

Xi'an, China, 11 – 15 October 2010

Agenda Item: 7.1.2.3**Source: Ericsson, ST-Ericsson****Title: Physical layer parameters to be configured by RRC****Document for: Discussion, Decision**

1 Introduction

This document captures the changes on L1 parameters introduced for CA, UL MIMO, eDLMA and aperiodic Sounding by RAN1 in Rel-10. The issues/parameters still open in RAN1 are also briefly described to give an overview what total impacts in RRC are expected. The intention of this document is to discuss the changes needed in RRC where the higher layer configuration is required, e.g. the placement of different parameters in RRC.

2 Discussion

2.1 Carrier Aggregation

PUCCH format

According to the draft 36.213 CR [3] sec 10.1

A UE that supports more than 4 ACK/NACK bits is configured by higher layer signalling to use either PUCCH format 1a/1b with channel selection or PUCCH format 3 for transmission of HARQ-ACK.

The higher layer configuration of the PUCCH format is used only for the bit range 1-4. For more than 4 ACK/NACK bits always PUCCH format 3 is used. The network decides which format to use based on the UE capability, the number of CCs configured for a UE and the DL transmission mode for each CC configured.

In RRC the PUCCH format between the two options needs to be signalled. And this parameter is UE specific, applicable to Pcell only since PUCCH is transmitted on only Pcell. The pucch-Format could be added as an extension to the current PUCCH-ConfigDedicated within physicalConfigDedicated.

Proposal 1: introduce a new parameter pucch-Format and included as an extension to the PUCCH-ConfigDedicated within physicalConfigDedicated. The pucch-Format is a UE specific parameter and applicable to only Pcell.

PUCCH resources

According to 36.213 CR [3] sec 10.1

A new parameter indicating PUCCH resource $n_{\text{PUCCH}}^{(3,p)}$ for transmission of HARQ-ACK on antenna port p using PUCCH format 3 needs to be configured by RRC. Table 10.1-1d in [3] defines the A/N resources for PUCCH format 3. This new parameter is UE specific, applicable to only Pcell since PUCCH is only transmitted on Pcell. In RRC it can be added as an extension to the current PUCCH-ConfigDedicated within physicalConfigDedicated. Note that it is FFS whether the A/N resources of format 3 is a list of resource values or only one value. Also it is not completely decided whether $n_{\text{PUCCH}}^{(3,p)}$ should be configurable per antenna port, which is depending on the discussions on UL MIMO.

In CA when the PUCCH format 3 is configured by the network, the UE always uses the A/N resources of PUCCH format 3 when at least one SCell is scheduled. It is not decided yet in RAN1 whether the Rel8/9 A/N resources/format or the A/N resources of format 3 should be used when only the Pcell is scheduled.

Proposal 2: introduce a new parameter for A/N resources of PUCCH format 3 and included as an extension to the PUCCH-ConfigDedicated within physicalConfigDedicated. This parameter is a UE specific parameter and applicable to only Pcell.

According to RAN1 agreement in [4], if the UE is configured for channel selection and when a SCell is scheduled from itself (non cross-carrier scheduling) or from a SCell (cross-carrier scheduling), the A/N resource allocation is explicitly configured by RRC. That means another parameter for A/N resources for channel selection is needed. The current draft 36.213 CR [3] has not included this parameter. But it is likely similar to the parameter for A/N resources of format 3.

Proposal 3: introduce a new parameter for A/N resources when the UE is configured for channel selection and when a SCell is not scheduled from Pcell in case of cross-carrier scheduling. This parameter can be included as an extension to the PUCCH-ConfigDedicated within physicalConfigDedicated and it is a UE specific parameter and applicable to only Pcell.

TPC-PDCCH-Config

Since RAN1 has agreed that UE does not monitor the common search space on any SCC, it seems make sense the parameter TPC-PDCCH-Config for PUCCH and PUSCH power control is applicable for only Pcell. However discussions in RAN1 have not concluded completely. The proposal is to still leave them FFS.

CQI aperiodic/periodic

To our understanding both cqi-ReportModeAperiodic and cqi-ReportPeriodic (except the cqi-PUCCH-ResourceIndex) are applicable to Pcell and SCells. However there are no clear agreements yet in RAN1. So the proposal is to still leave them FFS.

PDSCH starting position

The new parameter indicating the PDSCH starting position (refer to *PDSCHStartingPosition* in 7.1.6.4 of draft 36.213 CR [3]) has been included in the RRC CA running CR [6] based on the agreement from last meeting. According to 36.212 sec 5.3.4 the PDSCH starting position is either 1, 2 or 3 OFDM symbol for a DL system bandwidth >10 RBs or 2, 3 or 4 OFDM symbol for a DL system bandwidth ≤ 10 RBs, i.e. ENUMERATED {s1, s2, s3, s4}.

Proposal 4: include the value range for pdsch-Start is ENUMERATED {s1, s2, s3, s4}.

Scheduling cell

In the draft 36.212 CR [2] sec 5.3.3.1.5c, it says 'The DL cell from which PDSCH assignments for a given cell originate is configured by higher layers.' The new parameter schedulingCell has been included in the RRC CA running CR [6]. Considering the cross carrier scheduling related parameters are not MAC parameters, it would be better to introduce a group IE crossCarrierSchedulingConfig for all the cross carrier scheduling related parameters (currently the pdsch-Start and the schedulingCell) and to be included directly in the SCell configurations.

Proposal 5: introduce a group IE crossCarrierSchedulingConfig for the cross carrier scheduling related parameters and included as part of the SCell dedicated radio configurations (RadioResourceConfigDedicatedSCell).

