Testing Laboratory 3787

RADIO EXPOSURE TEST REPORT

FCC ID	:	MSQ-RTBE7D00
Equipment	:	BE6800 Dual-band WiFi Router
Brand Name	:	ASUS
Model Name	:	RT-BE86U, RT-BE6800
Applicant	:	ASUSTeK COMPUTER INC. 1F., No. 15, Lide Rd., Beitou, Taipei City 112, Taiwan
Standard	:	47 CFR Part 2.1091

The product was received on Mar. 18, 2024, and testing was started from Apr. 17, 2024 and completed on Jun. 05, 2024. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in 47 CFR Part 2.1091 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory
No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
FA3N2202-01	01	Initial issue of report	Jun. 17, 2024

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
2	-	Exposure evaluation	PASS	-

Conformity Assessment Condition:
1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account. 2. The measurement uncertainty please refer to each test result in the chapter "Measurement Uncertainty".
Disclaimer:
The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Sam Chen

Report Producer: Sophia Shiung

1 General Description

1.1 EUT General Information

RF General Information			
Evaluation Mode	**Frequency Range (MHz)**	**Operating Frequency (MHz)**	**Modulation Type**
2.4GHz WLAN	2400-2483.5	2412-2462	802.11b: DSSS (DBPSK, DQPSK, CCK) 802.11g/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) VHT: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM) 802.11be: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM, 4096QAM)
5GHz WLAN	5150-5250 5250-5350 5470-5725 5725-5850	5180-5250 5250-5320 5500-5720 5745-5825	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM) 802.11be: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM, 4096QAM)

1.2 Antenna Information

Set	Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	1~3	WALSIN	RFDPA141500SBLB807	Dipole	Reversed-SMA	Note 1
	4	INPAQ	RFPCA302604IM5B301	PCB	I-PEX	
2	1~3	WHA YU	C660-510490-A	Dipole	Reversed-SMA	
	4	WHA YU	C660-510579-A	PCB	I-PEX	

Note 1:

Set	Ant.	Port		Gain (dBi)				
		WLAN 2.4GHz	WLAN 5GHz	WLAN 2.4GHz	WLAN 5GHz			
					UNII 1	UNII 2A	UNII 2C	UNII 3
1	1	1	4	1.97	1.88	1.88	1.94	1.78
	2	2	3	1.97	1.88	1.88	1.94	1.78
	3	3	2	1.97	1.88	1.88	1.94	1.78
	4	-	1	-	1.99	1.99	1.99	1.99
2	1	1	4	1.95	1.87	1.87	1.93	1.72
	2	2	3	1.95	1.87	1.87	1.93	1.72
	3	3	2	1.95	1.87	1.87	1.93	1.72
	4	-	1	-	1.97	1.97	1.97	1.97

Note 2: Because Set 1 and Set 2 are composed of the same types of antennas, Set 1 with higher gain was selected to test.
Note 3: The above information was declared by manufacturer.
Note 4: Directional gain information of antenna Set 1

Type	Maximum Output Power	Power Spectral Density
Non-BF	Directional gain = Max.gain + array gain. For power measurements on IEEE 802.11 devices Array Gain = 0 dB (i.e., no array gain) for N ANT ≤ 4	$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$
BF	$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$	$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$

Ex.

Directional Gain (NSS1) formula : $Directiona\ lGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$

NSS1(g1,1) = $10^{G1/20}$; NSS1(g1,2)= $10^{G2/20}$; NSS1(g1,2)= $10^{G3/20}$; NSS1(g1,2)= $10^{G4/20}$

gj,k =$(Nss1(g1,1) + Nss1(g1,2) + Nss1(g1,3) + Nss1(g1,4))^2$

DG = 10 log$[(Nss1(g1,1) + Nss1(g1,2) + Nss1(g1,3) + Nss1(g1,4))^2 / N_{ANT}]$ => 10 log$[(10^{G1/20} + 10^{G2/20} + 10^{G3/20} + 10^{G4/20})^2 / N_{ANT}]$

Where;

