

FlexWave™ Prism

Flexible Outdoor Wireless Coverage and Capacity





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Prism ADC's Next Generation of Wireless Solutions for Improving Wireless Capacity, Coverage, Flexibility and Customer Retention

ADC's Prism is the most flexible, scalable and complete solution for addressing coverage and capacity needs for current and emerging wireless networks. The industry's first combination of DAS and RRH products, the Prism improves wireless network coverage and capacity by extending services from existing cell sites, to hard-to-reach areas by distributing coverage from a centralized radio suite.

Utilizing a centralized distributed architecture, service providers are able to recognize significant CAPEX/OPEX savings through a shared Base Station Hotel (multiple BTS co-located together), as well as a shared Remote Radio Transceiver approach. The Prism's flexibility and scalability offers service providers an optimal solution for multiple applications such as; dense urban centers, dense suburban areas, campuses, enterprise buildings, subways and tunnels. The Prism's distributed architecture and small form factor allows service providers to cost-effectively increase coverage and capacity in these hard-to-reach areas.

Overview

With the increasing popularity and reliance on wireless voice and data services, subscribers expect to have coverage at anytime, anywhere. In addition to increased wireless device usage, wireless service providers implementing 3G and 4G technologies have recognized a reduction in coverage patterns within existing coverage footprints, opening coverage "holes" within the network. To resolve this issue, it requires service providers to extend coverage and/or increase capacity within the non-coverage areas. This has been traditionally accomplished by adding new macro cell towers; however, with city centers becoming more congested and local government zoning regulations becoming more stringent, obtaining permits for new macro cell sites is becoming increasingly difficult. The Prism offers service providers a flexible, small form factor solution to extend coverage and capacity where needed, as well as support for the increasing number of protocols and frequencies available today and in the future.

Features and Benefits

- Flexible Architecture
 - Supports multiple frequency bands and wireless protocols in one enclosure
 - Air Interface and BTS vendor independent
 - Scalable and modular
 - Multiple non-contiguous segments of 1.5 to 75 MHz each
 - BTS interface supporting RF and OBSAI/CPRI standards
 - In-band 100 Mbps Ethernet backhaul
 - Digital Simulcast
 - Field upgradeable
- User Friendly
 - Embedded element management system, supporting web based access and SNMP
 - Fully sealed, maintenance free electronics for harsh outdoor applications
- Cost Effective
 - Efficient use of CAPEX equipment and real estate
 - Fast time to revenues/service
 - Backhaul efficient

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Application

The FlexWave Prism uses patented digital-over-fiber technology to distribute RF to desired locations. The Prism digitizes the entire designated RF band and/or multiplexes direct digital CPRI or OBSAI feeds over dark fiber or millimeter wave links and reconstructs the signal at full bandwidth, regardless of modulation technology or BTS vendor, at the remote location. ADC's digital RF transport allows RF signals to be replicated at full dynamic range, independent of the link length, for improved data throughput. As service providers migrate to 3G and 4G networks, high-data rate broadband services, networks utilizing a Prism backbone will be ready.

The Prism offers a flexible architecture to distribute wireless coverage and capacity. Its versatility and small form factor allow service providers to quickly deploy networks in areas where zoning restrictions often hinder installation of traditional macro cell towers and base stations.

Centralization of base station capacity can also be realized using the FlexWave Prism. This allows service providers to further benefit by reducing capital expenditures and annual operating costs.

System Description

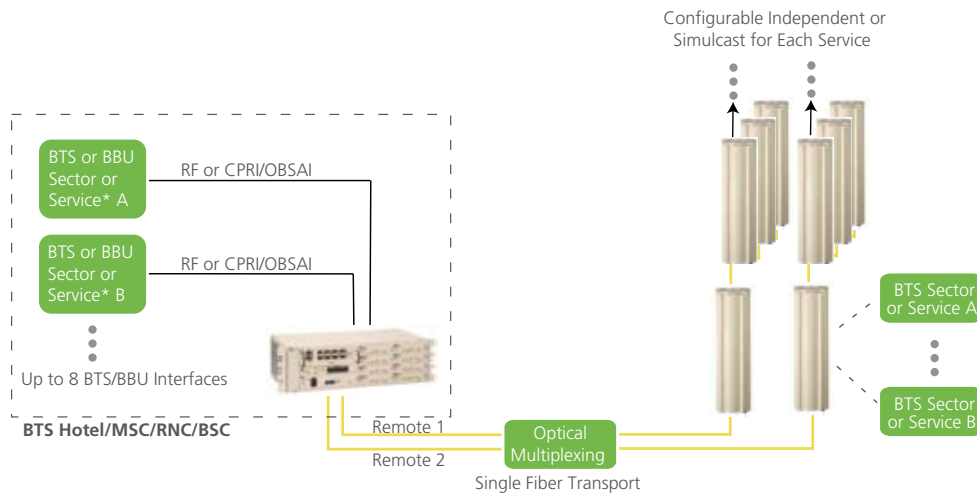
The FlexWave Prism is a flexible and cost effective solution for Distributed Antenna System applications: Microcell and/or CPRI/OBSAI Remote Radio Head applications:

- Next Generation DAS; optimized for multiple frequency bands, services or applications
- Serial RF processing (flexible SeRF technology), enables the unique combination of digitized RF and baseband (CPRI) over a single serial stream using less fiber
- Digital simulcast; capacity from a single sector is digitally combined and split to multiple remotes

Flexible remote radio and capacity management solution interfacing to existing BTS and BBU solutions

- Each remote is multi-purpose, providing 2G, 3G and 4G services concurrently, air interface and BTS/BBU independent
- Robust all-digital transport enabling highly-efficient fiber utilization (equivalent to 32 T1's over a single fiber)
- Backbone for BTS Hotel enabling maximum capacity and spectral utilization, trunking efficiencies and RAN maintenance

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Sample System Configuration



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Host Unit

The rack-mountable FlexWave Prism Host Unit is typically located at a Base Station or a facility housing a suite of Base Stations. On the forward path, the Host Unit receives the RF signals from the BTS and digitizes the designated RF bands and digitally transports them over single mode fiber or a millimeter wave link to the Remote Units. On the reverse path, the Host Unit receives the digitized RF signals from the Remote Unit and converts them back to RF for the BTS. The Prism Host Unit is completely modular in design. Digital/Analog Radio Transceiver (DARTS) are hot swappable providing easy upgrades to additional bands without interrupting existing service.

The Prism Host Unit supports up to eight DART cards (supporting up to eight BTS interfaces) and is capable of simulcasting signals up to as many as eight Remote Units. DART cards are available in either 35 MHz non-contiguous bandwidth or 75 MHz full bandwidth.

A Single SuperDART supports 35MHz of non-contiguous bandwidth across the total bandwidth of a given service. For example, PCS is 70 MHz wide. The Single SuperDART supports up to 35 MHz of bandwidth within that 70 MHz range, including two non-contiguous slices. The Single SuperDART uses a single DART position in the Host and one DART position in the RF Module. This card utilizes up to six time-slots and can be deployed in diversity-receive applications.

The Dual SuperDART supports up to 75 MHz of instantaneous bandwidth. For example, PCS is 70MHz wide. The Dual SuperDART will pass full bandwidth of desired spectrum. The Dual SuperDART uses two DART positions in the Host and two DART positions in the RF Module.



Host Unit

The Host Unit utilizes an embedded element management system for system configuration and network monitoring. The embedded EMS collects alarm information from both the Host and Remote Units. For multiple link deployments, multiple Host Units can be networked together at the same BTS site.

In addition to sending alarm notifications to the Element Management System (EMS) through software, the Prism Host Unit also features front panel alarm reporting. LEDs on the front panel of the Host Unit will change color depending on the status of the unit. LED displays provide information regarding the following items:

- Power
- System mode (active/standby)
- Indicate unit fault condition
- RF conditions



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Remote Units

The Prism Remote Units utilize a modular design, which supports up to four bands. Each Remote allows for future upgrades and easy field access.

Typical mounting options for the Remote Unit include: pole-mount, inside pole-mount, wall-mount, and sub-terrain vault-mount.

The electronics enclosure of the Prism Remote Unit is fully sealed IP-65 rated, which minimizes maintenance and is ideal for harsh environments. Fiber, antenna, and power input/output connectors are all sealed for maximum protection.

On the forward path, the Remote Unit receives the digitized spectrum from the Host Unit and converts the spectrum back into RF to be distributed via an externally mounted antenna system. On the reverse path, the Remote Unit digitizes the designated RF spectrum and digitally transports it over single-mode fiber or MMW to the Host Unit.

In addition to sending alarm notifications to the EMS, the Prism Remote Unit also features LED alarm reporting. An LED on the bottom of the Remote Unit will illuminate upon a fault condition.



The Remote Unit may be field upgraded and serviced.



