EXHIBIT C – AM44 TECHNICAL NARRATIVE

This exhibit demonstrates compliance with applicable Commission requirements for non-United States licensed systems.[1]

1.0 - Introduction

NewCom International ("NewCom") proposes to serve the United States market using a new satellite designated as the Express AM44 ("AM44"). The AM44 operates from the orbital location of 11.0 degrees west longitude. The AM44 will serve North America in the frequency bands 5975 – 6525 MHz and 3650 – 4200 MHz. The AM44 replaces the Express 3A spacecraft, which previously served the U.S. market from the same orbital location pursuant to special temporary authority.[2] NewCom will use the AM44 to provide customers in underserved areas with data services, including Internet backbone access. NewCom's proposed services will be exclusively non-common carrier and configured Single Channel Per Carrier ("SCPC").

The technical characteristics and parameters of the AM44 spacecraft as well as its compliance with the various provisions of Part 25 of the Commission's rules are provided in the remainder of this Technical Narrative.

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1 *See* 47 C.F.R. § 25.137(d); *see also* 47 C.F.R. § 25.114(d).

2 *See* FCC File Nos. SES-STA-20081110-01467 and SES-STA-20081010-01314.

2.0 - Spacecraft Overview

The AM44 is a 3-axis stabilized spacecraft with a sealed, cylinder shaped body ("platform" or "structure") that supports electronic, electrical and other subsystems. The AM44 utilizes two deployable solar array wings and a propulsion system that consists of SPT-M100 xenon based plasma thrusters for orbital maneuvers and hydrazine fueled electro-thermocatalytic thrusters for attitude adjustments. The telecommunications payload module is integrated on the forward section of the platform. A summary of the physical characteristics of the spacecraft is provided in **Table 1.0** below.

GENERAL SPACECRAFT CHARACTERISTICS	
Spacecraft Name	AM44
Orbital Location	11.0º W.L.
Spacecraft Type	3-Axis Stabilized
Spacecraft Dimensions	
Length	26.532 meters
Width	6.625 meters
Depth	5.062 meters
Spacecraft Mass	
Mass w/o fuel	2,327 kg
Mass w/fuel	2,532 kg
Spacecraft Expected Lifetime	>12 years
Eclipse Capability	100%
Station-keeping	
North-South	+/- 0.05º
East-West	+/- 0.05º
Propulsion Type	Orbit control and maneuvers: SPT M-100 plasma thrusters Fuel: Xenon Attitude control: Electro-thermocatalytic thrusters Fuel: Hydrazine
Maximum Solar Array Power	
Beginning of Life	8,354 Watts
End of Life	6,766 Watts
Deployed Area of Solar Array	61.2 meters

TABLE 1.0

2.1 Structure

The AM44's structure provides mechanical support for all subsystems. It also provides a stable platform for preserving the alignment of critical elements of the spacecraft.

Electronic subsystems and complementary electronic and electrical components are located within the sealed, pressurized cylinder. Batteries, fuel tanks, solar arrays and structural elements that interconnect the telecommunications module with the cylinder platform are mounted externally in ruggedized modules.

The forward section of the cylinder structure supports the telecommunications module. Commercial communications antennas, telecommand and telemetry antennas, repeaters and optical sensors are mounted externally to the telecommunications module.

The AM44 utilizes the following antennas:

- C-, Ku- and L-band communications antennas.
- Omnidirectional antennas for Telemetry, Telecommand and Control ("TT&C") during routine and emergency maneuvers.

The spacecraft utilizes two deployable solar arrays, which are mounted to the aft of the primary cylinder structure. The solar arrays provide the mounting surface for the solar cells. The solar arrays are connected to the main spacecraft platform through a dedicated solar array drive assembly.

The AM44's mass is provided below in **Table 2.0** and in the complementary **Schedule S**.

MASS BUDGET	
Mass of Spacecraft without Fuel (kg)	2,327
Mass of Fuel and Disposables (kg)	205
Launch Mass (kg)	2,532
Mass of Fuel, Beginning of Life, In Orbit (kg)	205

TABLE 2.0

2.2 Thermal Subsystem

Thermal control is accomplished through a combination of optical solar reflectors ("OSRs"), fluid loop equipment, insulation blankets and electrical heaters. The outer surface of the telecommunications payload module and the platform's radiator are covered with OSRs to maximize the heat rejection to space while minimizing the absorbed solar energy. The heat generated by high power sub-systems (*e.g.*, TWTAs) is removed by a fluid loop and dissipated in a radiator. Insulation blankets cover the majority of external surfaces areas, with the exception radiating components and solar arrays. Heaters limit the effects of extreme low temperatures on electronics, thrusters and propellant lines.

2.3 Power Subsystem

The power subsystem generates, conditions, stores and protects the AM44's electrical power. It also provides the energy required to operate the satellite during all modes of operation. The power subsystem consists of the solar arrays, batteries, associated electronics, and power harnesses that interconnect and control the systems.

The AM44 utilizes two deployable solar array wings, which are mounted to the aft section of the primary cylinder structure. Each solar array is composed of multiple solar panels. Each panel supports an array of solar cells. Subsequent to launch, both arrays were successfully unfurled. The AM44's solar arrays are designed to provide power to the spacecraft for at least 12 years.

Power from the solar arrays is transferred to the spacecraft through the use of a solar array drive assembly. During eclipse periods, rechargeable multiple cell batteries are the primary source of power to the spacecraft.

