

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, 200233, China
Product: LTE Cat M1/NB2 Module
Model No.: BG770S-GL
Brand Name: QUECTEL
FCC ID: XMR2025BG770SGL
Standards: 47 CFR Part 22
47 CFR Part 24
47 CFR Part 27
47 CFR Part 90
Report No.: PD20250147-R3B
Issue Date: 2025/10/27
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.

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Revision History

Report No.	Version	Description	Issue Date	Note
PD20250147-R3B	01	Initial Report	2025/10/27	Valid

CONTENTS

1 Test Laboratory	10
1.1 Notes of the Test Report	10
1.2 Test Facility	10
1.3 Testing Laboratory	10
2 General Description of Equipment under Test	10
2.1 Details of Application	10
2.2 Details of EUT	11
2.3 Frequency List of Low/Middle/High Channels	13
2.4 Application Standards	15
3 Test Condition	16
3.1 Test Environmental Conditions	16
3.2 Test Configuration	16
3.3 Equipment List	17
3.4 Test Uncertainty	18
4 Test Items Description	19
4.1 RF Output Power & Effective (Isotropic) Radiated Power	19
4.2 EIRP Power Density	20
4.3 Peak-to-Average Ratio	21
4.4 Occupied Bandwidth	22
4.5 Conducted Band Edge Measurement	23
4.6 Spurious Emissions at Antenna Terminals	24
4.7 Frequency Stability	25
4.8 Radiated Spurious Emission	26
ANNEX A: Test Results	28
ANNEX B: The EUT Appearance	29
ANNEX C: Test Setup Photographs	30

Test Summary

NB-IoT Band 2 / 25

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 10 th 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

NB-IoT Band 4 / 66

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

NB-IoT Band 5 / 26(824~849 MHz)

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 10 th 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

NB-IoT Band 26(814~824 MHz)

No.	Test Case	FCC Rules	Limit	Verdict
1	RF Output Power & Effective Radiated Power	§2.1046, §90.635(b)	< 100 W	PASS
2	Peak-to-Average Ratio	--	≤13 dB	PASS
3	Occupied Bandwidth	§2.1049	No limit.	Report Only
4	Emission Mask	§2.1051 § 90.691(a)	For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log ₁₀ (f/6.1) decibels or 50 + 10 Log ₁₀ (P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.	PASS
5	Spurious Emissions at Antenna Terminals	§2.1051, §90.691	< 43 + 10Log ₁₀ (P[Watts]) for all out-of- band emissions	PASS
6	Radiated Spurious Emission	§2.1053, §90.691		PASS
7	Frequency Stability	§2.1055 §90.213	Within authorized bands of operation/frequency block.	PASS

NB-IoT Band 13

No.	Test Case	FCC Rules	Limit	Verdict
1	RF Output Power & Effective Radiated Power	§2.1046, §27.50(b)(10)	ERP ≤ 3 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(c)	On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB; Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;	PASS
5	Spurious Emissions at Antenna Terminals	§2.1051, §27.53(c) §27.53(f)	FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges. On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations; For operations in the 746–758 MHz, 775–788 MHz, and 805–806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.	PASS
6	Radiated Spurious Emission	§2.1053, §27.53(c) §27.53(f)	FCC: ≤ -13 dBm/100 kHz. For operations in the 746–758 MHz, 775–788 MHz, and 805–806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.	PASS
7	Frequency Stability	§2.1055 §27.54	Within authorized bands of operation/frequency block.	PASS

NB-IoT Band 12 / 17 / 85

No.	Test Case	FCC Rules	Limit	Verdict
1	RF Output Power & Effective Radiated Power	§2.1046, §27.50(c)(10)	ERP ≤ 3 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(g)	≤ -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(g)	FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges.	PASS
6	Radiated Spurious Emission	§2.1053, §27.53(g)	FCC: ≤ -13 dBm/100 kHz.	PASS
7	Frequency Stability	§2.1055 §27.54	Within authorized bands of operation/frequency block.	PASS

Conducted detection date: 2025/09/10 to 2025/10/22

Radiated detection date: 2025/09/24 to 2025/10/10

Date of sample received: 2025/09/10

- The samples tested have been evaluated in accordance with the procedures given in the application standards in **Section 2.4** 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, 200233, China
Manufacturer	Quectel Wireless Solutions Co., Ltd.
Manufacturer Address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, 200233, China

