

TEST REPORT

Applicant: Franklin Technology
Address: 906 JEI Platz, 186, Gasan digital1-ro, Geumcheon-gu, Seoul 08502 Korea
Equipment Type: M2M Box
Model Name: RT410S
Brand Name: N/A
FCC ID: XHG-RT410S
Test Standard: 47 CFR Part 2.1091
KDB 447498 D04 v01
Test Date: Feb. 06, 2025 - Mar. 03, 2025
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ISSUED BY:

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Revision History

Version	Issue Date	Revisions Content
<u>Rev. 01</u>	<u>Mar. 11, 2025</u>	<u>Initial Issue</u>

TABLE OF CONTENTS

1	GENERAL INFORMATION	3
1.1	Test Laboratory	3
1.2	Test Location	3
2	PRODUCT INFORMATION	4
2.1	Applicant Information.....	4
2.2	Manufacturer Information	4
2.3	Factory Information	4
2.4	General Description for Equipment under Test (EUT)	4
2.5	Technical Information	5
3	SUMMARY OF TEST RESULT	6
3.1	Test Standards.....	6
4	DEVICE CATEGORY AND LEVELS LIMITS	7
5	ASSESSMENT RESULT	9
5.1	Output Power	9
5.2	Tune-up power	10
5.3	RF Exposure Evaluation Result.....	11
5.4	Collocated Power Calculation.....	11
5.5	Conclusion	12

1 GENERAL INFORMATION

1.1 Test Laboratory

Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100

1.2 Test Location

Name	Shenzhen BALUN Technology Co., Ltd.
Location	☐ Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
	☒ 1/F, Building B, Ganghongji High-tech Intelligent Industrial Park, No. 1008, Songbai Road, Yangguang Community, Xili Sub-district, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Franklin Technology
Address	906 JEI Platz, 186, Gasan digital1-ro, Geumcheon-gu, Seoul 08502 Korea

2.2 Manufacturer Information

Manufacturer	Franklin Technology
Address	906 JEI Platz, 186, Gasan digital1-ro, Geumcheon-gu, Seoul 08502 Korea

2.3 Factory Information

Factory	N/A
Address	N/A

2.4 General Description for Equipment under Test (EUT)

EUT Name	M2M Box
Model Name Under Test	RT410S
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	P2
Software Version	RT41021.TO.3305
Dimensions (Approx.)	L:131.9mm* W:64mm* H:19.5mm
Weight (Approx.)	N/A

2.5 Technical Information

Network and Wireless connectivity	3G Network WCDMA/HSDPA/HSUPA Band 1/2/4/5 4G Network LTE FDD Band 2/4/5/12/25/26/66/71 LTE TDD Band 41 2.4G WIFI 802.11b, 802.11g and 802.11n(HT20) 5G WIFI 802.11n(HT20/HT40), 802.11ac(VHT20/HT40)
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The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	WCDMA, LTE, WIFI		
Frequency Range	2.4G WIFI	2412 ~ 2462 MHz	
	5G WIFI	U-NII-1: 5150 ~ 5250MHz U-NII-3: 5725 ~ 5850MHz	
	WCDMA B2	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	WCDMA B4	TX: 1710 ~ 1755 MHz	RX: 2110 ~ 2155 MHz
	WCDMA B5	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	LTE B2	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	LTE B4	TX: 1710 ~ 1755 MHz	RX: 2110 ~ 2155 MHz
	LTE B5	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	LTE B12	TX: 699 ~ 716 MHz	RX: 729 ~ 746 MHz
	LTE B25	TX: 1850 ~ 1915 MHz	RX: 1930 ~ 1995 MHz
	LTE B26	TX: 814 ~ 824 MHz	RX: 859 ~ 869 MHz
		TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	LTE B66	TX: 1710 ~ 1780 MHz	RX: 2110 ~ 2180 MHz
	LTE B71	TX: 663 ~ 698 MHz	RX: 617 ~ 652 MHz
	LTE B41	TX: 2535 ~ 2655 MHz	RX: 2535 ~ 2655 MHz
Antenna Model Name	WIFI	PCB Antenna	
	WWAN	Dipole Antenna	
Exposure Category	General Population/Uncontrolled Exposure		
Product Type	Mobile Device		

3 SUMMARY OF TEST RESULT

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 2.1091	Radiofrequency radiation exposure evaluation: mobile devices
2	KDB 447498 D04 v01	447498 D04 Interim General RF Exposure Guidance v01

4 DEVICE CATEGORY AND LEVELS LIMITS

Mobile Devices:

CFR Title 47 §2.1091(b)

For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.

