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**EMI TEST REPORT FOR CERTIFICATION  
(MODULAR APPROVAL)  
to  
FCC PART 15 Subpart C (Section 15.249) & RSS-210**

FCC ID: ZT7-CVM-AP  
IC: 9802A-CVMAP

Test Sample: Wireless Access Point Radio  
Model Number: CVM-AP-R02

Report Number M111018\_Cert

Tested for: Mipac Pty Ltd

Issue Date: 17<sup>th</sup> November 2011

EMC Technologies Pty Ltd reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. EMC Technologies Pty Ltd shall have no liability for any deductions, inferences or generalisations drawn by the client or others from EMC Technologies Pty Ltd issued reports. This report shall not be used to claim, constitute or imply product endorsement by EMC Technologies Pty Ltd.



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EMC Technologies Report No. M111018\_Cert  
Issue Date: 17<sup>th</sup> November 2011**

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to  
FCC PART 15 Subpart C (Section 15.249) & RSS-210**

**Report Number:** M111018\_Cert

**Test Sample:** Wireless Access Point Radio  
**Model Number:** CVM-AP-R02  
**Serial Number:** 400  
**Part number:** 0088-04  
**Manufacturer:** Syndetic Pty Ltd

**FCC ID:** ZT7-CVM-AP  
**IC:** 9802A-CVMAP  
**Equipment Type:** Intentional Radiator

**Tested for:** Mipac Pty Ltd  
**Address:** 39 Navigator Place,  
Hendra, QLD 4011, Australia  
**Phone:** +61 7 3212 5600  
**Fax:** +61 7 3212 5699  
**Contact:** Tony Mathison

**Responsible Party:** Ross Varnes  
**Email:** Ross.varnes@syndetic.com.au

**Test Standards:** FCC Part 15, Subpart C – Intentional Radiators  
Section 15.249: Operation within the bands 902 – 928 MHz, 2400 – 2483.5 MHz, 5725 – 5875 MHz and 24.0 – 24.25 GHz.  
ANSI C63.4 – 2009  
RSS-210 Issue 8, Licence-Exempt Radio Apparatus  
Annex 2, A2.9: bands 902 – 928 MHz, 2400 – 2483.5 MHz and 5725 – 5875 MHz  
RSS-Gen Issue 3, General Requirements and Information for the Certification of Radiocommunication Equipment

**Test Dates:** 17<sup>th</sup> October to 16<sup>th</sup> November 2011

**Test Engineer:** Chieu Huynh

**Attestation:** *I hereby certify that the device(s) described herein were tested as described in this report and that the data included is that which was obtained during such testing.*



**Authorised Signatory:** Chieu Huynh  
EMC Technologies Pty Ltd

**Issued by EMC Technologies Pty. Ltd., 176 Harrick Road, Keilor Park, VIC, 3042, Australia.**  
**Phone: +61 3 9365 1000 Fax: +61 3 9331 7455 www.emctech.com.au**



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## 1.0 INTRODUCTION

EMI testing was performed on the Wireless Access Point Radio, model number: CVM-AP-R02.

The test sample **complied** with the requirements of 47 CFR, Part 15 Subpart C - Section 15.249.

The test sample also complied with the Industry Canada RSS-210 and RSS-Gen.

## 1.1 Summary of Results

Test results and procedures were performed in accordance with the following Federal Communications Commission (FCC) and Industry Canada standards/regulations.

FCC Part 15, Subpart C	Industry Canada RSS-210 and RSS-Gen	Test Performed	Result
15.203	RSS-Gen (7.1.2)	Antenna Requirement	Complied
15.207	RSS-Gen (7.2.4)	Conducted Emissions	Not Applicable
15.209	RSS-Gen (7.2.5)	Radiated Emissions	Complied
15.249 (a)	A2.9(a)	Fundamental Field Strength	Complied
15.249 (a)	A2.9(a)	Harmonics Emissions	Complied
15.249 (b)		Fixed, point to point	Not Applicable
15.249 (c)	A2.9(a)	Field strength limits @ 3 meters	Noted
15.249 (d)	A2.9(b)	Spurious Emissions	Complied
15.249 (e)		20 dB Peak to Average	Complied
15.249 (f)		Requirements – Manufacturing, etc	Noted

The measurement procedure used was in accordance with ANSI C63.4-2009. The instrumentation conformed to the requirements of ANSI C63.2-1996.

## 1.2 EUT – Voltage Power Conditions

Testing was performed with the test sample powered off an AC/DC plug pack.

## 1.3 Modifications

No modifications were performed.



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## 2.0 GENERAL INFORMATION

(Information supplied by the Client)

### 2.1 Product Details

<b>Test Sample:</b>	Wireless Access Point Radio
<b>Model Number:</b>	CVM-AP-R02
<b>Serial Number:</b>	400
<b>Part number:</b>	0088-04
<b>Manufacturer:</b>	Syndetic Pty Ltd
<b>Microcontroller:</b>	Atmel ATMEGA644P
<b>CPU Clock frequency:</b>	8 MHz
<b>Clock oscillator frequency:</b>	32.768 kHz
<b>RF Operating frequency:</b>	2401 MHz to 2482 MHz in 1 MHz steps (Ch 1 to 82)
<b>RF Output Power:</b>	0dBm ( $\pm 1$ dB)
<b>Antenna gain:</b>	up to 9dBi
<b>Radio reference frequency</b>	16 MHz
<b>Modulation</b>	GFSK
<b>Data Rate:</b>	1 Mb/s
<b>Supply Voltage</b>	5 to 30V (24V nominal), Powered from a support AC/DC plug pack
<b>AC/DC plug pack:</b>	D-Link
<b>Model Number:</b>	ADS6818-1505-A 0525

### 2.2 Operational Description

The Wireless Access Point is to be used in an industrial measurement and control system.

