

**SECTION 25.138(B) ANALYSIS**

In this application, DIRECTV Enterprises, LLC (“DIRECTV”) seeks to add additional telemetry, tracking and command (“TTAC”) and pointing beacon emission designators to an existing Ka-band earth station license. These emissions will be used to support TTAC and backup Radio Frequency Auto Tracking (RFAT) capabilities for the DIRECTV 14 satellite. The technical parameters requested in the application are such that the off-axis EIRP density levels set forth in Section 25.138(a)(1) of the Commission’s rules will not be met. The analysis below addresses these emissions.

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 emissions for DIRECTV 14 are 28351 MHz and 28353 MHz and the nominal on-station and maximum emergency transmit powers of the telecommand signal are 76 dBW and 91 dBW, respectively. After subtracting the main beam antenna gain of 66.4 dBi and scaling for bandwidth, the nominal on-station power density into the antenna for this telecommand carrier  $76 - 66.4 - 10 \cdot \log(800/40) = -13.4/40$  kHz, which is compliant with the 25.138 level. Note that the 91 dBW maximum emergency power level would exceed the Section 25.138 level by 12.2 dB, however this 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.

The specific frequency for the RFAT beacon signal for DIRECTV 14 is 29997 MHz and the peak transmit power of the beacon is 73 dBW. After subtracting the main beam antenna gain of 66.4 dBi, the maximum power into the antenna for this carrier is 6.6 dBW. Note that the transmit antenna for this earth station has performance that is approximately 6 dB better than that specified in Section 25.209, so the maximum allowable input power to the antenna while still complying with Section 25.138(a) is -4.6 dBW/40 kHz. As shown in Table 1 below, this emission will exceed the level of Section 25.138(a) by 11.2 dB. As this higher power density carrier is part of the TTAC system for DIRECTV 14, there is no impact to other communications carriers or baseline services and no resultant shortfall in any other carrier performance margins.

	<b>Beacon</b>
<b>Section 25.138 Analysis</b>	
Max RFAT EIRP (dBW)	73
RFAT Tx Antenna Gain (dBi)	66.4
Max carrier power into TX antenna (dBW)	6.6
Carrier Bandwidth (kHz)	CW
Max power density into antenna (dBW/40 kHz)	6.6
Max power density for §25.138 compliance (dBW/40 kHz) <sup>1</sup>	-10.6
Antenna off-axis performance relative to Section 25.209	-6
Excess pwr relative to Section 25.138(a) (dB)	11.2
1. This max power density is for an antenna just meeting the requirements of Section 25.209.	

