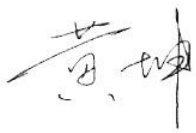
TEST REPORT

Applicant:	Tri Cascade Inc.
EUT Description:	VOS 5G Dongle
Model Tested:	VOS5-GF-2
Model Covered:	VOS5-NA-1, VOS5-NA-2, GC54310R-1
Brand:	TRI CASCADE VOS
FCC ID:	2ACARVOS5G
Standards:	FCC CFR Title 47 Part 2
	FCC CFR Title 47 Part 22
	FCC CFR Title 47 Part 24
	FCC CFR Title 47 Part 27
	FCC CFR Title 47 Part 90
	FCC CFR Title 47 Part 96
Date of Receipt:	2024/05/13
Date of Test:	2024/05/13 to 2024/08/02
Date of Issue:	2024/08/02

TOWE. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

the results documented in this report apply only the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility assure that additional production units of the model are manufactured with identical electrical and mechanical components. All sample tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise. without written approval of TOWE, the test report shall not be reproduced except in full.



Huangkun
Approved By:

ChenChengfu
Reviewed By:

Revision History

Rev.	Issue Date	Description	Revised by
01	2024/07/09	Original	ChenChengfu
02	2024/08/02	Update page 3 "Remark", Update ' Appendix-A NR ' data	ChenChengfu

Summary of Test Results

FCC Part	Test Band	Test Item	Test Result	Note
§2.1046 §22.913(a)(5) §27.50(c)(10) §90.541(c)	 NR n5 NR n12/71 NR n14	Effective Radiated Power	Pass	N/A
§2.1046 §24.232(c) §27.50(a)(3) §27.50(d)(4) §27.50(h)(2) §27.50(k)(3) §27.50(j)(3) §96.41(b)	 NR n2/25 NR n30 NR n66/70 NR n41 NR n77 NR n77 NR n48	Effective Isotropic Radiated Power	Pass	N/A
§22.913(d) §24.232(d) §27.50(d)(5) §96.41(g)	NR n5 NR n2/25 Others NR Band NR n48	Peak-Average Ratio	N/A*	See Remark
§2.1049	All NR Band	Occupied Bandwidth	N/A*	See Remark
§2.1051 §90.210(n)	 NR n14	Emission Mark	N/A*	See Remark
§2.1051 §22.917(a) §24.238(a) §27.53(g) §27.53(h) §27.53(a) §27.53(m) §27.53(n)(2) §27.53(i)(2) §90.543(e)(2)(3) §96.41(e)	 NR n5 NR n2/25 NR n12/71 NR n66/70 NR n30 NR n41 NR n77 NR n77 NR n14 NR n48	Band Edge	N/A*	See Remark
§2.1051 §22.917(a) §24.238(a) §27.53(g) §27.53(h) §27.53(m) §27.53(a) §27.53(n)(2) §27.53(i)(2) §90.543(c)(f) §96.41(e)	 NR n5 NR n2/25 NR n12/71 NR n66/70 NR n41 NR n30 NR n77 NR n77 NR n14 NR n48	Spurious Emission at Antenna Terminals	N/A*	See Remark
§2.1053 §22.917(a) §24.238(a) §27.53(g) §27.53(h) §27.53(m) §27.53(a) §27.53(n)(2) §27.53(i)(2) §90.543(c)(f) §96.41(e)(f)	 NR n5 NR n2/25 NR n12/71 NR n66/70 NR n41 NR n30 NR n77 NR n77 NR n14 NR n48	Field Strength of Spurious Radiation	Pass	N/A
§2.1055 §22.355 §24.235 §27.54 §90.213	 NR n5 NR n2/25 Others NR Band NR n14	Frequency Stability	N/A*	See Remark

Remark:
1. Pass: Meet the requirement.
2. N/A*: Refer to Module FCC ID: ZMOFM160NA, Detailed data reference Report No.: SUZR/2022/1002202, provided by SGS-CSTC Standards Technical Services (Suzhou) Co., Ltd. And regarding Band 48 refer Report No.: FYCR220400010001, provided by Compliance Certification Services (Kunshan) Inc. Shenzhen Branch.

Table of Contents

1 General Description

1.1 Lab Information

1.1.1 Testing Location

These measurements tests were conducted at the Sushi TOWE Wireless Testing(Shenzhen) Co., Ltd. facility located at F401 and F101, Building E, Hongwei Industrial Zone, Liuxian 3rd Road, Bao'an District, Shenzhen, China. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014
Tel.: +86-755-27212361
Contact Email: info@towewireless.com

1.1.2 Test Facility / Accreditations

A2LA (Certificate Number: 7088.01)
This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

FCC Designation No.: CN1353
Sushi TOWE Wireless Testing (Shenzhen) Co., Ltd. has been recognized as an accredited testing laboratory. Designation Number: CN1353.

