FCC EMI TEST REPORT

FCC ID	:	**2AVSJ-SWTPWMIT022**
Equipment	:	**Soiltech Wireless Sensor**
Brand Name	:	**Soiltech Wireless Inc.**
Model Name	:	**Soiltech Beacon v2** **Soiltech Beacon v2 Ext Ant** **Soiltech Beacon v2 CO2**
Applicant	:	**Soiltech Wireless Inc** **98A S 200 W, RUPERT, ID 83350 USA**
Manufacturer	:	**Soiltech Wireless Inc** **98A S 200 W, RUPERT, ID 83350 USA**
Standard	:	**FCC 47 CFR FCC Part 15 Subpart B Class B**

The product was received on Jun. 27, 2023 and testing was performed from Oct. 26, 2023 to Oct. 27, 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 C63.4a-2017 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
FC361402	01	Initial issue of report	Mar. 13, 2024

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.107	AC Conducted Emission	Pass	5.26 dB under the limit at 0.44 MHz
3.2	15.109	Radiated Emission	Pass	9.50 dB under the limit at 124.77 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/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”.

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: Danny Lee
Report Producer: Lilian Hou

1. General Description

1.1. Product Feature of Equipment Under Test

Product Feature
General Specs LTE and Bluetooth-LE **Antenna Type** WWAN: PCB Antenna Bluetooth-LE: PCB Antenna

Model Name	Configuration	WWAN Module	WWAN Antenna	Bluetooth Module	Bluetooth Antenna	CO2 Sensor	Top Cover	Bottom Cover
Soiltech Beacon v2	Configuration 1	Quectel BG96	Internal	BM832	Internal	Not mounted	Standard	Standard
Soiltech Beacon v2 Ext Ant	Configuration 2	Quectel BG96	External	BM832	Internal	Not mounted	Standard	Adjusted for CO2 sensor
Soiltech Beacon v2 CO2	Configuration 3	-	Internal	BM832	Internal	Mounted	Adjusted for CO2 sensor	Standard

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, 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 C63.4a-2017

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

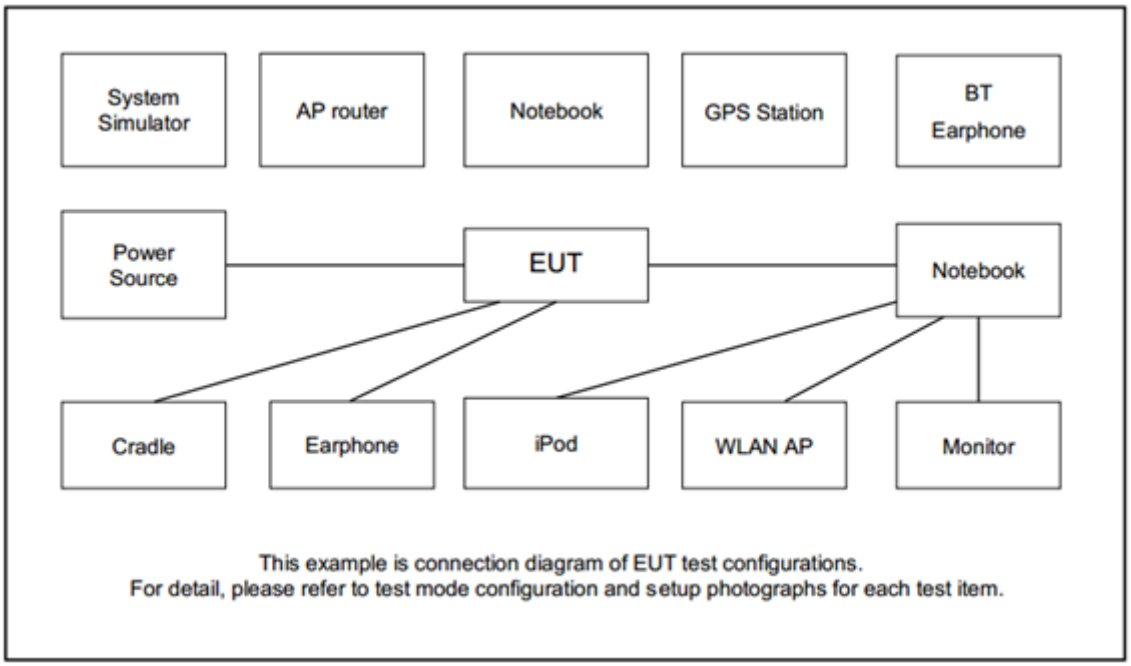
2. Test Configuration of Equipment Under Test

