RF Exposure Evaluation Declaration

FCC ID:	2AD8UFZCWO4A1
IC:	109D-FZCWO4A1
APPLICANT:	Nokia Solutions and Networks
Application Type:	Certification
Product:	Wi-Fi AP 4x4 OD ext. antenna US
	Wi-Fi AP 4x4 OD omni antenna US
	Wi-Fi AP 4x4 OD direct antenna US
	Wi-Fi AP 4x4 OD small omni antenna US
Model No.:	WO4C-AC400
Trademark:	Nokia
FCC Classification:	Digital Transmission System (DTS)
	Unlicensed National Information Infrastructure (UNII)

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Approved By : Chenz Ker
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Testing Laboratory
3261

Revision History

Report No.	Version	Description	Issue Date	Note
1608TW0110-U16	Rev. 01	Initial Report	07-31-2017	Invalid
1608TW0110-U16	Rev. 02	Revise some Maximum EIRP	08-17-2017	Valid

1. PRODUCT INFORMATION

1.1. Equipment Description

Product Name	Wi-Fi AP 4X4 OD ext. antenna US; Wi-Fi AP 4x4 OD omni antenna US; Wi-Fi AP 4x4 OD direct. antenna US; Wi-Fi AP 4x4 OD small omni antenna US
Model No.	WO4C-AC400
Brand Name	Nokia
Hardware Version:	AM3
Frequency Range	**2.4GHz:** For 802.11b/g/n-HT20: 2412 ~ 2462 MHz For 802.11n-HT40: 2422 ~ 2452 MHz **5GHz:** For 802.11a/n-HT20: 5180~5320MHz, 5500~5700MHz, 5745~5825MHz For 802.11ac-VHT20: 5180~5320MHz, 5500~5720MHz, 5745~5825MHz For 802.11n-HT40: 5190~5310MHz, 5510~5670MHz, 5755~5795MHz For 802.11ac-VHT40: 5190~5310MHz, 5510~5710MHz, 5755~5795MHz For 802.11ac-VHT80: 5210MHz, 5290MHz, 5530MHz, 5610MHz, 5690MHz, 5775MHz For 802.11ac-VHT80+80: 5210 MHz + 5290 MHz, 5210 MHz + 5530 MHz, 5210 MHz + 5610 MHz, 5210 MHz + 5690 MHz, 5210 MHz + 5775 MHz, 5290 MHz + 5530 MHz, 5290 MHz + 5610 MHz, 5290 MHz + 5690 MHz, 5290 MHz + 5775 MHz, 5530 MHz + 5610 MHz, 5530 MHz + 5690 MHz, 5530 MHz + 5775 MHz, 5610 MHz + 5690 MHz, 5610 MHz + 5775 MHz, 5690 MHz + 5775 MHz
Type of Modulation	802.11a/n/ac: OFDM
Modulation Technology	CCK, DQPSK, DBPSK for DSSS 16QAM, 64QAM, QPSK, BPSK for OFDM

Note 1: We select the POE adapter (M/N: PoE35-54A) to perform all RF testing.

Note 2: The product name difference as below:

- when the device has been connected the Galtronics Omni antenna, the product name is “Wi-Fi

AP 4x4 OD omni antenna US";

- when the device has been connected the Galtronics Directional antenna, the product name is "Wi-Fi AP 4x4 OD direct. antenna US";
- when the device has been connected the PCTEL antenna & HUBER+SUHNER, the product name is "Wi-Fi AP 4X4 OD ext. antenna US";
- when the device has been connected the Galtronics Small Omni antenna, the product name is "Wi-Fi AP 4x4 OD small omni antenna US";

1.2. Antenna Description

Antenna	Manufacturer	Frequency Band (GHz)	Product Number	Tx Paths
	PCTEL, Inc.	2.4	FPMI2458-DP4RPSMA	4
		5		4
		2.4	FPMI2458-DP2RPSMA	2
		5		2
	Galtronics	2.4	Galtronics Omni Antenna	2
		5		2
		2.4	Galtronics Directional Antenna	2
		5		2
		2.4	Galtronics Small Omni Antenna	2
		5		2
	HUBER+ SUHNER	5	Sector-Antenna 1356.17.0011	1
		5	Directional Antenna 1356.17.0077	1

Note 1: This device make the transmission with two “FPMI2458-DP2RPSMA” directional antenna, there is not any superposition of transmit signal between two antennas.

