

3GPP TSG RAN Meeting #84
Newport Beach, CA, USA
June 3rd – 6th, 2019

RP-191325



Support of trigger based CSI reporting for Rel-15 based inter-band CA deployments

Agenda Item: 3.1
Source: Ericsson
Document for: Discussion

Background



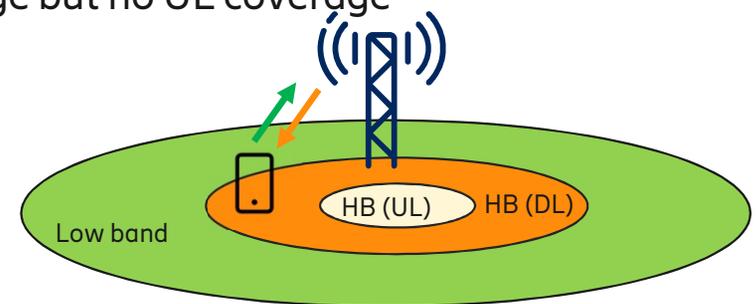
- RAN #83 came to a Working Agreement (WA) on Thu 21.03.2019 on
 - Capability for aperiodic CSI-RS triggering with different numerology between PDCCH and CSI-RS
 - RP-190632 (RAN1 TS 38.214 cat.F CR0007r3 for REL-15) is approved
 - RP-190633 (RAN2 TS 38.331 cat.F CR0792r2 for REL-15) is approved
 - RP-190634 (RAN2 TS 38.306 cat.F CR0073r2 for REL-15) is approved
 - as there were two companies who sustained their objection to these CRs.
- The CRs were implemented in corresponding specifications.
- The WA has been challenged prior to RAN#84.

- This contribution provides an overview on the motivations for supporting the CRs, the functionalities enabled by the CRs, as well as the consequences of reversing the implementation of the CRs and proposes a way forward.

Inter-band Carrier Aggregation (CA)



- What are the use cases for the CRs and how important are they?
- Carrier Aggregation of component carriers using different numerologies is part of CA in Rel-15
- The NR numerology (i.e., the subcarrier spacing) is configurable and in practice depends on the carrier frequency and deployment scenario
 - Inter-band Carrier Aggregation (CA) is a main component of NR and is supported in Rel-15
- UL coverage is more limited than DL coverage, especially so on high frequencies
 - There are areas of the high frequency cell with DL coverage but no UL coverage



Aperiodic CSI measurement/reporting for CA

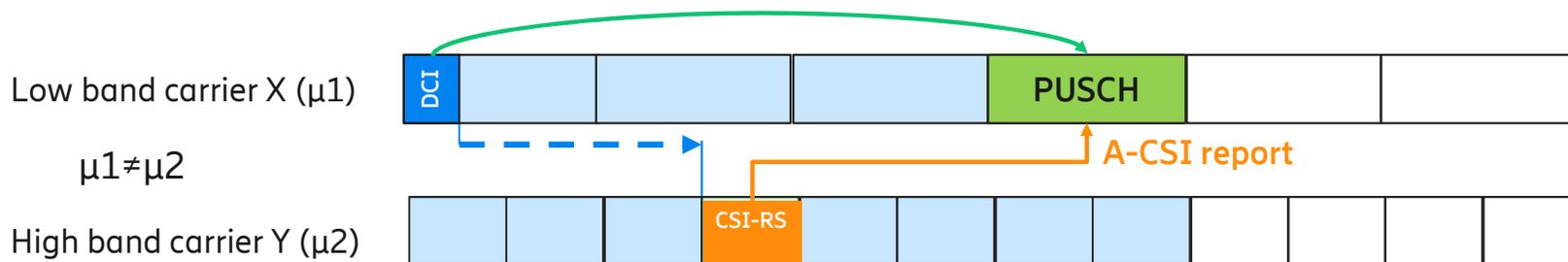


- Why use A-CSI measurement/reporting?
- A-CSI measurement reports are known to be preferred choice for CSI measurement reporting
 - Periodic/semi-persistent reporting is known consume more resources
 - Regularly consumes the entire UL slot when using analogue beamforming on high bands
 - Can't provide a full CSI report which is crucial for proper operation with FR2
- Why report A-CSI on low-band?
- Channel measurements are crucial for meaningful DL throughput
- Outside high band UL coverage, DL high band channel measurements have to be reported via low band UL
 - Otherwise high band DL coverage is significantly reduced

