ATTACHMENT 4

STATUS OF DIGITAL TELEVISION IN JAPAN

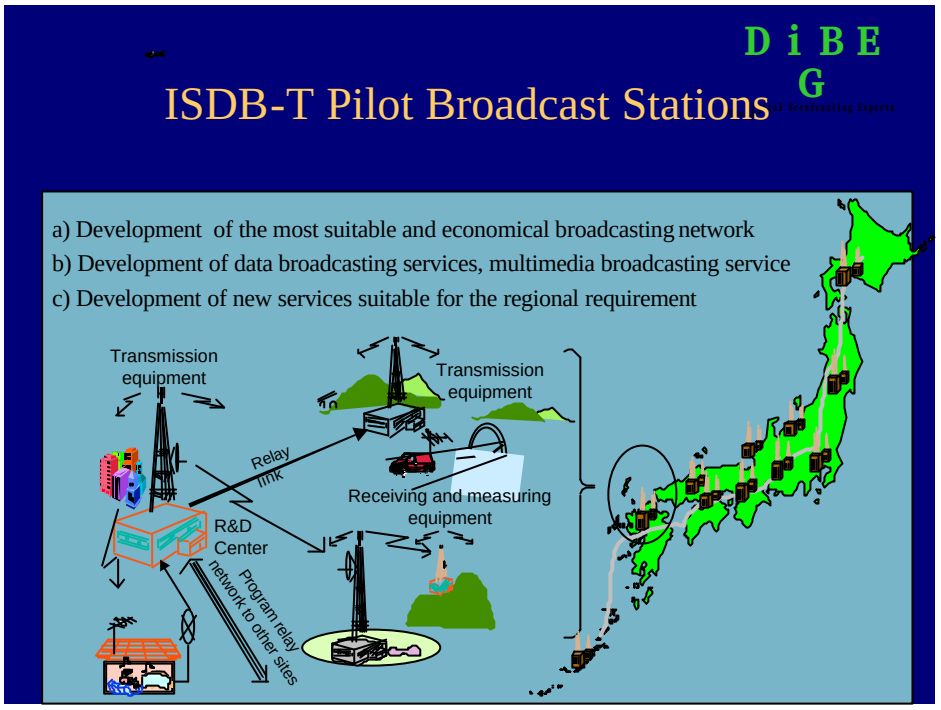
1. Adopted standard

The digital terrestrial broadcasting system has been discussed in Japan by the Telecommunications Technology Council (TTC) of Ministry of Post and Telecommunications – MPT, and detailed technical matters have been left to the Association of Radio Industries and Businesses (ARIB).

Based on the results of field trials, an ISDB-T system was found to offer superior reception characteristics; and consequently, the ISDB-T system was adopted as the Japanese standard for digital terrestrial television broadcasting (DTTB) and digital terrestrial sound broadcasting (DTSB) in 1999.

ISDB (Integrated Services Digital Broadcasting) is an emerging digital broadcasting concept. With ISDB, everything is handled digitally. The three kinds of systems, ISDB-S (Satellite), ISDB-T (Terrestrial) and ISDB-C (Cable) were developed in Japan to provide flexibility, expandability and commonality for the multimedia broadcasting services using each network.

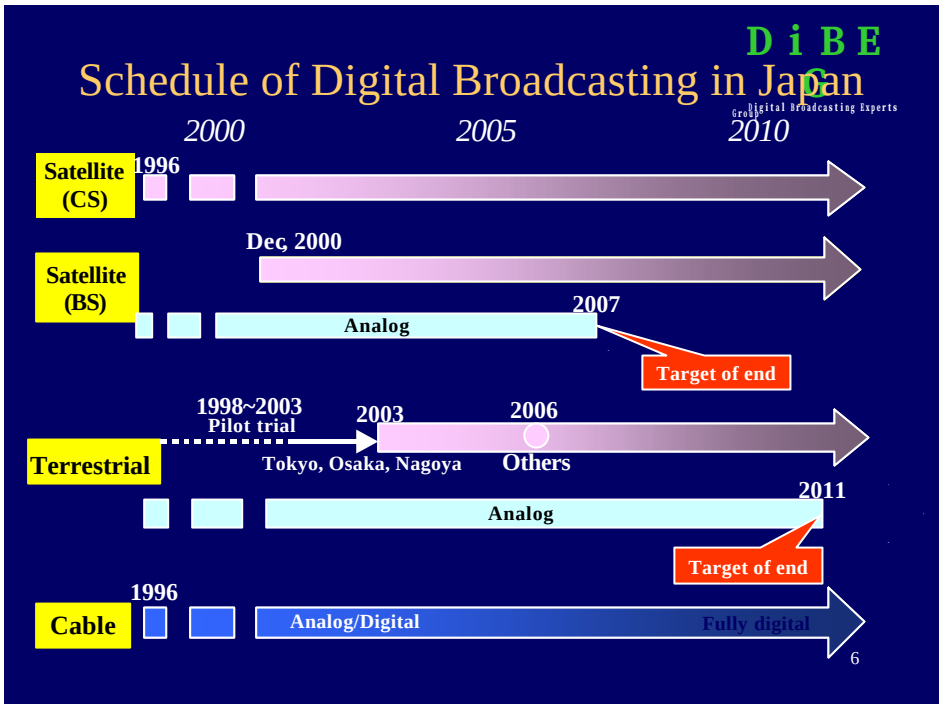
ISDB-T system was developed to provide flexibility, expandability, and commonality for multimedia broadcasting services using terrestrial networks. ISDB-T system adopted the Band Segmented Transmission - Orthogonal Frequency Division Multiplexing (BST-OFDM), which consists of a set of frequency blocks called OFDM segments. ISDB-T can provide services for both stationary and mobile receivers simultaneously, because BST-OFDM uses a set of OFDM segments with different transmission parameters to allow hierarchical transmission. To confirm the feasibility in real broadcast environments, pilot broadcast stations have been set up in 11 major areas of Japan, as shown in the figure below.



