Panasonic Avionics Corp.
Experimental STA Request for In-flight Entertainment and Connectivity ("IFEC") Solution
December 14, 2023

Description of Applicant and Need for STA

Panasonic Avionics Corporation ("PAC") provides global, high-speed in-flight entertainment and connectivity ("IFEC") services for commercial passenger aviation that delivers a high-quality entertainment experience for people when they fly. In this filing, PAC requests an experimental STA to test the performance and suitability of Stellar Blu Solutions LLC's ("SBS") Ku-band SATCOM multi-orbit terminal called the "Sidewinder" for use in delivering PAC's IFEC services. SBS' Sidewinder is designed to provide high data rate connectivity for IFEC services. PAC will use the Tx9/Rx9 configuration for this test.

PAC seeks an experimental STA for a period of 180 days, commencing January 12, 2024, to test the multi-orbit configuration of the Sidewinder terminal that is designed to connect with either geostationary ("GEO") satellite space stations or OneWeb's low-earth orbit ("LEO") satellite constellation, and to switch seamlessly between them while in use. PAC seeks to assess the suitability of the multi-orbit Sidewinder terminal specifically for use in delivering PAC's IFEC services.

Today, most IFEC services in the passenger cabins of commercial aircraft are delivered using terminals that communicate solely with GEO satellites, which limits the speed of the service and introduces data traffic latencies that are suboptimal for two-way interactive communications. PAC proposes to evaluate the ability of the multi-orbit Sidewinder terminal to deliver a superior user experience by integrating LEO and GEO communications capabilities. This test will include connecting to OneWeb's LEO constellation (S2963) ("Beams"), as well as selected geostationary satellites, SES-15 (S2951), EUTELSAT (S2873) and Intelsat GALAXY 16 (S2687). PAC's existing FCC-issued ESAA license, call sign E100089, authorizes communication with those geostationary satellites by other, previously licensed PAC terminals.

STA Request – Performance Testing

PAC requests this STA to test the Sidewinder terminal (Tx9/Rx9) to ascertain its suitability for use in delivering PAC's IFEC services. PAC will conduct the testing from two separate locations: (1) a stationary mount on the roof of its headquarters building in Irvine, California; and (2) a fixed ground location in the private parking lot of the SBS facility in San Diego, California. Additional details of these locations are shown below:

SITE NAME (or identifier/callsign):	**FIXED PAC-Park Place, CA**	**FIXED SBS-San Diego, CA**
Address	3347 Michelson Dr., Irvine CA, 92612	4542 Ruffner St. Suite 250 San Diego, CA 92111
Latitude (DMS, NAD 83)	33° 40' 20.5" N	32° 49' 24" N
Longitude (DMS, NAD 83)	117° 50' 23.17" W	117° 09' 27" W
Antenna Height	16 meters AGL	1.5 meters AGL
Ground Elevation at antenna site (AMSL)	11 meters AMSL	50 meters AMSL
Antenna Location (ground, roof)	Roof (static-fixed)	Ground
Location Radius	100 meters	100 meters
Path Details	Rooftop, as described above	No public roads, staying within private parking lot
Roof Height	15 meters AGL	N/A
Nearest Airport Landing Area	2.4 km (John Wayne Airport, IATA: SNA)	1.6 km (Montgomery-Gibbs Executive Airport, IATA: MYF)
Number of terminal units	5	1

LEO Mode:

While in LEO mode, the Sidewinder terminal will communicate with a OneWeb LEO constellation using the frequencies set forth in Table 1. The LEO mode terminal specification and test parameters are described in Appendix A.

Table 1

Point of Communication (Call Sign)	Satellite Licensee	Earth-to-Space Frequencies	Space-to-Earth Frequencies
ONEWEB (S2963)	WorldVu Satellites Limited (OneWeb)	14.0-14.5 GHz	10.7-12.7 GHz

GEO Mode:

While in GEO Mode, the Sidewinder terminal will communicate with the following geostationary satellites using the frequencies set forth in Table 2. The GEO mode terminal specification and test parameters are described in Appendix B.

