

TEST REPORT

Product Name : Tablet
Model Number : MS-NDA2
FCC ID : I4L-MSNDA201

Prepared for : Micro-Star Int'l Co.,Ltd.
Address : No.69, Lide St., Zhonghe Dist., New Taipei City 235, Taiwan

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Modified Information

Version	Report No.	Revision Date	Summary
Ver.1.0	ENS2408260033W00207R	/	Original Report

1 TEST RESULT CERTIFICATION

Applicant : Micro-Star Int'l Co.,Ltd.
Address : No.69, Lide St., Zhonghe Dist., New Taipei City 235, Taiwan
Manufacturer : Micro-Star International Co., Ltd.
Address : No.88 East Qianjin Road, Kunshan city, Jiangsu province, China
Product Name : Tablet
Model Number : MS-NDA2
Trademark : MSI

Measurement Procedure Used:

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 2 , Subpart J FCC 47 CFR Part 22, Subpart H FCC 47 CFR Part 24, Subpart E FCC 47 CFR Part 27 FCC 47 CFR Part 90	PASS

The device described above is tested by EMTEK (Shenzhen) Co., Ltd. to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and EMTEK (Shenzhen) Co., Ltd. is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the above table standards requirement.

This report applies to above tested sample only and shall not be reproduced in part without written approval of EMTEK (Shenzhen) Co., Ltd.

Date of Test : September 13, 2024 to October 22, 2024

Prepared by : 
Una Yu/Editor

Reviewer : 
Joe Xia/Supervisor

Approved & Authorized Signer : 
Lisa Wang/Manager



2 EUT TECHNICAL DESCRIPTION

Product Name:	Tablet
Model Number:	MS-NDA2
Operation Band:	LTE Band 2 LTE Band 4 LTE Band 5 LTE Band 7 LTE Band 12 LTE Band 13 LTE Band 17 LTE Band 25 LTE Band 26 LTE Band 41 LTE Band 66
Modulation:	QPSK, 16QAM
Operating Frequency Range(s):	LTE Band 2: Tx: 1850~1910MHz/ Rx: 1930~1990MHz LTE Band 4: Tx: 1710~1755MHz/ Rx: 2110~2155MHz LTE Band 5: Tx: 824~849MHz/ Rx: 869~894MHz LTE Band 7: Tx: 2500~2570MHz/ Rx: 2620~2690MHz LTE Band 12: Tx: 699~716MHz/ Rx: 729~746MHz LTE Band 13: Tx: 777~787MHz/ Rx: 746~756MHz LTE Band 17: Tx: 704~716MHz/ Rx: 734~746MHz LTE Band 25: Tx: 1850~1915MHz/ Rx: 1930~1995MHz LTE Band 26: Tx: 824~849MHz/ Rx: 869~894MHz LTE Band 41: Tx/Rx: 2496~2690MHz LTE Band 66: Tx/Rx: 1710~1780MHz
Antenna Type:	Integrated Antenna
Antenna Gain:	LTE Band 2: 2.95dBi LTE Band 4: 1.12dBi LTE Band 5: 0.02dBi LTE Band 7: 4.64dBi LTE Band 12: -0.41dBi LTE Band 13: 0.02dBi LTE Band 17: -0.41dBi LTE Band 25: 2.95dBi LTE Band 26: 0.02dBi LTE Band 41: 4.64dBi LTE Band 66: 1.12dBi (Note: The antenna information is provided by the customers, which will have a certain impact on the test results.)
Power Supply:	Rechargeable Li-ion Cylindrical Battery Model: 18650-2S3P 21NR19/66-3 Rating: 7.2V, 9447mAh, 68Wh
Temperature Range:	0°C ~ 50°C

Note: for more details, please refer to the user's manual of the EUT.

3 SUMMARY OF TEST RESULT

3.1 TEST ITEMS

FCC Rule	Test Parameter	Verdict	Remark
2.1046	RF Power Output	PASS	
22.913, 24.232, 27.50, 90.635	Equivalent (Isotropic) Radiated Power	PASS	
2.1047	Modulation Characteristics	PASS	
2.1049	Occupied Bandwidth	PASS	
2.1051, 22.917, 24.238, 27.53, 90.691	Out of Band Emissions at Antenna Terminals	PASS	
	Band Edge Compliance	PASS	
2.1053, 22.917, 24.238, 27.53, 90.691	Field Strength of Spurious Radiation	PASS	
2.1055, 22.355, 24.235, 27.54, 90.213	Frequency Stability versus Temperature	PASS	
	Frequency Stability versus Voltage	PASS	
24.232, 27.50	Peak to Average Ratio	PASS	
NOTE: The results of this report do not take into account the uncertainty.			

RELATED SUBMITTAL(S) / GRANT(S):

This submittal(s) (test report) is filing to comply with the above table standards requirement.

3.2 GENERAL DESCRIPTION OF APPLIED STANDARDS

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

FCC 47 CFR Part 2 , Subpart J
 FCC 47 CFR Part 22H
 FCC 47 CFR Part 24E
 FCC 47 CFR Part 27
 FCC 47 CFR Part 90
 KDB971168 D01:v02r02
 ANSI/TIA-603-D-2010
 ANSI C63.26:2015

3.3 MEASUREMENT EQUIPMENT USED

For Spurious Emissions Test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Pre-Amplifier	Bonn	BLMA 011001N	2213967A	2023/10/23	1Year
EMI Test Receiver	Rohde & Schwarz	ESR7	102551	2023/10/23	1Year
Bilog Antenna	Schwarzbeck	VULB9163	9163142	2024/7/8	2Year
Horn antenna	Schwarzbeck	BBHA9120D	9120D-1198	2023/6/2	2Year
Pre-Amplifier	Bonn	BLMA 0118-5G	2213967B-01	2023/10/23	1Year
Spectrum Analyzer	Rohde & Schwarz	FSV3044	101290	2023/10/23	1Year
Horn antenna	Schwarzbeck	BBHA9170	9170-399	2023/5/12	2Year
Pre-Amplifier	Lunar EM	LNA18G26-40	J1012131010001	2024/5/11	1Year
Pre-Amplifier	Lunar EM	LNA26G40-40	J1013131028001	2024/5/11	1Year
Loop Antenna	Schwarzbeck	FMZB1519	1519-012	2023/5/12	2Year
Wideband Radio Communication Tester	R&S	CMW500	147366	2024/5/10	1Year
Coaxial Cable	TIMES	NmNm-7-C15702	N/A	2024/5/23	1Year
Coaxial Cable	TIMES	HF290-NMSM-6.5M	N/A	2024/5/23	1Year

For Other Test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
5G Wireless Test Platform	KEYSIGHT	E7515B	MY60101197	2024/4/10	1Year
Wideband Radio Communication Tester	R&S	CMW500	147366	2024/5/10	1Year
Signal Analyzer	KEYSIGHT	N9010B	MY60240204	2023/9/19 2024/9/18	1Year
Vector Signal Generator	KEYSIGHT	N5182B	MY59100922	2023/9/19 2024/9/18	1Year
Analog Signal Generator	KEYSIGHT	N5173B	MY59100520	2023/9/19 2024/9/18	1Year
DC Power Supply	KEYSIGHT	E3642A	MY60266212	2023/9/19 2024/9/18	1Year
RF Control Unit	Tonscend	JS0806-1	20H8060306	N/A	N/A
Band Reject Filter	Tonscend	JS0806-F	20H8060310	N/A	N/A

Group					
Temperature&Humidity Chamber	ESPEC	EL-02KA	12107166	2024/5/10	1 Year



3.4 DESCRIPTION OF TEST MODES

The EUT has been tested under its typical operating condition. The CMU200 and CMW500 used to control the EUT staying in continuous transmitting and receiving mode for testing.

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

During all testing, EUT is in link mode with base station emulator at maximum power level.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

■ Test Mode and system config

Configure the CMW500 call box to support all LTE tests in respect to the 3GPP 36.521.

