

FCC CFR47 PART 27 CERTIFICATION TEST REPORT FCC ID:2AZSF-WATER-S

Product: Water 2 Smart Moving Robot Platform
Trade Mark: N/A
Model Number: WATER II-S
Family Model: N/A
Report No.: S20123102807004

Prepared for

Beijing Yunji Technology Co.,Ltd

Room 702, #67 North Fourth Ring Road West, Haidian District, Beijing

Prepared by

Shenzhen NTEK Testing Technology Co., Ltd.
1/F, Building E, Fenda Science Park, Sanwei Community,
Xixiang Street Bao'an District, Shenzhen 518126 P.R. China
Tel. 400-800-6106, 0755-2320 0050, 0755-2320 0090
Website: <http://www.ntek.org.cn>

TEST RESULT CERTIFICATION

Applicant's name : Beijing Yunji Technology Co.,Ltd

Address..... : Room 702, #67 North Fourth Ring Road West, Haidian District, Beijing

Manufacturer's Name..... : Shenzhen Zhongzhi Yonghao Robot Co. , Ltd.

Address..... : 1st Floor, Building 1, Wandaiheng Guangming High Tech Industrial Park, Zhen Mei Tong Fu Yu Industrial Area, Zhenmei Residential Area, Xinhua Street, Guangming District, Shenzhen,China

Product name..... : Water 2 Smart Moving Robot Platform

Model and/or type reference .. : WATER II-S

Family Model: : N/A

Standards..... : FCC CFR 47 Part 27

Test procedure : ANSI C63.26:2015
ANSI/TIA-603-E-2016

This device described above has been tested by NTEK, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

This report shall not be reproduced except in full, without the written approval of NTEK, this document may be altered or revised by NTEK, personal only, and shall be noted in the revision of the document.

Date of Test

Date (s) of performance of tests..... 22 Jan. 2021 ~23 Apr. 2021

Date of Issue 26 Apr. 2021

Test Result **Pass**

Testing Engineer :



(Allen Liu)

Technical Manager :



(Jason Chen)

Authorized Signatory :



(Alex Li)

TABLE OF CONTENTS

1. GENERAL INFORMATION.....	5
1. GENERAL INFORMATION.....	5
1.1 PRODUCT DESCRIPTION	5
1.2 RELATED SUBMITTAL(S) / GRANT (S)	6
1.3 TEST METHODOLOGY.....	6
1.4 TEST FACILITY.....	6
MEASUREMENT UNCERTAINTY	6
1.5 SPECIAL ACCESSORIES.....	6
1.6 WORST-CASE CONFIGURATION AND MODE.....	6
1.6 SUMMARY OF TEST RESULTS	7
2. SYSTEM TEST CONFIGURATION	8
2.1 EUT CONFIGURATION.....	8
2.2 EUT EXERCISE	8
2.3 CONFIGURATION OF EUT SYSTEM.....	8
2.4 TEST SETUP	9
3.TEST AND MEASUREMENT EQUIPMENT	10
4. OUTPUT POWER.....	12
4.1 OUTPUT POWER MEASUREMENT	12
6. BANDEDGE AND EMISSION MASK.....	15
7. OUT OF BAND EMISSIONS	16
7.1 MEASUREMENT METHOD	17
8. RADIATED MEASUREMENT	18
8.1. RADIATED POWER (ERP & EIRP).....	18

8.2 LTE BAND 41	19
9. SPURIOUS RADIATION EMISSION	21
9.2 LTE BAND 41	23
10. FREQUENCY STABILITY	25
10.9 LTE BAND 41	26
11. PEAK-TO-AVERAGE RATIO.....	28
11.1 Description of the PAR Measurement	28
11.2 Measuring Instruments	28
11.3 Test Procedures.....	28
11.4 Test Setup.....	29

1. GENERAL INFORMATION

1.1 PRODUCT DESCRIPTION

A major technical description of EUT is described as following:

