



RF TEST REPORT

Applicant Quectel Wireless Solutions Co., Ltd
FCC ID XMR201606EC21A
Product LTE Module
Brand Quectel
Model EC21-A, EC21-A MINIPCIE
Report No. R1805A0226-R3V3
Issue Date June 12, 2018

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2017)/ FCC CFR47 Part 27C (2017)**. 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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Summary of Measurement Results

Number	Test Case	Clause in FCC rules	Verdict
1	RF power output	2.1046	PASS
2	Effective Isotropic Radiated power	27.50(d)(4)	PASS
3	Occupied Bandwidth	2.1049	PASS
4	Band Edge Compliance	27.53(h)	PASS
5	Peak-to-Average Power Ratio	27.50(d)/KDB971168 D01(5.7)	PASS
6	Frequency Stability	2.1055 / 27.54	PASS
7	Spurious Emissions at Antenna Terminals	2.1051/27.53(h)	PASS
8	Radiates Spurious Emission	2.1053 /27.53(h) /27.53(g)	PASS
Date of Testing: May 24, 2018~ June 3, 2018			
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.			

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

CNAS (accreditation number: L2264)

TA Technology (Shanghai) Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

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.

IC (recognition number is 8510A)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Canada to perform electromagnetic emission measurement.

VCCI (recognition number is C-4595, T-2154, R-4113, G-10766)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Japan to perform electromagnetic emission measurement.

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.
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2 General Description of Equipment under Test

Client Information

Applicant	Quectel Wireless Solutions Co., Ltd
Applicant address	7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China
Manufacturer	Quectel Wireless Solutions Co., Ltd
Manufacturer address	7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China

General information

EUT Description			
Model	EC21-A, EC21-A MINIPCIE		
IMEI	861108037284717		
Hardware Version	R1.1		
Software Version	EC21AGBR05A05M4G		
Power Supply	External Power Supply		
Antenna Type	External Antenna (The EUT don't have standard Antenna. The Antenna used for testing in this report is the after-market accessory.)		
Test Mode(s)	WCDMA Band IV; LTE Band 4; LTE Band 12;		
Test Modulation	(WCDMA)QPSK; (LTE)QPSK 16QAM;		
HSDPA UE Category	24		
HSUPA UE Category	6		
DC-HSDPA UE Category	24		
HSPA+ Uplink Category	6		
LTE Category	1		
Maximum E.I.R.P. / E.R.P.	WCDMA Band IV:	25.89dBm	
	LTE Band 4	26.49dBm	
	LTE Band 12	18.00dBm	
Rated Power Supply Voltage:	3.8V		
Extreme Voltage	Minimum: 3.3V Maximum: 4.3V		
Extreme Temperature	Lowest: -30°C Highest: +50°C		
Operating Frequency Range(s)	Mode	Tx (MHz)	Rx (MHz)
	WCDMA Band IV	1710 ~ 1755	2110 ~ 2155
	LTE Band 4	1710 ~ 1755	2110 ~ 2155
	LTE Band 12	699 ~ 716	729 ~ 746
Note: 1. The information of the EUT is declared by the manufacturer.			

EC21-A, EC21-A MINIPCIE (Report No: R1805A0226-R3V3) is a variant model of EC21-A, EC21-A MINIPCIE (Report No: RTWK160719001-00). Tested band refer to the following table. The detailed product change description please refers to the ANNEX B.

Test items	Original			Variant		
	WCDMA Band IV	LTE Band 4	LTE Band 12	WCDMA Band IV	LTE Band 4	LTE Band 12
RF power output	pass	pass	pass	pass	pass	pass
Occupied Bandwidth	pass	pass	pass	pass	Refer to the Original	Refer to the Original
Band Edge Compliance	pass	pass	pass	pass	Refer to the Original	Refer to the Original
Peak-to-Average Power Ratio	pass	pass	pass	pass	Refer to the Original	Refer to the Original
Frequency Stability	pass	pass	pass	pass	Refer to the Original	Refer to the Original
Spurious Emissions at Antenna Terminals	pass	pass	pass	pass	Refer to the Original	Refer to the Original
Effective Radiated Power	pass	pass	pass	pass	pass	pass
Radiates Spurious Emission	pass	pass	pass	pass	pass	pass

3 Applied Standards

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

Test standards

FCC CFR47 Part 2 (2017)

FCC CFR47 Part 27C (2017)

ANSI/TIA-603-E (2016)

KDB 971168 D01 Power Meas License Digital Systems v03r01

4 Test Configuration

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, horizontal polarization) and the worst case was recorded.

All mode and data rates and positions and RB size and modulations were investigated. Subsequently, only the worst case emissions are reported.

The following testing in WCDMA/LTE is set based on the maximum RF Output Power.

The following testing in different Bandwidth is set to detail in the following table:

Test modes are chosen to be reported as the worst case configuration below for WCDMA Band IV:

Test items	Modulation
	WCDMA Band IV
RF power output	RMC/HSDPA/HSUPA/DC-HSDPA
Effective Isotropic Radiated power	RMC
Occupied Bandwidth	RMC
Band Edge Compliance	RMC
Peak-to-Average Power Ratio	RMC
Frequency Stability	RMC
Spurious Emissions at Antenna Terminals	RMC
Radiates Spurious Emission	RMC

Test modes are chosen to be reported as the worst case configuration below for LTE Band 4/12:

Test items	Modes	Bandwidth (MHz)						Modulation		RB			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	1	50%	100%	L	M	H
RF power output	LTE 4	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	LTE 12	O	O	O	O	-	-	O	O	O	O	O	O	O	O
Effective Isotropic Radiated power	LTE 4	O	O	O	O	O	O	O	O	-	-	O	O	O	O
	LTE 12	O	O	O	O	-	-	O	O	-	-	O	O	O	O
Radiates Spurious Emission	LTE 4	O	-	O	-	-	O	O	O	O	O	O	O	O	O
	LTE 12	O	-	O	O	-	-	O	O	O	O	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 Results

5.1 RF Power Output

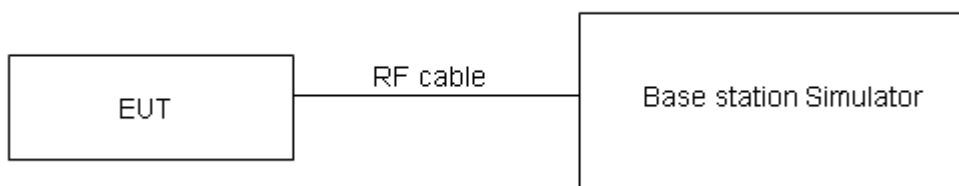
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

During the process of the testing, The EUT is controlled by the Base Station Simulator to ensure max power transmission and proper modulation.

Test Setup



The loss between RF output port of the EUT and the input port of the tester has been taken into consideration.

Limits

No specific RF power output requirements in part 2.1046.

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.

Test Results

WCDMA Band IV		AV Conducted Power(dBm)		
		Channel 1312	Channel 1413	Channel 1513
		1712.4 (MHz)	1732.6 (MHz)	1752.6(MHz)
RMC		23.16	23.22	23.27
HSDPA	Sub - Test 1	22.20	22.25	22.23
	Sub - Test 2	22.09	22.25	22.29
	Sub - Test 3	21.56	21.72	21.63
	Sub - Test 4	21.56	21.69	21.73
HSUPA	Sub - Test 1	22.16	22.17	22.13
	Sub - Test 2	21.56	21.69	21.70
	Sub - Test 3	22.02	22.11	22.16
	Sub - Test 4	22.12	22.30	22.22
	Sub - Test 5	22.11	22.23	22.18
DC-HSDPA	Sub - Test 1	23.09	23.11	23.16
	Sub - Test 2	23.08	23.10	23.15
	Sub - Test 3	22.57	22.59	22.64
	Sub - Test 4	22.56	22.68	22.62

LTE Band 4				AV Conducted Power(dBm)		
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				19957/1710.7	20175/1732.5	20393/1754.3
1.4MHz	QPSK	1	0	22.76	22.81	22.87
		1	2	22.92	22.94	22.99
		1	5	22.70	22.97	22.83
		3	0	22.54	22.79	22.71
		3	2	22.63	22.83	22.54
		3	3	22.55	22.73	22.69
		6	0	21.69	21.97	21.76
	16QAM	1	0	21.94	22.18	22.13
		1	2	21.93	22.19	22.21
		1	5	21.82	21.92	22.97
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				19965/1711.5	20175/1732.5	20385/1753.5
3MHz	QPSK	1	0	23.03	23.14	23.16
		1	7	23.17	23.05	22.98
		1	14	23.22	23.03	23.09
		8	0	21.86	21.87	21.99
		8	4	21.88	21.89	21.95
		8	7	22.04	21.90	21.72
		15	0	21.83	21.75	21.93
	16QAM	1	0	21.70	21.83	21.91
		1	7	21.83	21.78	21.90
		1	14	21.96	21.85	21.96
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				19975/1712.5	20175/1732.5	20375/1752.5
5MHz	QPSK	1	0	23.00	23.12	23.12
		1	13	23.15	23.01	22.95
		1	24	23.19	22.98	23.05
		12	0	21.83	21.82	21.95
		12	6	21.86	21.85	21.90
		12	13	22.02	21.88	21.68
		25	0	21.81	21.74	21.91
	16QAM	1	0	21.67	21.79	21.88
		1	13	21.80	21.76	21.87
		1	24	21.93	21.83	21.92
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				20000/1715	20175/1732.5	20350/1750
10MHz	QPSK	1	0	23.02	23.13	23.15
		1	25	23.18	23.06	22.99
		1	49	23.21	23.02	23.08



		25	0	21.86	21.87	21.99
		25	13	21.89	21.90	21.94
		25	25	22.04	21.92	21.73
		50	0	21.89	21.76	21.95
	16QAM	1	0	21.69	21.82	21.90
		1	25	21.83	21.80	21.90
		1	49	21.96	21.85	21.95
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				20025/1717.5	20175/1732.5	20325/1747.5
15MHz	QPSK	1	0	23.01	23.09	23.13
		1	38	23.16	23.05	22.96
		1	74	23.18	22.97	23.04
		36	0	21.84	21.83	21.96
		36	18	21.86	21.85	21.90
		36	39	22.01	21.89	21.69
		75	0	21.87	21.72	21.90
	16QAM	1	0	21.64	21.80	21.88
		1	38	21.81	21.77	21.88
		1	74	21.93	21.81	21.92
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				20050/1720	20175/1732.5	20300/1745
20MHz	QPSK	1	0	22.98	23.05	23.10
		1	50	23.15	23.01	22.94
		1	99	23.16	22.96	23.01
		50	0	21.81	21.78	21.92
		50	25	21.84	21.81	21.87
		50	50	21.98	21.84	21.65
		100	0	21.84	21.67	21.86
	16QAM	1	0	21.62	21.76	21.83
		1	50	21.77	21.75	21.84
		1	99	21.91	21.78	21.90

Note:

1) The following testing in worst case based on the maximum RF Output Power.

