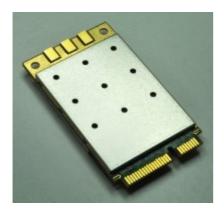
User Manual



NM-DB-3

Rugged/Military grade 2.4/5 GHz 3x3 MIMO Wi-Fi® Radio Transceivers



Features

- Qualcomm-Atheros AR9590-AR1B Chipset with Extended Temperature Range
- Up to 450 Mbps Throughput with 3x3 MIMO Technology
- Calibrated High Power 2.4 GHz (29 dBm) and 5 GHz operation (27 dBm) for Extended Range
- Supported Ath9k Linux Driver
- MiniPCIE Interface

TECHNICAL SPI	ECIFICATIO	NS				
Model No.		NM-DB-3				
MAC Chipset		Qualcomm Atheros QCA9590-AR1B with Extended Temperature range for Outdoor and Rugged models)				
Software Support		Linux Drivers ath9k				
Center Frequency Range		5.180 GHz -5.240 Ghz & 5.745 GHz -5.825 Ghz 2.412 GHz ~ 2.484 GHz This varies by the regulatory domain				
Channel Bandwidth*		20, 40 MHz channels				
Radio Modulation (Dynamic Link Adaptation)		BPSK, QPSK, 16 QAM, and 64 QAM (5.x GHz) CCK, BPSK, QPSK, 16 QAM, and 64 QAM (2.4 GHz)				
Data Rates Supported		802.11a: 6, 9, 12, 18, 24, 36, 48 and 54 Mbps (5.x GHz) 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)				
802.11n version 2.0 Capabilities		 802.11n and b/g Beam Forming 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, STA and Adhoc modes to implement Point to Point, Point to multi Point				
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	Radio Modulation	Coding Rate	Max Tx Power	Rx Sensitivity (Typ)		
5 GHz (20 MHz C	Channel)					
802.11a, STBC	BPSK	1/2	25.18	-96		
802.11a, STBC	64 QAM	3/4	25.09	-81		
MIMO	BPSK	1/2	25.09	-93		
MIMO	16 QAM	3/4	25.09	-83		
MIMO	64 QAM	5/6	25.09	-72		
5 GHz (40 MHz C	Channel)					
MIMO	BPSK	1/2	22.93	-90		
MIMO	16 QAM	3/4	22.93	-79		
MIMO	64 QAM	5/6	22.93	-69		
2.4.011- (22.85)	Chamas IV					
2.4 GHz (20 MHz	•	001/	07.00	400		
802.11b, STBC	1 Mbps	CCK	27.32	-100		
802.11g, STBC	64 QAM	3/4	27.16	-80		

