



TECHNICAL REPORT

**LTE;  
Evolved Universal Terrestrial Radio Access (E-UTRA) and  
Evolved Universal Terrestrial  
Radio Access Network (E-UTRAN);  
Derivation of test tolerances for User Equipment (UE)  
radio reception conformance tests  
(3GPP TR 36.904 version 19.0.0 Release 19)**



---

**Reference**

RTR/TSGR-0536904vj00

---

**Keywords**

LTE

**ETSI**

---

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° w061004871

---

**Important notice**

The present document can be downloaded from the  
[ETSI Search & Browse Standards](#) application.

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format on [ETSI deliver](#) repository.

Users should be aware that the present document may be revised or have its status changed,  
this information is available in the [Milestones listing](#).

If you find errors in the present document, please send your comments to  
the relevant service listed under [Committee Support Staff](#).

If you find a security vulnerability in the present document, please report it through our  
[Coordinated Vulnerability Disclosure \(CVD\)](#) program.

---

**Notice of disclaimer & limitation of liability**

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

---

**Copyright Notification**

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2026.  
All rights reserved.

---

# Intellectual Property Rights

## Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the [ETSI IPR online database](#).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

## Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

**DECT™**, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™**, **LTE™** and **5G™** logo are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM®** and the GSM logo are trademarks registered and owned by the GSM Association.

---

# Legal Notice

This Technical Report (TR) has been produced by ETSI 3rd Generation Partnership Project (3GPP).

The present document may refer to technical specifications or reports using their 3GPP identities. These shall be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between 3GPP and ETSI identities can be found at [3GPP to ETSI numbering cross-referencing](#).

---

# Modal verbs terminology

In the present document "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

# Contents

|   |           |
|---|-----------|
| Intellectual Property Rights .....  | 2         |
| Legal Notice .....  | 2         |
| Modal verbs terminology.....  | 2         |
| Foreword.....   | 4         |
| Introduction .....  | 4         |
| 1 Scope .....   | 5         |
| 2 References .....  | 5         |
| 3 Definitions, symbols and abbreviations .....                                      | 5         |
| 3.1 Definitions .....   | 5         |
| 3.2 Symbols.....  | 6         |
| 3.3 Abbreviations .....   | 6         |
| 4 General Principles .....  | 6         |
| 4.1 Principle of Superposition .....  | 6         |
| 4.2 Sensitivity analysis .....  | 6         |
| 4.3 Statistical combination of uncertainties.....                                   | 6         |
| 4.4 Correlation between uncertainties .....   | 7         |
| 4.4.1 Uncorrelated uncertainties .....  | 7         |
| 4.4.2 Positively correlated uncertainties .....                                     | 8         |
| 4.4.3 Negatively correlated uncertainties.....                                      | 8         |
| 4.4.4 Treatment of uncorrelated uncertainties .....                                 | 9         |
| 4.4.5 Treatment of positively correlated uncertainties with adverse effect.....     | 9         |
| 4.4.6 Treatment of positively correlated uncertainties with beneficial effect ..... | 9         |
| 4.4.7 Treatment of negatively correlated uncertainties .....                        | 9         |
| 5 Grouping of test cases defined in TS 36.521-1 .....                               | 10        |
| 5A Grouping of test cases defined in TS 36.521-4 .....                              | 11        |
| 6 Determination of Test System Uncertainties.....                                   | 11        |
| 6.1 General .....   | 11        |
| 6.2 Uncertainty figures .....   | 11        |
| 7 Determination of Test Tolerances .....  | 12        |
| 7.1 General .....   | 12        |
| <b>Annex A: Derivation documents.....</b>   | <b>13</b> |
| <b>Annex B: Change History .....</b>  | <b>14</b> |
| History .....   | 18        |

---

# Foreword

This Technical Report has been produced by the 3<sup>rd</sup> Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

---

# Introduction

---

# 1 Scope

The present document specifies a general method used to derive Test Tolerances for UE radio reception conformance tests in 3GPP TS 36.521-1 [2] and TS 36.521-4 [4] and establishes a system for relating the Test Tolerances to the measurement uncertainties of the Test System.

The test cases which have been analysed to determine Test Tolerances are included as .zip files.

The present document is applicable from Release 10 up to the release indicated on the front page of the present Terminal conformance specifications.

---

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 36.521-1: "User Equipment (UE) conformance specification, Radio transmission and reception Part 1: conformance testing".
- [3] ETSI ETR 273-1-2: "Improvement of radiated methods of measurement (using test sites) and evaluation of the corresponding measurement uncertainties; Part 1: Uncertainties in the measurement of mobile radio equipment characteristics; Sub-part 2: Examples and annexes".
- [4] 3GPP TS 36.521-4: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 4: Satellite access Radio Frequency (RF) and performance Conformance Testing".

---

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

Other definitions used in the present document are listed in 3GPP TS 36.521-1 [2].

## 3.2 Symbols

Symbols used in the present document are listed in 3GPP TR 21.905 [1], 3GPP TS 36.521-1 [2].

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

Other abbreviations used in the present document are listed in 3GPP TS 36.521-1 [2].

