



# FCC PART 22H, PART 24E TEST REPORT

For

**Hyundai Corporation**

25, Yulgok-ro 2-Gil, Jongno-gu, Seoul, 110-793, South Korea

**FCC ID: RQQHLT-FSE502A**

|                                                                                                                                                                                                                                                      |                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <b>Report Type:</b><br>Original Report                                                                                                                                                                                                               | <b>Product Type:</b><br>Smart Phone |
| <b>Report Number:</b> RSZ170706008-00D                                                                                                                                                                                                               |                                     |
| <b>Report Date:</b> 2017-07-27                                                                                                                                                                                                                       |                                     |
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| <b>Reviewed By:</b> Engineer                                                                                                                                                                                                                         | <i>Oscar Ye</i>                     |
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**Note:** This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

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## GENERAL INFORMATION

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### Product Description for Equipment under Test (EUT)

The *Hyundai Corporation's* product, model number: *e502 (FCC ID: RQQHLT-FSE502A)* in this report is a *Smart Phone* which was measured approximately: 143.0 mm (L) \* 71.0 mm (W) \* 9.0 mm (H), rated with input voltage: DC 3.7V from Li-ion battery or DC 5V from adapter.

#### Adapter Information:

Model: UAP-L05Y10-00AFC

Input: AC 100-240V, 50/60Hz, 0.15 A

Output: DC 5V, 1000mA

*\* All measurement and test data in this report was gathered from production sample serial number: 1701606 (Assigned by BACL, Kunshan). The EUT supplied by the applicant was received on 2017-07-06.*

### Objective

This type approval report is prepared on behalf of *Hyundai Corporation* in accordance with Part 2, Part 22-Subpart H, Part 24-Subpart E of the Federal Communication Commission's rules.

The objective is to determine the compliance of EUT with FCC rules for output power, modulation characteristic, occupied bandwidth, and spurious emission at antenna terminal, spurious radiated emission, frequency stability, and band edge.

### Related Submittal(s)/Grant(s)

FCC Part 15B JBP, Part 15.247 DSS & DTS submissions with FCC ID: RQQHLT-FSE502A.

### Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-Part J as well as the following parts:

Part 22 Subpart H - Public Mobile Services

Part 24 Subpart E - Personal Communication Services

Applicable Standards: TIA/EIA 603-D.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

**Measurement Uncertainty**

| Item                             |            | Uncertainty               |
|----------------------------------|------------|---------------------------|
| RF conducted test with spectrum  |            | $\pm 0.9\text{dB}$        |
| RF Output Power with Power meter |            | $\pm 0.5\text{dB}$        |
| Radiated emission                | 30MHz~1GHz | $\pm 5.91\text{dB}$       |
|                                  | Above 1G   | $\pm 4.92\text{dB}$       |
| Occupied Bandwidth               |            | $\pm 0.5\text{kHz}$       |
| Temperature                      |            | $\pm 1.0^{\circ}\text{C}$ |
| Humidity                         |            | $\pm 6\%$                 |

**Test Facility**

The Test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China

Bay Area Compliance Laboratories Corp. (Kunshan) has been accredited to ISO/IEC 17025 by CNAS(Lab code: L9963). And accredited to ISO/IEC 17025 by A2LA(Lab code: 4323.01), the FCC Designation No. CN1185 under the KDB 974614 D01.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 815570. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Bay Area Compliance Laboratories Corp. (Kunshan) was registered with ISED Canada under ISED Canada Registration Number 3062E.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The EUT was configured for testing according to TIA/EIA-603-D.  
The final qualification test was performed with the EUT operating at normal mode.

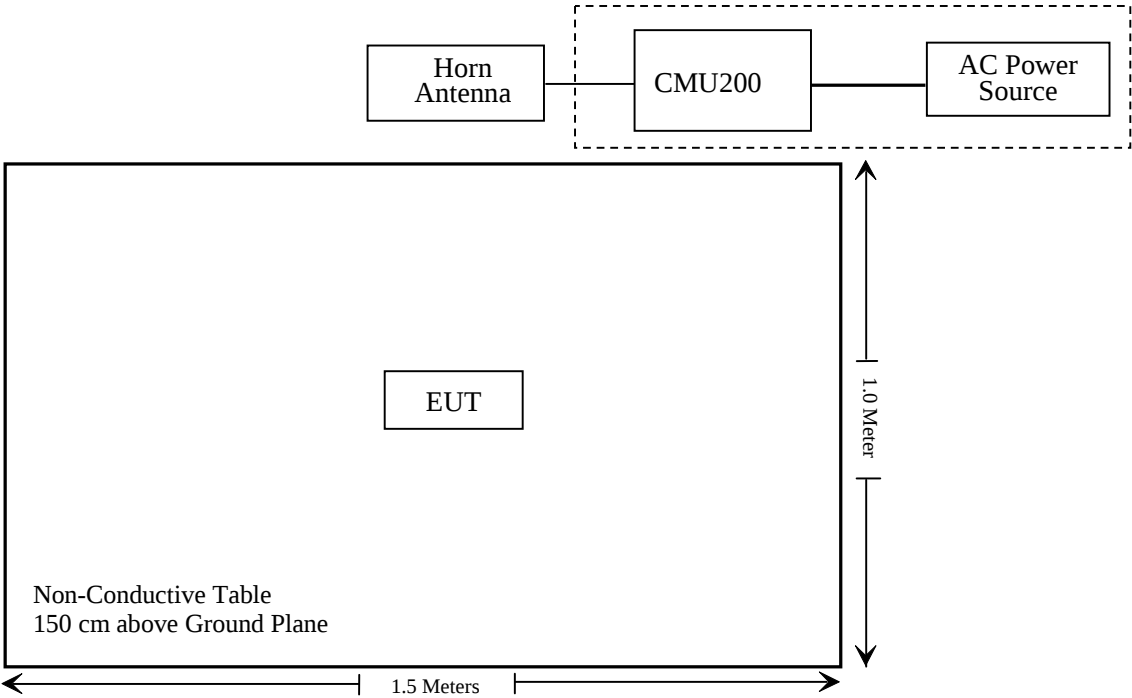
Equipment Modifications

No modification was made to the EUT.

Support Equipment List and Details

| Manufacturer    | Description                          | Model  | Serial Number |
|-----------------|--------------------------------------|--------|---------------|
| Rohde & Schwarz | Universal Radio Communication Tester | CMU200 | 110605        |

Block Diagram of Test Setup



**SUMMARY OF TEST RESULTS**

| FCC Rules                                | Description of Test                                                    | Result         |
|------------------------------------------|------------------------------------------------------------------------|----------------|
| §1.1307, §2.1093                         | RF Exposure (SAR)                                                      | Compliance*    |
| §2.1046;<br>§ 22.913 (a); § 24.232 (c)   | RF Output Power                                                        | Compliance     |
| § 2.1047                                 | Modulation Characteristics                                             | Not Applicable |
| § 2.1049; § 22.905<br>§ 22.917; § 24.238 | Bandwidth                                                              | Compliance     |
| § 2.1051,<br>§ 22.917 (a); § 24.238 (a)  | Spurious Emissions at Antenna Terminal                                 | Compliance     |
| § 2.1053<br>§ 22.917 (a); § 24.238 (a)   | Field Strength of Spurious Radiation                                   | Compliance     |
| § 22.917 (a); § 24.238 (a)               | Out of band emission, Band Edge                                        | Compliance     |
| § 2.1055<br>§ 22.355; § 24.235           | Frequency stability vs. temperature<br>Frequency stability vs. voltage | Compliance     |

Note: \* Please refer to SAR report released by BACL, report number: RSZ170706008-20.

**TEST EQUIPMENT LIST**

| Manufacturer                  | Description        | Model           | Serial Number | Calibration Date | Calibration Due Date |
|-------------------------------|--------------------|-----------------|---------------|------------------|----------------------|
| <b>Radiated Emission Test</b> |                    |                 |               |                  |                      |
| Sonoma Instrument             | Amplifier          | 330             | 171377        | 2016-12-12       | 2017-12-12           |
| Rohde & Schwarz               | EMI Test Receiver  | ESCI            | 100195        | 2016-11-25       | 2017-11-25           |
| Sunol Sciences                | Broadband Antenna  | JB3             | A090314-2     | 2016-01-09       | 2019-01-08           |
| Sunol Sciences                | Broadband Antenna  | JB3             | A090314-1     | 2016-01-09       | 2019-01-08           |
| Narda                         | Pre-amplifier      | AFS42-00101800  | 2001270       | 2016-09-08       | 2017-09-08           |
| EMCO                          | Horn Antenna       | 3116            | 00084159      | 2016-10-18       | 2019-10-17           |
| Rohde & Schwarz               | Signal Analyzer    | FSIQ26          | 100048        | 2016-11-25       | 2017-11-25           |
| ETS                           | Horn Antenna       | 3115            | 6229          | 2016-12-12       | 2019-12-12           |
| ETS                           | Horn Antenna       | 3115            | 9311-4159     | 2016-01-11       | 2019-01-10           |
| R&S                           | Auto test Software | EMC32           | V 09.10.0     | NCR              | NCR                  |
| haojintech                    | Coaxial Cable      | Cable-1         | 001           | 2016-12-12       | 2017-12-12           |
| haojintech                    | Coaxial Cable      | Cable-2         | 002           | 2016-12-12       | 2017-12-12           |
| haojintech                    | Coaxial Cable      | Cable-3         | 003           | 2016-12-12       | 2017-12-12           |
| MICRO-COAX                    | Coaxial Cable      | Cable-4         | 004           | 2016-12-12       | 2017-12-12           |
| MICRO-COAX                    | Coaxial Cable      | Cable-5         | 005           | 2016-12-12       | 2017-12-12           |
| MICRO-COAX                    | Coaxial Cable      | Cable-7         | 007           | 2016-12-12       | 2017-12-12           |
| HP                            | Signal Generator   | 8341B           | 2624A00116    | 2016-08-29       | 2017-08-29           |
| Ducommun Technologies         | Horn Antenna       | ARH-4223-02     | 563254        | 2014-12-29       | 2017-12-28           |
| Ducommun technologies         | Horn Antenna       | ARH-4223-02     | 563255        | 2014-12-29       | 2017-12-28           |
| Ducommun technologies         | Pre-amplifier      | ALN-22093530-01 | 7521463       | 2017-08-03       | 2018-08-03           |

| Manufacturer      | Description                          | Model       | Serial Number | Calibration Date | Calibration Due Date |
|-------------------|--------------------------------------|-------------|---------------|------------------|----------------------|
| RF Conducted test |                                      |             |               |                  |                      |
| BACL              | TS 8997 Cable-01                     | T-KS-EMC086 | T-KS-EMC086   | 2016-12-09       | 2017-12-08           |
| BACL              | RF cable                             | KS-LAB-012  | KS-LAB-012    | 2016-12-15       | 2017-12-14           |
| Kejian            | Temperature & Humidity Chamber       | HTC-1       | N/A           | 2017-06-19       | 2018-06-19           |
| Yizhan            | DC Power Supply                      | RYI3003-3D  | 801009421     | 2017-05-23       | 2018-05-23           |
| WEINSCHL          | 3dB Attenuator                       | 5326        | N/A           | 2017-06-18       | 2018-06-18           |
| Rohde & Schwarz   | Signal Analyzer                      | FSIQ26      | 836131/009    | 2016-09-21       | 2017-09-21           |
| Rohde & Schwarz   | Universal Radio Communication Tester | CMU200      | 110605        | 2016-11-25       | 2017-11-25           |
| HONOVA            | Power Splitter                       | ZFRSC-14-S+ | 019411452     | 2017-06-12       | 2018-06-12           |

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

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## **FCC §1.1307 & §2.1093 - RF EXPOSURE**

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### **Applicable Standard**

FCC§1.1310 and §2.1093.

### **Test Result**

Compliance, please refer to the SAR report: RSZ170706008-20.

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## **FCC §2.1047 - MODULATION CHARACTERISTIC**

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

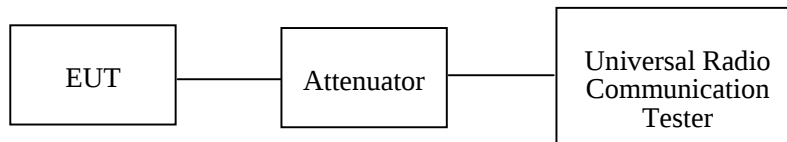
**FCC § 2.1046, § 22.913 (a) & § 24.232 (c) - RF OUTPUT POWER****Applicable Standard**

According to FCC §2.1046 and §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

According to FCC §2.1046 and §24.232 (c), mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

**Test Procedure***Conducted method:*

The RF output of the transmitter was connected to the wireless test set and the spectrum analyzer through sufficient attenuation.

*Radiated method:*

TIA 603-D section 2.2.17

**Test Data****Environmental Conditions**

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 25 °C     |
| <b>Relative Humidity:</b> | 57 %      |
| <b>ATM Pressure:</b>      | 101.0 kPa |

*The testing was performed by Chris Wang on 2017-07-09.*

**Conducted Power****Cellular Band (Part 22H)**

| Mode | Channel | Frequency (MHz) | Average Output Power (dBm) | Limit (dBm) |
|------|---------|-----------------|----------------------------|-------------|
| GSM  | 128     | 824.2           | 31.87                      | 38.45       |
|      | 190     | 836.6           | 32.13                      | 38.45       |
|      | 251     | 848.8           | 32.04                      | 38.45       |

| Mode | Channel | Frequency (MHz) | Average Output Power (dBm) |         |         |         | Limit (dBm) |
|------|---------|-----------------|----------------------------|---------|---------|---------|-------------|
|      |         |                 | 1 slot                     | 2 slots | 3 slots | 4 slots |             |
| GPRS | 128     | 824.2           | 31.95                      | 31.08   | 29.14   | 27.90   | 38.45       |
|      | 190     | 836.6           | 32.11                      | 31.27   | 29.35   | 28.10   | 38.45       |
|      | 251     | 848.8           | 32.12                      | 31.27   | 29.39   | 28.18   | 38.45       |

| Mode  | Channel | Frequency (MHz) | Average Output Power (dBm) |         |         |         | Limit (dBm) |
|-------|---------|-----------------|----------------------------|---------|---------|---------|-------------|
|       |         |                 | 1 slot                     | 2 slots | 3 slots | 4 slots |             |
| EGPRS | 128     | 824.2           | 26.79                      | 25.83   | 23.82   | 22.51   | 38.45       |
|       | 190     | 836.6           | 27.10                      | 26.01   | 24.01   | 22.70   | 38.45       |
|       | 251     | 848.8           | 27.12                      | 26.19   | 24.14   | 22.88   | 38.45       |

| Mode           | Test Condition | Test Mode | 3GPP Sub Test | Average Output Power (dBm) |                  |                |
|----------------|----------------|-----------|---------------|----------------------------|------------------|----------------|
|                |                |           |               | Low Frequency              | Middle Frequency | High Frequency |
| WCDMA (Band V) | Normal         | RMC12.2k  |               | 22.57                      | 22.31            | 22.38          |
|                |                | HSDPA     | 1             | 21.56                      | 21.33            | 21.41          |
|                |                |           | 2             | 21.44                      | 21.22            | 21.33          |
|                |                |           | 3             | 21.61                      | 21.41            | 21.49          |
|                |                |           | 4             | 21.47                      | 21.26            | 21.28          |
|                |                | HSUPA     | 1             | 21.47                      | 21.35            | 21.41          |
|                |                |           | 2             | 21.34                      | 21.30            | 21.36          |
|                |                |           | 3             | 21.56                      | 21.44            | 21.45          |
|                |                |           | 4             | 21.37                      | 21.24            | 21.33          |
|                |                |           | 5             | 21.54                      | 21.45            | 21.48          |
|                |                | HSPA+     | 1             | 21.52                      | 21.47            | 21.47          |

