



# FCC RADIO TEST REPORT

**FCC ID** : XIA-221  
**Equipment** : Vodafone MachineLink 4G Lite  
**Brand Name** :  NetCommWireless,  
Vodafone  
**Model Name** : NWL-221  
**Applicant** : NetComm Wireless Limited  
18-20 Orion Road Lane Cove NSW 2066 Australia  
**Manufacturer** : NetComm Wireless Limited  
18-20 Orion Road Lane Cove NSW 2066 Australia  
**Standard** : 47 CFR Part2, 22(H)

The product was received on Sep. 19, 2018, and testing was started from Oct. 02, 2018 and completed on Oct. 18, 2018. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI/TIA-603-E (2016), ANSI C63.26-2015 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

  
Approved by: Cliff Chang

**SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory**  
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)



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### Summary of Test Result

| Report Clause | Ref Std. Clause (FCC Rule) | Test Items                                    | Result (PASS/FAIL) | Remark |
|---------------|----------------------------|---|--------------------|--------|
| 3.1           | 2.1046                     | Conducted Output Power                        | PASS               | -      |
|               | 22.913(a)(2)               | Effective Radiated Power                      | PASS               | -      |
| 3.2           | 22.913(d)                  | Peak-to-Average Ratio                         | PASS               | -      |
| 3.3           | 2.1049                     | Occupied Bandwidth                            | PASS               | -      |
| 3.4           | 2.1051                     | Conducted Band Edge                           | PASS               | -      |
|               | 22.917(a)                  |   |                    |        |
| 3.5           | 2.1051                     | Conducted Emission                            | PASS               | -      |
|               | 22.917(a)                  |   |                    |        |
| 3.6           | 2.1053                     | Field Strength of Spurious Radiation          | PASS               | -      |
|               | 22.917(a)                  |   |                    |        |
| 3.7           | 2.1055                     | Frequency Stability for Temperature & Voltage | PASS               | -      |
|               | 22.355                     |   |                    |        |

Note: Reference to Sporton Project No.: 891369-02.

**Declaration of Conformity:**

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

**Comments and Explanations:**

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sam Chen

Report Producer: Wendy Pan



# 1 General Description

## 1.1 Information

### 1.1.1 RF General Information

| Items                                 | Description  |
|---------------------------------------|--|
| EUT Power Type                        | From power adapter<br>Note: The EUT was tested with a 12V power adapter and the device supports 8-40V.   |
| EUT Type                              | <input type="checkbox"/> Base Station<br><input checked="" type="checkbox"/> Mobile Station<br><input type="checkbox"/> Fixed Subscriber Station |
| TX Frequency (MHz)                    | WCDMA Band 5: 826.4 ~ 846.6  |
| RX Frequency (MHz)                    | WCDMA Band 5: 871.4 ~ 891.6  |
| Bandwidth (MHz)                       | 5  |
| Maximum Output Power to Antenna (dBm) | WCDMA Band 5: 23.47  |
| 99% Occupied Bandwidth (MHz)          | WCDMA Band 5: 4.148  |
| Type of Modulation                    | WCDMA: BPSK / QPSK<br>HSDPA: 16QAM<br>HSUPA: QPSK  |

### 1.1.2 Antenna Information

| Ant. | Brand           | Model Name | Antenna Type | Connector | Gain (dBi) |
|------|-----------------|------------|--------------|-----------|------------|
| 1    | NetCommWireless | NANT-00006 | Dipole Ant.  | SMA       | 0.40       |

Note: The EUT support 1TX, 2RX functions:

Only Main port can be used as transmitting functions.

Main port and Aux port could receive simultaneously.


### 1.1.3 Maximum ERP Power, Frequency Tolerance, and Emission Designator

| WCDMA    |              |                    |                 |                           |                     |
|----------|--------------|--------------------|-----------------|---------------------------|---------------------|
| FCC Rule | System       | Type of Modulation | Maximum ERP (W) | Frequency Tolerance (ppm) | Emission Designator |
| Part 22  | WCDMA Band 5 | QPSK               | 0.149           | 0.007                     | 4M15F9W             |



**1.1.4 Table for Multiple Listing**

The difference for brand name is shown as below:

| <b>Brand Name</b>   | <b>Equipment Name</b>           | <b>Model Name</b> | <b>Description</b>   |
|---|---------------------------------|-------------------|--|
|  <b>NetCommWireless.</b><br>Vodafone | Vodafone MachineLink<br>4G Lite | NWL-221           | All the brand name are identical;<br>different brand names serve as<br>marketing strategy. |



### 1.2 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part2, 22(H)
- ANSI/TIA-603-E (2016)
- ANSI C63.26-2015
- FCC KDB 971168 D01 v03r01

The following reference test guidance is not within the scope of accreditation of TAF.

- FCC KDB 412172 D01 v01r01
- FCC KDB 414788 D01 v01r01

**Remark:** All test items were verified and recorded according to the standards and without any deviation during the test.

### 1.3 Testing Location

| Testing Location                    |        |   |
|-------------------------------------|--------|---|
| <input type="checkbox"/>            | HWA YA | ADD : No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)<br>TEL : 886-3-327-3456 FAX : 886-3-327-0973        |
| <input checked="" type="checkbox"/> | JHUBEI | ADD : No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C.<br>TEL : 886-3-656-9065 FAX : 886-3-656-9085 |

| Test Condition | Test Site No. | Test Engineer | Test Environment | Test Date                     |
|----------------|---------------|---------------|------------------|-------------------------------|
| RF Conducted   | TH01-CB       | Lucke Hsieh   | 25°C / 60%       | Oct. 02, 2018 ~ Oct. 17, 2018 |
| Radiated       | 03CH01-CB     | Jay Luo       | 25°C / 60%       | Oct. 03, 2018 ~ Oct. 18, 2018 |

Test site Designation No. TW0006 with FCC.

Test site registered number IC 4086D with Industry Canada.

### 1.4 Measurement Uncertainty

| Test Items                           | Uncertainty | Remark                   |
|--------------------------------------|-------------|--------------------------|
| Radiated Emission (30MHz ~ 1,000MHz) | 3.6 dB      | Confidence levels of 95% |
| Radiated Emission (1GHz ~ 18GHz)     | 3.7 dB      | Confidence levels of 95% |
| Conducted Emission                   | 1.7 dB      | Confidence levels of 95% |



## 2 Test Configuration of Equipment Under Test

### 2.1 The Worst Case Measurement Configuration

| The Worst Case Mode for Following Conformance Tests |   |
|---|---|
| <b>Tests Item</b>                                   | Conducted Output Power<br>ERP<br>Peak-to-Average Ratio<br>99% OBW and 26dB Bandwidth<br>Conducted Band Edge<br>Conducted Spurious Emission<br>Frequency Stability |
| <b>Test Condition</b>                               | Conducted measurement at transmit chains  |
| <b>Test Mode</b>                                    | 1   EUT WCDMA Band 5  |

| The Worst Case Mode for Following Conformance Tests  |   |
|--|---|
| <b>Tests Item</b>  | Field Strength of Spurious Radiation  |
| <b>Test Condition</b>  | Radiated measurement<br>If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type. |
| <b>Operating Mode &gt; 1GHz</b>  | Normal Link   |
| The EUT was performed at Y axis and Z axis position and the worst case was found at Z axis. So the measurement will follow this same test configuration. |   |
| 1  | EUT in Z axis – WCDMA Band 5  |





