Shenzhen Huaxin Information Technology Service Co., Ltd

FCC TEST REPORT

FCC ID: 2ARH7-A-N70ST

On Behalf of

Shadowtrack Technologies, Inc.

ShadowDevice

Model No.: A-N70ST

Prepared for	:	Shadowtrack Technologies, Inc.
Address	:	5100 Village Walk, Suite 100, Covington LA 70433

Prepared By	:	Shenzhen Huaxin Information Technology Service Co., Ltd
Address	:	101, R & D Building, No.3 guansheng 4th Road, Luhu Community， Guanhu Street, Longhua District, Shenzhen, Guangdong, China

Report Number	:	HX230925R002
Date of Receipt	:	Sep.15th, 2023
Date of Test	:	Sep.15th, 2023- Sep.25th, 2023
Date of Report	:	Sep.25th, 2023
Version Number	:	V0

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TEST REPORT DECLARATION

Applicant	:	Shadowtrack Technologies, Inc.
Address	:	5100 Village Walk, Suite 100, Covington LA 70433
Manufacturer	:	ThinkRace Technology Co., Limited
Address	:	21/F Hing Lung Commercial Building 68-74 Bonham Strand East Sheung Wan Hongkong
EUT Description	:	ShadowDevice
(A) Model No.	:	A-N70ST
(B) Trademark	:	ShadoTrack

Measurement Standard Used:

FCC CFR Title 47 Part 2
FCC CFR Title 47 Part 22 Subpart H
FCC CFR Title 47 Part 24 Subpart E

The device described above is tested by Shenzhen Huaxin Information Technology Service Co., Ltd. to determine the maximum emission levels emanating from the device. The test results are contained in this test report and Shenzhen Huaxin Information Technology Service Co., Ltd is assumed of full responsibility for the accuracy and completeness of these tests.

After the test, our opinion is that EUT compliance with the requirement of the above standards.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Huaxin Information Technology Service Co., Ltd

Tested by (name + signature).....:	Eason Tan Project Engineer	Eason Tan
Approved by (name + signature).....:	Michael Wu Project Manager	Michael wu
Date of issue…… ……..:	Sep.25th, 2023	

Revision History

Revision	Issue Date	Revisions	Revised By
V0	Sep.25th, 2023	Initial released Issue	Eason Tan

1 Test Summary

Test Item	Section in CFR 47	Result
RF Output Power	Part 2.1046 Part 22.913(a) (5) Part 24.232 (c)	Pass
Peak-to-Average Ratio	Part 2.1046 Part 22.913(d) Part 24.232 (d)	Pass
Modulation Characteristics	Part 2.1047	Pass
99% & -26 dB Occupied Bandwidth	Part 2.1049 Part 22.917 Part 24.238	Pass
Spurious Emissions at Antenna Terminal	Part 2.1051 Part 22.917 (a) Part 24.238 (a)	Pass
Field Strength of Spurious Radiation	Part 2.1053 Part 22.917 (a) Part 24.238 (a)	Pass
Out of band emission, Band Edge	Part 22.917 (a) Part 24.238 (a)	Pass
Frequency stability vs. temperature	Part 2.1055(a)(1)(b)	Pass
Frequency stability vs. voltage	Part 2.1055(d)(1)(2)	Pass

Note: 1. Pass: The EUT complies with the essential requirements in the standard.

2. The conclusion of this test report is judged by actual test data without considering measurement uncertainty.

2 General Information

2.1 General Description of EUT

Description/PMN	:	ShadowDevice
Model Number/HVIN(s)	:	A-N70ST
Diff	:	/
Trademark	:	ShadoTrack
Test Voltage	:	DC 3.8V
Support Networks	:	GSM
Support Bands	:	GSM850, PCS1900
TX Frequency	:	GSM850: 824.20MHz-848.80MHz PCS1900: 1850.20MHz-1909.80MHz
Modulation type	:	GSM: GMSK
Antenna type	:	Internal antenna
Antenna gain	:	Maximum Gain is 0.16 dBi for GSM 850 Maximum Gain is 0.50 dBi for PCS1900 (Antenna information is provided by applicant.) There is WWAN diversity antenna inside the product, which is only for receiving function.
Software version	:	V1.0
Hardware version/FVIN	:	V1.0

Remark:
1.The worst-case simultaneous transmission configuration was evaluated with no non-compliance found. Results in this report are only for 2G function, and there is no other transmitter involved.

