

FCC REPORT (GSM)

Applicant: Aratek Biometrics Co., Ltd.

Address of Applicant: 2F, T2-A Building, ShenZhen Software Park South Area, Hi-Tech Park

Equipment Under Test (EUT)

Product Name: Automated Election Device

Model No.: VC331, BD1300

Trade mark: Aratek

FCC ID: 2AGUJ-VC331

Applicable standards: FCC CFR Title 47 Part 2
FCC CFR Title 47 Part 22 Subpart H
FCC CFR Title 47 Part 24 Subpart E

Date of sample receipt: 12 Jan., 2022

Date of Test: 13 Jan., to 13 Feb., 2022

Date of report issued: 22 Feb., 2022

Test Result: PASS*

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



Bruce Zhang
Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the JYT product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

2. Version

Version No.	Date	Description
00	14 Feb., 2022	Original
01	22 Feb., 2022	add model

Tested by: Mike.Ou **Date:** 22 Feb., 2022
Test Engineer

Reviewed by: Winner Zhang **Date:** 22 Feb., 2022
Project Engineer

3. Contents

Page

1.	COVER PAGE.....	1
2.	VERSION.....	2
3.	CONTENTS.....	3
4.	TEST SUMMARY.....	4
5.	GENERAL INFORMATION.....	5
5.1	CLIENT INFORMATION.....	5
5.2	GENERAL DESCRIPTION OF E.U.T.....	5
5.3	TEST ENVIRONMENT AND MODE	6
5.4	DESCRIPTION OF TEST AUXILIARY EQUIPMENT.....	6
5.5	MEASUREMENT UNCERTAINTY.....	6
5.6	ADDITIONS TO, DEVIATIONS, OR EXCLUSIONS FROM THE METHOD.....	6
5.7	LABORATORY FACILITY.....	6
5.8	LABORATORY LOCATION	7
5.9	TEST INSTRUMENTS LIST.....	7
6.	TEST RESULTS.....	8
6.1	CONDUCTED OUTPUT POWER, ERP AND EIRP	8
6.2	PEAK-TO-AVERAGE POWER RATIO	9
6.3	OCCUPY BANDWIDTH	10
6.4	MODULATION CHARACTERISTIC.....	11
6.5	OUT OF BAND EMISSION AT ANTENNA TERMINALS	11
6.6	FIELD STRENGTH OF SPURIOUS RADIATION MEASUREMENT.....	12
6.7	FREQUENCY STABILITY V.S. TEMPERATURE MEASUREMENT.....	15
6.8	FREQUENCY STABILITY V.S. VOLTAGE MEASUREMENT	16
7	TEST SETUP PHOTO.....	17
8	EUT CONSTRUCTIONAL DETAILS.....	19

4. Test Summary

Test Item	Section in CFR 47	Result
RF Exposure (SAR)	Part 1.1307 Part 2.1093	Pass (Please refer to SAR Report)
RF Output Power	Part 2.1046 Part 22.913 (a)(5) Part 24.232 (c)	Appendix A – GSM
Peak-to-Average Power Ratio	Part 24.232 (d)	Appendix B – GSM
Modulation Characteristics	Part 2.1047	Pass
99% & -26 dB Occupied Bandwidth	Part 2.1049 Part 22.917(b) Part 24.238(b)	Appendix C – GSM
Out of band emission at antenna terminals	Part 2.1053 Part 22.917 (a) Part 24.238 (a)	Appendix D – GSM Appendix E – GSM
Field strength of spurious radiation	Part 22.917 (a) Part 24.238 (a)	Pass
Frequency stability vs. temperature	Part 22.355 Part 24.235 Part 2.1055(a)(1)(b)	Appendix F – GSM
Frequency stability vs. voltage	Part 22.355 Part 24.235 Part 2.1055(d)(2)	Appendix F – GSM
Remark: 1. Pass: The EUT complies with the essential requirements in the standard. 2. The cable insertion loss used by "RF Output Power" and other conduction measurement items is 0.5dB(Fundamental Frequency below 1GHz)/1.0dB(Fundamental Frequency above 1GHz) (provided by the customer).		
Test Method:	ANSI/TIA-603-E-2016 ANSI C63.26-2015	

5. General Information

5.1 Client Information

Applicant:	Aratek Biometrics Co., Ltd.
Address:	2F, T2-A Building, ShenZhen Software Park South Area, Hi-Tech Park
Manufacturer:	Aratek Biometrics Co., Ltd.
Address:	2F, T2-A Building, ShenZhen Software Park South Area, Hi-Tech Park
Factory:	Aratek Biometrics Co., Ltd.
Address:	Block 4, 1st Industrial Park of Nan Gang, 1029# Song Bai Road of Bai Mang, Nan Shan District, Shenzhen 518055, China.

