RF TEST REPORT

Applicant	Quectel Wireless Solutions Co., Ltd
FCC ID	XMR2019SC650TNA
Product	Smart Module
Brand	Quectel
Model	SC650T-NA
Report No.	R2210A0926-R4V2
Issue Date	November 8, 2022

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2021)/ FCC CFR 47 Part 90S (2021)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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Version	Revision description	Issue Date
Rev.0	Initial issue of report.	October 26, 2022
Rev.1	Update FCC ID.	November 7, 2022
Rev.2	Update Model.	November 8, 2022
Note: This revised report (Report No. R2210A0926-R4V2) supersedes and replaces the previously issued report (Report No. R2210A0926-R4V1). Please discard or destroy the previously issued report and dispose of it accordingly.		

Summary of measurement results

No.	Test Case	Clause in FCC rules	Verdict
1	RF Power Output and Effective Radiated Power	2.1046/90.635(b)	PASS
2	Occupied Bandwidth	2.1049/ 90.209	NA
3	Emission Masks	2.1051 / 90.691	PASS
4	Peak-to-Average Power Ratio	KDB 971168 D01(5.7)	NA
5	Frequency Stability	2.1055 / 90.213	NA
6	Spurious Emissions at Antenna Terminals	2.1051 / 90.691	PASS
7	Radiated Spurious Emission	2.1053 /90.691	PASS
Date of Testing: October 12, 2022 ~ October 18, 2022 Date of Sample Received: October 12, 2022			
Note: PASS: The EUT complies with the essential requirements in the standard. FAIL: The EUT does not comply with the essential requirements in the standard. All indications of Pass/Fail in this report are opinions expressed by TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.			

1. Test Laboratory

1.1. Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein .Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2. Test facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

1.3. Testing Location

Company:	TA Technology (Shanghai) Co., Ltd.
Address:	Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China
City:	Shanghai
Post code:	201201
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E-mail:	xukai@ta-shanghai.com

2. General Description of Equipment under Test

2.1. Applicant and Manufacturer Information

Applicant	Quectel Wireless Solutions Co., Ltd
Applicant address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233
Manufacturer	Quectel Wireless Solutions Co., Ltd
Manufacturer address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233

2.2. General Information

EUT Description			
Model	SC650T-NA		
IMEI	IMEI1:865920060000042 IMEI2:865920060000059		
Hardware Version	R1.0		
Software Version	SC650TNALPAR05A01		
Power Supply	External power supply		
Antenna Type	The EUT don't have standard Antenna, The Antenna used for testing in this report is the after-market accessory (Dipole Antenna)		
Antenna Gain	3.19 dBi		
Test Mode(s)	LTE Band 26;		
Test Modulation	QPSK, 16QAM		
Maximum E.R.P.	LTE Band 26:	25.31 dBm	
Rated Power Supply Voltage	DC 3.8V		
Operating Voltage	Minimum: 3.55V Maximum: 4.40V		
Operating Temperature	Lowest: -35°C Highest: +75°C		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	LTE Band 26	814 ~ 824	859 ~ 869
Note: 1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.			

3. Applied Standards

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

Test standards:
FCC CFR 47 Part 90S (2021)

FCC CFR47 Part 2 (2021)

Reference standard:
ANSI C63.26-2015

KDB 971168 D01 Power Meas License Digital Systems v03r01

4. Test Configuration

There is more than one SIM card slot, each one should be applied throughout the compliance test re spectively, and however, only the worst case (SIM 1) will be recorded in this report.
Radiated measurements are performed by rotating the EUT in three different orthogonal test planes. EUT stand-up position (Z axis), lie-down position (X, Y axis). Receiver antenna polarization (horizontal and vertical), the worst emission was found in position (Z axis, vertical polarization) and the worst case was recorded.

All mode and data rates and positions were investigated.
The following testing in LTE is set based on the maximum RF Output Power.