Operation Frequency List:

GSM 850		PCS1900	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
128	824.20	512	1850.20
129	824.40	513	1850.40
⋮	⋮	⋮	⋮
189	836.40	660	1879.80
190	836.60	661	1880.00
191	836.80	662	1880.20
⋮	⋮	⋮	⋮
250	848.60	809	1909.60
251	848.80	810	1909.80

Regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Final test channel:

GSM 850		PCS1900	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
128	824.20	512	1850.20
190	836.60	661	1880.00
251	848.80	810	1909.80

2.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is filing to comply with Section Part 22 subpart H and Part 24 subpart E of the FCC CFR 47 Rules.

2.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures document on TIA/EIA 603 and FCC CFR 47.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055 and 2.1057

2.4 Test Facility

Company Name:	Shenzhen Huaxin Information Technology Service Co., Ltd
Address:	101, R & D Building, No.3 guansheng 4th Road, Luhu Community， Guanhu Street, Longhua District, Shenzhen, Guangdong, China
Telephone:	0775-21018313
Fax:	0775-21018313
FCC Test Firm Registration Number: 932271 Designation Number: CN1344 CAB ID ： CN0147	

2.5 Accessories of Device (EUT)

Accessories : /

Manufacturer : /

Model : /

Ratings : /

2.6 Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number	Certification or SDOC
1.	Notebook PC	Lenovo	ThinkPad E460	N/A	SDOC

2.7 Test Conditions

Items	Required	Actual
Temperature range:	15-35℃	24℃
Humidity range:	25-75%	56%
Pressure range:	86-106kPa	98kPa

2.8 Measurement Uncertainty

Item	MU	Remark
Conducted Emission（9K～0.15MHz）	2.18dB	
Conducted Emission（0.15M～30MHz）	2.17dB	
Radiation Emission ,3m (30MHz～1GHz)	4.45 dB	Polarize: V
	2.76 dB	Polarize: H
Radiation Emission, 3m (1GHz～6GHz)	4.02 dB	
Radiation Emission ,3m (6GHz～18GHz)	4.30 dB	
RF output power (conducted)	0.41 dB	
Power Spectral Density (conducted)	0.39 dB	
Spurious emissions (conducted)	0.59 dB	
Occupied Channel Bandwidth (conducted)	4.22%	

3 Test Instruments list

Equipment	Manufacture	Model No.	Firmware version	Serial No.	Last cal.	Cal Interval
9*6*6 anechoic chamber	Mao Rui	9*6*6	N/A	N/A	2022.06.15	3Year
Spectrum analyzer	R&S	FSV40-N	V7.0-4-62-2	101795	2023.09.17	1Year
Spectrum analyzer	Agilent	N9020A	A.14.16	MY51280803	2023.04.15	1Year
Receiver	R&S	ESR7	5.812	102543	2022.10.20	1Year
Receiver	R&S	ESCI	N/A		2022.10.20	1Year
Bilog Antenna	Schwarzbeck	VULB 9168	N/A	01318	2022.06.19	2Year
Horn Antenna	A.H. Systems	SAS-571	N/A	915	2022.06.17	2Year
Active Loop Antenna	Schwarzbeck	FMZB 1519B	N/A	/	/	2Year
RF Cable	/	N/J-NJ-RG58(1G) 9m	N/A	RE1	2023.09.17	1Year
RF Cable	/	N/J-NJ-RG58(1G) 10m	N/A	RE2	2023.09.17	1Year
RF Cable	/	N/J-SMAAJ-406(18G) 9m	N/A	CE1	2023.09.17	1Year
Pre-amplifier	HP	8447D	N/A	1616A02061	2023.04.15	1Year
Pre-amplifier	Agilent	8449B	N/A	3008A00551	2023.04.15	1Year
L.I.S.N.#1	R&S	ESH3-Z5	N/A	894981/024	2023.03.28	1Year
L.I.S.N.#2	R&S	ENV216	N/A	101291	2023.03.28	1 Year
Horn Antenna	A.H. Systems	SAS-571	N/A	915	2022.06.17	2 Year
power amplifier	Micotop	MPA-80-1000-250	N/A	MPA2206215	2023.04.15	1 Year
Power Meter	Keysight	E9300A	N/A	MY45105087	2023.04.15	1 Year
Power Sensor	Keysight	E9300A	N/A	MY55060025	2023.04.15	1 Year
power amplifier	Micotop	MPA-1000-6000-100	N/A	MPA2206216	2023.04.15	1 Year
Switching Mode Power Supply	PinHong	PH-1110	N/A	20220423007	2023.04.15	1 Year
Adjustable attenuator	MWRFtest	N/A	N/A	N/A	N/A	N/A
10dB Attenuator	/	10dB	N/A	N/A	2023.09.17	1 Year
Temperature and humidity test chamber	Asprey	LX-150L	N/A	N/A	2023.04.2	1 Year

