**Nemko USA, Inc.**
*2210 Faraday Avenue, Suite 150*
*Carlsbad, CA 92008*
*Phone (760) 444-3500 Fax (760) 444-3005*

# CERTIFICATION TEST REPORT

| | |
|---|---|
| Report Number: | 2012 01195775 FCC |
| Project Number: | 10219279 |
| Nex Number: | 195775 |
| Applicant: | HM ELECTRONICS, INC.<br>14110 STOWE DR.<br>Poway, CA 92064 |
| Equipment Under Test (EUT): | Wireless RF Module : XCVPRO2 |
| FCC ID:<br>IC: | BYMXCVPRO2<br>1860A-XCVPRO2 |
| In Accordance With: | FCC Part 15 Subpart C, 15.247<br>IC RSS-210 Issue 8 December 2010<br>IC RSS-Gen Issue 3 December 2010 |
| Tested By: | Nemko USA Inc.<br>11696 Sorrento Valley Road, Suite F<br>San Diego, CA 92121 |
| Authorized By: | Mark Philips, EMC/RF Test Engineer |
| Date: | FEBRUARY 14, 2012 |
| Total Number of Pages: | 46 |

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# Section 1. Summary of Test Results

## 1.1 General

All measurements are traceable to national standards

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15; Subpart C and RSS-210, Issue 8 December 2010. Radiated tests were conducted is accordance with ANSI C63.4-2003. Radiated emissions are made in a Semi-Anechoic Chamber. A description of the test facility is on file with the FCC and IC.

The assessment summary is as follows:

| | |
|---|---|
| Apparatus Assessed, model number: | XCVPRO2 |
| Apparatus Assessed, serial number: | N/A |
| Specifications: | FCC Part 15 Subpart C, 15.247<br>IC RSS-210 Issue 8 December 2010 |
| Date Received in Laboratory: | JANUARY 10, 2012 TO FEBRUARY 9, 2012 |
| Compliance Status: | Complies |
| Exclusions: | None |
| Non-compliances: | None |

## 1.2 Report Release History:

| REVISION | DATE | COMMENTS | |
|---|---|---|---|
| - | FEBRUARY 14, 2012 | Prepared By: | Mark Philips |
| - | FEBRUARY 14, 2012 | 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:
Mark Philips, EMC Test Engineer
Date: FEBRUARY 14, 2012

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# Section 2: Equipment Under Test

## 2.1 Product Identification

| DEVICE | MANUFACTURER<br>MODEL #<br>SERIAL # | POWER CABLE |
|---|---|---|
| EUT - Wireless RF Module | HM Electronics, Inc.<br>Model: XCVPRO2<br>Serial #: N/A | DC cable via external AC adapter |
| EUT – AC Adapter | eUrasia Power<br>Model: CP-8026<br>Serial #: 08470295 | Direct wall plug-in |
| Support (2X) – Communicator | HM Electronics, Inc.<br>Model: COM6000BP<br>Serial #: 21L01674 and 21L01675 | N/A |
| Support – Laptop | Toshiba<br>Tecra A6-EZ6311<br>X6114873K | N/A |

| CONNECTION | I/O CABLE |
|---|---|
| EUT – Ethernet Service Port | 7.0 m, unshielded, 26AWG, CAT 5 cable |
| EUT - J6/J14 Outside Speaker | 15.0 m, shielded, 22 AWG, 4 conductors with ground (term.) |
| EUT – J7/J16 Line Out | 12.0 m, shielded, 22 AWG, 4 conductors with ground (term.) |
| EUT – J7/J16 Line In | 12.0 m, shielded, 22 AWG, 4 conductors with ground (term.) |
| EUT – J1/J11 Mic | 32.0 m, shielded, 22 AWG, 4 conductors with ground (term.) |
| EUT – J1/J11Relay | 8.0 m, shielded, 22 AWG, 4 conductors with ground |
| EUT – J1/J11 Speaker | 32.0 m, shielded, 22 AWG, 4 conductors with ground (term.) |
| EUT to ISN | 3.0 m, unshielded, 26AWG, Crossover CAT 5 cable |
| ISN to Laptop | 3.0 m, unshielded, 26AWG, CAT 5 cable |

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## 2.2 Theory of Operation

The XCVPRO2 is a Wireless RF Module for a voice intercom communications. Its function, when installed into future HME products, is to provide medium-range data / voice communication between one or more mobile devices and one or two fixed wired speaker/mics at a drive up location. Base stations are mounted on walls in or nearby work areas to provide communication coverage for the mobile users. The RF Module was exercised by running in its normal mode of operation with factory set power levels and modulation levels. No external controls were used.

The manufacturer has determined the pass criteria for susceptibility testing. The unit under test shall not incur any permanent damage and shall recover normal operation by itself or by manual reset or a manual power cycle by the user. During testing it is acceptable for the unit to have interfering audio signals be heard by the user. Normal operation shall be recovered when the interference signal is shut down.

## 2.3 Technical Specifications of the EUT

| | |
|---|---|
| Manufacturer: | HM Electronics, Inc. |
| Operating Frequency: | 2401.920 to 2481.408 MHz<br>in the 2400 to 2483.5 MHz Band |
| Number of Operating Frequencies: | 47 |
| Output Power: | 68.1 mW |
| Modulation: | Digital |
| Emission Designator: | 1M32G1D |
| Antenna Data: | (2) post Antennas with RSMA connector |
| Antenna Connector: | Reverse SMA |
| Power Source: | Voltage supplied by host |

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# 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.

*IC RSS-210 Issue 8 December 2010*
Low-power Licence-exempt Radio-communication Devices (All Frequency Bands): Category I Equipment. Annex 8 - Frequency Hopping and Digital Modulation Systems Operating in the Bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

*IC RSS-Gen Issue 3 December 2010*
General Requirements and Information for the Certification of Radio-communication Equipment

## 3.3 Test Environment

All tests were performed under the following environmental conditions:

| | | |
|---|---|---|
| Temperature range | : | 15.6 – 23.3 $^{o}$C |
| Humidity range | : | 26 - 65 % |
| Pressure range | : | 86 - 106 kPa |
| Power supply range | : | +/- 1% of rated voltages |

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## 3.4 Test Equipment

| Nemko ID | Device | Manufacturer | Model | Serial Number | Cal Date | Cal Due Date |
|---|---|---|---|---|---|---|
| 111 | Antenna, LPA | EMCO | 3146 | 1382 | 11/29/2010 | 11/29/2012 |
| 128 | Antenna | Electro-Metrics | 3104 | 2882 | 3/21/2011 | 3/21/2013 |
| 317 | Preamp | HP | 8449A | 2749A00167 | 5/16/2011 | 5/16/2012 |
| 529 | Antenna, DRWG | EMCO | 3115 | 2505 | 10/18/2010 | 10/18/2012 |
| 752 | Antenna, DRWG | EMCO | 3115 | 4943 | 12/2/2010 | 12/2/2012 |
| 835 | Spectrum Analyzer | Rohde & Schwarz | RHDFSEK | 829058/005 | 7/22/2011 | 7/22/2012 |
| 911 | Spectrum Analyzer | Agilent | E4440A | US41421266 | Oct. 27, 2011 | Oct. 27, 2012 |
| E1017 | 9kHz to 7GHz Spectrum Analyzer | Rohde & Schwarz | FSP7 | 839337/0022 | 4/1/2011 | 4/1/2012 |
| 805 | LISN | Solar | 9348-50-R-24-BNC | 992823 | 4/7/2011 | 4/7/2012 |
| E1013 | DRG Horn | EMCO | 3116 | 00119488 | 12/23/2010 | 12/23/2012 |

Registration of the Semi-anechoic Chamber is on file with the Federal Communications Commission and with Industry Canada under Site Number 2040B-3.

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# 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 Deviations From Laboratory Test Procedures

No deviations from Laboratory Test Procedure

## 4.5 Test Deleted

No Tests were deleted from this assessment.

## 4.6 Additional Observations

There were no additional observations made during this assessment.

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Section 5: Results Summary

This section contains the following:

Test Results

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 test.
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 15 | RSS-210 | Test Description | Required | Result |
|---|---|---|---|---|
| 15.207 (a) | RSS-Gen 7.2.2 | Conducted Emission Limit | Y | Pass |
| 15.247 a1i | A81(3) | 20dB & 99% Bandwidth | Y | Pass |
| 12.247a1 | A81(3) | Channel Separation \| Average time of occupancy | Y | Pass |
| 15.247a1i | A81(3) | Number of Hopping Channels | Y | Pass |
| 15.247 b1 | A81(2) | Peak Output Power | Y | Pass |
| 15.209 a 15.247c | A81(3), A2.9 | Radiated Emissions within Restricted Bands | Y | Pass |
| 15.247c | A2.9 | Bandedge | Y | Pass |
| 15.109 | RSS-GEN 4.10 | Receiver Spurious Emissions | Y | Pass |

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# Appendix A: Test Results

## 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 μH/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 (dBμV) | |
|---|---|---|
| | 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: | XCVPRO2 | Temperature: | 22C |
| Date: | Feb. 9, 2012 | Humidity: | 40% |
| Modification State: | Low, Mid and High Channel | Tester: | Mark Philips |
| | | Laboratory: | Nemko GP3 |

Test Results: Plots below

Test Parameters

Peak RBW: 100kHz VBW: 100kHz
Quasi-Peak: RBW 9kHz, VBW 30 kHz
Average: RBW 9kHz, VBW 30 kHz
Quasi-Peak Limit Blue Line, Average Limit Green Line

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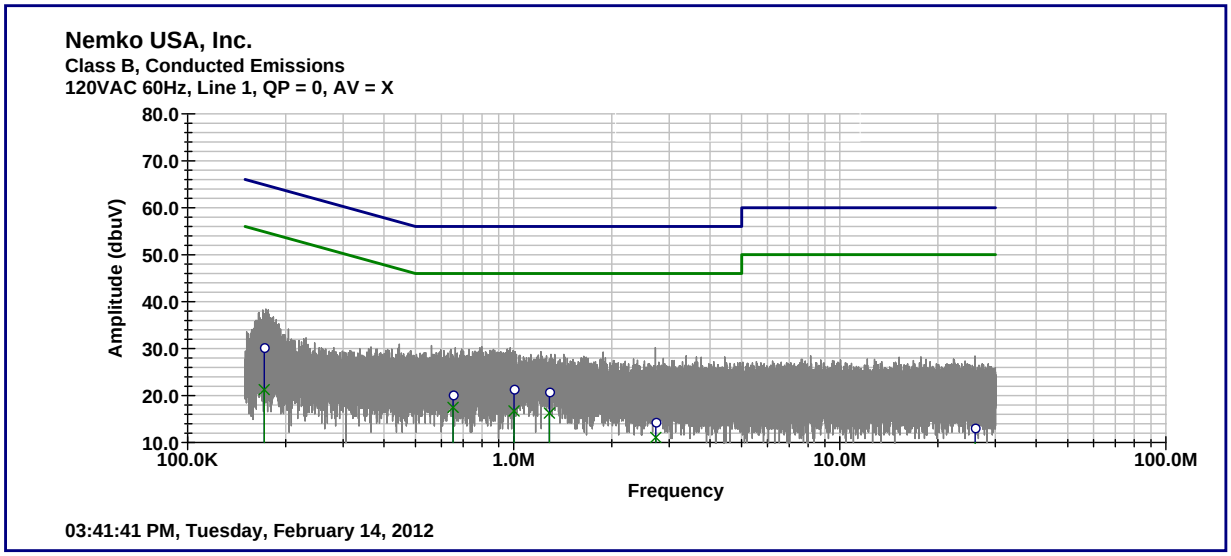
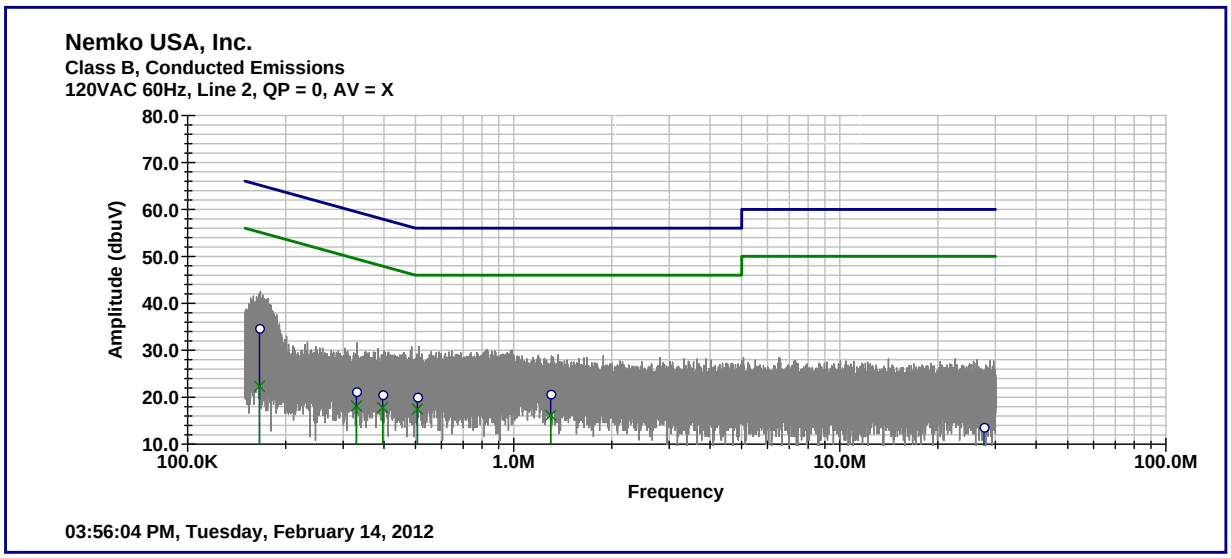
## AC to DC converter:
HP E3611A sn: KR41807331