## 2.2 Accessories

RJ-45\*1: Non-shielded 1.5m

DIN rail mounting bracket\*1

## 2.3 Support Equipment

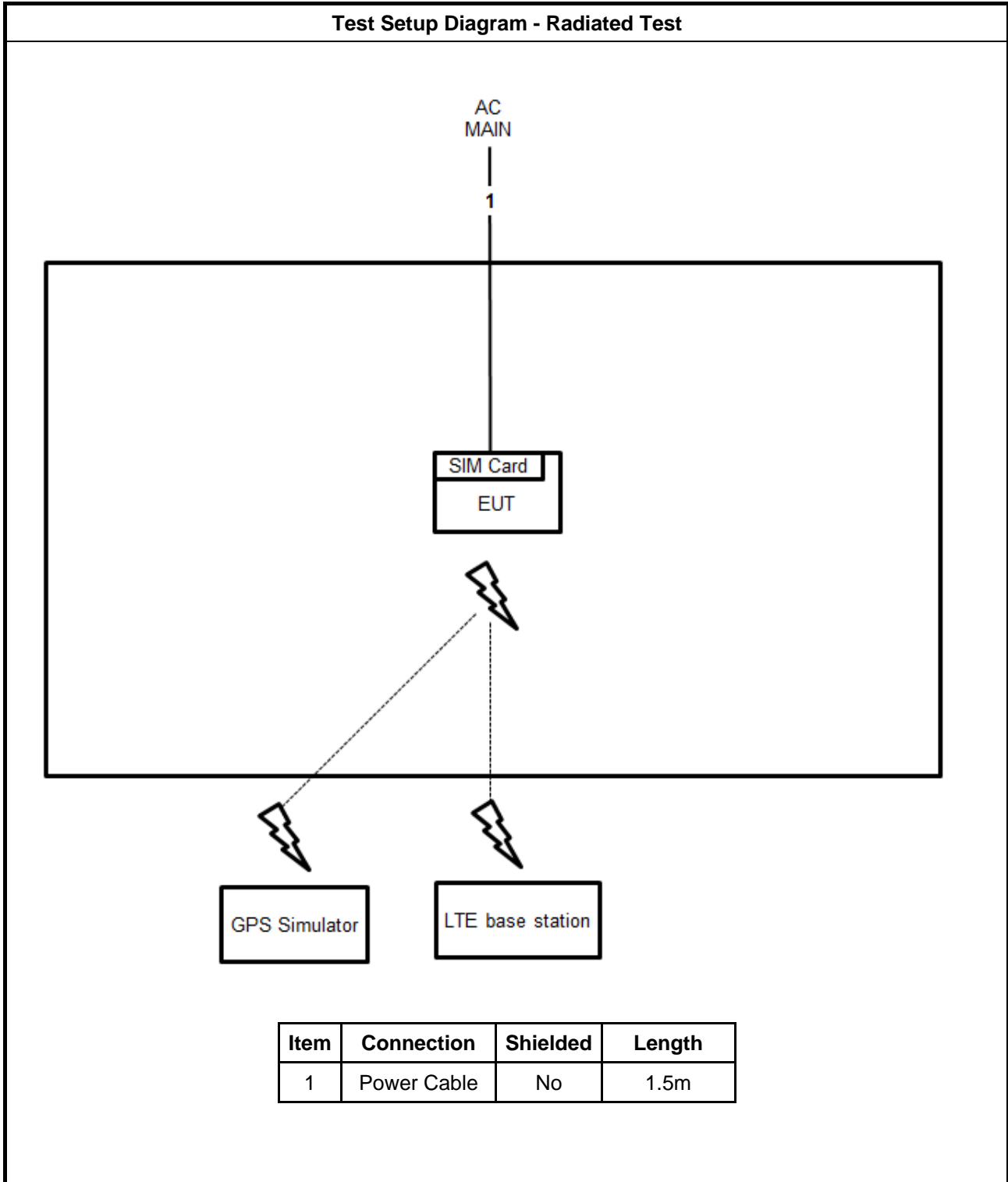
For test site: 03CH01-CB

| Support Equipment |                  |             |                |        |
|-------------------|------------------|-------------|----------------|--------|
| No.               | Equipment        | Brand Name  | Model Name     | FCC ID |
| 1                 | LTE base station | Anritsu     | MT8820C        | N/A    |
| 2                 | SIM Card         | Anritsu     | N/A            | N/A    |
| 3                 | GPS Simulator    | WELNAVIGATE | GS-100         | N/A    |
| 4                 | Adapter          | Tenpao      | S018BAM1200150 | N/A    |

For test site: TH01-CB

| Support Equipment |                  |            |                |        |
|-------------------|------------------|------------|----------------|--------|
| No.               | Equipment        | Brand Name | Model Name     | FCC ID |
| 1                 | NB               | DELL       | E4300          | N/A    |
| 2                 | LTE base station | Anritsu    | MT8820C        | N/A    |
| 3                 | SIM Card         | Anritsu    | N/A            | N/A    |
| 4                 | Adapter          | Tenpao     | S018BAM1200150 | N/A    |

## 2.4 Test Setup Diagram





## **2.5 Measurement Results Explanation Example**

### **For all conducted test items:**

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between RF conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level will be exactly the RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

The following shows an offset computation example with RF cable loss 1 dB and a 20dB attenuator.

Example:

Offset (dB) = RF cable loss (dB) + attenuator factor (dB).

$$= 1 + 20 = 21 \text{ (dB)}$$



### 3 Test Result

#### 3.1 Conducted Output Power and ERP Measurement

##### 3.1.1 Description of the Conducted Output Power and ERP Measurement

|   |  |
|---|--|
| <b>FCC</b>                                  |  |
| <b>Conducted Output Power Limit</b>         |  |
| <input checked="" type="checkbox"/> Band 5  | N/A  |
| <b>Effective Radiated Power (ERP) Limit</b> |  |
| <input checked="" type="checkbox"/> Band 5  | Base Station: 500 Watts or 400Watts (PSD)<br>Mobile Station: 7 Watts |

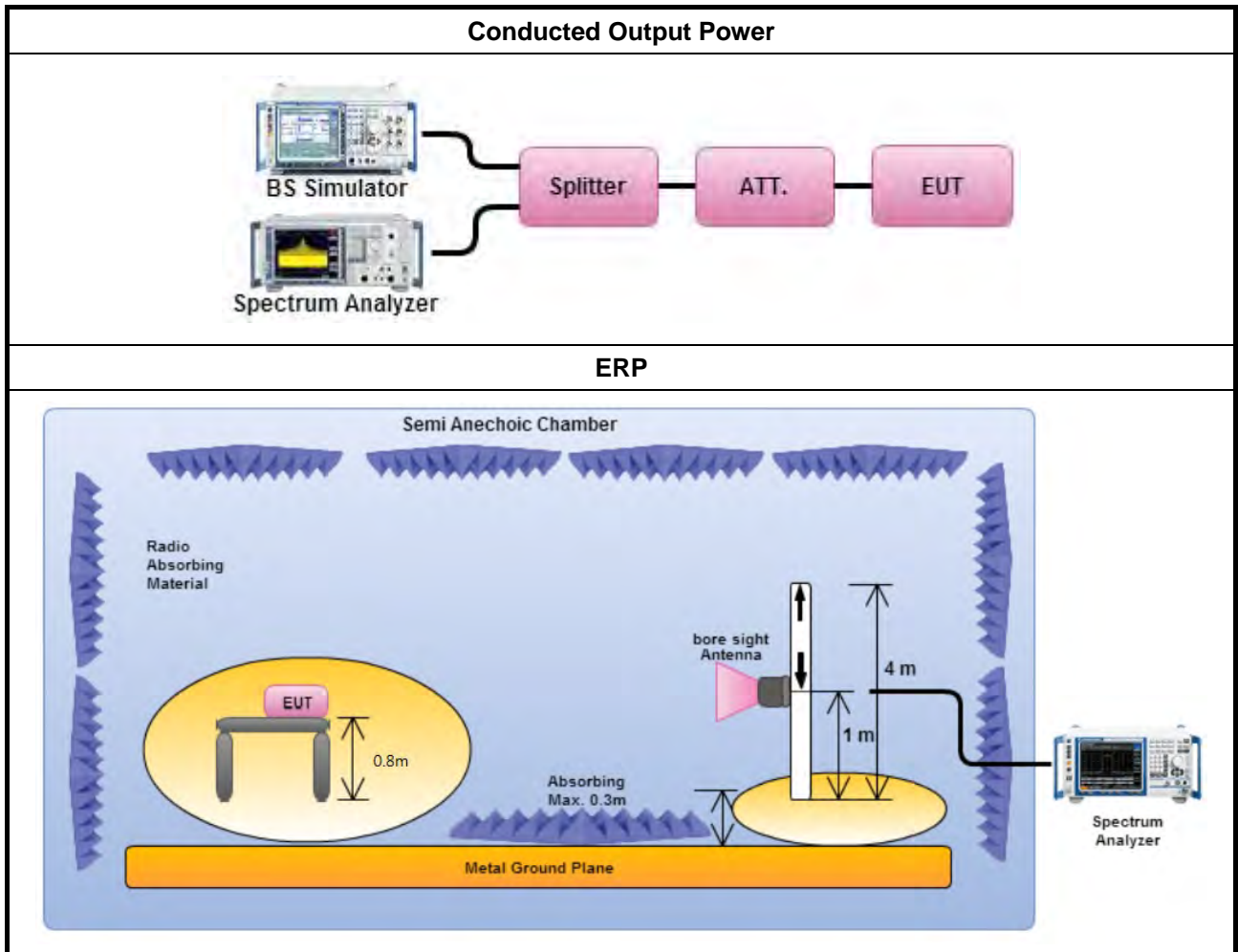
##### 3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

##### 3.1.3 Test Procedures

1. The transmitter output port was connected to the system simulator.
2. Set EUT at maximum power through system simulator.
3. Select lowest, middle, and highest channels for each band and different modulation.
4. Measure and record the power level from the system simulator.