1/2

3/4

26.84

26.84

-92

-82

802.11n, MIMO BPSK

802.11n, MIMO 16 QAM

Antenna port isolation for concurrent operation Up to +5 dBm signal strength for 2.4 GHz signal without degrading GHz operation Integrated Antenna Port Protection Receiver LNA Gain Receiver Adjacent Channel Rejection (ACR) Receiver Adjacent Channel Rejection (ALCR) Receiver Adjacent Channel Rejection (ALCR) Receive chain Noise Figure 146 B 11a, 6 Mbps (Typ) 158 dB @ 11a, 6 Mbps (Typ) 159 dB @ 11a, 6 Mbps (Typ) 150 dB @ 11a, 6 Mbps							
802.11n, MIMO BPSK 1/2 26.94 -90 802.11n, MIMO 6 QAM 3/4 26.94 -79 802.11n, MIMO 6 QAM 5/6 26.94 -79 802.11n, MIMO 6 QAM 5/6 26.94 -70 802.11n, MIMO 6 QAM 5/6 QAM 5/6 26.94 -70 802.11n, MIMO 6 QAM 5/6	802.11n, MIMO	64 QAM	5/6	26.84	-72		
802.11n, MIMO 16 QAM 5/6 26.94 -79 802.11n, MIMO 64 QAM 5/6 26.94 -70 **Nea: 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. **Nea: Max allowed Tx power depends on the regulatory domain Antenna Signal Strength Antenna port isolation for concurrent operation Up to +10 dBm signal strength for 5 GHz signal without degrading GHz operation Up to +5 dBm signal strength for 2.4 GHz signal without degrading GHz operation Up to +5 dBm signal strength for 2.4 GHz signal without degrading GHz operation Integrated Antenna Port Protection Receiver LNA Gain Receiver Algacent Channel Rejection (ACR) Receiver Algacent Channel Leakage power Ratio (ACLR) Receiver Algacent Channel Leakage power Ratio (ACLR) Receiver Algacent Channel Leakage power Ratio (ACLR) RF Power control RF Power control RF Hardware Disable (RF Kill) Available as an optional configuration Spectal Analysis PhysiCAL, ENVIRONMENTAL AND OTHER SPECIFICATIONS Antenna Ports 3 Ports (50 Ohms) with MMCX connectors. miniPCI-Express 1.2 Standard Any CPU board with Industry standard miniPCI-Express interface within minimal chains 3.75W @ 26 dBm power, in continuous data transfer mode on all chains 0.9w in continuous data rensfer mode on all chains 0.9w in continuous data rensfer mode on all chains 0.9w in continuous data receive mode 250 mW in Sleep mode Shield case temperature range (Operating) Humidity (Operating) Humidity (Operating) Humidity (Operating) Humidity (Operating) Humidity (Operating)	2.4 GHz (40 MHz	Channel)					
802.11n, MIMO 5/6 26.94 -70 Noss 1 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. Nose 2 Max allowed Tx power depends on the regulatory domain -35 to -85 dBm (Recommended), Absolute Maximum=+12 dBm Up to +10 dBm signal strength for 5 GHz signal without degrading. GHz operation Antenna port isolation for concurrent operation CHz operation Integrated Antenna Port Protection >20 KV (Human Body Model) Receiver LNA Gain >10 dB Receiver LNA Gain >18 dB @ 11a, 6 Mbps (Typ) Receiver LNA Gain >18 dB @ 11a, 6 Mbps (Typ) Receiver Adjacent Channel Rejection (ACR) >18 dB @ 11a, 6 Mbps (Typ) Receiver Adjacent Channel Rejection (ALCR) >16 dB Receiver Aliacent Channel Rejection (ALCR) >16 dB Receiver Aliacent Channel Rejection (ALCR) >16 dB Receiver Aliacent Channel Rejection (ALCR) >16 dB Transmitter Spurious 40 dBc Emission Suppression 40 dBc RF Power control Available as an optional configuration and tested. RF Hardware Disable (RF Kill) Available as an optional configuration a	802.11n, MIMO	BPSK	1/2	26.94	-90		
Note 1 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. Note 2 Max allowed Tx power depends on the regulatory domain Antenna Signal Strength Antenna Signal Strength Antenna port isolation for concurrent operation Integrated Antenna Port Protection Receiver LNA Gain Receiver Algacent Channel Rejection (ACR) Receiver Adjacent Channel Rejection (ACR) Receiver Algacent Channel Rejection (ALCR) Receiver Algacent Channel Rejection (Algacent Channel Rejection (Algacent Channel Rejection (Algacent C	802.11n, MIMO	16 QAM	3/4	26.94	-79		
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. **News Max allowed Tx power depends on the regulatory domain Antenna Signal Strength Antenna Signal Strength Antenna port isolation for concurrent operation Antenna port isolation for concurrent operation Up to +10 dBm signal strength for 5 GHz signal without degrading. GHz operation Up to +5 dBm signal strength for 2.4 GHz signal without degrading. GHz operation Integrated Antenna Port Protection Receiver LNA Gain Receiver Adjacent Channel Rejection (ALCR) Receiver Adjacent Channel Receiver Adjacent Channel Leakage power Ratio (ACLR) Transmitter Adjacent Channel Leakage power Ratio (ACLR) Transmitter Adjacent Channel Leakage power Ratio (ACLR) Transmitter