RF TEST REPORT

Applicant	Quectel Wireless Solutions Co., Ltd.
FCC ID	XMR201707BG96
Product	Quectel BG96
Brand	Quectel
Model	BG96
Report No.	RXA1706-0199RF03R1
Issue Date	July 12, 2017

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.

Jiangpeng Lan

Performed by: Jiangpeng Lan

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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) /27.50(b)(10) /27.50(c)(10)	PASS
3	Occupied Bandwidth	2.1049	PASS
4	Band Edge Compliance	27.53(h) /27.53(g)	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) /27.53(g) /27.53(f)	PASS
8	Radiates Spurious Emission	2.1053 /27.53(h) /27.53(g) /27.53(f)	PASS
Date of Testing: June 24, 2017~ July 3, 2017			
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.			

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1 Test Laboratory

1.1 Notes of the Test Report

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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 (recognition number is 428261)

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.

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1.3 Testing Location

Company:	TA Technology (Shanghai) Co., Ltd.
Address:	No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China
City:	Shanghai
Post code:	201201
Country:	P. R. China
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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, China
Manufacturer	Quectel Wireless Solutions Co., Ltd.
Manufacturer address	7th Floor, Hongye Building, No. 1801 Hongmei Road, Xuhui District, Shanghai, China

General information

EUT Description			
Model:	BG96		
Hardware Version:	R1.0		
Software Version:	BG96MAR02A02M1G		
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)		
Test Mode(s):	LTE Band 4; LTE Band 12, LTE Band 13;		
Test Modulation	QPSK 16QAM;		
LTE Category	M1		
Maximum E.I.R.P./ E.R.P.	LTE Band 4: 29.98dBm LTE Band 12: 27.92dBm LTE Band 13: 27.70dBm		
Rated Power Supply Voltage:	3.8V		
Extreme Voltage:	Minimum: 3.3V Maximum: 4.3V		
Extreme Temperature:	Lowest: -40°C Highest: +85°C		
Operating Frequency Range(s)	Mode	Tx (MHz)	Rx (MHz)
	LTE Band 4	1710 ~ 1755	2110 ~ 2155
	LTE Band 12	699 ~ 716	729 ~ 746
	LTE Band 13	777 ~ 787	746 ~ 756
Note：1. The information of the EUT is declared by the manufacturer.			

Accessory equipment	
Evaluation Board	RF Cable
RS232-to-USB Cable	Antenna: Dipole Antenna
Headset	USB Cable

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2.1 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 C63.26 (2015)

KDB 971168 D01 Power Meas License Digital Systems v02r02

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3 Test Configuration

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes. EUT lie-down stand-up position (X, Y axis)，lie-down position (Z 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 and RB size and modulations were investigated.
Subsequently, only the worst case emissions are reported.
The following testing in LTE is set based on the maximum RF Output Power.
The following testing in different Bandwidth is set to detailin the following table:
Test modes are chosen to be reported as the worst case configuration below for LTE Band 4/12/13:

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
	LTE 13	-	-	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
	LTE 13	-	-	O	O	-	-	O	O	-	-	O	O	O	O
Occupied Bandwidth	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
	LTE 13	-	-	O	O	-	-	O	O	-	-	O	O	O	O
Band Edge Compliance	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
	LTE 13	-	-	O	O	-	-	O	O	O	-	O	O	-	O
Peak-to-Average Power Ratio	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
	LTE 13	-	-	O	O	-	-	O	O	-	-	O	O	O	O
Frequency Stability	LTE 4	O	O	O	O	O	O	O	O	-	-	O	-	O	-
	LTE 12	O	O	O	O	-	-	O	O	-	-	O	-	O	-
	LTE 13	-	-	O	O	-	-	O	O	-	-	O	-	O	-
Spurious Emissions at Antenna Terminals	LTE 4	O	O	O	O	O	O	O	-	O	-	-	O	O	O
	LTE 12	O	O	O	O	-	-	O	-	O	-	-	O	O	O
	LTE 13	-	-	O	O	-	-	O	-	O	-	-	O	O	O

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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
	LTE 13	-	-	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.														

