

Co-Polarization Gain and Cross Polarization Gain of the CRATE1 Antenna

Co-polarization gain

§25.209(a)(1) of the Commission's rules gives maximum levels of off-axis gain for FSS earth stations for off-axis angles of 1° to 180°. For ease of analysis, the Norst SecureLink antenna ("CRATE1") off-axis gain is considered in three different off-axis angle ranges;

2.5°	to	35°
35°	to	180°
1°	to	2.5°

The antenna patterns for the CRATE1 antenna are given in Figures 1 and 2. These figures show the antenna radiation measurement for vertical and horizontal polarizations for +/- 180 degrees. Each figure includes a graph of the following function:

$29 - 25\log(\theta)$ dBi	$2.5^\circ < \theta \leq 35^\circ$
-10	$35^\circ < \theta \leq 130^\circ$
5	$130^\circ < \theta \leq 180^\circ$

From 2.5° to 35°, the mask shown in the figure is more restrictive or equal to the mask given in §25.209(a)(1). Over this range, the CRATE1 antenna patterns are below the curve at all points, and so the §25.209(a)(1) criteria is met over this range.

From 35° to 180°, the figures show a mask of -10 dBi (-52 db relative to Gmax), a level corresponding to the dark horizontal line in Figures 1 and 2. This too, is more restrictive or equal to the criteria of §25.209(a)(1). As seen in the figures, the CRATE1 antenna exceeds this level by about 10 dB at off-axis angles of about 170°.

Figure 3 shows the antenna gain in dBi over the range +/- 3°, along with the §25.209(a)(1) gain mask. Over the range shown in Figure 3, the maximum amount by which the CRATE1 antenna gain exceeds the §25.209(a)(1) criteria is 7.3 dB.

As shown in Figures 1, 2, and 3, the maximum amount by which the CRATE1 antenna exceeds the §25.209(a)(1) criteria is 10 dB. To maintain compatibility, Boeing will reduce its maximum power density below the -14 dBW/4kHz of §25.134(b) by 15.6 dB, for a power density level of -29.6 dBW/4kHz. This will meet the equivalent VSAT criteria e.i.r.p. mask with a margin of 5.6 dB.

Cross-polarization gain

§25.209(b) contains cross-polarization gain requirements for earth station antennas. Figure 4 shows the cross-polarization antenna gain for the CRATE1 antenna along with the antenna mask of §25.209(b). The test data displayed is limited by the dynamic range of the measurements performed. The lowest level of test data was 40 dB below mainbeam, which is shown as a gain of 2.5 dBi in Figure 4. Although it is likely that the gain of the CRATE1 antenna is less than the limits of §25.209(b), the figure shows that the cross-polarization antenna gain may exceed the limits by 4.5 dB. However, as stated above, Boeing will reduce its maximum power density below the -14 dBW/4kHz of §25.134(b) by 15.6 dB. With this power reduction, CRATE1 will meet the §25.209(b) mask with a margin of 11.1 dB.