The results of the field trials showed the feasibility of ISDB-T system for digital terrestrial television/sound/data broadcasting services.

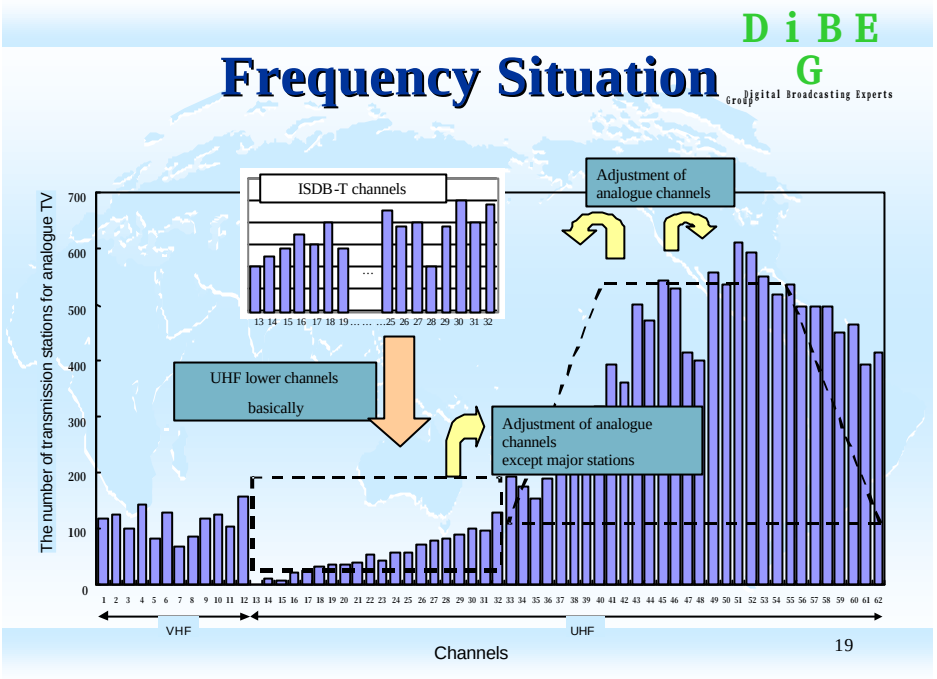
2. Time schedule

Figure shown below presents the time schedule for Digital Broadcasting in Japan.

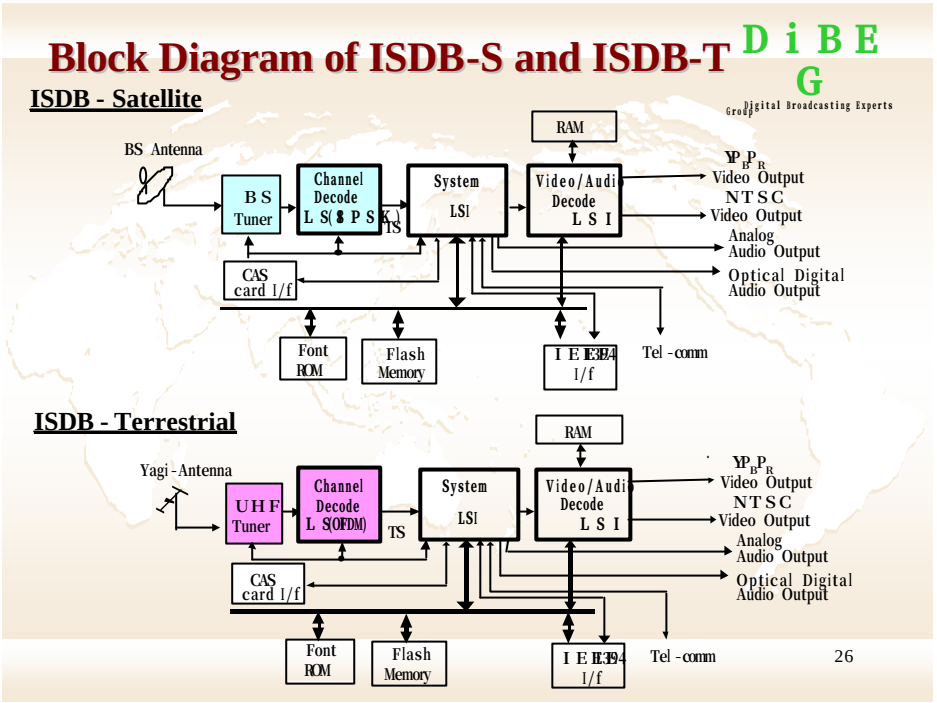


It should be noticed that terrestrial broadcasting is scheduled to be introduced in Japan only in 2003 by the sole reason that there are no available frequencies currently in Japan to be assigned to digital television.

The Japanese Government is undertaking a huge program which will cost around 800 million US dollars to move a quantity of analog television stations to another part of the spectrum in order to free frequencies for digital television.
This situation can be depicted in the figure below.



However is very important to have in mind that although terrestrial television broadcasting is scheduled to be introduced in Japan in 2003, the receivers currently used for ISDB-S (BS) are basically almost the same which will be used for ISDB-T. The only difference is the demodulator chip as it is shown in the figure below.



3. Digital satellite broadcasting

A new digital satellite broadcasting service started in Japan on December 1st, 2000. The technical standard for the transmission system was based on ISDB (Integrated Services Digital Broadcasting), to broadcast "any information accessible at any time" and provide not only video and audio but also new multimedia services by flexibly integrating the information to be broadcast. The system can handle multiple MPEG2-TSs (transport streams) by employing a frame structure. Broadcasters have their own MPEG2-TS in which they can integrate their services independently of each other even when they share a satellite channel. It also provides a large capacity sufficient to transmit two HDTV programs on one satellite channel, robustness against heavy rainfall attenuation, and high operational flexibility. One key feature of the system is hierarchical modulation, in which multiple modulation schemes are applied simultaneously. An information bit rate of 52 Mbps in one satellite channel is obtained by applying TC8PSK (Trellis-Coded eight PSK) and a low C/N reception at 2 dB is achieved by applying BPSK. The new ITU-R Recommendation which describes the ISDB-S transmission system was approved as BO.1408 in 1999.

