

## FCC PART 27

### MEASUREMENT AND TEST REPORT

For

#### Quectel Wireless Solutions Company Limited

Room501,Building 13,No.99 TianZhou Road, Xuhui District, Shanghai, China

**FCC ID: XMR201606EC21A**

|                                                                                                                                                                                                                                                                                |                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Report Type:</b><br>CIIPC                                                                                                                                                                                                                                                   | <b>Product Type:</b><br>LTE Module |
| <b>Test Engineer:</b> <u>David. Hsu</u> <i>David. Hsu</i>                                                                                                                                                                                                                      |                                    |
| <b>Report Number:</b> <u>RKS170320003-00A</u>                                                                                                                                                                                                                                  |                                    |
| <b>Report Date:</b> <u>2017-03-20</u>                                                                                                                                                                                                                                          |                                    |
| <b>Reviewed By:</b> <u>Jerry.Chang</u> <i>Jerry.Chang</i>                                                                                                                                                                                                                      |                                    |
| <b>Prepared By:</b><br>Bay Area Compliance Laboratories Corp. (Taiwan)<br>70, Lane 169, Sec. 2, Datong Road, Xizhi Dist.,<br>New Taipei City 22183, Taiwan, R.O.C.<br>Tel: +886 (02)27206758<br>Fax: +886 (02)27206722<br><a href="http://www.bacl.com.tw">www.bacl.com.tw</a> |                                    |

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## GENERAL INFORMATION

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

The Quectel Wireless Solutions Company Limited's product, model number: EC21-A (FCC ID: XMR201606EC21A) or the "EUT" in this report was a LTE Module , which was measured approximately 32mm(L) × 29mm(W) × 2.4mm(H). Rated with input voltage: DC3.8 V, EUT Operating Voltage Range: 3.3~4.3V.

*\* Note: The product's series model number: EC21-A MINIPCIE The difference between them was explained in the declaration letter.*

*\* All measurement and test data in this report was gathered from production sample serial number: 20160519001 (Assigned by BACL, Taipei).The EUT supplied by the applicant was received on 2016-05-19.*

### Objective

This type approval report is prepared on behalf of Quectel Wireless Solutions Company Limited in accordance with Part 2, Part 27 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.

This is a CIIPC base on the original report with FCC ID: XMR201606EC21A which was granted on 2016-07-27, the differences between the original device and the current one are as follows:

- 1.Add new Band (WCDMA Band IV)
- 2.Update RF Exposure Evaluation (MPE )

For the changes made to the device, according to Part 27-Subpart, the test items were performed.

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

N/A

### 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 27 – Miscellaneous wireless communications services

Applicable Standards: TIA/EIA 603-D.

All radiated and conducted emissions measurements were performed at Bay Area Compliance Laboratories Corp. (Taiwan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement uncertainty with radiated emission is 5.81 dB for 30MHz-1GHz.and 4.88 dB for above 1GHz, 1.95dB for conducted measurement.

## Test Facility

The Test site used by Bay Area Compliance Laboratories Corp.(Taiwan) 70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

Test site at Bay Area Compliance Laboratories Corp. (Taiwan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on October 31, 2103. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 431084. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

## SYSTEM TEST CONFIGURATION

### Justification

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 modifications were made to the EUT.

### Specific Accessory Equipment

| Description   | Parameter                            | Serial Number |
|---------------|--------------------------------------|---------------|
| WCDMA antenna | PCB antenna with typical gain:1.0dBi | N/A           |

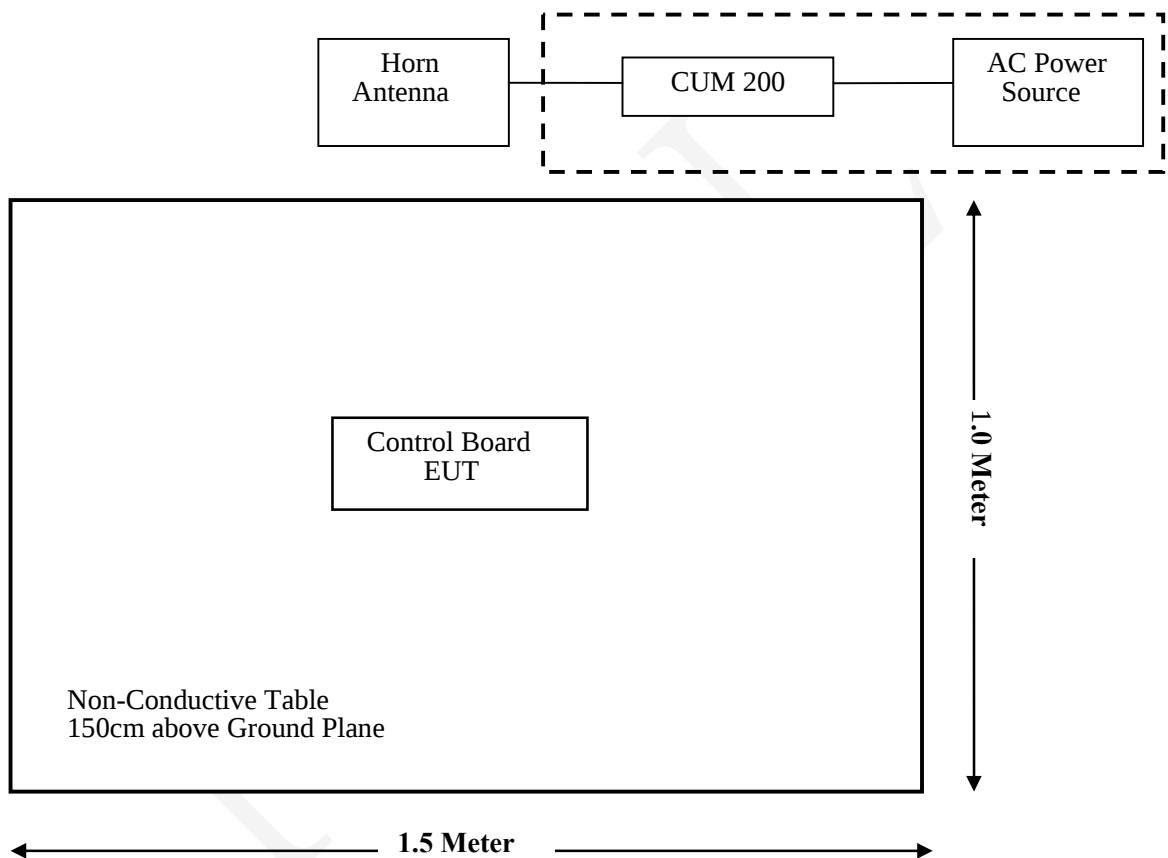
### Support Equipment List and Details

| Manufacturer                                    | Description                                                  | Model    | Serial Number   |
|-------------------------------------------------|--------------------------------------------------------------|----------|-----------------|
| Rohde & Schwarz                                 | Universal Radio Communication Tester                         | CMU200   | 106891          |
| Dell                                            | Notebook                                                     | E6410    | N/A             |
| Quectel                                         | Test Fixer                                                   | N/A      | N/A             |
| Shanghai Jingsai Electronic Technology Co.,Ltd. | ADAPATER<br>I/P: AC 100-240V, 50-60Hz<br>O/P: DC 5V, 2A, 12W | JS-400K  | N/A             |
| Quectel Wireless Solutions                      | Control Board                                                | S2-W2231 | MP76121D4000228 |