Test modes are chosen as the worst case configuration below for LTE Band 26

Test items	Bandwidth (MHz)				Modulation		RB			Test Channel		
	1.4	3	5	10	QPSK	16QAM	1	50%	100%	L	M	H
RF Power Output and Effective Radiated Power	O	-	-	-	O	O	O	O	O	O	O	O
Emission Mask	O	-	-	-	O	O	O	-	O	O	-	O
Spurious Emissions at Antenna Terminals	O	-	-	-	O	-	O	-	-	O	O	O
Radiated Spurious Emission	O	-	-	-	O	-	O	-	-	-	O	-
Note	1. The mark “O” means that this configuration is chosen for testing. 2. The mark “-” means that this configuration is not testing.											

5. Test Case

5.1. RF Power Output and Effective Radiated Power

Ambient condition

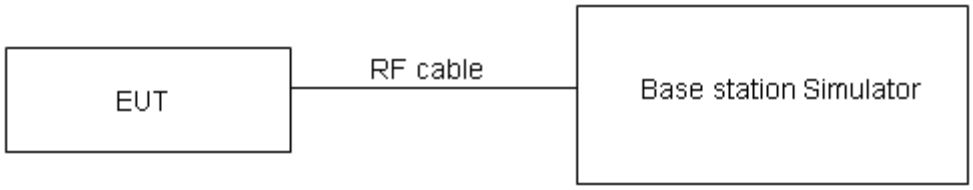
Temperature	Relative humidity
21°C ~25°C	40%~60%

Methods of Measurement

During the process of the testing, The EUT was connected to the Base Station Simulator with a known loss. The EUT is controlled by the Base Station Simulator test set to ensure max power transmission with proper modulation.

ERP can then be calculated as follows:
EIRP (dBm) = Output Power (dBm) + Antenna Gain (dBi)
where:dBd refers to gain relative to an ideal dipole.
EIRP (dBm) = ERP (dBm) + 2.15 (dB.)

Test Setup



Limits

Part 90.635 (b) the maximum output power of the transmitter for mobile stations is 100 watts.

Rule Part 90.635(b) specifies that “The maximum output power of the transmitter for mobile stations is 100 watts”.

Limit	≤ 100 W (50 dBm)

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 0.4 dB for RF power output, k = 2, U= 1.19 dB for ERP.

Test Results

Refer to the section 6.1 of this report for test data.

5.2. Emission Mask

Ambient condition

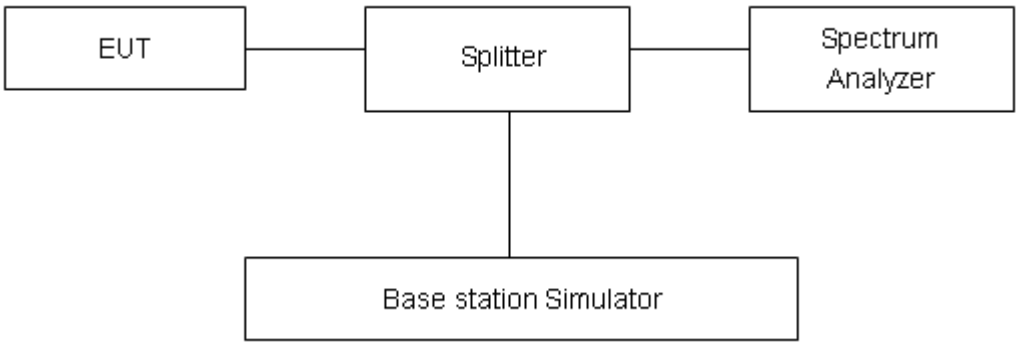
Temperature	Relative humidity
21°C ~25°C	40%~60%

Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The band edge of the lowest and highest channels were measured. The average detector is used.
For Section 90.691(a) compliance testing, use RBW = 300 Hz for offsets less than 37.5 kHz from a channel edge; RBW = 100 kHz for offsets greater than 37.5 kHz is allowed.

Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

Rule Part 90.691(a) specifies that " For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 $Log_{10}(f/6.1)$ decibels or 50 + 10 $Log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz."

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96, U=0.684dB.

Test Results

Refer to the section 6.2 of this report for test data.

