

RF EXPOSURE EVALUATION REPORT

Product Name: 802.11ac Wave-2 3×3:3 Enterprise Wi-Fi
Access Point
Trade Mark: GRANDSTREAM
Model No.: GWN7615
Report Number: 200108012RFC-3
Test Standards: FCC 47 CFR Part 1 Subpart I
FCC ID: YZZGWN7615
Test Result: PASS
Date of Issue: March 25, 2020

Prepared for:

Grandstream Networks, Inc.
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Prepared by:

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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
		5 725 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 March 24, 2020		

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

For 2.4 GHz ISM Band of Wi-Fi		
Frequency Band:	2400 MHz to 2483.5 MHz	
Frequency Range:	2412 MHz to 2462 MHz	
Support Standards:	IEEE 802.11b, IEEE 802.11g, IEEE 802.11n-HT20, IEEE 802.11n-HT40	
Type of Modulation:	IEEE 802.11b: DSSS(CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM(64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11n-HT20: OFDM(64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11n-HT40: OFDM(64-QAM, 16-QAM, QPSK, BPSK)	
Data Rate:	IEEE 802.11b: Up to 11 Mbps IEEE 802.11g: Up to 54 Mbps IEEE 802.11n-HT20: Up to MCS23 IEEE 802.11n-HT40: Up to MCS23	
Number of Channels:	IEEE 802.11b: 11 IEEE 802.11g: 11 IEEE 802.11n-HT20: 11 IEEE 802.11n-HT40: 7	
Channel Separation:	5 MHz	
Antenna Type:	Chain 0	PIFA Antenna
	Chain 1	PIFA Antenna
	Chain 2	PIFA Antenna
Antenna Gain:	Chain 0	3.0 dBi
	Chain 1	3.0 dBi
	Chain 2	3.0 dBi
Directional gain:	7.77 dBi	
Maximum Conducted output power:	MIMO_ Chain 0+1+2	IEEE 802.11b: 28.10Bm IEEE 802.11g: 25.01 dBm IEEE 802.11n-HT20:24.77dBm IEEE 802.11n-HT40: 24.36 dBm

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For 5 GHz U-NII Bands of Wi-Fi			
Frequency Bands:	5150 MHz to 5250 MHz (U-NII-1)		
	5 725 MHz to 5 850 MHz (U-NII-3)		
Frequency Ranges:	5180 MHz to 5240 MHz		
	5 745 MHz to 5 825 MHz		
Support Standards:	IEEE 802.11a/n/ac		
TPC Function:	Not Support		
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 802.11ac-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	
		5725 MHz to 5850 MHz: 3.0 dBi	
	Chain 1	5150 MHz to 5250 MHz: 3.0 dBi	
		5725 MHz to 5850 MHz: 3.0 dBi	
	Chain 2	5150 MHz to 5250 MHz: 3.0 dBi	
		5725 MHz to 5850 MHz: 3.0 dBi	
Maximum conducted output power (dBm):	MIMO_Chain 0+1	U-NII-1	U-NII-3
	IEEE 802.11a:	21.83	24.31
	IEEE 802.11n-HT20:	17.13	23.04
	IEEE 802.11n-HT40:	20.75	23.70
	IEEE 802.11ac-VHT20:	16.74	22.75
	IEEE 802.11ac-VHT40:	20.90	23.82
	IEEE 802.11ac-VHT80:	21.39	22.89

1.4 OTHER INFORMATION

Test channels for 2.4 GHz ISM Band of Wi-Fi				
Mode	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
IEEE 802.11b	2412 MHz to 2462 MHz	Channel 1	Channel 6	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11g	2412 MHz to 2462 MHz	Channel 1	Channel 6	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11n-HT20	2412 MHz to 2462 MHz	Channel 1	Channel 6	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11n-HT40	2422 MHz to 2452 MHz	Channel 3	Channel 6	Channel 9
		2422 MHz	2437 MHz	2452 MHz

Test channels for 5 GHz U-NII Bands of Wi-Fi				
Mode	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
IEEE 802.11a IEEE 802.11n-HT20 IEEE 802.11ac-VHT20	5150 MHz to 5250 MHz	Channel 36	Channel 44	Channel 48
		5180 MHz	5220 MHz	5240 MHz
	5725 MHz to 5850 MHz	Channel 149	Channel 157	Channel 165
		5745 MHz	5785 MHz	5825 MHz
IEEE 802.11n-HT40 IEEE 802.11ac-VHT40	5150 MHz to 5250 MHz	Channel 38	--	Channel 46
		5190 MHz	--	5230 MHz
	5725 MHz to 5850 MHz	Channel 151	--	Channel 159
		5755 MHz	--	5795 MHz
IEEE 802.11ac-VHT80	5150 MHz to 5250 MHz	--	Channel 42	--
		--	5210 MHz	--
	5725 MHz to 5850 MHz	--	Channel 155	--
		--	5775 MHz	--

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

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	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.

3.2.2 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 2412MHz to 2462 MHz for IEEE802.11b/g/n and
operating at 5150 MHz to 5250 MHz for IEEE802.11a/n/ac and
operating at 5725 MHz to 5850 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: 2412MHz to 2462 MHz: 3.0 dBi
5150 MHz to 5250 MHz: 3.0 dBi
5725 MHz to 5850 MHz: 3.0 dBi

Chain 1: 2412MHz to 2462 MHz: 3.0 dBi
5150 MHz to 5250 MHz: 3.0 dBi
5725 MHz to 5850 MHz: 3.0 dBi

Chain 2: 2412MHz to 2462 MHz: 3.0 dBi
5150 MHz to 5250 MHz: 3.0 dBi
5725 MHz to 5850 MHz: 3.0 dBi

For MIMO mode (3Tx/3Rx), there are three transmission antennas. The Chain 0, Chain 1 and Chain 2 are used at the same time and antenna ports have uniform output powers. The Chain 0, 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/cm²)	
MIMO (2TX/2RX)	IEEE 802.11b	2412-2462	27	1.5	7.77	36.27	4236.4297	1	0.8428
	IEEE 802.11g	2412-2462	24	1.5	7.77	33.27	2123.2445	1	0.4224
	IEEE 802.11n-HT20	2412-2462	24	1.5	7.77	33.27	2123.2445	1	0.4224
	IEEE 802.11n-HT40	2422-2452	23	1.5	7.77	32.27	1686.5530	1	0.3355
	IEEE 802.11a	5180-5240	21	1	7.77	29.77	948.4185	1	0.1887
		5745-5825	24	1	7.77	32.77	1892.3436	1	0.3765
	IEEE 802.11n-HT20	5180-5240	17	1	7.77	25.77	377.5722	1	0.0751
		5745-5825	23	1	7.77	31.77	1503.1420	1	0.2990
	IEEE 802.11n-HT40	5190-5230	20	1	7.77	28.77	753.3556	1	0.1499
		5755-5795	23	1	7.77	31.77	1503.1420	1	0.2990
	IEEE 802.11ac-VHT20	5180-5240	16	1	7.77	24.77	299.9163	1	0.0597
		5745-5825	22	1	7.77	30.77	1193.9881	1	0.2375
	IEEE 802.11ac-VHT40	5190-5230	20	1	7.77	28.77	753.3556	1	0.1499
		5755-5795	23	1	7.77	31.77	1503.1420	1	0.2990
	IEEE 802.11ac-VHT80	5210	21	1	7.77	29.77	948.4185	1	0.2990
		5775	22	1	7.77	30.77	1193.9881	1	0.2375

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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