LTE Band 12				AV Conducted Power(dBm)		
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				23017/699.7	23095/707.5	23173/715.3
1.4MHz	QPSK	1	0	23.13	23.14	23.02
		1	2	23.11	23.27	23.04
		1	5	23.07	23.30	23.06



		3	0	22.87	22.91	22.85
		3	2	22.93	23.03	22.91
		3	3	22.82	23.08	22.84
		6	0	22.20	22.41	22.24
	16QAM	1	0	22.18	22.78	22.16
		1	2	22.70	22.89	22.01
		1	5	22.52	22.66	22.44
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				23025/700.5	23095/707.5	23165/714.5
3MHz	QPSK	1	0	22.99	22.99	22.92
		1	7	23.13	23.32	22.90
		1	14	22.90	22.88	22.90
		8	0	22.30	22.38	22.46
		8	4	22.39	22.26	22.43
		8	7	22.49	22.36	22.39
		15	0	22.29	22.38	22.40
	16QAM	1	0	22.37	22.76	22.49
		1	7	22.61	23.07	22.36
		1	14	22.45	22.72	22.03
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				23035/701.5	23095/707.5	23155/713.5
5MHz	QPSK	1	0	22.98	22.95	22.90
		1	13	23.11	23.31	22.87
		1	24	22.87	22.83	22.86
		12	0	22.28	22.34	22.43
		12	6	22.36	22.21	22.39
		12	13	22.46	22.33	22.35
		25	0	22.27	22.34	22.35
	16QAM	1	0	22.32	22.74	22.47
		1	13	22.59	23.04	22.34
		1	24	22.42	22.68	22.00
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				23060/704	23095/707.5	23130/711
10MHz	QPSK	1	0	22.95	22.91	22.87
		1	25	23.10	23.27	22.85
		1	49	22.85	22.82	22.83
		25	0	22.25	22.29	22.39
		25	13	22.34	22.17	22.36
		25	25	22.43	22.28	22.31
		50	0	22.24	22.29	22.31
	16QAM	1	0	22.30	22.70	22.42
		1	25	22.55	23.02	22.30
		1	49	22.40	22.65	21.98

5.2 Effective Isotropic Radiated Power

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

1. The testing follows FCC KDB 971168 D01 v03r01 Section 5.8 and ANSI/TIA-603-E (2016).

a) Connect the equipment as illustrated. Mount the equipment with the manufacturer specified antenna in a vertical orientation on a manufacturer specified mounting surface located on a non-conducting rotating platform of a RF anechoic chamber (preferred) or a standard radiation site.

b) Key the transmitter, then rotate the EUT 360° azimuthally and record spectrum analyzer power level (LVL) measurements at angular increments that are sufficiently small to permit resolution of all peaks. If a standard radiation test site is used, raise and lower the test antenna to obtain a maximum reading at each angular increment. (Note: several batteries may be needed to offset the effect of battery voltage droop, which should not exceed 5% of the manufactured specified battery voltage during transmission).

c) Replace the transmitter under test with a vertically polarized half-wave dipole (or an antenna whose gain is known relative to an ideal half-wave dipole). The center of the antenna should be at the same location as the center of the antenna under test.

d) Connect the antenna to a signal generator with a known output power and record the path loss (in dB) as LOSS. If a standard radiation test site is used, raise and lower the test antenna to obtain a maximum reading. $LOSS = \text{Generator Output Power (dBm)} - \text{Analyzer reading (dBm)}$

e) Determine the effective radiated output power at each angular position from the readings in steps b) and d) using the following equation: $ERP \text{ (dBm)} = LVL \text{ (dBm)} + LOSS \text{ (dB)}$

f) The maximum ERP is the maximum value determined in the preceding step.

g) When calculating ERP, in addition to knowing the antenna radiation and matching characteristics, it is necessary to know the loss values of all elements (e.g. transmission line attenuation, mismatches, filters, combiners) interposed between the point where transmitter output power is measured, and the point where power is applied to the antenna. ERP can then be calculated as follows:

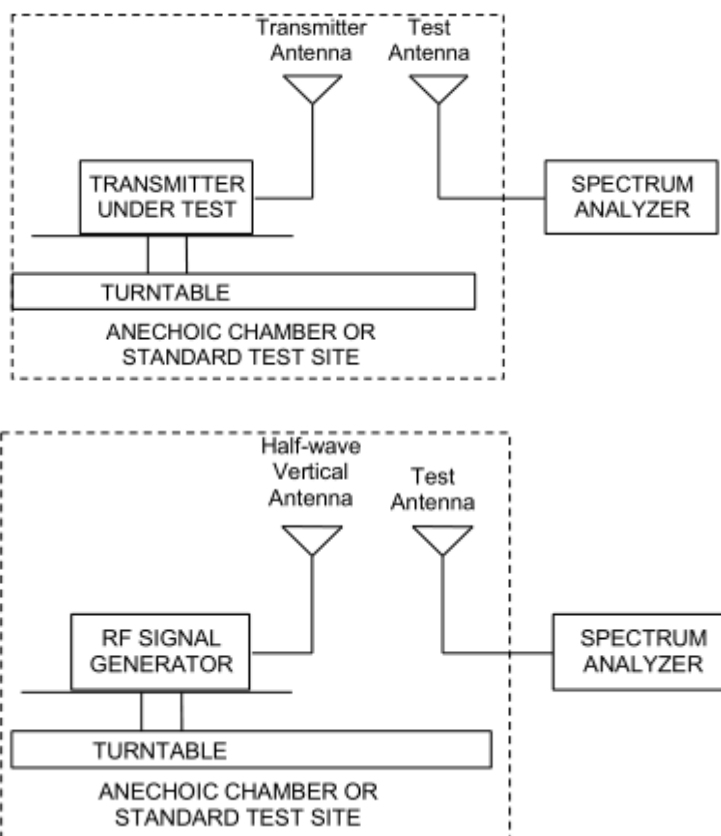
$$ERP \text{ (dBm)} = \text{Output Power (dBm)} - \text{Losses (dB)} + \text{Antenna Gain (dBd)}$$

where: dBd refers to gain relative to an ideal dipole.

$$EIRP \text{ (dBm)} = ERP \text{ (dBm)} + 2.15 \text{ (dB.)}$$

The RB allocation refers to section 5.1, using the maximum output power configuration.

Test setup



Note: Area side:2.4mX3.6m

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the worst case was recorded.

Limits

Rule Part 27.50(c) (10) specifies that “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”

Rule Part 27.50(d) (4) specifies that “Fixed, mobile and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP”

Part 27.50(c)(10)Limit	$\leq 3 \text{ W}$ (34.77 dBm)
Part 27.50(d)(4)Limit	$\leq 1 \text{ W}$ (30 dBm)

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 1.19 \text{ dB}$

Test Results

The measurement is performed for both of horizontal and vertical antenna Polarization, and only the data of worst mode is recorded in this report.

Mode	Channel	Frequency (MHz)	Polarization	EIRP (dBm)	Limit (dBm)	Conclusion
WCDMA Band IV	Low	1712.4	Horizontal	25.64	30	Pass
	Mid	1732.6	Horizontal	25.89	30	Pass
	High	1752.6	Horizontal	25.79	30	Pass

LTE Band 4						
Bandwidth	Channel	Frequency (MHz)	Polarization	EIRP (dBm)	Limit (dBm)	Conclusion
1.4 MHz (QPSK)	Low	1710.7	Horizontal	26.26	30	Pass
	Mid	1732.5	Horizontal	25.84	30	Pass
	High	1754.3	Horizontal	25.80	30	Pass
3 MHz (QPSK)	Low	1711.5	Horizontal	26.49	30	Pass
	Mid	1732.5	Horizontal	25.98	30	Pass
	High	1753.5	Horizontal	25.71	30	Pass
5 MHz (QPSK)	Low	1712.5	Horizontal	26.20	30	Pass
	Mid	1732.5	Horizontal	25.86	30	Pass
	High	1752.5	Horizontal	25.80	30	Pass
10 MHz (QPSK)	Low	1715	Horizontal	26.43	30	Pass
	Mid	1732.5	Horizontal	25.96	30	Pass
	High	1750	Horizontal	25.84	30	Pass
15 MHz (QPSK)	Low	1717.5	Horizontal	26.06	30	Pass
	Mid	1732.5	Horizontal	25.84	30	Pass
	High	1747.5	Horizontal	25.72	30	Pass
20 MHz (QPSK)	Low	1720	Horizontal	26.06	30	Pass
	Mid	1732.5	Horizontal	26.11	30	Pass
	High	1745	Horizontal	25.97	30	Pass
1.4 MHz (16QAM)	Low	1710.7	Horizontal	25.98	30	Pass
	Mid	1732.5	Horizontal	25.51	30	Pass
	High	1754.3	Horizontal	25.53	30	Pass
3 MHz (16QAM)	Low	1711.5	Horizontal	26.19	30	Pass
	Mid	1732.5	Horizontal	25.79	30	Pass
	High	1753.5	Horizontal	25.35	30	Pass
5 MHz (16QAM)	Low	1712.5	Horizontal	26.03	30	Pass
	Mid	1732.5	Horizontal	25.69	30	Pass
	High	1752.5	Horizontal	25.61	30	Pass
10 MHz (16QAM)	Low	1715	Horizontal	26.18	30	Pass
	Mid	1732.5	Horizontal	25.79	30	Pass
	High	1750	Horizontal	25.67	30	Pass
15 MHz	Low	1717.5	Horizontal	25.79	30	Pass



