

|                           |                                   |
|---------------------------|-----------------------------------|
| Product Name: LTE Module  | Report No: FCC022022-05502RF12(b) |
| Product Model: TOBY-L3414 | Security Classification: Open     |
| Version: V1.0             | Total Page: 52                    |

## Testing Report

| Prepared By: | Checked By: | Approved By: |  |
|--------------|-------------|--------------|--|
| Stone Tang   | Randy Lv    | Daniel Chen  |  |
| Stone Tang   | Randy Lv    | Daniel Chen  |  |

# FCC Radio Test Report

**FCC ID: 2A3Z6TOBYL3414**

**According to**

**47 CFR FCC Part 24E**

**47 CFR FCC Part 27**

**47 CFR FCC Part 2**

**ANSI C63.26**

Equipment : LTE Module  
Model No. : TOBY-L3414  
Trademark : TASHANG  
Product No. : 20220820018527  
Applicant : Tashang Semiconductor(Shanghai) Co., Ltd.  
Room 818, Building 4, No.89, Sanshahong Road, Chengqiao Town,  
Chongming District, Shanghai

- The test result referred exclusively to the presented test model /sample.
- Without written approval of TIRT Inc. the test report shall not reproduced except in full.
- Date of Receipt: 2022.09.05
- Date of Test: 2022.09.06-2022.09.30
- Issued Date: 2022.11.03

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## History of this test report

| Report Version | Description     | Issued Date   |
|----------------|-----------------|---------------|
| R00            | Original Issue. | Oct. 20, 2022 |
| R01            | Revised issue   | Nov. 03, 2022 |
|                |                 |               |
|                |                 |               |

## 1. GENERAL SUMMARY

Equipment : LTE Module  
Brand Name : TASHANG  
Test Model : TOBY-L3414  
Series Model : /  
Applicant : Tashang Semiconductor(Shanghai) Co., Ltd.  
Address : Room 818, Building 4, No.89, Sanshahong Road, Chengqiao Town,  
Chongming District, Shanghai  
Manufacturer : Tashang Semiconductor(Shanghai) Co., Ltd.  
Address : Room 818, Building 4, No.89, Sanshahong Road, Chengqiao Town,  
Chongming District, Shanghai  
Standard(s) : 47 CFR FCC Part 24 Subpart E  
47 CFR FCC Part 27  
47 CFR FCC Part 2  
ANSI C63.26:2015  
FCC KDB 971168 D01 Power Meas License Digital Systems v03r01

The above equipment has been tested and found compliance with the requirement of the relative standards by TIRT Inc.

## 2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

| FCC Rules                            | Description of Test                                                    | Result    |
|--------------------------------------|------------------------------------------------------------------------|-----------|
| Section 15.207                       | N/A                                                                    | N/A       |
| § 2.1046;<br>§ 24.232;<br>§ 27.50(d) | RF Output Power                                                        | Compliant |
| § 2.1049;                            | 99% & -26 dB Occupied Bandwidth                                        | Compliant |
| § 2.1051;<br>§ 24.238;<br>§ 27.53(h) | Spurious Emissions at Antenna Terminal                                 | Compliant |
| § 2.1053;<br>§ 24.238;<br>§ 27.53(h) | Field Strength of Spurious Radiation                                   | Compliant |
| § 2.1051;<br>§ 24.238;<br>§ 27.53(h) | Out of band emission, Band Edge                                        | Compliant |
| § 2.1055<br>§ 24.235<br>§ 27.54      | Frequency stability vs. temperature<br>Frequency stability vs. voltage | Compliant |
| § 2.1046;<br>§ 24.232;<br>§ 27.50(d) | Peak to average ratio                                                  | Compliant |

## 2.1 TEST FACILITY

|                                         |                                                                                                                    |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Company:                                | Beijing TIRT Technology Service Co.,Ltd Shenzhen                                                                   |
| Address:                                | 101, 3 # Factory Building, Gongjin Electronics Shatin Community, Kengzi Street, Pingshan District, Shenzhen, China |
| CNAS Registration Number:               | CNAS L14158                                                                                                        |
| A2LA Registration Number:               | 6049.01                                                                                                            |
| FCC Accredited Lab. Designation Number: | CN1309                                                                                                             |
| FCC Test Firm Registration Number:      | 825524                                                                                                             |
| Telephone:                              | +86-0755-27087573                                                                                                  |

## 2.2 MEASUREMENT UNCERTAINTY

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

The TIRT measurement uncertainty as below table:

| Uncertainty                                 |                           |
|---------------------------------------------|---------------------------|
| Parameter                                   | Uncertainty               |
| Occupied Channel Bandwidth                  | $\pm 142.12\text{kHz}$    |
| RF power conducted                          | $\pm 0.74\text{dB}$       |
| RF power radiated                           | $\pm 3.25\text{dB}$       |
| Spurious emissions, conducted               | $\pm 1.78\text{dB}$       |
| Spurious emissions, radiated (30MHz ~ 1GHz) | $\pm 4.6\text{dB}$        |
| Spurious emissions, radiated (1GHz ~ 18GHz) | $\pm 4.9\text{dB}$        |
| Conduction Emissions(150kHz~30MHz)          | $\pm 3.1\text{dB}$        |
| Humidity                                    | $\pm 4.6\%$               |
| Temperature                                 | $\pm 0.7^{\circ}\text{C}$ |
| Time                                        | $\pm 1.25\%$              |

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

### 3. GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

|                       |                                                 |          |
|-----------------------|-------------------------------------------------|----------|
| Equipment             | LTE Module                                      |          |
| Brand Name            | TASHANG                                         |          |
| Test Model            | TOBY-L3414                                      |          |
| Series Model          | /                                               |          |
| Model Difference(s)   | /                                               |          |
| Software Version      | M31.04.11.01.01                                 |          |
| Hardware Version      | V1.0                                            |          |
| Antenna Type          | External Antenna                                |          |
| Antenna Gain          | WCDMA BAND2                                     | 0.43 dBi |
|                       | WCDMA BAND4                                     | 3.05 dBi |
| Modulation Type       | QPSK, 16QAM                                     |          |
| Operation Frequency   | WCDMA BAND2: 1850-1910MHz(TX); 1930-1990MHz(RX) |          |
|                       | WCDMA BAND4: 1710-1755MHz(TX); 2110-2155MHz(RX) |          |
| Max. EIRP Power       | WCDMA BAND2: 23.46 dBm                          |          |
|                       | WCDMA BAND4: 27.06 dBm                          |          |
| Normal Test Voltage   | 3.8Vdc                                          |          |
| Extreme Test Voltage  | 3.3 to 4.2Vdc                                   |          |
| Operating Temperature | -40 °C to 85 °C                                 |          |

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

### 3.2 DESCRIPTION OF TEST MODES AND TEST CONDITION

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

The worst case was found when positioned on X-plane for EIRP and X-axis for radiated emission.

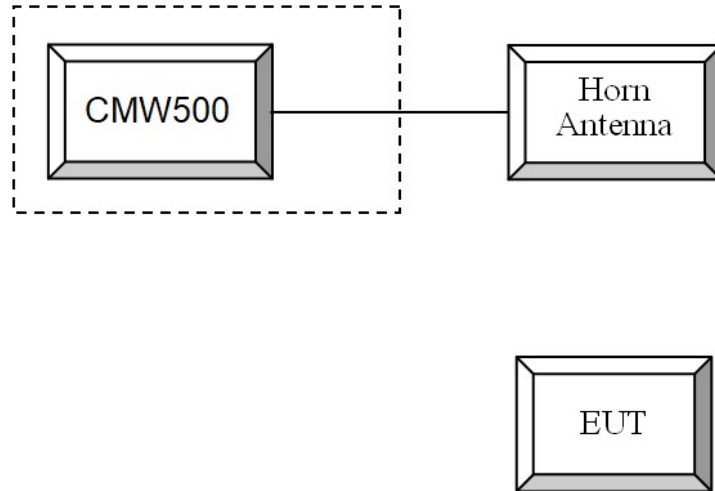
Following channel(s) was (were) selected for the final test as listed below:

| Test Item             | Test Channel                                                   | Test Mode          |
|-----------------------|----------------------------------------------------------------|--------------------|
| EIRP                  | WCDMA BAND2: 9262, 9400, 9538<br>WCDMA BAND4: 1312, 1413, 1513 | RMC, HSDPA+, HSUPA |
| RF Output Power       | WCDMA BAND2: 9262, 9400, 9538<br>WCDMA BAND4: 1312, 1413, 1513 | RMC, HSDPA+, HSUPA |
| Conducted Emission    | WCDMA BAND2: 9262, 9400, 9538<br>WCDMA BAND4: 1312, 1413, 1513 | RMC, HSDPA+, HSUPA |
| Radiated Emission     | WCDMA BAND2: 9262, 9400, 9538<br>WCDMA BAND4: 1312, 1413, 1513 | RMC, HSDPA+, HSUPA |
| Band Edge             | WCDMA BAND2: 9262, 9538<br>WCDMA BAND4: 1312, 1513             | RMC, HSDPA+, HSUPA |
| Peak to Average Ratio | WCDMA BAND2: 9262, 9400, 9538<br>WCDMA BAND4: 1312, 1413, 1513 | RMC, HSDPA+, HSUPA |
| Frequency Stability   | WCDMA BAND2: 9262, 9400, 9538<br>WCDMA BAND4: 1312, 1413, 1513 | RMC, HSDPA+, HSUPA |

### 3.3 EUT TEST CONDITIONS

| Test Item             | Temperature        | Humidity           | Test Voltage       | Tested By  |
|-----------------------|--------------------|--------------------|--------------------|------------|
| EIRP                  | 24.2°C             | 56%                | 3.8V DC            | Stone Tang |
| RF Output Power       | 24.6°C             | 55%                | 3.8V DC            | Stone Tang |
| Occupied Bandwidth    | 24.6°C             | 55%                | 3.8V DC            | Stone Tang |
| Conducted Emission    | 24.6°C             | 55%                | 3.8V DC            | Stone Tang |
| Radiated Emission     | 24.2°C             | 55%                | 3.8V DC            | Stone Tang |
| Band Edge             | 24.2°C             | 55%                | 3.8V DC            | Stone Tang |
| Peak to Average Ratio | 24.6°C             | 55%                | 3.8V DC            | Stone Tang |
| Frequency Stability   | Normal and Extreme | Normal and Extreme | Normal and Extreme | Stone Tang |

### 3.4 BLOCK DIGRAM SHOWING THE CONFIGURATIONOFSYSTEMTESTED



### 3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| Item | Equipment                           | Mfr/Brand       | Model/Type No. | Series No.          |
|------|-------------------------------------|-----------------|----------------|---------------------|
| 1    | Wideband Radio Communication Tester | Rohde & Schwarz | CMW500         | 1201.0002K50-116064 |

## 4. TEST RESULT

### 4.1 RFOUTPUT POWER MEASUREMENT

#### 4.1.1 DESCRIPTION OF TESTS

##### **Conducted Output Power:**

Measurement Procedure: FCC KDB 971168 D01 V03r01

The transmitter output was connected to a calibrated coaxial cable, attenuator and power meter, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The power output at the transmitter antenna port was determined by adding the value of the cable insertion loss to the power reading. The tests were performed at three frequencies (low channel, middle channel and high channel) and on the highest power levels, which can be setup on the transmitters. Description of Tests

##### **Effective (Isotropic) Radiated Power of Transmitter**

Measurement Procedure: FCC KDB 971168 D01 V03r01 ; ANSI/ C63.10

The measurements procedures specified in ANSI/TIA-603-E-2016 were applied.

