**3GPP TSG RAN WG1 Meeting #105-e R1-** **21XXXXX**

e-Meeting, May 19th – 27th, 2021

**Agenda item: 8.1.4**

**Source: Nokia, Nokia Shanghai Bell**

**Title: On the alternative SCI solutions**

**Document for: Discussion and Decision**

# 1 Introduction

In this document we provide some simple examples to illustrate the differences between the alternatives 0, 1 and 2 proposed for the SCI reporting.

*Proposal 13: Study following alternatives for reporting the strongest coefficient indication (SCI) for Rel-17 port selection codebook in W2*

* *Alt 0: Reporting of the position, [il\*, fl\*], of the strongest coefficient of layer l using ceil(log2(K0)) bits, where K0=Beta\*K1\*Mv*
* *Alt 1: Reporting of the position, [il\*, fl\*], of the strongest coefficient of layer l, using ceil(log2(K1\*Mv)) or ceil(log2(K1))+ceil(log2(Mv)) bits*
  + *FFS whether phase shifting the strongest coefficient to fl\* = 0 is needed*
* *Alt 2: phase shifting the strongest coefficient to fl\* = 0, and using ceil(log2(N)) bits to indicate the phase shift quantity for l-th layer. The strongest coefficient is indicated by il\*, using ceil (log2 (K1,l)) for l-th layer.*
* *Alt 3: SCI is not needed so that the SCI in R16 codebook is replaced with a strongest polarization indicator (1 bit)*

We consider a simple toy example with , , and two cases for the window size: and . We assume that, for , is reported with bit, whereas for , is not reported.

In the example we assume and the NZC are: . The strongest coefficient is in position .

# 2 Example 1:

Let’s assume .

* Alt 0.
  + Shift on (different from Rel16). The FD components are remapped with respect to , as , such that after remapping. In the example, only the FD component is reported.
  + Shift on (different from Rel16). None
  + SCI. The SCI is calculated from the bitmap and for example as follows:

In the example, , which is represented with bits.

* + UCI encoding (different from Rel16).
    - The SCI and bitmap need to be grouped together in G0 because the SCI depends on the bitmap.
    - If the FD component of the strongest coefficient is encoded first as in Rel16, because statistically more significant, the index needs to be remapped with respect to as , such that is reported as , i.e., the columns of are swapped
* Alt 1.
  + Shift on (different from Rel16). The FD components are remapped with respect to , as , such that after remapping. In the example, only the FD component is reported.
  + Shift on (same as Rel16). The index is remapped with respect to as , such that is reported as , i.e., the columns of are swapped, and the FD component of the strongest coefficient is encoded first in the UCI as in Rel16
  + SCI. The SCI is reported as with bits or calculated, for example, as follows:

which is represented with bits.

* + UCI encoding (same as Rel16).
* Alt 2.
  + Shift on (same as Rel16). The FD components are remapped with respect to , as , such that after remapping. In the example, only the FD component is reported (in the same way as for Rel16 *IntS* mechanism, where and the window size is instead of ).

also needs reporting with bits for each layer.

* + Shift on (same as Rel16). The index is remapped with respect to as , such that is reported as and the FD component of the strongest coefficient is encoded first in the UCI as in Rel16
  + SCI. The SCI is reported as with bits
  + UCI encoding (same as Rel16).

# 3 Example 2:

In this case and is not reported. Alt 1 and Alt 2 become equivalent (with separate reporting of and )

* Alt 0.
  + Shift on . None
  + SCI. Same as example 1
  + UCI encoding.
    - The SCI and bitmap need to be grouped together in G0.
    - If the FD component of the strongest coefficient is encoded first as in Rel16 because statistically more significant, the index needs to be remapped with respect to as , such that is reported as
* Alt 1.
  + Shift on . Same as example 1
  + SCI. Same as example
  + UCI encoding (same as Rel16).
* Alt 2.
  + Shift on . Same as example 1
  + SCI (almost same as Rel16). The SCI is reported as with bits and the shift is also reported with bits per layer. In this case the SCI is the same as Alt 1 when using bits.
  + UCI encoding (same as Rel16).