

Doodle Labs Smart Radio – RM-915

High-performance embedded MIMO radio/mesh router in a tiny form factor

Smart Radio Overview

The Smart Radios are an advanced 2×2 MIMO mesh system designed for easy plug & play integration. The tiny module carries all the bi-directional, high-speed Broadband communications (Control, Telemetry and Payload) into a single RF channel. Because the design is very low SWaP (Space, Weight and Power), the Smart Radios are very popular for mobile IIoT (Industrial Internet of Things) applications like drones, autonomous vehicles and mobile robotic applications in different industry verticals.



The Smart Radios employ Doodle Labs' [BII](#)® technology (Broadband for Industrial IoT) with state-of-the-art RF and networking capabilities to enable communication further, faster, and more reliably than ever before. The Ultra Reliable Low Latency Channel (URLLC) transports important C&C data over the wireless while optimized video streaming channel carries crystal clear 4K video.

Smart Radios are available in many frequency bands between 100 MHz and 4 GHz, allowing customers to switch the operating bands by simply swapping the radio module.

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

Datasheet

Key Features of the Smart Radio Platform

PERFORMANCE RF

- Long range and high throughput
- Interference resistant COFDM/MIMO for improved link quality in difficult RF environments;
- Exceptional Multipath and NrLOS performance
- Adaptive radio modulations from BPSK up to 64QAM, with continuous per packet optimization to maximize link performance in dynamic environments
- Software defined channel size for efficient re-use of spectrum
- Software defined operating frequency for global applications
- Convolutional coding, Forward Error Correction (FEC), ACK-retransmits, Maximal Ratio Combining, Spatial Multiplexing, and Space Time Block Coding for robust data transmission over noisy spectrum
- Time Division Duplexing (TDD) for bi-directional traffic

PERFORMANCE NETWORKING

- Ultra-Reliable Low Latency Channel (URLLC) for Command and Control
- Optimized video streaming channel on the same radio link
- Self-healing/self-forming mobile mesh for highly reliable network with redundancy
- End-to-end IP architecture for Unicast and Multicast traffic
- Up to 256-bit AES encryption for over the air data
- Leverage the benefits of the most advanced and most extensible OpenWrt ecosystem
- Fast hand-off for mobile applications
- Embedded network management APIs

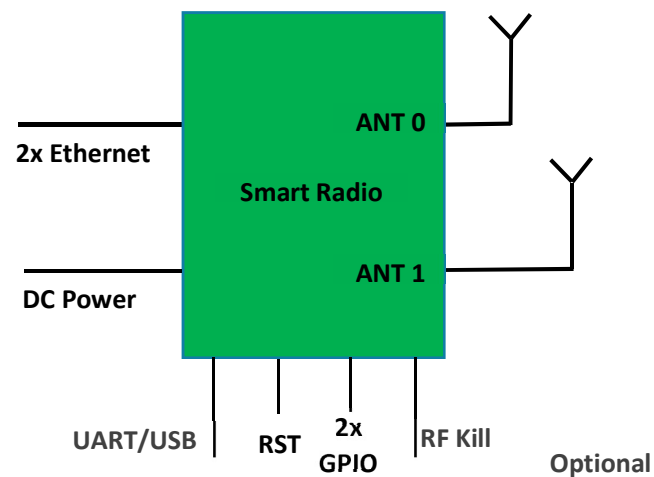
ADDITIONAL FEATURES

- Very small size, weight, and power (SWaP) for mobile applications
- Ethernet and UART interfaces to allow easy integration into different system architectures
- Rugged, vibration resistant construction, Industrial temperature range (-40C to +85C)
- COTS – Commercial off the Shelf
- Extended lifespan and availability

