

# TEST REPORT

**Product Name:** Global LTE Cat.M1/LTE Cat.NB2/2G  
Data-Only Module  
**Trade Mark:** CINTERION  
**Model No. / HVIN:** EXS82-W  
**Report Number:** 191019004RFM-1  
**Test Standards:** FCC 47 CFR Part 22 Subpart H,  
FCC 47 CFR Part 24 Subpart E,  
RSS-132 Issue 3, RSS-133 Issue 6  
RSS-Gen Issue 5  
**FCC ID:** QIPEXS82-W  
**IC:** 7830A-EXS82W  
**Test Result:** PASS  
**Date of Issue:** December 21, 2019

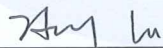
Prepared for:

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UTTR-RF-RSS2G-V1.0

## Version

| Version No. | Date              | Description |
|-------------|-------------------|-------------|
| V1.0        | December 21, 2019 | Original    |



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## 1. GENERAL INFORMATION

### 1.1 CLIENT INFORMATION

|                                 |                                      |
|---------------------------------|--------------------------------------|
| <b>Applicant:</b>               | Gemalto M2M GmbH                     |
| <b>Address of Applicant:</b>    | Siemensdamm 50 Berlin, 13629 Germany |
| <b>Manufacturer:</b>            | Gemalto M2M GmbH                     |
| <b>Address of Manufacturer:</b> | Siemensdamm 50 Berlin, 13629 Germany |

### 1.2 EUT INFORMATION

#### 1.2.1 General Description of EUT

|                                                              |                                                   |                                                                              |
|--------------------------------------------------------------|---------------------------------------------------|------------------------------------------------------------------------------|
| Product Name:                                                | Global LTE Cat.M1/LTE Cat.NB2/2G Data-Only Module |                                                                              |
| Model No. / HVIN:                                            | EXS82-W (See Note)                                |                                                                              |
| Trade Mark:                                                  | CINTERION                                         |                                                                              |
| DUT Stage:                                                   | Identical Prototype                               |                                                                              |
| EUT Supports Function:                                       | GSM Bands:                                        | GSM 850/ PCS 1900                                                            |
|                                                              | E-UTRA Bands:                                     | Band 2/ Band 4/ Band 5/ Band 12/ Band 13/ Band 25/ Band 26/ Band 66/ Band 71 |
| Sample Received Date:                                        | September 19, 2019                                |                                                                              |
| Sample Tested Date:                                          | September 19, 2019 to December 2, 2019            |                                                                              |
| Note:<br>This product EXS82-W has two forms of SIM and ESIM. |                                                   |                                                                              |

#### 1.2.2 Description of Accessories

None.

### 1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

|                                  |                  |                   |
|----------------------------------|------------------|-------------------|
| <b>Support Networks:</b>         | GPRS             |                   |
| <b>Type of Modulation:</b>       | GPRS:            | GMSK              |
| <b>Frequency Range:</b>          | GPRS 850:        | 824.2-848.8 MHz   |
|                                  | GPRS 1900:       | 1850.2-1909.8 MHz |
| <b>Max RF Output Power:</b>      | GPRS 850:        | 35.84dBm          |
|                                  | GPRS 1900:       | 28.51dBm          |
| <b>Emission Designator:</b>      | GPRS 850:        | 247KGXW           |
|                                  | GPRS 1900:       | 245KGXW           |
| <b>Antenna Type:</b>             | External Antenna |                   |
| <b>Antenna Gain:</b>             | GSM 850:         | 5.17 dBi          |
|                                  | PCS 1900:        | 2.17 dBi          |
| <b>GPRS Class:</b>               | Class 10         |                   |
| <b>Normal Test Voltage:</b>      | 3.8 Vdc          |                   |
| <b>Extreme Test Voltage:</b>     | 3.3 to 4.6Vdc    |                   |
| <b>Extreme Test Temperature:</b> | -40 °C to +60 °C |                   |

## 1.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

### 1) Support Equipment

| Description | Manufacturer | Model No.        | Serial Number | Supplied by |
|-------------|--------------|------------------|---------------|-------------|
| Antenna     | SMARTEQ      | MiniMag          | --            | Applicant   |
| Adapter     | Lenovo       | HKA02412020-3K   | N/A           | Applicant   |
| PCB board   | N/A          | W30880-Q9812-X-2 | N/A           | Applicant   |

### 2) Support Cable

| Cable No. | Description   | Connector | Length    | Supplied by |
|-----------|---------------|-----------|-----------|-------------|
| 1         | Antenna Cable | SMA       | 0.3 Meter | UnionTrust  |

## 1.5 TEST LOCATION

### Shenzhen UnionTrust Quality and Technology Co., Ltd.

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

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

### CNAS-Lab Code: L9069

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

### A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

### ISED Wireless Device Testing Laboratories

CAB identifier: CN0032

### FCC Accredited Lab.

Designation Number: CN1194

Test Firm Registration Number: 259480

## 1.7 DEVIATION FROM STANDARDS

None.

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## 1.8 ABNORMALITIES FROM STANDARD CONDITIONS

None.

## 1.9 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

## 1.10 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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

## 2. TEST SUMMARY

| FCC 47 CFR Part 22 Subpart H Test Cases |                                                                                       |                                         |        |
|-----------------------------------------|---------------------------------------------------------------------------------------|-----------------------------------------|--------|
| Test Item                               | Test Requirement                                                                      | Test Method                             | Result |
| Effective Radiated Power (ERP)          | FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 22.913(a)<br>RSS-132 Issue 3, Section 5.4 | ANSI C63.26-2015 & KDB 971168 D01v03r01 | PASS   |
| Conducted Output Power                  | FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 22.913(a)<br>RSS-132 Issue 3, Section 5.4 | ANSI C63.26-2015 & KDB 971168 D01v03r01 | PASS   |
| Peak-to-average ratio                   | FCC 47 CFR Part 22.913(a)<br>RSS-132 Issue 3, Section 5.4                             | ANSI C63.26-2015 & KDB 971168 D01v03r01 | PASS   |
| 99%&26dB Bandwidth                      | FCC 47 CFR Part 2.1049(h)<br>RSS-Gen Issue 5, Section 6.7                             | ANSI C63.26-2015 & KDB 971168 D01v03r01 | PASS   |
| Band Edge at antenna terminals          | FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 22.917(a)<br>RSS-132 Issue 3, Section 5.5    | ANSI C63.26-2015 & KDB 971168 D01v03r01 | PASS   |
| Spurious emissions at antenna terminals | FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 22.917(a)(b)<br>RSS-132 Issue 3, Section 5.5 | ANSI C63.26-2015 & KDB 971168 D01v03r01 | PASS   |
| Field strength of spurious radiation    | FCC 47 CFR Part 2.1053 & FCC 47 CFR Part 22.917(a)(b)<br>RSS-132 Issue 3, Section 5.5 | ANSI C63.26-2015 & KDB 971168 D01v03r01 | PASS   |
| Frequency stability                     | FCC 47 CFR Part 2.1055 & FCC 47 CFR Part 22.355<br>RSS-132 Issue 3, Section 5.3       | ANSI C63.26-2015 & KDB 971168 D01v03r01 | PASS   |

