

5G NR Measurements & Events

Introduction

The network may configure an RRC_CONNECTED UE to perform measurements and report them in accordance with the measurement configuration. The measurement configuration is provided by means of dedicated signalling i.e. using the *RRCReconfiguration*.

The network may configure the UE to perform the following **types** of measurements:

- NR measurements
- Inter-RAT measurements of E-UTRA frequencies

The network may configure the UE to report the following measurement information **based on SS/PBCH block(s)**:

- Measurement results per SS/PBCH block
- Measurement results per cell based on SS/PBCH block(s)
- SS/PBCH block(s) indexes

The network may configure the UE to report the following measurement information **based on CSI-RS resources**:

- Measurement results per CSI-RS resource
- Measurement results per cell based on CSI-RS resource(s)
- CSI-RS resource measurement identifiers

The measurement configuration includes the following parameters:

Measurement objects: A list of objects on which the UE shall perform the measurements.

Reporting configurations: A list of reporting configurations where there can be one or multiple reporting configurations per measurement object. Each reporting configuration consists of the following:

Reporting criterion: The criterion that triggers the UE to send a measurement report. This can either be periodical or a single event description.

RS type: The RS that the UE uses for beam and cell measurement results (SS/PBCH block or CSI-RS).

Reporting format: The quantities per cell and per beam that the UE includes in the measurement report (e.g. RSRP) and other associated information such as the maximum number of cells and the maximum number beams per cell to report.

Measurement identities: A list of measurement identities where each measurement identity links one measurement object with one reporting configuration. By configuring multiple measurement identities, it is possible to link more than one measurement object to the same reporting configuration, as well as to link more than one reporting configuration to the same measurement object. The measurement identity is also included in the measurement report that triggered the reporting, serving as a reference to the network.

Quantity configurations: The quantity configuration defines the measurement filtering configuration used for all event evaluation and related reporting, and for periodical reporting of that measurement. For NR measurements, the network may configure up to 2 quantity configurations with a reference in the NR measurement object to the configuration that is to be used. In each configuration, different filter coefficients can be configured for different measurement quantities, for different RS types, and for measurements per cell and per beam.

Measurement gaps: Periods that the UE may use to perform measurements.

Measuremet Reporting



The purpose of this procedure is to transfer measurement results from the UE to the network. The UE shall initiate this procedure only after successful security activation.

MeasConfig

The IE *MeasConfig* specifies measurements to be performed by the UE, and covers intra-frequency, inter-frequency and inter-RAT mobility as well as configuration of measurement gaps.

MeasConfig information element

```
MeasConfig ::= SEQUENCE {
    measObjectToRemoveList      MeasObjectToRemoveList OPTIONAL,
    measObjectToAddModList     MeasObjectToAddModList OPTIONAL,
    reportConfigToRemoveList   ReportConfigToRemoveList OPTIONAL,
    reportConfigToAddModList   ReportConfigToAddModList OPTIONAL,
    measIdToRemoveList         MeasIdToRemoveList OPTIONAL,
    measIdToAddModList         MeasIdToAddModList OPTIONAL,
    s-MeasureConfig            CHOICE {
        ssb-RSRP                RSRP-Range,
        csi-RSRP                 RSRP-Range
    } OPTIONAL,
    quantityConfig              QuantityConfig OPTIONAL,
```

measGapConfig	MeasGapConfig OPTIONAL,
measGapSharingConfig	MeasGapSharingConfig OPTIONAL,
}	
MeasObjectToRemoveList ::=	SEQUENCE (SIZE (1..maxNrofObjectId)) OF MeasObjectId
MeasIdToRemoveList ::=	SEQUENCE (SIZE (1..maxNrofMeasId)) OF MeasId
ReportConfigToRemoveList ::=	SEQUENCE (SIZE (1..maxReportConfigId)) OF ReportConfigId

***MeasConfig* field descriptions**

measGapConfig : Used to setup and release measurement gaps in NR.

measIdToAddModList : List of measurement identities to add and/or modify.

measIdToRemoveList : List of measurement identities to remove.

measObjectToAddModList : List of measurement objects to add and/or modify.

measObjectToRemoveList : List of measurement objects to remove.

reportConfigToAddModList : List of measurement reporting configurations to add and/or modify.

reportConfigToRemoveList : List of measurement reporting configurations to remove.

s-MeasureConfig : Threshold for NR SpCell RSRP measurement controlling when the UE is required to perform measurements on non-serving cells. Choice of *ssb-RSRP* corresponds to cell RSRP based on SS/PBCH block and choice of *csi-RSRP* corresponds to cell RSRP of CSI-RS.

measGapSharingConfig : Specifies the measurement gap sharing scheme and controls setup/ release of measurement gap sharing.

MeasGapConfig

The IE *MeasGapConfig* specifies the measurement gap configuration and controls setup/release of measurement gaps.