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 C63.4a-2017. 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: LTE Cat. M1 Band 12 Idle + Bluetooth-LE Idle + GPS RX + USB Cable (Charging from Notebook) for Configuration 1 Mode 2: LTE Cat. M1 Band 12 Idle + Bluetooth-LE Idle + GPS RX + USB Cable (Charging from Notebook) for Configuration 2 Mode 3: LTE Cat. M1 Band 12 Idle + Bluetooth-LE Idle + GPS RX + USB Cable (Charging from Notebook) for Configuration 3
Radiated Emissions	Mode 1: LTE Cat. M1 Band 12 Idle + Bluetooth-LE Idle + GPS RX + USB Cable (Charging from Notebook) for Configuration 1 Mode 2: LTE Cat. M1 Band 12 Idle + Bluetooth-LE Idle + GPS RX + USB Cable (Charging from Notebook) for Configuration 2 Mode 3: LTE Cat. M1 Band 12 Idle + Bluetooth-LE Idle + GPS RX + USB Cable (Charging from Notebook) for Configuration 3
Remark: **1.** The worst case of AC is mode 3; only the test data of this mode was reported. **2.** The worst case of RE is mode 1; only the test data of this mode was reported. **3.** For Radiation Emission after pre-scanned the cellular band between 30MHz ~ 960MHz (LTE Band 12); 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.	System Simulator	Anritsu	MT8821C	N/A	N/A	Unshielded, 1.8m
2.	GPS Station	Pendulum	GSG-54	N/A	N/A	Unshielded, 1.8m
3.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	Unshielded, 1.0m	Unshielded, 1.8m
4.	iPod	Apple	A1285	FCC DoC	Shielded, 1.0m	N/A
5.	Notebook	Lenovo	TP00116A	FCC DoC	Shielded, 1.0m	AC I/P：Unshielded, 1.2m DC O/P：Shielded, 1.8m
6.	Mobile Phone	SAMSUNG	SM-A730F/DS	A3LSMA730F	N/A	N/A
7.	Mobile Phone	Apple	A1586	BCG-E2816A	N/A	N/A

2.4. EUT Operation Test Setup

The EUT is in LTE 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 EUT is attached to the Mobile Phone via Bluetooth function, and the following programs installed in the EUT are programmed during the test:

1. Execute “GPS Test” to make the EUT receive 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.

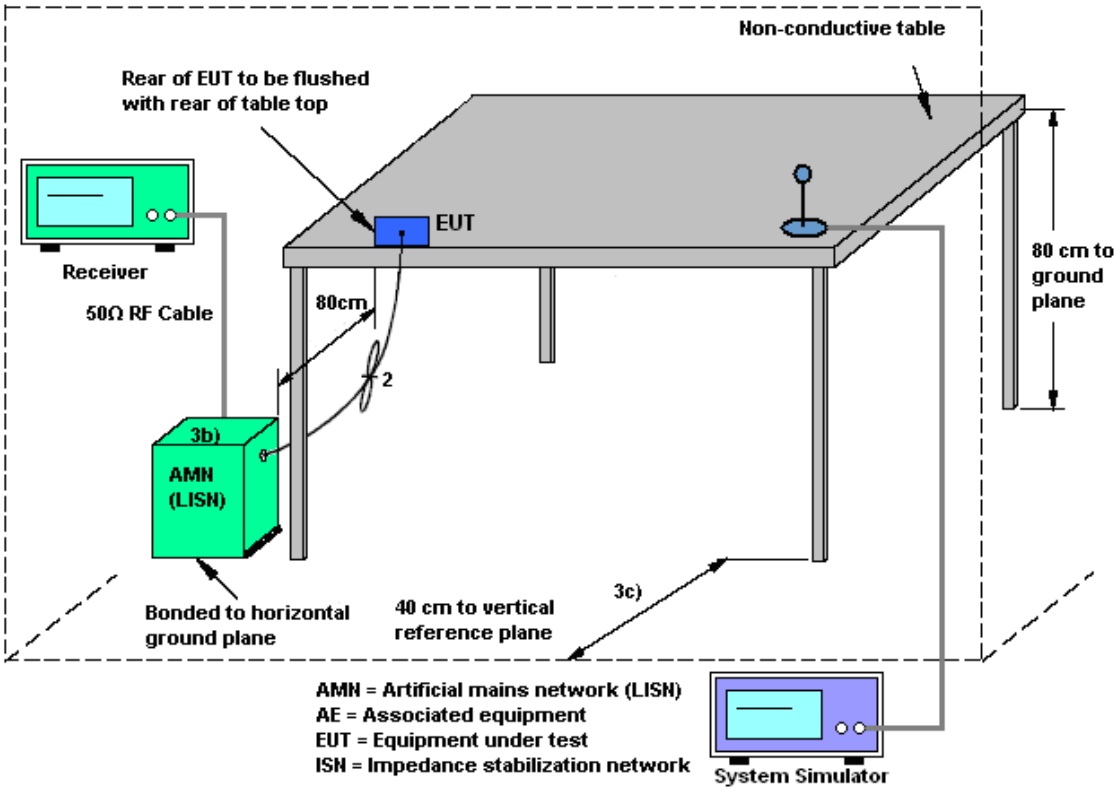
3.1.2. Measuring Instruments

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

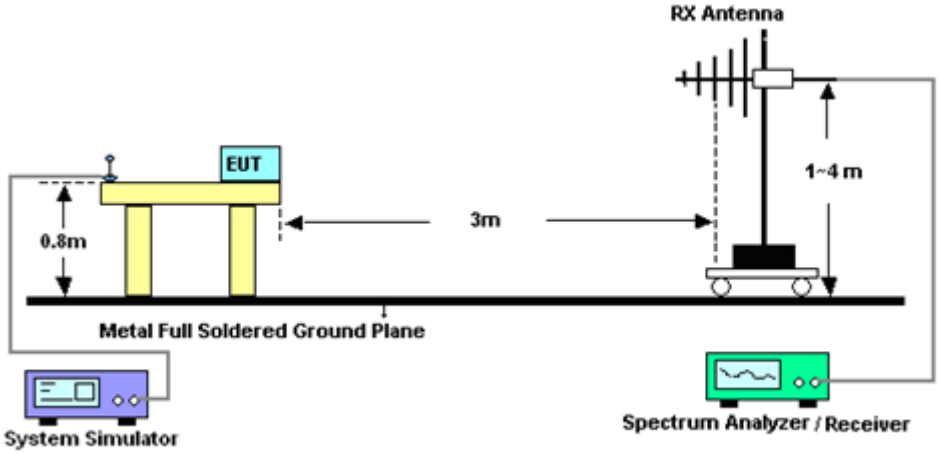
Please refer to the measuring equipment list in this test report.