The Remote Units are available in single, dual, tri and quad band sizes to support up to four bands. Refer to the physical specifications on page 9 for the unit size

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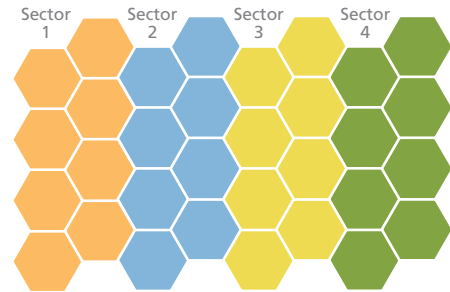
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Differences Between Analog and Digital Simulcast

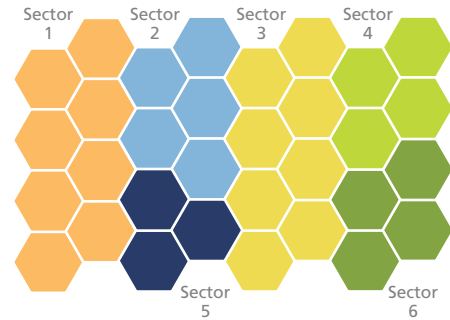
Digital simulcast is a feature in all of ADC's DAS product lines. The digital aspect is unique compared to analog DAS systems and to remote radio heads (RRH). Digital simulcast adjustments can be made through the GUI versus having to mechanically change the system capacity configuration with RF splitters and combiners. With analog DAS and RRH's, the adjustment is not only mechanical, it also fixed point-to-point and cannot dynamically be adjusted to support recurring fluid traffic patterns (such as commuter traffic or for a traffic spike near a stadium) or as swiftly in the event of an emergency.

Additionally, analog distribution systems must accommodate for signal loss sustained as it travels over distance. Since analog DAS simulcast is achieved with a physical RF splitter/combiner network (lots of cables and big metal) between the BTS and the analog DAS, there are multiple interfaces. With ADC's digital DAS, we have a single interface between the BTS and digital DAS complete with a switch matrix in our Host that enables simulcast in the digital domain and not have the big iron physical connections. Making a change to analog DAS requires "rewiring" this physical interface versus digital DAS changes are made through a GUI.

Simulcast DAS system must be designed such that the transport time to the remote antennas is equal for both analog and digital systems. With analog systems, which deal with changes in the physical world, this is achieved by ensuring that the cable runs to each remote antenna location is of equal length to create equal loss on each path. Each node will require the same amount of cable as the farthest location from the Host. The operator will purchase excess cable and spool it in a storage location. With a digital DAS, the operator can add delay in the digital domain through the GUI (change the delay setting). All calibration is done through the management system so the amplifier and antenna locations can be placed exactly where needed to optimize the wireless access. No excess cabling is required or the storage to support it.



8:1 Simulcast



Add capacity by splitting sectors and changing the simulcast configuration from 8:1 to 3:1 and 5:1 or 4:1 in high traffic areas

Digital Simulcast

Finally, analog DAS systems are also limited to support RF-output base stations where Prism can perform support RF-output and baseband/CPRI output base stations which are common with 3.5G and 4G radios.

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Alarm and Management System

The FlexWave Prism utilizes an embedded network management for system configuration and network monitoring. The Element Management System (EMS) utilizes a web based interface or SNMP protocol for easy accesses to the system.

The EMS provides operational and maintenance capabilities for the Prism system (Host and Remote). The EMS can be used to set up and monitor status of any Host and any associated Remote Units. The EMS has the ability to configure the system, view status and parameter settings, download software, change parameters and monitor system performance and alarms.

Access and troubleshooting can also be accomplished on-site at either the Host Unit and/or the Remote Unit by utilizing a craft interface. Thus, allowing technicians the ability to plug-in a laptop and access all associated units connected to it.

Host Site Capabilities

The EMS performs the following functions at the Host site:

- Provides real-time information regarding faults
- Set up simulcast ratios
- Digital timing delays
- Displays various system level values (voltages, RF, power, etc.)
- Records and generates history reports with time and date stamps
- Adjusts performance related parameters of the Host Unit and Remote Unit
- Permits placement of Host Unit and Remote Unit into standby mode
- Allows download of new software versions to the Host Unit and Remote Units

Network Monitoring Capabilities

The embedded EMS allows for remote alarm monitoring and network control of the Prism can also be performed from an off-site location or Network Operation Center (NOC). Communications to the NOC can be performed using the web based interface or SNMP protocol.