Japan has assigned 12 channels for DBS (Direct Broadcasting Service) in the 12 GHz BSS (Broadcasting Satellite Service) band. Eight channels were assigned by the WARC-77(BS)P lan and an additional four channels by the WRC-2000 Plan. At present, three analog NTSC channels and one analog MUSE-HDTV channel

are in service. The number of households receiving analog satellite broadcasting, including MUSE-HDTV, is more than 14 million (nearly one third of all households in Japan).
A new digital satellite broadcasting service called BS Digital Broadcasting started on December 1, 2000. Currently, BS digital broadcasting provides various services on four transponders. One of the transponders is used for digital simulcast with analog services; that is, the programs broadcast on the analog channels are digitally coded, multiplexed, and simultaneously broadcast on this channel in order to promote the smooth transition from analog to digital. The other three transponders are used for digital broadcasting, giving a central role to digital HDTV, where each channel is shared by two or more broadcasters. "10 million households in the first one thousand days" is the target penetration rate. The MPT (Ministry of Post and Telecommunications), the broadcasting industry and the electrical appliance industry are all committed to achieving this goal.

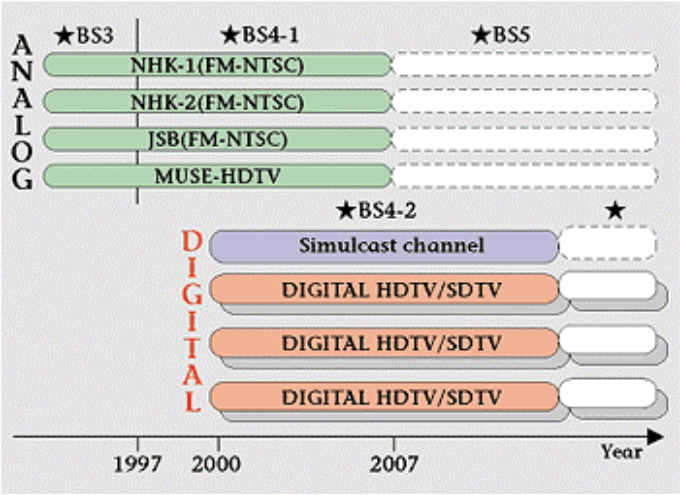


Figure 1: Outline plan for BS digital broadcasting

3.1 Features of the transmission system for BS

The transmission system for BS digital broadcasting is based on ISDB (Integrated Services Digital Broadcasting) and is called satellite ISDB (ISDB-S). ISDB is a new type of broadcasting for multimedia services.
The features of the ISDB-S system are summarized below and listed in Table 1.

Table 1: Summary of system characteristics

Moduclation scheme	TC8PSK/QPSK/BPSK
Raised cosine roll-off factor	0.35(square root)
Transmission symbol rate	28.86 Mbaud
Video coding	MPEG-2
	MP@HL for 1080i,720p
	MP@ML for 480i
	MP@H14 for 480p
Audio coding	MPEG-2 AAC
FEC(Outer code)	Reed-Solomon(204,188)
FEC(Inner code)	Convolutional(constraint length k=7)
Inner code ratio	1/2 for BPSK
	1/2,2/3,3/4,5/6,7/8 for QPSK
	2/3 for TC8PSK
Transport Layer	MPEG-2 systems
Packet size	188 bytes

- **Handling multiple MPEG-TSs**

The system systematically integrates various kinds of digital contents, each of which may include multi-program video from LDTV to HDTV, multi-program audio, graphics, texts, and so on. Most of the digital contents are nowadays encoded in the form of MPEG Transport Stream (MPEG-TS). The system therefore has to cover a wide range of requirements that may differ from one service to another. The system can handle multiple MPEG-TSs (up to eight TSs) to ensure the independence of broadcasters. This may be regarded in terms of the number of logical channels corresponding to that of broadcasters, although the physical satellite channels are limited.

- **Large transmission capacity**

The system employs hierarchical modulation schemes including TC8PSK, QPSK, and BPSK. The maximum information bit rate of about 52 Mbps, which is sufficient for transmitting two HDTV programs, is obtained in one satellite channel

by applying TC8PSK. The occupied bandwidth (99% energy bandwidth) is enlarged to 34.5 MHz compared with 27 MHz of the conventional analog system.

- **High service availability**

The system is robust against rainfall attenuation. For example, BPSK, with a coding rate of 1/2, achieves the required C/N of 2 dB.

- **Operational flexibility**

Multiple modulation schemes can be used simultaneously to meet the requirements of several services integrated on one satellite channel. For example, audio, downloaded data, etc. can be transmitted by BPSK, which is robust against rainfall attenuation, while video data can be transmitted by TC8PSK, which provides the maximum transmission capacity. The information on the modulation scheme is transmitted by a TMCC signal (Transmission and Multiplexing Configuration Control) [2].

4. Background of HDTV

Beginning in October 1997, HDTV programs were generally broadcast from 7:00 am to midnight. This schedule totaled 119 broadcast hours per week.

HDTV test broadcasting began on November 25, 1994. NHK and associated commercial broadcasters were allowed to divide up use of the one channel available from broadcasting satellite BS-3b, with each broadcasting company assigned specific usage days. This enabled the different broadcasting companies to provide HDTV services with greater independence than before.

In August 1997, BSAT-1a, the first new BS-4 satellite, which was launched in place of BS-3b, began operating. HDTV Test Broadcasting is now conducted nationwide via this new broadcasting satellite.

