

**Evaluation of the CSI Model T51080-SP78 BDA  
For  
Compliance with FCC Guidelines  
For Human Exposure to Radio Frequency  
Electromagnetic Fields**

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### ***General***

The CSI Model T51080-SP78 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 T51080-SP78 BDA, the maximum rated output power is +27dbm (500 mW) in both the 700 and 800 MHz SMR Band (<1.5 GHz). As stated in the Model T51080-SP78 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	27 dBm	3 dBi	30 dBm	610 mW	1.5 W
763-775 MHz	27 dBm	3 dBi	30 dBm	610 mW	1.5 W

In both the above cases the ERP is well below the allowable limits excluding the downlink from routine evaluation.

The Cautions in the Model T51080-SP78 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 Model T51080-SP78 BDA, the maximum rated output power is +27dbm (500 mW) in both the 700 and 800 MHz SMR Band (<1.5 GHz). As stated in the Model T51080-SP78 Manual, the maximum authorized outdoor antenna gain is 14 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	27 dBm	14 dBi	38 dBm	3847 mW	1.5 W
793-805 MHz	27 dBm	14 dBi	38 dBm	3847 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 = 500 mw average  
Cable Loss = 0 dB  
Ant Gain = 14 dBi  
Frequency = 808 MHz  $\pm$  15 MHz  
Main Beam (worst-case)  
100% Rooftop Reflection  
Reasonable Distance = 4 feet (120 cm)

Therefore, from OET Bulletin 65,

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

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 (120 cm) gives,

$$S = (500) (25.1) / \pi (120)^2 = \boxed{0.28 \text{ mw/cm}^2}$$

From FCC rules 1.1311, Table 1B, the allowable limit for uncontrolled exposure is  $f(\text{MHz}) / 1500$ . At 808 MHz this corresponds to a level of 0.54  $\text{mw/cm}^2$ .

The calculated value of 0.28 is below the limit of 0.54 thereby showing compliance under worst-case operating conditions.

As in the case of the downlink, the Cautions in the Model T51080-SP78 manual clearly define the antenna selection and installation criteria in order to maintain a conservative 4-foot separation.