The EMS performs the following functions at off-site locations such as the NOC:

- Provides real-time information regarding faults
- Displays various system level values (voltages, RF, power, etc.)
- Adjusts performance-related parameters of the Host Unit and Remote Unit
- Permits placement of Host Unit and Remote Unit into standby mode
- Access records and generates history reports with time and date stamps
- Allows download of new software versions to the Host Unit and Remote Units





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Specifications

RF SPECIFICATIONS

Supported Frequency Blocks:	1-4 per Remote Unit; 1-8 per Host Unit
Bandwidth:	1.5 to 75 MHz non-contiguous
Frequency Band Supported:	See table below
Digital Simulcast:	Up to 8:1 Single Host (can daisy chain Host for higher simulcast)
Diversity Receive:	Yes (Optional) MIMO: 2x2 and 4x4

PROPAGATION DELAY

System Delay:	<5 dB typical, 6 dB max
Delay Management:	Digital (Manual or Automatic)

NOISE FIGURE

Noise Figure:	<5 dB typical, 6 dB max
Input IP3:	>-8 dBm

OPTICAL SPECIFICATIONS

Optical Budget:	26 dB
Digital Transport Rate:	3.072 Gbps

OUTPUT POWER AT ANTENNA PORT (dBm)

	Frequency		Composite Output Power At Antenna Port (dBm)				
			Number of RF Carriers				
	TX	RX	1 P-out	2 P-out	4 P-out	8 P-out	16 P-out
700 Upper C	746 - 756	777 - 787	43	43	43	43	43
iDEN 800	851 - 869	806 - 824	38	38	38	38	38
iDEN 800/900	851 - 869	806 - 824	38	38	38	38	38
	935 - 940	896 - 901					
Cell 850	869 - 894	824 - 849	43	43	43	43	43
Cell 850 APAC	870 - 890	825 - 845	43	43	43	43	43
E-GSM 900	925 - 960	880 - 915	31	34	37	40	40
P-GSM 900	935 - 960	890 - 915	31	34	37	40	40
DCS 1800	1805 - 1880	1710 - 1785	34	37	40	42	42
PCS 1900	1930 - 2000	1850 - 1920	43	43	43	43	43
40W PCS 1900	1930 - 2000	1850 - 1920	46	46	46	46	46
UMTS 2100	2110 - 2170	1920 - 1980	42	42	42	42	42
AWS 2100	2110 - 2155	1710 - 1755	43	43	43	43	43
40W AWS 2100	2110 - 2155	1710 - 1755	46	46	46	46	46

REMOTE UNIT ENVIRONMENTAL SPECIFICATIONS

Outside Ambient

Temp Rating:	-40° C to +50° C (-40° F to +122° F)
Storage Temperature:	-40° C to +70° C (-40° F to +158° F)
Humidity:	10% to 90% non-condensing
Lightning Protection:	20kA IEC 1000-45 8/30 µs Waveform

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REMOTE UNIT

Enclosure: IP-65
Mounting: Wall, Pole, Inside Pole, Strand, and Vault
Cooling: Fan (exterior only)
Optical Connectors: Sealed Proax or pass-through
Dimensions:

	Dimensions (H x W x D)			Weight (Chassis Only)	Weight (With RF Modules)	Volume
Single-Band	25.2"	12.2"	11.2"	65 lbs.	83 lbs.	1.56 cubic ft
	64 cm	30.99 cm	28.45 cm	29 kg	38 kg	.044 cubic M
Dual-Band	33.2"	12.2"	11.2"	81 lbs.	117 lbs.	2.10 cubic ft
	84.33 cm	30.99 cm	28.45 cm	37 kg	53 kg	.059 cubic M
Tri-Band	41.2"	12.2"	11.2"	97 lbs.	151 lbs.	2.64 cubic ft
	104.65 cm	30.99 cm	28.45 cm	44 kg	68 kg	.075 cubic M
Quad-Band	52.4"	12.2"	11.2"	116 lbs.	188 lbs.	3.40 cubic ft
	133.10 cm	30.99 cm	28.45 cm	53 kg	85 kg	.096 cubic M

HOST UNIT

Mounting: 19-inch rack
Dimensions (H x W x D): 5.25" x 19" x 19" (13.34 cm x 48.26 cm x 48.26) (3 RUs)
Weight: <25 Pounds (<11 kg)

REMOTE UNIT POWER REQUIREMENTS

Power Supply: 100-240 VAC, 50-60 Hz
Battery Backup: Yes (optional external UPS)

