8K Broadcasting Toward 2020 Tokyo Olympics

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8K Super Hi-Vision (Ultimate TV)

- Ultimate TV format in the future
- As if you are in the venues..
8K Super Hi-Vision

Images

8K UHDTV
3, 300 million pixels

4K UHDTV
800 million pixels

2K HDTV
200 million pixels

Ultrahigh-definition images with 7680 X 4320 pixels

Sound

22.2 multichannel sound system with 3 layers
Full-featured 8K Super Hi-Vision

- **Ultimate format of 8K Super Hi-Vision**
  - **Featuring**
  - HDR (High Dynamic Range)  
    ITU-R BT.2100
  - WCG (Wide Color Gamut)  
    ITU-R BT.2020
  - HFR (High Frame rate)  
    120 frame/s  
    Hybrid Log-Gamma (HLG)  
    *ITU-R BT.2020 recommended
  - High Bit depth  
    12 bits  
    ITU-R BT.2020
  - 22.2 multichannel system  
    ITU-R BS.2051

- **8K test satellite broadcasting covers**
  - 8K HDR & WCG for images
  - 22.2 multichannel sound
Roadmap of 4K and 8K broadcasting in Japan

2011
Completion of Analog switch-off

2K Terrestrial broadcasting

2013
Set up 4K/8K-test broadcasting

2014
4K test broadcasting

2015
4K/8K Satellite broadcasting

2016
8K test broadcasting

August 1st, 2016 11° BS

2018
4K/8K Satellite broadcasting

2018
4K/8K broadcasting and programs viewed on commercial TV sets

2020
SHV full operation

SHV public viewing

SHV experimental service

SHV full operation

4K broadcasting with Communication satellite
Started Mar 2015

4K/8K Satellite broadcasting 2018

2018
2020

4K/8K broadcasting and programs viewed on commercial TV sets

August 1st, 2016 11° BS
Test Broadcasting started 2016 Aug 1st
Mon-Sun AM10:00-17:00
8K Broadcasting Facility

OB Sites

NHK Broadcasting Center

Viewers

Transmission Facility

Edit Room

Distribution Facility

Studios

Archiving

Events

Tuner/Receiver

Transfer Equipment

Recording Equipment

Mikes

Cameras

Broadcasting Vehicles

Editing Room
### 8K Camera System

<table>
<thead>
<tr>
<th>Handy Live Camera</th>
<th>ENG Camcorder</th>
</tr>
</thead>
<tbody>
<tr>
<td>S35mm 3,300million pixels CMOS</td>
<td>F8 @ 2000 Lux、S/N 約60dB（HD Downconvert）</td>
</tr>
<tr>
<td>PL mount、4K VF、Focus Assist</td>
<td></td>
</tr>
</tbody>
</table>

**Ikegami Handy Camera**

**Hitachi ENG Camcorder**
8K P2 Recorder/Player

Video

<table>
<thead>
<tr>
<th>Video</th>
<th>Signal format</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>8K</td>
<td>3G-SDI x 8</td>
<td>8K</td>
<td>3G-SDI x 8</td>
</tr>
<tr>
<td>4K</td>
<td>3G-SDI x 4</td>
<td>4K</td>
<td>3G-SDI x 4</td>
</tr>
</tbody>
</table>

Compression

AVC-Intra 4K/10bit

Memory

8K: P2 Express x 4

Audio

Input

SDI embedded/MADI (max 32ch)

Recording time

65分（256GB x 4）

Size (mm)

W424 x H176 x D500

Weight (kg)

18

Power (W)

152

Old

New

Size: 1/3

Pw Consumption: 1/2
8K Display

8K HDR

85inch (HLG)

98inch

55inch

17.3inch

13.3inch

9.6inch

フレキシブルOLED
8K OB Truck
# 8K OB Truck

## Production Room

A control room with a high number of monitors, switches, and inputs for camera control. It is equipped for 10 cameras, VTR x 4, and Slow Player x 4. Two different setups are available:

<table>
<thead>
<tr>
<th>Spec</th>
<th>SHC1</th>
<th>SHC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>L11.9m x H3.3m x W2.5m</td>
<td>10 cameras, VTR x 4, Slow Player x 4</td>
<td>16 input videomixer, 20 input videomixer</td>
</tr>
</tbody>
</table>

## VE Room

A control room dedicated to VTR control, with various switchboards and inputs for video and audio processing.

