Стратегия и концепция совмещенного LTE+2G+3G радиодоступа

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Москва, 26 мая 2009 года

LTE Russia & CIS 2009
Тенденции рынка. Различные поколения 3GPP и не-3GPP технологий будут сосуществовать на рынках в обозримом будущем.
Delivering Radio Access on a global scale
366 radio customers in 149 countries

Our **GSM/EDGE BSS** is operational in **299** operator networks in **131** countries offering services to close to 1.8B subscribers

We are indisputable no. 1 in EDGE with **179** EDGE references

We have **147 3G WCDMA Radio** Operator Customers

**112** of our WCDMA radio customers have **launched** HSDPA
GSM/EDGE track record

- 299 GSM radio customers in 131 countries
- 179 EDGE customers
- Our GSM/EDGE radio serving close to 1.8 billion subscribers
- Suppying 21 of 30 biggest GSM/EDGE operators*
- Delivery record of 200,000 TRX in one month achieved July 2008**

*Biggest operators by number of subscribers, status Dec 2008 / Informa Telecoms & Media WCIS database
** NSN Press release Oct 20 2008
NSN is the leader in WCDMA Radio Business

Contracts Won in 2007 & 2008

- NSN: 89
- Huawei: 78
- Ericsson: 51
- Alcatel-Lucent: 17
- Others: 3

Customers Rely on NSN

- 95% of ex-Siemens or NEC 3G radio continue with NSN
- 95%
- 5%

NSN has most WCDMA Radio Customers

- NSN: 147
- Ericsson: 141
- Huawei: 117
- Alcatel-Lucent: 40
- Others: 26

Strong NSN WCDMA References

- 147 WCDMA Radio customers
- 18 of 25 biggest WCDMA operators
- Over half the world’s 310 million* WCDMA / HSPA subscribers connected by Nokia Siemens Networks

* Subs estimate of Informa, Feb ’09
The future is more multiradio than ever

- **GSM, EDGE, EDGE evolution**: Basic voice and data, huge installed base
- **WCDMA, HSPA, HSPA evolution**: The mainstream broadband data & voice machine
- **LTE**: Broadband data, VoIP and flexibility beyond 2010
- **WiMAX**: Complementary broadband data machine for TDD frequencies

The networks need to support this evolution
Demand for mobile broadband is there

HSPA mobile broadband live traffic / day
Operators: 7 Europe, 3 APAC, 1 Americas
For these, average growth in 2008 over 1000%
Two tracks of Mobile Broadband

Laptops/PC’s

- Penetration growing fast
- Driven by peak data rates
- High data consumption
- No CS voice
- QoS mgmt becomes critical

Smart-phones

- Majority of 3G users
- Multiple app’s always-on
- Less data consumption
- Peak data rates not driving
- Battery life and set-up times

Different feature set required – NSN focuses on both
Market leader in OSS and SON features
SON = Self Optimized Networks

- BTS Plug-and-Play
- Automatic scrambling code allocation
- Inter-system (GSM) neighborcell configuration
- Automatic 3G neighborcell detection and reporting
- Remote antenna downtilts
- Load balancing 2G-3G
- BTS carrier shut-down for power saving

- NetAct is integrated management system for all current and future radio networks
- Enables multilayer, multivendor, multiradio optimization
- 250 NetAct customers
Awards Winning Flexi Multiradio Base Station

Winner –
best technology advance

“A worthy winner, based on the successful Flexi concept, incorporating new baseband and radio technology that enables operators to migrate from 3G/HSPA through to LTE, and NSN’s commitment to how it will support this type of migration strategy.”
Platforms for common evolution

**Flexi Multiradio BTS**

- Modular
- Integrated Ethernet transport
- 1 Gbps throughput
- GSM/HSPA/I-HSPA/LTE

**Multicontroller**

- Modular
- Ethernet switching and transport
- 35 Gbps throughput
- GSM and HSPA

Versatile, Modular, Scalable, Lightweight and future proof platforms
Towards simpler sites for multiradio networks

“The reason for our low CAPEX/revenue ratio is this new BTS concept called Flexi BTS”, CEO of North American operator

“Flexi BTS site concept saves more money at greenfield sites than the price of the BTS itself”, COO of operator in APAC
Стратегия и решения Nokia Siemens Networks по совмещенному LTE+2G+3G оборудованию радиодоступа для всех 3GPP стандартов.
LTE Overview
LTE / SAE introduces the mechanism to fulfill the requirements of a next generation mobile network

