

EMC TEST REPORT

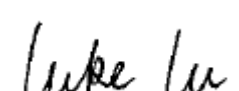
Applicant:	Continental Automotive Systems, Inc.
Address:	21440 W Lake Cook Rd., Deer Park, IL 60010, USA

Manufacturer or Supplier:	Continental Automotive Systems, Inc.
Address:	21440 W Lake Cook Rd., Deer Park, IL 60010, USA
Product:	FE5NA0020
Brand Name:	Continental
Model Name:	FE5NA0020
FCC ID:	LHJ-FE5NA0020
Date of tests:	Jun. 16, 2021 ~ Nov. 03, 2021

The submitted sample of the above equipment has been tested for according to the requirements of the following standards:

- ☐ FCC Part 15, Subpart B, Class A
☒ FCC Part 15, Subpart B, Class B
☒ ANSI C63.4:2014

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Prepared by Simon Wang Engineer / Mobile Department	Approved by Luke Lu Manager / Mobile Department
	
Date: Dec. 17, 2021	Date: Dec. 17, 2021

This report is governed by, and incorporates by reference, CPS Conditions of Service as posted at the date of issuance of this report at <http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions> and is intended for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. Measurement uncertainty is only provided upon request for accredited tests. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute you unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents.

TABLE OF CONTENTS

RELEASE CONTROL RECORD	3
1 GENERAL INFORMATION.....	4
1.1 GENERAL DESCRIPTION OF EUT.....	4
1.2 SUMMARY OF TEST RESULTS.....	6
1.3 MEASUREMENT UNCERTAINTY.....	7
1.4 DESCRIPTION OF TEST MODES.....	8
1.5 DESCRIPTION OF SUPPORT UNITS.....	9
2 EMISSION TEST	10
2.1 RADIATED EMISSION MEASUREMENT.....	10
2.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT	10
2.1.2 TEST INSTRUMENTS.....	12
2.1.3 TEST PROCEDURE.....	13
2.1.4 DEVIATION FROM TEST STANDARD	14
2.1.5 TEST SETUP.....	15
2.1.6 EUT OPERATING CONDITIONS.....	15
2.1.7 TEST RESULTS	16
3 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB.....	20



Test Report No.: W7L-P20210616-3EM01

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
W7L-P20210616-3EM01	original	Dec. 17, 2021

1 GENERAL INFORMATION

1.1 GENERAL DESCRIPTION OF EUT

PRODUCT	FE5NA0020	
BRAND NAME	Continental	
MODEL NAME	FE5NA0020	
NOMINAL VOLTAGE	EUT 4.0V	
MODULATION TYPE	GSM/GPRS/EDGE	GMSK, 8PSK
	WCDMA	QPSK
	LTE	QPSK/16QAM/64QAM
	5G NR	DFT-s-OFMA($\pi/2$ BPSK, QPSK, 16QAM, 64QAM, 256QAM); CP-OFMA(QPSK, 16QAM, 64QAM, 256QAM);
OPERATING FREQUENCY	GSM	824.2MHz ~ 848.8MHz (FOR GSM 850) 1850.2MHz ~ 1909.8MHz (FOR GSM 1900)
	WCDMA	1852.4MHz ~ 1907.6MHz (FOR WCDMA Band 2) 1712.4MHz ~ 1752.6MHz (FOR WCDMA Band 4) 826.4MHz ~ 846.6MHz (FOR WCDMA Band 5)
	LTE	1850.7MHz ~ 1909.3MHz (FOR LTE Band2) 1710.7MHz ~ 1754.3MHz (FOR LTE Band4) 824.7MHz ~ 848.3MHz (FOR LTE Band5) 825.6MHz ~ 847.4MHz (FOR LTE Band5B) 2502.5MHz ~ 2567.5MHz (FOR LTE Band7) 699.7MHz ~ 715.3MHz (FOR LTE Band12) 779.5MHz ~ 784.5MHz (FOR LTE Band13) 790.5MHz ~ 795.5MHz (FOR LTE Band14) 706.5MHz ~ 713.5MHz (FOR LTE Band17) 1850.7MHz ~ 1914.3MHz (FOR LTE Band25) 814.7MHz ~ 848.3MHz (FOR LTE Band26) 2498.5 MHz ~ 2687.5MHz (FOR LTE Band41/ LTE Band41-HPUE) 1710.7MHz ~ 1779.3MHz (FOR LTE Band66) 1713.3MHz ~ 1776.7MHz (FOR LTE Band66C) 665.5MHz ~ 695.5MHz (FOR LTE Band71)
	5G NR	EN-DC: DC_5A_n2A DC_12A_n2A DC_13A_n2A DC_14A_n2A DC_2A_n5A DC_7A_n5A



