

DTV

「 DTV

」 .

2000 . 12 . 31 .

: ()

: ()

: ()

1. : DTV
 2. : 2000.1.1 2000.12.31
 3. :
 - 4.
- 가.

		1	2	3	4	5	6	7	8	9	10	11	12	
o	ATSC													
	FCC													
o	DTV													
o	DTV													
o														
(%)		25			50			75			100			

- 1) ATSC FCC
 o TV ATSC FCC
 o ITU-R
- 2) DTV
 o
 -
 . : (6 , '00.6.8 9), (6 , '00.6.26 27)
 . : 5Km (20 , '00.4.24 28)
 . : 2 (, '00.6.15 6),
 SG3 (KBS , '00.8.24 25)
 - (93405- 192)
 . : '00.7 (1),
 . : (, ,),
 (,), (,)
 . :
 3) DTV
 o DTV
 -
 -
 - : 가

5.

- 가. DTV
 o (2)
 - DTV
 - ('00.11.20)
 . DTV
 o
 o

- - o (‘00.8.29)
 - o (‘00.11.4))
 - o (‘00.10.31, TV
)
- TV
 - o ‘ , (‘00.10.)
 - o FCC ATSC

6.

가.

- o 가
-
- o

7.

가.

- 1) PC 1
 - 2) 1
 - 3)
- - 1)
 - 2)

8.

가.

- 1)
- 2) TV

2001

,

RF

,

RF

()

.

ABSTRACT

We have implemented the trial service for digital television broadcasting in the frequency bands of 14, 15 and 16 in Korea. We verified performance on service multiplex transport and RF transmission of the systems from the test results we proposed the requirements of technical parameters for digital television broadcasting service.

1	.	.....	1
2	.	DTV	2
1	.	.....	2
2	.	.....	3
3	.	.....	3
4	.	RF	9
3	.	.....	12
1	.	.....	12
2	.	RF	16
4	.	.....	26
1	.	.....	26
2	.	.....	28
5	.	.....	35
1	.	()	35
2	.	RF ()	37
3	.	()	37
6	.	.....	41
		.....	42
	.	.....	43

1 .

가
가
(), ()
, ,
.
, , ,
2002
2000 2001
2002 가
2000 2001 2000 9
DTV
.
(‘00.12)
“(98.1)
36 ““(98.11)
, RF
.
,
RF

2 . DTV

1 .

DTV (19Mbps , 8- VSB) 6MHz
 가 . 가
 (38Mbps , 16- VSB) 6MHz 가 .
 ITU-R TG 11/3 2 1)
 3 .

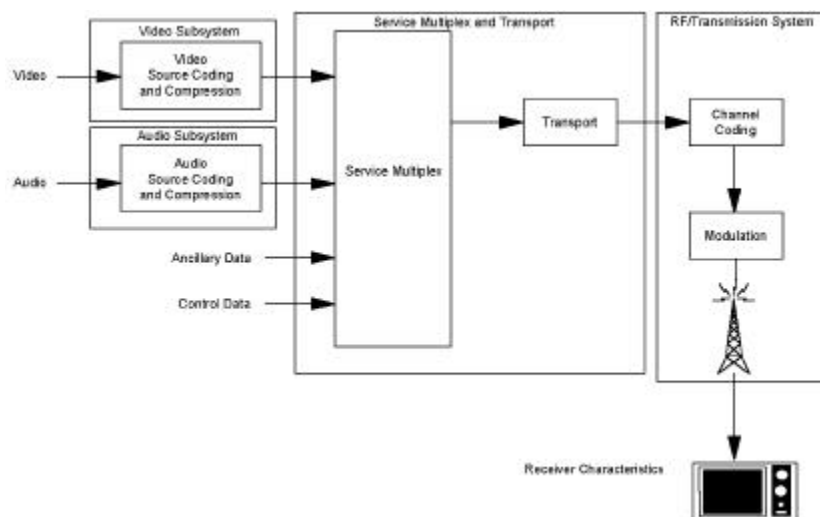
1) (Source coding and compression)

:
 - : 가
 - : 가
 - : , 가
 6MHz
 6MHz
 가 .

2) (Service multiplex and transport)

: , ,

3) RF (RF/Transmission)



2- 1. DTV ITU-R

1) ITU-R Document TG11/3-2, Outline of Work for Task Group 11/3, Digital Terrestrial Television Broadcasting, June 30, 1992.

2 .

MPEG-2 ()
 (HDTV 15Mbps 80Mbps
 가) AC-3 ()
 (5.1 가) .

3

1.

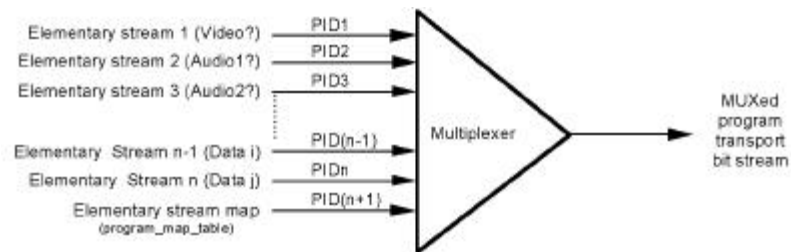
1)