## PCS Band (Part 24E)

| Mode | Channel | Frequency (MHz) | Average Output Power (dBm) | Limit (dBm) |
|------|---------|-----------------|----------------------------|-------------|
| GSM  | 512     | 1850.2          | 29.26                      | 33          |
|      | 661     | 1880.0          | 29.01                      | 33          |
|      | 810     | 1909.8          | 28.82                      | 33          |

| Mode | Channel | Frequency (MHz) | Average Output Power (dBm) |         |         |         | Limit (dBm) |
|------|---------|-----------------|----------------------------|---------|---------|---------|-------------|
|      |         |                 | 1 slot                     | 2 slots | 3 slots | 4 slots |             |
| GPRS | 512     | 1850.2          | 29.34                      | 28.52   | 26.64   | 25.44   | 33          |
|      | 661     | 1880.0          | 29.12                      | 28.32   | 26.47   | 25.27   | 33          |
|      | 810     | 1909.8          | 28.95                      | 28.19   | 26.48   | 25.33   | 33          |

| Mode  | Channel | Frequency (MHz) | Average Output Power (dBm) |         |         |         | Limit (dBm) |
|-------|---------|-----------------|----------------------------|---------|---------|---------|-------------|
|       |         |                 | 1 slot                     | 2 slots | 3 slots | 4 slots |             |
| EGPRS | 512     | 1850.2          | 27.01                      | 25.86   | 23.80   | 22.59   | 33          |
|       | 661     | 1880.0          | 26.61                      | 25.48   | 23.39   | 22.11   | 33          |
|       | 810     | 1909.8          | 26.41                      | 25.43   | 23.21   | 21.92   | 33          |

| Mode            | Test Condition | Test Mode | 3GPP Sub Test | Average Output Power (dBm) |                  |                |
|-----------------|----------------|-----------|---------------|----------------------------|------------------|----------------|
|                 |                |           |               | Low Frequency              | Middle Frequency | High Frequency |
| WCDMA (Band II) | Normal         | RMC12.2k  |               | 21.73                      | 21.99            | 21.79          |
|                 |                | HSDPA     | 1             | 21.03                      | 20.84            | 20.71          |
|                 |                |           | 2             | 20.97                      | 20.78            | 20.66          |
|                 |                |           | 3             | 21.12                      | 20.96            | 20.81          |
|                 |                |           | 4             | 20.99                      | 20.80            | 20.62          |
|                 |                | HSUPA     | 1             | 20.85                      | 21.06            | 20.99          |
|                 |                |           | 2             | 20.78                      | 20.96            | 20.91          |
|                 |                |           | 3             | 20.94                      | 21.10            | 21.07          |
|                 |                |           | 4             | 20.81                      | 20.95            | 20.87          |
|                 |                |           | 5             | 20.98                      | 21.12            | 21.11          |
|                 |                | HSPA+     | 1             | 20.93                      | 21.16            | 21.18          |

**Peak-to-average ratio (PAR)****Cellular Band**

| Mode | Channel | PAR (dB) | Limit (dB) |
|------|---------|----------|------------|
| GSM  | Low     | 0.32     | 13         |
|      | Middle  | 0.35     | 13         |
|      | High    | 0.33     | 13         |

| Mode  | Channel | PAR (dB) | Limit (dB) |
|-------|---------|----------|------------|
| EGPRS | Low     | 0.37     | 13         |
|       | Middle  | 0.42     | 13         |
|       | High    | 0.40     | 13         |

| Mode             | Channel | PAR (dB) | Limit (dB) |
|------------------|---------|----------|------------|
| WCDMA<br>(BPSK)  | Low     | 3.10     | 13         |
|                  | Middle  | 3.13     | 13         |
|                  | High    | 3.06     | 13         |
| HSDPA<br>(16QAM) | Low     | 3.02     | 13         |
|                  | Middle  | 3.07     | 13         |
|                  | High    | 2.98     | 13         |
| HSUPA<br>(BPSK)  | Low     | 2.91     | 13         |
|                  | Middle  | 2.96     | 13         |
|                  | High    | 2.88     | 13         |
| HSPA+<br>(16QAM) | Low     | 3.05     | 13         |
|                  | Middle  | 2.97     | 13         |
|                  | High    | 2.88     | 13         |

**PCS Band**

| Mode | Channel | PAR (dB) | Limit (dB) |
|------|---------|----------|------------|
| GSM  | Low     | 0.34     | 13         |
|      | Middle  | 0.33     | 13         |
|      | High    | 0.36     | 13         |

| Mode  | Channel | PAR (dB) | Limit (dB) |
|-------|---------|----------|------------|
| EGPRS | Low     | 0.43     | 13         |
|       | Middle  | 0.41     | 13         |
|       | High    | 0.46     | 13         |

| Mode             | Channel | PAR (dB) | Limit (dB) |
|------------------|---------|----------|------------|
| RMC<br>(BPSK)    | Low     | 3.15     | 13         |
|                  | Middle  | 2.89     | 13         |
|                  | High    | 3.06     | 13         |
| HSDPA<br>(16QAM) | Low     | 3.14     | 13         |
|                  | Middle  | 2.86     | 13         |
|                  | High    | 2.98     | 13         |
| HSUPA<br>(BPSK)  | Low     | 3.09     | 13         |
|                  | Middle  | 2.83     | 13         |
|                  | High    | 2.94     | 13         |
| HSPA+<br>(16QAM) | Low     | 3.12     | 13         |
|                  | Middle  | 2.87     | 13         |
|                  | High    | 2.89     | 13         |

**Radiated Power****GSM Mode:**

| Frequency<br>(MHz)                               | Receiver<br>Reading<br>(dBμV) | Turntable<br>Angle<br>Degree | Rx Antenna    |                | Substituted    |                       |                         | Absolute<br>Level<br>(dBm) | FCC Part 22H/24E |                |
|--------------------------------------------------|-------------------------------|------------------------------|---------------|----------------|----------------|-----------------------|-------------------------|----------------------------|------------------|----------------|
|                                                  |                               |                              | Height<br>(m) | Polar<br>(H/V) | Level<br>(dBm) | Cable<br>loss<br>(dB) | Antenna<br>Gain<br>(dB) |                            | Limit<br>(dBm)   | Margin<br>(dB) |
| ERP for Cellular Band (Part 22H), Middle Channel |                               |                              |               |                |                |                       |                         |                            |                  |                |
| 836.6                                            | 90.14                         | 313                          | 2.0           | H              | 20.4           | 0.26                  | 4.75                    | 24.89                      | 38.45            | 13.56          |
| 836.6                                            | 101.16                        | 316                          | 1.5           | V              | 27.4           | 0.26                  | 4.75                    | 31.89                      | 38.45            | 6.56           |
| EIRP for PCS Band (Part 24E), Middle Channel     |                               |                              |               |                |                |                       |                         |                            |                  |                |
| 1880.00                                          | 72.92                         | 230                          | 1.8           | H              | 11.4           | 0.45                  | 8.84                    | 19.79                      | 33               | 13.21          |
| 1880.00                                          | 83.25                         | 109                          | 1.3           | V              | 19.5           | 0.45                  | 8.84                    | 27.89                      | 33               | 5.11           |

**EGRPS Mode:**

| Frequency<br>(MHz)                               | Receiver<br>Reading<br>(dBμV) | Turntable<br>Angle<br>Degree | Rx Antenna    |                | Substituted    |                       |                         | Absolute<br>Level<br>(dBm) | FCC Part 22H/24E |                |
|--------------------------------------------------|-------------------------------|------------------------------|---------------|----------------|----------------|-----------------------|-------------------------|----------------------------|------------------|----------------|
|                                                  |                               |                              | Height<br>(m) | Polar<br>(H/V) | Level<br>(dBm) | Cable<br>loss<br>(dB) | Antenna<br>Gain<br>(dB) |                            | Limit<br>(dBm)   | Margin<br>(dB) |
| ERP for Cellular Band (Part 22H), Middle Channel |                               |                              |               |                |                |                       |                         |                            |                  |                |
| 836.6                                            | 84.11                         | 20                           | 1.2           | H              | 14.4           | 0.26                  | 4.75                    | 18.89                      | 38.45            | 19.56          |
| 836.6                                            | 94.63                         | 79                           | 1.3           | V              | 20.9           | 0.26                  | 4.75                    | 25.39                      | 38.45            | 13.06          |
| EIRP for PCS Band (Part 24E), Middle Channel     |                               |                              |               |                |                |                       |                         |                            |                  |                |
| 1880.00                                          | 70.44                         | 340                          | 2.0           | H              | 9.0            | 0.45                  | 8.84                    | 17.39                      | 33               | 15.61          |
| 1880.00                                          | 79.72                         | 9                            | 1.2           | V              | 16.0           | 0.45                  | 8.84                    | 24.39                      | 33               | 8.61           |

**WCDMA Mode:**

| Frequency<br>(MHz)                                | Receiver<br>Reading<br>(dBμV) | Turntable<br>Angle<br>Degree | Rx Antenna    |                | Substituted    |                       |                         | Absolute<br>Level<br>(dBm) | FCC Part 22H/24E |                |
|---------------------------------------------------|-------------------------------|------------------------------|---------------|----------------|----------------|-----------------------|-------------------------|----------------------------|------------------|----------------|
|                                                   |                               |                              | Height<br>(m) | Polar<br>(H/V) | Level<br>(dBm) | Cable<br>loss<br>(dB) | Antenna<br>Gain<br>(dB) |                            | Limit<br>(dBm)   | Margin<br>(dB) |
| ERP for WCDMA Band V (Part 22H), Middle Channel   |                               |                              |               |                |                |                       |                         |                            |                  |                |
| 836.6                                             | 83.34                         | 321                          | 1.2           | H              | 13.6           | 0.26                  | 4.75                    | 18.09                      | 38.45            | 20.36          |
| 836.6                                             | 90.86                         | 139                          | 1.3           | V              | 17.1           | 0.26                  | 4.75                    | 21.59                      | 38.45            | 16.86          |
| EIRP for WCDMA Band II (Part 24E), Middle Channel |                               |                              |               |                |                |                       |                         |                            |                  |                |
| 1880.00                                           | 68.69                         | 158                          | 1.4           | H              | 7.2            | 0.45                  | 8.84                    | 15.59                      | 33               | 17.41          |
| 1880.00                                           | 76.32                         | 147                          | 2.0           | V              | 12.6           | 0.45                  | 8.84                    | 20.99                      | 33               | 12.01          |

**Note:**

All above data were tested with no amplifier.

Absolute Level = Substituted Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

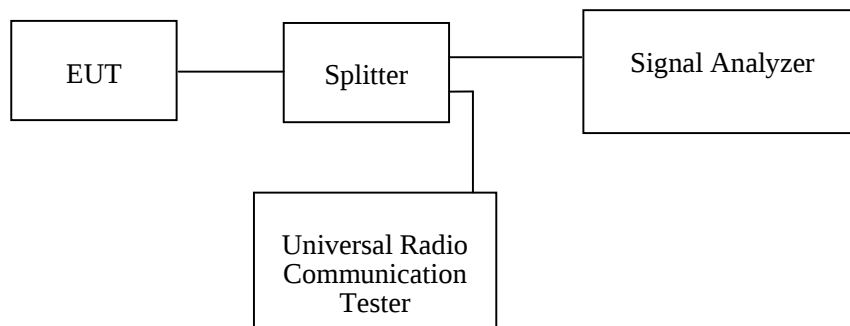
**FCC §2.1049, §22.917, §22.905 & §24.238 - BANDWIDTH****Applicable Standard**

FCC §2.1049, §22.917, §22.905 and §24.238.

**Test Procedure**

The RF output of the transmitter was connected to the simulator and the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 5 kHz (GSM) & 100 kHz (WCDMA) and the 26 dB & 99% bandwidth was recorded.

**Test Data****Environmental Conditions**

|                    |                  |
|--------------------|------------------|
| Temperature:       | 24~25 °C         |
| Relative Humidity: | 52~57 %          |
| ATM Pressure:      | 100.09~101.0 kPa |

*The testing was performed by Chris Wang from 2017-07-09 to 2017-07-21.*

*EUT operation mode: Transmitting*

Test Result: Compliance. Please refer to the following tables and plots.

### Cellular Band (Part 22H)

| Mode      | Frequency (MHz) | 99% Occupied Bandwidth (kHz) | 26 dB Emission Bandwidth (kHz) |
|-----------|-----------------|------------------------------|--------------------------------|
| GSM(GMSK) | 836.6           | 244.5                        | 314.6                          |

| Mode  | Frequency (MHz) | 99% Occupied Bandwidth (kHz) | 26 dB Emission Bandwidth (kHz) |
|-------|-----------------|------------------------------|--------------------------------|
| EGPRS | 836.6           | 246.5                        | 310.6                          |

| Mode          | Frequency (MHz) | 99% Occupied Bandwidth (MHz) | 26 dB Emission Bandwidth (MHz) |
|---------------|-----------------|------------------------------|--------------------------------|
| RMC (BPSK)    | 836.6           | 4.148                        | 4.709                          |
| HSUPA (BPSK)  | 836.6           | 4.148                        | 4.669                          |
| HSDPA (16QAM) | 836.6           | 4.148                        | 4.689                          |

