation (03CH10-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz~40GHz	Dec. 07, 2023	Sep. 11, 2024	Dec. 06, 2024	Radiation (03CH10-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% ($U = 2Uc(y)$)	6.34 dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 6000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.68 dB
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Uncertainty of Radiated Emission Measurement (6000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.3 dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.96 dB
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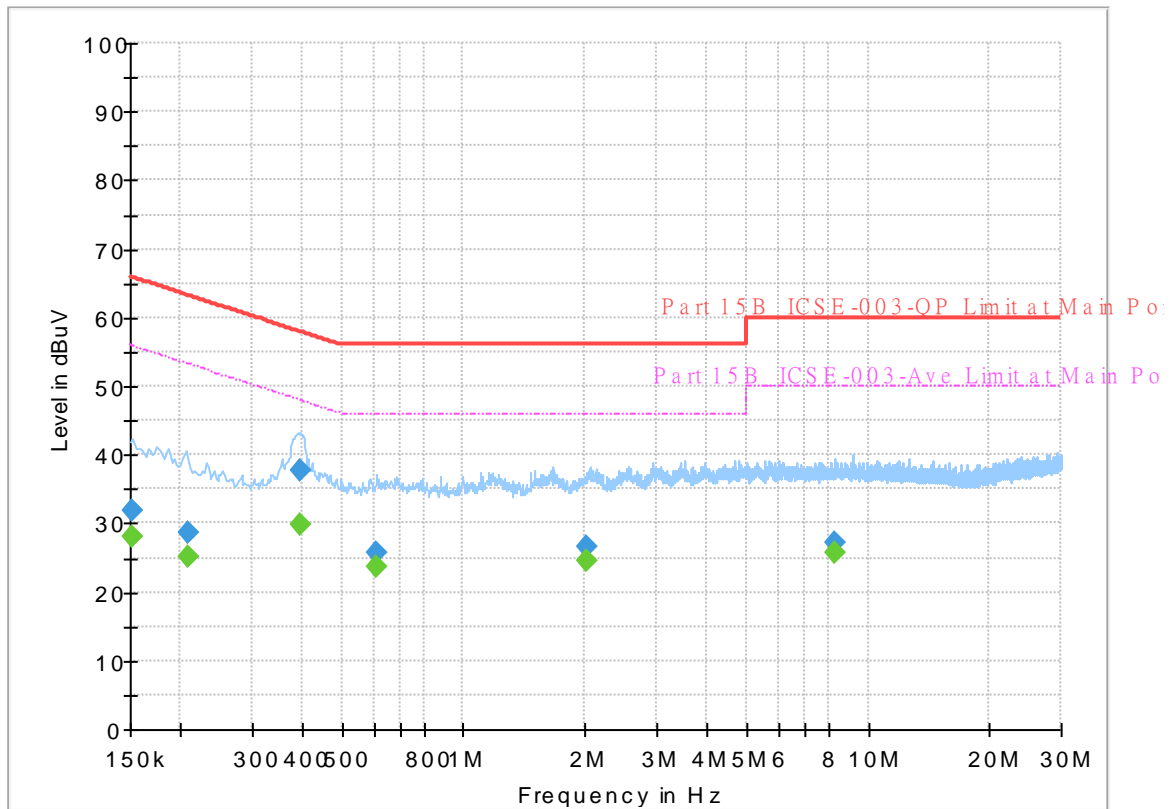
Appendix A. AC Conducted Emission Test Results

Test Engineer :	Calvin Wang	Temperature :	23~26℃
		Relative Humidity :	45~55%

EUT Information

Report NO : 482804-01
 Test Mode : Mode 1
 Test Voltage : 120Vac/60Hz
 Phase : Line

