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Confidential Report

Client:	Test of:
Schrader Electronics Ltd 11 Technology Park Belfast Road Antrim Northern Ireland BT41 1QS Att: James Kyle	CRMRS232 Receiver To: FCC CFR 47 Part 15 RSS Gen

FCC Site Registration: 92592
Industry Canada Assigned Code: 8517A

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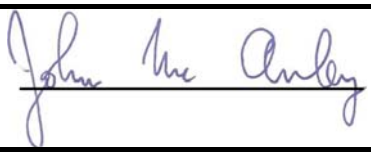
		SIGNATURE:	

Executive Summary

Emissions Testing performed according to FCC Part 15

Result:	Test standard referenced:	Test Title
Complied	FCC Part 15.109	Radiated Emissions
Complied	RSS Gen,	Radiated Emissions

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CONTENTS

1 Equipment Under Test (EUT)

1.1 Identification of EUT

FCCID :	MRXCRMRS232
Manufacturer:	Schrader Electronics Ltd
Model Name or Number:	CRMRS232
Power Supply Requirement:	24 V Battery

1.2 Description of E.U.T.

The EUT purpose is to receive data from Schrader tyre sensors over a radio link and to relay this data onto a controller over RS232 link.

1.3 Modifications

There were no modifications on the EUT

1.4 Date of Test

The tests were carried out on dates of the 8th and 9th January 2015.

2 Test Specification, Methods and Procedures

2.1 Emissions

Emissions were assessed to the following standards:

FCC CFR 47 Part 15.109
Federal Communications Commission: Part 15 Radio Frequency Devices
Radiated Emissions Limits

RSS Gen Issue 4 — General Requirements and Information for the Certification of Radio Apparatus

ANSI C63.4-2014
"Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electri-cal and Electronic Equipment in the Range of 9 kHz to 40 GHz"

3 Deviations and Exclusions from the Test Specifications

3.1 Deviations

There were no deviations from the test specification.

3.2 Exclusions

There were no exclusions from the test specification.

4 Operation of E.U.T. During Testing

4.1 Operating Environment

The EUT was powered using a 24 Volt battery.

4.2 Operating Mode:

The EUT was connected to a laptop via a RS232 connection and a Schrader tyre sensor (TMS truck sensor) provided pulses to the EUT over radio link. .
Note the laptop was used solely to exercise the EUT and in normal operation, the EUT would not connect to or exchange data with a laptop.

5 Results

5.1 Radiated Emissions

Compliant measurements of radiated emissions were carried out in an anechoic chamber from 30 MHz to 4.5GHz. The equipment and cable orientation were investigated to ensure that maximum emissions were obtained at critical frequencies.
The receiver bandwidth was set to 120 kHz for frequencies between 30 MHz and 1 GHz.

For frequencies between 1GHz and 6 GHz, the resolution bandwidth was 1MHz and video bandwidth was 1MHz. for peak measurements. The Video bandwidth was changed to 10Hz for Average measurements (as per ANSI 63.4-2014 Section 4.2.3 e) .

5.2.1 Measurement Uncertainty

The measurement uncertainty (with a 95% confidence level) for the radiated emissions test was ±5.3 dB (from 30 to 100 MHz), ±4.7 dB (from 100 to 300 MHz), ±3.9 dB (from 300 to 1000 MHz) and ±3.8 dB (from 1 to 12.75 GHz).

5.3 Radiated Emissions

Exploratory radiated emissions were carried out to determine the orientation that maximised the emissions.
Final radiated emissions measurements were carried out on the EUT in the orientation determined from the exploratory measurements.

For the spurious and harmonics measurements, below 1000 MHz, the EUT was set up at a 3 metre distance from the receiving antenna, in a semi Anechoic Chamber, with the EUT running in a receive mode. The EUT was rotated 360 degrees azimuth and the search antenna height varied 1 to 4m in order to maximize the emissions.
For measurements above 1000MHz, the EUT was set up at a 3 metre distance from the antenna, in a fully anechoic chamber, with the EUT running in receive mode. The EUT was rotated 360 degrees azimuth in order to maximize the emissions.

Significant peaks from the EUT were then recorded to determine margin to the limits.

