FCC RADIO TEST REPORT

FCC ID	:	**LHJ-FE4NA0210**
Equipment	:	**FE4NA0110**
Brand Name	:	**Continental**
Model Name	:	**FE4NA0110**
Applicant	:	**Continental Automotive Systems, Inc. 21440 W Lake Cook Rd.**
Manufacturer	:	**Continental Automotive Systems, Inc. 21440 W Lake Cook Rd.**
Standard	:	**FCC 47 CFR Part 2, 90(R)**

The product was received on Jun. 08, 2022 and testing was performed from Jun. 21, 2022 to Jul. 27, 2022. 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 / TIA-603-E 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
FG260854C	01	Initial issue of report	Aug. 12, 2022
FG260854C	02	Revise antenna gain	Aug. 15, 2022

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.2	§2.1046	Conducted Output Power	Reporting only	-
	§90.542 (a)(7)	Effective Radiated Power	Pass	-
-	-	Peak-to-Average Ratio	Not Required	-
-	§2.1049	Occupied Bandwidth	Not Required	-
-	§2.1053 §90.543 (e)(2)	Conducted Band Edge Measurement	Not Required	-
-	§2.1051 §90.210 (n)	Emission Mask	Not Required	-
-	§2.1053 §90.543 (e)(3)	Conducted Spurious Emission	Not Required	-
-	§2.1055 §90.539 (e)	Frequency Stability Temperature & Voltage	Not Required	-
4.2	§2.1053 §90.543 (e)(3) §90.543 (f)	Radiated Spurious Emission	Pass	4.62 dB under the limit at 1584.000 MHz

Remark:

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

2. This is a variant report by adding host information. All the test cases were performed on original report which can be referred to FCC ID: LHJ-FE4NA0210. Based on the original report, the test cases were verified.

Declaration of Conformity:
1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results. 2. The measurement uncertainty please refer to report "Uncertainty of Evaluation".
Comments and Explanations:
The product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Yun Huang

Report Producer: Cindy Liu

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	FE4NA0110
Brand Name	Continental
Model Name	FE4NA0110
FCC ID	LHJ-FE4NA0210
Installed into the Host	Equipment name: G12N400G1 Brand name: Continental Model name: G12N400G1
EUT supports Radios application	WCDMA/HSPA/LTE/GNSS
HW Version – NAD	P4
EUT Stage	Identical Prototype

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

1.2 Product Specification of Equipment Under Test

Product Specification is subject to this standard	
Tx Frequency	790.5 MHz ~ 795.5 MHz
Rx Frequency	760.5 MHz ~ 765.5 MHz
Bandwidth	5MHz / 10MHz
Maximum Output Power to Antenna	22.27 dBm
Antenna Type / Gain	**<Internal Antenna>:** Fixed Internal Antenna with gain 0.52 dBi **<External Antenna>:** Fixed External Antenna with gain 0.77 dBi
Type of Modulation	QPSK / 16QAM / 64QAM

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

1.3 Modification of EUT

No modifications are made to the EUT during all test items.

1.4 Testing Site

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.	
	TH03-HY	03CH07-HY
Test Engineer	HaoEn Zhang	Jesse Wang, Stan Hsieh and Ken Wu
Temperature (℃)	21.5~22.6	22.3~26.4
Relative Humidity (%)	52.5~53.8	61.3~67.4

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

FCC Designation No.: TW1190

1.5 Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ANSI C63.26-2015
- FCC 47 CFR Part 2, Part 90(R)
- ANSI / TIA-603-E
- 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 test items were verified and recorded according to the standards and without any deviation during the test.
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.