ATSC

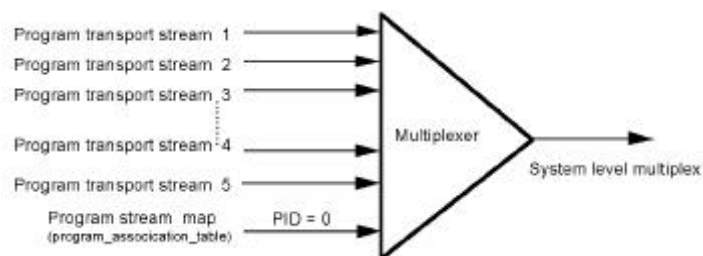
2- 8

ISO/IEC 13818- 1

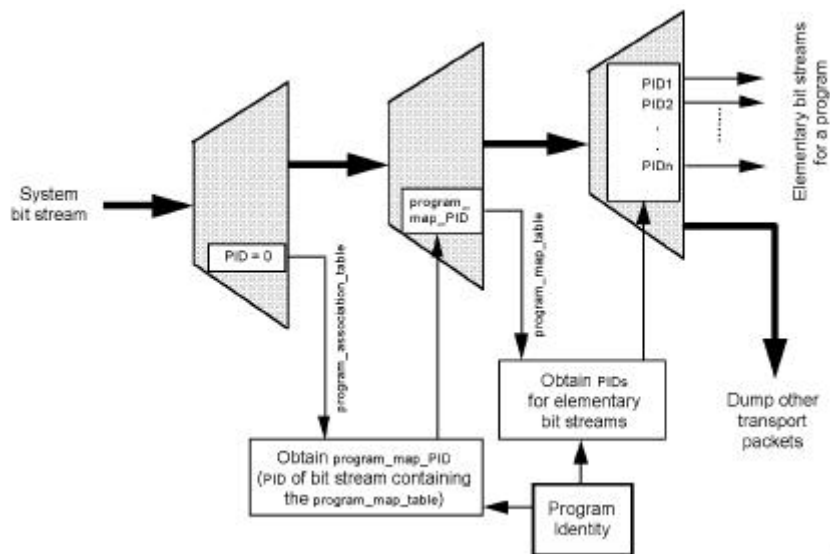
MPEG-2



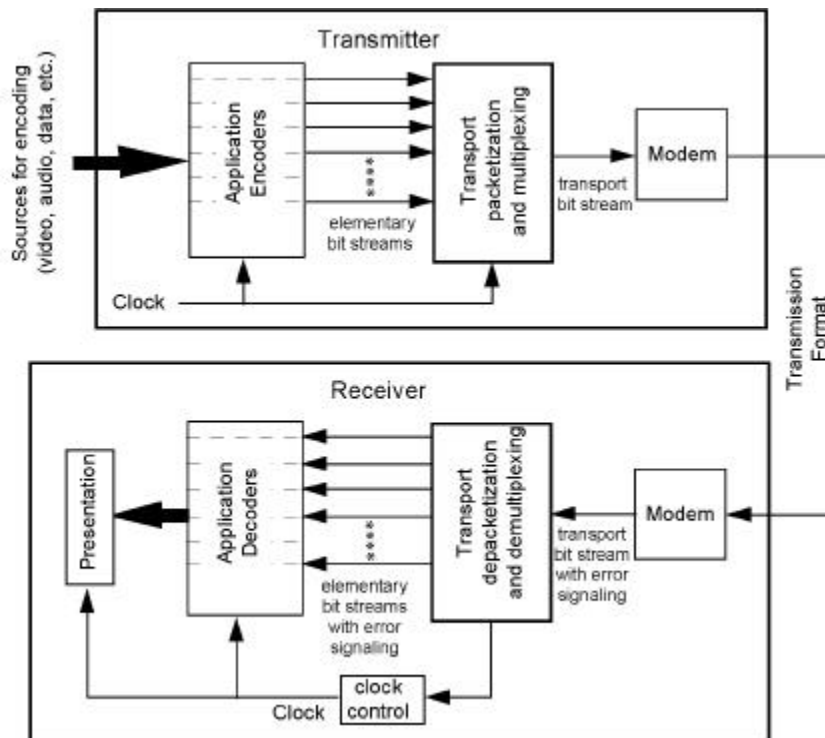
2- 5.



2- 6.



2-7.



2-8.

- o : ,
- o PES : Packetized Elementary Stream
- o : 가
- o PSI() :
- o :

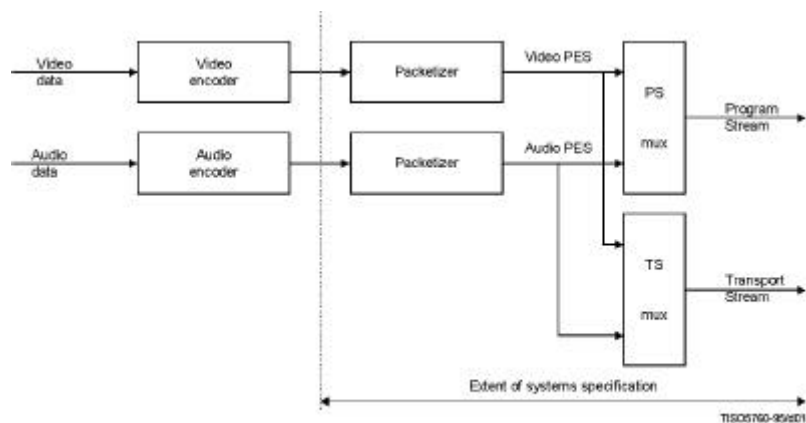


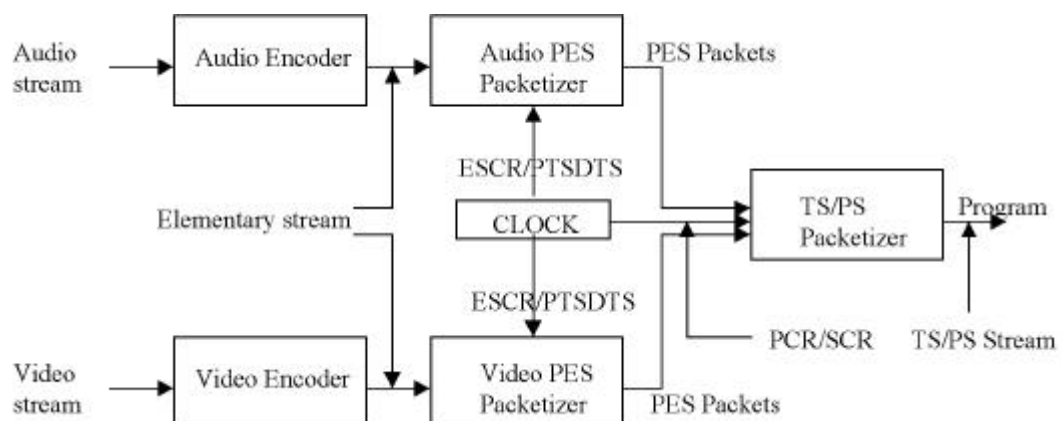
Figure Intro. 1 – Simplified overview the scope of this Recommendation | International Standard

2- 9. (ITU- T H.222.0)

188

“adaptation field”

184



2- 10.

2) (T - STD)

T - STD(Transport Stream System Target Decoder) MPEG

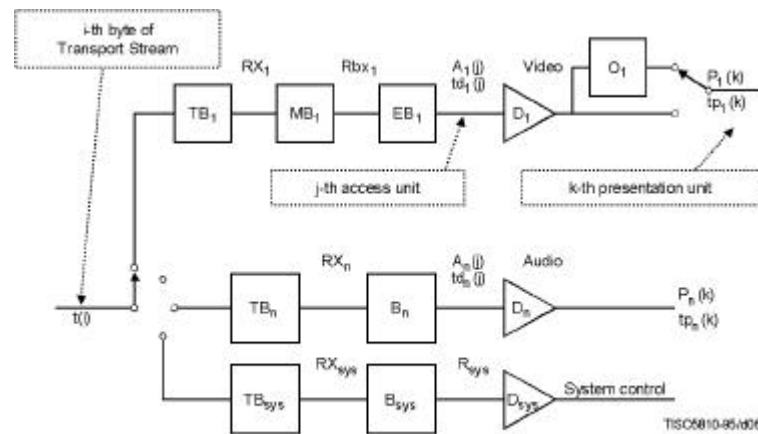


Figure 2-1 – Transport Stream system target decoder notation

2- 11. (ITU-T H.222.0)

i, i', i'' are indices to bytes in the Transport Stream. The first byte has index 0.

j is an index to access units in the elementary streams.

k, k', k'' are indices to presentation units in the elementary streams.

n is an index to the elementary streams.

p is an index to Transport Stream packets in the Transport Stream.

