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, HiSillicon

# 1 Overall description

RAN WG4 received the incoming LS from RAN WG1on 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 have been presented in RAN4 from multiple companies, with the latest representative published state-of-the-art PLL phase noise performance and has developed an up-to-date Phase noise model both for BS and UE including reasonable implementation margin for UE. In addition, a comparison between PLL input data, new proposed model and Ex-1 and Ex-2 were investigated [1] as well as qualitative analysis of phase noise characteristics was discussed.

Some companies in RAN4 have concluded the PN models in TR 38.803 example 2 (frequency scaled from FR2) reflect the hardware performance and are most appropriate for use.

A new phase noise model for UE was also presented in RAN4 [2] which in combination with TR 38.803 Ex2 BS model represents an alternative set for phase noise model.

A qualitative analysis over different phase noise models (existing and new up to date and state of the art models) was made and RAN WG4 concluded that the existing models do not align well with recent PLL performance data. It was shown that the existing models do not represent the technology envelope and could result in misperception e.g. on small SCSs suffer significantly from ICI problems and consequently non appropriate selection of SCS.

Thus, RAN4 respectfully propose RAN1 to consider three possible up to date phase noise models as following:

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 BS.

RAN4 has also made an observation that the UE phase noise would dominate the link performance when evaluating the numerology as UE phase noise is much 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 will be optionally considered in the RAN1 evaluation was not considered in RAN WG4. Developing such models for BS will take excessive amount of time and effort and it is not clear to RAN WG4 how such impairment models affect the numerology evaluations.

RAN4 may continue the work to develop a common phase noise model for this frequency range.

# 2 Actions

**To RAN WG1**

**ACTION:** RAN WG4 kindly request RAN WG1 to use the proposed new PN models for numerology evaluation studies on supporting NR from 52.6 GHz to 71 GHz.

# 3 Dates of next TSG RAN WG 4 meetings

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