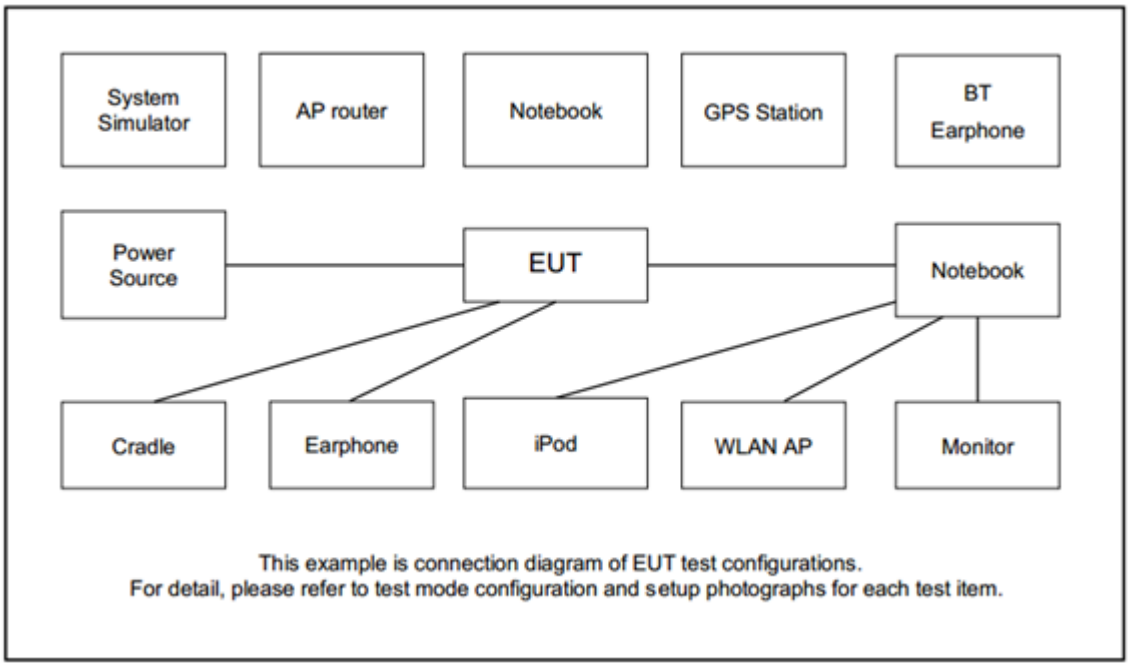
2 Test Configuration of Equipment Under Test

2.1 Test Mode

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

Conducted Test Cases	Band	Bandwidth (MHz)						Modulation			RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	64QAM	1	Half	Full	L	M	H
Max. Output Power	14	-	-	v	v	-	-	v	v	v	v	v	v	v	v	v
E.R.P	14	-	-	v	v	-	-	v	v	v	Max. Power					
Radiated Spurious Emission	14	-	-	v		-	-	v			v				v	
Remark	1. The mark "**v** " means that this configuration is chosen for testing 2. The mark "-" means that this bandwidth is not supported. 3. The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported.															

2.2 Connection Diagram of Test System



2.3 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
2.	External Antenna	Molex	4G Hexband NA	N/A	N/A	N/A
3.	Teddy Jr Load Box	Continental	N/A	N/A	N/A	N/A

2.4 Frequency List of Low/Middle/High Channels

LTE Band 14 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
10	Channel	-	23330	-
	Frequency	-	793	-
5	Channel	23305	23330	23355
	Frequency	790.5	793	795.5

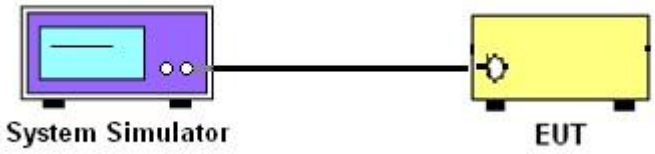
3 Conducted Test Items

3.1 Measuring Instruments

See list of measuring instruments of 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 Measurement and ERP

3.2.1 Description of the Conducted Output Power Measurement and ERP Measurement

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

The ERP of mobile transmitters must not exceed 3 Watts for LTE Band 14.

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 was connected to base station.
2. Set EUT at maximum power through base station.
3. Select lowest, middle, and highest channels for each band and different modulation.
4. Measure and record the power level from the system simulator.

