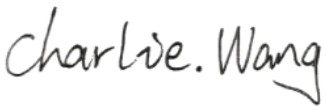
RF Test Report

Applicant:	Quectel Wireless Solutions Co., Ltd.
Address:	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China, 200233
Product:	LTE Cat 1 Module
Model No.:	EC600U-LA
Brand Name:	QUECTEL
FCC ID:	XMR2024EC600ULA
Standards:	47 CFR Part 22 47 CFR Part 24 47 CFR Part 27
Report No.:	PD20240081RF01
Issue Date:	2024/07/09
Test Result:	PASS *

* **Testing performed at Hefei Panwin Technology Co., Ltd. on the above equipment indicates the product meets the requirements of the relevant standards.**



Reviewed By: Charlie Wang **Approved By:** Alec Yang

Hefei Panwin Technology Co., Ltd.

Floor 1, Zone E, Plant 2#, Mingzhu Industrial Park, No.106 Chuangxin Avenue, High-tech Zone, Hefei City, Anhui Province,China

TEL: +86-0551-63811775

Revision History

Report No.	Version	Description	Issue Date	Note
PD20240081RF01	01	Initial Report	2024/07/09	Valid

CONTENTS

Test Summary

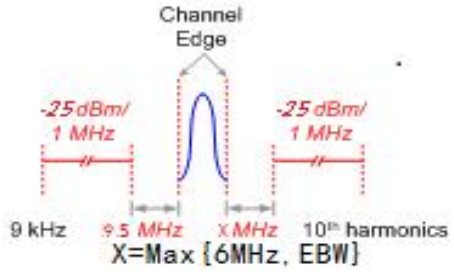
GSM1900 / LTE Band 2

No.	Test Case	FCC Rules	Limit	Verdict
1	RF Output Power & Effective Radiated Power	§2.1046, §24.232(c)	EIRP ≤2 Watt	PASS
2	Peak-to-Average Ratio	§24.232(d)	≤13 dB	PASS
3	Occupied Bandwidth	§2.1049	No limit.	Report Only
4	Conducted Band Edge Measurement	§2.1051, §24.238(a)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	PASS
5	Spurious Emissions at Antenna Terminals	§2.1051, §24.238(a)	≤ -13 dBm/1 MHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	PASS
6	Radiated Spurious Emission	§2.1053, §24.238(a)	≤ -13 dBm/1 MHz.	PASS
7	Frequency Stability	§2.1055 §24.235	Within authorized bands of operation/frequency block.	PASS

GSM850 / LTE Band 5

No.	Test Case	FCC Rules	Limit	Verdict
1	RF Output Power & Effective Radiated Power	§2.1046 §22.913 (a)(5)	ERP ≤ 7 Watt	PASS
2	Peak-to-Average Ratio	§22.913 (d)	≤13 dB	PASS
3	Occupied Bandwidth	§2.1049	No limit.	Report Only
4	Conducted Band Edge Measurement	§2.1051 §22.917 (a)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	PASS
5	Spurious Emissions at Antenna Terminals	§2.1051 §22.917(a)	FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	PASS
6	Radiated Spurious Emission	§2.1053 §22.917(a)	FCC: ≤ -13 dBm/100 kHz.	PASS
7	Frequency Stability	§2.1055 §22.355	< ±2.5 ppm	PASS

LTE Band 7

No.	Test Case	FCC Rules	Limit	Verdict
1	RF Output Power & Effective Radiated Power	§2.1046, §27.50(h)(2)	EIRP ≤ 2 Watt	PASS
2	Peak-to-Average Ratio	--	≤13 dB	PASS
3	Occupied Bandwidth	§2.1049	No limit.	Report Only
4	Conducted Band Edge Measurement	§2.1051, §27.53(m4)	For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz.	PASS
5	Spurious Emissions at Antenna Terminals	§2.1051, §27.53(m)		PASS
6	Radiated Spurious Emission	§2.1053, §27.53(m)		PASS
7	Frequency Stability	§2.1055 §27.54	Within authorized bands of operation/frequency block.	PASS