The AM44's power subsystem has been designed so that no single failure in the subsystem will cause a spacecraft failure. The subsystem will provide sufficient power to the spacecraft throughout its design life to support commercial communications, as well as all housekeeping activities. The beginning-of-life and end-of-life power budgets for the AM44 are provided below in **Table 3.0** and in the complementary Schedule S.

POWER BUDGET				
	BEGINNING OF LIFE		END OF LIFE	
	Autumn Equinox	Summer Solstice	Autumn Equinox	Summer Solstice
Payload (Watts)	4,410	4,410	4,410	4,410
Bus (Watts)	1,183	1,095	1,183	1,095
Total Power (Watts)	5,593	5,505	5,593	5,505
Solar Array Power (Watts)	8,354	7,443	6,766	6,029
Battery Discharge in Eclipse (W)	2,350	2,350	2,350	2,350

TABLE 3.0

2.4 Attitude Control Subsystem

The attitude control subsystem will maintain the spacecraft's attitude during geostationary operations. Additionally, the attitude control subsystem will be responsible for reacquisition of the spacecraft in case of emergency.

The attitude control subsystem employs redundant sun and earth sensors and inertial reference units to perform all attitude determination functions. Physical control of the spacecraft's attitude is accomplished through the use of redundant gyrostabilizers and pulsed or continuous firing of selected thrusters.

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 continuing throughout the satellite's operational life. The spacecraft will employ a propulsion system utilizing plasma thrusters and electro-thermocatalytic thrusters. The primary components of the propulsion system are:

- xenon tanks
- hydrazine tanks
- plasma thrusters
- eletro-thermocatalytic thrusters
- orbit control propulsion subsystem management unit
- attitude control propulsion subsystem management unit
- inter-unit pipes

The AM44 was successfully placed into geostationary orbit by a direct injection launch. Orbit control thrusters maintain the orbital position of the satellite and are mounted at various sites on the primary cylinder structure.

The architecture of the propulsion sub-system is an evolution of the 727 Express M bus utilizing space-proven components. The system incorporates full redundancy for all critical components.

2.6 *Satellite Station-Keeping*

The AM44 will maintain an operational orbit within 0.05º of its nominal orbital position in both east-west and north-south directions in full compliance with the provisions of Section 25.210(j) of the Commission's Rules.

The attitude of the AM44 will be maintained consistent with industry best practices. Satellite attitude will satisfy all performance obligations after incorporating potential error sources (*i.e.*, attitude perturbations, misalignments, orbital tolerances, thermal distortions and thruster perturbations).

2.7 *Satellite Lifetime*

The AM44 is designed to provide commercial communications from its nominal orbital position for a period of 12 years. To enhance the probability of survival, component redundancy is incorporated into the spacecraft design where possible. Materials and processes were selected so that aging and natural wearing will not adversely affect spacecraft performance during the estimated life of the AM44.

2.8 Satellite Reliability

Reliability is maximized by incorporating flight proven components to the greatest extent possible. All subsystems and components have a minimum design life of 12 years. All critical components are redundant. All single points of failure have been eliminated, except for the tanks and tubes of the propulsion subsystem.

3.0 - Telecommunications Payload

The AM44 has 10 active transponders operating in C-band frequencies.[3] All C-band transponders support 40 MHz channels and employ circular polarization.[4] The AM44 is the replacement spacecraft for a series of circular polarized satellites, the most recent of which is the Express 3A. The use of circular polarization will allow long-standing, legacy customers with limited resources to continue utilizing the 11.0° W.L. orbital slot without retrofitting earth station facilities. C-band transponder assignments are provided below in **Table 4.0**.

TRANSPONDER ASSIGNMENTS							
Transponder No.	Uplink Center Freq. (MHz)	Downlink Center Freq. (MHz)	Transponder Output Power (W)	Transponder Operating Bandwidth (MHz)	Uplink Service Area	Uplink Polarization	Downlink Polarization
6	6000	3675	100	40	Global	LHCP	RHCP
7	6050	3725	100	40	Zone	LHCP	RHCP
8	6100	3775	100	40	Zone	LHCP	RHCP
9	6150	3825	100	40	Zone	LHCP	RHCP
10	6200	3875	100	40	Global	LHCP	RHCP
11	6250	3925	100	40	Global	LHCP	RHCP
15	6350	4025	100	40	Zone	LHCP	RHCP
16	6400	4075	100	40	Zone	LHCP	RHCP
17	6450	4125	100	40	Zone	LHCP	RHCP
18	6500	4175	100	40	Zone	LHCP	RHCP

Table 4.0

The AM44's C-band transponders are not capable of switching polarizations.[5] With regard to neighboring satellites, the Russian Satellite Communications Company ("RSCC") operates the AM44 in a manner that is compliant with existing coordination agreements and within the same levels that were utilized on the Express 3A. Hence, the lack of C-band polarization switching capability aboard the AM44 does not affect compatibility with the co-frequency operation of the following:

Inmarsat 3F2 @ 15.5W

[3] In addition, the AM44 incorporates 16 Ku-band transponders. The AM44's Ku-band transponders do not radiate over the conterminous United States or U.S. territories. NewCom accordingly seeks a waiver of the obligation in Section 25.137 to provide technical specifics regarding these transponders. Please see Exhibit D.

