Multiband OEM Mesh Rider Radio – 4400~5925 MHz (C-Band)

(PRELIMINARY)

Overview

The Multiband OEM RM-5200-92 Mesh Rider Radio operates in the 4400 - 5925 MHz frequency range allowing it to be used in the NATO, 4.9-GHz public safety, UAS and C-Band US Government bands. Each device is a node on a long-range Mesh Rider network and uses Wi-Fi to bridge Tablets and Smartphones onto the network. The Multiband OEM Mesh Rider Radio is used to collaborate by streaming voice, video, and data on a fast, low latency, and encrypted network.

The Multiband OEM RM-5200-92 Mesh Rider Radio was designed to be embedded in an external chassis and uses small rugged MMCX (for RF) and JST-GH locking connectors.

As with all Mesh Rider Radio form factors, the Multiband OEM Mesh Rider Radio is available in many frequency bands between 900 MHz and 6 GHz freq range. This flexibility allows customers to use their industry specific frequency bands for deploying private wireless networks.

The Mesh Rider Radio employs Doodle Labs' patented Mesh Rider® technology with state-of-the-art RF and networking capabilities that enable communication further, faster, and more reliably than any comparable solution on the market. For example, optimized video streaming carries crystal clear 4K video while simultaneously carrying Ultra Reliable Low Latency (URLLC) command and control (C&C) data for machines.

For more information, please visit: https://doodlelabs.com/smart-radio/

Frequency Bands

Band	Frequency Range
4600-MHz	4400-MHz to 4800 MHz Nato C-Band
4870-MHz	4800-MHz to 4940 MHz US Govt Band
4965-MHz	4940-MHz to 4990 MHz FCC Part 90Y, Public Safety Band
5060-MHz	5030-MHz to 5091 MHz UAS band (planned)
5230-MHz	5180-MHz to 5280 MHz US Govt band
5660-MHz	5390-MHz to 5925 MHz US Govt band
5785-MHz	5725-MHz to 5825 MHz US Govt band
5790-MHz	5650-MHz to 5925 MHz US Govt band
5500-MHz	5150-MHz to 5895 MHz UNII Bands 1 - 4

Key Features - Mesh Rider Radio Platform

PERFORMANCE RF

- Long range (field tested >100km) and high throughput (up to 100 Mbps) Mesh Rider waveform
- Convolutional coding, Forward Error Correction (FEC), ACK-retransmits, Maximal Ratio Combining, Spatial Multiplexing, and

- Interference resistant COFDM for robust link quality in difficult RF environments
- Exceptional Multipath and NrLOS MIMO performance
- Adaptive radio modulations from BPSK up to 64QAM, with fast per packet optimization to maximize link performance in dynamic environments
- Software defined channel bandwidth for efficient re-use of spectrum

Space Time Block Coding for robust data transmission over noisy channel/spectrum
- Single channel, Time Division Duplexing (TDD) for bi-directional traffic
- Resistant to high-power jamming signals
- ATPC for widely dispersed mesh network
- Built-in Spectrum Scanner to help mitigate interference issues

PERFORMANCE NETWORKING

- Ultra-Reliable Low Latency Channel (URLLC) for Command and Control
- Optimized video streaming channel for Unicast and Multicast transport
- Self-healing/self-forming multi-frequency mobile mesh for highly reliable network with redundancy
- FIPS Certified AES 256- and 128-bit encryption
- End-to-end IP architecture with Ad Hoc, WDS transparent bridge, Client, AP, and Internet Gateway operating modes
- Embedded network management APIs

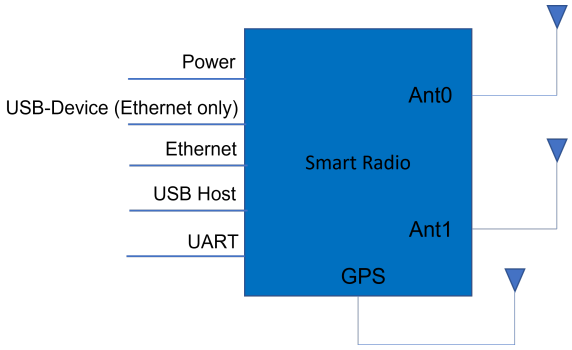
ADDITIONAL FEATURES

- Very small size, weight, and power for mobile applications
- Ethernet, USB, and UART interfaces to allow easy integration into different system architectures
- Leverage the benefits of the most extensible OpenWrt ecosystem and install 3rd party IoT applications
- Rugged, vibration resistant construction to meet MIL-specs
- MIL-spec temp range (-40C to +85C)
- High quality, manufactured in ISO 9001 and ISO 14001 certified facilities
- COTS – Commercial off the Shelf
- Extended lifespan and availability

System Integration

The Mesh Rider Radio has been designed to be plug and play. Only USB and a power supply are required for integration.

