

TEST REPORT

Applicant: Guangzhou Navigatoworx Technologies Co., Limited

Address of Applicant: Room 608, North Side, 6th Floor, Building No. 5, Guangzhou Sciencetech Park, No.9 Lan Yu No.4 Street, Huangpu District, Guangzhou City, Guangdong Province, China

Manufacturer/Factory: Guangzhou Navigatoworx Technologies Co., Limited

Address of Manufacturer/Factory: Room 608, North Side, 6th Floor, Building No. 5, Guangzhou Sciencetech Park, No.9 Lan Yu No.4 Street, Huangpu District, Guangzhou City, Guangdong Province, China

Equipment Under Test (EUT)

Product Name: NR500 Industrial Cellular VPN Router

Model No.: NR500-P4G, NR500-P3G, NR500-PNC, NR500-S4G, NR500-S3G, NR500-SNC

Trade Mark: 

FCC ID: 2A9WP-NR500

Applicable 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

Date of sample receipt: November 23, 2022

Date of Test: November 24, 2022-December 12, 2022

Date of report issued: December 12, 2022

Test Result : PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



Robinson Luo

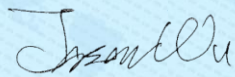
Laboratory Manager

This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

2 Version

Version No.	Date	Description
00	December 12, 2022	Original

Prepared By:

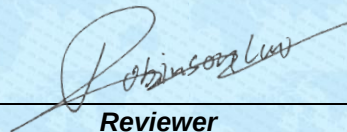


Project Engineer

Date:

December 12, 2022

Check By:



Reviewer

Date:

December 12, 2022

3 Contents

	Page
1 COVER PAGE	1
2 VERSION	2
3 CONTENTS	3
4 TEST SUMMARY	4
5 GENERAL INFORMATION	5
5.1 GENERAL DESCRIPTION OF EUT	5
5.2 RELATED SUBMITTAL(S) / GRANT (S)	7
5.3 TEST METHODOLOGY	7
5.4 DEVIATION FROM STANDARDS	7
5.5 ABNORMALITIES FROM STANDARD CONDITIONS	7
5.6 TEST FACILITY	7
5.7 TEST LOCATION	7
6 TEST INSTRUMENTS LIST	8
7 SYSTEM TEST CONFIGURATION	9
7.1 TEST MODE	9
7.2 CONFIGURATION OF TESTED SYSTEM	9
7.3 ERP/EIRP	10
7.4 SPURIOUS RADIATION EMISSIONS	13
8 TEST SETUP PHOTO	20
9 EUT CONSTRUCTIONAL DETAILS	20

4 Test Summary

Test Item	Section in CFR 47	Result
RF Output Power	Part 2.1046 Part 22.913 (a) Part 24.232 (c) Part 27.50	Pass*
ERP & EIRP	Part 2.1046 Part 22.913 (a) Part 24.232 (c) Part 27.50	Pass
Peak-to-Average Ratio	Part 2.1046 Part 24.232 Part 27.50	Pass*
Modulation Characteristics	Part 2.1047	N/A
99% Occupied Bandwidth & 26dB Bandwidth	Part 2.1049 Part 22.917(b) Part 24.238(b) Part 27.53	Pass*
Spurious Emissions at Antenna Terminal	Part 2.1051 Part 22.917 Part 24.238 Part 27.53	Pass*
Spurious Radiation Emissions	Part 2.1053 Part 22.917 Part 24.238 Part 27.53	Pass
Out of band emission, Band Edge	Part 22.913(a) Part 24.232(b) Part 27.50	Pass*
Frequency stability vs. temperature	Part 2.1055(a)(1)(b) Part 22.355 Part 24.235 Part 27.54	Pass*
Frequency stability vs. voltage	Part 2.1055(d)(1)(2) Part 22.355 Part 24.235 Part 27.54	Pass*

Remarks:

1. Pass*: This device has installed a certified modular which FCC ID: XMR2020008EC25AFXD, so these conducted test data directly reference the modular's data..
2. N/A: Not applicable.

5 General Information

5.1 General Description of EUT

Product Name:	NR500 Industrial Cellular VPN Router
Model No.:	NR500-P4G, NR500-P3G, NR500-PNC, NR500-S4G, NR500-S3G, NR500-SNC
Test Model No.:	NR500-P4G
Remark: All above models are identical in the same PCB layout, interior structure and electrical circuits. The only difference is model name for commercial purpose.	
Test sample(s) ID:	GTS202211000233-1
Sample(s) Status:	Engineer sample
Serial No.:	22115147330006
Hardware Version:	V1.0.0
Software Version:	3.0.0
Support Bands:	WCDMA Band II, WCDMA Band IV, WCDMA Band V
TX Frequency:	WCDMA Band II: 1850MHz -1910MHz WCDMA Band IV: 1710MHz -1755MHz WCDMA Band V: 824MHz -849MHz
Modulation type:	WCDMA Band II/IV/V: QPSK 16QAM
Antenna type:	ANT type 1: Terminal Antenna ANT type 2: Mobile Antenna The product includes two types of antennas. Each type of antenna includes ANT1 and ANT2 antennas respectively.
Antenna gain:	ANT type 1: 3dBi(ANT1 & ANT2) ANT type 2: 2dBi(ANT1 & ANT2)
Power supply:	AC/DC ADAPTER Model: SK02T-1200150U Input: AC 100-240V, 50/60Hz, 0.5A Output: DC 12V, 1.5A

