Subject: MPE Compliance Statement for Spotcell 141/142 Dual Band CU and 111/112 Split Band CU

Maximum Permissible Exposure (MPE) Compliance Statement for the SpotCell 141/142 Dual Band CU (800MHz Cellular and 1900MHz PCS dual band operation) , Spotcell 111/112 Split Band CU (split bands operation in the 1900MHz) In-door Adaptive Repeater for Uncontrolled Exposure (general population) and Occupational Workers (controlled exposure).

The SpotCell 141/142 Dual Band CU (Cellular 800MHz and PCS 1900MHz dual band CU) and Spotcell 111/112 Split Band CU In-door Adaptive Repeater equipment have 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) and 47 CFR Part 22.

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.

FCC regulation 47 CFR, Part 1.1307, Table 1 species that for Cellular Radiotelephone Services (subpart H of part 22), 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 > 1640 W EIRP.
- Building-mounted-antennas: total power of all channels > 1640 W EIRP.

Since the maximum radiated composite output power of the Spot-cell 141/142 Dual Band CU and Spotcell 111/112 Split Band CU is 13dBm EIRP (+7dBm from each adaptive processor, each with a maximum antenna gain of +3dBi) and the CU is mounted on walls where no one will be within a 20cm approach, the CU is excluded for a routine environmental evaluation or preparation of an EA. The customer

manual has instructions whereby installers are required to install the CU in places where no one will be within a 20cm approach.

Section I – Human Exposure Compliance Statement for Spotcell 141/142 Dual Band CU

Pursuant to 47 CFR, Part 1.1310, both the cellular band transmitter and the PCS band transmitter of the Spotcell 141/142 Dual Band CU 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 141/412 Dual Band CU In-door Adaptive repeater operates in both the 1900MHz PCS band and the 800MHz Cellular band simultaneously and is a low power adaptive repeater, having two integral antennas built into the CU module.

The Maximum Permissible Exposure (MPE) limit for the general public is $0.6mW/cm^2$ (f/1500, f = 894MHz) for the Cellular transmitter and a maximum of $1mW/cm^2$ for the PCS 1900MHz band, averaged over 30 minutes. For occupationally exposed persons, the MPE limit is $3mW/cm^2$ for the Cellular band and $5mW/cm^2$ for the PCS 1900MHz band, averaged over 6 minutes time, as specified by 47 CFR, Part 1.1310, Table 1. Applying the more stringent requirement of Cellular Band for both the Cellular band and the PCS 1900MHz band, the SpotCell 141/142 CU complies with this limit at the following line of sight distances from the radiating antenna structure of the CU:

Transmitting Device	Distance at which MPE limit occurs from device for General Public	Distance at which MPE limit occurs from device for Occupational workers
141/142 Dual Band CU	1.6cm	0.7cm
141/142 Dual Band CU co-located with external antenna	1.8cm	0.8cm

Prediction Method for Spotcell 141/142 Dual Band CU RF Power Density

Uncontrolled/General Public Exposure

For the general uncontrolled population, the Maximum Permissible Exposure (MPE) limit is 0.6mW/cm^2, as specified by 47 CFR, Part 1.1310, for the Cellular frequency band. This more stringent requirement is applied for both the Cellular transmitter and the PCS transmitter that are co-located at the CU.

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

$S = EIRP/(4\pi R^2)$, (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 Spotcell 141/142 Dual Band CU has maximum composite total radiated power of 20mW (13dBm) EIRP.

800MHz Cellular Maximum Composite conducted power = 7dBm.
Maximum antenna gain of Cellular transmitter = 3dBi.
Maximum Composite radiated power of Cellular band = 10dBm EIRP.
1900MHz PCS Maximum Composite conducted power = 7dBm.
Maximum antenna gain of PCS transmitter = 3dBi.
Maximum Composite radiated power of PCS band = 10dBm EIRP.
Total Maximum Composite radiated power = 13dBm EIRP.

Each band contributes a total composite power of 10dBm EIRP for a total of 13dBm EIRP. Hence,

S = 0.6mW/cm^2.
EIRP = 20mW (13dBm).
R = 1.6cm, using the formula in (1).

Since the Spotcell CU is deployed where no one will be within a 20cm of approach, the general public is in no danger of being exposed to this limit.

Controlled/Occupational Exposure to Spotcell 141/142 Dual Band CU RF Power

For occupational workers, the Maximum Permissible Exposure (MPE) limit is $3mW/cm^2$, for the 800MHz Cellular Band and $5mW/cm^2$ for the 1900MHz PCS band, as specified by 47 CFR, Part 1.1310, and Table 1. The more stringent requirement of the $3mW/cm^3$ is applied for both the 800MHz Cellular band and the 1900MHz PCS bands.

