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TEST REPORT

Marinco SPLR-1 PRECISION Spotlight Handheld Wireless Remote Control Transmitter

tested to the

Code of Federal Regulations (CFR) 47

Part 15 – Radio Frequency Devices, Subpart C – Intentional Radiators

Section 15.249 – Operation in the band 2400 – 2483.5 MHz

for

Actuant Electrical Ltd

This Test Report is issued with the authority of:

Andrew Cutler - General Manager



All tests reported
herein have been
performed in accordance
with the laboratory's
scope of accreditation

Table of Contents

1. STATEMENT OF COMPLIANCE	3
2. RESULTS SUMMARY	3
3. CLIENT INFORMATION	3
4. DESCRIPTION OF TEST SAMPLE	4
5. EQUIPMENT PARAMETERS	4
6. ATTESTATION	5
7. TRANSMITTER TEST RESULTS	6
7. TEST EQUIPMENT USED	12
8. ACCREDITATIONS	12
9. PHOTOGRAPHS	13

1. STATEMENT OF COMPLIANCE

The Marinco SPLR-1 PRECISION Spotlight Wireless Remote Control Transmitter complies with 47 CFR Part 15 and in particular Sections, 15.205, 15.207, 15.209, 15.215 and 15.249 as detailed below when tested in accordance with ANSI C63.4 – 2003.

2. RESULTS SUMMARY

The results of testing, carried out in July / August 2011 and June 2012, are detailed below.

Clause	Description	Result
15.201	Equipment authorisation requirement	Applied
15.203	Antenna requirement	Complies
15.204	External power amplifiers	Not applicable
15.205	Operation in restricted bands	Complies
15.207	Conducted emissions	Not applicable. Internal battery powered device.
15.209	Radiated emissions	See below
15.215	Additional provisions	Complies
15.249 (a)	Field strength of fundamental	Complies
15.249 (a)	Field strength of harmonics	Complies
15.249 (b)	Fixed, point to point operations	Not applicable
15.249 (c)	3 metre measurement distance	Noted
15.249 (d)	Spurious emission levels except harmonics	Complies
15.249 (e)	Detectors above 1000 MHz	Noted
15.249 (f)	Reference to section 15.37(d)	Noted

3. CLIENT INFORMATION

Company Name	Actuant Electrical Ltd
Address	55 Paul Matthews Road Rosedale
City	Auckland 0632
Country	New Zealand
Contact	Mr Jason Anderson

4. DESCRIPTION OF TEST SAMPLE

Brand Name	Marinco
Model	SPLR-1
Product	PRECISION Spotlight Wireless Remote Control Transmitter
Manufacturer	Actuant Electrical Ltd
Country of Origin	New Zealand
Serial Number	Sample not serialised
FCC ID	Not yet determined

5. EQUIPMENT PARAMETERS

The remote tested has the following RF specifications:

FCC Band:	2400 MHz – 2483.5 MHz
Test Frequency:	2434 MHz
Operating Frequencies:	2434 MHz
Rated Power:	1.00 mW (+0 dBm)
Modulation Type:	38 ms GFSK packet sent every 66 ms
Antenna Type:	Integral
Power Supply:	Internal 3 Vdc battery

The device tested is a handheld remote control transmitter that is used to manipulate a remotely sited searchlight.

The searchlight would typically be used in marine situations and it contains a 2.4 GHz band receiver.

6. ATTESTATION

This report describes the tests and measurements performed for the purpose of determining compliance with the specification with the following conditions:

The client selected the test sample.

The report relates only to the sample tested.

This report does not contain corrections or erasures.

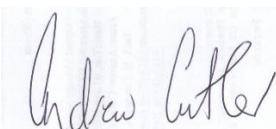
This report updates report number 110720.21 to include additional duty cycle measurements which have been used to calculate the Average field strength.

Measurement uncertainties with statistical confidence intervals of 95% are shown below test results. Both Class A and Class B uncertainties have been accounted for, as well as influence uncertainties where appropriate.

In addition this equipment has been tested in accordance with the requirements contained in the appropriate Commission regulations.

To the best of my knowledge, these tests were performed using measurement procedures that are consistent with industry or Commission standards and demonstrate that the equipment complies with the appropriate standards.

