Wireless Broadband Business Growth Strategy

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NEC Corporation
To be a leading global company leveraging the power of innovation to realize an information society friendly to humans and the earth

NEC Group Vision 2017
1. Business Overview

2. Key Business Strategy
   2.1 LTE Business Strategy
   2.2 Mobile Backhaul Business Strategy

3. Toward Achieving V2012
To provide products/systems/services which are necessary for transformation of carrier service as a business partner
Wireless Broadband (WBB) Business

- **Carrier Network Business Mid Term Strategy:**
  Strengthen position in the global market and recover growth and profitability

- **FY2012 Target:**
  Sales: JPY900B, OP Margin: 9%

Key Business Areas
1. Wireless Broadband Access
2. Mobile Backhaul
3. Submarine Cable System
4. Service & Management

Wireless Broadband Business: Sales Target JPY 250B (FY2012)
Wireless Broadband Access Business Environment

- Rapid increase of data traffic, including rich content, due to the increase of Smart Phones (e.g. iPhone)
- Increase in Wireless Broadband business opportunities

Rapid increase in rich content traffic

Business Opportunities

Provide High Speed Wireless Access/
High Quality Radio Access Area

- Improve usability (High-speed, Real time )
- Expansion of rich content services

Enhanced capability and capacity expansion of Mobile Backhaul

- Applicable to 3G/LTE (Transition to packet base NW )
- Rapid increase in Mobile data traffic
What is LTE?

- High speed data communication service
  (10 times faster and 1 tenth less delay than HSDPA)
- Improve spectrum efficiency (3-4 times efficient than HSPA)
- Support high speed mobility (up to 350km/h)

<table>
<thead>
<tr>
<th></th>
<th>LTE</th>
<th>3G (HSPA)</th>
<th>Points of Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access Method</td>
<td>Downlink: OFDMA</td>
<td>CDMA</td>
<td>Improved spectrum efficiency</td>
</tr>
<tr>
<td></td>
<td>Uplink: SC- FDMA</td>
<td></td>
<td>Improved transmission speed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Improved transmission quality</td>
</tr>
<tr>
<td>Modulation Method</td>
<td>QPSK/16QAM/64QAM</td>
<td>QPSK/16QAM</td>
<td></td>
</tr>
<tr>
<td>Antenna (MIMO)</td>
<td>2x2 to 4x4</td>
<td>SISO</td>
<td></td>
</tr>
<tr>
<td>Delay</td>
<td>&lt; 10 ms</td>
<td>&lt; 100 ms</td>
<td>Improved transfer speed</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>FDD</td>
<td>FDD</td>
<td>Allow introduction of LTE using the existing spectrum</td>
</tr>
<tr>
<td></td>
<td>1.4, 3, 5, 10, 15, 20MHz</td>
<td>5 MHz</td>
<td></td>
</tr>
<tr>
<td>Transmission Speed (DL)</td>
<td>75Mbps@10MHz</td>
<td>14.4Mbps@5 MHz</td>
<td>Improved transmission speed</td>
</tr>
<tr>
<td></td>
<td>MIMO:2 × 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed of mobility</td>
<td>&lt; 350km/h</td>
<td>&lt; 120km/h</td>
<td>Support high speed mobility</td>
</tr>
</tbody>
</table>
New LTE Business Opportunities

- Shorter download time and quicker responses reduces user’s stress
- Creation of variety of service/applications and increase ARPU for carrier

**Strong user demand**

Create variety of service applications
Increase ARPU for carriers

<table>
<thead>
<tr>
<th>File Type</th>
<th>Size</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music (MP3)</td>
<td>5MB</td>
<td>0.5s</td>
</tr>
<tr>
<td>News (MP3)</td>
<td>10MB</td>
<td>12s</td>
</tr>
<tr>
<td>Video Clip</td>
<td>15MB</td>
<td>17s</td>
</tr>
<tr>
<td>Video Podcast</td>
<td>20MB</td>
<td>22s</td>
</tr>
<tr>
<td>Music CD (MP3)</td>
<td>70MB</td>
<td>78s</td>
</tr>
</tbody>
</table>

*Download conditions = LTE: 75Mbps @ 10MHz, MIMO 2x2 / HSDPA: 7.2Mbps @ 5MHz*
1. Business Overview

2. **Key Business Strategy**
   2.1 LTE Business Strategy
   2.2 Mobile Backhaul Business Strategy