LTE Band 4 / 66

No.	Test Case	FCC Rules	Limit	Verdict
1	RF Output Power & Effective Radiated Power	§2.1046, §27.50(d)(4)	EIRP ≤ 1 Watt	PASS
2	Peak-to-Average Ratio	§27.50(d)(5)	≤13 dB	PASS
3	Occupied Bandwidth	§2.1049	No limit.	Report Only
4	Conducted Band Edge Measurement	§2.1051, §27.53(h)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	PASS
5	Spurious Emissions at Antenna Terminals	§2.1051, §27.53(h)	≤ -13 dBm/1 MHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	PASS
6	Radiated Spurious Emission	§2.1053, §27.53(h)	≤ -13 dBm/1 MHz.	PASS
7	Frequency Stability	§2.1055 §27.54	Within authorized bands of operation/frequency block.	PASS

Conducted detection date: 2024/06/21 to 2024/07/03
Radiated detection date: 2024/06/24 to 2024/07/08
Date of Sample Received: 2024/06/21

- The samples tested have been evaluated in accordance with the procedures given in the application standards in **Section 2.5** of this report and have been shown to comply with the applicable technical standards.
- All indications of PASS/FAIL in this report are 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 is invalid without signature of auditor and approver or with any alterations. The report shall not be partially reproduced without written approval of the testing company. Entrusted test results are only responsible for incoming samples. If there is any objection to the testing report, it shall be raised to the testing company within 15 days from the date of receiving the report. In the test results, "NA" means "not applicable", and the test items marked with "Δ" are subcontracted projects.

1.2 Test Facility

A2LA (Certificate Number: 6849.01)

Hefei Panwin Technology Co., Ltd. has been accredited by American Association for Laboratory Accreditation to perform measurement.

FCC (Designation Number: CN1361, Test Firm Registration Number: 473156)

Hefei Panwin Technology Co., Ltd. has been accredited on the US Federal Communications Commission list of test facilities recognized to perform measurements.

1.3 Testing Laboratory

Company Name	Hefei Panwin Technology Co., Ltd.
Address	Floor 1, Zone E, Plant 2#, Mingzhu Industrial Park, No.106 Chuangxin Avenue, High-tech Zone, Hefei City, Anhui Province,China
Telephone	+86-0551-63811775
Post Code	230031

2 General Description of Equipment under Test

2.1 Details of Application

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 Details of EUT

<table>
<tr><td>Product</td><td colspan="8">LTE Cat 1 Module</td></tr>
<tr><td>Model</td><td colspan="8">EC600U-LA</td></tr>
<tr><td>Hardware Version</td><td colspan="8">R1.0</td></tr>
<tr><td>Software Version</td><td colspan="8">EC600ULAACR03A06M08</td></tr>
<tr><td>SN</td><td colspan="8">Conducted: P1Y23LS11000890
Radiated: P1Y23LS0Z000907</td></tr>
<tr><td colspan="9">GSM Specification</td></tr>
<tr><td>Single Band</td><td colspan="8">GSM850, GSM1900</td></tr>
<tr><td>Multi-slot class</td><td colspan="8">GPRS: 12</td></tr>
<tr><td>Type of Modulation</td><td colspan="8">GMSK(GSM/GPRS)</td></tr>
<tr><td colspan="9">E-UTRA Specification</td></tr>
<tr><td>Single Band</td><td colspan="8">FDD Band: 2, 4, 5, 7, 66</td></tr>
<tr><td>Power Class for LTE</td><td colspan="8">PC3</td></tr>
<tr><td>Type of Modulation</td><td colspan="8">UL: QPSK, 16QAM
DL: QPSK, 16QAM, 64QAM</td></tr>
<tr><td>Antenna Type</td><td colspan="8">☑ External ☐ Integrated</td></tr>
<tr><td>Antenna Gain</td><td colspan="8">GSM850: 2.13dBi
GSM1900: 1.59dBi
LTE Band 2: 1.59dBi
LTE Band 4: 2.00dBi
LTE Band 5: 2.13dBi
LTE Band 7: 3.00dBi
LTE Band 66: 2.00dBi</td></tr>
<tr><td rowspan="3">GSM Frequency Range(s)</td><td colspan="3">Band</td><td colspan="3">Tx (MHz)</td><td colspan="2">Rx (MHz)</td></tr>
<tr><td colspan="3">GSM 850</td><td colspan="3">824 to 849</td><td colspan="2">869 to 894</td></tr>
<tr><td colspan="3">GSM 1900</td><td colspan="3">1850 to 1910</td><td colspan="2">1930 to 1990</td></tr>
<tr><td rowspan="6">Frequency Band(s)</td><td rowspan="2">SISO Band</td><td colspan="6">Supported Channel Bandwidth (MHz)</td><td rowspan="2">Tx (MHz)</td><td rowspan="2">Rx (MHz)</td></tr>
<tr><td>1.4</td><td>3</td><td>5</td><td>10</td><td>15</td><td>20</td></tr>
<tr><td>LTE Band 2</td><td>v</td><td>v</td><td>v</td><td>v</td><td>v</td><td>v</td><td>1850 to 1910</td><td>1930 to 1990</td></tr>
<tr><td>LTE Band 4</td><td>v</td><td>v</td><td>v</td><td>v</td><td>v</td><td>v</td><td>1710 to 1755</td><td>2110 to 2155</td></tr>
<tr><td>LTE Band 5</td><td>v</td><td>v</td><td>v</td><td>v</td><td>-</td><td>-</td><td>824 to 849</td><td>869 to 894</td></tr>
<tr><td>LTE Band 7</td><td>-</td><td>-</td><td>v</td><td>v</td><td>v</td><td>v</td><td>2500 to 2570</td><td>2620 to 2690</td></tr>
<tr><td>LTE Band 66</td><td>v</td><td>v</td><td>v</td><td>v</td><td>v</td><td>v</td><td>1710 to 1780</td><td>2110 to 2180</td></tr>
<tr><td colspan="9">Note: The declared of product specification for EUT and/or Antenna presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.</td></tr>
</table>