In an anechoic antenna test chamber, a half-wave dipole antenna for the frequency band of interest is placed at the reference centre of the chamber. An RF Signal source for the frequency band of interest is connected to the dipole with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A known (measured) power ( $P_{in}$ ) is applied to the input of the dipole, and the power received ( $P_r$ ) at the chamber's probe antenna is recorded.

The relevant equation for determining the ERP or EIRP from the conducted RF output power measured using the guidance provided above is:

$$ERP/EIRP = SGLevel - P_{cl} + G_a$$

where:

ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as SGLevel, typically dBW or dBm);

SGLevel = Signal generator output power or PSD, in dBm or dBW;

$G_a$  = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

$P_{cl}$  = signal attenuation in the connecting cable between the transmitter and antenna.

The EUT is substituted for the dipole at the reference centre of the chamber and a scan is performed to obtain the radiation pattern.

From the radiation pattern, the co-ordinates where the maximum antenna gain occurs are identified.

The EUT is then put into continuously transmitting mode at its maximum power level. Power mode measurements are performed with the receiving antenna placed at the coordinates determined in Step 3 to determine the output power as defined in Rule 24.232 (b) and (c). The "reference path loss" from Step1 is added to this result.

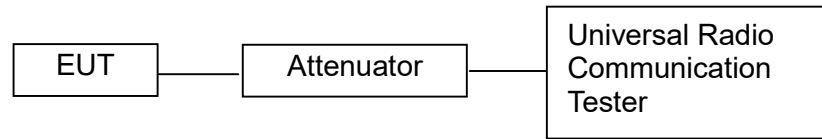
This value is EIRP since the measurement is calibrated using a half-wave dipole antenna of known gain (2.15 dBi) and known input power ( $P_{in}$ ).

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

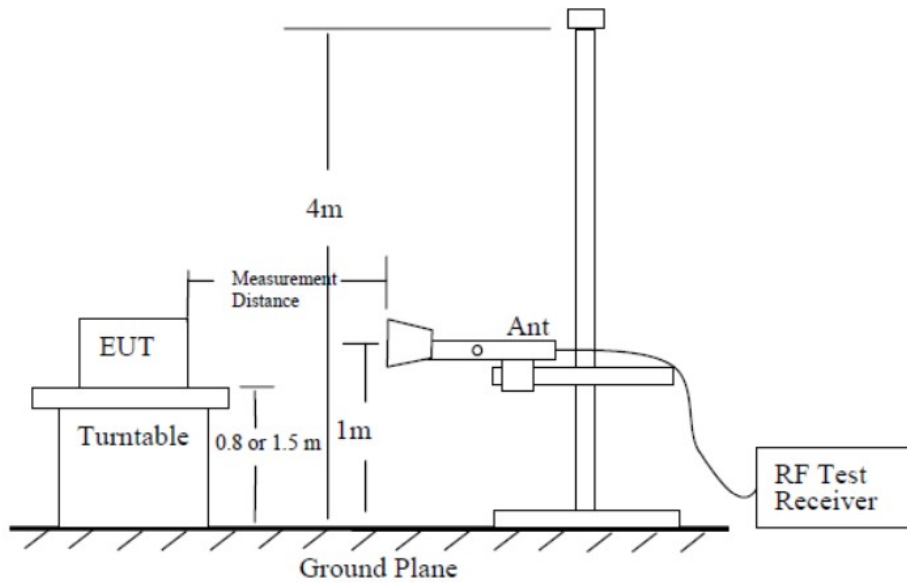
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

#### 4.1.2 TEST SETUP LAYOUT

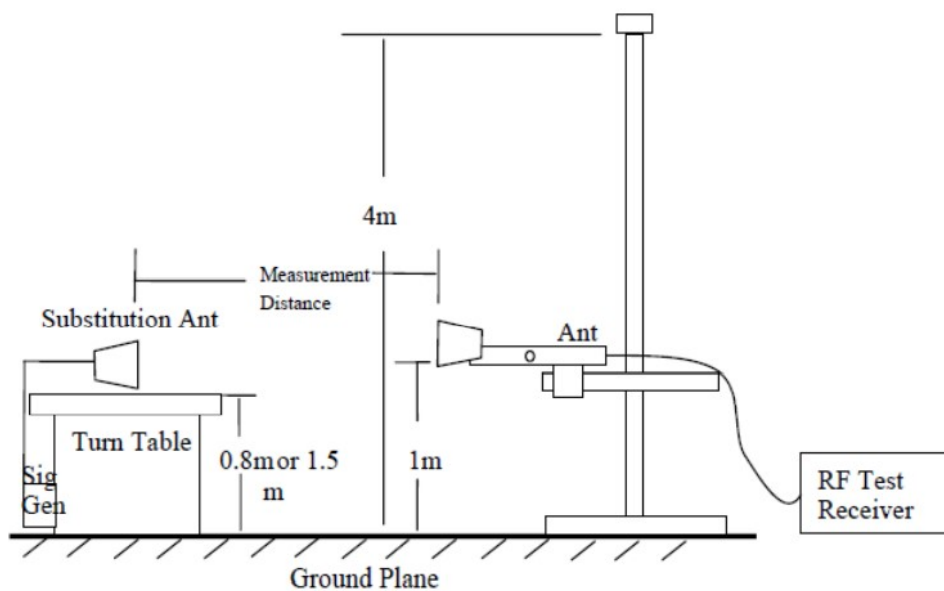
Conducted method:



Radiated method:



Test site-up for radiated ERP and/or EIRP measurements



Substitution method set-up for radiated emission

#### **4.1.3 TEST DEVIATION**

No deviation

#### **4.1.4 TEST RESULTS**

Please refer to the Appendix A.

## **4.2 OCCUPIED BANDWIDTH MEASUREMENT**

### **4.2.1 DESCRIPTION OF TESTS**

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 4.2

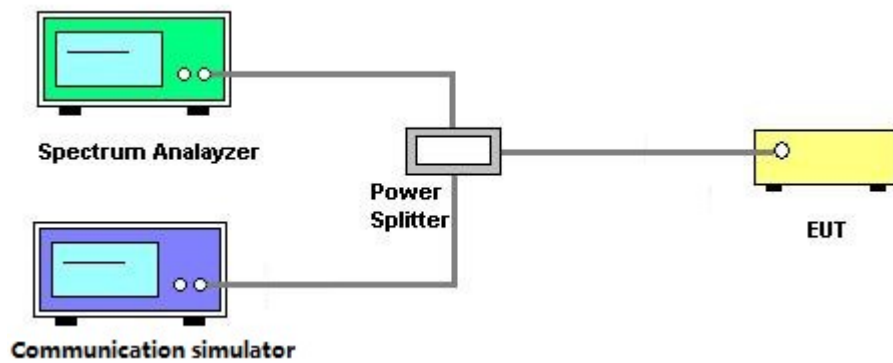
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyser, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at three frequencies (low channel, middle channel and high channel). The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1 percent of the selected span as is possible without being below 1 percent. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual. The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 percent of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth and 26dB bandwidth.

99% occupied bandwidth&-26dB occupied bandwidth test:

1. Set the resolution bandwidth (RBW) = 10 kHz.
2. Set the video bandwidth (VBW) = 30 kHz.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.

#### 4.2.2 TEST SETUP LAYOUT



#### 4.2.3 TEST DEVIATION

No deviation

#### 4.2.4 TEST RESULTS

Please refer to the Appendix B.

### 4.3 CONDUCTED EMISSIONS MEASUREMENT

#### 4.3.1 DESCRIPTION OF TESTS

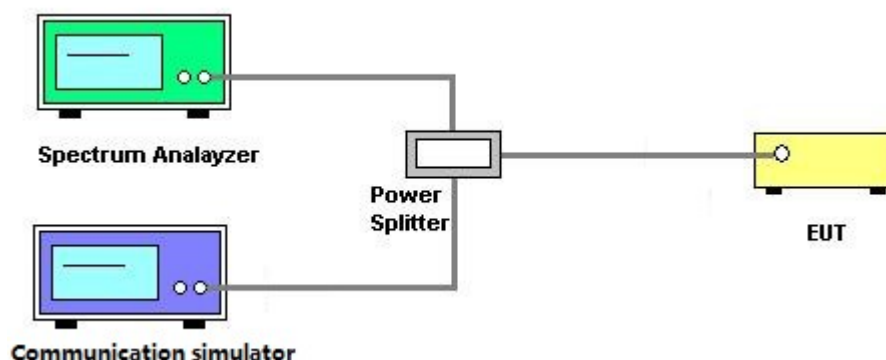
Measurement Procedure: FCC KDB 971168 D01 V03r01

The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyzer, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at three frequencies (low channel and high channel). The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

#### 4.3.2 TEST PROCEDURES

1. The testing follows FCC KDB 971168 v03r01 Section 6.0.
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The band edges of low and high channels for the highest RF powers were measured. Set  $RBW \geq 1\%$  EBW in the 1MHz band immediately outside and adjacent to the band edge.
4. Set spectrum analyzer with RMS detector.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

#### 4.3.3 TEST SETUP LAYOUT



#### 4.3.4 TEST DEVIATION

No deviation

#### 4.3.5 TEST RESULTS

Please refer to the Appendix C.

#### **4.4 RADIATED EMISSIONS MEASUREMENT**

##### **4.4.1 LIMIT**

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

##### **4.4.2 TEST PROCEDURES**

1. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
2. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value " of step a. Record the power level of S.G
3. The bandwidth of test receiver is set at 9kHz in below 30MHz. and set at 120kHz in 30-1000MHz, and 1MHz in above 1000MHz.

The frequency range from 9kHz to 20GHz is checked.

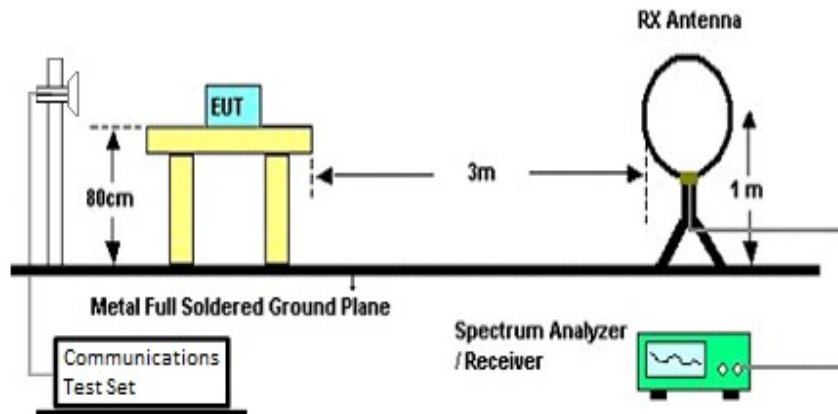
The final measurement in band 9-90kHz, 110-490kHz and above 1000MHz is performed with Average detector. Except those frequency bands mention above, the final measurement for frequencies below 1000MHz is performed with Quasi Peak detector.