Full Spectrum



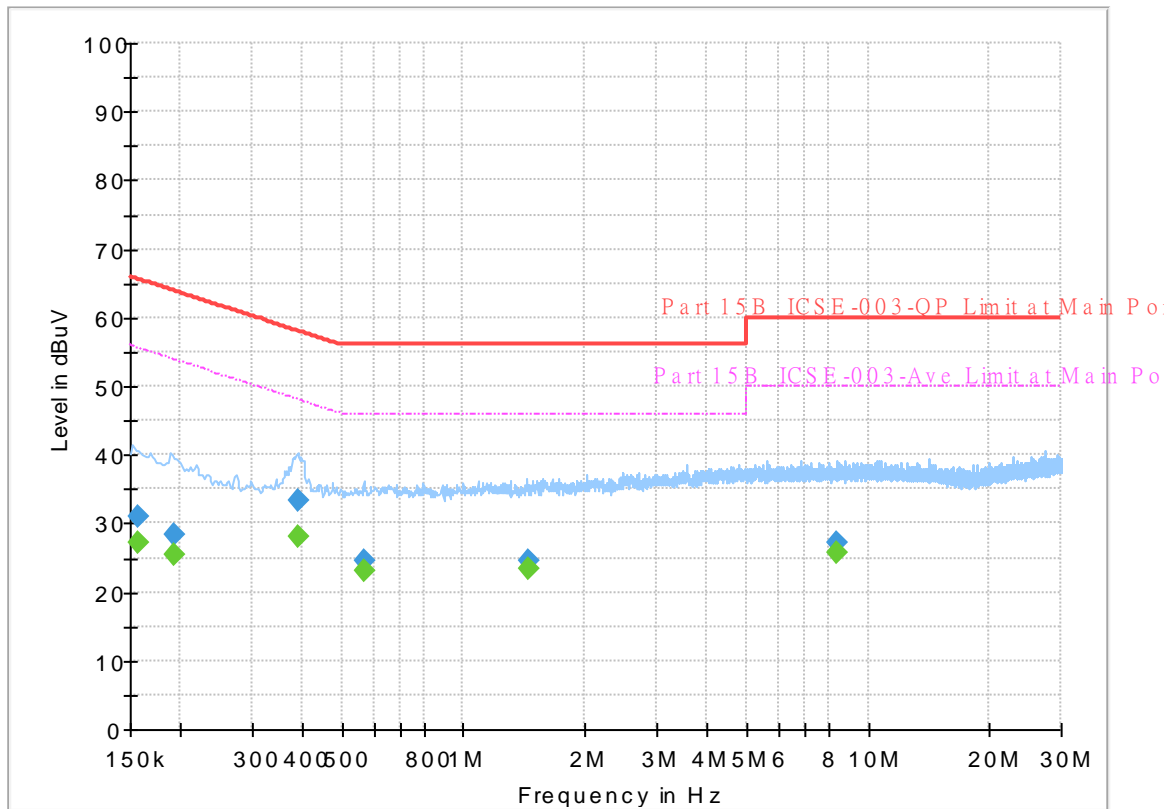
Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	28.14	55.88	27.74	L1	OFF	19.8
0.152250	31.84	---	65.88	34.04	L1	OFF	19.8
0.208500	---	25.24	53.27	28.03	L1	OFF	19.8
0.208500	28.52	---	63.27	34.75	L1	OFF	19.8
0.395250	---	29.81	47.95	18.14	L1	OFF	19.8
0.395250	37.61	---	57.95	20.34	L1	OFF	19.8
0.609000	---	23.75	46.00	22.25	L1	OFF	19.8
0.609000	25.79	---	56.00	30.21	L1	OFF	19.8
2.015250	---	24.62	46.00	21.38	L1	OFF	19.9
2.015250	26.57	---	56.00	29.43	L1	OFF	19.9
8.313000	---	25.83	50.00	24.17	L1	OFF	20.2
8.313000	27.08	---	60.00	32.92	L1	OFF	20.2

EUT Information

Report NO : 482804-01
 Test Mode : Mode 1
 Test Voltage : 120Vac/60Hz
 Phase : Neutral