[4] The AM44 is not strictly in compliance with the provisions of Section 25.210(a)(1) of the Commission's Rules that require orthogonal linear polarization in the 5975 – 6425 MHz and 3700 – 4200 MHz frequency bands. Section 25.210(a)(1), however, applies to satellites providing "domestic service." The AM44 is designed to provide intercontinental communications and will not provide "domestic service." In fact, the low look angle from the satellite physically prevents inland ground stations in the conterminous U.S. from using the AM44 as a point of communication.

[5] The AM44 is not strictly compliant with Section 25.210(a)(3) of the Commission's Rules. As discussed above, the satellite will not provide domestic service.

Telstar 12 @ 15W (Ku only)
Express 4A @ 14W (same operator)
Gorizont 32 @.13W
Atlantic Bird 1 @ 12.5W (Ku only)
Atlantic Bird 2 @ 8W (Ku only)
Telecom 2D @ 8W
HotBird 10 @ 7.4W
Nilesat 101 and Nilesat 102 @ 7W (Ku only)
Syracuse 3B @ 5W (X and EHF only)
Atlantic Bird 3 @ 5W

Further, the footprint of the AM44 is optimized for 11.0° W.L. Unlike satellites designed to operate from different orbital locations in the U.S. domestic arc, the AM44 cannot be readily relocated to another orbital location. Given that many satellites operating outside the U.S. arc do not have identical beam coverage or homogeneous channel bandwidth and/or spacing, the need to switch polarization in order to minimize the level of interference to other nearby satellites is not expected to arise. Accordingly, incorporation of polarization switching on the AM44 would not have the same benefits as it would have in the case of a satellite designed to operate in the U.S domestic orbital arc. See **Table 5.0** below for general communications payload characteristics.

COMMUNICATIONS PAYLOAD	
Frequency Bands	
Uplink	C-band: 5975 - 6525 MHz
Downlink	C-band: 3650 - 4200 MHz
Polarization	
Uplink	C-band: Left Hand Circular
Downlink	C-band: Right Hand Circular
Coverage Area	
Uplink	C-band: Africa, Asia, Europe and North America
Downlink	C-band: Africa, Asia, Europe and North America
Beam Cross-Polarization Isolation	
Uplink	> 33 dB at beam peak > 30 dB within service area
Downlink	> 33 dB at beam peak > 30 dB within service area
Number of Channels	10
Channel Bandwidth	40 MHz
Maximum Downlink EIRP	
North America (C-band)	47 dBW
Maximum Uplink G/T	

COMMUNICATIONS PAYLOAD	
North America (C-band)	3.5 dB/K
Uplink SFD Range @ Maximum G/T	
North America (C-band)	-76 to -100 dBW/m^2
Transponder Range	
Fixed Gain Mode	16 dB in 1 dB steps
Automatic Level Control Mode	16 dB
Maximum Power of Last Amplifier Stage	100 Watts of TWTA output power
Transmit Frequency Stability	< 0.002%

TABLE 5.0

3.1 Antennas and Beam Coverage

The AM44 will utilize a 4º x 10º C-band transmit/receive antenna to generate longitudinal zone beam coverage, and a 17º x 17º C-band receive antenna coupled with a 15º x 15º C-band transmit antenna to generate global beam coverage. The coverage provided by these antennas is shown below in the format prescribed in Section 25.114(d)(3) of the Commission's Rules. The peak Equivalent Isotropic Radiated Power ("EIRP") of the C-band transmit beams is 47 dBW for zone beams and 39 dBW for global beams. The peak G/T of the C-band receive beams is +3.5 dB/K for the zone beams and -7 dB/K for the global beams. The minimum saturation flux density ("SFD") corresponding to the peak G/T point of the C-band receive beams is -94 dBW/m2. SFD at any G/T contours 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 attenuated setting (dB), ranging from 0 to 16 dB in 1 dB steps

The AM44 transmit and receive beams are designed to have a minimum cross-polarization of 30 dB or greater within the primary coverage area and are fully compliant with Section 25.210(i).

The contour maps below illustrate the coverage and EIRP for the zone and global beams described above.

