



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: sales@emctech.com.au

**EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 15 Subpart C (Section 15.247)**

Test Sample: Catapult Sports Performance Monitoring Equipment
Model: Optimeye X4 Transmitter Module
FCC ID: 2ADAL-32301A

Report Number: M140718-7FCC Rev 1.0

Tested for: Catapult Sports

Issue Date: 1 June 2015

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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EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 15 Subpart C (Section 15.247)

Report Number: M140718-7FCC REV 1.0

Test Sample: Catapult Sports Performance Monitoring Equipment
Model: Optimeye X4 Transmitter Module

Equipment Type: Intentional Radiator (Transceiver)

Manufacturer: Catapult Sports
Address: 1 Aurora Lane, Docklands VIC 3008
Phone: +61 3 9095 8410
Fax:
Contact: Igor van de Griendt
Email: igor@catapultsports.com

Test Standards: FCC Part 15 – Radio Frequency Devices
FCC Part 15 Subpart C - Intentional Radiators
Section 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz,
and 5725-5850 MHz
ANSI C63.4 – 2009
KDB 558074 v03r02 - Guidance for Performing Compliance Measurements
on Digital Transmission Systems (DTS) Operating Under §15.247
RSS-210 Issue 8, Licence-Exempt Radio Apparatus
Category 1 Equipment
RSS-Gen Issue 4, General Requirements for Compliance of Radio Apparatus

Test Dates: 20th, 21st July 2014

Test Engineer: 
Mahan Ghassempouri

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: 
Chris Zombolas
EMC Technologies Pty Ltd



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**EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 15 Subpart C (Section 15.247)
&
IC RSS-210**

1.0 INTRODUCTION

EMI testing was performed on the Catapult Sports performance monitoring equipment, Model: Optimeye X4.

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

47 CFR, Part 15, Subpart C:	Rules for intentional radiators (particularly section 15.247)
Section 15.203:	Antenna requirements
Section 15.205:	Restricted bands of operation
Section 15.207:	Conducted Emission Limits
Section 15.209:	Radiated Emission Limits (General requirements)
Section 15.247:	Operation in the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz

The test sample **complied** with the requirements of 47 CFR, Part 15 Subpart C - Section 15.247.

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

1.1 Summary of Results

FCC Part 15 Subpart C	Industry Canada RSS-210 Issue 8 and RSS-Gen Clauses	Test Performed	Results
15.203	RSS-Gen (8.3)	Antenna requirement	Complied
15.205	RSS-Gen (8.10)	Operation in restricted Band	Complied
15.207	RSS-Gen (8.8)	Conducted emissions limits	N/A as the EUT is battery powered
15.209	RSS-Gen (8.9)	Radiated emissions limits	Complied
15.247 (a)(2)	RSS 210 A8.2 (a)	Minimum 6 dB Bandwidth	Complied
15.247 (b)(3)	RSS 210 A8.4 (4)	Peak Output Power	Complied
15.247 (c)	RSS-Gen (8.3)	Antenna Gain > 6 dBi	N/A as EUT uses integral antenna with less than 6 dBi gain and there is no external antenna connector
15.247 (d)	RSS 210 A8.5	Out of Band Emissions	Complied
15.247 (e)	RSS 210 A8.2 (b)	Peak Power Spectral Density	Complied
15.247 (f)	RSS 210 A8.3	Hybrid Systems	N/A as the EUT uses digital modulation
15.247 (g)	RSS 210 A8.1	Hopping channel application	N/A as the EUT uses digital modulation
15.247 (h)	RSS 210 A8.1	Incorporation of intelligence within FHSS	N/A as the EUT uses digital modulation
15.247 (i)	RSS-Gen (3.2)	Radio Frequency Hazard	Complied

N/A: Not Applicable

DTS: Digital Transmission Systems



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1.2 Modifications by EMC Technologies

No modifications were required to achieve compliance.

2.0 GENERAL INFORMATION

(Information supplied by the Client)

The Optimeye X4 transmitter units measures speed, distance, acceleration, heart rate and other parameters from a selection of MEMS sensors & GPS receiver with the device. These signals are processed, before being stored on the device in a flash memory card, as well as being transmitted to the systems Pole receiver. The data is then transferred to an attached laptop computer for analysis.

2.1 EUT (Transmitter) Details

The main RF transmitter operates at 2450 MHz band using Chirp Spread Spectrum (CSS). It uses a monopole antenna connected the PCB through UFL connector. Transmitter specifications are shown in below table.

Test Sample:	Performance Monitoring Equipment
Model Number:	Optimeye X4
Serial Number:	24152
Supply Voltage	Internal 3.7 VDC Battery
EUT Modulation Type:	DTS
Frequency band of operation:	2400 MHz – 2483.5 MHz
99% bandwidth:	58.6 MHz centred at 2442 MHz
Nominal Output Power:	30 dBm
Number Channels:	Not applicable as the EUT uses CSS modulation
Gain of Antenna Assembly:	1 dBi
Operating Temperature Range:	0 °C to 40 °C

2.2 EUT (Host) Details

The device is designed to operate from internal rechargeable battery.

2.3 Test Procedure

Emissions measurements were performed in accordance with the procedures of ANSI C63.4-2009. KDB 558074 v03r02 - Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 – was used to demonstrate compliance with FCC part 47CFR15.247.

2.4 Test Facility

2.4.1 General

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



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EMC Technologies open area test site (OATS) & indoor open area test site (iOATS) have been accepted by Industry Canada for the performance of radiated measurements in accordance with RSS 212, Issue 1 (Provisional) - **Industry Canada iOATS number - IC 3569B**

2.4.2 NATA Accreditation

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), NPL (UK), NIST (USA) 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).

EMC Technologies is accredited in Australia by the National Association of Testing Authorities (NATA). All testing in this report has been conducted in accordance with EMC Technologies' scope of NATA accreditation.

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.

2.5 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, Rhode and Schwarz, NMI, NPL or NIST. All equipment calibration is traceable to Australia national standards at the National Measurements Institute. The reference antenna calibration was performed by NPL and the working antennas (BiLog and horn) calibrated by EMC Technologies. The complete list of test equipment used for the measurements, including calibration dates and traceability is contained in Appendix A

FCC PART 15 Subpart C (Section 15.247)

3.0 ANTENNA REQUIREMENT (§15.203)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. EUT uses a permanently attached antenna so this is considered sufficient to comply with the provisions of this section. There is no external antenna connector available to the user.

