

Limited Test report

372945 - 1TRFEMC

Date of issue: May 13, 2019

Applicant:

MicroRidge Systems, Inc.

Product:

RF Module

Model:

MICRO-RM2.4

Model variant:

N/A

Specifications:

◆ ETSI EN 300 328 V2.1.1 (2016-11) - partial

Wideband transmission systems; Data transmission equipment operating in the 2.4 GHz ISM band and using wide band modulation techniques;

Harmonized Standard covering essential requirements under article 3.2 of Directive 2014/53/EU

Test location

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Website	www.nemko.com
FCC Site Number	Test Firm Registration Number: 392943 Designation Number: US5058
ISED Test Site	FCC: US5058; IC: 2040B

Tested by	Andres Martinez
Reviewed by	Juan M. Gonzalez
Review date	May 13, 2019
Reviewer signature	

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

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Table of contents

Table of contents	3
Section 1. Report summary	4
1.1 Applicant and manufacturer	4
1.2 Test specifications	4
1.3 Statement of compliance	4
1.4 Exclusions	4
1.5 Test report revision history	4
Section 2. Summary of test results	5
2.1 ETSI EN 300 328 V2.1.1 (2016-11) test results	5
Section 3. Equipment under test (EUT) details	6
3.1 Sample information	6
3.2 EUT information	6
3.3 Technical information	6
3.4 Receiver category	6
3.5 Modulation type	6
3.6 Adaptivity type	6
3.7 Product description and theory of operation	7
3.8 EUT exercise details	7
3.9 EUT setup diagram	7
3.10 EUT sub assemblies and support equipment	8
Section 4. Engineering considerations	9
4.1 Modifications incorporated in the EUT	9
4.2 Technical judgment	9
4.3 Deviations from laboratory tests procedures	9
Section 5. Test conditions	10
5.1 Atmospheric conditions	10
5.2 Power supply range	10
5.3 Regulated lead-acid battery power sources	10
5.4 Other power sources	10
Section 6. Measurement uncertainty	11
6.1 Uncertainty of measurement	11
Section 7. Test equipment	12
7.1 Test equipment list	12
Section 8. Testing data	13
8.1 Clause 4.3.2.11 Receiver blocking	13

Section 1. Report summary

1.1 Applicant and manufacturer

Company name	MicroRidge Systems, Inc
Address	56888 Enterprise Dr. P.O. Box 3249
City	Sunriver
Province/State	OR
Postal/Zip code	97707-0249
Country	United States

1.2 Test specifications

ETSI EN 300 328 V2.1.1 (2016-11)	Wideband transmission systems; Data transmission equipment operating in the 2.4 GHz ISM band and using wide band modulation techniques; Harmonized Standard covering essential requirements under article 3.2 of Directive 2014/53/EU
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1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard or as per detailed in the section 1.4 Exclusions below. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.4 Exclusions

Only Receiver Blocking test was performed as per test plan/quote

1.5 Test report revision history

Revision #	Details of changes made to test report
1TRFEMC	Original report issued

Section 2. Summary of test results

2.1 ETSI EN 300 328 V2.1.1 (2016-11) test results

Clause	Test description	Verdict
4.3.1	Technical requirements for Frequency Hopping equipment	Not applicable
4.3.1.12	Receiver Blocking	Not applicable
4.3.2	Technical requirements for other types of Wide Band modulation	Applicable
4.3.2.11	Receiver Blocking	Pass

Notes: None.

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	April 5, 2019
Nemko sample ID number	372945

3.2 EUT information

Product name	RF Module
Model	MICRO-RM 2.4
Serial number	1

3.3 Technical information

Operating band	ISM band.
Operating frequency range	2.4 GHz
Channel bandwidth	N/A
EUT power requirements	Power supply voltage of 1.8 to 3.6 VDC

3.4 Receiver category

Receiver category 1	☐ Adaptive equipment with a maximum RF output power greater than 10 dBm e.i.r.p. shall be considered as receiver category 1 equipment.
Receiver category 2	☒ Non-adaptive equipment with a Medium Utilization (MU) factor greater than 1 % and less than or equal to 10 % or adaptive equipment with a maximum RF output power of 10 dBm e.i.r.p. shall be considered as receiver category 2 equipment.
Receiver category 3	☐ Non-adaptive equipment with a maximum Medium Utilization (MU) factor of 1 % or adaptive equipment with a maximum RF output power of 0 dBm e.i.r.p. shall be considered as receiver category 3 equipment.