Note 2: For “FPMI2458-DP2RPSMA” directional antenna, one antenna port be connected with device’s Ant 0 & Ant 1, the other antenna port be connect with device’s Ant 2 & Ant 3, and this installation has been showed in the professional installation manual.

Note 3: For HUBER+SUHNER antenna, this device make the transmission with four antenna, they were installed by the four sides of the perpendicular. So the antenna was Independent of each other and had no MIMO, CDD or Beamforming mode.

Product Number	Frequency Band (MHz)	Tx Paths	Per Chain Max Antenna Gain (dBi)				Beam Forming Directional Gain (dBi)	CDD Directional Gain (dBi)
			Ant 0	Ant 1	Ant 2	Ant 3		
FPMI2458-DP4RPSMA	2412 ~2462	4	6.70	6.40	6.80	6.80	12.70	12.70
	5150 ~ 5250	4	5.79	5.57	5.89	5.05	11.60	11.60
	5150 ~ 5250 30°elevation angle	4	5.10	2.27	4.94	4.06	N/A	N/A
	5250 ~ 5350	4	5.68	5.53	5.65	4.91	11.47	11.47
	5470 ~ 5725	4	5.46	5.21	6.06	5.65	11.62	11.62
	5725 ~ 5850	4	5.24	5.09	6.73	5.62	11.71	11.71
FPMI2458-DP2RPSMA	2412 ~2462	2	6.70	6.40	--	--	9.56	9.56
			--	--	6.70	6.40	9.56	9.56
	5150 ~ 5250	2	5.79	5.57	--	--	8.69	8.69
			--	--	5.79	5.57	8.69	8.69
	5150 ~ 5250 30°elevation angle	2	5.10	2.27	--	--	N/A	N/A
			--	--	5.10	2.27	N/A	N/A
	5250 ~ 5350	2	5.68	5.53	--	--	8.62	8.62
			--	--	5.68	5.53	8.62	8.62
	5470 ~ 5725	2	5.46	5.21	--	--	8.35	8.35
			--	--	5.46	5.21	8.35	8.35
	5725 ~ 5850	2	5.24	5.09	--	--	8.18	8.18
			--	--	5.24	5.09	8.18	8.18

Product Number	Frequency Band (MHz)	Tx Paths	Per Chain Max Antenna Gain (dBi)				Beam Forming Directional Gain (dBi)	CDD Directional Gain (dBi)
			Ant 0	Ant 1	Ant 2	Ant 3		
Galtronics Omni Antenna	2412 ~2462	2	2.93	3.02	2.93	3.02	9.00	9.00
	5150 ~ 5250	2	6.68	6.53	6.68	6.53	12.63	12.63
	5150 ~ 5250 30°elevation angle	2	-1.32	-1.53	-1.32	-1.53	N/A	N/A
	5250 ~ 5350	2	6.68	6.53	6.68	6.53	12.63	12.63
	5470 ~ 5725	2	6.60	5.92	6.60	5.92	12.29	12.29
	5725 ~ 5850	2	6.78	6.55	6.78	6.55	12.69	12.69
Galtronics Directional Antenna	2412 ~2462	2	6.75	6.75	6.75	6.75	12.77	12.77
	5150 ~ 5250	2	8.39	8.16	8.39	8.16	14.30	14.30
	5150 ~ 5250 30°elevation angle	2	-1.54	-2.86	-1.54	-2.86	N/A	N/A
	5250 ~ 5350	2	8.39	8.16	8.39	8.16	14.30	14.30
	5470 ~ 5725	2	8.49	8.57	8.49	8.57	14.55	14.55
	5725 ~ 5850	2	8.92	8.82	8.92	8.82	14.89	14.89
Galtronics Small Omni Antenna	2412 ~2462	2	2.69	2.41	2.69	2.41	8.57	8.57
	5150 ~ 5250	2	3.27	3.85	3.27	3.85	9.59	9.59
	5150 ~ 5250 30°elevation angle	2	3.20	3.81	3.20	3.81	N/A	N/A
	5250 ~ 5350	2	2.77	3.30	2.77	3.30	9.06	9.06
	5470 ~ 5725	2	3.43	3.81	3.43	3.81	9.64	9.64
	5725 ~ 5850	2	4.35	4.30	4.35	4.30	10.35	10.35

