FlexWave Prism

Flexible Outdoor Wireless Coverage and Capacity

EVERY CONNECTION COUNTS

TE connectivity

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

The FlexWave Prism is the most flexible, scalable and complete solution for addressing coverage and capacity needs for current and emerging wireless networks. The industries 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. TE'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.

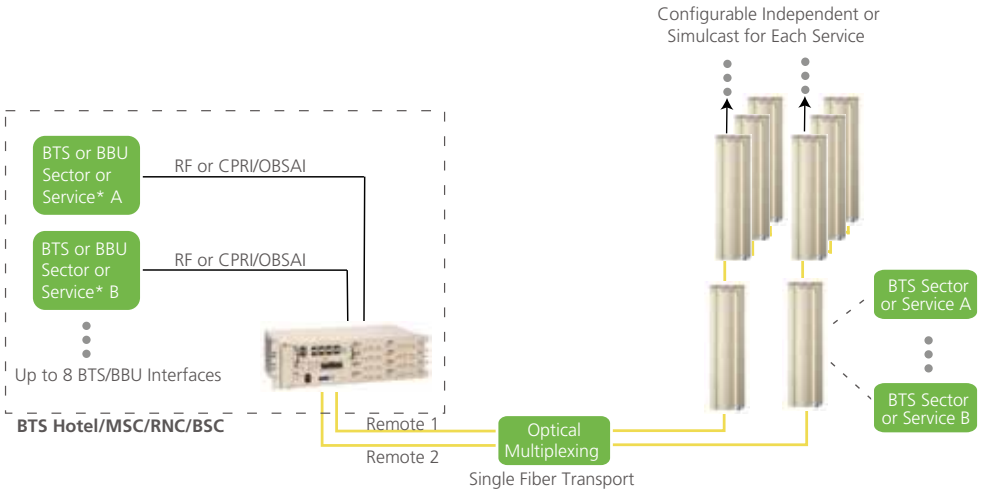
System Description

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 mulitple 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



Sample System Configuration

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 addtional 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.

Host Unit

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 Super DART uses two DART positions in the Host and two DART positions in the RF Module.

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

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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High-Density Module (HDM) RF Modules

High-Density Module (HDM) is TE's next generation power amplifier design, enabling double the number of frequency bands at 20W per bay within the Prism Remote allowing for a Quad-Bay Prism to support up to eight frequency bands; or HDM doubles the power output to 40W in a single Prism bay, allowing for the support up to four 40W RF modules per Remote. HDM enables TE to address mobile operators' growing need to add spectrum and upgrade MIMO solutions at antenna sites.

HDM addresses the need to add spectrum, such as 700 and AWS inclusive of MIMO support within a single enclosure or double the output power to support growing needs for capacity in the network. The flexibility of the FlexWave Prism platform is maintained with the HDM modules allowing a mix of dual density and high power (40W) within existing FlexWave Prism remote enclosures including support to add to fielded product. As with the current FlexWave Prism offering, HDM supports MIMO and SISO coexisting within a single system with HDM enabling support of MIMO within a single RF module slot.

HDM allows the operator to address the growing capacity needs for 4G services without changing hardware mounted in the network.

Open Space for Expansion within Existing Footprint

Half the Footprint with Existing Configurations

RELEASED HDM MODULES:

HDM	Path	Tx	Rx	1 P-out	2 P-out	4 P-out	8 P-out	16 P-out
40W 850 Cell	P1	869-894	824-849	46	46	46	46	46
20W 700 IABC MIMO	P1	698-716	728-746	43	43	43	43	43
	P2	698-716	728-746	43	43	43	43	43
20W 700 uC MIMO	P1	746-756	777-787	43	43	43	43	43
	P2	746-756	777-787	43	43	43	43	43
20W 850/1900 Dual	P1	869-894	824-849	43	43	43	43	43
	P1	1930-2000	1850-1920	43	43	43	43	43
20W 2100 AWS MIMO	P1	2110-2155	1710-1755	43	43	43	43	43
	P2	2110-2155	1710-1755	43	43	43	43	43
40W 1900 PCS	P1	1930-2000	1850-1920	46	46	46	46	46
40W 2100 AWS	P1	2110-2155	1710-1755	46	46	46	46	46

NOTE:

1. For a dual/MIMO HDM RF Modules, a Diversity/MIMO capable (Two RF/Antenna cables per bay) Remote Chassis is required. Please call TE to confirm your Remote Chassis type if there are any questions.
2. A Dual HDM 20W RF module supports up to 12 time-slots per module. The 12 time-slots are equally split between the two amplifiers/Paths, for a total of to six time-slots per amplifier/path.

