CRS+

The Conducted Emission Reference source

USER NOTES
&
Calibration Data

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Laplace Instruments Ltd

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CRS+ Conducted Emission Reference Source

Chapter 1 Introduction

The CRS+ has been developed to provide a means of quickly and very easily checking the accuracy of EMC conducted emission test systems.
It is a stable source of known emission levels, whose levels are traceable to National Standards (UK).
The frequency range covers that of internationally specified conducted emission limits (10KHz—30MHz) and the output levels are up to the same order as common limit levels.

The output is in the form of a comb, ie a harmonic series based on a spacing of 10KHz. This means that every 10KHz there is a continuous narrow band signal output from the CRS+. This frequency spacing means that the spectrum as measured by standard EMC Receivers and analysers in band B is essentially a continuous line, whilst in band A, the series of peaks can be observed (assuming the correct 200Hz RBW is invoked by the measuring device).
Because each harmonic is a continuous signal, the selection of detector (Peak (QP or Average) will only marginally affect the results.

Key features

- Small size … battery powered.
- Simple operation… simply connect to the EUT port and switch on.
- Output level in band B similar to many commercial standards.
- Can be used, via adaptors, with any standard mains output socket.

Shipping list

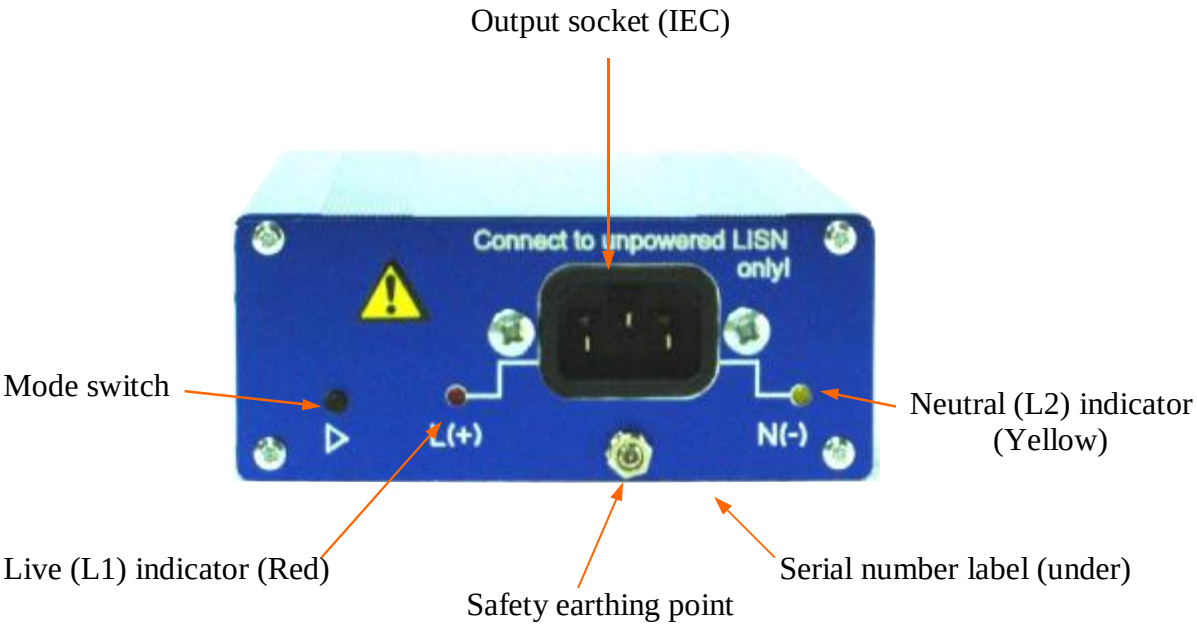
1	**CRS+ unit**
1	Output adaptor cable, fitted with mains plug to suit territory of end user. (UK, US, Euro … etc)*
1	Earth bonding cable
1	User manual and calibration data
2	Type AA (LR6) primary batteries

*The output adaptor cable can be produced by the user to suit non-standard requirements if necessary. Contact Laplace Instruments Ltd for guidance.

2.1 Description

The CRS+ comprises the main unit plus an output adaptor lead and batteries.
The adaptor lead is a short lead with an IEC plug at one end, the other having a mains plug suitable for attachment to the output socket of a LISN. If (for example) a CRS+ is shipped for use in mainland Europe, a Schuko plug will be fitted to the supplied adaptor lead.
If required, several adaptor leads can be supplied to suit different LISNs within one organisation.

Front panel



Rear Panel

Power

The CRS+ I uses standard primary cells type AA ((LR6) 1.5V.
Quantity 2 cells are required.

When the battery voltage drops so low that the output may be compromised, the CRS+ will turn off, thus avoiding erroneous results.

To fit the batteries, use a coin to press and turn the top cap of the battery holder quarter turn anti-clockwise. The top cap will release.
Fit 2 batteries with the +ve top cap uppermost (towards the top cap).
Press the top cap down on the batteries, align the two lugs and turn clockwise quarter turn to retain.

Operation

To check that the CRS+ is working and that the batteries are OK, press the mode button once. The red indicator L(+) should light. Double click the mode button again and now the yellow N(-) indicator should light.
Click the mode button again and the yellow indicator should go out and then both indicators should flash on for 1 second to confirm that the CRS+ is switching off.

