

RF EXPOSURE EVALUATION REPORT

Product Name: 802.11ac Wave-2 3x3:3 Enterprise Wi-Fi
Access Point
Trade Mark: GRANDSTREAM
Model No. / HVIN: GWN7615
Report Number: 200108018RFC-3
Test Standards: FCC 47 CFR Part 1 Subpart I
RSS-102 Issue 5
FCC ID: YZZGWN7615
IC: 11964A-GWN7615
Test Result: PASS
Date of Issue: April 10, 2020

Prepared for:

Grandstream Networks, Inc.
126 Brookline Ave., 3rd Floor Boston, MA 02215, USA

Prepared by:

Shenzhen UnionTrust Quality and Technology Co., Ltd.
16/F, Block A, Building 6, Baoneng Science and Technology Park,
Qingxiang Road No.1, Longhua New District, Shenzhen, China
TEL: +86-755-2823 0888
FAX: +86-755-2823 0886

Prepared by: _____

Henry Lu
Team Leader

Reviewed by: _____

Kevin Liang
Assistant Manager

Approved by: _____

Billy Li
Technical Director

Date: April 10, 2020

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China
Tel: +86-755-28230888 Fax: +86-755-28230886 E-mail: info@uttlab.com

<http://www.uttlab.com>

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Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China

Tel: +86-755-28230888

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UTTR-RF-RSS102-V1.0

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1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Grandstream Networks, Inc.
Address of Applicant:	126 Brookline Ave., 3rd Floor Boston, MA 02215, USA
Manufacturer:	Grandstream Networks, Inc.
Address of Manufacturer:	126 Brookline Ave., 3rd Floor Boston, MA 02215, USA

1.2 EUT INFORMATION

Product Name:	802.11ac Wave-2 3x3:3 Enterprise Wi-Fi Access Point		
Model No. / HVIN:	GWN7615		
Trade Mark:	GRANDSTREAM		
DUT Stage:	Identical Prototype		
EUT Supports Function:	2.4 GHz ISM Band:	IEEE 802.11b/g/n	
	5 GHz U-NII Bands:	5 150 MHz to 5 250 MHz	IEEE 802.11a/n/ac
		5 250 MHz to 5 350 MHz	IEEE 802.11a/n/ac
		5 470 MHz to 5 725 MHz	IEEE 802.11a/n/ac
		5 725 MHz to 5 850 MHz	IEEE 802.11a/n/ac
Software Version:	1.0.0.2		
Hardware Version:	V1.1B		
Sample Received Date:	January 9, 2020		
Sample Tested Date:	January 9, 2020 to April 7, 2020		

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Frequency Bands:	5150 MHz to 5250 MHz (U-NII-1)
	5250 MHz to 5350 MHz (U-NII-2A)
	5470 MHz to 5725 MHz (U-NII-2C)
	5725 MHz to 5850 MHz (U-NII-3)
Frequency Ranges:	5180 MHz to 5240 MHz
	5260 MHz to 5320 MHz
	5500 MHz to 5700 MHz
	5745 MHz to 5825 MHz
Support Standards:	IEEE 802.11a/n/ac
TPC Function:	Not Support
DFS Operational mode:	Master
Type of Modulation:	IEEE 802.11a: OFDM(64QAM, 16QAM, QPSK, BPSK)
	IEEE 802.11n: OFDM(64QAM, 16QAM, QPSK, BPSK)
	IEEE 802.11ac: OFDM(64QAM, 16QAM, QPSK, BPSK)
Channel Spacing:	IEEE 802.11a/n-HT20/ac-VHT20: 20 MHz
	IEEE 802.11n-HT40/ac-VHT40: 40 MHz
	IEEE 802.11ac-VHT80: 80 MHz
Data Rate:	IEEE 802.11a: Up to 54 Mbps
	IEEE 802.11n-HT20: Up to MCS23
	IEEE 802.11n-HT40: Up to MCS23
	IEEE 802.11ac-VHT20: Up to MCS8
	IEEE 802.11ac-VHT40: Up to MCS9