3. Toward Achieving V2012
2.1 LTE Business Strategy
Operator Trends on LTE Deployment

Status of LTE deployment by operators
- 180 operators in 70 countries are investing in LTE
- 128 LTE network commitment in 52 countries
- At least 64 LTE networks are anticipated to be in commercial service by end of 2012

Launch of Commercial LTE Networks

Source: List compiled by NEC based on press announcements and research firm data

Global Market Size of LTE Equipment

Source: NEC Estimates based on research firm data
LTE Business Strategy

- Successfully complete projects for leading domestic carriers and expand globally
  - Capitalize on the Femtocell footprint and Small Cell Solution which manifest high speed of LTE
- Expand LTE business by entering the TD-LTE market segment

Successful Trial
Successful Field Trial
Commercial Service
Selected as base station vendor
Delivery of Wireless Base Stations, Core Network Systems, MBH switches
Commercial Service
Commercial & Trial

Europe
- Denmark
  - TDC
- Norway
  - Network
- France
  - SFR
- SBM
- KDDI
- NTDOCOMO
- Asia
  - KDDI
  - SingTel
  - NTT
  - DOCOMO
- Americas
  - Telefonica
- Africa / Mid. East
  - 3 Co.
- 8 Co.
- 5 Co.

Only projects publicly announced are indicated (as of December 2010)
Target Market Segments for LTE

- Cultivate enhancement market segment for mobile Broadband service providers and market segment providing high-speed WiFi / fixed Broadband services

**Mobile BB Service**
- High-speed data services for 2G/3G/cdma networks
  - 3G → LTE migration
  - GSM → LTE migration
  - cdma → LTE migration
- High-speed data services for emerging networks with LTE (TD-LTE) markets

**High-speed WiFi BB Service**
- Wireless backhaul for public WiFi service access points
- Wireless access for mobile WiFi routers

**Fixed BB Service**
- FBWA (Fixed Broadband Wireless Access)
- Broadband wireless access for SOHO

Market Scale: JPY400 billion in 2012

Market Scale: JPY50 billion in 2012
Strategy for Mobile BB Service

Small Cell Solution
- Provide Small Cell Solutions that manifest high speed of LTE, in addition to macro cell deployment
- Applicable to zone deployment in urban areas / data dense regions
- Enter market with small, lightweight and easy to install base stations

Macro Cell deployment
500m～several km in radius

Small Cell deployment
Less than 200 meter radius (Urban, data density area)

(1) Improve data speed
Total throughput is independent of the cell size. Less number of devices in the cell means higher throughput for each device.

(2) Improve spectrum usage
More repetitive use of the spectrum
TD-LTE Market Strategy

**TD-LTE Market Expansion**
- TD-LTE is strategically promoted by Chinese government
- In India, winner of BWA spectrum in 2010 proactive to deploy TD-LTE
- TD-LTE adoption planned by Clearwire (USA), Yota (Russia), FarEasTone (Taiwan), etc.

* 33% of 18 companies surveyed by GSA plans to deploy TD-LTE

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**Chinese Market**
- Joint LTE product development by business collaboration with WRI
  - Capitalize on NEC’s LTE development assets in combination with WRI’s TD-LTE technologies to optimize development
  - (Develop TD-LTE base stations with common FD/TD LTE platform)
- Leverage WRI’s sales channels
  - Enter Chinese market utilizing WRI’s sales channel and 3G footprint

**Other Oversea Market**
- Cultivate PASOLINK market footprint with products developed in China following the success in Chinese TD-LTE market
Summary of press release (for Reference)

NEC and WRI Collaborate on LTE Infrastructure Business

Cooperation with WRI on development, manufacturing, sales and field support
- Collaborative target: LTE base stations, maintenance and operation systems, and Self Organizing Network (SON)
- These systems support both the TD-LTE and FD-LTE for Chinese market. Commercialization is planned for the second half of 2011.

Entry into China’s TD and FD-LTE market by leveraging WRI’s sales channel and 3G footprint.

