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CERTIFICATION TEST REPORT

Equipment Under Test (EUT): RF MODULE
Model: JN5139M4

Applicant: PROCURO INC.
10675 SORRENTO VALLEY RD. SUITE 101
San Diego, CA 92121

FCC ID: Y6Z5139M4

In Accordance With: FCC Part 15 Subpart C, 15.247

Tested By: Nemko USA Inc.
11696 Sorrento Valley Road, Suite F
San Diego, CA 92121

Authorized By: 
Alan Laudani, EMC/RF Test Engineer

Report Number: 2011 02165761 FCC
Project Number: 1024472
Nex Number: 165761
Date: February 10, 2011
Total Number of Pages: 28



Section1: Summary of Test Results

All measurements are traceable to national standards. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15; Subpart C and IC RSS-210. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC and IC.

The assessment summary is as follows:

Apparatus Assessed:	RF Module
Model:	JN5139M4
Specification:	FCC Part 15 Subpart C, 15.247
Date Received in Laboratory:	January 28, 2011
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None



1.1 Report Release History

REVISION	DATE	COMMENTS
-	February 10, 2011	Prepared By: Alan Laudani
-	February 10, 2011	Initial Release: Alan Laudani

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.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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TESTED BY:  Date: February 10, 2011
Alan Laudani, EMC Test Engineer

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Section 2: Equipment Under Test

2.1 Product Identification

The Equipment Under Test was identified as follows:

Procuco Inc. JN5139M4 RF Module

2.2 Theory of Operation

The JN5139M4 is a RF Module. It is based on the Zigbee chip and protocol. It is programmed for a maximum of -3 dBm with channels from 2405 MHz to 2480 MHz.

The EUT's performance during test was evaluated against the performance criterion specified by applicable test standards. Performance results are detailed in the test results section of this report.

2.3 Technical Specifications of the EUT

Manufacturer:	Procuco Inc.
Operating Frequency:	2405.0 to -2480.0 MHz in the 2400-2483.5 MHz Band
Rated Power:	-3.8 dBm or 0.418 mW
Modulation:	Zigbee
Antenna Connector:	SMA epoxied within enclosure Loctite Threadlocker 220 Med. Strength, blue.
Power Source:	2 AA batteries for test, may be powered from circuitry.



Section 3: Test Conditions

3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.247

Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz and 24.0-24.25 GHz bands.

3.2 Deviations From Laboratory Test Procedures

No deviations from Laboratory Test Procedure

3.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	16-22°C
Humidity range	39-45%
Pressure range	102.0 – 102.3 kPa
Power supply range	48VDC nominal

3.4 Test Equipment

Nemko ID	Device	Manufacturer	Model	Serial Number	Cal Date	Cal Due Date
N97	DC power supply	Kikusui	--	--	NCR	NCR
813	Multimeter	Fluke	111	78130060	9/16/2009	9/16/2011
110	Antenna, LPA	EMCO	LPA-25	1217	1/10/2009	2/10/2011
114	Antenna, Bicon	EMCO	3104	2997	3/5/2010	3/5/2012
317	Preamplifier	HP	8449A	2749A00167	5/7/2010	5/7/2011
877	Antenna, Dbl Ridge Horn	AH Systems	SAS-571	688	8/16/2010	8/16/2012
835	Spectrum Analyzer	Rohde & Schwarz	RHDFSEK	829058/005	7/12/2010	7/12/2011
898	EMI Receiver & filter set	HP	8546A	3625A00348	6/22/2010	6/22/2011
899	Filter Section	HP	85460A	3448A00288	6/22/2010	6/22/2011

Section 4: Observations

4.1 Modifications Performed During Assessment

No modifications were performed during assessment.

4.2 Record Of Technical Judgements

No technical judgements were made during the assessment.

4.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

4.4 Test Deleted

No Tests were deleted from this assessment.

4.5 Additional Observations

There were no additional observations made during this assessment.

Section 5: Results Summary

This section contains the following:

FCC Part 15 Subpart C:

The column headed "Required" indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N No: not applicable / not relevant

Y Yes: Mandatory i.e. the apparatus shall conform to these tests.

N/T Not Tested, mandatory but not assessed. (See section 4.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

5.1 Test Results

Part 15C	Test Description	Required	Result
15.215(c)	20% & 99% Bandwidth	Y	Pass
15.257(a)(2)	Maximum peak output power	Y	Pass
15.247(d) 15.205	Radiated Emissions within Restricted Bands	Y	Pass
15.247(d)	Out-of-band Emissions	Y	Pass
15.247(a)(2)	Minimum 6dB RF Bandwidth	Y	Pass
15.247(e)	Power Spectral Density	Y	Pass
15.207(a)	Transmitter and Receiver AC Power Lines Conducted Emission Limit	Y	Pass
	Receiver Spurious Emissions	Y	Pass

Appendix A: Test Results

Section 15.207(a) – Power Line Conducted Emissions

15.207(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

Test Conditions:

Sample Number:	JN5139M4	Temperature:	
Date:		Humidity:	
Modification State:		Tester:	Alan Laudani
		Laboratory:	

Test Results: EUT complies,

Conducted Emissions does not apply to mobile use of transmitters.

Additional Observations:

**Section 15.215(c) – 20 dB / 99% Bandwidth**

(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

RSS Gen 4.6 When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured. The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual. The trace data points are recovered and directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

Test Conditions:

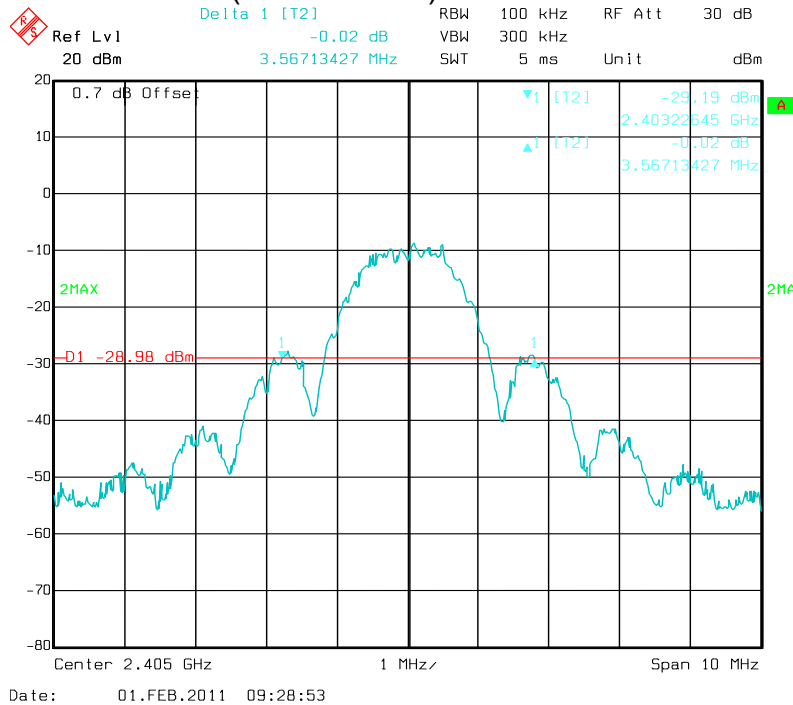
Sample Number:	JN5139M4	Temperature:	24°C
Date:		Humidity:	35%
Modification State:	Low , Mid and High Channel	Tester:	Alan Laudani
		Laboratory:	Nemko