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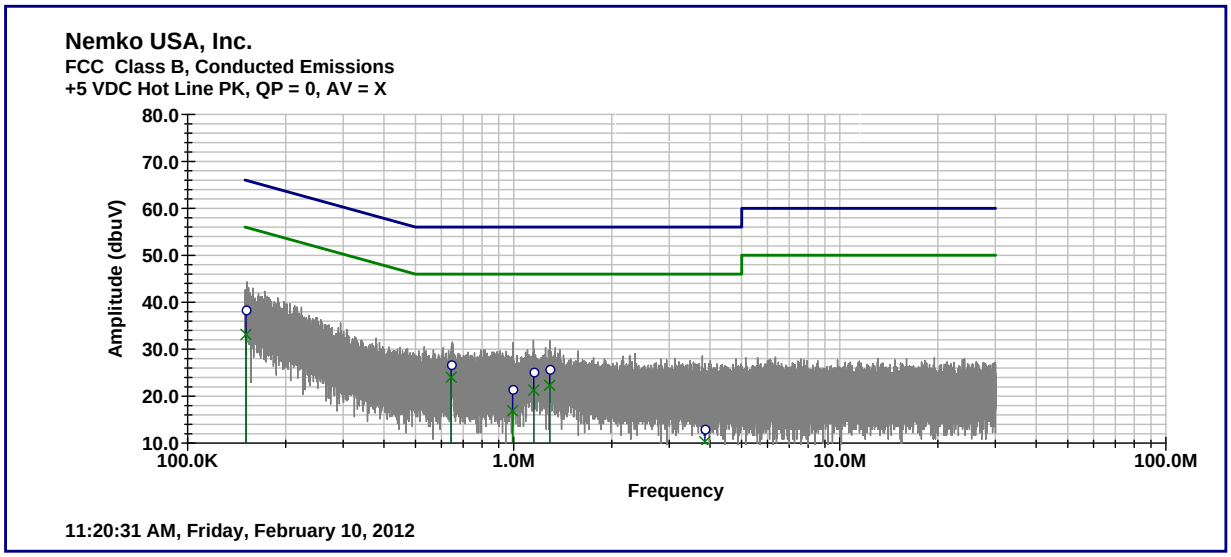
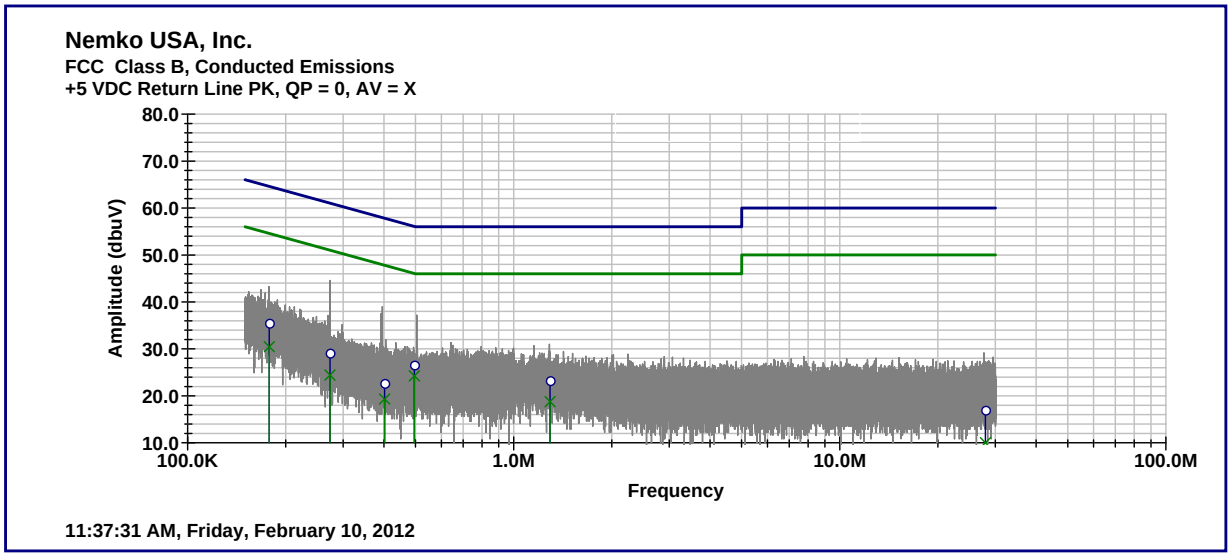
# The Actual Emissions from the RF Module



## 20 dB & 99% Bandwidth

Clause 15.247(a)(1)(i)
(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500kHz.

## Test Conditions:

| | | | |
|---|---|---|---|
| Sample Number: | XCVPRO2 | Temperature: | 20°C |
| Date: | January 18, 2012 | Humidity: | 31 % |
| Modification State: | Lo/Mid/High Channels | Tester: | Mark Philips |
| | | Laboratory: | Nemko |

## Test Results: EUT complies

- This was a conducted test.
- 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
- 99% bandwidth: Used Spectrum Analyzer's programmed function.
- 20 dB bandwidth: 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.
- The same radio circuitry creates the RF emissions for Antenna 1 and Antenna 2, therefore, only one Antenna port data is presented. Antenna 1.
- Observed maximum 20 dB BW is 1190 kHz (low channel).
- Observed maximum 20 dB BW is 1170 kHz (high channel).
- 2401.920 MHz – (1190/2) kHz = 2401.325 MHz (within the frequency band)
- 2181.408 MHz + (1170/2) kHz = 2481.993 MHz (within the frequency band)

| Channel Range | 20dB Bandwidth | 99% Bandwidth |
|---|---|---|
| Low (2401.920 MHz) | 1.19 MHz | 1.28 |
| Mid (2441.664 MHz) | 1.21 MHz | 1.32 |
| High (2481.408 MHz) | 1.17 MHz | 1.23 |

Equipment Used: 835

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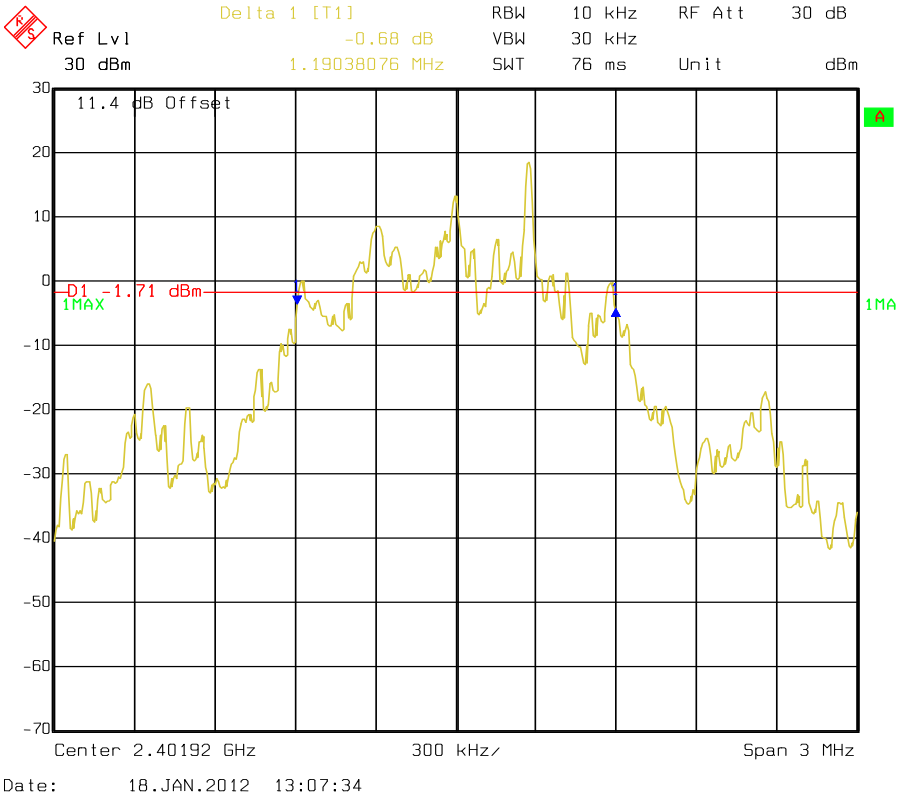
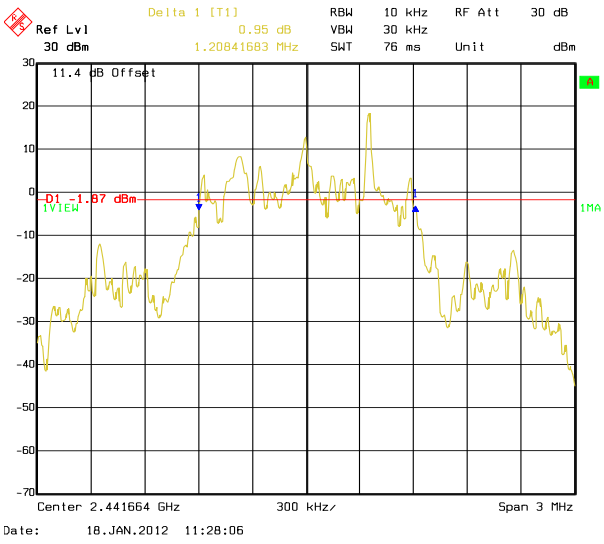
20dB Bandwidth

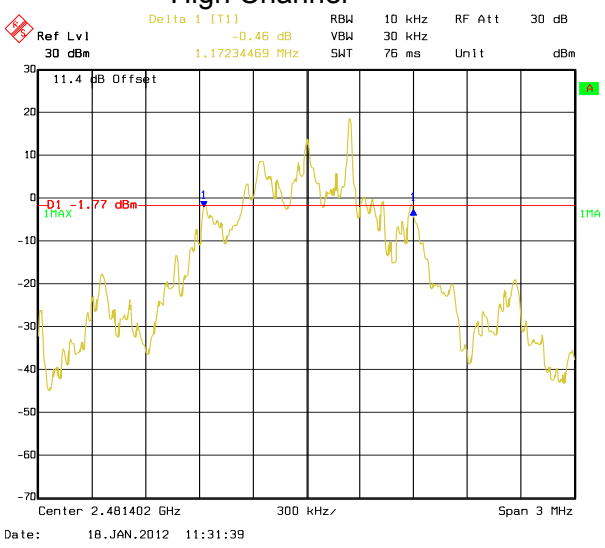
Low Channel




Mid Channel




High Channel



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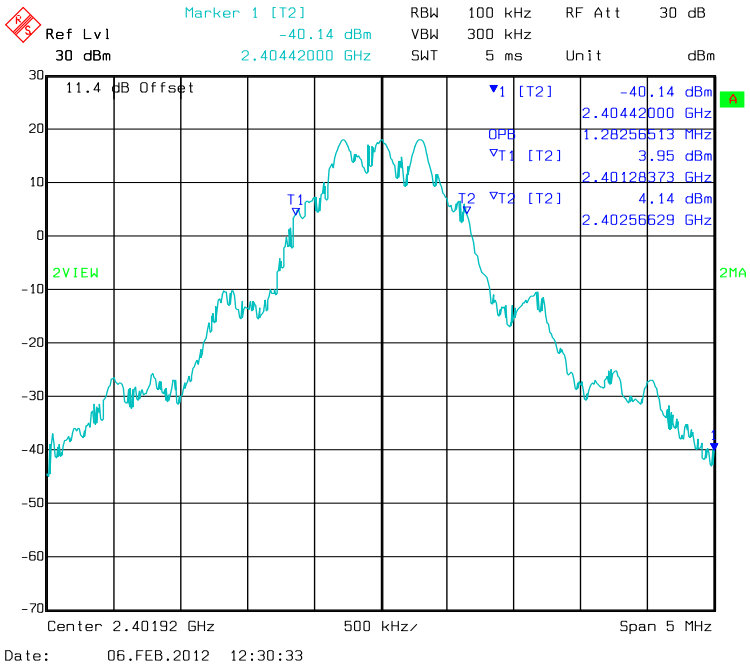
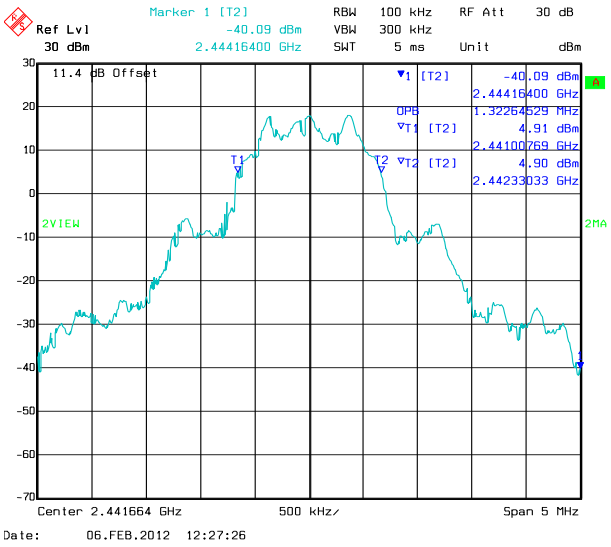
99% Bandwidth

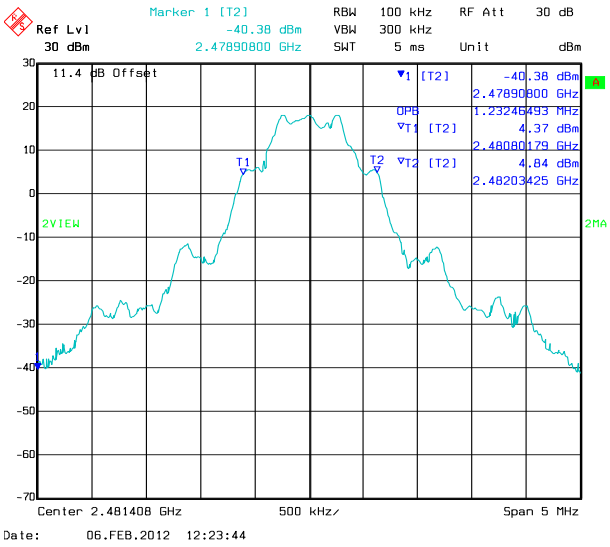
Low Channel




Mid Channel




High Channel



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## Frequency Hopping Systems Operating in the 2400-2483.5 MHz Band

(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### Test Conditions:

| | | | |
|---|---|---|---|
| Sample Number: | XCVPRO2 | Temperature: | 20°C |
| Date: | | Humidity: | 31 % |
| Modification State: | Lo/Mid/High Channels | Tester: | Mark Philips |
| | | Laboratory: | Nemko |

Test Results: EUT complies

Equipment Used: 835

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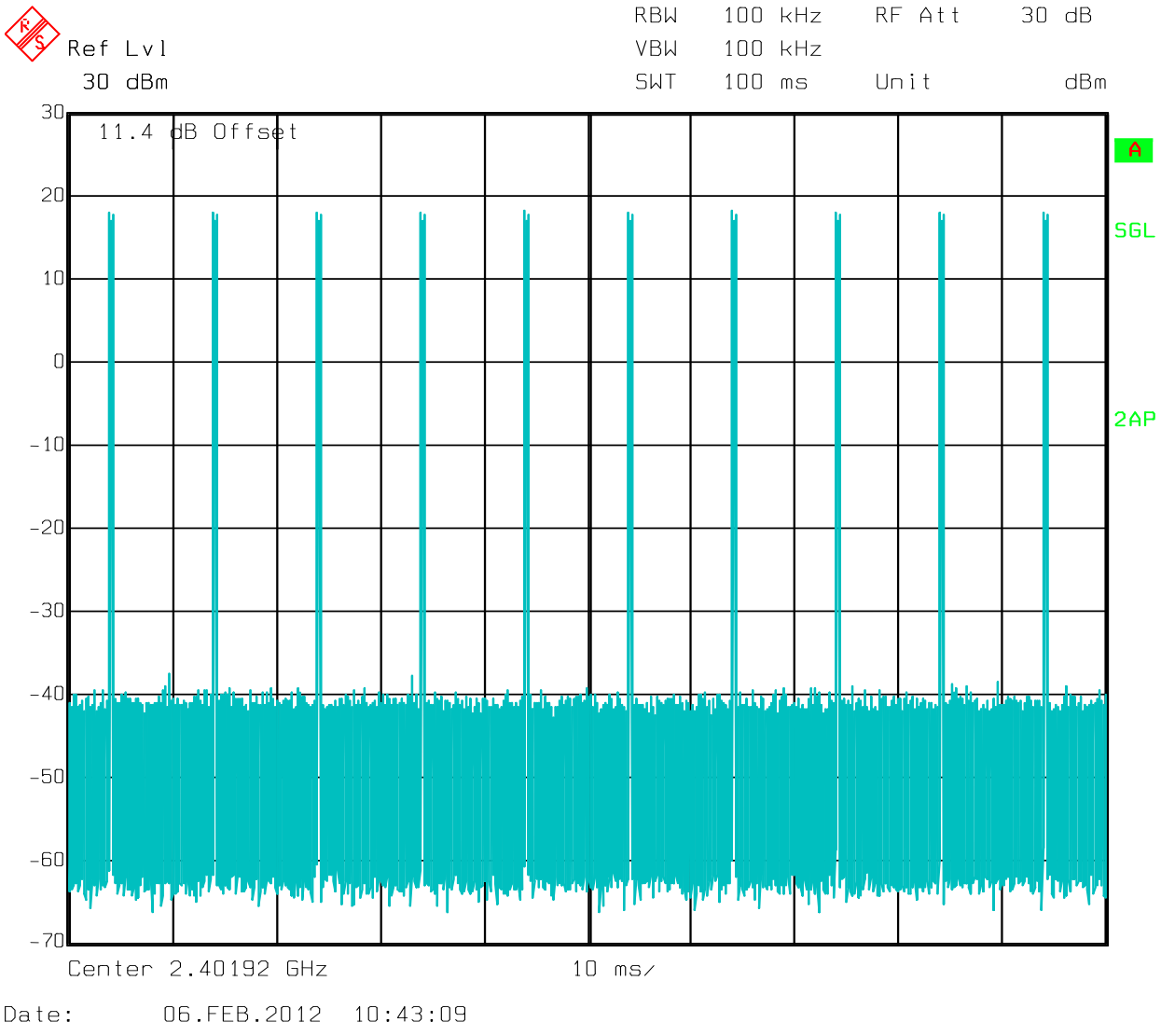
Duty Cycle