Visit Doodle Labs Technical Library for extensive design-in documents.



Technical Specifications (4400 - 5925 MHz)

Model Category	XTreme
ORDERING INFORMATION	
Radio Configuration	2x2 MIMO
Model #	RM-5200-92O3 (w/ GPS and HID board)
Antenna (Optional)	ANT-5200-3-O
Evaluation Kit (Optional)	EK-5200-92O: 2x Multi-band Antenna, Breakout board, Cables
Design-In Documentation	Doodle Labs Technical Library
PERFORMANCE OVERVIEW	
Data Throughput at 10-meter range with Attached 3 dBi Antennas (Indicative)	80 Mbps (20 MHz Channel) 40 Mbps (10 MHz Channel) 20 Mbps (5 MHz Channel) 12 Mbps (3 MHz Channel)
Over the Air Data Encryption	128-bit AES (Full throughput) 256-bit AES (12 Mbps max throughput)
FIPS Certification (Optional)	FIPS 140-3
Operating Modes	WiFi Radio: AP, Client Mesh, WDS AP, WDS Client Bridged or Internet Gateway with NAT
Command & Control channel	Ultra-Reliable Low Latency Channel (URLLC). Latency 1.5-10 ms
Video Channel	Optimized video streaming with Unicast and Multicast transmission

RF SPECIFICATIONS	
Protocol Compatibility	Fully compatible with Doodle Labs Mesh Rider Waveform
Operating Bands (Software Selectable)	4400 - 4800 MHz 4800 - 4940 MHz 4940 - 4990 MHz 5030 - 5091 MHz 5180 - 5280 MHz 5390 - 5925 MHz 5650 - 5925 MHz 5725 - 5825 MHz 5150 - 5895 MHz (ISM)
Advanced Band Filters	Dedicated filters for high interference immunity
Max RF Power at SMA port (Software control) Each radio individually calibrated	1.0W (30 dBm) @ MCS 0,8 0.8W (29 dBm) @ MCS 3,11 0.5W (27 dBm) @ MCS 5,13 250mW (24 dBm) @MCS 7,15
Channel Sizes (Software Selectable)	3, 5, 10, 20 MHz
Radio Data Rate	Auto adapting Modulation Coding Scheme (MCS0-15)
Antenna Signal Strength	-30 to -90 dBm (Recommended), Absolute Maximum= +12 dBm
RF Power Control	In 1 dBm steps, Tolerance ±1 dBm
Automatic Transmit Power Control (ATPC)	Intelligently adjusts the transmit power for very close range operation
Integrated Antenna Port Protection	Able to withstand open port, >10 KV (contact) and >15KV (open air discharge) as per IEC-61000-4-2
Wireless Error Correction	FEC, ARQ
Receive Noise Figure	+4 dB

Receive Adjacent Channel Rejection (ACRR)	34 dB @ MCS0 for 20 MHz channel (Typ)
Transmitter Adjacent Channel Leakage Ratio (ACLR)	< 28 dBr (Fc ± ChBW)
Transmitter Spurious Emission Suppression	< 40 dBc
Frequency Accuracy	±10 ppm max over life
WI-FI HOTSPOT SPECIFICATIONS	
WiFi Standard	IEEE 802.11n, 1x1 SISO
Frequency Range	2400 - 2482 MHz
RF Power Output (Typ)	50 mW (17 dBm) EIRP
Channel Size	20 MHz
Radio Data Rate	Auto adapting Modulation Coding Scheme (MCS 0-7)
Antenna Signal Strength	-25 to -85 dBm (Recommended), Absolute Maximum= +12 dBm
RF Power Control	In 1 dBm steps, Tolerance ±1 dBm
Wireless Error Correction	FEC, ARQ
NETWORKING SPECIFICATIONS	
Mesh Router	Self-Forming/Self-Healing, Peer to Peer
Custom Software Package Manager	Image Builder, OPKG, ipk
Radio Management	Web GUI (HTTPs), SSH and JSON-RPC
Access control	Password, MAC, IP, Port filtering

