

Nemko Test Report: 126984-13TRFWL

Applicant: DAP Technologies
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Apparatus: Handheld computer 8900K series

FCC ID: T5M8900K1

In Accordance With: FCC Part 15 Subpart C, 15.247
FHSS System and Digitally Modulated Radiators
902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz

Authorized By: 
Kevin Ma, Wireless/EMC Specialist

Date: November 24, 2009

Total Number of Pages: 19

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Section 1 : Report Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003.

The assessment summary is as follows:

| | |
|--------------------------------|---|
| Apparatus Assessed: | Handheld computer 8900K series |
| Specification: | FCC Part 15 Subpart C, 15.247 – Partial test |
| Compliance Status: | Complies |
| Exclusions: | None |
| Non-compliances: | None |
| Report Release History: | Original Release |
| Test Location: | Nemko Canada Inc. 303 River Road Ottawa, Ontario K1V 1H2 |
| Registration Number: | 176392 (3 m Semi-Anechoic Chamber) |
| Tests Performed By: | Andrey Adelberg, EMC/Wireless Specialist |
| Test Dates: | August–September 2009 |

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. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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Section 2 : Equipment Under Test

2.1 Identification of Equipment Under Test (EUT)

The following information identifies the EUT under test:

| | |
|----------------------|--------------------------------|
| Type of Equipment: | Handheld computer 8900K series |
| Brand Name: | DAP, Kinysis |
| Model Number: | 8900K1 |
| Serial Number: | HN00007 |
| Nemko Sample Number: | 2 |
| FCC ID: | T5M8900K1 |
| Date of Receipt: | June 12, 2009 |

2.2 Accessories

The following information identifies accessories used to exercise the EUT during testing:

| | |
|-----------------------|-------------------------------------|
| Description: | Docking station (Ethernet-USB host) |
| Brand Name: | DAP, Microflex |
| Model Name or Number: | CBCE840 |
| Serial Number: | EH03401 |
| Nemko Sample Number: | 5 |
| Connection Port: | Contact connection |

| | |
|-----------------------|----------------------------------|
| Description: | AC adapter |
| Manufacturer: | Cincon Electronics Co., Ltd. |
| Model Name or Number: | TRG36A15 |
| Serial Number: | 36150-0000202 |
| Nemko Sample Number: | 10 |
| Connection Port: | DC jack to the Ethernet-USB host |

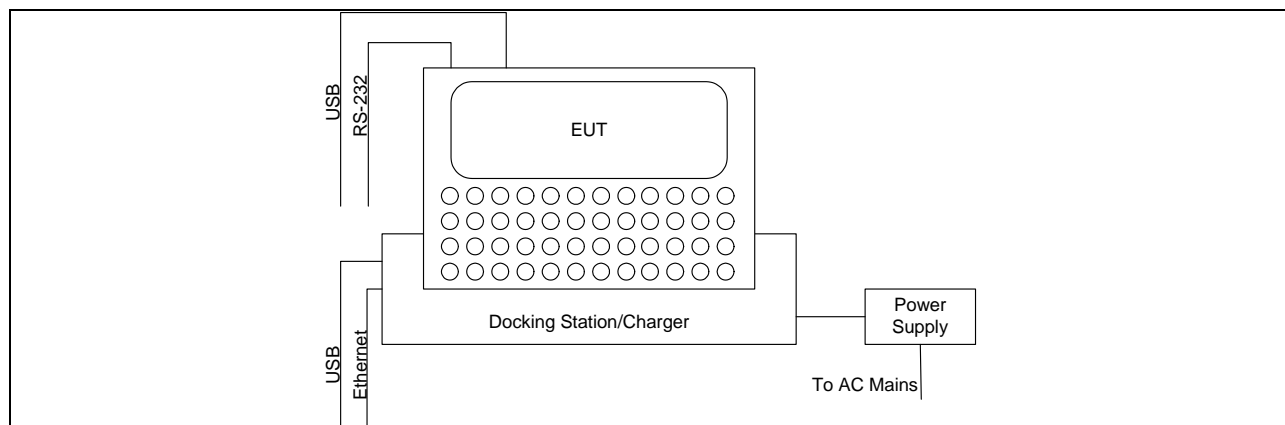
2.3 EUT Description

The EUT is a handheld computer with internal Bluetooth and WiFi connectivity.

