EMC Technologies Pty Ltd
ABN 82 057 105 549
176 Harrick Road
Keilor Park Victoria Australia 3042

Ph: + 613 9365 1000
Fax: + 613 9331 7455
email: melb@emctech.com.au

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

FCC ID: **PTK-0059**
IC ID: **10655A-0059**

Test Sample: Measuring Device Electromyography v5
Model Number: MD-E

Report Number M120346R_MD-E_Cert

Tested for: dorsaVi Pty Ltd

Re-Issue Date: 29th January 2013

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

EMC Technologies Report No. M120346R_MD-E_Cert

Re-Issue Date: 29th January 2013

CONTENTS

1.0 INTRODUCTION
2.0 GENERAL INFORMATION
3.0 CONDUCTED EMISSION MEASUREMENTS
4.0 RADIATED EMISSION MEASUREMENTS
5.0 ANTENNA REQUIREMENT
6.0 COMPLIANCE STATEMENT
7.0 MEASUREMENT UNCERTAINTIES
8.0 MEASUREMENT INSTRUMENT

CONFIDENTIAL 1 OPERATIONAL DESCRIPTION
CONFIDENTIAL 2 BLOCK DIAGRAM
CONFIDENTIAL 3 SCHEMATICS

ATTACHMENT 1 EXTERNAL PHOTOGRAPHS
ATTACHMENT 2 INTERNAL PHOTOGRAPHS
ATTACHMENT 3 TEST SETUP PHOTOGRAPHS
ATTACHMENT 4 LABEL
ATTACHMENT 5 USER MANUAL

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

Report Number:	M120346R_MD-E_Cert
Test Sample:	Measuring Device Electromyography v5
Model Number:	MD-E
Manufacturer:	dorsaVi Pty Ltd
Equipment Type:	Intentional Radiator
Tested for:	dorsaVi Pty Ltd
Address:	Level 1, 120 Jolimont Road, Melbourne East VIC 3002, Australia
Phone:	+61 (0)3 9652 2191
Contact:	Daniel Ronchi
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:	4th May 2012 to 18th January 2013
Test Engineers:	**Rob Weir** **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

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

1.0 INTRODUCTION

EMI testing was performed on the Measuring Device Electromyography v5, model number: MD-E.

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	**Complied**
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)			**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

The test sample is powered by the internal battery and also by a charging cradle.

1.3 Modifications

No modifications were performed.

2.0 GENERAL INFORMATION

(Information supplied by the Client)

2.1 Product Details

Test Sample:	Measuring Device Electromyography v5
Model Number:	MD-E
Manufacturer:	dorsaVi Pty Ltd
RF Operating frequency:	2405 MHz to 2475 MHz (channels 5 to 75)
Modulation	GFSK

2.2 Operational Description

The Measuring Device Electromyography v5 (MD-E) is a sensor unit with a differential operational amplifier which detects physiological activity signals (surface electromyogprahy).

2.3 Test Configuration

The MD-E was configured to transmit with modulation or without as needed.

Measurements were performed in two configurations:

- The EUT is powered by the internal battery (new battery fitted)
- The EUT is powered by a charging cradle

and rotated around 3 orthogonal planes. Worst-case results are reported.

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 10 metres from the EUT for frequencies 30 – 1000 MHz and 3 metres for frequency bands: > 1000MHz and 0.009 – 30 MHz.

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
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^2LA).

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 (biconilog 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.

3.0 CONDUCTED EMISSION MEASUREMENTS

3.1 Test Procedure

The arrangement specified in ANSI C63.4-2009 was adhered to for the conducted EMI measurements. The EUT was placed in the RF screened enclosure and a CISPR EMI Receiver as defined in ANSI C63.2-1996 was used to perform the measurements.

The EMI Receiver was operated under program control using the Max-Hold function and automatic frequency scanning, measurement and data logging techniques. The specified 0.15 MHz to 30 MHz frequency range was sub-divided into sub-ranges to ensure that all short duration peaks were captured.

3.2 Peak Maximising Procedure

The various operating modes of the system were investigated. For each of the sub-ranges, the EMI receiver was set to continuous scan with the Peak detector set to Max-Hold mode. The Quasi-Peak detector and the Average detector were then invoked to measure the actual Quasi-Peak and Average level of the most significant peaks, which were detected.

3.3 Calculation of Voltage Levels

The voltage levels were automatically measured in software and compared to the test limit. The method of calculation was as follows:

VEMI = **VRx + LBPF**

Where: **VEMI =** the Measured EMI voltage in dBµV to be compared to the limit.
VRx = the Voltage in dBµV read directly at the EMI receiver.
LBPF = the insertion loss in dB of the cables and the Limiter and Pass Filter.