UE term. Conn: User defined Channels.

Exp. Nominal Power Mode: According to UL Power Control Settings.

RS EPRE: -75.0 dBm/15kHz Full Cell BW Power: -50.2 dBm.

PSS Power Offset = SSS Power Offset = PBCH Power Offset = PCFICH Power Offset = PDCCH Power Offset = 0.0 dB.

PHICH Power Offset = -12 dB.

OCNG ON.

PDSCH Power Offset PA: 0 dB, Power Ratio Index PB: 0 (rhoB/rhoA: 1).

Active TPC Setup: Max Power.

Security Settings: Authentication OFF, NAS Security OFF, AS Security OFF.

Integrity Algorithm: NULL.

Milenage OFF.

Configure the desired channel, BW, resource block allocation and modulation.

Connect to test set.

Set CMW500 TPC Setup to Max Power (Up power control command).

According to 3GPP 36.521, V9.1.0., the output power level for Power Class 3 LTE is to be 23.0dBm + 2.7dB. The lower limit is shifted down by the MPR amount allowed for certain configurations.

Maximum Power Reduction (MPR) is allowed due to higher order modulation and transmit bandwidth configurations. These MPR levels reduce the lower limit of each output power by the either 1 or 2dB per 3GPP 36.521.

Modulation	Channel bandwidth / Transmission bandwidth configuration[RB]						MPR (dB)
	1.4MHz	3MHz	5MHz	10MHz	15MHz	20MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
64QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2
64QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3

Modulation	CA bandwidth Class B and C							MPR (dB)
	25 RB + 50 RB	50 RB + 50 RB	25 RB + 100 RB	50 RB + 100 RB	75 RB + 75 RB	75 RB + 100 RB	100 RB + 100 RB	
QPSK	> 8 and ≤25	> 12 and ≤50	> 8 and ≤25	> 12 and ≤50	> 16 and ≤75	> 16 and ≤75	> 18 and ≤100	≤ 1
QPSK	> 25	> 50	> 25	> 50	> 75	> 75	> 100	≤ 1
16 QAM	≤8	≤12	≤8	≤12	≤16	≤16	≤18	≤ 2
16 QAM	> 8 and ≤25	> 12 and ≤50	> 8 and ≤25	> 12 and ≤50	> 16 and ≤75	> 16 and ≤75	> 18 and ≤100	≤ 2
16 QAM	> 25	> 50	> 25	> 50	> 75	> 75	> 100	≤ 3

Modulation	CA bandwidth Class B and C							MPR (dB)
	25 RB + 50 RB	50 RB + 50 RB	25 RB + 100 RB	50 RB + 100 RB	75 RB + 75 RB	75 RB + 100 RB	100 RB + 100 RB	
64 QAM	8 and a≤llocation wholly contained within a single CC	12 and a≤llocation wholly contained within a single CC	8 and a≤llocation wholly contained within a single CC	12 and a≤llocation wholly contained within a single CC	16 and a≤llocation wholly contained within a single CC	16 and a≤llocation wholly contained within a single CC	18 and a≤llocation wholly contained within a single CC	≤ 2
64 QAM	> 8 or allocation extends across two CC's	> 12 or allocation extends across two CC's	> 8 or allocation extends across two CC's	> 12 or allocation extends across two CC's	> 16 or allocation extends across two CC's	> 16 or allocation extends across two CC's	> 18 or allocation extends across two CC's	≤ 3

■ Test Environment

Environment Parameter	Selected Values During Tests	
Relative Humidity	Ambient	
Temperature	TN	Ambient
Ambient	VL	DC 6.48V
	VN	DC 7.2V
	VH	DC 7.92V
NOTE: VL= Lower Extreme Test Voltage. VN= Nominal Voltage. VH= Upper Extreme Test Voltage. TN= Normal Temperature.		



4 FACILITIES AND ACCREDITATIONS

4.1 FACILITIES

Site Description

EMC Lab.

: **Accredited by CNAS**

The Certificate Registration Number is L2291

The Laboratory has been assessed and proved to be in compliance with
CNAS-CL01 (identical to ISO/IEC 17025:2017)

Accredited by FCC

Designation Number: CN1204

Test Firm Registration Number: 882943

Accredited by A2LA

The Certificate Number is 4321.01

Accredited by Industry Canada

The Conformity Assessment Body Identifier is CN0008

Name of Firm : EMTEK (SHENZHEN) CO., LTD.

Site Location : Building 69, Majialong Industry Zone, Nanshan District, Shenzhen,
Guangdong, China

4.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with preselectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

5 TEST SYSTEM UNCERTAINTY

The following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-5}$
RF Power Output	$\pm 1.0\text{dB}$
Radiated Emission Test	$\pm 2.0\text{dB}$
Occupied Bandwidth Test	$\pm 1.0\text{dB}$
Band Edge Test	$\pm 3\text{dB}$
All emission, radiated	$\pm 3\text{dB}$
Antenna Port Emission	$\pm 3\text{dB}$
Temperature	$\pm 0.5^{\circ}\text{C}$
Humidity	$\pm 3\%$

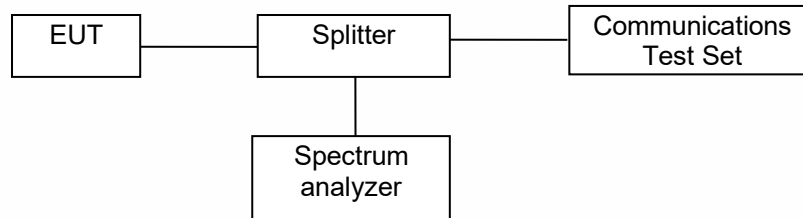
Measurement Uncertainty for a level of Confidence of 95%.



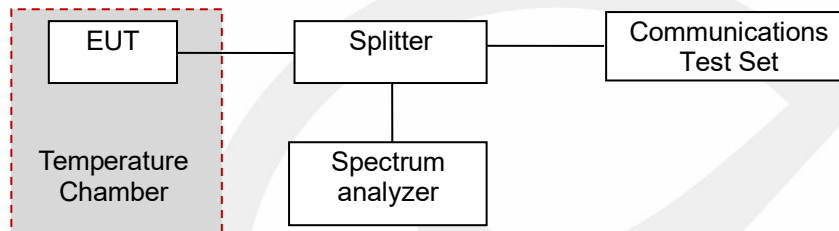
6 SETUP OF EQUIPMENT UNDER TEST

6.1 RADIO FREQUENCY TEST SETUP 1

The sample component's antenna ports(s) of the EUT are connected to the measurement instrument per an appropriate attenuator. The EUT is controlled by PC/software to emit the specified signals for the purpose of measurements.



6.2 RADIO FREQUENCY TEST SETUP 2



6.3 RADIO FREQUENCY TEST SETUP 3

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10. The test distance is 3m. The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.26-2015 and CAN/CSA-CEI/IEC CISPR 22.

Below 30MHz:

The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna (loop antenna). The Antenna should be positioned with its plane vertical at the specified distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. The center of the loop shall be 1 m above the ground. For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT.

