Proposal for ASP data structure
(R5w080108)

LTE / TTCN-3 Meeting   (MCC-TF160 & test industry)

07 - 08 July 2008

Sophia-Antipolis / France

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ASP definition –
# RAN5 decision at #39bis meeting in June 2008

l **Way forward regarding ASP definition (see R5-082064)**

- l MCC-TF160 & testing industry to agree on the principal ASP structure and an ASP-related style guide before start of the MCC-TF160 summer break (i.e. by mid July 2008).
- l MCC-TF160 to draft a TS 36.523-3 update that captures the achieved agreements and to submit the document for RAN5 agreement.
- l RAN5 to decide on the submitted TS 36.523-3 version at the latest at RAN5 #40 (Aug. 2008).
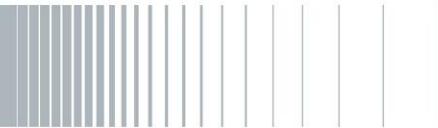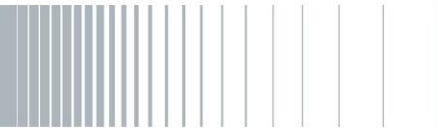
ASP definition –
Summary of already achieved agreements (~ 05/2008)

l Abstract Service Primitives (ASP) defined as TTCN-3 types,
using embedded RRC ASN.1 definitions from TS 36.331

l 2 different sets of ASP (D-ASP vs. C-ASP)

l Data ASP (D-ASP):
  l **for sending / receiving of Signaling Messages**
  l **for sending / receiving of PDCP/RLC/MAC PDU**
  l **for sending / receiving of User Data**
  l **consists of ASP header + data**
    (note: common header type used for both D-ASP and C-ASP)

l Control ASP (C-ASP):
  l **for local setting of cell (re-)configuration**
  l **for local setting of bearer (re-)configuration**
  l **for control of special function in a protocol entity (mainly used for L2 failure testing)**
  l **one combined C-ASP for (re-)configuration of all lower layers, i.e. no sequence of multiple C-ASPs for separate (re-) configuration of each Lower Layer**
  l **consists of ASP header + resp. local config data**
  l **RRC ASN.1 building blocks (containing IEs of P2P messages) are re-used for local (re-)configuration**
  l **codec type out-of-scope (e.g. PER not mandatory)**

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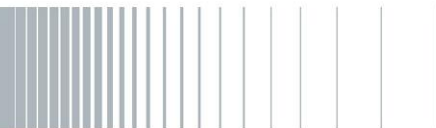
ASP definition –
Earlier proposals under discussion

I It was proposed that

- **C-ASP consist of ASP body (= config info, completely defined in ASN.1) and ASP header (= common part, defined as TTCN-3 type)**
- **'ASN.1 Extension Mechanism'** – *as introduced by RAN2 for peer-to-peer RRC PDUs* – **is used for adding extra test information to the ASN.1 types in the ASP body**
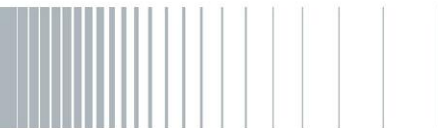
ASP definition –
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  - **C-ASP consist of ASP body (= config info, completely defined in ASN.1) and ASP header (= common part, defined as TTCN-3 type)**
  - *'ASN.1 Extension Mechanism' – as introduced by RAN2 for peer-to-peer RRC PDUs – is used for adding extra test information to the ASN.1 types in the ASP body*
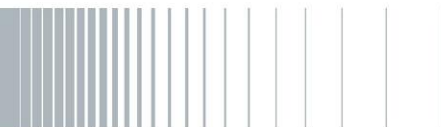
- R&S concerns:
  - **Intermediate import stage (i.e. ASP body defined in ASN.1) could increase MCC-TF160 maintenance effort**   à see next slide …
  - **No clean separation between ASN.1 and TTCN-3 type definitions, i.e. difficult to distinguish between core RRC ASN.1 and test specific ASN.1 extensions**

- Conclusion:
  - **ASP definition = overall TTCN-3 type with imported single RRC ASN.1 blocks**

ASP definition (… less import stages)

not recommended …
(mixed ASP type definition due to intermediate module)

RRC ASN.1 →

ASP body
RRC ASN.1
RRC ASN.1

→

ASP
ASP header

ASP body
RRC ASN.1
RRC ASN.1

Legend:
TTCN-3 type definition
ASN.1 type definition

therefore either …
(*ASP type def. = ASN.1*)