Operation Frequency List:

WCDMA Band V		WCDMA Band II		WCDMA Band IV	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
4132	826.40	9262	1852.40	1312	1712.40
4133	826.60	9263	1852.60	1313	1712.60
⋮	⋮	⋮	⋮	⋮	⋮
4181	836.20	9399	1879.80	1411	1732.20
4182	836.40	9400	1880.00	1412	1732.40
4183	836.60	9401	1880.20	1413	1732.60
⋮	⋮	⋮	⋮	⋮	⋮
4232	846.40	9537	1907.40	1512	1752.40
4233	846.60	9538	1907.60	1513	1752.60

Final test channel:

WCDMA Band V		WCDMA Band II		WCDMA Band IV	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
4132	826.40	9262	1852.40	1312	1712.4
4183	836.60	9400	1880.00	1414	1732.8
4233	846.60	9538	1907.60	1513	1752.6

5.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is filing to comply with Section Part 22 /24/27 of the FCC CFR 47 Rules.

5.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures document on ANSI C63.26:2015 and FCC CFR 47.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055 and 2.1057

5.4 Deviation from Standards

None.

5.5 Abnormalities from Standard Conditions

None.

5.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC —Registration No.: 381383**

Designation Number: CN5029

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files.

- **IC —Registration No.: 9079A**

CAB identifier: CN0091

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with.

- **NVLAP (LAB CODE:600179-0)**

Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

5.7 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.

Address: No. 123-128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102

Tel: 0755-27798480

Fax: 0755-27798960

6 Test Instruments list

Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	July 02, 2020	July 01, 2025
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	April 22, 2022	April 21, 2023
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9168	GTS640	March 21, 2022	March 20, 2023
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	GTS208	June 12, 2022	June 11, 2023
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	June 23, 2022	June 22, 2023
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
8	Coaxial Cable	GTS	N/A	GTS213	April 22, 2022	April 21, 2023
9	Coaxial Cable	GTS	N/A	GTS211	April 22, 2022	April 21, 2023
10	Coaxial cable	GTS	N/A	GTS210	April 22, 2022	April 21, 2023
11	Coaxial Cable	GTS	N/A	GTS212	April 22, 2022	April 21, 2023
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	April 22, 2022	April 21, 2023
13	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June 23, 2022	June 22, 2023
14	Band filter	Amindeon	82346	GTS219	June 23, 2022	June 22, 2023
15	Power Meter	Anritsu	ML2495A	GTS540	June 23, 2022	June 22, 2023
16	Power Sensor	Anritsu	MA2411B	GTS541	June 23, 2022	June 22, 2023
17	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS575	April 22, 2022	April 21, 2023
18	Splitter	Agilent	11636B	GTS237	June 23, 2022	June 22, 2023
19	Loop Antenna	ZHINAN	ZN30900A	GTS534	Nov. 29, 2022	Nov. 28, 2023
20	Broadband Preamplifier	SCHWARZBECK	BBV9718	GTS535	April 22, 2022	April 21, 2023
21	Breitband hornantenna	SCHWARZBECK	BBHA 9170	GTS579	Oct. 16, 2022	Oct. 15, 2023
22	Amplifier	TDK	PA-02-02	GTS574	Oct. 16, 2022	Oct. 15, 2023
23	Amplifier	TDK	PA-02-03	GTS576	Oct. 16, 2022	Oct. 15, 2023
24	PSA Series Spectrum Analyzer	Rohde & Schwarz	FSP	GTS578	June 23, 2022	June 22, 2023
25	Amplifier(1GHz-26.5GHz)	HP	8449B	GTS601	April 22, 2022	April 21, 2023

General used equipment:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Humidity/ Temperature Indicator	KTJ	TA328	GTS243	April 25, 2022	April 24, 2023
2	Barometer	KUMAO	SF132	GTS647	July 26, 2022	July 25, 2023

