

**Hughes Cellular Backhaul Solutions – PMP,
SCPC, and TDM/TDMA for GSM, CDMA, and 3G
Backhaul**

February 2007

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1.0 Executive Summary

Hughes Network System (Hughes) is the leader in Broadband Satellite and Cellular Services for over 30 years. The pioneer of Very Small Aperture Terminals (VSAT), Hughes has since grown into the premier global satellite and cellular broadband services company. Hughes provides a global satellite service and has shipped more than 1.2 million systems to customers in over 100 countries and provides service in 4 continents. Its broadband satellite products are based on the IPoS (IP over Satellite) global standard, approved by the TTA, ETSI, and ITU standards organizations. Hughes cellular products have been defined new frontiers in Telecommunication including THURAYA's GSM over Satellite Service and its Point-to-Multipoint product for Nokia. Its cellular products are based on standards that are approved by TTA, ETSI, and ITU standards organizations. With this depth of telecommunications expertise, Hughes is uniquely suited to provide Cellular Operators and Satellite Network Operators with a complete solutions package for all Cellular Backhaul markets.

1.1 What is Cellular Backhaul?

The Cellular Backhaul market is a growing market that is driven by the rapid growth of 2G and 3G networks globally. As Cellular networks grow by expanding their 2G capabilities across the rural and suburban regions while adding 3G services to their urban regions, their need for backhauls between Base Stations and switching centers also increases. Figure 1 provides an overview of the typical 2G and 3G network topology

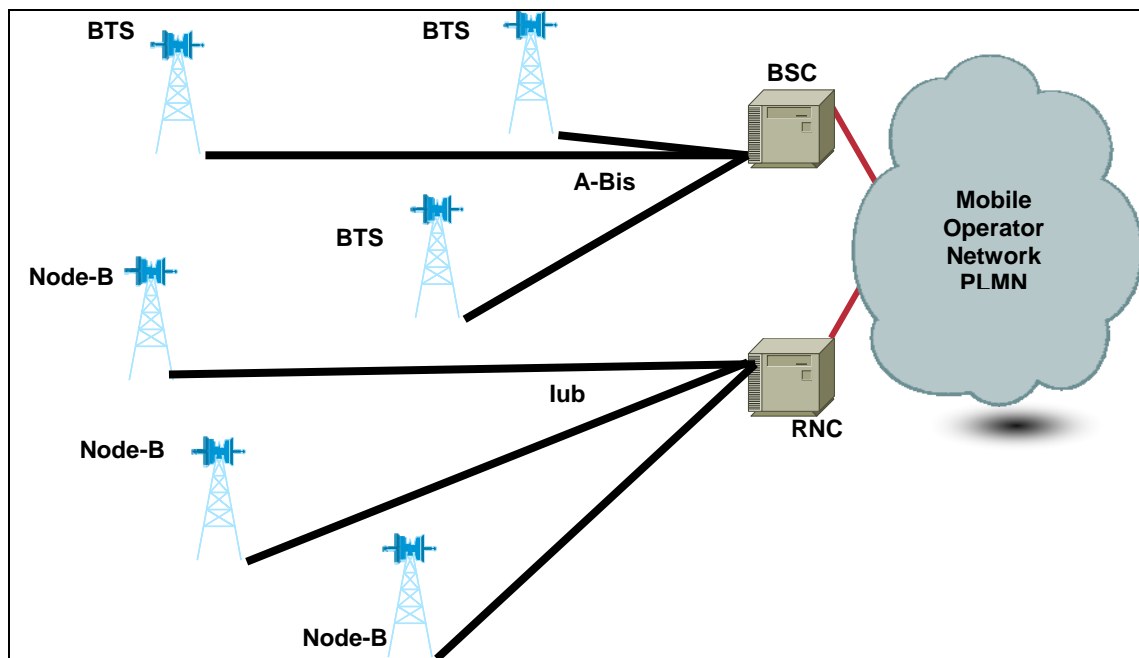


Figure 1 GSM Network Topology

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2.0 Hughes Cellular Backhaul Solution

Hughes offers a suite of products and services to meet the needs of its rapidly growing global market that is a combination of Point-to-Multipoint (PMP), Single Channel Per Carrier (SCPC), and Time Division Multiplexing/Time Division Multiple Access (TDM/TDMA) technologies. Leveraging its 30 year history in the telecommunications market, Hughes can provide Cellular and Satellite Operators this unique product suite.