Spurious Emission Suppression RF Power control RF Hardware Disable (RF Kill) Control for External Power Amp Spectral Analysis Pin 20 of miniPCI-E interface. (Required for FAA compliance) Available as an optional configuration Available as an optional configuration Spectral Analysis PHYSICAL, ENVIRONMENTAL AND OTHER SPECIFICATIONS Antenna Ports Host CPU Board Any CPU board with Industry standard miniPCI-Express interface winnimum 6 mm connector height Operating Voltage 3.3 Volts from miniPCI-Express connector 5.3W @ 25 dBm power, in continuous data transfer mode on all chains 3.75W @ 25 dBm power, in continuous data transfer mode on all chains 9.9W in continuous data receive mode 250 mW in Sleep mode 40°C to +80°C The System's thermal design should ensure that the transceiver's of temperature is maintained within these specifications.	802.11n, MIMO	64 QAM	5/6	26.94	-70		
Antenna Signal Strength Antenna port isolation for Concurrent operation Antenna port isolation for Concurrent operation Integrated Antenna Port Protection Receiver LNA Gain Receiver Adjacent Channel Rejection (ALCR) Receiver Alternate Channel Rejection (ALCR) Receiver Alternate Channel Leakage power Ratio (ACLR) Transmitter Adjacent Channel Leakage power Ratio (ACLR) Transmitter Spurious Emission Suppression RF Power control RF Hardware Disable (RF Kill) Control for External Power Amp Spectral Analysis PHYSICAL, ENVIRONMENTAL AND OTHER SPECIFICATIONS Antenna Ports Any CPU board with Industry standard miniPCI-Express interface winimum 6 mm connector height Operating Voltage Shield case temperature range (Operating) Humidity (Operating) Antenna Signal Strength for 5 GHz signal without degrading. GHz operation Up to +10 dBm signal strength for 2.4 GHz signal without degrading. GHz operation Up to +5 dBm signal strength for 2.4 GHz signal without degrading. GHz operation 10 to +5 dBm signal strength for 2.4 GHz signal without degrading. GHz operation 20 to W (Human Body Model) 210 dB 210 dB 211 dB 212 dKV (Human Body Model) 213 dB 214 dB 215 dB 216 dB 216 dB 217 dB 218 dB 219 dB 210 dB 218 dB 211 dB 210 dB	requirements. Sm issues. The system	aller bandwi m's SNR is h	dths provide more channigher at smaller Channe	nels to choose and he el Bandwidths and Ra	elp avoid interference		
Antenna port isolation for concurrent operation Check operation Integrated Antenna Port Protection Receiver LNA Gain Receiver Adjacent Channel Rejection (ACR) Receiver Adjacent Channel Rejection (ACR) Receiver Alternate Channel Rejection (ACR) Receiver Alternate Channel Rejection (ACR) Receiver Alternate Channel Leakage power Ratio (ACLR) Transmitter Adjacent Channel Leakage power Ratio (ACLR) Reresiver Alternate Channel Leakage power Ratio (ACLR) Transmitter Spurious Emission Suppression RF Power control RF Hardware Disable (RF Kill) Control for External Power Amp Spectral Analysis PHYSICAL, ENVIRONMENTAL AND OTHER SPECIFICATIONS Antenna Ports Host CPU Board Operating Voltage Shield case temperature range (Operating) Humidity (Operating) Humidity (Operating) Up to +5 dBm signal strength for 2.4 GHz signal without degrading GHz operation Up to +5 dBm signal strength for 2.4 GHz signal without degrading GHz operation Up to +5 dBm signal strength for 2.4 GHz signal without degrading GHz operation 20 KV (Human Body Model) 20 KV (Human Body Model) 210 dB 220 KV (Human Body Model) 220 KV (Human Body Model) 230 KV (Human Body Model) 240 MB Mbps (Typ) 235 dB @ 11a, 6 Mbps (Typ) 246 dB 250 MB msteps. Accuracy of power calibration loop ±2 dBm. Each transceiver individually calibrated and tested. Pin 20 of miniPCI-E interface. (Required for FAA compliance) Available as an optional configuration Available as an optional configuration 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. miniPCI-Express 1.2 Standard Mny CPU board with Industry standard miniPCI-Express interface within the minipcure of the province of the provinc		•	·		laximum=+12 dBm		