Spurious emissions in dB =  $10 \lg(\text{TXpwr in Watts}/0.001)$  – the absolute level

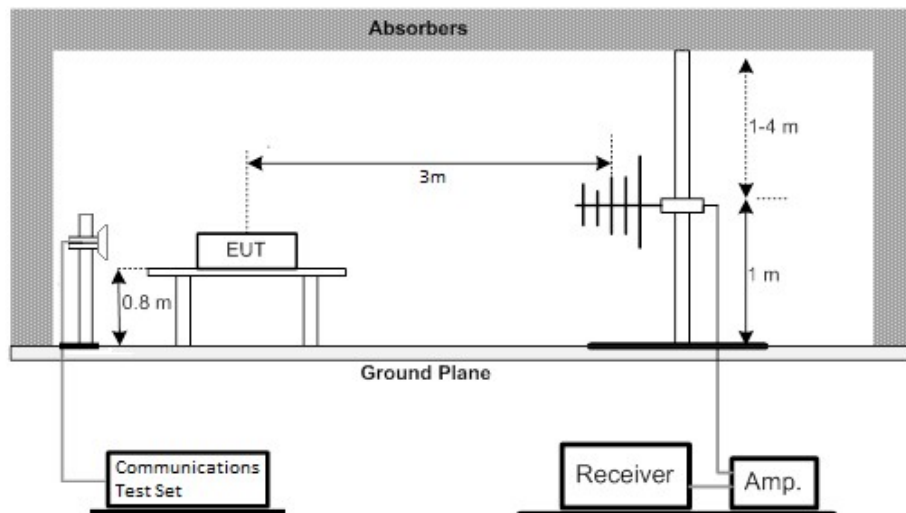
Spurious attenuation limit in dB =  $43 + 10 \log(P)$  (power out in Watts)

### 4.4.3 TEST SETUP LAYOUT

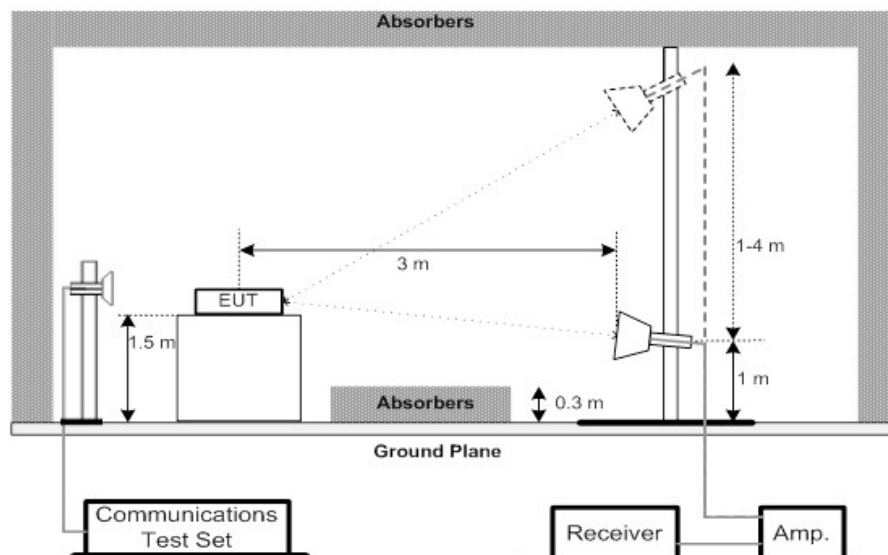
#### Below 30MHz



#### 30MHz to 1GHz



#### Above 1GHz



#### **4.4.4 TEST DEVIATION**

No deviation

#### **4.4.5 TEST RESULTS**

Please refer to the Appendix D, E, F.

## 4.5 BAND EDGE MEASUREMENT

### 4.5.1 DESCRIPTION OF TESTS

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 6.0

The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyser, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at three frequencies (low channel and high channel). in the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of 100kHz or 1% of the emission bandwidth of the fundamental emission of the transmitter may be employed. The EUT emission bandwidth is measured as the width of the signal between two points, outside of which all emission are attenuated at least 26dB below the transmitter power. The video bandwidth of the spectrum analyzer was set at thrice the resolution bandwidth. Detector Mode was set to peak or peak hold power.

### 4.5.2 TEST PROCEDURES

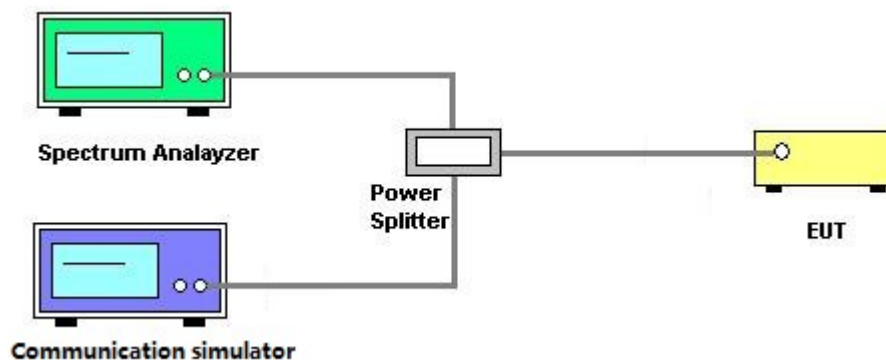
All measurements were done at low and high operational frequency range.

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

#### Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3.  $RBW \geq 1\%$  of the emission bandwidth
4.  $VBW \geq 3 \times RBW$
5. Detector = RMS
6. Number of sweep points  $\geq 2 \times \text{Span}/RBW$
7. Trace mode = trace average for continuous emissions, max hold for pulse emissions
8. Sweep time = auto couple
9. The trace was allowed to stabilize

### 4.5.3 TEST SETUP LAYOUT



### 4.5.4 TEST DEVIATION

No deviation

#### **4.5.5 TEST RESULTS**

Please refer to the Appendix G.

## 4.6 PEAK TO AVERAGE RATIO MEASUREMENT

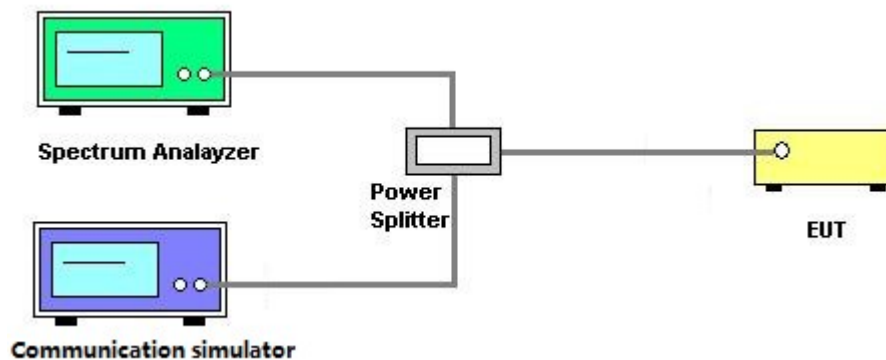
### 4.6.1 LIMIT

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

### 4.6.2 TEST PROCEDURES

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

### 4.6.3 TEST SETUP LAYOUT



### 4.6.4 TEST DEVIATION

No deviation

### 4.6.5 TEST RESULTS

Please refer to the Appendix H.

## 4.7 FREQUENCY STABILITY MEASUREMENT

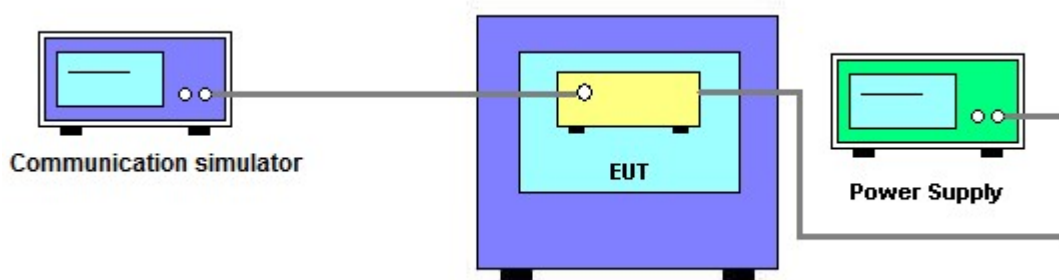
### 4.7.1 LIMIT

$\pm 1.5$  ppm is for base and fixed station.  $\pm 2.5$  ppm is for mobile station.

### 4.7.2 TEST PROCEDURES

1. Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
2. EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
3. The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the  $\pm 0.5^{\circ}\text{C}$  during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.
4. The frequency error was recorded frequency error from the communication simulator.

### 4.7.3 TEST SETUP LAYOUT



### 4.7.4 TEST DEVIATION

No deviation

### 4.7.5 TEST RESULTS

Please refer to the Appendix I.

## 5. LIST OF MEASUREMENT EQUIPMENTS

| Radiated Emission Measurement(9kHz-30MHz) |                                     |                 |                    |                     |                 |                  |
|-------------------------------------------|-------------------------------------|-----------------|--------------------|---------------------|-----------------|------------------|
| Item                                      | Kind of Equipment                   | Manufacturer    | Type No.           | Serial No.          | Calibrated date | Calibrated until |
| 1                                         | Loop Antenna                        | SCHWARZBECK     | FMZB1519B          | 00029               | 2021/11/10      | 2022/11/09       |
| 2                                         | EMI Test Receiver                   | Rohde&Schwarz   | ESR7               | 102013              | 2021/11/10      | 2022/11/09       |
| 3                                         | ECSI RF IN RF Cable                 | Rohde&Schwarz   | AP-X1              | \                   | 2021/11/10      | 2022/11/09       |
| 4                                         | Measurement Software                | Farad           | EZ-EMC Ver.TW-03A2 | N/A                 | N/A             | N/A              |
| 5                                         | Wideband Radio Communication Tester | Rohde & Schwarz | CMW500             | 1201.0002K50-116064 | 2021/11/03      | 2022/11/02       |

| Radiated Emission Measurement(30MHz-1GHz) |                                     |                 |                    |                     |                 |                  |
|-------------------------------------------|-------------------------------------|-----------------|--------------------|---------------------|-----------------|------------------|
| Item                                      | Kind of Equipment                   | Manufacturer    | Type No.           | Serial No.          | Calibrated date | Calibrated until |
| 1                                         | Integral Antenna                    | Schwarzbeck     | VULB 9163          | VULB 9163-361       | 2021/11/10      | 2022/11/09       |
| 2                                         | EMI Test Receiver                   | Rohde&Schwarz   | ESR7               | 102013              | 2021/11/10      | 2022/11/09       |
| 3                                         | Preamplifier                        | CD Systems Inc  | PAP-03036-30       | 85060000            | 2021/11/10      | 2022/11/09       |
| 4                                         | ECSI RF IN RF Cable                 | Rohde&Schwarz   | AP-X1              | \                   | 2021/11/10      | 2022/11/09       |
| 5                                         | Measurement Software                | Farad           | EZ-EMC Ver.TW-03A2 | N/A                 | N/A             | N/A              |
| 6                                         | Wideband Radio Communication Tester | Rohde & Schwarz | CMW500             | 1201.0002K50-116064 | 2021/11/03      | 2022/11/02       |

