FCC RADIO 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 Part 2, 27(L)**

The product was received on May 06, 2024 and testing was performed from Jul. 02, 2024 to Aug. 30, 2024. We, Sporton International (USA) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this partial 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

Table of Contents

History of this test report **3**
Summary of Test Result **4**
1 General Description **5**
1.1 Product Feature of Equipment Under Test 5
1.2 Product Specification of Equipment Under Test 6
1.3 Modification of EUT 7
1.4 Testing Location 7
1.5 Applicable Standards 7
2 Test Configuration of Equipment Under Test **8**
2.1 Test Mode 8
2.2 Connection Diagram of Test System 9
2.3 Support Unit used in test configuration 9
2.4 Frequency List of Low/Middle/High Channels 9
3 Conducted Test Result **10**
3.1 Measuring Instruments 10
3.2 Conducted Output Power and ERP/EIRP 11
4 Radiated Test Items **12**
4.1 Measuring Instruments 12
4.2 Test Setup 12
4.3 Test Result of Radiated Test 13
4.4 Field Strength of Spurious Radiation Measurement 14
5 List of Measuring Equipment **15**
6 Measurement Uncertainty **16**
Appendix A. Test Results of Conducted Test
Appendix B. Test Results of Radiated Test
Appendix C. Test Setup Photographs

History of this test report

Report No.	Version	Description	Issue Date
FG240808005A	01	Initial issue of report	Sep. 23, 2024

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.2	§2.1046	Conducted Output Power	Pass	-
	§27.50 (d)(4)	Equivalent Isotropic Radiated Power (WCDMA Band IV)		
-	-	Peak-to-Average Ratio	-	See Note
-	§2.1049 §27.53 (g)	Occupied Bandwidth (WCDMA Band IV)	-	See Note
-	§2.1051 §27.53 (g)	Band Edge Measurement (WCDMA Band IV)	-	See Note
-	§2.1051 §27.53 (g)	Conducted Emission (WCDMA Band IV)	-	See Note
-	§2.1055 §27.54	Frequency Stability Temperature & Voltage	-	See Note
4.4	§2.1053 §27.53 (h)	Field Strength of Spurious Radiation (WCDMA Band IV)	Pass	47.04 dB under the limit at 6930.00 MHz

Note:
1. For host device, Radiated Spurious Emission, Equivalent Isotropic Radiated Power and Effective Radiated Power are verified and complies with the limit in this test report.
2. For host device, the Conducted Output Power is no difference after compared to module (Model: FE5NAR110, FE5NAR111).

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.

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

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

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

Support band and evaluated information	
Supported band	WCDMA Band IV
Evaluated and Tested band	WCDMA Band IV

FDD/TDD band Power Class		
	PC3	**PC2**
WCDMA Band IV	V	

1.2 Product Specification of Equipment Under Test

<table>
<tr><th colspan="2">Product Specification is subject to this standard</th></tr>
<tr><td>Tx Frequency</td><td>WCDMA:
Band IV: 1712.4 MHz ~ 1752.6 MHz</td></tr>
<tr><td>Rx Frequency</td><td>WCDMA:
Band IV: 2112.4 MHz ~ 2152.6 MHz</td></tr>
<tr><td>Maximum Output Power to Antenna</td><td>WCDMA:
Band IV: 22.60 dBm</td></tr>
<tr><td>Radiated EIRP</td><td><table><tr><th>Band</th><th>Channel</th><th>EIRP (dBm)</th></tr><tr><td>WCDMA IV</td><td>CH1413</td><td>23.12</td></tr></table></td></tr>
<tr><td>Antenna Type / Gain</td><td><Internal Antenna>: TCP Antenna
AWS Band: 4.86 dBi
<External Glass Antenna (Composed by component PN: 85038208, 85038209, 85038210, 85732934)>:
AWS Band: 5.61 dBi
<External Front Fender Antenna (Composed by component PN: 86784729, 86784728)>:
AWS Band: 4.55 dBi</td></tr>
<tr><td>Type of Modulation</td><td>WCDMA: QPSK (Uplink)
HSDPA: 64QAM (Downlink)
HSUPA: QPSK (Uplink)</td></tr>
</table>