### 3.1.4 Test Setup



### 3.1.5 Test Result of Conducted Output Power

Refer as Appendix A

### 3.1.6 Test Result of ERP

Refer as Appendix A

## 3.2 Peak-to-Average Ratio Measurement

### 3.2.1 Description of the PAR Measurement

The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

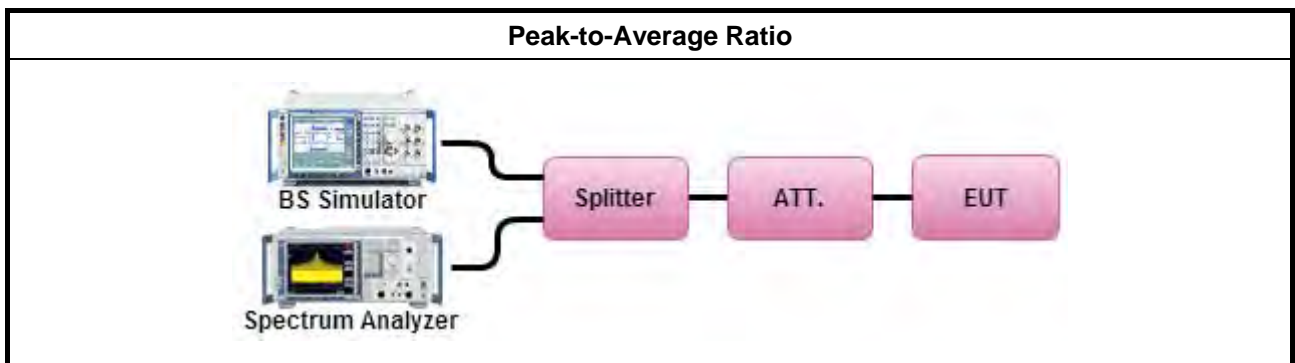
### 3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

### 3.2.3 Test Procedures

1. The EUT was connected to spectrum and system simulator via a power divider.
2. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
3. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.
4. Record the deviation as Peak to Average Ratio.

### 3.2.4 Test Setup



### 3.2.5 Test Result of Peak-to-Average Ratio

Refer as Appendix B



### **3.3 Occupied Bandwidth Measurement**

#### **3.3.1 Description of Occupied Bandwidth Measurement**

The occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean transmitted power.

The 26 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 26 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth.

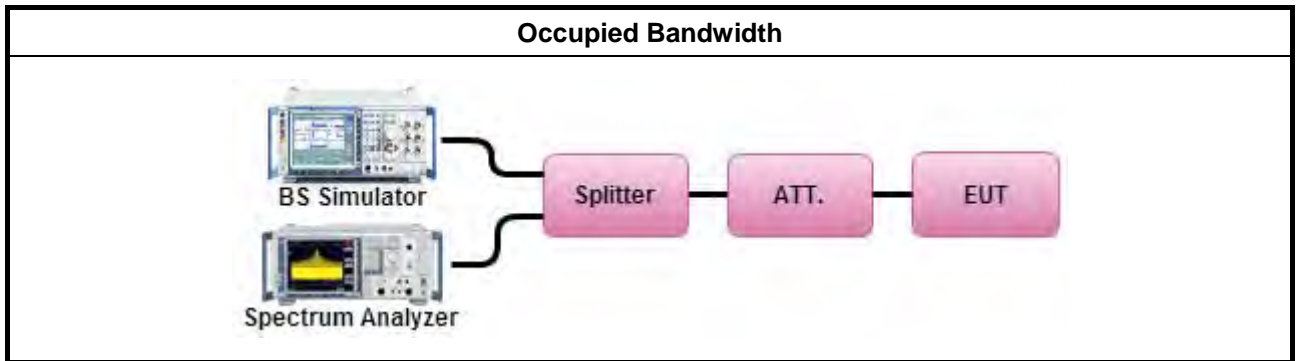
#### **3.3.2 Measuring Instruments**

The measuring equipment is listed in the section 4 of this test report.

#### **3.3.3 Test Procedures**

1. The EUT was connected to spectrum analyzer and system simulator via a power divider.
2. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency.  
The span range for the spectrum analyzer shall be between two and five times the anticipated OBW.
3. The nominal resolution bandwidth (RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.
4. Set the detection mode to peak, and the trace mode to max hold.
5. Determine the reference value: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace. (this is the reference value)
6. Determine the “-26 dB down amplitude” as equal to (Reference Value – X).
7. Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “-X dB down amplitude” determined in step 6. If a marker is below this “-X dB down amplitude” value it shall be placed as close as possible to this value. The OBW is the positive frequency difference between the two markers.
8. Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

### 3.3.4 Test Setup



### 3.3.5 Test Result of Occupied Bandwidth

Refer as Appendix C



### 3.4 Conducted Band Edge Measurement

#### 3.4.1 Description of Conducted Band Edge Measurement

| Conducted Band Edge |  |
|---------------------|--|
| ☒ Band 5            | 43 + 10log <sub>10</sub> (P[Watts]) dB below the transmitter power P(Watts) in a 100kHz bandwidth. However, in the 1MHz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. |

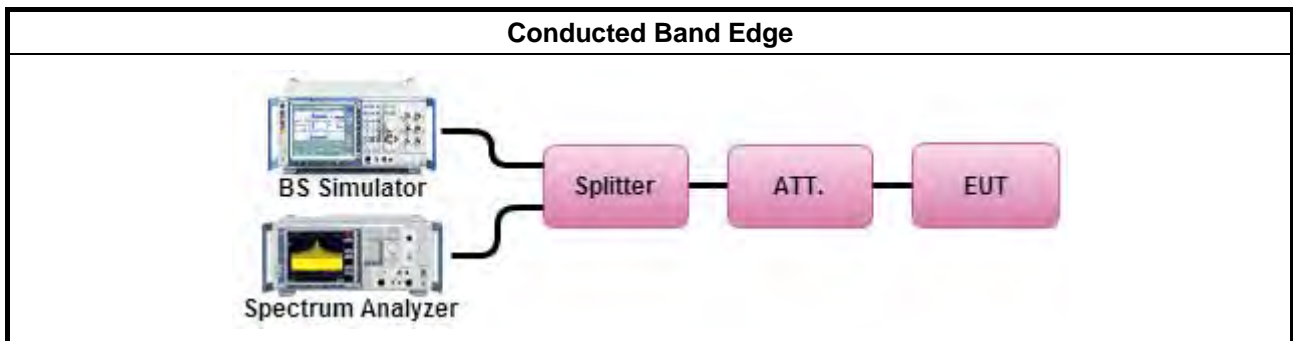
#### 3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

#### 3.4.3 Test Procedures

1. The EUT was connected to spectrum analyzer and system simulator via a power divider.
2. The band edges of low and high channels for the highest RF powers were measured.
3. Set RBW >= 1% EBW in the 1MHz band immediately outside and adjacent to the band edge.
4. Beyond the 1 MHz band from the band edge, RBW=1MHz was used.
5. Set spectrum analyzer with RMS detector.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
7. Checked that all the results comply with the emission limit line.

#### 3.4.4 Test Setup



#### 3.4.5 Test Result of Conducted Band Edge

Refer as Appendix D

### 3.5 Conducted Spurious Emission Measurement

#### 3.5.1 Description of Conducted Spurious Emission Measurement

| Conducted Band Edge                        |  |
|--|--|
| <input checked="" type="checkbox"/> Band 5 | The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB. |

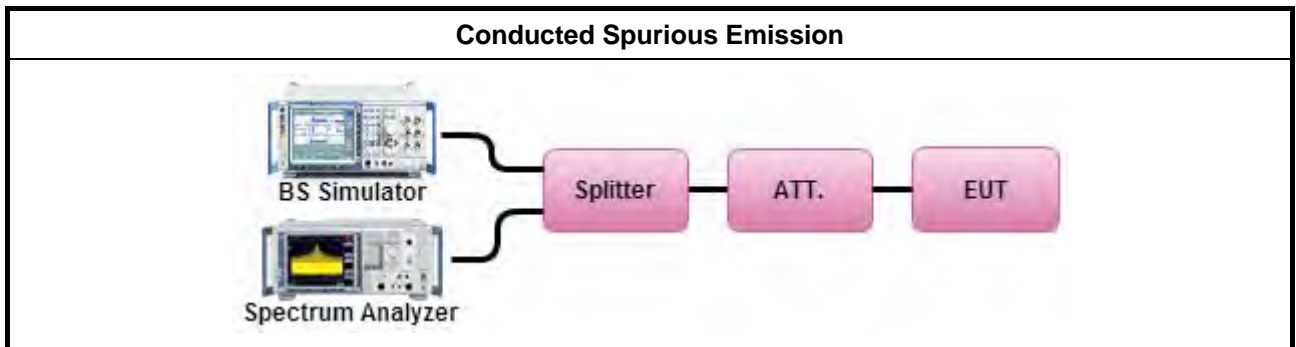
#### 3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

#### 3.5.3 Test Procedures

1. The EUT was connected to spectrum analyzer and system simulator via a power divider.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.  
The path loss was compensated to the results for each measurement.
3. The middle channel for the highest RF power within the transmitting frequency was measured.
4. The conducted spurious emission for the whole frequency range was taken.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz.
6. Set spectrum analyzer with RMS detector.
7. Taking the record of maximum spurious emission.
8. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

#### 3.5.4 Test Setup



#### 3.5.5 Test Result of Conducted Spurious Emission

Refer as Appendix D



### 3.6 Field Strength of Spurious Radiation Measurement

#### 3.6.1 Description of Field Strength of Spurious Radiated Measurement

| Field Strength of Spurious Radiated  |
|--|
| The radiated spurious emission was measured by substitution method according to ANSI / TIA-603-E. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB. |