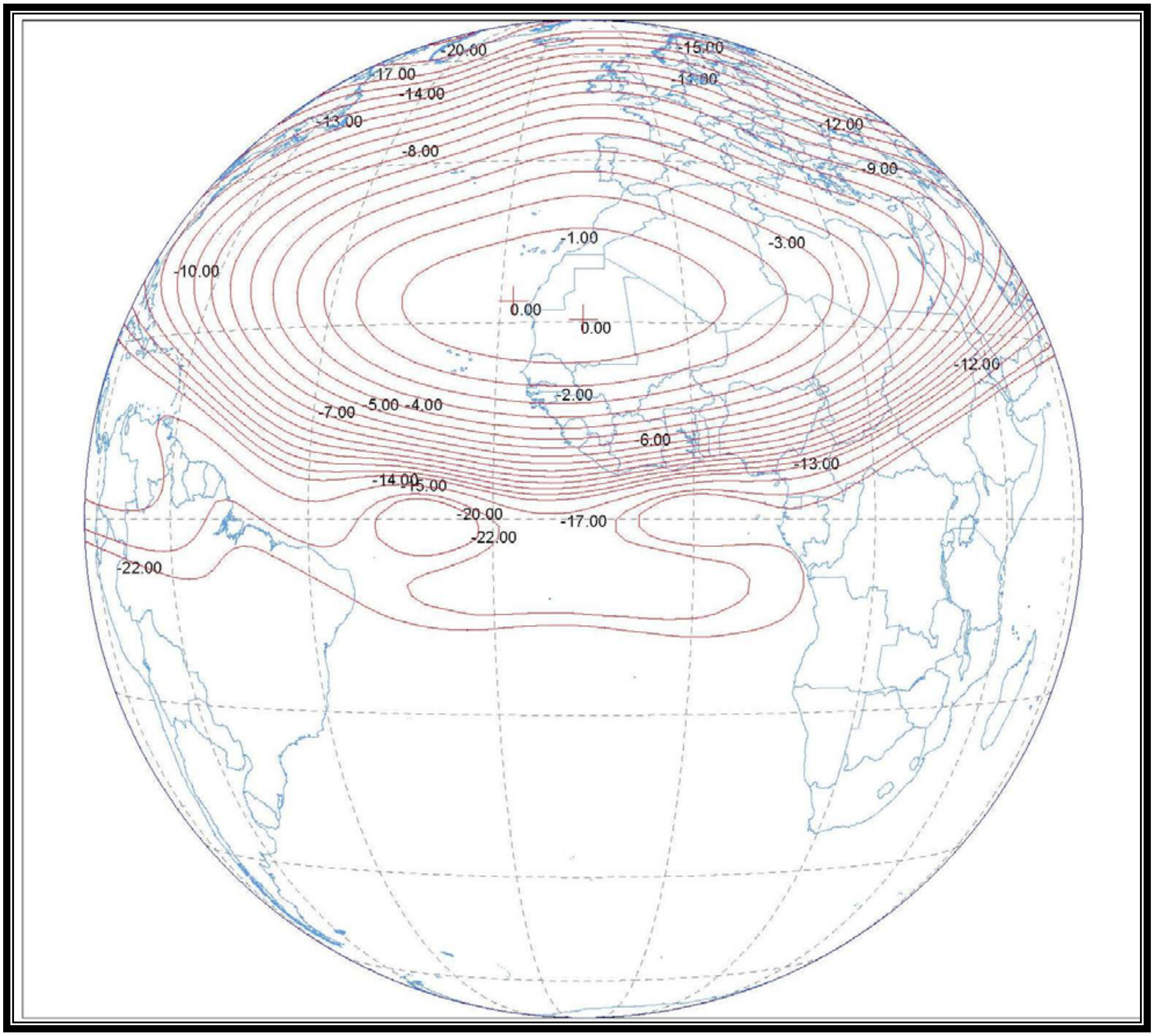

FIGURE 1.0

Figure 1.0 above represents the coverage of a zone beam space to earth.[6]

[6] Note: All zone beams have identical footprints.

