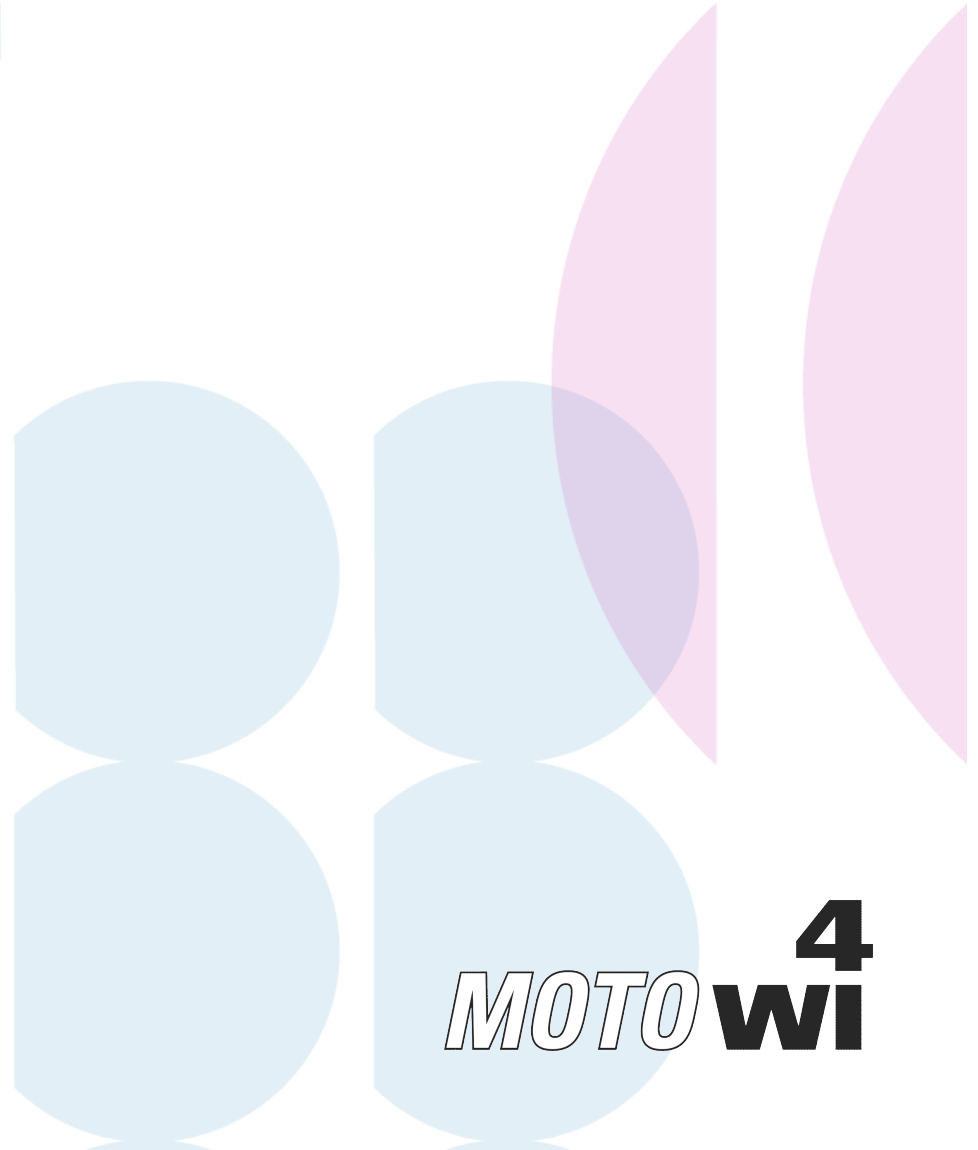


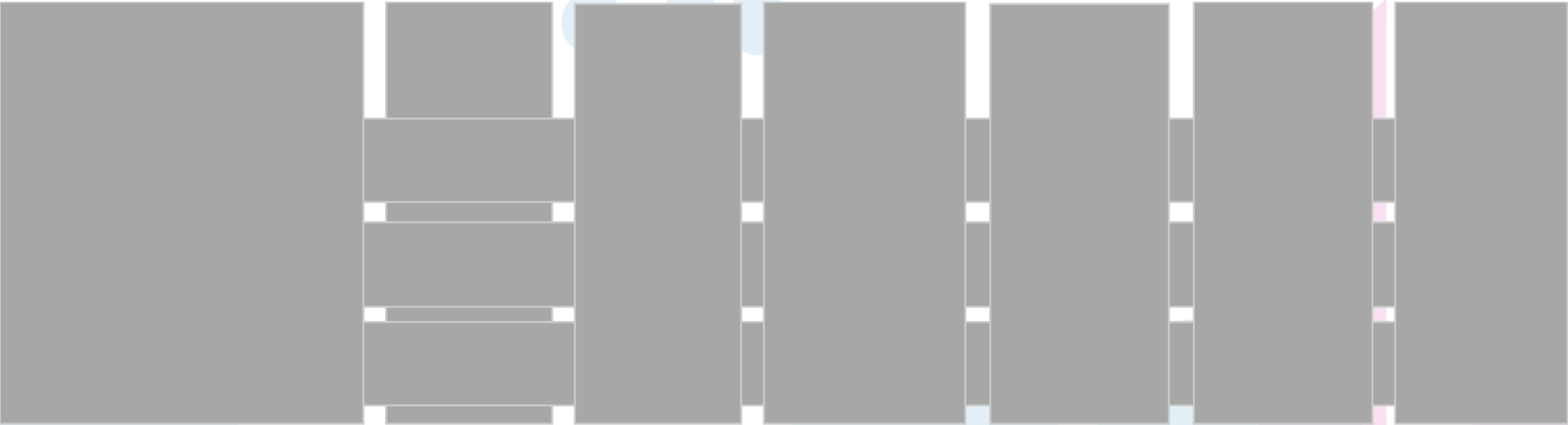


Point to Point PTP500



Motorola: For General Business Use, Point to Point Training
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The PTP Family of Products



Integrated ODU



Connectorised ODU



Powered Indoor Unit



Enhanced Indoor Unit



Lightning Protection Unit

MOTO 4 WI

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Summary of the PTP 500

- Launches April 2008
- Consider use if:
 - Capacity of PTP 400 is not enough
 - PTP 600 throughput is more than needed
- Key Features:
 - 5.4 and 5.8 GHz variants
 - Up to 105 Mbps at the Ethernet
 - Low latency < 2 ms
 - Lightning protection built into ODU; PIDU+ requires separate protection
 - Analogue output alignment aid
 - Improved link budget
 - Selectable 5/10/15 MHz channel
 - Multiple T1/E1's with EIDU



PTP 500 Connectorised – high-gain advantage of external antennas



PTP 500 Integrated with dual built-in antennas