### External Cable List and Details

| Cable Description | Length (m) | From Port | To |
|-------------------|------------|-----------|----|
| /                 | /          | /         | /  |

### Block Diagram of Test Setup



**SUMMARY OF TEST RESULTS**

| FCC Rules                   | Description of Test                    | Result         |
|-----------------------------|----------------------------------------|----------------|
| §1.1310, §2.1091            | MAXIMUM PERMISSIBLE EXPOSURE (MPE)     | Compliant      |
| §2.1046; §27.50 (d) (c)     | RF Output Power                        | Compliant      |
| § 2.1047                    | Modulation Characteristics             | Not Applicable |
| § 2.1049; §27.53 (c)        | Occupied Bandwidth                     | Compliant      |
| § 2.1051;<br>§27.53 (c) (h) | Spurious Emissions at Antenna Terminal | Compliant      |
| § 2.1053; §27.53 (c) (h)    | Spurious Radiated Emissions            | Compliant      |
| §27.53 (c) (h)              | Band Edge                              | Compliant      |
| § 2.1055; §27.54            | Frequency stability                    | Compliant      |

## **FCC §1.1310& §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

### **Applicable Standard**

According to subpart § 2.1091and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                                      |                                      |                                          |                                 |
|----------------------------------------------------------------|--------------------------------------|--------------------------------------|------------------------------------------|---------------------------------|
| <b>Frequency Range (MHz)</b>                                   | <b>Electric Field Strength (V/m)</b> | <b>Magnetic Field Strength (A/m)</b> | <b>Power Density (mW/cm<sup>2</sup>)</b> | <b>Averaging Time (minutes)</b> |
| 0.3-1.34                                                       | 614                                  | 1.63                                 | *(100)                                   | 30                              |
| 1.34-30                                                        | 824/f                                | 2.19/f                               | *(180/f <sup>2</sup> )                   | 30                              |
| 30-300                                                         | 27.5                                 | 0.073                                | 0.2                                      | 30                              |
| 300-1500                                                       | /                                    | /                                    | f/1500                                   | 30                              |
| 1500-100,000                                                   | /                                    | /                                    | 1.0                                      | 30                              |

f = frequency in MHz; \* = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$  = power density (in appropriate units, e.g. mW/cm<sup>2</sup>);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Base on ERP/EIRP Calculated Data:

| <b>Mode</b>     | <b>Max Turn-up Power (dBm)</b> | <b>ERP/EIRP Limit (dBm)</b> | <b>Max Antenna Gain (dBi)</b> |
|-----------------|--------------------------------|-----------------------------|-------------------------------|
| WCDMA (Band V)  | 23.5                           | 38.45                       | 14.95                         |
| WCDMA (Band II) | 23.5                           | 33                          | 9.5                           |
| WCDMA (Band IV) | 23.5                           | 30                          | 6.5                           |
| LTE (Band II)   | 24                             | 33                          | 9.0                           |
| LTE (Band IV)   | 24                             | 30                          | 6.0                           |
| LTE (Band XII)  | 24                             | 34.77                       | 10.77                         |

To meet MPE requirement, the allowed maximal gain for each band is below:

| Mode            | Frequency Range (MHz) | Antenna Gain |           | Target Power |        | Evaluation Distance (cm) | Power Density (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) |
|-----------------|-----------------------|--------------|-----------|--------------|--------|--------------------------|-------------------------------------|---------------------------------|
|                 |                       | (dBi)        | (Numeric) | (dBm)        | (mW)   |                          |                                     |                                 |
| WCDMA (Band V)  | 826.4-846.6           | 10.92        | 12.36     | 23.5         | 223.87 | 20                       | 0.551                               | 0.551                           |
| WCDMA (Band II) | 1852.4-1907.6         | 13.51        | 22.44     | 23.5         | 223.87 | 20                       | 1.0                                 | 1.0                             |
| WCDMA (Band IV) | 1712.4-1752.6         | 13.51        | 22.44     | 23.5         | 223.87 | 20                       | 1.0                                 | 1.0                             |
| LTE (Band II)   | 1850.7-1909.3         | 13.01        | 20.00     | 24           | 251.19 | 20                       | 1.0                                 | 1.0                             |
| LTE (Band IV)   | 1710.7-1754.3         | 13.01        | 20.00     | 24           | 251.19 | 20                       | 1.0                                 | 1.0                             |
| LTE (Band XII)  | 699.7-715.3           | 9.69         | 9.31      | 24           | 251.19 | 20                       | 0.465                               | 0.466                           |

Note:

1. The device meets FCC MPE at 20 cm distance.
2. Target Power =the max power including Tune-up tolerance, the tune up power declared by manufacture as:

WCDMA Bands: 22.5±1dBm;

LTE Bands: 22.5±1.5dBm

Output power is conducted. This device is to be used in mobile or fixed applications only. Antenna gain including cable loss must not exceed:

9.69 dBi of frequency band 699-716MHz  
 10.92 dBi of frequency band 824-849MHz  
 6.0dBi of frequency band 1710-1755MHz  
 9.0 dBi of frequency band 1850-1910MHz

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

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According to FCC § 2.1047(d) , Part 27 there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

FINAL

## **FCC§27.50 (d) (c) - RF OUTPUT POWER**

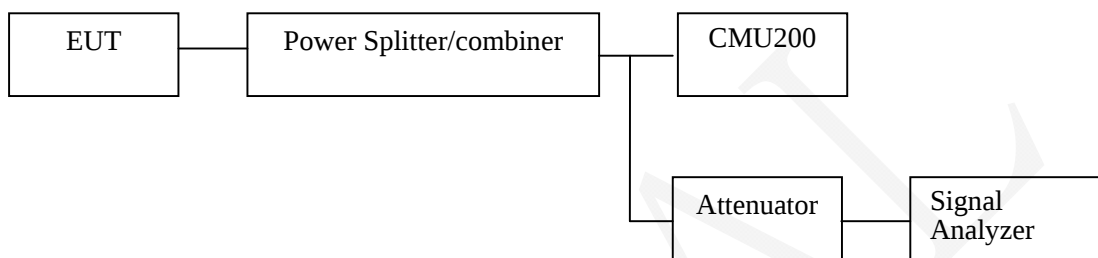
### **Applicable Standards**

According to §27.50(d), the maximum EIRP must not exceed 1Watts (30dBm) for 1710-1755MHzHz. 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:*

TIA603-D section 2.2.17

**Test Equipment List and Details**

| Manufacturer    | Description       | Model      | Serial Number | Calibration Date | Calibration Interval |
|-----------------|-------------------|------------|---------------|------------------|----------------------|
| Rohde & Schwarz | EMI Test Receiver | ESCI       | 100540        | 2016-07-25       | 2017-07-24           |
| Agilent         | Signal Generator  | 8648C      | 3537A01810    | 2016-07-04       | 2017-07-03           |
| Sunol Sciences  | Broadband Antenna | JB6        | A050115       | 2016-06-15       | 2017-06-14           |
| EMCO            | Horn Antenna      | 3115       | 9311-4158     | 2016-05-08       | 2017-05-07           |
| ETS             | Horn Antenna      | 3115       | 6431          | 2015-11-07       | 2016-11-06           |
| Rohde & Schwarz | Spectrum Analyzer | FSU 26     | 200268        | 2016-07-29       | 2017-08-28           |
| EMCO            | Turn Table        | 2081-1.21  | 9709-1885     | N.C.R            | N.C.R                |
| EMCO            | Antenna Tower     | 2075-2     | 9707-2060     | N.C.R            | N.C.R                |
| Controller      | EMCO              | 2090       | 9709-1256     | N.C.R            | N.C.R                |
| R&S             | Software          | EMC32      | V9.10.00      | NCR              | NCR                  |
| BACL            | RF cable          | KS-LAB-012 | KS-LAB-012    | 2015-12-16       | 2016-12-15           |
| BACL            | RF cable          | KS-LAB-010 | KS-LAB-010    | 2015-12-16       | 2016-12-15           |
| Mini            | Attenuator        | 10dB       | N/A           | 2016-01-11       | 2017-01-10           |