5.2 General Description of E.U.T.

Product Name:	Automated Election Device
Model No.:	VC331, BD1300
Operation Frequency range:	GSM 850: 824.20MHz-848.80MHz PCS1900: 1850.20MHz-1909.80MHz
Modulation type:	2G <input checked="" type="checkbox"/> Voice(GMSK) <input checked="" type="checkbox"/> GPRS(GMSK) <input type="checkbox"/> EGPRS(GMSK, 8PSK)
Antenna type:	Internal Antenna
Antenna gain:	GSM 850: 0.6 dBi(declare by Applicant) PCS 1900: 1.0 dBi(declare by Applicant)
Power supply:	Rechargeable Li-ion Battery DC11.1V, 13Ah
AC adapter:	Model: AK120WG-2400500W2 Input: AC100-240V, 50/60Hz, 2.0A Output: DC 24.0V, 5.0A
Remark:	Model No.: VC331, BD1300 were identical inside, the electrical circuit design, layout, components used and internal wiring, with only difference being model name.
Test Sample Condition:	The test samples were provided in good working order with no visible defects.

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:

GSM850			PCS1900		
Channel	Frequency(MHz)		Channel	Frequency(MHz)	
Lowest	128	824.20	Lowest	512	1850.20
Middle	190	836.60	Middle	661	1880.00
Highest	251	848.80	Highest	810	1909.80

5.3 Test environment and mode

Operating Environment:	
Temperature:	Normal: 15°C ~ 35°C, Extreme: -30°C ~ +50°C
Humidity:	20 % ~ 75 % RH
Atmospheric Pressure:	1008 mbar
Voltage:	Nominal: 11.1Vdc, Extreme: Low 9.44 Vdc, High 12.77 Vdc
Test mode:	
GSM mode	Keep the EUT communication with simulated station in GSM mode
GPRS mode	Keep the EUT communication with simulated station in GPRS mode
Remark: The EUT has been tested under continuous transmitting mode. Channel Low, Mid and High for each type band with rated data rate were chosen for full testing. The field strength of spurious radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for these modes. Just the worst case position (H mode) shown in report.	

5.4 Description of Test Auxiliary Equipment

Test Equipment	Manufacturer	Model No.	Serial No.
Simulated Station	Anritsu	MT8820C	6201026545

5.5 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%)
Radiated Emission (9kHz ~ 30MHz electric field) for 3m SAC	3.13 dB
Radiated Emission (9kHz ~ 30MHz magnetic field) for 3m SAC	3.13 dB
Radiated Emission (30MHz ~ 1GHz) for 3m SAC	4.45 dB
Radiated Emission (1GHz ~ 18GHz) for 3m SAC	5.34 dB
Radiated Emission (18GHz ~ 40GHz) for 3m SAC	5.34 dB

5.6 Additions to, deviations, or exclusions from the method

No

5.7 Laboratory Facility

<p>The test facility is recognized, certified, or accredited by the following organizations:</p> <ul style="list-style-type: none"> ● FCC - Designation No.: CN1211 JianYan Testing Group Shenzhen Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551. ● ISED – CAB identifier.: CN0021 The 3m Semi-anechoic chamber and 10m Semi-anechoic chamber of JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1. ● CNAS - Registration No.: CNAS L15527 JianYan Testing Group Shenzhen Co., Ltd. is accredited to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L15527. ● A2LA - Registration No.: 4346.01 This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: https://portal.a2la.org/scopepdf/4346-01.pdf
--

5.8 Laboratory Location

JianYan Testing Group Shenzhen Co., Ltd.
 Address: No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.
 Tel: +86-755-23118282, Fax: +86-755-23116366
 Email: info-JYTee@lets.com, Website: <http://jyt.lets.com>