ISED CAB identifier: CN0152
Sushi TOWE Wireless Testing (Shenzhen) Co., Ltd. has been recognized by ISED as an accredited testing laboratory.
CAB identifier: CN0152
Company Number: 31000

1.2 Client Information

1.2.1 Applicant

Applicant:	Tri Cascade Inc.
Address:	19200 Von Karman Ave, Ste 400, Irvine, CA 92612

1.2.2 Manufacturer

Manufacturer:	Tri Cascade Inc.
Address:	19200 Von Karman Ave, Ste 400, Irvine, CA 92612

1.3 Product Information

EUT Description:	VOS 5G Dongle		
Model Tested:	VOS5-GF-2		
Model Covered:	VOS5-NA-1, VOS5-NA-2, GC54310R-1		
Brand:	TRI CASCADE VOS		
Hardware Version:	V1.1		
Software Version:	FG19_V01.15b01		
IMEI:	862513050032357 (Test RF) 862513050034403 (Test RSE)		
Technical specification:			
Operation Frequency Range:	Band	TX Frequency	RX Frequency
	5G NR n2	1850 ~ 1910 MHz	1930 ~ 1990 MHz
	5G NR n5	824 ~ 849 MHz	869 ~ 894 MHz
	5G NR n12	699 ~ 716 MHz	729 ~ 746 MHz
	5G NR n14	788 ~ 798 MHz	758 ~ 768 MHz
	5G NR n25	1850 ~ 1915MHz	1930 ~ 1995 MHz
	5G NR n30	2305 ~ 2315 MHz	2350 ~ 2360 MHz
	5G NR n41	2496 ~ 2690MHz	2496 ~ 2690MHz
	5G NR n48	3550 ~ 3700MHz	3550 ~ 3700MHz
	5G NR n66	1710 ~ 1780 MHz	2110 ~ 2200 MHz
	5G NR n70	1695 ~ 1710 MHz	1995 ~ 2020 MHz
	5G NR n71	663 ~ 698 MHz	617 ~ 652 MHz
	5G NR n77 (3450 ~ 3550 MHz)	3450 ~ 3550 MHz	3450 ~ 3550 MHz
	5G NR n77 (3700 ~ 3980 MHz)	3700 ~ 3980 MHz	3700 ~ 3980 MHz
Type of Modulation:	☒ DFT-s-OFDM:	Pi/2-BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM	
	☒ CP-OFDM:	QPSK, 16-QAM, 64-QAM, 256-QAM	

Operation Bandwidth:

NR Band	SCS (KHz)	Bandwidth (MHz)											
		5	10	15	20	25	30	40	50	60	70	80	90	100
2	15	√	√	√	√									
5	15	√	√	√	√									
12	15	√	√	√										
14	15	√	√											
25	15	√	√	√	√	√	√	√						
30	15	√	√											
41	30				√		√	√	√	√	√	√	√	√
48	30		√		√		√	√						
66	15	√	√	√	√		√	√						
70	15	√	√	√										
71	15	√	√	√	√									
77	30		√	√	√		√	√	√	√	√	√	√	√

NR Mode	NSA(EN-DC): DC_2A_n77A/DC_5A_n77A/DC_12A_n77A/DC_13A_n77A/DC_66A_n77A

	DC_2A_n71A/DC_66A_n71A DC_2A_n5A/DC_12A_n5A/DC_13A_n5A/DC_30A_n5A/DC_48A_n5A/DC_66A_n5A DC_2A_n41A/DC_66A_n41A DC_2A_n30A/DC_5A_n30A/DC_12A_n30A/DC_66A_n30A DC_5A_n2A/DC_12A_n2A/DC_13A_n2A/DC_30A_n2A/DC_66A_n2A DC_12A_n25A/DC_48A_n25A/DC_66A_n25A DC_2A_n66A/DC_5A_n66A/DC_12A_n66A/DC_13A_n66A/DC_30A_n66A/DC_48A_n66A SA: n2/n5/n12/n14/n25/n41/n66//n70/n71/n77 UL-MIMO:n41/n77	
Antenna Type:	☐ External, ☒ Integrated	
Antenna Gain:	5G NR n2	Ant 0: 0.91dBi
	5G NR n5	Ant 3: -1.03dBi
	5G NR n12	Ant 3: 0.26dBi
	5G NR n14	Ant 3: 0.13dBi
	5G NR n25	Ant 0: 0.72dBi
	5G NR n30	Ant 0: -0.48dBi
	5G NR n41	Ant 0: 0.9dBi, Ant 3: 0.6dBi
	5G NR n48	Ant 0: 0.92dBi
	5G NR n66	Ant 0: 0.96dBi
	5G NR n70	Ant 0: 0.27dBi
	5G NR n71	Ant 3: -1.01dBi
	5G NR n77	Ant 0: 0.99dBi, Ant 3: -0.28dBi
	Provided by Applicant	

Remark:

1. The above EUT's information was declared by applicant, please refer to the specifications or user manual for more detailed description.
2. Reference applicant Model Confirmation Letter:
   Their electrical circuit design, layout, components used and internal wiring are identical,
   Only the combinations of device color and logo color are different.
   VOS5-NA-1 White/Light Grey,
   VOS5-GF-2 White/Dark Grey,
   GC54310R-1 Light Grey W/RGB logo,
   VOS5-NA-2 Dark Grey.

