Thales InFlyt Experience
Experimentation Description for an Airborne Earth Station
Modular Connectivity Terminal (MCT)

Thales InFlyt Experience, a subsidiary of Thales USA, Inc. seeks an experimental license to operate a fixed antenna modular connectivity terminal that is part of an Airborne Earth Station with the SES-1, SES-4, SES-6 and AMC-9 satellites. The satellites have been authorized to serve and provide coverage to North America (SES-1, SES-4, AMC-9), South America (SES-4, SES-6), Africa (SES-4), Europe (SES-4), Caribbean (SES-6)and Middle Eastern (SES-4) regions. The terminal will operate in the Ku band range of 13.75-14.50 GHz (transmit) and 10.70-12.75 GHz (receive) on SES-1 at the 101º W, SES-4 at 22º W, SES-6 at 40.5º W and AMC-9 at 83º W orbital positions.
This proposed modular connectivity terminal will be functionally similar to the Thales Ka band terminals already authorized to communicate with Inmarsat-5 F2. ISAT-US currently holds a blanket license authorization under call sign E140114 (SES-LIC-20141030-00832) to operate up-to 8,000 terminals in the 19.7-20.2 GHz, and 29.5-30.0 GHz bands using the Inmarsat-5 F2 satellite.

The Thales modular connectivity terminal proposed in this application will operate on the above mentioned Ku band frequencies when communicating with the SES-1, SES-4, SES-6 and AMC-9 satellites. As such, Thales USA would like to requests the Commission to grant the experimental license for this Airborne Earth Station Connectivity Terminal to be operated and tested infrequently from 8AM to 6PM EST in close coordination with SES, on the roof top of Thales building located at 700 S. Babcock Street, Melbourne, Florida 32901.