2.2 Details of EUT

Product	LTE Cat M1/NB2 Module		
Model	BG770S-GL		
Hardware Version	R1.1		
Software Version	BG770SGLAAR02A01		
SN	Conducted: E1C25H60B000134 Radiated: E1C25H533000075		
NB-IoT Specification			
Single Band	Band 2, 4, 5, 12, 13, 17, 25, 26, 66, 85		
Category	Cat NB2		
Power Class for LTE	PC3		
Type of Modulation	BPSK, QPSK		
Sub-carrier Spacing	3.75KHz, 15KHz		
Antenna Type	☒ External ☐ Integrated		
Antenna Gain	Band 2: 2.70dBi Band 17: 1.60dBi Band 4: 1.40dBi Band 25: 2.70dBi Band 5: 1.60dBi Band 26: 1.60dBi Band 12: 1.60dBi Band 66: 1.40dBi Band 13: 1.60dBi Band 85: 1.60dBi		
NB-IoT Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	NB-IoT Band 2	1850 to 1910	1930 to 1990
	NB-IoT Band 4	1710 to 1755	2110 to 2155
	NB-IoT Band 5	824 to 849	869 to 894
	NB-IoT Band 12	699 to 716	729 to 746
	NB-IoT Band 13	777 to 787	746 to 756
	NB-IoT Band 17	704 to 716	734 to 746
	NB-IoT Band 25	1850 to 1915	1930 to 1995
	NB-IoT Band 26	814 to 849	859 to 894
	NB-IoT Band 66	1710 to 1780	2110 to 2180
	NB-IoT Band 85	698 to 716	728 to 746
Note 1: 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. Note 2: From C63.26: As an alternative, the highest power level measured in a narrower RBW (relative to the specified reference bandwidth) can be scaled by applying a correction factor determined from: 10 log [(reference bandwidth) / (resolution or measurement bandwidth)]. When using a smaller RBW, the current usage limit needs to be converted from the original limit.			

Support Equipment

Equipment	Manufacturer	Description	Model	Serial Number
Base Station Simulator	Anritsu	-	MT8821C	PWC0039

2.3 Frequency List of Low/Middle/High Channels

NB-IoT Band 2 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
0.18	Channel	18602	18900	19198
	Frequency	1850.2	1880.0	1909.8

NB-IoT Band 4 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
0.18	Channel	19952	20175	20398
	Frequency	1710.2	1732.5	1754.8

NB-IoT Band 5 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
0.18	Channel	20402	20525	20648
	Frequency	824.2	836.5	848.8

NB-IoT Band 12 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
0.18	Channel	23012	23095	23178
	Frequency	699.2	707.5	715.8

NB-IoT Band 13 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
0.18	Channel	23182	23230	23278
	Frequency	777.2	782.0	786.8

NB-IoT Band 17 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
0.18	Channel	23732	23790	23848
	Frequency	704.2	710	715.8

NB-IoT Band 25 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
0.18	Channel	26042	26365	26688
	Frequency	1850.2	1882.5	1914.8

NB-IoT Band 26 (814 to 824MHz) Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
0.18	Channel	26692	26740	26788
	Frequency	814.2	819	823.8

NB-IoT Band 26 (824 to 849MHz) Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
0.18	Channel	26792	26915	27038
	Frequency	824.2	836.5	848.8

NB-IoT Band 66 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
0.18	Channel	131974	132322	132670
	Frequency	1710.2	1745.0	1779.8

NB-IoT Band 85 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
0.18	Channel	134004	134082	134180
	Frequency	698.2	706.0	715.8

2.4 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

47 CFR Part 90

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	3.3V	Voltage	High: 4.3V	Low: 3.1V

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.