| FCC 47 CFR Part 24 Subpart E Test Cases    |                                                                                       |                                         |        |
|--------------------------------------------|---------------------------------------------------------------------------------------|-----------------------------------------|--------|
| Test Item                                  | Test Requirement                                                                      | Test Method                             | Result |
| Equivalent Isotropic Radiated Power (EIRP) | FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 24.232(c)<br>RSS-133 Issue 6, Section 6.4 | ANSI C63.26-2015 & KDB 971168 D01v03r01 | PASS   |
| Conducted Output Power                     | FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 24.232(c)<br>RSS-133 Issue 6, Section 6.4 | ANSI C63.26-2015 & KDB 971168 D01v03r01 | PASS   |
| Peak-to-average ratio                      | FCC 47 CFR Part 24.232(d)<br>RSS-133 Issue 6, Section 6.4                             | KDB 971168 D01v03r01                    | PASS   |
| 99%&26dB Bandwidth                         | FCC 47 CFR Part 2.1049(h) & FCC 47 CFR Part 24.238(b)<br>RSS-Gen Issue 5, Section 6.7 | ANSI C63.26-2015 & KDB 971168 D01v03r01 | PASS   |
| Band Edge at antenna terminals             | FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 24.238(a)<br>RSS-133 Issue 6, Section 6.5    | ANSI C63.26-2015 & KDB 971168 D01v03r01 | PASS   |
| Spurious emissions at antenna terminals    | FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 24.238(a)(b)<br>RSS-133 Issue 6, Section 6.5 | ANSI C63.26-2015 & KDB 971168 D01v03r01 | PASS   |
| Field strength of spurious radiation       | FCC 47 CFR Part 2.1053 & FCC 47 CFR Part 24.238(a)(b)<br>RSS-133 Issue 6, Section 6.5 | ANSI C63.26-2015 & KDB 971168 D01v03r01 | PASS   |
| Frequency stability                        | FCC 47 CFR Part 2.1055 & FCC 47 CFR Part 24.235<br>RSS-133 Issue 6, Section 6.3       | ANSI C63.26-2015 & KDB 971168 D01v03r01 | PASS   |

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### 3. EQUIPMENT LIST

| Radiated Emission Test Equipment List |                                   |              |            |                            |                         |                             |
|---------------------------------------|-----------------------------------|--------------|------------|----------------------------|-------------------------|-----------------------------|
| Used                                  | Equipment                         | Manufacturer | Model No.  | Serial Number              | Cal. date (mm dd, yyyy) | Cal. Due date (mm dd, yyyy) |
| <input checked="" type="checkbox"/>   | 3M Chamber & Accessory Equipment  | ETS-LINDGREN | 3M         | N/A                        | Dec. 03, 2018           | Dec. 03, 2021               |
| <input checked="" type="checkbox"/>   | Receiver                          | R&S          | ESIB26     | 100114                     | Nov. 24, 2018           | Nov. 24, 2019               |
| <input checked="" type="checkbox"/>   | Receiver                          | R&S          | ESIB26     | 100114                     | Nov. 24, 2019           | Nov. 23, 2020               |
| <input type="checkbox"/>              | Loop Antenna                      | ETS-LINDGREN | 6502       | 00202525                   | Dec. 03, 2018           | Dec. 03, 2019               |
| <input checked="" type="checkbox"/>   | Broadband Antenna                 | ETS-LINDGREN | 3142E      | 00201566                   | Dec. 08, 2018           | Dec. 08, 2019               |
| <input checked="" type="checkbox"/>   | 6dB Attenuator                    | Talent       | RA6A5-N-18 | 18103001                   | Dec. 08, 2018           | Dec. 08, 2019               |
| <input checked="" type="checkbox"/>   | Preamplifier                      | HP           | 8447F      | 2805A02960                 | Nov. 24, 2018           | Nov. 24, 2019               |
| <input checked="" type="checkbox"/>   | Preamplifier                      | HP           | 8447F      | 2805A02960                 | Nov. 24, 2019           | Nov. 23, 2020               |
| <input type="checkbox"/>              | Broadband Antenna (Pre-amplifier) | ETS-LINDGREN | 3142E-PA   | 00201891                   | May 18, 2019            | May 18, 2020                |
| <input type="checkbox"/>              | Horn Antenna                      | ETS-LINDGREN | 3117       | 00164202                   | Dec. 08, 2018           | Dec. 08, 2019               |
| <input checked="" type="checkbox"/>   | Horn Antenna (Pre-amplifier)      | ETS-LINDGREN | 3117-PA    | 00201874                   | May 18, 2019            | May 18, 2020                |
| <input type="checkbox"/>              | Horn Antenna                      | ETS-LINDGREN | 3116C      | 00200180                   | Jun. 23, 2019           | Jun. 23, 2020               |
| <input checked="" type="checkbox"/>   | Horn Antenna (Pre-amplifier)      | ETS-LINDGREN | 3116C-PA   | 00202652                   | Jan. 05, 2019           | Jan. 05, 2020               |
| <input checked="" type="checkbox"/>   | Multi device Controller           | ETS-LINDGREN | 7006-001   | 00160105                   | N/A                     | N/A                         |
| <input checked="" type="checkbox"/>   | Test Software                     | Audix        | e3         | Software Version: 9.160323 |                         |                             |

| RF Test Equipment List              |                                     |              |           |                        |                         |                             |
|-------------------------------------|-------------------------------------|--------------|-----------|------------------------|-------------------------|-----------------------------|
| Used                                | Equipment                           | Manufacturer | Model No. | Serial Number          | Cal. date (mm dd, yyyy) | Cal. Due date (mm dd, yyyy) |
| <input checked="" type="checkbox"/> | Receiver                            | R&S          | ESR7      | 1316.3003K07-101181-K3 | Nov. 24, 2018           | Nov. 24, 2019               |
| <input checked="" type="checkbox"/> | Receiver                            | R&S          | ESR7      | 1316.3003K07-101181-K3 | Nov. 24, 2019           | Nov. 23, 2020               |
| <input checked="" type="checkbox"/> | EXA Spectrum Analyzer               | KEYSIGHT     | N9010A    | MY51440197             | Nov. 24, 2018           | Nov. 24, 2019               |
| <input checked="" type="checkbox"/> | EXA Spectrum Analyzer               | KEYSIGHT     | N9010A    | MY51440197             | Nov. 24, 2019           | Nov. 23, 2020               |
| <input checked="" type="checkbox"/> | Wideband Radio Communication Tester | R&S          | CMW500    | 120932                 | Jul. 19, 2019           | Jul. 19, 2020               |
| <input type="checkbox"/>            | Wideband Radio Communication Tester | R&S          | CMW500    | 119583                 | Jul. 31, 2019           | Jul. 31, 2020               |
| <input checked="" type="checkbox"/> | DC Source                           | KIKUSUI      | PWR400L   | LK003024               | Sep. 18, 2019           | Sep. 18, 2020               |
| <input checked="" type="checkbox"/> | Temp & Humidity chamber             | Votisch      | VT4002    | 58566133290020         | Jun. 05, 2018           | Jun. 05, 2020               |