Protection Receiver LNA Gain Receiver Adjacent Channel Rejection (ACR) Receiver Alternate Channel Rejection (ALCR) Receiver Adjacent Channel Rejection (ALCR) Receive Alternate Channel Rejection (ALCR) Receive Adjacent Channel Leakage power Ratio (ACLR) Transmitter Adjacent Channel Leakage power Ratio (ACLR) Transmitter Spurious Emission Suppression RF Power control RF Power control RF Hardware Disable (RF Kill) Control for External Power Amp Spectral Analysis Physical, Environmental And Other Specifications Antenna Ports Be bit resolution spectral FFTs available for software analysis PHYSICAL, Environmental And Other Specifications Antenna Ports By Orts (50 Ohms) with MMCX connectors. miniPCI-Express 1.2 Standard Any CPU board with Industry standard miniPCI-Express interface wininum 6 mm connector height Operating Voltage 3.3 Volts from miniPCI-Express connector 5.3W @ Max power, in continuous data transfer mode on all chains 3.75W @ 25 dBm power (ETSI max), in continuous data transfer mode on all chains 0.9W in continuous data receive mode 250 mW in Sleep mode 40°C to +80°C The System's thermal design should ensure that the transceiver's of temperature is maintained within these specifications. Humidity (Operating) 0% — 95% (Non-condensing)	Antenna port isolation for		Up to +10 dBm signal strength for 5 GHz signal without degrading 2.4 GHz operation Up to +5 dBm signal strength for 2.4 GHz signal without degrading 5.x				
Receiver Adjacent Channel Rejection (ACR) Receiver Alternate Channel Rejection (ALCR) Receiver Alternate Channel Rejection (ALCR) Receiver Andjacent Channel Rejection (ALCR) Receive chain Noise Figure Transmitter Adjacent Channel Leakage power Ratio (ACLR) Transmitter Spurious Emission Suppression RF Power control RF Hardware Disable (RF Kill) Control for External Power Amp Spectral Analysis PHYSICAL, ENVIRONMENTAL AND OTHER SPECIFICATIONS Antenna Ports Host CPU Board Operating Voltage Power Consumption Power Consumption Shield case temperature range (Operating) Humidity (Operating) P35 dB @ 11a, 6 Mbps (Typ) >35 dB @ 11a, 6 Mbps (Typ) +6 dB 45 dB (Fc ± ChBW) 46 dB 47 dB (Fc ± ChBW) 48 dB @ 11a, 6 Mbps (Typ) +6 dB 48 dB (Pc ± ChBW) 49 dB 45 dB (Fc ± ChBW) 40 dBc In 0.5 dBm steps. Accuracy of power calibration loop ±2 dBm. Each transceiver individually calibrated and tested. RF Power control In 0.5 dBm steps. Accuracy of power calibration loop ±2 dBm. Each transceiver individually calibrated and tested. RF Power control RF Power control Available as an optional configuration Poin 20 of miniPCI-E interface. (Required for FAA compliance) Available as an optional configuration S bit resolution spectral FFTs available for software analysis Physical, Environmental And Other Specifications Available as an optional configuration S ports (50 Ohms) with MMCX connectors. miniPCI-Express 1.2 Standard Any CPU board with Industry standard miniPCI-Express interface with minimum 6 mm connector height Operating Voltage 3.3 Volts from miniPCI-Express connector 5.3W @ Max power, in continuous data transfer mode on all chains 0.9W in continuous data receive mode 2.5W @ 20 dBm power (ETSI max), in continuous data transfer mode on all chains 0.9W in continuous data receive mode 2.5W @ 20 dBm power (ETSI max), in continuous data transfer mode on all chains 0.9W in continuous data receive mode 2.5W @ 20 dBm	_		·				
Rejection (ACR) Receiver Alternate Channel Rejection (ALCR) Receive chain Noise Figure +6 dB Transmitter Adjacent Channel Leakage power Ratio (ACLR) Transmitter Spurious Emission Suppression RF Power control RF Hardware Disable (RF Kill) Control for External Power Amp Spectral Analysis PHYSICAL, ENVIRONMENTAL AND OTHER SPECIFICATIONS Antenna Ports Host CPU Board Operating Voltage Power Consumption Power Consumption Shield case temperature range (Operating) Humidity (Operating) 146 dB 11a, 6 Mbps (Typ) 135 dB @ 11a, 6 Mbps (Typ) 146 dB 147 dB 148 dB 149 dB 149 dB 140 dBc 160 dBc In 0.5 dBm steps. Accuracy of power calibration loop ±2 dBm. Each transceiver individually calibrated and tested. RF Hardware Disable (RF Kill) Available as an optional configuration Available as an optional configuration 8 bit resolution spectral FFTs available for software analysis Physical, Environmental And Other Specifications 8 bit resolution spectral FFTs available for software analysis Pit Specific Atlons 1 an optional configuration Available as an optional configuration 8 bit resolution spectral FFTs available for software analysis Physical, Environmental And Other Specifications 1 an optional configuration 8 bit resolution spectral FFTs available for software analysis Physical, Environmental And Other Specifications 1 an optional configuration 8 bit resolution spectral FFTs available for software analysis Physical Called FFTs available for software analysis 1 an optional configuration 4 optional Called FFTs available for software analysis 1 an optional configuration 8 bit resolution spectral FFTs available for software analysis 1 an optional configuration 1 an opti			>10 dB				
