

Subject: MPE Compliance Statement for DU 1900 FULL BAND Outdoor Adaptive Repeater for Uncontrolled Exposure (general population) and Occupational Workers (controlled exposure).

Description: The DU 1900 FULL BAND Outdoor Adaptive Repeater is a full PCS band outdoor transmitter that is part of two systems. When deployed as part of the dual band transmitter system, Cellular and PCS, it is named Spotcell 141/142 PCS DU and when deployed as part of the PCS split band transmitter system, PCS and PCS, it is named Spotcell 111/112 (S) DU.

The DU 1900 Full Band outdoor 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 for fixed installations, pursuant to 47 CFR, Part 24.52 of the FCC rules and regulation for PCS equipment and 47 CFR, Part 1.1310(b).

Environmental Assessment Evaluation

For fixed transmitters, CFR 47, Part 1.1307 (b) requires evaluation of Environmental Assessment if the particular transmitter would cause human exposure to levels of radio frequency radiation in excess of the limits in 1.1310. FCC regulation 47 CFR, Part 1.1307, Table 1 specifies that for broadband PCS, subpart E, EA evaluation is required for the following sites:

- non-building mounted antennas: height above ground level to lowest point of antenna < 10m **and** total power of all channels > 3280 W EIRP.
- building mounted antennas: total power of all channels > 3280 W EIRP.

Since the maximum radiated composite output power of the DU 1900 Full Band is $\leq 30\text{dBm}$ EIRP (1 W EIRP) and the transmitter is designed for installation at outdoors and on rooftops, the transmitters are excluded for a routine environmental evaluation or preparation of an EA.

Section I – Human Exposure Compliance Statement for Spotcell 141/142 PCS DU (Dual Band Deployment)

Pursuant to 47 CFR, Part 1.1310, 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.

The Spotcell 141/142 PCS DU Outdoor Adaptive repeater operates in the 1900MHz PCS band and is a low power adaptive repeater, having integral antenna built into the DU module. The repeater is designed to operate in an outdoor environment.

The Maximum Permissible Exposure (MPE) limit for the general public is $1\text{mW}/\text{cm}^2$, averaged over 30 minutes, and for occupationally exposed persons is $5\text{mW}/\text{cm}^2$, averaged over 6 minutes time for the whole 1900MHz PCS band, as specified by 47 CFR, Part 1.1310, Table 1. The SpotCell 141/142 PCS DU complies with this limit at the following line of sight distances from the radiating antenna structure of the DU:

Transmitting Device	Distance at which MPE limit occurs from device for General Public	Distance at which MPE limit occurs from device for Occupational workers
Spotcell 141/142 PCS DU	8.9cm	4.0cm
Spotcell 141/142 PCS DU co-located with the Spotcell 100 DU	16.3cm	7.3cm

Prediction Method for Spotcell 141/142 PCS DU RF Power Density

Uncontrolled/General Public Exposure

For the general uncontrolled population the Maximum Permissible Exposure (MPE) limit is $1\text{mW}/\text{cm}^2$, as specified by 47 CFR, Part 1.1310, for the PCS frequency band.

The prediction methods used to calculate power density levels are based on worst-case far-field calculations:

$$S = \text{EIRP}/(4\pi R^2), \quad (1)$$

From Equations for Predicting RF Fields, OET, bulletin 65-, Edition 97-01, August 1997,

Where: S = power density in mW/cm^2 .

EIRP = Equivalent isotropically radiated power in mW.

R = distance in cm.

The DU has a maximum composite total radiated power of 1000mW (30dBm) EIRP. Hence,

$$S = 1\text{mW}/\text{cm}^2.$$

$$\text{EIRP} = 1000\text{mW}.$$

$$R = 8.92\text{cm}, \text{ using the formula in (1).}$$

Since the Spotcell 141/142 PCS DU is deployed where the separation from the publicly accessible area is greater than 1 meter, the public is in no danger of being exposed to this limit. The customer manual has guideline where installers are instructed to install the DU in areas where no one will be within a meter of approach.

Controlled/Occupational Exposure

For occupational workers, the Maximum Permissible Exposure (MPE) limit is $5\text{mW}/\text{cm}^2$, as specified by 47 CFR, Part 1.1310, Table 1.

Using equation (1) above, the distance at which the MPE limit occurs is 4cm.