---

# 4 General Principles

## 4.1 Principle of Superposition

For multi-cell tests there are several cells each generating various Physical channels. In general cells are combined along with AWGN, so the signal and noise seen by the UE may be determined by more than one cell.

Since several cells may contribute towards the overall power applied to the UE, a number of test system uncertainties affect the signal and noise seen by the UE. The aim of the superposition method is to vary each controllable parameter of the test system separately, and to establish its effect on the critical parameters as seen by the UE receiver. The superposition principle then allows the effect of each test system uncertainty to be added, to calculate the overall effect.

The contributing test system uncertainties shall form a minimum set for the superposition principle to be applicable.

## 4.2 Sensitivity analysis

A change in any one channel level or channel ratio generated at source does not necessarily have a 1:1 effect at the UE. The effect of each controllable parameter of the test system on the critical parameters as seen by the UE receiver shall therefore be established. As a consequence of the sensitivity scaling factors not necessarily being unity, the test system uncertainties cannot be directly applied as test tolerances to the critical parameters as seen by the UE.

**EXAMPLE:** In many of the tests described, the  $\hat{E}_s / I_{ot}$  is one of the critical parameters at the UE. Scaling factors are used to model the sensitivity of the  $\hat{E}_s / I_{ot}$  to each test system uncertainty. When the scaling factors have been determined, the superposition principle then allows the effect of each test system uncertainty to be added, to give the overall variability in the critical parameters as seen at the UE.

There are often constraints on several parameters at the UE. The aim of the sensitivity analysis, together with the acceptable test system uncertainties, is to ensure that the variability in each of these parameters is controlled within the limits necessary for the specification to apply. The test has then been conducted under valid conditions.

## 4.3 Statistical combination of uncertainties

The acceptable uncertainties of the test system are specified as the measurement uncertainty tolerance interval for a specific measurement that contains 95% of the performance of a population of test equipment, in accordance with 3GPP TS 36.521-1 [2] clause F.1. In the UE radio reception conformance tests covered by the present document, the Test System shall enable the stimulus signals in the test case to be adjusted to within the specified range, with an uncertainty not exceeding the specified values.

The method given in the present document combines the acceptable uncertainties of the test system, to give the overall variability in the critical parameters as seen at the UE. Since the process does not add any new uncertainties, the method of combination should be chosen to maintain the same tolerance interval for the combined uncertainty as is already specified for the contributing test system uncertainties.

The basic principle for combining uncertainties is in accordance with ETR 273-1-2 [3]. In summary, the process requires 3 steps:

- a) Express the value of each contributing uncertainty as a one standard deviation figure, from knowledge of its numeric value and its distribution.
- b) Combine all the one standard deviation figures as root-sum-squares, to give the one standard deviation value for the combined uncertainty.
- c) Expand the combined uncertainty by a coverage factor, according to the tolerance interval required.

Provided that the contributing uncertainties have already been obtained using this method, using a coverage factor of 2, further stages of combination can be achieved by performing step b) alone, since steps a) and c) simply divide by 2 and multiply by 2 respectively.

The root-sum-squares method is therefore used to maintain the same tolerance interval for the combined uncertainty as is already specified for the contributing test system uncertainties. In some cases where correlation between contributing uncertainties has an adverse effect, the method is modified in accordance with clause 4.4.5 of the present document.

In each analysis, the uncertainties are assumed to be uncorrelated, and are added result root-sum-square unless otherwise stated.

The combination of uncertainties is performed using dB values for simplicity. It has been shown that using dB uncertainty values gives a slightly worse combined uncertainty result than using linear values for the uncertainties. The analysis method therefore errs on the safe side.

## 4.4 Correlation between uncertainties

The statistical (root-sum-square) addition of uncertainties is based on the assumption that the uncertainties are independent of each other. For realisable test systems, the uncertainties may not be fully independent. The validity of the method used to add uncertainties depends on both the type of correlation and on the way in which the uncertainties affect the test requirements.

Clauses 4.4.1 to 4.4.3 give examples to illustrate different types of correlation.

Clauses 4.4.4 to 4.4.7 show how the scenarios applicable to multi-cell RRM tests are treated.

### 4.4.1 Uncorrelated uncertainties

The graph shows an example of two test system uncertainties, A and B, which affect a test requirement. Each sample from a population of test systems has a specific value of error in parameter A, and a specific value of error in parameter B. Each dot on the graph represents a sample from a population of test systems, and is plotted according to its error values for parameters A and B.

