



FCC EMI TEST REPORT

FCC ID : LHJ-FE5NAR110
Equipment : FE5NAR110, FE5NAR111
Brand Name : Continental
Model Name : FE5NAR110, FE5NAR111
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 May 06, 2024 and testing was performed from Sep. 04, 2024 to Sep. 04, 2024. We, Sporton International (USA) Inc., 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 (USA) Inc., the test report shall not be reproduced except in full.

Approved by: Neil Kao

Sporton International (USA) Inc.
1175 Montague Expressway, Milpitas, CA 95035



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History of this test report

Report No.	Version	Description	Issue Date
FC240808005	01	Initial issue of report	Sep. 26, 2024

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	1.06 dB under the limit at 44.55 MHz for Quasi-Peak

Note: Not required means after assessing, test items are not necessary to carry out.

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.

1. General Description

1.1. Product Feature of Equipment Under Test

Product Feature	
Equipment	FE5NAR110, FE5NAR111
Brand Name	Continental
Model Name	FE5NAR110, FE5NAR111
FCC ID	LHJ-FE5NAR110
Installed into the Host	Equipment name: G12N51RG1, G12N50RG1 Brand name: Continental Model name: G12N51RG1, G12N50RG1
EUT supports Radios application	WCDMA/HSPA/LTE/5G NR/GNSS
EUT Stage	Identical Prototype

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

Sample Information			
Sample	TA-code	L2/L5 GNSS	Band Difference
1	FE5NAR110	Support	/
2	FE5NAR111	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 5G NR n78: 3455.01 MHz ~ 3795 MHz
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: 3455.01 MHz ~ 3975 MHz 5G NR n78: 3455.01 MHz ~ 3795 MHz GNSS: 1559 MHz ~ 1610 MHz (L1/G1/E1/B1I) 1164 MHz ~ 1215 MHz (B2A/L5/E5a)

Product Specification is subject to this standard	
Antenna Type	WWAN: <Internal Antenna>: TCP Antenna <External Antenna (Composed by component PN: 85038208, 85038209, 85038210, 85732934)>: Glass antenna GPS/Glonass/BDS/Galileo/SBAS: external sharkfin antenna, sharkfin NA 5G+Single 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 GPS/Glonass/BDS/Galileo/SBAS: BPSK

Remark: The EUT's information above is 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 (USA) Inc.
Test Site Location	1175 Montague Expressway, Milpitas, CA 95035 TEL : 408 9043300
Test Site No.	Sporton Site No. 03CH01-CA

FCC Designation No.: US1250

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
- ♦ ANSI C63.4a-2017

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

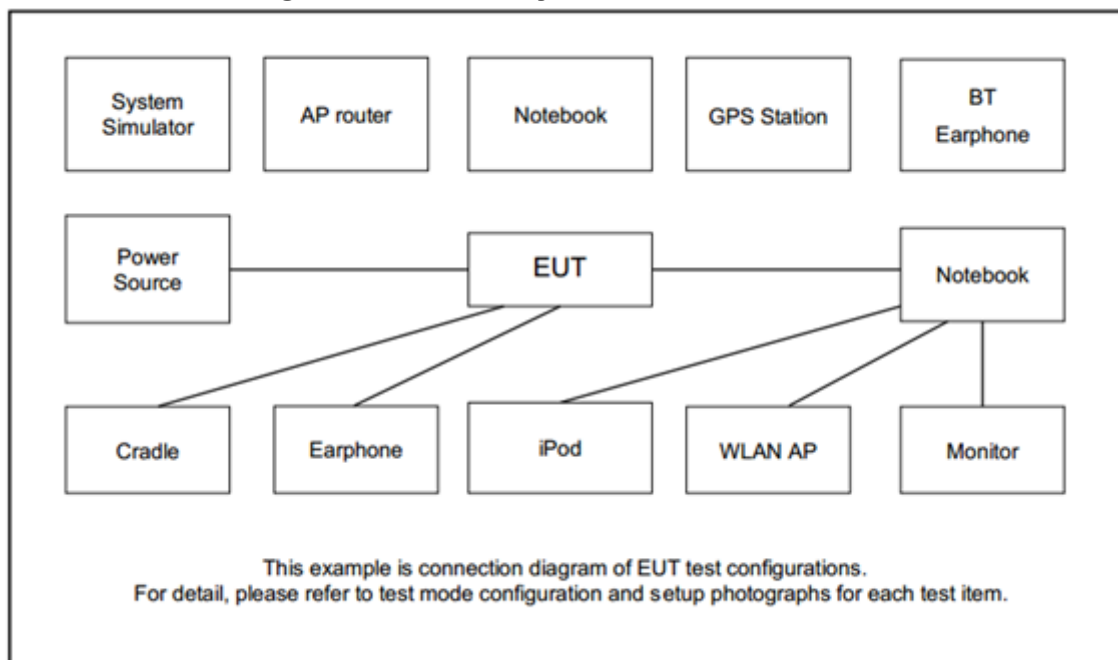
2. Test Configuration of Equipment Under Test