FCC KDB 447498 D04 General RF Exposure Guidance v01 Limit

Evaluation of compliance with the exposure limits in § 1.1310 is necessary if the ERP of the device is greater than ERP_{20cm} in Formula (B.1) [repeated from § 2.1091(c)(1) and § 1.1307(b)(1)(i)(B)].

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases} \quad (\text{B.1})$$

If the ERP is not easily obtained, then the available maximum time-averaged power may be used (i. e., without consideration of ERP only if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole.

SAR-based exemptions are constant at separation distances between 20 cm and 40 cm to avoid discontinuities in the threshold when transitioning between SAR-based and MPE-based exemption criteria at 40 cm, considering the importance of reflections.

The SAR-based exemption formula of § 1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by Formula (B.2).

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases} \quad (\text{B. 2})$$

where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right)$$

and f is in GHz, d is the separation distance (cm), and $ERP_{20 \text{ cm}}$ is per Formula (B.1). The example values shown in Table B.2 are for illustration only.

Table B.2—Example Power Thresholds (mW)

Frequency (MHz)	Distance (mm)										
		5	10	15	20	25	30	35	40	45	50
300		39	65	88	110	129	148	166	184	201	217
450		22	44	67	89	112	135	158	180	203	226
835		9	25	44	66	90	116	145	175	207	240
1900		3	12	26	44	66	92	122	157	195	236
2450		3	10	22	38	59	83	111	143	179	219
3600		2	8	18	32	49	71	96	125	158	195
5800		1	6	14	25	40	58	80	106	136	169

According with FCC KDB 447498 D04, Appendix A, Per § 1.1307(b)(3)(i)(A), a single RF source is exempt RF device (from the requirement to show data demonstrating compliance to RF exposure limits, as previously mentioned) if the available maximum time-averaged power is no more than 1 mW, regardless of separation distance.

This exemption applies to all operating configurations and exposure conditions, for the frequency range 100 kHz to 100 GHz, regardless of fixed, mobile, or portable device exposure conditions. This is a standalone exemption, and it cannot be applied in conjunction with any other test exemption.

When maximum available power each individual transmitting antenna within the same time averaging period is ≤ 1 mW, and the nearest parts of the antenna structures of the simultaneously operating transmitters are separated by at least 2 cm.

When the aggregate maximum available power of all transmitting antennas is ≤ 1 mW in the same time-averaging period.

5 ASSESSMENT RESULT

5.1 Output Power

WLAN			
Mode	2.4GWIFI	5GWIFI(U-NII-1)	5GWIFI(U-NII-3)
Conducted Power (dBm)	25.34	19.96	18.68
Antenna Gain (dBi)	-2.15	-2.02	-2.31
EIRP (dBm)	23.19	17.94	16.37
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-SH2520085-601 and BL-SH2520085-602 for more details.			

WCDMA			
Mode	Band 2	Band 4	Band 5
Conducted Power (dBm)	22.40	22.78	22.35
Antenna Gain (dBi)	1.25	1.25	1.58
ERP/EIRP (dBm)	23.65	24.03	21.78
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-SH2520085-501 for more details.			

LTE									
Mode	Band 2	Band 4	Band 5	Band 12	Band 25	Band 26	Band 66	Band 71	Band 41
Conducted Power (dBm)	21.88	22.85	21.79	22.29	22.34	23.37	22.81	23.31	24.14
Antenna Gain (dBi)	1.25	1.25	1.58	0.63	1.25	1.58	1.25	0.63	0.99
ERP/EIRP (dBm)	23.13	24.10	21.22	20.77	23.59	22.80	24.06	21.79	25.13
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-SH2520085-501 for more details.									