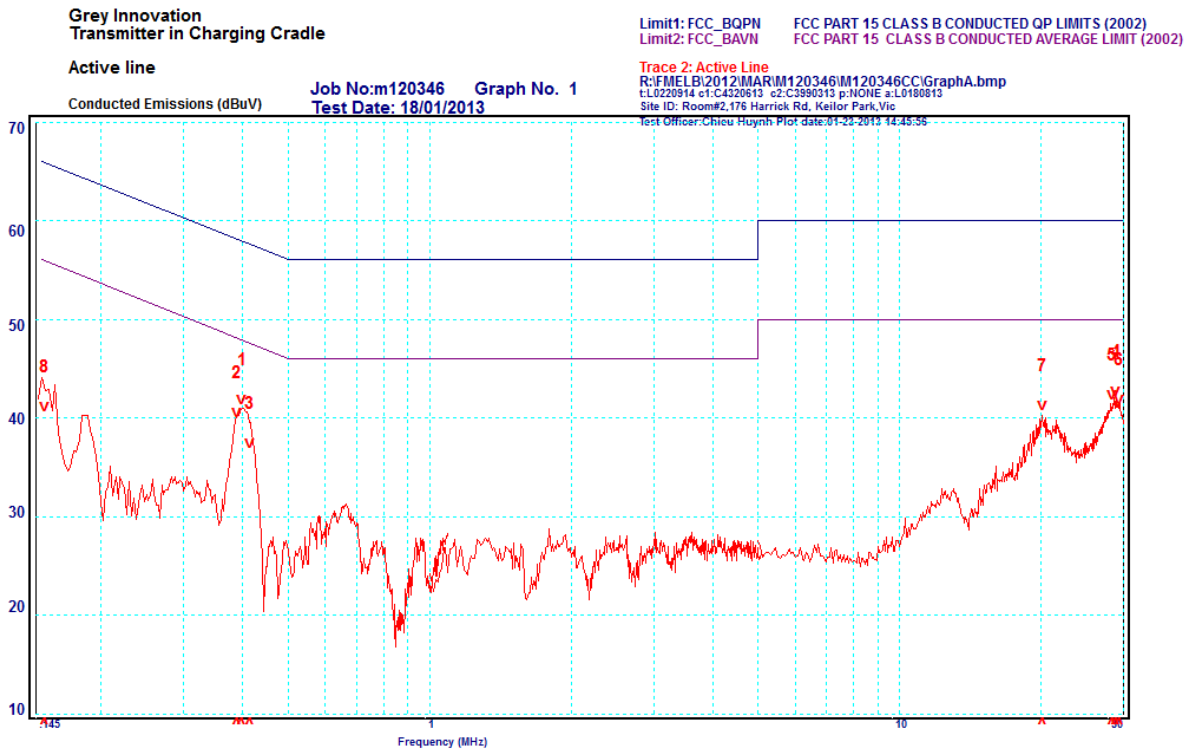
3.4 Plotting of Conducted Emission Measurement Data

The measurement data pertaining to each frequency sub-range were concatenated to form a single graph of (peak) amplitude versus frequency. This was performed for both Active and Neutral lines and the composite graph was subsequently plotted. A list of the highest relevant peaks and the respective Quasi-Peak and Average values were also plotted on the graph.

3.5 Results of Conducted Emission Measurement

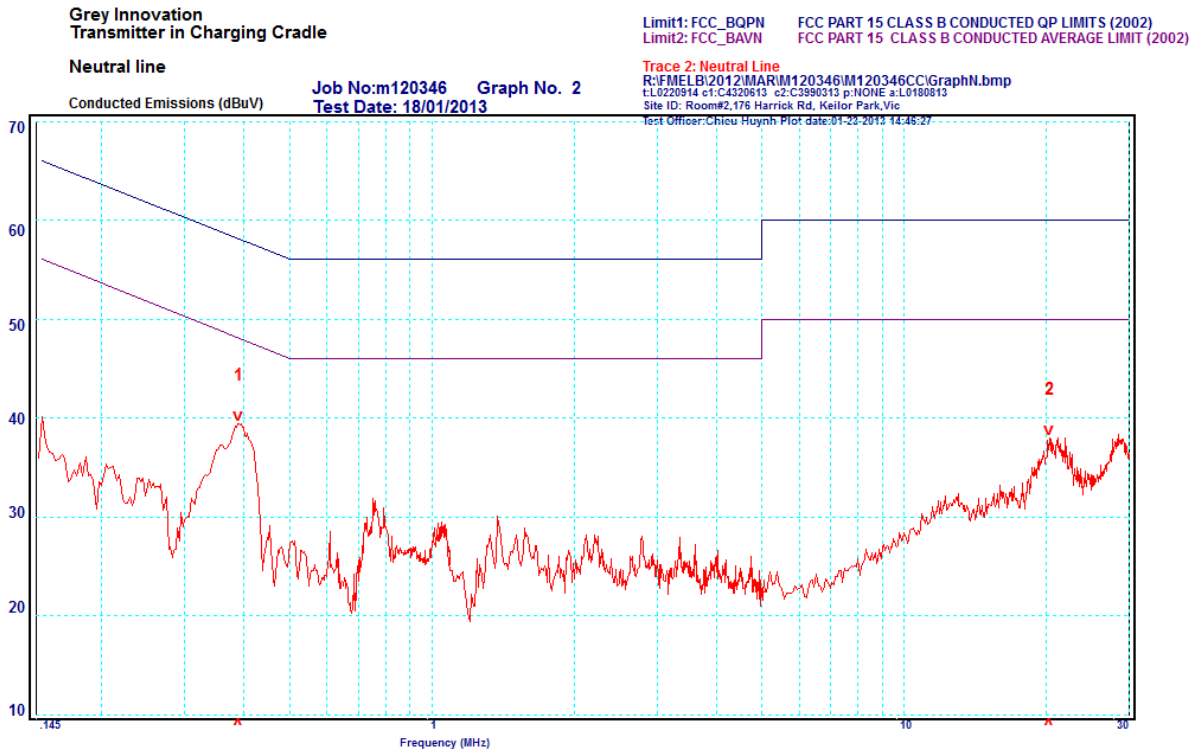
Worst case emissions occurred complied with the FCC Class B, quasi peak and average limits by margins of > 10 dB.

