DOODLE Labs ACM-DB-2M Radio Transceivers Instructions

Contents

Doodle

DOODLE Labs ACM-DB-2M Radio Transceivers

Features

- Qualcomm-Atheros QCA9890-BR4B Chipset with Extended Temperature Range
- Up to 1.3 Gbps Throughput with 3×3 MIMO Technology
- Calibrated High Power 2.4 GHz (29 dBm) afor Extended Range
- 802.11 Dynamic Frequency Selection (DFS) in AP and Client mode
- Supported by OpenWRT and Ath10k Open-Source Driver
- MiniPCIE Interface

Installation and Usage

The ACM-DB-2M has been FCC certified for indoor usage with Superbat 3-dBi rubber-duck antennas (WA2-1321-S02SP1-030 in the 5-GHz bands, and WA2-995-S02SP1-030 antennas in the 2.4GHz band). The ACM-DB-3 mates with a standard PCIE-mini slot and integrates with the Ath10k software driver which is pre-installed in Linux-based systems.

TECHNICAL SPECIFICATIONS	
Model No.	ACM-DB-2M(Rugged/Military Applications, 802.11ac)
MAC Chipset	QCA9890-BR4B with Extended Temperature range for Outdoor and Rugged mo dels)
Software Support	Open Source Linux Driver **ath10k** **OpenWRT** (Wireless Router/Linux OS)
Center Frequency Range	2.412 GHz ~ 2.484 GHz This varies by the regulatory domain
Channel Bandwidth/(No. of Non- overlapping Channels) *	20/(27), 40/(13) and 80/(6) MHz channels (5.x GHz) 20/(3), and 40/(1) MHz channels (2.4 GHz)
Radio Modulation (Auto Adju st)	BPSK, QPSK, 16 QAM, 64 QAM and 256 QAM (5.x GHz – 11ac models) CCK, BPSK, QPSK, 16 QAM, and 64 QAM (2.4 GHz – 11ac models)
Data Rates Supported	**802.11n:** MCS0-23 (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)

802.11ac Wave 1 Capabilities	● 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 1.3 Gbps (80 MHz channel)				
Operating Modes	AP, STA and Adhoc modes to implement Point to Point, Point to multi Point, 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				
FIPS Certification	Loop back mode to facilitate FIPS AES certification, Small packet size (96 bytes) in AES encryption at full packet rate				
Tx/Rx Specification	**Data Rate**	**Radio Modulation**	**Throughput** Mbps (Cabled Test Setup)**	**Max Tx Power (± 2 dBm) 3 Antennas**	**Rx Sensitivity (± 2 dBm) 3 Antennas**

2.4 GHz (20 MHz Channel)					
802.11b, Single Stream, STBC	1 Mbps	CCK	0.8	29	-100
802.11g, Single Stream, STBC	6 Mbps	BPSK	5.5	29	-98
802.11g, Single Stream, STBC	24 Mbps	16 QAM	18	29	-90
802.11g, Single Stream, STBC	36 Mbps	16 QAM	24	27	-87
802.11g, Single Stream, STBC	48 Mbps	64 QAM	31	26	-84
802.11g, Single Stream, STBC	54 Mbps	64 QAM	32	26	-82
802.11n, HT20, 3 Streams	MCS16	BPSK	18	29	-92
802.11n, HT20, 3 Streams	MCS18	QPSK	54	29	-86
802.11n, HT20, 3 Streams	MCS20	16QAM	108	27	-79
802.11n, HT20, 3 Streams	MCS22	64 QAM	162	24	-75
802.11n, HT20, 3 Streams	MCS23	64QAM	189	24	-74
2.4 GHz (40 MHz Channel)					
802.11n, HT40, 3 Streams	MCS16	BPSK	36	29	-87
802.11n, HT40, 3 Streams	MCS18	QPSK	108	29	-80
802.11n, HT40, 3 Streams	MCS20	16QAM	216	26	-74
802.11n, HT40, 3 Streams	MCS22	64 QAM	470	24	-70
802.11n, HT40, 3 Streams	MCS23	64QAM	486	23	-68

* It is advantageous to use the smallest Channel Bandwidth that can support the Throughput requirements. Smaller Bandwidths provide more channels to choose and help avoid interference issues. The system's SNR is higher at smaller Channel Bandwidths and Range is longer.

** Throughput of a wireless link depends on many environmental parameters. Here the bench measurement results are shown to give an indication of the real life performance of Doodle Labs modules. These results are lower than the theoretical values published in most of the literature. They do not include distance related derating.