7 System test configuration

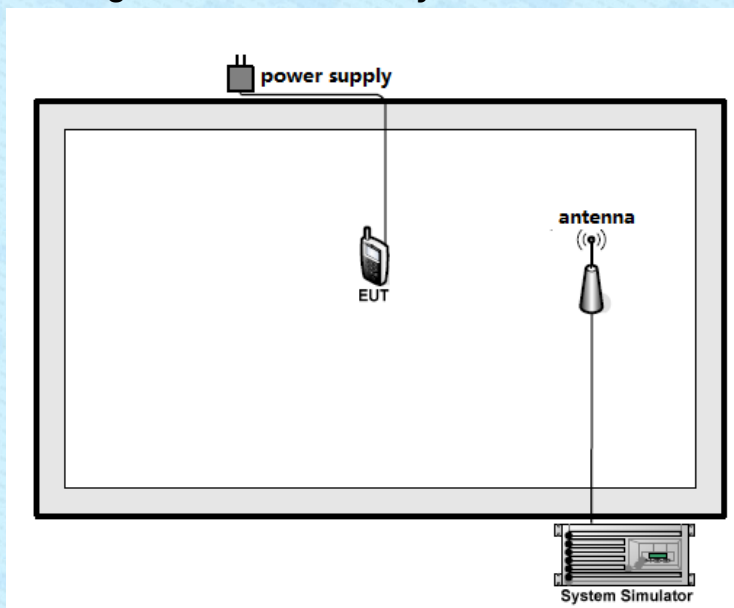
7.1 Test mode

During all testing, EUT is in link mode with base station emulator at maximum power level. The spurious emission measurements were carried out in semi-anechoic chamber with 3-meter test range, and EUT is rotated on the worst emission.

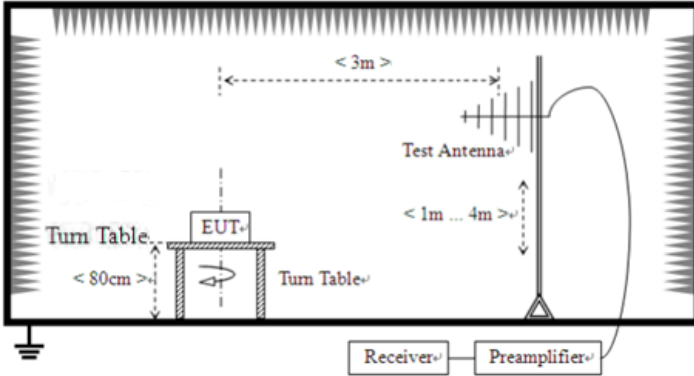
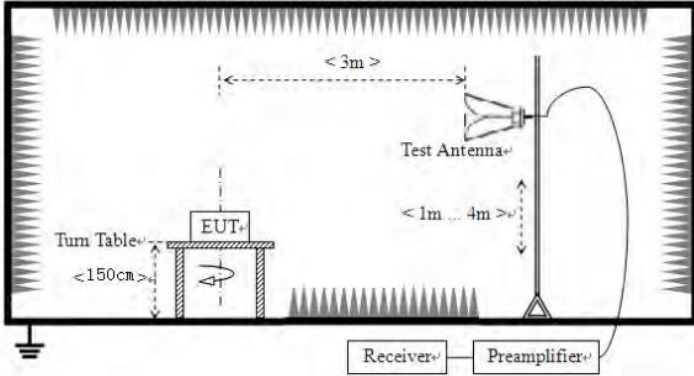
Test modes are chosen to be reported as the worst case configuration below:

Band	Test Mode
WCDMA II	RMC 12.2Kbps link, Middle channel
WCDMA Band IV	RMC 12.2Kbps link, Middle channel
WCDMA Band V	RMC 12.2Kbps link, Middle channel

7.2 Configuration of Tested System



7.3 ERP/EIRP

Test Requirement:	FCC part 22.913(a)
Test Method:	FCC part2.1046
Limit:	WCDMA Band V: 7W(38.45dBm) WCDMA Band II: 2W(33.01dBm) WCDMA Band IV:1W(30.00dBm)
Test setup:	For radiated emissions from 30MHz to1GHz  For radiated emissions above 1GHz 
Test Procedure:	Below 1GHz test procedure as below: 1.The EUT was powered ON and placed on a 0.8m high table in the chamber. The antenna of the transmitter was extended to its maximum length. 2.The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made. 3.Steps 1) and 2) were performed with the EUT and the receive antenna in both vertical and horizontal polarization. 4.The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter. 5.A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 2) is obtained for this set of conditions.