2.4G G1= 1.97 dBi ;G2= 1.97 dBi ;G3= 1.97 dBi
5G UNII-1 G1 = 1.99 dBi; G2 = 1.88 dBi;G3 = 1.88 dBi; G4 = 1.88 dBi
5G UNII-2A G1= 1.99 dBi; G2 = 1.88 dBi;G3 = 1.88 dBi; G4 = 1.88 dBi
5G UNII-2C G1 = 1.99 dBi; G2 = 1.94 dBi;G3 = 1.94 dBi; G4 = 1.94 dBi
5G UNII-3 G1 = 1.99 dBi; G2 = 1.78 dBi;G3 = 1.78 dBi; G4 = 1.78 dBi

3T1S
2.4G DG = 6.74 dBi
3T2S
2.4G DG=3.73 dBi

The 5GHz bands support four antennas, there are three antennas that are vertical polarization, and the other antenna is horizontal polarization. Thus, the cross-polarized array gain was calculated to 10log(3).

4T1S
5G UNII-1 DG = 6.65 dBi
5G UNII-2A DG = 6.65 dBi
5G UNII-2C DG = 6.71 dB
5G UNII-3 DG = 6.55 dBi
4T2S
5G UNII-1 DG = 3.64 dBi
5G UNII-3 DG = 3.54 dBi

Note 5: **For 2.4GHz function:**
For IEEE 802.11 b/g/n/VHT/ax/be (3TX/3RX):
Port 1~3 can be used as transmitting/receiving antenna.
Port 1~3 could transmit/receive simultaneously.
For 5GHz function:
For IEEE 802.11a/n/ac/ax/be (4TX/4RX):
Port 1~4 can be used as transmitting/receiving antenna.
Port 1~4 could transmit/receive simultaneously.

1.3 Table for Multiple Listing

Model Name	Description
RT-BE86U	All the models are identical; the different model names served as a strategy for marketing.
RT-BE6800	

Note 1: From the above models, model: RT-BE86U was selected as representative model for the test and its data was recorded in this report.

Note 2: The above information was declared by manufacturer.

1.4 Table for EUT support Function

Function	Support Type
AP Router	Master
Bridge	Client without radar detection
Repeater	Master
Mesh	Master

Note 1: The USB ports of the EUT support storage function and WWAN function. During the operation of WWAN function, the 10G WAN/LAN port will fix to WAN function.

Note 2: The above information was declared by manufacturer.

1.5 Accessories

Accessories				
Power	**Brand**	**Model**	**Rating**	Remark
Adapter 1	LEI	MU60B3120500-A1	Input: 100-240V~50/60Hz, 1.5A Output: 12.0V, 5.0A	-
Adapter 2	AcBel	ADH011	Input: 100-240V, 1.4A, 50-60Hz Output: 19.5V, 2.31A, 45.0W MAX.	DC power cable: Non-shielded, 1.8m
Adapter 3	AcBel	ADK008	Input: 100-240V, 1.4A, 50-60Hz Output: 19.5V, 2.31A, 45.0W MAX.	DC power cable: Non-shielded, 1.8m
Others				
Power cable 1 (For Adapter 2 use only)*1: Non-shielded, 0.8m				
Power cable 2 (For Adapter 3 use only)*1: Non-shielded, 0.8m				
RJ-45 cable*1: Shielded, 1.5m				

1.6 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 2.1091
- KDB 447498 D04 Interim General RF Exposure Guidance v01

The following reference test guidance is not within the scope of accreditation of TAF.

- 47 CFR Part 1.1307
- 47 CFR Part 1.1310

1.7 Testing Location

Testing Location Information	
Test Lab.：Sporton International Inc. Hsinchu Laboratory	
Hsinchu	ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)
(TAF: 3787)	TEL: 886-3-656-9065 FAX: 886-3-656-9085
	Test site Designation No. TW3787 with FCC.
	Conformity Assessment Body Identifier (CABID) TW3787 with ISED.

