

FULL DUPLEX POINT-TO-POINT **TR-FDD** SERIES

Tranzeo's **TR-FDD** Series features a high performance dual-radio system that provides full duplex point-to-point communications allowing data to flow in both directions at the same time, doubling total throughput and significantly reducing latency and jitter, and making it the backhaul solution of choice for applications such as Voice over IP (VoIP) and Internet TV (IPTV).



Unlike traditional single radio solutions where a single radio performs both transmitting and receiving in sequence, this high performance system utilizes two radios, allowing data to flow in both directions at the same time.

This system uses Frequency Division Duplexing (FDD), which utilizes two separate channels to send and receive data. The unique design of these products allows the use of interchangeable filters (see Figure 1), so operating frequencies can be adjusted to meet changing requirements. With at least 65dB of adjacent channel rejection, multiple radios can be collocated without any impact on performance.

These products support operation using 5, 10 and 20MHz wide channels. Unlike other solutions, the radio's filtering matches the channel size, meaning that the radio will only listen to the channels you want. Combined with Tranzeo's proven simple-to-install mounting system, and alignment LEDs that are visible in full sunlight, these fully integrated units offer a rugged and powerful solution at an affordable price.

How does it work?

This radio system combines Tranzeo's patent pending routing protocol with onboard radio filtering and channel shield technologies. The onboard filtering can significantly reduce adjacent channel noise, and greatly improve overall system performance.

In **Figure 2**, we see the effects of narrowband channels that do not use Tranzeo's method. In this test, the graph represents the strength an interfering signal would need to be to cause a 10% Bit Error Rate when using a 5 MHz channel. As you can see, the radio is affected by adjacent channels, greatly impacting overall system performance. As a result, although the card is transmitting across 5MHz, it is in fact listening on 20 MHz channel.

In **Figure 3**, we can see the much narrower filtering using Tranzeo's method. As you can see, the radio is rejecting the adjacent bands, allowing for more spectrum reuse. Up to 4 links can be placed side by side without interference.

However, this filtering alone is not sufficient to allow each radio to operate in isolation. Unlike a single board computer with two card slots, this system has been designed to create two completely isolated radio systems, preventing receiver de-sense that is caused by the close proximity of the second radio.

Typically, all 802.11a radios have onboard filtering that is designed to reject 50dB of adjacent channel noise. The near-field emissions of a PC card within can be so powerful - especially in comparison to the signals that are being received from the remote station - as to cause the receiver to lose sensitivity.

Channel Reuse

Each radio, in fact, has a minimum of 65dB of adjacent channel rejection, resulting in virtual channel isolation. With directional antennas, the same channel can be reused on the same tower multiple times. This allows for greater use of the same spectrum in one area, increasing density without vastly increasing noise.

High Throughput

Additionally, each radio in the link is driven by its own 250 MIPS network processor, with 16MB High-Speed DRAM for fast processing of data. These units are capable of transmitting and receiving up to 3,000 packets per second in each direction. As a result, the system can achieve throughputs of up to 23Mbps in TCP or 28Mbps in UDP, in each direction! That's more than enough to link together multiple buildings.

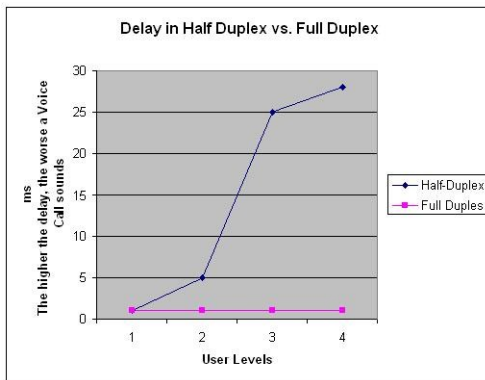
Tranzeo's PxP Routing Protocol

To ensure that network loops and other performance impacts cannot occur within the link, the system uses Tranzeo's own routing protocol. Tranzeo's routing protocol incorporates Tranzeo's proven PxP technology, ensuring that information is correctly routed between the radios, without modifying the packet's header in any way. This allows for MAC based authentication requests, VPN and VLAN packets to traverse the wireless segment intact.

Low Latency

The system also reduces the latency of the system by ensuring a clear path for TCP acknowledgements (ACKs). In a Half Duplex system, packets are delayed waiting for ACKs, tying up the link in order to receive a very small packet.

In Tranzeo's FDD system, the ACKs are returned on the receiving frequency, freeing the transmission channel to transmit other data in the queue without delay.



At the RF level, the system also reduces latency and improves throughput by allowing the user to adjust the RF ACK timing, changing the amount of time the system will wait for an RF ACK to be returned. Radio waves take a finite amount of time to reach a destination, namely the speed of light. Every packet sent via an RF link needs to be acknowledged, in order to ensure that the packet was correctly received. Even at moderate distances, the ACK times are set too short by default in the IEEE 802.11 standard, causing the unit to retransmit RF packets unnecessarily. By allowing for distance adjustment, and fine tuning in microseconds, the throughput can be greatly optimized.

Half Duplex systems work fine in many cases, especially when used for asymmetrical data links such as Customer Premise Equipment (CPE). However, when used as a backhaul, and when Half Duplex systems reach capacity, the latency can increase significantly. The effects this can have on a backhaul link where data flows are often symmetrical can cause increases in jitter, latency and impact overall system performance.