#### 3.6.2 Measuring Instruments

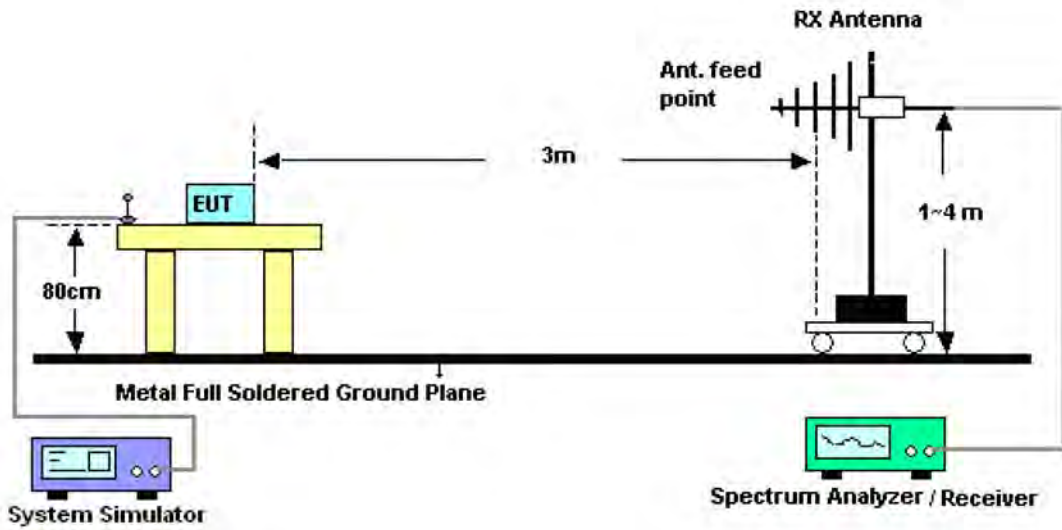
The measuring equipment is listed in the section 4 of this test report.

#### 3.6.3 Test Procedures

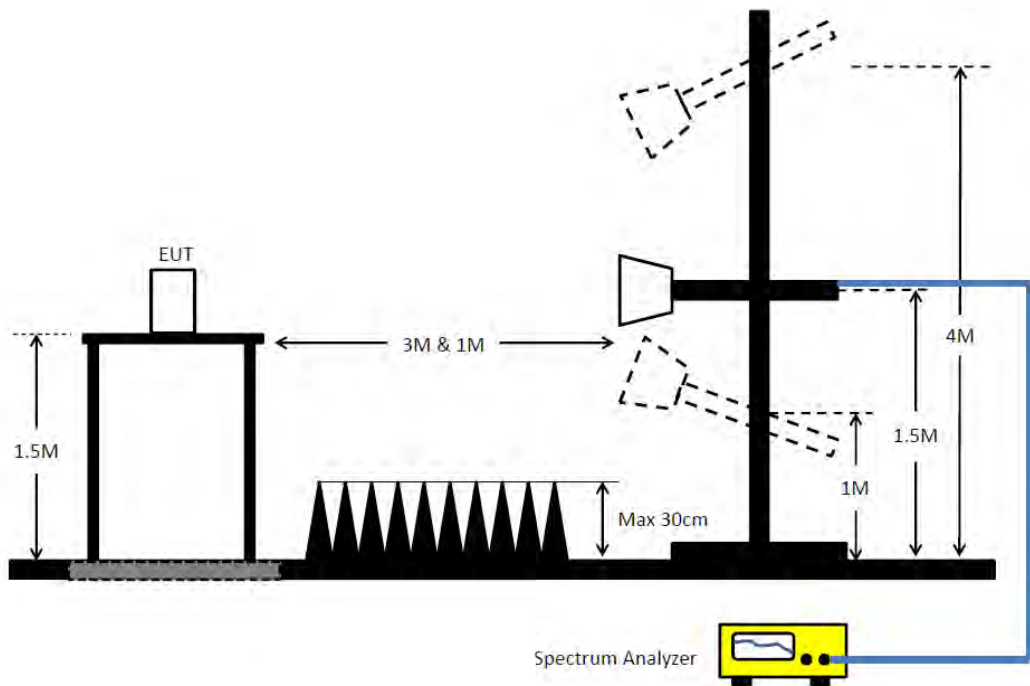
1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
6. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
7. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
8. Taking the record of output power at antenna port.
9. Repeat step 7 to step 8 for another polarization.
10. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

### 3.6.4 Test Setup

For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz





### **3.6.5 Measurement Results Calculation**

The measured Level is calculated using:

Corrected Reading: Antenna factor (AF) + Cable loss (CL) + Read level (Raw) - Preamp factor (PA)(if applicable) = Level.

### **3.6.6 Test Result of Field Strength of Spurious Radiated (Below 1GHz)**

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to KDB414788 Radiated Test Site, and the result came out very similar.

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

### **3.6.7 Test Result of Field Strength of Spurious Radiated (Above 1GHz)**

Refer as Appendix E

### 3.7 Frequency Stability Measurement

#### 3.7.1 Description of Frequency Stability Measurement

| Frequency Stability  |  |
|--|--|
| <input checked="" type="checkbox"/> Band 5   | Base Station: $\pm 1.5\text{ppm}$<br>Mobile Station: $\pm 2.5\text{ppm}$ |
| Note: The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. |  |

#### 3.7.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

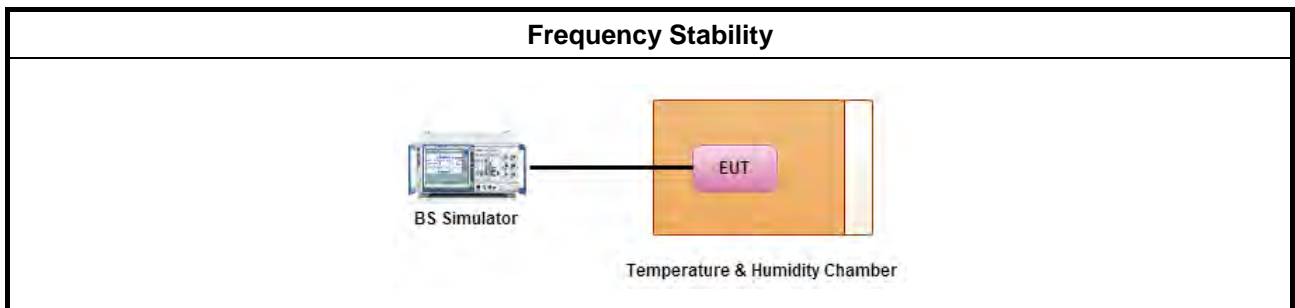
#### 3.7.3 Test Procedures for Temperature Variation

1. The EUT was set up in the thermal chamber and connected with the system simulator.
2. With power OFF, the temperature was decreased to  $-40^{\circ}\text{C}$  and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.
3. With power OFF, the temperature was raised in  $-40^{\circ}\text{C}$  steps up to  $70^{\circ}\text{C}$ . The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.

#### 3.7.4 Test Procedures for Voltage Variation

1. The EUT was placed in a temperature chamber at  $25\pm 5^{\circ}\text{C}$  and connected with the system simulator.
2. The power supply voltage to the EUT was varied from 85 to 115% of the nominal value measured at the input to the EUT.
3. The variation in frequency was measured for the worst case.

