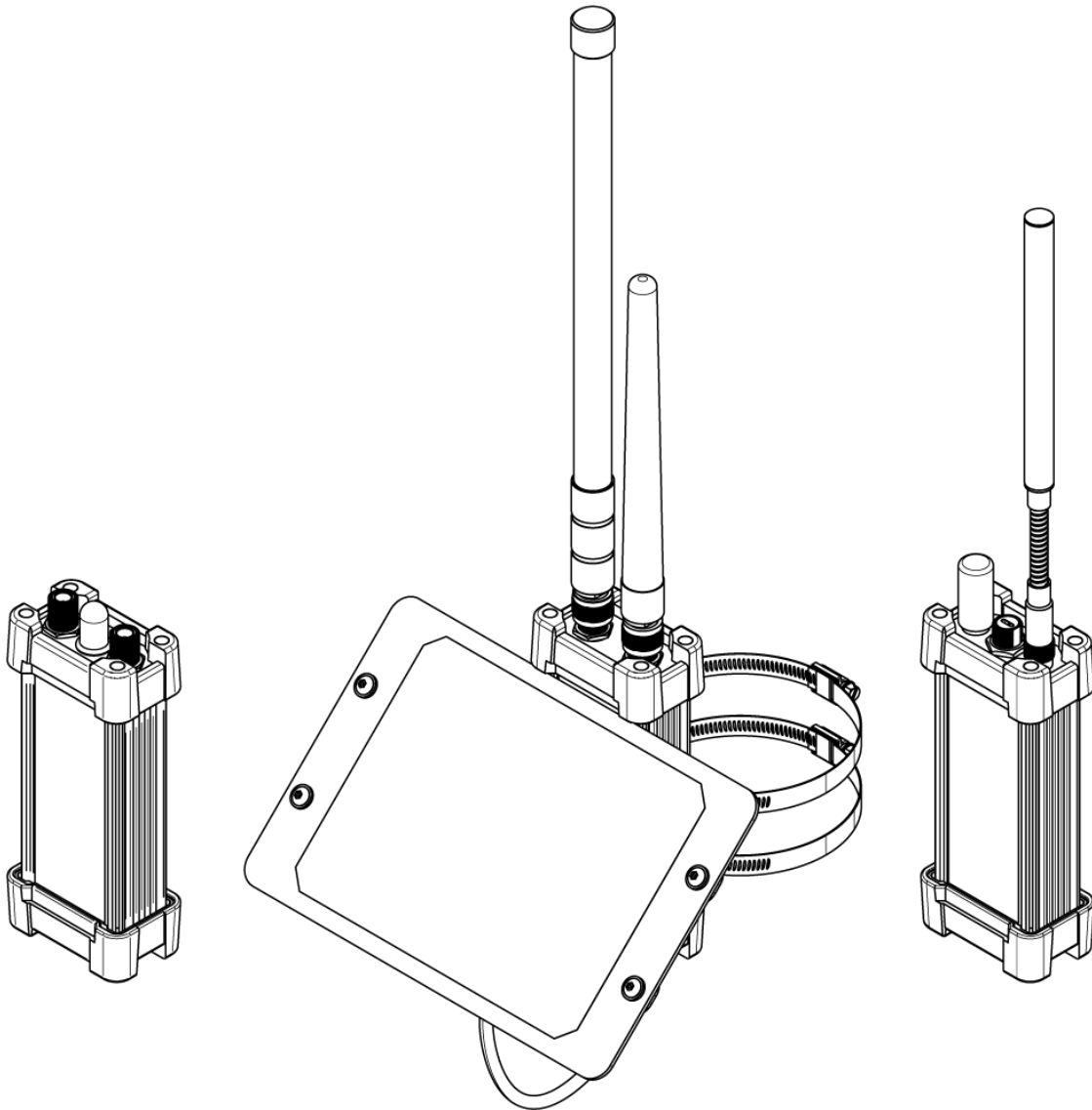# -AT LABS-

RM-1

MANET RADIO DEVICE FAMILY
SPECIFICATION DOCUMENT

Revision: -
Date: 05 August 2024

SUMMARY

The RM-1 family of devices provides ad-hoc mesh data networking capabilities for austere environments. Designed specifically for the needs of first responders, remote/austere workers, force protection entities, and utilities workers, the RM-1 devices deliver robust data connectivity options with highly flexible configurations.

