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INTERNATIONAL STANDARD

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Passive RF and microwave devices, intermodulation level measurement – Part 8: Measurement of passive intermodulation generated by objects exposed to RF radiation

Dispositifs RF et à micro-ondes passifs, mesure du niveau d'intermodulation – Partie 8: Mesure de l'intermodulation passive générée par des objets exposés au rayonnement RF

IEC 62037-8:2022-11(en-fr)

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PASSIVE RF AND MICROWAVE DEVICES, INTERMODULATION LEVEL MEASUREMENT –

Part 8: Measurement of passive intermodulation generated by objects exposed to RF radiation

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The text of this International Standard is based on the following documents:

Draft	Report on voting
46/902/FDIS	46/911/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts of the IEC 62037 series, under the general title: *Passive RF and microwave devices, intermodulation level measurement*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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PASSIVE RF AND MICROWAVE DEVICES, INTERMODULATION LEVEL MEASUREMENT –

Part 8: Measurement of passive intermodulation generated by objects exposed to RF radiation

1 Scope

This part of IEC 62037 defines a radiated passive intermodulation (PIM) test to determine PIM levels generated by a device or object when it is exposed to RF radiation. This test can be conducted on any material or object and is not limited to devices designed to propagate RF signals. This test can be conducted as either a near field or far field test as defined by the test specification in an outdoor test site or in an anechoic test chamber.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 62037-1, *Passive RF and microwave devices, intermodulation level measurement – Part 1: General requirements and measuring methods*

IEC 62037-6:2021, *Passive RF and microwave devices, intermodulation level measurement – Part 6: Measurement of passive intermodulation in antennas*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.2 Abbreviated terms

AIM Active intermodulation

DUT Device under test

IM Intermodulation

PIM Passive intermodulation

4 General considerations

4.1 Test environment

When applicable, radiated PIM measurements can be accomplished outdoors. In performing such a test, it is important to ensure that government regulations pertaining to the maximum authorized RF radiation levels are met. Also, the RF energy radiated by the test antenna can generate PIM in surrounding structures other than the DUT which can couple back into the test antenna resulting in invalid PIM test results. Additionally, external sources of RF radiation can interfere with the test measurements. A survey of the frequencies and power magnitude locally in use is recommended prior to testing. External sources of PIM in the test environment can be minimized or eliminated by performing the test within an anechoic test chamber providing a low PIM test environment. More information on the construction of anechoic test chambers suitable for PIM testing is provided in IEC 62037-6:2021, 6.8.

4.2 Safety

Performing PIM tests with antenna products can be dangerous. Potentially high voltages and high levels of RF energy can be present within the test environment. The DUT should be positioned such that personnel will not be exposed to electromagnetic fields exceeding the acceptable levels specified by government agencies.

5 Test set-up

5.1 Test configurations

5.1.1 General

A typical test set-up for radiated PIM testing is shown in Figure 1. Low PIM components should be used to construct the test system and the overall cable or waveguide lengths should be minimized to deliver maximum power to the transmitting antenna. Sufficient isolation shall be provided between the transmit and receive paths to prevent active intermodulation (AIM) within the test system receiver.

A second set-up for radiated PIM testing is shown in Figure 2. This configuration can be used to measure IM products that are outside of the operating bandwidth of the transmitting antenna.

A third set-up for radiated PIM testing is shown in Figure 3. This configuration can be used when the residual PIM of the test antenna is higher than desired, preventing accurate measurement of the DUT.