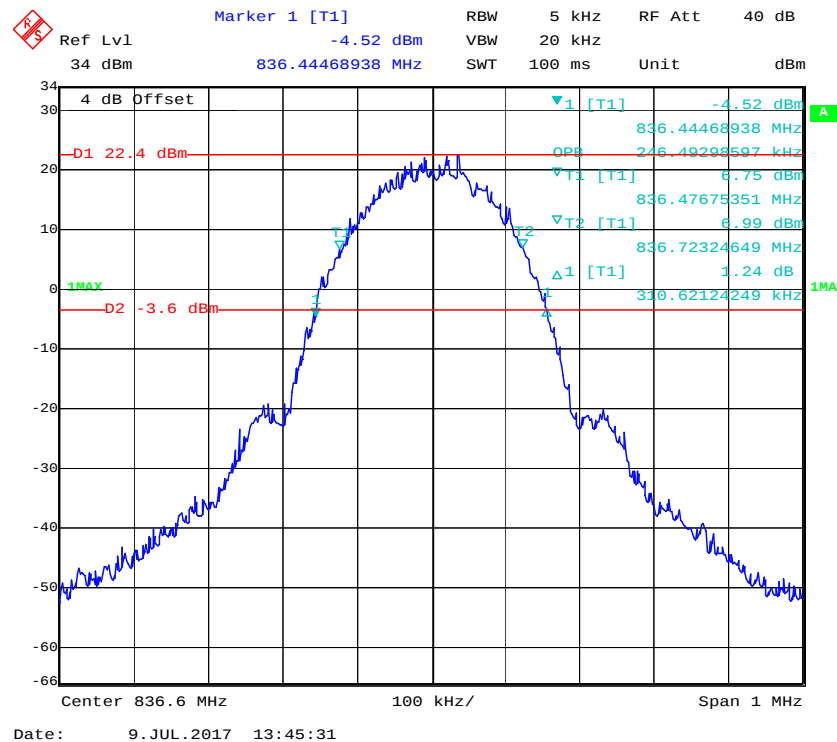
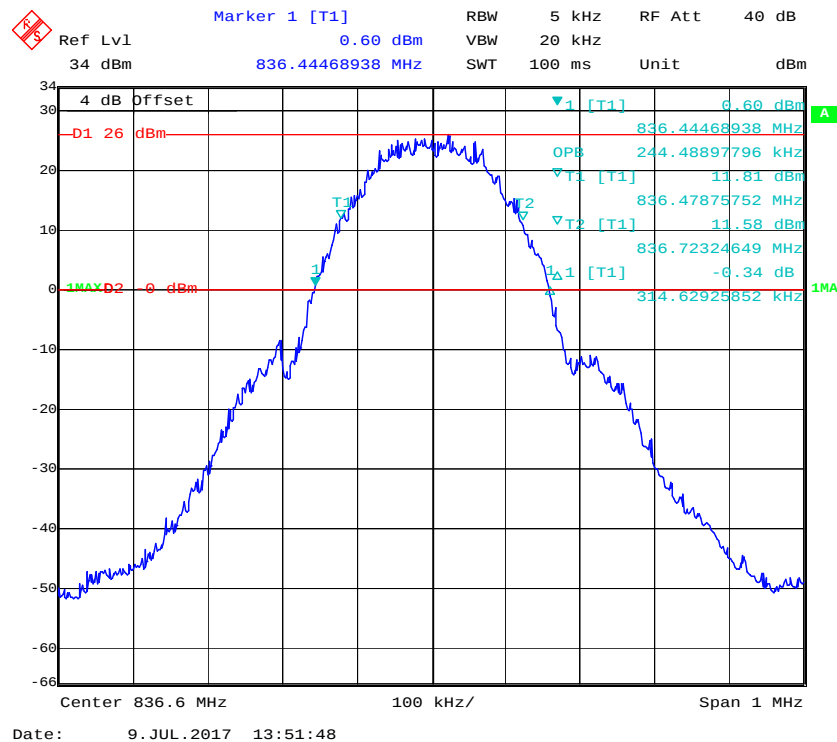
### PCS Band (Part 24E)

| Mode      | Frequency (MHz) | 99% Occupied Bandwidth (kHz) | 26 dB Emission Bandwidth (kHz) |
|-----------|-----------------|------------------------------|--------------------------------|
| GSM(GMSK) | 1880.0          | 242.5                        | 316.6                          |

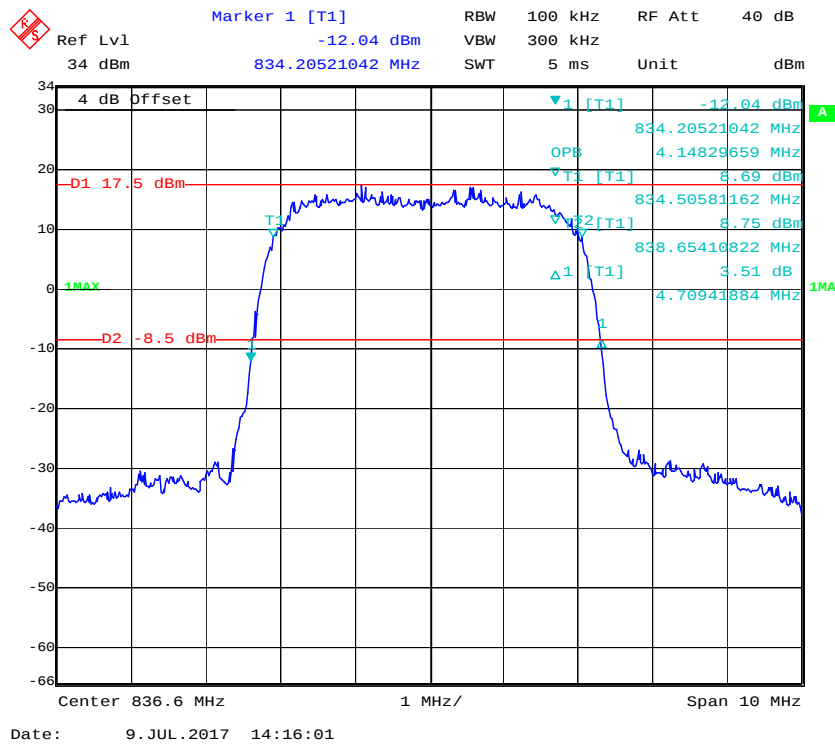
| Mode  | Frequency (MHz) | 99% Occupied Bandwidth (kHz) | 26 dB Emission Bandwidth (kHz) |
|-------|-----------------|------------------------------|--------------------------------|
| EGPRS | 1880.0          | 244.5                        | 318.6                          |

| Mode          | Frequency (MHz) | 99% Occupied Bandwidth (MHz) | 26 dB Emission Bandwidth (MHz) |
|---------------|-----------------|------------------------------|--------------------------------|
| RMC (BPSK)    | 1880.0          | 4.168                        | 4.729                          |
| HSUPA (BPSK)  | 1880.0          | 4.168                        | 4.729                          |
| HSDPA (16QAM) | 1880.0          | 4.168                        | 4.689                          |

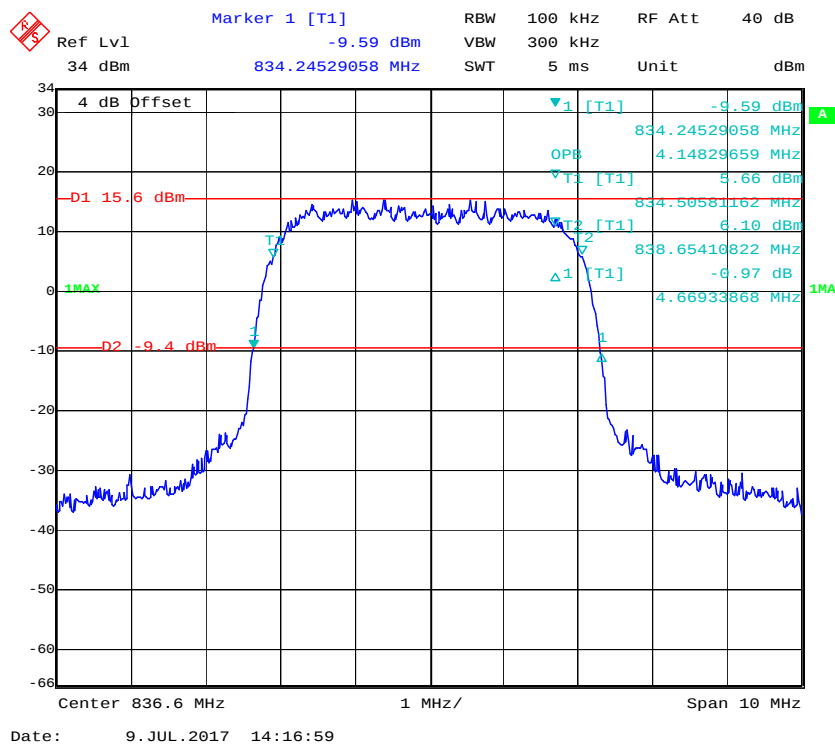
### 99% Occupied Bandwidth & 26 dB Emissions Bandwidth for GSM (GMSK) Mode

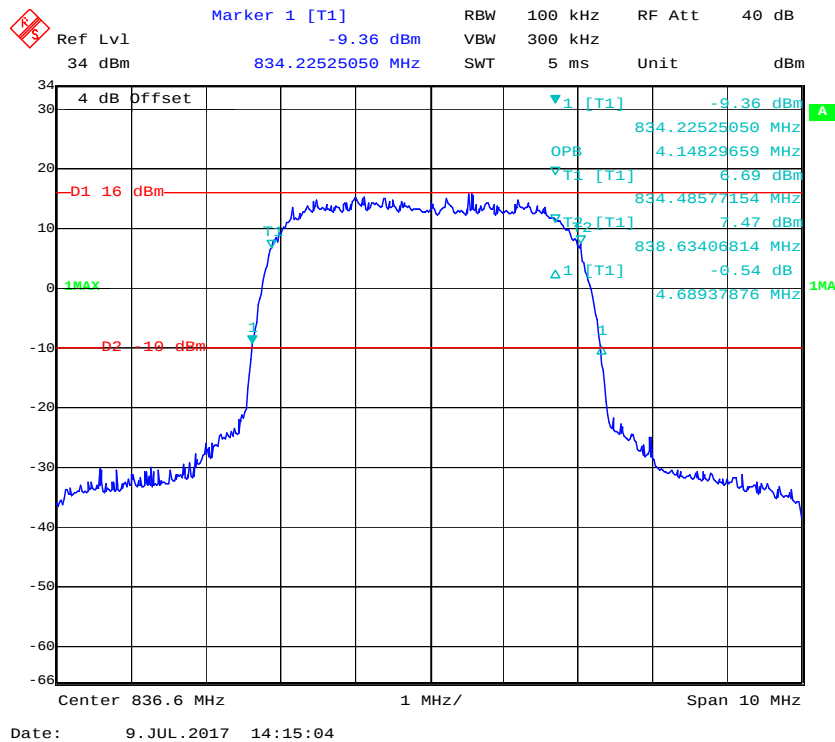


## 99% Occupied Bandwidth &amp; 26 dB Emissions Bandwidth for RMC (BPSK) Mode

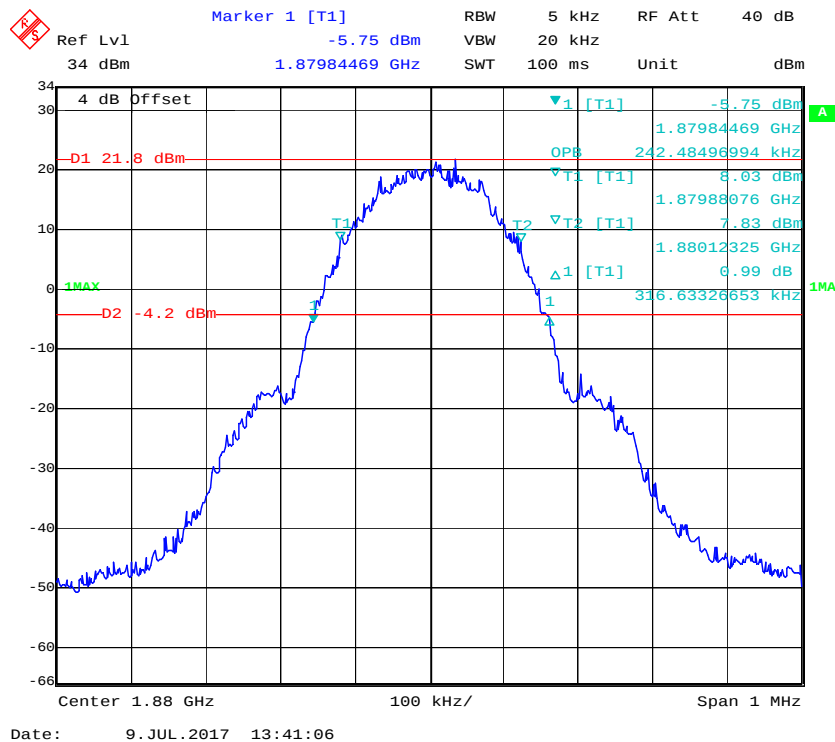


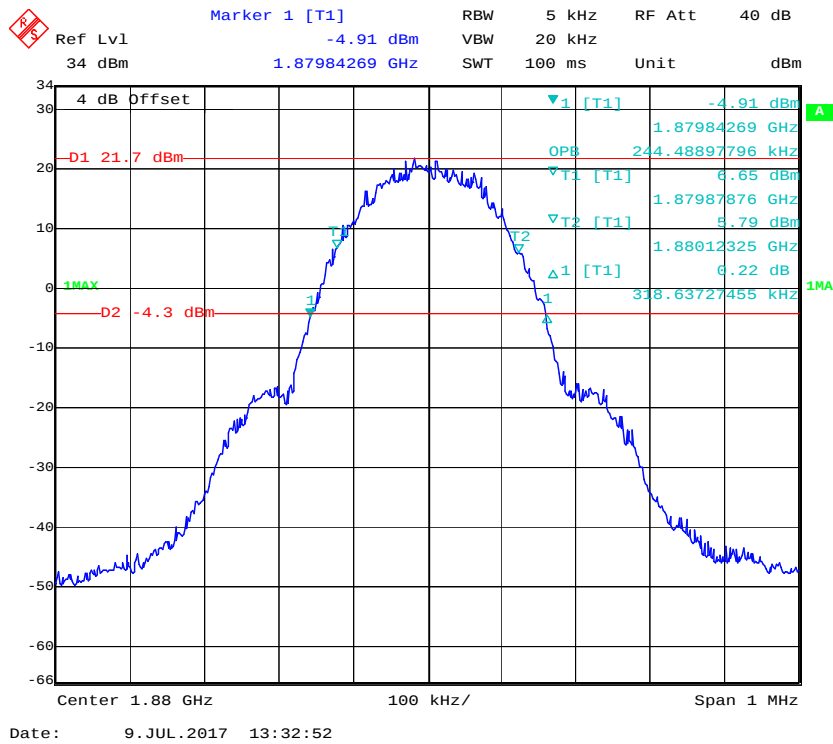
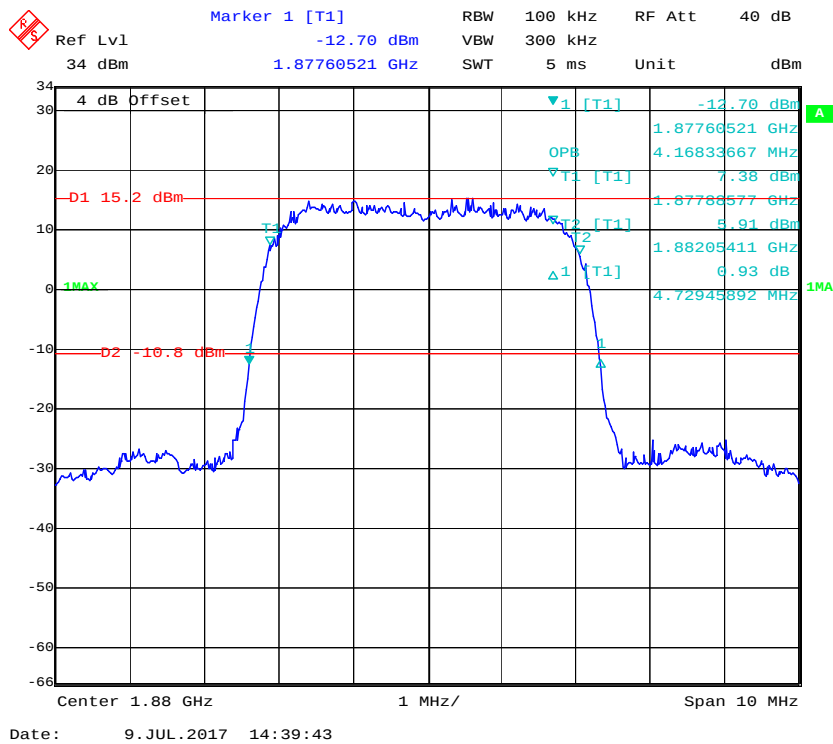
## 99% Occupied Bandwidth &amp; 26 dB Emissions Bandwidth for HSUPA (BPSK) Mode



