FCC EMI TEST REPORT

FCC ID	:	**LHJ-FE5NA0010**
Equipment	:	**FE5NA0010, FE5NA0011**
Brand Name	:	**Continental**
Model Name	:	**FE5NA0010, FE5NA0011**
Applicant	:	**Continental Automotive Systems, Inc.** **21440 W Lake Cook Rd., Deer Park, IL 60010, USA**
Manufacturer	:	**Continental Automotive Systems, Inc.** **21440 W Lake Cook Rd., Deer Park, IL 60010, USA**
Standard	:	**FCC 47 CFR FCC Part 15 Subpart B Class B**

The product was received on Mar. 15, 2023 and testing was performed from Apr. 11, 2023 to Apr. 11, 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
FC2N2201-01	01	Initial issue of report	Apr. 25, 2023
FC2N2201-01	02	Revise Summary note and Product Specification of Equipment Under Test This report is an updated version, replacing the report issued on Apr. 25, 2023.	Apr. 27, 2023

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	15.107	AC Conducted Emission	Not Required	-
3.1	15.109	Radiated Emission	Pass	1.16 dB under the limit at 594.000 MHz for Quasi-Peak

Note:

1. Not required means after assessing, test items are not necessary to carry out.
2. This is a variant report by adding external antenna (Model: 42862899). All the test cases were performed on original report which can be referred to Sporton Report Number FC2N2201. Based on the original report, only worst case was verified.

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: Yun Huang

Report Producer: Clio Lo

1. General Description

1.1. Product Feature of Equipment Under Test

Product Feature	
Equipment	FE5NA0010, FE5NA0011
Brand Name	Continental
Model Name	FE5NA0010, FE5NA0011
FCC ID	LHJ-FE5NA0010
Installed into the Host	Equipment name: G12N510G1, G12N500G1 Brand name: Continental Model name: G12N510G1, G12N500G1
EUT supports Radios application	WCDMA/HSPA/LTE/5G NR/GNSS
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer.

Sample Information			
Sample	**TA-code**	**L2/L5 GNSS**	**Band Difference**
1	FE5NA0010	Support	/
2	FE5NA0011	Not Support	BOM change: depopulated passive components from the GNSS RF front-end

1.2. Product Specification of Equipment Under Test

Product Specification is subject to this standard	
Tx Frequency	WCDMA Band V: 826.4 MHz ~ 846.6 MHz WCDMA Band IV : 1712.4 MHz ~ 1752.6 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz LTE Band 2: 1850.7 MHz ~ 1909.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz LTE Band 12: 699.7 MHz ~ 715.3 MHz LTE Band 13: 779.5 MHz ~ 784.5 MHz LTE Band 14 :790.5 MHz ~ 795.5 MHz LTE Band 66: 1710.7 MHz ~ 1754.3 MHz LTE Band 71: 665.5 MHz ~ 695.5 MHz 5G NR n2: 1852.5 MHz ~ 1907.5 MHz 5G NR n5: 826.5 MHz ~ 846.5 MHz 5G NR n25: 1852.5 MHz ~ 1912.5 MHz 5G NR n41: 2506.02 MHz ~ 2679.99 MHz 5G NR n66: 1712.5 MHz ~ 1777.5 MHz 5G NR n71: 668.0 MHz ~ 693.0 MHz 5G NR n77: 3700 MHz ~ 3980 MHz