#### 3.7.5 Test Setup



#### 3.7.6 Test Result of Temperature and Voltage Variation

Refer as Appendix G



## 4 Test Equipment and Calibration Data

| Instrument                         | Manufacturer      | Model No.             | Serial No.      | Characteristics      | Calibration Date | Calibration Due Date | Remark                |
|------------------------------------|-------------------|-----------------------|-----------------|----------------------|------------------|----------------------|-----------------------|
| Spectrum analyzer                  | Keysight          | N9020A                | MY55400138      | 10 Hz up to 26.5 GHz | Jan. 02, 2018    | Jan. 01, 2019        | Conducted (TH01-CB)   |
| MW Analog Signal Generator         | Keysight          | N5183A                | MY50142965      | 100kHz~20GHz         | Nov. 24, 2017    | Nov. 23, 2018        | Conducted (TH01-CB)   |
| Vector Signal Generator            | Keysight          | N5182B                | MY53052408      | 9kHz~6GHz            | Jan. 02, 2018    | Jan. 01, 2019        | Conducted (TH01-CB)   |
| Temp. and Humidity Chamber         | Gaint Force       | GTH-408-40-C P-AR     | MAA1410-011     | -40~100 degree       | Sep. 14, 2018    | Sep. 13, 2019        | Conducted (TH01-CB)   |
| RF Cable-high                      | Woken             | RG402                 | High Cable-06   | 1 GHz – 26.5 GHz     | Oct. 11, 2017    | Oct. 10, 2018        | Conducted (TH01-CB)   |
| RF Cable-high                      | Woken             | RG402                 | High Cable-06   | 1 GHz – 26.5 GHz     | Oct. 08, 2018    | Oct. 07, 2019        | Conducted (TH01-CB)   |
| RF Cable-high                      | Woken             | RG402                 | High Cable-07   | 1 GHz –26.5 GHz      | Oct. 11, 2017    | Oct. 10, 2018        | Conducted (TH01-CB)   |
| RF Cable-high                      | Woken             | RG402                 | High Cable-07   | 1 GHz –26.5 GHz      | Oct. 08, 2018    | Oct. 07, 2019        | Conducted (TH01-CB)   |
| RF Cable-high                      | Woken             | RG402                 | High Cable-08   | 1 GHz –26.5 GHz      | Oct. 11, 2017    | Oct. 10, 2018        | Conducted (TH01-CB)   |
| RF Cable-high                      | Woken             | RG402                 | High Cable-08   | 1 GHz –26.5 GHz      | Oct. 08, 2018    | Oct. 07, 2019        | Conducted (TH01-CB)   |
| RF Cable-high                      | Woken             | RG402                 | High Cable-09   | 1 GHz –26.5 GHz      | Oct. 11, 2017    | Oct. 10, 2018        | Conducted (TH01-CB)   |
| RF Cable-high                      | Woken             | RG402                 | High Cable-09   | 1 GHz –26.5 GHz      | Oct. 08, 2018    | Oct. 07, 2019        | Conducted (TH01-CB)   |
| RF Cable-high                      | Woken             | RG402                 | High Cable-10   | 1 GHz –26.5 GHz      | Oct. 11, 2017    | Oct. 10, 2018        | Conducted (TH01-CB)   |
| RF Cable-high                      | Woken             | RG402                 | High Cable-10   | 1 GHz –26.5 GHz      | Oct. 08, 2018    | Oct. 07, 2019        | Conducted (TH01-CB)   |
| Power Sensor                       | Agilent           | U2021XA               | MY53410001      | 50MHz~18GHz          | Nov. 20, 2017    | Nov. 19, 2018        | Conducted (TH01-CB)   |
| Test Software                      | SPORTON           | SENSE                 | V5.10           | -                    | N.C.R.           | N.C.R.               | Conducted (TH01-CB)   |
| BILOG ANTENNA with 6 dB attenuator | SCHAFFNER / Woken | CBL 6112B / N-6-06-06 | 2888 / AT-N0609 | 30MHz~1GHz           | Jan. 03, 2018    | Jan. 02, 2019        | Radiation (03CH01-CB) |
| Horn Antenna                       | EMCO              | 3115                  | 00075790        | 750MHz ~ 18GHz       | Nov. 20, 2017    | Nov. 19, 2018        | Radiation (03CH01-CB) |
| Pre-Amplifier                      | EMCI              | EMC330N               | 980332          | 20MHz ~ 3GHz         | May 02, 2018     | May 01, 2019         | Radiation (03CH01-CB) |
| Pre-Amplifier                      | Agilent           | 8449B                 | 3008A02310      | 1GHz ~ 26.5GHz       | Jan. 09, 2018    | Jan. 08, 2019        | Radiation (03CH01-CB) |



| Instrument        | Manufacturer | Model No.        | Serial No.       | Characteristics | Calibration Date | Calibration Due Date | Remark                |
|-------------------|--------------|------------------|------------------|-----------------|------------------|----------------------|-----------------------|
| Spectrum Analyzer | R&S          | FSP40            | 100056           | 9kHz ~ 40GHz    | Nov. 23, 2017    | Nov. 22, 2018        | Radiation (03CH01-CB) |
| EMI Test          | R&S          | ESCS             | 100354           | 9kHz ~ 2.75GHz  | Dec. 08, 2017    | Dec. 07, 2018        | Radiation (03CH01-CB) |
| Low Cable         | Woken        | RG402            | Low Cable-16+17  | 30MHz~1GHz      | Oct. 11, 2017    | Oct. 10, 2018        | Radiation (03CH01-CB) |
| Low Cable         | Woken        | RG402            | Low Cable-16+17  | 30MHz~1GHz      | Oct. 08, 2018    | Oct. 07, 2019        | Radiation (03CH01-CB) |
| High Cable        | Woken        | RG402            | High Cable-16    | 1GHz~18GHz      | Oct. 08, 2018    | Oct. 07, 2019        | Radiation (03CH01-CB) |
| High Cable        | Woken        | RG402            | High Cable-16    | 1GHz~18GHz      | Oct. 07, 2019    | Oct. 06, 2020        | Radiation (03CH01-CB) |
| High Cable        | Woken        | RG402            | High Cable-16+17 | 1GHz~18GHz      | Oct. 11, 2017    | Oct. 10, 2018        | Radiation (03CH01-CB) |
| High Cable        | Woken        | RG402            | High Cable-16+17 | 1GHz~18GHz      | Oct. 08, 2018    | Oct. 07, 2019        | Radiation (03CH01-CB) |
| RF Cable-high     | Woken        | High Cable-16+17 | N/A              | 1 GHz ~ 18 GHz  | Oct. 11, 2017    | Oct. 10, 2018        | Radiation (03CH01-CB) |
| RF Cable-high     | Woken        | High Cable-16+17 | N/A              | 1 GHz ~ 18 GHz  | Oct. 08, 2018    | Oct. 07, 2019        | Radiation (03CH01-CB) |
| Test Software     | SPORTON      | SENSE            | V5.10            | -               | N.C.R.           | N.C.R.               | Radiation (03CH01-CB) |

Note: Calibration Interval of instruments listed above is one year.





Summary

| Mode                       | Power (dBm) | Power (W) | ERP (dBm) | ERP (W) |
|----------------------------|-------------|-----------|-----------|---------|
| Band 5                     | -           | -         | -         | -       |
| Band 5_WCDMA_5MHz_Nss1_1TX | 23.47       | 0.222     | 21.72     | 0.149   |

Result

| Mode                | Result | Power (dBm) | Power (W) | Power Lim. (W) | DG (dBi) | ERP (dBm) | ERP (W) | ERP Lim. (W) | P1 (dBm) |
|---------------------|--------|-------------|-----------|----------------|----------|-----------|---------|--------------|----------|
| WCDMA_5MHz_Nss1_1TX | -      | -           | -         | -              | -        | -         | -       | -            | -        |
| 826.4MHz            | Pass   | 23.28       | 0.213     | Inf            | 0.4      | 21.53     | 0.142   | 7            | 23.28    |
| 836.6MHz            | Pass   | 23.41       | 0.219     | Inf            | 0.4      | 21.66     | 0.147   | 7            | 23.41    |
| 846.6MHz            | Pass   | 23.47       | 0.222     | Inf            | 0.4      | 21.72     | 0.149   | 7            | 23.47    |
| HSDPA Subtest-1     |        |             |           |                |          |           |         |              |          |
| 826.4MHz            | Pass   | 23.22       | 0.210     | Inf            | 0.4      | 21.47     | 0.140   | 7            | 23.22    |
| 836.6MHz            | Pass   | 23.38       | 0.218     | Inf            | 0.4      | 21.63     | 0.146   | 7            | 23.38    |
| 846.6MHz            | Pass   | 23.36       | 0.217     | Inf            | 0.4      | 21.61     | 0.145   | 7            | 23.36    |
| HSDPA Subtest-2     |        |             |           |                |          |           |         |              |          |
| 826.4MHz            | Pass   | 23.25       | 0.211     | Inf            | 0.4      | 21.5      | 0.141   | 7            | 23.25    |
| 836.6MHz            | Pass   | 23.33       | 0.215     | Inf            | 0.4      | 21.58     | 0.144   | 7            | 23.33    |
| 846.6MHz            | Pass   | 23.32       | 0.215     | Inf            | 0.4      | 21.57     | 0.144   | 7            | 23.32    |
| HSDPA Subtest-3     |        |             |           |                |          |           |         |              |          |
| 826.4MHz            | Pass   | 23.26       | 0.212     | Inf            | 0.4      | 21.51     | 0.142   | 7            | 23.26    |
| 836.6MHz            | Pass   | 23.35       | 0.216     | Inf            | 0.4      | 21.6      | 0.145   | 7            | 23.35    |
| 846.6MHz            | Pass   | 23.37       | 0.217     | Inf            | 0.4      | 21.62     | 0.145   | 7            | 23.37    |
| HSDPA Subtest-4     |        |             |           |                |          |           |         |              |          |
| 826.4MHz            | Pass   | 23.27       | 0.212     | Inf            | 0.4      | 21.52     | 0.142   | 7            | 23.27    |
| 836.6MHz            | Pass   | 23.39       | 0.218     | Inf            | 0.4      | 21.64     | 0.146   | 7            | 23.39    |
| 846.6MHz            | Pass   | 23.36       | 0.217     | Inf            | 0.4      | 21.61     | 0.145   | 7            | 23.36    |
| HSUPA Subtest-1     |        |             |           |                |          |           |         |              |          |
| 826.4MHz            | Pass   | 22.66       | 0.185     | Inf            | 0.4      | 20.91     | 0.123   | 7            | 22.66    |
| 836.6MHz            | Pass   | 22.73       | 0.187     | Inf            | 0.4      | 20.98     | 0.125   | 7            | 22.73    |
| 846.6MHz            | Pass   | 22.76       | 0.189     | Inf            | 0.4      | 21.01     | 0.126   | 7            | 22.76    |
| HSUPA Subtest-2     |        |             |           |                |          |           |         |              |          |
| 826.4MHz            | Pass   | 22.61       | 0.182     | Inf            | 0.4      | 20.86     | 0.122   | 7            | 22.61    |
| 836.6MHz            | Pass   | 22.78       | 0.190     | Inf            | 0.4      | 21.03     | 0.127   | 7            | 22.78    |
| 846.6MHz            | Pass   | 22.75       | 0.188     | Inf            | 0.4      | 21.00     | 0.126   | 7            | 22.75    |
| HSUPA Subtest-3     |        |             |           |                |          |           |         |              |          |
| 826.4MHz            | Pass   | 22.68       | 0.185     | Inf            | 0.4      | 20.93     | 0.124   | 7            | 22.68    |
| 836.6MHz            | Pass   | 22.74       | 0.188     | Inf            | 0.4      | 20.99     | 0.126   | 7            | 22.74    |
| 846.6MHz            | Pass   | 22.73       | 0.187     | Inf            | 0.4      | 20.98     | 0.125   | 7            | 22.73    |
| HSUPA Subtest-4     |        |             |           |                |          |           |         |              |          |
| 826.4MHz            | Pass   | 22.67       | 0.185     | Inf            | 0.4      | 20.92     | 0.124   | 7            | 22.67    |
| 836.6MHz            | Pass   | 22.77       | 0.189     | Inf            | 0.4      | 21.02     | 0.126   | 7            | 22.77    |
| 846.6MHz            | Pass   | 22.72       | 0.187     | Inf            | 0.4      | 20.97     | 0.125   | 7            | 22.72    |
| HSUPA Subtest-5     |        |             |           |                |          |           |         |              |          |
| 826.4MHz            | Pass   | 23.25       | 0.211     | Inf            | 0.4      | 21.5      | 0.141   | 7            | 23.25    |
| 836.6MHz            | Pass   | 23.35       | 0.216     | Inf            | 0.4      | 21.6      | 0.145   | 7            | 23.35    |
| 846.6MHz            | Pass   | 23.31       | 0.214     | Inf            | 0.4      | 21.56     | 0.143   | 7            | 23.31    |