4.0 CONDUCTED EMISSIONS (§15.207)

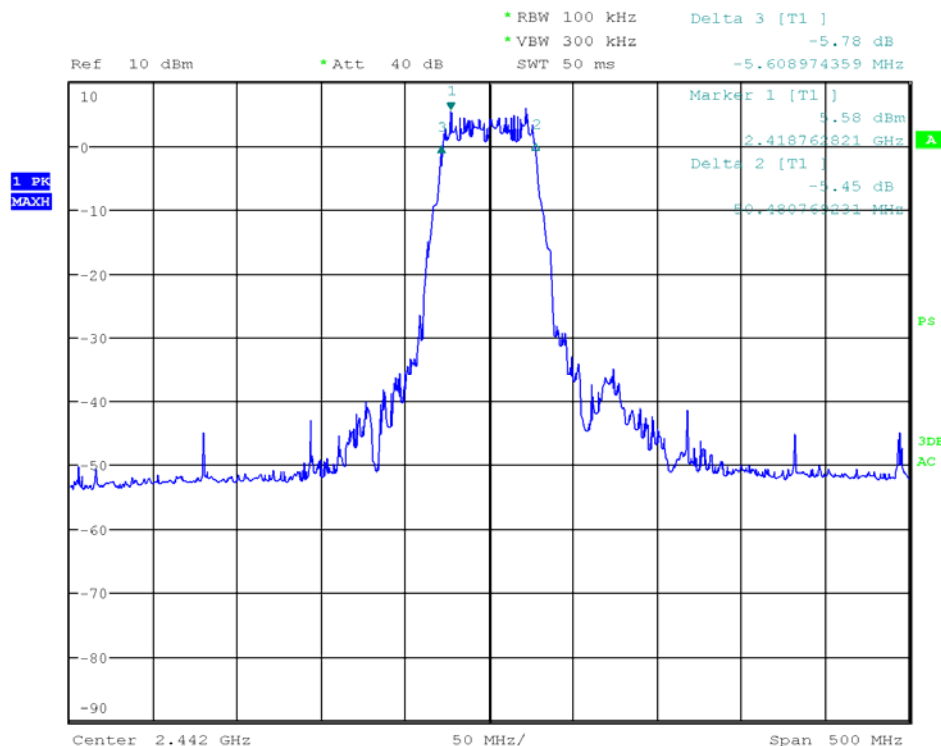
Not applicable as the EUT only employs battery power for operation and does not operate from the AC power line.

5.0 DTS 6 dB BANDWIDTH (§15.247 (a)(2))

Minimum 6 dB bandwidth shall be at least 500 kHz. Measurements were performed on lower, middle and upper channel. Care was taken so that the bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

5.1. Results

Measurement results are shown in Graph 1



Modulation	Measured 6 dB Bandwidth (MHz)	Limit	Result
CSS	56.1	>500 kHz	Pass

Graph 1: 6 dB bandwidth



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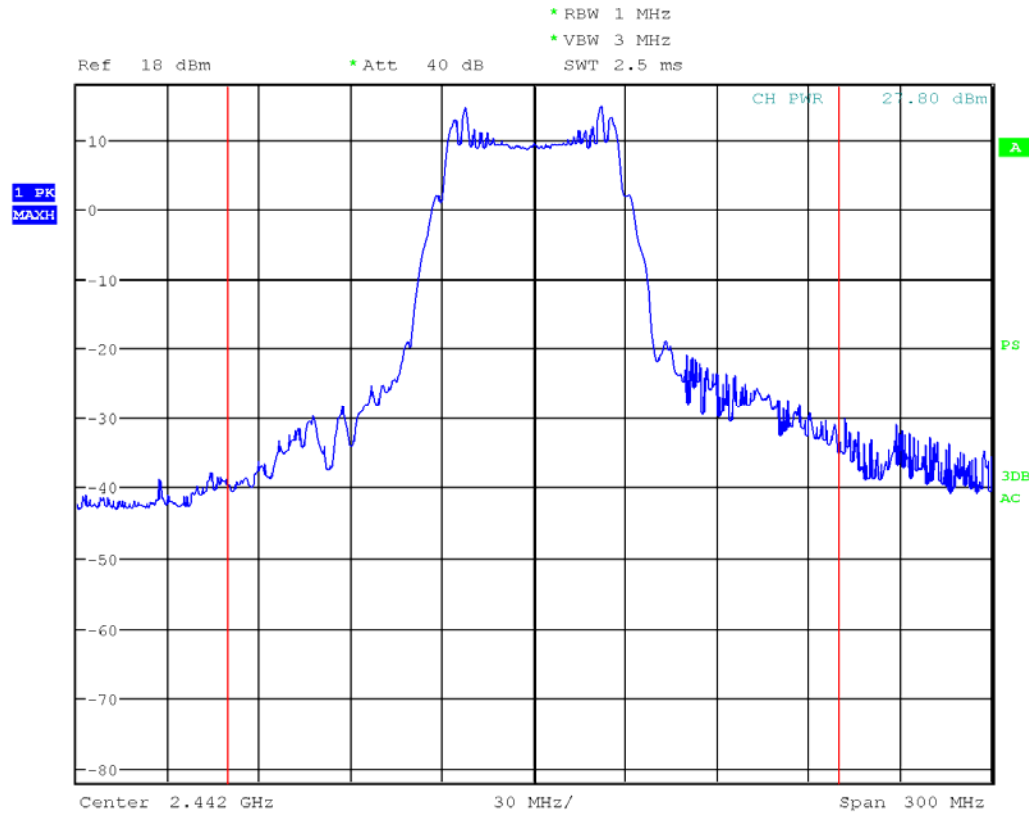
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6.0 PEAK OUTPUT POWER (§15.247 (b)(3))

As there was an antenna connector available on the PCB test was performed using conducted measurement. Integrated band power method was applied using power measurement function of spectrum analyzer.

6.1. Results

Measurement results are shown in Graph 2.



SA Power Reading (dBm)	Attenuation (dB)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
27.8	0.53	28.33	30	-1.67	Pass

Graph 2: Conducted power

7.0 BAND-EDGE EMISSIONS MEASUREMENTS

Emissions within 2 MHz of an authorized band edge were measured using the marker-delta method. Emissions were measured using conducted method. All emissions above and below the edge of the authorised band were more than 20 dB below in band intentional emission.

