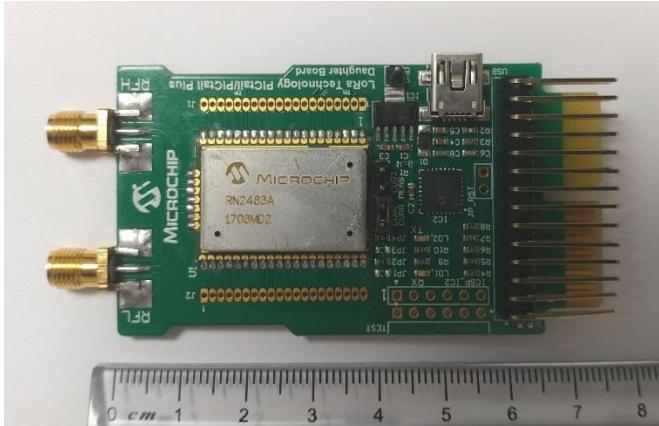


<b>Prüfbericht-Nr.:</b> <i>Test Report No.:</i>	31763075.002	<b>Auftrags-Nr.:</b> <i>Order No.:</i>	152357	Seite 1 von 8 <i>Page 1 of 8</i>	
<b>Kunden Referenz-Nr.:</b> <i>Client Reference No.:</i>	50016473	<b>Auftragsdatum:</b> <i>Order date:</i>	09-06-2017 (mm-dd-yyyy)		
<b>Auftraggeber:</b> <i>Client:</i>	Microchip Technology Inc. 2355 WEST CHANDLER BLVD AZ 85224, CHANDLER U.S.A.	Jonathan Pearce jdp@microchip.com +44 7585 123 576			
<b>Prüfgegenstand:</b> <i>Test item:</i>	Microchip LoRaWAN Module				
<b>Produkt:</b> <i>Product type:</i>	Radio Module (with embedded MCU and LoRaWAN stack) Series: Microchip RN Wireless Module Family				
<b>Bezeichnung / Typ-Nr.:</b> <i>Identification / Type No.:</i>	RN2483A-I/RM104				
<b>Auftrags-Inhalt:</b> <i>Order content:</i>	Test of Conformance to LoRaWAN™ Specification V1.0.1				
<b>Prüfgrundlage:</b> <i>Test specification:</i>	LoRa End Device Certification EU Version 1.2				
<b>Wareneingangsdatum:</b> <i>Date of receipt:</i>	11-29-2017				
<b>Prüfmuster-Nr.:</b> <i>Test sample No.:</i>	1703MD2 (OTAA) 1703MD2 (ABP)				
<b>Prüfzeitraum:</b> <i>Testing period:</i>	11-27-2017 to 11-30-2017				
<b>Ort der Prüfung:</b> <i>Place of testing:</i>	Pleasanton, CA				
<b>Prüflaboratorium:</b> <i>Testing laboratory:</i>	TUV Rheinland of North America, Inc.				
<b>Prüfergebnis:</b> <i>Test results:</i>	PASS				
<b>Geprüft von</b> <i>Tested by:</i>	Bernd Jungbluth	<b>Kontrolliert von</b> <i>Reviewed by:</i>	Adeola Alade		
					
12-07-2017	Bernd Jungbluth/ Senior Test Engineer	12-7-2017	Adeola Alade / Principal Test Engineer		
Datum	Name / Stellung	Unterschrift	Datum	Name / Stellung	Unterschrift
Date (mm-dd-yyyy)	Name / Position	Signature	Date (mm-dd-yyyy)	Name / Position	Signature
<b>Sontiges / Other:</b> -					
<p><b>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.</b></p> <p><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></p>					

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<b>Revisions</b> <i>Revisions</i>			
<b>Revision</b> Revision	<b>Datum</b> Date (mm-dd-yyyy)	<b>Anmerkung</b> Remark	<b>Verfasser</b> Author
0	12-07-2017	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 radio module for LoRaWAN Certification testing.

<b>General information</b>	
Product name:	Microchip LoRaWAN Module: RN2483A-I/RM104
Model:	RN2483A-I/RM104
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:	1.0.4
Firmware Version:	1.0.4
Technical contact person:	Sushma Myneni
Email:	Sushma.Myneni@microchip.com
Phone number:	+1 480 792 4238

<b>LoRaWAN information</b>		
Type of DUT	Module	
LoRa Device Class	A	
Geographical area of operation	Europe	
Operating frequency	868 MHz	Note: The module supports additionally the European Frequency Band 433MHz. This test report concerns only the European 868MHz operation.
Adaptive Data Rate (ADR) supported?	Yes	
Optional data rates supported?	DR6 (SF7BW250); DR7 (FSK50)	
Activation possibilities	Both Over the air and by personalization	
Test According LoRaWAN™ Spec	v1.0.1	
Output Power	+14 dBm, programmable down to -1 dBm	
Number / Type of Antenna(s)	1 (SMA port on Carrier board) Note: Port RFH 868MHZ. Port RFL intended for 433MHz operation.	
Antenna Gain	N/A	
Test sample information	production unit	

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<b>For OTA activation:</b>	
Serial No of Device with OTAA	1703MD2 – (S\N unavailable)
End-device identifier (DevEUI)	7777777777777777
Application identifier (AppEUI)	7777777777777777
Application key (AppKey)	12345678901234567890123456789012
<b>For activation by personalization:</b>	
Serial No of Device with ABP	1703MD2 – (S\N unavailable)
End-device identifier (DevAddr)	77777777
Application identifier (AppSKey)	12345678901234567890123456789012
Application key (NwkSKey)	12345678901234567890123456789012
Default RX2 Window Frequency	869.525MHz
Default RX2 Window Data Rate	DR0 (SF12, 125kHz)
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 Over the Air Activation (OTAA) mode and Activation by Personalization (ABP) mode.  
Package Error Rate test case 15 and 16 only executed in OTAA mode.

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## 2 Test Equipment

<b>Prüfmittel</b> <i>Test equipment</i>	<b>Marke</b> <i>Brand</i>	<b>Version</b> <i>Version</i>
Comprehensive Testing Environment (CTE)	TUV Rheinland (former 4ffcom AG)	CTE - TMF V44.5 CTE - SIG – LoRawan v3.2
Semtech Development Kit IOT868STK1-8 (Semtech Gateway) for EU863-870MHz	Semtech	SX1301-based concentrator reference design =>GW_V3.1.0
Semtech Development Kit IOT868STK1-8 (Semtech Packet Forwarder) for EU863-870MHz Band	Semtech	>= PF_V_2.2.1

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### 3 Summary

<b>Verdicts of functional requirements:</b>	<b>Verdict</b>
Test Mode Activation (Activation by Personalization)	<b>PASS</b>
Test Mode Activation (Over the Air Activation)	<b>PASS</b>
Over The Air Activation	<b>PASS</b>
Test Application Functionality	<b>PASS</b>
Over The Air Activation	<b>PASS</b>
Cryptography	<b>PASS</b>
Downlink Error Rate	<b>PASS</b>
Downlink Window Timing	<b>PASS</b>
Frame Sequence Number	<b>PASS</b>
Device Status Request MAC command	<b>PASS</b>
MAC Commands	<b>PASS</b>
New Channel Request MAC command	<b>PASS</b>
DIChannelReq MAC command	<b>PASS</b>
Confirmed packets	<b>PASS</b>
RX Parameter Setup Request MAC command	<b>PASS</b>
Packet Error Rate RX1	<b>PASS</b>
Packet Error Rate RX2	<b>PASS</b>
RX Timing Setup Request MAC command	<b>PASS</b>
Link ADR Request MAC command	<b>PASS</b>
TxParamSetupReq MAC command	<b>PASS</b>

<b>Supported optional features:</b>	<b>YES / NO</b>
Adaptive Data Rate (ADR)	<b>YES</b>

**Overall Test Result: PASS**

## 4 Test Case verdicts as per Test Specifications

Test results per test case (OTAA):			
Test item	Description	Implementation	Result
EU863-870 2.1	Device Activation	Mandatory	PASS
EU863-870 2.2	Test Application Functionality	Mandatory	PASS
EU863-870 2.3	Over The Air Activation	Mandatory	PASS
EU863-870 2.4	Packet Error Rate RX2 Default DR	Mandatory	PASS
EU863-870 2.5.a	AES encryption	Mandatory	PASS
EU863-870 2.5.b	MIC	Mandatory	PASS
EU863-870 2.6	Downlink window timing	Mandatory	PASS
EU863-870 2.7.a	Uplink sequence number	Mandatory	PASS
EU863-870 2.7.b	Downlink sequence number	Mandatory	PASS
EU863-870 2.8	DevStatusReq MAC command	Mandatory	PASS
EU863-870 2.9	MAC Commands	Mandatory	PASS
EU863-870 2.10.a	Read-only default channels	Mandatory	PASS
EU863-870 2.10.b	Addition and removal of multiple channels	Mandatory	PASS
EU863-870 2.10.c & 10.d	Addition and removal of a single channel	Mandatory	PASS
EU863-870 11.a	Uplink confirmed packets	Mandatory	PASS
EU863-870 11.b	Uplink retransmission	Mandatory	PASS
EU863-870 11.c	Downlink confirmed packets	Mandatory	PASS
EU863-870 11.d	Downlink retransmission	Mandatory	PASS
EU863-870 12	RXParamSetupReq MAC command	Mandatory	PASS
EU863-870 13	RXTimingSetupReq MAC command	Mandatory	PASS
EU863-870 14.a	ADR bit	Mandatory	PASS
EU863-870 14.b	TXPower	Mandatory	PASS
EU863-870 14.c	Required DataRates	Mandatory	PASS
EU863-870 14.d	Optional DataRates	Mandatory	PASS
EU863-870 14.e	ChannelMask	Mandatory	PASS
EU863-870 14.f	Redundancy	Mandatory	PASS
EU863-870 14.g	ADRACKReq bit	Mandatory	PASS
EU863-870 15.h	LinkADRReq commands block	Mandatory	PASS
EU863-870 16	Packet Error Rate RX1	Mandatory	PASS
EU863-870 17	Packet Error Rate RX2	Mandatory	PASS

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**Test results per test case (ABP):**

<b>Test item</b>	<b>Description</b>	<b>Implementation</b>	<b>Result</b>
EU863-870 2.1	Device Activation	Mandatory	<b>PASS</b>
EU863-870 2.2	Test Application Functionality	Mandatory	<b>PASS</b>
EU863-870 2.4	Packet Error Rate RX2 Default DR	Mandatory	<b>PASS</b>
EU863-870 2.5.a	AES encryption	Mandatory	<b>PASS</b>
EU863-870 2.5.b	MIC	Mandatory	<b>PASS</b>
EU863-870 2.6	Downlink window timing	Mandatory	<b>PASS</b>
EU863-870 2.7.a	Uplink sequence number	Mandatory	<b>PASS</b>
EU863-870 2.7.b	Downlink sequence number	Mandatory	<b>PASS</b>
EU863-870 2.8	DevStatusReq MAC command	Mandatory	<b>PASS</b>
EU863-870 2.9	MAC Commands	Mandatory	<b>PASS</b>
EU863-870 2.10.a	Read-only default channels	Mandatory	<b>PASS</b>
EU863-870 2.10.b	Addition and removal of multiple channels	Mandatory	<b>PASS</b>
EU863-870 2.10.c & 10.d	Addition and removal of a single channel	Mandatory	<b>PASS</b>
EU863-870 11.a	Uplink confirmed packets	Mandatory	<b>PASS</b>
EU863-870 11.b	Uplink retransmission	Mandatory	<b>PASS</b>
EU863-870 11.c	Downlink confirmed packets	Mandatory	<b>PASS</b>
EU863-870 11.d	Downlink retransmission	Mandatory	<b>PASS</b>
EU863-870 12	RXPParamSetupReq MAC command	Mandatory	<b>PASS</b>
EU863-870 13	RXTimingSetupReq MAC command	Mandatory	<b>PASS</b>
EU863-870 14.a	ADR bit	Mandatory	<b>PASS</b>
EU863-870 14.b	TXPower	Mandatory	<b>PASS</b>
EU863-870 14.c	Required DataRates	Mandatory	<b>PASS</b>
EU863-870 14.d	Optional DataRates	Mandatory	<b>PASS</b>
EU863-870 14.e	ChannelMask	Mandatory	<b>PASS</b>
EU863-870 14.f	Redundancy	Mandatory	<b>PASS</b>
EU863-870 14.g	ADRACKReq bit	Mandatory	<b>PASS</b>
EU863-870 15.h	LinkADRReq commands block	Mandatory	<b>PASS</b>

