Microlab Products
Microlab understands the complexities, challenges, and design considerations associated with deployments of radio base-stations, distributed antenna systems (DAS), and Small Cell technologies. Microlab’s commitment to offer system designers and integrators with reliable off-the-shelf and custom solutions continues to be key in supporting the enhancement of the existing coverage and capacity of service providers.

Microlab’s components deliver superior performance in the area of broadband frequency coverage, power handling, reliability, minimal loss and low PIM. Specific offerings for Small Cell applications include: neutral host and co-sitting combiner solutions, hybrid couplers and hybrid matrices, multi-band combiners, attenuators, RF terminations, RF power splitters and duplexers, as well as DCC series® DAS Carrier Conditioners for Low Power Output. Microlab products are available with N-Type, 7-16 DIN, 4.3-10 DIN, 4.1-9.5 DIN (Mini-DIN) and SMA connectors.

DCC Series®
• DCC220-A01: Passive DAS Tray

Multi-Band Combiners
• BK-20 & BK-24: Wideband Diplexers
• BK-21N & BK-62N: Cellular/WiFi Injectors
• BK-26N: 3 GHz Diplexer
• BK-27N: Cellular/WiFi-WiMax Injector
• BK-362: North America Band Triplexer
• BK-37 series: 700/850/PCS-AWS Triplexer
• BK-38N: Broadband Triplexer Filter
• BK-42D: Wireless Band Triplexer
• BK-722E: AWS/PCS Diplexer
• BK-962 series: Wideband Quadruplexer
• BK-741 series: PCS/AWS Bands

Directional Couplers
• CK-10 series: Low PIM Directional Coupler
• CP-10 series: Ultra-wideband, Low Loss Stripline Coupler

Hybrid Couplers 2x2, 3x3, and 4x4
• CA-84: Low PIM 2x2 Hybrid Couplers
• CA84K: Low PIM 2x2 for Extreme Environments
• CA-88: Low PIM 2x2 Hybrid Combiner
• CM-20: Low PIM, Low Loss 4 x 2 Hybrid Matrix
• CM-80 series: Low PIM 3 x 3 Hybrid Matrix
• CM-58/68/78/88 series: Low PIM 4 x 4 Hybrid Matrices

Splitters, Dividers and Tappers
• DN-99 series: 40 dB QMA Tapper
• Dx-08/16: Reactive Splitters
• Dx-69FN/FF: Low Cost Power Dividers, In Line Outputs
• Dx-72 series: Low PIM Wilkinson Dividers
• Dx-85: Low PIM Reactive Splitters
• Dx-95: Low PIM In-line Reactive Splitters

Attenuators and Terminations
• FY series: Low PIM 10W Attenuators
• TA/TB series: Low Cost Resistive Terminations
• TK-21 Series: 10W Low PIM Cable Loads
• TK-25 series: Portable Low PIM Terminations
• TK 200 series: Low Power, Low PIM Loads

Other
• BL series: Duplexers
• JA: Low PIM, High Performance Jumper Cables, Straight
• JB: Low PIM, High Performance Jumper Cables, Right-Angle
• JC series: Low PIM Jumper Cables Right Angle to Right Angle Connectors
BK-20 & BK-24: Wideband Diplexers
694 - 960/1710 - 2170 MHz & 80 - 520/698 - 2700 MHz
Low Loss, High Performance and Low PIM Diplexer in a low cost, weatherproof enclosure. For Cellular, Tetra and LTE. N or 7/16 DIN connectors. Low PIM <-161 dBC. *All PIM measurements performed using 2 test tones at +43dBm unless otherwise stated.

BK-21N & BK-62N: Cellular/WiFi Injectors
80 - 2170/2400 - 2500 MHz & 80 - 2170/2400 - 2500 & 4900 - 5200 MHz
Inject WLAN 802.11(b/g) into a broadband cellular signal path with minimal loss to either path. Model BK-62N also includes 5.8 WLAN 802.11 (a/n) and 4.9 WiMAX. BK-21 series also available with 7/16 DIN or 4.3-10 connectors. Low PIM <-161 dBC.

BK-26N: 3 GHz Diplexer
80 - 2690/3300 - 5850 MHz
Designed to separate and combine wireless cellular with those expanding applications in the 3.3 - 6 GHz band. Available for outdoor environments. Low PIM <-150 dBC.

BK-27N: Cellular/WiFi-WiMax Injector
80 - 1990/2400 - 2700 & 4900 - 5850 MHz
Inject WLAN 802.11(a/b/g/n) into a broadband cellular signal path with >50 dB of isolation and minimal loss. Available for outdoor environments. Low PIM <-150 dBC.