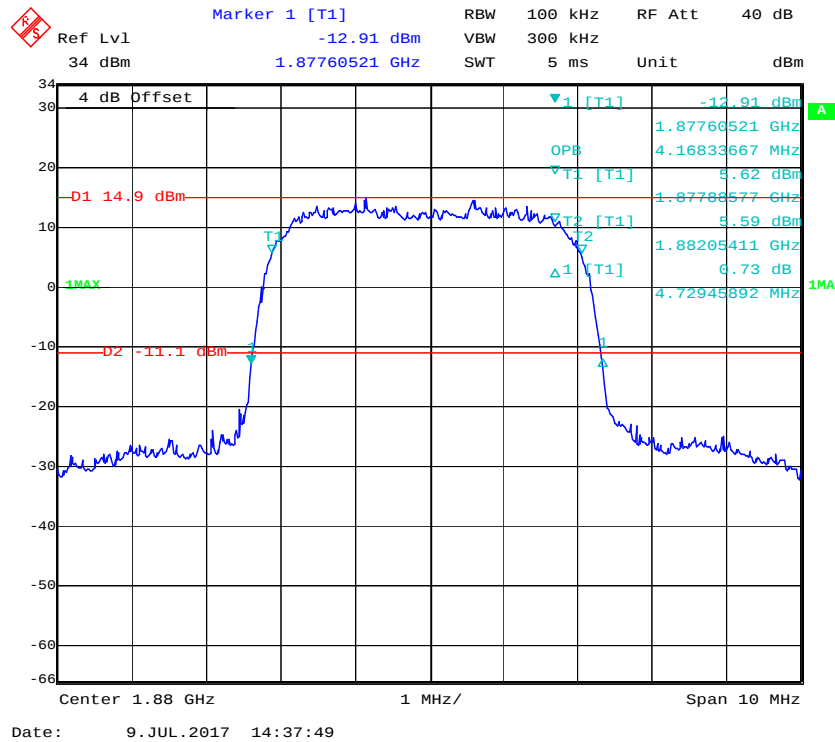


### 99% Occupied Bandwidth & 26 dB Emissions Bandwidth for GSM (GMSK) Mode

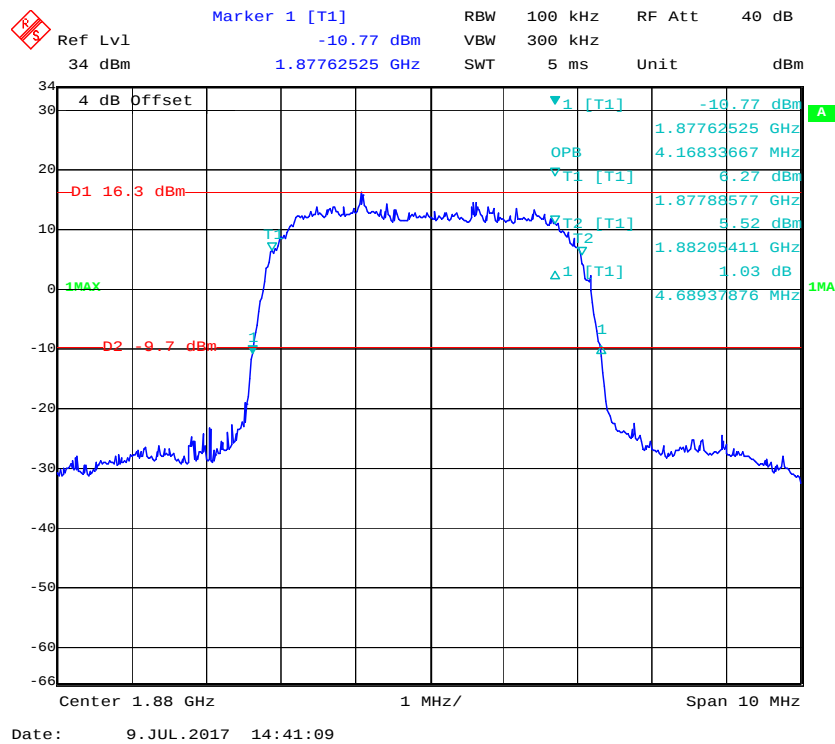


**26 dB Emissions & 99% Occupied Bandwidth for EGPRS (8PSK) Mode****99% Occupied Bandwidth & 26 dB Emissions Bandwidth for RMC (BPSK) Mode**

### 99% Occupied Bandwidth & 26 dB Emissions Bandwidth for HSUPA (BPSK) Mode



### 99% Occupied Bandwidth & 26 dB Emissions Bandwidth for HSDPA (16QAM) Mode



## FCC §2.1051, §22.917(a) & §24.238(a) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

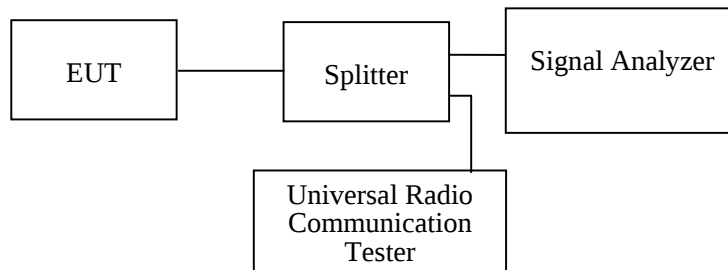
### Applicable Standard

FCC §2.1051, §22.917(a) and §24.238(a).

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1051.

### Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1MHz. Sufficient scans were taken to show any out of band emissions up to 10<sup>th</sup> harmonic.



### Test Data

#### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 25 °C     |
| Relative Humidity: | 57 %      |
| ATM Pressure:      | 101.0 kPa |

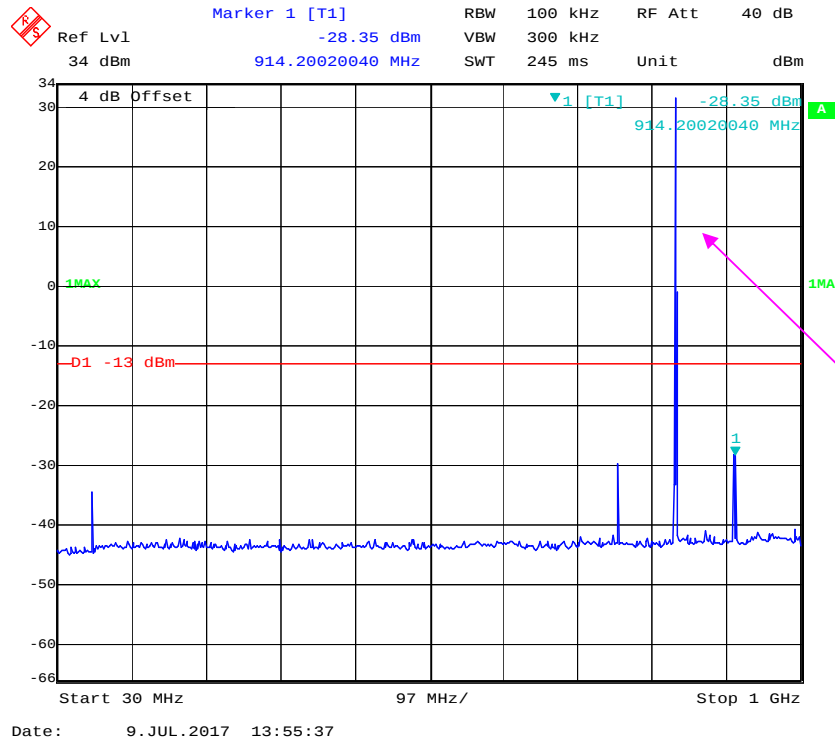
*The testing was performed by Chris Wang on 2017-07-09.*

*EUT operation mode: Transmitting*

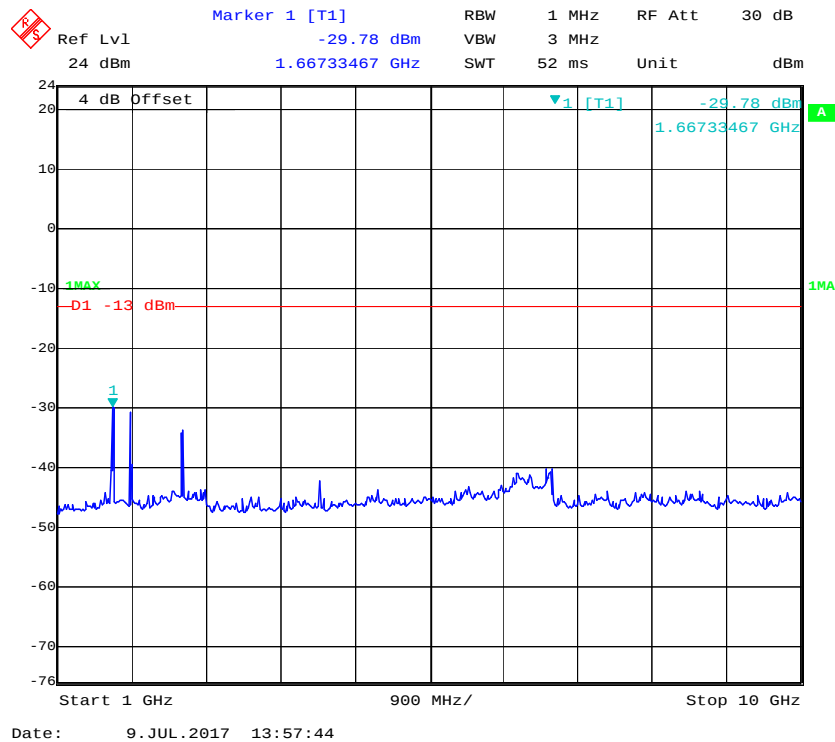
*Test result: Compliance, please refer to the following plots.*

Cellular Band (Part 22H)

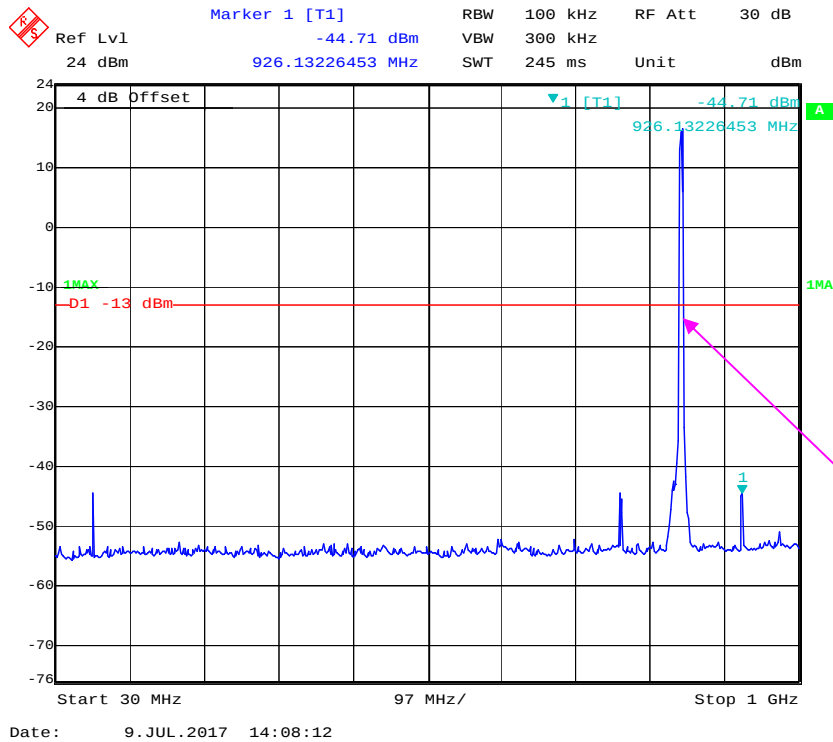
30 MHz – 1 GHz (GSM Mode)



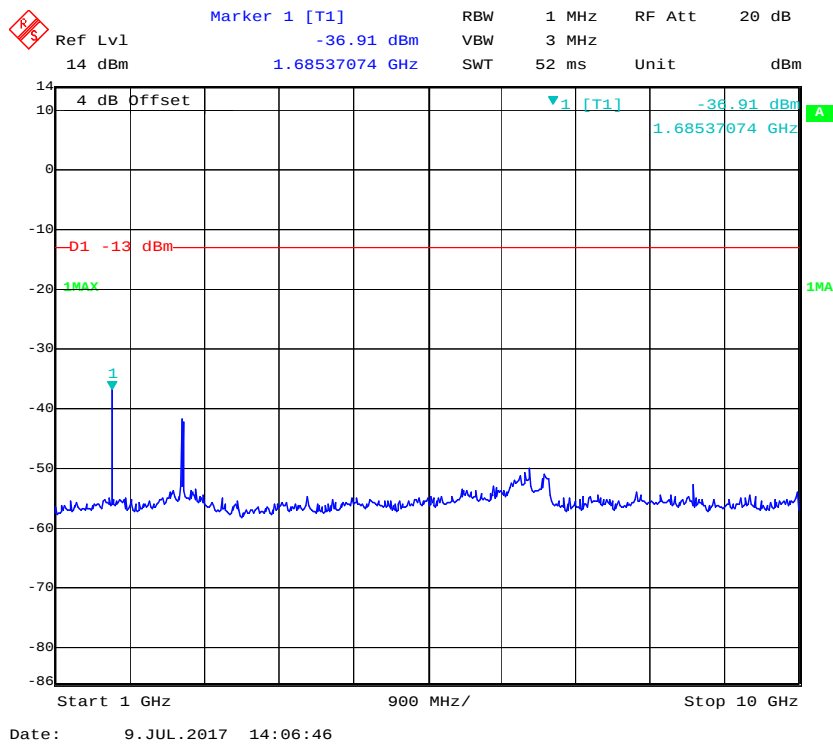
1 GHz – 10 GHz (GSM Mode)