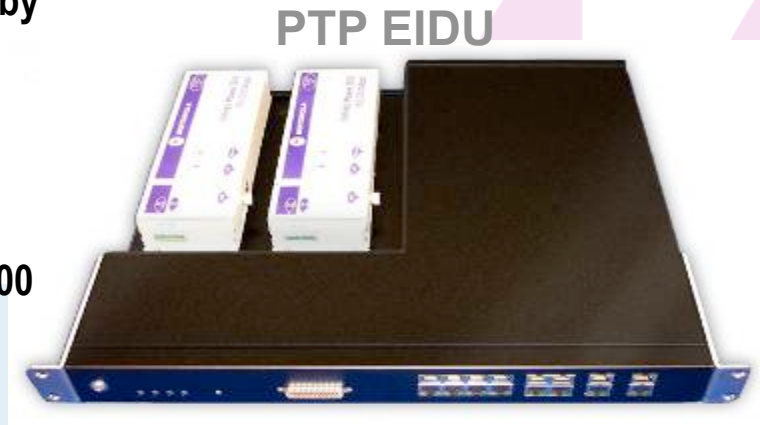
- Powered Indoor Unit (PIDU Plus)
- Power-over-Ethernet to outdoor units

MOTO **wi** **4**

New - PTP EIDU - for E1/T1, scalable, reliable, easy-to-deploy and use



- **1U 19 inch rack mount**
- **Optimized with Motorola PTP product, support two ODUs by single E-IDU Unit**
 - Support PTP600 and PTP500/300 radio platform
- **Easy scalable**
 - 8 x T1/E1 with single EIDU
 - 1 x 10/100/1000 BaseT Ethernet port
- **Ultra-low latency, as low as 1.5 ms E2E latency with PTP600**
- **Meeting all clock-synchronization requirements for GSM /UMTS network**
 - As specified in ETSI TS 145 010 and ETSI TS 125 104
- **TOS, Diffserv, QoS tagging and port priority enabled prioritize on multiple service classes (Voice, signaling, data, etc)**
- **Provide TDD synchronization reference clock to PTP 500/300 radio with single cable.**
- **Enriched O&M**
 - Front Panel Alarm indication
 - External Alarm
 - Out-band/In-band management
 - SNMP v.1/2c