Results

Frequency MHz	Quasi Peak Level dBuV/m	Antenna Polarity	Antenna Factor dB	Cable loss dB	Final Field Strength Quasi Peak dBuV/m	Quasi Peak Limit dBuV/m	Margin dB
433.768	-3.3	Vertical	16.1	1.2	14	46.0	32.0
715.306	-3.35	Vertical	20.6	1.4	18.65	46.0	27.4
828.681	-4.6	Vertical	22.2	1.4	19	46.0	27.0
885.581	-0.17	Vertical	22	1.4	23.23	46.0	22.8
433.981	11.9	Horizontal	16.1	1.2	29.2	46.0	16.8
828.006	1.4	Horizontal	22.2	1.4	25	46.0	21.0
921.106	4.84	Horizontal	22.9	1.4	29.14	46.0	16.9

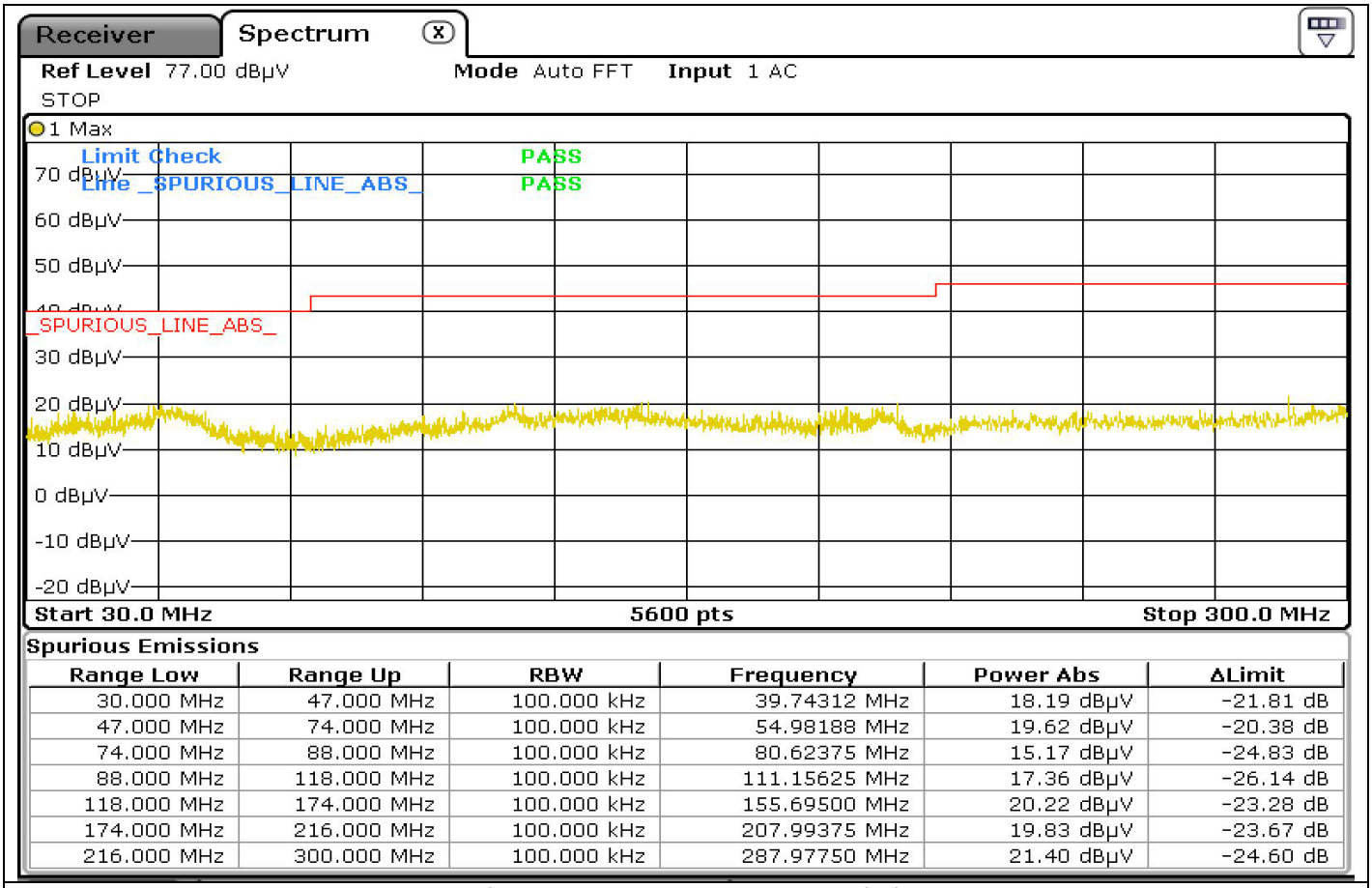
Table 1 Results for spurious emissions below 1 GHz (3 metre)