The range of HDTV programs has expanded steadily, and now includes a rich variety of sports, entertainment, drama, culture, and educational presentations. Among the programs broadcast in HDTV and given high marks by viewers are: movies, concerts and opera from Japan and other countries; live broadcasts of musicals and plays; and sumo, baseball, tennis, soccer, American football, and other sports both inside and outside Japan. Among feature programs in 1998, the Nagano Winter Olympic Games broadcast was particularly popular with the viewers. All the events in the Nagano Olympics, Japan's third following Tokyo and Sapporo, were broadcast by NHK through 8 OB Vans and about 100 Hi-Vision cameras. The total broadcast time amounted to 272 hours, including broadcasts of the popular ski jumping, alpine skiing, speed skating and the Nordic combined. In addition, NHK launched a joint production with 3 commercial broadcasters, the first of its kind in sports programming. Characterized by its picture width and high definition as well as its high quality, HDTV gives full play to human performance,

particularly in sports relay broadcasts, and was used for live broadcasts of the FIFA World Cup held in France from June through July 1998.

Coproductions with foreign companies are also a part of the new HDTV programming. Over 10 companies in Europe and the United States are already using HDTV technology, and the Japanese broadcasters are cooperating with additional companies in such areas as dramas, documentaries, music, and sports. This kind of joint production enables overseas broadcasts of high-quality programming, and thus contributes to the internationalization of HDTV.

Currently, by using BS (Broadcasting Satellite), HDTV television programming is broadcasted in Japan by the several broadcasters as follows:

NHK – h	HDTV	24 hs
BS – n	HDTV	24 hs
BS – i	HDTV	24 hs
BS Japan	HDTV	24 hs
BS Fuji	HDTV	24 hs
BS Asahi	HDTV	24 hs
WOWOW	HDTV/SDTV (Pay TV)	24 hs

5. Market size for transmitters, integrated receivers and STB's

5.1 Transmitters for terrestrial broadcasting

The current installed plant of transmitters in Japan comprises around 15000 transmitters, distributed as follows:

> 1kW		220 stations
30W	1kW	1074 stations
0.1W	30W	9359 stations
0.1W		4277 stations

As can be seen on item 2 of this attachment, analog television is scheduled to stop transmissions on 2011. So, it is possible to have an idea of market potential,

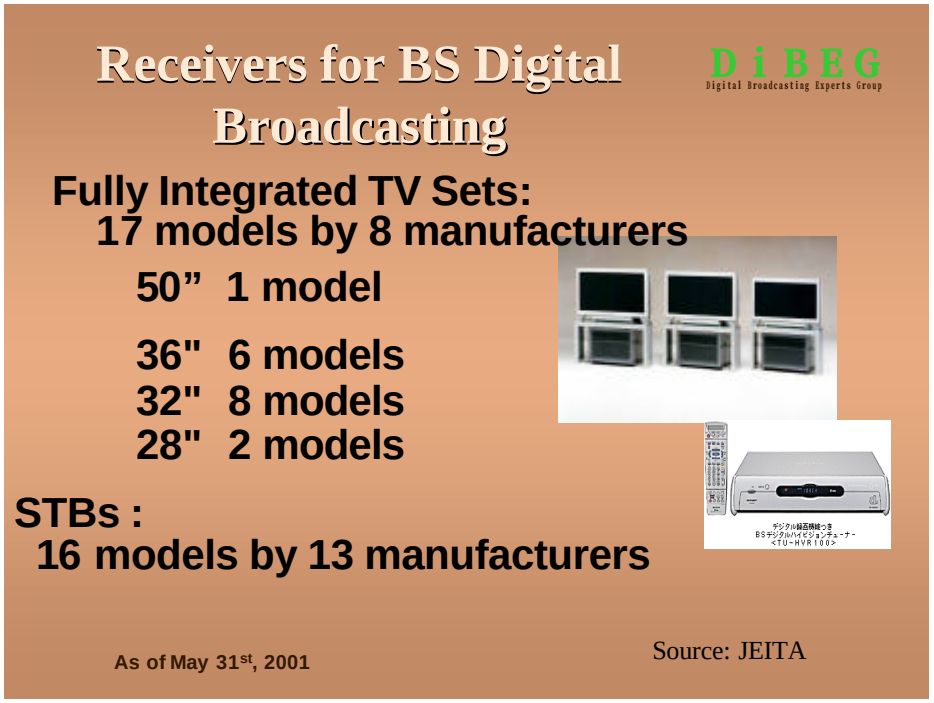
by considering that all those transmitters must be replaced before some three or four years before the scheduled date for stopping analog transmissions.

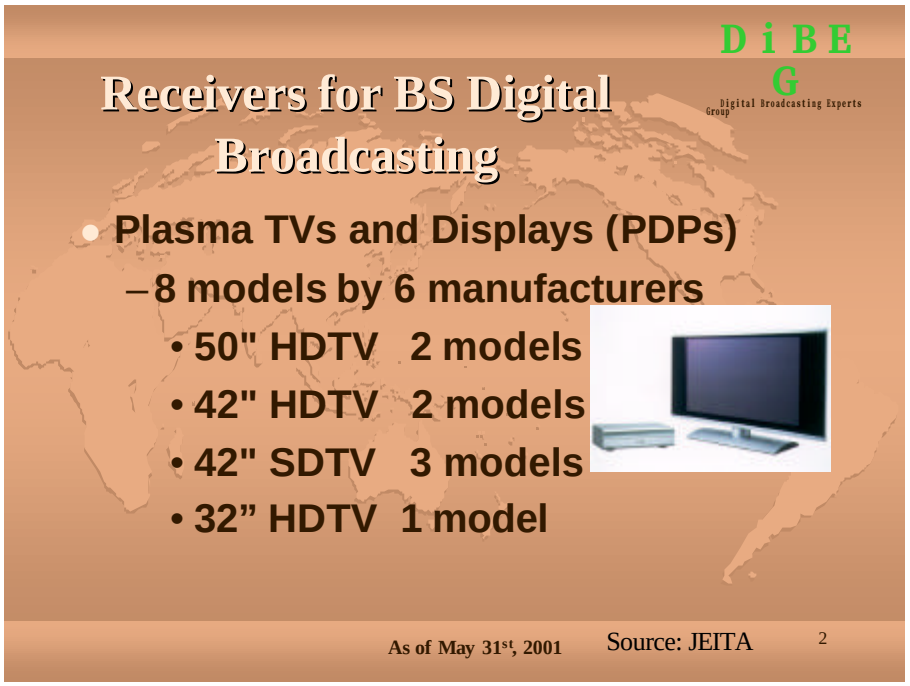
5.2 Receivers and STB's

As for integrated receivers and STB's, Japan became in a very short time (digital television started December, 2000) the biggest market for these products in the world.