Leverage the TD-LTE success in the Chinese market to expand globally

WRI operates under China’s State-owned Assets Supervision and Administration Commission (SASAC) as one of the top manufacturer in China’s communications Infrastructure field. Wuhan Fiberhome Mobile Communications Inc. is a joint venture between NEC and WRI established in 2005 that will market jointly developed products, mostly in the Chinese market, while NEC will mainly target other global markets.
Propose high-speed WiFi BB service / fixed BB service that utilize LTE to fixed-line operators and expand business (capitalize on the existing business footprint)

**High-speed WiFi BB Service**

- Smart Phone
- PC
- Tablet (PAD)
- LTE-WiFi Router (Pocket terminal)

**Fixed BB Service**

- STB
- IPTV
- PC
- Home GW
- Fixed Telephone

Carrier Network

Last one-mile by wireless fiber (LTE)
Commercial LTE Systems

LTE Base Station Equipment (eNodeB)

Ethernet Transmission Equipment (ERP-SW)

Core Network Equipment (EPC)

RRH
BBU
All in one eNodeB (BBU+RRH)
2.2 Mobile Backhaul Business Strategy
Mobile backhaul is an access network for mobile communications systems that transmits data traffic from mobile terminals to mobile core networks by inter-connecting several base stations scattered in wide area.
Trends to Improve Mobile Backhaul Network

- Moving towards next generation mobile backhaul aiming to reduce OPEX and CAPEX while coping with rapid increase in mobile data traffic.
  - Demand for TDM based legacy transport such as SONET / SDH decreases
  - Demand increase for hybrid TDM & packet based transport such as ether-net

Trend of Mobile Services

- Traffic increase with wireless access system evolution

Global Market Size for Mobile Backhaul Equipment

- Packet based network migration

Source: Infonetics, Mobile Backhaul Equipment and Services

10% CAGR 2010-2013

Packet / TDM hybrid equipment
Mobile Backhaul Requirements (Needs of Operators)

- Supports rapid growth of mobile data traffic
- Smooth migration from existing networks to next generation networks
- Power saving / space saving
- New management system to reduce operating costs

Further expand NEC’s business opportunity by introducing iPASOLINK series which meets market requirements
Meeting Next Generation Mobile Backhaul Requirements

- Converge NEC’s wireless / optical / IP and OSS technologies
  - A mobile backhaul solution that uniformly and economically handle the migration from 2G → 3G → 3.9G (LTE)
  - The coordination of integrated NMS with OSS enables the provision of E2E / multilayer pass management and provide high reliability and scalability
Launch of iPASOLINK 400

All-in-One Model in 1U (44mm in height)

- Up to 4-way branch configuration in 1U
- Universal slot enables flexible expansion (transport interface and/or functionality)
- Internal high capacity packet switch
- Compact design, high reliability

iPASOLINK 400

iPASOLINK 200

- 2-way branch (repeater function)
- Internal high capacity packet switch
- Compact design, high reliability
Orders for the iPASOLINK 200

Since its commercial release on September 1, 2010, orders for 23,000 units in 18 countries has been received.

Typical Usage of iPASOLINK 200 by Customers
- Communication line between mobile network base stations
- Deployment of new 3G (HSPA / HSPA+) and LTE networks
- Replacement of existing equipments (capacity expansion of existing access backhaul)
Total PASOLINK Shipments (Over 1.5 Million)

Major Shipment Milestone:
- 1.5 million shipments: achieved in 26 year (1984～2010)
- 1.0 million shipments: achieved in 24 year (2008.9)
- 1.0 → 1.5 million: achieved in 1 year 11 months (2010.8)

Countries: 145 (as of Dec. 2010)

Shipment growth to mobile operator:
- total shipment ratio to mobile operator:
  - 2000: 40%
  - 2009: 80%+

New Series
- iPASOLINK200/400
- PASOLINK NEO (Standard)
- PASOLINK NEO/c
- PASOLINK Mx
- PASOLINK V4
- PASOLINK+ V3
- PASOLINK-S
- PASOLINK V2
- Overseas Ver. PASOLINK50
- Overseas Ver. PASOLINK (joint dev. with overseas operators)

PASOLINK
High Performance (HP)

Total PASOLINK Shipments (Over 1.5 Million)
- 1.5 mil.
- 1.0 mil.
- 500 thou.
- 100 thou.
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3. Toward Achieving V2012
Toward Achieving V2012

- Sales of 900 billion yen in FY2012 (9% operating profit margin)

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<thead>
<tr>
<th></th>
<th>FY2009</th>
<th>FY2012</th>
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<tr>
<td>Overseas Sales Ratio</td>
<td>28%</td>
<td>40%</td>
</tr>
<tr>
<td>Key Business Ratio</td>
<td>34%</td>
<td>50%</td>
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<tr>
<td>Operating Income Margin</td>
<td>5%</td>
<td>9%</td>
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</table>

(Billions of yen)

Sales

- Sales 627.4
- Sales 900.0

CAGR +13% (09 → 12)

