

SECTION 25.138(B) ANALYSIS

In this application, DIRECTV Enterprises, LLC (“DIRECTV”) seeks to license a new Ka-band antenna to support telemetry, tracking and command (“TTAC”) functions for DIRECTV 14.

Section 25.138 (a) provides that an application for a blanket Ka-band earth station license will be routinely processed if it meets the following requirements:

GSO FSS earth station antenna off-axis EIRP spectral density for co-polarized signals shall not exceed the following values, within 3° of the GSO arc, under clear sky conditions:

18.5-25log(theta)-10log(N) dBW/40kHz..... for 2.0° <= theta <= 7°
-2.63-10log(N)..... dBW/40kHz..... for 7° <= theta <= 9.23°
21.5-25log(theta)-10log(N) dBW/40kHz..... for 9.23° <= theta <= 48°
-10.5-10log(N)..... dBW/40kHz..... for 48° <= theta <= 180°

Where:

theta is the angle in degrees from the axis of the main lobe; for systems where more than one earth station is expected to transmit simultaneously in the same bandwidth, *e.g.*, CDMA systems, N is the likely maximum number of simultaneously transmitting co-frequency earth stations in the receive beam of the satellite; N=1 for TDMA and FDMA systems.

This portion of Section 25.138 is clearly intended to ensure that the level of off-axis EIRP from the applicant’s earth station meets an agreed-upon level and thereby does not cause excessive interference to neighboring satellites spaced at 2° increments from the applicant’s satellite. For TDMA and FDMA systems, it can readily be shown that for an antenna that just meets the performance requirements of Section 25.209, an input power density of less than -10.6 dBW/40 kHz into the antenna will result in compliance with Section 25.138(a). For antennas with performance that exceeds the requirements of Section 25.209 (*i.e.*, with better off-axis gain performance), this value of input power density can be increased dB-for-dB relative to the improved off-axis performance.

Section 25.138(b) of the Commission’s rules requires that Ka-band applicants proposing to operate earth stations with off-axis EIRP in excess of the values in Section 25.138(a)(1) certify that operators of all co-frequency GSO FSS space stations within 6 degrees of the proposed satellite point(s) of communication are aware of the applicant’s proposal to operate with the higher power densities and have stated that they have no objection to such operation.

The specific frequencies for the telecommand signals for DIRECTV 14 are indicated in Table 1 below. Also indicated in this table are the emission designators and

the applied-for nominal on-station and maximum emergency transmit power levels. The analysis for these emissions follows.

Designator	Function	Freq (MHz)	EIRP levels (dBW)
800KF2D	CMD	28351, 28353	76 (nominal), 91 (emergency)

Table 1. Ka-band Telecommand Frequencies for DIRECTV 14

Table 2 below presents an analysis of off-axis EIRP density relative to the values called for in Section 25.138(a)(1). Note that the power density per 40 kHz was calculated by subtracting $10 \cdot \log(\text{carrier bandwidth}/40 \text{ kHz})$ dB. Also note that a 6 dB allowance has been included to account for the fact that this antenna is fully expected to have performance that exceeds that specified under Section 25.209 (*i.e.*, better off-axis performance) by this amount. As Table 2 shows, the nominal on-station command carrier may exceed the levels of Section 25.138(a) by 1.1 dB. The 91 dBW maximum power level would only be used in the case of spacecraft emergency, and once recovered from the emergency the command carrier power level would return to the nominal level.

Section 25.138 Analysis	
Nominal On-station Satellite Control Facility EIRP (dBW)	76
Satellite Control Facility (SCF) Tx Gain (dBi)	66.5
Max carrier power into SCF antenna (dBW)	9.5
Carrier Bandwidth (kHz)	800
Max power density into antenna (dBW/40 kHz)	-3.5
Max power density for §25.138 compliance (dBW/40 kHz) ¹	-10.6
Antenna performance relative to 25.209 (dB)	-6
Excess pwr relative to Section 25.138(a)	1.1
1. This max power density is for an antenna just meeting the requirements of Section 25.209.	

Table 2. Clear Sky Link Budget and Section 25.138 Analysis of Telecommand System for Set 3 Emission Designators

DIRECTV has evaluated the potential impact of these Ka-band TTAC emissions on operators of all co-frequency GSO FSS space stations within 6 degrees of the authorized satellite point of communication (*i.e.*, 99.235° W.L.). Hughes Network Systems, LLC (“HNS”) is the only operator with a co-frequency GSO FSS space station within that range of orbital arc. Within six degrees to the east of 99.235° W.L., Jupiter 97W is authorized to operate at 97.1° W.L.¹ Within six degrees to the west of 99° W.L., the only co-frequency Ka-band space stations are those operated by DIRECTV,² and DIRECTV certifies that the applied-for TT&C emissions are compatible with DIRECTV’s current operations. DIRECTV confirms that it has discussed the higher power in this application with HNS and HNS has stated that it has no objection to such operation.