(16QAM)	Mid	1732.5	Horizontal	25.61	30	Pass
	High	1747.5	Horizontal	25.32	30	Pass
20 MHz (16QAM)	Low	1720	Horizontal	25.87	30	Pass
	Mid	1732.5	Horizontal	25.93	30	Pass
	High	1745	Horizontal	25.61	30	Pass

LTE Band 12						
Bandwidth	Channel	Frequency (MHz)	Polarization	ERP (dBm)	Limit (dBm)	Conclusion
1.4 MHz (QPSK)	Low	699.7	Horizontal	17.52	34.77	Pass
	Mid	707.5	Horizontal	17.86	34.77	Pass
	High	715.3	Horizontal	17.97	34.77	Pass
3 MHz (QPSK)	Low	700.5	Horizontal	17.62	34.77	Pass
	Mid	707.5	Horizontal	17.98	34.77	Pass
	High	714.5	Horizontal	18.00	34.77	Pass
5 MHz (QPSK)	Low	701.5	Horizontal	17.27	34.77	Pass
	Mid	707.5	Horizontal	17.79	34.77	Pass
	High	713.5	Horizontal	17.73	34.77	Pass
10 MHz (QPSK)	Low	704	Horizontal	17.39	34.77	Pass
	Mid	707.5	Horizontal	17.75	34.77	Pass
	High	711	Horizontal	17.79	34.77	Pass
1.4 MHz (16QAM)	Low	699.7	Horizontal	17.28	34.77	Pass
	Mid	707.5	Horizontal	17.52	34.77	Pass
	High	715.3	Horizontal	17.38	34.77	Pass
3 MHz (16QAM)	Low	700.5	Horizontal	17.35	34.77	Pass
	Mid	707.5	Horizontal	17.71	34.77	Pass
	High	714.5	Horizontal	17.58	34.77	Pass
5 MHz (16QAM)	Low	701.5	Horizontal	17.20	34.77	Pass
	Mid	707.5	Horizontal	17.51	34.77	Pass
	High	713.5	Horizontal	17.43	34.77	Pass
10 MHz (16QAM)	Low	704	Horizontal	17.18	34.77	Pass
	Mid	707.5	Horizontal	17.70	34.77	Pass
	High	711	Horizontal	17.71	34.77	Pass

Note: 1. EIRP= E.R.P+2.15

5.3 Occupied Bandwidth

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

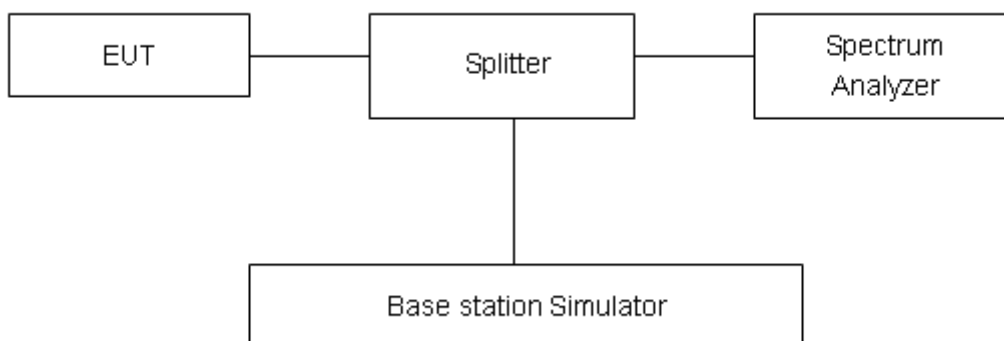
Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The occupied bandwidth is measured using spectrum analyzer.

RBW is set to 51 kHz, VBW is set to 160 kHz for WCDMA Band IV.

99% power and -26dBc occupied bandwidths are recorded. Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

No specific occupied bandwidth requirements in part 2.1049.

Measurement Uncertainty

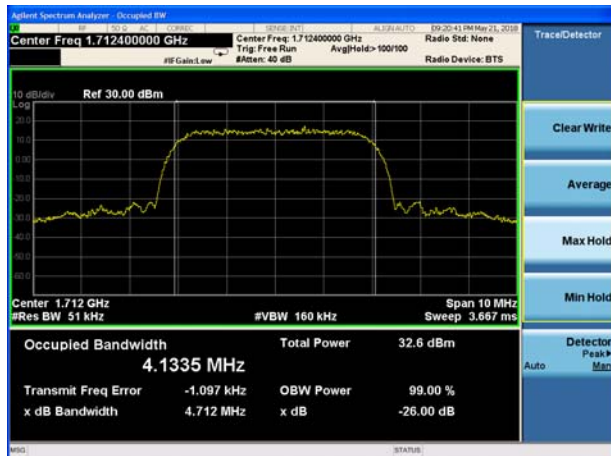
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U=624\text{Hz}$.



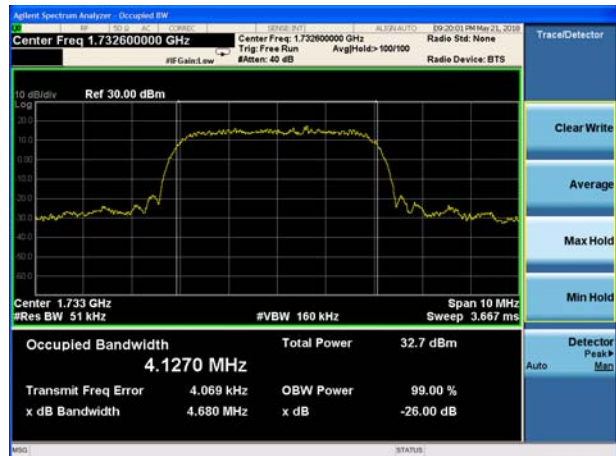
Test Result

Mode	Channel	Frequency (MHz)	99% Power Bandwidth(MHz)	-26dBc Bandwidth(MHz)
WCDMA Band IV (RMC)	1312	1712.4	4.1335	4.712
	1413	1732.6	4.1270	4.680
	1513	1752.6	4.1307	4.696

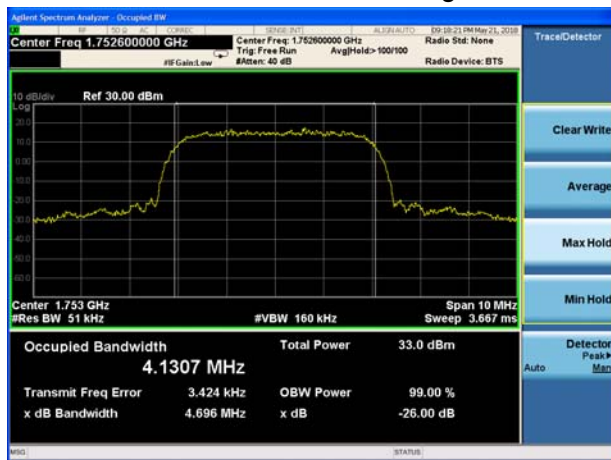
WCDMA Band IV CH-Low



WCDMA Band IV CH Middle



WCDMA Band IV CH High



5.4 Band Edge Compliance

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

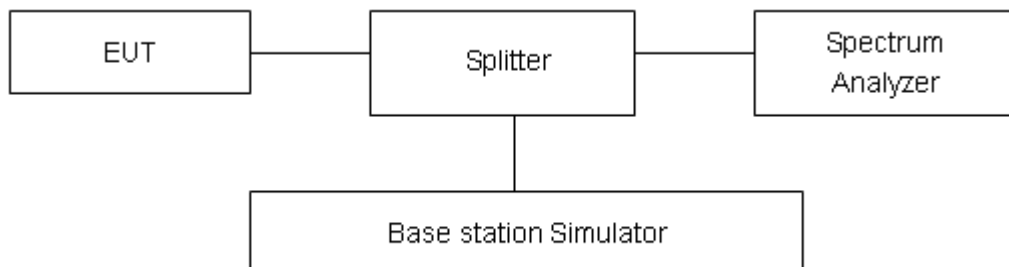
Method of Measurement

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 testing follows KDB 971168 D01 v03r01 Section 6.0

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. RBW is set to 51 kHz, VBW is set to 160 kHz for WCDMA Band IV. on spectrum analyzer.
3. Set spectrum analyzer with RMS detector.
4. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
5. Checked that all the results comply with the emission limit line.

Test Setup



Limits

Rule Part 27.53(h)/ specifies that “ for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB”

Measurement Uncertainty

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



Test Result

All the test traces in the plots shows the test results clearly.



5.5 Peak-to-Average Power Ratio (PAPR)

Ambient condition

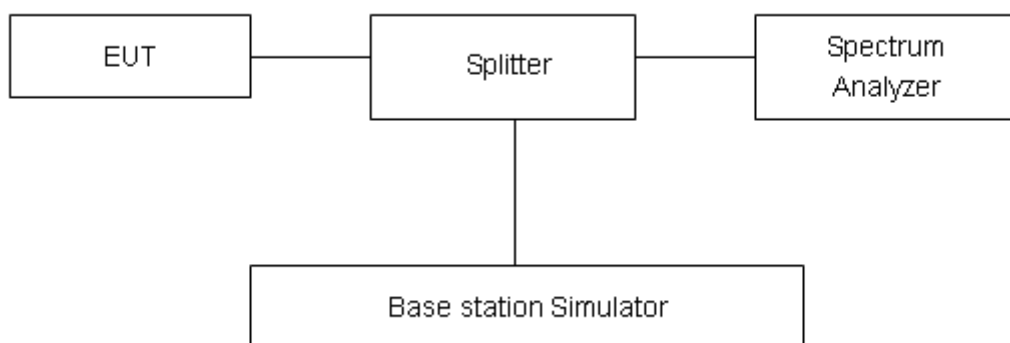
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

Measure the total peak power and record as PPk. And measure the total average power and record as PAvg. Both the peak and average power levels must be expressed in the same logarithmic units (e.g., dBm). Determine the PAPR from:

$$\text{PAPR (dB)} = \text{PPk (dBm)} - \text{PAvg (dBm)}.$$

Test Setup



Limits

Rule Part 27.50(d)(5) 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.

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.