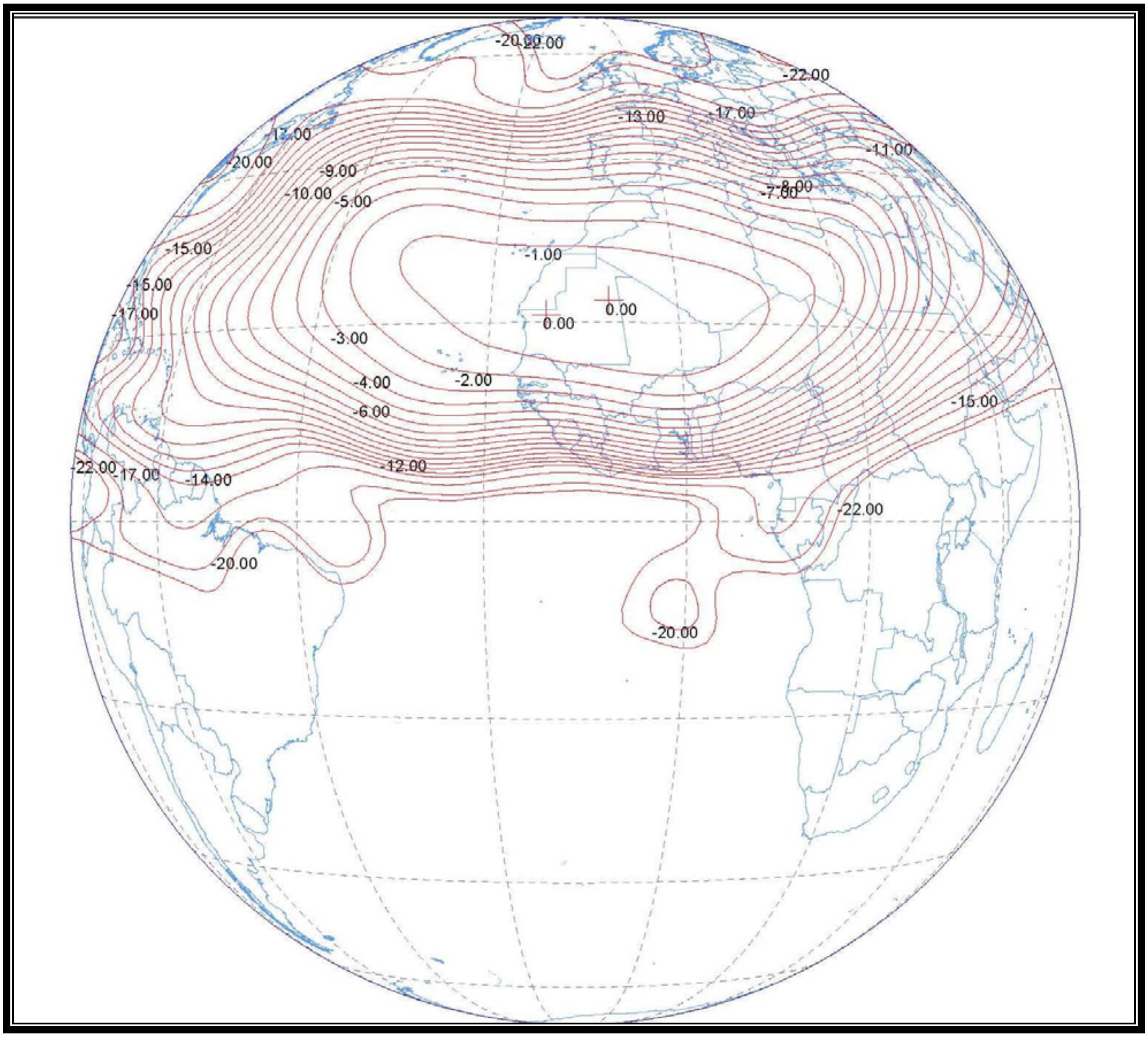

FIGURE 2.0

Figure 2.0 above represents the coverage of a zone beam earth-to-space.

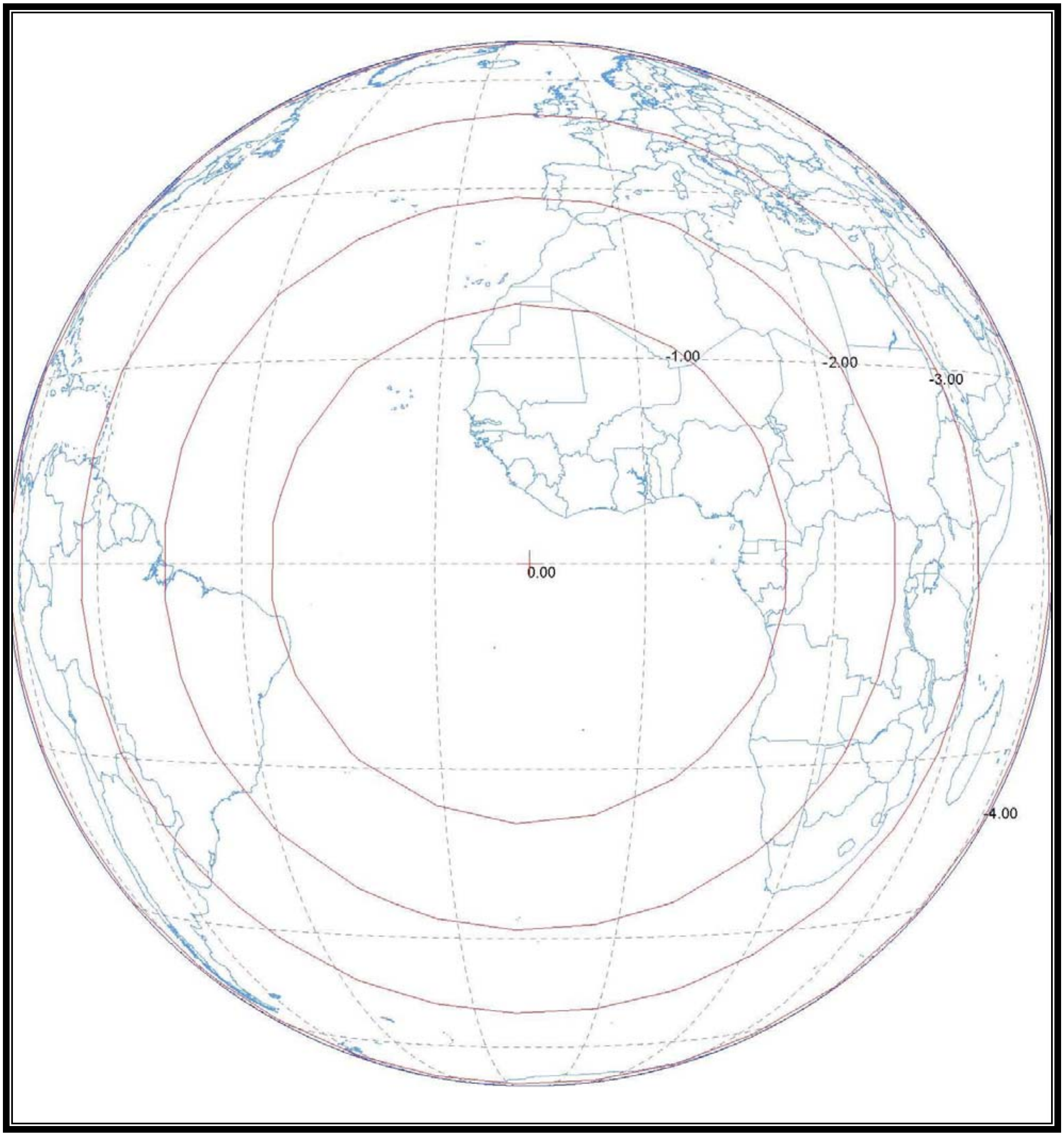

FIGURE 3.0

Figure 3.0 above represents the coverage of a global beam space-to-earth.[7]

[7] Note: Both global beams have identical footprints.