| Radiated Emission Measurement(Above 1GHz) |                                     |                 |                    |                     |                 |                  |
|-------------------------------------------|-------------------------------------|-----------------|--------------------|---------------------|-----------------|------------------|
| Item                                      | Kind of Equipment                   | Manufacturer    | Type No.           | Serial No.          | Calibrated date | Calibrated until |
| 1                                         | Preamplifier                        | emci            | EMC012645SE        | 980417              | 2021/11/10      | 2022/11/09       |
| 2                                         | Preamplifier                        | Schwarzbeck     | BBV9721            | 9721-019            | 2021/11/10      | 2022/11/09       |
| 3                                         | Horn Antenna                        | Schwarzbeck     | BBHA 9170          | 9170#685            | 2021/11/10      | 2022/11/09       |
| 4                                         | Integral Antenna                    | Schwarzbeck     | BBHA 9120D         | BBHA 9120D 1201     | 2021/11/10      | 2022/11/09       |
| 5                                         | Spectrum analyzer                   | Agilent         | N9010A             | MY52221119          | 2021/11/10      | 2022/11/09       |
| 6                                         | Measurement Software                | Farad           | EZ-EMC Ver.TW-03A2 | N/A                 | N/A             | N/A              |
| 7                                         | ECSI RF IN RF Cable                 | Rohde&Schwarz   | AP-X1              | \                   | 2021/11/10      | 2022/11/09       |
| 8                                         | Wideband Radio Communication Tester | Rohde & Schwarz | CMW500             | 1201.0002K50-116064 | 2021/11/03      | 2022/11/02       |

| Conducted Emission & Band Edge & Occupied Bandwidth Measurement |                                     |                 |          |                     |                 |                  |
|-----------------------------------------------------------------|-------------------------------------|-----------------|----------|---------------------|-----------------|------------------|
|                                                                 | Kind of Equipment                   | Manufacturer    | Type No. | Serial No.          | Calibrated date | Calibrated until |
| 1                                                               | Wideband Radio Communication Tester | Rohde & Schwarz | CMW500   | 1201.0002K50-116064 | 2021/11/03      | 2022/11/02       |
| 2                                                               | Spectrum Analyzer                   | KEYSIGHT        | N9020B   | MY57463781          | 2021/11/10      | 2022/11/09       |

| Frequency Stability Measurement |                                     |                 |             |                     |                 |                  |
|---------------------------------|-------------------------------------|-----------------|-------------|---------------------|-----------------|------------------|
|                                 | Kind of Equipment                   | Manufacturer    | Type No.    | Serial No.          | Calibrated date | Calibrated until |
| 1                               | Wideband Radio Communication Tester | Rohde & Schwarz | CMW500      | 1201.0002K50-116064 | 2021/11/03      | 2022/11/02       |
| 2                               | Spectrum Analyzer                   | KEYSIGHT        | N9020B      | MY57463781          | 2021/11/10      | 2022/11/09       |
| 3                               | Temp&Humidity Chamber               | ETMOA           | NTH1100-30A | 16080628            | 2021/11/10      | 2022/11/09       |

Remark: "N/A" denotes no model name, serial no. or calibration specified.

## APPENDIX A - OUTPUT POWER

### TEST DATA:

| WCDMA Band2      | Max. Tune-up Power | Conducted power |         |           | EIRP      |         |           |
|------------------|--------------------|-----------------|---------|-----------|-----------|---------|-----------|
| Tx Channel       |                    | 9262            | 9400    | 9538      | 9262      | 9400    | 9538      |
| Frequency        |                    | 1852.4MHZ       | 1880MHz | 1907.6MHz | 1852.4MHZ | 1880MHz | 1907.6MHz |
| RMC 12.2K        | 24+1/-3            | 22. 58          | 23. 03  | 22. 95    | 23. 01    | 23. 46  | 23. 38    |
| RMC 64K          | 24+1/-3            | 22. 63          | 22. 98  | 22. 96    | 23. 06    | 23. 41  | 23. 39    |
| RMC 144K         | 24+1/-3            | 22. 62          | 22. 97  | 22. 93    | 23. 05    | 23. 40  | 23. 36    |
| RMC 384K         | 24+1/-3            | 22. 63          | 22. 96  | 22. 98    | 23. 06    | 23. 39  | 23. 41    |
| HSDPA+ Subtest-1 | 24+1/-3            | 22. 30          | 22. 28  | 22. 32    | 22. 73    | 22. 71  | 22. 75    |
| HSDPA+ Subtest-2 | 24+1/-3            | 22. 30          | 22. 31  | 22. 33    | 22. 73    | 22. 74  | 22. 76    |
| HSDPA+ Subtest-3 | 24+1/-3            | 21. 84          | 21. 83  | 21. 90    | 22. 27    | 22. 26  | 22. 33    |
| HSDPA+ Subtest-4 | 24+1/-3            | 21. 83          | 21. 82  | 21. 91    | 22. 26    | 22. 25  | 22. 34    |
| HSUPA Subtest-1  | 24+1/-3            | 22. 21          | 22. 25  | 22. 23    | 22. 64    | 22. 68  | 22. 66    |
| HSUPA Subtest-2  | 24+1/-3            | 21. 74          | 21. 71  | 21. 73    | 22. 17    | 22. 14  | 22. 16    |
| HSUPA Subtest-3  | 24+1/-3            | 22. 41          | 22. 34  | 22. 32    | 22. 84    | 22. 77  | 22. 75    |
| HSUPA Subtest-4  | 24+1/-3            | 22. 23          | 22. 30  | 22. 33    | 22. 66    | 22. 73  | 22. 76    |
| HSUPA Subtest-5  | 24+1/-3            | 22. 41          | 22. 28  | 22. 40    | 22. 84    | 22. 71  | 22. 83    |

| WCDMA Band4      | Max. Tune-up Power | Conducted power |            |            | EIRP       |            |            |
|------------------|--------------------|-----------------|------------|------------|------------|------------|------------|
| Tx Channel       |                    | 1312            | 1413       | 1513       | 1312       | 1413       | 1513       |
| Frequency        |                    | 1712.4 MHz      | 1732.6 MHz | 1752.6 MHz | 1712.4 MHz | 1732.6 MHz | 1752.6 MHz |
| RMC 12.2K        | 24+1/-3            | 23. 98          | 23. 32     | 24. 01     | 27. 03     | 26. 37     | 27. 06     |
| RMC 64K          | 24+1/-3            | 23. 53          | 23. 22     | 23. 97     | 26. 58     | 26. 27     | 27. 02     |
| RMC 144K         | 24+1/-3            | 23. 46          | 23. 16     | 23. 95     | 26. 51     | 26. 21     | 27. 00     |
| RMC 384K         | 24+1/-3            | 23. 46          | 23. 13     | 23. 95     | 26. 51     | 26. 18     | 27. 00     |
| HSDPA+ Subtest-1 | 24+1/-3            | 23. 10          | 23. 15     | 22. 99     | 26. 15     | 26. 20     | 26. 04     |
| HSDPA+ Subtest-2 | 24+1/-3            | 23. 20          | 23. 31     | 23. 17     | 26. 25     | 26. 36     | 26. 22     |
| HSDPA+ Subtest-3 | 24+1/-3            | 22. 73          | 22. 79     | 22. 73     | 25. 78     | 25. 84     | 25. 78     |
| HSDPA+ Subtest-4 | 24+1/-3            | 22. 73          | 22. 80     | 22. 60     | 25. 78     | 25. 85     | 25. 65     |
| HSUPA Subtest-1  | 24+1/-3            | 23. 94          | 23. 82     | 23. 93     | 26. 99     | 26. 87     | 26. 98     |
| HSUPA Subtest-2  | 24+1/-3            | 23. 91          | 23. 90     | 23. 92     | 26. 96     | 26. 95     | 26. 97     |
| HSUPA Subtest-3  | 24+1/-3            | 23. 90          | 23. 84     | 23. 89     | 26. 95     | 26. 89     | 26. 94     |
| HSUPA Subtest-4  | 24+1/-3            | 23. 90          | 23. 91     | 23. 87     | 26. 95     | 26. 96     | 26. 92     |
| HSUPA Subtest-5  | 24+1/-3            | 23. 91          | 23. 85     | 23. 87     | 26. 96     | 26. 90     | 26. 92     |

## APPENDIX B - OCCUPIED BANDWIDTH

### TEST DATA:

| WCDMA BAND2 (Part 24E) |                 |                              |                                |
|------------------------|-----------------|------------------------------|--------------------------------|
| Channel                | Frequency (MHz) | 99% Occupied Bandwidth (MHz) | -26dB occupied bandwidth (MHz) |
| 9262                   | 1852.4          | 4.130                        | 4.687                          |
| 9400                   | 1880.0          | 4.127                        | 4.707                          |
| 9538                   | 1907.6          | 4.126                        | 4.682                          |

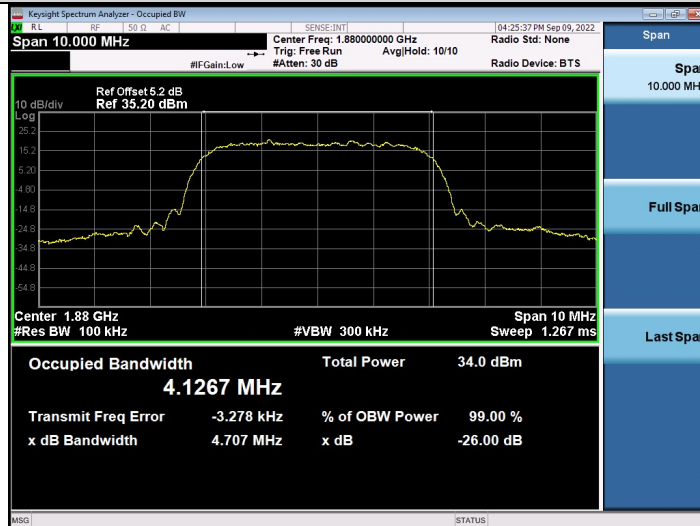
| WCDMA BAND4 (Part 27) |                 |                              |                                |
|-----------------------|-----------------|------------------------------|--------------------------------|
| Channel               | Frequency (MHz) | 99% Occupied Bandwidth (MHz) | -26dB occupied bandwidth (MHz) |
| 1312                  | 1712.4          | 4.122                        | 4.705                          |
| 1413                  | 1732.6          | 4.116                        | 4.688                          |
| 1513                  | 1752.6          | 4.126                        | 4.706                          |

