3GPP TSG-T (Terminals) Meeting #10 ***Tdoc TP-000233***
Bangkok, Thailand, 6 - 8 December, 2000

3GPP TSG-T WG1 meeting #9 ***TSG T1#9(00)0266***
Redondo Beach, USA, **16th-17th November 2000**

Source: TSG-T1

To: ARIB, ETSI/TFES
Cc: TSG T, TSG RAN

Title: Urgency of resolving the measurement uncertainty in 34.121.

Document for: Discussion and decision

Contact person: Guillot Edgar (France Telecom) edgar.guillot@rd.francetelecom.fr

T1RF is involved in the definition of the measurement uncertainty for the terminal (UE) while RAN4 is responsible for the same work but for the BTS. TSG T1RF#16 and RAN4#14 meetings have taken place in the same time. And the contribution R4-000906 made in RAN4#14 has drawn the attention of T1RF#16. This contribution made by Ericsson deals with measurement uncertainty for BTS. It states that :

- The Japanese TELEC test specifications and the Japanese law are based on the UTRA FDD BS 3GPP specifications.
- It takes a year to get a change implemented in the Japanese law and have it included in the TELEC specifications.
- RAN4 has to complete the TS25.141 by December./2000

- The European Harmonised standard is based on UTRA FDD BS specification.
- This will be approved as a standard in January/2001.
- Any change of 25.141 has to be done before January/2001, i.e. in December/2000 at RAN4#10.

- The time schedules in Europe and Japan stress the urgency in getting any necessary update, including the measurement uncertainty, into TS 25.141 at RAN4#10 meeting.

It seems to T1RF that the situation is the same for the UE test conformance testing specifications 34.121 and 34.122. Being done that the TELEC specification and the harmonised standard will be achieved by January 2001, this means that T1RF has two weeks before December 2000 to complete its specification and in particular the definition of the measurement uncertainty and test tolerances values.

T1RF is concerned by this time schedule as it leaves only short time to the group to complete its work. Therefore, T1RF would like to ask confirmation to ARIB and ETSI about the time schedule of the release of the TELEC specifcation and the harmonised standard for the UE.

Then T1RF would like to ask ARIB and ETSI to provide some information about the content of the TELEC Specification and the harmonised standard in order to measure the effort the T1RF group has to do:

- Will the TELEC specification or the harmonised standard make reference to the T1RF specifications?
- If yes, will it make reference to the version number of the specifications?
- Will the TELEC specification or the harmonised standard contain test limits and/or test tolerances copied from the T1RF specifications?
- Can the ARIB and ETSI provide to T1RF a priority list of the tests described in the TELEC specification and the harmonised standard?

It is not possible for T1/RF to complete the specifications by December 2000. However, T1RF will treat that issue in priority. And, with the information provided by ARIB, ETSI and T1, T1RF intends to complete the sections of the specifications concerned by that issue by its next meeting, in February 2001.

TSG-RAN Working Group 4 (Radio) meeting #14
Sophia-Antipolis, France, 13-17 November, 2000

TSG R4#14 (00)0906

Agenda Item: 5.8

Source: Ericsson

Title: Measurement uncertainties and relaxation of BS requirements in TS 25.141

Document for: Discussion and approval

Introduction

In 3GPP RAN WG4 it has been agreed to relax the core specification values with the measurement uncertainty and to implement the relaxed value in the test specifications. This is the result of a long discussions, including the creation of a new recommendation ITUR-R [IMT.UNCERTAIN]. The recommendation concludes that from a technical perspective, applying "Never fail a good DUT" to a test limit that equals the core specification value leads to the same result as applying "Shared risk" to a test limit being a relaxation of the core specification value.

Applied to the 3GPP UTRA FDD test specifications, this means that the core specification values are left untouched while test limits in TS 25.141 (and TS 34 .121) may be relaxed with the measurement uncertainty. At this point there is agreement on this principle, but it has not been implemented in the test specifications yet.

Urgency of resolving the measurement uncertainty in TS 25.141

The UTRA FDD BS test specification TS 25.141 is the basis for the Japanese TELEC test specifications, with the value also written into Japanese law. TELEC lists a subset of the BS Emission requirements (see TEM ad hoc output R4T(00)0035), while the Japanese law lists a larger set also including some Receiver requirements. It may take close to a year to get a change implemented in the Japanese law and have it included in the TELEC specifications. In order to have these ready in reasonable time at the market introduction of UTRA FDD, any changes to TS 25.141 need to be approved at RAN #10 in December 2000.