Active Line



Peak	Frequency MHz	Line	Measured QP Level dBµV	QP Limit dBµV	ΔQP ±dB	Measured AV Level dBµV	AV Limit dBµV	ΔAV ±dB
1	0.399	Active	40.7	57.9	-17.2	29.8	47.9	-18.1
2	0.389	Active	36.7	58.1	-21.4	28.9	48.1	-19.2
3	0.415	Active	36.2	57.6	-21.4	29.0	47.6	-18.6
4	28.91	Active	38.0	60.0	-22.0	33.4	50.0	-16.6
5	28.34	Active	37.7	60.0	-22.3	33.1	50.0	-16.9
6	29.35	Active	36.8	60.0	-23.2	32.3	50.0	-17.7
7	20.18	Active	33.6	60.0	-26.4	27.3	50.0	-22.7
8	0.152	Active	36.0	65.9	-29.9	26.5	55.9	-29.4

Neutral Line



Peak	Frequency MHz	Line	Measured QP Level dBµV	QP Limit dBµV	ΔQP ±dB	Measured AV Level dBµV	AV Limit dBµV	ΔAV ±dB
1	0.390	Neutral	38.1	58.1	-20.0	31.2	48.1	-16.9
2	20.34	Neutral	31.9	60.0	-28.1	25.1	50.0	-24.9

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 Biconilog antenna was used for measurements between 30 MHz to 1000 MHz. Calibrated EMCO 3115 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
Peak measurements above 1 GHz: RBW = VBW = 1 MHz

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 dBµV/m.
V = EMI Receiver Voltage in dBµV. (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 Field Strength Calculation**

Assuming a receiver reading of 34.0 dBµV 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:

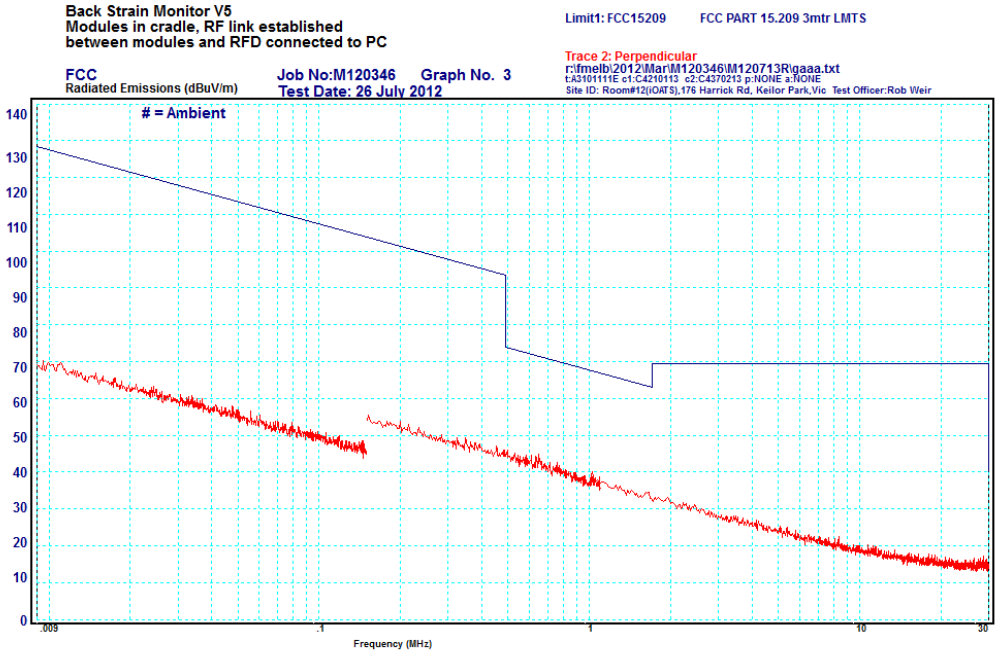
34.0 + 9.2 + 1.9 - 20 = 25.1 dBµV/m

4.3 Transmitter Fundamental and Spurious Emissions

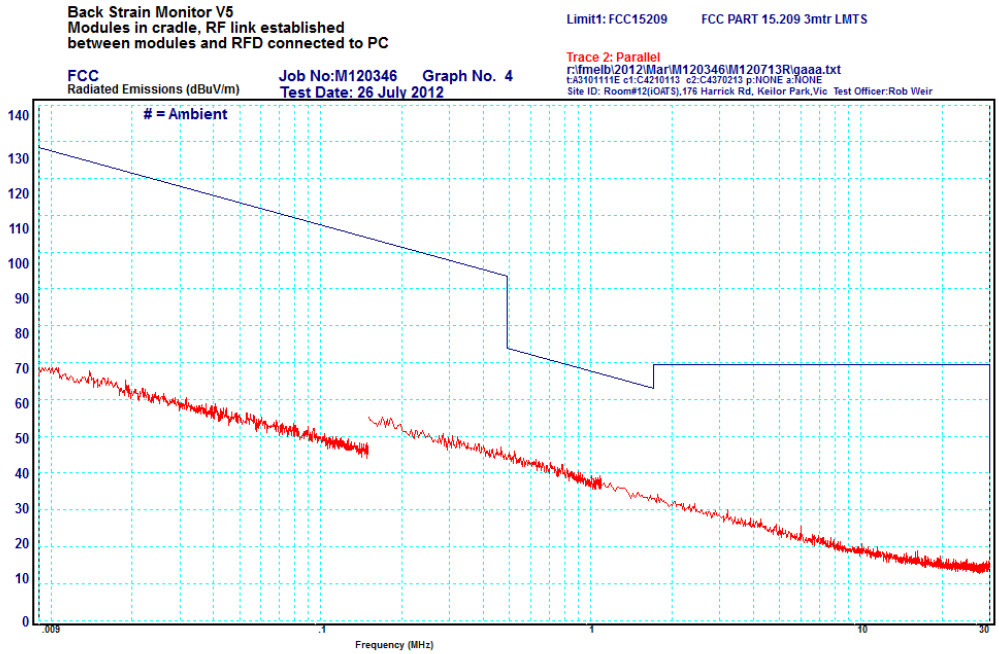
4.3.1 Frequency Band: 0.09 MHz - 30 MHz

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 2.440 GHz.