Differences Between Analog and Digital Simulcast

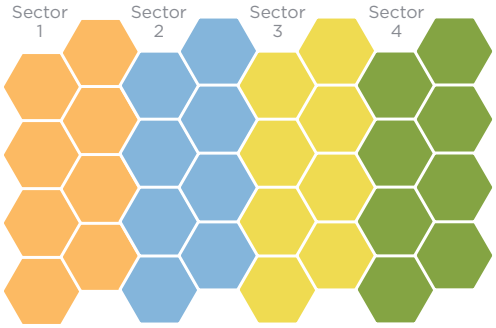
Digital simulcast is a feature in all of TE's DAS product lines. The digital aspect is unique compared to analog DAS systems and to remote radio heads (RRH). Digital simulcast adjustments can be made through the GUI versus having to mechanically change the system capacity configuration with RF splitters 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 patters (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 TE'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.

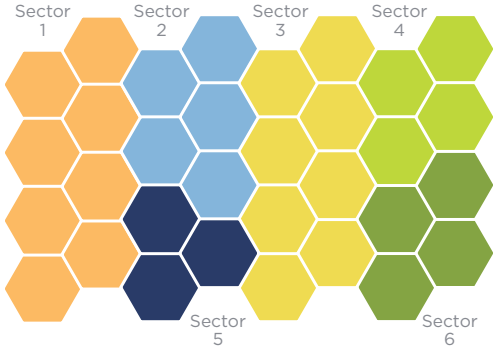
Simulcast DAS system must be designed such that the transport time to the remote antennas is equal for both analog and digital systems. With analog systems, which deal with changes in the physical world, this is achieved by ensuring that the cable runs to each remote antenna location is of equal length 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.

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.



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

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.

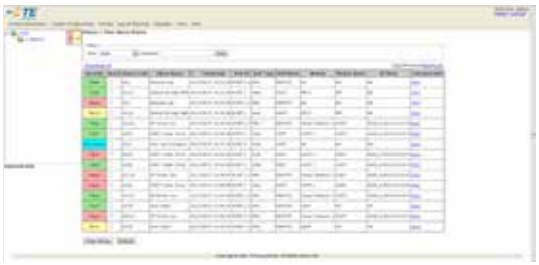
The EMS provides operational and maintenance capabilities for the Prism system (Host and Remote). The EMS can be used to set up and monitor status of any Host and any associated Remote Units. The EMS has the ability to configure the system, view status and parameter settings, download software, change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

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:	<12 µs forward, <12 µs reverse
Delay Management:	Digital (Manual or Automatic)

REVERSE PATH

	Noise Figure (dB) Typical	Noise Figure (dB) Max	Input IP3 (dBm)
Standard Gain Mode			
ClassicDART	5	6	>-8
SuperDART	4	5	>-4
High Gain Mode			
ClassicDART	4	5	>-18
SuperDART	3	4	>-14

SYSTEM GAIN

Classic:	36 dB standard gain mode, 38 dB high gain mode
SuperDART:	30 dB standard gain mode, 36 dB high gain mode

OPTICAL SPECIFICATIONS

Optical Budget:	26 dB standard, 13 dB optional
Digital Transport Rate:	3.072 Gbps

OUTPUT POWER AT ANTENNA PORT (DBM)

