

Doodle Labs Smart Radio – RM-2085

SWaP Optimized COFDM/MIMO Broadband Radio with Ethernet

Smart Radio Overview

The Smart Radio is a tiny, full-featured broadband MIMO radio and a mesh router. It has an Ethernet interface to allow easy integration into any system. With up to 1W of RF power and 2x2 MIMO technology, the Smart Radio can transmit large amounts of data (e.g. 4K video) in real-time from over 20 km away. Doodle Labs' Smart Radio has been designed to allow OEMs to rapidly develop new Industrial IoT applications.



The Smart Radio's flexible frequency architecture can satisfy customers' requirements in any market or country. The Smart Radios are available in many frequency bands up to 4 GHz and have been designed to be interchangeable, allowing customers to switch the operating bands by simply swapping the radio.

Key Features

PERFORMANCE RF

- Interference resistant COFDM for improved link quality in busy RF environments
- Adaptive radio modulations from DSSS up to 64QAM and continuous per packet optimization to maximize link performance in dynamic environments
- Software defined channel size of 6/12 MHz for efficient re-use of spectrum
- Software defined operating frequency band for global applications
- Exceptional Multipath and NLOS performance
- Convolutional Coding, Forward error correction (FEC), Ack-retransmits for robust data transmission over noisy spectrum
- Maximal Ratio Combining and beam forming for diversity antenna gain
- Spatial Multiplexing for enhanced throughput
- Space Time Block Coding for increased robustness
- Time Division Duplexing (TDD) for bi-directional traffic
- Distributed control with CSMA/CA to auto balance the network for

Enabling Industrial Internet Revolution

Data Sheet

asymmetric up/down traffic and throughput requirements of each node

- Long range (up to 20 km) with adjustable RF power to reduce interference
- Fast handoff for mobile applications

PERFORMANCE NETWORKING

- High data throughput up to 100 Mbps
- Advanced QOS and multimedia traffic prioritizations for low latency Command and Control as well as 4K video streaming on the same link
- Self-healing/self-forming mesh router with high scalability
- Multiple network access and authentication methods
- Support for all topologies, including infrastructure, adhoc, PtP, PtmP, and Repeater modes
- Up to 128-bit AES encryption for over the air data
- Firewall - MAC/IP/protocol/port filtering for restricted access control
- Embedded network management GUI with diagnostics
- Supported Protocols - DNS, HTTP, HTTPS, IP, ICMP, NTP, TCP, UDP,

RADIUS, DHCP, VLAN, STP/RSTP, VPN, IPsec, L2TP, GRE

- 3 levels of software licenses to meet customer requirements

ADDITIONAL FEATURES

- Very small size, weight, and power (SWaP) for mobile applications
- Ethernet interface to allow easy integration into various applications
- Available in 100 MHz – 4 GHz frequency range in form factor compatible models
- Rugged construction, Industrial temperature range (-40C to +85C)
- OTA firmware upgrade
- Field proven and deployed in critical applications where failure is not an option
- COTS – Commercial off the Shelf

TARGET APPLICATIONS

- Unmanned Aerial Vehicles (Drones)
- Mobile robotics
- Wireless Ethernet extensions

Enabling Industrial Internet Revolution

Data Sheet

Band Introduction – 2085 MHz Band

The 2085 MHz band ranges from 2025~2105 MHz. It is used for Broadcast Auxiliary Service (BAS) to relay TV broadcast programming material from mobile remote locations to a fixed receive location. Typical uses include relaying programming from the on-scene TV news trucks to the broadcast studio (ENG), the broadcast studio to the broadcast transmitter, or from one broadcast station to a translator station.

This service is used nationwide by broadcasters, and network entities. Broadcast Auxiliary stations in the 1990-2025 MHz band are being transitioned to the 2085 MHz band, through replacement of old analog equipment that operated on 16.5-18 MHz channels, with newer digital equipment that operates on narrower 12 MHz channels.

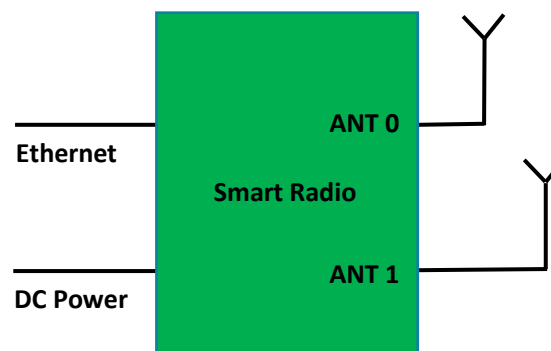
Doodle Labs Products for 2085 MHz Band

Description	Model No.
1x1 COFDM Smart Radio with Ethernet interface	RM-2085-1G
2x2 MIMO Smart Radio with Ethernet interface	RM-2085-2H

System Integration

The Smart Radio is easy to integrate. Only the Ethernet, Power supply and Antenna connections are required. The Smart Radio integrates the CPU and optimized OpenWRT to free the systems developer from the details.

Doodle Labs provides following documents upon request - Integration Guide, 3D CAD model, Mechanical Drawing and Cable Drawing.



