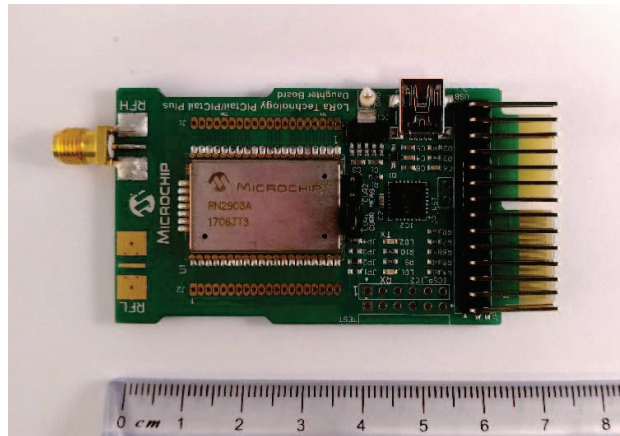


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Kunden Referenz-Nr.: <i>Client Reference No.:</i>		50016473		Auftragsdatum: <i>Order date:</i>		09-06-2017 (mm-dd-yyyy)			
Auftraggeber: <i>Client:</i>		Microchip Technology Inc. 2355 WEST CHANDLER BLVD AZ 85224, CHANDLER U.S.A.				Jonathan Pearce jdp@microchip.com +44 7585 123 576			
Prüfgegenstand: <i>Test item:</i>		Microchip LoRaWAN Module							
Produkt: <i>Product type:</i>		Radio Module (with embedded MCU and LoRaWAN stack) Series: Microchip RN Wireless Module Family							
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>		RN2903A-I/RM103							
Auftrags-Inhalt: <i>Order content:</i>		Test of Conformance to LoRaWAN™ Specification V1.0.1							
Prüfgrundlage: <i>Test specification:</i>		LoRa End Device Certification NA Version1.1							
Wareneingangsdatum: <i>Date of receipt:</i>		09-06-2017							
Prüfmuster-Nr.: <i>Test sample No.:</i>		1706JT3 (OTAA) 172119Y (ABP)							
Prüfzeitraum: <i>Testing period:</i>		09-06-2017 to 09-08-2017							
Ort der Prüfung: <i>Place of testing:</i>		Pleasanton, CA							
Prüflaboratorium: <i>Testing laboratory:</i>		TUV Rheinland of North America, Inc.							
Prüfergebnis: <i>Test results:</i>		PASS							
Geprüft von <i>Tested by:</i>		Bernd Jungbluth		Kontrolliert von <i>Reviewed by:</i>		Adeola Alade			
									
9-22-2017		Bernd Jungbluth/ Senior Test Engineer		9-22-2017		Adeola Alade / Principal Test Engineer			
Datum	Name / Stellung	Unterschrift	Datum	Name / Stellung	Unterschrift				
<i>Date (mm-dd-yyyy)</i>	<i>Name / Position</i>	<i>Signature</i>	<i>Date (mm-dd-yyyy)</i>	<i>Name / Position</i>	<i>Signature</i>				
Sontiges / Other: -									
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark</i>									



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Revisions <i>Revisions</i>			
Revision Revision	Datum Date (mm-dd-yyyy)	Anmerkung Remark	Verfasser Author
0	09-22-2017	Original Report	B. Jungbluth

Note: Latest revision report will replace all previous reports

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1 Product Information

The device under test (DUT) is a wireless Semtech LoRa North America Mote for LoRaWAN Certification testing

General information

Product name:	Microchip LoRaWAN Module: RN2903A-I/RM103
Model:	RN2903A-I/RM103
Description:	Radio Module (with embedded MCU and LoRaWAN stack)
Series:	Microchip RN Wireless Module Family
Manufacturer SKU	Microchip Technology Inc.
Hardware version:	A
Software version:	1.0.3
Firmware Version:	1.0.3
Technical contact person:	Sushma Myneni
Email:	Sushma.Myneni@microchip.com
Phone number:	+1 480 792 4238

LoRaWAN information

Type of DUT	Module
LoRa Device Class	A
Geographical area of operation	USA
Operating frequency	915 MHz
Adaptive Data Rate (ADR) supported?	Yes
Optional data rates supported?	N/A
Activation possibilities	Both Over the air and by personalization
Test According LoRaWAN™ Spec	v1.0.1
Output Power	20 dBm, programmable down to +2 dBm
Number / Type of Antenna(s)	1 (SMA port on Carrier board)
Antenna Gain	N/A
Test sample information	production unit

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For OTA activation:	
Serial No of Device with OTAA	113427
End-device identifier (DevEUI)	7777777777777777
Application identifier (AppEUI)	7777777777777777
Application key (AppKey)	12345678901234567890123456789012
For activation by personalization:	
Serial No of Device with ABP	113427
End-device identifier (DevAddr)	77777777
Application identifier (AppSKey)	12345678901234567890123456789012
Application key (NwkSKey)	12345678901234567890123456789012
Default RX2 Window Frequency	923.3MHz
Default RX2 Window Data Rate	DR8 (SF12, 500kHz)
RECEIVE_DELAY1	1 s
RECEIVE_DELAY2	2 s (must be RECEIVE_DELAY1 + 1s)
JOIN_ACCEPT_DELAY1	5 s
JOIN_ACCEPT_DELAY2	6 s
MAX_FCNT_GAP	16384
ADR_ACK_LIMIT	64
ADR_ACK_DELAY	32
ACK_TIMEOUT	2 +/- 1 s (random delay between 1 and 3 seconds)

Submitted Documents:

LoRa Certification Customer Questionnaire document.
LoRa Test Environment log files.

Remarks:

All test cases are tested with Activation by Personalization (ABP) mode, else explicitly Over the Air (OTA) to be tested.

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2 Test Equipment

Prüfmittel <i>Test equipment</i>	Marke <i>Brand</i>	Version <i>Version</i>
Comprehensive Testing Environment (CTE)	TUV Rheinland (former 4ffcom AG)	CTE - TMF V44.5 CTE - SIG – LoRawan v3.2
Senet 915MHz Gateway 0005863 (SX1301 Array library version)	Senet	>=1.0.rc10
Senet 915MHz Gateway 0005863(Semtech Packet Forwarder)	Senet	>=1.0.rc3

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3 Summary

Verdicts of functional requirements:	Verdict
Test Mode Activation (Activation by Personalization)	PASS
Test Mode Activation (Over the Air Activation) for both 125kHz& 500kHz channels	PASS
Test Application Functionality with all channels use check	PASS
Cryptography	PASS
Downlink Error Rate RX1 & RX2	PASS
Downlink Window Timing	PASS
Frame Sequence Number	PASS
Device Status Request MAC Command	PASS
MAC Commands	PASS
New Channel Request MAC Command	PASS
Confirmed packets	PASS
RX Parameter Setup Request MAC Command	PASS
Packet Error Rate RX1 Window	PASS
Packet Error Rate RX2 Window	PASS
RX Timing Setup Request MAC Command	PASS
Link ADR Request including channel management	PASS

Supported optional features:	Yes / No
Adaptive Data Rate (ADR)	YES

Overall Test Result: PASS

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4 Test Case verdicts as per Test Specifications

Test results per test case:

Test item	Description	Implementation	Result
US902-928 2.1.1	Test Mode Activation	Mandatory	PASS
US902-928 2.1.2	Over The Air Activation	Mandatory	PASS*
US902-928 2.2.1	Test Application Functionality	Mandatory	PASS
US902-928 2.2.2.a	AES Encryption	Mandatory	PASS
US902-928 2.2.2.b	MIC	Mandatory	PASS
US902-928 2.2.3	Downlink Error Rate	Mandatory	PASS
US902-928 2.2.4	Downlink Window Timing	Mandatory	PASS
US902-928 2.2.5.a	Uplink sequence Number	Mandatory	PASS
US902-928 2.2.5.b	Downlink sequence Number	Mandatory	PASS
US902-928 2.3.1	DevStatusReq MAC Command	Mandatory	PASS
US902-928 2.3.2	MAC Commands	Mandatory	PASS
US902-928 2.3.3.a & 2.3.3.b	Addition And Removal Of A Channel	Mandatory	PASS
US902-928 2.3.3.c	Addition And Removal Of Multiple channels	Mandatory	PASS
US902-928 2.3.4.a	Uplink Confirmed Packets	Mandatory	PASS
US902-928 2.3.4.b	Uplink Retransmission	Mandatory	PASS
US902-928 2.3.4.c	Downlink Confirmed Packets	Mandatory	PASS
US902-928 2.3.4.d	Downlink retransmission	Mandatory	PASS
US902-928 2.3.5	RXParamSetupReq MAC command	Mandatory	PASS
US902-928 2.3.6	RX1 Receive Window Test	Mandatory	PASS
US902-928 2.3.7	RX2 Receive Window Test	Mandatory	PASS
US902-928 2.3.8	RXTimingSetupReq MAC command	Mandatory	PASS
US902-928 2.3.9.a	ADR Bit	Mandatory	PASS
US902-928 2.3.9.b	TX Power	Mandatory	PASS
US902-928 2.3.9.c	125 KHz Channels Uplink Datarates	Mandatory	PASS
US902-928 2.3.9.d	500 KHz Channels Uplink Datarates	Mandatory	PASS
US902-928 2.3.9.e	Channel Management	Mandatory	PASS
US902-928 2.3.9.f	Redundancy	Mandatory	PASS
US902-928 2.3.9.g	ADRACKReq Bit	Mandatory	PASS

