**3GPP TSG RAN Meeting #91e DRAFT RP-210847**

**Electronic Meeting, March 22-26, 2021**

**Source: Moderator (Huawei)**

**Title: New SID: Optimizations of pi/2 BPSK uplink power in NR**

**Document for: Approval**

**Agenda Item: 9.1.5**

3GPP™ Study Item Description

Information on Work Items can be found at <http://www.3gpp.org/Work-Items>
See also the [3GPP Working Procedures](http://www.3gpp.org/specifications-groups/working-procedures), article 39 and the TSG Working Methods in [3GPP TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm)

# Title: **New SID: Optimizations of pi/2 BPSK uplink power in NR**

## Acronym: FS\_NR\_Opt\_pi2BPSK

## Unique identifier: [TBD]

NOTE: For new WIs/SIs leave the Unique identifier empty and make a proposal for an Acronym.

 For a revised WI/SI: Take Unique identifier and acronym as shown in 3GPP workplan.

 If this is a RAN WID including Core and Perf. part, then Title, Acronym and Unique identifier refer to the feature WI.

 Please tick (X) the applicable box(es) in the table below:

 Either:

|  |  |
| --- | --- |
| **This WID includes a Core part** | **x** |
| **This WID includes a Performance part** |  |

 or:

|  |  |
| --- | --- |
| **This WID includes a Testing part** |  |
| **and it addresses the following 3GPP work area:** | **Radio Access** |  |
| **Core Network** |  |
| **Services** |  |

Potential target Release: Rel-17

Note that this field above indicates the proposed Release at the time of submission of the WID to TSG approval. It can later be changed without a need to revise the WID. The updated target Release is indicated in the Work Plan. In case of contradiction with the target dates of clause 5, clause 5 determines the target release.

## 1 Impacts

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Affects:** | UICC apps | ME | AN | CN | Others (specify) |
| **Yes** |  | x |  |  |  |
| **No** | X |  | X | X |  |
| **Don't know** |  |  |  |  |  |

## 2 Classification of the Work Item and linked work items

### 2.1 Primary classification

|  |  |
| --- | --- |
|  | Feature |
|  | Building Block |
|  | *Work Task* |
| X | Study Item |

NOTE: Normally, Core/Perf./Testing parts in RAN WIDs are Building Blocks. Only if they are under an SA or CT umbrella, they are defined as work tasks. If you are in doubt, please contact MCC.

### 2.2 Parent Work Item

|  |
| --- |
| Parent Work / Study Items  |
| Acronym | Working Group | Unique ID | Title (as in 3GPP Work Plan) |
|  |  |  |  |

NOTE: RAN agreed some time ago, that it describes the feature WI + Core/Perf. part WI or Testing part WI in one WID. Therefore, the table above should just include the feature WI data (In case the feature covers Core and Perf. part, please list under Working Group the leading WG of the Core part).

### 2.3 Other related Work Items and dependencies

|  |
| --- |
| Other related Work Items (if any) |
| Unique ID | Title | Nature of relationship |
|  |  |  |

NOTE: Also related or dependent WIs/SIs in other TSGs should be indicated.

## 3 Justification

Coverage enhancement is a study item led by RAN1 for Rel-17. It has been identified that uplink channels are the bottleneck in many of the evaluated scenarios in terms of the coverage achieved. Given a fixed number of antennas and fixed MCS choices, an improvement in the uplink link budget is only possible through an increase in the UE’s UL power.

The current MPR tables may not fully exploit spectrum shaping of pi/2 BPSK waveforms. Meaningful reduction in MPR for certain waveforms could be achieved if UEs exclusively rely on ‘strong’ shaping. Increase in maximum achievable power may also be feasible relative to the MPR0 power level.

Using precedent in Rel-15 and Rel-16 for high power transmissions, duty cycle restrictions will help maintain average power levels at 23 dBm for compliance with SAR requirements.

In this study item, we propose to exploit strong spectrum shaping to realize UL power gains for pi2BPSK waveforms.

## 4 Objective

### 4.1 Objective of SI or Core part WI or Testing part WI

The objective of this study is to evaluate the feasibility of increasing the UE’s uplink power in TDD bands for pi/2 BPSK modulation assuming use of existing UE power classes as indicated per band or band combination. The objectives are applicable to FR1 TDD bands n40, n41, n77, n78 and n79.

