FCC RF Test Report

APPLICANT	**: Inseego Corp.**
EQUIPMENT	**: wireless device**
BRAND NAME	**: Inseego**
MODEL NAME	**: FG20003**
FCC ID	**: PKRISGFG20003**
STANDARD	**: 47 CFR Part 2, 90(R)**
CLASSIFICATION	**: PCS Licensed Transmitter (PCB)**

The product was received on Aug. 28, 2020 and completely tested on Sep. 24, 2020. We, Sporton International (Kunshan) Inc., would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.26 and shown compliance with the applicable technical standards.

This product installed a RF module (Brand Name: Inseego, Model Name: MD2000, FCC ID: PKRISGMD2000) during the test, only ERP and RSE test items are tested in this report, all the other test results are quoted on module RF report.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (Kunshan) Inc., the test report shall not be reproduced except in full.

Jason Jia

Reviewed by: Jason Jia / Supervisor

James Huang

Approved by: James Huang / Manager

Sporton International (Kunshan) Inc.
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People's Republic of China

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FG082811E	Rev. 01	Initial issue of report	Nov. 25, 2020

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	§2.1046	Conducted Output Power	Reporting only	PASS	1
	§90.542 (a)(6)	Effective Radiated Power	ERP < 30Watt	PASS	-
-	-	Peak-to-Average Ratio	Reporting only	-	1
-	§2.1049	Occupied Bandwidth	Reporting only	PASS	1
-	§2.1053 §90.543 (e)(2)(3)	Conducted Band Edge Measurement	Refer standard	PASS	1
-	§2.1051 §90.210(n)	Emission Mask	Mask B	PASS	1
-	§2.1053 §90.543 (e)(3)	Conducted Spurious Emission	< $43+10\log_{10}$(P[Watts])	PASS	1
-	§2.1055 §90.539 (e)	Frequency Stability Temperature & Voltage	< ±1.25 ppm	PASS	1
4.4	§2.1053 §90.543 (e)(3) §90.543 (f)	Radiated Spurious Emission	< $43+10\log_{10}$(P[Watts])	PASS	Under limit 25.39 dB at 1582.000 MHz

Note:

1. All conducted test items were leveraged from module RF report which can refer to Report No. "FG090125E"

2. The maximum power of host is lower than and very close to the module, therefore, we chose higher power of the module to calculate the ERP and show in the report.

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.

1 General Description

1.1 Applicant

Inseego Corp.
9710 Scranton Road, Suite 200 San Diego, CA 92121

1.2 Manufacturer

MeiG Smart Technology Co., Ltd
Floor 2, Office Building No.5, Lingxia Road, Fenghuang Community, Fuyong Street, Bao 'an District, Shenzhen

1.3 Feature of Equipment Under Test

Product Feature	
Equipment	wireless device
Brand Name	Inseego
Model Name	FG20003
FCC ID	PKRISGFG20003
Tx Frequency	LTE Band 14: 790.5 MHz ~ 795.5 MHz
Rx Frequency	LTE Band 14: 760.5 MHz ~ 765.5 MHz
Bandwidth	5MHz / 10MHz
Maximum Output Power to Antenna	23.71 dBm
Antenna Gain	1.8 dBi
Type of Modulation	QPSK / 16QAM / 64QAM / 256QAM
IMEI Code	Radiation: 990016260002868/990016260002744
HW Version	FG20003_SRT860H_V2.1
SW Version	1
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Maximum ERP Power, Frequency Tolerance, and Emission Designator

LTE Band 14		QPSK			16QAM		
BW (MHz)	Frequency Range (MHz)	Emission Designator (99%OBW)	Frequency Tolerance (ppm)	Maximum ERP(W)	Emission Designator (99%OBW)	Frequency Tolerance (ppm)	Maximum ERP(W)
5	790.5~795.5	-	-	0.2153	-	-	0.1837
10	793	-	-	0.2168	-	-	0.1832
LTE Band 14		64QAM			256QAM		
BW (MHz)	Frequency Range (MHz)	Emission Designator (99%OBW)	Frequency Tolerance (ppm)	Maximum ERP(W)	Emission Designator (99%OBW)	Frequency Tolerance (ppm)	Maximum ERP(W)
5	790.5~795.5	-	-	0.1439	-	-	0.0708
10	793	-	-	0.1419	-	-	0.0710

1.5 Testing Site

Sporton International (Kunshan) Inc. is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International (Kunshan) Inc.		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	03CH04-KS	CN1257	314309

1.6 Test Software

Item	Site	Manufacture	Name	Version
1.	03CH04-KS	AUDIX	E3	6.2009-8-24a

1.7 Applied Standards

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

- 47 CFR Part 2, Part 90(R)
- ANSI C63.26
- KDB 971168 D01 Power Meas License Digital Systems v03r01
- KDB 412172 D01 Determining ERP and EIRP 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.

