



MPE TEST REPORT

Applicant Starry, Inc.
FCC ID 2AGZ3S00111
Product Starry Station
Model S00111
Report No. RXA1512-0225MPE01R2
Issue Date February 3, 2016

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC 47 CFR Part 1 1.1310**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Jiang peng Lan

Reviewed by: Jiangpeng Lan

Kai Xu

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1 Test Laboratory

1.1 Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd**). The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above. This report must not be used by the client to claim product certification, approval, or endorsement by CNAS or any government agencies.

1.2 Test facility

CNAS (accreditation number:L2264)

TA Technology (Shanghai) Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

FCC (recognition number is 428261)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

IC (recognition number is 8510A)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Canada to perform electromagnetic emission measurement.

VCCI (recognition number is C-4595, T-2154, R-4113, G-766)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Japan to perform electromagnetic emission measurement.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.



1.3 Testing Location

Company: TA Technology (Shanghai) Co., Ltd.
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1.4 Laboratory Environment

Temperature	Min. = 18°C, Max. = 25 °C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5 Ω
Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

2 Description of Equipment under Test

Client Information

Applicant	Starry, Inc.
Applicant address	745 Atlantic Ave Fl 8, Boston, MA, United States
Manufacturer	Flextronics Manufacturing(Zhuhai) Co. Ltd
Manufacturer address	XinQing Science&Technology Industrial Park, Doumen County.Zhuhai

General Technologies

Model	S00111
SN	0010000999
Hardware Version	1.9
Software Version	1.0
Date of Testing:	December 28, 2015~ January 20, 2016

3 Maximum conducted output power (measured) and antenna Gain

the numeric gain (G) of the antenna with a gain specified in dB is determined by

$$\text{Numeric gain (G)} = 10^{(\text{antenna gain}/10)}$$

Antenna 1

Band		Maximum Conducted Output Power (dBm)	Antenna Gain (dBi)	Numeric gain (dB)
2.4G	802.11b	18.80	0.34	1.081
	802.11g	17.57	0.34	1.081
	802.11n HT20	18.64	0.34	1.081
	802.11n HT40	15.88	0.34	1.081
5G U-NII-1	802.11a	19.21	0.49	1.119
	802.11n HT20	19.30	0.49	1.119
	802.11n HT40	18.50	0.49	1.119
	802.11ac HT20	19.30	0.49	1.119
	802.11ac HT40	18.50	0.49	1.119
	802.11ac HT80	17.21	0.49	1.119
5G U-NII-3	802.11a	19.21	0.35	1.084
	802.11n HT20	19.31	0.35	1.084
	802.11n HT40	18.73	0.35	1.084
	802.11ac HT20	19.22	0.35	1.084
	802.11ac HT40	18.73	0.35	1.084
	802.11ac HT80	18.16	0.35	1.084

Antenna 2

Band		Maximum Conducted Output Power (dBm)	Antenna Gain (dBi)	Numeric gain (dB)
2.4G	802.11b	18.93	0.34	1.081
	802.11g	17.82	0.34	1.081
	802.11n HT20	18.82	0.34	1.081
	802.11n HT40	16.17	0.34	1.081
5G U-NII-1	802.11a	18.60	0.49	1.119
	802.11n HT20	18.48	0.49	1.119
	802.11n HT40	18.02	0.49	1.119
	802.11ac HT20	19.02	0.49	1.119
	802.11ac HT40	18.07	0.49	1.119
	802.11ac HT80	17.06	0.49	1.119
5G U-NII-3	802.11a	18.22	0.35	1.084
	802.11n HT20	18.30	0.35	1.084
	802.11n HT40	18.01	0.35	1.084
	802.11ac HT20	18.32	0.35	1.084
	802.11ac HT40	17.96	0.35	1.084
	802.11ac HT80	17.49	0.35	1.084

**Antenna 3**

Band		Maximum Conducted Output Power (dBm)	Antenna Gain (dBi)	Numeric gain (dB)
2.4G	802.11b	18.93	0.34	1.081
	802.11g	17.66	0.34	1.081
	802.11n HT20	18.81	0.34	1.081
	802.11n HT40	16.08	0.34	1.081
5G U-NII-1	802.11a	20.22	0.49	1.119
	802.11n HT20	20.35	0.49	1.119
	802.11n HT40	19.68	0.49	1.119
	802.11ac HT20	20.33	0.49	1.119
	802.11ac HT40	19.65	0.49	1.119
	802.11ac HT80	18.35	0.49	1.119
5G U-NII-3	802.11a	20.35	0.35	1.084
	802.11n HT20	20.55	0.35	1.084
	802.11n HT40	19.99	0.35	1.084
	802.11ac HT20	20.59	0.35	1.084
	802.11ac HT40	19.95	0.35	1.084
	802.11ac HT80	19.35	0.35	1.084

Antenna 4

Band		Maximum Conducted Output Power (dBm)	Antenna Gain (dBi)	Numeric gain (dB)
2.4G	802.11b	19.37	0.34	1.081
	802.11g	18.17	0.34	1.081
	802.11n HT20	19.18	0.34	1.081
	802.11n HT40	16.12	0.34	1.081
5G U-NII-1	802.11a	19.45	0.49	1.119
	802.11n HT20	19.63	0.49	1.119
	802.11n HT40	19.28	0.49	1.119
	802.11ac HT20	19.55	0.49	1.119
	802.11ac HT40	19.26	0.49	1.119
	802.11ac HT80	18.55	0.49	1.119
5G U-NII-3	802.11a	19.15	0.35	1.084
	802.11n HT20	19.25	0.35	1.084
	802.11n HT40	19.17	0.35	1.084
	802.11ac HT20	19.65	0.35	1.084
	802.11ac HT40	19.46	0.35	1.084
	802.11ac HT80	18.47	0.35	1.084

