FCC TEST REPORT

Product Name:	King Solutions 2G Tracker
Trade Mark:	KINGTRACKER
Model No.:	T12SE-KING
Report Number:	180719001RFM-1
Test Standards:	FCC 47 CFR Part 24 Subpart E FCC 47 CFR Part 2
FCC ID:	2APJT-GC658792
Test Result:	PASS
Date of Issue:	July 22, 2019

Prepared for:

King Solutions, Inc.
11011 Holly Lane N,Dayton Minnesota United States

Prepared by:

Shenzhen UnionTrust Quality and Technology Co., Ltd.
16/F, Block A, Building 6, Baoneng Science and Technology Park,
Qingxiang Road No.1, Longhua New District, Shenzhen, China
TEL: +86-755-2823 0888
FAX: +86-755-2823 0886

Tested by: Henry Lu, Team Leader

Reviewed by: Kevin Liang, Assistant Manager

Approved by: Billy Li, Technical Director

Date: July 22, 2019

Version

Version No.	Date	Description
V1.0	July 22, 2019	Original

CONTENTS

1. GENERAL INFORMATION 4
   1.1 CLIENT INFORMATION 4
   1.2 EUT INFORMATION 4
      1.2.1 GENERAL DESCRIPTION OF EUT 4
      1.2.2 DESCRIPTION OF ACCESSORIES 4
   1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD 4
   1.4 DESCRIPTION OF SUPPORT UNITS 5
   1.5 TEST LOCATION 5
   1.6 TEST FACILITY 5
   1.7 DEVIATION FROM STANDARDS 5
   1.8 ABNORMALITIES FROM STANDARD CONDITIONS 5
   1.9 OTHER INFORMATION REQUESTED BY THE CUSTOMER 5
   1.10 MEASUREMENT UNCERTAINTY 6
2. TEST SUMMARY 7
3. EQUIPMENT LIST 8
4. TEST CONFIGURATION 9
   4.1 ENVIRONMENTAL CONDITIONS FOR TESTING 9
      4.1.1 NORMAL OR EXTREME TEST CONDITIONS 9
   4.2 TEST SETUP 10
      4.2.1 FOR RADIATED EMISSIONS TEST SETUP 10
      4.2.2 FOR CONDUCTED RF TEST SETUP 12
   4.3 TEST CHANNELS 13
   4.4 SYSTEM TEST CONFIGURATION 13
   4.5 PRE-SCAN 13
5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION 14
   5.1 REFERENCE DOCUMENTS FOR TESTING 14
   5.2 EQUIVALENT ISOTROPIC RADIATED POWER (EIRP) 14
   5.3 CONDUCTED OUTPUT POWER 16
   5.4 PEAK-TO-AVERAGE RATIO 17
   5.5 99%&26DB BANDWIDTH 19
   5.6 BAND EDGE AT ANTENNA TERMINALS 21
   5.7 SPURIOUS EMISSIONS AT ANTENNA TERMINALS 22
   5.8 FIELD STRENGTH OF SPURIOUS RADIATION 24
      5.8.1 RADIATED EMISSION TEST DATA 25
   5.9 FREQUENCY STABILITY 28

APPENDIX 1 PHOTOS OF TEST SETUP 29
APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS 29

1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	King Solutions, Inc.
Address of Applicant:	11011 Holly Lane N,Dayton Minnesota United States
Manufacturer:	VJOY Car Electronics Limited
Address of Manufacturer:	405 ZEHUA BULDING, 988 MEI LONG ROAD, LONGHUA, SHENZHEN, CHINA

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	King Solutions 2G Tracker	
Model No.:	T12SE-KING	
Trade Mark:	KINGTRACKER	
DUT Stage:	Identical Prototype	
EUT Supports Function:	Band:	GPRS 1900
Software Version:	V1.003	
Hardware Version:	AK-GT38-V2.0	
Sample Received Date:	June 19, 2018	
Sample Tested Date:	June 19, 2018 to July 15, 2019	

1.2.2 Description of Accessories

Battery	
Trade Mark:	N/A
Model No.:	ICR18650
Battery Type:	Lithium-ion Polymer Rechargeable Battery
Rated Voltage:	3.7 Vdc
Rated Capacity:	2600 mAh
Manufacturer:	ZHUHAI GREAT POWER ENERGY CO.,LTD

Cable	
Description:	USB Micro-B Plug Cable
Cable Type:	Shielded without ferrite
Length:	0.62 Meter

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Support Networks:	GPRS	
Type of Modulation:	GPRS:	GMSK
Frequency Range:	GPRS 1900:	1850.2-1909.8 MHz
Type of Emission:	GPRS 1900:	248KGXW
Antenna Type:	FPCB Antenna	
Antenna Gain:	1 dBi	
GPRS Class:	Class 33	
Normal Test Voltage:	3.7 Vdc	
Extreme Test Voltage:	3.5 to 4.2Vdc	
Extreme Test Temperature:	-10 °C to +55 °C	

1.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Antenna Cable	SMA	0.30 Meter	UnionTrust

1.5 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China 518109
Telephone: +86 (0) 755 2823 0888
Fax: +86 (0) 755 2823 0886

1.6 TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L9069
The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC/EN 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

IC-Registration No.: 21600-1
The 3m Semi-anechoic chamber of Shenzhen UnionTrust Quality and Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 21600-1.

A2LA-Lab Certificate No.: 4312.01
Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC Accredited Lab.
Designation Number: CN1194
Test Firm Registration Number: 259480

1.7 DEVIATION FROM STANDARDS

None.

1.8 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.9 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.10 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product 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.

No.	Item	Measurement Uncertainty
1	Conducted emission 9KHz-150KHz	±3.8 dB
2	Conducted emission 150KHz-30MHz	±3.4 dB
3	Radiated emission 9KHz-30MHz	±4.9 dB
4	Radiated emission 30MHz-1GHz	±4.7 dB
5	Radiated emission 1GHz-18GHz	±5.1 dB
6	Radiated emission 18GHz-26GHz	±5.2 dB
7	Radiated emission 26GHz-40GHz	±5.2 dB

2. TEST SUMMARY

FCC 47 CFR Part 24 Subpart E Test Cases			
Test Item	**Test Requirement**	**Test Method**	**Result**
Equivalent Isotropic Radiated Power (EIRP)	FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 24.232(c)	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02	PASS
Conducted Output Power	FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 24.232(c)	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02	PASS
Peak-to-average ratio	FCC 47 CFR Part 24.232(d)	KDB 971168 D01v02r02	PASS
99%&26dB Bandwidth	FCC 47 CFR Part 2.1049(h) & FCC 47 CFR Part 24.238(b)	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02	PASS
Band Edge at antenna terminals	FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 24.238(a)	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02	PASS
Spurious emissions at antenna terminals	FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 24.238(a)(b)	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02	PASS
Field strength of spurious radiation	FCC 47 CFR Part 2.1053 & FCC 47 CFR Part 24.238(a)(b)	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02	PASS
Frequency stability	FCC 47 CFR Part 2.1055 & FCC 47 CFR Part 24.235	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02	PASS

