



**Recommendation ITU-R M.1545**  
(08/2001)

**Measurement uncertainty as it applies  
to test limits for the terrestrial  
component of International Mobile  
Telecommunications-2000**

**M Series**  
**Mobile, radiodetermination, amateur  
and related satellite services**

## Foreword

The role of the Radiocommunication Sector is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including satellite services, and carry out studies without limit of frequency range on the basis of which Recommendations are adopted.

The regulatory and policy functions of the Radiocommunication Sector are performed by World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by Study Groups.

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### Series of ITU-R Recommendations

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Series	Title
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<b>BR</b>	Recording for production, archival and play-out; film for television
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<b>BT</b>	Broadcasting service (television)
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<b>M</b>	<b>Mobile, radiodetermination, amateur and related satellite services</b>
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<b>S</b>	Fixed-satellite service
<b>SA</b>	Space applications and meteorology
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<b>SM</b>	Spectrum management
<b>SNG</b>	Satellite news gathering
<b>TF</b>	Time signals and frequency standards emissions
<b>V</b>	Vocabulary and related subjects

*Note: This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.*

*Electronic Publication*  
Geneva, 2011

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## RECOMMENDATION ITU-R M.1545\*, \*\*

**Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000**

(Question ITU-R 229/8)

(2001)

**Scope**

This Recommendation describes the application of measurement uncertainty to test limits when devices for terrestrial component of IMT-2000 are tested for conformance. Consistent with industry practice, it is recommended that the shared risk principle should be used for all tests and that any relaxation of core specification limits should be evaluated on a case-by-case basis.

The ITU Radiocommunication Assembly,

*considering*

- a) that Recommendation ITU-R M.1457 addresses the detailed specifications of the radio interface of International Mobile Telecommunications-2000 (IMT-2000);
- b) that it is reasonable to allow in practice some measurement uncertainty in the measurement method, measurement equipment and measurement test bench when the device is to be tested from a regulatory viewpoint;
- c) that a device that is manufactured in one country and passes a conformance test based on regulation of that country may not be well accepted by the regulator of another country, not due to actual inadequacy of the equipment but because of difference in the concepts employed for handling measurement uncertainty;
- d) that it is essentially important to achieve a common global understanding of how measurement uncertainty is applied when test limits are defined, in conjunction with how that is incorporated into pertinent specifications;
- e) that from a technical perspective, in a case that the measurement uncertainty can be reasonably defined, the following three methods lead to the same result:
  - “Never fail a good device under test (DUT)” principle applied to a test limit equals to the core specification value, where core specification value and measurement uncertainty are separately defined (see Annex 1, Fig. 1);
  - “Shared risk” principle applied to a test limit calculated by relaxing the core specification value by measurement uncertainty, where core specification value and measurement uncertainty are separately defined (see Annex 1, Fig. 2);
  - “Shared risk” principle applied to a test limit which equals the core specification value that includes measurement uncertainty (see Annex 1, Fig. 3),

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\* This Recommendation should be brought to the attention of Radiocommunication Study Group 1.

\*\* Radiocommunication Study Group 5 made editorial amendments to this Recommendation in November 2010.

*recommends*

- 1 that maximum allowable measurement uncertainty as it applies to test limits should be defined as a unique and consistent value associated with one or a combination of measurement methods and measurement equipment to be used, when the device for terrestrial component of IMT-2000 is to be tested for conformance;
- 2 that in order to be consistent with industry practice, the shared risk principle should be used for all tests and that it may be decided to relax the core specification value by a certain relaxation value that should be evaluated on a case-per-case basis taking into account different factors such as test system measurement uncertainty (test equipment uncertainty, mismatch, and so on), and criticality for system performance;
- 3 that it should be clearly indicated where the relaxation value is specified;
- 4 that in case the measurement uncertainty cannot be reasonably and clearly defined, the “shared risk” principle should be applied to core specification value without any relaxation.

NOTE 1 – Definitions applicable to this Recommendation:

*Measurement uncertainty*: error in measurement associated with one or a combination of measurement methods and measurement equipment to be used when the device is to be tested for conformance.

*Core specification value*: value defined in the core specification.

*Test limit*: threshold considered in a test to assess compliance of the device; it might be equal, relaxed or tightened compared to the corresponding core specification value.

*“Never fail a good DUT” principle*: measurement results are compared with test limits tolerating failures up to the measurement uncertainty (i.e. the DUT is considered to pass if the measurement result is within the test limits + tolerance up to measurement uncertainties).

