Doodle Labs Smart Radio – RM-915

Advanced MIMO Mesh Router in a Tiny Form Factor

Smart Radio Overview

Embedded

The Smart Radio is an advanced 2×2 MIMO mesh router designed for easy plug & play integration. The tiny module carries all bi-directional communication (e.g. Telemetry, Video) in a single high-speed broadband RF channel.

Due to its very low SWaP-C (Space, Weight and Power and Cost), the Smart Radio is very popular for mobile IIoT (Industrial Internet of Things) applications like drones, autonomous vehicles, and mobile robotics applications across various industries.

Technical Specifications (RM-915)

Model Category	Xtreme
ORDERING CODES	
Radio Configuration	2x2 MIMO
Model #	RM-915-2J-XM (Embedded, Industrial temp) RM-915-2J-XMC (Embedded, Commercial temp)
Evaluation Kit	EK-915-2J (Breakout board for Embedded model)
Design-In Documentation	https://www.doodlelabs.com/technologies/technical-library/
PERFORMANCE OVERVIEW	
Protocol (Waveform)	Mesh Rider (Not compatible with IEEE 802.11)
Max Operating Range (Indicative)	>20 Km (Recommended), (Max field demonstrated range >100km)
Max Data Throughput at 10-meter range (Indicative)	40 Mbps (10 MHz Channel)
Over the Air Data Encryption	256-bit AES (12 Mbps max throughput) (FIPS140-2, Level 2 compliant)
Operating Modes	Mesh, Relay, Routed Client, AP, Transparent Bridge, Internet Gateway
Command & Control channel	Ultra-Reliable Low Latency Channel (URLLC). Latency 3-30 ms
Video Channel	Optimized video streaming with Unicast and Multicast transmission
Spectrum Scan	Automatic spectrum scan on boot up.
Mesh Automatic Transmit Power Control (M-ATPC)	Intelligently adjusts the transmit output power based on signal strength. Allows the Smart Radios to be utilized in a widely dispersed and dynamic mesh.

Model Category	Xtreme
RF SPECIFICATIONS	
Frequency Range	907-923 MHz Channel plans available for all countries in Americas, Australia, New Zealand, and China
Channel Sizes (Software Selectable)	10 MHz
Radio Data Rate (Modulation Coding Scheme – MCS)	Dynamic Link Auto Adaptation
RF Power Output (Typ) **Each radio individually calibrated**	1W (30 dBm)
Antenna Signal Strength	-25 to -85 dBm (Recommended), Absolute Maximum= +12 dBm
Receiver LNA Gain	>10 dB
RF Power Control	In 1dB steps, Tolerance +/-1dB
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
Frequency Accuracy	±10 ppm max over life
Control for External Power Amp	DC biased signal over RF port
Automatic Transmit Power Control (ATPC)	Automatic adjustment of Tx power based on signal level, which ensures optimal link health at both short and long distances
NETWORKING SPECIFICATIONS	
Mesh Router	Self-Forming/Self-Healing, Peer to Peer
Video Multicast	High Rate
Custom Software Package Manager	OPKG
Device Management	SSH, RPC-JSON, LuCI, GUI
Access control	Password, MAC, IP, Port filtering
Network Security	VPN, L2TP, GRE, STP

Model Category	Xtreme
Supported Protocols	IPv6, QoS, DNS, HTTPS, IP, ICMP, NTP, DHCP
Integrate with 3rd Party Apps	Integrate with various apps e.g. ATAK, QGroundControl, and more
Software Upgrade	Over the air software upgrade supported
HARDWARE SPECIFICATIONS	
Case Material	Aluminum (Embedded)
Operating Voltage	6~42V DC
Dimensions	65 x 57 x 12 mm, 78 grams (Embedded)
Interfaces	2x RJ45, UART, USB, 2x GPIO
Antenna Connection	2x MMCX-Female (Embedded)
Host Interface (Embedded)	2x Ethernet (100 Base-T) and UART (3.3V FT234XD chipset) OR USB 2.0 Hub
Temperature range (Operating)	Industrial: -40°C to +85°C, Commercial: -10°C to +65°C
	System's thermal design should ensure that the radio's case temperature is maintained within these specifications.
Ingress Protection (Embedded)	IP 50 (Embedded), Dust Protected, No Liquids
Shock and Vibration Resistance	Compliant to MIL-STD-810H for high shock and vibration
DC Power Consumption	• 9W @ Max RF power in UDP data Tx mode • 3.4W in data Rx mode • 1.2W in Sleep mode
Reliability	Extreme Reliability, IPC Class 2 standard with Class 3 options
Integrated GPS (Optional)	Simultaneous multiple constellations (GPS/Galileo/Glonass/BeiDou/QZSS), 1.5 meter CEP position accuracy, -163 dBm tracking sensitivity
Integrated CPU	MIPS 24K, 540 MHz, 32MB Flash, 64MB DDR2 RAM
MTBF	>235k hours (25 years)
Temper Evident Seal	Yes