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

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

|                           |          |
|---------------------------|----------|
| <b>Temperature:</b>       | 25 °C    |
| <b>Relative Humidity:</b> | 50 %     |
| <b>ATM Pressure:</b>      | 101.0kPa |

*The testing was performed by David. Hsu on 2016-09-07.*

**Conducted Power****WCDMA Band IV**

| Mode            | Test Condition | Test Mode | 3GPP Sub Test | Average Output Power (dBm) |                  |                |
|-----------------|----------------|-----------|---------------|----------------------------|------------------|----------------|
|                 |                |           |               | Low Frequency              | Middle Frequency | High Frequency |
| WCDMA (Band IV) | Normal         | Rel99     | 1             | 22.53                      | 22.33            | 22.40          |
|                 |                | HSDPA     | 1             | 22.33                      | 22.42            | 22.45          |
|                 |                |           | 2             | 22.52                      | 22.32            | 22.58          |
|                 |                |           | 3             | 22.36                      | 22.45            | 22.58          |
|                 |                |           | 4             | 22.44                      | 22.53            | 22.42          |
|                 |                | HSUPA     | 1             | 22.35                      | 22.36            | 22.46          |
|                 |                |           | 2             | 22.40                      | 22.45            | 22.40          |
|                 |                |           | 3             | 22.30                      | 22.32            | 22.49          |
|                 |                |           | 4             | 22.41                      | 22.52            | 22.53          |
|                 |                |           | 5             | 22.34                      | 22.47            | 22.59          |
|                 |                | HSPA+     | 1             | 22.37                      | 22.44            | 22.51          |

**EIRP:**

| Frequency                          | Receiver Reading | Turn table Angle | RX Antenna |       | Substituted |       |              | Absolute Level | Limit | Margin |
|------------------------------------|------------------|------------------|------------|-------|-------------|-------|--------------|----------------|-------|--------|
|                                    |                  |                  | Height     | Polar | SG Level    | Cable | Antenna Gain |                |       |        |
| (MHz)                              | (dBμV)           | Degree           | (m)        | (H/V) | (dBm)       | (dB)  | (dB)         | (dBm)          | (dBm) | (dB)   |
| WCDMA Band IV Mode, Middle channel |                  |                  |            |       |             |       |              |                |       |        |
| 1732.40                            | 78.52            | 233              | 2.1        | H     | 4.69        | 0.31  | 10.40        | 14.78          | 30    | 15.22  |
| 1732.40                            | 84.65            | 358              | 1.3        | V     | 11.52       | 0.31  | 10.40        | 21.61          | 30    | 15.39  |

**Note:**

- 1) The unit of antenna gain is dBd for frequency below 1GHz and dBi for frequency above 1GHz.
- 2) Absolute Level = SG Level - Cable loss + Antenna Gain
- 3) Margin = Limit-Absolute Level
- 4) The antenna with gain (typical: 1.0dBi) which provided by manufacturer was used during test.
- 5) The fundamental was tested without amplifier.

**Peak-to-average ratio (PAR)****WCDMA Band IV**

| Mode  | Channel | PAR<br>(dB) | Limit<br>(dB) |
|-------|---------|-------------|---------------|
| Rel99 | Low     | 2.65        | 13            |
|       | Middle  | 2.64        | 13            |
|       | High    | 2.61        | 13            |
| HSDPA | Low     | 2.45        | 13            |
|       | Middle  | 2.43        | 13            |
|       | High    | 2.52        | 13            |
| HSUPA | Low     | 2.41        | 13            |
|       | Middle  | 2.44        | 13            |
|       | High    | 2.47        | 13            |

## FCC § 2.1049; §27.53 (c) - OCCUPIED BANDWIDTH

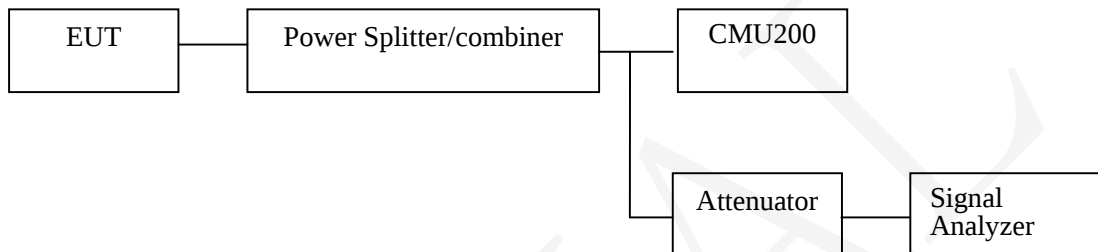
### Applicable Standards

FCC 47 §2.1049, §27.53.

### 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 100 kHz (WCDMA) and the 26 dB & 99% bandwidth was recorded.



### Test Equipment List and Details

| Manufacturer    | Description                          | Model       | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|--------------------------------------|-------------|---------------|------------------|----------------------|
| Rohde &Schwarz  | Signal Analyzer                      | FSIQ26      | 8386001028    | 2015-12-11       | 2016-12-11           |
| Rohde & Schwarz | Signal Analyzer                      | FSV40       | 101116        | 2016-07-04       | 2017-07-03           |
| Rohde & Schwarz | Universal Radio Communication Tester | CMU200      | 106891        | 2015-11-23       | 2016-11-23           |
| Mini            | Splitter                             | ZFRSC-14-S+ | SF019411452   | 2016-07-11       | 2016-12-10           |
| BACL            | RF cable                             | KS-LAB-020  | KS-LAB-020    | 2016-07-11       | 2016-12-10           |
| Mini            | Attenuator                           | 10dB        | N/A           | 2016-07-11       | 2016-12-10           |

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

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

|                           |          |
|---------------------------|----------|
| <b>Temperature:</b>       | 21 °C    |
| <b>Relative Humidity:</b> | 49 %     |
| <b>ATM Pressure:</b>      | 101.0kPa |

