**Microlab Signal Tappers – An Emerging Choice for In-Building DAS Design and Applications**

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**Introduction**

Microlab Signal Tappers, also known as Signal Sampler, are very similar to directional couplers. The signal sampler extracts all signals regardless of the direction of flow. These include direct-coupled resistive samplers as well as electrostatic and electromagnetic probe samplers. Tappers are frequently used in Distributed Antenna Systems (DAS) and are available with either N or 7-16 mm DIN connectors.
Challenges in DAS Design and Deployment

Distributed Antenna Systems (DAS) are a big part of the wireless infrastructure growth. With the increase of the system architecture, there are more frequency expansion challenges in DAS. In order to cover these frequency extremes in a single system, economic factors compromise the performance. The performance trade-off during the design stages is the biggest challenge in DAS applications.

Usually unequal splitters and directional couplers used to divide or combine wireless signals. In practice, the smaller more conveniently sized directional coupler is usually selected. The unequal splitters with multiple coupling sections offer a flatter response at a lower price and a DC connection to the branch line. The best choice, however, is the signal tapper (sampler) which has a very flat response with a modest price.

Comparison between Signal Tappers and Directional Couplers

Directional couplers sample signals flowing in one direction only. These directional couplers include parallel line couplers and loop couplers. Directional couplers provide flat coupling, high directivity and low VSWR. Directivity is approximately 20 dB for printed couplers, 25 dB or more for air dielectric couplers. Units can be supplied with coupling ranging from 3 dB to 50 dB.

Tappers split high power cellular signals unevenly in fixed ratios from 1000:1 to 2:1 with minimal reflections or loss over the wireless bands in the range of 350 MHz to 2700 MHz. Tappers work independently of the signal direction. These include direct-coupled resistive samplers as well as electrostatic and electromagnetic probe samplers.

Directional couplers are commonly used as power combiners, both to divide and combine signals. Signal samplers, on the other hand, are used only occasionally to combine signals, but often to add a test signal. Directional couplers have some limitation on bandwidth and technical challenges which makes the overall system design cost more expensive.

Fig 1: Tappers versus Directional Couplers
**Signal Tappers**

- Ultra Broad-band: 350-2700 MHz
- Lowest PIM (< -150 dBc)
- Highest Power (500 W avg.)
- Improved system performance.
- Very flat coupling values
- Low priced without impacting system performance
- No directivity
- Lower isolation

**Directional Couplers**

- Ultra Broad-band: 380-2700 MHz
- Low PIM (< -140 dBc)
- High Power (200 W avg.)
- Moderate system performance
- Flat coupling values
- Higher price for similar frequency coverage
- High directivity
- High isolation

**Conclusion**

Microlab Signal Tappers unevenly split high power cellular signals in fixed ratios with minimal reflections or loss over the wireless cellular bands. The innovative asymmetric design ensures an excellent input VSWR and coupling flatness across the band, even down to a 2:1 split. The lightweight design allows easy attachment to a wall using the supplied bracket. Designed with only a few solder joints and an air dielectric, loss is minimized and reliability enhanced. Tappers provide much less isolation than a directional coupler on a return path. Signal tappers have the benefit of easily realizable broad bandwidths. Major applications include LTE, WiMax, WiFi, PMR and Cellular Bands.

**References:**

(http://fxr.com/products/directional-couplers-and-tappers/tappersunequalssamplers)