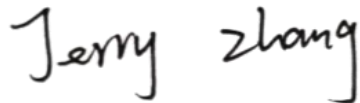


RF Test Report

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: 5G NR Module
Model No.: AG568N-NA
Brand Name: QUECTEL
FCC ID: XMR2024AG568NNA
Standards: 47 CFR Part 22
47 CFR Part 24
47 CFR Part 27
Report No.: PD20230212RF02
Issue Date: 2024/03/21
Test Result: PASS *

* The above equipment has been tested and compliance with the requirement of the relative standards by Hefei Panwin Technology Co., Ltd.



Reviewed By: Jerry Zhang

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
PD20230212RF02	1	Initial Report	2024/03/21	Valid

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Test Summary

NR Band n2

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

NR Band n5

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

NR Band n12

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

NR Band n66

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 10 th 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

NR Band n77(3700 to 3980MHz) / NR Band n78(3700 to 3800MHz)

No.	Test Case	FCC Rules	Limit	Verdict
1	RF Output Power & Effective Radiated Power	§2.1046, §27.50(j)(3)	EIRP ≤ 1W	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(l)(2)	For mobile operations in the 3700–3980 MHz band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed –13 dBm/MHz. Compliance with this paragraph (l)(2) is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, the minimum resolution bandwidth for the measurement shall be either one percent of the emission bandwidth of the fundamental emission of the transmitter or 350 kHz. In the bands between 1 and 5 MHz removed from the licensee's frequency block, the minimum resolution bandwidth for the measurement shall be 500 kHz.	PASS
5	Spurious Emissions at Antenna Terminals	§2.1051, §27.53(l)(2)	not exceed -13 dBm/MHz.	PASS
6	Radiated Spurious Emission	§2.1053, §27.53(l)(2)	not exceed -13 dBm/MHz.	PASS
7	Frequency Stability	§2.1055 §27.54	Within authorized bands of operation/frequency block.	PASS

NR Band n77(3450 to 3550MHz) / NR Band n78(3450 to 3550MHz)

No.	Test Case	FCC Rules	Limit	Verdict
1	RF Output Power & Effective Radiated Power	§2.1046, §27.50(k)(3)	EIRP ≤ 30dBm	PASS
2	Peak-to-Average Ratio	§27.50(k)(4)	≤13 dB	PASS
3	Occupied Bandwidth	§2.1049	No limit.	Report Only
4	Conducted Band Edge Measurement	§2.1051, §27.50(n)(2)	For mobile operations in the 3450-3550 MHz band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed -13 dBm/MHz.	PASS
5	Spurious Emissions at Antenna Terminals			PASS
6	Radiated Spurious Emission			PASS
7	Frequency Stability	§2.1055 §27.54	Within authorized bands of operation/frequency block.	PASS

Conducted detection date: 2024/01/18 to 2024/03/20

Radiated detection date: 2024/01/31 to 2024/03/01

Date of Sample Received: 2024/01/16

- We, Hefei Panwin Technology Co., Ltd., would like to declare that the tested sample has been evaluated in accordance with the procedures given in applied standard(s) in **Section 2.5** of this report and shown compliance 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

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

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

A2LA (Certificate Number: 6849.01)

