HUGHES

Broadband Mobility Solutions

HUGHES Broadband Systems

Hughes is the market leader in broadband satellite products and services with over 4 million terminals shipped to customers in over 100 countries. Hughes products and services are used in a wide range of markets, including consumer Internet, where support for a large number of terminals is required, and for enterprises, where Quality of Service (QoS) and Service Level Agreements (SLAs) are critical to service implementation. In support of these markets, Hughes has developed a set of powerful IP broadband satellite capabilities.

The HX System, an innovative IP broadband satellite system, is specifically designed and optimized for specialty applications including mobility. The HX System leverages the best of the features and capabilities of the highly successful Hughes HN broadband VSAT system and offers additional features to support applications that are predominantly high bandwidth and real time (cellular backhaul, video conferencing, etc.).

The HX System provides advanced bandwidth management capabilities which give operators the ability to custom design various QoS and SLAs on a per-remote basis. As a 100% IP-based solution, the HX System incorporates a strong set of IP functions and features. Leveraging the DVB-S2 transmission standard for the outbound channel, the HX System is able to achieve the best spectral efficiency of any TDM/TDMA network on the market. While the HX System allows operators to dedicate inbound/outbound bandwidth per remote, the aloha-based inbound TDMA channels provide the capability to dynamically allocate bandwidth based on usage and need—thus allowing operators to develop a wider range of service plans for their customers. Network management is highly advanced and includes an HTTP access which can be located remotely and shared with end users.

The HX System includes a set of features to specifically address mobile broadband services. This paper details these features.

Challenges of Mobile Broadband

Supporting continuous broadband satellite connectivity to mobile devices is challenging. While mobile satellite services at lower satellite frequencies (L-band in particular) have been available for some time, these services tend to provide lower rates of speed (less than 400 kbps) and tend to be very expensive as they are charged on a usage basis. Satellite broadband using higher frequency services, such as Ku-band and more recently Ka-band, can provide more bandwidth at a lower cost. But the very nature of these higher frequency services presents a significant challenge for the mobile terminal. Some of the challenges are outlined below.

Changing Transmission Path

As mobile broadband terminals travel, they will move through various contours of the satellite footprint, causing the path to the satellite to change. The challenge is for the satellite broadband system to dynamically adapt to changing link conditions in order to maintain availability while not wasting satellite capacity.

Frequent Blockage

As mobile vehicles travel, they will pass under various obstacles such as trees, overpasses, and tunnels which will obstruct the channel path to the satellite. The challenge is to be able to recover the link as quickly as possible.

Antenna Size Limitations

For most mobile applications, the antenna must be as small as possible. Antennas mounted on a vehicle must allow the vehicle to pass under overpasses while antennas on an aircraft, for example, must be installed in a limited space. The challenge with smaller antenna sizes is the need to conform to regulations regarding adjacent satellite interference.

Harsh Locations

By their very nature, mobile vehicles provide a harsh environment for any type of electronics. This includes continuous vibrations, dust, and temperature extremes. For electronics to work well in this challenging environment, they must be of a robust design.

Hughes Mobility Feature Set

Hughes has enhanced and optimized our satellite broadband products and services to directly address the key requirements found in many mobile applications. These features have been fully incorporated and integrated into the HX satellite broadband systems. Some of the key features include:

- **DVB-S2/ACM** — The use of Adaptive Coding and Modulation (ACM) of the outbound channel enables the remote terminal to continually monitor the received signal level of the outbound channel and to dynamically request changes to the combination of coding and modulation. This allows the downstream channel to be continually optimized as the mobile terminal travels through the various contours of the satellite footprint.
- **AIS** — With the AIS (Adaptive Inroute Selection) feature, the TDMA channel (uplink from the mobile device) is continually monitored by the hub and the remote terminal is thus continuously advised of its optimal TDMA transmission coding and power levels. Similar to the DVB-S2/ACM for the outbound channel, this feature means that the TDMA channel is also continually optimized as the remote terminal travels through the various contours of the satellite footprint.
- **TDMA Channel Spreading** — To overcome issues with off-axis emissions, the HX System supports spreading of the TDMA channel by two times and four times the nominal channel bandwidth. A 256 ksps TDMA channel with a nominal channel spacing of 320 kHz can be spread to either 640 kHz (2x spreading) or 1280 kHz (4x spreading). This feature enables the use of very small antennas as it mitigates adjacent satellite interference.
- **Doppler Compensation** — The HX System is being used to support aeronautical broadband as well as high-speed land applications. As these vehicles move at a very high rate of speed, the Hughes HX System continuously calculates and applies a Doppler compensation.
- **Outbound Flywheel and Fast Reacquisition** — As land mobile units will frequently encounter obstructions (trees, bridges, etc.) which prevent receipt of the outbound channel, Hughes has implemented a "flywheel" for the timing synchronization of the outbound channel. The flywheel can "spin" for as long as 30 seconds, whereby if the outbound signal is seen within the 30 seconds, the reacquisition of the outbound channel occurs immediately upon receipt of the first superframe marker.
- **External 10 MHz Reference** — To ensure fast TDMA transmit capability, the HX remote unit is capable of accepting an external 10 MHz reference. This eliminates the need for frequency stability to be derived from the outbound carrier (which is not accurate during the flywheel period) and enables the remote terminal to transmit the TDMA carrier immediately upon reacquisition of the outbound channel.
- **IP Steady State** — The HX System maintains the IP session during periods of link outages so that even if the signal is lost for longer than 30 seconds, (i.e., a train in a tunnel) once the link is restored, the users do not have to reestablish IP connectivity.
- **Ruggedized Chassis** — The HX remote terminals are configured with a ruggedized chassis permitting mounting in a 19 inch rack. Mobile terminals are often installed in environments with high heat, humidity, dust, and vibration.
- **Automatic Beam Switching** — Using a standard API, the HX remote terminal interfaces to an antenna control unit to determine location and when to command the antenna to switch to a new satellite.

Mobile Antenna Integration

Hughes has integrated the HX200 remote terminal with a number of antennas which are designed to support mobility. The HX200 is well suited for integration with mobile antennas as it supports an industry standard L-band BUC (Block Up-Converter). This enables the HX200 to operate with an antenna which has an integrated BUC. Hughes has successfully integrated the HX200 with mobile antenna systems from:

- Raysat Systems
- Orbit
- Sea Tel (Cobham)
- Intellian
- Aerosat

More Information Available

These are just some of the features that make the Hughes solution right for mobility applications. Visit www.hughes.com or consult your local Hughes representative for a more detailed briefing on Hughes solutions for mobility applications.

Proprietary Statement