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4 Test Information

4.1 RF Power Output

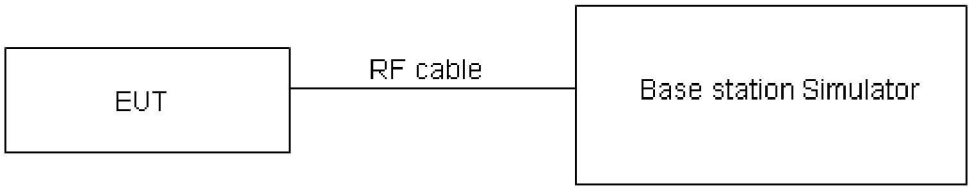
Ambient condition

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.

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Test Results

LTE TDD 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	22.38	22.31	22.37
		1	3	22.39	22.17	22.33
		1	5	22.28	22.27	22.36
		3	0	22.24	22.16	22.31
		3	2	22.23	22.11	22.30
		3	3	22.36	22.13	22.35
		6	0	22.13	22.09	22.23
	16QAM	1	0	21.94	22.02	22.13
		1	3	22.15	22.01	22.16
		1	5	22.16	21.93	22.35
		3	0	22.08	21.84	21.94
		3	2	22.07	21.92	21.94
		3	3	22.08	21.88	21.96
		5	0	22.06	22.03	22.21
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				19965/1711.5	20175/1732.5	20385/1753.5
3MHz	QPSK	1	0	22.40	22.35	22.40
		1	3	22.42	22.22	22.37
		1	5	22.31	22.32	22.40
		3	0	22.24	22.18	22.34
		3	2	22.25	22.11	22.32
		3	3	22.36	22.14	22.35
		6	0	22.16	22.13	22.26
	16QAM	1	0	21.97	22.04	22.16
		1	3	22.18	22.06	22.20
		1	5	22.18	21.97	22.38
		3	0	22.09	21.87	21.96
		3	2	22.08	21.95	21.96
		3	3	22.08	21.90	21.99
		5	0	22.09	22.07	22.24
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				19975/1712.5	20175/1732.5	20375/1752.5
5MHz	QPSK	1	0	22.37	22.33	22.36
		1	3	22.40	22.18	22.34
		1	5	22.28	22.27	22.36
		3	0	22.21	22.13	22.30
		3	2	22.23	22.07	22.27
		3	3	22.34	22.12	22.31
		6	0	22.14	22.12	22.24

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	16QAM	1	0	21.94	22.00	22.13
		1	3	22.15	22.04	22.17
		1	5	22.15	21.95	22.34
		3	0	22.07	21.83	21.93
		3	2	22.05	21.90	21.92
		3	3	22.05	21.85	21.95
		5	0	22.07	22.03	22.19
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				20000/1715	20175/1732.5	20350/1750
10MHz	QPSK	1	0	22.39	22.34	22.39
		1	3	22.43	22.23	22.38
		1	5	22.30	22.31	22.39
		3	0	22.24	22.18	22.34
		3	2	22.26	22.12	22.31
		3	3	22.36	22.16	22.36
		6	0	22.22	22.14	22.28
	16QAM	1	0	21.96	22.03	22.15
		1	3	22.18	22.08	22.20
		1	5	22.18	21.97	22.37
		3	0	22.10	21.88	21.97
		3	2	22.07	21.94	21.95
		3	3	22.08	21.90	21.99
		5	0	22.10	22.08	22.23
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				20025/1717.5	20175/1732.5	20325/1747.5
15MHz	QPSK	1	0	22.38	22.30	22.37
		1	3	22.41	22.22	22.35
		1	5	22.27	22.26	22.35
		3	0	22.22	22.14	22.31
		3	2	22.23	22.07	22.27
		3	3	22.33	22.13	22.32
		6	0	22.20	22.10	22.23
	16QAM	1	0	21.91	22.01	22.13
		1	3	22.16	22.05	22.18
		1	5	22.15	21.93	22.34
		3	0	22.07	21.86	21.94
		3	2	22.04	21.89	21.91
		3	3	22.06	21.86	21.96
		5	0	22.07	22.03	22.19
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				20050/1720	20175/1732.5	20300/1745
20MHz	QPSK	1	0	22.35	22.26	22.34
		1	3	22.40	22.18	22.33

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		1	5	22.25	22.25	22.32
		3	0	22.19	22.09	22.27
		3	2	22.21	22.03	22.24
		3	3	22.30	22.08	22.28
		6	0	22.17	22.05	22.19
	16QAM	1	0	21.89	21.97	22.08
		1	3	22.12	22.03	22.14
		1	5	22.13	21.90	22.32
		3	0	22.04	21.82	21.91
		3	2	22.01	21.87	21.88
		3	3	22.03	21.81	21.92
		5	0	22.05	21.99	22.16
Note:1) The following testing in worst case based on the maximum RF Output Power.						