$t(i)$ indicates the time in seconds at which the i -th byte of the Transport Stream enters the system target decoder. The value $t(0)$ is an arbitrary constant.

$PCR(i)$ is the time encoded in the PCR field measured in units of the period of the 27 MHz system clock where i is the byte index of the final byte of the program_clock_reference_base field.

$A_n(j)$ is the j -th access unit in elementary stream n . $A_n(j)$ is indexed in decoding order.

$td_n(j)$ is the decoding time, measured in seconds, in the system target decoder of the j -th access unit in elementary stream n .

$P_n(k)$ is the k -th presentation unit in elementary stream n . $P_n(k)$ results from decoding $A_n(j)$. $P_n(k)$ is indexed in presentation order.

$tp_n(k)$ is the presentation time, measured in seconds, in the system target decoder of the k -th presentation unit in elementary stream n .

t is time measured in seconds.

$F_n(t)$ is the fullness, measured in bytes, of the system target decoder input buffer for elementary stream n at time t .

B_n is the main buffer for elementary stream n . It is present only for audio elementary streams.

R_{es} The video elementary stream rate coded in a sequence header.

PCR PCR

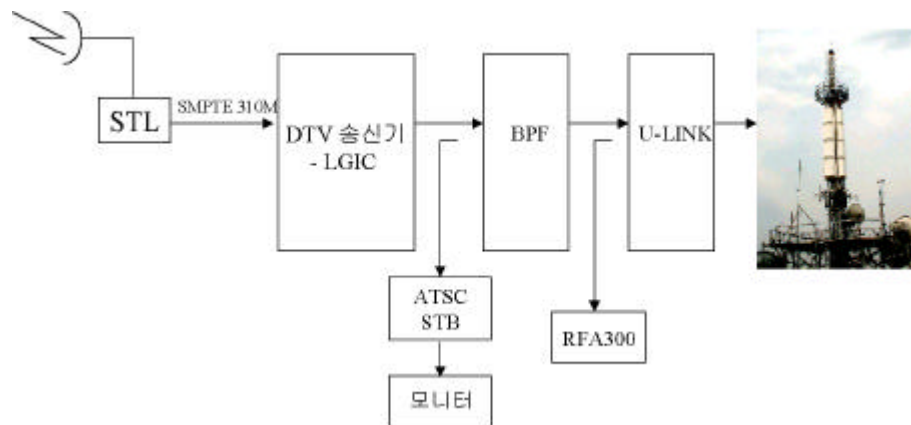
MPEG-2 PCR $\pm 500\text{ns}$
 . PCR
 transport_rate 가 .
 PCR 27MHz
 . PCR MPEG-1 base 33bits
 (extension) 9bits 6bits
 가 48bits (6byte) . PCR
 system_clock_frequency
 sampling_clock_frequency (0.0037nsec) PCR
 0 (0.0037nsec)* (42bits
)=162890.4 .
 DTS STD
 1/300 (=33bits) .
 PTS 가 (presentation)
 1/300 (=33bits) .
 PCR, SCR, ESCR, DTS, PTS
 MPEG-2 .
 ON
 PCR 0.1 , SCR/ESCR/PTS/DTS 0.7 , PSI
 0.7 .

4 RF (RF/Transmission)

1. RF

DTV SMPTE310M 2) , 8-VSB ,
Up-convert, HPA RF

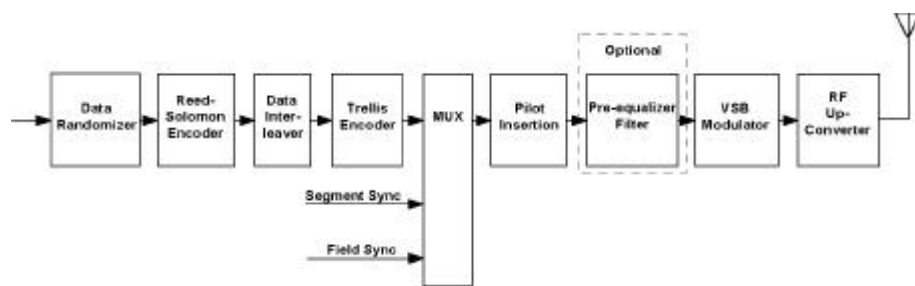
RF



2- 12.

RF

, R-S ,



2- 13. VSB

2) (SMPTE : Society of Motion Picture and Television Engineers)

313
 (data field sync.)
 (training sequence) , 312
 188
 ,
 . 832 4
 ,
 188 MPEG
 828 187
 가 가 (20)
 . 828 3 8
 , 828 x 3 = 2484 가
 , (protected)

$$\frac{187}{207} \times 8 + 20 \text{ RS} = 207$$

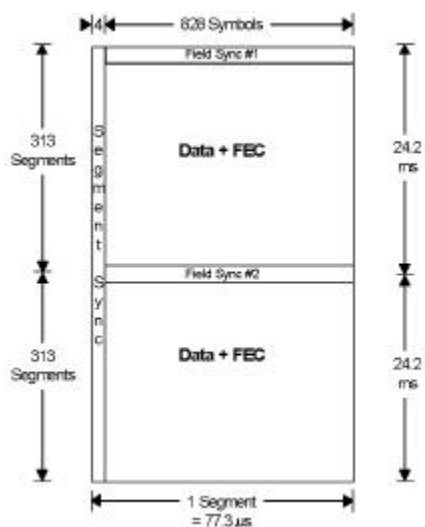
$$\frac{207}{2/3} \times 8 / = 1656$$

$$: 3/2 \times 1656 = 2484$$

(1) :
 $S_r \text{ (MHz)} = 4.5/286 \times 684 = 10.76... \text{ MHz}$

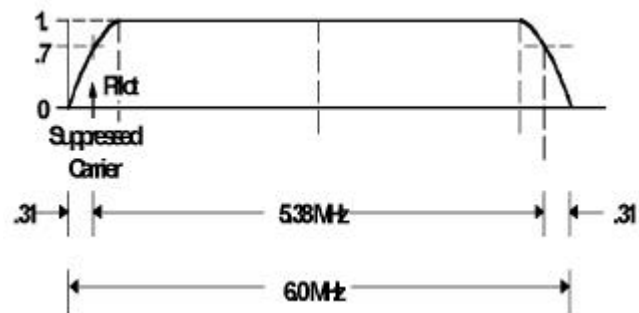
(2) :
 $f_{\text{seg}} = S_r / 832 = 12.94... \times 10^3$ / .

(3) :
 $f_{\text{frame}} = f_{\text{seg}}/626 = 20.66 ...$ / .



