Evaluation of the CSI Model 110 BDA
For
Compliance with FCC Guidelines
For Human Exposure to Radio Frequency
Electromagnetic Fields

8 December 1999

General

The CSI Model 110 Bi-directional amplifier is considered to be a "mobile" device operating in the Specialized Mobile Radio Service authorized under subpart H of part 22 and part 90. 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, as defined in 2.1091 of FCC rules.

Downlink

For the downlink portion of the Model 110 BDA, the maximum rated output power is +17dBm (50 mW). As stated in the Model 110 Manual, the maximum authorized antenna gain is 3 dBi, corresponding to a typical Omni-Directional antenna. Neglecting cable losses, the worst-case EIRP will be 0.10 watts or an ERP of 0.06 watts, (ERP=EIRP/1.64). This is well below the 1.5 watts and therefore excludes the downlink from routine evaluation. The Cautions in the Model 110 manual clearly define the antenna selection and installation criteria in order to maintain a minimum 20-centimeter separation.

Uplink

For the uplink portion of the BDA the maximum rated output power is +27 dBm (500 mW). With an authorized maximum antenna gain of 11 dBd, the worst-case ERP is 6.3 watts, neglecting cable losses between the antenna and BDA. Under these conditions the unit 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:

Po = 500 mW average
Cable Loss = 0 dB
Ant Gain = 11 dBd (13.2 dBi)
Frequency = 815 MHz $\pm$ 10 MHz
Main Beam (worst-case)
Rooftop 100% reflection
Reasonable Distance = 4 feet (120 cm)

Therefore, from OET Bulletin 65,

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

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

$$S = (2)^2\, PG/4\pi R^2 = EIRP/\pi R^2$$

Solving for S at a distance of 4 feet (120 cm) gives,

$$S = (500)\ (20.9)/\ \pi\ (120)^2 = \boxed{0.23\ mw/cm^2}$$

From FCC rules 1.1311, Table 1B, the allowable limit for uncontrolled exposure is f(MHz) / 1500. At 815 MHz this corresponds to a level of 0.54 mw/cm^2.

The calculated value of 0.23 is below the limit of 0.54 thereby showing compliance under worst-case operating conditions.

When the above equation is solved for minimum separation at the exposure limit,

$$R = \sqrt{(500)\ (20.9)/\ \pi\ (0.54)} = 78\ cm\ (2.6\ feet).$$

As in the case of the downlink, the Cautions in the Model 110 manual clearly define the antenna selection and installation criteria in order to maintain a conservative 4-foot separation.