



Implementing Cisco Ultra-Reliable Wireless Backhaul (CURWB)

WHITEPAPER



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ARMY TACTICAL OPERATIONS: HIGHER THROUGHPUT AND NEW MESHING SOLUTIONS

The Army has a large and complex communications infrastructure that depends on evolving technologies and tactics. The current tactical backhaul, comprised of 30,000 15-year-old radios, has limited capabilities acting as a technological bottleneck, throttling all throughput to the limited 2007 technology. Technology advancements utilized by the Army and tactical operations today have rendered the aging backhaul equipment insufficient and potentially obsolete.

The current equipment supports a combination of switching, routing, backhaul, and meshing capabilities. New equipment must meet these capabilities at a higher throughput or be deployed with other equipment to increase the overall throughput of the backhaul.

In addition to the updates, the Army announced the following throughput requirements:

- New bridging solution of 10 Mbps or greater at 18 miles (30KM)
- New meshing solution to provide 40 Mbps or greater at 300m

Army communications are essential for their mission effectiveness and readiness. The Department of Defense has a long history of adapting and adopting new technology to meet its needs. Below, we detail how they maintained critical communications in the modern era with Cisco Fluidmesh Radios.

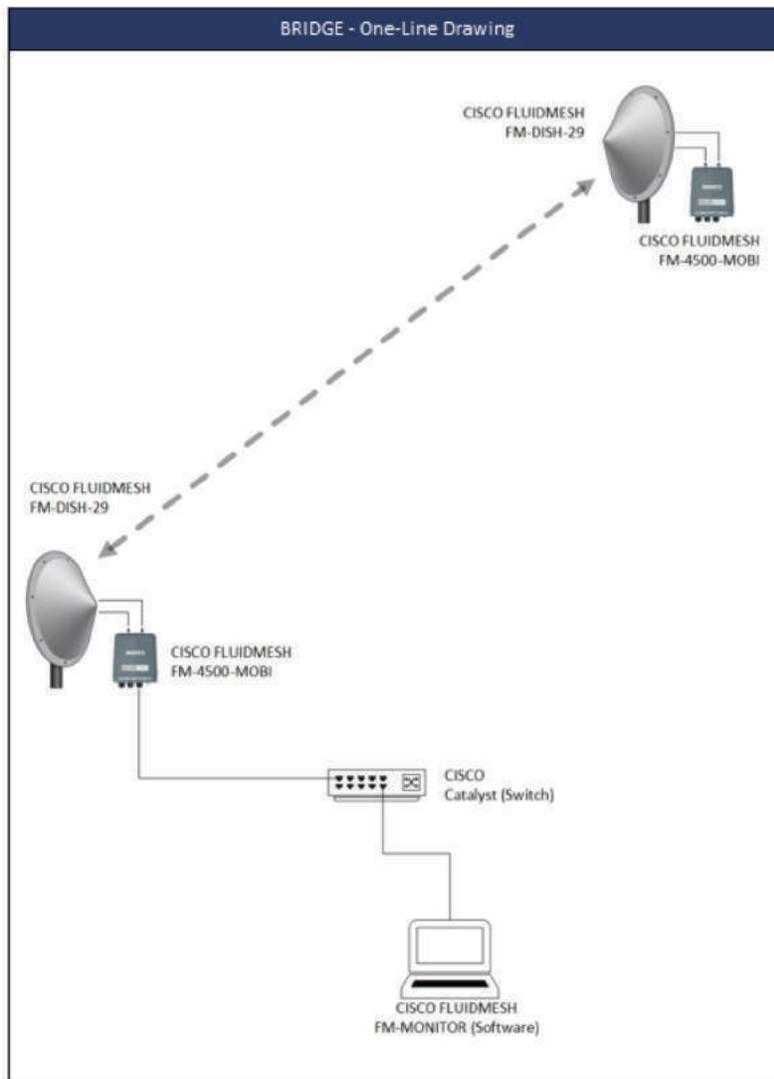


THE LEGACY SYSTEM SOLUTION: CISCO FLUIDMESH

Cisco has introduced a line of products that are uniquely capable of solving multiple issues with a single piece of hardware. With proper licensing, the Cisco Fluidmesh FM-4500-MOBI radio can be configured to operate as a bridge, an engineered point-to-multipoint system, or meshing system.