BK-362: North America Band Triplexer
698 - 787/817- 896 & 1850 - 2000/1695 - 1780 & 2110 - 2180 MHz
Low Loss, High Reliability Triplexer Integrates 700/850+PCS/AWS1 & 3 Bands with >50 dB of input isolation. For indoor applications. Low PIM <-161 dBC.

BK-37 series: 700/850/PCS-AWS Triplexer
698 - 793/824 - 894/1710 - 2170 MHz
Low Loss, Low PIM Triplexer combines LTE band 698-793 MHz, the 824-894 MHz cellular band and the PCS/AWS band, 1710-2170 MHz with either 4.3-10 N or 7/16 DIN connectors. Low PIM <-153 dBC.
**BK-42D: Wireless Band Triplexer**

698 - 960/1695 - 2180/2300 - 2600 MHz

Low Loss, Low PIM Triplexer integrates LTE upper and lower 700 MHz bands with cellular, PCS with AWS 1 & 3 bands, and WCS with bands up to 2600 MHz. For Outdoor Applications. Low PIM <-161 dBc.

**BK-722E: AWS/PCS Diplexer**

1850 - 2000/1695-1710 & 2110 - 2180 MHz

High Reliability, Low Cost Diplexers combines the signals in the AWS 1 & 3 bands 1695 -1780 MHz and 2110-2180 MHz with the PCS/GSM-1900 bands 1850-1990 MHz. 4.3 - 10 or 7/16 DIN connectors. For outdoor environments. Low PIM <-161 dBc.

**BK-962 Series: Wideband Quadraplexer**

698 - 787/817 - 896/1850 - 2000/1695 - 1780 & 2110 - 2180 MHz

Low Loss, Low PIM Multi-band Combiner for LTE-700/GSM-850/PCS/ AWS 1 & 3 with 4.3-10 or 7/16 DIN connectors. For Outdoor Applications. Low PIM <-161 dBc.

**BK-741 Series - Diplexer**

1850-2000/1695-1780 & 2110-2180 MHz

Low PIM, Low Loss Diplexer for Combiner PCS with AWS-1 and AWS-3. Available with 7/16 or 4.3-10 DIN connectors. Rugged enclosure sealed for outdoor applications. Low PIM <-161 dBc.
**CK-10 series: Low PIM Directional Coupler**
694 - 3600 MHz

*Microlab’s Top Performing Directional Coupler with PIM Guaranteed less than -161 dBc*

Very low loss tapered design for exceptional flatness. Available with N, 7/16 DIN, 4.3-10 DIN or 4.1-9.5 DIN (Mini-DIN) connectors.

**CP-10 series: Ultra-wideband, Low Loss Stripline Coupler**
698 - 2700 MHz

Directional Couplers designed to cover from 698 to 2700 MHz with minimal reflections or loss. 4.3-10 N or 7/16 DIN connectors. Available in a wide variety of coupling values from 5 to 30 dB. Low PIM <-153 dBc.
**CA-84: Low PIM 2x2 Hybrid Couplers**
694 - 2700 MHz
Narrow and wideband, with low loss, high isolation and very low PIM, for all wireless signal combining needs. N, 4.3-10 DIN, 7/16 DIN or 4.1-9.5 DIN (Mini-DIN) connectors. Available for outdoor environments. Low PIM <-161 dBC.

**CA-84K: Low PIM 2x2 Hybrid For Extreme Outdoor Environment**
694 - 2700 MHz
Same electrical performance as our standard CA-84 but build to withstand salt fog testing in accordance with ASTM-B117 for 30 days and IP68 Rated. This outdoor design is also available on other top tier passive components.

**CA-88: Low PIM 2x2 Hybrid Combiner**
698 - 2700 MHz
This smaller sized Hybrid Combines 2 broadband signals to 2 common outputs with low loss. Multi-Band Range for Cellular, PCS, UMTS and LTE. With either N, 4.3-10 DIN or 7/16 DIN connectors. Available for outdoor environments. Low PIM <-161 dBC.

**CM-80 series: Low PIM 3 x 3 Hybrid Matrix**
694 - 2700 MHz
Combine 3 broadband signals to 3 identical outputs with minimal interaction, low PIM and just 4.8 dB loss. Available for indoor and outdoor environments. N, 4.3-10 DIN 7/16 DIN or 4.1-9.5 DIN (Mini-DIN) connectors. Low PIM <-161dBC.

**CM-58/68/78/88 series: Low PIM 4 x 4 Hybrid Matrices**
Different Models Available from 350 MHz - 2700 MHz
New in-line design concept! 4 x 4 Hybrid Matrices with 30 dB isolation, low -155 dBC PIM, and available IP67 housings. Narrow and broadband models. N, 4.3-10 DIN or 7/16 DIN connectors.