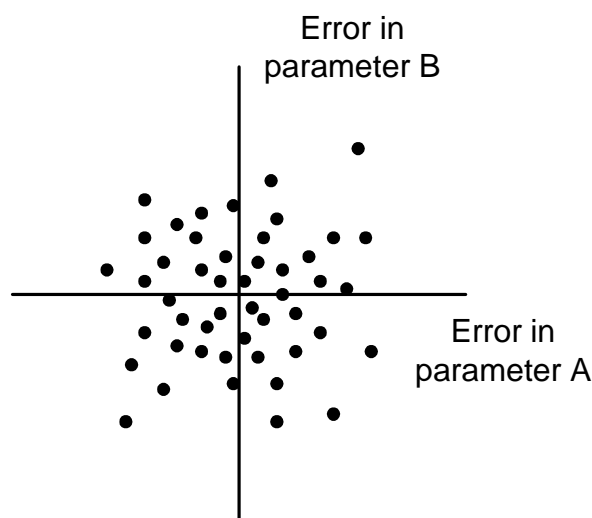
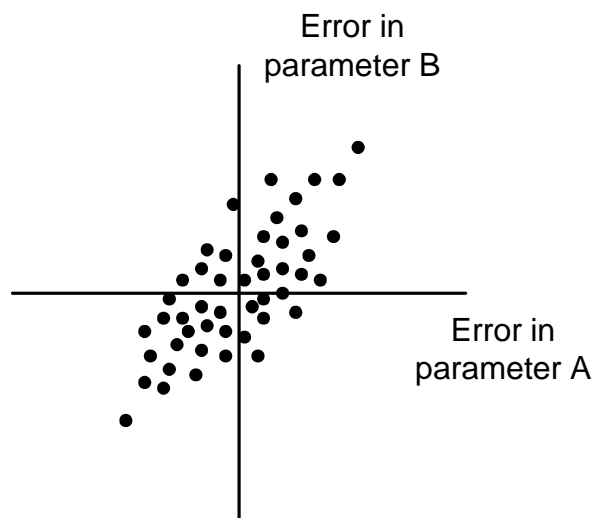


Figure 4.4.1.1: Example of two test system uncertainties affecting a test requirement

It can be seen that a positive value of error in parameter A, for example, is equally likely to occur with either a positive or a negative value of error in parameter B. This is expected when two parameters are uncorrelated, such as two uncertainties which arise from different and unrelated parts of the test system.

#### 4.4.2 Positively correlated uncertainties

The graph shows an example of two test system uncertainties, A and B, which affect a test requirement. Each sample from a population of test systems has a specific value of error in parameter A, and a specific value of error in parameter B. Each dot on the graph represents a sample from a population of test systems, and is plotted according to its error values for parameters A and B.



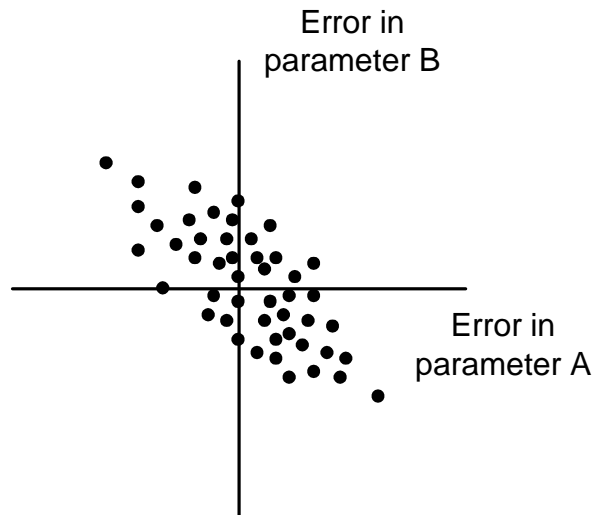
**Figure 4.4.2-1: Example of two test system uncertainties affecting a test requirement**

It can be seen that a positive value of error in parameter A, for example, is more likely to occur with a positive value of error in parameter B and less likely to occur with a negative value of error in parameter B. This can occur when the two uncertainties arise from similar parts of the test system, or when one component of the uncertainty affects both parameters in a similar way.

In an extreme case, if the error in parameter A and the error in parameter B came from the same sources of uncertainty, and no others, the dots would lie on a straight line of slope +1.

#### 4.4.3 Negatively correlated uncertainties

The graph shows an example of two test system uncertainties, A and B, which affect a test condition. Each sample from a population of test systems has a specific value of error in parameter A, and a specific value of error in parameter B. Each dot on the graph represents a sample from a population of test systems, and is plotted according to its error values for parameters A and B.



**Figure 4.4.3-1: Example of two test system uncertainties affecting a test condition**

It can be seen that a positive value of error in parameter A, for example, is more likely to occur with a negative value of error in parameter B and less likely to occur with a positive value of error in parameter B. This effect can theoretically occur, and is included for completeness, but is unlikely in a practical test system.

#### 4.4.4 Treatment of uncorrelated uncertainties

If two uncertainties are uncorrelated, they are added statistically in the analysis. Provided that each uncertainty is already expressed as an expanded uncertainty with coverage factor 2, the contributing uncertainties are added root-sum-squares to give a combined uncertainty which also has coverage factor 2, and the 95% tolerance interval is maintained.

This is the default assumption.

#### 4.4.5 Treatment of positively correlated uncertainties with adverse effect

If two test system uncertainties are positively correlated, and if they affect the value of a critical parameter in the same direction, the combined effect may be greater than predicted by adding the contributing uncertainties root-sum-squares.