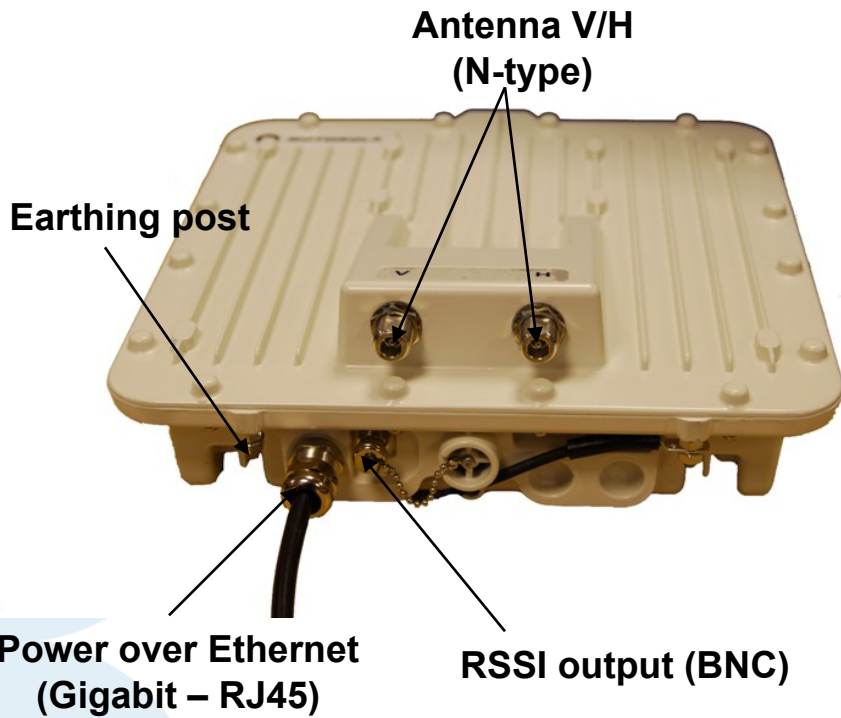


Clocking Modes:

- Loopback
- Adaptive
- Internal
- External
- Radio locked
- GPS locked

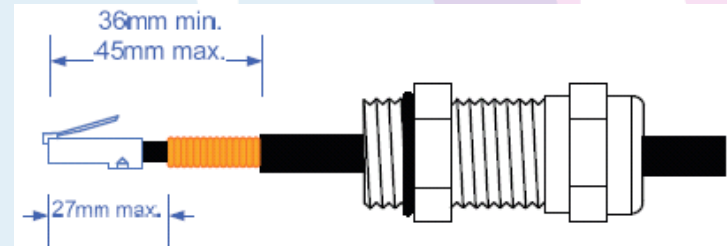
MOTO **4**
wi

PTP500 similar configuration to the PTP400but better!



NEW Strain relief gland(*)

Grounds directly to Cat5e Screen



(*) NEW Strain relief gland
Shipping as standard on LPU
and all PTP series radios