## TEST GRAPHS

### WCDMA BAND2-Channel 9262



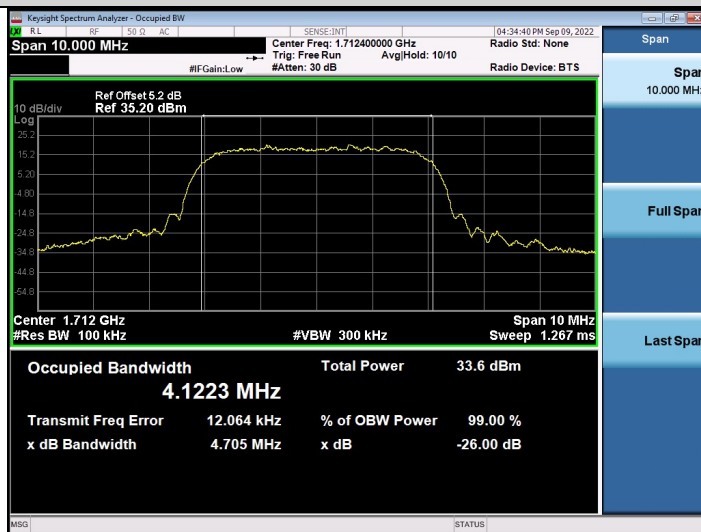
### WCDMA BAND2-Channel 9400



### WCDMA BAND2-Channel 9538



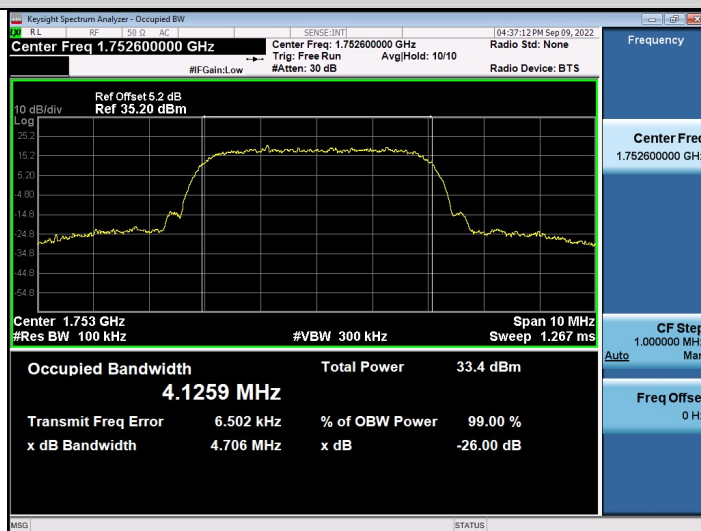
### WCDMA BAND4-Channel 1312



### WCDMA BAND4-Channel 1413



### WCDMA BAND4-Channel 1513



## APPENDIX C - CONDUCTED EMISSIONS

### TEST DATA:

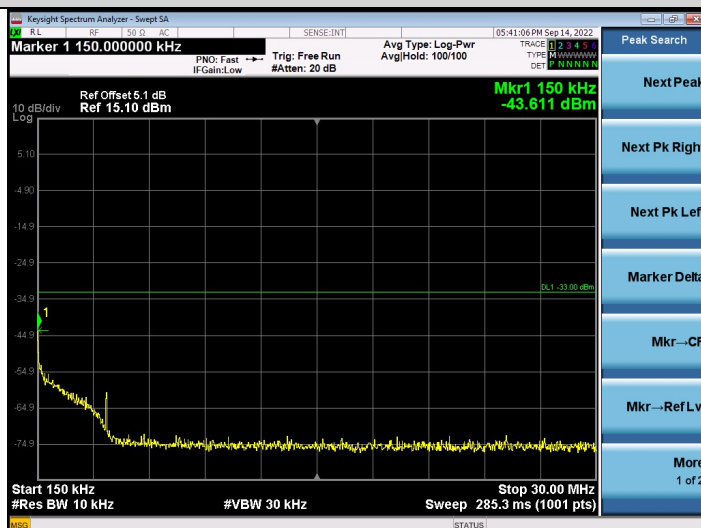
| Band        | Channel | Frequency Range | Frequency (MHz) | Result (dBm) | Limit (dBm) | Verdict |
|-------------|---------|-----------------|-----------------|--------------|-------------|---------|
| WCDMA BAND2 | 9400    | 0.009~0.15MHz   | 0.0193          | -50.687      | -43         | PASS    |
| WCDMA BAND2 | 9400    | 0.15~30MHz      | 0.15            | -43.611      | -33         | PASS    |
| WCDMA BAND2 | 9400    | 30~20000MHz     | 17843.0         | -39.313      | -13         | PASS    |
| WCDMA BAND4 | 1413    | 0.009~0.15MHz   | 0.038           | -49.207      | -43         | PASS    |
| WCDMA BAND4 | 1413    | 0.15~30MHz      | 0.15            | -45.384      | -33         | PASS    |
| WCDMA BAND4 | 1413    | 30~20000MHz     | 3465.0          | -38.292      | -13         | PASS    |

# TEST GRAPHS

## WCDMA BAND2 Channel 9400-0.009~0.15MHz



## WCDMA BAND2 Channel 9400-0.15~30MHz



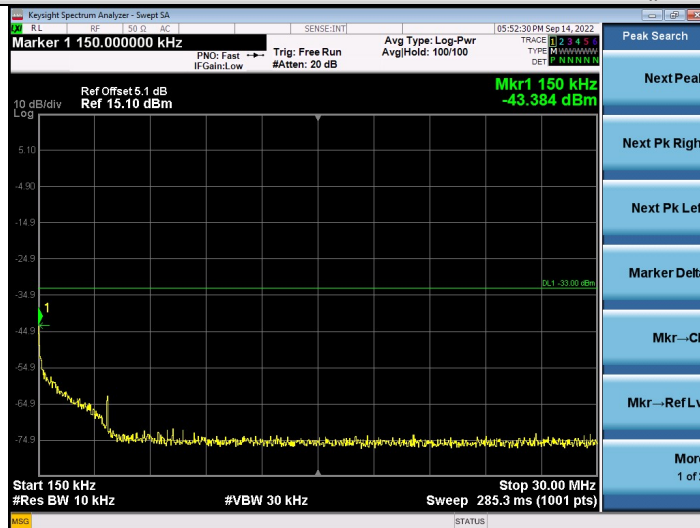
## WCDMA BAND2 Channel 9400-30~20000MHz



## WCDMA BAND4 Channel 1413-0.009~0.15MHz



## WCDMA BAND4 Channel 1413-0.15~30MHz()



## WCDMA BAND4 Channel 1413-30~20000MHz



## APPENDIX D - RADIATED EMISSION (9KHz TO 30MHz)

|            |               |
|------------|---------------|
| Test Mode: | WCDMA TX Mode |
|------------|---------------|

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

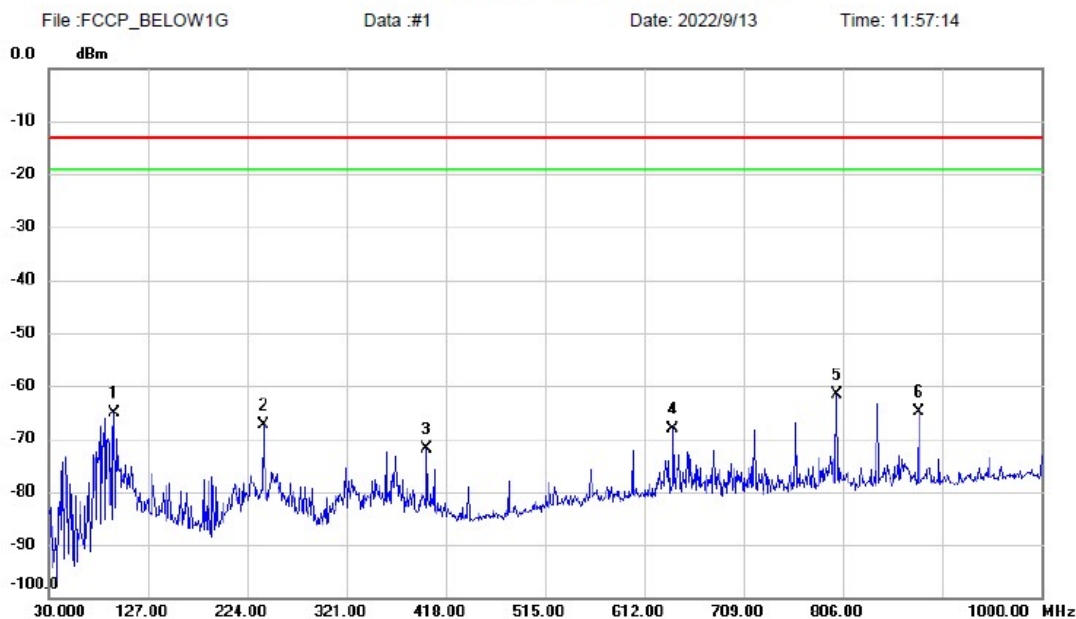
## APPENDIX E - RADIATED EMISSION (30MHZ-1GHZ)

- Note: 1. Emissions attenuated more than 20 dB below the permissible value are not reported.
2. The EUT is tested radiation emission at each test mode in three axes. The worst emissions are reported in all test mode and channels.
3. Measurement = Reading + Correct Factor
- Over = Measurement – Limit.
4. The EUT is tested radiation emission at each test mode (RMC mode, HSDPA+ mode and HSUPA mode) in three axes. The worst case emission(the RMC mode) are reflected in the following form.

|            |                     |
|------------|---------------------|
| Test Mode: | WCDMA BAND2 TX Mode |
|------------|---------------------|

|                             |                               |                     |
|-----------------------------|-------------------------------|---------------------|
| Site: SH-CB02               | Polarization: <b>Vertical</b> | Temperature: 24 (C) |
| Limit: FCC PART 24 EMISSION | Power: DC 3.8V                | Humidity: 58 %      |
| EUT: LTE Module             | Distance: 3m                  |                     |
| M/N: TOBY-L3414             | Mode: TX_WCDMA_B2             |                     |
| Note:                       |                               |                     |

### Radiated Emission Measurement



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBm | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBm | Limit<br>dBm | Margin<br>dB | Detector | Comment |
|-----|-----|--------------|-------------------------|-------------------------|-------------------------|--------------|--------------|----------|---------|
| 1   |     | 94.0200      | -63.24                  | -2.00                   | -65.24                  | -13.00       | -52.24       | RMS      |         |
| 2   |     | 239.5200     | -61.77                  | -5.49                   | -67.26                  | -13.00       | -54.26       | RMS      |         |
| 3   |     | 399.5700     | -70.30                  | -1.55                   | -71.85                  | -13.00       | -58.85       | RMS      |         |
| 4   |     | 640.1300     | -69.97                  | 1.95                    | -68.02                  | -13.00       | -55.02       | RMS      |         |
| 5   | *   | 800.1800     | -65.15                  | 3.44                    | -61.71                  | -13.00       | -48.71       | RMS      |         |
| 6   |     | 879.7200     | -68.81                  | 3.99                    | -64.82                  | -13.00       | -51.82       | RMS      |         |