OPERATING FREQUENCY	5G NR	DC_66A_n5A DC_5A_n7A DC_12A_n7A DC_5A_n66A DC_12A_n66A DC_13A_n66A DC_14A_n66A DC_2A_n71A DC_7A_n71A DC_66A_n71A DC_5A_n41A DC_26A_n41A B2A+N77A(3710-3970MHz) B5A+N77A(3710-3970MHz) B7A+N77A(3710-3970MHz) B13A+N77A(3710-3970MHz) B41A+N77A(3710-3970MHz) B66A+N77A(3710-3970MHz) SA: n41(2506.02-2679.99MHz) n66(1712.5-1777.5MHz) n71(665.5-695.5MHz) n77(3710-3970MHz)
HW VERSION	P4.1	
SW VERSION	MODEMSA515M_01.15.62	
I/O PORTS	Refer to user's manual	
CABLE SUPPLIED	N/A	
ACCESSORY DEVICES	Refer to note as below	

NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

1.2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart B			
Standard Section	Test Item	Result	Test lab*
FCC Part 15, Subpart B, Class B ANSI C63.4:2014	Conducted Test	N/A	/
	Radiated Emission Test (30MHz ~ 1GHz)	Compliance	A
	Radiated Emission Test (Above 1GHz)	Compliance	A

*Test Lab Information Reference

Lab A:

BV 7Layers Communications Technology (Shenzhen) Co. Ltd

Lab Address:

No.B102, Dazu Chuangxin Mansion, North of Beihuan Avenue, North Area, Hi-Tech Industrial Park,
Nanshan District, Shenzhen, Guangdong, China

Accredited Test Lab Cert 3939.01

The FCC Site Registration No. is 525120; The Designation No. is CN1171.

1.3 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	150kHz ~ 30MHz	$\pm 2.70\text{dB}$
Radiated emissions	30MHz~1GMHz	$\pm 4.98\text{dB}$
	1GMHz ~6GMHz	$\pm 4.70\text{dB}$
	6GMHz ~18GMHz	$\pm 4.60\text{dB}$



Test Report No.: W7L-P20210616-3EM01

1.4 DESCRIPTION OF TEST MODES

Test Mode	Test Condition
Radiated emission test	
1	DC 14V+ DC cable + EUT

NOTE:

1. For radiated emission test, test mode 1 was the verification case and only this mode was presented in this report

1.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

FOR ALL TESTS

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	Laptop	Lenovo	Thnikpad L440	R90FTFKP	N/A
2	GPS Simulator +Antenna	TOJOIN	GNSS-5000A	E1-010-010119	N/A
3	Universal radio communication tester	Rohde&Schwarz	CMW500	N/A	N/A
4	Radio Communication Analyzer	Anritsu(China) Co., Ltd	MT8000A	6262093255	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	N/A
2	N/A
3	N/A
4	N/A

2 EMISSION TEST

2.1 RADIATED EMISSION MEASUREMENT

2.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT

TEST STANDARD: FCC Part 15, Subpart B (Section: 15.109)

Emissions radiated outside of the specified bands, shall be according to the general radiated limits as following:

