

# FCC PART 22H, PART 24E MEASUREMENT AND TEST REPORT

For

**Bolt Modus Corp**

Oficina N.33 Edificio Ofidepositos Central, Calidonia - Distrito Federal, Panama

**FCC ID: 2APW4LIV1**

|                                                                                                                                                                                                                                                                                                                             |                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <b>Report Type:</b><br>Original Report                                                                                                                                                                                                                                                                                      | <b>Product Type:</b><br>Smart phone |
| <b>Report Number:</b> RSZ190701001-00D                                                                                                                                                                                                                                                                                      |                                     |
| <b>Report Date:</b> 2019-07-22                                                                                                                                                                                                                                                                                              |                                     |
| Xiangguang Kong <i>Xiangguang Kong</i>                                                                                                                                                                                                                                                                                      |                                     |
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The information marked # is provided by the applicant, the laboratory is not responsible for its authenticity.

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## GENERAL INFORMATION

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

|                              |                                                                                                                             |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Product                      | Smart phone                                                                                                                 |
| Model                        | LIV1                                                                                                                        |
| Frequency Range              | Cellular: 824.2-848.8 MHz(GSM/GPRS)<br>826.4-846.6 MHz(WCDMA)<br>PCS: 1850.2-1909.8 MHz(GSM/GPRS), 1852.4-1907.6 MHz(WCDMA) |
| Transmit Power<br>(ERP/EIRP) | Cellular: 0.977 W(GSM/GPRS), 0.120 W(WCDMA)<br>PCS: 0.676 W(GSM/GPRS), 0.166 W(WCDMA)                                       |
| Modulation<br>Technique      | 2G:GMSK<br>3G:BPSK,QPSK,16QAM                                                                                               |
| Antenna Specification        | PIFA Antennas<br>GSM850/WCDMA850:-1.7dBi<br>PCS1900/WCDMA1900: 0.3dBi                                                       |
| Voltage Range                | DC 3.8 V from battery or DC 5.0V from adapter                                                                               |
| Date of Test                 | 2019/07/04~2019/07/09                                                                                                       |
| Sample serial number         | 190701001                                                                                                                   |
| Received date                | 2019/07/01                                                                                                                  |
| Sample/EUT Status            | Good condition                                                                                                              |
| Adapter information          | Model: CLIV1<br>Input: AC 100-240V, 50/60 Hz<br>Output: DC 5.0V, 0.7A                                                       |

### Objective

This type approval report is prepared on behalf of *Bolt Modus Corp* 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 15.247 DSS & DTS submissions with FCC ID: 2APW4LIV1.

### 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

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

**Measurement Uncertainty**

| Parameter                    |            | Uncertainty |
|------------------------------|------------|-------------|
| Occupied Channel Bandwidth   |            | ±5%         |
| RF output power, conducted   |            | ±0.5dB      |
| Unwanted Emission, conducted |            | ±1.5dB      |
| Radiated Emissions           | Below 1GHz | ±4.75dB     |
|                              | Above 1GHz | ±4.88dB     |
| Temperature                  |            | ±3°C        |
| Supply voltages              |            | ±0.4%       |

*Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.*

**Test Facility**

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

## 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.

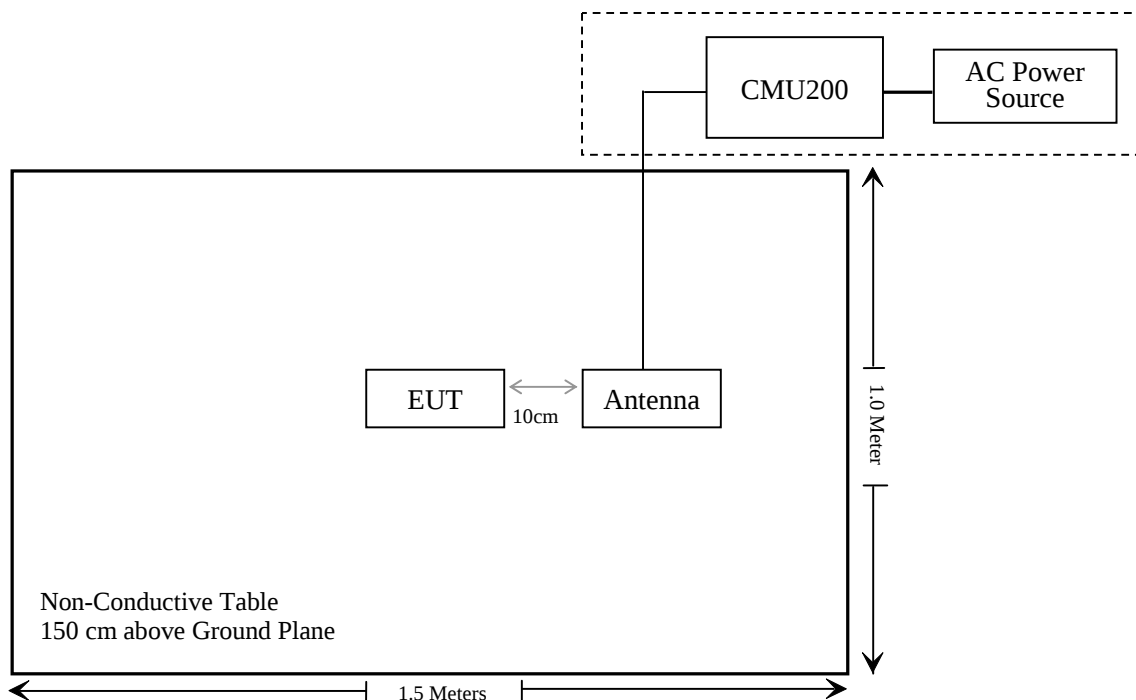
### Equipment Modifications

No modification was made to the EUT.

### Support Equipment List and Details

| Manufacturer    | Description                          | Model  | Serial Number |
|-----------------|--------------------------------------|--------|---------------|
| Rohde & Schwarz | Universal Radio Communication Tester | CMU200 | 106891        |

### 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; § 22.913 (a);<br>§ 24.232 (c)    | RF Output Power                        | Compliance     |
| § 2.1047                                  | Modulation Characteristics             | Not Applicable |
| § 2.1049; § 22.905;<br>§ 22.917; § 24.238 | Occupied Bandwidth                     | Compliance     |
| § 2.1051; § 22.917 (a);<br>§ 24.238 (a)   | Spurious Emissions at Antenna Terminal | Compliance     |
| § 2.1053; § 22.917 (a);<br>§ 24.238 (a)   | Field Strength of Spurious Radiation   | Compliance     |
| § 22.917 (a);<br>§ 24.238 (a)             | Band Edge                              | Compliance     |
| § 2.1055; § 22.355;<br>§ 24.235           | Frequency stability                    | Compliance     |

Compliance\*: Please refer to SAR report released by BACL, report number: RSZ190701001-20A.

**TEST EQUIPMENT LIST**

| Manufacturer                  | Description                          | Model               | Serial Number          | Calibration Date | Calibration Due Date |
|-------------------------------|--------------------------------------|---------------------|------------------------|------------------|----------------------|
| <b>Radiated Emission Test</b> |                                      |                     |                        |                  |                      |
| Sunol Sciences                | Horn Antenna                         | DRH-118             | A052604                | 2017-12-22       | 2020-12-21           |
| Rohde & Schwarz               | Signal Analyzer                      | FSV40               | 101473                 | 2019-01-09       | 2020-01-08           |
| Sunol Sciences                | Broadband Antenna                    | JB1                 | A040904-1              | 2017-12-22       | 2020-12-21           |
| COM-POWER                     | Pre-amplifier                        | PA-122              | 181919                 | 2018-11-12       | 2019-11-12           |
| Sonoma Instrument             | Amplifier                            | 310N                | 186238                 | 2018-11-12       | 2019-11-12           |
| Agilent                       | Signal Generator                     | N5183A              | MY51040755             | 2018-12-03       | 2019-12-03           |
| Rohde & Schwarz               | EMI Test Receiver                    | ESR                 | 1316.3003K03-101746-zn | 2018-07-11       | 2019-07-11           |
| COM-POWER                     | Dipole Antenna                       | AD-100              | 41000                  | NCR              | NCR                  |
| A.H. System                   | Horn Antenna                         | SAS-200/571         | 135                    | 2018-09-01       | 2021-08-31           |
| UTiFLEX MICRO-C0AX            | RF Cable                             | UFA147A-2362-100100 | MFR64639 231029-003    | 2018-11-12       | 2019-11-12           |
| Ducommun technologies         | RF Cable                             | 104PEA              | 218124002              | 2018-11-12       | 2019-11-12           |
| Ducommun technologies         | RF Cable                             | RG-214              | 1                      | 2018-11-12       | 2019-11-12           |
| Ducommun technologies         | RF Cable                             | RG-214              | 2                      | 2018-11-12       | 2019-11-12           |
| Ducommun Technologies         | Horn Antenna                         | ARH-4223-02         | 1007726-04             | 2017-12-29       | 2020-12-28           |
| Ducommun technologies         | Horn Antenna                         | ARH-4223-02         | 1007726-03             | 2017-12-29       | 2020-12-28           |
| Heatsink Required             | Amplifier                            | QLW-18405536-J0     | 15964001002            | 2018-11-12       | 2019-11-12           |
| <b>RF Conducted Test</b>      |                                      |                     |                        |                  |                      |
| Rohde & Schwarz               | Spectrum Analyzer                    | FSU26               | 200120                 | 2019-03-02       | 2020-03-01           |
| ESPEC                         | Temperature & Humidity Chamber       | EL-10KA             | 9107726                | 2019-01-05       | 2020-01-05           |
| Long Wei                      | DC Power Supply                      | TPR-6420D           | 398363                 | NCR              | NCR                  |
| Rohde & Schwarz               | Universal Radio Communication Tester | CMU200              | 106891                 | 2019-01-15       | 2020-01-15           |
| Ducommun technologies         | RF Cable                             | RG-214              | 3                      | Each Time        |                      |
| WEINSCHL                      | 3dB Attenuator                       | 6231                | 666                    | Each Time        |                      |
| WEINSCHL                      | Power Splitter                       | 1515                | RH386                  | Each Time        |                      |

\* Statement of Traceability: Bay Area Compliance Laboratories Corp. (Shenzhen) 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(b) & §2.1093 - RF EXPOSURE INFORMATION**

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### **Applicable Standard**

FCC§1.1310 and §2.1093.

### **Test Result**

Compliance, please refer to the SAR report: RSZ190701001-20A.

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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.

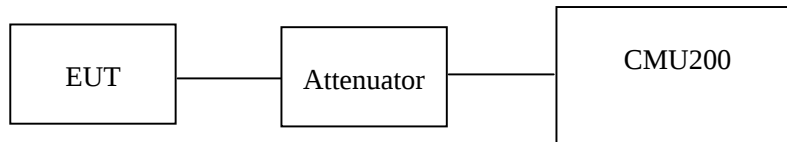
According to FCC §2.1046 and §24.232 (C), mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB.