Product Designation:	Water 2 Smart Moving Robot Platform
Trade Mark	N/A
Model Name	WATER II-S
Family Model	N/A
Model Difference	N/A
FCC ID:	2AZSF-WATER-S
Frequency Bands:	U.S. Bands: <input checked="" type="checkbox"/> LTE FDD Band 41
Frequency Range:	LTE FDD Band 41 Uplink: 2496MHz-2690MHz, Downlink: 2496MHz-2690MHz;
Type of Modulation:	QPSK/16QAM
Antenna:	Glue stick Antenna
Antenna gain:	Band 41: 2.5dBi
Power Supply:	DC 29.4V from Charging Point or DC 25.2V from Battery
Adapter:	N/A
Extreme Vol. Limits:	DC 21.42V to DC 28.98V (Nominal DC 25.2V) (Note 1)
Hardware version	Power Board: 3.1; Motor Board: 3.21; Periheral Board: 1.0; Router Board: 2.0
Firmware version	Power Board: 1.6; Motor Board: 3.6; Periheral Board: 1.8; Router Board: 2.4
Soft Ware Version	0.9.4.5
** Note1: The High Voltage DC 28.98V and Low Voltage 21.42V was declared by manufacturer, The EUT couldn't be operate normally with higher or lower voltage.	

1.2 RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID:2AZSF-WATER-S** filing to comply with the FCC Part 22H&24E&27.

1.3 TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI/TIA-603-E-2016, FCC CFR 47 Part 27, ANSI C63.26:2015.

1.4 TEST FACILITY

The test site used to collect the radiated data is located at:

ShenZhen NTEK Testing Technology Co., Ltd.

1/F, Building E, Fenda Science Park, Sanwei Community, Xixiang Street, Bao'an District, Shenzhen 518126 P.R.China.

The test site is constructed and calibrated to meet the FCC requirements in documents ANSI C63.26:2015& ANSI C63.4: 2014.

FCC Registration No.:463705

IC Registration No.:9270A-1,

CNAS Registration No.:L5516

MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	2.5dB

1.5 SPECIAL ACCESSORIES

The battery and the charger, earphone supplied by the applicant were used as accessories and being tested with EUT intended for FCC grant together.

1.6 WORST-CASE CONFIGURATION AND MODE

The worst-case scenario for all measurements is based on the investigation results.

The device has LTE Bands of: Band 41.

The RB Size was selected to measure for peak or average ERP and EIRP, which was based on the conducted power verification baseline data.

For the fundamental investigation of radiated emissions, the EUT is investigated for vertical and horizontal antenna orientations and X Y and Z orientations of the EUT alone. After the investigations the worst case was determined to be at X orientation for all LTE bands.

1.6 SUMMARY OF TEST RESULTS

FCC Part27, Subpart L, KDB 971168 D01 Power Meas License Digital Systems v03			
FCC Rule	Test Item	Verdict	Remark
2.1046	Conducted Output Power	PASS	
27.50(d)(5) KDB 971168 D01 Clause 5.7	Peak-to-Average Ratio	PASS	
2.1049 KDB 971168 D01 Clause 4.2	Occupied Bandwidth	PASS	
2.1051 27.53(c), (g), (h) KDB 971168 D01 Clause 6	Band Edge	PASS	
27.50(b)(10), (c)(10) KDB 971168 D01 Clause 5.6	Effective Radiated Power	PASS	
27.50(h)(2), (d)(4) KDB 971168 D01 Clause 5.6	Equivalent Isotropic Radiated Power	PASS	
2.1053 27.53(c)(g)(h)(m) KDB 971168 D01 Clause 7	Field Strength of Spurious Radiation	PASS	
2.1055 27.54 KDB 971168 D01 Clause 9	Frequency Stability for Temperature & Voltage	PASS	
2.1051 27.53(c)(g)(h)(m) KDB 971168 D01 Clause 6	Conducted Emission	PASS	
Remark: 1. "N/A" denotes test is not applicable in this Test Report. 2. All test items were verified and recorded according to the standards and without any deviation during the test. 3. No modifications are made to the EUT during all test items.			

2. SYSTEM TEST CONFIGURATION

2.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commission's requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT EXERCISE

The Transmitter was operated in the maximum output power mode through Communication Tester. The TX frequency was fixed which was for the purpose of the measurements.