8

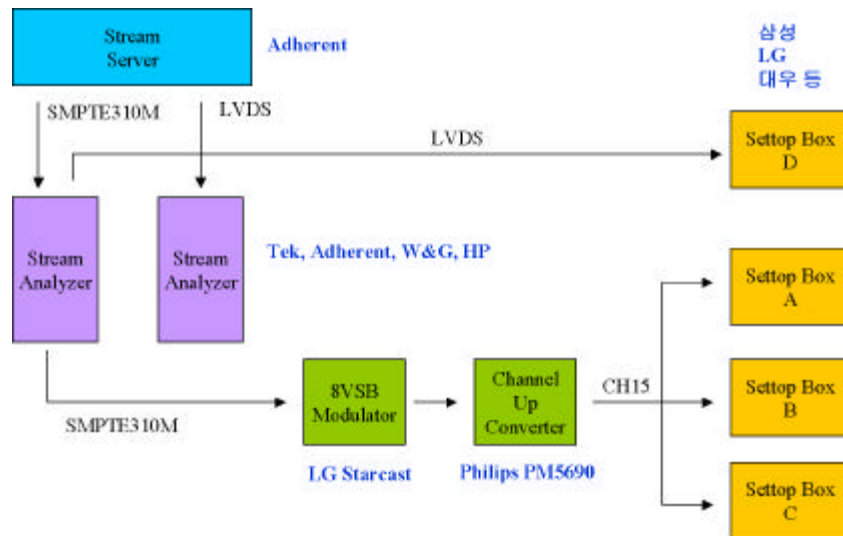
(suppressed-carrier)
 , (lower side band) .
 620 kHz (nominal square root raised cosine)
 가 가 (band edge) ,
 가 , 2- 15
 310 kHz 가
 (payload) 가 .



2- 15. 8- VSB

3 .

1 .



3- 1.

o

- : RF
- : RF ,
- : RF ,
- : RF

- . 1 : 1999.11. 4 11. 5, ETRI, 9
- . 2 : 1999.12.22 12.23, KBS, 9
- . 3 : 2000. 2.17, KBS, 7

3- 1. 1

Stream Parameter	A	B	C	비 고
PSI	OK	OK	OK	모 두 만 족
Timing	PAT : OK PMT : OK PCR : OK(90ms) PTS : 21~48ms PCR(j) : -50 ~50ns	PAT : OK PMT : OK PCR : OK(35ms) PTS : 14~96ms PCR(j) : -156~121ns	PAT : OK PMT : OK PCR : OK(45~70ms) PTS : 10~90ms PCR(j) : -78~99ns	모 두 만 족
T-STD	Video : OK Audio : U/F	Video : OK Audio : O/F	Video : O/F Audio : O/F	Buffer 문 제
PES Syntax	OK	OK	PES-private_data_flag = 1	C Stream 문 제
Settop 정 합	Audio error (Settop A)	OK	Not OK	C Stream 문 제
전 체	* C Stream 문제 발생 * 전반적으로 T-STD model을 위배함			

3-2. 2

Stream Parameter	A	B	C	비고
PSI	OK	OK	OK	모두 만족
Timing	PAT : <102ms PMT : <405ms PCR : OK(90ms) PTS : 꺾임 PCR(j) : -43 ~ 55ms	PAT : <135ms PMT : <400ms PCR : OK(32~33ms) PTS : 꺾임 PCR(j) : -125 ~ 130ms	PAT : <145ms PMT : <145ms PCR : OK(29~34ms) PTS : 꺾임 PCR(j) : -89 ~ 116ms	PAT : 모두 위배 PMT : A만 PCR : OK PTS : A 꺾임 PCR jitter : OK
T-STD	Video : OK Audio : OK	Video : MB(O/F) Audio : O/F	Video : OK Audio : O/F	Video : B 문제 Audio : B,C 문제
PES Syntax	OK	OK	PES-private_data_flag = 1	C Stream 문제
Settop 정합	OK	Not OK	OK	B Stream 문제
전 체	- B Stream 자체의 문제가 발생 - 전반적으로 PAT 주기 및 T-STD model을 위배함			

3-3. 3

Stream Parameter	A	B	C	비고
PSI	OK	OK	OK	모두 만족
Timing	PAT : <76ms PMT : <355ms PCR : OK(90ms) PTS : 33.333ms PCR(j) : -57 ~ 47ms	PAT : <140ms PMT : <400ms PCR : OK(32~33ms) PTS : 33.367ms PCR(j) : -135 ~ 121ms	PAT : <134ms PMT : <134ms PCR : OK(29~34ms) PTS : 33.367ms PCR(j) : -99 ~ 99ms	PAT : B,C 위배 PMT : OK PCR : OK PTS : OK PCR jitter : OK
T-STD	Video : OK Audio : OK	Video : MB(O/F) Audio : O/F	Video : OK Audio : O/F	Video : B 문제 Audio : B,C 문제
PES Syntax	OK	OK	OK	모두 만족
Settop 정합	OK	OK	OK	B Stream 문제
전 체	-- T-STD model을 위배함 -- PAT 주기가 위배됨			

o 2

- 1) : 1999.12.22 23
- 2) : KBS
- 3) : TS

o

- 1) ('99.12.22 14:00 17:30)
- (Adherent) 3 (KBS, MBC, SBS) 30
- 2) : '99.12.23 10:30 15:00
- PCR , PSI
-
- 30MB
PTS/DTS , T-STD
-
T-STD
(PTS/DTS) 가 T-STD
- PSI 가

o

- PSI (PAT/PMT) 가
- 가

o

- Stream-A:
 - 1) AC-3 : 44.1kHz, 512kbps, 3/2
 - 2) PTS/DTS 가 (2 3, 10 가)
- Stream-C:
 - 1) B (picture) PTS/DTS가
 - 2) AC-3 num channels=0xF ()

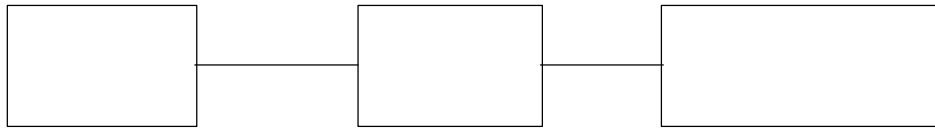
3-4.

			Stream - A	Stream - B	Stream - C
			O	X	O
TS	PSI	1 PMT / program	OK	OK	OK
		data_ _alignment_descri ptor (alignment_type = 0x02)	OK	OK	OK
	PAT	100 ms	102 ms	135 ms	145 ms
	PMT	400 ms	405 ms	400 ms	145 ms
	PCR	not specified, but 100 ms	90 ms	32~33 ms	29~34 ms
	PTS/DTS	video : every access unit	OK (PTS coding)	33.367 ms(OK)	33.367 ms(OK)
	PCR (500 ns)	Adherent	- 25~+25	?	- 80~+110
		MTS215	- 43~+55 ns	- 125 ~ +130 ns	- 89 ~ +116 ns
		WG	20 avg / 39 peak	44 / 102	31 / 70
Buffer	TB/MB	overflow check	OK	MB Overflow	OK Ov(W - G)
	B/EB	Video (underflow/overflow)	OK	OK	OK
		Audio (overflow/underflow)	OK	Overflow	Overflow
PES		PES_scrambling_control=00	OK	OK	OK
		ESCR_flag=0	OK	OK	OK
		ES_rate_flag=0	OK	OK	OK
		PES_CRC_flag=0	OK	OK	OK
		PES_private_data_flag=0			-
		pack_header_field_flag=0	-	-	1
		program_packet_sequence_cou nter_flag=0	-	-	-
		P-STD_buffer_flag=0	-	-	0
		PES_packet_length=0	OK	OK	OK
		data_alignment_indicator=1	OK	OK	OK
		stream_id = 0xBD	OK	OK	OK

Stream generation Adherent S-station, Analysis Adherent S-station MTS215, WG

2 . RF

1.