Frequency	Measured Peak Level	Antenna Factor	Preamp Gain	Cable Loss	Antenna Polarity	Final Peak Level	Average Limit+20dB	Margin
GHz	dBuV/m	dB	dB	dB		dBuV/m	dBuV/m	dB
2.113	42.7	28	39	3.2	Vertical	50.5	74.0	23.4
3.265	50.3	30.6	37.4	4.4	Vertical	52.7	74.0	21.3
3.895	53.0	30.6	37.7	4.8	Vertical	55.3	74.0	18.6
2.110	41.3	28	39	3.2	Horizontal	49.1	74.0	24.9
3.527	50.5	30.6	37.8	4.5	Horizontal	53.2	74.0	20.8
3.681	51.8	30.6	37.4	4.5	Horizontal	54.1	74.0	19.8

Frequency	Measured Average Level	Antenna Factor	Preamp Gain	Cable Loss	Antenna Polarity	Final Average Level	Average Limit	Margin
GHz	dBuV/m	dB	dB	dB		dBuV/m	dBuV/m	dB
2.113	31.0	28	39	3.2	Vertical	38.8	54.0	15.1
3.265	38.0	30.6	37.4	4.4	Vertical	40.4	54.0	13.6
3.895	40.4	30.6	37.7	4.8	Vertical	42.7	54.0	11.3
2.110	32.2	28	39	3.2	Horizontal	40.0	54.0	14.0
3.527	37.8	30.6	37.8	4.5	Horizontal	40.5	54.0	13.5
3.681	39.7	30.6	37.4	4.5	Horizontal	42.0	54.0	12.0

Table 2 Results for spurious emissions above 1 GHz (3 metre)

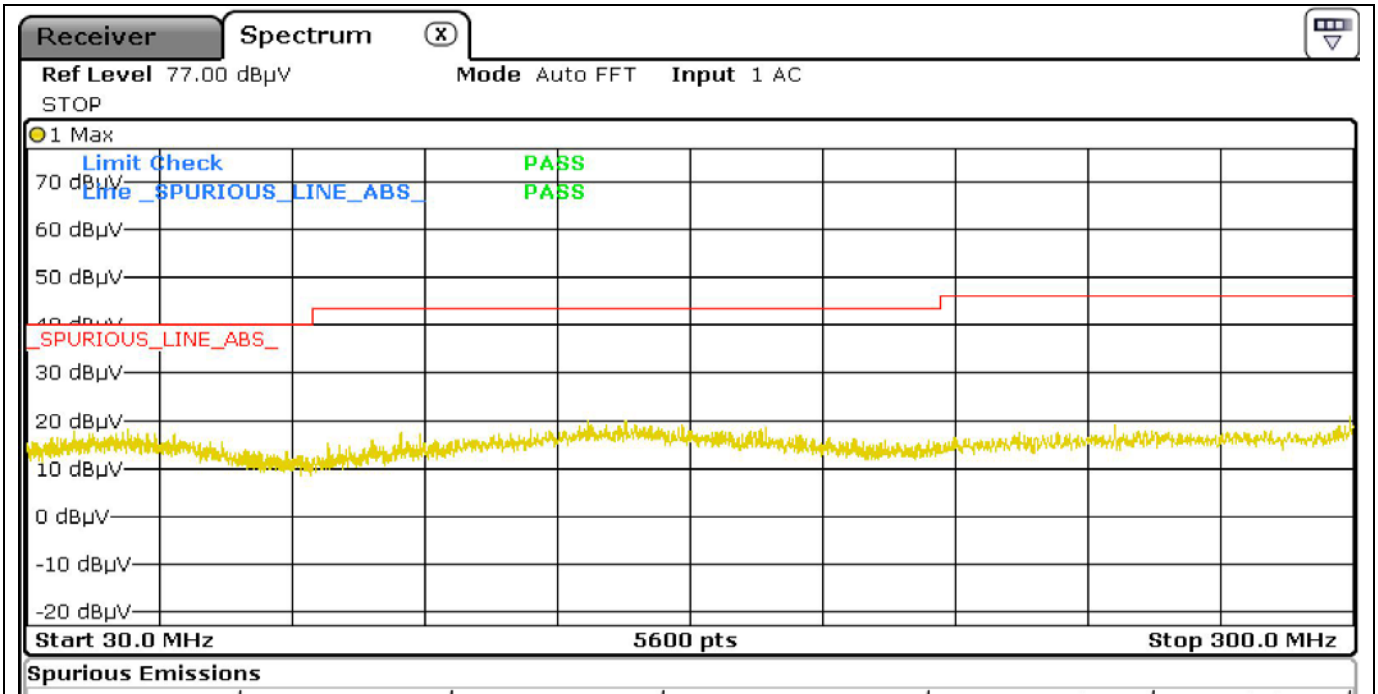
The plots are shown on the following pages.