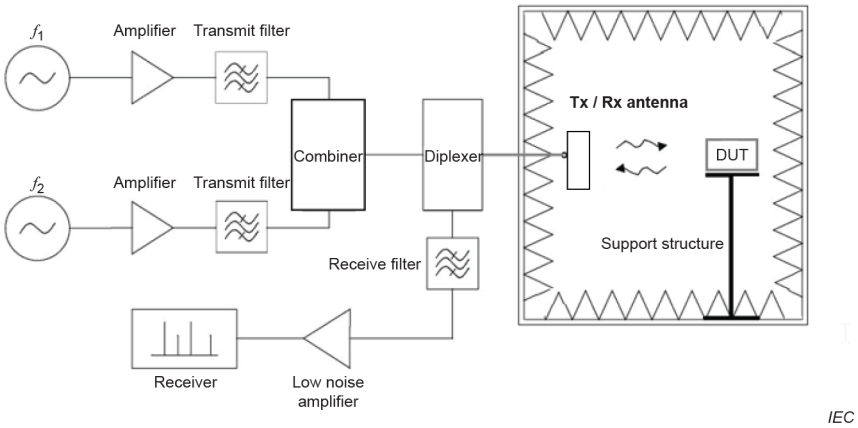

Figure 1 – Radiated PIM test set-up, single antenna, single band

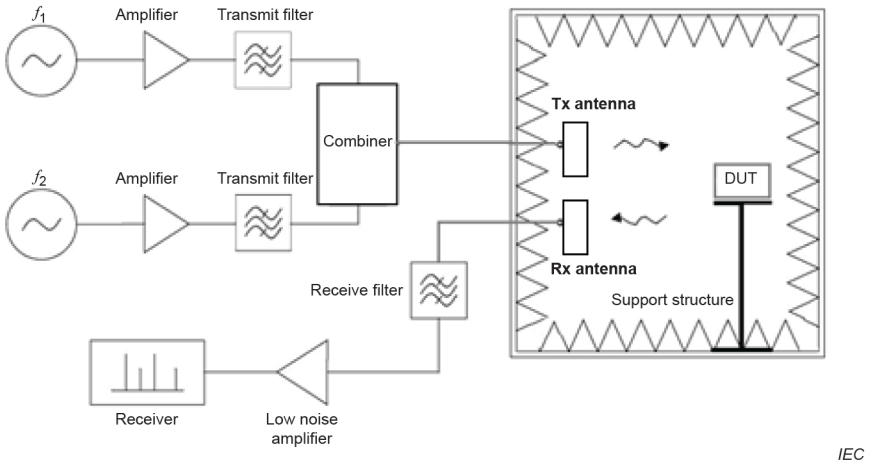

Figure 2 – Radiated PIM test set-up, dual antenna, dual band

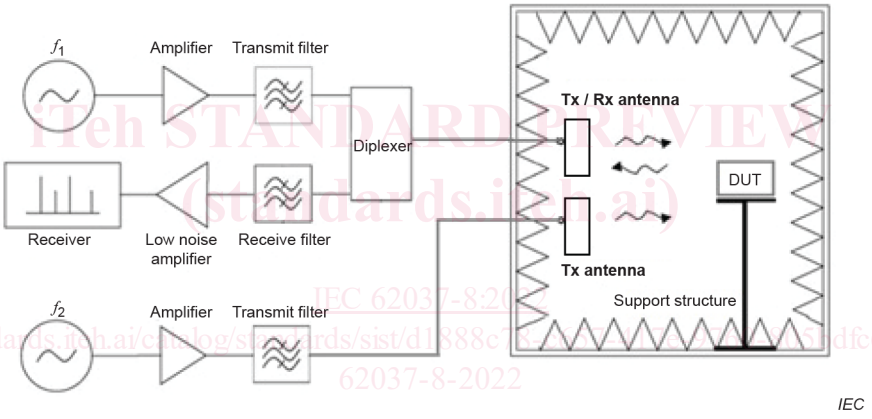

Figure 3 – Radiated PIM test set-up, dual antenna, single band

5.1.2 Antenna type

The transmit and receive antenna(s) will be directional panel or horn type antennas.

5.1.3 Antenna directivity

The transmit and receive antenna directivity will be 10,25 dBi ± 3,0 dBi at the f_1, f_2 and IM product test frequencies, where directivity is calculated using the formula:

$$\text{Directivity} = 4\ 1253 / (BW_A \times BW_E)$$

where

BW_A is the half power azimuth beam width of test antenna;

BW_E is the half power elevation beam width of test antenna.

5.1.4 Antenna VSWR

The transmit and receive antenna VSWR (voltage standing wave ratio) shall be < 1,92:1 (10 dB return loss) at the f_1, f_2 and IM product test frequencies when measured in the test environment excluding the DUT and DUT support structure (if required).

5.1.5 Antenna polarization

The transmit and receive antennas shall be linearly polarized. If separate transmit and receive antennas are used, the two antennas will be co-polarized while measuring PIM.