2 Maximum Permissible Exposure

2.1 Limit of Maximum Permissible Exposure

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	Averaging Time |E|²,|H|² or S (minutes)
0.3-3.0	614	1.63	*(100)	<6
3.0-30	1842/f	4.89/f	*(900/f²)	<6
30-300	61.4	0.163	1.0	<6
300-1500	-	-	f/300	<6
1500-100,000	-	-	5	<6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	Averaging Time |E|²,|H|² or S (minutes)
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*(180/f²)	<30
30-300	27.5	0.073	0.2	<30
300-1500	-	-	f/1500	<30
1500-100,000	-	-	1.0	<30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

2.2 MPE Calculation Method

The MPE was calculated at 49 cm for mode 1 and at 247 cm for mode 2 to show compliance with the power density limit. The following formula was used to calculate the Power Density:

E (V/m) = $\frac{\sqrt{30 \times P \times G}}{d}$ Power Density: *Pd* (W/m²) = $\frac{E^2}{377}$

E = Electric field (V/m)

P = RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

Pd = $\frac{30 \times P \times G}{377 \times d^2}$

2.3 MPE Exemption

Option (A): 1.1307(b)(3)(i)(A): Available maximum time-averaged power is < 1 mW

Option (B): 1.1307(b)(3)(i)(B): Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= Pth.

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

Where

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

and

$$ERP_{20\ cm}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases}$$

d = the separation distance (cm);

Option (C): 1.1307(b)(3)(i)(C): ERP is below a threshold calculated based on the distance R between the person and the antenna / radiating structure, where R > λ / 2 π.

Single RF Sources Subject to Routine Environmental Evaluation	
RF Source frequency (MHz)	**Threshold ERP (watts)**
0.3-1.34	1,920 R^2.
1.34-30	3,450 R^2/f^2.
30-300	3.83 R^2.
300-1,500	0.0128 R^2f.
1,500-100,000	19.2R^2.
Note: R is in meters, f is in MHz.	

2.4 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

Test mode: Mode 1

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
2.4G;D1D	6.74	27.58	32.17	0.50	1849.269	49	C	4610.0	0.4013
5.2G;D1D	6.65	29.33	33.83	0.01	2421.029	49	C	4610.0	0.5254
5.3G;D1D	6.65	23.31	27.81	0.03	608.135	49	C	4610.0	0.1320
5.6G;D1D	6.71	23.25	27.81	0.03	608.135	49	C	4610.0	0.1320
5.8G;D1D	6.55	29.41	33.81	0.03	2421.029	49	C	4610.0	0.5254

Simultaneous Transmission Analysis Mode: WLAN 2.4GHz + WLAN 5GHz

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
2.4G;D1D	6.74	27.58	32.17	0.50	1849.269	49	C	4610.0	0.4013
5.2G;D1D	6.65	29.33	33.83	0.01	2421.029	49	C	4610.0	0.5254
Sum TL Ratio_C	0.9267								
Ratio Limit	1								

Test mode: Mode 2

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
2.4G;D1D	6.74	27.58	32.17	0.50	1849.269	247	C	117138.3	0.0158
5.2G;D1D	6.65	29.33	33.83	0.01	2421.029	247	C	117138.3	0.0207
5.3G;D1D	6.65	23.31	27.81	0.03	608.135	247	C	117138.3	0.0052
5.6G;D1D	6.71	23.25	27.81	0.03	608.135	247	C	117138.3	0.0052
5.8G;D1D	6.55	29.41	33.81	0.03	2421.029	247	C	117138.3	0.0207
Band26;G7D	0.00	49.50	47.35	0.49	60813.500	247	C	63621.7	0.9562

Simultaneous Transmission Analysis Mode: WLAN 2.4GHz + WLAN 5GHz + WWAN

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
2.4G;D1D	6.74	27.58	32.17	0.50	1849.269	247	C	117138.3	0.0158
5.2G;D1D	6.65	29.33	33.83	0.01	2421.029	247	C	117138.3	0.0207
Band26;G7D	0.00	49.50	47.35	0.49	60813.500	247	C	63621.7	0.9562
Sum TL Ratio_C	0.9927								
Ratio Limit	1								

Note: The above antenna gain was declared by manufacturer.

———THE END———