Product Number	Frequency Band (MHz)	Tx Paths	Per Chain Max Antenna Gain (dBi)				Beam Forming Directional Gain (dBi)	CDD Directional Gain (dBi)
			Ant 0	Ant 1	Ant 2	Ant 3		
Sector-Antenna 1356.17.0011	5150 ~ 5250	1	16.00	16.00	16.00	16.00	N/A	N/A
	5150 ~ 5250 30°elevation angle	1	-1.22	-1.22	-1.22	-1.22	N/A	N/A
	5250 ~ 5350	1	16.00	16.00	16.00	16.00	N/A	N/A
	5470 ~ 5725	1	16.50	16.50	16.50	16.50	N/A	N/A
	5725 ~ 5850	1	17.00	17.00	17.00	17.00	N/A	N/A
Directional Antenna 1356.17.0077	5150 ~ 5250	1	14.00	14.00	14.00	14.00	N/A	N/A
	5150 ~ 5250 30°elevation angle	1	1.52	1.52	1.52	1.52	N/A	N/A
	5250 ~ 5350	1	14.00	14.00	14.00	14.00	N/A	N/A
	5470 ~ 5725	1	14.00	14.00	14.00	14.00	N/A	N/A
	5725 ~ 5850	1	14.00	14.00	14.00	14.00	N/A	N/A

Note

1. The EUT supports Cyclic Delay Diversity (CDD) technology for 802.11a/b/g mode, and CDD signals are correlated.
2. The EUT supports Beam Forming technology for 802.11n/ac mode, and exclude 802.11b/g mode. Correlated signals include, but are not limited to, signals transmitted in any of the following modes:
   - Any transmit Beam Forming mode, whether fixed or adaptive (e.g., phased array modes, closed loop MIMO modes, Transmitter Adaptive Antenna modes, Maximum Ratio Transmission (MRT) modes, and Statistical Eigen Beam Forming (EBF) modes).
   - CDD signals are correlated and create unintended array gain that varies with signal bandwidth, antenna geometry, and cyclic delay values. Consequently, depending on system parameters, it may be appropriate to use different values of array gain for compliance with power limits versus compliance with powerspectral density limits.
3. Unequal Antenna gains, with equal transmit powers. For Antenna gains given by G_1, G_2, …, G_N dBi transmit signals are correlated, then

- Directional gain = $10*\log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2/N_{ANT}]$ dBi [Note the “20”s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]
- For example (FPMI2458-DP4RPSMA Antenna): 5150 ~ 5250MHz Directional Gain = $10*\log[(10^{5.79/20} + 10^{5.57/20} + 10^{5.89/20} + 10^{5.05/20})^2/4]$ = 11.60 dBi

2. RF Exposure Evaluation

2.1. Limits

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (Minutes)
(A) Limits for Occupational/ Control Exposures				
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/ Uncontrolled Exposures				
300-1500	--	--	f/1500	6
1500-100,000	--	--	1	30

f= Frequency in MHz

Calculation Formula: Pd = (Pout*G)/(4*pi*r2)

Where
Pd = power density in mW/cm2
Pout = output power to antenna in mW
G = gain of antenna in linear scale
Pi = 3.1416
r = distance between observation point and center of the radiator in cm

Pd is the limit of MPE, $1mW/cm^2$. If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

2.2. Test Result of RF Exposure Evaluation

Product	Wi-Fi AP 4X4 OD ext. antenna US; Wi-Fi AP 4x4 OD omni antenna US; Wi-Fi AP 4x4 OD direct. antenna US; Wi-Fi AP 4x4 OD small omni antenna US
Test Item	RF Exposure Evaluation (For General Population)