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☒	3M Chamber & Accessory Equipment	ETS-LINDGREN	3M	N/A	Dec. 03, 2018	Dec. 03, 2021
☒	Receiver	R&S	ESIB26	100114	Nov. 24, 2018	Nov. 24, 2019
☐	Loop Antenna	ETS-LINDGREN	6502	00202525	Dec. 03, 2018	Dec. 03, 2019
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Dec. 08, 2018	Dec. 08, 2019
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	Dec. 08, 2018	Dec. 08, 2019
☒	Preamplifier	HP	8447F	2805A02960	Nov. 24, 2018	Nov. 24, 2019
☒	Broadband Antenna (Pre-amplifier)	ETS-LINDGREN	3142E-PA	00201891	May 19, 2018	May 18, 2020
☒	6dB Attenuator	Talent	RA6A5-N-18	18103002	Nov. 24, 2018	Nov. 24, 2019
☒	Horn Antenna	ETS-LINDGREN	3117	00164202	Dec. 08, 2018	Dec. 08, 2019
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201874	May 22, 2018	May 18, 2020
☐	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	Jan. 05, 2019	Jan. 05, 2020
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☒	Highpass Filter (1.2GHz~18GHz)	Micro-Tronics	HPM50108	G552	Nov. 29, 2018	Nov. 29, 2019
☒	Highpass Filter (3GHz~18GHz)	Micro-Tronics	HPM50117	G005	Nov. 29, 2018	Nov. 29, 2019
☒	Wideband Radio Communication Tester	R&S	CMW500	116254	Jun. 07, 2019	Jun. 07, 2020
☒	Test Software	Audix	e3	Software Version: 9.160333		

RF Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☒	Receiver	R&S	ESR7	1316.3003K07 -101181-K3	Nov. 24, 2018	Nov. 24, 2019
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY57471561	Nov. 24, 2018	Nov. 24, 2019
☒	Wideband Radio Communication Tester	R&S	CMW500	116254	Jun. 07, 2019	Jun. 07, 2020
☒	DC Source	KIKUSUI	PWR400L	LK003024	Sep. 18, 2018	Sep. 18, 2019
☐	Temp & Humidity chamber	Espec	GL(U)04K A(W)	16921H201P3	Sep. 20, 2018	Sep. 20, 2019
☒	Temp & Humidity chamber	Votisch	VT4002	58566133290 020	Jun. 05, 2018	Jun. 05, 2020

4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

Test Environment	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage (V)	Relative Humidity (%)
TN/VN	+15 to +35	3.7	20 to 75
TL/VL	-10	3.5	20 to 75
TH/VL	+55	3.5	20 to 75
TL/VH	-10	4.2	20 to 75
TH/VH	+55	4.2	20 to 75

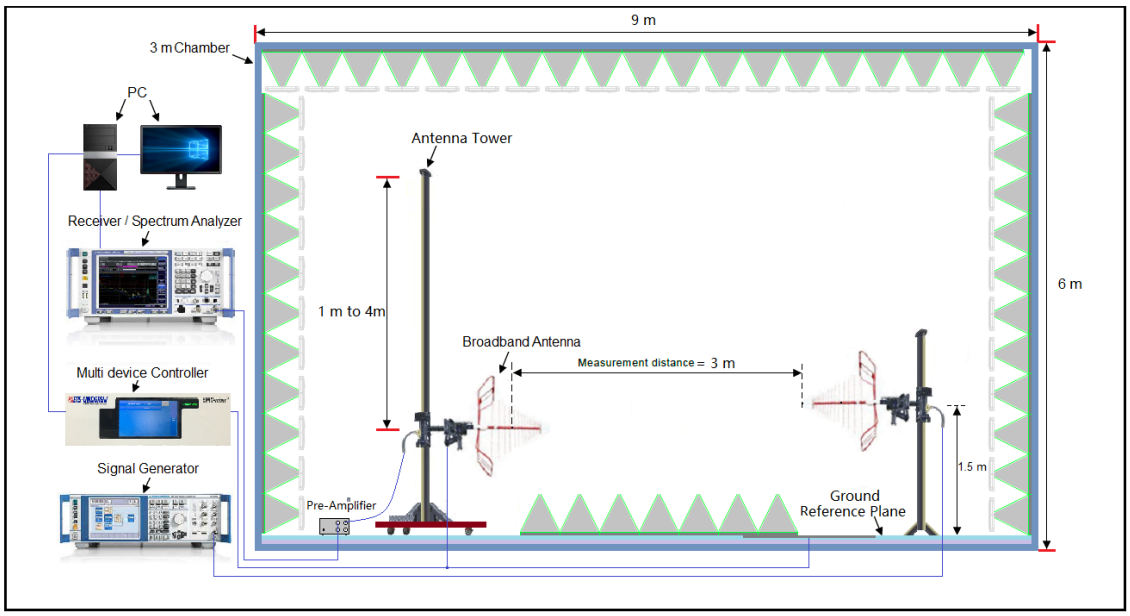
Remark:

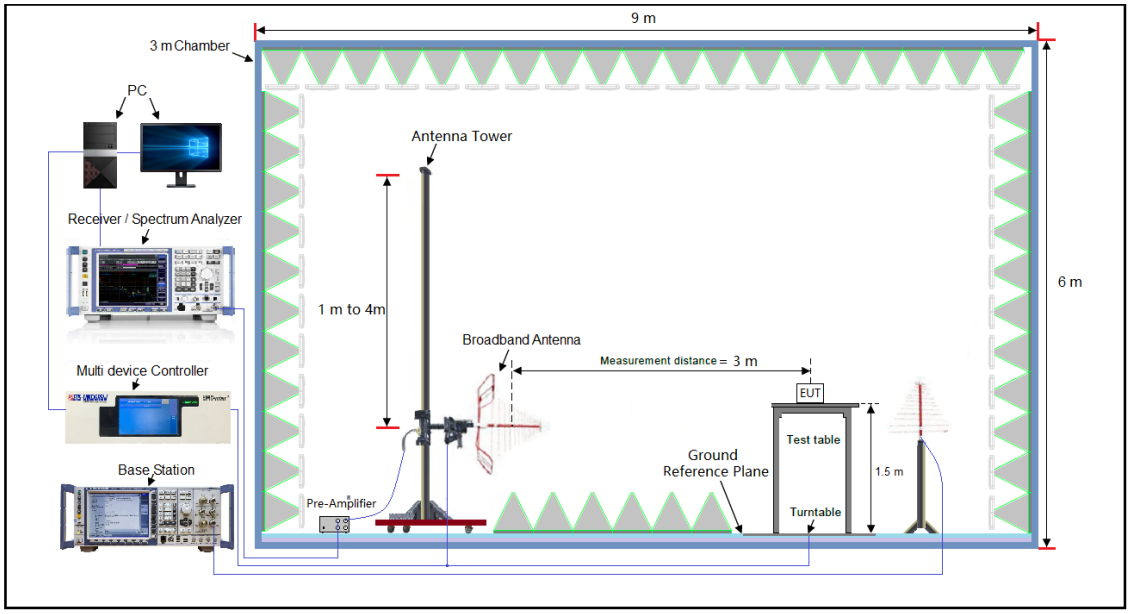
1) The EUT just work in such extreme temperature of -10 °C to +55 °C and the extreme voltage of 3.5 V to 4.2 V, so here the EUT is tested in the temperature of -10 °C to +55 °C and the voltage of 3.5 V to 4.2 V.
2) VN: Normal Voltage; TN: Normal Temperature;
   TL: Low Extreme Test Temperature; TH: High Extreme Test Temperature;
   VL: Low Extreme Test Voltage; VH: High Extreme Test Voltage.