Test Results: See attached plots.**Additional Observations:**

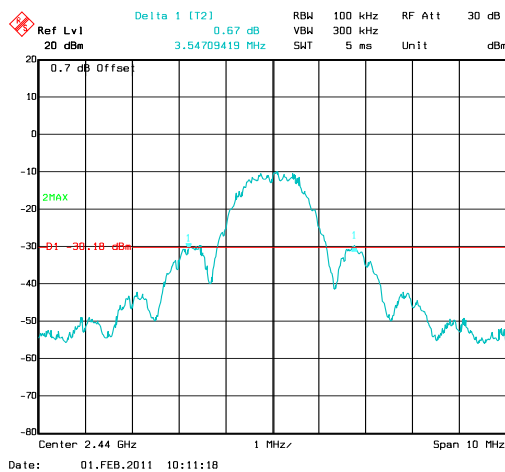
- Span is wide enough to capture the channel transmission
- RBW is 1% of the span
- VBW is 3X RBW
- Sweep is auto
- Detector is Peak
- Trace is Max Hold
- Tested with fresh batteries
- Used 99% bandwidth of Spectrum Analyzer's programmed functions.
- A peak output max hold reading was taken, a display line was drawn 20 dB lower than peak level. The 20 dB bandwidth was determined from where the channel output spectrum intersected the display line.
- Observed 20 dB BW is 3.56 MHz (high channel).
- Observed 20 dB BW is 3.53 MHz (high channel).
- $2405 \text{ MHz} - 5.56/2 \text{ MHz} = 2403.22 \text{ MHz}$ (within the frequency band)
- $2480 \text{ MHz} + 3.53/2 \text{ MHz} = 2481.76 \text{ MHz}$ (within the frequency band)

20 dB Band Width

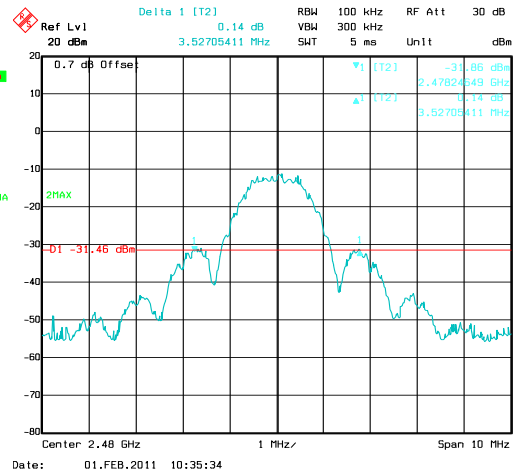
(Low Channel) 3.56 MHz



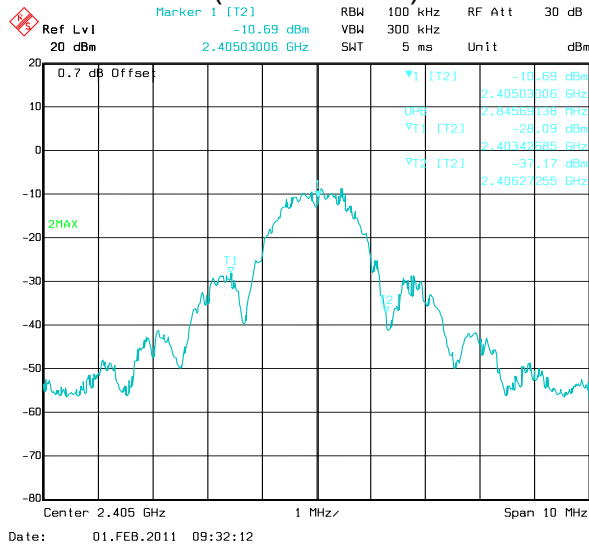
(Mid Channel) 3.54 MHz



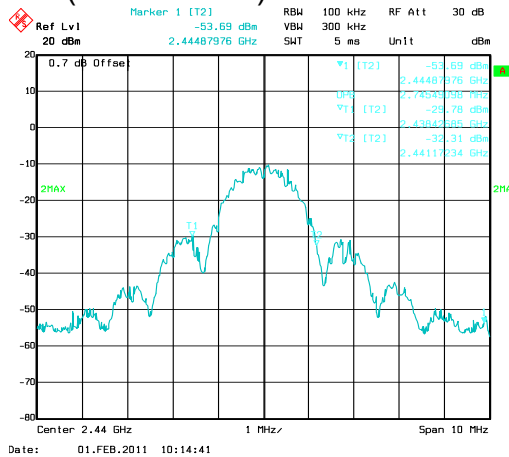
(High Channel) 3.53 MHz



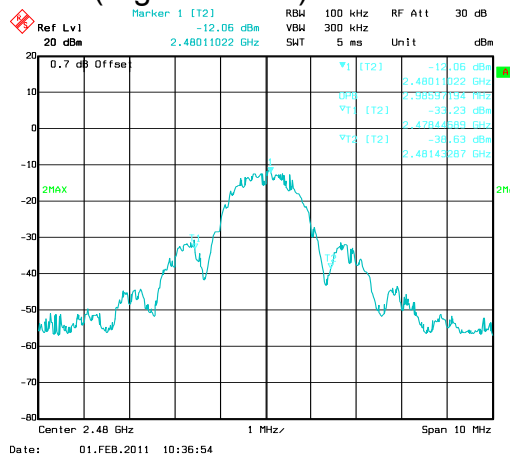
99% band width 2.84 MHz
(Low Channel)



(Mid Channel) 2.74 MHz



(High Channel) 2.98 MHz



Section 15.247(a)(2) – Minimum 6dB RF Bandwidth

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

RSS 210 8.2(a) The minimum -6 dB bandwidth shall be at least 500 kHz.

Test Conditions:

Sample Number:	JN5139M4	Temperature:	24°C
Date:	2-1-2011	Humidity:	35 %
Modification State:	Low ,Mid and High Channel	Tester:	Alan Laudani
		Laboratory:	Nemko

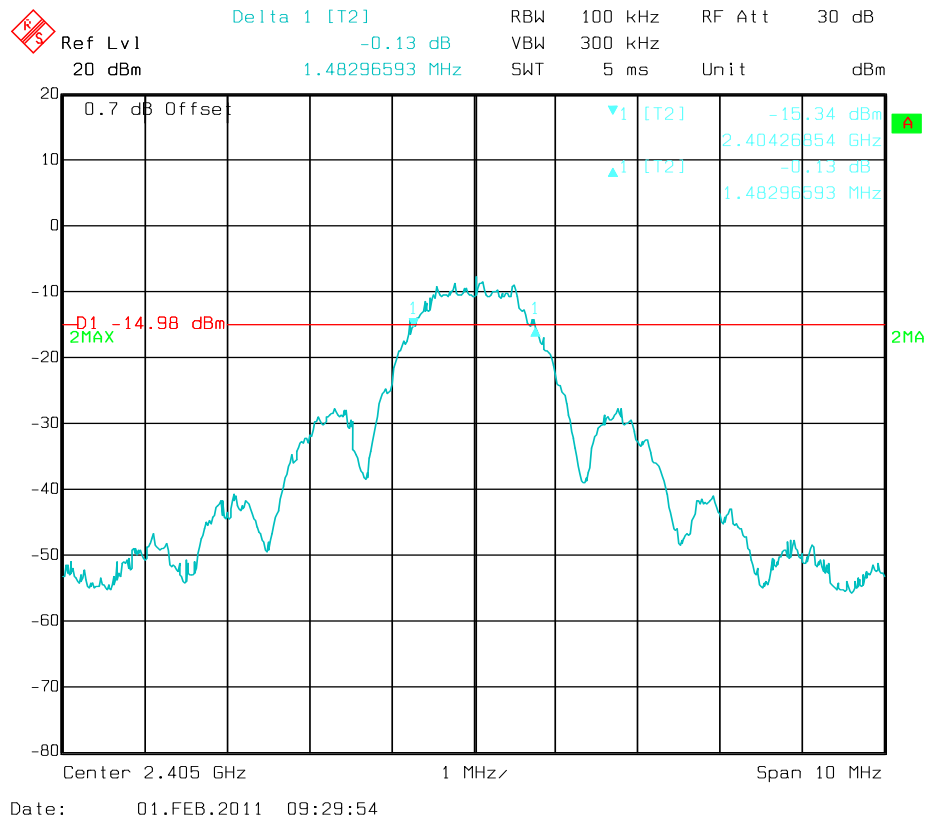
Test Results: EUT complies, See attached plots.

Additional Observations:

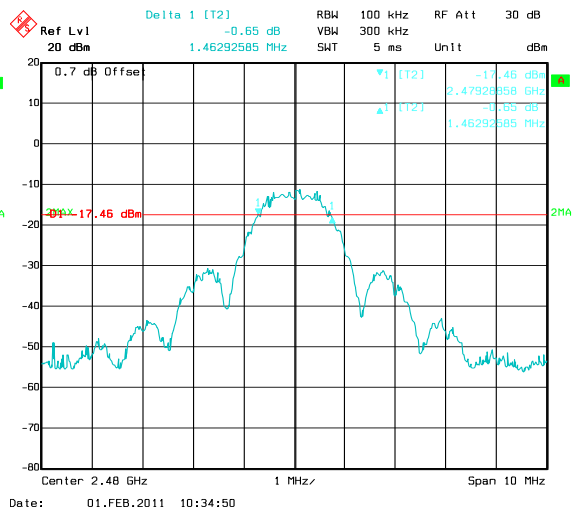
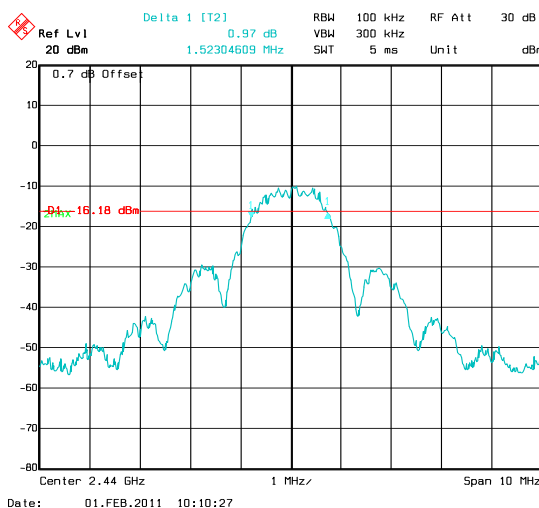
- This is a conducted test
- RBW is set to 100kHz
- VBW is 3X RBW
- Sweep is auto
- Detector is Peak
- Trace is Max Hold
- Tested with fresh batteries
- For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was plotted; a DISPLAY line was drawn 6 dB lower than PEAK level. The 6 dB bandwidth was determined from where the channel output spectrum intersected the display line.

Channel Range	Observed 6 dB bandwidth
Low (2405 MHz)	1.48 MHz
Mid (2440 MHz)	1.52 MHz
High (2480 MHz)	1.46 MHz

(Low Channel) Observed 6 dB Bandwidth is **1.48 MHz**



(Mid Channel) 6 dB Bandwidth is **1.52 MHz** (High Channel) 6 dB Bandwidth is **1.46 MHz**



Section 15.247(b)(1) – Peak Output Power

(3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

RSS 210 8.4(4) For systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz, the maximum peak conducted output power shall not exceed 1 W.

Test Conditions:

Sample Number:	JN5139M4	Temperature:	24°C
Date:	2-1-2011	Humidity:	35 %
Modification State:	Low ,Mid and High Channel	Tester:	Alan Laudani
		Laboratory:	Nemko

Test Results:

See attached plots.

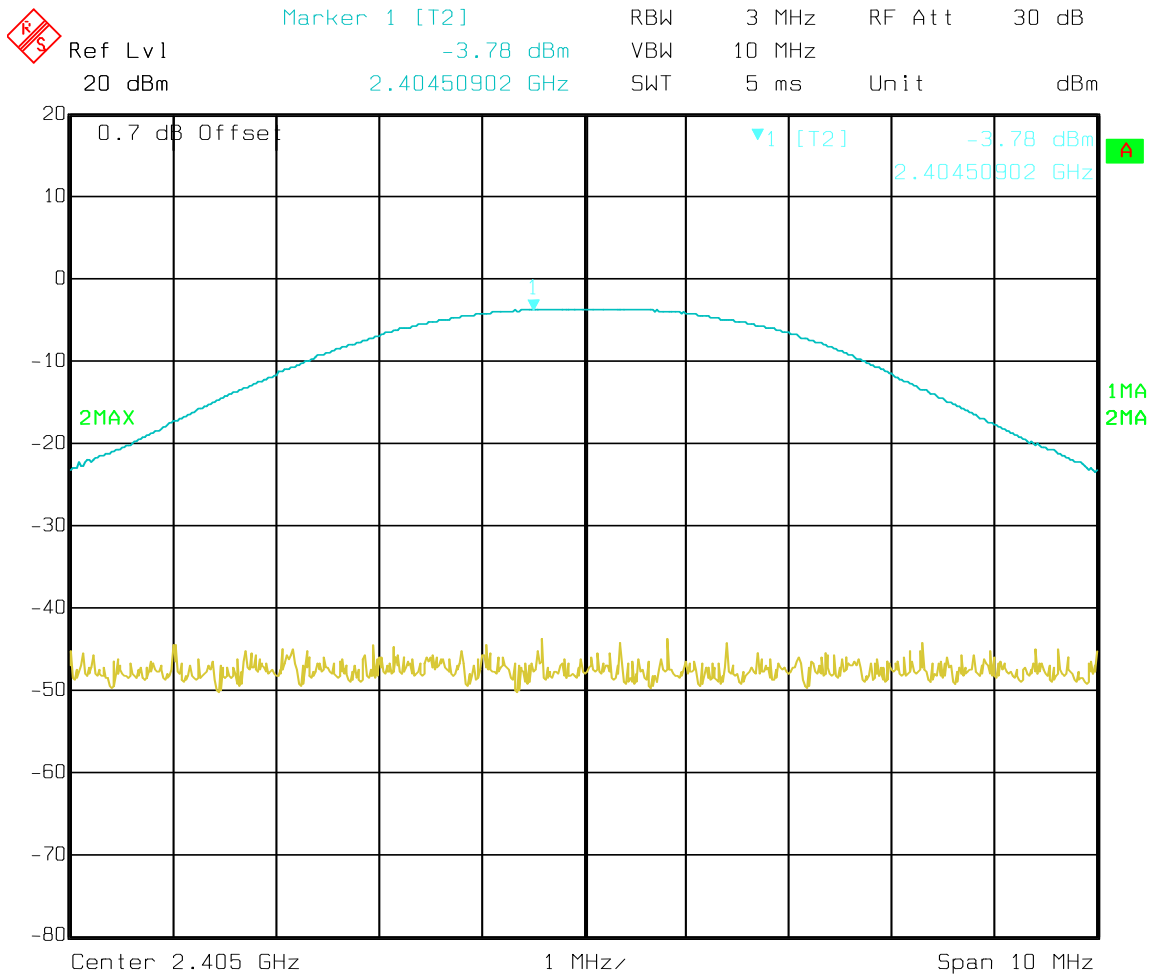
Additional Observations:

- This is a conducted test. A 0.7dB offset was added for the cable used.
- Input voltage to the EUT is varied from 3.3 VDC by +/-15%, however no variation in results observed. Otherwise, tested with fresh batteries.
- RBW = 3 MHz, greater than the 99% bandwidth; VBW = 10 MHz.

Channel Range	Peak Power Output (dBm)
Low (2405 MHz)	-3.78
Mid (2440 MHz)	-5.58
High (2480 MHz)	-6.74

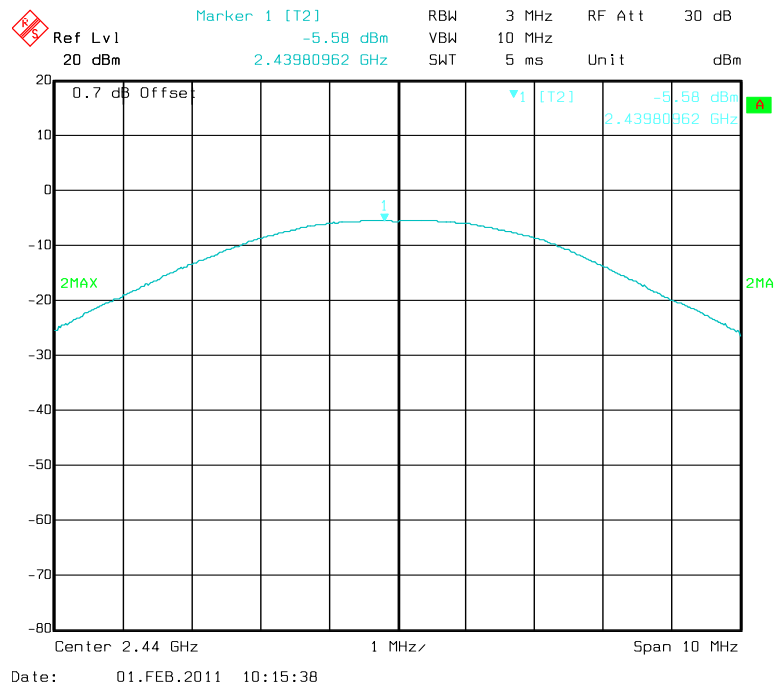
Peak Output Power = -3.78 dBm or **0.418 mW**

Test Plots:

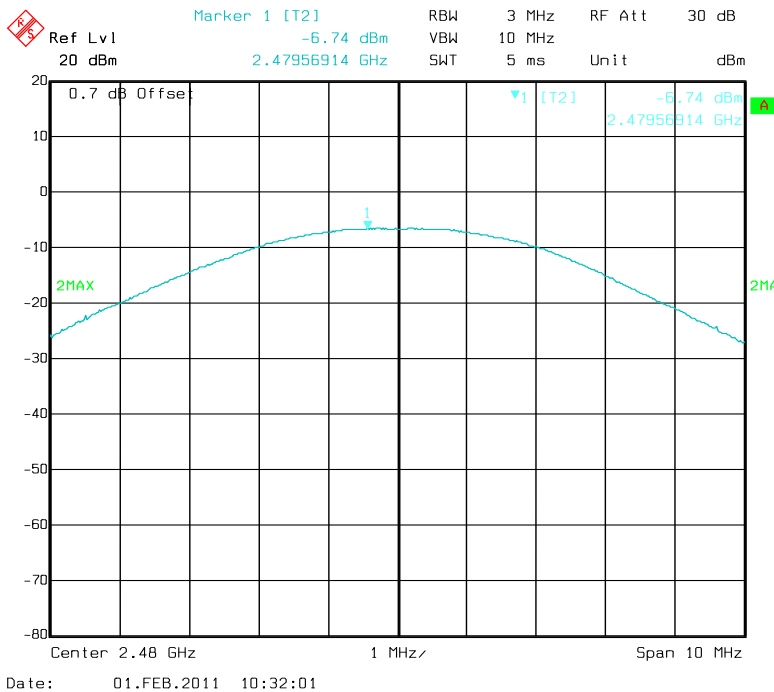


Date: 01.FEB.2011 09:25:00

Low Channel



Mid Channel



High Channel

**Section 15.247(d) – Band-edge Compliance of RF Conducted Emissions**

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

RSS-210 2.2 Category I license-exempt equipment is required to comply with the provisions in RSS-Gen with respect to emissions falling within restricted frequency bands. These restricted frequency bands are listed in RSS-Gen. (RSS Gen 7.2.2, 2 table 3)

Test Conditions:

Sample Number:	JN5139M4	Temperature:	23°C
Date:	2-1-2011	Humidity:	43 %
Modification State:	Low and High Channel	Tester:	Alan Laudani
		Laboratory:	Nemko

Test Results:

See attached plots.

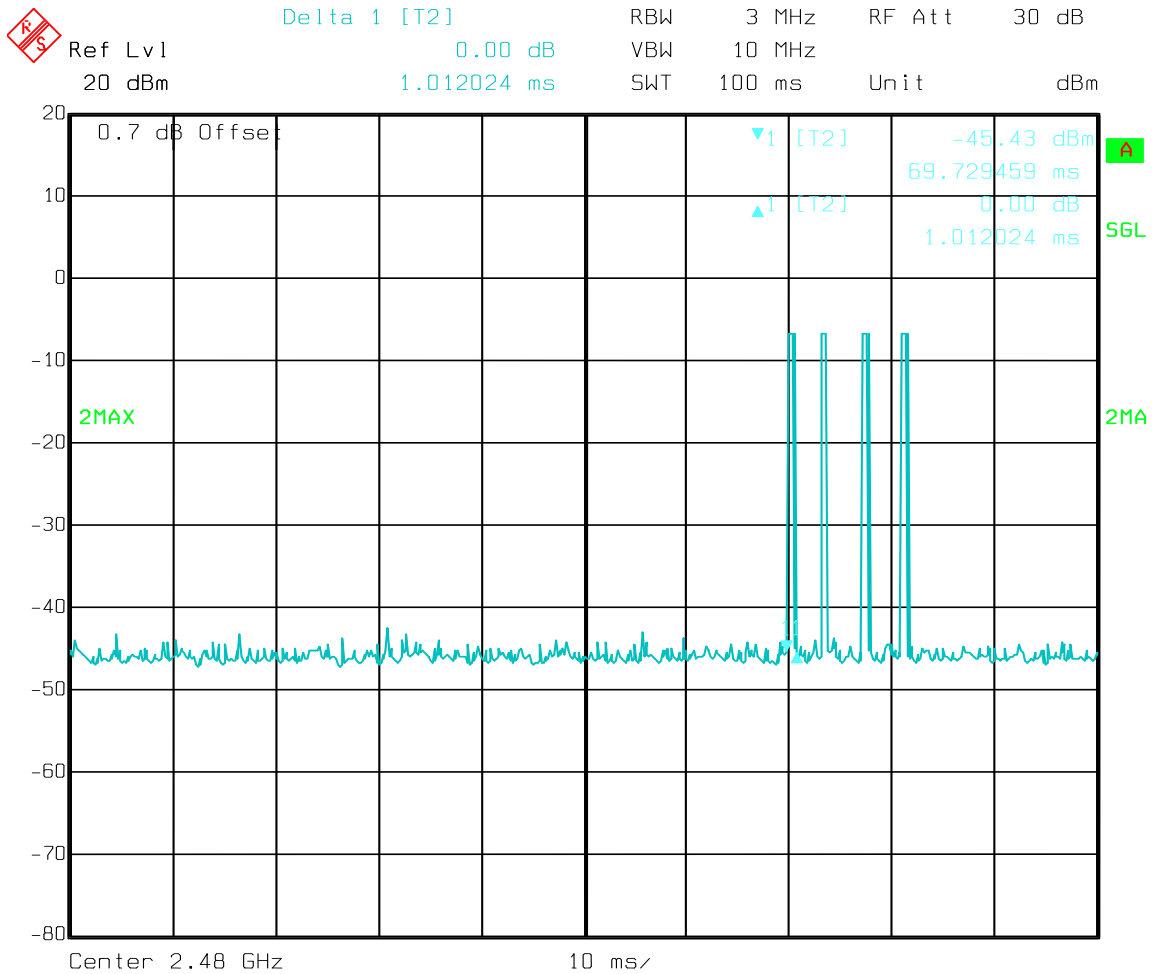
Additional Observations:

- This is a conducted test.
- The 0.7 dB offset is from the cable used.
- The peak level reading was taken at the carrier frequency then a display line was drawn 30 dBc below this level which will be the limit for this test.
- Span is wide enough to capture the peak level of the emission operating on the channel closest to the band edges (Lower and Upper).
- RBW is 100kHz
- VBW is 3X RBW
- Sweep is auto.
- Detector is Peak
- Trace is Max Hold
- Tested with fresh batteries



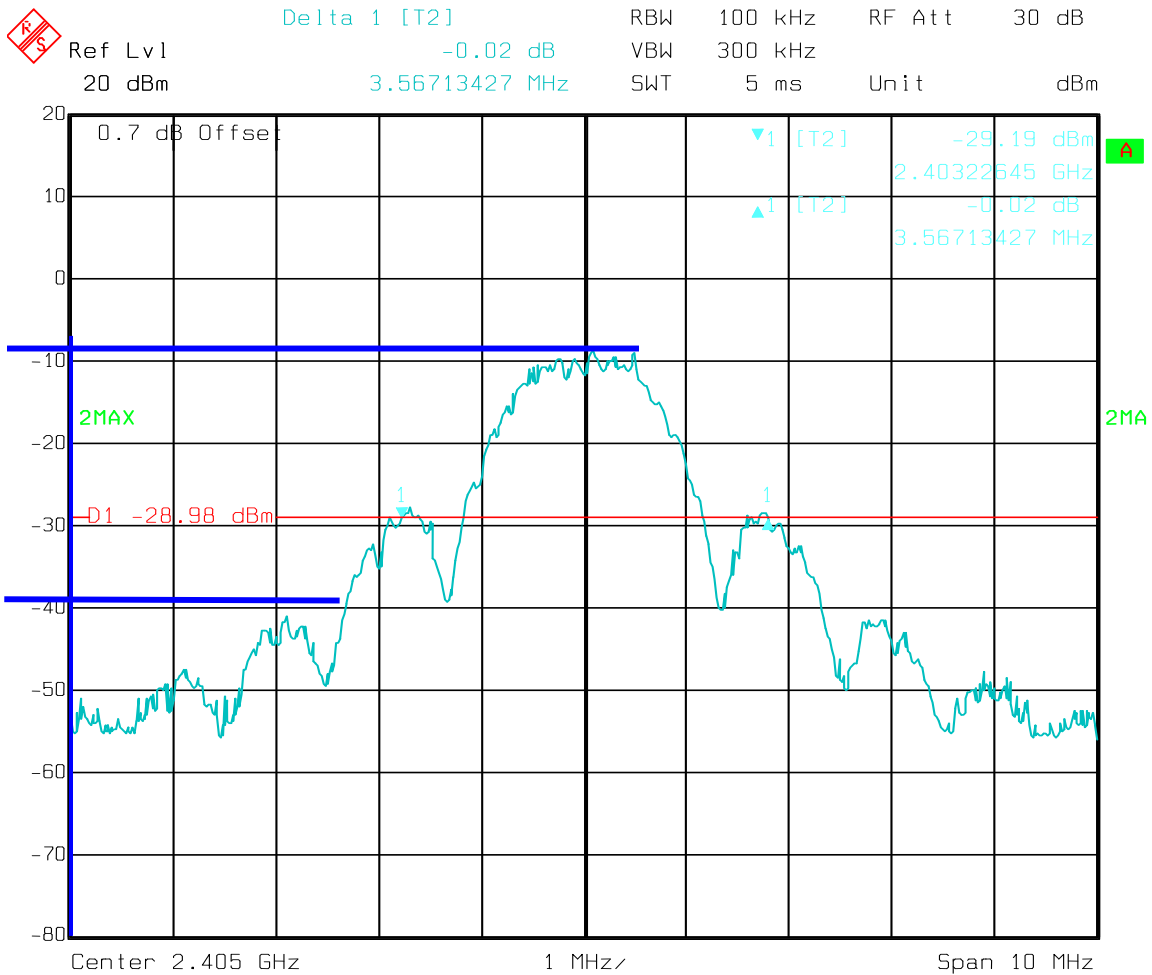
Duty Cycle in 100 ms

1.01 ms 4 times in 100 ms
 $20 \times \log(0.04) = -28 \text{ dB}$



Date: 01.FEB.2011 10:32:52

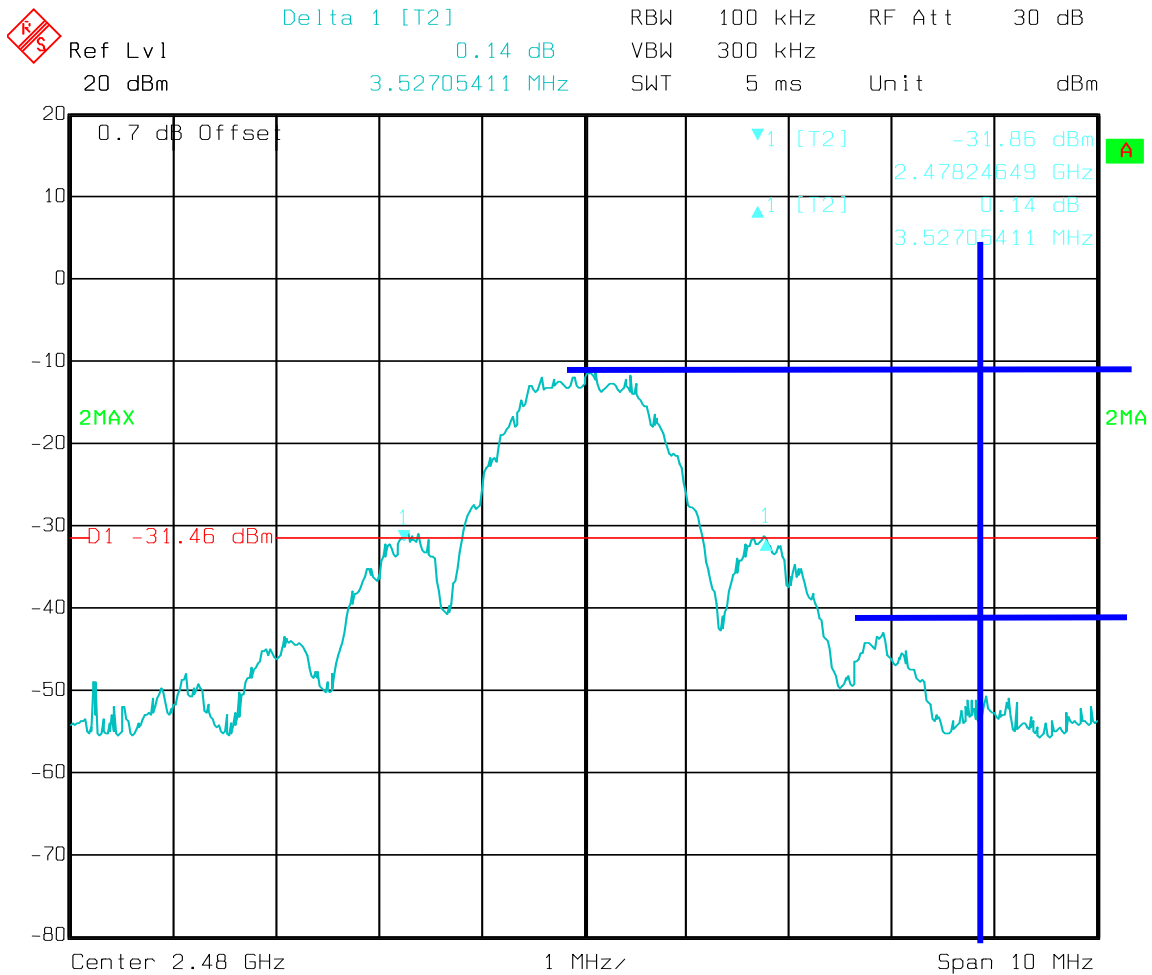
Low Channel centered at 2405 MHz



Date: 01.FEB.2011 09:28:53

Blue lines show -30 dB compliance at 2400 MHz

High Channel Peak



Date: 01.FEB.2011 10:35:34

Blue lines show -30 dB compliance at 2483.5 MHz

**Section 15.247(d) – Spurious RF Conducted Emissions**

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

A8.5 Out-of-band Emissions--In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section A8.4 (4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Test Conditions:

Sample Number:	JN5139M4	Temperature:	23°C
Date:	2-1-2011	Humidity:	43 %
Modification State:	Low, Mid and High Channel	Tester:	A. Laudani
		Laboratory:	Nemko

Test Results:

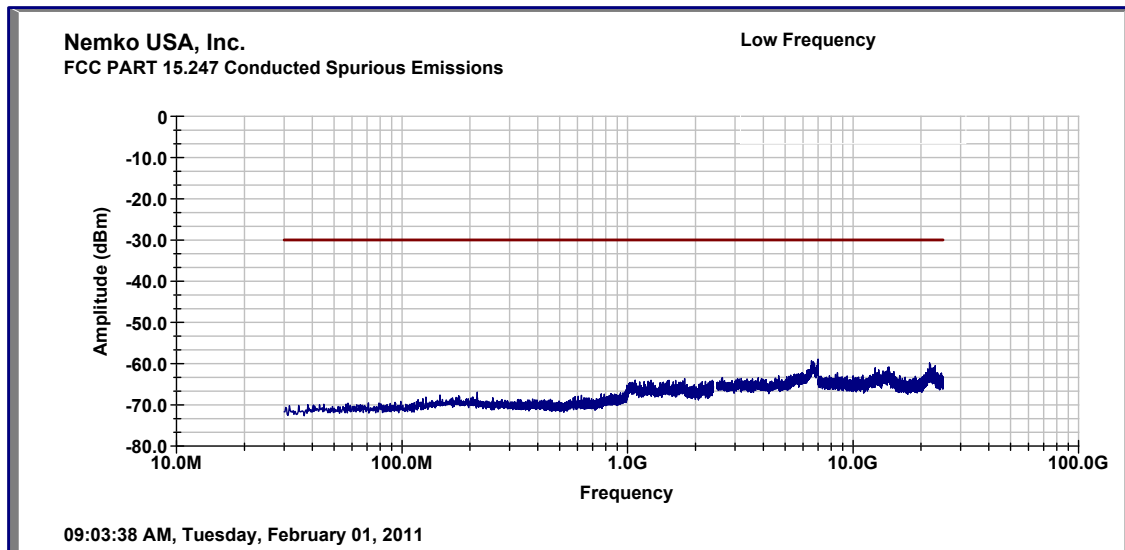
See attached plots.

Additional Observations:

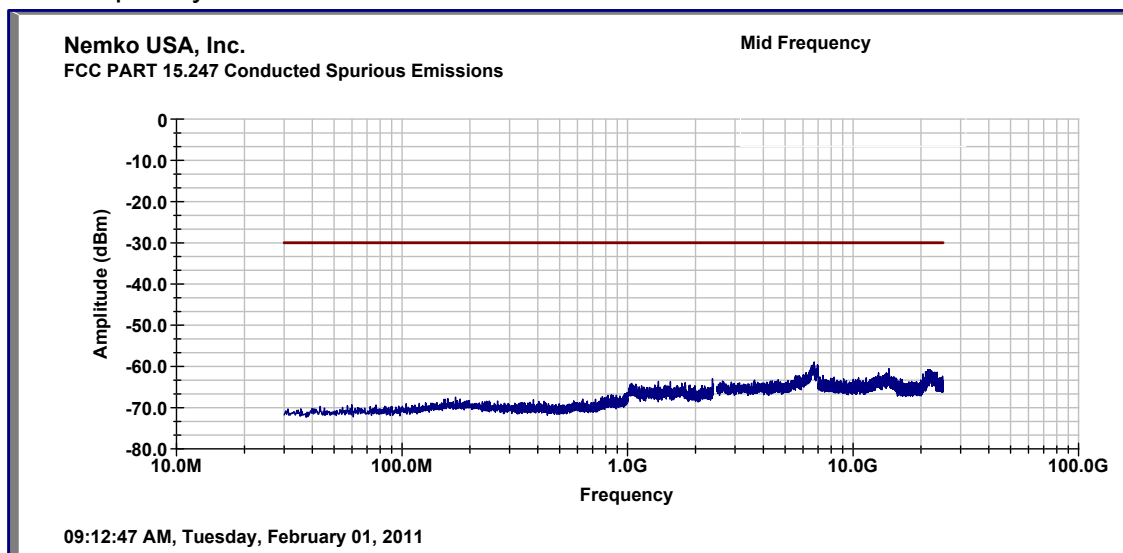
- This is a conducted test. The 0.7 dB offset is from the cable used.
- Frequencies scanned from 30 MHz to 25 GHz.
- The peak level reading was taken at the carrier frequency then a display line was drawn 30 dBc below this level which will be the limit for this test.
- VBW is 3X RBW
- Sweep is auto.
- Detector is Peak
- Trace is Max Hold
- Tested with fresh batteries
- EUT complies.

Low Frequency

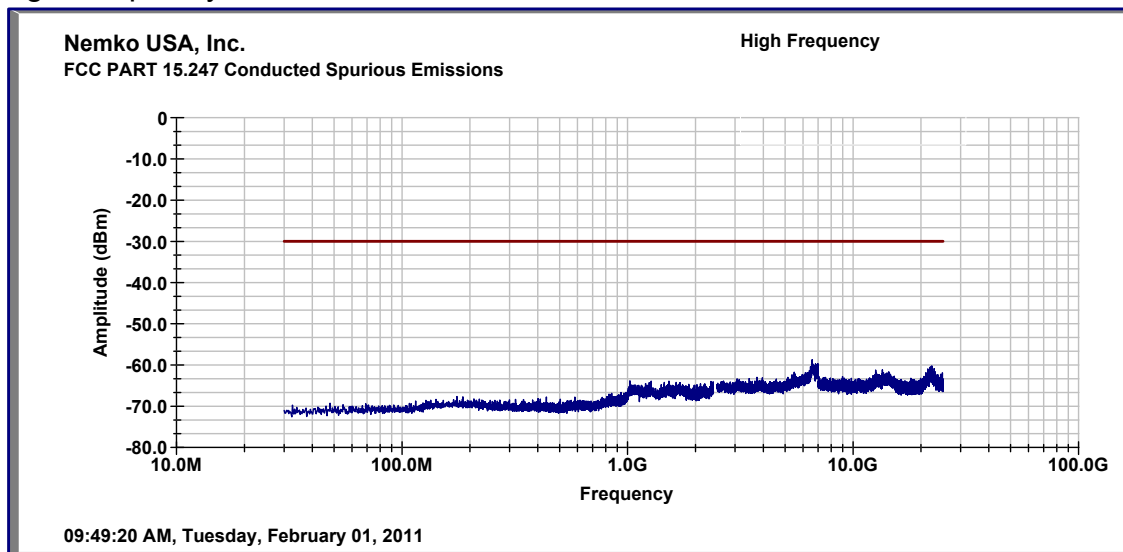
Limit line approximately 30 dBc



Mid Frequency



High Frequency



**Section 15.247(d) – Spurious Radiated Emissions**

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Conditions:

Sample Number:	JN5139M4	Temperature:	18°C
Date:	2-1-2011	Humidity:	36%
Modification State:	Transmit with modulation	Tester:	A. Laudani
		Laboratory:	Nemko SOATS

Test Results: EUT complies.