Software Information			
Test Item	Software Name	Manufacturer	Version
RE	EMC-I	SKET	V1.4.0.1
CE	EMC-I	SKET	V1.4.0.1
RF-CE	RF Test Software	TACHOY	V2.0

4 System test configuration

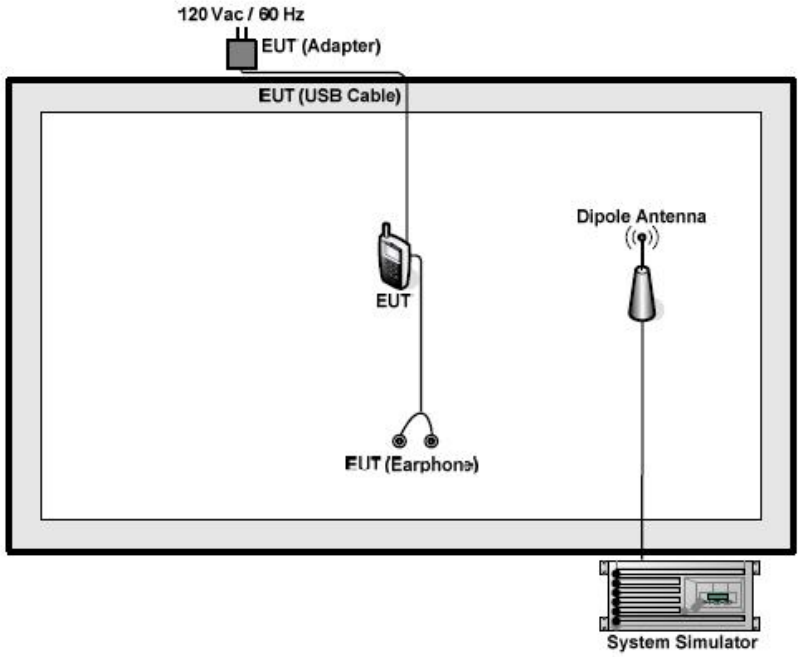
4.1 Test mode

During all testing, EUT is in link mode with base station emulator at maximum power level. The spurious emission measurements were carried out in semi-anechoic chamber with 3-meter test range, and EUT is rotated on three test planes to find out the worst emission.

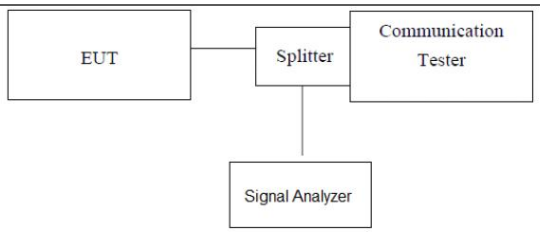
Test modes		
Band	Radiated	Conducted
GSM 850	■ GSM link	■ GSM link
PCS 1900	■ GSM link	■ GSM link

Note: The maximum power levels are GSM mode for GMSK link.