Flat Overall Architecture
- 2-node architecture
- IP routable transport architecture

Improved Radio Principles
- Peak data rates [Mbps]: 173 DL, 58 UL
- Scalable BW: 1.4, 3, 5, 10, 15, 20 MHz
- Short latency: 10 – 20 ms

New Core Architecture
- Simplified Protocol Stack
- Simple, more efficient QoS
- UMTS backward compatible security
Overview of 3GPP Evolution

<table>
<thead>
<tr>
<th>3GPP Rel. 6</th>
<th>3GPP Rel. 7</th>
<th>3GPP Rel. 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSDPA/HSUPA</td>
<td>HSPA Evo (step1)</td>
<td>HSPA Evo (step2)</td>
</tr>
<tr>
<td>LTE/SAE</td>
<td></td>
<td></td>
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</tbody>
</table>

I-HSPA (Flat Architecture)

1) HSPA capacity values normalized to 4 carriers (2 * 20MHz in total)
2) LTE values according to Nokia and Nokia Siemens Network simulations for NGMN performance evaluation report V1.3 (macro cell, full buffer, 500m ISD, pedestrian speed, 2x2 MIMO)
Comparison of Throughput and Latency

LTE shows excellent performance

Max. peak data rate *

Average cell throughput (macro cell, 2*20MHz or equivalent) *

Latency (Rountrip delay) **

VoIP capacity *

* LTE values according to Nokia and Nokia Siemens Network simulations for NGMN performance evaluation report V1.3 (macro cell, full buffer, 500m ISD, pedestrian speed)

** Server near RAN
Key benefits for operators and end-user

**Investment Protection**
- Re-use of
  - Sites and infrastructure
  - Backhauling
  - Frequency bands

**User experience → ARPU**
- Throughput
- Latency

**Low Costs**
- Cost per Mbyte

**Scalable bandwidth**
- Optimized spectrum usage

- 900 MHz
  - GSM
  - UMTS
  - Or
  - GSM
  - LTE

A head start for network migration towards LTE/SAE with Nokia Siemens Networks

2008
LTE demonstration and Network migration
- LTE air interface demonstrations
- Flexi Multimode BTS
- HSPA / I-HSPA / Direct tunnel

2009
LTE/SAE trial
- End-to-end LTE/SAE support
- Tight co-operation with Nokia terminals

2010
Commercial launch
- LTE capable devices
- LTE roll-out for capacity and coverage
- Data centric services

2011-
Operator service migration to LTE/SAE
- Volume LTE roll-out with full coverage
- Gradual migration of cellular services to LTE

E2E concept including devices from the beginning
Flexi Multiradio BTS
## Scope and Terminology

- Detailed SW release schedules for GSM/EDGE (RGxx), WCDMA/HSPA (RUxx) and LTE (RLxx) are explained in separate roadmap documents.

<table>
<thead>
<tr>
<th>HW module: Single Mode</th>
<th>HW module: Multiradio</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GSM or WCDMA</strong></td>
<td><strong>GSM and WCDMA and LTE</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SW: Single Mode</th>
<th>SW: Dedicated mode</th>
<th>SW: Concurrent mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexi BTS module operates in one radio mode. SW can not change the operational mode to another radio access mode.</td>
<td>Flexi BTS module operates in one radio mode at a time but can be changed to other operational mode by SW.</td>
<td>Same Flexi BTS module operates simultaneously in two or more radio access modes.</td>
</tr>
</tbody>
</table>
**Flexi 3-sector RF Module**

- 60 W output power per sector
- HW supports GSM, WCDMA and LTE operation at relevant frequency bands
- Single-band, Multi-carrier operation
- MIMO support (3 sector MIMO with 2 RF Modules)
- HW supports following SW operating modes
  - dedicated modes: GSM, WCDMA, LTE
  - GSM-WCDMA concurrent mode
  - WCDMA-LTE concurrent mode
  - GSM-LTE concurrent mode
  - GSM-WCDMA-LTE concurrent mode
### Flexi Multiradio 3-Sector 60W RF Module: example for 900/1800 Band