***MeasGapConfig* information element**

```
MeasGapConfig ::=          SEQUENCE {
    gapFR2                  SetupRelease { GapConfig } OPTIONAL,
    ...,
    [[
        gapFR1              SetupRelease { GapConfig } OPTIONAL,
        gapUE                SetupRelease { GapConfig } OPTIONAL
    ]]
}

GapConfig ::=              SEQUENCE {
    gapOffset               INTEGER (0..159),
    mgl                    ENUMERATED {ms1dot5, ms3, ms3dot5, ms4, ms5dot5, ms6},
    mgrp                   ENUMERATED {ms20, ms40, ms80, ms160},
    mgta                   ENUMERATED {ms0, ms0dot25, ms0dot5},
    ...
}
```

***MeasGapConfig* field descriptions**

gapFR1 : Indicates measurement gap configuration that applies to FR1 only. In EN-DC, *gapFR1* cannot be set up by NR RRC (i.e. only LTE RRC can configure FR1 gap). *gapFR1* can not be configured together with *gapUE*. The applicability of the measurement gap is according to TS 38.133.

gapFR2 : Indicates measurement gap configuration applies to FR2 only. *gapFR2* cannot be configured together with *gapUE*. The applicability of the measurement gap is according to TS 38.133.

gapUE : Indicates measurement gap configuration that applies to all frequencies (FR1 and FR2). In EN-DC, *gapUE* cannot be set up by NR RRC (i.e. only LTE RRC can configure per UE gap). If *gapUE* is

configured, then neither *gapFR1* nor *gapFR2* can be configured. The applicability of the measurement gap is according to TS 38.133.

gapOffset : Value *gapOffset* is the gap offset of the gap pattern with MGRP indicated in the field *mgrp*. The value range should be from 0 to *mgrp-1*.

mgl : Value *mgl* is the measurement gap length in ms of the measurement gap. The applicability of the measurement gap is according to TS 38.133. Value *ms1dot5* corresponds to 1.5 ms, *ms3* corresponds to 3 ms and so on.

mgrp : Value *mgrp* is measurement gap repetition period in (ms) of the measurement gap. The applicability of the measurement gap is according to TS 38.133.

mgta : Value *mgta* is the measurement gap timing advance in ms. The applicability of the measurement gap timing advance is according to TS 38.133. Value *ms0* corresponds to 0 ms, *ms0dot25* corresponds to 0.25 ms and *ms0dot5* corresponds to 0.5 ms. For FR2, the network only configures 0 ms and 0.25 ms.

MeasGapSharingConfig

The IE *MeasGapSharingConfig* specifies the measurement gap sharing scheme and controls setup/release of measurement gap sharing.

MeasGapSharingConfig information element

```
MeasGapSharingConfig ::=
    SEQUENCE {
        gapSharingFR2
            SetupRelease { MeasGapSharingScheme } OPTIONAL,
        ...,
        [[
            gapSharingFR1 S
                etupRelease { MeasGapSharingScheme } OPTIONAL,
            gapSharingUE
                SetupRelease { MeasGapSharingScheme } OPTIONAL
        ]]
    }

MeasGapSharingScheme ::=
    ENUMERATED {scheme00, scheme01, scheme10, scheme11}
```

MeasGapSharingConfig field descriptions

gapSharingFR1 : Indicates the measurement gap sharing scheme that applies to the gap set for FR1 only. In EN-DC, *gapSharingFR1* cannot be set up by NR RRC (i.e. only LTE RRC can configure FR1 gap sharing). *gapSharingFR1* can not be configured together with *gapSharingUE*. For the different gap sharing schemes, see TS 38.133. Value *scheme00* corresponds to scheme "00", value *scheme01* corresponds to scheme "01", and so on.

gapSharingFR2 : Indicates the measurement gap sharing scheme that applies to the gap set for FR2 only. *gapSharingFR2* cannot be configured together with *gapSharingUE*. For the different gap sharing schemes, see TS 38.133. Value scheme00 corresponds to scheme "00", value scheme01 corresponds to scheme "01", and so on.

gapSharingUE : Indicates the measurement gap sharing scheme that applies to the gap set per UE. In EN-DC, *gapSharingUE* cannot be set up by NR RRC (i.e. only LTE RRC can configure per UE gap sharing). If *gapSharingUE* is configured, then neither *gapSharingFR1* nor *gapSharingFR2* can be configured. For the different gap sharing schemes, see TS 38.133. Value scheme00 corresponds to scheme "00", value scheme01 corresponds to scheme "01", and so on.

MeasId

The IE *MeasId* is used to identify a measurement configuration, i.e., linking of a measurement object and a reporting configuration.

***MeasId* information element**

MeasId ::= INTEGER (1..maxNrofMeasId)

MeasIdToAddModList

The IE *MeasIdToAddModList* concerns a list of measurement identities to add or modify, with for each entry the *measId*, the associated *measObjectId* and the associated *reportConfigId*.