**Note:**

**Two preconfigured samples were used to test the ABP and OTAA mode separately.**

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## 5 Test Results

Detailed test results					
Test item	Test Case Name	DataRate/ Timing	Limit	Results	Verdict
EU863-870 2.4	Packet Error Rate RX1	SF12BW125	5%	0.00%	PASS
EU863-870 2.6	Downlink window timing	-20ms	-	-	PASS
		+20ms	-	-	PASS
EU863-870 2.16	Packet Error Rate RX1	SF12BW125	5%	0.00%	PASS
		SF11BW125	5%	0.00%	PASS
		SF9BW125	5%	0.00%	PASS
		SF8BW125	5%	0.00%	PASS
		SF7BW125	5%	0.00%	PASS
		SF7BW250	5%	1.67%	PASS
		FSK	5%	3.33%	PASS
EU863-870 2.17	Packet Error Rate RX2	SF12BW125	5%	0.00%	PASS
		SF11BW125	5%	0.00%	PASS
		SF10BW125	5%	0.00%	PASS
		SF9BW125	5%	0.00%	PASS
		SF8BW125	5%	0.00%	PASS
		SF7BW125	5%	0.00%	PASS
		SF7BW250	5%	3.33%	PASS
		FSK	5%	1.67%	PASS

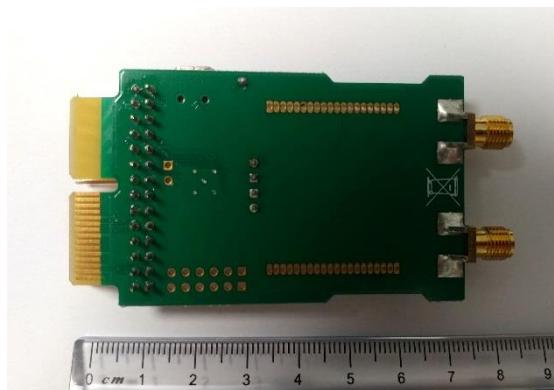
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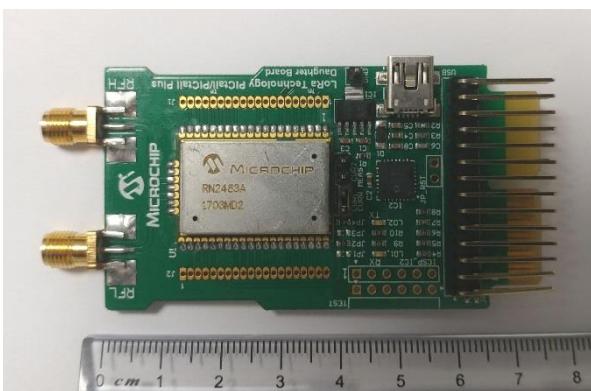
## 6 Photo Documentation



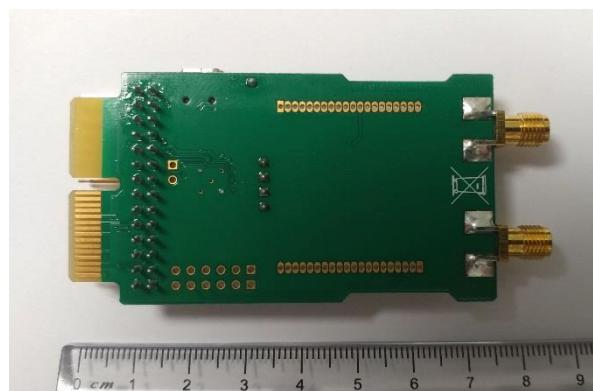
**Photo 1:**  
EUT – Sample 1 – OTAA configuration – PCB



**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

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Photo 5: Laboratory Setup View