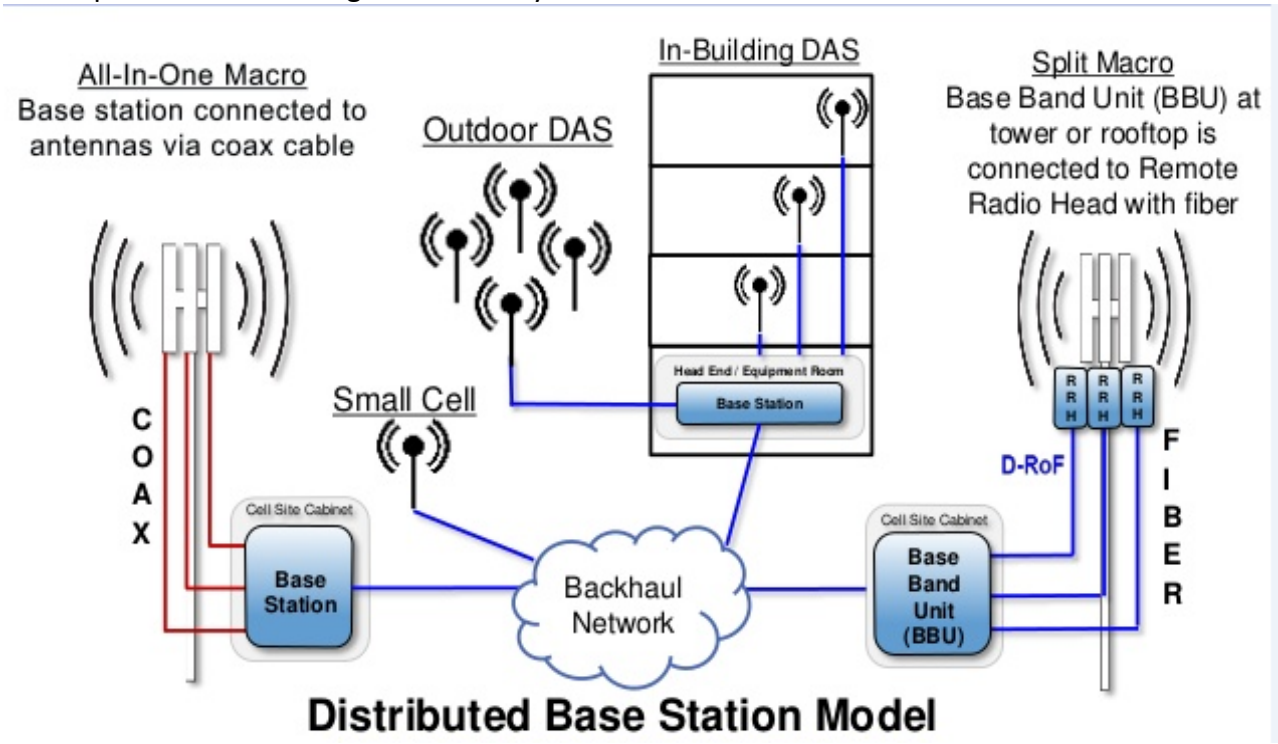
The Importance of GPS (GNSS) Derived Timing

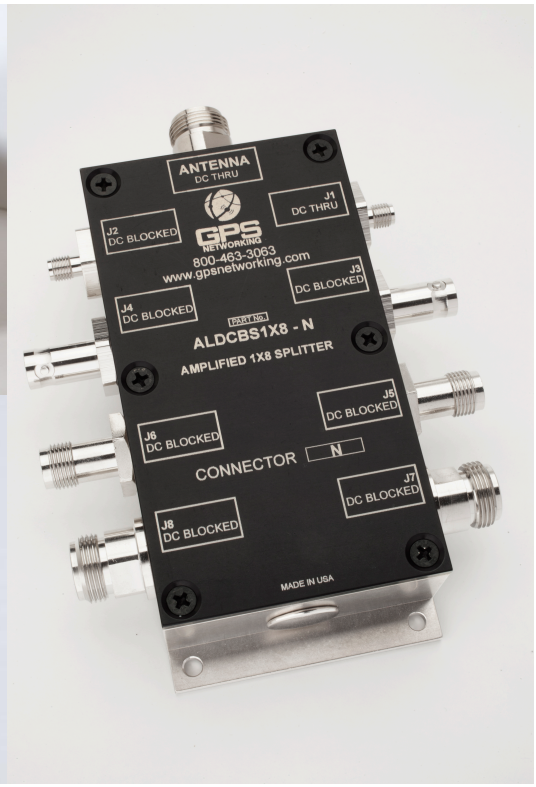
Most users think of GPS as a means of determining position, but the constellation of 24 satellites is also an excellent time keeper. In addition to longitude, latitude and altitude, GNSS systems provide a critical fourth dimension – time. Each satellite contains two Rubidium and two Cesium atomic clocks. These are monitored against atomic clocks on the ground, and the whole system is continuously calibrated against the world wide time standard, Universal Coordinated Time (UTC). GPS receivers decode these signals, effectively synchronizing each receiver to the atomic clocks enabling users to determine time to within 100 billionths of a second, without the cost of owning, operating and maintaining atomic clocks. Synchronization is now regarded as equally important to the output power of any cell site.