3- 2. RF

1)

가 . ,
.

2)

(50)
.
2 .
가
.

3)

.
1
가 ,
가 ,
가 .

2.

8- VSB RF
 (Out of Channel Emission), (Peak to Average
 Ratio), (Channel Spectrum)
 (SNR) & (EVM),
 (MER), , & (), &
 (), .
 SNR³⁾ I ()
 (1) Q .

$$SNR = \frac{Power(ideal\ I\ signal)}{Power(ideal\ I\ signal - actual\ I\ signal)} \quad (1)$$

EVM I Q I 가

$$EVM = \frac{RMS(ideal\ signal - actual\ signal)}{S_{max}} \quad (2)$$

RF Pre-correction .

SNR 가

Peak/ Average CW/FM NTSC 0dB 2.2dB
 10dB RF
 가 .

- | | |
|----------------------------|--------------------------|
| 1. Out of Channel Emission | 2. Spurious Radiation |
| 3. SNR / EVM | 4. Phase Noise |
| 5. Group Delay | 6. Frequency Response |
| 7. Amp. Error/Phase Error | 8. Peak to Average Ratio |
| 9. Power | 10. Frequency Tolerances |

1)

o

	(Doc.)	(Doc.)
	1000Hz ¹⁾	± 1000Hz FCC ²⁾

- 1) '98.1) 3 1
- AM : 10Hz
 - FM : 2000Hz
 - (470MHz 10.5GHz) : 100Hz
- 2) FCC('98.10) CFR47 PART73 § 73.1545
- AM : ± 20Hz
 - FM : ± 2000Hz ± 3000Hz

o

	()	(Doc.)	
	± 1ppm ¹⁾	± 3Hz FCC ²⁾	- 5 - 35Hz
		± 3, ± 10, ± 1000Hz AT SC ³⁾	
		± 2.7ppm AT SC ⁴⁾	

- 1) '99 가 ± 1ppm

1,000Hz
ppm() : Part Per Million
) Ch.50(686 692MHz) (f_p : 687.25MHz)
1ppm 687,250,000 / 1,000,000 = 687.25Hz

- 2) FCC('98.10) CFR47 PART73 § 73.622

(g)

(1) (b) "c" 88Km

5.082138MHz

(tolerance) ± 3Hz

(2) (g)(1) 가 ,
32Km

"locking"

가 .

- 3) ATSC Doc. A/64 DTV

4.1.6 (3가)

- Upper Adjacent channel DTV- INTO- NTSC OFFSET
ATTC DTV 가 NTSC chrominance beat
: DTV transmitter's tolerance : ± 3Hz
- Co- channel DTV- TO- DTV OFFSET : DTV transmitter's tolerance : ± 10Hz
- Co- channel NTSC- TO- DTV OFFSET : NTSC transmitter's tolerance : ± 1,000Hz

- 4) ATSC Doc. A/64 DTV

4.1.7

- ± 2.7ppm

4.1.3 Symbol rate tolerance

- f_{ym} f_p : ± 10
- f_{ym} 10,762,237.8Hz
- f_p 19,392,658.5Hz

o

(1)

: ('98.1.31) [1]

39.	39.	Offset (FCC, A/64) - DTV-to-DTV : ± 10Hz - NTSC-to-DTV : ± 1KHz - DTV-into-NTSC : ± 3Hz DTV

(2)

: ('98.1.31) [1]

7. 470MHz ~ 10.5GHz · (1) (2)	1,000Hz(28)	7. 470MHz ~ 10.5GHz · (1) (2)
		1,000Hz(28 , **)
		NTSC-Into-DTV Offset ± 3Hz

28. 1w · 가. 100MHz ~ 470MHz : 5kHz · 470MHz ~ 960MHz : 5kHz		
	** 470MHz ~ 960MHz 3Hz .	

2)

o

	(Doc.)				(Doc.)
	30MHz ~ 235MHz	25W	2.5 μ W 40dB	- 60dB	FCC ²⁾
		25W	1mW 60dB ¹⁾		
	235MHz ~ 960MHz	25W	2.5 μ W 40dB		
		25W	2.0 mW 60dB		

- 1) (*98.1) 5
 - AM : 50mW 40dB (9kHz ~ 30MHz)
 - FM (25W) : 60dB
 1 μ W(30MHz ~ 235MHz) 20mW(235MHz ~ 960MHz)

2) FCC(*98.10) 47CFR PART73 § 73.687 (e)

o

	()	(Doc.)	
	20mW 60dB	- 60dB Doc.A/64 ¹⁾	- 61 ~ - 60(dB) ²⁾

1) ATSC Doc. A/64 DTV

4.

4.1 8-VSB ()

4.1.1

2) 3 가 2 ,
 가 20mW 가

o

()

	(kW)	(dBm)	60dB	(dBm)
TV ()	30	85	316mW	25
" ()	20	73	20mW	13
" ()	10	70	10mW	10
TV ()	1	60	1mW	0
TV ()	0.1(100W)	50	0.1mW (100uW)	- 10
TV ()	0.01(10W)	40	0.01mW (10uW)	- 20

60dB

가

가

.

o

(WRC- 2000)

(RR) S3

,

.

o

30 235MHz	25W	60dB, 1m W		2003.1.1 (, 2012.1.1)
	25W	40dB, 25 μ W		
235 960MHz	25W	60dB, 20m W		
	25W	40dB, 25 μ W		
VHF TV		46+10log (P) 60dBc	1mW	2003.1.1 (, 2012.1.1)
UHF TV			12mW	

UHF

가 60dB

20mW

가 가 ,

가 가 WRC- 2000

.

60dBc 12mW(UHF)

가 가

.

3)

o

	(Doc.)	(Doc.)
	80 110% ¹⁾	80 110% FCC ²⁾
	가	가

- 1) ('98.1) 16
- AM : 90 105%
- FM : 80 110%()
- 2) FCC('98.10) CFR47 PART73 § 73.1545
- AM : 90 105%
- FM : 80 105%
- FM

o

	()	(Doc.)	
	± 5%	± 5% (Doc.A/ 64) ¹⁾	

- 1) ATSC Doc. A/64 DTV
- 4.1.5
- NTSC 가 80 110%(-0.97dB 04 1dB)
- DTV (0.97dB) (14.9dB)
- DTV 0.97dB = 5%

o

FCC(§ 73.664)

-
- ± 5%

6) /EVM

o /EVM

	()	(Doc.)	
S/N	27dB		32 36(dB)
EVM		4% ¹⁾ (Doc.A/64) ²⁾	1.7 2.6(%) (EQ : off)

1) Tektronix (IEEE) , S/N EVM
 $S/N \approx 39.3 - 20 \log [EVM(\%)] \text{ dB}$. EVM 4%
 S/N 27 , EVM 2% S/N 33dB .