2 Test Configuration

2.1 Test Channel

5G NR Band n2 and SCS 15 kHz						
Bandwidth	TX Frequency			RX Frequency		
	Range	Carrier centre (ARFCN)	Carrier centre (MHz)	Range	Carrier centre (ARFCN)	Carrier centre (MHz)
5MHz	Low	370500	1852.5	Low	386500	1932.5
	Middle	376000	1880	Middle	392000	1960
	High	381500	1907.5	High	397500	1987.5
10MHz	Low	371000	1855	Low	387000	1935
	Middle	376000	1880	Middle	392000	1960
	High	381000	1905	High	397000	1985
15MHz	Low	371500	1857.5	Low	387500	1937.5
	Middle	376000	1880	Middle	392000	1960
	High	380500	1902.5	High	396500	1982.5
20MHz	Low	372000	1860	Low	388000	1940
	Middle	376000	1880	Middle	392000	1960
	High	380000	1900	High	396000	1980
5G NR Band n5 and SCS 15 kHz						
Bandwidth	TX Frequency			RX Frequency		
	Range	Carrier centre (ARFCN)	Carrier centre (MHz)	Range	Carrier centre (ARFCN)	Carrier centre (MHz)
5MHz	Low	165300	826.5	Low	174300	871.5
	Middle	167300	836.5	Middle	176300	881.5
	High	169300	846.5	High	178300	891.5
10MHz	Low	165800	829	Low	174800	874
	Middle	167300	836.5	Middle	176300	881.5
	High	168800	844	High	177800	889
15MHz	Low	166300	831.5	Low	175300	876.5
	Middle	167300	836.5	Middle	176300	881.5
	High	168300	841.5	High	177300	886.5
20MHz	Low	166800	834	Low	175800	879
	Middle	167300	836.5	Middle	176300	881.5
	High	167800	839	High	176800	884
5G NR Band n12 and SCS 15 kHz						
Bandwidth	TX Frequency			RX Frequency		
	Range	Carrier centre (ARFCN)	Carrier centre (MHz)	Range	Carrier centre (ARFCN)	Carrier centre (MHz)
5MHz	Low	140300	701.5	Low	146300	731.5
	Middle	141500	707.5	Middle	147500	737.5
	High	142700	713.5	High	148700	743.5
10MHz	Low	140800	704	Low	146800	734
	Middle	141500	707.5	Middle	147500	737.5
	High	142200	711	High	148200	741
15MHz	Low	141300	706.5	Low	147300	736.5
	Middle	141500	707.5	Middle	147500	737.5
	High	141700	708.5	High	147700	738.5
5G NR Band n14 and SCS 15 kHz						
Bandwidth	TX Frequency			RX Frequency		
	Range	Carrier centre (ARFCN)	Carrier centre (MHz)	Range	Carrier centre (ARFCN)	Carrier centre (MHz)
5MHz	Low	158100	790.5	Low	152100	760.5
	Middle	158600	793	Middle	152600	763
	High	159100	795.5	High	153100	765.5
10MHz	Low	158600	793	Low	152600	763
	Middle			Middle		

	High			High		
5G NR Band n25 and SCS 15 kHz						
Bandwidth	TX Frequency			RX Frequency		
	Range	Carrier centre (ARFCN)	Carrier centre (MHz)	Range	Carrier centre (ARFCN)	Carrier centre (MHz)
5MHz	Low	370500	1852.5	Low	386500	1932.5
	Middle	376500	1882.5	Middle	392500	1962.5
	High	382500	1912.5	High	398500	1992.5
10MHz	Low	371000	1855	Low	387000	1935
	Middle	376500	1882.5	Middle	392500	1962.5
	High	382000	1910	High	398000	1990
15MHz	Low	371500	1857.5	Low	387500	1937.5
	Middle	376500	1882.5	Middle	392500	1962.5
	High	381500	1907.5	High	397500	1987.5
20MHz	Low	372000	1860	Low	388000	1940
	Middle	376500	1882.5	Middle	392500	1962.5
	High	381000	1905	High	397000	1985
25MHz	Low	372500	1862.5	Low	388500	1942.5
	Middle	376500	1882.5	Middle	392500	1962.5
	High	380500	1902.5	High	396500	1982.5
30MHz	Low	373000	1865	Low	389000	1945
	Middle	376500	1882.5	Middle	392500	1962.5
	High	380000	1900	High	396000	1980
40MHz	Low	374000	1870	Low	390000	1950
	Middle	376500	1882.5	Middle	392500	1962.5
	High	379000	1895	High	395000	1975
5G NR Band n30 and SCS 15 kHz						
Bandwidth	TX Frequency			RX Frequency		
	Range	Carrier centre (ARFCN)	Carrier centre (MHz)	Range	Carrier centre (ARFCN)	Carrier centre (MHz)
5MHz	Low	461500	2307.5	Low	470500	2352.5
	Middle	462000	2310	Middle	471000	2355
	High	462500	2312.5	High	471500	2357.5
10MHz	Low	462000	2310	Low	471000	2355
	Middle			Middle		
	High			High		

5G NR Band n41, SCS 30 kHz and ΔF_{Raster} 30 KHz			
Bandwidth	TX & RX Frequency		
	Range	Carrier centre (ARFCN)	Carrier centre (MHz)
10MHz	Low	500202	2501.01
	Middle	518598	2593.005
	High	537000	2685
15MHz	Low	500700	2503.5
	Middle	518598	2593.005
	High	536498	2682.495
20MHz	Low	501204	2506.005
	Middle	518598	2593.005
	High	535998	2679.99
30MHz	Low	502200	2511
	Middle	518598	2593.005
	High	534996	2674.993
40MHz	Low	503202	2516.01
	Middle	518598	2593.005
	High	534000	2670
50MHz	Low	504204	2521.005