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Production Room

VE Room

VTR control
22.2ch Audio Production Truck

Spec

- L11.5m, 車H3.5m, expansion body
- 22.2ch Mixer
- 22.2ch Speaker
- 22.2ch/5.1ch/2ch
22.2ch Audio Production Truck

Mixing Room
8K Production Editing Room

8K Video Editing Room

Dubbing Studios for 22.2 ch
8K Technical Operation Center
8K Encoder/Decoder

- **8K Encoder**
  - HEVC video encoder (in development)
  - Encoded signal processing
  - Multiple HEVC encoder LSI elements
  - 4画面分割並列処理
  - MMT/MUX

- **8K Decoder**
  - HEVC software decoder
  - Signal processing
  - MMT/IP
  - 24Gbps/85Mbps
8K Receiver

Configuration

- BS17ch
- Internet
- HDMI2.0 × 4
- HDMI1.0 × 3
- 7.1ch AV amplifier × 3
- 22.2ch speaker
- 85inch LCD

Receiver

- Demod LSI
- TLV/MMT DEMOD
- 4K HEVC/AAC Decoder
- 8K HEVC Decoder
- A/V Processor
- HDMI × 4
- HDMI × 3
- Audio amp
- 8K • 4K Broadcasting

Internet
# 8K Satellite Transmission System

<table>
<thead>
<tr>
<th>Transmission Parameter</th>
<th>8K Test Satellite Broadcasting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulation</td>
<td>16APSK</td>
</tr>
<tr>
<td>Frequency bandwidth</td>
<td>34.5 [MHz]</td>
</tr>
<tr>
<td>Roll-off rate</td>
<td>0.03</td>
</tr>
<tr>
<td>Symbol rate</td>
<td>33.76 [Mbaud]</td>
</tr>
<tr>
<td>Bit rate</td>
<td>about 100 [Mbps]</td>
</tr>
</tbody>
</table>

- **Earth-Station Transmitter**: NHK ・ B-SAT
- **Broadcast Satellite**: BSAT-3
- **Earth-Station Transmitting antenna**

![Modulator](image1.jpg)
![Earth-Station Transmitter](image2.jpg)
![Earth-Station Transmitting antenna](image3.jpg)
### HEVC Decoder

<table>
<thead>
<tr>
<th>Input</th>
<th>7680 x 4320, 60P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface (input)</td>
<td>PCI Express Gen 2</td>
</tr>
<tr>
<td>Interface (output)</td>
<td>HDMI 2.0 x 4ch</td>
</tr>
<tr>
<td>Size</td>
<td>45 mm x 45 mm</td>
</tr>
</tbody>
</table>
## 8K Receiver

### Items Specifications

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Receivable channel</strong></td>
<td>BS channel 17 (4K &amp; 8K programs)</td>
</tr>
<tr>
<td><strong>Color gamut</strong></td>
<td>Rec. BT 2020</td>
</tr>
<tr>
<td><strong>Dynamic range</strong></td>
<td>SDR / HDR (HLG)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF</td>
<td>1</td>
</tr>
<tr>
<td>LAN</td>
<td>1</td>
</tr>
<tr>
<td>USB</td>
<td>3 (Only for maintenance)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video</td>
<td>8K (HDMI 2.0 x 4)</td>
</tr>
<tr>
<td>Audio</td>
<td>22.2 chs (HDMI x 3)</td>
</tr>
</tbody>
</table>