2) ATSC Doc. A/64 DTV

4.

4.1 8-VSB ()

4.1.2 (In-band)

- (EVM) -27dB .

o

, . on
 off ()
 S/N . S/N
 EVM (off) .

o FCC('98.10) CFR47 PART73 § 73.623

(c)

S/N가 28dB

S/N

28dB

o SNR⁴⁾

I

Q

$$SNR = \frac{\text{Power}(\text{ideal I signal})}{\text{Power}(\text{ideal I signal} - \text{actual I signal})}$$

EVM I Q

I 가

$$EVM = \frac{RMS(\text{ideal signal} - \text{actual signal})}{S_{\max}}$$

4) Tektronix

: Signal to Noise Relationships In 8-VSB

7) (,)

o (,)

	()	(Doc.)	
1)	$\pm 0.5\text{dB}$		0.17 0.25(dB)
	$\pm 50\text{ns}$		18 48(ns)

1)

RF

Pre-correction

8) /

o /

	()	(Doc.)	
1)			0.24 0.29(dB)
			1.6 2.4(deg)

1)

SNR

가

9) Peak/ Average

o

	()	(Doc.)	
Peak/ Ave.		6.3dB(99.9%) (Doc.A/54) 1)	5.9 6(dB)

1) ATSC Doc. A/54 DTV

9. RF/

o CW/FM, NTSC

8- VSB/COFDM

가

(dummy load)

	CW/FM	NTSC	8- VSB/COFDM
Peak/ Average rate(dB)	0	2.2	10

Bird

4 . DTV

1 .

1. FCC

FCC () (47 CFR Part 73)

.
DTV (73.622) DTV ,
, DTV , DTV
(: (HAAT)가 550m ERP_{MAX} 400kW)
, TV (73.682) (6MHz), ((ATSC Doc.
A/52, 53, 54) , (73.614)
,
(73.635), (73.664), (73.685)
. TV (73.687) TV
가 1kHz 가 60dB .
(73.1560) AM 90 105%, FM
90 105%, TV () 80 110% .
Dolby AC-3
, ISO/IEC MPEG-2 ISO/IEC MPEG-2
.
o A/52 : ATSC
DTV o A/53 : ATSC
(FCC)
o A/54 : ATSC ()
· A :
· B :
· C :
· D : RF
· E :

	ATSC	Doc.
A/64		.
-		
-	NTSC	DTV
-	DTV	DTV
-		
-		
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2. ATSC

73.682

- (d) ATSC Doc. A/52, A/53
- ATSC Doc. A/54 가 .
- ATSC Doc. A/64 (, '97.11) A/52
- A/53 RF
- ,
- ATSC ('00.10.18) .
- o ATSC Doc. A/49('93. 5.13) : NTSC
 - o ATSC Doc. A/52('95.12.20) : (AC-3)
 - o ATSC Doc. A/53('95. 9.16) : ATSC DTV - No. 1 ('00.5.16)
 - o ATSC Doc. A/54('95.10. 4) : ATSC DTV
 - o ATSC Doc. A/57('96. 8.30) : Program/Episode/Version Identification Readers of A/57 ()
 - o ATSC Doc. A/63('97. 3. 2) : 25/50Hz
 - o ATSC Doc. A/64 - Revision A('00.5.30) : DTV
 - o ATSC Doc. A/65 - Revision A and Amendment No. 1('00.5.31) : PSIP
 - o ATSC Doc. A/70('99.7.17) : CAS ('00.5.31)
 - o ATSC Doc. A/80('99.7.17) : DTV
 - o ATSC Doc. A/90('00.7.26) :

Doc.IS- 151('99.11.18) : ATSC Group)

DIWG(Data Implementation Working Group) DTV
 - o ATSC Doc. A/58('96.9.16) : ATSC DTV DVB SI

2 .

1.

(‘98.1.31)

(‘85.1.26)		가 (‘98.12.19)
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()	(‘82.12.31)	(‘98.3)
()	,	(‘96.12.10)

4- 1.

(‘00.1)	
(‘98.11.5)	가)

()	(‘82.12.31)	(‘98.3)
()	,	(‘96.12.10)

() (‘98.11)

4- 2.

2.

4- 1.

		(‘98.1.31,)
1	2	3 () 4 () 5 ()
	5	8 () 9 () 10 ()
2	1	14 () 15 () 16 ()
	2	20 ()
	3	22 ()
4	2	35 () 36 () 37 () 38 () 39 () 40 ()

:

4-2.

		('00.11 ,)
1		1 . () 2 . () 3 . ()
		4 . () 5 . () 6 . () 7 . () 8 . () 9 . () 10 . () 11 . () 12 . () 13 . () 14 . () 15 . ()
3	1	16 . ()
	2	17 . () 18 . () 19 . ()
	3	20 . ()
4		21 . () 22 . () 23 . () 24 . () 25 . () 26 . ()
5		27 . () 28 . () 29 . ()

3. ()

4-3. DTV

(‘98.1)	.5, (‘98.11)	1 () 2 () 3 () 4 () 5 () 6 () 7 () <hr/> MPEG-2 ISO/IEC 13818-1 8 () 9 () 10 ()
(‘98.11)	() (‘98.11,)	o DTV - ISO/IEC IS 13818-1, International Standard (1994), <i>MPEG-2 Systems</i> . - ISO/IEC IS 13818-2, International Standard (1994), <i>MPEG-2 Video</i> . - ATSC Document A/52, <i>Digital Audio Compression (A C-3) Standard</i> , 20 Dec 95 - ATSC Document A/53, <i>ATSC Digital Television Standard with Amendment No. 1</i> (16 Mar 00), 16 Sep 95

1) (‘97.5.24)

1997-29 29 , 28 2

14 2

“ ” , 가 ,

(“ ”

) “ ” (“ ”

) 가

“ 가 ” ,

가

“ ”

1 , 2 , 3 ,

4 , 5

2)

4-4.

35 3	, (‘96. 12. 10)	: 1)		가
9 3	(‘82. 12. 31)	: 2)		"

1) , 16 [2]

4.