RRC ASN.1 →

ASP
ASP header

ASP body
RRC ASN.1
RRC ASN.1

or better …
(*ASP type def. = TTCN-3*)

RRC ASN.1 →

ASP
ASP header

ASP body
RRC ASN.1
RRC ASN.1

ASP definition –
Proposal under discussion

- It was proposed that
  - C-ASP consist of ASP body (= config info, completely defined in ASN.1) and ASP header (= common part, defined as TTCN-3 type)
  - **'ASN.1 Extension Mechanism'** – *as introduced by RAN2 for peer-to-peer RRC PDUs* – **is used for adding extra test information to the ASN.1 types in the ASP body**

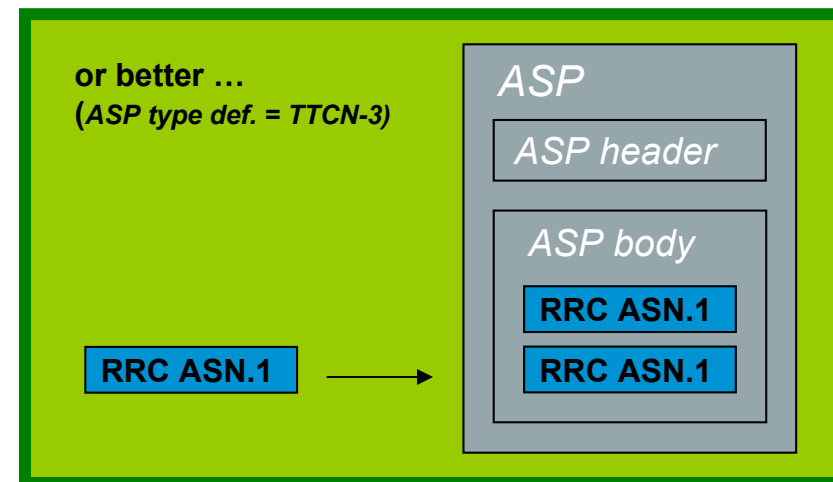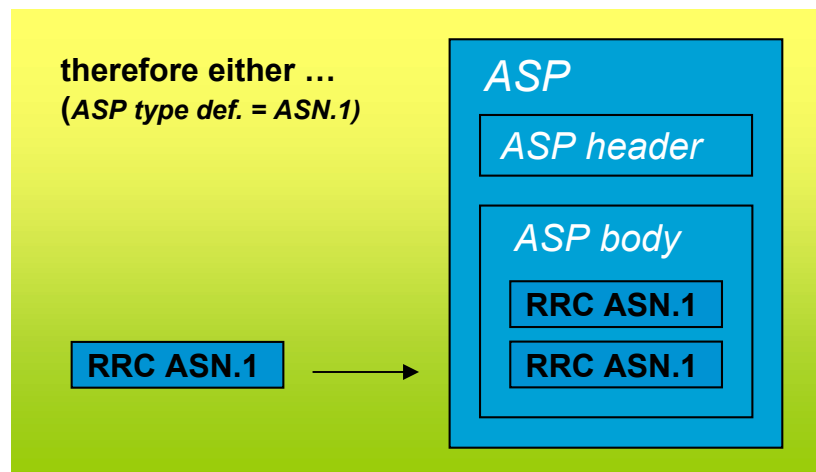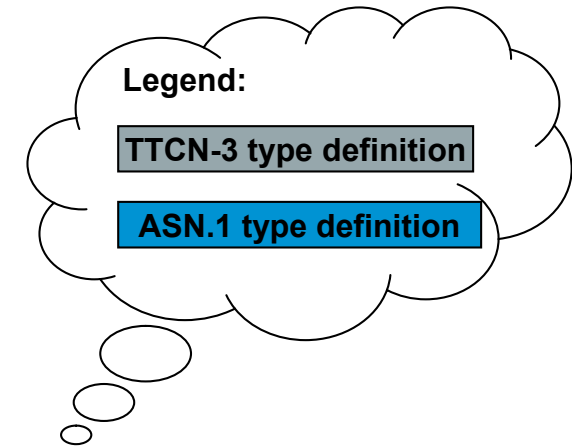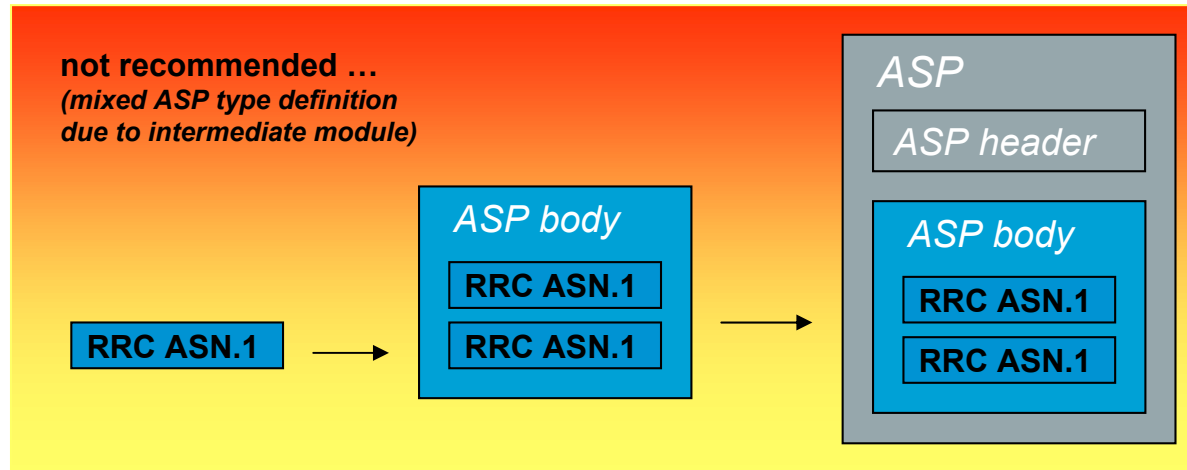- R&S concerns:
  - **no backwards compatibility** *(= rational for usage of ASN.1 extension mechanism)* **needed for C-ASP as the TTCN System Adapter is anyway modified in line with 3GPP baseline updates or ATS deliveries**
  - **Possible extension conflict if the same IE is extended first with test specific IE and at later stage with RRC ASN.1 Rel-9 IE extensions à MCC-TF160 style guide ?**
  - **Possible miscoding in TTCN tools if ASN.1 codec has to handle two different ASN.1 type definitions for Peer-PDUs and for local C-ASPs à MCC-TF160 style guide ?**