2.3 CONFIGURATION OF EUT SYSTEM

Table 2-1 Equipment Used in EUT System

Item	Equipment	Model No.	ID or Specification	Note
1	Water 2 Smart Moving Robot Platform	WATER II-S	FCC ID:2AZSF-WATER-S	EUT

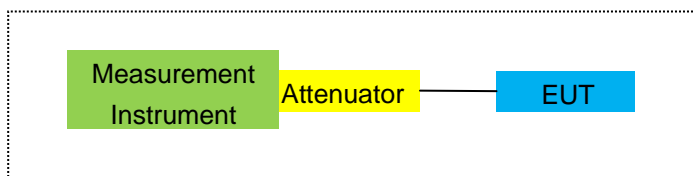
*Note: All the accessories have been used during the test.
the following "EUT" in setup diagram means EUT system.*

2.4 TEST SETUP

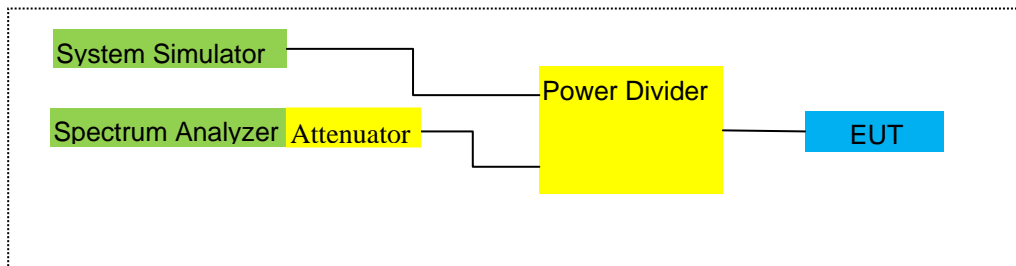
For Radiated Test Cases



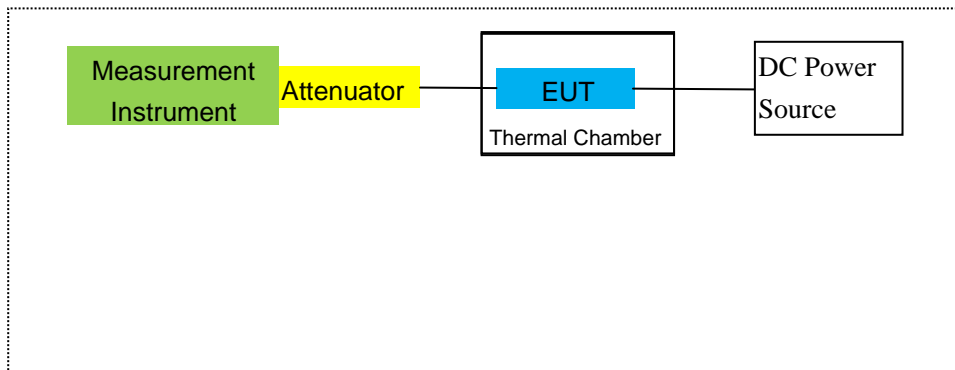
For Conducted Output Power



For Peak-to Average Ratio, Occupied Bandwidth, Conducted Band edge and Conducted Spurious Emission



For Frequency Stability



Note: EUT built-in battery-powered, the battery is fully-charged.

3.TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	MXA Signal Analyzer	Agilent	N9020A	MY49100060	2020.07.13	2021.07.12	1 year
2	Test Receiver	R&S	ESPI	101318	2020.05.11	2021.05.10	1 year
3	Bilog Antenna	TESEQ	CBL6111D	31216	2020.04.11 2021.03.29	2021.04.10 2022.03.28	1 year
4	50Ω Coaxial Switch	Anritsu	MP59B	6200983705	2020.05.11	2023.05.10	3 year
5	Horn Antenna	EM	EM-AH-1018 0	2011071402	2020.04.11 2021.03.29	2021.04.10 2022.03.28	1 year
6	Horn Ant	Schwarzbeck	BBHA 9170	9170-181	2020.11.20	2021.11.19	1 year
7	Amplifier	EM	EM-30180	060538	2020.07.13	2021.07.12	1 year
8	Loop Antenna	ARA	PLA-1030/B	1029	2020.05.11	2021.05.10	1 year
9	Power Meter	R&S	NRVS	100696	2020.07.13	2021.07.12	1 year
10	Power Sensor	R&S	URV5-Z4	0395.1619.0 5	2020.05.11	2021.05.10	1 year
11	Test Cable	N/A	R-01	N/A	2019.08.06	2022.08.05	3 year
12	Test Cable	N/A	R-02	N/A	2019.08.06	2022.08.05	3 year
13	Test Cable	N/A	R-03	N/A	2019.06.28	2022.06.27	3 year
14	Test Receiver	R&S	ESCI	101160	2020.05.11	2021.05.10	1 year
15	LISN	R&S	ENV216	101313	2020.05.11	2021.05.10	1 year
16	LISN	EMCO	3816/2	00042990	2020.05.11	2021.05.10	1 year
17	50Ω Coaxial Switch	Anritsu	MP59B	6200264417	2020.05.11	2021.05.10	1 year
18	Passive Voltage Probe	R&S	ESH2-Z3	100196	2020.04.11 2021.03.29	2021.04.10 2022.03.28	1 year
19	Test Cable	N/A	C01	N/A	2020.05.11	2023.05.10	3 year
20	Test Cable	N/A	C02	N/A	2020.05.11	2023.05.10	3 year
21	Test Cable	N/A	C03	N/A	2020.05.11	2021.05.10	1 year
22	Attenuator	MCE	24-10-34	BN9258	2020.05.11	2021.05.10	1 year
23	Spectrum Analyzer	agilent	e4440a	us44300399	2020.05.11	2021.05.10	1 year
24	test receiver	R&S	ESCI	a0304218	2020.05.11	2021.05.10	1 year
25	Communication Tester	R&S	CMU200	A0304247	2020.07.13	2021.07.12	1 year
26	Thermal Chamber	Ten Billion	TTC-B3C	TBN-960502	2020.05.11	2021.05.10	1 year

