TEST REPORT FOR BLUETOOTH RF CONFORMANCE TESTING

Report No: SRTC2021-9004(S)-21010802(A)

Product Name: Apollo-Blue AMA3B1KK-KBR

Product Model: Apollo3 Blue

Applicant: Ambiq Micro,Inc.

Manufacturer: Ambiq Micro,Inc.

Specification: RF PHY Bluetooth Test Specification

The State Radio_monitoring_center Testing Center (SRTC)

15th Building, No.30 Shixing Street, Shijingshan District,

Beijing, P.R.China

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Contents

1 GENERAL INFORMATION

1.1 Notes of the test report

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written permission of The State Radio_monitoring_center Testing Center (SRTC).

The test results relate only to individual items of the samples which have been tested.

1.2 Information about the testing laboratory

Company:	The State Radio_monitoring_center Testing Center (SRTC)
Address:	15th Building, No.30 Shixing Street, Shijingshan District
City:	Beijing
Country or Region:	P.R.China
Contacted person:	Peng Zhen
Tel:	+86 10 57996123
Email:	pengzhen@srtc.org.cn

1.3 Applicant's details

Company:	Ambiq Micro,Inc.
Address:	6500 River Place Blvd, Building 7, Suite 200, Austin, TX 78730
City:	Austin
Country or Region:	United States
Contacted person:	Longting zhao
Tel:	15221561998
Email:	lzhao@ambiq.com

1.4 Manufacturer's details

Company:	Ambiq Micro,Inc.
Address:	6500 River Place Blvd, Building 7, Suite 200, Austin, TX 78730
City:	Austin
Country or Region:	United States
Contacted person:	Longting zhao
Tel:	15221561998
Email:	lzhao@ambiq.com

1.5 Test Environment

Date of Receipt of test sample at SRTC:	2021.01.08
Testing Start Date:	2021.01.08
Testing End Date:	2021.01.18

Environmental Data:	Temperature (°C)	Humidity (%)
Ambient:	25	38

Normal Supply Voltage (V d.c.):	3.3

PIXIT:	See annex B
Conformance log reference:	Refer to LOG documents
Retention date for log reference:	5 years

2 DESCRIPTION OF THE EUT

Product Name:	Apollo-Blue AMA3B1KK-KBR
Product Model:	Apollo3 Blue
Software Revision:	REV1.0
Hardware Revision:	Rev 1.0
PICS:	See Annex A
Description of EUT:	Ultra low power Bluetooth low energy System on Chip.
Sampling Method:	Sample Delivered

3 REFERENCE SPECIFICATION

Specification	Version	Title
RF PHY	P15	Radio Frequency Physical Layer

4 KEY TO NOTES AND RESULT CODES

Code	Meaning
PASS	Test result shows that the requirements of the relevant specification have been met.
FAIL	Test result shows that the requirements of the relevant specification have not been met.
NTNV	Normal Temperature, Normal voltage
RTSB-A	CTTL-SYSTEMS - RTSB-A Test System

5 RESULTS SUMMARY

The following table summarises the test results obtained.

PASS	10
FAIL	0
Total	10

This Test Report Is Issued by: Mr. Peng Zhen	Checked by: Mr. Sun Yang
Tested by: Mr. Jiang Shuo	Issued date: 2021.01.18

6 TEST RESULTS

The following tables reflect the requirements of the relevant specification and show the tests performed. Result files verifying these verdicts are available for inspection at SRTC.

No.	Test Case Id	Conditions	Verdict	Platform
1.	TRM-LE-01C.- Output Power at NOC	NTNV	PASS	RTSB-A
2.	TRM-LE-03C.- In-band emissions at NOC	NTNV	PASS	RTSB-A
3.	TRM-LE-05C.- Modulation characteristics	NTNV	PASS	RTSB-A
4.	TRM-LE-06C.- Carrier frequency offset and drift at NOC	NTNV	PASS	RTSB-A
5.	RCV-LE-01C.- Receiver sensitivity at NOC	NTNV	PASS	RTSB-A
6.	RCV-LE-03C.- C/I and receiver selectivity performance	NTNV	PASS	RTSB-A
7.	RCV-LE-04C.- Blocking performance	NTNV	PASS	RTSB-A
8.	RCV-LE-05C.- Intermodulation performance	NTNV	PASS	RTSB-A
9.	RCV-LE-06C.- Maximum input signal level	NTNV	PASS	RTSB-A
10.	RCV-LE-07C.- PER Report Integrity	NTNV	PASS	RTSB-A