2.4 Technical Specifications of the EUT

| | |
|-----------------------------------|--------------------|
| Operating Band: | 2400–2483.5 MHz |
| Operating Frequencies: | 2412–2462 MHz |
| Modulation: | CCK; OFDM |
| Occupied Bandwidth: | 10.1 MHz; 16.4 MHz |
| Channel Spacing: | 20 MHz |
| Emission Designator: | G1D; W7D |
| Antenna Data: | Chip antenna 1 dBi |
| Power Supply Requirements: | 120 VAC, 60 Hz |

2.5 EUT Setup diagram



2.6 Operation of the EUT during testing

The EUT was operated using test software that would cause the EUT to transmit continuously.

2.7 Modifications incorporated in the EUT

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

Section 3 : Test Conditions

3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.247

FHSS System and Digitally Modulated Radiators

902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz

3.2 Deviations From Laboratory Test Procedures

No deviations were made from laboratory test procedures.

3.3 Test Environment

All tests were performed under the following environmental conditions:

| | | |
|--------------------|---|------------------------|
| Temperature range | : | 15–30 °C |
| Humidity range | : | 20–75 % |
| Pressure range | : | 86–106 kPa |
| Power supply range | : | ±5 % of rated voltages |

3.4 Measurement Uncertainty

Nemko Canada measurement uncertainty has been calculated using guidance of UKAS LAB 34:2003 and TIA-603-B Nov 7, 2002. All calculations have been performed to provide a confidence level of 95 % and can be found in Nemko Canada document MU-003.

3.5 Test Equipment

| Equipment | Manufacturer | Model No. | Asset/Serial No. | Cal. Date | Next Cal. |
|----------------------------|-----------------|------------|------------------|-------------|-------------|
| 3 m EMI Test Chamber | TDK | SAC-3 | FA002047 | May 06/09 | May 06/10 |
| Receiver/Spectrum Analyzer | Rohde & Schwarz | ESU 26 | FA002043 | Dec. 16/08 | Dec. 16/09 |
| Bilog | Sunol | JB3 | FA002108 | Jan. 27/09 | Jan. 27/10 |
| Horn Antenna #2 | EMCO | 3115 | FA000825 | Jan. 21/09 | Jan. 21/10 |
| 1 – 18 GHz Amplifier | JCA | JCA118-503 | FA002091 | Oct 2/08 | Oct 2/09 |
| LISN | Rohde & Schwarz | ENV216 | FA002023 | Sept. 08/09 | Sept. 08/10 |
| Horn 18 – 26.5 GHz | Electro-Metrics | SH-50/60-1 | FA000479 | COU | COU |

COU – Calibrate on Use

NCR – No Calibration Required

Section 4 : Results Summary

This section contains the following:

FCC Part 15 Subpart C : 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 tests.

N/T Not Tested, mandatory but not assessed. (See Report Summary)

4.1 FCC Part 15 Subpart C : Test Results

| Part 15 | Test Description | Required | Result |
|-------------------|--|----------|--------|
| 15.31(e) | Variation of power supply | Y | PASS |
| 15.207(a) | Powerline Conducted Emissions | Y | PASS |
| 15.209(a) | Radiated Emissions within Restricted Bands | Y | PASS |
| 15.247(a)(1) | Frequency hopping systems | N | |
| 15.247(a)(1)(i) | Frequency hopping systems operating in the 902–928 MHz band | N | |
| 15.247(a)(1)(ii) | Frequency hopping systems operating in the 5725–5850 MHz band | N | |
| 15.247(a)(1)(iii) | Frequency hopping systems operating in the 2400–2483.5 MHz band | N | |
| 15.247(a)(2) | Minimum 6 dB bandwidth | N/T* | |
| 15.247(b)(1) | Maximum peak output power of Frequency hopping systems operating in the 2400–2483.5 MHz band and 5725–5850 MHz band | N | |
| 15.247(b)(2) | Maximum peak output power of Frequency hopping systems operating in the 902–928 MHz band | N | |
| 15.247(b)(3) | Maximum peak output power of systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands | Y | PASS |
| 15.247(b)(4) | Maximum peak output power | Y | PASS |
| 15.247(c)(1) | Fixed point-to-point Operation with directional antenna gains greater than 6 dBi | N | |
| 15.247(c)(2) | Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams | N | |
| 15.247(d) | Radiated Emissions Not in Restricted Bands | Y | PASS |
| 15.247(e) | Power Spectral Density for Digitally Modulated Devices | N/T* | |
| 15.247(f) | Time of Occupancy for Hybrid Systems | N | |

*-The EUT uses a pre-approved WiFi module. However the antennas are off the module therefore only partial tests were performed.

