Engineering Statement

1) Introduction

Intelsat New Dawn Company, Ltd. ("Intelsat") proposes to modify the existing license for its New Dawn satellite, which is to be located at 32.8º E.L. Intelsat is currently authorized by the Commission to construct, launch and operate New Dawn from 32.8º E.L. (*see* File Nos.: SAT-LOA-20080509-00101 and SAT-AMD-20081205-00223). New Dawn will replace the Galaxy 11 spacecraft, which is licensed to Intelsat's sister company, PanAmSat Licensee Corp., and is operating from 32.8º E.L. (*see* FCC File No.: SAT-MOD-20080225-00051).

The proposed modification reflects the changes to the design and performance of New Dawn that have taken place since its initial authorization. The characteristics of the proposed New Dawn spacecraft are provided in this Engineering Statement and replace those that are currently associated with New Dawn's license.

New Dawn will utilize the C-band frequencies of 5850 – 6500 MHz and 3625 – 4200 MHz and Ku-band frequencies of 14000 – 14500 MHz, 10950 – 11200 MHz and 11450 – 11700 MHz. At C-band, New Dawn will provide service to Africa, Europe and the Middle East. At Ku-band, New Dawn will provide service to the southwestern portion of Africa.

2) Spacecraft Overview

2.1) Structure

New Dawn will be a three-axis stabilized type spacecraft, with a rectangular cube main body that will support the antennas and electronics for the various subsystems. The structural design of New Dawn will provide mechanical support for all subsystems. It will also provide a stable platform for preserving the alignment of critical elements of the spacecraft.

The spacecraft will be comprised of a number of panels that will form a cubical structure. A number of internally placed auxiliary panels will be employed in order to enhance the rigidity of the spacecraft structure and in order to provide additional surface area upon which various electronic and/or non-electronic units may be mounted and/or housed.

The structure externally will support the communication antennas, command and telemetry antennas, the solar wings, Earth and sun sensors, and the spacecraft thrusters. Internally, the structure will house all of the spacecraft's electronic units, batteries, momentum/reaction wheels and the propellant tanks.

New Dawn will utilize two deployable reflector antennas to be located on the east and west sides of the spacecraft. It will also employ four wide coverage antennas ("WCAs"), an omni-directional bicone antenna and two global horn antennas for Telemetry, Command and Ranging ("TC&R"). The wide coverage antennas will be grouped into two transmit/receive pairs, with one pair located on the nadir (Earth facing) section of the spacecraft and the other pair located in the aft section. The bicone antenna and the global horn antennas will be mounted on the nadir side of the spacecraft. The spacecraft will also utilize two global horn antennas – one C-band and one Ku-band – for Uplink Power Control ("ULPC"). The ULPC antennas will be mounted on the nadir side of the spacecraft.

The spacecraft will utilize two deployable solar wings, which will be extended when the spacecraft reaches its designated orbital location. One solar wing will be located on the north side of the spacecraft and the other on the south side of the spacecraft. The solar wings will provide the mounting surfaces for the solar cells. Each solar wing will be connected to the main spacecraft structure through a dedicated Solar Array Drive Assembly ("SADA").

The main Liquid Apogee Engine ("LAE") will be located at the aft end of the spacecraft.

The on-orbit configuration of New Dawn is shown in Exhibit 1. A summary of the basic spacecraft characteristics is provided in Exhibit 2. The New Dawn mass budget is provided in Exhibit 3.

2.2) <u>Thermal Subsystem</u>

Thermal control will be accomplished through the use of Optical Solar Reflectors ("OSRs"), heat pipes, Multilayer Insulation ("MLI") blankets and electrical heaters. The outer surface of the north and south panels will be covered with OSRs to maximize the heat rejection to space while minimizing the absorbed solar energy. The heat generated by high power units, *e.g.*, TWTAs, OMUXs, *etc.*, will be spread over the panels on which they will be mounted by means of heat pipes that will be embedded in the panels. New Dawn also utilizes Ku-band direct-radiation TWTAs, whereby most of the heat generated by each unit is radiated directly out to space. MLI blankets will cover all external areas, except radiative areas. Heaters will be used to limit the lower temperature extremes of the electronics as well as the propulsion thrusters and propellant lines.

2.3) <u>Power Subsystem</u>

The Electrical Power Subsystem ("EPS") will generate, store, condition and protect the satellite's electrical power. It will provide the energy required to operate the satellite during all modes of operation. The EPS will consist of the solar arrays, batteries, associated power electronics, and power harnesses that will integrate and regulate the systems.

New Dawn will utilize two deployable solar array wings, with one wing located on the north side of the spacecraft and the other located on the south side of the spacecraft. Each solar wing will be composed of multiple solar panels. Each panel will support an array of solar cells. During launch, the solar array wings will be in the stowed position. However, once on station, the solar wings are deployed, with each wing extending out on the north and south sides of the spacecraft. The solar array is designed to provide power to the spacecraft for at least 15 years.

Power from the solar arrays is transferred to the spacecraft through the use of two Solar Array Drive Assemblies ("SADAs") – one for each solar wing. The SADAs also control the rotation of the solar wings.

During eclipse periods, rechargeable multiple cell batteries are the primary source of power to the spacecraft. The battery packs will be located near the aft section of the spacecraft and will be mounted on the north and south sides of the spacecraft.

The New Dawn EPS has been designed so that no single failure in the subsystem will cause a spacecraft failure. The EPS will provide sufficient power to the spacecraft throughout its design life to support all active communication channels as well as all necessary housekeeping loads. The beginning of life ("BOL") and end of life ("EOL") power budgets for New Dawn are provided in Exhibit 4.

2.4) Attitude Control Subsystem

The Attitude Control Subsystem ("ACS") will maintain the spacecraft attitude during the transfer orbit, initial acquisition period, and on-station geostationary operations. Additionally, the ACS will be responsible for re-acquisition of the spacecraft in case of emergency and its placement into a safe configuration.

The ACS will employ primary and redundant sun and earth sensors and inertial reference units to perform all attitude determination functions. Control of spacecraft attitude will be accomplished through the use of four-for-three redundant reaction wheels and pulsed or continuous firing of selected thrusters by the ACS.

2.5) Propulsion Subsystem

The propulsion subsystem will provide impulse for the spacecraft maneuvering during all phases of the mission beginning with launch vehicle separation and through the operational lifetime of the satellite. The spacecraft will employ a dual mode propulsion system utilizing both bi-propellant and mono-propellant subsystems. The major features of the propulsion system are: 1) fuel tank, 2) oxidizer tanks, 3) Helium pressurant tanks, 4) the Liquid Apogee Engine ("LAE"), 5) auxiliary thrusters, 6) stationkeeping thrusters, and 7) propellant management system utilizing Helium as pressurant.

Prior to the start of the transfer orbit, the propellant tanks will be pressurized by the activation of the pressure blow-down system, whereby pressurized Helium will be injected into the fuel and oxidizer tanks. The system will then be operated in bi-propellant mode using the LAE. In case of an anomaly with the main thruster, the auxiliary thrusters in conjunction with a number of the station-keeping thrusters will be utilized as back-up to complete the transfer orbit maneuvers.

Upon completion of transfer orbit operations, the bipropellant LAE will be isolated from the on-orbit operation system. This leaves the propulsion system in a blow-down configuration. On-orbit operation is performed through the use of the station-keeping thrusters that will be mounted at various locations on the spacecraft.

The architecture of the propulsion systems is based on a low risk approach and is patterned after successful designs used throughout the industry utilizing space-proven or space-qualified components. The system will incorporate full redundancy for all critical components. All thrusters have been flight qualified to more than 1.25 times the required throughput to complete the mission life.

2.6) Communication Subsystem

2.6.1) Overview

New Dawn will provide 14 active communication channels at C-band frequencies. The C-band channels have a bandwidth of 72 MHz. At Ku-band frequencies, the spacecraft will utilize 16 channels. Eight of the Ku-band channels have a bandwidth of 36 MHz and eight channels have a bandwidth of 72 MHz. The New Dawn frequency and polarization plans are provided in Exhibits 5A and 5B.

At both C-band and Ku-band frequencies, New Dawn will employ full frequency reuse through the use of orthogonal polarization. Accordingly, New Dawn is compliant with provisions of section 25.210(f) of the Commission's rules.

Section 25.210(a)(1) of the FCC rules requires space stations that provide service to the United States to use orthogonal linear polarization with one of the planes defined by the equatorial plane. Section 25.210(a)(3) requires that space stations that provide service to the United States be capable of switching polarization sense upon ground command. However, given that New Dawn will not be providing service to the United States, the provisions of sections 25.210(a)(1) and 25.210(a)(3) are inapplicable.

With respect to the application of US 245, NG 169 and NG 185 of the United States Table of Frequency Allocations, contained in section 2.106 of the Commission's rules, in the frequency band 3625 – 3700 MHz, it is noted that the service area of New Dawn does not encompass the United States and transmissions from New Dawn will be to areas outside of the United States.

Similarly, with respect to the application of US 245 of the United States Table of Frequency Allocations in the frequency band 5850 – 5925 MHz, it is noted that New Dawn's coverage area does not encompass the United States and transmissions to New Dawn will therefore be from areas outside of the United States.

As shown in Exhibits 5A and 5B, New Dawn will utilize C-band command and telemetry frequencies that are located at approximately the middle of the allocated frequency band. Hence, New Dawn will not be compliant with the provisions of section 25.202(g) of the Commission's rules that require the command and telemetry channels to be located at either edges of the allocated band. Accordingly, Intelsat requests that its previously granted waiver of section 25.202(g) of the rules continues to apply to New Dawn. (*see Intelsat New Dawn Company, Ltd. Application to Amend Pending Application for Authority to Launch and Operate a Replacement Satellite at 32.8º E.L.*, File No. SAT-AMD-20081205-00223 (filed Dec. 5, 2008) (stamp granted with conditions Jan. 9, 2009)).

2.6.2) <u>Antennas and Beam Coverage</u>

New Dawn will utilize a C-band transmit/receive antenna deployed off the west side of the spacecraft and a Ku-band transmit/receive antenna deployed off the east side of the spacecraft. The coverage beams of the New Dawn antennas are shown in Exhibits 6A through 6H, in the format prescribed in section 25.114(d)(3) of the Commission's rules. These exhibits also provide the beam peak gain, EIRP, G/T and SFD.

With regard to the receive beams, the SFD at any G/T contour may be determined using the following formula:

$$SFD_D = SFD_P + [(G/T)_P - (G/T)_D] + A$$

where

SFD_D: SFD at desired G/T level (dBW/m^2)
SFD_P: Minimum SFD at peak G/T (dBW/m^2)
$(G/T)_D$: Desired G/T level (dB/K)
$(G/T)_P$: Peak G/T (dB/K)
A = Transponder attenuator setting (dB), ranging from 0 to 31 dB in 1 dB steps for C-band channels, and from 0 to

32 dB in 1 dB steps for Ku-band channels having a bandwidth of 36 MHz, and from 0 to 28 dB in 1 dB steps for Ku-band channels having a bandwidth of 72 MHz.

Exhibit 7 provides a detailed calculation of the EIRP, G/T and SFD of the New Dawn uplink and downlink beams.

The New Dawn uplink and downlink beams are designed to have a minimum cross-polarization of 30 dB or greater within the primary coverage area and are compliant with section 25.210(i)(1) of the Commission's rules.

2.6.3) Transponder description

This section provides descriptions of the C-band and Ku-band transponders.

2.6.3.1) C-band Transponder Description

Signals in the 5850 – 6500 MHz frequency band are received by the appropriate (horizontally polarized or vertically polarized) receive antenna horn. The output of the receive antenna is routed through a test coupler, a band-pass filter and then to a set of wide-band receivers.

The receivers are arranged in a four-for-two redundancy ring. Each uplink can access one of four receivers by ground command. The receivers establish the system noise figure and down-convert the received signal to the C-band transmit frequency band. Each receiver operates over the entire 5850 – 6500 MHz band in linear mode and is designed to have high sensitivity (*i.e.*, good noise performance) and low cross-talk coefficients (*i.e.*, good linearity characteristics).

From the receiver output, the signal is routed to a set of Input Multiplexers ("IMUXes"). The IMUXs are filters that provide frequency band separation for each channel.

For those New Dawn channels that are configured to operate in the C-to-Ku band cross-strapping mode, the signal from the band-pass filter is sent to a receiver and routed to an output port of the receiver that does not frequency convert the signal. From the receiver, the signal is sent to a set of C-to-Ku band frequency up-converters that translate the signal to the correct downlink frequency, and then is directed to the appropriate Ku-band IMUXs. The New Dawn up-converters are arranged in a four-for-two redundancy ring.

The output of each IMUX is connected to a dedicated Linearized Channel Traveling Wave Tube Amplifier ("LCTWTA") through a bank of redundancy switches. The redundancy switching permits the output of the IMUX to be routed to a redundant LCTWTA should the primary units fail or malfunction.

Each LCTWTA operates in the Fixed Gain Mode ("FGM") whereby the gain of each channel (and its associated transponder saturation flux density) may be independently adjusted by changing the attenuation of its designated LCTWTA by ground command. The output of each LCTWTA may be varied by ground command over a range of 31 dB in 1 dB increments. Accordingly, the C-band channels of the New Dawn satellite are compliant with the provisions of section 25.210(c) of the Commission's rules.

Each C-band New Dawn LCTWTA utilizes a TWTA which produces a nominal output power of 50 Watts. The C-band LCTWTAs are arranged in two ten-for-seven redundancy rings.

The output of each LCTWTA amplifier is routed through a bank of switches to the appropriate Output Multiplexer ("OMUX") bank. The switching network allows the output of a redundant LCTWTA to be forwarded to the appropriate OMUX should the primary pair of units fail or malfunction. The output of each OMUX is connected to the transmit antenna (feed) via a band-pass filter and a test coupler.

In the C-to-C-band channel configuration, the C-band receiver down-converts the received signal to the necessary frequency required for transmission. The frequency stability of the transmitted signal is thus controlled entirely by the receiver itself. The New Dawn C-band receiver will be able to maintain over the life of the spacecraft the frequency of the transmitted (down-converted) signal to within 0.002% of the desired value and thus is compliant with the provisions of section 25.202(e) of the Commission's rules.

In the C-to-Ku-band channel configuration, frequency translation is achieved through the C-to-Ku band frequency up-converter. The frequency stability of the transmitted signal is thus controlled by the frequency up-converter. The New Dawn C-to-Ku band frequency up-converter will maintain over the life of the spacecraft the frequency of the transmitted (up-converted) signal to within 0.002% of the desired value and thus is compliant with the provisions of section 25.202(e) of the Commission's rules.

2.6.3.2) Ku-band Transponder Description

Signals in the 14000 – 14500 MHz frequency band are received by the appropriate (horizontally polarized or vertically polarized) receive antenna horn. The output of the receive antenna is routed through, an ("Ortho-mode T-Junction") OMT/diplexer, a test coupler, a band-pass filter and then to a set of receivers.

The receivers are arranged in a four-for-two redundancy ring. Each uplink can access one of four receivers by ground command. The receivers establish the system noise figure and down-convert the received signal to the transmit frequency band of 11450 - 11700. Each receiver operates over the entire 14000 – 14500 MHz band in linear mode and is designed to have high sensitivity (*i.e.*, good noise performance) and low cross-talk coefficients (*i.e.*, good linearity characteristics).

For those New Dawn channels that operate in the 10950 – 11200 MHz band, the signal from the band-pass filter is sent to a receiver and routed to an output port of the receiver that does not frequency convert the signal. From the receiver, the signal is then sent to a set of Ku-to-Ku band frequency down-converters that translate the signal to the correct downlink frequency. The Ku-to-Ku band frequency down-converters are arranged in a four-for-two redundancy ring.

From the up-converters and receivers, the signal is routed to a set of IMUXs. The output of each IMUX is connected to a dedicated LCTWTA through a bank of redundancy switches. The redundancy switching permits the output of the IMUX to be routed to a redundant LCTWTA should the primary units fail or malfunction.

Each LCTWTA may operate in the fixed gain mode or in the automatic level control ("ALC") mode. When operating in the fixed gain mode, the gain of each channel (and its associated transponder saturation flux density) may be independently adjusted by changing the attenuation of its designated

LCTWTA by ground command. The output of each LCTWTA may be varied by ground command over a range of 32 dB in 1 dB increments for those channels that have a bandwidth of 36 MHz and over a range of 28 dB for those channels that have a bandwidth of 72 MHz. Accordingly, the Ku-band channels of the New Dawn satellite are compliant with the provisions of section 25.210(c) of the Commission's rules. When operating in the ALC mode, the input power into the TWTA may be maintained at a specific level chosen within a range of 15.5 dB, in 0.5 dB increments.

Each New Dawn Ku-band LCTWTA will utilize a TWTA which produces a nominal output power of 150 Watts. The New Dawn LCTWTAs are arranged in two eleven-for-eight redundancy rings.

The output of each LCTWTA amplifier is routed through a bank of switches to the appropriate OMUX bank. The switching network allows the output of a redundant LCTWTA to be forwarded to the appropriate OMUX should the primary pair of units fail or malfunction. The output of each OMUX is connected to the transmit antenna (feed) via a bandpass filter, test coupler, and OMT/diplexer.

For those New Dawn channels that are configured to operate in the Ku-to-C band cross-strapping mode, the signal from the band-pass filter is sent to a receiver and routed to an output port of the receiver that does not frequency convert the signal. From the receiver, the signal is sent to a set of Ku-to-C band frequency down-converters that translate the signal to the correct downlink frequency and is directed to the appropriate C-band IMUXs. The New Dawn down-converters are arranged in a two-for-one redundancy ring.

In the Ku-to-Ku channel configurations where the downlink frequency is in the 11450 – 11700 MHz band, the frequency stability of the transmitted signal is controlled entirely by the receivers. Each receiver unit will maintain over the life of the spacecraft the frequency of the transmitted (down-converted) signal to within 0.002% of the desired value and, thus, New Dawn is compliant with the provisions of section 25.202(e) of the Commission's rules.

In the Ku-to-Ku channel configurations where the downlink frequency is in the 10950 – 11200 MHz band, the frequency stability of the transmitted signal is controlled entirely by the Ku-to-Ku band frequency down-converters. Each down-converter unit will maintain over the life of the spacecraft the frequency of the transmitted (down-converted) signal to within 0.002% of the desired value and, thus, New Dawn is compliant with the provisions of section 25.202(e) of the Commission's rules.

In the Ku-to-C band channel configuration, frequency translation is achieved through the Ku-to-C band frequency down-converters. The frequency stability of the transmitted signal is thus controlled by the frequency down-converters. Each New Dawn Ku-to-C band frequency down-converter will maintain over the life of the spacecraft the frequency of the transmitted (up-converted) signal to within 0.002% of the desired value and thus, also in this configuration, New Dawn is compliant with the provisions of section 25.202(e) of the Commission's rules.

2.7) Telemetry, Command and Ranging Subsystem

The telemetry, command and ranging ("TC&R") subsystem will provide the following functions:

1) Acquisition, processing and transmission of spacecraft telemetry data.
2) Reception and retransmission of ground station generated ranging signals.
3) Reception, processing and distribution of telecommands.