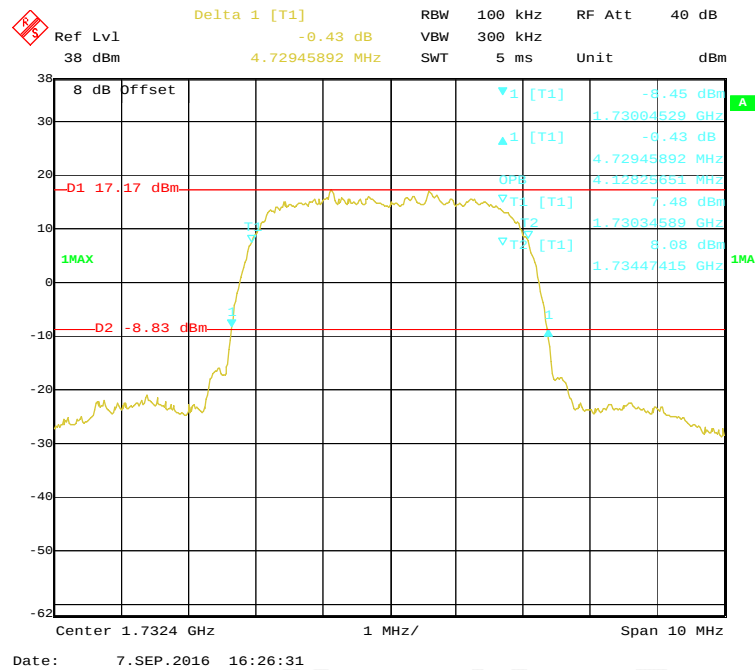
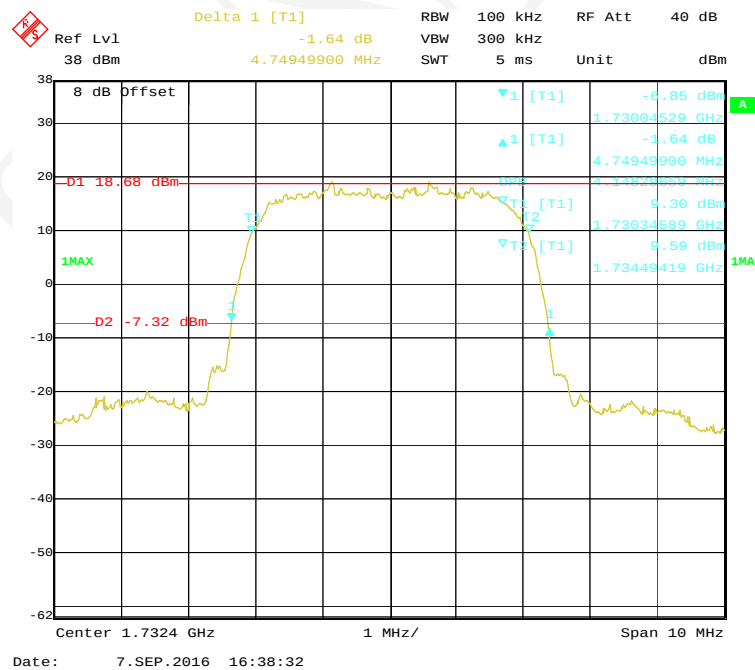
*The testing was performed by David. Hsu on 2016-09-07.*

*EUT operation mode: Transmitting*

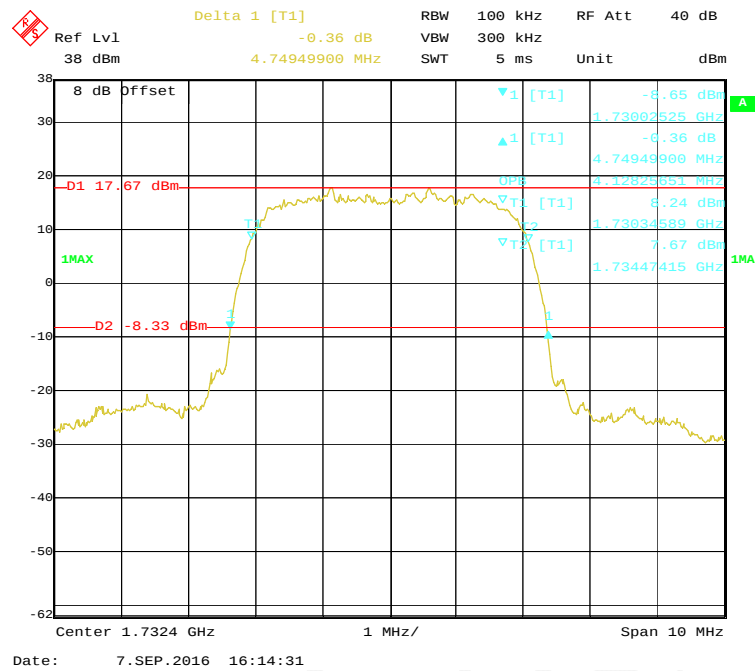
*Test Result: Compliance. Please refer to the following tables and plots.*

**WCDMA Band IV**

| Mode            | Test Condition | Test Mode | OCCUPIED BANDWIDTH (MHz) | 26dB BANDWIDTH (MHz) |
|-----------------|----------------|-----------|--------------------------|----------------------|
| WCDMA (Band IV) | Normal         | Rel99     | 4.13                     | 4.73                 |
|                 |                | HSDPA     | 4.15                     | 4.75                 |
|                 |                | HSUPA     | 4.13                     | 4.75                 |

**99% Occupied & 26 dB Emissions Bandwidth for Rel99 Mode****99% Occupied & 26 dB Emissions Bandwidth for HSDPA Mode**

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



## FCC§ 2.1051;§27.53 (c) (h)-SPURIOUS EMISSIONS AT ANTENNA TERMINALS

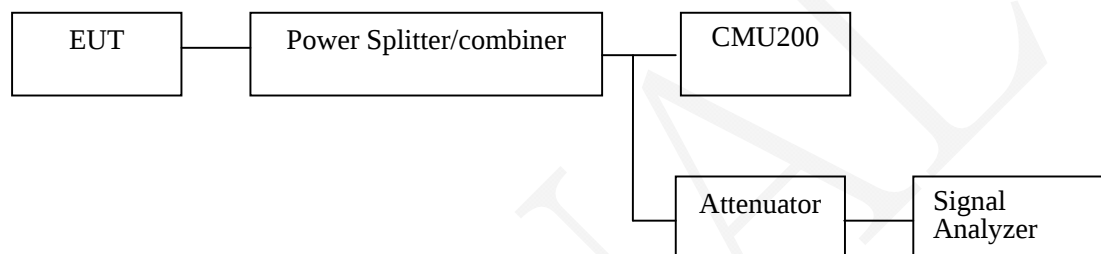
### Applicable Standards

FCC §2.1051, §27.53(c)(h).

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 100 kHz for below 1GHz; 1MHz for above 1GHz. Sufficient scans were taken to show any out of band emissions up to 10<sup>th</sup> harmonic.



### Test Equipment List and Details

| Manufacturer    | Description                          | Model       | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|--------------------------------------|-------------|---------------|------------------|----------------------|
| Rohde &Schwarz  | Signal Analyzer                      | FSIQ26      | 8386001028    | 2015-12-11       | 2016-12-11           |
| Rohde & Schwarz | Universal Radio Communication Tester | CMU200      | 106891        | 2015-11-23       | 2016-11-23           |
| Mini            | Splitter                             | ZFRSC-14-S+ | SF019411452   | 2016-07-11       | 2016-12-10           |
| BACL            | RF cable                             | KS-LAB-020  | KS-LAB-020    | 2016-07-11       | 2016-12-10           |
| Mini            | Attenuator                           | 10dB        | N/A           | 2016-07-11       | 2016-12-10           |