### 30 MHz – 1 GHz (WCDMA Mode)

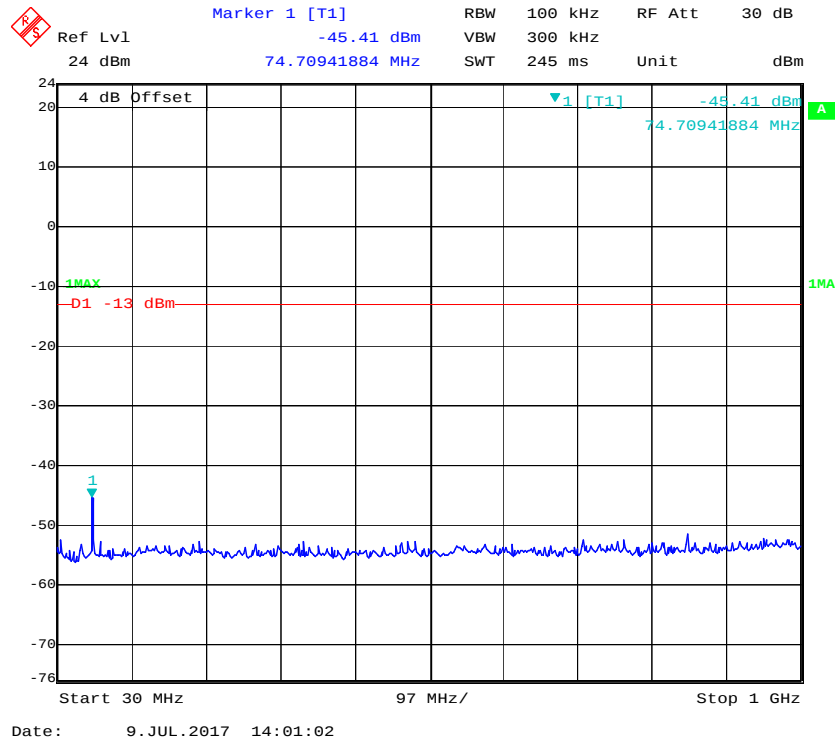


### 1 GHz – 10 GHz (WCDMA Mode)

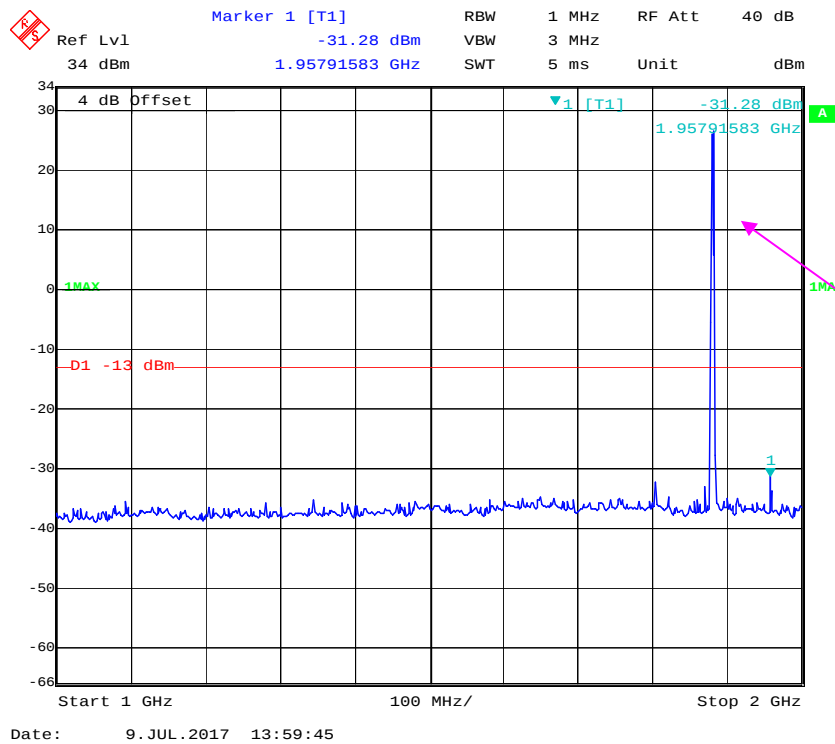


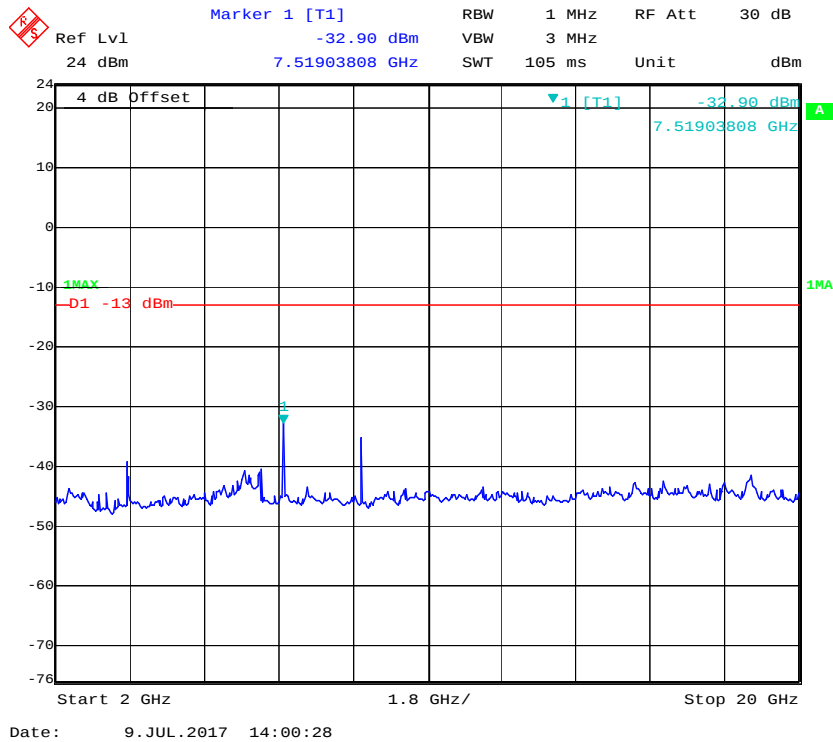
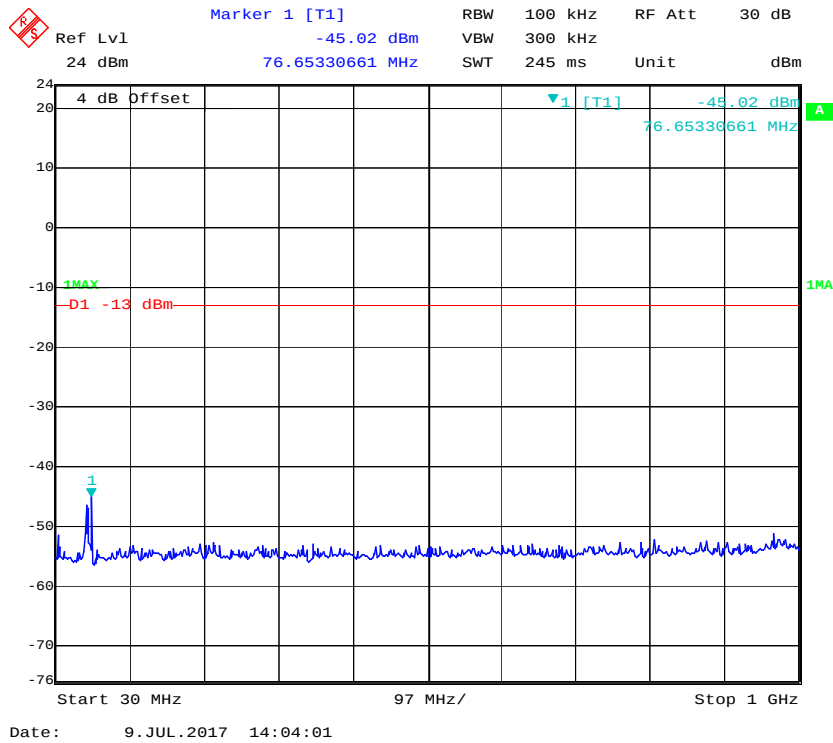
# PCS Band (Part 24E)

## 30 MHz – 1 GHz (GSM Mode)

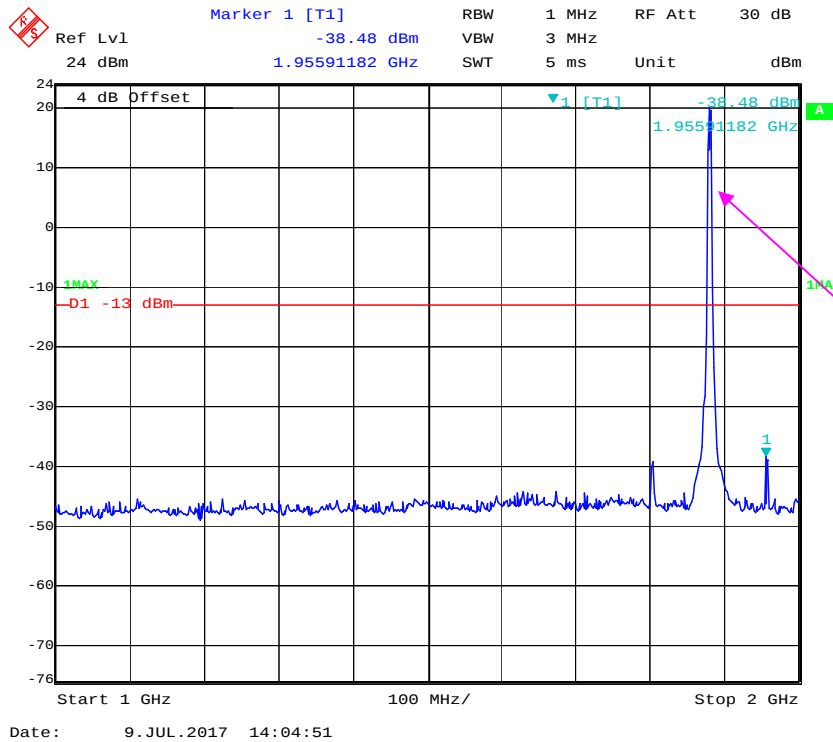


## 1 GHz – 2 GHz (GSM Mode)

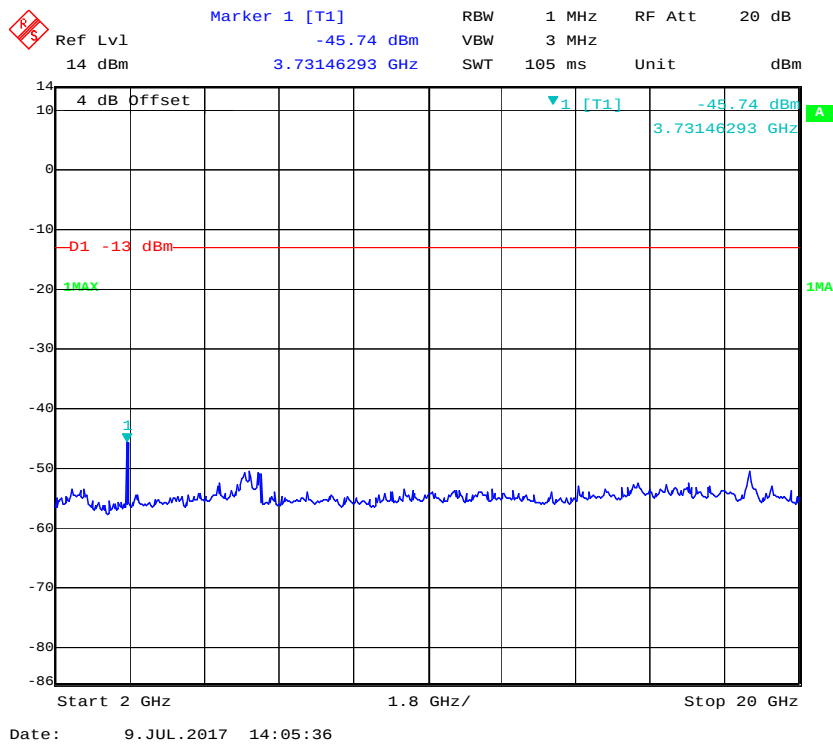


**2 GHz – 20 GHz (GSM Mode)****30 MHz – 1 GHz (WCDMA Mode)**

### 1 GHz – 2 GHz (WCDMA Mode)



### 2 GHz – 20 GHz (WCDMA Mode)



**FCC §2.1053, §22.917 & §24.238 - SPURIOUS RADIATED EMISSIONS****Applicable Standard**

FCC § 2.1053, §22.917 and § 24.238.

**Test Procedure**

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the receiving antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 lg (TXpwr in Watts/0.001) – the absolute level

Spurious attenuation limit in dB = 43 + 10 Log<sub>10</sub> (power out in Watts)

**Test Data****Environmental Conditions**

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 24 °C     |
| <b>Relative Humidity:</b> | 60 %      |
| <b>ATM Pressure:</b>      | 101.0 kPa |

*The testing was performed by Layne Li on 2017-07-16.*

*EUT operation mode: Transmitting*

*Pre-scan with Low, Middle and High channel, the worst case as below:*

**30 MHz ~ 10 GHz:****Cellular Band (Part 22H)**

| Frequency<br>(MHz)         | Receiver<br>Reading<br>(dBμV) | Turntable<br>Angle<br>Degree | Rx Antenna    |                | Substituted    |                       |                         | Absolute<br>Level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|----------------------------|-------------------------------|------------------------------|---------------|----------------|----------------|-----------------------|-------------------------|----------------------------|----------------|----------------|
|                            |                               |                              | Height<br>(m) | Polar<br>(H/V) | Level<br>(dBm) | Cable<br>Loss<br>(dB) | Antenna<br>Gain<br>(dB) |                            |                |                |
| GSM Mode, Middle channel   |                               |                              |               |                |                |                       |                         |                            |                |                |
| 244.88                     | 39.67                         | 6                            | 1.1           | H              | -65.3          | 0.14                  | 2.05                    | -63.39                     | -13            | 50.39          |
| 244.88                     | 39.01                         | 34                           | 2.0           | V              | -66.4          | 0.14                  | 2.05                    | -64.49                     | -13            | 51.49          |
| 1673.20                    | 50.00                         | 51                           | 2.3           | H              | -51.8          | 0.40                  | 8.52                    | -43.68                     | -13            | 30.68          |
| 1673.20                    | 50.67                         | 178                          | 2.0           | V              | -53.1          | 0.40                  | 8.52                    | -44.98                     | -13            | 31.98          |
| WCDMA Mode, Middle channel |                               |                              |               |                |                |                       |                         |                            |                |                |
| 244.88                     | 38.76                         | 257                          | 2.5           | H              | -66.2          | 0.14                  | 2.05                    | -64.29                     | -13            | 51.29          |
| 244.88                     | 38.30                         | 195                          | 1.5           | V              | -67.1          | 0.14                  | 2.05                    | -65.19                     | -13            | 52.19          |
| 1673.20                    | 59.00                         | 95                           | 1.3           | H              | -42.8          | 0.40                  | 8.52                    | -34.68                     | -13            | 21.68          |
| 1673.20                    | 62.57                         | 352                          | 1.6           | V              | -41.2          | 0.40                  | 8.52                    | -33.08                     | -13            | 20.08          |

**30 MHz ~ 20 GHz:****PCS Band (Part 24E)**

| Frequency<br>(MHz)         | Receiver<br>Reading<br>(dBμV) | Turntable<br>Angle<br>Degree | Rx Antenna    |                | Substituted    |                       |                         | Absolute<br>Level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|----------------------------|-------------------------------|------------------------------|---------------|----------------|----------------|-----------------------|-------------------------|----------------------------|----------------|----------------|
|                            |                               |                              | Height<br>(m) | Polar<br>(H/V) | Level<br>(dBm) | Cable<br>Loss<br>(dB) | Antenna<br>Gain<br>(dB) |                            |                |                |
| GSM Mode, Middle channel   |                               |                              |               |                |                |                       |                         |                            |                |                |
| 244.88                     | 39.67                         | 30                           | 2.5           | H              | -65.3          | 0.14                  | 2.05                    | -63.39                     | -13            | 50.39          |
| 244.88                     | 39.21                         | 350                          | 1.7           | V              | -66.2          | 0.14                  | 2.05                    | -64.29                     | -13            | 51.29          |
| 3760.00                    | 37.82                         | 219                          | 2.2           | H              | -58.2          | 0.59                  | 9.72                    | -49.07                     | -13            | 36.07          |
| 3760.00                    | 38.31                         | 284                          | 1.2           | V              | -58.8          | 0.59                  | 9.72                    | -49.67                     | -13            | 36.67          |
| WCDMA Mode, Middle channel |                               |                              |               |                |                |                       |                         |                            |                |                |
| 244.88                     | 39.46                         | 331                          | 1.6           | H              | -65.5          | 0.14                  | 2.05                    | -63.59                     | -13            | 50.59          |
| 244.88                     | 38.40                         | 262                          | 1.0           | V              | -67.0          | 0.14                  | 2.05                    | -65.09                     | -13            | 52.09          |
| 3760.00                    | 36.22                         | 111                          | 1.7           | H              | -59.8          | 0.59                  | 9.72                    | -50.67                     | -13            | 37.67          |
| 3760.00                    | 38.71                         | 311                          | 1.1           | V              | -58.4          | 0.59                  | 9.72                    | -49.27                     | -13            | 36.27          |

**Note:**

- 1) Absolute Level = Substituted Level - Cable loss + Antenna Gain
- 2) Margin = Limit- Absolute Level

## FCC §22.917(a) & §24.238(a) - BAND EDGES

### Applicable Standard

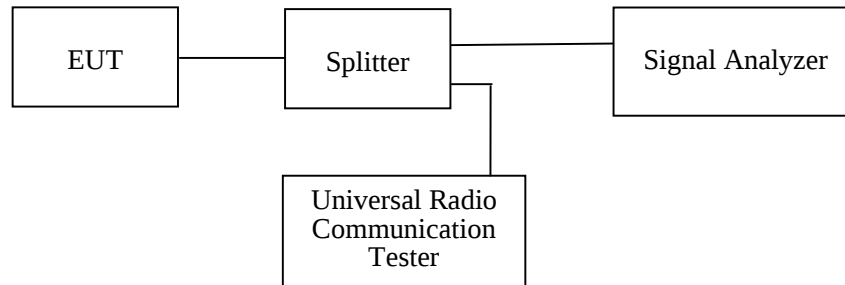
According to § 22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

According to §24.238(a), the power of any emissions 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.

### Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The center of the spectrum analyzer was set to block edge frequency



### Test Data

#### Environmental Conditions

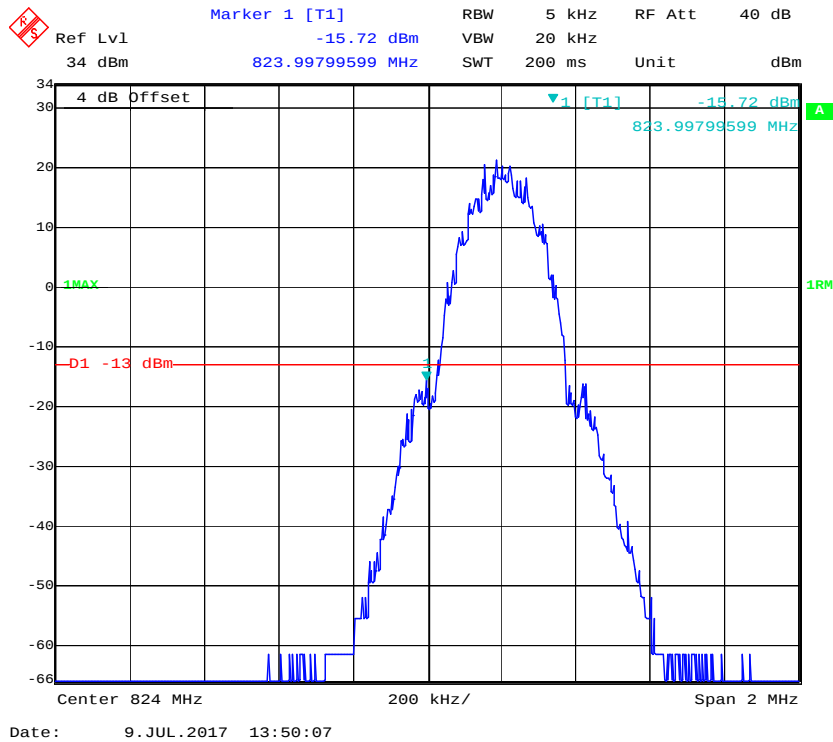
|                    |           |
|--------------------|-----------|
| Temperature:       | 25 °C     |
| Relative Humidity: | 57 %      |
| ATM Pressure:      | 101.0 kPa |

*The testing was performed by Chris Wang on 2017-07-09.*

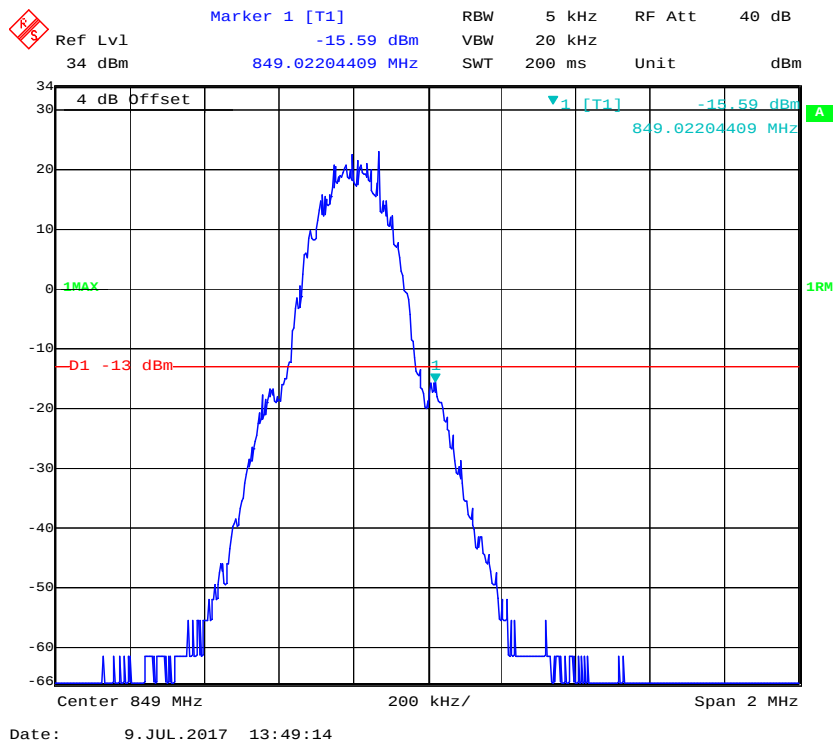
*EUT operation mode: Transmitting*

*Test Result: Compliance. Please refer to the following plots.*

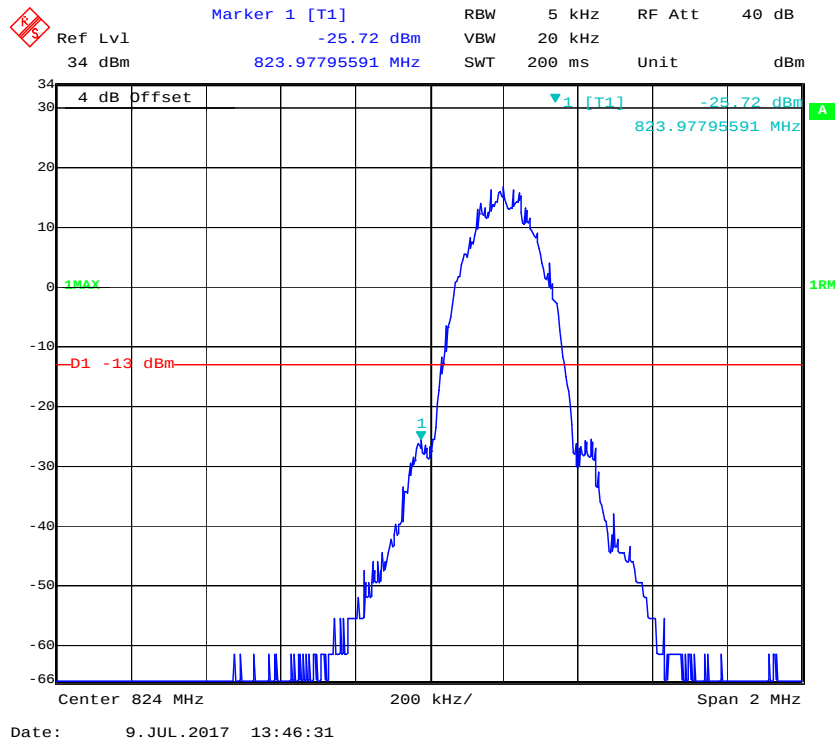
### Cellular Band, Left Band Edge for GSM (GMSK) Mode



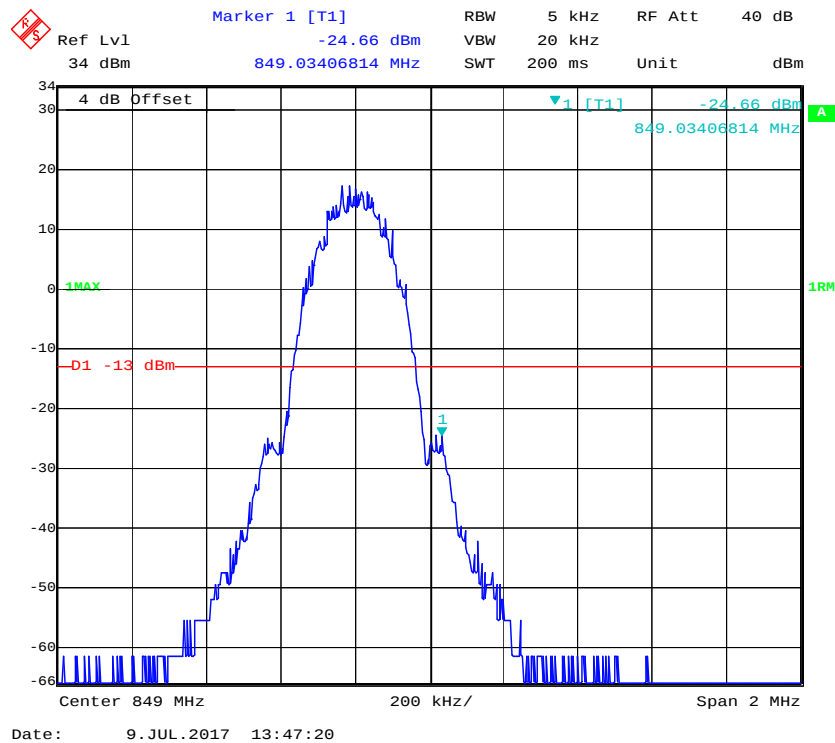
### Cellular Band, Right Band Edge for GSM (GMSK) Mode



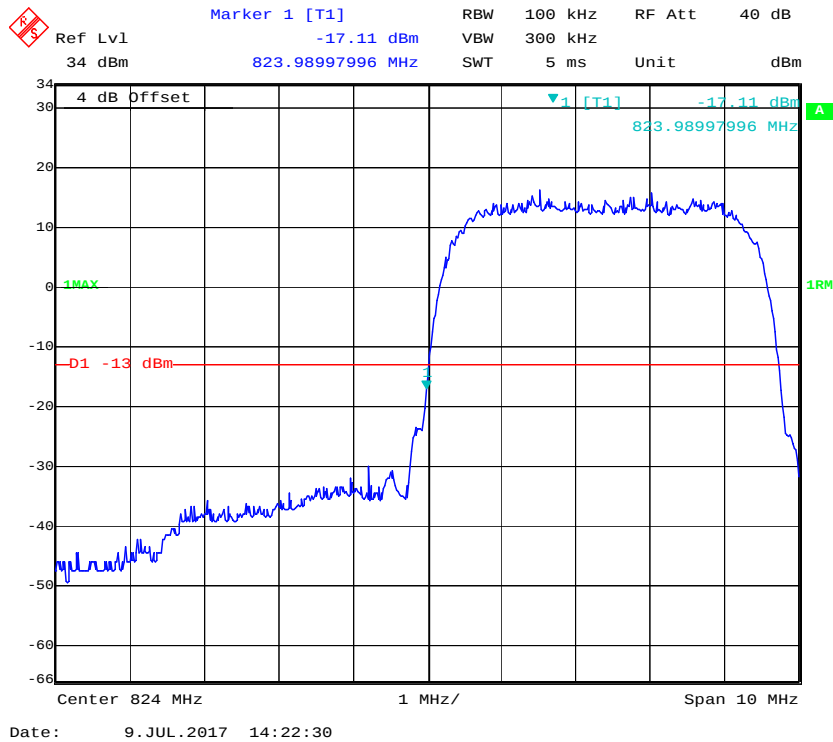
## Cellular Band, Left Band Edge for EGPRS Mode



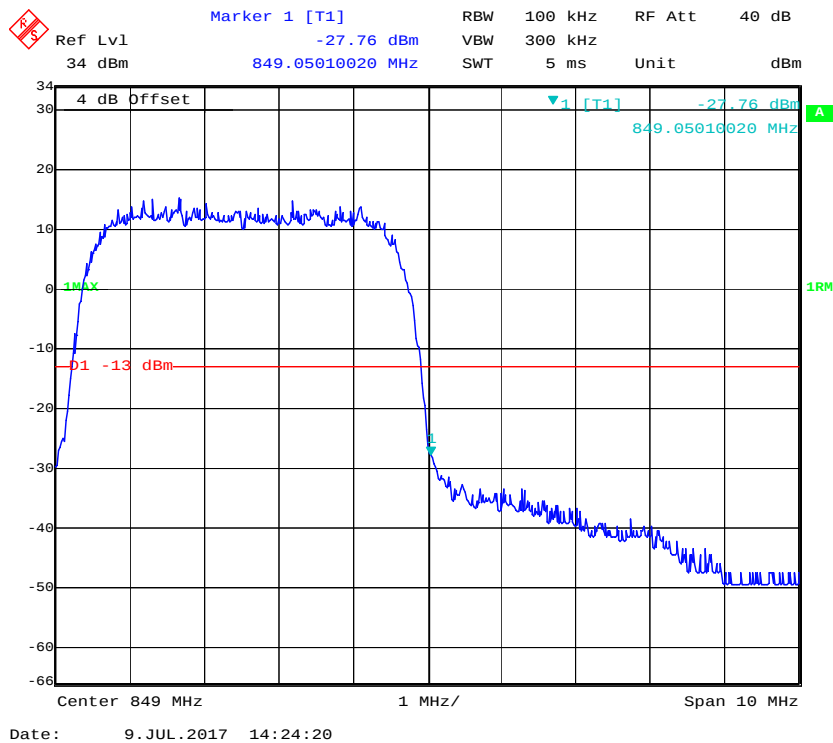
## Cellular Band, Right Band Edge for EGPRS Mode



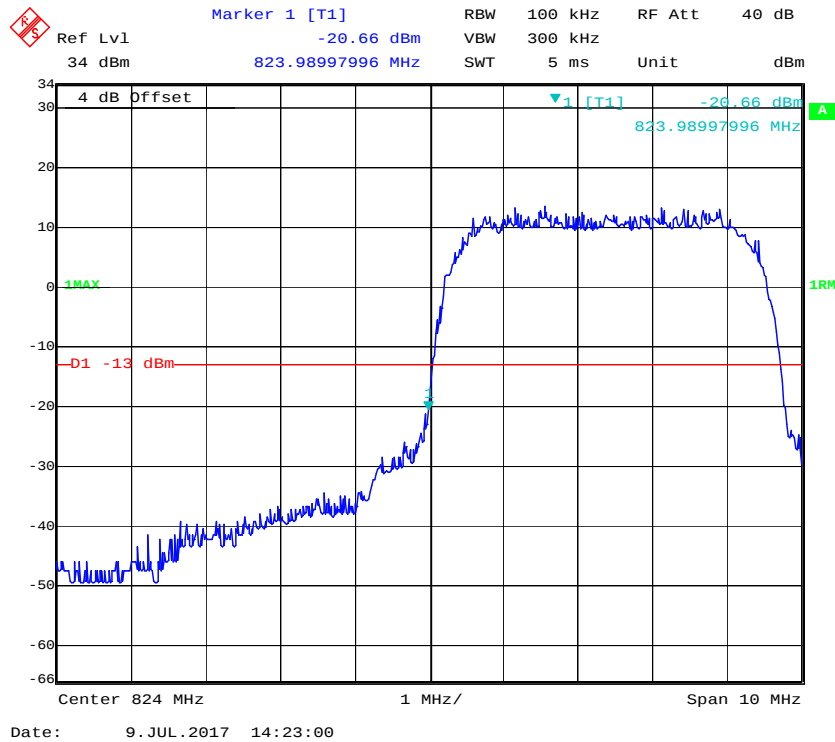
### Cellular Band, Left Band Edge for WCDMA (BPSK) Mode