Operational Description - Refer to Appendix D.

### 2.3 Test Configuration

The Wireless Access Point was configured to transmit with modulation. Receive mode was also tested.

### 2.4 Test Procedure

Emissions measurements were performed in accordance with the procedures of ANSI C63.4-2009. Radiated emissions tests were performed at a distance of 1 and 3 metres from the EUT.



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## 2.5 Test Facility

### 2.5.1 General

EMC Technologies Pty Ltd is listed by the FCC as a test laboratory able to perform compliance testing for the public. EMC Technologies is listed as an FCC part 47CFR2.948 test lab and may perform the testing required under Parts 15 and 18 – **FCC Registration Number 90560**

EMC Technologies Pty Ltd has also been accredited as a Conformity Assessment Body (CAB) by Australian Communications and Media Authority (ACMA) under the APECTEL MRA and is designated to perform compliance testing on equipment subject to Declaration of Conformity (DoC) and Certification under Parts 15 & 18 of the FCC Commission's rules – **Registration Number 494713 & Designation number AU0001.**

EMC Technologies has also been accepted by Industry Canada for the performance of radiated measurements in accordance with RSS 212, Issue 1 (Provisional) - **Industry Canada number 3569B.**

Measurements were performed at EMC Technologies' laboratory in Keilor Park, Victoria Australia.

### 2.5.2 NATA Accreditation

EMC Technologies is accredited in Australia to test to the following standards by the National Association of Testing Authorities (NATA).



***"FCC Part 15 unintentional and intentional emitters in the frequency range 9kHz to 18 GHz excluding TV receivers (15.117 and 15.119), TV interface devices (15.115), cable ready consumer electronic equipment (15.118), cable locating equipment (15.213) and unlicensed national information infrastructure devices (Sub part E)."***

The current full scope of accreditation can be found on the NATA website: [www.nata.asn.au](http://www.nata.asn.au)  
It also includes a large number of emissions, immunity, SAR, EMR and Safety standards.

NATA is the Australian national laboratory accreditation body and has accredited EMC Technologies to operate to the IEC/ISO17025 requirements. A major requirement for accreditation is the assessment of the company and its personnel as being technically competent in testing to the standards. This requires fully documented test procedures, continued calibration of all equipment to the National Standard at the National Measurements Institute (NMI) and an internal quality system to ISO 9002. NATA has mutual recognition agreements with the National Voluntary Laboratory Accreditation Program (NVLAP) and the American Association for Laboratory Accreditation (A<sup>2</sup>LA).

## 2.6 Test Equipment Calibration

Measurement instrumentation and transducers were calibrated in accordance with the applicable standards by an independent NATA registered laboratory such as Agilent Technologies (Australia) Pty Ltd or the National Measurement Institute (NMI). All equipment calibration is traceable to Australia national standards at the National Measurements Institute. The reference antenna calibration was performed by NMI and the working antennas (biconical, log-periodic and horns) calibrated by the EMC Technologies. The complete list of test equipment used for the measurements, including calibration dates and traceability is contained in the Measurement Instrument Details.

  <p>Accreditation No. 5292</p>	<p>Accredited for compliance with ISO/IEC 17025. The results of the test, calibrations and/or measurement included in this document are traceable to Australian/national standards. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports.</p> <p><b>This document shall only be reproduced in full, with the exception of the certificate on p3</b></p>
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### 3.0 CONDUCTED EMISSION MEASUREMENTS

Conducted emission testing was not applicable as the EUT is DC powered.

### 4.0 RADIATED EMISSION MEASUREMENTS

#### 4.1 Test Procedure

Testing was performed in accordance with the requirements of FCC Part 15.249.

The EUT was set up on the table top (placed on turntable) of total height 80 cm above the ground plane, and operated as described in section 2 of this report. The EMI Receiver was operated under software control via the PC Controller through the IEEE.488 Interface Bus Card Adaptor. The test frequency range was sub-divided into smaller bands with sufficient frequency resolution to permit reliable display and identification of possible EMI peaks while also permitting fast frequency scan times. A calibrated loop antenna was used for measurements between 0.009 MHz to 30 MHz. A calibrated Biconical antenna was used for measurements between 30 MHz to 200 MHz and a calibrated Logperiodic antenna used for measurements between 200 MHz to 1000 MHz. Calibrated EMCO 3115, EMCO 3116 and ETS standard gain horn antennas were used for measurements between 1 to 25 GHz.

The Receiver bandwidth was set to 6.0 dB.

