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Derivation of test tolerances for multi-cell Radio Resource Management (RRM) conformance tests
(Release 9)

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Foreword

This Technical Report has been produced by the 3rd 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.

1 Scope

The present document specifies a method used to derive Test Tolerances for multi-cell Radio Resource Management tests, and establishes a system for relating the Test Tolerances to the measurement uncertainties of the Test System.

The present document is applicable to Release 99 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 TS 34.121: "Terminal conformance specification, Radio transmission and reception (FDD), Release 99".

[2] 3GPP TS 34.121: "Terminal conformance specification, Radio transmission and reception (FDD), Release 4".

[3] 3GPP TS 34.121: "Terminal conformance specification, Radio transmission and reception (FDD), Release 5".

[4] 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".

[5] 3GPP TR 21.905: " Vocabulary for 3GPP Specifications".

[6] 3GPP TS 34.121: "Terminal conformance specification, Radio transmission and reception (FDD), Release 6".

[7] 3GPP TS 34.121: "Terminal conformance specification, Radio transmission and reception (FDD), Release 7".

[8] 3GPP TS 34.121: "Terminal conformance specification, Radio transmission and reception (FDD), Release 8".

[9] 3GPP TS 34.121: "Terminal conformance specification, Radio transmission and reception (FDD), Release 9".

3 Definitions, symbols and abbreviations

3.1 Definitions

Definitions used in the present document are listed in 3GPP TR 21.905 [5]

3.2 Symbols

Symbols used in the present document are listed in 3GPP TR 21.905 [5]. For the purposes of the present document, the following additional symbols apply:

Ioc(m) The power spectral density of a band limited white noise source on frequency channel m (simulating interference from cells which are not defined in a test procedure) as measured at the UE antenna connector.

Ior(n) The received power spectral density of the down link from Cell n as measured at the UE antenna connector.

3.3 Abbreviations

Abbreviations used in the present document are listed in 3GPP TR 21.905 [5].

4 General Principles

4.1 Principle of Superposition

For multi-cell tests there are several cells each generating various channels. Each cell contributes both specific channels, for example the CPICH, and also interference in the form of OCNS. The cells are combined along with AWGN, so the actual signal to noise ratio seen by the UE is determined by more than one cell.

Since several cells contribute towards the overall power applied to the UE, a number of test system uncertainties affect the signal to noise ratio seen by the UE. The aim of the superposition method given in the present document 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.

For many of the tests described, the CPICH_Ec/Io is the critical parameter at the UE. Scaling factors are used to model the sensitivity of the CPICH_Ec/Io 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.

The test requirement guidelines place 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 defined by the test requirement guidelines.

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 34.121 Ref [1, 2, 3] clause F.1. In the multi-cell RRM 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 [4]. 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 *Error summation* sheet of the spreadsheets in Annex A, the column labelled *Combi* adds up the correlated errors arithmetically first, then adds the result root-sum-squares to the uncorrelated errors. This has been selected as the most realistic model for these tests, and is in accordance with the treatment described in clauses 4.4.4 to 4.4.7 of the present document.

The combination of uncertainties using the spreadsheets in the present document 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 in the present document therefore errs on the safe side.

4.4 Correlation between uncertainties

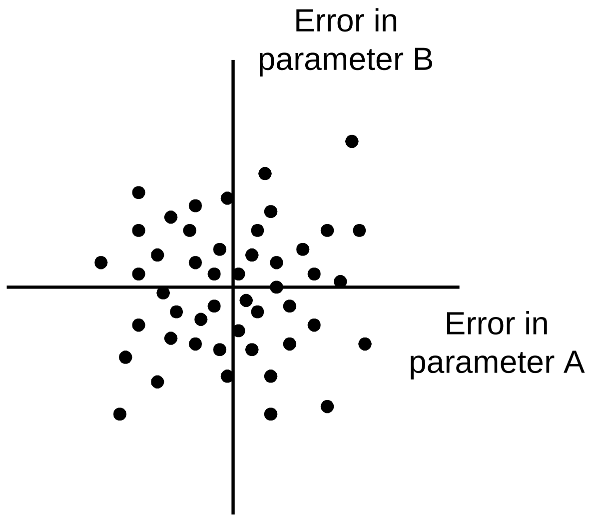
The statistical (root-sum-square) addition of uncertainties is based on the assumption that the uncertainties are independent of each other. For realisable test systems, the uncertainties may not be fully independent. The validity of the method used to add uncertainties depends on both the type of correlation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

4.4.1 Uncorrelated uncertainties

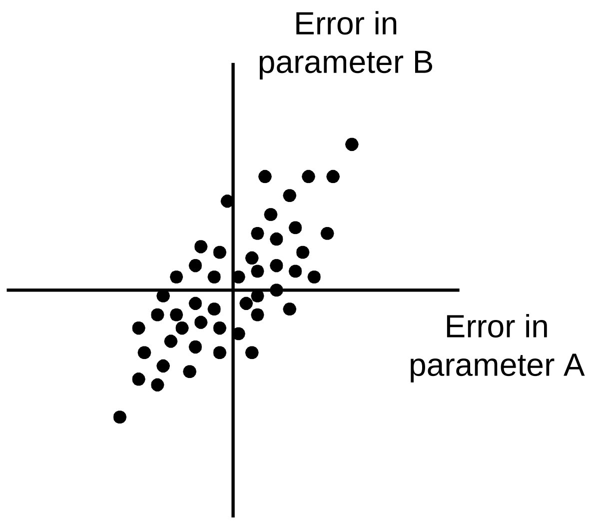
The graph shows an example of two test system uncertainties, A and B, which affect a test requirement. Each sample from a population of test systems has a specific value of error in parameter A, and a specific value of error in parameter B. Each dot on the graph represents a sample from a population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



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.

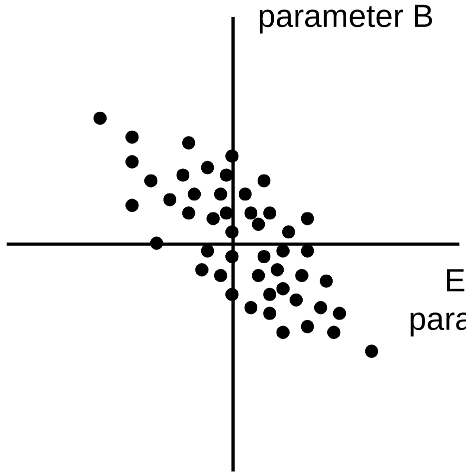


It can be seen that a positive value of error in parameter A, for example, is more likely to occur with a positive value of error in parameter B and less likely to occur with a negative value of error in parameter B. This can occur when the two uncertainties arise from similar parts of the test system,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



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 spreadsheets in Annex A. 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.

The assumption is written in the form "Uncertainty A and Uncertainty B are uncorrelated to each other".

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.

EXAMPLE: In 3GPP TS 34.121 Ref [1, 2, 3] test 8.3.5.2, the level uncertainty of Ior (3) relative to Ior (1) and the level uncertainty of Ior (4) relative to Ior (1) may be positively correlated, since the same method may be used to set up Ior (3) and Ior (4). Both of these level uncertainties affect the CPICH_Ec/Io of Cell 1 in the same direction.

In this scenario the two uncertainties are added worst-case in the spreadsheets in Annex A. 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%.

The assumption is written in the form "Uncertainty A and Uncertainty B may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated) ".

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.

EXAMPLE: In 3GPP TS 34.121 Ref [1, 2, 3] test 8.3.5.2, the absolute level uncertainty of Ior (1) and the absolute level uncertainty of Ioc (1) may be positively correlated. These level uncertainties affect the CPICH_Ec/Io of Cell 1 in opposite directions, so positive correlation will tend to reduce the uncertainty in CPICH_Ec/Io of Cell 1.

In this scenario the two uncertainties are added statistically in the spreadsheets in Annex A. 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%.

The assumption is written in the form "Uncertainty A and Uncertainty B may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated)".

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 One frequency multi-cell FDD tests

For the one-frequency tests all the cells are on the same channel, so the UE receiver is tuned to one channel. All the cells, and the noise, determine the CPICH_Ec/Io ratio.

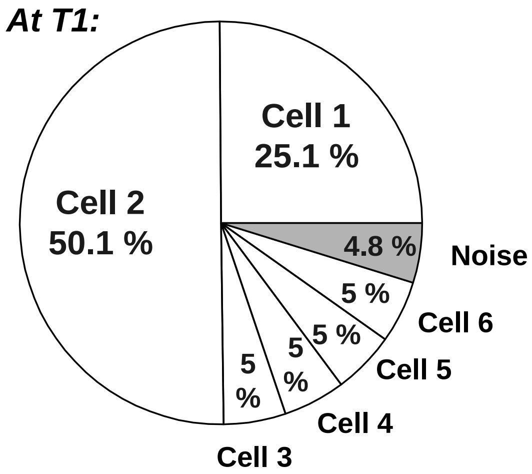
5.1 Test 8.2.2.1 Cell reselection in idle mode, one frequency

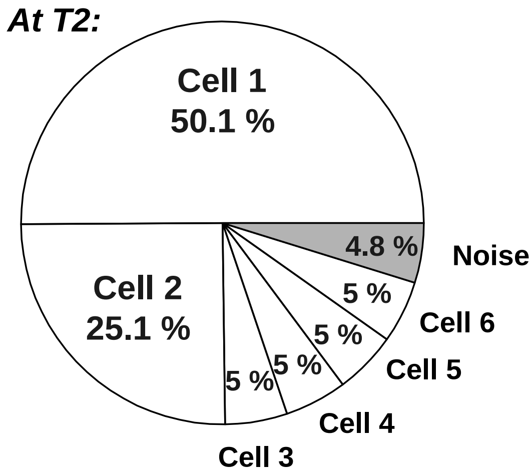
5.1.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] table 8.2.2.1.2.

The cell-specific parameters in 3GPP TS 34.121 [1, 2, 3] are expressed as $\hat{I}_{or}/I_{oc}$ ratios in dB, and I_{oc} is expressed in dBm/3.84 MHz. To analyse the relationship between the parameters which can be set by the test system and the signal presented to the UE, it is useful to show the composite signal in the form of a pie chart. The size of the pie is scaled according to the overall power Io on a channel, and the angle of the sector shows the percentage of power contributed by a cell.

NOTE: The pie charts do not attempt to show any of the code channel power ratios within each cell, only the cell powers and noise power.





The main points to note about the cell set-up for the one-frequency test are:

- The overall power within the radio channel does not change between T1 and T2, so the T1 and T2 pies are the same size.
- The noise is only a small fraction of the overall power.
- Cells 1 and 2 exchange values from T1 to T2.
- Cells 3 to 6 remain unchanged from T1 to T2.

5.1.2 Test requirement guidelines

The following guidelines are a prioritised list of which test parameters have the most effect on the results of the test. When the uncertainties of the test system are considered, the priorities given in the guidelines below are used in order to ensure that the most important parameters are optimised first. This will ensure that the test is carried out in conditions as close as possible to those for which the test purpose was originally defined.

a) The Worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

b) The worst-case difference during time T1 between Cell 2 CPICH_Ec/Io and Cell 1 CPICH_Ec/Io shall not be less than 3 dB, the value implied in the original table.

c) The worst-case difference during time T2 between Cell 1 CPICH_Ec/Io and Cell 2 CPICH_Ec/Io shall not be less than 3 dB, the value implied in the original table.

d) In order to ensure the geometry factors Îor/Ioc remain centred on the values stated in the original table, the nominal Io stated in the original table shall not be modified.

e) The worst-case CPICH_Ec/Io of cells 3 through 6 shall not be higher than the value stated in the original table. This will prevent the interfering cells from having a larger impact on the test than originally intended.

f) Provided guideline c) is met first, the worst-case CPICH_Ec/Io of cells 3 through 6 shall not fall below the CPICH_Ec/Io reporting range of –24 dB.

g) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

h) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

5.1.3 Uncertainty parameter set

One cell has been chosen as the reference, and has its power specified as an absolute accuracy. The other cells are specified relative to the reference cell. The other cells are not directly specified with respect to each other, as this would be a redundant constraint.

Within each channel, the noise is specified as an absolute accuracy. This is because it has a different bandwidth from the cell powers, and may be measured using different equipment.

During T1:

Level uncertainty of Ior (1, 3, 4, 5, 6) relative to Ior (2): +/- 0.3dB

Absolute level uncertainty of Ior (2): +/-0.7dB

During T2:

Level uncertainty of Ior (2, 3, 4, 5, 6) relative to Ior (1): +/- 0.3dB

Absolute level uncertainty of Ior (1): +/-0.7dB

During T1 and T2:

CPICH_Ec/Ior (n) uncertainty: +/-0.1dB

Absolute level uncertainty of Ioc: +/-1.0dB

The chosen parameters form a minimum set, allowing the principle of superposition to be applied. The values are chosen to be the same as uncertainties used elsewhere in other conformance tests.

5.1.4 Assumptions

a) The contributing uncertainties for Ior(n), channel power ratio, and Ioc are derived according to ETR 273-1-2 [4], with a coverage factor of k=2.

b) Within each cell, the uncertainty for Ior(n), and channel power ratio are uncorrelated to each other.

c) The relative uncertainties for Ior(n) across different cells may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

d) Across different cells, the channel power ratio uncertainties may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

e) The uncertainty for Ioc and Ior(n) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

f) The absolute uncertainty of Ior(2) at T1 and the relative uncertainty of Ior(1, 3, 4, 5, 6), are uncorrelated to each other. Similarly, the absolute uncertainty of Ior(1) at T2 and the relative uncertainty of Ior(2, 3, 4, 5, 6), are uncorrelated to each other.

5.1.5 Calculation of test requirements

The calculations are performed using the spreadsheet in Annex A.1.1. References to individual sheets within the spreadsheet are given in *italics*.

5.1.5.1 Sensitivity analysis

The pie charts in clause 5.1.1 represent the signal presented to the UE, and can be used to understand the basis for the equations in the *Error summation* sheet. It is necessary to first calculate the sensitivities before entering the equations in the *Apply uncertainties – Find Ior* sheet.

EXAMPLE: The CPICH_Ec/Io ratio for cell 1 at T1 is calculated using the following equation, which is copied from cell P25 of the *Error summation* sheet and is given in the same format:

Cell 1 CPICH_Ec/Io ratio =10*LOG((25.1*0.1)/(4.8+25.1+50.1+5+5+5+5))

- The terms in the denominator are all the linear powers, noise + 6 cells, added up as percentages.
- The *25.1* term in the numerator is the linear power of Cell 1 at T1, as a percentage.
- The **0.1* term in the numerator is the linear fraction of power in Cell 2 CPICH code channel.
- The *10 log* term gives the result in dB, in this case –16.00326dB with nominal values.

To calculate the sensitivity for a specific parameter, an arbitrary change of 0.01dB is applied to it. In the example below the absolute power of the noise is varied. A linear scaling factor for 0.01 dB expressed as *(10^(0.01/10)) is pasted into the equation, copied from cell P26 of the *Error summation* sheet:

New Cell 1 CPICH_Ec/Io ratio =10*LOG((25.1*0.1)/(4.8*(10^(0.01/10))+25.1+50.1+5+5+5+5))

This gives a new value for the CPICH_Ec/Io ratio of –16.00374dB with the scaled-up noise. The difference from the original is taken and then multiplied by 100 to get -0.048, which is the change of the Cell 1 CPICH_Ec/Io per dB change in the noise power. In this example the value is copied into cell P11 of the *Error summation* sheet.

A small change is chosen to get the correct value for the sensitivity. This sensitivity of –0.048, is clearly different from +1, and illustrates why the method is necessary. The sign of the sensitivity is negative, which shows that a rise in the noise power results in a reduction in the Cell 1 CPICH_Ec/Io ratio.

Each of the 13 contributing uncertainties on the one-frequency test is treated the same way by rewriting the equations. The resulting sensitivities are then copied into the relevant cells. The same process is repeated for each UE parameter listed in column A.

In cases where the value can be deduced as 1.000 or 0 by inspection the sensitivity is entered directly.

EXAMPLE: A change in the in the CPICH_Ec/Ior of Cell 3 will have no effect on the Cell 1 CPICH_Ec/Io ratio, so the sensitivity is entered as 0 in cell I27 of the *Error summation* sheet.

The contributing uncertainty, for example Cell P6, is multiplied by the sensitivity value, cell P11 in this example, to give the resultant uncertainty in cell P12.

5.1.5.2 Superposition of uncertainty effects

The *Error summation* sheet takes each test system uncertainty and uses the sensitivity factors derived in clause 5.15.1 to predict the overall effect on the critical parameters at the UE.

The uncertainties in the absolute and relative levels of the 6 cells, the uncertainty in the noise, and the uncertainty in channel power ratio, are entered in the pink cells in row 3 to 6 of the *Error summation* sheet. For this exercise only the Cell levels at T1 are considered, since the outcome at T2 will be the same but with the effects from cells 1 and 2 reversed.

The critical parameters at the UE are listed in rows 11, 14, 17 and 20 on the *Error summation* sheet. Each parameter has a figure for its sensitivity to each of the setting uncertainties. The sensitivities were obtained in clause 5.1.5.1, and are valid for parameters near the nominal figures. Each test system uncertainty is multiplied by the relevant sensitivity, to give the individual effect on each critical parameter at the UE.

The figures in the sum columns of the *Error summation* sheet are the overall spread that can be expected for those parameters. The *Combi* sum of errors in column U has been selected as the most realistic model for these tests, and is consistent with the assumptions given in clause 5.1.4.

5.1.5.3 Derivation of equations for Ior(n)

The *Apply uncertainties – Find Ior* sheet is used.

EXAMPLE: The Cell 2 CPICH_Ec/Io requirement is calculated using the following equation, which is copied from cell F19 of the *Apply uncertainties – Find Ior* sheet, and is given in the same format:

Cell 2 CPICH_Ec/Io (Req) =
F18+SQRT((0.251*C4)^2+(0.048*C3)^2+(4*0.05*C4)^2+(0.048*C17)^2)

- The *F18* term is the nominal Cell 2 CPICH_Ec/Io
- The *0.251*C4* term is the effect of Cell 1 Ior(n) relative uncertainty
- The *0.048*C3* term is the effect of Cell 2 Ior(n) absolute uncertainty
- The *4*0.05*C4* term is the effect of Cells 3 to 6 Ior(n) relative uncertainty, added worst-case because they will be correlated to each other
- The *0.048*C17* term is the effect of Noise Ioc absolute uncertainty

The uncorrelated terms are added as root-sum-squares.

A similar process is used for cell D19 to get Cell 1 CPICH_Ec/Io (Req), making sure that it meets the required difference between Cell 1 and Cell 2:

Cell 1 CPICH_Ec/Io (Req) = F19-(F18-D18)-SQRT(C8^2+C8^2+C4^2)

- The *F19* term is the required Cell 2 CPICH_Ec/Io
- The *(F18-D18)* term is the nominal difference
- The *SQRT(C8^2+C8^2+C4^2)* term takes account of the relevant uncertainties, which all happen to have a sensitivity of 1.

5.1.5.4 Determination of initial Cell 1 and Cell 2 CPICH offsets

The "Goal seek" spreadsheet tool is used to choose a value of Cells 1 and 2 CPICH offset in cell K24 which meets the target of –56.735 dBm for Io in cell D26.

The Ior(n) powers in cells D35 to O35 are then carried forward to the *Error analysis* sheet.

5.1.5.5 Prediction of spread in critical parameters

The "Combi" sum of errors is then used back in the *Error analysis* sheet to give high and low figures.

EXAMPLE: With cell K27 set to +0.005, the set value of Cell 1 CPICH_Ec/Io at T1 is –16.28dB as shown in cell D20, but it may be as high as –15.97dB (cell D21) or as low as –16.58dB (cell D22). The high and low values are obtained by simply adding or subtracting the summed uncertainties to the set value.

Other critical parameters are treated in the same way as the example.

The blue cells show the values that have to be checked against the test requirement guidelines.

5.1.5.6 Determination of final Cell 1 and Cell 2 CPICH offsets

The channel power ratios in Cells 1 and 2 were given an initial offset in clause 5.1.5.4. Comparing the Cell 1 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limit specified in clause 5.1.2 a). An offset to the CPICH_Ec/Io power ratio in Cells 1 and 2 has therefore been added in the *Error analysis* sheet.

A value of +0.6 dB in cell K27 ensures that the requirements are met.

A similar offset in cell K26 is applied to the other specified channels on Cells 1 and 2 to maintain the same relative power between code channels.

The power in OCNS decreases to keep the overall power of Cell 1 and Cell 2 correct.

5.1.5.7 Determination of Cell 3, Cell 4, Cell 5 and Cell 6 CPICH offsets

Initially the channel power ratios in Cells 3 to 6 were not given an offset. Comparing the Cell 3 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limits specified in clauses 5.1.2 e) and 5.1.2 f). An offset to the CPICH_Ec/Io power ratios in Cells 3 to 6 has therefore been added in the *Error analysis* sheet.

A value of -0.5 dB in cell K25 ensures that the requirements are met.

A similar offset in cell K24 is applied to the other specified channels on Cells 3 to 6 to maintain the same relative power between code channels.

The power in OCNS increases to keep the overall power of Cells 3 to 6 correct.

5.1.6 Check against test requirement guidelines

The numbers given are derived using the spreadsheet in Annex A.1.1 References to individual sheets within the spreadsheet are given in *italics*.

a) The Worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

Sheet *Error analysis* cells D22 and E22 give –15.98dB and –12.45dB, which comply with the requirements of -16dB and –13dB for Cell 1 at T1 and T2 respectively.

Sheet *Error analysis* cells F22 and G22 give –12.45dB and –15.98dB, which comply with the requirements of -13dB and –16dB for Cell 2 at T1 and T2 respectively.

b) The worst-case difference during time T1 between Cell 2 CPICH_Ec/Io and Cell 1 CPICH_Ec/Io shall not be less than 3 dB, the value implied in the original table.

Sheet *Error analysis* cell D24 gives a difference of -3.07dB for Cell 1 CPICH_Ec/Io / Cell 2 CPICH_Ec/Io, which complies with the requirement of -3dB during time T1.

c) The worst-case difference during time T2 between Cell 1 CPICH_Ec/Io and Cell 2 CPICH_Ec/Io shall not be less than 3 dB, the value implied in the original table.

Sheet *Error analysis* cell E25 gives a difference of 3.07dB for Cell 1 CPICH_Ec/Io / Cell 2 CPICH_Ec/Io, which complies with the requirement of 3dB during time T2.

d) In order to ensure the geometry factors Îor/Ioc remain centred on the values stated in the original table, the nominal Io stated in the original table shall not be modified.

Sheet *Error analysis* cells D27 and E27 give a nominal Io of –56.72dBm, which is within 0.01dB of the stated value of –56.73dBm.

e) The worst-case CPICH_Ec/Io of cells 3 through 6 shall not be higher than the value stated in the original table. This will prevent the interfering cells from having a larger impact on the test than originally intended.

Sheet *Error analysis* cells H21 to O21 all give values of –23.05dB, which comply with the requirements of -23dB for Cells 3 to 6.

f) Provided guideline c) is met first, the worst-case CPICH_Ec/Io of cells 3 through 6 shall not fall below the CPICH_Ec/Io reporting range of –24 dB.

Sheet *Error analysis* cells H22 to O22 all give values of –23.90dB, which comply with the requirements of -24dB for Cells 3 to 6.

g) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

Sheet *Error analysis* cells D11 to G13 show that the channel power ratios of all the other channels for Cell 1 and Cell 2 (except OCNS) are increased by the same amount as the CPICH. As their variability at the UE is subject to the same influences as the CPICH, which has already been shown to comply under guideline a), the other channels (except OCNS) will not fall below the stated Ec/Io ratio.

h) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

The channel power ratios of all the active channels in Cells 3 to 6 have been decreased by 0.5dB to meet guideline e). This change will have no material effect on the test.

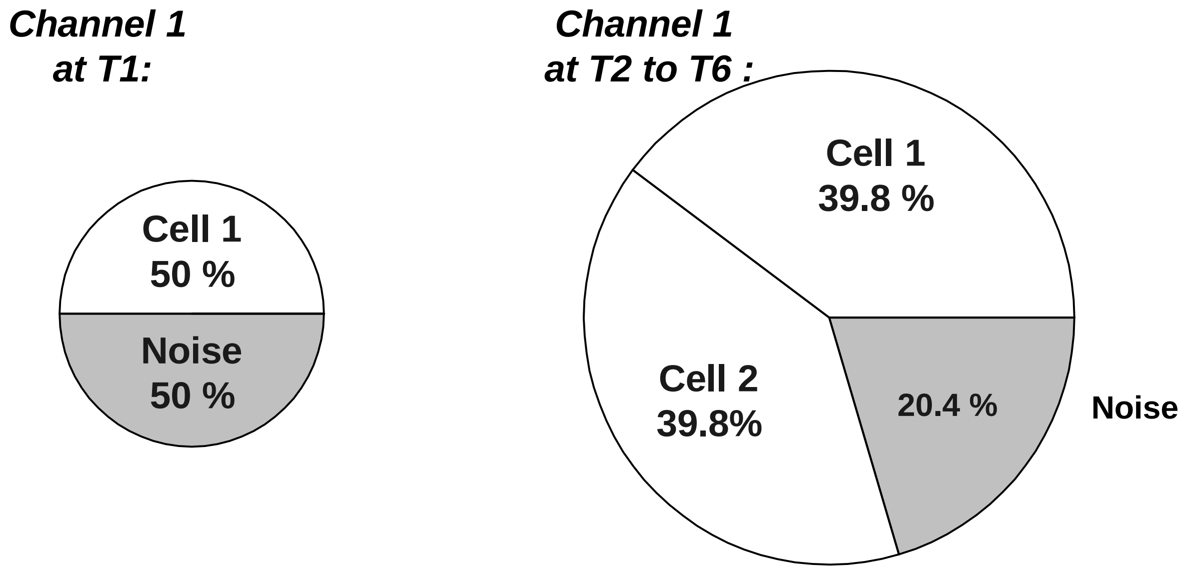
5.2 Test 8.3.1 FDD/FDD Soft Handover

5.2.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] table 8.3.1.2.

The cell-specific parameters in 3GPP TS 34.121 [1, 2, 3] are expressed as $\hat{I}_{or}/I_{oc}$ ratios in dB, and I_{oc} is expressed in dBm/3.84 MHz. To analyse the relationship between the parameters which can be set by the test system and the signal presented to the UE, it is useful to show the composite signal in the form of a pie chart. The size of the pie is scaled according to the overall power Io on a channel, and the angle of the sector shows the percentage of power contributed by a cell.

NOTE: The pie charts do not attempt to show any of the code channel power ratios within each cell, only the cell powers and noise power.



The main points to note about the cell set-up are:

- T2, T3, T4, T5 and T6 have the same cell conditions.
- The overall power within the radio channel changes between T1 and T2/T3/T4/T5/T6, so the pies are different sizes.
- Cell 1 is bigger in absolute power during T2/T3/T4/T5/T6 compared to its initial value in T1.
- Cell 2 does not exist during T1, and only appears during T2/T3/T4/T5/T6.
- The noise remains the same absolute power from T1 to T2, but becomes a smaller fraction of the overall power.

5.2.2 Test requirement guidelines

The following guidelines are a prioritised list of which test parameters have the most effect on the results of the test. When the uncertainties of the test system are considered, the priorities given in the guidelines below are used in order to ensure that the most important parameters are optimised first. This will ensure that the test is carried out in conditions as close as possible to those for which the test purpose was originally defined.

a) The worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

b) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2/T3/T4/T5/T6 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs.

c) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

d) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

e) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

5.2.3 Uncertainty parameter set

Cell 1 has been chosen as the reference, and has its power specified as an absolute accuracy. Cell 2 is specified relative to the reference cell.

Within each channel, the noise is specified as an absolute accuracy. This is because it has a different bandwidth from the cell powers, and may be measured using different equipment.

During T1:

None apply only during T1

During T2/T3/T4/T5/T6:

Level uncertainty of Ior (2) relative to Ior (1): +/- 0.3dB

During T1, T2, T3, T4, T5 and T6:

CPICH_Ec/Ior (n) uncertainty: +/-0.1dB

Absolute level uncertainty of Ior (1): +/-0.7dB

Absolute level uncertainty of Ioc: +/-1.0dB

The chosen parameters form a minimum set, allowing the principle of superposition to be applied. The values are chosen to be the same as uncertainties used elsewhere in other conformance tests.

5.2.4 Assumptions

a) The contributing uncertainties for Ior(n), channel power ratio, and Ioc are derived according to ETR 273-1-2 [4], with a coverage factor of k=2.

b) Within each cell, the uncertainty for Ior(n), and channel power ratio are uncorrelated to each other.

c) Across different cells, the channel power ratio uncertainties may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

d) The uncertainty for Ioc and Ior(n) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

e) The absolute uncertainty of Ior(1) and the relative uncertainty of Ior(2), are uncorrelated to each other.

5.2.5 Calculation of test requirements

The calculations are performed using the spreadsheet in Annex A.1.2. References to individual sheets within the spreadsheet are given in *italics*.

5.2.5.1 Sensitivity analysis

The pie charts in clause 5.2.1 represent the signal presented to the UE, and can be used to understand the basis for the equations in the *Error summation* sheet. It is necessary to first calculate the sensitivities before entering the equations in the *Apply uncertainties – Find Ior* sheet.

EXAMPLE: The CPICH_Ec/Io ratio for cell 1 at T2/T3/T4/T5/T6 is calculated using the following equation, which is copied from cell M23 of the *Error summation* sheet and is given in the same format:

Cell 1 CPICH_Ec/Io ratio =10*LOG(($F$22*$G$22)/($F$22+$J$22+$M$22))

- The terms in the denominator are all the linear powers, 2 cells + noise, added up as fractions.
- The *$F$22* term in the numerator is the linear power of Cell 1 at T2/T3/T4/T5/T6, as a fraction.
- The **$G$22* term in the numerator is the linear fraction of power in Cell 1 CPICH code channel.
- The *10 log* term gives the result in dB, in this case –14.00000dB with nominal values.

To calculate the sensitivity for a specific parameter, an arbitrary change of 0.01dB is applied to it. In the example below the absolute power of the noise is varied. A linear scaling factor for 0.01 dB expressed as *(10^(0.01/10)) is pasted into the equation, copied from cell M24 of the *Error summation* sheet:

New Cell 1 CPICH_Ec/Io ratio
=10*LOG(($F$22*$G$22)/($F$22+$J$22+$M$22*(10^(0.01/10))))

This gives a new value for the CPICH_Ec/Io ratio of –14.00204 dB with the scaled-up noise. The difference from the original is taken and then multiplied by 100 to get -0.204, which is the change of the Cell 1 CPICH_Ec/Io per dB change in the noise power. In this example cell M11 of the *Error summation* sheet is made equal to this value.

A small change is chosen to get the correct value for the sensitivity. This sensitivity of –0.204, is clearly different from +1, and illustrates why the method is necessary. The sign of the sensitivity is negative, which shows that a rise in the noise power results in a reduction in the Cell 1 CPICH_Ec/Io ratio.

Each of the 5 contributing uncertainties on the one-frequency test is treated the same way by rewriting the equations. The resulting sensitivities are then copied into the relevant cells. The same process is repeated for each UE parameter listed in column A. Because the conditions at T1 and T2/T3/T4/T5/T6 are different, the process is carried out twice: once for T1 and once for T2/T3/T4/T5/T6.

Cells are coloured grey when a parameter is not relevant, for example when Cell 2 does not exist during T1.

The contributing uncertainty, for example Cell M6, is multiplied by the sensitivity value, cell M11 in this example, to give the resultant uncertainty in cell M12.

5.2.5.2 Superposition of uncertainty effects

The *Error summation* sheet takes each test system uncertainty and uses the sensitivity factors derived in clause 5.2.5.1 to predict the overall effect on the critical parameters at the UE.

The uncertainties in the absolute and relative levels of the 2 cells, the uncertainty in the noise, and the uncertainty in channel power ratio, are entered in the pink cells in row 3 to 6 of the *Error summation* sheet. Separate sets of columns are used for T1 and for T2/T3/T4/T5/T6.

The critical parameters at the UE are listed in rows 11, 14, and 17 on the *Error summation* sheet. Each parameter has a figure for its sensitivity to each of the setting uncertainties. The sensitivities were obtained in clause 5.2.5.1, and are valid for parameters near the nominal figures. Each test system uncertainty is multiplied by the relevant sensitivity, to give the individual effect on each critical parameter at the UE.

The figures in the sum columns of the *Error summation* sheet are the overall spread that can be expected for those parameters. The *Combi* sum of errors has been selected in columns R and V as the most realistic model, but is the same as root-sum-squares combination for these tests because no adverse effects of correlation are envisaged. This is consistent with the assumptions given in clause 5.2.4.

5.2.5.3 Derivation of Ior(n)

Several strategies are possible to ensure that the test requirement guidelines are met. The strategy taken here is to make no changes to the Cell powers, but to meet the test requirements by changing only the channel power ratios. The benefit of this approach is simplicity. The *Apply uncertainties – Find Ior* sheet is used to calculate the nominal powers for each cell, but no uncertainties are applied, so it generates the same values as the *Original* sheet.

The Ior(n) values appear in cells D35 to G35 of the *Apply uncertainties – Find Ior* sheet, and are carried forward to the *Error analysis* sheet.

5.2.5.4 Determination of initial Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 are not given an offset.

A value of 0 dB is entered in cell K24 on the *Error analysis* sheet, but is modified later in clause 5.2.5.6.

5.2.5.5 Prediction of spread in critical parameters

The "Combi" sum of errors is then used back in the *Error analysis* sheet to give high and low figures.

EXAMPLE: With cell K24 set to 0, the set value of Cell 2 CPICH_Ec/Io at T2/T3/T4/T5/T6 is –14.00dB as shown in cell G20, but it may be as high as –13.68dB (cell G21) or as low as –14.32dB (cell G22). The high and low values are obtained by simply adding or subtracting the summed uncertainties to the set value.

Other critical parameters are treated in the same way as the example.

The blue cells show the values that have to be checked against the test requirement guidelines.

5.2.5.6 Determination of final Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 were not given an offset. Comparing the Cell 1 and Cell 2 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limit specified in clause 5.2.2 a). An offset to the CPICH_Ec/Io power ratio in Cells 1 and 2 has therefore been added in the *Error analysis* sheet.

A value of +0.7 dB in cell K24 ensures that the requirements are met.

A similar offset in cell K25 is applied to the other specified channels on Cells 1 and 2 to maintain the same relative power between code channels.

The power in OCNS decreases to keep the overall power of Cell 1 and Cell 2 correct.

5.2.6 Check against test requirement guidelines

The numbers given are derived using the spreadsheet in Annex A.1.2 References to individual sheets within the spreadsheet are given in *italics*.

a) The Worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

Sheet *Error analysis* cells D22 and E22 give –12.93dB and –13.60dB at T1 and T2/T3/T4/T5/T6 respectively, which comply with the requirement of –13 dB and –14 dB for Cell 1 at T1 and T2/T3/T4/T5/T6 respectively.

Sheet *Error analysis* cell G22 gives –13.62 dB at T2/T3/T4/T5/T6, which complies with the requirement of –14 dB for Cell 2.

b) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2/T3/T4/T5/T6 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs.

Sheet *Error analysis* cell E25 gives a difference of -0.33dB for Cell 2 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Even if the UE reports this a further 1.5dB low (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy) the lowest reported value would be –1.83dB, which complies with the requirement of -3dB during time T2/T3/T4/T5/T6.

c) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

Sheet *Error analysis* cells D27 and E27 give nominal Io values of –66.99dBm and –63.1dBm at T1 and T2/T3/T4/T5/T6 respectively, which are within 0.01dB of the stated values of –66.98dBm and –63.09dBm.

d) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

Sheet *Error analysis* cells D11 to G13 show that the channel power ratios of all the other channels for Cell 1 and Cell 2 (except OCNS) are increased by the same amount as the CPICH. As their variability at the UE is subject to the same influences as the CPICH, which has already been shown to comply under guideline a), the other channels (except OCNS) will not fall below the stated Ec/Io ratio.

e) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

No other parameters have been changed.

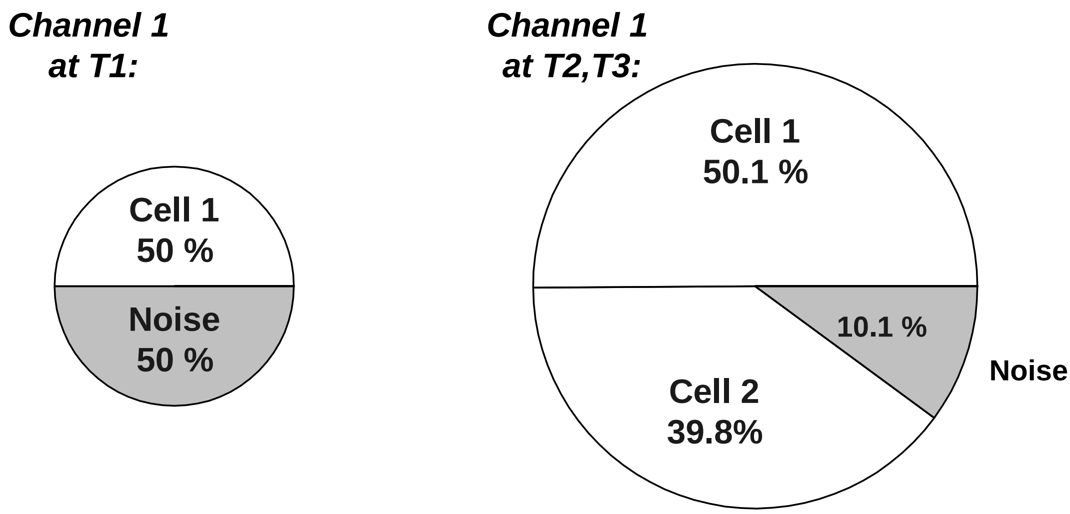
5.3 Test 8.3.2.1 FDD/FDD Hard Handover to intra-frequency cell

5.3.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] table 8.3.2.1.2.

The cell-specific parameters in 3GPP TS 34.121 [1, 2, 3] are expressed as $\hat{I}_{or}/I_{oc}$ ratios in dB, and I_{oc} is expressed in dBm/3.84 MHz. To analyse the relationship between the parameters which can be set by the test system and the signal presented to the UE, it is useful to show the composite signal in the form of a pie chart. The size of the pie is scaled according to the overall power Io on a channel, and the angle of the sector shows the percentage of power contributed by a cell.

NOTE: The pie charts do not attempt to show any of the code channel power ratios within each cell, only the cell powers and noise power.



The main points to note about the cell set-up for the one-frequency test are:

- T2 and T3 have the same cell conditions.
- The overall power within the radio channel changes between T1 and T2/T3, so the pies are different sizes.
- Cell 1 is bigger in absolute power during T2/T3 compared to its initial value in T1.
- Cell 2 does not exist during T1, and only appears during T2/T3.
- The noise remains the same absolute power from T1 to T2, but becomes a smaller fraction of the overall power.

5.3.2 Test requirement guidelines

The following guidelines are a prioritised list of which test parameters have the most effect on the results of the test. When the uncertainties of the test system are considered, the priorities given in the guidelines below are used in order to ensure that the most important parameters are optimised first. This will ensure that the test is carried out in conditions as close as possible to those for which the test purpose was originally defined.

a) The worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

b) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2/T3 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs.

c) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

d) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

e) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

5.3.3 Uncertainty parameter set

Cell 1 has been chosen as the reference, and has its power specified as an absolute accuracy. Cell 2 is specified relative to the reference cell.

Within each channel, the noise is specified as an absolute accuracy. This is because it has a different bandwidth from the cell powers, and may be measured using different equipment.

During T1:

None apply only during T1

During T2/T3:

Level uncertainty of Ior (2) relative to Ior (1): +/- 0.3dB

During T1, T2 and T3:

CPICH_Ec/Ior (n) uncertainty: +/-0.1dB

Absolute level uncertainty of Ior (1): +/-0.7dB

Absolute level uncertainty of Ioc: +/-1.0dB

The chosen parameters form a minimum set, allowing the principle of superposition to be applied. The values are chosen to be the same as uncertainties used elsewhere in other conformance tests.

5.3.4 Assumptions

a) The contributing uncertainties for Ior(n), channel power ratio, and Ioc are derived according to ETR 273-1-2 [4], with a coverage factor of k=2.

b) Within each cell, the uncertainty for Ior(n), and channel power ratio are uncorrelated to each other.

c) Across different cells, the channel power ratio uncertainties may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

d) The uncertainty for Ioc and Ior(n) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

e) The absolute uncertainty of Ior(1) and the relative uncertainty of Ior(2), are uncorrelated to each other.

5.3.5 Calculation of test requirements

The calculations are performed using the spreadsheet in Annex A.1.3. References to individual sheets within the spreadsheet are given in *italics*.

5.3.5.1 Sensitivity analysis

The pie charts in clause 5.3.1 represent the signal presented to the UE, and can be used to understand the basis for the equations in the *Error summation* sheet. It is necessary to first calculate the sensitivities before entering the equations in the *Apply uncertainties – Find Ior* sheet.

EXAMPLE: The CPICH_Ec/Io ratio for cell 1 at T2/T3 is calculated using the following equation, which is copied from cell M23 of the *Error summation* sheet and is given in the same format:

Cell 1 CPICH_Ec/Io ratio =10*LOG(($F$22*$G$22)/($F$22+$J$22+$M$22))

- The terms in the denominator are all the linear powers, 2 cells + noise, added up as fractions.
- The *$F$22* term in the numerator is the linear power of Cell 1 at T2/T3, as a fraction.
- The **$G$22* term in the numerator is the linear fraction of power in Cell 1 CPICH code channel.
- The *10 log* term gives the result in dB, in this case –13.00000dB with nominal values.

To calculate the sensitivity for a specific parameter, an arbitrary change of 0.01dB is applied to it. In the example below the absolute power of the noise is varied. A linear scaling factor for 0.01 dB expressed as *(10^(0.01/10)) is pasted into the equation, copied from cell M24 of the *Error summation* sheet:

New Cell 1 CPICH_Ec/Io ratio
=10*LOG(($F$22*$G$22)/($F$22+$J$22+$M$22*(10^(0.01/10))))

This gives a new value for the CPICH_Ec/Io ratio of –13.00101dB with the scaled-up noise. The difference from the original is taken and then multiplied by 100 to get -0.101, which is the change of the Cell 1 CPICH_Ec/Io per dB change in the noise power. In this example cell M11 of the *Error summation* sheet is made equal to this value.

A small change is chosen to get the correct value for the sensitivity. This sensitivity of –0.101, is clearly different from +1, and illustrates why the method is necessary. The sign of the sensitivity is negative, which shows that a rise in the noise power results in a reduction in the Cell 1 CPICH_Ec/Io ratio.

Each of the 5 contributing uncertainties on the one-frequency test is treated the same way by rewriting the equations. The resulting sensitivities are then copied into the relevant cells. The same process is repeated for each UE parameter listed in column A. Because the conditions at T1 and T2/T3 are different, the process is carried out twice: once for T1 and once for T2/T3.

Cells are coloured grey when a parameter is not relevant, for example when Cell 2 does not exist during T1.

The contributing uncertainty, for example Cell M6, is multiplied by the sensitivity value, cell M11 in this example, to give the resultant uncertainty in cell M12.

5.3.5.2 Superposition of uncertainty effects

The *Error summation* sheet takes each test system uncertainty and uses the sensitivity factors derived in clause 5.3.5.1 to predict the overall effect on the critical parameters at the UE.

The uncertainties in the absolute and relative levels of the 2 cells, the uncertainty in the noise, and the uncertainty in channel power ratio, are entered in the pink cells in row 3 to 6 of the *Error summation* sheet. Separate sets of columns are used for T1 and for T2/T3.

The critical parameters at the UE are listed in rows 11, 14, and 17 on the *Error summation* sheet. Each parameter has a figure for its sensitivity to each of the setting uncertainties. The sensitivities were obtained in clause 5.3.5.1, and are valid for parameters near the nominal figures. Each test system uncertainty is multiplied by the relevant sensitivity, to give the individual effect on each critical parameter at the UE.

The figures in the sum columns of the *Error summation* sheet are the overall spread that can be expected for those parameters. The *Combi* sum of errors has been selected in columns R and V as the most realistic model, but is the same as root-sum-squares combination for these tests because no adverse effects of correlation are envisaged. This is consistent with the assumptions given in clause 5.3.4.

5.3.5.3 Derivation of Ior(n)

Several strategies are possible to ensure that the test requirement guidelines are met. The strategy taken here is to make no changes to the Cell powers, but to meet the test requirements by changing only the channel power ratios. The benefit of this approach is simplicity. The *Apply uncertainties – Find Ior* sheet is used to calculate the nominal powers for each cell, but no uncertainties are applied, so it generates the same values as the *Original* sheet.

The Ior(n) values appear in cells D35 to G35 of the *Apply uncertainties – Find Ior* sheet, and are carried forward to the *Error analysis* sheet.

5.3.5.4 Determination of initial Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 are not given an offset.

A value of 0 dB is entered in cell K24 on the *Error analysis* sheet, but is modified later in clause 5.3.5.6.

5.3.5.5 Prediction of spread in critical parameters

The "Combi" sum of errors is then used back in the *Error analysis* sheet to give high and low figures.

EXAMPLE: With cell K24 set to 0, the set value of Cell 2 CPICH_Ec/Io at T2/T3 is –14.00dB as shown in cell G20, but it may be as high as –13.76dB (cell G21) or as low as –14.24dB (cell G22). The high and low values are obtained by simply adding or subtracting the summed uncertainties to the set value.

Other critical parameters are treated in the same way as the example.

The blue cells show the values that have to be checked against the test requirement guidelines.

5.3.5.6 Determination of final Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 were not given an offset. Comparing the Cell 1 and Cell 2 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limit specified in clause 5.3.2 a). An offset to the CPICH_Ec/Io power ratio in Cells 1 and 2 has therefore been added in the *Error analysis* sheet.

A value of +0.7 dB in cell K24 ensures that the requirements are met.

A similar offset in cell K25 is applied to the other specified channels on Cells 1 and 2 to maintain the same relative power between code channels.

The power in OCNS decreases to keep the overall power of Cell 1 and Cell 2 correct.

5.3.6 Check against test requirement guidelines

The numbers given are derived using the spreadsheet in Annex A.1.3 References to individual sheets within the spreadsheet are given in *italics*.

a) The Worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

Sheet *Error analysis* cells D22 and E22 give –12.93dB and –12.50dB at T1 and T2/T3 respectively, which comply with the requirement of -13dB for Cell 1.

Sheet *Error analysis* cell G22 gives –13.54dB at T2/T3, which complies with the requirement of -14dB for Cell 2.

b) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2/T3 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs.

Sheet *Error analysis* cell E25 gives a difference of -1.33dB for Cell 2 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Even if the UE reports this a further 1.5dB low (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy) the lowest reported value would be –2.83dB, which complies with the requirement of -3dB during time T2/T3.

c) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

Sheet *Error analysis* cells D27 and E27 give nominal Io values of –66.99dBm and –60.00dBm at T1 and T2/T3 respectively, which are within 0.03dB of the stated values of –66.98dBm and –60.03dBm.

d) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

Sheet *Error analysis* cells D11 to G13 show that the channel power ratios of all the other channels for Cell 1 and Cell 2 (except OCNS) are increased by the same amount as the CPICH. As their variability at the UE is subject to the same influences as the CPICH, which has already been shown to comply under guideline a), the other channels (except OCNS) will not fall below the stated Ec/Io ratio.

e) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

No other parameters have been changed.

5.4 Test 8.3.5.1 Cell reselection in CELL_FACH, one frequency

5.4.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] table 8.3.5.1.4.

The Cell powers and code channels are the same as for test 8.2.2.1 in clause 5.1.1, except for the addition of the S-CCPCH code channel on each cell. The addition of an extra code channel decreases the power in OCNS by a corresponding amount, but does not have any effect on the significant parameters for the test.

5.4.2 Test requirement guidelines

Same as defined for test 8.2.2.1 in clause 5.1.2.

5.4.3 Uncertainty parameter set

Same as defined for test 8.2.2.1 in clause 5.1.3.

5.4.4 Assumptions

Same as defined for test 8.2.2.1 in clause 5.1.4.

5.4.5 Calculation of test requirements

Same method as defined for test 8.2.2.1 in clause 5.1.5.

The calculations and results are contained in the spreadsheet in Annex A.1.4.

5.4.6 Check against test requirement guidelines

Same as defined for test 8.2.2.1 in clause 5.1.6.

The numbers derived using the spreadsheet in Annex A.1.4 apply.

5.5 Test 8.3.6.1 Cell reselection in CELL_PCH, one frequency

5.5.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] table 8.3.6.1.2.

The Cell powers and code channels are the same as for test 8.2.2.1 in clause 5.1.1.

5.5.2 Test requirement guidelines

Same as defined for test 8.2.2.1 in clause 5.1.2.

5.5.3 Uncertainty parameter set

Same as defined for test 8.2.2.1 in clause 5.1.3.

5.5.4 Assumptions

Same as defined for test 8.2.2.1 in clause 5.1.4.

5.5.5 Calculation of test requirements

Same method as defined for test 8.2.2.1 in clause 5.1.5.

The calculations and results are identical to those contained in the spreadsheet in Annex A.1.1.

5.5.6 Check against test requirement guidelines

Same as defined for test 8.2.2.1 in clause 5.1.6.

The numbers derived using the spreadsheet in Annex A.1.1 apply.

5.6 Test 8.3.7.1 Cell reselection in URA_PCH, one frequency

5.6.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] table 8.3.7.1.2.

The Cell powers and code channels are the same as for test 8.2.2.1 in clause 5.1.1.

5.6.2 Test requirement guidelines

Same as defined for test 8.2.2.1 in clause 5.1.2.

5.6.3 Uncertainty parameter set

Same as defined for test 8.2.2.1 in clause 5.1.3.

5.6.4 Assumptions

Same as defined for test 8.2.2.1 in clause 5.1.4.

5.6.5 Calculation of test requirements

Same method as defined for test 8.2.2.1 in clause 5.1.5.

The calculations and results are identical to those contained in the spreadsheet in Annex A.1.1.

5.6.6 Check against test requirement guidelines

Same as defined for test 8.2.2.1 in clause 5.1.6.

The numbers derived using the spreadsheet in Annex A.1.1 apply.

5.7 Void

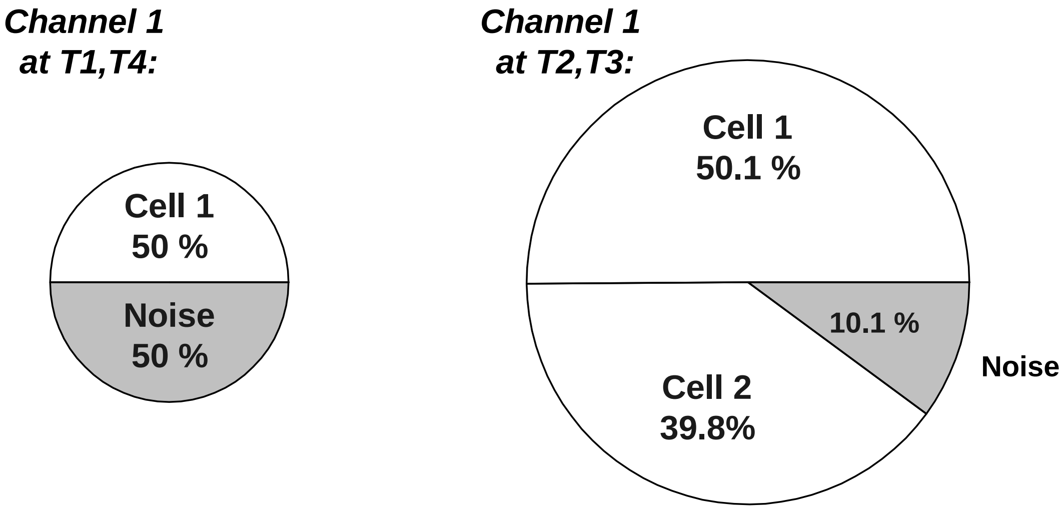
5.8 Test 8.6.1.1 Event triggered reporting in AWGN propagation conditions (R99)

5.8.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] table 8.6.1.1.2.

The cell-specific parameters in 3GPP TS 34.121 [1, 2, 3] are expressed as $\hat{I}_{or}/I_{oc}$ ratios in dB, and I_{oc} is expressed in dBm/3.84 MHz. To analyse the relationship between the parameters which can be set by the test system and the signal presented to the UE, it is useful to show the composite signal in the form of a pie chart. The size of the pie is scaled according to the overall power Io on a channel, and the angle of the sector shows the percentage of power contributed by a cell.

NOTE: The pie charts do not attempt to show any of the code channel power ratios within each cell, only the cell powers and noise power.



The main points to note about the cell set-up are:

- T1 and T4 have the same cell conditions.
- T2 and T3 have the same cell conditions.
- The overall power within the radio channel changes between T1/T4 and T2/T3, so the pies are different sizes.
- Cell 1 is bigger in absolute power during T2/T3 compared to its value in T1/T4.
- Cell 2 does not exist during T1/T4, and only appears during T2/T3.
- The noise remains the same absolute power from T1/T4 to T2/T3, but becomes a smaller fraction of the overall power.

5.8.2 Test requirement guidelines

The following guidelines are a prioritised list of which test parameters have the most effect on the results of the test. When the uncertainties of the test system are considered, the priorities given in the guidelines below are used in order to ensure that the most important parameters are optimised first. This will ensure that the test is carried out in conditions as close as possible to those for which the test purpose was originally defined.

a) The worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

b) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2/T3 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs.

c) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T4 shall be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1B (A Primary CPICH leaves the reporting range) occurs.

d) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

e) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

f) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

5.8.3 Uncertainty parameter set

Cell 1 has been chosen as the reference, and has its power specified as an absolute accuracy. Cell 2 is specified relative to the reference cell.

Within each channel, the noise is specified as an absolute accuracy. This is because it has a different bandwidth from the cell powers, and may be measured using different equipment.

During T1/T4:

None apply only during T1/T4

During T2/T3:

Level uncertainty of Ior (2) relative to Ior (1): +/- 0.3dB

During T1, T2, T3 and T4:

CPICH_Ec/Ior (n) uncertainty: +/-0.1dB

Absolute level uncertainty of Ior (1): +/-0.7dB

Absolute level uncertainty of Ioc: +/-1.0dB

The chosen parameters form a minimum set, allowing the principle of superposition to be applied. The values are chosen to be the same as uncertainties used elsewhere in other conformance tests.

5.8.4 Assumptions

a) The contributing uncertainties for Ior(n), channel power ratio, and Ioc are derived according to ETR 273-1-2 [4], with a coverage factor of k=2.

b) Within each cell, the uncertainty for Ior(n), and channel power ratio are uncorrelated to each other.

c) Across different cells, the channel power ratio uncertainties may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

d) The uncertainty for Ioc and Ior(n) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

e) The absolute uncertainty of Ior(1) and the relative uncertainty of Ior(2), are uncorrelated to each other.

5.8.5 Calculation of test requirements

The calculations are performed using the spreadsheet in Annex A.1.5. References to individual sheets within the spreadsheet are given in *italics*.

5.8.5.1 Sensitivity analysis

The pie charts in clause 5.8.1 represent the signal presented to the UE, and can be used to understand the basis for the equations in the *Error summation* sheet.

EXAMPLE: The CPICH_Ec/Io ratio for cell 1 at T2/T3 is calculated using the following equation, which is copied from cell M23 of the *Error summation* sheet and is given in the same format:

Cell 1 CPICH_Ec/Io ratio =10*LOG(($F$22*$G$22)/($F$22+$J$22+$M$22))

- The terms in the denominator are all the linear powers, 2 cells + noise, added up as fractions.
- The *$F$22* term in the numerator is the linear power of Cell 1 at T2/T3, as a fraction.
- The **$G$22* term in the numerator is the linear fraction of power in Cell 1 CPICH code channel.
- The *10 log* term gives the result in dB, in this case –13.00000dB with nominal values.

To calculate the sensitivity for a specific parameter, an arbitrary change of 0.01dB is applied to it. In the example below the absolute power of the noise is varied. A linear scaling factor for 0.01 dB expressed as *(10^(0.01/10)) is pasted into the equation, copied from cell M24 of the *Error summation* sheet:

New Cell 1 CPICH_Ec/Io ratio
=10*LOG(($F$22*$G$22)/($F$22+$J$22+$M$22*(10^(0.01/10))))

This gives a new value for the CPICH_Ec/Io ratio of –13.00101dB with the scaled-up noise. The difference from the original is taken and then multiplied by 100 to get -0.101, which is the change of the Cell 1 CPICH_Ec/Io per dB change in the noise power. In this example cell M11 of the *Error summation* sheet is made equal to this value.

A small change is chosen to get the correct value for the sensitivity. This sensitivity of –0.101, is clearly different from +1, and illustrates why the method is necessary. The sign of the sensitivity is negative, which shows that a rise in the noise power results in a reduction in the Cell 1 CPICH_Ec/Io ratio.

Each of the 5 contributing uncertainties for this test is treated the same way by rewriting the equations. The resulting sensitivities are then copied into the relevant cells. The same process is repeated for each UE parameter listed in column A. Because the conditions at T1/T4 and T2/T3 are different, the process is carried out twice: once for T1/T4 and once for T2/T3.

Cells are coloured grey when a parameter is not relevant, for example when Cell 2 does not exist during T1/T4.

The contributing uncertainty, for example Cell M6, is multiplied by the sensitivity value, cell M11 in this example, to give the resultant uncertainty in cell M12.

5.8.5.2 Superposition of uncertainty effects

The *Error summation* sheet takes each test system uncertainty and uses the sensitivity factors derived in clause 5.8.5.1 to predict the overall effect on the critical parameters at the UE.

The uncertainties in the absolute and relative levels of the 2 cells, the uncertainty in the noise, and the uncertainty in channel power ratio, are entered in the pink cells in row 3 to 6 of the *Error summation* sheet. Separate sets of columns are used for T1/T4 and for T2/T3.

The critical parameters at the UE are listed in rows 11, 14, and 17 on the *Error summation* sheet. Each parameter has a figure for its sensitivity to each of the setting uncertainties. The sensitivities were obtained in clause 5.8.5.1, and are valid for parameters near the nominal figures. Each test system uncertainty is multiplied by the relevant sensitivity, to give the individual effect on each critical parameter at the UE.

The figures in the sum columns of the *Error summation* sheet are the overall spread that can be expected for those parameters. The *Combi* sum of errors has been selected in columns R and V as the most realistic model, but is the same as root-sum-squares combination for these tests because no adverse effects of correlation are envisaged. This is consistent with the assumptions given in clause 5.8.4.

5.8.5.3 Derivation of Ior(n)

Several strategies are possible to ensure that the test requirement guidelines are met. The strategy taken here is to make no changes to the Cell powers, but to meet the test requirements by changing only the channel power ratios. The benefit of this approach is simplicity. The *Apply uncertainties – Find Ior* sheet is used to calculate the nominal powers for each cell, but no uncertainties are applied, so it generates the same values as the *Original* sheet.

The Ior(n) values appear in cells D35 to G35 of the *Apply uncertainties – Find Ior* sheet, and are carried forward to the *Error analysis* sheet.

5.8.5.4 Determination of initial Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 are not given an offset.

A value of 0 dB is entered in cell K24 on the *Error analysis* sheet, but is modified later in clause 5.8.5.6.

5.8.5.5 Prediction of spread in critical parameters

The "Combi" sum of errors is then used back in the *Error analysis* sheet to give high and low figures.

EXAMPLE: With cell K24 set to 0, the set value of Cell 2 CPICH_Ec/Io at T2/T3 is –14.00dB as shown in cell G20, but it may be as high as –13.76dB (cell G21) or as low as –14.24dB (cell G22). The high and low values are obtained by simply adding or subtracting the summed uncertainties to the set value.

Other critical parameters are treated in the same way as the example.

The blue cells show the values that have to be checked against the test requirement guidelines.

5.8.5.6 Determination of final Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 were not given an offset. Comparing the Cell 1 and Cell 2 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limit specified in clause 5.8.2 a). An offset to the CPICH_Ec/Io power ratio in Cells 1 and 2 has therefore been added in the *Error analysis* sheet.

A value of +0.7 dB in cell K24 ensures that the requirements are met.

A similar offset in cell K25 is applied to the other specified channels on Cells 1 and 2 to maintain the same relative power between code channels.

The power in OCNS decreases to keep the overall power of Cell 1 and Cell 2 correct.

5.8.6 Check against test requirement guidelines

The numbers given are derived using the spreadsheet in Annex A.1.5. References to individual sheets within the spreadsheet are given in *italics*.

a) The Worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

Sheet *Error analysis* cells D22 and E22 give –12.93dB and –12.50dB at T1/T4 and T2/T3 respectively, which comply with the requirement of -13dB for Cell 1.

Sheet *Error analysis* cell G22 gives –13.54dB at T2/T3, which complies with the requirement of -14dB for Cell 2.

b) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2/T3 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs.

Sheet *Error analysis* cell E25 gives a difference of -1.33dB for Cell 2 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Even if the UE reports this a further 1.5dB low (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy) the lowest reported value would be –2.83dB, which complies with the requirement of -3dB during time T2/T3.

c) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T4 shall be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1B (A Primary CPICH leaves the reporting range) occurs.

Sheet *Error analysis* cell D24 gives a difference of -87dB for Cell 2 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Although this is only calculated as a nominal figure which is dependent on the "-99.99" number entered in cell F18 of the *Apply uncertainties – Find Ior* sheet , it clearly complies with the requirement of -3dB during time T4.

d) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

Sheet *Error analysis* cells D27 and E27 give nominal Io values of –66.99dBm and –60.00dBm at T1/T4 and T2/T3 respectively, which are within 0.03dB of the stated values of –66.98dBm and –60.03dBm.

e) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

Sheet *Error analysis* cells D11 to G13 show that the channel power ratios of all the other channels for Cell 1 and Cell 2 (except OCNS) are increased by the same amount as the CPICH. As their variability at the UE is subject to the same influences as the CPICH, which has already been shown to comply under guideline a), the other channels (except OCNS) will not fall below the stated Ec/Io ratio.

f) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

No other parameters have been changed.

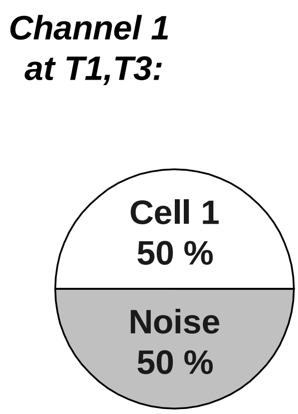
5.8A Test 8.6.1.1A Event triggered reporting in AWGN propagation conditions (Rel-4 and later)

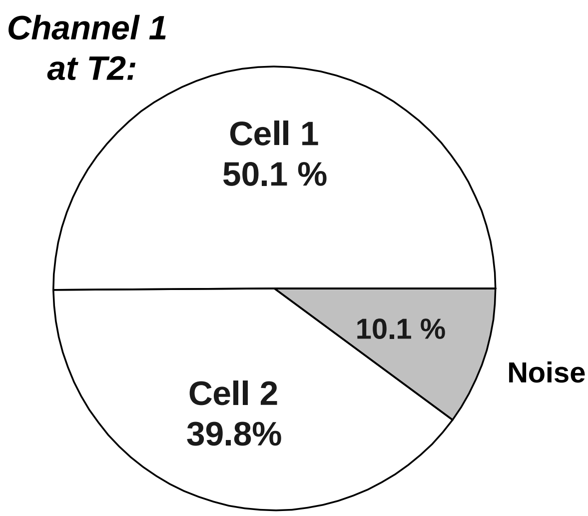
5.8A.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] table 8.6.1.1A.2.

The cell-specific parameters in 3GPP TS 34.121 [1, 2, 3] are expressed as $\hat{I}_{or}/I_{oc}$ ratios in dB, and I_{oc} is expressed in dBm/3.84 MHz. To analyse the relationship between the parameters which can be set by the test system and the signal presented to the UE, it is useful to show the composite signal in the form of a pie chart. The size of the pie is scaled according to the overall power Io on a channel, and the angle of the sector shows the percentage of power contributed by a cell.

NOTE: The pie charts do not attempt to show any of the code channel power ratios within each cell, only the cell powers and noise power.





The main points to note about the cell set-up are:

- T1 and T3 have the same cell conditions.
- The overall power within the radio channel changes between T1/T3 and T2, so the pies are different sizes.
- Cell 1 is bigger in absolute power during T2 compared to its initial value in T1/T3.
- Cell 2 does not exist during T1/T3, and only appears during T2.
- The noise remains the same absolute power from T1/T3 to T2, but becomes a smaller fraction of the overall power.

5.8A.2 Test requirement guidelines

The following guidelines are a prioritised list of which test parameters have the most effect on the results of the test. When the uncertainties of the test system are considered, the priorities given in the guidelines below are used in order to ensure that the most important parameters are optimised first. This will ensure that the test is carried out in conditions as close as possible to those for which the test purpose was originally defined.

a) The worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

b) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs.

c) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T3 shall be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1B (A Primary CPICH leaves the reporting range) occurs.

d) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

e) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

f) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

5.8A.3 Uncertainty parameter set

Cell 1 has been chosen as the reference, and has its power specified as an absolute accuracy. Cell 2 is specified relative to the reference cell.

Within each channel, the noise is specified as an absolute accuracy. This is because it has a different bandwidth from the cell powers, and may be measured using different equipment.

During T1/T3:

None apply only during T1/T3

During T2:

Level uncertainty of Ior (2) relative to Ior (1): +/- 0.3dB

During T1, T2 and T3:

CPICH_Ec/Ior (n) uncertainty: +/-0.1dB

Absolute level uncertainty of Ior (1): +/-0.7dB

Absolute level uncertainty of Ioc: +/-1.0dB

The chosen parameters form a minimum set, allowing the principle of superposition to be applied. The values are chosen to be the same as uncertainties used elsewhere in other conformance tests.

5.8A.4 Assumptions

Same as defined for test 8.6.1.1 in clause 5.8.4.

5.8A.5 Calculation of test requirements

The calculations are performed using the spreadsheet in Annex A.1.5A. References to individual sheets within the spreadsheet are given in *italics*.

5.8A.5.1 Sensitivity analysis

The pie charts in clause 5.8A.1 represent the signal presented to the UE, and can be used to understand the basis for the equations in the *Error summation* sheet.

EXAMPLE: The CPICH_Ec/Io ratio for cell 1 at T2 is calculated using the following equation, which is copied from cell M23 of the *Error summation* sheet and is given in the same format:

Cell 1 CPICH_Ec/Io ratio =10*LOG(($F$22*$G$22)/($F$22+$J$22+$M$22))

- The terms in the denominator are all the linear powers, 2 cells + noise, added up as fractions.
- The *$F$22* term in the numerator is the linear power of Cell 1 at T2, as a fraction.
- The **$G$22* term in the numerator is the linear fraction of power in Cell 1 CPICH code channel.
- The *10 log* term gives the result in dB, in this case –13.00000dB with nominal values.

To calculate the sensitivity for a specific parameter, an arbitrary change of 0.01dB is applied to it. In the example below the absolute power of the noise is varied. A linear scaling factor for 0.01 dB expressed as *(10^(0.01/10)) is pasted into the equation, copied from cell M24 of the *Error summation* sheet:

New Cell 1 CPICH_Ec/Io ratio
=10*LOG(($F$22*$G$22)/($F$22+$J$22+$M$22*(10^(0.01/10))))

This gives a new value for the CPICH_Ec/Io ratio of –13.00101dB with the scaled-up noise. The difference from the original is taken and then multiplied by 100 to get -0.101, which is the change of the Cell 1 CPICH_Ec/Io per dB change in the noise power. In this example cell M11 of the *Error summation* sheet is made equal to this value.

A small change is chosen to get the correct value for the sensitivity. This sensitivity of –0.101, is clearly different from +1, and illustrates why the method is necessary. The sign of the sensitivity is negative, which shows that a rise in the noise power results in a reduction in the Cell 1 CPICH_Ec/Io ratio.

Each of the 5 contributing uncertainties for this test is treated the same way by rewriting the equations. The resulting sensitivities are then copied into the relevant cells. The same process is repeated for each UE parameter listed in column A. Because the conditions at T1/T3 and T2 are different, the process is carried out twice: once for T1/T3 and once for T2.

Cells are coloured grey when a parameter is not relevant, for example when Cell 2 does not exist during T1/T3.

The contributing uncertainty, for example Cell M6, is multiplied by the sensitivity value, cell M11 in this example, to give the resultant uncertainty in cell M12.

5.8A.5.2 Superposition of uncertainty effects

The *Error summation* sheet takes each test system uncertainty and uses the sensitivity factors derived in clause 5.8A.5.1 to predict the overall effect on the critical parameters at the UE.

The uncertainties in the absolute and relative levels of the 2 cells, the uncertainty in the noise, and the uncertainty in channel power ratio, are entered in the pink cells in row 3 to 6 of the *Error summation* sheet. Separate sets of columns are used for T1/T3 and for T2.

The critical parameters at the UE are listed in rows 11, 14, and 17 on the *Error summation* sheet. Each parameter has a figure for its sensitivity to each of the setting uncertainties. The sensitivities were obtained in clause 5.8A.5.1, and are valid for parameters near the nominal figures. Each test system uncertainty is multiplied by the relevant sensitivity, to give the individual effect on each critical parameter at the UE.

The figures in the sum columns of the *Error summation* sheet are the overall spread that can be expected for those parameters. The *Combi* sum of errors has been selected in columns R and V as the most realistic model, but is the same as root-sum-squares combination for these tests because no adverse effects of correlation are envisaged. This is consistent with the assumptions given in clause 5.8A.4.

5.8A.5.3 Derivation of Ior(n)

Several strategies are possible to ensure that the test requirement guidelines are met. The strategy taken here is to make no changes to the Cell powers, but to meet the test requirements by changing only the channel power ratios. The benefit of this approach is simplicity. The *Apply uncertainties – Find Ior* sheet is used to calculate the nominal powers for each cell, but no uncertainties are applied, so it generates the same values as the *Original* sheet.

The Ior(n) values appear in cells D35 to G35 of the *Apply uncertainties – Find Ior* sheet, and are carried forward to the *Error analysis* sheet.

5.8A.5.4 Determination of initial Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 are not given an offset.

A value of 0 dB is entered in cell K24 on the *Error analysis* sheet, but is modified later in clause 5.8A.5.6.

5.8A.5.5 Prediction of spread in critical parameters

The "Combi" sum of errors is then used back in the *Error analysis* sheet to give high and low figures.

EXAMPLE: With cell K24 set to 0, the set value of Cell 2 CPICH_Ec/Io at T2 is –14.00dB as shown in cell G20, but it may be as high as –13.76dB (cell G21) or as low as –14.24dB (cell G22). The high and low values are obtained by simply adding or subtracting the summed uncertainties to the set value.

Other critical parameters are treated in the same way as the example.

The blue cells show the values that have to be checked against the test requirement guidelines.

5.8A.5.6 Determination of final Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 were not given an offset. Comparing the Cell 1 and Cell 2 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limit specified in clause 5.8A.2 a). An offset to the CPICH_Ec/Io power ratio in Cells 1 and 2 has therefore been added in the *Error analysis* sheet.

A value of +0.7 dB in cell K24 ensures that the requirements are met.

A similar offset in cell K25 is applied to the other specified channels on Cells 1 and 2 to maintain the same relative power between code channels.

The power in OCNS decreases to keep the overall power of Cell 1 and Cell 2 correct.

5.8A.6 Check against test requirement guidelines

The numbers given are derived using the spreadsheet in Annex A.1.5A. References to individual sheets within the spreadsheet are given in *italics*.

a) The Worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

Sheet *Error analysis* cells D22 and E22 give –12.93dB and –12.50dB at T1/T3 and T2 respectively, which comply with the requirement of -13dB for Cell 1.

Sheet *Error analysis* cell G22 gives –13.54dB at T2, which complies with the requirement of -14dB for Cell 2.

b) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs.

Sheet *Error analysis* cell E25 gives a difference of -1.33dB for Cell 2 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Even if the UE reports this a further 1.5dB low (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy) the lowest reported value would be –2.83dB, which complies with the requirement of -3dB during time T2.

c) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T3 shall be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1B (A Primary CPICH leaves the reporting range) occurs.

Sheet *Error analysis* cell D24 gives a difference of -87dB for Cell 2 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Although this is only calculated as a nominal figure which is dependent on the "-99.99" number entered in cell F18 of the *Apply uncertainties – Find Ior* sheet , it clearly complies with the requirement of -3dB during time T3.

d) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

Sheet *Error analysis* cells D27 and E27 give nominal Io values of –66.99dBm and –60.00dBm at T1/T3 and T2 respectively, which are within 0.03dB of the stated values of –66.98dBm and –60.03dBm.

e) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

Sheet *Error analysis* cells D11 to G13 show that the channel power ratios of all the other channels for Cell 1 and Cell 2 (except OCNS) are increased by the same amount as the CPICH. As their variability at the UE is subject to the same influences as the CPICH, which has already been shown to comply under guideline a), the other channels (except OCNS) will not fall below the stated Ec/Io ratio.

f) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

No other parameters have been changed.

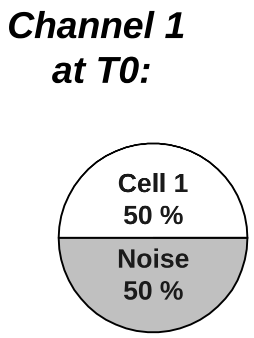
5.9 Test 8.6.1.2 Event triggered reporting of multiple neighbours in AWGN propagation condition (R99)

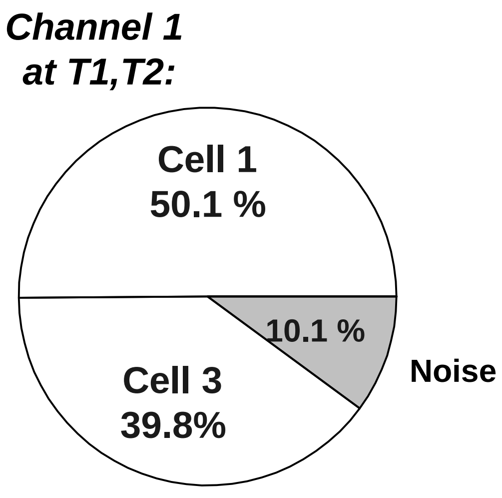
5.9.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] tables 8.6.1.2.1 and 8.6.1.2.3.

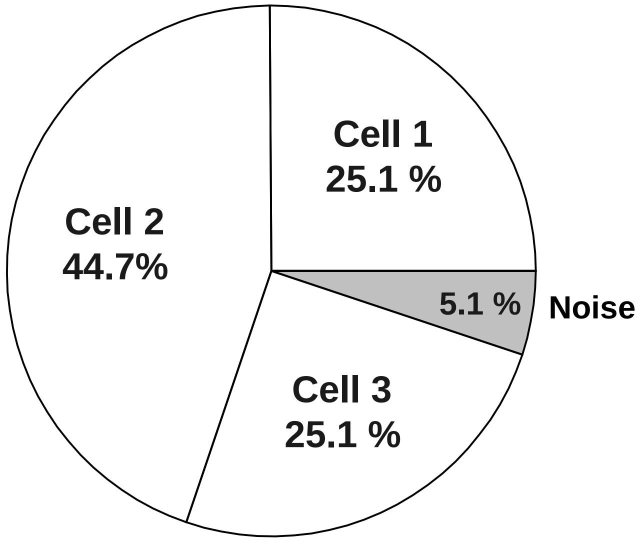
The cell-specific parameters in 3GPP TS 34.121 [1, 2, 3] are expressed as $\hat{I}_{or}/I_{oc}$ ratios in dB, and I_{oc} is expressed in dBm/3.84 MHz. To analyse the relationship between the parameters which can be set by the test system and the signal presented to the UE, it is useful to show the composite signal in the form of a pie chart. The size of the pie is scaled according to the overall power Io on a channel, and the angle of the sector shows the percentage of power contributed by a cell.

NOTE: The pie charts do not attempt to show any of the code channel power ratios within each cell, only the cell powers and noise power.

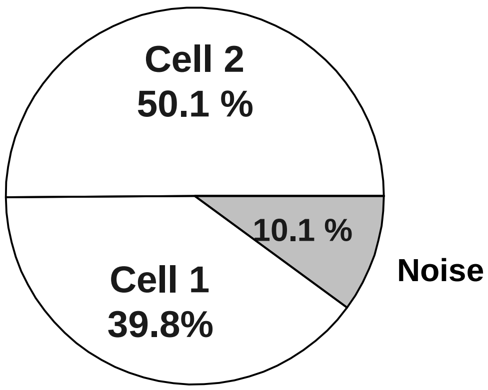


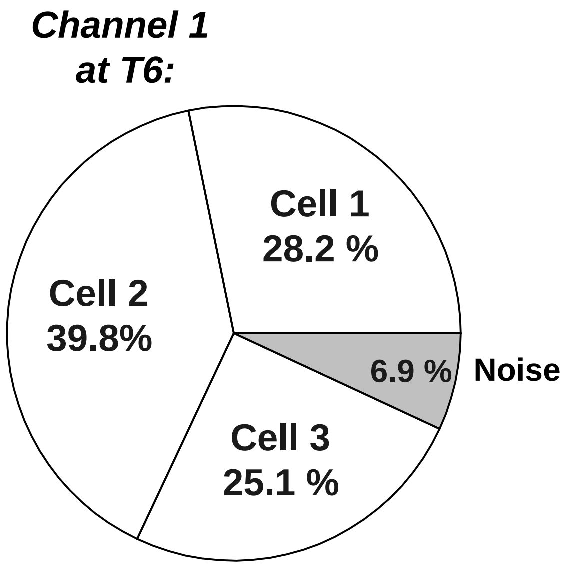


Channel 1 at T3:



Channel 1 at T4,T5:





The main points to note about the cell set-up are:

- T1 and T2 have the same cell conditions.
- T4 and T5 have the same cell conditions.
- The overall power within the radio channel changes between T0, T1/T2, T3, T4/T5 and T6, so the pies are different sizes.
- The cells change in absolute power between time periods.
- Cell 2 does not exist during T0 and during T1/T2, and only appears during T3, T4/T5 and T6.
- Cell 3 does not exist during T0 and during T4/T5, and only appears during T1/T2, T3 and T6.
- The noise remains the same absolute power during all the time periods, but changes as a fraction of the overall power.

5.9.2 Test requirement guidelines

The following guidelines are a prioritised list of which test parameters have the most effect on the results of the test. When the uncertainties of the test system are considered, the priorities given in the guidelines below are used in order to ensure that the most important parameters are optimised first. This will ensure that the test is carried out in conditions as close as possible to those for which the test purpose was originally defined.

a) The worst-case CPICH_Ec/Io of Cell 1, Cell 2 and Cell 3 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

b) The value of Cell 3 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T1 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 3.

c) With the value of W=0, the value of Cell 2 CPICH_Ec/Io relative to the best of Cell 1 CPICH_Ec/Io and Cell 3 CPICH Ec/Io as measured by the UE during time T3 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 2.

d) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T3 shall not be less than 0 dB, the value of the replacement activation threshold. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1C (A non-active primary CPICH becomes better than an active primary CPICH) occurs for Cell 2.

e) The value of Cell 3 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T4 shall be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1B (A Primary CPICH leaves the reporting range) occurs for Cell 3.

f) The value of Cell 3 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T6 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 3.

g) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

h) The worst-case Ec/Io ratios of all other channels (except OCNS) for Cell 1, Cell 2 and Cell 3 shall not fall below the values implied in the original table.

i) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

5.9.3 Uncertainty parameter set

Cell 1 has been chosen as the reference, and has its power specified as an absolute accuracy. Cell 2 and Cell 3 are specified relative to the reference cell.

Within each channel, the noise is specified as an absolute accuracy. This is because it has a different bandwidth from the cell powers, and may be measured using different equipment.

During T1/T2, T3 and T6:

Level uncertainty of Ior (3) relative to Ior (1): +/- 0.3dB

During T3, T4/T5 and T6:

Level uncertainty of Ior (2) relative to Ior (1): +/- 0.3dB

During T0 to T6:

CPICH_Ec/Ior (n) uncertainty: +/-0.1dB

Absolute level uncertainty of Ior (1): +/-0.7dB

Absolute level uncertainty of Ioc: +/-1.0dB

The chosen parameters form a minimum set, allowing the principle of superposition to be applied. The values are chosen to be the same as uncertainties used elsewhere in other conformance tests.

5.9.4 Assumptions

a) The contributing uncertainties for Ior(n), channel power ratio, and Ioc are derived according to ETR 273-1-2 [4], with a coverage factor of k=2.

b) Within each cell, the uncertainty for Ior(n), and channel power ratio are uncorrelated to each other.

c) The relative uncertainties for Ior(n) across different cells may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

d) Across different cells, the channel power ratio uncertainties may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

e) The uncertainty for Ioc and Ior(1) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

f) The absolute uncertainty of Ior(1) and the relative uncertainty of Ior(2, 3), are uncorrelated to each other.

5.9.5 Calculation of test requirements

The calculations are performed using the spreadsheet in Annex A.1.6. References to individual sheets within the spreadsheet are given in *italics*.

5.9.5.1 Sensitivity analysis

The pie charts in clause 5.9.1 represent the signal presented to the UE, and can be used to understand the basis for the equations in the *Error summation* sheet.

EXAMPLE: The CPICH_Ec/Io ratio for Cell 1 at T6 is calculated using the following equation, which is copied from cell AL32 of the *Error summation* sheet and is given in the same format:

Cell 1 CPICH_Ec/Io ratio =10*LOG(($L$31*$M$31)/($L$31+$V$31+$AF$31+AL$31))

- The terms in the denominator are all the linear powers, 3 cells + noise, added up as fractions.
- The *$L$31* term in the numerator is the linear power of Cell 1 at T6, as a fraction.
- The **$M$31* term in the numerator is the linear fraction of power in Cell 1 CPICH code channel.
- The *10 log* term gives the result in dB, in this case –15.50000dB with nominal values.

To calculate the sensitivity for a specific parameter, an arbitrary change of 0.01dB is applied to it. In the example below the absolute power of the noise is varied. A linear scaling factor for 0.01 dB expressed as *(10^(0.01/10)) is pasted into the equation, copied from cell AL33 of the *Error summation* sheet:

New Cell 1 CPICH_Ec/Io ratio
=10*LOG(($L$31*$M$31)/($L$31+$V$31+$AF$31+AL$31*(10^(0.01/10))))

This gives a new value for the CPICH_Ec/Io ratio of –15.50069dB with the scaled-up noise. The difference from the original is taken and then multiplied by 100 to get -0.069, which is the change of the Cell 1 CPICH_Ec/Io per dB change in the noise power. In this example cell AL11 of the *Error summation* sheet is made equal to this value.

A small change is chosen to get the correct value for the sensitivity. This sensitivity of –0.069, is clearly different from +1, and illustrates why the method is necessary. The sign of the sensitivity is negative, which shows that a rise in the noise power results in a reduction in the Cell 1 CPICH_Ec/Io ratio.

Each of the 7 contributing uncertainties for this test is treated the same way by rewriting the equations. The resulting sensitivities are then copied into the relevant cells. The same process is repeated for each UE parameter listed in column A. Because the conditions at T0, T1/T2, T3, T4/T5 and T6 are different, the process is carried out five times: once for each time interval.

Cells are coloured grey when a parameter is not relevant, for example when Cell 2 does not exist during T0.

The contributing uncertainty, for example Cell AL6, is multiplied by the sensitivity value, cell AL11 in this example, to give the resultant uncertainty in cell AL12.

5.9.5.2 Superposition of uncertainty effects

The *Error summation* sheet takes each test system uncertainty and uses the sensitivity factors derived in clause 5.9.5.1 to predict the overall effect on the critical parameters at the UE.

The uncertainties in the absolute and relative levels of the 2 cells, the uncertainty in the noise, and the uncertainty in channel power ratio, are entered in the pink cells in rows 3 to 6 of the *Error summation* sheet. Separate sets of columns are used for T0, T1/T2, T3, T4/T5 and T6.

The critical parameters at the UE are listed in rows 11, 14, 17, 20, 23 and 26 on the *Error summation* sheet. Each parameter has a figure for its sensitivity to each of the setting uncertainties. The sensitivities were obtained in clause

5.9.5.1, and are valid for parameters near the nominal figures. Each test system uncertainty is multiplied by the relevant sensitivity, to give the individual effect on each critical parameter at the UE.

The figures in the sum columns of the *Error summation* sheet are the overall spread that can be expected for those parameters. The *Combi* sum of errors has been selected in columns AN to AR as the most realistic model for this test, and is consistent with the assumptions given in clause 5.9.4. Note that the correct way to calculate the *Combi* sum depends on whether correlation has an adverse or a beneficial effect on the result.

5.9.5.3 Derivation of Ior(n)

Several strategies are possible to ensure that the test requirement guidelines are met. The strategy taken here is to make no changes to the Cell powers, but to meet the test requirements by changing only the channel power ratios. The benefit of this approach is simplicity. The *Original* sheet is used to calculate the nominal powers for each cell. The *Apply uncertainties – Find Ior* sheet is not used.

The Ior(n) values appear in cells D35 to R35 of the *Original* sheet, and are carried forward to the *Error analysis* sheet.

5.9.5.4 Determination of initial Cell 1, Cell 2 and Cell 3 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 are not given an offset.

A value of 0 dB is entered in cell M24 on the *Error analysis* sheet, but is modified later in clause 5.9.5.6.

5.9.5.5 Prediction of spread in critical parameters

The "Combi" sum of errors is then used back in the *Error analysis* sheet to give high and low figures.

EXAMPLE: With cell M24 set to 0, the set value of Cell 2 CPICH_Ec/Io at T3 is –13.50dB as shown in cell K20, but it may be as high as –13.23dB (cell K21) or as low as –13.77dB (cell K22). The high and low values are obtained by simply adding or subtracting the summed uncertainties to the set value.

Other critical parameters are treated in the same way as the example.

The blue cells show the values that have to be checked against the test requirement guidelines.

5.9.5.6 Determination of final Cell 1, Cell 2 and Cell 3 CPICH offsets

Initially the channel power ratios in Cells 1,2 and 3 were not given an offset. Comparing the Cell 1, Cell 2 and Cell 3 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limit specified in clause 5.9.2 a). An offset to the CPICH_Ec/Io power ratio in Cells 1, 2 and 3 has therefore been added in the *Error analysis* sheet.

A value of +0.7 dB in cell M24 ensures that the requirements are met.

A similar offset in cell M25 is applied to the other specified channels on Cells 1, 2 and 3 to maintain the same relative power between code channels.

The power in OCNS decreases to keep the overall power of Cell 1, Cell 2 and Cell 3 correct.

5.9.6 Check against test requirement guidelines

The numbers given are derived using the spreadsheet in Annex A.1.6. References to individual sheets within the spreadsheet are given in *italics*.

a) The worst-case CPICH_Ec/Io of Cell 1, Cell 2 and Cell 3 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

Sheet *Error analysis* cells D22, E22, F22, G22, and H22 give –12.93dB, –12.50dB, –15.54dB, –13.52dB and –15.04dB at T0, T1/T2, T3, T4/T5 and T6 respectively, which comply with the requirements of -13dB, -13dB, -16dB, -14dB and –15.5dB for Cell 1.

Sheet *Error analysis* cells K22, L22, and M22 give –13.07dB, –12.51dB and –13.59dB at T3, T4/T5 and T6 respectively, which comply with the requirements of –13.5dB, -13dB and –14dB for Cell 2.

Sheet *Error analysis* cells O22, P22, and R22 give –13.54dB, –15.68dB and –15.67dB at T1/T2, T3 and T6 respectively, which comply with the requirements of –14dB, -16dB and –16dB for Cell 3.

b) The value of Cell 3 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T1 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 3.

Sheet *Error analysis* cell E28 gives a difference of -1.33dB for Cell 3 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Even if the UE reports this a further 1.5dB low (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy for both Cell 3 and Cell 1 CPICH_Ec/Io >-14dB) the lowest reported value would be –2.83dB, which complies with the requirement of -3dB during time T1.

c) With the value of W=0, the value of Cell 2 CPICH_Ec/Io relative to the best of Cell 1 CPICH_Ec/Io and Cell 3 CPICH Ec/Io as measured by the UE during time T3 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 2.

Sheet *Error analysis* cell F25 gives a difference of +2.17dB for Cell 2 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Even if the UE reports this a further 2.0dB low (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy with Cell 1 CPICH_Ec/Io >-16dB) the lowest reported value would be +0.17dB, which complies with the requirement of -3dB during time T3. Taking the negative of Sheet *Error analysis* cell F30 gives a difference of +2.05dB for Cell 2 CPICH_Ec/Io / Cell 3 CPICH_Ec/Io. Even if the UE reports this a further 2.0dB low (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy with Cell 3 CPICH_Ec/Io >-16dB) the lowest reported value would be +0.05dB, which complies with the requirement of -3dB during time T3.

d) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T3 shall not be less than 0 dB, the value of the replacement activation threshold. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1C (A non-active primary CPICH becomes better than an active primary CPICH) occurs for Cell 2.

Sheet *Error analysis* cell F25 gives a difference of +2.17dB for Cell 2 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Even if the UE reports this a further 2.0dB low (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy with Cell 1 CPICH_Ec/Io >-16dB) the lowest reported value would be +0.17dB, which complies with the requirement of 0dB during time T3.

e) The value of Cell 3 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T4 shall be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1B (A Primary CPICH leaves the reporting range) occurs for Cell 3.

Sheet *Error analysis* cells G27 and G28 give a difference of -86dB for Cell 3 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Although this is only calculated as a nominal figure, it clearly complies with the requirement of less than -3dB during time T4/T5.

f) The value of Cell 3 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T6 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 3.

Sheet *Error analysis* cell H28 gives a difference of -0.83dB for Cell 3 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Even if the UE reports this a further 2.0dB low (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy with Cell 3 CPICH_Ec/Io >-16dB) the lowest reported value would be –2.83dB, which complies with the requirement of -3dB during time T6.

g) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

Sheet *Error analysis* cells D33, E33, F33, G33, and H33 give nominal Io values of –81.99dBm, –75.00dBm, –72.10dBm, –75.00dBm and –73.40dBm at T0, T1/T2, T3, T4/T5 and T6 respectively, which are within 0.03dB of the stated values of –81.98dBm, –75.03dBm, –72.07dBm, –75.03dBm and –73.38dBm.

h) The worst-case Ec/Io ratios of all other channels (except OCNS) for Cell 1, Cell 2 and Cell 3 shall not fall below the values implied in the original table.

Sheet *Error analysis* cells D11 to R13 and D14 to H14 show that the channel power ratios of all the other channels for Cell 1, Cell 2 and Cell 3 (except OCNS) are increased by the same amount as the CPICH. As their variability at the UE is subject to the same influences as the CPICH, which has already been shown to comply under guideline a), the other channels (except OCNS) will not fall below the stated Ec/Io ratio.

i) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

No other parameters have been changed.

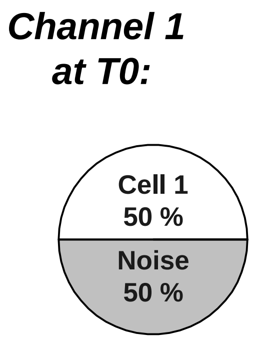
5.9A Test 8.6.1.2A Event triggered reporting of multiple neighbours in AWGN propagation condition (Rel-4 and later)

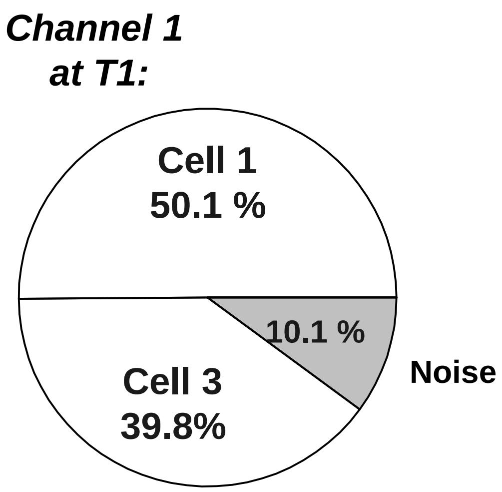
5.9A.1 Minimum requirements

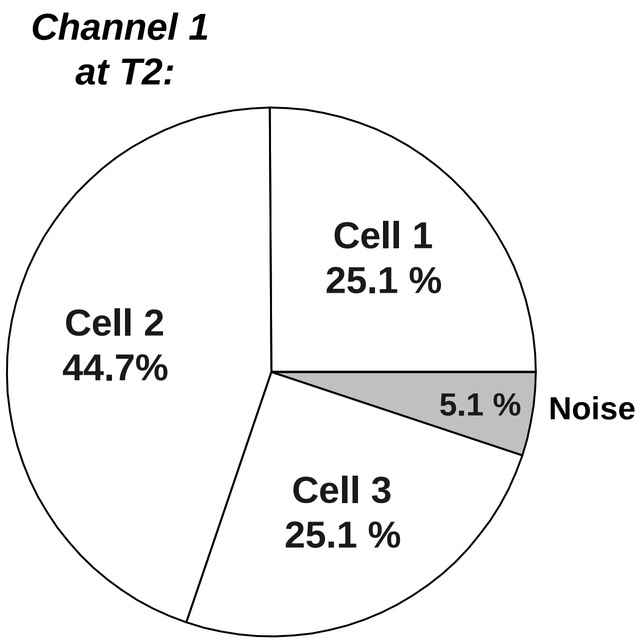
The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] tables 8.6.1.2A.1 and 8.6.1.2A.3.

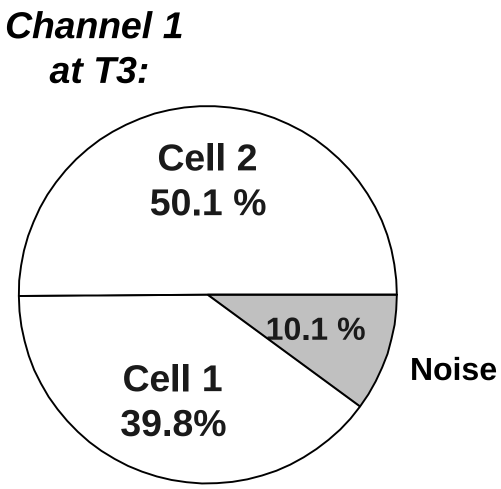
The cell-specific parameters in 3GPP TS 34.121 [1, 2, 3] are expressed as $\hat{I}_{or}/I_{oc}$ ratios in dB, and I_{oc} is expressed in dBm/3.84 MHz. To analyse the relationship between the parameters which can be set by the test system and the signal presented to the UE, it is useful to show the composite signal in the form of a pie chart. The size of the pie is scaled according to the overall power Io on a channel, and the angle of the sector shows the percentage of power contributed by a cell.

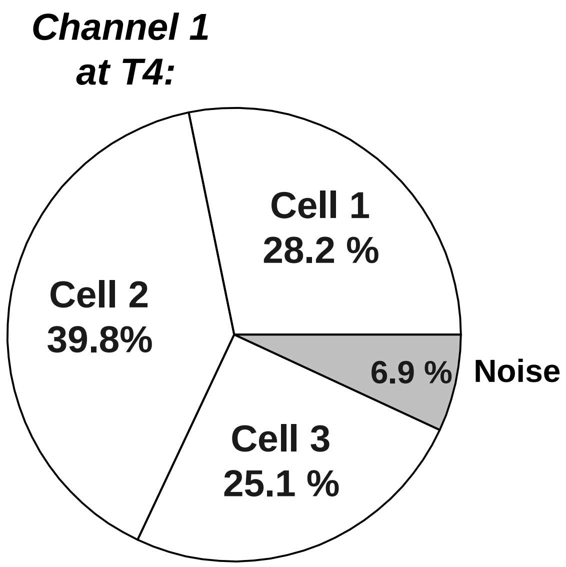
NOTE: The pie charts do not attempt to show any of the code channel power ratios within each cell, only the cell powers and noise power.






Channel 1
at T2:
Cell 1
25.1 %
Cell 2
44.7%
5.1 %
Noise
Cell 3
25.1 %


Channel 1
at T3:
Cell 2
50.1 %
10.1 %
Noise
Cell 1
39.8%



The main points to note about the cell set-up are:

- The overall power within the radio channel changes between T0, T1, T2, T3 and T4, so the pies are different sizes.
- The cells change in absolute power between time periods.
- Cell 2 does not exist during T0 and during T1, and only appears during T2, T3 and T4.
- Cell 3 does not exist during T0 and during T3, and only appears during T1, T2 and T4.
- The noise remains the same absolute power during all the time periods, but changes as a fraction of the overall power.

5.9A.2 Test requirement guidelines

The following guidelines are a prioritised list of which test parameters have the most effect on the results of the test. When the uncertainties of the test system are considered, the priorities given in the guidelines below are used in order to ensure that the most important parameters are optimised first. This will ensure that the test is carried out in conditions as close as possible to those for which the test purpose was originally defined.

a) The worst-case CPICH_Ec/Io of Cell 1, Cell 2 and Cell 3 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

b) The value of Cell 3 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T1 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 3.

c) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 2.

d) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than 0 dB, the value of the replacement activation threshold. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1C (A non-active primary CPICH becomes better than an active primary CPICH) occurs for Cell 2.

e) The value of Cell 3 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T3 shall be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io

Intra frequency relative measurement accuracy. This will ensure that Event 1B (A Primary CPICH leaves the reporting range) occurs for Cell 3.

f) The value of Cell 3 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T4 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 3.

g) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

h) The worst-case Ec/Io ratios of all other channels (except OCNS) for Cell 1, Cell 2 and Cell 3 shall not fall below the values implied in the original table.

i) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

5.9A.3 Uncertainty parameter set

Cell 1 has been chosen as the reference, and has its power specified as an absolute accuracy. Cell 2 and Cell 3 are specified relative to the reference cell.

Within each channel, the noise is specified as an absolute accuracy. This is because it has a different bandwidth from the cell powers, and may be measured using different equipment.

During T1, T2 and T4:

Level uncertainty of Ior (3) relative to Ior (1): +/- 0.3dB

During T2, T3 and T4:

Level uncertainty of Ior (2) relative to Ior (1): +/- 0.3dB

During T0 to T4:

CPICH_Ec/Ior (n) uncertainty: +/-0.1dB

Absolute level uncertainty of Ior (1): +/-0.7dB

Absolute level uncertainty of Ioc: +/-1.0dB

The chosen parameters form a minimum set, allowing the principle of superposition to be applied. The values are chosen to be the same as uncertainties used elsewhere in other conformance tests.

5.9A.4 Assumptions

Same as defined for test 8.6.1.2 in clause 5.9.4.

5.9A.5 Calculation of test requirements

The calculations are performed using the spreadsheet in Annex A.1.6A. References to individual sheets within the spreadsheet are given in *italics*.

5.9A.5.1 Sensitivity analysis

The pie charts in clause 5.9A.1 represent the signal presented to the UE, and can be used to understand the basis for the equations in the *Error summation* sheet.

EXAMPLE: The CPICH_Ec/Io ratio for Cell 1 at T4 is calculated using the following equation, which is copied from cell AL32 of the *Error summation* sheet and is given in the same format:

Cell 1 CPICH_Ec/Io ratio =10*LOG(($L$31*$M$31)/($L$31+$V$31+$AF$31+AL$31))

- The terms in the denominator are all the linear powers, 3 cells + noise, added up as fractions.

- The *$L$31* term in the numerator is the linear power of Cell 1 at T4, as a fraction.

- The **$M$31* term in the numerator is the linear fraction of power in Cell 1 CPICH code channel.

- The *10 log* term gives the result in dB, in this case –15.50000dB with nominal values.

To calculate the sensitivity for a specific parameter, an arbitrary change of 0.01dB is applied to it. In the example below the absolute power of the noise is varied. A linear scaling factor for 0.01 dB expressed as *(10^(0.01/10)) is pasted into the equation, copied from cell AL33 of the *Error summation* sheet:

New Cell 1 CPICH_Ec/Io ratio
=10*LOG(($L$31*$M$31)/($L$31+$V$31+$AF$31+AL$31*(10^(0.01/10))))

This gives a new value for the CPICH_Ec/Io ratio of –15.50069dB with the scaled-up noise. The difference from the original is taken and then multiplied by 100 to get -0.069, which is the change of the Cell 1 CPICH_Ec/Io per dB change in the noise power. In this example cell AL11 of the *Error summation* sheet is made equal to this value.

A small change is chosen to get the correct value for the sensitivity. This sensitivity of –0.069, is clearly different from +1, and illustrates why the method is necessary. The sign of the sensitivity is negative, which shows that a rise in the noise power results in a reduction in the Cell 1 CPICH_Ec/Io ratio.

Each of the 7 contributing uncertainties for this test is treated the same way by rewriting the equations. The resulting sensitivities are then copied into the relevant cells. The same process is repeated for each UE parameter listed in column A. Because the conditions at T0, T1, T2, T3 and T4 are different, the process is carried out five times: once for each time interval.

Cells are coloured grey when a parameter is not relevant, for example when Cell 2 does not exist during T0.

The contributing uncertainty, for example Cell AL6, is multiplied by the sensitivity value, cell AL11 in this example, to give the resultant uncertainty in cell AL12.

5.9A.5.2 Superposition of uncertainty effects

The *Error summation* sheet takes each test system uncertainty and uses the sensitivity factors derived in clause 5.9A.5.1 to predict the overall effect on the critical parameters at the UE.

The uncertainties in the absolute and relative levels of the 2 cells, the uncertainty in the noise, and the uncertainty in channel power ratio, are entered in the pink cells in rows 3 to 6 of the *Error summation* sheet. Separate sets of columns are used for T0, T1, T2, T3 and T4.

The critical parameters at the UE are listed in rows 11, 14, 17, 20, 23 and 26 on the *Error summation* sheet. Each parameter has a figure for its sensitivity to each of the setting uncertainties. The sensitivities were obtained in clause 5.9A.5.1, and are valid for parameters near the nominal figures. Each test system uncertainty is multiplied by the relevant sensitivity, to give the individual effect on each critical parameter at the UE.

The figures in the sum columns of the *Error summation* sheet are the overall spread that can be expected for those parameters. The *Combi* sum of errors has been selected in columns AN to AR as the most realistic model for this test, and is consistent with the assumptions given in clause 5.9A.4. Note that the correct way to calculate the *Combi* sum depends on whether correlation has an adverse or a beneficial effect on the result.

5.9A.5.3 Derivation of Ior(n)

Several strategies are possible to ensure that the test requirement guidelines are met. The strategy taken here is to make no changes to the Cell powers, but to meet the test requirements by changing only the channel power ratios. The benefit of this approach is simplicity. The *Original* sheet is used to calculate the nominal powers for each cell. The *Apply uncertainties – Find Ior* sheet is not used.

The Ior(n) values appear in cells D35 to R35 of the *Original* sheet, and are carried forward to the *Error analysis* sheet.

5.9A.5.4 Determination of initial Cell 1, Cell 2 and Cell 3 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 are not given an offset.

A value of 0 dB is entered in cell M24 on the *Error analysis* sheet, but is modified later in clause 5.9A.5.6.

5.9A.5.5 Prediction of spread in critical parameters

The "Combi" sum of errors is then used back in the *Error analysis* sheet to give high and low figures.

EXAMPLE: With cell M24 set to 0, the set value of Cell 2 CPICH_Ec/Io at T2 is –13.50dB as shown in cell K20, but it may be as high as –13.23dB (cell K21) or as low as –13.77dB (cell K22). The high and low values are obtained by simply adding or subtracting the summed uncertainties to the set value.

Other critical parameters are treated in the same way as the example.

The blue cells show the values that have to be checked against the test requirement guidelines.

5.9A.5.6 Determination of final Cell 1, Cell 2 and Cell 3 CPICH offsets

Initially the channel power ratios in Cells 1,2 and 3 were not given an offset. Comparing the Cell 1, Cell 2 and Cell 3 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limit specified in clause 5.9A.2 a). An offset to the CPICH_Ec/Io power ratio in Cells 1, 2 and 3 has therefore been added in the *Error analysis* sheet.

A value of +0.7 dB in cell M24 ensures that the requirements are met.

A similar offset in cell M25 is applied to the other specified channels on Cells 1, 2 and 3 to maintain the same relative power between code channels.

The power in OCNS decreases to keep the overall power of Cell 1, Cell 2 and Cell 3 correct.

5.9A.6 Check against test requirement guidelines

The numbers given are derived using the spreadsheet in Annex A.1.6A. References to individual sheets within the spreadsheet are given in *italics*.

a) The worst-case CPICH_Ec/Io of Cell 1, Cell 2 and Cell 3 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

Sheet *Error analysis* cells D22, E22, F22, G22, and H22 give –12.93dB, –12.50dB, –15.54dB, –13.52dB and –15.04dB at T0, T1, T2, T3 and T4 respectively, which comply with the requirements of -13dB, -13dB, -16dB, -14dB and –15.5dB for Cell 1.

Sheet *Error analysis* cells K22, L22, and M22 give –13.07dB, –12.51dB and –13.59dB at T2, T3 and T4 respectively, which comply with the requirements of –13.5dB, -13dB and –14dB for Cell 2.

Sheet *Error analysis* cells O22, P22, and R22 give –13.54dB, –15.68dB and –15.67dB at T1, T2 and T4 respectively, which comply with the requirements of –14dB, -16dB and –16dB for Cell 3.

b) The value of Cell 3 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T1 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 3.

Sheet *Error analysis* cell E28 gives a difference of -1.33dB for Cell 3 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Even if the UE reports this a further 1.5dB low (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy for both Cell 3 and Cell 1 CPICH_Ec/Io >-14dB) the lowest reported value would be –2.83dB, which complies with the requirement of -3dB during time T1.

c) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 2.

Sheet *Error analysis* cell F25 gives a difference of +2.17dB for Cell 2 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Even if the UE reports this a further 2.0dB low (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy with Cell 1 CPICH_Ec/Io >-16dB) the lowest reported value would be +0.17dB, which complies with the requirement of -3dB during time T2.

d) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than 0 dB, the value of the replacement activation threshold. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1C (A non-active primary CPICH becomes better than an active primary CPICH) occurs for Cell 2.

Sheet *Error analysis* cell F25 gives a difference of +2.17dB for Cell 2 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Even if the UE reports this a further 2.0dB low (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy with Cell 1 CPICH_Ec/Io >-16dB) the lowest reported value would be +0.17dB, which complies with the requirement of 0dB during time T2.

e) The value of Cell 3 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T3 shall be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1B (A Primary CPICH leaves the reporting range) occurs for Cell 3.

Sheet *Error analysis* cells G27 and G28 give a difference of -86dB for Cell 3 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Although this is only calculated as a nominal figure, it clearly complies with the requirement of less than -3dB during time T3.

f) The value of Cell 3 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T4 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 3.

Sheet *Error analysis* cell H28 gives a difference of -0.83dB for Cell 3 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Even if the UE reports this a further 2.0dB low (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy with Cell 3 CPICH_Ec/Io >-16dB) the lowest reported value would be –2.83dB, which complies with the requirement of -3dB during time T4.

g) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

Sheet *Error analysis* cells D33, E33, F33, G33, and H33 give nominal Io values of –81.99dBm, –75.00dBm, –72.10dBm, –75.00dBm and –73.40dBm at T0, T1, T2, T3 and T4 respectively, which are within 0.03dB of the stated values of –81.98dBm, –75.03dBm, –72.07dBm, –75.03dBm and –73.38dBm.

h) The worst-case Ec/Io ratios of all other channels (except OCNS) for Cell 1, Cell 2 and Cell 3 shall not fall below the values implied in the original table.

Sheet *Error analysis* cells D11 to R13 and D14 to H14 show that the channel power ratios of all the other channels for Cell 1, Cell 2 and Cell 3 (except OCNS) are increased by the same amount as the CPICH. As their variability at the UE is subject to the same influences as the CPICH, which has already been shown to comply under guideline a), the other channels (except OCNS) will not fall below the stated Ec/Io ratio.

i) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

No other parameters have been changed.

5.10 Test 8.6.1.3 Event triggered reporting of two detectable neighbours in AWGN propagation condition (R99)

5.10.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] tables 8.6.1.3.1 and 8.6.1.3.3.

The cell-specific parameters in 3GPP TS 34.121 [1, 2, 3] are expressed as $\hat{I}_{or}/I_{oc}$ ratios in dB, and I_{oc} is expressed in dBm/3.84 MHz. To analyse the relationship between the parameters which can be set by the test system and the signal presented to the UE, it is useful to show the composite signal in the form of a pie chart. The size of the pie is scaled according to the overall power Io on a channel, and the angle of the sector shows the percentage of power contributed by a cell.

NOTE: The pie charts do not attempt to show any of the code channel power ratios within each cell, only the cell powers and noise power.

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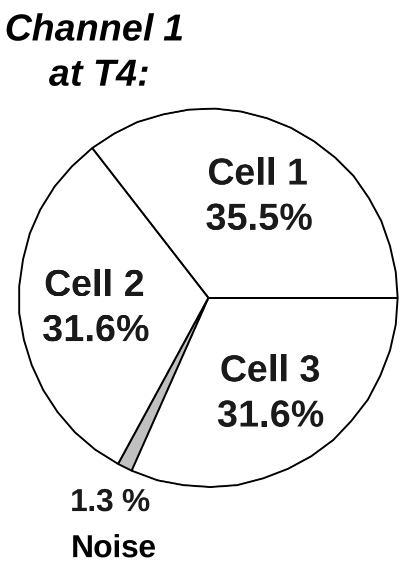
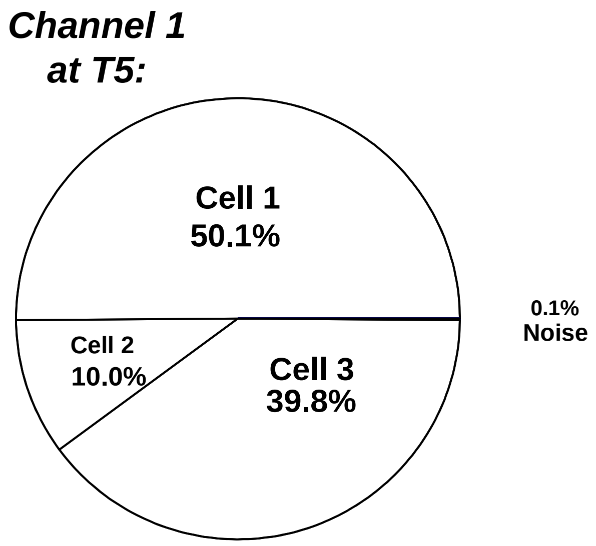




The main points to note about the cell set-up are:

- T2 and T3 have the same cell conditions.
- The overall power within the radio channel changes between T0, T1, T2/T3, T4 and T5, so the pies are different sizes.
- The cells change in absolute power between time periods.
- Cell 2 does not exist during T0 and during T1, and only appears during T2/T3, T4 and T5.
- Cell 3 does not exist during T0 and only appears during T1, T2/ T3, T4 and T5.
- The noise remains the same absolute power during all the time periods, but changes as a fraction of the overall power.

5.10.2 Test requirement guidelines

The following guidelines are a prioritised list of which test parameters have the most effect on the results of the test. When the uncertainties of the test system are considered, the priorities given in the guidelines below are used in order to ensure that the most important parameters are optimised first. This will ensure that the test is carried out in conditions as close as possible to those for which the test purpose was originally defined.

a) The worst-case CPICH_Ec/Io of Cell 1, Cell 2 and Cell 3 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

b) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 2.

c) The value of Cell 3 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T4 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 3.

d) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T5 shall be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1B (A Primary CPICH leaves the reporting range) occurs for Cell 2.

e) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

f) The worst-case Ec/Io ratios of all other channels (except OCNS) for Cell 1, Cell 2 and Cell 3 shall not fall below the values implied in the original table.

g) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

5.10.3 Uncertainty parameter set

Cell 1 has been chosen as the reference, and has its power specified as an absolute accuracy. Cell 2 and Cell 3 are specified relative to the reference cell.

Within each channel, the noise is specified as an absolute accuracy. This is because it has a different bandwidth from the cell powers, and may be measured using different equipment.

During T1, T2/T3, T4 and T5:

Level uncertainty of Ior (3) relative to Ior (1): +/- 0.3dB

During T2/T3, T4, and T5:

Level uncertainty of Ior (2) relative to Ior (1): +/- 0.3dB

During T0 to T5:

CPICH_Ec/Ior (n) uncertainty: +/-0.1dB

Absolute level uncertainty of Ior (1): +/-0.7dB

Absolute level uncertainty of Ioc: +/-1.0dB

The chosen parameters form a minimum set, allowing the principle of superposition to be applied. The values are chosen to be the same as uncertainties used elsewhere in other conformance tests.

5.10.4 Assumptions

a) The contributing uncertainties for Ior(n), channel power ratio, and Ioc are derived according to ETR 273-1-2 [4], with a coverage factor of k=2.

b) Within each cell, the uncertainty for Ior(n), and channel power ratio are uncorrelated to each other.

c) The relative uncertainties for Ior(n) across different cells may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

d) Across different cells, the channel power ratio uncertainties may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

e) The uncertainty for Ioc and Ior(1) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

f) The absolute uncertainty of Ior(1) and the relative uncertainty of Ior(2, 3), are uncorrelated to each other.

5.10.5 Calculation of test requirements

The calculations are performed using the spreadsheet in Annex A.1.7. References to individual sheets within the spreadsheet are given in *italics*.

5.10.5.1 Sensitivity analysis

The pie charts in clause 5.10.1 represent the signal presented to the UE, and can be used to understand the basis for the equations in the *Error summation* sheet.

EXAMPLE: The CPICH_Ec/Io ratio for Cell 1 at T5 is calculated using the following equation, which is copied from cell AL32 of the *Error summation* sheet and is given in the same format:

Cell 1 CPICH_Ec/Io ratio =10*LOG(($L$31*$M$31)/($L$31+$V$31+$AF$31+AL$31))

- The terms in the denominator are all the linear powers, 3 cells + noise, added up as fractions.
- The $*L$31* term in the numerator is the linear power of Cell 1 at T5, as a fraction.
- The **$M$31* term in the numerator is the linear fraction of power in Cell 1 CPICH code channel.
- The *10 log* term gives the result in dB, in this case –13.00000dB with nominal values.

To calculate the sensitivity for a specific parameter, an arbitrary change of 0.01dB is applied to it. In the example below the absolute power of the noise is varied. A linear scaling factor for 0.01 dB expressed as *(10^(0.01/10)) is pasted into the equation, copied from cell AL33 of the *Error summation* sheet:

New Cell 1 CPICH_Ec/Io ratio =10*LOG(($L$31*$M$31)/($L$31+$V$31+$AF$31+AL$31*(10^(0.01/10))))

This gives a new value for the CPICH_Ec/Io ratio of –13.30001dB with the scaled-up noise. The difference from the original is taken and then multiplied by 100 to get -0.001, which is the change of the Cell 1 CPICH_Ec/Io per dB change in the noise power. In this example cell AL11 of the *Error summation* sheet is made equal to this value.

A small change is chosen to get the correct value for the sensitivity. This sensitivity of –0.001, is clearly different from +1, and illustrates why the method is necessary. The sign of the sensitivity is negative, which shows that a rise in the noise power results in a reduction in the Cell 1 CPICH_Ec/Io ratio.

Each of the 7 contributing uncertainties for this test is treated the same way by rewriting the equations. The resulting sensitivities are then copied into the relevant cells. The same process is repeated for each UE parameter listed in column A. Because the conditions at T0, T1, T2/T3, T4 and T5 are different, the process is carried out five times: once for each time interval.

Cells are coloured grey when a parameter is not relevant, for example when Cell 2 does not exist during T0.

The contributing uncertainty, for example Cell AL6, is multiplied by the sensitivity value, cell AL11 in this example, to give the resultant uncertainty in cell AL12.

5.10.5.2 Superposition of uncertainty effects

The *Error summation* sheet takes each test system uncertainty and uses the sensitivity factors derived in clause 5.10.5.1 to predict the overall effect on the critical parameters at the UE.

The uncertainties in the absolute and relative levels of the 2 cells, the uncertainty in the noise, and the uncertainty in channel power ratio, are entered in the pink cells in rows 3 to 6 of the *Error summation* sheet. Separate sets of columns are used for T0, T1, T2/T3, T4, and T5.

The critical parameters at the UE are listed in rows 11, 14, 17, 20, 23 and 26 on the *Error summation* sheet. Each parameter has a figure for its sensitivity to each of the setting uncertainties. The sensitivities were obtained in clause 5.10.5.1, and are valid for parameters near the nominal figures. Each test system uncertainty is multiplied by the relevant sensitivity, to give the individual effect on each critical parameter at the UE.

The figures in the sum columns of the *Error summation* sheet are the overall spread that can be expected for those parameters. The *Combi* sum of errors has been selected in columns AN to AR as the most realistic model for this test, and is consistent with the assumptions given in clause 5.10.4. Note that the correct way to calculate the *Combi* sum depends on whether correlation has an adverse or a beneficial effect on the result.

5.10.5.3 Derivation of Ior(n)

Several strategies are possible to ensure that the test requirement guidelines are met. The strategy taken here is to make no changes to the Cell powers, but to meet the test requirements by changing only the channel power ratios. The benefit of this approach is simplicity. The *Original* sheet is used to calculate the nominal powers for each cell. The *Apply uncertainties – Find Ior* sheet is not used.

The Ior(n) values appear in cells D35 to R35 of the *Original* sheet, and are carried forward to the *Error analysis* sheet.

5.10.5.4 Determination of initial Cell 1, Cell 2 and Cell 3 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 are not given an offset.

A value of 0 dB is entered in cell M24 on the *Error analysis* sheet, but is modified later in clause 5.10.5.6.

5.10.5.5 Prediction of spread in critical parameters

The "Combi" sum of errors is then used back in the *Error analysis* sheet to give high and low figures.

EXAMPLE: With cell M24 set to 0, the set value of Cell 2 CPICH_Ec/Io at T3 is –14.00dB as shown in cell K20, but it may be as high as –13.77dB (cell K21) or as low as –14.23dB (cell K22). The high and low values are obtained by simply adding or subtracting the summed uncertainties to the set value.

Other critical parameters are treated in the same way as the example.

The blue cells show the values that have to be checked against the test requirement guidelines.

5.10.5.6 Determination of final Cell 1, Cell 2 and Cell 3 CPICH offsets

Initially the channel power ratios in Cells 1,2 and 3 were not given an offset. Comparing the Cell 1, Cell 2 and Cell 3 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limit specified in clause 5.10.2 a). An offset to the CPICH_Ec/Io power ratio in Cells 1, 2 and 3 has therefore been added in the *Error analysis* sheet.

A value of +0.4 dB in cell M24 ensures that the requirements are met.

A similar offset in cell M25 is applied to the other specified channels on Cells 1, 2 and 3 to maintain the same relative power between code channels.

The power in OCNS decreases to keep the overall power of Cell 1, Cell 2 and Cell 3 correct.

5.10.6 Check against test requirement guidelines

The numbers given are derived using the spreadsheet in Annex A.1.7. References to individual sheets within the spreadsheet are given in *italics*.

a) The worst-case CPICH_Ec/Io of Cell 1, Cell 2 and Cell 3 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

Sheet *Error analysis* cells D22, E22, F22, G22, and H22 give –10.86dB, –10.72dB, –12.78dB, –14.31dB and –12.78dB at T0, T1, T2/T3, T4 and T5 respectively, which comply with the requirements of -11dB, -11dB, -13dB, -14.50dB and -13.00dB for Cell 1.

Sheet *Error analysis* cells K22, L22, and M22 give –13.83dB, –14.92dB and –20.00dB at T2/T3, T4 and T5 respectively, which comply with the requirements of –14dB, -15dB and –20dB for Cell 2.

Sheet *Error analysis* cells O22, P22, Q22 and R22 give –17.37dB, –20.00dB, –14.92dB and -13.83dB at T1, T2/T3, T4 and T5 respectively, which comply with the requirements of –17.50dB, -20dB, -15dB and –14dB for Cell 3.

b) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 2.

Sheet *Error analysis* cell F25 gives a difference of -1.33dB for Cell 2 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Even if the UE reports this a further 1.5dB low (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy for both Cell 2 and Cell 1 CPICH_Ec/Io >-14dB) the lowest reported value would be –2.83dB, which complies with the requirement of -3dB during time T2.

c) The value of Cell 3 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T4 shall be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH leaves the reporting range) occurs for Cell 3.

Sheet *Error analysis* cell G28 gives a difference of -0.83dB for Cell 3 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Even if the UE reports this a further 2.0dB low (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy with Cell 3 CPICH_Ec/Io >-16dB) the lowest reported value would be –2.83dB, which complies with the requirement of -3dB during time T4.

d) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T5 shall be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1B (A Primary CPICH enters the reporting range) occurs for Cell 2.

Sheet *Error analysis* cells H24 give a difference of -6.67dB for Cell 2 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Even if the UE reports this a further 3.0dB high (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy with Cell 2 CPICH_Ec/Io >-20dB) the highest reported value would be –3.67dB, which complies with the requirement of less than -3dB during time T5.

e) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

Sheet *Error analysis* cells D33, E33, F33, G33, and H33 give nominal Io values of –78.11dBm, –69.40dBm, –53.50dBm, –66.00dBm and –53.50dBm at T0, T1, T2/T3, T4 and T5 respectively, which are within 0.05dB of the stated values of –78.13dBm, –69.45dBm, –53.49dBm, –66.05dBm and –53.49dBm.

f) The worst-case Ec/Io ratios of all other channels (except OCNS) for Cell 1, Cell 2 and Cell 3 shall not fall below the values implied in the original table.

Sheet *Error analysis* cells D11 to R13 and D14 to H14 show that the channel power ratios of all the other channels for Cell 1, Cell 2 and Cell 3 (except OCNS) are increased by the same amount as the CPICH. As their variability at the UE is subject to the same influences as the CPICH, which has already been shown to comply under guideline a), the other channels (except OCNS) will not fall below the stated Ec/Io ratio.

g) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

No other parameters have been changed.

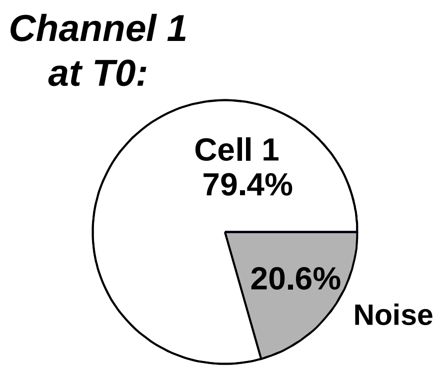
5.10A Test 8.6.1.3A Event triggered reporting of two detectable neighbours in AWGN propagation condition (Rel-4 and later)

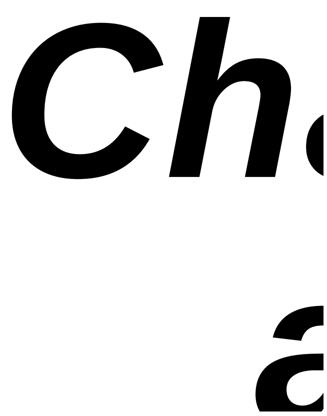
5.10A.1 Minimum requirements

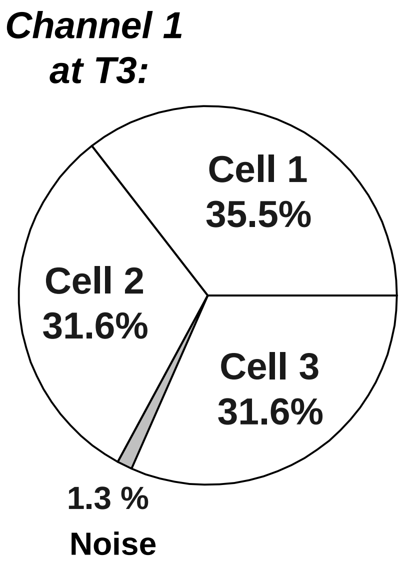
The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] tables 8.6.1.3A.1 and 8.6.1.3A.3.

The cell-specific parameters in 3GPP TS 34.121 [1, 2, 3] are expressed as $\hat{I}_{or}/I_{oc}$ ratios in dB, and I_{oc} is expressed in dBm/3.84 MHz. To analyse the relationship between the parameters which can be set by the test system and the signal presented to the UE, it is useful to show the composite signal in the form of a pie chart. The size of the pie is scaled according to the overall power Io on a channel, and the angle of the sector shows the percentage of power contributed by a cell.

NOTE: The pie charts do not attempt to show any of the code channel power ratios within each cell, only the cell powers and noise power.


Channel 1
at T0:
Cell 1
79.4%
20.6%
Noise





The main points to note about the cell set-up are:

- The overall power within the radio channel changes between T0, T1, T2, T3 and T4, so the pies are different sizes.
- The cells change in absolute power between time periods.
- Cell 2 does not exist during T0 and during T1, and only appears during T2, T3 and T4.
- Cell 3 does not exist during T0, and only appears during T1, T2, T3 and T4.
- The noise remains the same absolute power during all the time periods, but changes as a fraction of the overall power.

5.10A.2 Test requirement guidelines

The following guidelines are a prioritised list of which test parameters have the most effect on the results of the test. When the uncertainties of the test system are considered, the priorities given in the guidelines below are used in order to ensure that the most important parameters are optimised first. This will ensure that the test is carried out in conditions as close as possible to those for which the test purpose was originally defined.

a) The worst-case CPICH_Ec/Io of Cell 1, Cell 2 and Cell 3 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

b) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 2.

c) The value of Cell 3 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T3 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 3.

d) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T4 shall be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1B (A Primary CPICH leaves the reporting range) occurs for Cell 2.

e) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

f) The worst-case Ec/Io ratios of all other channels (except OCNS) for Cell 1, Cell 2 and Cell 3 shall not fall below the values implied in the original table.

g) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

5.10A.3 Uncertainty parameter set

Cell 1 has been chosen as the reference, and has its power specified as an absolute accuracy. Cell 2 and Cell 3 are specified relative to the reference cell.

Within each channel, the noise is specified as an absolute accuracy. This is because it has a different bandwidth from the cell powers, and may be measured using different equipment.

During T1, T2, T3 and T4:

Level uncertainty of Ior (3) relative to Ior (1): +/- 0.3dB

During T2, T3 and T4:

Level uncertainty of Ior (2) relative to Ior (1): +/- 0.3dB

During T0 to T4:

CPICH_Ec/Ior (n) uncertainty: +/-0.1dB

Absolute level uncertainty of Ior (1): +/-0.7dB

Absolute level uncertainty of Ioc: +/-1.0dB

The chosen parameters form a minimum set, allowing the principle of superposition to be applied. The values are chosen to be the same as uncertainties used elsewhere in other conformance tests.

5.10A.4 Assumptions

Same as defined for test 8.6.1.3 in clause 5.10.4.

5.10A.5 Calculation of test requirements

The calculations are performed using the spreadsheet in Annex A.1.7A. References to individual sheets within the spreadsheet are given in *italics*.

5.10A.5.1 Sensitivity analysis

The pie charts in clause 5.10A.1 represent the signal presented to the UE, and can be used to understand the basis for the equations in the *Error summation* sheet.

EXAMPLE: The CPICH_Ec/Io ratio for Cell 1 at T4 is calculated using the following equation, which is copied from cell AL32 of the *Error summation* sheet and is given in the same format:

Cell 1 CPICH_Ec/Io ratio =10*LOG(($L$31*$M$31)/($L$31+$V$31+$AF$31+AL$31))

- The terms in the denominator are all the linear powers, 3 cells + noise, added up as fractions.
- The $*L$31* term in the numerator is the linear power of Cell 1 at T4, as a fraction.
- The **$M$31* term in the numerator is the linear fraction of power in Cell 1 CPICH code channel.
- The *10 log* term gives the result in dB, in this case –13.00000dB with nominal values.

To calculate the sensitivity for a specific parameter, an arbitrary change of 0.01dB is applied to it. In the example below the absolute power of the noise is varied. A linear scaling factor for 0.01 dB expressed as *(10^(0.01/10)) is pasted into the equation, copied from cell AL33 of the *Error summation* sheet:

New Cell 1 CPICH_Ec/Io ratio
=10*LOG(($L$31*$M$31)/($L$31+$V$31+$AF$31+AL$31*(10^(0.01/10))))

This gives a new value for the CPICH_Ec/Io ratio of –13.00001dB with the scaled-up noise. The difference from the original is taken and then multiplied by 100 to get -0.001, which is the change of the Cell 1 CPICH_Ec/Io per dB change in the noise power. In this example cell AL11 of the *Error summation* sheet is made equal to this value.

A small change is chosen to get the correct value for the sensitivity. This sensitivity of –0.001, is clearly different from +1, and illustrates why the method is necessary. The sign of the sensitivity is negative, which shows that a rise in the noise power results in a reduction in the Cell 1 CPICH_Ec/Io ratio.

Each of the 7 contributing uncertainties for this test is treated the same way by rewriting the equations. The resulting sensitivities are then copied into the relevant cells. The same process is repeated for each UE parameter listed in column A. Because the conditions at T0, T1, T2, T3 and T4 are different, the process is carried out five times: once for each time interval.

Cells are coloured grey when a parameter is not relevant, for example when Cell 2 does not exist during T0.

The contributing uncertainty, for example Cell AL6, is multiplied by the sensitivity value, cell AL11 in this example, to give the resultant uncertainty in cell AL12.

5.10A.5.2 Superposition of uncertainty effects

The *Error summation* sheet takes each test system uncertainty and uses the sensitivity factors derived in clause 5.10A.5.1 to predict the overall effect on the critical parameters at the UE.

The uncertainties in the absolute and relative levels of the 2 cells, the uncertainty in the noise, and the uncertainty in channel power ratio, are entered in the pink cells in rows 3 to 6 of the *Error summation* sheet. Separate sets of columns are used for T0, T1, T2, T3 and T4.

The critical parameters at the UE are listed in rows 11, 14, 17, 20, 23 and 26 on the *Error summation* sheet. Each parameter has a figure for its sensitivity to each of the setting uncertainties. The sensitivities were obtained in clause

5.10A.5.1, and are valid for parameters near the nominal figures. Each test system uncertainty is multiplied by the relevant sensitivity, to give the individual effect on each critical parameter at the UE.

The figures in the sum columns of the *Error summation* sheet are the overall spread that can be expected for those parameters. The *Combi* sum of errors has been selected in columns AN to AR as the most realistic model for this test, and is consistent with the assumptions given in clause 5.10A.4. Note that the correct way to calculate the *Combi* sum depends on whether correlation has an adverse or a beneficial effect on the result.

5.10A.5.3 Derivation of Ior(n)

Several strategies are possible to ensure that the test requirement guidelines are met. The strategy taken here is to make no changes to the Cell powers, but to meet the test requirements by changing only the channel power ratios. The benefit of this approach is simplicity. The *Original* sheet is used to calculate the nominal powers for each cell. The *Apply uncertainties – Find Ior* sheet is not used.

The Ior(n) values appear in cells D35 to R35 of the *Original* sheet, and are carried forward to the *Error analysis* sheet.

5.10A.5.4 Determination of initial Cell 1, Cell 2 and Cell 3 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 are not given an offset.

A value of 0 dB is entered in cell M24 on the *Error analysis* sheet, but is modified later in clause 5.10A.5.6.

5.10A.5.5 Prediction of spread in critical parameters

The "Combi" sum of errors is then used back in the *Error analysis* sheet to give high and low figures.

EXAMPLE: With cell M24 set to 0, the set value of Cell 2 CPICH_Ec/Io at T2 is –14.00dB as shown in cell K20, but it may be as high as –13.77dB (cell K21) or as low as –14.23dB (cell K22). The high and low values are obtained by simply adding or subtracting the summed uncertainties to the set value.

Other critical parameters are treated in the same way as the example.

The blue cells show the values that have to be checked against the test requirement guidelines.

5.10A.5.6 Determination of final Cell 1, Cell 2 and Cell 3 CPICH offsets

Initially the channel power ratios in Cells 1,2 and 3 were not given an offset. Comparing the Cell 1, Cell 2 and Cell 3 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limit specified in clause 5.10A.2 a). An offset to the CPICH_Ec/Io power ratio in Cells 1, 2 and 3 has therefore been added in the *Error analysis* sheet.

A value of +0.4 dB in cell M24 ensures that the requirements are met.

A similar offset in cell M25 is applied to the other specified channels on Cells 1, 2 and 3 to maintain the same relative power between code channels.

The power in OCNS decreases to keep the overall power of Cell 1, Cell 2 and Cell 3 correct.

5.10A.6 Check against test requirement guidelines

The numbers given are derived using the spreadsheet in Annex A.1.7A. References to individual sheets within the spreadsheet are given in *italics*.

a) The worst-case CPICH_Ec/Io of Cell 1, Cell 2 and Cell 3 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

Sheet *Error analysis* cells D22, E22, F22, G22, and H22 give –10.86dB, –10.72dB, –12.78dB, –14.31dB and –12.78dB at T0, T1, T2, T3 and T4 respectively, which comply with the requirements of -11dB, -11dB, -13dB, -14.50dB and -13.00dB for Cell 1.

Sheet *Error analysis* cells K22, L22, and M22 give –13.83dB, –14.92dB and –20dB at T2, T3 and T4 respectively, which comply with the requirements of –14dB, -15dB and –20dB for Cell 2.

Sheet *Error analysis* cells O22, P22, Q22 and R22 give –17.37dB, –20.00dB, –14.92dB and -13.83dB at T1, T2, T3 and T4 respectively, which comply with the requirements of –17.50dB, -20dB, -15dB and –14dB for Cell 3.

b) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 2.

Sheet *Error analysis* cell F25 gives a difference of -1.33dB for Cell 2 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Even if the UE reports this a further 1.5dB low (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy for both Cell 2 and Cell 1 CPICH_Ec/Io >-14dB) the lowest reported value would be –2.83dB, which complies with the requirement of -3dB during time T2.

c) The value of Cell 3 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T3 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 3.

Sheet *Error analysis* cell G28 gives a difference of -0.83dB for Cell 3 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Even if the UE reports this a further 2.0dB low (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy with Cell 3 CPICH_Ec/Io >-16dB) the lowest reported value would be –2.83dB, which complies with the requirement of -3dB during time T3.

d) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T4 shall be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1B (A Primary CPICH leaves the reporting range) occurs for Cell 2.

Sheet *Error analysis* cell H24 gives a difference of -6.67dB for Cell 2 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. Even if the UE reports this a further 3.0dB high (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy with Cell 2 CPICH_Ec/Io >-20dB) the highest reported value would be –3.67dB, which complies with the requirement of less than -3dB during time T4.

e) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

Sheet *Error analysis* cells D33, E33, F33, G33, and H33 give nominal Io values of –78.11dBm, –69.40dBm, –53.50dBm, –66.00dBm and –53.50dBm at T0, T1, T2, T3 and T4 respectively, which are within 0.05dB of the stated values of –78.13dBm, –69.45dBm, –53.49dBm, –66.05dBm and –53.49dBm.

f) The worst-case Ec/Io ratios of all other channels (except OCNS) for Cell 1, Cell 2 and Cell 3 shall not fall below the values implied in the original table.

Sheet *Error analysis* cells D11 to R13 and D14 to H14 show that the channel power ratios of all the other channels for Cell 1, Cell 2 and Cell 3 (except OCNS) are increased by the same amount as the CPICH. As their variability at the UE is subject to the same influences as the CPICH, which has already been shown to comply under guideline a), the other channels (except OCNS) will not fall below the stated Ec/Io ratio.

g) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

No other parameters have been changed.

5.11 Test 8.6.1.4 Correct reporting of neighbours in fading propagation condition (R99)

[FFS].

5.11A Test 8.6.1.4A Correct reporting of neighbours in fading propagation condition (Rel-4 and later)

5.11A.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] table 8.6.1.4.2.

The cell-specific parameters in 3GPP TS 34.121 [1, 2, 3] are expressed as $\hat{I}_{or}/I_{oc}$ ratios in dB, and I_{oc} is expressed in dBm/3.84 MHz. To analyse the relationship between the parameters which can be set by the test system and the signal presented to the UE, it is useful to show the composite signal in the form of a pie chart. The size of the pie is scaled according to the overall power Io on a channel, and the angle of the sector shows the percentage of power contributed by a cell.

NOTE: The pie charts do not attempt to show any of the code channel power ratios within each cell, only the cell powers and noise power.

Channel 1 at T1:

The main points to note about the cell set-up are:

- The overall power within the radio channel is the same for T1 and T2, so the pies are the same size.
- Cell 1 is bigger in absolute power during T1 compared to its value in T2.
- Cell 2 is bigger in absolute power during T2 compared to its value in T1.
- The noise remains the same absolute power from T1 to T2.

5.11A.2 Test requirement guidelines

The following guidelines are a prioritised list of which test parameters have the most effect on the results of the test. When the uncertainties of the test system are considered, the priorities given in the guidelines below are used in order to ensure that the most important parameters are optimised first. This will ensure that the test is carried out in conditions as close as possible to those for which the test purpose was originally defined.

a) The worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

b) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T1 shall be lower than -4 dB. This will ensure that Event 1A (A Primary CPICH enters the reporting range) does not occur more frequently because of the test system.

c) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than 4 dB. This will ensure that Event 1B (A Primary CPICH leaves the reporting range) does not occur more frequently because of the test system.

d) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

e) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

f) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

5.11A.3 Uncertainty parameter set

Cell 1 has been chosen as the reference, and has its power specified as an absolute accuracy. Cell 2 is specified relative to the reference cell.

The noise is specified as an absolute accuracy. This is because it has a different bandwidth from the cell powers, and may be measured using different equipment.

During T1 and T2:

CPICH_Ec/Ior (n) uncertainty: +/-0.1dB

Absolute level uncertainty of Ior (1): +/-0.7dB

Level uncertainty of Ior (2) relative to Ior (1): +/- 0.3dB

Absolute level uncertainty of Ioc: +/-1.0dB

The chosen parameters form a minimum set, allowing the principle of superposition to be applied. The values are chosen to be the same as uncertainties used elsewhere in other conformance tests.

5.11A.4 Assumptions

a) The contributing uncertainties for Ior(n), channel power ratio, and Ioc are derived according to ETR 273-1-2 [4], with a coverage factor of k=2.

b) Within each cell, the uncertainty for Ior(n), and channel power ratio are uncorrelated to each other.

c) Across different cells, the channel power ratio uncertainties may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

d) The uncertainty for Ioc and Ior(n) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

e) The absolute uncertainty of Ior(1) and the relative uncertainty of Ior(2), are uncorrelated to each other.

5.11A.5 Calculation of test requirements

The calculations are performed using the spreadsheet in Annex A.1.8A. References to individual sheets within the spreadsheet are given in *italics*.

5.11A.5.1 Sensitivity analysis

The pie charts in clause 5.11A.1 represent the signal presented to the UE, and can be used to understand the basis for the equations in the *Error summation* sheet.

EXAMPLE: The CPICH_Ec/Io ratio for cell 1 at T2 is calculated using the following equation, which is copied from cell M24 of the *Error summation* sheet and is given in the same format:

Cell 1 CPICH_Ec/Io ratio =10*LOG(($F$23*$G$23)/($F$23+$J$23+$M$23))

- The terms in the denominator are all the linear powers, 2 cells + noise, added up as fractions.
- The *$F$23* term in the numerator is the linear power of Cell 1 at T2, as a fraction.
- The **$G$23* term in the numerator is the linear fraction of power in Cell 1 CPICH code channel.
- The *10 log* term gives the result in dB, in this case –16.00000dB with nominal values.

To calculate the sensitivity for a specific parameter, an arbitrary change of 0.01dB is applied to it. In the example below the absolute power of the noise is varied. A linear scaling factor for 0.01 dB expressed as *(10^(0.01/10)) is pasted into the equation, copied from cell M25 of the *Error summation* sheet:

New Cell 1 CPICH_Ec/Io ratio
=10*LOG(($F$23*$G$23)/($F$23+$J$23+$M$23*(10^(0.01/10))))

This gives a new value for the CPICH_Ec/Io ratio of –16.00118 dB with the scaled-up noise. The difference from the original is taken and then multiplied by 100 to get -0.118, which is the change of the Cell 1 CPICH_Ec/Io per dB change in the noise power. In this example cell M11 of the *Error summation* sheet is made equal to this value.

A small change is chosen to get the correct value for the sensitivity. This sensitivity of –0.118 is clearly different from +1, and illustrates why the method is necessary. The sign of the sensitivity is negative, which shows that a rise in the noise power results in a reduction in the Cell 1 CPICH_Ec/Io ratio.

Each of the 5 contributing uncertainties on the one-frequency test is treated the same way by rewriting the equations. The resulting sensitivities are then copied into the relevant cells. The same process is repeated for each UE parameter listed in column A. Because the conditions at T1 and T2 are different, the process is carried out twice: once for T1 and once for T2.

Cells are coloured grey when a parameter is not relevant.

The contributing uncertainty, for example Cell M6, is multiplied by the sensitivity value, cell M11 in this example, to give the resultant uncertainty in cell M12.

5.11A.5.2 Superposition of uncertainty effects

The *Error summation* sheet takes each test system uncertainty and uses the sensitivity factors derived in clause 5.11A.5.1 to predict the overall effect on the critical parameters at the UE.

The uncertainties in the absolute and relative levels of the 2 cells, the uncertainty in the noise, and the uncertainty in channel power ratio, are entered in the pink cells in row 3 to 6 of the *Error summation* sheet. Separate sets of columns are used for T1 and for T2.

The critical parameters at the UE are listed in rows 11, 14, and 17 on the *Error summation* sheet. Each parameter has a figure for its sensitivity to each of the setting uncertainties. The sensitivities were obtained in clause 5.11A.5.1, and are valid for parameters near the nominal figures. Each test system uncertainty is multiplied by the relevant sensitivity, to give the individual effect on each critical parameter at the UE.

The figures in the sum columns of the *Error summation* sheet are the overall spread that can be expected for those parameters. The *Combi* sum of errors has been selected in columns R and V as the most realistic model, but is the same as root-sum-squares combination for these tests because no adverse effects of correlation are envisaged. This is consistent with the assumptions given in clause 5.11A.4.

5.11A.5.3 Derivation of Ior(n)

Several strategies are possible to ensure that the test requirement guidelines are met. The strategy taken here is to make no changes to the Cell powers, but to meet the test requirements by changing only the channel power ratios. The benefit of this approach is simplicity. The *Original* sheet is used to calculate the nominal powers for each cell. The *Apply uncertainties – Find Ior* sheet is not used.

The Ior(n) values appear in cells D35 to G35 of the *Original* sheet, and are carried forward to the *Error analysis* sheet.

5.11A.5.4 Determination of initial Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 are not given an offset.

A value of 0 dB is entered in cells K24 and M24 on the *Error analysis* sheet, but is modified later in clause 5.11A.5.6.

5.11A.5.5 Prediction of spread in critical parameters

The "Combi" sum of errors is then used back in the *Error analysis* sheet to give high and low figures.

EXAMPLE: With cells K24 and M24 set to 0, the set value of Cell 2 CPICH_Ec/Io at T1 is –16.00dB as shown in cell F20, but it may be as high as –15.71dB (cell F21) or as low as –16.28dB (cell F22). The high and low values are obtained by simply adding or subtracting the summed uncertainties to the set value.

Other critical parameters are treated in the same way as the example.

The blue cells show the values that have to be checked against the test requirement guidelines.

5.11A.5.6 Determination of final Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 were not given an offset. Comparing the Cell 1 and Cell 2 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limit specified in clause 5.11A.2 a). In addition, the difference between Cell 2 CPICH_Ec/Io and Cell 1 CPICH_Ec/Io would fall outside the limits specified in clause 5.11A.2 b) and c). An offset to the CPICH_Ec/Io power ratio in Cells 1 and 2 has therefore been added in the *Error analysis* sheet, with different values allowed for Cell 1 and Cell 2 at T1 and T2. However, since Cell 1 and Cell 2 reverse their relative strengths between T1 and T2, only two independent values need be used.

A value of +0.3 dB in cell M24 ensures that the CPICH_Ec/Io values for Cell 1 at T2 and Cell 2 at T1 do not fall below their original value, and a value of +0.7 dB in cell K24 ensures that the difference between Cell 2 CPICH_Ec/Io and Cell 1 CPICH_Ec/Io is at least the original value. Cells N24 and L24 copy the values to meet the equivalent requirements under the remaining test conditions.

Similar offsets in cells K25 to N25 are applied to the other specified channels on Cells 1 and 2 to maintain the same relative power between code channels.

The power in OCNS decreases to keep the overall power of Cell 1 and Cell 2 correct.

5.11A.6 Check against test requirement guidelines

The numbers given are derived using the spreadsheet in Annex A.1.8A References to individual sheets within the spreadsheet are given in *italics*.

a) The Worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

Sheet *Error analysis* cells D22 and E22 give –11.49 dB and –15.96 dB at T1 and T2 respectively, which comply with the requirement of –12 dB and –16 dB for Cell 1 at T1 and T2 respectively.

Sheet *Error analysis* cells F22 and G22 give –15.98 dB and –11.51 dB at T1 and T2 respectively, which comply with the requirement of –16dB and –12 dB for Cell 2 at T1 and T2 respectively.

b) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T1 shall be lower than –4 dB. This will ensure that Event 1A (A Primary CPICH enters the reporting range) does not occur more frequently because of the test system.

Sheet *Error analysis* cell D24 gives a difference of –4.07 dB at T1 for Cell 2 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. This complies with the requirement of -4dB during time T1.

c) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than 4 dB. This will ensure that Event 1B (A Primary CPICH leaves the reporting range) does not occur more frequently because of the test system.

Sheet *Error analysis* cell E25 gives a difference of +4.07 dB at T2 for Cell 2 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. This complies with the requirement of 4dB during time T2.

d) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

Sheet *Error analysis* cells D27 and E27 give nominal Io values of –60.70dBm and –60.70dBm at T1 and T2 respectively, which are within 0.01dB of the stated values of –60.71dBm and –60.71dBm.

e) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

Sheet *Error analysis* cells D11 to G13 and D14 to E14 show that the channel power ratios of all the other channels for Cell 1 and Cell 2 (except OCNS) are increased by the same amount as the CPICH. As their variability at the UE is subject to the same influences as the CPICH, which has already been shown to comply under guideline a), the other channels (except OCNS) will not fall below the stated Ec/Io ratio.

f) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

No other parameters have been changed.

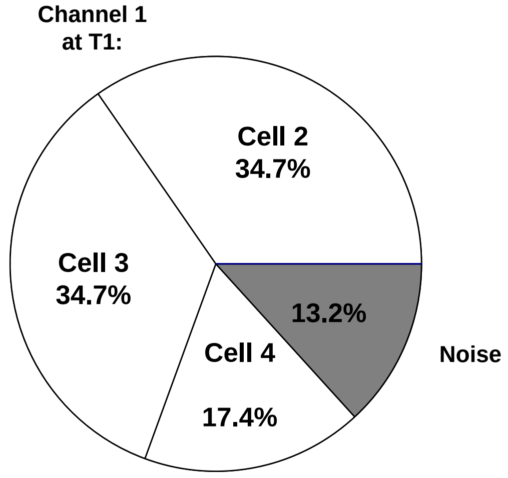
5.12 Test 8.6.1.5 Event triggered reporting of multiple neighbour cells in Case 1 fading conditions

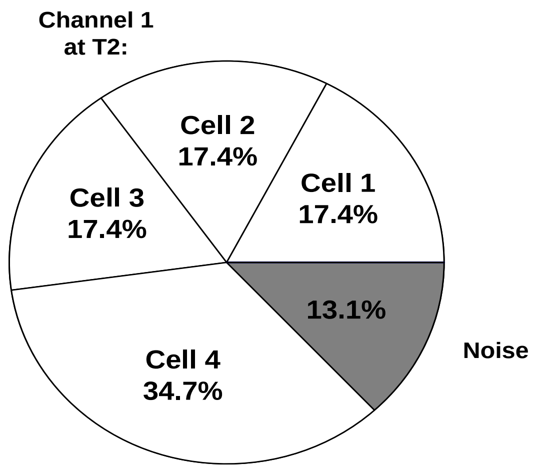
5.12.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] tables 8.6.1.5.2 and 8.6.1.5.3.

The cell-specific parameters in 3GPP TS 34.121 [1, 2, 3] are expressed as $\hat{I}_{or}/I_{oc}$ ratios in dB, and I_{oc} is expressed in dBm/3.84 MHz. To analyse the relationship between the parameters which can be set by the test system and the signal presented to the UE, it is useful to show the composite signal in the form of a pie chart. The size of the pie is scaled according to the overall power Io on a channel, and the angle of the sector shows the percentage of power contributed by a cell.

NOTE: The pie charts do not attempt to show any of the code channel power ratios within each cell, only the cell powers and noise power.





The main points to note about the cell set-up are:

- The overall power within the radio channel changes between T1 and T2, so the pies are different sizes.
- The cells change in absolute power between time periods.
- Cell 1 does not exist during T1, and only appears during T2.
- The noise remains the same absolute power during all the time periods, but changes as a fraction of the overall power.

5.12.2 Test requirement guidelines

The following guidelines are a prioritised list of which test parameters have the most effect on the results of the test. When the uncertainties of the test system are considered, the priorities given in the guidelines below are used in order to ensure that the most important parameters are optimised first. This will ensure that the test is carried out in conditions as close as possible to those for which the test purpose was originally defined.

a) The worst-case CPICH_Ec/Io of Cell 1, Cell 2, Cell 3 and Cell 4 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

b) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 2.

c) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

d) The worst-case Ec/Io ratios of all other channels (except OCNS) for Cell 1, Cell 2 and Cell 3 shall not fall below the values implied in the original table.

e) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

5.12.3 Uncertainty parameter set

Cell 2, Cell 3 and Cell 4 have been chosen as the reference, and has its power specified as an absolute accuracy. Cell 1 is specified relative to the reference cell.

Within each channel, the noise is specified as an absolute accuracy. This is because it has a different bandwidth from the cell powers, and may be measured using different equipment.

During T1 and T2:

Level uncertainty of Ior (2) relative to Ior (1): +/- 0.3dB

During T1 and T2:

CPICH_Ec/Ior (n) uncertainty: +/-0.1dB

Absolute level uncertainty of Ior (1): +/-0.7dB

Absolute level uncertainty of Ioc: +/-1.0dB

The chosen parameters form a minimum set, allowing the principle of superposition to be applied. The values are chosen to be the same as uncertainties used elsewhere in other conformance tests.

5.12.4 Assumptions

a) The contributing uncertainties for Ior(n), channel power ratio, and Ioc are derived according to ETR 273-1-2 [4], with a coverage factor of k=2.

b) Within each cell, the uncertainty for Ior(n), and channel power ratio are uncorrelated to each other.

c) The relative uncertainties for Ior(n) across different cells may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

d) Across different cells, the channel power ratio uncertainties may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

e) The uncertainty for Ioc and Ior(1) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

f) The absolute uncertainty of Ior(1) and the relative uncertainty of Ior(2), are uncorrelated to each other.

5.12.5 Calculation of test requirements

The calculations are performed using the spreadsheet in Annex A.1.9. References to individual sheets within the spreadsheet are given in *italics*.

5.12.5.1 Sensitivity analysis

The pie charts in clause 5.12.1 represent the signal presented to the UE, and can be used to understand the basis for the equations in the *Error summation* sheet.

EXAMPLE: The CPICH_Ec/Io ratio for Cell 1 at T2 is calculated using the following equation, which is copied from cell U44 of the *Error summation* sheet and is given in the same format:

Cell 1 CPICH_Ec/Io ratio =10*LOG(($F$43*$G$43)/($F$43+$J$41+$N$43+R$43))

- The terms in the denominator are all the linear powers, 3 cells + noise, added up as fractions.
- The *$F$43* term in the numerator is the linear power of Cell 1 at T2, as a fraction.
- The **$G$43* term in the numerator is the linear fraction of power in Cell 1 CPICH code channel.
- The *10 log* term gives the result in dB, in this case –17.60000dB with nominal values.

To calculate the sensitivity for a specific parameter, an arbitrary change of 0.01dB is applied to it. In the example below the absolute power of the noise is varied. A linear scaling factor for 0.01 dB expressed as *(10^(0.01/10)) is pasted into the equation, copied from cell U45 of the *Error summation* sheet:

New Cell 1 CPICH_Ec/Io ratio
=10*LOG(($F$31*$G$31)/($F$31+$J$31+$N$31+R$31*(10^(0.01/10))))

This gives a new value for the CPICH_Ec/Io ratio of –17.60132dB with the scaled-up noise. The difference from the original is taken and then multiplied by 100 to get -0.132, which is the change of the Cell 1 CPICH_Ec/Io per dB change in the noise power. In this example cell AL11 of the *Error summation* sheet is made equal to this value.

A small change is chosen to get the correct value for the sensitivity. This sensitivity of –0.132, is clearly different from +1, and illustrates why the method is necessary. The sign of the sensitivity is negative, which shows that a rise in the noise power results in a reduction in the Cell 1 CPICH_Ec/Io ratio.

Each of the 7 contributing uncertainties for this test is treated the same way by rewriting the equations. The resulting sensitivities are then copied into the relevant cells. The same process is repeated for each UE parameter listed in column A. Because the conditions at T1 and T2 are different, the process is carried out five times: once for each time interval.

Cells are coloured grey when a parameter is not relevant.

The contributing uncertainty, for example Cell U6, is multiplied by the sensitivity value, cell U11 in this example, to give the resultant uncertainty in cell U12.

5.12.5.2 Superposition of uncertainty effects

The *Error summation* sheet takes each test system uncertainty and uses the sensitivity factors derived in clause 5.12.5.1 to predict the overall effect on the critical parameters at the UE.

The uncertainties in the absolute and relative levels of the 1 cell, the uncertainty in the noise, and the uncertainty in channel power ratio, are entered in the pink cells in rows 3 to 6 of the *Error summation* sheet. Separate sets of columns are used for T1and T2.

The critical parameters at the UE are listed in rows 11, 14, 17, 20, 23, 26, 29, 32, 35 and 38 on the *Error summation* sheet. Each parameter has a figure for its sensitivity to each of the setting uncertainties. The sensitivities were obtained in clause 5.12.5.1, and are valid for parameters near the nominal figures. Each test system uncertainty is multiplied by the relevant sensitivity, to give the individual effect on each critical parameter at the UE.

The figures in the sum columns of the *Error summation* sheet are the overall spread that can be expected for those parameters. The *Combi* sum of errors has been selected in columns W to X as the most realistic model for this test, and is consistent with the assumptions given in clause 5.12.4. Note that the correct way to calculate the *Combi* sum depends on whether correlation has an adverse or a beneficial effect on the result.

5.12.5.3 Derivation of Ior(n)

Several strategies are possible to ensure that the test requirement guidelines are met. The strategy taken here is to make no changes to the Cell powers, but to meet the test requirements by changing only the channel power ratios. The benefit of this approach is simplicity. The *Original* sheet is used to calculate the nominal powers for each cell. The *Apply uncertainties – Find Ior* sheet is not used.

The Ior(n) values appear in cells D35 to K35 of the *Original* sheet, and are carried forward to the *Error analysis* sheet.

5.12.5.4 Determination of initial Cell 1, Cell 2, Cell 3 and Cell 4 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 are not given an offset.

A value of 0 dB is entered in cell J24 on the *Error analysis* sheet, but is modified later in clause 5.12.5.6.

5.12.5.5 Prediction of spread in critical parameters

The "Combi" sum of errors is then used back in the *Error analysis* sheet to give high and low figures.

EXAMPLE: With cell J24 set to 0, the set value of Cell 2 CPICH_Ec/Io at T2 is –16.90dB as shown in cell K20, but it may be as high as –16.73dB (cell K21) or as low as –17.07dB (cell K22). The high and low values are obtained by simply adding or subtracting the summed uncertainties to the set value.

Other critical parameters are treated in the same way as the example.

The blue cells show the values that have to be checked against the test requirement guidelines.

5.12.5.6 Determination of final Cell 1, Cell 2, Cell 3 and Cell 4 CPICH offsets

Initially the channel power ratios in Cells 1, 2, 3 and 4 were not given an offset. Comparing the Cell 1, Cell 2, Cell 3 and Cell 4 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limit specified in clause 5.12.2 a). An offset to the CPICH_Ec/Io power ratio in Cells 1, 2, 3, and 4 has therefore been added in the *Error analysis* sheet.

A value of +0.7 dB in cell J24 ensures that the requirements are met.

A similar offset in cell J25 is applied to the other specified channels on Cells 1, 2, 3 and 4 to maintain the same relative power between code channels.

The power in OCNS decreases to keep the overall power of Cell 1, Cell 2, Cell 3 and Cell 4 correct.

5.12.6 Check against test requirement guidelines

The numbers given are derived using the spreadsheet in Annex A.1.9. References to individual sheets within the spreadsheet are given in *italics*.

a) The worst-case CPICH_Ec/Io of Cell 1, Cell 2, Cell 3 and Cell 4 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

Sheet *Error analysis* cells E22 give –17.11dB at T2 respectively, which comply with the requirements of -17.60dB for Cell 1.

Sheet *Error analysis* cells F22 and G22 give –14.07dB and –17.07dB at T1and T2 respectively, which comply with the requirements of –14.6dB and –17.60dB for Cell 2.

Sheet *Error analysis* cells H22, and I22 give –14.06dB and –17.12dB at T1 and T2 respectively, which comply with the requirements of –14.60dB and –17.60dB for Cell 3.

Sheet *Error analysis* cells J22 and K22 give –17.03dB and –14.12dB at T1 and T2 respectively, which comply with the requirements of –17.60dB, and –14.60dB for Cell 4.

b) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than -1dB, the value of the reporting range. The requirement shall include the effect of UE

CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 2.

Sheet *Error analysis* cell F25 gives a difference of -0.17dB for Cell 2 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. This complies with the requirement of -1dB during time T2.

c) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

Sheet *Error analysis* cells E45 give nominal Io values of –61.20dBm at T2 respectively, which are within 0.03dB of the stated values of –61.23dBm.

d) The worst-case Ec/Io ratios of all other channels (except OCNS) for Cell 1, Cell 2 and Cell 3 shall not fall below the values implied in the original table.

Sheet *Error analysis* cells D11 to K13 and D14 to E14 show that the channel power ratios of all the other channels for Cell 1, Cell 2, Cell 3 and Cell 4 (except OCNS) are increased by the same amount as the CPICH. As their variability at the UE is subject to the same influences as the CPICH, which has already been shown to comply under guideline a), the other channels (except OCNS) will not fall below the stated Ec/Io ratio.

e) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

No other parameters have been changed.

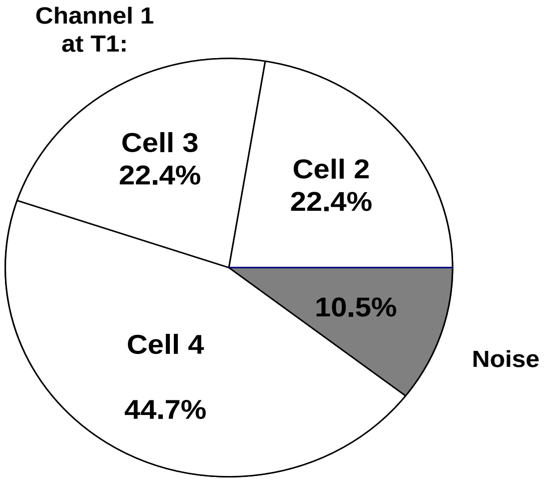
5.13 Test 8.6.1.6 Event triggered reporting of multiple neighbour cells in Case 3 fading conditions

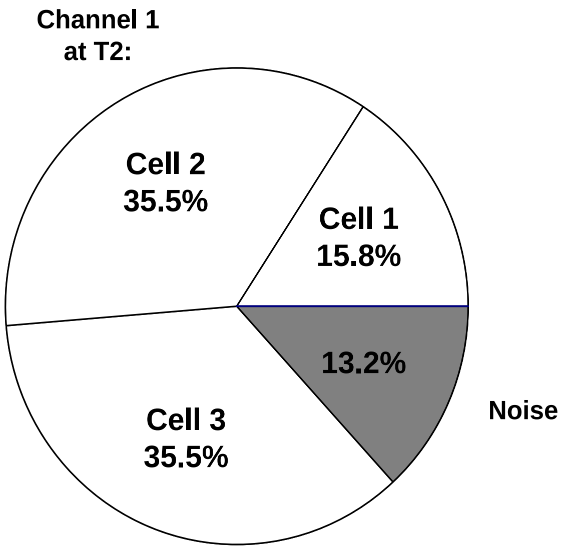
5.13.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] tables 8.6.1.6.1 and 8.6.1.6.3.

The cell-specific parameters in 3GPP TS 34.121 [1, 2, 3] are expressed as $\hat{I}_{or}/I_{oc}$ ratios in dB, and I_{oc} is expressed in dBm/3.84 MHz. To analyse the relationship between the parameters which can be set by the test system and the signal presented to the UE, it is useful to show the composite signal in the form of a pie chart. The size of the pie is scaled according to the overall power Io on a channel, and the angle of the sector shows the percentage of power contributed by a cell.

NOTE: The pie charts do not attempt to show any of the code channel power ratios within each cell, only the cell powers and noise power.





The main points to note about the cell set-up are:

- The overall power within the radio channel changes between T1 and T2, so the pies are different sizes.
- The cells change in absolute power between time periods.
- Cell 1 does not exist during T1, and only appears during T2.
- The noise remains the same absolute power during all the time periods, but changes as a fraction of the overall power.

5.13.2 Test requirement guidelines

The following guidelines are a prioritised list of which test parameters have the most effect on the results of the test. When the uncertainties of the test system are considered, the priorities given in the guidelines below are used in order to ensure that the most important parameters are optimised first. This will ensure that the test is carried out in conditions as close as possible to those for which the test purpose was originally defined.

a) The worst-case CPICH_Ec/Io of Cell 1, Cell 2, Cell 3 and Cell 4 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

b) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than -3 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 2.

c) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than 0 dB, the value of the replacement activation threshold. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1F (A non-active primary CPICH becomes better than an active primary CPICH) occurs for Cell 2.

d) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

e) The worst-case Ec/Io ratios of all other channels (except OCNS) for Cell 1, Cell 2, Cell 3 and Cell 4 shall not fall below the values implied in the original table.

f) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

5.13.3 Uncertainty parameter set

Cell 2, Cell 3 and Cell 3 have been chosen as the reference, and has its power specified as an absolute accuracy. Cell 1 is specified relative to the reference cell.

Within each channel, the noise is specified as an absolute accuracy. This is because it has a different bandwidth from the cell powers, and may be measured using different equipment.

During T1 and T2:

Level uncertainty of Ior (2) relative to Ior (1): +/- 0.3dB

During T1 and T2:

CPICH_Ec/Ior (n) uncertainty: +/-0.1dB

Absolute level uncertainty of Ior (1): +/-0.7dB

Absolute level uncertainty of Ioc: +/-1.0dB

The chosen parameters form a minimum set, allowing the principle of superposition to be applied. The values are chosen to be the same as uncertainties used elsewhere in other conformance tests.

5.13.4 Assumptions

a) The contributing uncertainties for Ior(n), channel power ratio, and Ioc are derived according to ETR 273-1-2 [4], with a coverage factor of k=2.

b) Within each cell, the uncertainty for Ior(n), and channel power ratio are uncorrelated to each other.

c) The relative uncertainties for Ior(n) across different cells may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

d) Across different cells, the channel power ratio uncertainties may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

e) The uncertainty for Ioc and Ior(1) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

f) The absolute uncertainty of Ior(1) and the relative uncertainty of Ior(2), are uncorrelated to each other.

5.13.5 Calculation of test requirements

The calculations are performed using the spreadsheet in Annex A.1.10. References to individual sheets within the spreadsheet are given in *italics*.

5.13.5.1 Sensitivity analysis

The pie charts in clause 5.13.1 represent the signal presented to the UE, and can be used to understand the basis for the equations in the *Error summation* sheet.

EXAMPLE: The CPICH_Ec/Io ratio for Cell 1 at T2 is calculated using the following equation, which is copied from cell U44 of the *Error summation* sheet and is given in the same format:

Cell 1 CPICH_Ec/Io ratio =10*LOG(($F$43*$G$43)/($F$43+$J$41+$N$43+R$43))

- The terms in the denominator are all the linear powers, 3 cells + noise, added up as fractions.
- The *$F$43* term in the numerator is the linear power of Cell 1 at T2, as a fraction.
- The **$G$43* term in the numerator is the linear fraction of power in Cell 1 CPICH code channel.
- The *10 log* term gives the result in dB, in this case –18.00000dB with nominal values.

To calculate the sensitivity for a specific parameter, an arbitrary change of 0.01dB is applied to it. In the example below the absolute power of the noise is varied. A linear scaling factor for 0.01 dB expressed as *(10^(0.01/10)) is pasted into the equation, copied from cell U45 of the *Error summation* sheet:

New Cell 1 CPICH_Ec/Io ratio
=10*LOG(($F$31*$G$31)/($F$31+$J$31+$N$31+R$31*(10^(0.01/10))))

This gives a new value for the CPICH_Ec/Io ratio of –18.00132dB with the scaled-up noise. The difference from the original is taken and then multiplied by 100 to get -0.132, which is the change of the Cell 1 CPICH_Ec/Io per dB change in the noise power. In this example cell AL11 of the *Error summation* sheet is made equal to this value.

A small change is chosen to get the correct value for the sensitivity. This sensitivity of –0.132, is clearly different from +1, and illustrates why the method is necessary. The sign of the sensitivity is negative, which shows that a rise in the noise power results in a reduction in the Cell 1 CPICH_Ec/Io ratio.

Each of the 7 contributing uncertainties for this test is treated the same way by rewriting the equations. The resulting sensitivities are then copied into the relevant cells. The same process is repeated for each UE parameter listed in column A. Because the conditions at T1 and T2 are different, the process is carried out five times: once for each time interval.

Cells are coloured grey when a parameter is not relevant.

The contributing uncertainty, for example Cell U6, is multiplied by the sensitivity value, cell U11 in this example, to give the resultant uncertainty in cell U12.

5.13.5.2 Superposition of uncertainty effects

The *Error summation* sheet takes each test system uncertainty and uses the sensitivity factors derived in clause 5.13.5.1 to predict the overall effect on the critical parameters at the UE.

The uncertainties in the absolute and relative levels of the 2 cells, the uncertainty in the noise, and the uncertainty in channel power ratio, are entered in the pink cells in rows 3 to 6 of the *Error summation* sheet. Separate sets of columns are used for T1 and T2.

The critical parameters at the UE are listed in rows 11, 14, 17, 20, 23, 26, 29, 32, 35 and 38 on the *Error summation* sheet. Each parameter has a figure for its sensitivity to each of the setting uncertainties. The sensitivities were obtained in clause 5.13.5.1, and are valid for parameters near the nominal figures. Each test system uncertainty is multiplied by the relevant sensitivity, to give the individual effect on each critical parameter at the UE.

The figures in the sum columns of the *Error summation* sheet are the overall spread that can be expected for those parameters. The *Combi* sum of errors has been selected in columns W to X as the most realistic model for this test, and is consistent with the assumptions given in clause 5.13.4. Note that the correct way to calculate the *Combi* sum depends on whether correlation has an adverse or a beneficial effect on the result.

5.13.5.3 Derivation of Ior(n)

Several strategies are possible to ensure that the test requirement guidelines are met. The strategy taken here is to make no changes to the Cell powers, but to meet the test requirements by changing only the channel power ratios. The benefit of this approach is simplicity. The *Original* sheet is used to calculate the nominal powers for each cell. The *Apply uncertainties – Find Ior* sheet is not used.

The Ior(n) values appear in cells D35 to K35 of the *Original* sheet, and are carried forward to the *Error analysis* sheet.

5.13.5.4 Determination of initial Cell 1, Cell 2, Cell 3 and Cell 4 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 are not given an offset.

A value of 0 dB is entered in cell J24 on the *Error analysis* sheet, but is modified later in clause 5.13.5.6.

5.13.5.5 Prediction of spread in critical parameters

The "Combi" sum of errors is then used back in the *Error analysis* sheet to give high and low figures.

EXAMPLE: With cell J24 set to 0, the set value of Cell 2 CPICH_Ec/Io at T2 is –13.80dB as shown in cell K20, but it may be as high as –13.63dB (cell K21) or as low as –13.97dB (cell K22). The high and low values are obtained by simply adding or subtracting the summed uncertainties to the set value.

Other critical parameters are treated in the same way as the example.

The blue cells show the values that have to be checked against the test requirement guidelines.

5.13.5.6 Determination of final Cell 1, Cell 2, Cell 3 and Cell 4 CPICH offsets

Initially the channel power ratios in Cells 1, 2, 3 and 4 were not given an offset. Comparing the Cell 1, Cell 2, Cell 3 and Cell 4 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limit specified in clause 5.13.2 a). An offset to the CPICH_Ec/Io power ratio in Cells 1, 2, 3 and 4 has therefore been added in the *Error analysis* sheet.

A value of +0.7 dB in cell J24 ensures that the requirements are met.

A similar offset in cell J25 is applied to the other specified channels on Cells 1, 2, 3 and 4 to maintain the same relative power between code channels.

The power in OCNS decreases to keep the overall power of Cell 1, Cell 2, Cell 3 and Cell 4 correct.

5.13.6 Check against test requirement guidelines

The numbers given are derived using the spreadsheet in Annex A.1.10. References to individual sheets within the spreadsheet are given in *italics*.

a) The worst-case CPICH_Ec/Io of Cell 1, Cell 2, Cell 3 and Cell 4 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

Sheet *Error analysis* cells E22 give –17.51dB at T2 respectively, which comply with the requirements of -18.00dB for Cell 1.

Sheet *Error analysis* cells F22 and G22 give –15.96dB and –13.97dB at T1and T2 respectively, which comply with the requirements of –16.50dB and –14.50dB for Cell 2.

Sheet *Error analysis* cells H22, and I22 give –15.93dB and –14.02dB at T1 and T2 respectively, which comply with the requirements of –16.50dB and –14.50dB for Cell 3.

Sheet *Error analysis* cells J22 give –12.92dB at T1 respectively, which comply with the requirements of –13.50dB for Cell 4.

b) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than 4dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs for Cell 2.

Sheet *Error analysis* cell F25 gives a difference of 3.67dB for Cell 2 CPICH_Ec/Io / Cell 1 CPICH_Ec/Io. This complies with the requirement of 4dB during time T2.

c) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

Sheet *Error analysis* cells E45 give nominal Io values of –61.20dBm at T2 respectively, which are within 0.03dB of the stated values of –61.23dBm.

d) The worst-case Ec/Io ratios of all other channels (except OCNS) for Cell 1, Cell 2 and Cell 3 shall not fall below the values implied in the original table.

Sheet *Error analysis* cells D11 to K13 and D14 to E14 show that the channel power ratios of all the other channels for Cell 1, Cell 2, Cell 3 and Cell 4 (except OCNS) are increased by the same amount as the CPICH. As their variability at the UE is subject to the same influences as the CPICH, which has already been shown to comply under guideline a), the other channels (except OCNS) will not fall below the stated Ec/Io ratio.

e) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

No other parameters have been changed.

6 Two frequency multi-cell FDD tests

For the two-frequency tests one or more cells are on one carrier, and one or more cells are on another carrier. The CPICH_Ec/Io ratio, as seen by the UE receiver, is determined therefore only by the cells and noise on that frequency channel. Two separate calculations are made to derive the CPICH_Ec/Io ratio, one for each frequency channel.

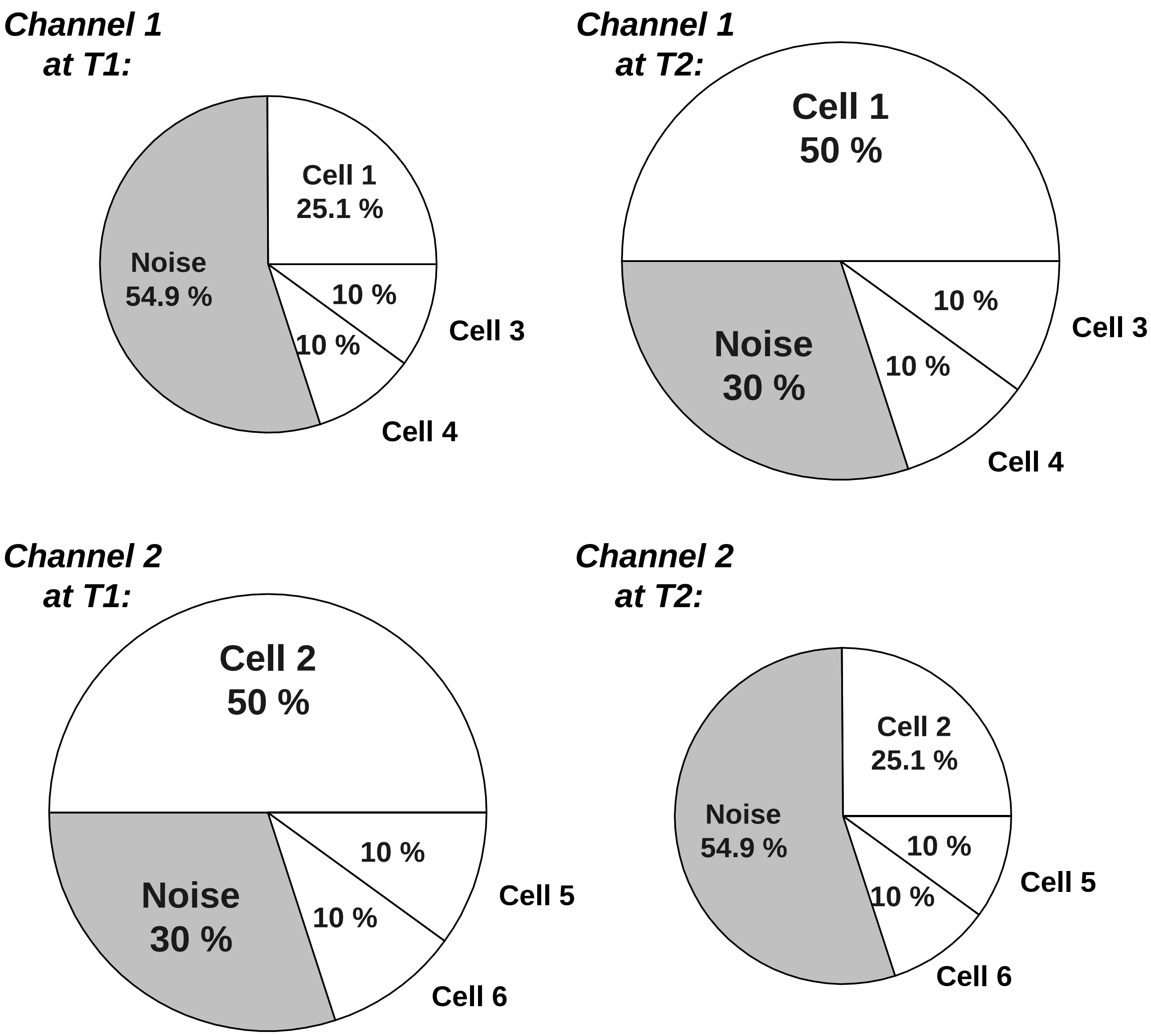
6.1 Test 8.2.2.2 Cell reselection in idle mode, two frequencies

6.1.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] table 8.2.2.2.2.

The cell-specific parameters in 3GPP TS 34.121 [1, 2, 3] are expressed as $\hat{I}_{or}/I_{oc}$ ratios in dB, and I_{oc} is expressed in dBm/3.84 MHz. To analyse the relationship between the parameters which can be set by the test system and the signal presented to the UE, it is useful to show the composite signal in the form of a pie chart. The size of the pie is scaled according to the overall power Io on a channel, and the angle of the sector shows the percentage of power contributed by a cell.

NOTE: The pie charts do not attempt to show any of the code channel power ratios within each cell, only the cell powers and noise power.



The main points to note about the cell set-up for a two-frequency test are:

- The overall power within each radio channel changes between T1 and T2, so the pies are different sizes.
- The noise is a significant fraction of the overall power.
- Cells 1 and 2 change both in absolute power, and as a fraction of the overall power, from T1 to T2.
- Cells 3 to 6 remain the same as a fraction of the overall power from T1 to T2, but their absolute power changes.

6.1.2 Test requirement guidelines

The following guidelines are a prioritised list of which test parameters have the most effect on the results of the test. When the uncertainties of the test system are considered, the priorities given in the guidelines below are used in order to ensure that the most important parameters are optimised first. This will ensure that the test is carried out in conditions as close as possible to those for which the test purpose was originally defined.

a) The Worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

b) The worst-case difference during time T1 between Cell 2 CPICH_Ec/Io and Cell 1 CPICH_Ec/Io shall not be less than 3 dB, the value implied in the original table.

c) The worst-case difference during time T2 between Cell 1 CPICH_Ec/Io and Cell 2 CPICH_Ec/Io shall not be less than 3 dB, the value implied in the original table.

d) In order to ensure the geometry factors Îor/Ioc remain centred on the values stated in the original table, the nominal Io for channel 1 and channel 2 stated in the original table shall not be modified.

e) The worst-case CPICH_Ec/Io of cells 3 through 6 shall not be higher than the value stated in the original table. This will prevent the interfering cells from having a larger impact on the test than originally intended.

f) Provided guideline e) is met first, the worst-case CPICH_Ec/Io of cells 3 through 6 shall not fall below the CPICH_Ec/Io reporting range of –24 dB.

g) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

h) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

6.1.3 Uncertainty parameter set

A parameter set is defined for each channel present. In the two frequency tests the Ior(n) levels for both channels change from T1 to T2. Since the UE is set to use CPICH_Ec/No as a quality measure for cell reselection, and CPICH_Ec/No is measured within the channel bandwidth, the quantity to be controlled is CPICH_Ec/Io. The overall Io level of channel 1 relative to channel 2 is not important, nor is the overall Io level of channel 1 or 2 at T1 relative to the same channel at T2.

The parameter set therefore sets the tightest constraints on the relative levels of the cells, within each channel, for each time period. The Io levels of both channels at both time periods are not constrained so tightly.

Within each channel, one cell has been chosen as the reference, and this cell has its power specified as an absolute accuracy. The other two cells on the same channel are specified relative to the reference cell for that channel. The other two cells are not directly specified with respect to each other, as this would be a redundant constraint.

Within each channel, the noise is specified as an absolute accuracy. This is because it has a different bandwidth from the cell powers, and may be measured using different equipment.

The two channels each have their own separate absolute power reference.

Channel 1 during T1:

Level uncertainty of Ior (3, 4) relative to Ior (1): +/- 0.3dB

Absolute level uncertainty of Ior (1): +/-0.7dB

Channel 1 during T2:

Level uncertainty of Ior (3, 4) relative to Ior (1): +/- 0.3dB

Absolute level uncertainty of Ior (1): +/-0.7dB

Channel 1 during T1 and T2:

CPICH_Ec/Ior (1,3,4) uncertainty: +/-0.1dB

Absolute level uncertainty of Ioc (1): +/-1.0dB

Channel 2 during T1:

Level uncertainty of Ior (5, 6) relative to Ior (2): +/- 0.3dB

Absolute level uncertainty of Ior (2): +/-0.7dB

Channel 2 during T2:

Level uncertainty of Ior (5, 6) relative to Ior (2): +/- 0.3dB

Absolute level uncertainty of Ior (2): +/-0.7dB

Channel 2 during T1 and T2:

CPICH_Ec/Ior (2,5,6) uncertainty: +/-0.1dB

Absolute level uncertainty of Ioc (2): +/-1.0dB

The chosen parameters form a minimum set, allowing the principle of superposition to be applied. The values are chosen to be the same as uncertainties used elsewhere in other conformance tests.

6.1.4 Assumptions

a) The contributing uncertainties for Ior(n), channel power ratio, and Ioc are derived according to ETR 273-1-2 [4], with a coverage factor of k=2.

b) Within each cell, the uncertainty for Ior(n), and channel power ratio are uncorrelated to each other.

c) The relative uncertainties for Ior(n) across different cells may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

d) Across different cells, the channel power ratio uncertainties may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

e) The uncertainty for Ioc and Ior(n) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

f) The absolute uncertainty of Ior(1) and the relative uncertainty of Ior(3, 4), are uncorrelated to each other. Similarly, the absolute uncertainty of Ior(2) and the relative uncertainty of Ior(5, 6), are uncorrelated to each other.

g) The absolute uncertainties for Ior(1) and Ior(2) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

h) The absolute uncertainties for Ioc(1) and Ioc(2) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).:

6.1.5 Calculation of test requirements

The calculations are performed using the spreadsheet in Annex A.2.1. References to individual sheets within the spreadsheet are given in *italics*.

6.1.5.1 Sensitivity analysis

The pie charts in clause 6.1.1 represent the signal presented to the UE, and can be used to understand the basis for the equations in the *Error summation* sheet. It is necessary to first calculate the sensitivities before entering the equations in the *Apply uncertainties – Find Ior* sheet.

EXAMPLE: The CPICH_Ec/Io ratio for cell 1 at T1 is calculated using the following equation, which is copied from cell P28 of the *Error summation* sheet and is given in the same format:

Cell 1 CPICH_Ec/Io ratio =10*LOG(($D$27*$E$27)/($P$27+$D$27+$H$27+$J$27))

- The terms in the denominator are all the linear powers for the cells on Channel 1, noise + 3 cells, added up as fractions.
- The *$D$27* term in the numerator is the linear power of Cell 1 at T1, as a fraction.
- The **$E$27* term in the numerator is the linear fraction of power in Cell 1 CPICH code channel.

- The *10* log* term gives the result in dB, in this case –16.00000dB with nominal values.

To calculate the sensitivity for a specific parameter, an arbitrary change of 0.01dB is applied to it. In the example below the absolute power of the noise is varied. A linear scaling factor for 0.01 dB expressed as *(10^(0.01/10)) is pasted into the equation, copied from cell P29 of the *Error summation* sheet:

New Cell 1 CPICH_Ec/Io ratio
=10*LOG(($D$27*$E$27)/($P$27*(10^(0.01/10))+$D$27+$H$27+$J$27))

This gives a new value for the CPICH_Ec/Io ratio of –16.00549dB with the scaled-up noise. The difference from the original is taken and then multiplied by 100 to get -0.549, which is the change of the Cell 1 CPICH_Ec/Io per dB change in the noise power. In this example cell P11 of the *Error summation* sheet is made equal to this value.

A small change is chosen to give the correct value for the sensitivity. The sensitivity of –0.549 is clearly different from +1, and illustrates why the method is necessary. The sign of the sensitivity is negative, which shows that a rise in the noise power results in a reduction in the Cell 1 CPICH_Ec/Io ratio.

Each of the 14 contributing uncertainties for the two-frequency test is treated the same way by rewriting the equations. The resulting sensitivities are then applied to the relevant cells. The same process is repeated for each UE parameter listed in column A.

In cases where the value can be deduced as 1.000 or 0 by inspection the sensitivity is entered directly.

EXAMPLE: Cells on channel 2 do not affect channel 1, so the sensitivity is entered as 0.

The contributing uncertainty, for example Cell P6, is multiplied by the sensitivity value, Cell P11 in this example, to give the resultant uncertainty in cell P12.

6.1.5.2 Superposition of uncertainty effects

The *Error summation* sheet takes each test system uncertainty and uses the sensitivity factors derived in clause 6.15.1 to predict the overall effect on the critical parameters at the UE.

The uncertainties in the absolute and relative levels of the 6 cells, the uncertainty in the noise, and the uncertainty in channel power ratio, are entered in the pink cells in row 3 to 6 of the *Error summation* sheet. For this exercise only the Cell levels at T1 are considered, since the outcome at T2 will be the same but with the effects from cells 1 and 2 reversed.

The critical parameters at the UE are listed in rows 11, 14, 17, 20 and 23 on the *Error summation* sheet. Each parameter has a figure for its sensitivity to each of the setting uncertainties. The sensitivities were obtained in clause 6.1.5.1, and are valid for parameters near the nominal figures. Each test system uncertainty is multiplied by the relevant sensitivity, to give the individual effect on each critical parameter at the UE.

The figures in the sum columns of the *Error summation* sheet are the overall spread that can be expected for those parameters. The *Combi* sum of errors in column U has been selected as the most realistic model for these tests, and is consistent with the assumptions given in clause 6.1.4.

6.1.5.3 Derivation of equations for Ior(n)

The *Apply uncertainties – Find Ior* sheet is used. Several strategies are possible to ensure that the Cell 1/Cell 2 CPICH ratio at least meets the original value as stated in clauses 6.1.2 b) and 6.1.2 c), and also to keep the nominal Io(1) and Io(2) values as stated in clause 6.1.2 d). The strategy taken here is to make no changes to the Cells on Channel 1, but to increase Ior(2) on channel 2 at the expense of Ioc. The benefits of this approach are:

a) Cell 2 CPICH_Ec/Io gets bigger, to decrease the Cell 1/Cell 2 CPICH ratio.

b) Cell 1 CPICH_Ec/Io does not get any smaller, so it does not need a large CPICH offset in clause 6.1.5.6 to maintain the minimum CPICH_Ec/Io value.

c) The setting of Ior(n) and the CPICH offsets become independent, non-iterative, steps.

A "Channel 2 Cell and noise calculator" is provided on the *Apply uncertainties – Find Ior* sheet, in rows 37 to 43 and columns G to O. The calculator is used to decide how much linear power to transfer from Ioc (the noise) to Cell 2. Using the sensitivities derived in clause 6.1.5.1, which are applied in cells K42 and N42, we can predict how much extra difference in the CPICH_Ec/Io value is needed to overcome the variations due to all relevant uncertainties.

The "Goal seek" spreadsheet tool is used to choose a value of cell K39 which meets the target of –0.78 dB in cell O43. The target value is obtained from cell V24 on the *Error summation* sheet.

The Ior(n) and Ioc(m) powers in cells D45 to S45 are then carried forward to the *Error analysis* sheet.

6.1.5.4 Determination of initial Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 are not given an offset.

A value of 0 dB is entered in cell K27 on the *Error analysis* sheet, but is modified later in clause 6.1.5.6.

6.1.5.5 Prediction of spread in critical parameters

The "Combi" sum of errors is then used back in the *Error analysis* sheet to give high and low figures.

EXAMPLE: With cell K27 set to zero, the set value of Cell 1 CPICH_Ec/Io at T1 is –16.00dB as shown in cell D20, but it may be as high as –15.32dB (cell D21) or as low as –16.68dB (cell D22). The high and low values are obtained by simply adding or subtracting the summed uncertainties to the set value.

Other critical parameters are treated in the same way as the example.

The blue cells show the values that have to be checked against the test requirement guidelines.

6.1.5.6 Determination of final Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 were not given an offset. Comparing the Cell 1 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limit specified in clause 6.1.2 a). An offset to the CPICH_Ec/Io power ratio in Cells 1 and 2 has therefore been added in the *Error analysis* sheet.

A value of +0.7 dB in cell K27 ensures that the requirements are met.

A similar offset in cell K26 is applied to the other specified channels on Cells 1 and 2 to maintain the same relative power between code channels.

The power in OCNS decreases to keep the overall power of Cell 1 and Cell 2 correct.

6.1.5.7 Determination of Cell 3, Cell 4, Cell 5 and Cell 6 CPICH offsets

Initially the channel power ratios in Cells 3 to 6 were not given an offset. Comparing the Cell 3 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limits specified in clauses 6.1.2 e) and 6.1.2 f). An offset to the CPICH_Ec/Io power ratios in Cells 3 to 6 has therefore been added in the *Error analysis* sheet.

A value of -0.8 dB in cell K25 ensures that the requirements are met.

A similar offset in cell K24 is applied to the other specified channels on Cells 3 to 6 to maintain the same relative power between code channels.

The power in OCNS increases to keep the overall power of Cells 3 to 6 correct.

6.1.6 Check against test requirement guidelines

The numbers given are derived using the spreadsheet in Annex A.2.1 References to individual sheets within the spreadsheet are given in *italics*.

a) The Worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

Sheet *Error analysis* cells D22 and E22 give –15.98dB and –11.89dB, which comply with the requirements of -16dB and –13dB for Cell 1 at T1 and T2 respectively.

Sheet *Error analysis* cells F22 and G22 give –11.98dB and –15.98dB, which comply with the requirements of -13dB and –16dB for Cell 2 at T1 and T2 respectively.

b) The worst-case difference during time T1 between Cell 2 CPICH_Ec/Io and Cell 1 CPICH_Ec/Io shall not be less than 3 dB, the value implied in the original table.

Sheet *Error analysis* cell D24 gives a difference of -3.01dB for Cell 1 CPICH_Ec/Io / Cell 2 CPICH_Ec/Io, which complies with the requirement of -3dB during time T1.

c) The worst-case difference during time T2 between Cell 1 CPICH_Ec/Io and Cell 2 CPICH_Ec/Io shall not be less than 3 dB, the value implied in the original table.

Sheet *Error analysis* cell E25 gives a difference of 3.01dB for Cell 1 CPICH_Ec/Io / Cell 2 CPICH_Ec/Io, which complies with the requirement of 3dB during time T2.

d) In order to ensure the geometry factors Îor/Ioc remain centred on the values stated in the original table, the nominal Io for channel 1 and channel 2 stated in the original table shall not be modified.

For channel 1 at T2 and channel 2 at T1, sheet *Error analysis* cells E28 and F29 give a nominal Io of –64.79dBm, which within 0.04dB of the stated value of –64.75dBm.

For channel 1 at T1 and channel 2 at T2, sheet *Error analysis* cells D28 and G29 give a nominal Io of –67.40dBm, which is within 0.01dB of the stated value of –67.39dBm.

e) The worst-case CPICH_Ec/Io of cells 3 through 6 shall not be higher than the value stated in the original table. This will prevent the interfering cells from having a larger impact on the test than originally intended.

Sheet *Error analysis* cells H21 to O21 all have values in the range –20.06dB to –20.33dB, which comply with the requirement of -20dB for Cells 3 to 6.

f) Provided guideline c) is met first, the worst-case CPICH_Ec/Io of cells 3 through 6 shall not fall below the CPICH_Ec/Io reporting range of –24 dB.

Sheet *Error analysis* cells H22 to O22 all have values in the range –21.29dB to –21.55dB, which comply with the requirements of -24dB for Cells 3 to 6.

g) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

Sheet *Error analysis* cells D11 to G13 show that the channel power ratios of all the other channels for Cell 1 and Cell 2 (except OCNS) are increased by the same amount as the CPICH. As their variability at the UE is subject to the same influences as the CPICH, which has already been shown to comply under guideline a), the other channels (except OCNS) will not fall below the stated Ec/Io ratio.

h) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

The channel power ratios of all the active channels in Cells 3 to 6 has been decreased by 0.8dB to meet guideline e). The nominal Ioc for Channel 1 at T2 and Channel 2 at T1 has been changed from –70.0dBm to –71.8dBm. These changes will not have any material effect on the test.

6.2 Void

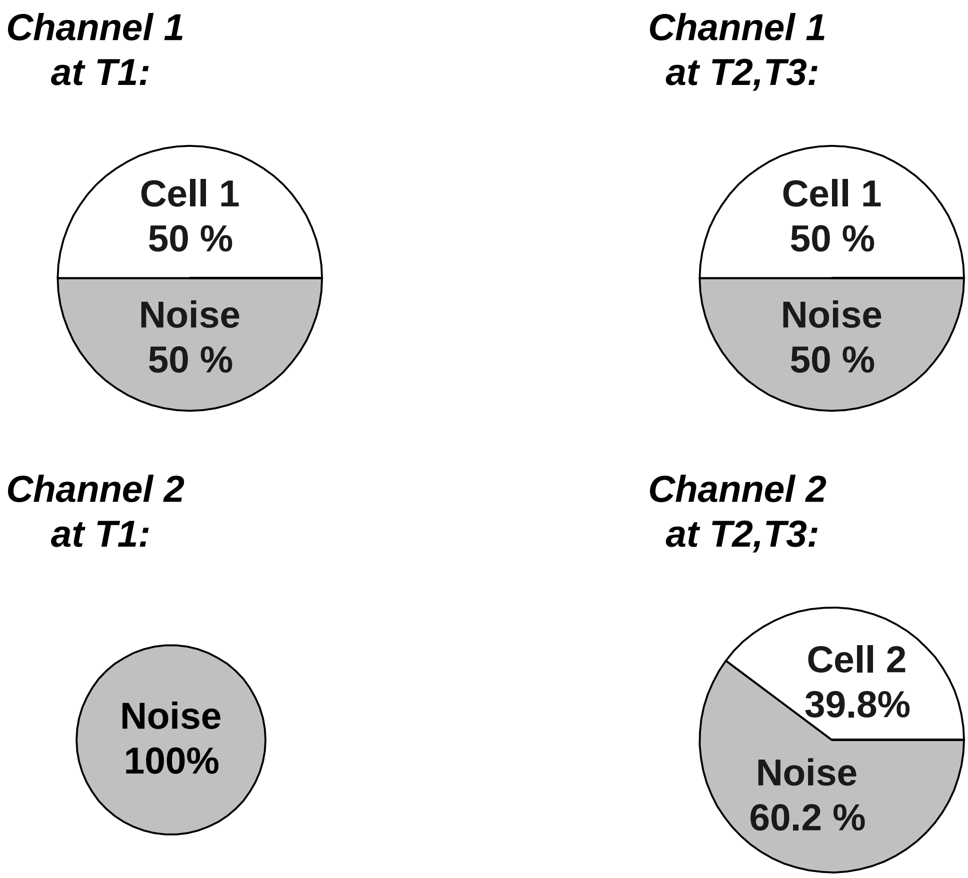
6.3 Test 8.3.2.2 FDD/FDD Hard Handover to inter-frequency cell

6.3.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] table 8.3.2.2.2.

The cell-specific parameters in 3GPP TS 34.121 [1, 2, 3] are expressed as $\hat{I}_{or}/I_{oc}$ ratios in dB, and I_{oc} is expressed in dBm/3.84 MHz. To analyse the relationship between the parameters which can be set by the test system and the signal presented to the UE, it is useful to show the composite signal in the form of a pie chart. The size of the pie is scaled according to the overall power Io on a channel, and the angle of the sector shows the percentage of power contributed by a cell.

NOTE: The pie charts do not attempt to show any of the code channel power ratios within each cell, only the cell powers and noise power.



The main points to note about the cell set-up for a two-frequency test are:

- T2 and T3 have the same cell conditions.
- Channel 1is unchanged between T1 and T2/T3.
- For channel 2, the overall power within the radio channel changes between T1 and T2/T3, so the pies are different sizes.
- Cell 2 does not exist during T1, and only appears during T2/T3.
- The channel 2 noise remains the same absolute power from T1 to T2, but becomes a smaller fraction of the overall power.

6.3.2 Test requirement guidelines

The following guidelines are a prioritised list of which test parameters have the most effect on the results of the test. When the uncertainties of the test system are considered, the priorities given in the guidelines below are used in order to ensure that the most important parameters are optimised first. This will ensure that the test is carried out in conditions as close as possible to those for which the test purpose was originally defined.

a) The Worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

b) The value of Cell 2 CPICH_Ec/Io as measured by the UE shall not be less than -18 dB, the threshold for a non-used frequency. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency absolute accuracy. This will ensure that Event 2C (The estimated quality of a non-used frequency is above a certain threshold) occurs.

c) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

d) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

e) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

6.3.3 Uncertainty parameter set

As there is only one cell for each channel, each cell has its power specified as an absolute accuracy. The relative power of one cell compared to the other is not important for this test.

Within each channel, the noise is specified as an absolute accuracy. This is because it has a different bandwidth from the cell powers, and may be measured using different equipment.

Channel 1 during T1, T2 and T3:

CPICH_Ec/Ior (1) uncertainty: +/-0.1dB

Absolute level uncertainty of Ior (1): +/-0.7dB

Absolute level uncertainty of Ioc (1): +/-1.0dB

Channel 2 during T1:

None apply only during T1

Channel 2 during T2/T3:

CPICH_Ec/Ior (2) uncertainty: +/-0.1dB

Absolute level uncertainty of Ior (2): +/-0.7dB

Channel 2 during T1, T2 and T3:

Absolute level uncertainty of Ioc (2): +/-1.0dB

The chosen parameters form a minimum set, allowing the principle of superposition to be applied. The values are chosen to be the same as uncertainties used elsewhere in other conformance tests.

6.3.4 Assumptions

a) The contributing uncertainties for Ior(n), channel power ratio, and Ioc are derived according to ETR 273-1-2 [4], with a coverage factor of k=2.

b) Within each cell, the uncertainty for Ior(n), and channel power ratio are uncorrelated to each other.

c) Across different cells, the channel power ratio uncertainties may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

d) The uncertainty for Ioc(n) and Ior(n) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

e) The absolute uncertainties for Ior(1) and Ior(2) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

f) The absolute uncertainties for Ioc(1) and Ioc(2) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).:

6.3.5 Calculation of test requirements

The calculations are performed using the spreadsheet in Annex A.2.3. References to individual sheets within the spreadsheet are given in *italics*.

6.3.5.1 Sensitivity analysis

The pie charts in clause 6.3.1 represent the signal presented to the UE, and can be used to understand the basis for the equations in the *Error summation* sheet. It is necessary to first calculate the sensitivities before entering the equations in the *Apply uncertainties – Find Ior* sheet.

EXAMPLE: The CPICH_Ec/Io ratio for cell 1 at T1 is calculated using the following equation, which is copied from cell L23 of the *Error summation* sheet and is given in the same format:

Cell 1 CPICH_Ec/Io ratio =10*LOG(($D$22*$E$22)/($D$22+$L$22))

- The terms in the denominator are the linear powers for the cell and the noise on Channel 1, added up as fractions.
- The *$D$22* term in the numerator is the linear power of Cell 1 at T1, as a fraction.
- The **$E$22* term in the numerator is the linear fraction of power in Cell 1 CPICH code channel.
- The *10* log* term gives the result in dB, in this case –13.00000dB with nominal values.

To calculate the sensitivity for a specific parameter, an arbitrary change of 0.01dB is applied to it. In the example below the absolute power of the noise is varied. A linear scaling factor for 0.01 dB expressed as *(10^(0.01/10)) is pasted into the equation, copied from cell L24 of the *Error summation* sheet:

New Cell 1 CPICH_Ec/Io ratio =10*LOG(($D$22*$E$22)/($D$22+$L$22*(10^(0.01/10))))

This gives a new value for the CPICH_Ec/Io ratio of –13.00499dB with the scaled-up noise. The difference from the original is taken and then multiplied by 100 to get -0.499, which is the change of the Cell 1 CPICH_Ec/Io per dB change in the noise power. In this example cell L11 of the *Error summation* sheet is made equal to this value.

A small change is chosen to give the correct value for the sensitivity. The sensitivity of –0.499 is clearly different from +1, and illustrates why the method is necessary. The sign of the sensitivity is negative, which shows that a rise in the noise power results in a reduction in the Cell 1 CPICH_Ec/Io ratio.

Each of the 6 contributing uncertainties on the two-frequency test is treated the same way by rewriting the equations. The resulting sensitivities are then copied into the relevant cells. The same process is repeated for each UE parameter listed in column A, keeping channel 1 and channel 2 separate. Because the conditions at T1 and T2/T3 are different, the process is carried out twice: once for T1 and once for T2/T3.

Cells are coloured grey when a parameter is not relevant, for example when Cell 2 does not exist during T1.

The contributing uncertainty, for example Cell L6, is multiplied by the sensitivity value, cell L11 in this example, to give the resultant uncertainty in cell L12.

6.3.5.2 Superposition of uncertainty effects

The *Error summation* sheet takes each test system uncertainty and uses the sensitivity factors derived in clause 6.35.1 to predict the overall effect on the critical parameters at the UE.

The uncertainties in the absolute levels of the cell on each channel, the uncertainty in the noise on each channel, and the uncertainty in channel power ratio, are entered in the pink cells in row 3 to 6 of the *Error summation* sheet. Separate sets of columns are used for T1 and for T2/T3.

The critical parameters at the UE are listed in rows 11 and 14 on the *Error summation* sheet. Each parameter has a figure for its sensitivity to each of the setting uncertainties. The sensitivities were obtained in clause 6.3.5.1, and are valid for parameters near the nominal figures. Each test system uncertainty is multiplied by the relevant sensitivity, to give the individual effect on each critical parameter at the UE.

The figures in the sum columns of the *Error summation* sheet are the overall spread that can be expected for those parameters. The *Combi* sum of errors has been selected in columns T and X as the most realistic model, but is the same as root-sum-squares combination for these tests because no adverse effects of correlation are envisaged. This is consistent with the assumptions given in clause 6.3.4.

6.3.5.3 Derivation of Ior(n)

Several strategies are possible to ensure that the test requirement guidelines are met. The strategy taken here is to make no changes to the Cell powers, but to meet the test requirements by changing only the channel power ratios. The benefit of this approach is simplicity. The *Apply uncertainties – Find Ior* sheet is used to calculate the nominal powers for each cell, but no uncertainties are applied, so it generates the same values as the *Original* sheet.

The Ior(n) values appear in cells D38, E38 and G43 of the *Apply uncertainties – Find Ior* sheet, and are carried forward to the *Error analysis* sheet

6.3.5.4 Determination of initial Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 are not given an offset.

A value of 0 dB is entered in cell K24 on the *Error analysis* sheet, but is modified later in clause 6.3.5.6.

6.3.5.5 Prediction of spread in critical parameters

The "Combi" sum of errors is then used back in the *Error analysis* sheet to give high and low figures.

EXAMPLE: With cell K24 set to zero, the set value of Cell 2 CPICH_Ec/Io at T2/T3 is –14.00dB as shown in cell G20, but it may be as high as –13.26dB (cell G21) or as low as –14.74dB (cell G22). The high and low values are obtained by simply adding or subtracting the summed uncertainties to the set value.

Other critical parameters are treated in the same way as the example.

The blue cells show the values that have to be checked against the test requirement guidelines.

6.3.5.6 Determination of final Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 were not given an offset. Comparing the Cell 1 and Cell 2 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limit specified in clause 6.3.2 a). An offset to the CPICH_Ec/Io power ratio in Cells 1 and 2 has therefore been added in the *Error analysis* sheet.

A value of +0.8 dB in cell K24 ensures that the requirements are met.

A similar offset in cell K25 is applied to the other specified channels on Cells 1 and 2 to maintain the same relative power between code channels.

The power in OCNS decreases to keep the overall power of Cell 1 and Cell 2 correct.

6.3.6 Check against test requirement guidelines

The numbers given are derived using the spreadsheet in Annex A.2.3 References to individual sheets within the spreadsheet are given in *italics*.

a) The Worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

Sheet *Error analysis* cells D22 and E22 give –12.83dB and –12.83dB at T1 and T2/T3 respectively, which comply with the requirement of -13dB for Cell 1.

Sheet *Error analysis* cell G22 gives –13.94dB at T2/T3, which complies with the requirement of -14dB for Cell 2.

b) The value of Cell 2 CPICH_Ec/Io as measured by the UE shall not be less than -18 dB, the threshold for a non-used frequency. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency absolute accuracy. This will ensure that Event 2C (The estimated quality of a non-used frequency is above a certain threshold) occurs.

Sheet *Error analysis* cell G22 gives –13.94dB at T2/T3, which already complies with the requirement of -14dB for Cell 2, and therefore also complies with the less stringent requirement of –18dB.

c) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

Sheet *Error analysis* cells D27 and E27 give nominal Io values of –66.99dBm and –66.99dBm for channel 1 at T1 and T2/T3 respectively, which are within 0.01dB of the stated values of –66.98dBm.

Sheet *Error analysis* cells F27 and G27 give nominal Io values of –70.00dBm and –67.80dBm for channel 2 at T1 and T2/T3 respectively, which are at the stated values of –70.00dBm and –67.80dBm.

d) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

Sheet *Error analysis* cells D11 to G13 show that the channel power ratios of all the other channels for Cell 1 and Cell 2 (except OCNS) are increased by the same amount as the CPICH. As their variability at the UE is subject to the same influences as the CPICH, which has already been shown to comply under guideline a), the other channels (except OCNS) will not fall below the stated Ec/Io ratio.

e) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

No other parameters have been changed.

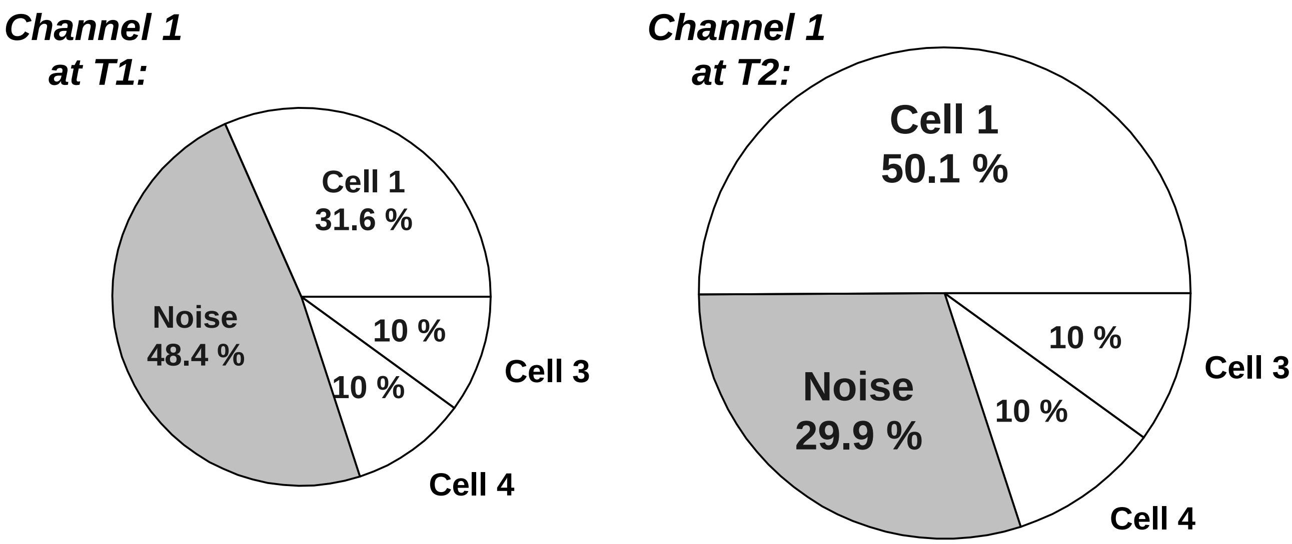
6.4 Test 8.3.5.2 Cell reselection in CELL_FACH, two frequencies

6.4.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] table 8.3.5.2.4.

The cell-specific parameters in 3GPP TS 34.121 [1, 2, 3] are expressed as $\hat{I}_{or}/I_{oc}$ ratios in dB, and I_{oc} is expressed in dBm/3.84 MHz. To analyse the relationship between the parameters which can be set by the test system and the signal presented to the UE, it is useful to show the composite signal in the form of a pie chart. The size of the pie is scaled according to the overall power Io on a channel, and the angle of the sector shows the percentage of power contributed by a cell.

NOTE: The pie charts do not attempt to show any of the code channel power ratios within each cell, only the cell powers and noise power.



The main points to note about the cell set-up for a two-frequency test are:

- The overall power within each radio channel changes between T1 and T2, so the pies are different sizes.
- The noise is a significant fraction of the overall power.
- Cells 1 and 2 change both in absolute power, and as a fraction of the overall power, from T1 to T2.
- Cells 3 to 6 remain the same as a fraction of the overall power from T1 to T2, but their absolute power changes.

6.4.2 Test requirement guidelines

The following guidelines are a prioritised list of which test parameters have the most effect on the results of the test. When the uncertainties of the test system are considered, the priorities given in the guidelines below are used in order to ensure that the most important parameters are optimised first. This will ensure that the test is carried out in conditions as close as possible to those for which the test purpose was originally defined.

a) The Worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

b) The worst-case difference during time T1 between Cell 2 CPICH_Ec/Io and Cell 1 CPICH_Ec/Io shall not be less than 2 dB, the value implied in the original table.

c) The worst-case difference during time T2 between Cell 1 CPICH_Ec/Io and Cell 2 CPICH_Ec/Io shall not be less than 2 dB, the value implied in the original table.

d) In order to ensure the geometry factors Îor/Ioc remain centred on the values stated in the original table, the nominal Io for channel 1 and channel 2 stated in the original table shall not be modified.

e) The worst-case CPICH_Ec/Io of cells 3 through 6 shall not be higher than the value stated in the original table. This will prevent the interfering cells from having a larger impact on the test than originally intended.

f) Provided guideline e) is met first, the worst-case CPICH_Ec/Io of cells 3 through 6 shall not fall below the CPICH_Ec/Io reporting range of –24 dB.

g) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

h) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

6.4.3 Uncertainty parameter set

Same as defined for test 8.2.2.2 in clause 6.1.3.

6.4.4 Assumptions

Same as defined for test 8.2.2.2 in clause 6.1.4.

6.4.5 Calculation of test requirements

The calculations are performed using the spreadsheet in Annex A.2.4. References to individual sheets within the spreadsheet are given in *italics*.

6.4.5.1 Sensitivity analysis

The pie charts in clause 6.2.1 represent the signal presented to the UE, and can be used to understand the basis for the equations in the *Error summation* sheet. It is necessary to first calculate the sensitivities before entering the equations in the *Apply uncertainties – Find Ior* sheet.

EXAMPLE: The CPICH_Ec/Io ratio for cell 1 at T1 is calculated using the following equation, which is copied from cell P28 of the *Error summation* sheet, and is given in the same format:

Cell 1 CPICH_Ec/Io ratio =10*LOG(($D$27*$E$27)/($P$27+$D$27+$H$27+$J$27))

- The terms in the denominator are all the linear powers for the cells on Channel 1, noise + 3 cells, added up as fractions.
- The *$D$27* term in the numerator is the linear power of Cell 1 at T1, as a fraction.
- The **$E$27* term in the numerator is the linear fraction of power in Cell 1 CPICH code channel.
- The *10* log* term gives the result in dB, in this case –15.00000dB with nominal values.

To calculate the sensitivity for a specific parameter, an arbitrary change of 0.01dB is applied to it. In the example below the absolute power of the noise is varied. A linear scaling factor for 0.01 dB expressed as *(10^(0.01/10)) is pasted into the equation, copied from cell P29 of the *Error summation* sheet:

New Cell 1 CPICH_Ec/Io ratio
=10*LOG(($D$27*$E$27)/($P$27*(10^(0.01/10))+$D$27+$H$27+$J$27))

This gives a new value for the CPICH_Ec/Io ratio of –15.00484dB with the scaled-up noise. The difference from the original is taken and then multiplied by 100 to get -0.484, which is the change of the Cell 1 CPICH_Ec/Io per dB change in the noise power. In this example cell P11 of the *Error summation* sheet is made equal to this value.

A small change is chosen to give the correct value for the sensitivity. The sensitivity of –0.484 is clearly different from +1, and illustrates why the method is necessary. The sign of the sensitivity is negative, which shows that a rise in the noise power results in a reduction in the Cell 1 CPICH_Ec/Io ratio.

Each of the 14 contributing uncertainties for the two-frequency test is treated the same way by rewriting the equations. The resulting sensitivities are then applied to the relevant cells. The same process is repeated for each UE parameter listed in column A.

In cases where the value can be deduced as 1.000 or 0 by inspection the sensitivity is entered directly.

EXAMPLE: Cells on channel 2 do not affect channel 1, so the sensitivity is entered as 0.

The contributing uncertainty, for example Cell P6, is multiplied by the sensitivity value, Cell P11 in this example, to give the resultant uncertainty in cell P12.

6.4.5.2 Superposition of uncertainty effects

The *Error summation* sheet takes each test system uncertainty and uses the sensitivity factors derived in clause 6.4.5.1 to predict the overall effect on the critical parameters at the UE.

The uncertainties in the absolute and relative levels of the 6 cells, the uncertainty in the noise, and the uncertainty in channel power ratio, are entered in the pink cells in row 3 to 6 of the *Error summation* sheet. For this exercise only the Cell levels at T1 are considered, since the outcome at T2 will be the same but with the effects from cells 1 and 2 reversed.

The critical parameters at the UE are listed in rows 11, 14, 17, 20 and 23 on the *Error summation* sheet. Each parameter has a figure for its sensitivity to each of the setting uncertainties. The sensitivities were obtained in clause 6.4.5.1, and are valid for parameters near the nominal figures. Each test system uncertainty is multiplied by the relevant sensitivity, to give the individual effect on each critical parameter at the UE.

The figures in the sum columns of the *Error summation* sheet are the overall spread that can be expected for those parameters. The *Combi* sum of errors in column U has been selected as the most realistic model for these tests, and is consistent with the assumptions given in clause 6.4.4.

6.4.5.3 Derivation of equations for Ior(n)

The *Apply uncertainties – Find Ior* sheet is used. Several strategies are possible to ensure that the Cell 1/Cell 2 CPICH ratio at least meets the original value as stated in clauses 6.4.2 b) and 6.4.2 c), and also to keep the nominal Io(1) and Io(2) values as stated in clause 6.4.2 d). The strategy taken here is to make no changes to the Cells on Channel 1, but to increase Ior(2) on channel 2 at the expense of Ioc. The benefits of this approach are:

a) Cell 2 CPICH_Ec/Io gets bigger, to decrease the Cell 1/Cell 2 CPICH ratio.

b) Cell 1 CPICH_Ec/Io does not get any smaller, so it does not need a large CPICH offset in clause 6.4.5.6 to maintain the minimum CPICH_Ec/Io value.

c) The setting of Ior(n) and the CPICH offsets become independent, non-iterative, steps.

A "Channel 2 Cell and noise calculator" is provided on the *Apply uncertainties – Find Ior* sheet, in rows 37 to 43 and columns G to O. The calculator is used to decide how much linear power to transfer from Ioc (the noise) to Cell 2. Using the sensitivities derived in clause 6.4.5.1, which are applied in cells K42 and N42, we can predict how much extra difference in the CPICH_Ec/Io value is needed to overcome the variations due to all relevant uncertainties.

The "Goal seek" spreadsheet tool is used to choose a value of cell K39 which meets the target of –0.71 dB in cell O43. The target value is obtained from cell V24 on the *Error summation* sheet.

The Ior(n) and Ioc(m) powers in cells D45 to S45 are then carried forward to the *Error analysis* sheet.

6.4.5.4 Determination of initial Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 are not given an offset.

A value of 0 dB is entered in cell K27 on the *Error analysis* sheet, but is modified later in clause 6.4.5.6.

6.4.5.5 Prediction of spread in critical parameters

The "Combi" sum of errors is then used back in the *Error analysis* sheet to give high and low figures.

EXAMPLE: With cell K27 set to zero, the set value of Cell 1 CPICH_Ec/Io at T1 is –14.98dB as shown in cell D20, but it may be as high as –14.38dB (cell D21) or as low as –15.58dB (cell D22). The high and low values are obtained by simply adding or subtracting the summed uncertainties to the set value.

Other critical parameters are treated in the same way as the example.

The blue cells show the values that have to be checked against the test requirement guidelines.

6.4.5.6 Determination of final Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 were not given an offset. Comparing the Cell 1 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limit specified in clause 6.4.2 a). An offset to the CPICH_Ec/Io power ratio in Cells 1 and 2 has therefore been added in the *Error analysis* sheet.

A value of +0.6 dB in cell K27 ensures that the requirements are met.

A similar offset in cell K26 is applied to the other specified channels on Cells 1 and 2 to maintain the same relative power between code channels.

The power in OCNS decreases to keep the overall power of Cell 1 and Cell 2 correct.

6.4.5.7 Determination of Cell 3, Cell 4, Cell 5 and Cell 6 CPICH offsets

Initially the channel power ratios in Cells 3 to 6 were not given an offset. Comparing the Cell 3 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limits specified in clauses 6.4.2 e) and 6.4.2 f). An offset to the CPICH_Ec/Io power ratios in Cells 3 to 6 has therefore been added in the *Error analysis* sheet.

A value of -0.7 dB in cell K25 ensures that the requirements are met.

A similar offset in cell K24 is applied to the other specified channels on Cells 3 to 6 to maintain the same relative power between code channels.

The power in OCNS increases to keep the overall power of Cells 3 to 6 correct.

6.4.6 Check against test requirement guidelines

The numbers given are derived using the spreadsheet in Annex A.2.4. References to individual sheets within the spreadsheet are given in *italics*.

a) The Worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

Sheet *Error analysis* cells D22 and E22 give –14.98dB and –12.03dB, which comply with the requirements of -15dB and –13dB for Cell 1 at T1 and T2 respectively.

Sheet *Error analysis* cells F22 and G22 give –12.03dB and –14.98dB, which comply with the requirements of -13dB and –15dB for Cell 2 at T1 and T2 respectively.

b) The worst-case difference during time T1 between Cell 2 CPICH_Ec/Io and Cell 1 CPICH_Ec/Io shall not be less than 2 dB, the value implied in the original table.

Sheet *Error analysis* cell D24 gives a difference of -2.01dB for Cell 1 CPICH_Ec/Io / Cell 2 CPICH_Ec/Io, which complies with the requirement of -2dB during time T1.

c) The worst-case difference during time T2 between Cell 1 CPICH_Ec/Io and Cell 2 CPICH_Ec/Io shall not be less than 2 dB, the value implied in the original table.

Sheet *Error analysis* cell E25 gives a difference of 2.01dB for Cell 1 CPICH_Ec/Io / Cell 2 CPICH_Ec/Io, which complies with the requirement of 2dB during time T2.

d) In order to ensure the geometry factors Îor/Ioc remain centred on the values stated in the original table, the nominal Io for channel 1 and channel 2 stated in the original table shall not be modified.

For channel 1 at T2 and channel 2 at T1, sheet *Error analysis* cells E28 and F29 give a nominal Io of –64.75dBm, which is the same as the stated value of –64.75dBm.

For channel 1 at T1 and channel 2 at T2, sheet *Error analysis* cells D28 and G29 give a nominal Io of –66.82dBm, which is within 0.03dB of the stated value of –66.85dBm.

e) The worst-case CPICH_Ec/Io of cells 3 through 6 shall not be higher than the value stated in the original table. This will prevent the interfering cells from having a larger impact on the test than originally intended.

Sheet *Error analysis* cells H21 to O21 all have values in the range –20.01dB to –20.27dB, which comply with the requirement of -20dB for Cells 3 to 6.

f) Provided guideline c) is met first, the worst-case CPICH_Ec/Io of cells 3 through 6 shall not fall below the CPICH_Ec/Io reporting range of –24 dB.

Sheet *Error analysis* cells H22 to O22 all have values in the range –21.16dB to –21.42dB, which comply with the requirements of -24dB for Cells 3 to 6.

g) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

Sheet *Error analysis* cells D11 to G14 show that the channel power ratios of all the other channels for Cell 1 and Cell 2 (except OCNS) are increased by the same amount as the CPICH. As their variability at the UE is subject to the same influences as the CPICH, which has already been shown to comply under guideline a), the other channels (except OCNS) will not fall below the stated Ec/Io ratio.

h) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

The channel power ratios of all the active channels in Cells 3 to 6 has been decreased by 0.7dB to meet guideline e). The nominal Ioc for Channel 1 at T2 and Channel 2 at T1 has been changed from –70.0dBm to –71.6dBm. These changes will not have any material effect on the test.

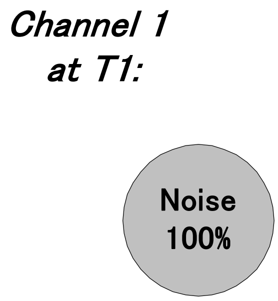
6.4A Test 8.3.5.4 Cell reselection in CELL_FACH during an MBMS session, two frequencies

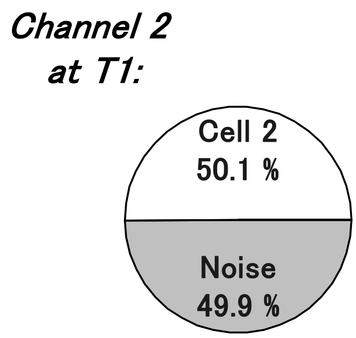
6.4A.1 Minimum requirements

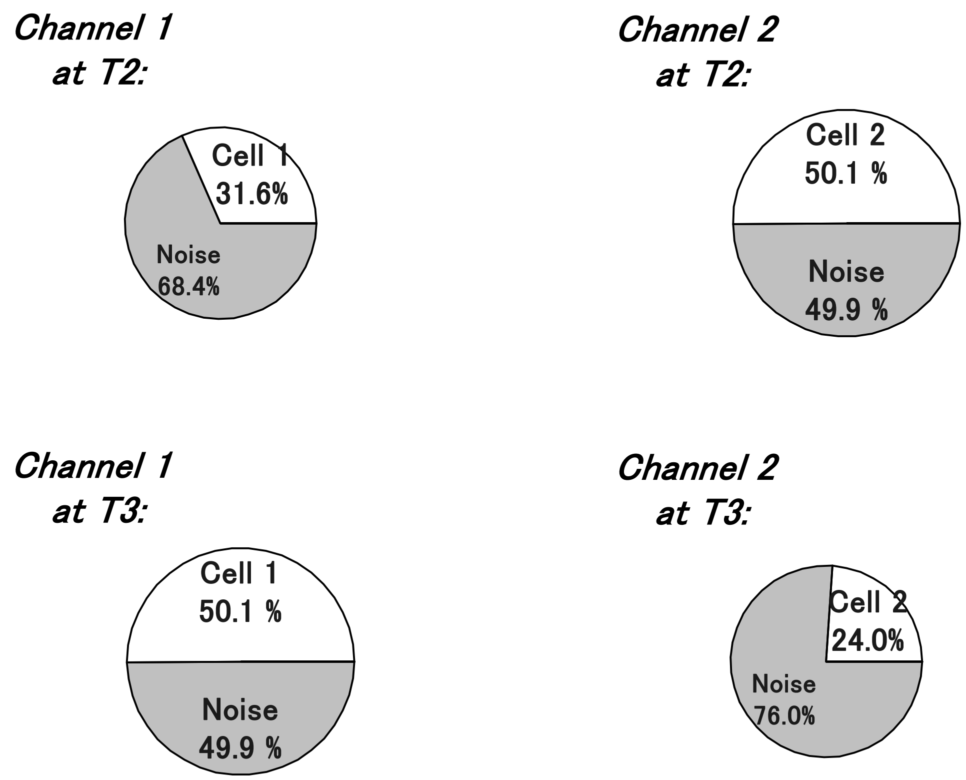
The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] table 8.3.5.4.4.6.

The cell-specific parameters in 3GPP TS 34.121 [1, 2, 3] are expressed as $\hat{I}_{or}/I_{oc}$ ratios in dB, and I_{oc} is expressed in dBm/3.84 MHz. To analyse the relationship between the parameters which can be set by the test system and the signal presented to the UE, it is useful to show the composite signal in the form of a pie chart. The size of the pie is scaled according to the overall power Io on a channel, and the angle of the sector shows the percentage of power contributed by a cell.

NOTE: The pie charts do not attempt to show any of the code channel power ratios within each cell, only the cell powers and noise power.







The main points to note about the cell set-up for a two-frequency test are:

- Cell 1 does not exist during T1, and only appears during T2 and T3.
- For channel 1, the overall power within the radio channel changes among T1, T2 and T3, so the pies are different sizes.
- Channel 2 is unchanged between T1 and T2.
- For channel 2, the overall power within the radio channel changes between T1/T2 and T3, so the pies are different sizes.
- The noise is a significant fraction of the overall power.

6.4A.2 Test requirement guidelines

The following guidelines are a prioritised list of which test parameters have the most effect on the results of the test. When the uncertainties of the test system are considered, the priorities given in the guidelines below are used in order to ensure that the most important parameters are optimised first. This will ensure that the test is carried out in conditions as close as possible to those for which the test purpose was originally defined.

a) The Worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

b) The worst-case difference during time T2 between Cell 2 CPICH_Ec/Io and Cell 1 CPICH_Ec/Io shall not be less than 2 dB, the value implied in the original table.

c) The worst-case difference during time T3 between Cell 1 CPICH_Ec/Io and Cell 2 CPICH_Ec/Io shall not be less than 3.2 dB, the value implied in the original table.

d) In order to ensure the geometry factors Îor/Ioc remain centred on the values stated in the original table, the nominal Io for channel 1 and channel 2 stated in the original table shall not be modified.

e) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

f) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

6.4A.3 Uncertainty parameter set

As there is only one cell for each channel, each cell has its power specified as an absolute accuracy. The relative power of one cell compared to the other is not important for this test.

Within each channel, the noise is specified as an absolute accuracy. This is because it has a different bandwidth from the cell powers, and may be measured using different equipment.

Channel 1 during T1:

Absolute level uncertainty of Ioc (1): +/-1.0dB

Channel 1 during T2 and T3:

CPICH_Ec/Ior (1) uncertainty: +/-0.1dB

Absolute level uncertainty of Ior (1): +/-0.7dB

Absolute level uncertainty of Ioc (1): +/-1.0dB

Channel 2 during T1, T2 and T3:

CPICH_Ec/Ior (1) uncertainty: +/-0.1dB

Absolute level uncertainty of Ior (1): +/-0.7dB

Absolute level uncertainty of Ioc (1): +/-1.0dB

The chosen parameters form a minimum set, allowing the principle of superposition to be applied. The values are chosen to be the same as uncertainties used elsewhere in other conformance tests.

6.4A.4 Assumptions

Same as defined for test 8.3.2.2 in clause 6.3.4.

6.4A.5 Calculation of test requirements

The calculations are performed using the spreadsheet in Annex A.2.4A. References to individual sheets within the spreadsheet are given in *italics*.

6.4A.5.1 Sensitivity analysis

The pie charts in clause 6.4A.1 represent the signal presented to the UE, and can be used to understand the basis for the equations in the *Error summation* sheet. It is necessary to first calculate the sensitivities before entering the equations in the *Apply uncertainties – Find Ior* sheet.

EXAMPLE: The CPICH_Ec/Io ratio for cell 1 at T2 is calculated using the following equation, which is copied from cell Q22 of the *Error summation* sheet, and is given in the same format:

Cell 1 CPICH_Ec/Io ratio =10*LOG(($F$21*$G$21)/($Q$21+$F$21))

- The terms in the denominator are the linear powers for the cell and the noise on Channel 1, added up as fractions.
- The *$F$21* term in the numerator is the linear power of Cell 1 at T2, as a fraction.
- The **$G$21* term in the numerator is the linear fraction of power in Cell 1 CPICH code channel.
- The *10* log* term gives the result in dB, in this case –15.00000dB with nominal values.

To calculate the sensitivity for a specific parameter, an arbitrary change of 0.01dB is applied to it. In the example below the absolute power of the noise is varied. A linear scaling factor for 0.01 dB expressed as *(10^(0.01/10)) is pasted into the equation, copied from cell Q23 of the *Error summation* sheet:

New Cell 1 CPICH_Ec/Io ratio =10*LOG(($F$21*$G$21)/($Q$21*(10^(0.01/10))+$F$21))

This gives a new value for the CPICH_Ec/Io ratio of –15.00684dB with the scaled-up noise. The difference from the original is taken and then multiplied by 100 to get -0.684, which is the change of the Cell 1 CPICH_Ec/Io per dB change in the noise power. In this example cell Q11 of the *Error summation* sheet is made equal to this value.

A small change is chosen to give the correct value for the sensitivity. The sensitivity of –0.684 is clearly different from +1, and illustrates why the method is necessary. The sign of the sensitivity is negative, which shows that a rise in the noise power results in a reduction in the Cell 1 CPICH_Ec/Io ratio.

Each of the 18 contributing uncertainties for the two-frequency test is treated the same way by rewriting the equations. The resulting sensitivities are then applied to the relevant cells. The same process is repeated for each UE parameter listed in column A, keeping channel 1 and channel 2 separate. Because the conditions at T1, T2 and T3 are different, the process is carried out thrice: once for T1, once for T2 and once for T3.

In cases where the value can be deduced as 1.000 or 0 by inspection the sensitivity is entered directly.

EXAMPLE: Cell on channel 2 do not affect channel 1, so the sensitivity is entered as 0.

The contributing uncertainty, for example Cell Q6, is multiplied by the sensitivity value, Cell Q11 in this example, to give the resultant uncertainty in cell Q12.

6.4A.5.2 Superposition of uncertainty effects

The *Error summation* sheet takes each test system uncertainty and uses the sensitivity factors derived in clause 6.4A.5.1 to predict the overall effect on the critical parameters at the UE.

The uncertainties in the absolute levels of the cell on each channel, the uncertainty in the noise on each channel, and the uncertainty in channel power ratio, are entered in the pink cells in row 3 to 6 of the *Error summation* sheet. Separate sets of columns are used for T1, for T2 and for T3.

The critical parameters at the UE are listed in rows 11, 14 and 17 on the *Error summation* sheet. Each parameter has a figure for its sensitivity to each of the setting uncertainties. The sensitivities were obtained in clause 6.4A.5.1, and are valid for parameters near the nominal figures. Each test system uncertainty is multiplied by the relevant sensitivity, to give the individual effect on each critical parameter at the UE.

The figures in the sum columns of the *Error summation* sheet are the overall spread that can be expected for those parameters. The *Combi* sum of errors in column Z, AD and AH has been selected as the most realistic model, but is the same as root-sum-squares combination for these tests because no adverse effects of correlation are envisaged. This is consistent with the assumptions given in clause 6.4A.4.

6.4A.5.3 Derivation of equations for Ior(n)

The *Apply uncertainties – Find Ior* sheet is used. Several strategies are possible to ensure that the Cell 1/Cell 2 CPICH ratio at least meets the original value as stated in clauses 6.4A.2 b) and 6.4A.2 c), and also to keep the nominal Io(1) and Io(2) values as stated in clause 6.4.2 d). The strategy taken here is to make no changes to the Cell 1 at T2 and Cell 2 at T3, but to increase Ior(2) at T2 and Ior(1) at T3 at the expense of Ioc. The benefits of this approach are:

a) Cell 2 CPICH_Ec/Io at T2 and Cell1 CPICH_Ec/Io at T3 get bigger, to decrease the Cell 1/Cell 2 CPICH ratio at T2 and the Cell 2/Cell 1 CPICH ratio at T3.

b) Cell 1 CPICH_Ec/Io at T2 and Cell 2 CPICH_Ec/Io at T3 do not get any smaller, so it does not need a large CPICH offset in clause 6.4A.5.6 to maintain the minimum CPICH_Ec/Io value.

c) The setting of Ior(n) and the CPICH offsets become independent, non-iterative, steps.

A "Channel 2 Cell and noise calculator" and "Channel 1 Cell and noise calculator" are provided on the *Apply uncertainties – Find Ior* sheet, in rows 38 to 48 and columns H to O. The calculator is used to decide how much linear power to transfer from Ioc (the noise) to Cell 2 at T2 and Cell 1 at T3. These calculations are done by increasing the CPICH_Ec/Io by similar amount of CPICH_Ec/Io error on the *Error summation* sheet.

The "Goal seek" spreadsheet tool is used to choose values of cell L40 and L46 which meet the targets of 1.04 dB in cell N42 and 1.12 dB in cell N48. The target values are obtained from cell AD18 and cell AH18 on the *Error summation* sheet.

The Ior(n) and Ioc(m) powers in cells D50 to O50 are then carried forward to the *Error analysis* sheet.

6.4A.5.4 Determination of initial Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 are not given an offset.

A value of 0 dB is entered in cell M27 on the *Error analysis* sheet, but is modified later in clause 6.4A.5.6.

6.4A.5.5 Prediction of spread in critical parameters

The "Combi" sum of errors is then used back in the *Error analysis* sheet to give high and low figures.

EXAMPLE: With cell M27 set to zero, the set value of Cell 1 CPICH_Ec/Io at T2 is –15.00dB as shown in cell E21, but it may be as high as –14.16dB (cell E22) or as low as –15.84dB (cell E23). The high and low values are obtained by simply adding or subtracting the summed uncertainties to the set value.

Other critical parameters are treated in the same way as the example.

The blue cells show the values that have to be checked against the test requirement guidelines.

6.4A.5.6 Determination of final Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 were not given an offset. Comparing the Cell 1 CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limit specified in clause 6.4A.2 a). An offset to the CPICH_Ec/Io power ratio in Cells 1 and 2 has therefore been added in the *Error analysis* sheet.

A value of +1.0 dB in cell M27 ensures that the requirements are met.

A similar offset in cell M26 is applied to the other specified channels on Cells 1 and 2 to maintain the same relative power between code channels.

The power in OCNS decreases to keep the overall power of Cell 1 and Cell 2 correct.

6.4A.6 Check against test requirement guidelines

The numbers given are derived using the spreadsheet in Annex A.2.4A. References to individual sheets within the spreadsheet are given in *italics*.

a) The Worst-case CPICH_Ec/Io of cell 1 and cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

Sheet *Error analysis* cells E23 and F23 give –14.84dB and –11.50dB, which comply with the requirements of -15dB and –13dB for Cell 1 at T2 and T3 respectively.

Sheet *Error analysis* cells G23, H23 and I23 give –12.62dB, –11.58dB and –16.13dB, which comply with the requirements of –13dB, –13dB and –16.2dB for Cell 2 at T1, T2 and T3 respectively.

b) The worst-case difference during time T2 between Cell 2 CPICH_Ec/Io and Cell 1 CPICH_Ec/Io shall not be less than 2 dB, the value implied in the original table.

Sheet *Error analysis* cell E25 gives a difference of -2.00dB for Cell 1 CPICH_Ec/Io / Cell 2 CPICH_Ec/Io, which complies with the requirement of -2dB during time T2.

c) The worst-case difference during time T3 between Cell 1 CPICH_Ec/Io and Cell 2 CPICH_Ec/Io shall not be less than 3.2 dB, the value implied in the original table.

Sheet *Error analysis* cell F26 gives a difference of 3.20dB for Cell 1 CPICH_Ec/Io / Cell 2 CPICH_Ec/Io, which complies with the requirement of 3.2dB during time T3.

d) In order to ensure the geometry factors Îor/Ioc remain centred on the values stated in the original table, the nominal Io for channel 1 and channel 2 stated in the original table shall not be modified.

For each channel at T1, T2 and T3, sheet *Error analysis* cells D29, E29, F29, G30, H30, and I30 give a nominal Io of –70.00dBm, –68.35dBm, –66.98dBm, –66.98dBm, –66.98dBm and –68.81dBm, which are the same as the stated values in the original table.

e) The worst-case Ec/Io ratios of all other channels (except OCNS) for cell 1 and cell 2 shall not fall below the values implied in the original table.

Sheet *Error analysis* cells D11 to I15 show that the channel power ratios of all the other channels for Cell 1 and Cell 2 (except OCNS) are increased by the same amount as the CPICH. As their variability at the UE is subject to the same influences as the CPICH, which has already been shown to comply under guideline a), the other channels (except OCNS) will not fall below the stated Ec/Io ratio.

f) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

The nominal Ioc for Channel 1 at T3 and Channel 2 at T2 has been changed from –70.0dBm to –71.52dBm and from –70.0dBm to –71.38dBm respectively. These changes will not have any material effect on the test.

6.5 Test 8.3.6.2 Cell reselection in CELL_PCH, two frequencies

6.5.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] table 8.3.6.2.2.

The values given in this table give the same requirement as defined for test 8.2.2.2 in clause 6.1.1.

6.5.2 Test requirement guidelines

Same as defined for test 8.2.2.2 in clause 6.1.2.

6.5.3 Uncertainty parameter set

Same as defined for test 8.2.2.2 in clause 6.1.3.

6.5.4 Assumptions

Same as defined for test 8.2.2.2 in clause 6.1.4.

6.5.5 Calculation of test requirements

Same as defined for test 8.2.2.2 in clause 6.1.5.

The calculations and results are identical to those contained in the spreadsheet in Annex A.2.1.

6.5.6 Check against test requirement guidelines

Same as defined for test 8.2.2.2 in clause 6.1.6.

The numbers derived using the spreadsheet in Annex A.2.1 apply.

6.6 Test 8.3.7.2 Cell reselection in URA_PCH, two frequencies

6.6.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] table 8.3.7.2.2.

The values given in this table give the same requirement as defined for test 8.2.2.2 in clause 6.1.1.

6.6.2 Test requirement guidelines

Same as defined for test 8.2.2.2 in clause 6.1.2.

6.6.3 Uncertainty parameter set

Same as defined for test 8.2.2.2 in clause 6.1.3.

6.6.4 Assumptions

Same as defined for test 8.2.2.2 in clause 6.1.4.

6.6.5 Calculation of test requirements

Same as defined for test 8.2.2.2 in clause 6.1.5.

The calculations and results are identical to those contained in the spreadsheet in Annex A.2.1.

6.6.6 Check against test requirement guidelines

Same as defined for test 8.2.2.2 in clause 6.1.6.

The numbers derived using the spreadsheet in Annex A.2.1 apply.

6.7 Void

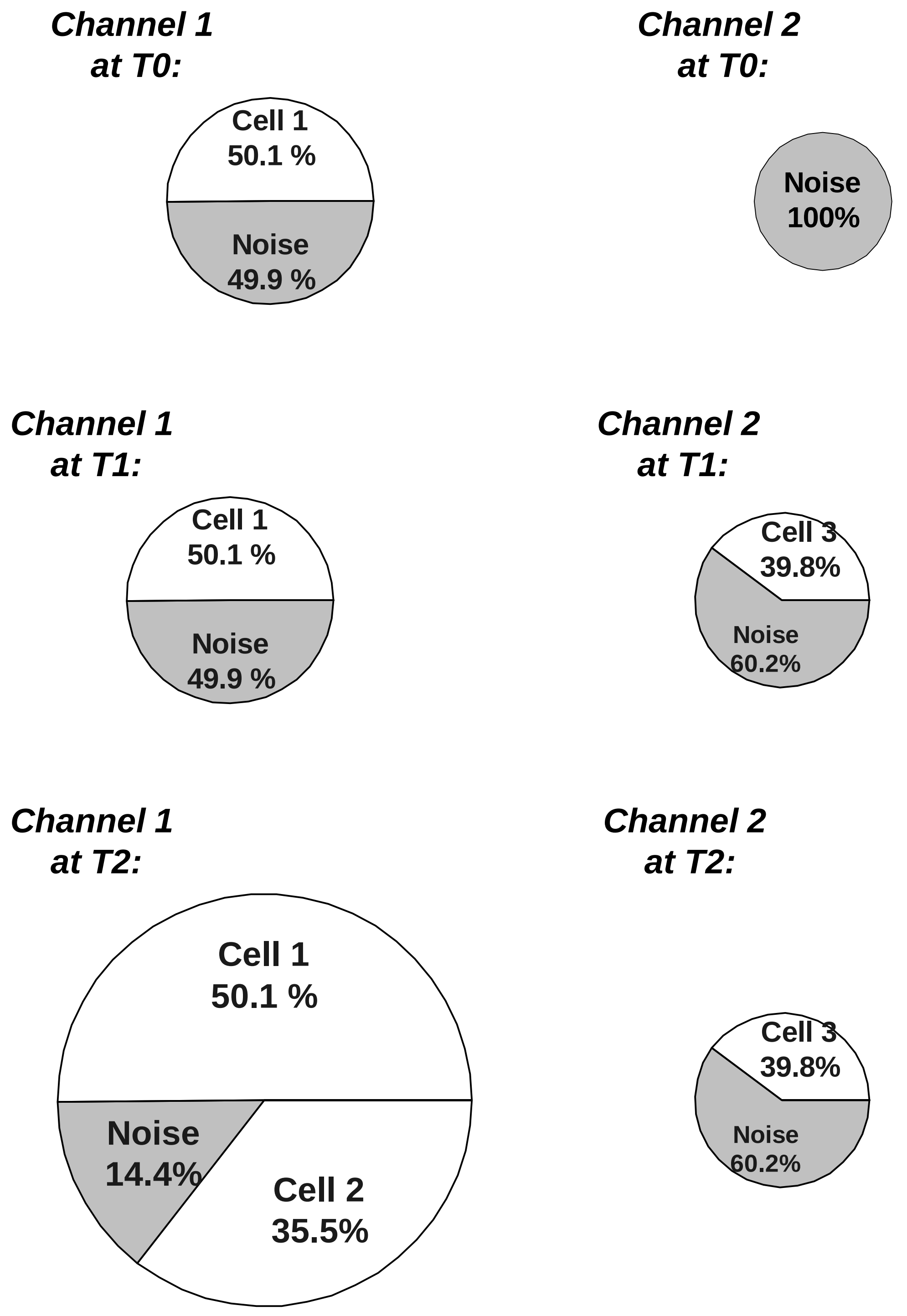
6.8 Test 8.6.2.1 Correct reporting of neighbours in AWGN propagation condition

6.8.1 Minimum requirements

The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] tables 8.6.2.1.1 and 8.6.2.1.3.

The cell-specific parameters in 3GPP TS 34.121 [1, 2, 3] are expressed as $\hat{I}_{or}/I_{oc}$ ratios in dB, and I_{oc} is expressed in dBm/3.84 MHz. To analyse the relationship between the parameters which can be set by the test system and the signal presented to the UE, it is useful to show the composite signal in the form of a pie chart. The size of the pie is scaled according to the overall power Io on a channel, and the angle of the sector shows the percentage of power contributed by a cell.

NOTE: The pie charts do not attempt to show any of the code channel power ratios within each cell, only the cell powers and noise power.



The main points to note about the cell set-up for this two-frequency test are:

- Cell 1 and Cell 2 are on channel 1
- Cell 3 is on channel 2.
- Channel 1is unchanged between T0 and T1.
- For channel 1, the overall power within the radio channel changes between T0/T1 and T2, so the pies are different sizes.
- Cell 2 does not exist during T0 or T1, and only appears during T2.

- Channel 2 is unchanged between T1 and T2
- Cell 3 does not exist during T0, and only appears during T1 and T2.
- The noise on both channel 1 and channel 2 remains the same absolute power during T0, T1 and T2, but becomes a smaller fraction of the overall power.

6.8.2 Test requirement guidelines

The following guidelines are a prioritised list of which test parameters have the most effect on the results of the test. When the uncertainties of the test system are considered, the priorities given in the guidelines below are used in order to ensure that the most important parameters are optimised first. This will ensure that the test is carried out in conditions as close as possible to those for which the test purpose was originally defined.

a) The worst-case CPICH_Ec/Io of Cell 1, Cell 2 and Cell 3 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

b) The value of Cell 3 CPICH_Ec/Io as measured by the UE during time T1 shall not be less than -18 dB, the value of the Ec/Io threshold for a non-used frequency. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency absolute accuracy. This will ensure that Event 2C (The estimated quality of a non-used frequency is above a certain threshold) occurs.

c) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than -4 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs.

d) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

e) The worst-case Ec/Io ratios of all other channels (except OCNS) for Cell 1, Cell 2 and Cell 3 shall not fall below the values implied in the original table.

f) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

6.8.3 Uncertainty parameter set

A parameter set is defined for each channel present. Since the UE is set to use CPICH_Ec/No as a quality measure, and CPICH_Ec/No is measured within the channel bandwidth, the quantity to be controlled is CPICH_Ec/Io. The overall Io level of channel 1 relative to channel 2 is not important.

The parameter set also puts a constraint on the level of Cell 2 relative to Cell 1 within channel 1, because the UE makes a relative measurement of the CPICH Ec/Io values.

Within each channel, the noise is specified as an absolute accuracy. This is because it has a different bandwidth from the cell powers, and may be measured using different equipment.

The two channels each have their own separate absolute power reference.

Channel 1 during T0, T1 and T2:

Absolute level uncertainty of Ior (1): +/-0.7dB

Absolute level uncertainty of Ioc (1): +/-1.0dB

CPICH_Ec/Ior (1) uncertainty: +/-0.1dB

Channel 1 during T2:

Level uncertainty of Ior (2) relative to Ior (1): +/- 0.3dB

CPICH_Ec/Ior (2) uncertainty: +/-0.1dB

Channel 2 during T0, T1 and T2:

Absolute level uncertainty of Ioc (2): +/-1.0dB

Channel 2 during T1 and T2:

Absolute level uncertainty of Ior (3): +/-0.7dB

CPICH_Ec/Ior (3) uncertainty: +/-0.1dB

The chosen parameters form a minimum set, allowing the principle of superposition to be applied. The values are chosen to be the same as uncertainties used elsewhere in other conformance tests.

6.8.4 Assumptions

a) The contributing uncertainties for Ior(n), channel power ratio, and Ioc are derived according to ETR 273-1-2 [4], with a coverage factor of k=2.

b) Within each cell, the uncertainty for Ior(n), and channel power ratio are uncorrelated to each other.

c) Across different cells, the channel power ratio uncertainties may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

d) The uncertainty for Ioc and Ior(n) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

e) The absolute uncertainty of Ior(1) and the relative uncertainty of Ior(2), are uncorrelated to each other.

f) The absolute uncertainties for Ior(1) and Ior(3) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

g) The absolute uncertainties for Ioc(1) and Ioc(2) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).:

6.8.5 Calculation of test requirements

The calculations are performed using the spreadsheet in Annex A.2.5. References to individual sheets within the spreadsheet are given in *italics*.

6.8.5.1 Sensitivity analysis

The pie charts in clause 6.8.1 represent the signal presented to the UE, and can be used to understand the basis for the equations in the *Error summation* sheet.

EXAMPLE: The CPICH_Ec/Io ratio for Cell 1 at T1 is calculated using the following equation, which is copied from cell W32 of the *Error summation* sheet and is given in the same format:

Cell 1 CPICH_Ec/Io ratio =10*LOG(($F$31*$G$31)/($F$31+$L$31+W$31))

- The terms in the denominator are all the linear powers for the cells on Channel 1, 2 cells + noise, added up as fractions.

- The *$F$31* term in the numerator is the linear power of Cell 1 at T1, as a fraction.

- The **$G$31* term in the numerator is the linear fraction of power in Cell 1 CPICH code channel.

- The *10* log* term gives the result in dB, in this case –13.00000dB with nominal values.

To calculate the sensitivity for a specific parameter, an arbitrary change of 0.01dB is applied to it. In the example below the absolute power of the noise is varied. A linear scaling factor for 0.01 dB expressed as *(10^(0.01/10)) is pasted into the equation, copied from cell W33 of the *Error summation* sheet:

New Cell 1 CPICH_Ec/Io ratio =
10*LOG(($F$31*$G$31)/($F$31+$L$31+W$31*(10^(0.01/10))))

This gives a new value for the CPICH_Ec/Io ratio of –13.00499dB with the scaled-up noise. The difference from the original is taken and then multiplied by 100 to get -0.499, which is the change of the Cell 1 CPICH_Ec/Io per dB change in the noise power. In this example cell W11 of the *Error summation* sheet is made equal to this value.

A small change is chosen to give the correct value for the sensitivity. The sensitivity of –0.499 is clearly different from +1, and illustrates why the method is necessary. The sign of the sensitivity is negative, which shows that a rise in the noise power results in a reduction in the Cell 1 CPICH_Ec/Io ratio.

Each of the 8 contributing uncertainties is treated the same way by rewriting the equations. The resulting sensitivities are then applied to the relevant cells. The same process is repeated for each UE parameter listed in column A. Because the conditions at T0, T1 and T2 are different, the process is carried out three times for T0, T1 and T2.

Cells are coloured grey when a parameter is not relevant, for example when a cell is not present in that time period.

In cases where the value can be deduced as 1.000 or 0 by inspection the sensitivity is entered directly.

EXAMPLE: Cells on channel 2 do not affect channel 1, so the sensitivity is entered as 0.

The contributing uncertainty, for example Cell W6, is multiplied by the sensitivity value, Cell W11 in this example, to give the resultant uncertainty in cell W12.

6.8.5.2 Superposition of uncertainty effects

The *Error summation* sheet takes each test system uncertainty and uses the sensitivity factors derived in clause 6.8.5.1 to predict the overall effect on the critical parameters at the UE.

The uncertainties in the absolute and relative levels of the 3 cells, the uncertainty in the noise on each channel, and the uncertainty in channel power ratio, are entered in the pink cells in row 3 to 6 of the *Error summation* sheet. Separate sets of columns are used for T0, T1 and T2.

The critical parameters at the UE are listed in rows 11, 14, 17 and 20 on the *Error summation* sheet. Each parameter has a figure for its sensitivity to each of the setting uncertainties. The sensitivities were obtained in clause 6.8.5.1, and are valid for parameters near the nominal figures. Each test system uncertainty is multiplied by the relevant sensitivity, to give the individual effect on each critical parameter at the UE.

The figures in the sum columns of the *Error summation* sheet are the overall spread that can be expected for those parameters. Root sum squares (RSS) summation of errors has been used in columns AC to AE because no adverse effects of correlation are envisaged, and is consistent with the assumptions given in clause 6.8.4.

6.8.5.3 Derivation of Ior(n)

Several strategies are possible to ensure that the test requirement guidelines are met. The strategy taken here is to make no changes to the Cell powers, but to meet the test requirements by changing only the channel power ratios. The benefit of this approach is simplicity. The *Original* sheet is used to calculate the nominal powers for each cell. The *Apply uncertainties – Find Ior* sheet is not used.

The Ior(n) values appear in cells D35 to L35 of the *Original* sheet, and are carried forward to the *Error analysis* sheet.

6.8.5.4 Determination of initial Cell 1, Cell 2 and Cell 3 CPICH offsets

Initially the channel power ratios in Cells 1, 2 and 3 are not given an offset.

A value of 0 dB is entered in cell M24 on the *Error analysis* sheet, but is modified later in clause 6.8.5.6.

6.8.5.5 Prediction of spread in critical parameters

The RSS sum of errors is then used back in the *Error analysis* sheet to give high and low figures.

EXAMPLE: With cell M24 set to zero, the set value of Cell 3 CPICH_Ec/Io at T1 is –14.00dB as shown in cell K20, but it may be as high as –13.26dB (cell K21) or as low as –14.74dB (cell K22). The high and low values are obtained by simply adding or subtracting the summed uncertainties to the set value.

Other critical parameters are treated in the same way as the example.

The blue cells show the values that have to be checked against the test requirement guidelines.

6.8.5.6 Determination of final Cell 1,Cell 2 and Cell 3 CPICH offsets

Initially the channel power ratios in Cells 1, 2 and 3 were not given an offset. Comparing the CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limit specified in clause 6.8.2 a). An offset to the CPICH_Ec/Io power ratio in Cells 1, 2 and 3 has therefore been added in the *Error analysis* sheet.

A value of +0.8 dB in cell M24 ensures that the requirements are met.

A similar offset in cell M25 is applied to the other specified channels on Cells 1, 2 and 3 to maintain the same relative power between code channels.

The power in OCNS decreases to keep the overall power of Cells 1, 2 and 3 correct.

6.8.6 Check against test requirement guidelines

The numbers given are derived using the spreadsheet in Annex A.2.5. References to individual sheets within the spreadsheet are given in *italics*.

a) The worst-case CPICH_Ec/Io of Cell 1, Cell 2 and Cell 3 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

Sheet *Error analysis* cells D22, E22 and F22 give –12.83dB, –12.83dB and –12.43dB at T0, T1 and T2 respectively, which comply with the requirement of -13dB for Cell 1.

Sheet *Error analysis* cell I22 gives –13.98dB at T3, which complies with the requirement of –14.5dB for Cell 2.

Sheet *Error analysis* cells K22 and L22 give –13.94dB and –13.94dB at T1 and T2 respectively, which comply with the requirement of –14dB for Cell 3.

b) The value of Cell 3 CPICH_Ec/Io as measured by the UE during time T1 shall not be less than -18 dB, the value of the Ec/Io threshold for a non-used frequency. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency absolute accuracy. This will ensure that Event 2C (The estimated quality of a non-used frequency is above a certain threshold) occurs.

Sheet *Error analysis* cell K22 gives –13.94dB at T1. Even if the UE reports this a further 1.5dB low (as allowed by its CPICH_Ec/Io Intra frequency absolute measurement accuracy with Cell 3 CPICH_Ec/Io >-14dB) the lowest reported value would be –15.44dB, which complies with the requirement of -18dB during time T1.

c) The value of Cell 2 CPICH_Ec/Io relative to Cell 1 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than -4 dB, the value of the reporting range. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency relative measurement accuracy. This will ensure that Event 1A (A Primary CPICH enters the reporting range) occurs.

Sheet *Error analysis* cell F25 gives –1.83dB at T2. Even if the UE reports this a further 2dB low (as allowed by its CPICH_Ec/Io Intra frequency relative measurement accuracy with Cell 1 and Cell 2 CPICH_Ec/Io >-16dB) the lowest reported value would be –3.83dB, which complies with the requirement of -4dB during time T2.

d) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

For channel 1 at T0, T1 and T2, sheet *Error analysis* cells D27, E27 and F27 give nominal Io values of –66.99dBm, -66.99dBm and –61.60dBm respectively, which are within 0.02dB of the stated values of –66.98dBm, -66.98dBm and –61.58dBm.

For channel 2 at T0, T1 and T2, sheet *Error analysis* cells D28, E28 and F28 give nominal Io values of –70.00dBm, -67.80dBm and –67.80dBm respectively, which are the same as the stated values of –70.00dBm, -67.80dBm and –67.80dBm.

e) The worst-case Ec/Io ratios of all other channels (except OCNS) for Cell 1, Cell 2 and Cell 3 shall not fall below the values implied in the original table.

Sheet *Error analysis* cells D11 to L13 and D14 to F14 show that the channel power ratios of all the other channels for Cell 1 and Cell 2 (except OCNS) are increased by the same amount as the CPICH. As their variability at the UE is subject to the same influences as the CPICH, which has already been shown to comply under guideline a), the other channels (except OCNS) will not fall below the stated Ec/Io ratio.

f) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

No other parameters have been changed.

6.9 Void

6.10 Void

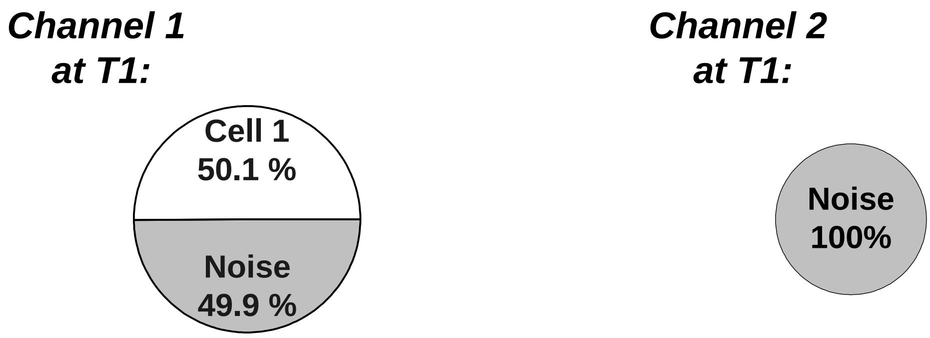
6.11 Test 8.6.2.2 Correct reporting of neighbours in fading propagation condition

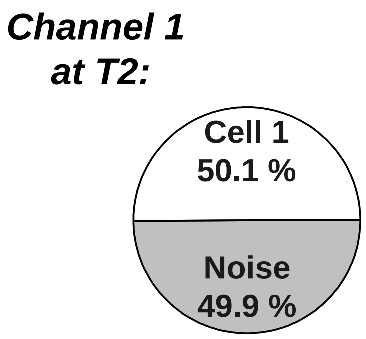
6.11.1 Minimum requirements

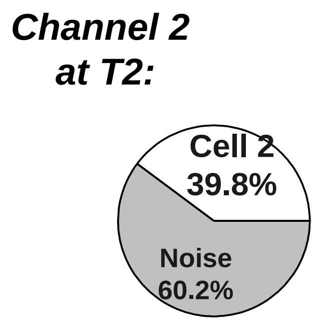
The normative reference for this requirement is 3GPP TS 34.121 [1, 2, 3] table 8.6.2.2.4.2.

The cell-specific parameters in 3GPP TS 34.121 [1, 2, 3] are expressed as $\hat{I}_{or}/I_{oc}$ ratios in dB, and I_{oc} is expressed in dBm/3.84 MHz. To analyse the relationship between the parameters which can be set by the test system and the signal presented to the UE, it is useful to show the composite signal in the form of a pie chart. The size of the pie is scaled according to the overall power Io on a channel, and the angle of the sector shows the percentage of power contributed by a cell.

NOTE: The pie charts do not attempt to show any of the code channel power ratios within each cell, only the cell powers and noise power.







The main points to note about the cell set-up for this two-frequency test are:

- Cell 1 is on channel 1.
- Cell 2 is on channel 2.
- Channel 1is unchanged between T1 and T2.
- Channel 2 is changed between T1 and T2.
- Cell 2 does not exist during T1, and only appears during T2.
- The noise on both channel 1 and channel 2 remains the same absolute power during T1 and T2, but becomes a smaller fraction of the overall power.

6.11.2 Test requirement guidelines

The following guidelines are a prioritised list of which test parameters have the most effect on the results of the test. When the uncertainties of the test system are considered, the priorities given in the guidelines below are used in order to ensure that the most important parameters are optimised first. This will ensure that the test is carried out in conditions as close as possible to those for which the test purpose was originally defined.

a) The worst-case CPICH_Ec/Io of Cell 1 and Cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

b) The value of Cell 2 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than -18 dB, the value of the Ec/Io threshold for a non-used frequency. The requirement shall include the effect of UE CPICH_Ec/Io Intra frequency absolute accuracy. This will ensure that Event 2C (The estimated quality of a non-used frequency is above a certain threshold) occurs.

c) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

d) The worst-case Ec/Io ratios of all other channels (except OCNS) for Cell 1 and Cell 2 shall not fall below the values implied in the original table.

e) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

6.11.3 Uncertainty parameter set

A parameter set is defined for each channel present. Since the UE is set to use CPICH_Ec/No as a quality measure, and CPICH_Ec/No is measured within the channel bandwidth, the quantity to be controlled is CPICH_Ec/Io. The overall Io level of channel 1 relative to channel 2 is not important.

Within each channel, the noise is specified as an absolute accuracy. This is because it has a different bandwidth from the cell powers, and may be measured using different equipment.

The two channels each have their own separate absolute power reference.

Channel 1 during T1 and T2:

Absolute level uncertainty of Ior (1): +/-0.7dB

Absolute level uncertainty of Ioc (1): +/-1.0dB

CPICH_Ec/Ior (1) uncertainty: +/-0.1dB

Channel 2 during T1 and T2:

Absolute level uncertainty of Ioc (2): +/-1.0dB

Channel 2 during T2:

Absolute level uncertainty of Ior (2): +/-0.7dB

CPICH_Ec/Ior (2) uncertainty: +/-0.1dB

The chosen parameters form a minimum set, allowing the principle of superposition to be applied. The values are chosen to be the same as uncertainties used elsewhere in other conformance tests.

6.11.4 Assumptions

a) The contributing uncertainties for Ior(n), channel power ratio, and Ioc are derived according to ETR 273-1-2 [4], with a coverage factor of k=2.

b) Within each cell, the uncertainty for Ior(n), and channel power ratio are uncorrelated to each other.

c) Across different cells, the channel power ratio uncertainties may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

d) The uncertainty for Ioc and Ior(n) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

e) The absolute uncertainties for Ior(1) and Ior(2) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).

f) The absolute uncertainties for Ioc(1) and Ioc(2) may have any amount of positive correlation from zero (uncorrelated) to one (fully correlated).:

6.11.5 Calculation of test requirements

The calculations are performed using the spreadsheet in Annex A.2.8. References to individual sheets within the spreadsheet are given in *italics*.

6.11.5.1 Sensitivity analysis

The pie charts in clause 6.9.1 represent the signal presented to the UE, and can be used to understand the basis for the equations in the *Error summation* sheet.

EXAMPLE: The CPICH_Ec/Io ratio for Cell 1 at T1 is calculated using the following equation, which is copied from cell L22 of the *Error summation* sheet and is given in the same format:

Cell 1 CPICH_Ec/Io ratio =10*LOG(($D$21*$E$21)/($D$21+ L$21))

- The terms in the denominator are all the linear powers for the cells on Channel 1, 2 cells + noise, added up as fractions.
- The *$D$21* term in the numerator is the linear power of Cell 1 at T1, as a fraction.
- The *$E$21* term in the numerator is the linear fraction of power in Cell 1 CPICH code channel.
- The *10* log* term gives the result in dB, in this case –13.00000dB with nominal values.

To calculate the sensitivity for a specific parameter, an arbitrary change of 0.01dB is applied to it. In the example below the absolute power of the noise is varied. A linear scaling factor for 0.01 dB expressed as *(10^(0.01/10)) is pasted into the equation, copied from cell L23 of the *Error summation* sheet:

New Cell 1 CPICH_Ec/Io ratio = 10*LOG(($D$21*$E$21)/($D$21+L$21*(10^(0.01/10))))

This gives a new value for the CPICH_Ec/Io ratio of –13.00499dB with the scaled-up noise. The difference from the original is taken and then multiplied by 100 to get -0.499, which is the change of the Cell 1 CPICH_Ec/Io per dB change in the noise power. In this example cell L10 of the *Error summation* sheet is made equal to this value.

A small change is chosen to give the correct value for the sensitivity. The sensitivity of –0.499 is clearly different from +1, and illustrates why the method is necessary. The sign of the sensitivity is negative, which shows that a rise in the noise power results in a reduction in the Cell 1 CPICH_Ec/Io ratio.

Each of the 6 contributing uncertainties is treated the same way by rewriting the equations. The resulting sensitivities are then applied to the relevant cells. The same process is repeated for each UE parameter listed in column A. Because the conditions at T1 and T2 are different, the process is carried out two times, for T1 and T2.

Cells are coloured grey when a parameter is not relevant, for example when a cell is not present in that time period.

In cases where the value can be deduced as 1.000 or 0 by inspection the sensitivity is entered directly.

EXAMPLE: The cell on channel 2 do not affect channel 1, so the sensitivity is entered as 0.

The contributing uncertainty, for example Cell L5, is multiplied by the sensitivity value, Cell L10 in this example, to give the resultant uncertainty in cell L11.

6.11.5.2 Superposition of uncertainty effects

The *Error summation* sheet takes each test system uncertainty and uses the sensitivity factors derived in clause 6.9.5.1 to predict the overall effect on the critical parameters at the UE.

The uncertainties in the absolute and relative levels of the 2 cells, the uncertainty in the noise on each channel, and the uncertainty in channel power ratio are entered in the pink cells in row 3 to 5 of the *Error summation* sheet. Separate sets of columns are used for T1 and T2.

The critical parameters at the UE are listed in rows 10 and 13 on the *Error summation* sheet. Each parameter has a figure for its sensitivity to each of the setting uncertainties. The sensitivities were obtained in clause 6.9.5.1, and are valid for parameters near the nominal figures. Each test system uncertainty is multiplied by the relevant sensitivity, to give the individual effect on each critical parameter at the UE.

The figures in the sum columns of the *Error summation* sheet are the overall spread that can be expected for those parameters. Root sum squares (RSS) summation of errors has been used in columns Q and R because no adverse effects of correlation are envisaged, and is consistent with the assumptions given in clause 6.9.4.

6.11.5.3 Derivation of Ior(n)

Several strategies are possible to ensure that the test requirement guidelines are met. The strategy taken here is to make no changes to the Cell powers, but to meet the test requirements by changing only the channel power ratios. The benefit of this approach is simplicity. The *Original* sheet is used to calculate the nominal powers for each cell. The *Apply uncertainties – Find Ior* sheet is not used.

The Ior(n) values appear in cells D35 to G35 of the *Original* sheet, and are carried forward to the *Error analysis* sheet.

6.11.5.4 Determination of initial Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 are not given an offset.

A value of 0 dB is entered in cell H24 on the *Error analysis* sheet, but is modified later in clause 6.9.5.6.

6.11.5.5 Prediction of spread in critical parameters

The RSS sum of errors is then used back in the *Error analysis* sheet to give high and low figures.

EXAMPLE: With cell H24 set to zero, the set value of Cell 2 CPICH_Ec/Io at T2 is –14.00dB as shown in cell G20, but it may be as high as –13.26dB (cell G21) or as low as –14.74dB (cell G22). The high and low values are obtained by simply adding or subtracting the summed uncertainties to the set value.

Other critical parameters are treated in the same way as the example.

The blue cells show the values that have to be checked against the test requirement guidelines.

6.11.5.6 Determination of final Cell 1 and Cell 2 CPICH offsets

Initially the channel power ratios in Cells 1 and 2 were not given an offset. Comparing the CPICH_Ec/Io (high) and CPICH_Ec/Io (low) values with the test requirement guidelines shows that with no offset, CPICH_Ec/Io (low) would fall outside the limit specified in clause 6.9.2 a). An offset to the CPICH_Ec/Io power ratio in Cells 1 and 2 has therefore been added in the *Error analysis* sheet.

A value of +0.8 dB in cell H24 ensures that the requirements are met.

A similar offset in cell H25 is applied to the other specified channels on Cells 1 and 2 to maintain the same relative power between code channels.

The power in OCNS decreases to keep the overall power of Cells 1 and 2 correct.

6.11.6 Check against test requirement guidelines

The numbers given are derived using the spreadsheet in Annex A.2.8. References to individual sheets within the spreadsheet are given in *italics*.

a) The worst-case CPICH_Ec/Io of Cell 1 and Cell 2 shall not fall below the values stated in the original table. This will prevent the UE from entering a less accurate CPICH_Ec/Io reporting range.

Sheet *Error analysis* cells D22 and E22 give –12.83dB and –12.83dB at T1 and T2 respectively, which comply with the requirement of -13dB for Cell 1.

Sheet *Error analysis* cell G22 give –13.94dB at T2, which comply with the requirement of –14dB for Cell 2.

b) The value of Cell 2 CPICH_Ec/Io as measured by the UE during time T2 shall not be less than -18 dB, the value of the Ec/Io threshold for a non-used frequency. The requirement shall include the effect of UE CPICH_Ec/Io Inter frequency absolute accuracy. This will ensure that Event 2C (The estimated quality of a non-used frequency is above a certain threshold) occurs.

Sheet *Error analysis* cell G22 gives –13.94dB at T2. Even if the UE reports this a further 1.5dB low (as allowed by its CPICH_Ec/Io Inter frequency absolute measurement accuracy with Cell 2 CPICH_Ec/Io >-14dB) the lowest reported value would be –15.44dB, which complies with the requirement of -18dB during time T2.

c) The nominal Io stated in the original table shall not be modified. This will ensure that the basic condition of the test is unchanged.

For channel 1 at T1 and T2, sheet *Error analysis* cells D27 and E27 give nominal Io values of –66.99dBm and -66.99dBm respectively, which are within 0.02dB of the stated values of –66.98dBm and -66.98dBm.

For channel 2 at T1 and T2, sheet *Error analysis* cells D28 and E28 give nominal Io values of –70.00dBm and -67.80dBm, which are the same as the stated values of –70.00dBm and –67.80dBm.

d) The worst-case Ec/Io ratios of all other channels (except OCNS) for Cell 1 and Cell 2 shall not fall below the values implied in the original table.

Sheet *Error analysis* cells D11 to G13 and D14 to E14 show that the channel power ratios of all the other channels for Cell 1 and Cell 2 (except OCNS) are increased by the same amount as the CPICH. As their variability at the UE is subject to the same influences as the CPICH, which has already been shown to comply under guideline a), the other channels (except OCNS) will not fall below the stated Ec/Io ratio.

e) All other parameters stated in the original table shall not be changed more than necessary to meet the requirements.

No other parameters have been changed.

7 Inter-RAT test cases originating in UTRA FDD

For these tests the UE starts on an UTRA FDD cell, and the test involves one or more cells with at least one being from a different RAT.

The test cases which have been analysed to determine Test Tolerances are included the present document as .zip files. The name of the zip file indicates the test cases covered, and includes both the source test specification number 34.121 and the number of the test case itself. All information relevant to derivation of the Test Tolerances is contained within the zip file, and no additional text is provided in the present document.

8 Inter-RAT test cases originating in UTRA TDD

For these tests the UE starts on an UTRA TDD cell, and the test involves one or more cells with at least one being from a different RAT.

The test cases which have been analysed to determine Test Tolerances are included the present document as .zip files. The name of the zip file indicates the test cases covered, and includes both the source test specification number 34.122 and the number of the test case itself. All information relevant to derivation of the Test Tolerances is contained within the zip file, and no additional text is provided in the present document.

Annex A: Spreadsheets

This annex contains references to the analyses spreadsheets used in the present document for background information or as a basis for various calculations. The spreadsheets in excel format are archived in a zip file (34902-500analyses.zip) which accompanies the present document.

A.1 One frequency multi-cell FDD tests

A.1.1 Analysis for test 8.2.2.1

Refer to spreadsheet included in zip file, One_freq_error_analysis_8_2_2_1.xls.

A.1.2 Analysis for test 8.3.1

Refer to spreadsheet included in zip file, SHO_analysis_8_3_1.xls.

A.1.3 Analysis for test 8.3.2.1

Refer to spreadsheet included in zip file, One_freq_error_analysis_8_3_2_1.xls.

A.1.4 Analysis for test 8.3.5.1

Refer to spreadsheet included in zip file, One_freq_error_analysis_8_3_5_1.xls.

A.1.5 Analysis for test 8.6.1.1

Refer to spreadsheet included in zip file, One_freq_error_analysis_8_6_1_1.xls.

A.1.5A Analysis for test 8.6.1.1A

Refer to spreadsheet included in zip file, One_freq_error_analysis_8_6_1_1A.xls.

A.1.6 Analysis for test 8.6.1.2

Refer to spreadsheet included in zip file, One_freq_error_analysis_8_6_1_2.xls.

A.1.6A Analysis for test 8.6.1.2A

Refer to spreadsheet included in zip file, One_freq_error_analysis_8_6_1_2A.xls.

A.1.7 Analysis for test 8.6.1.3

Refer to spreadsheet included in zip file, One_freq_error_analysis_8_6_1_3.xls.

A.1.7A Analysis for test 8.6.1.3A

Refer to spreadsheet included in zip file, One_freq_error_analysis_8_6_1_3A.xls.

A.1.8 Analysis for test 8.6.1.4

FFS

A.1.8A Analysis for test 8.6.1.4A

Refer to spreadsheet included in zip file, One_freq_error_analysis_8_6_1_4A.xls.

A.1.9 Analysis for test 8.6.1.5

Refer to spreadsheet included in zip file, One_freq_error_analysis_8_6_1_5.xls.

A.1.10 Analysis for test 8.6.1.6

Refer to spreadsheet included in zip file, One_freq_error_analysis_8_6_1_6.xls.

A.2 Two frequency multi-cell FDD tests

A.2.1 Analysis for test 8.2.2.2

Refer to spreadsheet included in zip file, Two_freq_error_analysis_8_2_2_2.xls.

A.2.2 Void

A.2.3 Analysis for test 8.3.2.2

Refer to spreadsheet included in zip file, Two_freq_error_analysis_8_3_2_2.xls.

A.2.4 Analysis for test 8.3.5.2

Refer to spreadsheet included in zip file, Two_freq_error_analysis_8_3_5_2.xls.

A.2.4A Analysis for test 8.3.5.4

Refer to spreadsheet included in zip file, Two_freq_error_analysis_8_3_5_4.xls.

A.2.5 Analysis for test 8.6.2.1

Refer to spreadsheet included in zip file, Two_freq_error_analysis_8_6_2_1.xls.

A.2.6 Void

A.2.7 Void

A.2.8 Analysis for test 8.6.2.2

Refer to spreadsheet included in zip file, Two_freq_error_analysis_8_6_2_2.xls.

Annex B: Change history

TSG Meeting	Doc-1st-Level	CR	Rev	Subject	Cat	Version -Current	Version -New	Doc-2nd-Level
TP-26	-	-	-	Proposed for approval (v.5.0.0) at TSG T#26, as agreed at T1#25	B	1.0.0	2.0.0	-
TP-26	-	-	-	Approved (v.5.0.0) at TSG T#26 (some 3GPP editing stile improvements done in 2005-02 MCC)	B	2.0.0	5.0.0	-
RP-28	RP-050284	0001	-	CR to 34.902: Addition of test system uncertainties for Test Case: 8.6.2.2 Correct reporting of neighbours in fading propagation condition	F	5.0.0	5.1.0	R5-050881
RP-28	RP-050284	0002	-	Editorial change to clearly mark the examples	D	5.0.0	5.1.0	R5-050882
RP-36	RP-070351	0003	-	CR to 34.902: Introduction of test cases for multi-path fading intra-frequency cell identification	F	5.1.0	5.2.0	R5-071095
RP-38	RP-070869	0005	-	Production of 34.902 pointer version in Rel-5 pointing to Rel-6 version	F	5.2.0	5.3.0	R5-073280
RP-38	RP-070877	0004	-	Addition of test tolerance derivation for 8.3.5.4.	F	5.2.0	6.0.0	R5-073372
RP-53	-	-	-	Formally moved to Rel-7 with no change.	-	6.0.0	7.0.0	-
RP-53	-	-	-	Formally moved to Rel-8 with no change.	-	7.0.0	8.0.0	-
RP-53	-	-	-	Formally moved to Rel-9 with no change.	-	8.0.0	9.0.0	-
RP-54	RP-111575	0009	-	34.121-1 Inter-RAT RRM Test Tolerance analyses agreed at RAN5#51 and RAN5#52 in 34.902	F	9.0.0	9.1.0	R5-115333
RP-54	RP-111575	0010	-	Add Test Tolerance analysis for TC 8.6.7.1 + 8.6.7.2 in 34.902	F	9.0.0	9.1.0	R5-115828
RP-55	RP-120175	0011	-	Add Test Tolerance analysis for TS34.122 test case 8.2.2.6.1	F	9.1.0	9.2.0	R5-120145
RP-55	RP-120175	0012	-	Add Test Tolerance analysis for TS34.122 test case 8.2.2.6.2	F	9.1.0	9.2.0	R5-120146
RP-55	RP-120175	0013	-	Add test tolerance analysis for 34.122 8.3.3c+8.3.3d in 34.902	F	9.1.0	9.2.0	R5-120382
RP-55	RP-120175	0014	-	Add Test Tolerance analysis for TS34.122 test cases 8.3.3a and 8.3.3b	F	9.1.0	9.2.0	R5-120850
RP-55	RP-120175	0015	-	Add Test Tolerance analysis for TS34.122 test cases 8.6.5.1 and 8.6.5.2	F	9.1.0	9.2.0	R5-120852
RP-55	RP-120175	0016	-	Add Test Tolerance analysis for TS34.122 test cases 8.6.5.3 and 8.6.5.4	F	9.1.0	9.2.0	R5-120854
RP-56	RP-120640	0017	-	Add Test Tolerance analyses for TS 34.122 Test cases 8.7.16 and 8.7.17	F	9.2.0	9.3.0	R5-121188
RP-56	RP-120640	0018	-	Add Test Tolerance analyses for TS 34.122 Test cases 8.7.14 and 8.7.15	F	9.2.0	9.3.0	R5-121238
RP-57	RP-121094	0019	-	Add Test Tolerance analyses for TS 34.121-1 Test Cases 8.7.10 and 8.7.11	F	9.3.0	9.4.0	R5-123928
RP-57	RP-121094	0020	-	Add Test Tolerance analyses for TS 34.121-1 Test Cases 8.7.12 and 8.7.13	F	9.3.0	9.4.0	R5-123930