



# RF EXPOSURE REPORT

**REPORT NO.:** SA940906H06

**MODEL NO.:** AP-80MB, AP-80SB, AP-80M, AP-80S

**ACCORDING:** FCC Guidelines for Human Exposure  
IEEE C95.1

**APPLICANT:** ARUBA WIRELESS NETWORKS INC.

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**ISSUED BY:** Advance Data Technology Corporation

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## RF Exposure Measurement

### 1. Introduction

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The Gain of the antenna used in this product is measured in a Fully Anechoic Chamber (FAC) calibrated for antenna measurement in ADT, and also the maximum total power input to the antenna is measured. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

### 2. RF Exposure Limit

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environmental 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 <sup>2</sup> )	Average Time (minutes)
<b>(A)Limits For Occupational / Control Exposures</b>				
300-1500	...	...	F/300	6
1500-100,000	...	...	5	6
<b>(B)Limits For General Population / Uncontrolled Exposure</b>				
300-1500	...	...	F/1500	6
1500-100,000	...	...	1.0	30

F = Frequency in MHz



### 3. Friis Formula

Friis transmission formula :  $P_d = (P_{out} * G) / (4 * \pi * r^2)$

where

$P_d$  = power density in  $mW/cm^2$

$P_{out}$  = 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

$P_d$  is the limit of MPE,  $1 mW/cm^2$ . If we know the maximum Gain of the antenna and the total power input to the antenna, through the calculation, we will know the MPE value at distance 20cm.

Ref. : David K. Cheng, *Field and Wave Electromagnetics*, Second Edition,  
Page 640, Eq. (11-133).

### 4 EUT Operating condition

The software provided by Manufacturer enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

### 5. Classification

This is a stand alone radio device. So under normal use condition, it is easy to be re-located in the place where at least 20 cm far away from the body of the user. Warning statement to the user for keeping at least 20cm or more separation distance with the antenna should be included in users manual. So, this device is classified as **Mobile Device**.



**6 Test Results**

**6.1 Antenna Gain**

**For 2.4GHz**

Antenna 1: The maximum Gain of the antenna is 8.0dBi.  
 Antenna 2: The maximum Gain of the antenna is 12.0dBi.  
 Antenna 3: The maximum Gain of the antenna is 5.0dBi.  
 Antenna 4: The maximum Gain of the antenna is 15.0dBi.  
 Antenna 5: The maximum Gain of the antenna is 7.0dBi.

**For 5GHz**

Antenna 1: The maximum Gain of the antenna is 9.0dBi.  
 Antenna 2: The maximum Gain of the antenna is 7.0dBi.  
 Antenna 3: The maximum Gain of the antenna is 10.0dBi.  
 Antenna 4: The maximum Gain of the antenna is 14.0dBi.  
 Antenna 5: The maximum Gain of the antenna is 17.0dBi.

For 2.4GHz					
No.	Model No.	Gain (dBi)	Cable Loss (dB)	Antenna Type	Antenna Connector
1	AP-ANT-80	8.0 dBi	0.79dB	Dipole	N-type
2	AP-ANT-82	12.0 dBi		Wide-Angle (H-Plane)90°Sectored	
3	AP-ANT-84	5.0 dBi		Wide-Angle 135° Directional	
4	AP-ANT-85	15.0 dBi		High Gain, Directional Panel	
5	AP-ANT-87	7.0 dBi		Wide-Angle (H-Plane)60° Patch	
6	AP-ANT-81	8.0 dBi		Wide-Angle (H-Plane)60° Sectored	
7	AP-ANT-83	7.0 dBi		Wide-Angle 90° Directional Sectored	
For 5GHz					
No.	Model No.	Gain (dBi)	Cable Loss (dB)	Antenna Type	Antenna Connector
1	AP-ANT-86	9.0dBi	1.36dB	Omnidirectional (Dipole)	N-type
2	AP-ANT-87	7.0dBi		Wide-Angle (H-Plane)60° Patch	
3	AP-ANT-88	10.0dBi		120° Sector, typical with 36" cable	
4	AP-ANT-89	14.0dBi	NA	Wide-Angle, High Gain, Directional Panel,	Probe Pin
5	ANT05535	17.0dBi		Directional, Patch Panel (Internal Antenna)	

**Note:**

- All of the above antennas are outdoor Antenna except the antenna model No.: ANT05535.
- Antenna Model No. AP-ANT-85 and AP-ANT-89 can be used in point-to-point applications.
- For 2.4GHz antennas, the antenna 1~ 5 were selected as representative antennas for the test and its data were recorded in this report.