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: 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 IV Idle + GPS Rx + TC + DC Cable
	Mode 2: LTE Band 4 Idle + GPS Rx + TC + DC Cable
	Mode 3: EN-DC 12A_n66A Idle + GPS Rx + TC + DC Cable
	Mode 4: 5G NR n66 Idle + GPS Rx + TC + Standalone
Remark: - The worst case of RE is mode 1; only the test data of this mode was reported. - For Radiation Emission after pre-scanned the cellular band between 30MHz ~ 960MHz (WCDMA Band IV/LTE Band 4); only the worst case for cellular band test data of this mode was reported. - TC stands for test configuration, and consists of Teddy Jr Load Box (X1 + X2), Glass Antenna (X3), Ethernet connector cable (X7) + Battery, Teddy Jr Load Box, Note book (USB Cable *2), Adapter, and 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	MT8820C	N/A	N/A	Unshielded,1.8m
2.	5G Wireless Test Platform	Keysight	E7515B	N/A	N/A	Unshielded,1.8m
3.	GPS Antenna	Pendulum	GSG-54	N/A	N/A	Unshielded,1.8m
4.	Power supply	GWINSTEK	SPS606	N/A	N/A	Unshielded,1.8m
5.	Notebook	Lenovo	PF2ZBK07	FCC DoC	N/A	AC I/P : Unshielded, 1.2m DC O/P : Shielded, 1.8m

2.4. EUT Operation Test Setup

The EUT is in WCDMA or LTE or 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 "VisualGPSCe" 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

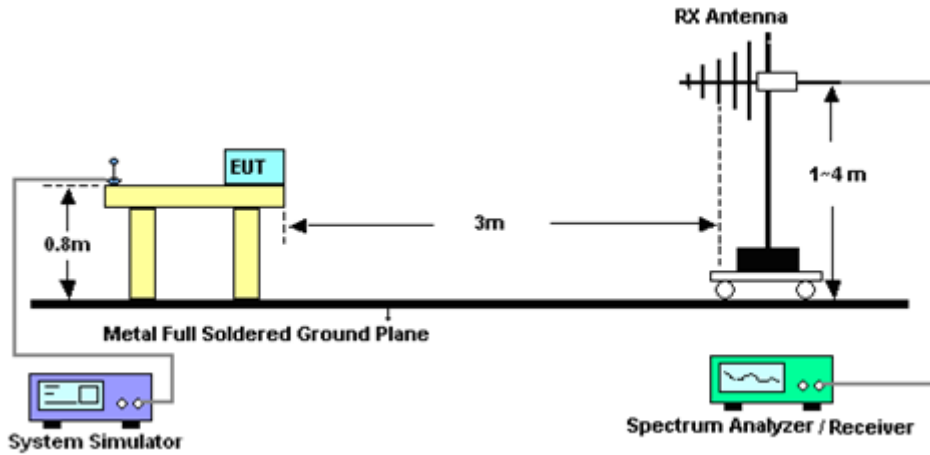
Please refer to the measuring equipment list in this test report.

