BS EN 62037-4:2012

BSI Standards Publication

Passive RF and microwave devices, intermodulation level measurement

Part 4: Measurement of passive intermodulation in coaxial cables

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The UK participation in its preparation was entrusted to Technical Committee EPL/46, Cables, wires and waveguides, radio frequency connectors and accessories for communication and signalling.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Dispositifs RF et à micro-ondes passifs, mesure du niveau d'intermodulation - Partie 4: Mesure de l'intermodulation passive dans les câbles coaxiaux (CEI 62037-4:2012)

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Foreword

The text of document 46/418/FDIS, future edition 1 of IEC 62037-4, prepared by IEC TC 46 "Cables, wires, waveguides, R.F. connectors, R.F. and microwave passive components and accessories" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62037-4:2012.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2013-05-28
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2015-08-28

This document supersedes EN 62037:1999 (PART).

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Endorsement notice

The text of the International Standard IEC 62037-4:2012 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 62037-1	-	Passive RF and microwave devices, intermodulation level measurement - Part 1: General requirements and measuring methods	EN 62037-1	-
IEC 62037-3	-	Passive RF and microwave devices, intermodulation level measurement - Part 3: Measurement of passive intermodulation in coaxial connectors	EN 62037-3	-

CONTENTS

PASSIVE RF AND MICROWAVE DEVICES, INTERMODULATION LEVEL MEASUREMENT –

Part 4: Measurement of passive intermodulation in coaxial cables

1 Scope

This part of IEC 62037 defines test fixtures and procedures recommended for measuring levels of passive intermodulation generated by coaxial cables. Two dynamic test methods and a static test method are defined.

All coaxial cables are subjected to the static and clamped cable loop dynamic test.

Cables classified as flexible or semi-flexible are additionally subjected to the flexing tool dynamic test.

2 Normative references

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

IEC 62037-1, *Passive r.f. and microwave devices, intermodulation level measurement – Part 1: General requirements and measuring methods*

IEC 62037-3, *Passive r.f. and microwave devices, intermodulation level measurement – Part 3: Measurement or passive intermodulation in coaxial connectors*

3 Abbreviations

DUT Device under test

IM Intermodulation

4 Test fixtures

For the dynamic tests, appropriate test fixtures are required. For the clamped cable loop test (see 5.2), a method shall be provided for laterally moving the cable and for clamping the cable each side of the region of movement, as shown schematically in Figure 1. Design of the clamps shall be such as to firmly support the cable at the required points without causing damage to the cable by crushing or kinking.

In the moving test using the flexing tool (see 5.3), the cable is flexed by a fixture through which the cable is threaded as shown in Figure 2. General design for the fixture is shown in Figure 2, and the detailed dimensions for different cable sizes (and different specified bend radii) are listed in Table 1 and Table 2.