DG = Directional Gain; Port X = Port X output power

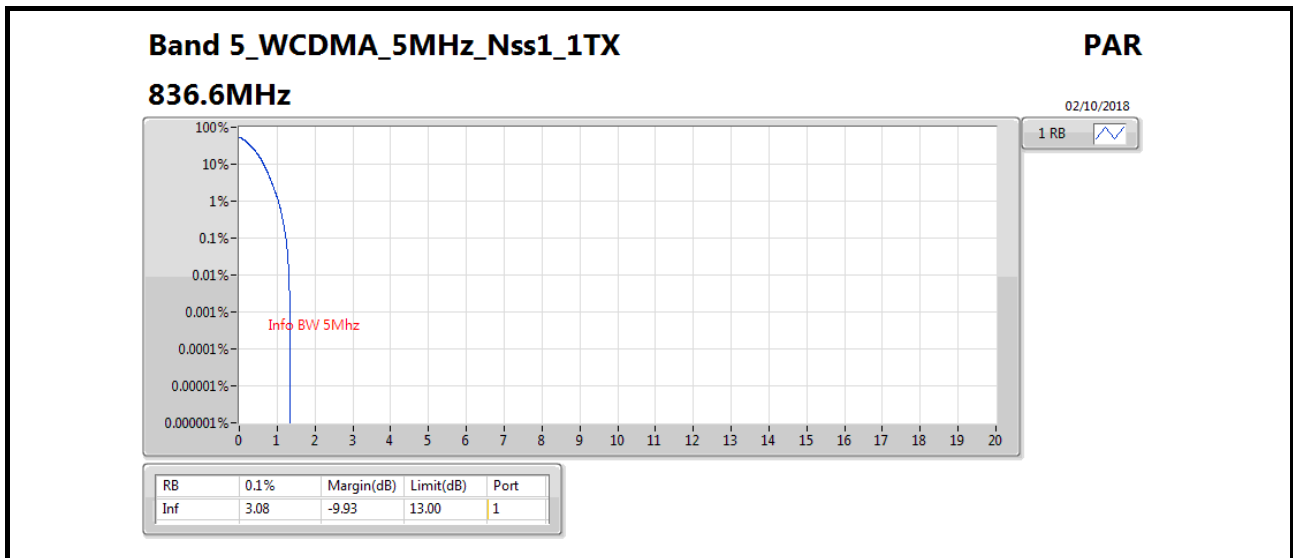


Summary

| Mode                       | Result | RB  | 0.1% | Margin (dB) | Limit (dB) | Port |
|----------------------------|--------|-----|------|-------------|------------|------|
| Band 5                     | -      | -   | -    | -           | -          | -    |
| Band 5_WCDMA_5MHz_Nss1_1TX | Pass   | Inf | 3.08 | -9.93       | 13.00      | 1    |

Result

| Mode                | Result | RB  | 0.1% | Margin (dB) | Limit (dB) | Port |
|---------------------|--------|-----|------|-------------|------------|------|
| WCDMA_5MHz_Nss1_1TX | -      | -   | -    | -           | -          | -    |
| 836.6MHz            | Pass   | Inf | 3.08 | -9.93       | 13.00      | 1    |





**Summary**

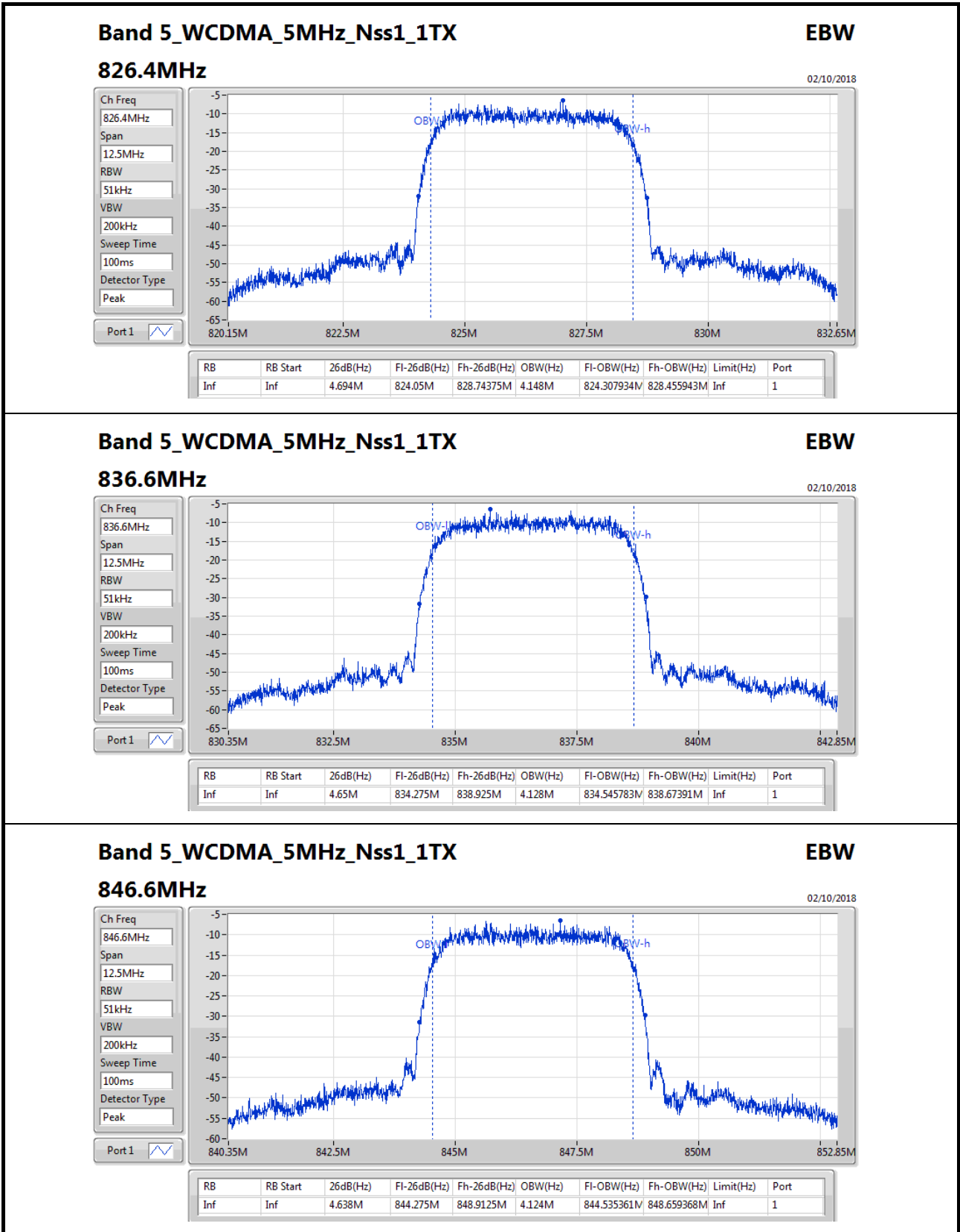
| Mode                       | Max-N dB<br>(Hz) | Max-OBW<br>(Hz) | ITU-Code | Min-N dB<br>(Hz) | Min-OBW<br>(Hz) |
|----------------------------|------------------|-----------------|----------|------------------|-----------------|
| Band 5                     | -                | -               | -        | -                | -               |
| Band 5_WCDMA_5MHz_Nss1_1TX | 4.694M           | 4.148M          | 4M15F9W  | 4.638M           | 4.124M          |