5.1.6 DUT location

5.1.6.1 DUT distance from transmit antenna

5.1.6.1.1 General

Radiated PIM tests can be conducted in either the near field or the far field region of the test system transmit antenna. Distance is defined as the shortest direct path between the front face of the transmit antenna and the closest point on the DUT. Unless otherwise specified, the following test distances will be used for far field and near field tests.

5.1.6.1.2 Far field test

Far field tests will be conducted within a distance range of $2 \times D^2/\lambda \pm 0{,}25 \times \lambda$, where λ is the lowest f_1 or f_2 test frequency wavelength and D is the largest linear dimension of the transmit antenna.

5.1.6.1.3 Near field test

Near field tests will be conducted at a distance of $1 \times \lambda \pm 0{,}1 \times \lambda$, where λ is the lowest f_1 or f_2 test frequency wavelength.

5.1.6.2 DUT location within the antenna beam

The center of the DUT will be positioned at the center of the transmit antenna's main beam with no part of the DUT extending outside of the transmit antenna's half-power azimuth or elevation beam widths, as shown in Figure 4. If the DUT is too large to meet this requirement, it is acceptable to move the DUT and repeat the test until all areas of the DUT have been exposed to the required level of RF energy. It is acceptable to move the DUT while PIM testing to meet this requirement if human safety is not at risk.

Maximum test zone width = $D_{MIN} + 2 \times S \times \text{Tan}\ (BW_A/2)$

where

D_{MIN} is the test antenna width or height, whichever is smaller;

S is the separation between antenna and DUT;

BW_A is the half power azimuth beam width of test antenna.

Maximum test zone height = $D_{MIN} + 2 \times S \times \text{Tan}\ (BW_E/2)$

where

D_{MIN} is the test antenna width or height, whichever is smaller;

S is the separation between antenna and DUT;

BW_E is the half power elevation beam width of test antenna.

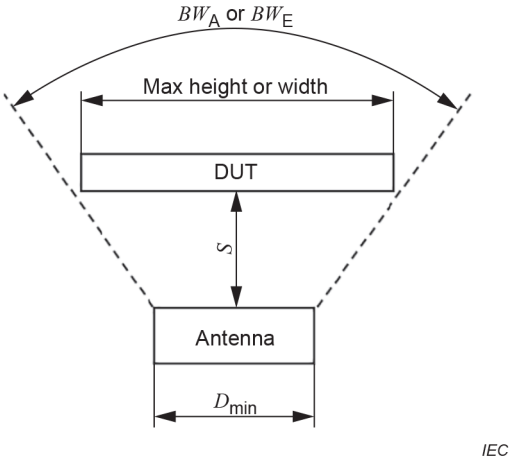

Figure 4 – Test zone definition

5.1.7 DUT orientation

During the radiated PIM test, devices/objects should be positioned in front of the test antenna in an orientation that simulates how they would normally be oriented in the field.

5.1.7.1 DUT surfaces to radiate

5.1.7.1.1 Flat objects

Flat objects/devices are those whose vertical and horizontal aspect ratios (h/t and w/t) are >10 as shown in Figure 5. The radiated PIM test will be conducted on the front and rear surfaces (DUT rotated 180°) only for flat objects/devices.

w / t > 10
and
h / t > 10

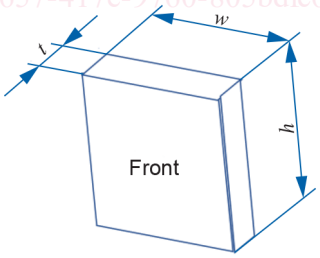

Figure 5 – Flat object definition

5.1.7.1.2 Non-flat objects

For non-flat objects/devices, the radiated PIM test will be conducted on the front surface, left surface (DUT rotated 90°), right surface (DUT rotated −90°) and rear surface (DUT rotated 180°). Unless otherwise specified, top and bottom surfaces will not be tested.

5.1.7.2 DUT orientation relative to antenna polarization

Radiated PIM tests will be conducted at two orthogonal polarizations for each DUT surface tested. This can be accomplished by rotating the transmit and receive antenna(s) by 90°, by radiating the DUT with orthogonal polarization ports of a dual polarized antenna, or by rotating the DUT by 90° as shown in Figure 6. It is acceptable to rotate the DUT while testing to meet this requirement.