Support Equipment				
Equipment	**Manufacturer**	**Description**	**Model**	**Serial Number**
EVB	QUECTEL	/	/	/
Adapter	STH	DC 5V / 2A	P12F050200	/

2.3 Frequency List of Low/Middle/High Channels

GSM850 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
0.2	Channel	128	190	251
	Frequency	824.2	836.6	848.8

GSM1900 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
0.2	Channel	512	661	810
	Frequency	1850.2	1880.0	1909.8

LTE Band 2 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
1.4	Channel	18607	18900	19193
	Frequency	1850.7	1880	1909.3
3	Channel	18615	18900	19185
	Frequency	1851.5	1880	1908.5
5	Channel	18625	18900	19175
	Frequency	1852.5	1880	1907.5
10	Channel	18650	18900	19150
	Frequency	1855	1880	1905
15	Channel	18675	18900	19125
	Frequency	1857.5	1880	1902.5
20	Channel	18700	18900	19100
	Frequency	1860	1880	1900

LTE Band 4 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
1.4	Channel	19957	20175	20393
	Frequency	1710.7	1732.5	1754.3
3	Channel	19965	20175	20385
	Frequency	1711.5	1732.5	1753.5
5	Channel	19975	20175	20375
	Frequency	1712.5	1732.5	1752.5
10	Channel	20000	20175	20350
	Frequency	1715	1732.5	1750
15	Channel	20025	20175	20325
	Frequency	1717.5	1732.5	1747.5
20	Channel	20050	20175	20300
	Frequency	1720	1732.5	1745

LTE Band 5 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
1.4	Channel	20407	20525	20643
	Frequency	824.7	836.5	848.3
3	Channel	20415	20525	20635
	Frequency	825.5	836.5	847.5
5	Channel	20425	20525	20625
	Frequency	826.5	836.5	846.5
10	Channel	20450	20525	20600
	Frequency	829	836.5	844

LTE Band 7 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
5	Channel	20775	21100	21425
	Frequency	2502.5	2535	2567.5
10	Channel	20800	21100	21400
	Frequency	2505	2535	2565
15	Channel	20825	21100	21375
	Frequency	2507.5	2535	2562.5
20	Channel	20850	21100	21350
	Frequency	2510	2535	2560

LTE Band 66 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
1.4	Channel	131979	132322	132665
	Frequency	1710.7	1745	1779.3
3	Channel	131987	132322	132657
	Frequency	1711.5	1745	1778.5
5	Channel	131997	132322	132647
	Frequency	1712.5	1745	1777.5
10	Channel	132022	132322	132622
	Frequency	1715	1745	1775
15	Channel	132047	132322	132597
	Frequency	1717.5	1745	1772.5
20	Channel	132072	132322	132572
	Frequency	1720	1745	1770

2.5 Application Standards

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

47 CFR Part 2
47 CFR Part 22
47 CFR Part 24
47 CFR Part 27
ANSI C63.26-2015
FCC KDB 971168 D01 Power Meas License Digital Systems v03r01
FCC KDB 412172 D01 Determining ERP and EIRP v01r01

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

3 Test Condition

3.1 Test Environmental Conditions

During testing, environmental conditions are described below.