System Integration

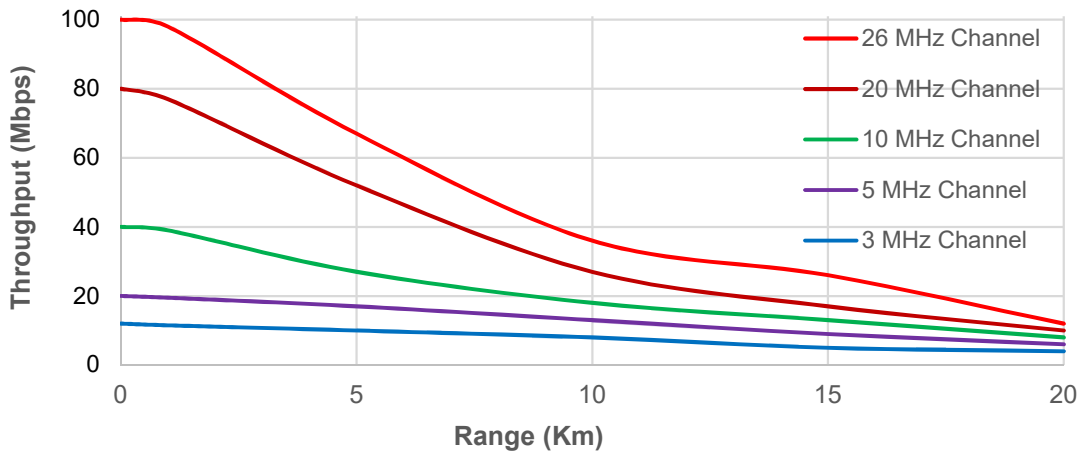
The Smart Radio is an embedded module. It has been designed to be nearly plug and play. Only Ethernet, power supply (5.5~42V), and antenna connections are required for integration.

Doodle Labs provides extensive Design-In documents upon request.
<https://doodlelabs.com/contact-us/>



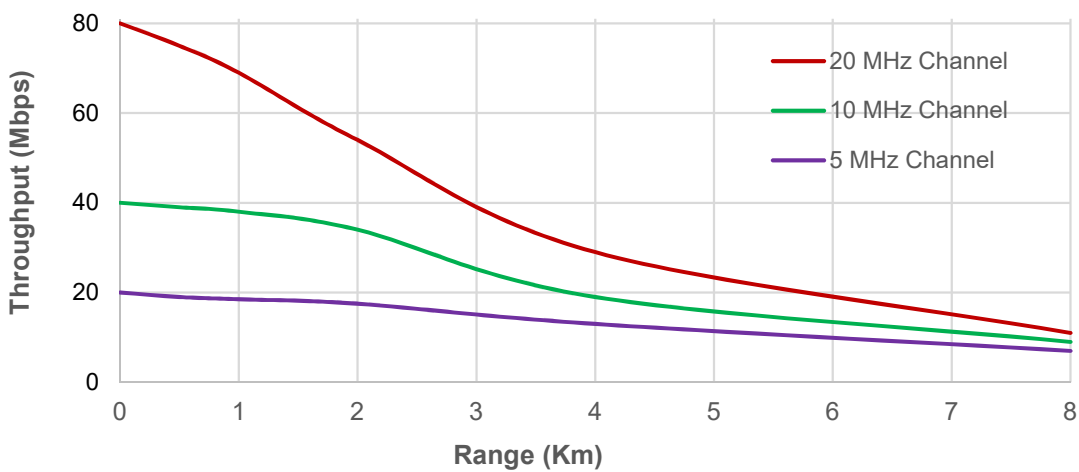
Data Sheet

Xtreme Link Performance (Indicative)



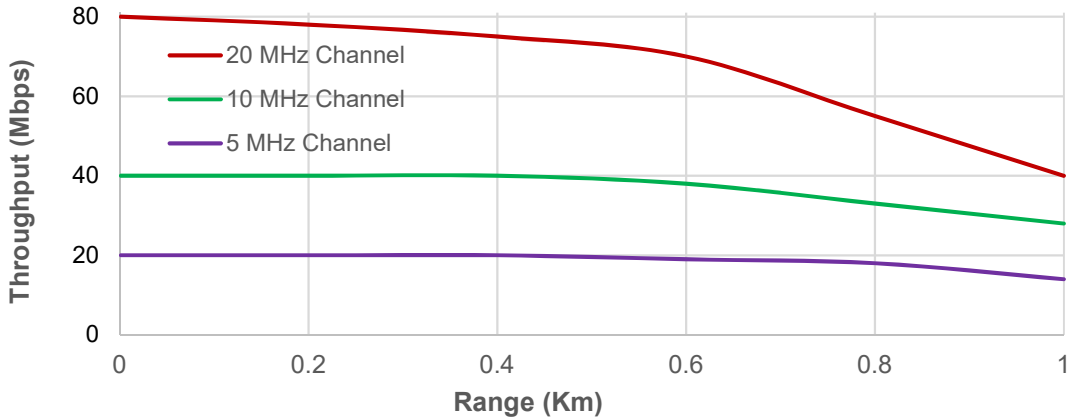
Link Configuration:
 9 dBi antennas on both ends of the link, Cross-polarized H and V antennas for maximum diversity.
 > 15 dBm fade margin to account for changing RF conditions.