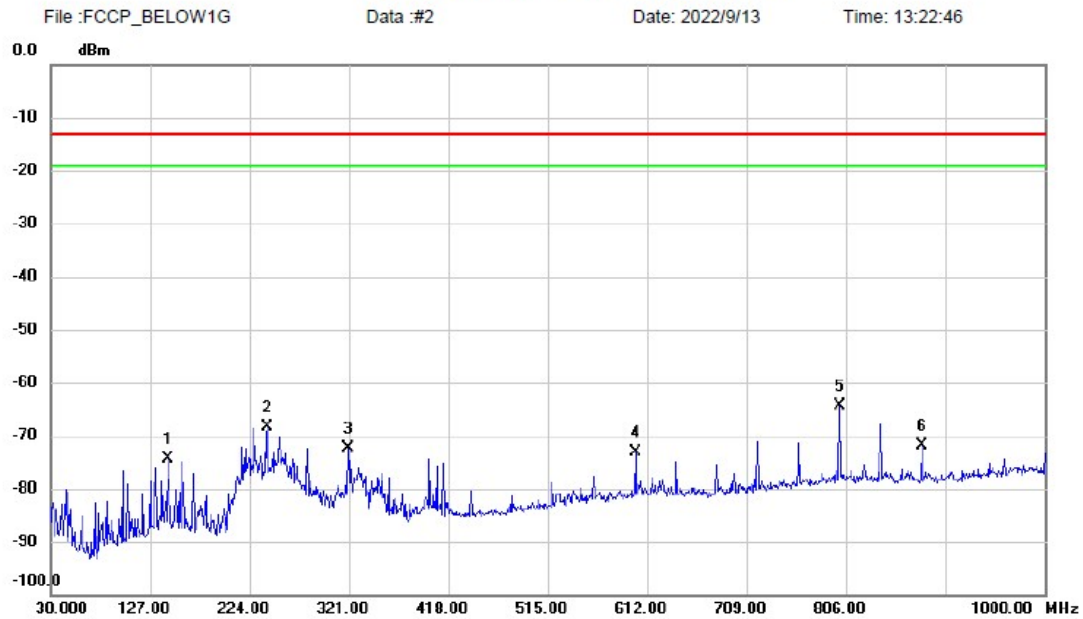
Test Mode: WCDMA BAND2 TX Mode

Site: SH-CB02  
 Limit: FCC PART 24 EMISSION  
 EUT: LTE Module  
 M/N: TOBY-L3414  
 Note:

Polarization: **Horizontal**  
 Power: DC 3.8V  
 Distance: 3m  
 Mode: TX\_WCDMA\_B2

Temperature: 24 (C)  
 Humidity: 58 %

### Radiated Emission Measurement



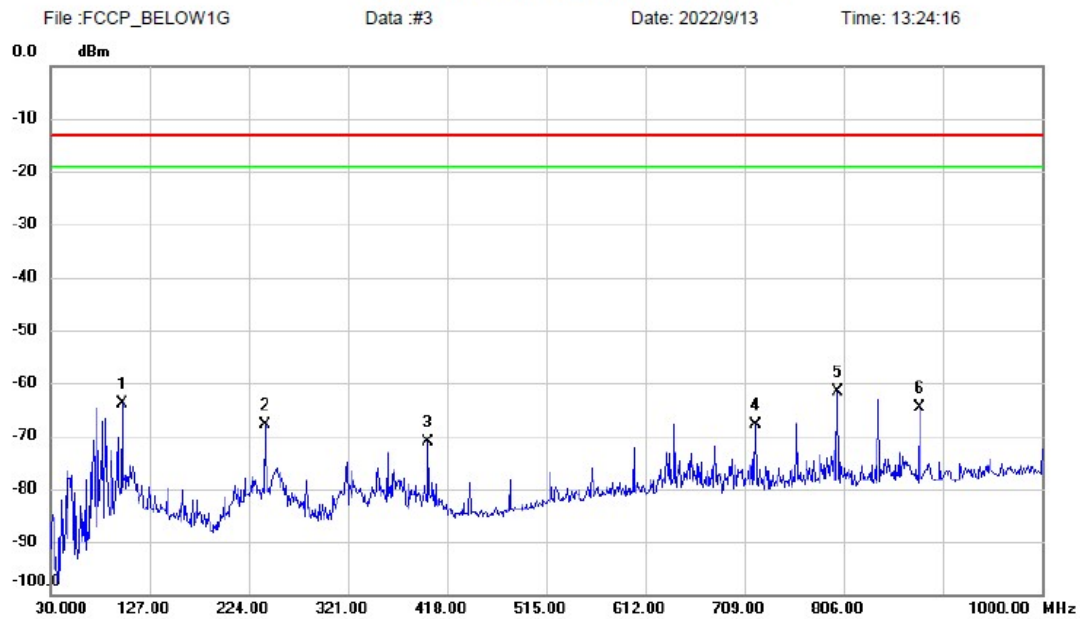
Test Mode: WCDMA BAND4 TX Mode

Site: SH-CB02  
 Limit: FCC PART 27 EMISSION  
 EUT: LTE Module  
 M/N: TOBY-L3414  
 Note:

Polarization: **Vertical**  
 Power: DC 3.8V  
 Distance: 3m  
 Mode: TX\_WCDMA\_B4

Temperature: 24 (C)  
 Humidity: 58 %

### Radiated Emission Measurement



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBm | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBm | Limit<br>dBm | Margin<br>dB | Detector | Comment |
|-----|-----|--------------|-------------------------|-------------------------|-------------------------|--------------|--------------|----------|---------|
| 1   |     | 99.8400      | -64.26                  | 0.38                    | -63.88                  | -13.00       | -50.88       | RMS      |         |
| 2   |     | 239.5200     | -62.43                  | -5.49                   | -67.92                  | -13.00       | -54.92       | RMS      |         |
| 3   |     | 399.5700     | -69.64                  | -1.55                   | -71.19                  | -13.00       | -58.19       | RMS      |         |
| 4   |     | 719.6700     | -70.53                  | 2.61                    | -67.92                  | -13.00       | -54.92       | RMS      |         |
| 5   | *   | 800.1800     | -65.00                  | 3.44                    | -61.56                  | -13.00       | -48.56       | RMS      |         |
| 6   |     | 879.7200     | -68.56                  | 3.99                    | -64.57                  | -13.00       | -51.57       | RMS      |         |

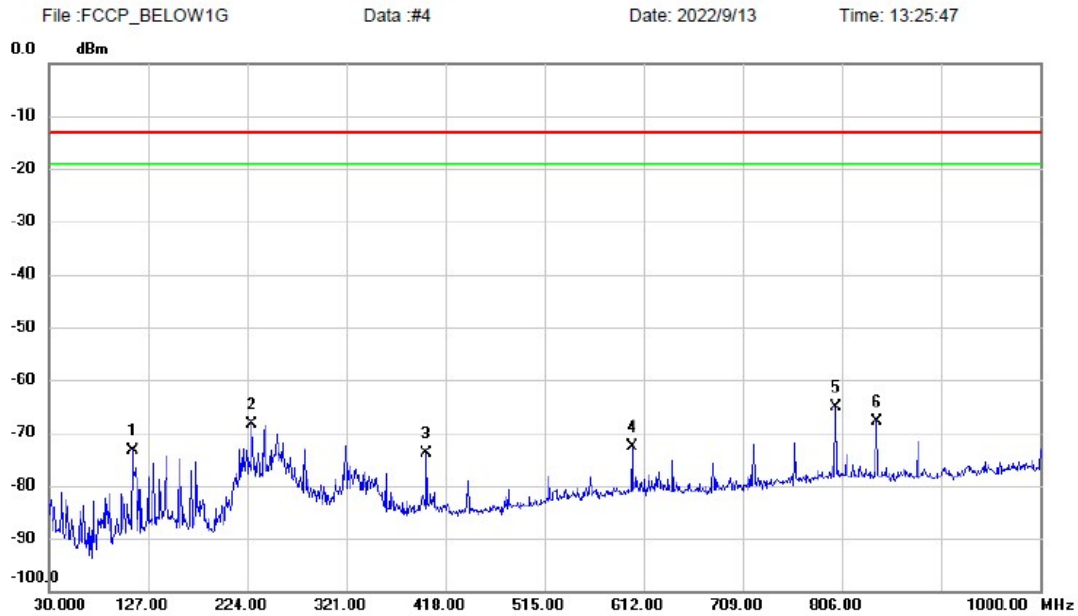
Test Mode: WCDMA BAND4 TX Mode

Site: SH-CB02  
Limit: FCC PART 27 EMISSION  
EUT: LTE Module  
M/N: TOBY-L3414  
Note:

Polarization: **Horizontal**  
Power: DC 3.8V  
Distance: 3m  
Mode: TX\_WCDMA\_B4

Temperature: 24 (C)  
Humidity: 58 %

### Radiated Emission Measurement



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBm | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBm | Limit<br>dBm | Margin<br>dB | Detector | Comment |
|-----|-----|--------------|-------------------------|-------------------------|-------------------------|--------------|--------------|----------|---------|
| 1   |     | 111.4800     | -65.16                  | -8.10                   | -73.26                  | -13.00       | -60.26       | RMS      |         |
| 2   |     | 228.8500     | -63.70                  | -4.66                   | -68.36                  | -13.00       | -55.36       | RMS      |         |
| 3   |     | 399.5700     | -72.15                  | -1.76                   | -73.91                  | -13.00       | -60.91       | RMS      |         |
| 4   |     | 600.3600     | -74.67                  | 1.95                    | -72.72                  | -13.00       | -59.72       | RMS      |         |
| 5   | *   | 800.1800     | -69.32                  | 4.28                    | -65.04                  | -13.00       | -52.04       | RMS      |         |
| 6   |     | 839.9500     | -72.12                  | 4.22                    | -67.90                  | -13.00       | -54.90       | RMS      |         |

## **APPENDIX F - RADIATED EMISSION (ABOVE 1GHZ)**

Note: 1. Emissions attenuated more than 20 dB below the permissible value are not reported

(For example:18-20GHz).

2. The EUT is tested radiation emission at each test mode in three axes. The worst emissions are reported in all test mode and channels.

3. Measurement = Reading + Correct Factor

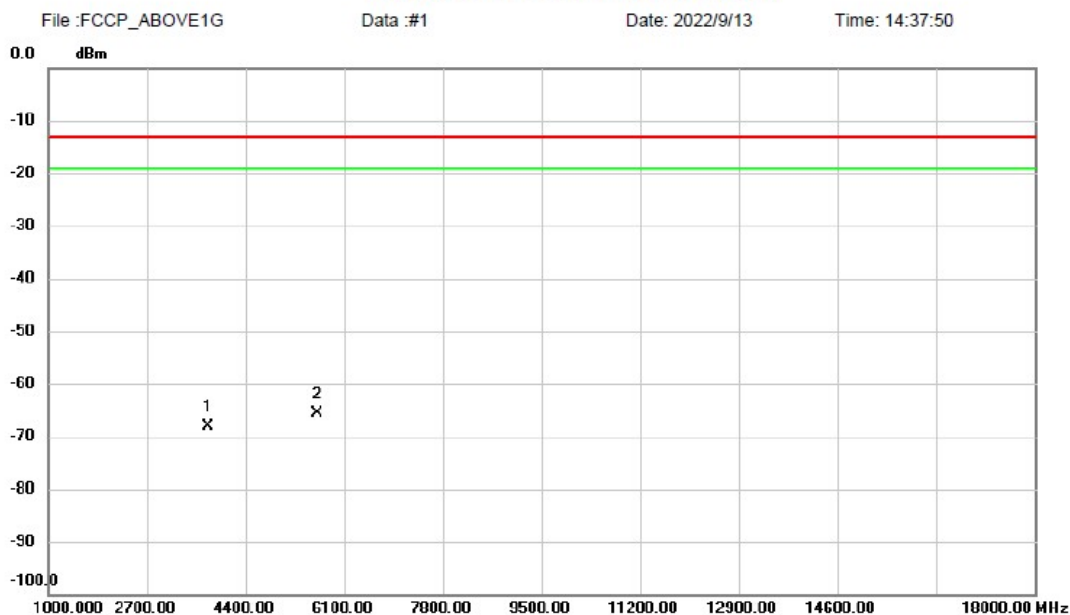
Over = Measurement – Limit.