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## 4. TEST CONFIGURATION

### 4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

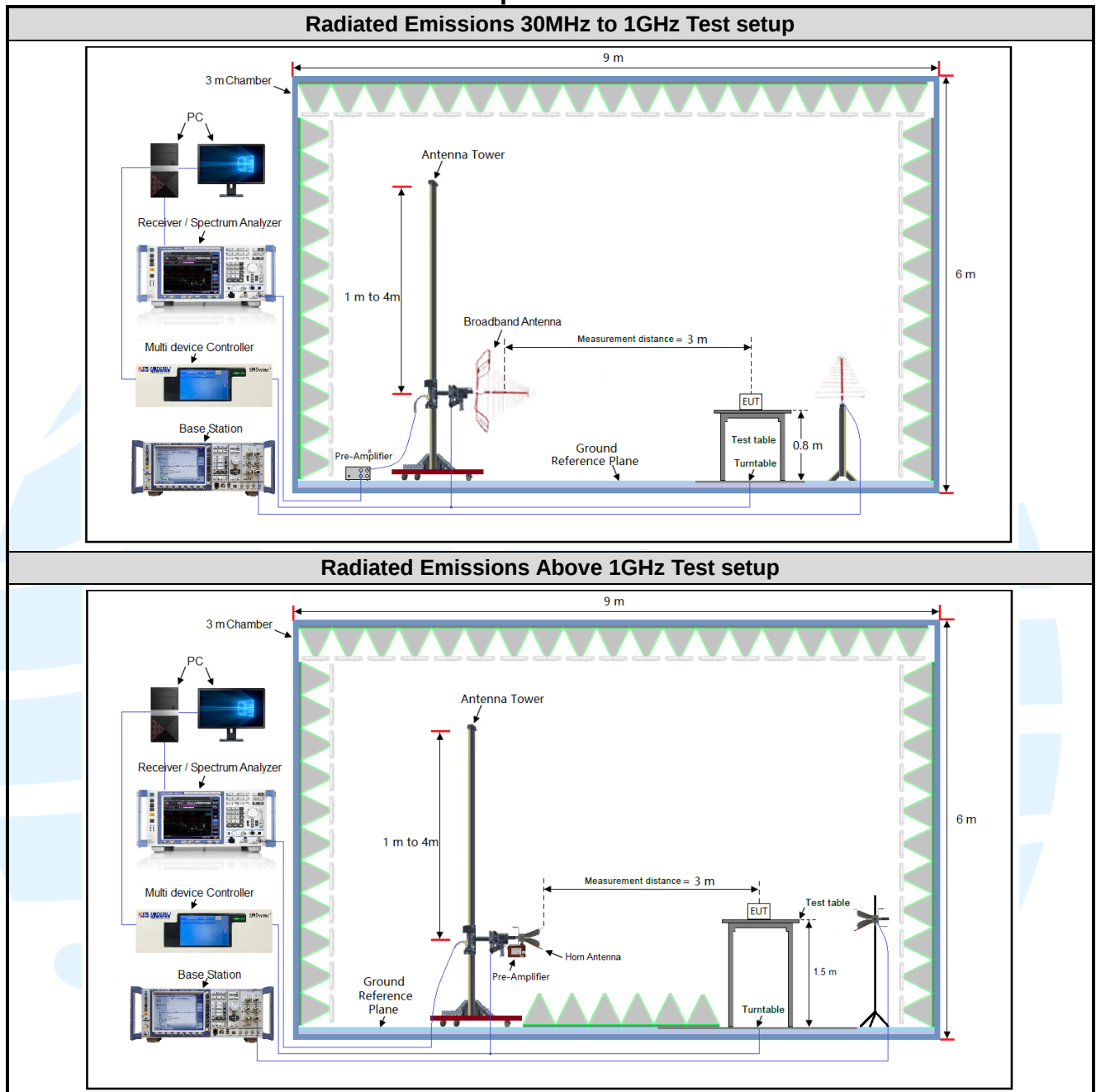
| Test Environment | Selected Values During Tests |             |                       |
|------------------|------------------------------|-------------|-----------------------|
| Test Condition   | Ambient                      |             |                       |
|                  | Temperature (°C)             | Voltage (V) | Relative Humidity (%) |
| TN/VN            | +15 to +35                   | 3.8         | 20 to 75              |
| TL/VL            | -40                          | 3.3         | 20 to 75              |
| TH/VL            | +60                          | 3.3         | 20 to 75              |
| TL/VH            | -40                          | 4.6         | 20 to 75              |
| TH/VH            | +60                          | 4.6         | 20 to 75              |

**Remark:**

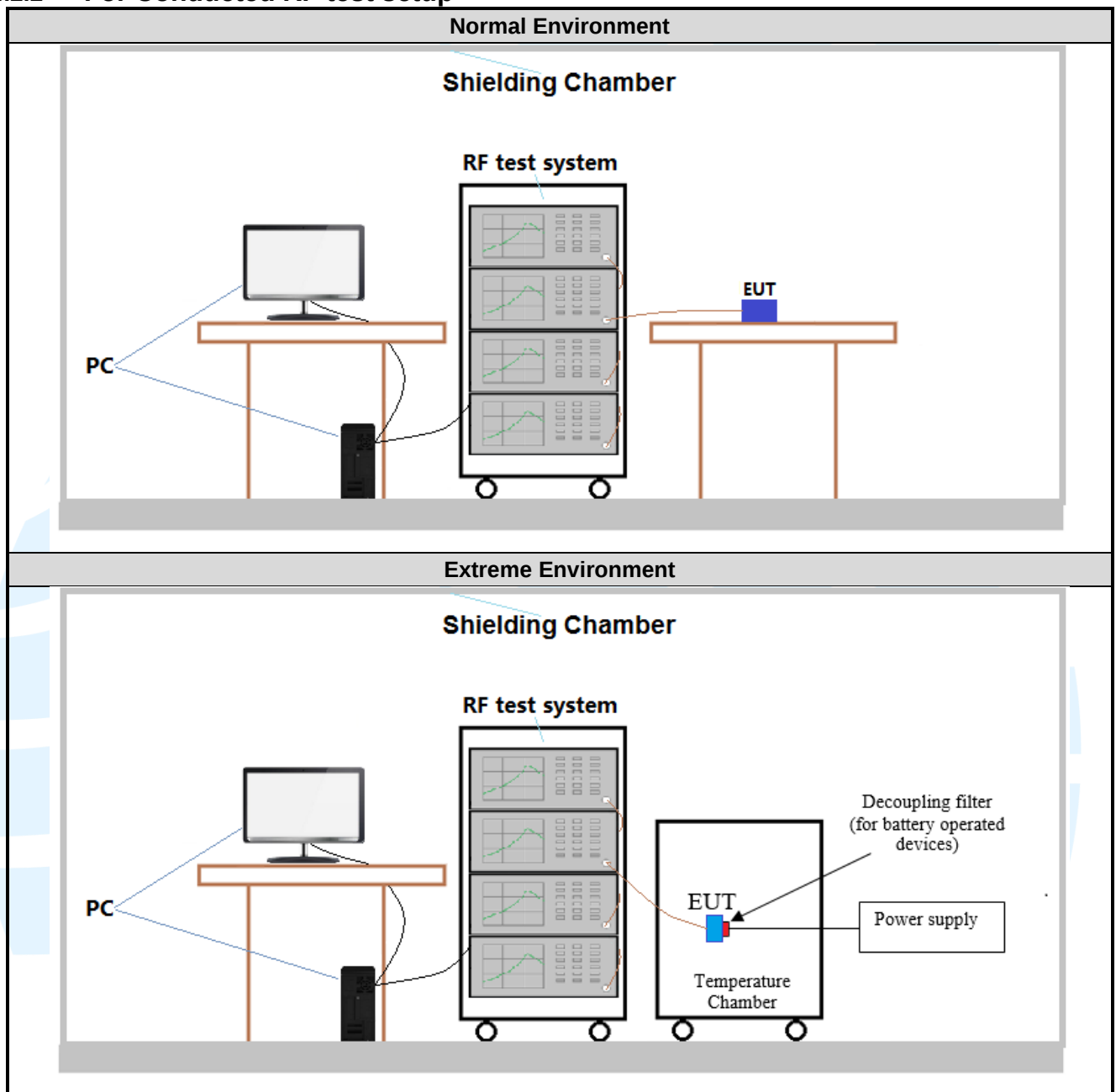
- 1) The EUT just work in such extreme temperature of -40 °C to +60 °C and the extreme voltage of 3.3 V to 4.6 V, so here the EUT is tested in the temperature of -40 °C to +60 °C and the voltage of 3.3 V to 4.6 V.
- 2) VN: Normal Voltage; TN: Normal Temperature;  
TL: Low Extreme Test Temperature; TH: High Extreme Test Temperature;  
VL: Low Extreme Test Voltage; VH: High Extreme Test Voltage.