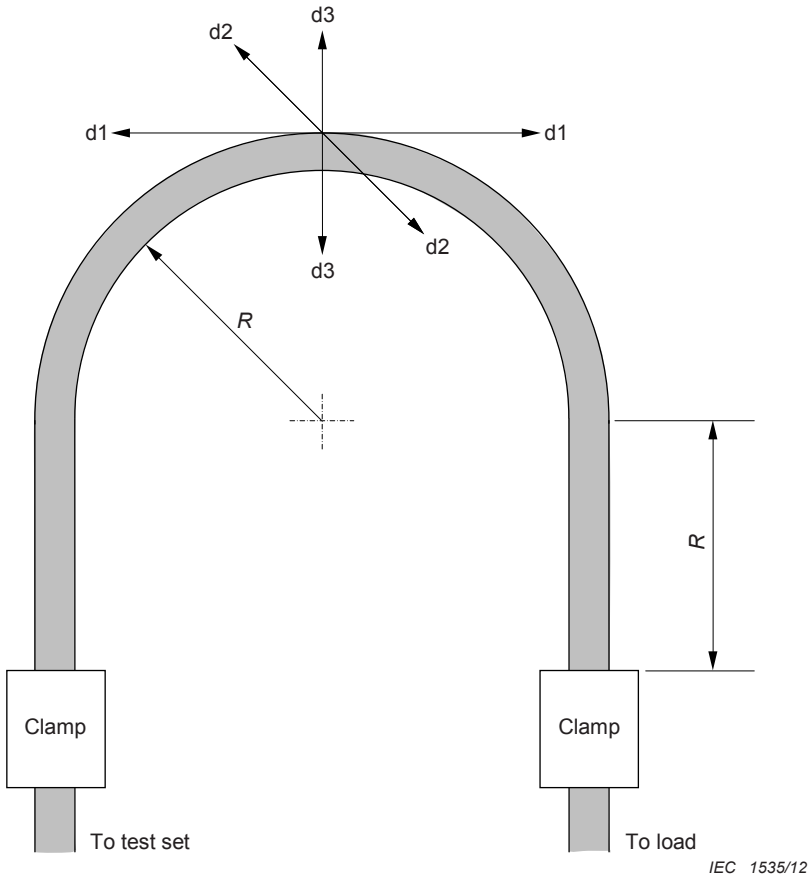

Figure 1 – Dynamic test using clamped "U" bend in cable

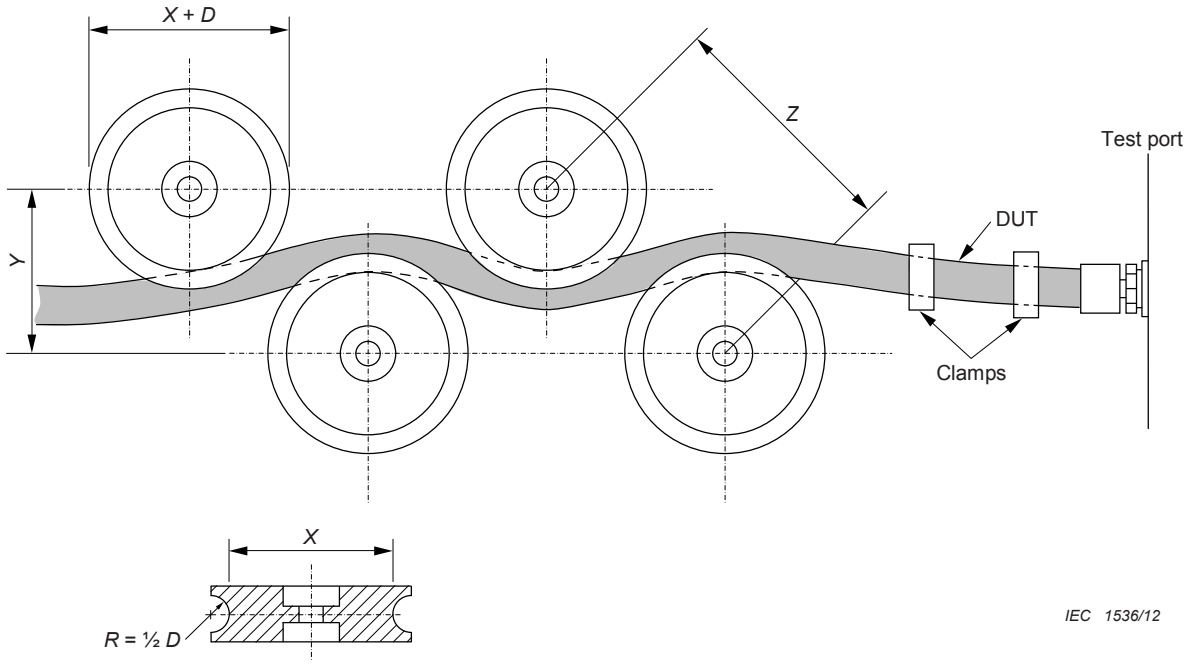

Figure 2 – Dynamic test using flexing tool

D is equal to or greater than the nominal diameter of the cable under test.

Values *X*, *Y* and *Z* depend on minimum bend radius of the cable for repeated bending.

Table 1 – Dimensions of the flexing tool

D	≥ diameter of the cable
*R*_min	Minimum bend radius of the cable for repeated bending
X	See Table 2
Y	2 × *R*_min
Z	*X* + 2,5 × cable diameter

Table 2 – Groove diameter

Minimum bending radius of cable under test	**Groove diameter *X*** mm
*R*_min ≤ 33 mm	66
33 mm < *R*_min ≤ 47 mm	94
47 mm < *R*_min ≤ 68 mm	136
68 mm < *R*_min ≤ 100 mm	200

Other values may be used if agreed upon by the customer and supplier or specified by the manufacturer.