Normal Configuration		Extreme Configuration		
Voltage	3.8V	Voltage	High: 4.3V	Low: 3.3V

3.2 Test Configuration

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). The worst cases were recorded in this report.

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes (Z, X, Y axis), receiver antenna polarization (horizontal and vertical), the worst emission was found in ‘ Z ‘ position and the worst case was recorded.

GSM								
Test Case	BW (MHz)	Modulation		RB		CH		
		GMSK	8PSK	1	full	L	M	H
RF Output Power & Effective (Isotropic) Radiated	0.2	v	v	--	--	v	v	v
Occupied Bandwidth	0.2	v	v	--	--	v	v	v
Conducted Band Edge	0.2	v	v	--	--	v	--	v
Spurious Emissions at Antenna Terminals	0.2	v	v	--	--	v	v	v
Peak-to-Average Ratio	0.2	v	v	--	--	v	v	v
Frequency Stability	0.2	v	v	--	--	--	v	--
Radiated Spurious Emission	worst case							

LTE									
Test Case	BW	Modulation				RB		CH		
		QPSK	16QAM	64QAM	256QAM	1	full	L	M	H
RF Output Power & Effective (Isotropic) Radiated	all	v	v	--	--	v	v	v	v	v
Occupied Bandwidth	all	v	v	--	--	--	v	--	v	--
Conducted Band Edge	all	v	--	--	--	v	v	v	--	v
Spurious Emissions at Antenna Terminals	all	v	--	--	--	v	--	v	v	v

Peak-to-Average Ratio	all	v	v	--	--	--	v	--	v	--
Frequency Stability	max	v	--	--	--	--	v	--	v	--
Radiated Spurious Emission	worst case									

Note:

1.The mark " V " means that this configuration is chosen for testing.

2.The mark " -- " means that this bandwidth is not supported.

3.The device is investigated from 30Hz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported.

4.Frequency Stability : Normal Voltage = 3.8V ; Low Voltage =3.3V. ; High Voltage =4.3V

3.3 Equipment List

Instrument	Manufacturer	Model	Asset No.	Cal. Interval	Cal. Due Date
Conducted					
Base Station Simulator	R&S	CMW500	PWC0052	1 Year	2024/10/11
Spectrum Analyzer	KEYSIGHT	N9020B	PWC0047	1 Year	2024/10/10
DC Power	KEYSIGHT	E3640A	PWC0046	1 Year	2024/10/11
Climate Chamber	Boyi	B-T-48C	PWC0051	1 Year	2024/11/12
Shielded Chamber	Mao Rui	MR534	PWC0041	3 Years	2026/08/26
Coupling unit	COM-MW	ZDC6-10M1	/	/	/
Test Software	Tonscend	JS1120 V3.1.46	/	/	/
Radiated					
Receiver	R&S	ESR7	PWB0023	1 Year	2024/10/11
Spectrum Analyzer	R&S	FSV3044	PWB0024	1 Year	2024/10/11
TRILOG Broadband Antenna	Schwarzbeck	VULB9162	PWB0029	1 Year	2024/10/14
Double-Ridged Guide Antenna	ETS-Lindgren	3117	PWB0031	1 Year	2024/10/12
Loop Antenna	R&S	HFH2-Z2E	PWB0026	1 Year	2024/10/21
k Type Horn Antenna	Steatite Antennas	QMS-00880	PWB0035	1 Year	2024/10/17
Horn Antenna	Steatite Antennas	QMS-00208	PWB0033	1 Year	2024/10/21
Pre-Amplifier	R&S	SCU08F1	PWB0030	1 Year	2024/10/11
Pre-Amplifier	R&S	SCU40F1	PWB0036	1 Year	2024/10/11
Pre-Amplifier	R&S	OSP220 (OSP-B155G)	PWB0042	1 Year	2024/10/13
Pre-Amplifier	R&S	SCU18F	PWB0034	1 Year	2024/10/11
Pre-Amplifier	COM-MW	DLNA8	PWB0094	1 Year	2024/11/08
Anechoic Chamber	ETS.LINDGREN	Fact 3-2m	PWB0003	3 Years	2026/06/05
Test Software	R&S	ELEKTRA 4.20.2	/	/	/