Radiated Emissions Limits at 10 meters (dB μ V/m)		
Frequencies (MHz)	FCC 15B Class A	FCC 15B Class B
30-88	39	29.5
88-216	43.5	33.1
216-230	46.4	35.6
230-960		
960-1000	49.5	43.5

Radiated Emissions Limits at 3 meters (dB μ V/m)		
Frequencies (MHz)	FCC 15B Class A	FCC 15B Class B
1000-3000	Avg: 60	Avg: 54
3000+	Peak: 80	Peak: 74

Frequency Range (For unintentional radiators)

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705-108	1000
108-500	2000
500-1000	5000
Above 1000	5 th harmonic of the highest frequency or 40GHz, whichever is lower

- NOTE:**
1. The lower limit shall apply at the transition frequencies.
 2. Emission level (dB μ V/m) = 20 log Emission level (uV/m).
 3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of



Test Report No.: W7L-P20210616-3EM01

modulation.

4. QP detector shall be applied if not specified.

2.1.2 TEST INSTRUMENTS

Frequency range below 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	Euroshieldpn-CT0001143-1216	May. 19,20	May. 18,23
Bilog Antenna	ETS-LINDGREN	3143B	00161965	Mar. 05,21	Mar. 04,22
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Apr. 22,21	Apr. 21,22
Signal Pre-Amplifier	EMSI	EMC 9135	980249	Jun. 02,21	Jun. 01,22
E3 Test Software	E3	V 9.160323	N/A	N/A	N/A

Frequency range above 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	Euroshieldpn-CT0001143-1216	May. 19,20	May. 18,23
Horn Antenna	ETS-LINDGREN	3117	00168728	Apr. 02,21	Apr. 01,22
Horn Antenna	NA	QWH-SL-18-40-K-SGQMS-00361	15433	Aug. 26,20	Aug. 25,21
Horn Antenna	NA	QWH-SL-18-40-K-SGQMS-00361	15433	Aug. 25,21	Aug. 24,22
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Apr. 22,21	Apr. 21,22
Signal Pre-Amplifier	EMSI	EMC 012645B	980257	Jun. 03,21	Jun. 02,22
E3 Test Software	E3	V 9.160323	N/A	N/A	N/A

NOTE: 1. The calibration interval of the above test instruments is 12 months or 36 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
2. The test was performed in 3m Chamber.

2.1.3 TEST PROCEDURE

<Frequency Range below 1GHz>

The basic test procedure was in accordance with ANSI C63.4:2014 (section 12).

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from 1 meter to 4 meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1GHz.

NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. $\text{Emission level(dBuV/m)} = \text{Raw Value(dBuV)} + \text{Correction Factor(dB/m)}$
3. $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)}$ (if the raw value not contains the amplifier);
4. $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)} - \text{Amplifier Gain(dB)}$ (if the raw value contains the amplifier).
5. $\text{Margin value} = \text{Emission level} - \text{Limit value}$.

<Frequency Range above 1GHz>

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter fully-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. The bore sight should be used during the test above 1GHz.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz

NOTE:

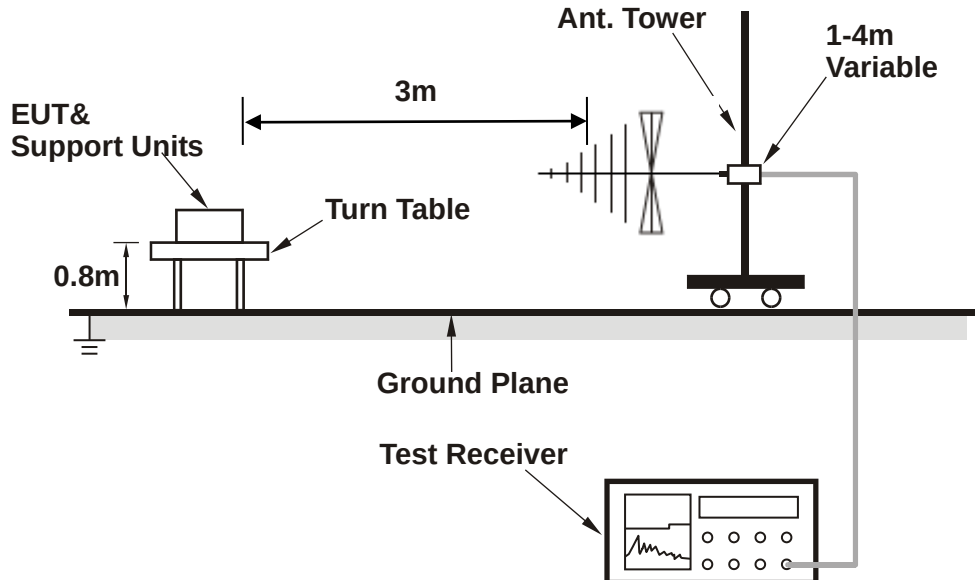
1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth of test receiver/spectrum analyzer is 1Hz for Average detection (AV) at frequency above 1GHz.
3. For measurement of frequency above 1000 MHz, the EUT was set 3 meters away from the receiver antenna.
4. $\text{Emission level(dBuV/m)} = \text{Raw Value(dBuV)} + \text{Correction Factor(dB/m)}$
5. $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)}$ (if the raw value not contains the amplifier);
6. $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)} - \text{Amplifier Gain(dB)}$ (if the raw value contains the amplifier)
7. $\text{Margin value} = \text{Emission level} - \text{Limit value}$.

2.1.4 DEVIATION FROM TEST STANDARD

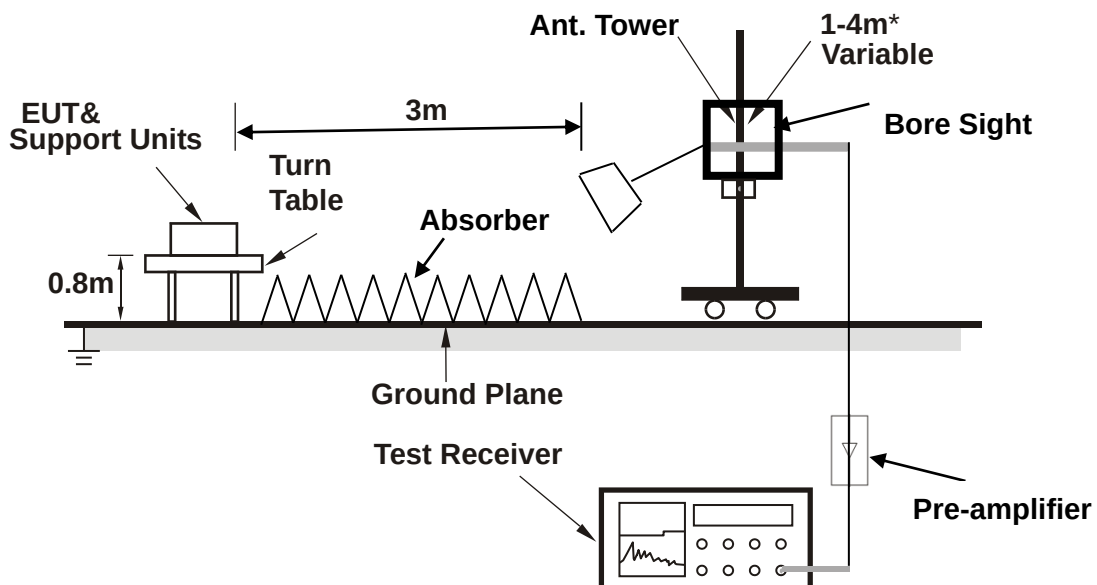
No deviation.

2.1.5 TEST SETUP

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



Note: Above 1G is a directional antenna

depends on the EUT height and the antenna 3dB bandwidth both, refer to section 7.3 of CISPR 16-2-3.

2.1.6 EUT OPERATING CONDITIONS

Same as item 2.1.6.