**Test Results**

WCDMA Band IV	Channel	Frequency (MHz)	Peak (dBm)	Avg (dBm)	PAPR (dB)	Limit (dB)	Conclusion
RMC	1312	1712.4	26.85	23.16	3.69	≤13	PASS
	1413	1732.6	26.86	23.22	3.64	≤13	PASS
	1513	1752.6	26.98	23.27	3.71	≤13	PASS

5.6 Frequency Stability

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

Frequency Stability (Temperature Variation)

The temperature inside the climate chamber is varied from -30°C to +50°C in 10°C step size.

(1) With all power removed, the temperature was decreased to -10°C and permitted to stabilize for three hours.

(2) Measure the carrier frequency with the test equipment in a “call mode”. These measurements should be made within 1 minute of powering up the mobile station, to prevent significant self warming.

(3) Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 1.5 hours at each temperature, un-powered, before making measurements.

Frequency Stability (Voltage Variation)

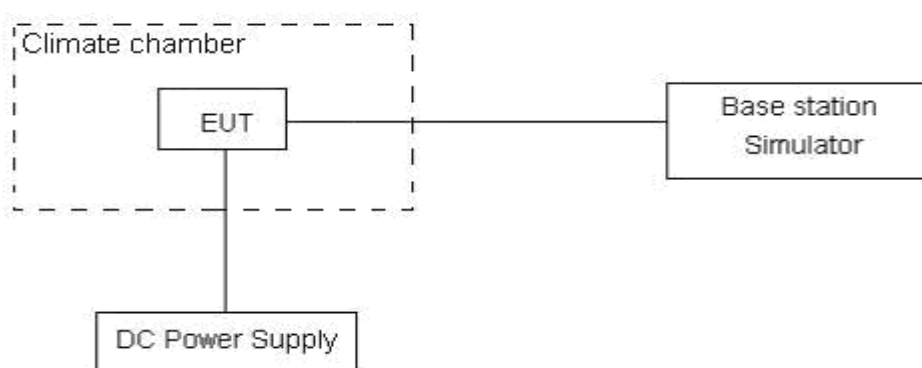
The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 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.

This transceiver is specified to operate with an input voltage of between 3.3 V and 4.3 V, with a nominal voltage of 3.8V.

Test setup



Limits

No specific frequency stability requirements in part 27.54

Measurement Uncertainty

The assessed measurement uncertainty to ensure 99.75% confidence level for the normal distribution is with the coverage factor $k = 3, U = 0.01\text{ppm}$.

Test Result

WCDMA Band IV

WCDMA Band IV					
Condition		1710	1755	Delta (Hz)	Frequency Stability (ppm)
Temperature	Voltage	F low@-13dBm(MHz)	F high@-13dBm(MHz)		
Normal (25°C)	Normal	1710.1098	1754.8294	-1.67	-0.00096
Extreme (50°C)		1710.1101	1754.8291	0.76	0.00044
Extreme (40°C)		1710.1093	1754.8299	1.10	0.00064
Extreme (30°C)		1710.1089	1754.8303	0.53	0.00030
Extreme (20°C)		1710.1095	1754.8297	-1.69	-0.00097
Extreme (10C)		1710.1092	1754.8302	-1.71	-0.00099
Extreme (0°C)		1710.1094	1754.8298	-1.74	-0.00100
Extreme (-10°C)		1710.1091	1754.8301	-2.55	-0.00147
Extreme (-20°C)		1710.1092	1754.8323	-0.12	-0.00007
Extreme (-30°C)		1710.1099	1754.8293	-2.82	-0.00163
25C	LV	1710.1088	1754.8304	-3.13	-0.00181
	HV	1710.1086	1754.8306	2.97	0.00171

5.7 Spurious Emissions at Antenna Terminals

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

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 9kHz to the 10th harmonic of the carrier. The peak detector is used.

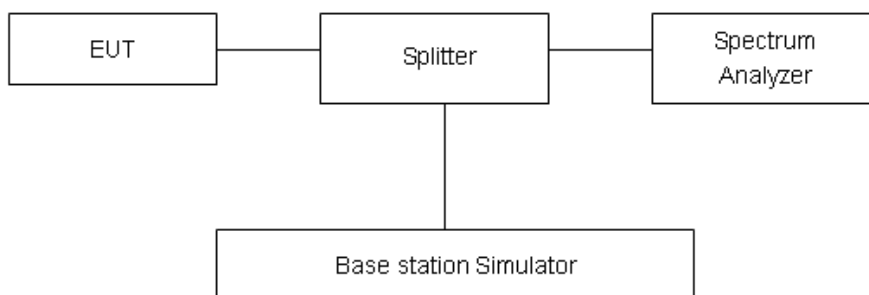
RBW is set to 100kHz, VBW is set to 300kHz for 30MHz~1GHz

RBW is set to 1MHz, VBW is set to 3MHz for above 1GHz, Sweep is set to ATUO.

Of those disturbances below (limit – 20 dB), the mark is not required for the EUT.

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

Test setup



Limits

Rule Part 27.53(h) specifies that “for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB..”

Part 27.53 (h) Limit	-13 dBm
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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
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9kHz-1GHz	0.684 dB
1GHz-27GHz	1.407 dB

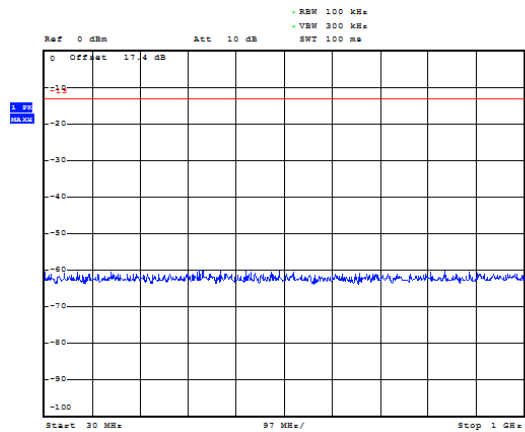
Test Result

Sweep from 9 kHz to 30MHz, and the emissions more than 20 dB below the permissible value are not reported.

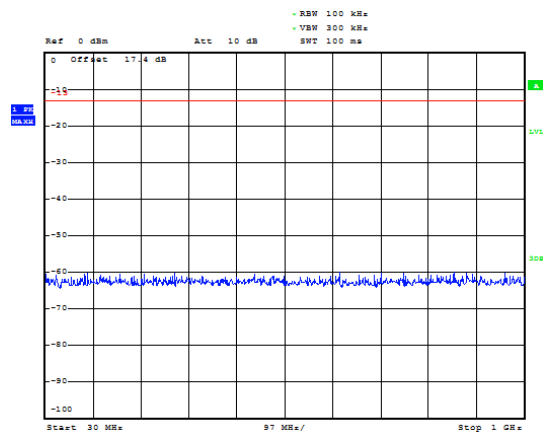
If disturbances were found more than 20dB below limit line, the mark is not required for the EUT.

The signal beyond the limit is carrier.