2 Test Configuration of Equipment Under Test

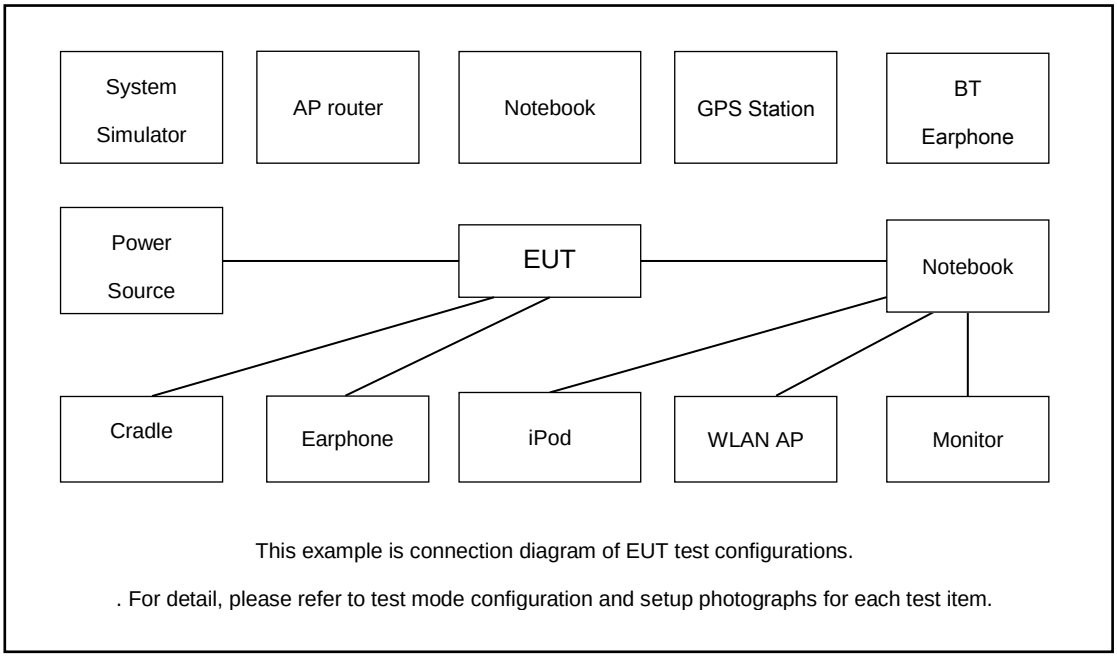
2.1 Test Mode

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.

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes to find the maximum emission.

Conducted Test Cases	Band	Bandwidth (MHz)						Modulation				RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	64QAM	256QAM	1	Half	Full	L	M	H
E.R.P	14	-	-	V		-	-	V	V	V	V	V			V	V	V
	14	-	-		V	-	-	V	V	V	V	V				V	
Radiated Spurious Emission	14	-	-	V	V	-	-	V				V				V	
Note	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



This example is connection diagram of EUT test configurations.

. For detail, please refer to test mode configuration and setup photographs for each test item.

2.3 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	LTE Base Station	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
2.	DC Power Supply	GW INSTEK	GPS-3030D	N/A	N/A	Unshielded, 1.8 m

3 Conducted Test Items

3.1 Conducted Output Power and ERP

3.1.1 Description of the Conducted Output Power Measurement and ERP

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.

Control stations and mobile stations transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to 30 watts ERP.

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

3.1.2 Test Procedures

1. The testing follows ANSI C63.26 Section 5.2
2. The transmitter output port was connected to the system simulator.
3. Set EUT at maximum power through the system simulator.
4. Select lowest, middle, and highest channels for each band and different modulation.
5. Measure and record the power level from the system simulator.