I further certify that the necessary measurements were made by EMC Technologies NZ Ltd, 47 MacKelvie Street, Grey Lynn, Auckland, New Zealand.



Andrew Cutler
General Manager
EMC Technologies NZ Ltd

7. TRANSMITTER TEST RESULTS

Section 15.201: Equipment authorisation requirement

Certification as detailed in Subpart J of Part 2 is required for this device as it contains a transmitter.

Section 15.203 – Antenna requirement

This device uses a 2.4 GHz antenna that is integral to the device

Result: Complies

Section 15.204: External radio frequency power amplifiers and antenna modifications

An external power amplifier is not supplied with this device and it is not possible to attach an external power amplifier.

Result: Complies.

Section 15.205 – Restricted bands of operation

Refer to measurements made with reference to Section 15.249 (a).

This device operates in the 2400 – 2483.5 MHz which is not a restricted band.

Result: Complies

Section 15.209 – Radiated emissions

In accordance with section 15.249 (d) the general emission limits specified in Section 15.209 (a) have been applied to all emissions except the transmitter harmonics.

See Section 15.249 (a) for further details.

Section 15.215 (c) – Additional provisions to the general radiated emission limitations

The device operates in the 2400 – 2483.5 MHz band.

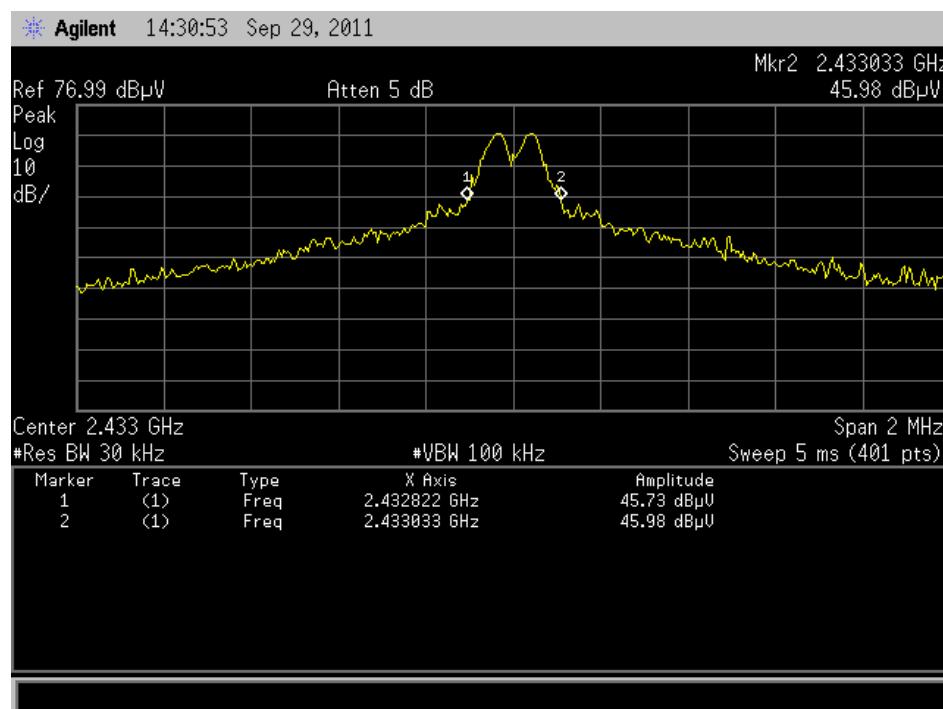
Spectrum mask measurements have been on the operating frequency of 2433.000 MHz.

Measurements have actually been made at the -20 dB points.

Frequency (MHz)	F low (MHz)	F high (MHz)
2433.000	2432.8220	2433.0330

The device can be seen to stay within the band of 2400 – 2483.5 MHz at the -20 dB points

The actual measurement plots are detailed below



Results: Complies

Section 15.249 (a) – Field strength of the Fundamental and Harmonics

Radiated emission measurements were carried out with the limits as per section 15.249 (a) being applied to the Fundamental and Harmonics of each transmitter.

Testing was carried out at EMC Technologies NZ Ltd Open Area Test Site, which is located at Driving Creek, Orere Point, Auckland.

The transmitter was placed on the test table top which was a total of 0.8 m above the test site ground plane.