0.09MHz to 30MHz – Perpendicular



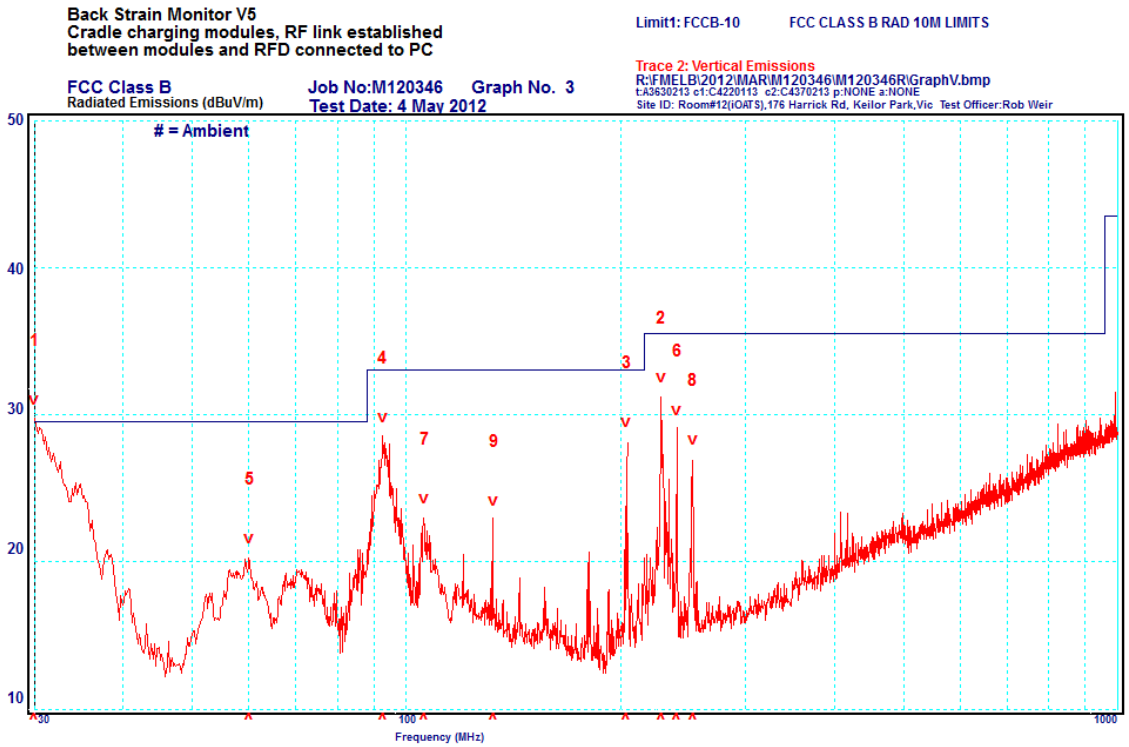
0.09MHz to 30MHz – Parallel



4.3.2 Frequency Band: 30 MHz - 1000 MHz

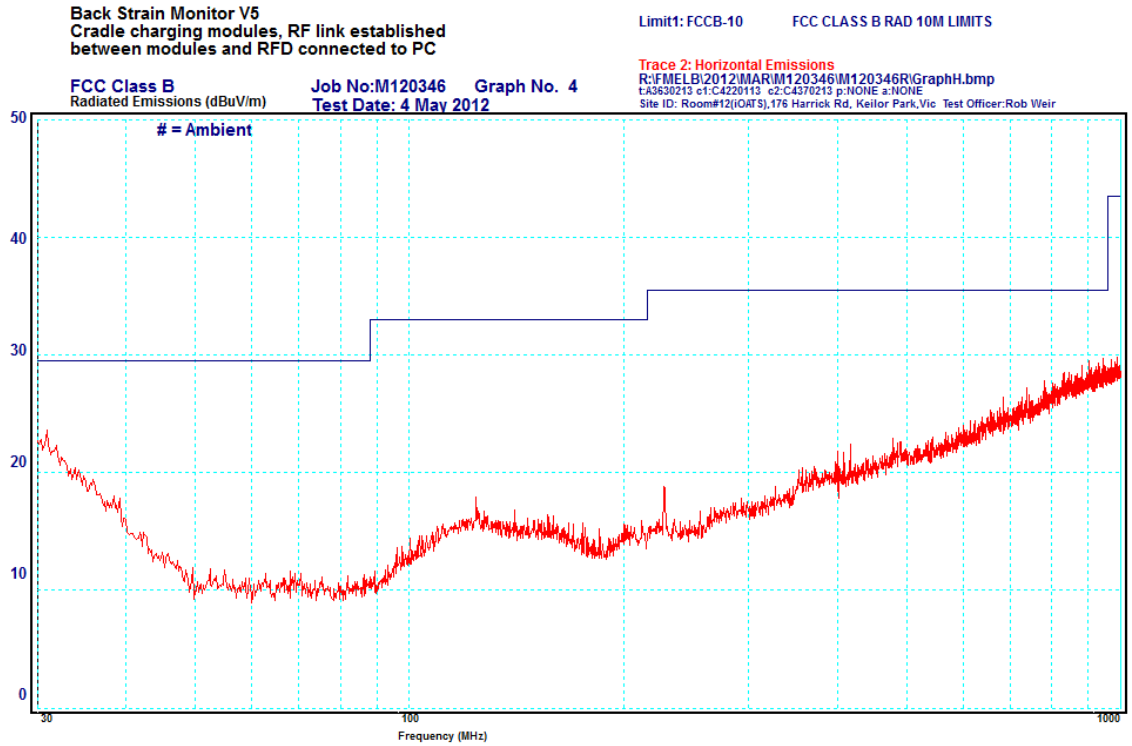
Initial investigations were performed with all three frequencies (low, middle and high). No significant differences in emissions were observed. Final testing was performed while the transmitter continuously operated at 2.440 GHz.

30MHz to 1000MHz - Vertical



Peak	Frequency MHz	Polarisation	QP Measured dBµV/m	QP Limit dBµV/m	ΔQP ± dB
1	30.04	Vertical	25.2	29.5	-4.3
2	228.03	Vertical	28.1	35.5	-7.4
3	204.03	Vertical	24.1	33.0	-8.9
4	92.64	Vertical	23.9	33.0	-9.1
5	60.24	Vertical	16.1	29.5	-13.4
6	239.95	Vertical	21.3	35.5	-14.2
7	106.06	Vertical	17.7	33.0	-15.3
8	252.78	Vertical	17.5	35.5	-18.0
9	132.71	Vertical	12.2	33.0	-20.8

30MHz to 1000MHz - Horizontal



4.3.3 Frequency Band: 1 – 25 GHz

The measurements were made with a peak detector. The average measurement results were calculated by subtracting 20dB to compensate for the pulse desensitization correction factor. Refer to section 4.3.6 for duty cycle calculation.

Low Frequency - Tx at 2405 MHz

Frequency GHz	Peak Detector dBµV/m	Average Detector dBµV/m	Peak Limit dBµV/m	Average Limit dBµV/m	Result
2.405	104.9	84.9	114.0	94.0	Complied
4.810	65.6	45.6	74.0	54.0	Complied
7.215	58.1	38.1	74.0	54.0	Complied
9.620	53.2	33.2	74.0	54.0	Complied
12.025	50.2	30.2	74.0	54.0	Complied

Middle Frequency - Tx at 2440 MHz

Frequency GHz	Peak Detector dBµV/m	Average Detector dBµV/m	Peak Limit dBµV/m	Average Limit dBµV/m	Result
2.440	105.4	85.4	114.0	94.0	Complied
4.880	67.3	47.3	74.0	54.0	Complied
7.320	56.8	46.8	74.0	54.0	Complied
9.760	53.0	33.0	74.0	54.0	Complied
12.200	49.1	29.1	74.0	54.0	Complied