Using equation (1) above, the distance at which the MPE limit occurs is 0.7cm.

$S = 3mW/cm^2$.
EIRP = 20mW.
R = 0.7cm, using the formula in (1).

The Spotcell 141/142 Dual Band CU has also a plastic radome which houses the integral antennas providing additional barrier to any one from coming closer to the radiating element.

MPE Limit Considerations during Deployment of the Spotcell 141/142 Dual Band CU with extended coverage external antenna.

The Spotcell 141/142 Dual Band CU is provided with an additional RF port for extended coverage area using an external antenna supplied by Spotwave Wireless Inc. The RF port is a wide band transmission port, which allows both the 800MHz Cellular Band and the 1900MHz PCS band signals to be conducted to the external antenna through an MCX connector. The maximum composite conducted output power at the RF port for the extended coverage is 4dB down, at 6dBm. Each band contributes a maximum composite power of +3dBm. The external antenna for extended coverage is a wide band radiator but the maximum gain is only 1dBi. A coaxial RF cable is used to conduct the signal from the RF port to the external antenna.

Antenna Co-location Considerations when deployed with Coverage Extension Antenna

The maximum radiated power from the extended coverage antenna is +7dBm EIRP or 5mW, excluding the RF cable loss. The worst-case scenario is if the Spotcell 141/142 Dual Band CU and the external antenna are deployed side-by-side facing in the same direction, whereby the radiation from each antenna element overlaps. If we assume a close antenna co-location and ignore the free space loss between the main antennas and the extended coverage external antenna, the total maximum composite output power will be 25mW EIRP (+7dBm EIRP and +13dBm EIRP = 14dBm).

In such a scenario, the distance at which the MPE limit for the general public occurs at R = 1.8cm.

$S = 0.6mW/cm^2$
EIRP = 25mW
R = 1.8cm, from the radiating element, using formula (1).

For the controlled exposure or for the occupational workers exposure, the MPE limit occurs at a distance of R = 0.8cm from the radiating elements.

$S = 3mW/cm^2$
EIRP = 25mW
R = 0.8cm, from the radiating elements, using formula (1).

Hence the distance at which the MPE limit occurs is still less than 2cm from the radiating elements even if the extended coverage antenna is co-located with the main CU. Both the main CU and the extended coverage external element will be deployed in places where no one will be within 20cm of approach. The customer manual has guidelines where installers are instructed to deploy the CU and the extended coverage in places where no one will be within 20cm of approach.

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." Since the CU and the extended coverage antenna are deployed on fixed places where no one comes within the 20cm approach and the Maximum Permissible Exposure, MPE, limit

occurs at distances less than 2cm from the radiating elements for both the general public and the occupational workers, no RF warning labels are required.

Conclusion

Spotcell 141/142 Dual CU complies with the MPE limits at distance of 1.6cm or greater from the radiating element for the general public and at distance of 0.7cm or greater from the radiating element for occupational workers. In addition, Spotcell 141/142 Dual Band CU meets the MPE limits when co-located with the extended coverage external antenna at distances of 1.8cm or greater for the general public and at distances of 0.8cm or greater for occupational workers.

The customer manual has deployment instructions whereby installers are required to install the CU and the extended coverage external antenna in places where on one will be within a 20cm approach of the radiating elements.

Section II - Human Exposure Compliance Statement for Spotcell 111/112 Split Band CU

Pursuant to 47 CFR, Part 1.1310, both PCS band transmitters of the Spotcell 111/112 Split Band CU 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 Split Band CU In-door Adaptive repeater operates in the 1900MHz PCS band. Both split bands operate simultaneously in different frequency bands. The CU is a low power adaptive repeater, having two integral antennas built into the CU module.

The Maximum Permissible Exposure (MPE) limit for the general public is $1mW/cm^2$ for the PCS 1900MHz band, averaged over 30 minutes. For occupationally exposed persons, the MPE limit is $5mW/cm^2$ 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 Split Band CU complies with this limit at the following line of sight distances from the radiating antenna structure of the CU:

Transmitting Device	Distance at which MPE limit occurs from device for General Public	Distance at which MPE limit occurs from device for Occupational workers
111/112 Split Band CU	1.3cm	0.6cm
111/112 Split Band CU co-located with external antenna	1.4cm	0.6cm

Prediction Method for Spotcell 111/112 Split Band CU RF Power Density

Uncontrolled/General Public Exposure
For the general uncontrolled population, the Maximum Permissible Exposure (MPE) limit is $1W/cm^2$, as specified by 47 CFR, Part 1.1310, for the PCS frequency band.