3.5 Modulation type

- ☐ Equipment using Frequency Hopping Spread Spectrum (FHSS) modulation
- ☒ Equipment using other types of wide band modulation (e.g. DSSS, OFDM, etc.)

3.6 Adaptivity type

- ☒ The EUT is a non-adaptive equipment
- ☐ The EUT is an adaptive equipment:
- ☐ Adaptive equipment using LBT based DAA
 - ☐ The EUT is Frame Based equipment
 - ☐ The EUT is Load Based equipment
 - ☐ Adaptive equipment using other forms of DAA (non-LBT based)

3.7 Product description and theory of operation

The MICRO-RM2.4 Radio Module from MicroRidge Systems is a small wireless module that uses the new Atmel ATmega2564RFR2 microcontroller. The ATmega2564RFR2 is a low-powered CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture combined with a high data rate transceiver for the 2.4 GHz ISM (industrial, scientific and medical) band.

3.8 EUT exercise details

EUT was set to receive mode while transmitting data using a Mitutoyo Caliper with a Mini Mobile Module attached.

RF channels (Channel 11 @ 2404MHz and Channel 25 @ 2480MHz) were set using a support laptop, while measuring signal strength using their own software.

3.9 EUT setup diagram

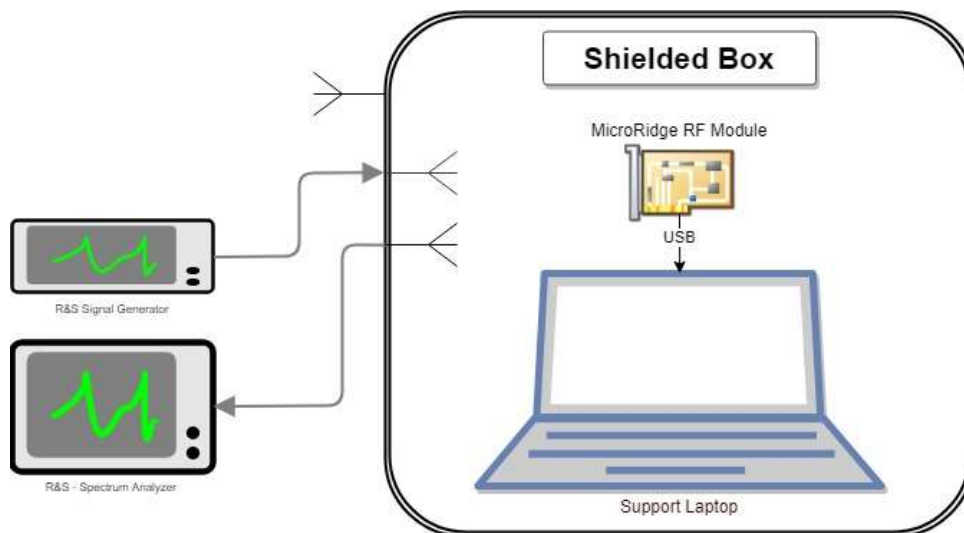


Figure 3.9-1: Setup diagram - Rx Blocking



Figure 3.9-2: Setup picture - Rx Blocking

3.10 EUT sub assemblies and support equipment

Table 3.10-1: EUT sub assemblies

Description	Brand name	Model/Part number	Serial number
MICRO-RM2.4 Radio Module Module	MicroRidge	MICRO-RM2.4	FCC ID: 2ACNQRM2IMEI: 351785-00-200557-8
Caliper	Mitutoyo	Absolute	N/A
Mini Mobile Module	MicroRidge	N/A	N/A

Table 3.10-2: Support equipment

Description	Brand name	Model/Part number	Serial number
Support Laptop	Dell	Vostro 3700	N/A

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages, for which the equipment was designed.

The frequency of the test power source corresponding to the ac mains shall be between 49 Hz and 51 Hz.

5.3 Regulated lead-acid battery power sources

When the radio equipment is intended for operation from the usual types of regulated lead-acid battery power source the normal test voltage shall be 1.1 multiplied by the nominal voltage of the battery (6 V, 12 V, etc.).

5.4 Other power sources

For operation from other power sources or types of battery (primary or secondary), the normal test voltage shall be that declared by the equipment manufacturer and where appropriate agreed by the accredited test laboratory. Such values shall be recorded and stated.

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

The following referenced documents are used as guidance for measurement uncertainty reasonable estimations with regards to previous experience and validation of data:

1. TIA-603-D Land Mobile FM or PM Communications Equipment, Measurement and Performance Standards.
2. UKAS LAB 34: 2003: The Expression of Uncertainty in EMC Testing: United Kingdom Accreditation Service.
3. ETSI TR 100 028-1 v1.4.1 (2001-12): Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part1".
4. ETSI TR 100 028-2 v 1.4.1(2001-12): Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part2".

Nemko USA, Inc. follows these test methods in order to satisfy ISO/IEC 17025 requirements for estimation of uncertainty of measurement for wireless products.

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of $K = 2$ with 95% certainty.

Test name	Measurement uncertainty, dB
All antenna port measurements / including OBW	0.55
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78
AC power line conducted emissions	1.38
Supply Voltages	0.05%
Time	2.09%

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: Rx blocking equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Spectrum Analyzer	Rohde & Schwarz	FSV40	E1120	1 yr.	7-27-2019
Signal Generator	Rohde & Schwarz	SMB 100A	E1128	2 yr.	4-10-2020
Variable Attenuator	ARS	50SDV100-967	N/A	N/A	Verified with FSV40
Power Splitter	Mini-Circuits	ZFRSC-123-S+	N/A	N/A	Verified with FSV40
Bi-directional coaxial coupler	Narda	3022	N/A	N/A	Verified with FSV40
20 dB attenuator	Mini-Circuits	VAT-30W2+	N/A	N/A	Verified with FSV40

Notes: None

Section 8. Testing data

8.1 Clause 4.3.2.11 Receiver blocking

8.1.1 Definitions and limits

Definition	Receiver blocking is a measure of the ability of the equipment to receive a wanted signal on its operating channel without exceeding a given degradation in the presence of an unwanted signal (blocking signal) at frequencies other than those of the operating band.
Clause 4.3.2.11.4 limit	While maintaining the minimum performance criteria the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category provided in the following tables.

Table 8.1-1: Receiver Blocking parameters for Receiver Category 1 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency, (MHz)	Blocking signal power ² , dBm	Type of blocking signal
Pmin + 6 dB	2380	-53	CW
	2503.5		
Pmin + 6 dB	2300	-47	CW
	2330		
Pmin + 6 dB	2360	-47	CW
	2523.5		
	2553.5		
	2583.5		
	2613.5		
	2643.5		
	2673.5		

Notes: ¹Pmin is the minimum level of wanted signal (in dBm) required to meet the minimum performance criteria in the absence of any blocking signal.

²The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.

Table 8.1-2: Receiver Blocking parameters for Receiver Category 2 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency, (MHz)	Blocking signal power ² , dBm	Type of blocking signal
Pmin + 6 dB	2380	-57	CW
	2503.5		
Pmin + 6 dB	2300	-47	CW
	2583.5		

Notes: ¹Pmin is the minimum level of wanted signal (in dBm) required to meet the minimum performance criteria in the absence of any blocking signal.

²The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.

Table 8.1-3: Receiver Blocking parameters for Receiver Category 3 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency, (MHz)	Blocking signal power ² , dBm	Type of blocking signal
Pmin + 12 dB	2380	-57	CW
	2503.5		
Pmin + 12 dB	2300	-47	CW
	2583.5		

Notes: ¹Pmin is the minimum level of wanted signal (in dBm) required to meet the minimum performance criteria in the absence of any blocking signal.

²The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.

8.1.2 Test summary

Test date	May 13, 2019	Temperature	23 °C
Test engineer	Andres Martinez	Air pressure	1001 mbar
Verdict	Pass	Relative humidity	46 %

8.1.3 Observations, settings and special notes

This is a Radiated antenna port test. EUT was tested on low and high channel.
Low Channel: 2405MHz (Channel 11)
High Channel: 2480Mhz (Channel 25)
TX output power from -17 dBm to 3.5 dBm
EUT is Receiver Category 2.