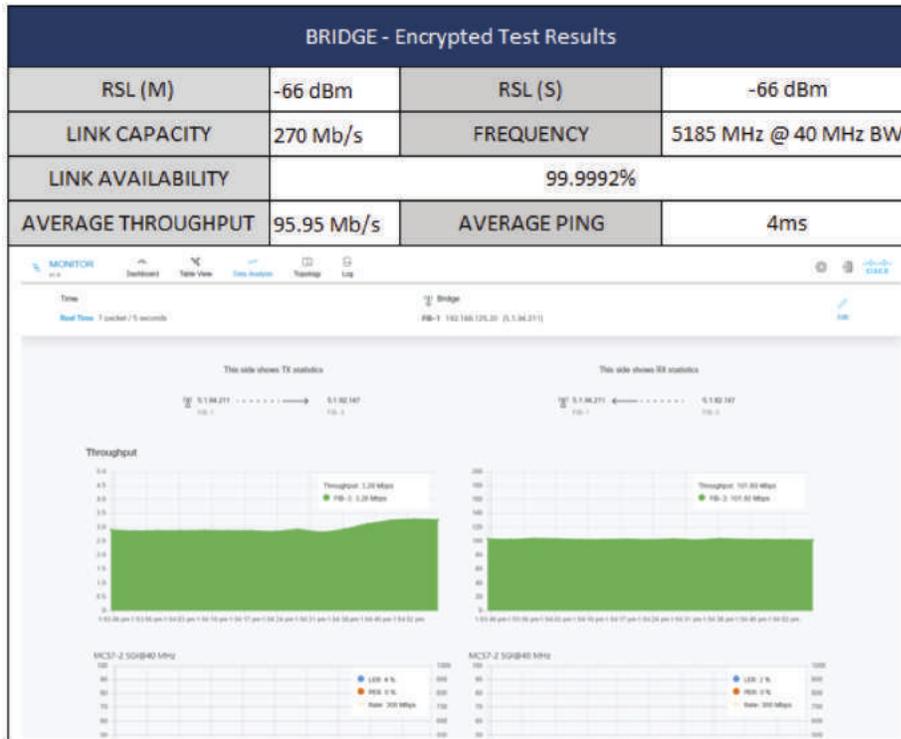
Bridge

The Cisco Fluidmesh FM-4500-MOBI configured as a bridge, and paired with Cisco Fluidmesh FM-DISH-29, 2' Dual Polarity dishes. Testing was performed at 18 miles utilizing a combination of iPERF and FM Monitor to create and monitor traffic.



THE LEGACY SYSTEM SOLUTION: CISCO FLUIDMESH (CONT.)

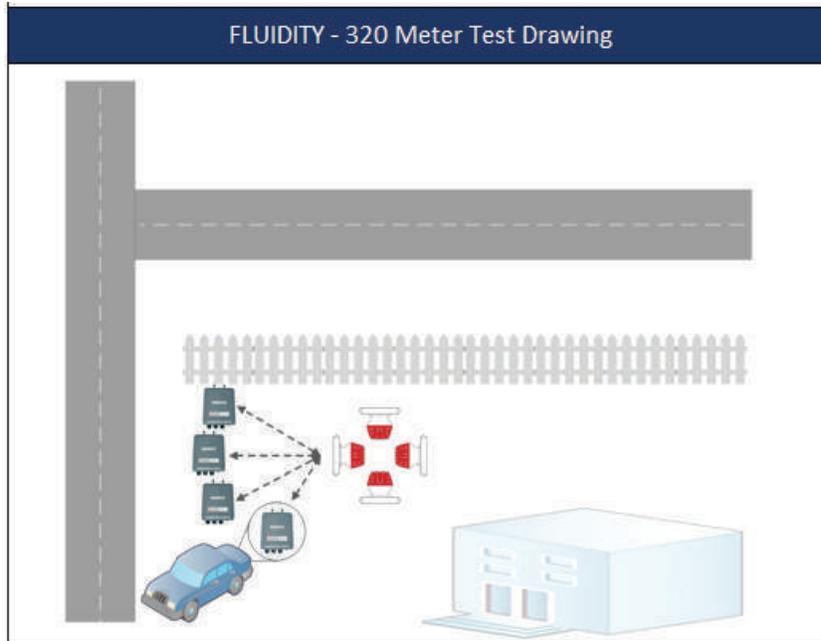
Achieved 95.95 Mb/s throughput with 99.999% reliability.