The DU has a radome with a separation of 3.5 cm from the radiating elements at the point where the gain is maximum. Hence there is only 0.5 cm of separation from the

housing where occupational workers could be exposed to the Maximum Permissible Exposure limit. The worst-case scenario is if some body touches the DU while transmitting. The maximum power density at the plastic housing is:

$$S = 1000\text{mW}/(4\pi 3.5^2) = 6.5\text{mW}/\text{cm}^2 \text{ (from OET, bulletin 65, page 11).}$$

At this power density, the maximum allowable time, T , is:

$$5\text{mW}/\text{cm}^2 \times 6 \text{ minutes} = 6.5\text{mW}/\text{cm}^2 \times T$$

$$T = 4.6 \text{ minutes}$$

Anyone who may be on a transient in front of the DU while transmitting may touch the housing of the transmitter or may linger for longer than 4.6 minutes at a distance less than 0.5cm. To prevent any person from staying longer than 4.6 minutes in front of the transmitter, at a distance less than 0.5cm, or from touching the radome for longer than 4.6 minutes, a warning label is applied on the DU informing installers to avoid being in front of the DU within a distance of one meter. This is being extra-cautious.

MPE Limit consideration when Spotcell 141/142 PCS DU and Spotcell 100 DU are co-located

The Spotcell 141/142 is a dual band transmitter system consisting of the uplink 800MHz Cellular band transmitter (Spotcell 100 DU) and the 1900MHz PCS transmitter. The two transmitters are connected by a 2 meters long RG-6 coaxial cable and may be deployed on the same installation pole. When both transmitters are operated in this mode, the radiation transmitted will add up and the MPE limit should be evaluated accordingly.

Maximum Composite Conducted power of Spotcell 100 = +20dBm.

Maximum antenna gain of the Spotcell 100 = +10dBi.

Maximum Composite radiated output power of Spotcell 100 = +30dBm EIRP.

Maximum Composite Conducted power of Spotcell 141/142 PCS DU = +18.5dBm.

Maximum antenna gain of the Spotcell 141/142 PCS DU = +11.5dBi.

Maximum Composite radiated output power of Spotcell 141/142 PCS DU = +30dBm EIRP.

Total Composite radiated output power of both DUs = +33dBm EIRP or 2000mW.

Applying the more stringent RF exposure limit of the Cellular band ($0.6\text{mW}/\text{cm}^2$ for the general public and $3\text{mW}/\text{cm}^2$ for occupational workers) for the total composite power and assuming antenna co-location deployment, the distance at which the MPE limit occurs is:

$R = 16.3\text{cm}$, for uncontrolled exposure or for the general public.

$R = 7.3\text{cm}$, for the controlled exposure or for occupational workers.

Both the Spotcell 141/142 PCS DU and the Spotcell 100 DU (Spotcell 141/142 Cellular DU) are provided with RF warning labels instructing anyone to avoid being within 1 meter of approach. Although the limit is still less than the 20cm, the label is applied to be more cautious.

Label Requirements

The revised section of 47 CFR, Part 1.1307 (b), subsection (iv) states that "Labels are not required on any fixed subscriber transceiver antenna if the transmitter is mounted such that persons can **never** be closer than 20cm from any part of the radiating structure and the device can be shown to comply with the MPE limits for the field strength and/or power density at a distance of 20 cm or more." To avoid anyone being within a 20cm distance from the DUs, the DUs are provided with warning labels informing individuals to avoid being within 1 meter in front of the transmitters.

Conclusion

Spotcell 141/142 PCS DU complies with the MPE limits at distance of 8.9cm or greater from the radiating element for the general public and at distance of 4 cm or greater from the radiating element for the occupational workers.

In addition, Spotcell 141/142 PCS DU complies with the MPE limits at distances of 16.3cm or greater when co-located with the Spotcell 141/142 Cellular DU (Spotcell 100 DU), for the general public limit and at distances of 7.3cm or greater when co-located with the Spotcell 141/142 Cellular DU, for occupational workers limit. The general public is not going to be within the 20 cm of approach from the DU. The transmitters are designed for installation on outdoors on rooftops. The 3.5cm separation of the radome of the DU from the radiating element also provides additional barrier to prevent any one from getting too close to the area which exceeds the limit. Additional warning labels are also provided for anyone approaching the DUs.

Section II - Human Exposure Compliance Statement for Spotcell 111/112 (S) DU

When the DU 1900 Full Band is deployed to transmit two PCS split bands as in the Spotcell 111/112 (S) system, the DU is referred to as a Spotcell 111/112 (S) DU.

Pursuant to 47 CFR, Part 1.1310, both bands of the Spotcell 111/112 (S) DU are subject to the radio frequency radiation requirement of Table 1. 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.

The Spotcell 111/112 (S) DU Out-door Adaptive repeater operates in the 1850MHz-1910MHz PCS band. Both split bands operate simultaneously in different frequency bands. The DU is a low power adaptive repeater, having an integral antenna built into the DU module.

