The Boeing Company
Application for Experimental Special Temporary Authorization

Technical Data on the L3-Datron FSS 4180 Antenna

This appendix provides technical data on the L3-Datron[1] FSS 4180 antenna, which Boeing proposes to operate on an experimental basis while mounted on a M1130 CV Stryker Command vehicle owned by the Army's 3rd Stryker Battalion.

Antenna Description

The L3-Datron FSS 4180 antenna is a center-fed reflector with 46 cm aperture as shown in Figure 1, which will be mounted on top of the vehicle under a radome. The unit features a three-axis design geometry for pointing and includes a fourth axis to actively track the linear polarization angle. The RF Electronics Unit ("RFEU") is mounted immediately underneath the antenna to minimize to RF losses in transmit. The RFEU contains a 25 watt power amplifier, as well as an IF to Ku upconverter (950-1450 MHz upconverted to 14-14.5 GHz). The downconverter will depend on the frequency band in use, and will downconvert from Ku-band to L-band. Both the upconverter and downconverter are locked to a 10 MHz reference source and are Phase Lock Loop ("PLL") based. The characteristics of the antenna are summarized in Table 1.

Figure 1 L3-Datron FSS 4180 antenna

[1] Formerly Titan-Datron, formerly Datron.

Table 1. Antenna Characteristics

Aperture Dimensions	46.0 cm circular
Antenna Beamwidth	3.2º
Transmit Band	14.0 GHz to 14.5 GHz
Receive Band	11.7 GHz to 12.2 GHz*
Transmit Gain	35.6 dBi @ 14.5 GHz
Receive Gain	33 dBi @ 10.95 GHz
EIRP	45.5 dBW
ERP	21.9 kW
Maximum PSD	10.2 dBW/4kHz
G/T	>13 dB/K
Antenna Polarization	Linear – Orthogonal

*The antenna is capable of receiving throughout the 10.7 GHz to 12.75 GHz band.

Antenna Pointing

For precise pointing angles a dedicated Smiths Inertial Reference Unit ("IRU") is used to give vehicle position and attitude data. The rms pointing error of the L3-Datron FSS 4180 antenna is 0.2 degrees. The tracking performance of the L3-Datron FSS 4180 antenna is summarized in Table 2.

Table 2. Antenna Tracking Characteristics

Measured Acceleration	
Az	600º/sec^2
X-Level	1000º/sec^2
El	1500º/sec^2
Cross-Poll	6000º/sec^2
Measured Velocity	
Az	1000º/sec
X-Level	1000º/sec
El	1000º/sec
Cross-Poll	1000º/sec

Given the tracking acceleration and velocity characteristics of the L3-Datron FSS 4180 antenna, it will be capable of maintaining accurate pointing within 0.2 degrees rms of the target satellite considering the expected motion of the antenna on the M1130 CV Stryker Command vehicle.

Transmit Antenna Pattern

The transmit antenna pattern of the L3-Datron FSS 4180 antenna is provided in Figure 2.