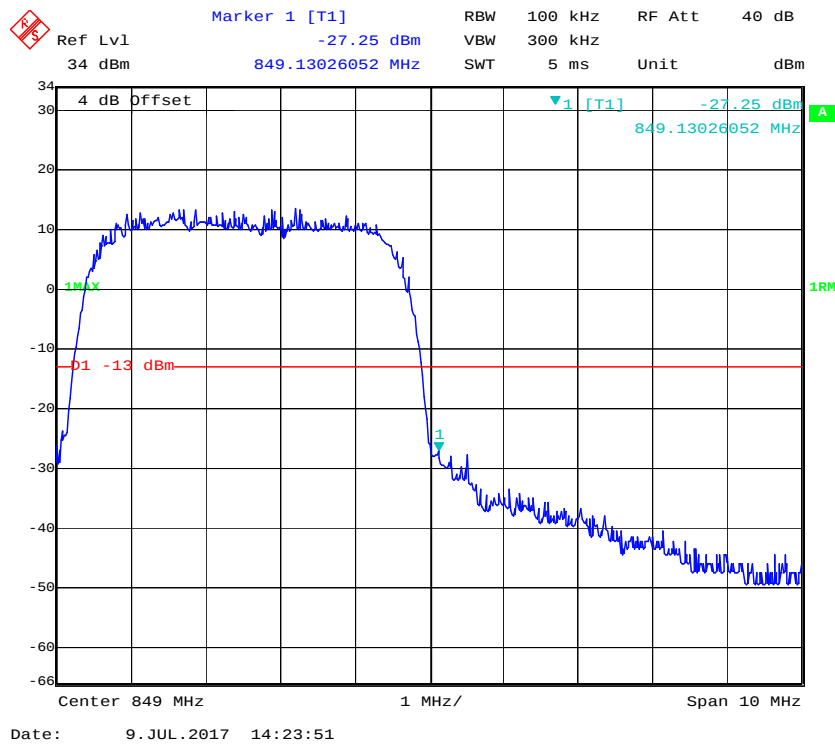
### Cellular Band, Right Band Edge for WCDMA (BPSK) Mode



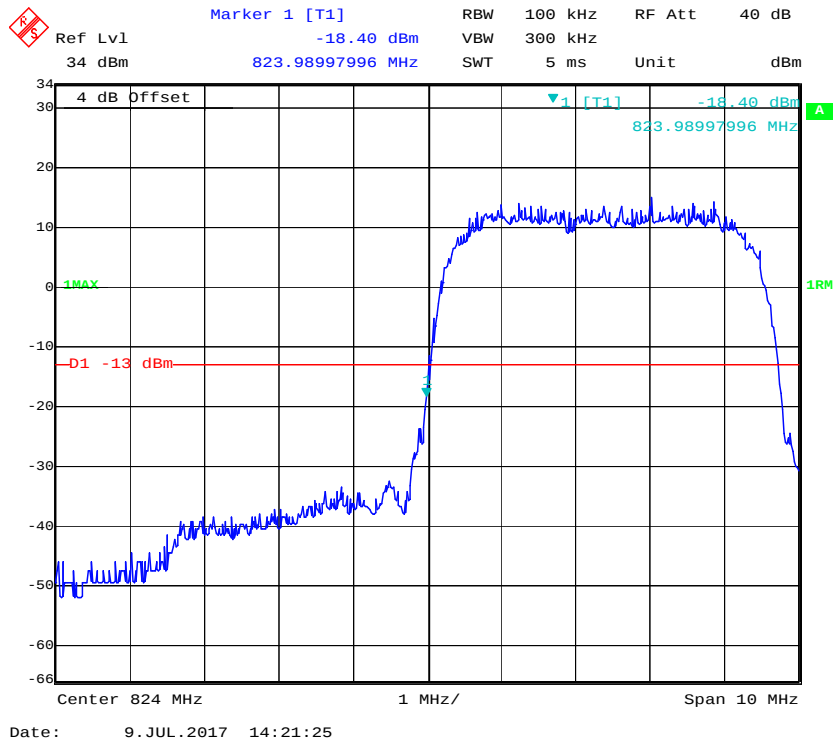
### Cellular Band, Left Band Edge for HSDPA (16QAM) Mode



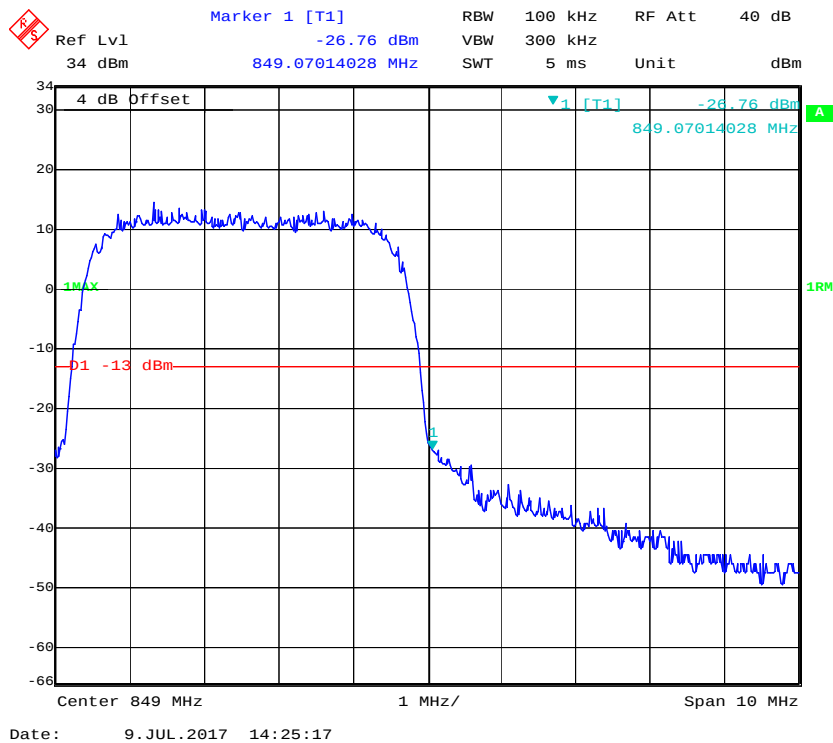
### Cellular Band, Right Band Edge for HSDPA (16QAM) Mode



### Cellular Band, Left Band Edge for HSUPA (BPSK) Mode



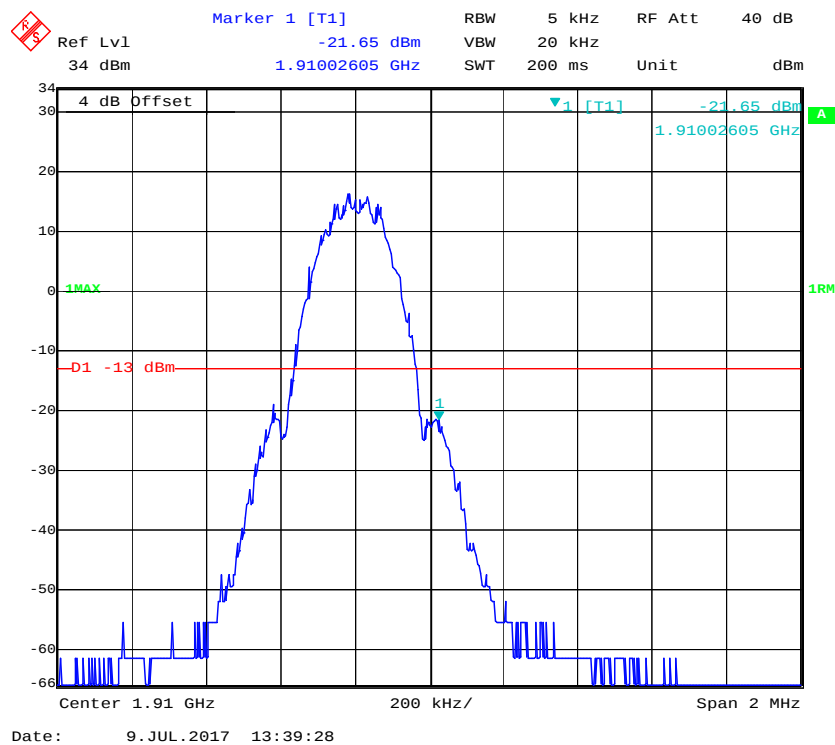
### Cellular Band, Right Band Edge for HSUPA (BPSK) Mode



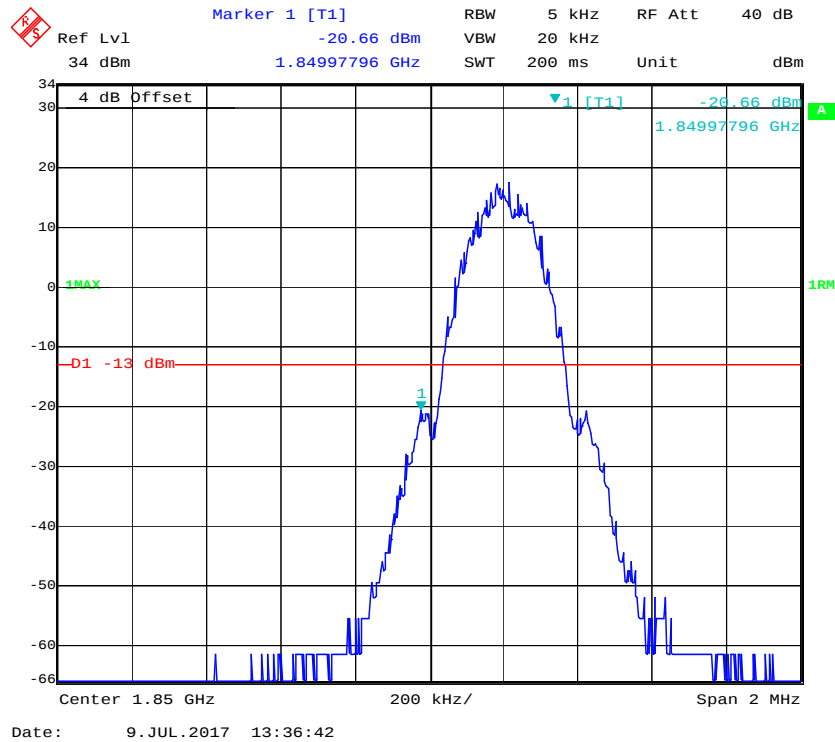
## PCS Band, Left Band Edge for GSM (GMSK) Mode



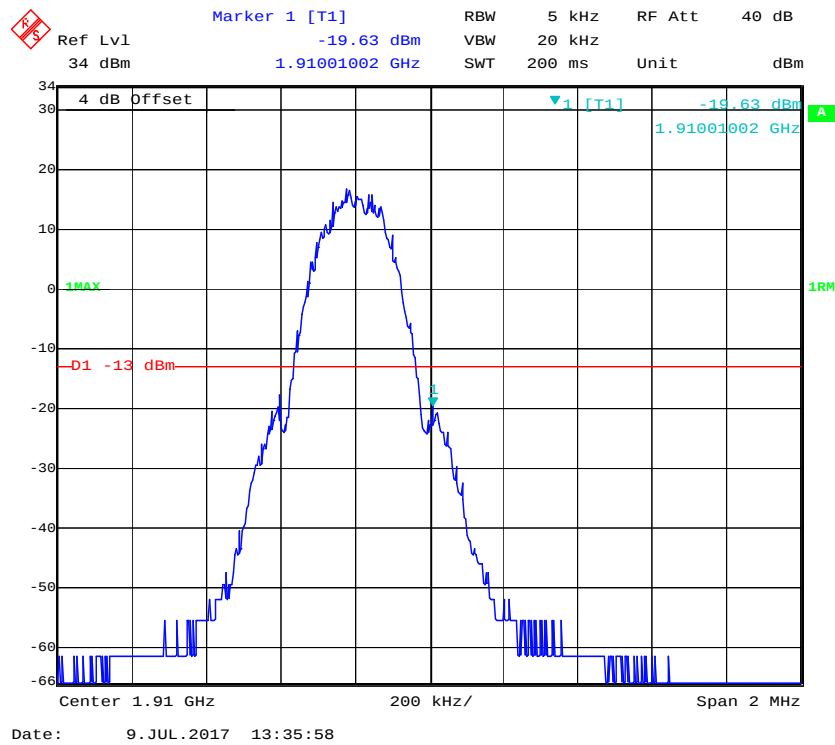
## PCS Band, Right Band Edge for GSM (GMSK) Mode



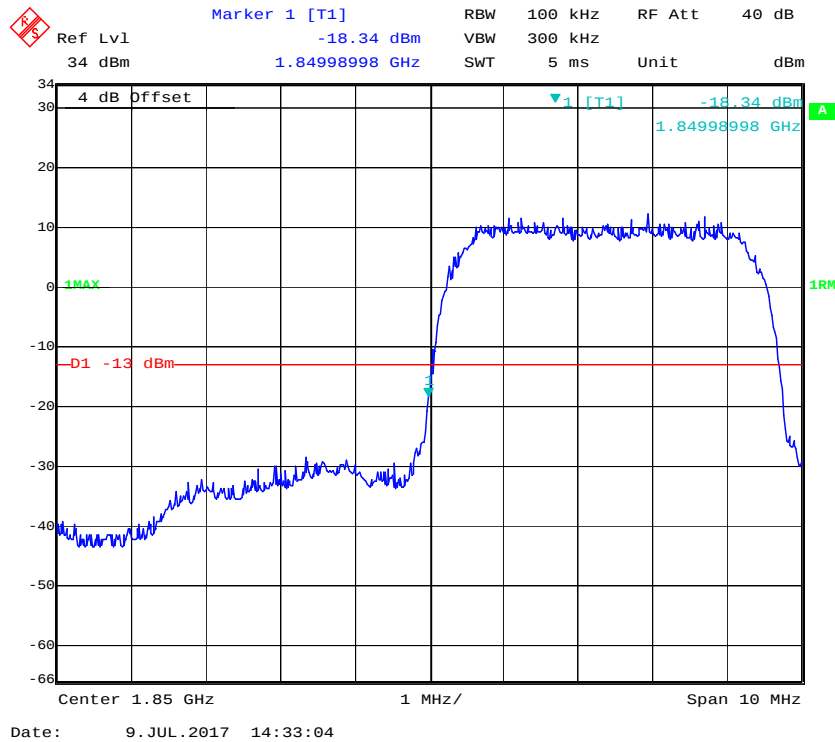
## PCS Band, Left Band Edge for EGPRS Mode