The TC&R subsystem will consist of the following elements: 1) two circularly polarized Wide Coverage Antennas ("WCAs") for commanding – one on the nadir side of the spacecraft and the other on the aft side; 2) two circularly polarized wide telemetry WCAs – one on the nadir side of the spacecraft and the other on the aft side; 3) one circularly polarized, toroidal, omni-directional Bicone transmit/receive antenna; 4) one circularly polarized global horn receive antenna; 5) one circularly polarized global horn transmit antenna; 6) two command receivers; 7) two telemetry transmitters; 8) data handling electronics including data encoders and decoders; and 9) Microwave components including filters, switches, couplers, isolators, cables, and waveguide.

2.7.1) Antennas

When on-station, command and telemetry signals are received and transmitted through New Dawn's global horn antenna. Typical receive and transmit gain patterns of a global horn antenna are provided in Exhibits 6I and 6L, respectively.

During emergencies and transfer orbit operations, command and telemetry signals are received and transmitted through the WCAs and the Bicone antenna. For command, one WCA will be located on the front (or nadir) section of the spacecraft and one will be located on the aft section. Similarly, for telemetry, one WCA will be located on the nadir section of the spacecraft and one will be located on the aft section. The Bicone antenna will be located on the nadir side of the spacecraft. Representative gain graphs for the command and telemetry WCAs are provided in Exhibits 6J and 6M, respectively. Representative gain graphs for the command and telemetry Bicone antenna are provided in Exhibits 6K and 6N, respectively.

In the azimuth plane, the Bicone antenna pattern has two approximately equi-value peak gain lobes that are separated by 180º. Exhibits 6K and 6N show the gain pattern for one of the two gain lobes at an azimuth angle of 0º. In the elevation plane, the variation in gain of the Bicone antenna at any given azimuth is typically small. Hence, the gain patterns shown in Exhibits 6K and 6N is also representative for other azimuth angles that are within the field of view of the Bicone antenna.

During emergency conditions, the Bicone antenna would be used, in conjunction with the WCAs, since its field of view is +/- 30º and the Earth disk is only +/- 8.4º. From Exhibits 6K and 6N, it is evident that the coverage of the Bicone antenna is relatively flat over the entire Earth, whereby the gain varies by less than 1 dB.

With regard to the wide coverage antennas, the graphs in Exhibits 6J and 6M show the variation in the gain of the antenna at 0° elevation angle, referenced to the (horizontal) plane on the center axis of the antenna aperture, with the azimuth varying from -120º and +120º. Given that the antennas are horn antennas having symmetrical gain performance about the center axis of the antenna aperture, the gain variation shown in Exhibits 6J and 6M is also representative of the case where the azimuth angle of the antenna is 0°, referenced to the (vertical) plane located at the center axis of the antenna aperture, with the elevation varying from -120° and +120°.

The field of view of the wide coverage antennas (±30º) envelopes the Earth disk (±8.4º). From Exhibits 6J and 6M it is evident that the coverage of the wide coverage antennas is relatively flat over the entire Earth and that the variation in gain will be typically less than 1.5 dB within the antennas' field of view.

The antenna gain diagrams associated with the TC&R global horn, Bicone and wide coverage antennas, shown in Exhibits 6I, 6J, 6K, 6L, 6M and 6N were not prepared in accordance with the parameters specified in section 25.114(d)(3) of the Commission's rules due to the fact that typically satellite manufacturers do not provide the patterns in the required form. Given the specificity of the situation, it is our understanding that Exhibits 6I, 6J, 6K, 6L, 6M and 6N together with the descriptive characterization given in the previous paragraphs, fulfill the requirements of section 25.114(d)(3). However, in case the Commission concludes differently, Intelsat requests that its previously granted waiver of the requirements of section 25.114(d)(3) of the FCC's rules with respect to the presentation of these antenna patterns continues to apply to New Dawn. (*see Intelsat New Dawn Company, Ltd. Application to Amend Pending Application for Authority to Launch and Operate a Replacement Satellite at 32.8º E.L.*, File No. SAT-AMD-20081205-00223 (filed Dec. 5, 2008) (stamp granted with conditions Jan. 9, 2009)).

2.7.2) Command

The New Dawn command subsystem performance summary is provided in Exhibit 8. Detailed calculation of the G/T and SFD for each command beam is provided in Exhibit 9.

During on-station operations, commands are transmitted to the spacecraft by transmission of circularly polarized, FM signals on the frequency of 6173.7 MHz and 6176.3 MHz. The command signal is received by the spacecraft through the global horn (command) antenna. The command signal is then routed to the two command receivers. The receivers amplify and demodulate the signal, and convert the command signal into a digital stream. The output of the command receivers are decoded and sent to the appropriate unit.

During transfer orbit or emergency operations, the operation of the command subsystem is similar to that for on-station operations, except that the transmitted command signals are received by the two WCAs and the

Bicone antenna. Exhibits 5A and 5B provide the frequency and polarization plan for the New Dawn command channels.

2.7.3) Telemetry

The New Dawn telemetry subsystem performance summary is provided in Exhibit 8. Detailed calculation of the EIRP for each telemetry beam is provided in Exhibit 9.

During on-station operations, telemetry is transmitted by the spacecraft on two independent, circularly polarized, PM signals on the frequencies of 3947.5 MHz and 3952.5 MHz. The telemetry baseband data from the various spacecraft units are collected, processed, multiplexed, formatted and encoded onto subcarriers. The encoded baseband signal is then routed to two telemetry transmitters where the signal is modulated onto the main carrier frequencies of 3947.5 MHz and 3952.5 MHz. The output of the telemetry transmitters is then routed to the global horn (telemetry) antenna for transmission to Earth. For on-station operations, the telemetry signal is sent through the low power (output) port of the telemetry transmitter to the transmitting antenna.

During transfer orbit or emergency operations, the operation of the telemetry subsystem is similar to that for on-station operations, except that the high power output port of each telemetry transmitter is utilized. The telemetry signal is then transmitted to Earth through the WCAs and the Bicone antenna. Exhibits 5A and 5B provide the frequency and polarization plan for the New Dawn telemetry channels.

2.7.4) Ranging

During all phases of the mission, the slant range of the spacecraft will be determined to a relatively high level of accuracy through the use of a multiple tone ranging system. The ranging tones selected are combined with the normal command data and modulated onto the command carrier and transmitted to the spacecraft. Once received by the spacecraft through the appropriate receiving antenna, the signal is routed to the command receiver where it is separated from the normal command data and routed directly to the spacecraft's telemetry transmitter. At the telemetry transmitter, the ranging signal is combined with other telemetry data and modulated onto the main telemetry carrier and transmitted to Earth through the appropriate spacecraft transmitting antenna. On the ground, the ranging tones are separated from the telemetry data, demodulated and their phase compared with that of the transmitted signal to determine the range of the satellite.

Because the ranging subsystem uses the command and telemetry subsystems, the descriptions of the operation of these two latter systems during on-station, transfer orbit and emergency conditions are applicable to the ranging subsystem as well. The performance summary of the New Dawn command, telemetry and ranging subsystems are provided in Exhibit 8.

2.8) <u>Uplink Power Control Subsystem ("ULPC")</u>

2.8.1) Antennas

New Dawn utilizes a dedicated (global) horn antenna to generate the C-band global ULPC beam. Similarly, at Ku-band, a dedicated Ku-band (global) horn antenna is utilized to generate the Ku-band global ULPC beam. The coverage patterns of the C-band and Ku-band ULPC beams are provided in Exhibits 6O and 6P, respectively.

With regard to the C-band and Ku-band ULPC antennas, the graphs in Exhibits 6O and 6P show the variation in the gain of the antenna at 0° azimuth angle, with the elevation varying from -120º and +120º. Given that the antennas are horn antennas having symmetrical gain performance about the center axis of the antenna aperture, the gain variations shown in Exhibits 6O and 6P are also representative of the case where the azimuth angle of the antenna is between 0° to 360º.

The antenna gain diagrams associated with the C-band and Ku-band ULPC antennas shown in Exhibits 6O and 6P were not prepared in accordance with the specifications in section 25.114(d)(3) of the Commission's rules due to the fact that typically satellite manufacturers do not provide the patterns in the required form. Given the specificity of the situation, it is our understanding that Exhibits 6O and 6P together with the descriptive characterization given in the previous paragraph, fulfill the requirements of section 25.114(d)(3). However, in case the Commission concludes differently, Intelsat requests that its previously granted waiver of the requirements of section 25.114(d)(3) of the FCC's rules with respect to the presentation of these antenna patterns continues to apply to New Dawn. (*see*

Intelsat New Dawn Company, Ltd. Application to Amend Pending Application for Authority to Launch and Operate a Replacement Satellite at 32.8° E.L., File No. SAT-AMD-20081205-00223 (filed Dec. 5, 2008) (stamp granted with conditions Jan. 9, 2009)).

2.8.2) ULPC System Description

New Dawn provides one C-band and two Ku-band beacons which can be used for uplink power control ("ULPC"). The C-band ULPC beacon is linearly polarized and operates on the frequency of 3950 MHz. The Ku-band ULPC beacons are circularly polarized and operate on the frequencies of 11198 MHz and 11452 MHz.

The characteristics of the ULPC beacons are provided in Exhibit 2. Detailed calculation of the EIRP for each ULPC beam is provided in Exhibit 7.

Each ULPC frequency is generated by separate two-for-one redundant transmitters. At C-band, the output of the transmitter is directed to a global horn antenna for transmission to Earth. At Ku-band, the output of each transmitter is multiplexed and then transmitted to Earth through a Ku-band global horn transmit antenna. The coverage patterns of the UPLC antennas are provided in Exhibit 6O and 6P.

2.9) Satellite Station-Keeping

The spacecraft will be maintained within 0.05° of its nominal position in the east-west direction as well as in the north-south direction. Accordingly, it is in compliance with the provisions of section 25.210(j) of the Commission's rules.

The attitude of the spacecraft will be maintained with an accuracy consistent with the achievement of the specified communications performance, after taking into account all error sources (*i.e.*, attitude perturbations, thermal distortions, misalignments, orbital tolerances, and thruster perturbations).

2.10) Satellite Useful Lifetime

The design lifetime of the satellite in orbit is 15 years. This has been determined by a conservative evaluation of the effect of the synchronous orbit environment on the solar array, the amount of fuel aboard the spacecraft, the effect of the charge-discharge cycling on the life of the battery, and the wear out of the amplifiers and other active units. The mass allocation of propellant for spacecraft station-keeping is at least 15 years. To enhance the probability of survival, equipment/unit redundancy is incorporated into the spacecraft design where possible. Materials and processes will be selected so that aging or wearing effects will not adversely affect spacecraft performance over the estimated life.

2.11) Spacecraft Reliability

New Dawn is designed for an operational and mission life of at least 15 years. Life and reliability are maximized by incorporating flight proven or flight qualified units and designs to the greatest extent possible. All subsystems and units have a minimum design life of 15 years. Redundancy concepts are applied to all critical components. All avoidable single-point failure modes have been eliminated.

The projected reliability of the payload is 81.1%. The projected reliability of the bus system is 83.8%. The overall reliability of the New Dawn spacecraft is projected to be 68%. The subsystem reliability assessments were based upon the use of failure rates, modeling assumptions from previous spacecraft programs and those specific to New Dawn.

3.0) Emission Limitations

The New Dawn receiver and transmitter channel filter response characteristics are provided in Exhibit 10, as required under section 25.114(c)(4)(vii) of the Commission's rules.

Intelsat will comply with the provisions of 25.202(f) of the Commission's rules with regard to New Dawn emissions.

4.0) Services and Emission Designators

New Dawn is to be a general purpose communications satellite and has been designed to support a wide variety of services. Depending upon the needs of the users, the transponders on New Dawn can accommodate television, radio, voice, or data communications. Typical types of communication services to be offered include:

a) Frequency modulated television (TV/FM)
b) Compressed digital video
c) High speed digital data
d) Digital single channel per carrier ("SCPC") data channels
e) Digital SCPC with 64 kbps data rates

Emission designators and allocated bandwidths for representative communication carriers, telemetry, and command signals are provided in Exhibit 11.

In the 3700 – 4200 MHz frequency band, Intelsat will ensure that analog (TV/FM) video transmissions comply with the provisions of section 25.211(a) of the Commission's rules. Should Intelsat place analog video carriers at frequencies that do not comply with those specified in section 25.211(a) of the Commission's rules, it will coordinate the operation of these carriers with all the affected adjacent satellite operators prior to initiating such transmissions.

5.0) Power Flux Density ("PFD")

The power flux density limits for space stations are specified in section 25.208 of the Commission's rules for the 3650 – 4200 MHz, 10950 – 11200 MHz and 11450 – 11700 MHz frequency bands. For each of these frequency bands, the power flux density ("PFD") level at the Earth's surface produced by New Dawn was calculated for a 36 MHz or a 72 MHz digital carrier (with an occupied bandwidth 30.133 MHz or 60.251 MHz, respectively), as applicable, and a 36 MHz TV/FM analog carrier. These carriers typically produce high power flux densities at the earth's surface. The PFD levels were also calculated for the New Dawn telemetry and ULPC carriers. As shown in Exhibit 12, the downlink PFD levels of New Dawn carriers do not exceed the limits specified in section 25.208(a) of the FCC's rules.

6.0) Service Area

At C-band, the primary service area of New Dawn is Africa, Europe and the Middle East. At Ku-band, the primary service area of the spacecraft is the southwestern portion of Africa. In addition, interconnection of the C-band and Ku-band coverage areas will be provided through C-to-Ku and Ku-to-C cross-strapped operation.

7.0) Orbital Location

Intelsat requests that it be assigned the 32.8° E.L. orbital location for New Dawn. New Dawn will replace Galaxy 11, which is currently located at 32.8° E.L. The 32.8° E.L. location satisfies New Dawn requirements for optimizing coverage, elevation angles and service availability and ensures that maximum operational, economic and public interest benefits will be derived.

8.0) Orbital Arc Limitations

New Dawn is intended to provide video, audio and data services within the service area described above. The 32.8° E.L. position affords reasonable earth station angles in this service area.

9.0) New Dawn Carrier Link Analysis

In the frequency bands of 5850 – 6425 MHz and 3625 – 4200 MHz, Intelsat will operate in accordance with existing coordination agreements.

Intelsat has, through the Commission, submitted a filing to the ITU for operation in the band 6425-6500 MHz. The nearest satellite operating in this band is PakSat 1, located at 38° E.L.

Intelsat has completed all the Ku-band coordinations required by the ITU. In particular, Intelsat has an agreement in place with Eutelsat, which operates a nominally collocated satellite (Eurobird 3 at 33° E.L.). New Dawn operations in the bands 14.0-14.5 GHz, 10.95-11.20 GHz and 11.45-11.70 GHz will be conducted in accordance with the coordination agreement with Eutelsat (largely based on beam isolation) as well as other existing agreements.

At C-band and Ku-band frequencies, link analysis for New Dawn was conducted for a number of representative carriers. For the analyses, it was assumed that the nearest satellites to New Dawn were a hypothetical satellite operating from 30.8° E.L. and a hypothetical satellite operating from 34.8° E.L. The hypothetical satellites were assumed to have the same operational parameters as New Dawn.

At C-band, the uplink power density of the emissions to each of the hypothetical satellites was assumed to be -38.7 dBW/Hz, the maximum level specified in section 25.212(d) of the Commission's rules for digital C-band carriers. The C-band downlink EIRP density of each of the hypothetical satellites was assumed to be one of the following values depending on the New Dawn downlink beam and channel bandwidth combination under consideration: -33.2 dBW/m^2, -39.2 dBW/m^2, -40.4 dBW/m^2, -42.2 dBW/m^2 and -43.4 dBW/m^2.

At Ku-band, the uplink power density of the emissions to each of the hypothetical satellites was assumed to be -50 dBW/Hz, the maximum level specified in section 25.212(c) of the Commission's rules for digital Ku-band carriers. At Ku-band, the maximum downlink EIRP density of the emissions from each of the hypothetical satellites was assumed to be -26 dBW/Hz, the maximum level specified in section 25.212(c) of the Commission's rules.

Other assumptions made for the link budget analysis were as follows:

a) In the plane of the geostationary satellite orbit, all transmitting and receiving earth station antennas have off-axis co-polar gains that are compliant with the limits specified in section 25.209(a)(1) of the FCC's rules.
b) All transmitting and receiving earth stations have a cross-polarization isolation value of at least 30 dB within their main beam lobe.
c) At C-band frequencies, degradation due to rain is not considered, given that rain (attenuation) effects are insignificant at C-band.
d) At Ku-band frequencies rain attenuation predictions are derived using Recommendation ITU-R 618-7.
e) At Ku-band frequencies, increase in noise temperature of the receiving earth station due to rain is taken into account.
f) For the cases where the transponder operates in a multi-carrier mode, the effects due to intermodulation interference are taken into account.

For both the C- and Ku-band analysis, the impact of the TV/FM carriers from the adjacent satellites on the transmissions of New Dawn was not considered. The reason was the fact that TV/FM carriers are known to be high-density carriers with most of the energy contained within the near vicinity of the carrier center frequency. Operation of sensitive narrow-band carriers is typically precluded within these high power density areas of the TV/FM carrier. Accordingly, placement and operation of TV/FM carriers are normally achieved through internal coordination and/or coordination discussions with the adjacent satellite operators, whichever may be the case, rather than through C/I calculations – since the results of such calculations would show that narrow-band carriers typically could not operate on a co-frequency basis with TV/FM carriers.

As shown in Exhibit 6, the performance of the various New Dawn beams in both polarizations is rather similar. In order to keep the number the New Dawn link calculations to a manageable number, worst-case performance values were assumed for each beam type. The worst-case beam parameters were derived from the beam parameters listed in Exhibit 6 and chosen in such a manner that would make carrier links utilizing any specific uplink / downlink beam combination as sensitive to adjacent satellite interference as possible. This would ensure that the link performance objectives would be achieved for all possible New Dawn uplink and downlink beam combinations. The worst-case beam performance for each New Dawn beam type is provided below:

Beam Name	Aggregate Beam Designation	Worst-Case Beam Peak G/T (dB/K)	Worst-Case Beam SFD Range @ Peak G/T (dBW/m^2)	Worst-Case Beam EIRP (dBW)
Landmass A	Landmass	-0.3	-111 to -80	42.2
Landmass B				
Africa (H)	Africa	5.3	-114.4 to -86.4	50.7
Africa (V)				

As shown in Exhibits 5A and 5B, at Ku-band New Dawn employs, with each beam, channels having varying bandwidths. In an effort to keep the number of link calculations to a manageable level, link calculations were not performed for each channel size, but rather for only one channel size. The channel size chosen for each beam was based upon the level of adjacent satellite downlink interference. As an example, if a channel having a bandwidth of 72 MHz and a channel having a bandwidth of 36 MHz have the same associated adjacent satellite downlink interfering EIRP density, then link budgets were performed only for emissions that were transmitted through the 72 MHz channel, since the carrier level would typically have less (uplink and downlink) power in comparison to those which would be transmitted through the 36 MHz channel; and thus the impact of the adjacent satellite interference would be greater on the former. As a second example, if the level of downlink interfering EIRP density to which the 36 MHz channel was subjected was larger than that for the 72 MHz channel (as may happen for the Ku-band link budgets), and if this additional level of interference was larger than ten times the logarithmic ratio of the two channel bandwidths (*i.e.*, 10log[72/36]), then link calculations were performed only for the emissions of the 36 MHz channel, since the impact of adjacent satellite interference is greater on emissions of this channel (in comparison to those being transmitted through the 72 MHz channel).