Enabling Industrial Internet Revolution

Data Sheet

Technical Specifications (2085 MHz Band)

Model No.	RM-2085-1G	RM-2085-2H
Radio Configuration	1x1 COFDM	2x2 MIMO
Frequency Range	2025-2105 MHz	
Channel Bandwidth	6 and 12 MHz	
Data Throughput (64 QAM, 20 MHz BW)	60 Mbps	120 Mbps
Operating Range (Indicative)	8 Km	15 Km
	11 dBi antenna on both sides, 20 dBm fade margin, BPSK rate	
RF Power Output	1W (30 dBm) @ BPSK 1W (30 dBm) @ 16QAM 250 mW (24 dBm) @ 64QAM	2W (33 dBm) @ BPSK 2W (33 dBm) @ 16QAM 500 mW (27 dBm) @ 64QAM
RF Power Control	In 0.5 dBm steps. Accuracy of power calibration loop ± 2 dBm. Each radio individually calibrated and tested.	
Rx Sensitivity (5 MHz Channel BW)	-92dBm @ BPSK -73 dBm @ 64QAM	-95 dBm @ BPSK -74 dBm @ 64QAM
Radio Data Rates (Dynamic Link Adaptation)	1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48 and 54 Mbps, MCS0-7	1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48 and 54 Mbps, MCS0-15
Wireless Protocol	TDD with Carrier Sense Multiple Access with Collision Avoidance	
Wireless Error Correction	FEC, ARQ	
Wireless Data Encryption	Up to 128-bit AES data encryption	
Special Features	<ul style="list-style-type: none"> Extended lifespan with many years' planned availability Extreme Reliability, IPC Class 2 standard with Class 3 options Compliant to MIL-STD-202G for high shock/vibration environments 	

Enabling Industrial Internet Revolution

Data Sheet

Model No.	RM-2085-1G	RM-2085-2H
SOFTWARE SPECIFICATIONS		
Operating Modes	AP, Client and Adhoc modes to implement Access Point, PtP, PtmP, and Mesh networks	
Traffic Prioritization	Advanced QOS and multimedia traffic prioritizations for low latency Command and Control as well as 4K video streaming on the same link	
Mesh Router	Self-Forming/Self-Healing, Peer to Peer	
Firewall	MAC/IP/protocol/port filtering for restricted access control	
Supported Protocols	DNS, HTTP, HTTPS, IP, ICMP, NTP, TCP, UDP, RADIUS, DHCP, VLAN, STP/RSTP, VPN, IPSec, L2TP, GRE	
Software License	3 Levels of Software licenses to meet customer requirements. See separate Software datasheet for more details.	
HARDWARE SPECIFICATIONS		
Operating Voltage	5.5~40V DC	
Power Consumption	6.3W @ Max power, in continuous data transfer mode 2.2W in continuous data receive mode 1W in Sleep mode	9W @ Max power in continuous data transfer mode 3.4W in continuous data receive mode 1.2W in Sleep mode
Antenna Signal Strength	-35 to -85 dBm (Recommended), Absolute Maximum=+12 dBm	
Interference Immunity	SAW filters on RF and ANT ports for immunity against other high-power transmissions in the neighboring bands	
Integrated Antenna Port Protection	Able to withstand open port, >10 KV (contact) and >15KV (open air discharge) as per IEC-6100-4-2	
Receiver LNA Gain	>10 dB	
Receiver Adjacent Channel Rejection (ACR)	>18 dB @ 6 Mbps (Typ)	

Enabling Industrial Internet Revolution

Data Sheet

Model No.	RM-2085-1G	RM-2085-2H
Receiver Alternate Channel Rejection (ALCR)	>35 dB @ 6 Mbps (Typ)	
Receive chain Noise Figure	+6 dB	
Transmitter Adjacent Channel Leakage Power Ratio (ACLR)	45 dB (Fc ± ChBW)	
Transmitter Spurious Emission Suppression	-55 dBc	
Freq Accuracy	±10 ppm Max	
Integrated CPU	MIPS 24K, 540 MHz, 32MB Flash, 64MB DDR2 RAM	
Control for External Power Amp	DC biased signal over RF ports	
PHYSICAL, ENVIRONMENTAL SPECIFICATIONS		
Dimensions	37x57x11 mm, 40 grams	65x57x11 mm, 60 grams
Antenna Connection	1x MMCX-Female	2x MMCX-Female
Host Interface	Ethernet	
Cable Assembly	Initial samples Include the harness with DC power. Cable assembly drawing available upon request.	
Shield case temperature range (Operating)	-40°C to +85°C System's thermal design should ensure that the transceiver's case temperature is maintained within these specifications.	
Humidity (Operating)	0% – 95% (Non-condensing)	
OTHER SPECIFICATIONS		
MTBF	25 years	
Regulatory Requirements	Designed and Verified to meet various FCC Part 74 regulatory requirements. Formal testing and approval is required based on the Integrator's host platform and antenna type. The	

Enabling Industrial Internet Revolution

Data Sheet

Model No.	RM-2085-1G	RM-2085-2H
	Integrator is also responsible for obtaining all required 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.