FPMI2458-DP4RPSMA Antenna:

Test Mode	Frequency Band (MHz)	Maximum EIRP (dBm)	Safety Distance (cm)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
802.11b/g/n-HT20/ n-HT40	2412 ~ 2462	35.85	25	0.4897	1
802.11a/n-HT20/ n-H40/ac-VHT20 ac-VHT40/ac-VHT80/ ac-VHT80+80	5150 ~ 5250	25.50	25	0.0452	1
	5250 ~ 5350	29.56	25	0.1151	1
	5470 ~ 5725	29.84	25	0.1227	1
	5725 ~ 5850	35.83	25	0.4874	1

Note: Directional Gain Calculation as below:

2412 ~ 2462MHz Directional Gain = $10*\log[(10^{6.70/20} + 10^{6.40/20} + 10^{6.80/20} + 10^{6.80/20})^2/4] = 12.70$ dBi

5150 ~ 5250MHz Directional Gain = $10*\log[(10^{5.79/20} + 10^{5.57/20} + 10^{5.89/20} + 10^{5.05/20})^2/4] = 11.60$ dBi

5250 ~ 5350MHz Directional Gain = $10*\log[(10^{5.68/20} + 10^{5.53/20} + 10^{5.65/20} + 10^{4.91/20})^2/4] = 11.47$ dBi

5470 ~ 5725MHz Directional Gain = $10*\log[(10^{5.46/20} + 10^{5.21/20} + 10^{6.06/20} + 10^{5.65/20})^2/4] = 11.62$ dBi

5725 ~ 5850MHz Directional Gain = $10*\log[(10^{5.24/20} + 10^{5.09/20} + 10^{6.73/20} + 10^{5.62/20})^2/4] = 11.71$ dBi

FPMI2458-DP2RPSMA Antenna:

Test Mode	Frequency Band (MHz)	Maximum EIRP (dBm)	Safety Distance (cm)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
802.11b/g/n-HT20/ n-HT40	2412 ~ 2462	35.65	25	0.4676	1
802.11a/n-HT20/ n-H40/ac-VHT20 ac-VHT40/ac-VHT80/ ac-VHT80+80	5150 ~ 5250	25.52	25	0.0454	1
	5250 ~ 5350	29.59	25	0.1159	1
	5470 ~ 5725	29.52	25	0.1140	1
	5725 ~ 5850	35.81	25	0.4852	1

Note: Directional Gain Calculation as below:

2412 ~ 2462MHz Directional Gain = $10*\log[(10^{6.70/20} + 10^{6.40\ 5/20})^2/2] = 9.56$ dBi

5150 ~ 5250MHz Directional Gain = $10*\log[(10^{5.79/20} + 10^{5.57/20})^2/2] = 8.69$ dBi

5250 ~ 5350MHz Directional Gain = $10*\log[(10^{5.68/20} + 10^{5.53/20})^2/2] = 8.62$ dBi

5470 ~ 5725MHz Directional Gain = $10*\log[(10^{5.46/20} + 10^{5.21/20})^2/2] = 8.35$ dBi

5725 ~ 5850MHz Directional Gain = $10*\log[(10^{5.24/20} + 10^{5.09/20})^2/2] = 8.18$ dBi

Galtronics Omni Antenna:

Test Mode	Frequency Band (MHz)	Maximum EIRP (dBm)	Safety Distance (cm)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
802.11b/g/n-HT20/ n-HT40	2412 ~ 2462	35.66	25	0.4687	1
802.11a/n-HT20/ n-H40/ac-VHT20 ac-VHT40/ac-VHT80/ ac-VHT80+80	5150 ~ 5250	34.93	25	0.3962	1
	5250 ~ 5350	29.71	25	0.1191	1
	5470 ~ 5725	29.67	25	0.1180	1
	5725 ~ 5850	35.66	25	0.4687	1

Note: Directional Gain Calculation as below:

2412 ~ 2462MHz Directional Gain = $10*\log[(10^{2.93/20} + 10^{3.02/20} + 10^{2.93/20} + 10^{3.02/20})^2/4] = 9.00$ dBi

