

**Evaluation of the CSI Model CS17-145-410 Repeater
For
Compliance with FCC Guidelines
For Human Exposure to Radio Frequency
Electromagnetic Fields**

17 March 2011

General

The CSI Model CS17-145-410 Repeater is considered to be a “mobile” device operating in the Cellular Service authorized under part 27. 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 CS17-145-410, the maximum rated output power is +24.25dbm (266 mW) in the LTE band (<1.5 GHz). As stated in the Model CS17-145-410 Manual, the maximum authorized indoor antenna gain is 3 dBi, corresponding to a typical Omni-Directional antenna. The Table below shows the results of the calculated ERP, neglecting cable losses.

Frequency	Power Out	Ant Gain	EIRP	ERP	Limit
746-757 MHz	24.25 dBm	3 dBi	27.25 dBm	324 mW	1.5 W

The ERP is well below the allowable limits excluding the downlink from routine evaluation.

The Cautions in the Model CS17-145-410 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 CS17-145-410, the maximum rated output power is +24.53dbm (284 mW) in the LTE band (<1.5 GHz). As stated in the Model CS17-145-410 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, neglecting cable losses.

Frequency	Power Out	Ant Gain	EIRP	ERP	Limit
776-787 MHz	24.53 dBm	14 dBi	38.53 dBm	4345 mW	1.5W

As shown in the above table, the LTE 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:

Po = 284 mw average
Cable Loss = 0 dB
Ant Gain = 14 dBi
Frequency = 781.5 MHz
Main Beam (worst-case)
Rooftop 100% reflection
Reasonable Distance = 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 (120 cm) gives,

$$S = (284) (25) / \pi (120)^2 = \boxed{0.157 \text{ mw/cm}^2}$$

From FCC rules 1.1311, Table 1B, the allowable limit for uncontrolled exposure is $f(\text{MHz}) / 1500$. At 781.5 MHz this corresponds to a level of $.521 \text{ mw/cm}^2$. For frequencies above 1500 MHz the limit is 1.0 mw/cm^2 .

The calculated value of 0.088 is below both these limits thereby showing compliance under worst-case operating conditions.