**Max-N dB** = Maximum 26dB downbandwidth; **Max-OBW** = Maximum 99% occupied bandwidth;  
**Min-N dB** = Minimum 26dB downbandwidth; **Min-OBW** = Minimum 99% occupied bandwidth;

**Result**

| Mode                | Result | RB  | RB Start | Limit | P1-N dB<br>(Hz) | P1-OBW<br>(Hz) |
|---------------------|--------|-----|----------|-------|-----------------|----------------|
| WCDMA_5MHz_Nss1_1TX | -      | -   | -        | -     | -               | -              |
| 826.4MHz            | Pass   | Inf | Inf      | Inf   | 4.694M          | 4.148M         |
| 836.6MHz            | Pass   | Inf | Inf      | Inf   | 4.65M           | 4.128M         |
| 846.6MHz            | Pass   | Inf | Inf      | Inf   | 4.638M          | 4.124M         |

**Port X-N dB** = Port X 26dB downbandwidth; **Port X-OBW** = Port X 99% occupied bandwidth;





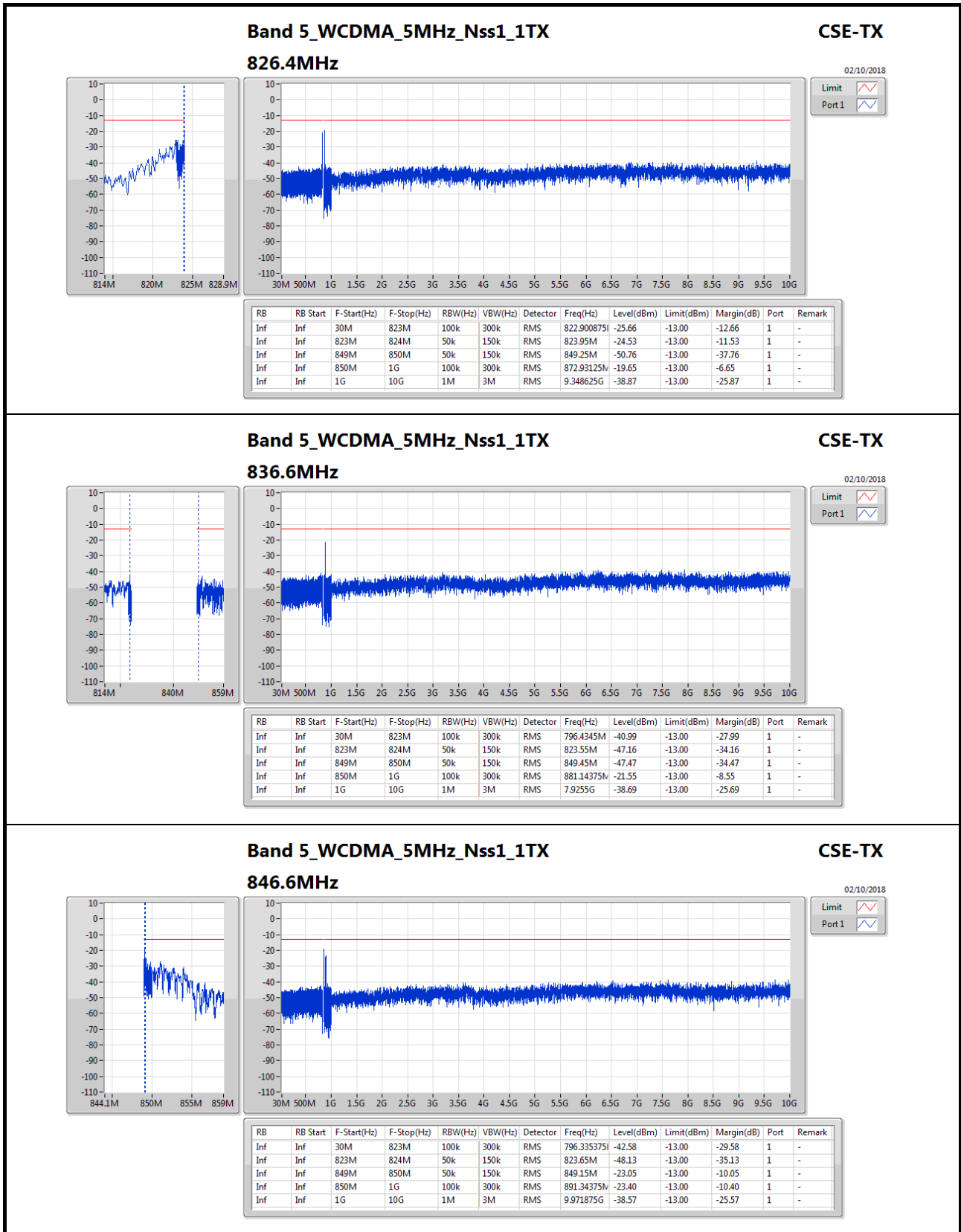
Summary

| Mode                       | Result | RB  | RB Start | F-Start<br>(Hz) | F-Stop<br>(Hz) | RBW<br>(Hz) | Detector | Freq<br>(Hz) | Level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) | Port | Remark |
|----------------------------|--------|-----|----------|-----------------|----------------|-------------|----------|--------------|----------------|----------------|----------------|------|--------|
| Band 5                     | -      | -   | -        | -               | -              | -           | -        | -            | -              | -              | -              | -    | -      |
| Band 5_WCDMA_5MHz_Nss1_1TX | Pass   | Inf | Inf      | 850M            | 1G             | 100k        | RMS      | 872.93125M   | -19.65         | -13.00         | -6.65          | 1    | -      |

DG = Directional Gain;

Result

| Mode                | Result | RB  | RB Start | F-Start<br>(Hz) | F-Stop<br>(Hz) | RBW<br>(Hz) | Detector | Freq<br>(Hz) | Level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) | Port | Remark |
|---------------------|--------|-----|----------|-----------------|----------------|-------------|----------|--------------|----------------|----------------|----------------|------|--------|
| WCDMA_5MHz_Nss1_1TX | -      | -   | -        | -               | -              | -           | -        | -            | -              | -              | -              | -    | -      |
| 826.4MHz            | Pass   | Inf | Inf      | 30M             | 823M           | 100k        | RMS      | 822.900875M  | -25.66         | -13.00         | -12.66         | 1    | -      |
| 826.4MHz            | Pass   | Inf | Inf      | 823M            | 824M           | 50k         | RMS      | 823.95M      | -24.53         | -13.00         | -11.53         | 1    | -      |
| 826.4MHz            | Pass   | Inf | Inf      | 849M            | 850M           | 50k         | RMS      | 849.25M      | -50.76         | -13.00         | -37.76         | 1    | -      |
| 826.4MHz            | Pass   | Inf | Inf      | 850M            | 1G             | 100k        | RMS      | 872.93125M   | -19.65         | -13.00         | -6.65          | 1    | -      |
| 826.4MHz            | Pass   | Inf | Inf      | 1G              | 10G            | 1M          | RMS      | 9.348625G    | -38.87         | -13.00         | -25.87         | 1    | -      |
| 836.6MHz            | Pass   | Inf | Inf      | 30M             | 823M           | 100k        | RMS      | 796.4345M    | -40.99         | -13.00         | -27.99         | 1    | -      |
| 836.6MHz            | Pass   | Inf | Inf      | 823M            | 824M           | 50k         | RMS      | 823.55M      | -47.16         | -13.00         | -34.16         | 1    | -      |
| 836.6MHz            | Pass   | Inf | Inf      | 849M            | 850M           | 50k         | RMS      | 849.45M      | -47.47         | -13.00         | -34.47         | 1    | -      |
| 836.6MHz            | Pass   | Inf | Inf      | 850M            | 1G             | 100k        | RMS      | 881.14375M   | -21.55         | -13.00         | -8.55          | 1    | -      |
| 836.6MHz            | Pass   | Inf | Inf      | 1G              | 10G            | 1M          | RMS      | 7.9255G      | -38.69         | -13.00         | -25.69         | 1    | -      |
| 846.6MHz            | Pass   | Inf | Inf      | 30M             | 823M           | 100k        | RMS      | 796.335375M  | -42.58         | -13.00         | -29.58         | 1    | -      |
| 846.6MHz            | Pass   | Inf | Inf      | 823M            | 824M           | 50k         | RMS      | 823.65M      | -48.13         | -13.00         | -35.13         | 1    | -      |
| 846.6MHz            | Pass   | Inf | Inf      | 849M            | 850M           | 50k         | RMS      | 849.15M      | -23.05         | -13.00         | -10.05         | 1    | -      |
| 846.6MHz            | Pass   | Inf | Inf      | 850M            | 1G             | 100k        | RMS      | 891.34375M   | -23.40         | -13.00         | -10.40         | 1    | -      |
| 846.6MHz            | Pass   | Inf | Inf      | 1G              | 10G            | 1M          | RMS      | 9.971875G    | -38.57         | -13.00         | -25.57         | 1    | -      |