	Middle	518598	2593.005
	High	532998	2664.99
60MHz	Low	505200	2506.005
	Middle	518598	2593.005
	High	531996	2679.99
70MHz	Low	507204	2536.02
	Middle	518598	2592.99
	High	529998	2649.99
80MHz	Low	507204	2511
	Middle	518598	2593.005
	High	529998	2674.993
90MHz	Low	508200	2516.01
	Middle	518598	2593.005
	High	528996	2670
100MHz	Low	509202	2521.005
	Middle	518598	2593.005
	High	528000	2664.99

5G NR Band n48, SCS 30 kHz and ΔF_{Raster} 30 KHz			
Bandwidth	TX & RX Frequency		
	Range	Carrier centre (ARFCN)	Carrier centre (MHz)
10MHz	Low	637000	3555
	Middle	641666	3624.99
	High	646332	3694.98
20MHz	Low	637334	3560.01
	Middle	641666	3624.99
	High	646000	3690
30MHz	Low	637668	3565.02
	Middle	641666	3624.99
	High	645666	3684.99
40MHz	Low	638000	3570
	Middle	641666	3624.99
	High	645332	3679.98

5G NR Band n66, SCS 15 kHz						
Bandwidth	TX Frequency			RX Frequency		
	Range	Carrier centre (ARFCN)	Carrier centre (MHz)	Range	Carrier centre (ARFCN)	Carrier centre (MHz)
5MHz	Low	435500	1712.5	Low	422500	2112.5
	Middle	342500	1745	Middle	429000	2145
	High	349000	1777.5	High	435500	2177.5
10MHz	Low	343000	1715	Low	423000	2115
	Middle	349000	1745	Middle	429000	2145
	High	355000	1775	High	435000	2175
15MHz	Low	343500	1717.5	Low	423500	2117.5
	Middle	349000	1745	Middle	429000	2145
	High	354500	1772.5	High	434500	2172.5
20MHz	Low	344000	1720	Low	424000	2120
	Middle	349000	1745	Middle	429000	2145
	High	354000	1770	High	434000	2170
30MHz	Low	345000	1725	Low	425000	2125
	Middle	349000	1745	Middle	429000	2145
	High	353000	1765	High	433000	2165
40MHz	Low	346000	1730	Low	426000	2130
	Middle	349000	1745	Middle	429000	2145
	High	352000	1760	High	432000	2160
5G NR Band n70, SCS 15 kHz						
Bandwidth	TX Frequency			RX Frequency		
	Range	Carrier centre (ARFCN)	Carrier centre (MHz)	Range	Carrier centre (ARFCN)	Carrier centre (MHz)
5MHz	Low	339500	1697.5	Low	399500	1997.5
	Middle	340500	1702.5	Middle	400500	2002.5
	High	341500	1707.5	High	401500	2007.5
10MHz	Low	340000	1700	Low	400000	2000
	Middle	340500	1702.5	Middle	400500	2002.5
	High	341000	1705	High	401000	2005
15MHz	Low	340500	1702.5	Low	400500	2002.5
	Middle			Middle		
	High			High		
5G NR Band n71, SCS 15 kHz						
Bandwidth	TX Frequency			RX Frequency		
	Range	Carrier centre (ARFCN)	Carrier centre (MHz)	Range	Carrier centre (ARFCN)	Carrier centre (MHz)
5MHz	Low	133100	665.5	Low	123900	619.5
	Middle	136100	680.5	Middle	126900	634.5
	High	139100	695.5	High	129900	649.5
10MHz	Low	133600	668	Low	124400	622
	Middle	136100	680.5	Middle	126900	634.5
	High	138600	693	High	129400	647
15MHz	Low	134100	670.5	Low	124900	624.5
	Middle	136100	680.5	Middle	126900	634.5
	High	138100	690.5	High	128900	644.5
20MHz	Low	134600	673	Low	125400	627
	Middle	136100	680.5	Middle	126900	634.5
	High	137600	688	High	128400	642

5G NR Band n77(3450~3550MHz), SCS 30 kHz and ΔF_{Raster} 30 KHz			
Bandwidth	TX & RX Frequency		
	Range	Carrier centre (ARFCN)	Carrier centre (MHz)
10MHz	Low	630334	3455.010
	Middle	633334	3500.010
	High	636332	3544.980
15MHz	Low	630500	3457.500
	Middle	633334	3500.010
	High	636166	3542.490
20MHz	Low	630668	3460.020
	Middle	633334	3500.010
	High	636000	3540.000
30MHz	Low	631000	3465.000
	Middle	633334	3500.010
	High	635666	3534.990
40MHz	Low	631334	3470.010
	Middle	633334	3500.010
	High	635332	3529.980
50MHz	Low	631668	3475.020
	Middle	633334	3500.010
	High	635000	3525.000
60MHz	Low	632000	3480.000
	Middle	633334	3500.010
	High	634666	3519.990
70MHz	Low	632334	3485.010
	Middle	633334	3500.010
	High	634332	3514.980
80MHz	Low	632668	3490.020
	Middle	633334	3500.010
	High	634000	3510.000
90MHz	Low	633000	3495.000
	Middle	633334	3500.010
	High	633666	3504.990
100MHz	Low	633334	3500.010
	Middle		
	High		
5G NR Band n77(3700~3980MHz), SCS 30 kHz and ΔF_{Raster} 30 KHz			
Bandwidth	TX & RX Frequency		
	Range	Carrier centre (ARFCN)	Carrier centre (MHz)
10MHz	Low	647000	3705.000
	Middle	656000	3840.000
	High	665000	3975.000
15MHz	Low	647168	3707.520
	Middle	656000	3840.000
	High	664832	3972.480
20MHz	Low	647334	3710.010
	Middle	656000	3840.000
	High	664666	3969.990
30MHz	Low	647668	3715.020
	Middle	656000	3840.000
	High	664332	3964.980
40MHz	Low	648000	3720.000
	Middle	656000	3840.000
	High	664000	3960.000