Each of the RM-1 variants is based on a common rugged housing, battery system, and base radio support options. The all-aluminum housings of the RM-1 radios ensure extreme protection of the internal components in the most austere of environments.

A choice of base radio allows the RM-1 to function as either an extreme-range low-bandwidth modem for data and text communications or as a long-range sub-GHz Wi-Fi modem capable of supporting data, voice, and video.

| QUICK SPECS	
Case Material	Aluminum (extruded body, cast end caps), Silicone
Base Radio	433/868/915mhz LoRa OR 915mhz Halow
Connectivity	BLE, USB-C, optional LAN/POE
Battery	1S3P 18650 Pack – 3.7V / 10,000mAH
Ingress Protection	IP67

ROLES

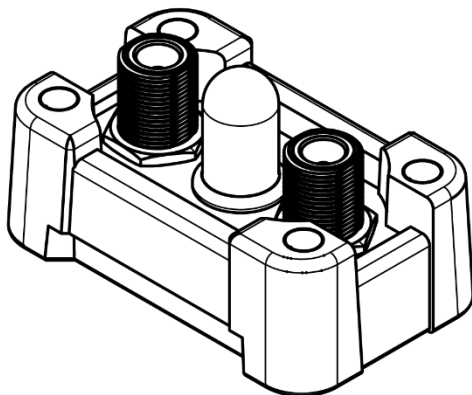The RM-1 series of devices are broken into three primary device roles:

- **Infrastructure** – Used as repeater and router nodes. Includes stainless steel brackets for solar panel installation and mounting to poles/trees/towers. Can also support LAN/POE for remote management options when combined with network infrastructure. Note: Devices ordered as infrastructure nodes will have additional machined holes in the housing to support the solar and mounting brackets.
- **Mobile** – Mounted to vehicles and equipment to track those assets and provide mesh resiliency. Optional 12v converter circuitry to tie to vehicle ignition system available.
- **Portable** – Mounted to belts, plate carriers, web gear, or backpacks/rucksacks and connected to personnel EUDs as mesh endpoints. Includes weatherproof USB-C bulkhead with matching thread-on cable.

