The Boeing Company
Application for Special Temporary Authority

Technical Data on Seatel .6m Antenna

This appendix provides technical data on the Seatel 0.6m antenna, which Boeing proposes to operate on an experimental basis while mounted on customized S710 aluminum rigid-foam shelter mounted on Boeing-owned HMMWV Mobile Wideband Testbed vehicles.

The Seatel 2403 antenna is a 0.6m diameter axially symmetric reflector with a dual-polarized dual-band backfire feed. The antenna is mounted on a 3-axis gimbal to maintain accurate pointing to the satellite, and adjust the plane of polarization for both forward (receive) and return (transmit) links by mechanical rotation of the feed assembly. The antenna is enclosed in a radome designed for low loss in both the transmit and receive bands.

Figure 1. Seatel 0.6 m antenna

Antenna Patterns and Charateristics

The plots provided in Figures 2 and 3 present the measured principal E- and H-plane patterns at mid-band frequencies in the transmit and receive bands (14.2 GHz and 12.0 GHz respectively). Table 1 provides antenna characteristics for the Seatel .6m antenna.

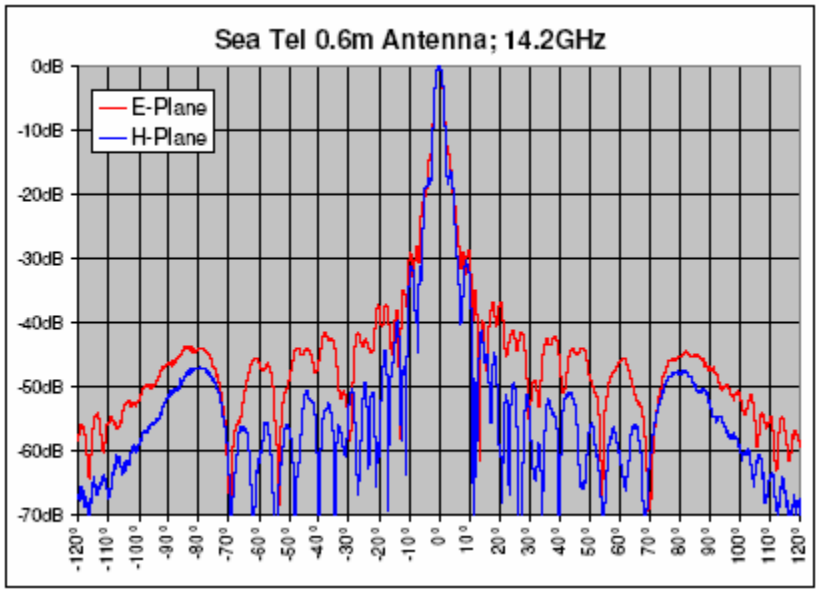

Figure 2. Measured transmit band patterns

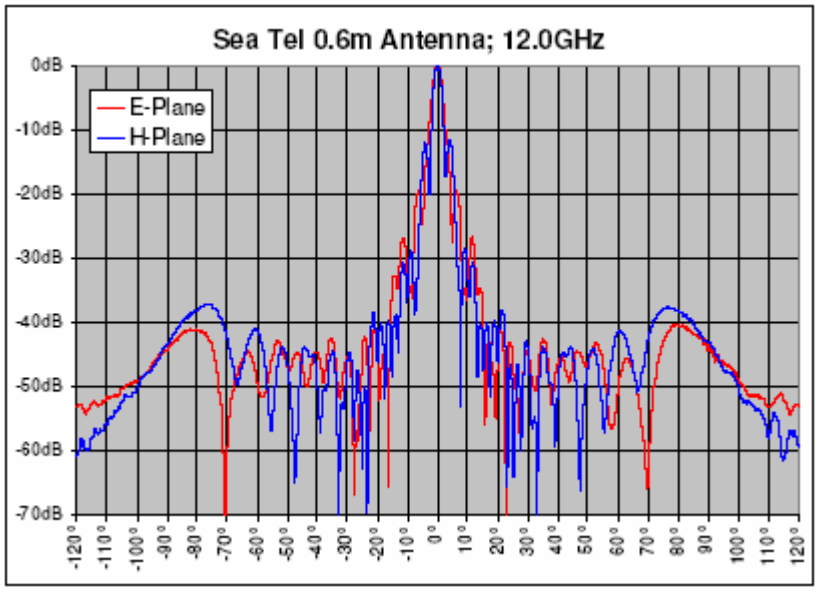

Figure 3. Measured receive band patterns

Antenna parameters	Specifications
Aperture Dimensions	60 cm circular
Antenna Beam-width (3 dB)	2.4º
Transmit Band	14.0 GHz to 14.5 GHz
Receive Band	11.2 GHz to 12.75 GHz
Transmit Gain	37.1 dBi
Receive Gain	35.5 dBi
Maximum EIRP	45.0 dBW
Peak ERP	19.5 kW
Maximum G/T	12.4 dB/K
Antenna Polarization	Tx: Single Variable Linear Rx: Dual Orthogonal Linear