Above 30MHz:

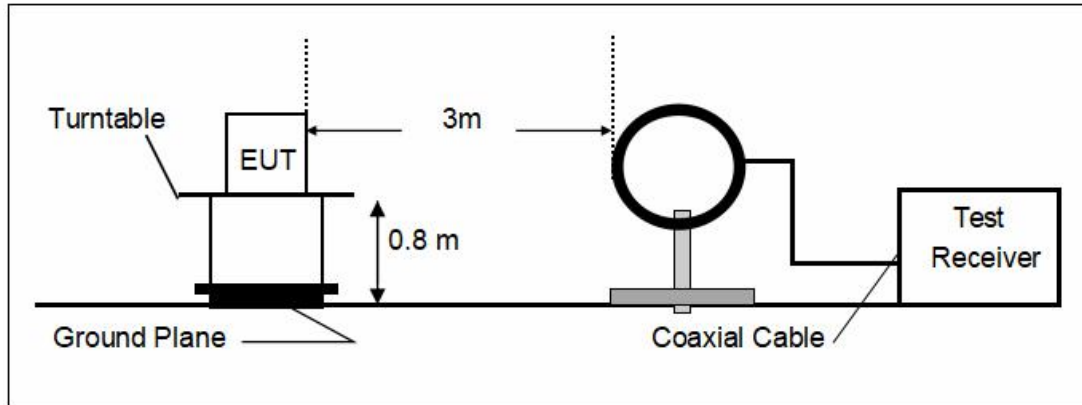
The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

Above 1GHz:

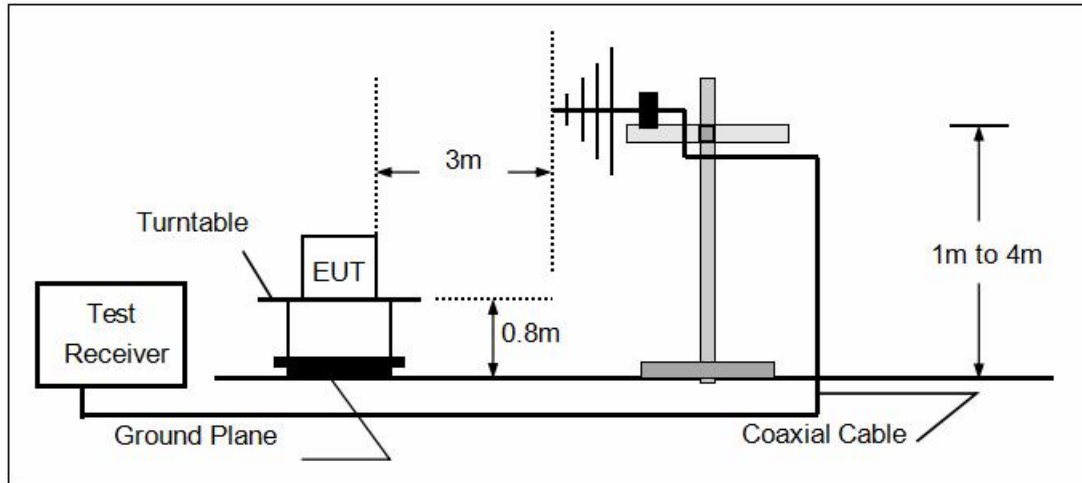
(Note: the FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 2, 2014.)

The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

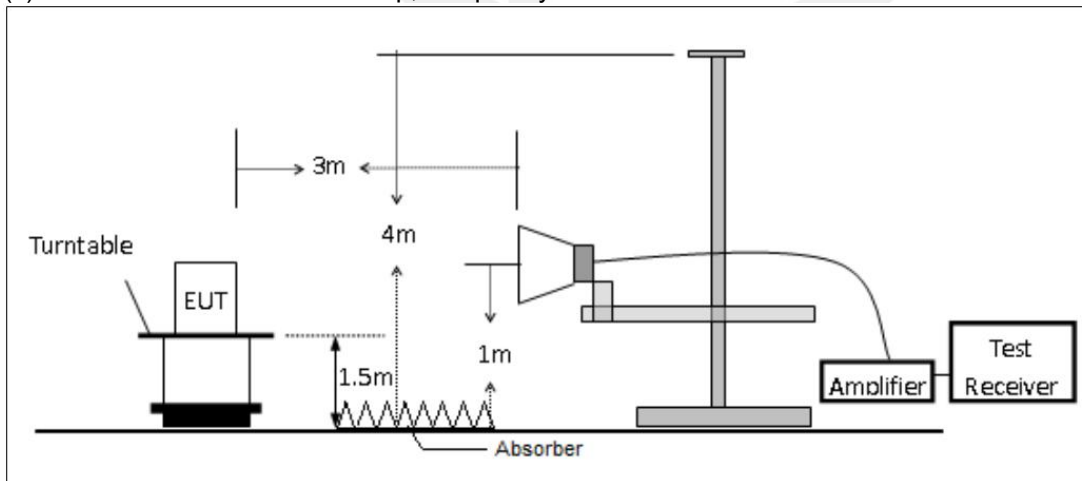
(a) Radiated Emission Test Set-Up, Frequency Below 30MHz



(b) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(c) Radiated Emission Test Set-Up, Frequency above 1000MHz



6.4 SUPPORT EQUIPMENT

N/A

Notes:

- 1.All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
- 2.Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.



7 TEST REQUIREMENTS

7.1 RF POWER OUTPUT

7.1.1 Conformance Limit

No limit requirement.

7.1.2 Test Configuration

Test according to clause 7.1 radio frequency test setup 1.

7.1.3 Test Procedure

Connect the EUT to Universal Radio Communication Tester CMU200 or CMU500 via the antenna connector. A call is set up by the SS according to the generic call set up procedure on a channel with ARFCN in the ARFCN range, power control level set to Max power. The frequency band is set as selected frequency. the RF output of the transmitter was connected to base station simulator.

Set EUT at maximum average power by base station simulator.

Set RBW = 1-5% of the OBW, not to exceed 1 MHz.

Set VBW $\geq 3 \times$ RBW.

Number of points in sweep $\geq 2 \times$ span / RBW. (This gives bin-to-bin spacing $\leq$ RBW/2, so that narrowband signals are not lost between frequency bins.)

Sweep time = auto.

Detector = RMS (power averaging).

Set sweep trigger to "free run".

Trace average at least 100 traces in power averaging (i.e., RMS) mode; however, the number of traces to be averaged shall be increased above 100 as needed such that the average accurately represents the true average over the on and off periods of the transmitter.

Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

Add $10 \log(1/x)$, where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add $10 \log(1/0.25) = 6$ dB if the duty cycle is a constant 25%.

Measure lowest, middle, and highest channels for each bandwidth and different modulation.

Measure and record the results in the test report.

7.1.4 Test Results

PASS

Temperature :	25°C	ATM Pressure:	1011 mbar
Humidity :	60 %	Test Engineer:	XXH

Please refer to FCC 4G Appendix Band.

7.2 EFFECTIVE (ISOTROPIC) RADIATED POWER

7.2.1 Conformance Limit

LTE BAND2 (25)	FCC Part 24.232
Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.	
LTE BAND4(66)	FCC Part 27.50
Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP. Fixed stations operating in the 1710-1755 MHz band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.	
LTE BAND5 (26)	FCC Part 22.913, Part 90.635
According to Part 22.913(a) the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts; According to Part 90.635(b), the maximum output power of the transmitter for mobile stations is 100 watts (20 dBw);	
LTE BAND7	FCC Part 27.50
Mobile and other user stations. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.	
LTE BAND12	FCC Part 27.50
Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.	
LTE BAND13	FCC Part 27.50
Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP	
LTE BAND17	FCC Part 27.50
Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP	
LTE BAND30	FCC Part 27.50
Mobile and portable stations. (i) For mobile and portable stations transmitting in the 2305-2315 MHz band or the 2350-2360 MHz band, the average EIRP must not exceed 50 milliwatts within any 1 megahertz of authorized bandwidth, except that for mobile and portable stations compliant with 3GPP LTE standards.	
LTE BAND41	FCC Part 27.50
Mobile and other user stations. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.	

7.2.2 Test Configuration

Test according to clause 7.3 radio frequency test setup 3.

7.2.3 Test Procedure

Connect the EUT to Universal Radio Communication Tester CMU200 or CMU500 via the antenna connector. A call is set up by the SS according to the generic call set up procedure on a channel with ARFCN in the Mid ARFCN range, power control level set to Max power. MS TXPWR_MAX_CCH is set to the maximum value supported by the Power Class of the Mobile under test.