**Test Procedure**

*Conducted method:*

The RF output of the transmitter was connected to the CMU200 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> | 52 %      |
| <b>ATM Pressure:</b>      | 101.0 kPa |

*The testing was performed by James Fu on 2019-07-04.*

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

| Mode | Channel | Frequency (MHz) | Average Output Power (dBm) | Limit (dBm) |
|------|---------|-----------------|----------------------------|-------------|
| GSM  | 128     | 824.2           | 31.90                      | 38.45       |
|      | 190     | 836.6           | 31.70                      | 38.45       |
|      | 251     | 848.8           | 31.70                      | 38.45       |

| Mode | Channel | Frequency (MHz) | Average Output Power (dBm) |         |         |         | Limit (dBm) |
|------|---------|-----------------|----------------------------|---------|---------|---------|-------------|
|      |         |                 | 1 slot                     | 2 slots | 3 slots | 4 slots |             |
| GPRS | 128     | 824.2           | 31.93                      | 29.76   | 27.71   | 25.75   | 38.45       |
|      | 190     | 836.6           | 31.77                      | 29.79   | 27.75   | 25.76   | 38.45       |
|      | 251     | 848.8           | 31.75                      | 29.80   | 27.77   | 25.79   | 38.45       |

| Mode           | Test Mode | 3GPP Sub Test | Average Output Power (dBm) |                  |                |
|----------------|-----------|---------------|----------------------------|------------------|----------------|
|                |           |               | Low Frequency              | Middle Frequency | High Frequency |
| WCDMA (Band V) | RMC       |               | 22.79                      | 22.44            | 22.29          |
|                | HSDPA     | 1             | 21.55                      | 21.01            | 20.86          |
|                |           | 2             | 21.61                      | 21.06            | 20.88          |
|                |           | 3             | 21.64                      | 21.13            | 20.92          |
|                |           | 4             | 21.68                      | 21.20            | 20.94          |
|                | HSUPA     | 1             | 21.48                      | 20.89            | 20.79          |
|                |           | 2             | 21.53                      | 20.92            | 20.85          |
|                |           | 3             | 21.58                      | 20.96            | 20.88          |
|                |           | 4             | 21.64                      | 20.98            | 20.94          |
|                |           | 5             | 21.70                      | 21.02            | 20.97          |

**PCS Band (Part 24E)**

| Mode | Channel | Frequency (MHz) | Average Output Power (dBm) | Limit (dBm) |
|------|---------|-----------------|----------------------------|-------------|
| GSM  | 512     | 1850.2          | 28.80                      | 33          |
|      | 661     | 1880.0          | 28.60                      | 33          |
|      | 810     | 1909.8          | 28.50                      | 33          |

| Mode | Channel | Frequency (MHz) | Average Output Power (dBm) |         |         |         | Limit (dBm) |
|------|---------|-----------------|----------------------------|---------|---------|---------|-------------|
|      |         |                 | 1 slot                     | 2 slots | 3 slots | 4 slots |             |
| GPRS | 512     | 1850.2          | 28.49                      | 26.29   | 24.76   | 22.78   | 33          |
|      | 661     | 1880.0          | 28.16                      | 25.95   | 24.49   | 22.49   | 33          |
|      | 810     | 1909.8          | 28.13                      | 25.78   | 24.33   | 22.33   | 33          |

| Mode            | Test Mode | 3GPP Sub Test | Average Output Power (dBm) |                  |                |
|-----------------|-----------|---------------|----------------------------|------------------|----------------|
|                 |           |               | Low Frequency              | Middle Frequency | High Frequency |
| WCDMA (Band II) | RMC       |               | 21.43                      | 21.28            | 21.39          |
|                 | HSDPA     | 1             | 20.69                      | 20.48            | 20.67          |
|                 |           | 2             | 20.74                      | 20.56            | 20.72          |
|                 |           | 3             | 20.77                      | 20.58            | 20.77          |
|                 |           | 4             | 20.84                      | 20.61            | 20.82          |
|                 | HSUPA     | 1             | 20.96                      | 21.32            | 20.56          |
|                 |           | 2             | 21.01                      | 21.34            | 20.63          |
|                 |           | 3             | 21.07                      | 21.39            | 20.68          |
|                 |           | 4             | 21.12                      | 21.44            | 20.73          |
|                 |           | 5             | 21.17                      | 21.52            | 20.80          |

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

| Mode | Channel | PAR (dB) | Limit (dB) |
|------|---------|----------|------------|
| GSM  | Low     | 1.37     | 13         |
|      | Middle  | 1.43     | 13         |
|      | High    | 1.41     | 13         |

| Mode          | Channel | PAR (dB) | Limit (dB) |
|---------------|---------|----------|------------|
| WCDMA (BPSK)  | Low     | 3.40     | 13         |
|               | Middle  | 3.41     | 13         |
|               | High    | 3.37     | 13         |
| HSDPA (16QAM) | Low     | 3.85     | 13         |
|               | Middle  | 3.88     | 13         |
|               | High    | 3.87     | 13         |
| HSUPA (BPSK)  | Low     | 3.92     | 13         |
|               | Middle  | 3.94     | 13         |
|               | High    | 3.90     | 13         |

**PCS Band**

| Mode | Channel | PAR (dB) | Limit (dB) |
|------|---------|----------|------------|
| GSM  | Low     | 1.47     | 13         |
|      | Middle  | 1.44     | 13         |
|      | High    | 1.42     | 13         |

| Mode          | Channel | PAR (dB) | Limit (dB) |
|---------------|---------|----------|------------|
| WCDMA (BPSK)  | Low     | 3.35     | 13         |
|               | Middle  | 3.37     | 13         |
|               | High    | 3.34     | 13         |
| HSDPA (16QAM) | Low     | 3.84     | 13         |
|               | Middle  | 3.86     | 13         |
|               | High    | 3.82     | 13         |
| HSUPA (BPSK)  | Low     | 4.15     | 13         |
|               | Middle  | 4.19     | 13         |
|               | High    | 4.18     | 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) | 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>(dBi) |                            |                |                |
| ERP for Cellular Band (Part 22H), Middle Channel |                               |                              |               |                |                |                       |                          |                            |                |                |
| 836.6                                            | 75.48                         | 249                          | 1.7           | H              | 16.1           | 1.90                  | 0.0                      | 14.20                      | 38.45          | 24.25          |
| 836.6                                            | 91.77                         | 134                          | 2.0           | V              | 31.8           | 1.90                  | 0.0                      | 29.90                      | 38.45          | 8.55           |
| EIRP for PCS Band (Part 24E), Middle Channel     |                               |                              |               |                |                |                       |                          |                            |                |                |
| 1880.00                                          | 88.31                         | 337                          | 1.5           | H              | 18.6           | 1.30                  | 9.40                     | 26.70                      | 33             | 6.30           |
| 1880.00                                          | 90.10                         | 142                          | 2.0           | V              | 20.2           | 1.30                  | 9.40                     | 28.30                      | 33             | 4.70           |

**WCDMA Mode:**

| 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>(dBi) |                            |                |                |
| ERP for WCDMA Band V (Part 22H), Middle Channel   |                               |                              |               |                |                |                       |                          |                            |                |                |
| 836.6                                             | 67.31                         | 334                          | 1.7           | H              | 7.9            | 1.90                  | 0.0                      | 6.00                       | 38.45          | 32.45          |
| 836.6                                             | 82.66                         | 311                          | 1.7           | V              | 22.7           | 1.90                  | 0.0                      | 20.80                      | 38.45          | 17.65          |
| EIRP for WCDMA Band II (Part 24E), Middle Channel |                               |                              |               |                |                |                       |                          |                            |                |                |
| 1880.00                                           | 80.28                         | 103                          | 2.1           | H              | 10.6           | 1.30                  | 9.40                     | 18.70                      | 33             | 14.30          |
| 1880.00                                           | 83.96                         | 202                          | 2.3           | V              | 14.1           | 1.30                  | 9.40                     | 22.20                      | 33             | 10.80          |

**Note:**

All above data were tested with no amplifier.

Absolute Level = Substituted Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

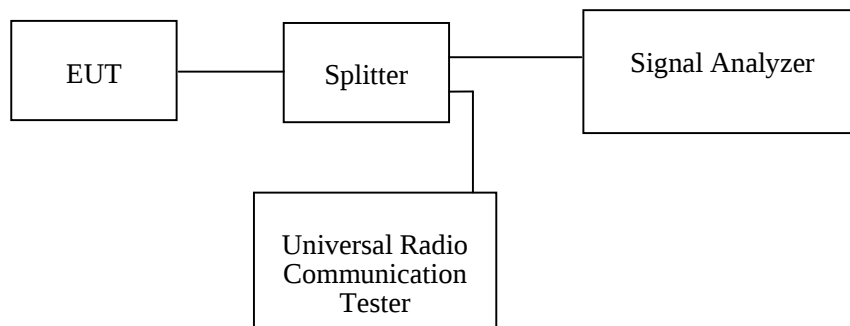
**FCC §2.1049, §22.917, §22.905 & §24.238 - OCCUPIED BANDWIDTH****Applicable Standard**

FCC 47 §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:       | 25 °C     |
| Relative Humidity: | 52 %      |
| ATM Pressure:      | 101.0 kPa |

*The testing was performed by James Fu from 2019-07-04 to 2019-07-05.*

*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           | 250.00                       | 322.12                         |

| Mode          | Frequency (MHz) | 99% Occupied Bandwidth (MHz) | 26 dB Emission Bandwidth (MHz) |
|---------------|-----------------|------------------------------|--------------------------------|
| RMC (BPSK)    | 836.6           | 4.13                         | 4.68                           |
| HSUPA (BPSK)  | 836.6           | 4.15                         | 4.68                           |
| HSDPA (16QAM) | 836.6           | 4.13                         | 4.65                           |

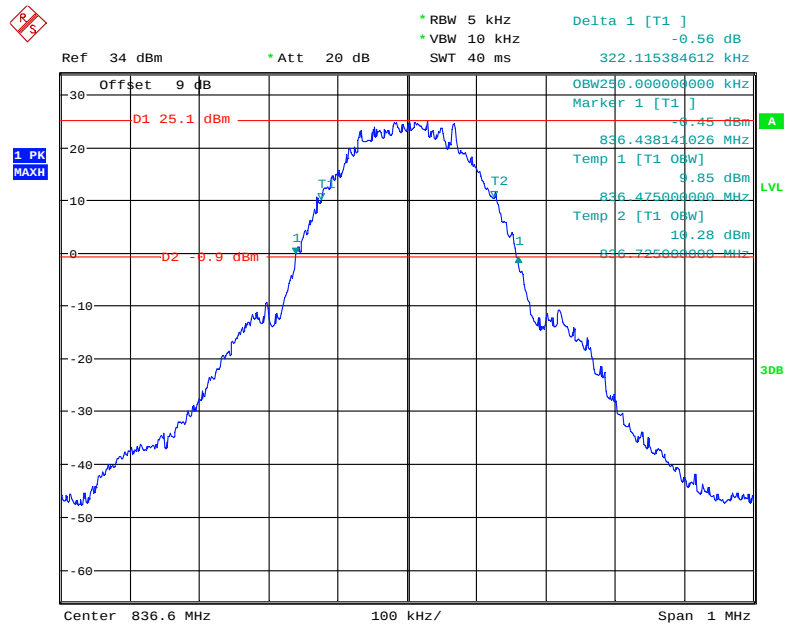
**PCS Band (Part 24E)**

| Mode      | Frequency (MHz) | 99% Occupied Bandwidth (kHz) | 26 dB Emission Bandwidth (kHz) |
|-----------|-----------------|------------------------------|--------------------------------|
| GSM(GMSK) | 1880            | 246.79                       | 315.71                         |

| Mode          | Frequency (MHz) | 99% Occupied Bandwidth (MHz) | 26 dB Emission Bandwidth (MHz) |
|---------------|-----------------|------------------------------|--------------------------------|
| RMC (BPSK)    | 1880.0          | 4.15                         | 4.70                           |
| HSUPA (BPSK)  | 1880.0          | 4.13                         | 4.66                           |
| HSDPA (16QAM) | 1880.0          | 4.17                         | 4.68                           |