2.1 What Product Do I Need?

The suite of Cellular Backhaul solutions from Hughes enables Cellular and Satellite Operators to provide backhaul for all 3 major types of markets: Metropolitan Radio Access Networks (RAN), Suburban RANs, and Rural RANs.

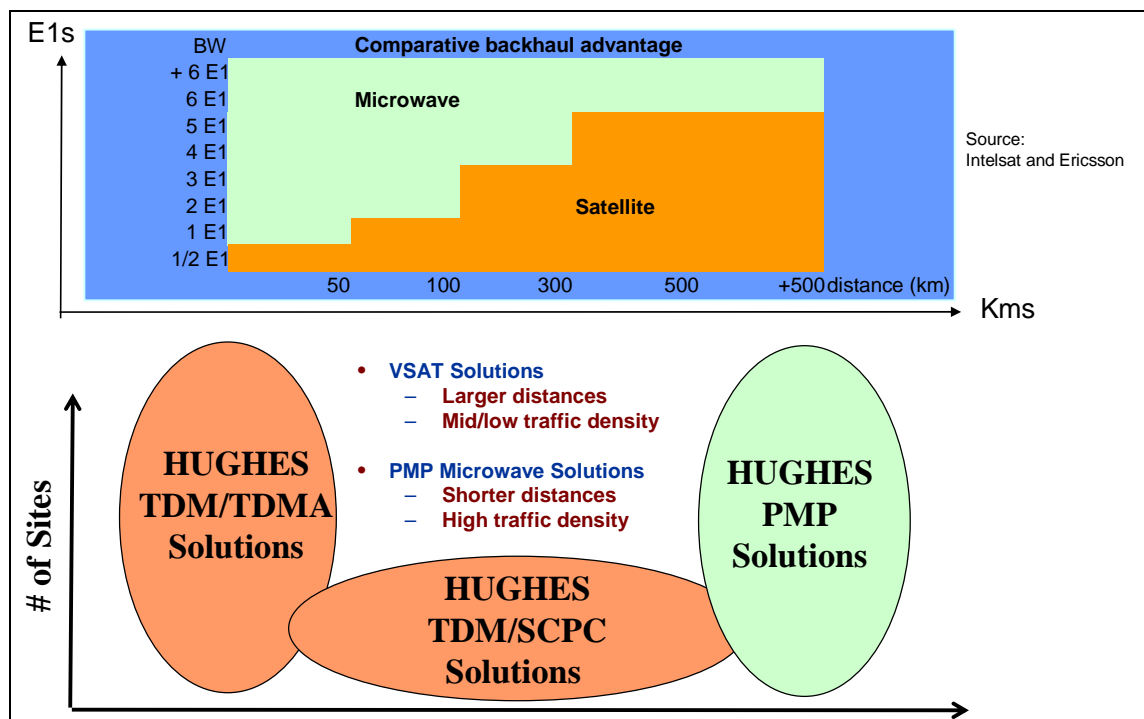


Figure 2 outlines the suitable technologies for each of these markets. For high density metro locations, the Hughes PMP product line provides operators with a high bandwidth, easy to implement solution that meets their requirement for advanced services such as 3G, Wi-Fi, and WiMax services, as well broadband services.

For suburban locals, the Hughes PMP in combination with Hughes SCPC solutions offers operators flexibility. Suburban locations that require advanced services can be supported using Hughes PMP products while locations further away will be supported by the Hughes SCPC solution.

For rural locations, the Hughes Broadband VSAT solution, Hughes HX system, uses Time-Division Multiplexing (TDM) and Time Division Multiple Access (TDMA) technology. This offers a cost-

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effective solution to enable universal connectivity while expanding a Cellular Operator’s network coverage.

3.0 Hughes PMP

3.1 Cell Site Connectivity Using PMP

The following figure shows PMP being used to connect GSM, CDMA, and 3G cell sites. The PMP system has the appropriate interfaces to connect with each type of system. Notice that all the cell sites share the base station or “hub.” The mobile traffic comes into the base station, and from there it is sent to the Mobile Telephone Switch using high-capacity circuits.