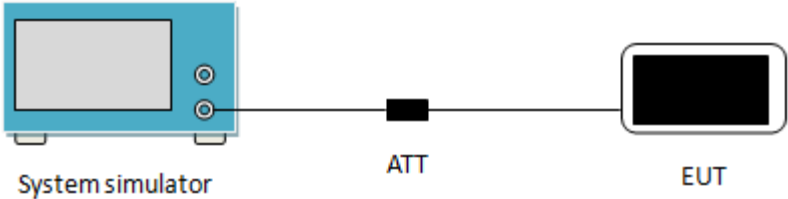
5.9 Test Instruments list

Radiated Emission:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
3m SAC	ETS	RFD-100	Q1984	04-14-2021	04-13-2024
Loop Antenna	SCHWARZBECK	FMZB 1519 B	1519B-044	03-07-2021	03-06-2022
BiConiLog Antenna	SCHWARZBECK	VULB9163	9163-1246	03-07-2021	03-06-2022
Biconical Antenna	SCHWARZBECK	VUBA 9117	9117#359	06-17-2021	06-17-2022
Horn Antenna	SCHWARZBECK	BBHA9120D	912D-916	03-07-2021	03-06-2022
Broad-Band Horn Antenna	SCHWARZBECK	BBHA9170	1067	04-02-2021	04-01-2022
Broad-Band Horn Antenna	SCHWARZBECK	BBHA9170	1068	04-02-2021	04-01-2022
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	03-03-2021	03-02-2022
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	03-03-2021	03-02-2022
Spectrum analyzer	Keysight	N9010B	MY60240202	10-27-2021	10-26-2022
Simulated Station	Anritsu	MT8820C	6201026545	03-03-2021	03-02-2022
Low Pre-amplifier	SCHWARZBECK	BBV9743B	00305	03-07-2021	03-06-2022
High Pre-amplifier	SKET	LNPA_0118G-50	MF280208233	03-07-2021	03-06-2022
Cable	Qualwave	JYT3M-1G-NN-8M	JYT3M-1	03-07-2021	03-06-2022
Cable	Qualwave	JYT3M-18G-NN-8M	JYT3M-2	03-07-2021	03-06-2022
Cable	Qualwave	JYT3M-1G-BB-5M	JYT3M-3	03-07-2021	03-06-2022
Cable	Bost	JYT3M-40G-SS-8M	JYT3M-4	04-02-2021	04-01-2022
EMI Test Software	Tonscend	TS+	Version:3.0.0.1		

Conducted method:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
Spectrum Analyzer	Keysight	N9020B	MY57431500	07-02-2021	07-01-2022
Simulated Station	Rohde & Schwarz	CMW500	108209	07-02-2021	07-01-2022
RF Control Unit	Tonscend	JS0806-1	N/A	N/A	N/A
Band Reject Filter Group	Tonscend	JS0806-F	21A8060360	N/A	N/A
Test Software	Tonscend	TS+	Version: 2.6.9.0526		

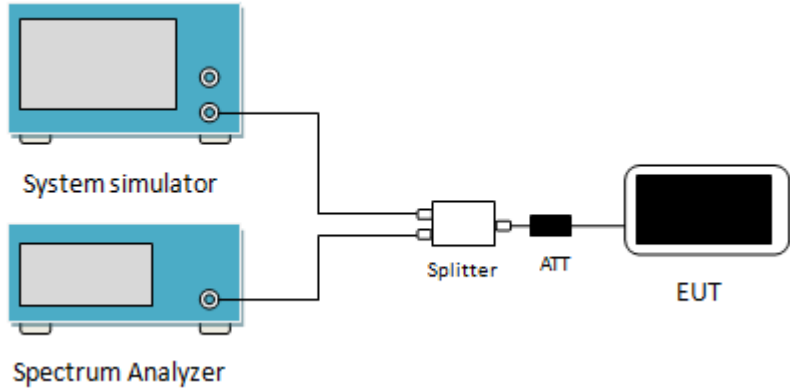
6. Test results

6.1 Conducted Output Power, ERP and EIRP

Test Requirement:	FCC part 22.913(a)(5), FCC part 24.232(c)
Limit:	GSM 850: 7W, PCS 1900: 2W
Test setup:	 <p>The diagram illustrates the test setup. On the left is a blue 'System simulator' with a screen and two ports. A line connects it to a black 'ATT' (attenuator) block. Another line connects the 'ATT' to a black 'EUT' (Equipment Under Test) device.</p>
Test Procedure:	The transmitter output was connected to a calibrated attenuator, the other end of which was connected to the simulated station. Transmitter output power was read off in dBm.
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