A similar situation exists in Europe, where the draft Harmonised Standard for UTRA FDD BS (in support of the R&TTE directive) is also based on TS 25.141. It will become European "law" after public inquiry and national voting, a procedure taking up to 9 months. The draft harmonised standard lists a subset of receiver and transmitter requirements, similar to what is included in the Japanese law (see TEM ad hoc output R4T(00)0035). In order for any changes in TS 25.141 to be included in the harmonised standard, they need to be approved in December 2000, since ETSI MSG & ERM will approve the standard in January 2001 and thereafter put it up for public inquiry. There are some possibilities to do minor updates after the public inquiry but before national voting.

The time schedules in Europe and Japan stress the urgency in getting any necessary update, including the measurement uncertainty, into TS 25.141 at this RAN4 meeting. A way forward is proposed later in this contribution.

Relaxation of parameters in TS 25.141

For each test in TS 25.141 it should be possible to determine a measurement uncertainty for the test parameter and apply a relaxation to it. When trying to do this in practice, it turns out to be harder for some tests than for others. In particular, receiver tests contain more parameters and are more difficult to relax in a consistent way.

In addition, all tests may not be desirable to relax for other reasons. If the test limit is based on e.g. the ITU-R SM.329-7 recommendation or a regional regulatory specification, a relaxation may create confusion on how to interpret the standard.

Because of these obstacles and the urgency of completing the standard, it is proposed to take a pragmatic approach to relaxation of requirements. An agreement should be made in RAN4 on what parameters to relax. The following could be a basis:

- RAN4 should not relax regulatory requirements such as spurious emissions.
- If it is difficult to conclude on how a parameter should be relaxed in a consistent way, do not relax it.

The approach is consistent with Recommends 4 of ITU-R [IMT.UNCERTAIN] which states

"that in case that the measurement uncertainty cannot be reasonably and clearly defined, "Shared risk" principle should be applied to core specification value without any relaxation."

We propose to adjust at least the following requirements with the measurement uncertainty:
- Base station output power
- Frequency accuracy
- Out of band emissions
- Output power dynamics
- Receiver sensitivity level
- Performance requirement (Clause 8)

"Output RF spectrum emissions" and "Rx spurious emissions" are to a large extent regulatory requirements. Transmit intermodulation and most receiver tests include two or more parameters for the test, making relaxation more complicated and unclear, as is further explained in the subsequent section of this paper. It is therefore proposed that these fall under Recommends 4 in ITU-R [IMT.UNCERTAIN] and are thus not relaxed.

Note however that measurement uncertainty still needs to be defined for all tests. Anyone applying the test specification will need to prove that the tests are performed within these allowed measurement uncertainties.

How to implement a relaxation in TS 25.141

ITU-R [IMT.UNCERTAIN] demonstrates in Annex 1 that "never fail a good DUT" means that the core specification value should be relaxed with the measurement uncertainty. The first thing to get agreement around is what "measurement uncertainty" is, especially in terms of confidence level.

Tdoc R4-000499 gives a very good overview of measurement uncertainty, confidence levels and how relaxation can be applied to tests, but mainly for "two-sided" tests with both an upper and a lower test limit. If the measurement uncertainty is determined with a 95% confidence level, it is reasonable that the relaxation will lead to a test where a good DUT (being exactly on the core requirement) passes the test with 95% probability. For all one-sided tests (with a single limit) this implies that the uncertainty should be 1.64σ, where σ is the standard deviation determined for the test assuming a Gaussian distribution.[1]

The actual adjustment of the test limit should be done in the conformance requirement and/or test limit stated in TS 25.141. In order to keep track of the adjustments done, an informative Annex should be added with a table listing both the core requirement and the adjusted test limit.

The tests in TS 25.141 are different in nature and pose different level of difficulty when trying to apply relaxation with the measurement uncertainty. An attempt is made here to group the tests according to the approach possible for relaxation. All requirements are included in this section, including the ones proposed *not* to be relaxed in the previous section.

Emission requirements

Tests in this group are
- Output RF spectrum emissions (excluding occupied bandwidth)
- Receiver spurious emissions

All these tests involve measuring a component of the emissions from the transmitter (or receiver) with a spectrum analyser or similar test equipment. Relaxation can be done directly on the measured value, since there is no other test parameter involved.

We propose not to relax the spurious emissions tests.