- Conclusion:
  - **Test-specific information is added to the ASP definition by using TTCN-3 types**
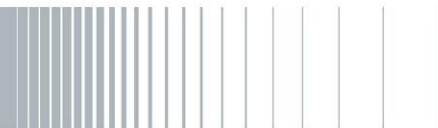
ASP definition –
Further design considerations (ASP structure)

l **Regardless of whether**

   l the overall ASP was defined as ASN.1 or TTCN-3 type

   l ASN.1 extension mechanism was used for addition of test-specific IEs

   it is still open how the ASPs will be structured and at which abstraction level the RRC ASN.1 IEs should be introduced.

l **The following slides discuss alternative ASP structures and shall trigger a more detailed discussion**
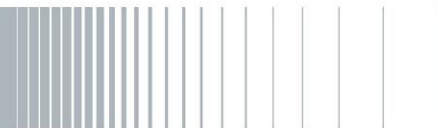
ASP definition using "layer-oriented" structure

Legend:
- New TTCN-3 type definition
- ASN.1 type definition from 36.331

Pros and Cons:

+ Clear config. info per layer
− Potentially duplicated information
− Many IEs may be set to omit if irrelevant for the current configuration need (e.g. RRConfigCommon at RBSetup)
− Which info is important may be SS dependent
− Higher maintainance effort as new IEs from new ASN.1 baselines must be incorporated in TTCN structures
− RAN5 approval process may cause delay when addition of new IEs (waiting for approval fo CR to 36.523-3)