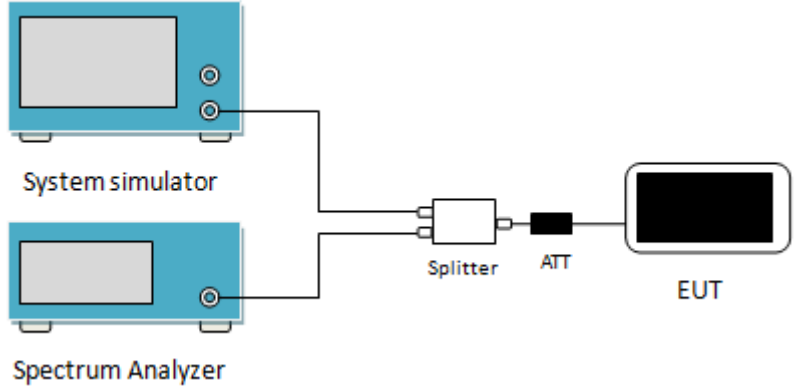
Measurement Data: Refer to Appendix A – GSM

6.2 Peak-to-Average Power Ratio

Test Requirement:	FCC part 24.232(d)
Limit:	The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.
Test setup:	 <p>The diagram shows a test setup for measuring Peak-to-Average Power Ratio (PAR). It includes a System simulator, a Spectrum Analyzer, a Splitter, an ATT (Attenuator), and an EUT (Equipment Under Test). The System simulator and Spectrum Analyzer are connected to the Splitter. The Splitter is connected to the ATT, which is then connected to the EUT.</p>
Test Procedure:	<ol style="list-style-type: none"> 1 The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. 2 Set the CCDF option in spectrum analyzer, $RBW \geq OBW$, 3 Set the EUT working in highest power level, measured and recorded the 0.1% as PAPR level. 4 Repeat step 1~3 at other frequency and modulations.
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data: Refer to Appendix B – GSM

6.3 Occupy Bandwidth

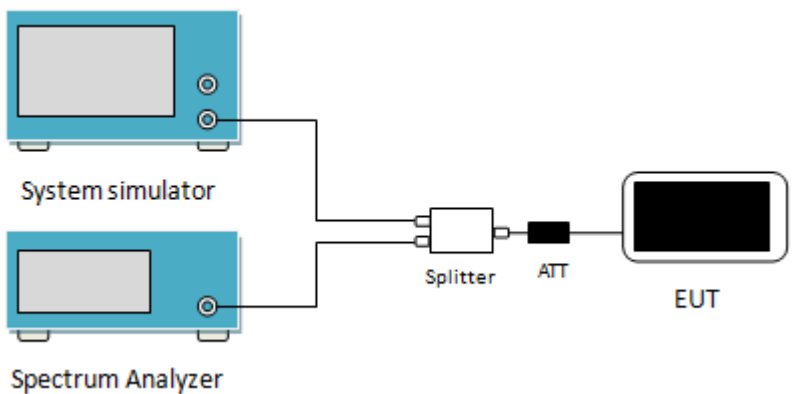
Test Requirement:	FCC part 22.917(b), FCC part 24.238(b)
Test setup:	 <p>The diagram illustrates the test setup. On the left, there are two blue rectangular units: the top one is labeled 'System simulator' and the bottom one is labeled 'Spectrum Analyzer'. Both have a single output port. These two ports are connected to a white 'Splitter' box. From the splitter, one line goes to the 'System simulator' and the other goes to a black 'ATT' (Attenuator) block. The output of the ATT is connected to the 'EUT' (Equipment Under Test), which is represented as a black smartphone icon.</p>
Test Procedure:	<ol style="list-style-type: none"> 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 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data: Refer to Appendix C – GSM

6.4 Modulation Characteristic

According to FCC § 2.1047(d), Part 22H & 24E there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