High Frequency - Tx at 2475 MHz

Frequency GHz	Peak Detector dBµV/m	Average Detector dBµV/m	Peak Limit dBµV/m	Average Limit dBµV/m	Result
2.475	106.0	86.0	114.0	94.0	Complied
4.950	69.1	49.1	74.0	54.0	Complied
7.425	62.3	42.3	74.0	54.0	Complied
9.900	55.2	35.2	74.0	54.0	Complied
12.375	47.8	27.8	74.0	54.0	Complied

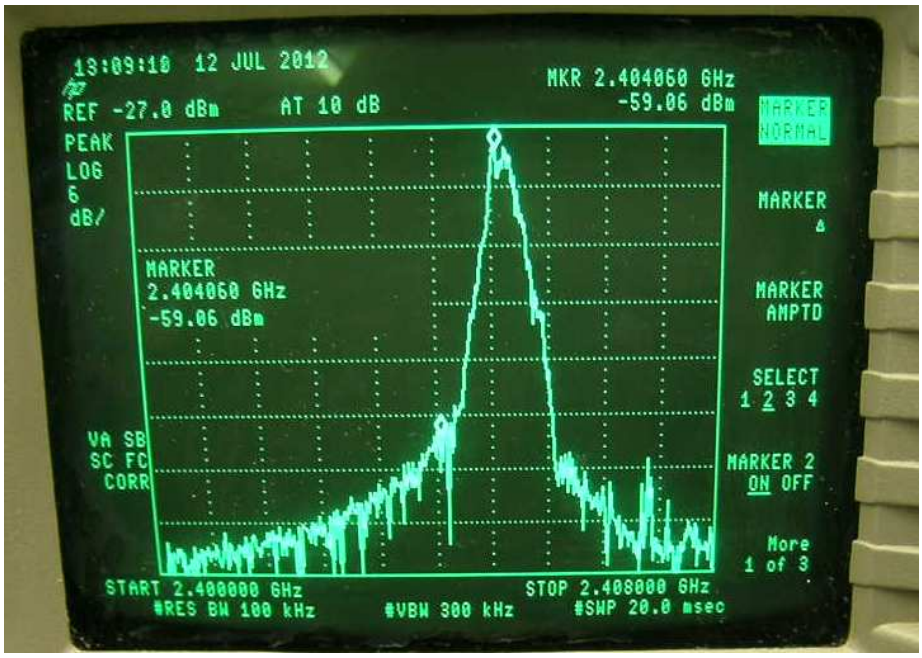
Results: The fundamental and harmonic emissions complied with the FCC limits in sections 15.209 and 15.249.

4.3.4 Band Edge Measurements

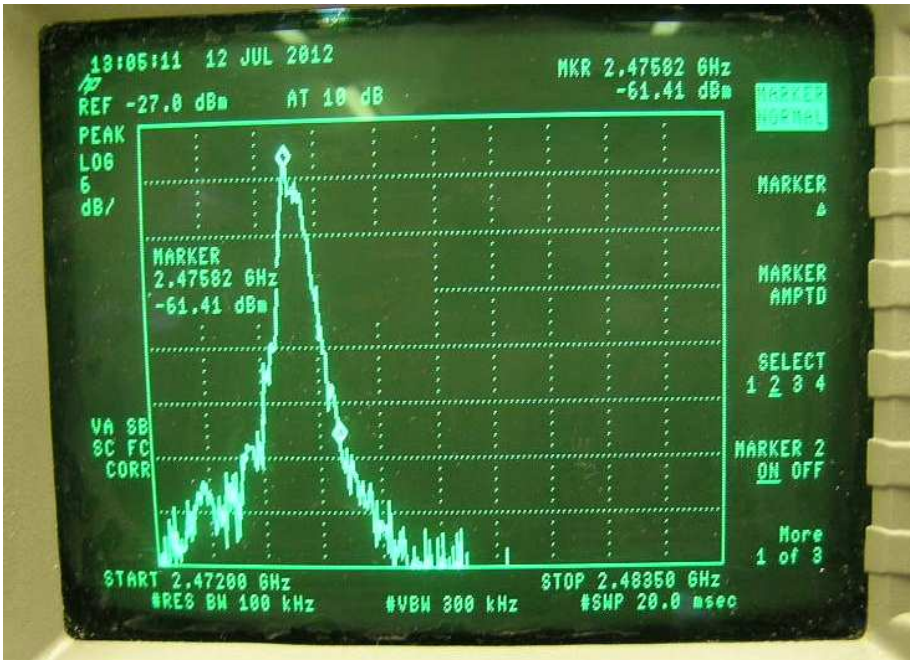
The test sample transmit frequency was adjusted to the lowest and highest frequency. 30 dB down from the peak was measured and the frequency recorded. At 3 metres the transmitted signal was 30 dB above the 15.209 spurious emission limit.

