GSM TEST REPORT

Report Number: C21T00052-RF01-V01

Applicant	Mobiwire Mobiles (Ningbo) Co.,Ltd
Product Name	4G Clamshell Feature Phone
Model Name	DFC-0380
Brand Name	Doro
FCC ID	WS5DFC0380

Industrial Internet Innovation Center (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in FCC Part 2/22/24, ANSI/TIA-603-E, ANSI C63.26, KDB 971168 D01.

Prepared by	范甲航	Reviewed by	王长青
Approved by	[illegible]	Issue Date	2021-10-13

Industrial Internet Innovation Center (Shanghai) Co., Ltd.

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Test Laboratory:
Industrial Internet Innovation Center (Shanghai) Co., Ltd.
Add: Building 4, No. 766 Jingang Rd, Pudong, Shanghai, China
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Revision Version

Report Number	Revision	Date	Memo
C21T00052-RF01-V00	00	2021-09-24	Initial creation of test report
C21T00052-RF01-V01	01	2021-10-13	Explain the date of section 6.1.2.6

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1. Test Laboratory

1.1. Testing Location

Company Name	Industrial Internet Innovation Center (Shanghai) Co., Ltd.
Address	Building 4, No. 766 Jingang Rd, Pudong, Shanghai, China
FCC Registration No.	958356
FCC Degistration No.	CN1177

1.2. Testing Environment

Normal Temperature	15℃~35℃
Relative Humidity	30%RH~60%RH
Supply Voltage	120V/60Hz

1.3. Project Information

Project Leader	XU Yuting
Testing Start Date	2021-07-16
Testing End Date	2021-09-09

2. Client Information

2.1. Applicant Information

Company Name	Mobiwire Mobiles (Ningbo) Co.,Ltd
Address	No.999,Dacheng East Road,Fenghua City,Zhejiang Province,China
Telephone	+86 574 59555707

2.2. Manufacturer Information

Company Name	Doro AB
Address	Jörgen Kocksgatan 1B, SE 211 20 MALMÖ, SWEDEN
Telephone	+46 46 280 50 00

3. Equipment under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Product Name	4G Clamshell Feature Phone
Model name	DFC-0380
Supported Radio Technology and Bands	GSM900/DCS1800/PCS1900 WCDMA Band I/ VIII LTE Band 1/3/7/8/20/28/38 BT 5.0 BR EDR
Hardware Version	V01(HW2011/2021/2031/2041）
Software Version	DFC-0380_SF296_N_S01A_V01_M210607_CE
FCC ID	WS5DFC0380
Extreme Temperature	-15℃~55℃
Nominal Voltage	3.7V
Extreme High Voltage	4.2V
Extreme Low Voltage	3.6V

3.2. Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version	Date of Receipt
N05	352683990007566	V01(HW code: 2011)	DFC-0380_SF296_N_S01A_V01_M210607_CE	2021-07-16
N08	352683990007913	V01(HW code: 2011)	DFC-0380_SF296_N_S01A_V01_M210607_CE	2021-08-02
N13	352683990008531	V01(HW code: 2021)	DFC-0380_SF296_N_S01A_V01_M210607_CE	2021-09-02
N14	352683990010651	V01(HW code: 2031)	DFC-0380_SF296_N_S01A_V01_M210607_CE	2021-09-02
N15	352683990011022	V01(HW code: 2041)	DFC-0380_SF296_N_S01A_V01_M210607_CE	2021-09-02

*EUT ID: is internally used to identify the test sample in the lab.

3.3. Internal Identification of AE used during the test

AE ID*	Description	Model	SN/Remark
AE1	RF cable	N/A	N/A

*AE ID: is internally used to identify the test sample in the lab.

4. Reference Documents

4.1. Reference Documents for testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS	2018-10-01
FCC Part 22	PUBLIC MOBILE SERVICES	2018-10-01
FCC Part 24	PERSONAL COMMUNICATIONS SERVICES	2018-10-01
ANSI-TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2016
ANSI C63.26	American National Standard of Procedures for Compliance Testing of Licensed Transmitters Used in Licensed Radio	2015
KDB 971168 D01	Measurement Guidance for Certification of Licensed Digital Transmitters	v03r01

4.2. Reference Information from client

Antenna gain Information of the test sample provided by Mobiwire Mobiles (Ningbo) Co.,Ltd
Maximum of Antenna Gain:
GSM900: -2.5dBi
DCS1800: -1.5dBi
PCS1900: -1.5dBi

5. Test Summary

5.1. Summary of Test Results

Measurement Items	Sub-clause	Verdict
Output Power	2.1046/22.913(a)/24.232(c)	Pass
Peak-to-Average Ratio	24.232(d)	Pass
99%Occupied Bandwidth	2.1049(h)(i)/ 22.917(b)	Pass
-26dB Emission Bandwidth	22.917(b)/§24.238(b)	Pass
Band Edge at antenna terminals	22.917(a)/24.238(a)	Pass
Frequency stability	2.1055/24.235	Pass
Conducted Spurious mission	2.1053/22.917(a)/24.238(a)	Pass
Emission Limit	2.1051/22.917/24.238/22.913/24.232	Pass

Test Conditions

Tnom	Normal Temperature
Tmin	Low Temperature
Tmax	High Temperature
Vnom	Normal Voltage
Vmin	Low Voltage
Vmax	High Voltage
Hnom	Norm Humidity
Anom	Norm Air Pressure

For this report, all the test case listed above are tested under Normal Temperature and Normal Voltage, and also under norm humidity, the specific conditions as following:

Temperature	Tnom	25℃
Voltage	Vnom	3.7V
Humidity	Hnom	48%
Air Pressure	Anom	1010hPa

5.2. Statements

The DFC-0380, manufactured by Doro AB is a new product for testing.

Industrial Internet Innovation Center (Shanghai) Co., Ltd. only performed test cases which identified with Pass/Fail/Inc result in section 5.1.

Industrial Internet Innovation Center (Shanghai) Co., Ltd. has verified that the compliance of the tested device specified in section 3 of this test report is successfully evaluated according to the procedure and test methods as defined in type certification requirement listed in section 4 of this test report.

6. Measurement Results

Shielding Room1 (6.0 meters×3.0 meters×2.7 meters) did not exceed following limits along the conducted RF performance testing:

Temperature	Min. = 15 ℃, Max. = 35 ℃
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Ground system resistance	< 0.5
Temperature	Min. = 15 ℃, Max. = 35 ℃

Control room did not exceed following limits along the EMC testing:

Temperature	Min. = 15 ℃, Max. = 35 ℃
Relative humidity	Min. =30 %, Max. = 60 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 10 k
Ground system resistance	< 0.5

Fully-anechoic chamber1 (6.9 meters×10.9 meters×5.4 meters) did not exceed following limits along the EMC testing:

Temperature	Min. = 15 ℃, Max. = 35 ℃
Relative humidity	Min. = 25 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 10 k
Ground system resistance	< 0.5
VSWR	Between 0 and 6 dB, from 1GHz to 18GHz
Site Attenuation Deviation	Between -4 and 4 dB,30MHz to 1GHz
Uniformity of field strength	Between 0 and 6 dB, from 80MHz to 3000 MHz

6.1. Output Power

6.1.1. Summary

During the process of testing, the EUT was controlled Rhode & Schwarz Digital Radio. Communication tester to ensure max power transmission and proper modulation.

This result contains peak output power and EIRP measurements for the EUT. In all cases, output power is within the specified limits.

6.1.2. Conducted

6.1.2.1. Method of Measurements

Method of measurements please refer to KDB971168 D01 v03 clause 5.

The EUT was set up for the max output power with pseudo random data modulation.

The power was measured with Rhode & Schwarz Spectrum Analyzer FSQ(peak).

These measurements were done at 3 frequencies, 1850.2 MHz, 1880.0MHz and 1909.8MHz for PCS1900 band(bottom, middle and top of operational frequency range).

6.1.2.2 Test procedures:

1. The transmitter output port was connected to base station.
2. Set the EUT at maximum power through base station.
3. Select lowest, middle, and highest channels for each band and different modulation.
4. Measure the maximum burst average power for GSM and maximum average power for other modulation signal.

6.1.2.3 Limit:

22.913(a) Mobile stations are limited to 7watts.

24.232(c) Mobile and portable stations are limited to 2 watts.