Remark:

1. The Radiated EIRP listed in this section is only for radiated record, please refer the actual value in the Section 3.2.
2. 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 Testing 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.**		
	TH01-CA	03CH01-CA <Radiation>	03CH01-CA <Radiated EIRP>
Test Engineer	Leo Liu	Ken Kuo	Leo Liu
Temperature (℃)	22.7~24.5	21.4~23.9	21.9~22.9
Relative Humidity (%)	43.5~51.6	42.3~49.8	40.0~51.8

Note: The test site complies with ANSI C63.4 2014 requirement.

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:

- ANSI C63.26-2015
- FCC 47 CFR Part 2, 27(L)
- FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- FCC KDB 412172 D01 Determining ERP and EIRP v01r01
- FCC KDB 414788 D01 Radiated Test Site v01r01

Remark:

1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.
3. The TAF code is not including all the FCC KDB listed without accreditation.

2 Test Configuration of Equipment Under Test

2.1 Test Mode

Antenna port conducted and radiated test items were performed according to KDB 971168 D01 Power Meas. License Digital Systems v03r01 with maximum output power.

Radiated emissions were investigated as following frequency range:

1. 30 MHz to 18000 MHz for WCDMA Band IV

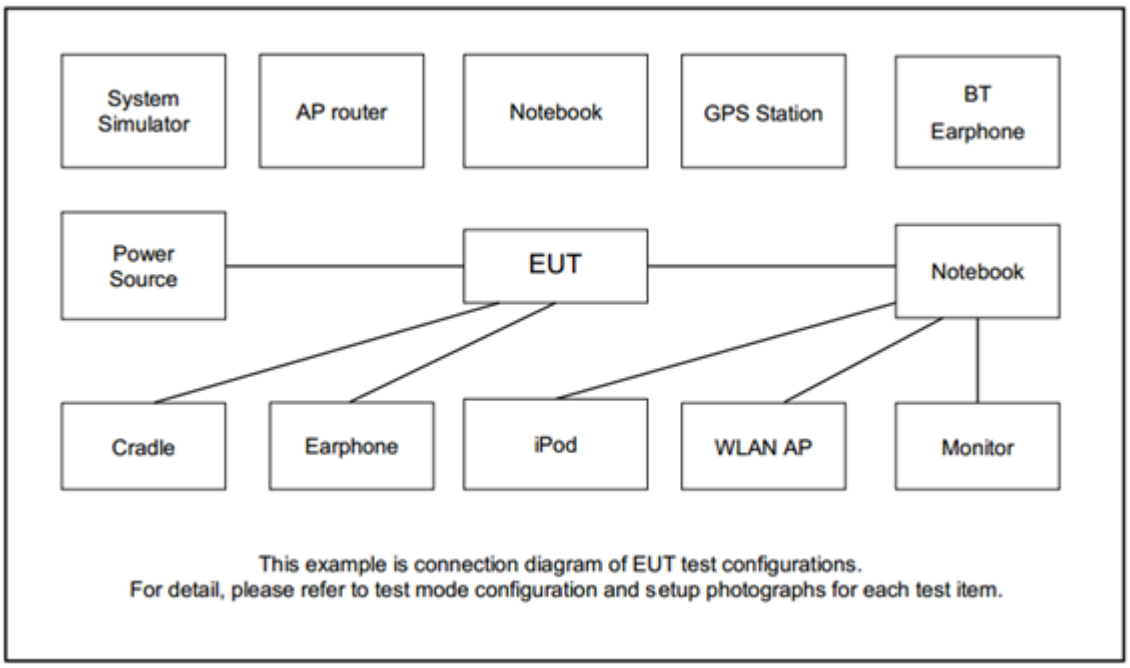
All modes, data rates and positions were investigated.