As previously mentioned, at Ku-band, New Dawn can utilize the downlink frequency bands of 10950 – 11200 MHz and 11450 – 11700 MHz. In order to keep the number of New Dawn link calculations to a manageable number, all Ku-band link calculations were conducted at the single representative uplink frequency of 14250 MHz and downlink frequency of 11325 MHz (that is midway between 10950 MHz and 11700 MHz). At C-band, all calculations were conducted at the single representative frequency of 6175 MHz for the uplink and 3950 MHz for the downlink.

The results of the C-band and Ku-band analysis are shown in Exhibit 13 and demonstrate that operation of the New Dawn satellite from 32.8º E.L, within a two-degree environment, would permit the intended services to achieve their respective performance objectives while maintaining sufficient link margin. Additionally, the levels of the carriers listed in Exhibit 13 comply with the limits contained in sections 25.212(c) and (d) of the Commission's rules.

10.0) <u>Adjacent Satellite Link Analysis</u>

The impact of the New Dawn emissions on the transmissions of adjacent satellites in a hypothetical two-degree environment was not analyzed because the power levels of New Dawn transmissions will be limited to those levels contained in section 25.212(c) and (d) of the FCC's rules. As previously discussed, operation of New Dawn in the actual environment around 32.8º E.L. will be conducted taking into account existing coordination agreements and actual operation of satellites deployed in the orbital arc under consideration. In those cases where Intelsat may be required to transmit carriers with power levels in excess of those in sections 25.212(c) or (d), it will coordinate with the affected adjacent satellite operators as part of the normal coordination process so as to limit the level of interference that is mutually caused and received by New Dawn and any adjacent satellite.

11.0) Schedule S Submission

Intelsat is providing with its application a Schedule S for the operations of New Dawn at 32.8º E.L. It is noted that the antenna gain pattern for the New Dawn command and telemetry Bicone, WCA and global horn antennas as well as the ULPC global horn antennas were included in column "e" (instead of column "f") of page S8 of the Schedule S, since they are not in GXT format (*see* sections 2.7.1 and 2.8.1).

In column "g" of section S13 of the Schedule S, a link budget file has been included for the first link (*i.e.*, the first row of data) contained in that section. This link budget file is applicable to all of the links listed in section S13 and should have been included with each row of data in that section of the Schedule S. However, given that the link budget file is rather large and its inclusion with each link (or data row) would lead to the Schedule S file having an unmanageable size, all other links (or rows of data) contain a small ASCII file that references the link budget file that is attached to the first link (*i.e.*, the link budget file attached to the first row of data).

12.0) Orbital Debris Mitigation Plan

Intelsat is proactive in ensuring safe operation and disposal of this and all spacecraft under its control. The four elements of debris mitigation are addressed below.

12.1) Spacecraft Hardware Design

The spacecraft is designed such that no debris will be released during normal operations. Intelsat has assessed the probability of collision with meteoroids and other small debris (<1 cm diameter) and has taken the following steps to limit the effects of such collisions: (1) critical spacecraft components will be located inside the protective body of the spacecraft and properly shielded; and (2) all spacecraft subsystems will have redundant components to ensure no single-point failures. The spacecraft will not use any subsystems for end-of-life disposal that are not used for normal operations.

12.2) Minimizing Accidental Explosions

Intelsat has assessed the probability of accidental explosions during and after completion of mission operations. The spacecraft is designed in a manner to minimize the potential for such explosions. Propellant tanks and thrusters will be isolated using redundant valves and electrical power systems will be shielded in accordance with standard industry practices. At the completion of the mission, and upon disposal of the spacecraft, Intelsat will ensure the removal of all stored energy on the spacecraft by depleting all propellant tanks, venting all pressurized systems and turning off all active units.

12.3) Safe Flight Profiles

Intelsat has assessed and limited the probability of the space station becoming a source of debris as a result of collisions with large debris or other operational space stations. Except as stated below, New Dawn will not be located at the same orbital location as another satellite or at an orbital location that has an overlapping station-keeping volume with another satellite.

The proposed orbital location for New Dawn is 32.8° E.L. Currently, Galaxy 11 operates from 32.8° E.L. Following transfer of traffic to New Dawn, Galaxy 11 shall be relocated to another orbital position such that its station-keeping volume shall not overlap with that of New Dawn. During the brief period in which communication traffic is being transferred from Galaxy 11 to New Dawn, Intelsat will take all the necessary steps to minimize the risk of collision between the two spacecraft.

With the exception of Galaxy 11, Intelsat is not aware of any other FCC licensed system, or any other system applied for and under consideration by the FCC, having an overlapping station-keeping volume with New Dawn. Intelsat is also not aware of any system with an overlapping station-keeping volume with New Dawn that is the subject of an ITU filing and that is either in orbit or progressing towards launch.

12.4) Post Mission Disposal

At the end of the mission, Intelsat will dispose of the spacecraft by moving it to a minimum altitude of 300 kilometers above the geostationary arc. This exceeds the minimum altitude established by the IADC formula. The New Dawn design currently contemplates that 6.8 kilograms of fuel will be reserved for this purpose. The reserved fuel figure will be provided for in the propellant budget. To calculate this figure, the "rocket equation" was used, taking into account the expected mass of the satellite at the end of life and the required delta-velocity to achieve the desired orbit. The fuel gauging uncertainty has been taken into account in these calculations.

In calculating the disposal orbit, Intelsat has used simplifying assumptions as permitted under the Commission's Orbital Debris Report and Order. For reference, the effective area to mass ratios (Cr*A/M) of the New Dawn spacecraft is expected to be 0.03 m^2/kg, resulting in a minimum perigee disposal altitude under the IADC formula of at most 238.2 kilometers above the geostationary arc, which is lower than the 300 kilometer above geostationary disposal altitude specified by Intelsat in this filing. Accordingly, the New Dawn planned disposal orbit complies with the FCC's rules.

Certification Statement

I hereby certify that I am a technically qualified person and am familiar with Part 25 of the Commission's rules and regulations. The contents of this engineering statement were prepared by me or under my direct supervision and to the best of my knowledge are complete and accurate.

/s/ Jose Albuquerque	October 29, 2010
Jose Albuquerque Intelsat Corporation Senior Director, Spectrum Engineering	Date

EXHIBIT 1: SPACECRAFT CONFIGURATION

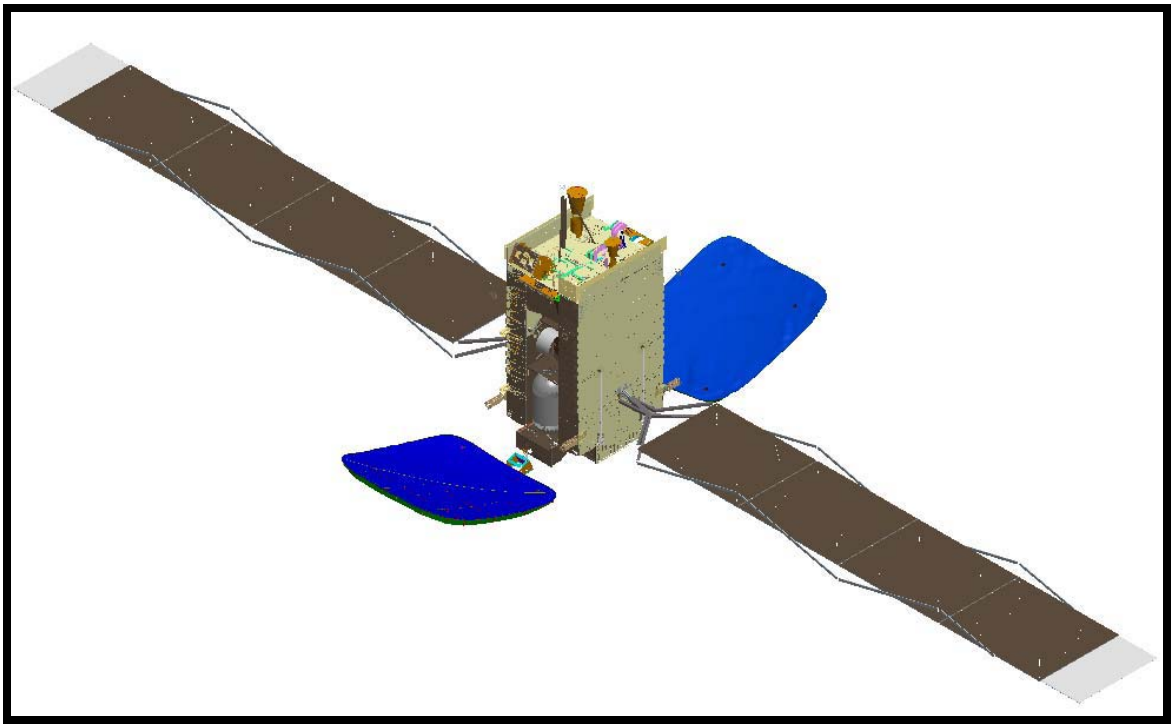


EXHIBIT 2: SUMMARY OF SPACECRAFT CHARACTERISTICS

GENERAL	
Spacecraft Name	New Dawn
Orbital Location	32.8° E.L.
Spacecraft Manufacturer	Orbital
Spacecraft Model	Star 2.4E Bus
Spacecraft Type	3-axis stabilized
Spacecraft Dimensions	
Length	23.6 meters
Width	4.9 meters
Depth	8.5 meters
Spacecraft Mass	
Mass w/o fuel	1297 kg
Mass w/ fuel	3000 kg
Spacecraft Expected Lifetime	≥ 15 years
Eclipse Capability	100%
Station-keeping	
North-South	±0.05°
East-West	±0.05°
Antenna Pointing Accuracy	
North-South	0.12°
East-West	0.12°
Rotational	0.12°
Spacecraft Reliability	68%
Payload Reliability	81.1 %
Bus Reliability	83.8 %
Propulsion Type	Bi-propellant
Maximum Solar Array Power	
Beginning of Life	7420 Watts
End of Life	6946 Watts
Deployed Area of Solar Array	31.1 m^2

EXHIBIT 2: SUMMARY OF SPACECRAFT CHARACTERISTICS
(continued)

COMMUNICATION	
Frequency Bands	
Uplink	5850 – 6500 MHz 14000 – 14500 MHz
Downlink	3625 – 4200 MHz 10950 – 11200 MHz 11450 – 11700 MHz
Polarization	
Uplink	C-Band: Right Hand Circular / Left Hand Circular Ku-Band: Horizontal / Vertical
Downlink	C-Band: Right Hand Circular / Left Hand Circular Ku-Band: Horizontal / Vertical
Coverage Area	
Uplink	C-Band: Africa, Europe and the Middle East Ku-band: Southwestern Africa
Downlink	C-Band: Africa, Europe and the Middle East Ku-band: Southwestern Africa
Beam Cross-Polarization Isolation	
Uplink	≥ 30 dB
Downlink	≥ 30 dB
Number of Channels	C-Band: 14 Ku-band: 16
Channel Bandwidth	C-Band: 72 MHz Ku-Band: 36 MHz and 72 MHz
Maximum Downlink EIRP	
Landmass A Beam (RHCP)	42.2 dBW
Landmass B Beam (LHCP)	42.2 dBW
Africa (H)	50.7 dBW
Africa (V)	51.1 dBW

EXHIBIT 2: SUMMARY OF SPACECRAFT CHARACTERISTICS (continued)

COMMUNICATION	
Maximum Uplink G/T	
Landmass A Beam (LHCP)	-0.3 dB/K
Landmass B Beam (RHCP)	-0.4 dB/K
Africa (H)	5.3 dB/K
Africa (V)	5.3 dB/K
Uplink SFD Range @ Maximum G/T	
Landmass A Beam (LHCP)	-111 to -80 dBW/m^2
Landmass B Beam (RHCP)	-111 to -80 dBW/m^2
Africa (H)	36 MHz Channel: -114.4 to -82.4 dBW/m^2 72 MHz Channel: -114.4 to -86.4 dBW/m^2
Africa (V)	36 MHz Channel: -114.4 to -82.4 dBW/m^2 72 MHz Channel: -114.4 to -86.4 dBW/m^2
Transponder Attenuation Range	
Fixed Gain Mode	C-Band Channels: 31 dB in 1 dB increments Ku-Band 36 MHz Channels: 32 dB in 1 dB increments Ku-band 72 MHz Channels: 28 dB in 1 dB increments
Automatic Level Control Mode – LTWTA IBO range	15.5 dB in 0.5 dB steps (Applicable at Ku-band only)
Transponder Gain	
Landmass A Uplink to Landmass A Downlink	135.7 – 104.7 dB
Landmass A Uplink to Africa Downlink	140.1 – 112.1 dB
Landmass B Uplink to Landmass B Downlink	135.7 – 104.7 dB
Landmass B Uplink to Africa Downlink	140.0 – 112.0 dB
Africa (H) Uplink to Africa (V) Downlink	36 MHz Channel: 143.6 – 111.6 dB 72 MHz Channel: 143.6 – 115.6 dB
Africa (H) Uplink to Landmass (A) Downlink	139.2 – 108.2 dB
Africa (V) Uplink to Africa (H) Downlink	36 MHz Channel: 143.5 – 111.5 dB 72 MHz Channel: 143.5 – 115.5 dB

EXHIBIT 2: SUMMARY OF SPACECRAFT CHARACTERISTICS (continued)

COMMUNICATION	
Unit Redundancy	
Receiver	C-Band: 4-for-2 Ku-Band: 4-for-2
Frequency Converter	C-to-Ku: 4-for-2 Ku-to-C: 2-for-1 Ku-to-Ku: 4-for-2
Amplifier	C-Band: 2x10-for-7 Ku-Band:2x11-for-8
Maximum Power of Last Amplifier Stage	C-Band: 50 Watts Ku-Band: 150 Watts
Transmit Frequency Stability	< 0.002%
TELEMETRY, COMMAND & RANGING	
Command Frequency	
Bicone Antenna	6173.7 / 6176.3 MHz
Wide Coverage Antenna	6173.7 / 6176.3 MHz
Global Horn Antenna	6173.7 / 6176.3 MHz
Command Polarization	
Bicone Antenna	Left Hand Circular
Wide Coverage Antenna	Left Hand Circular
Global Horn Antenna	Left Hand Circular
Command Carrier Modulation	FM
Command Carrier Bandwidth	
Occupied Bandwidth	860 kHz
Allocated Bandwidth	1000 kHz
Command Antennas	
Transfer Orbit / Emergency	2 Wide Coverage Antennas and a Bicone Antenna
On-Station	Global Coverage Antenna and 2 Wide Coverage Antenna
Command Threshold at Beam Peak	
Bicone Antenna	-97.4 dBW/m^2
Wide Coverage Antenna	-107.1 dBW/m^2
Global Horn Antenna	-116.2 dBW/m^2

EXHIBIT 2: SUMMARY OF SPACECRAFT CHARACTERISTICS (continued)

TELEMETRY, COMMAND & RANGING	
Command G/T at Beam Peak	
Bicone Antenna	-36.9 dB/K
Wide Coverage Antenna	-27.2 dB/K
Global Horn Antenna	-18.1 dB/K
Telemetry Frequency	
Bicone Antenna	3947.5 / 3952.5 MHz
Wide Coverage Antenna	3947.5 / 3952.5 MHz
Global Horn Antenna	3947.5 / 3952.5 MHz
Telemetry Polarization	
Bicone Antenna	Right Hand Circular
Wide Coverage Antenna	Right Hand Circular
Global Horn Antenna	Right Hand Circular
Telemetry Modulation	PM
Telemetry Carrier Bandwidth	
Occupied Bandwidth	300 kHz
Allocated Bandwidth	500 kHz
Telemetry Antenna	
Transfer Orbit / Emergency	2 Wide Coverage Antennas and a Bicone Antenna
On-Station	Global Horn Antenna
Telemetry EIRP at Beam Peak	
Bicone Antenna	7.1 dBW
Wide Coverage Antenna	15.0 dBW
Global Horn Antenna	12.5 dBW
Ranging Accuracy	≤ 10 meters
ULPC	
Frequency	C-Band: 3950 MHz Ku-Band: 11198 / 11452 MHz
Polarization	C-Band: Vertical Ku-Band: Right Hand Circular
Coverage Area	Global
Channel Bandwidth	≤ 25 kHz
Maximum Downlink EIRP	C-Band: 11.4 dBW Ku-Band: 13.9 dBW

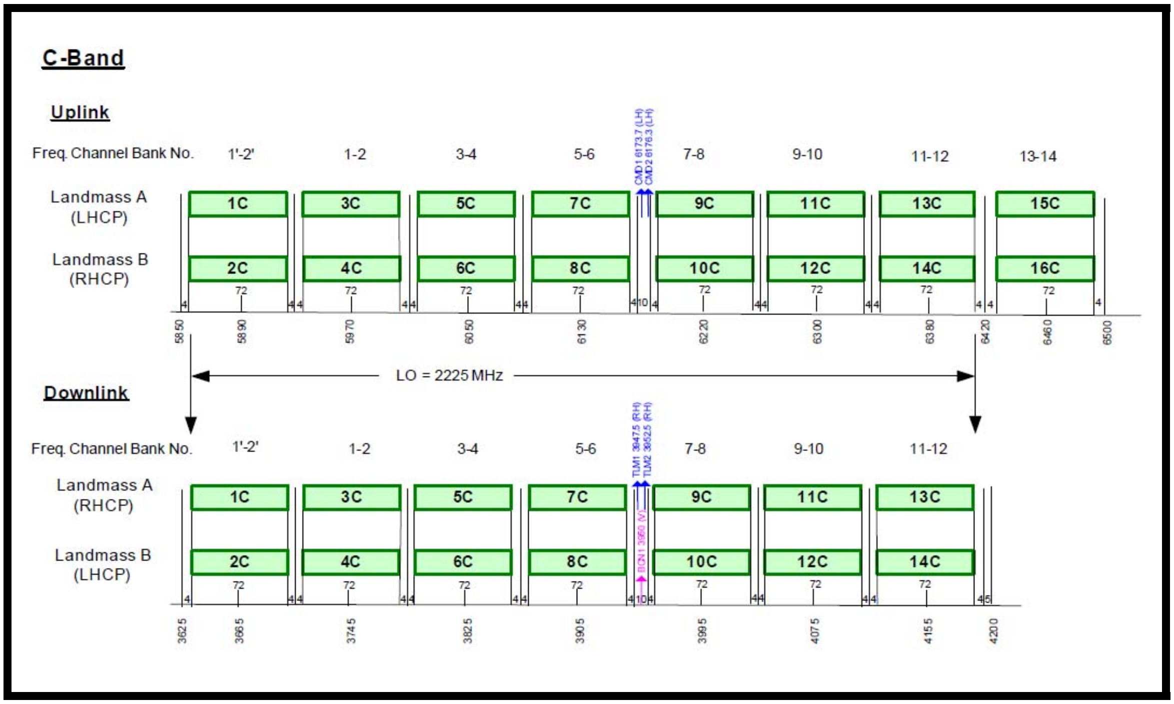
EXHIBIT 3: SPACECRAFT MASS BUDGET

Mass of Spacecraft without Fuel (kg)	1278
Mass of Fuel and Disposables (kg)	1722
Launch Mass (kg)	3000
Mass of Fuel, in orbit, at Beginning of Life (kg)	578