3.2.3. Test Procedures

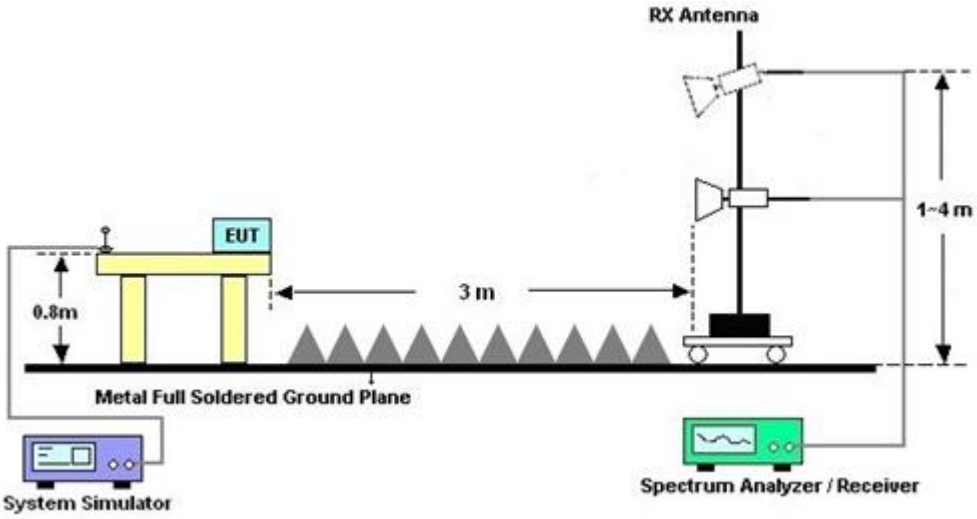
1. The EUT is placed on a turntable with 0.8 meter above ground.
2. The EUT is set 3 meters from the interference receiving antenna, which is mounted on the top of a variable height antenna tower.
3. The table is rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is 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	Oct. 26, 2023	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Dec. 01, 2022	Oct. 26, 2023	Nov. 30, 2023	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Dec. 01, 2022	Oct. 26, 2023	Nov. 30, 2023	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Nov. 17, 2022	Oct. 26, 2023	Nov. 16, 2023	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32	N/A	N/A	N/A	Oct. 26, 2023	N/A	Conduction (CO05-HY)
Pulse Limiter	SCHWARZBECK	VTSD 9561-F N	00691	9kHz-200MHz	Jul. 28, 2023	Oct. 26, 2023	Jul. 27, 2024	Conduction (CO05-HY)
LISN Cable	MVE	RG-400	260260	N/A	Dec. 29, 2022	Oct. 26, 2023	Dec. 28, 2023	Conduction (CO05-HY)
Amplifier	SONOMA	310N	186713	9kHz~1GHz	Apr. 17, 2023	Oct. 27, 2023	Apr. 16, 2024	Radiation (03CH06-HY)
Bilog Antenna	Schaffner	CBL 6111C & N-6-06	2725 & AT-N0601	30MHz~1GHz	Nov. 06, 2022	Oct. 27, 2023	Nov. 05, 2023	Radiation (03CH06-HY)
EMI Test Receiver	Rohde & Schwarz	ESU26	100472	20Hz~26.5GHz	Feb. 13, 2023	Oct. 27, 2023	Feb. 12, 2024	Radiation (03CH06-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-02037	1GHz~18GHz	Dec. 30, 2022	Oct. 27, 2023	Dec. 29, 2023	Radiation (03CH06-HY)
Preamplifier	Jet-Power	JPA00101800-30-10P	1601180001	1GHz~18GHz	Jul. 16, 2023	Oct. 27, 2023	Jul. 15, 2024	Radiation (03CH06-HY)
RF Cable	HUBER + SUHNER	104 SF102_2000mm SF102_3000mm SF102_7000mm	802433/4 532421/2 532422/2 532299/2	30Mhz to 18Ghz	Jul. 03, 2023	Oct. 27, 2023	Jul. 02, 2024	Radiation (03CH06-HY)
Antenna Mast	MF	MF-7802	MF780208212	1m~4m	N/A	Oct. 27, 2023	N/A	Radiation (03CH06-HY)
Turn Table	INN-CO	DS2000	420/650/00	0-360 degree	N/A	Oct. 27, 2023	N/A	Radiation (03CH06-HY)
Software	Audix	E3 6.2009-8-24(k5)	N/A	N/A	N/A	Oct. 27, 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

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	6.3 dB

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 6000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.7 dB

Uncertainty of Radiated Emission Measurement (6000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.6 dB