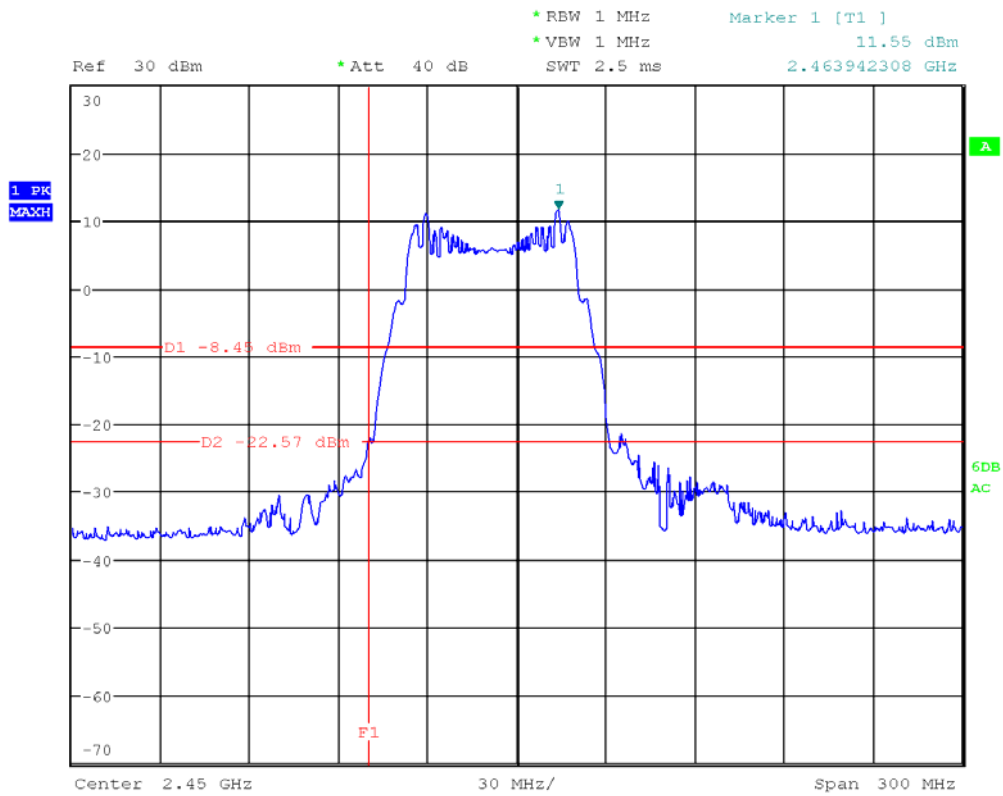
7.1. Results

Measurement results are shown in Graph 3 and Graph 4

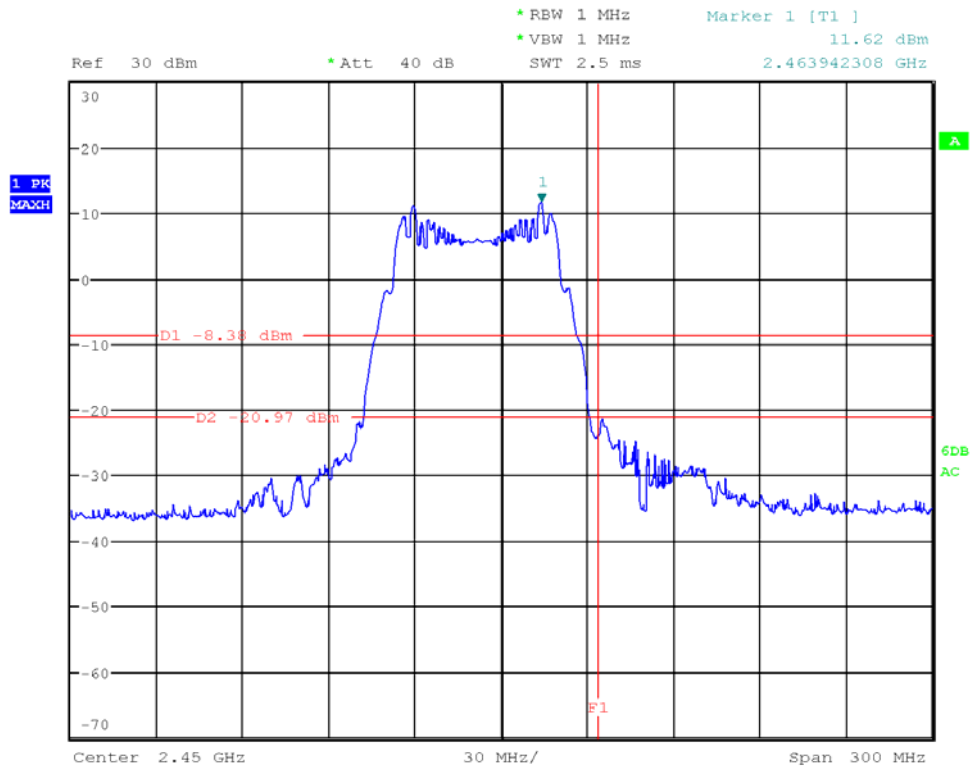


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Graph 3: Lower band-edge emissions



Graph 4: Upper band-edge emissions



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8.0 SPURIOUS EMISSION MEASUREMENTS (§15.247 (d))

Testing was performed in accordance with the requirements of FCC Part 15.247(d).

Radiated emission measurements were compared to the limits as FCC Part 15.209. The measurements were made in semi anechoic chamber. Emissions in restricted bands were also considered as per FCC Part 15.205.

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 test frequency range was subdivided 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 BiLog antenna was used for measurements between 30 MHz and 1000 MHz. Calibrated horn antennas were used for measurements between 1 to 26 GHz.

For emissions within restricted bands, limits of FCC Part 15.209 were applied using average detector. Measurements were repeated using peak detector and comparing results with limits of FCC Part 15.209 increased by 20 dB.

Maximum measured value of section 6 of this report was used to determine the limits of spurious emission out of 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. In addition, radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified in FCC Part 15.209. Spurious emissions out of restricted bands were measured using peak detector. Below table shows spurious emission limit for frequencies out of restricted bands.

Maximum in band conducted power measured in 1 MHz RBW	26.56 dBm
Maximum in band e.i.r.p considering 1 dBi antenna gain measured in 1 MHz RBW	27.56 dBm
Maximum in band e.i.r.p in 100 kHz RBW (corrected by $10 \log(100\text{kHz}/1\text{MHz})$)	17.56 dBm
Equivalent E-field for in band e.i.r.p in 100 kHz RBW at 3 metres distance	112.8 dB μ V/m
Spurious emission limit (-20 dBc) at 10 metres distance	82.8 dB μ V/m
Spurious emission limit (-20 dBc) at 3 metres distance	92.8 dB μ V/m
Spurious emission limit (-20 dBc) at 1 metres distance	102.8 dB μ V/m

Emissions between 30 - 1000 MHz were measured with the resolution bandwidth of 120 kHz and the video bandwidth of 300 kHz.

The measurement of emissions above 1000 MHz was measured using a following setting:

Peak measurements setting: RBW = VBW = 1 MHz

Average measurements setting: RBW = 1 MHz and VBW = 10 Hz

In the case of spurious emissions (out of restricted bands) exceeding the limits, measurements were performed using 100 kHz RBW.

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 with the Peak/Average Detectors. The measurement data for each frequency range was corrected for cable losses, antenna factors and preamplifier gain. This process was performed for both horizontal and vertical antenna polarisations. Different orientations of the EUT were investigated to produce the maximum emission.



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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 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)