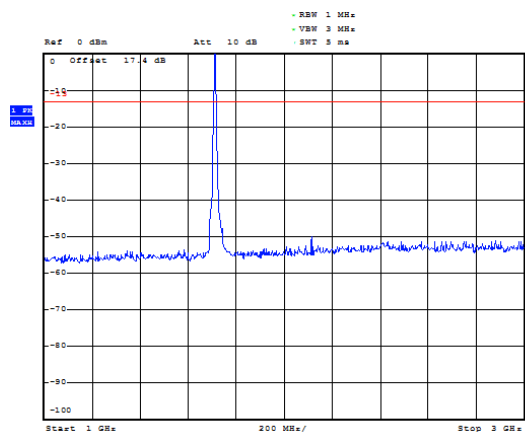
WCDMA Band IV CH-Low 30MHz~1GHz



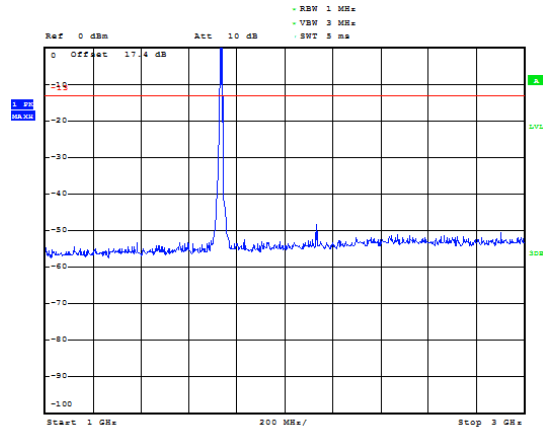
WCDMA Band IV CH- Middle 30MHz~1GHz



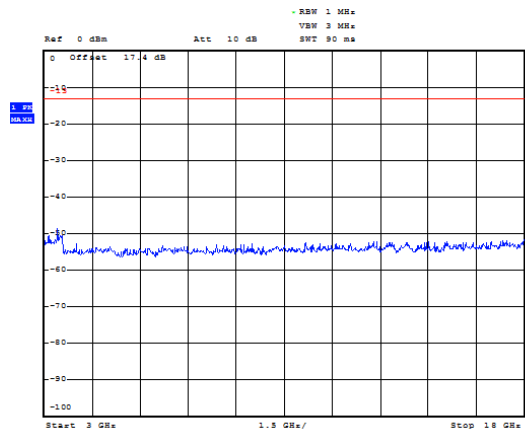
WCDMA Band IV CH-Low 1GHz~3GHz



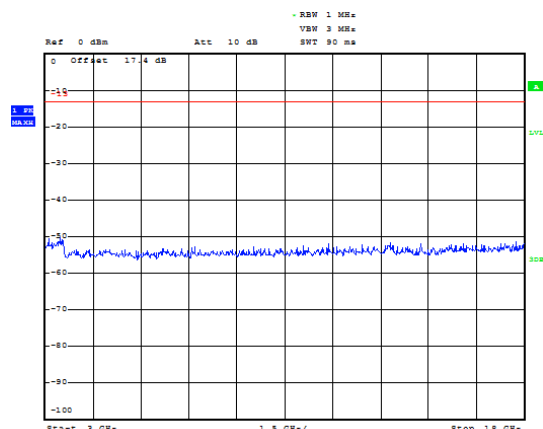
WCDMA Band IV CH- Middle 1GHz~3GHz



WCDMA Band IV CH-Low 3GHz~18GHz

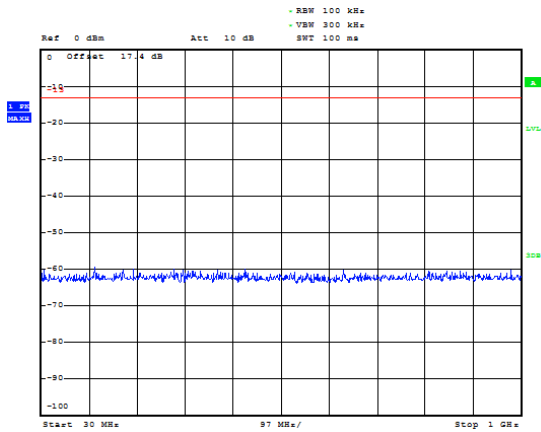


WCDMA Band IV CH- Middle 3GHz~18GHz

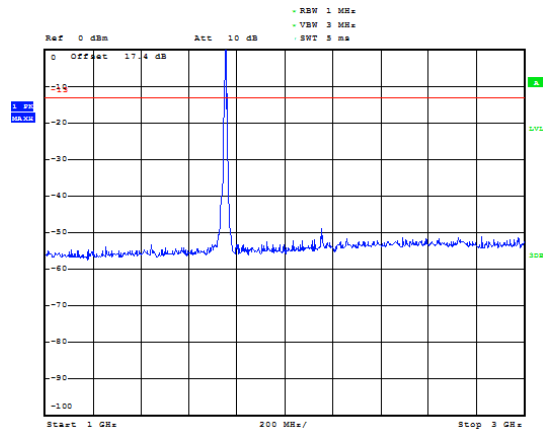




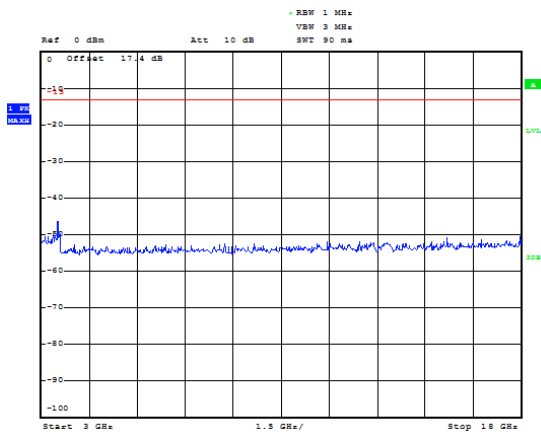
WCDMA Band IV CH-High 30MHz~1GHz



WCDMA Band IV CH- High 1GHz~3GHz



WCDMA Band IV CH- High 3GHz~18GHz



5.8 Radiates Spurious Emission

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

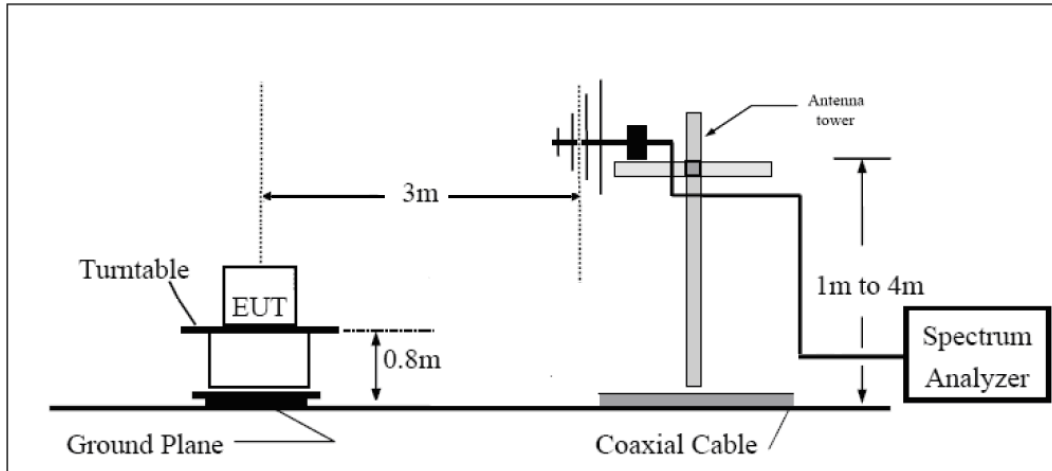
1. The testing follows FCC KDB 971168 D01 v03r01 Section 5.8 and ANSI/TIA-603-E (2016).
 2. The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. 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).
 3. A log-periodic antenna or double-ridged waveguide 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=1MHz, VBW=3MHz, 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:

$$\text{Power(EIRP)} = \text{PMea} - \text{PAG} - \text{Pcl} + \text{Ga}$$
The measurement results are amend as described below:

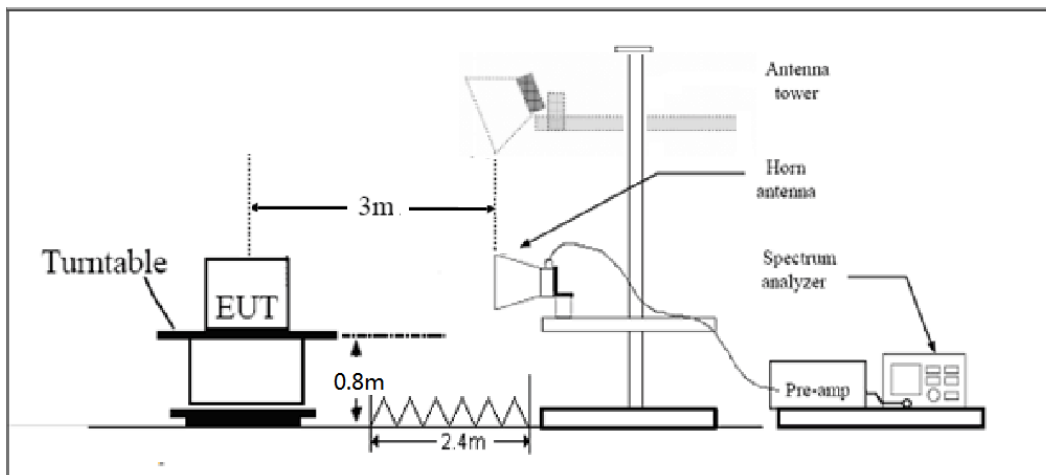
$$\text{Power(EIRP)} = \text{PMea} - \text{Pcl} + \text{Ga}$$
 8. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power. ERP can be calculated from EIRP by subtracting the gain of the dipole, $\text{ERP} = \text{EIRP} - 2.15\text{dBi}$.
- The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup

30MHz~~~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the worst case was recorded.

Limits

Rule Part 27.53(h) specifies that “for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB..”

LTE -12 Rule Part 27.53 (g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands



immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

LTE B4/12 Limit	-13 dBm
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Measurement Uncertainty

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

Test Result

Sweep the whole frequency band through the range from 30MHz to the 10th harmonic of the carrier, from 30MHz to 1GHz are all noise floor will not be recorded in the report.

WCDMA Band IV CH-Low

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3424.8	-71.24	2.6	10.15	Horizontal	-63.69	-13.00	50.69	180
3	5137.2	-68.56	2.4	11.35	Horizontal	-59.61	-13.00	46.61	225
4	6849.6	-62.54	4.5	10.85	Horizontal	-56.19	-13.00	43.19	180
5	8562.0	-63.67	5.1	11.35	Horizontal	-57.42	-13.00	44.42	135
6	10274.4	-61.96	5.3	11.95	Horizontal	-55.31	-13.00	42.31	45
7	11986.8	-63.44	5.5	13.55	Horizontal	-55.39	-13.00	42.39	135
8	13699.2	-60.36	6.3	13.75	Horizontal	-52.91	-13.00	39.91	225
9	15411.6	-57.95	6.7	13.85	Horizontal	-50.80	-13.00	37.80	180
10	17124.0	-57.55	6.8	14.25	Horizontal	-50.10	-13.00	37.10	270
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 Horizontal position.									

WCDMA Band IV CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3465.2	-71.07	2.6	10.75	Horizontal	-62.92	-13.00	49.92	45
3	5197.8	-69.13	2.4	11.05	Horizontal	-60.48	-13.00	47.48	225
4	6930.4	-62.62	4.5	11.15	Horizontal	-55.97	-13.00	42.97	315
5	8663.0	-61.41	5.1	11.35	Horizontal	-55.16	-13.00	42.16	270
6	10395.6	-61.47	5.3	11.95	Horizontal	-54.82	-13.00	41.82	45
7	12128.2	-63.27	5.5	13.55	Horizontal	-55.22	-13.00	42.22	90
8	13860.8	-60.57	6.3	13.75	Horizontal	-53.12	-13.00	40.12	315
9	15593.4	-58.45	6.7	13.85	Horizontal	-51.30	-13.00	38.30	270
10	17326.0	-57.92	6.8	14.25	Horizontal	-50.47	-13.00	37.47	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 Horizontal position.									

WCDMA Band IV CH-High

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3505.2	-72.39	2.6	10.15	Horizontal	-64.84	-13.00	51.84	45
3	5254.1	-68.36	2.4	11.05	Horizontal	-59.71	-13.00	46.71	90
4	7010.4	-64.27	4.5	11.15	Horizontal	-57.62	-13.00	44.62	180
5	8763.0	-60.34	5.1	11.35	Horizontal	-54.09	-13.00	41.09	315
6	10515.6	-61.97	5.3	11.95	Horizontal	-55.32	-13.00	42.32	1353
7	12268.2	-62.17	5.5	13.55	Horizontal	-54.12	-13.00	41.12	270
8	14020.8	-59.59	6.3	13.75	Horizontal	-52.14	-13.00	39.14	180
9	15773.4	-58.32	6.7	13.85	Horizontal	-51.17	-13.00	38.17	135
10	17526.0	-56.46	6.8	14.25	Horizontal	-49.01	-13.00	36.01	90

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 Horizontal position.

LTE Band 4 QPSK 1.4MHz CH-Low, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3421.4	-62.20	2.6	10.15	Horizontal	-54.65	-13.00	41.65	45
3	5131.1	-59.75	2.4	11.35	Horizontal	-50.80	-13.00	37.80	135
4	6842.8	-62.03	4.5	10.85	Horizontal	-55.68	-13.00	42.68	45
5	8553.5	-63.22	5.1	11.35	Horizontal	-56.97	-13.00	43.97	135
6	10264.2	-62.72	5.3	11.95	Horizontal	-56.07	-13.00	43.07	90
7	11974.9	-62.08	5.5	13.55	Horizontal	-54.03	-13.00	41.03	45
8	13685.6	-59.14	6.3	13.75	Horizontal	-51.69	-13.00	38.69	90
9	15396.3	-55.75	6.7	13.85	Horizontal	-48.60	-13.00	35.60	135
10	17107.0	-56.93	6.8	14.25	Horizontal	-49.48	-13.00	36.48	90

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 Horizontal position.