PASS*: Two preconfigured samples were used to test the Activation by Personalization mode, and ABP specific test case was retested.

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5 Test Results

Detailed test results:

Test item	Test Case Name	DataRate/ Timing	Limit	Results	Verdict
US902-928 2.2.3	Downlink Error Rate (RX1)	SF10BW500	5%	0%	PASS
	Downlink Error Rate (RX2)	SF10BW500	5%	0%	PASS
US902-928 2.2.4	Downlink window timing	-20us	-	-	PASS
		+20us	-	-	PASS
US902-928 2.3.6	RX1 Receive Window Test	SF12BW500	5%	0%	PASS
		SF11BW500	5%	0%	PASS
		SF10BW500	5%	0%	PASS
		SF9BW500	5%	0%	PASS
		SF8BW500	5%	1.7%	PASS
		SF7BW500	5%	0%	PASS
US902-928 2.3.7	RX2 Receive Window Test	SF12BW500	5%	0%	PASS
		SF11BW500	5%	1.7%	PASS
		SF10BW500	5%	0%	PASS
		SF9BW500	5%	0%	PASS
		SF8BW500	5%	0%	PASS
		SF7BW500	5%	0%	PASS

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6 Photo Documentation

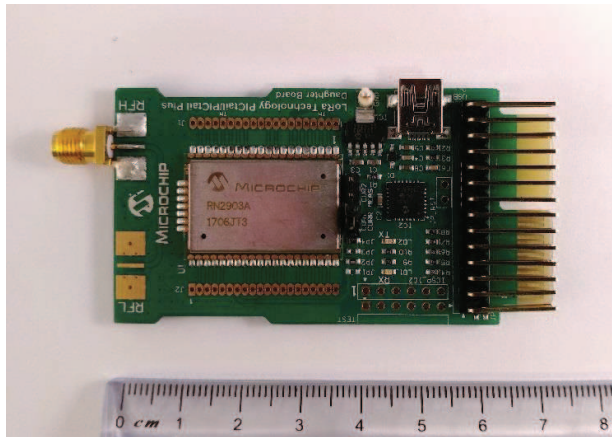


Photo 1:
EUT – Sample 1 – OTAA configuration – PCB

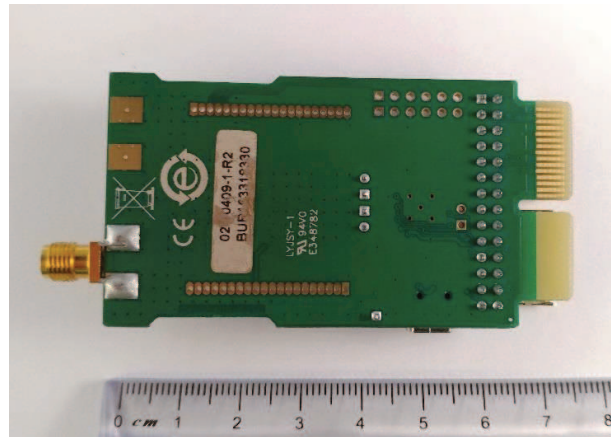


Photo 2:
EUT – Sample 1 – OTAA configuration – PCB Rear

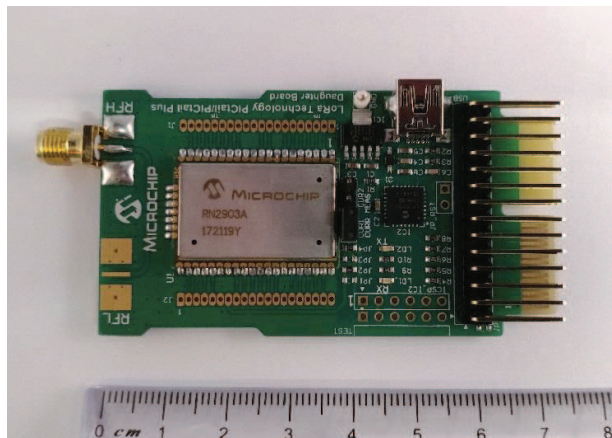


Photo 3:
EUT – Sample 2 – ABP configuration – PCB Top

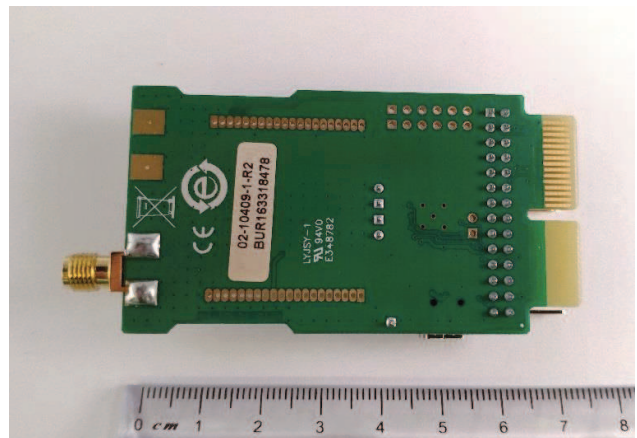


Photo 4:
EUT – Sample 2 – ABP configuration – PCB Rear

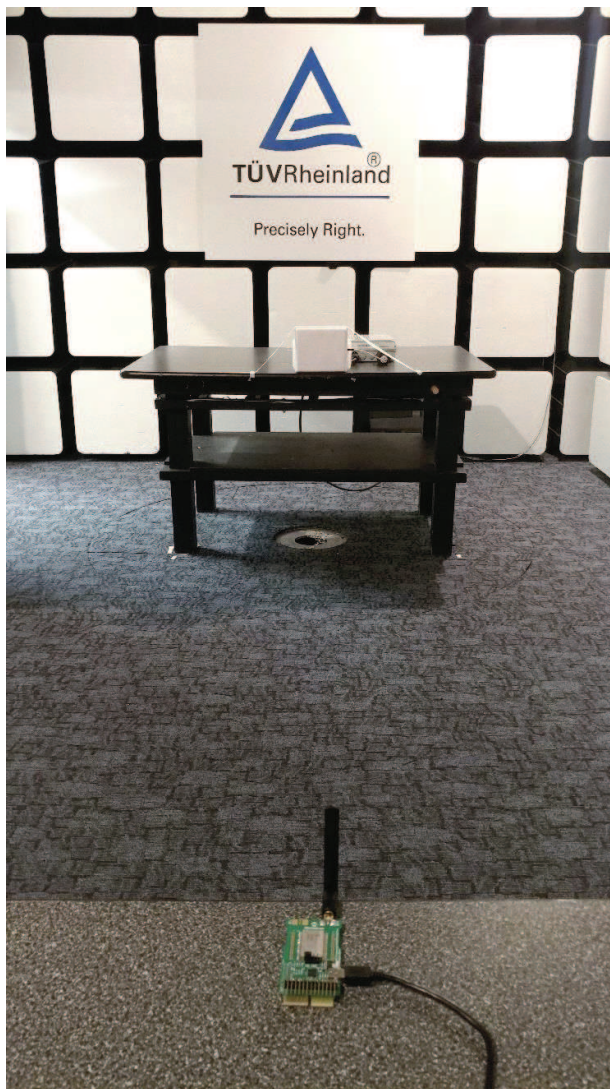


Photo 5: Laboratory Setup View