COMPONENTS OF BROADBAND ACCESS NETWORK
Report on components for Broadband Access Networks
Shinichi Tsuda

September, 2015

Corporate Profile (NEL)

◆ Feature : Member of NTT Group
◆ Established : June, 1982
◆ Capital : 6,577 Million yen
  (US $ 65 Million)
◆ President & CEO : Dr. Kazuo Hagimoto
◆ Business : Manufacture & Sales of the Key Devices/Modules to contribute to global IT industries
◆ Employees : 863 (As of April 1, 2015)
◆ Head Office : Yokohama, Japan

http://www.ntt-electronics.com/

June 20, 2011
Market Prospects

NEL is Developing businesses in four technological fields

 NT T Group
(776 companies) NTT
 DATA
 NTT
 docomo
 NTT R&D
 NTT West
 NTT
 Electronics
 NTT
 Communications
 Transferring Technologies & Licensing Patents
 Security & Safety Market
 Photonics Products (Optical Component)
 Sensing Market
 Broadband Network Products (LSI, Module)
 Communication Market
 Video Codec Products (LSI, System, Software)
 Digital Video (Broadcast) Market

Video Codec

(1) Codec LSI

■AVC/H.264 Codec LSI : ARQENC, SARADEC2
■MPEG-2 Codec LSI : VASAplus

ARQENC SARADEC2 VASAplus

(2) Video Codec System

■Video IP Gateway : NA8000 ■Mobile Encoder : WT1000

XVE9310 HVD9130 MV5000 HVX750 NA8000 WT1000
LSI for Broadband Network

(1) Core Network-LSI
- 100G Digital Coherent Signal Processing LSI (DSP-LSI)
- 100G OTN Framer LSI (OTN-LSI), 40G OTN Framer LSI
- 40G Linear Amplifier (TIA-AGC)

(2) Access & User-LSI
- Mac-LSI for 10G-EPON OLT/ONU
- 10G-Burst-TIA

Optical Communication Products

Metro Core
- 40G DQPSK DLI
- DQPSK Rx FE
- DQPSK Integrated Rx FE

Metro Access
- OCM
- TOSW
- TOSA
- Splitters
- 10G-EPON LSI
- 100G LH/ULH
- 50GHz AWG
- WDM-PON AWG
- A-AWG
- TLA
- DP-QPSK Receiver

Residential
- VMUX/ROADM
### NEL key components for Broadband Access networks

![Diagram showing various components of Broadband Access networks](image)

### Showcasing

<table>
<thead>
<tr>
<th>Item</th>
<th>Related ITU standard</th>
<th>Product Description</th>
<th>Sample display</th>
<th>Brochure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>G.671</td>
<td>Optical PLC Splitter PLC : Planar Lightwave Circuit</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>G.9801</td>
<td>EPON OLT/ONU MAC LSI</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>G.9801</td>
<td>10G/1G Burst-mode TIA</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Optical Splitters (G.671)

**Features**
- Completely passive, wide wavelength range of 1260 to 1660 nm, wide temperature range of -40 to 85 °C.
- Compact package (ex. 1×4 : 4 mm x 4 mm x 38 mm), suitable for cassette.
- Good performance/High reliability (based on ITU-T Recommendation G.671 and L.37)
- NEL has shipped 8 millions of splitters within 10 years all over the world. There is no failure in the field so far.

**Line up**
- 1×N Splitters : 1×4, 1×8, 1×16, 1×32, 1×64
- 2×N Splitters : 2×4, 2×8, 2×16, 2×32, 2×64
- (Others: 8 arrayed 2×1 WDM, 8 arrayed 1×4, 2 arrayed 1×16, etc.)

