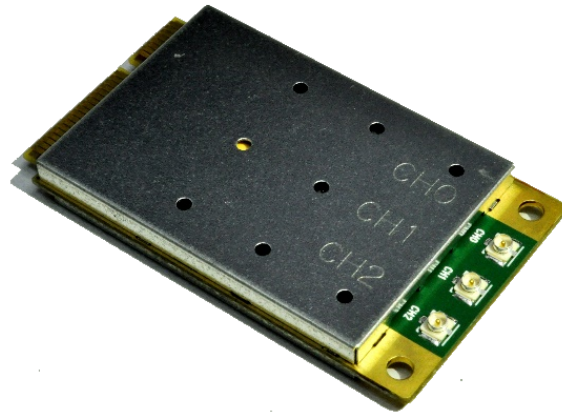# Doodle Labs NO-DB-2 Industrial Wi-Fi Transceiver

Product Family Overview

Doodle Labs' portfolio of Industrial Wi-Fi transceivers offer the industry's best-in-class performance. These transceivers have high transmit power to achieve long range and offer the rugged construction to withstand operation in the extended temperature range. In addition, our transceivers feature high interference immunity that allows successful operation in today's congested Wi-Fi environments. The transceivers are FCC, CE, and IC certified and have been deployed in numerous demanding applications.

Target Applications

The Doodle Labs Industrial Wi-Fi transceivers meet the demanding needs of customers across a broad range of industries. Examples include: - IoT applications - Access Points for large area coverage - Fixed wireless PtP links - Mesh networking deployments - Streaming HD video surveillance cameras - Fixed wireless infrastructure for campuses

Features

Best-in-class features include: - Modular FCC, CE, and IC certifications to expedite system integration and deployment - Integrated LNA for high Rx sensitivity to pick up low energy signals from mobile phones - Up to 27 dBm of RF power to communicate over a large area - Extended temperature range from -40C to +60C for outdoor operation - Electrical stress protection on antenna ports for outdoor operation

NO-DB-2 Specifications

Technical Specifications	
Ordering Code	NO-DB-2U with U.FL connectors
Radio Configuration	2x2 MIMO, Dual Band
MAC Chipset	Qualcomm Atheros: QCA9590-BR4B with Extended Temperature range
Software Support	Open Source Linux Drivers ath9k for 11n models OpenWRT (Wireless Router/Linux OS)
Center Frequency Range	5.180 GHz ~ 5.825 GHz 2.412 GHz ~ 2.484 GHz This varies by the regulatory domain
Channel Bandwidth*	20, 40 MHz channels
Radio Modulation/Data Rates (Dynamic Link Adaptation)	802.11a: 6, 9, 12, 18, 24, 36, 48 and 54 Mbps (5.x GHz) 802.11n: MCS0-15 (5.x and 2.4 GHz) 802.11b/g: 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48 and 54 Mbps (2.4 GHz)
802.11n version 2.0 Capabilities	• 802.11 dynamic frequency selection (DFS) as an AP and Client • Packet aggregation: A-MPDU (Tx/Rx), A-MSDU (Tx/Rx), Maximal ratio combining (MRC), Cyclic shift diversity (CSD), Frame aggregation, block ACK, 802.11e compatible bursting, Spatial multiplexing, cyclic-delay diversity (CDD), low-density parity check (LDPC), Space Time Block Code (STBC) • Phy data rates up to 450 Mbps (40 MHz channel)
Operating Modes	AP, Client, and Adhoc modes for Access Point, PtP, PtmP, and Mesh networks
MAC Protocol	TDD with Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA)

Wireless Error Correction	FEC, ARQ
Wireless Data Security	128 bit AES, WEP, TKIP and WAPI hardware encryption. Support for IEEE 802.11d, e, h, i, k, r, v, w and time stamp standards

Tx and Rx performance at 5 GHz

TX/RX Specification	Xtreme	Coding Rate	Tx Power(±2dBm)[2]	Rx Sensitivity (Typ)
5 GHz (20 MHz Channel) - 11n models				
802.11a, STBC	BPSK	1/2	24	-94
802.11a	64 QAM	3/4	19	-77
802.11n	BPSK	1/2	24	-95
802.11n	16 QAM	3/4	22	-82
802.11n	64 QAM	5/6	19	-75
5 GHz (40 MHz Channel) - 11n models				
802.11n	BPSK	1/2	24	-91
802.11n	16 QAM	3/4	22	-79
802.11n	64 QAM	5/6	19	-72

Tx and Rx performance at 2.4 GHz

TX/RX Specification	Xtreme	Coding Rate	Tx Power(±2dBm)[2]	Rx Sensitivity (Typ)
2.4 GHz (20 MHz Channel) - 11n models				
802.11b	1 Mbps	CCK	26	-100
802.11g	64 QAM	3/4	21	-79

802.11n	BPSK	1/2	26	-93
802.11n	16 QAM	3/4	24	-81
802.11n	64 QAM	5/6	21	-74
2.4 GHz (40 MHz Channel) - 11n models				
802.11n	BPSK	1/2	26	-90
802.11n	16 QAM	3/4	24	-78
802.11n	64 QAM	5/6	21	-71