50MHz	Low	648334	3725.010
	Middle	656000	3840.000
	High	663666	3954.990
60MHz	Low	648668	3730.020
	Middle	656000	3840.000
	High	663332	3949.980
70MHz	Low	649000	3735.000
	Middle	656000	3840.000
	High	663000	3945.000
80MHz	Low	649334	3740.010
	Middle	656000	3840.000
	High	662666	3939.990
90MHz	Low	649668	3745.020
	Middle	656000	3840.000
	High	662332	3934.980
100MHz	Low	650000	3750.000
	Middle	656000	3840.000
	High	662000	3930.000

2.2 Test Mode

Test Mode	Description
TM 1	EUT communication with simulated station in DFT-s-OFDM BPSK mode
TM 2	EUT communication with simulated station in DFT-s-OFDM QPSK mode
TM 3	EUT communication with simulated station in DFT-s-OFDM 16QAM mode
TM 4	EUT communication with simulated station in DFT-s-OFDM 64QAM mode
TM 5	EUT communication with simulated station in DFT-s-OFDM 256QAM mode
TM 6	EUT communication with simulated station in CP QPSK mode
TM 7	EUT communication with simulated station in CP 16QAM mode
TM 8	EUT communication with simulated station in CP 64QAM mode
TM 9	EUT communication with simulated station in CP 256QAM mode

2.3 Support Unit used in test

Description	Manufacturer	Model	Serial Number
Laptop	Apple	MacBook Pro 13	C02SPBESFVH3

2.4 Test Environment

Temperature:	Normal: 15℃ ~ 35℃
Relative Humidity	45-56 % RH Ambient
Voltage:	DC 5V

2.5 Test RF Cable

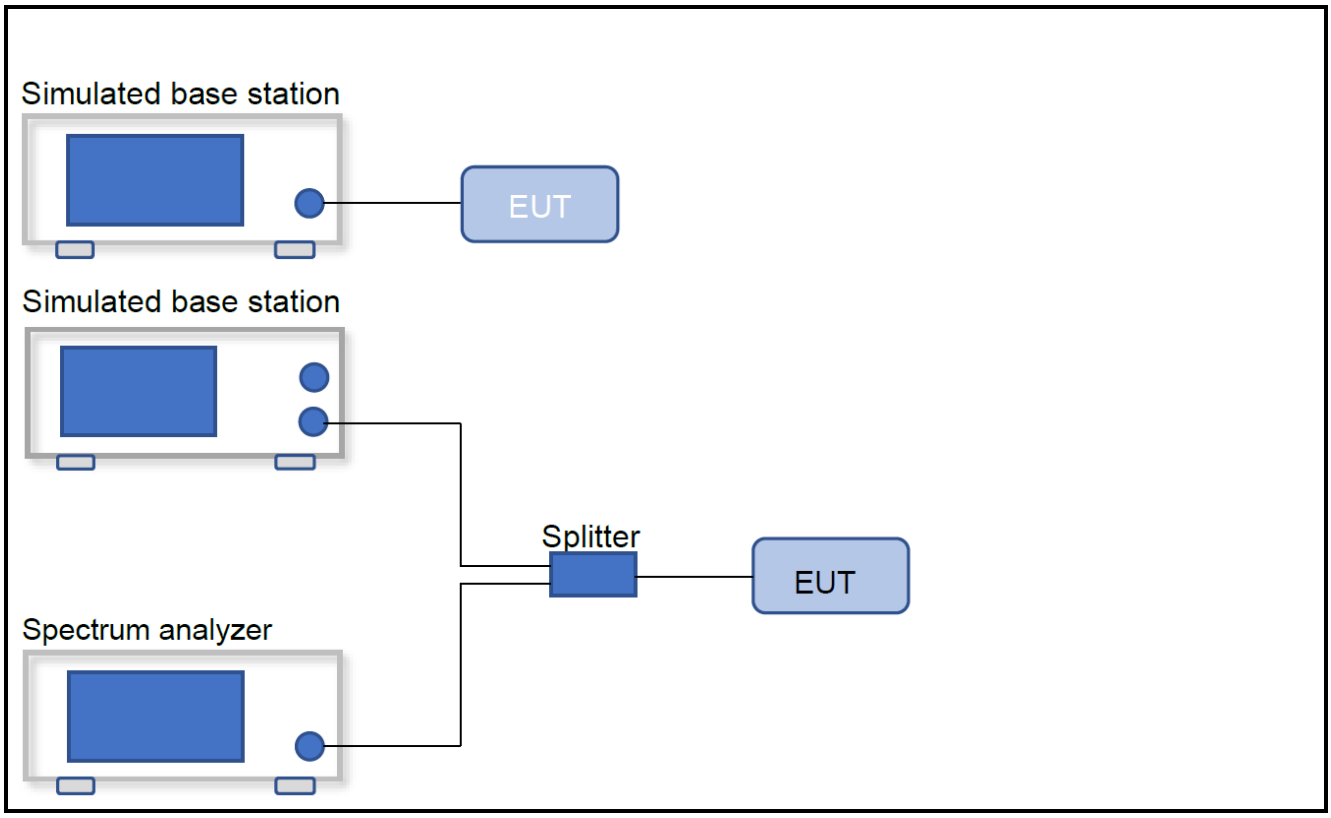
For all conducted test items: The offset level is set spectrum analyzer to compensate the RF cable loss and attenuator factor between RF conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level will be exactly the RF output level.
The spectrum analyzer offset is derived from RF cable loss and attenuator factor.
Offset = RF cable loss + attenuator factor.