5.3. Spurious Emissions at Antenna Terminals

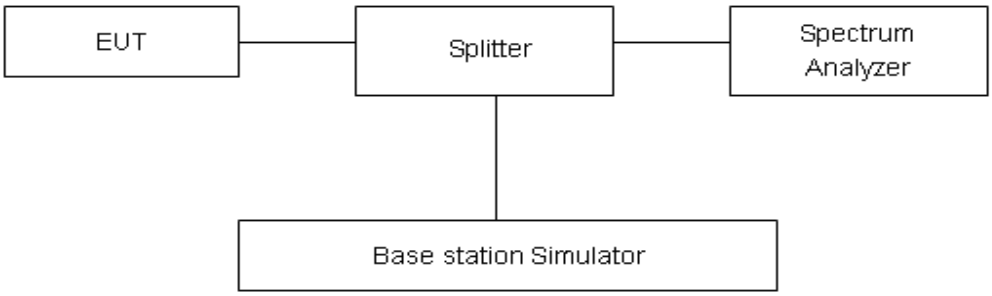
Ambient condition

Temperature	Relative humidity
21°C ~25°C	40%~60%

Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The measurement is carried out using a spectrum analyzer. The spectrum analyzer scans from 30MHz to the 10th harmonic of the carrier. The peak detector is used.
RBW is set to 1 kHz (0.009MHz~ 0.15 MHz),
RBW is set to 10 kHz (0.15 MHz~ 30 MHz)
RBW is set to 100 kHz (30MHz~1000 MHz)
RBW is set to 1000 kHz (above 1000MHz)
Sweep is set to ATUO.

Test setup



Limits

Rule Part 90.691 specifies that “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.”

Limit	-13 dBm

Measurement Uncertainty

The assessed measurement uncertainty to ensure 99.75% confidence level for the normal distribution is with the coverage factor *k* = 1.96.

Frequency	Uncertainty
9kHz-1GHz	0.684 dB
1GHz-12.75GHz	1.407 dB

Test Results

Refer to the section 6.3 of this report for test data.

5.4. Radiated Spurious Emission

Ambient condition

Temperature	Relative humidity
21°C ~25°C	40%~60%

Method of Measurement

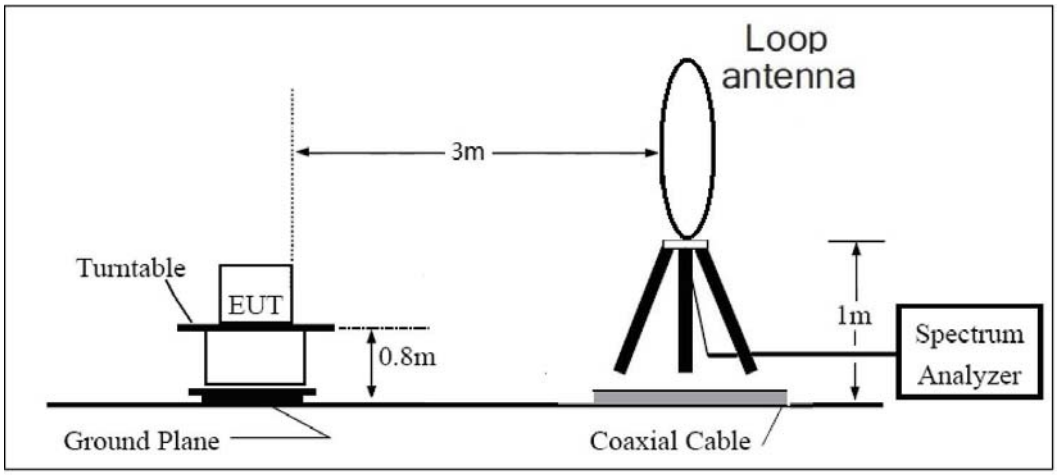
1. The testing follows FCC KDB 971168 v03r01 Section 5.8 and ANSI C63.26-2015.
2. Below 1GHz: The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable 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).
3. A loop antenna, A log-periodic antenna or horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
4. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=100kHz,VBW=300kHz, and the maximum value of the receiver should be recorded as (Pr).
5. The EUT shall be replaced by a substitution antenna. 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 antenna polarization.
6. 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.
7. The measurement results are obtained as described below:
Power(EIRP)=PMea- PAg - Pcl + Ga
The measurement results are amend as described below:
Power(EIRP)=PMea- Pcl + Ga
8. 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.