This channel was 0.48 ms and repeats 10x = 4.8ms

DCF 20 x log .048 = -26.4 dB



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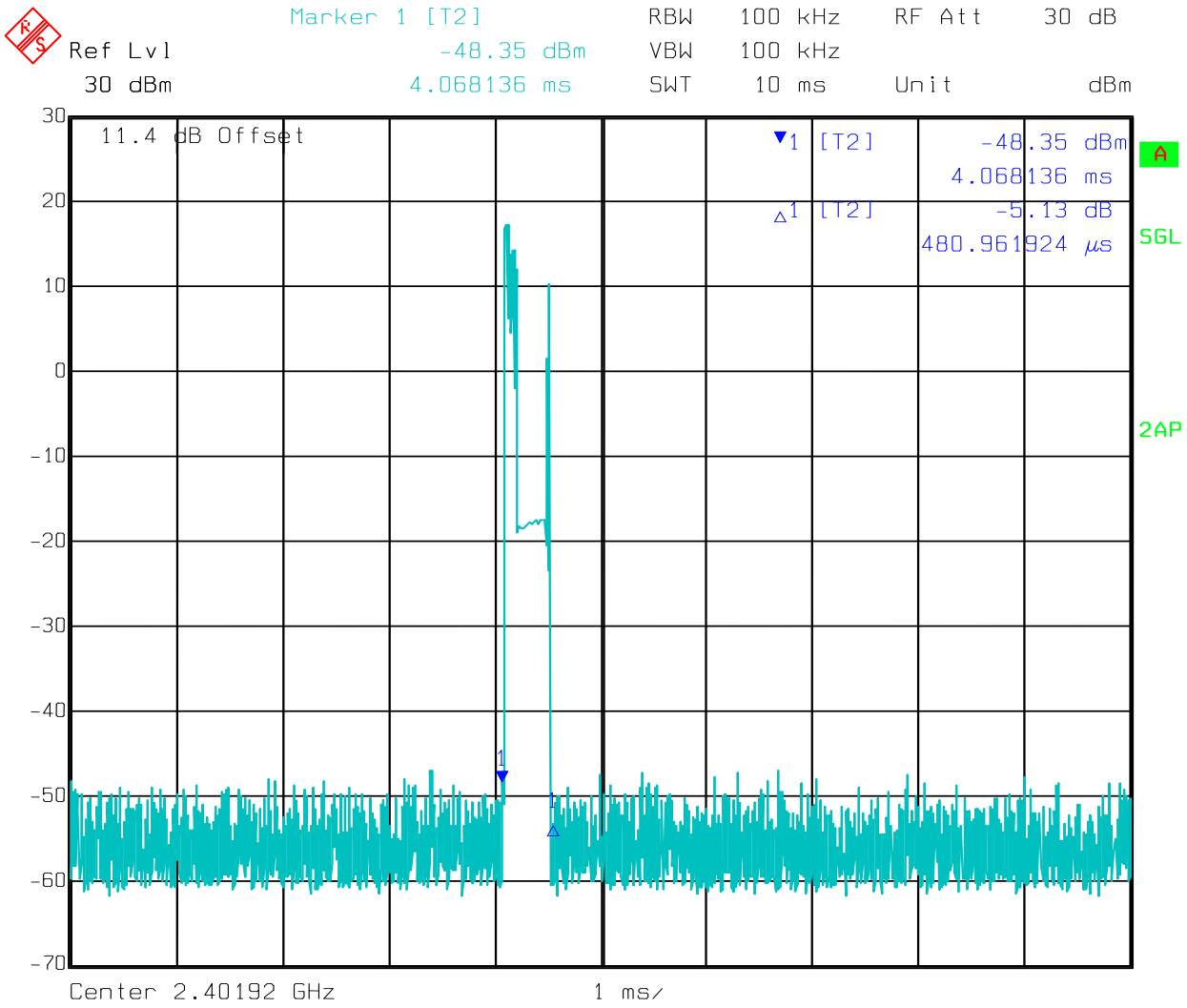

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## Channel Separation

Clause 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.



Test Conditions:

| | | | |
|---|---|---|---|
| Sample Number: | XCVPRO2 | Temperature: | 20°C |
| Date: | | Humidity: | 31 % |
| Modification State: | Lo/Mid/High Channels | Tester: | Mark Philips |
| | | Laboratory: | Nemko |

Test Results: EUT Complies

- The Spectrum Analyzer RES BW was set to 100 kHz.
- Detector was peak, max hold.
- The test sample was set to hopping mode and the frequency span was set to a value to capture two or more hopping channels.
- Marker delta shows frequency separation.

Equipment Used: 835

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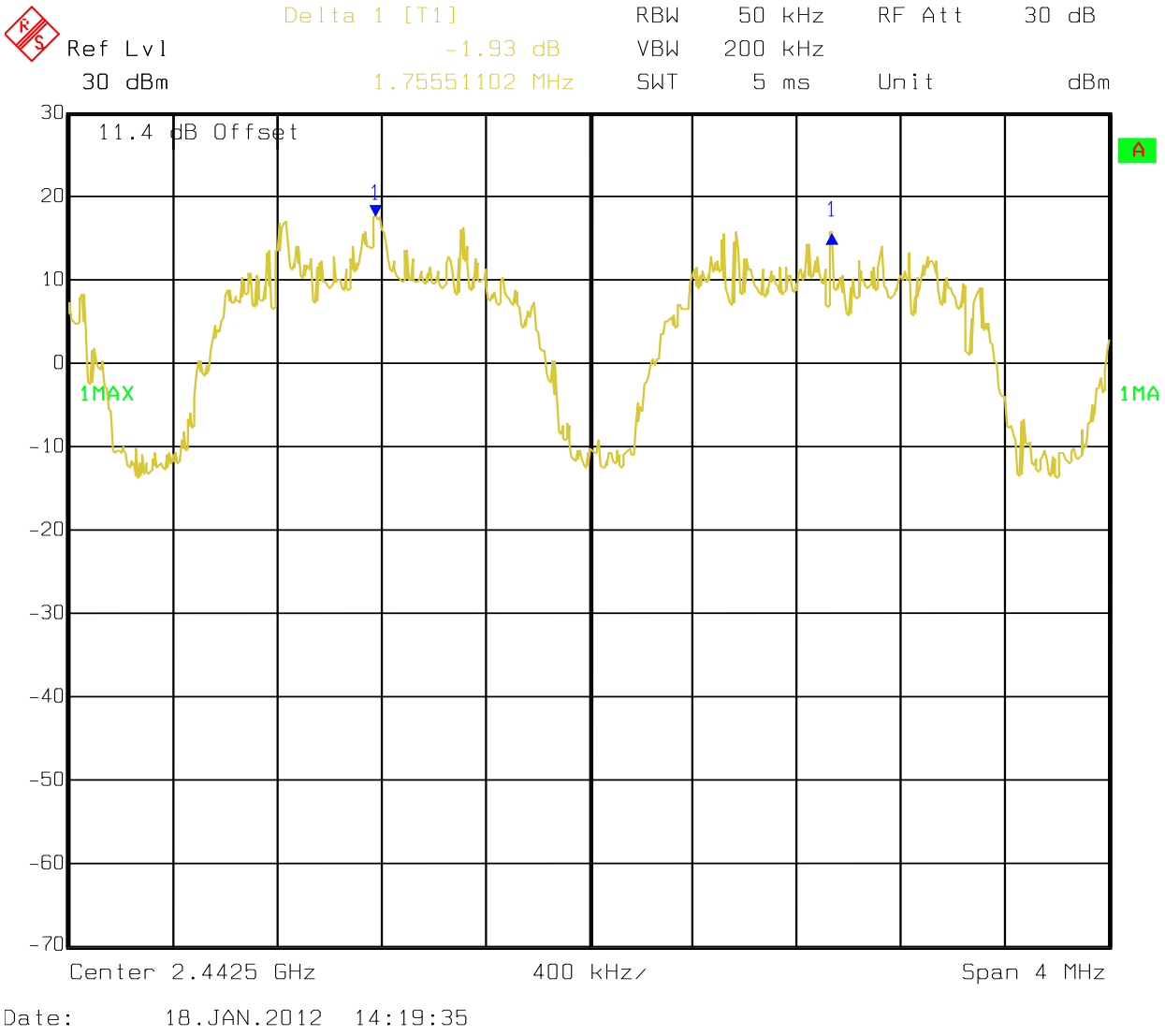
## Channel Separation

Channel Separation (1.755 MHz) is larger than the 20 dB bandwidth



## Frequency Plan

Clause 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.



### Test Conditions:

| | | | |
|---|---|---|---|
| Sample Number: | XCVPRO2 | Temperature: | |
| Date: | | Humidity: | |
| Modification State: | All Channels | Tester: | Mark Philips |
| | | Laboratory: | Nemko |

### Test Results:

The Frequency Plan is discussed in the Technical Description exhibit and was reviewed by this test engineer and was found to comply.

- 47 channels: channel 0 at 2401.920 MHz to channel 47 at 2481.408.
- Psuedo-Random Hopping Sequence:

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 25 | | 11 | 42 | | 21 | 8 | | 31 | 24 | | 41 | 2 |
| 2 | 34 | | 12 | 6 | | 22 | 15 | | 32 | 37 | | 42 | 19 |
| 3 | 17 | | 13 | 38 | | 23 | 35 | | 33 | 18 | | 43 | 27 |
| 4 | 33 | | 14 | 13 | | 24 | 4 | | 34 | 9 | | 44 | 5 |
| 5 | 46 | | 15 | 32 | | 25 | 29 | | 35 | 45 | | 45 | 21 |
| 6 | 39 | | 16 | 22 | | 26 | 20 | | 36 | 30 | | 46 | 41 |
| 7 | 12 | | 17 | 11 | | 27 | 44 | | 37 | 23 | | | |
| 8 | 31 | | 18 | 3 | | 28 | 26 | | 38 | 0 | | | |
| 9 | 43 | | 19 | 28 | | 29 | 10 | | 39 | 7 | | | |

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## Time of Occupancy

(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

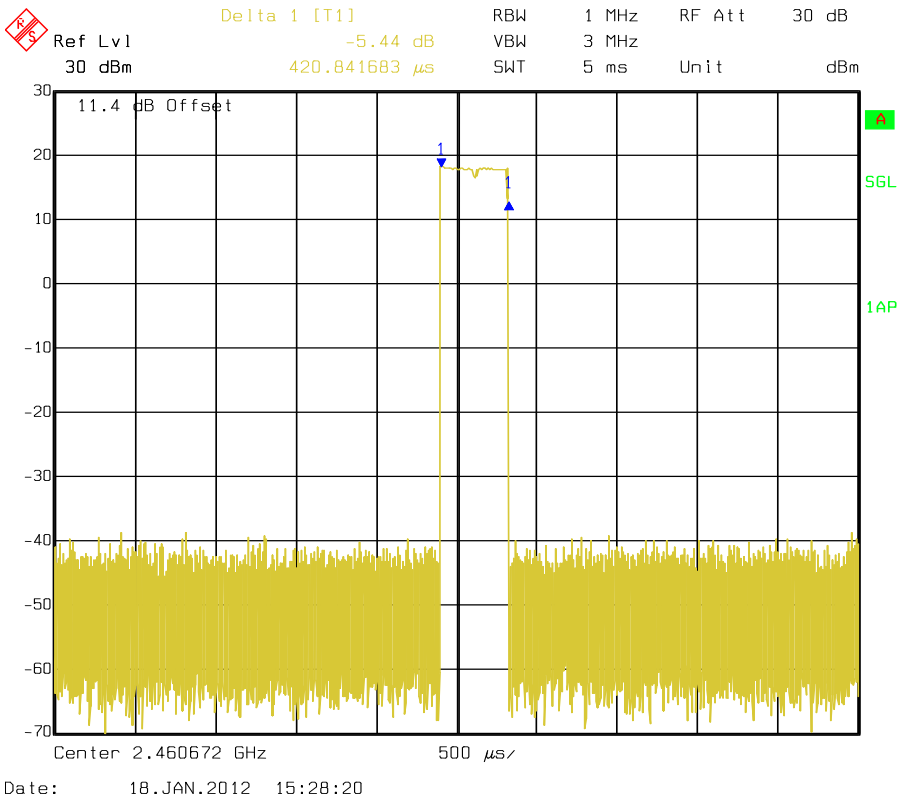
## Test Conditions:

| | | | |
|---|---|---|---|
| Sample Number: | XCVPRO2 | Temperature: | 21°C |
| Date: | January 18, 2012 | Humidity: | 31 % |
| Modification State: | Mid Channel | Tester: | Mark Philips |
| | | Laboratory: | Nemko |

EUT was placed in pseudo – hopping mode, all channels.