4.2 Configuration of Tested System



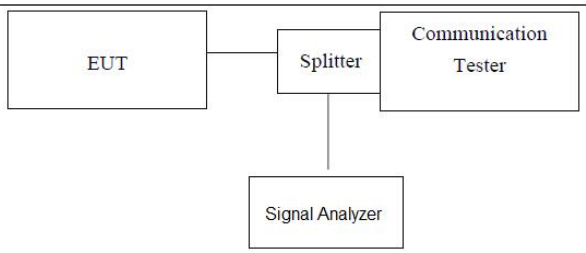
4.3 Conducted Output Power

Test Requirement:	FCC part22.913(a) and FCC part24.232(b)
Test Method:	FCC part2.1046
Limit:	GSM850: 7W(38.45dbm) PCS1900: 2W(33.01dbm)
Test setup:	 *Note: Measurement setup for testing on Antenna connector*
Test Procedure:	1. The transmitter output port was connected to base station. 2. The RF output of EUT was connected to the Signal Analyzer by RF cable and attenuator, the path loss was compensated to the results for each measurement. 3. Set EUT at maximum power through base station. 4. Select lowest, middle, and highest channels for each band and different modulation. 5. Measure the maximum burst average power.
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

Measurement Data

Please refer to separated files for APPENDIX I TEST RESULTS.

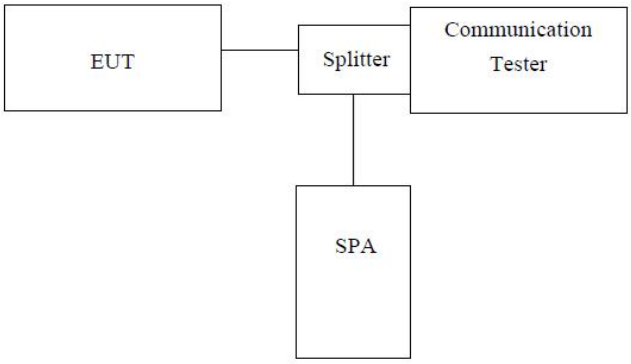
4.4 Peak-to-Average Ratio

Test Requirement:	Part 22.913(d), FCC part24.232(d)
Test Method:	FCC part2.1046
Limit:	13db
Test setup:	 *Note: Measurement setup for testing on Antenna connector*
Test Procedure:	1. The transmitter output port was connected to base station. 2. The RF output of EUT was connected to the Signal Analyzer by RF cable and attenuator, the path loss was compensated to the results for each measurement. 3. Set EUT at maximum power through base station. 4. Select lowest, middle, and highest channels for each band and different modulation. 5. Measure the maximum burst average power. 6. Record the maximum peak-to-average ratio value.
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

Measurement data

Please refer to separated files for APPENDIX I TEST RESULTS.

4.5 Occupy Bandwidth

Test Requirement:	FCC part22.913(a), FCC part24.232(b)
Test Method:	FCC part2.1049
Test setup:	 *Note: Measurement setup for testing on Antenna connector*
Test Procedure:	1. The EUT's output RF connector was connected with a short cable to the spectrum analyzer 2. RBW was set to about 1% of emission BW, VBW= 3 times RBW. 3. -26dBc display line was placed on the screen (or 99% bandwidth), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace.
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

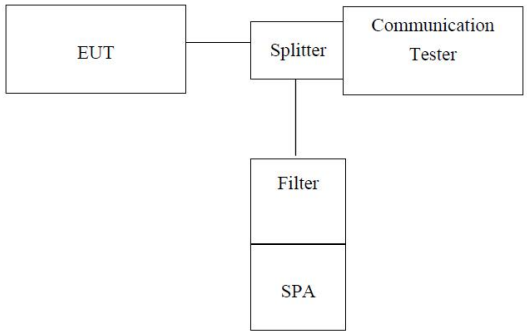
Measurement Data

Please refer to separated files for APPENDIX I TEST RESULTS.

4.6 MODULATION CHARACTERISTIC

According to FCC § 2.1047(d), Part 24E there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