LTE Band 4 QPSK 1.4MHz CH-Middle, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3464.3	-65.33	2.6	10.75	Horizontal	-57.18	-13.00	44.18	225
3	5197.5	-60.06	2.4	11.05	Horizontal	-51.41	-13.00	38.41	270
4	6930.0	-61.69	4.5	11.15	Horizontal	-55.04	-13.00	42.04	270
5	8662.5	-62.15	5.1	11.35	Horizontal	-55.90	-13.00	42.90	135
6	10395.0	-61.05	5.3	11.95	Horizontal	-54.40	-13.00	41.40	135
7	12127.5	-61.30	5.5	13.55	Horizontal	-53.25	-13.00	40.25	45
8	13860.0	-60.34	6.3	13.75	Horizontal	-52.89	-13.00	39.89	0
9	15592.5	-56.67	6.7	13.85	Horizontal	-49.52	-13.00	36.52	180
10	17325.0	-55.79	6.8	14.25	Horizontal	-48.34	-13.00	35.34	90
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 Horizontal position.									

LTE Band 4 QPSK 1.4MHz CH-High, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3507.8	-60.87	2.6	10.15	Horizontal	-53.32	-13.00	40.32	90
3	5261.6	-57.77	2.4	11.05	Horizontal	-49.12	-13.00	36.12	135
4	7017.2	-63.49	4.5	11.15	Horizontal	-56.84	-13.00	43.84	135
5	8771.5	-60.79	5.1	11.35	Horizontal	-54.54	-13.00	41.54	45
6	10525.8	-61.49	5.3	11.95	Horizontal	-54.84	-13.00	41.84	45
7	12280.1	-64.46	5.5	13.55	Horizontal	-56.41	-13.00	43.41	315
8	14034.4	-59.89	6.3	13.75	Horizontal	-52.44	-13.00	39.44	315
9	15788.7	-56.76	6.7	13.85	Horizontal	-49.61	-13.00	36.61	270
10	17543.0	-57.06	6.8	14.25	Horizontal	-49.61	-13.00	36.61	270
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 Horizontal position.									

LTE Band 4 QPSK 5MHz CH-Low, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3425.0	-62.40	2.6	10.15	Horizontal	-54.85	-13.00	41.85	135
3	5131.1	-59.86	2.4	11.35	Horizontal	-50.91	-13.00	37.91	45
4	6850.0	-61.36	4.5	10.85	Horizontal	-55.01	-13.00	42.01	225
5	8562.5	-63.34	5.1	11.35	Horizontal	-57.09	-13.00	44.09	270
6	10275.0	-62.03	5.3	11.95	Horizontal	-55.38	-13.00	42.38	225
7	11987.5	-63.08	5.5	13.55	Horizontal	-55.03	-13.00	42.03	270
8	13700.0	-59.46	6.3	13.75	Horizontal	-52.01	-13.00	39.01	270
9	15412.5	-56.87	6.7	13.85	Horizontal	-49.72	-13.00	36.72	270
10	17125.0	-55.75	6.8	14.25	Horizontal	-48.30	-13.00	35.30	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 Horizontal position.									

LTE Band 4 QPSK 5MHz CH-Middle, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3460.5	-62.90	2.6	10.75	Horizontal	-54.75	-13.00	41.75	135
3	5191.5	-59.94	2.4	11.05	Horizontal	-51.29	-13.00	38.29	315
4	6930.0	-62.94	4.5	11.15	Horizontal	-56.29	-13.00	43.29	315
5	8662.5	-63.16	5.1	11.35	Horizontal	-56.91	-13.00	43.91	315
6	10395.0	-62.58	5.3	11.95	Horizontal	-55.93	-13.00	42.93	225
7	12127.5	-62.69	5.5	13.55	Horizontal	-54.64	-13.00	41.64	45
8	13860.0	-59.83	6.3	13.75	Horizontal	-52.38	-13.00	39.38	45
9	15592.5	-56.51	6.7	13.85	Horizontal	-49.36	-13.00	36.36	270
10	17325.0	-56.44	6.8	14.25	Horizontal	-48.99	-13.00	35.99	270
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 Horizontal position.									



LTE Band 4 QPSK 5MHz CH-High, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3500.6	-62.87	2.6	10.15	Horizontal	-55.32	-13.00	42.32	270
3	5251.1	-63.75	2.4	11.05	Horizontal	-55.10	-13.00	42.10	45
4	7010.0	-62.26	4.5	11.15	Horizontal	-55.61	-13.00	42.61	135
5	8762.5	-62.92	5.1	11.35	Horizontal	-56.67	-13.00	43.67	135
6	10515.0	-62.37	5.3	11.95	Horizontal	-55.72	-13.00	42.72	135
7	12267.5	-60.73	5.5	13.55	Horizontal	-52.68	-13.00	39.68	225
8	14020.0	-59.50	6.3	13.75	Horizontal	-52.05	-13.00	39.05	45
9	15772.5	-55.41	6.7	13.85	Horizontal	-48.26	-13.00	35.26	45
10	17525.0	-54.72	6.8	14.25	Horizontal	-47.27	-13.00	34.27	0

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 Horizontal position.

LTE Band 4 QPSK 20MHz CH-Low, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3440.0	-61.61	2.6	10.15	Horizontal	-54.06	-13.00	41.06	45
3	5133.4	-59.59	2.4	11.35	Horizontal	-50.64	-13.00	37.64	225
4	6880.0	-61.25	4.5	10.85	Horizontal	-54.90	-13.00	41.90	225
5	8600.0	-61.99	5.1	11.35	Horizontal	-55.74	-13.00	42.74	315
6	10320.0	-61.93	5.3	11.95	Horizontal	-55.28	-13.00	42.28	315
7	12040.0	-63.88	5.5	13.55	Horizontal	-55.83	-13.00	42.83	90
8	13760.0	-58.50	6.3	13.75	Horizontal	-51.05	-13.00	38.05	90
9	15480.0	-55.40	6.7	13.85	Horizontal	-48.25	-13.00	35.25	90
10	17200.0	-56.92	6.8	14.25	Horizontal	-49.47	-13.00	36.47	135

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 Horizontal position.



LTE Band 4 QPSK 20MHz CH-Middle, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3465.0	-58.92	2.6	10.75	Horizontal	-50.77	-13.00	37.77	0
3	5170.9	-59.24	2.4	11.05	Horizontal	-50.59	-13.00	37.59	135
4	6930.0	-61.36	4.5	11.15	Horizontal	-54.71	-13.00	41.71	45
5	8662.5	-60.93	5.1	11.35	Horizontal	-54.68	-13.00	41.68	90
6	10395.0	-62.19	5.3	11.95	Horizontal	-55.54	-13.00	42.54	135
7	12127.5	-60.96	5.5	13.55	Horizontal	-52.91	-13.00	39.91	0
8	13860.0	-59.24	6.3	13.75	Horizontal	-51.79	-13.00	38.79	0
9	15592.5	-57.33	6.7	13.85	Horizontal	-50.18	-13.00	37.18	0
10	17325.0	-56.31	6.8	14.25	Horizontal	-48.86	-13.00	35.86	0

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 Horizontal position.

LTE Band 4 QPSK 20MHz CH-High, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	3490.0	-63.64	2.6	10.15	Horizontal	-56.09	-13.00	43.09	0
3	5208.4	-60.53	2.4	11.05	Horizontal	-51.88	-13.00	38.88	0
4	6980.0	-61.51	4.5	11.15	Horizontal	-54.86	-13.00	41.86	135
5	8725.0	-60.90	5.1	11.35	Horizontal	-54.65	-13.00	41.65	315
6	10470.0	-62.34	5.3	11.95	Horizontal	-55.69	-13.00	42.69	270
7	12215.0	-62.06	5.5	13.55	Horizontal	-54.01	-13.00	41.01	270
8	13960.0	-60.46	6.3	13.75	Horizontal	-53.01	-13.00	40.01	270
9	15705.0	-56.02	6.7	13.85	Horizontal	-48.87	-13.00	35.87	270
10	17450.0	-56.87	6.8	14.25	Horizontal	-49.42	-13.00	36.42	135

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 Horizontal position.

LTE Band 12 QPSK 1.4MHz CH-Low, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1399.4	-71.81	2.00	10.15	Horizontal	-63.66	-13.00	50.66	315
3	2099.1	-69.59	2.50	11.35	Horizontal	-60.74	-13.00	47.74	270
4	2798.8	-60.56	4.20	10.85	Horizontal	-53.91	-13.00	40.91	45
5	3498.5	-57.42	5.20	11.35	Horizontal	-51.27	-13.00	38.27	180
6	4198.2	-65.49	5.50	11.95	Horizontal	-59.04	-13.00	46.04	315
7	4897.9	-66.29	5.70	13.55	Horizontal	-58.44	-13.00	45.44	270
8	5597.6	-64.66	6.30	13.75	Horizontal	-57.21	-13.00	44.21	270
9	6297.3	-63.74	6.80	13.85	Horizontal	-56.69	-13.00	43.69	180
10	6997.0	-62.33	6.90	14.25	Horizontal	-54.98	-13.00	41.98	135
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 Horizontal position.									

LTE Band 12 QPSK 1.4MHz CH-Middle, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1415.0	-73.22	2.00	10.75	Horizontal	-64.47	-13.00	51.47	0
3	2122.5	-68.46	2.51	11.05	Horizontal	-59.92	-13.00	46.92	135
4	2830.0	-62.46	4.20	11.15	Horizontal	-55.51	-13.00	42.51	180
5	3537.5	-62.19	5.20	11.15	Horizontal	-56.24	-13.00	43.24	90
6	4245.0	-66.64	5.50	11.95	Horizontal	-60.19	-13.00	47.19	45
7	4952.5	-68.15	5.70	13.55	Horizontal	-60.30	-13.00	47.30	180
8	5660.0	-66.31	6.30	13.75	Horizontal	-58.86	-13.00	45.86	135
9	6367.5	-64.75	6.80	13.85	Horizontal	-57.70	-13.00	44.70	90
10	7075.0	-64.09	6.90	14.25	Horizontal	-56.74	-13.00	43.74	135
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 Horizontal position.									