**RSE above 1GHz Result**

|                     |                  |                  |             |
|---------------------|------------------|------------------|-------------|
| <b>Band</b>         | WCDMA Band 5     | <b>Test Mode</b> | QPSK / 5MHz |
| <b>Test Channel</b> | 4132 (826.4 MHz) |                  |             |

**Horizontal**

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | CableAntenna Loss | Antenna Factor | Preamp Factor | A/Pos | T/Pos | Remark  | Pol/Phase  |
|---|---------|--------|------------|------------|------------|-------------------|----------------|---------------|-------|-------|---------|------------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB                | dB/m           | dB            | cm    | deg   |         |            |
| 1 | 1649.98 | 33.48  | 82.20      | -48.72     | 38.49      | 3.78              | 25.79          | 34.58         | 150   | 26    | Average | HORIZONTAL |

**Vertical**

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | CableAntenna Loss | Antenna Factor | Preamp Factor | A/Pos | T/Pos | Remark  | Pol/Phase |
|---|---------|--------|------------|------------|------------|-------------------|----------------|---------------|-------|-------|---------|-----------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB                | dB/m           | dB            | cm    | deg   |         |           |
| 1 | 1654.74 | 41.64  | 82.20      | -40.56     | 46.56      | 3.79              | 25.87          | 34.58         | 128   | 88    | Average | VERTICAL  |



**RSE above 1GHz Result**

|                     |                  |                  |             |
|---------------------|------------------|------------------|-------------|
| <b>Band</b>         | WCDMA Band 5     | <b>Test Mode</b> | QPSK / 5MHz |
| <b>Test Channel</b> | 4183 (836.6 MHz) |                  |             |

**Horizontal**

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | CableAntenna Loss | Antenna Factor | Preamp Factor | A/Pos | T/Pos | Remark  | Pol/Phase  |
|---|---------|--------|------------|------------|------------|-------------------|----------------|---------------|-------|-------|---------|------------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB                | dB/m           | dB            | cm    | deg   |         |            |
| 1 | 1675.46 | 32.53  | 82.20      | -49.67     | 37.36      | 3.82              | 25.94          | 34.59         | 154   | 79    | Average | HORIZONTAL |

**Vertical**

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | CableAntenna Loss | Antenna Factor | Preamp Factor | A/Pos | T/Pos | Remark  | Pol/Phase |
|---|---------|--------|------------|------------|------------|-------------------|----------------|---------------|-------|-------|---------|-----------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB                | dB/m           | dB            | cm    | deg   |         |           |
| 1 | 1675.14 | 39.91  | 82.20      | -42.29     | 44.75      | 3.81              | 25.94          | 34.59         | 198   | 101   | Average | VERTICAL  |





**RSE above 1GHz Result**

|                     |                  |                  |             |
|---------------------|------------------|------------------|-------------|
| <b>Band</b>         | WCDMA Band 5     | <b>Test Mode</b> | QPSK / 5MHz |
| <b>Test Channel</b> | 4233 (846.6 MHz) |                  |             |

**Horizontal**

|   | Freq    | Level  | Limit<br>Line | Over<br>Limit | Read<br>Level | CableAntenna<br>Loss | Antenna<br>Factor | Preamp<br>Factor | A/Pos | T/Pos | Remark  | Pol/Phase  |
|---|---------|--------|---------------|---------------|---------------|----------------------|-------------------|------------------|-------|-------|---------|------------|
|   | MHz     | dBuV/m | dBuV/m        | dB            | dBuV          | dB                   | dB/m              | dB               | cm    | deg   |         |            |
| 1 | 1695.74 | 32.01  | 82.20         | -50.19        | 36.74         | 3.84                 | 26.02             | 34.59            | 147   | 67    | Average | HORIZONTAL |

**Vertical**

|   | Freq    | Level  | Limit<br>Line | Over<br>Limit | Read<br>Level | CableAntenna<br>Loss | Antenna<br>Factor | Preamp<br>Factor | A/Pos | T/Pos | Remark  | Pol/Phase |
|---|---------|--------|---------------|---------------|---------------|----------------------|-------------------|------------------|-------|-------|---------|-----------|
|   | MHz     | dBuV/m | dBuV/m        | dB            | dBuV          | dB                   | dB/m              | dB               | cm    | deg   |         |           |
| 1 | 1690.54 | 38.44  | 82.20         | -43.76        | 43.18         | 3.83                 | 26.02             | 34.59            | 221   | 91    | Average | VERTICAL  |



**Summary**

| Mode        | Voltage (V) | Temp (°C) | Ch (Hz) | Center (Hz)  | Fl (Hz)      | Fh (Hz)      | Fl Limit (Hz) | Fh Limit (Hz) | ppm   | Limit (ppm) | Port | Remark |
|-------------|-------------|-----------|---------|--------------|--------------|--------------|---------------|---------------|-------|-------------|------|--------|
| Band 5      | -           |           | -       | -            | -            | -            | -             | -             | -     | -           | -    | -      |
| WCDMA_5M Hz | 110         | 0         | 836.5M  | 836.500434 M | 836.402406 M | 836.598462 M | 824M          | 849M          | 0.007 | 2.5         | 1    | -      |



**Result**

| Mode       | Voltage (V) | Temp (°C) | Ch (Hz) | Center (Hz) | Fl (Hz)     | Fh (Hz)     | Fl Limit (Hz) | Fh Limit (Hz) | ppm   | Limit (ppm) | Port | Result |
|------------|-------------|-----------|---------|-------------|-------------|-------------|---------------|---------------|-------|-------------|------|--------|
| WCDMA_5MHz |             |           | -       | -           | -           | -           | -             | -             | -     | -           | -    | -      |
| 836.5MHz   | 110         | -40       | 836.5M  | 836.499957M | 836.400486M | 836.599428M | 824M          | 849M          | 0.003 | 2.5         | 1    | Pass   |
| 836.5MHz   | 110         | -30       | 836.5M  | 836.499764M | 836.400946M | 836.598581M | 824M          | 849M          | 0.003 | 2.5         | 1    | Pass   |
| 836.5MHz   | 110         | -20       | 836.5M  | 836.500303M | 836.401655M | 836.598952M | 824M          | 849M          | 0.005 | 2.5         | 1    | Pass   |
| 836.5MHz   | 110         | -10       | 836.5M  | 836.500672M | 836.401609M | 836.599734M | 824M          | 849M          | 0.004 | 2.5         | 1    | Pass   |
| 836.5MHz   | 110         | 0         | 836.5M  | 836.500434M | 836.402406M | 836.598462M | 824M          | 849M          | 0.007 | 2.5         | 1    | Pass   |
| 836.5MHz   | 110         | 10        | 836.5M  | 836.500361M | 836.401313M | 836.59941M  | 824M          | 849M          | 0.005 | 2.5         | 1    | Pass   |
| 836.5MHz   | 93.5        | 20        | 836.5M  | 836.50012M  | 836.4014M   | 836.598841M | 824M          | 849M          | 0.004 | 2.5         | 1    | Pass   |
| 836.5MHz   | 110         | 20        | 836.5M  | 836.500043M | 836.401384M | 836.598702M | 824M          | 849M          | 0.003 | 2.5         | 1    | Pass   |
| 836.5MHz   | 126.5       | 20        | 836.5M  | 836.499733M | 836.400996M | 836.598469M | 824M          | 849M          | 0.007 | 2.5         | 1    | Pass   |
| 836.5MHz   | 110         | 30        | 836.5M  | 836.499992M | 836.40127M  | 836.598713M | 824M          | 849M          | 0.005 | 2.5         | 1    | Pass   |
| 836.5MHz   | 110         | 40        | 836.5M  | 836.499966M | 836.40129M  | 836.598641M | 824M          | 849M          | 0.003 | 2.5         | 1    | Pass   |
| 836.5MHz   | 110         | 50        | 836.5M  | 836.499998M | 836.400474M | 836.599521M | 824M          | 849M          | 0.004 | 2.5         | 1    | Pass   |
| 836.5MHz   | 110         | 60        | 836.5M  | 836.499494M | 836.400859M | 836.598129M | 824M          | 849M          | 0.004 | 2.5         | 1    | Pass   |
| 836.5MHz   | 110         | 70        | 836.5M  | 836.500408M | 836.401946M | 836.59887M  | 824M          | 849M          | 0.003 | 2.5         | 1    | Pass   |