Product Specification is subject to this standard	
Rx Frequency	WCDMA Band V: 871.4 MHz ~ 891.6 MHz WCDMA Band IV: 2112.4 MHz ~ 2152.6 MHz WCDMA Band II: 1932.4 MHz ~ 1987.6 MHz LTE Band 2: 1930.7 MHz ~ 1989.3 MHz LTE Band 4: 2110.7 MHz ~ 2154.3 MHz LTE Band 5: 869.7 MHz ~ 893.3 MHz LTE Band 7: 2622.5 MHz ~ 2687.5 MHz LTE Band 12: 729.7 MHz ~ 745.3 MHz LTE Band 13: 748.5 MHz ~ 753.5 MHz LTE Band 14: 760.5 MHz ~ 765.5 MHz LTE Band 29: 718.5 MHz ~ 726.5 MHz LTE Band 30: 2352.5 MHz ~ 2357.5 MHz LTE Band 66: 2110.7 MHz ~ 2154.3 MHz LTE Band 71: 619.5 MHz ~ 649.5 MHz 5G NR n2: 1932.5 MHz ~ 1987.5 MHz 5G NR n5: 871.5 MHz ~ 891.5 MHz 5G NR n25: 1932.5 MHz ~ 1992.5 MHz 5G NR n41: 2506.02 MHz ~ 2679.99 MHz 5G NR n66: 1712.5 MHz ~ 1777.5 MHz 5G NR n71: 668.0 MHz ~ 693.0 MHz 5G NR n77: 3700 MHz ~ 3980 MHz GNSS : 1559 MHz ~ 1610 MHz (GPS / Glonass / BDS / Galileo / SBAS)
Antenna Type	WWAN: **<External (Model: 86783279) >:** External Sharkfin Antenna + XM + Dual GNSS +5G **<External (Model: 42862899) >:** external sharkfin antenna, sharkfin NA 5G+Dual GNSS+XM **<Internal >:** TCP Antenna GNSS: **<External (Model: 86783279) >:** External Sharkfin Antenna + XM + Dual GNSS +5G **<External (Model: 42862899) >:** external sharkfin antenna, sharkfin NA 5G+Dual GNSS+XM
Type of Modulation	WCDMA: QPSK (Uplink) HSDPA: 64QAM (Downlink) HSUPA : QPSK (Uplink) LTE: QPSK / 16QAM / 64QAM 5G NR: PI/2 BPSK / QPSK / 16QAM / 64QAM / 256QAM GNSS: BPSK

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

1.3. Modification of EUT

No modifications made to the EUT during the testing.

1.4. 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.**
	03CH06-HY

FCC designation No.: TW1093

1.5. 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

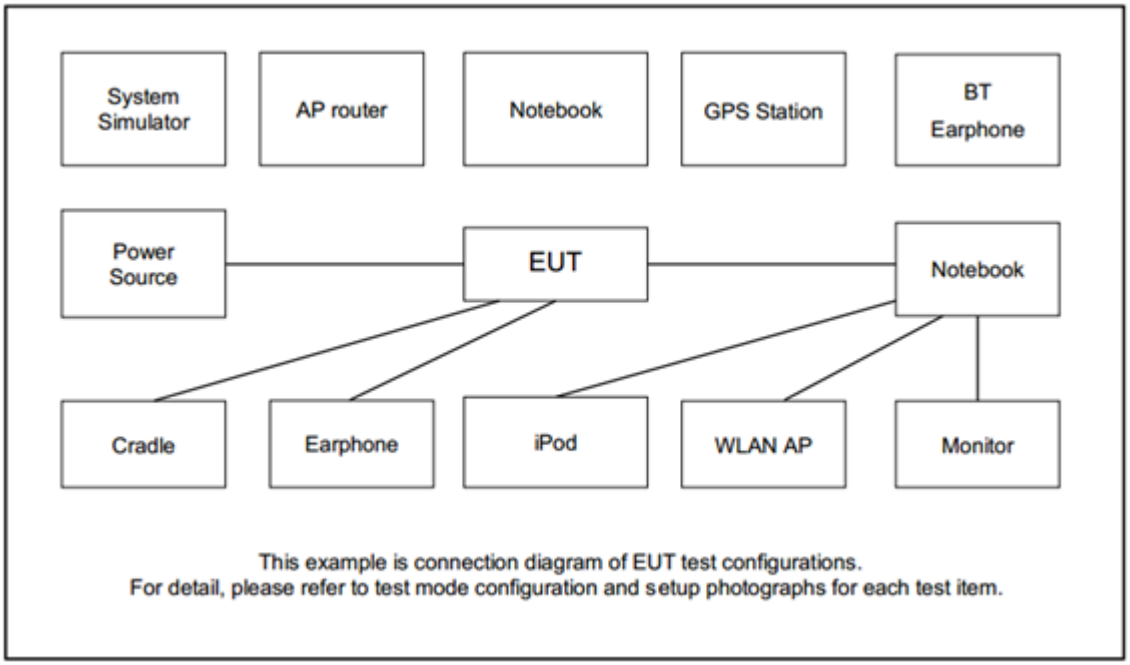
The EUT is tested along with the peripherals, operating under possible configurations in compliant with normal operation. The maximum emissions can be identified by a pre-scan carried out in different orientations of placement pursuant to ANSI C63.4-2014. Frequency range covered: Radiation Emission (30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