Configured DL cells

According to 36.212 CR [2] sec 5.2.3.1, N_{cells}^{DL} is the number of cells configured by higher layers for the UE. The UE should be able to derive the number of configured cells based on the SCells configurations from eNB. So there is no need to signal separately the number of configured cells in RRC.

Proposal 6: no need to signal separately the number of configured cells in RRC.

2.2 eDLMA

Transmission mode

A new transmission mode tm9 is introduced in Rel-10 according to RAN1 decisions. In current RRC,

```
AntennaInfoDedicated ::= SEQUENCE {
    transmissionMode          ENUMERATED {
        tm1, tm2, tm3, tm4, tm5, tm6,
        tm7, tm8-v920},
    codebookSubsetRestriction CHOICE {
        n2TxAntenna-tm3      BIT STRING (SIZE (2)),
        n4TxAntenna-tm3      BIT STRING (SIZE (4)),
        n2TxAntenna-tm4      BIT STRING (SIZE (6)),
        n4TxAntenna-tm4      BIT STRING (SIZE (64)),
        n2TxAntenna-tm5      BIT STRING (SIZE (4)),
        n4TxAntenna-tm5      BIT STRING (SIZE (16)),
        n2TxAntenna-tm6      BIT STRING (SIZE (4)),
        n4TxAntenna-tm6      BIT STRING (SIZE (16))
    } OPTIONAL,
    ue-TransmitAntennaSelection CHOICE{
        release              NULL,
        setup                ENUMERATED {closedLoop, openLoop}
    }
}
```

There is no possibility to extend from the existing IE transmissionMode. Also the transmissionMode is a mandatory field within antennaInfoDedicated. Therefore there is a need to introduce a Rel-10 version of antennaInfoDedicated in order to include tm9.

Proposal 7: introduce a new transmission mode tm9 and a Rel-10 version of antennaInfoDedicated to include tm9.

Feedback reporting

Similar to other transmission modes (tm3, tm4, tm5, tm6, tm8), the codebook subset restriction is also supported for transmission mode 9 if the UE is configured with PMI/RI reporting. The draft 36.213 CR [3] currently includes the number of bits in codebook subset restriction bitmap for tm9 as defined in table 7.2-1b. In RRC we need to introduce the corresponding signalling for the tm9 codebook subset restriction bitmap. Considering the proposal 7 above when the Rel-10 version of antennaInfoDedicated needs to be introduced for tm9, the tm9 codebook subset restriction bitmap can be included in the Rel-10 version of codebookSubsetRestriction. The ASN.1 for antennaInfoDedicated-r10 will then look like below:

```
AntennaInfoDedicated-r10 ::= SEQUENCE {
    transmissionMode-r10      ENUMERATED {
        tm1, tm2, tm3, tm4, tm5, tm6, tm7, tm8-v920, tm9-v10x0,
        spare7, spare6, spare5, spare4, spare3, spare2, spare1},
    codebookSubsetRestriction-r10 CHOICE {
        n2TxAntenna-tm3      BIT STRING (SIZE (2)),
        n4TxAntenna-tm3      BIT STRING (SIZE (4)),
        n2TxAntenna-tm4      BIT STRING (SIZE (6)),
        n4TxAntenna-tm4      BIT STRING (SIZE (64)),
        n2TxAntenna-tm5      BIT STRING (SIZE (4)),
        n4TxAntenna-tm5      BIT STRING (SIZE (16)),
        n2TxAntenna-tm6      BIT STRING (SIZE (4)),
        n4TxAntenna-tm6      BIT STRING (SIZE (16))
        n2TxAntenna-tm8-r9    BIT STRING (SIZE (6)),
        n4TxAntenna-tm8-r9    BIT STRING (SIZE (32)),
        n2TxAntenna-tm9-r10   BIT STRING (SIZE (6)),
        n4TxAntenna-tm9-r10   BIT STRING (SIZE (64)),
        n8TxAntenna-tm9-r10   BIT STRING (SIZE (FFS)),
        ...
    } OPTIONAL,
    ue-TransmitAntennaSelection-r10 CHOICE{
        release              NULL,
        setup                ENUMERATED {closedLoop, openLoop}
    }
}
```

Conditional presence	Explanation
TM2	The field is mandatory present if the <i>transmissionMode</i> is set to tm3, tm4, tm5, tm6, tm8 or tm9. Otherwise the field is not present and the UE shall delete any existing value for this field.

7 spare values in *transmissionMode-r10* are reserved for future extensions. Also it can be considered whether an extension marker should be added in the *codebookSubsetRestriction-r10*. There might be a need to extend the *codebookSubsetRestriction-r10* again in the future when a new transmission mode is introduced and the codebook subset restriction is also supported.

Proposal 8: introduce the codebook subset restriction bitmap for tm9 and included in *codebookSubsetRestriction-r10*.

Also RAN1 is discussing the periodic/aperiodic CQI reporting modes for tm9. The draft 36.213 CR [3] currently includes the aperiodic CQI reporting modes 1-2, 2-2, 3-1 and the periodic reporting modes 1-1 and 2-1 for tm9. Discussions on reporting modes are not completely concluded in RAN1. There are likely changes on the currently defined modes and new modes could be introduced. So it is not clear right now whether any changes are needed for *cqi-ReportModeAperiodic* and *cqi-FormatIndicatorPeriodic* in RRC.

Signaling of CSI-RS

RAN1 has introduced a Channel-State Information (CSI) reference signal to be used by the UE to derive the CQI value reported on uplink for transmission mode 9. But it has not been decided which feedback reporting modes will be based on the CSI-RS. It has been agreed that the following parameters for the CSI-RS are configured by RRC [5]:

- Number of CSI-RS ports
- CSI Configuration
- Duty cycle
- Subframe offset
 - Duty cycle and subframe offset are jointly encoded
- α , used to control UE assumption on reference PDSCH transmitted power for CSI feedback

Parameters and the values in the table below are agreed as baseline and to be confirmed at RAN1#62bis meeting.