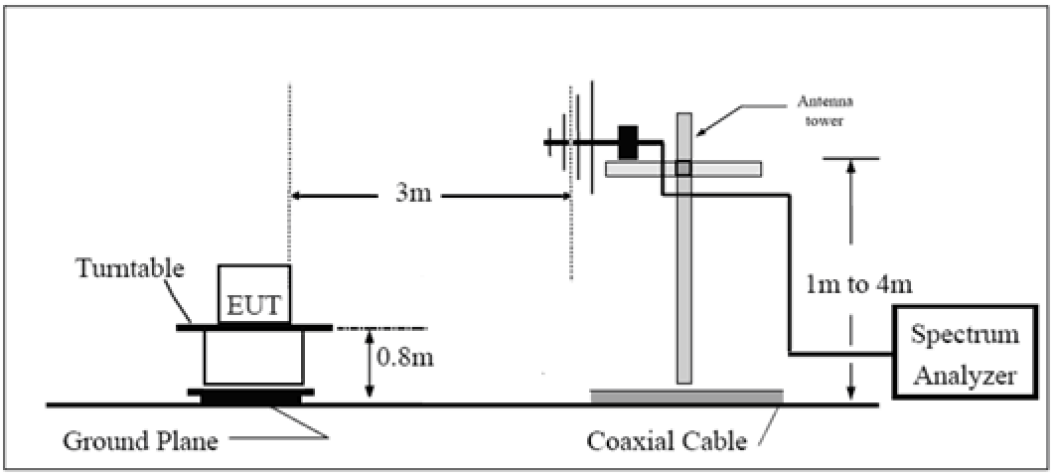
The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup

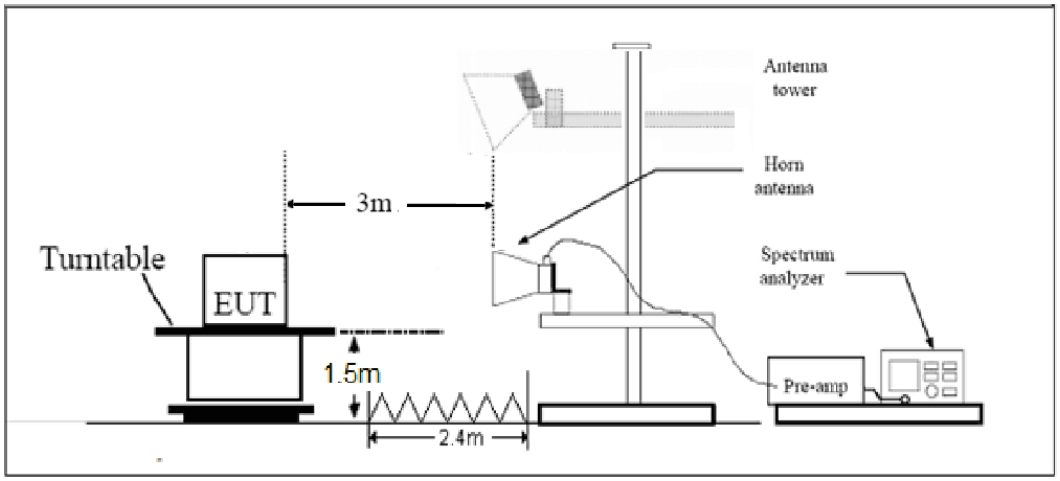
9KHz~ 30MHz



30MHz~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

Limits

Rule Part 90.691 specifies that “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.”

Limit	-13 dBm

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95％ confidence level for the normal distribution is with the coverage factor k = 1.96, U= 3.55 dB.

Test Results

Refer to the section 6.4 of this report for test data.