The instrument must have an available measurement/resolution bandwidth that is equal to or exceeds the OBW. If this capability is available, then the following procedure can be used to determine the total peak output power.

- Set the RBW $\geq$ OBW.
- Set VBW $\geq 3 \times$ RBW.
- Set span $\geq 2 \times$ RBW.
- Sweep time = auto couple.
- Detector = peak.

- f) Ensure that the number of measurement points $\geq$ span/RBW.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the peak amplitude level.

The EUT was placed on a turn table which is 0.8m above ground plane. Maximum procedure was performed on the six highest emissions to ensure EUT compliance. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. Repeat above procedures until all frequency measured was complete.

A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.

The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as (Pr).

The EUT shall be replaced by a substitution antenna. The test setup refers to figure below. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (PMea) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). The power of signal source (PMea) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenapolarization.

A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna.

The cable loss (Pcl) ,the Substitution Antenna Gain (Ga) and the Amplifier Gain (PAg) should be recorded after test.

The measurement results are obtained as described below:

Power(EIRP)=PMea- PAg - Pcl - Ga.

This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.

ERP can be calculated from EIRP by subtracting the gain of the dipole.

ERP = EIRP -2.15dBi.

7.2.4 Test Results

PASS

Temperature :	25°C	ATM Pressure:	1011 mbar
Humidity :	60 %	Test Engineer:	XXH

Please refer to FCC 4G Appendix Band.

7.3 MODULATION CHARACTERISTICS

7.3.1 Conformance Limit

No limit requirement.

7.3.2 Test Configuration

Test according to clause 7.1 radio frequency test setup 1.

7.3.3 Test Procedure

Connect the EUT to Universal Radio Communication Tester CMU200 or CMU500 via the antenna connector. A call is set up by the SS according to the generic call set up procedure on a channel with ARFCN in the Mid ARFCN range, power control level set to Max power. MS TXPWR_MAX_CCH is set to the maximum value supported by the Power Class of the Mobile under test, The frequency band is set as selected frequency, test method was according to 3GPP TS 51.010 and 3GPP TS 34.121. and 3GPP2 C.S0011/TIA-98-E for 1XRTT, and 3GPP2 C.S0033-0/tia-866 for Rel.0 and 3GPP2 C.S0033-A for Rev.A The waveform quality and constellation of the was tested.

7.3.4 Test Results

PASS

Temperature :	25°C	ATM Pressure:	1011 mbar
Humidity :	60 %	Test Engineer:	XXH

Please refer to FCC 4G Appendix Band.

7.4 OCCUPIED BANDWIDTH

7.4.1 Conformance Limit

No limit requirement.

7.4.2 Test Configuration

Test according to clause 7.1 radio frequency test setup 1.

7.4.3 Test Procedure

Connect the EUT to Universal Radio Communication Tester CMU200 or CMU500 via the antenna connector. A call is set up by the SS according to the generic call set up procedure on a channel with ARFCN in the Mid ARFCN range, power control level set to Max power. MS TXPWR_MAX_CCH is set to the maximum value supported by the Power Class of the Mobile under test.

■ 99% Occupied bandwidth

The following procedure shall be used for measuring (99 %) power bandwidth.

- The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (i.e., two to five times the OBW).
- The nominal IF filter bandwidth (3 dB 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.
- Set the reference level of the instrument as required to keep the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope must be at least $10\log(\text{OBW} / \text{RBW})$ below the reference level.
- NOTE—Steps a) through c) may require iteration to adjust within the specified tolerances.
- Set the detection mode to peak, and the trace mode to max hold.
- Use the 99 % power bandwidth function of the spectrum analyzer (if available) and report the measured bandwidth.
- If the instrument does not have a 99 % power bandwidth function, the trace data points are to be recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99 % power bandwidth is the difference between these two frequencies.
- The OBW shall be reported by providing plot(s) of the measuring instrument display. The frequency and amplitude axes and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

■ 26 dB Occupied bandwidth

The reference value is the highest level of the spectral envelope of the modulated signal.

- 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.
- 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.
- Set the reference level of the instrument as required to prevent the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope must be at least $10\log(\text{OBW} / \text{RBW})$ below the reference level.
- NOTE—Steps a) through c) may require iteration to adjust within the specified tolerances.
- The dynamic range of the spectrum analyzer at the selected RBW shall be at least 10 dB below the target “-X dB down” requirement (i.e., if the requirement calls for measuring the -26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference value).
- Set the detection mode to peak, and the trace mode to max hold.
- 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).
- Determine the “-X dB down amplitude” as equal to (Reference Value – X). Alternatively, this calculation can be performed by the analyzer by using the marker-delta function.

- i) 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 g). 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.
- j) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display. The frequency and amplitude axes and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

7.4.4 Test Results

PASS

Temperature :	25°C	ATM Pressure:	1011 mbar
Humidity :	60 %	Test Engineer:	XXH

Please refer to FCC 4G Appendix Band.



7.5 BAND EDGE COMPLIANCE

7.5.1 Conformance Limit

LTE BAND5 (26) FCC Part 22.917, Part 90.691

$\leq -13 \text{ dBm}/1\% \text{EBW}$, in 1 MHz bands immediately outside and adjacent to the frequency block.

LTE BAND2 (25) FCC Part 24.238

$\leq -13 \text{ dBm}/1\% \text{EBW}$, in 1 MHz bands immediately outside and adjacent to the frequency block.

LTE BAND4(66) FCC Part 27.53(h)

$\leq -13 \text{ dBm}/1\% \text{EBW}$, in 1 MHz bands immediately outside and adjacent to the frequency block.

LTE BAND7 (41) FCC Part 27.53(m)

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

LTE BAND12 FCC Part 27.53(g)

$\leq -13 \text{ dBm}/1\% \text{EBW}$, in 1 MHz bands immediately outside and adjacent to the frequency block.

LTE BAND13 FCC Part 27.53(c)

$\leq -13 \text{ dBm}/1\% \text{EBW}$, in 1 MHz bands immediately outside and adjacent to the frequency block.

LTE BAND30 FCC Part 27.53(a)

By a factor of not less than: $43 + 10 \log (P)$ dB on all frequencies between 2305 and 2320 MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band(s) of operation, not less than $55 + 10 \log (P)$ dB on all frequencies between 2320 and 2324 MHz and on all frequencies between 2341 and 2345 MHz, not less than $61 + 10 \log (P)$ dB on all frequencies between 2324 and 2328 MHz and on all frequencies between 2337 and 2341 MHz, and not less than $67 + 10 \log (P)$ dB on all frequencies between 2328 and 2337 MHz

By a factor of not less than $43 + 10 \log (P)$ dB on all frequencies between 2300 and 2305 MHz, $55 + 10 \log (P)$ dB on all frequencies between 2296 and 2300 MHz, $61 + 10 \log (P)$ dB on all frequencies between 2292 and 2296 MHz, $67 + 10 \log (P)$ dB on all frequencies between 2288 and 2292 MHz, and $70 + 10 \log (P)$ dB below 2288 MHz

7.5.2 Test Configuration

Test according to clause 7.1 radio frequency test setup 1.

7.5.3 Test Procedure

Connect the EUT to Universal Radio Communication Tester CMU200 or CMU500 via the antenna connector. A call is set up by the SS according to the generic call set up procedure on a channel with ARFCN in the Mid ARFCN range, power control level set to Max power. MS TXPWR_MAX_CCH is set to the maximum value supported by the Power Class of the Mobile under test.

Spectrum Analyzer is set as below:

SET RBW $\geq 1\%$ of Emission BW.

SET VBW about three times of RBW.

Detector: RMS.

Trace mode= max hold.

7.5.4 Test Results

PASS

Temperature : 25℃
Humidity : 60 %

ATM Pressure: 1011 mbar
Test Engineer: XXH

Please refer to FCC 4G Appendix Band.