6.1.2.4 Test Procedure:

The transmitter output power was connected to calibrated attenuator, the other end of which was connected to signal analyzer. Transmitter output power was read off the power in dBm. The power outputs at the transmitter antenna port was determined by adding the value of attenuator to the signal analyzer reading.

6.1.2.5 GSM Test Condition:

RBW	VBW	Sweep time	Span
3MHz	10MHz	Auto	50MHz

6.1.2.6 Measurement results:

GSM 1900(GMSK)	
Channel/fc(MHz)	Peak power (dBm)
Mid 661/1880	29.80
Low 512/1850.2	29.82
High 810/1909.8	29.77
GPRS 1900 (GMSK 1 Slot)	
Channel/fc(MHz)	Peak power (dBm)
Mid 661/1880	29.85
Low 512/1850.2	29.86
High 810/1909.8	29.82
EDGE 1900 (8PSK 1 Slot)	
Channel/fc(MHz)	Peak power (dBm)
Mid 661/1880	21.31
Low 512/1850.2	21.44
High 810/1909.8	21.29

Note：The data in the above table are all conducted power.

6.2. Peak-to-Average Power Ratio

Method of test measurements please refer to KDB971168 D01 v03 clause 5.7.

6.2.1 PAPR Limit

The peak-to-average power ratio (PAPR) of the transmission may not exceed 13dB

6.2.2 Test procedures

1. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
2.
   1) Select the spectrum analyzer CCDF function.
   2) Set RBW ≥ signal's occupied bandwidth.
   3) Set the number of counts to a value that stabilizes the measured CCDF cure;
   4) Sweep time ≥ 1s.
3. Record the maximum PAPR level associated with a probability of 0.1%.

6.2.3 Test results:

GSM1900			
Channel	512	661	810
Frequency (MHz)	1850.2	1880	1909.8
PAPR(dB)	7.69	8.01	10.67
GPRS1900			
Channel	512	661	810
Frequency (MHz)	1850.2	1880	1909.8
PAPR(dB)	10.67	10.64	10.67
EDGE 1900			
Channel	512	661	810
Frequency (MHz)	1850.2	1880	1909.8
PAPR(dB)	7.66	10.64	8.3

6.3. 99% Occupied Bandwidth

Method of test please refer to KDB971168 D01 v03 clause 4.0.

6.3.1. Occupied Bandwidth

Similar to conducted emissions; occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of GSM850, PCS1900.

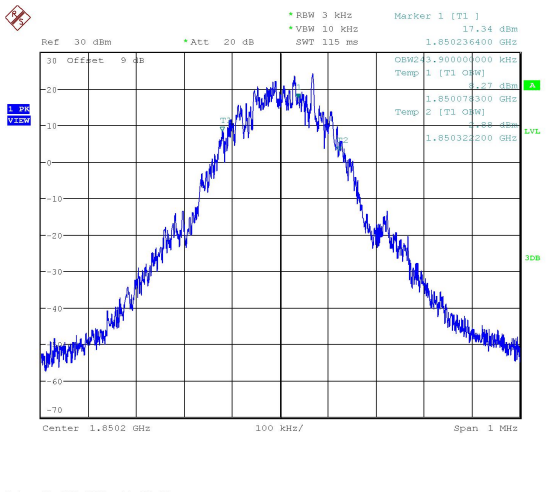
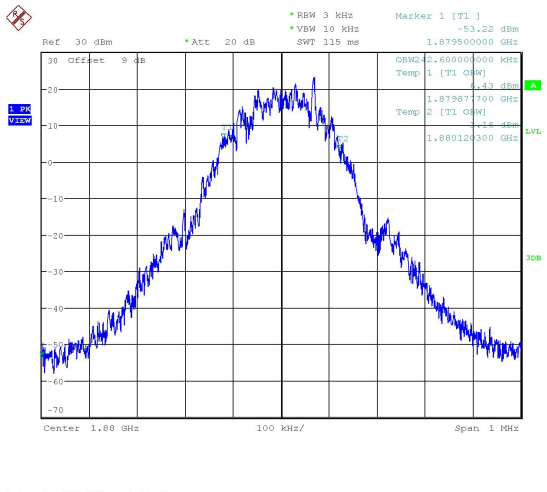
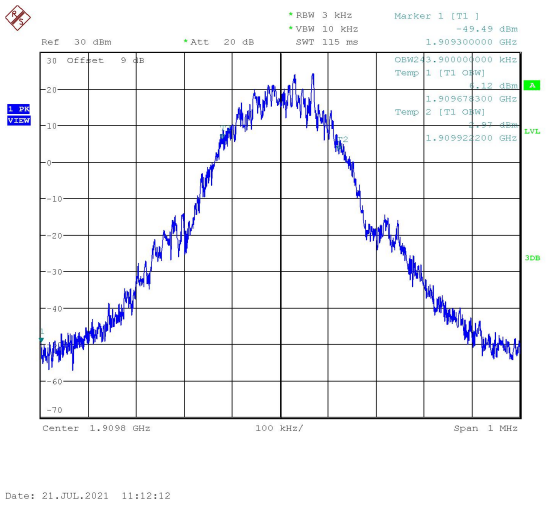
6.3.2 Test Procedure:

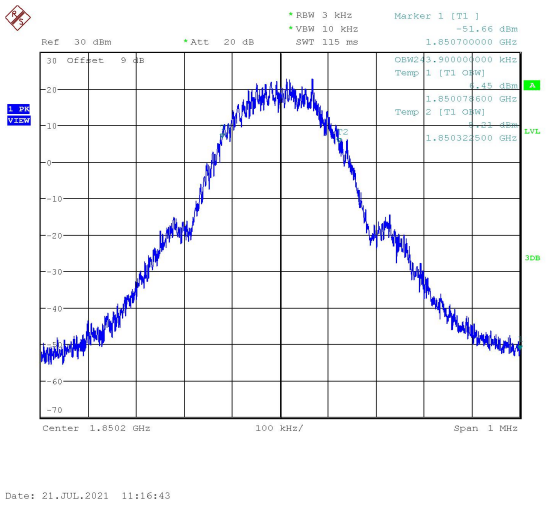
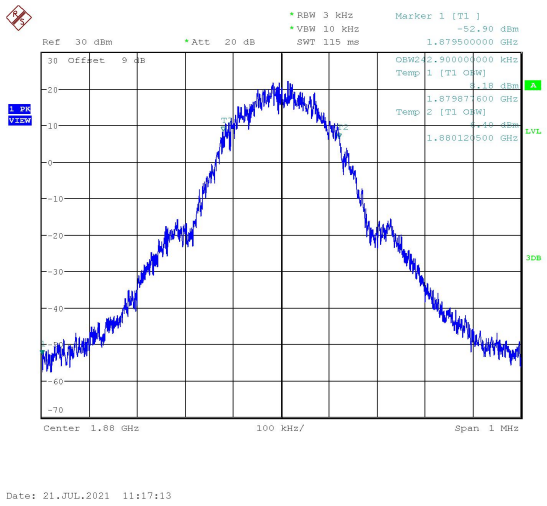
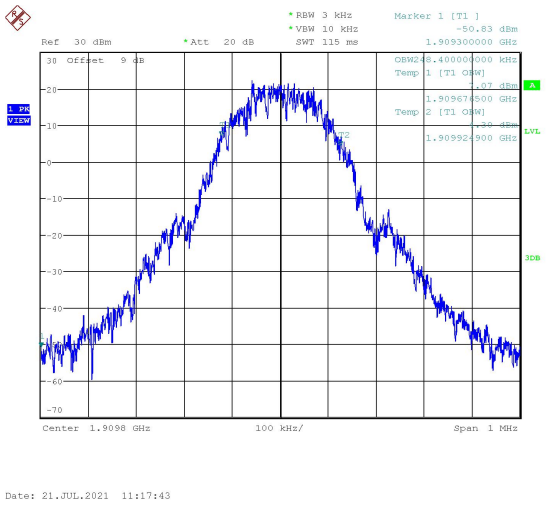
1. The EUT output RF connector was connected with a short cable to the signal analyzer.
2. RBW was set to about 1% of emission BW, VBW >= 3 times RBW,.
3. 99% bandwidth were measured, the occupied bandwidth is delta frequency between the two points where the display line intersects the signal trace.