Test Items	Functions Enabled
Radiated Emissions	Mode 1 : WCDMA Band II Idle (with External Antenna) + GPS Rx + TC for Sample 1 Mode 2 : LTE Band 12 Idle (with External Antenna) + GPS Rx + TC + DC 12V for Sample 1

Remark:

1. The worst case of RE is mode 2; only the test data of this mode was reported.
2. 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.
3. TC stands for test configuration, and consists of EUT + "T Teddy Jr Load Box (X1 + X2) + Sharkfin Antenna with metal plate (X3) + Ethernet connector cable (X7) + Battery" + Teddy Jr Load Box, "Notebook (USB Cable *2) + Adapter + DC Cable".

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, 1.8 m
2.	GPS Station	Pendulum	GSG-54	N/A	N/A	Unshielded, 1.8 m
3.	Notebook	DELL	Latitude 3400	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
4.	Teddy Jr Load Box	Continental	N/A	N/A	N/A	N/A
5.	Adapter	TePoo	PT-WC-03	N/A	N/A	N/A
6.	Metal Plate	N/A	N/A	N/A	N/A	N/A
7.	Sharkfin Antenna	Amphenol	42862899	N/A	N/A	N/A

2.4. EUT Operation Test Setup

The EUT is in WCDMA or 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.

The following programs installed in the EUT are programmed during the test:

1. Execute “lte_x24_hwtool_0.6.24.exe” to make the EUT receive continuous signals from GPS station.

3. Test Result

3.1. Test of Radiated Emission Measurement

3.1.1. 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

3.1.2. Measuring Instruments

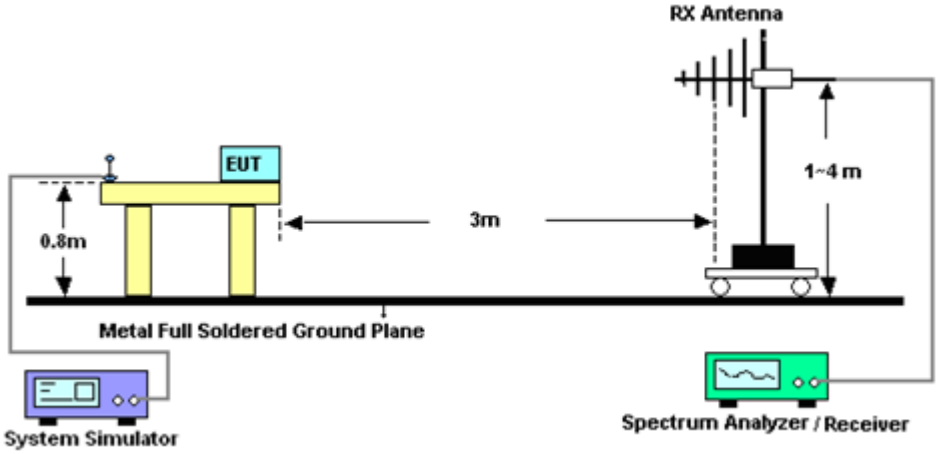
Please refer to the measuring equipment list in this test report.

