SECTION 25.138(B) ANALYSIS

In this application, DIRECTV Enterprises, LLC ("DIRECTV") seeks to add an additional Ka-band TT&C antenna to its existing ground infrastructure. The technical parameters requested in the application are such that this antenna could be used to communicate with any of DIRECTV's existing Ka-band satellites. In some cases, due to the power level required for, and the relatively narrowband nature of, TT&C emissions, the off-axis EIRP density levels set forth in Section 25.138(a)(1) of the Commission's rules will not be met. Analyses are included below to address each of these cases

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) submit link budget analyses of the operations proposed, along with a detailed explanation of how each uplink carrier density figure is derived. It further requires applicants to submit a narrative summary indicating whether there are margin shortfalls in any of the current baseline services as a result of the addition of the

applicant's higher power service and, if so, how the applicant intends to resolve those shortfalls. Finally, this section requires that applicants certify that all potentially affected parties (*i.e.*, GSO FSS satellite networks that are within 2, 4, and 6 degrees) acknowledge and do not object to the use of the applicant's higher power densities.

The specific frequencies for the telecommand and beacon signals for DIRECTV's Ka-band satellites are indicated in the table below. Also indicated in this table are the emission designators and the applied-for maximum clear sky and faded transmit power levels. Separate analyses follow below for the various different emission designator cases.

Set	Designator	Function	Freq (MHz)	EIRP levels (dBW)
1	1M30F9D	CMD	29501.302, 29509.1146 29503.9063, 29511.7188	50 (clear sky), 89.5 (max faded)
	25K0N0N	BCN	29527.34, 29532.55 29527.34, 29532.55	50 (clear sky), 75.8 (max faded)
2	1M30F9D	CMD(pri) CMD	29251, 29253, 29255 29493, 29495, 29497	76 (clear sky), 91 (max faded)
	160KF3N	BCN	29251, 29253, 29255	76 (clear sky), 91 (max faded)
3	800KF2D	CMD	28351, 28353	76 (clear sky), 91 (max faded)

Table 1. Ka-band Telecommand and Beacon Frequencies for DIRECTV Satellites

For the first set of emission designators in Table 1, there are two different emission designators to consider, both of which have a maximum clear sky EIRP of 50 dBW. After subtracting the main beam antenna gain of 66.5 dBi, the maximum clear sky power into the antenna for these carrier is -16.5 dBW, which is compliant with Section 25.138 even without scaling for bandwidth. Section 25.138(a)(5) allows the maximum power density into the antenna under faded conditions to be up to 20 dB greater than that for clear sky, or 9.4 dBW/40 kHz. After subtracting the main beam antenna gain of 66.5 dBi and scaling for bandwidth by subtracting 10*log(carrier bandwidth/40 kHz) dB for each carrier type, the maximum power density into the antenna for faded conditions is 7.9 dBW/40 kHz and 9.3 dBW/40 kHz, for the 1.3 MHz and 25 kHz emission designators, respectively. As such, both of these emissions are compliant with Section 25.138 under max faded conditions.

For the second set of emission designators in Table 1, there are primary and secondary telecommand frequencies and there is a pointing beacon that is only transmitted on the primary command frequency. The link budget set forth in Table 2 below details the clear sky transmit power from the earth station that will be communicating with the satellites that use these emission designators, and immediately below that link budget is 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 for each carrier was calculated by subtracting 10*log(carrier bandwidth/40 kHz) dB for each carrier type. Also note that a 6 dB allowance was included due to the fact that the applied-for antenna performance is fully expected to have off-axis gain performance at least 6 dB better than

the requirements of Section 25.209. As these higher power density carriers are part of the TT&C system for these satellites, there is no impact to other communications carriers or baseline services and no resultant shortfall in any other carrier performance margins.