7.6 OUT OF BAND EMISSIONS AT ANTENNA TERMINALS

7.6.1 Conformance Limit

LTE BAND2 (25)

FCC Part 24.238

Out of band emissions. 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.

LTE BAND4(66)

FCC Part 27.53(h)

Out of band emissions. 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.

LTE BAND5(26)

FCC Part 22.917

Out of band emissions. 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.

LTE BAND7 (41)

FCC Part 27.53(m)

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

LTE BAND12

FCC Part 27.53(g)

Out of band emissions. 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.

LTE BAND13

FCC Part 27.53(c)

Out of band emissions. 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.

LTE BAND30

FCC Part 27.53(a)

By a factor of not less than $43 + 10 \log(P)$ dB on all frequencies between 2360 and 2365 MHz, and not less than $70 + 10 \log(P)$ dB above 2365 MHz.

The specification that emissions shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

7.6.2 Test Configuration

Test according to clause 7.1 radio frequency test setup 1.

7.6.3 Test Procedure

The transmitter output (antenna port) was connected to the spectrum analyzer

Connect the EUT to Universal Radio Communication Tester CMU200 or CMU500 via the antenna connector. A call is set up by the SS according to the generic call set up procedure on a channel with ARFCN in the Mid ARFCN range, power control level set to Max power. MS TXPWR_MAX_CCH is set to the maximum value supported by the Power Class of the Mobile under test.

Spectrum Analyzer is set as below:

9kHz~150kHz, RBW = 1KHz, VBW $\geq 3 \times$ RBW.

150kHz~30MHz, RBW = 10KHz, VBW $\geq 3 \times$ RBW.

30MHz~1GHz, RBW = 100 kHz, VBW = 300 kHz. Above 1GHz, RBW = 1 MHz, VBW = 3 MHz.

Detector: Peak.

Trace mode= max hold.

7.6.4 Test Results

PASS

Temperature : 25℃
Humidity : 60 %

ATM Pressure: 1011 mbar
Test Engineer: XXH

Please refer to FCC 4G Appendix Band.



7.7 FIELD STRENGTH OF SPURIOUS RADIATION

7.7.1 Conformance Limit

LTE BAND2 (25)

FCC Part 24.238

Out of band emissions. 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.

LTE BAND4(66)

FCC Part 27.53(h)

Out of band emissions. 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.

LTE BAND5(26)

FCC Part 22.917

Out of band emissions. 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.

LTE BAND7 (41)

FCC Part 27.53(m)

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

LTE BAND12

FCC Part 27.53(g)

Out of band emissions. 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.

LTE BAND13

FCC Part 27.53(c)

Out of band emissions. 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.

LTE BAND30

FCC Part 27.53(a)

By a factor of not less than $43 + 10 \log(P)$ dB on all frequencies between 2360 and 2365 MHz, and not less than $70 + 10 \log(P)$ dB above 2365 MHz.

The specification that emissions shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

7.7.2 Test Configuration

Test according to clause 7.3 radio frequency test setup 3.

7.7.3 Test Procedure

Connect the EUT to Universal Radio Communication Tester CMU200 or CMU500 via the antenna connector. A call is set up by the SS according to the generic call set up procedure on a channel with ARFCN in the Mid ARFCN range, power control level set to Max power. MS_TXPWR_MAX_CCH is set to the maximum value supported by the Power Class of the Mobile under test.

Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. 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. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as

specified). 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 emissions are attenuated at least 26 dB below the transmitter power, then the following procedure can be used to determine spurious emission.

- a) RBW = 1 MHz for $f \geq 1$ GHz(1GHz to 25GHz), 100 kHz for $f < 1$ GHz(30MHz to 1GHz), 200Hz for $f < 150$ KHz(9KHz to 150KHz), 9KHz for $f < 30$ MHz(150KHz to 30KHz).
- b) Set VBW $\geq 3 \times$ RBW.
- c) Set span wide enough to fully capture the emission being measured.
- d) Sweep time = auto couple.
- e) Detector = peak.
- f) Ensure that the number of measurement points $\geq$ span/RBW.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the peak amplitude level.

Step1. The EUT was placed on a rotatable wooden table with 0.8 meter above ground.

Step2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.

Step3. The table was rotated 360 degrees to determine the position of the highest spurious emission.

Step4. 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.

Step5. Make the measurement with the spectrum analyzer's RBW , VBW , taking the record of maximum spurious emission.

Step6. A horn antenna was substituted in place of the EUT and was driven by a signal generator.

Step7. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.

Step8. Taking the record of output power at antenna port.

Step9. Repeat step 7 to step 8 for another polarization.

Step10. Emission level (dBm) = output power + substitution Gain.

7.7.4 Test Results

PASS

Temperature :	25℃	ATM Pressure:	1011 mbar
Humidity :	60 %	Test Engineer:	CZF

All modes have been tested, and the worst result recorded was report as below:

■ Spurious Emission below 30MHz (9KHz to 30MHz)

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m) PK	Limit 3m(dBuV/m) PK	Over(dB) PK
--	--	--	--	--

Note: Data of measurement within this frequency range shown “ -- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

■ Spurious Emission Above 30MHz (30MHz to 1 GHz)

Temperature: 25°C		Mode		LTE Band 2		
Humidity: 60%						
Air Pressure 106kPa						
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
54.3967	V	100	-63.90	-13.00	50.90	PASS
341.1916	V	100	-60.21	-13.00	47.21	PASS
514.6362	V	100	-57.37	-13.00	44.37	PASS
675.3248	V	100	-54.72	-13.00	41.72	PASS
836.0133	V	100	-54.12	-13.00	41.12	PASS
977.4464	V	100	-51.94	-13.00	38.94	PASS
36.7903	H	100	-63.21	-13.00	50.21	PASS
240.4035	H	100	-60.30	-13.00	47.30	PASS
404.1962	H	100	-58.89	-13.00	45.89	PASS
603.7837	H	100	-54.66	-13.00	41.66	PASS
791.6821	H	100	-52.52	-13.00	39.52	PASS
989.1355	H	100	-50.51	-13.00	37.51	PASS

■ Spurious Emission Above 1GHz (1GHz to 10th harmonics)

Temperature: 25°C		Mode		LTE Band 2		
Humidity: 60%						
Air Pressure 106kPa						
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
3591.318	V	1000	-43.47	-13.00	30.47	PASS
6505.701	V	1000	-36.63	-13.00	23.63	PASS
8678.735	V	1000	-29.44	-13.00	16.44	PASS
11004.80	V	1000	-26.60	-13.00	13.60	PASS
14293.25	V	1000	-21.95	-13.00	8.95	PASS
17948.98	V	1000	-23.08	-13.00	10.08	PASS
2190.238	H	1000	-42.92	-13.00	29.92	PASS
6488.697	H	1000	-37.82	-13.00	24.82	PASS
9416.683	H	1000	-30.39	-13.00	17.39	PASS
11025.20	H	1000	-26.87	-13.00	13.87	PASS
14279.65	H	1000	-21.14	-13.00	8.14	PASS
17948.98	H	1000	-21.26	-13.00	8.26	PASS

■ Spurious Emission Above 30MHz (30MHz to 1 GHz)

Temperature:	25°C	Mode		LTE Band 4		
Humidity:	60%					
Air Pressure	106kPa					
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
53.7177	V	100	-63.01	-13.00	50.01	PASS
352.8806	V	100	-60.50	-13.00	47.50	PASS
487.1839	V	100	-58.46	-13.00	45.46	PASS
663.5387	V	100	-56.56	-13.00	43.56	PASS
835.9163	V	100	-53.68	-13.00	40.68	PASS
880.6355	V	100	-51.91	-13.00	38.91	PASS
38.1969	H	100	-63.60	-13.00	50.60	PASS
231.4306	H	100	-60.27	-13.00	47.27	PASS
417.2919	H	100	-59.44	-13.00	46.44	PASS
598.2059	H	100	-54.62	-13.00	41.62	PASS
791.2456	H	100	-53.02	-13.00	40.02	PASS
978.7559	H	100	-49.87	-13.00	36.87	PASS

