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colour inside

Metallic communication cable test methods – Part 4-13: Electromagnetic compatibility (EMC) – Coupling attenuation of links and channels (laboratory conditions) – Absorbing clamp method

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International Standard IEC 62153-4-13 has been prepared by IEC technical committee 46: Cables, wires, waveguides, R.F. connectors, R.F. and microwave passive components and accessories.

The text of this standard is based on the following documents:

CDV	Report on voting
46/313/CDV	46/329/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication is to be read in conjunction with IEC 62153-4-5 (2006).

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 62153 series, under the general title: *Metallic communication cable test methods*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version may be issued at a later date.

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METALLIC COMMUNICATION CABLE TEST METHODS –

Part 4-13: Electromagnetic compatibility (EMC) – Coupling attenuation of links and channels (laboratory conditions) – Absorbing clamp method

1 Scope

This part of IEC 62153 details the method of laboratory test to determine the coupling attenuation for links and channels used in analogue and digital communication systems.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-726, *International Electrotechnical Vocabulary – Chapter 726: Transmission lines and waveguides*

IEC 61196-1, *Coaxial communication cables – Part 1: Generic specification – General, definitions and requirements*

IEC 62153-4-5:2006, *Metallic communication cables test methods – Part 4-5: Electromagnetic compatibility (EMC) – Coupling or screening attenuation – Absorbing clamp method*

ISO/IEC 11801, *Information technology – Generic cabling for customer premises*

ITU-T Recommendation G.117:1996, *Transmission aspects of unbalance about earth*

ITU-T Recommendation O.9:1999, *Measuring arrangements to assess the degree of unbalance about earth*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-726 and IEC 61196-1 apply.

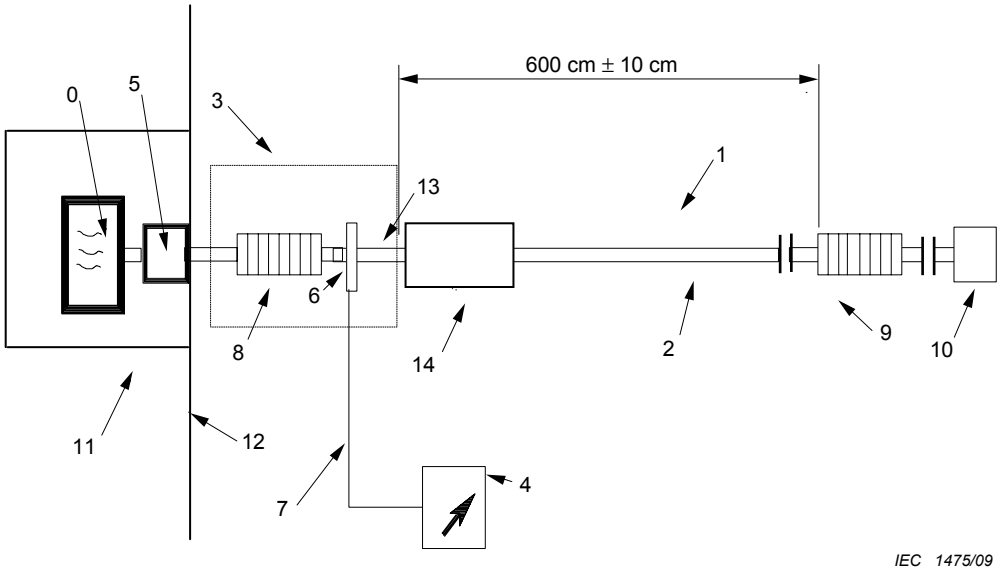
In this document, connecting hardware is defined as a complete connecting device including compensating or matching networks (if any), connectors and cable terminations.

4 Test method

4.1 Equipment

4.1.1 General

See 5.1.1 of IEC 62153-4-5 and Figure 1 below.