Pro Link Performance (Indicative)



Link Configuration:
 6 dBi antennas on both ends of the link, Cross-polarized H and V antennas for maximum diversity.
 > 15 dBm fade margin to account for changing RF conditions.

Standard Link Performance (Indicative)



Link Configuration:
 3 dBi antennas on both ends of the link, Cross-polarized H and V antennas for maximum diversity.
 > 10 dBm fade margin to account for changing RF conditions.

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Technical Specifications (900 MHz Band)



| Model Category | Standard | Pro | Xtreme |
|--|--|---|--|
| ORDERING CODES | | | |
| Radio Configuration | 2x2 MIMO | | |
| With 2x Ethernet and UART interfaces | RM-915-2H-SS | RM-915-2H-PS | RM-915-2H-XS |
| Evaluation Kit | RM-915-2H-SS-EK | RM-915-2H-PS-EK | RM-915-2H-XS-EK |
| Design-In Support | Doodle Labs provides extensive Design-In documents upon request. https://doodlelabs.com/contact-us/ | | |
| Special Configurations | <ul style="list-style-type: none"> • Compact models (37x57x11 mm, 40 grams) with Single RF stream • USB and GPIO interfaces | | |
| PERFORMANCE OVERVIEW | | | |
| Max Operating Range (Indicative) | 1 Km | 8 Km | >20 Km |
| Max Data Throughput at 10-meter range (Indicative) | 80 Mbps (20 MHz Channel) 40 Mbps (10 MHz Channel) 20 Mbps (5 MHz Channel) | | 100 Mbps (26 MHz Channel) 12 Mbps (3 MHz Channel) |
| Interference Immunity | Standard | SAW filters on RF and ANT ports for strong out of band noise immunity | + Adjustable squelch for resistance against high-power jamming |
| Over the Air Data Encryption | 128-bit AES hardware data encryption @ full rate | | 256-bit AES software encryption (12 Mbps max throughput) |
| Operating Modes | Mesh, AP, Client and Transparent Bridge | | + Gateway |
| Command & Control channel | Advanced QoS | Ultra-Reliable Low Latency Channel (URLLC) | |
| Video Channel | Advanced QoS | Optimized video streaming channel | |

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| RF SPECIFICATIONS | | | |
|---|---|--|--|
| Frequency Range | 902-928 MHz Channel plans available for all countries in Americas, Australia, New Zealand, and China | | |
| Channel Sizes (Software Selectable) | 5, 10, 20 MHz | | 3, 5, 10, 20, 26 MHz |
| RF Power Output (Typ) Each radio individually calibrated | 0.1W (20 dBm) @ MCS 0,8 0.1W (20 dBm) @ MCS 3,11 0.1W (20 dBm) @ MCS 5, 13 0.1 mW (20 dBm) @ MCS 7, 15 | 0.5W (27 dBm) @ MCS 0,8 0.5W (27 dBm) @ MCS 3,11 0.4W (26 dBm) @ MCS 5,13 250mW (24 dBm) @ MCS 7,15 | 1W (30 dBm) @ MCS 0,8 0.8W (29 dBm) @ MCS 3,11 0.4W (26 dBm) @ MCS 5,13 250mW (24 dBm) @ MCS 7,15 |
| RF Power Control | In 1 dBm steps, Tolerance ± 1 dBm | | |
| Integrated Antenna Port Protection | NA | Able to withstand open port, >10 KV (contact) and >15KV (open air discharge) as per IEC-61000-4-2 | |
| Hardware RF Kill function for Airborne applications | NA | NA | Pin 4 of AUX connector |
| NETWORKING SPECIFICATIONS | | | |
| Mesh Router | Self-Forming/Self-Healing, Peer to Peer | | |
| Multicast | Standard Rate | High Rate | |
| Custom Software Package Manager | OPKG | | |
| Radio Management | LuCI Web Interface, and UCI command line interface | | |
| Access control | Password, MAC, IP, Port filtering | | |
| Network Security | VPN, IPSec, L2TP, GRE, STP | | |
| Supported Protocols | IPv6, QoS, DNS, HTTPS, IP, ICMP, NTP, DHCP, VLAN | | |