Parameters	Values
Number of CSI-RS ports	2, 4, 8
Intra-subframe location index	32 / 16 / 8 patterns for 2 / 4 / 8 CSI-RS ports
α	FFS

$I_{\text{cycle,subframe offset}}$	Duty cycle	Subframe offset
$I_{\text{cycle,subframe offset}} \leq 4$	5	$I_{\text{cycle,subframe offset}}$
$5 \leq I_{\text{cycle,subframe offset}} \leq 14$	10	$I_{\text{cycle,subframe offset}} - 5$
$15 \leq I_{\text{cycle,subframe offset}} \leq 34$	20	$I_{\text{cycle,subframe offset}} - 15$
$35 \leq I_{\text{cycle,subframe offset}} \leq 74$	40	$I_{\text{cycle,subframe offset}} - 35$
$75 \leq I_{\text{cycle,subframe offset}} \leq 154$	80	$I_{\text{cycle,subframe offset}} - 75$

Since the use of CSI-RS is likely based on the feedback reporting modes configured, the UE needs to know the CSI-RS configurations only until the UE has been configured with the reporting mode that is based on the CSI-RS. Therefore the CSI-RS configuration could be included as an extension within the *physicalConfigDedicated*. But considering that discussions are ongoing in RAN1 and it has not been decided whether all reporting modes or only some of the reporting modes should be based on the CSI-RS, the placement of the CSI-RS-Config could be left FFS pending RAN1 final decisions. The CSI-RS-Config can be defined as below. All the value ranges still need RAN1 confirmations.

```
CSI-RS-Config ::= CHOICE {
    release
    NULL,
```

```

    setup
    csi-RS-Ports          SEQUENCE {
    locationIndex          ENUMERATED {p2, p4, p8, spare1},
    csi-RS-ConfigIndex    INTEGER (FFS),
    alpha                  INTEGER (0..154),
    }                     INTEGER (FFS)
}
-- Value ranges FFS

```

Proposal 9: introduce a group IE CSI-RS-Config and it is FFS whether it can be included as an extension in physicalConfigDedicated.

Muting

Discussions on muting of the CSI-RS are ongoing in RAN1. So it is not clear if any changes are required in RRC.

2.3 UL-MIMO

UL antenna ports

RAN1 has agreed in Rel-10 there could be more than one antenna ports for uplink. Currently RAN1 is still discussing how to activate 2 antenna ports for PUCCH. It is not clear whether the higher layer configuration will be required.

In case UL antenna port configuration on PUCCH can be configured for 1 or 2 antenna ports, the PUCCH resource parameters for SR and SPS in the current RRC need to be updated to be configurable per antenna port. In 36.213 draft CR [3] sec 10.1, the parameter $n_{PUCCH}^{(1)}$ (corresponding to n1-PUCCH-AN-PersistentList) is replaced by $n_{PUCCH}^{(1,p)}$ for antenna port P0 or P1. Similar change on $n_{PUCCH,SRI}^{(1)}$ (corresponding to sr-PUCCH-ResourceIndex) replaced by $n_{PUCCH,SRI}^{(1,p)}$. There is a similar discussion for ACK/NACK repetition if it should support 2 antenna port transmissions or not in RAN1. In case ACK/NACK repetition supports 2 antenna port transmission then $n_{PUCCH,ANRep}^{(1)}$ (corresponding to n1PUCCH-AN-Rep) is replaced by $n_{PUCCH,ANRep}^{(1,p)}$, i.e. the n1PUCCH-AN-Rep could be configured per antenna port.

UL transmission mode

With the UL MIMO the uplink transmission mode is introduced. According to the draft 36.213 CR [3] sec 8, two uplink transmission modes, denoted mode 1 and 2 as defined in table 8-3 are configured by higher layer. Transmission mode 1 is the default uplink transmission mode for a UE until the UE is assigned an uplink transmission mode by higher layer signalling. In RRC a new parameter ul-TransmissionMode is expected. And 3 bits are proposed for future extensions if considering the development of DL MIMO.

It is FFS in RAN1 whether the ul-TransmissionMode can be different for PUCCH and PUSCH and even different for different PUCCH formats.

Proposal 10: introduce a new parameter ul-TransmissionMode and allocate 3 bits for future extensions.

UCI resource size

RAN1 agreed to adopt two RRC-configured PUSCH beta offset values, one for single codeword transmission, the other for multi codeword transmission. In draft 36.213 CR [3] sec 8.6.3: Offset values are defined for single codeword PUSCH transmission and multiple codeword PUSCH transmission. Single codeword PUSCH transmission offsets $\beta_{offset}^{HARQ-ACK}$, β_{offset}^{RI} and β_{offset}^{CQI} shall be configured to values according to Table 8.6.3-1,2,3 with the higher layer signalled indexes $I_{offset}^{HARQ-ACK}$, I_{offset}^{RI} , and I_{offset}^{CQI} , respectively.

In RRC, the current set of beta offset values is corresponding to the single codeword offsets. Most likely another set of values similar to the existing one need to be introduced for multi-CW transmission offsets.

```
PUSCH-ConfigDedicated ::= SEQUENCE {
    betaOffset-ACK-Index      INTEGER (0..15),
    betaOffset-RI-Index       INTEGER (0..15),
    betaOffset-CQI-Index      INTEGER (0..15)
}
```

Proposal 11: introduce a placeholder PUSCH-ConfigDedicated-v10x0 in physicalConfigDedicated prepared for multi-CW PUSCH transmission offsets parameters.