Rejection (ALCR) Receive chain Noise Figure Transmitter Adjacent Channel Leakage power Ratio (ACLR) Transmitter Spurious Emission Suppression RF Power control RF Hardware Disable (RF Kill) Control for External Power Amp Spectral Analysis PHYSICAL, ENVIRONMENTAL AND OTHER SPECIFICATIONS Antenna Ports Host CPU Board Operating Voltage 3.3 Volts from miniPCI-Express connector 5.3W @ Max power, in continuous data transfer mode on all chains 3.75W @ 25 dBm power, in continuous data transfer mode on all chains 0.9W in continuous data receive mode 250 mW in Sleep mode -40°C to +80°C The System's thermal design should ensure that the transceiver's of temperature range (Operating) **OBE	Receiver Adjacent Channel		>18 dB @ 11a, 6 Mbps (Typ)				
Transmitter Adjacent Channel Leakage power Ratio (ACLR) Transmitter Spurious Emission Suppression RF Power control RF Power control RF Hardware Disable (RF Kill) Control for External Power Amp Spectral Analysis PHYSICAL, ENVIRONMENTAL AND OTHER SPECIFICATIONS Antenna Ports Host CPU Board Any CPU board with Industry standard miniPCI-Express interface wininimum 6 mm connector height Operating Voltage Power Consumption Power Consumption Shield case temperature range (Operating) Humidity (Operating) 45 dB (Fc ± ChBW) 45 dB (Fc ± ChBW) 40 dBc In 0.5 dBm steps. Accuracy of power calibration loop ±2 dBm. Each transceiver individually calibrated and tested. Pin 20 of miniPCI-E interface. (Required for FAA compliance) Available as an optional configuration Available as an optional c			>35 dB @ 11a, 6 Mbps (Typ)				
Leakage power Ratio (ACLR) Transmitter Spurious Emission Suppression RF Power control RF Power control RF Hardware Disable (RF Kill) Control for External Power Amp Spectral Analysis PHYSICAL, ENVIRONMENTAL AND OTHER SPECIFICATIONS Antenna Ports Host CPU Board Operating Voltage 3.3 Volts from miniPCI-Express connector 5.3W @ Max power, in continuous data transfer mode on all chains 3.75W @ 25 dBm power (ETSI max), in continuous data transfer mode on all chains 0.9W in continuous data receive mode 250 mW in Sleep mode 49 dBc In 0.5 dBm steps. Accuracy of power calibration loop ±2 dBm. Each transceiver's of temperature is maintained within these specifications.			+6 dB				
Emission Suppression RF Power control RF Power control RF Hardware Disable (RF Kill) Control for External Power Amp Spectral Analysis Physical, Environmental And Other Specifications Antenna Ports Host CPU Board Operating Voltage Power Consumption Power Consumption Spectral Case temperature range (Operating) Shield case temperature range (Operating) An 0.5 dBm steps. Accuracy of power calibration loop ±2 dBm. Each transceiver individually calibrated and tested. In 0.5 dBm steps. Accuracy of power calibration loop ±2 dBm. Each transceiver individually calibrated and tested. In 0.5 dBm steps. Accuracy of power calibration loop ±2 dBm. Each transceiver individually calibrated and tested. In 0.5 dBm steps. Accuracy of power calibration loop ±2 dBm. Each transceiver individually calibrated and tested. Pin 20 of miniPCI-E interface. (Required for FAA compliance) Available as an optional configuration Available as an optional configuration Spectral Analysis Spit resolution spectral FFTs available for software analysis Prover (50 Ohms) with MMCX connectors. miniPCI-Express 1.2 Standard Any CPU board with Industry standard miniPCI-Express interface with industry standard miniPCI-Express interface with industry standard miniPCI-Express interface with industry standard miniPCI-Express connector 5.3W @ Max power, in continuous data transfer mode on all chains 9.75W @ 25 dBm power (ETSI max), in continuous data transfer mode on all chains 9.9W in continuous data receive mode 250 mW in Sleep mode 40°C to +80°C The System's thermal design should ensure that the transceiver's of temperature is maintained within these specifications. Humidity (Operating) Operating Voltage Operating Voltage In 0.5 dBm steps. Accuracy of miniPCI-Express (Required for FAA compliance) Available as an optional configuration Available as an optional config	-		45 0B (FC + CDBVV)				