Test modes are chosen to be reported as the worst case configuration below:

Test Modes		
Band	**Radiated TCs**	**Conducted TCs**
WCDMA Band IV	■ RMC 12.2Kbps Link	■ RMC 12.2Kbps Link

Remark: All the radiated test cases were performed with Sample 1.

2.2 Connection Diagram of Test System



2.3 Support Unit used in test configuration

Item	Equipment	Brand Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	R&S	CMU 500	N/A	N/A	Unshielded, 1.8 m
2.	Power supply	GW Instek	SPS-606	N/A	N/A	N/A

2.4 Frequency List of Low/Middle/High Channels

Frequency List				
Band	**Channel/Frequency(MHz)**	**Lowest**	**Middle**	**Highest**
WCDMA Band IV	Channel	1312	1413	1513
	Frequency	1712.4	1732.6	1752.6

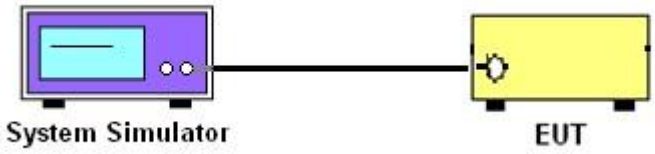
3 Conducted Test Result

3.1 Measuring Instruments

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

3.1.1 Test Setup

3.1.2 Conducted Output Power



3.1.3 Test Result of Conducted Test

Please refer to Appendix A.

3.2 Conducted Output Power and EIRP

3.2.1 Description of the Conducted Output Power and EIRP

A system simulator was used to establish communication with the EUT. Its parameters were set to enforce EUT transmitting at the maximum power. The measured power in the radio frequency on the transmitter output terminals shall be reported.

The EIRP of mobile transmitters must not exceed 1 Watts for WCDMA Band IV

According to KDB 412172 D01 Power Approach,

EIRP = P_T + G_T – L_C, ERP = EIRP -2.15, where

P_T = transmitter output power in dBm

G_T = gain of the transmitting antenna in dBi

L_C = signal attenuation in the connecting cable between the transmitter and antenna in dB

3.2.2 Test Procedures

1. The transmitter output port is connected to the system simulator.
2. Set EUT at maximum power through system simulator.
3. Select the lowest, middle, and the highest channels for each band and different modulation.
4. Measure the maximum burst average power for GSM and maximum average power for other modulation signal.

