

Maximum Permissible Exposure (MPE) Compliance Statement for the SpotCell 163 (IDEN, SMR Band) Adaptive Repeater for Uncontrolled Exposure (general population) and Occupational Workers (controlled exposure).

The SpotCell 163 (806-821MHz paired with 851-866MHz) adaptive Repeater equipment has been tested and the performance characterized in accordance with the MPE requirement of 47 CFR, Part 1.1310, Radiofrequency Exposure Limits. The Power density prediction was done in accordance with the FCC Office of Engineering and Technology (OET) Bulletin 65, Edition 97-01, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields". The new adopted changes to the Commission's Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields, as specified in document FCC 03-132, released on June 26, 2003 have also been implemented.

CU RF Exposure Limit (Downlink Transmit)

The system is a low power adaptive repeater, having integral antennas built into the CU and DU modules. The maximum rated radiated power of the CU is +17dBm EIRP. (The RF rated power is +14dBm and the maximum antenna gain is +3dBi in the center). At maximum operating frequency of 866MHz in the Downlink, the MPE limit is $0.6\text{W}/\text{cm}^2$ for the general public, averaged over 30 minutes, and $2.9\text{mW}/\text{cm}^2$ for occupationally exposed persons averaged over 6 minutes time. The maximum exposure limit for the CU RF power is obtained in accordance with Table 1 of 47 CFR, Part 1.1310(Radiofrequency Radiation Exposure Limits), for RF Exposed workers and Table 1 (B) of 47 CFR, Part 1.1310 (Radiofrequency Radiation Exposure Limits) for persons not classified as RF exposed workers including the general public.

For the general public, the maximum exposure limit is $f/1500 \text{ mW}/\text{cm}^2$ or $0.6\text{mW}/\text{cm}^2$ for a maximum frequency of 866MHz (f in MHz). (1)

For the occupational workers, the maximum exposure limit is $f/300 \text{ mW}/\text{cm}^2$ or $2.9\text{mW}/\text{cm}^2$ for a maximum frequency of 866MHz (f in MHz). (2)

The SpotCell 163 CU complies with these limits at the following line of sight distances from the antenna element for a maximum radiated rated power of +17dBm EIRP or 50mW: (3)

For the general public, the maximum exposure limit of 0.6mW/cm^2 occurs at 2.6cm from the line of sight of the antenna element.

For occupational workers, the maximum exposure limit of 2.9mW/cm^2 occurs at a distance of 1.2cm from the line of sight of the antenna element.

Prediction Method

The prediction method used is in accordance with guidelines outlined in OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, Edition 97-01, August 1997.

The prediction methods provided are based on worst-case far-field calculations;
 $S = \text{EIRP}/(4\pi R^2)$, (4)

Where

S = power density in mW/cm^2 at a distance R from the radiating element.

EIRP = radiated power in mW.

R = distance in cm.

Using this prediction method, for the CU of EIRP = 50mW (+17dBm), the distance at which the maximum exposure limit occurs for the general public is:

$S = 0.6\text{mW/cm}^2$ (for the General Public, from (1) above).

EIRP = 50mW (from (3) above).

$R = \sqrt{\text{EIRP}/(4\pi S)} = 2.6\text{cm}$ (from equation (4) above). (5)

For occupational workers, the Maximum Permissible Exposure (MPE) limit is 2.9mW/cm^2 , from (2) above.

Using the same prediction method (4), the distance at which maximum exposure limit for occupational workers occurs is at:

$S = 2.9\text{mW/cm}^2$, from (2) above;

EIRP = 50mW from (3) above;

$R = \sqrt{\text{EIRP}/(4\pi S)} = 1.2\text{cm}$, using equation (4) above. (6)

The distance at which maximum exposure occurs is < 20cm for both the General Public and the Occupational workers. The CU is not going to be within 20cm of any human being when deployed and as such no warning label statements shall be applied. The antenna element is also housed within a radome which provides a separation > 1.5cm. The customer manual shall include deployment instructions warning installers that the CU shall never be installed in locations where any human being could be within 20cm of approach in front of the antenna.

CU Extension Coverage RF port Exposure Limit

The CU is also provisioned with a second RF port at the back of the CU to be used for extended coverage area by customers who wish to do so. The RF signal from the second RF port will be conducted via a coax cable to an external antenna with a maximum antenna gain of 3dBi. Spotwave shall provide the external antenna in a similar housing as the main CU housing. There will be a maximum cable loss of 6dB and a minimum cable loss of 1dB between the external antenna and the RF port for the extended coverage. The RF port for the extended coverage at the back of the CU shall have the same rated maximum output power of +14dBm.

Prediction Method.

The prediction method used is in accordance with guidelines outlined in OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, Edition 97-01, August 1997.