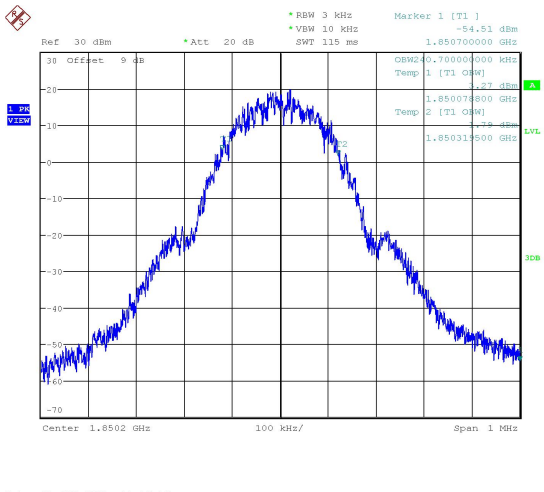
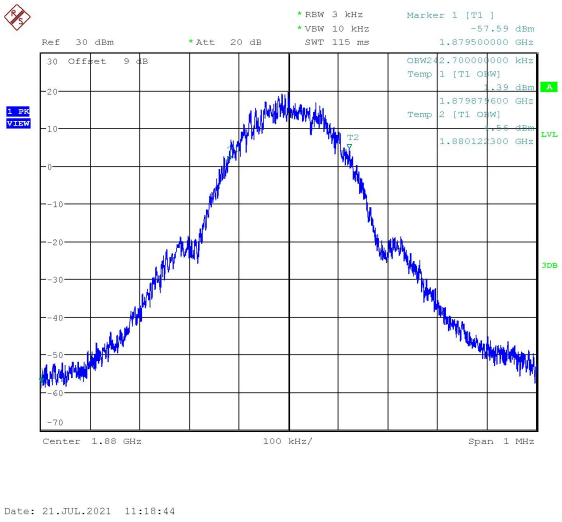
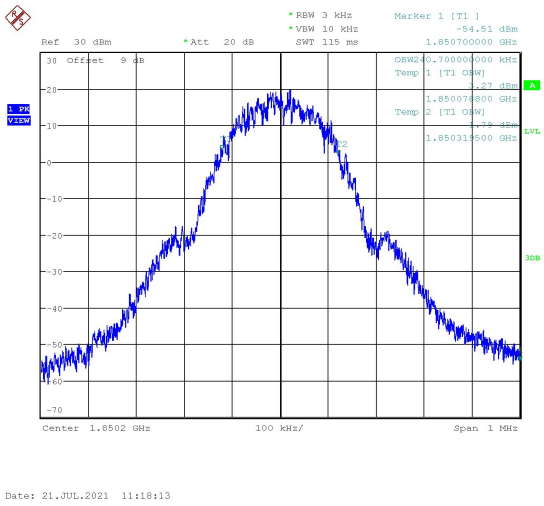
6.3.3 Test result:

GSM1900		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(kHz)
Mid 661	1880	242.60
Low 512	1850.2	243.90
High 810	1909.8	243.90
GPRS1900		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(kHz)
Mid 661	1880	242.90
Low 512	1850.2	243.90
High 810	1909.8	248.40
EDGE1900		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(kHz)
Mid 661	1880	242.70
Low 512	1850.2	240.70
High 810	1909.8	242.50

Conclusion: PASS

GSM 1900	
Channel 512-Occupied Bandwidth (99%)	Channel 661-Occupied Bandwidth (99%)
	
Channel 810-Occupied Bandwidth (99%)	/
	/

GPRS 1900	
Channel 512-Occupied Bandwidth (99%)	Channel 661-Occupied Bandwidth (99%)
	
Channel 810-Occupied Bandwidth (99%)	/
	/

EDGE 1900	
Channel 512-Occupied Bandwidth (99%)	Channel 661-Occupied Bandwidth (99%)
	
Channel 810-Occupied Bandwidth (99%)	/
	/

6.4. -26dB Emission Bandwidth

Method of test please refer to KDB971168 D01 v03 clause 4.0.

6.4.1. -26dB Emission Bandwidth

Similar to conducted emissions; occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of GSM850, PCS1900.

6.4.2 Test Procedure:

1. The EUT output RF connector was connected with a short cable to the signal analyzer.
2. RBW was set to about 1% of emission BW, VBW >= 3 times RBW,.
3. 26dB bandwidth were measured, the occupied bandwidth is delta frequency between the two points where the display line intersects the signal trace.

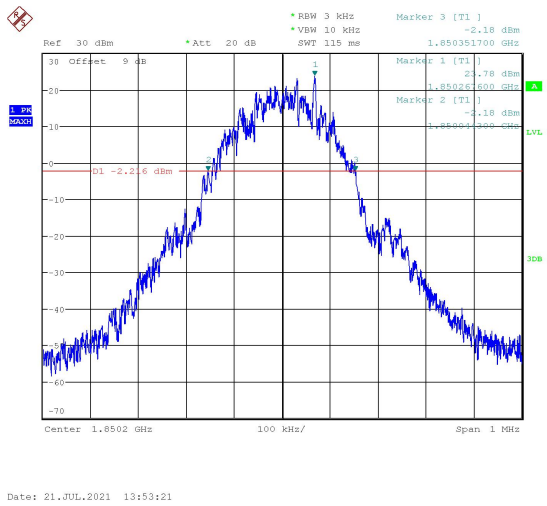
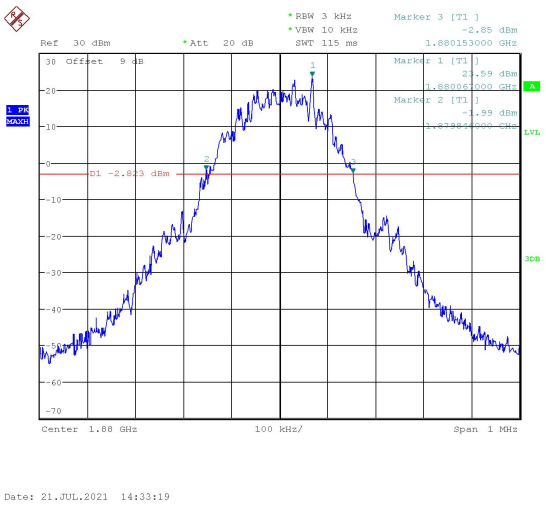
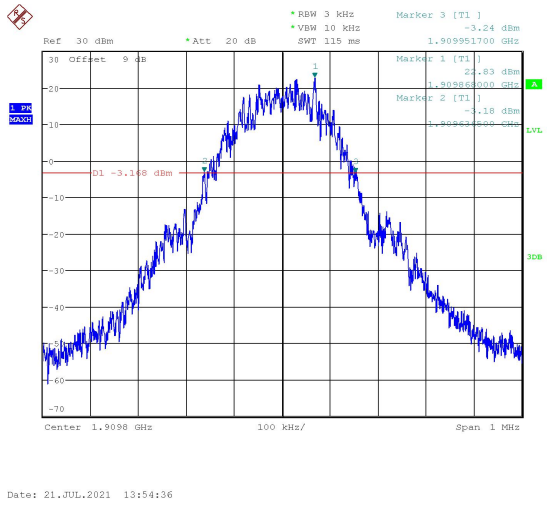
6.4.3 Measurement methods:

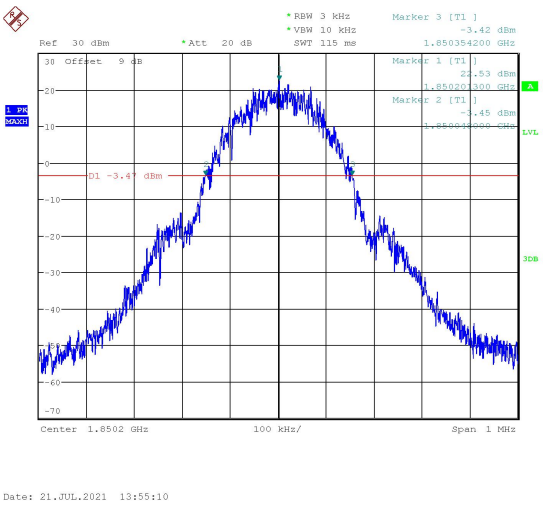
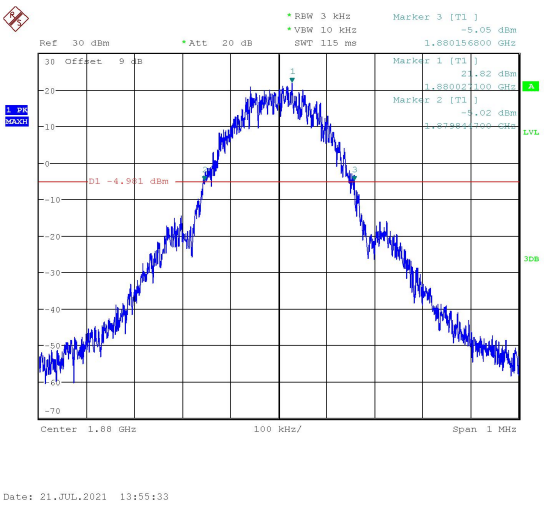
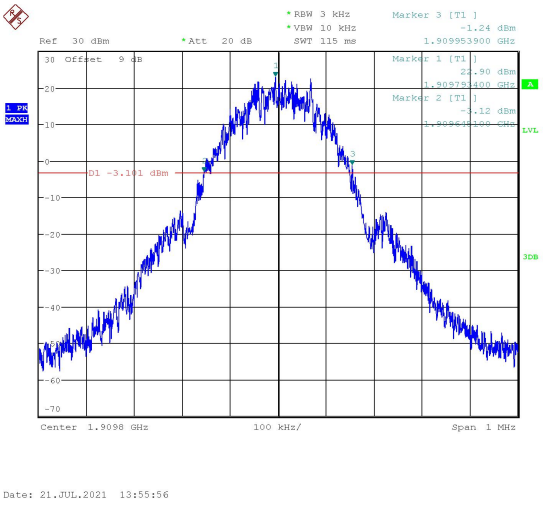
For GSM: signal analyzer setting as: RBW= 3KHz; VBW=10KHz; Span=1MHz.

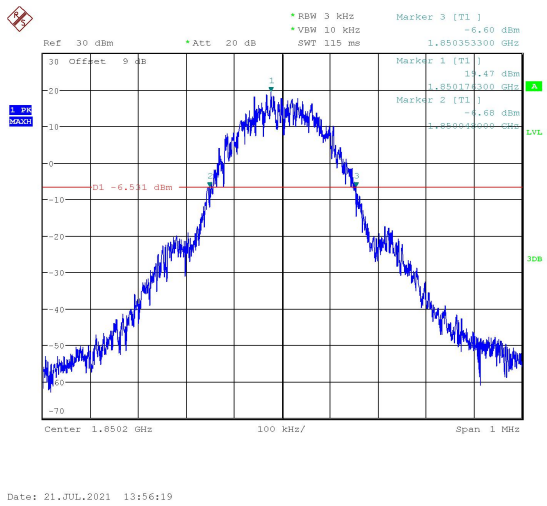
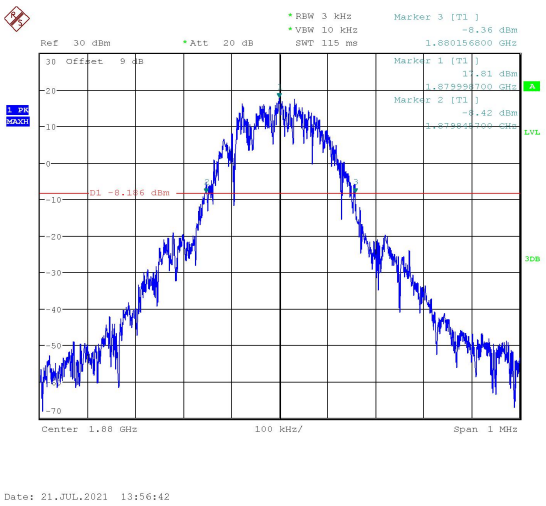
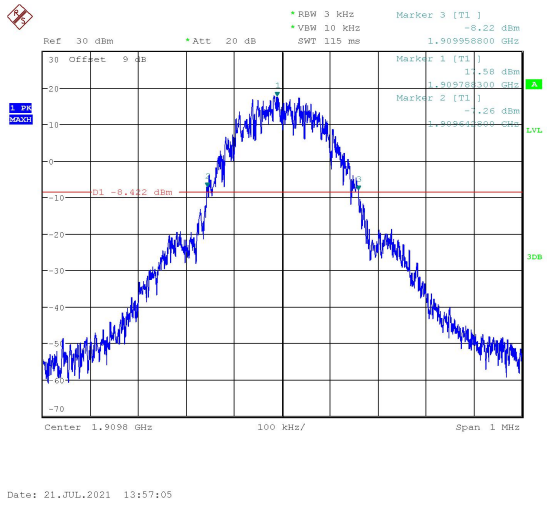
6.4.4 Test results:

GSM1900		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(kHz)
Mid 661	1880	307.00
Low 512	1850.2	307.00
High 810	1909.8	315.00
GPRS1900		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(kHz)
Mid 661	1880	312.00
Low 512	1850.2	306.00
High 810	1909.8	309.00
EDGE1900		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(kHz)
Mid 661	1880	311.00
Low 512	1850.2	305.00
High 810	1909.8	316.00

Conclusion: PASS

GSM 1900	
Channel 512- Emission Bandwidth (-26dBc BW)	Channel 661- Emission Bandwidth (-26dBc BW)
	
Channel 810- Emission Bandwidth (-26dBc BW)	/
	/

GPRS 1900	
Channel 512- Emission Bandwidth (-26dBc BW)	Channel 661- Emission Bandwidth (-26dBc BW)
	
Channel 810- Emission Bandwidth (-26dBc BW)	/
	/

EDGE 1900	
Channel 512- Emission Bandwidth (-26dBc BW)	Channel 881- Emission Bandwidth (-26dBc BW)
	
Channel 810- Emission Bandwidth (-26dBc BW)	/
	/

6.5 Band Edge at antenna terminals

Method of test measurements please refer to KDB971168 D01 v03 clause 6

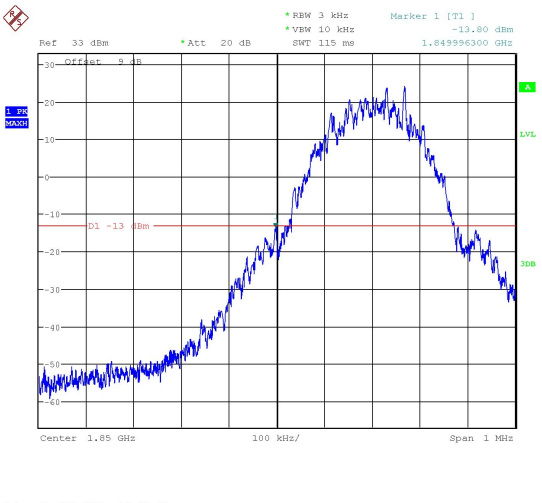
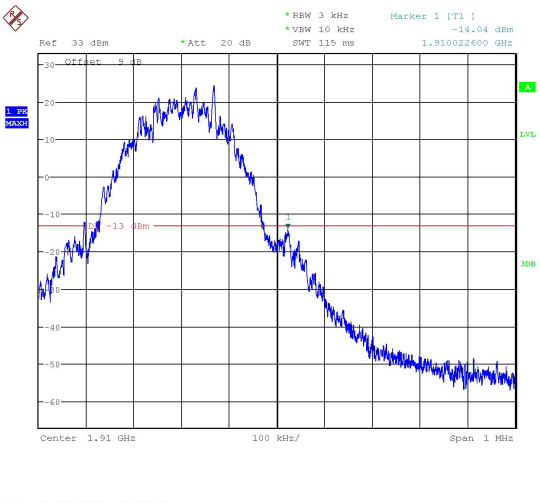
6.5.1 Limit:

The magnitude of each spurious and harmonic emission that can be detected when the equipment is operated under the conditions specification in the instruction manual and/or alignment procedure, shall not be less than 43+10log (Mean power in watts) dBc below the mean power output outside a license's frequency block(-13dBm).

