Doubling Capacity in Wireless Channels

1 Introduction

During the last decade, service providers have adopted and introduced to the market many services that require high capacity. Technologies like xDSL, cable modem, wireless transmission and fiberoptic transmission have been developed to satisfy the bandwidth hunger. In each segment, a large portion of the technology moved from big and complex systems to simple and highly integrated silicon-based solutions. This evolution brought several technologies to the general availability stage, making it possible for many companies to develop and provide such solutions.

Cross-polarization interference cancellation (XPIC) technology was developed to double the wireless capacity over the same channel. Using merchant silicon, Provigent Inc. is the first silicon company to introduce such a solution and to make it generally available.

2 Advantages of wireless links

Wireless systems are commonly used for both public and private networks. These systems are used not just in rural areas, where it is expensive or impossible to deploy wires, but also as cost-effective alternatives to wired solutions in urban areas. In addition, wireless systems are the technology of choice not just for mobile networks but also for the access, metropolitan and core networks where mobility is not required.

As network capacity grows and predicting the required capacity becomes difficult, providers prefer to deploy flexible and modular networks, and wireless systems are far more flexible than other transmission technologies. The flexibility and easy installation of wireless systems make it the preferred solution for public as well as private networks. For example, wireless networks enable easy and cost-effective capacity increases, depending on the network evolvement. It also makes it easy to remove and reinstall equipment from site to site.

3 XPIC Technology

XPIC technology doubles the capacity of wireless transmission, a clear advantage to the network operator at the dense frequency bands. Microwave radio energy travels in waves, transmitting in both horizontal and vertical directions. This physical phenomenon enables the transmission of RF waves on both polarizations at the same time. **Figure 1** illustrates single-polarization transmission, and **Figure 2** depicts co-channel dual-polarization (CCDP) transmission.