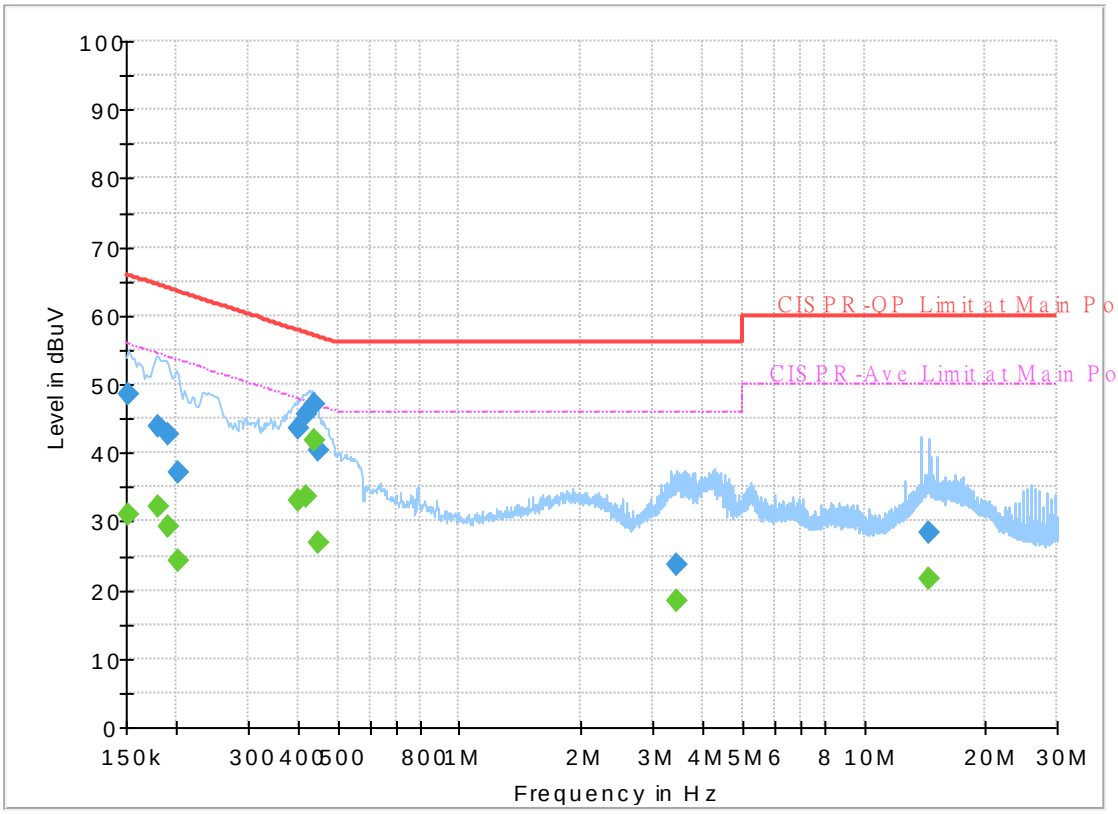
Appendix A. AC Conducted Emission Test Results

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

EUT Information

Report NO :	361402
Test Mode :	Mode 3
Test Voltage :	Power From System
Phase :	Line