2.6 Modifications

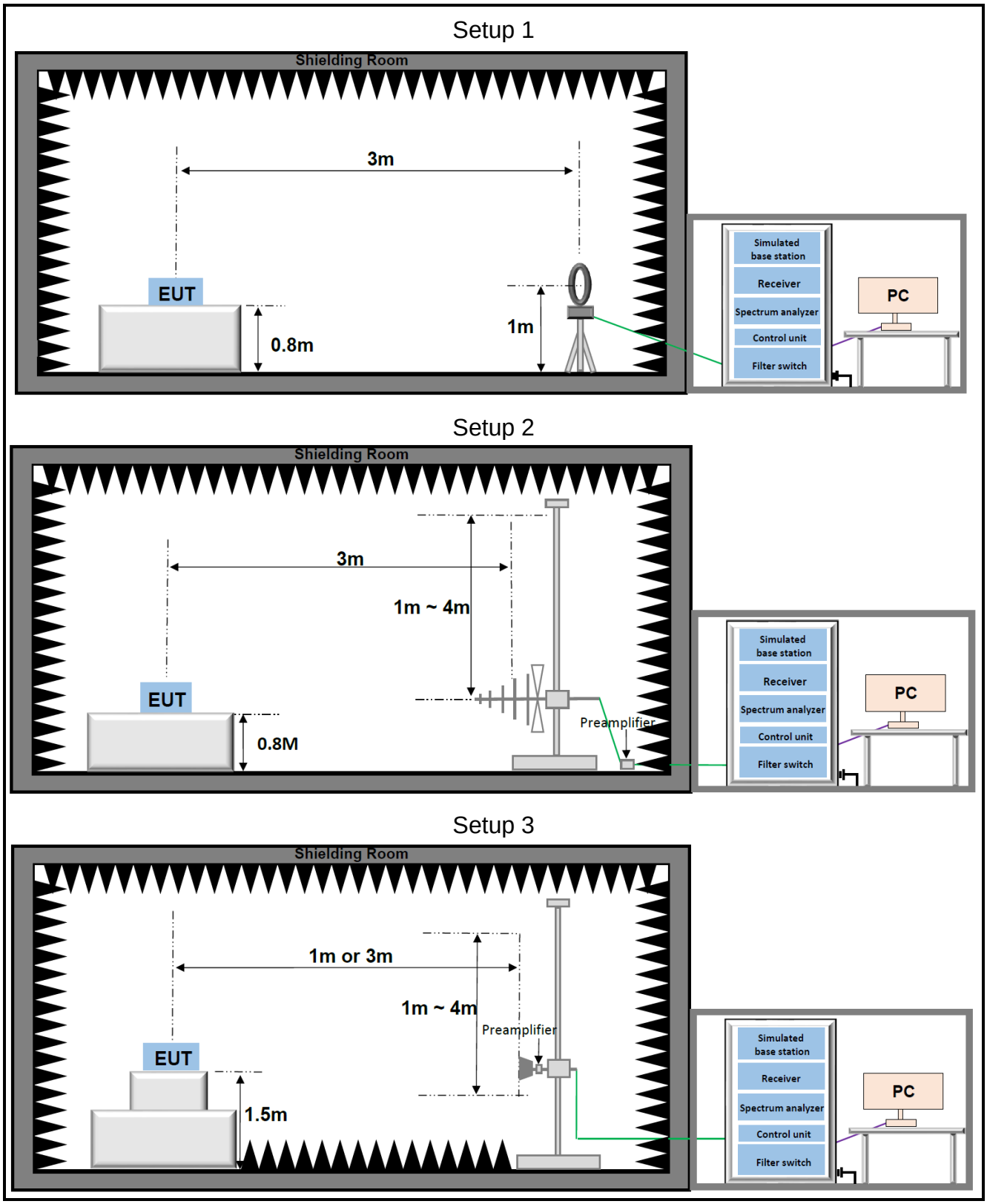
No modifications were made during testing.

2.7 Test Setup Diagram

2.7.1 Conducted Configuration



2.7.2 Radiated Configuration



3 Equipment and Measurement Uncertainty

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, whichever is less, and where applicable is traceable recognized national standards.