<table>
<thead>
<tr>
<th>Frequency/Bandwidth</th>
<th>900MHz 15 MHz</th>
<th>1800MHz 20MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSM TRX’s</td>
<td>6+6+6</td>
<td>6+6+6</td>
</tr>
<tr>
<td>WCDMA carriers</td>
<td>3+3+3</td>
<td>4+4+4</td>
</tr>
<tr>
<td>LTE bandwith</td>
<td>1.4/3/5/10</td>
<td>1.4/3/5/10/15/20</td>
</tr>
<tr>
<td>Concurrent mode(s)</td>
<td>GSM/LTE, GSM/WCDMA, GSM/WCDMA/LTE, WCDMA/LTE</td>
<td>GSM/LTE, GSM/WCDMA, GSM/WCDMA/LTE, WCDMA/LTE</td>
</tr>
<tr>
<td>max 10MHz LTE/WCDMA per MCPA</td>
<td>3+3+3+10MHz LTE or WCDMA</td>
<td></td>
</tr>
<tr>
<td>Output power/sector</td>
<td>60W</td>
<td>60W</td>
</tr>
</tbody>
</table>

**Figures are design targets**
Flexi RF Module: Distributed site

Feederless and distributed site architecture

Flexi 3-sector RF Module in distributed sites
- 60 W output power per antenna input
  - 120 W to one cross-polarized antenna
- MIMO support with a single RF Module
  - 120 W per sector
Distributed Site Example Flexi LTE
1+1+1 Multimode BTS 2x2 MIMO

Easier Installation with 2X2 MIMO
Less wind load and weight
One optical and DC cable to tower
Optional 4 way UL diversity

Flexi RF Module can be installed close to antenna for performance gains such as:
- 2dB better RX sensitivity than specified in TR 36.804 without MHA (at RF Module antenna connector)
Improved TX performance
  ⇒ No need for MHAs
  ⇒ no feeders
  ⇒ easy dual band

Two 3-sector RF:
3 x {60+60W & 2X2 MIMO} total

OR

Three 1-sector RH:
3 x {30+30 W & 2X2 MIMO} total

with DC max 200 meters
Flexi Multiradio BTS - System Modules

**Flexi Multimode System Module**
- HW supports following SW operating modes
  - WCDMA dedicated mode
  - LTE dedicated mode
  - WCDMA-LTE concurrent mode under study
- Multiband support
  - RF Modules for different frequency bands can be connected to same System Module

**Flexi EDGE System Module**
- Performance optimized for single mode operation
- 18 carrier and 36 carrier variants
- Multiband support
  - RF Modules for different frequency bands can be connected to same System Module
Flexi Multiradio BTS – Product Concept

- GSM BTS
  - 3-sector RF
  - EDGE SM

- EDGE/WCDMA/LTE BTS
  - 3-sector RF
  - Multimode SM*
  - EDGE SM

- WCDMA BTS
  - 3-sector RF
  - Multimode SM

- LTE BTS
  - 3-sector RF
  - Multimode SM

*) System Module sharing WCDMA/LTE
Flexi Multiradio BTS in Concurrent Mode Operation

RF Module sharing GSM-LTE
- EDGE 18/36 Carrier System Module
- Multimode System Module LTE SW
- 3-sector RF Module

RF Module sharing GSM-WCDMA
- EDGE 18/36 Carrier System Module
- Multimode System Module WCDMA SW
- 3-sector RF Module

RF Module sharing WCDMA-LTE
- Multimode System Module LTE SW
- Multimode System Module WCDMA SW
- 3-sector RF Module

RF and System Module sharing WCDMA-LTE
- Multimode System Module WCDMA/LTE SW
- 3-sector RF Module

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Flexi Multiradio BTS in Concurrent Mode Operation with multiple frequency bands - Examples

- RF Module sharing GSM-LTE
- RF Module sharing WCDMA-LTE
- RF and System Module sharing WCDMA-LTE
Number one in energy efficiency

GSM + WCDMA BTS site

Based on 1+1+1 WCDMA BTS and 4+4+4 GSM BTS
Roadmaps

Flexi Multiradio BTS

RF Modules, RRHs and System Modules
Flexi Multiradio BTS – Dedicated operational modes

### WCDMA mode
- Multimode System Module, WCDMA SW
- 01/09
- 04/09 (RU10)

### LTE mode
- Multimode System Module, LTE SW
- 11/09 (RL09)

### GSM mode
- EDGE System Module (RG10*)
- 2Q/10
- 3Q/10 (GSM RG10*)

*) on top feature
- **CP**: limited commercial availability
- **C5**: full commercial availability

Software for RF module sharing with WCDMA-GSM concurrent mode will come in 3Q/2010 for 900 MHz and 4Q/2010 for 1800 MHz diapazones.
## Flexi Multiradio BTS System Modules – HW Characteristics