2.1.7 TEST RESULTS

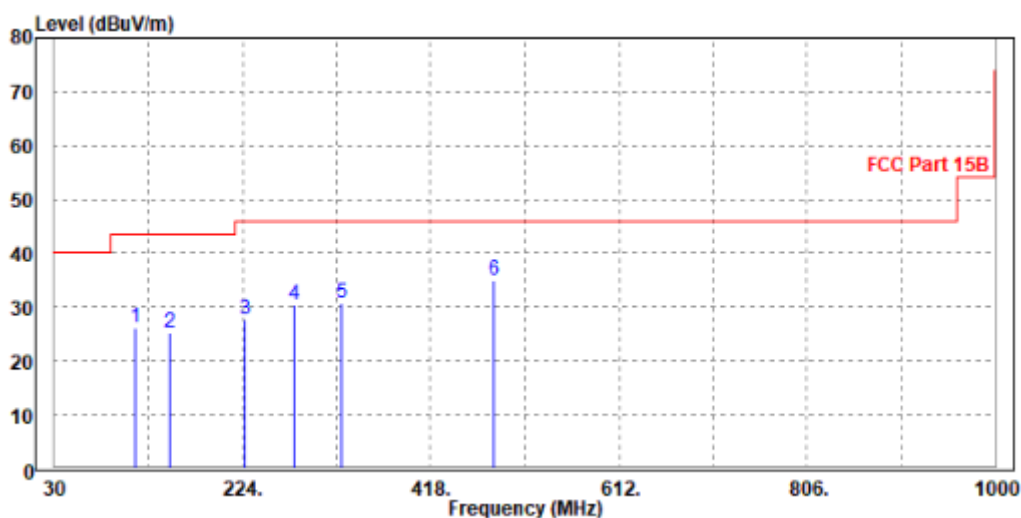
Worst case:

TEST VOLTAGE	EUT 4.0Vdc	FREQUENCY RANGE	30-1000 MHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70%RH	DETECTOR FUNCTION & RESOLUTION BANDWIDTH	Quasi-Peak, 120 kHz
TESTED BY	Jace Hu		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

	Freq	Level	Read Level	Limit	Over Limit	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m		
1	113.420	26.22	53.97	43.50	-17.28	-27.75	Peak	Horizontal
2	148.340	25.33	51.23	43.50	-18.17	-25.90	Peak	Horizontal
3	226.910	27.64	50.15	46.00	-18.36	-22.51	Peak	Horizontal
4	276.380	30.54	51.51	46.00	-15.46	-20.97	Peak	Horizontal
5	326.820	30.65	50.34	46.00	-15.35	-19.69	Peak	Horizontal
6 PP	482.990	35.13	50.85	46.00	-10.87	-15.72	Peak	Horizontal

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
 2. Negative sign (-) in the margin column signify levels below the limit.
 3. Frequency range scanned: 30MHz to 1000MHz.
 4. Only emissions significantly above equipment noise floor are reported.