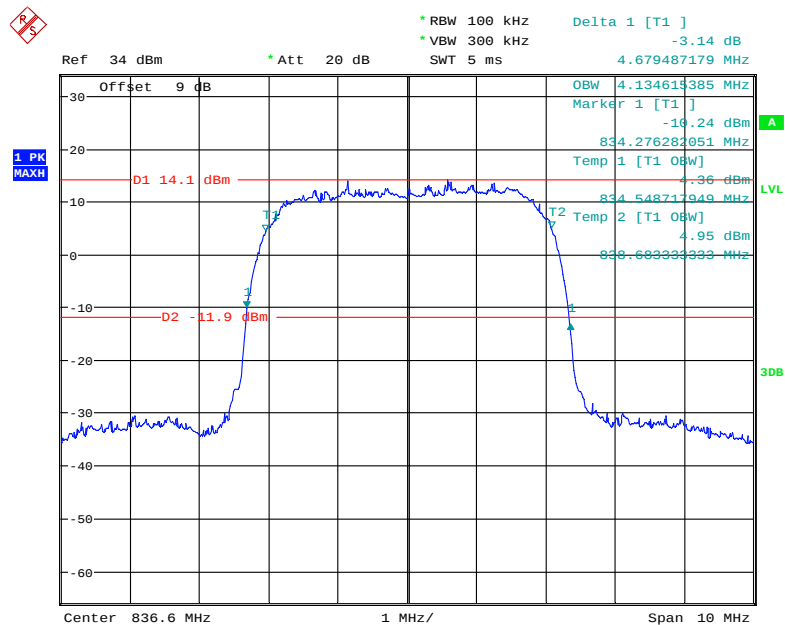
## Cellular Band (Part 22H)

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



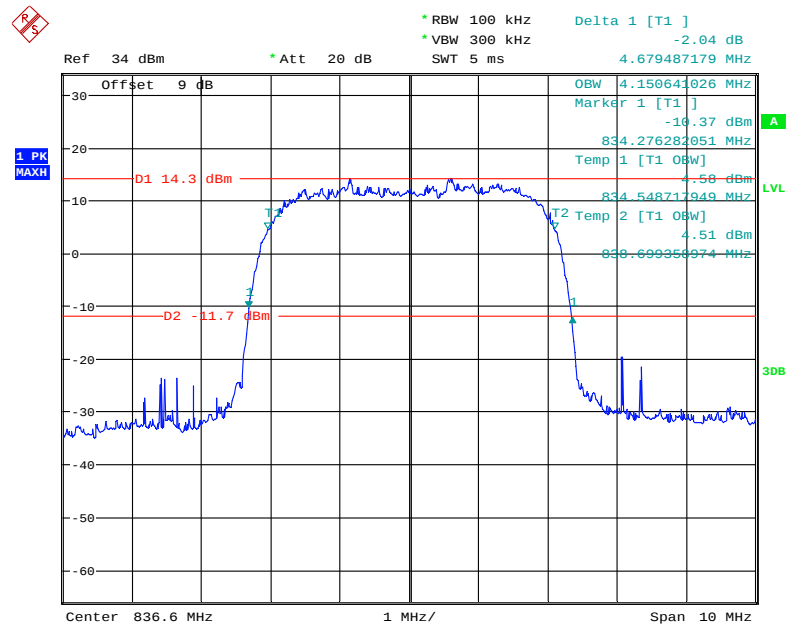
Date: 4.JUL.2019 23:00:12

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



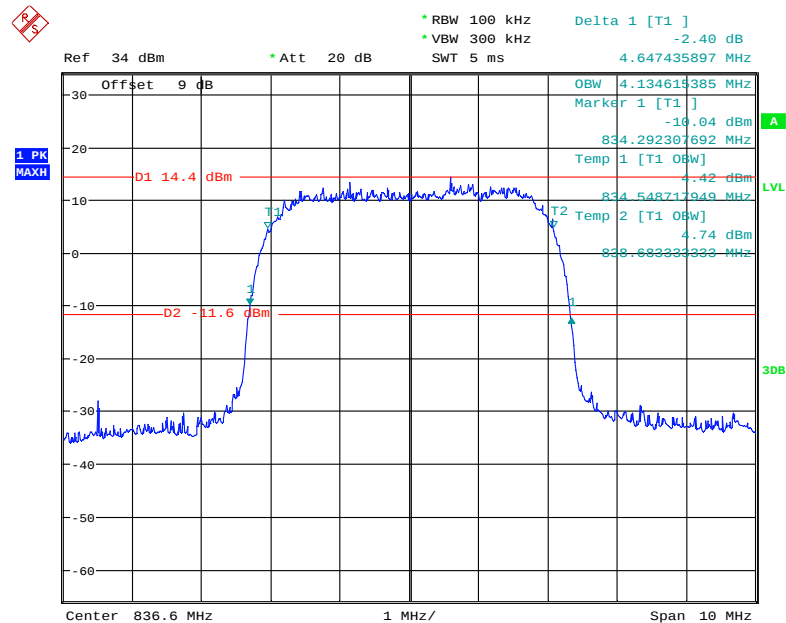
Date: 5.JUL.2019 20:26:20

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



Date: 5.JUL.2019 20:23:18

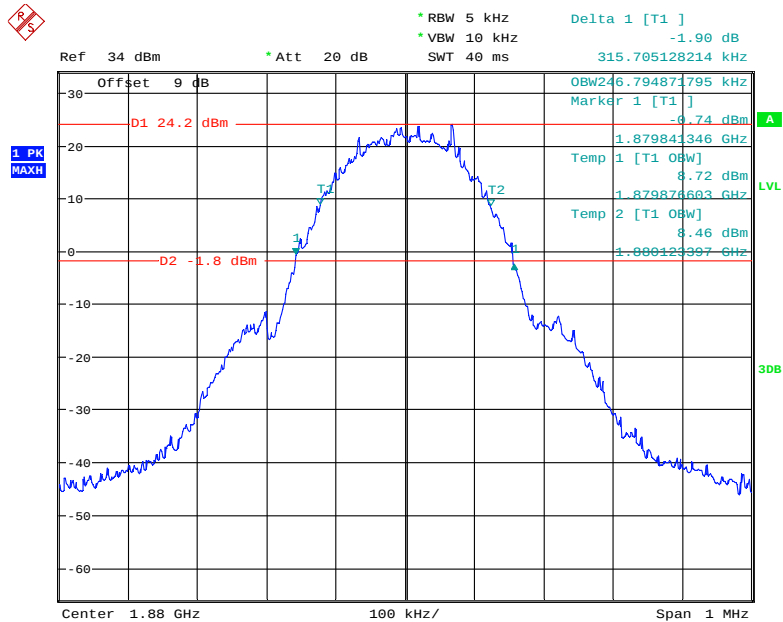
## 26 dB Emissions & 99% Occupied Bandwidth for HSDPA (16QAM) Mode



Date: 5.JUL.2019 20:20:20

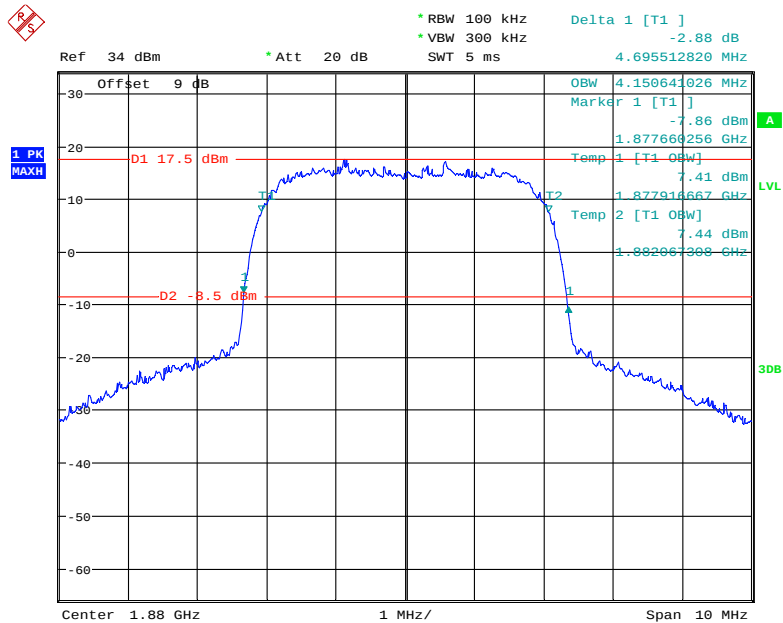
## PCS Band (Part 24E)

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

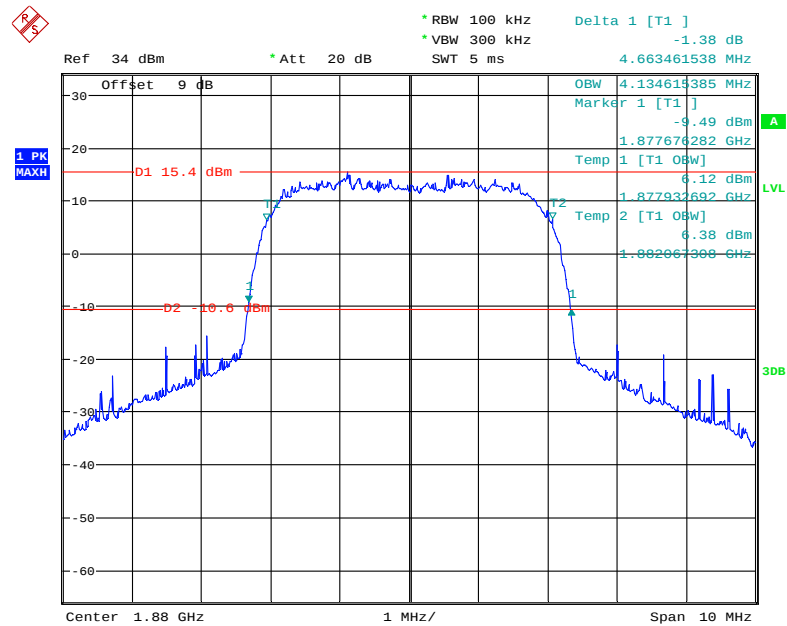


Date: 4.JUL.2019 23:16:51

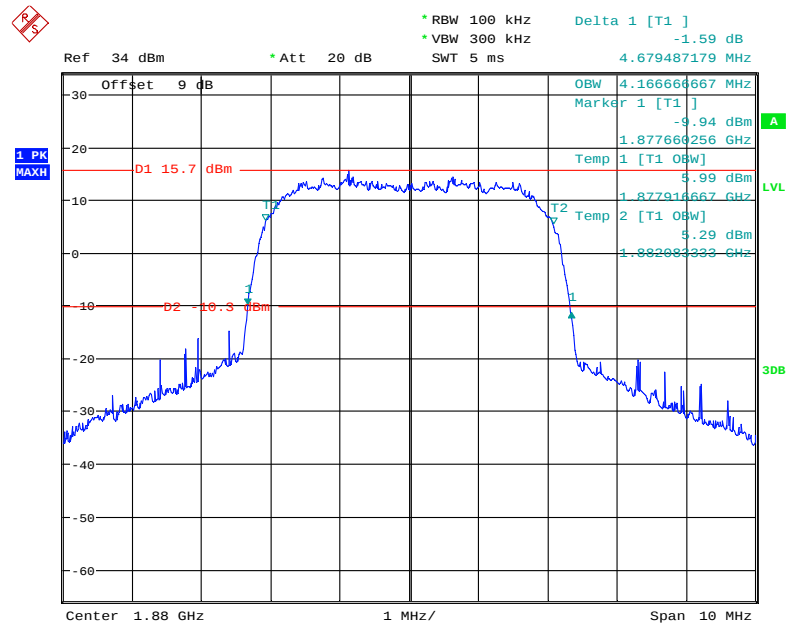
## 26 dB Emissions &amp; 99% Occupied Bandwidth for RMC (BPSK) Mode



