

Appendix B. Maximum Permissible Exposure

1. Maximum Permissible Exposure

1.1. Applicable Standard

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

1.2. MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = Average RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained.

1.3. Calculated Result and Limit

<Model No.: IBR600E>

For WLAN function:

Antenna Type : Dipole antenna

Max Conducted Power for IEEE 802.11n MCS0 20MHz: 16.29 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
5	3.1623	16.2938	42.5970	0.026812	1	Complies

For EV-DO Cell Band Function (3G Module, FCC ID: N7N-MC5728):

Antenna Type : Dipole Antenna

Frequency (MHz)	Average Output Power (dBm)	Antenna Gain (dBi)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
836.52	25.07	3.69	0.149606	0.558	Complies

For EV-DO PCS Band Function (3G Module, FCC ID: N7N-MC5728):

Antenna Type : Dipole Antenna

Frequency (MHz)	Average Output Power (dBm)	Antenna Gain (dBi)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
1908.75	24.90	2.2	0.102082	1	Complies

CONCLUSION:

Both of the WLAN function and EVDO/CDMA function can transmit simultaneously, the formula of calculated the MPE is:

$$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$$

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is $0.026812 / 1 + 0.149606 / 0.558 = 0.294923$, which is less than "1".

This confirmed that the device comply with FCC 1.1310 MPE limit.

<Model No.: IBR600LE / IBR600LE-PWD >

For WLAN function:

Antenna Type : Dipole antenna

Max Conducted Power for IEEE 802.11n MCS0 20MHz: 16.29 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
5	3.1623	16.2938	42.5970	0.026812	1	Complies

For GPRS/EDGE Function (FCC ID: N7NMC7750):

Cellular GSM

Antenna Type : Dipole Antenna

Frequency (MHz)	Average Output Power (dBm)	EIRP power(dBm)	EIRP power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
848.8	32.6000	34.7400	2978.5164	0.592858	0.566	Complies

EDGE 850

Antenna Type : Dipole Antenna

Frequency (MHz)	Average Output Power (dBm)	EIRP power(dBm)	EIRP power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
848.8	26.2200	28.3600	685.4882	0.136443	0.566	Complies

PCS GSM

Antenna Type : Dipole Antenna (FCC ID: N7NMC7750)

Frequency (MHz)	Average Output Power (dBm)	EIRP power(dBm)	EIRP power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
1880	29.5400	31.6800	1472.3125	0.293056	1.253	Complies

EDGE1900

Antenna Type : Dipole Antenna (FCC ID: N7NMC7750)

Frequency (MHz)	Average Output Power (dBm)	EIRP power(dBm)	EIRP power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
1909.8	25.3100	27.4500	555.9043	0.110650	1.273	Complies

For WCDMA/HSPA Function (FCC ID: N7NMC7750):

Cell. WCDMA

Antenna Type : Dipole Antenna

Frequency (MHz)	Average Output Power (dBm)	EIRP power(dBm)	EIRP power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
836.6	23.4200	25.5600	359.7493	0.071606	0.557	Complies

PCS WCDMA

Antenna Type : Dipole Antenna

Frequency (MHz)	Average Output Power (dBm)	EIRP power(dBm)	EIRP power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
1880	22.6100	24.7500	298.5383	0.059422	1.253	Complies

For CDMA/EVDO Function

Cell. CDMA

Antenna Type : Dipole Antenna

Frequency (MHz)	Average Output Power (dBm)	EIRP power(dBm)	EIRP power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
824.7	25.3100	27.4500	555.9043	0.110650	0.549	Complies

PCS CDMA

Antenna Type : Dipole Antenna

Frequency (MHz)	Average Output Power (dBm)	EIRP power(dBm)	EIRP power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
1853.25	25.2800	27.4200	552.0774	0.109888	1.236	Complies

For LTE Function (FCC ID: N7NMC7750):

Antenna Type : Dipole Antenna

Frequency (MHz)	Average Output Power (dBm)	EIRP power(dBm)	EIRP power (mW))	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
784.5	23.5100	25.6500	367.2823	0.073106	0.523	Complies

Antenna Type : Dipole Antenna

Frequency (MHz)	Average Output Power (dBm)	EIRP power(dBm)	EIRP power (mW))	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
782	23.5600	25.7000	371.5352	0.073106	0.521	Complies

CONCLUSION:

Both of the WLAN function and LTE/EVDO/CDMA function can transmit simultaneously, the formula of calculated the MPE is:

$$CPD1 / LPD1 + CPD2 / LPD2 +etc. < 1$$

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is $0.026812 / 1 + 0.592858 / 0.566 = 0.61967$, which is less than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.

<Model No.: IBR600LP / IBR600LP-PWD >

For WLAN function:

Antenna Type : Dipole antenna

Max Conducted Power for IEEE 802.11n MCS0 20MHz: 16.29 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
5	3.1623	16.2938	42.5970	0.026812	1	Complies

For LTE Function (LTE Module, FCC ID: N7NMC7700):

Frequency range: 824 – 849 MHz

Antenna with 7.5dBi gain.

Frequency (MHz)	Max. Conducted output Power (dBm)	Max. EIRP power(dBm)	Max. EIRP power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
824	32.5	40	10000.00	0.249	0.55	Complies

For LTE Function (LTE Module, FCC ID: N7NMC7700):

Frequency range: 704 – 716 MHz

Antenna with 9dBi gain.

Frequency (MHz)	Max. Conducted output Power (dBm)	Max. EIRP power(dBm)	Max. EIRP power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
704	24.2	33.2	2089.2961	0.42	0.469	Complies

CONCLUSION:

Both of the WLAN function and LTE/HSPA+/WCDMA function can transmit simultaneously, the formula of calculated the MPE is:

$$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$$

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is $0.026812 / 1 + 0.42 / 0.469 = 0.922334$, which is less than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.

<Model No.: IBR600P>

For WLAN function:

Antenna Type : Dipole antenna

Max Conducted Power for IEEE 802.11n MCS0 20MHz: 16.29 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
5	3.1623	16.2938	42.5970	0.026812	1	Complies

For 2G/3G Function (FCC ID: NMNMC8705):

Frequency range: 824 – 849 MHz

Antenna with 5dBi gain.

Frequency (MHz)	Max. Conducted output Power (dBm)	Max. EIRP power(dBm)	Max. EIRP power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
824	32	37	5012	0.49	0.55	Complies

Frequency range: 1850 – 1910 MHz

Antenna with 3.3dBi gain.

Frequency (MHz)	Max. Conducted output Power (dBm)	Max. EIRP power(dBm)	Max. EIRP power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
1850	29.7	33	1995	0.39	0.55	Complies

CONCLUSION:

Both of the WLAN Function and the HSPA+/WCDMA Function can transmit simultaneously, the formula of calculated the MPE is:

$$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$$

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is $0.026812 / 1 + 0.49 / 0.55 = 0.917$, which is less than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.

<Model No.: IBR600NM>

For WLAN function:

Antenna Type : Dipole antenna

Max Conducted Power for IEEE 802.11n MCS0 20MHz: 16.29 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
5	3.1623	16.2938	42.5970	0.026812	1	Complies