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CONFIGURATIONS

The housing system of the RM-1 family of MANET radios allows for a high degree of flexibility in their general configuration. Each device, regardless of role, has six (6) potential locations for the various power, RF, control, and data IOs on the radio. Each endcap of the device has three (3) location zones which can accommodate these configuration options.
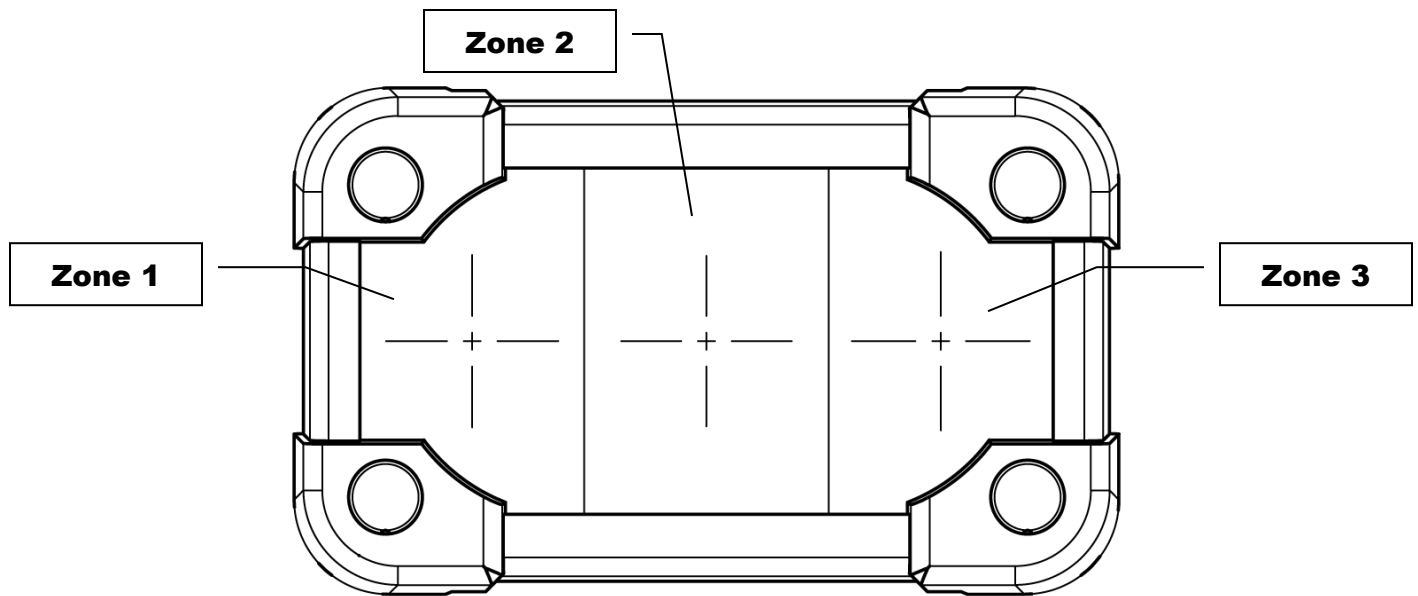
Each location zone on the end cap can accommodate one of the connectivity options listed:

- Primary Antenna
- BLE Antenna
- GPS Antenna
- USB-C Bulkhead
- External Power (e.g., solar)
- Vent
- User Button
- Charging Pad (BOTTOM ONLY)
- RJ45 Bulkhead
- General IO Connector Bulkhead (LEMO or similar)

Example configuration with two (2) N-Type bulkheads and a BLE radome antenna.

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BASE RADIO OPTIONS - BB

Designation	Base Radio	Protocol
[AA]	Rak WisBlock 915MHz	Meshtastic / Reticulum
[AB]	Rak WisBlock 868MHz	Meshtastic / Reticulum
[AC]	Rak WisBlock 433MHz	Meshtastic / Reticulum
[BB]	Teledatics TD-XPAH 915Mhz	Halow Sub-GHz Wi-Fi

ANTENNA OPTIONS

BASE RADIO (required)	
Rak WisBlock (any band)	1x Primary Antenna 1x BLE Antenna
Teledatics TD-XPAH	1x Primary Antenna
GPS (optional)	
uBlox ZOE-M8Q	1x GPS Antenna

PRIMARY ANTENNA OPTIONS

Designation	N-Type	Designation	SMA
[N0]	-BLANK- (customer supplied antenna)	[S0]	-BLANK- (customer supplied antenna)
[N1]	5 dBi omni		
[N2]	4 dBi gooseneck		

BLUETOOTH ANTENNA OPTIONS

Designation	N-Type	Designation	RPSMA
[N0]	-BLANK- (customer supplied antenna)	[R0]	-BLANK- (customer supplied antenna)
[N3]	4 dBi omni		

Designation	Radome	Designation	PCB
[R1]	2.7 dBi omni	[B1]	3.1 dBi trace

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GPS ANTENNA OPTIONS

Designation	N-Type	Designation	SMA
[N0]	-BLANK- (customer supplied antenna)	[G0]	-BLANK- (customer supplied antenna)
		[G1]	-2.5 dBi active helical

POWER AND I/O OPTIONS

Designation	Item	Designation	Item
[P1]	Solar power input	[C1]	RJ45 (non-POE)
[P2]	12v power input	[C2]	6 pin GPIO**
[P3]	POE input	[C3]	USB-C bulkhead
[P4]	Switch*	[C4]	Vent
[P5]	Charging pad***	[C5]	User button**