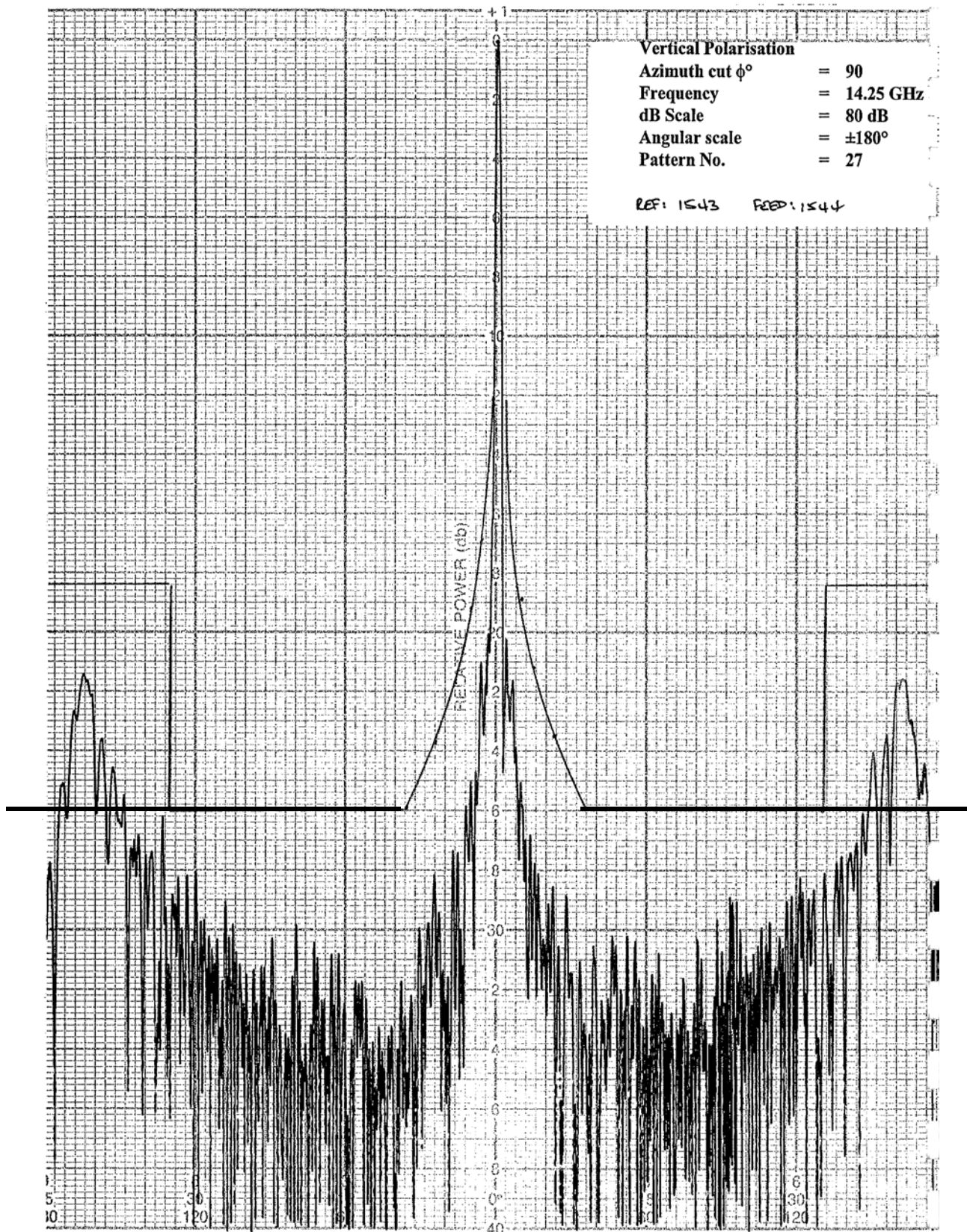


Figure 1. CRATE1 antenna gain, ± 180 degrees, vertical polarization

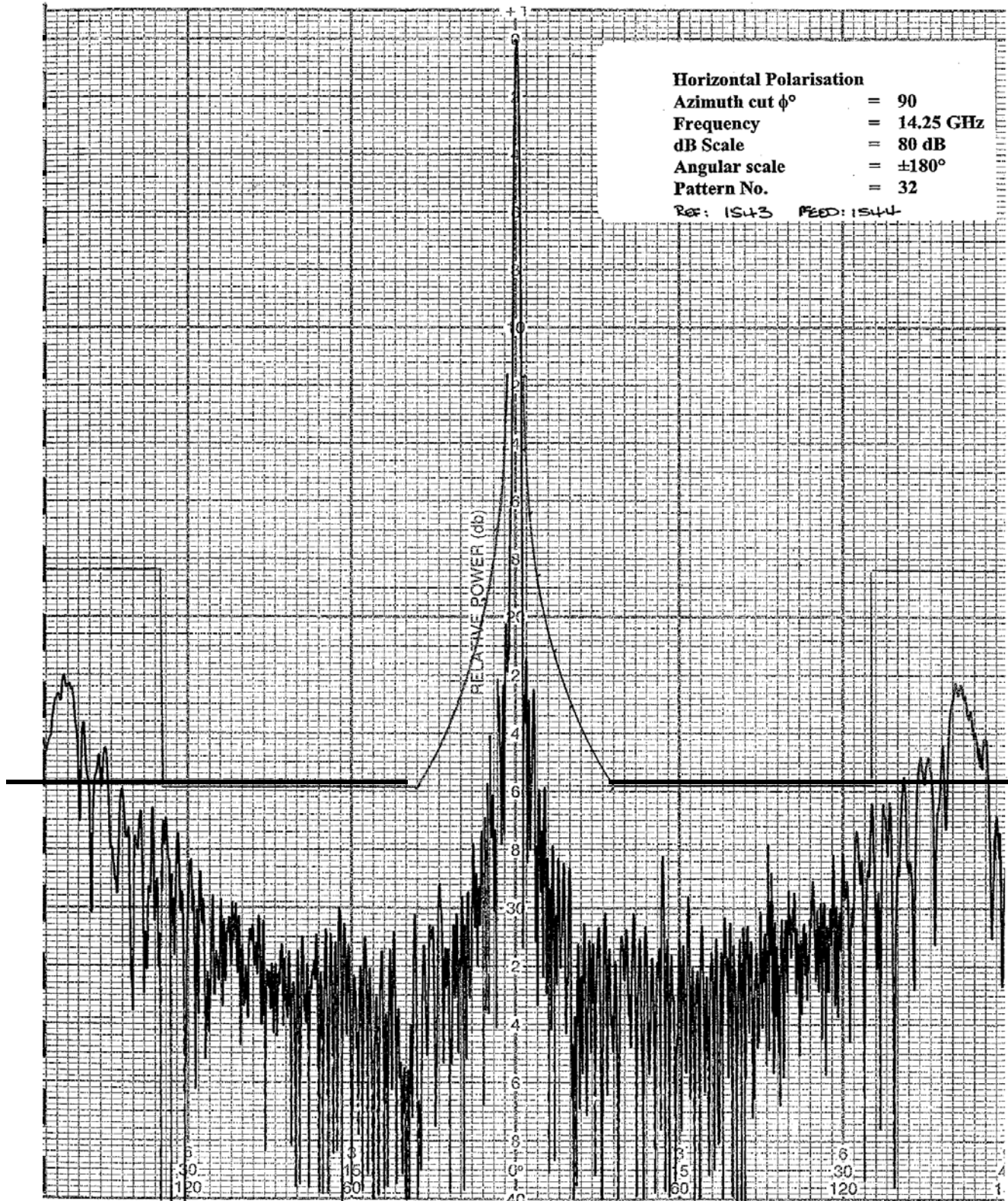