■ Spurious Emission Above 1GHz (1GHz to 10th harmonics)

Temperature:	25°C	Mode		LTE Band 4		
Humidity:	60%					
Air Pressure	106kPa					
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
3788.557	V	1000	-43.52	-13.00	30.52	PASS
6468.293	V	1000	-37.59	-13.00	24.59	PASS
8695.739	V	1000	-30.29	-13.00	17.29	PASS
10708.94	V	1000	-26.59	-13.00	13.59	PASS
14276.25	V	1000	-21.31	-13.00	8.31	PASS
17867.37	V	1000	-22.97	-13.00	9.97	PASS
2210.642	H	1000	-42.62	-13.00	29.62	PASS
6481.896	H	1000	-37.53	-13.00	24.53	PASS
8705.941	H	1000	-29.76	-13.00	16.76	PASS
10753.15	H	1000	-26.70	-13.00	13.70	PASS
14269.45	H	1000	-21.96	-13.00	8.96	PASS
17789.15	H	1000	-21.15	-13.00	8.15	PASS

■ Spurious Emission Above 30MHz (30MHz to 1 GHz)

Temperature:	25°C	Mode		LTE Band 5		
Humidity:	60%					
Air Pressure	106kPa					
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
54.6877	V	100	-63.03	-13.00	50.03	PASS
348.7579	V	100	-60.17	-13.00	47.17	PASS
496.5448	V	100	-58.44	-13.00	45.44	PASS
644.2347	V	100	-56.42	-13.00	43.42	PASS
817.3884	V	100	-53.33	-13.00	40.33	PASS
991.3666	V	100	-52.10	-13.00	39.10	PASS
70.936	H	100	-64.05	-13.00	51.05	PASS
229.9755	H	100	-61.03	-13.00	48.03	PASS
404.1477	H	100	-59.46	-13.00	46.46	PASS
601.3101	H	100	-54.92	-13.00	41.92	PASS
760.2525	H	100	-52.92	-13.00	39.92	PASS
973.6632	H	100	-50.99	-13.00	37.99	PASS

■ Spurious Emission Above 1GHz (1GHz to 10th harmonics)

Temperature:	25°C	Mode		LTE Band 5		
Humidity:	60%					
Air Pressure	106kPa					
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
3815.763	V	1000	-42.82	-13.00	29.82	PASS
6475.095	V	1000	-37.47	-13.00	24.47	PASS
9335.067	V	1000	-29.39	-13.00	16.39	PASS
11049.00	V	1000	-26.06	-13.00	13.06	PASS
14279.65	V	1000	-21.65	-13.00	8.65	PASS
16707.74	V	1000	-22.88	-13.00	9.88	PASS
2200.440	H	1000	-41.84	-13.00	28.84	PASS
6481.896	H	1000	-37.64	-13.00	24.64	PASS
8695.739	H	1000	-30.04	-13.00	17.04	PASS
11083.01	H	1000	-27.72	-13.00	14.72	PASS
14286.45	H	1000	-22.28	-13.00	9.28	PASS
17850.37	H	1000	-21.24	-13.00	8.24	PASS

■ Spurious Emission Above 30MHz (30MHz to 1 GHz)

Temperature: 25°C		Mode		LTE Band 7		
Humidity: 60%						
Air Pressure 106kPa						
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
54.2027	V	100	-63.77	-13.00	50.77	PASS
345.3628	V	100	-60.28	-13.00	47.28	PASS
506.0998	V	100	-58.63	-13.00	45.63	PASS
674.3062	V	100	-56.60	-13.00	43.60	PASS
833.2972	V	100	-54.35	-13.00	41.35	PASS
986.7588	V	100	-52.08	-13.00	39.08	PASS
71.1301	H	100	-63.18	-13.00	50.18	PASS
232.9341	H	100	-59.83	-13.00	46.83	PASS
400.413	H	100	-59.66	-13.00	46.66	PASS
603.1532	H	100	-54.84	-13.00	41.84	PASS
784.6492	H	100	-53.16	-13.00	40.16	PASS
974.0512	H	100	-50.60	-13.00	37.60	PASS

■ Spurious Emission Above 1GHz (1GHz to 10th harmonics)

Temperature: 25°C		Mode		LTE Band 7		
Humidity: 60%						
Air Pressure 106kPa						
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
3825.965	V	1000	-43.02	-13.00	30.02	PASS
6502.300	V	1000	-37.53	-13.00	24.53	PASS
8702.540	V	1000	-30.07	-13.00	17.07	PASS
10719.14	V	1000	-26.89	-13.00	13.89	PASS
14640.12	V	1000	-21.83	-13.00	8.83	PASS
17955.79	V	1000	-23.05	-13.00	10.05	PASS
3822.564	H	1000	-42.91	-13.00	29.91	PASS
6413.882	H	1000	-37.78	-13.00	24.78	PASS
8705.941	H	1000	-29.18	-13.00	16.18	PASS
10671.53	H	1000	-27.80	-13.00	14.80	PASS
14313.66	H	1000	-22.79	-13.00	9.79	PASS
17863.97	H	1000	-21.09	-13.00	8.09	PASS

Spurious Emission Above 30MHz (30MHz to 1 GHz)

Temperature:	25°C	Mode		LTE Band 12		
Humidity:	60%					
Air Pressure	106kPa					
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
35.5778	V	100	-63.62	-13.00	50.62	PASS
348.3214	V	100	-60.43	-13.00	47.43	PASS
490.579	V	100	-58.16	-13.00	45.16	PASS
665.9153	V	100	-56.15	-13.00	43.15	PASS
825.8278	V	100	-54.18	-13.00	41.18	PASS
976.2338	V	100	-51.63	-13.00	38.63	PASS
69.3355	H	100	-63.75	-13.00	50.75	PASS
227.9384	H	100	-60.45	-13.00	47.45	PASS
423.5487	H	100	-58.76	-13.00	45.76	PASS
601.5526	H	100	-53.54	-13.00	40.54	PASS
760.495	H	100	-53.39	-13.00	40.39	PASS
973.4692	H	100	-50.73	-13.00	37.73	PASS

Spurious Emission Above 1GHz (1GHz to 10th harmonics)

Temperature:	25°C	Mode		LTE Band 12		
Humidity:	60%					
Air Pressure	106kPa					
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
3564.112	V	1000	-43.67	-13.00	30.67	PASS
6505.701	V	1000	-37.97	-13.00	24.97	PASS
9348.669	V	1000	-29.97	-13.00	16.97	PASS
10736.14	V	1000	-26.69	-13.00	13.69	PASS
14286.45	V	1000	-21.97	-13.00	8.97	PASS
17744.94	V	1000	-22.99	-13.00	9.99	PASS
3805.561	H	1000	-42.55	-13.00	29.55	PASS
6478.495	H	1000	-37.09	-13.00	24.09	PASS
8654.931	H	1000	-30.35	-13.00	17.35	PASS
10688.53	H	1000	-27.26	-13.00	14.26	PASS
14286.45	H	1000	-22.17	-13.00	9.17	PASS
17775.55	H	1000	-21.16	-13.00	8.16	PASS

■ Spurious Emission Above 30MHz (30MHz to 1 GHz)