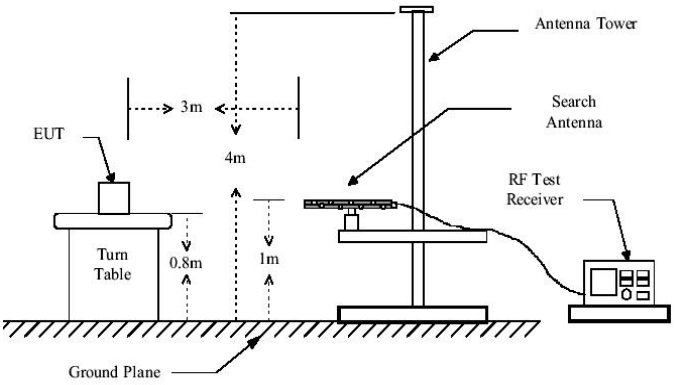
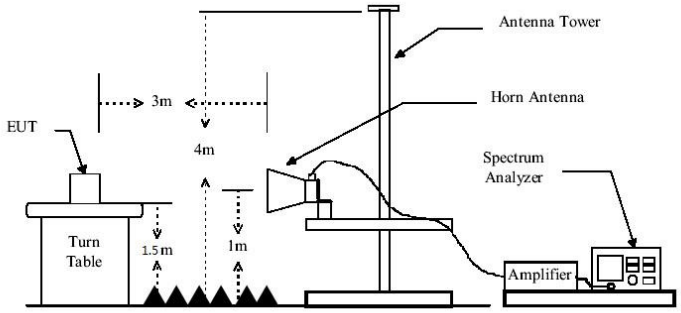
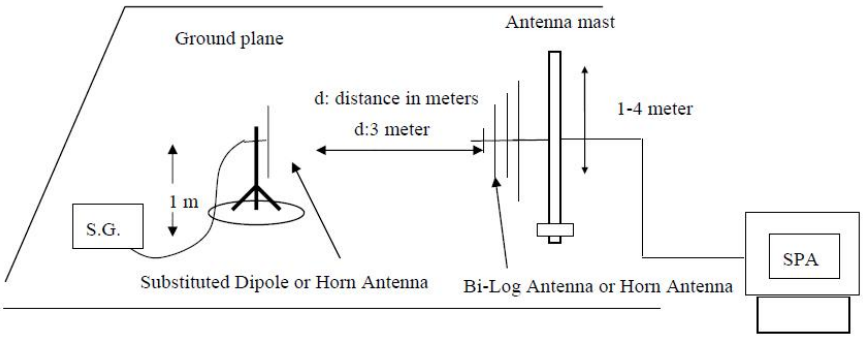
4.7 Out of band emission at antenna terminals

Test Requirement:	FCC part22.913(a), FCC part24.238(a)
Test Method:	FCC part2.1051
Limit:	-13dBm
Test setup:	 *Note: Measurement setup for testing on Antenna connector*
Test Procedure:	1 The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. 2 The resolution bandwidth of the spectrum analyzer was set at 1MHz, sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic. 3 For the out of band: Set the RBW, VBW = 1MHz, Start=30MHz, Stop= 10th harmonic. 4 Band Edge Requirements: In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to measure the out of band Emissions.
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

Measurement Data

Please refer to separated files for APPENDIX I TEST RESULTS.

4.8 Field strength of spurious radiation measurement

Test Requirement:	FCC part22.913(a), FCC part24.238(a)
Test Method:	FCC part2.1053
Limit:	-13dBm
Test setup:	Below 1GHz  Above 1GHz  Substituted method: 

Test Procedure:	1. The EUT was placed on an non-conductive turntable using a non-conductive support. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and EMI spectrum analyzer. 2. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations. 3. The frequency range up to tenth harmonic was investigated for each of three fundamental frequency (low, middle and high channels). Once spurious emission was identified, the power of the emission was determined using the substitution method. 4. The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and the spurious emissions frequency. ERP / EIRP = S.G. output (dBm) + Antenna Gain(dB/dBi) – Cable Loss (dB)
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

