

IC: 4100A-BM833

# **Maximum Permissible Exposure (MPE)**

# **Standard Applicable**

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Mobile device, the MPE is required.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for Maximum Permissive Exposure (MPE)

Frequency Range	Electric Field	Magnetic Field	Power Density	Averaging Time
(MHz)	Strength (V/m)	Strength (A/m)	(mW/cm <sup>2</sup> )	(minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-15000	/	/	1.0	30

F = frequency in MHz

<sup>\* =</sup> Plane-wave equipment power density



IC: 4100A-BM833

According to RSS 102 issue 5.

## 2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz6 and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 22.48/fo.5W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1.31 x 10-2 f0.6834 W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.



IC: 4100A-BM833

# **Maximum Permissible Exposure (MPE) Evaluation (BLE)**

PCB Antenna

Maximum output power at antenna input terminal:	8.16	(dBm)
Maximum output power at antenna input terminal:	6.546361741	(mW)
Tune-Up power Tolerance:	1	dB
Duty cycle:	100	(%)
Maximum Pav :	8.24138115	(mW)
Antenna gain (typical):	0.51	(dBi)
Maximum antenna gain:	1.124604974	(numeric)
Prediction distance:	20	(cm)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm^2)
Power density at predication frequency at 20 (cm)	0.0018448	(mW/cm^2)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

 $S=PG/4 \pi R^2$ 

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

#### **Measurement Result:**

The predicted power density level at 20 cm is  $0.0018448 \text{ mW/cm}^2$ . This is below the uncontrolled exposure limit of  $1 \text{ mW/cm}^2$ .



IC: 4100A-BM833

# **Maximum Permissible Exposure (MPE) Evaluation**

Dipole Antenna

Maximum output power at antenna input terminal:	8.16	(dBm)
Maximum output power at antenna input terminal:	6.546361741	(mW)
Tune-Up power Tolerance:	1	dB
Duty cycle:	100	(%)
Maximum Pav :	8.24138115	(mW)
Antenna gain (typical):	6	(dBi)
Maximum antenna gain:	3.981071706	(numeric)
Prediction distance:	20	(cm)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm^2)
Power density at predication frequency at 20 (cm)	0.0065306	(mW/cm^2)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

 $S=PG/4 \pi R^2$ 

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

#### **Measurement Result:**

The predicted power density level at 20 cm is  $0.0065306 \text{ mW/cm}^2$ . This is below the uncontrolled exposure limit of  $1 \text{ mW/cm}^2$ .



IC: 4100A-BM833

## **Power measurement: (BLE)**

IC EIRP level

PCB Antenna

Frequency:	2480	MHz
Maximum output power at antenna input terminal:	8.16	(dBm)
Tune-Up power Tolerance:	1	dB
Duty cycle:	100	(%)
Antenna gain (typical):	0.51	(dBi)
EIRP:	9.268	mW
EIRP:	0.00927	W
EIRP Limit	2.736	W

#### **Measurement Result:**

The EIRP level is 0.00927W which less than RSS102 section 2.5.2 Exemption Limits above 300 MHz and below 6 GHz condition.

### IC EIRP level

Dipole Antenna

Frequency:	2480	MHz
Maximum output power at antenna input terminal:	8.16	(dBm)
Tune-Up power Tolerance:	1	dB
Duty cycle:	100	(%)
Antenna gain (typical):	6	(dBi)
EIRP:	32.810	mW
EIRP:	0.03281	W
EIRP Limit	2.736	W

## **Measurement Result:**

The EIRP level is 0.03281W which less than RSS102 section 2.5.2 Exemption Limits above 300 MHz and below 6 GHz condition.