# Doodle Labs Smart Radio – CBRS
# RM-3625

**Advanced MIMO Mesh Router in a tiny Form Factor**

## Overview

The Smart Radios for the 3.5 GHz CBRS band are advanced 2×2 MIMO mesh routers. The RM-3625 models are fully compliant to FCC Part 96 regulatory requirements. They provide all the building blocks to deploy license free, high performance and interference free private broadband networks. The CBRS Smart Radios are available as CBSD/Gateway (Short Range CBSD-A and Rural CBSD-B), and EUD-A and EUD-B functions.

**Embedded**

## Technical Specifications (CBSD/Gateway)

| Model Category | Xtreme |
|---|---|
| **ORDERING CODES** | |
| **Model # (Embedded)** | RM-3625-2J-SD**B-MG** |
| **Evaluation Kit** | EK-3625 |
| **Design-In Documentation** | https://doodlelabs.com/technologies/technical-library/ |
| **PERFORMANCE OVERVIEW** | |
| **Protocol Compatibility** | Fully compatible with Mesh Rider Waveform |
| **Operating Modes** | Gateway/AP (CBSD-A),<br>Rural Gateway/AP (CBSD-B),<br>Transparent Client Bridge (EUD-A),<br>Transparent Client Bridge (EUD-B) |
| **Max Operating Range (Indicative)** | 40 Km (Recommended) |
| **Max Data Throughput at 10-meter range (Indicative)** | 35 Mbps (10 MHz Channel) |
| **Over the Air Data Encryption** | 128-bit AES hardware data encryption @ full rate,<br><br>256-bit AES software data encryption @ 12 Mbps |
| **Command & Control Channel** | Ultra-Reliable Low Latency Channel (URLLC). Latency 1.5-10 ms |
| **Video Channel** | Optimized video streaming with Unicast and Multicast transmission |
| **Automatic Transmit Power Control** | Intelligently adjusts the transmit output power based on signal strength. Allows the Smart Radios to be utilized in a widely dispersed and dynamic network. |
| **RF SPECIFICATIONS** | |
| **Radio Configuration** | 2x2 MIMO |
| **Frequency Range** | 3550-3700 MHz (Supports GA and PAL users) |
| **Channel Sizes (Software Selectable)** | 3, 5, 10 MHz |
| **Channel Aggregation** | Up to 4 channels |

| Model Category | Xtreme |
|---|---|
| **RF Power Output (Typ)**<br>**Each radio individually calibrated** | 1W, 30 dBm @ MCS 0, 8<br>1W, 30 dBm @ MCS 3, 11<br>400mW, 26 dBm @ MCS 5,13<br>250mW, 24 dBm @ MCS 7, 15 |
| **Antenna Signal Strength** | -25 to -85 dBm (Recommended), Absolute Maximum= +12 dBm |
| **Receiver LNA Gain** | >20 dB |
| **RF Power Control** | In 1 dBm steps, Tolerance ±1 dBm |
| **Integrated Antenna Port Protection** | Able to withstand open port, >10 KV (contact) and >15KV (open air discharge) as per IEC-61000-4-2 |
| **Radio Data Rate (Modulation Coding Scheme – MCS)** | Dynamic Link Auto Adaptation |
| **Wireless Error Correction** | FEC, ARQ |
| **Frequency Accuracy** | ±10 ppm max over life |
| **NETWORKING SPECIFICATIONS** | |
| **Mesh Router** | Self-Forming/Self-Healing, Peer to Peer |
| **Video Multicast** | 1080p HD video to 4 stations (Reccomended) |
| **Custom Software Package Manager** | OPKG |
| **Radio Management** | APIs, SSH, LuCI Web Interface, UCI command line, and SNMP |
| **Access control** | Password, MAC, IP, Port filtering |
| **Network Security** | VPN, L2TP, STP |
| **Supported Protocols** | IPv6, QoS, DNS, HTTPS, IP, ICMP, NTP, DHCP, VLAN |
| **Software Upgrade** | Over the air software upgrade supported |
| **HARDWARE SPECIFICATIONS** | |
| **Operating Voltage** | Embedded: 5.5~42V DC |
| **Dimensions** | 65 x 57 x 12 mm, 70 grams |