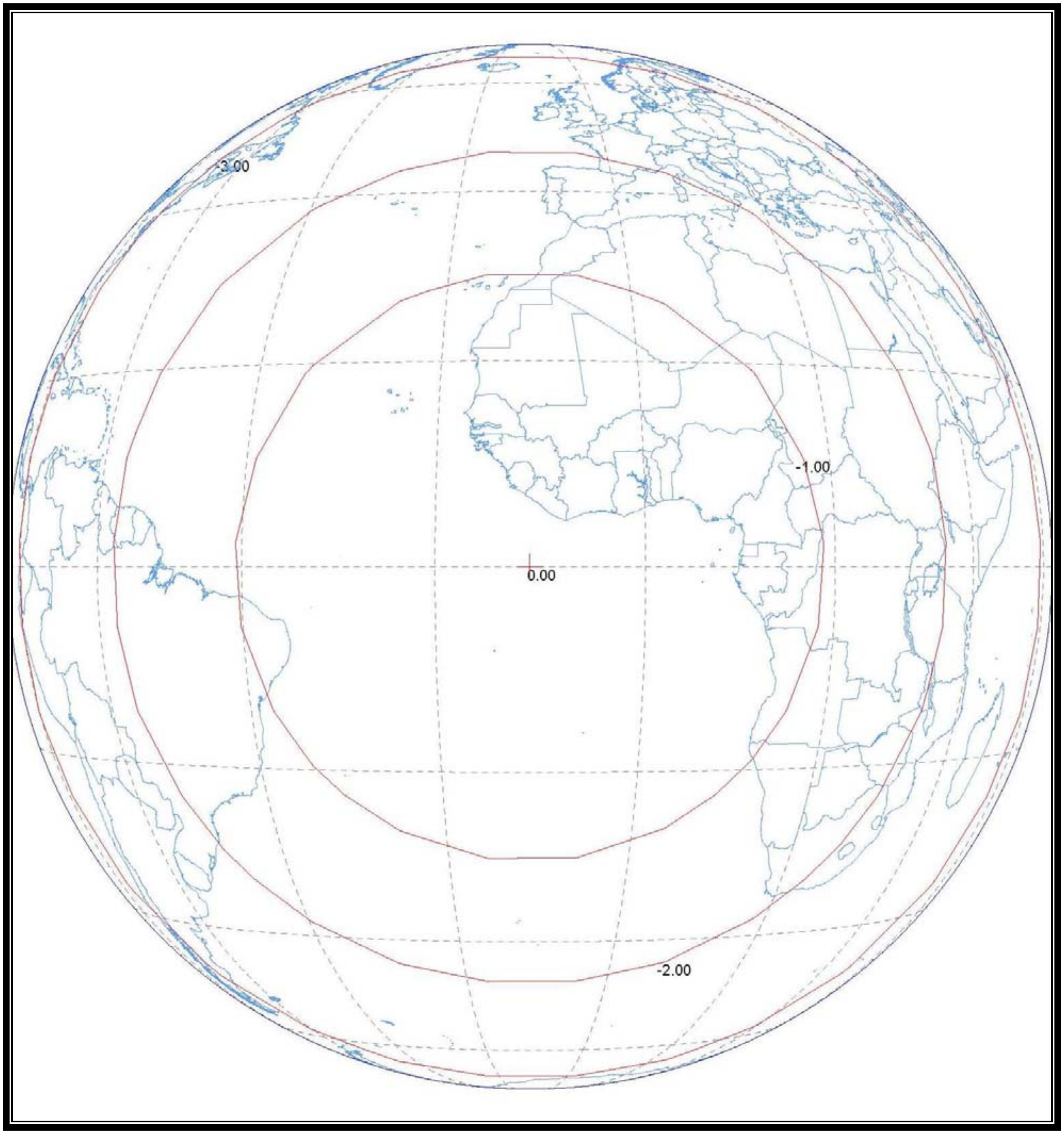

FIGURE 4.0

Figure 4.0 above represents the coverage of a global beam earth-to-space.

3.2 C-band Transponder Description

Earth-to-space signals in the 5975 – 6525 MHz frequency band are received by a left-hand polarized receive antenna horn. The output of the receive antenna is routed through, a diplexer, a test coupler, a band-pass filter and then to a set of wide-band receivers.

The receivers are arranged in a redundant ring, and each uplink can access redundant receivers by ground command. The receivers establish the system noise figure and down-convert the received signal to the transmit frequency band. Each receiver operates over the entire 5975 – 6525 MHz band and is designed to have high sensitivity (*i.e.*, good noise performance) and low cross-talk coefficients (*i.e.*, good linearity characteristics). The AM44 C-band receiver is able to maintain the frequency of the transmitted (downconverted) signal to within 0.002% of the desired value over the life of the spacecraft. Accordingly, AM44 C-band transponders are compliant with the provisions of Section 25.202(e) of the Commission's rules.

The output of the receivers is distributed to a bank of Input Multiplexors ("IMUXs") through a switching network. The IMUXs are filters that provide frequency band separation for each channel. The output of each IMUX is connected to a dedicated Traveling Wave Tube Amplifier ("TWTA") equipped with a linearizer and channel amplifier ("LCTWTA") through a bank of redundancy switches. The redundancy switching permits the output of the IMUX to be routed to a redundant TWTA should the primary unit fail or malfunction.

Each C-band LCTWTA utilizes a TWTA that produces nominal output power of 100 Watts. The LCTWTAs are configured in redundancy rings. Each LCTWTA may operate in Fixed Gain Mode ("FGM") or in Automatic Level Control ("ALC") mode. When operating in FGM, 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. Consequently, the output of each LCTWTA may be varied by ground command over a range of 16 dB in 1 dB increments. Accordingly, the C-band channels of the AM44 are compliant with the provisions of Section 25.210(c) of the Commission's rules. When operating in ALC mode, the input power into the LCTWTA may be maintained at a specific level chosen within a range of 16 dB, in 1 dB increments.

