



FCC RADIO TEST REPORT

FCC ID : PKRISGM2000B
Equipment : Wireless Hotspot Modem
Brand Name : Inseego
Model Name : M2000B
Marketing Name : M2000
Applicant : Inseego Corporation
9710 Scranton Road Suite 200, San Diego, CA 92121
Manufacturer : Inseego Corporation
9710 Scranton Road Suite 200, San Diego, CA 92121
Standard : FCC 47 CFR Part 2, 90(R)

The product was received on Jul. 30, 2020 and testing was started from Sep. 01, 2020 and completed on Sep. 16, 2020. 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 of 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, Taiwan (R.O.C.)



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History of this test report

Report No.	Version	Description	Issued Date
FG041658-01E	01	Initial issue of report	Sep. 23, 2020



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	Under limit 19.75 dB at 1576.000 MHz

Remark:

- Not required means after assessing, test items are not necessary to carry out.
- This is a variant report, please refer to the Declaration of Similarity Letter provided by the applicant for the deviation against its parent model. All the test cases were performed on original report which can be referred to Sporton Report Number FG041657-01E as appendix D. Based on the original report, the test cases were verified.

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Wii Chang

Report Producer: Dara Chiu



1 General Description

1.1 Product Feature of Equipment Under Test

WCDMA/LTE/5G NR, Wi-Fi 2.4GHz 802.11b/g/n/ax, Wi-Fi 5GHz 802.11a/n/ac/ax and GNSS

Product Specification subjective to this standard	
Antenna Type	WWAN: Fixed Internal Antenna WLAN: <Ant. 1>: Fixed Internal Antenna <Ant. 2>: Fixed Internal Antenna GPS: Fixed Internal Antenna

1.2 Modification of EUT

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

1.3 Testing Site

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	Sporton Site No. TH05-HY
Test Engineer	Benjamin Lin
Temperature	21.5~23.6°C
Relative Humidity	45.7~46.9%

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	Sporton Site No. 03CH12-HY
Test Engineer	Jack Cheng, Lance Chiang, and Chuan Chu
Temperature	24.3~26.4°C
Relative Humidity	58~66%

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

FCC Designation No. TW1190 and TW0007



1.4 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. The TAF code is not including all the FCC KDB listed without accreditation.

2 Test Configuration of Equipment Under Test

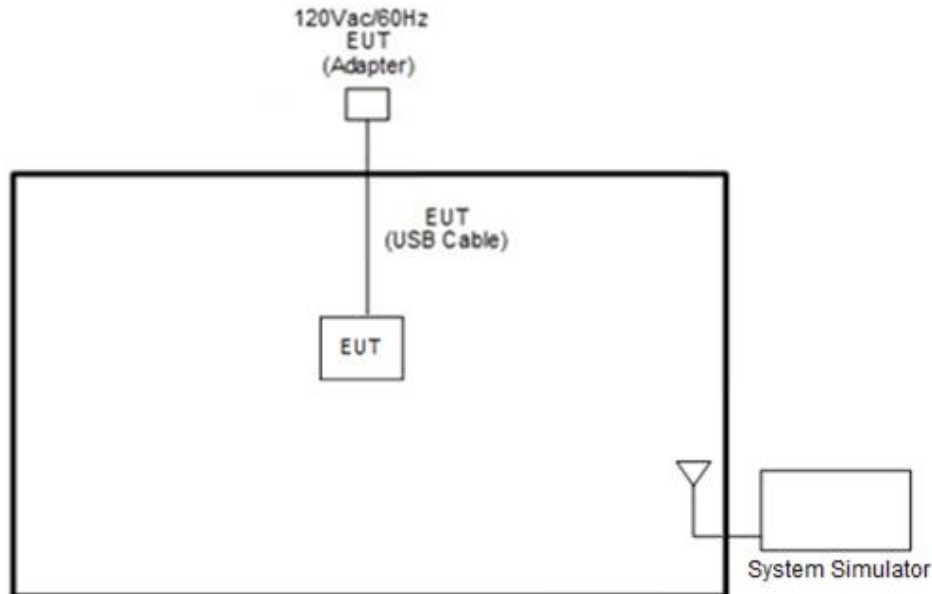
2.1 Test Mode

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.