At the antenna input port for the extended coverage, the maximum RF input power shall be +13dBm (+14dBm – 1dB). The maximum radiated power shall be +16dBm (+13dBm + 3dBi) or 40mW.

The prediction method provided is based on worst-case far field calculations. Using equation (4) above, the distance at which the maximum exposure for the general public occurs is at:

$$R = \sqrt{EIRP/(4\pi S)} = \sqrt{40/(4\pi 0.6)} = 2.3\text{cm.} \quad (7)$$

The distance at which the maximum exposure for the occupational workers occurs is at:

$$R = \sqrt{EIRP/(4\pi S)} = \sqrt{40/(4\pi 2.9)} = 1.0\text{cm.} \quad (8)$$

The distance at which maximum exposure occurs is $< 20\text{cm}$ for both the General Public and the Occupational workers. The coverage extension antenna is not going to be within 20cm of any human being when deployed and as such no warning label statements shall be applied. The customer manual shall have instructions warning installers never to deploy the extended coverage antenna in a location where anyone could be within 20cm of approach. The antenna element shall also be housed within a radome that provides a separation $>1.5\text{cm}$. The main CU antenna and the external antenna are never going to be co-located. Spotwave Wireless Inc will make an instruction in the customer manual that a minimum of 10 cm of separation be applied when the antennas are deployed near to each other.

DU RF Exposure Limit (Uplink Transmit)

The DU transmits IDEN carriers to the Base Radio (BR) in the frequency range of 806MHz to 821MHz . The DU has a maximum rated radiated power of $+40\text{dBm}$ or 10^4mW EIRP. (9)

Prediction Method.

The prediction method used is in accordance with guidelines outlined in OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, Edition 97-01, August 1997.

The prediction methods provided are based on worst-case far-field calculations. For a maximum transmit frequency of 821MHz , the maximum RF exposure limit for the General Public is $f/1500\text{ mW/cm}^2$ or 0.5mW/cm^2 (f in MHz). (10)

For a maximum transmit frequency of 821MHz , the maximum RF exposure limit for the Occupational Workers is $f/300\text{mW/cm}^2$ or 2.7mW/cm^2 (f in MHz). (11)

Using prediction method (4), the distance at which the maximum exposure limit for the general public occurs at:

$$\begin{aligned} S &= 0.5\text{mW/cm}^2 \text{ from (10);} \\ \text{EIRP} &= 10^4\text{mW from (9);} \\ R &= 39.9\text{cm, using (4).} \end{aligned} \quad (12)$$

Using prediction method (4), the distance at which the maximum exposure limit for the Occupational Workers occurs at:

$$\begin{aligned} S &= 2.7\text{mW/cm}^2, \text{ from (11);} \\ \text{EIRP} &= 10^4\text{mW/cm}^2 \text{ from (9);} \\ R &= 17.2\text{cm, using (4);} \end{aligned} \tag{13}$$

For both the general public and the occupational workers, the distance at which the maximum RF exposure occurs exceeds the radome height.

Accordingly, the User Manual, which also incorporates the installation instructions, includes a warning statement on page (i) of the document under the heading “Important Safety Information”. The warning instructs the installer to ensure the DU is mounted in a location where people will not approach within 1 meter of the front of the unit. This distance provides additional safety margin for the product. The DU shall also have a warning label indicating that the DU shall not be installed in a location where people will approach within 1 meter of the front of the unit. This distance provides additional safety margin for the product. The "Coverage Extension Install Guide for Spotcell 163" also states the minimum separation required between the main CU and the coverage extension antenna. This distance is 10 cm when the CUs are deployed near to each other.

Conclusion

For the Downlink RF exposure, i.e. CU output power, the distance at which the maximum RF exposure limit occurs is:

For the public general at 2.6cm from the front of the antenna element;

For the occupational workers at 1.2cm from the front of the antenna element;

For the extended coverage antenna, the distance at which the maximum RF exposure limit occurs is:

For the general public at 2.3cm from the front of the antenna element;

For the occupational workers at 1.0cm from the front of the antenna element;

For the Uplink RF Exposure, i.e. the DU RF output power, the distance at which the maximum RF exposure occurs is:

For the general public at 39.9cm from the antenna element;

For the occupational workers at 17.2cm from the antenna element;



No warning labels will be required for the CU and the coverage extension antennas. The Important Safety Warning shall include statements warning installers that the main CU antenna and the extended coverage antennas are never to be deployed in locations where any one could be within 20cm approach in front of the antennas. Important Safety Warnings and instructions for main CU antenna and external antenna separation are provided in the customer manual. The DU is also provided with a Warning Label instructing installers to not locate the DU where anyone could be within 1m in front of the DU.

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