



Global Product Certification
EMC-EMF Safety Approvals

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**EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 90.217**

FCC ID: XZ4-1000-0700

Test Sample: Agile Base Station
Part Number: 1000-0700
Manufacturer: Square One Laboratories Pty Ltd

Report Number: M091201R_FCC_1000-0700

Issue Date: 17th December 2012

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. M091201R_FCC_1000-0700

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Report No. M091201R_FCC_1000-0700

Test Sample: Agile Base Station
Part Number: 1000-0700
Manufacturer: Square One Laboratories Pty Ltd

FCC ID: XZ4-1000-0700
Equipment Type: Intentional Radiator (Transceiver)

Tested for: Square One Laboratories Pty Ltd
Address: 2/25 Manton Road,
Oakleigh South, VIC 3167 Australia
(PO Box 303, Oakleigh MDC VIC 3166 Australia)
Phone: +61 3 9545 5777
Fax: +61 3 9545 6777
Responsible Party: Motti Grinberg

Test Standards: FCC Part 90.217
FCC Part 2
ANSI/TIA/EIA-603-C
ANSI C63.4

Test Dates: 4th December 2009 to 13th December 2012



Kevin Hansen
Lee Hopkins
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**
Senior EMC Engineer
EMC Technologies Pty Ltd

EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 90.217

1.0 INTRODUCTION

EMI testing was performed on the Agile Base Station, Part number: 1000-0700. The test results and procedures were performed in accordance with the following Federal Communications Commission (FCC) standards/regulations. The test sample **complied** with the requirements of FCC: 47 CFR, Part 90.217.

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

FCC Part 90.217 and FCC Part 2 Clauses	Test Description	Results
FCC 2.1046	Output Power	Complied
FCC 2.1049	Occupied Bandwidth	Complied
FCC 2.1049	Emission mask	Complied
FCC 2.1051	Conducted Emissions	Complied
FCC 2.1053	Radiated Emissions	Complied
FCC 2.1055	Frequency stability	Complied

The measurement procedure used was in accordance with ANSI/TIA/EIA-603-C and ANSI C63.4.

1.1 EUT – Voltage Power Conditions

The Base Station is DC powered (12V DC from Host unit).

1.2 Modifications

No modifications were required.

2.0 GENERAL INFORMATION

(Information supplied by the Client)

2.1 EUT Details

Agile Base Station:	(also sold under the name RadioNET Base)
Part Number:	1000-0700
Serial Number:	20201217
Power Rating:	12V DC, 1.8W max
Frequency Range:	450 – 470 MHz
Antenna Type:	1/4 Wave Whip
Gain:	Unity
Microprocessor:	MSP430
Crystal Frequency:	14.7456 MHz
Real Time Clock Freq:	32768 Hz
Manufacturer:	Square One Laboratories Pty Ltd

2.2 Description supplied by Client

The Base Station (1000-0700) is part of an Agile Radio System. The minimum system consist of a Base Station, a Control RTU (1000-0710) & a Data RTU (1000-0730) and a Host (unintentional).

Base Station: The Base unit is connected via a 2m standard cable which is supplied with the Host. The Base unit manages the radio network and mediates all communications between the RTUs and the Host.

RTU: RTUs are powered by 6V DC provided by 4 x AA batteries, or by optional solar power. RTUs are available in two flavours: a Control RTU designed to control and directly drive up to 9 valves; and a Data RTU designed to collect data.

Host: The host interfaces a PC for configuration and a controller to the Base Station. The host is designed to be powered by a 12V DC rechargeable battery. All command and data sent to and from the PC and the controller are managed by the host unit. The host communicates with, and supplies power to, the Base Station.

2.3 Test Configuration

The Base station was configured in transmitting mode and was connected to a Host.

2.4 Test Procedure

Emissions measurements were performed in accordance with the procedures of ANSI/TIA/EIA-603-C and ANSI C63.4. Radiated emissions tests were performed at a distance of 3 metres from the EUT.

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 open area test site (OATS) has also been accepted by Industry Canada for the performance of radiated measurements in accordance with RSS 212, Issue 1 (Provisional) - **Industry Canada OATS number - IC 3569B-1**.

Radiated field strength emission measurements were performed at EMC Technologies Open Area Test Site (OATS) situated at Lerderderg Gorge, near the township of Bacchus Marsh in Victoria, Australia.

Other 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
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 (A²LA).

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 (loop, biconical, log-periodic and horn) calibrated by the NATA approved procedures. The complete list of test equipment used for the measurements, including calibration due dates are contained in this report

2.7 Ambients at OATS

The Open Area Test Site (OATS) is an area of low background ambient signals. No significant broadband ambients are present however commercial radio and TV signals exceed the limit in the FM radio, VHF and UHF television bands. Radiated prescan measurements were performed in the shielded enclosure to check for possible radiated emissions at the frequencies where the OATS ambient signals exceeded the test limit.

FCC Part 90.217

Radiated emissions field strength was measured using a HP8546A receiver connected to a calibrated antenna located 3m away from the EUT.

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 9 kHz 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 horn antenna was used for measurements between 1 GHz to 4.7 GHz.

The resolution bandwidth and video bandwidth settings were:

9 kHz – 150 kHz:	1 kHz RBW, 3 kHz VBW
150 kHz – 30 MHz:	10 kHz RBW, 30 kHz VBW
30 MHz – 1000 MHz:	120 kHz RBW, 300 kHz VBW
1 GHz – 4.7 GHz:	1 MHz RBW, 1MHz VBW

The receiver bandwidth was set to 6 dB.

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. This process was performed for both horizontal and vertical antenna polarisations.

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

$$E = V + AF - G + L \quad \text{Where:}$$

E	=	Radiated Peak Field Strength in dB μ V/m.
V	=	EMI Receiver Voltage in dB μ V. (measured value)
AF	=	Antenna Factor in dB(m $^{-1}$). (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 Peak Field Strength Calculation**

Assuming a receiver reading of 34.0 dB μ 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:

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

3.0 OUTPUT POWER

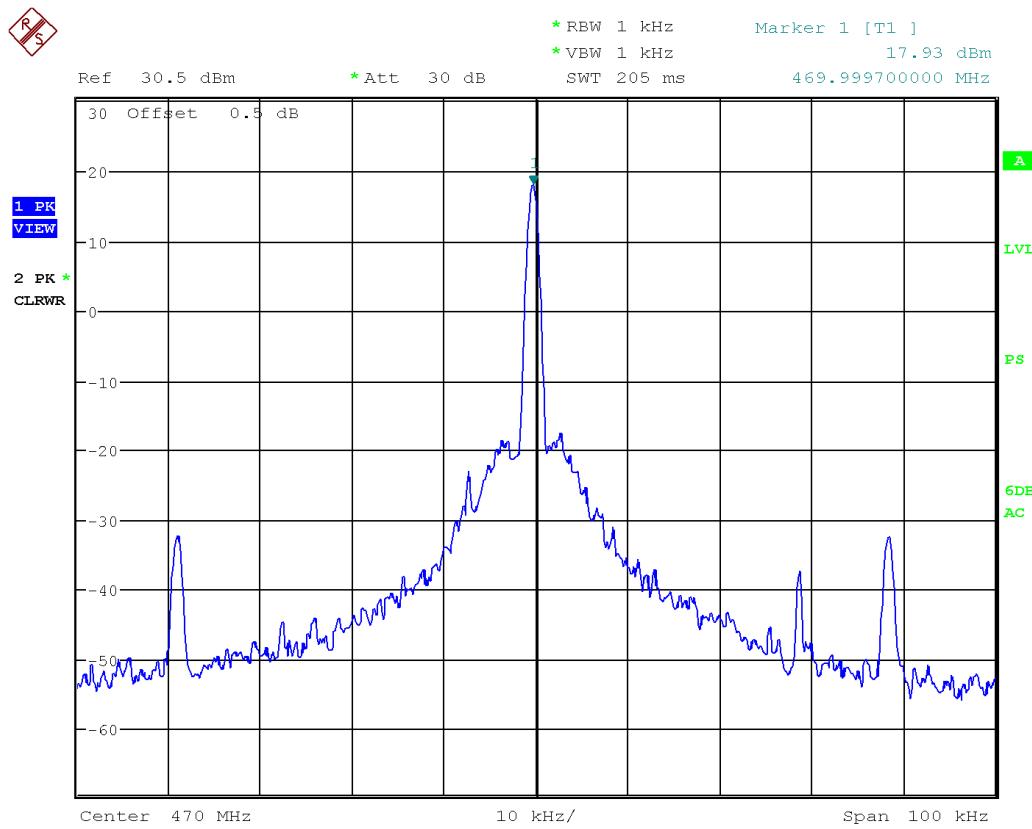
3.1 Radiated Measurements

Measurements were performed at a distance of 3 metres from the EUT.

Tx Frequency MHz	Measured Field Strength dB μ V/m	Calculated Measured Power mW	Limit mW	Results
450	114.7	88.5	120	Pass
460	114.1	77.1	120	Pass
470	114.0	75.4	120	Pass

Substitution measurements were performed. The EUT was replaced with a calibrated dipole antenna that was connected to a signal generator. The output level of the signal generator was adjusted until the same level on the receiver observed. The level of the signal generator output in dB μ V or dBm less any loss due to the connecting cable and added the gain of the substitute antenna.

3.2 Conducted Measurements - Antenna Port



Tx Frequency MHz	Antenna Gain dBi	Measured Power dBm	Calculated Power mW	Limit mW	Results
450	Unity	18.21	83.4	120	Pass
460		18.08	81.0		Pass
470		17.93	78.2		Pass

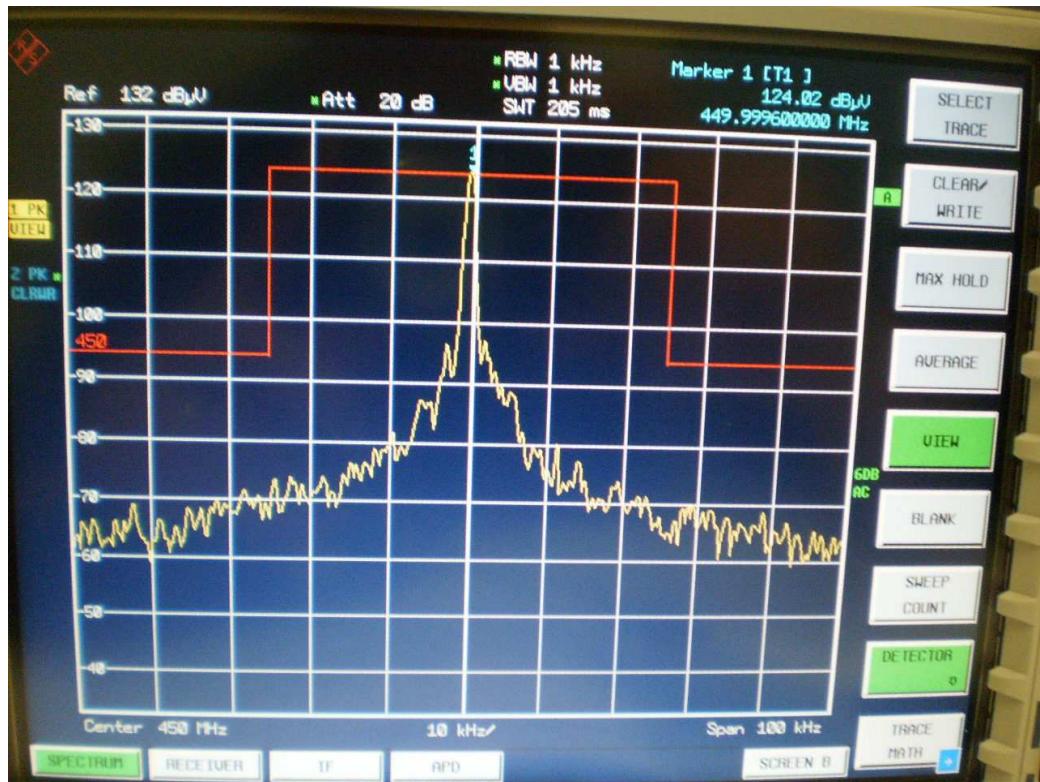
4.0 OCCUPIED BANDWIDTH – Antenna Port

Frequency MHz	Measured Bandwidth kHz	Limit kHz	Results
450	8.9	12.5	Pass
460	8.9	12.5	Pass
470	8.9	12.5	Pass