LTE Band 12 QPSK 1.4MHz CH-High, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1399.4	-72.05	2.00	10.15	Horizontal	-63.90	-13.00	50.90	135
3	2099.1	-67.80	2.51	11.05	Horizontal	-59.26	-13.00	46.26	180
4	2798.8	-62.12	4.20	11.15	Horizontal	-55.17	-13.00	42.17	225
5	3576.5	-61.03	5.20	11.15	Horizontal	-55.08	-13.00	42.08	225
6	4291.8	-66.88	5.50	11.95	Horizontal	-60.43	-13.00	47.43	270
7	5007.1	-66.21	5.70	13.55	Horizontal	-58.36	-13.00	45.36	315
8	5722.4	-64.54	6.30	13.75	Horizontal	-57.09	-13.00	44.09	270
9	6437.7	-62.93	6.80	13.85	Horizontal	-55.88	-13.00	42.88	225
10	7153.0	-66.06	6.90	14.25	Horizontal	-58.71	-13.00	45.71	315
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 Horizontal position.									



LTE Band 12 QPSK 5MHz CH-Low, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1403.0	-71.71	2.00	10.15	Horizontal	-63.56	-13.00	50.56	180
3	2104.5	-68.02	2.50	11.35	Horizontal	-59.17	-13.00	46.17	135
4	2806.0	-61.19	4.20	10.85	Horizontal	-54.54	-13.00	41.54	45
5	3507.5	-59.34	5.20	11.35	Horizontal	-53.19	-13.00	40.19	90
6	4209.0	-66.33	5.50	11.95	Horizontal	-59.88	-13.00	46.88	45
7	4910.5	-66.72	5.70	13.55	Horizontal	-58.87	-13.00	45.87	45
8	5612.0	-66.52	6.30	13.75	Horizontal	-59.07	-13.00	46.07	315
9	6313.5	-64.65	6.80	13.85	Horizontal	-57.60	-13.00	44.60	90
10	7015.0	-63.31	6.90	14.25	Horizontal	-58.11	-13.00	45.11	270

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 Horizontal position.

LTE Band 12 QPSK 5MHz CH-Middle, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1415.0	-72.06	2.00	10.75	Horizontal	-63.31	-13.00	50.31	135
3	2122.5	-67.23	2.51	11.05	Horizontal	-58.69	-13.00	45.69	225
4	2830.0	-62.22	4.20	11.15	Horizontal	-55.27	-13.00	42.27	180
5	3537.5	-63.43	5.20	11.15	Horizontal	-57.48	-13.00	44.48	315
6	4245.0	-66.24	5.50	11.95	Horizontal	-59.79	-13.00	46.79	90
7	4952.5	-67.58	5.70	13.55	Horizontal	-59.73	-13.00	46.73	270
8	5660.0	-65.50	6.30	13.75	Horizontal	-58.05	-13.00	45.05	180
9	6367.5	-63.93	6.80	13.85	Horizontal	-56.88	-13.00	43.88	90
10	7075.0	-64.41	6.90	14.25	Horizontal	-57.06	-13.00	44.06	315

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 Horizontal position.

LTE Band 12 QPSK 5MHz CH-High, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1427.0	-72.06	2.00	10.15	Horizontal	-63.91	-13.00	50.91	270
3	2140.5	-69.12	2.51	11.05	Horizontal	-60.58	-13.00	47.58	135
4	2854.0	-62.40	4.20	11.15	Horizontal	-55.45	-13.00	42.45	225
5	3567.5	-61.82	5.20	11.15	Horizontal	-55.87	-13.00	42.87	225
6	4281.0	-67.11	5.50	11.95	Horizontal	-60.66	-13.00	47.66	90
7	4994.5	-67.21	5.70	13.55	Horizontal	-59.36	-13.00	46.36	270
8	5708.0	-65.39	6.30	13.75	Horizontal	-57.94	-13.00	44.94	315
9	6421.5	-64.99	6.80	13.85	Horizontal	-57.94	-13.00	44.94	45
10	7135.0	-65.50	6.90	14.25	Horizontal	-58.15	-13.00	45.15	90
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 Horizontal position.									

LTE Band 12 QPSK 10MHz CH-Low, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1408.0	-72.15	2.00	10.15	Horizontal	-64.00	-13.00	51.00	315
3	2112.0	-68.31	2.51	11.35	Horizontal	-59.47	-13.00	46.47	270
4	2816.0	-61.93	4.20	10.85	Horizontal	-55.28	-13.00	42.28	45
5	3520.0	-59.30	5.20	11.35	Horizontal	-53.15	-13.00	40.15	225
6	4224.0	-66.96	5.50	11.95	Horizontal	-60.51	-13.00	47.51	315
7	4928.0	-65.74	5.70	13.55	Horizontal	-57.89	-13.00	44.89	90
8	5632.0	-66.57	6.30	13.75	Horizontal	-59.12	-13.00	46.12	180
9	6336.0	-63.80	6.80	13.85	Horizontal	-56.75	-13.00	43.75	135
10	7040.0	-65.44	6.90	14.25	Horizontal	-58.09	-13.00	45.09	45
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 Horizontal position.									



LTE Band 12 QPSK 10MHz CH-Middle, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1415.0	-72.06	2.00	10.75	Horizontal	-63.31	-13.00	50.31	90
3	2122.5	-68.32	2.51	11.05	Horizontal	-59.78	-13.00	46.78	315
4	2830.0	-61.61	4.20	11.15	Horizontal	-54.66	-13.00	41.66	270
5	3537.5	-68.35	5.20	11.15	Horizontal	-62.40	-13.00	49.40	315
6	4245.0	-67.12	5.50	11.95	Horizontal	-60.67	-13.00	47.67	90
7	4952.5	-68.52	5.70	13.55	Horizontal	-60.67	-13.00	47.67	315
8	5660.0	-65.65	6.30	13.75	Horizontal	-58.20	-13.00	45.20	90
9	6367.5	-64.30	6.80	13.85	Horizontal	-57.25	-13.00	44.25	270
10	7075.0	-64.66	6.90	14.25	Horizontal	-57.31	-13.00	44.31	315

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 Horizontal position.

LTE Band 12 QPSK 10MHz CH-High, RB 1

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1422.0	-72.21	2.00	10.15	Horizontal	-64.06	-13.00	51.06	225
3	2133.0	-68.27	2.51	11.05	Horizontal	-59.73	-13.00	46.73	45
4	2844.0	-62.76	4.20	11.15	Horizontal	-55.81	-13.00	42.81	90
5	3555.0	-62.25	5.20	11.15	Horizontal	-56.30	-13.00	43.30	45
6	4266.0	-67.14	5.50	11.95	Horizontal	-60.69	-13.00	47.69	90
7	4977.0	-67.81	5.70	13.55	Horizontal	-59.96	-13.00	46.96	225
8	5688.0	-65.54	6.30	13.75	Horizontal	-58.09	-13.00	45.09	315
9	6399.0	-64.32	6.80	13.85	Horizontal	-57.27	-13.00	44.27	270
10	7110.0	-66.27	6.90	14.25	Horizontal	-58.92	-13.00	45.92	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 Horizontal position.

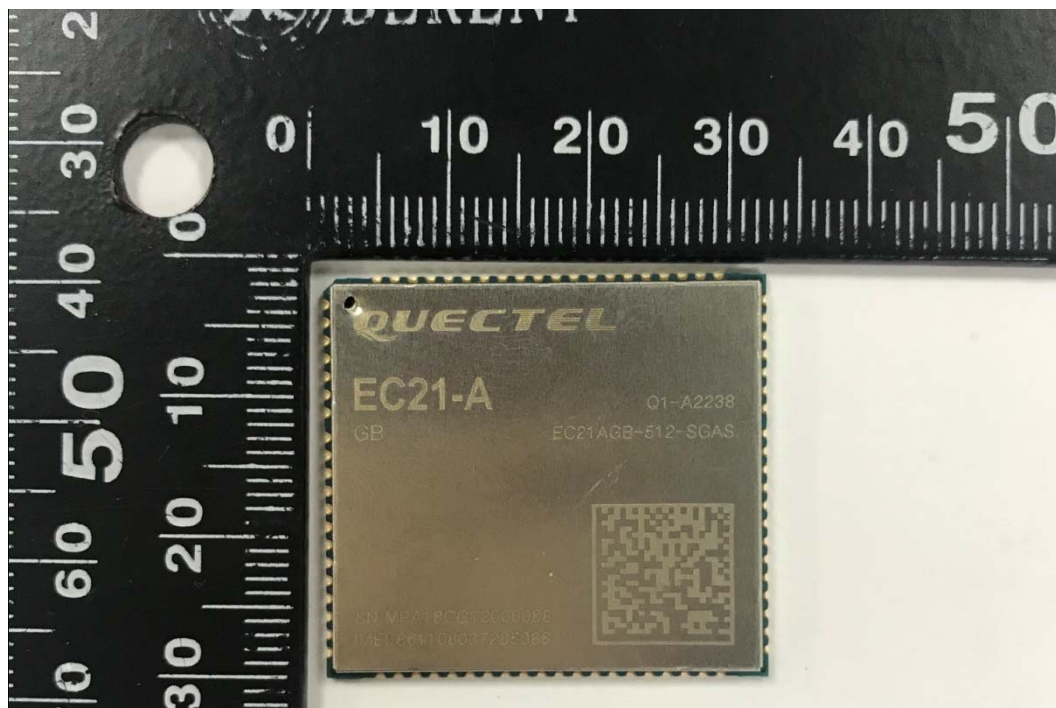
6 Main Test Instruments

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Date
Base Station Simulator	R&S	CMW500	113645	2018-05-20	2019-05-19
Power Splitter	Hua Xiang	SHX-GF2-2-13	10120101	2018-05-20	2019-05-19
Spectrum Analyzer	Key sight	N9010A	MY50210259	2018-05-20	2019-05-19
Signal Analyzer	R&S	FSV30	100815	2017-12-17	2018-12-16
Signal generator	R&S	SMB 100A	102594	2018-05-20	2019-05-19
EMI Test Receiver	R&S	ESCI	100948	2018-05-20	2019-05-19
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2014-12-06	2019-12-05
Trilog Antenna	SCHWARZBECK	VUBL 9163	9163-201	2017-11-18	2020-11-17
Horn Antenna	R&S	HF907	100126	2014-12-06	2019-12-05
Horn Antenna	ETS-Lindgren	3160-09	00102643	2015-01-30	2020-01-29
Climatic Chamber	Re Ce	PT-30B	20101891	2015-07-18	2018-07-17
RF Cable	Agilent	SMA 15cm	0001	NA	NA
Preamplifier	R&S	SCU18	102327	2017-06-18	2018-06-17
MOB COMMS DC SUPPLY	Keysight	66319D	MY43004105	2018-05-20	2019-05-19
Software	R&S	EMC32	V 8.52.0	NA	NA