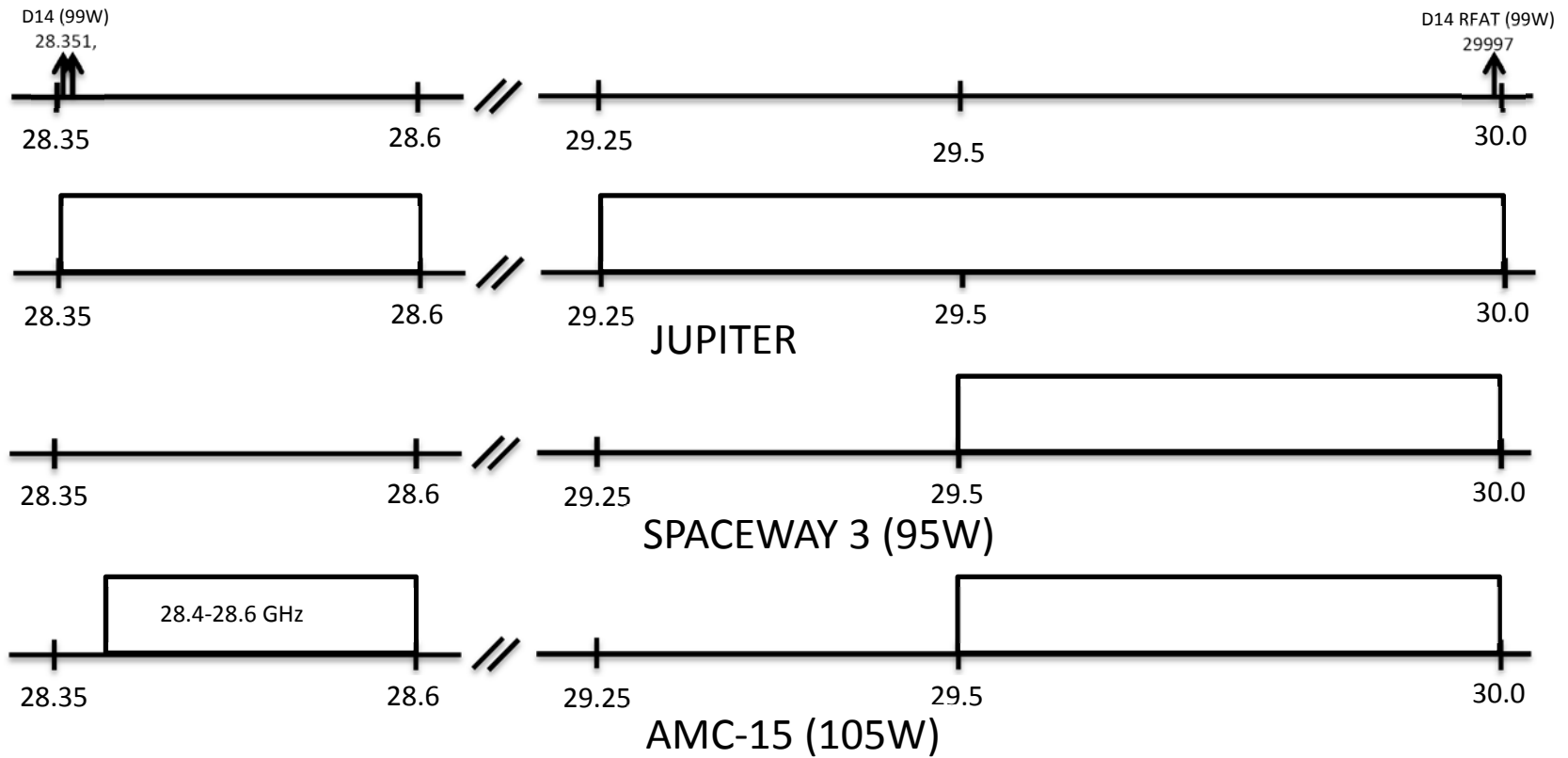
**Table 1. Section 25.138 Analysis of RFAT Beacon For DIRECTV 14**

DIRECTV has analyzed the potential impact of these TTAC and RFAT beacon emissions on other potentially affected GSO FSS networks within 6° of DIRECTV 14's authorized location of 99.235° W.L. Within 6 degrees to the east of 99.235° W.L., SPACEWAY 3 is operating nominally at 95° W.L. and Jupiter 97W is authorized to operate nominally at 97° W.L.<sup>1</sup> Within 6 degrees to the west of 99° W.L., DIRECTV has Ka-band satellites operating at the nominal 101° W.L. and 103° W.L. locations, and SES has AMC-15 operating nominally at 105° W.L. DIRECTV confirms that the proposed

<sup>1</sup> Note that ICO-G is operating at 92.85° W.L., which is more than 6° away from DIRECTV 14's authorized location.

operation of DIRECTV 14 TTAC is compatible with DIRECTV's other Ka-band operations.

As for other potentially affected operators, Figure 1 below was produced as a result of reviewing the current authorizations for each of the potentially affected satellites mentioned in the paragraph above. DIRECTV confirms that it has discussed this issue with both SES and HNS and that both parties have stated that they have no objection to this operation.



**Figure 1. Relation of DIRECTV 14 TTAC and RFAT to other Potentially Affected Satellites**