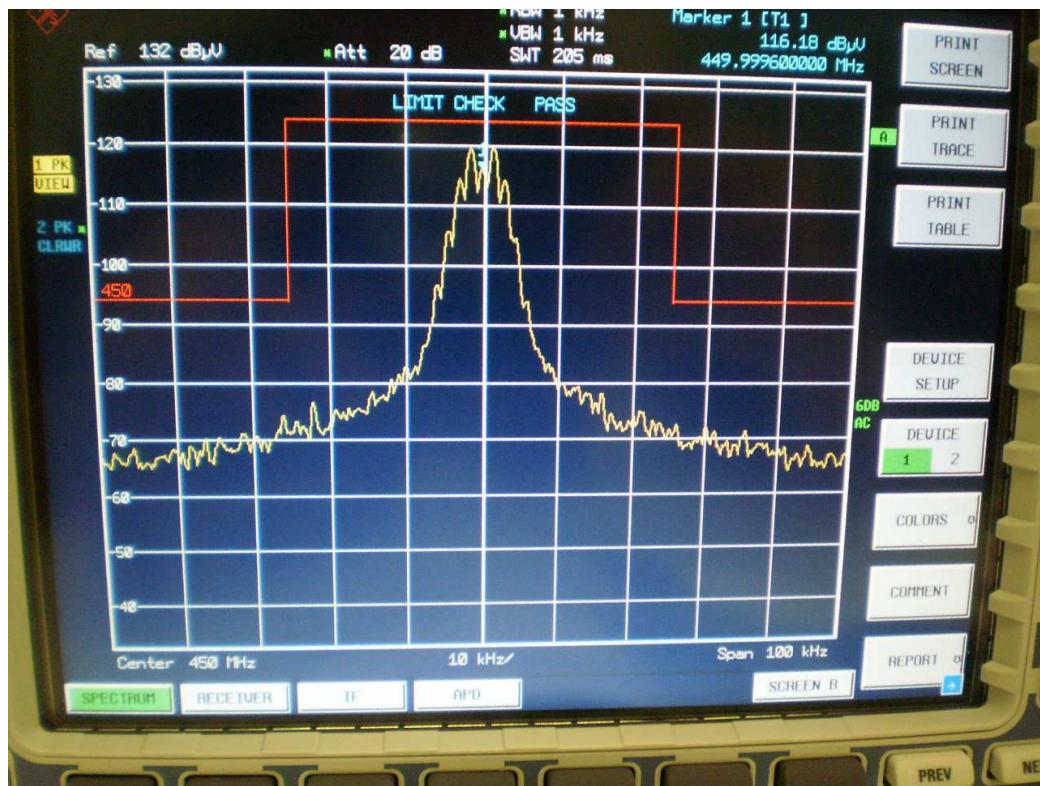


5.0 EMISSION MASK – Antenna Port

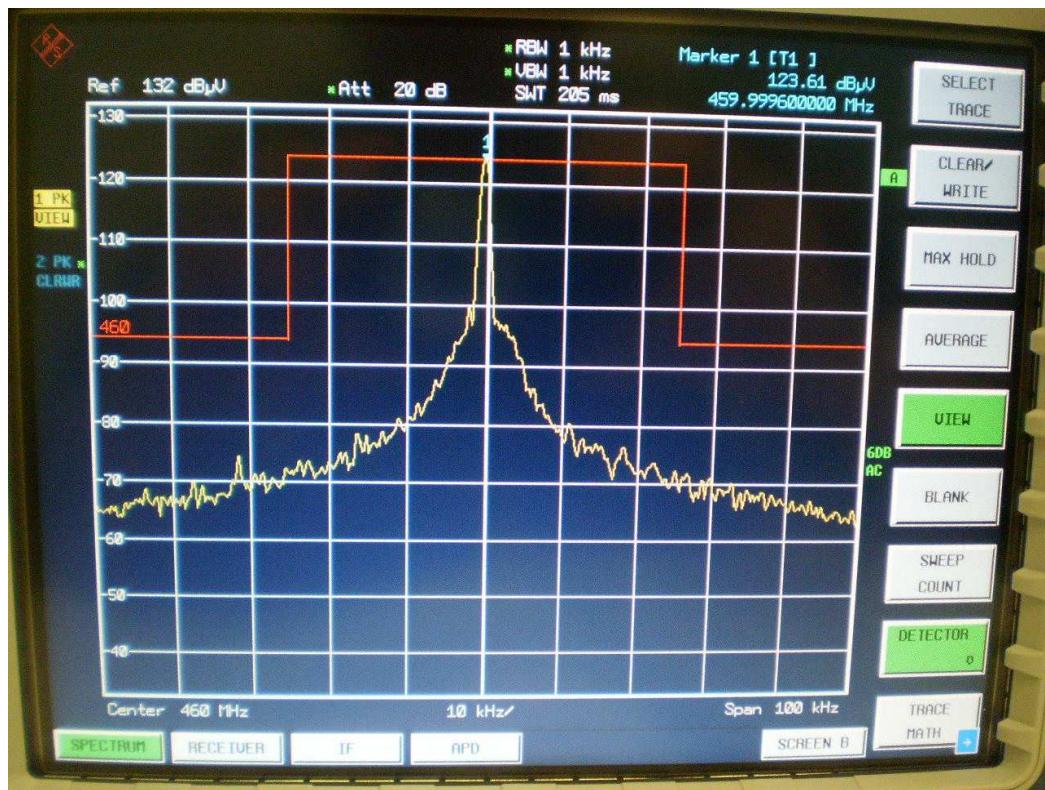
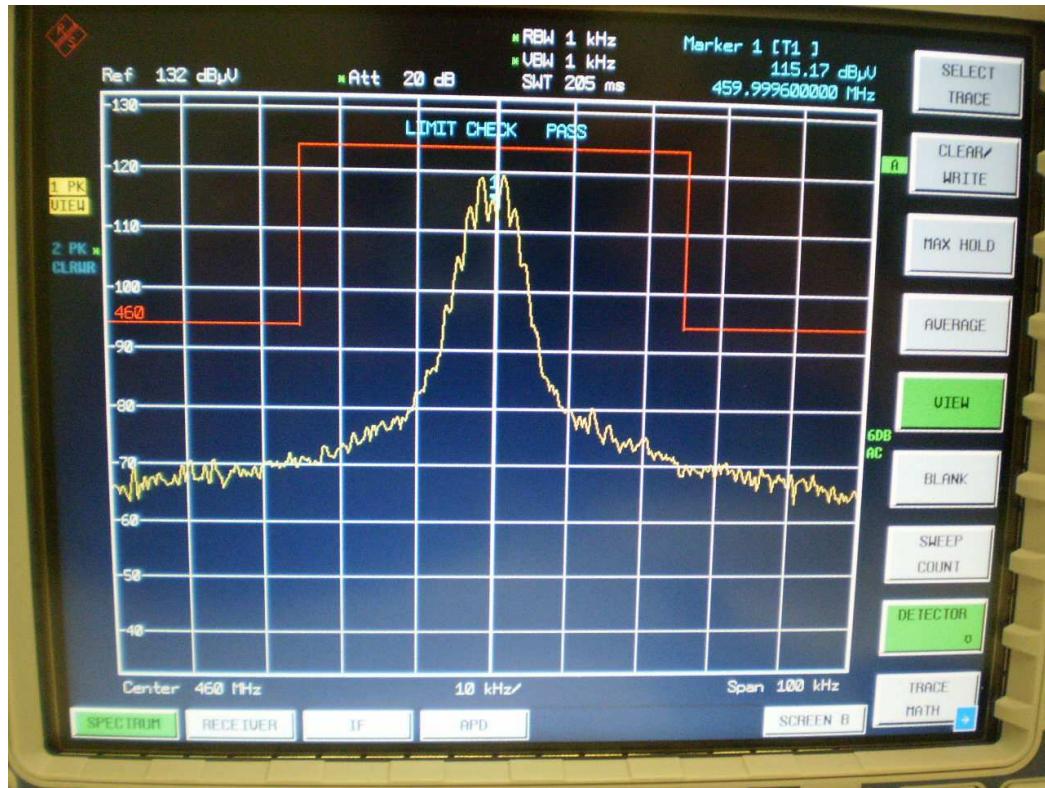
450 MHz Carrier