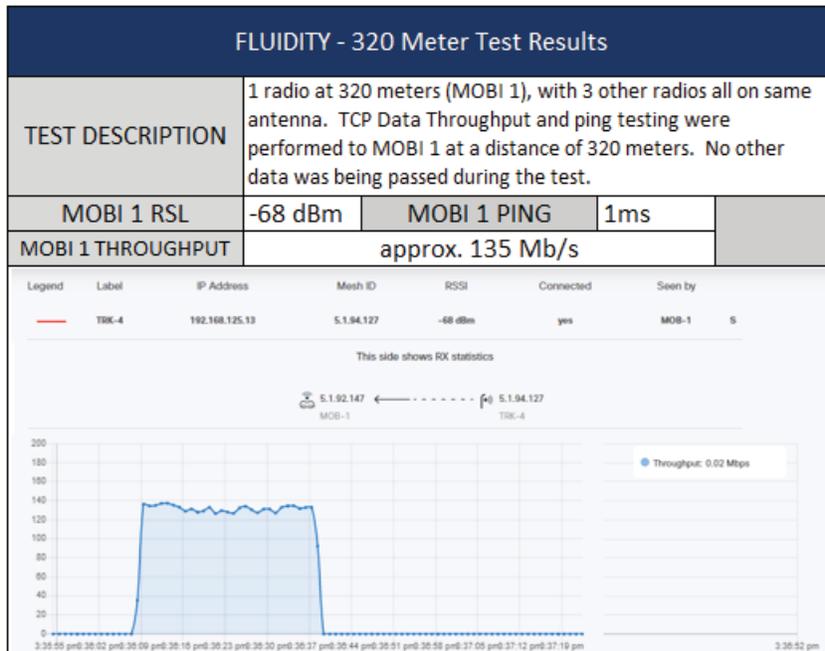
THE LEGACY SYSTEM SOLUTION: CISCO FLUIDMESH

Fluidity

The Fluidity configuration utilized the Cisco Fluidmesh FM-4500-MOBI radio configured for Fluidity (Point to Multi-Point), paired with Cisco Fluidmesh FM-OMNI-10 antennas for the mobile solutions and (4) Cisco Fluidmesh FM-4500-MOBI radios paired with (4) Cisco FM-HORN-90, 90-degree horns as the infrastructure. Achieved 135 Mb/s at 320 Meters



Achieved 135 Mb/s at 320 Meters



CISCO FM 4500 MOBI

The Cisco FM4500 Mobi is a high-performance mobility-communications radio transceiver, designed to deliver fast, stable connectivity from any slow- or fast-moving vehicle to a wayside network, particularly within mission-critical market sectors and in extreme environments.

The FM4500 Mobi has received numerous railway and transport certifications, making it a popular choice for deployment on many transportation systems in the USA and worldwide, as well as in ports, intermodal yards and mining environments. Its low-latency, high-bandwidth characteristics make it the class leader in a diverse portfolio of applications, including but not limited to computer-based train control (CBTC), real-time situation monitoring, and on-board client services for rail (such as Wi-Fi and VoIP).

The FM4500 Mobi is equipped with M12 connectors, making it the ideal choice for onboard communications in very high-vibration environments (such as mine trucks, terminal yard cranes and tractors).



Figure 1.
FM4500M radio model

Wi-Fi on board

Your passengers expect wireless high-speed connectivity everywhere, and FLUIDITY delivers it. With our trackside technology, we are able to deliver connectivity up to 500 Mbps to fast-moving vehicles and trains.

Works with FLUIDITY, our unique mobility solution

The FM4500 Mobi supports FLUIDITY, the ultimate broadband connectivity solution both for high-speed vehicles and very high-bandwidth situations.

Up to 500 Mbps of usable throughput is now a reality, no matter what the situation: Environments of extreme temperature and humidity, punishing vibration levels, safety-critical working conditions, demanding contractual requirements, and vehicles traveling at up to 225 mph/360 Km/h are all part of what the FM4500 Mobi was designed to handle.

FLUIDITY's seamless 'Make-before-break' approach ensures zero-millisecond handoff times, persistent network sessions, and can accommodate any type of data traffic.

Reduce the cost of network ownership by selecting the amount of throughput you need

Limit the cost of network ownership with FluidThrottle by selecting only the amount of throughput required. More throughput can be easily achieved by upgrading the system with software plug-ins when traffic requirements increase. FluidThrottle makes Cisco FM cost-effective and future-ready.

Prodigy 2.0 for reliable mission-critical applications

Our Multiprotocol Label Switching (MPLS)-based transmission protocol is built to overcome the limits of standard wireless protocols and to deliver an infrastructure with a higher level of reliability.