Lowest band edge = 2.404060 GHZ (requirement > 2.4000 GHz)
Upper band edge = 2.47582 GHZ (requirement < 2.4835 GHz)

Band-Edge Low

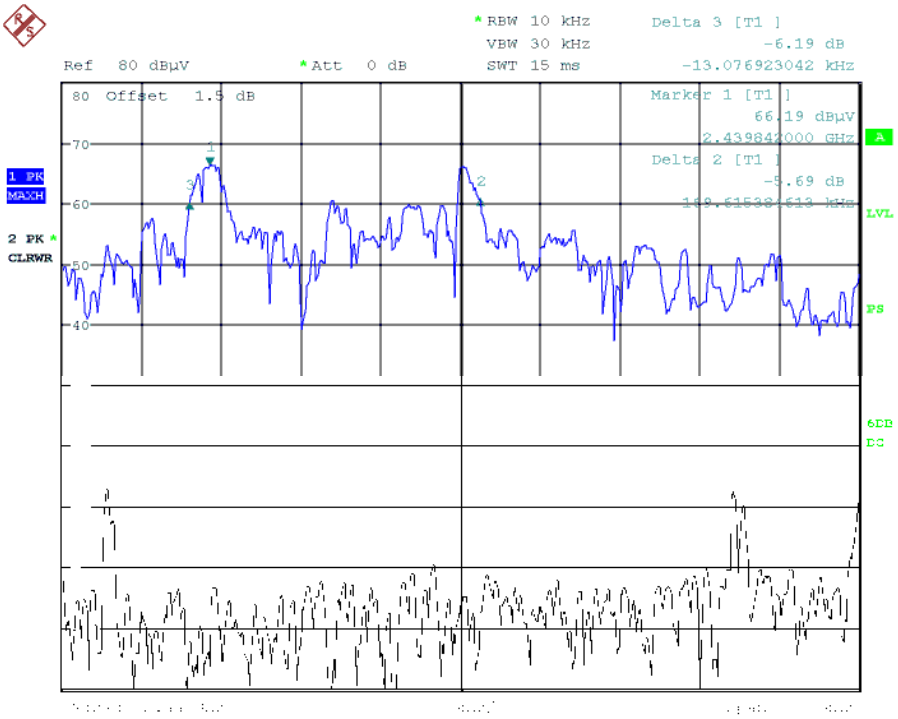


Band-Edge High

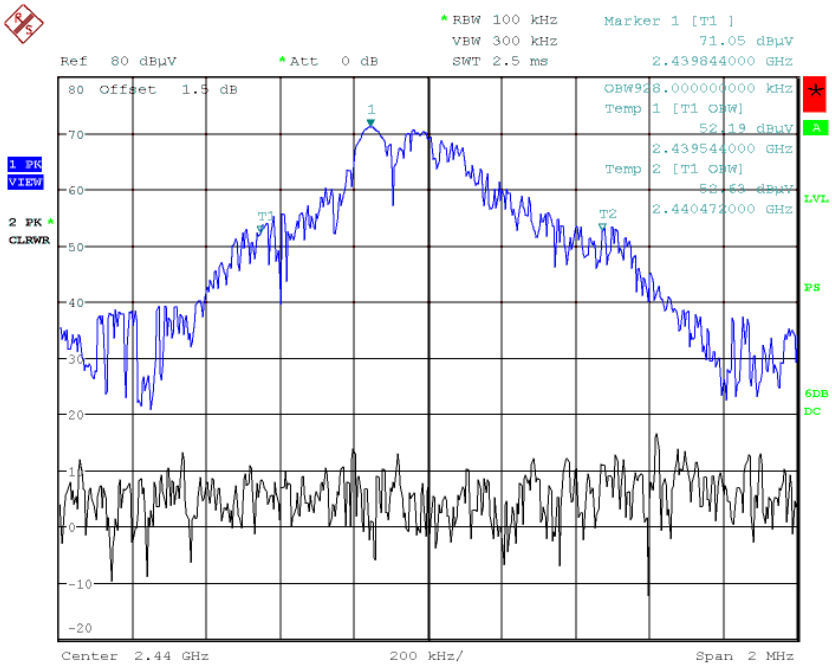


4.3.5 Band Width Measurements

The 6 dB down bandwidths were measured at the upper, middle and lower frequencies. They were all similar; below is the bandwidth with the transmit frequency adjusted to 2.44 GHz.