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

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

Product		5G NR Module					
Model		AG568N-NA					
Hardware Version		R2.0					
Software Version		AG568NAAR06A13M8G_OCPU					
SN		Conducted: E1A23LJ15000062 Radiated: E1A23LJ15000019					
Single Band		FDD Band: n2, n5, n12, n66 TDD Band: n77, n78					
NSA Band		DC_2A_n5A, DC_5A_n2A, DC_66A_n5A, DC_5A_n66A, DC_12A_n66A, DC_12A_n2A, DC_2A_n77A, DC_5A_n77A, DC_12A_n77A, DC_66A_n77A					
CA Band		DL CA: CA_n2A-n5A, CA_n2C, CA_n66C, CA_n2A-n77A, CA_n5A-n77A, CA_n12A-n77A, CA_n66A-n77A, CA_n77C, CA_n5A-n66A, CA_n2A-n66A					
HPUE Power Class		Class 2: n77, n78					
Type of Modulation		UL: Up to 256QAM DL: Up to 256QAM					
Antenna Type		<input checked="" type="checkbox"/> External <input type="checkbox"/> Integrated					
Support		<input checked="" type="checkbox"/> SA <input checked="" type="checkbox"/> NSA					
Antenna Gain		n2: 0.98dBi (Ant0) n66: 0.54dBi (Ant0) n5: 0 . 1 2 dBi (Ant0) n77: -1.50dBi (Ant1) n12: 0.97dBi (Ant0) n78: -1.50dBi (Ant1)					
Frequency Band(s)	SISO Band	Supported Channel Bandwidth (MHz)				Tx (MHz)	Rx (MHz)
	NR Band n2	5	10	15	20	1850 to 1910	1930 to 1990
	NR Band n5	5	10	15	20	824 to 849	869 to 894
	NR Band n12	5	10	15	--	699 to 716	729 to 746
	NR Band n66	5	10	15	20	1710 to 1780	2110 to 2200
		40	--	--	--		
	NR Band n77	10	15	20	40	3700 to 3980 3450 to 3550	3700 to 3980 3450 to 3550
		50	60	80	90		
		100	--	--	--		
	NR Band n78	10	15	20	40	3700 to 3800 3450 to 3550	3700 to 3800 3450 to 3550
		50	60	80	90		
		100	--	--	--		
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: The frequency band subcarrier interval of TDD is 30kHz, and the frequency band subcarrier interval of FDD is 15kHz.							

Note 3: Tested the power and RSE of ENDC, report only show worst mode.

Note 4: All the supported ENDC combinations are verified conducted power, only the ENDC combination with highest power are shown in the report.

Note 5: 5G NR support SA mode and NSA mode. According to the maximum power between SA and NSA mode, SA covers NSA mode. SA covers DL CA mode.

Note 6: The maximum ERP/EIRP is calculated from max output power and max antenna gain.

Note 7: All modulations have been tested, only the worst test results of PSK & QAM are shown in the report.

Note 8: The device supports two PAs for 5G NR n2/n66 (main PA with Ant.0 for SA mode, and other PA with Ant.2 for NSA mode), both the PA are full test.

Support Equipment

Equipment	Manufacturer	Description	Model	Serial Number
EVb	QUECTEL	/	/	/
Power Adapter	Dong Guan City GangQi Electronic Co.,Ltd	/	GQ36-120300-AX	/
External Antenna	QUECTEL	/	YECT003AA	/

2.3 Maximum Conducted power and Emission Designator

NR Band	BW (MHz)	DFT -s-Pi/2-BPSK / QPSK		16QAM / 64QAM / 256QAM	
		Max Power (W)	Designator	Max Power (W)	Designator
NR Band n2	5	0.2004	4M48G7D	0.1556	4M50W7D
	10	0.2032	9M26G7D	0.1549	9M28W7D
	15	0.1959	14M1G7D	0.1517	14M1W7D
	20	0.1972	18M9G7D	0.1549	18M9W7D
NR Band n5	5	0.2089	4M47G7D	0.1641	4M47W7D
	10	0.2070	9M29G7D	0.1637	9M29W7D
	15	0.2009	14M1G7D	0.1592	14M1W7D
	20	0.2014	18M9G7D	0.1592	18M9W7D
NR Band n12	5	0.2028	4M46G7D	0.1567	4M46W7D
	10	0.2023	9M26G7D	0.1622	9M28W7D
	15	0.1972	14M0G7D	0.1611	14M1W7D
NR Band n66	5	0.2042	4M46G7D	0.1600	4M46W7D
	10	0.2042	9M27G7D	0.1600	9M29W7D
	15	0.1982	14M1G7D	0.1581	14M1W7D
	20	0.1982	18M9G7D	0.1567	18M9W7D
	40	0.1954	38M5G7D	0.1531	38M5W7D
NR Band n77 (3450 to 3550)	10	0.4508	8M56G7D	0.3451	8M56W7D
	15	0.4266	13M6G7D	0.3327	13M6W7D
	20	0.4315	18M2G7D	0.3381	18M2W7D
	40	0.4227	37M9G7D	0.3311	37M8W7D
	50	0.4217	47M5G7D	0.3436	47M5W7D
	60	0.4325	57M8G7D	0.3459	57M8W7D
	80	0.4276	76M8G7D	0.3516	77M4W7D
	90	0.4285	86M9G7D	0.3436	87M4W7D
	100	0.4276	97M4G7D	0.3342	97M5W7D
NR Band n77 (3700 to 3980)	10	0.4667	8M56G7D	0.3698	8M60W7D
	15	0.4581	13M6G7D	0.3548	13M6W7D
	20	0.4571	18M2G7D	0.3776	18M2W7D
	40	0.4603	37M8G7D	0.3664	37M8W7D
	50	0.4699	47M5G7D	0.3707	47M5W7D