The output of each LCTWTA is routed through a bank of switches to redundant Output Multiplexors ("OMUXs"). The switching network also 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 the OMUX is connected to the transmit antenna (feed) via a band-pass filter, a test coupler and a diplexer.

3.3 Power Flux Density

The power flux density limits for space stations are specified in Section 25.208 of the Commission's Rules for the 3650 – 4200 MHz frequency band. For this band the power flux density ("PFD") level at the Earth's surface produced by AM44 was calculated for a 40 MHz digital carrier, using worst case parameters. As shown in **Table 6.0**, the downlink PFD levels of this carrier do not exceed the limits specified in Section 25.208(a) of the FCC's rules. No contemplated space-to-earth emission will produce PFD levels that exceed the levels created by the proposed 40 MHz carrier.

POWER FLUX DENSITY							
40M0G7W / 3650-4200 MHz							
Elevation Angle (degrees)	0	5	10	15	20	25	90
EIRP (dBW)	47.0	47.0	47.0	47.0	47.0	47.0	47.0
Carrier Occupied Bandwidth (kHz)	40000	40000	40000	40000	40000	40000	40000
Spreading Loss (dB/m^2)	163.4	163.3	163.2	163.0	162.9	162.8	162.3
Maximum EIRP Spectral Density (dBW/m^2/4kHz)	-155.9	-155.8	-155.7	-155.6	-155.5	-155.4	-154.8
FCC Limit (dBW/m^2/4 kHz)	-152.0	-152.0	-149.5	-147.0	-144.5	-142.0	-142.0
Margin (dB)	3.9	3.8	3.7	3.6	3.5	3.4	2.8

TABLE 6.0

3.4 Emissions Limitations

The AM44 transmitter channel filter response characteristics are provided in **Table 7.0**, as required under Section 25.114(c)(4)(vii) of the Commission's Rules.

The AM44 will comply with the provisions of 25.202(f) of the Commission's Rules with regard to emissions.

CHANNEL FREQUENCY RESPONSE CHARACTERISTICS	
FREQUENCY OFFSET RELATIVE TO CHANNEL CENTER FREQUENCY (MHz)	ATTENUATION LEVEL RELATIVE TO PEAK LEVEL (dB) OUTPUT SECTION
+/- 12 MHz	0.8
+/- 16 MHz	1
+/- 18 MHz	1.5

TABLE 7.0

3.5 Service Area

The AM44's C-band transponders primarily serve Africa, Asia, Europe and South America. The AM44 has partial C-band coverage of North America and the Caribbean.

3.6 Orbital Location

The AM44 is licensed under the Russian administration and is located at 11.0º W.L. The AM44 has been fully coordinated in the conventional C- and Ku-band at 11.0º W.L., as well as in certain extended C- and Ku-band frequencies. The ITU Master Register may be consulted to confirm successful coordination of the AM44 in these frequency bands.

3.7 Services and Emission Designators

The AM44 is a general purpose communications satellite and has been designed to support a variety of services. The C-band transponders on the AM44 can accommodate data and voice applications. NewCom will use the satellite exclusively to offer the following service:

- High speed digital data
- Digital SCPC data channels

Emission designators and allocated bandwidths for representative communication carriers are provided in **Table 8.0** below.

EMISSION DESIGNATORS		
SIGNAL TYPE	EMISSION DESIGNATOR	ALLOCATED BANDWIDTH (kHz)
Digital SCPC or MCPC	40M0G7W	40000
Digital SCPC Carrier	128KG7D	128
Digital SCPC Carrier	45K0G7D	45

TABLE 8.0

3.8 Link Analysis

In the frequency bands of 5975 – 6525 MHz and 3650 – 4200 MHz, the AM44 will operate in accordance with existing coordination agreements without generating interference that adversely affects the operation of adjacent satellites. All ITU coordination obligations in the C-band have been satisfied.

The results of the C-band analyses are shown in Exhibit H and demonstrate that operation of the AM44 satellite from 11.0º W.L., within a two-degree environment, would permit the intended SCPC services to achieve their respective performance objectives while maintaining sufficient link margin. Additionally, the EIRP density levels of the carriers listed in Exhibit H comply with the limits contained in Section 25.212(d) of the Commission's Rules.

3.9 Adjacent Satellite Link Analysis

The AM44 will operate in accordance with existing coordination agreements. Operation of the AM44 will be compatible with the operation of existing and planned adjacent satellites.

3.10 Schedule S Submission

Pursuant to Section 25.114(a) of the Commission's Rules, NewCom has provided a Schedule S with data for each C-band transponder that will serve the U.S. market.

4.0 - Telemetry

The telemetry, telecommand and control ("TT&C") subsystem provides the following functions:

- Collection, processing and transmission of spacecraft telemetry data.
- Reception, processing and distribution of telecommands.
- Reception and retransmission of ground station generated ranging signals.

4.1 Antennas

At all times telemetry and command signals are transmitted and received through omnidirectional antennas mounted at redundant points on the spacecraft.[8]

4.2 Telemetry

During normal on-station operations, telemetry data is transmitted by the AM44 via redundant, space-to-earth carriers. Specifically, telemetry data from the various subsystems is collected, processed, aggregated and encoded onto subcarriers. Each encoded subcarrier is modulated onto the primary space-to-earth carriers. The telemetry transmission is received and decoded at RSCC's TT&C operations center.