Pass Bands

		Frequency		Power Output/RF Carriers				
Band	**3GPP Band**	**Tx**	**Rx**	**1 P-out**	**2 P-out**	**4 P-out**	**8 P-out**	**16 P-out**
20 W 700 Upper C	13	746-756	777-787	43	43	43	43	43
40 W 700 Upper C	13	746-756	777-787	46	46	46	46	46
20W 700 Lower ABC	12	698-716	728-746	43	43	43	43	43
40W 700 Lower ABC	12	698-716	728-746	46	46	46	46	46
20W 800DD	20	791-821	832-862	43	43	43	43	43
800 iDEN	NA	851-869	806-824	38	38	38	38	38
iDEN 800 APAC	NA	851-870	806-825	38	38	38	38	38
iDEN 800/900	27	851-869	806-824	38	38	38	38	38
	NA	935-940	896-901					
20 W Cell 850	5	869-894	824-849	43	43	43	43	43
40 W Cell 850	5	869-894	824-849	46	46	46	46	46
Cell 850 APAC	NA	870-890	825-845	43	43	43	43	43
900 E-GSM	8	925-960	880-915	31	34	37	40	40
900 E-GSM APAC	8	930-960	885-915	31	34	37	40	40
900 P-GSM	8	935-960	890-915	31	34	37	40	40
1800 DCS	3	1805-1880	1710-1785	34	37	40	42	42
1900 PCS	2+25	1930-2000	1850-1920	43	43	43	43	43
40 W 1900 PCS*	2+25	1930-2000	1850-1920	46	46	46	46	46
2100 UMTS	1	2110-2170	1920-1980	42	42	42	42	42
20 W 2100 AWS	4	2110-2155	1710-1755	43	43	43	43	43
40 W 2100 AWS*	4	2110-2155	1710-1755	46	46	46	46	46
20W 2600	7	2620-2690	2500-2570	43	43	43	43	43
20W 800DD	20	791-821	832-862	43	43	43	43	43
20W 1800 DCS	3	1805-1880	1710-1785	43	43	43	43	43
20W 2100 UMTS	1	2110-2170	1920-1980	43	43	43	43	43
20W 2600	7	2620-2690	2500-2570	43	43	43	43	43

REMOTE UNIT ENVIRONMENTAL SPECIFICATIONS

Outside Ambient

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

Remote Unit

Enclosure:	IP-65, (Fan IP-55)
Mounting:	Wall, Pole, Inside Pole, and Vault
Cooling:	Fan (external only)
Optical Connectors:	Sealed HMFOC (Multi-fiber connector - 8 fibers) 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 8.43" (13.34 cm x 48.26 cm x 21.41 cm) (3 RUs)
Weight:	<25 Pounds (<11 kg)

Remote Unit Power Requirements

Power Supply:	100-240 VAC, 50-60 Hz 48 VDC (OPTIONAL)
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
Fully Populated.

Prism Remote Unit Module Configurator

Catalog Number
FWP - __ __ __ __ __ 0 0 MOD

Band

L	700 Lower ABC
U	700 Upper C
4	800 SMR
D	800 SMR/900 iDEN
B	850 Cell Wideband
C	850 CELLI/1900 PCS
8	1900 PCS
A	2100 AWS
6	900 E-GSM
7	1800 DCS
9	2100 UMTS
F	Singapore GSM
I	800 iDEN-APAC
J	Cell 850 APAC
K	900 P-GSM

Specials

0	Standard
1	Single-Slot 40W

Dart Type

0	Classic
6	Single SuperDART
S	Dual SuperDART
T	TX/RX (HDM)

Non-Diversity/Diversity/MIMO

1	Non-Diverstiy
2	Diverstiy
M	MIMO

Power Output

2	6.5 W (SMR, GSM, E-GSM, PGSM)
4	20 W (PCS, AWS, 700, CELL, DCS, UMTS)
8	40 W (CELL, 700, PCS, AWS)

Examples
FWP-B410000MOD: PRISM, 20 W Wideband Cell Module, Non-Diversity, Classic
FWP-7416000MOD: PRISM, 18 W GSM 1800 Module, Non-Diversity, Single SuperDART
FWP-U4MT000MOD: PRISM, DUAL 20W 700 uC MODULE, MIMO (SGL-SLOT)
FWP-B810100MOD: PRISM, 40W WIDEBAND CELL MODULE, NON-DIVERSITY, (SGL-SLOT)

Prism Host DART Configurator

Catalog Number
FWU - __ __ 0 0 0 HUDART

Band

L	700 Lower ABC
U	700 Upper C
4	800 SMR
2	850 Cell Wideband
8	1900 PCS
A	2100 AWS
6	900 E-GSM
7	1800 DCS
9	2100 UMTS
I	800 iDEN-APAC

DART Type

0	Classic
6	Single SuperDART
S	Dual SuperDART

Examples
FWU-20000HUDART: PRISM, 800 CELL, One Dart, Classic
FWU-8S000HUDART: PRISM, 1900 PCS, One Dart, Dual SuperDART
FWU-76000HUDART: PRISM, 1800 GSM, One Dart, Single SuperDART

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