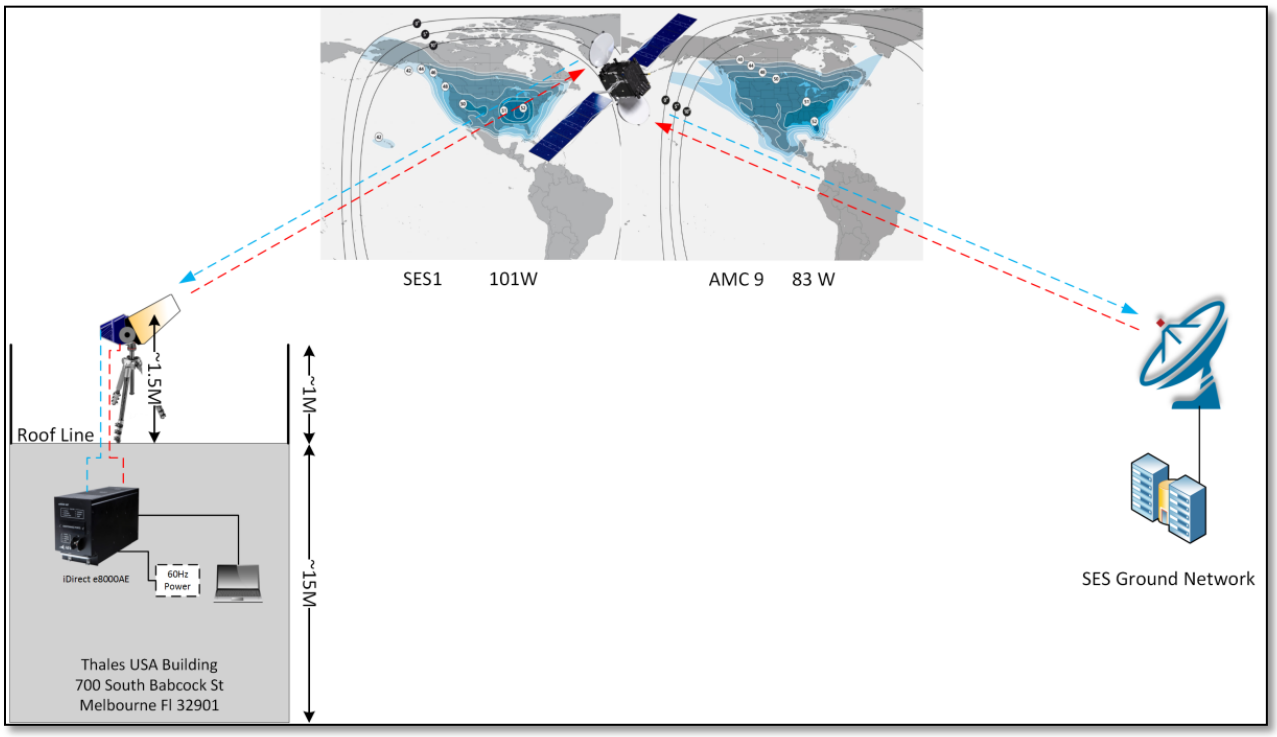
AES System Description

The Airborne Earth Station Modular Connectivity Terminal (MCT) consists of:

- One Thales Modular Dorsal Antenna-Ku Band (MDA-U), Part # LV10-150702-101
- One Thales Antenna System Interface (ASI), Part # LV10-150701-101
- One iDirect Modular Modem Unit (MMU), Part # E0002006-001

Figure 1 below, shows the exemplar configuration of the Airborne Earth Station Modular Connectivity Terminal system on top of Thales Building with the end-to-end system operations.

Figure 1 Airborne Earth Station Modular Connectivity Terminal system on top of Thales Building



Thales will be using the modular connectivity terminal system in a stationary configuration on the roof top to experiment the two way communications with SES-1 (North America beam), SES-4 (North America and South America beams), SES-6 (North America and Brazil beams) and AMC-9 (North America beam) satellites. The MCT antenna will use satellite pointing software to precisely point to the intended satellite before establishing two way communication link. The Ku band MCT antenna will receive the satellite downlink signals in the frequency range of 10.7 GHz to 12.75 GHz, and transmit with a maximum EIRP of 46 dBW in the Ku frequency band ranging from 13.75 GHz to 14.5 GHz. The MCT will be able to use various modulation and coding formats as per DVB-S2 and the transmission power spectral density will be compliant as per FCC 47 CFR 25.227 and ETSI EN 302 186.

Modular Dorsal Antenna –Ku Band (MDA-U), Part # LV10-150702-101

The MDA-U is a Ku-band aeronautical subsystem that generates and steers an antenna beam, and transmits and receives in a full duplex fashion RF signals over that beam, to and from a geosynchronous equatorial orbit (GEO) satellite.

When coupled to a modem via ASI, the MDA-U becomes an integral part of an airborne satellite connectivity terminal.

The MDA-U consists of an antenna aperture, RF Up/Down converter subsystems, an antenna positioning subsystem, and an antenna control subsystem.

The MDA-U includes antenna aperture panel consisting of a micro-horn array that supports two orthogonal linear polarizations.

The up/down converter is used for frequency conversions and RF signal amplification. The Block Up-converter converts IF frequencies (950 MHz – 1950 MHz) from the MMU to Ku-band RF frequencies (13.75 GHz to 14.5

GHz) and amplifies the RF signal to be transmitted to the satellite. The Block Down-converter converts the receive Ku-band frequencies (10.7 GHz to 12.75 GHz) to IF (950 MHz – 2150 MHz) signal to feed the MMU IF receive input.
The antenna positioning and antenna control subsystems provide mechanical beam steering in azimuth and elevation using satellite pointing software.

Antenna System Interface (ASI), Part # LV10-150701-101
Antenna System Interface converts 115 VAC aircraft power to +28 VDC power for the MDA-U. ASI enables communication between the Modular Modem Unit (MMU) and the Modular Dorsal Antenna (MDA-U).

Modular Modem Unit (MMU), Part # E0002006-001
The Modular Modem Unit (MMU) provides data communications between system elements on board the aircraft and Ku-band Satellite providers. In the Forward link direction (ground to aircraft), the MMU demodulates and decodes data. Then the data is reassembled and decrypted into IP packets and sent to the Ethernet LAN port which is typically connected to the on-board Inflight Entertainment system.
In the Return link direction (aircraft to ground), user data from the LAN is first encrypted, segmented, and encapsulated by software and proprietary firmware. Then, the data is encoded, modulated and transmitted to the ground network via satellite.
The MMU subsystem is an aircraft grade modem that provides the MDA-U a transmit IF signal which is up-converted to RF frequencies and transmitted from the antenna. The MDA-U provides the MMU the IF signal which is a down-converted version of the satellite RF signal collected by the antenna.