4. The EUT is tested radiation emission at each test mode (RMC mode, HSDPA+ mode and HSUPA mode) in three axes. The worst case emission(the RMC mode) are reflected in the following form.

|            |                     |
|------------|---------------------|
| Test Mode: | WCDMA BAND2 TX Mode |
|------------|---------------------|

|                             |                               |                     |
|-----------------------------|-------------------------------|---------------------|
| Site: SH-CB02               | Polarization: <b>Vertical</b> | Temperature: 24 (C) |
| Limit: FCC PART 24 EMISSION | Power: DC 3.8V                | Humidity: 58 %      |
| EUT: LTE Module             | Distance: 3m                  |                     |
| M/N: TOBY-L3414             | Mode: TX_WCDMA_B2             |                     |
| Note:                       |                               |                     |

### Radiated Emission Measurement



| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measurement | Limit  | Margin |          |         |
|-----|-----|----------|---------------|----------------|-------------|--------|--------|----------|---------|
|     |     | MHz      | dBm           | dB             | dBm         | dBm    | dB     | Detector | Comment |
| 1   |     | 3754.000 | -61.15        | -7.08          | -68.23      | -13.00 | -55.23 | RMS      |         |
| 2   | *   | 5641.000 | -61.28        | -4.27          | -65.55      | -13.00 | -52.55 | RMS      |         |

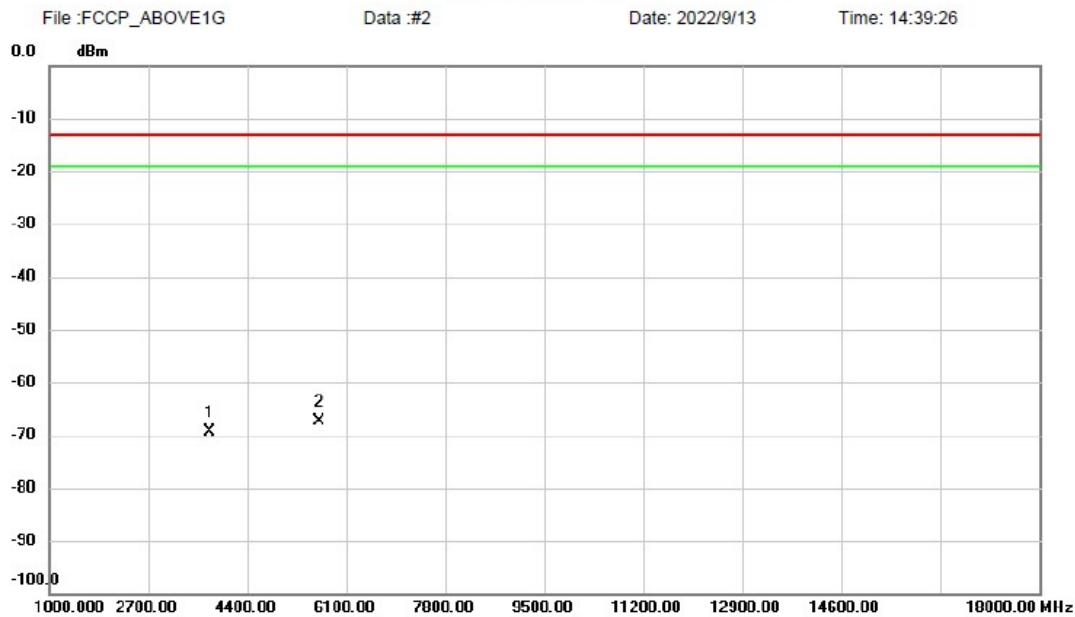
Test Mode: WCDMA BAND2 TX Mode

Site: SH-CB02  
 Limit: FCC PART 24 EMISSION  
 EUT: LTE Module  
 M/N: TOBY-L3414  
 Note:

Polarization: **Horizontal**  
 Power: DC 3.8V  
 Distance: 3m  
 Mode: TX\_WCDMA\_B2

Temperature: 24 (C)  
 Humidity: 58 %

### Radiated Emission Measurement



| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measure-ment | Limit  | Margin | Detector | Comment |
|-----|-----|----------|---------------|----------------|--------------|--------|--------|----------|---------|
|     |     | MHz      | dBm           | dB             | dBm          | dBm    | dB     |          |         |
| 1   |     | 3754.000 | -62.56        | -6.89          | -69.45       | -13.00 | -56.45 | RMS      |         |
| 2   | *   | 5641.000 | -63.25        | -4.19          | -67.44       | -13.00 | -54.44 | RMS      |         |

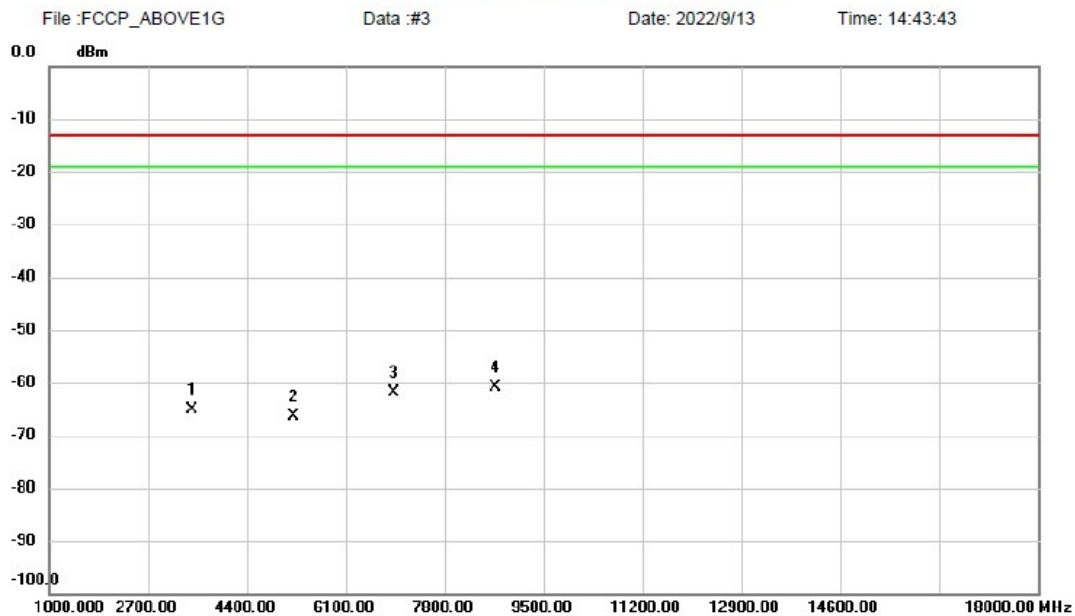
Test Mode: WCDMA BAND4 TX Mode

Site: SH-CB02  
 Limit: FCC PART 27 EMISSION  
 EUT: LTE Module  
 M/N: TOBY-L3414  
 Note:

Polarization: **Vertical**  
 Power: DC 3.8V  
 Distance: 3m  
 Mode: TX\_WCDMA\_B4

Temperature: 24 (C)  
 Humidity: 58 %

### Radiated Emission Measurement



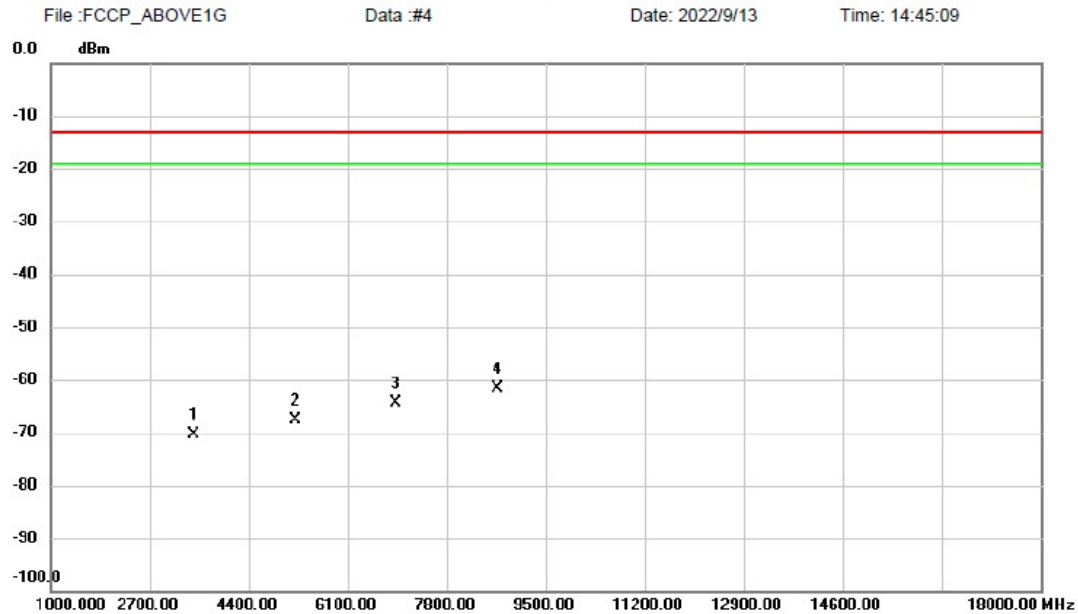
Test Mode: WCDMA BAND4 TX Mode

Site: SH-CB02  
 Limit: FCC PART 27 EMISSION  
 EUT: LTE Module  
 M/N: TOBY-L3414  
 Note:

Polarization: **Horizontal**  
 Power: DC 3.8V  
 Distance: 3m  
 Mode: TX\_WCDMA\_B4

Temperature: 24 (C)  
 Humidity: 58 %

### Radiated Emission Measurement



## APPENDIX G - BAND EDGE

### WCDMA BAND2 (Part 24E)

| Mode        | Frequency<br>(MHz) | Emission<br>(dBm) | Limit<br>(dBm) | Verdict |
|-------------|--------------------|-------------------|----------------|---------|
| WCDMA BAND2 | 1852.400           | -14.065           | -13            | PASS    |
|             | 1907.600           | -14.293           | -13            | PASS    |

### WCDMA BAND4 (Part 27)

| Mode        | Frequency<br>(MHz) | Emission<br>(dBm) | Limit<br>(dBm) | Verdict |
|-------------|--------------------|-------------------|----------------|---------|
| WCDMA BAND4 | 1712.4             | -14.331           | -13            | PASS    |
|             | 1752.600           | -13.949           | -13            | PASS    |

Note: The offset on the picture below = The loss of test cable+Splitter.