Full Spectrum



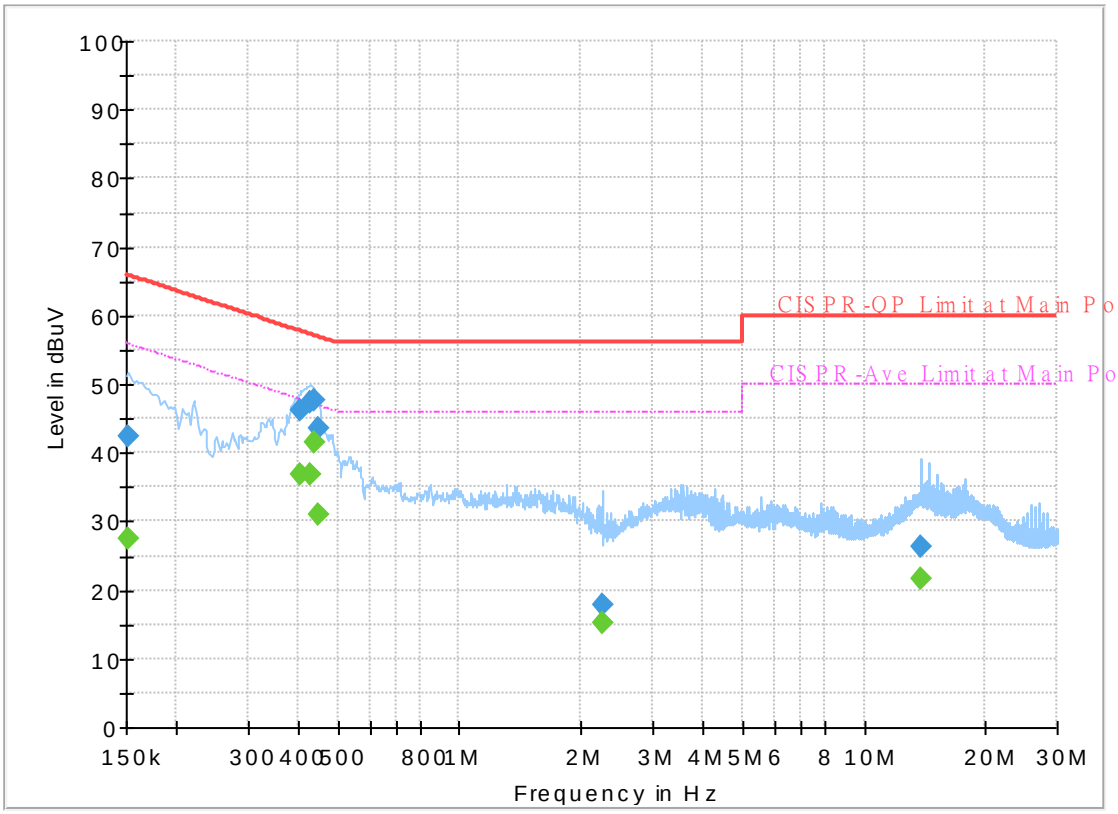
Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	31.07	55.88	24.81	L1	OFF	19.8
0.152250	48.62	---	65.88	17.26	L1	OFF	19.8
0.179250	---	32.19	54.52	22.33	L1	OFF	19.8
0.179250	43.76	---	64.52	20.76	L1	OFF	19.8
0.190500	---	29.22	54.02	24.80	L1	OFF	19.8
0.190500	42.59	---	64.02	21.43	L1	OFF	19.8
0.201750	---	24.31	53.54	29.23	L1	OFF	19.8
0.201750	37.23	---	63.54	26.31	L1	OFF	19.8
0.397500	---	33.13	47.91	14.78	L1	OFF	19.8
0.397500	43.69	---	57.91	14.22	L1	OFF	19.8
0.417750	---	33.60	47.49	13.89	L1	OFF	19.8
0.417750	45.55	---	57.49	11.94	L1	OFF	19.8
0.435750	---	41.88	47.14	5.26	L1	OFF	19.8
0.435750	46.97	---	57.14	10.17	L1	OFF	19.8
0.447000	---	26.92	46.93	20.01	L1	OFF	19.8
0.447000	40.42	---	56.93	16.51	L1	OFF	19.8
3.428250	---	18.36	46.00	27.64	L1	OFF	19.9
3.428250	23.65	---	56.00	32.35	L1	OFF	19.9
14.480250	---	21.50	50.00	28.50	L1	OFF	19.9
14.480250	28.43	---	60.00	31.57	L1	OFF	19.9

EUT Information

Report NO :	361402
Test Mode :	Mode 3
Test Voltage :	Power From System
Phase :	Neutral