	60	0.4710	57M7G7D	0.3855	57M8W7D
	80	0.4887	77M4G7D	0.3846	77M4W7D
	90	0.4864	87M2G7D	0.3926	87M4W7D
	100	0.4853	97M3G7D	0.3917	97M3W7D
NR Band n78 (3450 to 3550)	10	0.4519	8M56G7D	0.3388	8M61W7D
	15	0.4305	13M6G7D	0.3281	13M6W7D
	20	0.4266	18M1G7D	0.3428	18M2W7D
	40	0.4207	37M7G7D	0.3273	37M8W7D
	50	0.4295	47M4G7D	0.3436	47M4W7D
	60	0.4305	57M7G7D	0.3420	57M9W7D
	80	0.4198	77M5G7D	0.3396	77M5W7D
	90	0.4236	87M5G7D	0.3404	87M5W7D
	100	0.4305	97M4G7D	0.3388	97M4W7D
NR Band n78 (3700 to 3800)	10	0.5383	8M57G7D	0.4188	8M58W7D
	15	0.5200	13M5G7D	0.4130	13M6W7D
	20	0.5152	18M2G7D	0.4046	18M2W7D
	40	0.4943	37M8G7D	0.4055	37M8W7D
	50	0.5035	47M5G7D	0.4018	47M4W7D
	60	0.4943	57M8G7D	0.4130	57M8W7D
	80	0.4932	77M4G7D	0.3882	77M5W7D
	90	0.4932	87M2G7D	0.3882	87M3W7D
	100	0.4920	97M1G7D	0.3882	97M4W7D

2.4 Frequency List of Low/Middle/High Channels

NR Band n2 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
5	Channel	370500	376000	381500
	Frequency	1852.5	1880	1907.5
10	Channel	371000	376000	381000
	Frequency	1855	1880	1905
15	Channel	371500	376000	380500
	Frequency	1857.5	1880	1902.5
20	Channel	372000	376000	380000
	Frequency	1860	1880	1900

NR Band n5 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
5	Channel	165300	167300	169300
	Frequency	826.5	836.5	846.5
10	Channel	165800	167300	168800
	Frequency	829	836.5	844
15	Channel	166300	167300	168300
	Frequency	831.5	836.5	841.5
20	Channel	166800	167300	167800
	Frequency	834	836.5	839

NR Band n12 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
5	Channel	140300	141500	142700
	Frequency	701.5	707.5	713.5
10	Channel	140800	141500	142200
	Frequency	704	707.5	711
15	Channel	141300	141500	141700
	Frequency	706.5	707.5	708.5

NR Band n66 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
5	Channel	342500	349000	355500
	Frequency	1712.5	1745	1777.5
10	Channel	343000	349000	355000
	Frequency	1715	1745	1775
15	Channel	343500	349000	354500
	Frequency	1717.5	1745	1772.5
20	Channel	344000	349000	354000

	Frequency	1720	1745	1770
40	Channel	346000	349000	352000
	Frequency	1730	1745	1760