## Test Results:

Burst: 0.42 ms x 28bursts = 0.1176 seconds, EUT complies
0.42 ms per burst



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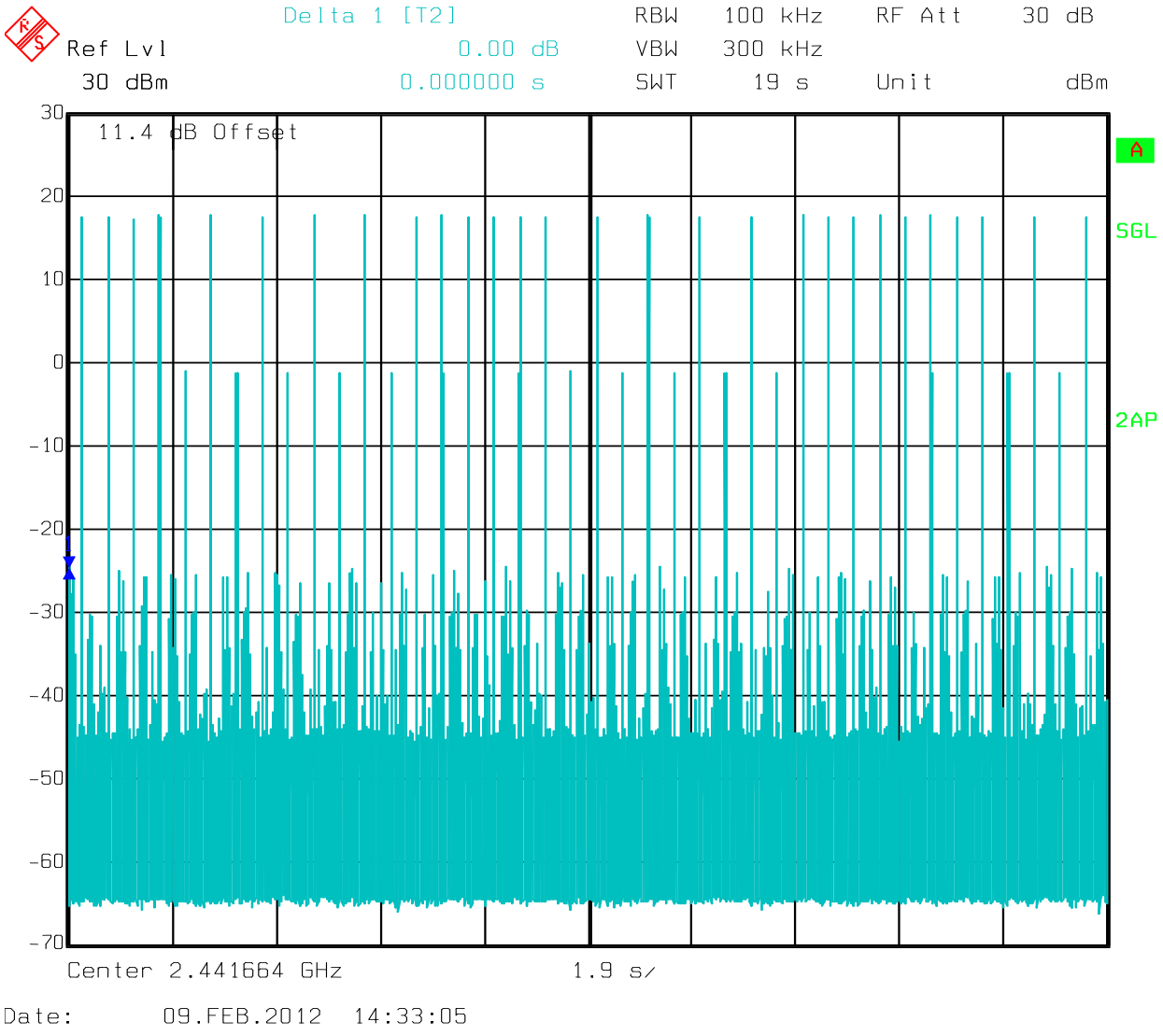
## 28 bursts of channel in 19 Seconds



Number of Hopping Channels

| |
|---|
| (iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used. |



Test Conditions:

| | | | |
|---|---|---|---|
| Sample Number: | XCVPRO2 | Temperature: | 20°C |
| Date: | | Humidity: | 31 % |
| Modification State: | Lo/Mid/High Channels | Tester: | Mark Philips |
| | | Laboratory: | Nemko |

Test Results: 47 Channels, EUT complies.

- This is a conducted test
- The Spectrum Analyzer RES BW was set to 300 kHz to discriminate channels.
- Three plots were used to display all channels

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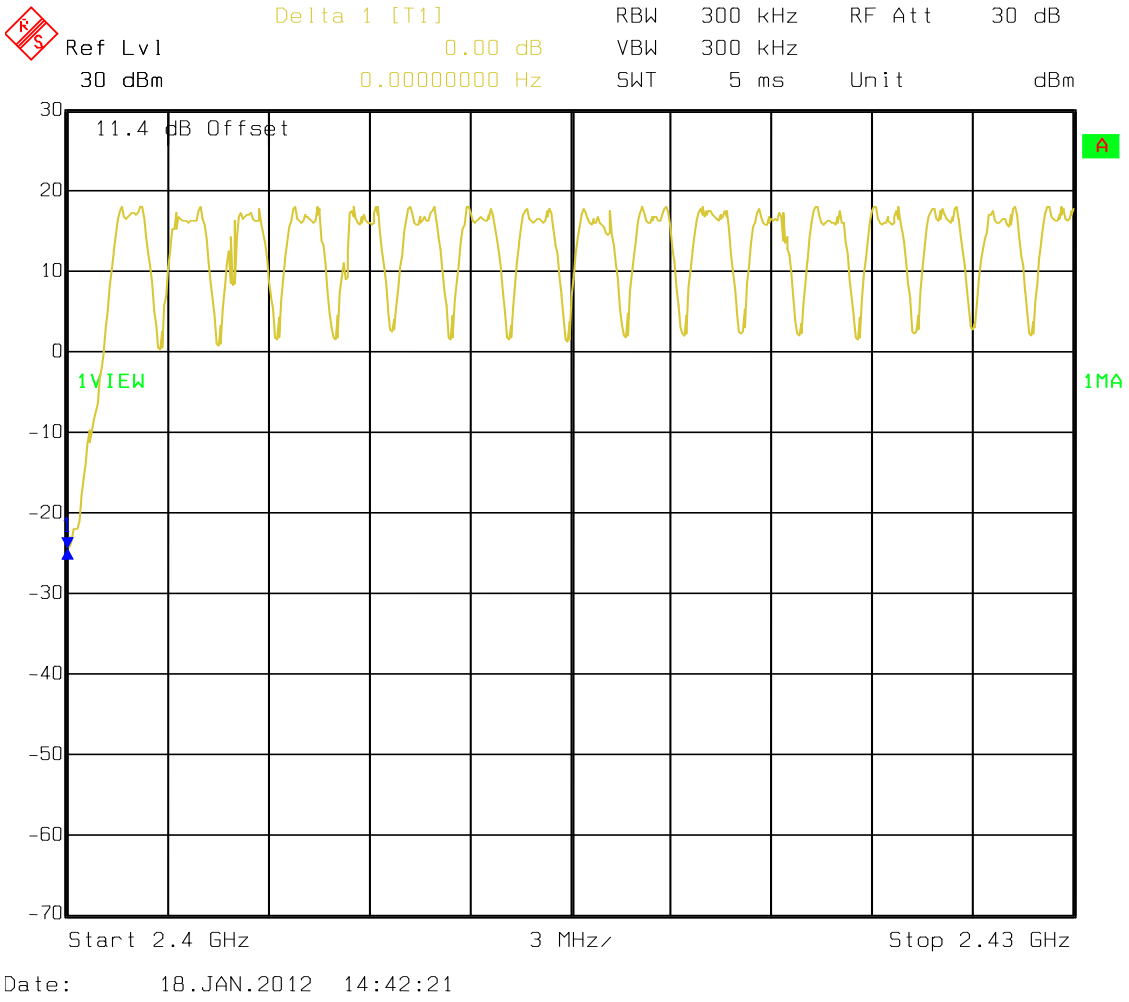
17 channels



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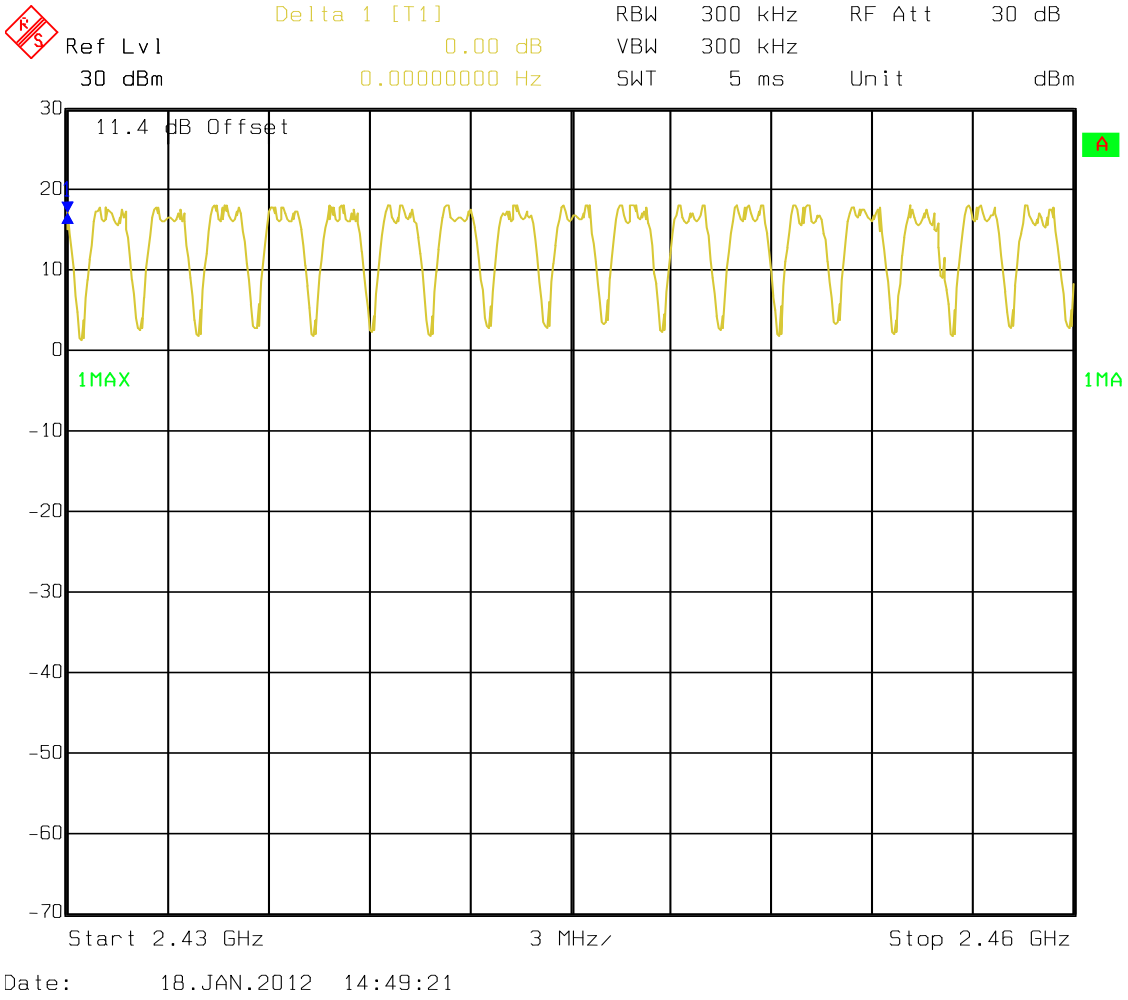
## 17 Channels



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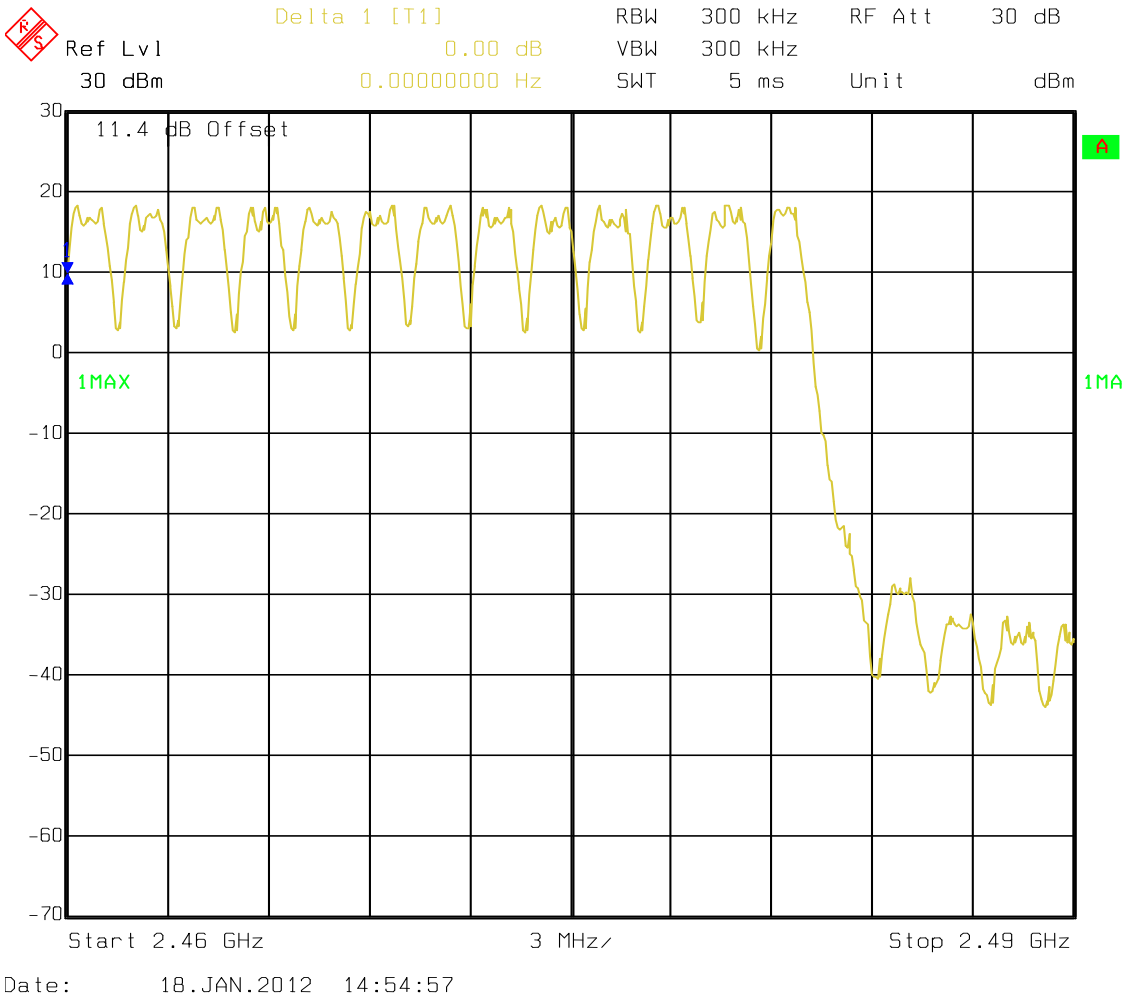
17 + 17 + 13 = 47 Channels



## Radiated Emissions within Restricted Bands

Clause 15.209(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Field Strength (uV/meter) | Measurement Distance (meter) |
|---|---|---|
| 0.009-0.490 | 2400/F (kHz) | 300 |
| 0.490-1.705 | 24000/F (kHz) | 30 |
| 1.705-30.0 | 30 | 3 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

15.247 (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 Sec. 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Sec. 15.205(a) must also comply with the radiated emission limits specified in Sec. 15.209(a) (see Sec. 15.205(c)).

