

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

Anuj Shah, The Aerospace Corporation, anuj.s.shah@aero.org , 310-336-2889

David Hinkley, The Aerospace Corporation, david.a.hinkley@aero.org , 310-336-5211

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 in Table 1:

Table 1 Field Strength to be Protected for Land Mobile Service Systems (from Appendix)

System to be protected	Class of station	Frequency (MHz)	Noise Figure (dB)	Feeder Loss (dB)	Receiving antenna gain (dBi) at 90°	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](#)).

Per table 1, the maximum field strength allowed for the GSM-R receiving base station is 16 dBμV/m. Note that only an interference with the “Receiving Base Stations” is considered because the “Receiving Mobile Stations” are outside the frequency band of the AeroCube transmitter.

Analysis

The AeroCube has one TT&C radio in the 902-928 MHz band. It operates at a fixed frequency of 914.7 MHz. It has an output power of 1.3 W and a maximum antenna gain of -2.5 dBic. The resulting EIRP (Pt) is -1.36 dBW.

From Recommendation ITU-R P.525-4 “Calculation of free-space propagation” equation 7, the field strength at a point at distance d from an isotropic emitter is

$$E = Pt - 20 \log d + 74.8$$

where:

Pt: isotropically transmitted power (dB(W))

E: electric field strength (dB(μV/m))

d: radio path length (km).

Table 2 Computation of AeroCube 914.7 MHz field strength at 525 km minimum range

Parameter	Value	Units	Comment
Pt	-1.36	dBW	AeroCube satellite radio EIRP
20LOGd	54.4	dB	d set to 525 km, per appendix
Factor	74.8	dB	V/M to dBμV/m conversion constant
915MHz min bandwidth	1.1	MHz	AeroCube necessary bandwidth
Victim bandwidth	0.2	MHz	Victim bandwidth for GSM and GSM-R
BW adjust	-7.4	dB	Adjustment to determine the portion of the interfering power that gets into the victim bandwidth
E	11.6	dBμW/m	E = field strength on the surface of the earth
Protection Criterion	16	dBμW/m	Source: Interference Protection Guiden 902-928 MHz
Margin	4.37	dB	

Conclusion

The AeroCube 914.7 MHz TT&C transmitter will not interfere with “Receiving Base Stations” in the 902-928 MHz band because calculated field strength is below the allowable limits in Table 1.

The AeroCube 914.7 MHz TT&C transmitter will not interfere with the “Receiving Mobile Stations” because 914.7 MHz is not within the 925 – 960 MHz band.

APPENDIX