Full Spectrum

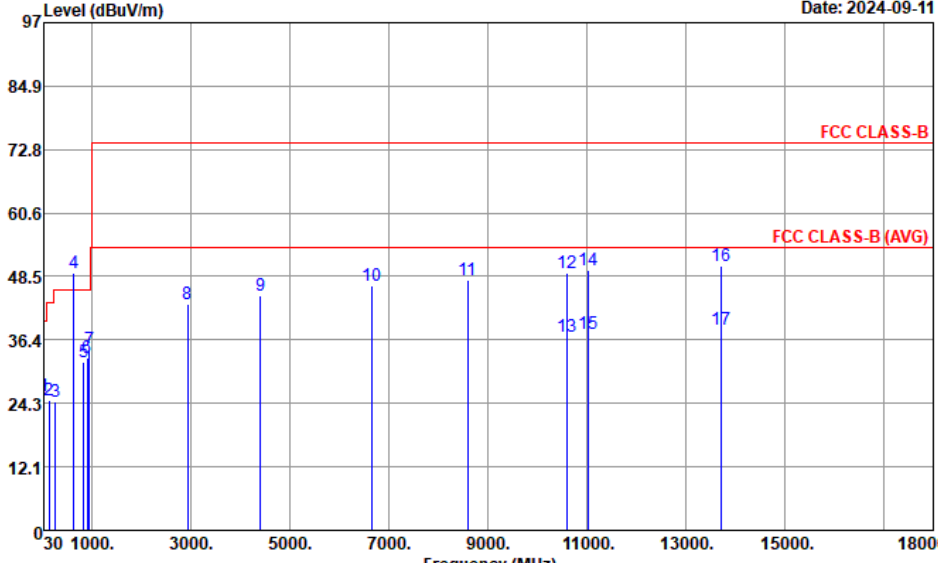


Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.156750	---	27.10	55.63	28.53	N	OFF	19.8
0.156750	31.09	---	65.63	34.54	N	OFF	19.8
0.192750	---	25.33	53.92	28.59	N	OFF	19.8
0.192750	28.46	---	63.92	35.46	N	OFF	19.8
0.388500	---	28.19	48.10	19.91	N	OFF	19.8
0.388500	33.26	---	58.10	24.84	N	OFF	19.8
0.566250	---	23.22	46.00	22.78	N	OFF	19.8
0.566250	24.70	---	56.00	31.30	N	OFF	19.8
1.448250	---	23.32	46.00	22.68	N	OFF	19.9
1.448250	24.66	---	56.00	31.34	N	OFF	19.9
8.385000	---	25.65	50.00	24.35	N	OFF	20.2
8.385000	27.12	---	60.00	32.88	N	OFF	20.2



Appendix B. Radiated Emission Test Result

Test Engineer :	Donny Tang	Temperature :	22.8~24.1°C								
		Relative Humidity :	59.2~61.3%								
Test Distance :	3m	Polarization :	Horizontal								
Remark :	#4 is system simulator signal which can be ignored.										
■ Emission level (dBμV/m) = 20 log Emission level (μV/m)											
■ Corrected Reading: Antenna Factor + Cable Loss – Preamp Factor + Read Level = Level											
<div><div>Level (dBuV/m)</div><div><div>Date: 2024-09-11</div></div></div>											
Site : 03CH10-HV											
Condition : FCC CLASS-B 3m 9120D-1325_231018 HORIZONTAL											
Project : 482804-01											
Power : DC 4V											
Mode : 1											
	Freq	Level	Over Limit	Limit Line	ReadAntenna	Cable	Preamp	A/Pos	T/Pos	Remark	
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	32.70	25.76	-14.24	40.00	34.53	22.46	1.37	32.60	---	---	Peak
2	143.94	24.77	-18.73	43.50	37.77	17.11	2.47	32.58	---	---	Peak
3	261.93	24.54	-21.46	46.00	34.48	19.47	3.17	32.58	---	---	Peak
4 *	634.50	49.19			50.70	26.16	4.77	32.44	---	---	Peak
5	838.30	32.27	-13.73	46.00	30.49	28.61	5.36	32.19	---	---	Peak
6	909.70	33.00	-13.00	46.00	30.34	28.67	5.57	31.58	---	---	Peak
7	953.10	34.60	-11.40	46.00	29.66	30.32	5.72	31.10	---	---	Peak
8	2942.00	43.30	-30.70	74.00	63.10	29.00	9.78	58.58	---	---	Peak
9	4414.00	44.96	-29.04	74.00	60.15	31.60	12.27	59.06	---	---	Peak
10	6652.00	46.80	-27.20	74.00	55.55	35.80	15.15	59.70	---	---	Peak
11	8590.00	47.79	-26.21	74.00	53.71	37.38	17.02	60.32	---	---	Peak
12	10602.00	49.30	-24.70	74.00	51.26	38.90	18.94	59.80	---	---	Peak
13	10602.00	37.08	-16.92	54.00	39.04	38.90	18.94	59.80	---	---	Average
14	11022.00	49.71	-24.29	74.00	51.68	38.46	19.34	59.77	---	---	Peak
15	11022.00	37.48	-16.52	54.00	39.45	38.46	19.34	59.77	---	---	Average
16	13715.00	50.62	-23.38	74.00	46.98	40.47	21.62	58.45	---	---	Peak
17	13715.00	38.39	-15.61	54.00	34.75	40.47	21.62	58.45	---	---	Average