	IEEE 802.11ac-VHT80: Up to MCS9		
Number of Channels:	5150 MHz to 5250 MHz: 4 for IEEE 802.11a/n-HT20/ac-VHT20 2 for IEEE 802.11n-HT40)/ac-VHT40 1 for IEEE 802.11acVHT80		
	5250 MHz to 5350 MHz: 4 for IEEE 802.11a/n-HT20/ac-VHT20 2 for IEEE 802.11n-HT40)/ac-VHT40 1 for IEEE 802.11acVHT80		
	5470 MHz to 5725 MHz: 11 for IEEE 802.11a/n-HT20/ac-VHT20 5 for IEEE 802.11n-HT40/ac-VHT40 2 for IEEE 802.11ac-VHT80		
	5725 MHz to 5850 MHz: 5 for IEEE 802.11a/n-HT20/ac-VHT20 2 for IEEE 802.11n-HT40/ac-VHT40 1 for IEEE 802.11ac-VHT80		
Antenna Type:	Chain 0	PIFA Antenna	
	Chain 1	PIFA Antenna	
	Chain 2	PIFA Antenna	
Antenna Gain:	Chain 0	5150 MHz to 5250 MHz: 3.0 dBi	
		5250 MHz to 5350 MHz: 3.0 dBi	
		5470 MHz to 5725 MHz: 3.0 dBi	
		5725 MHz to 5850 MHz: 3.0 dBi	
	Chain 1	5150 MHz to 5250 MHz: 3.0 dBi	
		5250 MHz to 5350 MHz: 3.0 dBi	
		5470 MHz to 5725 MHz: 3.0 dBi	
		5725 MHz to 5850 MHz: 3.0 dBi	
	Chain 2	5150 MHz to 5250 MHz: 3.0 dBi	
		5250 MHz to 5350 MHz: 3.0 dBi	
		5470 MHz to 5725 MHz: 3.0 dBi	
		5725 MHz to 5850 MHz: 3.0 dBi	
Maximum conducted output power (dBm):	MIMO_Chain 0+1+2	U-NII-2A	U-NII-2C
	IEEE 802.11a:	18.35	18.17
	IEEE 802.11n-HT20:	19.23	18.53
	IEEE 802.11n-HT40:	21.44	19.96
	IEEE 802.11ac-VHT20:	19.26	18.66
	IEEE 802.11ac-VHT40:	21.57	20.07
	IEEE 802.11ac-VHT80:	15.55	15.04

1.4 OTHER INFORMATION

Operation Frequency Each of Channel				
	U-NII-1	U-NII-2A	U-NII-2C	U-NII-3
IEEE 802.11a, IEEE 802.11n-HT20, IEEE 802.11ac-VHT20	f = 5000 + 5k, k = 32 + 4n			f = 5000 + 5k, k = 145 + 4n
	n = 1,..., 4	n = 5,..., 8	n = 17,..., 27	n = 1,..., 5
IEEE 802.11n-HT40, IEEE 802.11ac-VHT40	f = 5000 + 5k, k = 30 + 8n			f = 5000 + 5k, k = 143 + 8n
	n = 1, 2	n = 1,..., 5	n = 9,..., 13	n = 1, 2
IEEE 802.11ac-VHT80	f = 5000 + 5k, k = 26 + 16n			f = 5000 + 5k, k = 155
	n = 1	n = 1, 2	n = 5, 6	
Note: f is the operating frequency (MHz); k is the operating channel.				

1.5 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF product, according to the specifications of the manufacturers. It must comply with the requirements of the following standards:

FCC 47 CFR Part 1 Subpart I
RSS-102 Issue 5

All test items have been performed and recorded as per the above standards

1.6 DEVIATION FROM STANDARDS

None.

1.7 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.8 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

2. EQUIPMENT LIST

Please refer to the RF test report.

3. MPE EVALUATION

3.1 REFERENCE DOCUMENTS FOR EVALUATION

No.	Identity	Document Title
1	FCC 47 CFR Part 1 Subpart I	PROCEDURES IMPLEMENTING THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969
2	RSS-102 Issue 5	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
3	KDB 447498 D01 General RF Exposure Guidance v06	RF EXPOSURE PROCEDURES AND EQUIPMENT AUTHORIZATION POLICIES FOR MOBILE AND PORTABLE DEVICES

3.2 MPE COMPLIANCE REQUIREMENT

3.2.1 Limits

3.2.1.1 FCC 47 CFR Part 1 Subpart I

According to §1.1307(b)(1), system operating under the provisions of this section shall be operating in a manner that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure.

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 Times 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)*	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	F/300	6
1500-100000	/	/	5	6

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 Times 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)*	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-100000	/	/	1	30

Note: f = frequency in MHz: * = Plane-wave equivalents power density.

3.2.1.2 RSS-102 Issue 5

According to RSS-102 Issue 5, system operating under the provisions of this section shall be operating in a manner that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure.

According to RSS-102 Issue 5, system operating under the provisions of this section shall be operating in a manner that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure.

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz⁶ and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

3.2.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

3.3 MPE CALCULATION METHOD

FCC 47 CFR Part 1 Subpart I

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

S = power density (in appropriate units, e.g., mw/cm²)

P = power input to the antenna (in appropriate units, e.g., mw)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor is normally numeric gain.