	Command	**Beacon**
Satellite Control Facility TX EIRP (dBW)	76	76
Free Space Loss (dB)	213.31	213.31
Gaseous Atten (dB)	0.37	0.37
Rcvd Isotropic Power (RIP) @ Spacecraft (dBW)	-137.68	-137.68
Required RIP (dBW)	-148.85	-147.85
Margin (dB)	11.17	10.17
Section 25.138 Analysis		
Max Satellite Control Facility EIRP (dBW)	76	76
Satellite Control Facility (SCF) Tx Gain (dBi)	66.5	66.5
Max carrier power into SCF antenna (dBW)	9.5	9.5
Carrier Bandwidth (kHz)	1300	160
Max power density into antenna (dBW/40 kHz)	-5.6	3.5
Max power density for §25.138 compliance (dBW/40 kHz)[1]	-10.6	-10.6
Antenna off-axis performance relative to Section 25.209	-6	-6
Excess pwr relative to Section 25.138(a)	-1	8.1

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 and Beacon System For Set 2 Emission Designators

From these results it can be seen that the clear sky command carrier is compliant with Section 25.138(a), but that the pointing beacon exceeds allowable levels by 8.1 dB. Faded results would be the same as the transmit power would increase dB-for-dB with the amount of fade and the maximum faded EIRP is only 15 dB greater than the maximum clear sky EIRP and less than the 20 dB allowable under Section 25.138(a)(5).

For the third set of emission designators in Table 1, a very similar analysis was performed. The link budget set forth in Table 3 below details the clear sky transmit power from the earth station that will be communicating with the satellites that use this emission designator, and immediately below that link budget is 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 for each carrier was calculated by subtracting 10*log(carrier bandwidth/40 kHz) dB for each carrier type and that a 6 dB allowance was included due to the fact that the applied-for antenna performance is fully expected to have off-axis gain performance at least 6 dB better than the requirements of Section 25.209. As these higher power density carriers are part of the TT&C system for these three satellites, there is no impact to other communications carriers or baseline services and no resultant shortfall in any other carrier performance margins. As Table 3 shows, the clear sky command carrier exceeds the levels of Section 25.138(a) by 1.1 dB.

	Command
Satellite Control Facility TX EIRP (dBW)	76
Free Space Loss (dB)	213.31
Gaseous Atten (dB)	0.37
Rcvd Isotropic Power (RIP) @ Spacecraft (dBW)	-137.68
Required RIP (dBW)	-151.2
Margin (dB)	13.52
Section 25.138 Analysis	
Max 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 off-axis performance relative to Section 25.209	-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 3. Clear Sky Link Budget and Section 25.138 Analysis of Telecommand System for Set 3 Emission Designators

DIRECTV has analyzed the potential impact of these Ka-band TT&C emissions on other potentially affected GSO FSS networks within 6° of DIRECTV's Ka-band satellites. Within 6° to the east of 99° W.L., SPACEWAY 3 is operating nominally at 95° W.L. and Jupiter 97W is authorized to operate nominally at 97° W.L.[1] Within 6° to the west of 103° W.L., AMC-15 is operating nominally at 105° W.L. and Echo 17 is operating nominally at 107° W.L. No entity is currently authorized to operate Ka-band at the nominal 109° W.L. location.

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. As can be seen, there is no frequency overlap of DIRECTV's Ka-band TT&C with either SPACEWAY 3 at the nominal 95° W.L. location or AMC-15 at the nominal 105° W.L. location, and these satellites therefore cannot be affected. The only remaining satellites are Jupiter 97W and Echo 17, both of which are operated by EchoStar. DIRECTV confirms that it has discussed this issue with EchoStar and that EchoStar has not objected to these higher power telecommand and pointing beacon operations.

[1] Note that ICO-G is operating at 92.85° W.L., which is more than 6° away from DIRECTV's Ka-band satellites at the nominal 99° W.L. location.