**4K/8K receiver**
8K Contents Productions
8K Contents Productions

RIO Carnival

Under Water

Short Movie

SHV Drama
8K LIVE Productions (RIO Olympics)
Shipping and Setting up
Cameras

8K Ikegami SHK-810

4K SSM SONY HDC-4800

4K SSM FOR-A FT-One
RIO Olympics 8K Live Broadcasting

**Crew-A**
- Opening Ceremony, Swimming, Basketball
- 8K Cam x4
- 4K Slow-Mo Cam x2

**Crew-B**
- Judo, Athletics, Soccer, Closing Ceremony
- 8K Cam x4
- 4K Slow-Mo Cam x2

**Beach Volleyball/Gymnastics**
- HDR-ready

**SHC-1**
- Recording, Editing

**SHC-2**
- 350 inch PJ at Museu do Amanhã

**NHK Tokyo Network Center**
- Via Pacific Route
- Via Russia
- Recording, Editing

**IBC**
- IBC PV theatre
- 350 inch PJ
- 85 inch LCD

**RX Studio**
- LIVE

**SHV TOC**
- Playout

**Globo.com**
- Terrestrial Transmission Trial

**5 PV locations in Tokyo and Osaka**

**NHK Branch Stations**

- BSAT-3

※HDR Production in Opening Ceremony
Camera Plan (Opening Ceremony)

- Entertainment FOP
- Protocol Stage
- Cam6 (8K)
- Cam5 (8K)
- Cam4 (8K)
- Cam3 (8K)
- Cam2 (8K)
- Cam1 (8K)
- ENG (HDR)
- Cauldron this end TBD
- Presidential Box
- Entertainment - Big Set
- Parade of Athletes
Rio Olympics (Production Trucks)
Public Viewing (Brasil)

IBC 350inch Theatre

TOKYO2020 JAPAN HOUSE 85inch LCD
Rio Terrestrial Test Broadcasting

Mt. Sumaré

Museu do Amanhã

IBC Theatre

Globo.com

IBC

Globo HQ

AVC (90Mbit/s)

H.264 (280Mbit/s)

Japan

Tokyo 2020 Japan House

(Cidade das Artes)

Uncompressed

4096QAM

STL 2km

Wired

Wireless

8km

IBC Theatre
• Pacific route(x2) and Russia route(x2) = 4 routes
• 140Mbit/s stream x2 = 280Mbit/s using AVC compression
Public Viewing in Tokyo

Ariake  Panasonic Tokyo Center
240inch Projector

Marunouchi  MARUCUBE
85inch LCD × 3
55inch LCD × 2

More than 80,000 audiences
NHK local Stations
**8K Terrestrial Transmission Test**
(NHK - Science & Technology Research Laboratory)

1. **Test Satellite Broadcasting**
   - 85inch 8K LCD + 22.2ch
   - **BS 17ch (85Mbps)**
   - 85inch 8K LCD

2. **Fiber Transmission**
   - 8K Projector + 22.2ch
   - **Opt. Cable**
   - **300 inch**

3. **Demonstration (Terrestrial Transmission)**
   - **Transmitter**
   - **SHV TOC**
   - **HEVC ENC**
   - **E/O**
   - MIMO-OFDM
   - **10W/10W (H/V)**
   - **UHF 31ch (80Mbps)**
   - **Opt. Cable**

**Network Diagram**
- **E/O**
- **STRL**
- **O/E**
- **HEVC ENC**
- **HEVC DEC**
- **8K Receiver**
- **85inch 8K LCD**
- **22.2ch**

*Confidential/NHK*
8K Terrestrial Transmission Test
(NHK - Science & Technology Research Laboratory)
Progress of Broadcasting Technology

1964 Tokyo
Color TV
Satellite Broadcasting

1984 Los Angeles
HDTV Production

1988 SEOUL
HDTV Live

2008 Beijin
HDTV & 5.1ch with world feed

2020 Tokyo
SHV Production Broadcasting
8K Applications in The Future

Signage

Education

Cinema

Broadcasting

Medical

Art

Thank You!!