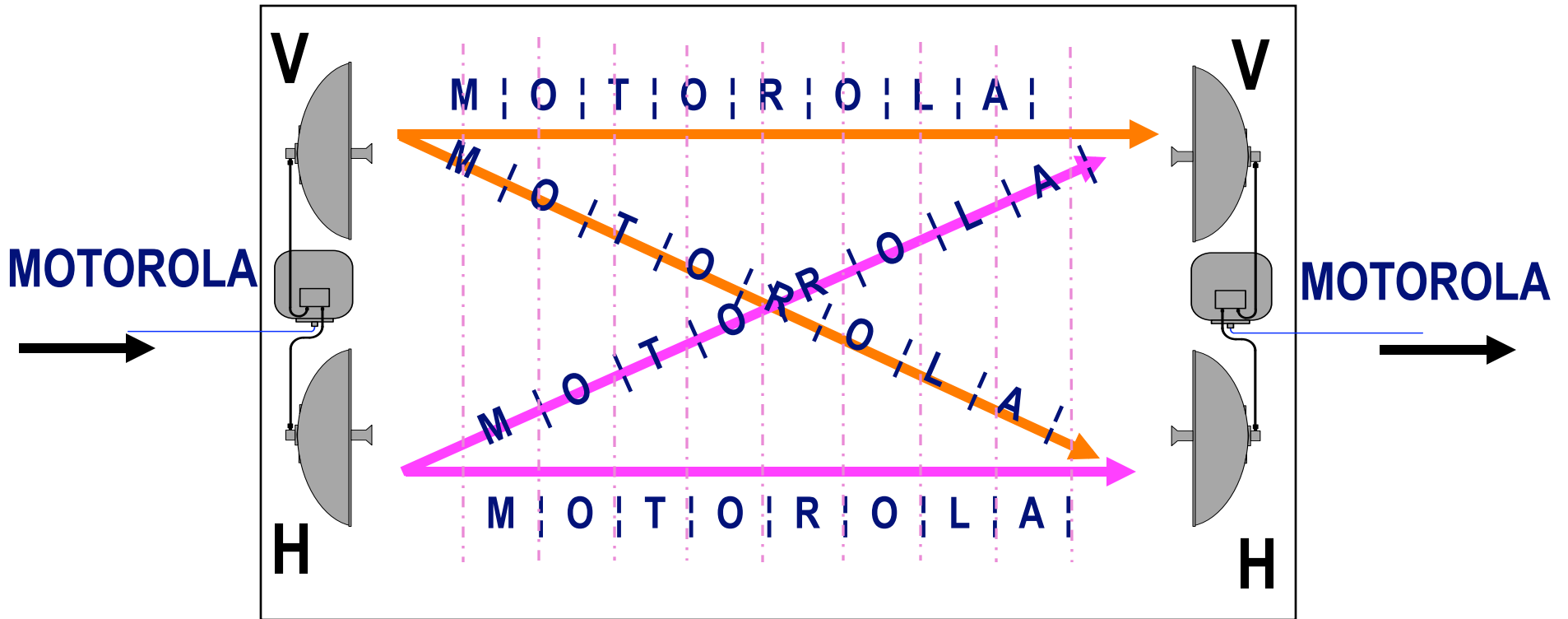
MOTO **wi** **4**



Advanced Features

MOTO **wi** **4**

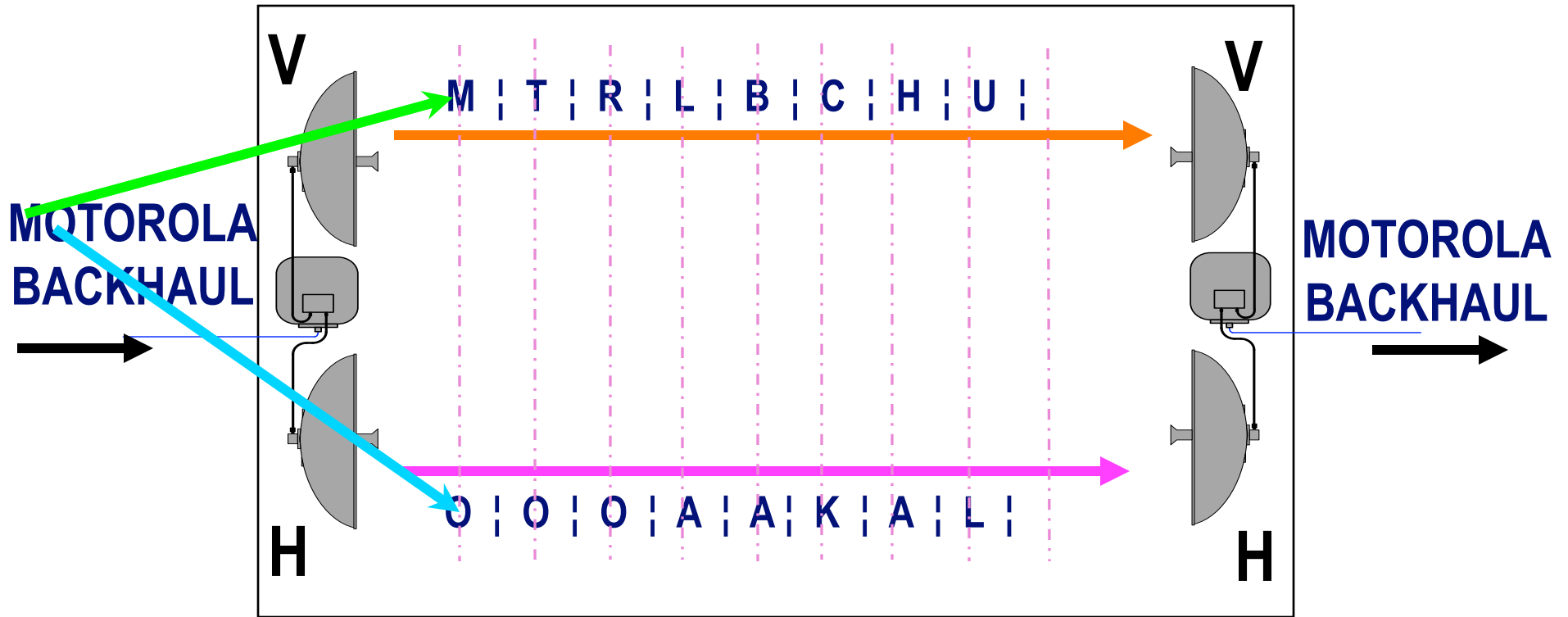
PTP 500 series uses MIMO (Single Payload)



Data is sent with two polarizations giving radio signal redundancy

With LOS the signal maintains its polarization

PTP 500 Series also uses DUAL PAYLOAD



Different data is sent separately over the two polarizations giving radio ultra high efficiency

Spectrum Management with Intelligent-Dynamic Frequency Selection (I-DFS)

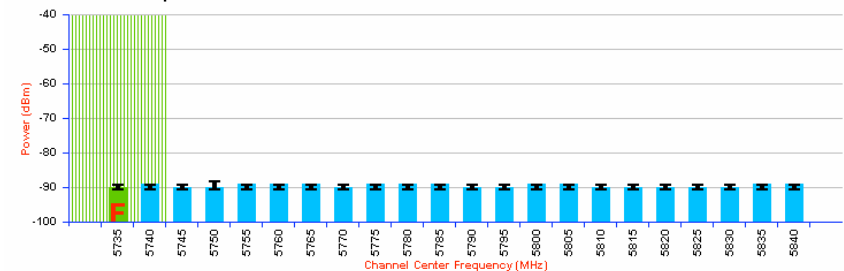
Robust when Interference is present:

- 5,10 & 15 MHz operating channels*
- 5.8GHz Band for 10-25 Channels (4-25 adjacent)*
- 5.4GHz Band for 23-50 Channels (8-50 adjacent)*
- Continuously monitors all channels
- Automatically moves to the cleanest channel
- Avoids Interference
- Allows for Co-Existence with other products