**Dx-95: Low PIM In-Line Reactive Splitters**
694 - 2700 MHz
Unique in-line design to equally split signals 2 ways or 3 ways. Available with 4.3 - 10 DIN or 7-16 DIN connectors. Sealed to IP67, Low PIM -161dBC.
**DN-x4 series: Multi-Band Unequal Splitters**
350 - 5850 MHz
Low PIM, Tappers unevenly split signals in fixed ratios from 1000:1 to 2:1 with minimal reflections or loss over the wireless bands in the range 350 - 5,850 MHz. Available with N, 4.3-10 DIN, 7/16 DIN or 4.1-9.5 DIN (Mini-DIN) connectors. For Outdoor environments. Low PIM <-161 dBc.

**DN-99 series: 40 dB QMA Tapper**
698 - 2700 MHz
Low PIM Tapper allows monitoring of Tx signals with minimal reflections or loss over the range 698 - 2,700 MHz with -40 dB QMA monitor tap. Available with 7/16 DIN or N (m-f) through ports. Low PIM <-160 dBc.

**Dx-08/16: Reactive Splitters**
380 - 2700 & 698 - 3800 MHz
Low cost, Low PIM Splitters to cover all wireless bands with specified low PIM. In 2, 3 and 4 way models. N or 7/16 DIN connectors. Dx-08, Low PIM <-155 dBC. Dx-16, Low PIM <-153 dBC.

**Dx-69FN/FF: Low Cost Power Dividers, In Line Outputs**
698 - 2700 MHz
Low cost, general purpose Power Dividers in 2 to 8 ways covering the full 698 - 2700 MHz with either N or SMA connectors.

**Dx-72FN series: Low PIM Wilkinson Dividers**
698 - 2700 MHz
Wilkinson style Power Dividers for low PIM applications where output isolation is preferable over lowest possible loss. N and 4.3-10 DIN connectors. In either 2, 3, or 4 way configuration. Low PIM <-154 dBC.

**Dx-85: Low PIM Reactive Splitters**
694 - 2700 MHz
Low cost, Low PIM, high power, high performance splitters to satisfy the growing interest in all wireless bands, with low PIM and IP67. Available in 2, 3, 4, 5 and 6 way configurations, N, 4.3-10 DIN, 7/16 DIN or 4.1-9.5 DIN (Mini-DIN). Low PIM <-161 dBC.
**FY series: Low PIM 10W Attenuators**
694 - 2700 MHz
Low Power (10 W), Low PIM, broadband unidirectional Attenuators covering all wireless bands from LTE-700 to WiMAX-2600 MHz with a flat attenuation response. Available with either N, 4.3-10 DIN or 7/16 DIN (Mini-DIN) connectors. Guaranteed PIM <-165 dBC. *PIM measurement performed using test tones at +37 dBm.

**TA/TB series: Low Cost Resistive Terminations**
1 W to 250 W
Rugged, reliable terminations for most wireless applications where low PIM is not critical.

**TK-23: 30W Low PIM Cable Loads**
400 - 2700 MHz
Low VSWR Cable Loads for extremely low PIM applications. N, 4.3-10 DIN or 7/16 DIN connectors. For indoor applications. Low PIM <-161 dBC.

**TK-25 series: Portable Low PIM Terminations**
694 - 2700 MHz
50W Terminations for applications where portability is essential such as mast head antenna test requirements. Low PIM <-161 dBC.

**TK-200 series: Small Cell Low PIM Loads**
400 - 2700 MHz
Available in 5W and 10W models. Low profile design for small spaces. Can be used in outdoor applications. Low PIM <-161 at maximum power rating.
**BL series: Duplexers**
Splits or combines the Tx and Rx elements of a duplexed signal with high isolation and low loss.

**JA: Low PIM, High Performance Jumper Cables, Straight**
DC - 6000 MHz
Low PIM jumper cables, using sheathed 0.141 coaxial cable series uses straight to straight N, 7-16 DIN or 4.1-9.5 DIN (Mini-DIN) connectors. Standard lengths from stock. Low PIM <-158 dBC.

**JB: Low PIM, High Performance Jumper Cables, Right-Angle**
DC - 6000 MHz
Low PIM jumper cables, using sheathed 0.141 coaxial cable series uses straight to right angled N connectors. Low PIM <-153 dBC.