Date: 5.JUL.2019 19:58:44

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

Date: 5.JUL.2019 20:03:03

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

Date: 5.JUL.2019 20:01:35

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

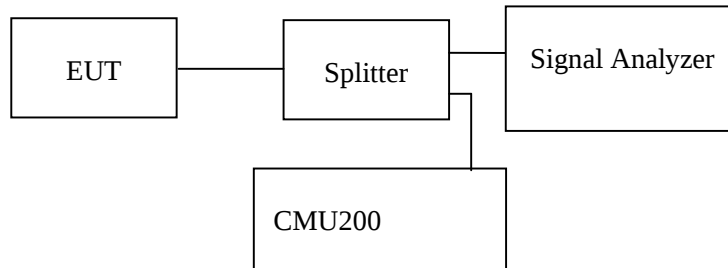
### Applicable Standard

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 100kHz for below 1GHz and 1MHz for above 1GHz. 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: | 52 %      |
| ATM Pressure:      | 101.0 kPa |

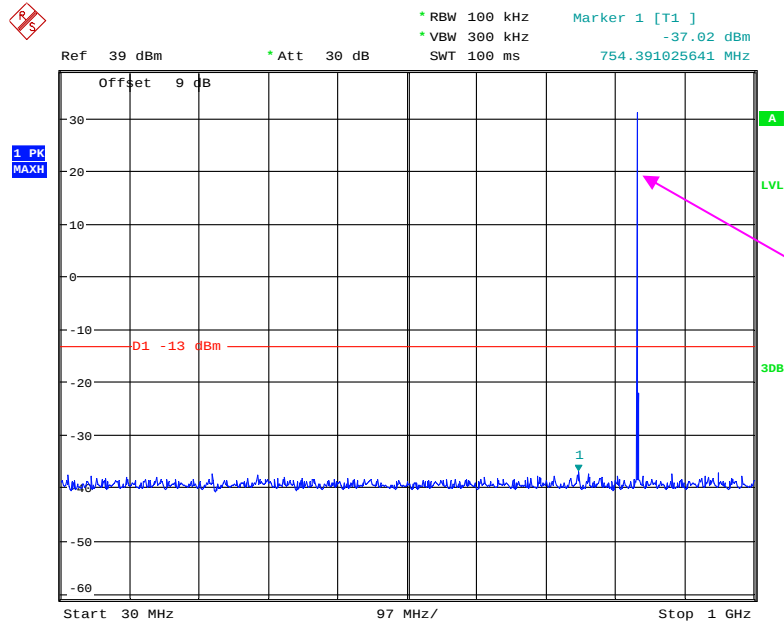
*The testing was performed by James Fu from 2019-07-04 to 2019-07-05.*

*EUT operation mode: Transmitting*

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

# Cellular Band (Part 22H)

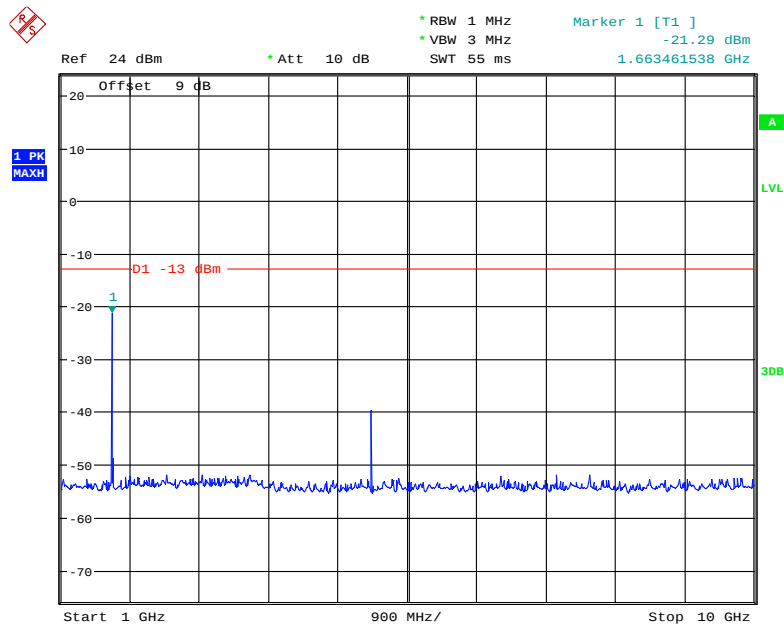
## 30 MHz – 1 GHz (GSM Mode)



Fundamental test

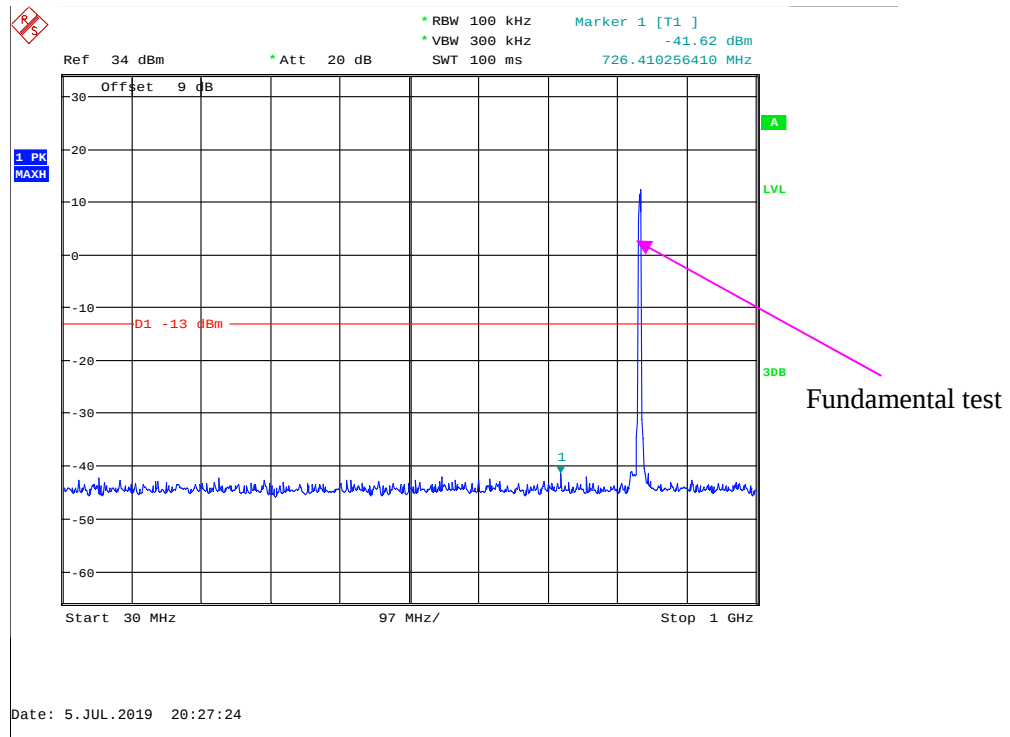
Date: 4.JUL.2019 23:02:02

## 1 GHz – 10 GHz (GSM Mode)

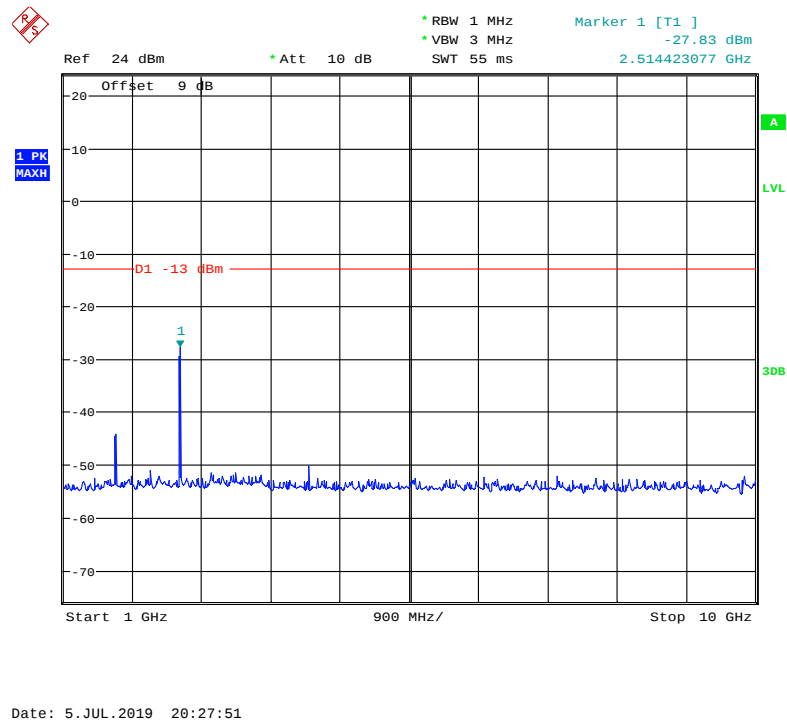


Date: 4.JUL.2019 23:02:38

### 30 MHz – 1 GHz (WCDMA Mode)

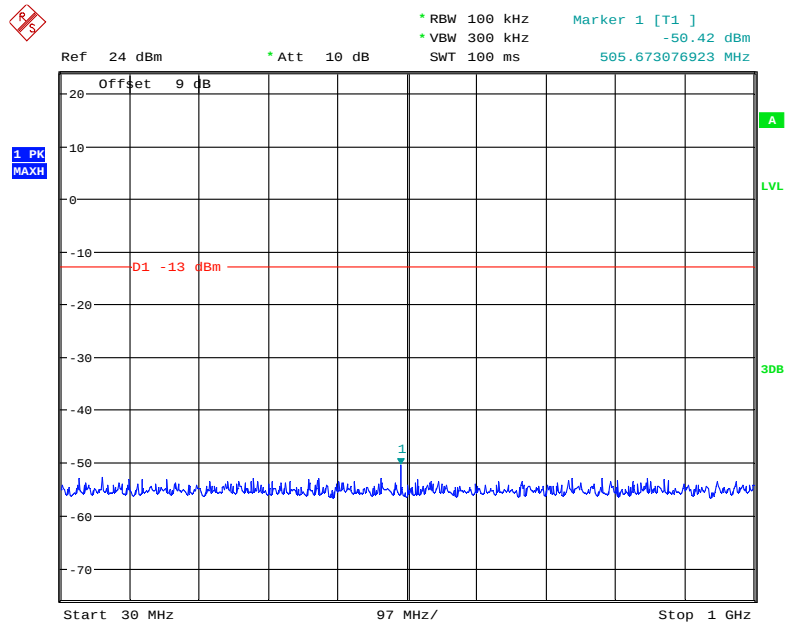


### 1 GHz – 10GHz (WCDMA Mode)



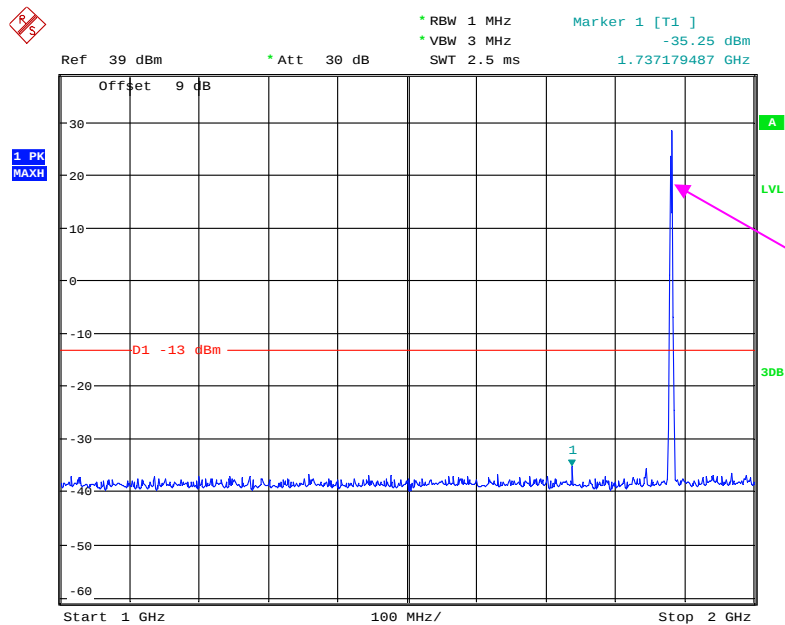
# PCS Band (Part 24E)