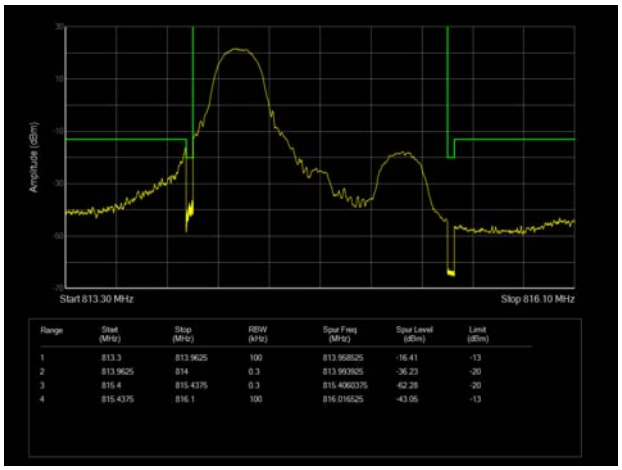
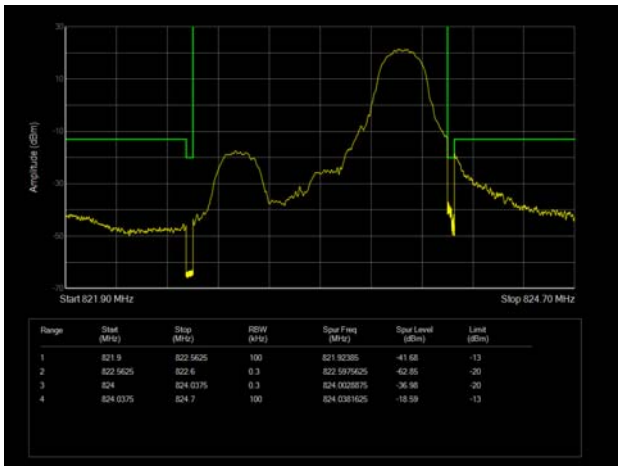
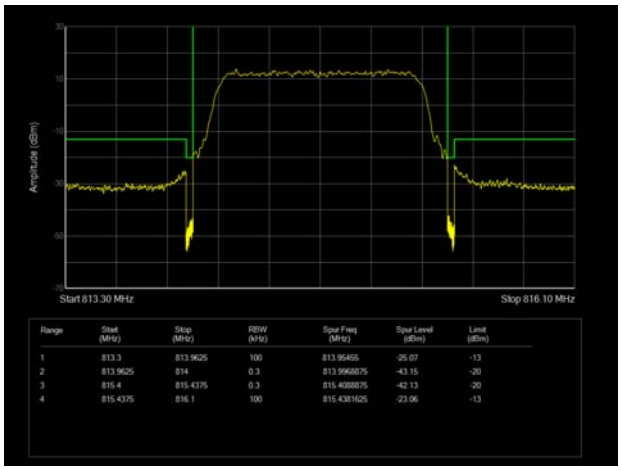
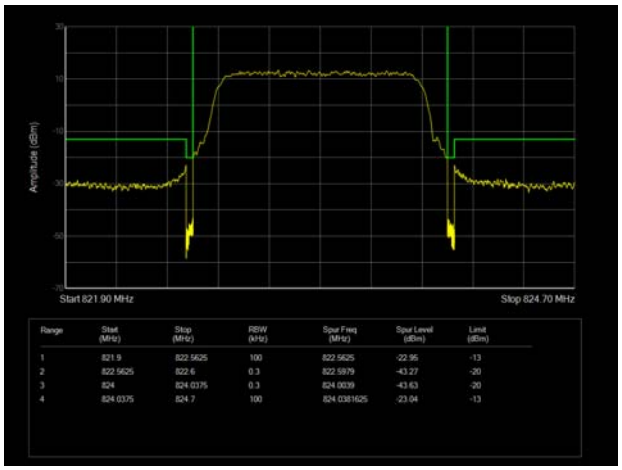
6. Test Results