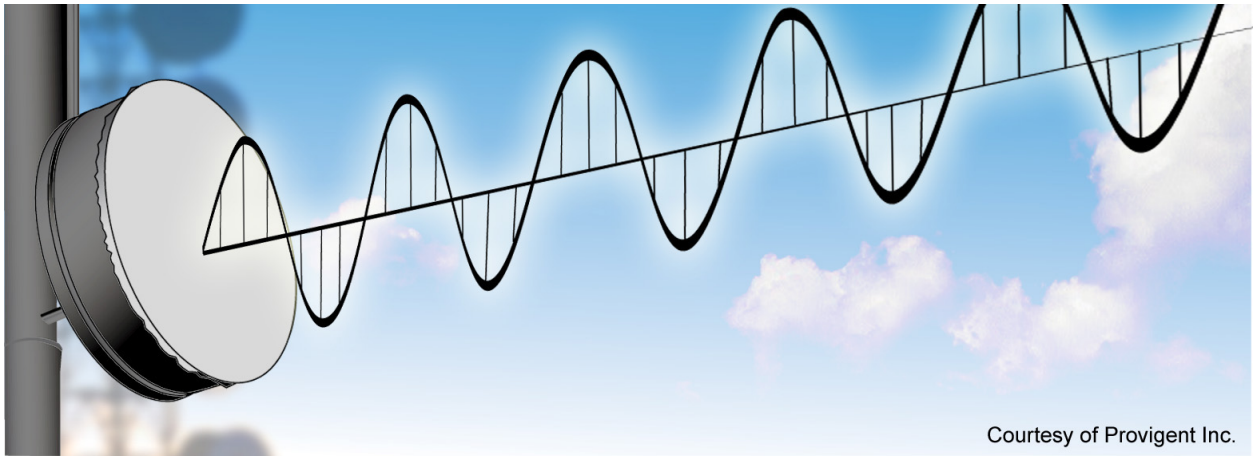

Figure 1: Single-polarization transmission

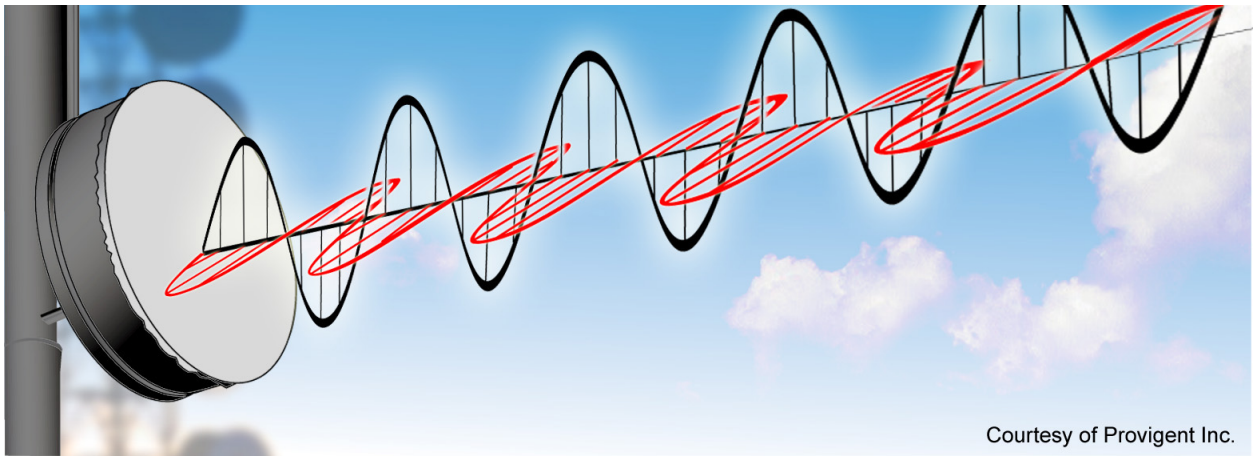

Figure 2: Co-channel dual-polarization transmission

CCDP operation provides two parallel communication channels over the same link with orthogonal polarizations, thus doubling the link capacity. Separate and independent signals are transmitted over the same wireless channel using single antenna. However, despite the orthogonality of the two signals, some interference between the signals almost inevitably occurs, due to imperfect antenna isolation and channel degradation. In order to cancel the effects of this interference, the receiver may include an XPIC, which processes and combines the signals from the two receiving paths to recover the original, independent signals. **Figure 3** shows the high-level block diagram of an XPIC system.

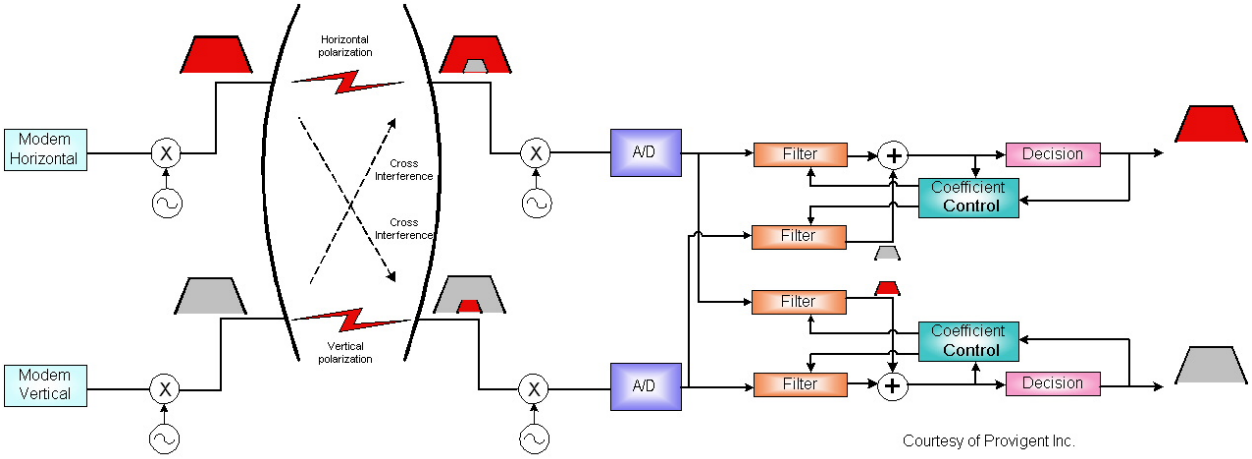

Figure 3: XPIC block diagram

Each polarization demodulator path receives a large signal from the opposite polarization, causing cross-polarization interference. XPIC systems filter the cross-polarization interference signal in order to successfully receive or decode the desire signal. This way, two separate data streams can be transmitted over the same channel.

In XPIC technology, each polarization path receives both the polar signal and the cross-polar signal. The receiver subtracts the cross-polar signal from the polar signal and cancels the cross-polar interference.

An XPIC solution doubles the wireless link capacity and enables operators to reduce operating expenditures in terms of their frequency license fee. For example, the FCC divides the spectrum into 28MHz slices. In order to transmit OC-3 (155Mbps) over the 28MHz band, a 7-bit/Hz modulation is required. Two OC-3 channels can be transmitting over the same 28MHz channel using XPIC technology.

Provigent's PVG610X and PVG310 XPIC solution uses advanced signal processing techniques that allow easy migration from traditional systems that use single polarization to CCDP operation using XPIC technology systems.

Systems based on the PVG610X and PVG310

1) Can be installed using existing radio equipment, as the two receivers can be non-synchronized. In addition, cable length differences between the horizontal ODU-IDU and the vertical ODU-IDU are allowed;
2) Achieve improved XPD tolerance and improved notches performance.

For additional information:

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