2.4 SRS

Aperiodic Sounding

RAN1 agreed that the cell specific sounding parameters (SoundingRS-UL-ConfigCommon) are the same between periodic and aperiodic sounding. And the UE specific sounding parameters are separate for periodic and aperiodic sounding. Basically the set of parameters (SoundingRS-UL-ConfigDedicated) is also introduced for aperiodic sounding, see 36.211 CR in [1].

In RRC, the current SoundingRS-UL-ConfigDedicated is for periodic sounding. For aperiodic sounding the following parameters according to 36.211 CR [1] are needed.

```
SoundingRS-UL-ConfigDedicatedAperiodic ::= CHOICE{
    release      NULL,
    setup        SEQUENCE {
        srs-BandwidthAp          ENUMERATED {bw0, bw1, bw2, bw3},
        srs-HoppingBandwidthAp   ENUMERATED {hbw0, hbw1, hbw2, hbw3},
        freqDomainPositionAp     INTEGER (0..23),
        transmissionCombAp       INTEGER (0..1),
        cyclicShiftAp            ENUMERATED {cs0, cs1, cs2, cs3, cs4, cs5, cs6, cs7}
    }
} -- Value ranges FFS
```

The SoundingRS-UL-ConfigDedicatedAperiodic, similar to SoundingRS-UL-ConfigDedicated, are UE specific parameters and configurable per cell.

Note that the above parameters and the corresponding value ranges need RAN1 confirmations.

Proposal 12: introduce a set of UE specific parameters for aperiodic sounding and they are configurable per cell.

3 Conclusion

RAN2 is kindly requested to consider the following proposals:

Proposal 1: introduce a new parameter pucch-Format and included as an extension to the PUCCH-ConfigDedicated within physicalConfigDedicated. The pucch-Format is a UE specific parameter and applicable to only Pcell.

Proposal 2: introduce a new parameter for A/N resources of PUCCH format 3 and included as an extension to the PUCCH-ConfigDedicated within physicalConfigDedicated. This parameter is a UE specific parameter and applicable to only Pcell.

Proposal 3: introduce a new parameter for A/N resources when the UE is configured for channel selection and when a Scell is not scheduled from Pcell in case of cross-carrier scheduling. This parameter can be included as an extension to the PUCCH-ConfigDedicated within physicalConfigDedicated and it is a UE specific parameter and applicable to only Pcell.

Proposal 4: include the value range for pdsch-Start is ENUMERATED {s1, s2, s3, s4}.

Proposal 5: introduce a group IE crossCarrierSchedulingConfig for the cross carrier scheduling related parameters and included as part of the Scell dedicated radio configurations (RadioResourceConfigDedicatedScell).

Proposal 6: no need to signal separately the number of configured cells in RRC.

Proposal 7: introduce a new transmission mode tm9 and a Rel-10 version of antennaInfoDedicated to include tm9.

Proposal 8: introduce the codebook subset restriction bitmap for tm9 and included in codebookSubsetRestriction-r10.

Proposal 9: introduce a group IE CSI-RS-Config and it is FFS whether it can be included as an extension in physicalConfigDedicated.

Proposal 10: introduce a new parameter ul-TransmissionMode and allocate 3 bits for future extensions.

Proposal 11: introduce a placeholder PUSCH-ConfigDedicated-v10x0 in physicalConfigDedicated prepared for multi-CW PUSCH transmission offsets parameters.

Proposal 12: introduce a set of UE specific parameters for aperiodic sounding and they are configurable per cell.

A text proposal based on 36.331v9.4.0 for the required ASN.1 changes is provided in section 5 for inclusion in draft 36.331 CR.

4 Reference

[1] R1-105096 draft 36.211 CR for Rel-10

[2] R1-105097 draft 36.212 CR for Rel-10

[3] R1-105111 draft 36.213 CR for Rel-10

[4] R1-105040 WF on PUCCH resource allocation

[5] RAN1#62 meeting minutes

[6] R2-104991 RRC CA running CR

5 Text proposal

– *AntennaInfo*

The IE *AntennaInfoCommon* and the *AntennaInfoDedicated* are used to specify the common and the UE specific antenna configuration respectively.

AntennaInfo information elements

```
-- ASN1START

AntennaInfoCommon ::=
    antennaPortsCount
}

AntennaInfoDedicated ::=
    transmissionMode
    codebookSubsetRestriction
        n2TxAntenna-tm3
        n4TxAntenna-tm3
        n2TxAntenna-tm4
        n4TxAntenna-tm4
        n2TxAntenna-tm5
        n4TxAntenna-tm5
        n2TxAntenna-tm6
        n4TxAntenna-tm6
    } OPTIONAL,
    ue-TransmitAntennaSelection
        release
}

SEQUENCE {
    ENUMERATED {an1, an2, an4, spare1}
}

SEQUENCE {
    ENUMERATED {
        tm1, tm2, tm3, tm4, tm5, tm6,
        tm7, tm8-v920},
    CHOICE {
        BIT STRING (SIZE (2)),
        BIT STRING (SIZE (4)),
        BIT STRING (SIZE (6)),
        BIT STRING (SIZE (64)),
        BIT STRING (SIZE (4)),
        BIT STRING (SIZE (16)),
        BIT STRING (SIZE (4)),
        BIT STRING (SIZE (16))
    }
}

CHOICE{
    NULL,
    -- Cond TM
}
```

```

        setup                ENUMERATED {closedLoop, openLoop}
    }
}

AntennaInfoDedicated-v920 ::= SEQUENCE {
    codebookSubsetRestriction-v920 CHOICE {
        n2TxAntenna-tm8-r9        BIT STRING (SIZE (6)),
        n4TxAntenna-tm8-r9        BIT STRING (SIZE (32))
    } OPTIONAL -- Cond TM8
}

AntennaInfoDedicated-r10 ::= SEQUENCE {
    transmissionMode-r10          ENUMERATED {
        tm1, tm2, tm3, tm4, tm5, tm6, tm7, tm8-v920, tm9-v10x0,
        spare7, spare6, spare5, spare4, spare3, spare2, spare1},
    codebookSubsetRestriction-r10 CHOICE {
        n2TxAntenna-tm3          BIT STRING (SIZE (2)),
        n4TxAntenna-tm3          BIT STRING (SIZE (4)),
        n2TxAntenna-tm4          BIT STRING (SIZE (6)),
        n4TxAntenna-tm4          BIT STRING (SIZE (64)),
        n2TxAntenna-tm5          BIT STRING (SIZE (4)),
        n4TxAntenna-tm5          BIT STRING (SIZE (16)),
        n2TxAntenna-tm6          BIT STRING (SIZE (4)),
        n4TxAntenna-tm6          BIT STRING (SIZE (16)),
        n2TxAntenna-tm8-r9       BIT STRING (SIZE (6)),
        n4TxAntenna-tm8-r9       BIT STRING (SIZE (32)),
        n2TxAntenna-tm9-r10      BIT STRING (SIZE (6)),
        n4TxAntenna-tm9-r10      BIT STRING (SIZE (64)),
        n8TxAntenna-tm9-r10      BIT STRING (SIZE (FFS)),
        ...
    } OPTIONAL, -- Cond TMX
    ue-TransmitAntennaSelection-r10 CHOICE{
        release                  NULL,
        setup                    ENUMERATED {closedLoop, openLoop}
    }
}

-- ASN1STOP