Table 2

Point of Communication (Call Sign)	Satellite Licensee	Earth-to-Space Frequencies	Space-to-Earth Frequencies
SES-15 (S2951) @ 129.15° W.L (Gibraltar-licensed).	SES Satellites (Gibraltar) Ltd.	14.0-14.5 GHz	10.7-12.2 GHz
EUTELSAT 117WA (S2873) @ 116.8° W.L. (formerly SATMEX 8) (Mexico-licensed)	Satélites Mexicanos, S.A. de C.V.	14.0-14.5 GHz	11.7-12.2 GHz
GALAXY 16 (S2687) @ 99.0° W.L. (U.S.-licensed)	Intelsat License LLC	14.0-14.5 GHz	11.7-12.2 GHz

In either LEO or GEO mode, the antenna has the directivity patterns as shown in **Error! Reference source not found.** to **Error! Reference source not found.** in Appendix C.

SBS Sidewinder Antenna Details and Supplier Specifications are described in Appendix D. As stated above, PAC will use the Tx9/Rx9 configuration.

Non-Interference to Other Services

The Sidewinder terminal will operate on a non-interference basis to other services and in accordance with the requirements of the FCC's satellite earth station rules, including but not limited to the applicable technical standards set forth in Part 25, Subpart C.

Stop Buzzer Contact

In case of any reported interference, PAC will cease Sidewinder transmissions as soon as possible upon notification to PAC's 24/7 point of contact:

Stephen Moon
(949) 462-1320

APPENDIX A

SBS Sidewinder Antenna – Technical Specifications and Test Parameters for LEO operation

Tx Antenna Boresight Characteristics:

All parameters reported at broadside. Beamwidth is maximum half-power beamwidth (HPBW)

1. Size: 0.47m x 0.47m
2. Antenna Gain: 34.1 dBi
3. Antenna Full Beamwidth: 3.5 degrees
4. Tx Power max (W): 15.5 W
5. Tx ERP max (kW): 39.8 kW
6. Tx EIRP max (dBW): 46 dBW
7. Tx Input Power at Antenna Flange nominal (W): 7.7 W
8. Tx ERP nominal (kW): 19.9 kW
9. Tx EIRP nominal (dBW): 43 dBW

Antenna gain pattern performances:

a. Not to Radiate within +/-6° of GSO Arc when communicating with ONEWEB (Call Sign S2963). Co-polarized gain (DBi), plus and minus from 0 to 10 degrees, 0 to 45 degrees, and 0 to 180 degrees with FCC 25.209 envelope superimposed on each measured pattern, in the azimuth and elevation planes, at 14.25 GHz for the user terminal (antenna).

b. Off-axis EIRP density envelopes (dBW/4 kHz), plus and minus from 0 to 10 degrees, 0 to 45 degrees, and 0 to 180 degrees with FCC 25.218 envelope superimposed on each measured pattern, in the azimuth and elevation planes, at 14.25 GHz for the user terminal (antenna).

APPENDIX B

SBS Sidewinder Antenna – Technical Specifications and Test Parameters for GEO operation

Tx Antenna Boresight Characteristics:

All parameters reported at broadside. Beamwidth is maximum half-power beamwidth (HPBW)

1. Size: 0.47m x 0.47m
2. Antenna Gain: 34.1 dBi
3. Antenna Full Beamwidth: 3.5 degrees (TBD)
4. Tx Power max (W): 61.7 W
5. Tx ERP max (kW): 158.5 kW
6. Tx EIRP max (dBW): 52 dBW
7. Tx Input Power at Antenna Flange nominal (W): 30.9 W
8. Tx ERP nominal (kW): 79.4 kW
9. Tx EIRP nominal (dBW): 49 dBW

Antenna gain pattern performances:

a. In accordance with Part 25, Subpart C, including Sections 25.209(a-b); 25.212(c); and 25.218(f) of the Commission's rules, 47 C.F.R. §§ 25.209(a-b), 25.212(c), 25.218(f).