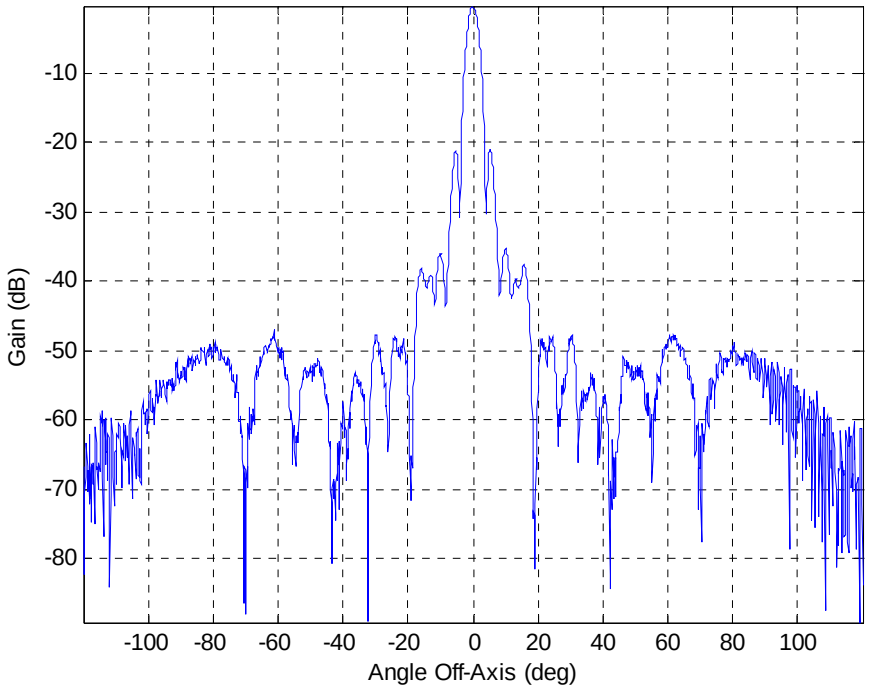

Figure 2. 14.50 GHz Transmit Pattern

Off-Axis EIRP

Boeing seeks to operate theL3-Datron FSS 4180 antenna at an EIRP of 45.5 dBW. As shown in Figure 3, this will result in an off-axis EIRP substantially below that of routinely licensed Ku-band VSATs even for the minimum operating bandwidth of 13.5 MHz. Multiple FSS 4180 antennas can be accommodated with in the VSAT limits by managing the aggregate EIRP of the terminals.

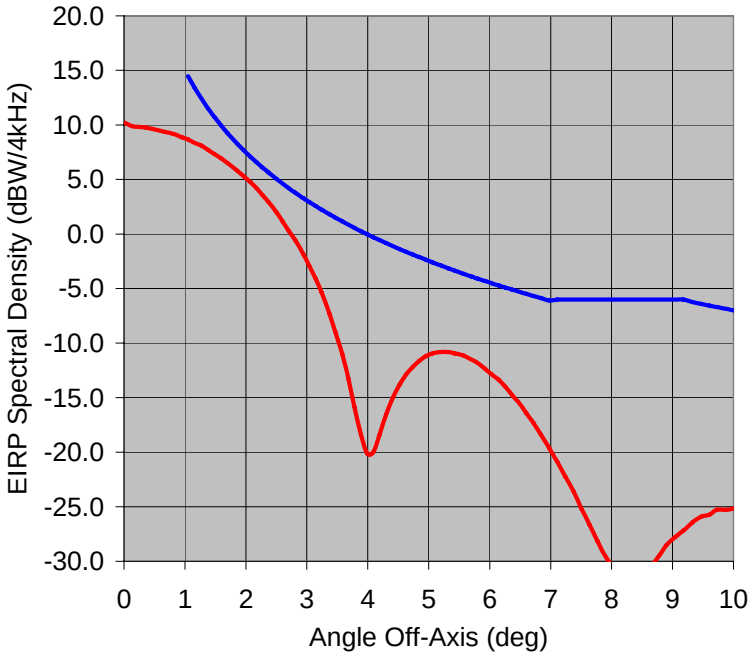

Figure 3. Predicted L3-Datron FSS 4180 Antenna EIRP Spectral Density

Waveform Definition

In the context of the proposed experimental operations using Stryker Vehicles equipped with L3-Datron FSS 4180 antennas, Boeing will use identical waveforms to the licensed and well-proven Connexion by Boeing℠ AMSS system. Both the forward and return link waveforms use Direct Sequence Spread Spectrum ("DSSS") modulation to reduce the waveform EIRP spectral density. Signals will be spread to 90% of the fraction of the transponder that is used. The waveform characteristics for both the forward and return links are nearly identical and are shown in Table 3.

Table 3. Waveform Characteristics

Typical 3 dB Bandwidth	13.5 MHz to 32.4 MHz
Typical ITU Emission Designations	13M5G7W, 32M4G7W
Modulation	DSSS / Offset-QPSK
Multiplex Carrier Access Scheme	Forward link: Single carrier with packet multiplexing Return link: Code Division Multiple Access (CDMA)
Filtering	Square Root Raised Cosine (SRRC), $\alpha = 0.35$