



TESTREPORT

Applicant Name : Franklin Technology Inc.
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South Korea
Report Number: RA221101-50847E-RF-00E
FCC ID: XHG-RG2102

Test Standard (s)

FCC PART 96

Sample Description

Product Type: Mobile Hotspot
Model No.: RG2102
Multiple Model(s) No.: N/A
Trade Mark: N/A
Date Received: 2022/11/01
Report Date: 2023/01/31

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Approved By:

Andy Yu
EMC Engineer

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EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

Shenzhen Accurate Technology Co., Ltd. is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk "*". Customer model name, addresses, names, trademarks etc. are not considered data.

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REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	RA221101-50847E-RF-00E	Original Report	2022/12/29
1	RA221101-50847E-RF-00E	Updated the summary table	2023/01/31

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Frequency Range	LTE Band 48: 3550-3700MHz (TX/RX)
Modulation Technique	4G: QPSK, 16QAM
Carrier Aggregation	None Carrier aggregation
Antenna Specification*	LTE Band 48: -1.71dBi (provided by the applicant)
Voltage Range	DC 3.8V from battery or DC 5V from adapter
Sample serial number	1OJ3-1 for Radiated Emissions 1OJ4-2 for RF Conducted Test (Assigned by ATC)
Sample/EUT Status	Good condition
Adapter Information	Model: PD018W-G Input: 100-240V,50/60Hz,0.5A Max Output: 5.0V,3.0A;9.0V,2.0A;12V,1.5A

Objective

This test report is in accordance with Part 2-Subpart J and Part 96 of the Federal Communication Commission's rules.

The objective is to determine the compliance of the EUT with FCC rules for output power, modulation characteristic, occupied bandwidth, and spurious emission at antenna terminal, spurious radiated emission, frequency stability and band edge.

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2-Subpart J as well as the following parts:

Part 96 –Citizens Broadband Radio Service

ANSI C63.26-2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Each test item follows test standards and with no deviation.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF Frequency		0.082×10^{-7}
RF output power, conducted		0.73dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions		2.72dB
Emissions, Radiated	9kHz - 30MHz	2.66dB
	30MHz - 1GHz	4.28dB
	1GHz - 18GHz	4.98dB
	18GHz -26.5GHz	5.06dB
	26.5GHz -40GHz	4.72dB
Temperature		1°C
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The Test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISED), the Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The final qualification test was performed with the EUT operating at normal mode.

Frequency band	Bandwidth (MHz)	Test Frequency(MHz)		
		Low	Middle	High
LTE B48	5	3552.5	3625.0	3697.5
	10	3555	3625.0	3695
	15	3557.5	3625	3692.5
	20	3560	3625	3690

Equipment Modifications

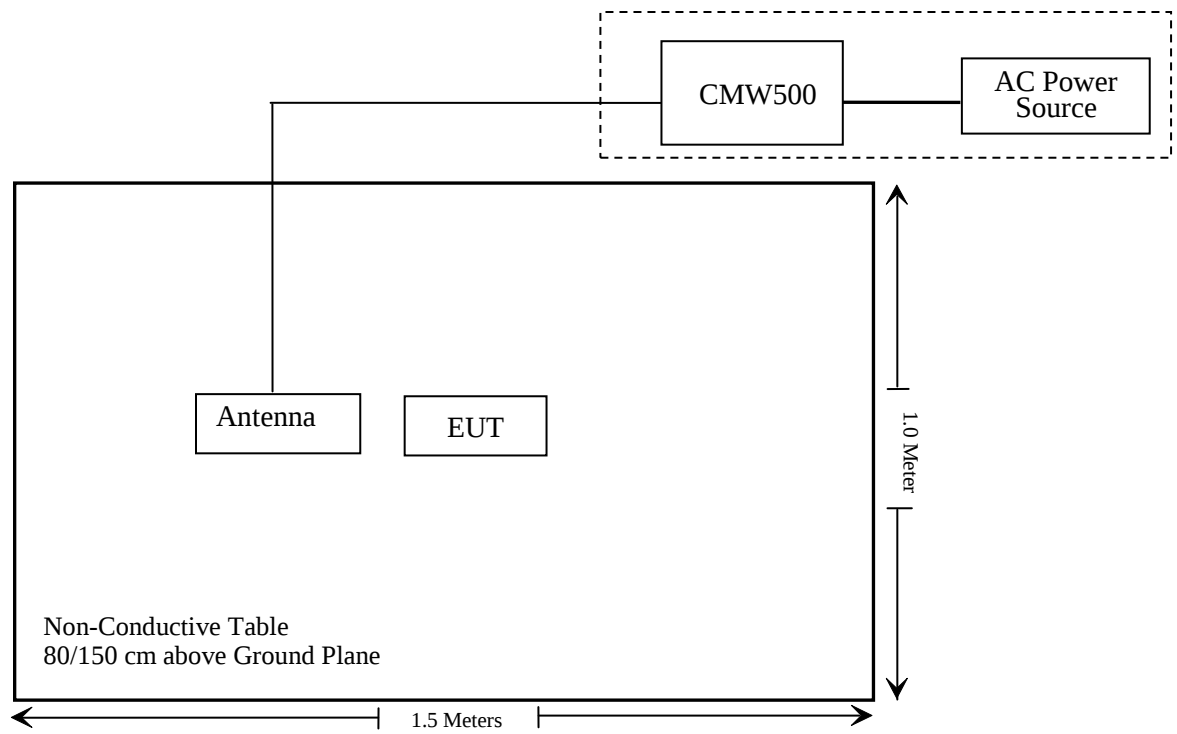
No modification was made to the EUT.