3.4 Test Uncertainty

No.	Parameter	Uncertainty
1	Maximum transmit power	0.677dB
2	Frequency error	37.064Hz
3	Bandwidth occupied	5.9kHz
4	Emission spurious, Band edge and PAPR	10Hz-3.5GHz: 0.982dB 3.5GHz-18GHz: 1dB 18GHz-26.5GHz: 0.777dB 26.5GHz-40GHz: 1.066dB
5	Radiated Spurious Emission	Below 1GHz: 4.88 dB Above 1GH: 5.06 dB
6	Temperature	3°C
7	Humidity	1.3 %
8	Supply voltages	0.006 V

4 Test Items Description

Ambient condition

Shielded Chamber

Temperature [°C]	23.4 to 27.8
Humidity [%RH]	35 to 47
Pressure [kPa]	100.2 to 102.4

Anechoic Chamber

Temperature [°C]	20.1 to 25.2
Humidity [%RH]	47 to 61
Pressure [kPa]	99.8 to 100.7

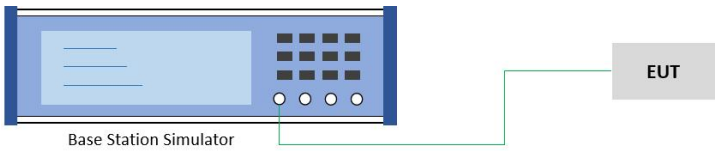
4.1 RF Output Power & Effective (Isotropic) Radiated Power

Methods of Measurement

Base Station Simulator was used to establish communication with the EUT. Its parameters were set to force the EUT transmitting at maximum output power. The measured power in the radio frequency on the transmitter output terminals shall be reported.

According to KDB 412172 D01 Power Approach,
EIRP = PT + GT - LC, ERP = EIRP - 2.15, where
PT = transmitter output power in dBm
GT = gain of the transmitting antenna in dBi
LC = signal attenuation in the connecting cable between the transmitter and antenna in dB

Test Setup



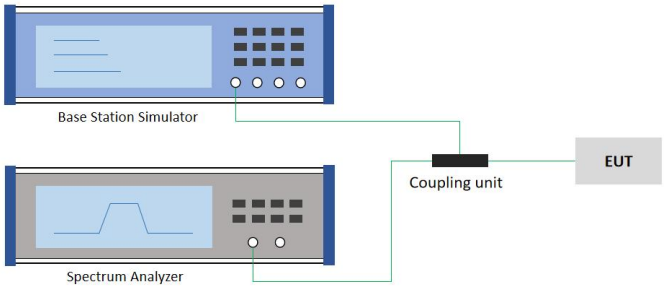
1.The testing follows ANSI C63.26 Section 5.2.
2.The transmitter output port was connected to the base station simulator.
3.Set EUT at maximum power through the base station simulator
4.Select lowest, middle, and highest channels for each band and different modulation.
5.Measure and record the power level from the system simulator.

4.2 EIRP Power Density

Methods of Measurement

Measurement Procedure: C63.26 -2015 section 5.2.4

Test Setup



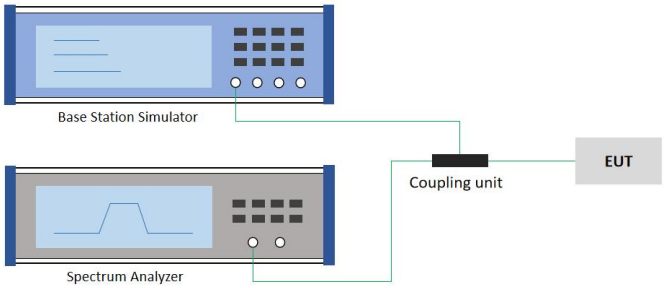
1.Set instrument center frequency to OBW center frequency.
2.Set span to at least 1.5 times the OBW.
3.Set the RBW to the specified reference bandwidth (often 1 MHz).
4.Set VBW ≥ 3 × RBW.
5.Detector = RMS (power averaging).
6.Ensure that the number of measurement points in the sweep ≥ 2 × span/RBW.
7.Sweep time = auto couple.
8.Employ trace averaging (RMS) mode over a minimum of 100 traces.
9.Use the peak marker function to determine the maximum amplitude level within the reference bandwidth (PSD).