Appendix C

Tx Antenna Patterns @ 14.125GHz, ϕ=0°

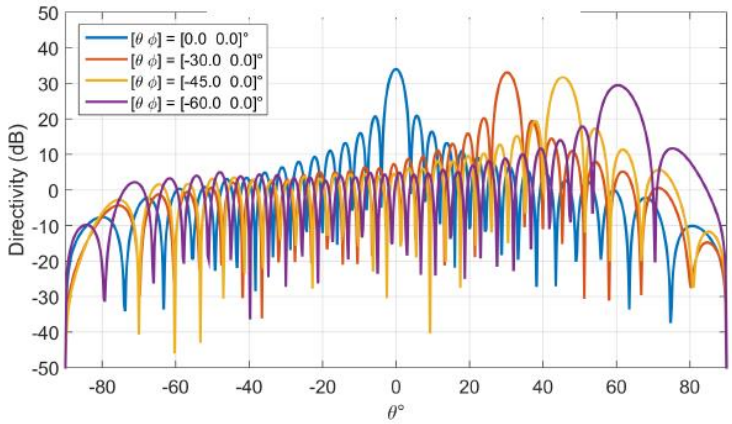


Figure 1: Antenna directivity at 14.125 GHz and elevation ϕ = 0°.

Tx Antenna Patterns @ 14.125GHz, ϕ=90°

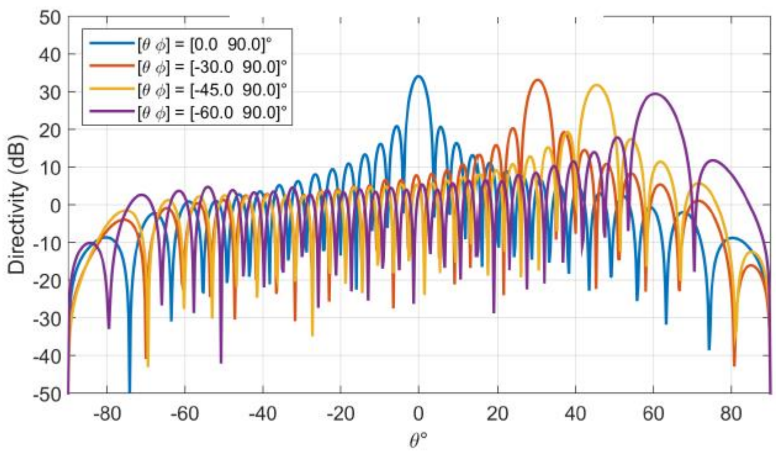


Figure 2: Antenna directivity at 14.125 GHz and elevation f = 90°.

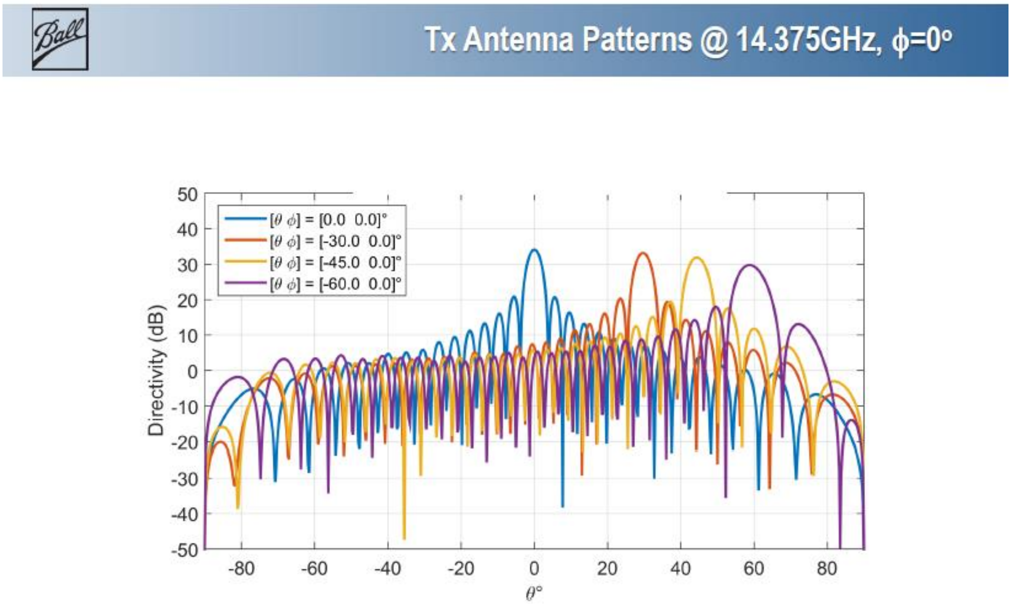


Figure 3: Antenna directivity at 14.375 GHz and elevation $\phi = 0°$.

