TSG-RAN Working Group 4 (Radio) meeting #97-ER4-2016928

Electronic Meeting, 2nd – 13th November 2020

**Title: LS on Phase noise and other RF Impairment modelling**

**Response to: RAN WG1: R1-2005196,** **LS to RAN4 on Phase noise and other RF Impairment modelling**

**Release: Rel-17**

**Work Item: FS\_NR\_52\_to\_71GHz**

**Source: TSG RAN WG4**

**To: TSG RAN WG1**

**Cc:**

**Contact person: Torbjörn Elfström**

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**Send any reply LS to: 3GPP Liaisons Coordinator,** [**mailto:3GPPLiaison@etsi.org**](mailto:3GPPLiaison@etsi.org)

**Attachments:**

[1] R4-2014976, “On 52.6 to 71 GHz phase noise characteristics, TP to TR and draft LS to RAN1”, Ericsson

[2] R4-2016533, “On PN model for 52.6~71GHz”, Huawei, HiSilicon

[3] R4-2015443, “Phase noise and RF impairment considerations”, Nokia, Nokia Shanghai Bell

# 1 Overall description

RAN WG4 received the incoming LS from RAN WG1 on Phase noise and other RF Impairment modelling considering RAN WG1 studies on Evaluation Methodology for the Study on supporting NR from 52.6 GHz to 71 GHz. In the LS, WG RAN1 states that Phase noise (PN) modelling is necessary in the RAN1 evaluation of applicable numerology including subcarrier spacing and channel BW and requests timely feedback from RAN WG4 on the applicability of the two PN models provided in TR 38.803 (Ex-1 and Ex-2 developed during rel-15 NR study item) to NR in the 52.6 to 71 GHz frequency range.

Additional information has been presented in RAN4 which include the latest published low-power PLL phase noise performance, on which phase noise models both for BS and UE including implementation margin for UE has been proposed. In addition, a comparison between PLL input data, new additional information [1, 2, 3] and Ex-1 and Ex-2 were investigated [1] as well as qualitative analysis of phase noise characteristics was discussed.

Some companies in RAN4 consider that the phase noise models in TR 38.803 example 2 (frequency scaled from FR2) reflect the hardware performance and can be appropriate for use.

A new phase noise model for UE was also presented in RAN4 [2].

Thus, RAN4 respectfully informs RAN1 of following combinations:

* Alternative 1: BS and UE phase noise model set presented in [1].
* Alternative 2: Set based on BS phase noise model based on TR 38.803 Ex 2 and UE phase noise model presented in [2].
* Alternative 3: Set based on TR 38.803 Ex 2 phase noise model for both UE and BSs.

None of the models have been agreed in RAN4. RAN4 has made an observation that the UE phase noise is higher compared to BS regardless of the model.

Modelling of other impairments e.g. power amplifier (PA), either directly or approximately via EVM injection, and other RF impairments, such as I/Q imbalance and frequency offset which may be optionally considered in the RAN1 evaluation was not considered in RAN WG4 for base stations. Developing such models for BS will take excessive amount of time. For UE RF impairments no conclusions have been made yet.

RAN4 also studied performance gain introduced by ICI compensating, both implementation-based approach which use the Rel-15 PTRS pattern and new PTRS pattern approach are analysed. RAN4 sees enhancements to PT-RS may be useful for >52.6 GHz frequencies.

# 2 Actions

**To RAN WG1**

**ACTION:** RAN WG4 kindly request RAN WG1 to take the information above into account.

# 3 Dates of next TSG RAN WG 4 meetings

3GPP RAN4#98-E, 2021-01-25 - 2021-02-05, Electronic Meeting