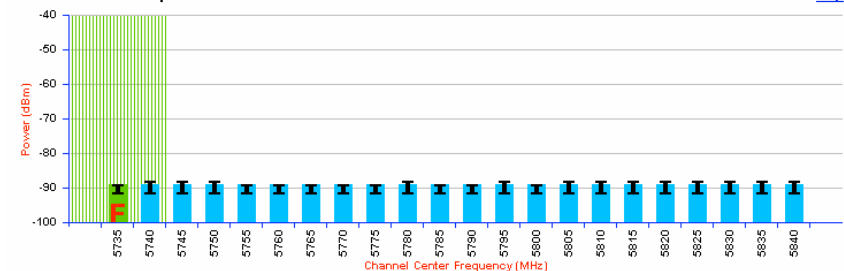
Spectrum Management - Fixed Frequency Mode

Local Channel 21: State=AAVAILABLE, Mean=-91 dBm, 99.9%=-89 dBm, Peak=-89 dBm

Local Receive Channel Spectrum



Peer Receive Channel Spectrum



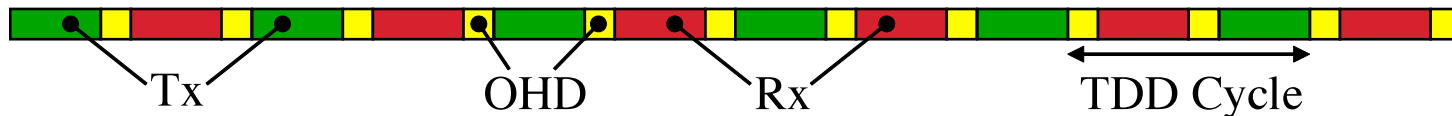
Attributes	Value	Units	Attributes	Value	Units
Spectrum Management Page Refresh Period	3600	Seconds	Channel Bandwidth	15	MHz
			<input type="button" value="Submit configuration changes"/> <input type="button" value="Reset form"/>		

Adaptive Modulation & Power Control

- **Link continually optimized for varying RF path conditions**
- **15 modulation schemes available:**
 - Link automatically adapts to best modulation; driven by measured path loss
 - Constantly monitors fading and other link conditions
 - Default or operator set margin used for shifting threshold; dependent on:
 - Link Loss
 - Receive Power above Interference and Noise floor
- **Additionally, adaptive power control ‘backs off’ transmit power when link conditions permit**

PTP 500 Series - Dynamic TDD

Under normal conditions link operates symmetrically, optimised for lowest latency



Under heavy traffic conditions the TDD cycle is 'stretched' to maximise data throughput



'Stretching' is dynamic, and is applied on Tx or Rx path independently based on where traffic load exists

Once traffic load reduces the link returns to normal operation

Benefits

- Provides highest data rate to user, especially over long link lengths
- Dynamically allocates capacity on send route and return route according to demand