EXHIBIT 4: SPACECRAFT POWER BUDGET

	BEGINNING OF LIFE		END OF LIFE	
	AUTUMN EQUINOX	SUMMER SOLSTICE	AUTUMN EQUINOX	SUMMER SOLSTICE
PAYLOAD (WATTS)	4818	4818	4818	4818
BUS (WATTS)	372	307	372	307
TOTAL POWER (WATTS)	5190	5125	5190	5125
SOLAR ARRAY POWER (WATTS)	7420	6653	6946	6400
DEPTH OF BATTERY DISCHARGE (%)	45.1%	N/A	70.1%	N/A

EXHIBIT 5A: FREQUENCY PLAN



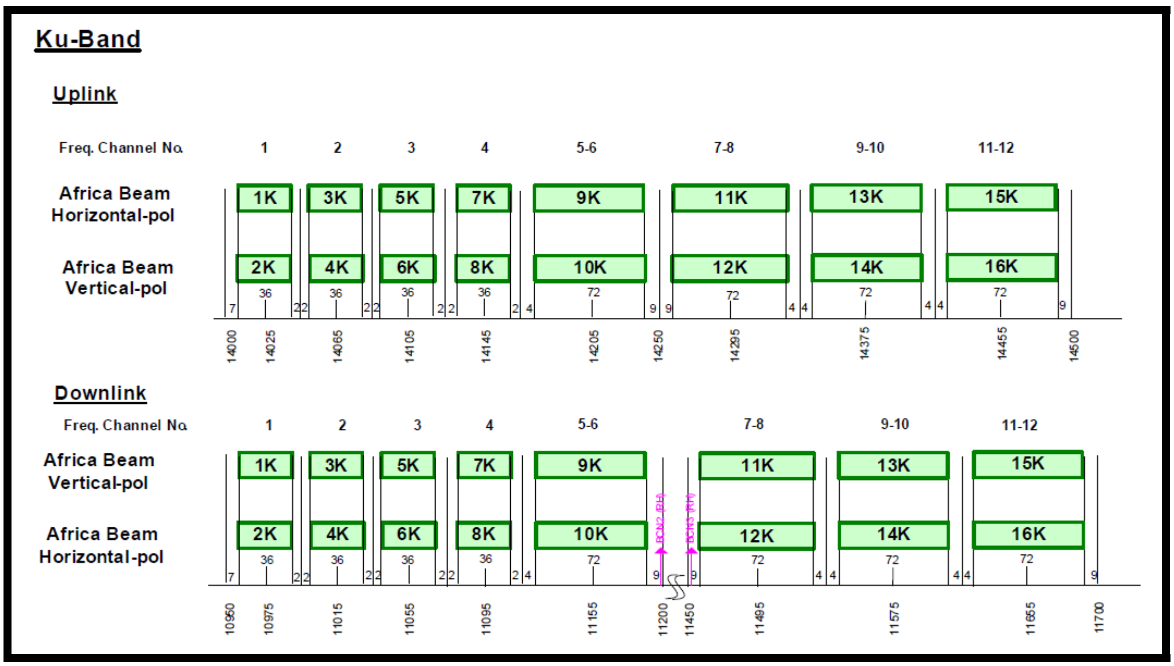


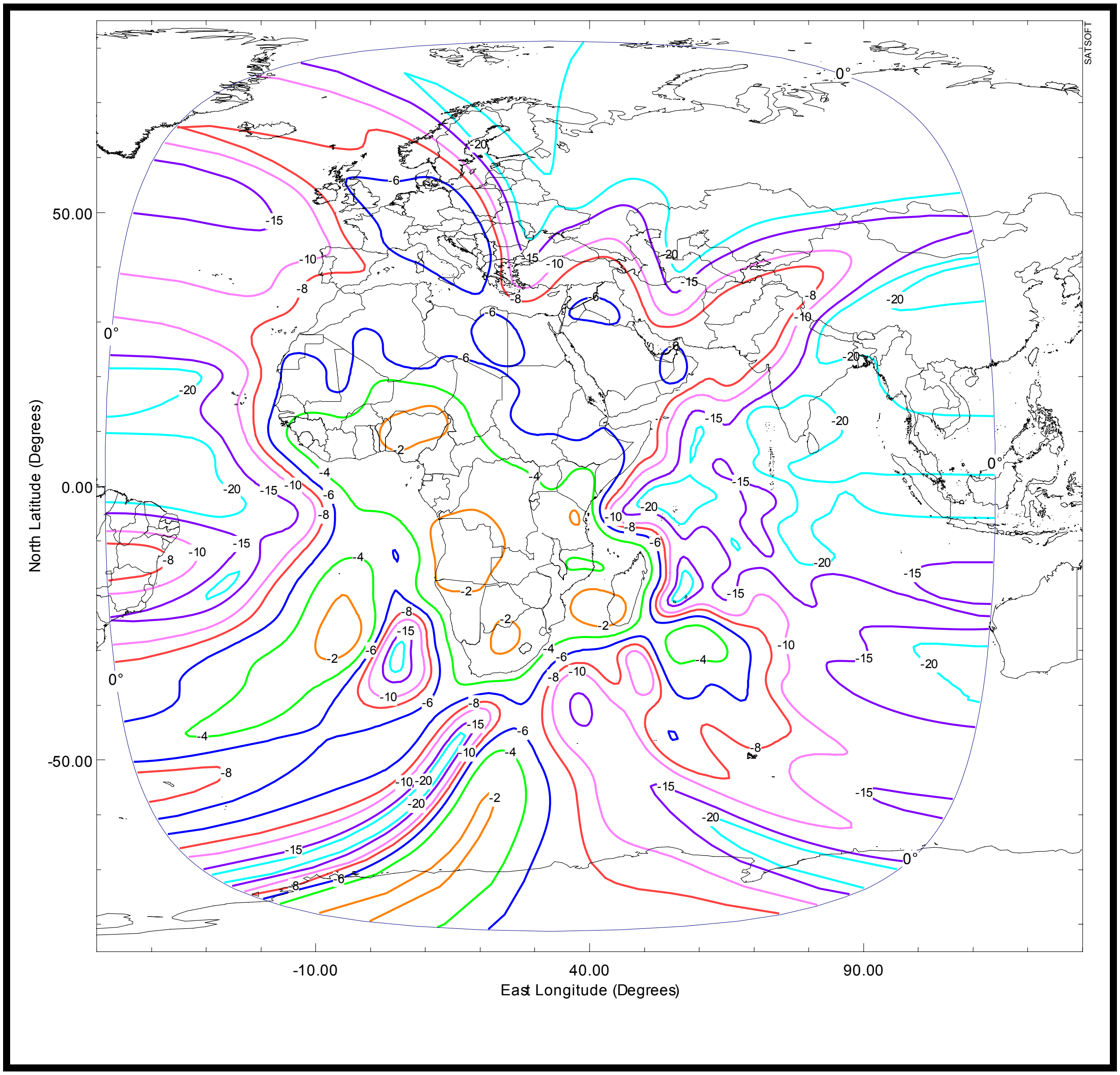
EXHIBIT 5B: FREQUENCY ASSIGNMENTS

Uplink Channel Designation	Uplink Beam Name	Uplink Beam Polarization	Uplink Center Frequency (MHz)	Downlink Channel Designation	Downlink Beam Name	Downlink Beam Polarization	Downlink Center Frequency (MHz)	Channel Bandwidth (MHz)	Maximum Channel Gain (dB)
1C	Landmass A	LHCP	5890	1C	Landmass A	RHCP	3665	72	135.7
3C	Landmass A	LHCP	5970	3C	Landmass A	RHCP	3745	72	135.7
5C	Landmass A	LHCP	6050	5C	Landmass A	RHCP	3825	72	135.7
7C	Landmass A	LHCP	6130	7C	Landmass A	RHCP	3905	72	135.7
9C	Landmass A	LHCP	6220	9C	Landmass A	RHCP	3995	72	135.7
11C	Landmass A	LHCP	6300	11C	Landmass A	RHCP	4075	72	135.7
				11K	Africa	V	11495	72	140.1
13C	Landmass A	LHCP	6380	13C	Landmass A	RHCP	4155	72	135.7
				13K	Africa	V	11575	72	140.1
15C	Landmass A	LHCP	6460	15K	Africa	V	11655	72	140.1
2C	Landmass B	RHCP	5890	2C	Landmass B	LHCP	3665	72	135.7
4C	Landmass B	RHCP	5970	4C	Landmass B	LHCP	3745	72	135.7
6C	Landmass B	RHCP	6050	6C	Landmass B	LHCP	3825	72	135.7
8C	Landmass B	RHCP	6130	8C	Landmass B	LHCP	3905	72	135.7
10C	Landmass B	RHCP	6220	10C	Landmass B	LHCP	3995	72	135.7
12C	Landmass B	RHCP	6300	12C	Landmass B	LHCP	4075	72	135.7
14C	Landmass B	RHCP	6380	14C	Landmass B	LHCP	4155	72	135.7
				14K	Africa	H	11575	72	140.0
16C	Landmass B	RHCP	6460	16K	Africa	H	11655	72	140.0
1K	Africa	H	14025	1K	Africa	V	10975	36	143.6
3K	Africa	H	14065	3K	Africa	V	11015	36	143.6
5K	Africa	H	14105	5K	Africa	V	11055	36	143.6
7K	Africa	H	14145	7K	Africa	V	11095	36	143.6
9K	Africa	H	14205	9K	Africa	V	11155	72	143.6
11K	Africa	H	14295	11K	Africa	V	11495	72	143.6
				11C	Landmass A	RHCP	4075	72	139.2
13K	Africa	H	14375	13K	Africa	V	11575	72	143.6
				13C	Landmass A	RHCP	4155	72	139.2
15K	Africa	H	14455	15K	Africa	V	11655	72	143.6
2K	Africa	V	14025	2K	Africa	H	10975	36	143.5
4K	Africa	V	14065	4K	Africa	H	11015	36	143.5
6K	Africa	V	14105	6K	Africa	H	11055	36	143.5
8K	Africa	V	14145	8K	Africa	H	11095	36	143.5
10K	Africa	V	14205	10K	Africa	H	11155	72	143.5
12K	Africa	V	14295	12K	Africa	H	11495	72	143.5
14K	Africa	V	14375	14K	Africa	H	11575	72	143.5
16K	Africa	V	14455	16K	Africa	H	11655	72	143.5
CMD 1	Global (Horn)	LHCP	6173.7					1	
CMD 2	Global (Horn)	LHCP	6176.3					1	
CMD 3	Global (WCA)	LHCP	6173.7					1	
CMD 4	Global (WCA)	LHCP	6176.3					1	
CMD 5	Global (Omni)	LHCP	6173.7					1	
CMD 6	Global (Omni)	LHCP	6176.3					1	
				TLM 1	Global (Horn)	RHCP	3947.5	0.5	
				TLM 2	Global (Horn)	RHCP	3952.5	0.5	
				TLM 3	Global (WCA)	RHCP	3947.5	0.5	
				TLM 4	Global (WCA)	RHCP	3952.5	0.5	
				TLM 5	Global (Omni)	RHCP	3947.5	0.5	
				TLM 6	Global (Omni)	RHCP	3952.5	0.5	
				UPC 1	Global	V	3950	0.025	
				UPC 2	Global	RHCP	11198	0.025	
				UPC 3	Global	RHCP	11452	0.025	

H: Horizontal Polarization **V:** Vertical Polarization
RCHP: Right Hand Circular Polarization **LHCP:** Left Hand Circular Polarization

EXHIBIT 6A: LANDMASS A RECEIVE BEAM

Beam Polarization: Left Hand Circular
Peak Antenna Gain: 27.1 dBi
Peak G/T: -0.3 dB/K
Saturated Flux Density at Peak G/T: -111 to -80 dBW/m^2
(Schedule S Beam Designation: LLUP)



Note: When the channel is operating in the C-to-Ku mode, the beam peak SFD ranges from -111 to -83 dBW/m^2.

EXHIBIT 6B: LANDMASS B RECEIVE BEAM

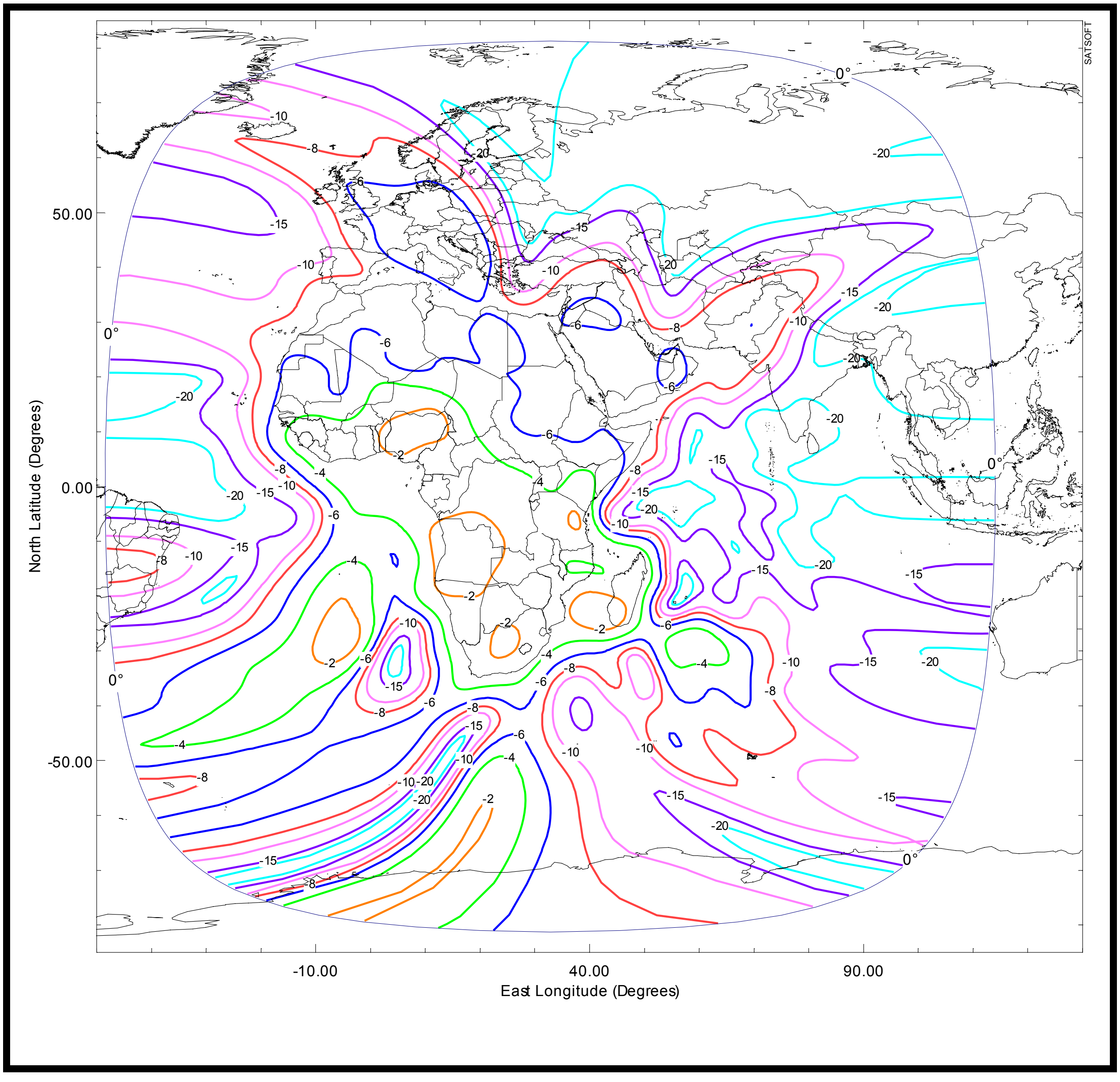
Beam Polarization: Right Hand Circular

Peak Antenna Gain: 27.1 dBi

Peak G/T: -0.4 dB/K

Saturated Flux Density at Peak G/T: -111 to -80 dBW/m^2

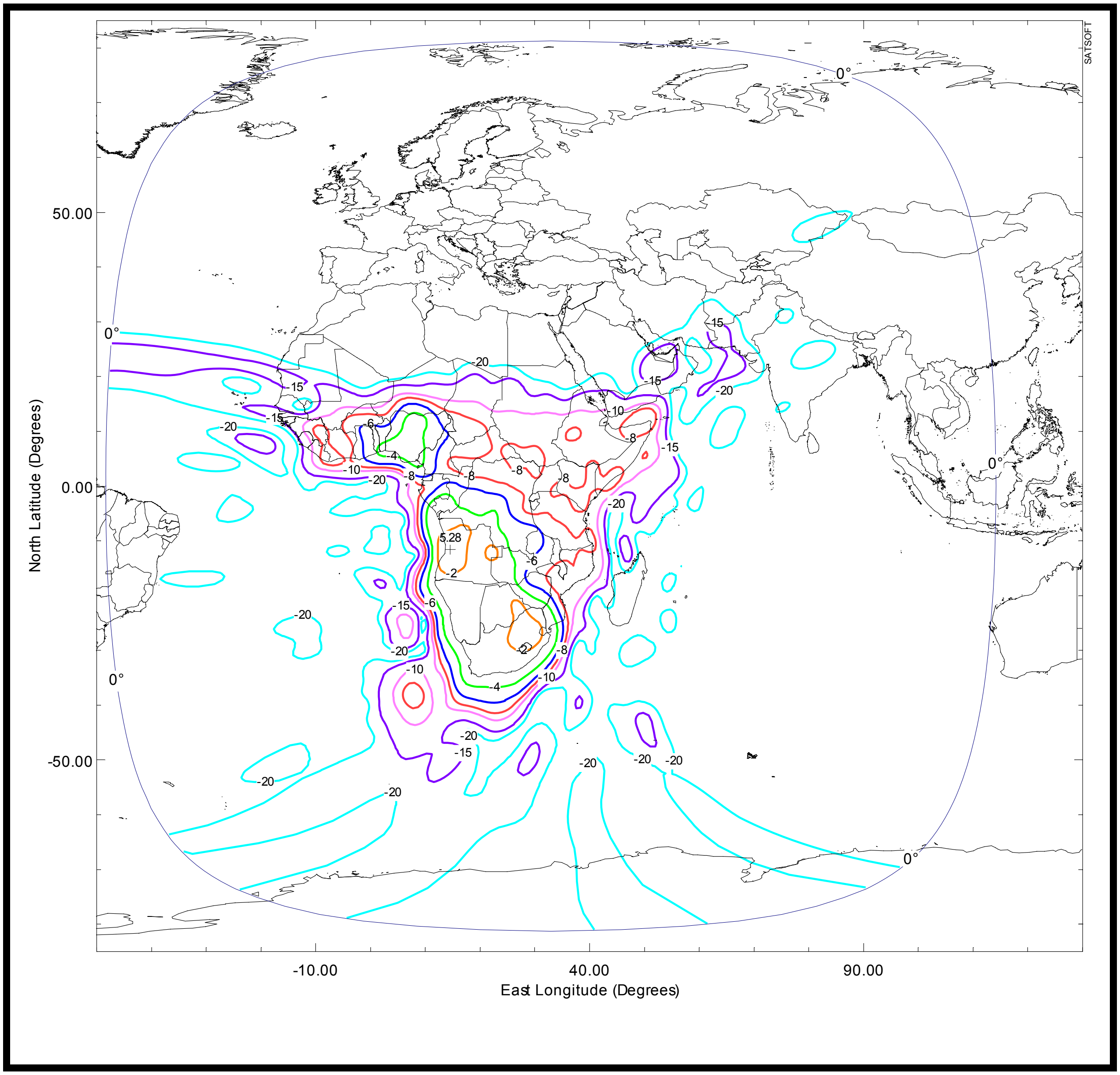
(Schedule S Beam Designation: LRUP)



Note: When the channel is operating in the C-to-Ku mode, the beam peak SFD ranges from -111 to -83 dBW/m^2.