MIMO

Band		Maximum Conducted Output Power (dBm)	Antenna Gain (dBi)	Numeric gain (dB)
2.4G	802.11n HT20	22.52	0.34	1.081
	802.11n HT40	22.47	0.34	1.081
5G U-NII-1	802.11n HT20	11.76	0.49	1.119
	802.11n HT40	10.85	0.49	1.119
	802.11ac HT20	11.51	0.49	1.119
	802.11ac HT40	10.63	0.49	1.119
	802.11ac HT80	10.21	0.49	1.119
5G U-NII-3	802.11n HT20	12.68	0.35	1.084
	802.11n HT40	11.66	0.35	1.084
	802.11ac HT20	12.20	0.35	1.084
	802.11ac HT40	12.02	0.35	1.084
	802.11ac HT80	11.59	0.35	1.084

Band	Maximum Conducted Output Power (dBm)	Antenna Gain (dBi)	Numeric gain (dB)
Zigbee	21.80	-0.09	0.979
Bluetooth (Low Energy)	9.672	-0.09	0.979

According to section 1.1310 of FCC 47 CFR Part 1, limits for maximum permissible exposure (MPE) are as following

TABLE 1 – LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3-30	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				
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

f = frequency in MHz

* = Plane-wave equivalent power density

Note1. Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational / controlled limits apply provided he or she is made aware of the potential for exposure.

Note2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.



The maximum permissible exposure for 1500~100,000MHz is 1.0. So

Band	The maximum permissible exposure
Wi-Fi 2.4G	1.0mW/cm ²
Wi-Fi 5G	1.0mW/cm ²
Zigbee	1.0mW/cm ²
Bluetooth (Low Energy)	1.0mW/cm ²

IMPORTANT NOTE: To comply with the FCC RF exposure compliance requirements, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. No change to the antenna or the device is permitted. Any change to the antenna or the device could result in the device exceeding the RF exposure requirements and void user's authority to operate the device.

RF Exposure Calculations:

The following information provides the minimum separation distance for the highest gain antenna provided. This calculation is based on the conducted power, considering maximum power and antenna gain. The formula shown in KDB 865664 D01 is used in the calculation.

Equation from KDB 865664 D01, Edition 97-01 is:

$$S = PG / 4\pi R^2$$

Where: S = power density (in appropriate units, e.g. mW/cm²)

P = Time-average maximum tune up procedure (in appropriate units, e.g., mW)

G = the numeric gain of the antenna

R = distance to the center of radiation of the antenna (20 cm = limit for MPE)

Antenna 1

Wi-Fi 2.4G PG = 18.80dBm + (1.081dB) = 19.881 dBm = 97.30 mW

Wi-Fi 5G PG = 19.31dBm + (1.084dB) = 20.394 dBm = 109.50 mW

Antenna 2

Wi-Fi 2.4G PG = 18.93dBm + (1.081dB) = 20.011 dBm = 100.25 mW

Wi-Fi 5G PG = 19.02dBm + (1.119dB) = 20.139 dBm = 103.25 mW

Antenna 3

Wi-Fi 2.4G PG = 18.93dBm + (1.081dB) = 20.011 dBm = 100.25 mW

Wi-Fi 5G PG = 20.59dBm + (1.084dB) = 21.674 dBm = 147.03 mW

Antenna 4

Wi-Fi 2.4G PG = 19.37dBm + (1.081dB) = 20.451 dBm = 110.94 mW

Wi-Fi 5G PG = 19.65dBm + (1.084dB) = 20.734 dBm = 118.41 mW

MIMO

Wi-Fi 2.4G PG = 22.52dBm + (1.081dB) = 23.601 dBm = 229.14 mW

Wi-Fi 5G PG = 12.68dBm + (1.084dB) = 13.764 dBm = 23.79 mW

Zigbee: PG = 21.80dBm + (0.979dB) = 22.779 dBm = 189.63 mW

Bluetooth (Low Energy): PG = 9.672dBm + (0.979dB) = 10.651 dBm = 11.62 mW

Band		PG (mW)	Test Result (mW/cm ²)	Limit Value (mW/cm ²)	The MPE ratio
Antenna 1	WiFi 2.4G	97.30	0.019	1.0	0.019
	WiFi 5G	109.50	0.022	1.0	0.022
Antenna 2	WiFi 2.4G	100.25	0.020	1.0	0.020
	WiFi 5G	103.25	0.021	1.0	0.021
Antenna 3	WiFi 2.4G	100.25	0.020	1.0	0.020
	WiFi 5G	147.03	0.029	1.0	0.029
Antenna 4	WiFi 2.4G	110.94	0.022	1.0	0.022
	WiFi 5G	118.41	0.024	1.0	0.024
MIMO	WiFi 2.4G	229.14	0.046	1.0	0.046
	WiFi 5G	23.79	0.005	1.0	0.005
Zigbee		189.63	0.038	1.0	0.038
Bluetooth (Low Energy)		11.62	0.002	1.0	0.002
Note: The MPE ratio = Mac Test Result ÷ Limit Value					

So the simultaneous transmitting antenna pairs as below:

Single Antenna

$$\sum \text{of MPE ratios} = \text{WiFi 2.4G} + \text{WiFi 5G} + \text{BLE} + \text{Zigbee} = 0.022 + 0.029 + 0.038 + 0.002 = 0.091 < 1$$

MIMO Antennas

$$\sum \text{of MPE ratios} = \text{WiFi 2.4G} + \text{WiFi 5G} + \text{BLE} + \text{Zigbee} = 0.046 + 0.005 + 0.038 + 0.002 = 0.091 < 1$$

Note: For transmitters, minimum separation distance is 20cm, even if calculations indicate MPE distance is less.