Measurement Data

GSM 850							
No.	Frequency	SA Reading	Correction factor	EIRP Result	Limit	Margin	Ant. Pol.
	(MHz)	(dBm)	(dB/m)	(dBm)	(dBm)	(dB)	
GSM_ Lowest Channel							
1	348.514	-87.69	33.09	-54.60	-13.00	-41.60	Horizontal
2	523.876	-87.77	37.44	-50.33	-13.00	-37.33	Horizontal
3	787.475	-86.91	41.17	-45.74	-13.00	-32.74	Horizontal
4	1648.400	-61.22	0.04	-61.18	-13.00	-48.18	Horizontal
5	2472.600	-63.15	2.72	-60.43	-13.00	-47.43	Horizontal
6	91.700	-81.04	25.03	-56.01	-13.00	-43.01	Vertical
7	578.036	-88.25	38.30	-49.95	-13.00	-36.95	Vertical
8	698.804	-87.66	39.59	-48.07	-13.00	-35.07	Vertical
9	1648.400	-61.04	-0.74	-61.78	-13.00	-48.78	Vertical
10	2472.600	-62.16	2.32	-59.84	-13.00	-46.84	Vertical
GSM_ Middle Channel							
1	421.329	-87.71	34.94	-52.77	-13.00	-39.77	Horizontal
2	535.038	-87.79	37.47	-50.32	-13.00	-37.32	Horizontal
3	698.804	-87.85	40.73	-47.12	-13.00	-34.12	Horizontal
4	1673.200	-60.41	0.19	-60.22	-13.00	-47.22	Horizontal
5	2509.800	-61.71	2.82	-58.89	-13.00	-45.89	Horizontal
6	91.057	-80.51	24.97	-55.54	-13.00	-42.54	Vertical
7	452.001	-87.61	35.15	-52.46	-13.00	-39.46	Vertical
8	578.036	-87.37	38.30	-49.07	-13.00	-36.07	Vertical
9	1673.200	-60.95	-0.57	-61.52	-13.00	-48.52	Vertical
10	2509.800	-60.58	2.41	-58.17	-13.00	-45.17	Vertical
GSM_ Highest Channel							
1	97.002	-86.62	25.42	-61.20	-13.00	-48.20	Horizontal
2	415.449	-88.35	34.98	-53.37	-13.00	-40.37	Horizontal
3	776.485	-87.01	40.93	-46.08	-13.00	-33.08	Horizontal
4	1697.600	-60.10	0.34	-59.76	-13.00	-46.76	Horizontal
5	2546.400	-61.34	2.93	-58.41	-13.00	-45.41	Horizontal
6	37.565	-84.59	28.43	-56.16	-13.00	-43.16	Vertical
7	93.653	-80.82	25.18	-55.64	-13.00	-42.64	Vertical
8	689.051	-87.33	39.07	-48.26	-13.00	-35.26	Vertical
9	1697.600	-57.96	-0.40	-58.36	-13.00	-45.36	Vertical
10	2546.400	-60.05	2.50	-57.55	-13.00	-44.55	Vertical

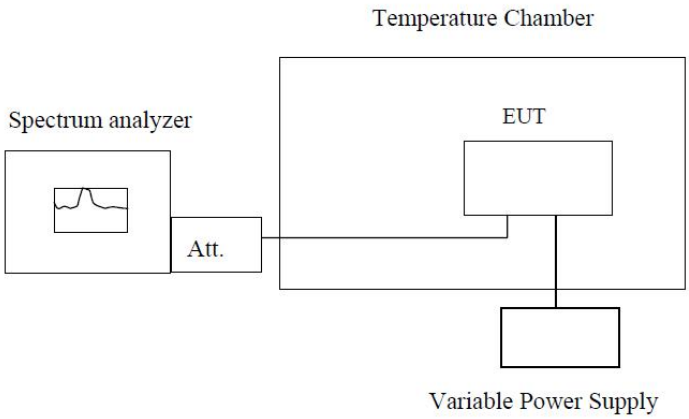
PCS 1900							
No.	Frequency	SA Reading	Correction factor	EIRP Result	Limit	Margin	Ant. Pol.
	(MHz)	(dBm)	(dB/m)	(dBm)	(dBm)	(dB)	
GSM_ Lowest Channel							
1	94.979	-66.92	-3.56	-70.48	-13.00	-57.48	Horizontal
2	259.443	-68.65	1.90	-66.75	-13.00	-53.75	Horizontal
3	965.474	-77.22	14.34	-62.88	-13.00	-49.88	Horizontal
4	3700.400	-64.48	6.78	-57.70	-13.00	-44.70	Horizontal
5	5550.600	-63.38	10.87	-52.51	-13.00	-39.51	Horizontal
6	42.630	-52.98	-2.97	-55.95	-13.00	-42.95	Vertical
7	95.649	-54.76	-3.49	-58.25	-13.00	-45.25	Vertical
8	965.474	-70.56	13.21	-57.35	-13.00	-44.35	Vertical
9	3700.400	-64.65	6.76	-57.89	-13.00	-44.89	Vertical
10	5550.600	-64.55	11.36	-53.19	-13.00	-40.19	Vertical
GSM_ Middle Channel							
1	263.115	-69.91	1.99	-67.92	-13.00	-54.92	Horizontal
2	798.620	-81.10	12.02	-69.08	-13.00	-56.08	Horizontal
3	965.474	-71.92	14.34	-57.58	-13.00	-44.58	Horizontal
4	3760.000	-65.34	6.93	-58.41	-13.00	-45.41	Horizontal
5	5640.000	-66.40	10.84	-55.56	-13.00	-42.56	Horizontal
6	42.630	-53.03	-2.97	-56.00	-13.00	-43.00	Vertical
7	96.323	-54.12	-3.45	-57.57	-13.00	-44.57	Vertical
8	965.474	-70.36	13.21	-57.15	-13.00	-44.15	Vertical
9	3760.000	-63.90	6.93	-56.97	-13.00	-43.97	Vertical
10	5640.000	-65.66	11.32	-54.34	-13.00	-41.34	Vertical
GSM_ Highest Channel							
1	261.273	-71.27	1.94	-69.33	-13.00	-56.33	Horizontal
2	781.961	-80.73	11.64	-69.09	-13.00	-56.09	Horizontal
3	965.474	-71.97	14.34	-57.63	-13.00	-44.63	Horizontal
4	3819.600	-64.56	7.08	-57.48	-13.00	-44.48	Horizontal
5	5729.400	-64.06	10.82	-53.24	-13.00	-40.24	Horizontal
6	43.233	-53.39	-3.17	-56.56	-13.00	-43.56	Vertical
7	95.649	-52.94	-3.49	-56.43	-13.00	-43.43	Vertical
8	965.474	-69.78	13.21	-56.57	-13.00	-43.57	Vertical
9	3819.600	-63.59	7.11	-56.48	-13.00	-43.48	Vertical
10	5729.400	-64.69	11.27	-53.42	-13.00	-40.42	Vertical