C-ASP example ("layer-oriented structure")

```
 1  module LTE_CASP {
 2
 3    import from EUTRA_RRC_Definitions language "ASN.1:2002" all;
 4
 5    type record CASPConfigRequest {
 6      ASPHeaderType   aspHeader,
 7      LayerConfigType layerConfig
 8    }
 9
10    type record CASPConfigConfirm {
11      ASPHeaderType aspHeader,
12      boolean       success,
13      charstring    errorMessage optional
14    }
15
16    type record ASPHeaderType {
17      integer          cellId,
18      RoutingInfoType routingInfo,
19      TimingInfoType  timingInfo,
20      ControlInfoType controlInfo
21    }
22
23    type record RoutingInfoType {
24      integer RadioBearerId
25    }
26
27    type record TimingInfoType {
28    }
29
30    type record ControlInfoType {
31    }
32
33    type record LayerConfigType {
34      PhyConfigType   phyConfig,
35      MacConfigType   macConfig,
36      RlcConfigType   rlcConfig,
37      PdcpConfigType pdcpConfig
38    }
39
```

```
40    type record PhyConfigType {
41      // RRC ASN.1 definitions
42      EUTRA_CarrierFreq            eutraCarrierFreq optional,
43      EUTRA_CarrierBandwitdh       eutraCarrierBandwitdh optional,
44      PHICH_Configuration          phichConfiguration optional,
45      PRACH_ConfigurationSIB       prachConfiguration optional,
46      PDSCH_ConfigCommon           pdschConfiguration optional,
47      PUSCH_Configuration          puschConfiguration optional,
48      PUCCH_ConfigCommon           pucchConfiguration optional,
49      SoundingRsUl_ConfigCommon    soundingRsUlConfig optional,
50      UplinkPowerControlCommon     uplinkPowerControl optional,
51      PDSCH_ConfigDedicated        pdschConfiguration optional,
52      PUCCH_ConfigDedicated        pucchConfiguration optional,
53      UplinkPowerControlDedicated  uplinkPowerControl optional,
54      CQI_Reporting                cqiReporting optional,
55      SoundingRsUl_ConfigDedicated soundingRsUlConfig optional,
56      // Extensions
57      enumerated {n1, n2, n4}      numberOfTransmitAntennas optional,
58      enumerated {s15, s7_5}       subcarrierSpacing optional,
59      enumerated {cNorm, cExt}     cyclicPrefix optional,
60      DlPowerConfig                dlPowerConfig optional,
61      UlPowerConfig                ulPowerConfig optional
62    }
63
64    type record MacConfigType {
65      // RRC ASN.1 definitions
66      EUTRA_CarrierFreq            eutraCarrierFreq optional,
67      EUTRA_CarrierBandwitdh       eutraCarrierBandwitdh optional,
68      SchedulingInformation        schedulinInformation optional,
69      GenericRandomAccessParams    genRandomAccessParams optional,
70      BCCH_Configuration           bcchConfiguration optional,
71      PCCH_Configuration           pcchConfiguration optional,
72      TransportChannelConfiguration transportChannelConfiguration optional,
73      LogicalChannelConfig         logicalChannelConfig optional,
74      RB_MappingInfo               rbMappingInfo optional,
75      // Extensions
76    }
77
78    type record RlcConfigType {
79      // RRC ASN.1 definitions
80      RLC_Configuration rlcConfiguration
81      // Extensions
82    }
83
84    type record PdcpConfigType {
85      // RRC ASN.1 definitions
86      PDCP_Configuration pdcpConfiguration
87      // Extensions
88    }
89
90    type record DlPowerConfig {
91      integer maxCellPower,
92      integer pdschPowerOffset
93    }
94
95    type record UlPowerConfig {
96      integer maxUlPower
97    }
98  }
```