6.5 Out of band emission at antenna terminals

Test Requirement:	FCC part 22.917(a), FCC part 24.238(a)
Limit:	-13dBm
Test setup:	 <p>The diagram illustrates the test setup for out-of-band emission measurement. It shows a 'System simulator' and a 'Spectrum Analyzer' connected to a 'Splitter'. The 'Splitter' is connected to an 'ATT' (attenuator), which is then connected to the 'EUT' (Equipment Under Test).</p>
Test Procedure:	<ol style="list-style-type: none"> 1 The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. 2 For the out of band: For GSM850&WCDMA850 set the RBW=100 kHz, VBW=300 kHz and for PCS1900 & WCDMA1900 set the RBW=1MHz, VBW=3MHz when below 1 GHz, RBW =1 MHz, VBW=3 MHz when above 1 GHz, Start=30MHz, Stop= 10th harmonic. 3 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 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data:

Band edge emission: Refer to Appendix D – GSM

Spurious emission: Refer to Appendix E – GSM

6.6 Field strength of spurious radiation measurement

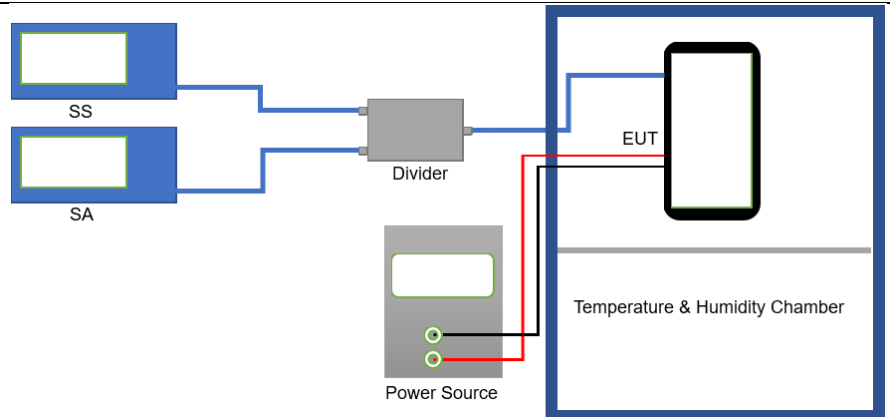
Test Requirement:	FCC part 22.917(a), FCC part 24.238(a)
Limit:	-13dBm
Test setup:	<p>Below 1GHz</p> <p>Above 1GHz</p>
Test Procedure:	<ol style="list-style-type: none"> The EUT was placed on the top of a rotating table 0.8m(below 1GHz)/1.5m(above 1GHz) above the ground at a 3 meter camber. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and EMI spectrum analyzer. 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. 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. The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and the spurious emissions frequency. $ERP / EIRP = S.G. \text{ output (dBm)} + \text{Antenna Gain(dB/dBi)} - \text{Cable Loss (dB)}$
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details.
Test results:	Passed

Measurement Data (worst case):

GSM850						
Lowest channel						
Frequency (MHz)	Spurious Emission level (dBm)	Factor (dB)	Level at antenna terminals (dBm)	Limit Line (dBm)	Margin (dB)	Polarization
1648.40	-41.24	-11.10	-52.34	-13.00	39.34	Vertical
2472.60	-42.56	-6.19	-48.75	-13.00	35.75	Vertical
3296.80	-45.48	-4.94	-50.42	-13.00	37.42	Vertical
1648.40	-31.64	-11.00	-42.64	-13.00	29.64	Horizontal
2472.60	-42.82	-6.54	-49.36	-13.00	36.36	Horizontal
3296.80	-47.71	-5.21	-52.92	-13.00	39.92	Horizontal
Middle channel						
Frequency (MHz)	Spurious Emission level (dBm)	Factor (dB)	Level at antenna terminals (dBm)	Limit Line (dBm)	Margin (dB)	Polarization
1673.20	-40.99	-11.13	-52.12	-13.00	39.12	Vertical
2509.80	-42.27	-6.21	-48.48	-13.00	35.48	Vertical
3346.40	-45.31	-5.02	-50.33	-13.00	37.33	Vertical
1673.20	-31.38	-11.04	-42.42	-13.00	29.42	Horizontal
2509.80	-42.73	-6.51	-49.24	-13.00	36.24	Horizontal
3346.40	-47.68	-5.23	-52.91	-13.00	39.91	Horizontal
Highest channel						
Frequency (MHz)	Spurious Emission level (dBm)	Factor (dB)	Level at antenna terminals (dBm)	Limit Line (dBm)	Margin (dB)	Polarization
1697.60	-41.18	-11.09	-52.27	-13.00	39.27	Vertical
2546.40	-42.45	-6.38	-48.83	-13.00	35.83	Vertical
3395.20	-45.28	-5.20	-50.48	-13.00	37.48	Vertical
1697.60	-31.44	-11.15	-42.59	-13.00	29.59	Horizontal
2546.40	-42.63	-6.06	-48.69	-13.00	35.69	Horizontal
3395.20	-47.92	-5.09	-53.01	-13.00	40.01	Horizontal
<i>Remark:</i>						
1. The emission levels of below 1 GHz are lower than the limit 20dB and not show in test report.						