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	47.000 MHz	100.000 kHz	39.74312 MHz	18.19 dBµV	-21.81 dB
47.000 MHz	74.000 MHz	100.000 kHz	54.98188 MHz	19.62 dBµV	-20.38 dB
74.000 MHz	88.000 MHz	100.000 kHz	80.62375 MHz	15.17 dBµV	-24.83 dB
88.000 MHz	118.000 MHz	100.000 kHz	111.15625 MHz	17.36 dBµV	-26.14 dB
118.000 MHz	174.000 MHz	100.000 kHz	155.69500 MHz	20.22 dBµV	-23.28 dB
174.000 MHz	216.000 MHz	100.000 kHz	207.99375 MHz	19.83 dBµV	-23.67 dB
216.000 MHz	300.000 MHz	100.000 kHz	287.97750 MHz	21.40 dBµV	-24.60 dB

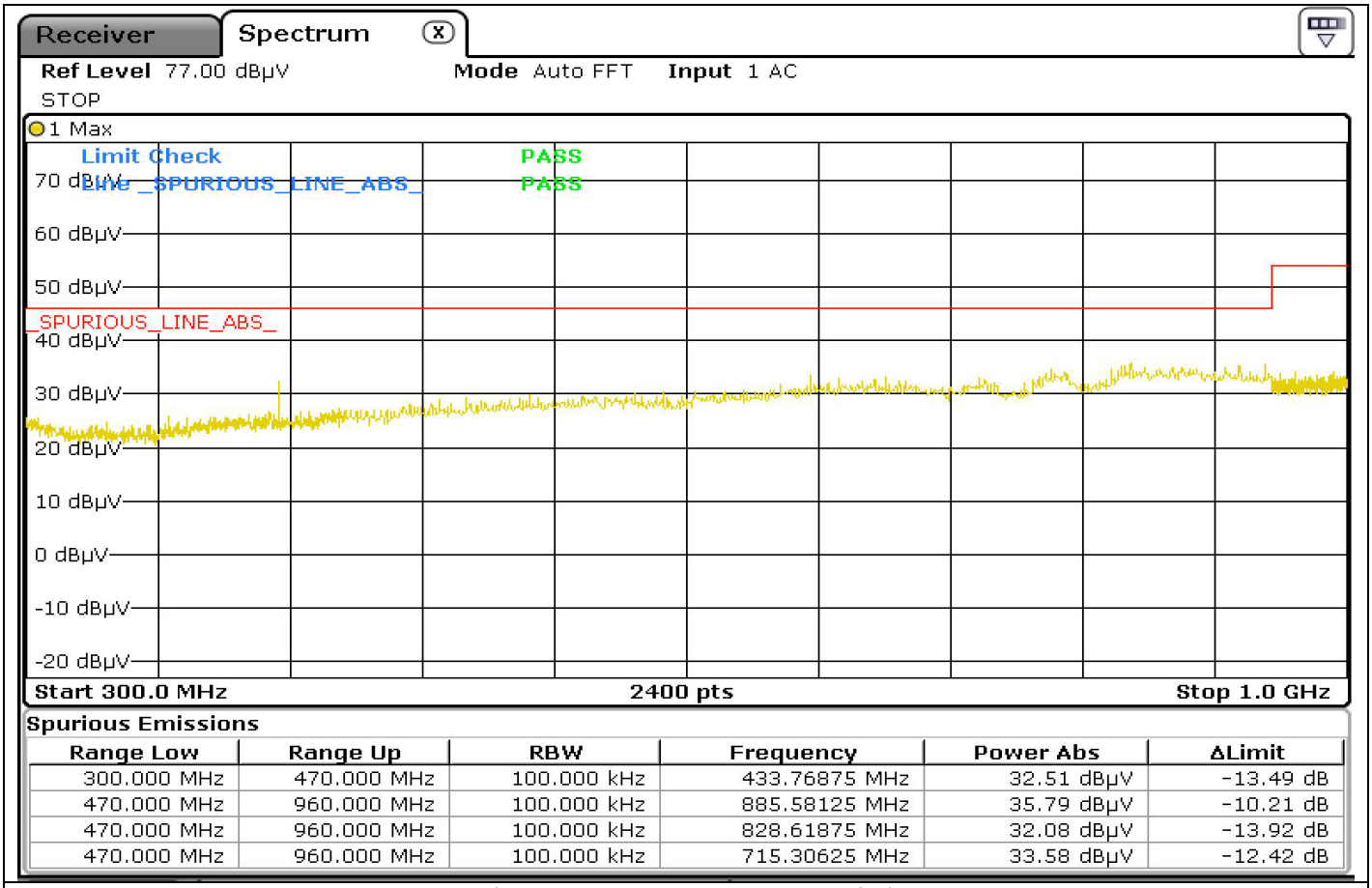
Fig 1 Scan 30MHz – 300MHz Vertical



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	47.000 MHz	100.000 kHz	39.50937 MHz	17.94 dBµV	-22.06 dB
47.000 MHz	74.000 MHz	100.000 kHz	50.66188 MHz	18.14 dBµV	-21.86 dB
74.000 MHz	88.000 MHz	100.000 kHz	74.28875 MHz	13.86 dBµV	-26.14 dB
88.000 MHz	118.000 MHz	100.000 kHz	106.05625 MHz	17.56 dBµV	-25.94 dB
118.000 MHz	174.000 MHz	100.000 kHz	144.28500 MHz	19.98 dBµV	-23.52 dB
174.000 MHz	216.000 MHz	100.000 kHz	180.43125 MHz	18.43 dBµV	-25.07 dB
216.000 MHz	300.000 MHz	100.000 kHz	299.31750 MHz	20.91 dBµV	-25.09 dB