Additional RF performance information

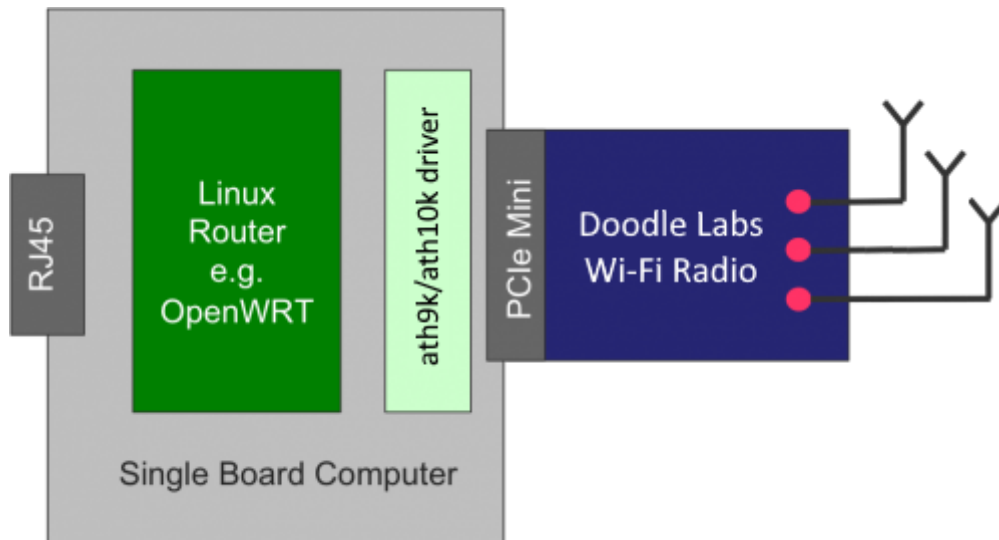| Additional RF Specifications	
Antenna Signal Strength	-35 to -85 dBm (Recommended), Absolute Maximum=+12 dBm
Integrated Antenna Port Protection	10 kV
Receiver LNA Gain	>10 dB
Receiver Adjacent Channel Rejection (ACR)	>18 dB @ 11a, 6 Mbps (Typ)
Receiver Alternate Channel Rejection (ALCR)	>35 dB @ 11a, 6 Mbps (Typ)
Receive chain Noise Figure	+6 dB
Transmitter Adjacent Channel Leakage Power Ratio (ACLR)	45 dB (Fc ± ChBW)
Transmitter Spurious Emission Suppression	-40 dBc
RF Power control	In 0.5 dBm steps. Accuracy of power calibration loop ±2 dBm. Each transceiver individually calibrated and tested.

Physical, Environment, and Other Specifications

Physical, Environment, and Other Specifications	
Host Interface	miniPCI-Express 1.2 Standard
Host CPU Board	Any CPU board with miniPCIe interface

Operating Voltage	3.3 Volts from miniPCI-Express connector
Power Consumption	3.9W @ Max power, in continuous data transfer mode on all chains 2W @ 20 dBm power (ETSI max), in continuous data transfer mode on all chains 0.7W in continuous data receive mode 250 mW in Sleep mode
Shield case temperature range (Operating)	-40°C to +60°C
Humidity (Operating)	0% - 95% (Non-condensing)
Dimensions	30 x 50 x 5.3 mm, 12 grams. High Res Photos - Mechanical drawings and 3D-CAD files available upon request
MTBF	25 years
Regulatory Requirements	Designed and verified to meet various regulatory requirements. Formal testing and approval is required based on the Integrator's particular host platform and antenna type. The Integrator is also responsible for obtaining all required regulatory approvals in target markets for the finished product.
FCC ID	2AG87NM-DB-3-R2. DFS compliance in both Master and Client modes.
CE/ETSI	Conforms with all the requirements of the European Directive 2014/53/EU – EN 62311:2008, EN 62368-1:2014+A11:2017, Draft EN 301 489-17 V3.2.2 (2019-12), EN 301 489-3 V2.1.1 (2019-03), EN 301 489-1 V2.2.3 (2019-11), EN 300 328 V2.2.2 (2019-07), EN 301 893 V2.1.1 (2017-05), EN 300 440 V2.2.1 (2018-07)
Industry Canada (IC)	21411-NMDB3R2
RoHS/WEEE Compliance	Yes. 100% Recyclable/Biodegradable packaging

EXPORT INFORMATION

ECCN Code	5A992
HS Code	85256010

System Integration

System Integration Block Diagram

As shown in the block diagram, the modular nature of the MIMO radio transceivers allow for accelerated development of the wireless modem. Any embedded Single Board Computer with standard miniPCI-Express interface is required. The Linux distribution OpenWRT has evolved over time and provides advanced features in a wireless router. It is a stable distribution and many OEMs are using OpenWRT as a starting point and customize further for their application. The distribution includes the ath9k driver to interface with the MIMO transceivers. Both OpenWRT and open source drivers (ath9k and ath10k) have extensive online documentation available. User group forums also provide responsive technical support.

Portfolio Index

Doodle Labs' Industrial Wi-Fi transceiver portfolio provides configurations optimized for a vast variety of project needs. All models are form-factor compatible. For information on other models, please visit - https://doodlelabs.com/industrial-wifi-transceivers/

FCC Statement

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

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 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 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

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

CE Statement

This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

CAUTION: To comply with the Europe CE requirement, this device must be installed with CE certified computer equipment which meet with Class A limits. Be aware that outdoor installations require special attention and will only be handled by trained and qualified installation personnel.

All cables used to connect this device must be shielded and grounded. Operation with non-certified computers or incorrect cables may result in interference to other devices or undesired effects to the product. Particular attention has to be given allowed operational frequencies.

IC Statement

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

1. This device may not cause interference; and

2. This device must accept any interference, including interference that may cause undesired operation of the device.

The term "IC: " before the certification/registration number only signifies that the Industry Canada technical specifications were met. This product meets the applicable Industry Canada technical specifications.

Le présent appareil est conforme aux CNR d'Industrie Canada applicable aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement