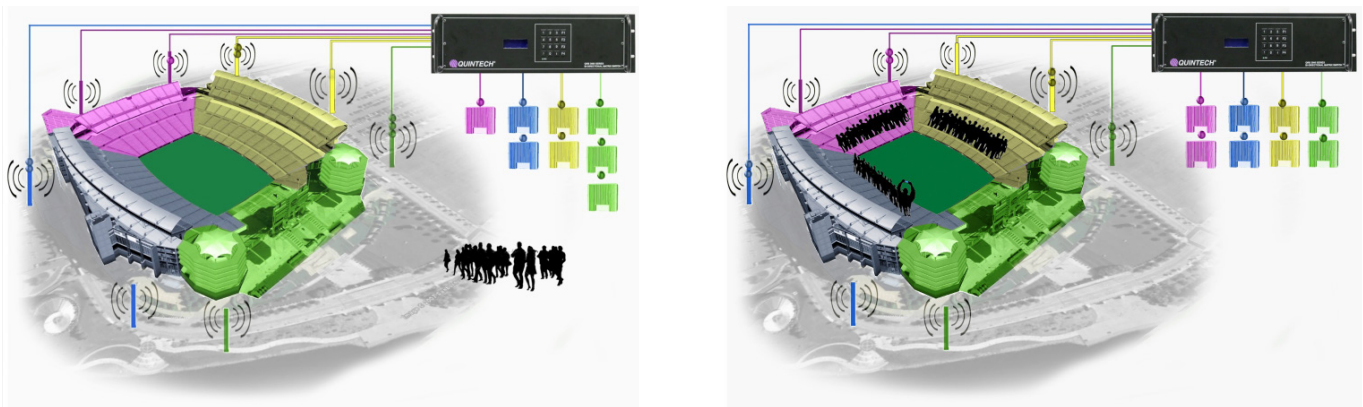


## Reconfigurable Multi-Operator Matrix Switch for Self Optimized Heterogeneous Networks: NEXUS-3 16 x 16

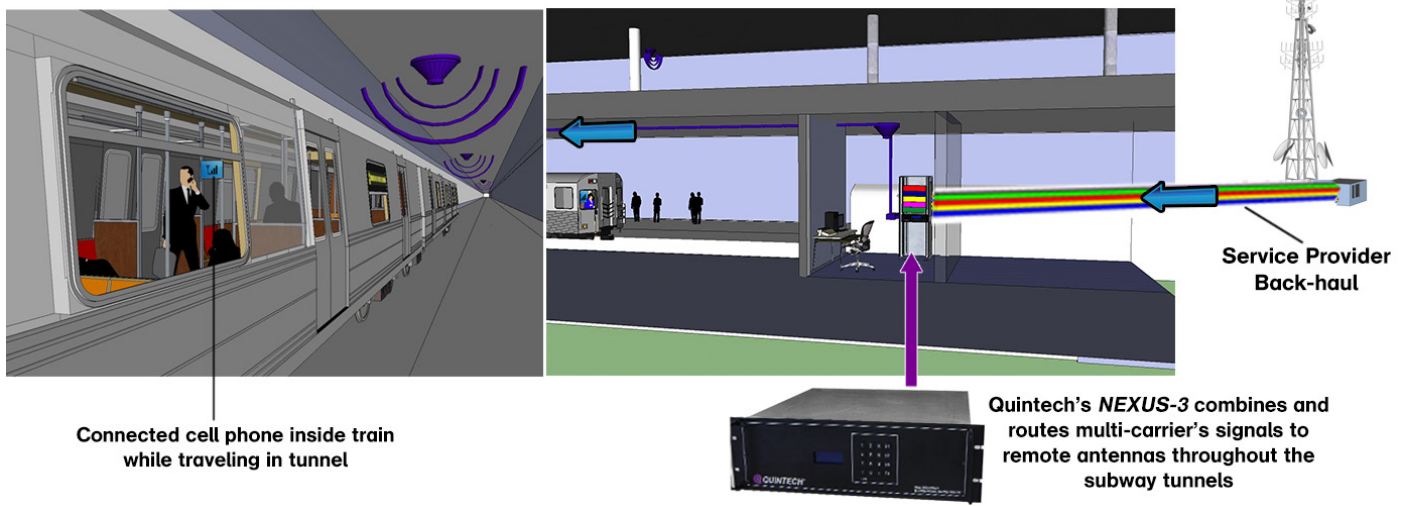
Heterogeneous Networks (Het-Net) including Distributed Antenna Systems (DAS), pico, femto and micro cells, are rapidly gaining in popularity and usage as the need to eliminate dead zones or provide greater signal bandwidths arise with increased use of mobile broadband. To make these evolving architectures cost effective and to meet increasing demand, carriers, service providers and network operators are planning to implement self optimizing networks (SON.) Integrators and OEMs require adaptive and reconfigurable equipment to achieve these new initiatives to deliver improved wireless services in stadiums, subway systems, office buildings, healthcare campuses, or anywhere signal reception is weak and bandwidth demands are high.