***MeasIdToAddModList* information element**

MeasIdToAddModList ::= SEQUENCE (SIZE (1..maxNrofMeasId)) OF MeasIdToAddMod

MeasIdToAddMod ::=	SEQUENCE {
measId	MeasId,
measObjectId	MeasObjectId,
reportConfigId	ReportConfigId }

MeasObjectEUTRA

The IE MeasObjectEUTRA specifies information applicable for E-UTRA cells.

***MeasObjectEUTRA* information element**

```
MeasObjectEUTRA ::= SEQUENCE {
    carrierFreq                ARFCN-ValueEUTRA,
    allowedMeasBandwidth        EUTRA-AllowedMeasBandwidth,
    cellsToRemoveListEUTRAN     EUTRA-CellIndexList OPTIONAL,
    cellsToAddModListEUTRAN     SEQUENCE (SIZE (1..maxCellMeasEUTRA)) OF EUTRA-Cell
    OPTIONAL,
    blackCellsToRemoveListEUTRAN EUTRA-CellIndexList OPTIONAL,
    blackCellsToAddModListEUTRAN SEQUENCE (SIZE (1..maxCellMeasEUTRA)) OF EUTRA-
    BlackCell OPTIONAL,
    eutra-PresenceAntennaPort1  EUTRA-PresenceAntennaPort1,
    eutra-Q-OffsetRange         EUTRA-Q-OffsetRange OPTIONAL,
    widebandRSRQ-Meas           BOOLEAN,
    ...
}

EUTRA-CellIndexList ::= SEQUENCE (SIZE (1..maxCellMeasEUTRA)) OF EUTRA-CellIndex
EUTRA-CellIndex ::= INTEGER (1..maxCellMeasEUTRA)
EUTRA-Cell ::= SEQUENCE {
    cellIndexEUTRA            EUTRA-CellIndex,
    physCellId                EUTRA-PhysCellId,
    cellIndividualOffset       EUTRA-Q-OffsetRange
}

EUTRA-BlackCell ::= SEQUENCE {
    cellIndexEUTRA            EUTRA-CellIndex,
    physCellIdRange           EUTRA-PhysCellIdRange
}
```


***EUTRAN-BlackCell* field descriptions**

cellIndexEUTRA : Entry index in the cell list.

physicalCellIdRange : Physical cell identity or a range of physical cell identities.

***EUTRAN-Cell* field descriptions**

physicalCellId : Physical cell identity of a cell in the cell list.

cellIndividualOffset : Cell individual offset applicable to a specific cell. Value dB-24 corresponds to -24 dB, dB-22 corresponds to -22 dB and so on.

***MeasObjectEUTRA* field descriptions**

allowedMeasBandwidth : The maximum allowed measurement bandwidth on a carrier frequency as defined by the parameter Transmission Bandwidth Configuration "NRB" TS 36.104.

blackCellsToAddModListEUTRAN : List of cells to add/ modify in the black list of cells.

blackCellsToRemoveListEUTRAN : List of cells to remove from the black list of cells.

carrierFreq Identifies E-UTRA carrier frequency for which this configuration is valid. E-UTRAN does not configure more than one measurement object for the same physical frequency regardless of the E-ARFCN used to indicate this.

cellsToAddModListEUTRAN List of cells to add/ modify in the cell list.

cellsToRemoveListEUTRAN List of cells to remove from the cell list.

eutra-PresenceAntennaPort1 : When set to *true*, the UE may assume that at least two cell-specific antenna ports are used in all neighbouring cells.

eutra-Q-OffsetRange : Used to indicate a cell, or frequency specific offset to be applied when evaluating candidates when evaluating triggering conditions for measurement reporting. The value is in dB. Value dB-24 corresponds to -24 dB, value dB-22 corresponds to -22 dB and so on.

widebandRSRQ-Meas If set to *true*, the UE shall, when performing RSRQ measurements, use a wider bandwidth in accordance with TS 36.133. The network may set the field to *true* if the measurement bandwidth indicated by *allowedMeasBandwidth* is 50 resource blocks or larger; otherwise the network sets this field to *false*.

MeasObjectId

The IE *MeasObjectId* used to identify a measurement object configuration.

***MeasObjectId* information element**

MeasObjectId ::= INTEGER (1..maxNrofObjectId)

MeasObjectNR

The IE *MeasObjectNR* specifies information applicable for SS/PBCH block(s) intra/inter-frequency measurements and/or CSI-RS intra/inter-frequency measurements.