Introducing PTP 500 Series

MOTO **wi** **4**

Primary Features: PTP 500 Links

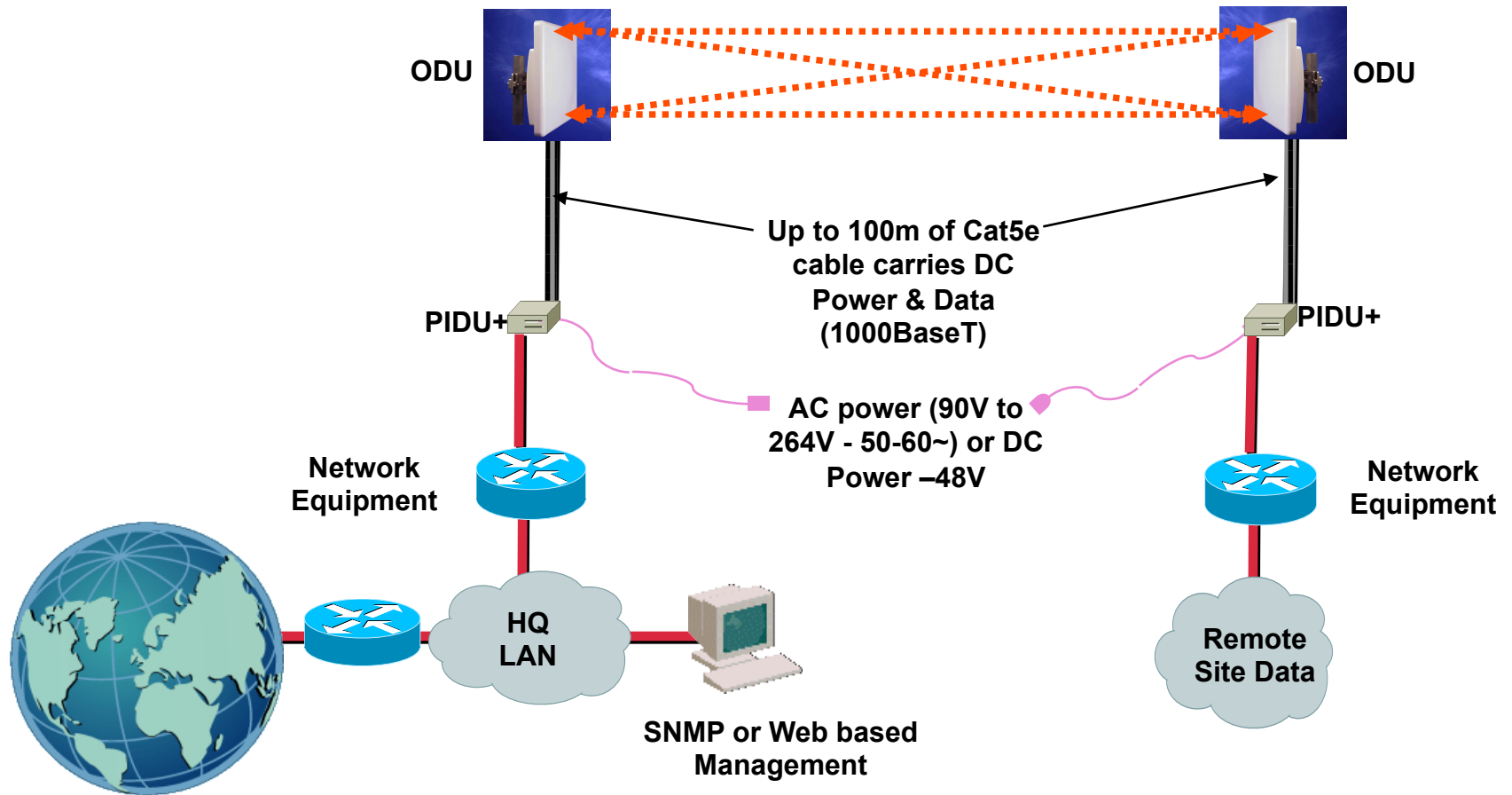


4th Generation, Software Defined, Multi-Channel, Point to Point wireless bridge, interfacing at layer 2, supporting IP and operating in the 5.4GHz & 5.8GHz bands whilst providing **TRUE** NLoS & LoS performance. Variable bandwidths 5, 10, 15, & 30MHz*

... *plus* ...

- Versatility** : Solves NLoS and LoS challenges with Integrated and Connectorised versions
- Capacity** : Up to 105 Mbps; 52.5 Mbps Lite (useable, aggregate, Ethernet rate)
- Range (Max)** : Up to 200km Line of Sight
- Availability** : Carrier Grade. Up to 99.999%. Delivered by use of: Best in class radio, MIMO and iOFDM
- Security** : Complex proprietary air interface, optional AES 128 and/or 256 bit encryption, transparent to VLAN and VPN
- Interference** : Sophisticated Spectrum Management: i-DFS
- Easy Set Up** : Simple to install, commission and manage via SNMP or embedded Web server
- Ruggedised** : Environment proof Outdoor Unit, built-to-last. Life-span up to 25 years

PTP 500 System Configuration



PTP 500 Installation Procedure – User Guide – Sect. 6 & 7

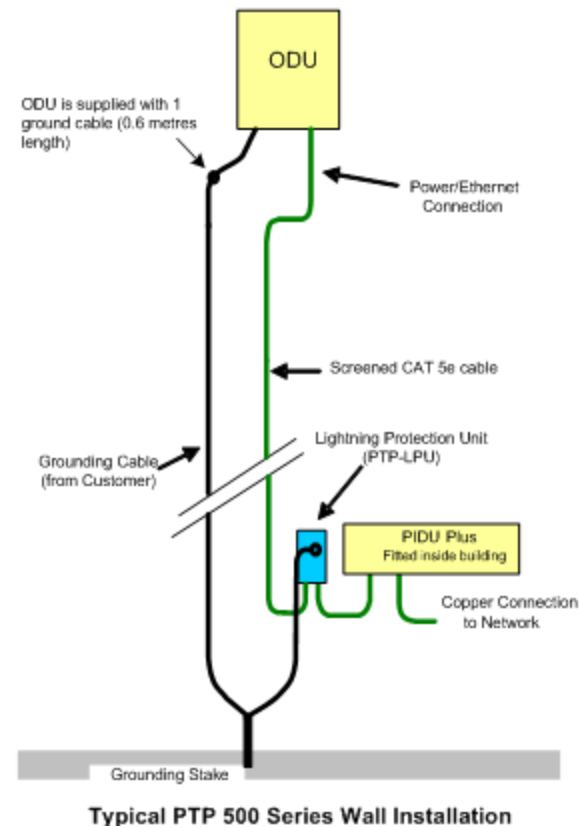
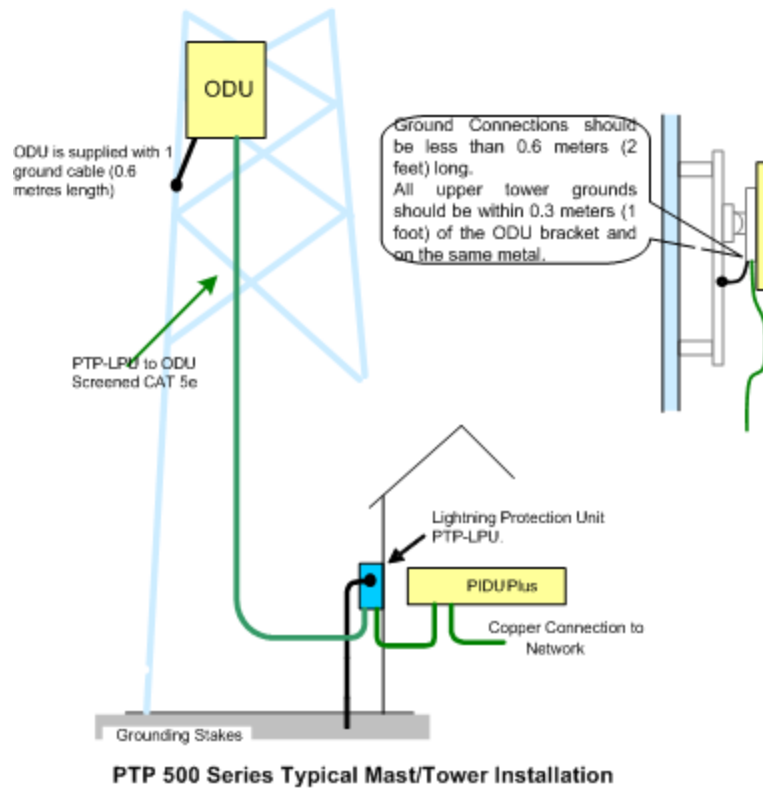
Ensure:

- link has been bench tested
- The correct tools are available
- best safety practices are followed
- A successful link plan has been completed – Sect 6

Follow the procedure for :

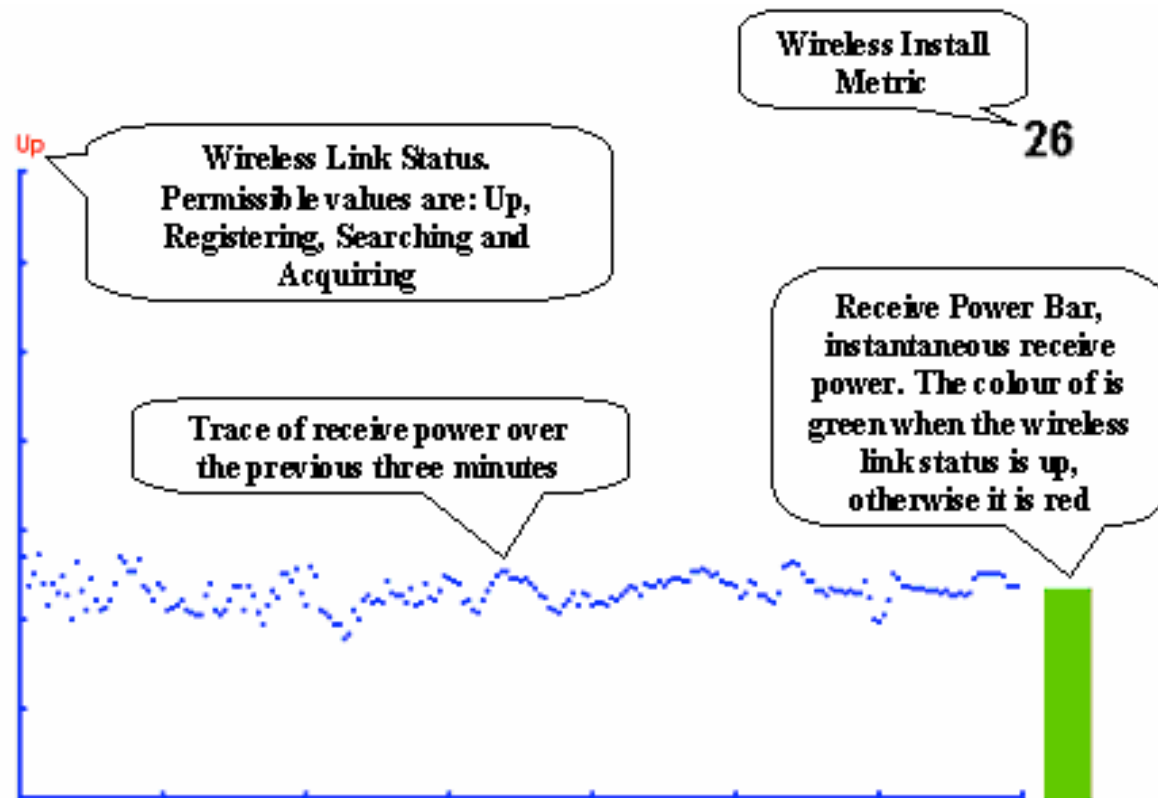
- Mounting ODU in correct positions – Sect 7.6
- Connecting cable preparation – Sect 7.7.1
- Connecting ODU and PIDU – Sect 7.7.2 & 3
- Mounting PIDU – 7.7.9
- Fitting LPU to PIDU – Section 11
- Initial powering up – Sect 7.7.10
- ODU Alignment – Sect 7.7.11