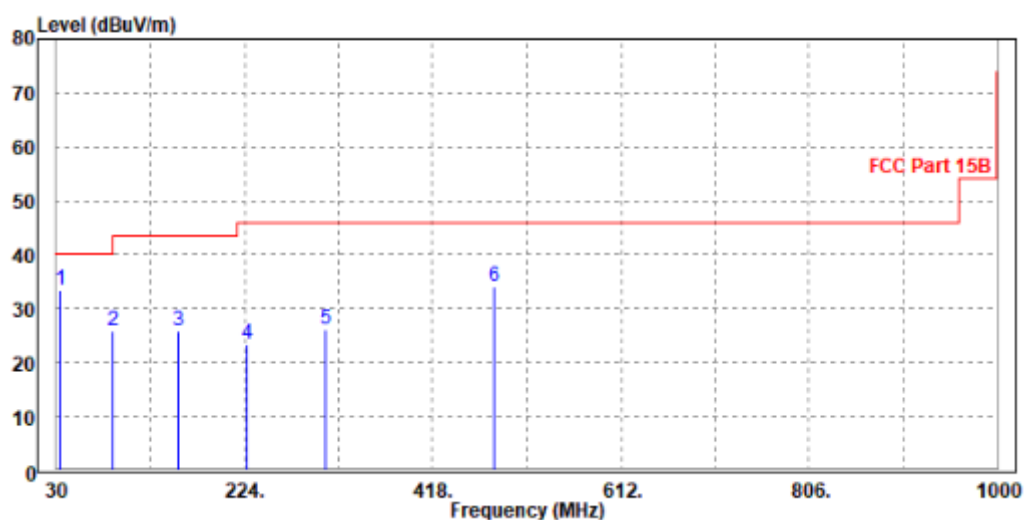


TEST VOLTAGE	EUT 4.0Vdc	FREQUENCY RANGE	30-1000 MHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70 %RH	DETECTOR FUNCTION & RESOLUTION BANDWIDTH	Quasi-Peak, 120 kHz
TESTED BY	Jace Hu		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m		
1 PP	33.880	33.48	51.78	40.00	-6.52	-18.30	Peak	Vertical
2	88.200	25.93	53.54	43.50	-17.57	-27.61	Peak	Vertical
3	155.130	25.99	50.40	43.50	-17.51	-24.41	Peak	Vertical
4	226.910	23.38	45.33	46.00	-22.62	-21.95	Peak	Vertical
5	307.420	26.18	45.55	46.00	-19.82	-19.37	Peak	Vertical
6	481.050	33.92	49.29	46.00	-12.08	-15.37	Peak	Vertical

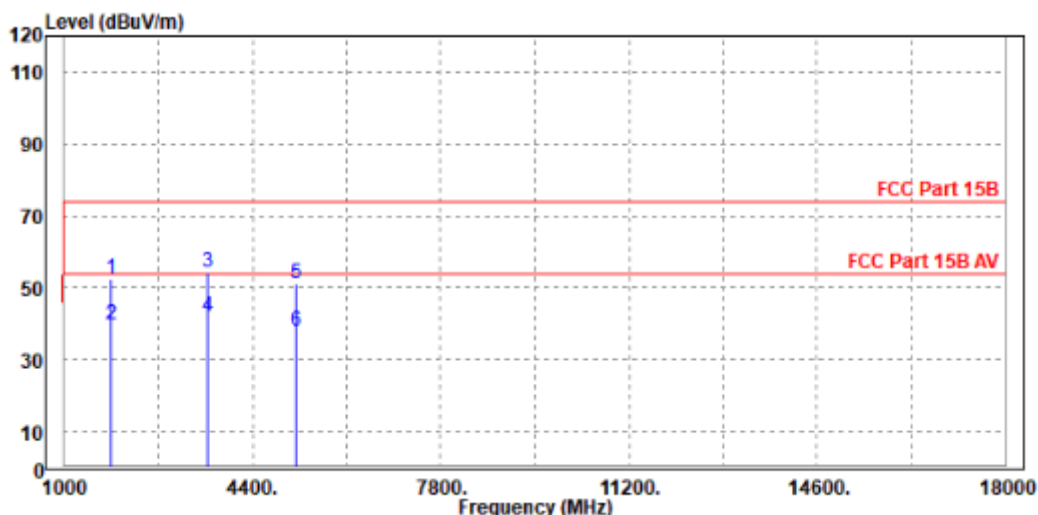
- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
 2. Negative sign (-) in the margin column signify levels below the limit.
 3. Frequency range scanned: 30MHz to 1000MHz.
 4. Only emissions significantly above equipment noise floor are reported.