EXHIBIT 6C: AFRICA RECEIVE BEAM

Beam Polarization: Horizontal
Peak Antenna Gain: 33.8 dBi
Peak G/T: 5.3 dB/K
Saturated Flux Density at Peak G/T: -114.4 to -82.4 dBW/m^2 [36 MHz Channels]
-114.4 to -86.4 dBW/m^2 [72 MHz Channels]
(Schedule S Beam Designation: AHUP)



Note: When the channel is operating in the Ku-to-C mode, the beam peak SFD ranges from -110.9 to -79.9 dBW/m^2.

EXHIBIT 6D: AFRICA RECEIVE BEAM

Beam Polarization: Vertical
Peak Antenna Gain: 33.8 dBi
Peak G/T: 5.3 dB/K
Saturated Flux Density at Peak G/T: -114.4 to -82.4 dBW/m^2 [36 MHz Channels]
-114.4 to -86.4 dBW/m^2 [72 MHz Channels]
(Schedule S Beam Designations: AVUP)

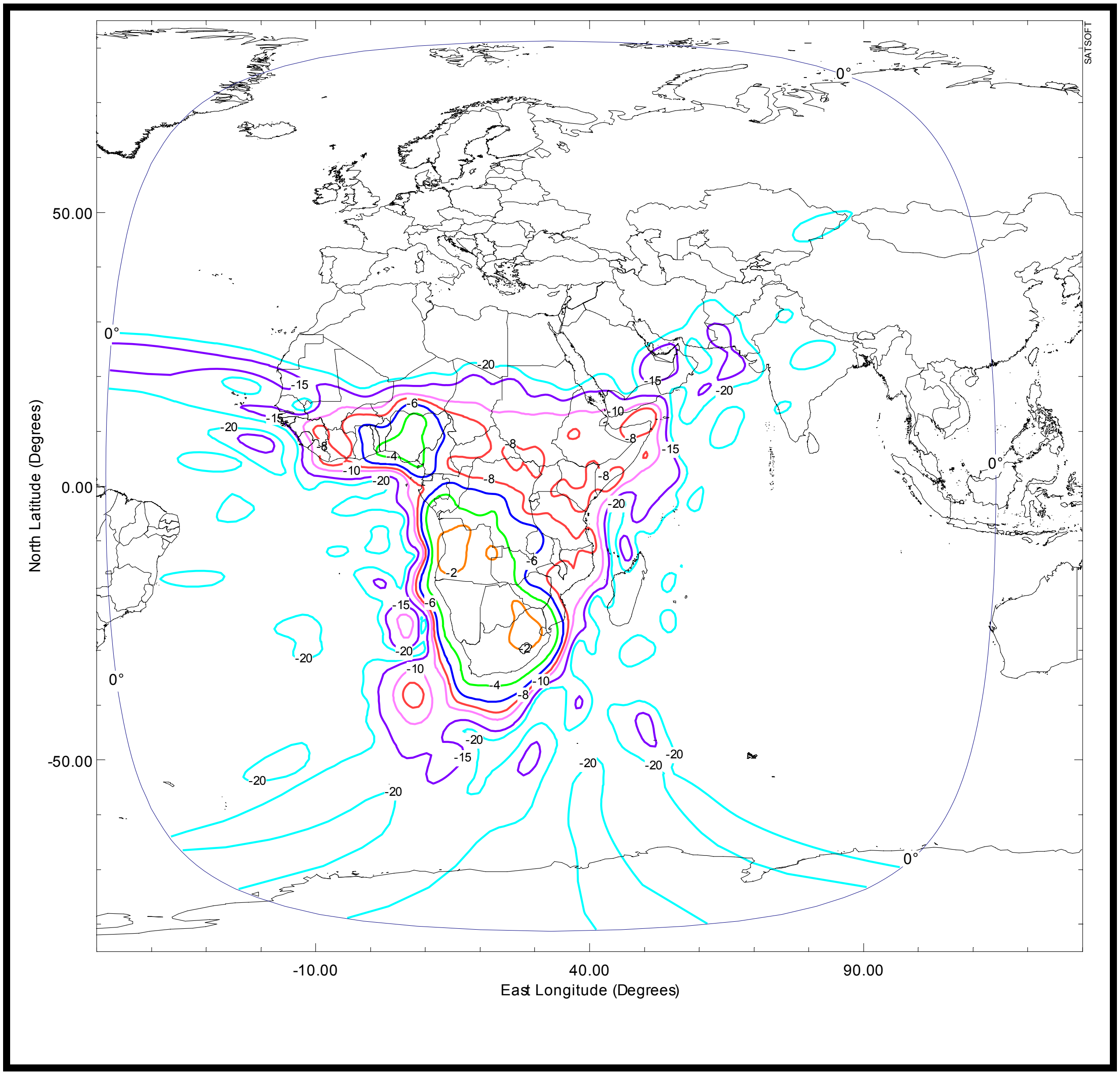


EXHIBIT 6E: LANDMASS A TRANSMIT BEAM

Beam Polarization: Right Hand Circular

Peak Antenna Gain: 27.7 dBi

Peak EIRP: 42.2 dBW

(Schedule S Beam Designation: LRDN)

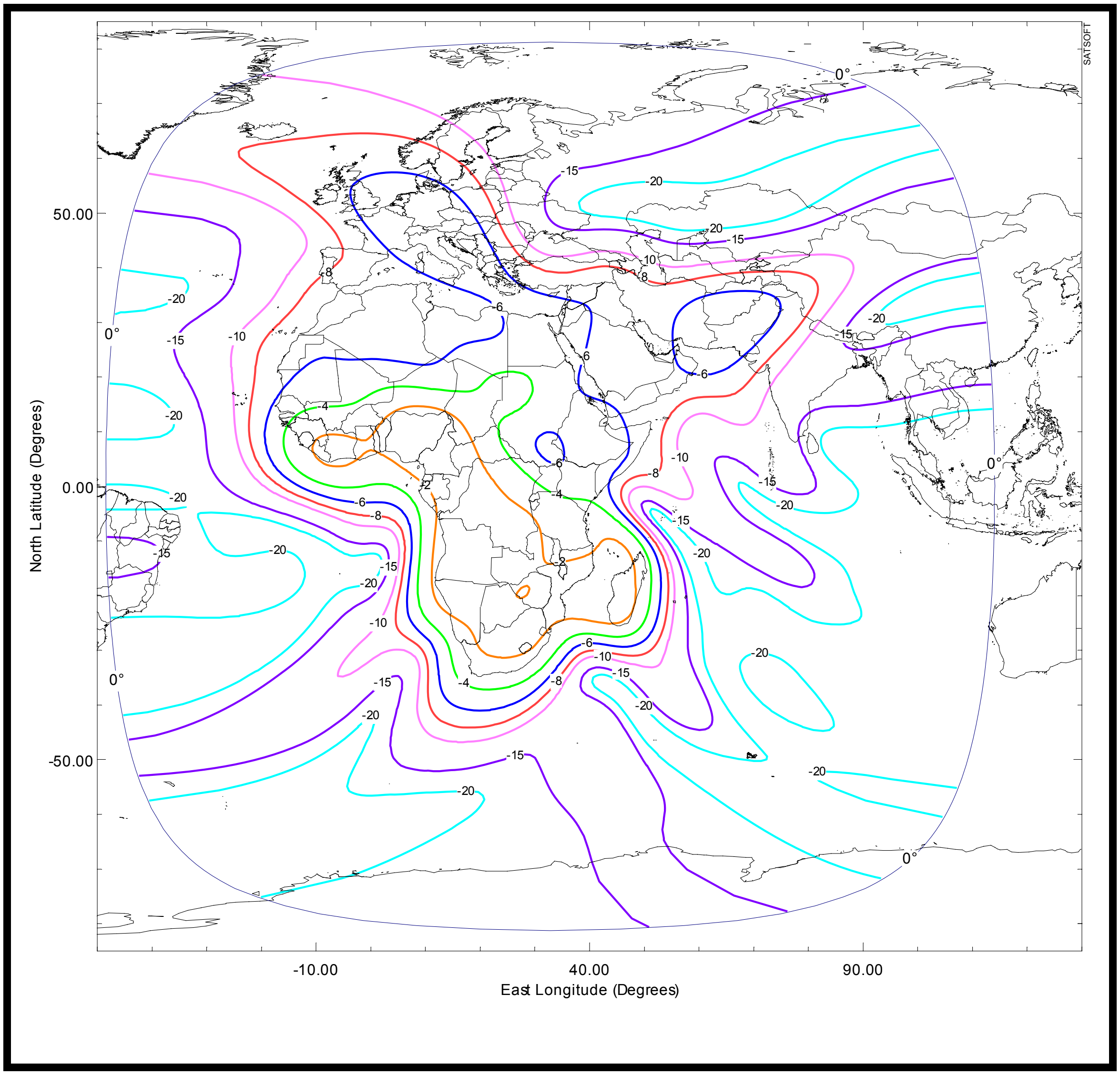


EXHIBIT 6F: LANDMASS B TRANSMIT BEAM

Beam Polarization: Left Hand Circular

Peak Antenna Gain: 27.7 dBi

Peak EIRP: 42.2 dBW

(Schedule S Beam Designation: LLDN)

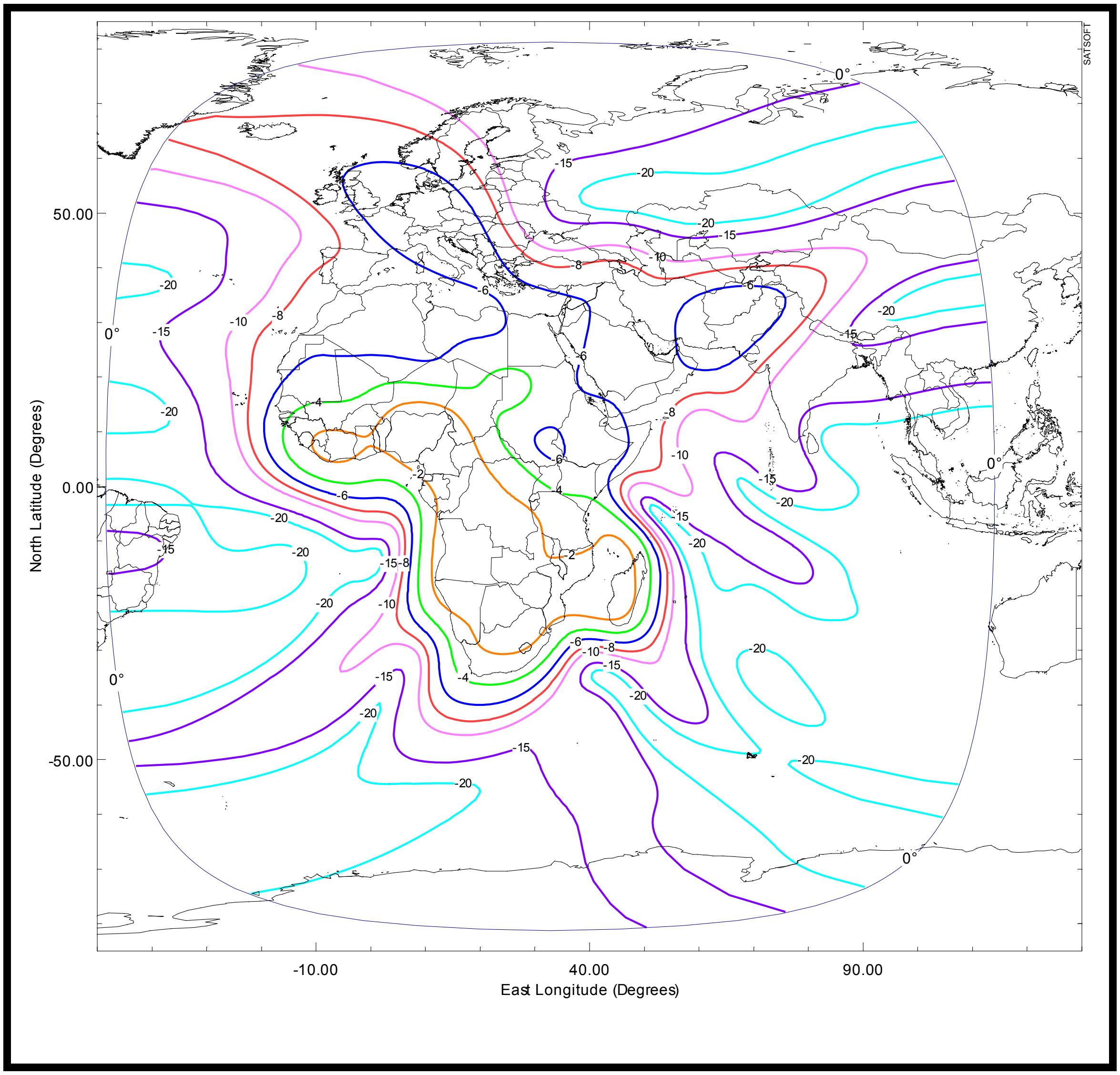


EXHIBIT 6G: AFRICA TRANSMIT BEAM

Beam Polarization: Horizontal
Peak Antenna Gain: 31.9 dBi
Peak EIRP: 50.7 dBW
(Schedule S Beam Designation: AHDN)

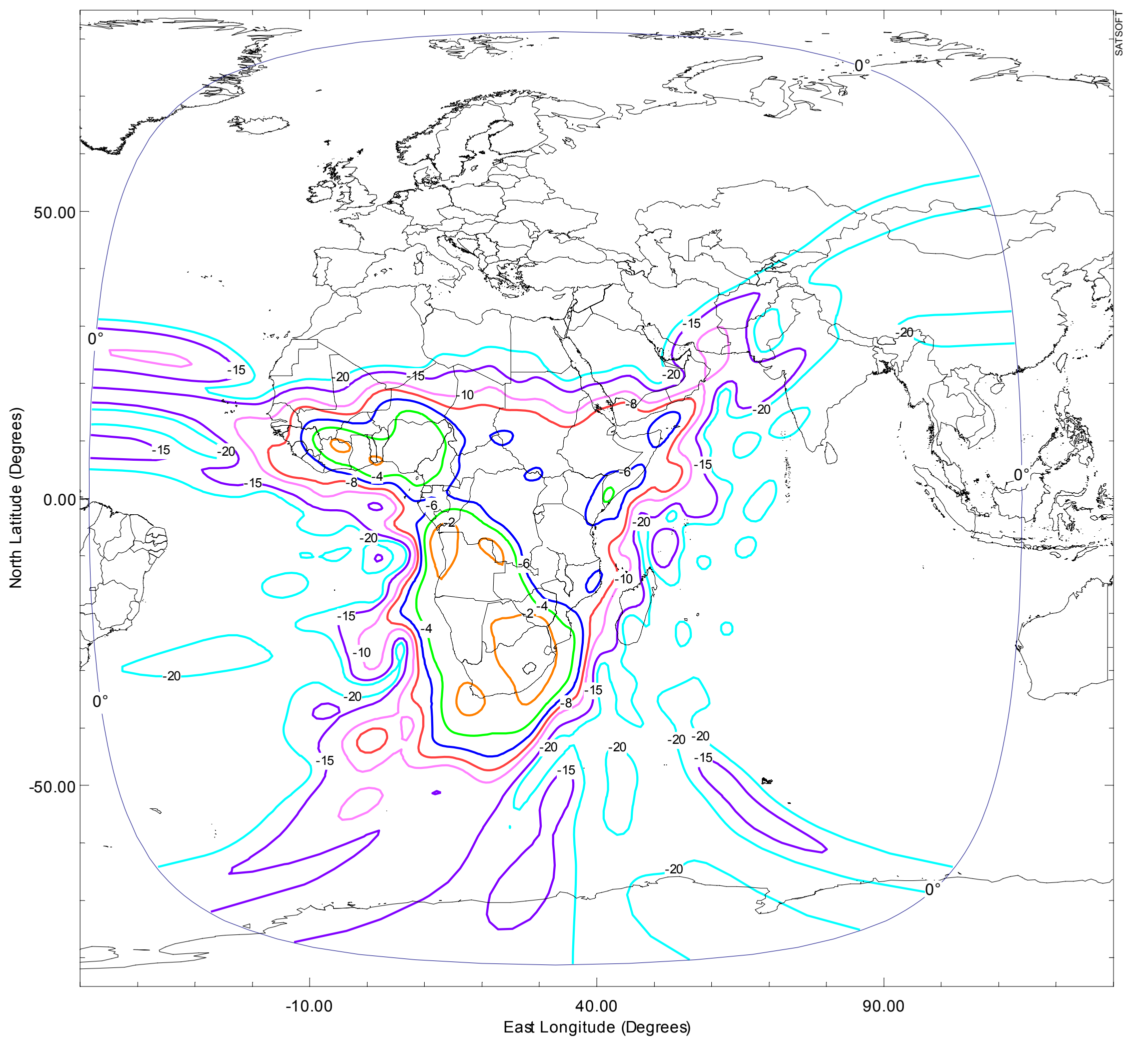


EXHIBIT 6H: AFRICA TRANSMIT BEAM

Beam Polarization: Vertical
Peak Antenna Gain: 32.2 dBi
Peak EIRP: 51.1 dBW
(Schedule S Beam Designation: AVDN)