## 4.2 TEST SETUP

### 4.2.1 For Radiated Emissions test setup



#### 4.2.2 For Conducted RF test setup



### 4.3 TEST CHANNELS

| Bands        | Tx/Rx Frequency           | RF Channel  |             |             |
|--------------|---------------------------|-------------|-------------|-------------|
|              |                           | Low(L)      | Middle(M)   | High(H)     |
| GPRS/<br>850 | Tx<br>(824 MHz ~ 849 MHz) | Channel 128 | Channel 190 | Channel 251 |
|              |                           | 824.2 MHz   | 836.6 MHz   | 848.8 MHz   |

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

## 4.4 SYSTEM TEST CONFIGURATION

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

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, X/Y/Z axis, and antenna ports.

The worst case was found when positioned as the table below.

| Bands    | Mode | Antenna Port | Worst-case axis positioning |
|----------|------|--------------|-----------------------------|
| GSM 850  | 1TX  | Chain 0      | Y axis                      |
| PCS 1900 | 1TX  | Chain 0      | Y axis                      |

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

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

## 4.5 PRE-SCAN

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

SIM 1 Card Conducted transmitter power measurement result.

| GSM 850 Maximum Average Power (dBm) |           |           |           |
|-------------------------------------|-----------|-----------|-----------|
| Channel                             | 128       | 189       | 251       |
| Frequency(MHz)                      | 824.2 MHz | 836.4 MHz | 848.8 MHz |
| GPRS (GMSK, 1Tx-slot)               | 32.38     | 32.82     | 32.37     |

| PCS 1900 Maximum Average Power (dBm) |            |            |            |
|--------------------------------------|------------|------------|------------|
| Channel                              | 512        | 661        | 810        |
| Frequency(MHz)                       | 1850.2 MHz | 1880.0 MHz | 1909.8 MHz |
| GPRS (GMSK, 1Tx-slot)                | 28.46      | 28.26      | 28.49      |

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

| Band           | Radiated                   | Conducted                  |
|----------------|----------------------------|----------------------------|
| GPRS/ 850/1900 | GPRS (GMSK, 1Tx-slot) Link | GPRS (GMSK, 1Tx-slot) Link |

## 5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

### 5.1 REFERENCE DOCUMENTS FOR TESTING

| No. | Identity           | Document Title                                                                                    |
|-----|--------------------|---------------------------------------------------------------------------------------------------|
| 1   | FCC 47 CFR Part 2  | Frequency allocations and radio treaty matters; general rules and regulations                     |
| 2   | FCC 47 CFR Part 22 | Public Mobile Services                                                                            |
| 3   | FCC 47 CFR Part 24 | Personal Communications Services                                                                  |
| 4   | RSS-Gen Issue 5    | General Requirements for Compliance of Radio Apparatus                                            |
| 5   | RSS-132 Issue 3    | Cellular Telephone Systems Operating in the Bands 824-849 MHz and 869-894 MHz                     |
| 6   | RSS-133 Issue 6    | 2 GHz Personal Communications Services Aussi disponible                                           |
| 7   | ANSI C63.26-2015   | American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services |
| 8   | KDB 971168 D01     | KDB 971168 D01 Power Meas License Digital Systems v03r01                                          |

### 5.2 MAXIMUM ERP/EIRP

**Test Requirement:** FCC 47 CFR Part 2.1046(a),  
FCC 47 CFR Part 22.913(a),  
FCC 47 CFR Part 24.232(c),  
RSS-132 Issue 3, Section 5.4,  
RSS-133 Issue 6, Section 6.4,

**Test Method:** KDB 971168 D01v03r01 Section 5.6 & ANSI C63.26-2015

**Limit:**

**FCC 47 CFR Part 22.913(a)**

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

**FCC 47 CFR Part 24.232(c)**

Mobile and portable stations are limited to 2 watts EIRP.

**RSS-132 Issue 3, Section 5.4,**

The transmitter output power shall be measured in terms of average power. The equivalent isotropically radiated power (e.i.r.p.) for mobile equipment shall not exceed 11.5 watts.

**RSS-133 Issue 6, Section 6.4**

The equivalent isotropically radiated power (e.i.r.p.) for transmitters shall not exceed the limits given in SRSP-510. Moreover, base station transmitters operating in the band 1930-1995 MHz shall not have output power exceeding 100 watts.

**Test Procedure:**

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 (Pr). 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.

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UTTR-RF-RSS2G-V1.0

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)=PMea+ PAg- Pcl+ Ga

5. This value is EIRP since the measurement is calibrated using an antenna of known gain (0dBi) and known input power.

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

**Test Setup:** Refer to section 4.2.1 for details.

**Instruments Used:** Refer to section 3 for details

**Test Mode:** Link mode

**Test Results:** Pass

**Test Data:** See table below

| Bands                     | Modulation | Channel | FCC Limit | RSS Limit | ERP   |          | Result |
|---------------------------|------------|---------|-----------|-----------|-------|----------|--------|
|                           |            |         | (W)       | (W)       | (dBm) | (W)      |        |
| GPRS 850<br>(824-849 MHz) | GPRS       | Low     | 7.0       | 11.5      | 35.84 | 3.837072 | Pass   |
|                           |            | Mid     |           |           | 35.40 | 3.467369 | Pass   |
|                           |            | High    |           |           | 35.39 | 3.459394 | Pass   |

| Bands                       | Modulation | Channel | FCC Limit | RSS Limit | EIRP  |          | Result |
|-----------------------------|------------|---------|-----------|-----------|-------|----------|--------|
|                             |            |         | (W)       | (W)       | (dBm) | (W)      |        |
| PCS 1900<br>(1850-1910 MHz) | GPRS       | Low     | 2.0       | 2.0       | 28.28 | 0.672977 | Pass   |
|                             |            | Mid     |           |           | 28.48 | 0.704693 | Pass   |
|                             |            | High    |           |           | 28.51 | 0.709578 | Pass   |

### 5.3 CONDUCTED OUTPUT POWER

**Test Requirement:** FCC 47 CFR Part 2.1046(a),  
FCC 47 CFR Part 22.913(a),  
FCC 47 CFR Part 24.232(c),,  
RSS-132 Issue 3, Section 5.4,  
RSS-133 Issue 6, Section 6.4,

**Test Method:** KDB 971168 D01v03r01 & ANSI C63.26-2015

**Limit:**

**FCC 47 CFR Part 22.913(a)**

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

**FCC 47 CFR Part 24.232(c)**

Mobile and portable stations are limited to 2 watts EIRP.

**RSS-132 Issue 3, Section 5.4,**

The transmitter output power shall be measured in terms of average power. The equivalent isotropically radiated power (e.i.r.p.) for mobile equipment shall not exceed 11.5 watts.

**RSS-133 Issue 6, Section 6.4**

The equivalent isotropically radiated power (e.i.r.p.) for transmitters shall not exceed the limits given in SRSP-510. Moreover, base station transmitters operating in the band 1930-1995 MHz shall not have output power exceeding 100 watts.

