

Part 2 Technical Aspects

- Specifications of UHD TV satellite broadcasting
- Trial of 8K terrestrial broadcasting

UHDTV Satellite Broadcasting

Two types of satellite broadcasting

- Wide band (34.5 MHz bandwidth) broadcasting satellite
 - Currently (2000-), HDTV services using ISDB-S, MPEG-2 TS, MPEG-2 Video and MPEG-2 AAC
- Narrow band (27 MHz bandwidth) communication satellite (fixed satellite)
 - Currently (2007-), HDTV services using DVB-S2, MPEG-2 TS, MPEG-4 AVC and MPEG-2 AAC

→ UHDTV services by adopting new technologies

Key Technologies (1)

■ Modulation and channel coding for the wide band

- APSK, LDPC + BCH
- Steep roll-off (roll-off rate = 0.03)
- Large capacity and sufficient service availability
 - ✓ About 100Mbit/s per 34.5MHz (16APSK, 7/9)
 - ✓ More than 99.7% in the worst month

■ Video formats

- 3840 × 2160 and 7680 × 4320, 60 and 120 Hz, wide color-gamut (Rec. ITU-R BT.2020)

■ Audio formats

- Up to 22.2ch (Rec. ITU-R BS.2051)

Key Technologies (2)

■ Video source coding

- ITU-T H.265 | MPEG-H HEVC, Main 10 (10 bit, 4:2:0)
- Estimates of required bit rates
 - 80 – 100 Mbit/s for 8K/60/P
 - 30 – 40 Mbit/s for 4K/60/P
 - 10 – 15 Mbit/s for 2K/60/P
 - About 10% addition for 120/P

■ Audio source coding

- MPEG-4 AAC and MPEG-4 ALS (lossless)

■ Multiplexing

- “MPEG-H MMT + IP” for better harmonization with services over telecom or conventional “MPEG-2 TS”

Trial of UHDTV Terrestrial Broadcasting Conducted by NHK

■ Long distance transmission

- Large capacity content (91.89Mbit/s) was transmitted within one UHF channel (6MHz bandwidth)
- The world's first long distance (27km) transmission of 8K-UHDTV over terrestrial broadcasting

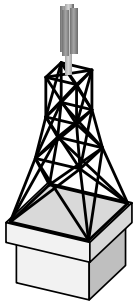
Key Technologies

Next-generation Digital Terrestrial Broadcasting

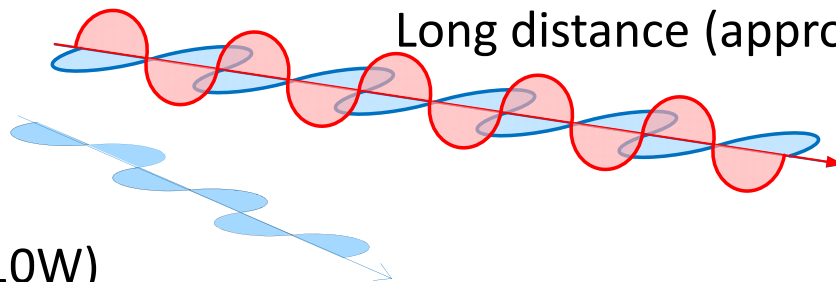
- Ultra-multilevel OFDM (4096QAM) Doubled
- Dual-polarized MIMO Doubled

91.8Mbit/s within 6MHz (approx. 4 times of current DTV)

Dual polar Tx.

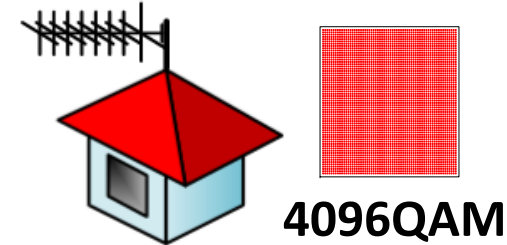


Test station (10W)
(Hitoyoshi, Kumamoto-pref. Japan)



Long distance (approx. 27km)

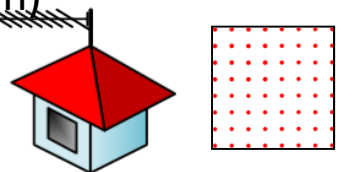
Dual polar Rx.



