

**Evaluation of the CSI Model DSP85-25XH-CP BDA
For
Compliance with FCC Guidelines
For Human Exposure to Radio Frequency
Electromagnetic Fields**

1 December 2010

General

The CSI Model DSP85-25XH-CP Repeater is considered to be a dual-band “mobile” device operating in both the Cellular Service authorized under subpart H of part 22 and in the Personal Communication Service authorized under part 24. As such, the equipment is required to be evaluated for RF exposure if operated below 1.5 GHz with an effective radiated power (ERP) of 1.5 watts or more or if operated above 1.5 GHz with an effective radiated power (ERP) of 3.0 watts or more, as defined in 2.1091 of FCC rules.

Downlink

For the downlink portion of the Model DSP85-25XH-CP Repeater, the maximum rated output power is +33.0 dBm (2000 mW) in the Cellular Band (<1.5 GHz) and 30.0 dBm (2000 mW) in the PCS band (>1.5 GHz). As stated in the Model DSP85-25XH-CP Manual, the maximum authorized indoor antenna gain is 3 dBi, corresponding to a typical Multi-Band Omni-Directional antenna. The Table below shows the results of the calculated ERP for both cases, neglecting cable losses.

Frequency	Power Out	Ant Gain	EIRP	ERP	Limit
869-894 MHz	37.0 dBm	3 dBi	40.0 dBm	6068 mW	1.5 W
1930-1990 MHz	37.0 dBm	3 dBi	40.0 dBm	6068 mW	3.0 W

As shown above, both frequency bands exceed the allowable limit and must be evaluated for minimum separation distances in order to comply with the exposure limits of 1.1310 of the FCC rules

Using the guidelines in FCC OET Bulletin 65 and Supplement C, the power density at a reasonable distance from the maximum gain antenna was calculated. The minimum safe distance was also determined based on the uncontrolled exposure limits defined in Table 1B of FCC rules 1.1311. The following assumptions are made concerning these calculations:

<u>CELL Band</u>	<u>PCS Band</u>
Po = 5000 mw average	5000 mw
Cable Loss = 0 dB	0 dB
Ant Gain = 3 dBi	3 dBi
Frequency = 881.5 MHz	1960 MHz
Main Beam (worst-case)	Main Beam
100% reflection	100% reflection
Reasonable Distance = 4 feet (122 cm)	4 feet (122 cm)

Therefore, from OET Bulletin 65,

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

For 100% reflection, a doubling of the field strength can be expected. The above equation can be modified to,

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

Solving for S at a distance of 4 feet (122 cm) gives,

$$S = (5000) (2) / \pi (122)^2 = 0.21 \text{ mw/cm}^2$$

From FCC rules 1.1311, Table 1B, the allowable limit for uncontrolled exposure is $f(\text{MHz}) / 1500$. At 881.5 MHz this corresponds to a level of 0.59 mw/cm^2 . For frequencies above 1500 MHz the limit is 1.0 mw/cm^2 .

The calculated value of 0.21 is below both these limits thereby showing compliance under worst-case operating conditions.

The Cautions in the Model DSP85-25XH-CP manual clearly define the antenna selection and installation criteria in order to maintain a minimum 122-centimeter separation.

Uplink

For the downlink portion of the Model DSP85-25XH-CP, the maximum rated output power is +31.0dbm (1258 mW) in the Cellular Band (<1.5 GHz) and 27.0 dBm (500 mW) in the PCS band (>1.5 GHz). As stated in the Model DSP85-25XH-CP Manual, the maximum authorized outdoor antenna gain is 14 dBi, corresponding to a typical Multi-Element Yagi-Directional antenna. The Table below shows the results of the calculated ERP for both cases, neglecting cable losses.

Frequency	Power Out	Ant Gain	EIRP	ERP	Limit
824-849 MHz	31.0 dBm	14 dBi	45.0 dBm	19,188 mW	1.5 W
1850-1910 MHz	27.0 dBm	14 dBi	41.0 dBm	7,639 mW	3.0 W

As shown in the above table, the Cellular and PCS band exceeds the allowable limit and must be evaluated for minimum separation distances in order to comply with the exposure limits of 1.1310 of the FCC rules.

Using the guidelines in FCC OET Bulletin 65 and Supplement C, the power density at a reasonable distance from the maximum gain antenna was calculated. The minimum safe distance was also determined based on the uncontrolled exposure limits defined in Table 1B of FCC rules 1.1311. The following assumptions are made concerning these calculations:

Cellular Band	PCS Band
Po = 1258 mw average	500 mw
Cable Loss = 0 dB	0 dB
Ant Gain = 14 dBi	14 dBi
Frequency = 836.5 MHz	1920 MHz
Main Beam (worst-case)	Main Beam
Rooftop 100% reflection	Rooftop
Reasonable Distance = 6 feet (183 cm)	6 feet

Therefore, from OET Bulletin 65,

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

For 100% reflection, a doubling of the field strength can be expected. The above equation can be modified to,

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

Solving for S at a distance of 6 feet (183 cm) gives,

<u>Cellular</u>	<u>PCS</u>
$S = (1258) (25) / \pi (183)^2 = 0.30 \text{ mw/cm}^2$	$S = (500) (25) / \pi (183)^2 = 0.12 \text{ mw/cm}^2$

From FCC rules 1.1311, Table 1B, the allowable limit for uncontrolled exposure is $f(\text{MHz}) / 1500$. At 836.5 MHz this corresponds to a level of 0.56 mw/cm^2 .

For frequencies above 1500 MHz the limit is 1.0 mw/cm^2 .

The calculated values of 0.30 and 0.12 are below both these limits thereby showing compliance under worst-case operating conditions.

As in the case of the downlink, the Cautions in the Model DSP85-25XH-CP manual clearly define the antenna selection and installation criteria in order to maintain a conservative 6-foot separation.