## Test Conditions:

| | | | |
|---|---|---|---|
| Sample Number: | XCVPRO2 | Temperature: | 22 °C |
| Date: | January 25, 2012 | Humidity: | 30 % |
| Modification State: | Lo/Mid/High Channels | Tester: | Mark Philips |
| | | Laboratory: | Anechoic Chamber |

## Test Results:

See Table Below.

## Additional Observations:

The Spectrum was searched from 30 MHz to the 10th Harmonic.
There are no emissions found that apply to the restricted bands defined in FCC Part 15 Subpart C, 15.205. The

Measurements below 1GHz were performed at 3m with a Quasi-Peak detector while Peak and Average detectors were used above 1GHz.

As the emission is pulsing, a duty cycle factor was introduced to spurious harmonics. See calculation in section on Time of Occupancy.

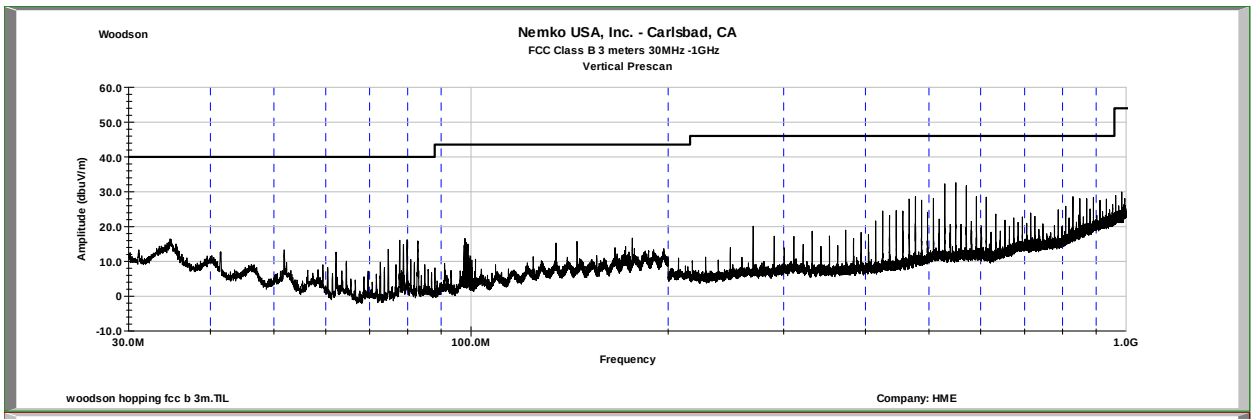
Math: Corrected Reading =
Max of Vertical or Horizontal measured + Antenna Factor + Cable Loss – preamplifier (if used). – Duty Cycle Factor

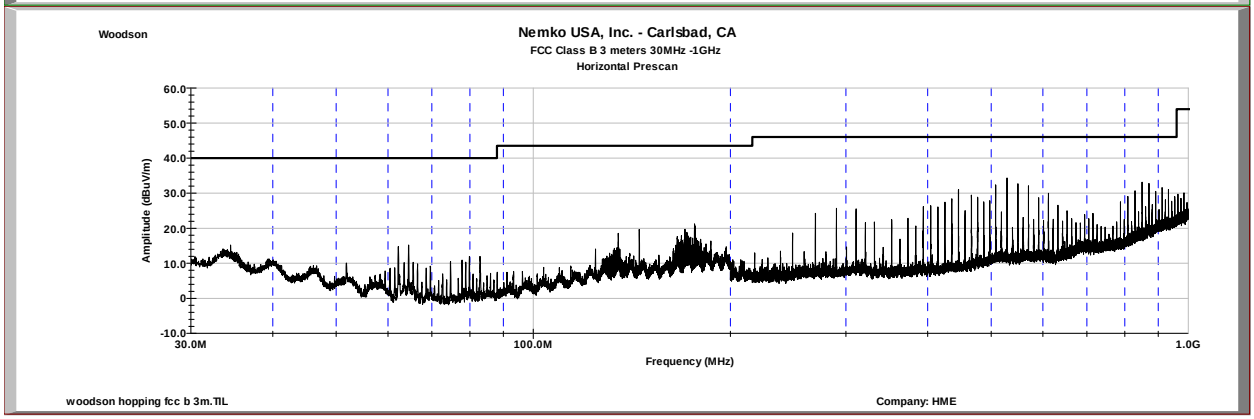
CR/SL Dif = Limit – Corrected Reading. Pass if result is negative.

At 1819.092 MHz: 52.4 = 59.1 + 25.5 + 2.0 – 28.0 –6.2
52.4 – 74 = -21.6

Radiated Emissions 30 MHz to 1000 MHz

- Comment: Digital emissions that occur regardless of transmit frequency.
- Peak data, max hold at 120 kHz RBW, 300 kHz VBW
- Maximized for EUT rotation and receiving antenna height 1—4m
- Distance between EUT and receiving antenna 3m
- No emissions above 1000 MHz within 20 dB of the margin observed for digital sources.
- Highest peak value = 33.84 dBuV/m at 528.733 MHz
- No differences in emissions when individual channels are selected, frequency hopping mode is worst case and presented below.



Radiated Emissions 1000 MHz to 25000 MHz

No other emissions within 20dB of the limits were observed.
Antenna 1—non hopping
Hopping was using both antennas (worst case)

**Radiated Emissions Data**

| | | | | | |
|---|---|---|---|---|---|
| Job # : | 10219279 | Date : | 1/25/2012 | Page | 1 of 1 |
| NEX#: | 195775 | Time : | 1930 | | |
| | | Staff : | aal | | |
| Client Name : | HME | | | EUT Voltage : | 5.0 VDC |
| EUT Name : | RF Module | | | EUT Frequency : | |
| EUT Model # : | Woodson | | | Phase: | |
| EUT Serial # : | | | | | |
| EUT Config. : | Antenna 1 | | | | |
| | Second to last channel measured | | | Distance < 1000 MHz: | 3 m |
| | Last channel power reduced to comply | | | Distance > 1000 MHz: | 3 m |
| Specification : | & CFR47 Part 15, Subpart B, Class B | | | | |
| Loop Ant. #: | NA | | | | |
| Bicon Ant.#: | NA | Temp. (°C) : | 20 | | |
| Log Ant.#: | NA | Humidity (%) : | 42 | | |
| DRG Ant. # | 752 | Spec Analyzer #: | 911 | | |
| Cable LF#: | NA | Analyzer Display #: | 911 | | |
| Cable HF#: | WCC | | | | |
| Preamp LF#: | NA | Duty Cycle (%): | 4.80 | | |
| Preamp HF# | 317 | | | | |

Peak RBW: 1 MHz
Video Bandwidth 3 MHz
Average = Peak + Duty Cycle Factor
DCF = 20 x log(duty cyle)

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 DEG | Ant. Height cm | Max. Reading (dBµV) | Corrected Reading (dBµV) | Spec. limit (dBµV) | CR/SL Diff. (dB) | Pass Fail | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | BAND EDGE |
| 2401.92 | 78.9 | 73.4 | P | 209 | 130 | 78.9 | 115.1 | 125.3 | -10.2 | Pass | 100 kHz RBW |
| | | | | | | | | | | | |
| 2390.00 | 24.0 | 22.4 | P | 209 | 140 | 24.0 | 60.2 | 74.0 | -13.8 | Pass | 1 MHz RBW |
| 2390.00 | 24.0 | 22.4 | A | 209 | 140 | 24.0 | 33.8 | 54.0 | -20.2 | Pass | 1 MHz RBW |
| 2400.00 | 30.2 | 21.6 | P | 210 | 130 | 30.2 | 66.4 | 95.1 | -28.7 | Pass | 100 kHz RBW |
| 2400.00 | 30.2 | 21.6 | A | 210 | 130 | 30.2 | 40.0 | 75.1 | -35.1 | Pass | 100 kHz RBW |
| | | | | | | | | | | | channel 2d |
| 2483.50 | 32.2 | 24.7 | P | 359 | 108 | 32.2 | 68.4 | 74.0 | -5.6 | Pass | 1 MHz RBW |
| 2483.50 | 32.2 | 24.7 | A | 359 | 108 | 32.2 | 42.0 | 54.0 | -12.0 | Pass | 1 MHz RBW |
| | | | | | | | | | | | channel 2e |
| 2483.50 | 35.5 | 27.8 | P | 63 | 123 | 35.5 | 71.7 | 74.0 | -2.3 | Pass | 1 MHz RBW |
| 2483.50 | 35.5 | 27.8 | A | 63 | 123 | 35.5 | 45.3 | 54.0 | -8.7 | Pass | 1 MHz RBW |
| | | | | | | | | | | | |
| | | | | | | | | | | | hopping |
| 2400.00 | 29.2 | 19.4 | P | 209 | 140 | 29.2 | 65.4 | 95.1 | -29.7 | Pass | 1 MHz RBW |
| 2400.00 | 29.2 | 19.4 | A | 209 | 140 | 29.2 | 39.0 | 75.1 | -36.1 | Pass | 1 MHz RBW |
| 2483.500 | 36.1 | 33.9 | P | 63.0 | 1.3 | 36.1 | 72.3 | 74.0 | -1.7 | Pass | 1 MHz RBW |
| 2483.500 | 36.1 | 33.9 | A | 63.0 | 1.3 | 36.1 | 45.9 | 54.0 | -8.1 | Pass | 1 MHz RBW |
| | | | | | | | | | | | HARMONICS |
| | | | | | | | | | | | not hopping |
| | | | | | | | | | | | low channel |
| 4803.840 | 42.1 | 38.1 | P | 100 | 120 | 42.1 | 49.3 | 74.0 | -24.7 | Pass | 1 MHz RBW |
| 4803.840 | 42.1 | 38.1 | A | 100 | 120 | 42.1 | 22.9 | 54.0 | -31.1 | Pass | 1 MHz RBW |
| | | | | | | | | | | | mid channel |
| 4883.328 | 43.6 | 39.3 | P | 100 | 115 | 43.6 | 50.8 | 74.0 | -23.2 | Pass | 1 MHz RBW |
| 4883.328 | 43.6 | 39.3 | A | 100 | 115 | 43.6 | 24.4 | 54.0 | -29.6 | Pass | 1 MHz RBW |
| | | | | | | | | | | | channel 2d |
| 4959.360 | 42.1 | 38.1 | P | 155.0 | 110.0 | 42.1 | 49.3 | 74.0 | -24.7 | Pass | 1 MHz RBW |
| 4959.360 | 42.1 | 38.1 | A | 155.0 | 110.0 | 42.1 | 22.9 | 54.0 | -31.1 | Pass | 1 MHz RBW |
| | | | | | | | | | | | channel 2e |
| 4962.816 | 46.3 | 38.8 | P | 150 | 141 | 46.3 | 53.5 | 74.0 | -20.5 | Pass | 1 MHz RBW |
| 4962.816 | 46.3 | 38.8 | A | 150 | 141 | 46.3 | 27.1 | 54.0 | -26.9 | Pass | 1 MHz RBW |

Antenna 2—non hopping
Hopping was using both antennas (worst case)

**Radiated Emissions Data**

| | | | | | |
|---|---|---|---|---|---|
| Job # : | 10219279 | Date : | 1/25/2012 | Page | 1 of 1 |
| NEX #: | 195775 | Time : | 18:20 | | |
| | | Staff : | aal | | |
| Client Name : | HME | | | EUT Voltage : | 5.0 VDC |
| EUT Name : | RF Module | | | EUT Frequency : | |
| EUT Model # : | Woodson | | | Phase: | |
| EUT Serial # : | | | | | |
| EUT Config. : | Antenna 2 | | | | |
| | Second to last channel measured | | | Distance < 1000 MHz: | 3 m |
| | Last channel power reduced to comply | | | Distance > 1000 MHz: | 3 m |
| Specification : | & CFR47 Part 15, Subpart B, Class B | | | | |
| Loop Ant. #: | NA | | | | |
| Bicon Ant.#: | NA | Temp. (°C) : | 20 | | |
| Log Ant.#: | NA | Humidity (%) : | 42 | | |
| DRG Ant. # | 752 | Spec Analyzer #: | 911 | | |
| Cable LF#: | NA | Analyzer Display #: | 911 | | |
| Cable HF#: | WCC | | | | |
| Preamp LF#: | NA | Duty Cycle (%): | 4.80 | | |
| Preamp HF# | 317 | | | | |

Peak RBW: 1 MHz
Video Bandw idth 3 MHz
Average = Peak + Duty Cycle Factor
DCF = 20 x log(duty cyle)

Measurements below 1 GHz are Quasi-Peak values, unless otherw ise stated.
Measurements above 1 GHz are Average values, unless otherw ise stated.

| Meas. Freq. (MHz) | Meter Reading **Vertical** | Meter Reading **Horizontal** | Det. | EUT Side DEG | Ant. Height cm | Max. Reading (dBµV) | Corrected Reading (dBµV) | Spec. limit (dBµV) | CR/SL Diff. (dB) | Pass Fail | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | BAND EDGE |
| 2401.92 | 81.4 | 76.4 | P | 62.0 | 1.3 | 81.4 | 117.6 | 125.3 | -7.7 | Pass | 100 kHz RBW |
| | | | | | | | | | | | |
| 2390.00 | 23.0 | 22.5 | P | 64.0 | 1.3 | 23.0 | 59.2 | 74.0 | -14.8 | Pass | 1 MHz RBW |
| 2390.00 | 23.0 | 22.5 | A | 64.0 | 1.3 | 23.0 | 32.8 | 54.0 | -21.2 | Pass | 1 MHz RBW |
| 2400.00 | 34.7 | 19.4 | P | 63.0 | 1.3 | 34.7 | 70.9 | 97.6 | -26.7 | Pass | 100 kHz RBW |
| 2400.00 | 34.7 | 19.4 | A | 63.0 | 1.3 | 34.7 | 44.5 | 77.6 | -33.1 | Pass | 100 kHz RBW |
| | | | | | | | | | | | channel 2d 2479.68 |
| 2483.500 | 32.8 | 24.5 | P | 63.0 | 1.3 | 32.8 | 69.0 | 74.0 | -5.0 | Pass | 1 MHz RBW |
| 2483.500 | 32.8 | 24.5 | A | 63.0 | 1.3 | 32.8 | 42.6 | 54.0 | -11.4 | Pass | 1 MHz RBW |
| | | | | | | | | | | | high channel |
| 2483.500 | 36.9 | 34.6 | P | 63.0 | 1.4 | 36.9 | 73.1 | 74.0 | -0.9 | Pass | 1 MHz RBW |
| 2483.500 | 36.9 | 34.6 | A | 63.0 | 1.4 | 36.9 | 46.7 | 54.0 | -7.3 | Pass | 1 MHz RBW |
| | | | | | | | | | | | hopping |
| 2400.00 | 29.2 | 19.4 | P | 63.0 | 1.3 | 29.2 | 65.4 | 97.6 | -32.2 | Pass | 100 kHz RBW |
| 2400.00 | 29.2 | 19.4 | A | 63.0 | 1.3 | 29.2 | 39.0 | 77.6 | -38.6 | Pass | 100 kHz RBW |
| 2483.500 | 36.1 | 33.9 | P | 63.0 | 1.3 | 36.1 | 72.3 | 74.0 | -1.7 | Pass | 1 MHz RBW |
| 2483.500 | 36.1 | 33.9 | A | 63.0 | 1.3 | 36.1 | 45.9 | 54.0 | -8.1 | Pass | 1 MHz RBW |
| | | | | | | | | | | | |
| | | | | | | | | | | | HARMONICS |
| 4803.840 | 54.5 | 49.3 | P | 198.0 | 153.0 | 54.5 | 61.7 | 74.0 | -12.3 | Pass | 1 MHz RBW |
| 4803.840 | 54.5 | 49.3 | A | 198.0 | 153.0 | 54.5 | 35.3 | 54.0 | -18.7 | Pass | 1 MHz RBW |
| | | | | | | | | | | | |
| 4883.328 | 56.4 | 50.5 | P | 132.0 | 152.0 | 56.4 | 63.6 | 74.0 | -10.4 | Pass | 1 MHz RBW |
| 4883.328 | 56.4 | 50.5 | A | 132.0 | 152.0 | 56.4 | 37.2 | 54.0 | -16.8 | Pass | 1 MHz RBW |
| | | | | | | | | | | | |
| 4959.360 | 46.9 | 34.0 | P | 155.0 | 110.0 | 46.9 | 54.1 | 74.0 | -19.9 | Pass | 1 MHz RBW |
| 4959.360 | 46.9 | 34.0 | A | 155.0 | 110.0 | 46.9 | 27.7 | 54.0 | -26.3 | Pass | 1 MHz RBW |
| | | | | | | | | | | | |
| 4962.816 | 47.3 | 38.3 | P | 155.0 | 110.0 | 47.3 | 54.5 | 74.0 | -19.5 | Pass | 1 MHz RBW |
| 4962.816 | 47.3 | 38.3 | A | 155.0 | 110.0 | 47.3 | 28.1 | 54.0 | -25.9 | Pass | 1 MHz RBW |

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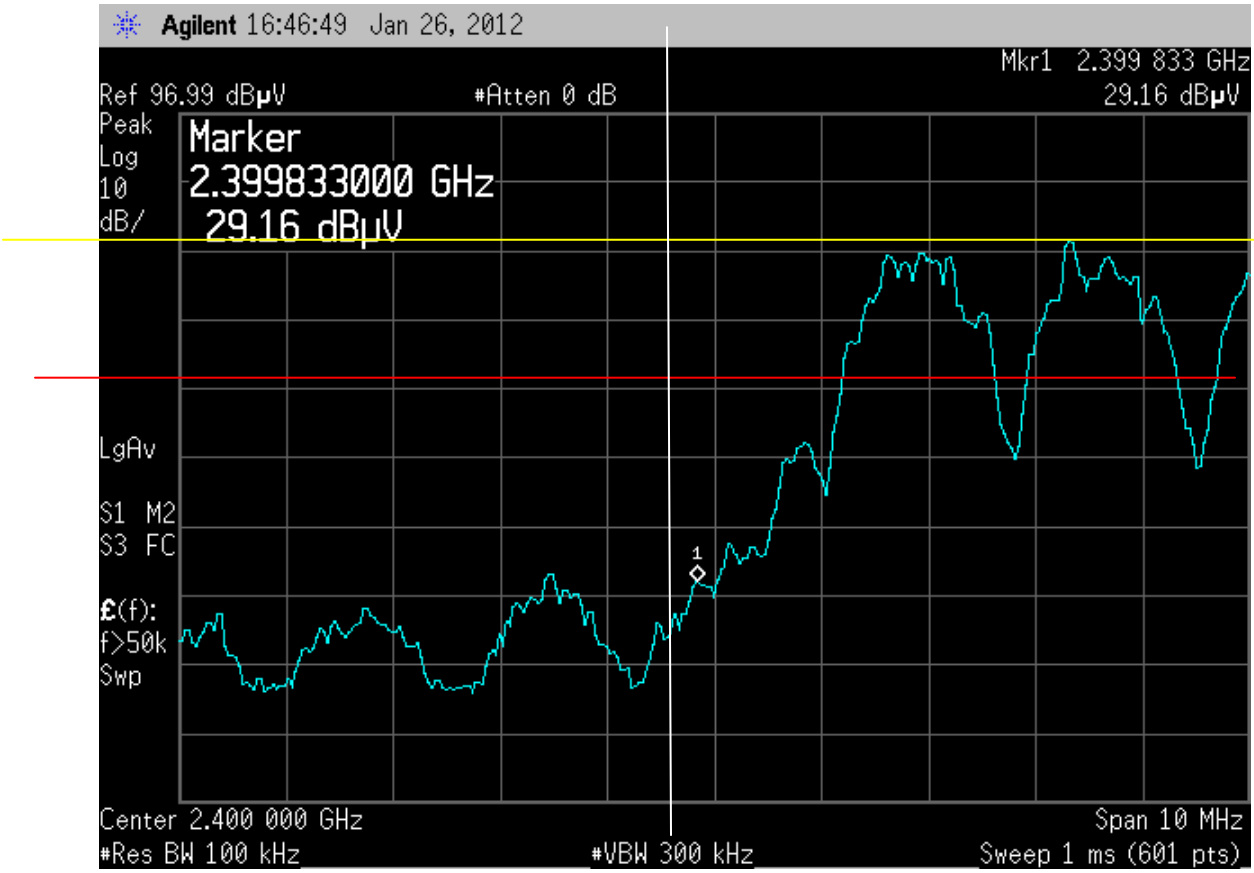
Band Edge Plots

Hopping, lower Band Edge
Limit is 20 dBc—Red line



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Non-Hopping, lower Band Edge
Limit is 20 dBc—Red line
Antenna 1

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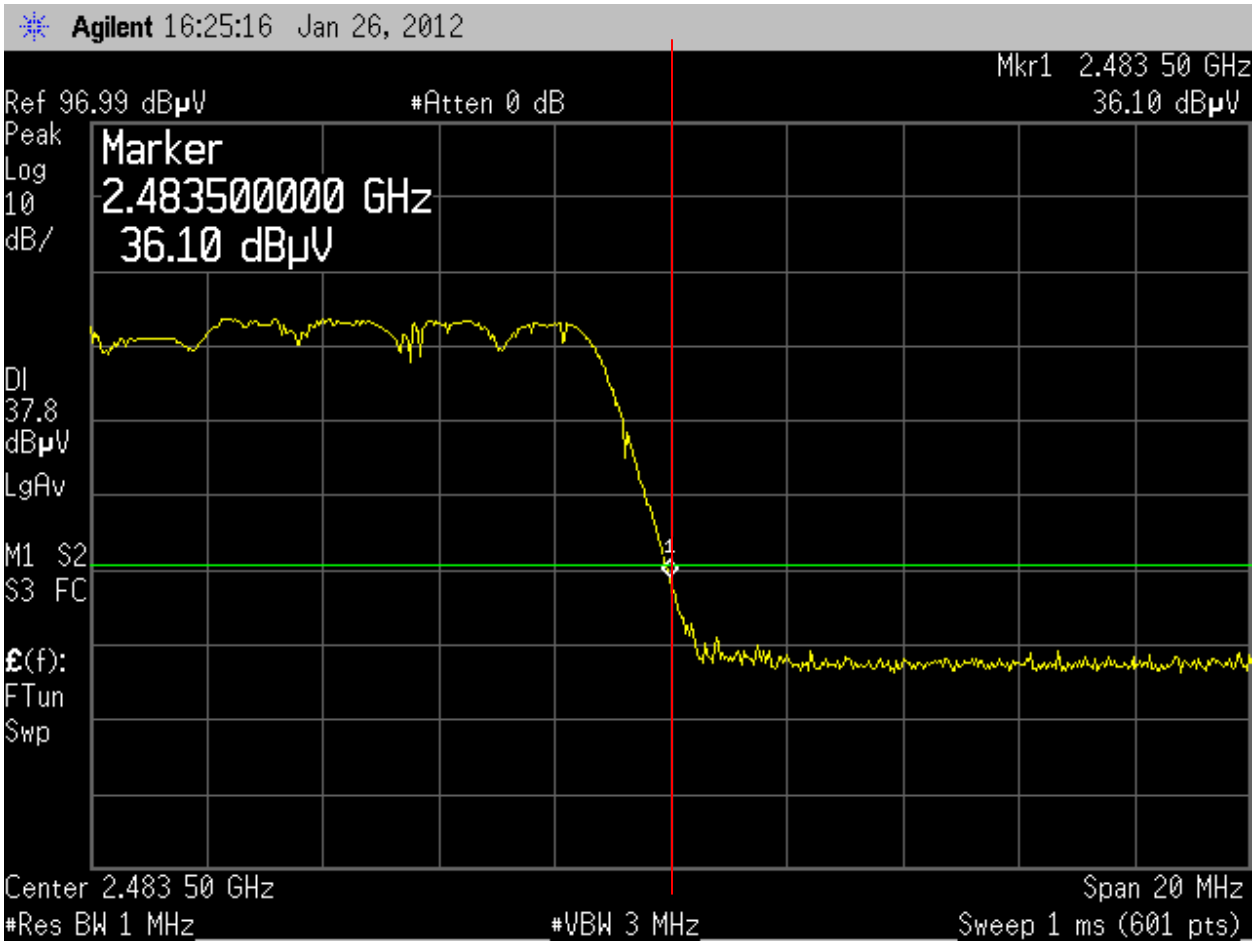
Upper Bandedge Measurements

Detector is Peak, Trace is Max Hold
3m, equipment used: 835, 752




High Channel Hopping Mode

Red line 2483.5MHz
Green Line equivalent to 74 dBuV/m (= 37.8 dBuV +ant factor + cable loss)

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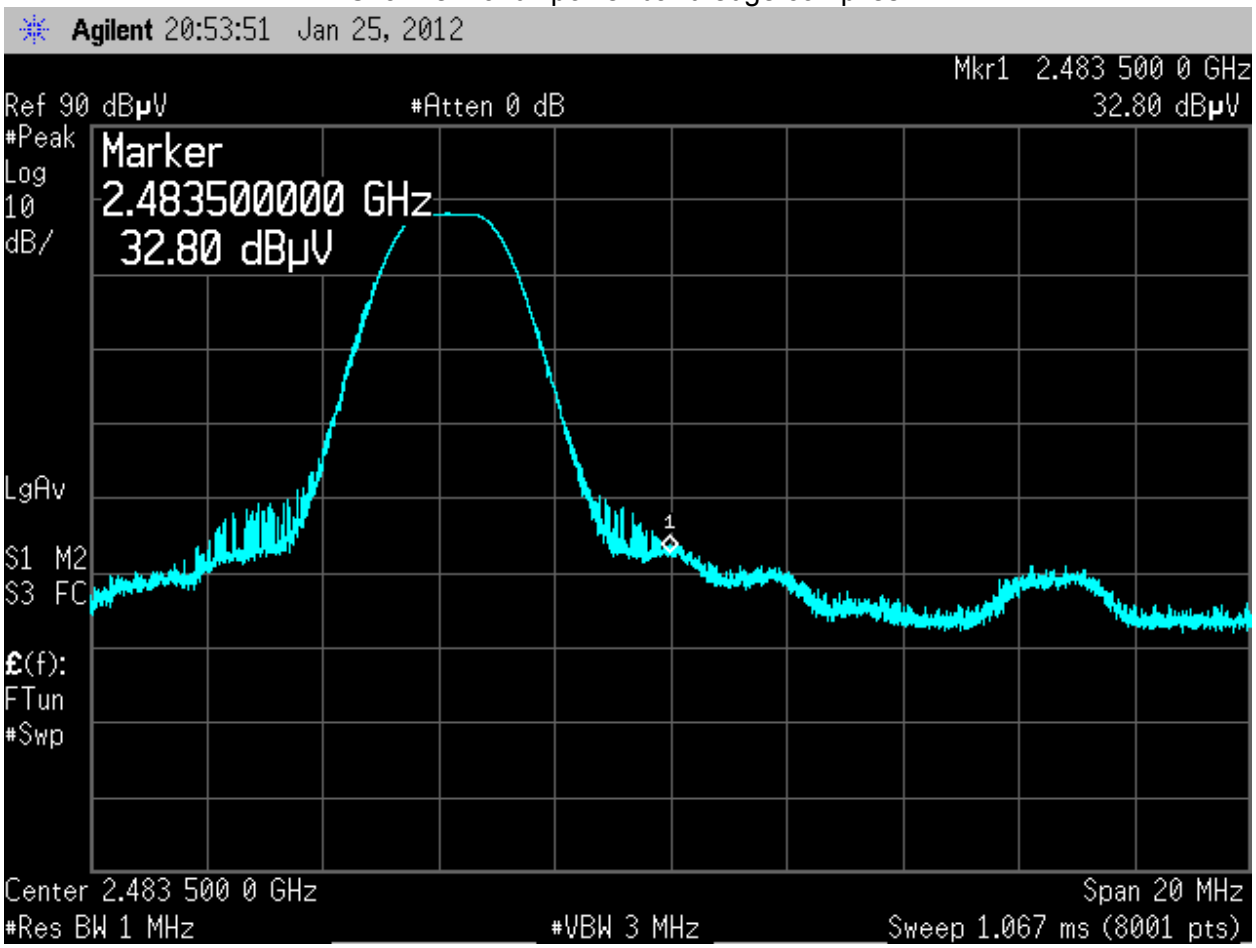
High Channel Not-Hopping Mode
Antenna 2—worst case

Channel 46 full power band edge complies.



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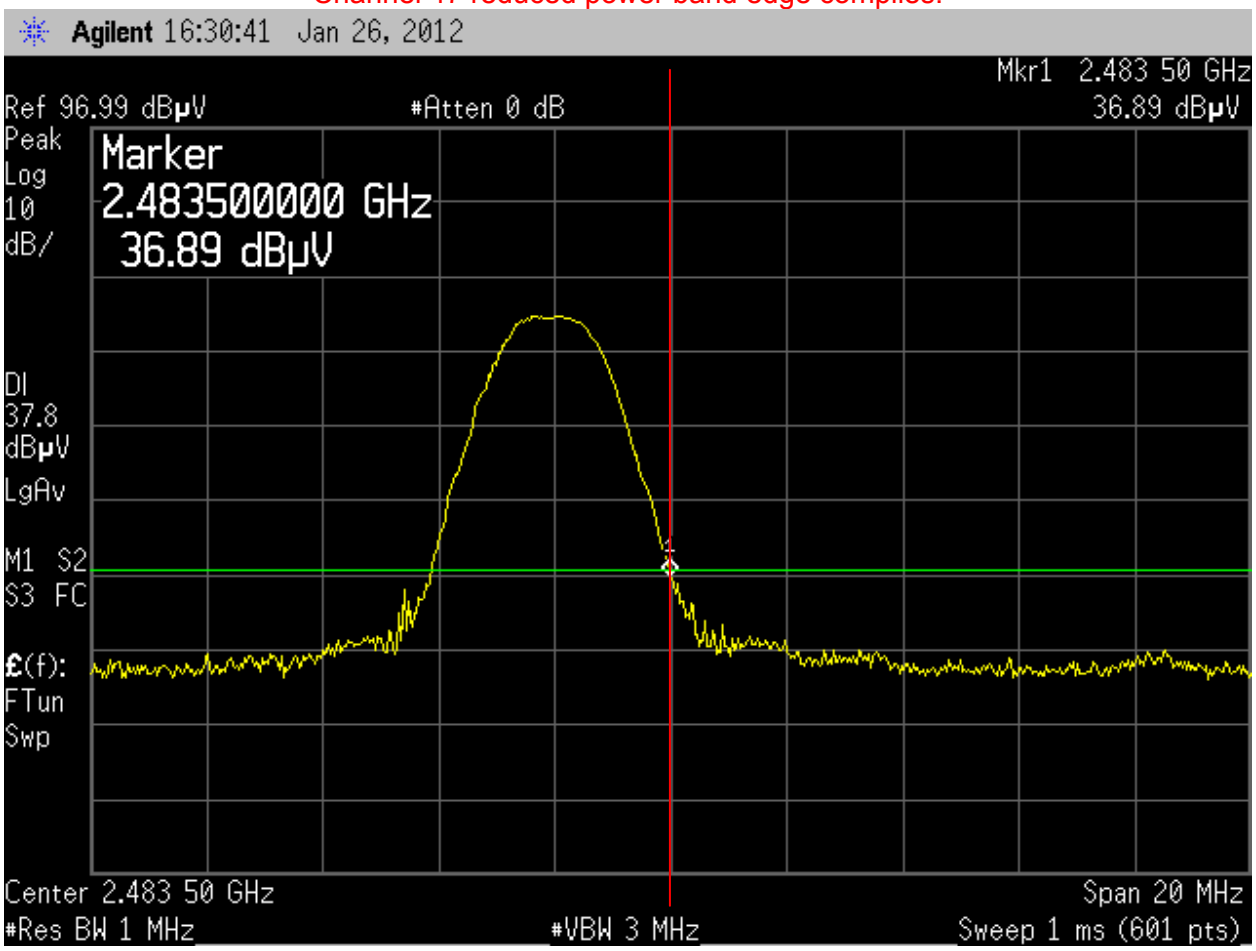
High Channel Not-Hopping Mode
Antenna 2-worst case

Channel 47 reduced power band edge complies.