Test Items	BW	Sub-carrier Spacing (kHz)		Modulation		Tones					Test Channel		
		3.75	15	BPSK	QPSK	1@0	1@47	1@11	3@3	12@0	L	M	H
RF Output Power & Effective (Isotropic) Radiated Power	0.18M	V	V	V	V	V	V	V	V	--	V	V	V
Peak-to- Average Ratio	0.18M	V	V	V	V	V	V	V	V	--	--	V	--
26dB and 99% Bandwidth	0.18M	V	V	V	V	V	--	--	--	V	--	V	--
Conducted Band Edge	0.18M	V	V	V	V	V	V	V	--	V	V	--	V
Conducted Spurious Emission	0.18M	V	V	V	V	V	V	V	--	V	V	V	V
Frequency Stability	0.18M	V	V	--	V	V	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 is not testing.
- 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 = 3.3V ; Low Voltage =3.1V . ; 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	PWC0006	1 Year	2026/09/07
Spectrum Analyzer	R&S	FSV3030	PWC0003	1 Year	2026/09/07
DC Power	KEYSIGHT	E3640A	PWC0028	1 Year	2026/09/07
Climate Chamber	ESPEC	GSU-64	PWC0025	1 Year	2026/09/07
Shielded Chamber	MIX-BEP	SR 433	PWC0002	3 Years	2027/07/09
RF cable	TIMES Microwave Systems	SFT205PUR-NMSWSM-1.50M	PWD0074	1 Year	2026/09/07
RF cable	TIMES Microwave Systems	HF160-KMKMR-1.50M	PWD0073	1 Year	2026/09/07
Coupling unit	Tonscend	JS0806-1	PWC0007	1 Year	2026/09/07
Test Software	Tonscend	JS1120 V2.7.51	-	-	-
Radiated					
Receiver	R&S	ESR7	PWB0023	1 Year	2026/09/07
Spectrum Analyzer	R&S	FSV3044	PWB0024	1 Year	2026/09/07
Loop Antenna	R&S	HFH2-Z2E	PWB0026	1 Year	2026/09/11
TRILOG Broadband Antenna	Schwarzbeck	VULB9162	PWB0029	1 Year	2026/09/08
Double-Ridged Guide Antenna	ETS-Lindgren	3117	PWB0031	1 Year	2025/09/26 2026/09/24
k Type Horn Antenna	Steatite Antennas	QMS-00880	PWB0035	1 Year	2026/09/07
Pre-Amplifier	R&S	OSP220 (OSP-B155G)	PWB0042	1 Year	2026/09/08
Pre-Amplifier	COM-MW	DLNA8	PWB0094	1 Year	2026/09/08
Pre-Amplifier	R&S	SCU18F	PWB0034	1 Year	2026/09/08
Pre-Amplifier	R&S	SCU40F1	PWB0036	1 Year	2026/09/08
Anechoic Chamber	ETS-Lindgren	Fact 3-2m	PWB0003	3 Years	2026/06/05
Test Software	Tonscend	JS36 V5.0.0	-	-	-

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]	20.1 to 26.5
Humidity [%RH]	39 to 45
Pressure [kPa]	100.9 to 103.1

Anechoic Chamber

Temperature [°C]	20.3 to 25.7
Humidity [%RH]	47 to 57
Pressure [kPa]	100.1 to 102.0

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,

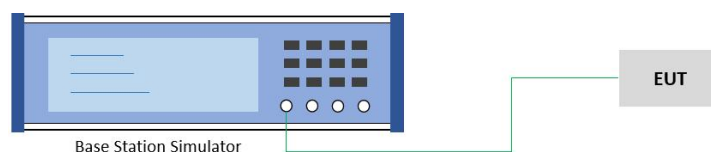
$EIRP = PT + GT - LC$, $ERP = EIRP - 2.15$, where

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



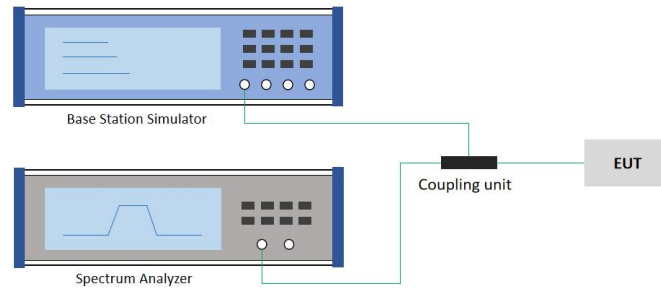
- 1.The testing follows ANSI C63.26 Section 5.2.
- 2.The transmitter output port was connected to the base station simulator.
- 3.Set EUT at maximum power through the base station simulator
- 4.Select lowest, middle, and highest channels for each band and different modulation.
- 5.Measure and record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



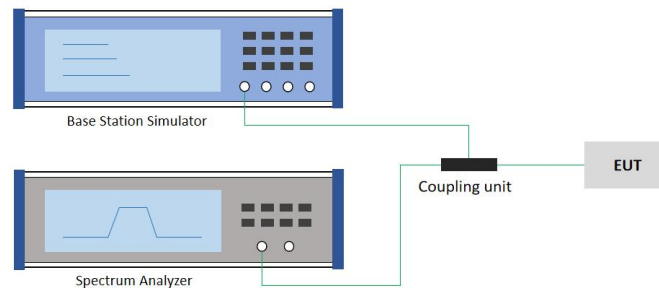
- 1.Set instrument center frequency to OBW center frequency.
- 2.Set span to at least 1.5 times the OBW.
- 3.Set the RBW to the specified reference bandwidth (often 1 MHz).
- 4.Set $VBW \geq 3 \times RBW$.
- 5.Detector = RMS (power averaging).
- 6.Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span}/RBW$.
- 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.