For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Z plane) were recorded in this report.

Conducted Test Cases	Band	Bandwidth (MHz)						Modulation			RB #			Test Channel				
		1.4	3	5	10	15	20	QPSK	16 QAM	64 QAM	256 QAM	1	Half	Full	L	M	H	
Max. Output Power	14	-	-	v	v	-	-	v	v	v	v	v	v	v	v	v	v	v
E.R.P	14	-	-	v	v	-	-	v	v	v	v	v				v	v	v
Radiated Spurious Emission	14	-	-	v	v	-	-	v							v		v	v
Remark	<ol style="list-style-type: none"> The mark "v " means that this configuration is chosen for testing The mark "- " means that this bandwidth is not supported. 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. All the radiated test cases were performed with Battery 2. 																	

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	8821C	N/A	N/A	Unshielded, 1.8 m

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

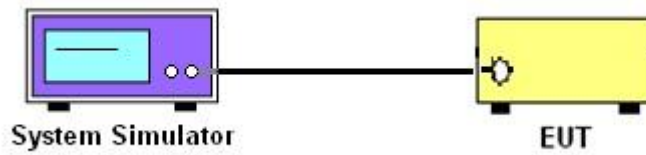
3 Conducted Test Items

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.

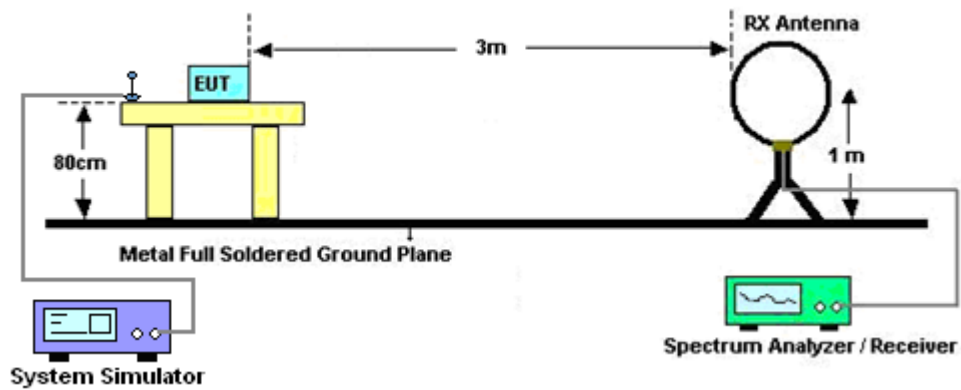
4 Radiated Test Items

4.1 Measuring Instruments

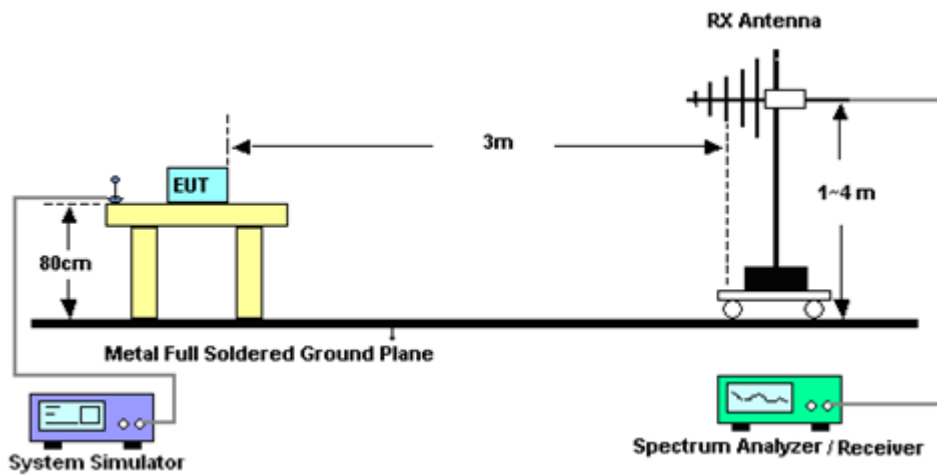
See list of measuring instruments of this test report.

