



RF EXPOSURE REPORT

REPORT NO.: SA990622C09-1

MODEL NO.: MRLBB-1003

FCC ID: RTP-MRLBB1003

ACCORDING: FCC Guidelines for Human Exposure
IEEE C95.1

APPLICANT: Hewlett-Packard Co

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ISSUED BY: Bureau Veritas Consumer Products Services
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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
Original release	NA	Dec. 08, 2010

1. RF EXPOSURE LIMIT

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)
LIMITS FOR GENERAL POPULATION / UNCONTROLLED EXPOSURE				
300-1500	F/1500	30
1500-100,000	1.0	30

F = Frequency in MHz

2. MPE CALCULATION FORMULA

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

where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

3. CLASSIFICATION

The antenna of this product, under normal use condition, is at least 100cm away from the body of the user. So, this device is classified as **Mobile Device**.

4. CALCULATION RESULT OF MAXIMUM CONDUCTED POWER

TEST MODE A 1 - EUT with beam forming function + Antenna 1 (Model: 5184-6684)

MODULATION MODE	FREQUENCY BAND (MHz)	MAX POWER (dBm)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm ²)	LIMIT (mW/cm ²)
802.11b	2412-2462	24.8	10.18	100	0.025	1
802.11g	2412-2462	25.4	10.18	100	0.029	1
802.11n (20MHz)	2412-2462	25.4	10.18	100	0.029	1
802.11n (40MHz)	2422-2452	25.2	10.18	100	0.027	1
802.11a	5180-5240	10.6	11.79	100	0.001	1
802.11n (20MHz)	5180-5240	10.8	11.79	100	0.001	1
802.11n (40MHz)	5190-5230	10.8	11.79	100	0.001	1
802.11a	5745-5825	24.0	11.79	100	0.030	1
802.11n (20MHz)	5745-5825	24.0	11.79	100	0.030	1
802.11n (40MHz)	5755-5795	24.0	11.79	100	0.030	1

NOTE:

Antenna 1 (Model: 5184-6684) is not used for point to point operation, so the directional gain are as below:

For 2.4GHz Band: Directional gain = 5.41dBi + 10log(3)=10.18dBi > 6dBi

For 5.180 ~ 5.240GHz Band: Directional gain = 7.02dBi + 10log(3)=11.79dBi > 6dBi

For 5.745 ~ 5.825GHz Band: Directional gain = 7.02dBi + 10log(3)=11.79dBi > 6dBi



TEST MODE A 2 - EUT without beam forming function + Antenna 1 (Model: 5184-6684)

MODULATION MODE	FREQUENCY BAND (MHz)	MAX POWER (dBm)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm ²)	LIMIT (mW/cm ²)
802.11b	2412-2462	24.7	10.18	100	0.024	1
802.11g	2412-2462	25.5	10.18	100	0.029	1
802.11n (20MHz)	2412-2462	28.6	5.41	100	0.020	1
802.11n (40MHz)	2422-2452	26.1	5.41	100	0.011	1
802.11a	5180-5240	10.7	11.79	100	0.001	1
802.11n (20MHz)	5180-5240	15.6	7.02	100	0.001	1
802.11n (40MHz)	5190-5230	15.4	7.02	100	0.001	1
802.11a	5745-5825	24.1	11.79	100	0.031	1
802.11n (20MHz)	5745-5825	24.6	7.02	100	0.012	1
802.11n (40MHz)	5755-5795	23.7	7.02	100	0.009	1

NOTE:

Antenna 1 (Model: 5184-6684) is not used for point to point operation, so the directional gain are as below:

For 2.4GHz Band (802.11 b/g): Directional gain =5.41dBi + 10log(3)=10.18dBi > 6dBi

For 5.180 ~ 5.240GHz Band (802.11 a): Directional gain =7.02dBi + 10log(3)=11.79dBi > 6dBi

For 5.745 ~ 5.825GHz Band (802.11 a): Directional gain =7.02dBi + 10log(3)=11.79dBi > 6dBi



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TEST MODE B 1 - EUT with beam forming function + Antenna 2 (Model: J9169A)

MODULATION MODE	FREQUENCY BAND (MHz)	MAX POWER (dBm)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm ²)	LIMIT (mW/cm ²)
802.11b	2412-2462	26.5	12.77	100	0.067	1
802.11g	2412-2462	27.6	12.77	100	0.087	1
802.11n (20MHz)	2412-2462	27.7	12.77	100	0.089	1
802.11n (40MHz)	2422-2452	25.9	12.77	100	0.059	1
802.11a	5745-5825	23.5	15.47	100	0.063	1
802.11n (20MHz)	5745-5825	23.6	15.47	100	0.064	1
802.11n (40MHz)	5755-5795	23.5	15.47	100	0.063	1

NOTE:

Antenna 2 (Model: J9169A) is not used for point to point operation, so the directional gain are as below:

For 2.4GHz Band (802.11 b/g): Directional gain =8.0dBi + 10log(3)=12.77dBi > 6dBi