```

AntennaInfo field descriptions	
antennaPortsCount	Parameter represents the number of cell specific antenna ports where an1 corresponds to 1, an2 to 2 antenna ports etc. see TS 36.211 [21, 6.2.1].
transmissionMode	Points to one of Transmission modes defined in TS 36.213 [23, 7.1] where tm1 refers to transmission mode 1, tm2 to transmission mode 2 etc.
codebookSubsetRestriction	Parameter: <i>codebookSubsetRestriction</i> , see TS 36.213 [23, 7.2] and TS 36.211 [21, 6.3.4.2.3]. The field <i>codebookSubsetRestriction-v920</i> is applicable only if PMI/RI reporting is configured.
ue-TransmitAntennaSelection	For value <i>setup</i> the field indicates whether UE transmit antenna selection control is closed-loop or open-loop as described in TS 36.213 [23, 8.7].

Conditional presence	Explanation
<i>TM</i>	The field is mandatory present if the <i>transmissionMode</i> is set to tm3, tm4, tm5 or tm6. Otherwise the field is not present and the UE shall delete any existing value for this field.
<i>TM8</i>	The field is optional present, need OR, if <i>AntennaInfoDedicated</i> is included and <i>transmissionMode</i> is set to <i>tm8</i> . If <i>AntennaInfoDedicated</i> is included and <i>transmissionMode</i> is set to a value other than <i>tm8</i> , the field is not present and the UE shall delete any existing value for this field. Otherwise the field is not present and the UE takes no action i.e. continues to use the existing value, if previously configured.
<i>TMX</i>	<u>The field is mandatory present if the <i>transmissionMode</i> is set to tm3, tm4, tm5, tm6, tm8 or tm9. Otherwise the field is not present and the UE shall delete any existing value for this field.</u>

CSI-RS-Config

The IE *CSI-RS-Config* is used to specify the CSI (Channel-State Information) reference signal configuration.

CSI-RS-Config information elements

```
-- ASN1START
CSI-RS-Config-r10 ::= CHOICE {
    release                NULL,
    setup                  SEQUENCE {
        csi-RS-Ports-r10   ENUMERATED {p2, p4, p8, spare1},
        locationIndex-r10  INTEGER (FFS),
        csi-RS-ConfigIndex-r10  INTEGER (0..154),
        alpha-r10          INTEGER (FFS)
    }
}
-- Value ranges FFS
-- ASN1STOP
```

CSI-RS-Config field descriptions

csi-RS-Ports

Parameter and reference tbd.

locationIndex

Parameter and reference tbd.

csi-RS-ConfigIndex

Parameter and reference tbd.

Alpha

Parameter and reference tbd.

CrossCarrierSchedulingConfig^[EU1]

The IE *CrossCarrierSchedulingConfig* is used to specify the configuration when the cross carrier scheduling is used in a cell.

CrossCarrierSchedulingConfig information elements

```
-- ASN1START
CrossCarrierSchedulingConfig-r10 ::= SEQUENCE {
    pdsch-Start-r10        ENUMERATED {s1, s2, s3, s4}          OPTIONAL,  -- Need FFS
    schedulingCell-r10     ServCellIndex-r10                   OPTIONAL,  -- Need FFS
    ...
}
ServCellIndex-r10 ::= INTEGER (0..7)                          -- Value range FFS
-- ASN1STOP
```

CrossCarrierSchedulingConfig field descriptions

pdsch-Start

Parameter: *PDSCHStartingPosition*, see TS 36.213 [23, 7.1.6.4]. Value s1 corresponds to 1 OFDM symbol, s2 to 2 OFDM symbol etc. If *dl-Bandwidth* is larger than 10RB, the *pdsch-Start* is either 1, 2, or 3 OFDM symbol. Otherwise the *pdsch-start* is either 2, 3, or 4 OFDM symbol.

schedulingCell

Indicates which cell signals the downlink allocations and uplink grants, if applicable, for the concerned SCell. Reference tbd.

ServCellIndex

A short identity used to identify a serving cell i.e. either the PCell or an SCell. Value 0 applies for the PCell, while the *SCellIndex* that has previously been assigned applies for SCells.

PhysicalConfigDedicated

The IE *PhysicalConfigDedicated* is used to specify the UE specific physical channel configuration.