7 MEASUREMENT UNCERTAINTIES

According to Radio Frequency (RF) Bluetooth Test Specification, Revision RF.TS.P30, RF PHY Bluetooth Test Specification, Revision RF-PHY.TS.P15,the following uncertainty values[1,2] have been calculated and compared to the specified limits as in the table below.

7.1 RTSB-A Test System Measurement Uncertainty

Testing Path Architecture	RF Tester Uncertaint (95% confidence level)		Test Cases Validated in TestingPath
Testing Path 1 Tx_Normal	In BT Band	0.46 dB	TRM_01-16 TRM_LE_01-14
	Out of BT Band (worst case)	0.83 dB	
Testing Path 2 TxRx_Direct	In BT Band	1.16 dB	TRM_11,12 RCV_01,02,06-08,10 RCV_LE_01,06-08,12-14,18-20 RCV_LE_24-27,30-33,36,37
Testing Path 3 Rx_CI	Wanted signal uncertainty level	1.16 dB	RCV_03,09 RCV_LE_03,09,15,21 RCV_LE_28,29,34,35
	Interfering signal uncertainty level (worst case)	0.69dB	
Testing Path 4 Rx_IPPATH_PSG _EUT_INBAND	Wanted signal uncertainty level	1.16 dB	RCV_05 RCV_LE_05,11,17,23
	Interfering signal uncertainty level (worst case)-ESG	0.69dB	
	Interfering signal uncertainty level (worst case)-ASG	1.31dB	
Testing Path 5 Rx_BPPATH_PSG _EUT_OUTBAND	Wanted signal uncertainty level	1.16 dB	RCV_04 RCV_LE_04,10,16,22
	Interfering signal uncertainty level -30MHz to 2GHz	0.872 dB	
	Interfering signal uncertainty level -2GHz to 12.75GHz	1.31dB	

8 TEST EQUIPMENT LIST

Conformance testing was performed using test equipment calibrated in accordance with CNAS accreditation requirements. Calibration, configuration records and equipment details used for conformance testing are available for inspection at SRTC if required.

8.1 RTSB-A Test System

Hardware：					
No.	Equipment Name	Manufacturer	ModelNumber	Serial Number	Calibration Due Date
1	Spectrum Analyzer	Agilent	N9030A	MY51380467	2021.08.19
2	Sweep Generator	Agilent	E8257D	MY46520645	2021.08.19
3	RF Signal Generator	Agilent	E4438C	MY45093904	2021.08.19
4	Bluetooth Test Set	Anritsu	MT8852B	1142010	2021.08.19
5	Switching Unit	CTTL	CTTLBTTSIFSG	---	---
Software:					
Test Engine version 3.0.0					

Annex A – Protocol Implementation Conformance Staement (PICS)

PICS performance for RF-PHY (LE)				
Item	Capability	Reference	Status	Support: Yes/ No
1	LE Transmitter (Non-connectable, Broadcaster)	[1] 3	C.1	YES
2	LE Receiver (Non-connectable, Observer)	[1] 4	C.1	YES
3	LE Transceiver (connectable, Peripheral/Central)	[1] 3, 4	C.1	YES
4	LE 2M PHY	[3] 3, 4	C.2	NO
5	Stable Modulation Index (Transmitter)	[3] 3.1.1	C.3	NO
6	Stable Modulation Index (Receiver)	[3] 3.1.1	C.4	NO
7	LE Coded PHY	[3] 3, 4	C.2	NO
8	Transmitting Constant Tone Extensions	[4] 5	C.3	NO
9	2 µs Antenna Switching During Constant Tone Extension Transmission (AoD)	[4] 5	C.5	NO
10	1 µs Antenna Switching During Constant Tone Extension Transmission (AoD)	[4] 5	C.6	NO
11	2 µs Antenna Sampling During Constant Tone Extension Reception (AoD)	[4] 5	C.4	NO
12	2 µs Antenna Switching and Sampling During Constant Tone Extension Reception (AoA)	[4] 5	C.7	NO