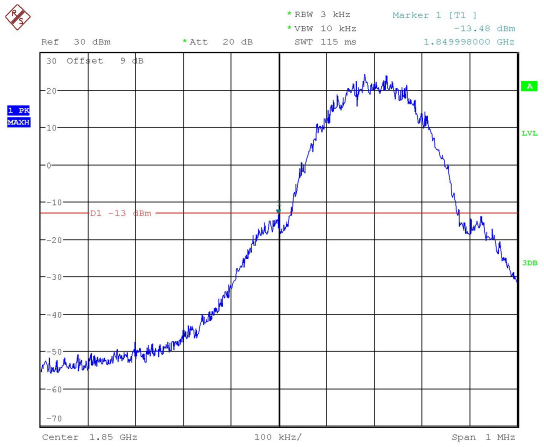
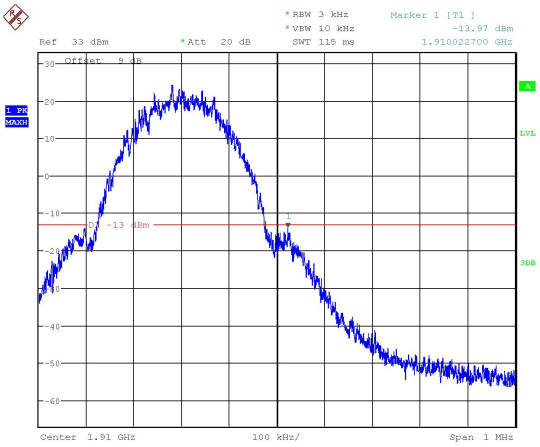
6.5.2 Test procedure:

1. The RF output of the transceiver was connected to a signal analyzer through appropriate attenuation.
2. In the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.
3. The RF fundamental frequency should be excluded against the limit line in the operating frequency band
4. 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

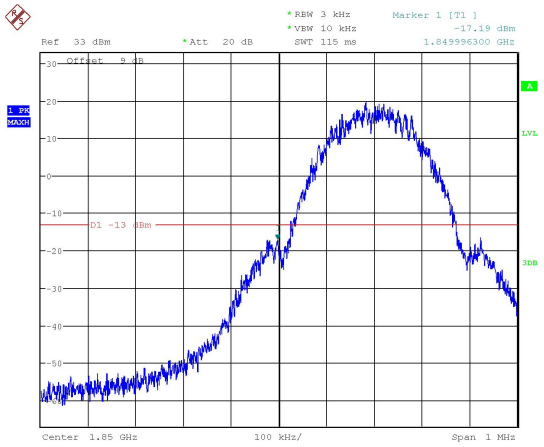
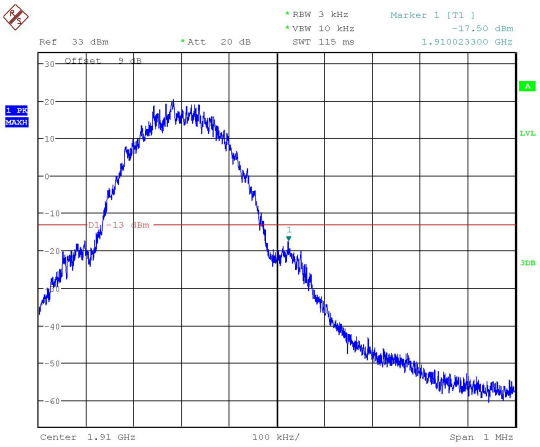
6.5.3 Test Result:

GSM 1900	
Channel 512- LOW BAND EDGE BLOCK	Channel 810- LOW BAND EDGE BLOCK
	

GPRS 1900

Channel 512- LOW BAND EDGE BLOCK	Channel 810- LOW BAND EDGE BLOCK
	

EDGE 1900

Channel 512- LOW BAND EDGE BLOCK	Channel 810- LOW BAND EDGE BLOCK
	

6.6. Frequency Stability

Method of test measurements please refer to KDB971168 D01 v03 clause 9

6.6.1. Method of Measurement and test procedures

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a “call mode”. This is accomplished with the use of R&S CMW 500 DIGITAL RADIO COMMUNICATION TESTER.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -10℃.
3. With the EUT, powered via nominal voltage, connected to the CMW 500 and in a simulated call on mid channel of GSM850, PCS1900 measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at -10℃ increments from -10℃ to +50℃. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1 1/2 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50℃.
7. With the EUT, powered via nominal voltage, connected to the CMW 500 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 C increments from +50℃ to -10℃. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.

6.6.2. Measurement Limit

6.6.2.1. For Hand carried battery powered equipment

According to the JTC standard the GSM frequency stability of the carrier shall be accurate to within 0.1ppm of the received frequency from the base station. And the WCDMA is 2.5ppm. This accuracy is sufficient to meet Sec.24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d)(2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.6VDC and 4.35VDC, with a nominal voltage of 3.8VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. These voltages was varied from 85% to 115%.

6.6.2.2. For equipment powered by primary supply voltage

According to the JTC standard the GSM frequency stability of the carrier shall be accurate to within 0.1ppm of the received frequency from the base station. And the WCDMA is 2.5ppm. This accuracy is sufficient to meet Sec.24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. For this EUT section 2.1055(d)(1) applies. This requires varying primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

6.6.3 Test results

GSM1900 Mid Channel/fc(MHz) 661/1880

Frequency Error VS Temperature

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
3.7	-30	1.49	196
3.7	-20	10.43	196
3.7	-10	-7.23	196
3.7	0	-8.07	196
3.7	10	-15.01	196
3.7	20	-11.72	196
3.7	30	8.98	196
3.7	40	-10.72	196
3.7	50	6.42	84

Frequency Error VS Voltage

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
3.6	25	-1.97	196
3.7	25	-5.13	196
4.2	25	-1.42	196

GPRS1900 Mid Channel/fc(MHz) 661/1880

Frequency Error VS Temperature

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
3.7	-30	-8.56	196
3.7	-20	-12.20	196
3.7	-10	-1.16	196
3.7	0	-16.27	196
3.7	10	-24.18	196
3.7	20	-1.13	196
3.7	30	-1.87	196
3.7	40	8.36	196
3.7	50	-17.60	84

Frequency Error VS Voltage

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
3.6	25	5.13	196
3.7	25	-10.56	196
4.2	25	7.68	196

EDGE1900 Mid Channel/fc(MHz) 661/1880

Frequency Error VS Temperature

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
3.7	-30	14.50	196
3.7	-20	-3.75	196
3.7	-10	9.52	196
3.7	0	8.04	196
3.7	10	7.26	196
3.7	20	8.23	196
3.7	30	16.43	196
3.7	40	20.28	196
3.7	50	6.04	84

Frequency Error VS Voltage

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
3.6	25	0.68	196
3.7	25	-4.00	196
4.2	25	17.82	196

6.7. Conducted Spurious Emission

6.7.1. GSM Measurement Method and test procedures

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the equipment of PCS1900 band, this equates to a frequency range of 30 MHz to 19.1 GHz, data taken from 30 MHz to 20 GHz. For GSM850, data taken from 30 MHz to 10 GHz.
2. The sweep time is set automatically by instrument itself. That should be the optimal sweep time for the span and the RBW. If the sweep time is too short, that is sweep is too fast, the sweep result is not accurate; If the sweep time is too long, that is sweep is too low, some frequency components may be lost. The instrument will give a optimal sweep time according the selected span and RBW.
3. The procedure to get the conducted spurious emission is as follows:
The trace mode is set to MaxHold to get the highest signal at each frequency;
Wait 25 seconds; Get the result.
4. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

PCS 1900 Transmitter

Channel	Frequency(MHz)
512	1850.2
661	1880.0
810	1909.8

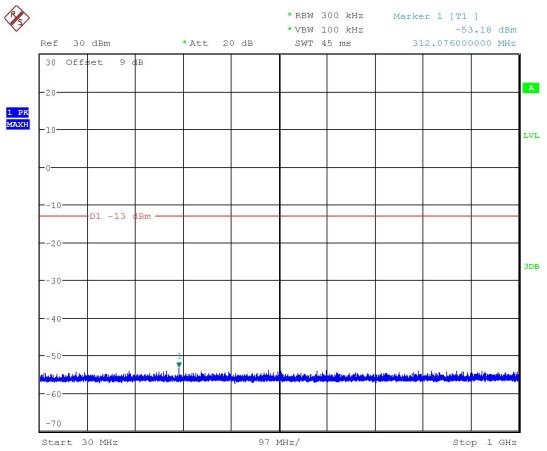
6.7.1.1. Measurement Limit

Part 24.238 and Part 22.917 specify that 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 specification that emissions shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

