Evaluation of the CSI Model T61080-10W BDA
For
Compliance with FCC Guidelines
For Human Exposure to Radio Frequency
Electromagnetic Fields

10 April 2009

General

The CSI Model T61080-10W Bi-directional amplifier is considered to be a dual-band "mobile" device operating in the Specialized Mobile Radio Service authorized under of 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 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 T61080-10W BDA, the maximum rated output power is +31dbm (1259 mW) in both the 700 and 800 MHz SMR Band (<1.5 GHz). As stated in the Model T61080-10W 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
851-869 MHz	31 dBm	3 dBi	34 dBm	1531 mW	1.5 W
763-775 MHz	31 dBm	3 dBi	34 dBm	1531 mW	1.5 W

In both the above cases the ERP 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:

Po = 1258 mw average
Cable Loss = 0 dB
Ant Gain = 3 dBi
Frequency = 860 MHz $\pm$ 9 MHz
Main Beam (worst-case)
Reasonable Distance = 4 feet (120 cm)

Therefore, from OET Bulletin 65,

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

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

$$S = (1258)\,(2)/\,4\pi\,(120)^2 = \boxed{0.014 \text{ mw/cm}^2}$$

From FCC rules 1.1311, Table 1B, the allowable limit for uncontrolled exposure is f(MHz) / 1500. At 860 MHz this corresponds to a level of 0.57 mw/cm^2.

The calculated value of 0.014 is well below the limit of 0.57 thereby showing compliance under worst-case operating conditions.

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

$$R = \sqrt{(1258)\,(2)/\,4\pi\,(0.57)} = \quad 18 \text{ cm } (7.4 \text{ inches}).$$

The Cautions in the Model T61080-10W manual clearly define the antenna selection and installation criteria in order to maintain a conservative 4-foot separation.

Uplink

For the uplink portion of the Model T61080-10W BDA, the maximum rated output power is +31dbm (1259 mW) in both the 700 and 800 MHz SMR Band (<1.5 GHz). As stated in the Model T61080-10W Manual, the maximum authorized outdoor antenna gain is 11 dBi, corresponding to a typical Multi-Band Yagi 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
806-824 MHz	31 dBm	11 dBi	42 dBm	9664 mW	1.5 W
793-805 MHz	31 dBm	11 dBi	42 dBm	9664 mW	1.5 W

In both the above cases the ERP 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:

Po = 1258 mw average
Cable Loss = 0 dB
Ant Gain = 11 dBi
Frequency = 815 MHz $\pm$ 9 MHz
Main Beam (worst-case)
100% Rooftop 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,

$$S = (1258)\,(12.6)/\,\pi\,(120)^2 \;=\; \boxed{0.35 \text{ mw/cm}^2}$$

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 0.35 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,

$$R = \sqrt{(1258)\,(12.6)/\,\pi\,(0.54)} \;=\; 96 \text{ cm (38 inches, or 3.2 feet).}$$

As in the case of the downlink, the Cautions in the Model T61080-10W manual clearly define the antenna selection and installation criteria in order to maintain a conservative 4-foot separation.