RADIO TEST REPORT

Report No: STS2201205H02

Issued for

Asteria Technology Pte. Ltd.

160 ROBINSON ROAD, #19-05 SBF CENTER,
SINGAPORE 068914

Product Name:	Gravio Hub 2
Brand Name:	Gravio
Model Name:	GHUB002
Series Model:	N/A
FCC ID:	2AT7Z-GHUB002
Test Standard:	FCC 47CFR §2.1091

Shenzhen STS Test Services Co., Ltd.
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Test Report Certification

Applicant's Name	:	Asteria Technology Pte. Ltd.
Address	:	160 ROBINSON ROAD, #19-05 SBF CENTER, SINGAPORE 068914
Manufacturer's Name	:	Asteria Technology Pte. Ltd.
Address	:	160 ROBINSON ROAD, #19-05 SBF CENTER, SINGAPORE 068914

Product Description

Product Name	:	Gravio Hub 2
Brand Name	:	Gravio
Model Name	:	GHUB002
Series Model	:	N/A
Standards	:	FCC 47CFR §2.1091 447498 D04 Interim General RF Exposure Guidance v01

Date of Test	:	
Date of receipt of test item	:	20 Apr. 2022
Date (s) of performance of tests	:	20 Apr. 2022 ~ 12 Aug. 2022
Date of Issue	:	12 Aug. 2022
Test Result	:	**Pass**

Testing Engineer : Chris Chen

(Chris Chen)

Technical Manager : Sean She

(Sean she)

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(Bovey Yang)

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Revision History

Rev.	Issue Date	Report No.	Effect Page	Contents
00	12 Aug. 2022	STS2201205H02	ALL	Initial Issue

1. GENERAL INFORMATION

1.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Gravio Hub 2	
Brand Name	Gravio	
Model Name	GHUB002	
Series Model	N/A	
Model Difference	N/A	
Product Description	The EUT is Gravio Hub 2	
	Operation Frequency:	BT: 2402~2480 MHz 2.4G WLAN: 802.11b/g/n 20: 2412~2462 MHz 802.11n(40MHz):2422~2452MHz 5G WLAN: IEEE 802.11a/ n(HT20)/ac(VHT20): 5.180GHz-5.240GHz IEEE 802.11n(HT40)/ac(VHT40): 5.190GHz-5.230GHz IEEE 802.11ac(VHT80): 5.210GHz IEEE 802.11a/ n(HT20)/ac(VHT20): 5.745GHz-5.825GHz IEEE 802.11a/ n(HT40)/ac(VHT40): 5.755GHz-5.795GHz IEEE 802.11ac(VHT80): 5.775GHz Zigbee: 2405 ~ 2480 MHz GSM 850: 824 MHz ~ 849 MHz GSM 1900: 1850 MHz ~ 1910MHz WCDMA 1900: 1850 MHz ~1910MHz WCDMA 850: 824 MHz ~849MHz WCDMA 1700: 1710 MHz ~1755 MHz LTE Band 2:1850~1910MHz LTE Band 4:1710~1755MHz LTE Band 5:824~849MHz LTE Band 7:2500~2570MHz LTE Band 12:699~716MHz LTE Band 13:777~787MHz LTE Band 25:1850~1915MHz LTE Band 26:814~849MHz LTE Band 38:2570~2620MHz LTE Band 41:2555~2655MHz

	Modulation Type:	BT: GFSK(1Mbps), π/4-DQPSK(2Mbps), 8DPSK(3Mbps) 2.4G WLAN: 802.11b(DSSS):CCK,DQPSK,DBPSK 802.11g(OFDM): BPSK,QPSK,16-QAM,64-QAM 802.11n(OFDM): BPSK,QPSK,16-QAM,64-QAM 5G WLAN: 802.11a(OFDM): BPSK,QPSK,16-QAM,64-QAM 802.11n(OFDM): BPSK,QPSK,16-QAM,64-QAM 802.11ac(OFDM): BPSK,QPSK,16-QAM,64-QAM,256-QAM Zigbee: O-QPSK GSM: GMSK for GPRS; GMSK and 8PSK for EDGE WCDMA: WCDMA: QPSK; HSDPA:QPSK/16QAM; HSUPA:BPSK LTE: QPSK/16QAM
	Antenna gain:	2dBi
	Antenna Designation:	BT/WIFI/Zigbee: Ceramic GSM/WCDMA/LTE: FPC
Rating	Input: DC 12V	
Hardware version number	V4.4	
Software version number	V2.0	

1.2 TEST FACTORY

SHENZHEN STS TEST SERVICES CO., LTD
Add. : A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China

FCC test Firm Registration Number: 625569

IC test Firm Registration Number: 12108A

A2LA Certificate No.: 4338.01

2. FCC 47CFR §2.1091 REQUIREMENT

2.1 TEST STANDARDS

Follow the maximum permissible exposure (MPE) limits specified in 447498 D04 Interim General Radio Frequency Exposure Guidelines v01. The gain of the antenna used in the product was extracted from the supplied antenna data sheet and the maximum total power input to the antenna was also measured. Calculate the distance from the product to the MPE limit by the formula.