***MeasObjectNR* information element**

MeasObjectNR ::= SEQUENCE {

ssbFrequency	ARFCN-ValueNR OPTIONAL,
ssbSubcarrierSpacing	SubcarrierSpacing OPTIONAL,
smtc1	SSB-MTC OPTIONAL,
smtc2	SSB-MTC2 OPTIONAL,
refFreqCSI-RS	ARFCN-ValueNR OPTIONAL,
referenceSignalConfig	ReferenceSignalConfig,
absThreshSS-BlocksConsolidation	ThresholdNR OPTIONAL,
absThreshCSI-RS-Consolidation	ThresholdNR OPTIONAL,
nrofSS-BlocksToAverage OPTIONAL,	INTEGER (2..maxNrofSS-BlocksToAverage)
nrofCSI-RS-ResourcesToAverage OPTIONAL,	INTEGER (2..maxNrofCSI-RS-ResourcesToAverage)
quantityConfigIndex	INTEGER (1..maxNrofQuantityConfig),
offsetMO	Q-OffsetRangeList,
cellsToRemoveList	PCI-List OPTIONAL,
cellsToAddModList	CellsToAddModList OPTIONAL,
blackCellsToRemoveList	PCI-RangeIndexList OPTIONAL,

}

blackCellsToAddModList RangeElement OPTIONAL,	SEQUENCE (SIZE (1..maxNrofPCI-Ranges)) OF PCI-	
whiteCellsToRemoveList	PCI-RangeIndexList OPTIONAL,	
whiteCellsToAddModList RangeElement OPTIONAL,	SEQUENCE (SIZE (1..maxNrofPCI-Ranges)) OF PCI-	
...		
[[
freqBandIndicatorNR-v1530	FreqBandIndicatorNR OPTIONAL,	
measCycleSCell-v1530 sf1024, sf1280} OPTIONAL -- Need R	ENUMERATED {sf160, sf256, sf320, sf512, sf640,	
]]		
}		
ReferenceSignalConfig::=	SEQUENCE {	
ssb-ConfigMobility	SSB-ConfigMobility OPTIONAL,	
csi-rs-ResourceConfigMobility OPTIONAL	SetupRelease { CSI-RS-ResourceConfigMobility }	
}		
SSB-ConfigMobility::=	SEQUENCE {	
SSB-ssb-ToMeasure	SetupRelease { SSB-ToMeasure } OPTIONAL,	
deriveSSB-IndexFromCell	BOOLEAN,	
ss-RSSI-Measurement	SS-RSSI-Measurement OPTIONAL,	
...		
}		
Q-OffsetRangeList ::=	SEQUENCE {	
rsrpOffsetSSB	Q-OffsetRange	DEFAULT dB0,
rsrqOffsetSSB	Q-OffsetRange	DEFAULT dB0,
sinrOffsetSSB	Q-OffsetRange	DEFAULT dB0,
rsrpOffsetCSI-RS	Q-OffsetRange	DEFAULT dB0,
rsrqOffsetCSI-RS	Q-OffsetRange	DEFAULT dB0,

sinrOffsetCSI-RS	Q-OffsetRange	DEFAULT dB0
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}

ThresholdNR ::=

thresholdRSRP	RSRP-Range OPTIONAL,
thresholdRSRQ	RSRQ-Range OPTIONAL,
thresholdSINR	SINR-Range OPTIONAL

}

CellsToAddModList ::= SEQUENCE (SIZE (1..maxNrofCellMeas)) OF CellsToAddMod

CellsToAddMod ::= SEQUENCE {

physCellId	PhysCellId,
cellIndividualOffset	Q-OffsetRangeList

}

***CellsToAddMod* field descriptions**

cellIndividualOffset : Cell individual offsets applicable to a specific cell.

physCellId : Physical cell identity of a cell in the cell list.

***MeasObjectNR* field descriptions**

absThreshCSI-RS-Consolidation : Absolute threshold for the consolidation of measurement results per CSI-RS resource(s) from L1 filter(s). The field is used for the derivation of cell measurement results and the reporting of beam measurement information per CSI-RS resource.

absThreshSS-BlocksConsolidation : Absolute threshold for the consolidation of measurement results per SS/PBCH block(s) from L1 filter(s). The field is used for the derivation of cell measurement results and the reporting of beam measurement information per SS/PBCH block index.

blackCellsToAddModList : List of cells to add/modify in the black list of cells. It applies only to SSB resources.

blackCellsToRemoveList : List of cells to remove from the black list of cells.

cellsToAddModList : List of cells to add/modify in the cell list.

cellsToRemoveList : List of cells to remove from the cell list.

freqBandIndicatorNR : The frequency band in which the SSB and/or CSI-RS indicated in this *MeasObjectNR* are located and according to which the UE shall perform the RRM measurements. This field is always provided when the network configures measurements with this *MeasObjectNR*.

measCycleSCell : The parameter is used only when an SCell is configured on the frequency indicated by the *measObjectNR* and is in deactivated state, see TS 38.133. gNB configures the parameter whenever an SCell is configured on the frequency indicated by the *measObjectNR*, but the field may also be signalled when an SCell is not configured. Value *sf160* corresponds to 160 sub-frames, value *sf256* corresponds to 256 sub-frames and so on.

nrofCSIInrofCSI-RS-ResourcesToAverage : Indicates the maximum number of measurement results per beam based on CSI-RS resources to be averaged. The same value applies for each detected cell associated with this *MeasObjectNR*.

nrofSS-BlocksToAverage : Indicates the maximum number of measurement results per beam based on SS/PBCH blocks to be averaged. The same value applies for each detected cell associated with this *MeasObject*.