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| Software Upgrade | Over the air software upgrade supported | | |
| HARDWARE SPECIFICATIONS | | | |
| Operating Voltage | 5.5~42V DC | | |
| Dimensions | 65 x 57 x 11 mm, 60 grams | | |
| Antenna Connection | 2x MMCX-Female | | |
| Host Interface | 2x Ethernet (100 Base-T) and UART (3.3V FT234XD chipset) | | |
| Temperature range (Operating) | -10°C to +50°C | -40°C to +70°C | -40°C to +85°C |
| | System's thermal design should ensure that the radio's case temperature is maintained within these specifications. | | |
| Shock and Vibration Resistance | Standard | Compliant to MIL-STD-202G for high shock and vibration | |
| DC Power Consumption | <ul style="list-style-type: none"> • 8W @ Max RF power in UDP data Tx mode • 3.4W in data Rx mode • 1.2W in Sleep mode | <ul style="list-style-type: none"> • 8.5W @ Max RF power in UDP data Tx mode • 3.4W in data Rx mode • 1.2W in Sleep mode | <ul style="list-style-type: none"> • 9W @ Max RF power in UDP data Tx mode • 3.4W in data Rx mode • 1.2W in Sleep mode |
| Reliability | Standard | Extreme Reliability, IPC Class 2 standard with Class 3 options | |
| Integrated CPU | MIPS 24K, 540 MHz, 32MB Flash, 64MB DDR2 RAM | | |
| MTBF | >25 years | | |
| Humidity (Operating) | 0% – 95% (Non-condensing) | | |
| Life Cycle Planning | Standard | Extended lifespan with 3 years' guaranteed availability | Extended lifespan with 7 years' guaranteed availability |
| REGULATORY INFORMATION | | | |
| FCC ID | 2AG87RM-915-2H | | |
| Industry Canada (IC) | 21411-RM9152H | | |

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| 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 | |
| ADDITIONAL RF SPECIFICATIONS | | |
| Radio Data Rates (Dynamic Per Packet Link Auto Adaptation) | MCS15 = 64QAM (5/6) MCS14 = 64 QAM (3/4) MCS13 = 64 QAM (2/3) MCS12 = 16QAM (3/4) MCS11 = 16QAM (1/2) MCS10 = QPSK (3/4) MCS9 = QPSK (1/2) MCS8 = BPSK (1/2) MCS7 = 64QAM (5/6) MCS6 = 64 QAM (3/4) MCS5 = 64 QAM (2/3) MCS4 = 16QAM (3/4) MCS3 = 16QAM (1/2) MCS2 = QPSK (3/4) MCS1 = QPSK (1/2) MCS0 = BPSK (1/2) | |
| Wireless Protocol | TDD with Carrier Sense Multiple Access with Collision Avoidance | |
| Wireless Error Correction | FEC, ARQ | |
| Freq Accuracy | ±10 ppm Max over life | |
| Antenna Signal Strength | -25 to -85 dBm (Recommended), Absolute Maximum=+12 dBm | |
| Control for External Power Amp | NA | DC biased signal over RF port |
| Receiver LNA Gain | >10 dB | |
| Rx Sensitivity (3 MHz Channel BW) | NA | -100 dBm @ MCS 0 -97 dBm @ MCS 1 |

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| | | <p>-95 dBm @ MCS 2</p> <p>-92 dBm @ MCS 3</p> <p>-87 dBm @ MCS 4</p> <p>-85 dBm @ MCS 5</p> <p>-82 dBm @ MCS 6</p> <p>-79 dBm @ MCS 7</p> <p>-97 dBm @ MCS 8</p> <p>-83 dBm @ MCS 9</p> <p>-91 dBm @ MCS 10</p> <p>-88 dBm @ MCS 11</p> <p>-84 dBm @ MCS 12</p> <p>-80 dBm @ MCS 13</p> <p>-79 dBm @ MCS 14</p> <p>-78 dBm @ MCS 15</p> |
| Rx Sensitivity (5 MHz Channel BW) | | <p>-98 dBm @ MCS 0</p> <p>-95 dBm @ MCS 1</p> <p>-93 dBm @ MCS 2</p> <p>-90 dBm @ MCS 3</p> <p>-85 dBm @ MCS 4</p> <p>-83 dBm @ MCS 5</p> <p>-80 dBm @ MCS 6</p> <p>-77 dBm @ MCS 7</p> <p>-95 dBm @ MCS 8</p> <p>-91 dBm @ MCS 9</p> <p>-89 dBm @ MCS 10</p> <p>-85 dBm @ MCS 11</p> <p>-82 dBm @ MCS 12</p> <p>-78 dBm @ MCS 13</p> <p>-77 dBm @ MCS 14</p> <p>-76 dBm @ MCS 15</p> |
| Rx Sensitivity (10 MHz Channel BW) | | -96 dBm @ MCS 0 |