The following bandwidth settings were used:

RBW = 1 kHz and VBW = 3 kHz for frequency band 9 kHz – 150 kHz

RBW = 9 kHz and VBW = 30 kHz for frequency band 150 kHz – 30 MHz

RBW = 120 kHz and VBW = 300 kHz for frequency band 30 MHz – 1000 MHz

RBW = 200 Hz and VBW = 10 Hz for frequency bands 9 kHz – 90 kHz and 110 kHz – 490 kHz

Peak measurements above 1 GHz: RBW = VBW = 1 MHz

Average measurements above 1 GHz: RBW = 1 MHz and VBW = 10 Hz

The EUT was slowly rotated with the Peak Detector set to Max-Hold. This was performed for two antenna heights. When an emission was located, it was positively identified and its maximum level found by rotating the automated turntable, and by varying the antenna height. Each significant peak was investigated with the Quasi-Peak/Average Detectors. The software for cable losses automatically corrected the measurement data for each frequency range, antenna factors and preamplifier gain and all data was then stored on disk in sequential data files. This process was performed for both horizontal and vertical antenna polarisations.

#### 4.2 Calculation of field strength

The field strength was calculated automatically by the software using all the pre-stored calibration data. The method of calculation is shown below:

**E = V + AF - G + L** Where:

**E** = Radiated Field Strength in dB $\mu$ V/m.

**V** = EMI Receiver Voltage in dB $\mu$ V. (measured value)

**AF** = Antenna Factor in dB(m<sup>-1</sup>). (stored as a data array)

**G** = Preamplifier Gain in dB. (stored as a data array)

**L** = Cable loss in dB. (stored as a data array of Insertion Loss versus frequency)

- Example Field Strength Calculation**

Assuming a receiver reading of 34.0 dB $\mu$ V is obtained at 90 MHz, the Antenna Factor at that frequency is 9.2 dB. The cable loss is 1.9 dB while the preamplifier gain is 20 dB. The resulting Field Strength is therefore as follows:

$$34.0 + 9.2 + 1.9 - 20 = 25.1 \text{ dB}\mu\text{V/m}$$



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### 4.3 Transmitter Fundamental and Spurious Emissions

#### 4.3.1 Frequency Band: 1 – 25 GHz

##### Low Frequency - Tx at 2401 MHz

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2401	105.7	77.0	114.0	94.0	Complied
4802	61.5	39.8	74.0	54.0	Complied
7203	59.5	40.0	74.0	54.0	Complied

##### Middle Frequency - Tx at 2441 MHz

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2441	104.8	75.5	114.0	94.0	Complied
4882	59.9	38.2	74.0	54.0	Complied
7323	59.7	40.5	74.0	54.0	Complied

##### High Frequency - Tx at 2482 MHz

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2482	105.1	76.8	114.0	94.0	Complied
4964	60.8	39.1	74.0	54.0	Complied
7446	60.0	41.0	74.0	54.0	Complied

**Results:** The fundamental and harmonic emissions complied with the FCC limits in sections 15.209 and 15.249.



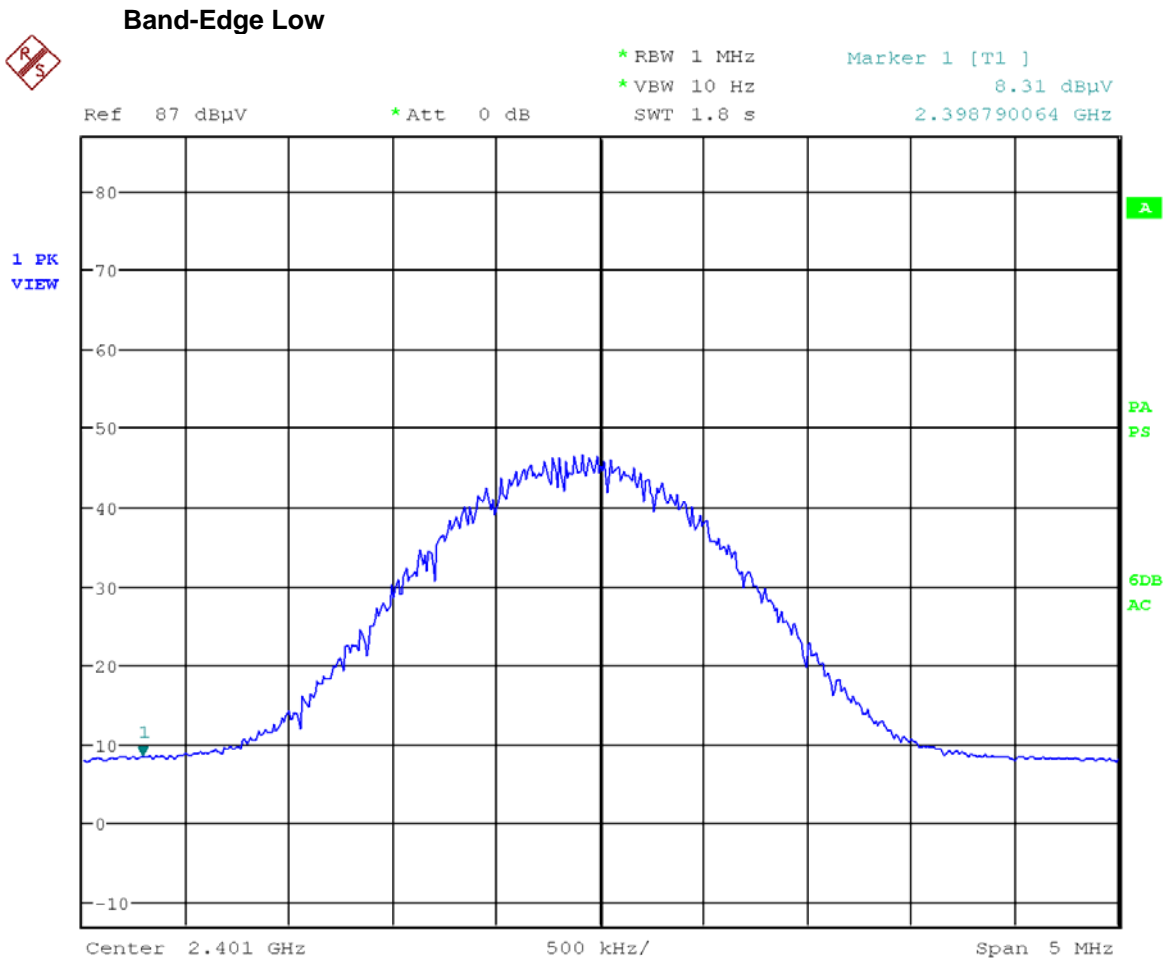
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4.3.2 Band Edge Measurements