RF Power control transceiver individually calibrated and tested. RF Hardware Disable (RF Kill) Control for External Power Amp 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. Host Interface miniPCI-Express 1.2 Standard Host CPU Board Any CPU board with Industry standard miniPCI-Express interface of minimum 6 mm connector height Operating Voltage 3.3 Volts from miniPCI-Express connector 5.3W @ Max power, in continuous data transfer mode on all chains 3.75W @ 25 dBm power, in continuous data transfer mode on all chains 0.9W in continuous data receive mode 250 mW in Sleep mode Shield case temperature range (Operating) Humidity (Operating) transceiver individually calibrated and tested. Pin 20 of miniPCI-E interface. (Required for FAA compliance) Available as an optional configuration Available as an optional positions By available for software analysis By available for software analysis Available as an optional positions Available as an optional positions Available as an optional positions By available for software analysis Available as an optional positions Available as an optional positions Available as an opt	•		-40 dBc				
Kill) Control for External Power Amp 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. Host Interface miniPCI-Express 1.2 Standard Host CPU Board Any CPU board with Industry standard miniPCI-Express interface wininimum 6 mm connector height Operating Voltage 3.3 Volts from miniPCI-Express connector 5.3W @ Max power, in continuous data transfer mode on all chains 3.75W @ 25 dBm power, in continuous data transfer mode on all chains 2.5W @ 20 dBm power (ETSI max), in continuous data transfer mode on all chains 0.9W in continuous data receive mode 250 mW in Sleep mode -40°C to +80°C The System's thermal design should ensure that the transceiver's of temperature is maintained within these specifications. Humidity (Operating) 0% – 95% (Non-condensing)	RF Power control		In 0.5 dBm steps. Accuracy of power calibration loop ±2 dBm. Each transceiver individually calibrated and tested.				
Amp 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. Host Interface miniPCI-Express 1.2 Standard Any CPU board with Industry standard miniPCI-Express interface with minimum 6 mm connector height Operating Voltage 3.3 Volts from miniPCI-Express connector 5.3W @ Max power, in continuous data transfer mode on all chains 3.75W @ 25 dBm power, in continuous data transfer mode on all chains 2.5W @ 20 dBm power (ETSI max), in continuous data transfer mode on all chains 0.9W in continuous data receive mode 250 mW in Sleep mode 40°C to +80°C The System's thermal design should ensure that the transceiver's of temperature is maintained within these specifications. Humidity (Operating) OW - 95% (Non-condensing)	•		·				
PHYSICAL, ENVIRONMENTAL AND OTHER SPECIFICATIONS Antenna Ports 3 Ports (50 Ohms) with MMCX connectors. Host Interface miniPCI-Express 1.2 Standard Any CPU board with Industry standard miniPCI-Express interface wininimum 6 mm connector height Operating Voltage 3.3 Volts from miniPCI-Express connector 5.3W @ Max power, in continuous data transfer mode on all chains 3.75W @ 25 dBm power, in continuous data transfer mode on all chains 2.5W @ 20 dBm power (ETSI max), in continuous data transfer mode on all chains 0.9W in continuous data receive mode 250 mW in Sleep mode -40°C to +80°C The System's thermal design should ensure that the transceiver's of temperature is maintained within these specifications. Humidity (Operating) 0% — 95% (Non-condensing)	Control for External Power		Available as an optional configuration				
Antenna Ports Host Interface Host CPU Board Operating Voltage Power Consumption Shield case temperature range (Operating) Host Interface Any CPU board with Industry standard miniPCI-Express interface with minimum 6 mm connector height 3.3 Volts from miniPCI-Express connector 5.3W @ Max power, in continuous data transfer mode on all chains 3.75W @ 25 dBm power, in continuous data transfer mode on all chains 2.5W @ 20 dBm power (ETSI max), in continuous data transfer mode on all chains 0.9W in continuous data receive mode 250 mW in Sleep mode -40°C to +80°C The System's thermal design should ensure that the transceiver's of temperature is maintained within these specifications. Humidity (Operating) O% — 95% (Non-condensing)	Spectral Analysis		8 bit resolution spectral FFTs available for software analysis				
Host Interface 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 5.3W @ Max power, in continuous data transfer mode on all chains 3.75W @ 25 dBm power, in continuous data transfer mode on all chains 2.5W @ 20 dBm power (ETSI max), in continuous data transfer mode on all chains 0.9W in continuous data receive mode 250 mW in Sleep mode Shield case temperature range (Operating) -40°C to +80°C The System's thermal design should ensure that the transceiver's of temperature is maintained within these specifications. Humidity (Operating) 0% – 95% (Non-condensing)	PHYSICAL, ENVI	RONMENT	AL AND OTHER SPECI	FICATIONS			