As of April 30st, 2001, that is 5 months after lauching of digital television, 605,000 integrated receivers and STB's have been sold in the Japanese market.
This means 6 times more than what has been sold of ATSC receivers and STB's in 2 and half years.
This also means about half of the DVB-T receivers and STB's sales in the same period (2 and half months).

In the 2 following figures the diversity of digital television products on the Japanese market can be seen,

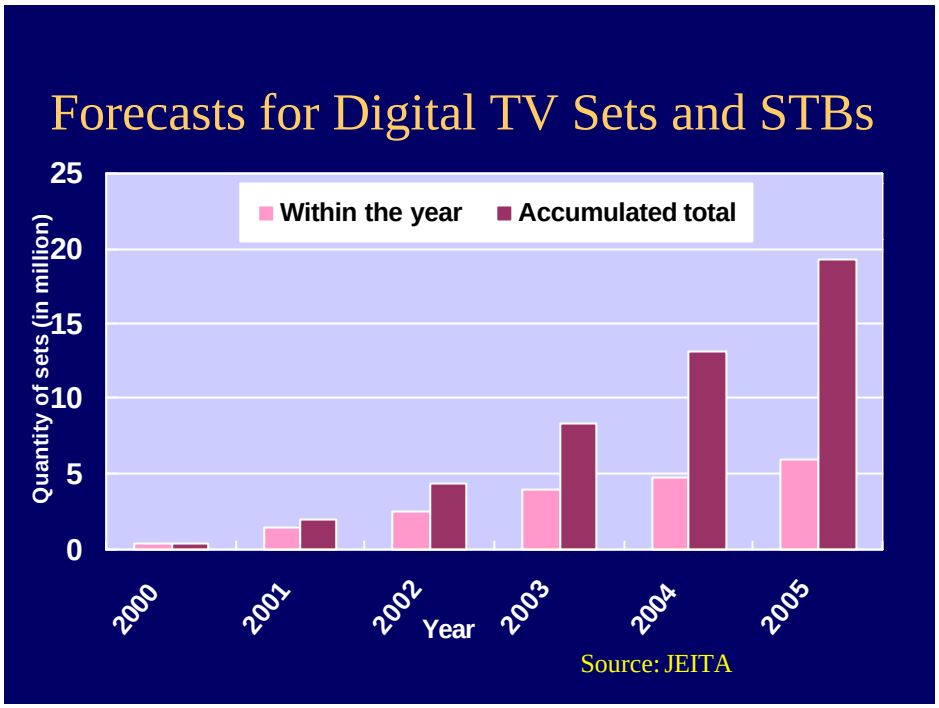




It is very important to notice that the scale of production of the Japanese market will benefit other markets which adopt ISDB-T because as shown on item 2 of this Attachment, receivers for ISDB-S basically differ from receivers for ISDB-T only by the demodulator chip.

From year 2003 receivers and STB’s will be capable of receiving both satellite and terrestrial broadcasting.

Regarding the expectations for receivers and STB’s in Japan, the following figure shows the evolution of the market in a 5 years term.



6. Competition on TV broadcasting in Japan

The broadcasting market in Japan is a fully competitive market. Although one of the players in the market is a Public Company – NHK, which does not get its income from the advertising market, the struggle for audience is one of the toughest in the world.

With the introduction of digital television in Japan, broadcasters are eager to take advantage of the new possibilities digital television can allow.

By adopting ISDB-T, which besides providing the biggest set of features among the international digital television standards, is the most flexible one, the Japanese broadcasters, in order to reach their target public, can build their businesses models in the most flexible way and dynamically change the businesses models according to the circumstances.

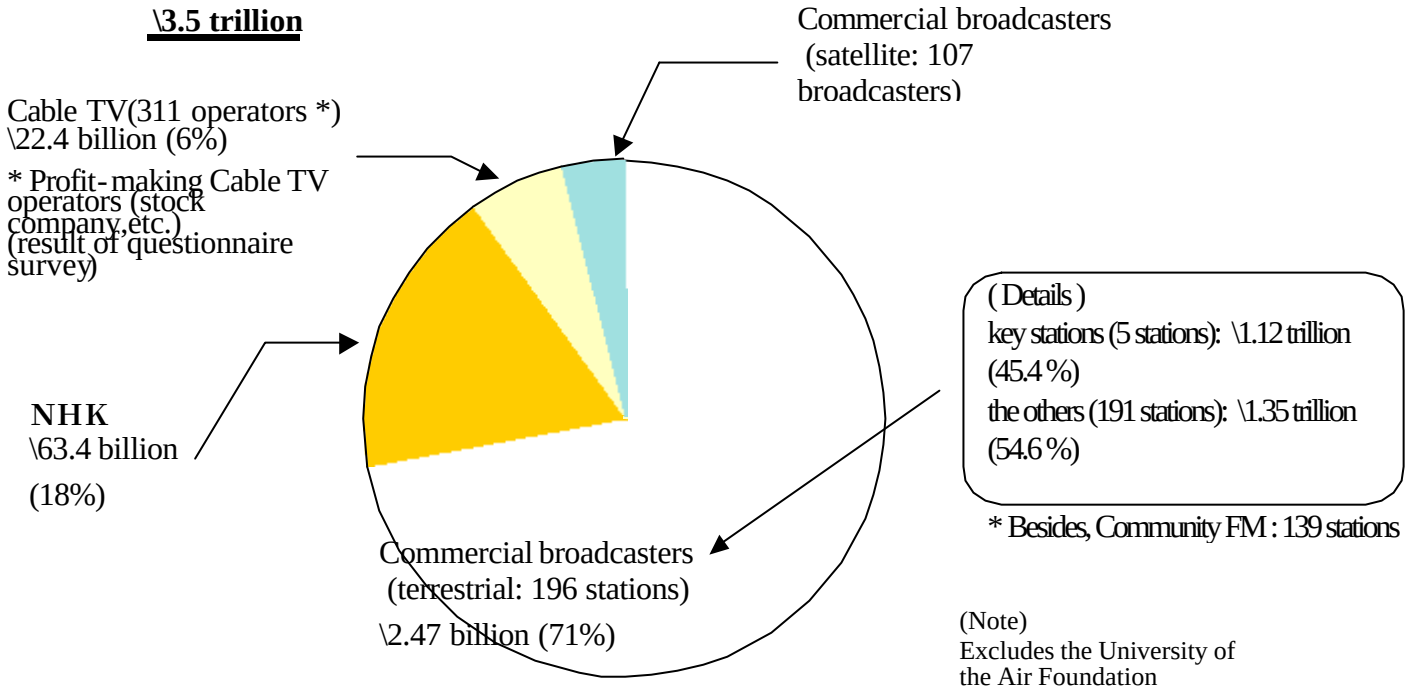
This is one of the remarkable characteristics of ISDB-T. It is not necessary nor recommendable to have a static business model. By using all the potentialities of the system, it is possible to have the most effective solution to comply with broadcasters and consumer needs.