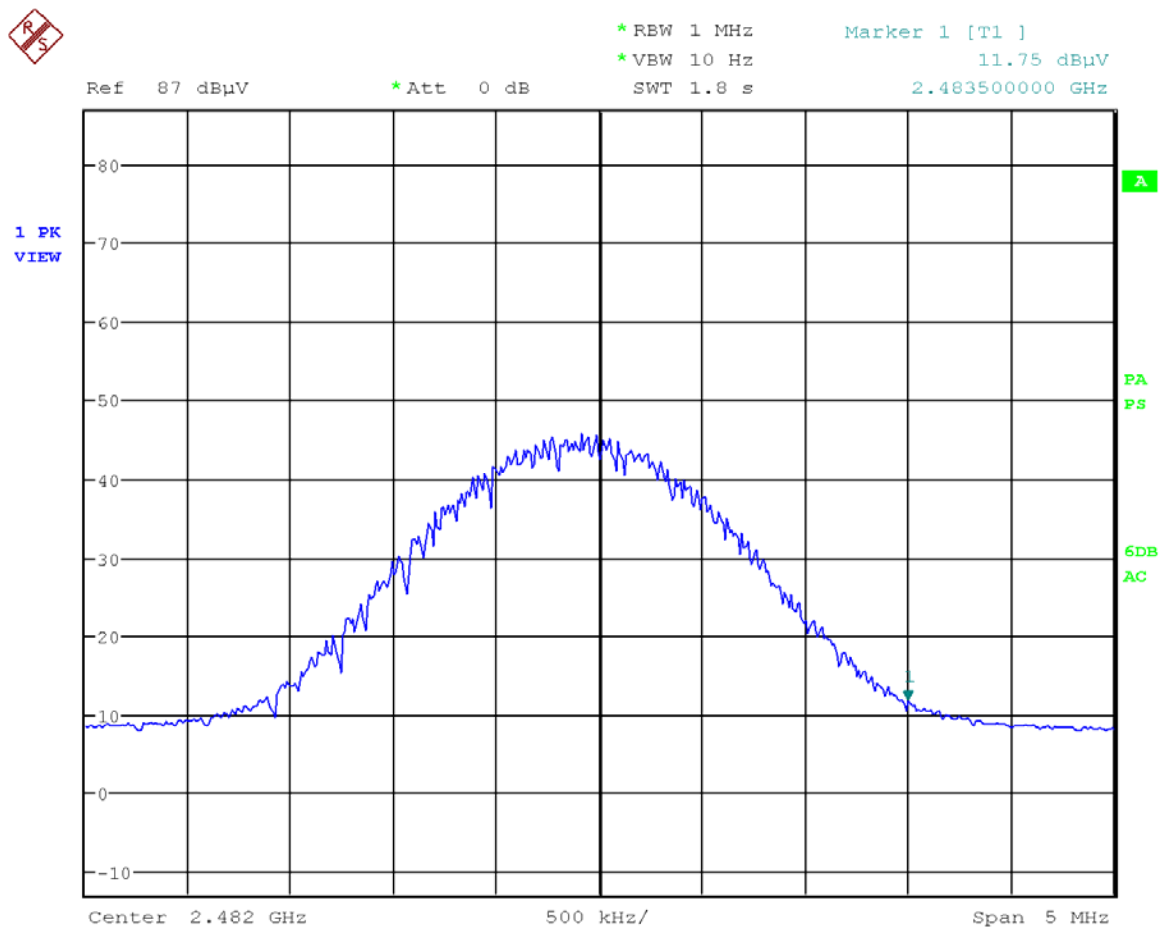
Frequency MHz	Average Detector dBuV	Correction Factor dB	Average Level dBuV/m	Average Limit dBuV/m	Result
2400	8.31	31.0	39.31	54.0	Complied
2483.5	11.75	31.0	42.75	54.0	Complied