**Test Procedure:**

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

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

**Test Setup:** Refer to section 4.2.2 for details.

**Instruments Used:** Refer to section 3 for details

**Test Mode:** Link mode

**Test Results:** Pass

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

## 5.4 PEAK-TO-AVERAGE RATIO

**Test Requirement:** FCC 47 CFR Part 22.913(a),  
FCC 47 CFR Part 24.232(c),  
RSS-132 Issue 3, Section 5.4,  
RSS-133 Issue 6, Section 6.4,

**Test Method:** KDB 971168 D01v03r01 Section 5.7

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

### Test Procedure:

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

- Set resolution/measurement bandwidth  $\geq$  signal's occupied bandwidth
- Set the number of counts to a value that stabilizes the measured CCDF curve
- Record the maximum PAPR level associated with a probability of 0.1 %

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

**Test Setup:** Refer to section 4.2.2 for details.

**Instruments Used:** Refer to section 3 for details

**Test Mode:** Link mode

**Test Results:** Pass

**Test Data:** See table below

| Bands    | Modulation | Peak-to-average ratio (dB) |        |         | Limit (dBm) | Result |
|----------|------------|----------------------------|--------|---------|-------------|--------|
|          |            | Lowest                     | Middle | Highest |             |        |
| GSM 850  | GPRS       | 8.37                       | 8.40   | 8.43    | 13          | Pass   |
| PCS 1900 | GPRS       | 8.43                       | 8.40   | 8.43    | 13          | Pass   |

**5.5 99%&26DB BANDWIDTH**

**Test Requirement:** FCC 47 CFR Part 2.1049(h),  
FCC 47 CFR Part 22.917(b),  
FCC 47 CFR Part 24.238(b),  
RSS-Gen Issue 5, Section 6.7

**Test Method:** ANSI C63.26-2015 & KDB 971168 D01v03r01 Section 4

**Limit:** No Limit, for reporting purposes only.

**Test Procedure:**

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

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

**Test Setup:** Refer to section 4.2.2 for details.

**Instruments Used:** Refer to section 3 for details

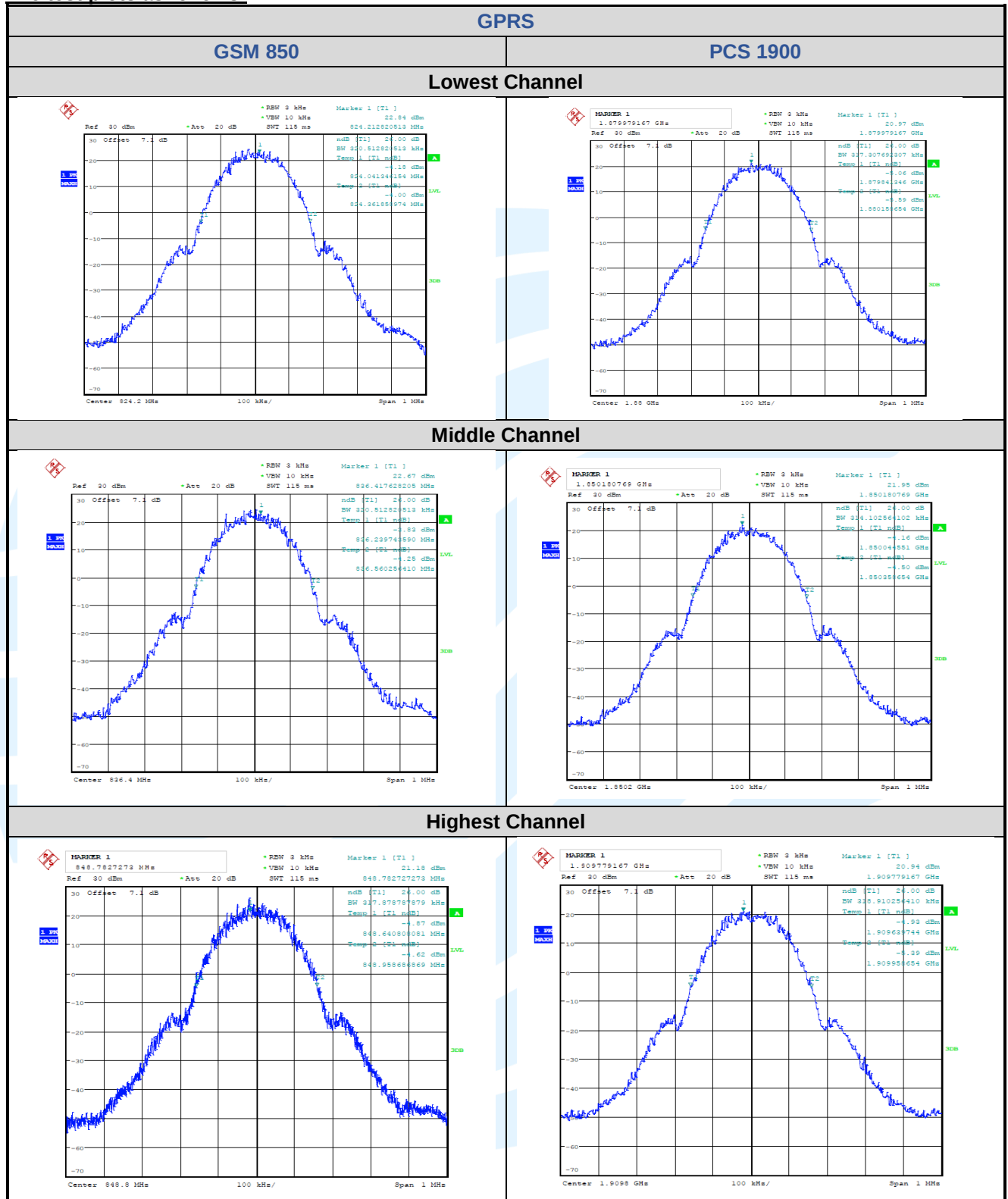
**Test Mode:** Link mode

**Test Results:** Pass

**Test Data:** See table below

| Bands    | Modulation | Channel | Frequency (MHz) | 26 dB BW (kHz) | 99% BW (kHz) |
|----------|------------|---------|-----------------|----------------|--------------|
| GSM 850  | GPRS       | 128     | 824.2           | 321            | 246.8        |
|          |            | 189     | 836.4           | 320            | 245.2        |
|          |            | 251     | 848.8           | 318            | 243.7        |
| PCS 1900 | GPRS       | 512     | 1850.2          | 314            | 245.2        |
|          |            | 661     | 1880.0          | 317            | 245.2        |
|          |            | 810     | 1909.8          | 319            | 243.6        |

The test plots as follows:



## 5.6 BAND EDGE AT ANTENNA TERMINALS

**Test Requirement:** FCC 47 CFR Part 2.1051,  
FCC 47 CFR Part 22.917(a),  
FCC 47 CFR Part 24.238(a),  
RSS-132 Issue 3, Section 5.5,  
RSS-133 Issue 6, Section 6.5,  
**Test Method:** ANSI C63.26-2015 & KDB 971168 D01v03r01

**Limit:**

**FCC 47 CFR Part 22.917(a), FCC 47 CFR Part 24.238(a), FCC 47 CFR Part 27.53(h)(1),**

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

**RSS-132 Issue 3, Section 5.5,**

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  $43 + 10 \log_{10} p$  (watts).

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  $43 + 10 \log_{10} p$  (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

**RSS-133 Issue 6, Section 6.5,**

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  $43 + 10 \log_{10} p$  (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  $43 + 10 \log_{10} p$  (watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

**错误!未找到引用源。 , Section 6.6,**

In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least  $43 + 10 \log_{10} p$  (watts) dB.

After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least  $43 + 10 \log_{10} p$  (watts) dB.