The Maximum Permissible Exposure (MPE) limit for the general public is $1\text{mW}/\text{cm}^2$ for the PCS 1900MHz band, averaged over 30 minutes. For occupationally exposed persons, the MPE limit is $5\text{mW}/\text{cm}^2$ for the PCS 1900MHz band, averaged over 6 minutes time, as specified by 47 CFR, Part 1.1310, Table 1. Applying this maximum power density exposure limit for the PCS 1900MHz band, the SpotCell 111/112 (S) DU complies with this limit at the following line of sight distances from the radiating antenna structure of the DU:

Transmitting Device	Distance at which MPE limit occurs from device for General Public	Distance at which MPE limit occurs from device for Occupational workers
Spotcell 111/112 (S) DU	8.9cm	4.0cm

Prediction Method for Spotcell 111/112 (S) DU RF Power Density

Uncontrolled/General Public Exposure

For the general uncontrolled population the Maximum Permissible Exposure (MPE) limit is $1\text{mW}/\text{cm}^2$, as specified by 47 CFR, Part 1.1310, for the PCS frequency band.

The prediction methods used to calculate power density levels are based on worst-case far-field calculations:

$$S = \text{EIRP}/(4\pi R^2), \quad (1)$$

From Equations for Predicting RF Fields, OET, bulletin 65-, Edition 97-01, August 1997,

Where: S = power density in mW/cm^2 .

EIRP = Equivalent isotropically radiated power in mW.

R = distance in cm.

The DU has a maximum composite total radiated power of 1000mW (30dBm) EIRP. Hence,

$$S = 1\text{mW}/\text{cm}^2.$$

$$\text{EIRP} = 1000\text{mW}.$$

$$R = 8.92\text{cm}, \text{ using the formula in (1).}$$

Since the Spotcell 111/112 (S) DU is deployed where the separation from the publicly accessible area is greater than 1 meter, the public is in no danger of being exposed to this limit. The customer manual has guideline where installers are instructed to install the DU in areas where no one will be within a meter of approach.

Controlled/Occupational Exposure

For occupational workers, the Maximum Permissible Exposure (MPE) limit is $5\text{mW}/\text{cm}^2$, as specified by 47 CFR, Part 1.1310, Table 1.

Using equation (1) above, the distance at which the MPE limit occurs is 4cm.

The DU has a radome with a separation of 3.5 cm from the radiating elements at the point where the gain is maximum. Hence there is only 0.5 cm of separation from the housing where occupational workers could be exposed to the Maximum Permissible

Exposure limit. The worst-case scenario is if some body touches the DU while transmitting. The maximum power density at the plastic housing is:

$$S = 1000\text{mW}/(4\pi 3.5^2) = 6.5\text{mW}/\text{cm}^2 \text{ (from OET, bulletin 65, page 11).}$$

At this power density, the maximum allowable time, T , is:

$$5\text{mW}/\text{cm}^2 \times 6 \text{ minutes} = 6.5\text{mW}/\text{cm}^2 \times T$$

$$T = 4.6 \text{ minutes}$$

Anyone who may be on a transient in front of the DU while transmitting may touch the housing of the transmitter or may linger for longer than 4.6 minutes at a distance less than 0.5cm. To prevent any person from staying longer than 4.6 minutes in front of the transmitter, at a distance less than 0.5cm, or from touching the radome for longer than 4.6 minutes, a warning label is applied on the DU informing installers to avoid being in front of the DU within a distance of one meter. This is being extra-cautious.

Label Requirements

The revised section of 47 CFR, Part 1.1307 (b), subsection (iv) states that "Labels are not required on any fixed subscriber transceiver antenna if the transmitter is mounted such that persons can **never** be closer than 20cm from any part of the radiating structure and the device can be shown to comply with the MPE limits for the field strength and/or power density at a distance of 20 cm or more." To avoid anyone being within a 20cm distance from the DU, the DUs are provided with warning labels informing individuals to avoid being within 1 meter in front of the transmitters.

Conclusion

Spotcell 111/112 DU complies with the MPE limits at distance of 8.9cm or greater from the radiating element for the general public and at distance of 4 cm or greater from the radiating element for the occupational workers. The 3.5cm separation of the radome of the DU from the radiating element also provides additional barrier to prevent any one from getting too close to the area which exceeds the limit, which is only 0.5 cm around the DU. Additional warning labels are also provided for anyone approaching the DUs within 1 meter.

References:

- 1 – FCC OET Bulletin 65 – Evaluating Compliance with the FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, Edition 97 – 01, August 1997.
- 2 – FCC 03-132, Proposed Changes in the Commission's Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields, Adopted: June 12, 2003, Released: June 26, 2003.
- 3 – 47 CFR, Part 1.1310, Radiofrequency Exposure Limits.
- 4 – 47 CFR, Part 1.1307, Actions that may have a significant environmental effect, for which Environmental Assessments (EA) must be prepared, part (b), (iv) – Labeling Requirement.
- 4 – 47 CFR, Part 24.52, RF hazards.

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