4.3 Peak-to-Average Ratio

Methods of Measurement

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth.

Test Setup



1.The testing follows ANSI C63.26 Section 5.2.3.4 (CCDF).
2.The EUT was connected to spectrum and system simulator via a coupling unit.
3.Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
4.The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.
5.Record the deviation as Peak to Average Ratio.

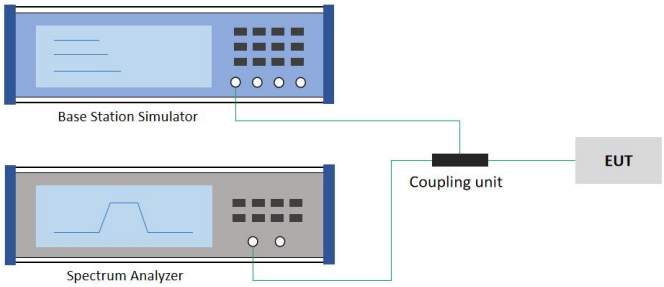
4.4 Occupied Bandwidth

Methods of Measurement

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

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

Test Setup



The testing follows ANSI C63.26 Section 5.4.
The EUT was connected to spectrum analyzer and system simulator via a coupling unit.
The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between two and five times the anticipated OBW.
The nominal resolution bandwidth (RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.
Set the detection mode to peak, and the trace mode to max hold.
Determine the reference value: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace.
(this is the reference value).
Determine the '-26 dB down amplitude' as equal to (Reference Value – X).
Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the '–X dB down amplitude' determined in step 6. If a marker is below this '-X dB down amplitude' value it shall be placed as close as possible to this value. The OBW is the positive frequency difference between the two markers.
Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

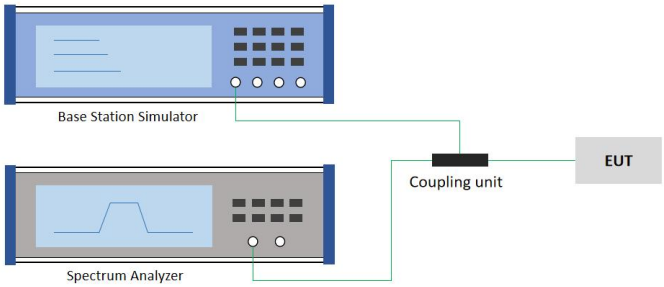
4.5 Conducted Band Edge Measurement

Methods of Measurement

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 6.0

The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyser, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at two frequencies (low channel and high channel). In the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of 100kHz or 1% of the emission bandwidth of the fundamental emission of the transmitter may be employed. The EUT emission bandwidth is measured as the width of the signal between two points, outside of which all emission are attenuated at least 26dB below the transmitter power. The video bandwidth of the spectrum analyzer was set at thrice the resolution bandwidth. Detector Mode was set to RMS.

Test Setup



1.The testing follows ANSI C63.26 section 5.7

2.The EUT was connected to spectrum analyzer and system simulator via a coupling unit.

3.The band edges of low and high channels for the highest RF powers were measured.

4.Set RBW >= 1% EBW in the 1MHz band immediately outside and adjacent to the band edge.

5.Beyond the 1 MHz band from the band edge, RBW=1MHz was used or a narrower RBW was used and the measured power was integrated over the full required measurement bandwidth of 1 MHz.

6.Set spectrum analyzer with RMS detector.