**Test Procedure:**

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

For each band edge measurement:

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

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

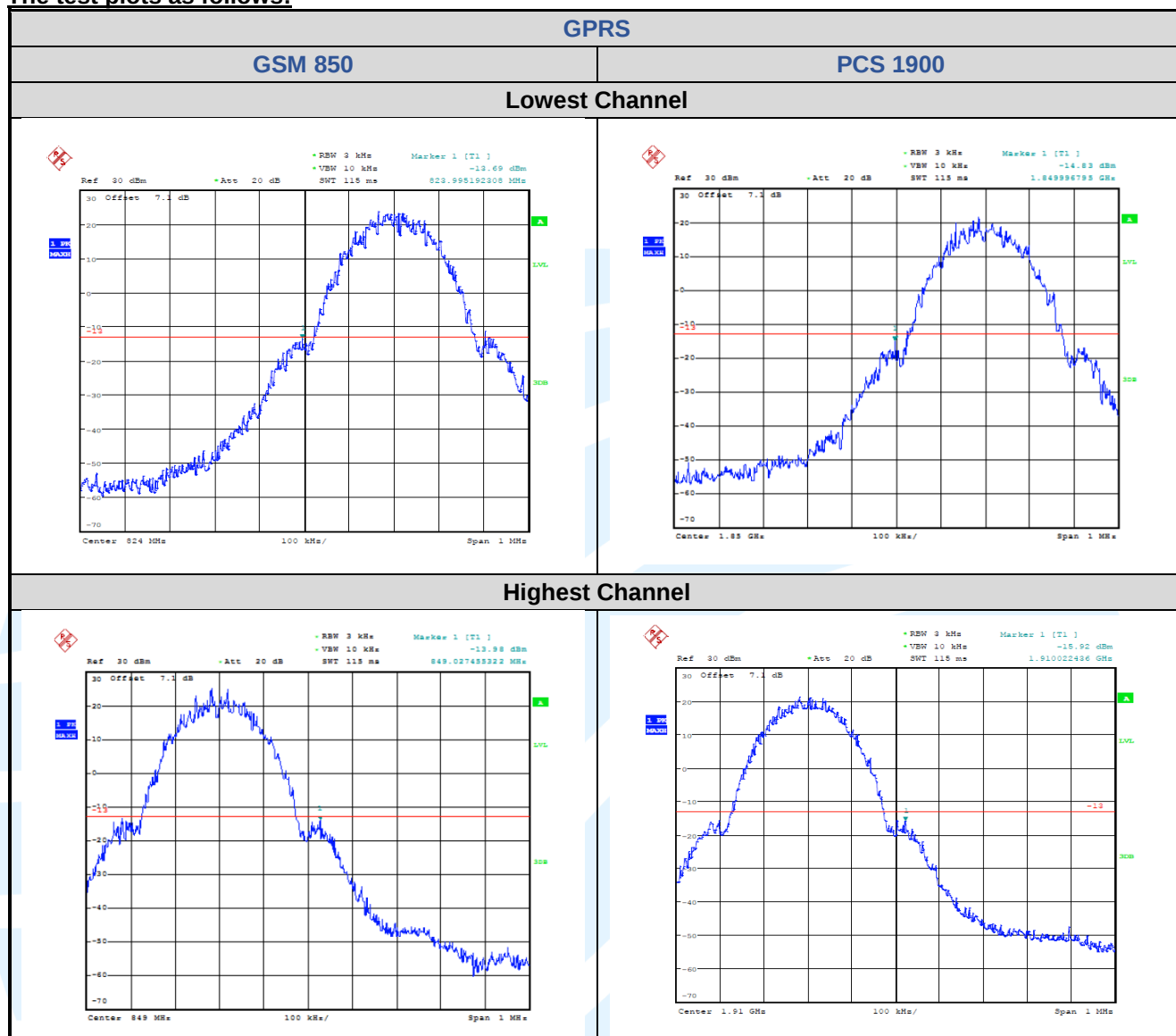
**Test Setup:** Refer to section 4.2.2 for details.

**Instruments Used:** Refer to section 3 for details

**Test Mode:** Link mode

**Test Results:** Pass

The test plots as follows:



## 5.7 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

**Test Requirement:** FCC 47 CFR Part 2.1051,  
FCC 47 CFR Part 22.917(a)(b),  
FCC 47 CFR Part 24.238(a)(b),  
RSS-132 Issue 3, Section 5.5,  
RSS-133 Issue 6, Section 6.5,

**Test Method:** ANSI C63.26-2015 & KDB 971168 D01v03r01

**Limit:**

**FCC 47 CFR Part 22.917(a), FCC 47 CFR Part 24.238(a),**

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

**RSS-132 Issue 3, Section 5.5, RSS-133 Issue 6, Section 6.6,**

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

**Test Procedure:**

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

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

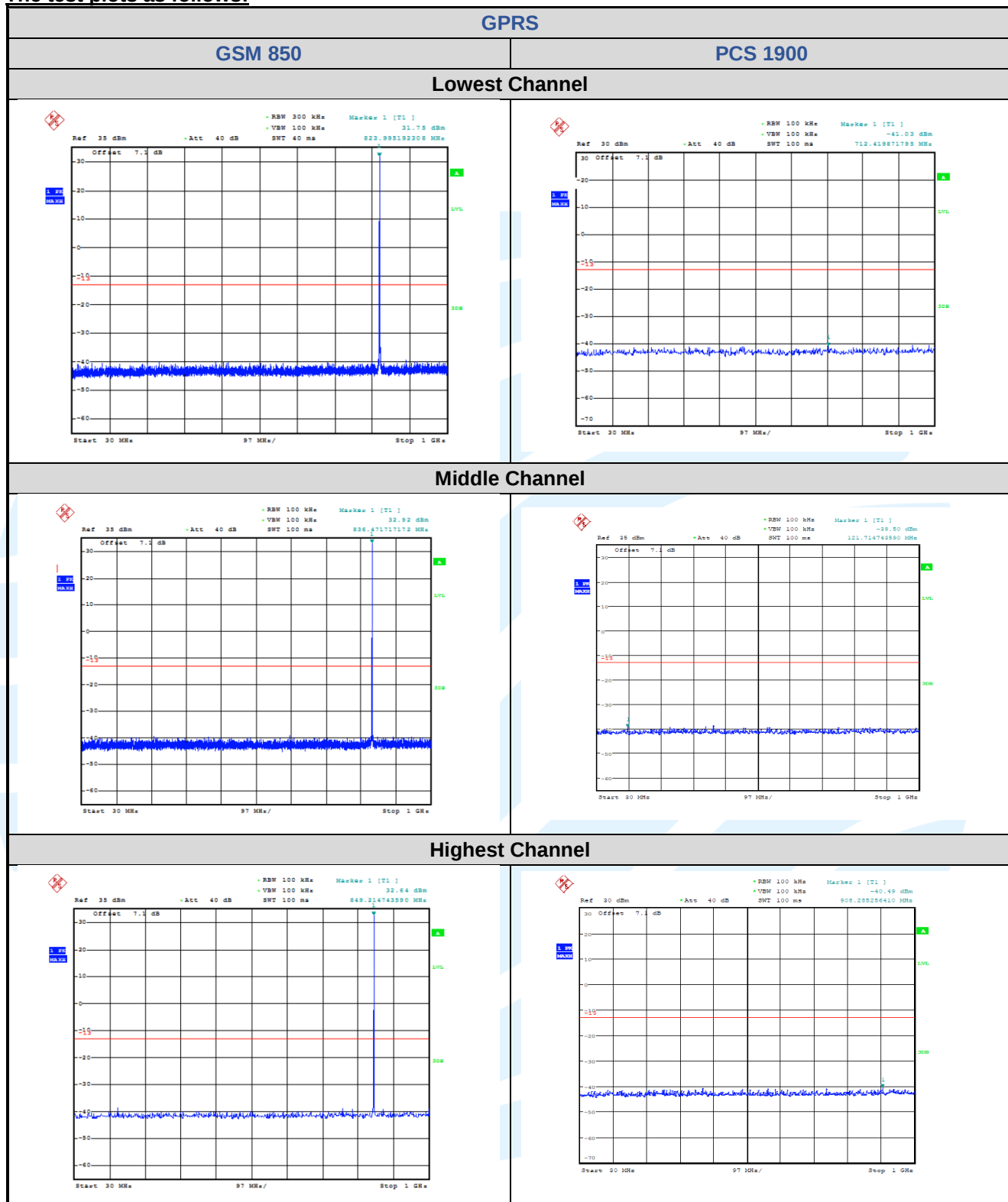
**Test Setup:** Refer to section 4.2.2 for details.