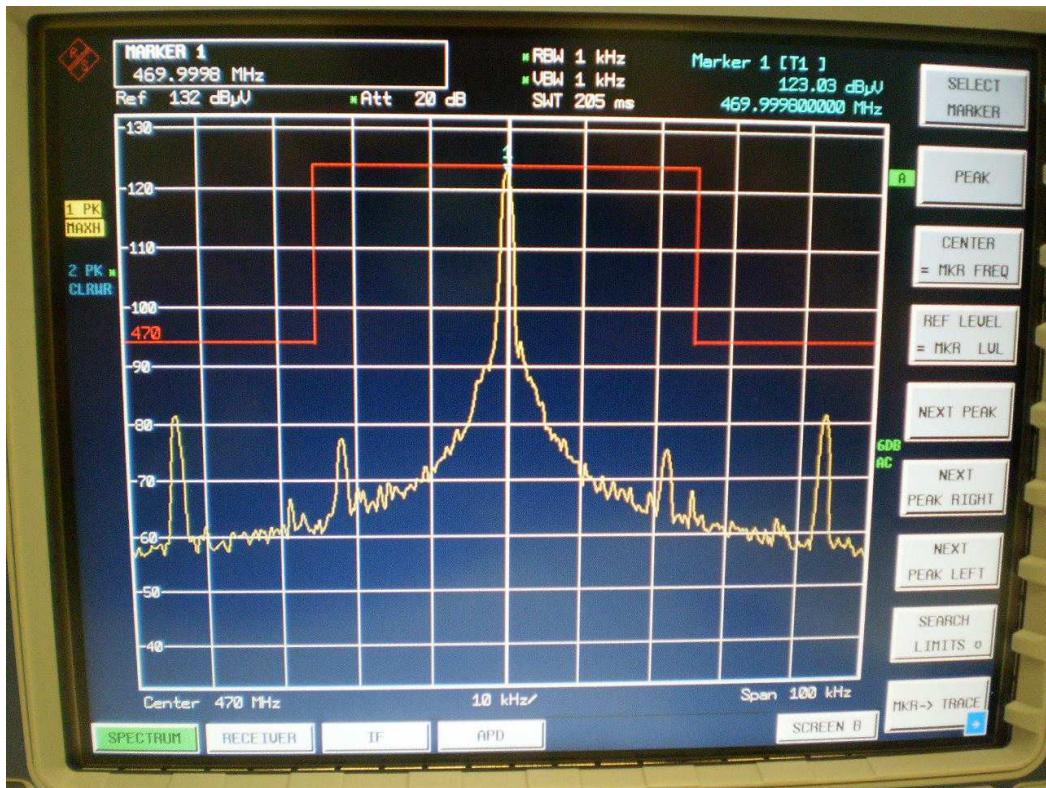
450 MHz Modulated



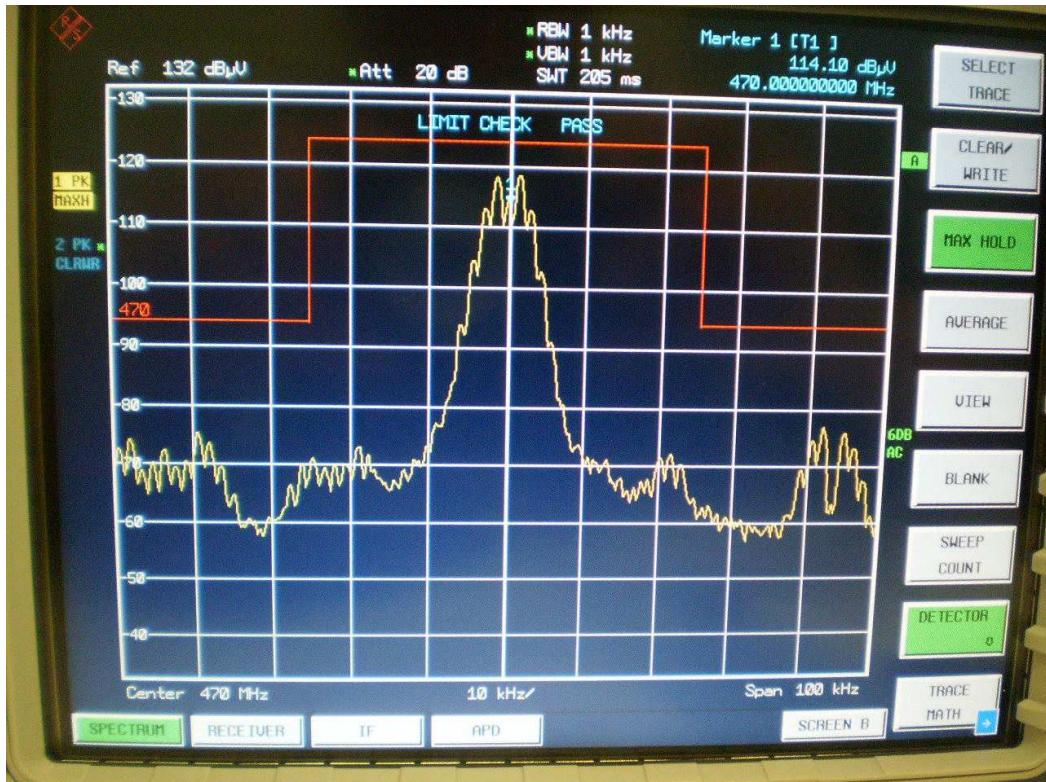
Results - Complied

460 MHz Carrier**460 MHz Modulated****Results - Complied**

470 MHz Carrier



470 MHz Modulated



Results - Complied

The Conducted Spurious emissions (out of band emissions from 9 kHz up to the 10th harmonic) measured at the antenna terminal were greater than 20 dB below the limit.

6.0 CONDUCTED EMISSIONS

Not applicable, test sample is DC powered.

7.0 RADIATED EMISSIONS

Measurements were performed at a distance of 3 metres from the EUT.

The limits of any emissions outside the frequency band shall be attenuated by at least 30dBc.

7.1 Frequency Band: 0.009 - 30 MHz

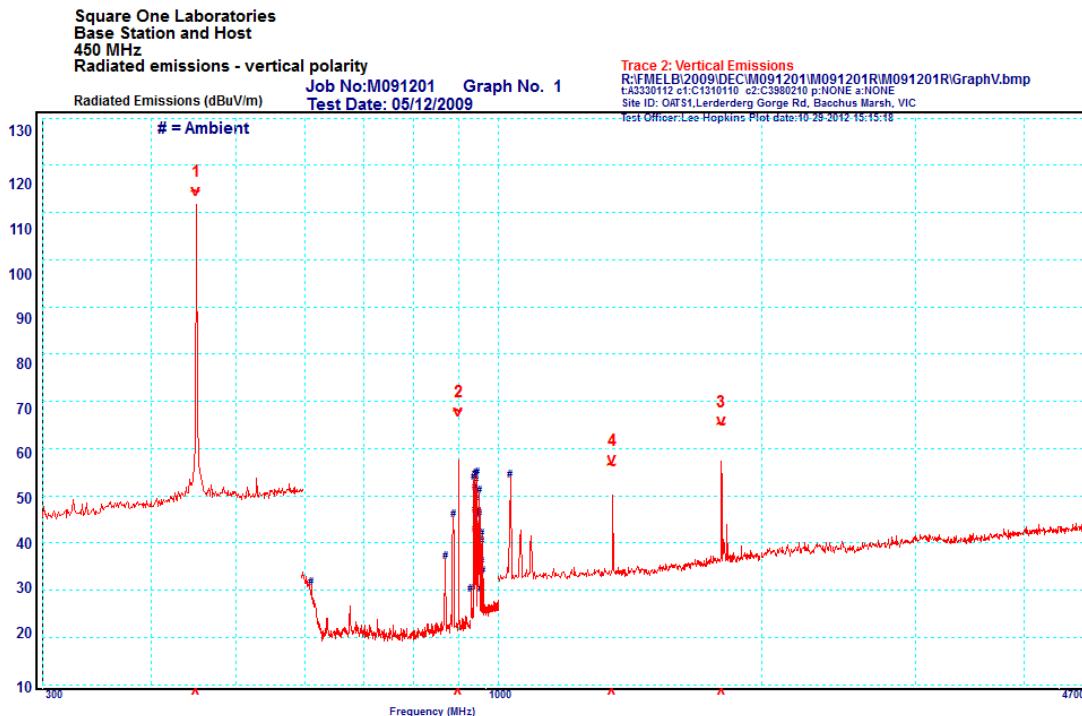
Result: Complied by a margin of greater than 10 dB (no emissions were recorded within 40 dB below the carrier).

7.2 Frequency Band: 30 - 300 MHz

Result: Complied by a margin of greater than 10 dB (no emissions were recorded within 40 dB below the carrier).

7.3 Frequency Band: 300 MHz – 4.7 GHz

450 MHz – Vertical



Peak	Frequency MHz	Polarity	Level Measured dBuV/m	Limit dB μ V/m	$\Delta \pm$ dB
1	450.01	Vertical	114.7	116.0	-1.3*
2	900.01	Vertical	68.1	84.7	-16.6
3	1800.01	Vertical	66.0	84.7	-18.7
4	1350.06	Vertical	57.8	84.7	-26.9

*This result falls within the laboratory's measurement uncertainty. Refer to Section 11.0.

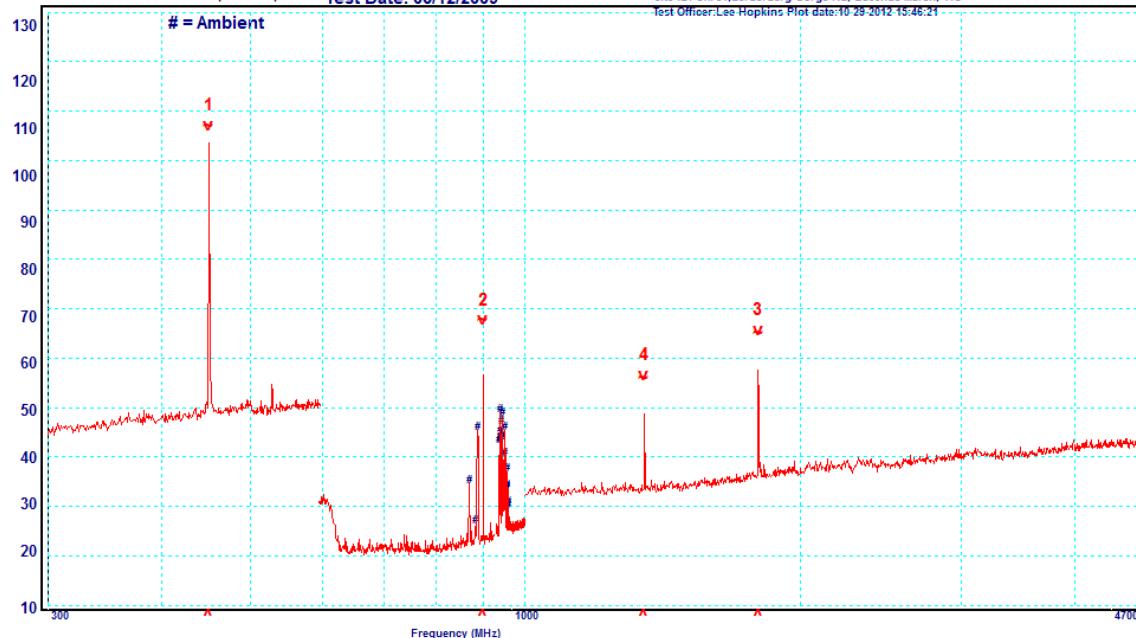
450 MHz – Horizontal

Square One Laboratories
Base Station and Host
450 MHz

Radiated emissions - horizontal polarity

Radiated Emissions (dBuV/m) Job No: M091201 Graph No. 2
Test Date: 05/12/2009

Trace 2: Horizontal Emissions
R:\FMELB\2009\DEC\091201\091201R\GraphH.bmp
t:4330112 c1:C1310110 c2:C3880210 p:None a:None
Site ID: OAT51,Lerderberg Gorge Rd, Bacchus Marsh, VIC



Peak	Frequency MHz	Polarity	Level Measured dBuV/m	Limit dB μ V/m	$\Delta \pm$ dB
1	450.01	Horizontal	107.3	116.0	-8.7
2	900.01	Horizontal	67.9	77.3	-9.4
3	1799.99	Horizontal	65.9	77.3	-11.4
4	1350.10	Horizontal	56.8	77.3	-20.5

460 MHz - Vertical

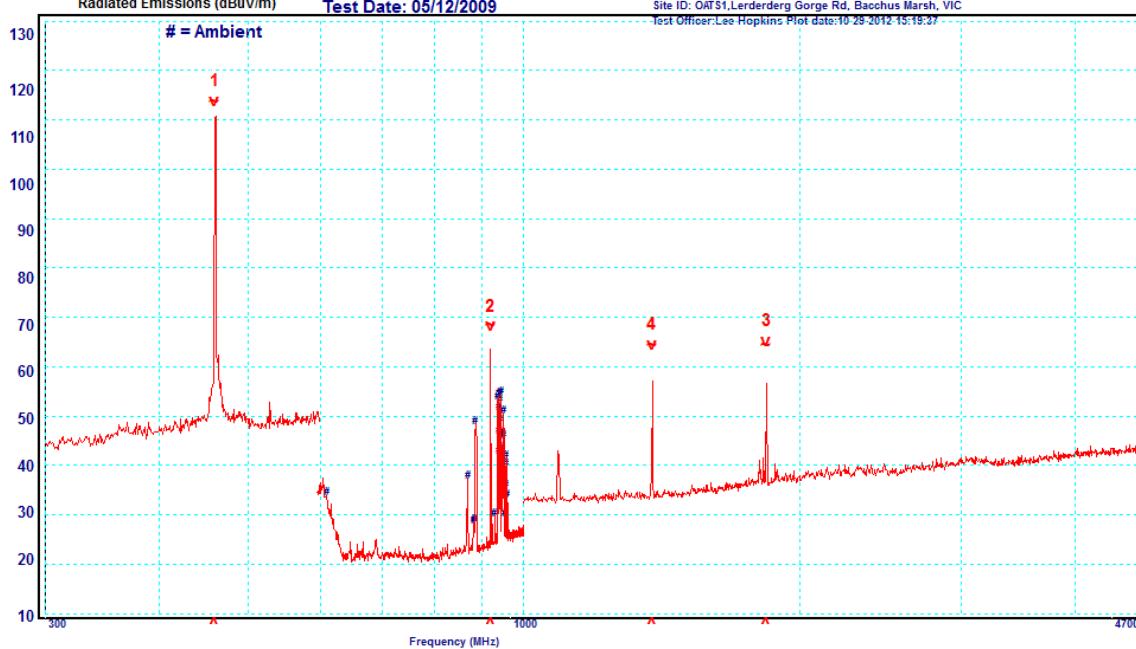
Square One Laboratories
Base Station and Host
460 MHz

Radiated emissions - vertical polarity

Job No: M091201 Graph No. 3
Test Date: 05/12/2009

Trace 2: Vertical Emissions
R:\FIELDB2009\DECM091201\IM091201R\IM091201R\GraphV.bmp
t:A3320112 c1:C1310110 c2:C3900210 p:None a:None
Site ID: OAT51, Lerderberg Gorge Rd, Bacchus Marsh, VIC

Test Officer: Lee Hopkins Plot date: 10-29-2012 15:19:37



Peak	Frequency MHz	Polarity	Level Measured dBuV/m	Limit dB μ V/m	$\Delta \pm \text{dB}$
1	460.01	Vertical	114.1	116.0	-1.9*
2	920.01	Vertical	68.4	84.1	-15.7
3	1839.99	Vertical	64.3	84.1	-19.8
4	1379.99	Vertical	64.5	84.1	-19.6

*This result falls within the laboratory's measurement uncertainty. Refer to Section 11.0.