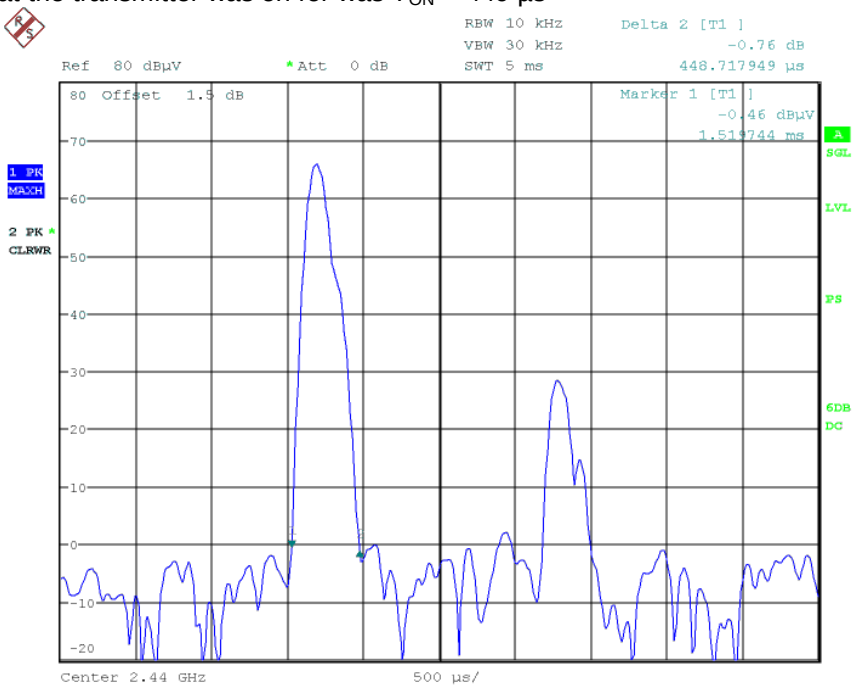
6dB down bandwidth = 169.615 kHz
(bandwidth using RBW=100kHz was < 500 kHz)



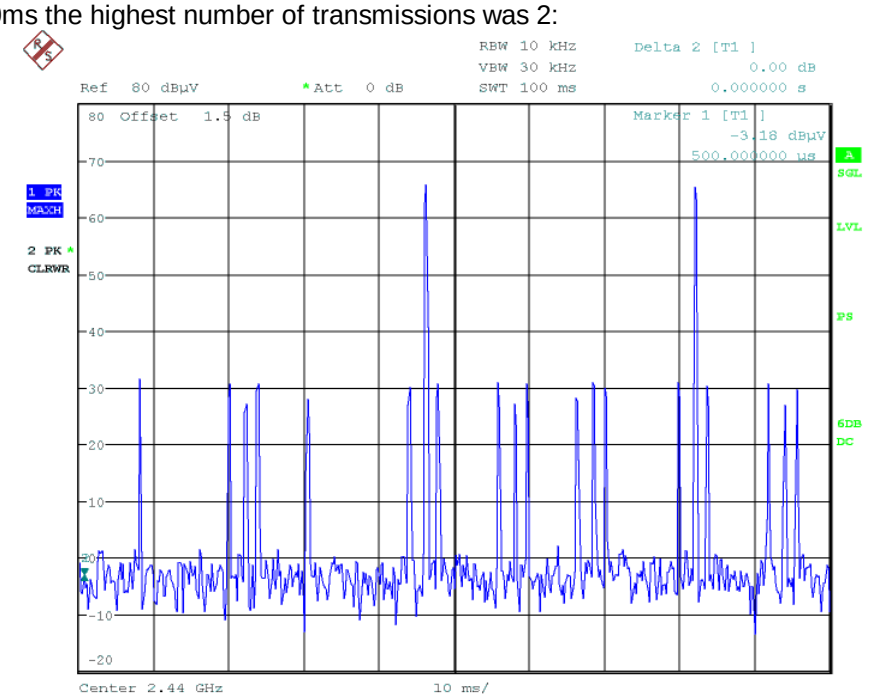
99% power bandwidth = 928 kHz

4.3.6 Duty Cycle Measurements

The time that the transmitter was on for was T_{ON} = 449 µs



In any 100ms the highest number of transmissions was 2:



* The smaller signals were from the other modules as a link was required between the modules to work correctly.

Duty Cycle:
(T_{ON} × 2) ÷ (100ms) × 100% = **0.90%**
Pulse desensitization correction factor = -40dB (applied maximum -20dB factor).

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 Measuring Device Electromyography v5, model number: MD-E tested on behalf of DorsaVi, **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	**Complied**
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)			**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:

Conducted Emissions:	9kHz 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%.

8.0 MEASUREMENT INSTRUMENT

EQUIPMENT TYPE	MANUFACTURER, MODEL NUMBER and SERIAL NUMBER	CALIBRATION DUE DD/MM/YYYY
EMI RECEIVER	Hewlett Packard 8546A, 9kHz to 6.5GHz SN: 3549A00290	05/09/2013
	HP 8546A Sn: 3520A00249 (R-017)	14/11/2013
	Rohde & Schwarz ESU40 20Hz to 40GHz, SN: 1302.6005.40	13/01/2013
ANTENNAS	EMCO Active Receiving Loop Antenna 6502 9kHz-30 MHz, SN: 2021	19/11/2012
	Sunol Sciences Corporation JB6 Hybrid 30MHz to 6GHz, SN: A012312	02/02/2013
	EMCO 3115 Double Ridged Horn 1GHz to 18GHz, SN: 8908-3282	16/01/2015
	ETS-Lindgren Standard Gain Horn 3160-09 18-26.5 GHz, SN: 66032	08/02/2014
LISN	EMCO 3825/2 (L-022) Sn. 9607-1505	05/09/2014
LIMITER	HP LIMITER TRANSIENT (L-017) (9 kHz – 200 MHz) 11947A Sn. 3107A02888	23/08/2014