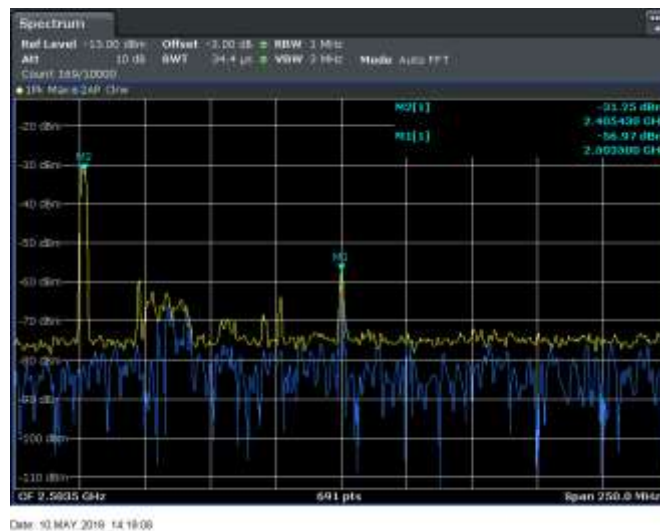
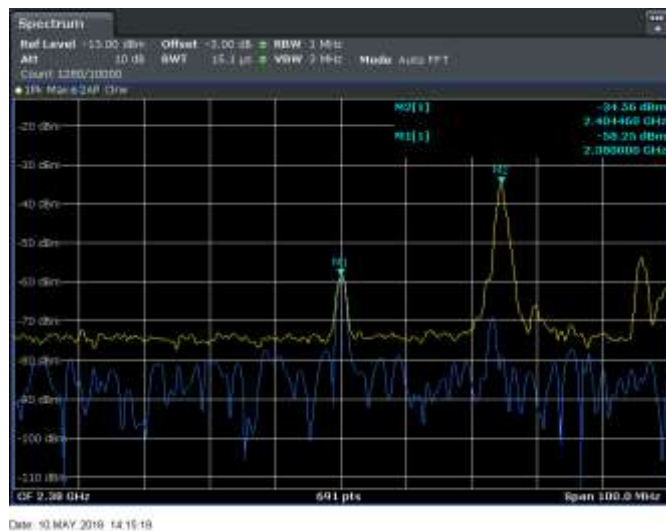
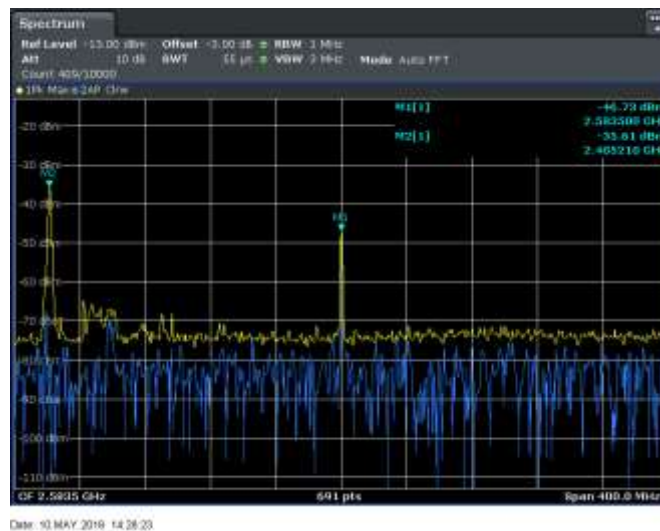
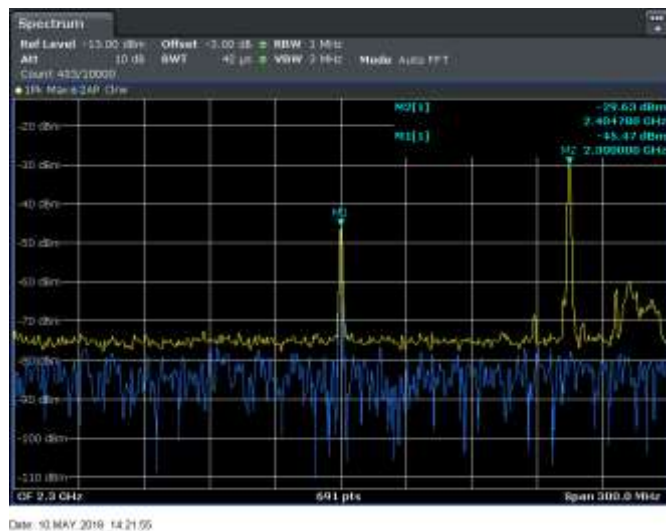
8.1.4 Test data

Table 8.1-4: Receiver Blocking test results for Receiver Category 2

Blocking signal frequency, (MHz)	Blocking signal power, dBm	Verdict*
2300.0	-47	Pass
2380.0	-57	Pass
2503.5	-57	Pass
2583.5	-47	Pass

Note: * No degradation of performance was observed during blocking signal application. Test performed at low and high channel.

See below plots for signals verification.