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

## Test Data

### Environmental Conditions

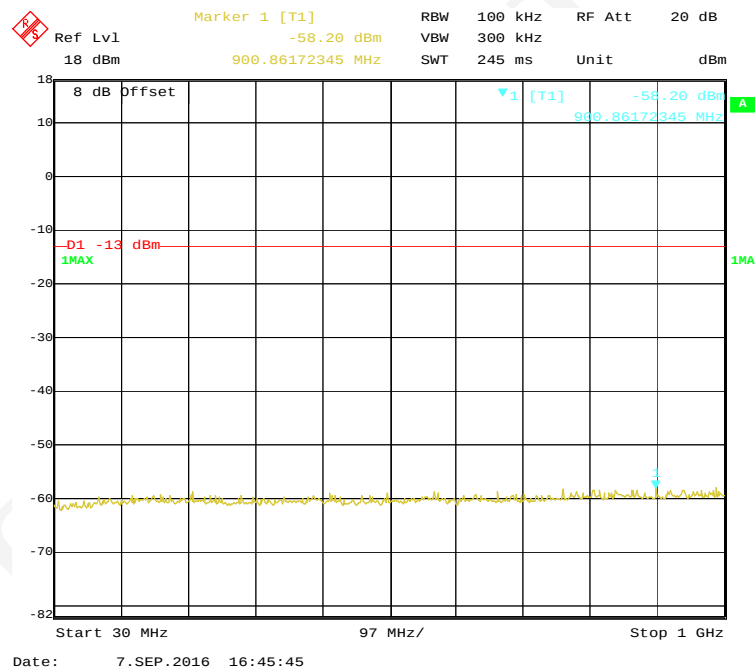
|                    |                |
|--------------------|----------------|
| Temperature:       | 20~23 °C       |
| Relative Humidity: | 48~50 %        |
| ATM Pressure:      | 100.5~101.0kPa |

The testing was performed by David. Hsu on 2016-09-07.

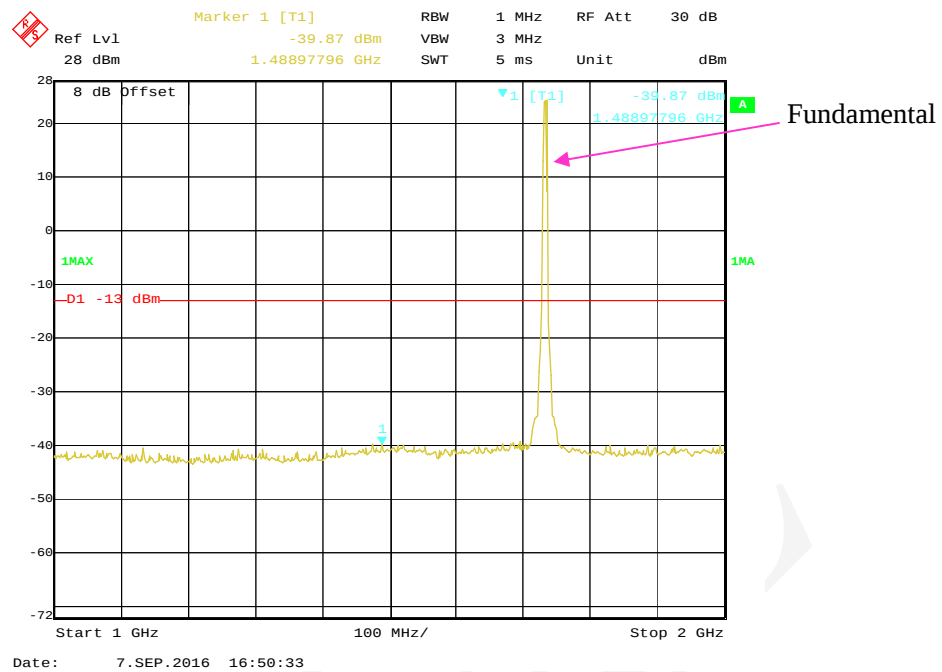
Please refer to the following plots.

### WCDMA Band IV

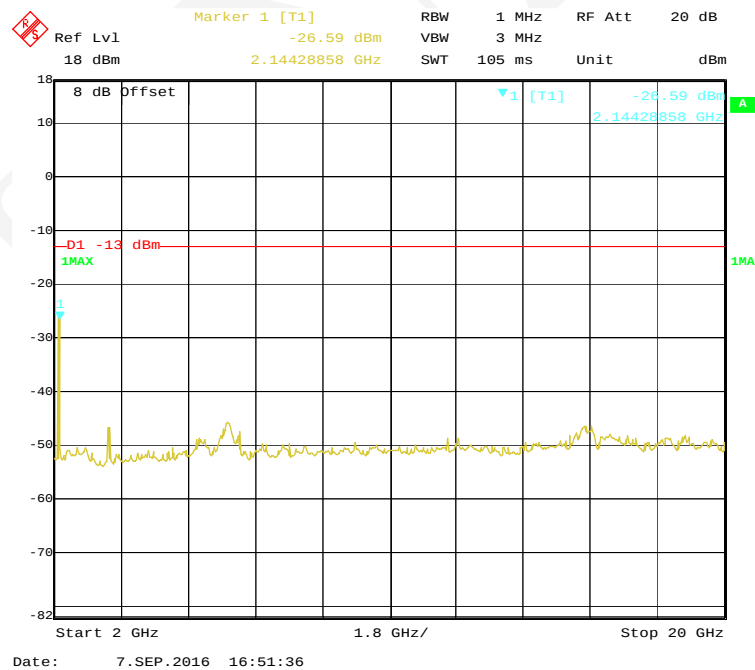
#### 30 MHz – 1 GHz



## 1 GHz – 2 GHz



## 2 GHz – 20 GHz



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**FCC § 2.1053; §27.53 (c) (h) SPURIOUS RADIATED EMISSIONS**

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**Applicable Standards**

FCC § 2.1053, § 27.53(c)(h)

For mobile digital stations, the attenuation factor shall be not less than  $40 + 10 \log (P)$  dB on all frequencies between the channel edge and 5 megahertz from the channel edge,  $43 + 10 \log (P)$  dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and  $55 + 10 \log (P)$  dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less than  $43 + 10 \log (P)$  dB on all frequencies between 2490.5 MHz and 2496 MHz and  $55 + 10 \log (P)$  dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

**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 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 =  $10 \lg (\text{TX pwr in Watts}/0.001)$  – the absolute level

Spurious attenuation limit in dB =  $43 + 10 \text{Log}_{10} (\text{power out in Watts})$

**Test Equipment List and Details**

| Manufacturer    | Description       | Model          | Serial Number  | Calibration Date | Calibration Interval |
|-----------------|-------------------|----------------|----------------|------------------|----------------------|
| Sonoma          | Amplifier         | 310N           | 130601         | 2016-07-02       | 2017-07-01           |
| Rohde & Schwarz | EMI Test Receiver | ESCI           | 100540         | 2016-07-25       | 2017-07-24           |
| Sunol Sciences  | Broadband Antenna | JB6            | A050115        | 2016-06-15       | 2017-06-14           |
| Sunol Sciences  | Broadband Antenna | JB3            | A090314-1      | 2015-11-07       | 2016-11-06           |
| Mini            | Amplifier         | ZVA-213-S+     | 460901516      | 2016-08-21       | 2017-08-21           |
| EMCO            | Horn Antenna      | 3115           | 9311-4158      | 2016-05-08       | 2017-05-07           |
| ETS             | Horn Antenna      | 3115           | 6431           | 2015-11-07       | 2016-11-06           |
| Rohde & Schwarz | Spectrum Analyzer | FSU 26         | 200268         | 2016-07-29       | 2017-08-28           |
| EMCO            | Turn Table        | 2081-1.21      | 9709-1885      | N.C.R            | N.C.R                |
| EMCO            | Antenna Tower     | 2075-2         | 9707-2060      | N.C.R            | N.C.R                |
| Controller      | EMCO              | 2090           | 9709-1256      | N.C.R            | N.C.R                |
| R&S             | Software          | EMC32          | V9.10.00       | NCR              | NCR                  |
| HP              | Signal Generator  | E4421B         | 3426A01336     | 2015-11-04       | 2016-11-03           |
| BACL            | RF cable          | KS - LAB - 012 | KS - LAB - 012 | 2015-12-16       | 2016-12-15           |
| BACL            | RF cable          | KS - LAB - 010 | KS - LAB - 010 | 2015-12-16       | 2016-12-15           |

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

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

|                           |          |
|---------------------------|----------|
| <b>Temperature:</b>       | 25 °C    |
| <b>Relative Humidity:</b> | 48 %     |
| <b>ATM Pressure:</b>      | 101.0kPa |

The testing was performed by David. Hsu on 2016-09-07.