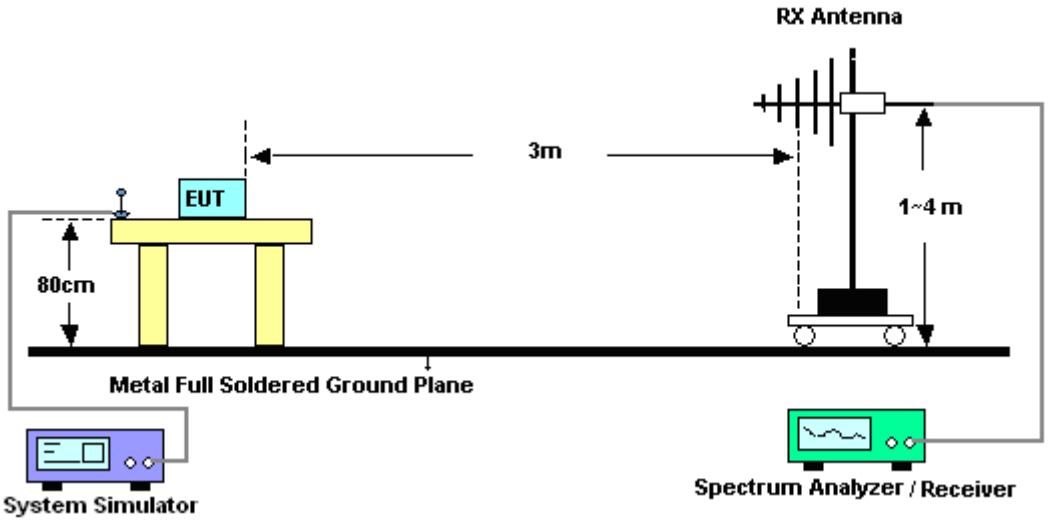
4 Radiated Test Items

4.1 Measuring Instruments

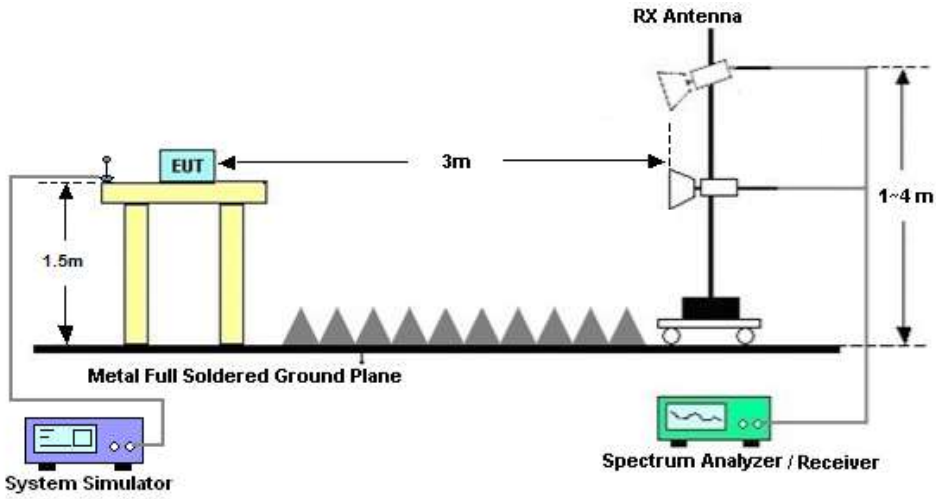
See list of measuring instruments of this test report.

4.2 Test Setup

4.2.1 For radiated test from 30MHz to 1GHz



4.2.2 For radiated test above 1GHz



4.3 Test Result of Radiated Test

Please refer to Appendix B.

4.4 Radiated Spurious Emission Measurement

4.4.1 Description of Radiated Spurious Emission

The radiated spurious emission was measured by substitution method according to ANSI C63.26. 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.

4.4.2 Test Procedures

1. The testing follows ANSI C63.26 Section 5.5
1. The EUT was placed on a turntable with 0.8 meter height for frequency below 1GHz and 1.5 meter height for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the receiving antenna 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 1m to 4m to search the maximum spurious emission for both horizontal and vertical polarizations.
5. During the measurement, the system simulator parameters were set to force the EUT transmitting at maximum output power.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
7. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
8. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
9. EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain
10. ERP (dBm) = EIRP - 2.15
11. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
    The limit line is derived from 43 + 10log(P)dB below the transmitter power P(Watts)
    = P(W)- [43 + 10log(P)] (dB)
    = [30 + 10log(P)] (dBm) - [43 + 10log(P)] (dB)
    = -13dBm.