At the base of our innovative transmission protocol is a traffic optimization algorithm that allows every Cisco FM radio to assign a specific level of priority and reliability to every packet transmitted. The result is a better, more reliable, multiservice wireless infrastructure.

Web interface configures, monitors, and troubleshoots the wireless network

The Cisco FM4500 Mobi includes the FMQuadro web interface, which allows you to configure, monitor, and troubleshoot the wireless network in real time, without any additional software.

Quick peek

Rugged die-cast aluminum housing

Specific for harsh environments and long-lasting performance

FluidThrottle

Select only the throughput you need

Prodigy 2.0

MPLS transmission protocol with intelligent QoS

FMQuadro

Web-based interface to easily configure, monitor, and troubleshoot the network

FluidMAX

Change the network's architecture, not the radios

FLUIDITY

Connectivity solution for vehicles and trains

Multiple frequencies

4.9 GHz and 5.1 to 5.8 GHz

Ethernet port



Operational applications

- Communication-Based Train Control (CBTC)
- Remote system configuration and diagnostics
- Telemetry
- 24/7 maintenance and service data
- Onboard ticketing
- Onboard Point of Sale (POS)
- VoIP communications

Security applications

- Live video streaming
- Live front-facing camera streaming
- Level crossing monitoring
- Incident analysis
- Online virtual black box
- Emergency VoIP intercom

Passenger services

- Internet on board (Wi-Fi)
- Passenger information system
- Entertainment
- Digital advertising
- Emergency service phone
- Onboard femtocells



Figure 2.
FM4500M front and rear view

Table 1. Product specifications

System		
Chipset	CPU	880 MHz 1004 Kc MIPS network processor
	RF	MIMO 2x2
Interface	Ethernet	2x 10/100/1000 M12 ports
	SFP-Fiber (optional)	1x dual LC ruggedized SFP XCO connector 100/1000 Mbps instead of one of the two M12 ports
	Reset	1x Reset button for factory default
LED 1		1x Power
LED 2		1x Ethernet 1
LED 3		1x Ethernet 2
LEDs 4 to 7		4x RSSI

Radio	
Operating frequencies	5150 to 5350 MHz / 5470 to 5850 MHz 4940 to 4990 MHz
Channel width	20/40/80 MHz
Data rate	6/9/12/18/24/36/48/54 Mbps 30/60/90/120/180/240/300 Mbps 65/130/195/260/390/520/585/650/780/866.6 Mbps
Modulation	OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)
Compatible standards	IEEE 802.11p, IEEE 802.11e
Coaxial connectors	2x Cu-Sn-Zn-plated QMA compliant with ASTM B-117
Supported roaming vehicle speed	Up to 225 mph/362 kmh
MPLS technology	Yes
Output power	Up to 30 dBm*



Electrical	
Radio power input	48 VDC active 802.3at POE+ 48 VDC passive PoE input** 24-48VDC M12 power input
Max power consumption	20W

Physical	
Dimensions (in)	6.59 (H) x 5.21 (W) x 2.39 (D)
Dimensions (mm)	167.4 (H) x 132.4 (W) x 60.5 (D)
Weight	25 oz, (700 g)
Finishing	Powder coating Pantone cool gray 10c

Regulatory compliance	
Approvals	FCC Part 15.B, FCC Part 15.C, FCC Part 15.E, NII/RSS-210 Annex 9, FCC Part 90y, OET 65 MPE/RSS102, EN893+DFS, EN301189-1-17/ EN55022 EN 623111, EN60950, IC RS210, CE, ROHS24
Railway certifications	EN50155, EN50121-3, EN50121-4, EN45545, EN50129, IEC 60571, AREMA 11.5.1, CBTC: EN50129
Environmental specs	T3

Environmental	
Operating temperature	-40° to 176°F -40° to 80°C
Humidity	5% to 95% non condensing
Mounting	Pole mounting kit and DIN rail mounting included
Enclosure characteristic	Die-cast aluminum
IP rating	IP66
Shock and vibration	ETSI 300 - 019 - 1.4



Network	
Protocols	UDP, TCP, IP, RTP, RTCP, RTSP, HTTP, HTTPS, ICMP, ARP
Web-based interface	Yes
Multicast support	Yes
UPnP support	Yes
SNMP support	Yes

Security	
VPN/L2TP	Yes
Full compatibility with AES, 3DES, RSA, HTTPS, SSL	Yes

* Depends on configuration and regulations.