3.1.3. Test Procedures

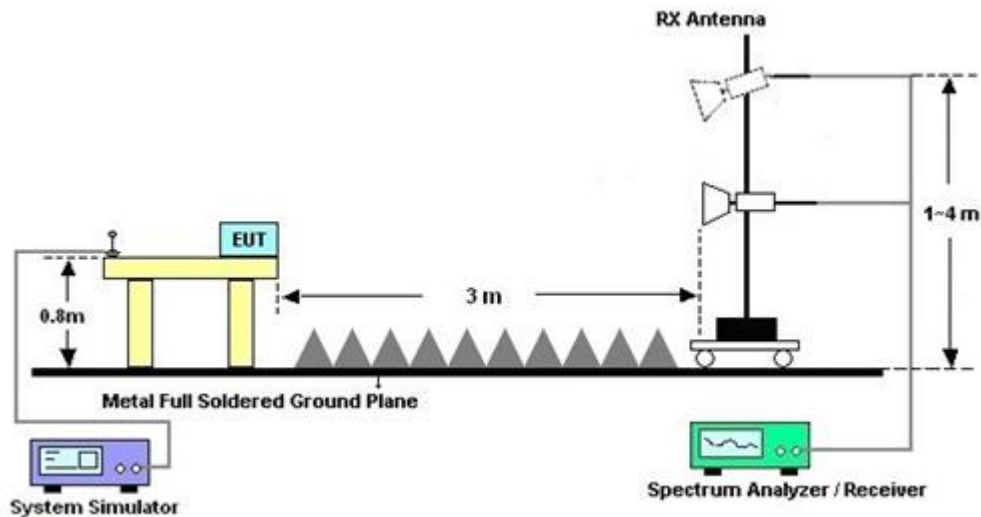
1. The EUT is placed on a turntable with 0.8 meter above ground.
2. The EUT is set 3 meters (30 M~18 G) and 1 meters (18 G~40 G) from the interference receiving antenna, which is mounted on the top of a variable height antenna tower.
3. The table is rotated 360 degrees to determine the position of the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

3.1.4. Test Setup of Radiated Emission

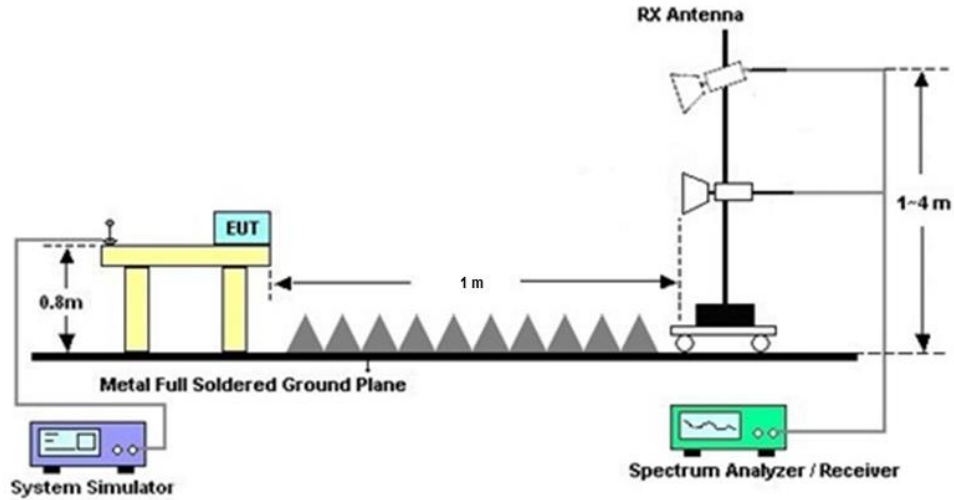
For Radiated Emissions from 30 MHz to 1 GHz



