RF Exposure Evaluation Declaration

FCC ID: 2AD6M-Z500

APPLICANT: P2 Mobile Technologies Limited

Application Type:	Certification
Product:	Z500 dual band 802.11ac Outdoor AP
Model No.:	Z500
FCC Classification:	Digital Transmission System (DTS)
	Unlicensed National Information Infrastructure (UNII)

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ACCREDITED
TESTING LABORATORY
CERTIFICATE #3628.01

Revision History

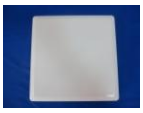
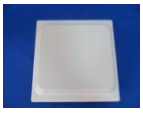
Report No.	Version	Description	Issue Date
1509RSU00404	Rev. 01	Initial report	10-14-2015
1509RSU00404	Rev. 02	Added some Calculation methods	10-28-2015

1. PRODUCT INFORMATION

1.1. Equipment Description

Product Name	Z500 dual band 802.11ac Outdoor AP
Model No.	Z500
Frequency Range	**For 2.4GHz Band:** 802.11b/g/n: 2412 ~ 2462 MHz **For 5GHz Band:** For 802.11a/n-HT20/ac-VHT20: 5180~5240MHz, 5745~5825MHz For 802.11n-HT40/ac-VHT40: 5190~5230MHz, 5755~5795MHz For 802.11ac-VHT80: 5210MHz, 5775MHz
Type of Modulation	802.11b: DSSS 802.11g/a/n/ac: OFDM
Maximum Average Output Power	**For 2.4GHz:** 802.11b: 27.49dBm 802.11g: 27.71dBm 802.11n-HT20: 27.67dBm 802.11n-HT40: 27.55dBm **For 5GHz:** 802.11a: 29.14dBm 802.11n-HT20: 29.08dBm 802.11n-HT40: 27.25dBm 802.11ac-VHT20: 29.11dBm 802.11ac-VHT40: 27.31dBm 802.11ac-VHT80: 16.05dBm

1.2. Antenna Description

Antenna Type	Frequency Band (GHz)	Tx Paths	Max Peak Gain (dBi)	Beam Forming Directional Gain (dBi)	CDD Directional Gain (dBi)	
					For Power	For PSD
	2.4	2	12	12	12	12
	5	2	19	22	19	22

1. The EUT supports Cyclic Delay Diversity (CDD) mode, and CDD signals are correlated.
   For CDD transmissions, directional gain is calculated as follows, N_{ANT} = 2, N_{SS} = 1.
   1) If all Antennas have the same gain, G_{ANT}, Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.
   - For power spectral density (PSD) measurements on all devices,
     Array Gain = 10 log (N_{ANT}/ N_{SS}) dB = 3.01;
   - For power measurements on IEEE 802.11 devices,
     Array Gain = 0 dB for $N_{ANT} \leq 4$;
2. The EUT supports Beam Forming technology for 802.11n/ac mode, and exclude 802.11a 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).
   - All antennas have the same gain, GANT:

   Directional gain = GANT + 10 log(N_{ANT}/N_{SS}) dBi, where N_{SS} = the number of independent spatial streams of data and GANT is the antenna gain in dBi.
3. The 2.4GHz antenna is belong to cross-polarized antenna (horizontal and vertical polarizations) refer to antenna specification.
   For a system in which the antennas have fixed orientations relative to one another that ensure that the antennas are cross-polarized regardless of any user actions, the directional gain is computed as follows.
   - Cross-polarized antennas with NANT = 2. In the case of a transmitter with only two outputs driving a pair of antennas that are cross-polarized (e.g., vertical and horizontal), directional gain is the gain of an individual antenna. If the two antennas have different gains, the larger gain applies.

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	Z500 dual band 802.11ac Outdoor AP
Test Item	Z500

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 12dBi for 2.4GHz, 22dBi for 5.2GHz, and 22dBi for 5.8GHz in logarithm scale.

For 2.4GHz ISM Band:

Test Mode	Frequency Band (MHz)	Maximum Average Output Power (dBm)	Limit of Power Density S(mW/cm^2)	Safety Distance (cm)
802.11b/g/n-HT20	2412 ~ 2462	27.71	1	27.28
802.11n-HT40	2422 ~ 2452	27.55	1	26.79

Test Mode	Frequency Band (MHz)	Maximum Average Output Power (dBm)	Power Density at R = 129 cm (mW/cm^2)	Limit (mW/cm^2)
802.11b/g/n-HT20	2412 ~ 2462	20.74	0.0090	1
802.11n-HT40	2422 ~ 2452	20.12	0.0078	1

For 5GHz UNII Band:

Test Mode	Frequency Band (MHz)	Maximum Average Output Power (dBm)	Limit of Power Density S(mW/cm^2)	Safety Distance (cm)
802.11a/n-HT20/ ac-VHT20	5180 ~ 5240	29.14	1	101.72
	5745 ~ 5825	26.18	1	72.34
802.11n-HT40/ ac-VHT40	5190 ~ 5230	27.31	1	82.39
	5755 ~ 5795	23.60	1	53.75
802.11ac-VHT80	5210	16.05	1	22.54
	5775	9.28	1	10.34

Test Mode	Frequency Band (MHz)	Maximum Average Output Power (dBm)	Power Density at R = 129 cm (mW/cm^2)	Limit (mW/cm^2)
802.11a/n-HT20/ ac-VHT20	5180 ~ 5240	29.14	0.6217	1
	5745 ~ 5825	26.18	0.3145	1
802.11n-HT40/ ac-VHT40	5190 ~ 5230	27.31	0.4080	1
	5755 ~ 5795	23.60	0.1736	1
802.11ac-VHT80	5210	16.05	0.0305	1
	5775	9.28	0.0064	1

CONCULISON:

Both of the WLAN 2.4GHz Band and WLAN 5GHz Band can transmit simultaneously. The Safety Distance of the **Z500 dual band 802.11ac Outdoor AP, FCC ID: 2AD6M-Z500** was 129.0cm. Therefore, the Max Power Density at R (20 cm) = 0.0090mW/cm^2+ 0.6217mW/cm^2 = 0.6307mW/cm^2 < 1mW/cm^2.

So the EUT complies with the requirement.

The End