For 5.745 ~ 5.825GHz Band (802.11 a): Directional gain =10.70dBi + 10log(3)=15.47dBi > 6dBi



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TEST MODE B 2 - EUT without beam forming function + Antenna 2 (Model: J9169A)

MODULATION MODE	FREQUENCY BAND (MHz)	MAX POWER (dBm)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm ²)	LIMIT (mW/cm ²)
802.11b	2412-2462	26.6	12.77	100	0.069	1
802.11g	2412-2462	27.7	12.77	100	0.089	1
802.11n (20MHz)	2412-2462	28.6	8.00	100	0.036	1
802.11n (40MHz)	2422-2452	26.1	8.00	100	0.020	1
802.11a	5745-5825	23.7	15.47	100	0.066	1
802.11n (20MHz)	5745-5825	23.7	10.70	100	0.022	1
802.11n (40MHz)	5755-5795	23.7	10.70	100	0.022	1

NOTE:

Antenna 2 (Model: J9169A) is not used for point to point operation, so the directional gain are as below:

For 2.4GHz Band: Directional gain =8.0dBi + 10log(3)=12.77dBi > 6dBi

For 5.745 ~ 5.825GHz Band: Directional gain =10.70dBi + 10log(3)=15.47dBi > 6dBi



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TEST MODE C 1 - EUT with beam forming function + Antenna 3 (Model: J9170A)

MODULATION MODE	FREQUENCY BAND (MHz)	MAX POWER (dBm)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm ²)	LIMIT (mW/cm ²)
802.11b	2412-2462	19.7	15.67	100	0.027	1
802.11g	2412-2462	25.6	15.67	100	0.107	1
802.11n (20MHz)	2412-2462	26.4	15.67	100	0.128	1
802.11n (40MHz)	2422-2452	25.5	15.67	100	0.104	1
802.11a	5745-5825	24.0	18.27	100	0.134	1
802.11n (20MHz)	5745-5825	24.0	18.27	100	0.134	1
802.11n (40MHz)	5755-5795	23.9	18.27	100	0.131	1

NOTE:

Antenna 3 (Model: J9170A) is used for point to point operation, so the directional gain are as below:

For 2.4GHz Band: Directional gain = $10.9\text{dBi} + 10\log(3) = 15.67\text{dBi} > 6\text{dBi}$

For 5.745 ~ 5.825GHz Band: Directional gain = $13.50\text{dBi} + 10\log(3) = 18.27\text{dBi} > 6\text{dBi}$



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TEST MODE C 2 - EUT without beam forming function + Antenna 3 (Model: J9170A)

MODULATION MODE	FREQUENCY BAND (MHz)	MAX POWER (dBm)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm ²)	LIMIT (mW/cm ²)
802.11b	2412-2462	19.8	15.67	100	0.028	1
802.11g	2412-2462	25.7	15.67	100	0.109	1
802.11n (20MHz)	2412-2462	27.3	10.90	100	0.053	1
802.11n (40MHz)	2422-2452	25.7	10.90	100	0.036	1
802.11a	5745-5825	24.1	18.27	100	0.137	1
802.11n (20MHz)	5745-5825	24.1	13.50	100	0.046	1
802.11n (40MHz)	5755-5795	24.1	13.50	100	0.046	1

NOTE:

Antenna 3 (Model: J9170A) is used for point to point operation, so the directional gain are as below:

For 2.4GHz Band (802.11 b/g): Directional gain = $10.9\text{dBi} + 10\log(3) = 15.67\text{dBi} > 6\text{dBi}$

For 5.745 ~ 5.825GHz Band (802.11 a): Directional gain = $13.50\text{dBi} + 10\log(3) = 18.27\text{dBi} > 6\text{dBi}$

**TEST MODE D 1 - EUT with beam forming function + Antenna 4 (Model: J9171A)**

MODULATION MODE	FREQUENCY BAND (MHz)	MAX POWER (dBm)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm ²)	LIMIT (mW/cm ²)
802.11b	2412-2462	24.0	7.77	100	0.012	1
802.11g	2412-2462	27.6	7.77	100	0.027	1
802.11n (20MHz)	2412-2462	28.2	7.77	100	0.031	1
802.11n (40MHz)	2422-2452	27.0	7.77	100	0.024	1
802.11a	5180-5240	13.6	8.77	100	0.001	1
802.11n (20MHz)	5180-5240	13.8	8.77	100	0.001	1
802.11n (40MHz)	5190-5230	13.6	8.77	100	0.001	1
802.11a	5745-5825	24.2	8.77	100	0.016	1
802.11n (20MHz)	5745-5825	24.3	8.77	100	0.016	1
802.11n (40MHz)	5755-5795	23.6	8.77	100	0.014	1

NOTE:

Antenna 4 (Model: J9171A) is not used for point to point operation, so the directional gain are as below:

For 2.4GHz Band: Directional gain = $3\text{dBi} + 10\log(3) = 7.77\text{dBi} > 6\text{dBi}$

