Digital Cable Television Broadcasting

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Japan Cable Television Engineering Association
(JCTEA)
Standardization Organization For Telecommunication & Broadcasting

**Dpa**
Operation technical specification for radio broadcasting

**ARIB**
Technical standards for radio communication & broadcasting

**JCL**
Operation technical specification for CATV

**JCTEA**
Technical standards for CATV

**TTC**
Technical standard for telecommunication network

**ITU-R**

**ITU-T**

JCTEA: Japan Cable Television Engineering Association
ARIB: Association of Radio Industries of Businesses
TTC: The Telecommunication Technology Committee
((): Standardization Organization)

JCL: Japan Cable Laboratory
Dpa: The Association of Promotion for Digital Broadcasting
JCTEA Standards About Network, Equipment, STB & Measuring Method For Digital, FTTH & Internet

- STD-001 Conditional Access for Digital Cable Television*
- STD-002 Multiplex System for Digital Cable Television*
- STD-003 Service Information for Digital Cable Television*
- STD-005 Data Transmission Equipment for Cable Television Network
- STD-006 Symbolmark for Cable Television System
- STD-007 Receiver for Digital Cable Television *
- STD-008 BS Digital Broadcasting Pass-through System for Cable Television
- STD-009 Method of Measurement for Cable Modem System
- STD-010-OFDM Method of Measurement for OFDM Signal Transmission system*
- STD-010-PSK Method of Measurement for PSK Signal Transmission system*
- STD-010-QAM Method of Measurement for QAM Signal Transmission system*
- STD-011 Pass-through Method for Digital Terrestrial Television Broadcasting signal over Cable Television System*
- STD-012 Head-amplifier for Retransmitting Digital Terrestrial Broadcasting over Cable Television System
- STD-013 Transmission System for MDU
- STD-014 Optical Network and using Equipments for FTTH Cable Television System
- STD-015 Method of Measurement for FTTH Cable Television System
- STD-016 Method of Interference Measurement for Cable Television Signal Transmission System
- STD-017 Examination Facilities equaled with Actual Cable Television Network for Cable Television Signal Transmission System
- STD-018 Optical Network Specification for FTTH Cable Television System

*Regarding STDs for Digital Cable Television
## Transmission Signals Of FTTH or HFC

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Retransmission method over Cable-television system for Terrestrial Broadcasting

1. Pass-through method
   ① Received ISDB-T(OFDM) signals are transmitted through cable without any adjustment (same frequency).
   ② Received ISDB-T(OFDM) signals are transmitted after filtering out individually and adjusting each level.
   ③ Received ISDB-T(OFDM) signals are transmitted after filtering out, converting frequency and adjusting level, changing channel frequency. (Frequency converted pass-through)
   ④ Digital TV sets on the market are available, its most convenient.

2. Trans-modulation method
   ① TS (on terrestrial broadcasting) is transferred on QAM signals over cable-television system without changing of contents, functions, etc.
   ② Only cable television STB is available.

3. Dig-Ana transfer method
   ① Digital audio/video signal is transferred into traditional analog signal (NTSC-VSB-AM) for conventional analog TV sets.
   ② HD video, data service, EPG etc. are not available.
Retransmission method over Cable-television system for Terrestrial Broadcasting

Digital TV receiver available at stores

Pass-through receiving (OFDM)

Digital TV tuner

Conventional analog TV receiver

• Digital TV receiver equips terrestrial OFDM tuner, BS tuner, CS tuner
• STB equips terrestrial OFDM tuner, QAM tuner, and/or Hard disk memory
Pass-through Retransmission Method (JCTEA STD-011)

- **Signal processor**
  - OFDM-SP
- **Cable network**
  - MIX
- **Receiver**
  - Terrestrial digital TV receiver
  - Terrestrial digital tuner
  - Display

**Diagram Details:***
- **UHF (470~770MHz)**
  - Freq. convert
  - IF: Inter. freq.
  - fn: Local occ.
  - Output level ~110dBμV
- **Transmitting into cable after level adjustment**
- **VHF/UHF (90~770MHz)**
  - Freq. convert
  - IF: Inter. freq
  - f1, fn: Local occ.
  - Output level ~110dBμV

**Additional Notes:**
- OFDM-SP
- 6MHz band
- Transmitting into cable after frequency conversion and level adjustment
BER for received signal at receiver terminal:

BER before error correction by Reed Solomon (204,188) : less than $1 \times 10^{-4}$

*Desirable BER is not more than $1 \times 10^{-8}$, meaning that about 3dB margin added to $1 \times 10^{-4}$, because some equipments, example indoor booster etc. will be connected on receiver terminal.

OFDM signal processor (SP) performance is specified on the following items (Example)

1) Quality of OFDM-SP output
   1. Frequency spectral mask : Right upper figure
   2. BER : $1 \times 10^{-4}$
   3. Out-band noise : Right lower figure

2) Rating of OFDM-SP
   1. Amplitude deviation in passing band : $\pm 1$ dB
   2. Group delay deviation in passing band : $\pm 200$ ns
   3. Signal suppression deviation out of band : $\geq 10$ dB
   4. Phase noise of frequency converted carrier : $\leq 0.5^\circ$ rms
   5. Spurious of frequency converted carrier :
      \[-60\text{dB}(\pm 6\text{MHz})\]
Single TS & Multiple TS Multiplexer (JCTEA STD-002)

Fig. 1 Conceptual illustration of single TS multiplexer

Fig. 2 Conceptual illustration of multiple TS multiplexer
Basic Configuration Of Multiple TS Multiplexer

This multiplexer has a function to multiplex streams of various programs including digital television broadcasting, data broadcasting and on-demand audiovisual services using the MPEG-2 transport stream format as a logical format together with service information containing MPEG-2 program specific information (PSI) into multiple transport streams. It may include another function to multiplex NIT suitable for cable TV network and the related information signal for conditional access with the transport stream.

Functional Diagram:

- TS input interface
- Multiplex input interface
- QAM input interface
- QAM output interface

- TS signal
- RF or IF Signal
- NIT/Multi-frame header information

- Scramble encoder
- TS signal
- Test signal
- Related information (EMM/ECM)

- Ks: Encryption Scramble key
- ECM: Entitlement Control Message
- EMM: Entitlement Management Message
- NIT: Network Information Table
- TS signal: Transport Stream (MPEG-2 System)
Basic Configuration Of Single TS Multiplexer

This multiplexer has a function to multiplex streams of various programs including digital television broadcasting, data broadcasting and on-demand audiovisual services using the MPEG-2 transport stream format as a logical format together with service information containing MPEG-2 program specific information (PSI) into a single transport stream. It may include another function to multiplex the related information signal for conditional access with the transport stream.

- **Input signal interface**
- **Multiplex output interface**
- **QAM input interface**
- **QAM output interface**

**Program signal**

**Service information**

**Related information ECM/EMM**

**Test signal**

**Scramble encoder**

**QAM Modulator**

64QAM / 256QAM

**MIX**

- **Ks**: Encryption Scramble key
- **ECM**: Entitlement Control Message
- **EMM**: Entitlement Management Message