Appendix A : Test Results

Clause 15.207(a) Powerline Conducted Emissions

Frequency of Conducted limit (dB μ V)

| Emission (MHz) | Quasi-peak | Average |
|----------------|------------|-----------|
| 0.15–0.5 | 66 to 56* | 56 to 46* |
| 0.5–5 | 56 | 46 |
| 5–30 | 60 | 50 |

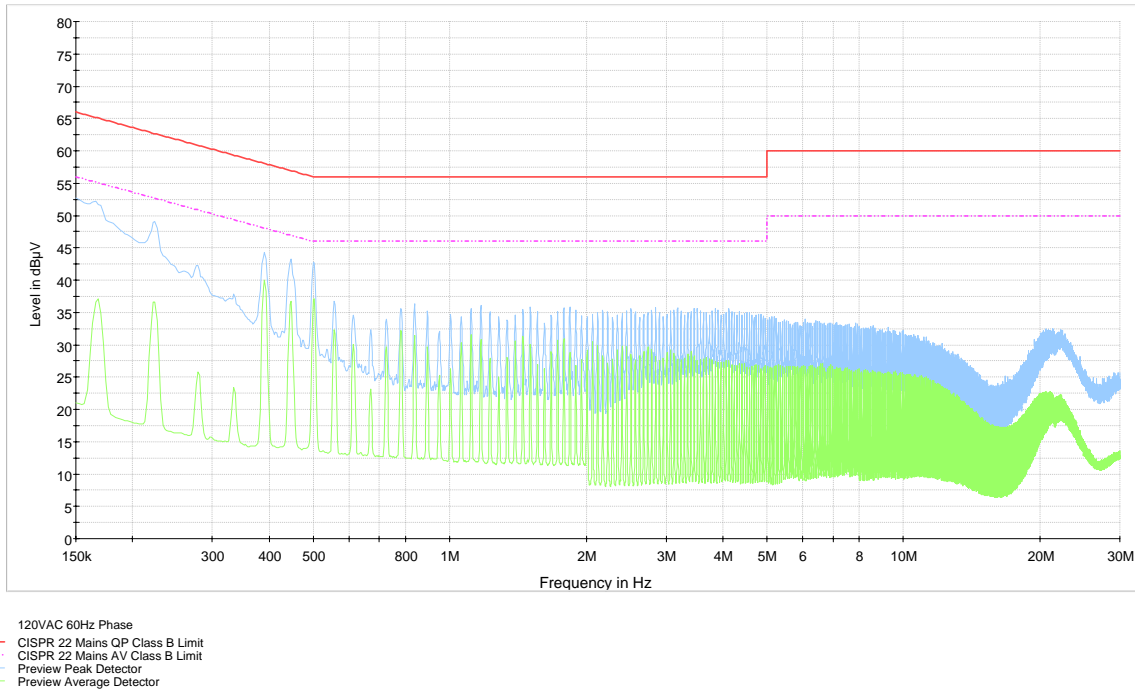
* Decreases with the logarithm of the frequency.