Test mode: Transmitting

**For EC21-A**

Test mode: Transmitting (Pre-scan with Low, Middle, High channel, and the worse case data as below)

**30 MHz ~ 18 GHz:**

**WCDMA Band IV**

| Frequency<br>(MHz)           | Polar<br>(H/V) | Receiver<br>Reading<br>(dBμV) | Substituted Method     |                              |                    | Absolute<br>Level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|------------------------------|----------------|-------------------------------|------------------------|------------------------------|--------------------|----------------------------|----------------|----------------|
|                              |                |                               | S.G.<br>Level<br>(dBm) | Antenna<br>Gain<br>(dBd/dBi) | Cable Loss<br>(dB) |                            |                |                |
| Middle Channel: 1732.400 MHz |                |                               |                        |                              |                    |                            |                |                |
| 3464.80                      | H              | 61.40                         | -48.60                 | 13.90                        | 1.90               | -36.60                     | -13.00         | 23.60          |
| 3464.80                      | V              | 64.00                         | -46.00                 | 13.90                        | 1.90               | -34.00                     | -13.00         | 21.00          |
| 5197.20                      | H              | 62.00                         | -45.20                 | 14.00                        | 2.30               | -33.50                     | -13.00         | 20.50          |
| 5197.20                      | V              | 63.80                         | -43.40                 | 14.00                        | 2.30               | -31.70                     | -13.00         | 18.70          |
| 239.20                       | H              | 28.60                         | -69.60                 | 0.00                         | 0.50               | -70.10                     | -13.00         | 57.10          |
| 281.30                       | V              | 31.20                         | -67.00                 | 0.00                         | 0.50               | -67.50                     | -13.00         | 54.50          |

**For EC21-A MINIPICIE**

Test mode: Transmitting (Pre-scan with Low, Middle, High channel, and the worse case data as below)

**30 MHz ~ 18 GHz:**

**WCDMA Band IV**

| Frequency<br>(MHz)           | Polar<br>(H/V) | Receiver<br>Reading<br>(dBμV) | Substituted Method     |                              |                    | Absolute<br>Level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|------------------------------|----------------|-------------------------------|------------------------|------------------------------|--------------------|----------------------------|----------------|----------------|
|                              |                |                               | S.G.<br>Level<br>(dBm) | Antenna<br>Gain<br>(dBd/dBi) | Cable Loss<br>(dB) |                            |                |                |
| Middle Channel: 1732.400 MHz |                |                               |                        |                              |                    |                            |                |                |
| 3464.80                      | H              | 61.27                         | -48.73                 | 13.90                        | 1.90               | -36.73                     | -13.00         | 23.73          |
| 3464.80                      | V              | 63.51                         | -46.49                 | 13.90                        | 1.90               | -34.49                     | -13.00         | 21.49          |
| 5197.20                      | H              | 61.09                         | -46.11                 | 14.00                        | 2.30               | -34.41                     | -13.00         | 21.41          |
| 5197.20                      | V              | 64.68                         | -42.52                 | 14.00                        | 2.30               | -30.82                     | -13.00         | 17.82          |
| 239.20                       | H              | 27.64                         | -70.56                 | 0.00                         | 0.50               | -71.06                     | -13.00         | 58.06          |
| 281.30                       | V              | 31.53                         | -66.67                 | 0.00                         | 0.50               | -67.17                     | -13.00         | 54.17          |

## FCC §27.53 (c)(h) - BAND EDGES

### Applicable Standards

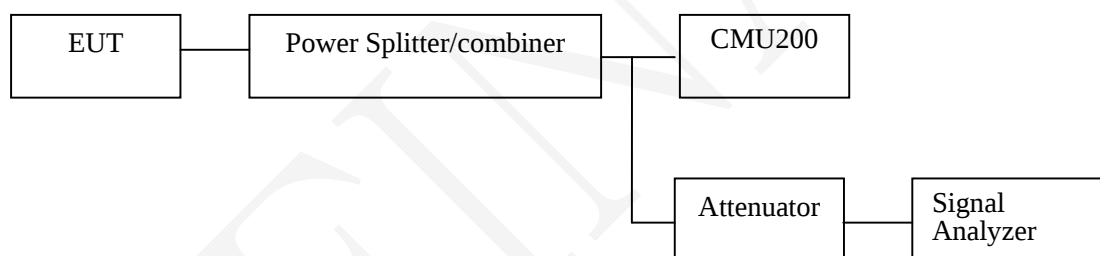
According to FCC §27.53 (c)(h), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

For mobile digital stations, the attenuation factor shall be not less than  $40 + 10 \log(P)$  dB on all frequencies between the channel edge and 5 megahertz from the channel edge,  $43 + 10 \log(P)$  dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and  $55 + 10 \log(P)$  dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less than  $43 + 10 \log(P)$  dB on all frequencies between 2490.5 MHz and 2496 MHz and  $55 + 10 \log(P)$  dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

### 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 Equipment List and Details**

| Manufacturer    | Description                          | Model       | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|--------------------------------------|-------------|---------------|------------------|----------------------|
| Rohde &Schwarz  | Signal Analyzer                      | FSIQ26      | 8386001028    | 2015-12-11       | 2016-12-11           |
| Rohde & Schwarz | Universal Radio Communication Tester | CMU200      | 106891        | 2015-11-23       | 2016-11-23           |
| Mini            | Splitter                             | ZFRSC-14-S+ | SF019411452   | 2016-07-11       | 2016-12-10           |
| BACL            | RF cable                             | KS-LAB-020  | KS-LAB-020    | 2016-07-11       | 2016-12-10           |
| Mini            | Attenuator                           | 10dB        | N/A           | 2016-07-11       | 2016-12-10           |