Model Category	Xtreme
Humidity (Operating)	0% – 95% (Non-condensing)
Life Cycle Planning	Extended lifespan with 7 years guaranteed availability
REGULATORY INFORMATION	
FCC ID	2AG87RM915-2J (In Progress)
Industry Canada (IC)	21411-RM9152J (In Progress)
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

* Specifications are subject to change without prior notice

FCC Statement

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

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

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursua nt to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful inte rference in a residential installation. This equipment generates uses and can radiate radio frequency energy a nd, if not installed and used in accordance with the instructions, may cause harmful interference to radio com munications. 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 turn ing 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 important announcement

Important Note:

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 25cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Country Code selection feature to be disabled for products marketed to the US/Canada.

This device is intended only for OEM integrators under the following conditions:

1. The antenna must be installed such that 25cm is maintained between the antenna and users, and
2. The transmitter module may not be co-located with any other transmitter or antenna,

Important Note:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

The final end product must be labeled in a visible area with the following" Contains FCC ID: **2AG87RM915-2J**"

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

2.2 List of applicable FCC rules

CFR 47 FCC PART 15 SUBPART C has been investigated. It is applicable to the modular transmitter

2.3 Specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

2.4 Limited module procedures

Not applicable

2.5 Trace antenna designs

Not applicable

2.6 RF exposure considerations

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 25cm between the radiator & your body.

2.7 Antennas

This radio transmitter **FCC ID:2AG87RM915-2J** has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Antenna No.	Model No. of antenna:	Type of antenna and Gain of the antenna (Max.)	Frequency range:
Antenna0	001-0002	External Antenna ： 196mm Dipole, 2.0dBi(Max.)	902-928MHz
Antenna1	001-0002	External Antenna : 196mm Dipole, 2.0dBi(Max.)	902-928MHz

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following" Contains **FCC ID:2AG87RM915-2J**".

2.9 Information on test modes and additional testing requirements

Host manufacturer which install this modular with single modular approval should perform the test of radiated emission and spurious emission according to FCC part 15C:15.247 and 15.209 requirement, only if the test result comply with FCC part 15.247 and 15.209 requirement, then the host can be sold legally.

2.10 Additional testing, Part 15 Subpart B disclaimer

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B.

ISED Statement

English: This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) This device may not cause interference, a nd (2) This device must accept any interference, including interference that may cause undesired operation of the device.

The digital apparatus complies with Canadian CAN ICES-3 (B)/NMB-3(B).

- French: Le présentappareilestconforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitationestautorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareildoit accepter tout brouillageradi oélectriquesubi, mêmesi le brouillageest susceptible d'encompromettre le fonctionnement.

l'appareil numérique du ciem conforme canadien peut - 3 (b) / nmb - 3 (b).

This device meets the exemption from the routine evaluation limits in section 2.5 of RSS 102 and compliance with RSS 102 RF exposure, users can obtain Canadian information on RF exposure and compliance.

cet appareil est conforme à l'exemption des limites d'évaluation courante dans la section 2.5 du cnr - 102 et conformité avec rss 102 de l'exposition aux rf, les utilisateurs peuvent obtenir des données canadiennes sur l'exposition aux champs rf et la conformité.

This equipment complies with Canada radiation exposure limits set forth for an uncontrolled environment.

Cet équipement est conforme Canada limites d'exposition aux radiations dans un environnement non contrôlé.

This equipment should be installed and operated with minimum distance 25cm between the radiator & your body.

Cet équipementdoit être installé et utilisé à une distance minimale de 25cm entre le radiateur et votre corps.

Note Importante:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the ISED cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l' ISED ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

End Product Labeling

The final end product must be labeled in a visible area with the following: Contains IC: 21411-RM9152J .

Plaque signalétique du produit final

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: Contient des IC: 21411-RM9152J .

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.