GPS as a source of timing is not only a key component for the synchronization in telecommunications but to critical infrastructure in general. Of the 18 Critical Resource and Key Infrastructure (CIKR) sectors, 15 use GPS derived timing to function correctly. One notable application where highly accurate timing accuracy (and the means to maintain it through holdover) is in the use of Synchrophasors in the power industry to detect line faults. Another important application is low latency trading applications in capital markets which is surging demand within the banking industry worldwide. Accurate synchronization in wireless base stations rely on timing to operate correctly, particularly for the handoff that occurs when a user moves from one cell to another. In these applications, holdover is used in base stations to ensure continued operation while GPS is unavailable and to reduce the costs associated with emergency repairs, since holdover allows the site to continue to function correctly until maintenance can be performed at a convenient time. Some of the most stringent requirements come from the newer generation of wireless base stations, where phase accuracy targets as low as 1µs need to be maintained for correct operation. Greater timing precision throughout a network will ensure the ability of that network to perform to its highest capabilities. However, the need for accurate timing has been an integral part of the history of wireless communication systems. The search for reliable and cost effective timing solutions was spurred on by the need for CDMA to compete with lower cost solutions. More recently, however, providers have learned that upfront investments with respect to increased timing reliability have been justified by lower network maintenance costs and increased data throughput (ability to serve more customers). Within the base station, besides standard functions, accurate timing and the means to maintain it through holdover is also vitally important for services such as E911.

GPS signals are sensitive to jamming and interference due to its very low power (-130dBm) and can easily be swamped by other sources, that can be either accidental or deliberate. Since GPS depends on line of sight, other factors often need to be considered on a case-by-case basis when considering the mounting location of the outdoor receiving antenna. A GPS outage is not initially critical because clocks can go into holdover, allowing the interference to be alleviated as much as the stability of the oscillator providing holdover will allow. The more stable the oscillator, the longer the system can operate without GPS. Despite improvements in holdover methods, maintaining 24X7 GPS signal availability is still the most efficient and cost effective technique to ensure the highest reliability.



As shown in the figure above, there are a multitude of different types of 'cell sites'. GPS is is the primary source of timing for all of them. Splitting the GPS signal is currently the most efficient means of adding additional base stations in order to increase network capacity. There are several ways to deliver a strong, reliable GPS signal to the multitude of downstream devices requiring GPS for synchronization. Placement of a reliable GPS antenna on the roof with a clear view of the sky with minimal interference from any local transmissions is a key starting point. A tested, low-loss RF cable will bring the GPS signal to the location of the timing devices with integrated GPS receivers. Since most applications today consist of a wide and growing array of these devices, a GPS splitter is the most scalable and cost-effective means to distribute the signal to all of these devices from a single antenna. Unlike low cost broadband splitters, a true GPS Splitter is designed for the low power, high frequency and sensitive nature of the incoming signals. GPS Splitters are typically amplified to compensate for long or short cable runs and may consist of however many outputs an application requires today and may also include additional outputs to cover future expansion. The flexibility and scalability of splitting a single GPS signal without encountering significant signal degradation is the main reason why true GPS Splitters have become fixtures at nearly all cell towers, DAS networks, small cells, utility networks and financial networks.



GPS Networking Splitters are available with high isolation and custom gain and are made with 2, 4, 8, 16 and 32 outputs. These splitters may be cascaded from each other to enable GPS availability for hundreds of devices simultaneously from a single antenna. The GPS Networking Splitter's low noise amplification will actually improve system signal-to-noise ratios and may prevent issues like inclement weather from disrupting the signal and putting the network into a holdover condition. Minimizing the duration and number of holdover events increases network performance and minimizes service calls and other related expenses. GPS Networking now also carries a complete line of Mil-Spec splitters to handle even the most challenging environments. GPS Networking is widely regarded as the worldwide GNSS signal distribution experts and have been designing and developing custom solutions for over 20 years. Contact them to discuss any application and allow them to develop a reliable and cost-effective solution to satisfy any network requirements.

GPS NETWORKING

GPS NETWORKING, INC.
373 E. INDUSTRIAL BLVD.
PUEBLO WEST, CO 81007

PHONE: 719-595-9880
TOLL FREE: 1-800-463-3063
www.gpsnetworking.com
salestech@gpsnetworking.com