PhysicalConfigDedicated information element

```
-- ASN1START
PhysicalConfigDedicated ::= SEQUENCE {
```

```

pdsch-ConfigDedicated      PDSCH-ConfigDedicated      OPTIONAL,      -- Need ON
pucch-ConfigDedicated      PUCCH-ConfigDedicated      OPTIONAL,      -- Need ON
pusch-ConfigDedicated      PUSCH-ConfigDedicated      OPTIONAL,      -- Need ON
uplinkPowerControlDedicated UplinkPowerControlDedicated OPTIONAL,      -- Need ON
tpc-PDCCH-ConfigPUCCH      TPC-PDCCH-Config      OPTIONAL,      -- Need ON
tpc-PDCCH-ConfigPUSCH      TPC-PDCCH-Config      OPTIONAL,      -- Need ON
cqi-ReportConfig           CQI-ReportConfig           OPTIONAL,      -- Need ON
soundingRS-UL-ConfigDedicated SoundingRS-UL-ConfigDedicated OPTIONAL,      -- Need ON
antennaInfo                CHOICE {
    explicitValue          AntennaInfoDedicated,
    defaultValue           NULL
}
ON[E2]                      OPTIONAL,      -- Need
schedulingRequestConfig    SchedulingRequestConfig    OPTIONAL,      -- Need ON
...
[ cqi-ReportConfig-v920      CQI-ReportConfig-v920      OPTIONAL,      -- Need ON
  antennaInfo-v920          AntennaInfoDedicated-v920    OPTIONAL      -- Need ON
]
[[ antennaInfo-r10          CHOICE {
    explicitValue          AntennaInfoDedicated-r10,
    defaultValue           NULL
}
    OPTIONAL,      -- Cond REL10
pucch-ConfigDedicated-v10x0 PUCCH-ConfigDedicated-v10x0 OPTIONAL,      -- Need FFS
pusch-ConfigDedicated-v10x0 PUSCH-ConfigDedicated-v10x0 OPTIONAL,      -- Need FFS
soundingRS-UL-ConfigDedicatedAperiodic-r10
    SoundingRS-UL-ConfigDedicatedAperiodic-r10 OPTIONAL,      -- Need FFS
-- FFS whether CSI-RS-Config should be included in physicalConfigDedicated
csi-RS-Config-r10          CSI-RS-Config-r10          OPTIONAL,      -- Cond TM9
ul-AntennaInfo-r10         UL-AntennaInfo-r10         OPTIONAL      -- Need FFS
]]
}
-- ASN1STOP

```

PhysicalConfigDedicated field descriptions	
antennaInfo	A choice is used to indicate whether the <i>antennaInfo</i> is signalled explicitly or set to the default antenna configuration as specified in section 9.2.4.
tpc-PDCCH-ConfigPUCCH	PDCCH configuration for power control of PUCCH using format 3/3A, see TS 36.212 [22].
tpc-PDCCH-ConfigPUSCH	PDCCH configuration for power control of PUSCH using format 3/3A, see TS 36.212 [22].

<u>Conditional presence</u>	<u>Explanation</u>
<u>REL10</u>	<u>FFS. (only used towards Rel-10 or later UE)</u>
<u>TM9</u>	<u>This field applies to DL transmission mode tm9 and FFS feedback reporting modes.</u>

NOTE: During handover, the UE performs a MAC reset, which involves reverting to the default CQI/ SRS/ SR configuration in accordance with subclause 5.3.13 and TS 36.321 [6, 5.9 & 5.2]. Hence, for these parts of the dedicated radio resource configuration, the default configuration (rather than the configuration used in the source cell) is used as the basis for the delta signalling that is included in the message used to perform handover.

– PUCCH-Config

The IE *PUCCH-ConfigCommon* and IE *PUCCH-ConfigDedicated* are used to specify the common and the UE specific PUCCH configuration respectively.

PUCCH-Config information elements

```

-- ASN1START
PUCCH-ConfigCommon ::=
    deltaPUCCH-Shift
    nRB-CQI
    nCS-AN
    n1PUCCH-AN
SEQUENCE {
    ENUMERATED {ds1, ds2, ds3},
    INTEGER (0..98),
    INTEGER (0..7),
    INTEGER (0..2047)
}

```

```

PUCCH-ConfigDedicated ::= SEQUENCE {
    ackNackRepetition CHOICE {
        release NULL,
        setup SEQUENCE {
            repetitionFactor ENUMERATED {n2, n4, n6, spare1},
            n1PUCCH-AN-Rep INTEGER (0..2047)
        }
    },
    tdd-AckNackFeedbackMode ENUMERATED {bundling, multiplexing} OPTIONAL -- Cond TDD
}

PUCCH-ConfigDedicated-v10x0 ::= SEQUENCE {
    -- FFS whether it is a list of resource values or only one value
    n3PUCCH-AN-List-r10 SEQUENCE (SIZE (1..FFS)) OF INTEGER (FFS) OPTIONAL, -- Need FFS
    n1PUCCH-AN-CS-List-r10 SEQUENCE (SIZE (1..FFS)) OF INTEGER (FFS) OPTIONAL, -- Need FFS
    pucch-Format-r10 ENUMERATED {format3, channelSelection} OPTIONAL -- Need FFS
}

-- ASN1STOP