## 30 MHz – 1 GHz (GSM Mode)



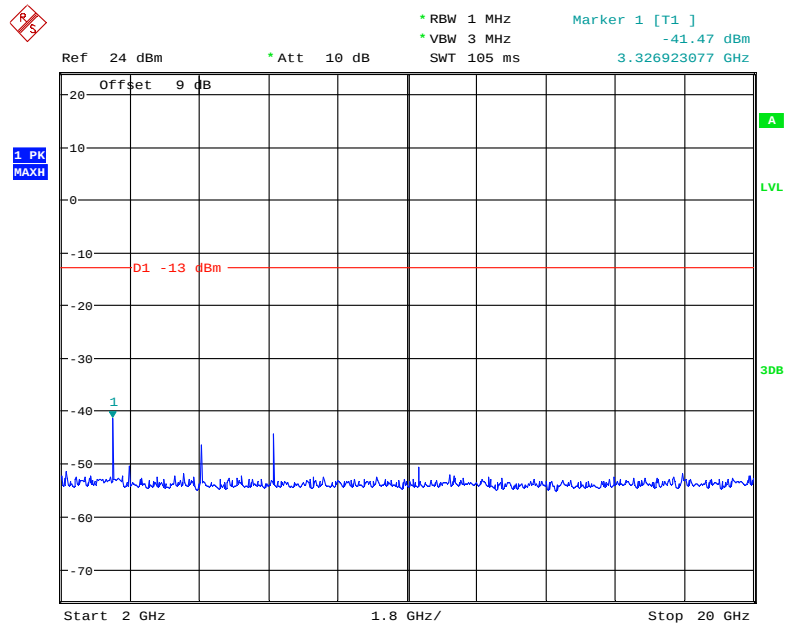
Date: 4.JUL.2019 23:17:30

## 1 GHz – 2 GHz (GSM Mode)

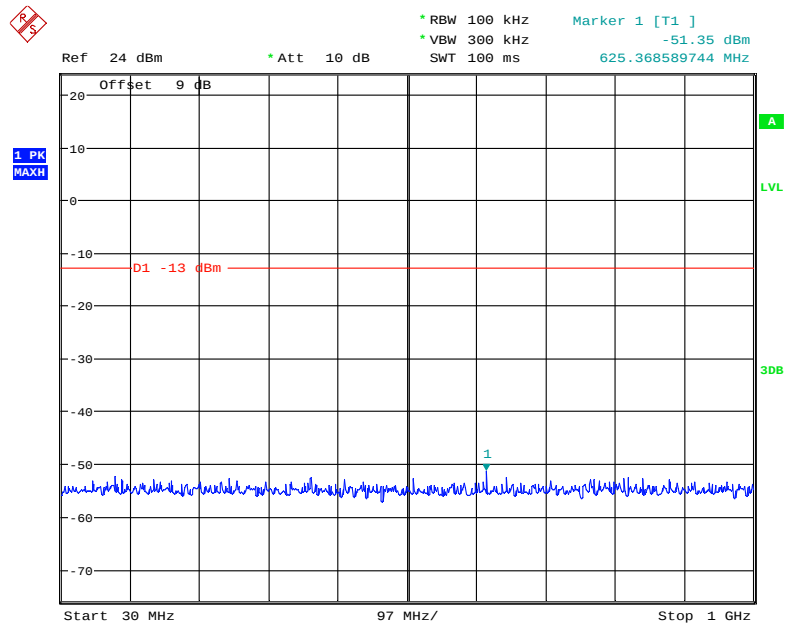


Fundamental test

Date: 4.JUL.2019 23:18:21

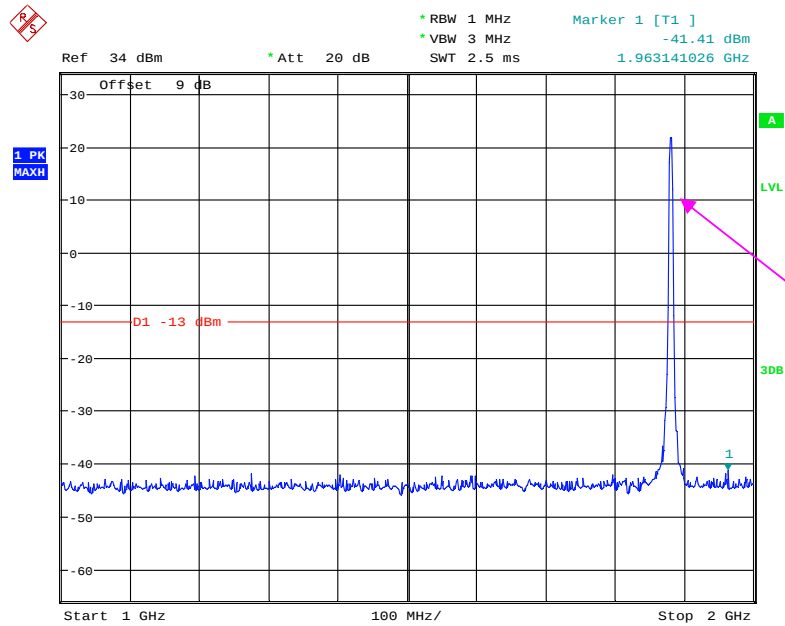
**2 GHz – 20 GHz (GSM Mode)**

Date: 4.JUL.2019 23:17:51

**30 MHz – 1 GHz (WCDMA Mode)**

Date: 5.JUL.2019 20:10:30

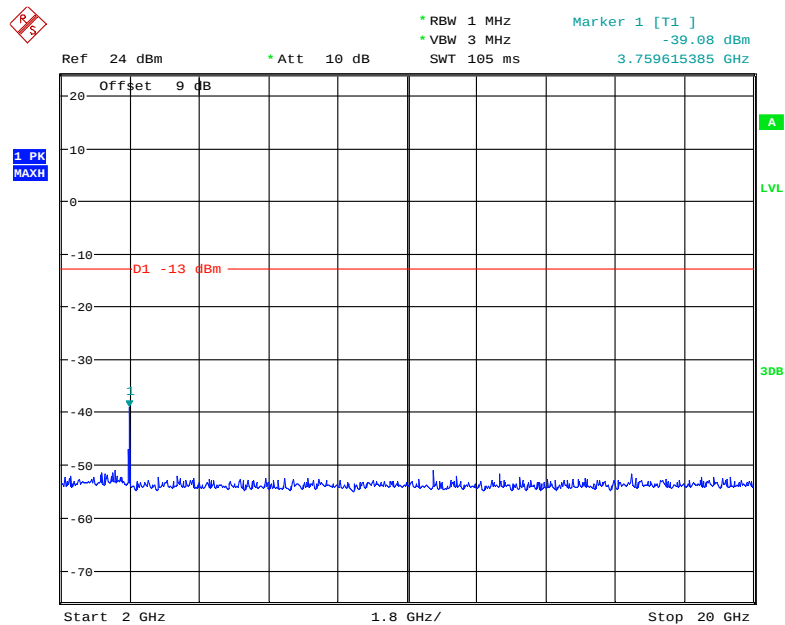
### 1 GHz – 2 GHz (WCDMA Mode)



Fundamental test

Date: 5.JUL.2019 20:11:17

### 2 GHz – 20 GHz (WCDMA Mode)



Date: 5.JUL.2019 20:11:43

**FCC § 2.1053; § 22.917 (a);§ 24.238 (a) -SPURIOUS RADIATED EMISSIONS****Applicable Standard**

FCC § 2.1053, §22.917(a) and § 24.238(a).

**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 (TX pwr 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>       | 25 °C     |
| <b>Relative Humidity:</b> | 56 %      |
| <b>ATM Pressure:</b>      | 101.0 kPa |

*The testing was performed by Curry Xiang on 2019-07-09.*

*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>(dBi) |                            |                |                |
| GSM Mode, Middle channel   |                               |                              |               |                |                |                       |                          |                            |                |                |
| 942.35                     | 36.86                         | 70                           | 1.2           | H              | -63.7          | 1.37                  | 0.0                      | -65.07                     | -13            | 52.07          |
| 942.35                     | 37.48                         | 55                           | 1.4           | V              | -61.9          | 1.37                  | 0.0                      | -63.27                     | -13            | 50.27          |
| 1673.20                    | 62.27                         | 52                           | 1.8           | H              | -44.1          | 1.30                  | 8.90                     | -36.50                     | -13            | 23.50          |
| 1673.20                    | 64.31                         | 315                          | 2.3           | V              | -41.4          | 1.30                  | 8.90                     | -33.80                     | -13            | 20.80          |
| 2509.80                    | 55.97                         | 293                          | 1.5           | H              | -47.4          | 2.60                  | 10.20                    | -39.80                     | -13            | 26.80          |
| 2509.80                    | 50.06                         | 315                          | 2.4           | V              | -52.7          | 2.60                  | 10.20                    | -45.10                     | -13            | 32.10          |
| 3346.40                    | 51.47                         | 250                          | 1.4           | H              | -49.4          | 1.50                  | 11.70                    | -39.20                     | -13            | 26.20          |
| 3346.40                    | 54.21                         | 211                          | 2.3           | V              | -46.7          | 1.50                  | 11.70                    | -36.50                     | -13            | 23.50          |
| 4183.00                    | 53.59                         | 206                          | 1.8           | H              | -48.4          | 1.50                  | 11.80                    | -38.10                     | -13            | 25.10          |
| 4183.00                    | 48.19                         | 7                            | 1.1           | V              | -53.0          | 1.50                  | 11.80                    | -42.70                     | -13            | 29.70          |
| 5019.60                    | 52.99                         | 172                          | 1.6           | H              | -45.8          | 1.70                  | 12.00                    | -35.50                     | -13            | 22.50          |
| 5019.60                    | 56.42                         | 259                          | 1.2           | V              | -41.8          | 1.70                  | 12.00                    | -31.50                     | -13            | 18.50          |
| WCDMA Mode, Middle channel |                               |                              |               |                |                |                       |                          |                            |                |                |
| 942.35                     | 36.88                         | 163                          | 1.5           | H              | -63.7          | 1.37                  | 0.0                      | -65.07                     | -13            | 52.07          |
| 942.35                     | 37.08                         | 214                          | 1.4           | V              | -62.3          | 1.37                  | 0.0                      | -63.67                     | -13            | 50.67          |
| 1673.20                    | 51.22                         | 345                          | 1.4           | H              | -55.1          | 1.30                  | 8.90                     | -47.50                     | -13            | 34.50          |
| 1673.20                    | 52.59                         | 229                          | 1.6           | V              | -53.1          | 1.30                  | 8.90                     | -45.50                     | -13            | 32.50          |
| 2509.80                    | 45.41                         | 332                          | 2.4           | H              | -57.9          | 2.60                  | 10.20                    | -50.30                     | -13            | 37.30          |
| 2509.80                    | 44.55                         | 41                           | 2.0           | V              | -58.2          | 2.60                  | 10.20                    | -50.60                     | -13            | 37.60          |
| 3346.40                    | 45.90                         | 257                          | 1.3           | H              | -55.0          | 1.50                  | 11.70                    | -44.80                     | -13            | 31.80          |
| 3346.40                    | 46.36                         | 313                          | 1.8           | V              | -54.6          | 1.50                  | 11.70                    | -44.40                     | -13            | 31.40          |