TEST VOLTAGE	EUT 4.0Vdc	FREQUENCY RANGE	1-18 GHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70 %RH	DETECTOR FUNCTION & RESOLUTION BANDWIDTH	Peak/Average, 1 MHz
TESTED BY	Jace Hu		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
1833	52.31	63.97	74	-21.69	29.67	5.11	46.44	100	13	Peak
1833	39.81	51.47	54	-14.19	29.67	5.11	46.44	100	13	Average
3584	54.15	60.2	74	-19.85	33.05	7.28	46.38	100	308	Peak
3584	41.86	47.91	54	-12.14	33.05	7.28	46.38	100	308	Average
5182	51.09	53.31	74	-22.91	34.55	9.58	46.35	100	3	Peak
5182	37.86	40.08	54	-16.14	34.55	9.58	46.35	100	3	Average

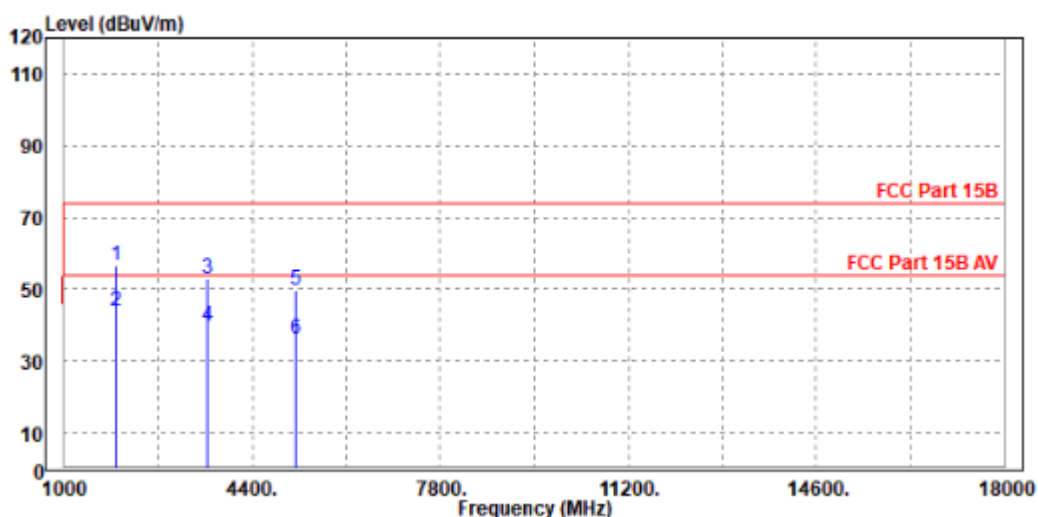
- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
 2. Negative sign (-) in the margin column signify levels below the limit.
 3. Frequency range scanned: 1GHz to 5th harmonic of the highest frequency or 40GHz, whichever is lower. For frequency above 18GHz, the emission was tested 20db below the limit so the data not recorded in the sheet.
 4. Only emissions significantly above equipment noise floor are reported.



TEST VOLTAGE	EUT 4.0Vdc	FREQUENCY RANGE	1-18 GHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70 %RH	DETECTOR FUNCTION & RESOLUTION BANDWIDTH	Peak/Average, 1 MHz
TESTED BY	Jace Hu		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
1918	56.45	67	74	-17.55	30.63	5.22	46.4	200	289	Peak
1918	43.93	54.48	54	-10.07	30.63	5.22	46.4	200	289	Average
3584	53.13	59.28	74	-20.87	32.95	7.28	46.38	200	119	Peak
3584	39.8	45.95	54	-14.2	32.95	7.28	46.38	200	119	Average
5182	49.61	51.78	74	-24.39	34.6	9.58	46.35	200	183	Peak
5182	36.26	38.43	54	-17.74	34.6	9.58	46.35	200	183	Average

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
 2. Negative sign (-) in the margin column signify levels below the limit.
 3. Frequency range scanned: 1GHz to 5th harmonic of the highest frequency or 40GHz, whichever is lower. For frequency above 18GHz, the emission was tested 20db below the limit so the data not recorded in the sheet.
 4. Only emissions significantly above equipment noise floor are reported.





Test Report No.: W7L-P20210616-3EM01

3 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications were made to the EUT by the lab during the test.

---END---