offsetMO : Offset values applicable to all measured cells with reference signal(s) indicated in this *MeasObjectNR*.

quantityConfigIndex : Indicates the n-th element of *quantityConfigNR-List* provided in *MeasConfig*.

referenceSignalConfig : RS configuration for SS/PBCH block and CSI-RS.

refFreqCSI-RS : Point A which is used for mapping of CSI-RS to physical resources according to TS 38.211.

smtc1 : Primary measurement timing configuration.

smtc2 : Secondary measurement timing configuration for SS corresponding to this *MeasObjectNR* with PCI listed in *pci-List*. For these SS, the periodicity is indicated by periodicity in *smtc2* and the timing offset is equal to the offset indicated in *periodicityAndOffset* modulo periodicity. periodicity in *smtc2* can only be set to a value strictly shorter than the periodicity indicated by *periodicityAndOffset* in *smtc1* (e.g. if *periodicityAndOffset* indicates *sf10*, periodicity can only be set of *sf5*, if *periodicityAndOffset* indicates *sf5*, *smtc2* cannot be configured).

ssbFrequency : Indicates the frequency of the SS associated to this *MeasObjectNR*.

ssbSubcarrierSpacing : Subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (6GHz) are applicable.

whiteCellsToAddModList : List of cells to add/modify in the white list of cells. It applies only to SSB resources.

whiteCellsToRemoveList : List of cells to remove from the white list of cells.

***ReferenceSignalConfig* field descriptions**

csi-rs-ResourceConfigMobility : CSI-RS resources to be used for CSI-RS based RRM measurements.

ssb-ConfigMobility : SSB configuration for mobility (nominal SSBs, timing configuration).

SSB-ConfigMobility field descriptions

deriveSSB-IndexFromCell : If this field is set to *true*, UE assumes SFN and frame boundary alignment across cells on the same frequency carrier. Hence, if the UE is configured with a serving cell for which (*absoluteFrequencySSB, subcarrierSpacing*) in *ServingCellConfigCommon* is equal to (*ssbFrequency, ssbSubcarrierSpacing*) in this *MeasObjectNR*, this field indicates whether the UE can utilize the timing of this serving cell to derive the index of SS block transmitted by neighbour cell. Otherwise, this field indicates whether the UE may use the timing of any detected cell on that target frequency to derive the SSB index of all neighbour cells on that frequency.

ssb-ToMeasure : The set of SS blocks to be measured within the SMTC measurement duration. The first/leftmost bit corresponds to SS/PBCH block index 0, the second bit corresponds to SS/PBCH block index 1, and so on. Value 0 in the bitmap indicates that the corresponding SS/PBCH block is not to be measured while value 1 indicates that the corresponding SS/PBCH block is to be measured . When the field is not configured the UE measures on all SS blocks. Regardless of the value of this field, SS/PBCH blocks outside of the applicable smtc are not to be measured.

Conditional Presence :

CSI-RS : This field is mandatory present if *csi-rs-ResourceConfigMobility* is configured, otherwise, it is absent.

SSBorAssociatedSSB : This field is mandatory present if *ssb-ConfigMobility* is configured or *associatedSSB* is configured in at least one cell, otherwise, it is absent and the UE releases a previously configured value.

IntraFreqConnected : This field is optionally present, Need R if the UE is configured with a serving cell for which (*absoluteFrequencySSB, subcarrierSpacing*) in *ServingCellConfigCommon* is equal to (*ssbFrequency, ssbSubcarrierSpacing*) in this *MeasObjectNR*, otherwise, it is absent.

MeasObjectToAddModList

The IE *MeasObjectToAddModList* concerns a list of measurement objects to add or modify.

MeasObjectToAddModList information element

MeasObjectToAddModList ::= SEQUENCE (SIZE (1..maxNrofObjectId)) OF MeasObjectToAddMod

MeasObjectToAddMod ::= SEQUENCE {
 measObjectId MeasObjectId,
 measObject CHOICE {
 measObjectNR MeasObjectNR,

```

    ... ,
    measObjectEUTRA                      MeasObjectEUTRA
  }
}

```

MeasResultCellListSFTD

The IE MeasResultCellListSFTD consists of SFN and radio frame boundary difference between the PCell and an NR cell as specified in TS 38.215 and TS 38.133.

***MeasResultCellListSFTD* information element**

MeasResultCellListSFTD ::= SEQUENCE (SIZE (1..maxCellsFTD)) OF MeasResultCellsFTD

```

MeasResultCellsFTD ::= SEQUENCE {
    physCellId                PhysCellId,
    sfn-OffsetResult           INTEGER (0..1023),
    frameBoundaryOffsetResult  INTEGER (-30720..30719),
    rsrp-Result                RSRP-Range
}

```

***MeasResultsFTD* field descriptions**

sfn-OffsetResult : Indicates the SFN difference between the PCell and the NR cell as an integer value according to TS 38.215.

frameBoundaryOffsetResult : Indicates the frame boundary difference between the PCell and the NR cell as an integer value according to TS 38.215.