(Figure 1 Stadium DAS network)

Quintech has developed the NEXUS-3 reconfigurable multi-operator matrix switch which allows the network to readily move bandwidth as needed to meet user demands. Quintech's NEXUS-3 integrates bi-directional splitters, combiners, attenuators, and switches into a compact 3RU chassis that is ready-to-use in any HetNet. Figure 1 shows a stadium before and during an event where the bandwidth capacity requirements shift due to user traffic patterns from high capacity at the entrance to even capacity during the event. The NEXUS-3 helps meet the changing capacity demands by reconnecting one of the base stations from the front of the stadium to rear of the stadium.

The base stations are connected via high isolation coaxial cables to the input (A) ports of the NEXUS-3. The NEXUS-3 splits the signals, balances the signal levels, and aggregates them to multiple output (B) ports. The B ports are connected to the various Het-Net antennas.

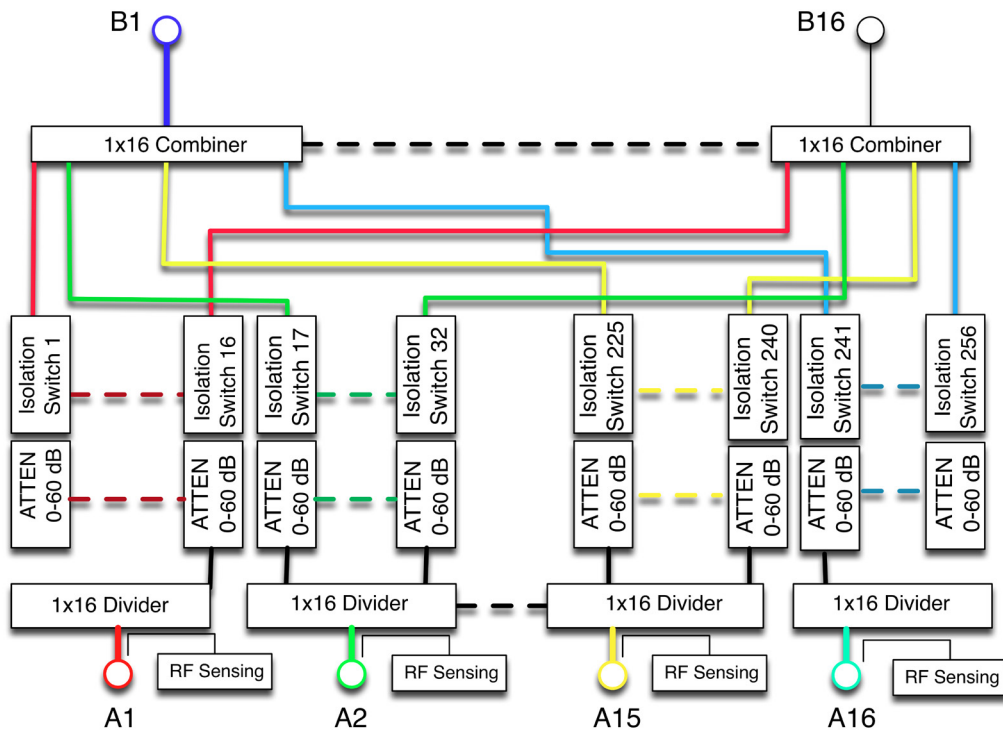


(Figure 2 Subterranean Het-Net network)

Figure 2 shows a different example of a Het-Net installation in a subterranean environment. In this case, the NEXUS-3 provides multi operator signal combining, equalization and routing.