Emissions were searched from 30 MHz to 25000 MHz, no other emissions within 20 dB of the limit were detected.

Tested with fresh batteries

Example Frequency = 2400 MHz

31.0 dBμV (max hold spectrum analyzer reading)

+10.0 dB (cable loss @ frequency)

31.0 dBμV

+39.1 dB/m (antenna factor @ frequency)

70. dBμV/m

-33.2 dB (preamp @ frequency)

36.9 dBμV

Final adjusted value

Band Edge Radiated emissions

Radiated Emissions Data											
Job # :	1024472	Date :	2-4-2011		Page	1	of	1			
NEX #:	165761	Time :	0920		Staff :	aal					
Client Name :	Procuco Inc.					EUT Voltage :	bat				
EUT Name :	RF Module					EUT Frequency :					
EUT Model # :	JN5139M4					Phase:					
EUT Serial # :	NA					NOATS	X				
EUT Config. :	Transmit					SOATS					
						Distance < 1000 MHz:	3 m				
						Distance > 1000 MHz:	3 m				
Specification :	CFR47 Part 15, Subpart B, Class B										
Loop Ant. #:	NA										
Bicon Ant. #:	114 3m		Temp. (°C) :		10						
Log Ant. #:	110 3m		Humidity (%) :		53						
DRG Ant. #	877		Spec Analyzer #:		898						
Cable LF#:	NOATS		Analyzer Display #:		898						
Cable HF#:	NOATS		Quasi-Peak Detector #:		898						
Preamp LF#:	NA		Preselector #:		899						
Preamp HF#	317										
Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.											
Measurements above 1 GHz are Average values, unless otherwise stated.											
Meas. Freq. (MHz)	Meter Reading Vertical	Meter Reading Horizontal	Det.	EUT Side F/L/R/B	Ant. Height m	Max. Reading (dBµV)	Corrected Reading (dBµV/m)	Spec. limit (dBµV/m)	CR/SL Diff. (dB)	Pass Fail	Comment
2400.0	28.2	31.0	P	-	1.0	31.0	36.9	74.0	-37.0	Pass	PEAK MEET AVE LIMIT!
2483.5	36.5	36.8	P	-	1.0	36.8	42.7	74.0	-31.2	Pass	PEAK MEET AVE LIMIT!

Section 15.247(e) – Power Spectral Density for Digitally Modulated Devices

(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Conditions:

Sample Number:	JN5139M4	Temperature:	22°C
Date:	2-1-2011	Humidity:	35 %
Modification State:	Low ,Mid and High Channel	Tester:	A. Laudani
		Laboratory:	Nemko

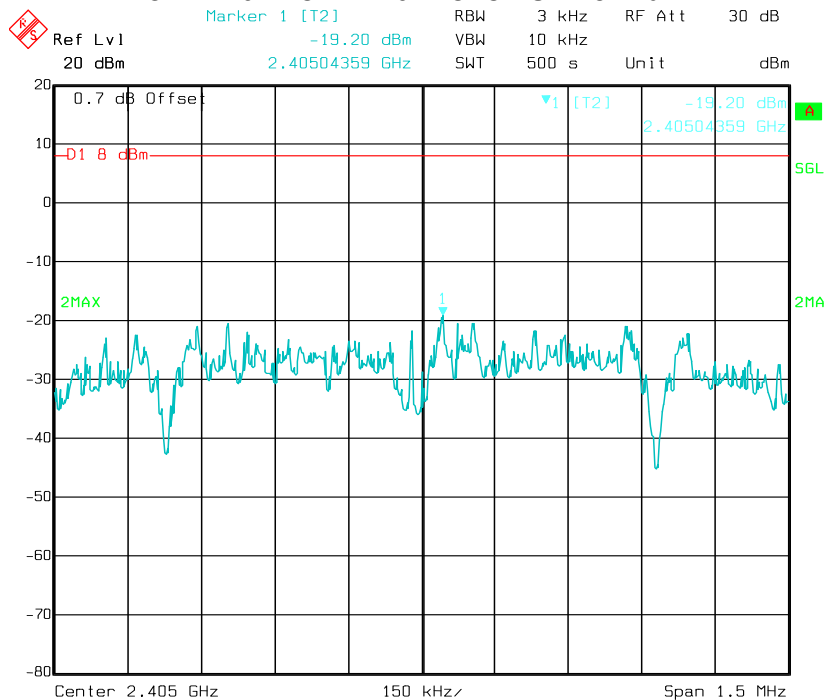
Test Results:

See attached plots.

Additional Observations:

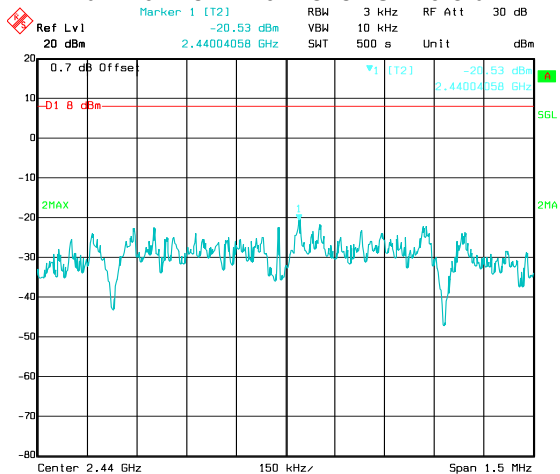
- This is a conducted test. The 0.7 dB offset is from the cable used.
- RBW is 3kHz
- VBW is ≥ 9 kHz
- Span is 1.5 MHz, therefore Sweep Time = 500 seconds.
- Tested with fresh batteries

Low Channel – Max level is -19.2 dBm



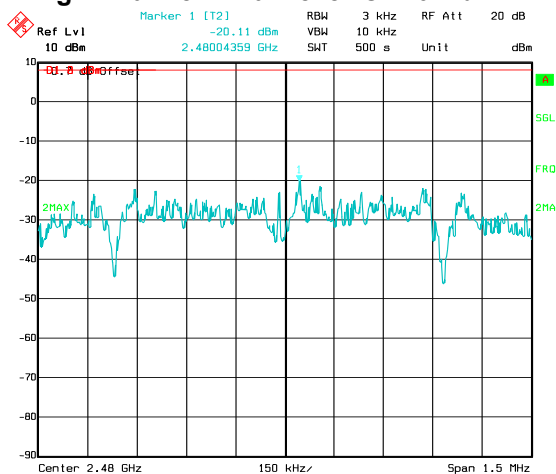
Date: 01.FEB.2011 09:42:17

Mid Channel – Max level is -20.5 dBm



Date: 01.FEB.2011 10:29:56

High Channel – Max level is -20.1 dBm



Date: 01.FEB.2011 16:01:03