NR Band n77 (3700 to 3980MHz) Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
10	Channel	647000	656000	665000
	Frequency	3705	3840	3975
15	Channel	647168	656000	664832
	Frequency	3707.52	3840	3972.48
20	Channel	647334	656000	664666
	Frequency	3710.01	3840	3969.99
40	Channel	648000	656000	664000
	Frequency	3720	3840	3960
50	Channel	648334	656000	663666
	Frequency	3725.01	3840	3954.99
60	Channel	648668	656000	663332
	Frequency	3730.02	3840	3949.98
80	Channel	649334	656000	662666
	Frequency	3740.01	3840	3939.99
90	Channel	649668	656000	662332
	Frequency	3745.02	3840	3934.98
100	Channel	650000	656000	662000
	Frequency	3750	3840	3930

NR Band n77 (3450 to 3550MHz) Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
10	Channel	630334	633334	636334
	Frequency	3455.01	3500.01	3545.01
15	Channel	630500	633334	636166
	Frequency	3457.5	3500.01	3542.49
20	Channel	630666	633334	636000
	Frequency	3459.99	3500.01	3540
40	Channel	631334	633334	635334
	Frequency	3470.01	3500.01	3530.01
50	Channel	631666	633334	635000
	Frequency	3474.99	3500.01	3525
60	Channel	632000	633334	634666
	Frequency	3480	3500.01	3519.99
80	Channel	632666	633334	634000
	Frequency	3489.99	3500.01	3510
90	Channel	633000	633334	633666

	Frequency	3495	3500.01	3504.99
100	Channel	/	633334	/
	Frequency	/	3500.01	/

NR Band n78 (3700 to 3800MHz) Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
10	Channel	647000	650000	653000
	Frequency	3705	3750	3795
15	Channel	647168	650000	652832
	Frequency	3707.52	3750	3792.48
20	Channel	647334	650000	652666
	Frequency	3710.01	3750	3789.99
40	Channel	648000	650000	652000
	Frequency	3720	3750	3780
50	Channel	648334	650000	651666
	Frequency	3725.01	3750	3774.99
60	Channel	648668	650000	651332
	Frequency	3730.02	3750	3769.98
80	Channel	649334	650000	650666
	Frequency	3740.01	3750	3759.99
90	Channel	649668	650000	650332
	Frequency	3745.02	3750	3754.98
100	Channel	/	650000	/
	Frequency	/	3750	/

NR Band n78 (3450 to 3550MHz) Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
10	Channel	630334	633334	636334
	Frequency	3455.01	3500.01	3545.01
15	Channel	630500	633334	636166
	Frequency	3457.5	3500.01	3542.49
20	Channel	630666	633334	636000
	Frequency	3459.99	3500.01	3540
40	Channel	631334	633334	635334
	Frequency	3470.01	3500.01	3530.01
50	Channel	631666	633334	635000
	Frequency	3474.99	3500.01	3525
60	Channel	632000	633334	634666
	Frequency	3480	3500.01	3519.99
80	Channel	632666	633334	634000
	Frequency	3489.99	3500.01	3510
90	Channel	633000	633334	633666

	Frequency	3495	3500.01	3504.99
100	Channel	/	633334	/
	Frequency	/	3500.01	/

2.5 Applied 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.

Test Case	BW	modulation					RB		CH		
		BPSK	QPSK	16QAM	64QAM	256QAM	1	full	L	M	H
RF Output Power & Effective (Isotropic) Radiated Power	all	v	v	v	v	v	v	v	v	v	v
Occupied Bandwidth	all	--	v	v	v	v	--	v	--	v	--
Conducted Band Edge Measurement	all	v	v	--	--	--	v	v	v	--	v
Spurious Emissions at Antenna Terminals	max	v	v	--	--	--	v	--	v	v	v
Peak-to-Average Ratio	max	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
- 5.For radiation spurious emission, the worst cases were recorded for PSK/QPSK modulation in this report.