Test Results: Pass

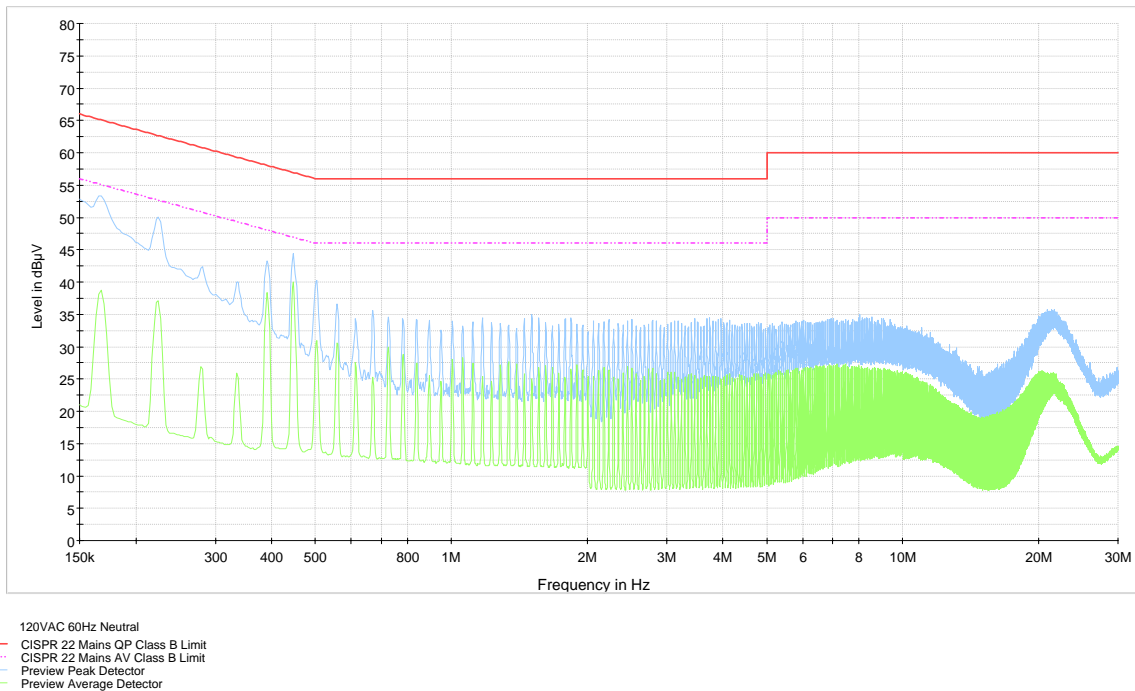
Additional Observations:

All plots were obtained using a sweeping receiver with an IF of 9 kHz using a Peak and Average detector. The plots have been corrected with the cable loss and LISN loss to show compliance.

Phase



Neutral



Clause 15.209(a) Radiated Emissions within Restricted Bands

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 | | Measurement Distance (meters) |
|--------------------|----------------|----------------|----------------------------------|
| | (μ V/m) | (dB μ V/m) | |
| 0.009–0.490 | 2400/F | 67.6–20log(F) | 300 |
| 0.490–1.705 | 24000/F | 87.6–20log(F) | 30 |
| 1.705–30.0 | 30 | 29.5 | 30 |
| 30–88 | 100 | 40.0 | 3 |
| 88–216 | 150 | 43.5 | 3 |
| 216–960 | 200 | 46.0 | 3 |
| Above 960 | 500 | 54.0 | 3 |

Note: F = fundamental frequency in kHz

Test Results: Pass

Additional Observations:

These results apply to emissions found in the Restricted bands defined in FCC Part 15 Subpart C, 15.205.

The EUT was measured on three orthogonal axis.

The Emissions measured at a distance of 3 m and the spectrum was searched from 30 MHz to 25 GHz. Measurements were performed using a Peak detector with 1 MHz RBW / 1 MHz VBW for the Peak values and 1 MHz RBW / 10 Hz VBW for the Average values for the frequencies above 1 GHz.
 For the frequency below 1 GHz Quasi-Peak detector with 120 kHz RBW/300 kHz VBW was used.

Frequencies above 1 GHz:

| Channel | Frequency, MHz | Pol. | Peak FS, dB μ V/m | Pk Limit, dB μ V/m | Pk Margin, dB |
|-----------------|----------------|------|-----------------------|------------------------|---------------|
| CCK modulation | | | | | |
| 1 | 4824 | H | 52.17 | 74.00 | 21.83 |
| 1 | 4824 | V | 60.37 | 74.00 | 13.63 |
| 6 | 4872 | H | 56.10 | 74.00 | 17.90 |
| 6 | 4872 | V | 60.79 | 74.00 | 13.21 |
| 11 | 4924 | H | 56.92 | 74.00 | 17.08 |
| 11 | 4924 | V | 53.23 | 74.00 | 20.77 |
| OFDM modulation | | | | | |
| 1 | 4824 | H | 43.49 | 74.00 | 30.51 |
| 1 | 4824 | V | 51.69 | 74.00 | 22.31 |
| 6 | 4872 | H | 47.42 | 74.00 | 26.58 |
| 6 | 4872 | V | 52.11 | 74.00 | 21.89 |
| 11 | 4924 | H | 48.24 | 74.00 | 25.76 |
| 11 | 4924 | V | 44.55 | 74.00 | 29.45 |