During transfer orbit maneuvers and emergencies, telemetry data is collected, processed and encoded in an identical manner to when the satellite is functioning normally, on-station; however, the output from the telemetry transmitters is routed to a dedicated amplifier. The amplified signal is then transmitted space-to-earth via an omnidirectional antenna.

4.3 Ranging

The slant range of the AM44 will be measured throughout the operational life of the spacecraft using a multiple tone ranging system. The ranging tones are combined with normal command data and modulated onto the primary command carrier and transmitted to the spacecraft. Upon reception at the spacecraft the signal is routed to the command receiver where it is separated from the normal command data and routed directly to the telemetry transmitter for retransmission to the TT&C operations center on the ground. At RSCC's TT&C operations center, the ranging tones are separated from the telemetry data, demodulated and compared with that of the transmitted signal to determine the range of the satellite.

5.0 - Orbital Debris Mitigation Plan

This exhibit demonstrates compliance with Section 25.114(d) of the Commission's Rules concerning design and operational strategies to mitigate orbital debris.[9]

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[8] RSCC policy prohibits the disclosure of telemetry and telecommand frequencies or antenna parameters. NewCom has applied for a partial waiver of Section 25.137. See Exhibit D.

[9] A copy of Russian State Standard R 52925-2008 concerning orbital debris mitigation is attached. An unofficial English translation is also attached. See Exhibit E.

5.1 Spacecraft Hardware Design

The AM44 was designed and manufactured by NPO Prikladnoy Mekhaniki ("NPO PM") in cooperation with Alcatel Alenia Space France ("AASF"). Specifically, the satellite platform (727 Express M bus) and subsystems were manufactured by NPO-PM, while the telecommunications payload module was manufactured by AASF. The 727 Express M bus is a 3-axis stabilized platform that uses a combination of hydrazine and xenon propellants for stationkeeping and orbit raising maneuvers.

The AM44 spacecraft was designed so that during normal operation debris is not released. RSCC has assessed the probability of a collision between the spacecraft and meteoroids or small debris less than one centimeter in diameter ("<1cm debris"). RSCC has taken the following steps to limit the probability of the AM44 becoming a source of debris due to a collision with <1cm debris that causes loss of control and prevents post-mission disposal. Specifically:

- The AM44 has been ruggedized and all critical components are located inside the protective outer body of the spacecraft or within ruggedized modules interconnected to the body.
- All AM44 subsystems are redundant, with no single point of failure, except for the tanks and tubes associated with the propulsion subsystem.

Based on the architecture of the spacecraft, a single collision with <1cm debris is unlikely to reach critical subsystems or the satellite's propulsion system, and to the extent the satellite was affected by such an event, subsystem redundancy dramatically reduces the probability that RSCC loses control or is prevented from properly disposing of the spacecraft post-mission.

5.2 Prevention of Accidental Explosions

RSCC has assessed and limited the probability of accidental explosions during and after completion of mission operations. In designing the AM44, NPO-PM took appropriate measures to ensure that debris will not result from the conversion of energy sources on board the spacecraft into energy that fragments the spacecraft. Specifically:

- Propellant tanks and thrusters are isolated using redundant valves.
- Electrical systems are shielded and excessive battery charging or discharging is prevented by carefully monitored automated systems.
- Pressure in batteries and fuel tanks is remotely monitored, and there is significant margin between operating pressure levels and burst levels.
- During stationkeeping maneuvers thruster temperatures, impulse and duration are remotely monitored and may be discontinued by closing redundant valves.

At the end of the AM44's mission, and upon reaching final disposal orbit, all energy sources and pressurized systems on the spacecraft will be depleted. Residual chemical propellant will be vented in a controlled manner to maintain perigee height of the final disposal orbit. Batteries will be left in a permanent state of discharge.

5.3 Safe Flight Profiles

RSCC has assessed and limited the probability of the spacecraft becoming a source of debris as a result of collisions with large debris or other operational space stations. Specifically, RSCC has evaluated operational and planned ITU coordinated space stations in proximity to the AM44's operational orbital position at 11 degrees west longitude. Based on this review, RSCC has concluded that the AM44's station keeping volume will not overlap with the volume of another space station. As a result, at this time there is no requirement to physically coordinate the AM44 with another satellite operator.

5.4 Post Mission Disposal

Upon the conclusion of its mission, RSCC will dispose of the AM44 by raising it to a minimum altitude of 235 kilometers above the geostationary arc. This final orbit raising maneuver will ensure that the AM44 achieves an altitude that exceeds the requirements of the Inter-Agency Space Debris Coordination Committee ("IADC") formula.[10]

RSCC has reserved 1.74 kilograms of fuel for the AM44's final orbit raising maneuver. RSCC has assessed fuel gauging uncertainty, and the above referenced volume of propellant provides a sufficient margin of reserve fuel to address the uncertainty.

[10] The IADC recommended minimum increase in perigee altitude at the end of re-orbiting, which takes into account all orbital perturbations, is: 235 km + (1000·*Cr x·A/m*), where *Cr*: solar radiation pressure coefficient (typical values are between 1 & 2), *A/m*: Aspect area to dry mass ratio [m^2/kg].

NEWCOM INTERNATIONAL
Linking your World. *FAST!*

CERTIFICATION OF PERSON RESPONSIBLE FOR PREPARING ENGINEERING INFORMATION

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this application, that I am familiar with Part 25 of the Commission's rules, that I have either prepared or reviewed the engineering information submitted in this application and that it is complete and accurate to the best of my knowledge and belief.

Raul Acosta
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