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Band-Edge High

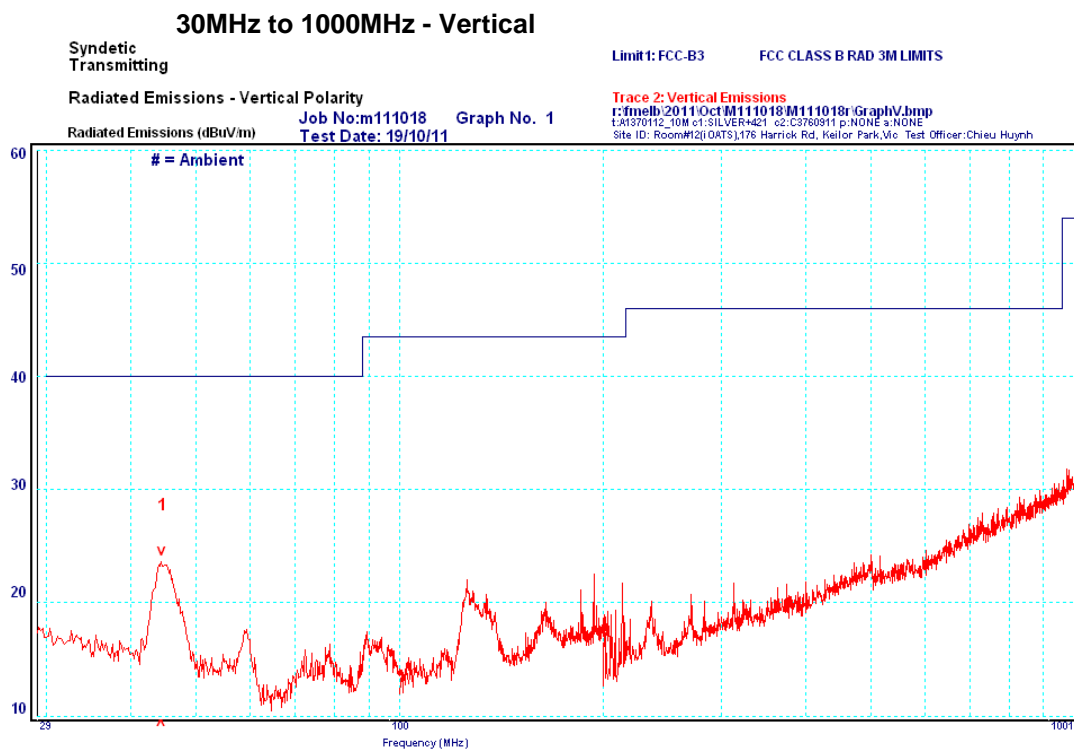
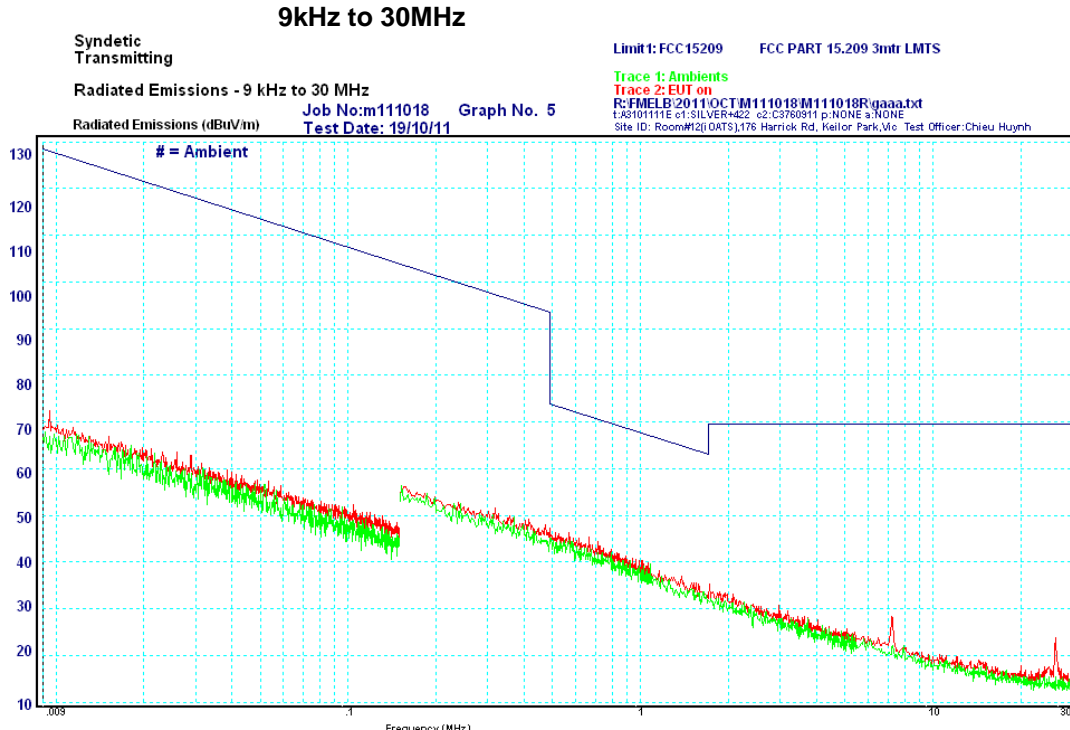


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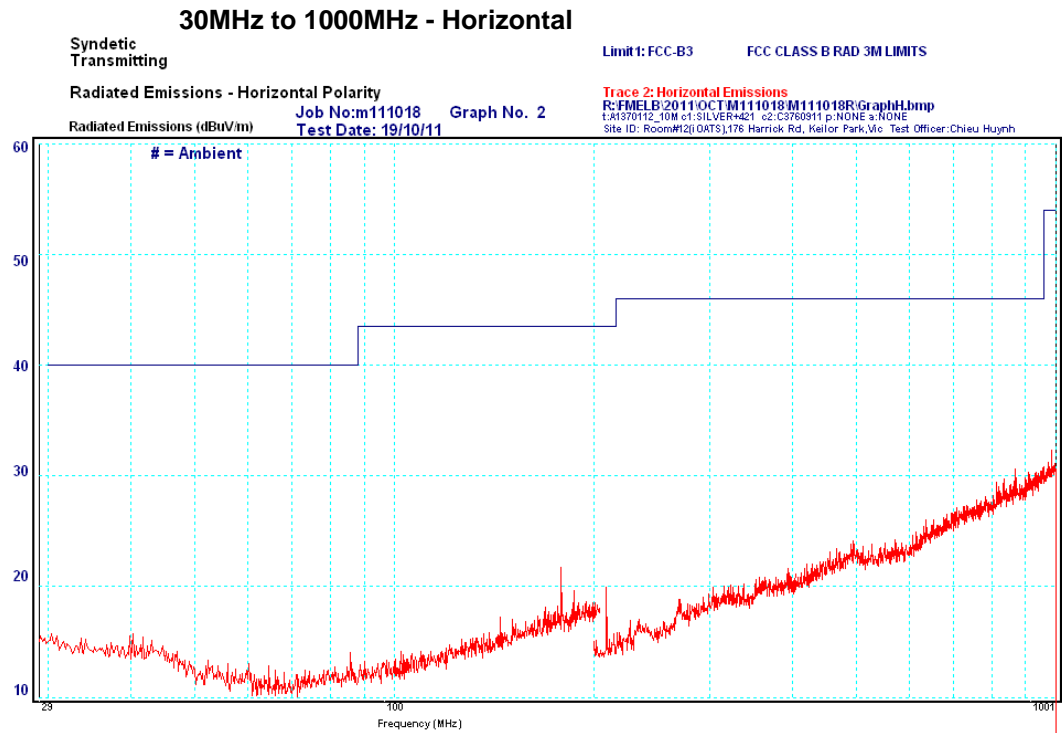
#### 4.3.3 Frequency Band: 9 kHz - 1000 MHz

Initial investigations were performed with all three frequencies (low, middle and high). No significant differences in emissions were observed. Final testing was performed while the transmitter continuously operated at 2.441 GHz.