In this scenario the two uncertainties are added worst-case in the analysis. Provided that each uncertainty is already expressed as an expanded uncertainty with coverage factor 2, the combined uncertainty will cover a 95% tolerance interval even when the two contributing uncertainties are fully correlated. If the two contributing uncertainties are less than fully correlated, the combined uncertainty will cover a tolerance interval greater than 95%.

#### 4.4.6 Treatment of positively correlated uncertainties with beneficial effect

If two test system uncertainties are positively correlated, and if they affect the value of a critical parameter in opposite directions, the combined effect will be less than predicted by adding the contributing uncertainties root-sum-squares.

In this scenario the two uncertainties are added statistically in the analysis. Provided that each uncertainty is already expressed as an expanded uncertainty with coverage factor 2, the combined uncertainty will cover a 95% tolerance interval when the two contributing uncertainties are uncorrelated. If the two contributing uncertainties are positively correlated, the combined uncertainty will cover a tolerance interval greater than 95%.

#### 4.4.7 Treatment of negatively correlated uncertainties

Negatively correlated uncertainties are excluded by the assumptions. This has been agreed as an acceptable restriction on practical test systems, as the mechanisms which produce correlation generally arise from similarities between two parts of the test system, and therefore produce positive correlation.

## 5 Grouping of test cases defined in TS 36.521-1

The Test cases are grouped from the viewpoint of efficiently defining the uncertainties and test tolerances. Tests in the same group generally have the same type of uncertainties.

**Table 5-1: Test case groups for test tolerance analysis**

| Group  | E-UTRA FDD   | E-UTRA TDD   | Comments   |
|--|--|--|--|
| eICIC demodulation tests   | 8.2.1.2.3_C.1<br>8.2.1.3.3_C.1<br>8.2.1.3.3_C.2<br>8.4.1.2.3_C.1<br>8.4.1.2.3_C.2<br>8.5.1.2.3_C.1 | 8.2.2.2.3_C.1<br>8.2.2.3.3_C.1<br>8.2.2.3.3_C.2<br>8.4.2.2.3_C.1<br>8.4.2.2.3_C.2<br>8.5.2.2.3_C.1 | Two cell eICIC demodulation tests.<br>Various number of sub-tests.<br>Tests have AWGN or fading conditions.  |
| Enhanced performance requirement Type A demodulation tests       | 8.2.1.2.4<br>8.2.1.4.3<br>8.3.1.1.3  | 8.2.2.2.4<br>8.2.2.4.3<br>8.3.2.1.4  | Two or three cell enhanced performance requirement Type A demodulation tests.<br>Various number of sub-tests.<br>Tests have fading conditions.   |
| Enhanced Downlink Control Channel Performance Requirement Type A | 8.4.1.2.5<br>8.4.1.2.6<br>8.5.1.2.5<br>8.5.1.2.6<br>8.8.4.1<br>8.8.6.1                             | 8.4.2.2.5<br>8.4.2.2.6<br>8.5.2.2.5<br>8.5.2.2.6<br>8.8.4.2<br>8.8.5.1                             | Enhanced Downlink Control Channel Performance Requirement Type A<br>Test cases for PCFICH-PDCCH, PHICH & PEDPCCH<br>Tests have fading conditions   |
| Enhanced performance requirement Type A CSI reporting tests      | 9.3.5.1.1<br>9.3.5.2.1   | 9.3.5.1.2<br>9.3.5.2.2   | Two cell enhanced performance requirement Type A CSI reporting tests.<br>Various number of sub-tests.<br>Serving cell has fading condition while interfering cell have static condition. |
| feICIC demodulation tests  | 8.2.1.2.3_E.1<br>8.2.1.3.3_E.1<br>8.2.1.4.1_E.1<br>8.4.1.2.3_E.1<br>8.4.1.2.3_E.2<br>8.5.1.2.3_E.1 | 8.2.2.2.3_E.1<br>8.2.2.3.3_E.1<br>8.2.2.4.1_E.1<br>8.4.2.2.3_E.1<br>8.4.2.2.3_E.2<br>8.5.2.2.3_E.1 | Three cell feICIC demodulation tests.<br>Various number of sub-tests.<br>Tests have AWGN or fading conditions.   |
| feICIC CSI reporting tests                                       | 9.2.1.5_E.1<br>9.3.1.3.1_E.1<br>9.5.4.1_E.1  | 9.2.1.6_E.1<br>9.3.1.3.2_E.1<br>9.5.4.2_E.1  | Three cell feICIC demodulation tests.<br>Various number of sub-tests.<br>Tests have AWGN or fading conditions.   |
| Enhanced performance requirement Type C demodulation tests       | 8.2.1.3.1C   | 8.2.2.3.1C   | Two cell enhanced performance requirement Type C demodulation tests.<br>One sub-test per test case.<br>Tests have fading conditions.   |
| Enhanced performance requirement Type B demodulation tests       | 8.2.1.2.5<br>8.2.1.2.6<br>8.2.1.4.4<br>8.3.1.1.4<br>8.3.1.1.5<br>8.3.1.1.6<br>8.3.1.1.7            | 8.2.2.2.6<br>8.2.2.2.7<br>8.2.2.4.5<br>8.3.2.1.5<br>8.3.2.1.6<br>8.3.2.1.7<br>8.3.2.1.8            | Three cell enhanced performance requirement Type B demodulation tests.<br>Various number of sub-tests.<br>Tests have fading conditions.  |
| Enhanced Downlink Control Channel Performance Requirement Type B | 8.4.1.2.7<br>8.4.1.2.8<br>8.5.1.2.7<br>8.5.1.2.8   | 8.4.2.2.7<br>8.4.2.2.8<br>8.5.2.2.7<br>8.5.2.2.8   | Enhanced Downlink Control Channel Performance Requirement Type B<br>Test cases for PCFICH-PDCCH & PHICH<br>Tests have fading conditions  |
| Enhanced performance requirement Type B CSI reporting tests      | 9.3.8.1.1<br>9.3.8.2.1<br>9.3.8.3.1  | 9.3.8.1.2<br>9.3.8.2.2<br>9.3.8.3.2  | Three cell enhanced performance requirement Type B CSI reporting tests.<br>One sub-test per test case.<br>Tests have fading conditions.  |