4.1.1 Test Setup

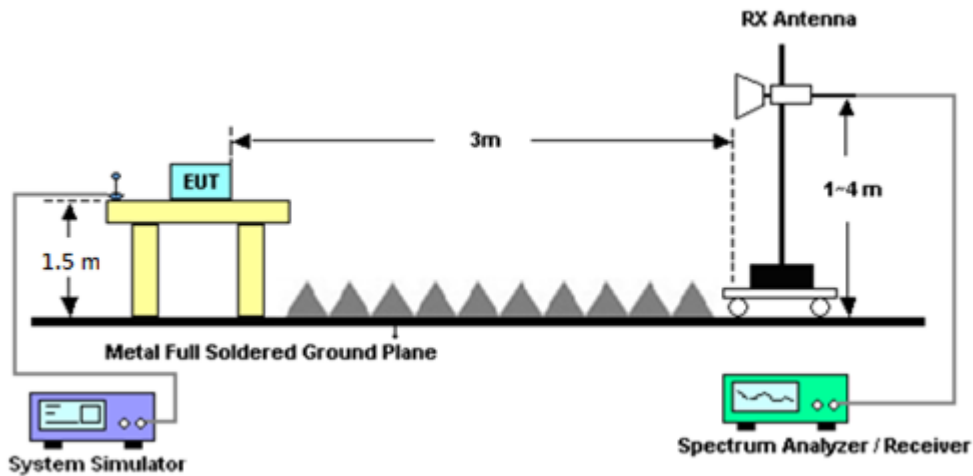
For radiated emissions below 30MHz



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 a comparison data 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 $43 + 10\log(P)$ 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
Base Station (Measure)	Anritsu	MT8821C	6262025280	GSM / GPRS /WCDMA / LTE FDD/TDD with 44) /LTE-3CC DLCA,2CC ULCA	Oct. 25, 2019	Sep. 01, 2020 ~ Sep. 10, 2020	Oct. 24, 2020	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101908	10Hz~40GHz	May 13, 2020	Sep. 01, 2020 ~ Sep. 10, 2020	May 12, 2021	Conducted (TH05-HY)
Coupler	Warison	20dB 25W SMA Directional Coupler	#A	1-18GHz	Jan. 13, 2020	Sep. 01, 2020 ~ Sep. 10, 2020	Jan. 12, 2021	Conducted (TH05-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Dec. 26, 2019	Sep. 08, 2020 ~ Sep. 16, 2020	Dec. 25, 2020	Radiation (03CH12-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N-06	37059 & 01	30MHz~1GHz	Oct. 12, 2019	Sep. 08, 2020 ~ Sep. 16, 2020	Oct. 11, 2020	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1328	1GHz~18GHz	Nov. 14, 2019	Sep. 08, 2020 ~ Sep. 16, 2020	Nov. 13, 2020	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1522	1GHz ~ 18GHz	Sep. 19, 2019	Sep. 08, 2020 ~ Sep. 16, 2020	Sep. 18, 2020	Radiation (03CH12-HY)
Preamplifier	COM-POWER	PA-103	161075	10MHz~1GHz	Mar. 25, 2020	Sep. 08, 2020 ~ Sep. 16, 2020	Mar. 24, 2021	Radiation (03CH12-HY)
Preamplifier	Keysight	83017A	MY57280120	1GHz~26.5GHz	Jul. 20, 2020	Sep. 08, 2020 ~ Sep. 16, 2020	Jul. 19, 2021	Radiation (03CH12-HY)
Preamplifier	Jet-Power	JPA0118-55-303K	1710001800054002	1GHz~18GHz	Feb. 07, 2020	Sep. 08, 2020 ~ Sep. 16, 2020	Feb. 06, 2021	Radiation (03CH12-HY)
Spectrum Analyzer	Agilent	N9010A	MY54200485	10Hz~44GHz	Feb. 10, 2020	Sep. 08, 2020 ~ Sep. 16, 2020	Feb. 09, 2021	Radiation (03CH12-HY)
Signal Generator	Anritsu	MG3694C	163401	0.1Hz~40GHz	Feb. 15, 2020	Sep. 08, 2020 ~ Sep. 16, 2020	Feb. 14, 2021	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	9kHz~30MHz	Mar. 12, 2020	Sep. 08, 2020 ~ Sep. 16, 2020	Mar. 11, 2021	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0058/126E	30MHz~18GHz	Dec. 12, 2019	Sep. 08, 2020 ~ Sep. 16, 2020	Dec. 11, 2020	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz~40GHz	Feb. 25, 2020	Sep. 08, 2020 ~ Sep. 16, 2020	Feb. 24, 2021	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30MHz~40GHz	Feb. 25, 2020	Sep. 08, 2020 ~ Sep. 16, 2020	Feb. 24, 2021	Radiation (03CH12-HY)
Hygrometer	TECPEL	DTM-303B	TP140349	N/A	Oct. 25, 2019	Sep. 08, 2020 ~ Sep. 16, 2020	Oct. 24, 2020	Radiation (03CH12-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Sep. 08, 2020 ~ Sep. 16, 2020	N/A	Radiation (03CH12-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Sep. 08, 2020 ~ Sep. 16, 2020	N/A	Radiation (03CH12-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Sep. 08, 2020 ~ Sep. 16, 2020	N/A	Radiation (03CH12-HY)
Software	Audix	E3 6.2009-8-24	RK-000989	N/A	N/A	Sep. 08, 2020 ~ Sep. 16, 2020	N/A	Radiation (03CH12-HY)