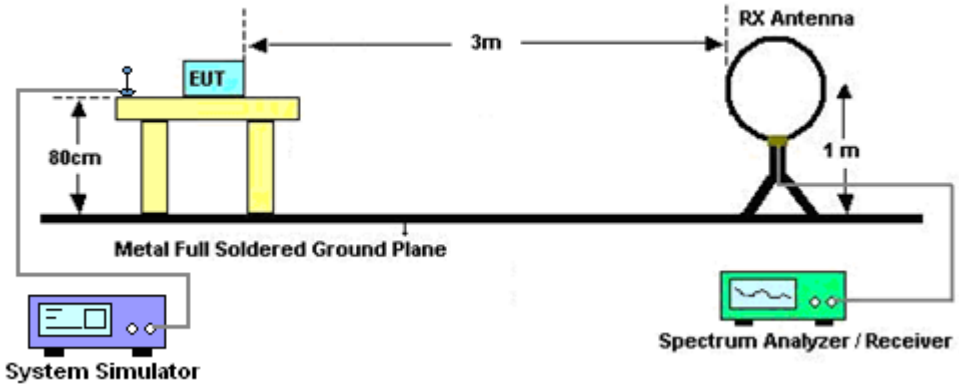
4 Radiated Test Items

4.1 Measuring Instruments

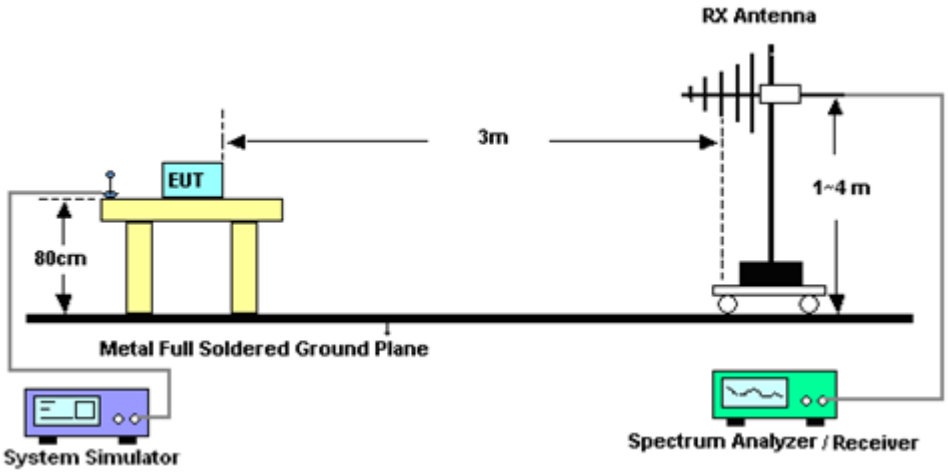
Please refer to the measuring equipment list in this test report.

4.2 Test Setup

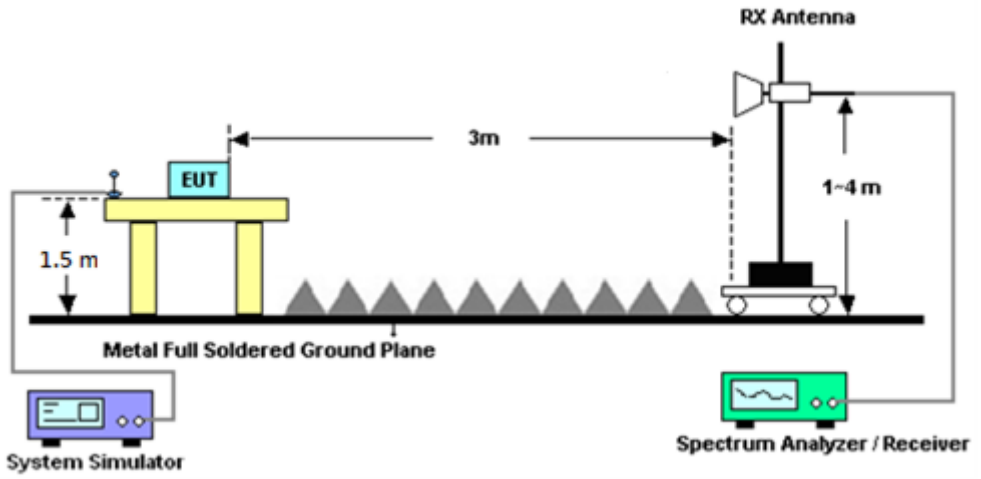
For radiated test below 30MHz



For radiated test from 30MHz to 1GHz



For radiated test above 1GHz



4.3 Test Result of Radiated Test

Please refer to Appendix B.

Note:

The low frequency, which starts from 9 kHz to 30 MHz, is pre-scanned and the result which is 20 dB lower than the limit line is not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

4.4 Field Strength of Spurious Radiation Measurement

4.4.1 Description of Field Strength of Spurious Radiated Measurement

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least 43 + 10 log (P) dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

4.4.2 Test Procedures

The testing follows FCC KDB 971168 D01 v03r01 Section 7 and ANSI C63.26-2015 section 5.5.4 Radiated measurement using the field strength method.