## TEST GRAPHS

### WCDMA BAND2 Low Channel



### WCDMA BAND2 High Channel



### WCDMA BAND4 Low Channel



### WCDMA BAND4 High Channel

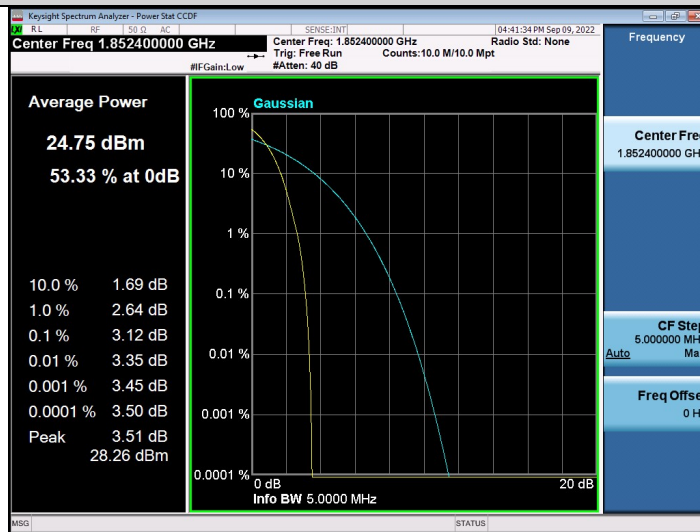


**APPENDIX H - PEAK TO AVERAGE RATIO**

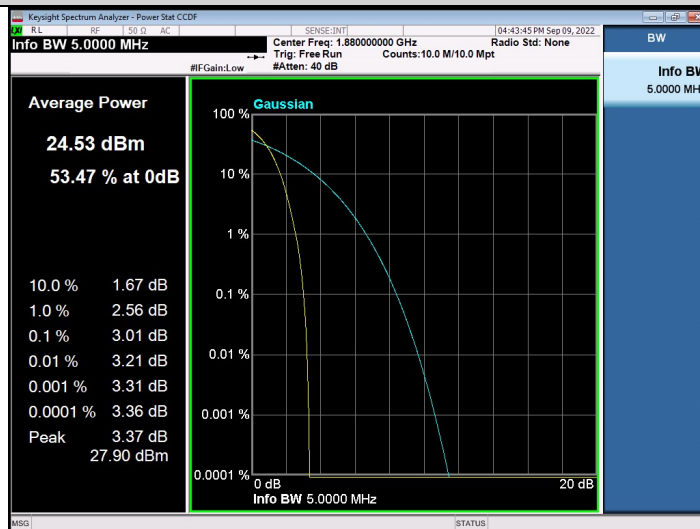
| Mode        | CHANNEL | Frequency<br>(MHz) | PEAK TO<br>AVERAGE RATIO<br>(dB) | Limit(dB) | Verdict |
|-------------|---------|--------------------|----------------------------------|-----------|---------|
| WCDMA BAND2 | 9262    | 1852.4             | 3.12                             | 13        | PASS    |
| WCDMA BAND2 | 9400    | 1880               | 3.01                             | 13        | PASS    |
| WCDMA BAND2 | 9538    | 1907.6             | 3.17                             | 13        | PASS    |
| WCDMA BAND4 | 1312    | 1712.4             | 3.12                             | 13        | PASS    |
| WCDMA BAND4 | 1413    | 1732.6             | 3.38                             | 13        | PASS    |
| WCDMA BAND4 | 1513    | 1752.6             | 3.28                             | 13        | PASS    |

## TEST GRAPHS

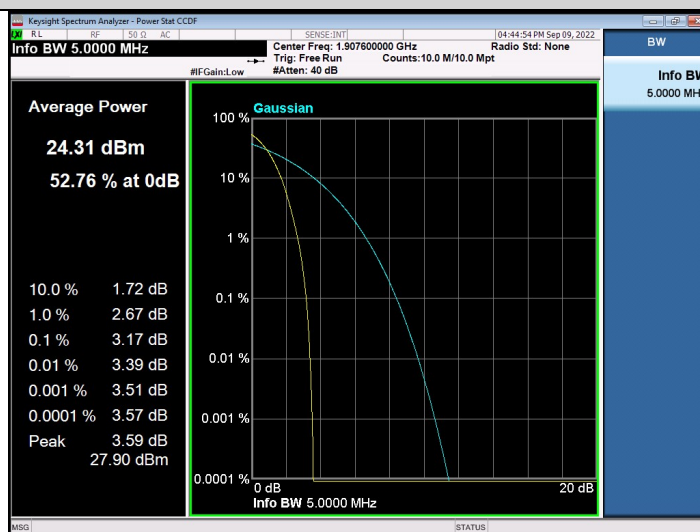
### WCDMA BAND2-Channel 9262



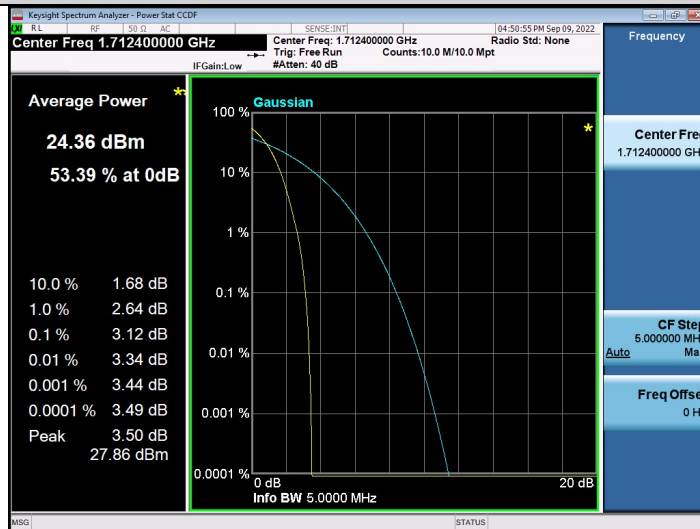
### WCDMA BAND2-Channel 9400



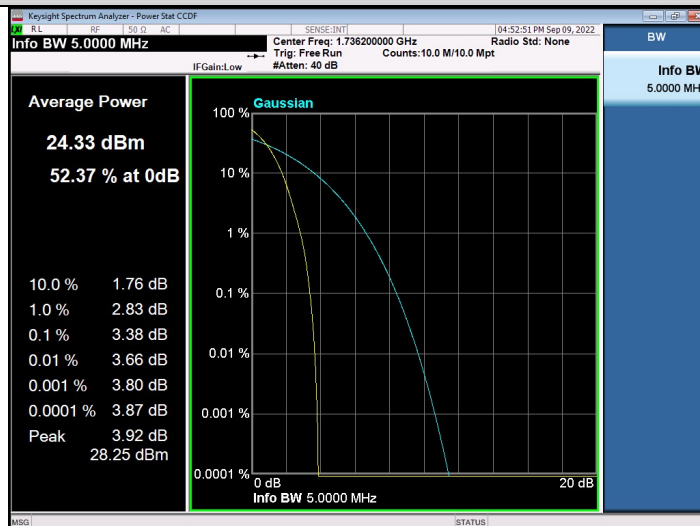
### WCDMA BAND2-Channel 9538



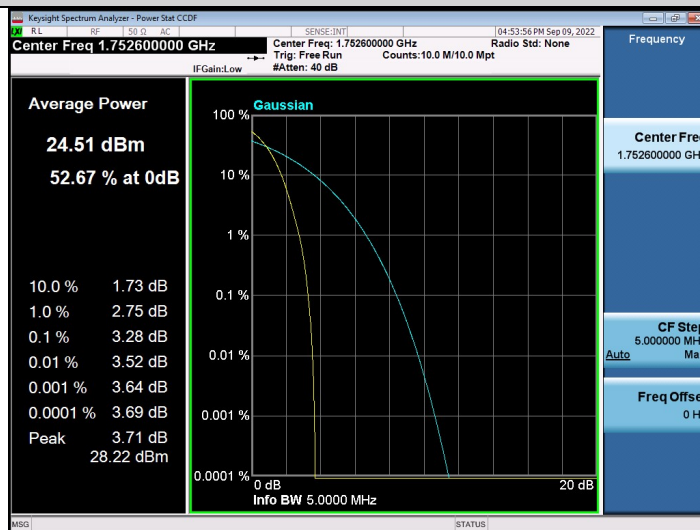
### WCDMA BAND4-Channel 1312



### WCDMA BAND4-Channel 1413



### WCDMA BAND4-Channel 1513



## APPENDIX I - FREQUENCY STABILITY

| WCDMA BAND2                         |                      |                       |            |
|-------------------------------------|----------------------|-----------------------|------------|
| Channel:                            | 9400                 | Frequency:            | 1880MHz    |
| Temperature vs. Frequency Stability |                      |                       |            |
| Temperature(°C)                     | Frequency Error (Hz) | Frequency Error (ppm) | Limit(ppm) |
| -35                                 | 4.32                 | 0.002297872           | ±2.5       |
| -30                                 | 5.22                 | 0.002776596           |            |
| -20                                 | -7.55                | 0.004015957           |            |
| -10                                 | 3.89                 | 0.002069149           |            |
| 0                                   | -4.67                | 0.002484043           |            |
| 10                                  | 5.42                 | 0.002882979           |            |
| 20                                  | -2.96                | 0.001574468           |            |
| 30                                  | -4.32                | 0.002297872           |            |
| 40                                  | -5.22                | 0.002776596           |            |
| 50                                  | -5.10                | 0.002712766           |            |
| 60                                  | -3.25                | 0.001728723           |            |
| 70                                  | -5.69                | 0.003026596           |            |
| 75                                  | -3.76                | 0.002                 |            |
| Max. Deviation (ppm)                | 5.42                 | 0.004015957           |            |

| Voltage vs. Frequency Stability |                      |                       |            |
|---------------------------------|----------------------|-----------------------|------------|
| Voltage(Volts)                  | Frequency Error (Hz) | Frequency Error (ppm) | Limit(ppm) |
| 4.5                             | -5.20                | 0.002765957           | ±2.5       |
| 3.8                             | -6.22                | 0.003308511           |            |
| 3.4                             | 2.85                 | 0.001515957           |            |
| Max. Deviation (ppm)            | 6.22                 | 0.003308511           |            |

| WCDMA BAND4                         |                      |                       |            |
|-------------------------------------|----------------------|-----------------------|------------|
| Channel:                            | 1413                 | Frequency:            | 1732.6MHz  |
| Temperature vs. Frequency Stability |                      |                       |            |
| Temperature(°C)                     | Frequency Error (Hz) | Frequency Error (ppm) | Limit(ppm) |
| -35                                 | -4.27                | 0.002464504           | ±2.5       |
| -30                                 | -5.22                | 0.003012813           |            |
| -20                                 | -7.35                | 0.004242179           |            |
| -10                                 | -5.34                | 0.003082073           |            |
| 0                                   | -4.49                | 0.002591481           |            |
| 10                                  | 5.67                 | 0.003272538           |            |
| 20                                  | 7.85                 | 0.004530763           |            |
| 30                                  | 2.24                 | 0.001292855           |            |
| 40                                  | -3.65                | 0.002106661           |            |
| 50                                  | 5.19                 | 0.002995498           |            |
| 60                                  | -6.22                | 0.00358998            |            |
| 70                                  | 6.84                 | 0.003947824           |            |
| 75                                  | -4.18                | 0.002412559           |            |
| Max. Deviation (ppm)                | 7.85                 | 0.004530763           |            |

| Voltage vs. Frequency Stability |                      |                       |            |
|---------------------------------|----------------------|-----------------------|------------|
| Voltage(Volts)                  | Frequency Error (Hz) | Frequency Error (ppm) | Limit(ppm) |
| 4.5                             | -5.29                | 0.003053215           | ±2.5       |
| 3.8                             | -6.39                | 0.003688099           |            |
| 3.4                             | -6.52                | 0.003763131           |            |
| Max. Deviation (ppm)            | 6.52                 | 0.003763131           |            |

End of Test Report