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Report No.: 1511RSU00202
Report Version: V02
Issue Date: 01-22-2016

RF Exposure Evaluation Declaration

FCC ID: 2AD6M-X20

APPLICANT: P2 Mobile Technologies Limited

Application Type:	Certification
Product:	MeshRanger X20 Dual 5GHz 802.11ac
Model No.:	X20
FCC Classification:	Unlicensed National Information Infrastructure (UNII)

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Revision History

Report No.	Version	Description	Issue Date
1511RSU00202	Rev. 01	Initial report	01-20-2016
1511RSU00202	Rev. 02	Revised the safety distance	01-22-2016

1. PRODUCT INFORMATION

1.1. Equipment Description

Product Name	MeshRanger X20 Dual 5GHz 802.11ac
Model No.	X20
Frequency Range	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	802.11a/n/ac: OFDM
Maximum Average Output Power with 5GHz Card #1	802.11a: 29.31dBm 802.11n-HT20: 29.19dBm 802.11n-HT40: 28.47dBm 802.11ac-VHT20: 29.29dBm 802.11ac-VHT40: 28.67dBm 802.11ac-VHT80: 20.85dBm
Maximum Average Output Power with 5GHz Card #2	802.11a: 28.60dBm 802.11n-HT20: 28.52dBm 802.11n-HT40: 28.05dBm 802.11ac-VHT20: 28.58dBm 802.11ac-VHT40: 28.08dBm 802.11ac-VHT80: 14.30dBm

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
Internal Antenna						
	5	2	18	21	18	21
External Antenna						
	5	2	20	23	20	23

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.

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: $Pd = (Pout*G)/(4*pi*r^2)$

Where

Pd = power density in mW/cm^2

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	MeshRanger X20 Dual 5GHz 802.11ac
Test Item	RF Exposure Evaluation

Antenna Gain refer to section 1.2 in this report.

For 5GHz Card #1 UNII Band:

Test Mode	Frequency Band (MHz)	Maximum Average Output Power (dBm)	Limit (mW/cm^2)
802.11a/n-HT20/ n-H40/ac-VHT20 ac-VHT40/ac-VHT80	5180 ~ 5240	29.31	1
	5745 ~ 5825	27.24	1

For 5GHz Card #2 UNII Band:

Test Mode	Frequency Band (MHz)	Maximum Average Output Power (dBm)	Limit (mW/cm^2)
802.11a/n-HT20/ n-H40/ac-VHT20 ac-VHT40/ac-VHT80	5180 ~ 5240	28.60	1
	5745 ~ 5825	27.20	1

CONCULISON:

Both of the WLAN 5GHz Card #1 Band and 5GHz Card #2 Band can transmit simultaneously.

Therefore, the worst-case distance = $\sqrt{(10^{((29.31dBm+21dBi)/10)} + 10^{((28.60dBm+23dBi)/10)})}/ (4*pi)$ = 141.59cm.

The Safety Distance of this equipment was 141.59cm.

The End