3.1.3. Test Procedures

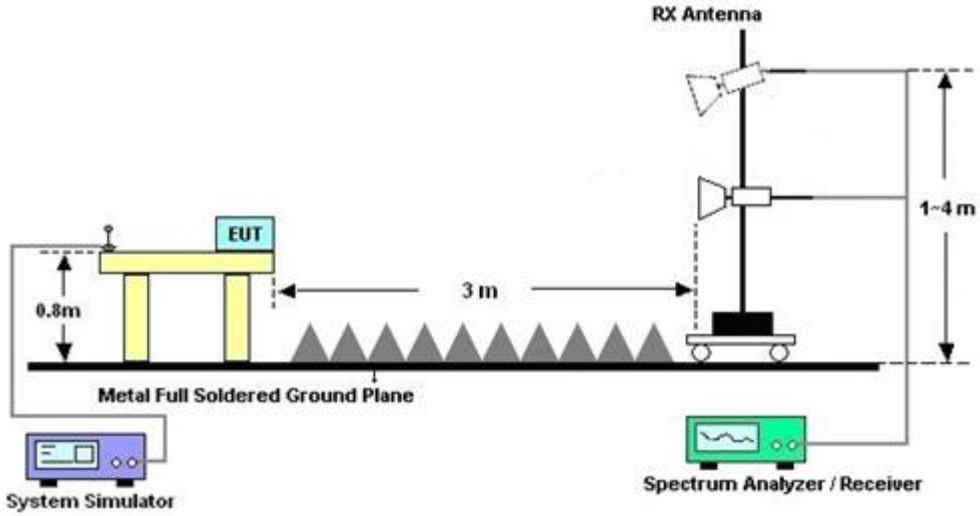
1. The EUT is placed on a turntable with 0.8 meter above ground.
2. The EUT is set 3 meters from the interference receiving antenna, which is mounted on the top of a variable height antenna tower.
3. The table is rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is 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.

3.1.4. Test Setup of Radiated Emission

For Radiated Emissions from 30 MHz to 1 GHz



For Radiated Emissions above 1GHz



3.1.5. Test Result of Radiated Emission

Please refer to Appendix A.

4. List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Amplifier	SONOMA	310N	186713	9kHz~1GHz	Apr. 28, 2022	Apr. 11, 2023	Apr. 27, 2023	Radiation (03CH06-HY)
Bilog Antenna	Schaffner	CBL 6111C & N-6-06	2725 & AT-N0601	30MHz~1GHz	Nov. 06, 2022	Apr. 11, 2023	Nov. 05, 2023	Radiation (03CH06-HY)
EMI Test Receiver	Rohde & Schwarz	ESU26	100472	20Hz~26.5GHz	Feb. 13, 2023	Apr. 11, 2023	Feb. 12, 2024	Radiation (03CH06-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-02037	1GHz~18GHz	Dec. 30, 2022	Apr. 11, 2023	Dec. 29, 2023	Radiation (03CH06-HY)
Preamplifier	Jet-Power	JPA00101800-30-10P	1601180001	1GHz~18GHz	Jul. 18, 2022	Apr. 11, 2023	Jul. 17, 2023	Radiation (03CH06-HY)
RF Cable	HUBER + SUHNER	SF102_7000mm	532299/2	30MHz to 40GHz	Jul. 04, 2022	Apr. 11, 2023	Jul. 03, 2023	Radiation (03CH06-HY)
RF Cable	HUBER + SUHNER	SF102_3000mm	532422/2	30MHz to 40GHz	Jul. 04, 2022	Apr. 11, 2023	Jul. 03, 2023	Radiation (03CH06-HY)
RF Cable	HUBER + SUHNER	SF102_2000mm	532421/2	30MHz to 40GHz	Jul. 04, 2022	Apr. 11, 2023	Jul. 03, 2023	Radiation (03CH06-HY)
RF Cable	HUBER + SUHNER	SF104	802433/4	30Mhz to 18Ghz	Aug. 18, 2022	Apr. 11, 2023	Aug. 17, 2023	Radiation (03CH06-HY)
Hygrometer	TECPEL	DTM-303B	TP210018	N/A	Oct. 27, 2022	Apr. 11, 2023	Oct. 26, 2023	Radiation (03CH06-HY)
Controller	INN-CO	EM1000	060782	Control Turn table & Ant Mast	N/A	Apr. 11, 2023	N/A	Radiation (03CH06-HY)
Antenna Mast	MF	MF-7802	MF780208212	1m~4m	N/A	Apr. 11, 2023	N/A	Radiation (03CH06-HY)
Turn Table	INN-CO	DS2000	420/650/00	0-360 degree	N/A	Apr. 11, 2023	N/A	Radiation (03CH06-HY)
Software	Audix	E3 6.2009-8-24(k5)	N/A	N/A	N/A	Apr. 11, 2023	N/A	Radiation (03CH06-HY)

