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## EMCTLA TECHNICAL GUIDANCE NOTE #42

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**Topic:** Emissions tests on telecom ports as per CISPR 22 (EN 55022)

### **Background**

EN 55022: 2006 (the fifth edition) describes, at clause 9.6 and annexes C, D and F, conducted emission measurements at telecommunication ports. Earlier editions of the standard were open to various interpretations, particularly in terms of the choice of test method for a given EUT cable type. Also, there was controversy over the specification of the Impedance Stabilizing Network (ISN) given in the standard, which has led to some caution in investing in new networks. These factors resulted in excessive variation and lack of repeatability between test laboratories in performing the test.

### **Problem**

What are the preferred and alternative test methods for particular cable types?

### **Guidance**

The first edition of this Guidance Note was drafted to address the deficiencies in the standard, which have been largely rectified in the fifth edition of EN55022. This second edition has been revised to recognize the changes made in the fifth edition and to preserve consistency with that standard. It cancels and replaces version 1.1 of TGN 42 dated 14<sup>th</sup> February 01, and its addendum 1 of the same date.

### **Choice and application of test method**

In the following table, the tests are ranked in order of preference, depending on cable type.

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Cable type		Guidance on applicable tests	Comment
<b>Unscreened, balanced cables, up to four pairs</b>	ISO/IEC11801 cat 3	<p>The preferred test is to use an Annex D ISN adapted for LCL according to 9.6.2. c)3). The test method is as per C.1.1. The voltage division factor to be used is that which is drawn from the actual calibration of the ISN. Whilst clause 9.6.2.e) specifies that the accuracy of the voltage division factor "shall be <math>\pm 1</math> dB", the laboratory's own uncertainty budget should take into account the actual use of correction factors and accuracy of calibration of the ISN.</p> <p>If this ISN is not available then a CDN according to IEC 61000-4-6 for balanced pair cables can be substituted as per C.1.1, if it allows correct operation of the EUT, and if its LCL is appropriate for the cable category connected to the tested port. A voltage measurement with a <math>50\Omega</math> receiver at the output port is preferred, but a current measurement with the output port terminated with a <math>50\Omega</math> load is permitted.</p> <p>If this is not possible then the method of C.1.3 must be used, as per the final part of this table.</p> <p>In all cases the test set-up is as per figs 4 – 9 of the standard, as appropriate for tabletop or floor-standing EUTs.</p> <p>If either of the latter two methods are employed then the test laboratory shall make clear in its test report that the method is a substitute for the preferred method, and shall document the reason for choosing it.</p>	<p><i>The ISN/CDN voltage measurement is preferred over the current measurement since the ISN/CDN is explicitly designed for voltage coupling with the cable; the extra uncertainty introduced by a current probe is eliminated.</i></p> <p><i>The advice in Annex F.1 should be respected: "Asymmetry in the ISN is purposely constructed to yield the specified LCL. This asymmetry may enhance or cancel the asymmetry of the EUT. In the interest of determining the worst case emissions and optimization of test repeatability, consideration should therefore be given to repeating the testing with the LCL imbalance on each wire of a balanced pair when using the appropriate ISN as defined in 9.5.2."</i></p> <p><i>This means that the test should be carried out twice per pair, with each pair connected through the ISN first in one polarity (+ to + and – to –) and then in the other (+ to – and – to +).</i></p>
	ISO/IEC11801 cat 5	As above with an Annex D ISN adapted for LCL according to 9.6.2. c)2)	As above
	ISO/IEC11801 cat 6	As above with an Annex D ISN adapted for LCL according to 9.6.2. c)1)	As above
<b>All screened cables</b>		<p>The method of using a <math>150\Omega</math> resistor to the outside surface of the cable screen as per C.1.2 is preferred in general. A voltage measurement using the <math>150</math>-to-<math>50\Omega</math> adaptor is preferred over a current measurement.</p> <p>However, in cases where an IEC 61000-4-6 CDN is available for the type of screened cable under test, using this in the same way as C.1.1. for either a voltage (preferred) or current measurement is regarded as equivalent. In this case, there is no need to measure and report the common mode (CM) impedance.</p>	<p><i>The <math>150</math>-to-<math>50\Omega</math> adaptor method is easier and more repeatable than any of the other variations suggested by the standard.</i></p> <p><i>The common mode impedance of the IEC 61000-4-6 CDN is well enough specified that there is no need for an extra check.</i></p>

	<p>In other cases, the CM impedance need only be measured according to C.2 once for a given setup of ferrite, cable and AE, it is not necessary to repeat this measurement for each test if this setup remains the same.</p> <p>In all cases the test set-up is as per figs 4 – 9 of the standard, as appropriate for tabletop or floor-standing EUTs.</p> <p>The phrases “sufficiently large” and “much greater” in respect of the CM impedance shall be interpreted in the light of Annex F.6.</p>	
<p><b>Unscreened, unbalanced cables or those containing more than four balanced pairs</b></p>	<p>The test method of C.1.3 is preferred. C.1.4. is only to be applied at the specific request of the customer, at spot frequencies, if emissions at these frequencies breach either voltage or current limits in C.1.3. The common mode impedance must be measured and reported as per C.2 for each frequency. If the common mode impedance cannot be adjusted to 150Ω as mandated by C.1.4, the measurement setup and the actual common mode impedance achieved shall be recorded in the test report.</p> <p>It is not necessary for compliance testing to measure or record the CM impedance if C.1.3. is used.</p> <p>In any case the test set-up is as per figs 4 – 9 of the standard, as appropriate for tabletop or floor-standing EUTs.</p>	<p><i>Because ferrites that are effective at the lower end of the frequency range of this test are specialized and may be unavailable, it is often not possible to meet the impedance condition imposed by C.1.4. The test is highly unrepeatable as a result, and should be used only as a last resort.</i></p> <p><i>The capacitive voltage probe used for C.1.3. measurements shall comply with 5.2.2 of CISPR 16-1-2.</i></p> <p><i>A non-invasive CDN using a length of screened cable of the same characteristics as the unscreened cable to be tested, was described in the EMC &amp; Compliance Journal of January 2005, pp 14-18. It may offer a means to circumvent the difficulties of C.1.3 and C.1.4 by applying C.1.1 instead.</i></p>