Antenna Signal Strength	-50 to -90 dBm (Recommended), Absolute Maximum=+12 dBm
Antenna port isolation for concurrent operation	Up to +5 dBm signal strength for 2.4 GHz signal without degrading 5.x GHz operation
Integrated Antenna Port Protection	>12 KV (Human Body Model) for Outdoor and Rugged models (ACO/ACM-DB-3 and NO/NM-DB-3)
Receiver LNA Gain	>12 dB
Receiver Adjacent Channel Rejection (ACR)	>28 dB @6 Mbps, 13 dB @54 Mbps, 3 dB @ VHT80, MCS9
Receiver Next to Adjacent Channel Rejection (ALCR)	>40 dB
Receive chain Noise Figure	+5 dB
Transmitter Adjacent Channel Leakage power Ratio (ACLR)	Min 45 dB (Fc ± ChBW)

Transmitter Spurious Emission Suppression	-40 dBc (Minimum)
RF Power control by Driver	In 0.5 dBm steps. Accuracy of power calibration ±2 dBm
RF Hardware Disable	Pin 20 of miniPCI-E interface. (Required for FAA compliance)
Control for External Power Amp	Available as an optional configuration
Spectral Analysis	8 bit resolution spectral FFTs available for software analysis
PHYSICAL, ENVIRONMENTAL AND OTHER SPECIFICATIONS	
Antenna Ports	3 Ports (50 Ohms) with MMCX connectors. Optional configuration with U.FL connectors available on request
Host Interface	miniPCI-Express 1.2 Standard
Host CPU Board	Any CPU board with Industry standard miniPCI-Express interface with minimum 6 mm connector height
Operating Voltage	3.3 Volts from miniPCI-Express connector
Power Consumption	5W @ Max power, in continuous data transfer mode on all 3 chains 3.5W @ 25 dBm power, in continuous data transfer mode on all 3 chains 2.5W @ 20 dBm power (ETSI max), in continuous data transfer mode on all 3 chains 0.9W in continuous data receive mode 250 mW in Sleep mode
Shield case temperature range (Operating)	0°C to +60°C (Enterprise/Indoor "*E-DB-3" models) -40°C to +60°C (Outdoor "*O-DB-3" models) -40°C to +80°C (Rugged "*M-DB-3" models) The System's thermal design should ensure that the transceiver's case temperature is maintained within these specifications.
Humidity (Operating)	0% – 95% (Non-condensing)
Dimensions	30 x 50 x 7 mm, 14 grams (Rugged models). Mechanical drawing and 3D-CAD files available upon request
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	2AG87ACM-DB-2M
CE/ETSI	11ac models in AP and Client modes with full DFS – in conformity with all the requirements of the European Directive 1999/5/EC – EN 301 893 V1.8.1, EN 300 328 V.1.8.1, EN 301 489-1 V1.9.2, EN 301 489-17 V2.2.1, EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011+ A2:2013
Industry Canada (IC)	21411-ACMDB2M
RoHS/WEEE Compliance	Yes. 100% Recyclable/Biodegradable packaging

FCC Statement

FCC standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247 External antenna with gain ANT0: 7dBi, ANT1: 7dBi FCC Regulatory Compliance: This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- this device may not cause harmful interference, and
- this device must accept any interference received, including interference that may cause undesired operation. Note: 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.

  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 compliance with 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. Notice to OEM integratorIf the FCC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. The end product shall haves the words "Contains Transmitter Module FCC ID: 2AG87ACM-DB-2M". The device must be professionally installed. 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. Any company of the host device which installs this modular with unlimited modular approval should perform the test of radiated & conducted emission and spurious emission, etc. according to FCC part 15C: 15.247 and15.209 & 15.207, 15B Class B requirement, only if the tests result comply with FCC part 15C: 15.247 and 15.209 & 15.207, 15B Class B requirement, then the host can be sole legally. When the module is installed inside another device, the user manual of the hose contain below

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation

IC statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic DevelopmentCanada's license-exempt
RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
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.

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Please notice that if the ISED certification number is not visible when the module is installed inside another device, then theoutside of the device into which
the module is installed o display a label referring to the enclosed module. This exteriorlabel can use wording such as the following: "Contains IC:21411-ACMDB2M" any similar wording that expresses the same meaningmay be used.

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Documents / Resources

	DOODLE Labs ACM-DB-2M Radio Transceivers [pdf] Instructions ACM-DB-2M, ACMDB2M, 2AG87ACM-DB-2M, 2AG87ACMDB2M, ACM-DB-2M Radio Transceivers, ACM-DB-2M, Radio Transceivers

References

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- [OpenWrt Wiki] Welcome to the OpenWrt Project