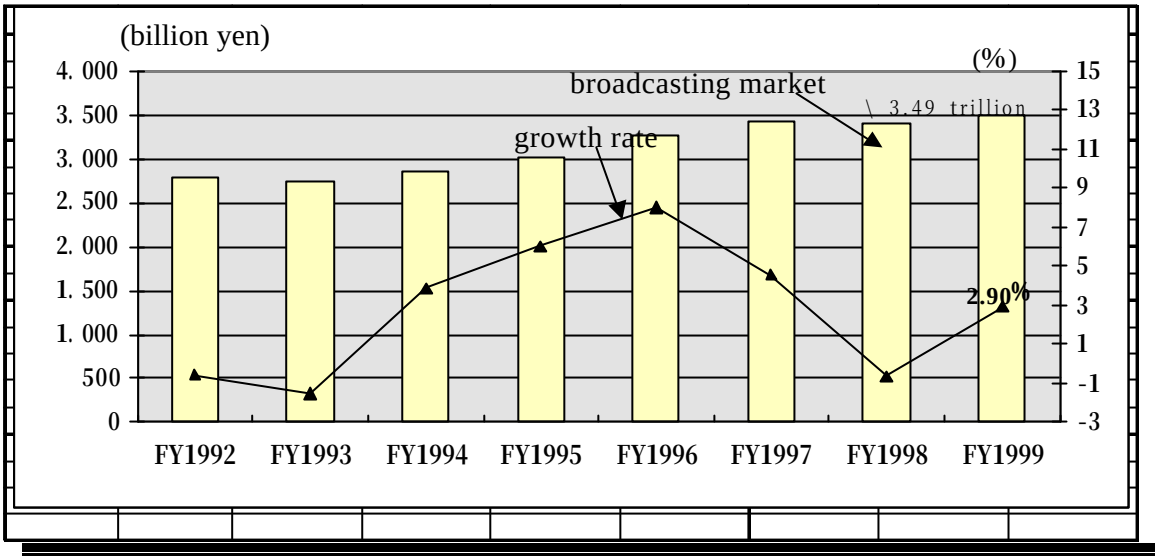
The broadcasting market in Japan can be described as follows:

Broadcasting in Japan is operated by NHK (Nippon Hoso Kyokai), a special juridical person based on receiver's fee, and commercial broadcasters based on advertising revenue. (NHK: since 1950) (commercial broadcasters: AM broadcasting since 1951, TV broadcasting since 1953). The University of the Air Foundation broadcasts for education.(since 1981)

6.1 Outline of broadcasting in Japan

6.1.1 Broadcasting market (Fiscal Year 1999)





6.1.2 NHK - Nippon Hoso Kyokai (Japan Broadcasting Corporation)

Established in 1950 to provide an abundant and high quality broadcast programs to be received all over Japan.

Number of channels: 2 TV channels; 4 radio channels [AM (2), FM (1) and short-wave (1)] ; 3 channels of BS broadcasting (analog 3 channels, digital 3 channels (simulcasting)

Number of subscriptions: 37.28 million households (includes 10.59 million households receiving BS broadcasting) [as the end of February 2001]

Monthly amount of receiver's fee:
color TV (terrestrial service only) contract \1,345
satellite color TV (terrestrial & satellite services) contract \ 2,290

6.1.3 The University of the Air Foundation

Established in 1981 to provide university-level education through broadcasting, etc.

Number of channels: 2 channels of terrestrial broadcasting [TV, radio (FM)]; 2 channels of communications satellite (CS) broadcasting (TV, radio) [started broadcasting January 21, 1998]

6.1.4 Commercial broadcasting

- **Terrestrial broadcasting**

Number of broadcasters: 127 TV broadcasters; 5 TV broadcasters specializing in TV multiplex broadcasting; 234 radio broadcasters [AM (47), FM (49), community FM (139), foreign-language FM (4), short-wave (1)]; 1 VHF broadcaster specializing in teletext multiplex broadcasting (Vehicle Information and Communication System: VICS)
[as the end of March 2001]

Note: 47 AM broadcasters including 36 broadcasters also TV broadcasting

- **Satellite broadcasting**

a. Analog broadcasters via BS: 2 broadcasters (1 TV broadcaster for 1 channel, 1 radio broadcaster for 1 channel)

b. Digital broadcasters via BS: 19 broadcasters (6 HDTV broadcasters for 6 channels, 7 SDTV broadcasters for 19 channels, 10 radio broadcaster for 23 channels, 9 data broadcasters for 9 channels)

c. Digital broadcasters via CS: 117 broadcasters (114 TV broadcasters for 192 channels, 7 radio broadcasters for 105 channels, 1 data broadcaster for 37 channels)
*exclusive of digital broadcasting via 110°E CS

d. Digital broadcasters via 110°E CS: 18 broadcasters (1 HDTV broadcasters for 2 channels, 15 SDTV broadcasters for 61 channels, 1 radio broadcaster for 20 channels, 8 data broadcasters for 10 channels) (Service expected by the end of 2001)
[as the end of March 2001]

6.1.5 Cable TV

Number of operators: 686 operators (those broadcasting original programs)
[as the end of March 2000]

Note: Profit-making Cable TV operators: 311 operators

6.2 Terrestrial broadcasting

Terrestrial broadcasting service is provided nationwide both by TV broadcasting and by radio broadcasting.

For TV broadcasting, in addition to two (2) NHK channels, 33 prefectures (comprising 89% of all Japanese households) are covered by more than four (4) channels of commercial broadcasting.
simultaneously

6.2.1 TV broadcasting (exclusive of the University of the Air Foundation)

8 channels: 6 prefectures
7 channels: 14 prefectures
6 channels: 13 prefectures
5 channels: 9 prefectures
4 channels: 3 prefectures
3 channels: 2 prefectures

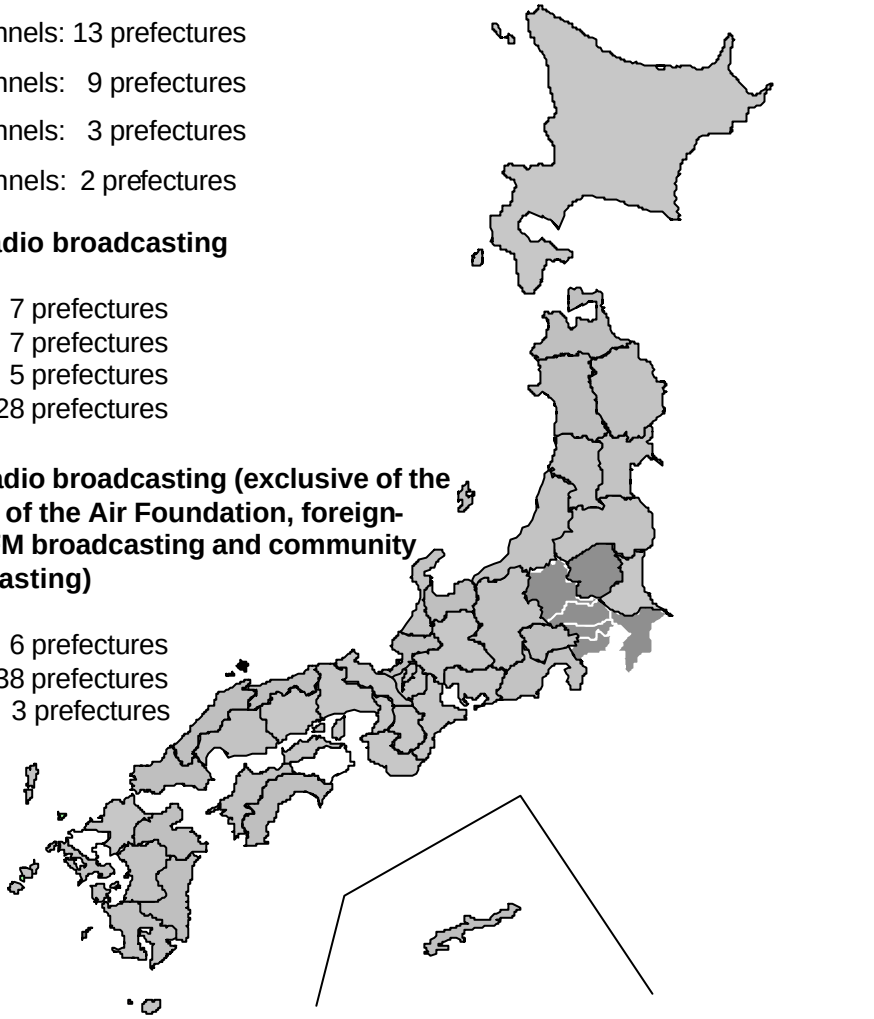
6.2.2 AM radio broadcasting

6 channels: 7 prefectures
5 channels: 7 prefectures
4 channels: 5 prefectures
3 channels: 28 prefectures

6.2.3 FM radio broadcasting (exclusive of the University of the Air Foundation, foreign-language FM broadcasting and community FM broadcasting)

3 channels: 6 prefectures
2 channels: 38 prefectures
l channel : 3 prefectures

［**Number of TV channels available**］



6.2.4 Other Terrestrial Broadcasting Services

- **Community FM Broadcasting**

Community FM stations providing information closely linked to the community have been diffused at a steady rate, with 139 stations in operation as the end of March 2001. Among them, four (4) stations also offer teletext multiplex broadcasting.

- **Foreign-language FM Broadcasting**

Foreign-language FM stations provide services in Tokyo, Nagoya, Osaka and Fukuoka.

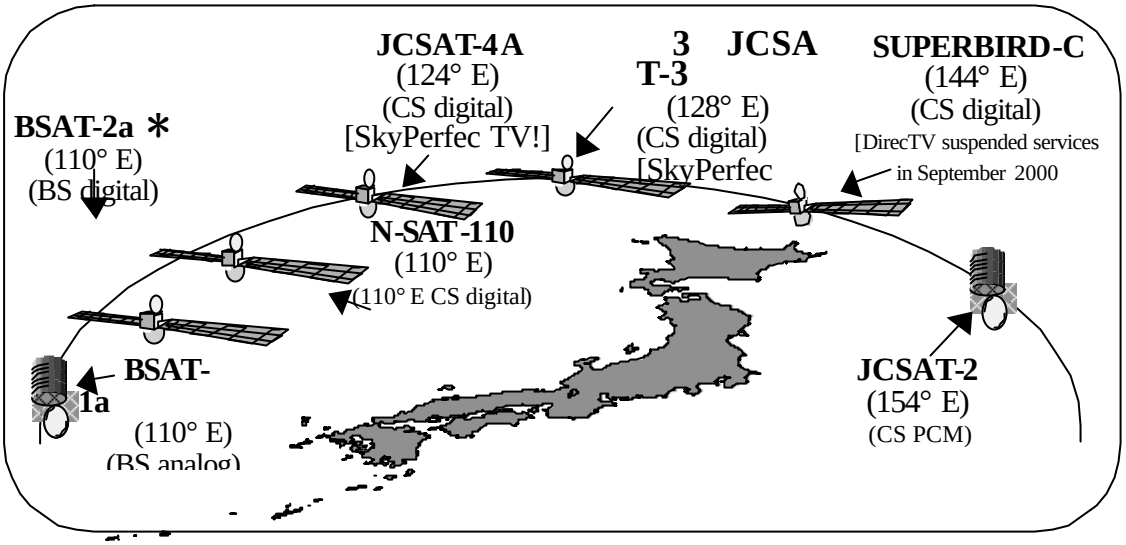
- **Television Data Multiplex Broadcasting**