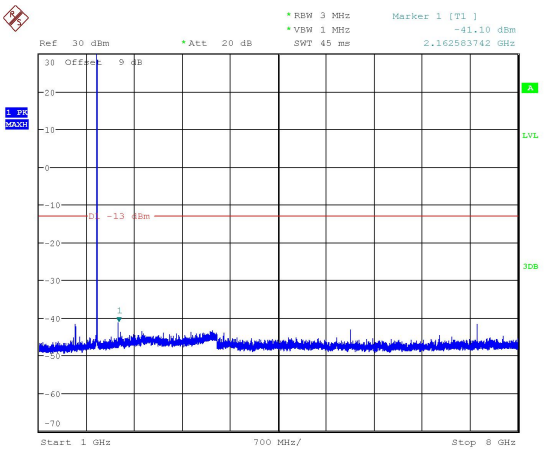
GSM1900

Channel 512: 30MHz~1GHz



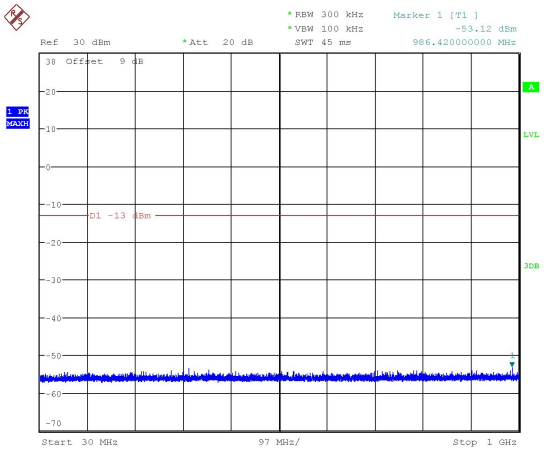
Date: 21.JUL.2021 11:20:41

Channel 512: 1GHz~8GHz



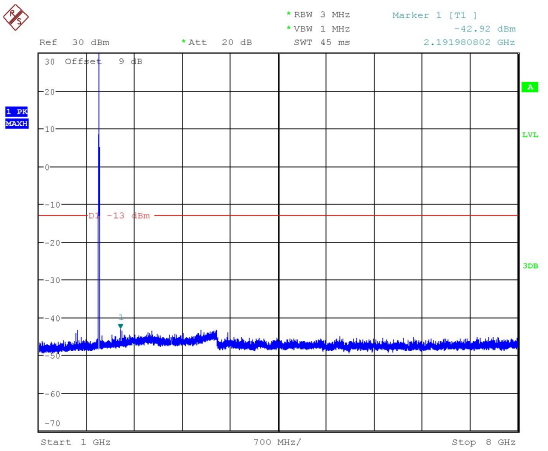
Date: 21.JUL.2021 11:21:01

Channel 661: 30MHz~1GHz



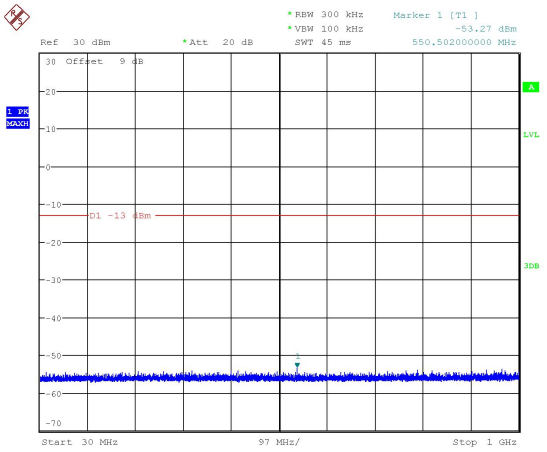
Date: 21.JUL.2021 11:21:43

Channel 661: 1GHz~8GHz



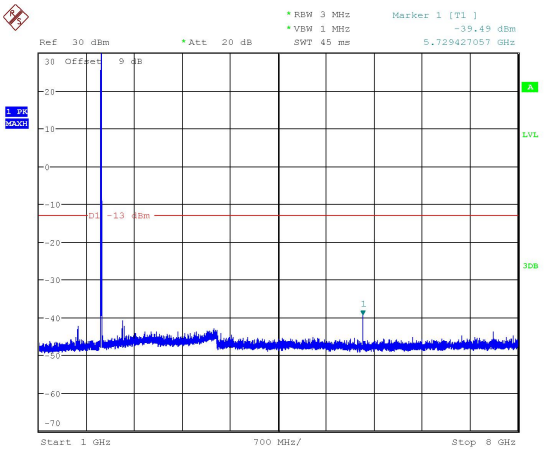
Date: 21.JUL.2021 11:22:03

Channel 810: 30MHz~1GHz



Date: 21.JUL.2021 11:23:22

Channel 810: 1GHz~8GHz



Date: 21.JUL.2021 11:23:42

6.8. Radiated

6.8.1. GSM EIRP

6.8.1.1. Description

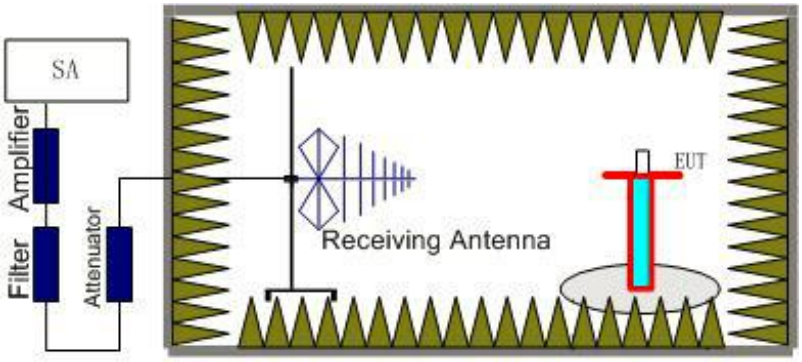
This is the test for the maximum radiated power from the EUT.

Rule Part 24.232(c) specifies, "Mobile/portable stations are limited to 2 watts e.i.r.p. Peak power" and 24.232(c) specifies that "Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage." Rule Part 22.913(a) specifies " The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts."

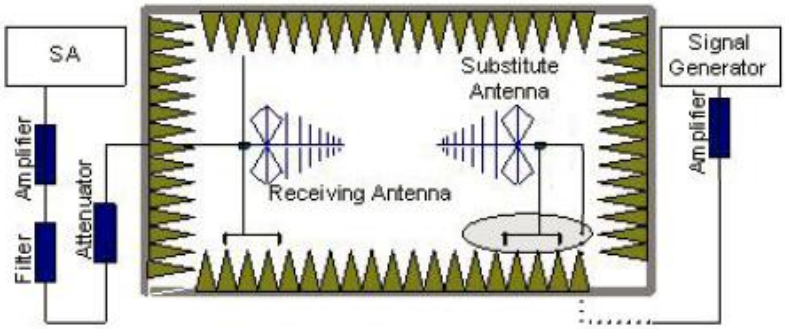
6.8.1.2. Method of Measurement

The measurements procedures in TIA-603E-2016 are used.

1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as (Pr).
3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna

polarization.

4. A amplifier should be connected to the Signal Source output port. And the cable should be connected between the Amplifier and the Substitution Antenna.

The cable loss (P_{cl}) ,the Substitution Antenna Gain (G_a) and the Amplifier Gain (P_{Ag}) should be recorded after test.

The measurement results are obtained as described below:

Power(EIRP)=P_{Mea}+ P_{Ag}- P_{cl}+ G_a

5. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15dBi) and known input power.

6. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dBi.

6.8.1.3. Measurement Limits

Rule 2.1051/22.917/24.238/22.913/24.232 specifies that " In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p(watts).

After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required." Limit -13 dBm

Rule 2.1051/22.917/24.238/22.913/24.232 specifies that " In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p(watts).