5150 ~ 5250MHz Directional Gain = $10*\log[(10^{6.68/20} + 10^{6.53/20} + 10^{6.68/20} + 10^{6.53/20})^2/4] = 12.63$ dBi

5250 ~ 5350MHz Directional Gain = $10*\log[(10^{6.68/20} + 10^{6.53/20} + 10^{6.68/20} + 10^{6.53/20})^2/4] = 12.63$ dBi

5470 ~ 5725MHz Directional Gain = $10*\log[(10^{6.60/20} + 10^{5.92/20} + 10^{6.60/20} + 10^{5.92/20})^2/4] = 12.29$ dBi

5725 ~ 5850MHz Directional Gain = $10*\log[(10^{6.78/20} + 10^{6.55/20} + 10^{6.78/20} + 10^{6.55/20})^2/4] = 12.69$ dBi

Galtronics Directional Antenna:

Test Mode	Frequency Band (MHz)	Maximum EIRP (dBm)	Safety Distance (cm)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
802.11b/g/n-HT20/ n-HT40	2412 ~ 2462	35.81	26	0.4486	1
802.11a/n-HT20/ n-H40/ac-VHT20 ac-VHT40/ac-VHT80/ ac-VHT80+80	5150 ~ 5250	35.70	26	0.4374	1
	5250 ~ 5350	29.79	26	0.1122	1
	5470 ~ 5725	29.84	26	0.1135	1
	5725 ~ 5850	36.20	26	0.4907	1

Note: Directional Gain Calculation as below:

2412 ~ 2462MHz Directional Gain = $10*\log[(10^{6.75/20} + 10^{6.75/20} + 10^{6.75/20} + 10^{6.75/20})^2/4] = 12.77$ dBi

5150 ~ 5250MHz Directional Gain = $10*\log[(10^{8.39/20} + 10^{8.16/20} + 10^{8.39/20} + 10^{8.16/20})^2/4] = 14.30$ dBi

5250 ~ 5350MHz Directional Gain = $10*\log[(10^{8.39/20} + 10^{8.16/20} + 10^{8.39/20} + 10^{8.16/20})^2/4] = 14.30$ dBi

5470 ~ 5725MHz Directional Gain = $10*\log[(10^{8.49/20} + 10^{8.57/20} + 10^{8.49/20} + 10^{8.57/20})^2/4] = 14.55$ dBi

5725 ~ 5850MHz Directional Gain = $10*\log[(10^{8.92/20} + 10^{8.82/20} + 10^{8.92/20} + 10^{8.82/20})^2/4] = 14.89$ dBi

Sector-Antenna 1356.17.0011 Antenna:

Test Mode	Frequency Band (MHz)	Maximum EIRP (dBm)	Safety Distance (cm)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
802.11a/n-HT20/ n-H40/ac-VHT20 ac-VHT40/ac-VHT80/ ac-VHT80+80	5150 ~ 5250	36.21	20	0.8312	1
	5250 ~ 5350	29.66	20	0.1840	1
	5470 ~ 5725	29.70	20	0.1857	1
	5725 ~ 5850	35.65	20	0.7307	1

Directional Antenna 1356.17.0077 Antenna:

Test Mode	Frequency Band (MHz)	Maximum EIRP (dBm)	Safety Distance (cm)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
802.11a/n-HT20/ n-H40/ac-VHT20 ac-VHT40/ac-VHT80/ ac-VHT80+80	5150 ~ 5250	33.26	20	0.4214	1
	5250 ~ 5350	29.71	20	0.1861	1
	5470 ~ 5725	29.63	20	0.1827	1
	5725 ~ 5850	35.67	20	0.7341	1

Galtronics Small Omni Antenna:

Test Mode	Frequency Band (MHz)	Maximum EIRP (dBm)	Safety Distance (cm)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
802.11b/g/n-HT20/ n-HT40	2412 ~ 2462	35.23	25	0.4245	1
802.11a/n-HT20/ n-H40/ac-VHT20 ac-VHT40/ac-VHT80/ ac-VHT80+80	5150 ~ 5250	21.49	25	0.0179	1
	5250 ~ 5350	27.15	25	0.0661	1
	5470 ~ 5725	27.86	25	0.0778	1
	5725 ~ 5850	34.47	25	0.3564	1

