Analysis of AeroCube Non-Interference with 902-928 MHz Band

Technical POC: Andrew Chin
The Aerospace Corporation
Andrew.Chin@aero.org
310-336-5994

Scope

Through analysis, show that the AeroCube space service at 914.7 MHz does not interfere with protected land base station services in the 902-928 MHz band.

Protection Criteria for the IMT Systems

For non-interference, space services require field strength below the following values:

TABLE 1

Field strength to be protected for land mobile service systems

System to be protected	Class of station	Frequency (MHz)	Noise Figure (dB)	Feeder Loss (dB)	Receiving antenna gain (dBi) at 90^0	Field strength to be protected (dBµV/m)			Receiving antenna height (m)
						200 kHz GSM-R	200 kHz GSM	5 MHz LTE	
GSM or LTE system	Receiving base station	880-915	5	3	-1.5* (G_{max}= 15)	16	19	33	30
	Receiving mobile station	925-960	9	0	0 (GSM-R and GSM) -3 (LTE)	15	18	35	1.5

* -1.5 dB of omnidirectional vertical antenna gain at the elevation angle of 90 degree as the worst case is used for calculation. (See *recommends* 2.2 of Recommendation ITU-R F.1336-4).

The minimum field strength allowed is 16 $\mathrm{dB\mu V/m}$. Only interference with the Receiving Base Stations is considered because the Receiving Mobile Stations are outside the frequency band of the AeroCube transmitter.

Analysis

From Recommendation ITU-R P.525-3, the field strength is calculated as

$$e = \frac{\sqrt{30p}}{d}$$

where:

e: r.m.s. field strength (V/m)

p: equivalent isotropically radiated power (EIRP) of the transmitter in the direction of the point in question (W)

d: distance from the transmitter to the point in question (m).

From the AeroCube FCC filing, there are two satellites, both with two radios operating at 914.7 MHz, and both radios have the same ERP. The ERP is 1 W, and converting from ERP, the EIRP, *p*, is 1.64 W. The distance, *d*, is 450 km.

The electric field strength, *e*, can then be calculated as:

$$e = 1.56 \cdot 10^{-5}\ \mathrm{V/m}\ = 11.89\ \mathrm{dB\mu V/m}.$$

Conclusion

For the AeroCube spacecraft parameters, the electric field strength is calculated to be 11.89 dBµV/m at the land mobile service system. This value is below the minimum non-interference requirement of 16 $\mathrm{dB\mu V/m}$ for Receiving Base Stations. Therefore, the AeroCube spacecraft will not interfere with Receiving Base Stations in the 902-928 MHz band or the Receiving Mobile Stations in the 925-960 MHz band.