Any CPU board with Industry standard miniPCI-Express interface with minimum 6 mm connector height Operating Voltage 3.3 Volts from miniPCI-Express connector 5.3W @ Max power, in continuous data transfer mode on all chains 3.75W @ 25 dBm power, in continuous data transfer mode on all chains 2.5W @ 20 dBm power (ETSI max), in continuous data transfer mode on all chains 0.9W in continuous data receive mode 250 mW in Sleep mode Shield case temperature range (Operating) Humidity (Operating) Any CPU board with Industry standard miniPCI-Express interface with minimum 6 mm connector height 3.3 Volts from miniPCI-Express connector 5.3W @ Max power, in continuous data transfer mode on all chains 0.9W @ 20 dBm power (ETSI max), in continuous data transfer mode on all chains 0.9W in continuous data receive mode 250 mW in Sleep mode 40°C to +80°C The System's thermal design should ensure that the transceiver's of temperature is maintained within these specifications. Humidity (Operating) 0% — 95% (Non-condensing)	Antenna Ports		3 Ports (50 Ohms) with MMCX connectors.				
minimum 6 mm connector height 3.3 Volts from miniPCI-Express connector 5.3W @ Max power, in continuous data transfer mode on all chains 3.75W @ 25 dBm power, in continuous data transfer mode on all chains 2.5W @ 20 dBm power (ETSI max), in continuous data transfer mode on all chains 0.9W in continuous data receive mode 250 mW in Sleep mode Shield case temperature range (Operating) Humidity (Operating) minimum 6 mm connector height 3.3 Volts from miniPCI-Express connector 5.3W @ Max power, in continuous data transfer mode on all chains 0.75W @ 20 dBm power (ETSI max), in continuous data transfer mode on all chains 0.9W in continuous data receive mode 250 mW in Sleep mode -40°C to +80°C The System's thermal design should ensure that the transceiver's of temperature is maintained within these specifications. Humidity (Operating) 0% – 95% (Non-condensing)	Host Interface		miniPCI-Express 1.2 Standard				
5.3W @ Max power, in continuous data transfer mode on all chains 3.75W @ 25 dBm power, in continuous data transfer mode on all chains Power Consumption 2.5W @ 20 dBm power (ETSI max), in continuous data transfer mode on all chains 0.9W in continuous data receive mode 250 mW in Sleep mode Shield case temperature range (Operating) 40°C to +80°C The System's thermal design should ensure that the transceiver's of temperature is maintained within these specifications. Humidity (Operating) 0% – 95% (Non-condensing)	Host CPU Board		Any CPU board with Industry standard miniPCI-Express interface with minimum 6 mm connector height				
3.75W @ 25 dBm power, in continuous data transfer mode on all chains Power Consumption 2.5W @ 20 dBm power (ETSI max), in continuous data transfer mode on all chains 0.9W in continuous data receive mode 250 mW in Sleep mode Shield case temperature range (Operating) 40°C to +80°C The System's thermal design should ensure that the transceiver's of temperature is maintained within these specifications. Humidity (Operating) 0% – 95% (Non-condensing)	Operating Voltage)	3.3 Volts from miniPCI-l	Express connector			
Shield case temperature range (Operating) The System's thermal design should ensure that the transceiver's operature is maintained within these specifications. Humidity (Operating) The System's thermal design should ensure that the transceiver's operations are the system's thermal design should ensure that the transceiver's operations are the system's thermal design should ensure that the transceiver's operations are the system's thermal design should ensure that the transceiver's operations are the system's thermal design should ensure that the transceiver's operations are the system's thermal design should ensure that the transceiver's operations are the system's thermal design should ensure that the transceiver's operations are the system's thermal design should ensure that the transceiver's operations are the system's thermal design should ensure that the transceiver's operations are the system's the system'	Power Consumption		chains 2.5W @ 20 dBm power (ETSI max), in continuous data transfer mode on all chains 0.9W in continuous data receive mode 250 mW in Sleep mode				
Humidity (Operating) 0% – 95% (Non-condensing)			The System's thermal design should ensure that the transceiver's case				
	Humidity (Operating)		0% – 95% (Non-condensing)				
Dimensions 30 x 50 x 7 mm, 14 grams	Dimensions		30 x 50 x 7 mm, 14 grams				