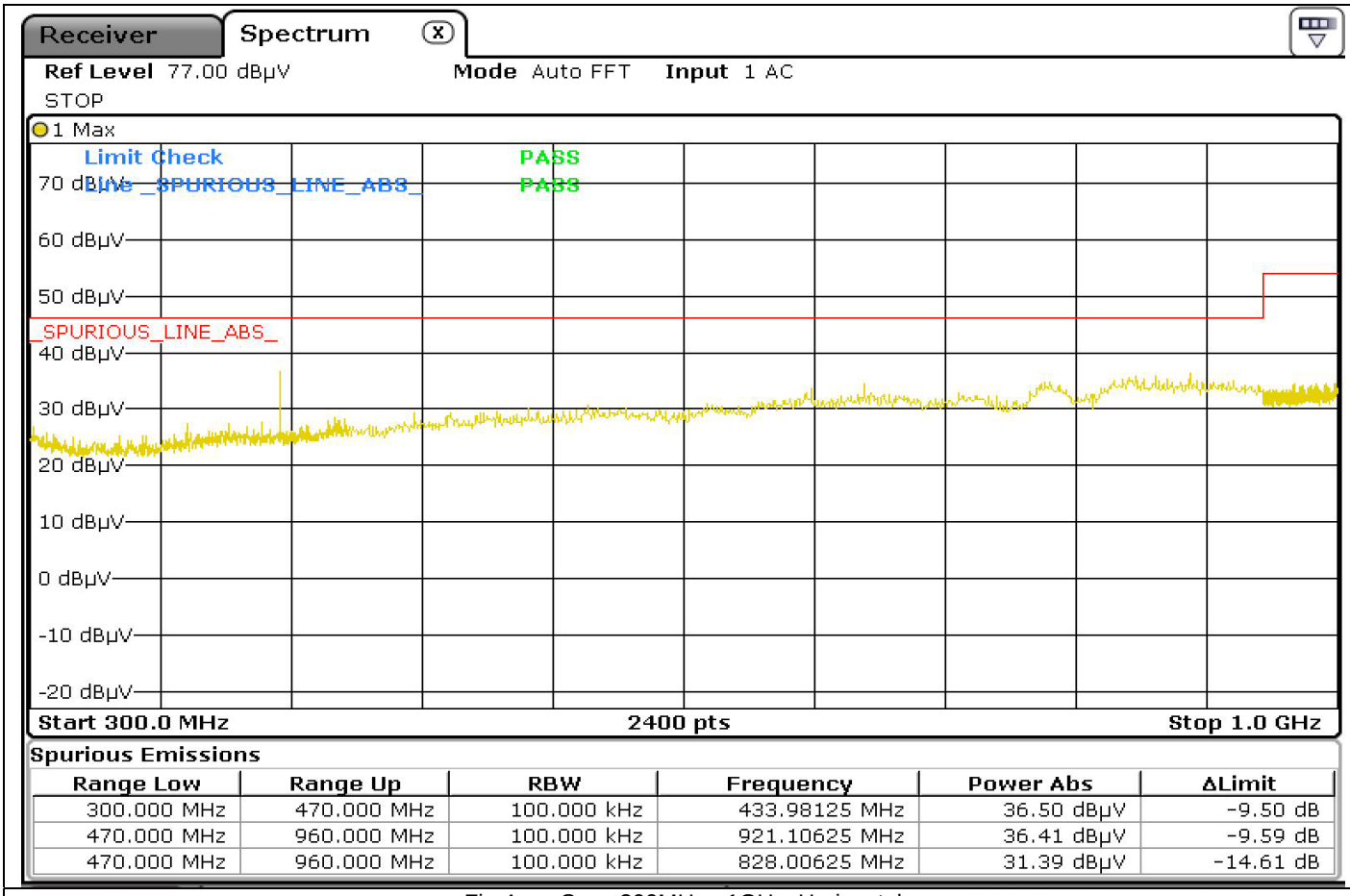
Fig 2 Scan 30MHz – 300MHz Horizontal



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
300.000 MHz	470.000 MHz	100.000 kHz	433.76875 MHz	32.51 dBµV	-13.49 dB
470.000 MHz	960.000 MHz	100.000 kHz	885.58125 MHz	35.79 dBµV	-10.21 dB
470.000 MHz	960.000 MHz	100.000 kHz	828.61875 MHz	32.08 dBµV	-13.92 dB
470.000 MHz	960.000 MHz	100.000 kHz	715.30625 MHz	33.58 dBµV	-12.42 dB

Fig 3 Scan 300MHz - 1GHz Vertical



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
300.000 MHz	470.000 MHz	100.000 kHz	433.98125 MHz	36.50 dBµV	-9.50 dB
470.000 MHz	960.000 MHz	100.000 kHz	921.10625 MHz	36.41 dBµV	-9.59 dB
470.000 MHz	960.000 MHz	100.000 kHz	828.00625 MHz	31.39 dBµV	-14.61 dB