	6.The output power into the substitution antenna was then measured. 7.Steps 5) and 6) were repeated with both antennas polarized. 8.Calculate power in dBm by the following formula: $\text{ERP (dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBd)}$ Where: Pg is the generator output power into the substitution antenna. Above 1GHz test procedure as below: 1.Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber 2.Calculate power in dBm by the following formula: $\text{EIRP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBi)}$ $\text{EIRP} = \text{ERP} + 2.15\text{dB}$ Where: Pg is the generator output power into the substitution antenna. 3.Test the EUT in the lowest channel, the middle channel the Highest channel 4.The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, Only the test worst case mode is recorded in the report. 5.Repeat above procedures until all frequencies measured was complete.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 7.1 for details
Test results:	Pass

Measurement Data

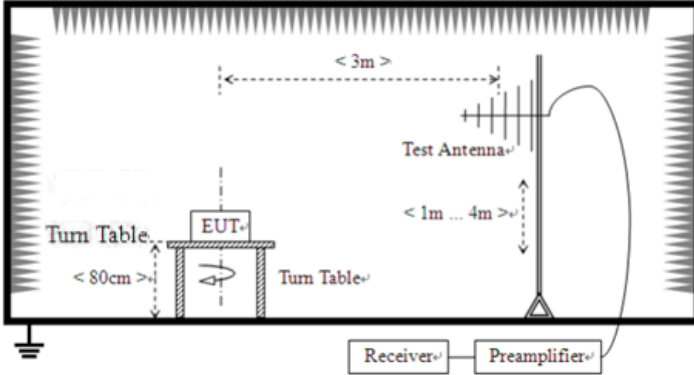
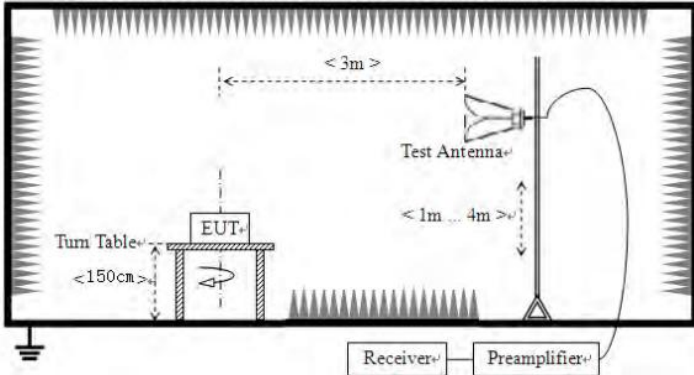
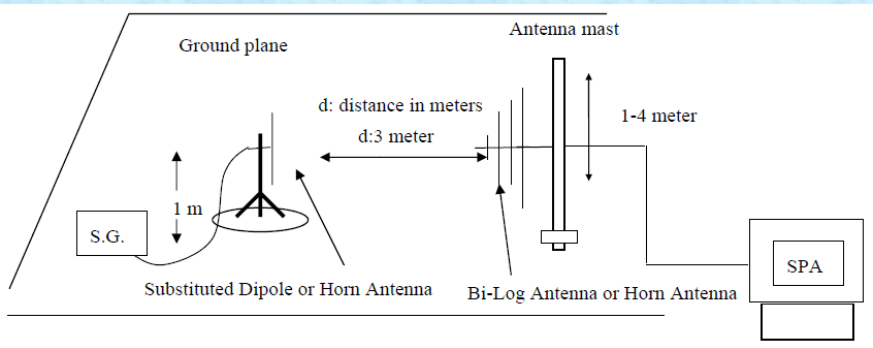
ANT type 1:

Mode	Channel	Frequency (MHz)	Polarization	EIRP (dBm)	Limit (dBm)	Conclusion
WCDMA Band II	Low	1852.4	Horizontal	22.18	33	Pass
	Mid	1880	Horizontal	22.72	33	Pass
	High	1907.6	Horizontal	23.74	33	Pass
WCDMA Band IV	Low	1712.4	Horizontal	23.91	30	Pass
	Mid	1732.6	Horizontal	24.19	30	Pass
	High	1752.6	Horizontal	23.88	30	Pass
WCDMA Band V	Low	826.4	Horizontal	21.48	38.45	Pass
	Mid	836.6	Horizontal	21.52	38.45	Pass
	High	846.6	Horizontal	21.84	38.45	Pass

ANT type 2:

Mode	Channel	Frequency (MHz)	Polarization	EIRP (dBm)	Limit (dBm)	Conclusion
WCDMA Band II	Low	1852.4	Horizontal	21.15	33	Pass
	Mid	1880	Horizontal	21.57	33	Pass
	High	1907.6	Horizontal	22.75	33	Pass
WCDMA Band IV	Low	1712.4	Horizontal	22.82	30	Pass
	Mid	1732.6	Horizontal	23.22	30	Pass
	High	1752.6	Horizontal	22.72	30	Pass
WCDMA Band V	Low	826.4	Horizontal	20.34	38.45	Pass
	Mid	836.6	Horizontal	20.57	38.45	Pass
	High	846.6	Horizontal	20.73	38.45	Pass

7.4 Spurious Radiation Emissions

Test Requirement:	FCC part 22.917 and FCC part 24.238 and Part 27.53
Test Method:	FCC part 2.1053 and ANSI C63.26:2015
Test setup:	Below 1GHz  Above 1GHz  Substituted method: 
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 7.1 for details
Test results:	Pass

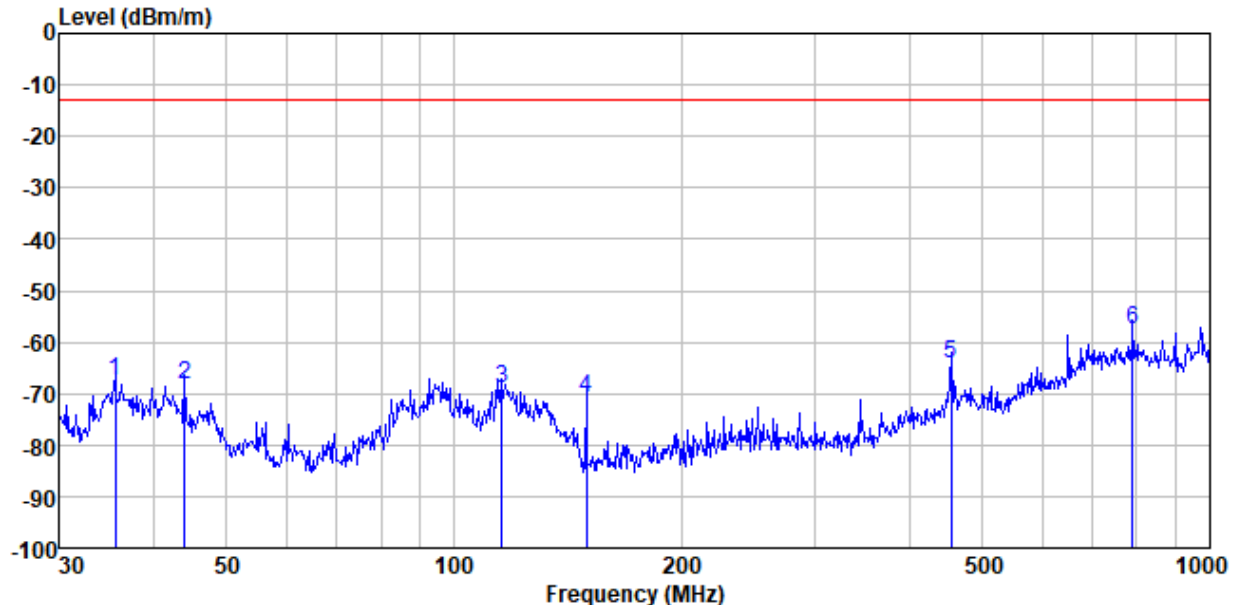
Measurement Data

Below 1GHz

Pre-scan all test modes, found worst case at WCDMA Band II, and so only show the test result of it

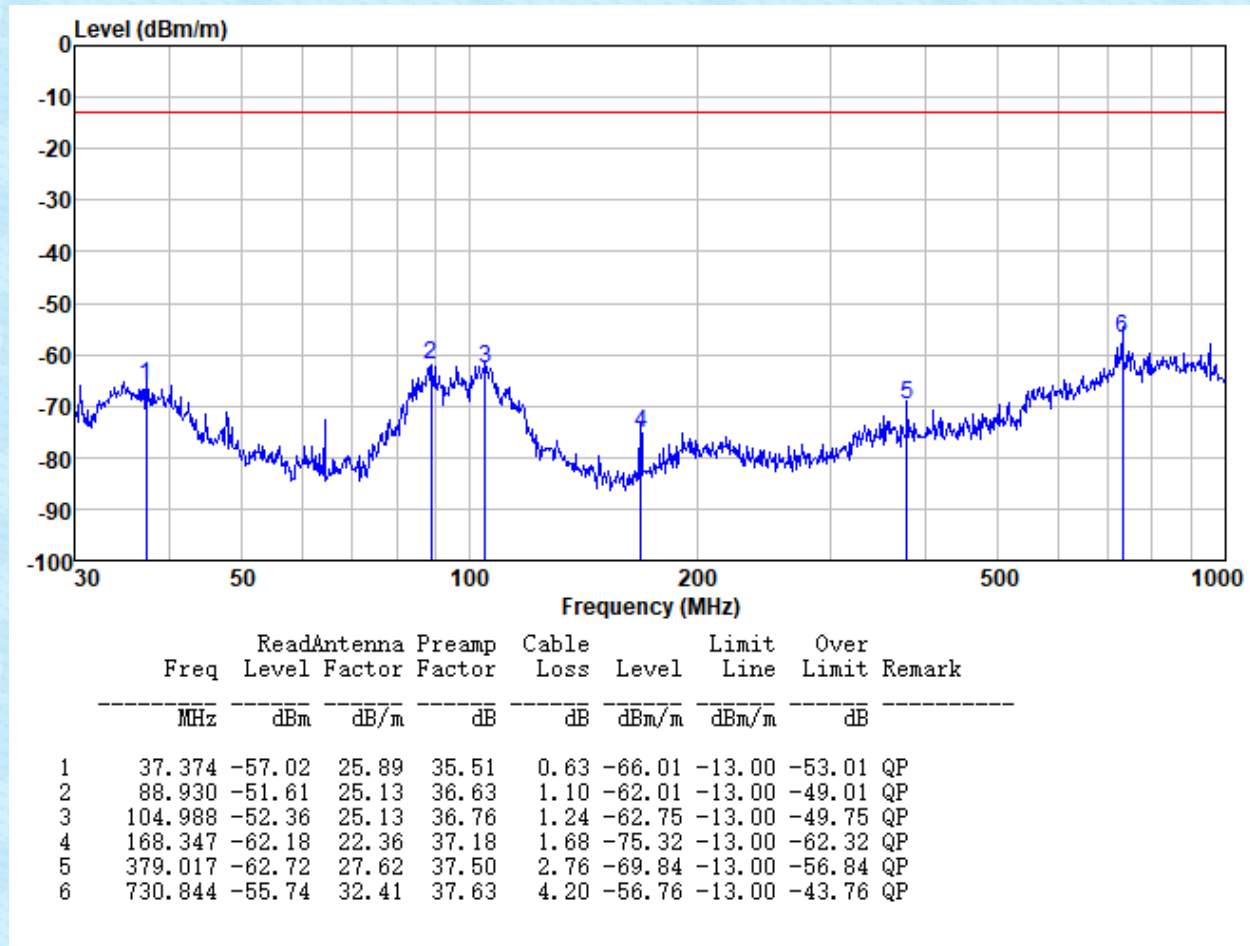
ANT type 1:

Horizontal:

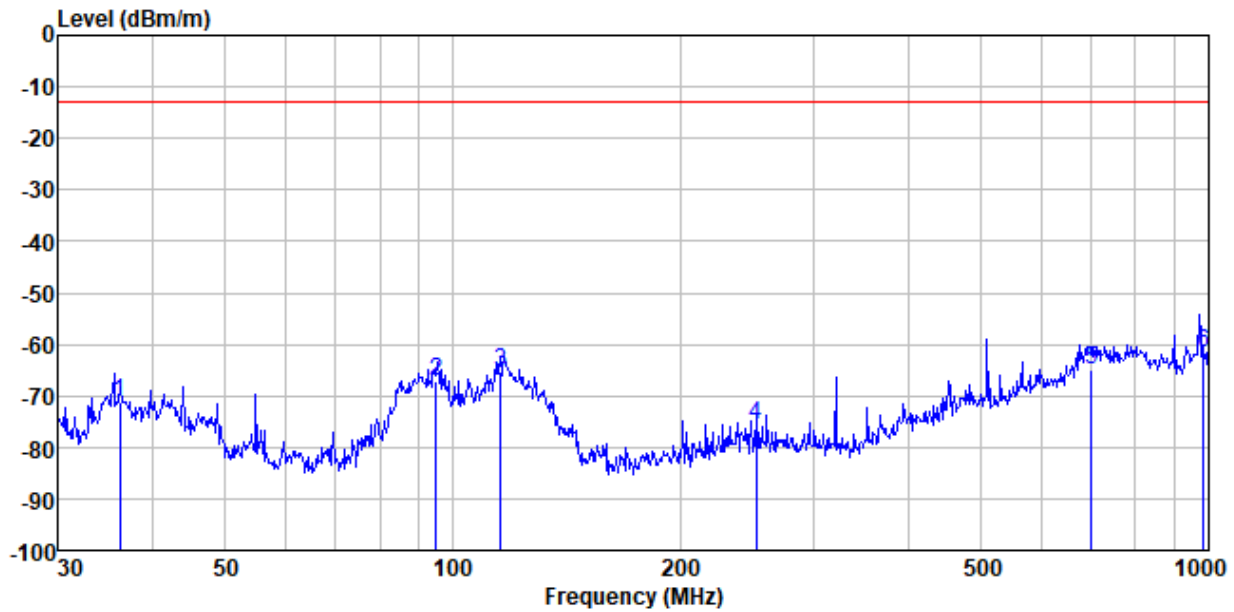


	Freq	ReadAntenna	Preamp	Cable	Level	Limit	Over	
	Level	Factor	Factor	Loss	Line	Limit	Limit	Remark
	dBm	dB/m	dB	dB	dBm/m	dBm/m	dB	
	MHz	dBm	dB/m	dB	dB	dBm/m	dB	
1	35.624	-58.69	25.89	35.40	0.62	-67.58	-13.00	-54.58 QP
2	43.960	-58.61	25.44	35.88	0.71	-68.34	-13.00	-55.34 QP
3	115.557	-56.84	23.18	36.85	1.32	-69.19	-13.00	-56.19 QP
4	149.603	-56.59	21.23	37.07	1.56	-70.87	-13.00	-57.87 QP
5	454.108	-58.61	28.93	37.51	3.11	-64.08	-13.00	-51.08 QP
6	789.711	-57.67	33.15	37.62	4.42	-57.72	-13.00	-44.72 QP