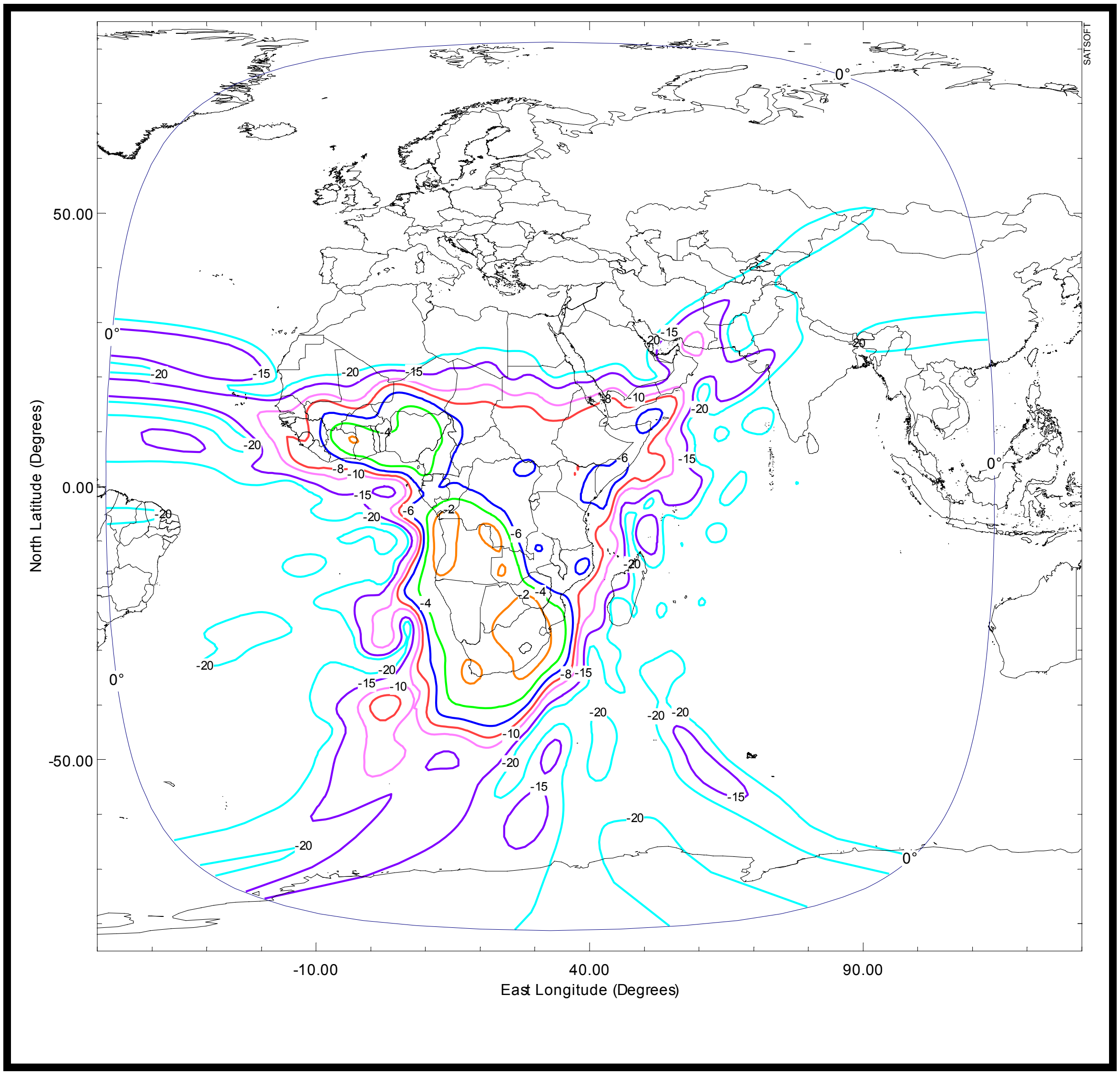


EXHIBIT 6I: ON-STATION COMMAND BEAM

Beam Polarization: Left Hand Circular
Peak Antenna Gain: 20.8 dBi
Peak G/T: -18.1 dB/K
Command Threshold Flux Density at Peak G/T: -116.2 dBW/m^2
(Schedule S Beam Designations: CMDG)

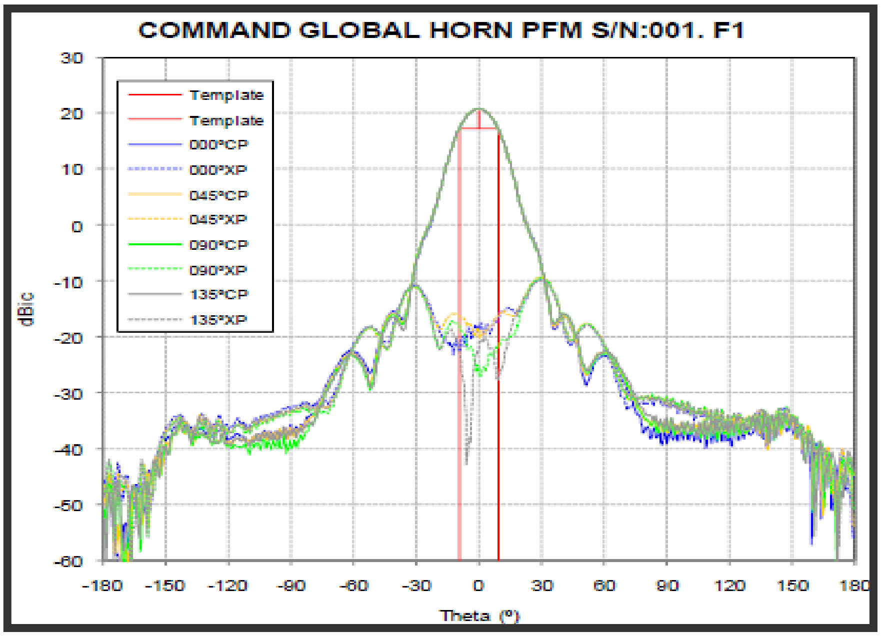


EXHIBIT 6J: WIDE COVERAGE ANTENNA COMMAND BEAM

Beam Polarization: Left Hand Circular

Peak Antenna Gain: 13.6 dBi

Peak G/T: -27.2 dB/K

Command Threshold Flux Density at Peak G/T: -107.1 dBW/m^2

(Schedule S Beam Designations: CMDW)

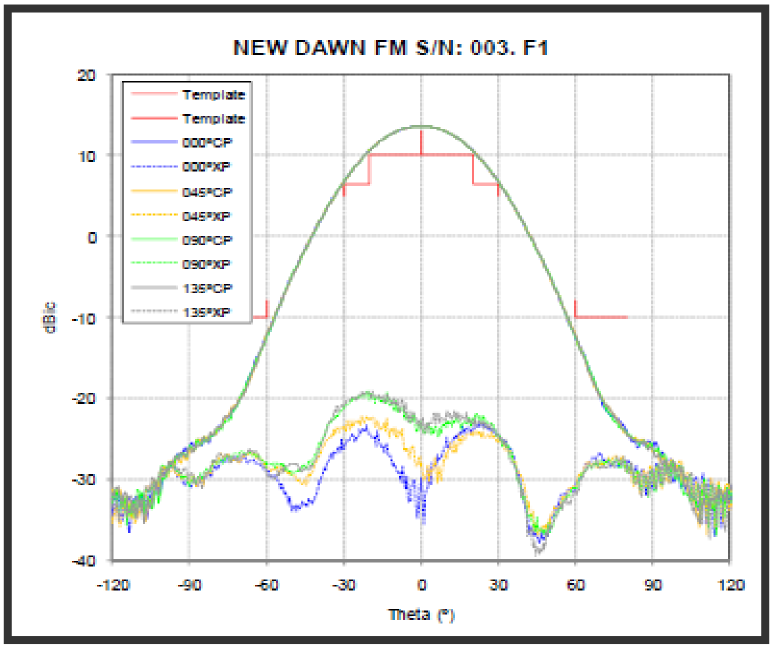


EXHIBIT 6K: BICONE ANTENNA COMMAND BEAM

Beam Polarization: Left Hand Circular

Peak Antenna Gain: 2.5 dBi

Peak G/T: -36.9 dB/K

Command Threshold Flux Density at Peak G/T: -97.4 dBW/m^2

(Schedule S Beam Designations: CMDO)

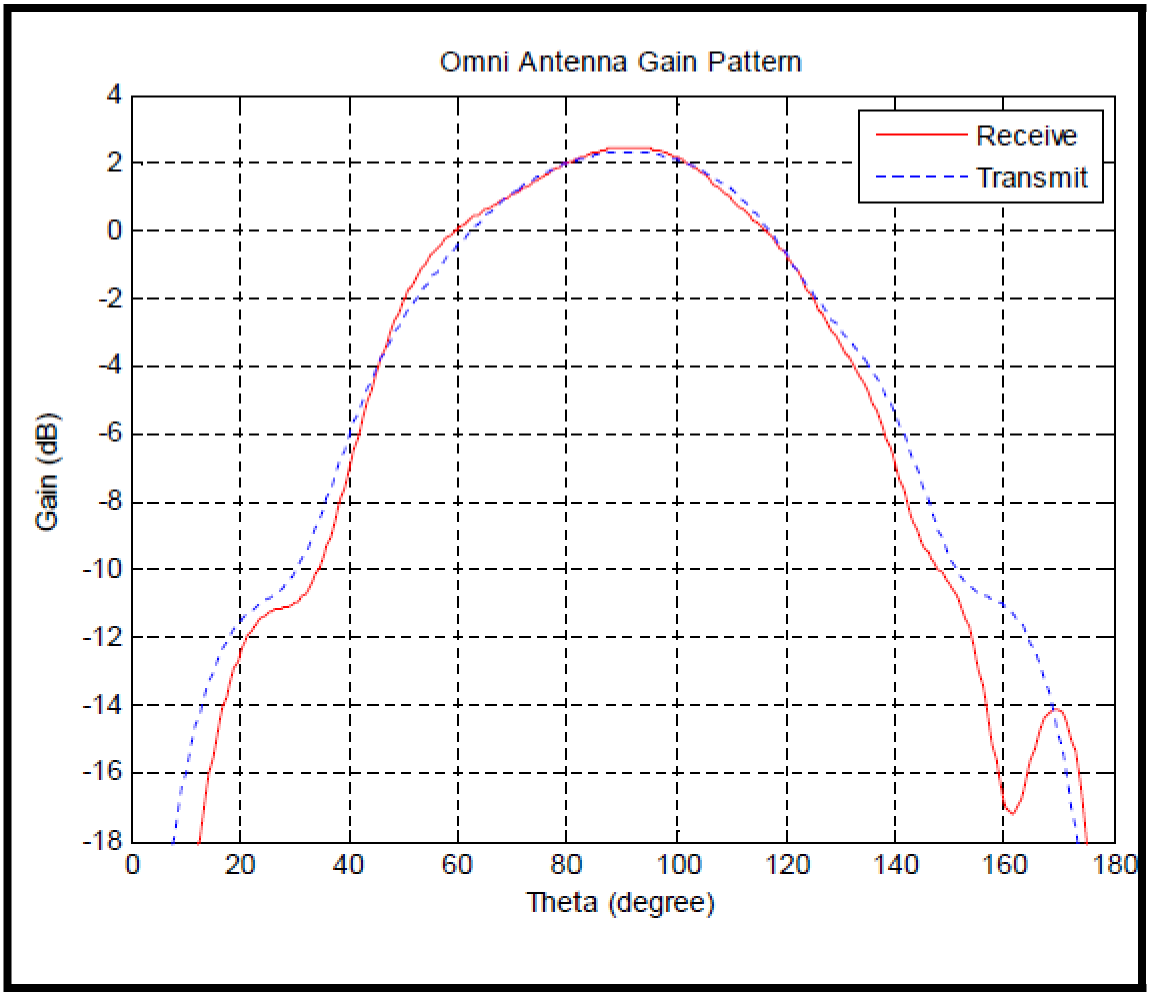


EXHIBIT 6L: ON-STATION TELEMETRY BEAM

Beam Polarization: Right Hand Circular

Peak Antenna Gain: 20.2 dBi

Peak EIRP: 12.5 dBW

(Schedule S Beam Designation: TLMG)

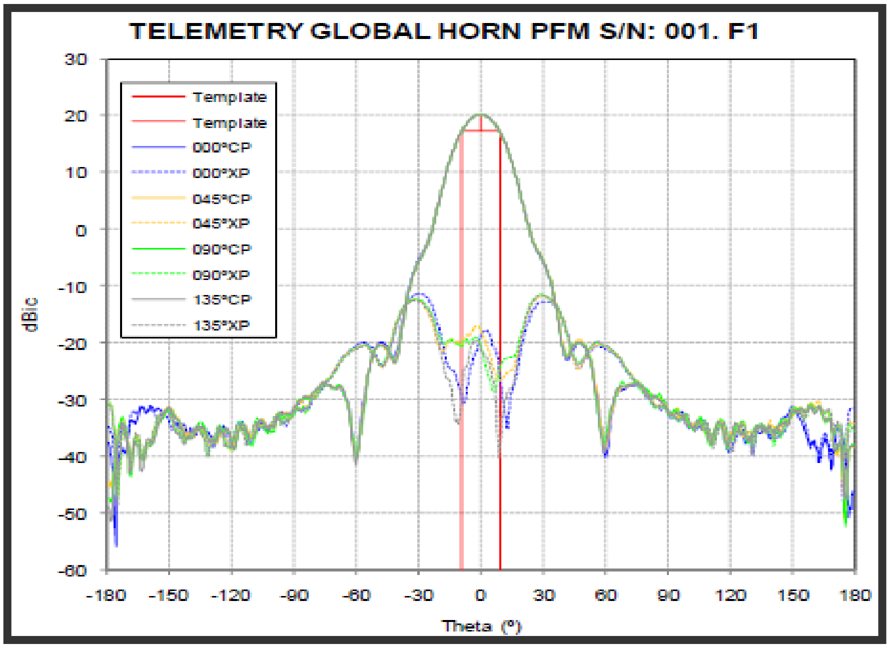


EXHIBIT 6M: WIDE COVERAGE ANTENNA TELEMETRY BEAM

Beam Polarization: Right Hand Circular
Peak Antenna Gain: 13.3 dBi
Peak EIRP: 15.0 dBW
(Schedule S Beam Designation: TLMW)

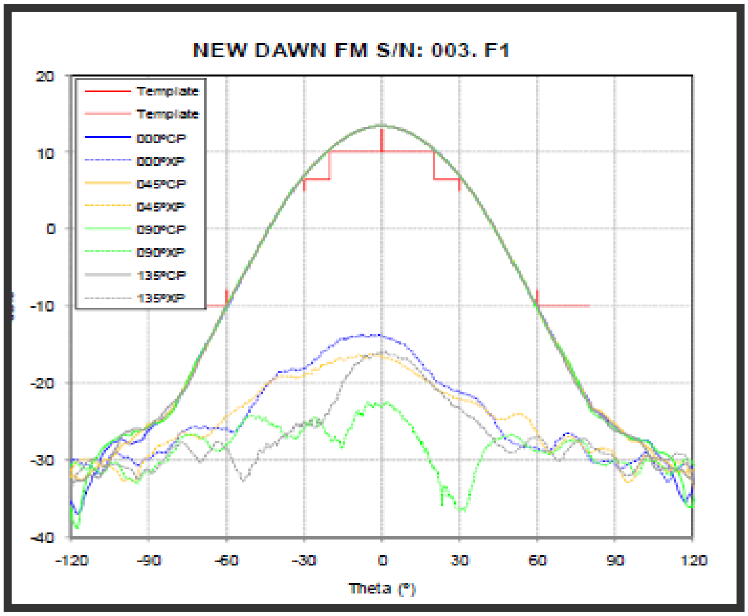


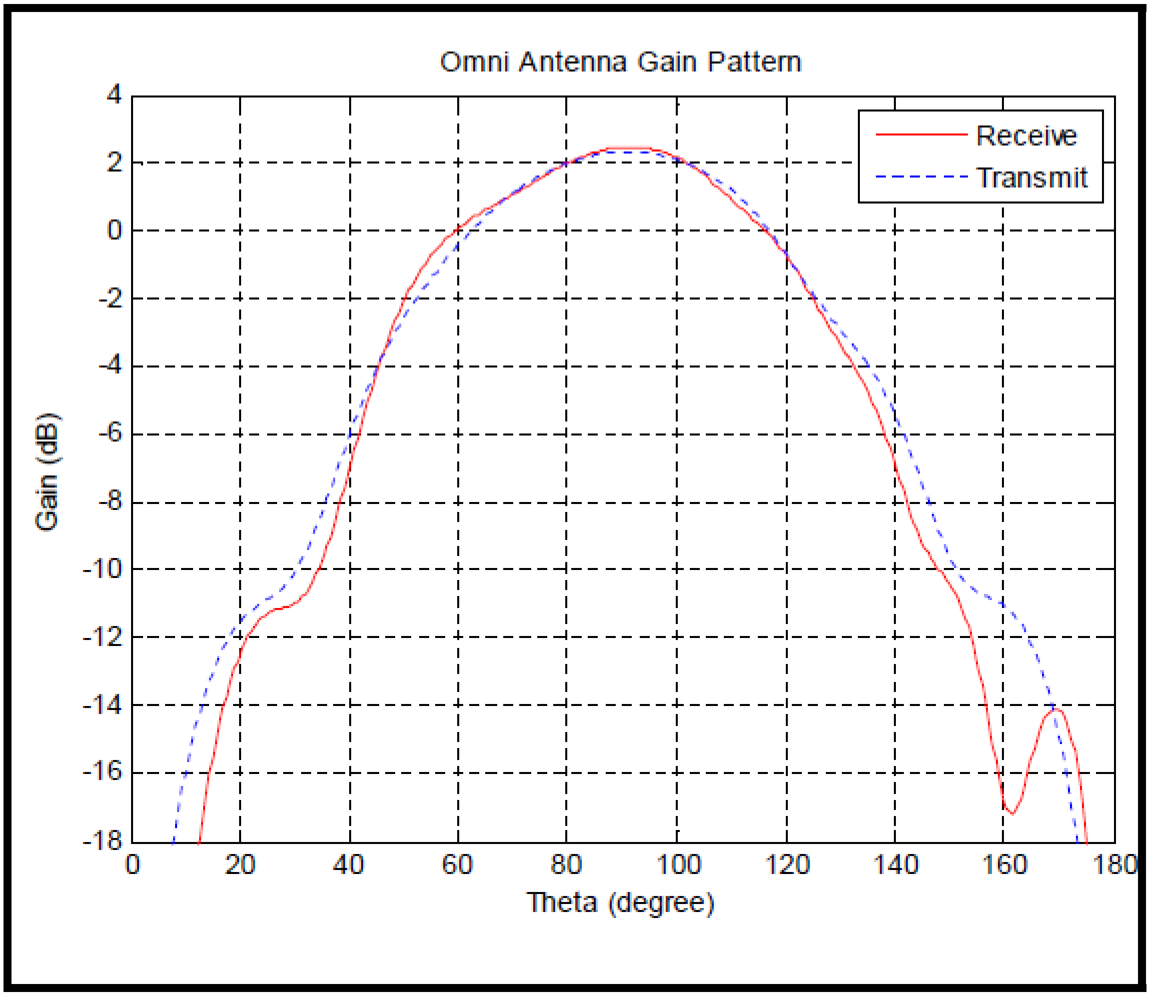
EXHIBIT 6N: BICONE ANTENNA TELEMETRY BEAM

Beam Polarization: Right Hand Circular

Peak Antenna Gain: 2.3 dBi

Peak EIRP: 7.1 dBW

(Schedule S Beam Designation: TLMO)



<u>**EXHIBIT 6O: C-BAND ULPC BEAM**</u>

Beam Polarization: Vertical
Peak Antenna Gain: 13.0 dBi
Peak EIRP: 11.4 dBW
(Schedule S Beam Designation: UPCC)