Red Line is 2483.5 MHz
Green Line equivalent to 74 dBuV/m (= 37.8 dBuV +ant factor + cable loss)

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## Conducted Spurious Emissions

15.247 (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 Sec. 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Sec. 15.205(a) must also comply with the radiated emission limits specified in Sec. 15.209(a) (see Sec. 15.205(c)).

### Test Conditions:

| | | | |
|---|---|---|---|
| Sample Number: | XCVPRO2 | Temperature: | 22 °C |
| Date: | January 23, 2012 | Humidity: | 47 % |
| Modification State: | Lo/Mid/High Channels | Tester: | Mark Philips |
| | | Laboratory: | Nemko |

### Test Results: EUT complies

See plots below.

### Additional Observations:

- The peak level reading was taken at the carrier frequency 10 dBm then a display line was drawn 30 dBc below this level (-20 dBm) which will be the limit for this test.
- RBW is 100 kHz
- VBW is 3X RBW
- Sweep is auto.
- Detector is Peak, Trace is Max Hold
- A 10 dB attenuator was used between the input of the Spectrum Analyzer and the EUT's antenna port.
- The Spectrum was searched from 30 MHz to 9500 MHz using a computer to control sweep time, ranges and record peak hold data. RBW = 100 kHz, VBW = 300 kHz.
- Emissions were searched from 30 MHz to 2400 MHz and from 2483.5 MHz to 25G Hz, no emissions within 20 dB of the limit were detected.

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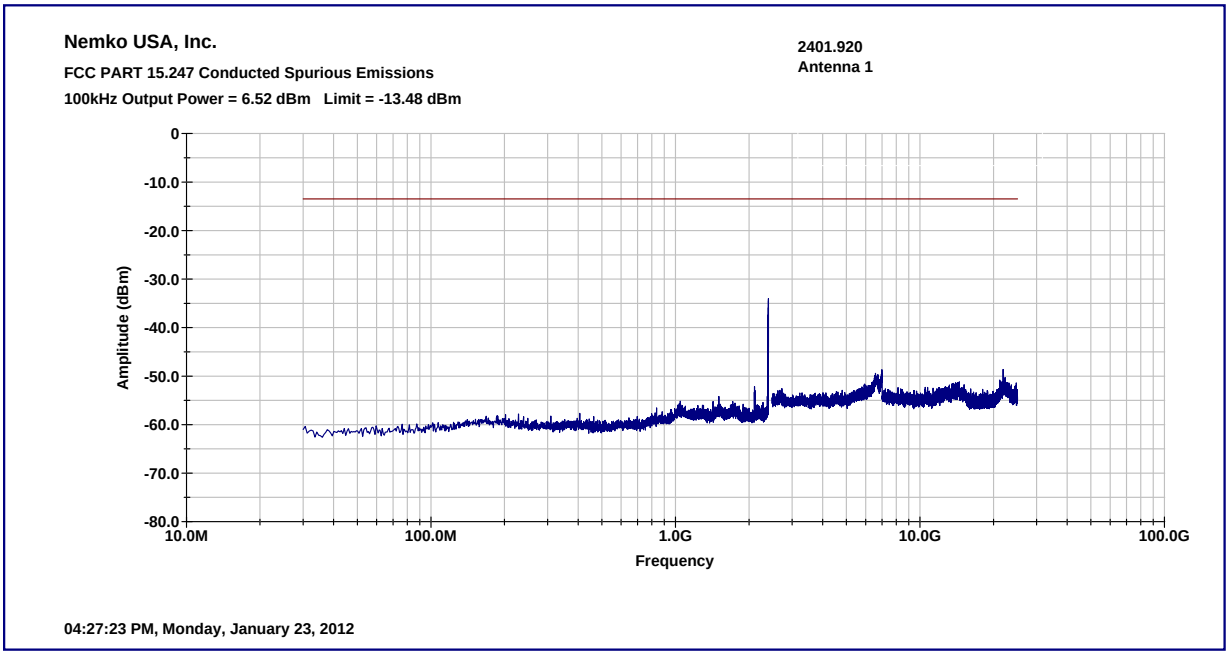


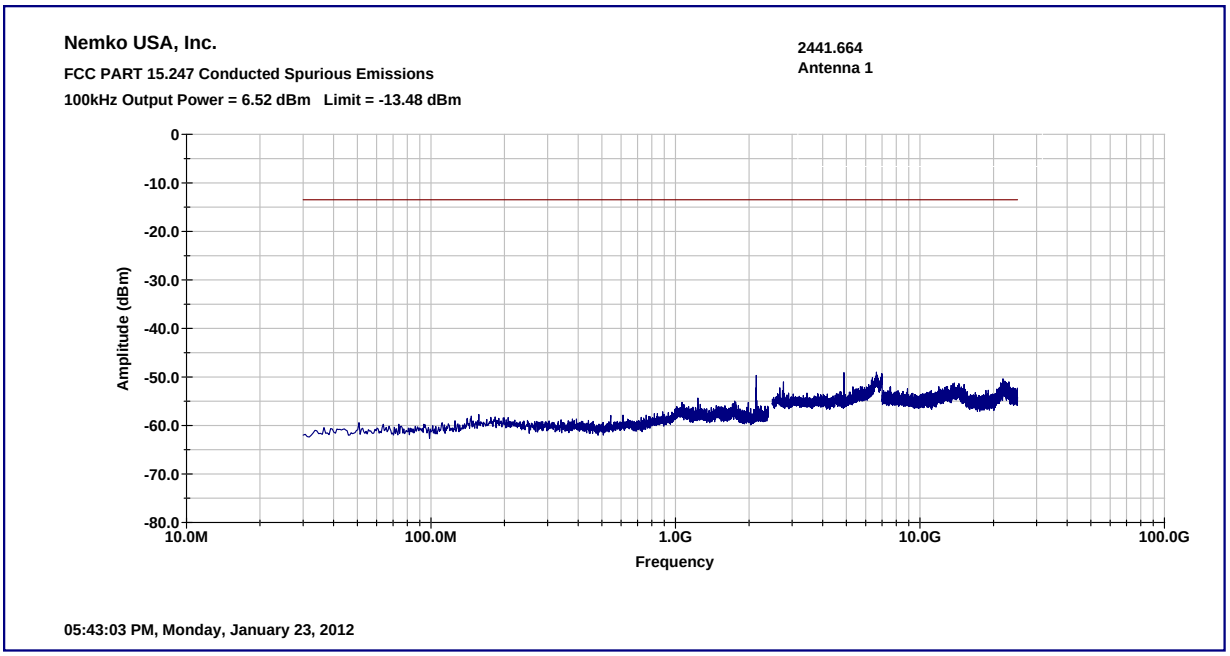

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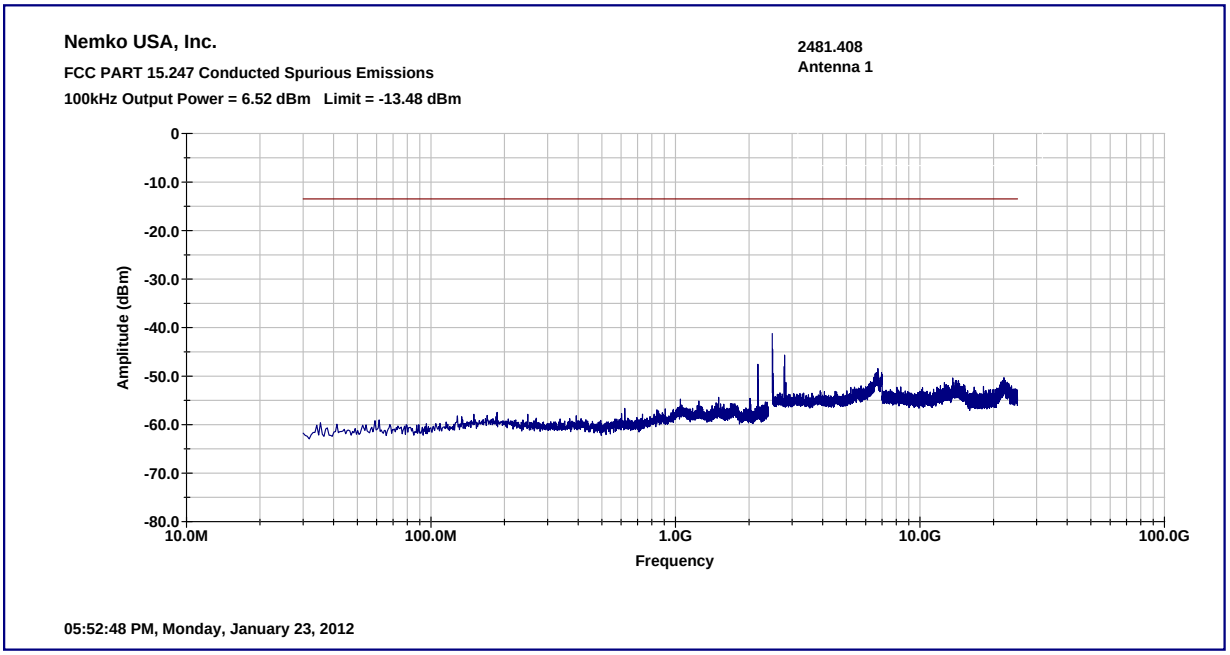


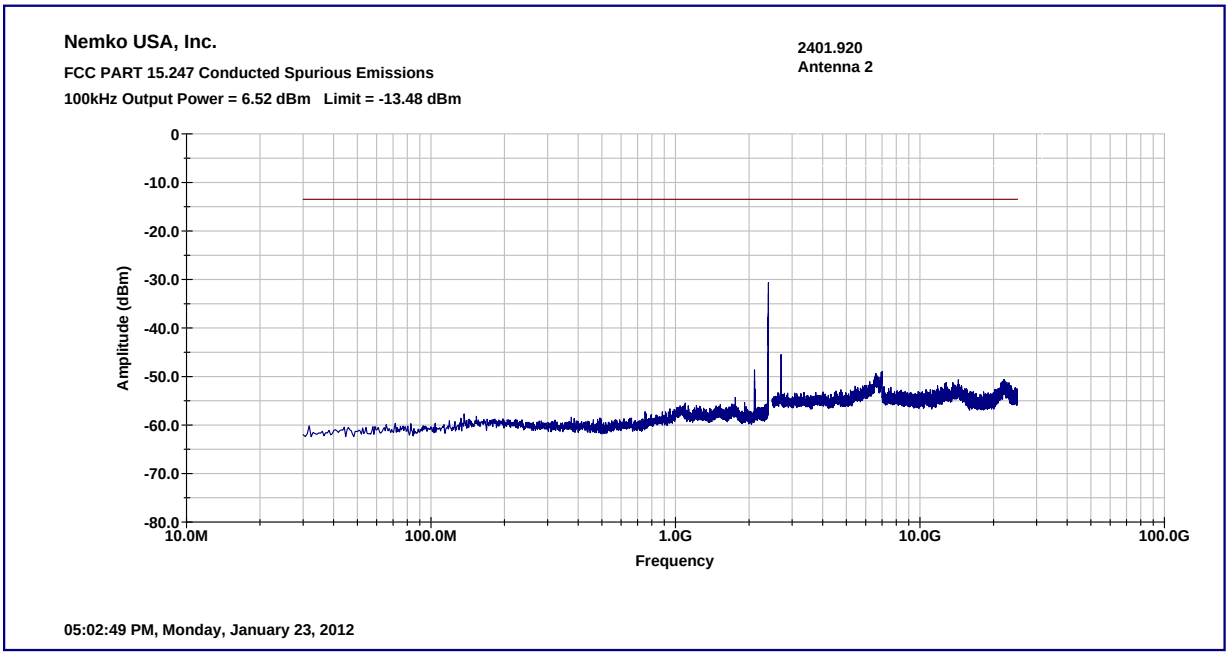

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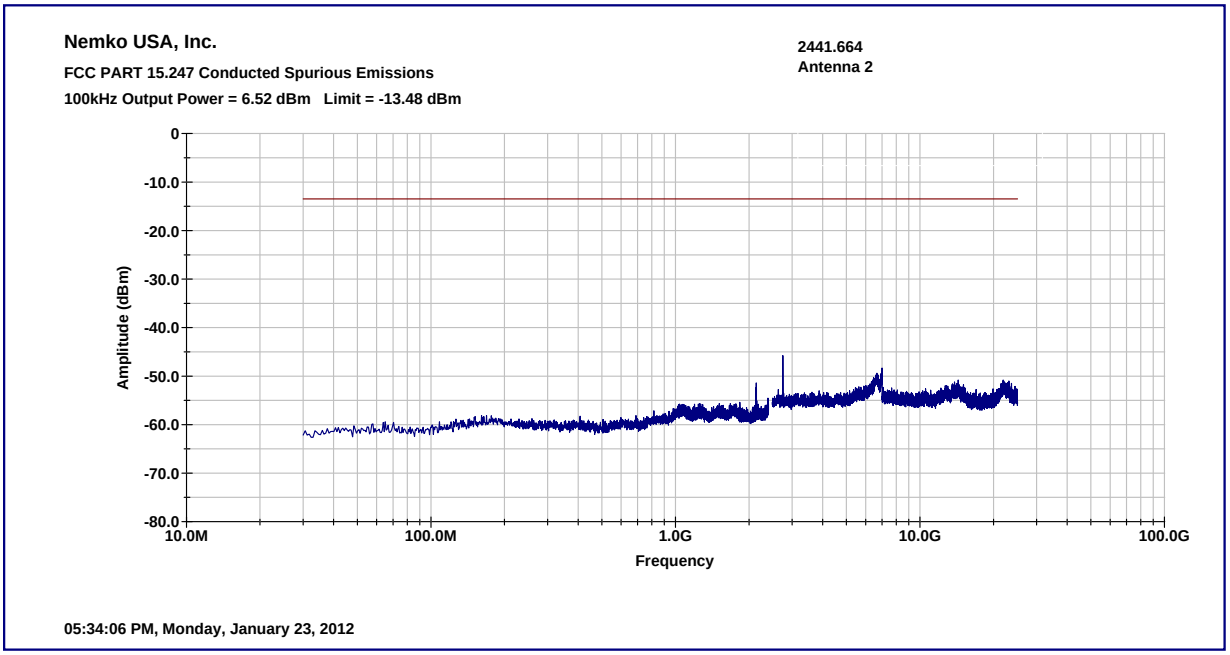