## 5A Grouping of test cases defined in TS 36.521-4

The Test cases are grouped from the viewpoint of efficiently defining the uncertainties and test tolerances. Tests in the same group generally have the same type of uncertainties.

**Table 5A-1: Test case groups for test tolerance analysis**

| Group  | IoT-NTN FDD                         | Comments   |
|--|-------------------------------------|--|
| Performance requirement for eMTC NTN under NTN fading conditions   | 8.2.1.1.1                           | Single eMTC NTN cell performance<br>Tests have NTN fading conditions   |
| Performance requirement for NB-IoT NTN under NTN fading conditions | 8.3.1.1.1                           | Single NB-IoT NTN cell performance<br>Tests have NTN fading conditions |
| Performance requirement for NB-IoT NTN under fading conditions     | 8.3.1.1.2<br>8.3.1.1.3<br>8.3.1.2.1 | Single NB-IoT NTN cell performance<br>Tests have fading conditions     |

---

## 6 Determination of Test System Uncertainties

### 6.1 General

The uncertainty of a test system when making measurements reduces the ability of the test system to distinguish between conformant and non-conformant test subjects. The aim is therefore to minimise uncertainty, subject to a number of practical constraints:

- a) A vendor's test system should be reproducible in the required quantities.
- b) A choice of test systems should be available from different vendors.
- c) The uncertainties should allow reasonable freedom of test system implementation
- d) The test system can be run automatically
- e) The test system may include several radio access technologies
- f) It should be possible to maintain calibration of deployed test systems over reasonable spans of time and environmental conditions

In practice therefore within 3GPP the acceptable uncertainty of the test system is the smallest value that can be agreed between the test system vendors represented, consistent with the above constraints. The uncertainty will not therefore be as low as could be achieved, for example, by a national standards laboratory.

### 6.2 Uncertainty figures

The actual figures for the acceptable uncertainty of a test system are defined in Annex F of 36.521-1 [2]. To avoid maintenance issues with figures in separate specifications, the uncertainties are not formally defined within the present document.

---

## 7 Determination of Test Tolerances

### 7.1 General

The general principles given in the present document are applied to each test case, according to the applicable uncertainties and requirements to obtain a correct verdict.

The test cases which have been analysed to determine Test Tolerances are included in the present document as .zip files. The name of the zip file indicates the test cases covered.

Annex A gives the rationale for their inclusion.

---

## Annex A: Derivation documents

The documents (and spreadsheets where applicable) used to derive the test tolerances for each test case are included in the present document as zip files.

The aim is to provide a reference to completed test cases, so that test tolerances for similar test cases can be derived on a common basis. The information on test case grouping in section 5 can be used to identify similarities.