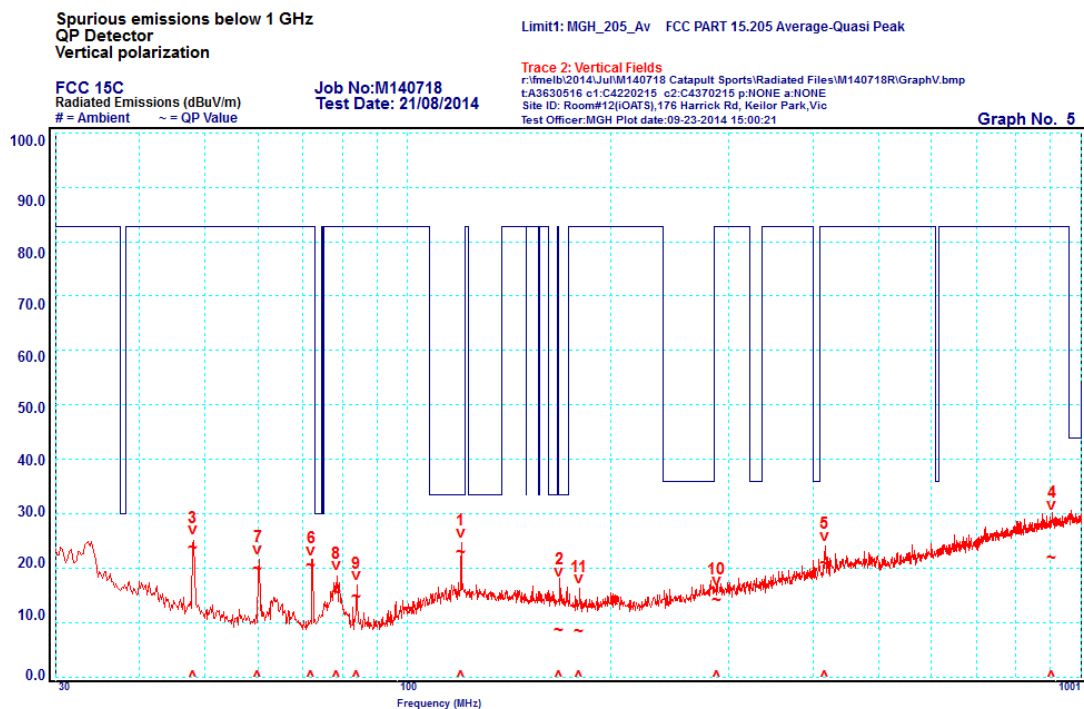
• Example Field Strength Calculation

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:

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

8.1. Results

Emission results are shown in graph 5 to 12 graph



Peak	Frequency MHz	Polarisation	Measured Level dB μ V/m	Limit dB μ V/m	Δ Limit $\pm$ dB
1	120.00	Vertical	22.9	33.5	-10.6
2	168.13	Vertical	8.5	33.5	-25.0
3	48.02	Vertical	23.5	82.8	-56.3
4	906.37	Vertical	21.9	82.8	-60.9
5	416.00	Vertical	20.8	82.8	-62.0
6	72.01	Vertical	20.3	82.8	-62.5
7	60.01	Vertical	19.8	82.8	-63.0
8	78.39	Vertical	15.4	82.8	-67.4
9	84.01	Vertical	14.6	82.8	-68.2
10	288.02	Vertical	14.0	82.8	-68.8
11	180.11	Vertical	8.3	82.8	-74.5



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Spurious emissions below 1 GHz
QP Detector
Horizontal polarization

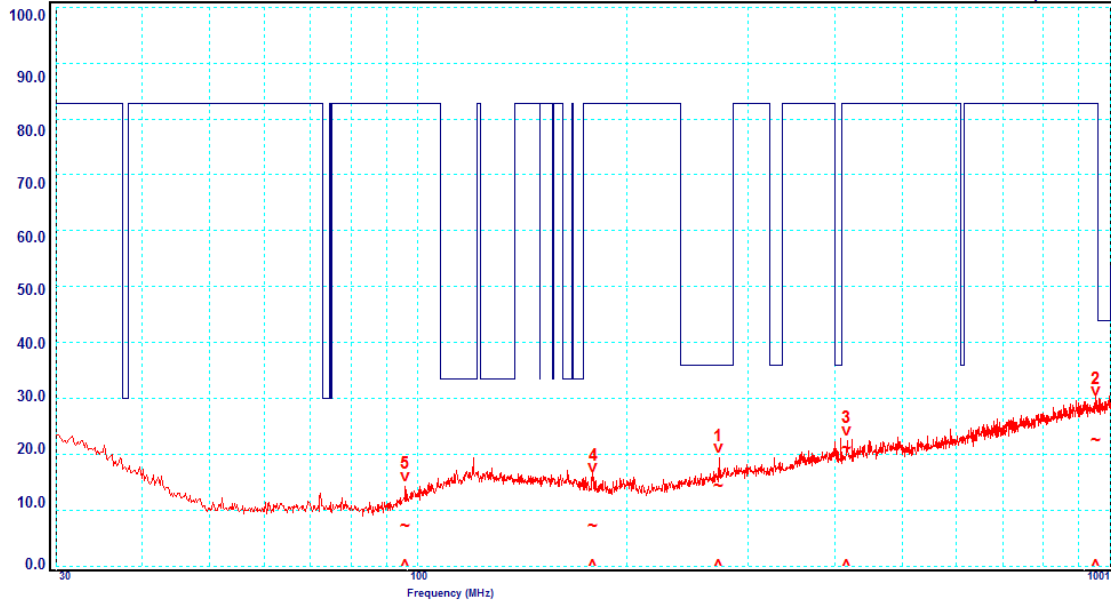
Limit1: MGH_205_Av FCC PART 15.205 Average-Quasi Peak

FCC 15C
Radiated Emissions (dBuV/m)
= Ambient ~ = QP Value

Job No: M140718
Test Date: 21/08/2014

Trace 2: Horizontal Fields
r:\mclb\2014\Jul\M140718 Catapult Sports\Radiated Files\M140718R\GraphH.bmp
r:\A3630516 c1\C4220215 c2\C4370215 p:NONE a:NONE
Site ID: Room#12(jOATS),176 Harrick Rd, Keilor Park,Vic
Test Officer:MGH Plot date:09-23-2014 15:10:57

Graph No. 6



Peak	Frequency MHz	Polarisation	Measured Level dBuV/m	Limit dBuV/m	Δ Limit $\pm$ dB
1	272.03	Horizontal	14.2	36.0	-21.8
2	952.72	Horizontal	22.4	82.8	-60.4
3	416.00	Horizontal	21.0	82.8	-61.8
4	179.18	Horizontal	7.1	82.8	-75.7
5	95.99	Horizontal	7.1	82.8	-75.7



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Spurious emissions 1 GHz- 6 GHz

Peak detector

Red: Vertical polarization

Blue: Horizontal polarization

FCC 15C

Radiated Emissions (dBuV/m)

= Ambient ~ = QP Value

Job No: M140718

Test Date: 24/09/2014

Limit1: MGH_205_Pk FCC PART 15.205 Peak

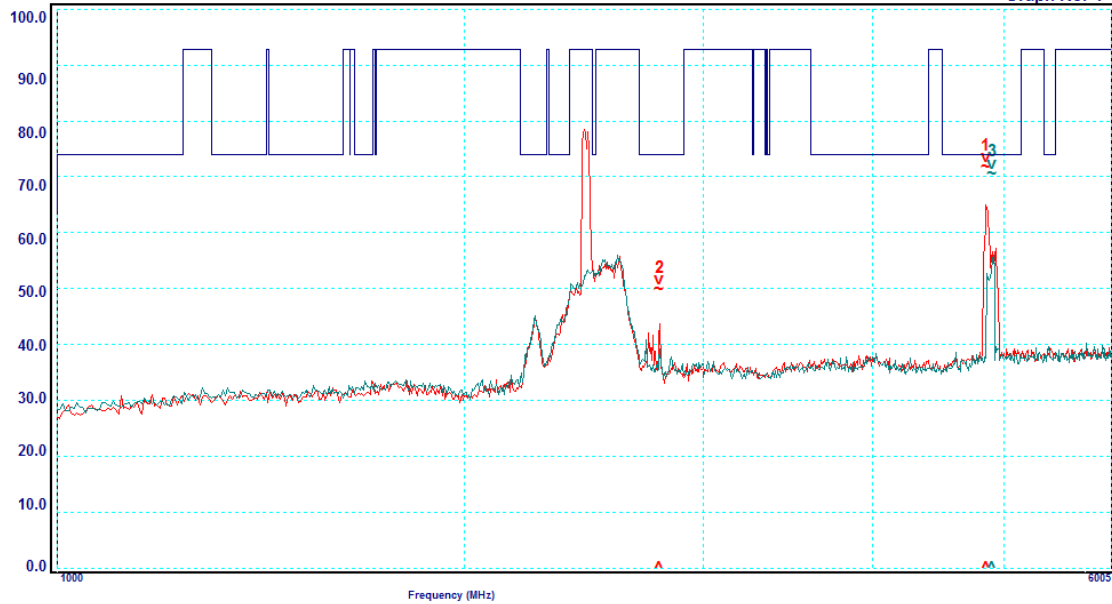
r:\mclb\2014\Jul\M140718 Catapult Sports\Radiated Files\M140718G6G\gaaa.txt

t:A0040516 c1:C4210215 c2:C4370215 p:A2880215 a:F0160414

Site ID: Room#12(jOATS), 176 Harrick Rd, Keilor Park, Vic

Test Officer: MGH Plot date: 09-24-2014 15:28:53

Graph No. 7



Peak	Frequency MHz	Polarisation	Measured Level dBuV/m	Limit dBuV/m	Δ Limit $\pm$ dB
1	4848.51	Vertical	71.6	74	-2.4
2	2784.15	Vertical	49.8	74	-24.2
3	4903.64	Horizontal	70.5	74	-3.5

Intentional transmission band (2400 MHz-2483.5 MHz) was excluded from measurement.



Accreditation No. 5292

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Spurious emissions 1 GHz- 6 GHz

Average detector

Red: Vertical polarization

Blue: Horizontal polarization

FCC 15C

Radiated Emissions (dBuV/m)

= Ambient ~ = QP Value

Job No: M140718

Test Date: 24/09/2014

Limit1: MGH_205_Av FCC PART 15.205 Average-Quasi Peak

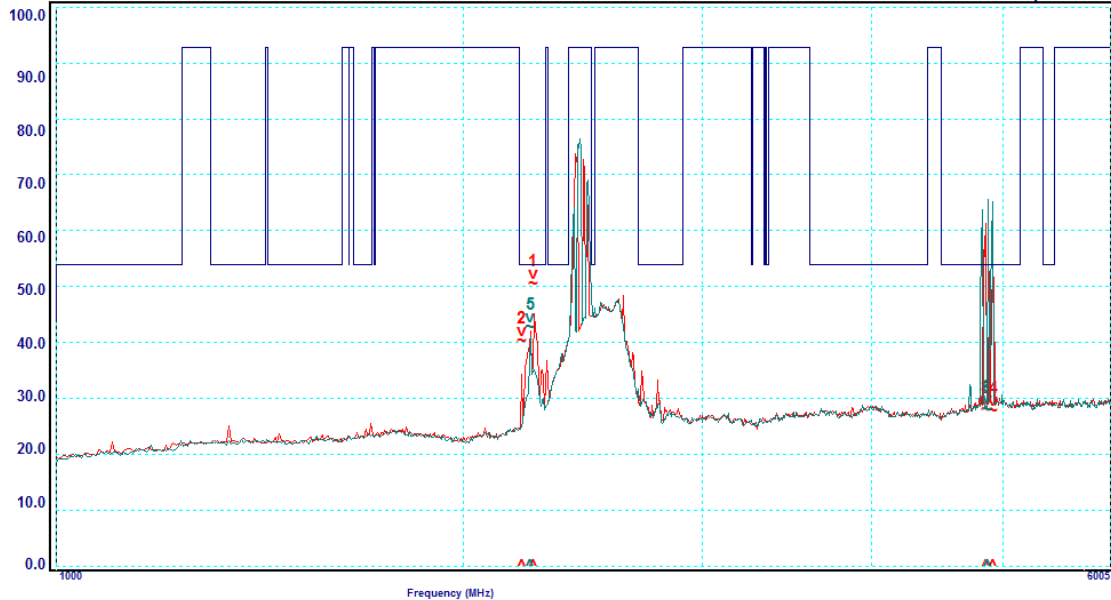
r:\mnlb\2014\Jul\M140718 Catapult Sports\Radiated Files\M140718G6G\gaaa.txt

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Site ID: Room#12(jOATS), 176 Harrick Rd, Keilor Park, Vic

Test Officer: MGH Plot date: 09-24-2014 15:35:02

Graph No. 8



Peak	Frequency MHz	Polarisation	Measured Level dB μ V/m	Limit dB μ V/m	Δ Limit $\pm$ dB
1	2252.51	Vertical	50.5	54	-3.5
2	2207.95	Vertical	40.3	54	-13.7
3	4859.28	Vertical	27.9	54	-26.1
4	4924.38	Vertical	27.7	54	-26.3
5	2239.93	Horizontal	42.7	54	-11.3
6	4869.24	Horizontal	28.0	54	-26.0

Intentional transmission band (2400 MHz-2483.5 MHz) was excluded from measurement.

Initial traces (exceeding average limit) were captured using peak detector. Final measurements on individual peaks were performed using average detector which were below the limit.



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Spurious emissions 6 GHz-18 GHz

Peak detector

Red: Vertical polarization

Blue: Horizontal polarization

FCC 15C

Radiated Emissions (dBuV/m)

= Ambient ~ = QP Value

Job No: M140718

Test Date: 21/08/2014

Limit1: MGH_205_Pk FCC PART 15.205 Peak

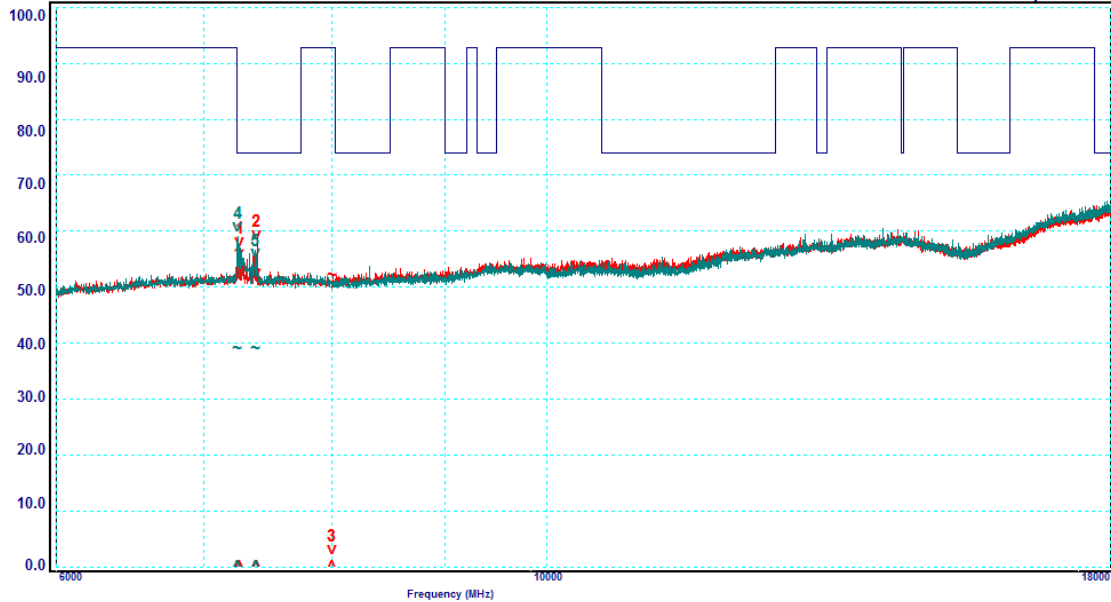
r:\fme\b\2014\Jul\M140718 Catapult Sports\Radiated Files\M140718R-F-PK1\gaaa.txt

t:A3330516 c1:C3370914 c2: p:NONE a:

Site ID: Room#12(jOATS),176 Harrick Rd, Keilor Park, Vic

Test Officer: MGH Plot date: 09-23-2014 16:49:03

Graph No. 9



Peak	Frequency MHz	Polarisation	Measured Level dB μ V/m	Limit dB μ V/m	Δ Limit $\pm$ dB
1	7268.25	Vertical	56.5	74.0	-17.5
2	7396.65	Vertical	52.9	74.0	-21.1
3	7999.18	Vertical	52.2	92.8	-40.6
4	7252.61	Horizontal	39.1	74.0	-34.9
5	7386.71	Horizontal	38.9	74.0	-35.1



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Spurious emissions 6 GHz-18 GHz

Average detector

Red: Vertical polarization

Blue: Horizontal polarization

FCC 15C

Radiated Emissions (dBuV/m)

= Ambient ~ = QP Value

Job No: M140718

Test Date: 14/08/2014

Limit1: MGH_205_Av FCC PART 15.205 Average-Quasi Peak

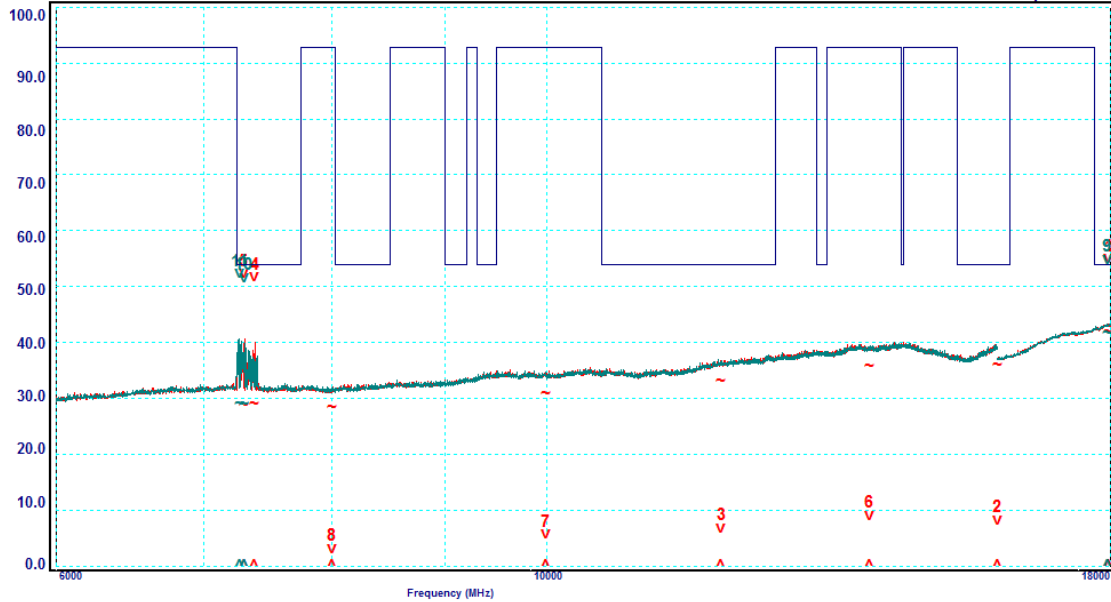
r:\melb\2014\Jul\M140718 Catapult Sports\Radiated Files\M140718R-F-AV1\gaaa.txt

t:A3330516 c1:C3370914 c2:p:NONE a:

Site ID: Room#12(jOATS),176 Harrick Rd, Keilor Park,Vic

Test Officer:MGH Plot date:09-24-2014 16:08:56

Graph No. 10



Peak	Frequency MHz	Polarisation	Measured Level dBuV/m	Limit dBuV/m	Δ Limit $\pm$ dB
1	17974.34	Vertical	41.8	54.0	-12.2
2	15998.81	Vertical	35.8	54.0	-18.2
3	12000.76	Vertical	33.0	54.0	-21.0
4	7381.97	Vertical	29.0	54.0	-25.0
5	7300.86	Vertical	28.9	54.0	-25.1
6	13999.38	Vertical	35.8	92.8	-57.0
7	9998.72	Vertical	30.9	92.8	-61.9
8	8001.29	Vertical	28.4	92.8	-64.4
9	17938.39	Horizontal	41.7	54.0	-12.3
10	7300.90	Horizontal	28.9	54.0	-25.1
11	7265.82	Horizontal	28.9	54.0	-25.1



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Spurious emissions 18 GHz-26 GHz

Peak detector

Red: Vertical polarization

Blue: Horizontal polarization

FCC 15C

Radiated Emissions (dBuV/m)

= Ambient ~ = QP Value

Job No: M140718

Test Date: 22/08/2014

Limit1: MGH_205_Pk FCC PART 15.205 Peak

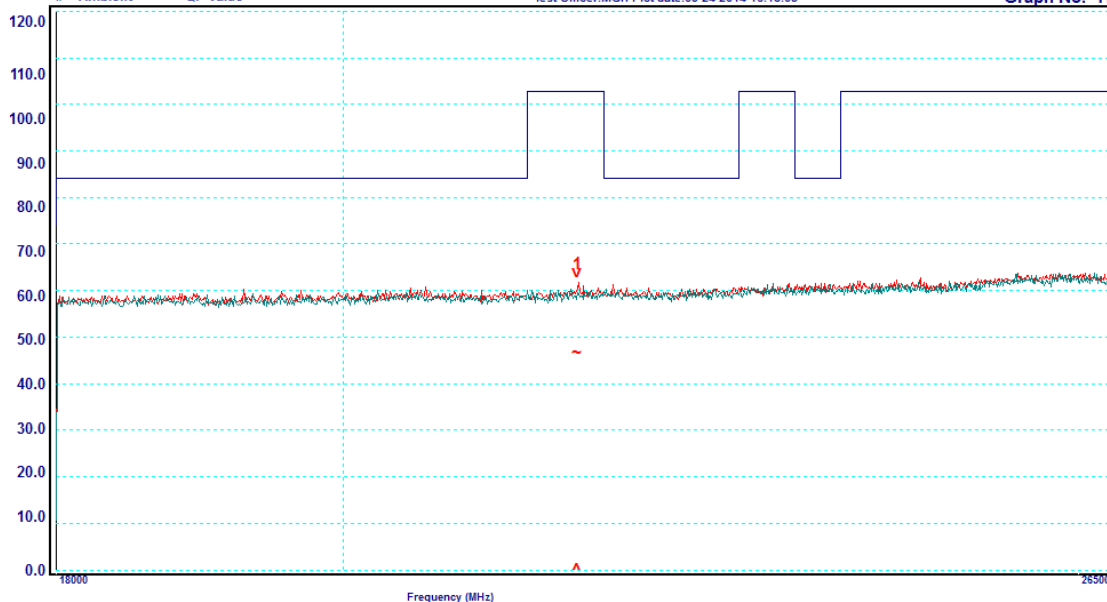
r:\melb\2014\Jul\M140718 Catapult Sports\Radiated Files\M140718G-18-26G\gaaa.txt

t:A3071115 c1:C2730914 c2:p:NONE a:

Site ID: Room#12(jOATS),176 Harrick Rd, Keilor Park,Vic

Test Officer:MGH Plot date:09-24-2014 16:18:03

Graph No. 11



Emissions were more than 10 dB below the limit.

Spurious emissions 18 GHz-26 GHz

Average detector

Red: Vertical polarization

Blue: Horizontal polarization

FCC 15C

Radiated Emissions (dBuV/m)

= Ambient ~ = QP Value

Job No: M140718

Test Date: 22/08/2014

Limit1: MGH_205_Pk FCC PART 15.205 Peak

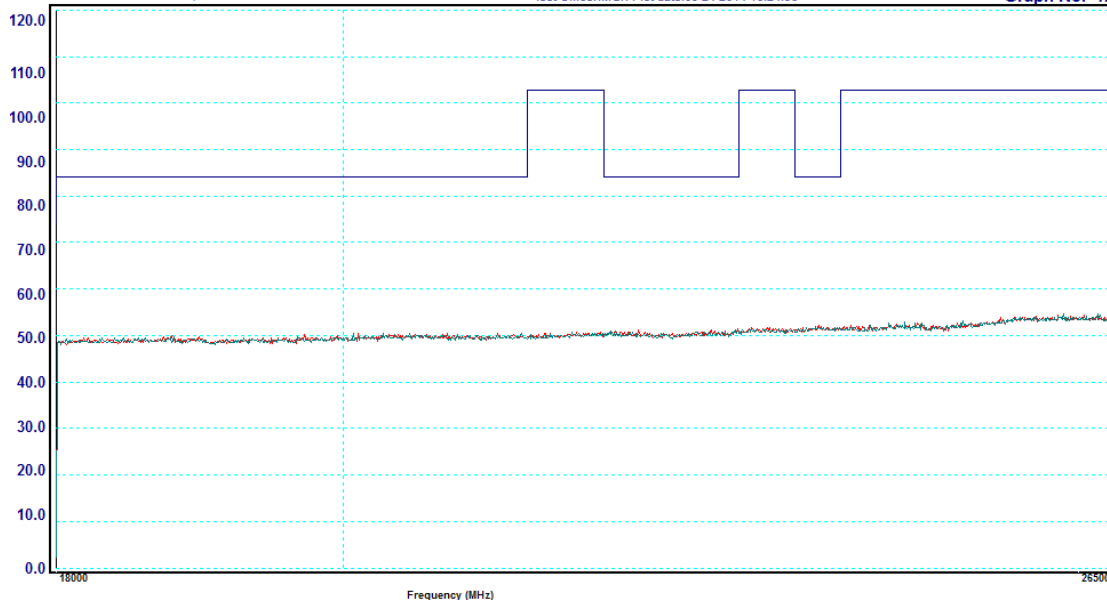
r:\melb\2014\Jul\M140718 Catapult Sports\Radiated Files\M140718G-18-26G\gaaa.txt

t:A3071115 c1:C2730914 c2:p:NONE a:

Site ID: Room#12(jOATS),176 Harrick Rd, Keilor Park,Vic

Test Officer:MGH Plot date:09-24-2014 16:24:36

Graph No. 12



Emissions were more than 10 dB below the limit.



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Spurious emissions 9 kHz-30 MHz
Red: Parallel
Blue: Perpendicular

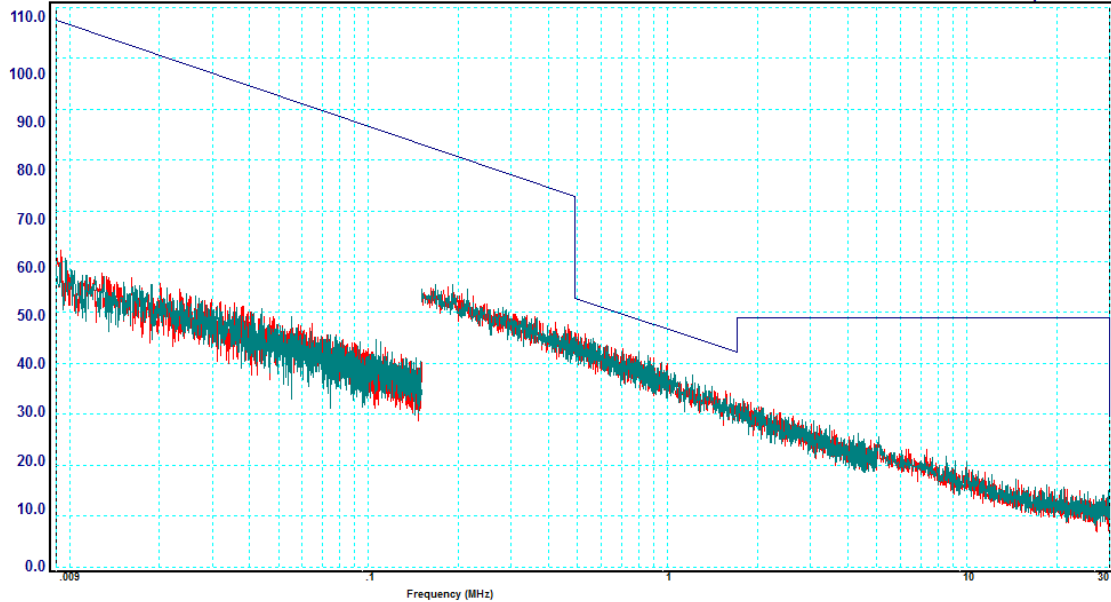
Limit1: FCC15209-10 FCC PART 15.209 10mtr LMTS

FCC 15.247
Radiated Emissions (dBuV/m)
= Ambient ~ = QP Value

Job No: M140718
Test Date: 27/05/2015

r:\finalb\2014\UulM140718 Catapult Sports\Radiated Files\M140718RM\gaaa.txt
t:A2310815E c1:C4220416 c2:C4370416 p:NONE a:NONE
Site ID: Room#12(jOATS),176 Harrick Rd, Keilor Park,Vic
Test Officer:MGH Plot date:05-27-2015 16:50:39

Graph No. 13



Emissions were more than 10 dB below the limit.