4.2 TEST SETUP

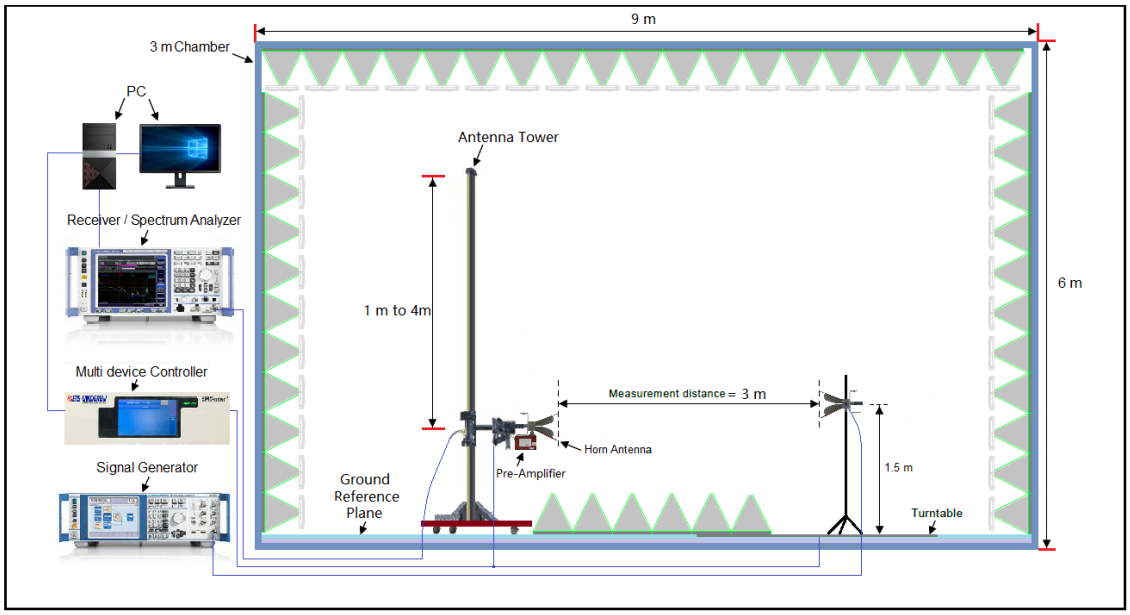
4.2.1 For Radiated Emissions test setup

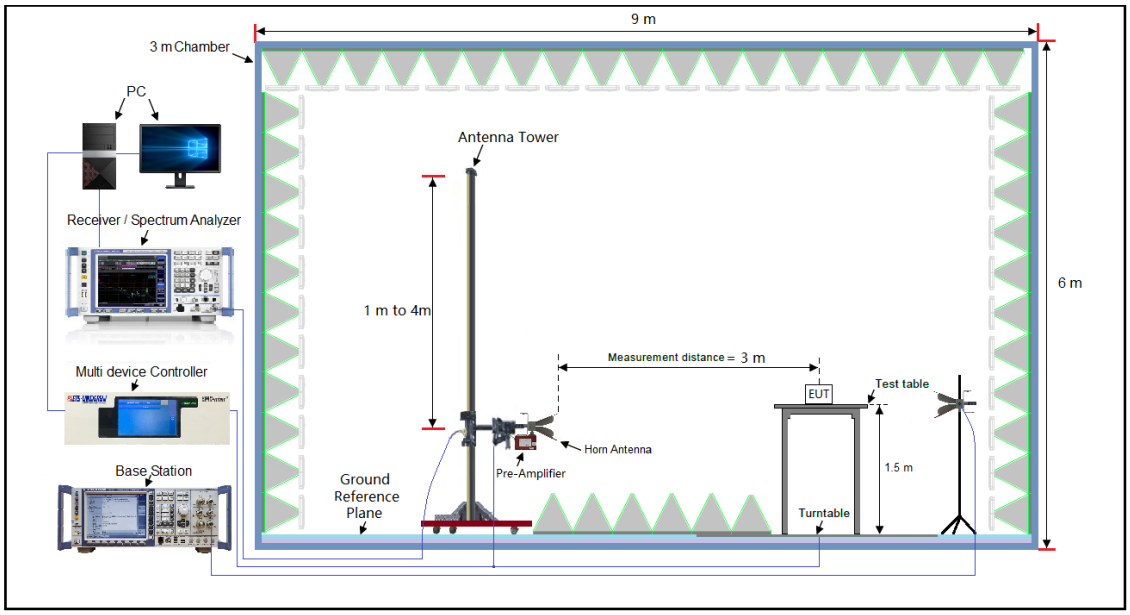
Setup - 1_ERP Test setup



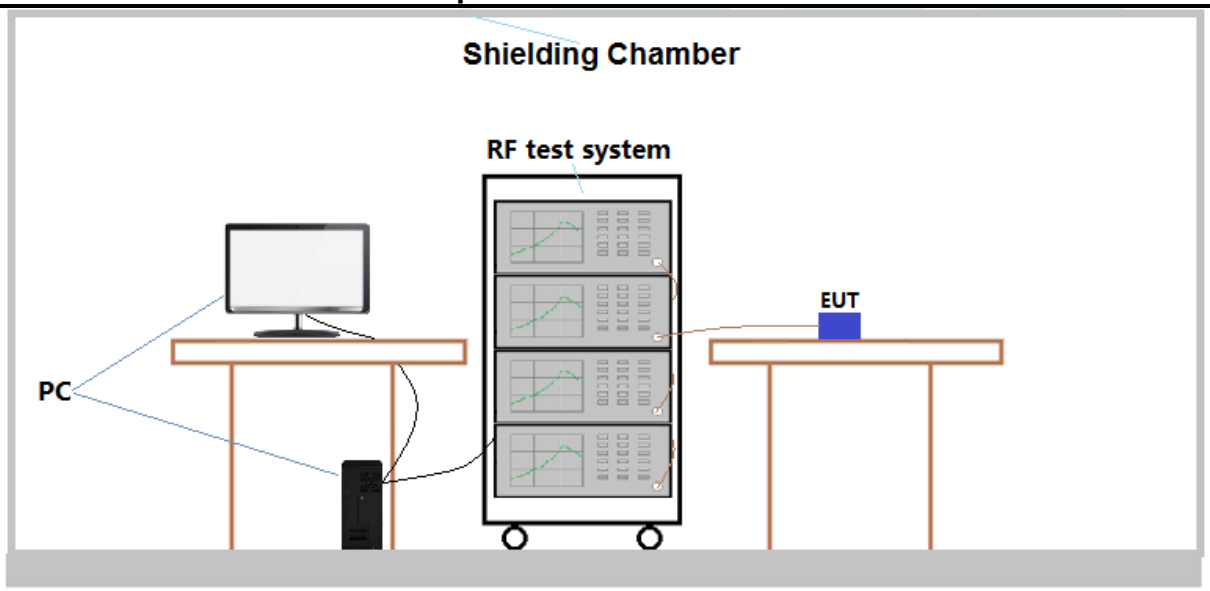


Setup - 2_EIRP Test setup

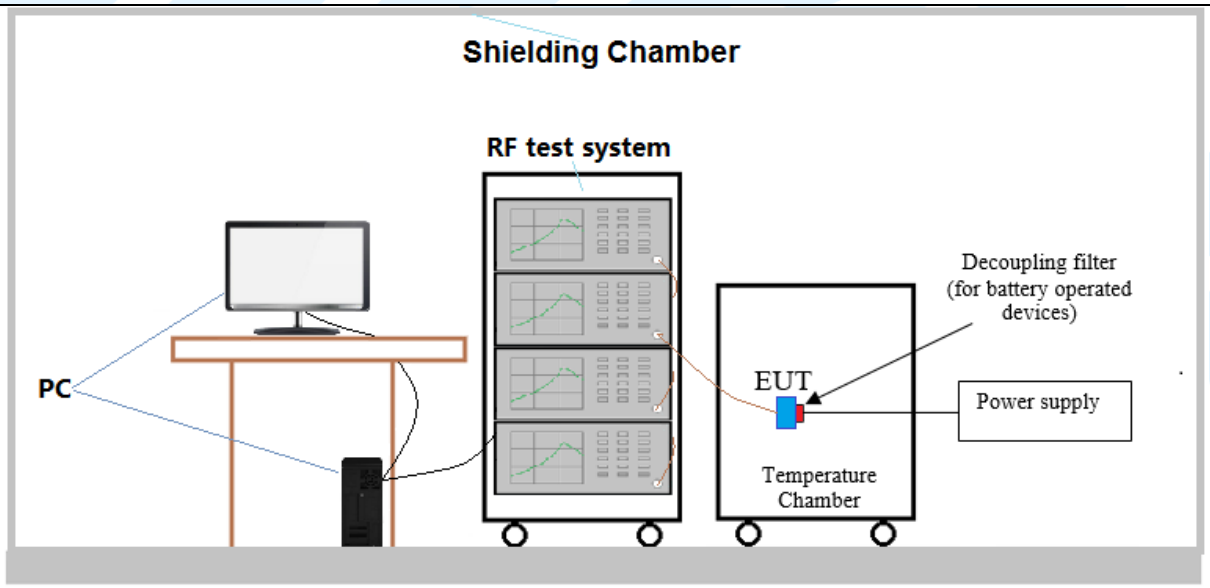




4.2.2 For Conducted RF test setup



Normal Environment



Extreme Environment

4.3 TEST CHANNELS

Band	Tx/Rx Frequency	RF Channel		
		Low(L)	Middle(M)	High(H)
GPRS 1900	Tx (1850 MHz-1910 MHz)	Channel 512	Channel 661	Channel 810
		1850.2 MHz	1880.0 MHz	1909.8 MHz

4.4 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. It was powered by a 3.7Vdc rechargeable Li-on battery. Only the worst case data were recorded in this test report.

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, X/Y/Z axis, and antenna ports.
The worst case was found when positioned as the table below.

Band	Mode	Antenna Port	Worst-case axis positioning
GPRS 1900	1TX	Chain 0	X axis

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000MHz. The resolution is 1 MHz or greater for frequencies above 1000MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4.5 PRE-SCAN

Pre-scan under all rate at lowest middle and highest channel, find the transmitter power as below:

GPRS 1900 Maximum Average Power (dBm)			
Channel	**512**	**661**	**810**
Frequency(MHz)	**1850.2 MHz**	**1880.0 MHz**	**1909.8 MHz**
GPRS (GMSK, 1Tx-slot)	28.85	28.96	28.23
GPRS (GMSK, 2Tx-slot)	28.18	28.32	28.49
GPRS (GMSK, 3Tx-slot)	27.19	27.26	27.78
GPRS (GMSK, 4Tx-slot)	26.39	26.42	26.33

Pre-scan all bandwidth, find worse case mode are chosen to the report, the worse mode applicability and tested channel detail as below:

Band	Radiated	Conducted
GPRS 1900	1) GPRS (GMSK, 1Tx-slot) Link	1) GPRS (GMSK, 1Tx-slot) Link

5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part 2 Subpart J	Frequency allocations and radio treaty matters; general rules and regulations
2	FCC 47 CFR Part 24 Subpart E	PART 24 – PERSONAL COMMUNICATIONS SERVICES Subpart E – Broadband PCS
3	ANSI/TIA-603-D 2010	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
4	KDB 971168 D01	KDB 971168 D01 Power Meas License Digital Systems v02r02

5.2 EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

Test Requirement: FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 24.232(c)

Test Method: KDB 971168 D01v02r02 & ANSI/TIA/EIA-603-D 2010

Limit:

Mobile and portable stations are limited to 2 watts EIRP.

Test Procedure:

Test procedure as below:

1) The EUT was powered ON and placed on a 0.8/1.5m high table at a 3 meter semi/fully Anechoic Chamber. The antenna of the transmitter was extended to its maximum length. Modulation mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.
2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3) The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
4) Steps 1) to 3) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
5) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.
6) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 3) is obtained for this set of conditions.