```

PUCCH-Config field descriptions	
<i>deltaPUCCH-Shift</i>	
Parameter: $\Delta_{\text{shift}}^{\text{PUCCH}}$, see 36.211, 5.4.1, where ds1 corresponds to value 1 ds2 to 2 etc.	
<i>nRB-CQI</i>	
Parameter: $N_{\text{RB}}^{(2)}$, see TS 36.211 [21, 5.4].	
<i>nCS-An</i>	
Parameter: $N_{\text{cs}}^{(1)}$ see TS 36.211 [21, 5.4].	
<i>n1Pucch-AN</i>	
Parameter: $N_{\text{PUCCH}}^{(1)}$ see TS 36.213 [23, 10.1].	
<i>ackNackRepetition</i>	
Parameter indicates whether ACK/NACK repetition is configured, see TS 36.213 [23, 10.1].	
<i>repetitionFactor</i>	
Parameter N_{ANRep} see TS 36.213 [23, 10.1] where n2 corresponds to repetition factor 2, n4 to 4.	
<i>n1Pucch-AN-Rep</i>	
Parameter: $n_{\text{PUCCH, ANRep}}^{(1)}$ see TS 36.213 [23, 10.1].	
<i>tdd-AckNackFeedbackMode</i>	
Parameter indicates one of the two TDD ACK/NACK feedback modes used, see TS 36.213 [23, 7.3]. bundling corresponds to use of ACK/NACK bundling whereas, multiplexing corresponds to ACK/NACK multiplexing. The same value applies to both ACK/NACK feedback modes on PUCCH as well as on PUSCH. For TDD configuration 5, E-UTRAN should always set this field to bundling.	
<i>n3PUCCH-AN-List</i>	
Parameter and reference: tbd	
<i>n1PUCCH-AN-CS-List</i>	
Parameter and reference: tbd	
<i>pucch-Format</i>	
Parameter indicates one of the PUCCH formats used, see TS 36.213 [23, tbd].	

Conditional presence	Explanation
<i>TDD</i>	The field is mandatory present for TDD; it is not present for FDD and the UE shall delete any existing value for this field.

– PUSCH-Config

The IE *PUSCH-ConfigCommon* is used to specify the common PUSCH configuration and the reference signal configuration for PUSCH and PUCCH. The IE *PUSCH-ConfigDedicated* is used to specify the UE specific PUSCH configuration.

PUSCH-Config information element

```
-- ASN1START
```

```

PUSCH-ConfigCommon ::=          SEQUENCE {
    pusch-ConfigBasic            SEQUENCE {
        n-SB                      INTEGER (1..4),
        hoppingMode               ENUMERATED {interSubFrame, intraAndInterSubFrame},
        pusch-HoppingOffset       INTEGER (0..98),
        enable64QAM               BOOLEAN
    },
    ul-ReferenceSignalsPUSCH      UL-ReferenceSignalsPUSCH
}

PUSCH-ConfigDedicated ::=        SEQUENCE {
    betaOffset-ACK-Index          INTEGER (0..15),
    betaOffset-RI-Index           INTEGER (0..15),
    betaOffset-CQI-Index          INTEGER (0..15)
}

UL-ReferenceSignalsPUSCH ::=      SEQUENCE {
    groupHoppingEnabled           BOOLEAN,
    groupAssignmentPUSCH          INTEGER (0..29),
    sequenceHoppingEnabled        BOOLEAN,
    cyclicShift                   INTEGER (0..7)
}

PUSCH-ConfigDedicated-v10x0 ::= SEQUENCE {
    betaOffset-ACK-Index-MC-r10   INTEGER (FFS),
    betaOffset-RI-Index-MC-r10    INTEGER (FFS),
    betaOffset-CQI-Index-MC-r10   INTEGER (FFS)
}

-- ASN1STOP

```

PUSCH-Config field descriptions
<i>n-SB</i> Parameter: N_{sb} see TS 36.211 [21, 5.3.4].
<i>hoppingMode</i> Parameter: <i>Hopping-mode</i> , see TS 36.211 [21, 5.3.4].
<i>pusch-hoppingOffset</i> Parameter: N_{RB}^{HO} , see TS 36.211 [21, 5.3.4].
<i>enable64QAM</i> See TS 36.213 [23, 8.6.1]. TRUE indicates that 64QAM is allowed while FALSE indicates that 64QAM is not allowed.
<i>betaOffset-ACK-Index</i> Parameter: $I_{offset}^{HARQ-ACK}$, see TS 36.213 [23, Table 8.6.3-1].
<i>betaOffset-RI-Index</i> Parameter: I_{offset}^{RI} , see TS 36.213 [23, Table 8.6.3-2].
<i>betaOffset-CQI-Index</i> Parameter: I_{offset}^{CQI} , see TS 36.213 [23, Table 8.6.3-3].
<u><i>betaOffset-ACK-Index-MC</i></u> Parameter and reference: tbd
<u><i>betaOffset-RI-Index-MC</i></u> Parameter and reference: tbd
<u><i>betaOffset-CQI-Index-MC</i></u> Parameter and reference: tbd
<i>ul-ReferenceSignalsPUSCH</i> Used to specify parameters needed for the transmission on PUSCH (or PUCCH).
<i>groupHoppingEnabled</i> Parameter: <i>Group-hopping-enabled</i> , see TS 36.211 [21, 5.5.1.3].
<i>groupAssignmentPUSCH</i> Parameter: ΔSS See TS 36.211 [21, 5.5.1.3].
<i>sequenceHoppingEnabled</i> Parameter: <i>Sequence-hopping-enabled</i> , see TS 36.211 [21, 5.5.1.4].
<i>cyclicShift</i> Parameters: <i>cyclicShift</i> , see TS 36.211 [21, Table 5.5.2.1.1-2].

– SoundingRS-UL-Config

The IE *SoundingRS-UL-Config* is used to specify the uplink Sounding RS configuration for periodic and aperiodic sounding.