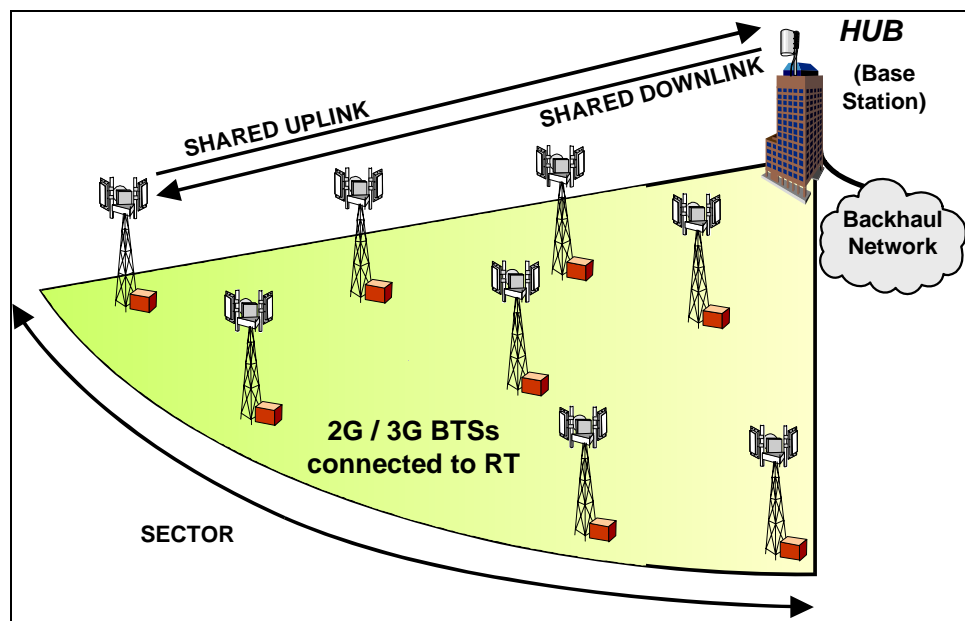


Figure 3 Hughes PMP Solution

4.0 Hughes SCPC

4.1 Cell Site Connectivity Using Hughes SCPC

The Hughes SCPC Solution provides operators with a solution to meet suburban locations that are out of reach of Terrestrial networks. The SCPC solution offers a high-bandwidth solution to allow services such as GSM Voice with EDGE and GPRS, CDMA2000 1x and Wireless Local Loop. The solution offers Operators the capability to provide up to 20 Mbps connections with E1 or IP interfaces for connecting Base Stations in suburban locations not supported by Fiber or other Terrestrial networks while still being completely managed. In addition the Hughes SCPC solution

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provides RAN optimization allowing for the most efficient use of this high bandwidth connection.. Figure 4 shows a typical Hughes SCPC deployment.

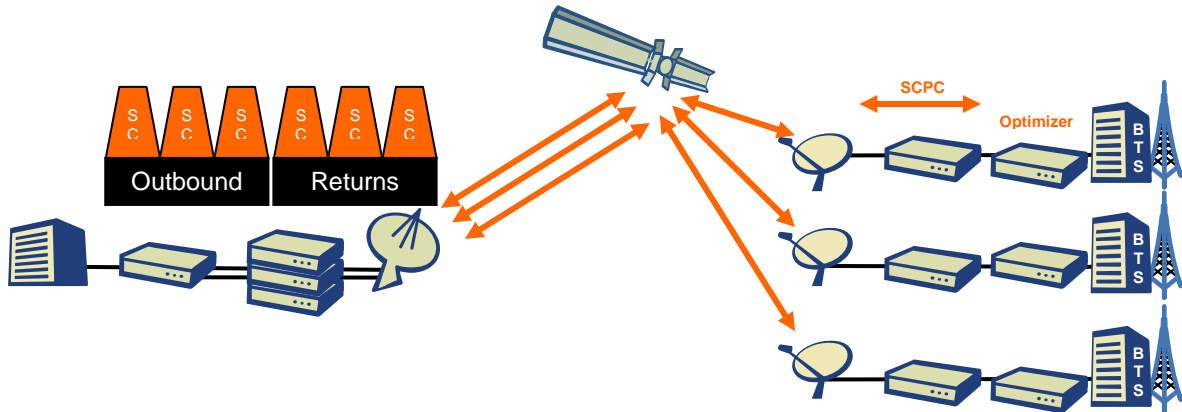


Figure 4 Hughes SCPC Solution

4.2 Cell Site Connectivity Using Hughes HX/SCPC

The Hughes HX/SCPC Solution provides operators with a solution to meet suburban locations with a bandwidth and spectrum efficient solution. The solution leverages a TDM/SCPC architecture and offers a managed, high-bandwidth solution to allow services such as GSM Voice with EDGE and GPRS, CDMA2000 1x and Wireless Local Loop. The solution offers Operators the capability to provide up to 20 Mbps connections with E1 or IP interfaces for connecting Base Stations in suburban locations not supported by Fiber or other Terrestrial networks while still being bandwidth and spectrum efficient and can be completely managed. The solution is combination of the Hughes HX TDM with the Hughes SCPC solution to ensure the high availability required by operators. Like the Hughes SCPC solution the HX/SCPC solution also provides a GSM and CDMA2000 RAN optimization to ensure the most efficient use of bandwidth over the system, as shown in figure 5.