27	DC Power Source	N/A	PS-6005D	2017040292 3	2020.05.11	2023.05.10	3 year
28	PSG Analog Signal Generator	Agilent	E8257D	MY51110112	2020.07.13	2021.07.12	1 year
29	Communication Tester	R&S	CMW500	148500	2020.05.11	2021.05.10	1 year

Note: Each piece of equipment is scheduled for calibration once a year except the Test Cable& DC Power Source which is scheduled for calibration every 3 years.

4. OUTPUT POWER

4.1 OUTPUT POWER MEASUREMENT

LTE Measurement Procedure:

All LTE bands conducted power peak and average are obtained from the CMW500 telecommunication test set. The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.

UE Power Class: 3 (23 +/- 2dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3

Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

The allowed A-MPR values specified below in Table 6.2.4.-1 of 3GPP TS36.101 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signaling Value of "NS_01".3

Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)

Network Signalling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	NA
NS_03	6.6.2.2.1	2, 4, 10, 23, 25, 35, 36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2	41	5	>6	≤ 1
			10, 15, 20	See Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10, 15, 20	≥ 50	≤ 1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	n/a
NS_07	6.6.2.2.3 6.6.3.3.2	13	10	Table 6.2.4-2	Table 6.2.4-2
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4-3	Table 6.2.4-3
NS_11	6.6.2.2.1	23 ¹	1.4, 3, 5, 10	Table 6.2.4-5	Table 6.2.4-5
..					
NS_32	-	-	-	-	-

Note 1: Applies to the lower block of Band 23, i.e. a carrier placed in the 2000-2010 MHz region.

Test data reference attachment.

5. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

LIMITS

For reporting purposes only

TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band. The -26dB bandwidth was also measured and recorded.

MODES TESTED

LTE Band 41

RESULTS

PASS

Test data reference attachment.

6. BANDEDGE AND EMISSION MASK

RULE PART(S)

FCC: §2.1051, §27.53(c)(g)(h)(m)

FCC: §2.1046,

LIMITS

The minimum permissible attenuation level of any spurious emission is $43 + \log_{10}(P[\text{Watts}])$, where P is the transmitter power in Watts.

The minimum permissible attenuation level for Band 7 is as following.

Per 27.53(g) for operations in the 698-746 MHz band, in the 100 kHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 30 kHz may be employed to demonstrate compliance with the out-of-band emissions limit.

Per 27.53(c.5) for operations in the 776-788 MHz band, in the 100 kHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 30 kHz may be employed to demonstrate compliance with the out-of-band emissions limit.

For all plots showing emissions in the 763 – 775MHz and 793 – 805MHz band, the FCC limit per 27.53(c.4) is $65 + 10\log_{10}(P) = -35\text{dBm}$ in a 6.25kHz bandwidth.

Per 27.53(m) for operations in the BRS/EBS bands, the attenuation factor shall be not less than $40 + 10 \log (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log (P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth.

TEST PROCEDURE

The transmitter output was connected to a CMW500 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

For each band edge measurement:

Set the spectrum analyzer span to include the block edge frequency

Set a marker to point the corresponding band edge frequency in each test case.

Set resolution bandwidth to at least 1% of emission bandwidth.

MODES TESTED

LTE Band 41

RESULTS

Test data reference attachment.

Note: Both QPSK and 16QAM has been tested, the worst case is QPSK mode, the report just reported the worst case.

7. OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §27.53(c)(g)(h)(m)

LIMITS

The minimum permissible attenuation level of any spurious emission is $43 + \log_{10}(P[\text{Watts}])$, where P is the transmitter power in Watts.

The minimum permissible attenuation level for Band 7 is as following.

Per 27.53(g) for operations in the 698-746 MHz band, in the 100 kHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 30 kHz may be employed to demonstrate compliance with the out-of-band emissions limit.

Per 27.53(c.5) for operations in the 776-788 MHz band, in the 100 kHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 30 kHz may be employed to demonstrate compliance with the out-of-band emissions limit.

For all plots showing emissions in the 763 – 775MHz and 793 – 805MHz band, the FCC limit per 27.53(c.4) is $65 + 10\log_{10}(P) = -35\text{dBm}$ in a 6.25kHz bandwidth.

Per 27.53(m) for operations in the BRS/EBS bands, the attenuation factor shall be not less than $40 + 10 \log (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log (P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth.

TEST PROCEDURE

The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.

For each out of band emissions measurement:

- ☐ Set display line
- ☐ Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.

MODES TESTED

- ☐ LTE Band 41
- ☐

7.1 MEASUREMENT METHOD

The test set up and general procedure is similar to conducted peak output power test. Only different for setting the measurement configuration of the measuring instrument of Spectrum Analyzer.

Test data reference attachment.

8. RADIATED MEASUREMENT

8.1. RADIATED POWER (ERP & EIRP)

RULE PART(S)

FCC: §2.1046, §27.50 (h)(2), (b)(10), (c)(10), (d)(4)

LIMITS:

27.50 (c) (10) the following power and antenna height requirements apply to stations transmitting in the 698–746 MHz band, the portable stations (hand-held devices) are limited to 3 watts ERP.

27.50 (b)(10) Portable stations (hand-held devices) transmitting in the 746–757 MHz, 758–763 MHz, 776–793 MHz, and 805–806 MHz bands are limited to 3 watts ERP.

27.50 (d)(4) The following power and antenna height requirements apply to stations transmitting in the 1710–1755 MHz and 2110–2155 MHz bands: Fixed, mobile, and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP.

27.50 (h)(2) Mobile and other user stations in the 2500–2570 MHz and 2620–2690 MHz bands. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.

TEST PROCEDURE

ANSI/TIA-603-E Clause 2.2.17

KDB 971168 v02r01 RF power output using broadband peak and average power meter method.

KDB 971168 D01 Power Meas License Digital Systems v02r01, “Measurement Guidance for Certification of Licensed Digital Transmitters”