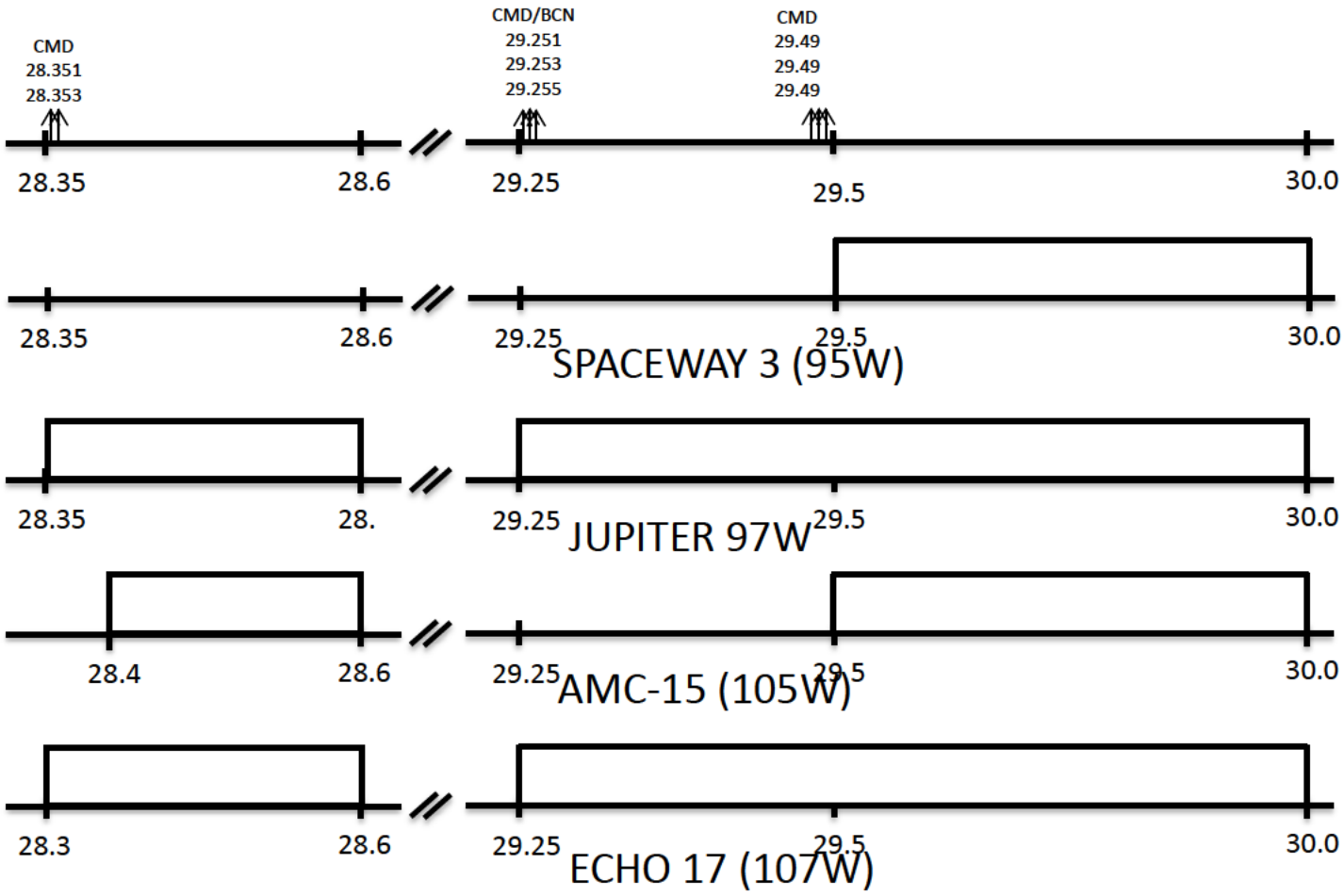

Figure 1. Relation of DIRECTV TT&C signals to Potentially Affected Satellites