Full Spectrum



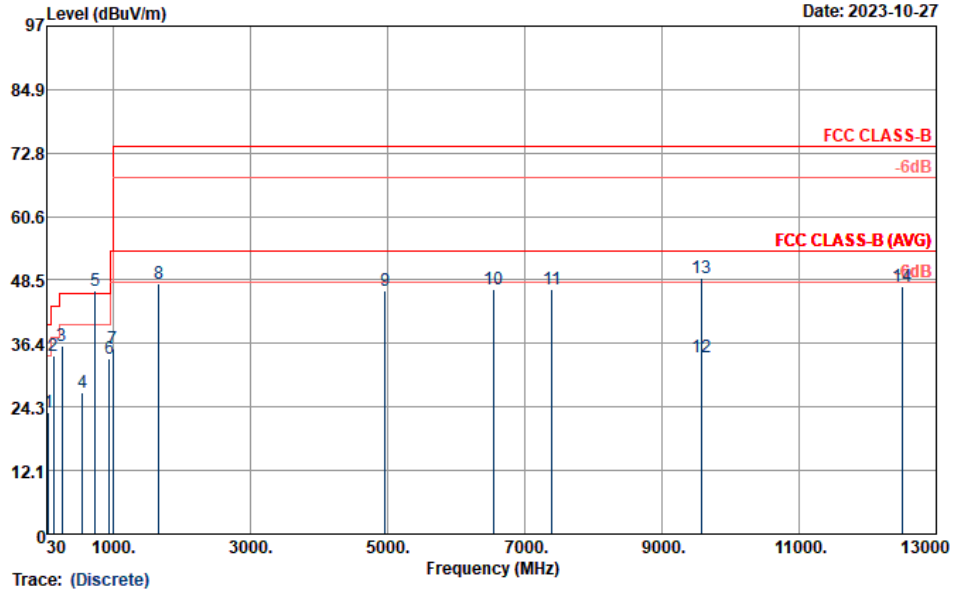
Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	27.56	55.88	28.32	N	OFF	19.8
0.152250	42.39	---	65.88	23.49	N	OFF	19.8
0.402000	---	36.92	47.81	10.89	N	OFF	19.8
0.402000	46.22	---	57.81	11.59	N	OFF	19.8
0.429000	---	36.96	47.27	10.31	N	OFF	19.8
0.429000	47.23	---	57.27	10.04	N	OFF	19.8
0.438000	---	41.53	47.10	5.57	N	OFF	19.8
0.438000	47.58	---	57.10	9.52	N	OFF	19.8
0.449250	---	31.08	46.89	15.81	N	OFF	19.8
0.449250	43.53	---	56.89	13.36	N	OFF	19.8
2.253750	---	15.12	46.00	30.88	N	OFF	19.8
2.253750	17.95	---	56.00	38.05	N	OFF	19.8
13.872750	---	21.76	50.00	28.24	N	OFF	20.0
13.872750	26.20	---	60.00	33.80	N	OFF	20.0

Appendix B. Radiated Emission Test Result

Test Engineer :	Bor-Shiang,Huang	**Temperature :**	23~26°C
		Relative Humidity :	43~47%
Test Distance :	3m	**Polarization :**	Horizontal
Remark :	#5 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

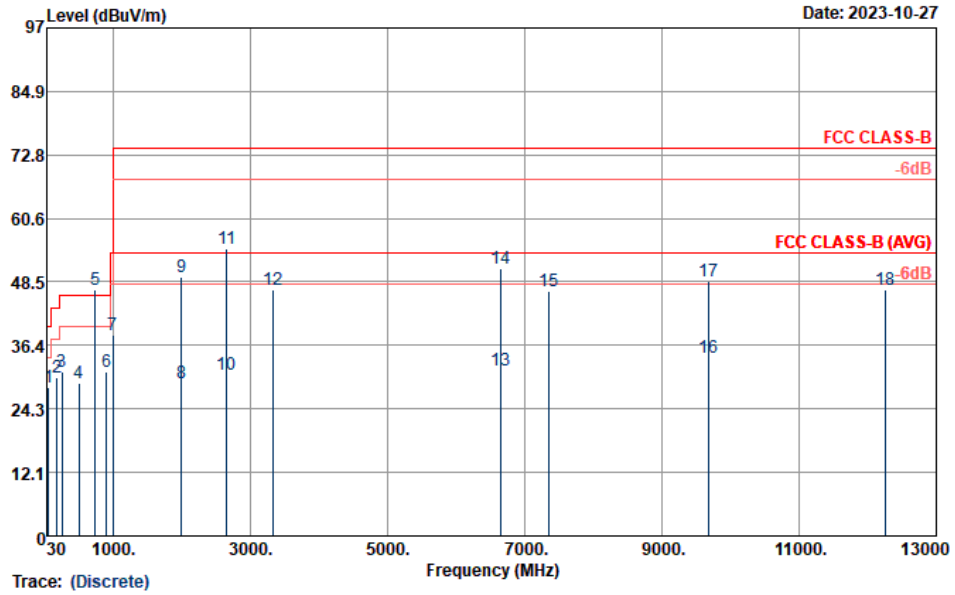


Site : 03CH06-HY
Condition : FCC CLASS-B 3m 9120D_02037 HORIZONTAL
Project : 361402
Power : From System
Memo : Mode 1