7) The output power into the substitution antenna was then measured.
8) Steps 6) and 7) were repeated with both antennas polarized.
9) Calculate power in dBm by the following formula:

$$ERP(dBm) = Pg(dBm) – cable\ loss\ (dB) + antenna\ gain\ (dBd)$$
$$EIRP(dBm) = Pg(dBm) – cable\ loss\ (dB) + antenna\ gain\ (dBi)$$
$$EIRP=ERP+2.15dB$$

where:
Pg is the generator output power into the substitution antenna.

10) Test the EUT in the lowest channel, the middle channel the Highest channel
11) The radiation measurements are performed in X, Y, Z axis positioning for EUT operation mode, and found the X axis positioning which it is worse case.
12) Repeat above procedures until all frequencies measured was complete.

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
30MHz-1GHz	Peak	100kHz	300kHz	Peak
Above 1GHz	Peak	1MHz	3MHz	Peak

Test Setup: Refer to section 4.2.1 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Pass

Test Data: See table below

Maximum EIRP (dBm)			
Channel	**GPRS 1Tx-slot**	**Limit (dBm)**	**Result**
Lowest	29.85	33.01	Pass
Middle	28.96	33.01	Pass
Highest	28.23	33.01	Pass

5.3 CONDUCTED OUTPUT POWER

Test Requirement: FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 24.232(c)

Test Method: ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02

Limit:

Mobile and portable stations are limited to 2 watts EIRP.

Test Procedure:

The EUT was set up for the maximum power with GSM, GPRS, EDGE, WCDMA, CDMA2000, and LTE link data modulation and link up with simulator. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.2.2 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Pass

Test Data: The full result refer to section 4.5 for details.

5.4 PEAK-TO-AVERAGE RATIO

Test Requirement: FCC 47 CFR Part 24.232(d)

Test Method: KDB 971168 D01v02r02

Limit: In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB

Test Procedure:

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer.

a) Set resolution/measurement bandwidth ≥ signal's occupied bandwidth
b) Set the number of counts to a value that stabilizes the measured CCDF curve
c) Record the maximum PAPR level associated with a probability of 0.1 %

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.2.2 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Pass

Test Data: See table below

Peak-to-average ratio (dB)			
Channel	**GPRS 1Tx-slot**	**Limit (dB)**	**Result**
Lowest	1.15	13	Pass
Middle	1.04	13	Pass
Highest	0.68	13	Pass

The test plot as follows:

GPRS 1Tx-slot	
Lowest Channel	**Middle Channel**
Highest Channel	

5.5 99%&26DB BANDWIDTH

Test Requirement: FCC 47 CFR Part 2.1049(h) & FCC 47 CFR Part 24.238(b)

Test Method: ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02

Limit: No Limit

Test Procedure:

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band. The 99% and -26dB bandwidths was also measured and recorded.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.2.2 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