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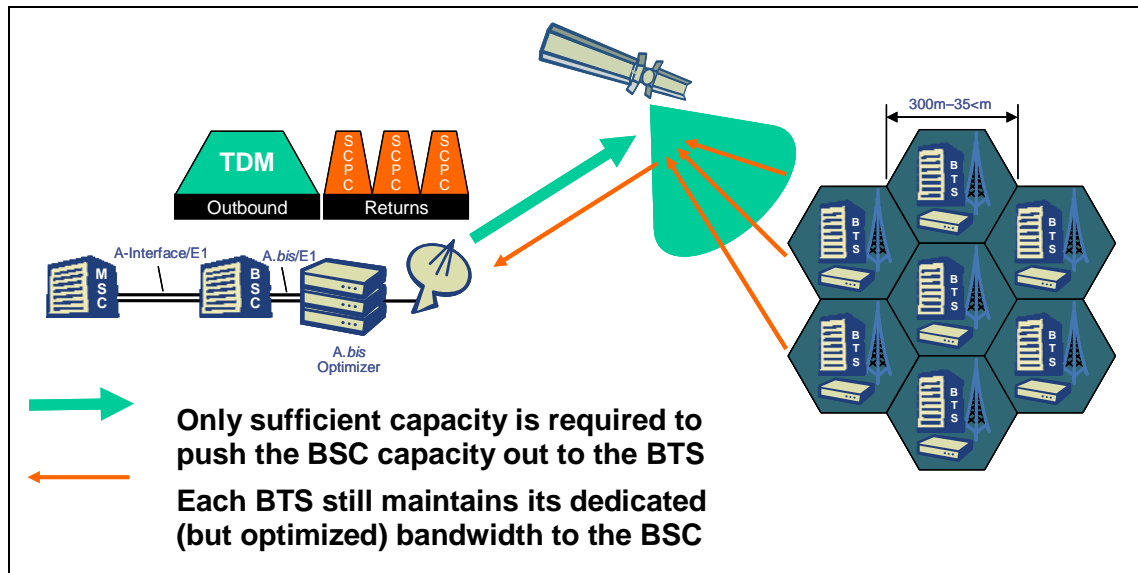


Figure 5 Hughes HX/SCPC Solution

5.0 Hughes HX

5.1 Cell Site Connectivity Using Hughes HX

The Hughes HX system, launched in October 2006, is a cost and spectrum effective solution for Cellular Backhaul for TDM/TDMA markets. It is ideally suited to support the rural markets as they quickly grow. The Hughes HX solution offers operators capacities of up to 3 Mbps connections with E1 and IP interfaces. The services and applications that can be supported on the Hughes HX platform include GSM Voice with GPRS and Edge, CDMA2000 1x, CDMA wireless local loop, VoIP, and Video-over-IP. The Hughes HX solution also utilizes RAN optimization to provide operators with a bandwidth and spectrum efficient solution for the lower traffic locations, and enables operators with a lower total cost of ownership while providing a completely managed solution as seen in Figure 6. The HX solution leverages technology and expertise gained over 10 years of providing Managed Networks to Enterprise customers while addressing the specific requirements of the Cellular market.