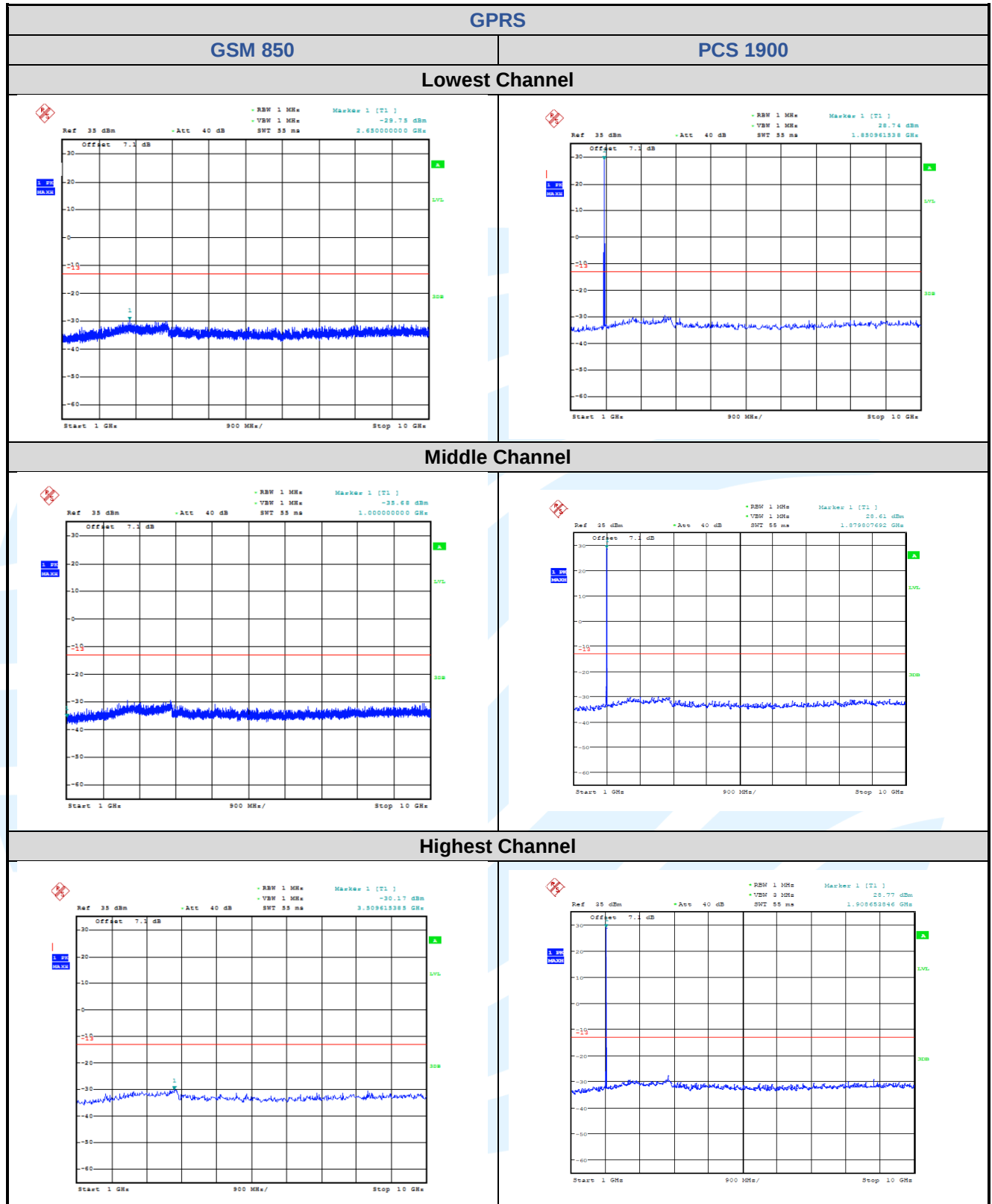
**Instruments Used:** Refer to section 3 for details

**Test Mode:** Link mode

**Test Results:** Pass

The test plots as follows:





Remark:

The disturbance above 10GHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

## 5.8 FIELD STRENGTH OF SPURIOUS RADIATION

**Test Requirement:** FCC 47 CFR Part 2.1053,  
FCC 47 CFR Part 22.917(a)(b),  
FCC 47 CFR Part 24.238(a)(b),  
RSS-132 Issue 3, Section 5.5,  
RSS-133 Issue 6, Section 6.5,

**Test Method:** ANSI C63.26-2015 & KDB 971168 D01v03r01 Section 7

**Limits:**

**FCC 47 CFR Part 22.917(a), FCC 47 CFR Part 24.238(a),**

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

**RSS-132 Issue 3, Section 5.5, RSS-133 Issue 6, Section 6.6,**

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

**Test Setup:** Refer to section 4.2.1 for details.

**Test Procedures:** KDB 971168 D01v03r01 Section 7

**Equipment Used:** Refer to section 3 for details.

**Test Result:** Pass

**The measurement data as follows:**

| Frequency | Channel | Frequency Range | Result |
|-----------|---------|-----------------|--------|
| GSM850    | Low     | 30MHz~10GHz     | PASS   |
|           | Middle  | 30MHz~10GHz     | PASS   |
|           | High    | 30MHz~10GHz     | PASS   |
| GSM1900   | Low     | 30MHz~20GHz     | PASS   |
|           | Middle  | 30MHz~20GHz     | PASS   |
|           | High    | 30MHz~20GHz     | PASS   |

### GPRS Mode Channel 128

| Frequency (MHz) | PMea (dBm) | Pcl (dBm) | Ga (dBi) | Peak EIRP (dBm) | Limit (dBm) | Polarization |
|-----------------|------------|-----------|----------|-----------------|-------------|--------------|
| 1482.5          | -37.09     | 4.1       | 3.4      | -37.79          | -13         | V            |
| 2475.0          | -37.66     | 5.3       | 3.7      | -39.26          | -13         | V            |
| 3566.5          | -45.86     | 6.4       | 4.7      | -47.56          | -13         | V            |
| 4165.4          | -50.95     | 7.0       | 7.7      | -50.25          | -13         | V            |
| 4950.0          | -52.75     | 7.7       | 9.0      | -51.45          | -13         | V            |
| 5776.2          | -50.43     | 8.4       | 10.5     | -48.33          | -13         | V            |

### GPRS Mode Channel 189

| Frequency (MHz) | PMea (dBm) | Pcl (dBm) | Ga (dBi) | Peak EIRP (dBm) | Limit (dBm) | Polarization |
|-----------------|------------|-----------|----------|-----------------|-------------|--------------|
| 1713.2          | -43.15     | 4.4       | 2.9      | -44.65          | -13         | V            |
| 2537.1          | -36.76     | 5.4       | 3.7      | -38.46          | -13         | V            |
| 3407.3          | -49.29     | 6.3       | 4.7      | -50.89          | -13         | V            |
| 4246.2          | -50.74     | 7.1       | 7.7      | -50.14          | -13         | V            |
| 5161.2          | -50.81     | 7.9       | 8.7      | -50.01          | -13         | H            |
| 5986.2          | -48.5      | 8.6       | 10.4     | -46.70          | -13         | V            |

**GPRS Mode Channel 251**

| Frequency (MHz) | PMea (dBm) | Pcl (dBm) | Ga (dBi) | Peak EIRP (dBm) | Limit (dBm) | Polarization |
|-----------------|------------|-----------|----------|-----------------|-------------|--------------|
| 1699.3          | -43.97     | 4.4       | 2.9      | -45.47          | -13         | V            |
| 2545.7          | -35.56     | 5.4       | 3.7      | -37.26          | -13         | H            |
| 3342.7          | -48.92     | 6.2       | 4.7      | -50.42          | -13         | V            |
| 4243.8          | -40.73     | 7.1       | 7.7      | -40.13          | -13         | H            |
| 5031.9          | -51.87     | 7.8       | 9.0      | -50.67          | -13         | H            |
| 6403.1          | -47.95     | 8.9       | 11.5     | -45.35          | -13         | V            |