Supported Protocols	IPv6, QoS, DNS, HTTPS, IP, ICMP, NTP, DHCP
Software Upgrade	Over the air software upgrade supported
HARDWARE SPECIFICATIONS	
Power Input	6V - 24V, USB-PD Compliant
DC Power Consumption	4400 - 4800 MHz: 14W Peak Tx power @ max range, 5W Rx mode, 2W Standby Mode 4800 - 5895 MHz: 12W Peak Tx power @ max range, 5W Rx mode, 2W Standby Mode
Dimensions	57mm * 86mm * 13mm 86 grams
Mesh Rider Antenna Ports	2x MMCX-Female Connector
Host Interface	USB-Device Interface (Ethernet only), Ethernet (100 Base-T), 1x UART (3.3V), USB-Host
Temperature range (Operating)	Industrial: -30°C to +70°C ** System's thermal design should ensure that the radio's case temperature is maintained within these specifications.*
Temperature range (Non-Operating)	-40°C to +100°C
Ingress Protection	TBD
Relative Humidity	5% to 95% noncondensing
Shock and Vibration Resistance	Compliant to MIL-STD-810H for high shock and vibration
Reliability	Extreme Reliability, IPC Class 2 standard with Class 3 options

WiFi Hotspot Antennas	1x MMCX-Female Connector
GPS Features	Simultaneous multiple constellations (GPS/SBAS/Galileo/Glonass/BeiDou/QZSS) Receive Sensitivity -167 dBm, Max. Velocity 500m/sec ± 0.05m/S, Heading ± 0.3 degrees, Position Accuracy 2m
Integrated GPS Module with LNA	u-blox MAX-M8 series Concurrent GNSS Module (u-blox.com)
GPS Antenna	1x MMCX-Female Connector
Integrated CPU	MIPS 24Kc, 540 MHz, 32MB Flash, 64MB DDR2 RAM
ESD Protection	IEC 61000-4-2 test criteria, Level 3 (±6KV) for Contact Discharge and Level 4 (±15KV) for Air Discharge
MTBF	>235k hours (25 years)
Life Cycle Planning	Extended lifespan with 7 years guaranteed availability
REGULATORY INFORMATION	
J/F-12 Certification	N.A.
FCC ID	2AG87RM-5500 (in progress)
Industry Canada (IC)	21411-RM5500 (in progress)
CE	Fully Certified (in progress)
Japan (MIC)	N.A.
Regulatory Requirements	Designed and verified to meet various regulatory requirements. Formal testing and approval are required for the Integrator's antenna type. The Integrator is responsible for obtaining all regulatory approvals in target markets for the finished product.
RoHS/WEEE Compliance	Yes. 100% Recyclable/Biodegradable packaging

EXPORT INFORMATION	
ECCN Code	5A992
HS Code	85256010

ADDITIONAL RF SPECIFICATIONS				
MCS Rate	**Modulation**	**Combined Output Power (dBm)**	**Sensitivity (dBm)**	**UDP Throughput (Mbps)**
0	BPSK (1/2)	30	-93	5.4
1	QPSK (1/2)	29	-91	10.62
2	QPSK (3/4)	29	-89	15.66
3	16-QAM (1/2)	29	-87	20.52
4	16-QAM (3/4)	28	-83	29.88
5	64-QAM (2/3)	27	-79	38.88
6	64-QAM (3/4)	26	-77	43.11
7	64-QAM (5/6)	24	-75	47.34
8	BPSK (1/2)	30	-90	10.53
9	QPSK (1/2)	29	-88	20.43
10	QPSK (3/4)	29	-86	29.7
11	16-QAM (1/2)	29	-84	38.52
12	16-QAM (3/4)	28	-80	54.72
13	64-QAM (2/3)	27	-76	69.3
14	64-QAM (3/4)	26	-74	76.14
15	64-QAM (5/6)	24	-72	82.8

Note 1: Performance based on 20-MHz bandwidth
Note 2: Sensitivity and throughput are approximately proportional to bandwidth.

FCC Statement

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions (1)this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation

IC Statement

This device complies with Industry Canada’s licence-exempt RSSs. Operation is subject to the following two conditions:

1. This device may not cause interference; and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

The term "IC: " before the certification/registration number only signifies that the Industry Canada technical specifications were met. This product meets the applicable Industry Canada technical specifications.

Le présent appareil est conforme aux CNR d'Industrie Canada applicable aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter

tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement

CE Statement

This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

CAUTION: To comply with the Europe CE requirement, this device must be installed with CE certified computer equipment which meet with Class A limits. Be aware that outdoor installations require special attention and will only be handled by trained and qualified installation personnel.

All cables used to connect this device must be shielded and grounded. Operation with non-certified computers or incorrect cables may result in interference to other devices or undesired effects to the product. Particular attention has to be given allowed operational frequencies.