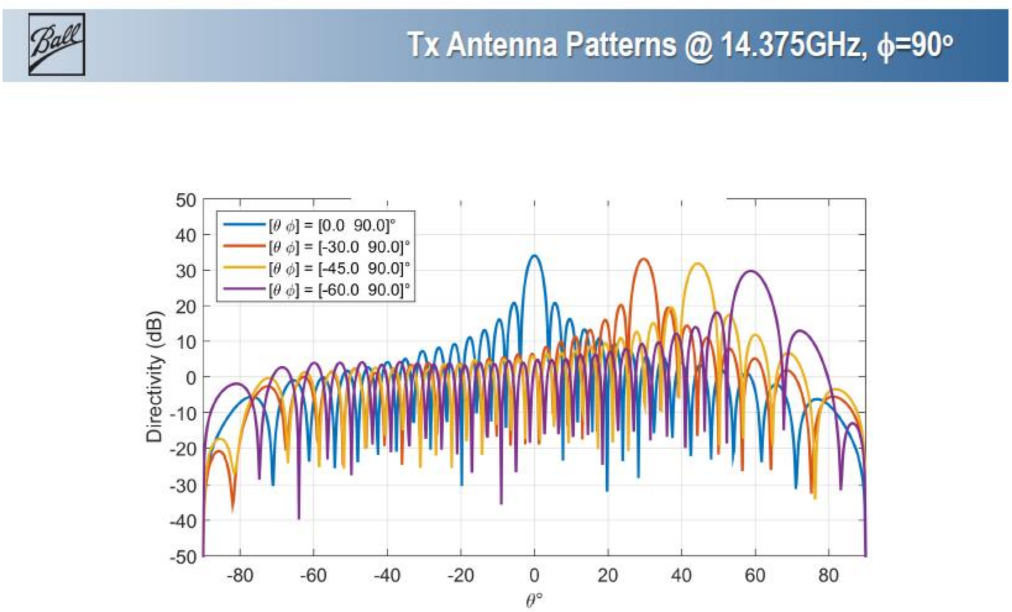


Figure 4: Antenna directivity at 14.375 GHz and elevation $\phi = 90°$.