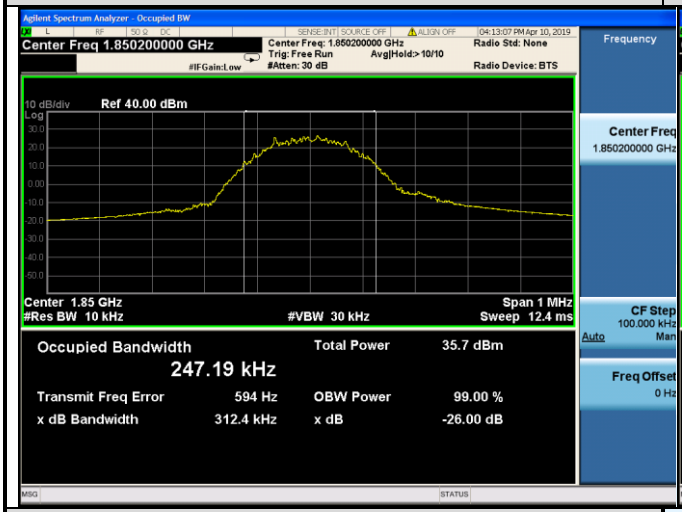
Test Results: Pass

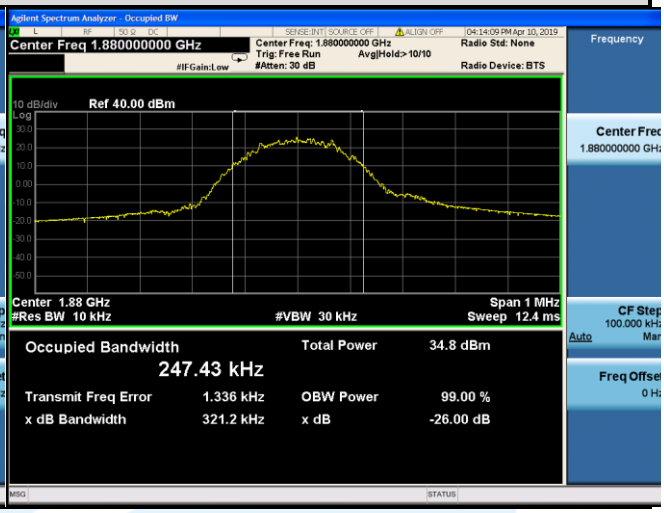
Test Data: See table below

99% & 26 dB Bandwidth				
Test Mode	**Channel**	**Frequency (MHz)**	**26 dB BW (kHz)**	**99% BW (kHz)**
GPRS 1Tx-slot	512	1850.2	312.4	247.19
	661	1880.0	321.2	247.43
	810	1909.8	318.9	248.14

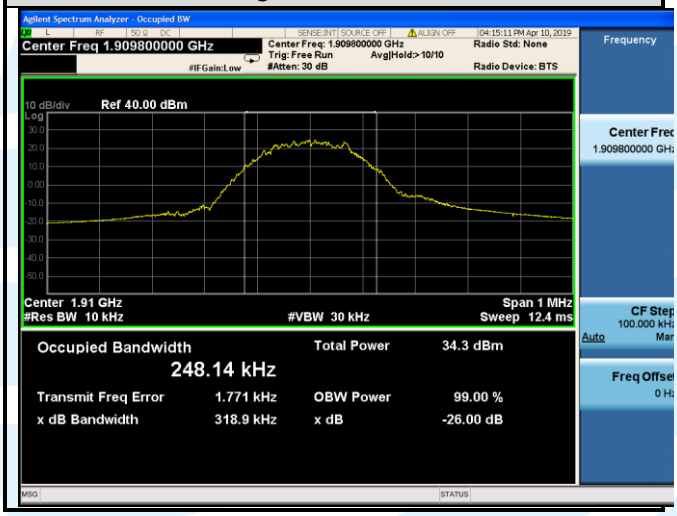
The test plot as follows:

GPRS 1Tx-slot	
Lowest Channel	**Middle Channel**





Highest Channel



5.6 BAND EDGE AT ANTENNA TERMINALS

Test Requirement: FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 24.238(a)

Test Method: ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02

Limit:

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB. The emission limit equal to -13 dBm

Test Procedure:

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer.

For each band edge measurement:

1) Set the spectrum analyzer span to include the block edge frequency.
2) Set a marker to point the corresponding band edge frequency in each test case.
3) Set display line at -13 dBm
4) Set resolution bandwidth to at least 1% of emission bandwidth.
5) Set spectrum analyzer with RMS detector.
6) Record the max trace plot into the test report

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

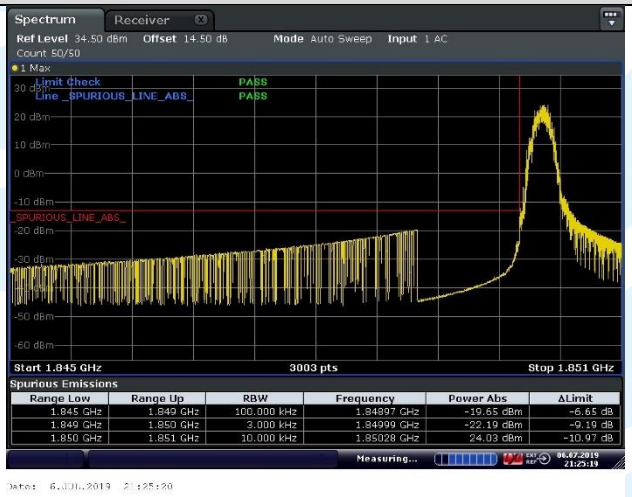
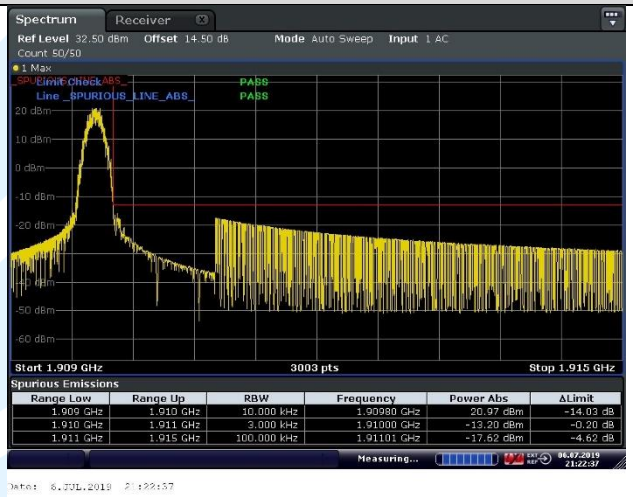
Test Setup: Refer to section 4.2.2 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Pass

The test plot as follows:

GPRS 1Tx-slot	
Lowest Channel	**Highest Channel**
	

5.7 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Requirement: FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 24.238(a)(b)

Test Method: ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02

Limit:

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB. The emission limit equal to -13 dBm

Test Procedure:

The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range. b. Measuring frequency range is from 30 MHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

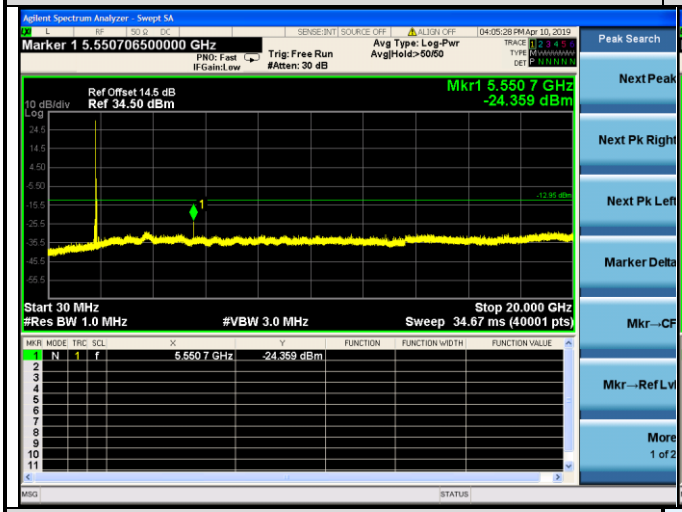
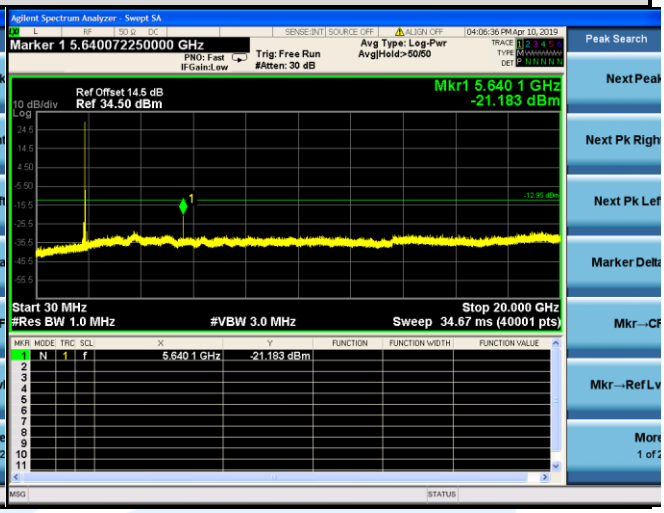
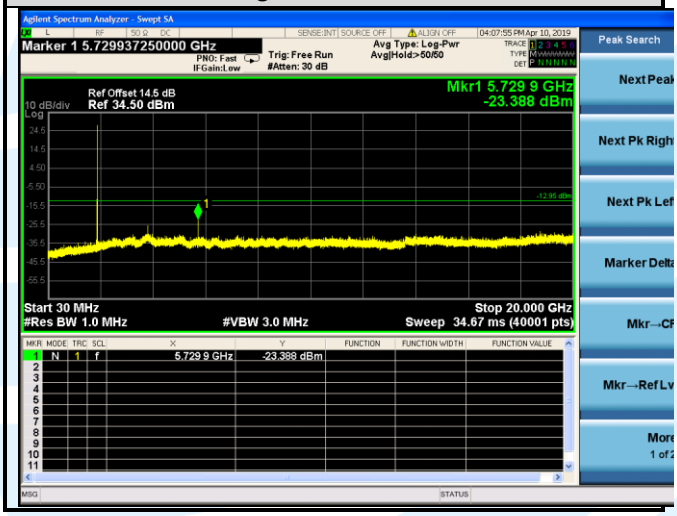
Test Setup: Refer to section 4.2.2 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Pass