5.2 Tune-up power

Mode		Conducted Power Range (dBm)	EIRP Range (dBm)	ERP Range (dBm)
WCDMA	Band 2	【21.50,23.50】	【22.75,24.75】	【20.60,22.60】
	Band 4	【22.00,24.00】	【23.25,25.25】	【21.10,23.10】
	Band 5	【21.50,23.50】	/	【20.93,22.93】
LTE	Band 2	【21.00,23.00】	【22.25,24.25】	【20.10,22.10】
	Band 4	【22.00,24.00】	【23.25,25.25】	【21.10,23.10】
	Band 5	【21.00,23.00】	/	【20.43,22.43】
	Band 12	【21.50,23.50】	/	【19.98,21.98】
	Band 25	【21.50,23.50】	【22.75,24.75】	【20.60,22.60】
	Band 26	【22.50,24.50】	/	【21.93,23.93】
	Band 66	【22.00,24.00】	【23.25,25.25】	【21.10,23.10】
	Band 71	【22.50,24.50】	/	【20.98,22.98】
	Band 41	【23.00,25.00】	【23.99,25.99】	【21.84,23.84】
2.4GWIFI		【24.50,26.50】	【22.35,24.35】	【20.20,22.20】
5GWIFI(U-NII-1: 5150-5250MHz)		【19.00,21.00】	【16.98,18.98】	【14.83,16.83】
5GWIFI(U-NII-3: 5725-5850MHz)		【17.50,19.50】	【15.19,17.19】	【13.04,15.04】
Note1: ERP= EIRP -2.15dB.				
Note2: According KDB 447498 D04, used the greater of maximum conducted power and ERP to compare with the threshold value Pth.				

5.3 RF Exposure Evaluation Result

Evolution mode		f(MHz)	Distance (cm)	Maximum power (dBm)	Maximum power (mw)	Threshold Power (mW)	P/Plimit	Verdict
WCDMA	Band 2	1850	20	23.50	223.87	3060.00	0.0732	Pass
	Band 4	1710	20	24.00	251.19	3060.00	0.0821	Pass
	Band 5	824	20	23.50	223.87	1680.96	0.1332	Pass
LTE	Band 2	1850	20	23.00	199.53	3060.00	0.0652	Pass
	Band 4	1710	20	24.00	251.19	3060.00	0.0821	Pass
	Band 5	824	20	23.00	199.53	1680.96	0.1187	Pass
	Band 12	699	20	23.50	223.87	1425.96	0.1570	Pass
	Band 25	1850	20	23.50	223.87	3060.00	0.0732	Pass
	Band 26	814	20	24.50	281.84	1660.56	0.1697	Pass
	Band 66	1710	20	24.00	251.19	3060.00	0.0821	Pass
	Band 71	663	20	24.50	281.84	1352.52	0.2084	Pass
	Band 41	2535	20	25.00	316.23	3060.00	0.1033	Pass
WLAN	2.4GWIFI	2412	20	26.50	446.68	3060.00	0.1460	Pass
	5GWIFI(U-NII-1: 5150-5250MHz)	5150	20	21.00	125.89	3060.00	0.0411	Pass
	5GWIFI(U-NII-3: 5725-5850MHz)	5725	20	19.50	89.13	3060.00	0.0291	Pass

5.4 Collocated Power Calculation

Evolution mode	Frequency(MHz)	Power /Limit	$\Sigma(\text{Power / Limit})$ of WWAN + WLAN	Verdict
LTE Band 71	663MHz ~ 698MHz	0.2084	0.3544	Pass
2.4G WIFI	2412 MHz ~ 2462 MHz	0.1460		

Note:

- $\Sigma(\text{Power / Limit})$: This is a summation of [(power for each transmitter/ antenna included in the simultaneous transmission)/ (corresponding Power limit)], for WWAN+ WLAN.
- Both of the WWAN+ WLAN can transmit simultaneously, the formula of calculated the Power is $CP1 / LP1 + CP2 / LP2 + \dots \text{etc.} < 1$
 CP = Calculation power
 LP = Limit of power
- Both of the 2.4GHz WIFI and 5GHz WIFI can't transmit simultaneously at same time.
- The worst-case situation is 0.3544, which is less than "1". This confirmed that the device comply with FCC KDB 447498 D04 Power limit.
- The DUT work frequency range used is 663 MHz ~ 698 MHz, 699 MHz ~ 716 MHz, 814 MHz ~ 849 MHz, 1850 MHz ~ 1915 MHz, 1710 MHz ~ 1780 MHz, 2535 MHz ~ 2655 MHz, 2412MHz ~ 2462 MHz, 5150MHz ~ 5250 MHz, 5725MHz ~ 5850 MHz the result close to the limit by the above

formula, so we select worst case power to calculate the exclusion power threshold.

6. More power list please refer to RF test report.

5.5 Conclusion

This EUT is deemed to comply with the reference level limits, therefore the basic restrictions are compliant with human exposure limits.

Statement

1. The laboratory guarantees the scientificity, accuracy and impartiality of the test, and is responsible for all the information in the report, except the information provided by the customer. The customer is responsible for the impact of the information provided on the validity of the results.
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5. The test data and results are only valid for the tested samples provided by the customer.
6. This report shall not be partially reproduced without the written permission of the laboratory.
7. Any objection shall be raised to the laboratory within 30 days after receiving the report.

--END OF REPORT--