Interactive television data multiplex broadcasting stations provide Interactive services connected with TV programs, news data to viewer's personal computers and other terminals, with 33 stations in operation as the end of March 2001.

6.3 Satellite Broadcasting

Satellite broadcasting makes use of satellites in geostationary orbit some 36,000 km above the equator, and comes in two forms, both of which are gaining in popularity: broadcasting satellite (BS) broadcasting (BS broadcasting); communications satellite (CS) broadcasting (CS broadcasting).
Digital broadcasting via CS started in June 1996, and Digital broadcasting via BS started in December 2000
Program-Supplying Broadcasters by the 110°E CS were approved in December 2000.

6.3.1 Orbits of Satellites used for Satellite Broadcasting



* BS digital broadcasting is using BSAT-1B (spare satellite)

6.3.2 Dissemination of Satellite Broadcasting

(as the end of February 2001)

[BS analog broadcasting]

- NHK: 10.59 million subscriptions
- WOWOW : 2.64 million subscriptions

[BS digital broadcasting]

- Domestic shipments Tuner: 354 thousand units
  TV set with a built in tuner: 173 thousand units

[CS digital broadcasting]

- About 2.54 million subscriptions

6.3.3 CS Digital Broadcasting

(as of the end of February 2001)

- Sky PerfecTV!: TV 192 channels, radio 105channels, and data 37channels

Notes: 1. Sky PerfecTV! started service in June 1996. (JSkyB was merged in May 1998 with PerfecTV!, and became Sky PerfecTV!.)

2. DIRECTV started service in November 1997, and suspended service in September 2000.

6.3.4 BS Digital Broadcasting

• BS digital broadcasting service started on December 1, 2000.

• Advanced broadcasting services are provided such as high quality television services, various data broadcasting services, etc. by introduction of digital technology.
[program-supplying broadcasters (compiler of broadcast programs) 19 broadcasters]

lassification of broadcast	Broadcasters
HDTV	6
SDTV	7
Radio	10
Data	9

6.3.5 110°E CS Digital Broadcasting

• The Communications Satellite (N-SAT 110) was Started in October 2000 in the same orbit (110°E) as Broadcasting Satellite

• Broadcasting services via 110°E CS satellite is to be received by same parabolic antennas as BS broadcasting.

• 41 companies applied for approval of program-supplying broadcast business, and 18 program-supplying broadcasters were approved in December 2000.

• It is expected to start advanced broadcasting services by introduction of digital technology from the end of 2001.

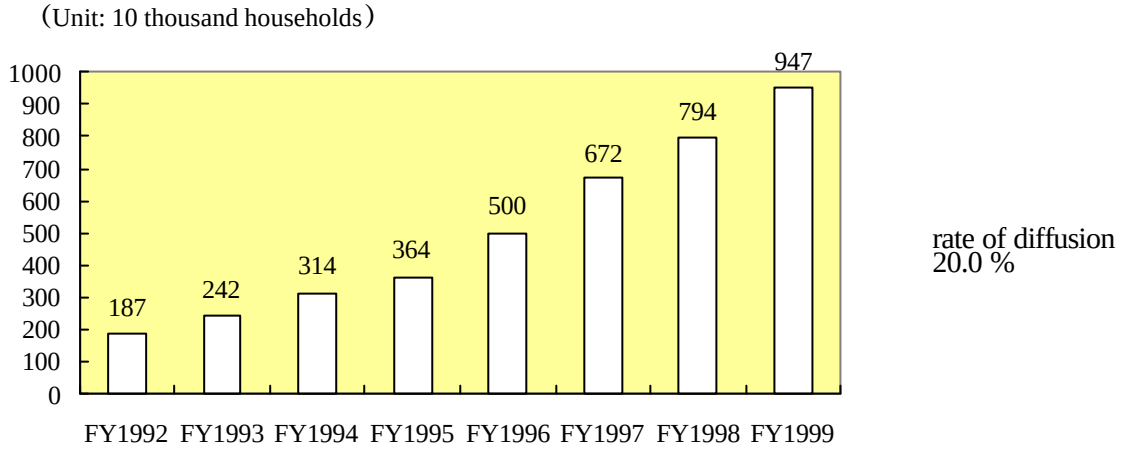
[program-supplying broadcasters (compiler of broadcast programs): 18 broadcasters]

Classification of broadcast	Broadcasters
HDTV	1
SDTV	15
Radio	1
Data	8

6.4 Cable TV

Cable TV (those broadcasting original programs) have been diffused at a steady rate, with 9.47 million households subscriptions at the end of fiscal 1999 (penetration rate 20%).
Cable televisions are gaining channel capacity, and cable TV operators providing telecommunications services is increasing. Cable TV is expected to develop as a regional telecommunications infrastructure.

6.4.1 Cable TV Subscriptions



Cable TV operators (those broadcasting original programming): 686 operators
(as the end of fiscal 1999)

6.4.2 Cable TV Shifting to Full Services

Cable TV operators with Type I telecommunications business license: 226 operators
(as the end of December 2000)
Operators started Internet connectivity: 188 operators

Users of the Internet connection services via Cable TV: 625 thousands