MeasResults

The IE MeasResults covers measured results for intra-frequency, inter-frequency, and inter-RAT mobility.

***MeasResults* information element**

```

MeasResults ::= SEQUENCE {
    measId                MeasId,
    measResultServingMOList  MeasResultServMOList,
    measResultNeighCells    CHOICE {

```

```

    measResultListNR
    ...,
    measResultListEUTRA
  },
  ...
}

MeasResultServMOList ::= SEQUENCE (SIZE (1..maxNrofServingCells)) OF MeasResultServMO
MeasResultServMO ::= SEQUENCE {
    ServCellId ServCellIndex,
    measResultServingCell MeasResultNR,
    measResultBestNeighCell MeasResultNR OPTIONAL,
    ...
}

MeasResultListNR ::= SEQUENCE (SIZE (1..maxCellReport)) OF MeasResultNR
MeasResultNR ::= SEQUENCE {
    physCellId PhysCellId OPTIONAL,
    measResult SEQUENCE {
        cellResults SEQUENCE{
            resultsSSB-Cell MeasQuantityResults OPTIONAL,
            resultsCSI-RS-Cell MeasQuantityResults OPTIONAL
        },
        rsIndexResults SEQUENCE{
            resultsSSB-Indexes ResultsPerSSB-IndexList OPTIONAL,
            resultsCSI-RS-Indexes ResultsPerCSI-RS-IndexList OPTIONAL
        } OPTIONAL
    },
    ...,
    [[
        cgi-Info CGI-Info OPTIONAL
    ]],
    ...
}

```



```

]]
}

MeasResultListEUTRA ::=          SEQUENCE (SIZE (1..maxCellReport)) OF MeasResultEUTRA
MeasResultEUTRA ::=              SEQUENCE {
    eutra-PhysCellId              PhysCellId,
    measResult                    MeasQuantityResultsEUTRA,
    cgi-Info                      SEQUENCE {
        cgi-info-EPC              SEQUENCE {
            cgi-info-EPC-legacy    CellAccessRelatedInfo-EUTRA-EPC,
            cgi-info-EPC-list      SEQUENCE (SIZE (1..maxPLMN))
                                   CellAccessRelatedInfo-EUTRA-EPC OPTIONAL
        }

        cgi-info-5GC              SEQUENCE (SIZE (1..maxPLMN)) OF
                                   CellAccessRelatedInfo-EUTRA-5GC OPTIONAL,

        freqBandIndicator          FreqBandIndicatorEUTRA,
        multiBandInfoList          MultiBandInfoListEUTRA OPTIONAL,
        freqBandIndicatorPriority   ENUMERATED {true} OPTIONAL
    } OPTIONAL,
    ...
}

MultiBandInfoListEUTRA ::=        SEQUENCE (SIZE (1..maxMultiBands)) OF
                                   FreqBandIndicatorEUTRA

MeasQuantityResults ::=           SEQUENCE {
    rsrp                          RSRP-Range OPTIONAL,
    rsrq                          RSRQ-Range OPTIONAL,
    sinr                          SINR-Range OPTIONAL
}

MeasQuantityResultsEUTRA ::=      SEQUENCE {
    rsrp                          RSRP-RangeEUTRA OPTIONAL,
    rsrq                          RSRQ-RangeEUTRA OPTIONAL,

```

sinr	SINR-RangeEUTRA OPTIONAL
}	
ResultsPerSSB-IndexList::=	SEQUENCE (SIZE (1..maxNrofIndexesToReport2)) OF ResultsPerSSB-Index
ResultsPerSSB-Index ::=	SEQUENCE {
ssb-Index	SSB-Index,
ssb-Results	MeasQuantityResults OPTIONAL
}	
ResultsPerCSI-RS-IndexList::=	SEQUENCE (SIZE (1..maxNrofIndexesToReport2)) OF ResultsPerCSI-RS-Index
ResultsPerCSI-RS-Index ::=	SEQUENCE {
csi-RS-Index	CSI-RS-Index,
csi-RS-Results	MeasQuantityResults OPTIONAL
}	

MeasResultEUTRA field descriptions

cgi-info-5GC : This field includes the cellAccessRelatedInfo-5GC-r15 of TS 36.331.

cgi-info-EPC-legacy : This field includes the cellAccessRelatedInfo of TS 36.331.

cgi-info-EPC-list : This field includes the cellAccessRelatedInfoList-r14 of TS 36.331.

freqBandIndicatorPriority : This field includes the freqBandIndicatorPriority-r12 of TS 36.331.

eutra-PhysCellId : Identifies the physical cell identity of the E-UTRA cell for which the reporting is being performed. The UE reports a value in the range 0..503, other values are reserved.

MeasResultNR field descriptions

Cellresults : Cell level measurement results.