	Mechanical drawing and 3D-CAD files available upon request	
Regulatory Requirements	Designed and Verified to meet various regulatory requirements. Form 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-3N	
CE/ETSI	Q3 2016	
Industry Canada (IC)	Q3 2016	
RoHS/WEEE Compliance	Yes. 100% Recyclable/Biodegradable packaging	

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

Radiation Exposure Statement:

The modular can be installed or integrated in mobile or fix devices only.

This modular cannot be installed in any portable device, for example, USB dongle like transmitters is forbidden.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This transmitter must not be collocated or operating in conjunction with any other antenna or transmitter.

The availability of some specific channels and/or operational frequency bands are country dependent and are firmware programmed at the factory to match the intended destination.

The firmware setting is not accessible by the end user.

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter, except in accordance with FCC multi-transmitter product procedures.

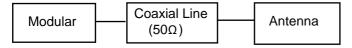
If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID:2AG87NM-DB-3N Or Contains FCC ID:2AG87NM-DB-3N" when the module is installed inside another device, the user manual of this device must contain below warning statements;

- 1. 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.
- (2) This device must accept any interference received, including interference that may cause undesired operation.
- Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

The antenna type used is the reverse screw R-SMA antenna and the max antenna gain is 3dBi.

The diagram shows how to connect the modular with its intended antenna.



Singapore:

Doodle Labs (SG) Pte. Ltd.

150 Kampong Ampat KA Center, Suite 05-03 Singapore 368324

Tel: +65 6253 0100

USA:

Doodle Labs LLC

2 Mattawang Drive Somerset, NJ 08873

Tel: +1 862 345 6781 Fax: +65 6353 5564