MODES TESTED

- ☐ LTE Band 41

RESULTS

Pass

8.2 LTE BAND 41

Radiated Power (EIRP) for Band 41									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Antenna Gain (dB)	Max. EIRP Average (dBm)	Max. EIRP Average (mW)	Polarization Of Max. ERP	
5.0MHz Band QPSK	25/0	2498.5	0.94	4.54	27.75	24.15	259.75	Horizontal	Pass
		2593	0.56	4.69	27.72	23.59	228.55	Horizontal	Pass
		2687.5	1.19	4.71	27.71	24.19	262.16	Horizontal	Pass
10.0MHz Band QPSK	50/0	2685	0.68	4.55	27.76	23.89	244.74	Horizontal	Pass
		2593	1.29	4.69	27.72	24.32	270.16	Horizontal	Pass
		2501	1.05	4.72	27.7	24.03	253.20	Horizontal	Pass
15.0MHz Band QPSK	75/0	2503.5	1.42	4.55	27.77	24.64	290.83	Horizontal	Pass
		2593	1.01	4.69	27.72	24.04	253.75	Horizontal	Pass
		2682.5	0.80	4.72	27.69	23.77	238.18	Horizontal	Pass
20.0MHz Band QPSK	100/0	2506	0.72	4.57	27.78	23.93	247.41	Horizontal	Pass
		2593	1.18	4.73	27.72	24.17	261.41	Horizontal	Pass
		2680	1.32	4.75	27.68	24.25	265.95	Horizontal	Pass
5.0MHz Band QPSK	25/0	2498.5	1.30	4.54	27.75	24.51	282.31	Vertical	Pass
		2593	1.06	4.69	27.72	24.09	256.46	Vertical	Pass
		2687.5	0.92	4.71	27.71	23.92	246.82	Vertical	Pass
10.0MHz Band QPSK	50/0	2685	0.97	4.55	27.76	24.18	261.56	Vertical	Pass
		2593	1.01	4.69	27.72	24.04	253.49	Vertical	Pass
		2501	1.52	4.72	27.7	24.50	282.12	Vertical	Pass
15.0MHz Band QPSK	75/0	2503.5	1.38	4.55	27.77	24.60	288.34	Vertical	Pass
		2593	1.09	4.69	27.72	24.12	258.46	Vertical	Pass
		2682.5	1.16	4.72	27.69	24.13	258.81	Vertical	Pass
20.0MHz Band QPSK	100/0	2506	0.99	4.57	27.78	24.20	262.85	Vertical	Pass
		2593	1.34	4.73	27.72	24.33	270.77	Vertical	Pass
		2680	1.72	4.75	27.68	24.65	291.76	Vertical	Pass

Radiated Power (EIRP) for Band 41									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Antenna Gain (dB)	Max. EIRP Average (dBm)	Max. EIRP Average (mW)	Polarization Of Max. ERP	
5.0MHz Band 16 QAM	25/0	2498.5	0.90	4.54	27.75	24.11	257.37	Horizontal	Pass
		2593	0.52	4.69	27.72	23.55	226.47	Horizontal	Pass
		2687.5	1.15	4.71	27.71	24.15	259.79	Horizontal	Pass
10.0MHz Band 16 QAM	50/0	2685	0.64	4.55	27.76	23.85	242.48	Horizontal	Pass
		2593	1.25	4.69	27.72	24.28	267.73	Horizontal	Pass
		2501	1.01	4.72	27.7	23.99	250.87	Horizontal	Pass
15.0MHz Band 16 QAM	75/0	2503.5	1.38	4.55	27.77	24.60	288.14	Horizontal	Pass
		2593	0.97	4.69	27.72	24.00	251.37	Horizontal	Pass
		2682.5	0.76	4.72	27.69	23.73	235.98	Horizontal	Pass
20.0MHz Band 16 QAM	100/0	2506	0.68	4.57	27.78	23.89	245.13	Horizontal	Pass
		2593	1.14	4.73	27.72	24.13	259.01	Horizontal	Pass
		2680	1.28	4.75	27.68	24.21	263.50	Horizontal	Pass
5.0MHz Band 16 QAM	25/0	2498.5	1.26	4.54	27.75	24.47	279.72	Vertical	Pass
		2593	1.02	4.69	27.72	24.05	254.13	Vertical	Pass
		2687.5	0.88	4.71	27.71	23.88	244.56	Vertical	Pass
10.0MHz Band 16 QAM	50/0	2685	0.93	4.55	27.76	24.14	259.13	Vertical	Pass
		2593	0.97	4.69	27.72	24.00	251.18	Vertical	Pass
		2501	1.48	4.72	27.7	24.46	279.51	Vertical	Pass
15.0MHz Band 16 QAM	75/0	2503.5	1.34	4.55	27.77	24.56	285.65	Vertical	Pass
		2593	1.05	4.69	27.72	24.08	256.10	Vertical	Pass
		2682.5	1.12	4.72	27.69	24.09	256.46	Vertical	Pass
20.0MHz Band 16 QAM	100/0	2506	0.95	4.57	27.78	24.16	260.41	Vertical	Pass
		2593	1.30	4.73	27.72	24.29	268.28	Vertical	Pass
		2680	1.68	4.75	27.68	24.61	289.08	Vertical	Pass

Note:

SG Level= Signal generator output

Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)

Factor Gain(dB)=Antenna Gain(dB) + Amplifier Factor (dB)

9. SPURIOUS RADIATION EMISSION

RULE PART(S)

FCC: §2.1051, §27.53(c)(g)(h)(m)

LIMIT

For Band 7, the minimum permissible attenuation level of any spurious emission is $55 + \log_{10} (P \text{ [Watts]})$.