- Overseas Sales
- Key Business
- Existing Business

- Japan
- Overseas

WBB Business 100 billion yen

WBB Business 250 billion yen

△ forecast as of July 8, 2010
# Abbreviations

<table>
<thead>
<tr>
<th>ARPU</th>
<th>Average Revenue Per User</th>
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<tbody>
<tr>
<td>BB</td>
<td>Broadband</td>
</tr>
<tr>
<td>BBU</td>
<td>Base Band Unit</td>
</tr>
<tr>
<td>BDE</td>
<td>Base station Digital processing Equipment</td>
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<tr>
<td>BRE</td>
<td>Base station Radio processing Equipment</td>
</tr>
<tr>
<td>BSC</td>
<td>Base Station Controller</td>
</tr>
<tr>
<td>BSS</td>
<td>Business Support Systems/Billing Support Systems</td>
</tr>
<tr>
<td>BWA</td>
<td>Broadband Wireless Access</td>
</tr>
<tr>
<td>CAGR</td>
<td>Compound Annual Growth Rate</td>
</tr>
<tr>
<td>eNB</td>
<td>evolutional Node B</td>
</tr>
<tr>
<td>E2E</td>
<td>End to End</td>
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<tr>
<td>EPC</td>
<td>Evolved Packet Core</td>
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<tr>
<td>ERP-SW</td>
<td>Ethernet Ring Protection Switch</td>
</tr>
<tr>
<td>FBWA</td>
<td>Fixed Broadband Wireless Access</td>
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<tr>
<td>FDD</td>
<td>Frequency Division Duplex</td>
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<tr>
<td>GW</td>
<td>Gateway</td>
</tr>
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<td>GSM</td>
<td>Global System for Mobile communications</td>
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<tr>
<td>HSDPA</td>
<td>High Speed Downlink Packet Access</td>
</tr>
<tr>
<td>HSPA</td>
<td>High Speed Packet Access</td>
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<tr>
<td>IMS</td>
<td>IP Multimedia Subsystem</td>
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<tr>
<td>LRE</td>
<td>Low power Radio processing Equipment</td>
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<tr>
<td>LTE</td>
<td>Long Term Evolution</td>
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<tr>
<td>MBH</td>
<td>Mobile Backhaul</td>
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<tr>
<td>MIMO</td>
<td>Multiple Input Multiple Output</td>
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<tr>
<td>MME</td>
<td>Mobility Management Entity</td>
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<tr>
<td>NMS</td>
<td>Network Management System</td>
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<tr>
<td>NW</td>
<td>Network</td>
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<tr>
<td>OSS</td>
<td>Operational Support Systems</td>
</tr>
<tr>
<td>P2P</td>
<td>Peer to Peer</td>
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<tr>
<td>PF</td>
<td>Platform</td>
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<tr>
<td>P-GW</td>
<td>PDN Gateway</td>
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<tr>
<td>RNC</td>
<td>Radio Network Controller</td>
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<tr>
<td>RRE</td>
<td>Optical Remote Radio processing Equipment</td>
</tr>
<tr>
<td>RRH</td>
<td>Remote Radio Head</td>
</tr>
<tr>
<td>SDH</td>
<td>Synchronous Digital Hierarchy</td>
</tr>
<tr>
<td>S-GW</td>
<td>Serving Gateway</td>
</tr>
<tr>
<td>SOHO</td>
<td>Small Office / Home Office</td>
</tr>
<tr>
<td>SON</td>
<td>Self Organizing Network</td>
</tr>
<tr>
<td>SONET</td>
<td>Synchronous Optical Network</td>
</tr>
<tr>
<td>STB</td>
<td>Set Top Box</td>
</tr>
<tr>
<td>TDD</td>
<td>Time Division Duplex</td>
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<tr>
<td>TDM</td>
<td>Time Division Multiplexing</td>
</tr>
<tr>
<td>WBB</td>
<td>Wireless Broadband</td>
</tr>
<tr>
<td>WDM</td>
<td>Wavelength Division Multiplexing</td>
</tr>
<tr>
<td>Wi-Fi</td>
<td>Wireless Fidelity</td>
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<tr>
<td>WiMAX</td>
<td>Worldwide Interoperability for Microwave Access</td>
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<td>WRI</td>
<td>Wuhan Research Institute of Post and Telecommunications</td>
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<tr>
<td>XaaS</td>
<td>X as a Service</td>
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Empowered by Innovation

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