Required for portable and infrastructure roles. Recommended for all roles.
*** Requires additional configuration and setup information. Contact AT Labs for additional information.*
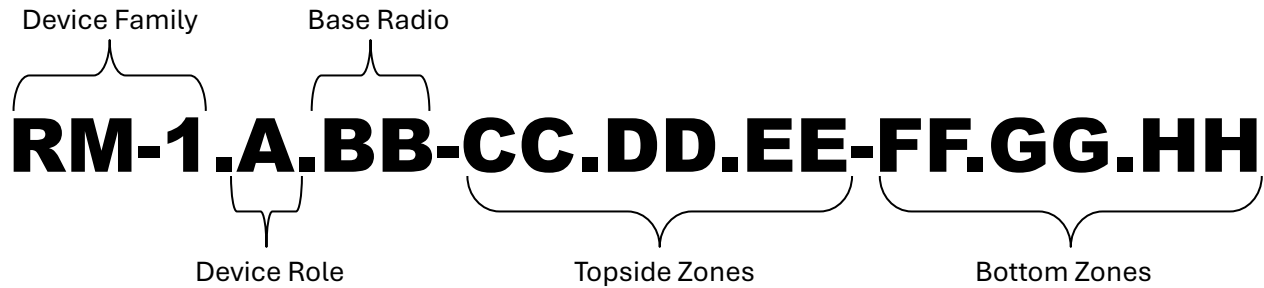**** Bottom endcap only. Required for portable role. NOT recommended for other roles.*

ROLE OPTIONS

Designation	Role	Defining Feature
[I]	Infrastructure	Solar Panel / Mounting Bracket
[M]	Mobile	12V Input
[P]	Portable	USB-C / Drop-in Charging

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MODEL NUMBER CONVENTION

The RM-1 family of devices is highly configurable for their intended mission use. Each device has a model number which corresponds to the options selected during the manufacturing and assembly process. Any zone which is to remain unpopulated can be represented with a [00] as the designation.

Device Family · Base Radio

RM-1.A.BB-CC.DD.EE-FF.GG.HH

Device Role · Topside Zones · Bottom Zones

Model Number Segment	Description	Example
A	Role	[I] – Infrastructure
BB	Base Radio	[AA] – WisBlock 915MHz
CC	Topside Zone 1	[N1] – N type 5 dBi
DD	Topside Zone 2	[00] – EMPTY
EE	Topside Zone 3	[R1] – BLE radome
FF	Bottom Zone 1	[P2] – Solar Power Input
GG	Bottom Zone 2	[P4] - Switch
HH	Bottom Zone 3	[C4] - Vent

EXAMPLE MODEL NUMBERS

[RM-1.I.AA-N1.00.R1-P2.P4.C4]
- Infrastructure Role
- WisBlock 915Mhz
- Topside
  - N-Type 5 dBi Omni
  - EMPTY
  - BLE Radome
- Bottom
  - Solar Power Input
  - Switch
  - Vent

[RM-1.P.AA-N2.C3.G1-P5.B1.P4]
- Portable Role
- WisBlock 915Mhz
- Topside
  - N-Type 4 dBi gooseneck
  - USB-C bulkhead
  - Helical GPS
- Bottom
  - Charging Pad
  - BLE PCB antenna (blank exterior)
  - Switch

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BASE RADIO PERFORMANCE DESCRIPTIONS

Rak WisBlock Systems

- Extreme range capable (50 miles+, conditions permitting)
- Low bandwidth – data/text only
- Low energy consumption (<50mA continuous)
- Transmit power: Up to 1W
- Recommended protocols: Meshtastic or Reticulum