Key

0 signal generator, output impedance Z_0

1 link or channel under test, nominal characteristic impedance Z_1

2 outer circuit of the link or channel under test, impedance Z_2

3 absorbing clamp, impedance Z_3

4 measuring receiver

5 balun (if applicable)

6 current transformer

7 measuring receiver cable (use the same in measurement and calibration)

8 absorber (ferrite tube) of the clamp, insertion loss > 10 dB

9 absorber (or second clamp), insertion loss > 10 dB

10 termination of the far-end extension cable connected to link or channel under test

11 shield of signal generator and balun if needed for high dynamic range

12 reflector plate

13 extension cable connected through mating connector to link or channel under test, if applicable

14 connecting hardware in measured end of link or channel

Figure 1 – Measurement of surface wave at connecting hardware in one end of a link or channel

4.1.2 Balun requirements

For measurement of symmetrical cable assemblies, a means for generating symmetrical signals shall be provided. If the generator is unbalanced, this may be performed by the use of a balun or 180° power splitter.

The minimum requirements for this device are specified in Table 1.

The attenuation of the balun shall be kept as low as possible because it will limit the dynamic range of the coupling attenuation or screening attenuation measurements.

Table 1 – Balun performance characteristics

Parameter	Value
Impedance, primary[a]	50 Ω (unbalanced)
Impedance, secondary[b]	100 Ω or 150 Ω (balanced)
Operational attenuation[d] (including matching pads if used)	≤ 10 dB
Return loss, bi-directional	≥ 6 dB
Power rating	To accommodate the power of the generator and amplifier (if applicable)
Output signal balance[c]	≥ 50 dB from 30 MHz to 100 MHz ≥ 30 dB from 100 MHz to the highest measured frequency

[a] Primary impedance may differ if necessary to accommodate analyzer outputs other than 50 Ω.

[b] Balanced outputs of the test baluns shall be matched to the nominal impedance of the symmetrical patch cord / cable pair. 100 Ω shall be used for termination of 120 Ω cabling.

[c] Measured per ITU-T Recommendations G.117 and O.9.

[d] The operational attenuation of a balun shall be mathematically deduced from 3 operational attenuation measurements with 3 baluns back-to-back.

4.1.3 Extension cable requirements

An extension cable is only required if the channel or link under test does not include a cable, which can be connected to the test set-up.

Unscreened extension cables shall be used for testing unscreened, balanced link or channels. Screened, balanced extension cables shall be used for testing screened, balanced cable assemblies. Unbalanced (coaxial) extension cables shall be used for testing unbalanced cable assemblies.

The electrical transmission performance including electromagnetic screening and unbalance attenuation of the extension cables shall be better or equal to the performance of the link or channel under test. The choice of the extension cable should assure the minimum insertion loss and reflection loss of the set-up possible.

The extension cables shall have the same nominal characteristic impedance as the link or channel under test. Likewise, the velocity of propagation of the extension cables shall correspond to the link or channel under test (same type of isolation e.g. foamed or solid). The insertion loss of a near-end extension cable including mating connector, if applicable, shall be less than 2,0 dB up to the highest measurement frequency. The insertion loss of set-up validation cable shall be less than the insertion loss of any cable included in the link or channel under test.

The extension cables, any mating connectors and the connection between extension cables and the mating connectors, if applicable, shall have a balance or screening or balance and screening as good as possible. To further enhance the measurement sensitivity, the connection between the mating connector and the extension cable may be improved since it does not form part of the device under test. It is not allowed to improve any contact between the connecting hardware of the link or channel under test and the mating connector of the extension cable, if applicable. The measurement sensitivity shall be 6 dB better than the specified requirement limit for the link or channel under test. See 4.4.2.1 for determination of the measurement sensitivity.

In case of doubt regarding the interoperability between any mating connector and the connecting hardware of the link or channel under test, it is recommended to use the mating

connector specified or advised by the supplier of the connecting hardware of the link or channel under test.

4.2 Test sample

4.2.1 General

The test sample consists of the link or channel under test, and, in addition, in each end where it terminates in a connecting hardware component, an extension cable equipped with or without a mating connector. In the near end, an extension cable is used to connect the link or channel with the balun (if applied), network analyzer or signal generator. In the far end, an extension cable may be used to apply end termination. The extension cable may also be used to adjust the entire length to 10 m including near-end extension cable (for shorter links or channels). If the length of the link or channel under test is longer than 9 m, a 1 m far-end extension cable may be used for the termination.