3.1 Test Equipment List

RF07					
Description	**Manufacturer**	**Model**	**SN**	**Last Due**	**Cal Due**
Radio Communication Test Station	Anritsu	MT8000A	6262208297	2023/11/07	2024/11/06
Signal Analyzer	Keysight	N9020A	MY53280106	2024/03/25	2025/03/24
EXA Signal Analyzer, Multi-touch	Keysight	N9010B	MY63440541	2023/06/27	2024/06/26
				2024/05/30	2025/05/29
Measurement Software	Tonscend	JS1120 V3.1.46	10636	N/A	N/A

966					
Description	**Manufacturer**	**Model**	**SN**	**Last Due**	**Cal Due**
Biconic Logarithmic Periodic Antennas	Schwarzbeck	VULB9163	1643	2023/06/25	2025/06/24
Double-Ridged Horn Antennas	Schwarzbeck	BBHA 9120D	2809	2023/06/25	2025/06/24
Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	1290	2023/06/25	2025/06/24
Loop Antenna	Schwarzbeck	FMZB 1519C	1519C-028	2023/06/29	2025/06/28
Signal Analyzer	Keysight	N9020A	MY49100252	2024/03/25	2025/03/24
5G NR Basestation	StartPoint	SP9500-CTS	SP20722	2024/03/25	2025/03/24
Low Noise Amplifier	Tonscend	TAP9K3G40	AP23A8060273	2023/04/08	2025/04/07
Low Noise Amplifier	Tonscend	TAP01018050	AP22G806258	2023/04/08	2025/04/07
Low Noise Amplifier	Tonscend	TAP18040048	AP22G806247	2023/04/08	2025/04/07
Hygrometer	BINGYU	HTC-1	N/A	2023/06/01	2025/05/31
Test Software	Tonscend	TS+ Version: 5.0.0	N/A	N/A	N/A

3.2 Measurement Uncertainty

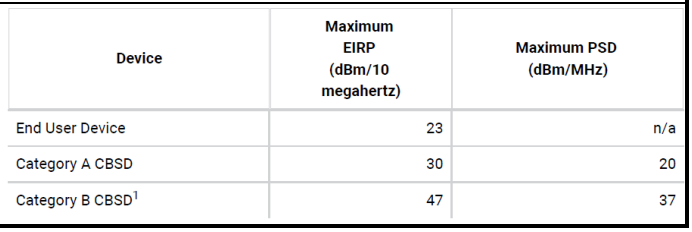
Parameter	U_{lab}
Output power	0.74dB
Radiated Emissions(9kHz~30MHz)	2.40dB
Radiated Emissions(30MHz~1000MHz)	4.66dB
Radiated Emissions(1GHz~18GHHz)	5.42dB
Radiated Emissions(18GHz~40GHHz)	5.46dB

Uncertainty figures are valid to a confidence level of 95%

4 Test Results

4.1 Output Power (ERP / EIRP / Conducted Power)

Limits

FCC Part	Test Band	Limit
§22.913(a)(5)	5G NR n5	The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7watts.
§24.232(c)	5G NR n2/25	Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.
§27.50(h)(2)	5G NR n41	Mobile and other user stations. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power
§27.50(d)(4)	5G NR n66/70	Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780MHz bands are limited to 1watt EIRP. Fixed stations operating in the 1710-1755MHz band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.
§27.50(c)(10)	5G NR n12/71	Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3watts ERP.
§27.50(k)(3)	5G NR n77(3450-3550MHz)	Mobile devices are limited to 1Watt (30 dBm) EIRP
§27.50(j)(3)	5G NR n77(3700-3980MHz)	Mobile and portable stations are limited to 1 Watt EIRP
§27.50(a)(3)	5G NR n30	Mobile and portable stations. (i) For mobile and portable stations transmitting in the 2305-2315 MHz band or the 2350-2360 MHz band, the average EIRP must not exceed 50 milliwatts within any 1 megahertz of authorized bandwidth,
§90.542(a)	5G NR n14	Portable stations (hand-held devices) transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to 3 watts ERP.
§96.41(b)	5G NR n48	

Device	Maximum EIRP (dBm/10 megahertz)	Maximum PSD (dBm/MHz)
End User Device	23	n/a
Category A CBSD	30	20
Category B CBSD[1]	47	37

Test Procedure

KDB 971168 D01 V03r01 Section 5.2.1, for Conducted Output Power
KDB 971168 D01 V03r01 Section 5.2, for Effective (Isotropic) Radiated Power

Test Settings

Conducted Output Power:

The transmitter output was connected to a calibrated attenuator, the other end of which was connected to the simulated base station. The simulated station was set to force the EUT to its maximum power setting, Transmitter output power was read off in dBm, read values have added cable loss and attenuation.

Radiated Power:

The formula for calculating ERP/EIRP based on conduction power is as follows:
EIRP (dBm) = Conducted Power (dBm) + antenna gain (dBi)
ERP=EIRP - 2.15dB

Test Notes

The transmitter output was connected to a calibrated coaxial cable and coupler, The other end is connected to the spectrum analyzer and simulated station.
The simulated base station was set to force the EUT to its maximum transmitting power.

1. NR n30 test Setting:
   RBW =5MHz
   VBW ≥5MHz
2. NR n48 test Setting:
   RBW =8MHz
   VBW ≥8MHz

**Result (dBm/10MHz) = Measurement value(dBm/8MHz) - 10log(Test RBW / Limit RBW) + Duty cycle factor*

Test Setup

Refer to section 2.7.1

Measuring Instruments

The measuring equipment is listed in the section 3.1 of this test report.

