

**Source:** SoftBank Corp.  
**Title:** On MSD and REFSENS definition including diversity path  
**Agenda item:** 7.45  
**Document for:** Approval

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## 1. Introduction

The issues of MSD and REFSENS considering Rx diversity path have been discussed for several meetings including RAN-P and are becoming diversified. This paper is intended for further discussion on this aspect: discussion is limited to when Tx- diversity Rx coupling plays a dominant role for sensitivity degradation.

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## 2. On basic setting

It seems that the discussion includes two different aspects as:

- (1) Differences between assumption (antenna coupling) and real tests (conductive), and
- (2) Assumed values for minimum requirements (10dB or 15 – 20dB?).

A problem is (1) and (2) can both be separated or related depending on a point of view. While the author's interpretation is that (2) could be meaningless once we assume conductive testing in (1) where antenna port coupling could be far smaller than 10 or 20dB but there might be the others who believe that values of 10dB or 20dB are still to be discussed even under conductive measurement. Thus,

**[Proposal-1] Firstly we should agree on (1), i.e. talking about real world or conductive test.**

To be straight, current status of TRP/TRS and MIMO-OTA do not give strong confidence for early introduction of relevant over-the-air tests. Then it is proposed that we should discuss conductivity test at least for the time being.

**[Proposal-2] For the time being, we should focus on conductivity testing.**

On the other hand, we have to admit that:

**[Observation -1] while we stick to conductive testing, it is basically impossible to capture antenna-related effects properly.**

So this could be more or less a matter of compromise.

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## 3. What is to be defined/tested

Assuming conductive tests in mind, the main contribution of antenna (port) coupling is leakage of connectors, assuming we have already counted in PCB coupling or other elements properly in different ways. Checking RF connector catalogues, around 60dB is a worst value in spec. from vendors, [1] for instance. If this is the case, current 10dB assumption is too big (50dB difference) to justify, regardless of how we name it.

Apparently the MSD or REFSENS based on the value (60dB leakage) could be the valid requirements for current conductive tests but it does not correspond to any real-world phenomenon esp. when Tx- diversity Rx interactions matters.

The other option could be to inject relevant signal emulating Tx leakage. Depending on how the Tx imperfection is emulated, the method may have a clear draw back not to test Tx performance but only on Rx.

As other parties, esp. test equipment vendors, might propose far better and implementable schemes, it might be over my head to give a clear consequence. But one thing for sure is that a reason for the test should be in question as long as the current schemes/assumptions are retained with some contradictions in it.

**[Observation -2] With current scheme and assumptions, a question is directed to the necessity of this test.**

So,

**[Proposal-3] If we fail to find a rational method/requirement for conductive testing, we might consider not to test REFSENS/MSD cases where Tx – diversity Rx plays a dominant role.**

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## 4. Conclusion

This paper considers further on issues related to Tx – diversity Rx and MSD/REFSENS. The proposals are:

**[Proposal-1] Firstly we should agree on (1), i.e. talking about real world or conductive test.**

**[Proposal-2] For the time being, we should focus on conductivity testing.**

**[Proposal-3] Provided we fail to find a rational method for conductive testing, we might consider not to test REFSENS/MSD cases where Tx – diversity Rx plays a dominant role.**

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## 5. Reference

[1] Huber-Suhner website, <http://www.hubersuhner.com/en/Products/Radio-Frequency/Connectors>