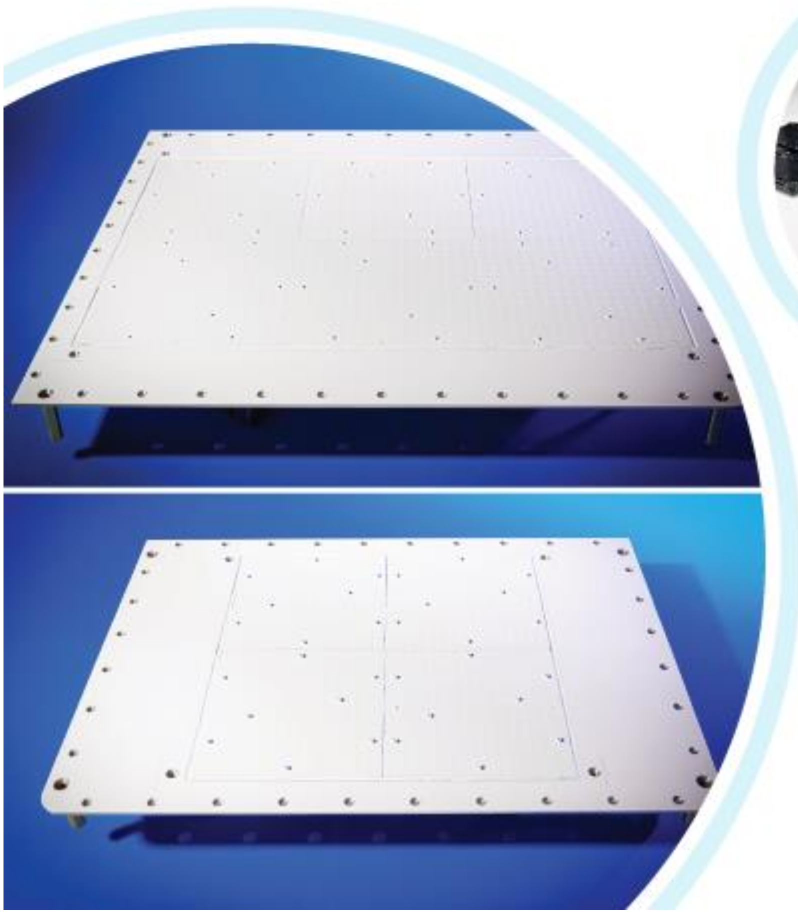
Appendix D

Ku-BAND SATCOM

Phased Array Terminals

Ball Aerospace's industry-leading line of electronically steerable antennas (ESAs) provide reliable, secure and high-speed communications across networks, frequencies and platforms. Our antenna solutions deliver unmatched flexibility to meet any use case, enabling fully customizable and affordable ESAs in Ku frequency bands for government, military and commercial markets.

ESA technology will transform how we connect and share information across the world. With our scale, experience and resources along with our global manufacturing partners, we are bringing the promise of ESA technology to the market today.



Top Left Image: Rx array;
Bottom Left Image: Tx array.

GO BEYOND WITH BALL.®

Architecture Overview

Ball's electronically steered Ku-Band phased array antennas feature our innovative subarray antenna architecture. The subarray is an environmentally-sealed ESA building block. A terminal's transmit and receive antenna sizes are optimized by tiling multiple subarrays together to meet requirements. Our subarrays are fully electronic with no unique materials or complex assembly processes. This allows the antennas to be assembled in volume, minimizing cost. The subarrays support both military and commercial use cases, including in-flight connectivity (IFC), communications on the move (COTM) and enterprise.

Durable & Dependable

- Subarrays are an environmentally-sealed assembly, protecting all electronics

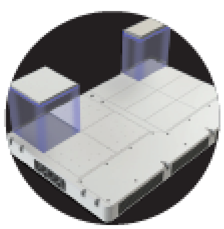
Affordable

- Designed for existing high-volume manufacturing processes
- Use highly-integrated commercial semiconductor devices and circuit boards
- Designed with integrated radome to reduce system cost and improve performance

Interoperable / Future-Proof

- Antenna terminals are network and modem agnostic to support access to multiple networks
- ESA fast beam update rates easily support LEO satellite tracking
- Software-defined antenna enables our architecture to meet the network needs of today and tomorrow

COTM Terminal: 4Tx + 8Rx Subarrays



ESA: Proven & Ready

Ball has assembled and tested multiple ESA terminals, demonstrating the performance and scalability of the subarray design. Terminals have been demonstrated on geostationary orbit (GEO) and low-Earth orbit (LEO) networks, showcasing the flexibility and robust communication capabilities of our terminals to maintain links under highly dynamic maneuvers.

Ball ESA terminals are ready today to meet your SATCOM needs. The company is actively ramping up our production of subarrays. We offer a flexible partnership model that capitalizes on each organizations' expertise, whether delivering full terminal solutions or just the antenna.

ESA CAPABILITIES	
Frequency	Transmit: 13.75* – 14.50 GHz Receive: 10.70 – 12.75 GHz
Polarization	V/H/RHCP/LHCP (software switchable)
Axial Ratio	< 2.0 dB (software controlled)
Coverage	Azimuth: 360° Elevation: 10° to 90°
Beam Update Rate	< 1ms (any position, any polarization)
Interfaces	Open AMIP / Custom
Dual Beam	Receive capable

Extendable down to 12.75

ANTENNA CONFIGURATION (SUBARRAYS)		ESTIMATE ANTENNA PERFORMANCE		APERTURE SIZE		WEIGHT (SUBARRAYS ONLY)
Tx	Rx	EIRP (dBW)	G/T (dB/K)	Tx (in)	Rx (in)	(lbs)
2	4	40.5	9	13×7	15×15	18
4	6	46.5	10.8	13×13	15×23	30
9	9	53.6	12.5	19×19	23×23	50

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