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	154606

Support Cable Description

Cable Description	Length (m)	From / Port	To
Unshielded Un-detachable AC cable	1.2	AC Power	CMW50

Block Diagram of Test Setup

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result	Remark
§ 1.1307 , §2.1093	RF Exposure (SAR)	Compliant	-
§2.1046; §96.41 (b) (g)	RF Output Power	Reporting only	-
§ 2.1047	Modulation Characteristics	Not Applicable	/
§ 2.1049; §96.41	Occupied Bandwidth	-	See Note
§ 2.1051; §96.41	Spurious Emissions at Antenna Terminal	-	See Note
§ 2.1053; §96.41	Field Strength of Spurious Radiation	Compliant	-
§2.1049, §96.41(e)	Out-Of-Band Emissions and Band Edge	-	See Note
§ 2.1055; §96.41	Frequency stability	-	See Note

Note:

- 1: The manufacturer declared the WWAN module installed in EUT is identical to the certified module (FCC ID: XHG-M2500), which granted on 08/30/2022 and 01/09/2023.
- 2: The RF output power was spot checked and it's consistently with the module report.
- 3: The ATC is responsible for all the information provided in this report, except when information is provided by the customer as identified in this report.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Rohde& Schwarz	Test Receiver	ESR	102725	2022/11/25	2023/11/24
Rohde&Schwarz	Spectrum Analyzer	FSV40	101949	2022/11/25	2023/11/24
SONOMA INSTRUMENT	Amplifier	310 N	186131	2022/11/08	2023/11/07
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2022/11/08	2023/11/07
Quinstar	Amplifier	QLW-184055 36-J0	15964001002	2022/11/08	2023/11/07
Unknown	RF Coaxial Cable	No.10	N050	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.11	N1000	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.12	N040	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.13	N300	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.14	N800	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.15	N600	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.16	N650	2022/11/25	2023/11/24
Schwarzbeck	Bilog Antenna	VULB9163	9163-194	2020/01/05	2023/01/04
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-655	2020/01/05	2023/01/04
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
PASTERNAK	Horn Antenna	PE9852/2F-20	1120 (ATC-BA-024-1)	2020/01/05	2023/01/04
PASTERNAK	Horn Antenna	PE9852/2F-20	1120 (ATC-BA-025-1)	2020/01/05	2023/01/04
PASTERNAK	Horn Antenn	PE9850/2F-20	720 (ATC-BA-024)	2020/01/05	2023/01/04
PASTERNAK	Horn Antenn	PE9850/2F-20	720 (ATC-BA-025)	2020/01/05	2023/01/04
Unknown	RF Coaxial Cable	No.16	N200	2022/11/25	2023/11/24
Agilent	Signal Generator	N5183A	MY51040755	2022/11/25	2023/11/24

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
WEINSCHTEL	10dB Attenuator	5324	AU 3842	2022/11/25	2023/11/24
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	154606	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.31	RF-01	Each time	

* Statement of Traceability: Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §1.1310& §2.1093 - RF EXPOSURE INFORMATION

Applicable Standard

FCC§1.1310 and §2.1093.

Test Result

Compliant, please refer to the SAR report: RA221101-50847E-SA.

FCC §2.1047 - MODULATION CHARACTERISTIC

According to FCC §2.1047(d), Part 96, there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

FCC § 2.1046 & § 96.41(b) (g)- RF OUTPUT POWER

Applicable Standard

According to §96.41

(b)Power limits:Unless otherwise specified in this section, the maximum effective isotropic radiated power (EIRP) and maximum Power Spectral Density (PSD) of any CBSD and End User Device must comply with the limits shown in the table in this paragraph (b):

Device must comply with the limits shown in the table in this paragraph (b).