1. The EUT is placed on a rotatable wooden table 0.8 meters for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz above the ground.
2. The EUT is set 3 meters away from the receiving antenna, which is mounted on the antenna tower.
3. The table is rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving antenna is varied between one meter and four meters to search for the maximum spurious emission for both horizontal and vertical polarizations.
5. Make the measurement with the spectrum analyzer's RBW = 1 MHz, VBW = 3 MHz, taking record of maximum spurious emission.
6. To convert spectrum reading E(dBuV/m) to EIRP(dBm)
   EIRP(dBm) = Level (dBuV/m) + 20log(d) -104.77,
   where d is the distance at which filed strength limit is specified in the rules
7. Field Strength Level (dBm) = Spectrum Reading (dBm) + Antenna Factor + Cable Loss + Read Level - Preamp Factor.
8. ERP (dBm) = EIRP (dBm) - 2.15
9. The RF fundamental frequency shall be excluded against the limit line in the operating frequency band.
10. The limit line is derived from 43 + 10log(P) dB below the transmitter power P(Watts)

5 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Hygrometer	Testo	608-H1	45142595	N/A	Aug. 14, 2024	Aug. 26, 2024~ Aug. 30, 2024	Aug. 13, 2025	Conducted (TH01-CA)
Wideband Radio Communication Tester	R&S	CMW500	150251	N/A	Apr. 26, 2024	Aug. 26, 2024~ Aug. 30, 2024	Apr. 25, 2025	Conducted (TH01-CA)
Horn Antenna	SCHWARZBECK	BBHA 9120D	02113	1GHz~18GHz	Apr. 26, 2024	Aug. 30, 2024	Apr. 25, 2025	Radiated EIRP (03CH01-CA)
RF Cable	HUBER+SUHNER	SUCOFLEX 102	8015932/2, 8015762/2, 804938/2	N/A	Mar. 05, 2024	Aug. 30, 2024	Mar. 04, 2025	Radiated EIRP (03CH01-CA)
Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	150251	N/A	Apr. 26, 2024	Aug. 30, 2024	Apr. 25, 2025	Radiated EIRP (03CH01-CA)
UXM 5G Wireless Test Platform	Keysight	E7515B	MY59321821	N/A	Oct. 29, 2023	Aug. 30, 2024	Oct. 28, 2024	Radiated EIRP (03CH01-CA)
Hygrometer	TESEO	608-H1	45142559	N/A	Aug. 14, 2024	Aug. 30, 2024	Aug. 13, 2025	Radiated EIRP (03CH01-CA)
Controller	Chaintek	EM-1000	060881	Control Turn Table & Antenna Mast	N/A	Aug. 30, 2024	N/A	Radiated EIRP (03CH01-CA)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Aug. 30, 2024	N/A	Radiated EIRP (03CH01-CA)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Aug. 30, 2024	N/A	Radiated EIRP (03CH01-CA)
Test Software	Audix E3	E3 230621 Sporton US,V9	PK-002093	N/A	N/A	Aug. 30, 2024	N/A	Radiated EIRP (03CH01-CA)
Bilog Antenna	TESEQ	6111D	54683	30MHz~1GHz	Nov. 13, 2023	Jul. 02, 2024~ Jul. 08, 2024	Nov 12, 2024	Radiation (03CH01-CA)
Horn Antenna	SCHWARZBECK	BBHA 9120D	02115	1GHz~18GHz	Aug. 09, 2023	Jul. 02, 2024~ Jul. 08, 2024	Aug. 08, 2024	Radiation (03CH01-CA)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA9170	00842	18GHz~40GHz	Jul. 17, 2023	Jul. 02, 2024~ Jul. 08, 2024	Jul. 16, 2024	Radiation (03CH01-CA)
Amplifier	SONOMA	310N	372241	9kHz~1GHz	Apr. 24, 2024	Jul. 02, 2024~ Jul. 08, 2024	Apr. 23, 2025	Radiation (03CH01-CA)
Preamplifier	E-instrument	ERA-100M-18G-56-01-A70	EC1900251	1GHz~18GHz	Apr. 24, 2024	Jul. 02, 2024~ Jul. 08, 2024	Apr. 23, 2025	Radiation (03CH01-CA)
Preamplifier	EMEC	EMC18G40G	060725	18GHz-40GHz	Apr. 24, 2024	Jul. 02, 2024~ Jul. 08, 2024	Apr. 23, 2025	Radiation (03CH01-CA)
RF Cable	HUBER+SUHNER	SUCOFLEX 102	8015932/2, 8015762/2, 804938/2	N/A	Mar. 05, 2024	Jul. 02, 2024~ Jul. 08, 2024	Mar. 04, 2025	Radiation (03CH01-CA)
Hygrometer	TESEO	608-H1	45142559	N/A	Aug. 30, 2023	Jul. 02, 2024~ Jul. 08, 2024	Aug. 29, 2024	Radiation (03CH01-CA)
Controller	Chaintek	EM-1000	060881	Control Turn Table & Antenna Mast	N/A	Jul. 02, 2024~ Jul. 08, 2024	N/A	Radiation (03CH01-CA)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Jul. 02, 2024~ Jul. 08, 2024	N/A	Radiation (03CH01-CA)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Jul. 02, 2024~ Jul. 08, 2024	N/A	Radiation (03CH01-CA)
Test Software	Audix E3	E3 230621 Sporton US,V9	PK-002093	N/A	N/A	Jul. 02, 2024~ Jul. 08, 2024	N/A	Radiation (03CH01-CA)