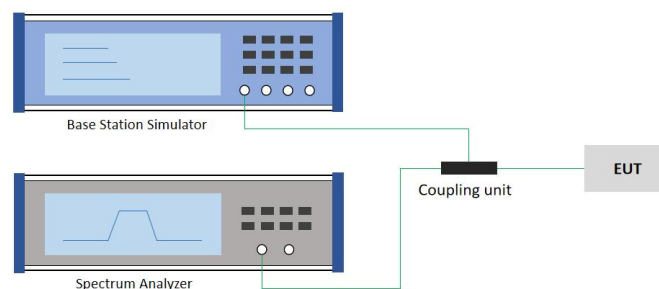
4.4 Occupied Bandwidth

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.

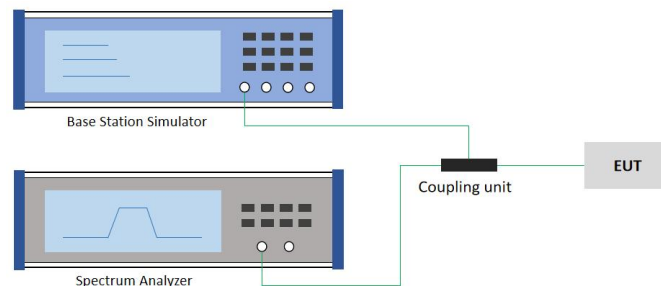
4.5 Conducted Band Edge Measurement

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 $\geq$ 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.

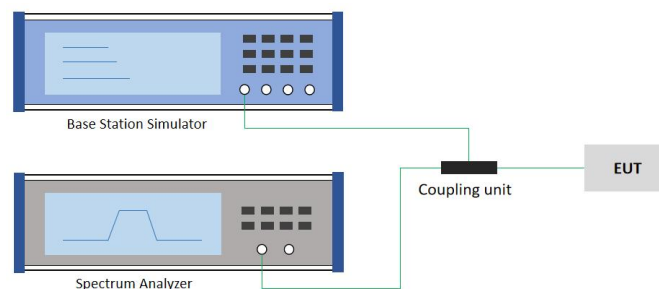
4.6 Spurious Emissions at Antenna Terminals

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.

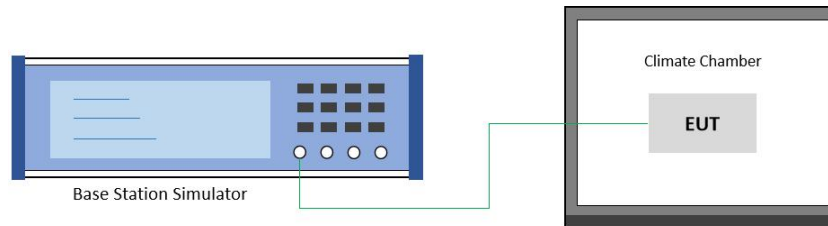
Note: As described in Section C63.26 4.2.3: Generally, the measurement must be corrected by adding $10 \log [(reference\ bandwidth) / (resolution\ or\ measurement\ bandwidth)]$ to the measured value (such bandwidth scaling is limited to cases where the measurement bandwidth used to perform the measurement 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 $\pm 0.00025\%$ ($\pm 2.5\text{ppm}$) 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 $20\pm 5^{\circ}\text{C}$ 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.