The minimum permissible attenuation level of any spurious emission is $43 + \log_{10} (P \text{ [Watts]})$, where P is the transmitter power in Watts.

TEST PROCEDURE

For Cellular equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. 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. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). 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 emissions are attenuated at least 26 dB below the transmitter power.

For PCS equipment - Compliance with these rules 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. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). 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 emissions are attenuated at least 26 dB below the transmitter power.

The unwanted emission power shall be measured with a resolution bandwidth of at least 1% of the occupied bandwidth in the 1 MHz band immediately outside and adjacent to the channel edge of the equipment. Beyond the 1 MHz band immediately outside the channel edge of the equipment, a resolution bandwidth of 1 MHz shall be employed. A narrower resolution bandwidth is allowed to be used provided that the measured power is integrated over the full required measurement bandwidth of 1 MHz or 1% of the occupied bandwidth as applicable.

The power of any unwanted emissions measured from the channel edge of the equipment shall be attenuated below the transmitter power, P (dBW), as follows:

- a. for base station and subscriber equipment, other than mobile subscriber equipment, the attenuation shall not be less than $43 + 10 \log_{10}(p)$, dB; and
- b. for mobile subscriber equipment, the attenuation shall not be less than $43 + 10 \log_{10}(p)$, dB at the channel edges and $55 + 10 \log_{10}(p)$ at 5.5 MHz away and beyond the channel edges where p in (a) and (b) is the transmitter power measured in watts.

MODES TESTED

LTE Band 41,

RESULTS

PASS

9.2 LTE BAND 41

QPSK EIRP POWER FOR LTE BAND 41 (5MHZ BANDWIDTH)

Test Results for Low Channel 2498.5MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit (dBm)	Margin(dBm)	Polarity
4997	-59.61	2.63	27.26	-34.98	-13	-21.98	Horizontal
4997	-58.16	2.63	27.26	-33.53	-13	-20.53	Vertical
7495.5	-60.72	2.67	27.58	-35.81	-13	-22.81	Vertical
7495.5	-62.74	2.67	27.58	-37.83	-13	-24.83	Horizontal
Test Results For Mid Channel 2593MHz							
5186	-50.5	2.62	27.28	-25.84	-13	-12.84	Horizontal
5186	-55.32	2.62	27.28	-30.66	-13	-17.66	Vertical
7779	-58.79	2.85	27.62	-34.02	-13	-21.02	Vertical
7779	-56.61	2.85	27.62	-31.84	-13	-18.84	Horizontal
Test Results for High Channel 2687.5MHz							
5375	-50.44	2.64	27.28	-25.8	-13	-12.8	Horizontal
5375	-57.7	2.64	27.28	-33.06	-13	-20.06	Vertical
8062.5	-57.6	2.85	27.7	-32.75	-13	-19.75	Vertical
8062.5	-55.84	2.85	27.7	-30.99	-13	-17.99	Horizontal

QPSK EIRP POWER FOR LTE BAND 41 (5MHZ BANDWIDTH)

Test Results for Low Channel 2506MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit (dBm)	Margin(dBm)	Polarity
5012	-58.71	2.63	27.3	-34.04	-13	-21.04	Horizontal
5012	-53.28	2.63	27.3	-28.61	-13	-15.61	Vertical
7518	-59.75	2.67	27.62	-34.8	-13	-21.8	Vertical
7518	-62.69	2.67	27.62	-37.74	-13	-24.74	Horizontal
Test Results for Mid Channel 2593MHz							
5186	-58.38	2.62	27.33	-33.67	-13	-20.67	Horizontal
5186	-55.62	2.62	27.33	-30.91	-13	-17.91	Vertical
7779	-60.08	2.85	27.67	-35.26	-13	-22.26	Vertical
7779	-59.98	2.85	27.67	-35.16	-13	-22.16	Horizontal
Test Results for High Channel 2680MHz							
5360	-56.53	2.64	27.33	-31.84	-13	-18.84	Horizontal
5360	-58.85	2.64	27.33	-34.16	-13	-21.16	Vertical
8040	-60.23	2.85	27.67	-35.41	-13	-22.41	Vertical
8040	-56.9	2.85	27.67	-32.08	-13	-19.08	Horizontal

10. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §27.54

LIMITS

§22.355 - The carrier frequency shall not depart from the reference frequency in excess of ± 2.5 ppm for mobile stations.