Connection
Disconnect the LISN from the mains supply. (see note below).
Connect an earth bonding wire from the earth stud on the CRS+ to a reliable earth point, ensuring a good connection.
Connect the supplied adaptor lead from the IEC socket on the CRS+ to the mains EUT outlet on the LISN.

- **Position the CRS+ as far from the LISN as the cable will permit. It has been noticed that the magnetic field created by the air core inductors in LISNs can couple to the CRS+ and can affect the performance at high frequencies. Never locate the CRS+ on top of the LISN.**

Ensure the connections to the receiver/analyser are as used for measuring the EUT, with any pre-amplifiers and/or transient limiters switched on.

Note:
The removal of mains from the LISN is good safety practice. However, the CRS+ will NOT be damaged if the LISN is live (connected to the mains). This practice is NOT recommended. It is absolutely essential that in these circumstances the earth bonding connection has good integrity.

Operating Modes

Switch the CRS+, L(+) indicator on by pressing the mode button.
Sweep the receiver/analyser over the desired band. Generally use Peak detector for speed. The choice of detector should not significantly affect the results.
Compare the result with the CRS+ calibration data. Any significant deviations should be investigated before using the equipment for compliance testing.
Repeat with N(-) selected.

When the checks are completed, ensure that the CRS+ is switched off to conserve the battery.

Calibration data

Each CRS+ is individually calibrated and the data shown on the following pages.

The calibration is by correlation against a master source which is itself regularly measured by an independent UKAS (United Kingdom Accrediation Service) accredited test laboratory, using equipment which is directly traceable to national standards.

A copy of the test certificate and UKAS results are included in Appendix 1.

The correlation was performed with the following equipment:

LISN type VN-1 by Cranage EMC Technology, serial number 002742

EMC analyser type SA1002-A, serial number: 1025

Detector:	Peak
RBW:	200Hz and 9KHz
Dwell time:	200ms and 12ms
Frequency Step:	100Hz and 5KHz

Pre-selector type RF915, serial number 1005

The master unit is scanned before and after the target CRS+ to ensure that no changes or drift in the equipment occurs during the correlation process.

Results from both the master and target are processed using an excel spreadsheet such that any differences between the two are reflected in the calibration data for the target unit. The software checks that there are no differences greater than 2 dBuV between any units. This ensures that all units are totally consistent.

Accuracy

Measurement uncertainty due to the master CRS+ : 1.5dB
Measurement uncertainty due to the correlation : 1.0dB

Temperature: +10°C to +30°C: <1dB

Long term drift: <1dB over 12 months

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CRS+ calibration

Correlation file

Master: Silver calibrated: 22.01.09 Report ref: R3114 E8488 Cranage EMC
Target: 08CR007 Correlated: 23.01.09

	Live (L1)					Neutral (L2)				
Frequency	Master calibration		Target	Target corrected		Master calibration		Target	Target corrected	
	Pk	QP	Pk	Pk	QP	Pk	QP	Pk	Pk	QP
0.035	35.5	34.8	-1	34.5	33.8	35.5	34.81	0	35.5	34.81
0.055	40.78	39.69	0	40.78	39.69	40.84	39.91	-1	39.84	38.91
0.105	45.52	44.59	0	45.52	44.59	45.58	44.73	0	45.58	44.73
0.2	48	47.05	0	48	47.05	48.1	47.22	0	48.1	47.22
0.4	48.6	47.78	0	48.6	47.78	49.25	48.26	0	49.25	48.26
0.6	49.17	48.28	0	49.17	48.28	49.5	48.51	0	49.5	48.51
1	49.18	48.24	0	49.18	48.24	49.5	48.49	0	49.5	48.49
1.5	49.19	48.14	0	49.19	48.14	49.5	48.4	0	49.5	48.4
2	49	48.06	0	49	48.06	49.47	48.32	0	49.47	48.32
3	49	48	0	49	48	49.5	48.2	0	49.5	48.2
4	48.9	47.86	0	48.9	47.86	49.5	48.2	0	49.5	48.2
5	48.6	47.58	0	48.6	47.58	49.2	48.1	0	49.2	48.1
6	48.45	47.41	0	48.45	47.41	49.1	48.05	0	49.1	48.05
8	48.35	47.4	0	48.35	47.4	48.94	48.01	0	48.94	48.01
10	48.2	47.22	0	48.2	47.22	48.74	47.7	0	48.74	47.7
12	48	47.13	0	48	47.13	48.4	47.38	0	48.4	47.38
14	47.8	46.87	0	47.8	46.87	47.6	46.58	0	47.6	46.58
16	47.4	46.4	0	47.4	46.4	46.8	45.87	0	46.8	45.87
18	46.3	45.4	0	46.3	45.4	46	45.1	0	46	45.1
20	45.8	45	0	45.8	45	45	44.18	0	45	44.18
22	44.9	43.88	0	44.9	43.88	43.9	42.97	1	44.9	43.97
25	44.1	43.08	0	44.1	43.08	41.7	40.8	0	41.7	40.8
27	43.3	42.36	0	43.3	42.36	40.1	39.24	0	40.1	39.24
30	39.8	38.9	0	39.8	38.9	38.8	38.98	0	38.8	38.98