3.3 Equipment List

Name of Equipment	Manufacturer	Model	Asset No.	Cal. Interval	Cal. Due Date
Base Station Simulator	KEYSIGHT	E7515E	PWC0042	1 Year	2024/10/10
Spectrum Analyzer	KEYSIGHT	N9020B	PWC0049	1 Year	2024/10/10
Matrix Control Unit	Tonscend	JS0806-1	PWC0056	1 Year	2024/11/08
DC Power	KEYSIGHT	E3640A	PWC0045	1 Year	2024/10/11
Shielded Chamber	Mao Rui	MR534	PWC0041	3 Years	2026/08/26
Base Station Simulator	Anritsu	MT8000A_020/021	PWC0032	1 Year	2024/10/11
Spectrum Analyzer	R&S	FSV3044	PWC0036	1 Year	2024/10/11
Matrix Control Unit	Tonscend	JS0806-1	PWC0034	1 Year	2024/10/12
DC Power	KEYSIGHT	E3640A	PWB0080	1 Year	2024/10/11
Climate Chamber	Boyi	B-T-48C	PWC0035	1 Year	2024/10/10
Shielded Chamber	Kaituo	KT-SR423	PWC0031	3 Years	2024/08/08
Test Software	Tonscend	JS1120 V2.4.1	/	/	/
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	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	400MHz≤f < 3GHz 0.684dB 3GHz≤f < 6GHz 1.210dB
2	Frequency error	37.074Hz
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	30MHz-18GHz: 4.46 dB 18GHz-40GHz: 4.46 dB
6	Temperature	±3℃
7	Humidity	±1.3 %
8	Supply voltages	±0.006 V

4 Test Items Description

Ambient condition

Shielded Chamber

Temperature [°C]	20.8 to 25.2
Humidity [%RH]	26 to 48
Pressure [kPa]	100.7 to 103.1

Anechoic Chamber

Temperature [°C]	20.0 to 24.6
Humidity [%RH]	40 to 48
Pressure [kPa]	100.8 to 103.0

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,

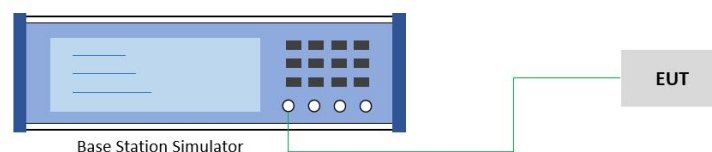
$EIRP = PT + GT - LC$, $ERP = EIRP - 2.15$, where

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



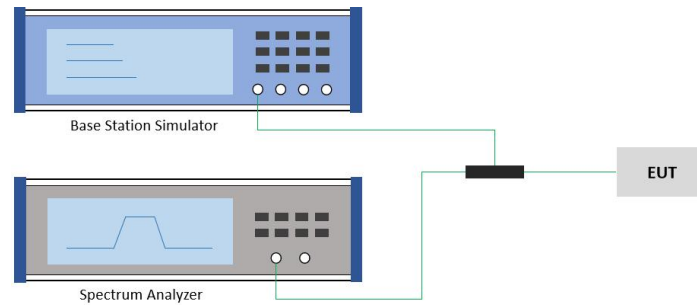
- 1.The testing follows ANSI C63.26 Section 5.2.
- 2.The transmitter output port was connected to the base station simulator.
- 3.Set EUT at maximum power through the base station simulator
- 4.Select lowest, middle, and highest channels for each band and different modulation.
- 5.Measure and record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



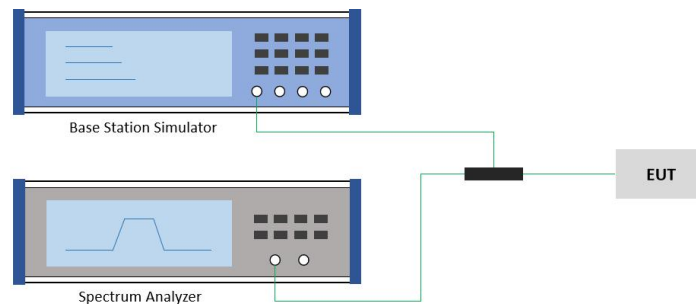
- 1.Set instrument center frequency to OBW center frequency.
- 2.Set span to at least 1.5 times the OBW.
- 3.Set the RBW to the specified reference bandwidth (often 1 MHz).
- 4.Set VBW $\geq 3 \times$ RBW.
- 5.Detector = RMS (power averaging).
- 6.Ensure that the number of measurement points in the sweep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