¹ See Grant Stamp, IBFS File No. SAT-LOI-20110809-00148 (granted July 27, 2012). Note that ICO-G is operating at 92.85° W.L., and that SPACEWAY 3 is operating at 95° W.L., however these satellites do not operate co-frequency with the TTAC emissions that are the subject of this application.

² Note that SES operates the AMC-15 satellite at 105° W.L., however the Ka-band payload on this satellite does not operate co-frequency with the TTAC emissions that are the subject of this application.

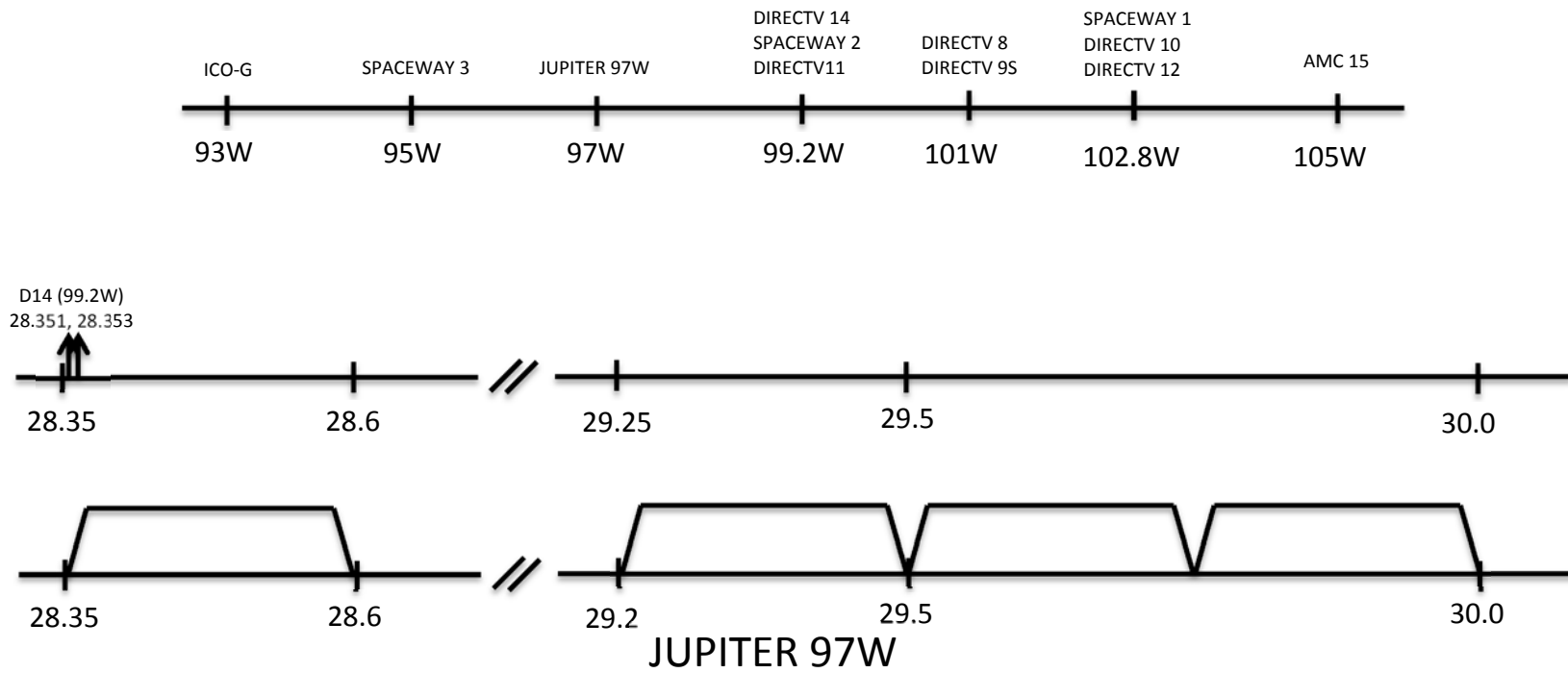


Figure 1. Relation of DIRECTV 14 Telecommand signals to JUPITER 97W Satellite