Note: Directional Gain Calculation as below:

2412 ~ 2462MHz Directional Gain = $10*\log[(10^{2.69/20} + 10^{2.41/20} + 10^{2.69/20} + 10^{2.41/20})^2/4]$ = 8.57 dBi

5150 ~ 5250MHz Directional Gain = $10*\log[(10^{3.27/20} + 10^{3.85/20} + 10^{3.27/20} + 10^{3.85/20})^2/4]$ = 9.59 dBi

5250 ~ 5350MHz Directional Gain = $10*\log[(10^{2.77/20} + 10^{3.30/20} + 10^{2.77/20} + 10^{3.30/20})^2/4]$ = 9.06 dBi

5470 ~ 5725MHz Directional Gain = $10*\log[(10^{3.43/20} + 10^{3.81/20} + 10^{3.43/20} + 10^{3.81/20})^2/4]$ = 9.64 dBi

5725 ~ 5850MHz Directional Gain = $10*\log[(10^{4.35/20} + 10^{4.30/20} + 10^{4.35/20} + 10^{4.30/20})^2/4]$ = 10.35 dBi

Product	WW WI-FI AP 4X4 OD ext. antenna
Test Item	RF Exposure Evaluation (For Occupational)

FPMI2458-DP4RPSMA Antenna:

Test Mode	Frequency Band (MHz)	Maximum EIRP (dBm)	Safety Distance (cm)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
802.11b/g/n-HT20/ n-HT40	2412 ~ 2462	35.85	20	0.7651	5
802.11a/n-HT20/ n-H40/ac-VHT20 ac-VHT40/ac-VHT80/ ac-VHT80+80	5150 ~ 5250	25.50	20	0.0706	5
	5250 ~ 5350	29.56	20	0.1798	5
	5470 ~ 5725	29.84	20	0.1917	5
	5725 ~ 5850	35.83	20	0.7616	5

Note: Directional Gain Calculation as below:

2412 ~ 2462MHz Directional Gain = $10*\log[(10^{6.70/20} + 10^{6.40/20} + 10^{6.80/20} + 10^{6.80/20})^2/4] = 12.70$ dBi

5150 ~ 5250MHz Directional Gain = $10*\log[(10^{5.79/20} + 10^{5.57/20} + 10^{5.89/20} + 10^{5.05/20})^2/4] = 11.60$ dBi

5250 ~ 5350MHz Directional Gain = $10*\log[(10^{5.68/20} + 10^{5.53/20} + 10^{5.65/20} + 10^{4.91/20})^2/4] = 11.47$ dBi

5470 ~ 5725MHz Directional Gain = $10*\log[(10^{5.46/20} + 10^{5.21/20} + 10^{6.06/20} + 10^{5.65/20})^2/4] = 11.62$ dBi

5725 ~ 5850MHz Directional Gain = $10*\log[(10^{5.24/20} + 10^{5.09/20} + 10^{6.73/20} + 10^{5.62/20})^2/4] = 11.71$ dBi

FPMI2458-DP2RPSMA Antenna:

Test Mode	Frequency Band (MHz)	Maximum EIRP (dBm)	Safety Distance (cm)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
802.11b/g/n-HT20/ n-HT40	2412 ~ 2462	35.65	20	0.7307	5
802.11a/n-HT20/ n-H40/ac-VHT20 ac-VHT40/ac-VHT80/ ac-VHT80+80	5150 ~ 5250	25.52	20	0.0709	5
	5250 ~ 5350	29.59	20	0.1810	5
	5470 ~ 5725	29.52	20	0.1781	5
	5725 ~ 5850	35.81	20	0.7581	5

Note: Directional Gain Calculation as below:

2412 ~ 2462MHz Directional Gain = $10*\log[(10^{6.70/20} + 10^{6.40\ 5/20})^2/2] = 9.56$ dBi