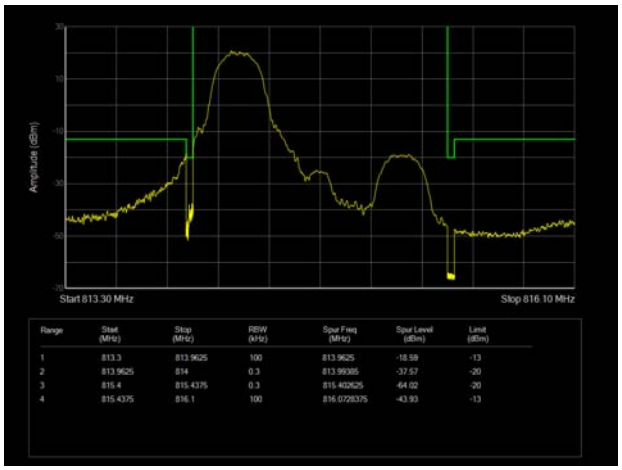
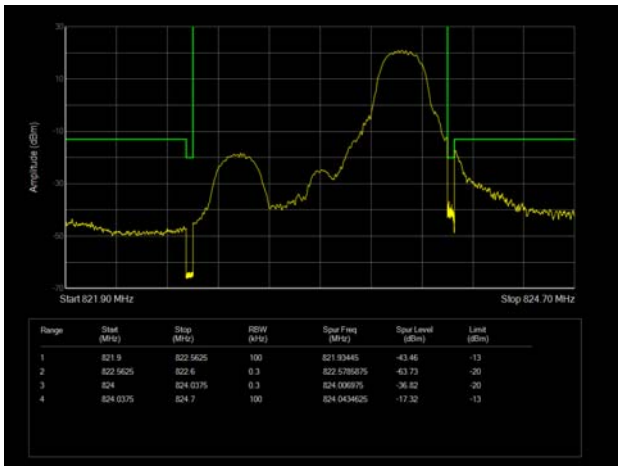
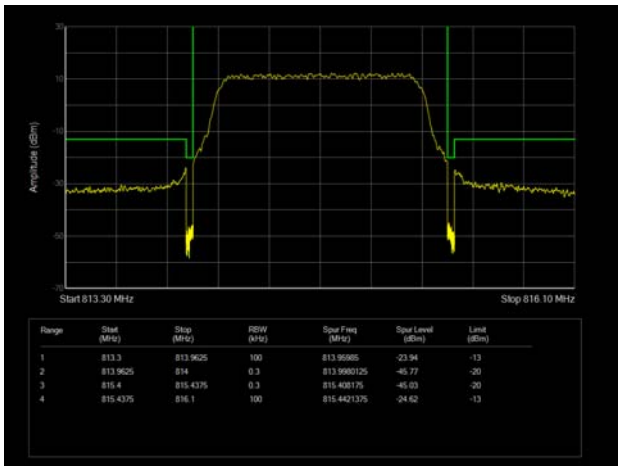
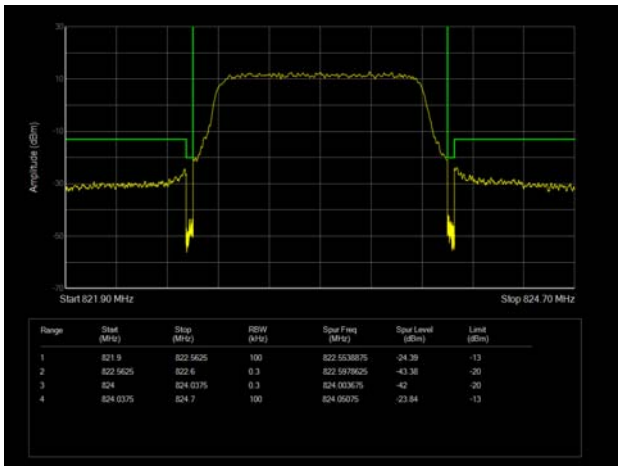
6.1. RF Power Output and Effective Radiated Power