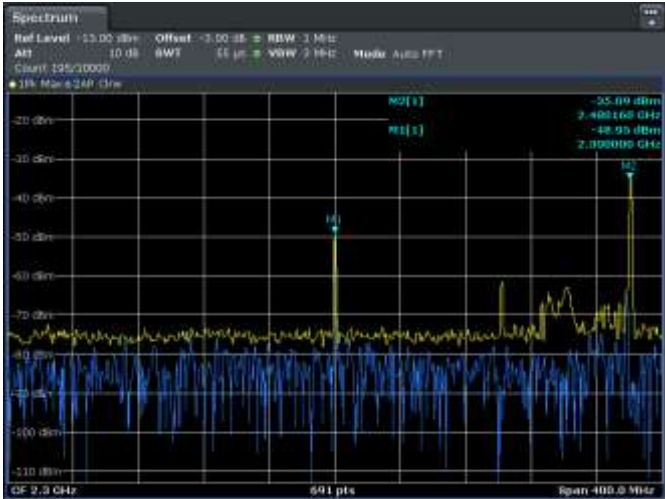


Figure 8.1-5: High Channel with 2300MHz @ -47dBm

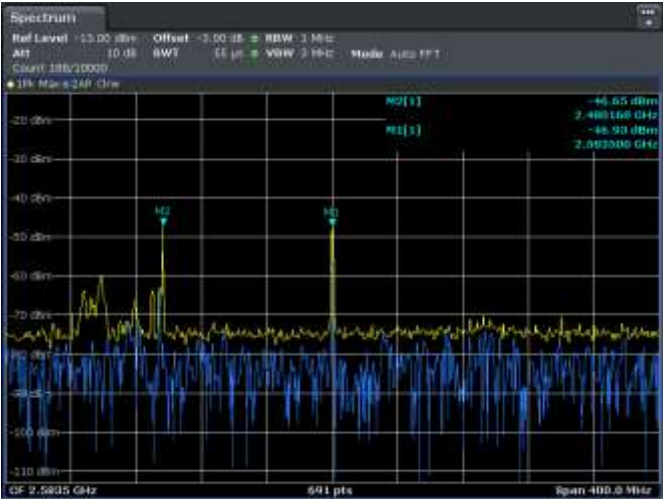


Figure 8.1-6: High Channel with 2583.5MHz @ -47dBm

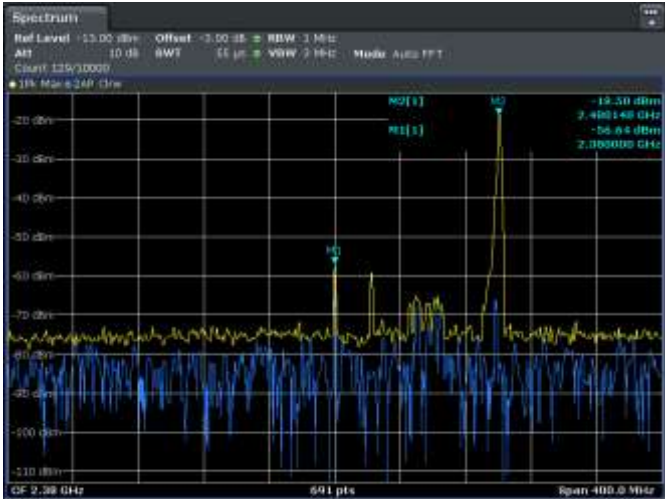


Figure 8.1-7: High Channel with 2380MHz @ -57dBm

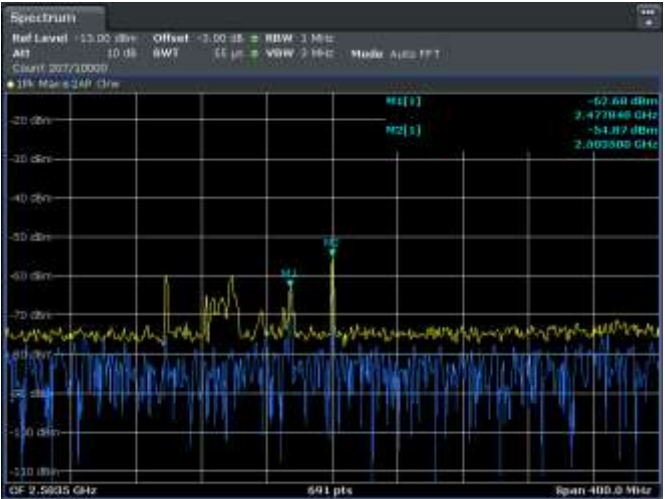


Figure 8.1-8: High Channel with 2503.5MHz @ -57dBm

Thank you for choosing