5150 ~ 5250MHz Directional Gain = $10*\log[(10^{5.79/20} + 10^{5.57/20})^2/2] = 8.69$ dBi

5250 ~ 5350MHz Directional Gain = $10*\log[(10^{5.68/20} + 10^{5.53/20})^2/2] = 8.62$ dBi

5470 ~ 5725MHz Directional Gain = $10*\log[(10^{5.46/20} + 10^{5.21/20})^2/2] = 8.35$ dBi

5725 ~ 5850MHz Directional Gain = $10*\log[(10^{5.24/20} + 10^{5.09/20})^2/2] = 8.18$ dBi

Galtronics Omni Antenna:

Test Mode	Frequency Band (MHz)	Maximum EIRP (dBm)	Safety Distance (cm)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
802.11b/g/n-HT20/ n-HT40	2412 ~ 2462	35.66	20	0.7324	5
802.11a/n-HT20/ n-H40/ac-VHT20 ac-VHT40/ac-VHT80/ ac-VHT80+80	5150 ~ 5250	34.93	20	0.6191	5
	5250 ~ 5350	29.71	20	0.1861	5
	5470 ~ 5725	29.67	20	0.1844	5
	5725 ~ 5850	35.66	20	0.7324	5

Note: Directional Gain Calculation as below:

2412 ~ 2462MHz Directional Gain = $10*\log[(10^{2.93/20} + 10^{3.02/20} + 10^{2.93/20} + 10^{3.02/20})^2/4]$ = 9.00 dBi

5150 ~ 5250MHz Directional Gain = $10*\log[(10^{6.68/20} + 10^{6.53/20} + 10^{6.68/20} + 10^{6.53/20})^2/4]$ = 12.63 dBi

5250 ~ 5350MHz Directional Gain = $10*\log[(10^{6.68/20} + 10^{6.53/20} + 10^{6.68/20} + 10^{6.53/20})^2/4]$ = 12.63 dBi

5470 ~ 5725MHz Directional Gain = $10*\log[(10^{6.60/20} + 10^{5.92/20} + 10^{6.60/20} + 10^{5.92/20})^2/4]$ = 12.29 dBi

5725 ~ 5850MHz Directional Gain = $10*\log[(10^{6.78/20} + 10^{6.55/20} + 10^{6.78/20} + 10^{6.55/20})^2/4]$ = 12.69 dBi

Galtronics Directional Antenna:

Test Mode	Frequency Band (MHz)	Maximum EIRP (dBm)	Safety Distance (cm)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
802.11b/g/n-HT20/ n-HT40	2412 ~ 2462	35.81	20	0.7581	5
802.11a/n-HT20/ n-H40/ac-VHT20 ac-VHT40/ac-VHT80/ ac-VHT80+80	5150 ~ 5250	35.70	20	0.7391	5
	5250 ~ 5350	29.79	20	0.1896	5
	5470 ~ 5725	29.84	20	0.1917	5
	5725 ~ 5850	36.20	20	0.8293	5

Note: Directional Gain Calculation as below:

2412 ~ 2462MHz Directional Gain = $10*\log[(10^{6.75/20} + 10^{6.75/20} + 10^{6.75/20} + 10^{6.75/20})^2/4]$ = 12.77 dBi

5150 ~ 5250MHz Directional Gain = $10*\log[(10^{8.39/20} + 10^{8.16/20} + 10^{8.39/20} + 10^{8.16/20})^2/4]$ = 14.30 dBi

5250 ~ 5350MHz Directional Gain = $10*\log[(10^{8.39/20} + 10^{8.16/20} + 10^{8.39/20} + 10^{8.16/20})^2/4]$ = 14.30 dBi

5470 ~ 5725MHz Directional Gain = $10*\log[(10^{8.49/20} + 10^{8.57/20} + 10^{8.49/20} + 10^{8.57/20})^2/4]$ = 14.55 dBi

5725 ~ 5850MHz Directional Gain = $10*\log[(10^{8.92/20} + 10^{8.82/20} + 10^{8.92/20} + 10^{8.82/20})^2/4]$ = 14.89 dBi