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

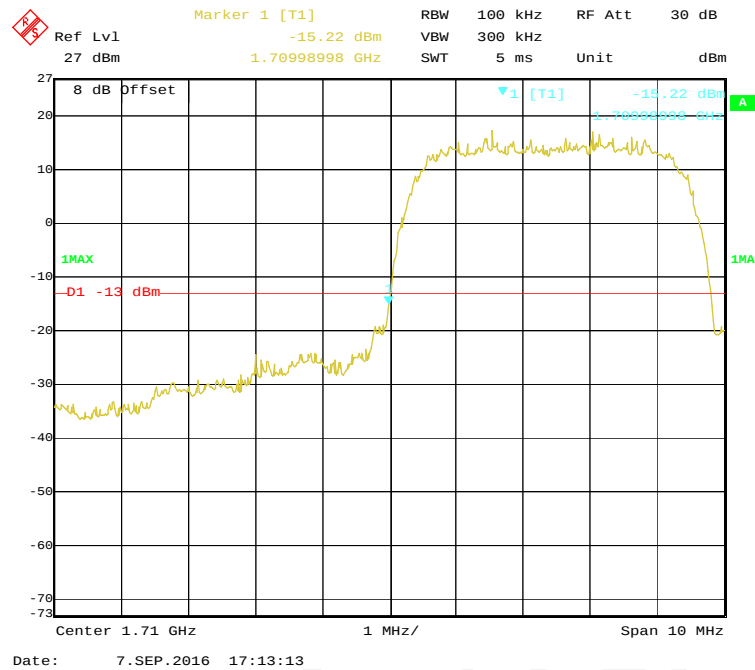
|                           |                |
|---------------------------|----------------|
| <b>Temperature:</b>       | 20~23 °C       |
| <b>Relative Humidity:</b> | 48~52 %        |
| <b>ATM Pressure:</b>      | 100.5~101.0kPa |