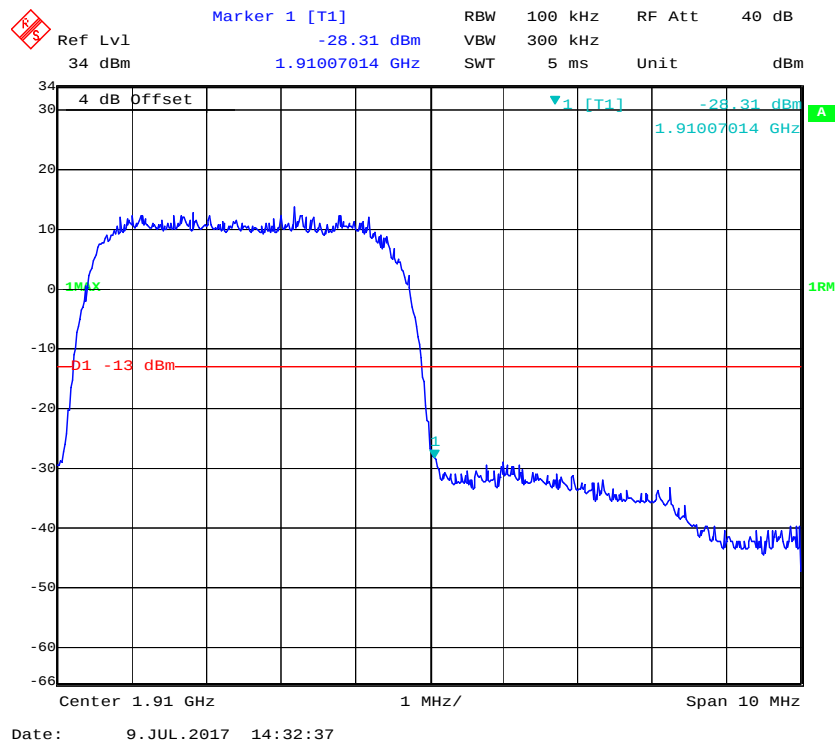
## PCS Band, Right Band Edge for EGPRS Mode



### PCS Band, Left Band Edge for WCDMA (BPSK) Mode

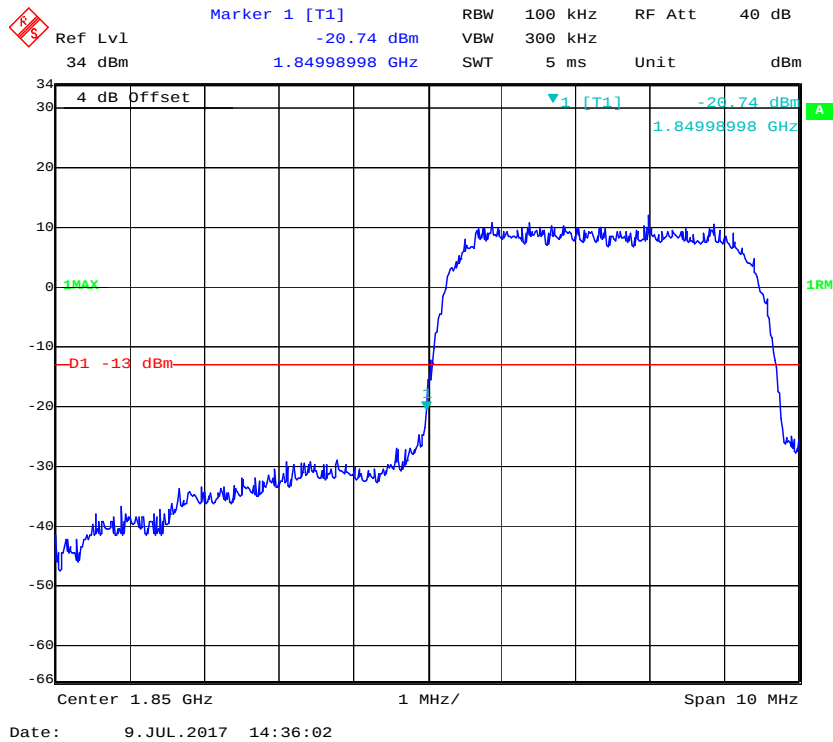


### PCS Band, Right Band Edge for WCDMA (BPSK) Mode

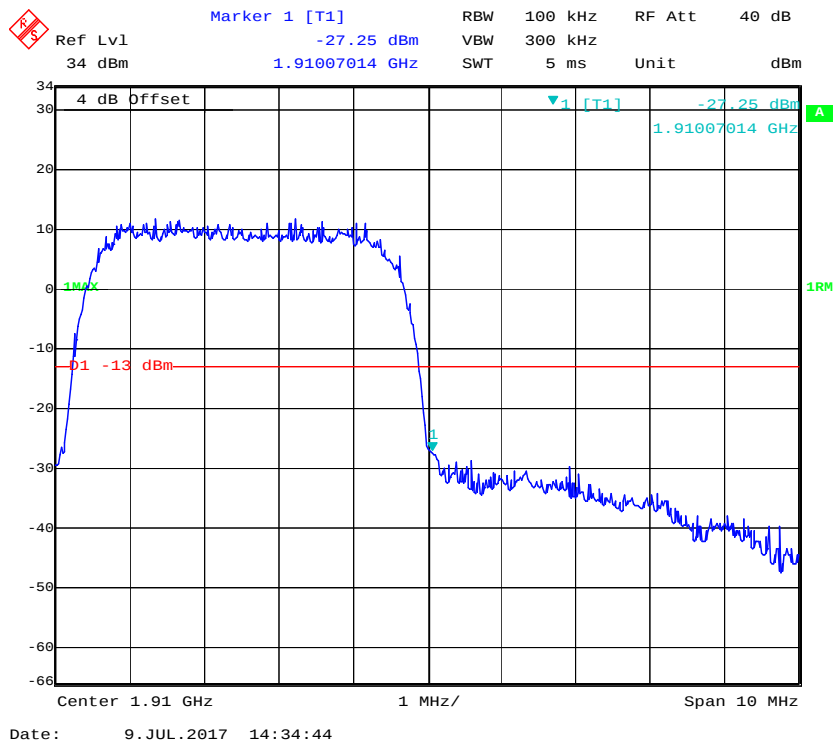




### PCS Band, Left Band Edge for HSUPA (BPSK) Mode



### PCS Band, Right Band Edge for HSUPA (BPSK) Mode



**FCC §2.1055, §22.355 & §24.235 - FREQUENCY STABILITY****Applicable Standard**

FCC § 2.1055, §22.355, §24.235

According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table below:

Frequency Tolerance for Transmitters in the Public Mobile Services

| Frequency Range (MHz) | Base, fixed (ppm) | Mobile $\leq 3$ watts (ppm) | Mobile $> 3$ watts (ppm) |
|-----------------------|-------------------|-----------------------------|--------------------------|
| 25 to 50              | 20.0              | 20.0                        | 50.0                     |
| 50 to 450             | 5.0               | 5.0                         | 50.0                     |
| 450 to 512            | 2.5               | 5.0                         | 5.0                      |
| 821 to 896            | 1.5               | 2.5                         | 2.5                      |
| 928 to 929.           | 5.0               | N/A                         | N/A                      |
| 929 to 960.           | 1.5               | N/A                         | N/A                      |
| 2110 to 2220          | 10.0              | N/A                         | N/A                      |

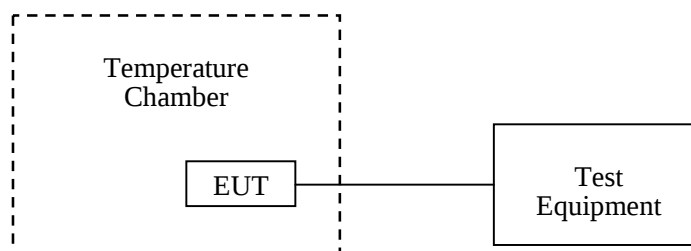
According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

**Test Procedure**

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency Stability vs. Voltage: For hand carried, battery powered equipment; reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.



**Test Data****Environmental Conditions**

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 25 °C     |
| <b>Relative Humidity:</b> | 57 %      |
| <b>ATM Pressure:</b>      | 101.0 kPa |

*The testing was performed by Chris Wang on 2017-07-09.*

*EUT operation mode: Transmitting*

*Test Result: Compliance. Please refer to the following tables.*

**Cellular Band (Part 22H)****GSM Mode**

| Middle Channel, $f_0 = 836.6\text{MHz}$ |                                   |                      |                       |             |
|-----------------------------------------|-----------------------------------|----------------------|-----------------------|-------------|
| Temperature (°C)                        | Power Supplied (V <sub>DC</sub> ) | Frequency Error (Hz) | Frequency Error (ppm) | Limit (ppm) |
| -30                                     | 3.7                               | 9                    | 0.010758              | 2.5         |
| -20                                     |                                   | 8                    | 0.009563              | 2.5         |
| -10                                     |                                   | 5                    | 0.005977              | 2.5         |
| 0                                       |                                   | -1                   | -0.001195             | 2.5         |
| 10                                      |                                   | 2                    | 0.002391              | 2.5         |
| 20                                      |                                   | 10                   | 0.011953              | 2.5         |
| 30                                      |                                   | 6                    | 0.007172              | 2.5         |
| 40                                      |                                   | 13                   | 0.015539              | 2.5         |
| 50                                      |                                   | 16                   | 0.019125              | 2.5         |
| 25                                      | V <sub>min</sub> = 3.5            | 24                   | 0.028688              | 2.5         |
| 25                                      | V <sub>max</sub> = 4.2            | 27                   | 0.032273              | 2.5         |

**EGPRS Mode**

| Middle Channel, $f_0 = 836.6\text{MHz}$ |                                   |                      |                       |             |
|-----------------------------------------|-----------------------------------|----------------------|-----------------------|-------------|
| Temperature (°C)                        | Power Supplied (V <sub>DC</sub> ) | Frequency Error (Hz) | Frequency Error (ppm) | Limit (ppm) |
| -30                                     | 3.7                               | -5                   | -0.005977             | 2.5         |
| -20                                     |                                   | 8                    | 0.009563              | 2.5         |
| -10                                     |                                   | 6                    | 0.007172              | 2.5         |
| 0                                       |                                   | 3                    | 0.003586              | 2.5         |
| 10                                      |                                   | 2                    | 0.002391              | 2.5         |
| 20                                      |                                   | -1                   | -0.001195             | 2.5         |
| 30                                      |                                   | 4                    | 0.004781              | 2.5         |
| 40                                      |                                   | 3                    | 0.003586              | 2.5         |
| 50                                      |                                   | 8                    | 0.009563              | 2.5         |
| 25                                      | V <sub>min</sub> = 3.5            | 11                   | 0.013148              | 2.5         |
| 25                                      | V <sub>max</sub> = 4.2            | 15                   | 0.017930              | 2.5         |

**WCDMA Mode**

| Middle Channel, $f_0=836.6\text{MHz}$ |                             |                      |                       |             |
|---------------------------------------|-----------------------------|----------------------|-----------------------|-------------|
| Temperature (°C)                      | Power Supplied ( $V_{DC}$ ) | Frequency Error (Hz) | Frequency Error (ppm) | Limit (ppm) |
| -30                                   | 3.7                         | 1                    | 0.001195              | 2.5         |
| -20                                   |                             | 2                    | 0.002391              | 2.5         |
| -10                                   |                             | -2                   | -0.002391             | 2.5         |
| 0                                     |                             | 3                    | 0.003586              | 2.5         |
| 10                                    |                             | -2                   | -0.002391             | 2.5         |
| 20                                    |                             | 1                    | 0.001195              | 2.5         |
| 30                                    |                             | 3                    | 0.003586              | 2.5         |
| 40                                    |                             | 2                    | 0.002391              | 2.5         |
| 50                                    |                             | 8                    | 0.009563              | 2.5         |
| 25                                    | $V_{min}=3.5$               | 6                    | 0.007172              | 2.5         |
| 25                                    | $V_{max}=4.2$               | 12                   | 0.014344              | 2.5         |

**PCS Band (Part 24E)****GSM Mode**

| Middle Channel, $f_0=1880.0\text{ MHz}$ |                             |                      |                       |        |
|-----------------------------------------|-----------------------------|----------------------|-----------------------|--------|
| Temperature (°C)                        | Power Supplied ( $V_{DC}$ ) | Frequency Error (Hz) | Frequency Error (ppm) | Result |
| -30                                     | 3.7                         | 9                    | 0.010758              | pass   |
| -20                                     |                             | 8                    | 0.009563              | pass   |
| -10                                     |                             | 5                    | 0.005977              | pass   |
| 0                                       |                             | -1                   | -0.001195             | pass   |
| 10                                      |                             | 2                    | 0.002391              | pass   |
| 20                                      |                             | 10                   | 0.011953              | pass   |
| 30                                      |                             | 6                    | 0.007172              | pass   |
| 40                                      |                             | 13                   | 0.015539              | pass   |
| 50                                      |                             | 16                   | 0.019125              | pass   |
| 25                                      | $V_{min}=3.5$               | 24                   | 0.028688              | pass   |
| 25                                      | $V_{max}=4.2$               | 27                   | 0.032273              | pass   |

**EGPRS Mode**

| Middle Channel, $f_o = 1880.0$ MHz |                             |                      |                       |        |
|------------------------------------|-----------------------------|----------------------|-----------------------|--------|
| Temperature (°C)                   | Power Supplied ( $V_{DC}$ ) | Frequency Error (Hz) | Frequency Error (ppm) | Result |
| -30                                | 3.7                         | 1                    | 0.000532              | pass   |
| -20                                |                             | -2                   | -0.001064             | pass   |
| -10                                |                             | 2                    | 0.001064              | pass   |
| 0                                  |                             | 1                    | 0.000532              | pass   |
| 10                                 |                             | -1                   | -0.000532             | pass   |
| 20                                 |                             | -2                   | -0.001064             | pass   |
| 30                                 |                             | -1                   | -0.000532             | pass   |
| 40                                 |                             | 3                    | 0.001596              | pass   |
| 50                                 |                             | 6                    | 0.003191              | pass   |
| 25                                 | $V_{min.} = 3.5$            | 2                    | 0.001064              | pass   |
| 25                                 | $V_{max.} = 4.2$            | 9                    | 0.004787              | pass   |

**WCDMA Mode**

| Middle Channel, $f_o = 1880.0$ MHz |                             |                      |                       |        |
|------------------------------------|-----------------------------|----------------------|-----------------------|--------|
| Temperature (°C)                   | Power Supplied ( $V_{DC}$ ) | Frequency Error (Hz) | Frequency Error (ppm) | Result |
| -30                                | 3.7                         | 1                    | 0.000532              | Pass   |
| -20                                |                             | 5                    | 0.002660              | Pass   |
| -10                                |                             | 3                    | 0.001596              | Pass   |
| 0                                  |                             | -2                   | -0.001064             | Pass   |
| 10                                 |                             | 1                    | 0.000532              | Pass   |
| 20                                 |                             | 0                    | 0.000000              | Pass   |
| 30                                 |                             | 3                    | 0.001596              | Pass   |
| 40                                 |                             | 5                    | 0.002660              | Pass   |
| 50                                 |                             | 4                    | 0.002128              | Pass   |
| 25                                 | $V_{min.} = 3.5$            | 9                    | 0.004787              | Pass   |
| 25                                 | $V_{max.} = 4.2$            | 14                   | 0.007447              | pass   |

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