LTE FDD 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	22.74	23.12	23.37
		1	3	22.80	23.24	23.23
		1	5	22.87	23.32	23.13
		3	0	23.00	23.17	23.07
		3	2	22.91	23.26	23.18
		3	3	22.96	23.22	23.13
		6	0	22.48	22.66	22.64
	16QAM	1	0	23.23	22.81	23.02
		1	3	23.64	23.16	23.17
		1	5	23.60	23.17	22.93
		3	0	23.38	22.81	22.76
		3	2	23.33	22.75	22.81
		3	3	23.35	22.74	22.83
		5	0	22.71	22.90	22.79
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				23025/700.5	23095/707.5	23165/714.5
3MHz	QPSK	1	0	22.76	23.13	23.40
		1	3	22.83	23.29	23.27
		1	5	22.89	23.36	23.16
		3	0	23.03	23.22	23.11
		3	2	22.94	23.31	23.22
		3	3	22.98	23.26	23.18
		6	0	22.56	22.68	22.68
	16QAM	1	0	23.25	22.84	23.04
		1	3	23.67	23.20	23.20
		1	5	23.63	23.19	22.96

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		3	0	23.41	22.86	22.80
		3	2	23.35	22.79	22.84
		3	3	23.38	22.79	22.87
		5	0	22.74	22.95	22.83
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				23035/701.5	23095/707.5	23155/713.5
5MHz	QPSK	1	0	22.75	23.09	23.38
		1	3	22.81	23.28	23.24
		1	5	22.86	23.31	23.12
		3	0	23.01	23.18	23.08
		3	2	22.91	23.26	23.18
		3	3	22.95	23.23	23.14
		6	0	22.54	22.64	22.63
	16QAM	1	0	23.20	22.82	23.02
		1	3	23.65	23.17	23.18
		1	5	23.60	23.15	22.93
		3	0	23.38	22.84	22.77
		3	2	23.32	22.74	22.80
		3	3	23.36	22.75	22.84
		5	0	22.71	22.90	22.79
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				23060/704	23095/707.5	23130/711
10MHz	QPSK	1	0	22.72	23.05	23.35
		1	3	22.80	23.24	23.22
		1	5	22.84	23.30	23.09
		3	0	22.98	23.13	23.04
		3	2	22.89	23.22	23.15
		3	3	22.92	23.18	23.10
		6	0	22.51	22.59	22.59
	16QAM	1	0	23.18	22.78	22.97
		1	3	23.61	23.15	23.14
		1	5	23.58	23.12	22.91
		3	0	23.35	22.80	22.74
		3	2	23.29	22.72	22.77
		3	3	23.33	22.70	22.80
		5	0	22.69	22.86	22.76

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LTE FDD Band 13				Conducted Power(dBm)		
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				23205/779.5	23230/782	23255/784.5
5MHz	QPSK	1	0	23.10	23.32	23.11
		1	3	23.11	23.35	23.00
		1	5	23.07	23.40	23.05
		3	0	22.85	22.77	22.75
		3	2	22.79	22.71	22.76
		3	3	22.76	22.69	22.72
		6	0	22.80	22.68	22.67
	16QAM	1	0	23.81	23.14	23.72
		1	3	23.71	23.13	23.91
		1	5	23.86	23.00	23.87
		3	0	22.78	22.31	22.87
		3	2	22.81	22.44	22.92
		3	3	22.90	22.57	22.89
		5	0	21.84	22.19	21.93
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)		
				/	23230/782	/
10MHz	QPSK	1	0	/	23.07	/
		1	3	/	23.13	/
		1	5	/	23.00	/
		3	0	/	23.16	/
		3	2	/	23.19	/
		3	3	/	23.20	/
		6	0	/	22.77	/
	16QAM	1	0	/	23.70	/
		1	3	/	23.79	/
		1	5	/	23.34	/
		3	0	/	23.32	/
		3	2	/	23.35	/
		3	3	/	23.38	/
		5	0	/	22.95	/

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4.2 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 ANSI C63.26 (2015) Section 5.5.2.3.
2. 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).
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:
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.