5 Procedure

5.1 General

The test method of IEC 62037-1 shall be used.

Intermodulation in long cables is measured using the reverse set-up because of the significant attenuation of these cables. If the cable to be measured is long enough, i.e. with a one-way insertion loss of 10 dB or greater, it is required only to connectorize the end to be tested.

Use connectors with known low IM performance relative to the DUT. Soldered joints are preferred. Similarly, if a termination is required, this shall also be of known low IM performance relative to the DUT. See IEC 62037-3 for additional information.

Perform the required tests for the appropriate cable type as described in 5.2, 5.3 and 5.4.

5.2 Dynamic test procedure – Clamped cable loop

The procedure is as follows:

a) Connect the cable to be tested to the IM test set, and to the low IM termination if used (for short cables) as shown in Figure 1. Bend the cable into a "U" shape and position clamps on the limbs of the "U" as shown.

b) Adjust the radius of the "U" bend and the positions of the clamps so that dimensions "*R*" are at the minimum bend radius for the cable under test. Then firmly clamp the cable on both sides of the movement region, so that mechanical stresses resulting from cable movement are not transmitted to the test set or load connections, possibly creating high IM conditions.

c) The test described in item b) shall also be conducted on another sample, except done at the multiple bend radius. Prior to conducting the test, the cable shall be subjected to multiple bends.

d) Record the level of passive intermodulation generated in the static condition.

e) Apply movement to the cable in each of three directions, d1, d2, d3, as shown in Figure 1. The movement may be applied by hand, or by suitable mechanical means. If mechanical means is used, this shall cause no damage to the cable (e.g. by kinking or crushing) at the point of application or elsewhere.

   - The amplitude of movement in each direction for the cable size under test shall be a minimum of 20 mm.
   - The amplitude may be of a higher value if specified.

     A minimum of 3 cycles (movement in both directions) per axis shall be performed; each cycle shall be between 1 s and 5 s duration.

f) Record the maximum level of passive intermodulation generated during movement.

   NOTE If using a spectrum analyser, it is helpful to use the “max-hold” function.

g) Finally, record the level of passive intermodulation generated in the static condition after movement has ceased.

5.3 Dynamic test – Flexing tool

The procedure is as follows:

a) Thread the cable to be tested through the flexing tool, and connect the ends to the IM test set, and to the low IM termination if used (for short cables) as shown in Figure 2. Fasten clamps at the ends of the cable length, so that mechanical stresses resulting from cable movement are not transmitted to the test set or load connections, possibly creating high IM conditions.

b) Record the level of passive intermodulation generated in the static condition.

c) Move the flexing tool along the length of the cable, so that the cable is flexed along the whole test length as it passes the wheels of the tool. Care shall be taken that mechanical strains are not transmitted to the test set or the terminating load (if used). Rotate the fixture 90° about the axis of the cable length (to test the orthogonal plane) and move the flexing tool back along the length of the cable.

d) Record the maximum level of passive intermodulation generated during movement and the length of the cable that the test was performed on.

   NOTE If using a spectrum analyser, it is helpful to use the “max-hold” function to record the maximum level of passive intermodulation.

e) Finally, record the level of passive intermodulation generated in the static condition after movement has ceased.

5.4 Static test

The procedure is as follows:

a) Connect the cable to be tested to the test equipment. For large diameter feeder cables (16 mm nominal diameter and larger) with high inherent stiffness, the cable under test should be connected to the IM test equipment via a short flexible jumper cable of known and suitably low IM performance.

b) Record the level of passive intermodulation generated.

Annex A
(informative)

General test considerations

For flexible and semi flexible cables, dynamic tests involve lateral cable movement (bending and flexing), and are suitable for initial cable qualification of smaller cables (up to 16 mm in diameter), and cables designed for use in jumper applications (which may be up to 28 mm in diameter over the cable sheath). One dynamic test involves moving a clamped cable loop in different directions, and is suitable for rapidly testing stability against flexure in different planes. In the second dynamic test, the cable is flexed through a set of wheels, which allows for a greater length of cable to be tested, but just in a single plane per traverse. This test using the flexing tool is suitable for use with cables up to 18 mm in diameter.

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