Deployment Plans Toward 5G Implementation

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Ph.1 WI: NSA(Non-Standalone) will be standardized in advance (1)

- Early 5G deployment may be possible by EPC-based NSA.
- 3GPP RAN meeting in March 2017 agreed to standardize NSA in advance to SA.

<table>
<thead>
<tr>
<th>Study Item</th>
<th>Phase I Work Item</th>
<th>Phase II</th>
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</thead>
<tbody>
<tr>
<td>2016</td>
<td>2017</td>
<td>2018</td>
</tr>
<tr>
<td>Rel.14</td>
<td>Rel.15</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Expedite by 6 months</td>
</tr>
<tr>
<td>March</td>
<td>December</td>
<td>June</td>
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</tbody>
</table>

- Early 5G deployment may be possible by EPC-based NSA.
- 3GPP RAN meeting in March 2017 agreed to standardize NSA in advance to SA.

**EPC based Arch.**

- NSA(Non-Standalone) Arch. based on EPC

**Standalone Arch.**

- SA(Standalone) Arch. Based on 5G Core

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## Comparison between NSA and SA

<table>
<thead>
<tr>
<th>NSA</th>
<th>SA</th>
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<tbody>
<tr>
<td>Connection to both LTE and 5G mandatory</td>
<td>Can work by 5G alone (LTE not necessary)</td>
</tr>
<tr>
<td><strong>Control (Location Registration)</strong></td>
<td><strong>5G will be used for both U-Plane and C-Plane</strong></td>
</tr>
<tr>
<td>5G will be focused on U-Plane alone, while LTE is used for control including call origination/termination, location registration, etc.</td>
<td>5G radio control parameters can be exchanged through 5G.</td>
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<tr>
<td><strong>5G radio control parameters</strong></td>
<td><strong>5G radio control parameters will be exchanged through LTE. For that purpose, functions should be added to eNB.</strong></td>
</tr>
<tr>
<td><strong>Paging Channels</strong></td>
<td><strong>UE monitors paging channels on 5G.</strong></td>
</tr>
<tr>
<td>UE monitors paging channels on LTE.</td>
<td></td>
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</tbody>
</table>
5G Deployment Scenarios

- Multiple architectures are under study at 3GPP, according to different 5G deployment scenarios of each administration.
- Multiple architecture options available depending on different combinations of Core (EPC, 5G Core) x SA (LTE, 5G) x NSA (LTE Anchor, 5G Anchor)
Example of Migration from 4G to 5G

EPC-based core configuration will be standardized in Rel.15 NSA while 5G core will be standardized in Rel.15.

EPC(4G)-based NW config. (Opt.3)

The Internet

EPC

LTE eNB

5G gNB (NSA)

5G UE

5G core-based NW config. (Opt.7)

The Internet

EPC

LTE eNB

5G gNB (NSA)

5G gNB (SA)

5G UE

5G UE
Example of 5G Roadmap based on Standardization Schedule

- **eMBB**
- **IoT**
- **URLLC**

**Video Transmission**
- eMTC
- NB-IoT
- Low Lat. in Radio

**Surveillance Camera**
- eMTC
- NB-IoT

**Connected Car**

**FY 2020~**
- NSA
- 28GHz
- Below6GHz
- 4G
- Existing 4G Bands
- eMBB scenario will be supported

**FY 2022~**
- NSA
- 28GHz
- Below6GHz
- 4G
- Existing 4G Bands
- eMBB scenario will be supported

**FY 202X~**
- NSA
- SA
- 28GHz
- Below6GHz
- 4G
- Existing 4G Bands
- eMBB scenario will be supported

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Example of Frequency Bands Usage

Several frequency bands will be used separately or jointly depending on the characteristics of the bands and use cases.

Area Coverage
- LTE (800 MHz etc.)
- Below 6 GHz (New RAT)
- IoT (Massive MTC)

Uplink/Downlink
- 28 GHz (New RAT)
  - eMBB, URLLC
- Surveillance Camera
- Connected Car (Dynamic Map)
- Stadium

IoT (Massive MTC)

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Illustrative Frequency bands utilization and 5G use cases

Appropriate frequency bands will be chosen depending on needs and services.

Examples of use cases for better society

Areas

- Urban
- Suburb
- Rural

5G Bands

Maintain continuity and quality by interworking (Dual Connectivity)

28GHz

5G (28GHz帯)

5G(Below6GHz)

3GPP Bands

LTE

LTE/LTE-A

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5G bands (Below 6GHz, Above 6GHz (ex: 28GHz)) should be used in combination with 4G to complement each other, taking into account the following factors:

- Requirement of use cases (Mobility, Area, Latency, etc.)
- Separation of C-Plane and U-Plane
- Standalone, Non-Standalone scenarios
Importance of Multi-sites and Multi-bands technologies

- In order to compensate the blocking effect in higher frequency bands (ex: 28GHz), multi sites technologies (CoMP etc.) employing multiple base stations are important.
- Interwork with 4G frequency bands (Dual Connectivity, etc.) is also essential.

* Coordinated Multiple Point transmission/reception