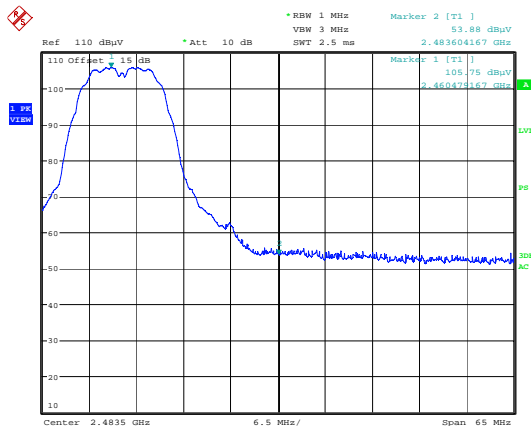
| Channel | Frequency, MHz | Pol. | Average FS, dB μ V/m | Avg Limit, dB μ V/m | Avg Margin, dB |
|-----------------|----------------|------|--------------------------|-------------------------|----------------|
| CCK modulation | | | | | |
| 1 | 4824 | H | 40.61 | 54.00 | 13.39 |
| 1 | 4824 | V | 48.81 | 54.00 | 5.19 |
| 6 | 4872 | H | 44.54 | 54.00 | 9.46 |
| 6 | 4872 | V | 49.23 | 54.00 | 4.77 |
| 11 | 4924 | H | 45.36 | 54.00 | 8.64 |
| 11 | 4924 | V | 41.67 | 54.00 | 12.33 |
| OFDM modulation | | | | | |
| 1 | 4824 | H | 31.93 | 54.00 | 22.07 |
| 1 | 4824 | V | 40.13 | 54.00 | 13.87 |
| 6 | 4872 | H | 35.86 | 54.00 | 18.14 |
| 6 | 4872 | V | 40.55 | 54.00 | 13.45 |
| 11 | 4924 | H | 36.68 | 54.00 | 17.32 |
| 11 | 4924 | V | 32.99 | 54.00 | 21.01 |

Note: Peak FS and Average FS values include antenna factor, cable losses and amplifier gain.

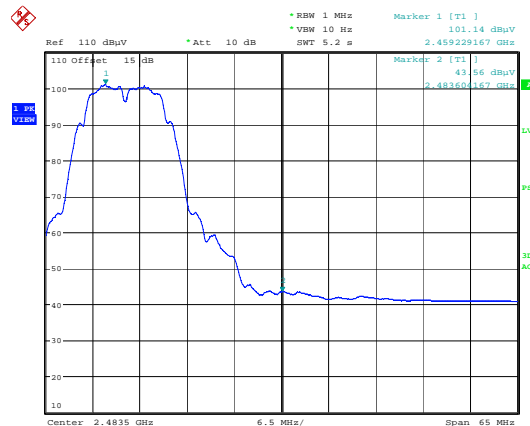
Frequencies below 1 GHz:

| Frequency MHz | Quasi-Peak dB μ V/m | Polarity | Corr. dB | Margin dB | Limit dB μ V/m |
|---------------|-------------------------|----------|----------|-----------|--------------------|
| 124.890 | 32.9 | V | 15.4 | 10.6 | 43.5 |
| 166.620 | 37.6 | V | 13.5 | 5.9 | 43.5 |
| 168.270 | 36.7 | V | 13.5 | 6.8 | 43.5 |
| 169.230 | 34.7 | V | 13.4 | 8.8 | 43.5 |
| 999.690 | 47.3 | H | 26.6 | 6.7 | 54.0 |