Accreditation No. 5292

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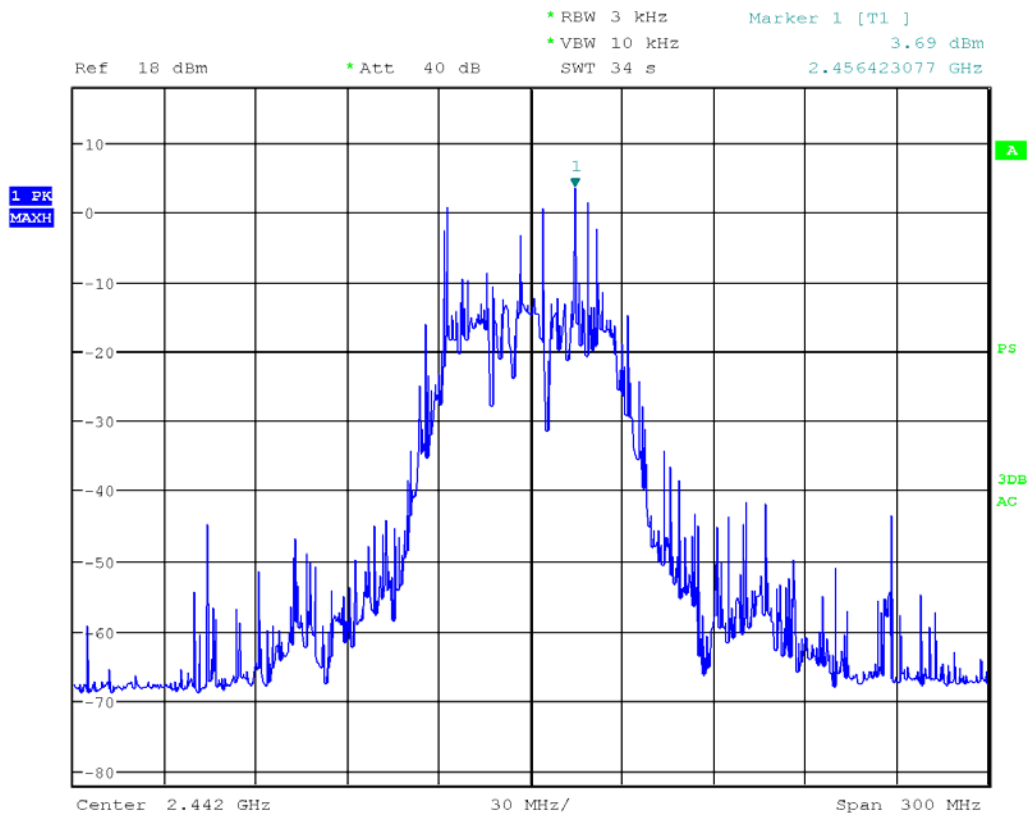
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9.0 POWER SPECTRAL DENSITY (§15.247 (d))

The PKPSD method according to KDB 558074 was used to demonstrate compliance. Correction factors in section 6 were applied.

9.1. Results

Measurement results are shown in Graph 13.



SA Power Reading (dBm)	Attenuation (dB)	Conducted Power (dBm)	Limit (dBm)	Result
3.69	0.53	4.22	8	Pass

Graph 13: Transmitter peak power spectral density

10.0 RADIO FREQUENCY EXPOSURE (HAZARD)

EUT complies with the requirements of FCC §15.247 (i) for public RF exposure. Refer to EMC Technologies SAR test report No. M140719X4F for detail.



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11.0 COMPLIANCE STATEMENT

Performance monitoring equipment, Model: Optieye X4 tested on behalf of Catapult Sport, **complied** with the requirements of 47 CFR, Part 15 Subpart C - Rules for Radio Frequency Devices (intentional radiators), Section 15.247 - Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

Summary of results are shown in below table:

FCC Part 15 Subpart C	Industry Canada RSS-210 Issue 8 and RSS-Gen Clauses	Test Performed	Results
15.203	RSS-Gen (8.3)	Antenna requirement	Complied
15.205	RSS-Gen (8.10)	Operation in restricted Band	Complied
15.207	RSS-Gen (8.8)	Conducted emissions limits	N/A as the EUT is battery powered
15.209	RSS-Gen (8.9)	Radiated emissions limits	Complied
15.247 (a)(2)	RSS 210 A8.2 (a)	Minimum 6 dB Bandwidth	Complied
15.247 (b)(3)	RSS 210 A8.4 (4)	Peak Output Power	Complied
15.247 (c)	RSS-Gen (8.3)	Antenna Gain > 6 dBi	N/A as EUT uses integral antenna with less than 6 dBi gain and there is no external antenna connector
15.247 (d)	RSS 210 A8.5	Out of Band Emissions	Complied
15.247 (e)	RSS 210 A8.2 (b)	Peak Power Spectral Density	Complied
15.247 (f)	RSS 210 A8.3	Hybrid Systems	N/A as the EUT uses digital modulation
15.247 (g)	RSS 210 A8.1	Hopping channel application	N/A as the EUT uses digital modulation
15.247 (h)	RSS 210 A8.1	Incorporation of intelligence within FHSS	N/A as the EUT uses digital modulation
15.247 (i)	RSS-Gen (3.2)	Radio Frequency Hazard	Complied



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12.0 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
	18 GHz to 26 GHz	±5.1 dB
Peak Output Power:		±1.5 dB
Peak Power Spectral Density:		±1.5 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%.

APPENDIX A: MEASUREMENT INSTRUMENT DETAILS

EQUIPMENT TYPE	MAKE/MODEL SERIAL NUMBER	LAST CAL. DD/MM/YY	DUE DATE DD/MM/YY	CAL. INTERVAL
EMI RECEIVERS	HP 8546A Sn: 3549A00290 (R-009)	12/09/13	12/09/14	1 Year
	R&S ESU40 Sn: 100182 (R-037)	30/01/14	30/01/15	1 Year
ANTENNAS	EMCO 6502 Active loop antenna (A-231) 9 kHz – 30 MHz Sn: 9311-2801	20/08/2012	20/08/2015	3 Years
	SUNOL JB6 BiLog (A-363) 30 - 6000 MHz Sn: A012312	16/05/14	16/05/15	1 Year
	EMCO Horn antenna (A-004) 1-18 GHz Sn: 8908-3282	09/05/13	09/05/16	3 Years
	ETS-Lindgren 3160-09 Horn antenna (A-307) 18 - 26.5 GHz Sn: 66032	12/11/15	12/11/15	3 Years
	ETS-Lindgren 3160-10 Horn antenna (A-306) 26.5 - 40 GHz Sn: 64179	12/11/15	12/11/15	3 Years
CABLES	Huber-Suhner Sucoflex 104 (C-337) 1-18 GHz	18/09/13	18/09/14	1 Year
	Huber-Suhner Sucoflex 102 (C-273) 18-40 GHz Sn: 27319/2	18/09/13	18/09/14	1 Year
	P1to10mSR EMCT (A-422)	06/02/14	06/02/15	1 Year
	CA-02013A13A700 EMCT (A-337)	06/02/14	06/02/15	1 Year
	SMA-UFL-1-1-6GHz	01/09/14	01/09/15	1 Year



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