Measurements of the radiated field were made 3 metres from the transmitting antenna.

Measurements below 1000 MHz were made using a Quasi Peak Detector with a bandwidth of 120 kHz.

Measurements above 1000 MHz were made using an average detector with a bandwidth of 1.0 MHz and also a peak detector with a bandwidth of 1.0 MHz.

When an emission is located, it is positively identified and its maximum level is found by rotating the automated turntable, and by varying the antenna height with an automated antenna tower.

All emissions were measured in both vertical and horizontal antenna polarisations.

The emission is measured in both vertical and horizontal antenna polarisations with no measurements were made above the 10th harmonic

As the device is portable measurements were attempted while it was being manipulated in all three axis (X, Y and Z axis) with the highest emission level being recorded above.

The emission level is determined in field strength by taking the following into consideration:

Level (dB μ V/m) = Receiver Reading (dB μ V) + Antenna Factor (dB) + Coax Loss (dB) – Amplifier Gain (dB)

Section 15.249 specifies a limit of 50 mV/m (94 dB μ V/m) when an average detector is used for devices operating the band 2400 – 2483.5 MHz.

A peak limit of 114 dB μ V/m has also been applied.

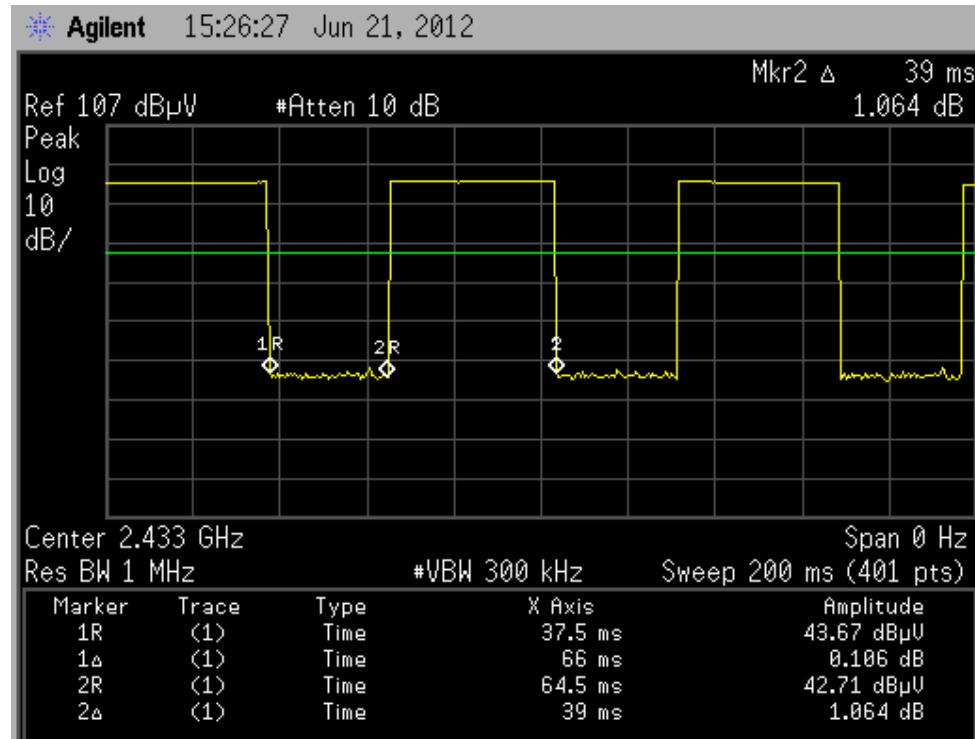
This limit has been converted to dB μ V/m using the formula $20 * (\log 0.050 / 0.000001)$

Fundamental emission

The client has stated that this device transmits a GFSK 39 ms packet every 66 ms approximately when any of the remote control buttons are actuated.

As per section 15.35(c) measurements have been made to determine the duty cycle of this transmission during a 100 ms period as an average limit has been defined for this band.

Measurements are detailed below:



Therefore the duty cycle will be $20 * (\log((39/66)) = -4.6 \text{ dB}$

Peak radiated emissions measurements were then made and adjusted using this factor to determine the average value.