SoundingRS-UL-Config information element

```
-- ASN1START

SoundingRS-UL-ConfigCommon ::= CHOICE {
    release      NULL,
    setup        SEQUENCE {
        srs-BandwidthConfig      ENUMERATED {bw0, bw1, bw2, bw3, bw4, bw5, bw6, bw7},
        srs-SubframeConfig       ENUMERATED {
            sc0, sc1, sc2, sc3, sc4, sc5, sc6, sc7,
            sc8, sc9, sc10, sc11, sc12, sc13, sc14, sc15},
        ackNackSRS-SimultaneousTransmission BOOLEAN,
        srs-MaxUpPts             ENUMERATED {true}          OPTIONAL    -- Cond TDD
    }
}

SoundingRS-UL-ConfigDedicated ::= CHOICE {
    release      NULL,
    setup        SEQUENCE {
        srs-Bandwidth      ENUMERATED {bw0, bw1, bw2, bw3},
        srs-HoppingBandwidth      ENUMERATED {hbw0, hbw1, hbw2, hbw3},
        freqDomainPosition      INTEGER (0..23),
        duration                BOOLEAN,
        srs-ConfigIndex          INTEGER (0..1023),
        transmissionComb         INTEGER (0..1),
        cyclicShift              ENUMERATED {cs0, cs1, cs2, cs3, cs4, cs5, cs6, cs7}
    }
}

SoundingRS-UL-ConfigDedicatedAperiodic-r10 ::= CHOICE {
    release      NULL,
```

```

    setup
    srs-BandwidthAp-r10      ENUMERATED {bw0, bw1, bw2, bw3},
    srs-HoppingBandwidthAp-r10  ENUMERATED {hbw0, hbw1, hbw2, hbw3},
    freqDomainPositionAp-r10    INTEGER (0..23),
    transmissionCombAp-r10      INTEGER (0..1),
    cyclicShiftAp-r10           ENUMERATED {cs0, cs1, cs2, cs3, cs4, cs5, cs6, cs7}
  }
}
-- All value ranges FFS

-- ASN1STOP

```

SoundingRS-UL-Config field descriptions	
srs-BandwidthConfig	Parameter: SRS Bandwidth Configuration. See TS 36.211, [21, table 5.5.3.2-1, 5.5.3.2-2, 5.5.3.2-3 and 5.5.3.2-4]. Actual configuration depends on UL bandwidth. bw0 corresponds to value 0, bw1 to value 1 and so on.
srs-SubframeConfig	Parameter: SRS Subframe Configuration. See TS 36.211, [21, table 5.5.3.3-1] applies for FDD whereas TS 36.211, [21, table 5.5.3.3-2] applies for TDD. sc0 corresponds to value 0, sc1 to value 1 and so on.
ackNackSRS-SimultaneousTransmission	Parameter: <i>Simultaneous-AN-and-SRS</i> , see TS 36.213 [23, 8.2].
srs-Bandwidth	Parameter: B_{SRS} , see TS 36.211 [21, tables 5.5.3.2-1, 5.5.3.2-2, 5.5.3.2-3 and 5.5.3.2-4].
freqDomainPosition	Parameter: n_{RRC} , see TS 36.211 [21, 5.5.3.2].
srs-HoppingBandwidth	Parameter: SRS hopping bandwidth $b_{\text{hop}} \in \{0,1,2,3\}$, see TS 36.211 [21, 5.5.3.2] where hbw0 corresponds to value 0, hbw1 to value 1 and so on.
Duration	Parameter: Duration. See TS 36.213 [21, 8.2]. FALSE corresponds to “single” and value TRUE to “indefinite”.
srs-ConfigIndex	Parameter: l_{SRS} . See TS 36.213 [23, table 8.2-1].
transmissionComb	Parameter: $k_{\text{TC}} \in \{0,1\}$, see TS 36.211 [21, 5.5.3.2].
cyclicShift	Parameter: n_{SRS} . See TS 36.211 [21, 5.5.3.1], where cs0 corresponds to 0 etc.
srs-MaxUpPts	Parameter: srsMaxUpPts, see TS 36.211 [21, 5.5.3.2]. If this field is present, reconfiguration of $m_{\text{SRS},0}^{\text{max}}$ applies for UpPts, otherwise reconfiguration does not apply.
srs-BandwidthAp	Parameter: <i>srs-Bandwidth-ap</i> , see TS 36.211 [21, 5.5.3.2].
freqDomainPositionAp	Parameter: <i>freqDomainPosition-ap</i> , see TS 36.211 [21, 5.5.3.2].
srs-HoppingBandwidthAp	Parameter: <i>srs-HoppingBandwidth-ap</i> , see TS 36.211 [21, 5.5.3.2] where hbw0 corresponds to value 0, hbw1 to value 1 and so on.
transmissionCombAp	Parameter: <i>transmissionComb-ap</i> , see TS 36.211 [21, 5.5.3.2].
cyclicShiftAp	Parameter: <i>cyclicShift-ap</i> , See TS 36.211 [21, 5.5.3.1], where cs0 corresponds to 0 etc.

Conditional presence	Explanation
TDD	This field is optional present for TDD, need OR; it is not present for FDD and the UE shall delete any existing value for this field.

UL-AntennaInfo

The IE *UL-AntennaInfo* is used to specify the UL antenna configurations.

UL-AntennaInfo information elements

```
-- ASN1START
```

```
UL-AntennaInfo-r10 ::= SEQUENCE {
```

```
ul-TransmissionMode-r10      ENUMERATED {tm1, tm2, spare6, spare5,  
                                spare4, spare3, spare2, spare1},  
    ...  
}  
-- Value ranges and additional parameters FFS  
  
-- ASN1STOP
```

<u>UL-AntennaInfo field descriptions</u>
<u>ul-TransmissionMode</u> Points to one of UL Transmission modes defined in TS 36.213 [23, 8] where tm1 refers to transmission mode 1, tm2 to transmission mode 2 etc.