2.4835 GHz Band Edge CCK modulation:



Date: 28.SEP.2009 14:51:43

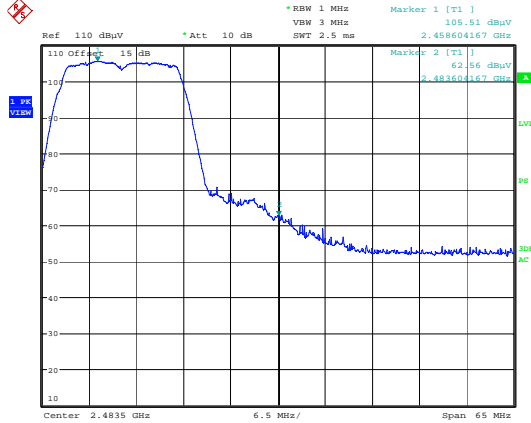


Date: 28.SEP.2009 14:54:23

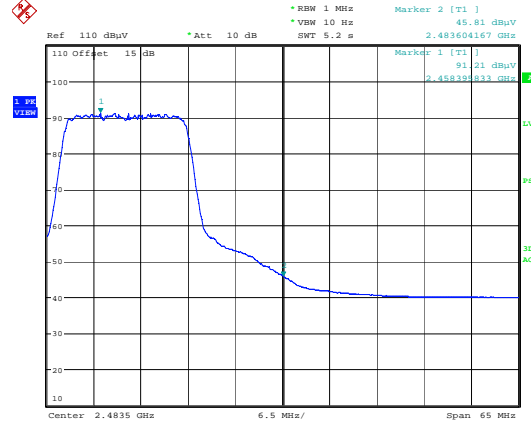
| Frequency, MHz | Peak Field strength, dBμV/m | Limit, dBμV/m | Margin, dB |
|----------------|-----------------------------|---------------|------------|
| 2483.5 | 53.88 | 74.00 | 20.12 |

| Frequency, MHz | Average Field strength, dBμV/m | Limit, dBμV/m | Margin, dB |
|----------------|--------------------------------|---------------|------------|
| 2483.5 | 43.56 | 54.00 | 10.44 |

2.4835 GHz Band Edge OFDM modulation:



Date: 28.SEP.2009 14:45:24



Date: 28.SEP.2009 14:44:15

| Frequency, MHz | Peak Field strength, dBμV/m | Limit, dBμV/m | Margin, dB |
|----------------|-----------------------------|---------------|------------|
| 2483.5 | 62.56 | 74.00 | 11.44 |

| Frequency, MHz | Average Field strength, dBμV/m | Limit, dBμV/m | Margin, dB |
|----------------|--------------------------------|---------------|------------|
| 2483.5 | 45.81 | 54.00 | 8.19 |

Clause 15.247(b)(3) Maximum peak output power of systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz and 5725–5850 MHz bands

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 W. As an alternative to a peak power measurement, compliance with the 1 W 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 signalling 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.

Clause 15.247(b)(4) Maximum peak output power

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test Results: Pass

Additional Observations:

The EUT was modified to perform the peak output power and average output power tests conducted.

Peak measurements were performed according to FCC DTS guidelines using power option 1, using spectrum analyzer with peak detector; the power was integrated across the emission band. RBW was used 100 kHz for CCK and 200 kHz for OFDM.

Average measurements were performed according to FCC DTS guidelines using method 3 of the power option 2.

The input voltage has been changed ± 15 % of nominal; no significant change in power reading was noticed.

Peak Output Power:

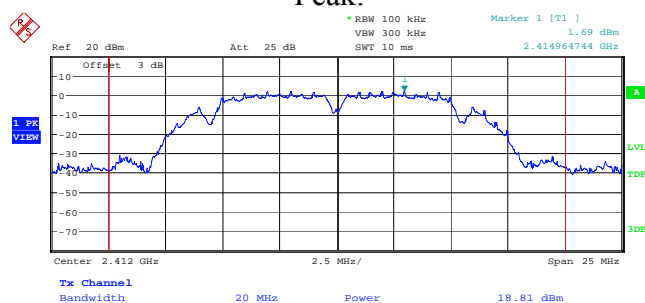
| Channel | Frequency MHz | Peak power dBm | Limit dBm | Margin dB |
|-----------------|---------------|----------------|-----------|-----------|
| CCK modulation | | | | |
| Low | 2412 | 18.91 | 30.00 | 11.09 |
| Mid | 2437 | 18.44 | 30.00 | 11.56 |
| High | 2462 | 18.94 | 30.00 | 11.06 |
| OFDM modulation | | | | |
| Low | 2412 | 18.41 | 30.00 | 11.59 |
| Mid | 2437 | 18.36 | 30.00 | 11.64 |
| High | 2462 | 18.33 | 30.00 | 11.67 |

Average Output Power:

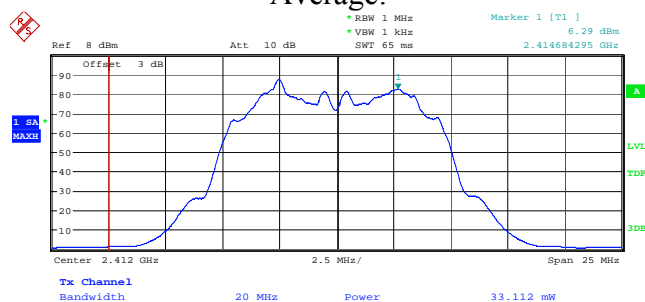
| Channel | Frequency MHz | Average power mW | Average power dBm | Limit dBm | Margin dB |
|-----------------|---------------|------------------|-------------------|-----------|-----------|
| CCK modulation | | | | | |
| Low | 2412 | 33.113 | 15.20 | 30.00 | 14.80 |
| Mid | 2437 | 32.659 | 15.14 | 30.00 | 14.86 |
| High | 2462 | 37.239 | 15.71 | 30.00 | 14.29 |
| OFDM modulation | | | | | |
| Low | 2412 | 19.861 | 12.98 | 30.00 | 17.02 |
| Mid | 2437 | 19.231 | 12.84 | 30.00 | 17.16 |
| High | 2462 | 19.999 | 13.01 | 30.00 | 16.99 |

Sample plots:

Peak:



Average:



Clause 15.247(d) Spurious Emissions Not in Restricted Bands

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 Results: Pass

Additional Observations:

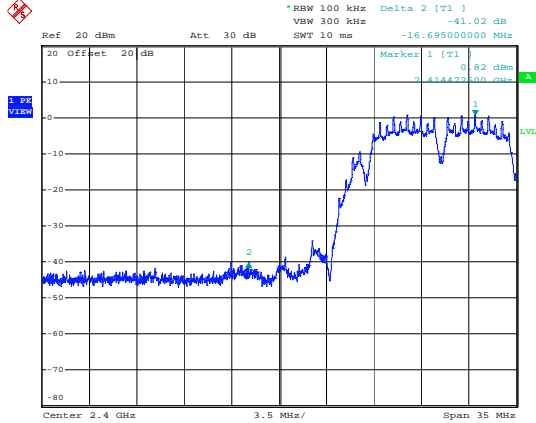
The EUT was modified to perform the test conducted.

The spectrum was searched from 30 MHz to 25 GHz.

Measurements were performed using a Peak detector with 100 kHz RBW / 300 kHz VBW.

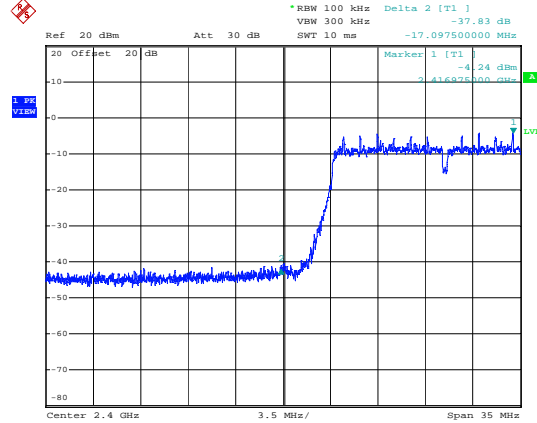
No emissions were detected higher than 30 dB below the in-band emission measured with 100 kHz IF bandwidth.

2.4 GHz Band Edge: CCK modulation:



Date: 11.NOV.2009 08:39:57

OFDM modulation:



Date: 11.NOV.2009 08:41:44

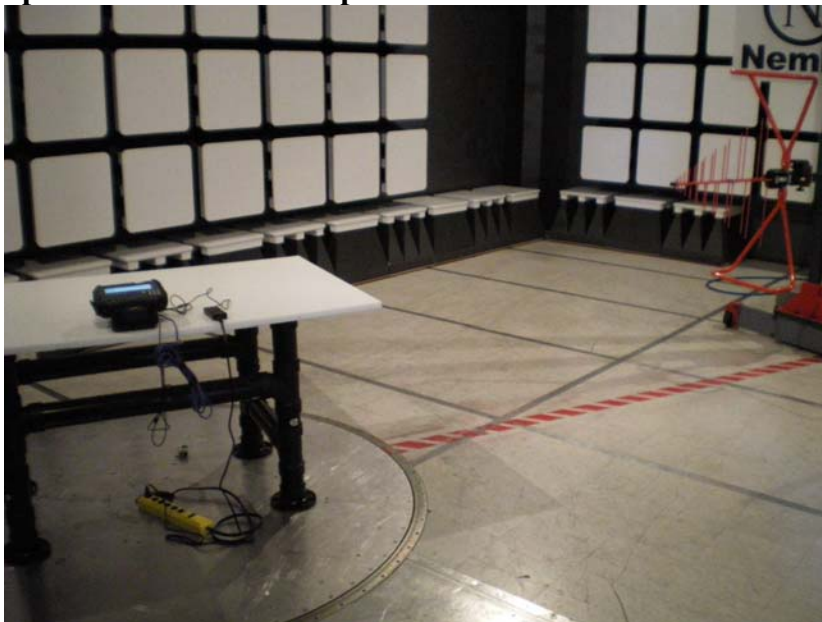
| Modulation | Band edge result, dBc/100 kHz | Limit, dBc/100 kHz | Margin, dB |
|------------|-------------------------------|--------------------|------------|
| CCK | -41.02 | -30.00 | 11.02 |
| OFDM | -37.83 | -30.00 | 7.83 |