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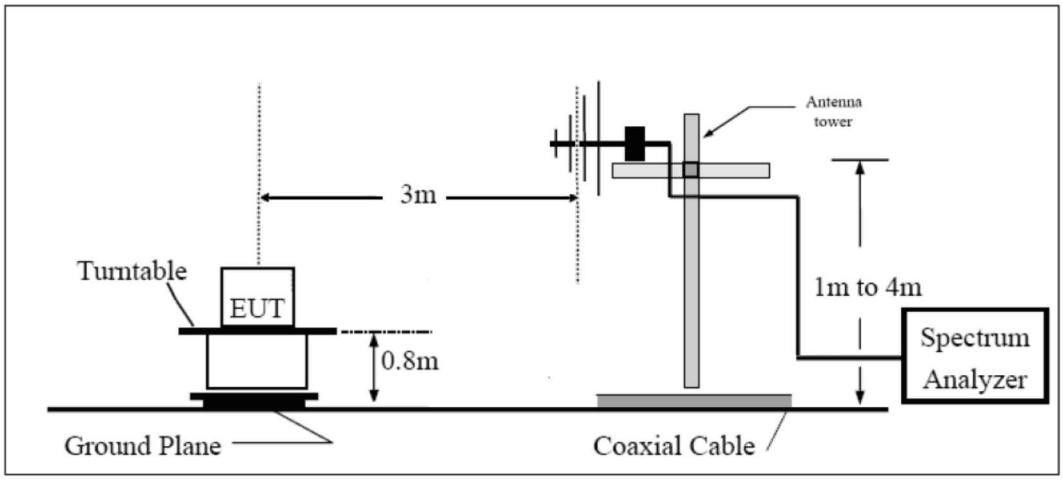
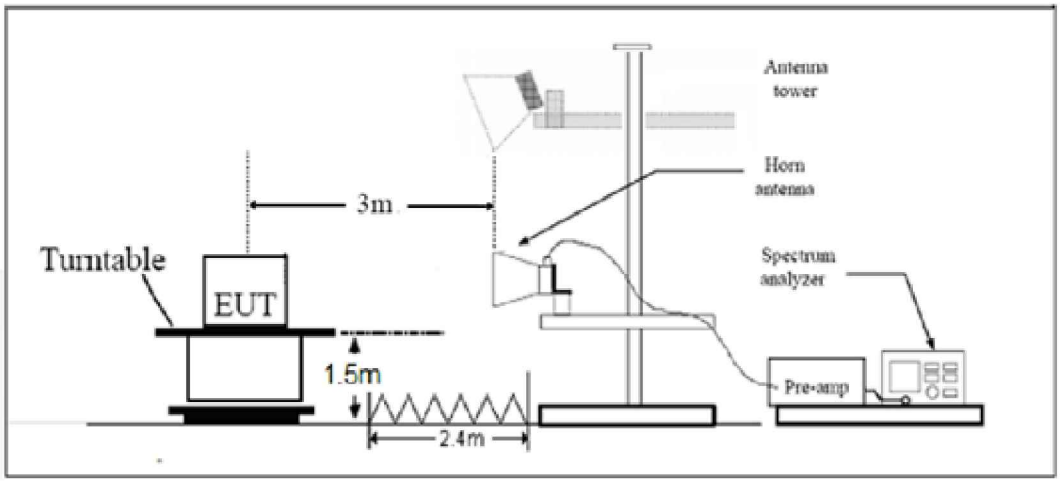
Test setup

30MHz~~~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

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Limits

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

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(b)(10)Limit (ERP)	≤ 3 W (34.77 dBm)
Part 27.50(c)(10)Limit (ERP)	≤ 3 W (34.77 dBm)
Part 27.50(d)(4)Limit (EIRP)	≤ 1 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 dB

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