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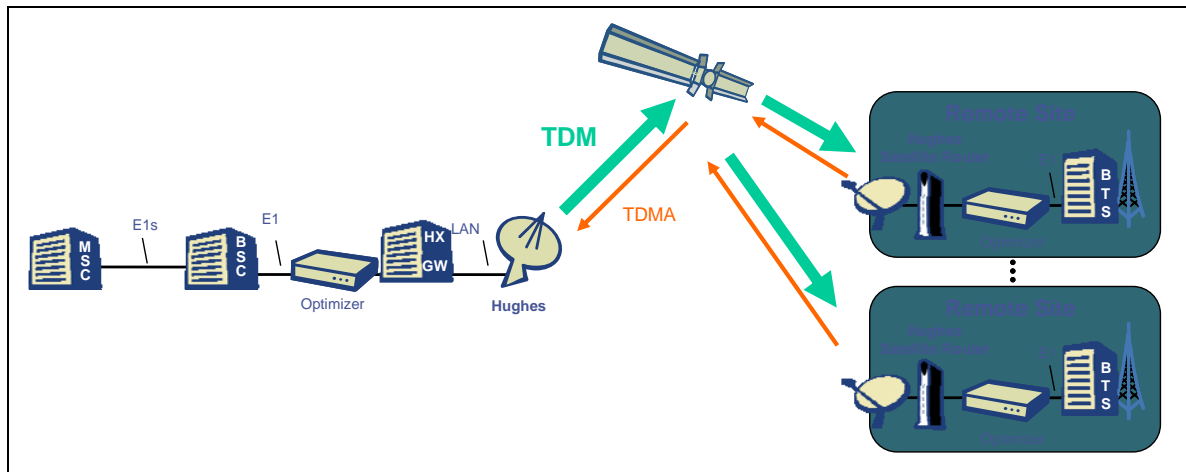
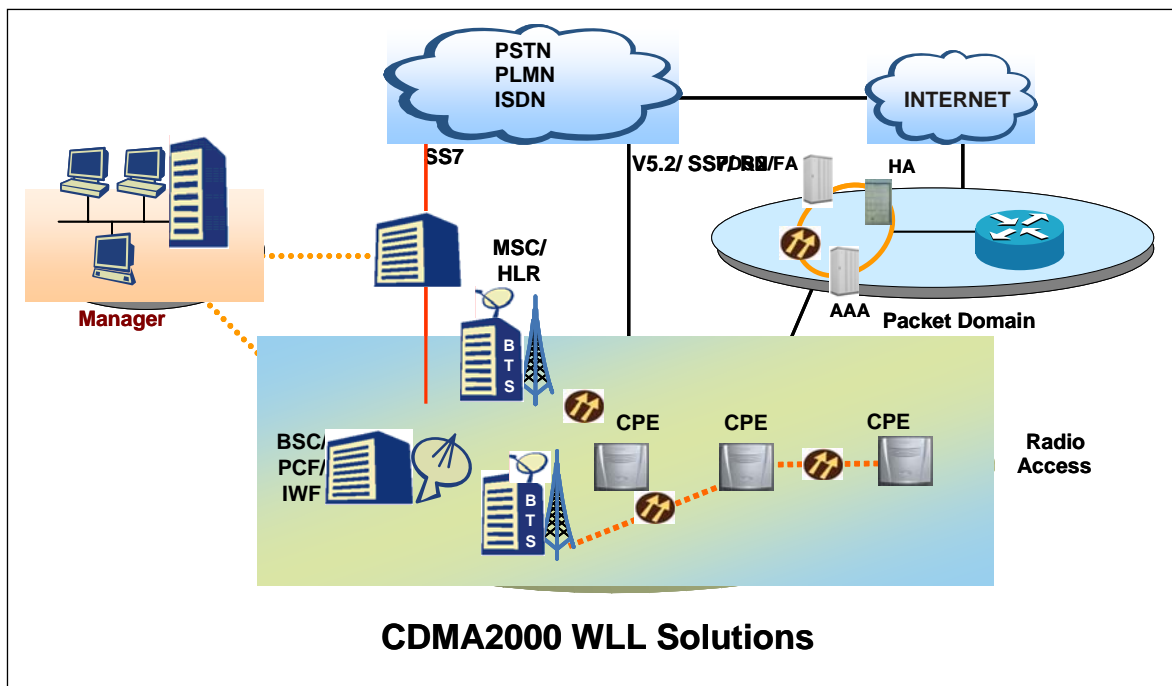


Figure 6 Hughes HX Cellular Backhaul Solution

5.2 CDMA2000 Wireless Local Loop Connectivity Using Hughes HX

The Hughes HX solution provides an ideal solution for backhauling of CDMA2000 Wireless Local Loop for rural locations. The bandwidth and spectral efficiencies that apply for backhauling of Cellular traffic are also beneficial to the CDMA2000 Wireless Local Loop market.



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6.0 Summary

From the examples presented above, Hughes provides the complete answer for Cellular Backhaul Solutions. GSM, CDMA, 3G mobile and CDM2000 WLL networks are growing at a phenomenal pace, and all those cell sites need to be connected to the Mobile Switching Center (MSC). Using Hughes PMP, SCPC, or HX, Hughes can provide an operator with a single vendor for all their needs.

Hughes is the “one-stop-shop” for Cellular Backhaul Solutions.

For further information please contact Hughes Network Systems at www.hughes.com or our regional sales offices.