After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required." Limit -13 dBm

6.8.1.4 PCS 1900-EIRP 24.232(c)

6.8.1.4.1 Measurement result

GSM (GMSK)

Frequency(MHz)	Peak EIRP (dBm)	Polarization
1850.2	27.32	V
1880.0	27.30	H
1909.8	27.27	V

GPRS (GMSK)

Frequency(MHz)	Peak EIRP (dBm)	Polarization
1850.2	27.36	V
1880.0	27.35	H
1909.8	27.32	V

EDGE (8PSK)

Frequency(MHz)	Peak EIRP (dBm)	Polarization
1850.2	18.94	V
1880.0	18.81	H
1909.8	18.79	V

6.8.2 EMISSION LIMIT

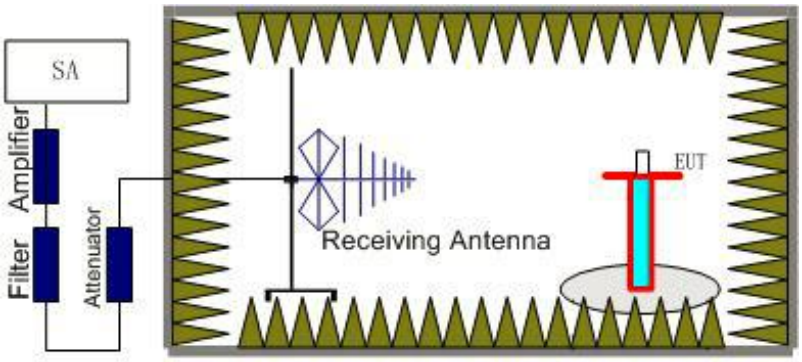
6.8.2.1 GSM Measurement Method

The measurement procedures in TIA-603E-2016are used.

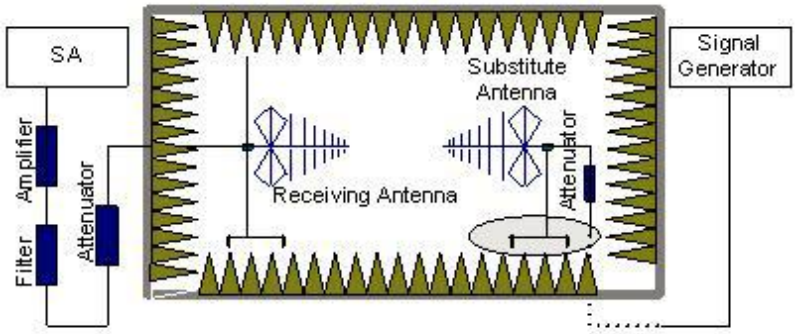
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1910 MHz. The resolution bandwidth is set as outlined in Part 24.238 and Part 22.917. The spectrum is scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of PCS1900 and GSM850.

6.8.2.2 The procedure of radiated spurious emissions is as follows:

1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all non-harmonic and harmonics of the transmit frequency through the 10thharmonic were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as (Pr).
3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
4. The Path loss (P_{pl}) between the Signal Source with the Substitution Antenna and the Substitution Antenna Gain (G_a) should be recorded after test.
A amplifier should be connected in for the test.
The Path loss (P_{pl}) is the summation of the cable loss .
The measurement results are obtained as described below:
Power(EIRP)=P_{Mea}- P_{pl}+ G_a
5. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
6. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dBi

6.8.2.3 Measurement Limit

Rule 2.1051/22.917/24.238/22.913/24.232 specifies that " In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43

+ 10 log10 p (watts).
(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required." Limit -13 dBm
Rule 2.1051/22.917/24.238/22.913/24.232 specifies that " In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p(watts).
After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required." Limit -13 dBm

6.8.2.4 Measurement Results

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the PCS1900 band (1850.2 MHz, 1880 MHz and 1909.8 MHz) and GSM850 band (824.2MHz, 836.6MHz, 848.8MHz) . It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the PCS1900 ,GSM850 into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

6.8.2.5 Measurement Results

Measurements results:

	Channel	Frequency	Frequency Range	Result
GSM1900	L	1850.2	30MHz~20GHz	Pass
	M	1880	30MHz~20GHz	Pass
	H	1909.8	30MHz~20GHz	Pass

Note:

Power(ERP)= Pmea-Pcl+Ga

This method Applicable to the following table.

RSE-G1900-L

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
3699.6	-50.25	6.6	7.9	-48.95	-13	V
5551.2	-50.47	8.2	9.8	-48.87	-13	V
7400.4	-51.16	9.7	11.6	-49.26	-13	H
9250.8	-47.05	10.7	12.7	-45.05	-13	H
11101.2	-39.04	12.1	12.3	-38.84	-13	H
12951.6	-33.5	13.2	12.3	-34.4	-13	H

RSE-G1900-M

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
5209.8	-50.54	8.0	9.4	-49.14	-13	H
6284.4	-51.56	8.8	10.3	-50.06	-13	V
7568.4	-53.06	9.7	11.6	-51.16	-13	V
9399.6	-45.84	10.7	12.7	-43.84	-13	H
11280.0	-36.92	12.1	12.3	-36.72	-13	H
13160.4	-38.54	13.0	12.3	-39.24	-13	H

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
3819.6	-47.28	6.7	7.9	-46.08	-13	H
7639.2	-51.82	9.7	11.8	-49.72	-13	H
9549.6	-49.3	10.7	12.7	-47.3	-13	H
11458.8	-42.15	12.3	12.3	-42.15	-13	H
13369.2	-34.83	13.7	12.3	-36.23	-13	H
15278.4	-37.19	14.4	12.3	-39.29	-13	H

Conclusion: PASS

Note: the EUT was displayed in several different direction, the worst cases were shown.

BB12

RSE-G1900-L

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
5551.2	-50.52	8.2	9.8	-48.92	-13	H
7400.4	-50.13	9.7	11.6	-48.23	-13	H
9250.8	-47.32	10.7	12.7	-45.32	-13	H
11100.0	-41.19	12.1	12.3	-40.99	-13	V
12951.6	-32.17	13.2	12.3	-33.07	-13	H
14802.0	-35.93	14.3	12.3	-37.93	-13	H

RSE-G1900-M

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
5115.0	-52.04	7.9	9.6	-50.34	-13	V
6207.6	-51.68	8.7	10.3	-50.08	-13	V
7579.2	-51.53	9.7	11.6	-49.63	-13	H
9399.6	-43.98	10.7	12.7	-41.98	-13	H
11280.0	-38.85	12.1	12.3	-38.65	-13	H
13160.4	-36.92	13.0	12.3	-37.62	-13	H

RSE-G1900-H

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
3819.6	-48.98	6.7	7.9	-47.78	-13	V
6055.2	-51.57	8.6	10.2	-49.97	-13	V
7639.2	-49.71	9.7	11.8	-47.61	-13	H
9549.6	-46.82	10.7	12.7	-44.82	-13	H
11458.8	-38.85	12.3	12.3	-38.85	-13	H
13369.2	-32.98	13.7	12.3	-34.38	-13	H

RSE-GPRS1900-L

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
3700.2	-49.34	6.6	7.9	-48.04	-13	V
5550.6	-50.37	8.2	9.8	-48.77	-13	V
7400.4	-50.56	9.7	11.6	-48.66	-13	H
9250.8	-46.86	10.7	12.7	-44.86	-13	H
11101.2	-39.66	12.1	12.3	-39.46	-13	H
12951.6	-32.32	13.2	12.3	-33.22	-13	H

RSE-GPRS1900-M

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
3759.6	-50.23	6.6	7.9	-48.93	-13	H
5640.0	-52.75	8.3	10.2	-50.85	-13	V
7492.8	-51.61	9.7	11.6	-49.71	-13	V
9399.6	-44.07	10.7	12.7	-42.07	-13	H
11280.0	-38.75	12.1	12.3	-38.55	-13	H
13160.4	-35.06	13.0	12.3	-35.76	-13	H

RSE-GPRS1900-H

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
3819.6	-49.03	6.7	7.9	-47.83	-13	H
5274.0	-51.06	8.0	9.4	-49.66	-13	V
7639.2	-50.62	9.7	11.8	-48.52	-13	H
9549.6	-46.69	10.7	12.7	-44.69	-13	H
11458.8	-40.46	12.3	12.3	-40.46	-13	H
13369.2	-32.55	13.7	12.3	-33.95	-13	H

RSE-EGPRS1900-L

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
3700.2	-51.46	6.6	7.9	-50.16	-13	V
5551.8	-52.69	8.2	9.8	-51.09	-13	V
7402.8	-52.27	9.7	11.6	-50.37	-13	H
9250.8	-49.92	10.7	12.7	-47.92	-13	H
11100.0	-44.3	12.1	12.3	-44.1	-13	H
12951.6	-34.56	13.2	12.3	-35.46	-13	H

RSE-EGPRS1900-M

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
3760.2	-52.15	6.6	7.9	-50.85	-13	H
5640.0	-53.66	8.3	10.2	-51.76	-13	H
7518.0	-52.26	9.7	11.6	-50.36	-13	V
9403.2	-50.73	10.7	12.7	-48.73	-13	H
11280.0	-44.84	12.1	12.3	-44.64	-13	H
13160.4	-43.73	13.0	12.3	-44.43	-13	H

RSE-EGPRS1900-H

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
3819.6	-48.64	6.7	7.9	-47.44	-13	H
5733.0	-53.52	8.5	10.2	-51.82	-13	H
7639.2	-52.42	9.7	11.8	-50.32	-13	H
9548.4	-49.59	10.7	12.7	-47.59	-13	H
11458.8	-39.2	12.3	12.3	-39.2	-13	H
13369.2	-36.55	13.7	12.3	-37.95	-13	H

Conclusion: PASS

Note: the EUT was displayed in several different direction, the worst cases were shown.