13	1 μs Antenna Sampling During Constant Tone Extension Reception (AoD)	[4] 5	C.7	NO
14	1μs Antenna Switching and Sampling During Constant Tone Extension Reception (AoA)	[4] 5	C.8	NO

C.1: Mandatory to support at least one of these capabilities.

C.2: Optional IF (SUM ICS 21/16 “Core 5.0” OR SUM ICS 21/18 “Core 5.1”) AND RF PHY 1/3 “LE Transceiver” are supported, otherwise Excluded.

C.3: Optional IF (SUM ICS 21/16 “Core 5.0” OR SUM ICS 21/18 “Core 5.1”) AND (RF PHY 1/1 “LE Transmitter” OR RF PHY 1/3 “LE Transceiver”) are supported, otherwise Excluded.

C.4: Optional IF (SUM ICS 21/16 “Core 5.0” OR SUM ICS 21/18 “Core 5.1”) AND (RF PHY 1/2 “LE Receiver” OR RF PHY 1/3 “LE Transceiver”) are supported, otherwise Excluded.

C.5: Optional IF RF PHY 1/8 “Transmitting Constant Tone Extensions” is supported, otherwise Excluded.

C.6: Optional IF 1/9 “2 μs Antenna Switching During Constant Tone Extension Transmission (AoD)” is supported, otherwise Excluded.

C.7: Optional IF RF PHY 1/11 “2 μs Antenna Sampling During Constant Tone Extension Reception (AoD)” is supported, otherwise Excluded.

C.8: Mandatory IF RF PHY 1/12 “2 μs Antenna Switching and Sampling During Constant Tone Extension Reception (AoA)” and RF/PHY 1/13 “1 μs Antenna Sampling During Constant Tone Extension Reception (AoD)” are supported, otherwise Excluded..

Bluetooth Test Interface Capabilitiesfor RF-PHY (LE)				
Item	Capability	Reference	Status	Support: Yes/ No
1	HCI Test Interface	Direct Test Mode, Volume 6, Part F, Version 4.0 or later, 2	C.1	YES
2	UART Test Interface	Direct Test Mode, Volume 6, Part F, Version 4.0 or later, 3	C.1	NO

C.1: Mandatory to support at least one of these capabilities

References :

[1] Specification of the Bluetooth System, Physical Layer Specification (PHY) Volume 6, Part A, Version 4.0 or later

[2] Specification of the Bluetooth System, Direct Test Mode, Volume 6, Part F, Version 4.0 or later

[3] Specification of the Bluetooth System, Physical Layer Specification (PHY) Volume 6, Part A, Version 5.0 or later

[4] Specification of the Bluetooth System, Physical Layer Specification (PHY) Volume 6, Part A, Version 5.1 or later

Annex B – Protocol Implementation Extra Information For Testing (PIXIT)