Test Results

The detailed test data see: **Appendix.**

4.2 Field Strength of Spurious Radiation

Limits

FCC part	Test Band	Limit
§22.917(a) §24.238(a) §27.53(g) §27.53(h) §90.543(f)	5G NR n2/5/12/25/66/70/71	The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
§90.543(e)(f)	5G NR n14	least 43 + 10 log (P) dB. For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotopically radiated power (EIRP) for wideband signals.
§27.53(m)	5G NR n41	All frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz.
§27.53(a)	5G NR n30	By a factor of not less than: 43 + 10 log (P) dB on all frequencies between 2305 and 2320 MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band(s) of operation, not less than 55 + 10 log (P) dB on all frequencies between 2320 and 2324 MHz and on all frequencies between 2341 and 2345 MHz, not less than 61 + 10 log (P) dB on all frequencies between 2324 and 2328 MHz and on all frequencies between 2337 and 2341 MHz, and not less than 67 + 10 log (P) dB on all frequencies between 2328 and 2337 MHz; By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2300 and 2305 MHz, 55 + 10 log (P) dB on all frequencies between 2296 and 2300 MHz, 61 + 10 log (P) dB on all frequencies between 2292 and 2296 MHz, 67 + 10 log (P) dB on all frequencies between 2288 and 2292 MHz, and 70 + 10 log (P) dB below 2288 MHz; By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2360 and 2365 MHz, and not less than 70 + 10 log (P) dB above 2365 MHz.
§96.41	5G NR n48	the conducted power of any End User Device emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed −13 dBm/MHz within 0 to B megahertz (where B is the bandwidth in megahertz of the assigned channel or multiple contiguous channels of the End User Device) above the upper CBSD-assigned channel edge and within 0 to B megahertz below the lower CBSD-assigned channel edge. At all frequencies greater than B megahertz above the upper CBSD assigned channel edge and less than B megahertz below the lower CBSD-assigned channel edge, the conducted power of any End User Device emission shall not exceed −25 dBm/MHz the conducted power of emissions below 3540 MHz or above 3710 MHz shall not exceed −25 dBm/MHz, and the conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed −40dBm/MHz.

§27.53(n)(2)	5G NR n77(3450-3550MHz)	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
§27.53(l)(2)	5G NR n77(3700-3980MHz)	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

Test Procedure

KDB 971168 D01 V03r01 Section 7

Test Settings

1. For radiated emissions measurements performed at frequencies less than or equal to 1GHz, the EUT shall be placed on a RF-transparent table or support at a nominal height of 80cm above the reference ground plane.
2. For radiated emissions measurements performed at frequencies above 1GHz, the EUT shall be placed on a RF-transparent table or support at a nominal height of 150cm above the ground plane.
3. Radiated measurements shall be made with the measurement antenna positioned in both horizontal and vertical polarization. The measurement antenna shall be varied from 1m to 4m in height above the reference ground in a search for the relative positioning that produces the maximum radiated signal level (i.e, field strength or received power), when orienting the measurement antenna in vertical polarization, the minimum height of the lowest element of the antenna shall clear the site reference ground plane by at least 25cm.
4. For each suspected emission, the EUT was ranged its worst case and then tune the antenna tower(from 1~4m) and turntable(from 0~360°) find the maximum reading. Preamplifier and a high pass filter are used for the test in order get better signal level comply with the guidelines.
5. The simulated base station was set to force the EUT to its maximum transmitting power.
6. spectrum analyzer setting:
   Measurements 9KHz~150KHz: RBW = 300Hz; VBW ≥ 3 kHz; Detector = RMS
   Measurements 150KHz~30MHz: RBW = 10KHz; VBW ≥ 30 kHz; Detector = RMS
   Measurements 30MHz~1000MHz: RBW = 100KHz or 1MHz; VBW ≥ 1MHz or 3MHz; Detector = RMS
   Measurements Above 1000MHz: RBW = 1 MHz; VBW ≥ 3 MHz; Detector = RMS
7. The field strength is calculated by adding the Antenna Factor, Cable Factor. The basic equation with a sample calculation is as follows:
   E(dBμV/m) = Measured amplitude level (dBμV) + Cable Loss (dB) + Antenna Factor (dB/m).
   E(dBμV/m) = Measured amplitude level (dBm) + 107 + Cable Loss (dB) + Antenna Factor (dB/m).
   E(dBuV/m) = EIRP(dBm) - 20log(D) + 104.8; where D is the measurement distance(in the far field region) in m.
   EIRP(dBm) = E(dBμV/m) + 20log(D) - 104.8; where D is the measurement distance(in the far field region) in m.
   *So, from d: The measuring distance is usually at 3m, then 20*Log(3)=9.5424*
   Then, EIRP (dBm)= E (dBμV/m) +9.5424-104.8=E (dBμV/m)-95.2576
8. Repeat above procedures until all frequencies measured was complete.
9. Measure and record the results in the test report.

Test notes

1. The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst-case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.
2. Radiated spurious emissions were investigated from 9kHz to 30MHz, 30MHz-1GHz and above 1GHz. the disturbance between 9KHz to 30MHz and 18GHz to 40GHz was very low. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be recorded, so only the harmonics had been displayed.
3. The "/" shown in the following RSE tables are used to denote a noise floor measurement.

Test Setup

Refer to section 2.7.2.

Measuring Instruments

The measuring equipment is listed in the section 3.1 of this test report.

Test Result

The detailed test data see: **Appendix.**

Appendix

Appendix List:

Appendix-A NR

~The End~