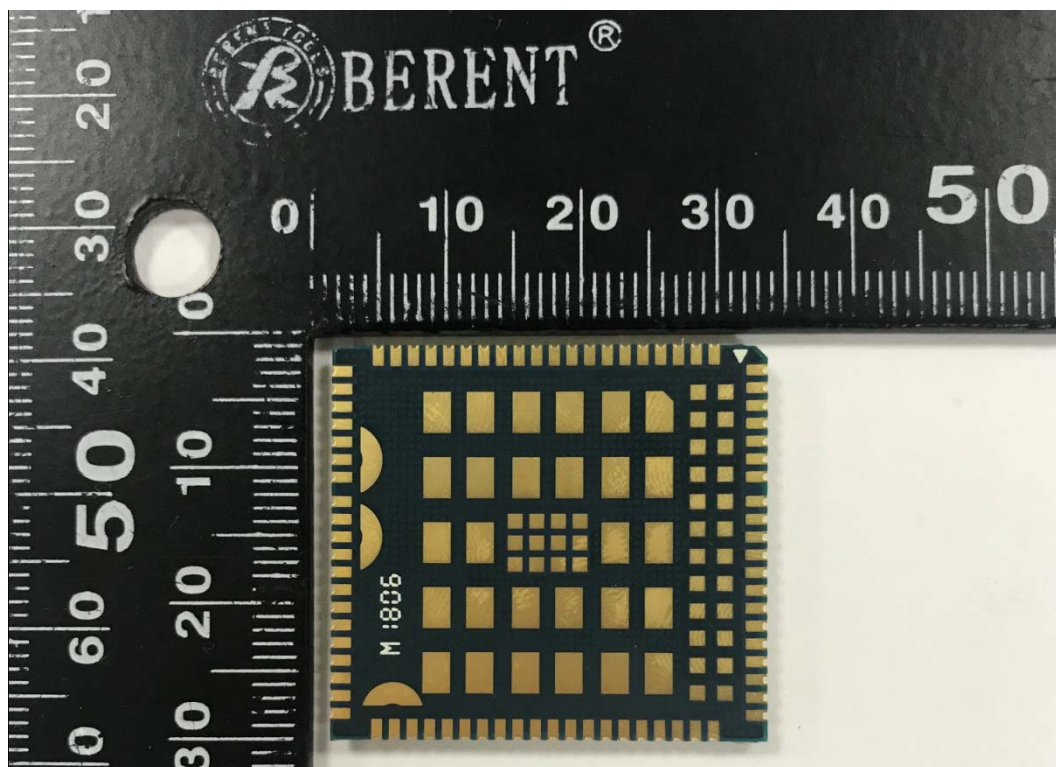
*****END OF REPORT *****

ANNEX A: EUT Appearance and Test Setup

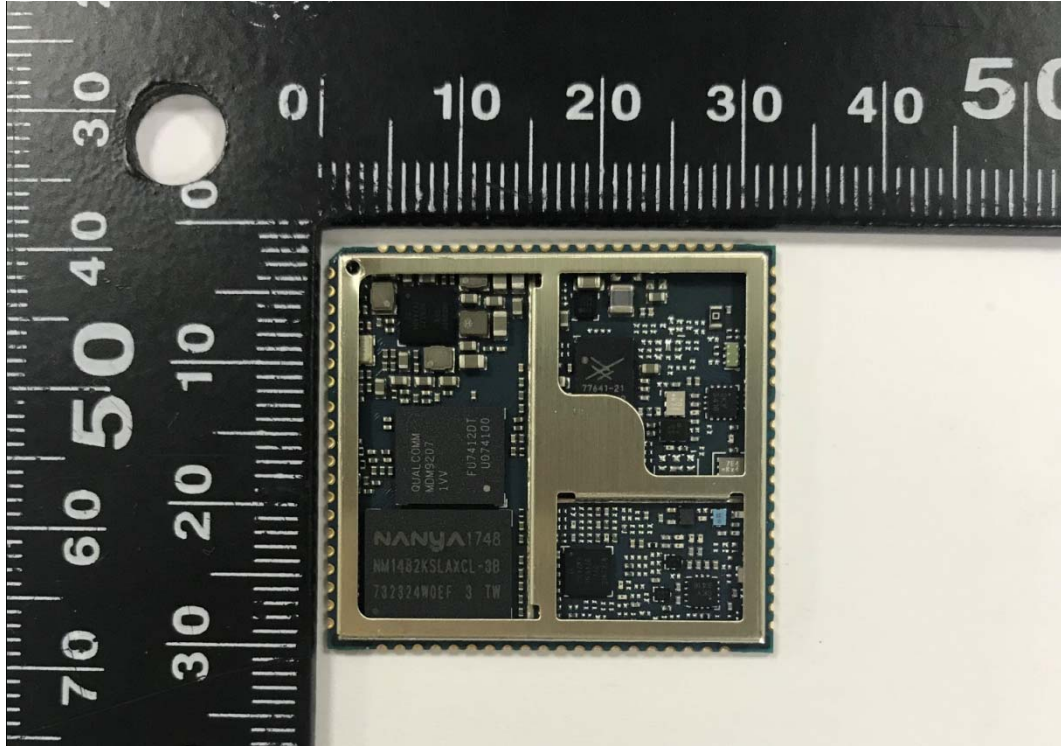
A.1 EUT Appearance



Front Side



Back Side



No sheilding

a: EUT

Picture 1 EUT and Accessory

A.2 Test Setup



Picture 2: Radiated Spurious Emissions Test setup

ANNEX B: Product Change Description

We Quectel Wireless Solutions Co., Ltd declare the following models.

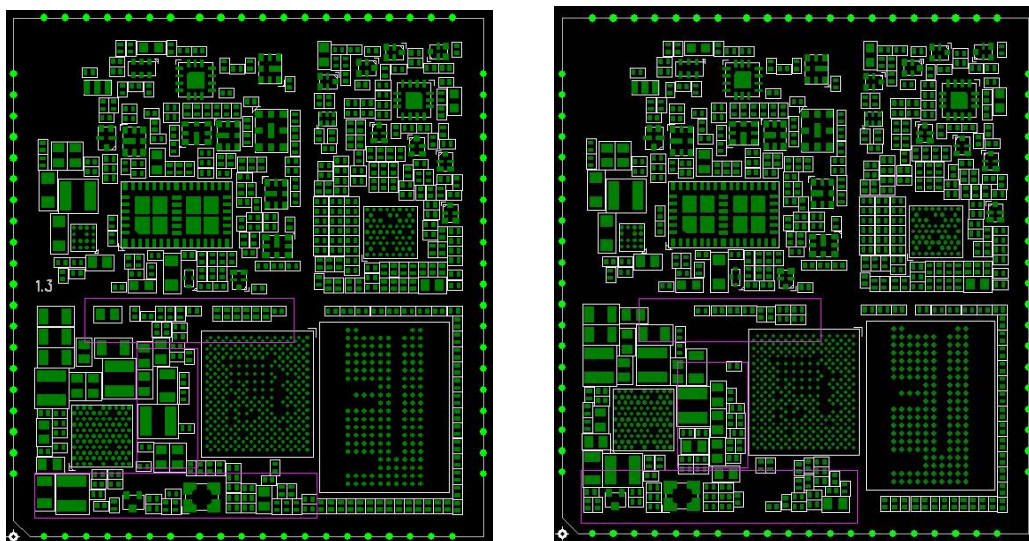
Product Name: LTE Module

Model Number: EC21-A, EC21-A MINIPCIE,
EC21-V, EC21-V MINIPCIE,

Hardware version: Refer to below table

Model	Certified HW Version A	New HW Version B
EC21-A, EC21-A MINIPCIE	R1.0	R1.1
EC21-V, EC21-V MINIPCIE	R1.0	R1.1

All above series models share the same hardware and software design. Here we need to update the hardware to improve power supply. There are some differences between **Certified HW Version A** and **New HW Version B** on PCB design which are some capacitors and resistors' location which used for BB. The details are shown as following pictures and table.



Designator	R1.0 Position (mm, mm)	R1.1 Position (mm, mm)
C0301	(5.8, 13.7)	(9.7,6.89)
C0306	(7.475, 13.75)	(10.84,7.81)
C0310	-	(8.707, 13.847)
C0307	(10.85, 11.1)	-
C0328	(8.85, 12.78)	-
C0227	(8.085, 11.15)	-
R0501	(16.35, 13.9)	(19.08, 13.91)
C0340	-	(9.23, 1.7)



C0402	-	(12.37, 4.25)
C0227	(8.085, 11.15)	(4.45, 13.58)
C0330	(9.1, 11.375)	(9.66, 5.12)
C0211	(2.575, 11.03)	(2.42, 12.35)
L0201	(2.35, 9.15)	(2.32, 10.45)
L0202	(8.925, 7.1)	(8.15, 7.94)
C0214	(1.91, 2.73)	(1.89, 4.05)
L0204	(3.62, 2.64)	(3.78, 3.97)
Y0101	(11.61, 2.45)	(7.45, 2.39)
Q0101	(7.36, 2.125)	(3.32, 2.12)
C0317	(15.46, 2.3)	(17.01, 1.87)

We hereby state that there is no any other internal difference between them and the change is layout part of power supply BB which won't affect the RF portions and the original RF data can be re-used.

Your assistance on this matter is highly appreciated.

Sincerely,

Name: Jean Hu

Title: Certification Section