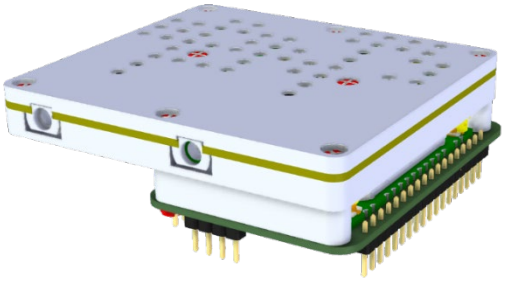
Doodle Labs Smart Radio, Hex Band – 1625~2510 MHz

Advanced Mesh Datalink In OEM Form Factor

Overview

The Hex Band Smart Radio is an advanced MIMO mesh router in a very small form factor. The custom development of the radio is supported by the Department of Defense for sUAS programs. The six bands in the 1625 to 2500 MHz range allows the sUAS to be seamlessly used globally without any hardware changes.

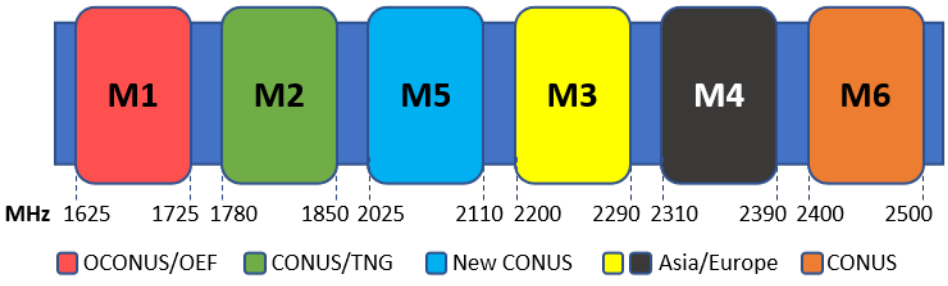


The Hex Band Smart Radio employs Doodle Labs' patented Mesh Rider® technology with state-of-the-art RF and networking capabilities that enable communication further, faster, and more reliably than any comparable solution on the market. For example, optimized video streaming carries crystal clear 4K video while simultaneously carrying low latency Command and Control data for machines.

The Smart Radio platform is available in many frequency bands between 600 MHz and 6 GHz in OEM, Embedded and Wearable form factors. This flexibility allows customers to use their industry specific frequency bands for deploying private wireless networks that encompasses all the use cases for human and machine collaboration.

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

Frequency Bands



Key Features - Smart Radio Platform

PERFORMANCE RF

- Long range (field tested >100km) and high throughput (up to 100 Mbps)
- Interference resistant advanced band filters for robust operation in harsh RF environments
- Exceptional Multipath and NrLOS MIMO 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
- 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
- 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 256 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, UART and GPIO 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

Technical Specifications

Model Category	Xtreme
ORDERING CODES	
Radio Configuration	2x2 MIMO
Model #	RM-2025-2LX-SA-ST
Antenna (Optional)	ANT-HEX-3-O
Design-In Documentation	https://www.doodlelabs.com/technologies/technical-library/
PERFORMANCE OVERVIEW	
Protocol Compatibility	Fully compatible with Doodle Labs Mesh Rider Waveform
Max Operating Range (Indicative)	20 Km (Recommended), (Max field demonstrated range >100km)
Max Data Throughput at 10-meter range with External 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 hardware data encryption @ full rate 256-bit AES (12 Mbps max throughput). FIPS Certification (Optional)
Operating Modes	Mesh, AP, Client, Bridge, Internet Gateway
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 (ATPC)	Intelligently adjusts the transmit power for very close range operation

Model Category	Xtreme
Frequency Bands	1625-1725 MHz 1780-1850 MHz 2025-2110 MHz 2200-2290 MHz 2310-2350 MHz 2400-2500 MHz
Channel Sizes (Software Selectable)	3, 5, 10, 20, 26 MHz
Radio Data Rate (Modulation Coding Scheme – MCS)	Dynamic Link Auto Adaptation
RF Power Output (Typ) **Each radio individually calibrated**	2W (33 dBm) @ MCS 0,8 1.6W (32 dBm) @ MCS 3,11 0.8W (29 dBm) @ MCS 5,13 500mW (27 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 and short circuit port
Wireless Error Correction	FEC, ARQ
~~Frequency~~ Accuracy	±10 ppm max over life
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, Image Builder
Radio Management	SSH, RPC-JSON, SNMP, UCI, GUI
Access control	Password, MAC, IP, Port filtering

Model Category	Xtreme
Network Security	VPN, L2TP, STP
Supported Protocols	IPv6, QoS, DNS, HTTPS, IP, ICMP, NTP, DHCP, VLAN
Software Upgrade	Over the air software upgrade supported