§24.235 - The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

TEST PROCEDURE

Use CMW 500 with Frequency Error measurement capability.

- ☐ Temp. = -30° to $+50^{\circ}\text{C}$
- ☐ Voltage = low voltage, DC 21.42V, Normal, DC 25.2V and High voltage, DC 28.98V.

Frequency Stability vs Temperature:

The EUT is placed inside a temperature chamber. The temperature is set to -30°C and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until $+50^{\circ}\text{C}$ is reached.

Frequency Stability vs Voltage:

The peak frequency error is recorded (worst-case).

MODES TESTED

LTE Band 41,

RESULTS

See the following pages.

10.9 LTE BAND 41

QPSK, (20MHz BANDWIDTH)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 41 QPSK, (CH 40640 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
21.42	2593	8.6	0.00332	2.5
25.2	2593	6.7	0.00258	2.5
28.98	2593	7.7	0.00297	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 41 QPSK, (CH 40640 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
Normal (25C)	2593	7.5	0.00289	2.5
Extreme (50C)	2593	4.6	0.00177	2.5
Extreme (40C)	2593	5.2	0.00201	2.5
Extreme (30C)	2593	10.7	0.00413	2.5
Extreme (10C)	2593	6.6	0.00255	2.5
Extreme (0C)	2593	5.2	0.00201	2.5
Extreme (-10C)	2593	9.6	0.00370	2.5
Extreme (-20C)	2593	7.4	0.00285	2.5
Extreme (-30C)	2593	6.7	0.00258	2.5

16QAM, (20MHz BANDWIDTH)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 41 16QAM, (CH 40640 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
21.42	2593	8.2	0.00316	2.5
25.2	2593	6.5	0.00251	2.5
28.98	2593	6.6	0.00255	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
AND 41 16QAM, (CH 40640 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
Normal (25C)	2593	7.7	0.00297	2.5
Extreme (50C)	2593	4.8	0.00185	2.5
Extreme (40C)	2593	5.4	0.00208	2.5
Extreme (30C)	2593	10.7	0.00413	2.5
Extreme (10C)	2593	6	0.00231	2.5
Extreme (0C)	2593	4.7	0.00181	2.5
Extreme (-10C)	2593	9.1	0.00351	2.5
Extreme (-20C)	2593	6.5	0.00251	2.5
Extreme (-30C)	2593	3.5	0.00135	2.5

***Note:** Frequency error measurements were made by using the build-in capability of the Wireless Communication Test Set.

11. Peak-to-Average Ratio

11.1 Description of the PAR Measurement

The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

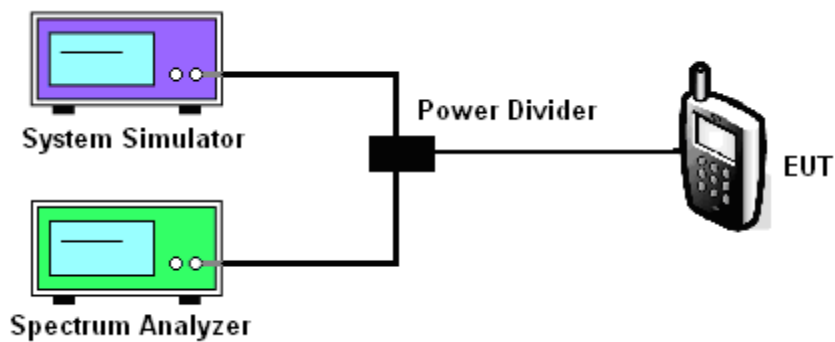
11.2 Measuring Instruments

See list of measuring instruments of this test report.

11.3 Test Procedures

1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. 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.
3. For GSM/EGPRS operating modes:
 - a. Set the RBW = 1MHz, VBW = 1MHz, Peak detector in spectrum analyzer.
 - b. Set EUT in maximum power output, and triggered the burst signal.
 - c. Measured respectively the Peak level and Mean level, and the deviation was recorded as Peak to Average Ratio.
4. For UMTS operating modes:
 - a. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
 - b. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.

11.4 Test Setup



MODES TESTED

LTE Band 41,

Test data reference attachment.

----END OF REPORT----