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|---|---|
| | <p>-93 dBm @ MCS 1</p> <p>-91 dBm @ MCS 2</p> <p>-88 dBm @ MCS 3</p> <p>-83 dBm @ MCS 4</p> <p>-81 dBm @ MCS 5</p> <p>-78 dBm @ MCS 6</p> <p>-75 dBm @ MCS 7</p> <p>-93 dBm @ MCS 8</p> <p>-89 dBm @ MCS 9</p> <p>-87 dBm @ MCS 10</p> <p>-84 dBm @ MCS 11</p> <p>-80 dBm @ MCS 12</p> <p>-76 dBm @ MCS 13</p> <p>-75 dBm @ MCS 14</p> <p>-74 dBm @ MCS 15</p> |
| <p>Rx Sensitivity (20 MHz Channel BW)</p> | <p>-93 dBm @ MCS 0</p> <p>-90 dBm @ MCS 1</p> <p>-88 dBm @ MCS 2</p> <p>-85 dBm @ MCS 3</p> <p>-80 dBm @ MCS 4</p> <p>-78 dBm @ MCS 5</p> <p>-75 dBm @ MCS 6</p> <p>-72 dBm @ MCS 7</p> <p>-90 dBm @ MCS 8</p> <p>-86 dBm @ MCS 9</p> <p>-84 dBm @ MCS 10</p> <p>-81 dBm @ MCS 11</p> <p>-77 dBm @ MCS 12</p> <p>-73 dBm @ MCS 13</p> <p>-72 dBm @ MCS 14</p> <p>-71 dBm @ MCS 15</p> |

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|---|---|--|
| Rx Sensitivity (26 MHz Channel BW) | NA | -92 dBm @ MCS 0 -89 dBm @ MCS 1 -87 dBm @ MCS 2 -84 dBm @ MCS 3 -79 dBm @ MCS 4 -77 dBm @ MCS 5 -74 dBm @ MCS 6 -71 dBm @ MCS 7 -89 dBm @ MCS 8 -85 dBm @ MCS 9 -83 dBm @ MCS 10 -80 dBm @ MCS 11 -76 dBm @ MCS 12 -72 dBm @ MCS 13 -71 dBm @ MCS 14 -70 dBm @ MCS 15 |
| Receive Adjacent Channel Rejection (ACR) | >18 dB @ 6 Mbps (Typ) | |
| Receive Alternate Channel Rejection (ALCR) | >35 dB @ 6 Mbps (Typ) | |
| Receive Noise Figure | +4 dB | |
| Transmitter Adjacent Channel Leakage Ratio (ACLR) | -28 dB _r (F _c ± ChBW) | |
| Transmitter Spurious Emission Suppression | -55 dB _c | |

* Specifications are subject to change without prior notice.

Band Introduction – 900 MHz ISM Band

The 900 MHz band is also known as the 33-centimeter band and ranges from 902 to 928 MHz. RF signals at 900 MHz can penetrate through building walls, vegetation, and other obstacles. 900 MHz signals can also go around objects by refraction. Due to these transmission characteristics, broadband communication in the 900 MHz band achieves a good balance of range, penetration, and throughput.

The 900 MHz band is license-free in large parts of the world: all of ITU’s region 2 (23 countries in Americas) and some additional countries like China, Australia, New Zealand and South Korea. In the USA, like WiFi, FCC Part 15 certified radios are permitted for unlicensed operation. A private wireless broadband network implemented in a license-free band avoids the recurring monthly cost of public cellular network.

Additional Doodle Labs Products - 900 MHz ISM Band

| Description | Model No. |
|--|------------------------|
| 2x2 MIMO Broadband Transceiver with miniPCIe interface | NM-915 |
| 2x2 MIMO Smart Radio with Ethernet interface | RM-915 |
| 2x2 MIMO Band shifter for Wi-Fi to 915 MHz | FM-915 |



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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