

Agenda Item: 6.26
Source: Motorola Mobility, Intel, ETS-Lindgren, Elektrobit
Title: Definition of absolute radiated data throughput
Document for: Approval

1. Background

This contribution provides a definition for the term “absolute radiated data throughput” and outlines a methodology for its measurement.

During the last 3GPP RAN4 MIMO ad hoc meeting #62 in Dresden, the MIMO OTA group agreed in the fundamental FoM for MIMO, from R4-120998 “TP for 3GPP TR 37.976 v1.6.0” [1]:

“Currently throughput is the figure of merit to be used as to compare the different results across the different methods. Absolute throughput is agreed as the only figure of merit that will enable comparable testing across different methods.”

The goal of this contribution is to outline a calibration methodology that compares each method’s ability to emulate the specified network and channel propagation characteristics based on an absolute throughput metric. This calibration would quantify the ability of different testing methodologies to provide comparable results.

2. Discussion

Understandably the term coined during MIMO OTA meeting “absolute throughput” might generate dubious interpretations, thus this contribution will clarify the methodology to generate the “absolute throughput” figure of merit.

For the purposes of this calibration, absolute throughput is a metric based on a specific DUT and is based on the following characteristics:

- a. Network characteristics inherent in the eNodeB emulator settings (the reference measurement channel, MCS, etc.)
- b. Antenna complex radiation pattern, as widely accepted the complex radiation pattern will be based on CTIA MIMO 2x2 reference antennas [2];

- c. Chipset characteristics (such as receiver algorithm implementation)

In addition to these characteristics, this metric will be generated based on controllable channel conditions, such as:

- d. Defined channel model and multipath profile
- e. Defined drop(s), e.g. a set of drops characterizing uniform, narrow and wide angular spread;
- f. Defined SNR, to properly assess MIMO functionality SNR should be higher than 24dB;

The method to calibrate the propagation conditions using absolute data throughput should be MIMO OTA test agnostic, therefore independent of test method implementation. This method does not include the following DUT characteristics that are necessary to evaluate the true OTA performance of a UE:

- a. Interference/coupling between antenna elements integrated into the UE
- b. Sources of self-interference coupling to the receiver chains via antenna elements integrated into the UE

Originally the concept was based on MIMO full link simulations using the a~f inputs, thus predicting through simulation the absolute data throughput of each DUT participating in the measurement campaign. However it is a fact that each LTE chipset will have a different algorithm, therefore a full link simulation tool will need to be tailored for each chipset to generate accurate results. This task might be very time consuming and the effort won't target directly the problem that the MIMO OTA group is addressing.

An alternative approach to determining an absolute throughput reference in the timeframe needed, thus generating a baseline for future MIMO OTA test campaign, and working around the different LTE MIMO algorithms from different chipset vendors, would be to use a conducted throughput measurement through a channel emulator with inclusion of the reference antenna complex radiation pattern. While this measurement setup might be very similar to proposed two-stage method [3], it doesn't endorse it as absolute MIMO OTA method for two reasons:

1. Doesn't require all chipsets to record the antenna system complex radiation pattern, since the OTA measurement will be done with CTIA reference antennas;
2. Doesn't address the potential issue of radiated self interference of each DUT, since all measurements will be based on conducted performance, therefore only conducted self interference will be considered;

Figure 1 below illustrates the proposed method of performing an absolute throughput conducted reference measurement.

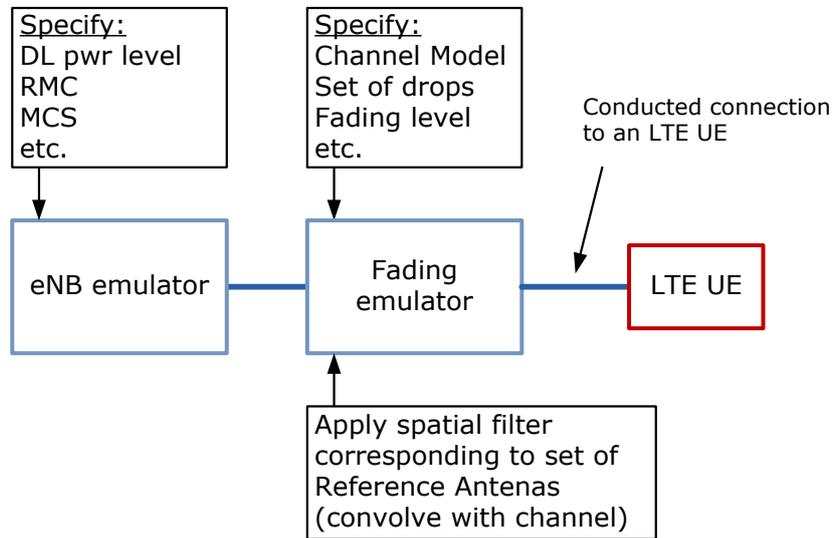


Figure 1: Proposed method of measuring the absolute throughput conducted reference metric for the purpose of methodology calibration

The conducted data throughput measured in this way gives a DUT-specific absolute data throughput reference. It can be used to evaluate a methodology's ability to reproduce all of the assumed characteristics listed above by using the same DUT in a radiated measurement with the CTIA reference antennas as illustrated in Figure 2 below.

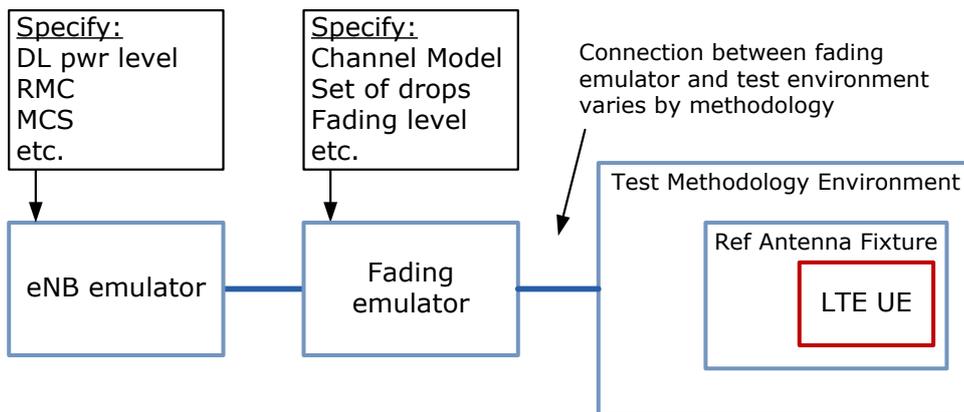


Figure 2: Proposed method of measuring the absolute radiated data throughput metric for the purposes of methodology calibration

3. Conclusions

The absolute radiated data throughput calibration method can be used to assess how accurately each test method is able to emulate the network and channel characteristics defined in the MIMO OTA testing methodology, and eventually would provide a direction towards acceptance of test method(s). This decision will be based on an absolute throughput metric defined in this paper.

To enable this initiative, the correlation between base station and channel emulator vendors [4 - 6] needs to be concluded, as specified in the charter of the CTIA MOSG Test Equipment Verification Taskforce.

4. References

- [1] http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_62/Docs/R4-120998.zip

- [2] http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_62/Docs/R4-120240.zip

- [3] http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_54/Documents/R4-100720.zip

- [4] http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_62/Docs/R4-120739.zip

- [5] http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_62/Docs/R4-120675.zip

- [6] http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_62/Docs/R4-120529.zip