<table>
<thead>
<tr>
<th>Module name</th>
<th>Supported technologies</th>
<th>HW capacity</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexi Multimode System Module (FSMD)</td>
<td>WCDMA, HSPA+ and LTE</td>
<td>Up to 500 CE in WCDMA; LTE 3 cells à 10 MHz with MIMO</td>
<td>Multiband support; two System Modules can be chained for capacity extension</td>
</tr>
<tr>
<td>Flexi Multimode System Module (FSME)</td>
<td>WCDMA, HSPA+ and LTE</td>
<td>Up to 750 CE in WCDMA; LTE 3 cells à 20 MHz with MIMO</td>
<td>Multiband support; two System Modules can be chained for capacity extension</td>
</tr>
<tr>
<td>Flexi EDGE 18 carrier System Module (ESMB)</td>
<td>GSM</td>
<td>Up to 18 TRXs</td>
<td>Flexi Multiradio BTS; single mode operation; multiband support</td>
</tr>
<tr>
<td>Flexi EDGE 36 carrier System Module (ESMC)</td>
<td>GSM</td>
<td>Up to 36 TRXs</td>
<td>Flexi Multiradio BTS; single mode operation; multiband support</td>
</tr>
</tbody>
</table>

*CE=channel elements in WCDMA use, actual capacity depends on SW release*

HSPA+: 64 QAM DL, 16 QAM UL, Flexible RLC, Continuous Packet Connectivity, Frequency Domain Equalizer, Interference Cancellation, CS Voice over HSPA,…
## Flexi RF Modules – HW Characteristics (FDD)

<table>
<thead>
<tr>
<th>Module name</th>
<th>Supported technologies</th>
<th>LTE modulation bandwidth</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexi RF Module Triple 2100 (FRGF)</td>
<td>WCDMA/LTE</td>
<td>1.4, 3 MHz and 5 MHz</td>
<td>HW is LTE prepared*; SW support will be decided according to market demand</td>
</tr>
<tr>
<td>Flexi RF Module Triple 2100 (FRGP)</td>
<td>WCDMA/LTE</td>
<td>Up to 20 MHz</td>
<td>HW ready for concurrent mode operation</td>
</tr>
<tr>
<td>Flexi RF Module Triple 2600 (FRHA)</td>
<td>WCDMA/LTE</td>
<td>Up to 20 MHz</td>
<td>HW ready for concurrent mode operation</td>
</tr>
<tr>
<td>Flexi RF Module Triple 1.7/2.1 (FRIE)</td>
<td>WCDMA/LTE</td>
<td>Up to 20 MHz</td>
<td>HW ready for concurrent mode operation</td>
</tr>
<tr>
<td>Flexi RF Module Triple 1800 (FXEA)</td>
<td>GSM/WCDMA/LTE</td>
<td>Up to 20 MHz</td>
<td>HW ready for concurrent mode operation</td>
</tr>
<tr>
<td>Flexi RF Module Triple 1900 (FXFA)</td>
<td>GSM/WCDMA/LTE</td>
<td>Up to 20 MHz</td>
<td>HW ready for concurrent mode operation</td>
</tr>
<tr>
<td>Flexi RF Module Triple 900 (FXDA)</td>
<td>GSM/WCDMA/LTE</td>
<td>Up to 15 MHz</td>
<td>HW ready for concurrent mode operation</td>
</tr>
<tr>
<td>Flexi RF Module Triple 850 (FXCA)</td>
<td>GSM/WCDMA/LTE</td>
<td>Up to 15 MHz</td>
<td>Covers also iDEN and Japanese 800 band; HW ready for concurrent mode operation</td>
</tr>
<tr>
<td>Flexi RF Module Triple 1500 (FRKA)</td>
<td>WCDMA/LTE</td>
<td>Up to 20 MHz</td>
<td>HW ready for concurrent mode operation</td>
</tr>
<tr>
<td>Flexi RF Module Triple 800EU (FRMA)</td>
<td>WCDMA/LTE</td>
<td>Up to 15 MHz</td>
<td>European Digital Dividend band 790-862 MHz , HW ready for concurrent mode operation</td>
</tr>
</tbody>
</table>

* 5 MHz in concurrent mode under study
Flexi Multiradio Base Station
Perfect match for multiradio future

- Easy to install, small, modular, weatherproof
- 6+6+6 GSM, 4+4+4 WCDMA, 1+1+1 LTE@20MHZ
- Any combination of the 3 technologies - concurrently
- High output power 3 x 60 W RF
- Energy efficient: 790 W for common WCDMA/GSM site