PIXIT for RF-PHY (LE)				
Item	Identifier	Units	Comments	Value
RF-PHY: P1:1/2/3	Inband Image frequency	MHz	RCV-LE/CA/03/C(C/I and Receiver selectivity Performance)	3
RF-PHY: P2:1/2/3	Value n for intermodulation test	Integer	RCV-LE/CA/05/C (Intermodulation Performance)	5
RF-PHY: P4	Power source voltage-Nominal (NOC)	V	Vol. 6, Part A, Appendix A, Section A.1.2, Nominal Supply Voltage	3.3
RF-PHY: P5	Operating temperature -Nominal（NOC）	ºC	Vol. 6, Part A, Appendix A, Section A.1.1, Normal Temperature and Air Humidity. The NOC test temperature shall be within ±10°C of this value.	25
RF-PHY: P6:1/2/3	Operating air humidity range (relative)	%	Chapter 6.3.1, Normal Temperature and Air Humidity The level shall be within declared range	38
RF-PHY: P7:1	Test interface implementation -HCI or 2-wire UART	--	Part F, Chapter 1, Bluetooth Low Energy Controller Specification	HCI
RF-PHY: P7:2	Test interface implementation -Datarate	bps	Part F, Chapter 3.1, Bluetooth Low Energy Controller Specification	---
RF-PHY: P9:1	Maximum TX packet length (MAX_TX_LENGTH)	Bytes	Chapter 6.7, Bluetooth Low Energy RF 37 to 255(Value)	255
RF-PHY: P9:2	Maximum RX packet length (MAX_RX_LENGTH)	Bytes	Chapter 6.7, Bluetooth Low Energy RF 37 to 255(Value)	255
RF-PHY: P9:3	Maximum TX packet length (MAX_TX_LENGTH) 2M	Bytes	37 to 255(Value)	---
RF-PHY: P9:4	Maximum TX packet length (MAX_TX_LENGTH) S=2	Bytes	37 to 255(Value)	---
RF-PHY: P9:5	Maximum TX packet length (MAX_TX_LENGTH) S=8	Bytes	37 to 255(Value)	---
RF-PHY: P9:6	Maximum RX packet length (MAX_RX_LENGTH) 2M	Bytes	37 to 255(Value)	---

PIXIT for RF-PHY (LE)				
Item	Identifier	Units	Comments	Value
RF-PHY: P9:7	Maximum RX packet length (MAX_RX_LENGTH) S=2	Bytes	37 to 255(Value)	---
RF-PHY: P9:8	Maximum RX packet length (MAX_RX_LENGTH) S=8	Bytes	37 to 255(Value)	---
RF-PHY: P10:1	Maximum TX mode output power	dBm	Part A, Chapter 3, Bluetooth Low Energy Controller Specification -20 to 10 (CSA5 unsupported) -20 to 20 (CSA5 supported)	---
RF-PHY: 11.1/2/3	Inband Image Frequency (2Ms/s)	MHz	RF-PHY/RCV-LE/CA/BV-09-C (C/I and Receiver Selectivity Performance at 2Ms/s)	---
RF-PHY: 12.1/2/3	Value n for Intermodulation test (2Ms/s)	Integer	RF-PHY/RCV-LE/CA/BV-11-C (Intermodulation performance at 2 Ms/s)	---
RF-PHY: 13.1/2/3	Inband Image Frequency (Stable Modulation Receiver)	MHz	RF-PHY/RCV-LE/CA/BV-15-C (C/I and Receiver Selectivity Performance, Stable Modulation Index)	---
RF-PHY: 14.1/2/3	Value n for Intermodulation test (Stable Modulation Receiver)	Integer	RF-PHY/RCV-LE/CA/BV-17-C (Intermodulation performance, Stable Modulation Index)	---
RF-PHY: 15.1/2/3	Inband Image Frequency (Stable Modulation Receiver, 2Ms/s)	MHz	RF-PHY/RCV-LE/CA/BV-21-C (C/I and Receiver Selectivity Performance at 2Ms/s, Stable Modulation Index)	---
RF-PHY: 16.1/2/3	Value n for Intermodulation test (Stable Modulation Receiver, 2Ms/s)	Integer	RF-PHY/RCV-LE/CA/BV-23-C (Intermodulation performance at 2Ms/s, Stable Modulation Index)	---