**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>(dBi) |                            |                |                |
| GSM Mode, Middle channel   |                               |                              |               |                |                |                       |                          |                            |                |                |
| 942.35                     | 37.41                         | 311                          | 2.2           | H              | -63.2          | 1.37                  | 0.0                      | -64.57                     | -13            | 51.57          |
| 942.35                     | 36.89                         | 102                          | 2.2           | V              | -62.5          | 1.37                  | 0.0                      | -63.87                     | -13            | 50.87          |
| 3760.00                    | 53.19                         | 301                          | 1.7           | H              | -49.2          | 1.50                  | 11.80                    | -38.90                     | -13            | 25.90          |
| 3760.00                    | 54.32                         | 153                          | 1.4           | V              | -47.6          | 1.50                  | 11.80                    | -37.30                     | -13            | 24.30          |
| 5640.00                    | 50.38                         | 358                          | 1.1           | H              | -45.4          | 1.70                  | 12.40                    | -34.70                     | -13            | 21.70          |
| 5640.00                    | 53.88                         | 53                           | 1.1           | V              | -41.5          | 1.70                  | 12.40                    | -30.80                     | -13            | 17.80          |
| 7520.00                    | 50.93                         | 129                          | 2.3           | H              | -43.8          | 1.90                  | 10.70                    | -35.00                     | -13            | 22.00          |
| 7520.00                    | 60.73                         | 261                          | 2.0           | V              | -33.6          | 1.90                  | 10.70                    | -24.80                     | -13            | 11.80          |
| 9400.00                    | 52.25                         | 203                          | 1.8           | H              | -42.3          | 2.20                  | 11.50                    | -33.00                     | -13            | 20.00          |
| 9400.00                    | 55.13                         | 138                          | 2.4           | V              | -39.7          | 2.20                  | 11.50                    | -30.40                     | -13            | 17.40          |
| 11280.00                   | 43.70                         | 40                           | 1.2           | H              | -44.1          | 2.50                  | 10.00                    | -36.60                     | -13            | 23.60          |
| 11280.00                   | 45.80                         | 106                          | 2.4           | V              | -42.6          | 2.50                  | 10.00                    | -35.10                     | -13            | 22.10          |
| WCDMA Mode, Middle channel |                               |                              |               |                |                |                       |                          |                            |                |                |
| 942.35                     | 37.05                         | 54                           | 2.5           | H              | -63.5          | 1.37                  | 0.0                      | -64.87                     | -13            | 51.87          |
| 942.35                     | 37.63                         | 127                          | 1.8           | V              | -61.7          | 1.37                  | 0.0                      | -63.07                     | -13            | 50.07          |
| 3760.00                    | 61.57                         | 309                          | 1.0           | H              | -40.5          | 1.50                  | 11.80                    | -30.20                     | -13            | 17.20          |
| 3760.00                    | 62.60                         | 66                           | 2.0           | V              | -39.0          | 1.50                  | 11.80                    | -28.70                     | -13            | 15.70          |
| 5640.00                    | 47.89                         | 306                          | 2.2           | H              | -51.8          | 1.70                  | 12.40                    | -41.10                     | -13            | 28.10          |
| 5640.00                    | 50.32                         | 178                          | 1.7           | V              | -49.0          | 1.70                  | 12.40                    | -38.30                     | -13            | 25.30          |

**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**

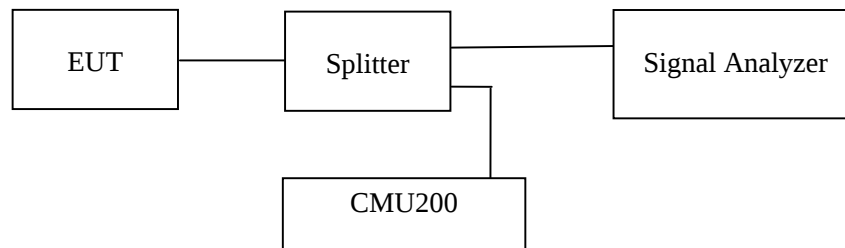
According to § 22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

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**

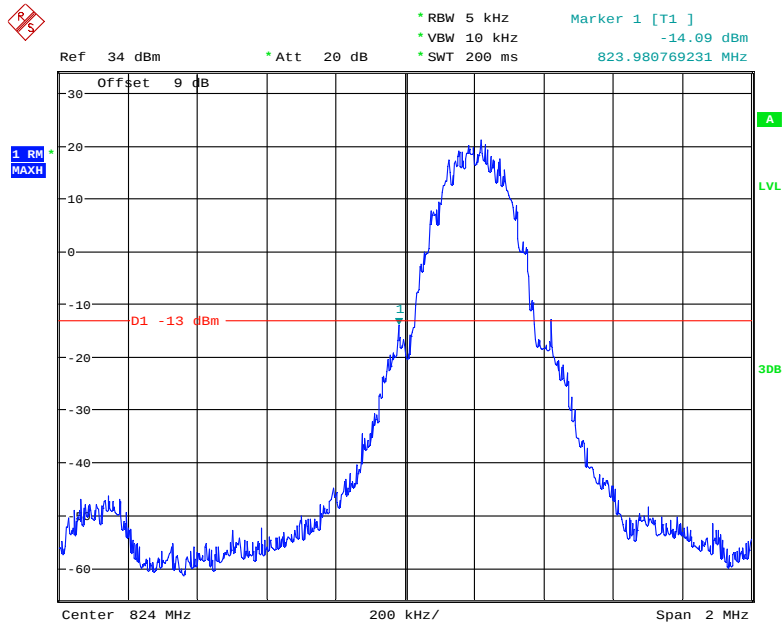
|                    |           |
|--------------------|-----------|
| Temperature:       | 25 °C     |
| Relative Humidity: | 52 %      |
| ATM Pressure:      | 101.0 kPa |

*The testing was performed by James Fu from 2019-07-04 to 2019-07-05.*

*EUT operation mode: Transmitting*

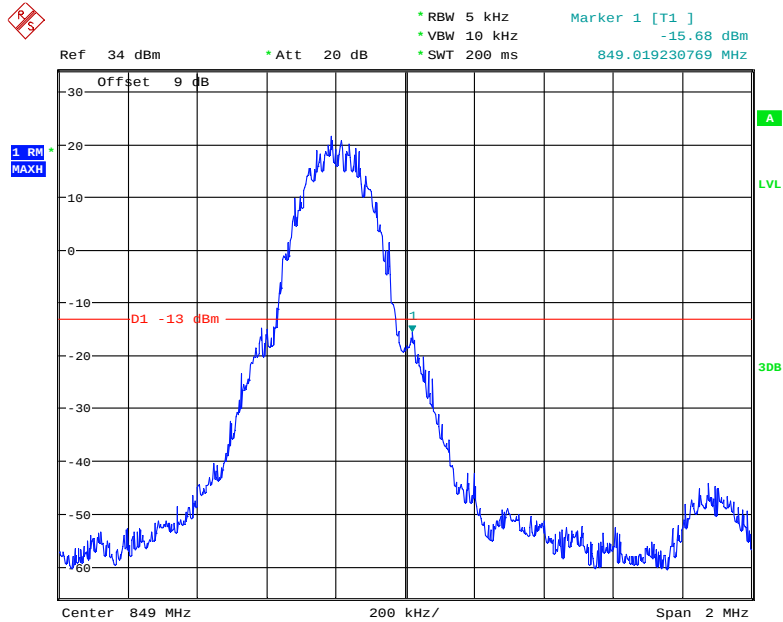
*Test Result: Compliance. Please refer to the following plots.*