Remark:1.Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain, the value was added to Original Receiver Reading by the software automatically.

2.Result = Reading + Correct Factor.

3.Margin = Result – Limit

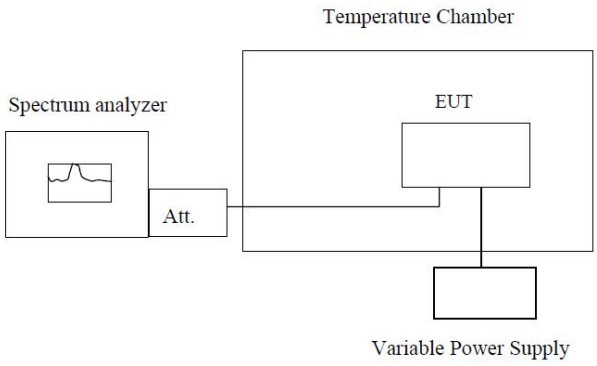
4.9 Frequency stability V.S. Temperature measurement

Test Requirement:	FCC Part2.1055(a)(1)(b)
Test Method:	FCC Part2.1055(a)(1)(b)
Limit:	2.5ppm
Test setup:	 **Note :** Measurement setup for testing on Antenna connector
Test procedure:	1. The equipment under test was connected to an external DC power supply and input rated voltage. 2. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. 3. The EUT was placed inside the temperature chamber. 4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25°C operating frequency as reference frequency. 5. Turn EUT off and set the chamber temperature to –30°C. After the temperature stabilized for approximately 30 minutes recorded the frequency. 6. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

Measurement Data

Please refer to separated files for APPENDIX I TEST RESULTS.

4.10 Frequency stability V.S. Voltage measurement

Test Requirement:	FCC Part2.1055(d)(1)(2)
Test Method:	FCC Part2.1055(d)(1)(2)
Limit:	2.5ppm
Test setup:	 **Note :** Measurement setup for testing on Antenna connector
Test procedure:	1. Set chamber temperature to 25°C. Use a variable DC power source to power the EUT and set the voltage to rated voltage. 2. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency. 3. Reduce the input voltage to specified extreme voltage variation (+/- 15%) and endpoint, record the maximum frequency change.
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

Measurement Data

Please refer to separated files for APPENDIX I TEST RESULTS.

5 Test Setup Photo

Please refer to separated files for APPENDIX IV Test Setup Photos.

-------END OF REPORT-------