Frequency (MHz)	Vertical (dB μ V/m)	Horizontal (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector
2433.000	93.4	97.4	114.0	16.6	Peak
2433.000	88.8	92.8	94.0	1.2	Calculated Average
2433.000	91.1	92.8	94.0	1.2	Measured Average

Result: Complies

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests $(30 - 25,000 \text{ MHz}) \pm 4.1 \text{ dB}$

Spurious emissions

Transmitting on 2433 MHz

Frequency (MHz)	Vertical (dBuV/m)	Horizontal (dBuV/m)	Limit (dBuV/m)	Antenna	Detector
4808.000	> 50.0	> 50.0	74.0	Vert/Hort	Peak
4808.000	> 45.0	> 45.0	54.0	Vert/Hort	Average
7212.000	> 50.0	> 50.0	74.0	Vert/Hort	Peak
7212.000	> 45.0	> 45.0	54.0	Vert/Hort	Average
9616.000	> 50.0	> 50.0	74.0	Vert/Hort	Peak
9616.000	> 45.0	> 45.0	54.0	Vert/Hort	Average
12020.000	> 50.0	> 50.0	74.0	Vert/Hort	Peak
12020.000	> 45.0	> 45.0	54.0	Vert/Hort	Average
14424.000	> 50.0	> 50.0	74.0	Vert/Hort	Peak
14424.000	> 45.0	> 45.0	54.0	Vert/Hort	Average
16828.000	> 50.0	> 50.0	74.0	Vert/Hort	Peak
16828.000	> 45.0	> 45.0	54.0	Vert/Hort	Average
19232.000	> 50.0	> 50.0	74.0	Vert/Hort	Peak
19232.000	> 45.0	> 45.0	54.0	Vert/Hort	Average
21636.000	> 50.0	> 50.0	74.0	Vert/Hort	Peak
21636.000	> 45.0	> 45.0	54.0	Vert/Hort	Average
24040.000	> 50.0	> 50.0	74.0	Vert/Hort	Peak
24040.000	> 45.0	> 45.0	54.0	Vert/Hort	Average

In addition radiated measurements were made in the restricted bands of 2310 – 2390 MHz and 2483.5 – 2500 MHz where the standard FCC part 15 limits as defined in section 15.209 are applied.

No emissions were observed to exceed the noise floor of approximately 40 dBuV/m when using an average detector with a 1 MHz bandwidth or a noise floor of approximately 50 dBuV/m when using a peak with a 1 MHz bandwidth.

No spurious emissions were detected from this device when it was transmitting on 2433 MHz

Measurements were attempted at a distance of 3 metres using vertical and horizontal polarisations using both a peak and an average detector with a 1 MHz bandwidth.

As per section 15.249 a limit of 500 uV/m applies to the harmonic emissions when an average detector is used.

This limit has been converted to dBuV/m using the formula $20 * (\log 500)$

The emission level is determined in field strength by taking the following into consideration:

Level (dB μ V/m) = Receiver Reading (dB μ V) + Antenna Factor (dB) + Coax Loss (dB) –
Microwave Preamplifier Gain (dB)

Result: Complies

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (30 – 25,000 MHz) \pm 4.1 dB

7. TEST EQUIPMENT USED

Instrument	Manufacturer	Model	Serial No	Asset Ref	Cal Due
Aerial Controller	EMCO	1090	9112-1062	RFS 3710	Not applic
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708	Not applic
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	Not applic
Receiver	R & S	ESHS 10	828404/005	3728	21 Aug 2012
Mains Network	R & S	ESH2-Z5	881362/032	3628	21 Aug 2012
Receiver	R & S	ESCS 30	847124/020	E1595	21 Feb 2012
Receiver	R & S	ESIB 40	100171	R-27-1	21 Aug 2012
Spectrum Analyser	Hewlett Packard	E7405A	US39150142	3771	20 April 2013
VHF Balun	Schwarzbeck	VHA 9103	-	RFS 3603	7 Feb 2012
Biconical Antenna	Schwarzbeck	BBA 9106	-	RFS 3612	7 Feb 2012
Log Periodic	Schwarzbeck	VUSLP 9111	9111-228	3785	7 Feb 2012
Horn Antenna	EMCO	3115	9511-4629	E1526	10 May 2013
Horn Antenna	EMCO	3116	92035	-	10 May 2013

8. ACCREDITATIONS

Testing was carried out in accordance with EMC Technologies NZ Ltd registration with the Federal Communications Commission as a listed facility, Registration Number: 90838, which was updated in February 2011.