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



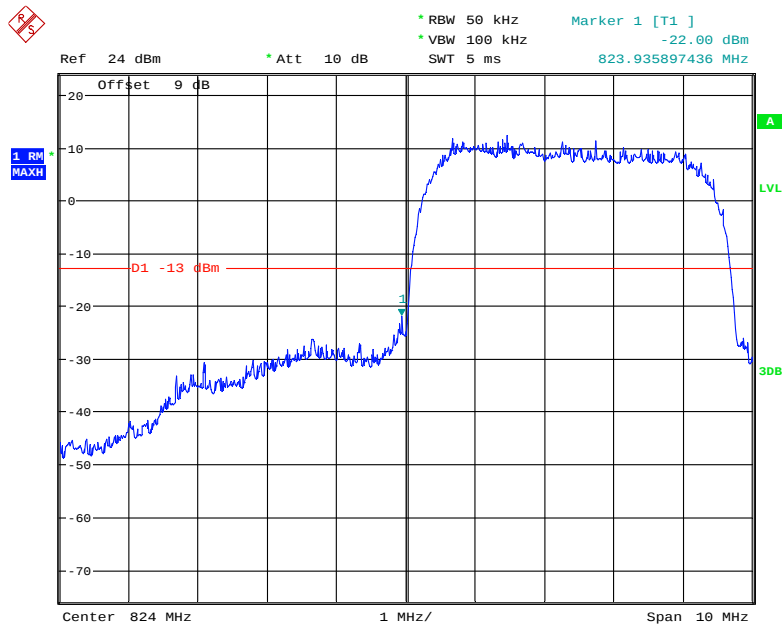
Date: 4.JUL.2019 23:03:54

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



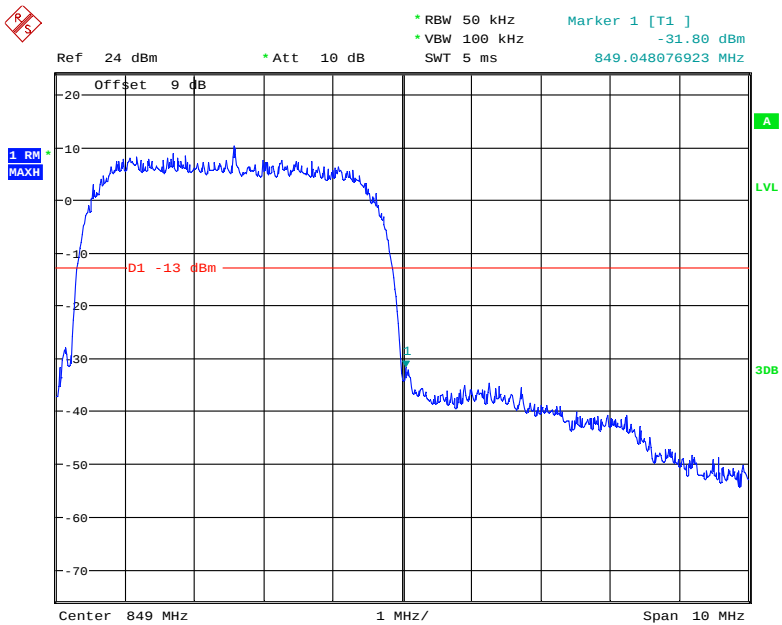
Date: 4.JUL.2019 23:04:22

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



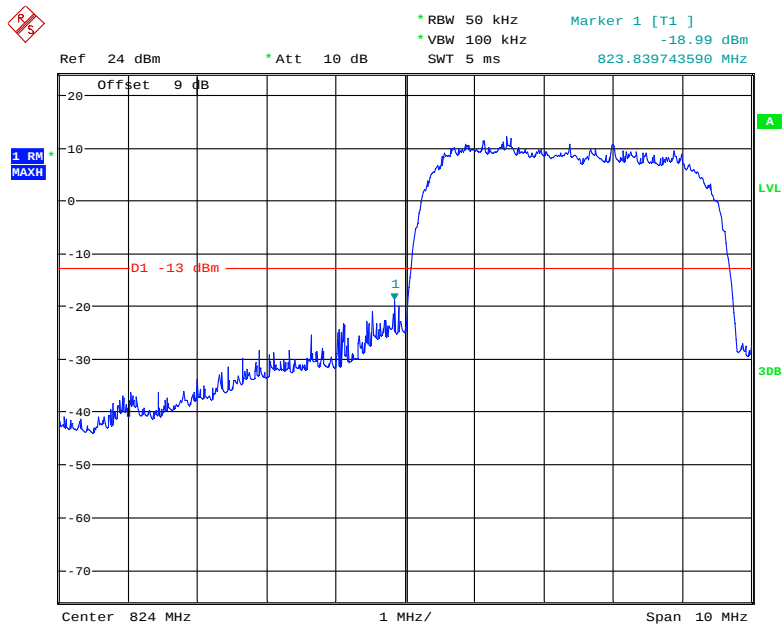
Date: 5.JUL.2019 20:29:08

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



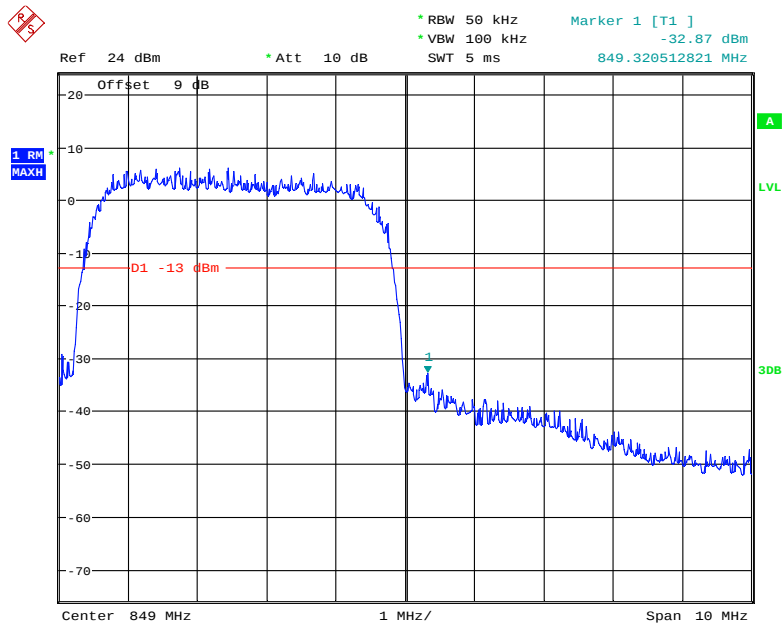
Date: 5.JUL.2019 20:29:35

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



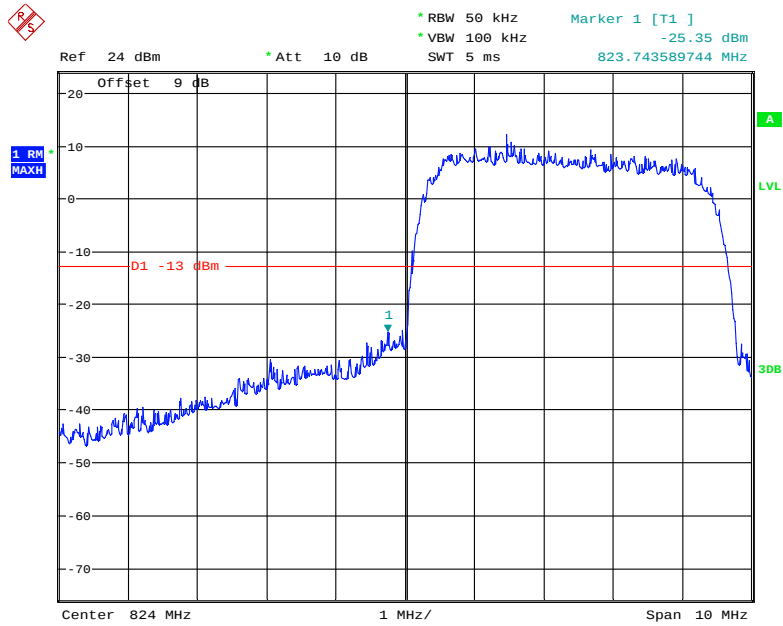
Date: 5.JUL.2019 20:32:42

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



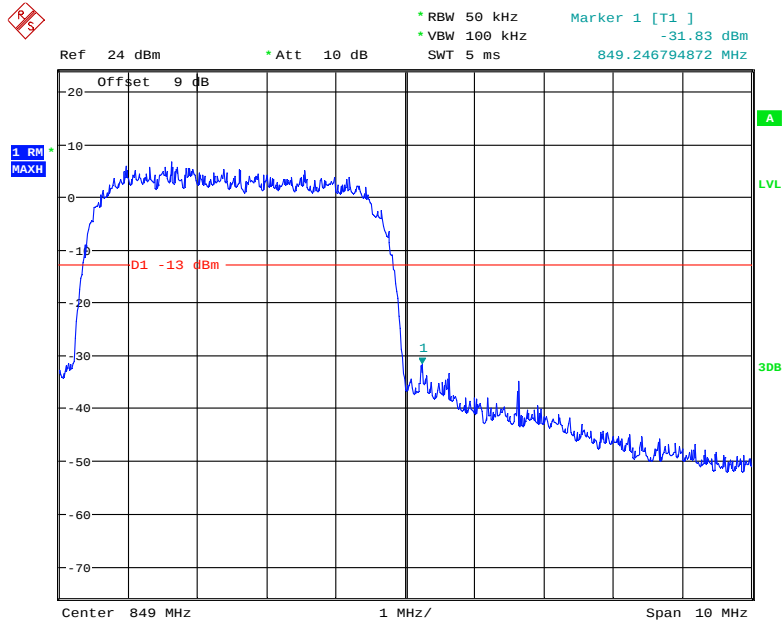
Date: 5.JUL.2019 20:33:01

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



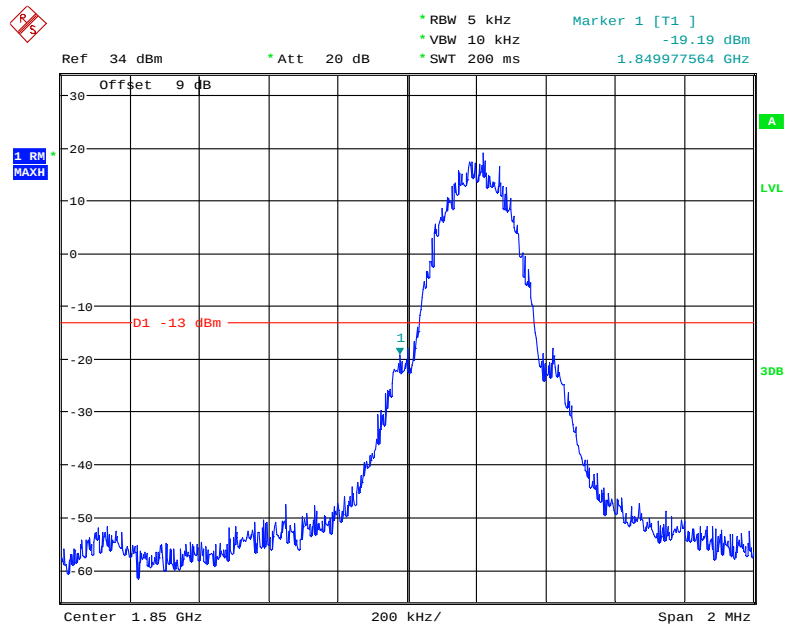
Date: 5.JUL.2019 20:30:30

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



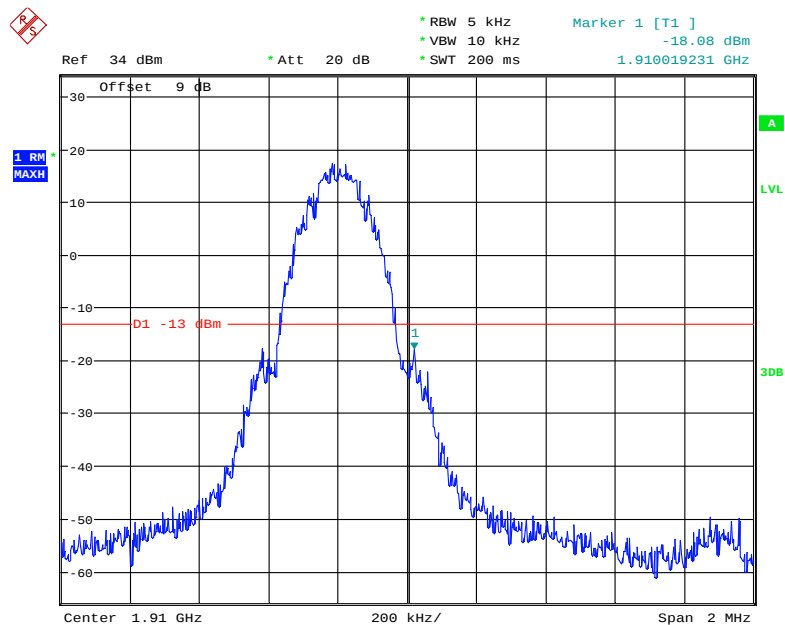
Date: 5.JUL.2019 20:30:08

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



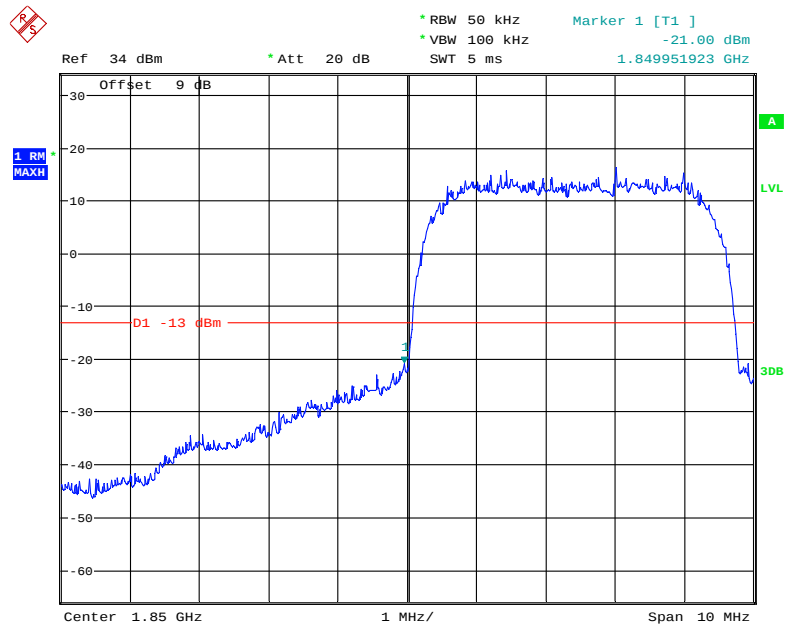
Date: 4.JUL.2019 23:09:28

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

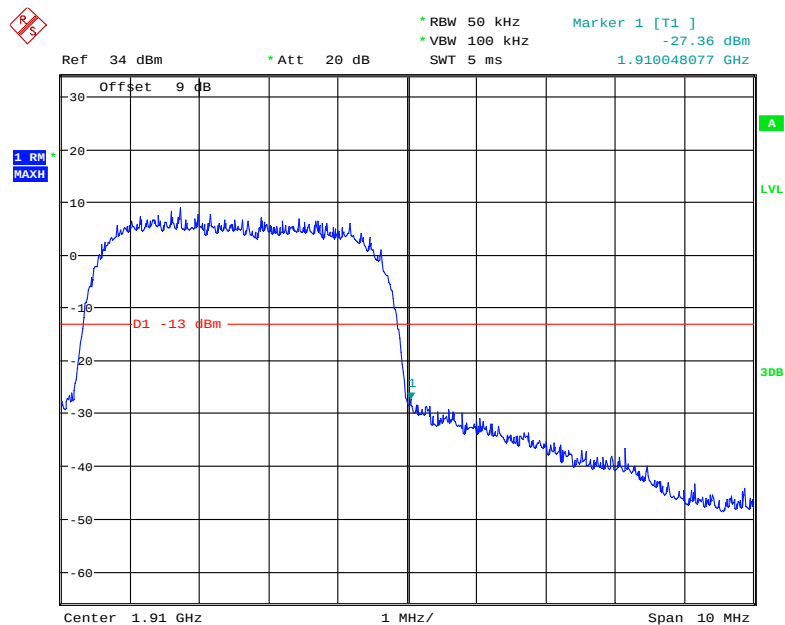


Date: 4.JUL.2019 23:09:53

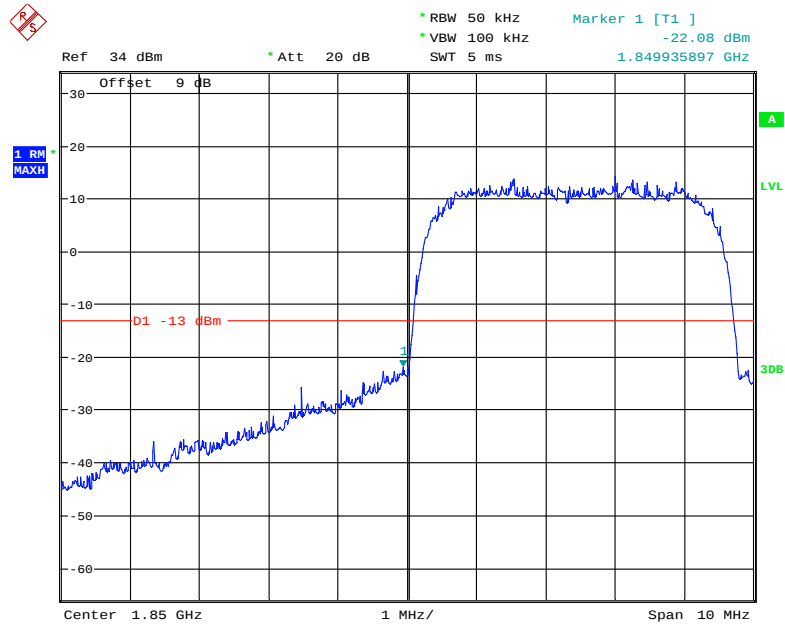
### PCS Band, Left Band Edge for WCDMA (BPSK) Mode



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

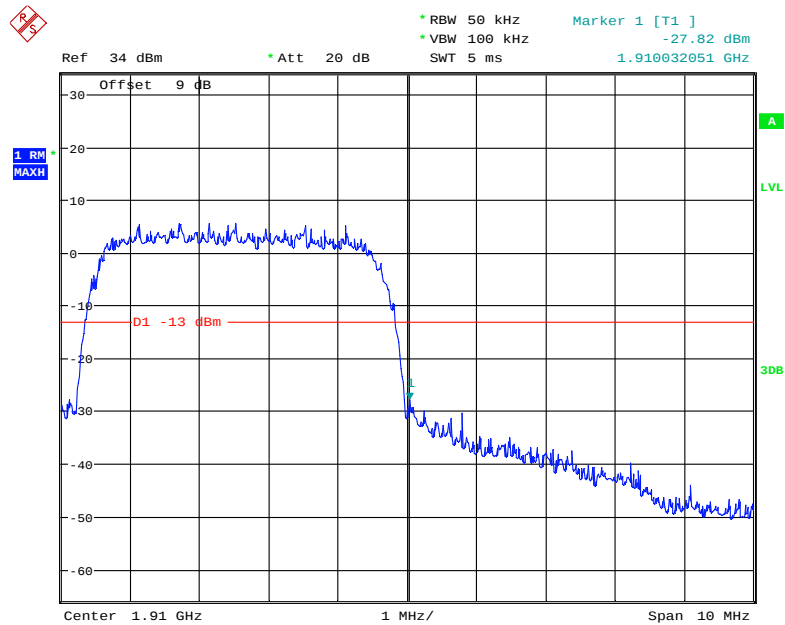


### PCS Band, Left Band Edge for HSDPA (16QAM) Mode



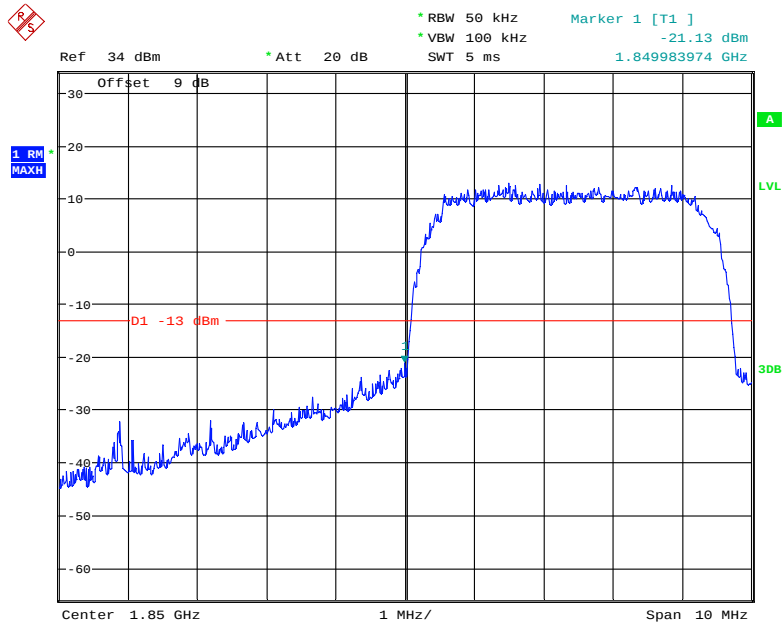
Date: 5.JUL.2019 20:06:59

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



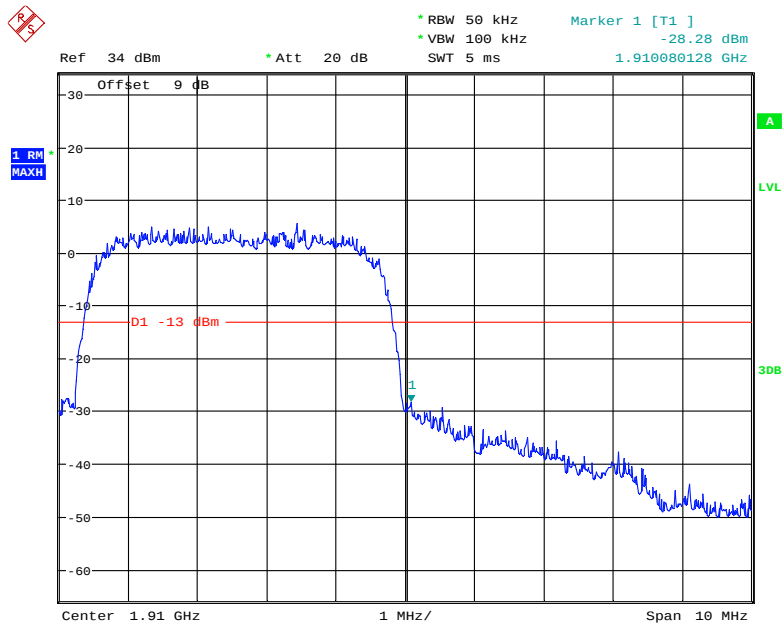
Date: 5.JUL.2019 20:06:17

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



Date: 5.JUL.2019 20:04:46

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



Date: 5.JUL.2019 20:05:13

**FCC § 2.1055; § 22.355; § 24.235 - FREQUENCY STABILITY****Applicable Standard**

FCC § 2.1055, §22.355 and §24.235.

According to FCC §2.1055, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

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 ≤ 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                    |

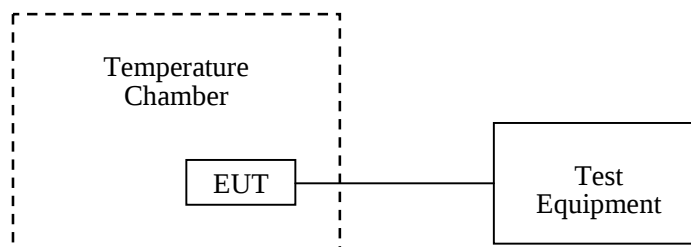
According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

**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> | 52 %      |
| <b>ATM Pressure:</b>      | 101.0 kPa |

The testing was performed by James Fu from 2019-07-04 to 2019-07-05.

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                                   | 3.8                               | 7                    | 0.0084                | 2.5         |
| -20                                   |                                   | 10                   | 0.0120                | 2.5         |
| -10                                   |                                   | 12                   | 0.0143                | 2.5         |
| 0                                     |                                   | 13                   | 0.0155                | 2.5         |
| 10                                    |                                   | 16                   | 0.0191                | 2.5         |
| 20                                    |                                   | 19                   | 0.0227                | 2.5         |
| 30                                    |                                   | 20                   | 0.0239                | 2.5         |
| 40                                    |                                   | 22                   | 0.0263                | 2.5         |
| 50                                    |                                   | 24                   | 0.0287                | 2.5         |
| 25                                    | V min.= 3.6                       | 26                   | 0.0311                | 2.5         |
| 25                                    | V max.= 4.35                      | 29                   | 0.0347                | 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                                     | 3.8                         | -8                   | -0.0096               | 2.5         |
| -20                                     |                             | -6                   | -0.0072               | 2.5         |
| -10                                     |                             | -7                   | -0.0084               | 2.5         |
