**3GPP TSG-RAN5 Meeting #90-e R5-210312
Electronic Meeting, 22nd Feb – 5th Mar 2021**

**Agenda item:** 5.3.2.17

**Source:** Keysight Technologies

**Title:** On minimum requirements for Transmit ON/OFF time mask in UL MIMO FR1

**Document for:** Discussion and Endorsement

# Introduction

The aim of this document is to analyse the minimum requirements for test case 6.3D.3 Transmit ON/OFF time mask for UL MIMO [1], present the potential inconsistency for measuring the ON power compared to other test cases and propose a way forward to solve it.

# Discussion

## Minimum Requirements analysis

The minimum requirements for the test case 6.3D.3 Transmit ON/OFF time mask for UL MIMO, as an adaptation of those defined in [2], section 6.3D.3, are the next:

### 6.3D.3 Transmit ON/OFF time mask for UL MIMO

…

#### 6.3D.3.3 Minimum conformance requirements

For UE supporting UL MIMO, the ON/OFF time mask requirements in subclause 6.3.3.2.3 apply to each transmit antenna connector.

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the general ON/OFF time mask requirements specified in subclause 6.3.3.2.3 apply to each transmit antenna connector with the UL MIMO configurations specified in Table 6.3D.3.3-1.

That it, the requirements apply to each antenna connector. In the ON/OFF time mask test case, both ON and OFF power need to be measured.

For measuring OFF power, the requirement applicability to each transmit antenna connector is consistent with the minimum requirements for Transmit OFF power for UL MIMO:

### 6.3D.2 Transmit OFF power for UL MIMO

#### 6.3D.2.1 Test purpose

…

#### 6.3D.2.3 Minimum conformance requirements

The transmit OFF power is defined as the mean power at each transmit connector in a duration of at least one sub-frame (1ms) excluding any transient periods.

However, for measuring the ON power, the requirement applicability to each transmit antenna connector seems inconsistent with the rest of test cases where ON power is measured for UL MIMO (maximum output power, minimum output power, (absolute, relative) power control tolerance..), where the requirement applies to the sum of the output power from both UE antenna connectors. Example from absolute power tolerance for UL MIMO test case:

#### 6.3D.4.1 Absolute power tolerance for UL MIMO

##### 6.3D.4.1.1 Test purpose

To verify the ability of the UE transmitter for UL MIMO to set its initial output power to a specific value at the start of a contiguous transmission or non-contiguous transmission with a long transmission gap, i.e. transmission gap is larger than 20ms.

##### 6.3D.4.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

##### 6.3D.4.1.3 Minimum conformance requirements

For UE supporting UL MIMO, the power control tolerance applies to the sum of output power at each transmit antenna connector.

This example is the best to illustrate the inconsistency because in both Transmit ON/OFF time mask for UL MIMO test case and Absolute power tolerance for UL MIMO test case the open loop power control is used but it is only in the second where the requirement applies to the sum of output power at each transmit antenna connector when ON power is measured.For measuring ON power for UL MIMO, since there is no requirement indicating how power need to be distributed between each transmit connector, it seems most appropriate to apply the requirements to the to the sum of the output power from both UE antenna connectors.

***Observation 1: Minimum requirement to measure ON power as part of the transmit ON/OFF time mask measurement for UL MIMO seems inconsistent with minimum requirements for many other cases where ON power needs to be measured for UL MIMO. The Absolute power tolerance for UL MIMO test case is the best to illustrate this inconsistency because it uses open loop power control like the Transmit ON/OFF time mask for UL MIMO test case.***

***Observation 2: for measuring ON power for UL MIMO, since there is no requirement indicating how power needs to be distributed between each transmit connector, it seems most appropriate to apply the requirements to the sum of the output power from both UE antenna connectors.***

It is worth then to contact RAN4 to clarify the minimum requirements for transmit ON/OFF time mask for UL MIMO.

***Proposal 1: Send an LS to RAN4 to clarify the minimum requirements for transmit ON/OFF time mask for UL MIMO when ON power needs to be measured.***

## Test procedure inconsistency

In test case 6.3D.3 Transmit ON/OFF time mask for UL MIMO, current test procedure measures and checks ON power as the sum of the output power from both UE antenna connectors. Despite reasonable as per observations 1 and 2 above, formally current test procedure is misaligned with current minimum requirements.

***Observation 3: Current test procedure measures ON power as the sum of the output power from both UE antenna connectors, what is not aligned with current minimum requirements*.**

Given current implementation is reasonable and given the timeline offset between RAN4 and RAN5 meetings, it is proposed to add an editor’s note indicating the interpretation of the minimum requirements for measuring ON power needs to be confirmed.

***Proposal 2: Add an editor’s note indicating the interpretation of the minimum requirements for measuring ON power needs to be confirmed.***

# Conclusion

The following observations and proposals were made in this contribution:

***Observation 1: Minimum requirement to measure ON power as part of the transmit ON/OFF time mask measurement for UL MIMO seems inconsistent with minimum requirements for many other cases where ON power needs to be measured for UL MIMO. The Absolute power tolerance for UL MIMO test case is the best to illustrate this inconsistency because it uses open loop power control like the Transmit ON/OFF time mask for UL MIMO test case.***

***Observation 2: for measuring ON power for UL MIMO, since there is no requirement indicating how power needs to be distributed between each UE transmit connector, it seems most appropriate to apply the requirements to the sum of the output power from both UE antenna connectors.***

***Proposal 1: Send an LS to RAN4 to clarify the minimum requirements for transmit ON/OFF time mask for UL MIMO when ON power needs to be measured.***

***Observation 3: Current test procedure measures ON power as the sum of the output power from both UE antenna connectors, what is not aligned with current minimum requirements*.**

***Proposal 2: Add an editor’s note indicating the interpretation of the minimum requirements for measuring ON power needs to be confirmed.***

# References

1. 3GPP TS 38.521-1: "NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Range 1 Standalone".
2. 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".