PhysCellId : The physical cell identity of the NR cell cell for which the reporting is being performed.

resultsSSB-Cell : Cell level measurement results based on SS/PBCH related measurements.

resultsSSB-Indexes : Beam level measurement results based on SS/PBCH related measurements.

resultsCSI-RS-Cell : Cell level measurement results based on CSI-RS related measurements.

resultsCSI-RS-Indexes : Beam level measurement results based on CSI-RS related measurements.

RsIndexResults : Beam level measurement results.

MeasResults field descriptions

MeasId : Identifies the measurement identity for which the reporting is being performed.

MeasResultEUTRA : Measured results of an E-UTRA cell.

measResultListEUTRA : List of measured results for the maximum number of reported best cells for an E-UTRA measurement identity.

measResultListNR : List of measured results for the maximum number of reported best cells for an NR measurement identity.

measResultNR : Measured results of an NR cell.

measResultServingMOList : Measured results of measured cells with reference signals indicated in the serving cell measurement objects including measurement results of SpCell, configured SCell(s) and best neighbouring cell within measured cells with reference signals indicated in on each serving cell measurement object.

Events

1. Event A1 (Serving becomes better than threshold)

- The UE entering condition for this event is as below:

$$Ms - Hys > Thresh$$

- The UE leaving condition for this event is as below:

$$Ms + Hys < Thresh$$

Where

Ms is the measurement result of the serving cell, not taking into account any offsets. It is expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

Hys is the hysteresis parameter for this event (i.e. hysteresis as defined within reportConfigNR for this event). It is expressed in dB.

Thresh is the threshold parameter for this event (i.e. a1-Threshold as defined within reportConfigNR for this event). It is expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

2. Event A2 (Serving becomes worse than threshold)

- The UE entering condition for this event is as below:

$$Ms + Hys < Thresh$$

- The UE leaving condition for this event is as below:

$$Ms - Hys > Thresh$$

Where

Ms is the measurement result of the serving cell, not taking into account any offsets. It is expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

Hys is the hysteresis parameter for this event (i.e. hysteresis as defined within reportConfigNR for this event). It is expressed in dB.

Thresh is the threshold parameter for this event (i.e. a2-Threshold as defined within reportConfigNR for this event). It is expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

3. Event A3 (Neighbour becomes offset better than SpCell)

- The UE entering condition for this event is as below:

$$Mn + Ofn + Ocn - Hys > Mp + Ofp + Ocp + Off$$

- The UE leaving condition for this event is as below:

$$Mn + Ofn + Ocn + Hys < Mp + Ofp + Ocp + Off$$

Where

Mn is the measurement result of the neighbouring cell, not taking into account any offsets. It is expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

Ofn is the measurement object specific offset of the reference signal of the neighbour cell (i.e. offsetMO as defined within measObjectNR corresponding to the neighbour cell). It is expressed in dB.

Ocn is the cell specific offset of the neighbour cell (i.e. cellIndividualOffset as defined within measObjectNR corresponding to the frequency of the neighbour cell), and set to zero if not configured for the neighbour cell. it is expressed in dB.

Mp is the measurement result of the SpCell, not taking into account any offsets. it is expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

Ofp is the measurement object specific offset of the SpCell (i.e. offsetMO as defined within measObjectNR corresponding to the SpCell). it is expressed in dB.

Ocp is the cell specific offset of the SpCell (i.e. cellIndividualOffset as defined within measObjectNR corresponding to the SpCell), and is set to zero if not configured for the SpCell. it is expressed in dB.

Hys is the hysteresis parameter for this event (i.e. hysteresis as defined within reportConfigNR for this event). it is expressed in dB.

Off is the offset parameter for this event (i.e. a3-Offset as defined within reportConfigNR for this event). it is expressed in dB.

4. Event A4 (Neighbour becomes better than threshold)

- The UE entering condition for this event is as below:

$$Mn + Ofn + Ocn - Hys > Thresh$$

- The UE leaving condition for this event is as below:

$$Mn + Ofn + Ocn + Hys < Thresh$$

Where

Mn is the measurement result of the neighbouring cell, not taking into account any offsets. It is expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

Ofn is the measurement object specific offset of the neighbour cell (i.e. offsetMO as defined within measObjectNR corresponding to the neighbour cell). it is expressed in dB.

Ocn is the measurement object specific offset of the neighbour cell (i.e. cellIndividualOffset as defined within measObjectNR corresponding to the neighbour cell), and set to zero if not configured for the neighbour cell. it is expressed in dB.

Hys is the hysteresis parameter for this event (i.e. hysteresis as defined within reportConfigNR for this event). it is expressed in dB.

Thresh is the threshold parameter for this event (i.e. a4-Threshold as defined within reportConfigNR for this event). It is expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

5. **Event A5 (SpCell becomes worse than threshold1 and neighbour becomes better than threshold2)**

- The UE entering conditions for this event is as below:

$$Mp + Hys < Thresh1$$

$$Mn + Ofn + Ocn - Hys > Thresh2$$

- The UE leaving conditions for this event is as below:

$$Mp - Hys > Thresh1$$

$$Mn + Ofn + Ocn + Hys < Thresh2$$

Where

Mp is the measurement result of the NR SpCell, not taking into account any offsets.its expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

Mn is the measurement result of the neighbouring cell, not taking into account any offsets.its expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

Ofn is the measurement object specific offset of the neighbour cell (i.e. *offsetMO* as defined within *measObjectNR* corresponding to the neighbour cell).its expressed in dB.