6 Measurement Uncertainty

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.70 dB**

Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.50 dB**

Appendix A. Test Results of Conducted Test

Conducted Output Power(Average power) & EIRP

WCDMA Band IV Maximum Average Power [dBm] (GT - LC = 5.61 dB)					
Channel	1312	1413	1513	EIRP (dBm)	EIRP (W)
Frequency	1712.4	1732.6	1752.6		
RMC 12.2K	22.60	22.51	22.40	28.21	0.6622
Limit	EIRP < 1W			Result	Pass

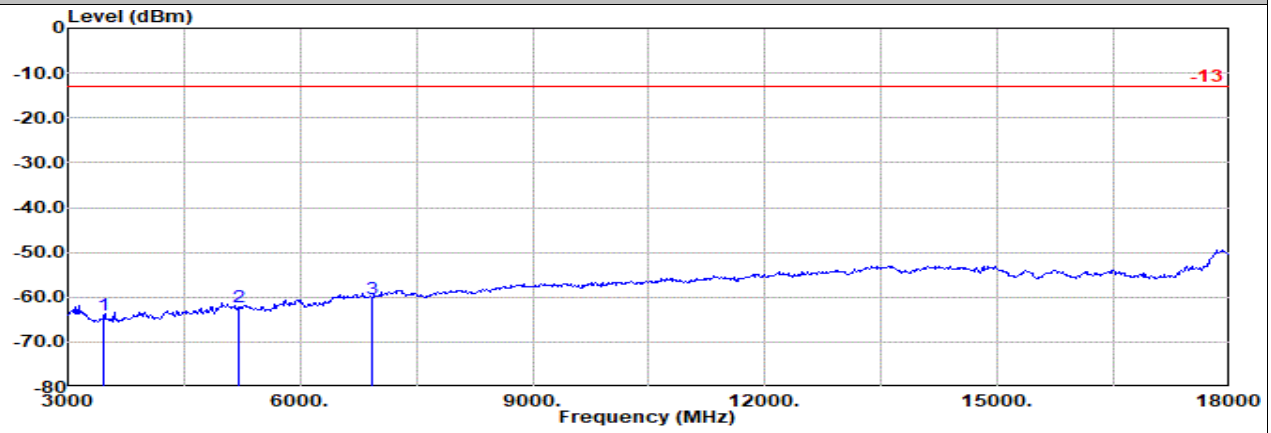
Appendix B. Test Results of Radiated Test