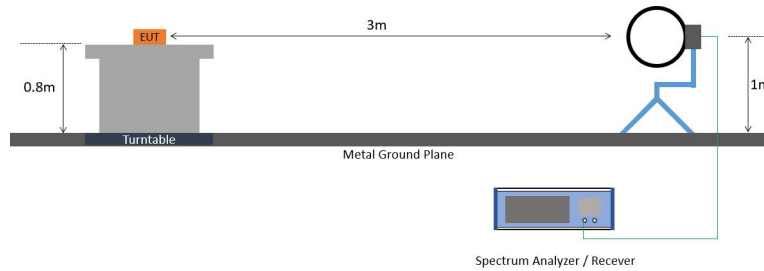
4.8 Radiated Spurious Emission

Methods of Measurement

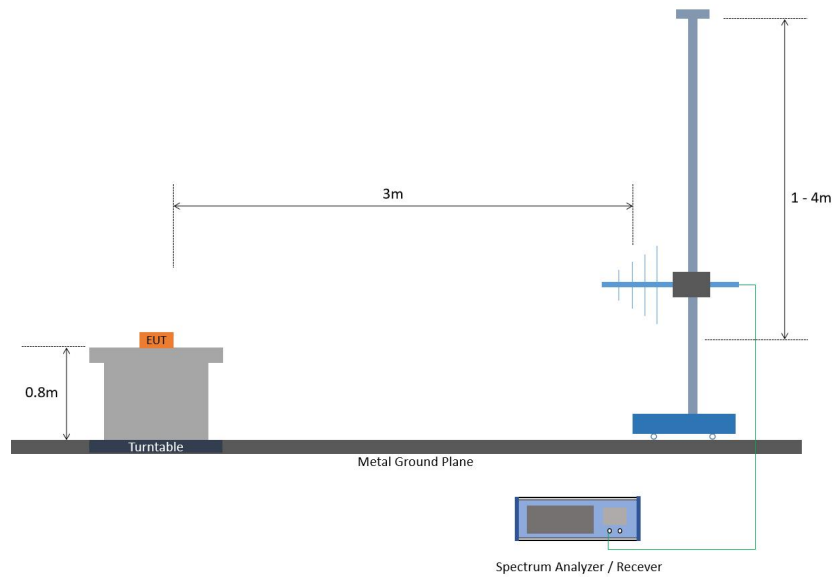
The radiated spurious emission was measured by substitution method according to ANSI C63.26. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB.

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

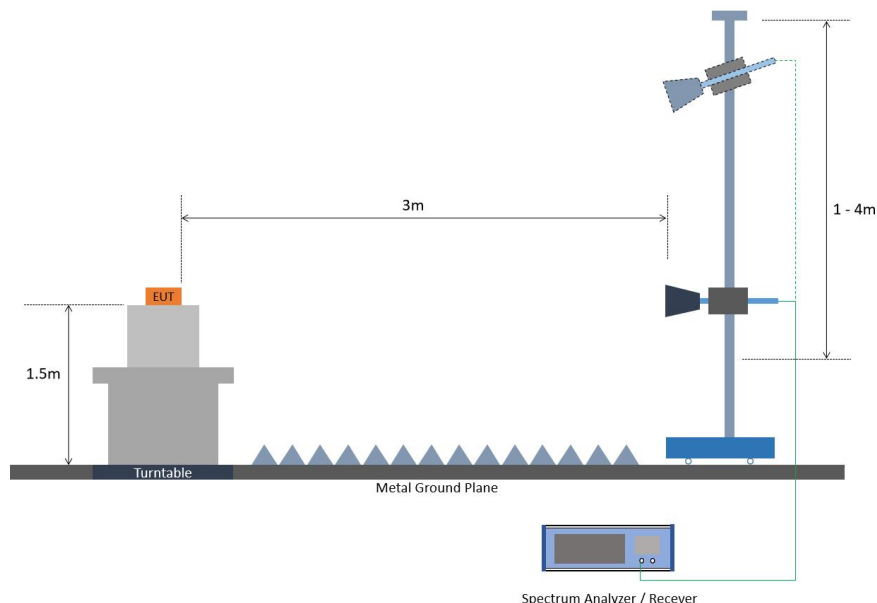
Test Setup



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.

----- THE END -----

ANNEX A: Test Results

Test Results of Conducted Test

NB-IoT Band 2	Refer to ANNEX A.1
NB-IoT Band 4	Refer to ANNEX A.2
NB-IoT Band 5	Refer to ANNEX A.3
NB-IoT Band 12	Refer to ANNEX A.4
NB-IoT Band 13	Refer to ANNEX A.5
NB-IoT Band 17	Refer to ANNEX A.6
NB-IoT Band 25	Refer to ANNEX A.7
NB-IoT Band 26(814 to 824MHz)	Refer to ANNEX A.8
NB-IoT Band 26(824 to 849MHz)	Refer to ANNEX A.9
NB-IoT Band 66	Refer to ANNEX A.10
NB-IoT Band 85	Refer to ANNEX A.11

Test Results of Radiated Test

Radiated Emission	Refer to ANNEX A.12
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ANNEX B: The EUT Appearance

The EUT Appearance (internal and external photographs) are submitted separately.

ANNEX C: Test Setup Photographs

The Test Setup Photographs are submitted separately.