LTE Band26						
Bandwidth (MHz)	UL Channel	RB Size	RB Position	Modulation	Maximum Output Power (dBm)	ERP (dBm)
1.4	26697	1	#0	QPSK	24.09	25.13
1.4	26697	1	#Mid	QPSK	24.22	25.26
1.4	26697	1	#Max	QPSK	23.96	25.00
1.4	26697	3	#0	QPSK	24.09	25.13
1.4	26697	3	#Mid	QPSK	24.09	25.13
1.4	26697	3	#Max	QPSK	24.06	25.10
1.4	26697	6	#0	QPSK	23.13	24.17
1.4	26697	1	#0	16QAM	23.12	24.16
1.4	26697	1	#Mid	16QAM	23.44	24.48
1.4	26697	1	#Max	16QAM	23.17	24.21
1.4	26697	3	#0	16QAM	23.25	24.29
1.4	26697	3	#Mid	16QAM	23.30	24.34
1.4	26697	3	#Max	16QAM	23.38	24.42
1.4	26697	6	#0	16QAM	22.19	23.23
1.4	26740	1	#0	QPSK	23.92	24.96
1.4	26740	1	#Mid	QPSK	24.17	25.21
1.4	26740	1	#Max	QPSK	24.01	25.05
1.4	26740	3	#0	QPSK	24.20	25.24
1.4	26740	3	#Mid	QPSK	24.09	25.13
1.4	26740	3	#Max	QPSK	24.14	25.18
1.4	26740	6	#0	QPSK	23.25	24.29
1.4	26740	1	#0	16QAM	23.40	24.44
1.4	26740	1	#Mid	16QAM	23.70	24.74
1.4	26740	1	#Max	16QAM	23.81	24.85
1.4	26740	3	#0	16QAM	23.63	24.67
1.4	26740	3	#Mid	16QAM	23.27	24.31
1.4	26740	3	#Max	16QAM	23.54	24.58
1.4	26740	6	#0	16QAM	22.24	23.28
1.4	26783	1	#0	QPSK	24.06	25.10
1.4	26783	1	#Mid	QPSK	24.27	25.31
1.4	26783	1	#Max	QPSK	24.06	25.10
1.4	26783	3	#0	QPSK	24.01	25.05
1.4	26783	3	#Mid	QPSK	24.00	25.04

1.4	26783	3	#Max	QPSK	23.99	25.03
1.4	26783	6	#0	QPSK	23.21	24.25
1.4	26783	1	#0	16QAM	22.68	23.72
1.4	26783	1	#Mid	16QAM	22.67	23.71
1.4	26783	1	#Max	16QAM	22.56	23.60
1.4	26783	3	#0	16QAM	22.77	23.81
1.4	26783	3	#Mid	16QAM	23.05	24.09
1.4	26783	3	#Max	16QAM	22.98	24.02
1.4	26783	6	#0	16QAM	21.93	22.97

6.2. Emission Mask

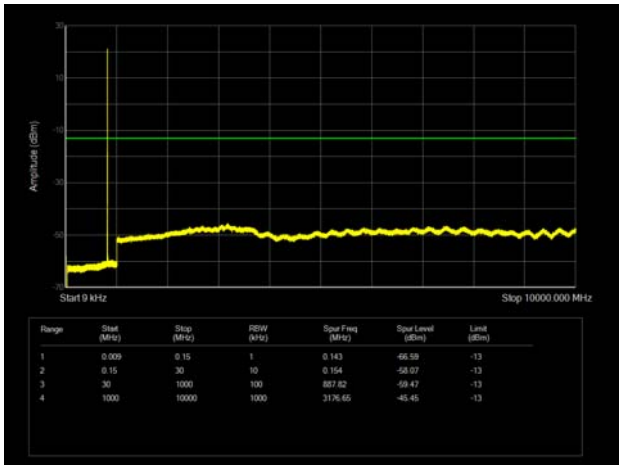
LTE Band 26 QPSK 1.4MHz CH-Low 1RB	LTE Band 26 QPSK 1.4MHz CH-High 1RB
	
LTE Band 26 QPSK 1.4MHz CH-Low 100%RB	LTE Band 26 QPSK 1.4MHz CH-High 100%RB
	

LTE Band 26 16QAM 1.4MHz CH-Low 1RB	LTE Band 26 16QAM 1.4MHz CH-High 1RB
	
LTE Band 26 16QAM 1.4MHz CH-Low 100%RB	LTE Band 26 16QAM 1.4MHz CH-High 100%RB
	

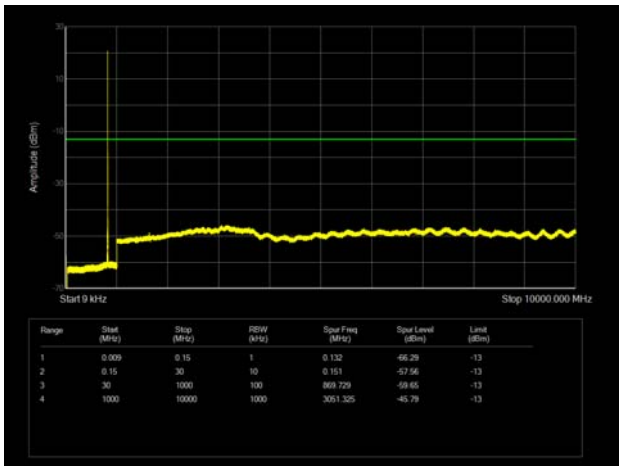
6.3. Spurious Emissions at Antenna Terminals