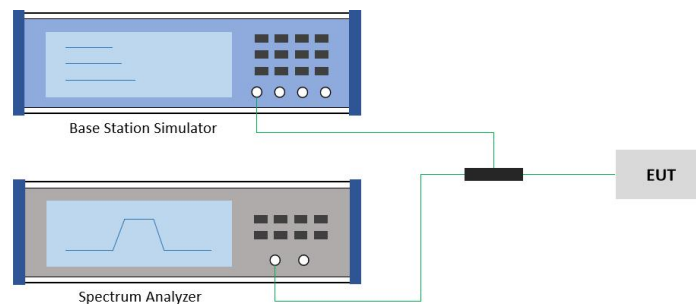
4.4 Occupied Bandwidth

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 power divider.

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.

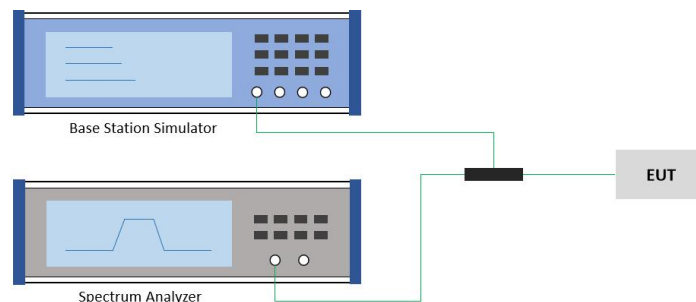
4.5 Conducted Band Edge Measurement

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 power divider.
- 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.

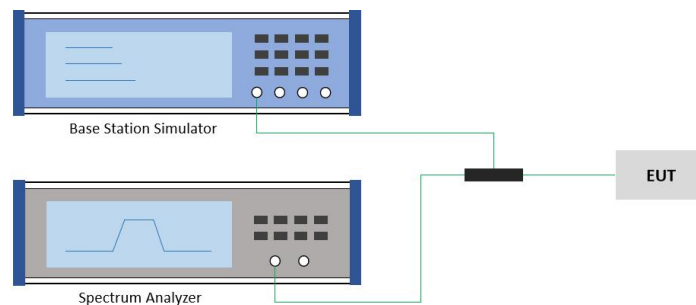
4.6 Spurious Emissions at Antenna Terminals

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 power divider.
- 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.

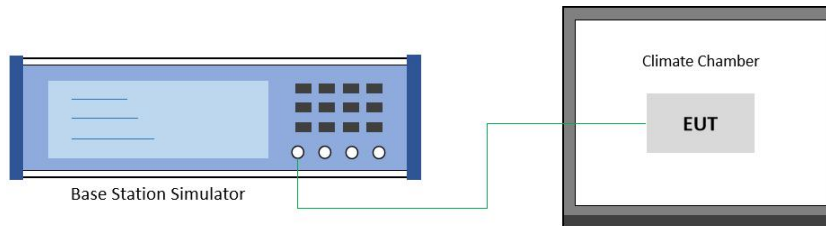
Note: As described in Section C63.26 4.2.3: Generally, the measurement must be corrected by adding $10 \log [(reference\ bandwidth) / (resolution\ or\ measurement\ bandwidth)]$ to the measured value (such bandwidth scaling is limited to cases where the measurement bandwidth used to perform the measurement 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.

