



MRX

Backhaul and Client Mesh Wireless Router

- x **Wireless Router / Wireless Switch**
- x **Mobile Ad-Hoc Network (MANET)**
- x **High Throughput (up to 1,3Gbit/s)**
- x **Encrypted and meshed radio based on Wi-Fi**
- x **Additional Wi-Fi Access Point to connect mobile devices**
- x **Roaming supported for mobile devices**
- x **Uplink in public mobile network (3G, 4G)**
- x **LAN/WAN Ethernet-Ports (1000Mbit/s)**



The "wireless mesh" is an ad-hoc and mobile network based on Wi-Fi technology. Each MRX station serves as relay point as well as access point within the mesh. The mesh can be arbitrarily enlarged and designed redundantly. New MRX stations are automatically recognized and integrated into the mesh. All user data and communication within the mesh are encrypted. Only devices that know the mesh-key can log in, collaborate and send/receive data.

The mesh can be used as a supply network which is flexible and very easy to expand. Places hard to reached are easily accessible through a daisy chain of MRX stations.

Introduction

The MRX (mobile router) technology for wireless mesh allows the setup of a large, flexible and robust radio network based on IEEE802.11 (Wi-Fi) standard. A special protocol allows to combine lots of MRX stations to a meshed network, with redundancy and autonomous path-finding. The communication and payload traffic within the mesh is encrypted and only stations, which know the mesh-key can enter the network and get part of the system.

Any new station, which gets into the reach of the mesh and which knows the correct mesh-key is automatically integrated into the system and the potential new paths are considered for usage. When stations disappear from the mesh, either because of power down or the radio distances are too high, the changed setup of the mesh is recognized, considered and an autonomous re-route is done. There is no need to define

alternative routes to prepare such cases. The mesh is working without any external help or interaction - this makes it so robust and flexible.

The MRX is the entry-point into the mesh and offers different interfaces to connect the mesh towards WAN and to connect clients. The WAN-port can either be a mobile uplink (3G, 4G) or the Ethernet-link to an external router (TP, cable, mobile). Clients can be connected via a second Wi-Fi port, which is acting as a standard access-point. It uses non-meshed Wi-Fi and laptops, mobile-phones or tablets can be connected via the wireless interface. Two Ethernet interfaces (1000BaseT) offer the possibility to connect PCs and external switches to the mesh.

The MRX can be installed wall-mounted, in vehicles (ground, sea, air) and on top of antenna poles. Special housing is available to fit even the harshest environments.



Features

- Mesh acc. IEEE 802.11s
 - Wi-Fi compliant to IEEE 802.11 a/b/g/n/ac
 - ↳ 2,4GHz and 5GHz supported
 - ↳ Wi-Fi operates in 3x3 MIMO
 - High Bandwith (up to 1.3Gbps)
 - High Distances (up to 2000m)
 - ↳ max. power limited by law (1W)
 - ↳ higher distances possible
 - Mesh-Encryption AES256
 - Mobile Uplink (EDGE, HSPA, UMTS, LTE)
 - 2x 10/100/1000BaseT interfaces
 - ↳ LAN or WAN port
 - Optional integrated satellite navigation module
 - Easy to use
 - ↳ short installation time
 - ↳ easy to expand / modify
 - ↳ stations are free to move
- Full autonomous operation
 - ↳ self-finding
 - ↳ self-healing
- Redundant
- Access control at client ports
 - ↳ IEEE 802.1X
 - ↳ RADIUS support
- axMesh Graph to show topology and peering
 - ↳ auto-discovery of all stations
 - ↳ RXpower and throughput is visible
 - ↳ performance monitoring
 - ↳ direct access to stations
 - ↳ open for 3rd party equipment
- SNMPv2c, SNMPv3, Web-GUI (http), SSH VT100 management options
- Low power demand (<20W)
 - ↳ depends on installed Wi-Fi and mobile features
- IP42 hardened housing

Application Example

The MRX is designed to build a mobile ad-hoc network (MANET) for special situations, where authorities or rescue forces need a reliable infra-structure. The MRX mesh is quickly installed and flexible in operation. In disaster areas, when local infra-structure is destroyed or during special missions the need for an own data- and communication setup is needed. It must be robust, easy to install, simple to use, dynamic to establish and reliable to operate. Seismic or flood areas, humanitarian disasters or special operation forces need the MRX mesh to setup an independant network.