| Model Category | Xtreme |
|---|---|
| **Antenna Connections** | 2x MMCX |
| **Host Interface** | Embedded: 2x Ethernet, 2x USB (Host), UART, 2x GPIO, GPS |
| **Integrated GPS** | Simultaneous multiple constellations (GPS/Galileo/Glonass/BeiDou/QZSS), 1.5 meter CEP position accuracy, -163 dBm tracking sensitivity |
| **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: IP50 (dust protected, no liquids) |
| **Shock and Vibration Resistance** | Compliant to MIL-STD-810H for high shock and vibration |
| **DC Power Consumption** | • 14W @ Max RF power in UDP data Tx mode<br>• 5.6W in data Rx mode<br>• 1.8W in Sleep mode |
| **Reliability** | Extreme Reliability, IPC Class 2 standard with Class 3 options |
| **Integrated CPU** | MIPS24Kc, 650 MHz, 32MB Flash, 64MB DDR2 RAM |
| **MTBF** | >235k hours (25 years) |
| **Humidity (Operating)** | 0% – 95% (Non-condensing) |
| **Life Cycle Planning** | Extended lifespan with 7 years guaranteed availability |
| **REGULATORY INFORMATION** | |
| **FCC ID** | 2AG87RM-3625 (In Progress) |
| **Flammability Rating** | UL94 V-0 compliant |
| **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.

## Technical Specifications (End User Device, EUD)

The Smart Radios are available as lower cost End User Devices (EUD) to work with the CBSD/Gateway devices. The EUDs can interoperate with all CBSD options available. The table below shows only the specifications that are different than the CBSD specifications.
This module can only operate in a host device acting as an end user device.

| Model Category | Xtreme |
|---|---|
| **ORDERING CODES** | |
| **Model # (Embedded)** | RM-3625-2J-UDB-MG |
| **Integrated GPS** | Yes |
| **EUD SPECIFICATIONS** | |
| **Operating Modes** | Transparent Client Bridge |
| **RF Power Output (Typ)** | 23 dBm |
| **DC Power Consumption** | 8.2 W @ 23 dBm<br>5.6 W @ RX<br>1.8 W @ standby |
| **REGULATORY INFORMATION** | |
| **FCC ID** | 2AG87-RM3625 (In Progress) |

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## FCC Regulatory Statement:

FCC Standards: FCC CFR Title 47 Part 96

External Antenna :
For End User Device: 3 dBi
For Category A Device: 9.5 dBi
For Category B Device: 18 dBi

FCC Regulatory Compliance:
**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.**
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 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

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

~~If power exceeds the limit and the distance(Over 20cm distance in actual use between the device and user) is compliancewith the requirement~~

**RF Exposure Compliance**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and any part of your body.

**Labeling and Notice to OEM Integrator**
If the FCC ID is not visible when the module is installed inside another device, then the outside of the finished product into which the module is installed must display a label referring to the enclosed module. This exterior label can use wording as follows:

For the RM-3625: Category A and Category B devices
**Contains Transmitter Module FCC ID: 2AG87RM-3625**
**or**
Contains FCC ID: 2AG87RM-3625

This device must be professionally installed. (Applies to Category B device)

For the RM-3625: End User device
**Contains Transmitter Module FCC ID: 2AG87-RM3625**

**or**
Contains FCC ID: 2AG87-RM3625

The intended use is generally not for the general public. It is generally for industry/commercial use. The connector is within the transmitter enclosure and can only be accessed by disassembly of the transmitter that is not normally required. The user has no access to the connector. Installation must be controlled. Installation requires special training.

A transmitter with a modular grant can be installed in different end-use products (referred to as a host, host product, or host device) by the grantee or other equipment manufacturer, then the host product may not require additional testing or equipment authorization for the transmitter function provided by that specific module or limited module device.

A host product itself is required to comply with all other applicable FCC equipment authorization regulations, requirements, and equipment functions that are not associated with the transmitter module portion. For example, compliance must be demonstrated: to regulations for other transmitter components within a host product; to requirements for unintentional radiators (Part 15 Subpart B), such as digital devices, computer peripherals, radio receivers, etc.; and to additional authorization requirements for the non-transmitter functions on the transmitter module (i.e., Verification or Declaration of Conformity) as appropriate (e.g.,Bluetooth and Wi-Fi transmitter modules may also contain digital logic functions).

Reference to KDB Publication 996369 D04 Module Integration Guide (which is available at the FCC Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB) https://apps.fcc.gov/oetcf/kdb/index.cfm ), any manufacturer of the host device which installs this modular with unlimited modular approval should perform the test of radiated and conducted emission and spurious emission, etc. according to FCC CFR Title 47 Part 96 requirement, only if the tests result comply with FCC CFR Title 47 Part 96 requirement, then the host can be sold legally.

A user's manual for the finished product should include the following statement:
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 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