2.2 LIMIT

For single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2) of this section): A single RF source is exempt if:

(A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of Part 1.1307. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

(B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold Pth (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). Pth is given by:

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

Where

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

(C) Or using below table and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least λ/2π, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of λ/4 or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

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.

For multiple RF sources: Multiple RF sources are exempt if:

(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those is paragraph (b)(3)(i)(A) of Part 1.1307. Medical implant devices may only use this exemption and that in paragraph (b)(3)(i)(A).

(B) in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

Where:

a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(B) of Part 1.1307 for Pth, including existing exempt transmitters and those being added.

b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(C) of Part 1.1307 for Threshold ERP, including existing exempt transmitters and those being added.

c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

Pi = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive).

Pth,i = the exemption threshold power (Pth) according to paragraph (b)(3)(i)(B) of this section for fixed, mobile, or portable RF source i.

ERPj = the ERP of fixed, mobile, or portable RF source j.

ERPth,j = exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least λ/2π according to the applicable formula of paragraph (b)(3)(i)(C) of Part 1.1307.

Evaluatedk = the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation at the location of exposure.

Exposure Limitk = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source k, as applicable from § 1.1310.

2.3 TEST RESULT

Turn up

Mode	Detector	Turn up Power
BT	AV	5±1dBm
2.4G WLAN	AV	9±1dBm
5G WLAN	AV	3±1dBm
Zigbee	AV	16±1dBm
GSM 850	AV	32±1
GSM 1900	AV	29±1
WCDMA B2	AV	23±1
WCDMA B4	AV	23±1
WCDMA B5	AV	23±1
LTE Band 2	AV	24±1
LTE Band 4	AV	24±1
LTE Band 5	AV	24±1
LTE Band 7	AV	23±1
LTE Band 12	AV	24±1
LTE Band 13	AV	24±1
LTE Band 25	AV	24±1
LTE Band 26 (814-824)	AV	24±1
LTE Band 26 (824-849)	AV	23±1
LTE Band 38	AV	23±1
LTE Band 41	AV	23±1

Protocol	Fre. (GHz)	Separation distance (cm)	Max Turn up power (dBm)	ANT Gain (dBi)	Max EIRP (dBm)	Max EIRP (mW)	Limit (mW)	Ratio	Result
BT	2.402	20	6	2	8	6.310	3060	0.0021	Pass
2.4G WLAN	2.412	20	10	2	12	15.849	3060	0.0052	Pass
5G WLAN	5.240	20	4	2	6	3.981	3060	0.0013	Pass
Zigbee	2.405	20	17	2	19	79.433	3060	0.0260	Pass

Protocol	Fre. (GHz)	Separation distance (cm)	Max Turn up power (dBm)	ANT Gain (dBi)	Duty Cycle Fator (dB)	Max EIRP (dBm)	Max EIRP (mW)	Limit (mW)	Ratio	Result
GSM 850	0.8366	20	33.00	2	-9.03	25.97	395.367	1707	0.2317	Pass
GSM 1900	1.8502	20	30.00	2	-9.03	22.97	198.153	3060	0.0648	Pass
WCDMA B2	1.8524	20	24.00	2	0.00	26.00	398.107	3060	0.1301	Pass
WCDMA B4	1.7124	20	24.00	2	0.00	26.00	398.107	3060	0.1301	Pass
WCDMA B5	0.8264	20	24.00	2	0.00	26.00	398.107	1686	0.2361	Pass
LTE Band 2	1.8800	20	25.00	2	0.00	27.00	501.187	3060	0.1638	Pass
LTE Band 4	1.7325	20	25.00	2	0.00	27.00	501.187	3060	0.1638	Pass
LTE Band 5	0.8365	20	25.00	2	0.00	27.00	501.187	1706.46	0.2937	Pass
LTE Band 7	2.5600	20	24.00	2	0.00	26.00	398.107	3060	0.1301	Pass
LTE Band 12	0.7075	20	25.00	2	0.00	27.00	501.187	1443.3	0.3473	Pass
LTE Band 13	0.7845	20	25.00	2	0.00	27.00	501.187	1600.38	0.3132	Pass
LTE Band 25	1.9100	20	25.00	2	0.00	27.00	501.187	3060	0.1638	Pass
LTE Band 26 (814-824)	0.8315	20	25.00	2	0.00	27.00	501.187	1696.26	0.2955	Pass
LTE Band 26 (824-849)	0.8440	20	24.00	2	0.00	26.00	398.107	1721.76	0.2312	Pass
LTE Band 38	2.5950	20	24.00	2	-1.99	24.01	251.768	3060	0.0823	Pass
LTE Band 41	2.5930	20	24.00	2	-1.99	24.01	251.768	3060	0.0823	Pass

Multiple transmission:

LTE+2.4G WIFI+Zigbee=0.3473+0.0052+0.0260=0.3785＜1

Note:

The Maxinum power is less than the limit, complies with the exemption requirements.

BT and WIFI can not transmit at the same time.

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