



H.B. Compliance Solutions

Intentional Radiator Test Report

For the

Microchip Technology Inc.

Low Power Long Range LoRa Technology Transceiver Module Model RN2903

Tested under

The FCC Rules contained in Title 47 of the CFR, Part 15.247 for
Digitally Transmitting Sequence / Hybrid (Class II Permissive Change)

Prepared for:

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Cert # ATL-0062-E

Engineering Statement: The measurements shown in this report were made in accordance with the procedure indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurement made, the equipment tested is capable of operation in accordance with the requirements of Part 15 of the FCC Rules under normal use and maintenance.



Report Status Sheet

Revision #	Report Date	Reason for Revision
∅	May 18, 2016	Initial Issue
1	May/26/2016	TCB Comments

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EXECUTIVE SUMMARY

1. Testing Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15.247. All tests were conducted using measurement procedure from ANSI C63.10-2013, FCC Public Notice 558074 DTS Guide April 09, 2013 as appropriate.

Test Name	Test Method/Standard	Result	Comments
Radiated Spurious Emissions & Restricted Band	15.247(d), 15.209(a), 15.205	Pass	Addition of PCB Trace Antenna – Class II Permissive Change



EQUIPMENT CONFIGURATION

1. Overview

H.B Compliance Solutions was contracted by Microchip to perform testing on the Low power transceiver LoRa Technology module RN2903 under the purchase order number 60004450

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Microchip Technology, Low power transceiver LoRa Technology module RN2903.

The tests were based on FCC Part 15 Rules. The tests described in this document were formal tests as described with the objective of the testing was to evaluate compliance of the Equipment Under Test (EUT) to the requirements of the aforementioned specifications. Microchip Technology should retain a copy of this document and it should be kept on file for at least five years after the manufacturing of the EUT has been permanently discontinued. The results obtained relate only to the item(s) tested.

Product Name:	Low-Power Long Range LoRa Technology Transceiver Module
Model(s) Tested:	RN2903
FCC ID:	T9JRN2903
Supply Voltage Input:	Primary Power : 3.3 Vdc
Frequency Range:	902.3 - 927.5MHz (Hybrid Mode) 903 – 927.5 (DTS Mode)
No. of Channels:	8 (DTS) 25 or 64 (Hybrid)
Necessary Bandwidth	N/A
Type(s) of Modulation:	FSK
Range of Operation Power:	0.0809W
Emission Designator:	N/A
Channel Spacing(s)	None
Test Item:	Pre-Production
Type of Equipment :	Fixed
Antenna Requirement (§15.203) :	Type of Antenna: PCB Trace Gain of Antenna: +1.3dBi
Environmental Test Conditions:	Temperature: 15-35°C Humidity: 30-60% Barometric Pressure: 860-1060 mbar
Modification to the EUT:	None
Evaluated By:	Staff at Artesyn Embedded & H.B. Compliance Solutions
Test Date(s):	10/21/15

2. Test Facility

Radiated Emission testing was performed at Artesyn Embedded Technologies. This facility is located at 2900 S. Diablo Way, Suite 190, Tempe, AZ 85282. All equipment used in making physical determination is accurate and bears recent traceability to the National Institute of Standards and Technology.

Test facility at Artesyn Embedded Technologies is an A2LA accredited test site. The A2LA certificate number is 2716.01. The scope of accreditation covers the FCC Method - 47 CFR Part 15, ICES-003, CISPR 22, AS/NZS 3548 and VCCI

Conducted testing was performed at H.B. Compliance Solutions. This facility is located at 5005 S. Ash Avenue, Suite # A-10, Tempe AZ 85282.

Radiated Emissions measurements were performed in a semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at Emerson Network Power.

3. Description of Test Sample

The Microchip, RN2903 is a low power long range LoRa Technology transceiver module which provides an easy to use low-power solution for long range wireless data transmission 902-928MHz LoRa Technology modules with an external antenna connector.

4. Equipment Configuration

Ref. ID	Name / Description	Model Number	Serial Number
# 1	Low Power Long Range Transceiver Module	RN2903	N/A

Table 1. Equipment Configuration

5. Support Equipment

All support equipment supplied is listed in the following Support Equipment List.

Ref ID	Name / Description	Manufacturer	Model #	Serial #
# 2	Laptop Computer	IBM	Thinkpad T 41	99-K3967

Table 2. Support Equipment

6. Ports and Cabling Information

Ref ID	Port name on the EUT	Cable Description	Qty.	Length (m)	Shielded? (Y/N)	Termination Box ID & Port ID
# 3	Power	USB	1	2	N	Laptop

Table 3. Ports and Cabling Information

7. Method of Monitoring EUT Operation

A test receiver will be used to monitor the data transmission from the EUT.

8. Mode of Operation

The EUT will be configured to transmit at maximum power level. The modules were programmed with special test software that allowed to cycle through test modes. Test mode was provided to select the lower, middle and upper band of the. This software allowed the selection of the channel on the transmitter from three frequencies modulated and the other three in CW mode. These settings were created for testing purpose only.

Description of Test Modes

To investigate the maximum EMC emission characteristics generated from the EUT, the test system was pre-tested for the following EUT operation mode or test configuration mode which can produce the highest EMI emission level. Each of these EUT configuration mode(s) mentioned below was evaluated respectively. Only the highest test mode for each test has been reported.

Spreading Factor (S.F)	Payload
7	158
8	85
9	40
10	14

9. Modifications

9.1 Modifications to EUT

No modifications were made to the EUT

9.2 Modifications to Test Standard

No Modifications were made to the test standard.

10. Disposition of EUT

The test sample including all support equipment submitted to H.B Compliance Solutions for testing will be returned to Microchip Technology upon completion of testing & certification

Criteria for Intentional Radiators

1. Radiated Spurious Emissions and Restricted Band

Test Requirement(s):	§15.247(d), 15.209(a), 15.205	Test Engineer(s):	Keith T.
Test Results:	Pass	Test Date(s):	10/21/15

Test Procedures: As required by 47 CFR 15.247, Radiated spurious measurements were made in accordance with the procedures of the ANSI C63.10-2013.

The EUT was placed on a non-reflective table inside a 3 meter semi-anechoic room. The EUT was set on continuous transmit.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The frequency range up to the 10th harmonic was investigated.

To get a maximum emission level from the EUT, the EUT was rotated throughout the X-axis, Y-axis and Z-axis. Worst case is X-axis

Detector Setting	Resolution Bandwidth	Video Bandwidth	Span
Peak	1MHz	1MHz	As necessary
Average	1MHz	10Hz	0 Hz

Table 6. Analyzer Settings

Frequency (MHz)	Peak Amplitude (dbuV/m)	Peak Limit (dBuV/m)	Average Amplitude (dBuV/m)	Average Limit (dBuV/m)
1804.6	41.7	115.5	-	95.5
2706.9	38.72	54.0	-	74.0

Table 7 - Spurious Radiated Emission Data – Low Band –Chip Antenna

Frequency (MHz)	Peak Amplitude (dbuV/m)	Peak Limit (dBuV/m)	Average Amplitude (dBuV/m)	Average Limit (dBuV/m)
1832	41.36	115.5	-	95.5
2744.7	39.04	54.0	-	74.0

Table 8– Spurious Radiated Emission Data – Mid Band - Chip Antenna

Frequency (MHz)	Peak Amplitude (dbuV/m)	Peak Limit (dBuV/m)	Average Amplitude (dBuV/m)	Average Limit (dBuV/m)
1855	41.02	115.5	-	95.5
2782.5	38.33	54.0	-	74.0

Table 9– Spurious Radiated Emission Data – High Band - Chip Antenna

NOTE 1: There were no detectable emissions found

Emission marked as “N.F” is system noise floor and no detectable emission were found from the EUT.

I. Test Equipment

Equipment	Manufacturer	Model	Serial #	Last Cal Date	Cal Due Date
Spectrum Analyzer	Agilent	E4402B	US41192757	Jan/27/15	Jan/27/16
Temperature Meter	Control Company	6066N53	140536623	Aug/08/14	Aug/08/16
Spectrum Analyzer	Hewlett Packard	8563E	3821A09316	Oct/03/15	Oct/03/16
High Pass Filter	Mini-Circuits	VHF-3100+	1023	Verified	
High Pass Filter	Mini-Circuits	VHF-1320+	1034	Verified	
Signal Generator	R&S	SMY02	1062.5502.12	NCR	None
Attenuator 10dB	Huber+Suhner	6810.17.A	747300	Verified	
Horn Antenna	Com Power	AHA-118	711150	Feb/10/15	Feb/10/16
Bilog Antena	Chase	CBL6140	1040	Nov/09/14	Nov/09/15

Table 12 – Test Equipment List

***Statement of Traceability:** Test equipment is maintained and calibrated on a regular basis. All calibrations have been performed by a 17025 accredited test facility, traceable to National Institute of Standards and Technology (NIST)

END OF TEST REPORT