R = distance to the center of radiation of the antenna (in appropriate units, e.g., cm)

3.4 MPE CALCULATION RESULTS

Note: For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

3.4.1 For WLAN

For Wi-Fi function, operating at 5250 MHz to 5350 MHz for IEEE802.11a/n/ac and
operating at 5470 MHz to 5725 MHz for IEEE802.11a/n/ac.

3.4.1.1 Antenna Type:

Chain 0: PIFA Antenna

Chain 1: PIFA Antenna

Chain 2: PIFA Antenna

3.4.1.2 Antenna Gain:

Chain 0: 5250 MHz to 5350 MHz: 3.0 dBi

5470 MHz to 5725 MHz: 3.0 dBi

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Tel: +86-755-28230888

Fax: +86-755-28230886

E-mail: info@uttlab.com

<http://www.uttlab.com>

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Chain 1: 5250 MHz to 5350 MHz: 3.0 dBi
5470 MHz to 5725 MHz: 3.0 dBi

Chain 2: 5250 MHz to 5350 MHz: 3.0 dBi
5470 MHz to 5725 MHz: 3.0 dBi

For MIMO mode (3Tx/3Rx), there are three transmission antennas. Chain 0 and Chain 1 and Chain 2 used at the same time and antenna ports have uniform output powers. The Chain 0 and Chain 1 and Chain 2 antenna ports can be used alone. The transmit signals are correlated with each other.

$$\text{The directional gain} = G_{\text{ANT}} + 10 \log(N_{\text{ANT}}) \text{ dBi} = 3 + 10 \log(3) = 7.77 \text{ dBi}$$

3.4.1.3 Results for FCC 47 CFR Part 1 Subpart I

For MIMO (3TX/3RX) Mode

Operating Mode		Freq.	Declared maximum conducted average output power	Max. positive Tolerance according manufacturer	Directional Gain	Calculated maximum EIRP	Declared maximum EIRP	MPE Limit	MPE Value
		(MHz)	(dBm)		(dBi)	(dBm)	(mW)	(mW/cm ²)	
MIMO (3TX/3RX)	IEEE 802.11a	5260-5320	18	1	7.77	26.77	475.3352	1	0.0946
		5500-5700	18	1	7.77	26.77	475.3352	1	0.0946
	IEEE 802.11n-HT20	5260-5320	19	1	7.77	27.77	598.4116	1	0.1190
		5500-5700	18	1	7.77	26.77	475.3352	1	0.0946
	IEEE 802.11n-HT40	5270-5310	21	1	7.77	29.77	948.4185	1	0.1887
		5510-5670	19	1	7.77	27.77	598.4116	1	0.1190
	IEEE 802.11ac-VHT20	5260-5320	19	1	7.77	27.77	598.4116	1	0.1190
		5500-5700	18	1	7.77	26.77	475.3352	1	0.0946
	IEEE 802.11ac-VHT40	5270-5310	21	1	7.77	29.77	948.4185	1	0.1887
		5510-5670	20	1	7.77	28.77	753.3556	1	0.1499
	IEEE 802.11ac-VHT80	5290	15	1	7.77	23.77	238.2319	1	0.0474
		5530	15	1	7.77	23.77	238.2319	1	0.0474

3.4.1.4 Results for RSS-102 Issue 5

For MIMO (3TX/3RX) Mode

Operating Mode		Freq.	Declared maximum conducted average output power	Max. positive Tolerance according manufacturer	Directional Gain	Calculated maximum EIRP	Declared maximum EIRP	Limit
		(MHz)	(dBm)		(dBi)	(dBm)	(W)	(W)
MIMO (3TX/3RX)	IEEE 802.11a	5260-5320	18	1	7.77	26.77	0.4753	4.57
		5500-5700	18	1	7.77	26.77	0.4753	4.71
	IEEE 802.11n-HT20	5260-5320	19	1	7.77	27.77	0.5984	4.57
		5500-5700	18	1	7.77	26.77	0.4753	4.71
	IEEE 802.11n-HT40	5270-5310	21	1	7.77	29.77	0.9484	4.58
		5510-5670	19	1	7.77	27.77	0.5984	4.72
	IEEE 802.11ac-VHT20	5260-5320	19	1	7.77	27.77	0.5984	4.57
		5500-5700	18	1	7.77	26.77	0.4753	4.71
	IEEE 802.11ac-VHT40	5270-5310	21	1	7.77	29.77	0.9484	4.58
		5510-5670	20	1	7.77	28.77	0.7534	4.72
	IEEE 802.11ac-VHT80	5290	15	1	7.77	23.77	0.2382	4.59
		5530	15	1	7.77	23.77	0.2382	4.73

APPENDIX 1 PHOTOS OF TEST SETUP

N/A

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal Photos.

*** End of Report ***

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