Temperature:	25°C	Mode	LTE Band 13			
Humidity:	60%					
Air Pressure	106kPa					
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
54.8817	V	100	-63.31	-13.00	50.31	PASS
352.7351	V	100	-60.45	-13.00	47.45	PASS
496.1568	V	100	-57.80	-13.00	44.80	PASS
643.4587	V	100	-56.14	-13.00	43.14	PASS
816.8063	V	100	-54.23	-13.00	41.23	PASS
990.0085	V	100	-51.71	-13.00	38.71	PASS
69.578	H	100	-64.01	-13.00	51.01	PASS
228.4234	H	100	-61.03	-13.00	48.03	PASS
403.2262	H	100	-59.56	-13.00	46.56	PASS
604.0747	H	100	-55.07	-13.00	42.07	PASS
767.2369	H	100	-52.96	-13.00	39.96	PASS
968.5219	H	100	-51.11	-13.00	38.11	PASS

■ Spurious Emission Above 1GHz (1GHz to 10th harmonics)

Temperature:	25°C	Mode	LTE Band 13			
Humidity:	60%					
Air Pressure	106kPa					
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
3785.157	V	1000	-42.37	-13.00	29.37	PASS
6502.300	V	1000	-37.02	-13.00	24.02	PASS
8685.537	V	1000	-29.77	-13.00	16.77	PASS
10702.14	V	1000	-26.23	-13.00	13.23	PASS
14300.06	V	1000	-20.23	-13.00	7.23	PASS
17687.13	V	1000	-22.97	-13.00	9.97	PASS
3788.557	H	1000	-42.20	-13.00	29.20	PASS
6447.889	H	1000	-37.10	-13.00	24.10	PASS
9314.662	H	1000	-30.48	-13.00	17.48	PASS
11093.21	H	1000	-27.11	-13.00	14.11	PASS
14300.06	H	1000	-22.15	-13.00	9.15	PASS
17823.16	H	1000	-21.13	-13.00	8.13	PASS

Spurious Emission Above 30MHz (30MHz to 1 GHz)

Temperature:	25°C	Mode		LTE Band 17		
Humidity:	60%					
Air Pressure	106kPa					
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
54.3967	V	100	-63.47	-13.00	50.47	PASS
348.8549	V	100	-60.21	-13.00	47.21	PASS
485.1953	V	100	-58.66	-13.00	45.66	PASS
644.8652	V	100	-56.31	-13.00	43.31	PASS
833.4427	V	100	-53.40	-13.00	40.40	PASS
987.0499	V	100	-50.80	-13.00	37.80	PASS
35.9173	H	100	-63.70	-13.00	50.70	PASS
230.3635	H	100	-60.78	-13.00	47.78	PASS
404.2447	H	100	-59.24	-13.00	46.24	PASS
596.9934	H	100	-53.48	-13.00	40.48	PASS
759.816	H	100	-53.35	-13.00	40.35	PASS
973.5662	H	100	-50.92	-13.00	37.92	PASS

■ Spurious Emission Above 1GHz (1GHz to 10th harmonics)

Temperature:	25°C	Mode		LTE Band 17		
Humidity:	60%					
Air Pressure	106kPa					
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
3543.708	V	1000	-42.93	-13.00	29.93	PASS
6505.701	V	1000	-37.15	-13.00	24.15	PASS
8712.742	V	1000	-29.94	-13.00	16.94	PASS
10708.94	V	1000	-25.86	-13.00	12.86	PASS
14272.85	V	1000	-21.62	-13.00	8.62	PASS
17503.50	V	1000	-23.67	-13.00	10.67	PASS
3808.961	H	1000	-43.12	-13.00	30.12	PASS
6481.896	H	1000	-37.89	-13.00	24.89	PASS
9352.070	H	1000	-30.01	-13.00	17.01	PASS
10702.14	H	1000	-26.56	-13.00	13.56	PASS
14283.05	H	1000	-22.23	-13.00	9.23	PASS
17761.95	H	1000	-21.19	-13.00	8.19	PASS

■ Spurious Emission Above 30MHz (30MHz to 1 GHz)

Temperature:	25°C	Mode		LTE Band 25		
Humidity:	60%					
Air Pressure	106kPa					
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
54.9302	V	100	-63.17	-13.00	50.17	PASS
352.3956	V	100	-59.99	-13.00	46.99	PASS
494.4592	V	100	-58.13	-13.00	45.13	PASS
671.8326	V	100	-56.40	-13.00	43.40	PASS
762.4351	V	100	-53.54	-13.00	40.54	PASS
905.7598	V	100	-52.09	-13.00	39.09	PASS
70.742	H	100	-63.63	-13.00	50.63	PASS
233.3222	H	100	-60.59	-13.00	47.59	PASS
413.5087	H	100	-59.42	-13.00	46.42	PASS
598.7394	H	100	-53.42	-13.00	40.42	PASS
760.98	H	100	-53.14	-13.00	40.14	PASS
982.2481	H	100	-50.68	-13.00	37.68	PASS

■ Spurious Emission Above 1GHz (1GHz to 10th harmonics)

Temperature:	25°C	Mode		LTE Band 25		
Humidity:	60%					
Air Pressure	106kPa					
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
3774.955	V	1000	-42.21	-13.00	29.21	PASS
6492.098	V	1000	-37.12	-13.00	24.12	PASS
8668.533	V	1000	-29.48	-13.00	16.48	PASS
11100.02	V	1000	-26.94	-13.00	13.94	PASS
14313.66	V	1000	-21.45	-13.00	8.45	PASS
17823.16	V	1000	-23.03	-13.00	10.03	PASS
3768.153	H	1000	-42.79	-13.00	29.79	PASS
6481.896	H	1000	-37.07	-13.00	24.07	PASS
9403.080	H	1000	-29.87	-13.00	16.87	PASS
10725.94	H	1000	-27.31	-13.00	14.31	PASS
14296.65	H	1000	-22.02	-13.00	9.02	PASS
17880.97	H	1000	-21.28	-13.00	8.28	PASS

Spurious Emission Above 30MHz (30MHz to 1 GHz)

Temperature:	25°C	Mode		LTE Band 26		
Humidity:	60%					
Air Pressure	106kPa					
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
53.0387	V	100	-63.30	-13.00	50.30	PASS
345.1203	V	100	-60.80	-13.00	47.80	PASS
507.4579	V	100	-58.46	-13.00	45.46	PASS
674.1607	V	100	-56.25	-13.00	43.25	PASS
811.9076	V	100	-54.09	-13.00	41.09	PASS
987.0014	V	100	-51.71	-13.00	38.71	PASS
73.5067	H	100	-63.34	-13.00	50.34	PASS
254.6632	H	100	-60.65	-13.00	47.65	PASS
412.2961	H	100	-59.06	-13.00	46.06	PASS
612.5141	H	100	-54.51	-13.00	41.51	PASS
760.301	H	100	-53.50	-13.00	40.50	PASS
977.8344	H	100	-50.99	-13.00	37.99	PASS

■ Spurious Emission Above 1GHz (1GHz to 10th harmonics)

Temperature:	25°C	Mode		LTE Band 26		
Humidity:	60%					
Air Pressure	106kPa					
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
3751.150	V	1000	-43.43	-13.00	30.43	PASS
6485.297	V	1000	-37.63	-13.00	24.63	PASS
9267.053	V	1000	-30.14	-13.00	17.14	PASS
10773.55	V	1000	-25.95	-13.00	12.95	PASS
14283.05	V	1000	-21.06	-13.00	8.06	PASS
17982.99	V	1000	-22.84	-13.00	9.84	PASS
3812.362	H	1000	-42.22	-13.00	29.22	PASS
6498.899	H	1000	-37.73	-13.00	24.73	PASS
8699.139	H	1000	-29.41	-13.00	16.41	PASS
11015.00	H	1000	-27.43	-13.00	14.43	PASS
14283.05	H	1000	-22.23	-13.00	9.23	PASS
17772.15	H	1000	-21.19	-13.00	8.19	PASS

■ Spurious Emission Above 30MHz (30MHz to 1 GHz)