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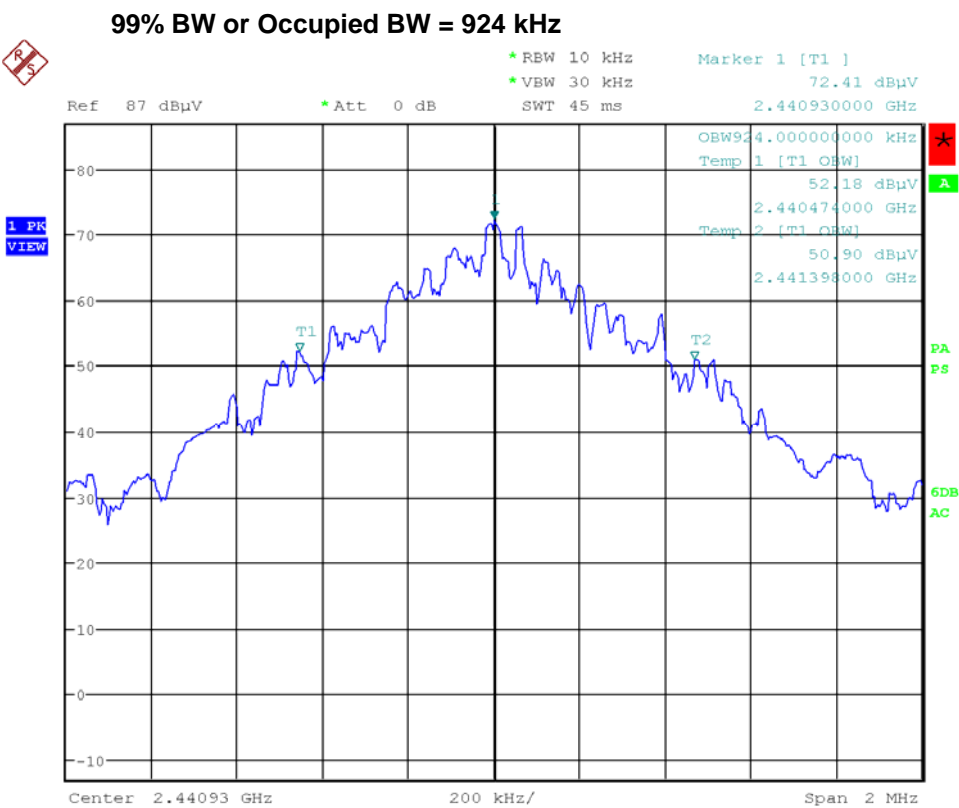
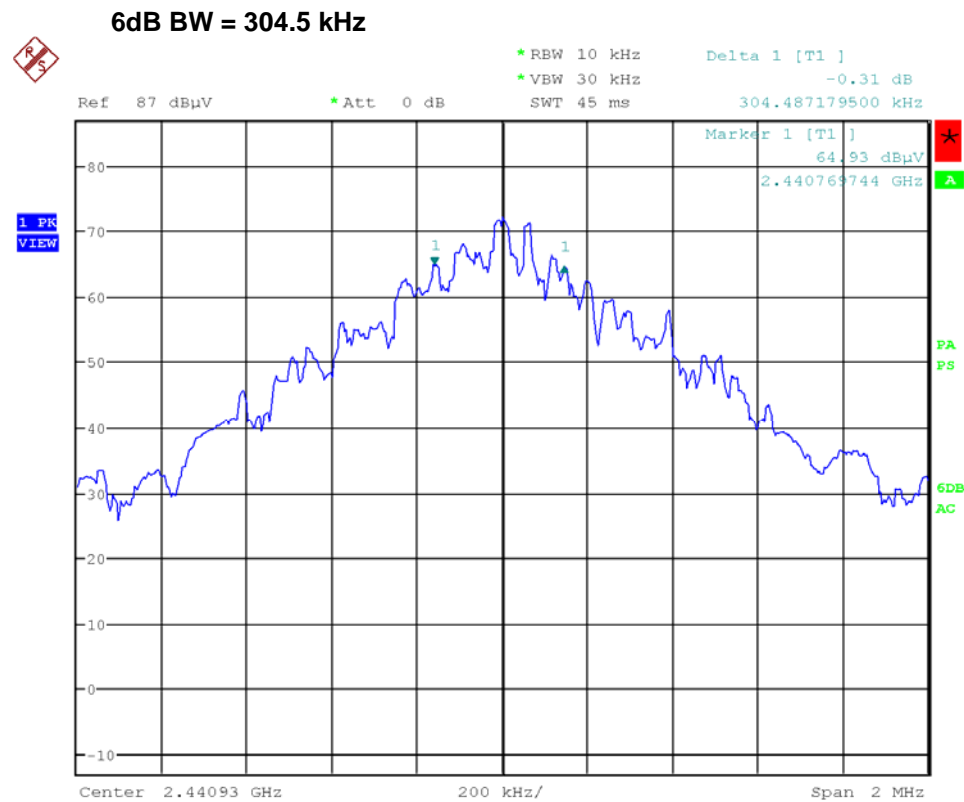
**Results:** The worst case radiated EMI complied with the FCC Class B, quasi peak limit by a margin of >15 dB. Refer to above graphs 1 & 2.



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4.3.4 Band Width Measurements

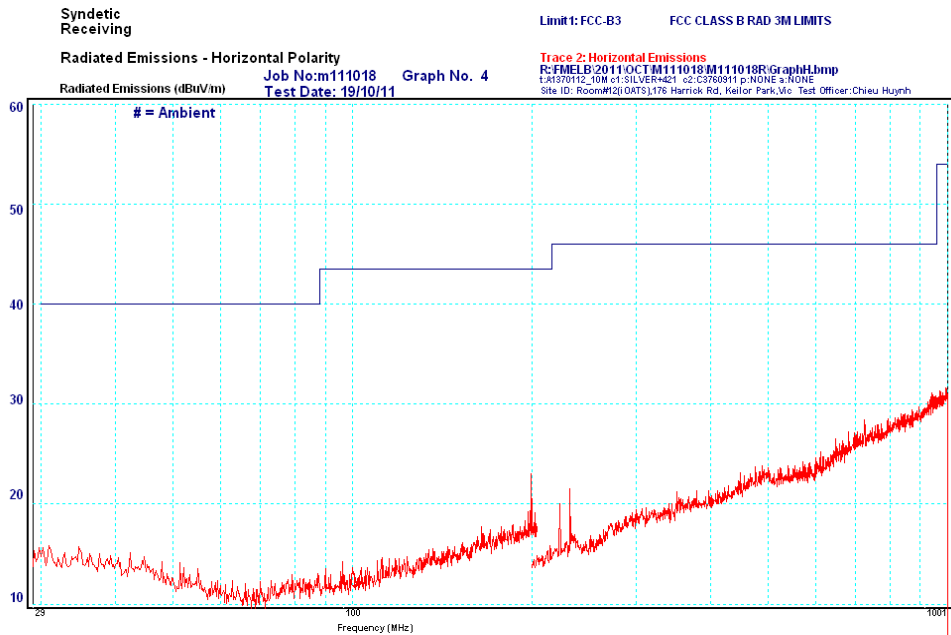
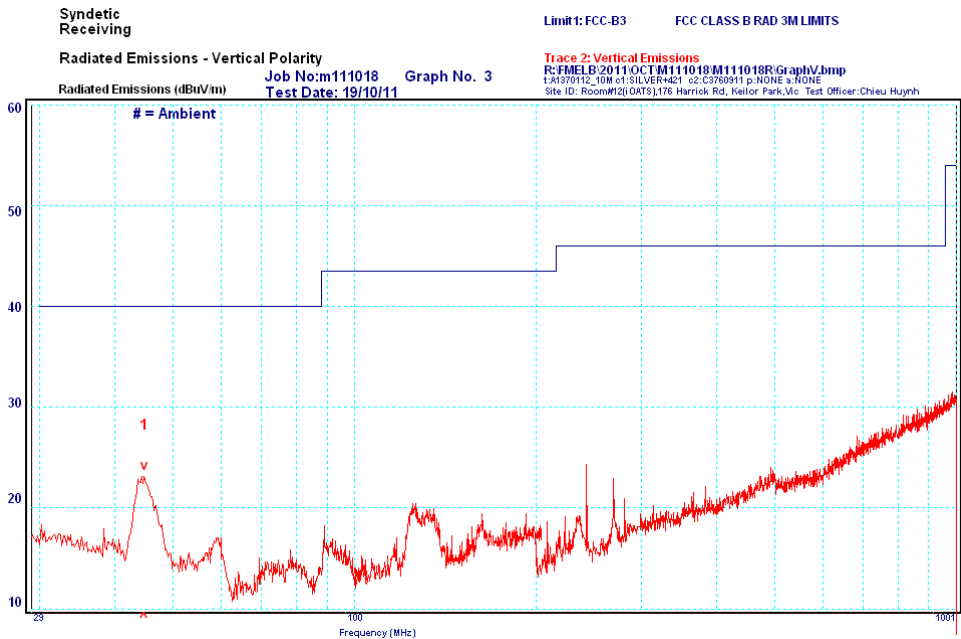