Optical PLC Splitters (Photo)
### WDM-PON AAWG (NG-PON2)

- Wide operation temperature range
- Can be used in both of C-band and L-band with cyclic design
- Water immersion and corrosion resistance tested

<table>
<thead>
<tr>
<th></th>
<th>Gaussian</th>
<th>Flat-top</th>
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</thead>
<tbody>
<tr>
<td>Package size (mm³)</td>
<td>80 x 60 x 10</td>
<td>120 x 70 x 10</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-30 to 70 degree C</td>
<td></td>
</tr>
<tr>
<td>Channel spacing (GHz)</td>
<td>100 GHz</td>
<td></td>
</tr>
<tr>
<td>Channel number</td>
<td>Up to 40 ch</td>
<td></td>
</tr>
<tr>
<td>Insertion loss (Typ.)</td>
<td>&lt; 4 dB</td>
<td>&lt; 6 dB</td>
</tr>
<tr>
<td>1dB bandwidth</td>
<td>&gt; 25 GHz</td>
<td>&gt; 40 GHz</td>
</tr>
<tr>
<td>3dB bandwidth</td>
<td>&gt; 50 GHz</td>
<td>&gt; 62.5 GHz</td>
</tr>
<tr>
<td>AXT</td>
<td>&lt; -25 dB</td>
<td>&lt; -25 dB</td>
</tr>
<tr>
<td>NXT</td>
<td>&lt; -30 dB</td>
<td></td>
</tr>
</tbody>
</table>

### EPON SoCs (G.9801)

- IEEE802.3av compliant (10G-EPON), IEEE802.3ah compliant (EPON)
- 10G-EPON SoCs achieve low cost high-speed access with 1G/10G/1G&10G connection
- EPON SoC realizes low-power ONU equipment with lower cost

<table>
<thead>
<tr>
<th>SoC</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>10G-EPON OLT SoC</td>
<td>1G/10G dual-rate connection supported</td>
</tr>
<tr>
<td></td>
<td>IEEE802.3av compliant MPCP</td>
</tr>
<tr>
<td></td>
<td>IEEE802.3-2005 compliant OAM</td>
</tr>
<tr>
<td></td>
<td>IEEE802.1p compliant priority control</td>
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<tr>
<td></td>
<td>IEEE802.1q compliant VLAN control</td>
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<tr>
<td></td>
<td>IEEE802.1AE encryption and FEC supported</td>
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<tr>
<td></td>
<td>128 ONUs connection(OLT)</td>
</tr>
<tr>
<td></td>
<td>IEEE802.3az power save supported(ONU)</td>
</tr>
<tr>
<td>10G-EPON ONU SoC</td>
<td>EPON ONU</td>
</tr>
<tr>
<td></td>
<td>IEEE802.1D bridge, IEEE802.1q VLAN</td>
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<tr>
<td></td>
<td>MAC address filter for multicast</td>
</tr>
<tr>
<td></td>
<td>Built-in SERDES, large packet buffer</td>
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<tr>
<td></td>
<td>ARM processor</td>
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</tbody>
</table>
10G/1G Burst-mode TIA (G.9801)

- 1G/10G burst-mode trans-impedance amplifier (TIA) for 1G/10G EPON OLT fully conforming to both IEEE802.3ah and IEEE802.3av.
- High sensitivity and fast response are achieved in small-size PKG.
- ES: 2015 September, CP: 2015 November

NLY3016EXX

- Application: 1G/10G Dual-rate, 10G Symmetric, 10G/1G Asymmetric, 1G Symmetric
- Sensitivity 10G: -31.9dBm@BER 10^-3
- Sensitivity 1G: -34.5dBm@BER 10^-12
- 2R Response 10G: 400 ns (w/o Guard time)
- 2R Response 1G: 200 ns (w/o Guard time)

* Design results

Roadmap of EPON SoCs and TIA

- Next version of PON SoCs is low power consumption and small size type and will evolve for NG-PON2 use.
- B-TIA is under testing for NG-PON2 use.
Summary

- NTT Electronics (NEL) is a member of NTT group. Most of our service and our key devices are provided by using NTT Laboratories advanced technologies.
- Optical power splitters are used in worldwide more than 10 years, more than 8M units. PLC technology is proved with long term reliability. NEL believes that we can contribute to deploy splitters in Asia pacific region.
- Furthermore, MAC SoCs and Burst-mode TIA are developed for next generation 10G-EPON as key components. NEL can provide them.

Thank you