6 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.07
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.21
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Appendix A. Test Results of Conducted Test

Conducted Output Power(Average power)

LTE Band 14 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
10	1	0	QPSK		23.67	
10	1	25			23.59	
10	1	49			23.60	
10	25	0			22.63	
10	25	12			22.64	
10	25	25			22.71	
10	50	0			22.63	
10	1	0	16-QAM		22.94	
10	1	25			22.95	
10	1	49			22.95	
10	25	0			21.65	
10	25	12			21.66	
10	25	25			21.71	
10	50	0			21.66	
10	1	0	64-QAM		21.90	
10	1	25			21.95	
10	1	49			21.83	
10	25	0			20.67	
10	25	12			20.69	
10	25	25			20.71	
10	50	0			20.66	
10	1	0	256-QAM		18.53	
10	1	25			18.55	
10	1	49			18.60	
10	25	0			18.52	
10	25	12			18.51	
10	25	25			18.54	
10	50	0			18.51	



LTE Band 14 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
5	1	0	QPSK	23.62	23.58	23.57
5	1	12		23.66	23.66	23.66
5	1	24		23.61	23.63	23.58
5	12	0		22.74	22.66	22.61
5	12	7		22.76	22.73	22.74
5	12	13		22.66	22.68	22.65
5	25	0		22.70	22.65	22.60
5	1	0	16-QAM	22.93	22.92	22.92
5	1	12		23.00	22.99	23.00
5	1	24		22.97	22.99	22.92
5	12	0		21.73	21.67	21.63
5	12	7		21.76	21.77	21.74
5	12	13		21.72	21.72	21.68
5	25	0		21.70	21.62	21.62
5	1	0	64-QAM	21.87	21.89	21.84
5	1	12		21.91	21.92	21.90
5	1	24		21.90	21.89	21.91
5	12	0		20.78	20.71	20.69
5	12	7		20.82	20.78	20.78
5	12	13		20.74	20.72	20.72
5	25	0		20.72	20.67	20.62
5	1	0	256-QAM	18.45	18.52	18.44
5	1	12		18.48	18.46	18.54
5	1	24		18.51	18.52	18.51
5	12	0		18.45	18.48	18.47
5	12	7		18.50	18.41	18.44
5	12	13		18.48	18.49	18.46
5	25	0		18.43	18.48	18.48