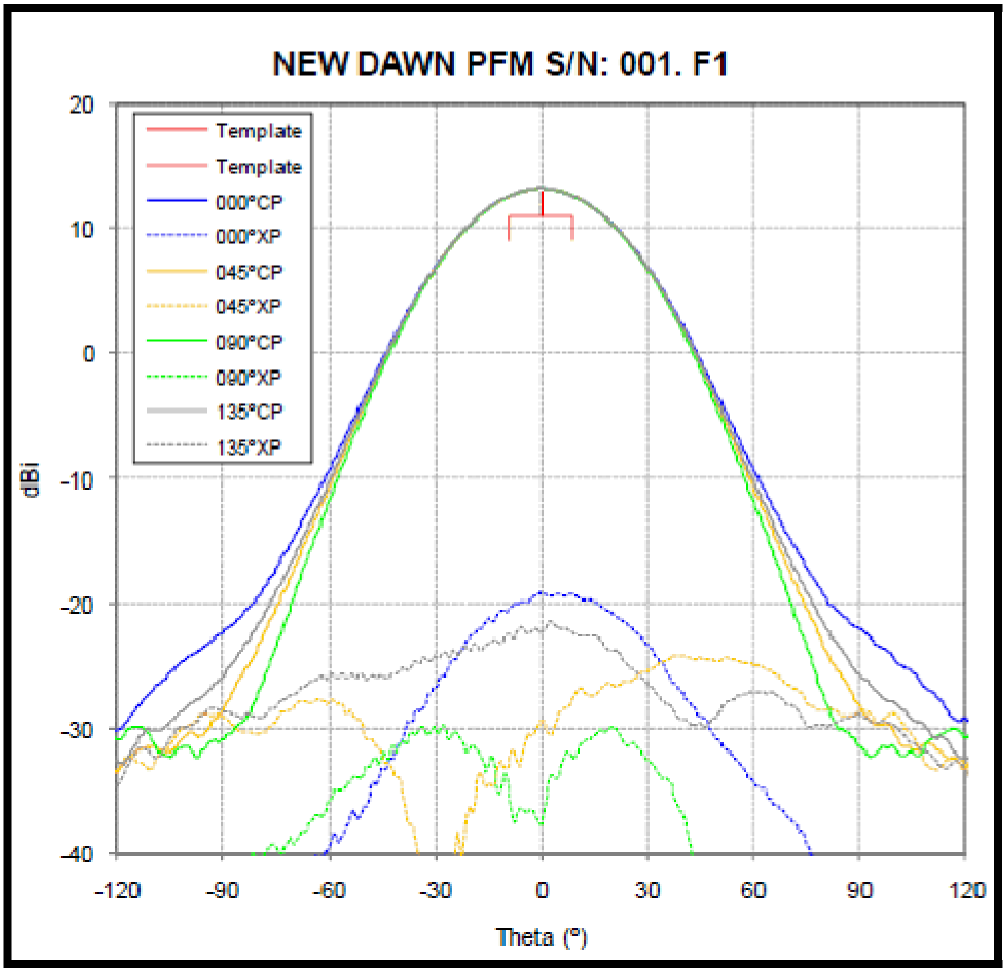


EXHIBIT 6P: Ku-BAND ULPC BEAM

Beam Polarization: Right Hand Circular

Peak Antenna Gain: 20.6 dBi

Peak EIRP: 13.9 dBW

(Schedule S Beam Designation: UPCK)

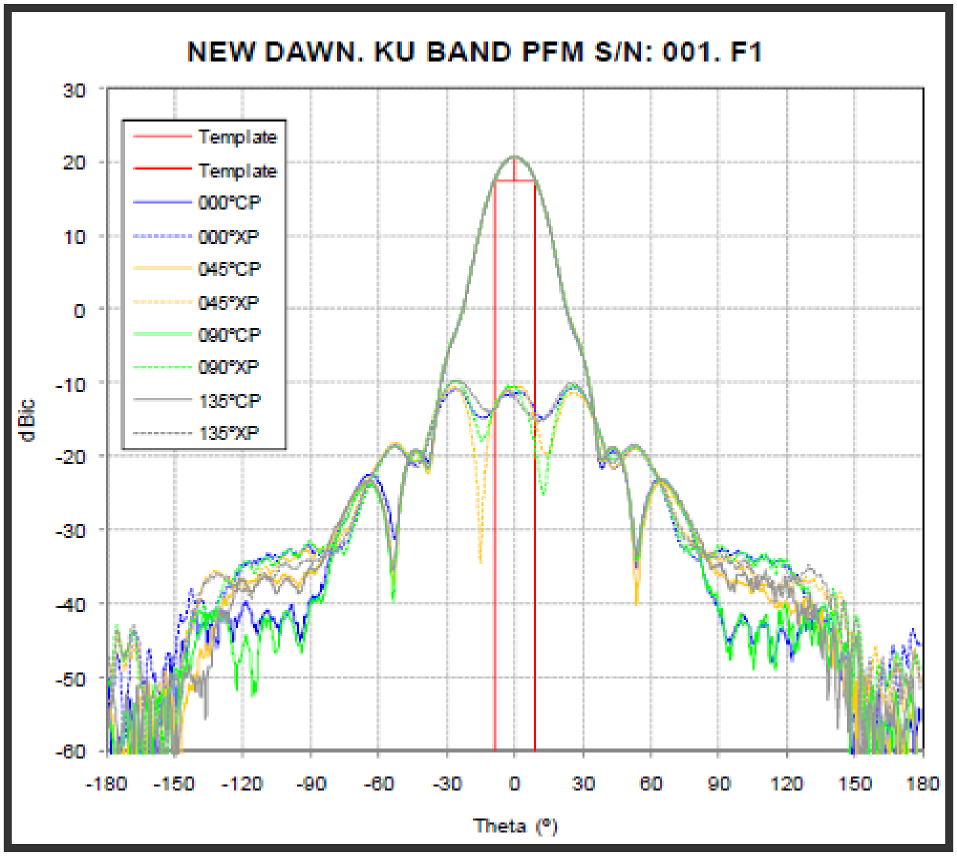


EXHIBIT 7: COMMUNICATION SUBSYSTEM EIRP AND G/T BUDGETS

Frequency Band (MHz)	5850 - 6500	5850 - 6500	14000 - 14500	14000 - 14500		
Uplink Beam Name	Landmass A	Landmass B	Africa	Africa		
Uplink Beam Polarization	LHCP	RHCP	H	V		
Antenna Noise Temperature (ºKelvin)	150	150	200	200		
Receiver Noise Temperature (ºKelvin)	400	412	508	508		
Total System Noise Temperature (ºKelvin)	550	562	708	708		
Total System Noise Temperature (ºdB-K)	27.4	27.5	28.5	28.5		
Peak Antenna Gain (dBi)	27.1	27.1	33.8	33.8		
Beam Peak G/T (dB/K)	-0.3	-0.4	5.3	5.3		
Beam Peak Minimum SFD (dBW/m^2)	-111.0	-111.0	-114.4	-114.4		
Frequency Band (MHz)	3625 - 4200	3625 - 4200	10950 - 11200 11450 - 11700	10950 - 11200 11450 - 11700	3950	11198 11452
Downlink Beam Name	Landmass A	Landmass B	Africa	Africa	C-Band ULPC	Ku-Band ULPC
Downlink Beam Polarization	RHCP	LHCP	V	H	Vertical	RHCP
Transmitter Output Power (Watts)	50.0	50.0	150	150	1.0	0.4
Transmitter Output Power (dBW)	17.0	17.0	21.8	21.8	0.0	-3.8
Line Loss (dB)	2.5	2.5	2.9	3.0	1.6	2.9
Power At Antenna Input (dBW)	14.5	14.5	18.9	18.8	-1.6	-6.7
Power At Antenna Input (Watts)	28.2	28.2	77.6	75.9	0.7	0.2
Peak Antenna Gain (dBi)	27.7	27.7	32.2	31.9	13.0	20.6
Beam Peak EIRP (dBW)	42.2	42.2	51.1	50.7	11.4	13.9

H: Horizontal Polarization   **V:** Vertical Polarization
RHCP: Right Hand Circular Polarization   **LHCP**: Left Hand Circular Polarization

EXHIBIT 8: TC&R SUBSYSTEM CHARACTERISTICS

	Spacecraft Antenna		
	Global	**WCA**	**Bicone**
Command Frequency (MHz) / Polarization (see note)			
Transfer Orbit / Emergency	n/a	6173.7 (LHCP) 6176.3 (LHCP)	6173.7 (LHCP) 6176.3 (LHCP)
On-Station	6173.7 (LHCP) 6176.3 (LHCP)	n/a	n/a
Command Modulation	FM	FM	FM
Bandwidth of Command Carrier (kHz)			
Occupied Bandwidth	860	860	860
Allocated Bandwidth	1000	1000	1000
Command Threshold (dBW/m^2)			
Beam Peak	-116.2	-107.1	-97.4
Edge of Coverage	-112.2	-103.1	-93.4
Command G/T (dB/K)			
Beam Peak	-18.1	-27.2	-36.9
Edge of Coverage	-22.1	-31.2	-40.9
Telemetry Frequency (MHz) / Polarization (see note)			
Transfer Orbit / Emergency	n/a	3947.5 (RHCP) 3952.5 (RHCP)	3947.5 (RHCP) 3952.5 (RHCP)
On-Station	3947.5 (RHCP) 3952.5 (RHCP)	n/a	n/a
Telemetry Modulation	PM	PM	PM
Bandwidth of Telemetry Carrier (kHz)			
Occupied	250	250	250
Allocated	500	500	500
Telemetry EIRP			
Beam Peak	12.5	15.0	7.1
Edge of Coverage	8.5	11.0	3.1
On-Station Ranging Accuracy (meters)	≤ 10	≤ 10	≤ 10

RHCP: Right Hand Circular Polarization
LHCP: Left Hand Circular Polarization

EXHIBIT 9: TC&R SUBSYSTEM EIRP and G/T BUDGETS

Antenna Type	Global	WCA	Bicone
Frequency Band (MHz)	6173.7 / 6176.3	6173.7 / 6176.3	6173.7 / 6176.3
Polarization	Left Hand Circular	Left Hand Circular	Left Hand Circular
Antenna Noise Temperature (°Kelvin)	150	150	150
Receiver Noise Temperature (°Kelvin)	7606	11939	8569
Total System Noise Temperature (°Kelvin)	7756	12089	8719
Total System Noise Temperature (dBK)	38.9	40.8	39.4
Peak Gain of Satellite Receive Antenna (dBi)	20.8	13.6	2.5
Peak G/T (dB/K)	-18.1	-27.2	-36.9
Command Threshold Flux Density at Peak G/T (dBW/m^2)	-116.2	-107.1	-97.4
Antenna Type	Global	WCA	Bicone
Frequency Band (MHz)	3947.5 / 3952.5	3947.5 / 3952.5	3947.5 / 3952.5
Polarization	Right Hand Circular	Right Hand Circular	Right Hand Circular
Maximum Power At The Output of Last Stage Amplifier (dBW)	-2.4	10	10
Loss From Last Stage Amplifier To Transmit Antenna Interface (dB)	5.3	8.3	5.2
Power into Transmit Antenna (dBW)	-7.7	1.7	4.8
Power into Transmit Antenna (Watts)	0.2	1.5	3.0
Peak Gain of Satellite Transmit Antenna (dBi)	20.2	13.3	2.3
Maximum Downlink EIRP (dBW)	12.5	15.0	7.1

EXHIBIT 10: CHANNEL FREQUENCY RESPONSE CHARACTERISTIC

Frequency Offset Relative to Channel Center Frequency (MHz)	Attenuation Relative To Peak Level (dB) Input Section	Output Section	Total
C-Band: 72 MHz Channel			
±16	0.37	0.37	0.63
±24	0.45	0.55	0.85
±28	0.51	0.87	1.21
±32	0.60	0.98	1.40
±36	0.95	1.90	2.64
Ku-Band: 72 MHz Channel			
±16	0.24	0.29	0.43
±24	0.30	0.48	0.65
±28	0.35	0.83	1.04
±32	0.53	0.98	1.35
±36	1.03	1.81	2.66
Ku-Band: 36 MHz Channel			
±8	0.21	0.36	0.49
±12	0.29	0.62	0.81
±14	0.36	0.89	1.13
±16	0.64	1.57	2.08
±18	1.43	3.71	4.99

EXHIBIT 11: EMISSION DESIGNATORS

Signal Type	Emission Designator	Allocated Bandwidth (kHz)
Analog TV/FM Carrier	36M0F3F	36000
49138 kbps Carrier	72M0G7W	72000
24575 kbps Carrier	36M0G7W	36000
6000 kbps carrier	10M3G7W	10300
512 kbps Carrier	1M45G7W	1450
128 kbps Carrier	400KG7W	400
64 kbps Carrier	100KG7W	100

EXHIBIT 12: POWER FLUX DENSITY CALCULATIONS

Frequency Band: 3625 – 4200 MHz							
Landmass A (RHCP): 36M0F3F							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	41.4*	41.3*	42.2	42.2	42.2	42.2	42.2
Occupied Bandwidth (kHz)	4000	4000	4000	4000	4000	4000	4000
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density ($dBW/m^2/4kHz$)	-152.0	-152.0	-151.0	-150.8	-150.7	-150.6	-149.9
PFD Limit ($dBW/m^2/4kHz$)	-152	-152	-149.5	-147.0	-144.5	-142.0	-142.0
Margin (dB)	0.0	0.0	1.5	3.8	6.2	8.6	7.9
Landmass A (RHCP): 72M0G7W							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	42.2	42.2	42.2	42.2	42.2	42.2	42.2
Occupied Bandwidth (kHz)	60251	60251	60251	60251	60251	60251	60251
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density ($dBW/m^2/4kHz$)	-163.0	-162.9	-162.7	-162.6	-162.5	-162.4	-161.6
PFD Limit ($dBW/m^2/4kHz$)	-152	-152	-149.5	-147.0	-144.5	-142.0	-142.0
Margin (dB)	11.0	10.9	13.2	15.6	18.0	20.4	19.6
Landmass B (LHCP): 36M0F3F							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	41.4*	41.3*	42.2	42.2	42.2	42.2	42.2
Occupied Bandwidth (kHz)	4000	4000	4000	4000	4000	4000	4000
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density ($dBW/m^2/4kHz$)	-152.0	-152.0	-151.0	-150.8	-150.7	-150.6	-149.9
PFD Limit ($dBW/m^2/4kHz$)	-152	-152	-149.5	-147.0	-144.5	-142.0	-142.0
Margin (dB)	0.0	0.0	1.5	3.8	6.2	8.6	7.9
Landmass B (LHCP): 72M0G7W							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	42.2	42.2	42.2	42.2	42.2	42.2	42.2
Occupied Bandwidth (kHz)	60251	60251	60251	60251	60251	60251	60251
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density ($dBW/m^2/4kHz$)	-163.0	-162.9	-162.7	-162.6	-162.5	-162.4	-161.6
PFD Limit ($dBW/m^2/4kHz$)	-152	-152	-149.5	-147.0	-144.5	-142.0	-142.0
Margin (dB)	11.0	10.9	13.2	15.6	18.0	20.4	19.6
Telemetry - Global Horn Antenna (LHCP)							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Occupied Bandwidth (kHz)	250	250	250	250	250	250	250
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density ($dBW/m^2/4kHz$)	-168.8	-168.7	-168.6	-168.5	-168.4	-168.3	-167.5
PFD Limit ($dBW/m^2/4kHz$)	-152	-152	-149.5	-147.0	-144.5	-142.0	-142.0
Margin (dB)	16.8	16.7	19.1	21.5	23.9	26.3	25.5

EXHIBIT 12: POWER FLUX DENSITY CALCULATIONS (continued)

Frequency Band: 3625 – 4200 MHz							
Telemetry - Wide Coverage Antenna (LHCP)							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	13.3	13.3	13.3	13.3	13.3	13.3	13.3
Occupied Bandwidth (kHz)	250	250	250	250	250	250	250
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density ($dBW/m^2/4kHz$)	-168.0	-167.9	-167.8	-167.7	-167.6	-167.5	-166.7
PFD Limit ($dBW/m^2/4kHz$)	-152	-152	-149.5	-147.0	-144.5	-142.0	-142.0
Margin (dB)	16.0	15.9	18.3	20.7	23.1	25.5	24.7
Telemetry - Bicone Antenna (RHCP)							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	7.1	7.1	7.1	7.1	7.1	7.1	7.1
Occupied Bandwidth (kHz)	250	250	250	250	250	250	250
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density ($dBW/m^2/4kHz$)	-174.2	-174.1	-174.0	-173.9	-173.8	-173.7	-172.9
PFD Limit ($dBW/m^2/4kHz$)	-152	-152	-149.5	-147.0	-144.5	-142.0	-142.0
Margin (dB)	22.2	22.1	24.5	26.9	29.3	31.7	30.9
C-Band ULPC Beam (V)							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	11.4	11.4	11.4	11.4	11.4	11.4	11.4
Occupied Bandwidth (kHz)	25	25	25	25	25	25	25
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density ($dBW/m^2/4kHz$)	-159.9	-159.8	-159.7	-159.6	-159.5	-159.4	-158.6
PFD Limit ($dBW/m^2/4kHz$)	-152	-152	-149.5	-147.0	-144.5	-142.0	-142.0
Margin (dB)	7.9	7.8	10.2	12.6	15.0	17.4	16.6
Frequency Band: 10950 – 11200 MHz and 11450 – 11700 MHz							
Africa (H): 36M0F3F							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	43.4*	43.3*	45.7*	48.0*	50.4*	50.7	50.7
Occupied Bandwidth (kHz)	4000	4000	4000	4000	4000	4000	4000
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density ($dBW/m^2/4kHz$)	-150.0	-150.0	-147.5	-145.0	-142.5	-142.1	-141.4
PFD Limit ($dBW/m^2/4kHz$)	-150	-150	-147.5	-145.0	-142.5	-140.0	-140.0
Margin (dB)	0.0	0.0	0.0	0.0	0.0	2.1	1.4
Africa (H): 36M0G7W							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	50.7	50.7	50.7	50.7	50.7	50.7	50.7
Occupied Bandwidth (kHz)	30133	30133	30133	30133	30133	30133	30133
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density ($dBW/m^2/4kHz$)	-151.5	-151.3	-151.2	-151.1	-151.0	-150.9	-150.1
PFD Limit ($dBW/m^2/4kHz$)	-150	-150	-147.5	-145.0	-142.5	-140.0	-140.0
Margin (dB)	1.5	1.3	3.7	6.1	8.5	10.9	10.1

Frequency Band: 10950 – 11200 MHz and 11450 – 11700 MHz							
Africa (V): 36M0F3F							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	43.4*	43.3*	45.7*	48.0*	50.4*	51.1	51.1
Occupied Bandwidth (kHz)	4000	4000	4000	4000	4000	4000	4000
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density (dBW/m^2/4kHz)	-150.0	-150.0	-147.5	-145.0	-142.5	-141.7	-141.0
PFD Limit (dBW/m^2/4kHz)	-150	-150	-147.5	-145.0	-142.5	-140.0	-140.0
Margin (dB)	0.0	0.0	0.0	0.0	0.0	1.7	1.0
Africa (V): 36M0G7W							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	51.1	51.1	51.1	51.1	51.1	51.1	51.1
Occupied Bandwidth (kHz)	30133	30133	30133	30133	30133	30133	30133
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density (dBW/m^2/4kHz)	-151.1	-150.9	-150.8	-150.7	-150.6	-150.5	-149.7
PFD Limit (dBW/m^2/4kHz)	-150	-150	-147.5	-145.0	-142.5	-140.0	-140.0
Margin (dB)	1.1	0.9	3.3	5.7	8.1	10.5	9.7
ULPC Beam (RHCP)							
Elevation Angle (degrees)	0	5	10	15	20	25	90
Assumed EIRP (dBW)	13.9	13.9	13.9	13.9	13.9	13.9	13.9
Occupied Bandwidth (kHz)	25	25	25	25	25	25	25
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.1
Maximum EIRP Spectral Density (dBW/m^2/4kHz)	-157.4	-157.3	-157.2	-157.1	-157.0	-156.9	-156.1
PFD Limit (dBW/m^2/4kHz)	-150	-150	-147.5	-145.0	-142.5	-140.0	-140.0
Margin (dB)	7.4	7.3	9.7	12.1	14.5	16.9	16.1

* This is the maximum allowable EIRP level at the specified elevation angle. The actual EIRP level of the carrier at this particular elevation angle will be made to be equal to or lower than the value listed in the table through reduction in the output power of the channel.