** PoE injector and PoE converters available upon request.

Plug-Ins and Licenses

FM4500M (Mobi)

- Mobi radios come pre-configured with throughput support up to 15Mbps
- Mobi licenses can be upgraded once purchased

Table 2. Plugins and Licenses

		Cisco FM4500 Mobi Plugin and License Summary		
Type of Plugin or License	Part Numbers	Description	Cisco PIDs	
Hardware P/N	FM4500M-HW	Cisco FM4500 Mobi, single MIMO radio device, 15 Mbit/s Ethernet Throughput (no mobility application), 4.9-5.8 GHz. Two (2) M12 Ethernet Ports. EN50155 Certified. Requires external antenna and cables. Does not include Fluidcare support plan.	FLMESH-HW-4500-2NA	NAM/LAM /Taiwan version
			FLMESH-HW-4500-2	Rest of the World version



		Cisco FM4500 Mobi Plugin and License Summary	
Type of Plugin or License	Part Numbers	Description	Cisco PIDs
Point-to-Multipoint (PtMP)	FM4500-30	Enable ETHERNET throughput up to 30 Mbit/s in FM4500	L-FLMESH-4500-17
	FM4500-60	Enable ETHERNET throughput up to 60 Mbit/s in FM4500	L-FLMESH-4500-18
	FM4500-200	Enable ETHERNET throughput up to 200 Mbit/s in FM4500	L-FLMESH-4500-16
	FM4500-UN	Enable ETHERNET throughput UNLIMITED (up to 500 Mbit/s) in FM4500	L-FLMESH-4500-22
Point-to-Point (PtP)	FM4500-PTP-UN	Enable ETHERNET throughput UNLIMITED (up to 500 Mbit/s) in FM4500 for BRIDGE MODE ONLY	L-FLMESH-4500-21
Fluidity Licensing: Mobile	FM4500-FLU-MOB-1	Enable FLUIDITY Mobile-Unit Mode up to 1 Mbit/sec in FM4500	L-FLMESH-4500-19
	FM4500-FLU-MOB-5	Enable FLUIDITY Mobile-Unit Mode up to 5 Mbit/sec in FM4500	L-FLMESH-4500-7
	FM4500-FLU-MOB-10	Enable FLUIDITY Mobile-Unit Mode up to 10 Mbit/sec in FM4500	L-FLMESH-4500-1
	FM4500-FLU-MOB-15	Enable FLUIDITY Mobile-Unit Mode up to 15 Mbit/sec in FM4500	L-FLMESH-4500-2
	FM4500-FLU-MOB-20	Enable FLUIDITY Mobile-Unit Mode up to 20 Mbit/sec in FM4500	L-FLMESH-4500-4
	FM4500-FLU-MOB-30	Enable FLUIDITY Mobile-Unit Mode up to 30 Mbit/sec in FM4500	L-FLMESH-4500-6
	FM4500-FLU-MOB-60	Enable FLUIDITY Mobile-Unit Mode up to 60 Mbit/sec in FM4500	L-FLMESH-4500-8
	FM4500-FLU-MOB-150	Enable FLUIDITY Mobile-Unit Mode up to 150 Mbit/sec in FM4500	L-FLMESH-4500-3
	FM4500-FLU-MOB-250	Enable FLUIDITY Mobile-Unit Mode up to 250 Mbit/sec in FM4500	L-FLMESH-4500-5
	FM4500-FLU-MOB-UN	Enable FLUIDITY Mobile-Unit Mode UNLIMITED (up to 500 Mbit/sec) in	L-FLMESH-4500-9