5 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EXA Spectrum Analyzer	Keysight	N9010A	MY55150244	10Hz-44G,MAX 30dB	Apr. 15, 2020	Sep. 24, 2020	Apr. 14, 2021	Radiation (03CH04-KS)
Bilog Antenna	TeseQ	CBL6111D	49922	30MHz-1GHz	Jan. 03, 2020	Sep. 24, 2020	Jan. 02, 2021	Radiation (03CH04-KS)
Horn Antenna	Schwarzbeck	BBHA9120D	1356	1GHz~18GHz	Apr. 20, 2020	Sep. 24, 2020	Apr. 19, 2021	Radiation (03CH04-KS)
SHF-EHF Horn	Com-power	AH-840	101115	18GHz~40GHz	Nov. 10, 2019	Sep. 24, 2020	Nov. 09, 2020	Radiation (03CH04-KS)
Amplifier	SONOMA	310N	187289	9KHz-1GHz	Jan. 03, 2020	Sep. 24, 2020	Jan. 02, 2021	Radiation (03CH04-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 08, 2020	Sep. 24, 2020	Jan. 07, 2021	Radiation (03CH04-KS)
high gain Amplifier	MITEQ	AMF-7D-00101800-30-10P	2025788	1Ghz-18Ghz	Jan. 03, 2020	Sep. 24, 2020	Jan. 02, 2021	Radiation (03CH04-KS)
Amplifier	Keysight	83017A	MY57280106	500MHz~26.5GHz	Oct. 15, 2019	Sep. 24, 2020	Oct. 14, 2020	Radiation (03CH04-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Sep. 24, 2020	NCR	Radiation (03CH04-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Sep. 24, 2020	NCR	Radiation (03CH04-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Sep. 24, 2020	NCR	Radiation (03CH04-KS)

NCR: No Calibration Required

6 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.26-2015. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.3dB**

Uncertainty of Radiated Emission Measurement (1GHz ~ 40GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.8dB**

Appendix A. Test Results of Conducted Test

ERP

LTE Band 14 (G_T - L_C = 1.8 dBi) QPSK						
Bandwidth	5M				10M	
Channel	23305	23330	23355		23330	
	(Low)	(Mid)	(High)		(Mid)	
Frequency (MHz)	790.5	793	795.5		793	
Conducted Power (dBm)	23.68	23.61	23.53		23.71	
Conducted Power (Watts)	0.2333	0.2296	0.2254		0.2350	
ERP(dBm)	23.33	23.26	23.18		23.36	
ERP(Watts)	0.2153	0.2118	0.2080		0.2168	

LTE Band 14 (G_T - L_C = 1.8 dBi) 16QAM						
Bandwidth	5M				10M	
Channel	23305	23330	23355		23330	
	(Low)	(Mid)	(High)		(Mid)	
Frequency (MHz)	790.5	793	795.5		793	
Conducted Power (dBm)	22.99	22.93	22.77		22.98	
Conducted Power (Watts)	0.1991	0.1963	0.1892		0.1986	
ERP(dBm)	22.64	22.58	22.42		22.63	
ERP(Watts)	0.1837	0.1811	0.1746		0.1832	

LTE Band 14 (G_T - L_C = 1.8 dBi) 64QAM						
Bandwidth	5M				10M	
Channel	23305	23330	23355		23330	
	(Low)	(Mid)	(High)		(Mid)	
Frequency (MHz)	790.5	793	795.5		793	
Conducted Power (dBm)	21.93	21.88	21.80		21.87	
Conducted Power (Watts)	0.1560	0.1542	0.1514		0.1538	
ERP(dBm)	21.58	21.53	21.45		21.52	
ERP(Watts)	0.1439	0.1422	0.1396		0.1419	

LTE Band 14 (G_T - L_C = 1.8 dBi) 256QAM						
Bandwidth	5M				10M	
Channel	23305	23330	23355		23330	
	(Low)	(Mid)	(High)		(Mid)	
Frequency (MHz)	790.5	793	795.5		793	
Conducted Power (dBm)	18.80	18.85	18.68		18.86	
Conducted Power (Watts)	0.0759	0.0767	0.0738		0.0769	
ERP(dBm)	18.45	18.50	18.33		18.51	
ERP(Watts)	0.0700	0.0708	0.0681		0.0710	

Appendix B. Test Results of Radiated Test

Field Strength of Spurious Radiated

LTE Band 14 / QPSK / RB Size 1 Offset 0								
Bandwidth	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Over Limit (dB)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
5MHz	1582	-67.90	-42.15	-25.75	-70.53	1.09	5.87	H
	2372	-65.95	-13	-52.95	-68.35	1.37	5.92	H
	3162	-64.17	-13	-51.17	-68.06	1.64	7.68	H
	1582	-67.54	-42.15	-25.39	-70.17	1.09	5.87	V
	2372	-66.22	-13	-53.22	-68.62	1.37	5.92	V
	3162	-64.22	-13	-51.22	-68.11	1.64	7.68	V
10MHz	1578	-68.27	-42.15	-26.12	-70.90	1.09	5.87	H
	2366	-66.86	-13	-53.86	-69.26	1.37	5.92	H
	3156	-64.39	-13	-51.39	-68.28	1.64	7.68	H
	1578	-67.84	-42.15	-25.69	-70.47	1.09	5.87	V
	2366	-66.60	-13	-53.60	-69.00	1.37	5.92	V
	3156	-64.52	-13	-51.52	-68.41	1.64	7.68	V
	Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.							
Test Result					PASS			