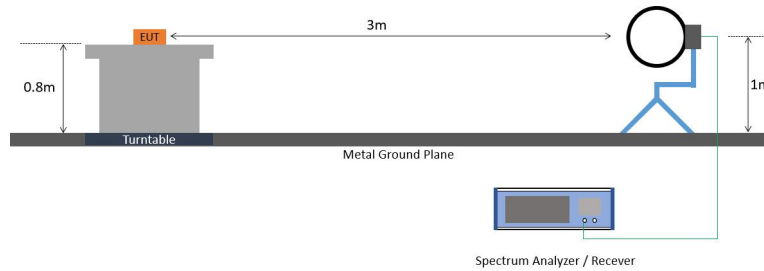
4.8 Radiated Spurious Emission

Methods of Measurement

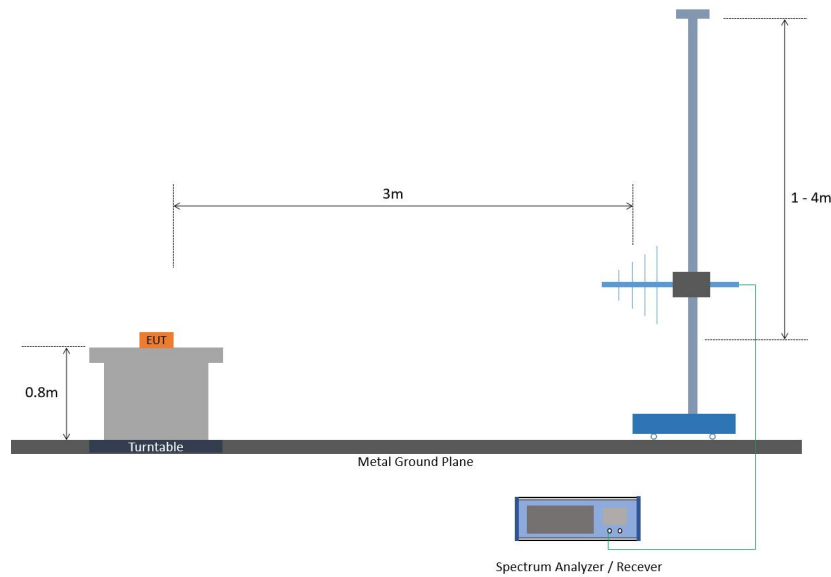
The radiated spurious emission was measured by substitution method according to ANSI C63.26. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB.

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

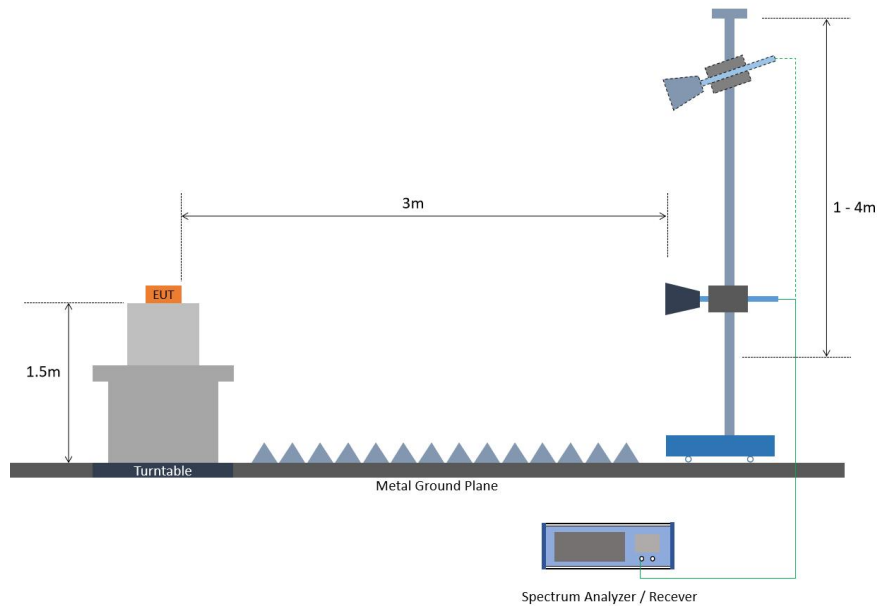
Test Setup



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.

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

NR Band n2	Refer to "Attachment B.9" file.
NR Band n5	Refer to "Attachment B.10" file.
NR Band n12	Refer to "Attachment B.11" file.
NR Band n66	Refer to "Attachment B.12" file.
NR Band n77 (3450 to 3550)	Refer to "Attachment B.13" file.
NR Band n77 (3700 to 3980)	Refer to "Attachment B.14" file.
NR Band n78 (3450 to 3550)	Refer to "Attachment B.15" file.
NR Band n78 (3700 to 3800)	Refer to "Attachment B.16" file.

Test Results of Radiated Test

All NR SA Bands	Refer to "Attachment C.3" file.
All NR NSA Bands	Refer to "Attachment C.4" file.

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