## Annex B: Change History

| Date    | TSG #  | TSG Doc.  | CR   | Rev | Subject/Comment  | Old    | New    |
|---------|--------|-----------|------|-----|--|--------|--------|
| 2014-04 | RAN#63 | R5-142065 | -    | -   | TR 36.904 Skeleton proposed for RAN#63   | -      | 0.0.1  |
| 2014-05 | RAN#63 | R5-142066 | -    | -   | TR 36.904 update proposed including all technically endorsed TT analyses on RAN#63   | 0.0.1  | 0.0.2  |
| 2014-05 | RAN#64 | RP-140610 | -    | -   | TR 36.904 presented as 2.0.0 for approval at RAN#64  | 0.0.2  | 2.0.0  |
| 2014-06 | RAN#64 | -         | -    | -   | Upgraded to v11.0.0 with no change   | 2.0.0  | 11.0.0 |
| 2014-09 | RAN#65 | R5-144067 | 0001 | -   | Add Test Tolerance analyses for TS 36.521-1 Test case 8.2.2.2.4  | 11.0.0 | 11.1.0 |
| 2014-09 | RAN#65 | R5-144069 | 0002 | -   | Add Test Tolerance analyses for TS 36.521-1 Test case 8.2.2.4.3  | 11.0.0 | 11.1.0 |
| 2014-09 | RAN#65 | R5-144071 | 0003 | -   | Add Test Tolerance analyses for TS 36.521-1 Test case 8.3.1.1.3  | 11.0.0 | 11.1.0 |
| 2014-09 | RAN#65 | R5-144073 | 0004 | -   | Add Test Tolerance analyses for TS 36.521-1 Test case 8.3.2.1.4  | 11.0.0 | 11.1.0 |
| 2014-09 | RAN#65 | R5-144078 | 0005 | -   | Add Test Tolerance analysis for TS 36.521-1 Test cases 8.2.1.3.3_E.1 and 8.2.2.3.3_E.1   | 11.0.0 | 11.1.0 |
| 2014-09 | RAN#65 | R5-144100 | 0006 | -   | Test Tolerance Analysis for TS 36.521-1 TC 8.2.1.4.1_E.1+8.2.2.4.1_E.1   | 11.0.0 | 11.1.0 |
| 2014-09 | RAN#65 | R5-144106 | 0007 | -   | Test Tolerance Analysis for TS 36.521-1 TC 8.4.1.2.3_E.2+8.4.2.2.3_E.2   | 11.0.0 | 11.1.0 |
| 2014-09 | RAN#65 | R5-144110 | 0008 | -   | Corrections to TR 36.904 for felCIC Group  | 11.0.0 | 11.1.0 |
| 2014-09 | RAN#65 | R5-144113 | 0009 | -   | Test Tolerance Analysis for TS 36.521-1 TC 9.2.1.5_E.1+9.2.1.6_E.1   | 11.0.0 | 11.1.0 |
| 2014-09 | RAN#65 | R5-144116 | 0010 | -   | Test Tolerance Analysis for TS 36.521-1 TC 9.3.1.3.1_E.1+9.3.1.3.2_E.1   | 11.0.0 | 11.1.0 |
| 2014-09 | RAN#65 | R5-144119 | 0011 | -   | Test Tolerance Analysis for TS 36.521-1 TC 9.5.4.1_E.1+9.5.4.2_E.1   | 11.0.0 | 11.1.0 |
| 2014-09 | RAN#65 | R5-144285 | 0012 | -   | Add Test Tolerance analysis for TS 36.521-1 Test cases 8.2.1.2.3_C.1 and 8.2.2.2.3_C.1   | 11.0.0 | 11.1.0 |
| 2014-09 | RAN#65 | R5-144288 | 0013 | -   | Add Test Tolerance analysis for TS 36.521-1 Test cases 8.2.1.2.3_E.1 and 8.2.2.2.3_E.1   | 11.0.0 | 11.1.0 |
| 2014-09 | RAN#65 | R5-144296 | 0014 | -   | Editorial update of eICIC CSI Test Tolerance analyses  | 11.0.0 | 11.1.0 |
| 2014-09 | RAN#65 | R5-144816 | 0015 | -   | Add Test Tolerance analysis for TS 36.521-1 Test cases 9.3.6.1_F and 9.3.6.2_F   | 11.0.0 | 11.1.0 |
| 2014-09 | RAN#65 | R5-144823 | 0016 | -   | Add Test Tolerance analyses for TS 36.521-1 Test cases 9.3.5.2.1 and 9.3.5.2.2   | 11.0.0 | 11.1.0 |
| 2014-12 | RAN#66 | R5-145826 | 0017 | -   | Test Tolerance Analysis for TS 36.521-1 TC 8.5.1.2.3_E.1+8.5.2.2.3_E.1   | 11.1.0 | 11.2.0 |
| 2014-12 | RAN#66 | R5-145834 | 0018 | -   | Update Test Tolerance analyses for TS 36.521-1 Test cases 9.5.3.x and 9.5.4.x  | 11.1.0 | 11.2.0 |
| 2015-03 | RAN#67 | R5-150217 | 0019 | -   | Test Tolerance Analysis for TS 36.521-1 TC 8.3.1.2.1_D_1+8.3.2.2.1_D_1   | 11.2.0 | 11.3.0 |
| 2015-12 | RAN#70 | R5-155883 | 0020 | 1   | Add Test Tolerance analysis for FDD multi-cell SU-MIMO test case (8.2.1.3.1C)  | 11.3.0 | 12.0.0 |
| 2015-12 | RAN#70 | R5-155884 | 0021 | 1   | Add Test Tolerance analysis for TDD multi-cell SU-MIMO test case (8.2.2.3.1C)  | 11.3.0 | 12.0.0 |
| 2015-12 | RAN#70 | R5-155885 | 0022 | 1   | Addition of LTE Type C group into 36.904   | 11.3.0 | 12.0.0 |
| 2016-03 | RAN#71 | R5-160032 | 0024 | -   | Add Test Tolerance analysis for FDD PDSCH Transmit Diversity 2x2 with TM9 Interference Model - Enhanced Performance Requirement Type B (8.2.1.2.6) | 12.0.0 | 12.1.0 |
| 2016-03 | RAN#71 | R5-160033 | 0025 | -   | Add Test Tolerance analysis for TDD PDSCH Transmit Diversity 2x2 with TM2 Interference Model - Enhanced Performance Requirement Type B (8.2.2.2.6) | 12.0.0 | 12.1.0 |
| 2016-03 | RAN#71 | R5-160034 | 0026 | -   | Add Test Tolerance analysis for TDD PDSCH Transmit Diversity 2x2 with TM9 Interference Model - Enhanced Performance Requirement Type B (8.2.2.2.7) | 12.0.0 | 12.1.0 |
| 2016-03 | RAN#71 | R5-160035 | 0027 | -   | Add Test Tolerance analysis for FDD and TDD CQI reporting under fading conditions (PUCCH) TM4 - Enhanced Receiver Type B (9.3.8.1.1 and 9.3.8.1.2) | 12.0.0 | 12.1.0 |
| 2016-03 | RAN#71 | R5-160036 | 0028 | -   | Addition of LTE Type B groups into TR 36.904   | 12.0.0 | 12.1.0 |

|         |        |           |      |   |   |        |        |
|---------|--------|-----------|------|---|---|--------|--------|
| 2016-03 | RAN#71 | R5-160040 | 0029 | - | Add Test Tolerance analysis for FDD PDSCH Transmit Diversity 2x2 with TM2 Interference Model - Enhanced Performance Requirement Type B (8.2.1.2.5)  | 12.0.0 | 12.1.0 |
| 2016-03 | RAN#71 | R5-160157 | 0032 | - | Test Tolerance Analysis for TS 36.521-1 TC 9.3.7.1+9.3.7.2  | 12.0.0 | 12.1.0 |
| 2016-03 | RAN#71 | R5-160160 | 0033 | - | Test Tolerance Analysis for TS 36.521-1 TC 9.4.1.4.1+9.4.1.4.2+9.4.2.3.3+9.4.2.3.4  | 12.0.0 | 12.1.0 |
| 2016-03 | RAN#71 | R5-161124 | 0031 | 2 | Test Tolerance Analysis for TS 36.521-1 TC 9.6.1.3.1+9.6.1.3.2+9.6.1.4.1+9.6.1.4.2  | 12.0.0 | 12.1.0 |
| 2016-06 | RAN#72 | R5-162173 | 0036 | - | Add Test Tolerance analysis for Power Control Relative power tolerance for CA (intra-band contiguous DL CA and UL CA) test case   | 12.1.0 | 12.2.0 |
| 2016-06 | RAN#72 | R5-162899 | 0037 | 1 | Update of NAICS demod TT analyses to clarify handling of flatness   | 12.1.0 | 12.2.0 |
| 2016-06 | RAN#72 | R5-162950 | 0034 | 1 | Add Test Tolerance analysis for FDD PDSCH Closed Loop Single Layer Spatial Multiplexing 2x2 with TM4 Interference Model - Enhanced Performance Requirement Type B (8.2.1.4.4)                     | 12.1.0 | 12.2.0 |
| 2016-06 | RAN#72 | R5-162951 | 0035 | 1 | Add Test Tolerance analysis for TDD PDSCH Closed Loop Single Layer Spatial Multiplexing 2x2 with TM4 Interference Model - Enhanced  | 12.1.0 | 12.2.0 |
| 2016-12 | RAN#74 | R5-168690 | 0041 | - | Add Test Tolerance analysis for FDD PDSCH Closed Loop Single-layer Spatial Multiplexing on antenna ports 7 or 8 with TM9 Interference Model - Enhanced Performance Requirement Type B (8.3.1.1.4) | 12.2.0 | 12.3.0 |
| 2016-12 | RAN#74 | R5-168691 | 0042 | - | Add Test Tolerance analysis for FDD PDSCH Closed Loop Single-layer Spatial Multiplexing on antenna ports 7 or 8 with TM3 interference Model - Enhanced Performance Requirement Type B (8.3.1.1.6) | 12.2.0 | 12.3.0 |
| 2016-12 | RAN#74 | R5-168692 | 0043 | - | Add Test Tolerance analysis for TDD PDSCH Closed Loop Single-layer Spatial Multiplexing on antenna ports 7 or 8 with TM9 Interference Model - Enhanced Performance Requirement Type B (8.3.2.1.5) | 12.2.0 | 12.3.0 |
| 2016-12 | RAN#74 | R5-168693 | 0044 | - | Add Test Tolerance analysis for TDD PDSCH Closed Loop Single-layer Spatial Multiplexing on antenna ports 7 or 8 with TM3 interference Model - Enhanced Performance Requirement Type B (8.3.2.1.7) | 12.2.0 | 12.3.0 |
| 2016-12 | RAN#74 | R5-168694 | 0045 | - | Add Test Tolerance analysis for FDD and TDD CQI Reporting under fading conditions - PUCCH 1-1 (CSI Reference Symbol) TM9 - Enhanced Receiver Type B (9.3.8.2.1 and 9.3.8.2.2)                     | 12.2.0 | 12.3.0 |
| 2016-12 | RAN#74 | R5-169739 | 0046 | - | Add Test Tolerance analysis for FDD PDSCH Closed Loop Single Layer Spatial Multiplexing 2x4 with TM4 Interference Model – Enhanced Performance Requirement Type A                                 | 12.3.0 | 13.0.0 |
| 2016-12 | RAN#74 | R5-169740 | 0047 | - | Add Test Tolerance analysis for FDD PDSCH Single-layer Spatial Multiplexing 2x4 on antenna ports 7 or 8 with TM9 interference model – Enhanced Performance Requirement Type A                     | 12.3.0 | 13.0.0 |
| 2017-03 | RAN#75 | R5-171044 | 0051 | - | Test Tolerance analysis for CQI reporting enhanced receiver typeB test cases  | 13.0.0 | 13.1.0 |
| 2017-03 | RAN#75 | R5-171045 | 0052 | - | Add Test Tolerance analysis for TDD PDSCH Single-layer Spatial Multiplexing 2x4 on antenna ports 7 or 8 with TM9 interference model – Enhanced Performance Requirement Type A                     | 13.0.0 | 13.1.0 |
| 2017-03 | RAN#75 | R5-171747 | 0053 | 1 | Test Tolerance analysis for NAICS demod test cases with CRS interference (8.3.1.1.5, 8.3.2.1.6)   | 13.0.0 | 13.1.0 |
| 2017-03 | RAN#75 | R5-171749 | 0048 | 1 | Addition of Test Tolerance analysis for TS36.521-1 TC 9.9.2.1.1 and 9.9.2.1.2.  | 13.0.0 | 13.1.0 |