1			
1- 1		39	
1- 2		3 , 36	-
1- 3		16	
1- 4		5	
1- 5		74	
2			-
2- 1		36 , 40	
3		46	
4	TV ,	130	
5	TV	1995- 102	
		1996- 100	

2) 4. ()

1.	5mV/cm - 10V/cm (10MAGNIFIER) : 5μs/cm - 0.5μs/cm : DC-50MHz	
2.	: CH1 - CH13 TV Sweep Signal : : 75 ohm MARKER : 가 EXT	
3. Pattern Generator	: , (N.T.S.C), (5, 10 Step가) Bar Subcarrier On- Off 가 : 1Vpp (75 ohm) A P L : 0 - 90% 가	
4. N.T.S.C Vector Scope	: DC DP Vector 가 : 75 ohm : ± 15 : ± 10% : Vector ± 2.5	.
5.	: : 20 - 120dB	

3)

"

, ('96.12.10,)"

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4-5.

o	- - - - -
o	-
o	
o TV	
o TV	

4)

(6MHz)

■

(6MHz)

■

RF

(transmission)

(multiplex and

transport)

•

4-6. TV

o	- - - - -	
o	- - -	: - ISO/IEC 13818- 1, - ATSC A.53

5) DTV

		FCC
ATSC	, RF	DTV

4-7. RF	DTV	()
1. 8-VSB (RFA300)	o 가 - () - S/N (EVM) - / - - -	
2.	o - : 2.5kW - : 5%	
3.	o - : 20 120dB	가
4.	o 가 - : 1/2	

4-8.		
1.	o	
2.	o (:)	: -ISO/IEC 13818- 1, -ATSC A.53

5 .

1 . ()

(, ,)

(電波)가 (傳播) .

가

(6MHz) . , , TS/PES

, , .

1) ISO/IEC ATSC

5- 1.

Timing	PAT	100 ms	'95, A/53 Annex C P.38
	PMT	400 ms	'95, A/53 Annex C P.38
	PCR	100 ms (or SCR 700ms)	'96, ISO/IEC 13818- 1 Annex D (not form)
	PCR	± 500ns	'96, ISO/IEC 13818- 1 P.12
	Multiplex Jitter	4 ms	'96, ISO/IEC 13818- 1 Annex D (not form)
	PTS/DTS	video : every access unit	'95, A/53 Annex C P.39
TS Syntax	PSI	1 PMT / program	'95, A/53 Annex C
		data_ _alignment_descriptor (alignment_type = 0x02)	
Buffer status	TB/MB	overflow check	'95, A/53 Annex C and '96, ISO/IEC 13818- 1 (2.4.2.3 Buffering)
	B/EB	Video (underflow/overflow)	
		Audio (overflow/underflow)	
PES syntax		PES_scrambling_control=00	'95, A/53 Annex C ()
		ESCR_flag=0	
		ES_rate_flag=0	
		PES_CRC_flag=0	
		PES_private_data_flag=0	
		pack_header_field_flag=0	
		program_packet_sequence_count er_flag=0	
		P-STD_buffer_flag=0	
		PES_packet_length=0	
		data_alignment_indicator=1	
		stream_id = 0xBD	

- PSI : Program Specific Information (4)
 - 1) Program Association Table (PAT), 2) TS Program Map Table (PMT)
 - 3) Network Information Table (NIT), 4) Conditional Access Table (CAT)
- PSIP : Program and System Information Protocol
- PCR : Program Clock Reference
- DTS : Decoding Time Stamp (PTS : Presentation Time Stamp)
- PES : Packetized Elementary Stream
- TS : Transport Stream
- TB_n is the transport buffer for elementary stream n.
- MB_n is the multiplexing buffer, for elementary stream n. It is present only for video elementary streams.
- B_n is the main buffer for elementary stream n. It is present only for audio elementary streams.
- EB_n is the elementary stream buffer for elementary stream n. It is present only for video elementary streams.

2) ATSC (PSIP STD Model)⁵⁾

EIT , ETT PSIP
 PID PSIP
 , EIT - 0 500ms .

5- 2. STT , MGT , VCT , RRT

	STT	MGT	VCT	RRT
Cycle time (ms)	1000	150	400	60000

5- 3. PSIP Packet Stream

PID	base_PID	EIT_PID	ETT_PID	
Rate (bps)	250,000	250,000	250,000	

- STD : System Target Decoder,
- ETT : Extended Text Table,
- STT : System Time Table,
- VCT : Virtual Channel Table,
- EIT : Event Information Table
- PID : Packet Identifier
- MGT : Master Guide Table
- RRT : Rating Region Table

5) Program and System Information Protocol for Terrestrial Broadcast and Cable (ATSC A/65 Doc. '99.12.17)

2 . RF ()

RF
RF (SG1)

(FCC) (ATSC)

5-4. RF

			()	()	
(98.1)	(Offset)	DTV-to-DTV:±10Hz - ATSC Doc.A/64 NTSC-to-DTV:±1KHz - ATSC Doc.A/64 DTV-into-NTSC - CFR § 73.622 : ±3Hz	± 1ppm		- 5 - 35Hz
		F sym ± 2.79ppm - ATSC Doc.A/64	-	F sym ± 2.79ppm	-
		6MHz - CFR § 73.682	6MHz	6MHz	-
		- 60dB - CFR § 73.687	20mW 60dB	12mW 60dB	-61 -60 (dB)
		± 5% - ATSC Doc.A/64	± 5%	± 5%	
		- 47 @ ± 3.5MHz - 110 @ ± 9MHz - CFR § 73.622 ()	- 47 @ ± 3.5MHz - 110 @ ± 9MHz		-51@±35MHz -110@±9MHz
(EVM)		27dB - ATSC Doc.A/64 (4%)	27dB	27dB	32 36 (dB) 1.7 2.6 (%) (EQ : off)
		- 104dBc/Hz @20kHz - ATSC Doc.A/64	- 104dB @20kHz z	- 104dB @20kHz	- 106 - 124 (dB)
Peak/Average		6.3dB (99.9%) - ATSC Doc.A/54	-	6.3dB (99.9%)	5.9 6 (dB)
		- - -	± 0.5dB	-	0.17 0.25 (dB)
		- - -	± 50ns	-	18 48 (ns)
		- - -		-	0.24 0.29 (dB)
		- - -		-	1.6 2.4 (deg)

: ITU-R 6)

6)
o“ ”

o“ ”

3 . ()

1. DTV

1)

5-5. TV

		(FCC)	ITU - R
	4 · 10m	9m	10m

5-6. TV

	()	(FCC)	ITU - R
	9m	9m	10m

5-7.

: dBuV/m

					(FCC)			
	TV ()	TV			TV	TV		
						Grade A	Grade B	
Ch. 2 6	28	54	68	74	28	68	47	74
Ch. 7 13	36				36	71	56	77
Ch. 14 69	41	70			41-EQN	74	64	80

DTV FCC EQN $20\log[615/$

) . EQN

2)

5- 8.

		(dBuV/m)	(dBuV)
TV	VHF	54()	54
	UHF	70	70
TV	VHF	36	36
	UHF	41	41

(dBuV) . (dBuV/m) DTV
(10 20dB)
TV
.

3)

(wanted) (unwanted)
.