Sector-Antenna 1356.17.0011 Antenna:

Test Mode	Frequency Band (MHz)	Maximum EIRP (dBm)	Safety Distance (cm)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
802.11a/n-HT20/ n-H40/ac-VHT20 ac-VHT40/ac-VHT80/ ac-VHT80+80	5150 ~ 5250	36.21	20	0.8312	5
	5250 ~ 5350	29.66	20	0.1840	5
	5470 ~ 5725	29.70	20	0.1857	5
	5725 ~ 5850	35.65	20	0.7307	5

Directional Antenna 1356.17.0077 Antenna:

Test Mode	Frequency Band (MHz)	Maximum EIRP (dBm)	Safety Distance (cm)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
802.11a/n-HT20/ n-H40/ac-VHT20 ac-VHT40/ac-VHT80/ ac-VHT80+80	5150 ~ 5250	33.26	20	0.4214	5
	5250 ~ 5350	29.71	20	0.1861	5
	5470 ~ 5725	29.63	20	0.1827	5
	5725 ~ 5850	35.67	20	0.7341	5

Galtronics Small Omni Antenna:

Test Mode	Frequency Band (MHz)	Maximum EIRP (dBm)	Safety Distance (cm)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
802.11b/g/n-HT20/ n-HT40	2412 ~ 2462	35.23	20	0.6633	5
802.11a/n-HT20/ n-H40/ac-VHT20 ac-VHT40/ac-VHT80/ ac-VHT80+80	5150 ~ 5250	21.49	20	0.0280	5
	5250 ~ 5350	27.15	20	0.1032	5
	5470 ~ 5725	27.86	20	0.1215	5
	5725 ~ 5850	34.47	20	0.5568	5

Note: Directional Gain Calculation as below:

2412 ~ 2462MHz Directional Gain = $10*\log[(10^{2.69/20} + 10^{2.41/20} + 10^{2.69/20} + 10^{2.41/20})^2/4] = 8.57$ dBi

5150 ~ 5250MHz Directional Gain = $10*\log[(10^{3.27/20} + 10^{3.85/20} + 10^{3.27/20} + 10^{3.85/20})^2/4] = 9.59$ dBi

5250 ~ 5350MHz Directional Gain = $10*\log[(10^{2.77/20} + 10^{3.30/20} + 10^{2.77/20} + 10^{3.30/20})^2/4] = 9.06$ dBi

5470 ~ 5725MHz Directional Gain = $10*\log[(10^{3.43/20} + 10^{3.81/20} + 10^{3.43/20} + 10^{3.81/20})^2/4] = 9.64$ dBi

5725 ~ 5850MHz Directional Gain = $10*\log[(10^{4.35/20} + 10^{4.30/20} + 10^{4.35/20} + 10^{4.30/20})^2/4] = 10.35$ dBi

2.3. Summary of Test Result

The maximum calculations of above situations

Model	Configuration	The formula of calculated the MPE (mW/cm2)	Calculation Power Density (mW/cm2)	Limit	Result
General Population	2.4GHz + 5GHz	0.4897 + 0.4874	0.9771	1	Pass
Occupational	2.4GHz + 5GHz	0.7581 + 0.8293	1.5874	5	Pass

The wireless device described within this report has been shown to be capable of compliance with basic restrictions related to human exposure to electromagnetic fields for both General public and Occupational. The calculations shown in this report were made in accordance the procedures specified in the applied test specifications

Antenna Product Number	Configuration	Required Compliance Boundary (cm)	
		General Population	Occupational
FPMI2458-DP4RPSMA	2.4GHz + 5GHz	25	20
FPMI2458-DP2RPSMA	2.4GHz + 5GHz	25	20
Galtronics Omni Antenna	2.4GHz + 5GHz	25	20
Galtronics Directional Antenna	2.4GHz + 5GHz	26	20
Sector-Antenna 1356.17.0011	5GHz	20	20
Directional Antenna 1356.17.0077	5GHz	20	20
Galtronics Small Omni Antenna	2.4GHz + 5GHz	25	20

The End