### Integrated Splitters and Combiners in a 3RU Chassis

Figure 3 below shows a block diagram of the NEXUS-3, consisting of splitters, combiners, attenuators and switches. The NEXUS-3 is a fully non-blocking, bi-directional switch having 256 independent



(Figure 3 Block diagram of the NEXUS-3 16x16)

connection paths with programmable variable attenuators. All possible configurations of multiple operator signals (from 700 to 2800 MHz) to Het-Net antennas are available. The power levels of each carrier's signal can be independently attenuated on each connection prior to combining onto the B ports.

The *NEXUS-3* provides an equal insertion loss profile across all connections, which simplifies the link budget calculation to each Het-Net antenna. Each connection has a programmable variable attenuator which allows the input signal levels from each of the operators to be equalized relative to each other prior to combining the feeds to the Het-Net antenna.

### ***Switched Resources***

Self optimizing networks (SON) are a keystone requirement of the Heterogenous Networks that allow bandwidth to be dynamically delivered to meet user demands.

The *NEXUS-3* allows the operator of the SON to minimize hardware requirements while maximizing bandwidth management. Based upon bandwidth monitoring of zone loading, the *NEXUS-3* Matrix Switch is used to focus bandwidth from one zone to another, depending upon real time capacity demand. The operator may determine how to manage bandwidth using the *NEXUS-3* Matrix Switch based upon their individual analytics.

The *NEXUS-3* full routing and non-blocking switching capability allows operators to be added to the Het-Net system and connected to any combination or all of the antennas with millisecond switching time. This capability allows new operators to be added to the system without service interruption of the other existing operators.

In networking equipment failure events, the *NEXUS-3* is rapidly reconfigured to switch in redundant network equipment ensuring that quality of service (QoS) and service level agreements (SLA) are met.

### ***QoS Monitoring and Test Access***

The *NEXUS-3* allows any of the B ports to be configured as a dedicated test and monitoring port. This test port can be configured to allow monitoring or testing of any of the operator's signals that are connected to the A ports. The *NEXUS-3* can connect any operator in isolation or allow monitoring of all the operators in aggregate. This configuration flexibility allows operator equipment signals to be monitored for proper performance using monitoring/test equipment connected to the test port. Channel power levels, SNR, and center frequency can be monitored using a separate test set.

During equipment failure the test port aids in remote diagnosis of the failed operator signal. The *NEXUS-3* can be programmed to provide continuous monitoring. The *NEXUS-3* connects the test port to each network operator input one at a time allowing real time remote diagnosis of operator signals. Once the failed operator is identified the *NEXUS-3* implements fault recovery by connecting in the redundant operator feed.

## ***Future Proof***

In each of the above examples the keystone attributes of the *NEXUS-3* in Het-Net applications are featured. In these applications the *NEXUS-3* enables multiband deployment, carrier aggregation, and scalable capacity. The *NEXUS-3* allows for seamless upgrades and ease of installation for future carriers on the Self Optimizing Heterogeneous Network system through flexible frequency expansion and re-use.

## **About Quintech Electronics and Communications, Inc.**

Quintech, founded in 1989, designs and manufactures state-of-the-art proprietary hardware solutions (DC to 40 GHz) to facilitate RF signal management for satellite, uplink and downlink applications in satellite teleports, cable, HFC headends, broadcast, wireless and military telecommunications networks. Quintech specializes in industrial grade RF / microwave products for broadband, cable, satellite, L-band and all wireless frequencies. Quintech's product line includes rack mount RF matrix switches, routers, fiber optic links, splitters, combiners, frequency converters, relay switches, redundancy switches, line amplifiers, and DC powering products. Quintech products are known for their reliability and are deployed worldwide.