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

$S = EIRP/(4\pi R^2)$, (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 Spotcell 111/112 Split Band CU has maximum composite total radiated power of 20mW (13dBm) EIRP.

Primary 1900MHz PCS transmitter Maximum Composite conducted power = 7dBm.
Maximum antenna gain of PCS transmitter = 3dBi.
Maximum Composite radiated power of first PCS band = 10dBm EIRP.
Secondary 1900MHz PCS transmitter Maximum Composite conducted power = 7dBm.
Maximum antenna gain of PCS transmitter = 3dBi.

Maximum Composite radiated power of PCS band = 10dBm EIRP.
Total Maximum Composite radiated power = 13dBm EIRP.

Each band contributes a total composite power of 10dBm EIRP for a total of 13dBm EIRP. Hence,

$S = 1mW/cm^2$.
EIRP = 20mW (13dBm).
R = 1.26cm, using the formula in (1).

Since the Spotcell CU is deployed where no one will be within a 20cm of approach, the general public is in no danger of being exposed to this limit.

Controlled/Occupational Exposure to Spotcell 111/112 Split Band CU RF Power

For occupational workers, the Maximum Permissible Exposure (MPE) limit is $5mW/cm^2$ for the 1900MHz PCS band, as specified by 47 CFR, Part 1.1310, and Table 1.

Using equation (1) above, the distance at which the MPE limit occurs is 0.6cm.

$S = 5mW/cm^2$.
EIRP = 20mW.
R = 0.6cm, using the formula in (1).

The Spotcell 111/112 Split Band CU has also a plastic radome which houses the integral antennas providing additional barrier to any one from coming closer to the radiating element.

MPE Limit Considerations during Deployment of the Spotcell 111/112 Split Band CU with extended coverage external antenna.

The Spotcell 111/112 Split Band CU is provided with an additional RF port for extended coverage area using an external antenna supplied by Spotwave Wireless Inc. The maximum composite conducted output power at the RF port for the extended coverage is 4dB down, at 6dBm. Each split band contributes a maximum composite power of +3dBm. The external antenna for extended coverage is a wide band radiator but the maximum gain is only 1dBi. A coaxial RF cable is used to conduct the signal from the RF port to the external antenna.

Antenna Co-location Considerations

The maximum radiated power from the extended coverage antenna is +7dBm EIRP or 5mW, excluding the RF cable loss. The worst-case scenario is if the Spotcell 111/112 Split Band CU and the external antenna are deployed side-by-side facing in the same direction, whereby the radiation from each antenna element overlaps. If we assume a close antenna co-location and ignore the free space loss between the main antennas and the extended coverage external antenna, the total maximum composite output power will be 25mW EIRP (+7dBm EIRP and +13dBm EIRP = 14dBm).

In such a scenario, the distance at which the MPE limit for the general public occurs at R = cm.

$S = 1mW/cm^2$
EIRP = 25mW
R = 1.4cm, from the radiating element, using formula (1).

For the controlled exposure or for the occupational workers exposure, the MPE limit occurs at a distance of R = 0.6cm from the radiating elements.

$S = 5mW/cm^2$
EIRP = 25mW
R = 0.6cm, from the radiating elements, using formula (1).

Hence the distance at which the MPE limit occurs is still less than 2cm from the radiating elements even if the extended coverage antenna is co-located with the main CU. Both the main CU and the extended coverage external element will be deployed in places where no one will be within 20cm of approach. The customer manual has guidelines where installers are instructed to deploy the CU and the extended coverage in places where no one will be within 20cm of approach.

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." Since the CU and the extended coverage antenna are deployed on fixed places where no one comes within the 20cm approach and the Maximum Permissible Exposure, MPE, limit

occurs at distances less than 2cm from the radiating elements for both the general public and the occupational workers, no RF warning labels are required.

Conclusion

Spotcell 111/112 Split Band CU complies with the MPE limits at distance of 1.3cm or greater from the radiating element for the general public and at distance of 0.6cm or greater from the radiating element for occupational workers. In addition, Spotcell 111/112 Split Band CU meets the MPE limits when co-located with the extended coverage external antenna at distances of 1.4cm or greater for the general public and at distances of 0.6cm or greater for occupational workers.

The customer manual has deployment instructions whereby installers are required to install the CU and the extended coverage external antenna in places where on one will be within a 20cm approach of the radiating elements.

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.

5 – 47 CFR, Part 24.52, RF hazards.

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