

## 6 RF Exposure

### 6.1 Exposure Requirements – FCC Parts 90.1217, 1.1307 and 1.1310

**FCC 90.1217:-** Licensees and manufacturers are subject to the radiofrequency radiation exposure requirements specified in §§ 1.1307(b), 2.1091 and 2.1093 of this chapter, as appropriate. Applications for equipment authorization of mobile or portable devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

**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).

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Average Time (minutes)
<b>LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)</b>				
1500-100,000	...	...	5	6

#### (A) Limits for Occupational/Control Exposures

1500-100,000	...	...	1.0	30
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#### (B) Limits for General Population/Uncontrolled Exposure

F = Frequency in MHz

### 6.1.1 RF Exposure Limit

According to FCC 1.1310 table 1: 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)

**TABLE 1—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> )	Averaging time (minutes)
<b>(A) Limits for Occupational/Controlled Exposures</b>				
0.3–3.0 .....	614	1.63	*(100)	6
3.0–30 .....	1842/f	4.89/f	*(900/f <sup>2</sup> )	6
30–300 .....	61.4	0.163	1.0	6
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
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

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F = Frequency in MHz

### ***6.1.1.1 Antenna Gain***

The maximum Gain measured in Semi-Anechoic Chamber is 8 dBi or 7.08 (numeric).

13.5 dBi or 25.12 (numeric)

21 dBi or 125.89 (numeric)

26 dBi or 398.11 (numeric)

30 dBi or 1000 (numeric)

### ***6.1.1.2 Output Power into Antenna & RF Exposure value at distance >20cm: Mobile***

Calculations for this report are based on highest power measurement and all the various antenna gains. Limit for MPE (from FCC part 1.1310 table 1) is  $5 \text{ mW/cm}^2$  for professionally installed devices.

The highest output power is 25.55 dBm at 4965 MHz, this frequency and power will be used for all Antenna Calculations.

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8 dBi Gain Antenna at 4965 MHz

Corrected (including calibration factors) Measurement:	25.55	dBm	
The Gain of the antenna:	8.00	dBi	
Type of Measurement:	Conducted		Direct measurement at Antenna Port
Impedance:	50.00	$\Omega$	
Measuring Distance:	3.00	m	Not used for Direct measurements.
Time weighted Duty Cycle:	100.00	%	

Frequency range from 10 MHz to 40 GHz:

Frequency:	4965	MHz
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Power output with DC and antenna Gain (EiRP):

Power (dBm):	33.55
Power (mW):	2264.644
Power (W):	2.264644

R = distance in	20	cm
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FCC:

Controlled Exposures - Limit =	5	mW/cm <sup>2</sup>
Uncontrolled Exposures - Limit =	1	mW/cm <sup>2</sup>
Pd =	0.4505367	mW/cm <sup>2</sup>
Controlled Margin to Limit =	4.5495	mW/cm <sup>2</sup>
Uncontrolled Margin to Limit =	0.5495	mW/cm <sup>2</sup>

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**While using the following antenna a minimum separation distance must be at least 30 cm**

13.5 dBi Gain Antenna

Corrected (including calibration factors) Measurement:	25.55	dBm
The Gain of the antenna:	13.50	dBi
Type of Measurement:	Conducted	Port
Impedance:	50.00	$\Omega$
Measuring Distance:	3.00	m
Time weighted Duty Cycle:	100.00	%

Direct measurement at Antenna

The Power Out would

be:	0.358921935	Watts
or:	358.92193	mW
or:	358921.93	$\mu$ W
or:	25.55	dBm

Frequency range from 10 MHz to 40 GHz:

Frequency:	4965	MHz
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Power output with DC and antenna Gain (EIRP):

Power (dBm):	39.05
Power (mW):	8035.261
Power (W):	8.035261

R = distance in	30	cm
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FCC:

Controlled Exposures - Limit =	5	mW/cm <sup>2</sup>
Uncontrolled Exposures - Limit =	1	mW/cm <sup>2</sup>
Pd =	0.7104731	mW/cm <sup>2</sup>
Controlled Margin to Limit =	4.2895	mW/cm <sup>2</sup>
Uncontrolled Margin to Limit =	0.2895	mW/cm <sup>2</sup>

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**While using the following antenna a minimum separation distance must be at least 60 cm**

21 dBi Gain Antenna

Corrected (including calibration factors) Measurement:	25.55	dBm
The Gain of the antenna:	21.00	dBi
Type of Measurement:	Conducted	Port
Impedance:	50.00	$\Omega$
Measuring Distance:	3.00	m
Time weighted Duty Cycle:	100.00	%

Direct measurement at Antenna

The Power Out would

be:	0.358921935	Watts
or:	358.92193	mW
or:	358921.93	$\mu$ W
or:	25.55	dBm

Frequency range from 10 MHz to 40 GHz:

Frequency:	4965	MHz
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Power output with DC and antenna Gain (EIRP):

Power (dBm):	46.55
Power (mW):	45185.594
Power (W):	45.185594

R = distance in	60	cm
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FCC:

Controlled Exposures - Limit =	5	mW/cm <sup>2</sup>
Uncontrolled Exposures - Limit =	1	mW/cm <sup>2</sup>
Pd =	0.9988209	mW/cm <sup>2</sup>
Controlled Margin to Limit =	4.0012	mW/cm <sup>2</sup>
Uncontrolled Margin to Limit =	0.0012	mW/cm <sup>2</sup>

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**While using the following antenna a minimum separation distance must be at least 120 cm**

26 dBi Gain Antenna

Corrected (including calibration factors) Measurement:	25.55	dBm
The Gain of the antenna:	26.00	dB
Type of Measurement:	Conducted	Port
Impedance:	50.00	$\Omega$
Measuring Distance:	3.00	m
Time weighted Duty Cycle:	100.00	%

Direct measurement at Antenna

The Power Out would

be:	0.358921935	Watts
or:	358.92193	mW
or:	358921.93	$\mu$ W
or:	25.55	dBm

Frequency range from 10 MHz to 40 GHz:

Frequency:	4965	MHz
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Power output with DC and antenna Gain (EIRP):

Power (dBm):	51.55
Power (mW):	142889.396
Power (W):	142.889396

R = distance in	120	cm
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FCC:

Controlled Exposures - Limit =	5	mW/cm <sup>2</sup>
Uncontrolled Exposures - Limit =	1	mW/cm <sup>2</sup>
Pd =	0.7896373	mW/cm <sup>2</sup>
Controlled Margin to Limit =	4.2104	mW/cm <sup>2</sup>
Uncontrolled Margin to Limit =	0.2104	mW/cm <sup>2</sup>

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**While using the following antenna a minimum separation distance must be at least 170 cm**

30 dBi Gain Antenna

Corrected (including calibration factors) Measurement:	25.55	dBm
The Gain of the antenna:	30.00	dBi
Type of Measurement:	Conducted	Port
Impedance:	50.00	$\Omega$
Measuring Distance:	3.00	m
Time weighted Duty Cycle:	100.00	%

Direct measurement at Antenna

The Power Out would

be:	0.358921935	Watts
or:	358.92193	mW
or:	358921.93	$\mu$ W
or:	25.55	dBm

Frequency range from 10 MHz to 40 GHz:

Frequency:	4965	MHz
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Power output with DC and antenna Gain (EIRP):

Power (dBm):	55.55
Power (mW):	358921.935
Power (W):	358.921935

R = distance in	170	cm
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FCC:

Controlled Exposures - Limit =	5	mW/cm <sup>2</sup>
Uncontrolled Exposures - Limit =	1	mW/cm <sup>2</sup>
Pd =	0.9883080	mW/cm <sup>2</sup>
Controlled Margin to Limit =	4.0117	mW/cm <sup>2</sup>
Uncontrolled Margin to Limit =	0.0117	mW/cm <sup>2</sup>

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