Annex C – EUT Photograph

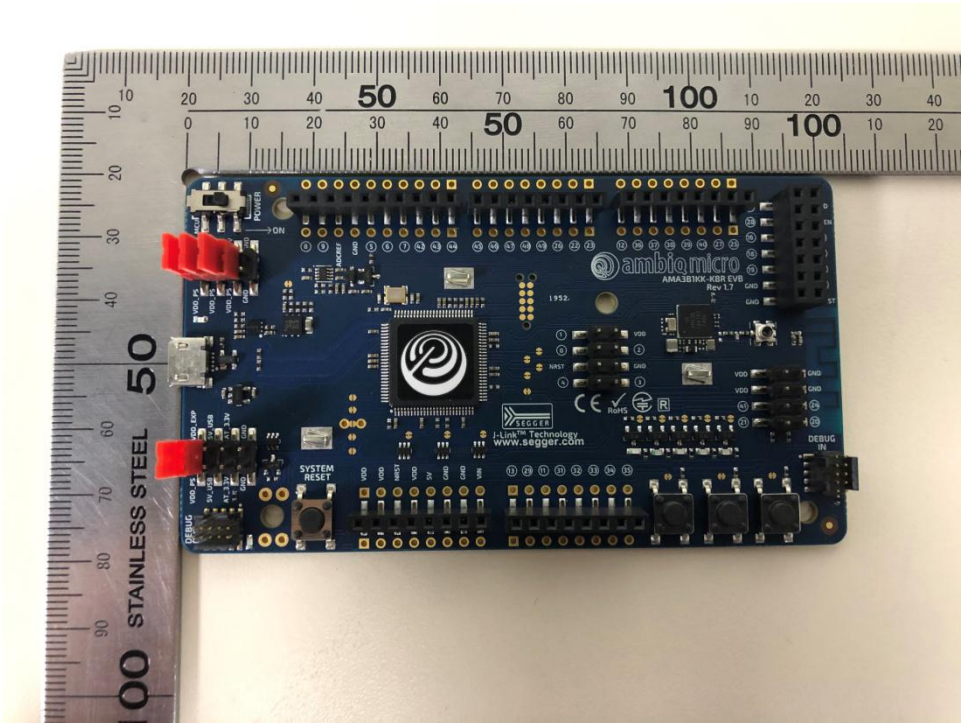

Photo1: The front view of EUT

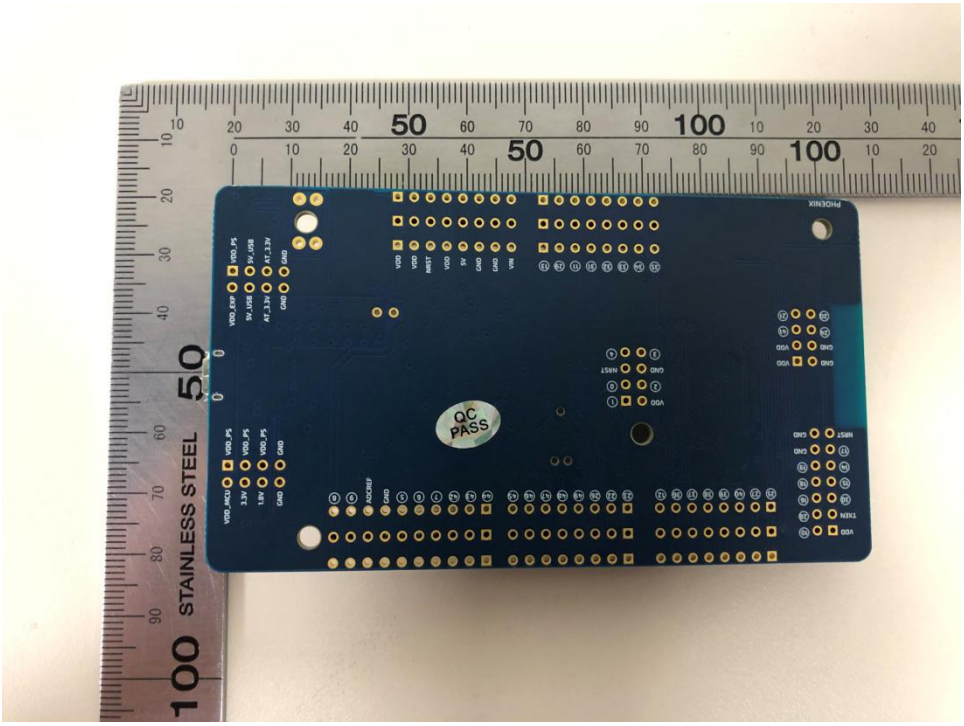

Photo2: The back view of EUT

---End of Test Report---