For Radiated Emissions from 1GHz to 18GHz



For Radiated Emissions above 18GHz



3.1.5. 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
Bilog Antenna	TESEQ	6111D	54683	30MHz~1GHz	Nov. 13, 2023	Sep. 04, 2024	Nov. 12, 2024	Radiation (03CH01-CA)
Horn Antenna	SCHWARZBECK	BBHA 9120D	02113	1GHz~18GHz	Apr. 26, 2024	Sep. 04, 2024	Apr. 25, 2025	Radiation (03CH01-CA)
Preamplifier	SONOMA	310N	372241	9kHz~1GHz	Apr. 24, 2024	Sep. 04, 2024	Apr. 23, 2025	Radiation (03CH01-CA)
Preamplifier	E-instrument	ERA-100M-18 G-56-01-A70	EC1900251	1GHz~18GHz	Apr. 24, 2024	Sep. 04, 2024	Apr. 23, 2025	Radiation (03CH01-CA)
EMI Test Receiver	R&S	ESU26	100049	20Hz~26.5GHz	Apr. 25, 2024	Sep. 04, 2024	Apr. 24, 2025	Radiation (03CH01-CA)
RF Cable	HUBER+SUHNER	SUCOFLEX 102	8015932/2,8015762/2, 804938/2	NA	Mar. 05, 2024	Sep. 04, 2024	Mar. 04, 2025	Radiation (03CH01-CA)
Hygrometer	TESTO	608-H1	45142559	NA	Aug. 14, 2024	Sep. 04, 2024	Aug. 13, 2025	Radiation (03CH01-CA)
Controller	Chaintek	EM-1000	060881	Control Turn Table & Antenna Mast	N/A	Sep. 04, 2024	N/A	Radiation (03CH01-CA)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Sep. 04, 2024	N/A	Radiation (03CH01-CA)
Test Software	Audix E3	E6.2009-8-24d	PK-002093	N/A	N/A	Sep. 04, 2024	N/A	Radiation (03CH01-CA)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA9170	00842	18GHz~40GHz	Aug. 19, 2024	Sep. 04, 2024	Aug. 18, 2025	Radiation (03CH01-CA)
Preamplifier	EMEC	EMC18G40G	060725	18GHz-40GHz	Apr. 24, 2024	Sep. 04, 2024	Apr. 23, 2025	Radiation (03CH01-CA)
Spectrum Analyzer	R&S	FSW43	104042	2Hz~43GHz	Dec. 22, 2023	Sep. 04, 2024	Dec. 21, 2024	Radiation (03CH01-CA)

