

Hop Devil Support Loopback Bandwidth Request

To: Michael K. Glasby
Sr. Director, Global Network Solutions
Intelsat General Corporation
6550 Rock Spring Drive
Bethesda, MD 20817 USA
Telephone: 301.571.7671
Mobile: 202.445.0557
E-Mail: michael.glasby@intelsatgeneral.com

Description

This describes the first of two demonstrations to be performed in support of the Hop Devil Proposal. After our team wins, we are required to have a SATCOM system in place with 30-45 days of contract initiation. The objective of this test is to connect a full duplex link, transmitting and receiving from the same antenna at Raytheon – Sunnyvale, CA. Once the link is setup, various tests will be conducted.

The second demonstration will be performed at Raytheon and will be documented after this has been reviewed.

Diagram

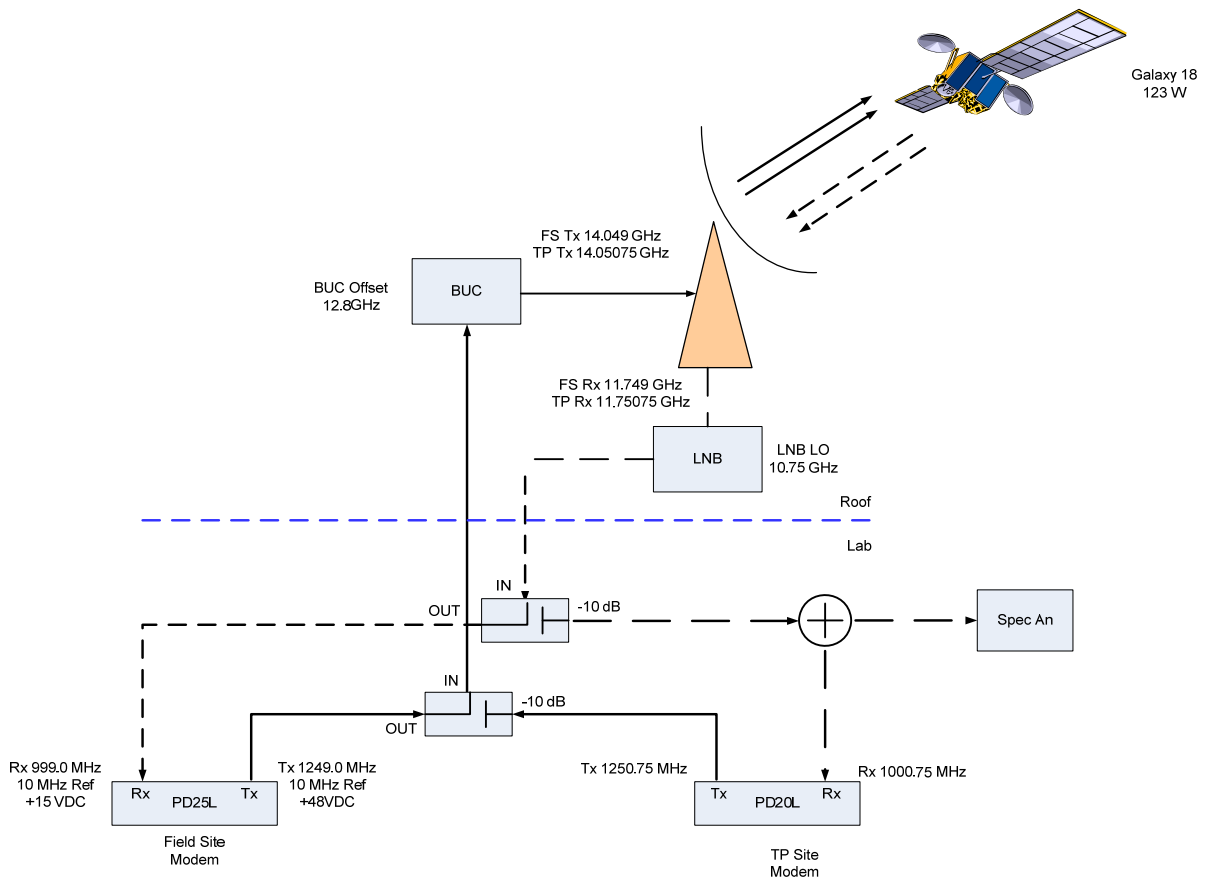


Figure 1 Test Diagram

Parameters

Following are the uplink and downlink parameters for the full duplex link:

| | |
|------------------|---|
| Tx Location | R-AST SVO Lat 37.3811 deg Long -122.0361 deg Elevation ~175 ft above sea level |
| Tx Antenna | 1.8 Meter |
| Tx Antenna Gain | 46.5 dBi |
| Tx Band | Ku |
| Tx Frequencies | 14.0 – 14.5 GHz F1 Field Site Tx F2 TP Tx |
| Modulations | QPSK |
| Tx HPA Power | 25 Watts max. |
| Modem | Paradise PD20L |
| Tx Data Rates | 2048 kbps |
| Tx FEC types | TPC |
| Tx FEC Rates | R7/8 |
| Tx Symbol Rates | 1170.287 ksps |
| Tx Occupied BWs | 1.2 MHz |
| Tx Allocated BWs | 1.65 MHz (OBW x 1.4)?? |
| Rx Location | R-AST SVO Lat 37.3811 deg Long -122.0361 deg Elevation ~175 ft above sea level |
| Rx Antenna | Same 1.8 Meter |
| Rx Antenna Gain | 45 dBi |
| Rx Band | Ku |
| Rx Frequencies | 11.7 – 12.2 GHz F3 Field Site Rx F4 TP Rx |
| Modulations | QPSK |
| Rx Modem | Paradise PD25L |
| Rx Data Rates | 2048 kbps |
| Rx FEC types | TPC |
| Rx FEC Rates | R7/8 |
| Rx Symbol Rate | 1170.287 ksps |
| Rx Occupied BWs | 1.2 MHz |
| Rx Allocated BWs | 1.65 MHz (OBW x 1.4)?? |
| Satellite | Currently pointed at Galaxy 18 123 W |

Schedule

We request 2 days for configuration with Intelsat support, plus 2 contiguous days between June 11 and June 22, 2012 for testing with Intelsat support.

Day 1-2: Link configurations, pointing to satellite, polarizations,

Day 3-4: Transmitting: Antenna/RF/Modem Verification plus data path testing.

Test Plan

Link Setup

1. Point (re-point) to correct Satellite (assume Galaxy 18)
2. Find Horizontal, Vertical beacon frequencies
Do at L band on roof
3. Optimize H or V polarization
L band on roof
Use beacon freq's or designated other signals?
4. Configure uplink for CW (FS Tx, TP Tx)
Set FS, TP Tx modems to Test CW mode
Tune to Intelsat designated frequencies
Bring modem, BUC powers up while Intelsat monitors power (estimate +5 dBw, +35 dBm)
5. Tune to designated operational frequencies (if necessary).
6. Turn on modulation.
7. Tune Rx modems to translated downlink frequencies.
8. Confirm Rx modems lock.
9. Ping from both directions to confirm full duplex link closed.

RF tests

1. RF Characterization
Characterize uplink parameters (modem settings, BUC settings)
Characterize downlink parameters (Rx level, Ebno's on both Rx modems)
Take snapshots of both downlinks.
Other?

Data Path Tests

Raytheon Link Calculations

The following link calculations were assumed are for transmitting and receiving from Raytheon Sunnyvale and assume the satellite is Galaxy 18 123 W.

| ID | Uplink carrier | From FS | Units |
|----|--------------------|---------|-----------------------|
| 1 | Power | 5.1 | (dBW) |
| 2 | Carrier frequency | 14.30 | (GHz) |
| 3 | Antenna diameter | 1.8 | (m) |
| 4 | Antenna efficiency | 0.61 | (fraction) |
| 5 | Antenna gain | 46.5 | (dBi) |
| 6 | EIRP uplink | 51.5 | (dBW) |
| 7 | Range | 37722 | (km) |
| 8 | Path loss | -207.1 | (dB) |
| 9 | Sat. flux density | -111.0 | (dBW/m ²) |
| 10 | G/T satellite | 2.6 | (dB/K) |

| | | | |
|----|-----------------|-------|------------|
| 11 | C/No uplink | 75.6 | (dBHz) |
| 12 | Data rate | 2.048 | (Mbps) |
| 13 | FEC rate | 0.875 | (fraction) |
| 14 | Mod. bits/sym | 2 | (bits/sym) |
| 15 | Noise bandwidth | 60.7 | (dBHz) |
| 16 | C/N uplink | 15.0 | (dB) |

| ID | Downlink carrier | To TP | Units |
|----|--------------------|--------|------------|
| 17 | EIRP downlink | 26.5 | (dBW) |
| 18 | Range | 37722 | (km) |
| 19 | Path loss | -205.9 | (dB) |
| 20 | Carrier frequency | 12.50 | (GHz) |
| 21 | Antenna diameter | 1.8 | (m) |
| 22 | Antenna efficiency | 0.65 | (fraction) |
| 23 | Antenna gain | 45.6 | (dBiL) |
| 24 | Noise temp system | 110.0 | (K) |
| 25 | G/T earth station | 25.2 | (dB/K) |
| 26 | C/No downlink | 74.3 | (dB) |
| 27 | Noise bandwidth | 60.7 | (dBHz) |
| 28 | C/N downlink | 13.7 | (dB) |

| ID | System overall | At TP | Units |
|----|------------------|-------|-------|
| 29 | C/I adjacent SAT | 20.0 | (dB) |
| 30 | C/I cross polar. | 24.0 | (dB) |
| 31 | C/N overall | 10.5 | (dB) |
| 32 | Eb/No | 8.1 | (dB) |
| 33 | Eb/No threshold | 4.5 | (dB) |
| 34 | Link margin | 3.6 | (dB) |

Raytheon Needs before starting the Verifications

Satellite information and the Intelsat POC for 4 days.

Raytheon POC: John Canavan 408-522-2849 (office) 408-892-0667 (mobile)

john.canavan@raytheon.com

Raytheon PM: Jim Robinson 801-908-2400 (office) 801-502-9750 (mobile)

jim.robinson@raytheon.com