5. Measurement Uncertainty

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))	4.6 dB

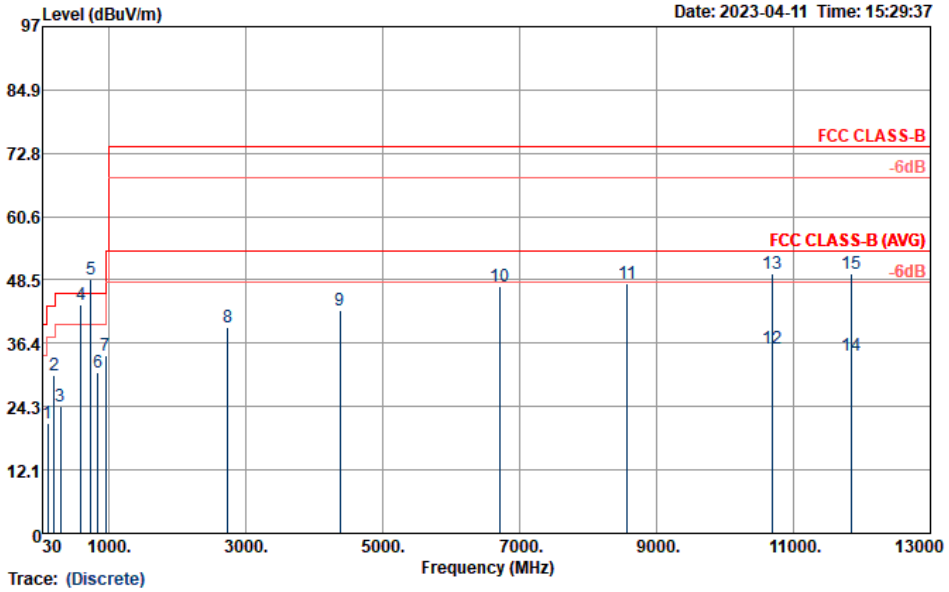
Uncertainty of Radiated Emission Measurement (6000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.5 dB

Appendix A. Radiated Emission Test Result

Test Engineer :	Bor-Shiang Huang	**Temperature :**	22~25°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