Temperature:	25°C	Mode		LTE Band 41		
Humidity:	60%					
Air Pressure	106kPa					
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
54.0087	V	100	-62.84	-13.00	49.84	PASS
347.5454	V	100	-59.49	-13.00	46.49	PASS
504.7417	V	100	-57.99	-13.00	44.99	PASS
676.5858	V	100	-55.93	-13.00	42.93	PASS
819.0375	V	100	-53.78	-13.00	40.78	PASS
979.4835	V	100	-51.02	-13.00	38.02	PASS
70.2085	H	100	-63.88	-13.00	50.88	PASS
232.5946	H	100	-60.50	-13.00	47.50	PASS
393.6227	H	100	-59.18	-13.00	46.18	PASS
606.3543	H	100	-54.62	-13.00	41.62	PASS
775.9673	H	100	-52.87	-13.00	39.87	PASS
973.6632	H	100	-50.64	-13.00	37.64	PASS

■ Spurious Emission Above 1GHz (1GHz to 10th harmonics)

Temperature:	25°C	Mode		LTE Band 41		
Humidity:	60%					
Air Pressure	106kPa					
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
3819.163	V	1000	-42.87	-13.00	29.87	PASS
6492.098	V	1000	-37.78	-13.00	24.78	PASS
8675.335	V	1000	-29.26	-13.00	16.26	PASS
10742.94	V	1000	-26.50	-13.00	13.50	PASS
14266.05	V	1000	-21.93	-13.00	8.93	PASS
17877.57	V	1000	-22.96	-13.00	9.96	PASS
3615.123	H	1000	-42.86	-13.00	29.86	PASS
6475.095	H	1000	-38.37	-13.00	25.37	PASS
9392.878	H	1000	-30.96	-13.00	17.96	PASS
11025.20	H	1000	-26.18	-13.00	13.18	PASS
14296.65	H	1000	-22.10	-13.00	9.10	PASS
16707.74	H	1000	-20.28	-13.00	7.28	PASS

■ Spurious Emission Above 30MHz (30MHz to 1 GHz)

Temperature:	25°C	Mode	LTE Band 66			
Humidity:	60%					
Air Pressure	106kPa					
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
55.0273	V	100	-63.24	-13.00	50.24	PASS
348.4669	V	100	-60.47	-13.00	47.47	PASS
512.1141	V	100	-58.38	-13.00	45.38	PASS
648.5029	V	100	-56.10	-13.00	43.10	PASS
837.5654	V	100	-53.58	-13.00	40.58	PASS
995.6348	V	100	-51.88	-13.00	38.88	PASS
70.354	H	100	-64.18	-13.00	51.18	PASS
232.7886	H	100	-60.44	-13.00	47.44	PASS
421.0751	H	100	-58.69	-13.00	45.69	PASS
613.4842	H	100	-54.14	-13.00	41.14	PASS
771.4081	H	100	-52.90	-13.00	39.90	PASS
981.1811	H	100	-50.42	-13.00	37.42	PASS

■ Spurious Emission Above 1GHz (1GHz to 10th harmonics)

Temperature:	25°C	Mode	LTE Band 66			
Humidity:	60%					
Air Pressure	106kPa					
Frequency (MHz)	Antenna Polarization	RBW (kHz)	Emission level (dBm)	Limit (dBm)	Over (dB)	Verdict
3802.160	V	1000	-43.12	-13.00	30.12	PASS
6481.896	V	1000	-37.42	-13.00	24.42	PASS
8695.739	V	1000	-29.37	-13.00	16.37	PASS
10715.74	V	1000	-25.61	-13.00	12.61	PASS
14320.46	V	1000	-21.15	-13.00	8.15	PASS
17778.95	V	1000	-23.12	-13.00	10.12	PASS
3802.160	H	1000	-43.03	-13.00	30.03	PASS
6488.697	H	1000	-37.31	-13.00	24.31	PASS
9219.443	H	1000	-30.30	-13.00	17.30	PASS
10746.34	H	1000	-26.61	-13.00	13.61	PASS
14286.45	H	1000	-21.96	-13.00	8.96	PASS
17952.39	H	1000	-21.23	-13.00	8.23	PASS

Note:(1) Emission Level= Reading Level+ Correct Factor +Cable Loss.

(2) Correct Factor= Ant_F + Cab_L - Preamp.

(3) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

7.8 FREQUENCY STABILITY

7.8.1 Conformance Limit

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. The frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ ($\pm 2.5\text{ppm}$) of the center frequency.

7.8.2 Test Configuration

Test according to clause 7.2 conducted emission test setup2.

7.8.3 Test Procedure

Connect the EUT to Universal Radio Communication Tester CMU200 or CMU500 via the antenna connector. A call is set up by the SS according to the generic call set up procedure on a channel with ARFCN in the ARFCN range, power control level set to Max power. MS TXPWR_MAX_CCH is set to the maximum value supported by the Power Class of the Mobile under test.

EUT was placed at temperature chamber and connected to an external power supply.

Temperature and voltage condition shall be tested to confirm frequency stability.

(a) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short-term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(b) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 95 to 105 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point, which shall be specified by the manufacturer.

7.8.4 Test Results

PASS

Temperature :	25°C	ATM Pressure:	1011 mbar
Humidity :	60 %	Test Engineer:	XXH

Please refer to FCC 4G Appendix Band.

7.9 PEAK TO AVERAGE RATIO

7.9.1 Conformance Limit

LTE BAND2 (25)

FCC Part 24.232

Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. 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.

LTE BAND4(7)(30)(41)(66)

FCC Part 27.50

Equipment employed must be authorized in accordance with the provisions of §24.51. Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. 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.

7.9.2 Test Configuration

Test according to clause 7.1 conducted emission test setup1.

7.9.3 Test Procedure

The EUT was connected to Spectrum Analyzer and Base Station via power divider.

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.

Set the number of counts to a value that stabilizes the measured CCDF curve.

Set the measurement interval to 1 ms.

Record the maximum PAPR level associated with a probability of 0.1%.

a) Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function.

b) Set resolution/measurement bandwidth $\geq$ signal's occupied bandwidth.

c) Set the number of counts to a value that stabilizes the measured CCDF curve.

d) Set the measurement interval as follows.

1) for continuous transmissions, set to 1 ms.

2) for burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize and set the measurement interval to a time that is less than or equal to the burst duration.

e) Record the maximum PAPR level associated with a probability of 0.1%.

7.9.4 Test Results

PASS

Temperature : 25°C

ATM Pressure: 1011 mbar

Humidity : 60 %

Test Engineer: XXH

Please refer to FCC 4G Appendix Band.

Detail of factor for radiated emission:

Frequency(MHz)	Ant F(dB)	Cab L(dB)	Preamp(dB)	Correct Factor(dB)
0.009	20.6	0.03	\	20.63
0.15	20.7	0.1	\	20.8
1	20.9	0.15	\	21.05
10	20.1	0.28	\	20.38
30	18.8	0.45	\	19.25
30	11.7	0.62	27.9	-15.58
100	12.5	1.02	27.8	-14.28
300	12.9	1.91	27.5	-12.69
600	19.2	2.92	27	-4.88
800	21.1	3.54	26.6	-1.96
1000	22.3	4.17	26.2	0.27
1000	25.6	1.76	41.4	-14.04
3000	28.9	3.27	43.2	-11.03
5000	31.1	4.2	44.6	-9.3
8000	36.2	5.95	44.7	-2.55
10000	38.4	6.3	43.9	0.8
12000	38.5	7.14	42.3	3.34
15000	40.2	8.15	41.4	6.95
18000	45.4	9.02	41.3	13.12
18000	37.9	1.81	47.9	-8.19
21000	37.9	1.95	48.7	-8.85
25000	39.3	2.01	42.8	-1.49
28000	39.6	2.16	46.0	-4.24
31000	41.2	2.24	44.5	-1.06
34000	41.5	2.29	46.6	-2.81
37000	43.8	2.30	46.4	-0.3
40000	43.2	2.50	42.2	3.5

--- End of Report ---

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