		Cisco FM4500 Mobi Plugin and License Summary	
Type of Plugin or License	Part Numbers	Description	Cisco PIDs
Fluidity Licensing: Trackside	FM4500-FLU-TRK-15	Enable FLUIDITY Infrastructure Mode up to 15 Mbit/sec in FM4500	L-FLMESH-4500-20
	FM4500-FLU-TRK-20	Enable FLUIDITY Infrastructure Mode up to 20 Mbit/sec in FM4500	L-FLMESH-4500-11
	FM4500-FLU-TRK-30	Enable FLUIDITY Infrastructure Mode up to 30 Mbit/sec in FM4500	L-FLMESH-4500-13
	FM4500-FLU-TRK-60	Enable FLUIDITY Infrastructure Mode up to 60 Mbit/sec in FM4500	L-FLMESH-4500-14
	FM4500-FLU-TRK-150	Enable FLUIDITY Infrastructure Mode up to 150 Mbit/sec in FM4500	L-FLMESH-4500-10
	FM4500-FLU-TRK-250	Enable FLUIDITY Infrastructure Mode up to 250 Mbit/sec in FM4500	L-FLMESH-4500-12
	FM4500-FLU-TRK-UN	Enable FLUIDITY Infrastructure Mode UNLIMITED (up to 500 Mbit/sec) in FM4500	L-FLMESH-4500-15
General Licenses	FM-AES	AES Plug-in. Enables One plug-in is required for each hardware device where encryption is desired. ECCN 5D002 (Export Licensed Required to be exported in certain countries; no license required to be sold in North America and in the European Union).	L-FLMESH-ENCR-1
	FM-TITAN	TITAN Plug-in. Enables Fast Failover in case of network, radio or power failure on a single Fluidmesh product. All Fluidmesh devices in a network must have a plug-in to operate.	L-FLMESH-TITAN-1
	FM-PROFINET	PROFINET Plug-in. Enables support to Layer 2 ethertype 0x8892 on one Fluidmesh product. It requires also QoS support and the VLAN plug-in. All Fluidmesh hardware devices in a network must have these plug-ins to operate.	L-FLMESH-PROFINET
	FM-VLAN	VLAN Plug-in. Enables port-based and MAC address-based VLANs on a single Fluidmesh product. All Fluidmesh hardware devices in a network must have a plug-in for VLAN to operate.	L-FLMESH-VLAN-1
	FM-QNET	QNET Plug-in. Enables support to Layer 2 ethertype 0x8204 on one Fluidmesh product. All Fluidmesh hardware devices in a network must have a plug-ins to operate.	L-FLMESH-QNET



		Cisco FM4500 Mobi Plugin and License Summary	
Type of Plugin or License	Part Numbers	Description	Cisco PIDs
	FM-CANBUS	CANBUS Plug-in. Enables CANBUS Support on Fluidmesh radios. All Fluidmesh devices in a network must have these plugin-ins to operate.	L-FLMESH-CANBUS

Product sustainability

Information about Cisco’s Environmental, Social and Governance (ESG) initiatives and performance is provided in Cisco’s CSR and sustainability [reporting](#).

Table 3. Cisco environmental sustainability information

Sustainability Topic		Reference
General	Information on product-material-content laws and regulations	Materials
	Sustainability Inquiries	Contact: csr_inquiries@cisco.com
	Countries and Regions Supported	Table: Regulatory compliance
Power	Power (Including Pluggable)	Table: Electrical
Material	Product packaging weight and materials	Contact: environment@cisco.com
	Weight	Table: Physical
Recycled Content	Pre-consumer	0.55%
	Post-Consumer	2.49%

Cisco Capital

Flexible payment solutions to help you achieve your objectives

Cisco Capital makes it easier to get the right technology to achieve your objectives, enable business transformation and help you stay competitive. We can help you reduce the total cost of ownership, conserve capital, and accelerate growth. In more than 100 countries, our flexible payment solutions can help you acquire hardware, software, services and complementary third-party equipment in easy, predictable payments. [Learn more.](#)



Document history

New or Revised Topic	Described In	Date
Typos and missing captions fixed	Figure 1. FM4500M radio model Figure 2. FM4500M front and rear view Table 1. Product Specifications Table 2. Plugins and Licenses Table 3	5/17/2022
New supported Region (Taiwan) for – NA PID version	Table 1	5/17/2022



INSTALLATION PHOTOS



ONE RADIO: MULTIPLE SOLUTIONS

Utilizing the Cisco Fluidmesh line of radios, the Army can program one radio to accommodate bridging, infrastructure, and mobile configurations. Unifying systems and streamlining communications have several benefits for the Army.

Cisco Fluidmesh immediate improvements:

- Reduction in training time with single, configuration interface.
- Inventory reduction as the FM-4500-MOBI can be configured to operate in any of the 3 required scenarios; only requires a license change to accommodate.
- Greater flexibility and redundancy in the field. If a device fails, one of the other devices can be reconfigured to support the requirement (pending appropriate licensing).
- Improved throughput due to the higher throughput capabilities, exceeding the government requirements.
- Cost-savings, the Cisco FluidMesh line of radios are priced significantly less than competitive alternatives.

RESOURCES

On the battlefield, critical communications are vitally important, and the Army has worked to maintain their critical communication systems in the face of technological change. With Cisco Ultra-Reliable Wireless Backhaul (CURWB), learn how to be more agile and effective with the latest technology to keep your communications powerful.

Cisco FluidMesh Product Line