Figure 2. CRATE1 antenna gain, +/- 180 degrees, horizontal polarization

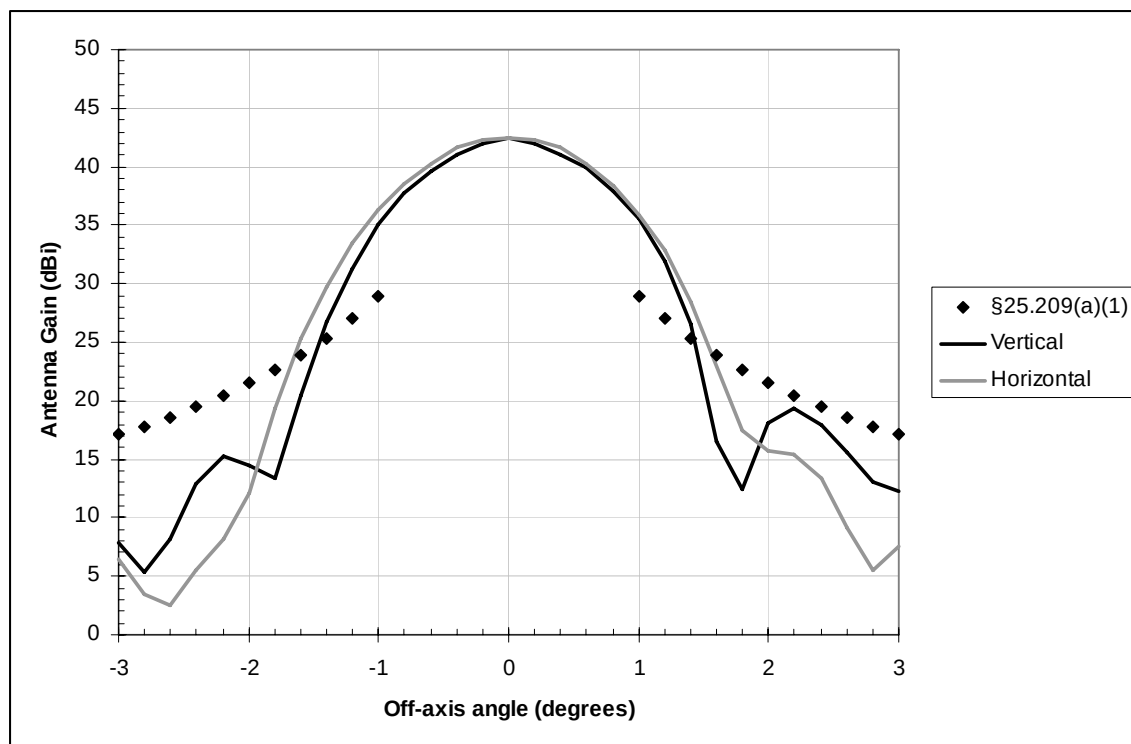