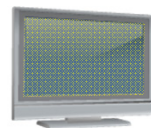
4096QAM

Current DTV in Japan

- 64QAM
- Single polar



64QAM



HDTV

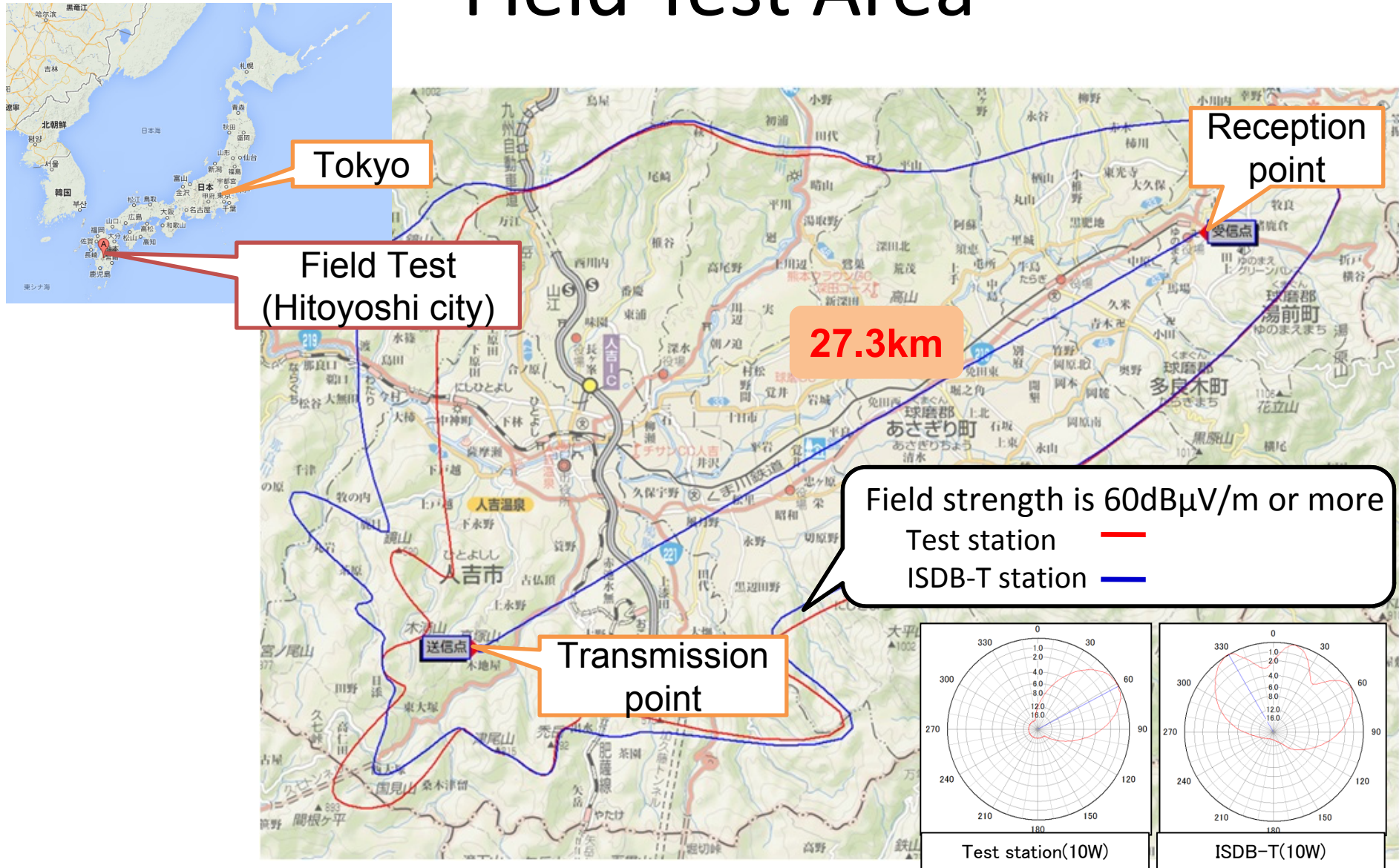


8K-SHV

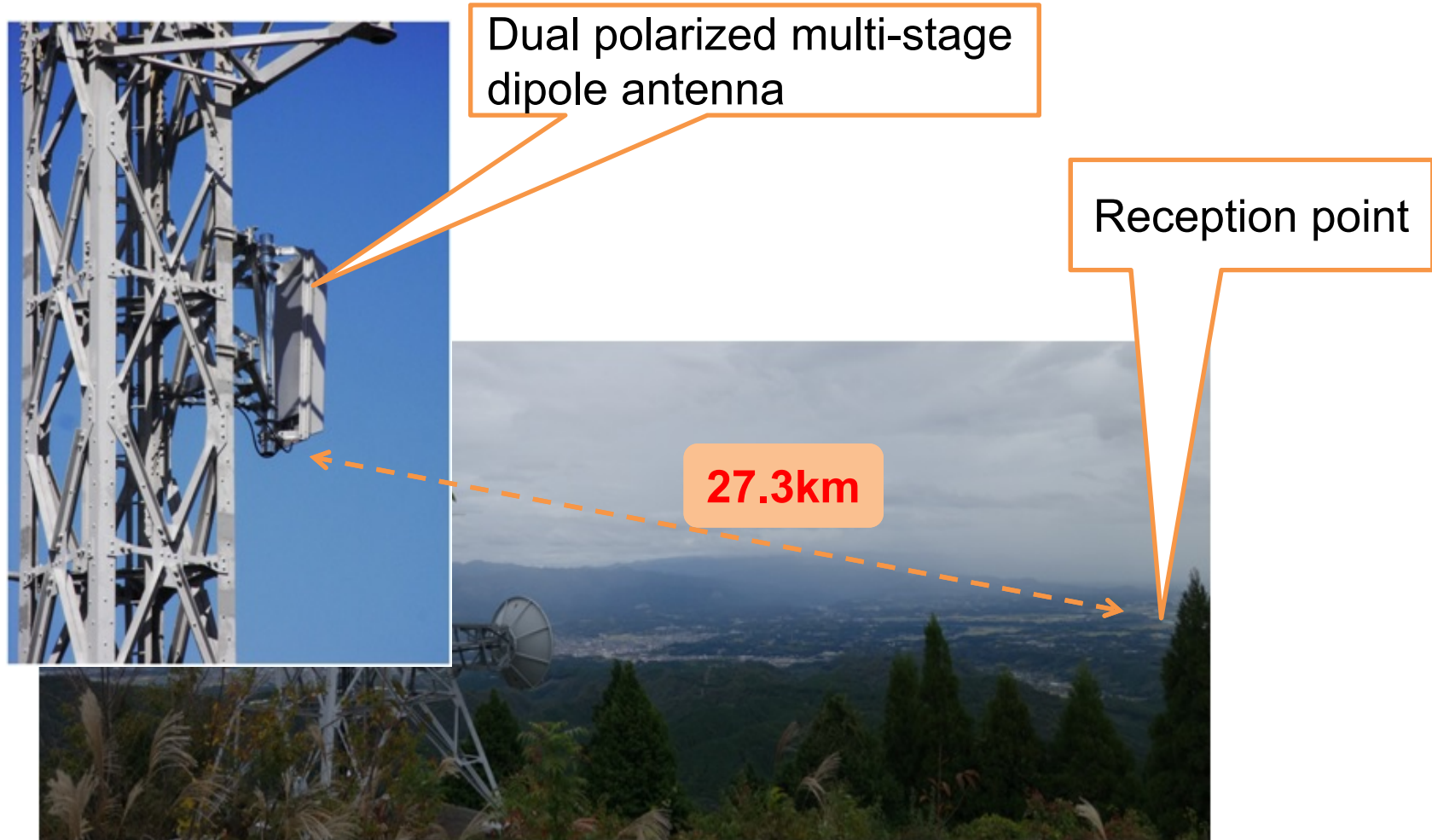
Transmission Parameters

Modulation method	OFDM
Occupied Bandwidth	5.57 MHz
Transmission Frequency	671.142857 MHz (UHF 46ch)
Transmission Power	Horizontal polarization : 10W Vertical polarization : 10W
Carrier Modulation	4096QAM
FFT size(Carrier Numbers)	32k (22,465)
Guard Interval ratio	1/32(126 μ s)
Error-correcting code	Inner code: LDPC, r=3/4 Outer code: BCH
Transmission Capacity	91.8 Mbit/s

Field Test Area



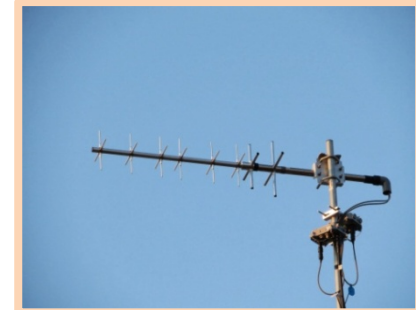
Transmission Antenna and Surrounding Area



Reception Point and Equipment



Dual polarized 8-element YAGI antenna



85-inch 8K display

Conclusion

- UHDTV broadcasting is expected to start very soon in Japan, by adopting state-of-the-art technologies on the basis of ITU Recommendations and ISO/IEC standards.
 - In 2014, 4K test broadcasting
 - In 2016, 8K test broadcasting
 - In 2020, practical UHDTV broadcasting
- R&D continues toward practical/commercial satellite broadcasting and terrestrial broadcasting of UHDTV.