| 0                                       |                             | -5                   | -0.0060               | 2.5         |
| 10                                      |                             | -3                   | -0.0036               | 2.5         |
| 20                                      |                             | -1                   | -0.0012               | 2.5         |
| 30                                      |                             | 1                    | 0.0012                | 2.5         |
| 40                                      |                             | 0                    | 0                     | 2.5         |
| 50                                      |                             | 2                    | 0.0024                | 2.5         |
| 25                                      | V min.= 3.6                 | 3                    | 0.0036                | 2.5         |
| 25                                      | V max.= 4.35                | 5                    | 0.0060                | 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                                       | 3.8                         | 10                   | 0.0053                | pass   |
| -20                                       |                             | 11                   | 0.0059                | pass   |
| -10                                       |                             | 15                   | 0.0080                | pass   |
| 0                                         |                             | 17                   | 0.0090                | pass   |
| 10                                        |                             | 19                   | 0.0101                | pass   |
| 20                                        |                             | 20                   | 0.0106                | pass   |
| 30                                        |                             | 21                   | 0.0112                | pass   |
| 40                                        |                             | 23                   | 0.0122                | pass   |
| 50                                        |                             | 24                   | 0.0128                | pass   |
| 25                                        | V min.= 3.6                 | 25                   | 0.0133                | pass   |
| 25                                        | V max.= 4.35                | 28                   | 0.0149                | pass   |

**WCDMA Mode**

| Middle Channel, $f_0$ =1880.0 MHz |                                   |                      |                       |        |
|-----------------------------------|-----------------------------------|----------------------|-----------------------|--------|
| Temperature (°C)                  | Power Supplied (V <sub>DC</sub> ) | Frequency Error (Hz) | Frequency Error (ppm) | Result |
| -30                               | 3.8                               | -9                   | -0.0048               | pass   |
| -20                               |                                   | -7                   | -0.0037               | pass   |
| -10                               |                                   | -5                   | -0.0027               | pass   |
| 0                                 |                                   | -4                   | -0.0021               | pass   |
| 10                                |                                   | -2                   | -0.0011               | pass   |
| 20                                |                                   | -1                   | -0.0005               | pass   |
| 30                                |                                   | 1                    | 0.0005                | pass   |
| 40                                |                                   | 2                    | 0.0011                | pass   |
| 50                                |                                   | 4                    | 0.0021                | pass   |
| 25                                | V min.= 3.6                       | 5                    | 0.0027                | pass   |
| 25                                | V max.= 4.35                      | 8                    | 0.0043                | pass   |

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