**JC series: Low PIM Jumper Cables Right Angle to Right Angle Connectors**
DC - 6000 MHz
Coaxial Jumper Cables built for reliability and consistent low loss and guaranteed Low PIM <-145 dBC. N standard connector. Low PIM <-145 dBC.
Neutral Host Quasi-Omni oDAS Solution

Product: CM-80DP, 3x3 Hybrid Matrix, 698-2700 MHz, Low PIM, Outdoor Model
Application:
Small Cell Outdoor Installation
Location: KS/MO Market

Site Specs:
- 700 MHz LTE MIMO (2x30W)
- 2100 MHz LTE MIMO (2x60W)
- 65°, 3 sector Quasi-Omni MIMO antenna, dual band
- Light pole mounted antenna
- Outdoor equipment cabinet

With the expanding use of multi-band macro base station and small-cell antennas, it has become increasingly challenging to feed the multiple MIMO signals from multiple base stations to a multi-sector antenna. The base stations or small cells in this case, be it of the same operator providing service in different bands and modes, or of different operators, sharing a multi-sector antenna have to deliver power to the multiple inputs of an antenna. In fact, increasing number of frequency bands thrown into the mix to meet the increasing capacity needs, has made antenna and infrastructure sharing inevitable. Such RF signal conditioning, dividing and combining requires careful selection of components and designs that will minimize the impact on electrical performance, as well as size and weight.

A tri-sector multi-band antenna in this example is being fed by two small cells with MIMO outputs at 700 and 2100 MHz bands (Fig.3). It is a three sector, high and low band antenna, with vertical polarization. This is a total of 12 inputs to the antenna that the dual outputs of two (in this case) small cells need to feed. Basically each one of the two 700 MHz MIMO outputs of the small cell need to be divided into three equal outputs and each resulting pair need to be fed to a polarized pair of inputs of the antenna. This needs to be repeated for the high band, 2100 MHz outputs.
What is ideally needed is a broadband high power 3-way divider. Four of them would be required in this example to properly divide the small cell outputs into 6 pairs of cross polarized antenna inputs (Fig 1). Microlab 3x3 high power combiner/divider is ideally suited for this. With two inputs terminated by low-PIM broadband loads, it becomes a very compact broadband high power 3-way divider. Since this is a hybrid component, the power dividing is essentially lossless (Fig 2). Microlab has designed and constructed an assembly that integrates four of these combiners into an antenna feed network that is very compact, factory tested, outdoor rated, light and easy to install.

Another very powerful feature of such hybrid matrix is its ability to combine multiple inputs with good isolation and over-broad bandwidths. In the example shown (Fig 3), one can replace one of the input terminations on one of the high-band 3x3, and feed it with a legacy 1900 MHz source which would work with the new 2100 band without any disturbance. Key is high isolation, good port match and low-PIM. Or one can feed MIMO 1900 MHz LTE and re-farm the band by replacing an input termination of each one of the high-band 3x3 with a MIMIO 1900 small cell. In fact this same 4x(3x3) assembly can have up two additional low bands and two additional high-bands combined on the antenna independent of all other inputs.

The following example shows the flexibility of multiple inputs to multiple outputs using Microlab’s Hybrid Matrix Combiners leaving open ports for future overlay projects.
Who We Are

Wireless Telecom Group is a global designer and manufacturer of radio frequency ("RF") and microwave-based products for wireless and advanced communications industries. We market our products and services worldwide under the Boonton Electronics ("Boonton"), Microlab/FXR ("Microlab") and Noisecom brands. Our Brands and products have maintained a reputation for their accuracy and performance as they support our customers' technological advancements within communications. We offer our customers a complementary suite of high performance instruments and components meeting a variety of standards including peak power meters, signal analyzers, noise sources, power splitters, combiners, diplexers, noise modules and precision noise generators. We serve commercial and government markets within the satellite, cable, radar, avionics, medical, and computing applications. We are headquartered in Parsippany, New Jersey, in the New York City metropolitan area and we maintain a global network of Sales offices dedicated to providing excellent product support.

Wireless Telecom Group, Inc. continuously targets opportunities that allow us to capitalize on our synergies and our talents. Our technological capabilities along with our customer service strategies remain essential competencies for our success.

Noisecom

Noisecom is a global provider of electronic noise generation equipment and noise sources in the commercial and military telecommunications fields. Utilized for accurate, reliable measurements, users look to Noisecom for specialized assistance with their equipment design.

Boonton

Boonton Electronics, a wholly owned subsidiary, is a leader in the manufacture of test equipment dedicated to measuring the power of RF and Microwave systems used in multiple telecommunication markets. A pioneer in the industry, Boonton continues to provide high quality and high value instruments for users backed with outstanding customer support.

Microlab

Microlab, a Wireless Telecom Group company, is a global provider of microwave components including power splitters, directional couplers, and filters. These products are employed as system components in commercial applications such as wireless base stations for cellular communications, in–building wireless signal distributed antenna systems (DAS), DAS site monitoring and control, television transmitters and aircraft navigation landing systems. Microlab products are also used in railway communications, military systems and medical equipment.