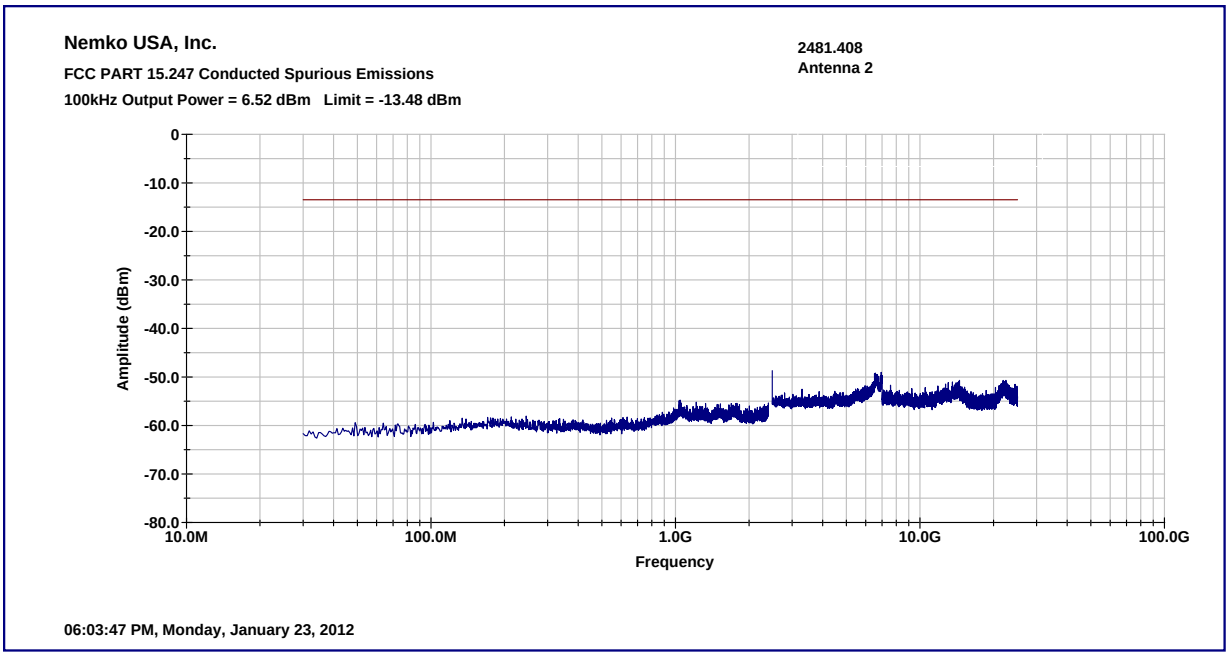

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## Peak Output Power

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:
(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

## Test Conditions:

| | | | |
|---|---|---|---|
| Sample Number: | XCVPRO2 | Temperature: | 21°C |
| Date: | February 6, 2012 | Humidity: | 38 % |
| Modification State: | Lo/Mid/High Channels | Tester: | Mark Philips |
| | | Laboratory: | Nemko |

## Test Results: EUT complies.

- Input to the RF Module test board was varied +/-15% from 102 to 138 VAC. No significant change in output power was noted.
- RBW is 5 MHz
- VBW is 5 MHz
- Detector is Peak, Trace is Max Hold
- A 10 dB attenuator was used between the input of the Spectrum Analyzer and the EUT's antenna port.
- The highest channel's power was reduced to pass bandedge emissions, therefore the next highest channel's power is measured and reported below.

## Conducted Peak Output Power:

| Channel | Frequency | Peak Output Power dBm Antenna 1 | Peak Output Power dBm Antenna 2 | Calculated Output Power (mW) |
|---|---|---|---|---|
| Low | 2401.920 MHz | 18.20 dBm | 18.25 dBm | |
| Mid | 2441.408 MHz | 18.26 dBm | 18.33 dBm | 68.1 |
| 46th | 2469.680 MHZ | 17.96 dBm | 17.72 dBm | |
| High | 2481.408 MHz | 10.51 dBm | 10.39 dBm | |

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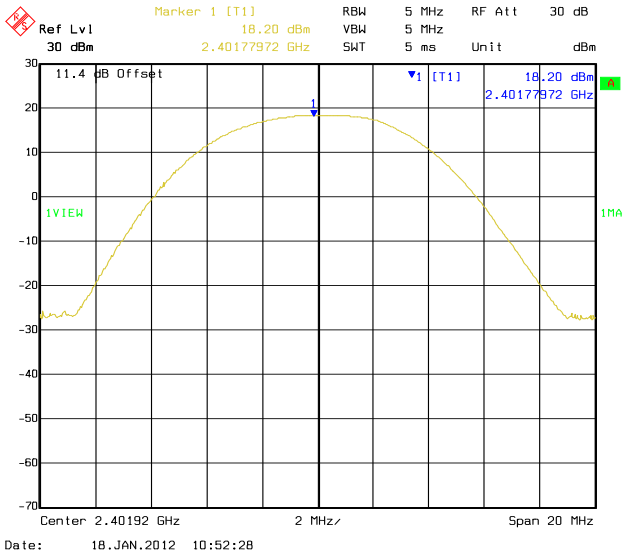
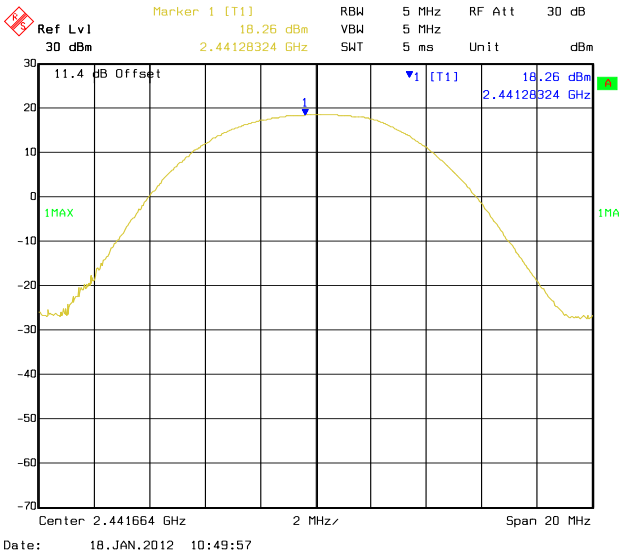
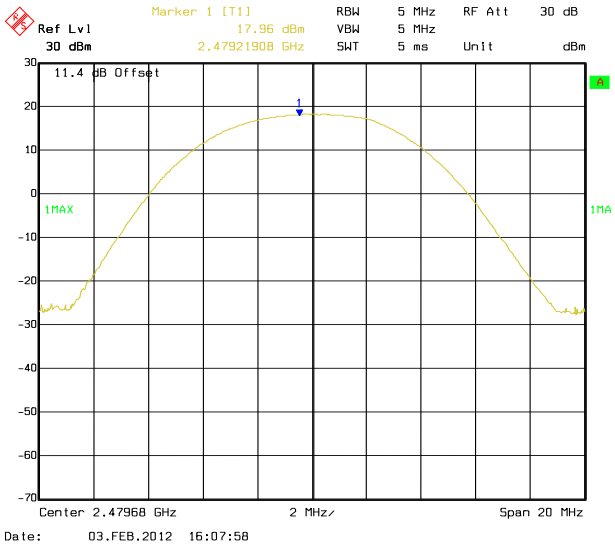
## Antenna Port 1



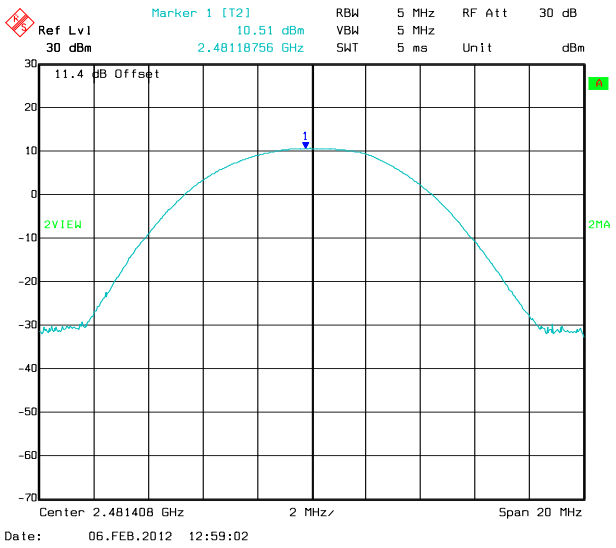

Low Channel




Mid Channel




Channel #46 Full power




High Channel #47 reduced power

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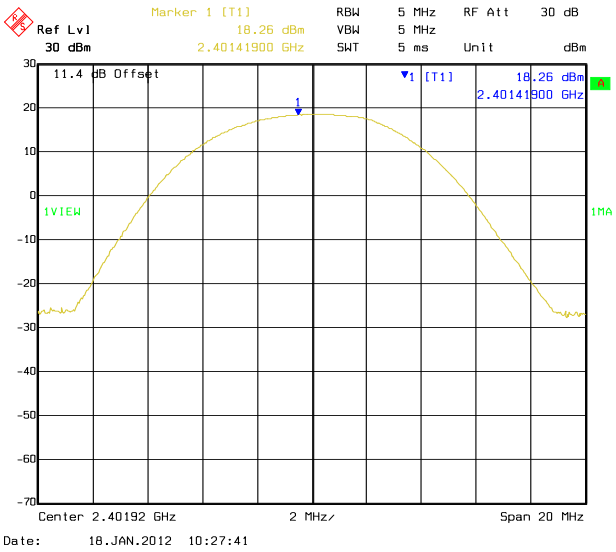
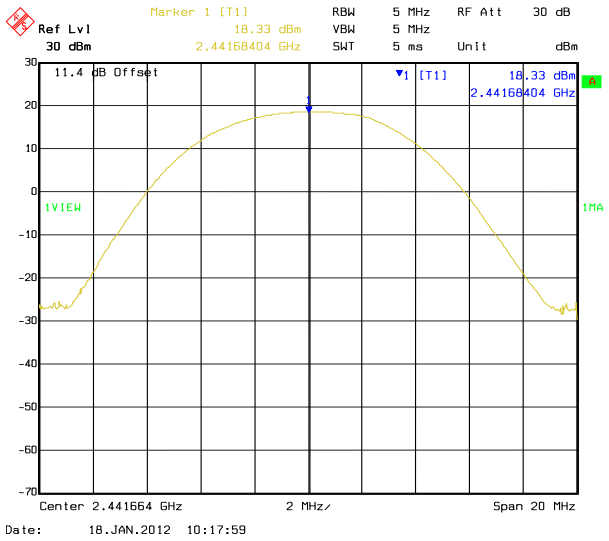
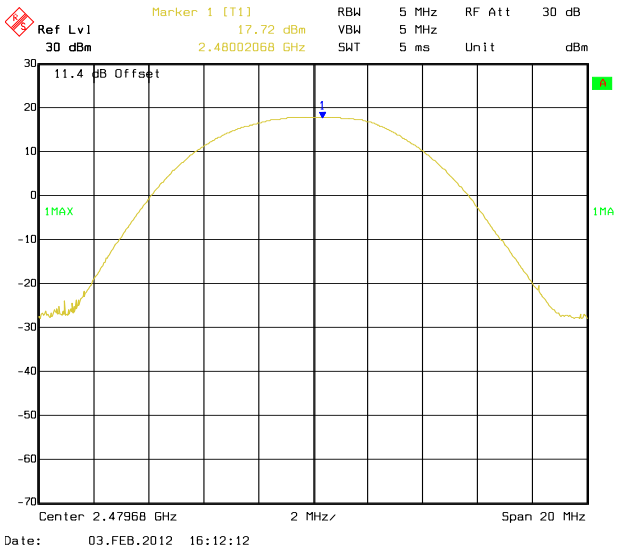
## Antenna Port 2



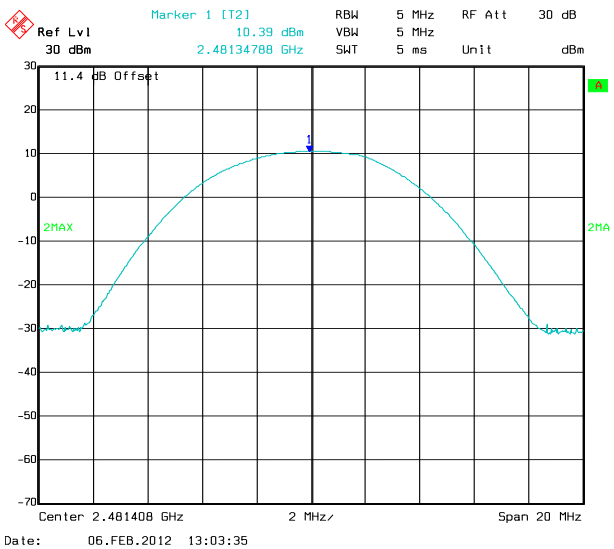

Low Channel




Mid Channel




Channel #46 Full power




High Channel #47 reduced power

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## Receiver Spurious Emissions

The following receiver spurious emission limits shall be complied with:
(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 1.
Table 1 - Spurious Emission Limits for Receivers

| Spurious Frequency (MHz) | Field Strength (microvolt/m at 3 meters) |
|---|---|
| 30-88 | 100 |
| 88-216 | 150 |
| 216-960 | 200 |
| Above 960 | 500 |

## Test Conditions:

| | | | |
|---|---|---|---|
| Sample Number: | XCVPRO2 | Temperature: | 21°C |
| Date: | January 23, 2012 | Humidity: | 39 % |
| Modification State: | test receive mode | Tester: | A. Laudani |
| | | Laboratory: | 10m Chamber |

Test Results:

See attached test result.

Additional Observations:

- The Spectrum was searched from 30 MHz to 15000 MHz using a computer to control sweep time, ranges and record peak hold data. RBW = 100 kHz, VBW = 300 kHz.
- Below 1GHz measurements are measured using CISPR quasi-peak detector while above 1GHz are measured using average detector with 1MHz RBW.
- No other emissions within 20 dB of the limit were detected.
- Highest peak value = 33.84 dBuV/m at 528.733 MHz
- No differences in emissions when individual channels are selected, frequency hopping mode is worst case and presented below.

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