If disturbances were found more than 20dB below limit line, the mark is not required for the EUT. The signal beyond the limit is carrier.

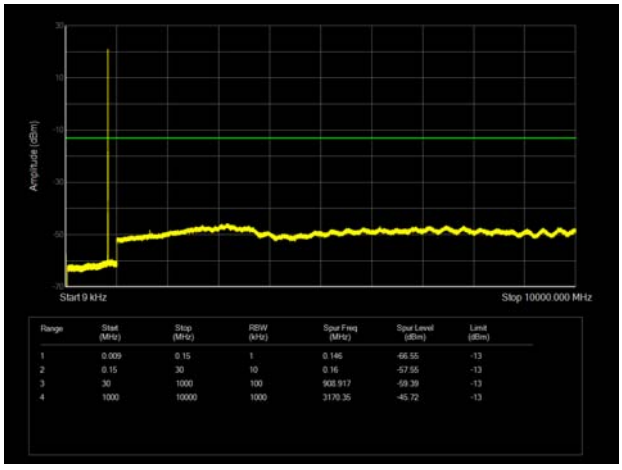
LTE Band 26 1.4MHz CH Low 9KHz~10GHz



LTE Band 26 1.4MHz CH Middle 9KHz~10GHz



LTE Band 26 1.4MHz CH High 9KHz~10GHz



6.4. Radiated Spurious Emission

Sweep the whole frequency band through the range from 30MHz to the 10th harmonic of the carrier, the emissions below the noise floor will not be recorded in the report.

LTE Band 26 1.4MHz CH Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1637.25	-64.87	1.70	8.70	Vertical	-60.02	-13.00	47.02	90
3	2455.85	-60.35	2.30	12.00	Vertical	-52.80	-13.00	39.80	135
4	3273.20	-64.63	2.20	13.10	Vertical	-55.88	-13.00	42.88	45
5	4091.50	-62.47	3.00	12.50	Vertical	-55.12	-13.00	42.12	90
6	4909.80	-59.72	3.10	12.50	Vertical	-52.47	-13.00	39.47	270
7	5728.10	-58.18	3.40	12.50	Vertical	-51.23	-13.00	38.23	45
8	6546.40	-58.59	3.80	11.50	Vertical	-53.04	-13.00	40.04	135
9	7364.70	-55.68	4.20	12.20	Vertical	-49.83	-13.00	36.83	45
10	8183.00	-54.72	4.30	12.30	Vertical	-48.87	-13.00	35.87	225
Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor. 2. The worst emission was found in the antenna is Vertical position.									

7. Main Test Instruments

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Date
Base Station Simulator	R&S	CMW500	150415	2022-05-14	2023-05-13
Spectrum Analyzer	Keysight	N9020A	MY50510203	2021-12-12	2022-12-11
Signal Analyzer	R&S	FSV3030	101411	2021-12-12	2022-12-11
Climatic Chamber	ESPEC	SU-242	93000506	2021-12-12	2022-12-11
Universal Radio Communication Tester	Agilent	E5515C	GB44400275	2021-12-12	2022-12-11
Radiated Spurious Emissions					
Signal Analyzer	R&S	FSV30	100815	2021-12-12	2022-12-11
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2020-04-02	2023-04-01
TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	01439	2021-06-30	2024-06-29
Horn Antenna	Schwarzbeck	BBHA 9120D	01799	2022-09-01	2025-08-31
Software	R&S	EMC32	10.35.10	/	/

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

ANNEX A: The EUT Appearance

The EUT Appearance is submitted separately.

ANNEX B: Test Setup Photos

The Test Setup Photos is submitted separately.