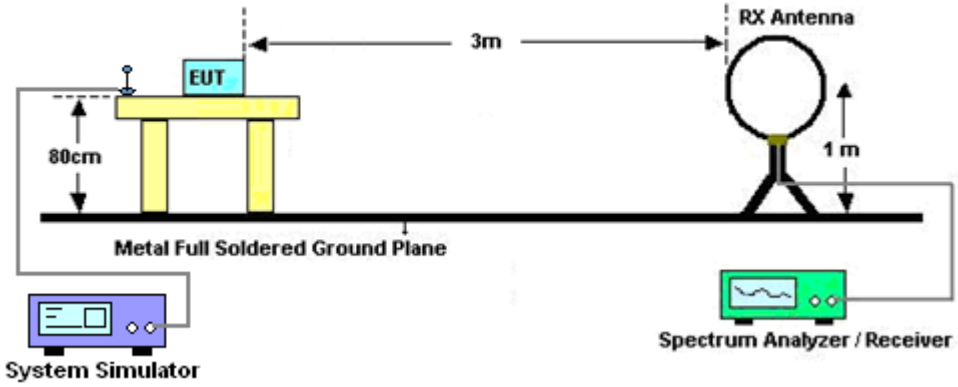
4 Radiated Test Items

4.1 Measuring Instruments

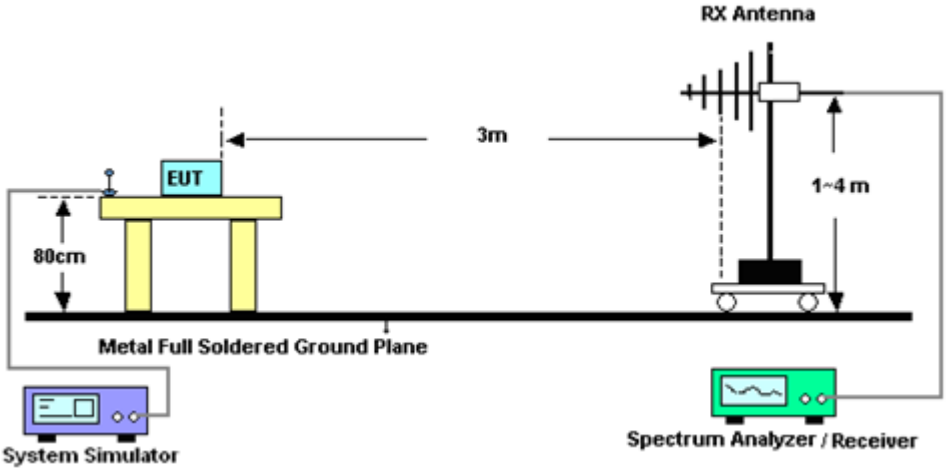
See list of measuring instruments of this test report.

4.1.1 Test Setup

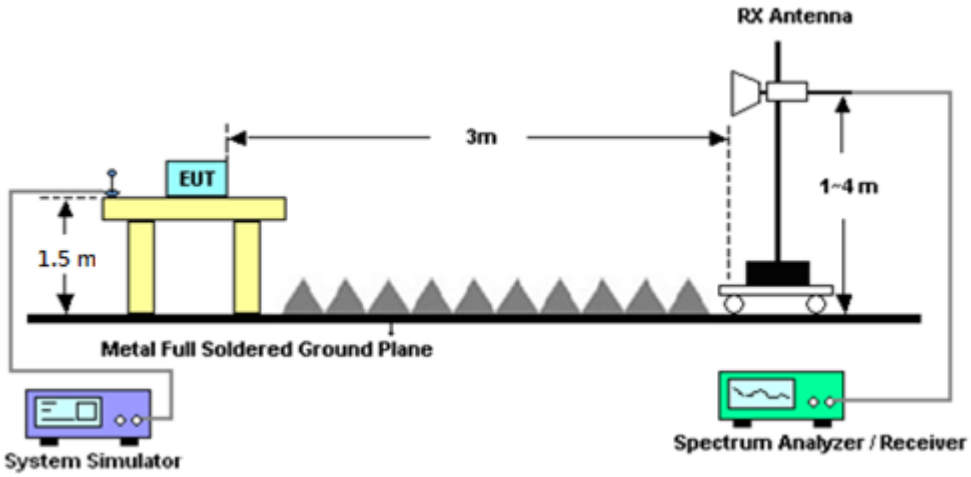
For radiated test below 30MHz



For radiated test from 30MHz to 1GHz



For radiated test above 1GHz



4.1.2 Test Result of Radiated Test

Please refer to Appendix B.

Note:

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was 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.

4.2 Radiated Spurious Emission

4.2.1 Description of Radiated Spurious Emission

The radiated spurious emission was measured by substitution method according to ANSI / TIA-603-E. 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.

For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559–1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

4.2.2 Test Procedures

The testing follows FCC KDB 971168 D01 v03r01 Section 7 and ANSI / TIA-603-E Section 2.2.12.

1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was 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 the maximum spurious emission for both horizontal and vertical polarizations.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, Sweep = 500ms, Taking the record of maximum spurious emission.
6. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
7. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
8. Taking the record of output power at antenna port.
9. Repeat step 7 to step 8 for another polarization.
10. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
11. 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
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N-06	35419 & 03	30MHz~1GHz	Apr. 24, 2022	Jun. 21, 2022~ Jul. 27, 2022	Apr. 23, 2023	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Dec. 03, 2021	Jun. 21, 2022~ Jul. 27, 2022	Dec. 02, 2022	Radiation (03CH07-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jan. 07, 2022	Jun. 21, 2022~ Jul. 27, 2022	Jan. 06, 2023	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1590075	1GHz~18GHz	Apr. 21, 2022	Jun. 21, 2022~ Jul. 27, 2022	Apr. 20, 2023	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz~1GHz	Oct. 04, 2021	Jun. 21, 2022~ Jul. 27, 2022	Oct. 03, 2022	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A02362	1GHz~26.5GHz	Oct. 04, 2021	Jun. 21, 2022~ Jul. 27, 2022	Oct. 03, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY15682/4	30MHz to 18GHz	Feb. 23, 2022	Jun. 21, 2022~ Jul. 27, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24971/4	9kHz to 18GHz	Feb. 23, 2022	Jun. 21, 2022~ Jul. 27, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY28655/4	9kHz to 18GHz	Feb. 23, 2022	Jun. 21, 2022~ Jul. 27, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126	532078/126E	30MHz~18GHz	Sep. 17, 2021	Jun. 21, 2022~ Jul. 27, 2022	Sep. 16, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	801606/2	9KHz ~ 40GHz	Apr. 14, 2022	Jun. 21, 2022~ Jul. 27, 2022	Apr. 13, 2023	Radiation (03CH07-HY)
Controller	EMEC	EM1000	N/A	Control Ant Mast	N/A	Jun. 21, 2022~ Jul. 27, 2022	N/A	Radiation (03CH07-HY)
Controller	MF	MF-7802	N/A	Control Turn table	N/A	Jun. 21, 2022~ Jul. 27, 2022	N/A	Radiation (03CH07-HY)
Antenna Mast	EMEC	AM-BS-4500E	N/A	Boresight mast 1M~4M	N/A	Jun. 21, 2022~ Jul. 27, 2022	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Jun. 21, 2022~ Jul. 27, 2022	N/A	Radiation (03CH07-HY)
Software	Audix	E3	N/A	N/A	N/A	Jun. 21, 2022~ Jul. 27, 2022	N/A	Radiation (03CH07-HY)
USB Data Logger	TECPEL	TR-32	HE17XB2495	N/A	Mar. 07, 2022	Jun. 21, 2022~ Jul. 27, 2022	Mar. 06, 2023	Radiation (03CH07-HY)
Bilog Antenna	TESEQ	CBL 6111D & N-6-06	35414 & AT-N0602	30MHz~1GHz	Oct. 09, 2021	Jun. 21, 2022~ Jul. 27, 2022	Oct. 08, 2022	Radiation (03CH07-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz~44GHz	Oct. 15, 2021	Jun. 21, 2022~ Jul. 27, 2022	Oct. 14, 2022	Radiation (03CH07-HY)
Double Ridge Horn Antenna	EMCO	3117	00227856	1 - 18 GHz	Sep. 14, 2021	Jun. 21, 2022~ Jul. 27, 2022	Sep. 13, 2022	Radiation (03CH07-HY)
Signal Generator	Rohde & Schwarz	SMF100A	101107	100kHz~40GHz	Dec. 08, 2021	Jun. 21, 2022~ Jul. 27, 2022	Dec. 07, 2022	Radiation (03CH07-HY)