5. Measurement Uncertainty

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.7 dB
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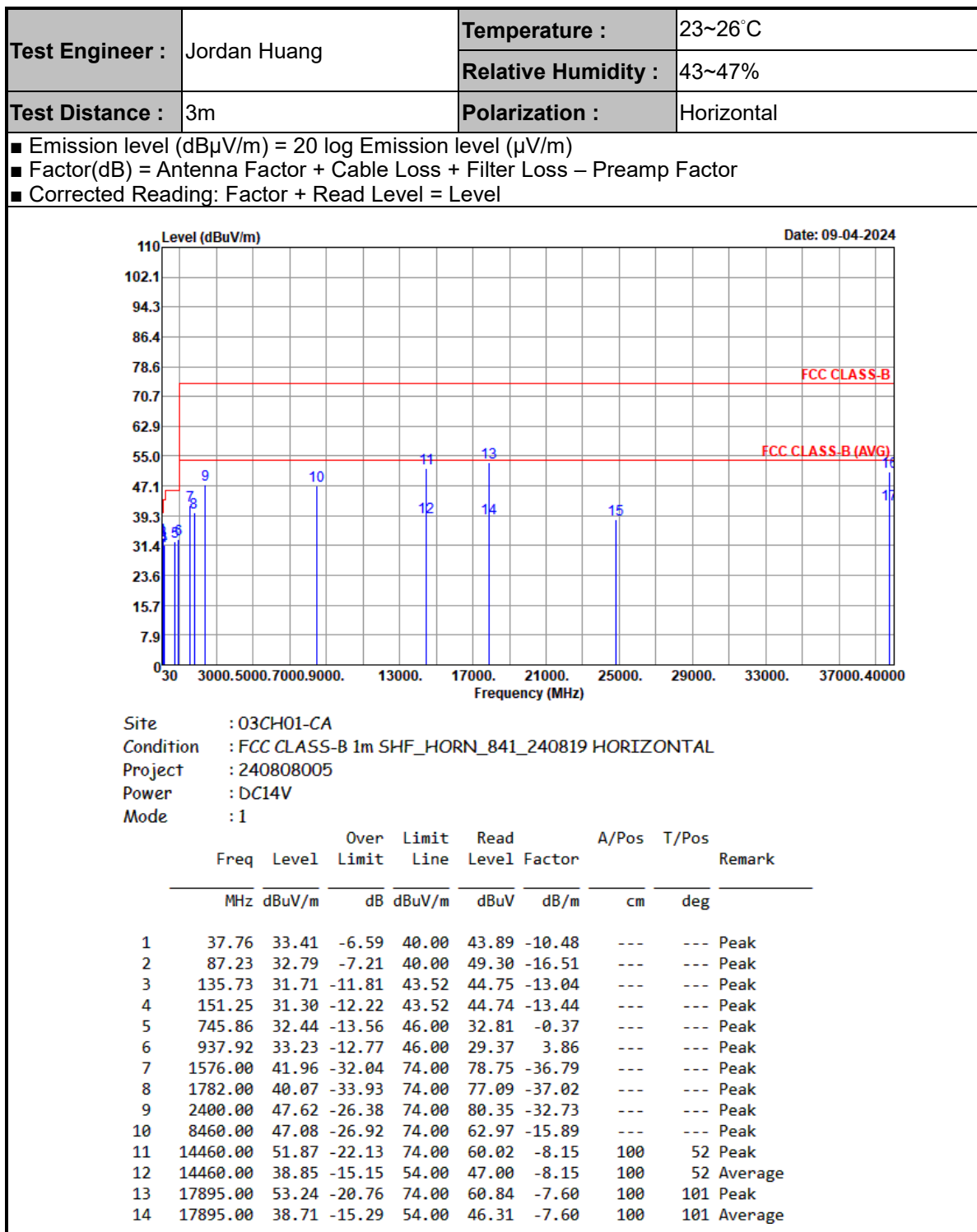
Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.5 dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

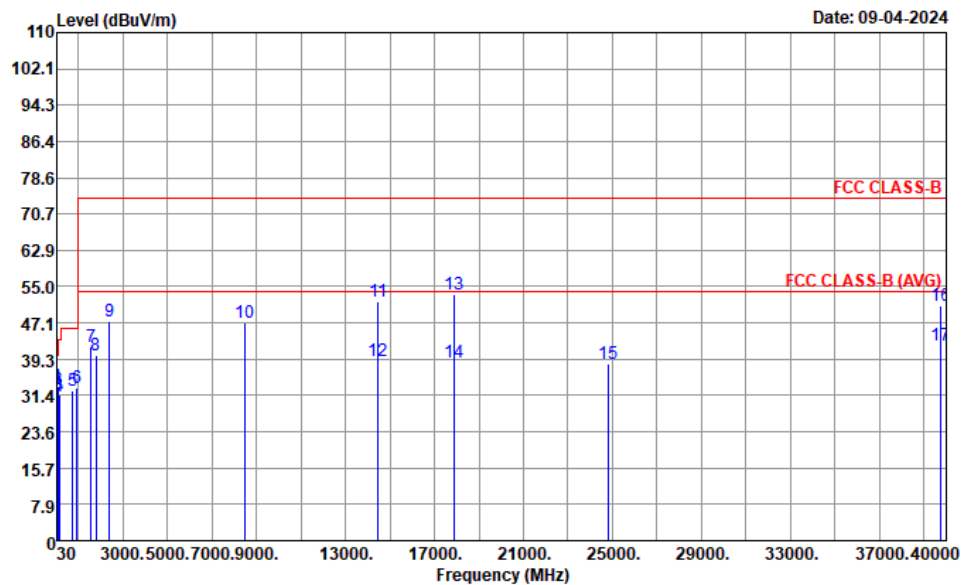
Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.5 dB
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Appendix A. Radiated Emission Test Result