CRs for enabling A-CSI for CA with mixed SCSs



- Why are the CRs needed?
- For A-CSI reporting the timing relation between the triggering slot (DCI on low band), the measurement slot (CSI-RS on high band), and the reporting slot (PUSCH on low band) was only based on **same slot length**
 - Triggering DCI and CSI-RS on different carriers with same numerology (same slot length) works
 - Incorrect CSI-RS measurement slot when DCI is on low band and CSI-RS on high band
 - (basically impossible for UEs to measure that quickly)
- What do the CRs do?
- The CRs in question corrected that flaw so that measurement and reporting works
 - Defines a slot offset allowing enough time for starting CSI-RS measurements (optional feature)



Overview on Rel-15 CRs w.r.t. different SCS



- **Situation of Rel-15 CRs w.r.t. mixed numerologies?**
- Earlier version of specifications often worked for the same SCS between carriers.
- The need for corrections was soon identified for some NR features
 - Otherwise, the features would be broken/not applicable for mixed SCS
- Examples of couple of corrections in case of mixed SCS between carriers:
 - Without CRs, UE processing had to be based on the higher capability at the presence of data on carriers with lower capability. UE capability depends on SCS.
 - Some conclusions/corrections/UE features to support mixed SCS among carriers in a PUCCH group
- **Without the CRs in question the specifications were broken in case of different SCS spacing.**
 - **The CRs for A-CSI use similar approaches as the cases mentioned above**
 - **The feature coupled to corrections is considered optional**

RAN discussion arguments



- **What are the arguments against the CRs?**
- **Late change – yes, but...**
 - correction to an optional feature
 - not destabilizing NR specifications
 - not impacting initial product launch (which neither contains NR standalone nor CA)
 - has been discussed in RAN1 and RAN for more than 6 months
 - CRs were long available and have been checked by others
 - Many other late changes agreed to fix operations with mixed SCSs
- **“Feature has not been implemented by us” – maybe, but...**
 - aperiodic CSI reporting is optional
- **Other alternatives exist – yes, but...**
 - known for being inefficient even for LTE and not providing full report (important for FR2)

De-implementation of the CRs



- Specification impact due to de-implementing the CRs?
- If working agreement fails, the current 3GPP procedure states that: “All changes which were made based on the working agreement shall be reversed”
- Simply reversing changes in ASN.1 is not possible (38.331 and 38.306 CRs).
 - There could be UE implementations expecting extension brackets to be in use.
 - And there might be other parameters inside same brackets from June plenary.
- Only option would be to dummify the bits but that also creates unstable specifications.
- Also reversing changes in layer 1 (38.214 CR), results in a specification where A-CSI reporting would be a broken feature for mixed numerologies.
 - Destabilizing the specifications as opposed to other features

```
RF-Parameters ::= SEQUENCE {
    supportedBandListNR          SEQUENCE (SIZE
(1..maxBands)) OF BandNR,
    supportedBandCombinationList BandCombinationList
                                OPTIONAL,
    appliedFreqBandListFilter    FreqBandList
                                OPTIONAL,
    ...,
    [[
supportedBandCombinationList-v1540 BandCombinationList-
v1540                               OPTIONAL,
srs-SwitchingTimeRequested       ENUMERATED
{true}                             OPTIONAL
]],
    [[
supportedBandCombinationList-v15xy BandCombinationList-
v15xy                               OPTIONAL
]]
}
```

Summary



- **Consequences of overturning the Working Agreement?**
- Even later CRs to de-implement correction (needing to avoid ASN.1 impact)
 - **5G perceived as unstable**
- **Setting back ongoing 5G deployments**
 - Product roadmaps and deployment plans have been fixed month/years in advance and would have to be changed
 - Korea, US, Japan, Hong Kong, Singapore, Australia, Europe, ...
- 3GPP spending Rel-16 time to discuss the same issue again
- 3GPP not being perceived constructive and helpful by the industry investing in 3GPP technologies

Way forward
Support the Working Agreement and avoid voting