Fig 4 Scan 300MHz - 1GHz Horizontal

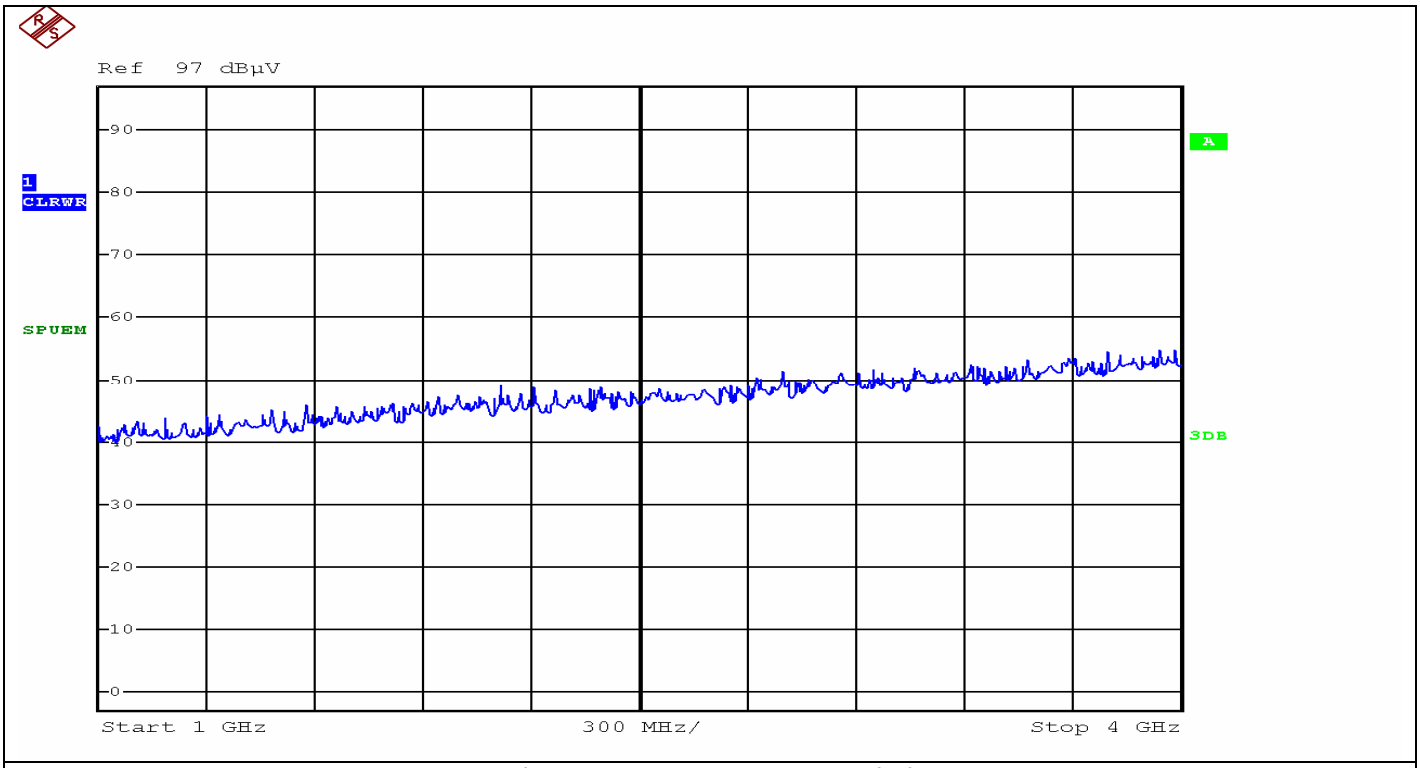


Fig 5 Scan 1GHz – 4GHz Vertical

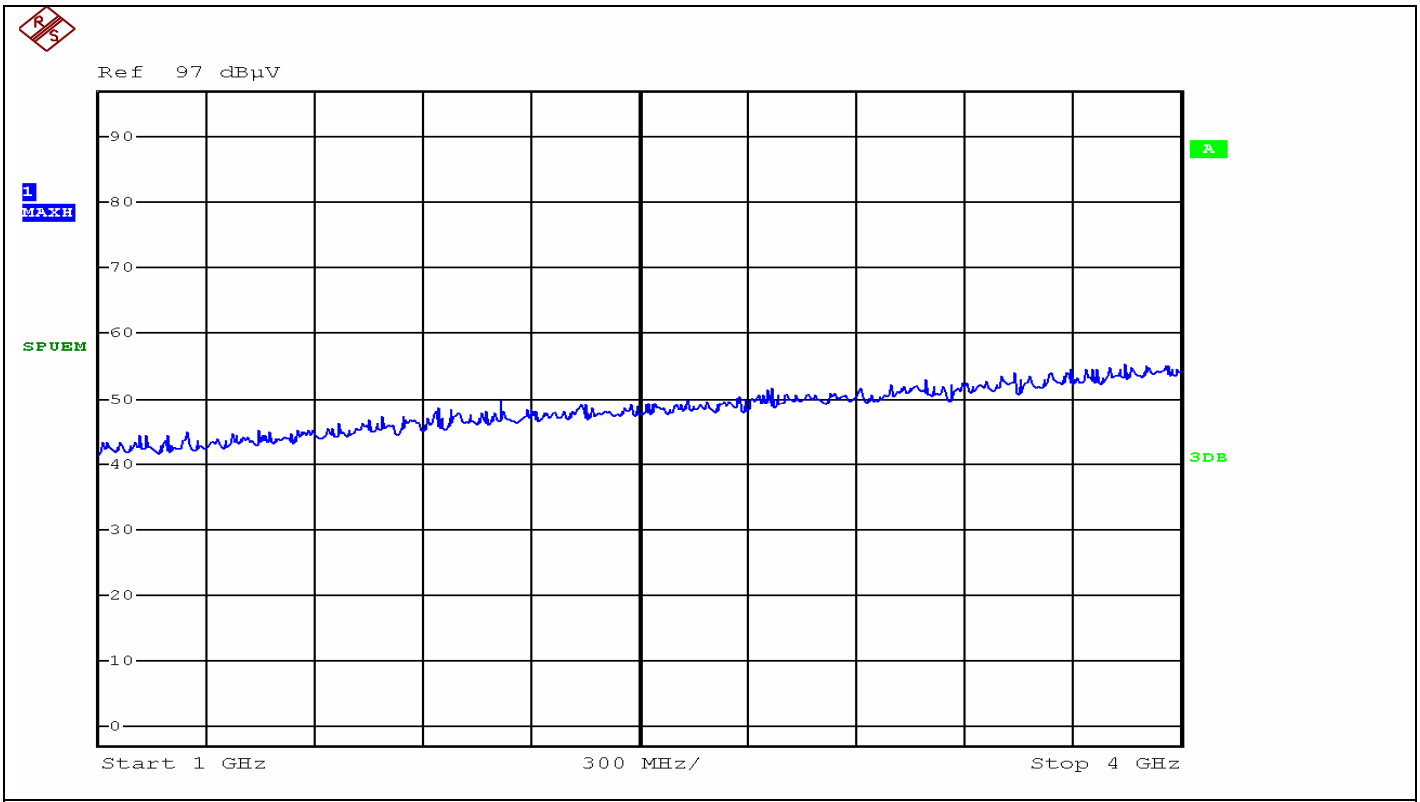


Fig 6 Scan 1GHz – 4GHz Horizontal

6 Analysis of Test Results, Conclusions

6.1 Measurement Uncertainties

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4 with a confidence level of 95%.

6.2 Radiated Emissions to FCC Part 15, Class B

The E.U.T. complied with the radiated emission specification.

Appendix A
Test Equipment Used:

Instrument	Manufacturer.	Model	CEI Ref No.	Cal Due Date
Preamplifier	Hewlett Packard	83017A	805	19/09/2015
Spectrum Analyser	Rohde & Schwarz	FSP 40	850	14/08/2015
Spectrum Analyser/Receiver	Rohde & Schwarz	ESR	869	06/06/2017
Antenna Trilog	Schwarzbeck	VULB 9160	889	29/07/2017
Anechoic Chamber	CEI	10M	845	23/09/2015
Antenna Log Periodic	Chase	UPA6108	609	11/09/2015
Horn Antenna	EMCO	3115	655	14/11/2015

Table A1

End of Report