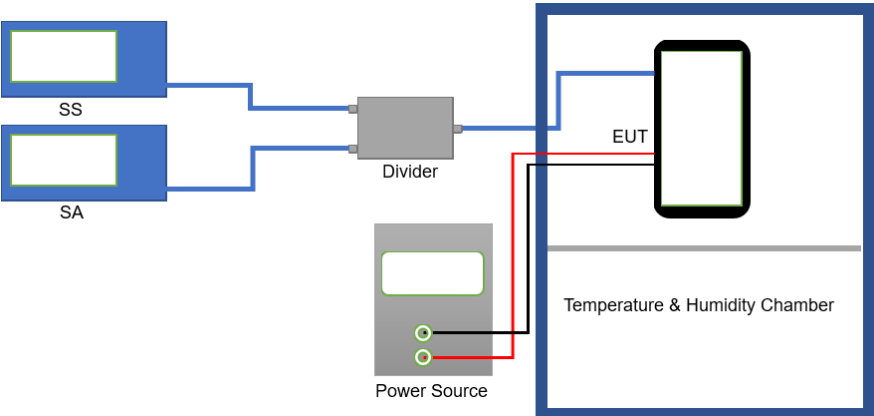
PCS1900						
Lowest channel						
Frequency (MHz)	Spurious Emission level (dBm)	Factor (dB)	Level at antenna terminals (dBm)	Limit Line (dBm)	Margin (dB)	Polarization
3700.40	-49.13	-1.61	-50.74	-13.00	37.74	Vertical
5550.60	-51.24	5.40	-45.84	-13.00	32.84	Vertical
3700.40	-49.66	-2.10	-51.76	-13.00	38.76	Horizontal
5550.60	-46.58	3.80	-42.78	-13.00	29.78	Horizontal
Middle channel						
Frequency (MHz)	Spurious Emission level (dBm)	Factor (dB)	Level at antenna terminals (dBm)	Limit Line (dBm)	Margin (dB)	Polarization
3760.00	-48.89	-1.31	-50.20	-13.00	37.20	Vertical
5640.00	-51.08	6.96	-44.12	-13.00	31.12	Vertical
3760.00	-49.50	-1.81	-51.31	-13.00	38.31	Horizontal
5640.00	-46.33	4.29	-42.04	-13.00	29.04	Horizontal
Highest channel						
Frequency (MHz)	Spurious Emission level (dBm)	Factor (dB)	Level at antenna terminals (dBm)	Limit Line (dBm)	Margin (dB)	Polarization
3819.60	-49.35	-1.02	-50.37	-13.00	37.37	Vertical
5729.40	-51.43	8.20	-43.23	-13.00	30.23	Vertical
3819.60	-49.68	-1.49	-51.17	-13.00	38.17	Horizontal
5729.40	-46.56	5.72	-40.84	-13.00	27.84	Horizontal
<i>Remark:</i>						
1. The emission levels of below 1 GHz are lower than the limit 20dB and not show in test report.						

6.7 Frequency stability V.S. Temperature measurement

Test Requirement:	FCC Part 22.355, FCC Part 24.235, FCC Part 2.1055(a)(1)(b)
Limit:	±2.5 ppm for GSM 850 Within authorized band for PCS 1900
Test setup:	
Test procedure:	<ol style="list-style-type: none"> 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 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data: Refer to Appendix F – GSM

6.8 Frequency stability V.S. Voltage measurement

Test Requirement:	FCC Part 22.355, FCC Part 24.235, FCC Part 2.1055(d)(2)
Limit:	±2.5 ppm for GSM 850 Within authorized band for PCS 1900
Test setup:	
Test procedure:	<ol style="list-style-type: none"> 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 specify extreme voltage variation (+/- 15%) and endpoint, record the maximum frequency change.
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data: Refer to Appendix F – GSM