Figure 3. Antenna gain over the off-axis range +/- 3°

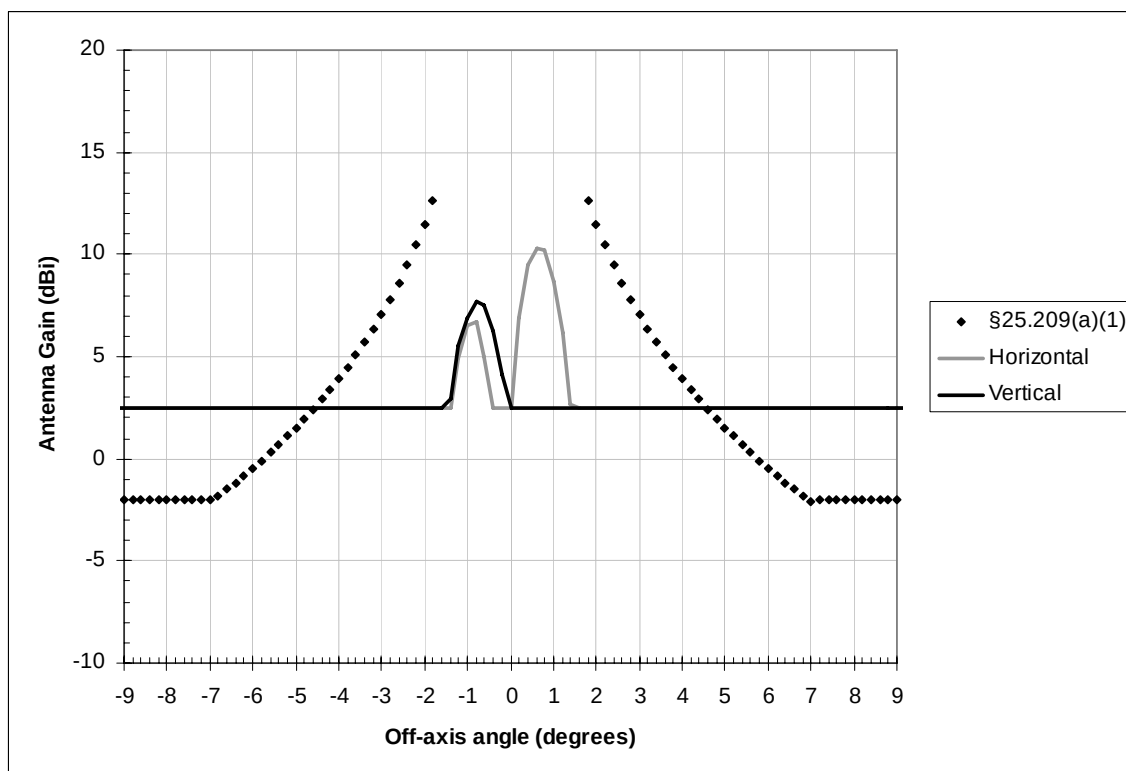


Figure 4. Cross-polarization antenna gain