BMSB 2015

Countdown to the ultimate television

Kenichi Murayama

Science and Technology Research Laboratories
The Past, Present and Future of Digital Broadcasting

8K Broadcasting will start soon!

NHK STRL OPEN HOUSE 2015
  ✔ 8K satellite test broadcasting experiment
  ✔ Technologies for terrestrial broadcasting

Others
The Past, Present and Future of Digital Broadcasting
Diversification of the viewing environment

The Past

Mobile phone

Smartphone

Tablet

June 19, 2015
Coping with disaster

The Past

Major tsunami alert  Miyagi Prefecture
Tsunami impact confirmed  Waves of >10 m expected

Iwate, Miyagi & Fukushima
Major tsunami alert
Media to which people first connected after the Great East Japan Earthquake
The Past

Coping with disaster

June 19, 2015

BMSB2015
The Present

Converged Broadcast/Broadband Service

June 19, 2015

Technical changes
High speed broadband, Smartphones, Tablets, TV receivers with high performance CPUs

Social changes
Spread of SNS, Literacy, Privacy protection, Diversification of viewer preferences
The Present

IP simultaneous retransmission

- March 11, 2011: Great East Japan Earthquake
  - Experienced simultaneous retransmission of TV on the Internet as an emergency measure.
  - People were able to access information in real time not only from Japan but also from overseas.
- Broadcast law amendment
  - Following an amendment to Japan's broadcast law, we are investigating a framework that will allow IP delivery to be used not only for “previously broadcast content”, but also for “simultaneous live broadcasts” and “the delivery of scheduled broadcast programs”.

*However, the constant simultaneous delivery of TV broadcasts is still impossible.
The Future

UHDTV Broadcasting

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8K broadcasting will start soon!

Ultra high-definition image, 16 times that of Hi-Vision (2K)

8K Super Hi-Vision broadcasting will start soon.

- 2020: Full-fledged broadcasting will start.
- 2016: Practical broadcasting will start.
- 2014: Super Hi-Vision was used for public viewing events of the FIFA World Cup.
- 2012: Super Hi-Vision was recommended by the ITU-R as an international TV standard.
- 2002: First ultra high-definition video was shown at NHK Science & Technology Research Laboratories.
- 1995: Research began at NHK

June 19, 2015
was held from 28th May to 31st.

http://www.nhk.or.jp/strl/open2015/en/
• Toward realization of 8K Super Hi-vision Satellite Broadcasting
  – Production Equipment
  – Video and Audio Encoder/Decoder
  – Multiplexing Equipment
  – Transmission and Reception equipment
  Accelerating development of key equipment

• Accelerate the preparations for 8K Satellite Broadcasting in accordance with Roadmap

• Conducting 8K Satellite Broadcasting Experiment via the actual broadcast satellite that include all equipment like camera, switcher, recorder, encoder/decoder, multiplex, transmitter/receiver and display was showcased.

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Overview of 8K satellite broadcasting experiment

6K Camera System

U-SDI Interface

Contribution Transmission

Recording

8K TV

Closed captioning

22.2ch Sound

Multichannel microphone

Recording

Transmission

Scrambling

Multiplexing

Coding

Reception

Descrambling

Demultiplexing

Decoding

Broadcast Satellite (BS-17ch)

CATV transmission system

8K Satellite

Multiplexing

Scrambling

Transmission

Recording

Contribution Transmission

Multichannel microphone
Production Equipment

Recorded 8K CG

8K switcher

8K HEVC ENC
U-SDI I/F

Live Camera 1
Tokyo Bay Area

Live Camera 2
inside the exhibition venue

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### Specification of Video/Audio Encoder

<table>
<thead>
<tr>
<th><strong>Video ENCODER</strong></th>
<th><strong>MPEG-H HEVC/H.265</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>7,680 x 4,320/59.95P</td>
</tr>
<tr>
<td>Frame Rate</td>
<td>4:2:0 / 10bit</td>
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<tr>
<td>Interface</td>
<td>3G-SDI x 17</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Audio Encoding</strong></th>
<th><strong>MPEG-4 AAC</strong></th>
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</thead>
<tbody>
<tr>
<td>Audio Format</td>
<td>48kHz/24bit</td>
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<tr>
<td>Audio Interface</td>
<td>MADI (AES10)</td>
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</table>

<table>
<thead>
<tr>
<th><strong>Multiplexing</strong></th>
<th><strong>MPEG-H MMT</strong></th>
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</thead>
<tbody>
<tr>
<td>Interface</td>
<td>RJ-45 x 1</td>
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</table>
Satellite transmission system

Transmission Parameters of 8K satellite broadcasting experiment

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulation Scheme</td>
<td>16APSK</td>
</tr>
<tr>
<td>Symbol Rate</td>
<td>33.7561 Mboud</td>
</tr>
<tr>
<td>Roll Off Factor</td>
<td>0.03</td>
</tr>
<tr>
<td>FEC</td>
<td>LDPC(7/9)+BCH</td>
</tr>
<tr>
<td>Bit Rate</td>
<td>100.4898 Mbps</td>
</tr>
<tr>
<td>Multiplexing</td>
<td>MMT/TLV</td>
</tr>
</tbody>
</table>
Terrestrial Broadcasting

4K-NUC

Received Signal
Terrestrial Broadcasting

Transmission Antenna @NHK STRL

Reception Antenna @NHK Broadcasting Center
Industrial Applications
Applications for 8K Super Hi-Vision

8K Super Hi-Vision

- Digital cinema
- 3D television
- Publishing/Advertising
- Live public viewings
- Education
- Art museum exhibits
- Receivers
- Medical
- Video equipment

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Medical Applications

- 8K filming with an endoscope
- Remote surgery, robot surgery
- Remote medical treatment support
Thank you for your attention

Kenichi Murayama

Science and Technology Research Laboratories