HOST UNIT POWER REQUIREMENTS

Power Source: 21 to 60 VDC

ELEMENT MANAGEMENT

Embedded EMS: Yes
SNMP Based Management: Yes

Note: Unless noted otherwise specifications are typical and subject to change

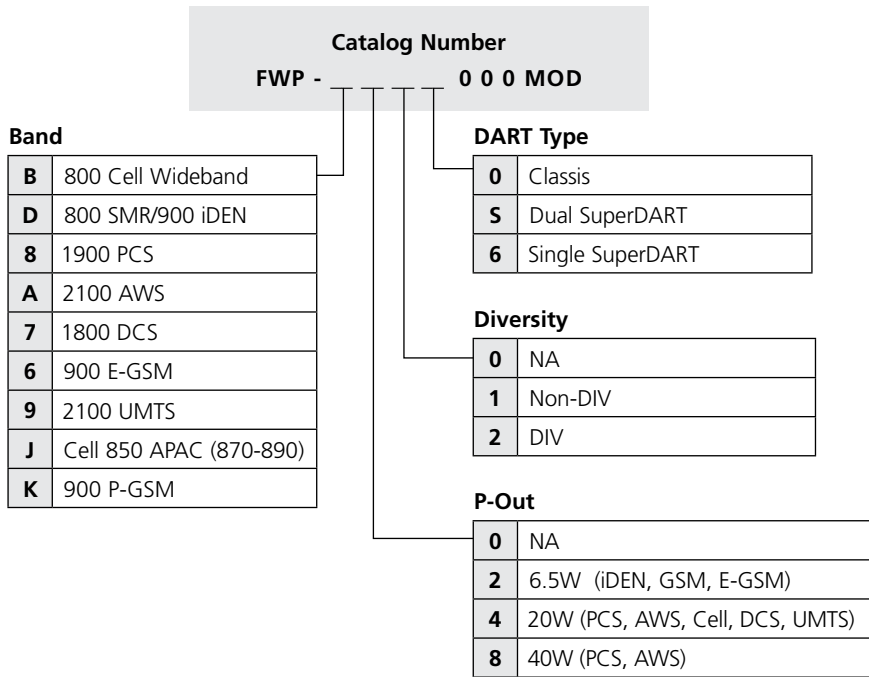
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Prism Remote Unit Module Configurator



Examples:

FWP-B410000MOD: PRISM, 20 W Wideband Cell Module, Non-Diversity, Classic

FWP-841S000MOD: PRISM, 20 W PCS Module, Non-Diversity, Dual Superdart

FWP-7416000MOD: PRISM, 18 W GSM 1800 Module, Non-Diversity, Single Superdart

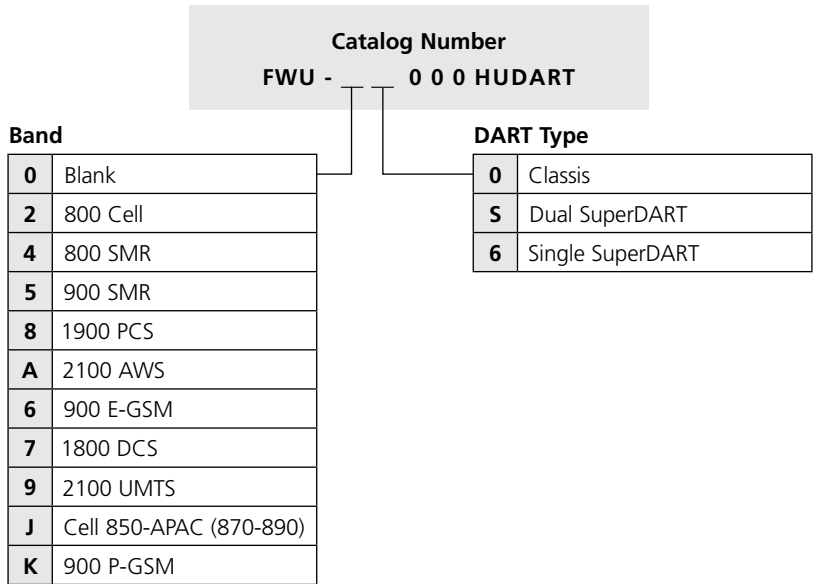
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Prism Host DART Configurator



Examples:

FWU-20000HUDART: PRISM, 800 CELL, One Dart, Classic

FWU-85000HUDART: PRISM, 1900 PCS, One Dart, Dual Superdart

FWU-76000HUDART: PRISM, 1800 GSM, One Dart, Single Superdart

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