Appendix B : Setup Photographs

Conducted Emissions Setup:

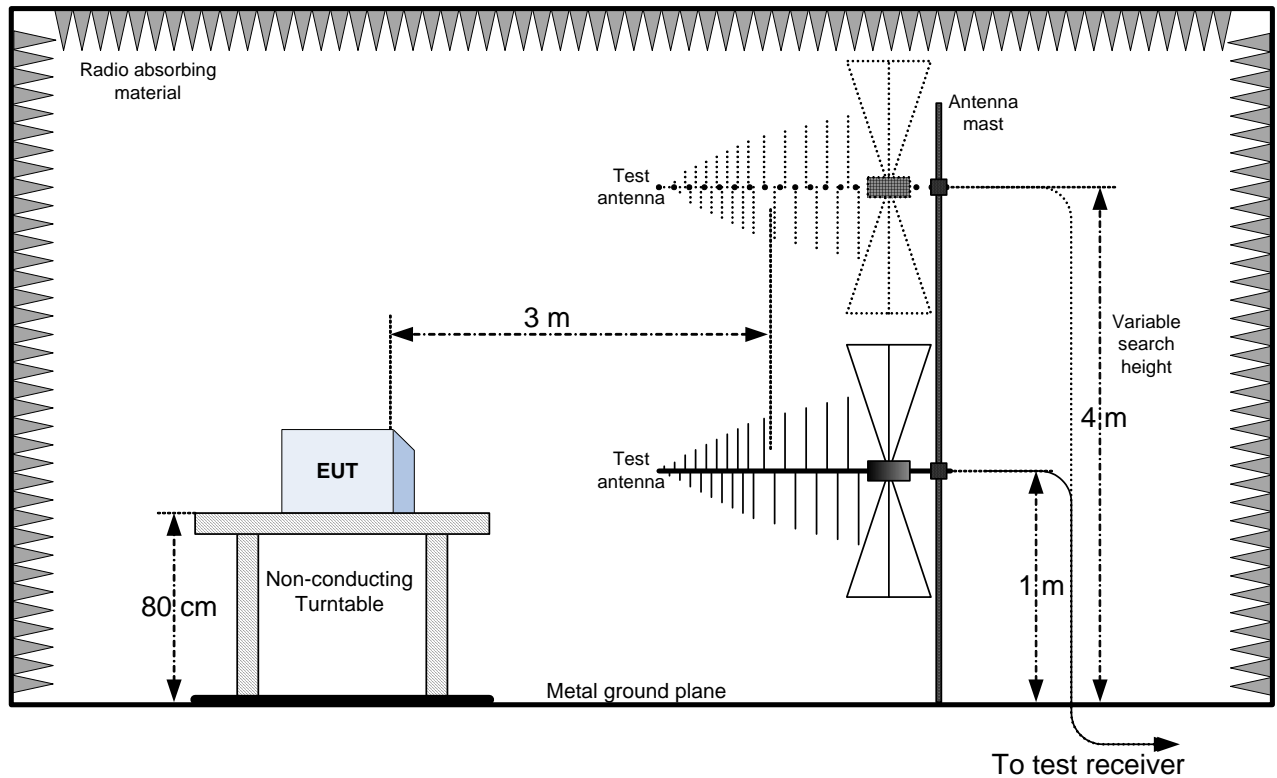


Spurious Emissions Setup:



Appendix C : Block Diagram of Test Setups

Radiated Emissions above 30 MHz Test Site



Conducted Emissions Test Site