Secondary Supply

RSE-G1900-L

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
3700.2	-47.27	6.6	7.9	-45.97	-13	H
4797.6	-48.16	7.6	9.0	-46.76	-13	H
9250.8	-48.11	10.7	12.7	-46.11	-13	V
11100.0	-44.61	12.1	12.3	-44.41	-13	V
12951.6	-34.9	13.2	12.3	-35.8	-13	V
14800.8	-36.46	14.3	12.3	-38.46	-13	V

RSE-G1900-M

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
6058.8	-51.92	8.6	10.2	-50.32	-13	H
7470.0	-52.42	9.7	11.6	-50.52	-13	V
9399.6	-47.74	10.7	12.7	-45.74	-13	V
11280.0	-45.69	12.1	12.3	-45.49	-13	V
13160.4	-36.35	13.0	12.3	-37.05	-13	V
15039.6	-40.09	14.4	12.3	-42.19	-13	V

RSE-G1900-H

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
4795.8	-51.5	7.6	9.0	-50.1	-13	H
5982.6	-52.37	8.6	10.2	-50.77	-13	V
7548.0	-52.32	9.7	11.6	-50.42	-13	V
9548.4	-49.51	10.7	12.7	-47.51	-13	V
11458.8	-42.56	12.3	12.3	-42.56	-13	V
13368.0	-36.6	13.7	12.3	-38	-13	V

Conclusion: PASS

Note: the EUT was displayed in several different direction, the worst cases were shown.

RSE-G1900-L

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
3700.2	-44.5	6.6	7.9	-43.2	-13	H
5550.6	-41.89	8.2	9.8	-40.29	-13	H
9250.8	-46.95	10.7	12.7	-44.95	-13	H
11101.2	-39.48	12.1	12.3	-39.28	-13	V
12951.6	-36.71	13.2	12.3	-37.61	-13	V
14802.0	-35.12	14.3	12.3	-37.12	-13	V

RSE-G1900-M

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
3759.6	-48.92	6.6	7.9	-47.62	-13	H
5640.0	-46.61	8.3	10.2	-44.71	-13	V
7579.2	-52.82	9.7	11.6	-50.92	-13	H
9399.6	-47.63	10.7	12.7	-45.63	-13	V
11280.0	-38.37	12.1	12.3	-38.17	-13	V
13160.4	-38.2	13.0	12.3	-38.9	-13	V

RSE-G1900-H

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
3819.6	-48.79	6.7	7.9	-47.59	-13	H
5728.8	-46.72	8.5	10.2	-45.02	-13	H
7534.8	-52.08	9.7	11.6	-50.18	-13	H
9548.4	-47.59	10.7	12.7	-45.59	-13	H
11458.8	-42.32	12.3	12.3	-42.32	-13	V
13368.0	-39.52	13.7	12.3	-40.92	-13	V

Conclusion: PASS

Note: the EUT was displayed in several different direction, the worst cases were shown.

Fourthly Supply

RSE-G1900-L

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
3700.2	-42.85	6.6	7.9	-41.55	-13	H
5550.6	-49.86	8.2	9.8	-48.26	-13	H
9252.0	-49.3	10.7	12.7	-47.3	-13	V
11102.4	-41.85	12.1	12.3	-41.65	-13	V
12951.6	-35.94	13.2	12.3	-36.84	-13	V
14802.0	-39.97	14.3	12.3	-41.97	-13	V

RSE-G1900-M

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
3759.6	-48.15	6.6	7.9	-46.85	-13	H
4967.4	-51.84	7.7	9.6	-49.94	-13	H
6286.8	-51.55	8.8	10.3	-50.05	-13	V
9399.6	-47.14	10.7	12.7	-45.14	-13	V
11280.0	-37.28	12.1	12.3	-37.08	-13	V
13160.4	-39.08	13.0	12.3	-39.78	-13	V

RSE-G1900-H

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit（dBm）	Polarization
3819.6	-46.03	6.7	7.9	-44.83	-13	H
6118.8	-52.32	8.7	10.2	-50.82	-13	V
9548.4	-46.46	10.7	12.7	-44.46	-13	V
11458.8	-37.79	12.3	12.3	-37.79	-13	V
13369.2	-35.3	13.7	12.3	-36.7	-13	H
15279.6	-37.92	14.4	12.3	-40.02	-13	H

Conclusion: PASS

Note: the EUT was displayed in several different direction, the worst cases were shown.

7. Test Equipment List

7.1. Conducted Test System

Item	Equipment Name	Type	Serial Number	Manufacturer	Cal. Date	Cal. interval
1	Universal Radio Communication Tester	CMW500	148874	R&S	2021-05-10	1 year
2	Vector Signal Analyzer	FSQ26	101091	R&S	2021-05-10	1 year
3	DC Power Supply	ZUP60-14	LOC-220Z006 -0007	TDL-Lambda	2021-05-09	1 year
4	Eagle Test Software	Eagle V3.1 FCC BT/WIFI	N/A	ECIT	N/A	N/A

7.2. Radiated Emission Test System

Item	Equipment Name	Type	Serial Number	Manufacturer	Cal. Date	Cal. Interval
1	Universal Radio Communication Tester	CMW500	104178	R&S	2021-05-10	1 year
2	Test Receiver	ESU40	100307	R&S	2021-05-10	1 year
3	TRILOG Antenna	VULB9163	VULB9163-51 5	Schwarzbeck	2020-02-28	2 years
4	Double Ridged Guide Antenna	ETS-3117	135890	ETS	2020-02-28	2 years
5	2-Line V-Network	ENV216	101380	R&S	2021-05-10	1 year
6	RF Signal Generator	SMF100A	102314	R&S	2021-05-10	1 year
7	Amplifier	SCU08	10146	R&S	2021-05-10	1 year
8	EMI Test Software	EMC32 V9.15.00	N/A	R&S	N/A	N/A

Anechoic chamber

Fully anechoic chamber by ETS.

Annex A: Measurement Uncertainty

Measurement uncertainty for all the testing in this report are within the limit specified in 3IN documents. The detailed measurement uncertainty is defined in 3IN documents.

Measurement Items	Range	Confidence Level	Calculated Uncertainty
Maximum Peak Output Power	30MHz-3600MHz	95%	±0.544dB
EBW and VBW	30MHz-3600MHz	95%	±62.04Hz
Transmitter Spurious Emission-Conducted	30MHz-2GHz	95%	±0.90dB
Transmitter Spurious Emission-Conducted	2GHz-3.6GHz	95%	±0.88dB
Transmitter Spurious Emission-Conducted	3.6GHz-8GHz	95%	±0.96dB
Transmitter Spurious Emission-Conducted	8GHz-20GHz	95%	±0.94dB
Transmitter Spurious Emission-Radiated	9KHz-30MHz	95%	±5.66dB
Transmitter Spurious Emission-Radiated	30MHz-1000MHz	95%	±4.98dB
Transmitter Spurious Emission-Radiated	1000MHz -18000MHz	95%	±5.06dB
Transmitter Spurious Emission-Radiated	18000MHz -40000MHz	95%	±5.20dB
Frequency stability	1MHz-16GHz	95%	±62.04Hz

Annex B: Accreditation Certificate

ilac-MRA a2LA

Accredited Laboratory

A2LA has accredited

INDUSTRIAL INTERNET INNOVATION CENTER (SHANGHAI) CO., LTD.

Shanghai, People's Republic of China

for technical competence in the field of

Electrical Testing

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*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 12th day of April 2021.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3682.01
Valid to February 28, 2023

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

**********END OF REPORT**********