5- 9. ()

	/	
TV		+40dB
	(10kHz offset)	+28dB
	()	- 13dB
	()	- 12dB
FM	()	+45dB
	()	+36dB
	(200kHz,)	+ 7dB
	(200kHz,)	+ 6dB
	(400kHz)	- 20dB
AM	(9kHz)	+30dB + 9dB

5- 10. (TV)

TV		DTV - into- AT V AT V - into- DT V DT V - into- DT V	+34dB + 2dB +15dB
		DT V - into- AT V DT V - into- AT V AT V - into- DT V AT V - into- DT V DT V - into- DT V DT V - into- DT V	- 14dB - 17dB - 48dB - 49dB - 28dB - 26dB
		N ± 2, 3, 4, 7, 8 N+14, 15	

5- 11. (TV)

TV (UHF)		DTV - to- DT V DTV - to- AT V	Zone I : 196.3 km Zone II & III: 223.7 km Zone I : 217.3 km Zone II & III: 244.6 km
		DTV - to- DT V DTV - to- AT V	24 km 110 km(12 km 106 km.(
		DTV - to- AT V ()	Zone I Zone II & III : 24.1 km 80.5 km(24.1 km 96.6 km(

6 .

RF

RF

(6MHz)

()

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, DT V

DT V

193 Km

217.3 Km

DT V

24 110 Km

12 106 Km

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가

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(ERP),

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- [1] The Federal Communications Commission (FCC, <http://www.fcc.gov/>).
- [2] The Advanced Television Systems Committee (ATSC, <http://www.atsc.org>).
- [3] ISO/IEC IS 13818-1, International Standard (1994), *MPEG-2 Systems*.
- [4] ISO/IEC IS 13818-2, International Standard (1994), *MPEG-2 Video*.
- [5] ATSC Document A/52, *Digital Audio Compression (AC-3) Standard*, 20 Dec 95
- [6] ATSC Document A/53, *Digital Television Standard with Amendment No. 1* (16 Mar 00)
- [7] ATSC Document A/54, *Guide to the Use of the ATSC Digital Television Standard*, 4 Oct 95
- [8] ATSC Document A/64, *Transmission Measurement and Compliance for Digital Television*, 17 Nov 97
- [9] ATSC Document A/65, *Program and System Information Protocol for Terrestrial Broadcast and Cable*, 23 Dec 97
- [10] ATSC Document A/66, *Corrigendum No. 1 to PSIP for Terrestrial Broadcast and Cable A/65*, 17 Dec 99
- [11] ATSC Document A/67, *Amendment No. 1 to PSIP for Terrestrial Broadcast and Cable A/65*, 17 Dec 99
- [12] ATSC Document A/70, *Conditional Access System for Terrestrial Broadcast*, 17 Jul 99
- [13] (45), 1998.1.31.

$$[\quad] .$$

1.

1. ■

	ITU-T G.711	3.4KHz	64kbps	
	ITU-T G.721	3.4KHz	32kbps	ADPCM
	ITU-T G.722	7KHz AM	48/56/64kbps	SB-ADPCM
	ITU-T G.728	3.4KHz	16kbps	LD-CELP
	ISO MPEG	(CD)	64 192kbps/ch	MUSICAM
	ITU/ISO JPEG	TV	64kbps	DCT
	ITU-T H.261		64 1,920kbps	DCT, MC
	ISO MPEG-1	VTR	1 1.5Mbps	DCT, MC
	ISO MPEG-2 ITU-T H.262	TV	5Mbps	DCT, MC /

. DCT	:		, Discrete Cosine Transform
. MC	:		, Motion Compensation
. SB-ADPCM	:		, Subband Adaptive Pulse Code Modulation
. LD-CELP	:		, Low Delay-Code Excited Linear Prediction
. MUSICAM	:		, Masking pattern adapted Universal Sub-band Integrated Coding And Multiplexing

2.

	()			()
	230Mbits	64Kbps	16kbps	4 : 1
	5.3Gbits	1.5Mbps	256kbps	6 : 1
SDTV	850Gbits	240Mbps	8Mbps	30 : 1
HDTV	5125Gbits	1.4Gbps	30Mbps	40 : 1

2.

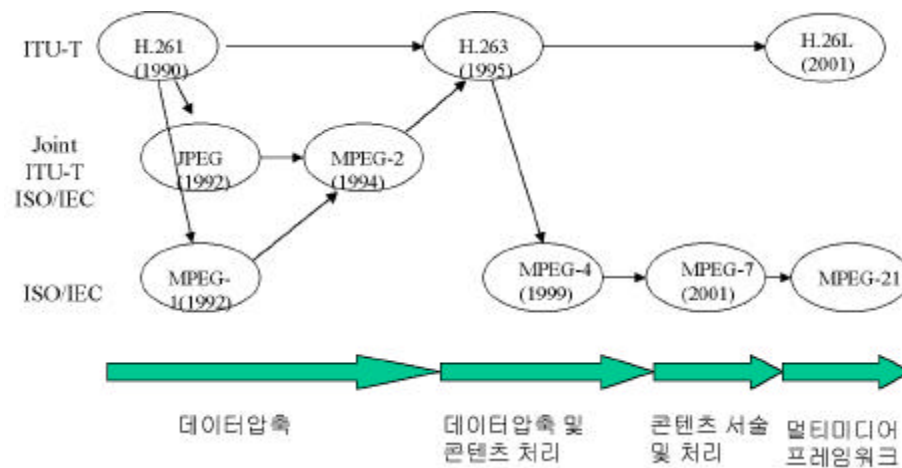
3.

ITU - T	H.261	px 64kbps	1990
	H.262*		1995
	H.263, 262+	64kbps	1995
ITU - R	BT .601- 3	TV	1982
	CMTT .721- 2	140Mbps (component)	1993
	CMTT .723- 2	34 45Mbps (component)	1993
ISO/IEC	11172- 2(MPEG- 1)	1.5Mbps	1992
	13818- 2(MPEG- 2)		1995
	14496- 2(MPEG- 4)		1999
	MPEG- 7	description interface	2001

3. MPEG

MPEG ISO/IEC JTC/SC29 MPEG (Moving Pictures Experts Group)

- . MPEG-1 : Video CD, VOD
- . MPEG-2 :
- . MPEG-4 : , ,
- . MPEG-7 : ,



1) MPEG-1

MPEG-1

MPEG-1 CD

1.5Mbps

MPEG-1

MPEG-1 5

, 3

1.5Mbps

Transform)

DCT

(DPCM : Differential Pulse Code Modulation)

(VLC : Variable Length Coding)

3

가

CD

12:1

MP3

3

2) MPEG-4

MPEG-4

MPEG-4 MPEG-1 MPEG-2
가 ,

, ,

MPEG-4

. MPEG-4
TV AV

가

MPEG-4 , ,

TV , WWW

가 ,

MPEG-4

가 가 ,

가 가

가 . MPEG-4 4가

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/ (AVO, Audio/visual Objects)

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가 /

가 .

3) MPEG-7

MPEG-7

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가 .

가 . ,

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. MPEG-7

WD (Working Draft)

가 2001

MPEG-7

MPEG-7

가 .

MPEG-7

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2. MPEG-7

MPEG-7

MPEG-7

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4) MPEG-21()

MPEG-21_____

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MPEG-21

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