**GPRS Mode Channel 512**

| Frequency (MHz) | PMea (dBm) | Pcl (dBm) | Ga (dBi) | Peak EIRP (dBm) | Limit (dBm) | Polarization |
|-----------------|------------|-----------|----------|-----------------|-------------|--------------|
| 3760.8          | -53.87     | 6.6       | 7.7      | -52.77          | -13         | H            |
| 5550.0          | -47.97     | 8.2       | 9.5      | -46.67          | -13         | V            |
| 7477.2          | -53.71     | 9.7       | 14.6     | -48.81          | -13         | H            |
| 9348.0          | -54.77     | 10.7      | 18.5     | -46.97          | -13         | V            |
| 11286.0         | -48.81     | 12.1      | 18.5     | -42.41          | -13         | V            |
| 12955.2         | -46.88     | 13.2      | 20.2     | -39.88          | -13         | V            |

**GPRS Mode Channel 661**

| Frequency (MHz) | PMea (dBm) | Pcl (dBm) | Ga (dBi) | Peak EIRP (dBm) | Limit (dBm) | Polarization |
|-----------------|------------|-----------|----------|-----------------|-------------|--------------|
| 4099.8          | -52.81     | 7.0       | 7.7      | -52.11          | -13         | V            |
| 5277.6          | -52.31     | 8.0       | 8.7      | -51.61          | -13         | V            |
| 6946.8          | -52.84     | 9.3       | 12.9     | -49.24          | -13         | H            |
| 9216.0          | -54.3      | 10.5      | 18.5     | -46.30          | -13         | H            |
| 11910.0         | -46.06     | 12.5      | 17.1     | -41.46          | -13         | H            |
| 14302.8         | -47.58     | 13.6      | 23.5     | -37.68          | -13         | V            |

**GPRS Mode Channel 810**

| Frequency (MHz) | PMea (dBm) | Pcl (dBm) | Ga (dBi) | Peak EIRP (dBm) | Limit (dBm) | Polarization |
|-----------------|------------|-----------|----------|-----------------|-------------|--------------|
| 3811.8          | -53.58     | 6.7       | 7.7      | -52.58          | -13         | V            |
| 5751.6          | -54.06     | 8.5       | 10.5     | -52.06          | -13         | V            |
| 7611.6          | -54.2      | 9.7       | 14.6     | -49.30          | -13         | H            |
| 9525.6          | -54.79     | 10.7      | 18.6     | -46.89          | -13         | V            |
| 11470.8         | -49.66     | 12.3      | 18.1     | -43.86          | -13         | V            |
| 13329.6         | -47.35     | 13.6      | 21.8     | -39.15          | -13         | H            |

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

## 5.9 FREQUENCY STABILITY

**Test Requirement:** FCC 47 CFR Part 2.1055 &  
FCC 47 CFR Part 22.355 &  
FCC 47 CFR Part 24.235 &  
RSS-132 Issue 3, Section 5.3,  
RSS-133 Issue 6, Section 6.3,  
**Test Method:** ANSI C63.26-2015 & KDB 971168 D01v03r01

**Limits:**

**FCC 47 CFR Part 22.355,**

The carrier frequency shall not depart from the reference frequency in excess of  $\pm 2.5$  ppm for mobile stations.

**FCC 47 CFR Part 24.235,**

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

**RSS-132 Issue 3, Section 5.3,**

The carrier frequency shall not depart from the reference frequency in excess of  $\pm 2.5$  ppm for mobile stations and  $\pm 1.5$  ppm for base stations

**RSS-133 Issue 6, Section 6.3,**

The carrier frequency shall not depart from the reference frequency, in excess of  $\pm 2.5$  ppm for mobile stations and  $\pm 1.0$  ppm for base stations.

**Test Setup:** Refer to section 4.2.2 for details.

**Test Procedures:**

- 1) Use CMW 500 with Frequency Error measurement capability.
  - a) Temp. =  $-30^{\circ}$  to  $+50^{\circ}\text{C}$
  - b) Voltage = low voltage, 3.3 Vdc, Normal, 3.8 Vdc and High voltage, 4.6 Vdc.

- 2) Frequency Stability vs Temperature:

The EUT is placed inside a temperature chamber. The temperature is set to  $20^{\circ}\text{C}$  and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until  $+50^{\circ}\text{C}$  is reached.

- 3) Frequency Stability vs Voltage:

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

**Equipment Used:** Refer to section 3 for details.

**Test Result:** Pass

| Modulation | Channel/<br>Frequency<br>(MHz) | Voltage<br>(Vdc) | Temperature<br>(°C) | Deviation<br>(Hz) | Deviation<br>(ppm) | Limit<br>(ppm) | Result |
|------------|--------------------------------|------------------|---------------------|-------------------|--------------------|----------------|--------|
| GSM 850    |                                |                  |                     |                   |                    |                |        |
| GPRS       | 189 / 836.4                    | VL               | TN                  | 5.62              | 0.0067             | ± 2.5          | Pass   |
|            |                                | VN               |                     | 9.94              | 0.0119             | ± 2.5          | Pass   |
|            |                                | VH               |                     | 4.49              | 0.0054             | ± 2.5          | Pass   |
|            |                                | VN               | 50                  | 6.97              | 0.0083             | ± 2.5          | Pass   |
|            |                                |                  | 40                  | 5.13              | 0.0061             | ± 2.5          | Pass   |
|            |                                |                  | 30                  | 6.49              | 0.0078             | ± 2.5          | Pass   |
|            |                                |                  | 20                  | 7.23              | 0.0086             | ± 2.5          | Pass   |
|            |                                |                  | 10                  | 9.27              | 0.0111             | ± 2.5          | Pass   |
|            |                                |                  | 0                   | 9.78              | 0.0117             | ± 2.5          | Pass   |
|            |                                |                  | -10                 | 12.62             | 0.0151             | ± 2.5          | Pass   |
|            |                                |                  | -20                 | 12.30             | 0.0147             | ± 2.5          | Pass   |
|            |                                |                  | -30                 | 7.65              | 0.0091             | ± 2.5          | Pass   |

| Modulation | Channel/<br>Frequency<br>(MHz) | Voltage<br>(Vdc) | Temperature<br>(°C) | Deviation<br>(Hz) | Deviation<br>(ppm) | Limit<br>(ppm) | Result |
|------------|--------------------------------|------------------|---------------------|-------------------|--------------------|----------------|--------|
| PCS 1900   |                                |                  |                     |                   |                    |                |        |
| GPRS       | 661 / 1880.0                   | VL               | TN                  | 11.11             | 0.0059             | N/A            | Pass   |
|            |                                | VN               |                     | 9.30              | 0.0049             |                | Pass   |
|            |                                | VH               |                     | 10.62             | 0.0056             |                | Pass   |
|            |                                | VN               | 50                  | 8.52              | 0.0045             |                | Pass   |
|            |                                |                  | 40                  | 5.04              | 0.0027             |                | Pass   |
|            |                                |                  | 30                  | 10.88             | 0.0058             |                | Pass   |
|            |                                |                  | 20                  | 7.65              | 0.0041             |                | Pass   |
|            |                                |                  | 10                  | 11.04             | 0.0059             |                | Pass   |
|            |                                |                  | 0                   | 10.69             | 0.0057             |                | Pass   |
|            |                                |                  | -10                 | 8.68              | 0.0046             |                | Pass   |
|            |                                |                  | -20                 | 9.81              | 0.0052             |                | Pass   |
|            |                                |                  | -30                 | 9.75              | 0.0052             |                | Pass   |

## APPENDIX 1 PHOTOS OF TEST SETUP

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

## APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

\*\*\* End of Report \*\*\*

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

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