Test Engineer :	Jordan Huang	Temperature :	23~26°C
		Relative Humidity :	43~47%
Test Distance :	1m	Polarization :	Horizontal

- Emission level (dBμV/m) = 20 log Emission level (μV/m)
- Distance extrapolation factor = 20 log (specific distance / test distance) (dB)
- EX.: Distance extrapolation factor = 20 log (3/1) = 9.54 (dB)
- Corrected Reading: Antenna Factor + Cable Loss – Preamp Factor - Distance extrapolation factor + Read Level = Level



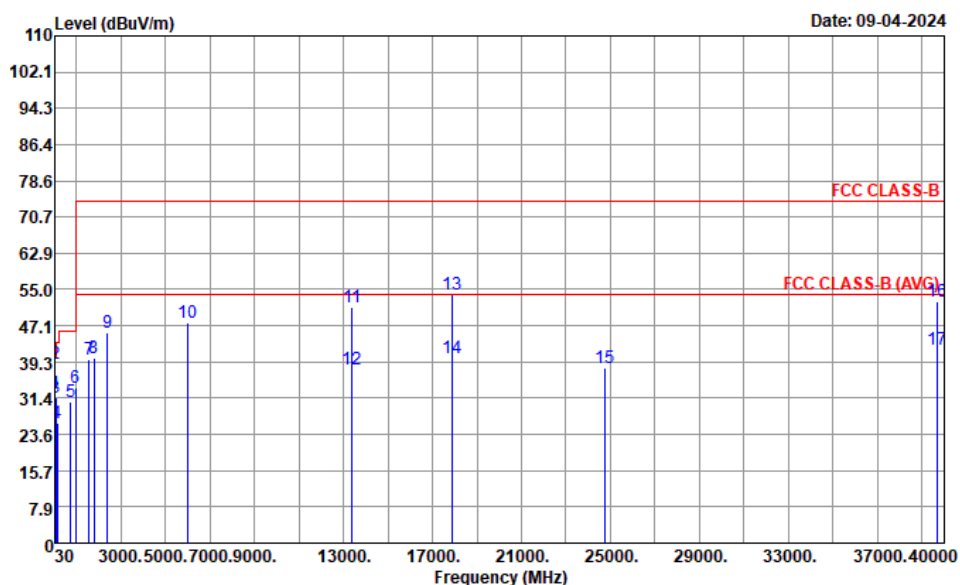
Site : 03CH01-CA
 Condition : FCC CLASS-B 1m SHF_HORN_841_240819 HORIZONTAL
 Project : 240808005
 Power : DC14V
 Mode : 1

	Freq	Level	Over	Limit	Read		A/Pos	T/Pos	Remark
	MHz	dBuV/m	Limit	Line	Level	Factor	cm	deg	
15	24840.00	38.24	-35.76	74.00	35.42	2.82	---	---	Peak
16	39776.00	50.76	-23.24	74.00	36.41	14.35	---	---	Peak
17	39776.00	42.19	-11.81	54.00	27.84	14.35	---	---	Average



Test Engineer :	Jordan Huang	Temperature :	23~26°C
		Relative Humidity :	43~47%
Test Distance :	3m	Polarization :	Vertical