Figure 1: Tranzeo's Channel Shield

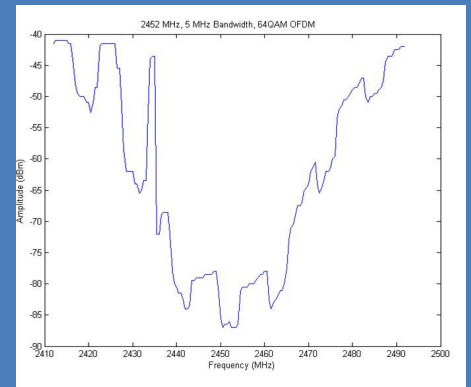


Figure 2: Traditional Narrowband Receive Filtering

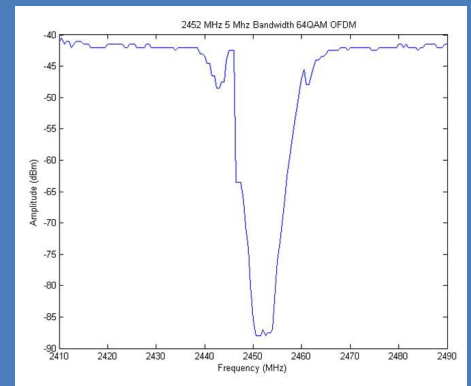


Figure 3: Tranzeo's Narrowband Receive Filtering

Field Testing

The ultimate proof of any product is how it performs in the field, not on the bench. In field testing, with links up to 12 kilometers apart, there was a repeatable increase in bidirectional UDP throughput of 267% when compared to a pair of Tranzeo's TR-5Plus-24 units at the same location. But, what about a TCP link, where the ACK timing can have a significant impact? TCP throughput increased by at least 235% under the same test conditions.

High Output Power

By combining all of these features with a high powered +26 dBm radio, these units are built for long range applications. But, since the power is fully adjustable, the user can scale back the power for shorter distances to avoid noise issues and to meet local regulatory requirements.

Industry Leading Warranty

Fully backed by an industry-leading 5 year parts and 3 year labour warranty and lifetime support, and built to last in the toughest environments, these units are designed to be used outdoors. Our design requirements for this platform demanded that the unit cold start after being frozen at -60°C for 48 hours. The unit had to immediately boot up and pass traffic, and it does! Yet, the design also allows the unit to operate at 140°F (60°C) without requiring additional heat dissipation measures. Designed by installers for installers, this is the simplest system to install. A spanner and a cable crimper are all you need in your toolbox.

Alignment LEDs and POE Power Supply

Each radio in the system has an externally visible high brightness alignment LEDs that are clearly readable in full sunlight, making antenna alignment very simple, and not requiring you to carry a heavy laptop up the tower. These units are shipped complete with POE injector with built-in surge protection and DC adapter. The low-cost Tranzeo POE injector is capable of shunting thousands of watts of surge in less than a billionth of a second. The POE can be hit multiple times and still protect the radio, as well as the device that it is attached to. Additionally, it can support cable lengths of up to 330 feet (100 m).

Solar Friendly

These products are also solar friendly, requiring a total draw of less than 18 watts, far lower than many other devices on the market today.

Remote Firmware Upgrade

Despite all of these powerful features, the system offers a simple web based interface that makes configuration fast and simple. Configuration changes can be rolled back at the click of a mouse. The firmware can be updated remotely from anywhere in the world, even over the link itself. Truck rolls for a firmware upgrade can be avoided. Even security is easy with these devices. Capable of supporting both WPA and WPA2, a secure link has never been easier.



About Tranzeo Wireless™

Tranzeo Wireless Technologies Inc. (TSX:TZT) leads the wireless broadband industry as a premier manufacturer of high-performance wireless network equipment that allows communities and businesses to communicate without boundaries. Tranzeo's optimum cost effectiveness, premium quality and responsive support have attracted a growing and devoted worldwide following of more than 2,465 dealers and 16 distributors. Tranzeo's full spectrum of point-to-point and point-to-multipoint radios, WiMAX equipment, and mesh network solutions are designed for wireless internet service providers, governments, campuses, military, carriers, enterprise customers, and systems integrators around the globe. Headquartered in British Columbia, Canada, Tranzeo also has offices in San Diego, California, San Jose, California, and Shannon, Ireland.

Aperto Networks operates as a wholly owned subsidiary of Tranzeo. Aperto is a leading supplier of wireless broadband, mobile WiMAX and Enterprise VPN solutions using highly versatile and cost-effective carrier-grade WiMAX Forum Certified infrastructure equipment.



Available Radio Models:

Model No.	Antenna Type
TR-FDD-24	Integrated 24dBi Panel
TR-FDD-26	External 26dBi Grid
TR-FDD-29	External 29dBi Dish & Radome
TR-FDD-32	External 32 dBi Dish & Radome

Note: All of the above models are also available in the high powered GT version (TR-FDD-XX-GT).

Available Channel Shield Options:

Model No.	LOW BAND	HIGH BAND
TR-CS1	5745MHz	5825 MHz
TR-CS2	5745MHz	5785 MHz
TR-CS3	5765MHz	5805 MHz

Accessories:

All units are shipped with following hardware:

- POE Injector with built-in surge protection
- 24VDC/1.9A Switching Power Supply
- Weatherproof Ethernet Boot and Gasket
- L-Bracket and U-Bolt Mounting Hardware
- N-Connector Accessory Kit for models with external antenna

Applications:

- ISP Backhaul
- VoIP Backhaul
- Video Transmission
- Leased line Replacement
- Private Networks & Inter-building Links