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Interested committees:

Title: BS EN 62037-7 Ed.2.0 Draft Passive RF and microwave devices, intermodulation level measurement. Part 7: Field measurements of passive intermodulation.

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



46/1053/CD

COMMITTEE DRAFT (CD)

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CLOSING DATE FOR COMMENTS:

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46/974/RR

IEC TC 46 : CABLES, WIRES, WAVEGUIDES, RF CONNECTORS, RF AND MICROWAVE PASSIVE COMPONENTS AND ACCESSORIES

SECRETARIAT:

United States of America

SECRETARY:

Mr David Hess

OF INTEREST TO THE FOLLOWING COMMITTEES:

SC 46A, SC 46F

HORIZONTAL FUNCTION(S):

ASPECTS CONCERNED:

Electromagnetic Compatibility

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Recipients of this document are invited to submit, with their comments, notification of any local regulations or technical reasons that may exist and should be considered should this proposal proceed, recognizing that failure to address such requirements could result in the need for new or existing "In Some Countries" clauses. (See [AC/22/2007](#) or [NEW GUIDANCE DOC](#)).

TITLE:

Passive RF and microwave devices, intermodulation level measurement – Part 7: Field measurements of passive intermodulation

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PASSIVE RF AND MICROWAVE DEVICES, INTERMODULATION LEVEL MEASUREMENT –

Part 7: Field measurements of passive intermodulation

FOREWORD

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IEC 62037-7 has been prepared by IEC technical committee 46: Cables, wires, waveguides, RF connectors, RF and microwave passive components and accessories. It is an International Standard.

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

Draft	Report on voting
46/903/FDIS	46/912/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

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

PASSIVE RF AND MICROWAVE DEVICES, INTERMODULATION LEVEL MEASUREMENT –

Part 7: Field measurements of passive intermodulation

1 Scope

This part of IEC 62037 defines test methods for reverse measurement of passive intermodulation (PIM) in systems of RF components deployed in the field. Field PIM measurements can be conducted on RF systems terminated into low PIM loads or on antenna feed systems that broadcast the test signals into the environment.

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 62037-1:2021, *Passive RF and microwave devices, intermodulation level measurement – Part 1: General requirements and measuring methods*

IEC 62037-2:2021, *Passive RF and microwave devices, intermodulation level measurement – Part 2: Measurement of passive intermodulation in coaxial cable assemblies*

IEC 62037-3:2021, *Passive RF and microwave devices, intermodulation level measurement – Part 3: Measurement of passive intermodulation in coaxial connectors*

IEC 62037-5:2021, *Passive RF and microwave devices, intermodulation level measurement – Part 5: Measurement of passive intermodulation in filters*

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

DAS	Distributed antenna system
DTP	Distance to PIM
DUT	Device under test
IM	Intermodulation
MIMO	Multiple input multiple output
PIM	Passive intermodulation
RF	Radio Frequency
TMA	Tower mounted amplifier
VSWR	Voltage standing wave ratio

4 General considerations

4.1 Test environment

When a field PIM measurement is conducted on an antenna feed system that allows the test signals to broadcast into the environment, it is important to ensure that government regulations pertaining to the maximum authorized RF radiation levels are met. This applies to all fixed frequency PIM tests, swept PIM tests and distance-to-PIM (DTP) tests described in this document. See Annex A for information on distance-to-PIM measurements.

Field PIM measurements conducted on antenna feed systems measure the linearity of the entire RF path including the site RF infrastructure (coaxial cables, filters, antennas, etc.) and the environment where the antenna is installed (mounting hardware, cable support brackets, metal objects in front of or in the vicinity of the antenna). Technicians performing field PIM tests through an antenna shall avoid placing objects with non-linear PIM behaviour such as keys, cell phones, ladders and tools in locations in front of or in the vicinity of the antenna that might impact results.

4.2 Test frequencies

The f_1 , f_2 and IM product frequency selected for testing a RF path shall fall within the operating bandwidth of the path under test. The f_1 and f_2 test frequencies shall be able to pass through the entire system and the IM product frequency being measured shall be able to return to the PIM analyzer for measurement. If devices are present in the RF path that block the f_1 and/or f_2 test frequency or prevent the desired IM product frequency from returning to the PIM analyzer, bypass these devices with short, low PIM jumper cables while testing. See Annex B for test frequency suggestions for inbuilding distributed antenna system (DAS) testing.

The f_1 and f_2 test signals shall be spaced far enough apart in frequency to place the IM product being measured in the receive band of the PIM analyzer. To meet this requirement, one or both test signals will likely be outside of the spectrum owned by the operator commissioning the test. While it is unlikely that PIM test signals will cause harmful interference to other operators, it is good practice to select f_1 and f_2 test frequencies that fall in the guard bands between operators.

When PIM testing through an antenna, interfering signals can be received from user equipment operating at the IM product frequency. A survey of frequencies locally in use should be conducted prior to testing. If interfering signals are detected, change the f_1 and/or f_2 test frequency to move

the IM product frequency to unused spectrum, such as a guard band frequency between active channels.

Figures 1 and 2 demonstrate the concept of adjusting the f_1 and/or f_2 test frequencies to intentionally place the IM3 frequency being measured into a guard band frequency between operators. The f_1 and f_2 test frequencies shown in Figure 1 generate an IM3 frequency that falls in operator 2's uplink. User equipment transmitting in operator 2's spectrum will interfere with PIM measurements made using these test frequencies. This interference can be eliminated by changing the f_2 test frequency as shown in Figure 2 to move the IM3 frequency to the guard band frequency between operator 1 and operator 2.

