



RADIO EXPOSURE TEST REPORT

FCC ID : QDS-BRCM1096
Equipment : 802.11be WLAN PCI-E Custom Combination Card
Brand Name : Broadcom
Model Name : BCM94398FCREF7X7
Applicant : Broadcom Corporation
270 Innovation Drive San Jose California USA
Manufacturer : Broadcom Corporation
270 Innovation Drive San Jose California USA
Standard : 47 CFR Part 2.1091

The product was received on Oct. 03, 2022, and testing was started from Oct. 04, 2022 and completed on Oct. 12, 2022. 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

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Table of Contents

History of this test report.....3
Summary of Test Result.....4
1 General Description5
1.1 EUT General Information5
1.2 Antenna Information5
1.3 Accessories6
1.4 Applicable Standards6
1.5 Testing Location6
2 Maximum Permissible Exposure7
2.1 Limit of Maximum Permissible Exposure7
2.2 MPE Calculation Method7
2.3 MPE Exemption8
2.4 Calculated Result and Limit.....9

Photographs of EUT v01



Summary of Test Result

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

Declaration of Conformity:

1. The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to report "Measurement Uncertainty".

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: **Sam Chen**

Report Producer: **Viola Huang**



1 General Description

1.1 EUT General Information

| RF General Information | | | |
|------------------------|-----------------------|---------------------------|--|
| Evaluation Mode | Frequency Range (MHz) | Operating Frequency (MHz) | Modulation Type |
| 6GHz WLAN | 5925 ~ 7125 | 6105-6905 | 802.11be: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM, 4096QAM) |

1.2 Antenna Information

| Ant. | Port | Brand | Model Name | Antenna Type | Connector | Gain (dBi) |
|------|------|---------|------------|--------------|-----------|------------|
| 1 | 1 | Airgain | N60AGAU | PCB Antenna | I-PEX | 3.4 |
| 2 | 2 | Airgain | N60AGAU | PCB Antenna | I-PEX | 3.4 |

Note 1: The above information was declared by manufacturer.

Note 2: Directional gain information

| Maximum Output Power | Power Spectral Density |
|---|--|
| 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 | $DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{in}} \left[\sum_{k=1}^{N_{ANT}} \xi_{j,k} \right]^2}{N_{ANT}} \right]$ |

Ex.

Directional Gain (NSS1) formula :

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{in}} \left[\sum_{k=1}^{N_{ANT}} \xi_{j,k} \right]^2}{N_{ANT}} \right]$$

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

$$g_{j,k} = (NSS1(g1,1) + NSS1(g1,2))^2$$

$$DG = 10 \log[(NSS1(g1,1) + NSS1(g1,2))^2 / N_{ANT}] => 10 \log[(10^{G1/20} + 10^{G2/20})^2 / N_{ANT}]$$

Where ;

$$G1 = 10 ; G2 = 10$$

$$6G G1 = 3.4dBi; G2 = 3.4 dBi; DG = 6.41dBi$$

For IEEE 802.11be mode (2TX/2RX):

Port 1 and Port 2 can be used as transmitting/receiving antenna.

Port 1 and Port 2 could transmit/receive simultaneously.



1.3 Accessories

N/A

1.4 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

1.5 Testing Location

| Testing Location Information | |
|---|---|
| Test Lab. : Sporton International Inc. Hsinchu Laboratory | |
| Hsinchu (TAF: 3787) | ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.) 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/ cm ²) | 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/f ²) | <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/ cm ²) | 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/f ²) | <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 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

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

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.

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

Where

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

and

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

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 $R > \lambda / 2 \pi$.

| 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 ² f. |
| 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

For Mode 1: EUT Connected to Standard-Power AP

| Mode | DG (dBi) | Power (dBm) | EIRP (dBm) | Tolerance (dB) | Tune-up EIRP (dBm) | Distance (cm) | S (mW/cm ²) | S Limit (mW/cm ²) | Option *1 | TL EIRP (dBm) *2 | TL Ratio *3 |
|----------|----------|-------------|------------|----------------|--------------------|---------------|-------------------------|-------------------------------|-----------|------------------|-------------|
| 6.2G:D1D | 3.40 | 22.42 | 25.82 | 0.50 | 26.32 | 20 | 0.08526 | 1.00000 | C | 31.002 | 0.3402 |

For Mode 2: EUT Connected to LPI AP

| Mode | DG (dBi) | Power (dBm) | EIRP (dBm) | Tolerance (dB) | Tune-up EIRP (dBm) | Distance (cm) | S (mW/cm ²) | S Limit (mW/cm ²) | Option *1 | TL EIRP (dBm) *2 | TL Ratio *3 |
|----------|----------|-------------|------------|----------------|--------------------|---------------|-------------------------|-------------------------------|-----------|------------------|-------------|
| 6.2G:D1D | 3.40 | 17.96 | 21.36 | 0.50 | 21.86 | 20 | 0.03053 | 1.00000 | C | 31.002 | 0.1218 |
| 6.4G:D1D | 3.40 | 17.78 | 21.18 | 0.50 | 21.68 | 20 | 0.02929 | 1.00000 | C | 31.002 | 0.1169 |
| 6.7G:D1D | 3.40 | 17.58 | 20.98 | 0.50 | 21.48 | 20 | 0.02797 | 1.00000 | C | 31.002 | 0.1116 |
| 7.0G:D1D | 3.40 | 17.34 | 20.74 | 0.50 | 21.24 | 20 | 0.02647 | 1.00000 | C | 31.002 | 0.1056 |

Note 1: Option A, B and C refer as clause 2.3

Note 2: For option B, Pth(mW) convert to TL EIRP(dBm); For option C, ERP(W) convert to TL EIRP(dBm)

Note 3: TL Ratio=Tune-up EIRP(mW)/TL EIRP(mW)

—————THE END—————