Model Category	Xtreme
HARDWARE SPECIFICATIONS	
Operating Voltage	5V
Dimensions	Baseband: 47 x 28 x 5 mm RF Board: 46 x 51 x 6.5 mm 25-30 grams (depending on configuration)
Antenna Connection	2x MMCX
Host Interface	USB-Device, Ethernet (100 Base-T), 1x UART (3.3V FT234XD chipset), and 1x GPIO ports
Temperature range (Operating)	-40°C to +85°C
	System's thermal design should ensure that the radio's case temperature is maintained within these specifications.
Ingress Protection	IP50 (Dust Protected, No Liquid Protection)
Shock and Vibration Resistance	Compliant to MIL-STD-810H for high shock and vibration
DC Power Consumption	• 12W @ Max Data Throughput • 10W @ Max Range • 4W in Rx mode • 1W in Standby mode • 0.04W in Sleep mode
Suggested Input Power Supply	TBD
Reliability	Extreme Reliability, IPC Class 2 standard with Class 3 options
Integrated CPU	MIPS 24K, 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)
Humidity (Operating)	0% – 95% (Non-condensing)
Life Cycle Planning	Extended lifespan with 7 years guaranteed availability
REGULATORY INFORMATION	
J/F-12 Certification	11929 (NTIA DD1494 available upon request)

Model Category	Xtreme
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 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)
Rx Sensitivity (3 MHz Channel BW)	-100 dBm @ MCS 0 -97 dBm @ MCS 1 -95 dBm @ MCS 2 -92 dBm @ MCS 3 -87 dBm @ MCS 4 -85 dBm @ MCS 5 -82 dBm @ MCS 6 -79 dBm @ MCS 7 -97 dBm @ MCS 8 -93 dBm @ MCS 9 -91 dBm @ MCS 10 -88 dBm @ MCS 11

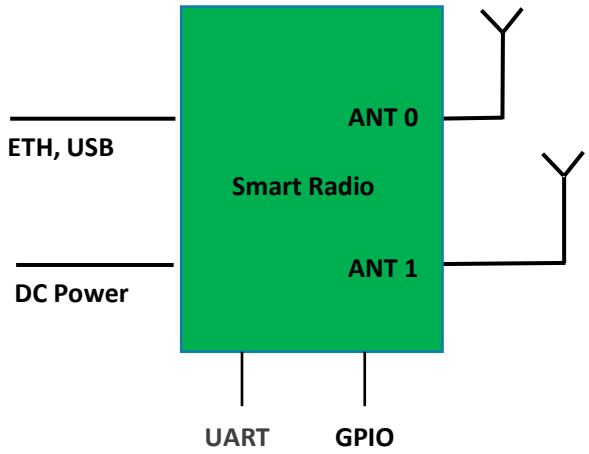
Model Category	Xtreme
	-84 dBm @ MCS 12 -80 dBm @ MCS 13 -79 dBm @ MCS 14 -78 dBm @ MCS 15
Rx Sensitivity (5 MHz Channel BW)	-98 dBm @ MCS 0 -95 dBm @ MCS 1 -93 dBm @ MCS 2 -90 dBm @ MCS 3 -85 dBm @ MCS 4 -83 dBm @ MCS 5 -80 dBm @ MCS 6 -77 dBm @ MCS 7 -95 dBm @ MCS 8 -91 dBm @ MCS 9 -89 dBm @ MCS 10 -85 dBm @ MCS 11 -82 dBm @ MCS 12 -78 dBm @ MCS 13 -77 dBm @ MCS 14 -76 dBm @ MCS 15
Rx Sensitivity (10 MHz Channel BW)	-96 dBm @ MCS 0 -93 dBm @ MCS 1 -91 dBm @ MCS 2 -88 dBm @ MCS 3 -83 dBm @ MCS 4 -81 dBm @ MCS 5 -78 dBm @ MCS 6 -75 dBm @ MCS 7 -93 dBm @ MCS 8 -89 dBm @ MCS 9 -87 dBm @ MCS 10 -84 dBm @ MCS 11

Model Category	Xtreme
	-80 dBm @ MCS 12 -76 dBm @ MCS 13 -75 dBm @ MCS 14 -74 dBm @ MCS 15
Rx Sensitivity (20 MHz Channel BW)	-93 dBm @ MCS 0 -90 dBm @ MCS 1 -88 dBm @ MCS 2 -85 dBm @ MCS 3 -80 dBm @ MCS 4 -78 dBm @ MCS 5 -75 dBm @ MCS 6 -72 dBm @ MCS 7 -90 dBm @ MCS 8 -86 dBm @ MCS 9 -84 dBm @ MCS 10 -81 dBm @ MCS 11 -77 dBm @ MCS 12 -73 dBm @ MCS 13 -72 dBm @ MCS 14 -71 dBm @ MCS 15
Receive Adjacent Channel Rejection (ACRR)	>34 dB @ MCS0 for 20 MHz channel (Typ)
Receive Noise Figure	+3 dB
Transmitter Adjacent Channel Leakage Ratio (ACLR)	-28 dBr (Fc ± ChBW)
Transmitter Spurious Emission Suppression	-40 dBc

* Specifications are subject to change without prior notice

System Integration

The Smart Radio has been designed to be nearly plug and play. Only Ethernet or USB are required for integration into a system.



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