Lightning Protection via LPU For PIDU+



Graphical Installation

- To aid installation 2 graphical aids have been introduced to the PTP 500:
 - A PDA installation screen
 - A larger screen driven from the http management interface



PTP 500 Series Maximum Range Can be Limited Due to Local Regulation

Power Limit	Maximum Range Non Line of Sight (Km)	Maximum Range Near Line of Sight (Km)	Maximum Range Line of Sight (Km)
FCC (1 Watt Peak Transmit Power to the Antenna)	5	20	200
2 Watts EIRP	2	6	25
1 Watt EIRP	1.5	4	20
0.5 Watt EIRP	1	3	15

Selectable Channel Sizes

Available from Release 3 (October)

PTP 500 Channel Size	Max Ethernet Data Rates	Latency One Way
5 MHz Channel	Up to 35 Mbps	< 2 ms Typical
10 MHz Channel	Up to 70 Mbps	< 2 ms Typical
15 MHz Channel	Up to 105 Mbps	< 2 ms Typical

Competition



PTP500 Competitors

Manufacturer	Model
Redline	AN80i
Alvarion:	BreezeNET B100
Solectek	SkyWay 5000
Exalt	EX-5R

PTP 500 Value Proposition
105Mbps Throughput
Best-in-Class Link Budget
MIMO as standard – tackle LOS/Tough LOS with confidence
Real-Time Spectrum Manager – avoids interference
Sophisticated Link Planner
Rich Web GUI

Comparison Guide

Capabilities	PTP XX500	Redline AN80i	Alvarion B100	USP
Highest Throughput & Efficiency	105 Mbps 15 MHz	90 Mbps 40MHz	70 Mbps 40MHz	MIMO Intelligent OFDM
Reach	Integ – up to 48 Km Conn – up to 200 Km Over-Water	< 90 Km	< 48 Km	Spatial diversity 27dBm Tx power Best Rx sensitivity
NLoS	Up to 9 Km	Poor availability	Poor availability	MIMO
Link Planning	Easy Accurate			PTP Link Estimator
Install	Fast, Fewest Ancillaries, Easy Align	External Proprietary Lightning Prot.	Transtector. No RSSI	Built in lightning protect, grounding cable gland, RSSI
Price	Lowest Total cost of ownership			

Based on publicly available information



Air Interface Security

MOTO **wi** **4**

Security (1)

Complex, proprietary Air Interface protocol

The wireless signal is a complex proprietary signal with scrambling applied. On transmission the signal passes through the following processes;

- Reed-Solomon forward error correction when added bits are applied.
- The signal is scrambled with a code that repeats every eight Reed-Solomon code words (about 1 ms).
- The signal is then interleaved (which means that the order is changed)
- The signal is then encoded
- Then the signal is coded onto one of the BPSK, QPSK, 16QAM, 64QAM or 256QAM waveforms
- Then the signal is interleaved across a 1024 carrier OFDM waveform

The specifics of these processes are proprietary but each, individually, are built upon generally available and published techniques

Security (2)

Best in class Encryption Key

The Advanced Encryption Standard (AES) is a computer security standard introduced in 2002, by the US based National Institute of Standards and Technology (NIST) to replace the earlier Data Encryption Standards (DES and triple DES). The cryptography scheme is a symmetric block cipher that encrypts and decrypts 128-bit blocks of data. Lengths of 128, 192, and 256 bits are standard key lengths used by AES. For the Motorola PTP radios a 128-256 bit key length is employed. AES as used on the Motorola PTP radios FIPS 197 certified

VLAN Support

VLAN tagged Ethernet packets are passed transparently through the system. VLAN tagged packets with a non-zero priority will be transmitted via a priority queue, giving a method of managing QoS for VoIP and TDM traffic.

PTP 500 Summary

Feature	Benefit
Analogue RSSI output Built in lightning protection Grounding strain relief	Less time on the tower Reduced install cost
Latency <2ms	Lower network delay than PTP400
105 Mbps throughput in 15 MHz of Spectrum	Deployment flexibility
5.4 and 5.8GHz variants - 5.4 FCC (2)	Choice, flexibility
Significantly improved link planner	Design a link with confidence
Selectable channel 5/10/15 MHz (3)	Optimal use of available spectrum
TDD Sync (3)	Increased deployment density on tower
Enhanced QoS (3)	802.1p - 4 level queue
Wayside 1xT1/E1 <u>or</u> OOB Mgmt (3)	All on the one drop cable
Enhanced security (3)	SNMPv3 / TSL / HTTPS / IPv6
Plus existing great Orthogon features... - MIMO - Spectrum management - Highest link budget in class - Rich Web GUI	- Tough LOS/Non-LOS links - Avoids Interference - Highest availability - Easy to manage

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