460 MHz - Horizontal

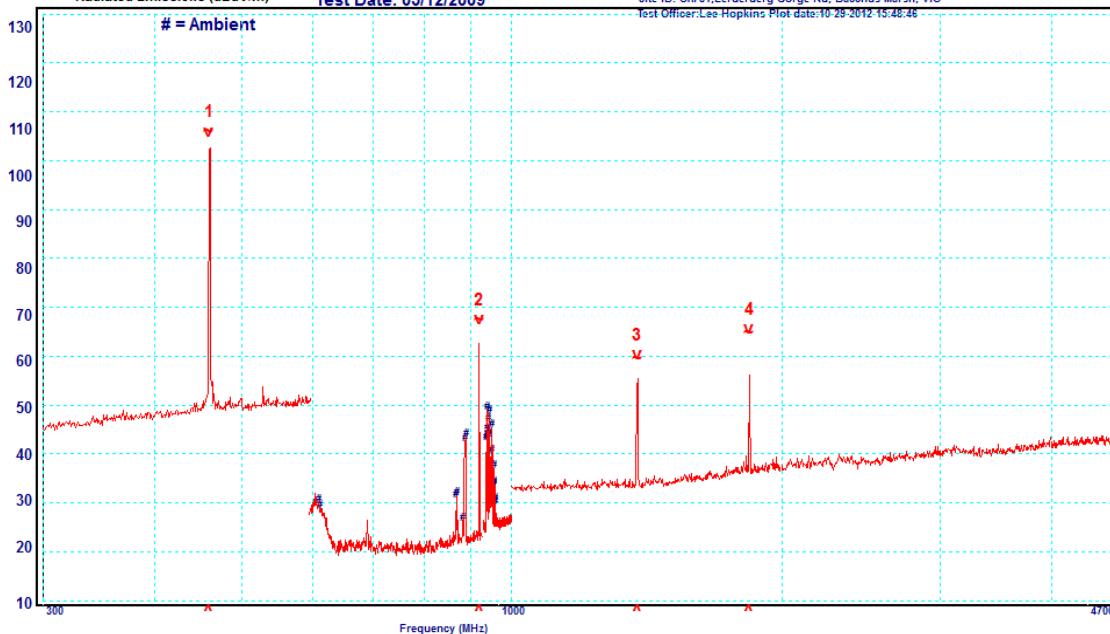
Square One Laboratories
Base Station and Host
460 MHz

Radiated emissions - horizontal polarity

Job No:M091201 Graph No. 4
Radiated Emissions (dB μ V/m)
Test Date: 05/12/2009

Trace 2: Horizontal Emissions
R:\FMELB\2009\DEC\IM091201\IM091201R\IM091201R\GraphH.bmp
t:A330112 c1:C1310110 c2:C3880210 p:NONE s:NONE
Site ID: OAT51, Lerderderg Gorge Rd, Bacchus Marsh, VIC

Test Officer: Leo Hopkins Plot date: 16/08/2012 15:48:46



Peak	Frequency MHz	Polarity	Level Measured dB μ V/m	Limit dB μ V/m	$\Delta \pm \text{dB}$
1	460.01	Horizontal	106.1	116.0	-9.9
2	920.01	Horizontal	67.7	76.1	-8.4
3	1379.66	Horizontal	60.5	76.1	-15.6
4	1839.98	Horizontal	65.8	76.1	-10.3

470 MHz – Vertical

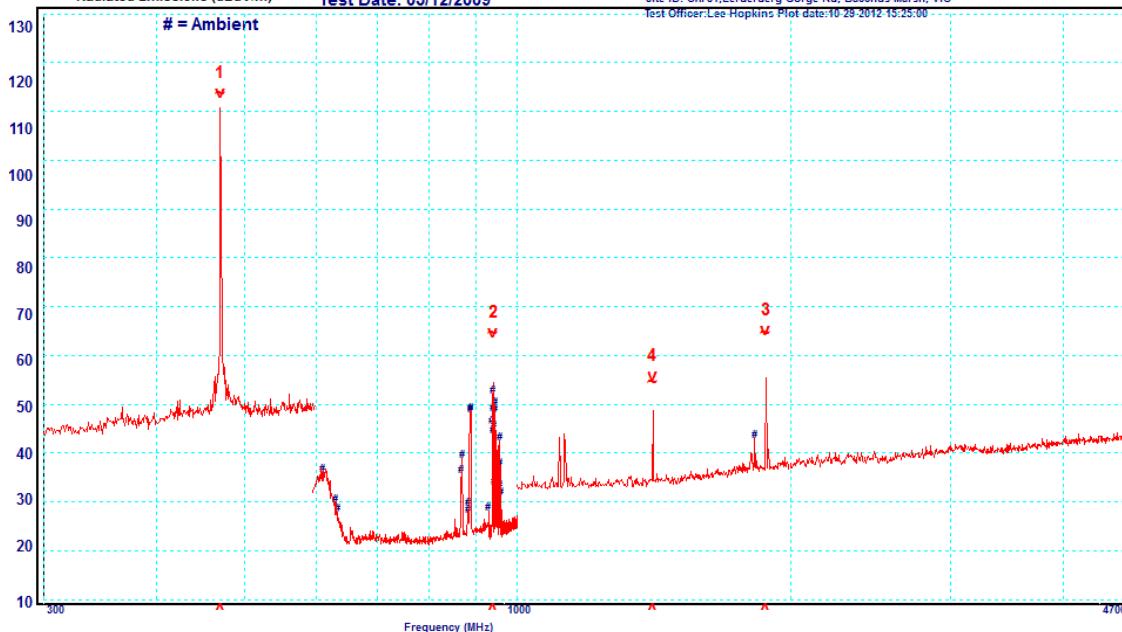
Square One Laboratories
Base Station and Host
470 MHz

Radiated emissions - vertical polarity

Radiated Emissions (dB μ V/m) **Job No: M091201** **Graph No. 5**
Test Date: 05/12/2009

Trace 2: Vertical Emissions
R:\F:\MEL\B\2009\DEC\091201\091201R\091201R\GraphV.bmp
LA3330112.c1:C1310110 c2:C3850210 p:None a:None
Site ID: OATS1 Lenderberg Gorge Rd, Bacchus Marsh, VIC

Test Officer: Lee Hopkins Plot date: 10-28-2012 15:25:08



Peak	Frequency MHz	Polarity	Level Measured dB μ V/m	Limit dB μ V/m	$\Delta \pm$ dB
1	470.01	Vertical	114.0	116.0	-2.0*
2	940.01	Vertical	64.9	84.0	-19.1
3	1879.95	Vertical	65.4	84.0	-18.6
4	1409.97	Vertical	54.6	84.0	-29.4

*This result falls within the laboratory's measurement uncertainty. Refer to Section 11.0.