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ASP definition using "procedure-oriented" structure
(high-level import of RRC ASN.1 blocks)

```
CASPConfigRequest
    │
    ├── ASPHeaderType
    │
    └── ASConfigType
        (AS = Access Stratum)
        │
        ├── CellConfigType
        │   │
        │   ├── MIB
        │   ├── SIB1
        │   └── CellExtraInfoType
        │
        └── RadioBearerSetupType
            │
            ├── RadioResourceConfiguration
            └── RadioBearerExtraInfoType
```
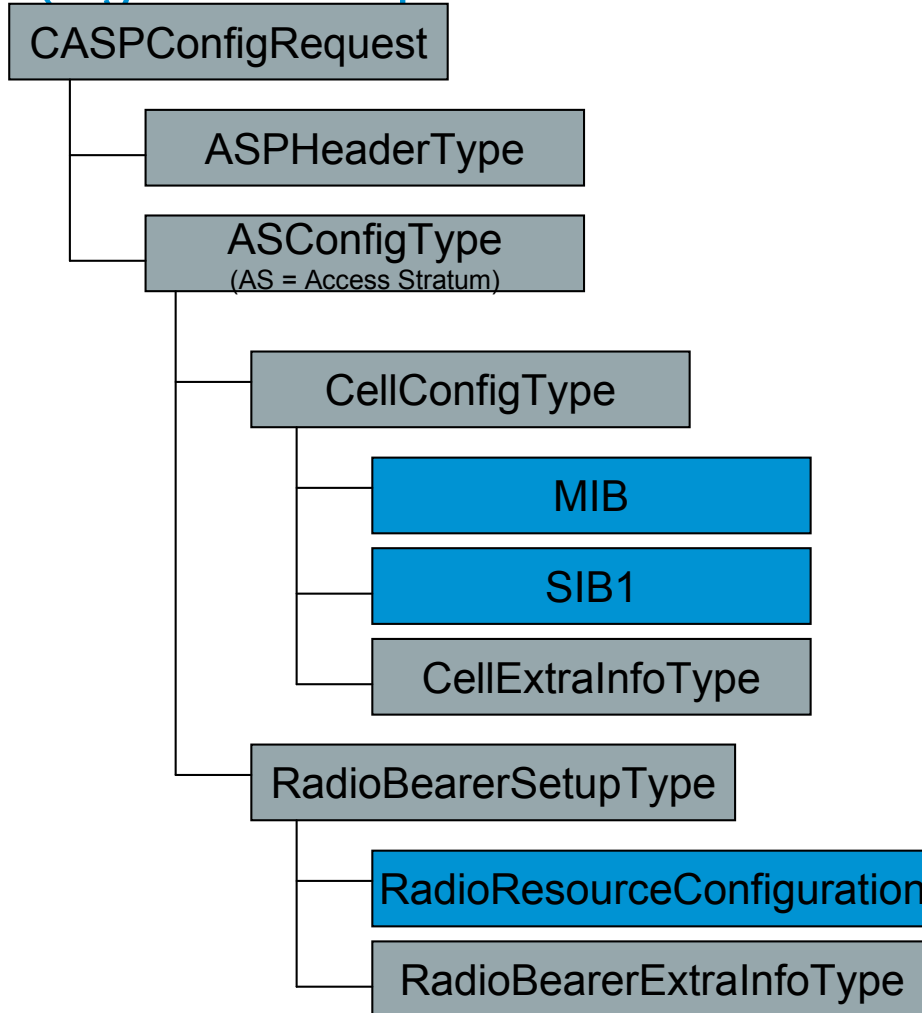
```
type record CellConfigType {

        MasterInformationBlock mIB,
        SystemInformationBlockType1 sIB1,
        SystemInformationBlockType2 sIB2,
        CellExtraInfoType        cellExtraInfo

}
```
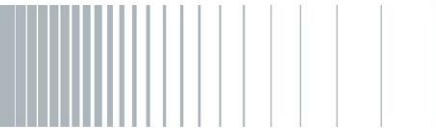
Pros and Cons:

+ Procedure based structure better supports the dynamics of local configuration

+ Easier to maintain as larger blocks of the RRC ASN.1 can be referenced

+ Easier to document

− Unimportant information may be transmitted in sub IEs

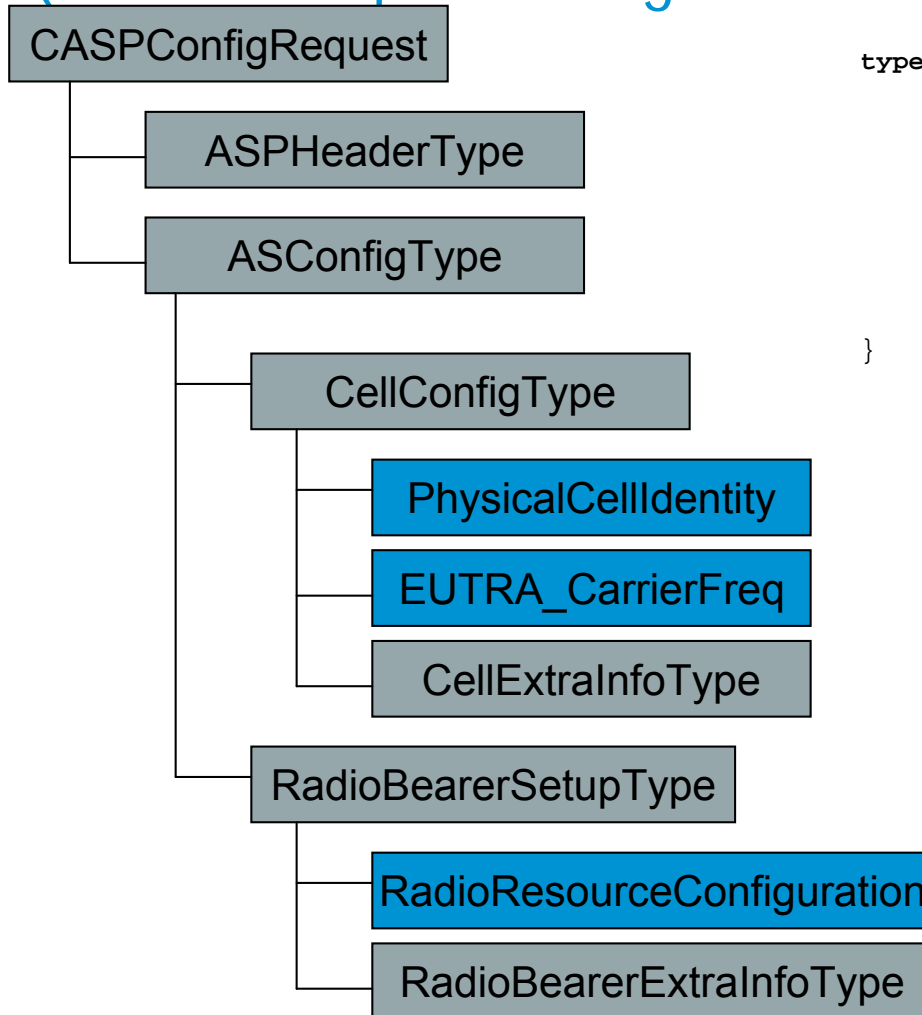− Not transparent which information is used by adapter to configure the stack

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C-ASP example ("proc.-oriented structure / high-level import of RRC ASN.1 blocks")

```
1   module LTE_CASP {
2
3     import from EUTRA_RRC_Definitions language "ASN.1:2002" all;
4
5     type record CASPConfigRequest {
6       ASPHeaderType    aspHeader,
7       LocalConfigType localConfig
8     }
9
10    type record CASPConfigConfirm {
11      ASPHeaderType aspHeader,
12      boolean       success,
13      charstring    errorMessage optional
14    }
15
16    type record ASPHeaderType {
17      integer          cellId,
18      RoutingInfoType routingInfo,
19      TimingInfoType  timingInfo,
20      ControlInfoType controlInfo
21    }
22
23    type record RoutingInfoType {
24    }
25
26    type record TimingInfoType {
27    }
28
29    type record ControlInfoType {
30    }
31
32    type union LocalConfigType {
33      CellConfigType        cellConfig,
34      RadioBearerSetupType radioBearerSetup
35    }
36
```

```
37    type record CellConfigType {
38      // RRC ASN.1 definitions
39      MasterInformationBlock      mIB,
40      SystemInformationBlockType1 sIB1,
41      SystemInformationBlockType2 sIB2,
42      // Extensions
43      enumerated {n1, n2, n4}       numberOfTransmitAntennas,
44      enumerated {s15, s7_5}        subcarrierSpacing,
45      enumerated {cNorm, cExt}      cyclicPrefix,
46      DlPowerConfig                 dlPowerConfig,
47      UlPowerConfig                 ulPowerConfig
48    }
49
50    type record RadioBearerSetupType {
51      // RRC ASN.1 definitions
52      RadioResourceConfiguration rrConfig
53      // Extensions
54    }
55
56    type record DlPowerConfig {
57      integer maxCellPower,
58      integer pdschPowerOffset
59    }
60
61    type record UlPowerConfig {
62      integer maxUlPower
63    }
64  }
```

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ASP definition using "procedure-oriented" structure
(low-level import of single RRC ASN.1 IEs)

```
CASPConfigRequest
    ASPHeaderType
    ASConfigType
        CellConfigType
            PhysicalCellIdentity
            EUTRA_CarrierFreq
            CellExtraInfoType
        RadioBearerSetupType
            RadioResourceConfiguration
            RadioBearerExtraInfoType
```

```
type record CellConfigType {
    PhysicalCellIdentity cellId,
    EUTRA_CarrierFreq eutra_CarrierFreq,
    EUTRA_CarrierBandwitdh eutra_CarrierBandwidth,
    // ... More elements
    CellExtraInfoType        cellExtraInfo
}
```