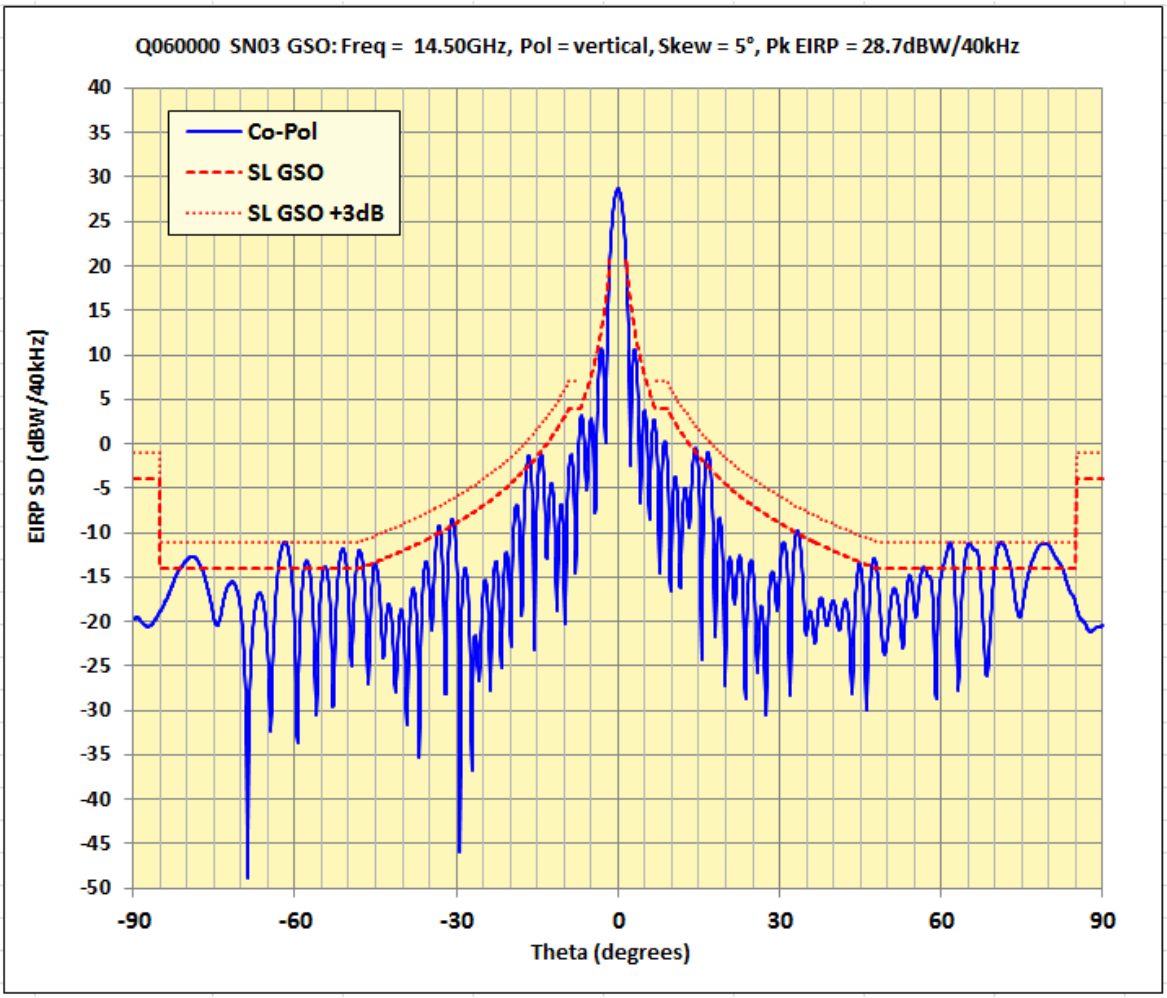
MCT Antenna Performance
The Thales Modular Connectivity Terminal antenna is a two-axis (azimuth & elevation) motorized antenna with the rectangular micro horn array aperture dimensions of 62.4 cm (Width) and 16.2 cm (Height). Due to its low profile, rectangular shape, the antenna presents an asymmetrical directional beam with the following beam-width patterns:

3dB Beam-width in AZ = 2° - 3° (depending on skew angle)
3 dB Beam-width in EL = 5° - 6° (depending on skew angle)

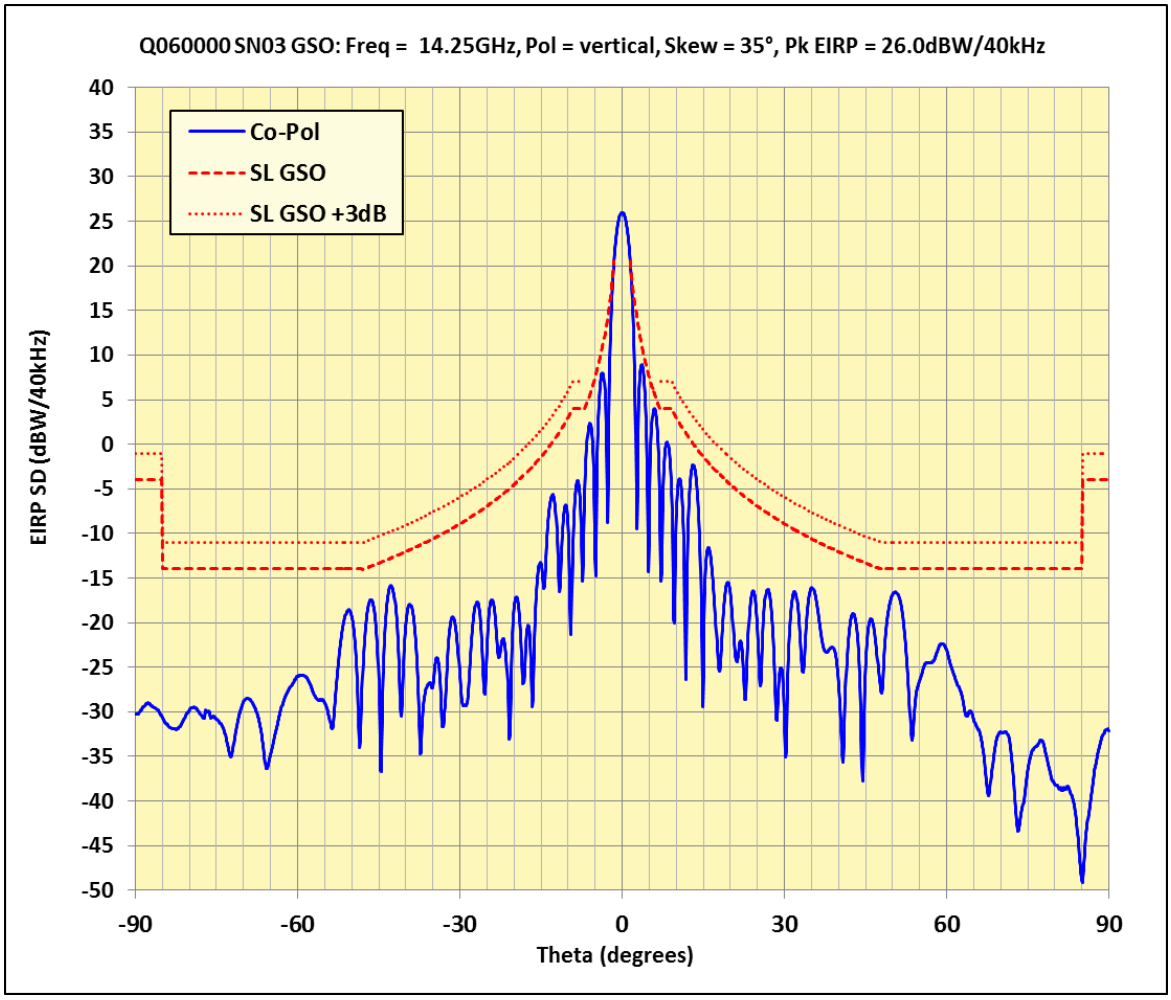
The antenna performance is fully compliant with the requirements in 47 CFR Section 25.138(a), as illustrated by the Max EIRP SD and off-axis EIRP Spectral Density plots attached hereto as Exhibit A.