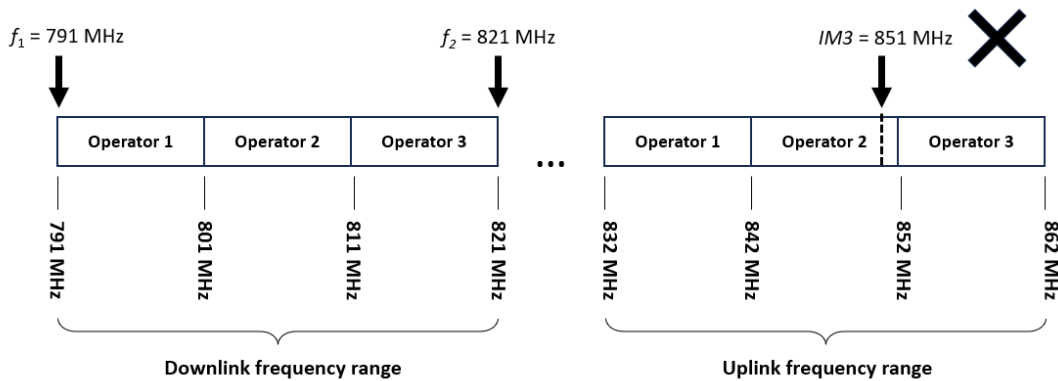


Figure 1 – Example of poor test frequency selection

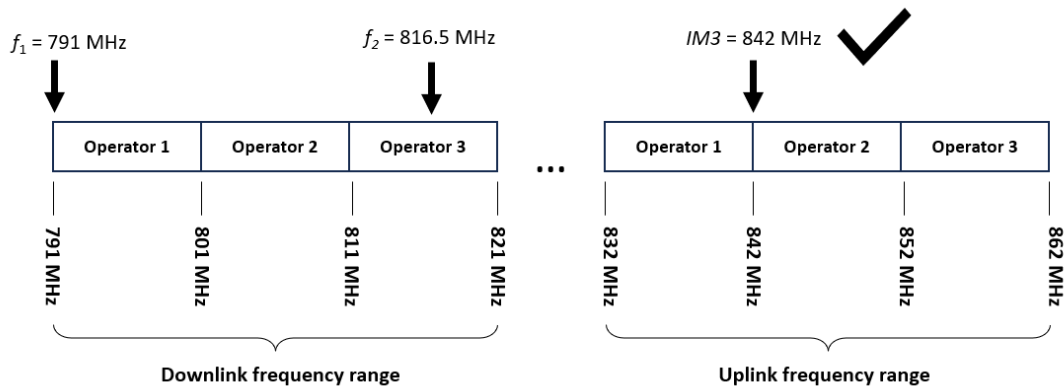


Figure 2 – Example of good test frequency selection

93

94 **4.3 Safety**

95 Performing field PIM tests through antennas can be dangerous. Potentially high voltages and
 96 high levels of RF energy can be present near the antenna. Technicians performing field PIM tests
 97 shall remain at a safe distance from the antenna and minimize exposure to electromagnetic fields
 98 in order to not exceed the acceptable levels specified by government agencies.

99 PIM tests require technicians to disconnect the coaxial cables at the radio output ports. Make
 100 sure that all radios feeding the line under test are locked-off and non-transmitting to prevent RF
 101 burns.

102 **5 Field PIM test equipment**

103 PIM test equipment used for field measurements shall be capable of performing a reverse
 104 (reflected) PIM test in accordance with IEC 62037-1:2021, 6.2.2. Field PIM test equipment will
 105 experience shock and vibration during transportation to a site and during use. In addition, field
 106 test equipment will often be used in outdoor, uncontrolled thermal environments. For these
 107 reasons, field PIM test equipment shall be ruggedized to perform reliably under typical test
 108 conditions.

109 **6 Test procedure**110 **6.1 General**

111 Unless otherwise specified, test tones from the PIM analyzer will be injected into the system
 112 under test through the same connector that transmit signals enter the system from the radio.
 113 When multiple radio ports are present, each RF path shall be tested.

114 **6.2 Equipment verification**115 **6.2.1 General**

116 Because field PIM test equipment can be exposed to mechanical and thermal stress between
 117 tests, it is important to verify before testing that the equipment is in good operating condition. In
 118 addition to good operating condition verification, the following verification steps can be performed
 119 as needed while testing to rule out equipment issues when unexpected results are encountered.

120 **6.2.2 Clean and inspect RF connections**

121 Clean and inspect all RF connectors in the test set-up using isopropyl alcohol and a lint-free
 122 wipe prior to beginning verification tests. Mating surfaces inside the RF connectors should be
 123 clean and free of oils, dirt or objects that will increase contact resistance. In addition, all metal
 124 flakes shall be removed from inside the RF connector. Replace any worn or damaged
 125 components found during visual inspection.

126 **6.2.3 Residual PIM test**

127 Measure the residual PIM of the test set-up including the PIM analyzer and any coaxial cables
 128 and RF adapters used to connect the PIM analyzer to the system under test. Connect one end of
 129 the coaxial cable test lead to the PIM analyzer and the other end to a low PIM termination. Flex
 130 the test cable while measuring the test set-up. The test set-up maximum self-intermodulation