Appendix B. Test Results of ERP and Radiated Test

ERP

LTE Band 14 / 5MHz (Average) (GT - LC = 0.2 dB)							
Channel	Mode	RB		Conducted		ERP	
		Size	Offset	Power (dBm)	Power (Watts)	ERP(dBm)	ERP(W)
Lowest	QPSK	1	12	23.66	0.2323	21.71	0.1483
Middle		1	12	23.66	0.2323	21.71	0.1483
Highest		1	12	23.66	0.2323	21.71	0.1483
Lowest	16QAM	1	12	23.00	0.1995	21.05	0.1274
Middle		1	12	22.99	0.1991	21.04	0.1271
Highest		1	12	23.00	0.1995	21.05	0.1274
Lowest	64QAM	1	12	21.91	0.1552	19.96	0.0991
Middle		1	12	21.92	0.1556	19.97	0.0993
Highest		1	12	21.90	0.1549	19.95	0.0989
Lowest	256QAM	1	24	18.51	0.0710	18.71	0.0743
Middle		1	24	18.52	0.0711	18.72	0.0745
Highest		1	24	18.51	0.0710	18.71	0.0743
Limit	ERP < 3W			Result		PASS	

LTE Band 14 / 10MHz (Average) (GT - LC = 0.2 dB)							
Channel	Mode	RB		Conducted		ERP	
		Size	Offset	Power (dBm)	Power (Watts)	ERP(dBm)	ERP(W)
Lowest	QPSK	-	-	-	-	-	-
Middle		1	0	23.67	0.2328	21.72	0.1486
Highest		-	-	-	-	-	-
Lowest	16QAM	-	-	-	-	-	-
Middle		1	25	22.95	0.1972	21.00	0.1259
Highest		-	-	-	-	-	-
Lowest	64QAM	-	-	-	-	-	-
Middle		1	25	21.95	0.1567	20.00	0.1000
Highest		-	-	-	-	-	-
Lowest	256QAM	-	-	-	-	-	-
Middle		1	49	18.60	0.0724	18.80	0.0759
Highest		-	-	-	-	-	-
Limit	ERP < 3W			Result		PASS	



Radiated Spurious Emission

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)
Highest	1592	-63.35	-42.15	-21.20	-71.69	-68.75	0.90	8.45	H
	2384	-58.73	-13	-45.73	-72.19	-65.99	1.12	10.54	H
	3184	-57.58	-13	-44.58	-73.09	-65.87	1.30	11.74	H
	3976	-54.97	-13	-41.97	-73.35	-64.12	1.48	12.79	H
	4776	-51.73	-13	-38.73	-72.84	-60.70	1.52	12.64	H
									H
									H
	1592	-63.62	-42.15	-21.47	-71.55	-69.02	0.90	8.45	V
	2384	-59.04	-13	-46.04	-72.37	-66.30	1.12	10.54	V
	3184	-57.05	-13	-44.05	-73.04	-65.34	1.30	11.74	V
	3976	-55.05	-13	-42.05	-73.38	-64.20	1.48	12.79	V
	4776	-52.49	-13	-39.49	-72.96	-61.46	1.52	12.64	V
									V
									V

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



LTE Band 14 / 10MHz / 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	1576	-61.90	-42.15	-19.75	-70.36	-67.24	0.90	8.39	H
	2368	-58.74	-13	-45.74	-72.3	-65.98	1.12	10.52	H
	3152	-57.76	-13	-44.76	-73.22	-65.98	1.30	11.66	H
	3944	-52.91	-13	-39.91	-71.19	-62.05	1.48	12.77	H
	4728	-45.89	-13	-32.89	-66.88	-54.89	1.50	12.65	H
									H
									H
	1576	-63.35	-42.15	-21.20	-71.28	-68.69	0.90	8.39	V
	2368	-59.10	-13	-46.10	-72.43	-66.34	1.12	10.52	V
	3152	-57.25	-13	-44.25	-73.13	-65.47	1.30	11.66	V
	3944	-53.13	-13	-40.13	-71.41	-62.27	1.48	12.77	V
	4728	-46.87	-13	-33.87	-67.18	-55.87	1.50	12.65	V
									V
									V

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