The sample therefore consists of

- one extension cable with mating connector in the near end of the link or channel under test, if applicable,
- one extension cable with mating connector in the far end of the link or channel under test, if applicable,
- a number of connecting hardware contained in the link or channel under test,
- a number of cables contained in the link or channel under test.

4.2.2 Length of extension cables

The minimum length of extension cables with mating connectors, if applicable, is different for near end (reflector plate end) and far end (termination end).

a) Extension cable at reflector plate (near end)

The length of the near-end extension cable, if applicable, shall be 100 cm ± 10 cm.

b) Extension cable in termination end (far end)

The entire length of link or channel including any near and far-end extension cables shall be 10 m ± 0,5 m or 1 m ± 0,5 m longer than link or channel including near-end extension cable, whichever is the longest.

4.2.3 Tested length

The effective test length of each measurement is limited by the absorbing clamp and the ferrite tube, as shown in Figure 1. This length shall be 600 cm ± 10 cm.

4.2.4 Preparation of test sample

4.2.4.1 General

The diameter of any extension cables must be selected to allow insertion in the bore of the absorbing clamp.

When a special type of socket interface is specified for termination of the link or channel, such interface shall be used in the mating connector in question.

The bore of the absorbing clamp shall be larger than the diameter of the cables of the measured parts of the link or channel under test.

4.2.4.2 Balanced cable assemblies

Differential and common mode terminations are required for each unmeasured pair at the near end of the link or channel or any applied extension cable. See Figure 2.

Differential and common mode terminations are required for each pair at the far end of the link or channel or any applied extension cable. See Figure 2.

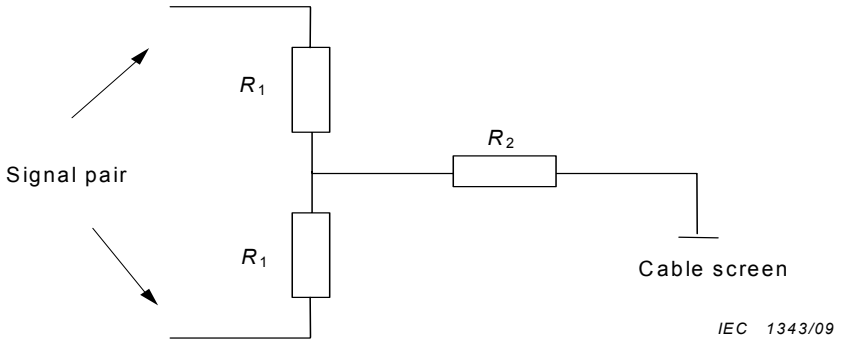


Figure 2 – Termination of link or channel or applied extension cable

The value of the R_1 resistors shall be one half the nominal characteristic impedance of the link or channel.

NOTE For 100 Ω balanced cabling, the common mode impedance will be equal to 25 Ω when R_2 is short-circuited. The common mode impedance of the termination may vary from 25 Ω (R_2= 0 Ω) to 100 Ω (R_2=75 Ω).

In case of screened cables, the terminating resistors shall be screened and R_2 shall be equal to 0 Ω.

The centre taps of the terminations shall be connected together. In the case of screened cables, the centre taps shall be connected to the screens.

4.2.4.3 Multi-conductor links or channels

Under consideration.

4.2.4.4 Coaxial links and channels

Under consideration.

4.3 Calibration procedure

See 5.3 of IEC 62153-4-5.

4.4 Test set-up

4.4.1 General

See 5.4 of IEC 62153-4-5.

As shown in Figure 3, the near-end coupling attenuation test set-up for measuring the outer components of one end of the link or channel (in the shown case, the tested length includes extension cable and one connecting hardware sample with one type of cable) is as follows.

The near-end extension cable or the outer cable of the link or channel under test is connected to the output terminal of the signal generator or balun (see IEC 62153-4-5). The far end of the