Frequency accuracy and emission bandwidth

Tests in this group are
- Frequency error
- Occupied bandwidth

These tests rely on accuracy on measuring a frequency, but in different ways. "Occupied bandwidth" is more difficult to establish a measurement uncertainty for since it also involves power measurement, but it is not a critical test.

We propose not to relax the emission bandwidth tests.

[1] Usually the measurement uncertainty for 95% confidence is determined to be $\pm 1.96\sigma$, where σ is the standard deviation determined for the test. But then the probability is 2.5% to be above the upper limit, not 5% as is the intent here.

Power accuracy requirements

Tests in this group are

- Base station maximum output power
- Output power dynamics

The tests include power measurements of the BS transmitted power with a power meter or the power of a code with a code domain analyser. The test limits are in most cases double sided. For "Base station maximum output power" the test limits are separated 4 dB, which seems to be much more than the measurement uncertainty. In order to pass a good DUT (at the core specification limit) with 95% probability, the relaxation should also here be with a measurement uncertainty defined as 1.64σ.

Transmit intermodulation

The test limits are the same here as for the spurious emission requirements. In addition, a strong interfering signal is injected into the antenna connector. The impact on the test from the measurement uncertainty of this signal will vary depending on what order of intermodulation product that is measured.

For the third order intermodulation product, the impact will for the most critical product not be multiplied and can be treated as equivalent to a measurement error on the emissions. For this case, the square sum of the two measurement errors can be used as the total measurement error. If the intermodulation product is of higher order, the square of the interference measurement error need to be counted multiple times. The relaxation with the total uncertainty should be applied to one of the signals.

We propose not to relax the transmit intermodulation test.

Receiver performance

Tests in this group are

- Receiver sensitivity
- Performance requirement (section 8)

For these tests a carrier signal is applied at a defined level and BER or BLER is measured at the receiver. The measurement error of the signal applied can be determined and a relaxation applied, but in addition there is the error when measuring BER/BLER.

We proposed not to have a relaxation of BER/BLER in the tests, since that error has far less impact on overall measurement uncertainty. The reason is that the relation between signal level and BER has a very steep slope, making even a 50-100% relative error in BER correspond to only a few tenths of a dB in signal level. This is even more true for BLER, especially when turbo codes are applied. It is however very important to decide the necessary number of samples to achieve sufficient confidence in the BER/BLER for the test.

For the performance requirement in section 8, it is the error of the relative signal level between carrier and the AWGN signal (E_b/N_0) that the measurement uncertainty should be determined on.

Receiver immunity to strong interferers

These are tests of the receiver's ability to handle strong interference on other frequencies. Tests in this group are

- Adjacent Channel Selectivity
- Blocking characteristics
- Intermodulation characteristics

Also for these tests a carrier signal is applied at a defined level and BER or BLER is measured at the receiver, but in addition there are one or more strong interfering signals at other frequencies. The total measurement uncertainty can be determined as the sum of squares of the uncertainty on the individual signals.

For intermodulation there will be three signals of which one interfering signal has double impact since the intermodulation product is of the third order. The error of that signal should be counted twice in the sum of the squares equation to determine the total measurement uncertainty.

We propose not to relax the receiver immunity tests.

Other requirements

There are a few more tests in TS 25.141, but they are not treated in this paper and are not relevant to TELEC or ETSI TFES.

Proposed way forward

The urgency of the matter makes the way forward to implement relaxation a very important matter. Formally, RAN4 would need to approve the CRs for TS 25.141, including the relaxed requirements at this RAN4 meeting. That is most likely not possible, since the TEM ad hoc has not finally concluded on the values for measurement uncertainty. It is not even within the scope of TEM to determine the test tolerances, only the uncertainty of individual test equipment.

For this reason, the following procedure is proposed:

1. RAN4#14 determines what requirements in TS 25.141 to relax and which ones not to relax. The decision must include at least the tests needed for TELEC and ETSI TFES, in order to make sure their work can be completed in time.
2. A CR is drafted for the clauses in TS 25.141 that are agreed to be relaxed, with the relaxed numbers in brackets. The CR is endorsed by the group, with approval of a complete CR pending on the RAN4 reflector. An editor is assigned with the task of completing the CR.
3. The TEM ad hoc is given the mandate to determine the necessary measurement uncertainties of the complete test bed (test tolerances). These values together with the updated CR (completed with relaxed values) are approved on the RAN4 reflector, for submission to RAN#10 and final approval in December.