7.The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

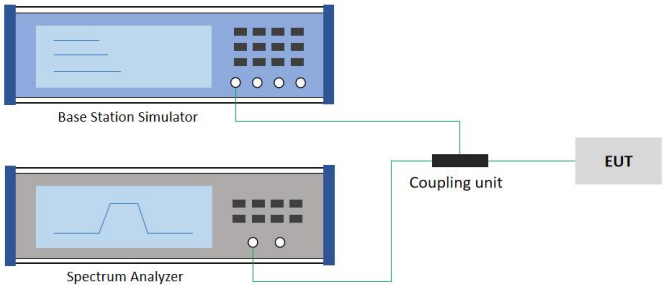
4.6 Spurious Emissions at Antenna Terminals

Methods of Measurement

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 6.0

The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyzer, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log(P) dB. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

Test Setup



1.The testing follows ANSI C63.26 section 5.7

2.The EUT was connected to spectrum analyzer and system simulator via a coupling unit.

3.The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

4.The middle channel for the highest RF power within the transmitting frequency was measured.

5.The conducted spurious emission for the whole frequency range was taken.

6.Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz.

7.Set spectrum analyzer with RMS detector.

8.Taking the record of maximum spurious emission.

9.The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

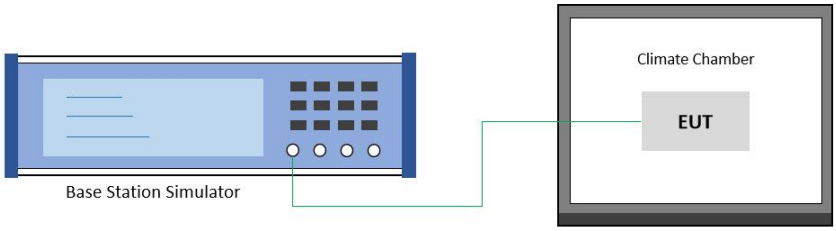
Note: As described in Section C63.26 4.2.3: Generally, the measurement must be corrected by adding 10 log [(reference bandwidth) / (resolution or measurement bandwidth)] to the measured value (such bandwidth scaling is limited to cases where the measurement bandwidth used to perform the measurement is less than the reference bandwidth). Therefore, the converted limit value is the standard limit value minus the conversion factor.

4.7 Frequency Stability

Methods of Measurement

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5ppm) of the center frequency.

Test Setup



Test Procedures for Temperature Variation

1.The testing follows ANSI C63.26 section 5.6.4

2.The EUT was set up in the thermal chamber and connected with the system simulator.

3.With power OFF, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.

4.With power OFF, the temperature was raised in 10°C step up to 50°C. The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.

Test Procedures for Voltage Variation

1.The testing follows ANSI C63.26 section 5.6.5

2.The EUT was placed in a temperature chamber at 20±5°C and connected with the system simulator.

3.The power supply voltage to the EUT was varied from 85% to 115% of the nominal value for other than hand carried battery equipment.

4.For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.

5.The variation in frequency was measured for the worst case.

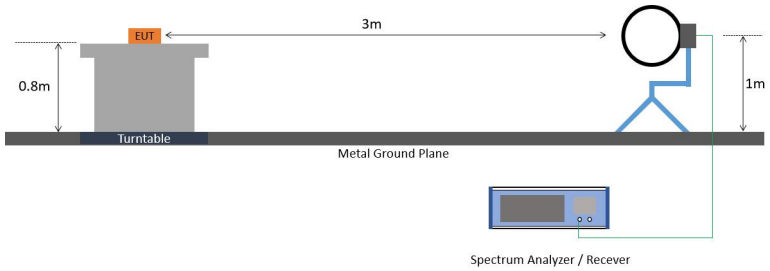
4.8 Radiated Spurious Emission

Methods of Measurement

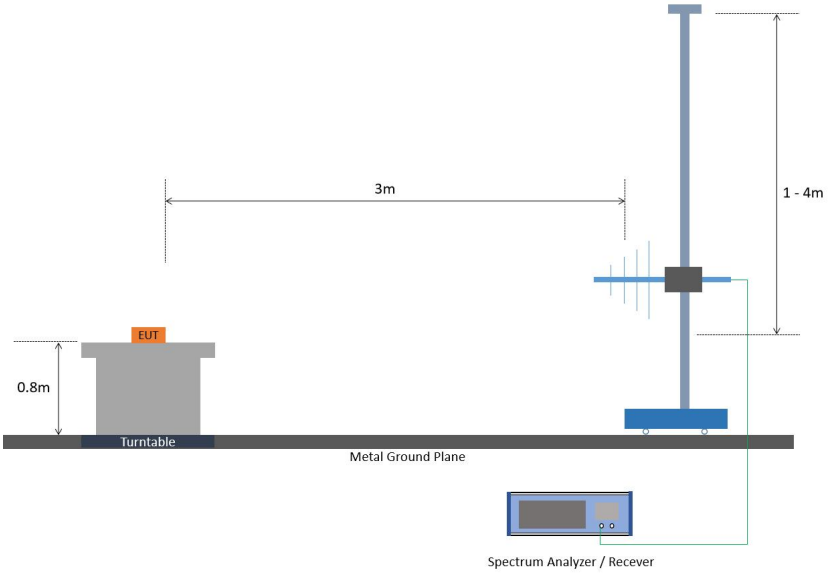
The radiated spurious emission was measured by substitution method according to ANSI C63.26. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least 43 + 10 log (P) dB.