In addition testing was carried out in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to NZS/IEC/ISO 17025:2005.

All measurement equipment has been calibrated in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to NZS/IEC/ISO 17025: 2005.

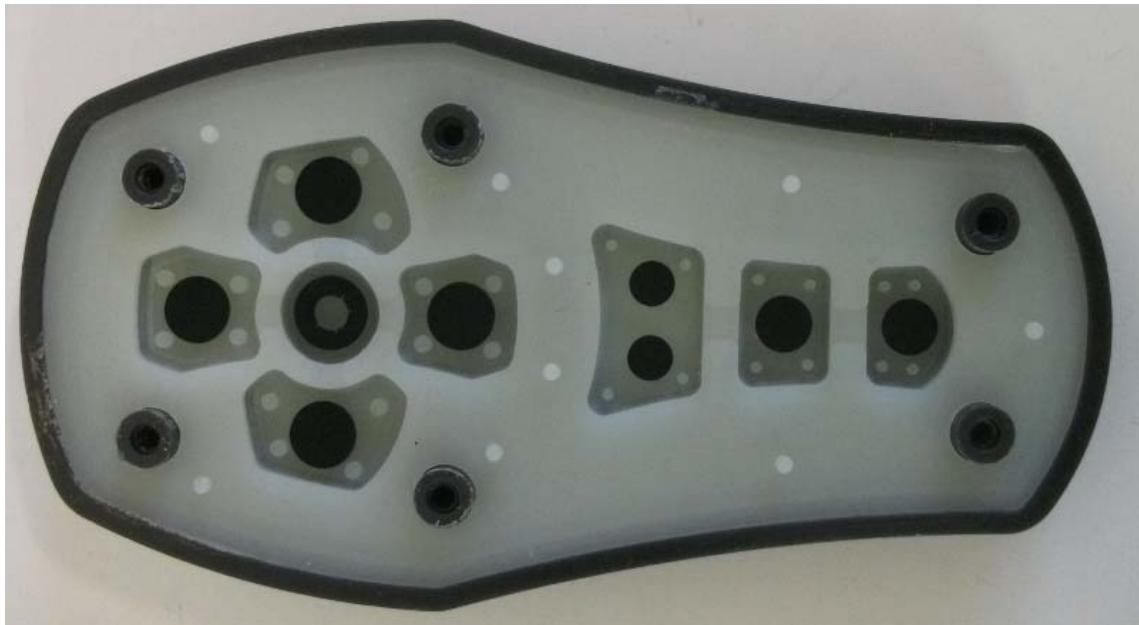
International Accreditation New Zealand has Mutual Recognition Arrangements for testing and calibration with a number of accreditation bodies in various economies. This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden). Further details can be supplied on request.

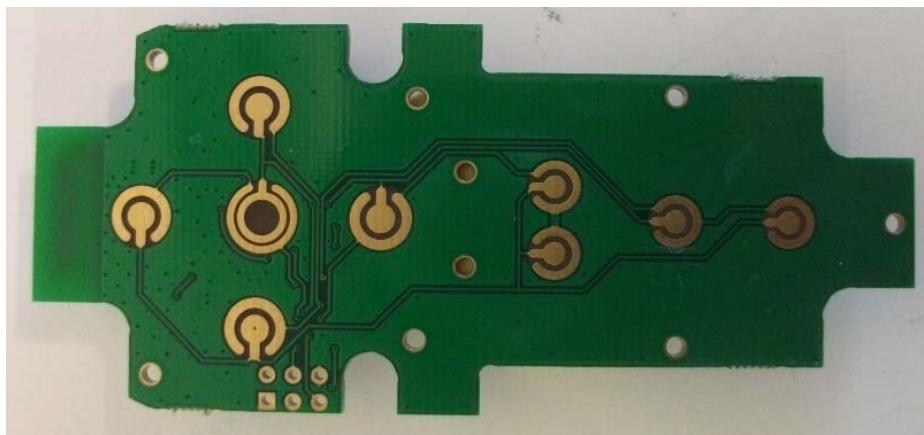
9. PHOTOGRAPHS

External photos



Internal Photos





Radiated emission test set up photos