Ocn is the cell specific offset of the neighbour cell (i.e. *cellIndividualOffset* as defined within *measObjectNR* corresponding to the neighbour cell), and set to zero if not configured for the neighbour cell. its expressed in dB.

Hys is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigNR* for this event). its expressed in dB.

Thresh1 is the threshold parameter for this event (i.e. *a5-Threshold1* as defined within *reportConfigNR* for this event) .its expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

Thresh2 is the threshold parameter for this event (i.e. *a5-Threshold2* as defined within *reportConfigNR* for this event).its expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

6. **Event A6 (Neighbour becomes offset better than SCell)**

- The UE entering condition for this event is as below:

$$Mn + Ocn - Hys > Ms + Ocs + Off$$

- The UE leaving condition for this event is as below:

$$Mn + Ocn + Hys < Ms + Ocs + Off$$

Where

Mn is the measurement result of the neighbouring cell, not taking into account any offsets.its expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

Ocn is the cell specific offset of the neighbour cell (i.e. *cellIndividualOffset* as defined within the associated *measObjectNR*), and set to zero if not configured for the neighbour cell.its expressed in dB.

Ms is the measurement result of the serving cell, not taking into account any offsets. its expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

Ocs is the cell specific offset of the serving cell (i.e. *cellIndividualOffset* as defined within the associated *measObjectNR*), and is set to zero if not configured for the serving cell.its expressed in dB.

Hys is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigNR* for this event).its expressed in dB.

Off is the offset parameter for this event (i.e. *a6-Offset* as defined within *reportConfigNR* for this event).its expressed in dB.

7. **Event B1 (Inter RAT neighbour becomes better than threshold)**

- The UE entering condition for this event is as below:

$$Mn + Ofn + Ocn - Hys > Thresh$$

- The UE leaving condition for this event is as below:

$$Mn + Ofn + Ocn + Hys < Thresh$$

Where

Mn is the measurement result of the inter-RAT neighbour cell, not taking into account any offsets.its is expressed in dBm or in dB, depending on the measurement quantity of the inter-RAT neighbour cell.

Ofn is the measurement object specific offset of the frequency of the inter-RAT neighbour cell (i.e. *eutra-QOffsetRange* as defined within the *measObjectEUTRA* corresponding to the frequency of the neighbour interRAT cell). its expressed in dB.

Ocn is the cell specific offset of the inter-RAT neighbour cell (i.e. *cellIndividualOffset* as defined within the *measObjectEUTRA* corresponding to the neighbour inter-RAT cell), and set to zero if not configured for the neighbour cell. its expressed in dB.

Hys is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigInterRAT* for this event).its expressed in dB.

Thresh is the threshold parameter for this event (i.e. *b1-ThresholdEUTRA* as defined within *reportConfigInterRAT* for this event).its is expressed in dBm or in dB, depending on the measurement quantity of the inter-RAT neighbour cell.

8. **Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2)**

- The UE entering conditions for this event is as below:

$$Mp + Hys < Thresh1$$

$$Mn + Ofn + Ocn - Hys > Thresh2$$

- The UE leaving conditions for this event is as below:

$$Mp - Hys > Thresh1$$

$$Mn + Ofn + Ocn + Hys < Thresh2$$

Where

Mp is the measurement result of the PCell, not taking into account any offsets. it is expressed in dBm in case of RSRP, or in dB in case of RSRQ and SINR.

Mn is the measurement result of the inter-RAT neighbour cell, not taking into account any offsets. it is expressed in dBm or dB, depending on the measurement quantity of the inter-RAT neighbour cell.

Ofn is the measurement object specific offset of the frequency of the inter-RAT neighbour cell (i.e. *eutra-QOffsetRange* as defined within the *measObjectEUTRA* corresponding to the frequency of the inter-RAT neighbour cell). it is expressed in dB.

Ocn is the cell specific offset of the inter-RAT neighbour cell (i.e. *cellIndividualOffset* as defined within the *measObjectEUTRA* corresponding to the neighbour inter-RAT cell), and set to zero if not configured for the neighbour cell. it is expressed in dB.

Hys is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigInterRAT* for this event). it is expressed in dB.

Thresh1 is the threshold parameter for this event (i.e. *b2-Threshold1* as defined within *reportConfigInterRAT* for this event). it is expressed in dBm in case of RSRP, or in dB in case of RSRQ and SINR.

Thresh2 is the threshold parameter for this event (i.e. *b2-Threshold2EUTRA* as defined within *reportConfigInterRAT* for this event). it is expressed in dBm or dB, depending on the measurement quantity of the inter-RAT neighbour cell.

Reference : TS 38.331 Rel 15

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