470 MHz - Horizontal

Square One Laboratories
Base Station and Host
470 MHz

Radiated emissions - horizontal polarity

Radiated Emissions (dB μ V/m)

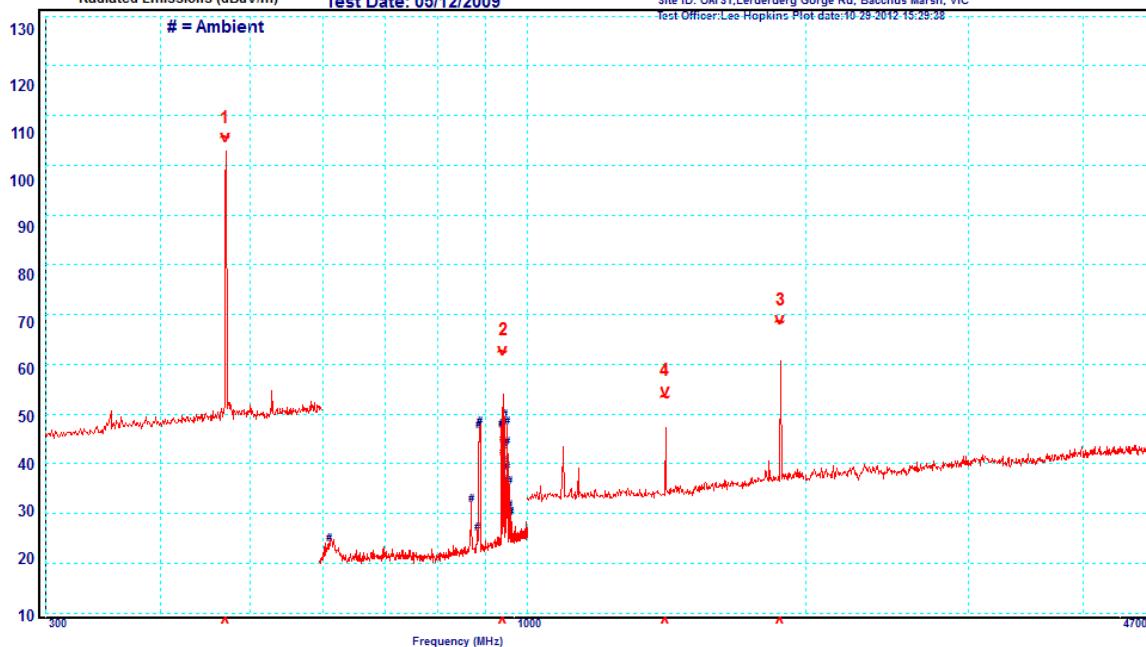
Job No: M091201 Graph No. 6
Test Date: 05/12/2009

Trace 2: Horizontal Emissions

R:\FMELB\2009\DECM091201M091201R\GraphH.bmp
t:3339112 c1:C1310110 c2:C3880210 p:NONE x:NONE

Site ID: ORTS1,Lerderderg Gorge Rd, Bacchus Marsh, VIC

Test Officer: Lee Hopkins Plot date: 10-23-2012 15:29:28



Peak	Frequency MHz	Polarity	Level Measured dB μ V/m	Limit dB μ V/m	$\Delta \pm \text{dB}$
1	470.01	Horizontal	105.8	116.0	-10.2
2	940.01	Horizontal	63.0	75.8	-12.8
3	1880.03	Horizontal	69.1	75.8	-6.7
4	1409.90	Horizontal	54.9	75.8	-20.9

Substitution measurements were performed. The EUT was replaced with a calibrated dipole antenna (below 1 GHz) or horn antenna (above 1 GHz) that was connected to a signal generator. The output level of the signal generator was adjusted until the same level on the receiver observed. The level of the signal generator output in dB μ V or dBm less any loss due to the connecting cable and added the gain of the substitute antenna.

8.0 FREQUENCY STABILITY

Low Channel (450 MHz)

Temperature (°C)	Frequency MHz	Frequency Error Hz	Frequency Error ppm	Limits ppm	Results
-30	449.99965	350	0.78	1.5	Pass
-25	449.99970	300	0.67		
-15	449.99995	50	0.11		
-5	450.00010	100	0.22		
+5	450.00010	100	0.22		
+15	450.00010	100	0.22		
+25	450.00010	100	0.22		
+35	450.00000	0	0		
+45	449.99985	150	0.33		
+55	449.99950	500	1.11		

High Channel (470 MHz)

Temperature (°C)	Frequency MHz	Frequency Error Hz	Frequency Error ppm	Limits ppm	Results
-30	469.99970	300	0.64	1.5	Pass
-25	469.99970	300	0.64		
-15	469.99990	100	0.21		
-5	470.00010	100	0.21		
+5	470.00010	100	0.21		
+15	470.00010	100	0.21		
+25	470.00005	50	0.11		
+35	469.99990	100	0.21		
+45	469.99980	200	0.43		
+55	469.99935	650	1.38		

Measurements were also performed with varying the supply voltage. The maximum transmitter frequency error of 650 Hz was recorded.

9.0 TRANSIENT FREQUENCY

Transmitters designed to operate in the 421-512 MHz frequency band must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated.

Transient frequency behaviour for equipment designed to operate on 12.5 kHz channels:

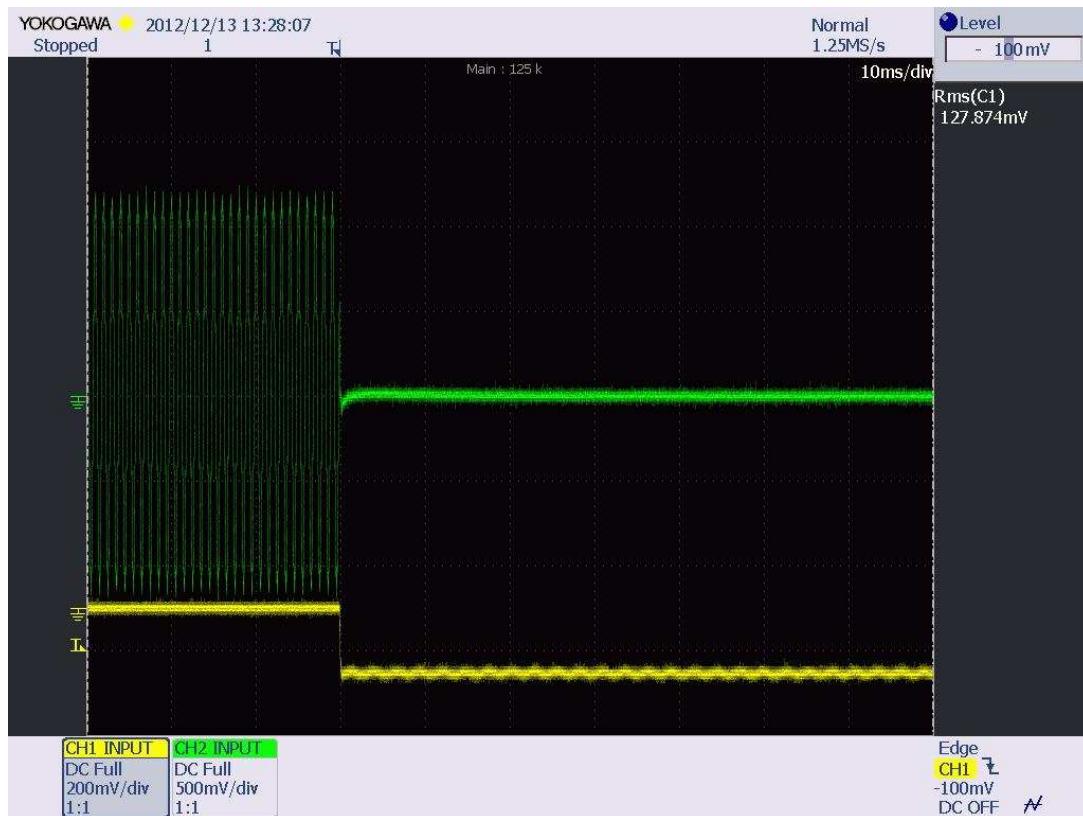
Time Intervals	Maximum Frequency Difference	421 – 512 MHz Equipment	Results
t_1	± 12.5 kHz	10.0 ms	Complied Refer to plots
t_2	± 6.25 kHz	25.0 ms	
t_3	± 12.5 kHz	10.0 ms	

t_1 is the time period immediately following t_{on}

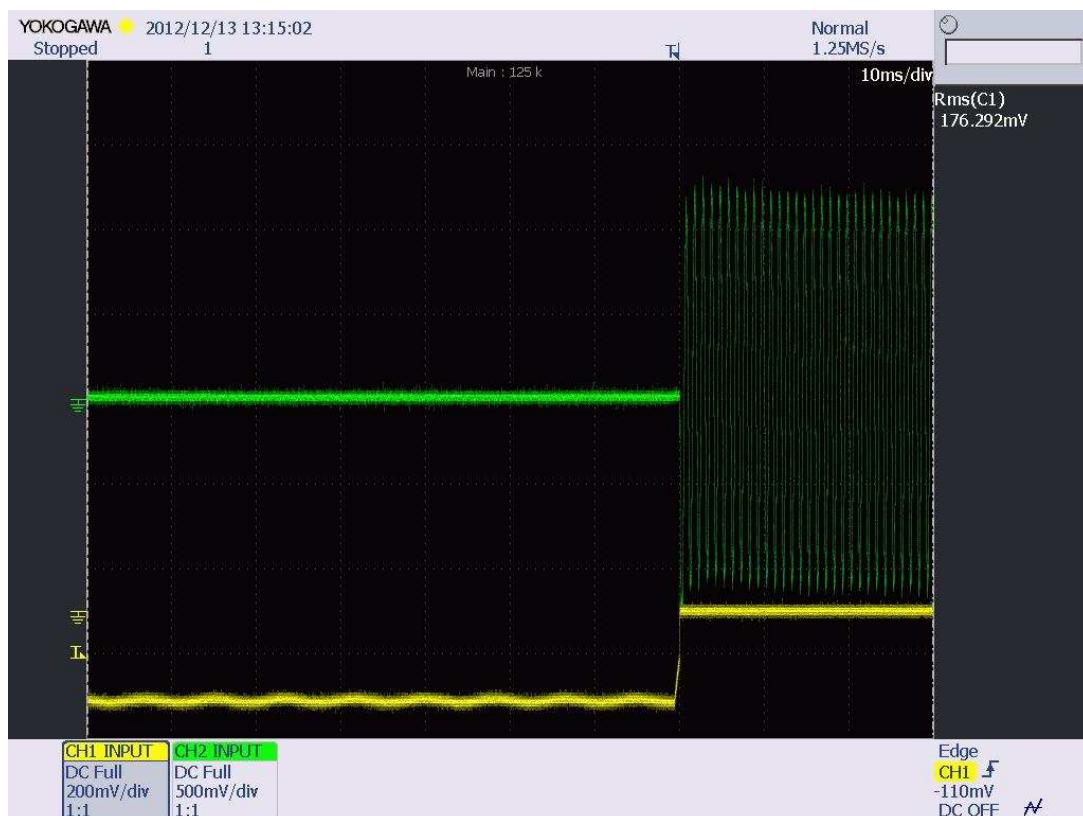
t_2 is the time period immediately following t_1

t_3 is the time period from the instant when the transmitter is turned off until t_{off}

Turn ON



Turn OFF



10.0 COMPLIANCE STATEMENT

The Agile Base Station, Part number: 1000-0700, tested on behalf of Square One Laboratories Pty Ltd **complied** with the requirements of 47 CFR, Part 90.217

FCC Part 90.217 and FCC Part 2 Clauses	Test Description	Results
FCC 2.1046	Output Power	Complied
FCC 2.1049	Occupied Bandwidth	Complied
FCC 2.1049	Emission mask	Complied
FCC 2.1051	Conducted Emissions	Complied
FCC 2.1053	Radiated Emissions	Complied
FCC 2.1055	Frequency stability	Complied

11.0 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:

Conducted Emissions:	9 kHz to 30 MHz	±3.2 dB
Radiated Emissions:	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%.

12.0 MEASUREMENT INSTRUMENT

EQUIPMENT TYPE	MANUFACTURER, MODEL NUMBER and SERIAL NUMBER	CALIBRATION DUE DD/MM/YYYY
EMI RECEIVER	HP 8546A Sn: 3549A00290 (R-009)	05/09/2013
	Rohde & Schwarz, Model ESU40 Sn: 1302.6005.40, 20 Hz – 40 GHz	12/01/2013
ANTENNA	EMCO 6502 LOOP ANTENNA 9 kHz – 30 MHz Sn: 2021	19/11/2012
	EMCO 93110B BICONICAL (A-110) 20 – 300 MHz, Sn: 96122801	02/05/2012
	EMCO 93146A LOG PERIODIC (A-136) 200 – 1000 MHz, Sn: 98035033	02/05/2012
	EMCO 3115 DOUBLE RIDGED HORN 1 - 18 GHz Sn: 8908-3282	16/01/2015
	EMCO 3121C Dipole	01/02/2013
	ComPower Horn, Model: AH-118, Sn: 71168	19/01/2015
Signal Generator	HP8340B Sn: 2819A00943	Calibration or verify before use
	Rohde & Schwarz, Model SML 01 Sn: 1090 3000 11	Calibration or verify before use
Attenuator	HP8496B, S/N: 2827A18252	Calibration or verify before use
Power Divider or Splitter	Weinschel Engineering 1870A	Calibration or verify before use
	Weinschel Engineering 1506A	Calibration or verify before use
Oscilloscope	Yokogawa DL9140	27/07/2013
Thermal Chamber	Haereus Votsch Model HT4033 Temp Range -40°C-180°C	Not Required