*The testing was performed by David. Hsu on 2016-09-07.*

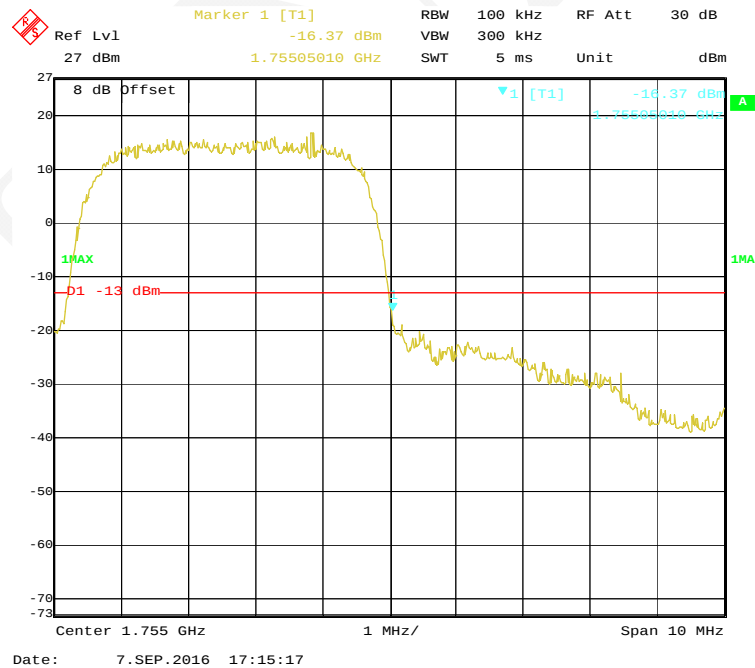
*EUT operation mode: Transmitting*

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

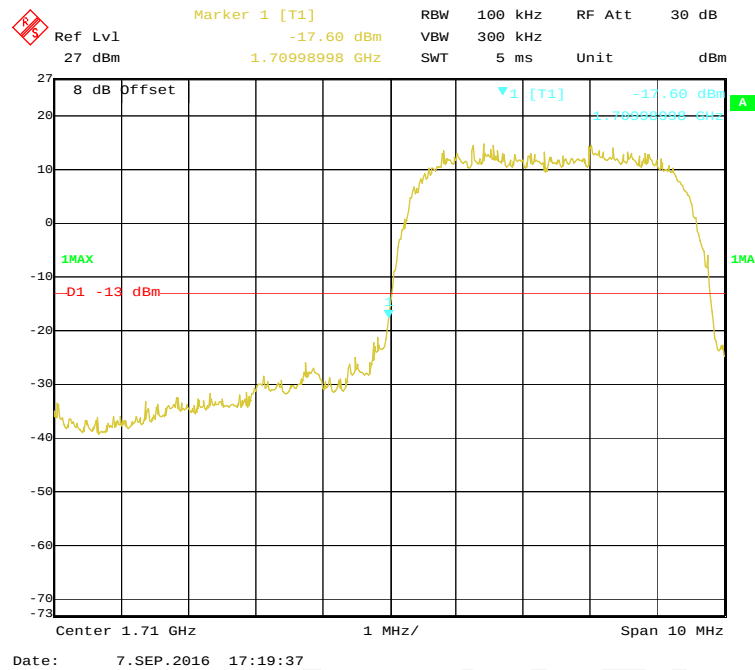
## Left Band Edge for Rel99 Mode



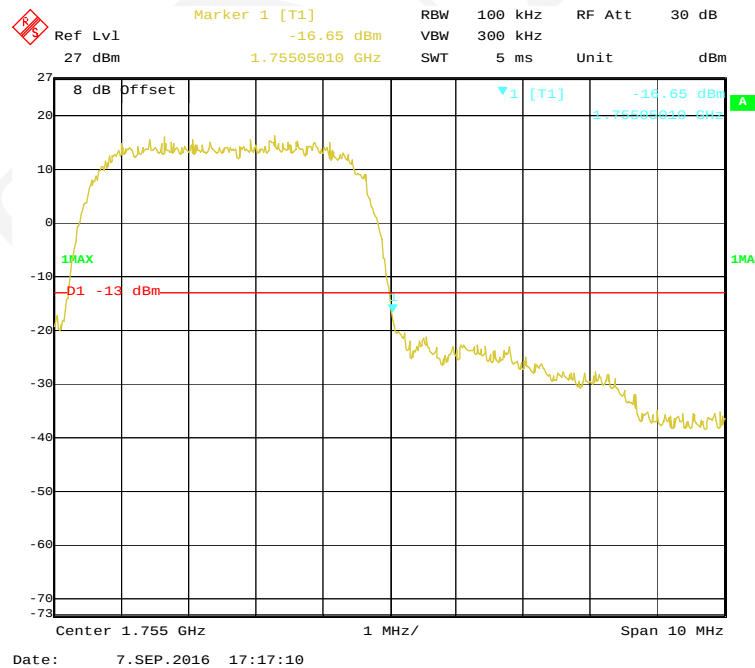
## Right Band Edge for Rel99 Mode



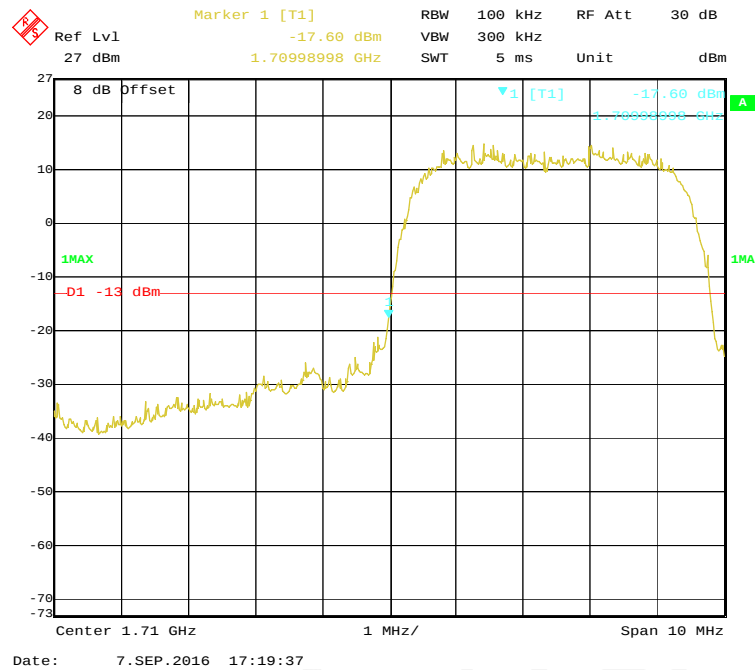
## Left Band Edge for HSDPA Mode



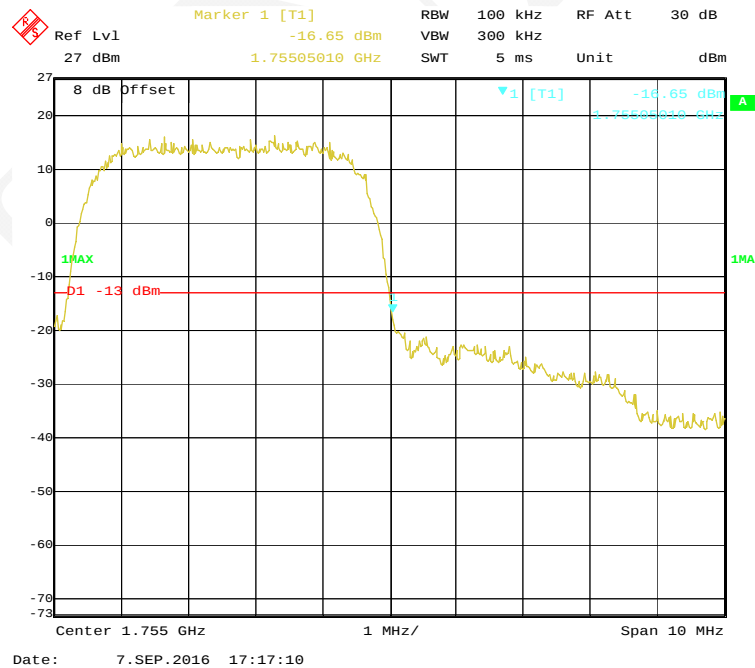
## Right Band Edge for HSDPA Mode



### Left Band Edge for HSUPA Mode



### Right Band Edge for HSUPA Mode



## **FCC § 2.1055; §27.54 - FREQUENCY STABILITY**

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### **Applicable Standards**

FCC § 2.1055 & §27.54.

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

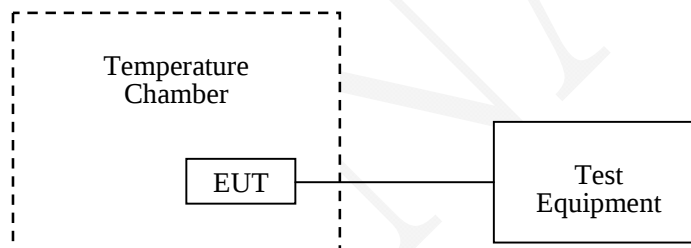
According to §27.54, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

### **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 Equipment List and Details**

| Manufacturer    | Description                          | Model       | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|--------------------------------------|-------------|---------------|------------------|----------------------|
| Rohde &Schwarz  | Signal Analyzer                      | FSIQ26      | 8386001028    | 2015-12-11       | 2016-12-11           |
| BACL            | Temperature Chamber                  | BTH - 150   | 30023         | 2015-11-12       | 2016-11-11           |
| Rohde & Schwarz | Universal Radio Communication Tester | CMU200      | 106891        | 2015-11-23       | 2016-11-23           |
| Mini            | Splitter                             | ZFRSC-14-S+ | SF019411452   | 2016-07-11       | 2016-12-10           |
| BACL            | RF cable                             | KS-LAB-020  | KS-LAB-020    | 2016-07-11       | 2016-12-10           |
| Mini            | attenuator                           | 10dB        | N/A           | 2016-07-11       | 2016-12-10           |

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

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

|                           |          |
|---------------------------|----------|
| <b>Temperature:</b>       | 23 °C    |
| <b>Relative Humidity:</b> | 50 %     |
| <b>ATM Pressure:</b>      | 101.0kPa |

*The testing was performed by David. Hsu on 2016-09-07.*

*EUT operation mode: Transmitting*

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

**WCDMA Band IV Rel99 Mode**

| Middle Channel, $f_o=1732.4\text{MHz}$ |                      |                      |                       |        |
|----------------------------------------|----------------------|----------------------|-----------------------|--------|
| Temperature (°C)                       | Power Supplied (VDC) | Frequency Error (Hz) | Frequency Error (ppm) | Result |
| -30                                    | 3.8                  | 7                    | 0.0040                | pass   |
| -20                                    |                      | 9                    | 0.0052                | pass   |
| -10                                    |                      | 7                    | 0.0040                | pass   |
| 0                                      |                      | 8                    | 0.0046                | pass   |
| 10                                     |                      | 7                    | 0.0040                | pass   |
| 20                                     |                      | 9                    | 0.0052                | pass   |
| 30                                     |                      | 13                   | 0.0075                | pass   |
| 40                                     |                      | 13                   | 0.0075                | pass   |
| 50                                     |                      | 11                   | 0.0063                | pass   |
| 25                                     | $V_{\min.}=3.5$      | 13                   | 0.0075                | pass   |
| 25                                     | $V_{\max.}=4.2$      | 11                   | 0.0063                | pass   |

**WCDMA Band IV HSDPA Mode**

| Middle Channel, $f_o=1732.4\text{MHz}$ |                      |                      |                       |        |
|----------------------------------------|----------------------|----------------------|-----------------------|--------|
| Temperature (°C)                       | Power Supplied (VDC) | Frequency Error (Hz) | Frequency Error (ppm) | Result |
| -30                                    | 3.8                  | 12                   | 0.0069                | pass   |
| -20                                    |                      | 11                   | 0.0063                | pass   |
| -10                                    |                      | 11                   | 0.0063                | pass   |
| 0                                      |                      | 14                   | 0.0081                | pass   |
| 10                                     |                      | 15                   | 0.0087                | pass   |
| 20                                     |                      | 6                    | 0.0035                | pass   |
| 30                                     |                      | 12                   | 0.0069                | pass   |
| 40                                     |                      | 8                    | 0.0046                | pass   |
| 50                                     |                      | 7                    | 0.0040                | pass   |
| 25                                     | $V_{\min.}=3.5$      | 13                   | 0.0075                | pass   |
| 25                                     | $V_{\max.}=4.2$      | 10                   | 0.0058                | pass   |

**WCDMA Band IV HSUPA Mode**

| Middle Channel, $f_o = 1732.4$ MHz |                      |                      |                       |        |
|------------------------------------|----------------------|----------------------|-----------------------|--------|
| Temperature (°C)                   | Power Supplied (VDC) | Frequency Error (Hz) | Frequency Error (ppm) | Result |
| -30                                | 3.8                  | 6                    | 0.0035                | pass   |
| -20                                |                      | 9                    | 0.0052                | pass   |
| -10                                |                      | 14                   | 0.0081                | pass   |
| 0                                  |                      | 12                   | 0.0069                | pass   |
| 10                                 |                      | 5                    | 0.0029                | pass   |
| 20                                 |                      | 10                   | 0.0058                | pass   |
| 30                                 |                      | 14                   | 0.0081                | pass   |
| 40                                 |                      | 7                    | 0.0040                | pass   |
| 50                                 |                      | 12                   | 0.0069                | pass   |
| 25                                 | $V_{min.} = 3.5$     | 14                   | 0.0081                | pass   |
| 25                                 | $V_{max.} = 4.2$     | 11                   | 0.0063                | pass   |

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