Table 1. Seatel 0.6 m antenna characteristics

0.6 m Antenna Pointing Control

"DishScan" is used to spatially track the satellite signal. DishScan moves the antenna beam in a circular path around the line-of-sight to the satellite, with a typical angular displacement of 0.08°. Received signal strength is monitored during this movement which allows the antenna to be positioned to equalize the signal received on all four quadrants of the antenna. In this way, satellite tracking is maintained within accepted industry standards. Polarization tracking is accomplished "open loop," based on knowledge of the satellite and ship locations and the polarization of the satellite transponder. The antenna plane of polarization is adjusted by mechanical rotation of the feed assembly within the reflector.

The antenna scan range is 0-90° in elevation and 360° (continuous) in azimuth. A blanking sector will be defined based on illumination of the ship's mast and other superstructure parts (if any), and the antenna subsystem will be inhibited from transmitting when pointing within this sector. Stabilization rates exceed 90 degrees per second for the elevation and cross-level axes. Azimuth stabilization exceeds 12 degrees per second with unlimited azimuth capability.

Off-Axis e.i.r.p

Boeing seeks to operate the Seatel .6m antenna at the same power level previously authorized by the Commission – 19.5 kW (45 dBW) – which result in an off-axis e.i.r.p. substantially below that of routinely licensed Ku-band VSATs. Figure 4 shows the e.i.r.p. spectral density of a single Seatel 0.6m antenna relatively to the permissible off-axis e.i.r.p. of a routinely licensed Ku-band VSAT antenna.

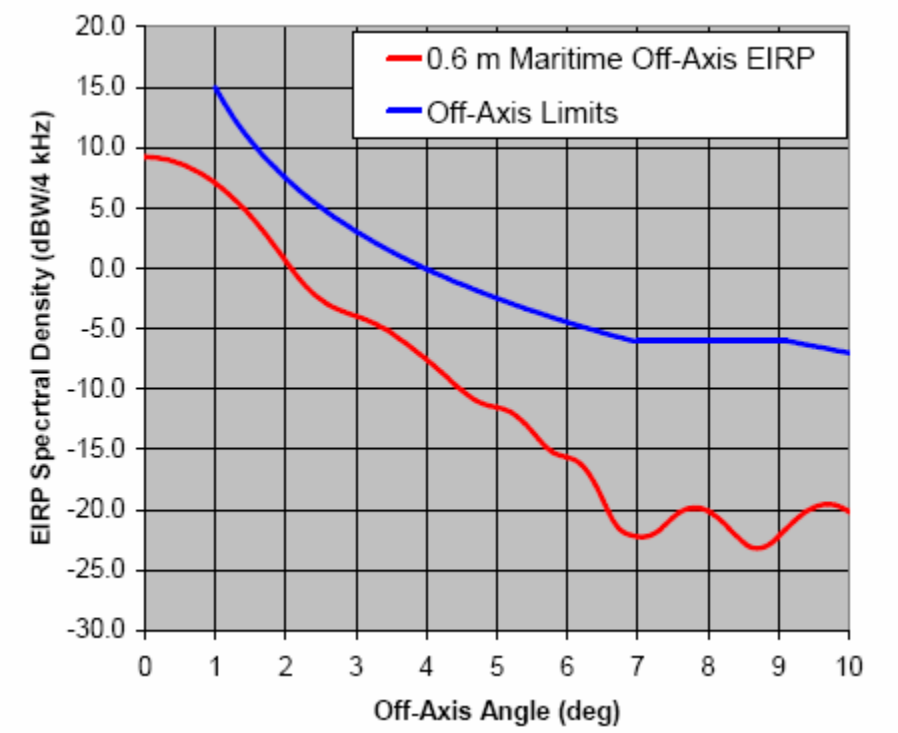

Figure 4. Predicted CBBM 0.6 m antenna e.i.r.p. spectral density

Waveform Definition

In the context of the proposed experimental operations using HMMWVs equipped with Seatel .6m antennas, Boeing will use identical waveforms to the licensed and well-proven Connexion by Boeing^{SM} AMSS system. Both the forward and return link waveforms use Direct Sequence Spread Spectrum ("DSSS") modulation to reduce the waveform e.i.r.p 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 2.

Typical 3 dB Bandwidth	up to 32.4 MHz
Typical ITU Emission Designation	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), $\alpha = 0.35$

Table 2. Waveform Characteristics