Teledatics TD-XPAH Systems

- Long range Wi-Fi (up to 3 miles, conditions permitting)
- High bandwidth – Capable of real-time video
- Moderate energy consumption (<250mA continuous)
- Transmit power: Up to 1W
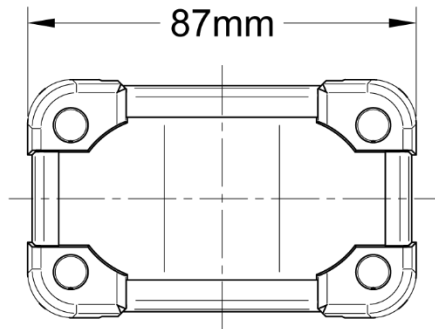
BASE RADIO PROTOCOL DESCRIPTIONS

Meshtastic

Meshtastic is an open-source software stack aimed at providing text and data transmissions using low cost/power LoRa hardware. The Meshtastic system provides mesh administration, message routing, encryption, and remote device management functionality. Meshtastic provides iOS, Android, and PC applications which offer text messaging as well as telemetry transmission. In addition to the built-in text messaging, Meshtastic also works in conjunction with TAK to provide a COT transmission mechanism.
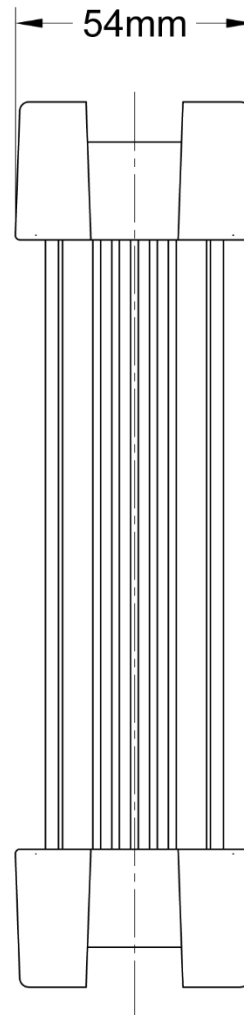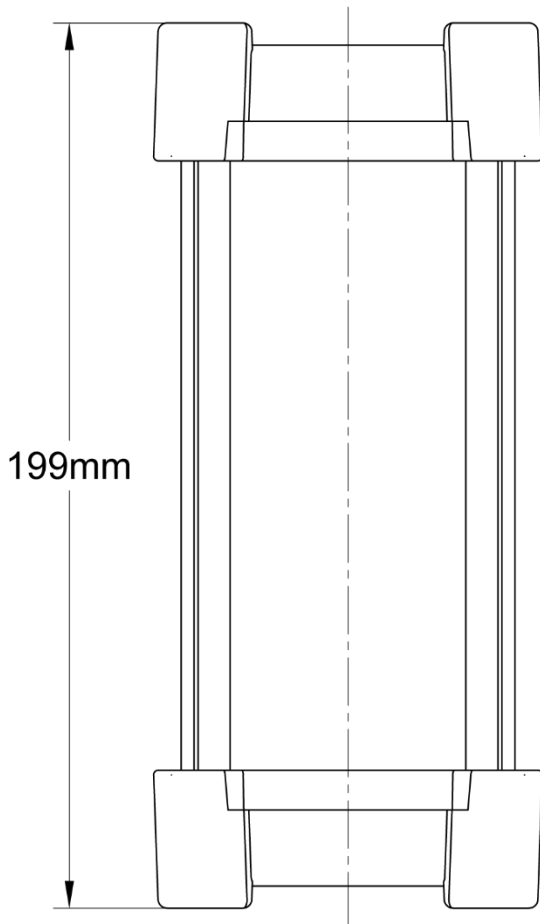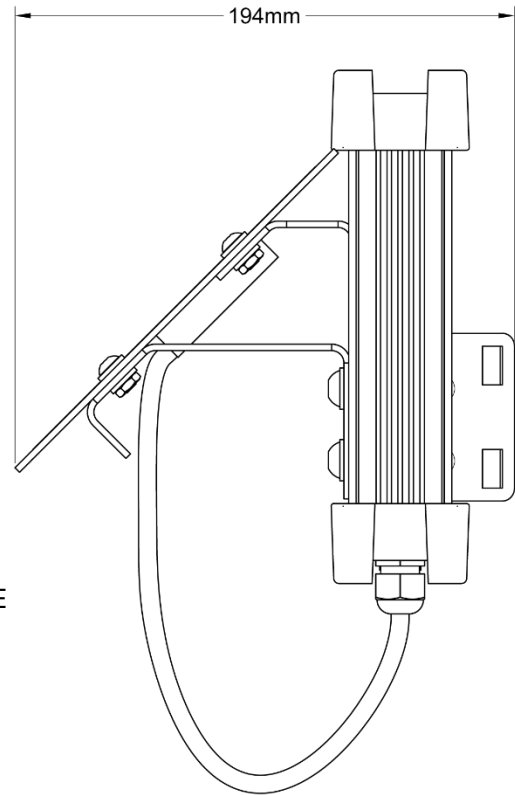
Reticulum