EXHIBIT 13: NEW DAWN LINK BUDGETS

UPLINK BEAM INFORMATION								
Uplink Beam Name	LANDMASS	LANDMASS	LANDMASS	LANDMASS	LANDMASS	LANDMASS	LANDMASS	LANDMASS
Uplink Frequency (GHz)	6.175	6.175	6.175	6.175	6.175	6.175	6.175	6.175
Uplink Beam Polarization	CIRCULAR	CIRCULAR	CIRCULAR	CIRCULAR	CIRCULAR	CIRCULAR	CIRCULAR	CIRCULAR
Uplink Relative Contour Level (dB)	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0
Uplink Contour G/T (dB/K)	-8.3	-8.3	-8.3	-8.3	-8.3	-8.3	-8.3	-8.3
Uplink SFD (dBW/m2)	-81	-84	-80	-80	-79	-82	-80	-80
Rain Rate (mm/hr)	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0
DOWNLINK BEAM INFORMATION								
Downlink Beam Name	LANDMASS	LANDMASS	LANDMASS	LANDMASS	AFRICA	AFRICA	AFRICA	AFRICA
Downlink Frequency (GHz)	3.950	3.950	3.950	3.950	11.325	11.325	11.325	11.325
Downlink Beam Polarization	CIRCULAR	CIRCULAR	CIRCULAR	CIRCULAR	LINEAR	LINEAR	LINEAR	LINEAR
Downlink Relative Contour Level (dB)	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0
Downlink Contour EIRP (dBW)	34.2	34.2	34.2	34.2	42.7	42.7	42.7	42.7
Rain Rate (mm/hr)	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0
ADJACENT SATELLITE 1								
Satellite 1 Orbital Location	30.8E	30.8E	30.8E	30.8E	30.8E	30.8E	30.8E	30.8E
Uplink Power Density (dBW/Hz)	-38.7	-38.7	-38.7	-38.7	-38.7	-38.7	-38.7	-38.7
Uplink Polarization Advantage (dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Downlink EIRP Density (dBW/Hz)	-43.6	-43.6	-43.6	-43.6	-26.0	-26.0	-26.0	-26.0
Downlink Polarization Advantage (dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ADJACENT SATELLITE 2								
Satellite 1 Orbital Location	34.8E	34.8E	34.8E	34.8E	34.8E	34.8E	34.8E	34.8E
Uplink Power Density (dBW/Hz)	-38.7	-38.7	-38.7	-38.7	-38.7	-38.7	-38.7	-38.7
Uplink Polarization Advantage (dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Downlink EIRP Density (dBW/Hz)	-43.6	-43.6	-43.6	-43.6	-26.0	-26.0	-26.0	-26.0
Downlink Polarization Advantage (dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CARRIER INFORMATION								
Carrier ID	36M0F3F	72M0G7E	10M3G7W	100KG7W	36M0F3F	72M0G7E	10M3G7W	100KG7W
Carrier Modulation	TV/FM	QPSK	QPSK	QPSK	TV/FM	QPSK	QPSK	QPSK
Peak to Peak Bandwidth of EDS (MHz)	4	N/A	N/A	N/A	4	N/A	N/A	N/A
Information Rate(kbps)	N/A	49138	6000	64	N/A	49138	6000	64
Code Rate	N/A	1/2x188/204	1/2x188/204	1/2x239/256	N/A	1/2x188/204	1/2x188/204	1/2x239/256
Occupied Bandwidth(kHz)	36000	60251	6771.1	75.4	36000	60251	6771.1	75.4
Allocated Bandwidth(kHz)	36000	72000	10300	100	36000	72000	10300	100
Minimum C/N, Clear Sky (dB)	10.0	3.4	3.9	3.0	10.0	3.4	3.9	3.0
Minimum C/N, Rain (dB)	10.0	3.4	3.6	2.8	10.0	3.4	3.6	2.8
UPLINK EARTH STATION								
Earth Station Diameter (meters)	11.0	11.0	6.1	6.1	13.0	13.0	6.1	6.1
Earth Station Gain (dBi)	55.4	55.4	49.4	49.4	56.4	56.4	49.4	49.4
Earth Station Elevation Angle	20	20	20	20	20	20	20	20
DOWNLINK EARTH STATION								
Earth Station Diameter (meters)	11.0	3.0	3.5	3.5	6.1	1.8	2.4	2.4
Earth Station Gain (dBi)	51.9	39.7	41.1	41.1	55.0	44.3	47.0	47.0
Earth Station G/T (dB/K)	31.0	19.2	21.0	21.0	32.6	21.8	24.5	24.5
Earth Station Elevation Angle	20	20	20	20	20	20	20	20
LINK FADE TYPE	Clear Sky	Clear Sky	Clear Sky	Clear Sky	Clear Sky	Clear Sky	Clear Sky	Clear Sky
UPLINK PERFORMANCE								
Uplink Earth Station EIRP (dBW)	78.9	78.9	67.9	47.5	80.9	80.9	67.8	47.5
Uplink Path Loss, Clear Sky (dB)	-200.2	-200.2	-200.2	-200.2	-200.2	-200.2	-200.2	-200.2
Uplink Rain Attenuation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Satellite G/T(dB/K)	-8.3	-8.3	-8.3	-8.3	-8.3	-8.3	-8.3	-8.3
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (dB-Hz)	-75.6	-77.8	-68.3	-48.8	-75.6	-77.8	-68.3	-48.8
Uplink C/N(dB)	23.4	21.2	19.7	18.8	25.4	23.2	19.6	18.8
DOWNLINK PERFORMANCE								
Downlink EIRP per Carrier (dBW)	30.0	34.2	23.9	3.5	38.5	42.7	32.3	12.0
Antenna Pointing Error (dB)	-.5	-.5	-.5	-.5	-.5	-.5	-.5	-.5
Downlink Path Loss, Clear Sky (dB)	-196.3	-196.3	-196.3	-196.3	-205.5	-205.5	-205.5	-205.5
Downlink Rain Attenuation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Earth Station G/T (dB/K)	31.0	19.2	21.0	21.0	32.6	21.8	24.5	24.5
Boltzman Constant(dBW / K - Hz)	228.6	228.6	228.6	228.6	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (dB-Hz)	-75.6	-77.8	-68.3	-48.8	-75.6	-77.8	-68.3	-48.8
Downlink C / N(dB)	17.2	7.4	8.3	7.4	18.2	9.3	11.1	10.4
COMPOSITE LINK PERFORMANCE								
C/N Uplink (dB)	23.4	21.2	19.7	18.8	25.4	23.2	19.6	18.8
C/N Downlink (dB)	17.2	7.4	8.3	7.4	18.2	9.3	11.1	10.4
C/I Intermodulation (dB)	N/A	N/A	20.1	19.2	N/A	N/A	20.0	19.2
C/I Uplink Co-Channel (dB)*	27.0	27.0	28.6	28.3	27.0	27.0	28.6	28.4
C/I Downlink Co-Channel (dB)*	27.0	27.0	28.6	28.3	27.0	27.0	28.6	28.4
C/I Uplink Adjacent Satellite 1 (dB)	16.0	13.8	12.3	11.4	18.0	15.8	12.2	11.5
C/I Downlink Adjacent Satellite 1 (dB)	27.9	11.2	15.5	14.6	22.1	12.6	14.7	13.9
C/I Uplink Adjacent Satellite 2 (dB)	16.0	13.8	12.3	11.4	18.0	15.8	12.2	11.5
C/I Downlink Adjacent Satellite 2 (dB)	28.9	19.9	20.3	19.4	22.8	14.8	16.4	15.6
C/(N+I) Composite (dB)	11.0	4.4	4.9	4.0	11.9	5.7	5.6	4.8
Required System Margin (dB)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Net C/(N+I) Composite (dB)	10.0	3.4	3.9	3.0	10.9	4.7	4.6	3.8
Minimum Required C/N (dB)	-10.0	-3.4	-3.9	-3.0	-10.0	-3.4	-3.9	-3.0
Excess Link Margin (dB)	0.0	0.0	0.0	0.0	.9	1.4	.7	.8
Number of Carriers	2	1.0	4.8	527.8	2	1.0	4.9	521.9
CARRIER DENSITY LEVELS								
Uplink Power Density (dBW/Hz)	-42.5	-54.3	-49.8	-50.7	-41.5	-53.3	-49.9	-50.7
Downlink EIRP Density At Beam Peak (dBW/Hz)	-28.0	-35.6	-36.4	-37.3	-19.5	-27.1	-28.0	-28.8

EXHIBIT 13: NEW DAWN LINK BUDGETS (continued)

UPLINK BEAM INFORMATION										
Uplink Beam Name	AFRICA	AFRICA	AFRICA	AFRICA	AFRICA	AFRICA	AFRICA	AFRICA	AFRICA	AFRICA
Uplink Frequency (GHz)	14.250	14.250	14.250	14.250	14.250	14.250	14.250	14.250	14.250	14.250
Uplink Beam Polarization	LINEAR	LINEAR	LINEAR	LINEAR	LINEAR	LINEAR	LINEAR	LINEAR	LINEAR	LINEAR
Uplink Relative Contour Level (dB)	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0
Uplink Contour G/T (dB/K)	-4.7	-4.7	-4.7	-4.7	-4.7	-4.7	-4.7	-4.7	-4.7	-4.7
Uplink SFD (dBW/m2)	-81.4	-82.4	-78.4	-78.4	-78.4	-78.4	-79.9	-82.9	-77.9	-77.9
Rain Rate (mm/hr)	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0
DOWNLINK BEAM INFORMATION										
Downlink Beam Name	AFRICA	AFRICA	AFRICA	AFRICA	AFRICA	AFRICA	LANDMASS	LANDMASS	LANDMASS	LANDMASS
Downlink Frequency (GHz)	11.325	11.325	11.325	11.325	11.325	11.325	3.950	3.950	3.950	3.950
Downlink Beam Polarization	LINEAR	LINEAR	LINEAR	LINEAR	LINEAR	LINEAR	CIRCULAR	CIRCULAR	CIRCULAR	CIRCULAR
Downlink Relative Contour Level (dB)	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0
Downlink Contour EIRP (dBW)	42.7	42.7	42.7	42.7	42.7	42.7	34.2	34.2	34.2	34.2
Rain Rate (mm/hr)	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0
ADJACENT SATELLITE 1										
Satellite 1 Orbital Location	30.8E	30.8E	30.8E	30.8E	30.8E	30.8E	30.8E	30.8E	30.8E	30.8E
Uplink Power Density (dBW/Hz)	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0
Uplink Polarization Advantage (dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Downlink EIRP Density (dBW/Hz)	-26.0	-26.0	-26.0	-26.0	-26.0	-26.0	-43.6	-43.6	-43.6	-43.6
Downlink Polarization Advantage (dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ADJACENT SATELLITE 2										
Satellite 1 Orbital Location	34.8E	34.8E	34.8E	34.8E	34.8E	34.8E	34.8E	34.8E	34.8E	34.8E
Uplink Power Density (dBW/Hz)	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0
Uplink Polarization Advantage (dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Downlink EIRP Density (dBW/Hz)	-26.0	-26.0	-26.0	-26.0	-26.0	-26.0	-43.6	-43.6	-43.6	-43.6
Downlink Polarization Advantage (dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CARRIER INFORMATION										
Carrier ID	36M0F3F	72M0G7E	10M3G7W	100KG7W	1M45G7W	400KG7W	36M0F3F	72M0G7E	10M3G7W	100KG7W
Carrier Modulation	TV/FM	QPSK	QPSK	QPSK	BPSK	BPSK	TV/FM	QPSK	QPSK	QPSK
Peak to Peak Bandwidth of EDS (MHz)	4	N/A	N/A	N/A	N/A	N/A	4	N/A	N/A	N/A
Information Rate(kbps)	N/A	49138	6000	64	512	128	N/A	49138	6000	64
Code Rate	N/A	1/2x188/204	1/2x188/204	1/2x239/256	R1/2	R1/2	N/A	1/2x188/204	1/2x188/204	1/2x239/256
Occupied Bandwidth(kHz)	36000	60251	6771.1	75.4	1229.0	307.0	36000	60251	6771.1	75.4
Allocated Bandwidth(kHz)	36000	72000	10300	100	1450.0	400.0	36000	72000	10300	100
Minimum C/N, Clear Sky (dB)	10.0	3.4	3.9	3.0	3.4	3.4	10.0	3.4	3.9	3.0
Minimum C/N, Rain (dB)	10.0	3.4	3.6	2.8	2.7	2.7	10.0	3.4	3.6	2.8
UPLINK EARTH STATION										
Earth Station Diameter (meters)	6.1	6.1	6.1	6.1	6.1	2.4	6.1	6.1	6.1	6.1
Earth Station Gain (dBi)	56.9	56.9	56.9	56.9	56.9	49.0	56.9	56.9	56.9	56.9
Earth Station Elevation Angle	20	20	20	20	20	20	20	20	20	20
DOWNLINK EARTH STATION										
Earth Station Diameter (meters)	6.1	1.8	2.4	2.4	2.4	6.1	8.1	3.0	3.5	3.5
Earth Station Gain (dBi)	55.0	44.3	47.0	47.0	47.0	55.0	49.3	39.7	41.1	41.1
Earth Station G/T (dB/K)	32.6	21.8	24.5	24.5	24.5	32.6	28.4	19.2	21.0	21.0
Earth Station Elevation Angle	20	20	20	20	20	20	20	20	20	20
LINK FADE TYPE	Clear Sky	Clear Sky	Clear Sky	Clear Sky	Clear Sky	Clear Sky	Clear Sky	Clear Sky	Clear Sky	Clear Sky
UPLINK PERFORMANCE										
Uplink Earth Station EIRP (dBW)	78.5	80.5	69.2	49.0	61.0	50.0	80.0	80.0	70.1	50.0
Uplink Path Loss, Clear Sky (dB)	-207.5	-207.5	-207.5	-207.5	-207.5	-207.5	-207.5	-207.5	-207.5	-207.5
Uplink Rain Attenuation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Satellite G/T(dB/K)	-4.7	-4.7	-4.7	-4.7	-4.7	-4.7	-4.7	-4.7	-4.7	-4.7
Boltzman Constant(dBW/K-Hz)	228.6	228.6	228.6	228.6	228.6	228.6	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (dB-Hz)	-75.6	-77.8	-68.3	-48.8	-60.9	-54.9	-75.6	-77.8	-68.3	-48.8
Uplink C/N(dB)	19.4	19.1	17.3	16.6	16.5	11.6	20.9	18.6	18.2	17.6
DOWNLINK PERFORMANCE										
Downlink EIRP per Carrier (dBW)	38.5	42.7	32.1	11.9	23.9	12.9	30.0	34.2	24.0	3.9
Antenna Pointing Error (dB)	-.5	-.5	-.5	-.5	-.5	-.5	-.5	-.5	-.5	-.5
Downlink Path Loss, Clear Sky (dB)	-205.5	-205.5	-205.5	-205.5	-205.5	-205.5	-196.3	-196.3	-196.3	-196.3
Downlink Rain Attenuation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Earth Station G/T (dB/K)	32.6	21.8	24.5	24.5	24.5	32.6	28.4	19.2	21.0	21.0
Boltzman Constant(dBW / K - Hz)	228.6	228.6	228.6	228.6	228.6	228.6	228.6	228.6	228.6	228.6
Carrier Noise Bandwidth (dB-Hz)	-75.6	-77.8	-68.3	-48.8	-60.9	-54.9	-75.6	-77.8	-68.3	-48.8
Downlink C / N(dB)	18.2	9.3	10.9	10.2	10.1	13.3	14.6	7.4	8.5	7.8
COMPOSITE LINK PERFORMANCE										
C/N Uplink (dB)	19.4	19.1	17.3	16.6	16.5	11.6	20.9	18.6	18.2	17.6
C/N Downlink (dB)	18.2	9.3	10.9	10.2	10.1	13.3	14.6	7.4	8.5	7.8
C/I Intermodulation (dB)	N/A	N/A	19.8	19.1	19.0	14.1	N/A	N/A	20.2	19.6
C/I Uplink Co-Channel (dB)*	27.0	27.0	28.3	28.3	28.7	23.3	27.0	27.0	28.8	28.8
C/I Downlink Co-Channel (dB)*	27.0	27.0	28.3	28.3	28.7	23.3	27.0	27.0	28.8	28.8
C/I Uplink Adjacent Satellite 1 (dB)	24.9	24.7	22.9	22.2	22.1	17.2	26.4	24.2	23.8	23.2
C/I Downlink Adjacent Satellite 1 (dB)	22.1	12.6	14.4	13.8	13.7	17.3	25.1	11.2	15.6	15.0
C/I Uplink Adjacent Satellite 2 (dB)	24.9	24.7	22.9	22.2	22.1	17.2	26.4	24.2	23.8	23.2
C/I Downlink Adjacent Satellite 2 (dB)	22.8	14.8	16.1	15.4	15.3	17.9	26.5	19.9	20.4	19.8
C/(N+I) Composite (dB)	13.1	6.4	7.3	6.7	6.6	6.2	12.5	5.3	6.7	6.1
Required System Margin (dB)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Net C/(N+I) Composite (dB)	12.1	5.4	6.3	5.7	5.6	5.2	11.5	4.3	5.7	5.1
Minimum Required C/N (dB)	-10.0	-3.4	-3.9	-3.0	-3.4	-3.4	-10.0	-3.4	-3.9	-3.0
Excess Link Margin (dB)	2.1	2.1	2.5	2.7	2.2	1.8	1.5	.9	1.8	2.1
Number of Carriers	2	1.0	5.1	537.5	33.8	180.0	2	1.0	4.6	481.1
CARRIER DENSITY LEVELS										
Uplink Power Density (dBW/Hz)	-44.4	-54.2	-56.0	-56.7	-56.8	-53.8	-42.9	-54.7	-55.1	-55.7
Downlink EIRP Density At Beam Peak (dBW/Hz)	-19.5	-27.1	-28.2	-28.9	-29.0	-33.9	-28.0	-35.6	-36.3	-36.9