For 5.180 ~ 5.240GHz Band: Directional gain = $4\text{dBi} + 10\log(3) = 8.77\text{dBi} > 6\text{dBi}$

For 5.745 ~ 5.825GHz Band: Directional gain = $4\text{dBi} + 10\log(3) = 8.77\text{dBi} > 6\text{dBi}$



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TEST MODE D 2 - EUT without beam forming function + Antenna 4 (Model: J9171A)

MODULATION MODE	FREQUENCY BAND (MHz)	MAX POWER (dBm)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm ²)	LIMIT (mW/cm ²)
802.11b	2412-2462	24.1	7.77	100	0.012	1
802.11g	2412-2462	27.7	7.77	100	0.028	1
802.11n (20MHz)	2412-2462	28.6	3	100	0.012	1
802.11n (40MHz)	2422-2452	27.1	3	100	0.008	1
802.11a	5180-5240	13.8	8.77	100	0.001	1
802.11n (20MHz)	5180-5240	16.8	4	100	0.001	1
802.11n (40MHz)	5190-5230	16.7	4	100	0.001	1
802.11a	5745-5825	24.4	8.77	100	0.017	1
802.11n (20MHz)	5745-5825	24.4	4	100	0.006	1
802.11n (40MHz)	5755-5795	23.7	4	100	0.005	1

NOTE:

Antenna 4 (Model: J9171A) is not used for point to point operation, so the directional gain are as below:

For 2.4GHz Band (802.11 b/g): Directional gain = $3\text{dBi} + 10\log(3) = 7.77\text{dBi} > 6\text{dBi}$

For 5.180 ~ 5.240GHz Band (802.11 a): Directional gain = $4\text{dBi} + 10\log(3) = 8.77\text{dBi} > 6\text{dBi}$

For 5.745 ~ 5.825GHz Band (802.11 a): Directional gain = $4\text{dBi} + 10\log(3) = 8.77\text{dBi} > 6\text{dBi}$



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TEST MODE E 1 - EUT with beam forming function + Antenna 5 (Model: J9659A)

MODULATION MODE	FREQUENCY BAND (MHz)	MAX POWER (dBm)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm ²)	LIMIT (mW/cm ²)
802.11b	2412-2462	26.5	6.77	100	0.017	1
802.11g	2412-2462	28.3	6.77	100	0.026	1
802.11n (20MHz)	2412-2462	28.5	6.77	100	0.027	1
802.11n (40MHz)	2422-2452	27.0	6.77	100	0.019	1
802.11a	5180-5240	16.1	6.77	100	0.002	1
802.11n (20MHz)	5180-5240	16.0	6.77	100	0.002	1
802.11n (40MHz)	5190-5230	16.0	6.77	100	0.002	1
802.11a	5745-5825	24.2	6.77	100	0.010	1
802.11n (20MHz)	5745-5825	24.4	6.77	100	0.010	1
802.11n (40MHz)	5755-5795	23.6	6.77	100	0.009	1

NOTE:

Antenna 5 (Model: J9659A) is not used for point to point operation, so the directional gain are as below:

For 2.4GHz Band: Directional gain = 2dBi + 10log(3) = 6.77dBi > 6dBi

For 5.180 ~ 5.240GHz Band: Directional gain = 2dBi + 10log(3) = 6.77dBi > 6dBi

For 5.745 ~ 5.825GHz Band: Directional gain = 2dBi + 10log(3) = 6.77dBi > 6dBi

**TEST MODE E 2 - EUT without beam forming function + Antenna 5 (Model: J9659A)**

MODULATION MODE	FREQUENCY BAND (MHz)	MAX POWER (dBm)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/cm ²)	LIMIT (mW/cm ²)
802.11b	2412-2462	26.6	6.77	100	0.017	1
802.11g	2412-2462	28.5	6.77	100	0.027	1
802.11n (20MHz)	2412-2462	28.6	2.00	100	0.009	1
802.11n (40MHz)	2422-2452	27.1	2.00	100	0.006	1
802.11a	5180-5240	16.2	6.77	100	0.002	1
802.11n (20MHz)	5180-5240	16.8	2.00	100	0.001	1
802.11n (40MHz)	5190-5230	16.7	2.00	100	0.001	1
802.11a	5745-5825	24.4	6.77	100	0.010	1
802.11n (20MHz)	5745-5825	24.6	2.00	100	0.004	1
802.11n (40MHz)	5755-5795	23.7	2.00	100	0.003	1

NOTE:

Antenna 5 (Model: J9659A) is not used for point to point operation, so the directional gain are as below:

For 2.4GHz Band (802.11 b/g): Directional gain = $2\text{dBi} + 10\log(3) = 6.77\text{dBi} > 6\text{dBi}$

For 5.180 ~ 5.240GHz Band (802.11 a): Directional gain = $2\text{dBi} + 10\log(3) = 6.77\text{dBi} > 6\text{dBi}$

For 5.745 ~ 5.825GHz Band (802.11 a): Directional gain = $2\text{dBi} + 10\log(3) = 6.77\text{dBi} > 6\text{dBi}$