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



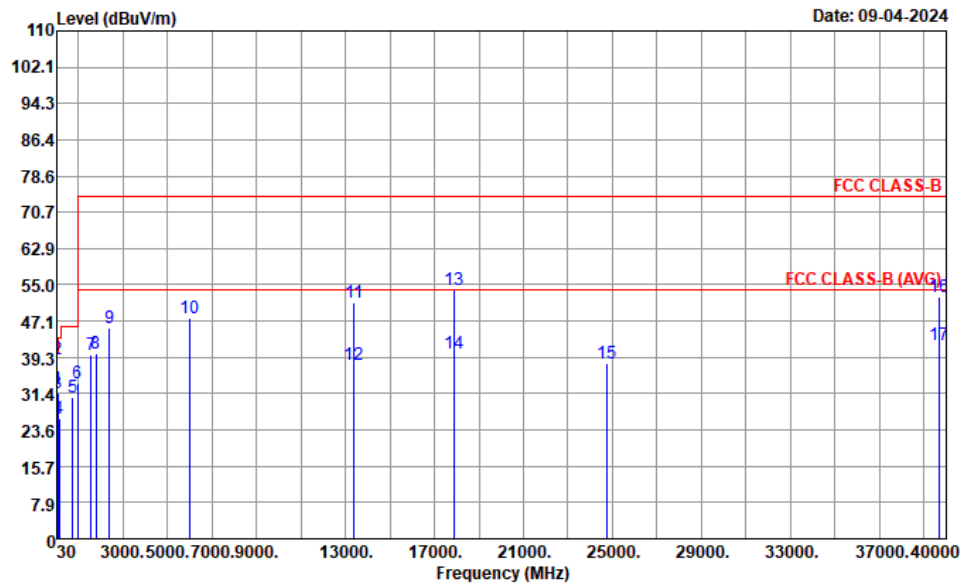
Site : 03CH01-CA
Condition : FCC CLASS-B 1m SHF_HORN_841_240819 VERTICAL
Project : 240808005
Power : DC14V
Mode : 1

	Freq	Level	Over	Limit	Read		A/Pos	T/Pos	Remark
	MHz	dBuV/m	Limit	Line	Level	Factor			
			dB	dBuV/m	dBuV	dB/m	cm	deg	
1	31.94	32.50	-7.50	40.00	39.83	-7.33	---	---	Peak
2	44.55	38.94	-1.06	40.00	53.29	-14.35	100	35	QP
3	87.23	31.54	-8.46	40.00	48.05	-16.51	---	---	Peak
4	138.64	26.09	-17.43	43.52	39.10	-13.01	100	20	QP
5	745.86	30.50	-15.50	46.00	30.87	-0.37	---	---	Peak
6	951.50	33.85	-12.15	46.00	29.34	4.51	---	---	Peak
7	1574.00	39.94	-34.06	74.00	76.67	-36.73	---	---	Peak
8	1800.00	40.21	-33.79	74.00	77.12	-36.91	---	---	Peak
9	2400.00	45.73	-28.27	74.00	78.39	-32.66	---	---	Peak
10	6000.00	47.84	-26.16	74.00	67.65	-19.81	---	---	Peak
11	13380.00	51.23	-22.77	74.00	60.49	-9.26	100	310	Peak
12	13380.00	37.74	-16.26	54.00	47.00	-9.26	100	310	Average
13	17910.00	53.92	-20.08	74.00	61.20	-7.28	100	152	Peak
14	17910.00	40.22	-13.78	54.00	47.50	-7.28	100	152	Average



Test Engineer :	Jordan Huang	Temperature :	23~26°C
		Relative Humidity :	43~47%
Test Distance :	1m	Polarization :	Vertical

- Emission level (dBμV/m) = 20 log Emission level (μV/m)
- Distance extrapolation factor = 20 log (specific distance / test distance) (dB)
- EX.: Distance extrapolation factor = 20 log (3/1) = 9.54 (dB)
- Corrected Reading: Antenna Factor + Cable Loss – Preamp Factor - Distance extrapolation factor + Read Level = Level



Site : 03CH01-CA
Condition : FCC CLASS-B 1m SHF_HORN_841_240819 VERTICAL
Project : 240808005
Power : DC14V
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	
15	24736.00	37.95	-36.05	74.00	35.20	2.75	---	---	Peak
16	39678.00	52.55	-21.45	74.00	38.92	13.63	---	---	Peak
17	39678.00	41.98	-12.02	54.00	28.35	13.63	---	---	Average