|         |         |           |      |   |   |        |        |
|---------|---------|-----------|------|---|---|--------|--------|
| 2017-03 | RAN#75  | R5-171750 | 0049 | 1 | Addition of Test Tolerance analysis for TS36.521-1 TC 9.9.2.2.1 and 9.9.2.2.2.  | 13.0.0 | 13.1.0 |
| 2017-03 | RAN#75  | R5-171751 | 0050 | 1 | Add Test Tolerance analysis for TDD PDSCH Closed Loop Single Layer Spatial Multiplexing 2x4 with TM4 Interference Model – Enhanced Performance Requirement Type A                                 | 13.0.0 | 13.1.0 |
| 2017-09 | RAN#77  | R5-175034 | 0055 | 1 | Add Test Tolerance analysis for FDD and TDD Dual-Layer Spatial Multiplexing 2x4 (User-Specific Reference Symbols)   | 13.1.0 | 13.2.0 |
| 2018-09 | RAN#81  | R5-184314 | 0056 | - | Update of Test Tolerance analyses for TDD-FDD CA PDSCH Closed Loop Single Layer Spatial Multiplexing 2x4 with TM4 Interference Model-Enhanced Performance Requirement Type A (2DL CA)             | 13.2.0 | 13.3.0 |
| 2018-09 | RAN#81  | R5-184315 | 0057 | - | Update of Test Tolerance analyses for TDD-FDD CA PDSCH Single-layer Spatial Multiplexing 2x4 on antenna ports 7 or 8 with TM9 Interference Model-Enhanced Performance Requirement Type A (2DL CA) | 13.2.0 | 13.3.0 |
| 2019-03 | RAN#83  | R5-192104 | 0058 | - | Test tolerance analysis for Interference Mitigation for Downlink Control Channels Demod TCs   | 13.3.0 | 13.4.0 |
| 2023-03 | RAN#99  | -         | -    | - | Upgrade to Rel-14 with no change  | 13.4.0 | 14.0.0 |
| 2023-03 | RAN#99  | -         | -    | - | Upgrade to Rel-15 with no change  | 14.0.0 | 15.0.0 |
| 2023-03 | RAN#99  | -         | -    | - | Upgrade to Rel-16 with no change  | 15.0.0 | 16.0.0 |
| 2023-03 | RAN#99  | -         | -    | - | Upgrade to Rel-17 with no change  | 16.0.0 | 17.0.0 |
| 2023-03 | RAN#99  | R5-230401 | 0059 | - | Update to scope and reference of E-UTRA RF TT and MU for IoT-NTN  | 17.0.0 | 18.0.0 |
| 2023-03 | RAN#99  | R5-230402 | 0060 | - | Addition of grouping of test cases defined in TS 36.521-4   | 17.0.0 | 18.0.0 |
| 2024-03 | RAN#103 | R5-241803 | 0066 | 1 | Update of grouping of test cases defined in TS 36.521-4   | 18.0.0 | 18.1.0 |
| 2025-12 | RAN#110 | -         | -    | - | Administrative release upgrade to match the release of TS 36.521-1 and TS 36.521-4 which were upgraded at RAN#110 to Rel-19 due to Rel-19 relevant CR(s)  | 18.1.0 | 19.0.0 |

---

## History

| <b>Version</b> | <b>Date</b>   | <b>Status</b> |
|----------------|---------------|---------------|
| V19.0.0        | February 2026 | Publication   |
|                |               |               |
|                |               |               |
|                |               |               |
|                |               |               |