The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

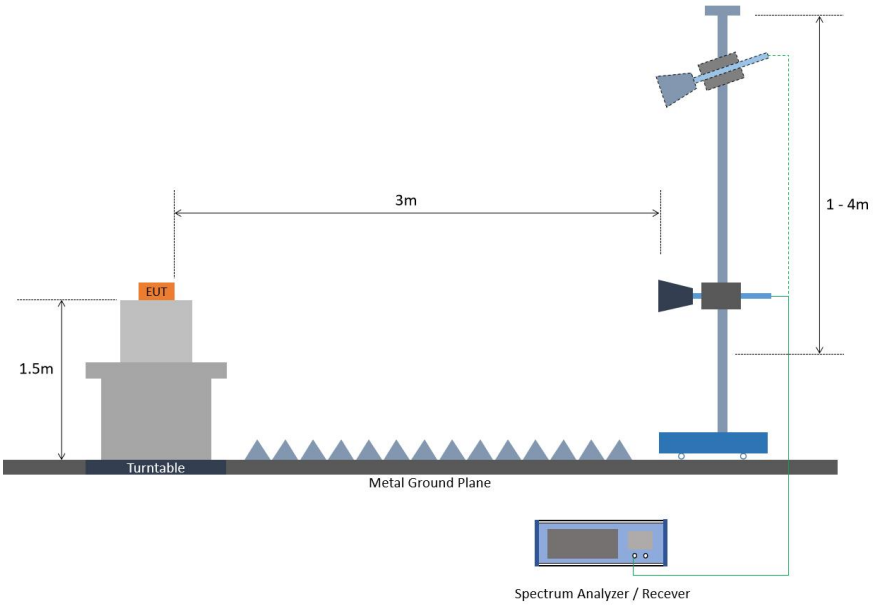
Test Setup



For radiated test below 30MHz



For radiated test from 30MHz to 1GHz



For radiated test above 1GHz

1.The testing follows ANSI C63.26 Section 5.5
2.The EUT was placed on a turntable with 0.8 meter height for frequency below 1GHz and 1.5 meter height for frequency above 1GHz respectively above ground.
3.The EUT was set 3 meters from the receiving antenna mounted on the antenna tower.
4.The table was rotated 360 degrees to determine the position of the highest spurious emission.
5.The height of the receiving antenna is varied between 1m to 4m to search the maximum spurious emission for both horizontal and vertical polarizations.
6.During the measurement, the system simulator parameters were set to force the EUT transmitting at maximum output power.
7.Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
8.A horn antenna was substituted in place of the EUT and was driven by a signal generator.
9.Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
10.EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain
11.ERP (dBm) = EIRP - 2.15
12.The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

Remark: The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

Appendixes

External Photograph	Refer to “Attachment A.1: External Photograph” file.
Internal Photograph	Refer to “Attachment A.2: Internal Photograph” file.
Test Setup Photograph	Refer to “Attachment A.4: RF Test Setup Photograph” file.

Test Results of Conducted Test

GSM 850	Refer to “Attachment B.1” file.
GSM 1900	Refer to “Attachment B.2” file.
LTE Band 2	Refer to “Attachment B.3” file.
LTE Band 4	Refer to “Attachment B.4” file.
LTE Band 5	Refer to “Attachment B.5” file.
LTE Band 7	Refer to “Attachment B.6” file.
LTE Band 66	Refer to “Attachment B.7” file.

Test Results of Radiated Test

Radiation spurious test data	Refer to “Attachment C” file.

****** End of the Report ******