X Technical Specifications

Common

- Wireless Router / Wireless Switch
- Full encrypted wireless meshed network
- 1x WiFi Mesh-IF
- 1x WiFi AP (optional)
- 1x mobile uplink (optional)
- 1x GNSS (optional)
- Battery/UPS available (optional)

Wireless Radio

- 3x Wi-Fi antennas
 - ↳ 3x3 MIMO
- IEEE 802.11a/b/g/n/ac
- Dual Band:
 - ↳ 2.4GHz:
 - ↳ HT20/40
 - ↳ 2.412 ~ 2.472 GHz
 - ↳ max. 23dBm
 - ↳ 5GHz:
 - ↳ HT20/40/80
 - ↳ 5.180 ~ 5.825 GHz
 - ↳ max. 30dBm
- BW: up to 1.3Gbps
- Modulation Techniques
 - ↳ OFDM: BPSK, QPSK, DBPSK, DQPSK, CCK, 16-QAM, 64-QAM, 256-QAM
- Support of radar detection
- Connector: 6x RP-SMA
- Mesh and AP mode

Mesh Features

- IEEE 802.11s
- Full encrypted (AES 256)
 - ↳ Diffie-Hellman key-exchange
- Self-forming, self-healing
- HWMP routing
- Scalable number of nodes and clients

Access Point (optional)

- Handover
- Several SSIDs possible
 - ↳ Mobile Controlled Handover (MCHO)
- Fast Transission (IEEE802.11r)

Mobile Uplink (optional)

- EDGE, HSPA+, UMTS, LTE
- Network Bands:
 - ↳ LTE (FDD): B1, B2, B3, B4, B5, B7, B8, B20
 - ↳ DC-HSPA+ / HSPA+ / HSPA / UMTS: B1, B2, B5, B8
 - ↳ EDGE / GPRS / GSM: 850 / 900 / 1800 / 1900 MHz
- Speed / Bandwidth:
 - ↳ DC-HSPA+ : Downlink: 42 Mbps, Uplink: 5.76 Mbps
 - ↳ LTE FDD: Downlink: 150 Mbps, Uplink: 50 Mbps @Bandwidth 20M
- Dual SIM
 - ↳ 2x Mini-SIM
- Connector: 1x SMA

LAN/WAN Interfaces

- 2x 10/100/1000BaseT
 - ↳ IEEE 802.3
 - ↳ Auto-MDIX
 - ↳ Auto-Negotiation
- IEEE 802.1Q (VLAN)
- MAC loopback
- 9k jumbos supported
- Connector: RJ45

Satellite Navigation GNSS (optional)

- GPS, GALILEO and/or GLONASS
- -166 dBm Navigation

sensitivity

- TCXO based
- AssistNow Online
- AssistNow Offline (35 days)
- AssistNow Autonomous (6 days)
- Up to 18 Hz Navigation Rate
- Active CW jamming detection
- Connector: 1x SMA

Other HW Interfaces

- 3x USB2.0 (host)
- 1x Serial
 - ↳ UART; RS-232
 - ↳ D-SUB9, male
- 1x Voice
 - ↳ MIC; Line OUT
- 1x Video
 - ↳ DVI-I (dual link)
- 4x GPIO (2x In/2x Out)
 - ↳ Relay 12V; 100mA

Security

- Encryption of all wireless traffic
- Hidden SSID
- IP Firewall @WAN-ports
- Access control on client ports
 - ↳ IEEE 802.1X port authentication
 - ↳ RADIUS support
 - ↳ PEAP (Cisco) support
- MAC address filters
- Login to device always secured
 - ↳ SSH, https

System Management

- https
- ssh
- SNMPv2/3

Build-in Servers and Clients

- DHCP server / client
- DNS

Technical Specifications (contd)

Power

- Power-Supply: 9-36VDC
 - ↳ ext. power supply (AC) available
- Power demand: <20W
 - ↳ peak power demand up to 60W
- Fanless design

Physical

- Weight: 1500g
- Dim: 210x190x50mm

Environment

- Operation: -20 .. +70°C
- Vibration/Shock: MIL-STD810F
- IP42 protection

axMesh Graph

The axMesh Graph is a graphical tool to show the mesh, its stations and the wireless connections between them. All discovered MRX stations are shown in the graph plus the active links between them. Different colours and line widths show the attenuation and data throughput in between. This makes it very easy to understand the mesh and watch its operation.

Area sensitive tooltips can be shown to get more details about each station. If this is not sufficient, the symbol of the station gives direct access to log into the single device to get full access.

The ax Mesh Graph is based on HTMLS connection and a standard web-browser is sufficient to use this mighty tool.

In the example below four MRX stations are discovered and all possible links are used. the quality of the links is quite different and the so is the throughput.