## 6.2 Output Power Into Antenna & RF Exposure value at distance 20cm:

### For 2.4GHz

802.11b:

#### Antenna 1

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	2412	57.80960474	0.060496344	1.0
6	2437	237.6840287	0.248730549	1.0
11	2462	98.1747943	0.102737532	1.0

#### Antenna 2

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	2412	7.079457844	0.018609261	1.0
6	2437	50.81594426	0.133576214	1.0
11	2462	35.80964371	0.094130232	1.0

#### Antenna 3

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	2412	57.80960474	0.030319995	1.0
6	2437	237.6840287	0.124660576	1.0
11	2462	106.1695557	0.055683834	1.0

#### Antenna 4

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	2412	7.079457844	0.037130357	1.0
6	2437	50.81594426	0.266519585	1.0
11	2462	35.80964371	0.187814505	1.0

#### Antenna 5

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	2412	43.05266105	0.035787316	1.0
6	2437	237.6840287	0.197573698	1.0
11	2462	79.0678628	0.065724778	1.0



802.11g:  
Antenna 1

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	2412	38.54783577	0.040339372	1.0
6	2437	254.6830253	0.266519585	1.0
11	2462	88.7156012	0.092838717	1.0
Turbo 6	2437	86.29785478	0.090308604	1.0

Antenna 2

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	2412	9.120108394	0.023973372	1.0
6	2437	70.14552984	0.184386504	1.0
11	2462	35.64511334	0.093697743	1.0
Turbo 6	2437	21.97859873	0.05777356	1.0

Antenna 3

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	2412	38.54783577	0.020217578	1.0
6	2437	254.6830253	0.133576214	1.0
11	2462	101.3911386	0.053177649	1.0
Turbo 6	2437	86.29785478	0.045261519	1.0

Antenna 4

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	2412	9.120108394	0.047833166	1.0
6	2437	70.14552984	0.367899442	1.0
11	2462	35.64511334	0.186951575	1.0
Turbo 6	2437	21.97859873	0.115273407	1.0

Antenna 5

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	2412	30.90295433	0.025687931	1.0
6	2437	254.6830253	0.211704032	1.0
11	2462	77.26805851	0.0642287	1.0
Turbo 6	2437	73.45138682	0.06105611	1.0



## For 5GHz

Operated in 5250MHz ~ 5350MHz: (15.407)

### Antenna 1

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	5260	110.6623784	0.12785836	1.0
4	5320	64.26877173	0.074255586	1.0
Turbo 1	5290	86.89604293	0.10039894	1.0

### Antenna 2

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	5260	179.0605854	0.130535648	1.0
4	5320	79.9834255	0.058308132	1.0
Turbo 1	5290	161.4358557	0.117687173	1.0

### Antenna 3

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	5260	86.49679188	0.125814046	1.0
4	5320	64.26877173	0.093482244	1.0
Turbo 1	5290	86.89604293	0.126394777	1.0

### Antenna 4

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	5260	45.28975799	0.165473758	1.0
4	5320	43.85306978	0.160224575	1.0
Turbo 1	5290	43.95416154	0.160593931	1.0



Operated in 5725 ~ 5850MHz band: (15.247)

#### Antenna 1

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	5745	314.7748314	0.363688132	1.0
3	5785	304.789499	0.362017137	1.0
5	5825	274.1574172	0.362017137	1.0
Turbo 1	5760	313.3285724	0.362017137	1.0
Turbo 2	5800	279.2543841	0.322648113	1.0

#### Antenna 2

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	5745	314.7748314	0.229471698	1.0
3	5785	304.789499	0.228417371	1.0
5	5825	274.1574172	0.228417371	1.0
Turbo 1	5760	313.3285724	0.228417371	1.0
Turbo 2	5800	279.2543841	0.203577196	1.0

#### Antenna 3

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	5745	314.7748314	0.457856231	1.0
3	5785	304.789499	0.455752573	1.0
5	5825	274.1574172	0.455752573	1.0
Turbo 1	5760	313.3285724	0.455752573	1.0
Turbo 2	5800	279.2543841	0.406189908	1.0





## Antenna 4

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	5745	314.7748314	0.950481698	1.0
3	5785	304.789499	0.946114631	1.0
5	5825	274.1574172	0.946114631	1.0
Turbo 1	5760	313.3285724	0.946114631	1.0
Turbo 2	5800	279.2543841	0.843225553	1.0

## Antenna 5

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	5745	11.22018454	0.11187399	1.0
3	5785	18.87991349	0.188247462	1.0
5	5825	16.10645635	0.160593931	1.0
Turbo 1	5760	17.7827941	0.177308326	1.0
Turbo 2	5800	22.38721139	0.223217957	1.0