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Radio Communication Analyzer	Anritsu	MT8821C	6262025280	LTE FDD/TDD LTE-2CC DLCA/ULCA	Oct. 29, 2021	Jun. 27, 2022	Oct. 28, 2022	Conducted (TH03-HY)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101908	10Hz~40GHz	Oct. 01, 2021	Jun. 27, 2022	Sep. 30, 2022	Conducted (TH03-HY)
Thermal Chamber	ESPEC	SH-641	92013720	-40℃ ~90℃	Sep. 09, 2021	Jun. 27, 2022	Sep. 08, 2022	Conducted (TH03-HY)
DC Power Supply	GW Instek	GPP-2323	GES906037	0V~64V；0A~6A	Jan. 06, 2022	Jun. 27, 2022	Jan. 05, 2023	Conducted (TH03-HY)
Coupler	Warison	20dB 25W SMA Directional Coupler	#B	1-18GHz	Jan. 07, 2022	Jun. 27, 2022	Jan. 06, 2023	Conducted (TH03-HY)

6 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.25 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.50 dB**

Appendix A. Test Results of Conducted Test

Conducted Output Power(Average power & ERP)

LTE Band 14 Maximum Average Power [dBm] (GT - LC = 0.77 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP (W)
10	1	0	QPSK	-	22.27	-	20.89	0.1227
10	1	25			22.18			
10	1	49			22.17			
10	25	0			21.92			
10	25	12			21.71			
10	25	25			21.72			
10	50	0			21.81			
10	1	0	16-QAM		21.79		20.52	0.1127
10	1	25			21.69			
10	1	49			21.90			
10	25	0			20.96			
10	25	12			20.84			
10	25	25			20.82			
10	50	0			20.91			
10	1	0	64-QAM		20.83		19.45	0.0881
10	1	25			20.76			
10	1	49			20.71			
10	25	0			19.93			
10	25	12			19.87			
10	25	25			19.74			
10	50	0			19.76			
Limit	ERP < 3W			Result			Pass	

LTE Band 14 Maximum Average Power [dBm] (GT - LC = 0.77 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP (W)
5	1	0	QPSK	22.26	22.26	22.19	20.88	0.1225
5	1	12		22.12	22.16	22.16		
5	1	24		22.08	22.15	22.15		
5	12	0		21.81	21.88	21.88		
5	12	7		21.65	21.67	21.66		
5	12	13		21.59	21.65	21.65		
5	25	0		21.71	21.78	21.69		
5	1	0	16-QAM	21.69	21.77	21.76	20.52	0.1127
5	1	12		21.55	21.59	21.56		
5	1	24		21.80	21.90	21.85		
5	12	0		20.82	20.87	20.77		
5	12	7		20.72	20.82	20.77		
5	12	13		20.79	20.80	20.77		
5	25	0		20.82	20.86	20.82		
5	1	0	64-QAM	20.76	20.76	20.88	19.50	0.0891
5	1	12		20.80	20.82	20.84		
5	1	24		20.69	20.62	20.69		
5	12	0		19.94	19.90	19.83		
5	12	7		19.86	19.91	19.95		
5	12	13		19.77	19.64	19.85		
5	25	0		19.83	19.80	19.69		
Limit	ERP < 3W			Result			Pass	

Appendix B. Test Results of Radiated Test

<Internal Antenna>

LTE Band 14

LTE Band 14 / 5MHz / QPSK									
Channel	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Middle	1584	-51.37	-42.15	-9.22	-62.65	-53.34	0.95	5.06	H
	2372	-60.53	-13	-47.53	-77.38	-62.15	1.25	5.02	H
	3162	-59.83	-13	-46.83	-78.41	-62.69	1.50	6.51	H
									H
									H
									H
									H
	1584	-46.77	-42.15	-4.62	-58.55	-48.74	0.95	5.06	V
	2372	-57.73	-13	-44.73	-74.95	-59.35	1.25	5.02	V
	3162	-56.42	-13	-43.42	-75.72	-59.28	1.50	6.51	V
									V
									V
									V
									V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

<External Antenna>

LTE Band 14

LTE Band 14 / 5MHz / QPSK									
Channel	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Middle	1584	-54.13	-42.15	-11.98	-65.41	-56.1	0.95	5.06	H
	2372	-59.43	-13	-46.43	-76.06	-61.05	1.25	5.02	H
	3162	-59.34	-13	-46.34	-77.83	-62.2	1.50	6.51	H
									H
									H
									H
									H
	1584	-50.53	-42.15	-8.38	-61.63	-52.5	0.95	5.06	V
	2372	-55.68	-13	-42.68	-72.64	-57.3	1.25	5.02	V
	3162	-58.08	-13	-45.08	-76.91	-60.94	1.50	6.51	V
									V
									V
									V
									V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.