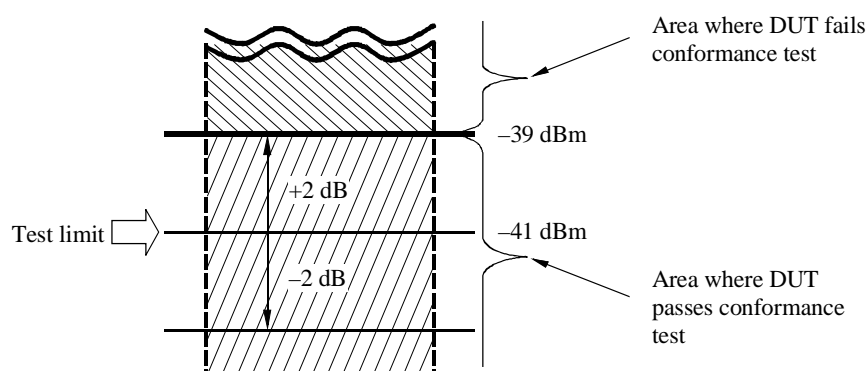
*“Shared risk” principle*: measurement results are compared with test limits (i.e. the DUT is considered to pass if the measurement result is within the test limits).

ANNEX 1<sup>1</sup>

## Examples of two criteria using “never fail a good DUT” and “shared risk” principles

FIGURE 1

“Never fail a good DUT” principle where core specification value and measurement uncertainty are separately defined



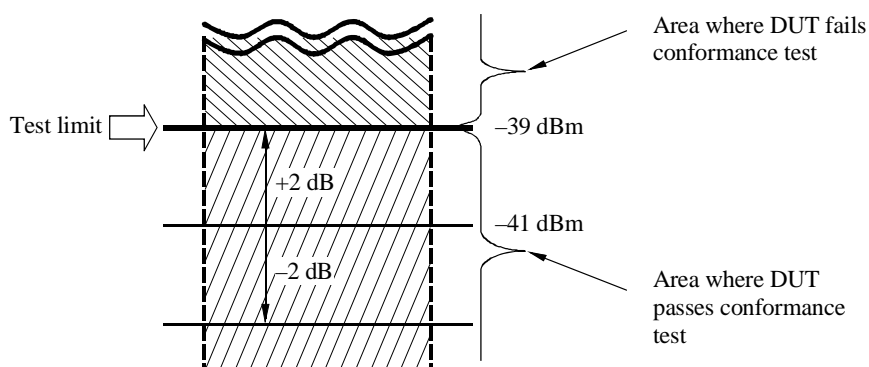
Example:

- Core specification: no greater than  $-41$  dBm
- Measurement uncertainty:  $\pm 2$  dB

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FIGURE 2

Application of “shared risk” principle where test limit is calculated by relaxing the core specification value by measurement uncertainty (when core specification value and measurement uncertainty are separately defined)



Example:

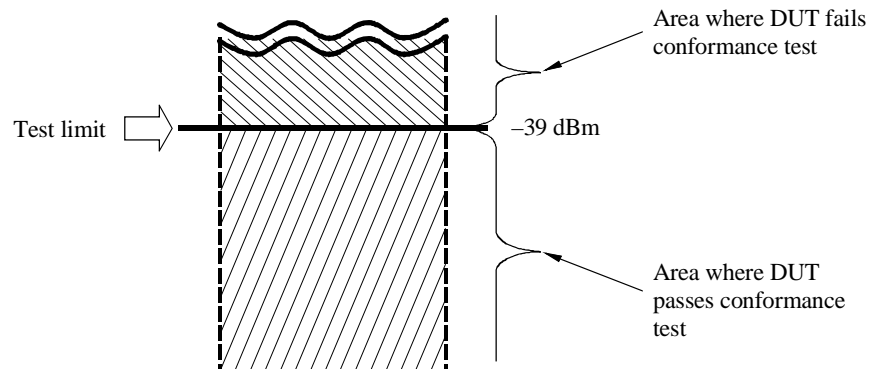
- Core specification: no greater than  $-41$  dBm
- Measurement uncertainty:  $\pm 2$  dB

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<sup>1</sup> The confidence level is not considered in this Recommendation.

FIGURE 3

Application of “shared risk” principle where the test limit is the core specification value that includes measurement uncertainty



Example:

- Core specification: (including measurement uncertainty of  $\pm 2$  dB): no greater than -39 dBm