Reticulum is an open-source software stack aimed at the creation of robust encrypted networks. Reticulum runs on a variety of hardware including embedded systems, mobile phones, and desktop computers and there are several messaging systems capable of leveraging the Reticulum created networks for communication. While Reticulum can work with any bandwidth, the embedded forms are constrained by the hardware involved.

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MECHANICAL DETAILS

NOT TO SCALE

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270mm

194mm
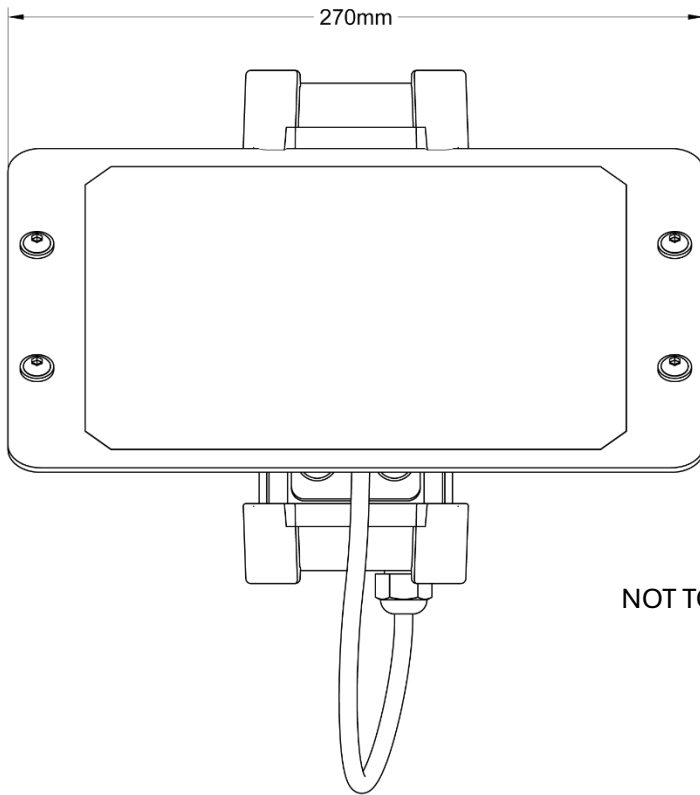
NOT TO SCALE

MATERIALS

Item	Material	Color
Housing Bumpers	Silicone	Black
Housing End Caps	Diecast Aluminum	Black
Housing Body	Extruded Aluminum	Black
Solar Panel Mounting Brackets	Stainless Steel	Natural
Pole Mounting Bracket	Stainless Steel	Natural

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PROTECTION DETAILS

Mechanical Ingress

- Rubber seals on housing end caps
- Epoxy potting on end cap penetrations (cast fill)
- Epoxy potting on main body penetrations (brush on)
- Flexible conduit on power inputs
- Cable gland on power inputs
- Bulkhead connectors for all other IOs
- Optional hydrophobic vent
- All PCB connections mechanically secured
- Optional open cell foam fill for vehicle roles

Electrical Isolation

- Acrylic potting on all PCBs
- PCB securely mounted to non-conductive sled
- Battery pack PVC wrapped

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Document History

Revision	Date	Description
-	05AUG24	Initial Release

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