Pros and Cons:

+ Procedure based structure better supports the dynamics of local configuration
+ Only neccessary information will be send to SS, i.e. local config. is more transparent
− Which info is important may be SS dependent
− Higher maintainance effort as new IEs from new ASN.1 baselines must be incorporated in TTCN structures
− RAN5 approval process may cause delay when addition of new IEs
  (waiting for approval fo CR to 36.523-3)

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C-ASP example ("proc.-oriented structure / low-level import of single RRC ASN.1 IEs")

```
1    module LTE_CASP {
2
3        import from EUTRA_RRC_Definitions language "ASN.1:2002" all;
4
5        type record CASPConfigRequest {
6            ASPHeaderType    aspHeader,
7            LocalConfigType  localConfig
8        }
9
10       type record CASPConfigConfirm {
11           ASPHeaderType aspHeader,
12           boolean          success,
13           charstring       errorMessage optional
14       }
15
16       type record ASPHeaderType {
17           integer          cellId,
18           RoutingInfoType routingInfo,
19           TimingInfoType  timingInfo,
20           ControlInfoType controlInfo
21       }
22
23       type record RoutingInfoType {
24           integer  RadioBearerId
25       }
26
27       type record TimingInfoType {
28       }
29
30       type record ControlInfoType {
31       }
32
33       type union LocalConfigType {
34           CellConfigType        cellConfig,
35           RadioBearerSetupType radioBearerSetup
36       }
37
```

```
38       type record CellConfigType {
39           // RRC ASN.1 definitions
40           EUTRA_CarrierFreq         eutraCarrierFreq,
41           EUTRA_CarrierBandwitdh    eutraCarrierBandwitdh,
42           PHICH_Configuration       phichConfiguration,
43           SchedulingInformation     schedulinInformation,
44           GenericRandomAccessParams genRandomAccessParams,
45           BCCH_Configuration        bcchConfiguration,
46           PCCH_Configuration        pcchConfiguration,
47           PRACH_ConfigurationSIB    prachConfiguration,
48           PDSCH_ConfigCommon        pdschConfiguration,
49           PUSCH_Configuration       puschConfiguration,
50           PUCCH_ConfigCommon        pucchConfiguration,
51           SoundingRsUl_ConfigCommon soundingRsUlConfig,
52           UplinkPowerControlCommon  uplinkPowerControl,
53           // Extensions
54           enumerated {n1, n2, n4}    numberOfTransmitAntennas,
55           enumerated {s15, s7_5}     subcarrierSpacing,
56           enumerated {cNorm, cExt}   cyclicPrefix,
57           DlPowerConfig             dlPowerConfig,
58           UlPowerConfig             ulPowerConfig
59       }
60
61       type record RadioBearerSetupType {
62           // RRC ASN.1 definitions
63           PDSCH_ConfigDedicated        pdschConfiguration,
64           PUCCH_ConfigDedicated        pucchConfiguration,
65           UplinkPowerControlDedicated  uplinkPowerControl,
66           CQI_Reporting                cqiReporting,
67           SoundingRsUl_ConfigDedicated soundingRsUlConfig,
68           TransportChannelConfiguration transportChannelConfiguration,
69           LogicalChannelConfig         logicalChannelConfig,
70           RB_MappingInfo               rbMappingInfo,
71           RLC_Configuration            rlcConfiguration,
72           PDCP_Configuration           pdcpConfiguration,
73           // Extensions
74       }
75
76       type record DlPowerConfig {
77           integer maxCellPower,
78           integer pdschPowerOffset
79       }
80
81       type record UlPowerConfig {
82           integer maxUlPower
83       }
84   }
```

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ASP definition –
Overall conclusion and proposal

l **RRC ASN.1 modules shall not be extended for the purpose of including test-specific information**

  - l Use TTCN-3 type definitions for overall ASP structure as well as for adding special test IEs (C-ASP)
  - l However RRC ASN.1 may be extended for error case Peer-PDU definition (D-ASP)

l **C-ASPs design shall be „procedure"-oriented (alternative 2 or 3) and <u>not</u> „layer"-oriented**

l **On which abstraction level the import of RRC ASN.1 shall be done („single IEs" or „building blocks") needs to be further discussed and resolved latest at next TTCN-3 / LTE meeting (7–8 July 2008)**