The test plot as follows:

GPRS 1Tx-slot	
Lowest Channel	**Middle Channel**
	
Highest Channel	
	

5.8 FIELD STRENGTH OF SPURIOUS RADIATION

Test Requirement: FCC 47 CFR Part 2.1053 & FCC 47 CFR Part 24.238(a)(b)

Test Method: ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
0.009 MHz-30 MHz	Peak	10 kHz	30 KHz	Peak
30 MHz-1 GHz	Quasi-peak	100 kHz	300 KHz	Peak
Above 1 GHz	Peak	1 MHz	3 MHz	Peak

Limits:

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB. The emission limit equal to -13 dBm

Test Setup: Refer to section 4.2.1 for details.

Test Procedures:

1. Scan up to 10th harmonic, find the maximum radiation frequency to measure.
2. The technique used to find the Spurious Emissions of the transmitter was the antenna substitution method. Substitution method was performed to determine the actual ERP/EIRP emission levels of the EUT.

Test procedure as below:

1) The EUT was powered ON and placed on a 0.8/1.5m high table at a 3 meter semi/fully Anechoic Chamber. The antenna of the transmitter was extended to its maximum length. Modulation mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.
2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3) The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
4) Steps 1) to 3) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
5) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.
6) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 3) is obtained for this set of conditions.
7) The output power into the substitution antenna was then measured.
8) Steps 6) and 7) were repeated with both antennas polarized.
9) Calculate power in dBm by the following formula:

ERP(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBd)

EIRP(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBi)

EIRP=ERP+2.15dB

where:

Pg is the generator output power into the substitution antenna.

10) Test the EUT in the lowest channel, the middle channel the Highest channel
11) The radiation measurements are performed in X, Y, Z axis positioning for EUT operation mode, and found the X axis positioning which it is worse case.
12) Repeat above procedures until all frequencies measured was complete.

Equipment Used: Refer to section 3 for details.

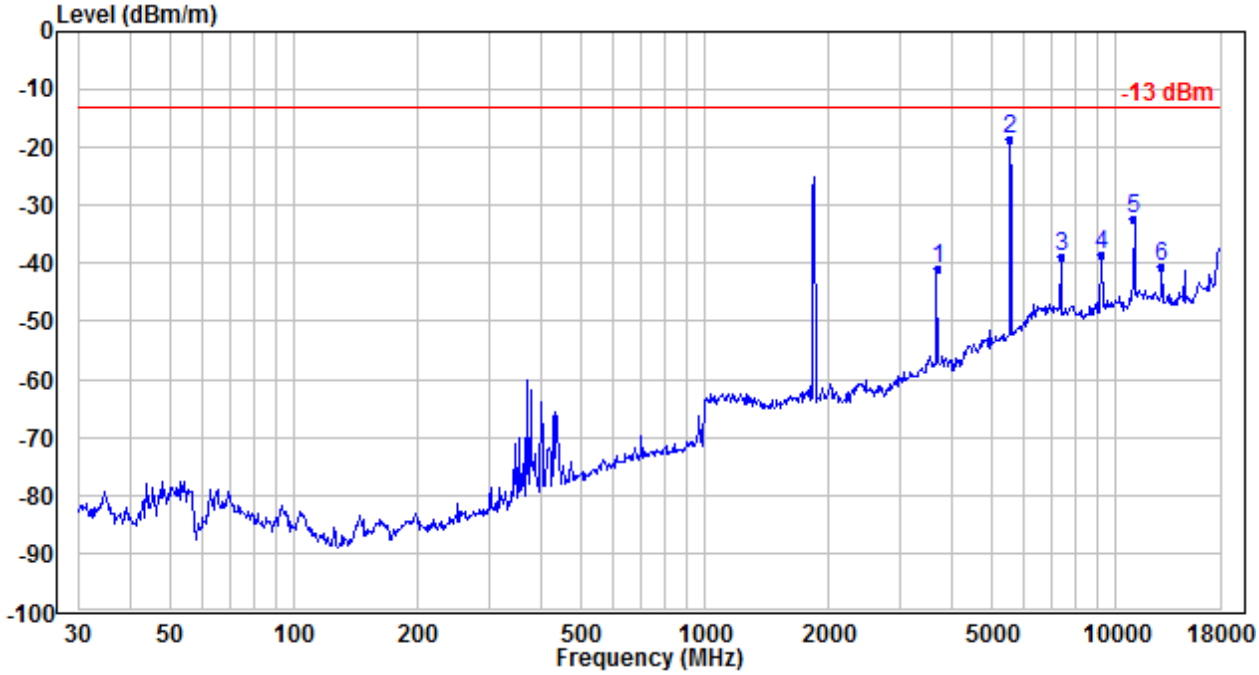
Test Result: Pass

The measurement data as follows:

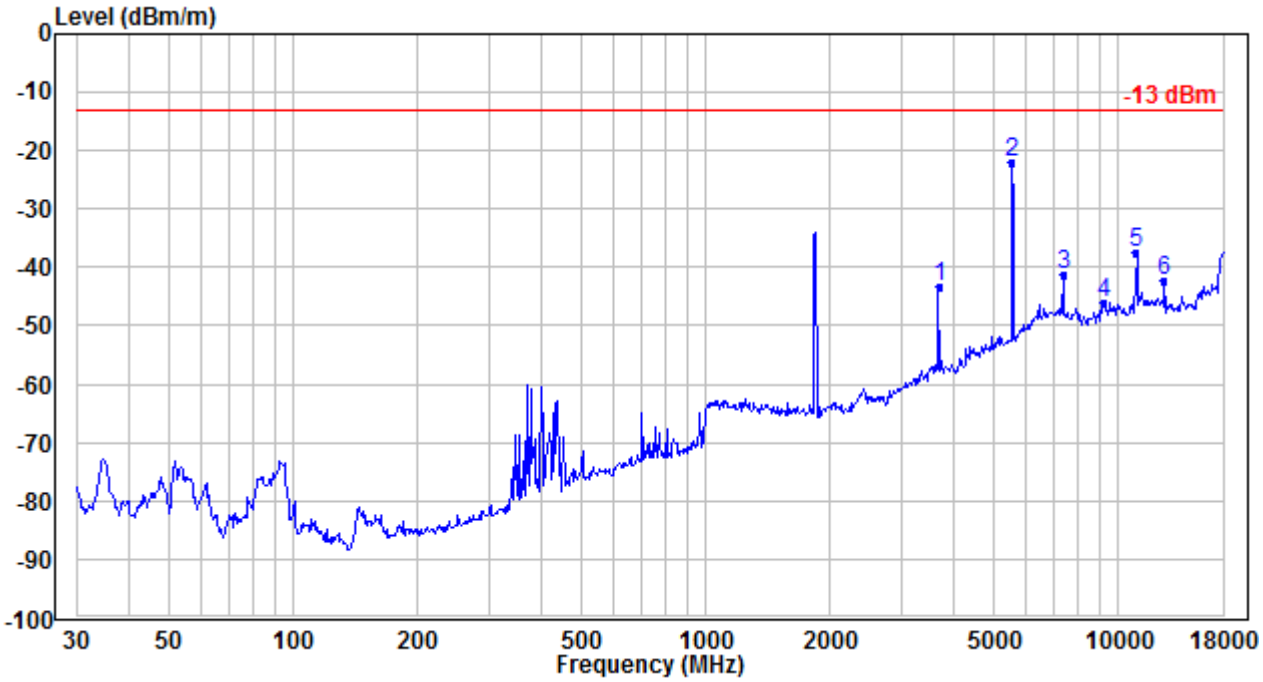
5.8.1 Radiated Emission Test Data

GPRS 1Tx-slot_Lowest Channel

Horizontal

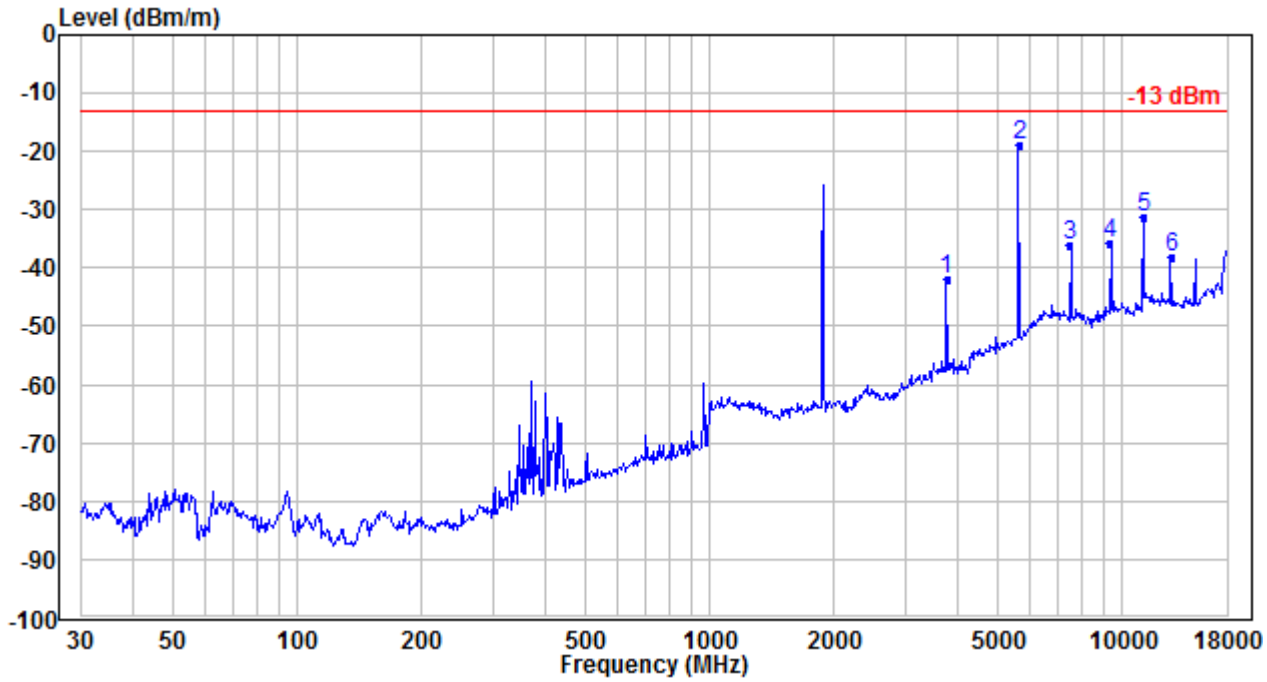


Vertical

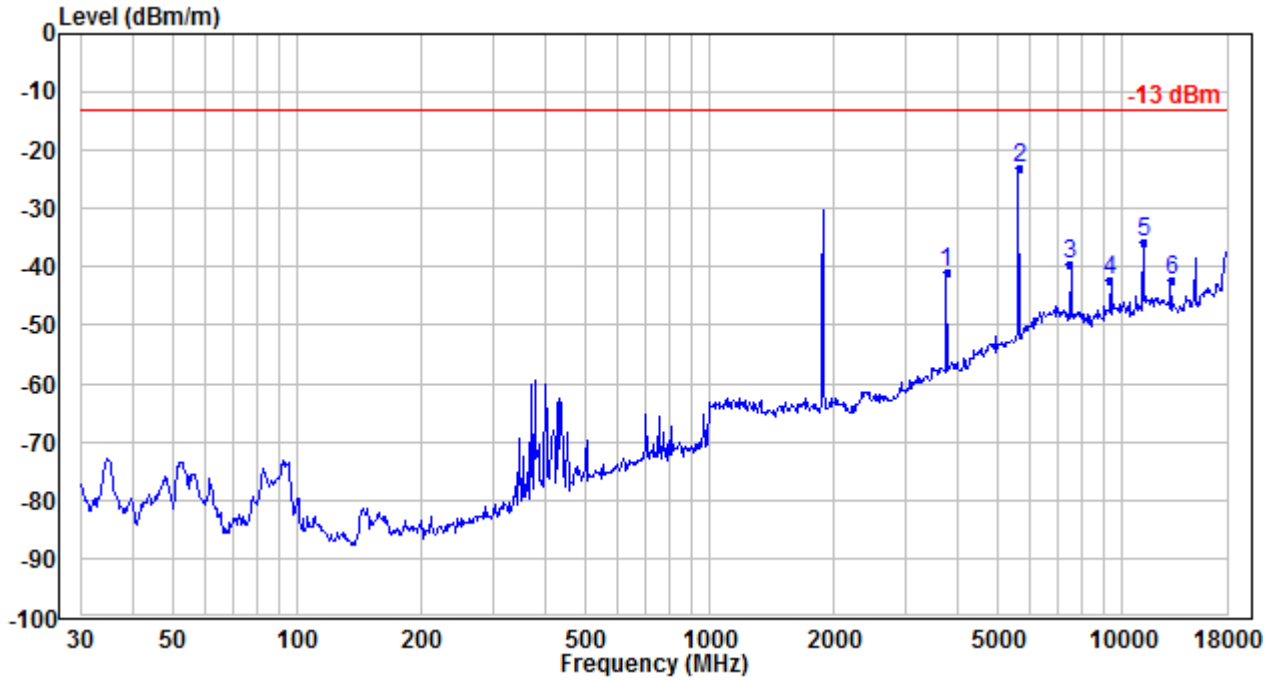


GPRS 1Tx-slot_Middle Channel

Horizontal

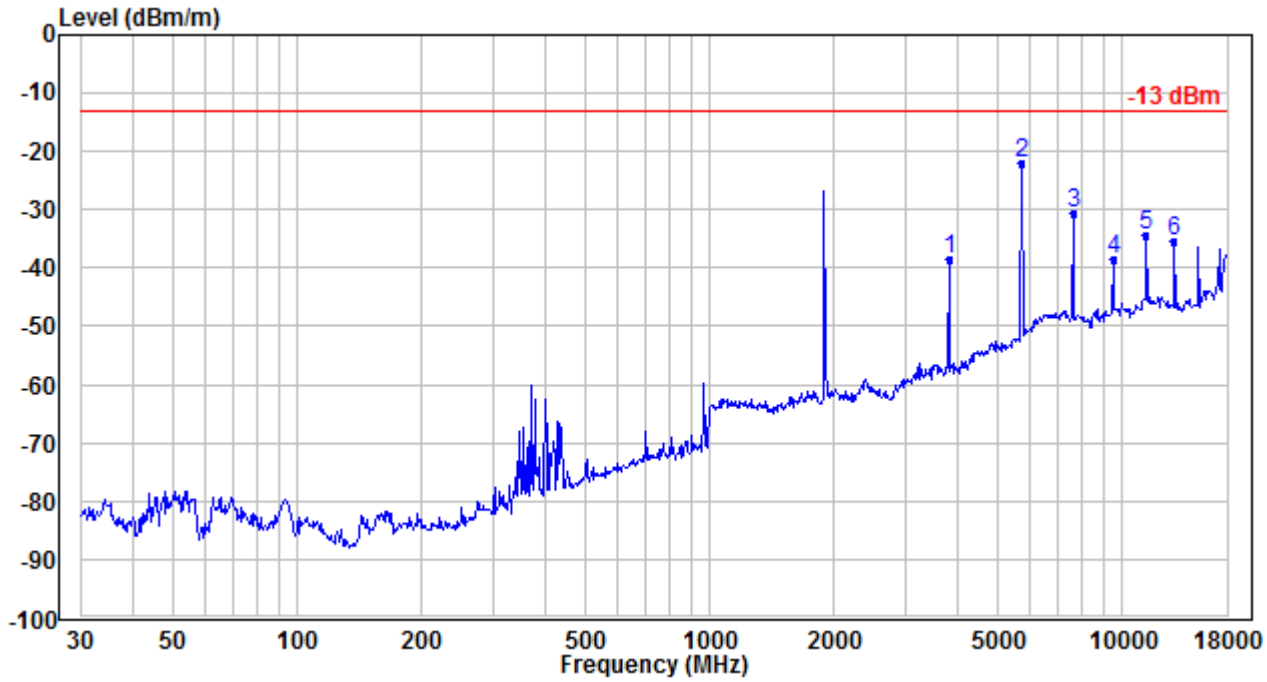


Vertical

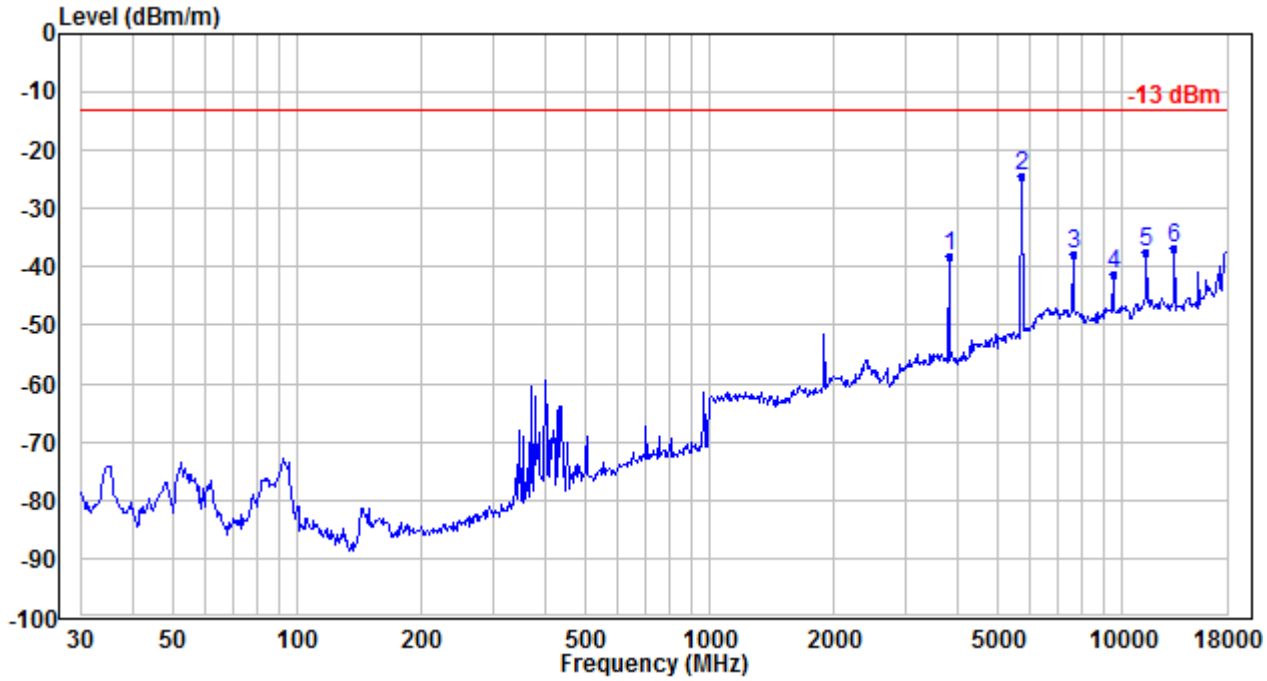


GPRS 1Tx-slot_Highest Channel

Horizontal



Vertical



Remark:

1) The disturbance above 18GHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

2) All tested is under the condition of the main wave is filtered out.

5.9 FREQUENCY STABILITY

Test Requirement: FCC 47 CFR Part 2.1055 & FCC 47 CFR Part 24.235

Test Method: ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02

Limits: The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Setup: Refer to section 4.2.2 for details.

Test Procedures:

1) Use CMW 500 or CMU 200 with Frequency Error measurement capability.
   a) Temp. = −30° to + 50°C
   b) Voltage =low voltage, 3.5 Vdc, Normal, 3.7 Vdc and High voltage, 4.2 Vdc.
2) Frequency Stability vs Temperature:

The EUT is place inside a temperature chamber. The temperature is set to 20ºC and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until +50ºC is reached.

3) Frequency Stability vs Voltage:

The peak frequency error is recorded (worst-case).

Equipment Used: Refer to section 3 for details.

Test Result: Pass

Modulation	Channel/ Frequency (MHz)	Voltage (Vdc)	Temperature (℃)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Pass/ Fail
GPRS 1Tx-slot							
GMSK	661 / 1880.0	VL	TN	-33	-0.0176	Note 1	Pass
		VN		-32	-0.0170		Pass
		VH		-36	-0.0191		Pass
		VN	50	-37	-0.0197		Pass
			40	-32	-0.0170		Pass
			30	-41	-0.0218		Pass
			20	-39	-0.0207		Pass
			10	-40	-0.0213		Pass
			0	-34	-0.0181		Pass
			-10	-32	-0.0170		Pass
			-20	-33	-0.0176		Pass
			-30	-31	-0.0165		Pass

Note1: The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

APPENDIX 1 PHOTOS OF TEST SETUP

See test photos attached in Appendix 1 for the actual connections between Product and support equipment.

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

*** End of Report ***

The test report is effective only with both signature and specialized stamp. The result(s) shown in this report refer only to the sample(s) tested. Without written approval of UnionTrust, this report can't be reproduced except in full.