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4.3.5 Receiving Mode

4.3.5.1 Frequency Band: 30 - 1000 MHz



**Results:** The worst case radiated EMI complied with the FCC Class B, quasi peak limit by a margin of >15 dB. Refer to above graphs 3 & 4.

4.3.5.2 Frequency Band: 1 - 25 GHz

**Results:** No spurious emissions were recorded. Emissions complied with the FCC limit in section 15.209 by a margin of >15 dB.



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## 5.0 ANTENNA REQUIREMENT

This intentional radiator was designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

## 6.0 COMPLIANCE STATEMENT

The Wireless Access Point Radio, model number: CVM-AP-R02 tested on behalf of Mipac Pty Ltd, **complied** with the requirements of 47 CFR, Part 15 Subpart C - Rules for Radio Frequency Devices (intentional radiators), Section 15.249.

The test sample also complied with the Industry Canada RSS-210 and RSS-Gen.

Results were as follows:

FCC Part 15, Subpart C	Industry Canada RSS-210 and RSS-Gen	Test Performed	Result
15.203	RSS-Gen (7.1.2)	Antenna Requirement	Complied
15.207	RSS-Gen (7.2.4)	Conducted Emissions	Not Applicable
15.209	RSS-Gen (7.2.5)	Radiated Emissions	Complied
15.249 (a)	A2.9(a)	Fundamental Field Strength	Complied
15.249 (a)	A2.9(a)	Harmonics Emissions	Complied
15.249 (b)		Fixed, point to point	Not Applicable
15.249 (c)	A2.9(a)	Field strength limits @ 3 meters	Noted
15.249 (d)	A2.9(b)	Spurious Emissions	Complied
15.249 (e)		20 dB Peak to Average	Complied
15.249 (f)		Requirements – Manufacturing, etc	Noted

## 7.0 MEASUREMENT UNCERTAINTIES

EMC Technologies has evaluated the equipment and the methods used to perform the emissions testing. The estimated measurement uncertainties for emissions tests shown within this report are as follows:

<b>Radiated Emissions:</b>	9 kHz to 30 MHz	±4.1 dB
	30 MHz to 300 MHz	±5.1 dB
	300 MHz to 1000 MHz	±4.7 dB
	1 GHz to 18 GHz	±4.6 dB

The above expanded uncertainties are based on standard uncertainties multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.



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## 8.0 MEASUREMENT INSTRUMENT

EQUIPMENT TYPE	MANUFACTURER, MODEL NUMBER and SERIAL NUMBER	CALIBRATION DUE DD/MM/YY
EMI RECEIVER	Rohde & Schwarz, Model ESU40 SN 1302.6005.40, 20 Hz – 40 GHz	08/12/11
	HP 8546A Sn: 3549A00290 (R-009)	11/08/12
ANTENNAS	Narda Standard Gain Horn, M/N: 644	19/11/12
	ETS Standard Gain Horn, M/N: 3160-03	19/11/12
	ETS Standard Gain Horn, M/N: 3160-05	19/11/12
	ETS Standard Gain Horn, M/N: 3160-06	19/11/12
	ETS Standard Gain Horn, M/N: 3160-07	19/11/12
	ETS Standard Gain Horn, M/N: 3160-08	19/11/12
	ETS Standard Gain Horn, M/N: 3160-09	08/02/14
	EMCO 6502 LOOP ANTENNA 9 kHz – 30 MHz Sn: 2021	29/11/11
	EMCO 93110B BICONICAL 20 - 300 MHz Sn. 96122801	02/05/12
	EMCO 93146A LOG PERIODIC 200 -1000MHz Sn. 98035033	17/01/12
	EMCO 3115 DOUBLE RIDGED HORN 1 - 18 GHz Sn: 8908-3282	12/01/12



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