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

¹Category B CBSDs will only be authorized for use after an ESC is approved and commercially deployed consistent with §§96.15 and 96.67.

(g)Power measurement:The peak-to-average power ratio (PAPR) of any CBSD transmitter output power must not exceed 13 dB. PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities or another Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

Test Procedure

Conducted method:

The RF output of the transmitter was connected to the CMW500 through sufficient attenuation.



Note: the path loss (cable loss and attenuator) was included to the test result.

Test Data

Environmental Conditions

Temperature:	27 °C
Relative Humidity:	49 %
ATM Pressure:	101.0 kPa

The testing was performed by Cat Kang from 2022-12-07 to 2022-12-09.

LTE Band 48:

Bandwidth (MHz)	Modulation	RB size/ RB Offset	Conducted Average Output Power (dBm)			EIRP(dBm)		
			Low	Mid	High	Low	Mid	High
5.0	QPSK	RB1#0	21.23	21.10	21.22	19.52	19.39	19.51
	16QAM	RB1#0	20.19	20.33	20.43	18.48	18.62	18.72
10.0	QPSK	RB1#0	21.23	21.36	21.32	19.52	19.65	19.61
	16QAM	RB1#0	20.55	20.29	20.32	18.84	18.58	18.61
15.0	QPSK	RB1#0	21.18	21.11	21.17	19.47	19.40	19.46
	16QAM	RB1#0	19.96	20.24	20.35	18.25	18.53	18.64
20.0	QPSK	RB1#0	21.13	21.31	21.33	19.42	19.60	19.62
		RB1#99	21.08	21.16	21.15	19.37	19.45	19.44
		RB100#0	20.15	20.17	19.82	18.44	18.46	18.11
	16QAM	RB1#0	20.58	20.19	20.03	18.87	18.48	18.32

Note: $EIRP(dBm) = \text{Conducted Power}(dBm) + \text{Antenna Gain}(dBi)$

For Band48: Antenna Gain = -1.71dBi

Limit: $EIRP \leq 23dBm/10MHz$

For 5MHz mode, the reference bandwidth(10MHz) is greater than the channel bandwidth(5MHz), so the channel power is equal to the test result in dBm/10MHz

For 10MHz mode, the channel power is equal to the test result in dBm/10MHz

For 15MHz/20MHz mode, the channel power is sum of 15MHz/20MHz bandwidth, the result is less than 23dBm, so in any 10MHz bandwidth, it will not exceed the limit

FCC §2.1053& §96.41(e) (2) (3) - SPURIOUS RADIATED EMISSIONS**Applicable Standard**

FCC §2.1053and §96.41(e) (2) (3).

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1051.

Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the receiving antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Test Data**Environmental Conditions**

Temperature:	24.5~25.5 °C
Relative Humidity:	52 ~54%
ATM Pressure:	101.0 kPa

The testing was performed by Jimi Zheng from 2022-12-03 to2022-12-19

EUT operation mode: Transmitting (Scan with X-AXIS, Y-AXIS, Z-AXIS, the worst case Y-AXIS was recorded)

The worst case is as below:

LTE Bands: (pre-scan all bandwidth/modulation, the worst case as below)

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
LTE Band 48, Test frequency range: 30MHz-38GHz								
QPSK,5MHz,3552.5MHz								
239.87	-58.46	12	1.8	H	7.4	-51.06	-40	-11.06
634.25	-48.17	340	2.4	V	7.0	-41.17	-40	-1.17
7105	-65.1	103	2	H	16.8	-48.30	-40	-8.30
7105	-67.2	121	2.4	V	16.7	-50.50	-40	-10.50
QPSK, 5MHz,3625MHz								
239.13	-58.53	308	2.2	H	7.4	-51.13	-40	-11.13
633.91	-48.31	174	1.8	V	7.0	-41.31	-40	-1.31
7250	-68.3	340	2	H	18.9	-49.40	-40	-9.40
7250	-69.8	206	1.8	V	18.5	-51.30	-40	-11.30
QPSK, 5MHz,3697.5MHz								
239.29	-58.08	220	1.3	H	7.4	-50.68	-40	-10.68
634.67	-48.15	237	1.7	V	7.0	-41.15	-40	-1.15
7395	-68.9	281	1.4	H	19.8	-49.10	-40	-9.10
7395	-69.91	29	2.3	V	19.01	-50.90	-40	-10.90

Note:

Absolute Level = Reading Level + Substituted Factor

Substituted Factor contains: SG Level - Cable loss + Antenna Gain

Margin = Limit - Absolute Level

For WWAN and WLAN transmit simultaneously condition, please refer to DTS report.

******* END OF REPORT *******