Radiation Hazard Analysis for
Hiber Mobile Earth Stations

I.   Introduction

This analysis demonstrates compliance with applicable radiation limits for Hiber mobile earth station devices ("MES devices"). The calculations performed in this analysis comply with the methods described in Federal Communications Commission Office of Engineering & Technology Bulletin, Number 65 (Edition 97-01) ("OET Bulletin 65") and demonstrate compliance with the Maximum Permissible Exposure ("MPE") limits set forth in Section 1.1310 of the Commission's rules.

II.   Customer Mobile Earth Station Description and Operating Parameters

Hiber's MES devices fulfill the criteria for mobile devices set forth in Section 2.1091(b) of the Commission's rules, as the devices can be readily relocated and are generally operated a minimum distance of 20 centimeters from the human body. The installation and operating manuals for the Hiber MES devices will specify a minimum 20 cm separation distance between any person, including the user, and the earth station antenna while operating the device.

Section 1.1310 of the Commission's rules and OET Bulletin 65 specify radiation limits for two different scenarios: occupational/controlled exposures and general population/uncontrolled exposures. The limits for occupational/controlled exposure apply when persons are exposed as a consequence of their employment, provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. General population/uncontrolled exposure limits apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

Hiber's MES devices will be deployed in a wide variety of commercial and industrial applications.   As such, the analysis below reflects the more restrictive general population/uncontrolled exposure limits to demonstrate compliance in all potential deployment environments and scenarios. The applicable MPE limits for general population/uncontrolled exposure for MES devices are shown in Table 1.

Table 1: MPE limits for general population/uncontrolled exposure for Hiber MES devices.[1]

Frequency Range (MHz)	Power Density (S) (mW/cm²)	Averaging Time |E|², |H|², or S (minutes)
300-1500	400/1500 ≈ 0.2667	30

As specified in Section 2.1091 of the Commission's rules, for mobile devices intended for use in general population/uncontrolled environments, "source-based" time-averaging based on an inherent property or duty-cycle of a device is permitted.[2] The maximum duty cycle of a Hiber MES device is 0.44% over any fifteen-minute period. The maximum duty cycle over the averaging time of thirty minutes specified in Table 1 is also 0.44%, and the radiation hazard analysis below accounts for this maximum duty cycle value.

III.   Analysis

The exposure power density is derived from equation (5) in OET Bulletin 65 and adjusted for the duty cycle of the Hiber device:[3]

$$S = \frac{0.41\ Max\ ERP(W)\ x\ D}{\pi\ x\ R\ x\ R}$$

where: S = power density
             D = duty cycle
             R = the minimum distance of 20 cm
             Max ERP is measured in Watts

Table 2 below sets forth the operating parameters of the Hiber MES device.

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[1] *See* 47 C.F.R. § 1.1310(e) and Federal Communications Commission Office of Engineering & Technology Bulletin, Number 65 (Edition 97-01).

[2] *See* 47 C.F.R. § 2.1091(d)(2).

[3] *See* OET Bulletin 65 at 19 ("These equations are generally accurate in the far-field of an antenna but will over-predict power density in the near field, where they could be used for making a 'worst case' or conservative prediction.").

Table 2: Parameters used for Determining Power Flux Density for Hiber MES

Parameter	Symbol	Value	Units
Maximum ERP	Max ERP (dBW)	7.16	dBW
Maximum ERP	Max ERP (W)	5.19	W
Operating Frequency	F	0.4	GHz
Duty Cycle	D	0.44 %	4 seconds of uplink messages in a time window of 15 minutes

For a Hiber MES device, the maximum power input to the antenna is 5.19 W and the maximum gain is 5.4 dBi. The minimum operating distance between a user and the device is 20 cm.

$$\frac{0.41 \; x \; 5.19 \; x \; 0.44 \; x 10^{-2}}{\pi \; x \; 20 \; x \; 20} = 7.45 \; x \; 10^{-6} \; \frac{W}{cm^2} = 7.45 \; x \; 10^{-3} \; \frac{mW}{cm^2}$$

As shown, a Hiber MES device operates with a maximum power density of 0.00745 mW/cm^2 over the applicable averaging time, and therefore does not exceed the MPE limit of 0.2667 mW/cm^2 averaged over a thirty-minute period.

IV.   Conclusion

As demonstrated in the analysis above, operation of Hiber's MES devices will not result in exposure levels exceeding the applicable radiation hazard limits.