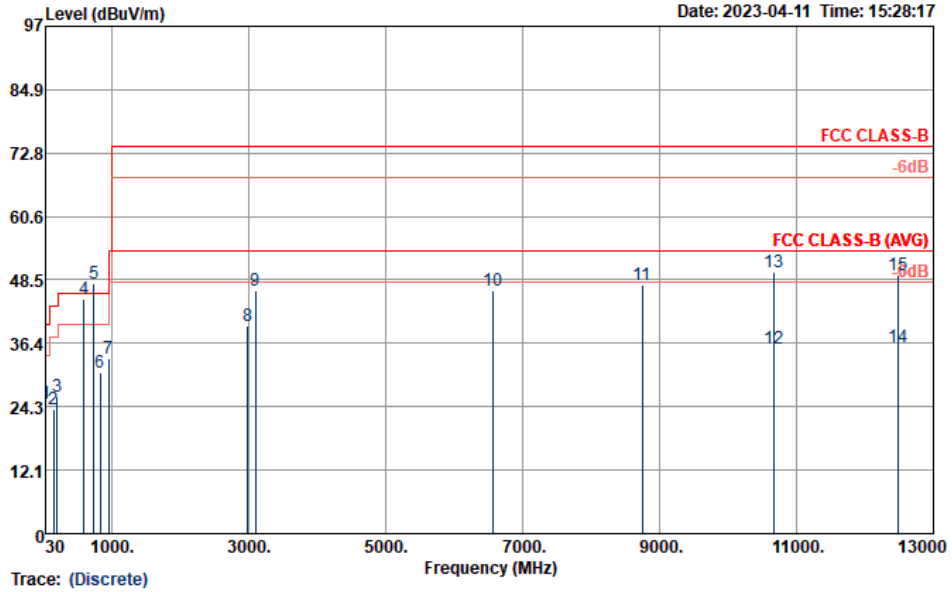


Site : 03CH06-HY
Condition : FCC CLASS-B 3m 9120D_02037 HORIZONTAL
Project : 2N2201-01
Power : DC12V
Memo : Mode 2

		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		105.06	20.99	-22.51	43.50	34.18	-13.19	---	---	Peak
2		197.94	30.21	-13.29	43.50	44.57	-14.36	---	---	Peak
3		290.28	24.37	-21.63	46.00	34.06	-9.69	---	---	Peak
4	!	594.00	43.64	-2.36	46.00	45.80	-2.16	100	355	QP
5	*	737.50	48.54			47.71	0.83	---	---	Peak
6		838.30	30.72	-15.28	46.00	28.21	2.51	---	---	Peak
7		951.70	34.09	-11.91	46.00	28.97	5.12	---	---	Peak
8		2740.00	39.37	-34.63	74.00	64.56	-25.19	---	---	Peak
9		4372.00	42.77	-31.23	74.00	62.34	-19.57	---	---	Peak
10		6716.00	47.34	-26.66	74.00	61.10	-13.76	---	---	Peak
11		8572.00	47.73	-26.27	74.00	59.38	-11.65	---	---	Peak
12		10684.00	35.41	-18.59	54.00	42.81	-7.40	100	225	Average
13		10684.00	49.66	-24.34	74.00	57.06	-7.40	100	225	Peak
14		11852.00	34.16	-19.84	54.00	40.90	-6.74	100	313	Average
15		11852.00	49.83	-24.17	74.00	56.57	-6.74	100	313	Peak

Test Engineer :	Bor-Shiang Huang	**Temperature :**	22~25°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 : 2N2201-01
Power : DC12V
Memo : Mode 2

		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		30.27	24.89	-15.11	40.00	31.67	-6.78	---	---	Peak
2		143.94	23.81	-19.69	43.50	36.08	-12.27	---	---	Peak
3		197.94	26.28	-17.22	43.50	40.64	-14.36	---	---	Peak
4	!	594.00	44.84	-1.16	46.00	47.00	-2.16	150	124	QP
5	*	737.50	47.82			46.99	0.83	---	---	Peak
6		830.60	30.71	-15.29	46.00	28.47	2.24	---	---	Peak
7		957.30	33.48	-12.52	46.00	28.15	5.33	---	---	Peak
8		2984.00	39.63	-34.37	74.00	63.74	-24.11	---	---	Peak
9		3100.00	46.39	-27.61	74.00	70.01	-23.62	---	---	Peak
10		6566.00	46.47	-27.53	74.00	60.47	-14.00	---	---	Peak
11		8752.00	47.59	-26.41	74.00	58.77	-11.18	---	---	Peak
12		10674.00	35.36	-18.64	54.00	42.79	-7.43	100	288	Average
13		10674.00	50.02	-23.98	74.00	57.45	-7.43	100	288	Peak
14		12488.00	35.75	-18.25	54.00	41.50	-5.75	100	17	Average
15		12488.00	49.34	-24.66	74.00	55.09	-5.75	100	17	Peak