B1. Summary of each worse mode

Mode	Part	Band	Ch	Freq (MHz)	Level (dBm)	Det	Ant Factor (dB)	Amp\Cbl (dB)	Filter (dB)	EIRPCF (dB)	Reading (dBuV)	Limit (dBm)	Margin (dB)	Pol	Ant
1	Part 27L	WCDMA B4	M	6930	-60.04	RMS	35.96	-53.78	0.34	-95.23	52.67	-13.00	-47.04	V	External Glass Antenna

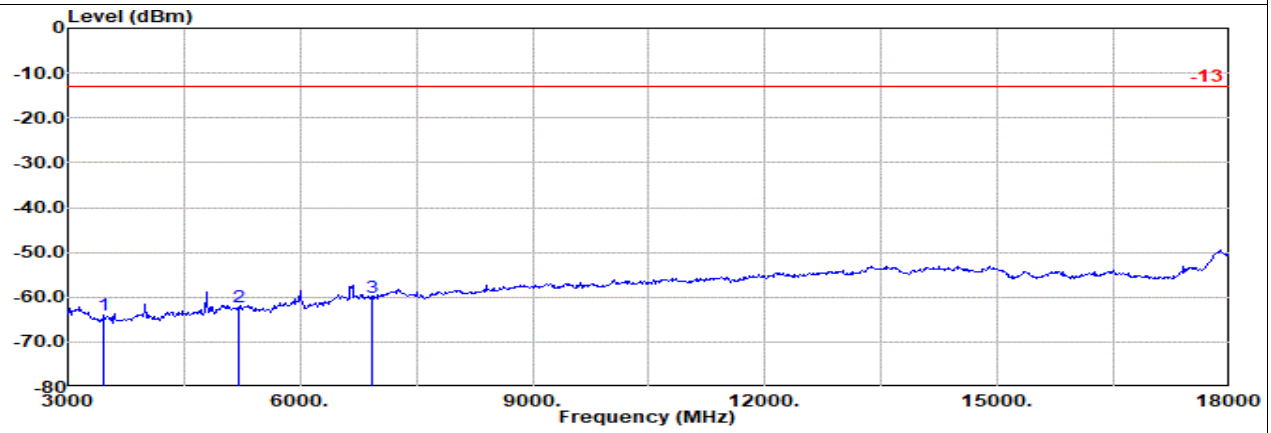
External Glass Antenna

Part 27L Mode 1
WCDMA B4 Ch1413
M



Site : 03CH01-CA
Condition: -13 3m HORN_02115_230809 Horizontal
: WCDMA B4 Ch1413

	Freq	Level	Detector	Ant Factor	Amp\Cbl	Filter	EIRPCF	Reading	Limit	Margin	Pol
	MHz	dBm		dB/m	dB	dB	dB	dBuV	dBm	dB	
1	3465.20	-63.86	RMS	29.47	-58.38	1.00	-95.23	59.28	-13.00	-50.86	Horizontal
2	5197.80	-62.22	RMS	33.00	-56.14	0.48	-95.23	55.67	-13.00	-49.22	Horizontal
3	6930.40	-60.38	RMS	35.89	-53.78	0.34	-95.23	52.40	-13.00	-47.38	Horizontal



Site : 03CH01-CA
Condition: -13 3m HORN_02115_230809 Vertical
: WCDMA B4 Ch1413

	Freq	Level	Detector	Ant Factor	Amp\Cbl	Filter	EIRPCF	Reading	Limit	Margin	Pol
	MHz	dBm		dB/m	dB	dB	dB	dBuV	dBm	dB	
1	3465.20	-64.13	RMS	29.54	-58.38	1.00	-95.23	58.94	-13.00	-51.13	Vertical
2	5197.80	-62.23	RMS	33.00	-56.14	0.48	-95.23	55.66	-13.00	-49.23	Vertical
3	6930.40	-60.04	RMS	35.96	-53.78	0.34	-95.23	52.67	-13.00	-47.04	Vertical