		Freq	Level	Over Limit	Limit Line	Read Level	Factor	A/Pos	T/Pos	Remark
		MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	cm	deg	
1		57.54	23.36	-16.64	40.00	41.57	-18.21	---	---	Peak
2		124.77	34.00	-9.50	43.50	45.97	-11.97	---	---	Peak
3		256.80	35.87	-10.13	46.00	45.39	-9.52	---	---	Peak
4		549.20	27.14	-18.86	46.00	29.54	-2.40	---	---	Peak
5	*	737.50	46.46			45.43	1.03	---	---	Peak
6		942.60	33.46	-12.54	46.00	28.40	5.06	---	---	Peak
7		998.60	35.26	-18.74	54.00	29.10	6.16	---	---	Peak
8		1660.00	47.89	-26.11	74.00	77.42	-29.53	---	---	Peak
9		4960.00	46.52	-27.48	74.00	64.03	-17.51	---	---	Peak
10		6536.00	46.63	-27.37	74.00	60.46	-13.83	---	---	Peak
11		7394.00	46.83	-27.17	74.00	58.79	-11.96	---	---	Peak
12		9578.00	33.90	-20.10	54.00	42.80	-8.90	100	225	Average
13		9578.00	49.00	-25.00	74.00	57.90	-8.90	100	225	Peak
14		12510.00	47.40	-26.60	74.00	53.43	-6.03	---	---	Peak

Test Engineer :	Bor-Shiang,Huang	**Temperature :**	23~26°C
		Relative Humidity :	43~47%
Test Distance :	3m	**Polarization :**	Vertical
Remark :	#5 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



Site : 03CH06-HY
Condition : FCC CLASS-B 3m 9120D_02037 VERTICAL
Project : 361402
Power : From System
Memo : Mode 1

		Freq	Level	Over Limit	Limit Line	Read Level	Factor	A/Pos	T/Pos	Remark
		MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	cm	deg	
1		56.73	28.45	-11.55	40.00	46.52	-18.07	---	---	Peak
2		178.50	30.37	-13.13	43.50	44.61	-14.24	---	---	Peak
3		255.45	31.46	-14.54	46.00	41.17	-9.71	---	---	Peak
4		500.20	29.28	-16.72	46.00	33.15	-3.87	---	---	Peak
5	*	737.50	47.12			46.09	1.03	---	---	Peak
6		901.30	31.45	-14.55	46.00	28.11	3.34	---	---	Peak
7		996.50	38.27	-15.73	54.00	32.09	6.18	---	---	Peak
8		1994.00	29.27	-24.73	54.00	55.89	-26.62	100	180	Average
9		1994.00	49.37	-24.63	74.00	75.99	-26.62	100	180	Peak
10		2656.00	30.91	-23.09	54.00	54.10	-23.19	100	355	Average
11		2656.00	54.81	-19.19	74.00	78.00	-23.19	100	355	Peak
12		3326.00	47.09	-26.91	74.00	68.29	-21.20	---	---	Peak
13		6646.00	31.68	-22.32	54.00	44.90	-13.22	100	25	Average
14		6646.00	51.08	-22.92	74.00	64.30	-13.22	100	25	Peak
15		7358.00	46.84	-27.16	74.00	58.71	-11.87	---	---	Peak
16		9678.00	33.94	-20.06	54.00	43.11	-9.17	100	117	Average
17		9678.00	48.51	-25.49	74.00	57.68	-9.17	100	117	Peak
18		12264.00	47.04	-26.96	74.00	53.13	-6.09	---	---	Peak