1. Identify achievable UE Tx power for pi/2 BPSK with the pulse shaping filter studied in this study item.
2. Evaluate SAR-related duty-cycle restrictions and reporting mechanisms
3. Identify shaping filter characteristics necessary to enable the new power capability while ensuring good and robust BS receiver performance.
	1. Justify specification of a pulse shaping filter for this new identified UE power capability if it differs from filter impulse response specification in TS38.101-1 clause 6.4.2.4.1.E
	2. Evaluate possible pulse shaping filter requirement applicable to the identified new UE power capability if achievable
	3. Identify if necessary changes are needed to EVM equalizer flatness mask requirements to capture necessary filter shaping. Changes to the existing 14 dB p-p baseline to be assessed in relation to any potential gains in UL link performance while still ensuring robust BS receiver performance for all UEs in a cell.

The objectives are applicable to FR1.

Note: whether or not a new UE power class will be introduced for the identified achievable UE Tx power for pi/2 BPSK will be decided at the drafting stage of the following WI.

### 4.2 Objective of Performance part WI

NOTE: Leave empty if the WI proposal does not contain a RAN performance part.

### 4.3 RAN time budget request (not applicable to RAN5 WIs/SIs)

NOTE: For all new RAN related WIs/SIs which are not led by RAN WG5 the WI/SI rapporteur has to fill out the attached Excel table to request time budgets for corresponding RAN WG meetings.
The Excel table has to be filled out for all affected RAN WGs and up to the target date of the WI/SI.
One time unit (TU) corresponds to ~ 2 hours in the meeting.
If no TU is needed, then leave the field empty otherwise enter a number >0 in the field.

 For revisions of already approved WI/SI descriptions: Please remove the Excel table from the WID/SID's zip file. The time budgets are already recorded. If you want to modify them, then this has to be done via the status report and not via a revised WID/SID.

 If this WID is covering Core and Performance part, then please fill out one line for each part in the attached Excel table.

**additional comments to the time budget request in the attached Excel table:**

## 5 Expected Output and Time scale

|  |
| --- |
| **New specifications** *{One line per specification. Create/delete lines as needed}* |
| Type  | TS/TR number | Title | For info at TSG#  | For approval at TSG# | Remarks |
| Internal TR | 38.xyz | Study on optimizations of pi/2 BPSK uplink power in NR | TSG#93 | TSG#94 | Rapporteur: Chan Fernando, Qualcomm Incorporated, mcfernan@qti.qualcomm.com |

*{Note 1: Only TSs may contain normative provisions. Study Items shall create or impact only TRs.
"Internal TR" is intended for 3GPP internal use only whereas "External TR" may be transposed by OPs.}*

NOTE: If this is a RAN WI including Core and Perf. part, then all new Core part specs have to be listed first and then all new Perf. part specs. Indicate "Core part" or "Perf. part" under Remarks for each spec.
By default a new specs can only be new for one of both parts.

|  |
| --- |
| **Impacted existing TS/TR** *{One line per specification. Create/delete lines as needed}* |
| TS/TR No. | Description of change  | Target completion plenary# | Remarks |
|  |  |  |  |

NOTE: If this is a RAN WI including Core and Perf. part, then all new Core part specs have to be listed first and then all new Perf. part specs. Indicate "Core part" or "Perf. part" under Remarks for each spec.
If an existing spec is affected by both (Core part and Perf. part), then it has to be listed twice with appropriate approval dates.

## 6 Work item Rapporteur(s)

[Qualcomm Incorporated, Chan Fernando, mcfernan@qti.qualcomm.com]

## 7 Work item leadership

RAN WG4

## 8 Aspects that involve other WGs

None

NOTE: For RAN WIs: Section 8 applies only to WGs outside of TSG RAN because RAN WG aspects have to be covered in section 4.

## 9 Supporting Individual Members

|  |
| --- |
| Supporting IM name |
| Qualcomm Incorporated |
| Ericsson |
| Samsung |
| Nokia |
| Nokia Shanghai Bell |
| IITH |
| IITM |
| Tejas Networks |
| CeWiT |
| Reliance Jio |
| Huawei |
| HiSilicon |
| [Apple] |
| [VIVO] |
| [Intel] |
| [OPPO] |
| [Skyworks] |
| [MediaTek] |
| [Saankhya Labs] |