The test location coordinates are: 28.1°N, 80.62°W and the corresponding skew angle to AMC-9 is -4.4°. Below, shown measured data is for a skew angle of 5°.

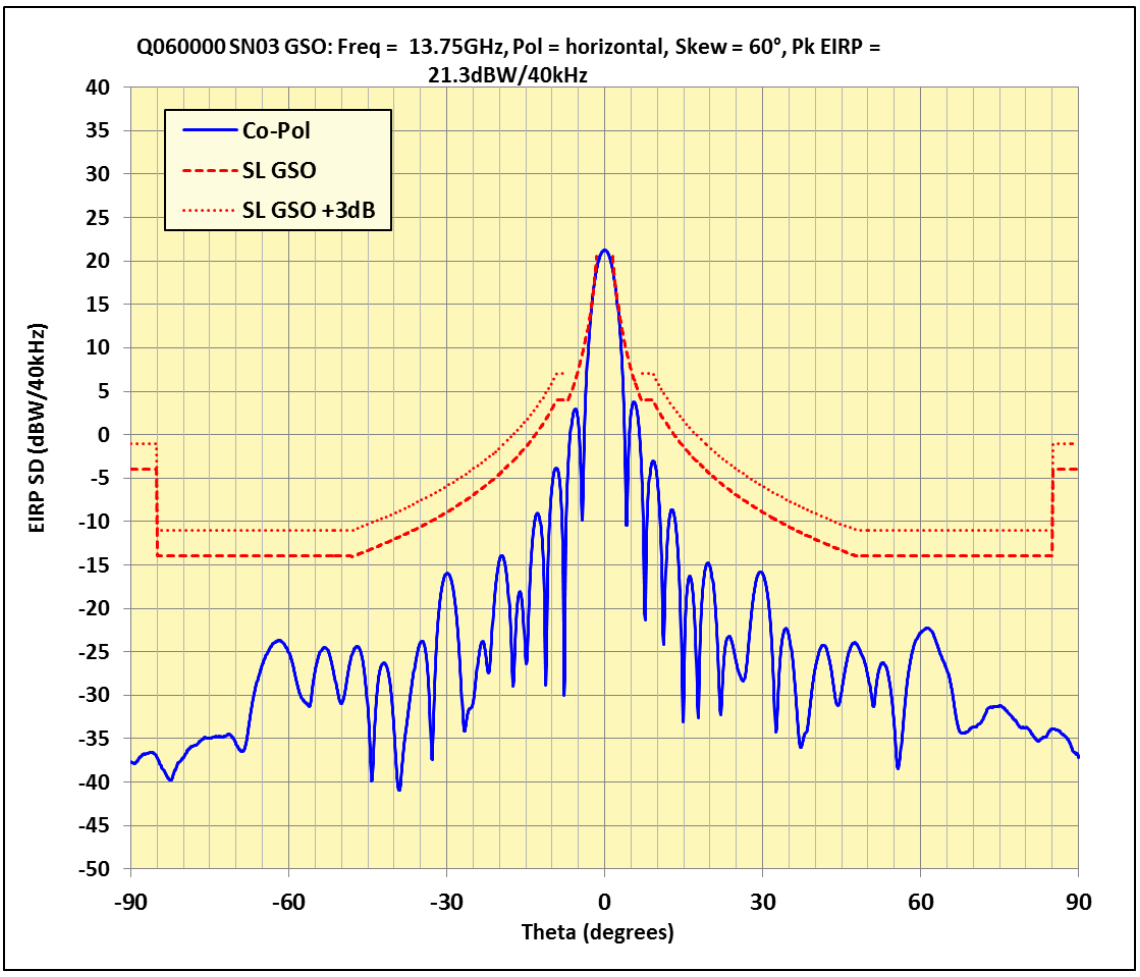
AMC-9 @ 83°W – Max EIRP SD for Skew angle = 5°