Vertical:

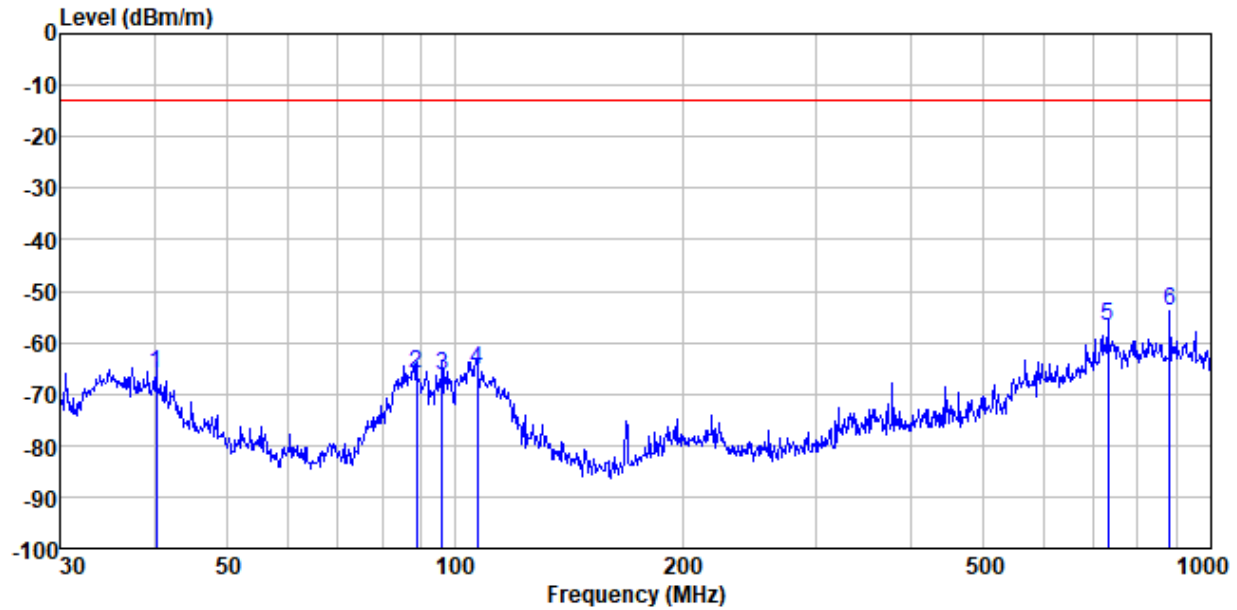


ANT type 2:
Horizontal:



	Freq	ReadAntenna	Preamp	Cable	Limit	Over		
	Level	Factor	Factor	Loss	Level	Line	Limit	Remark
	MHz	dBm	dB/m	dB	dBm/m	dBm/m	dB	
1	36.287	-62.19	25.89	35.44	0.62	-71.12	-13.00	-58.12 QP
2	95.035	-56.78	25.13	36.68	1.15	-67.18	-13.00	-54.18 QP
3	115.557	-52.84	23.18	36.85	1.32	-65.19	-13.00	-52.19 QP
4	251.669	-65.65	25.13	37.38	2.13	-75.77	-13.00	-62.77 QP
5	699.198	-63.50	32.08	37.63	4.08	-64.97	-13.00	-51.97 QP
6	985.353	-65.09	35.81	37.52	5.17	-61.63	-13.00	-48.63 QP

Vertical:



	Freq	Read Level	Antenna Factor	Preamplifier Factor	Cable Loss	Level	Limit	Over	Remark
	MHz	dBm	dB/m	dB	dB	dBm/m	dBm/m	dB	
1	40.235	-56.37	25.44	35.68	0.66	-65.95	-13.00	-52.95	QP
2	88.930	-55.61	25.13	36.63	1.10	-66.01	-13.00	-53.01	QP
3	96.093	-55.98	25.13	36.69	1.16	-66.38	-13.00	-53.38	QP
4	106.943	-54.93	25.13	36.78	1.25	-65.33	-13.00	-52.33	QP
5	730.844	-55.74	32.41	37.63	4.20	-56.76	-13.00	-43.76	QP
6	882.125	-55.14	34.05	37.60	4.79	-53.90	-13.00	-40.90	QP

Notes:

Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

Above 1GHz

Notes: Margin= Result+ Factor-Limit

ANT type 1:

WCDMA Band II @RMC 12.2Kbps link									
Channel	Frequency (MHz)	Ant. Pol.	Result (dBm)	Factor (dB)	Limit (dBm)	Margin (dB)	Ant. Height[cm]	Turntable deg.	verdict
Middle	2683.00	H	-51.74	-7.9	-13	-46.64	150	95.58	Pass
	6712.00	H	-56.28	3.06	-13	-40.22	150	72.18	Pass
	16334.00	H	-60.63	14.55	-13	-33.08	150	353.98	Pass
	1646.00	V	-49.10	-10.92	-13	-47.02	150	120.44	Pass
	7681.00	V	-56.05	6.15	-13	-36.90	150	100.35	Pass
	15416.00	V	-61.23	13.03	-13	-35.20	150	47.18	Pass

WCDMA Band IV @RMC 12.2Kbps link									
Channel	Frequency (MHz)	Ant. Pol.	Result (dBm)	Factor (dB)	Limit (dBm)	Margin (dB)	Ant. Height[cm]	Turntable deg.	verdict
Middle	1816.00	H	-49.97	-10.09	-13	-47.06	150	99.97	Pass
	10452.00	H	-58.91	9.84	-13	-36.07	150	15.01	Pass
	13614.00	H	-62.28	10.82	-13	-38.46	150	29.83	Pass
	2972.00	V	-51.85	-7.1	-13	-45.95	150	122.83	Pass
	7681.00	V	-56.05	6.15	-13	-36.9	150	75.16	Pass
	12968.00	V	-61.78	8.3	-13	-40.48	150	79.26	Pass

WCDMA Band V @RMC 12.2Kbps link									
Channel	Frequency (MHz)	Ant. Pol.	Result (dBm)	Factor (dB)	Limit (dBm)	Margin (dB)	Ant. Height[cm]	Turntable deg.	verdict
Middle	3312.00	H	-52.15	-6.49	-13	-45.64	150	65.19	Pass
	8871.00	H	-57.27	7.12	-13	-37.15	150	107.23	Pass
	14736.00	H	-62.12	13.21	-13	-35.91	150	36.55	Pass
	2326.00	V	-50.99	-8.7	-13	-46.69	150	271.91	Pass
	11744.00	V	-58.46	9.23	-13	-36.23	150	234.34	Pass
	16912.00	V	-63.1	15.43	-13	-34.67	150	171.33	Pass

ANT type 2:

WCDMA Band II @RMC 12.2Kbps link									
Channel	Frequency (MHz)	Ant. Pol.	Result (dBm)	Factor (dB)	Limit (dBm)	Margin (dB)	Ant. Height[cm]	Turntable deg.	verdict
Middle	2683.00	H	-52.63	-7.9	-13	-47.53	150	100.4	Pass
	6712.00	H	-57.3	3.06	-13	-41.24	150	77	Pass
	16334.00	H	-61.6	14.55	-13	-34.05	150	358.8	Pass
	1646.00	V	-49.96	-10.92	-13	-47.88	150	125.26	Pass
	7681.00	V	-56.96	6.15	-13	-37.81	150	105.17	Pass
	15416.00	V	-62.22	13.03	-13	-36.19	150	52	Pass

WCDMA Band IV @RMC 12.2Kbps link									
Channel	Frequency (MHz)	Ant. Pol.	Result (dBm)	Factor (dB)	Limit (dBm)	Margin (dB)	Ant. Height[cm]	Turntable deg.	verdict
Middle	1816.00	H	-50.86	-10.09	-13	-47.95	150	104.79	Pass
	10452.00	H	-59.93	9.84	-13	-37.09	150	19.83	Pass
	13614.00	H	-63.25	10.82	-13	-39.43	150	34.65	Pass
	2972.00	V	-52.71	-7.1	-13	-46.81	150	127.65	Pass
	7681.00	V	-56.96	6.15	-13	-37.81	150	79.98	Pass
	12968.00	V	-62.77	8.3	-13	-41.47	150	84.08	Pass

WCDMA Band V @RMC 12.2Kbps link									
Channel	Frequency (MHz)	Ant. Pol.	Result (dBm)	Factor (dB)	Limit (dBm)	Margin (dB)	Ant. Height[cm]	Turntable deg.	verdict
Middle	3312.00	H	-53.04	-6.49	-13	-46.53	150	70.01	Pass
	8871.00	H	-58.29	7.12	-13	-38.17	150	112.05	Pass
	14736.00	H	-63.09	13.21	-13	-36.88	150	41.37	Pass
	2326.00	V	-51.85	-8.7	-13	-47.55	150	276.73	Pass
	11744.00	V	-59.37	9.23	-13	-37.14	150	239.16	Pass
	16912.00	V	-64.09	15.43	-13	-35.66	150	176.15	Pass

8 Test Setup Photo

Reference to the **appendix I** for details.

9 EUT Constructional Details

Reference to the **appendix II** for details.

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