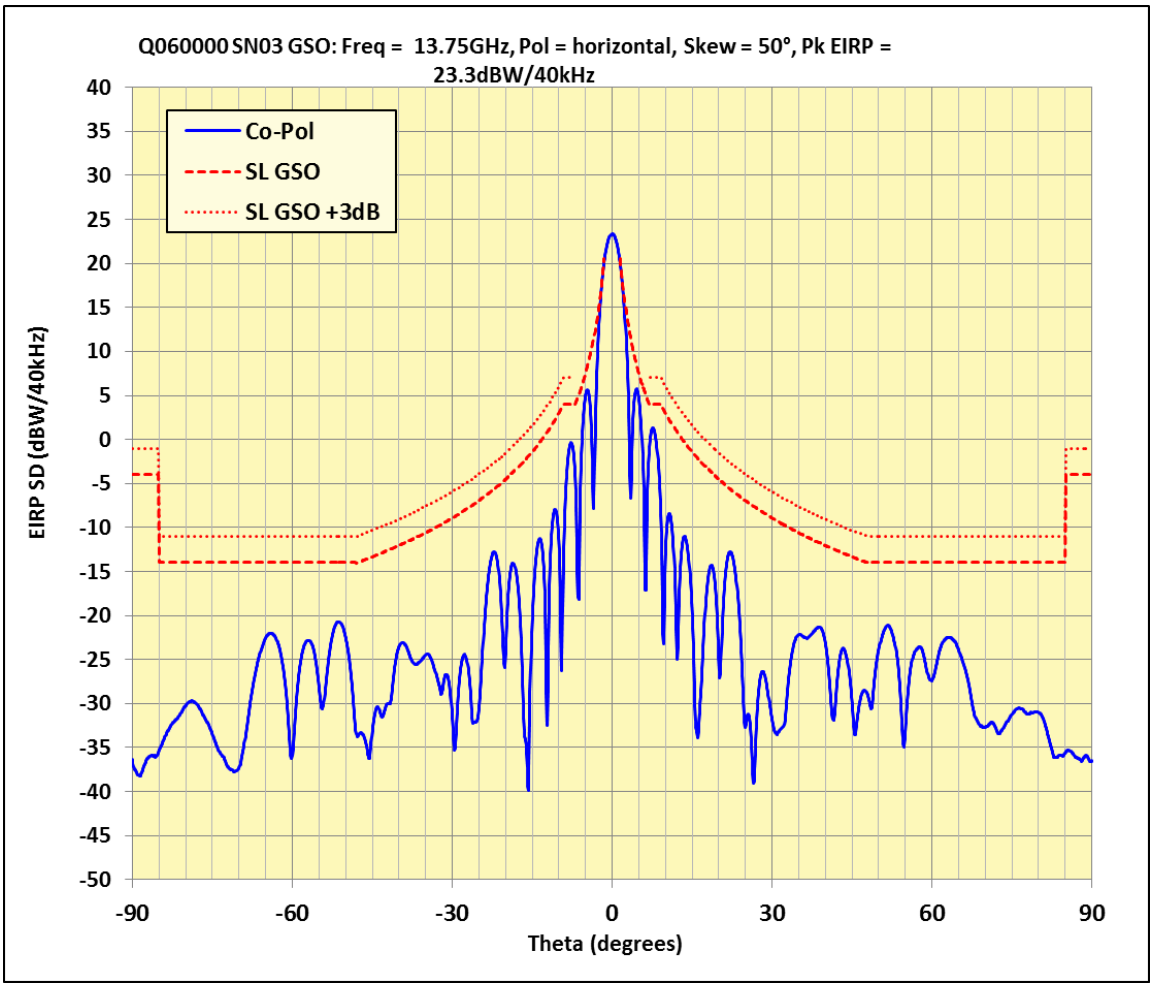
SES-1 @ 101°W - EIRP SD for Skew angle = 35°



SES-4 @ 22°W EIRP SD for Skew angle = 60°



SES-6 @ 40.5°W EIRP SD for Skew angle = 50°



Antenna Max EIRP SD performance for SES-1, SES-4, SES-6 and AMC-9 satellites:

Maximum EIRP SD vs. Skew Angles