DISTRIBUCIÓN DE LA SEÑAL DIGITAL SERIE Y MULTIPLEXADO DE DATOS

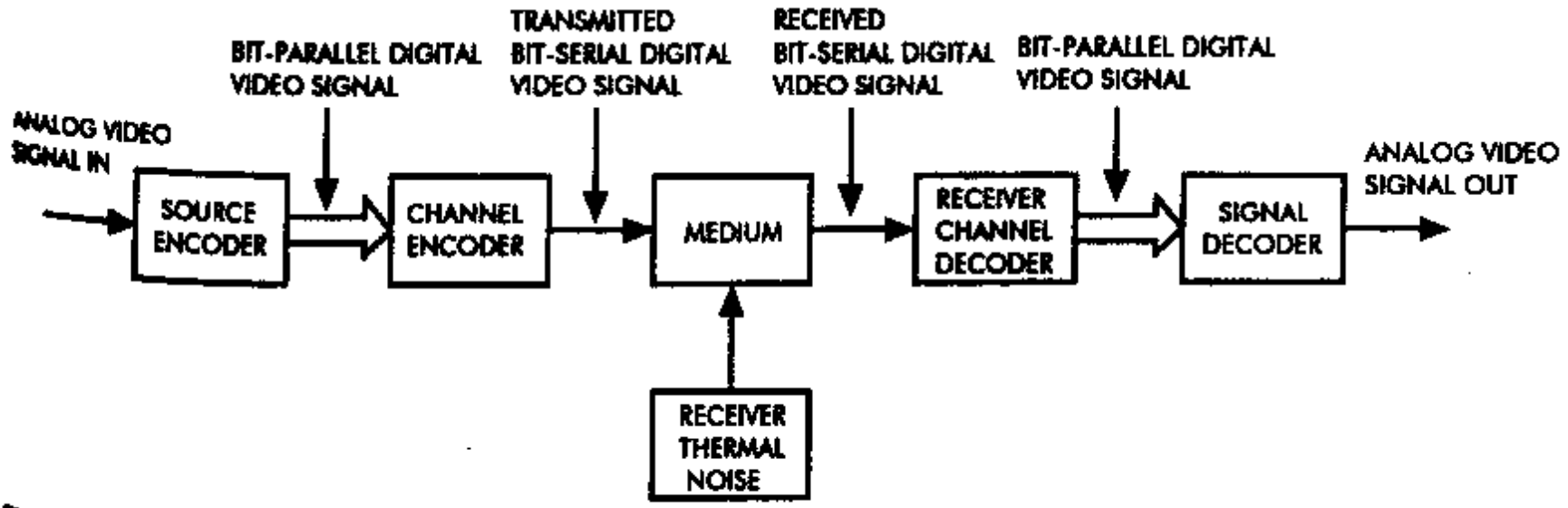
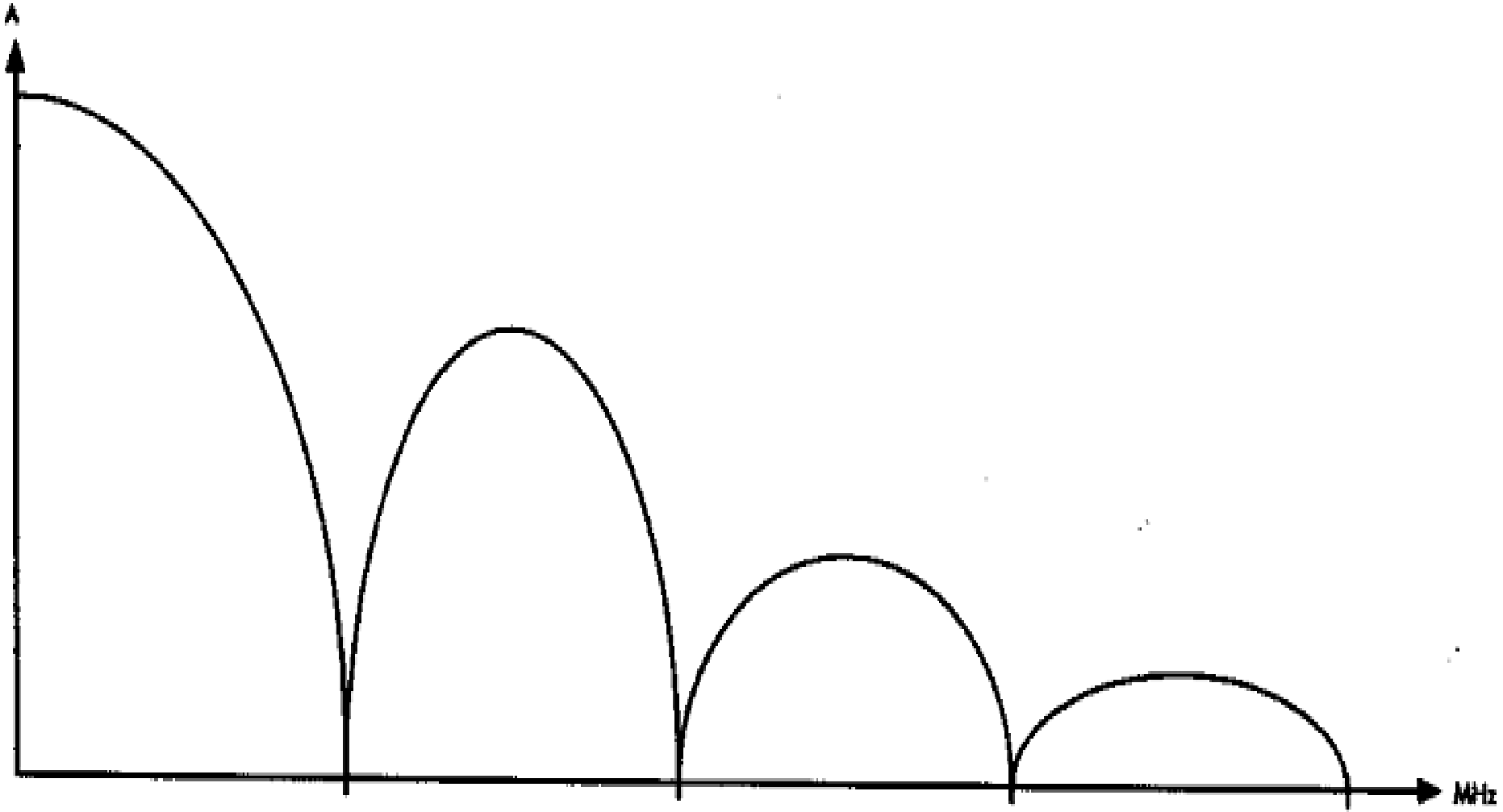


Figure 7.1 Bit-serial digital video distribution model.

Bit-serial rate (Mbps) = Parallel bit rate (Mpalabras/s) × Número de bits por palabra

4:2:2 → Bit-serial rate = 27 Mpalabras/s × 10 bits/palabra = 270 Mbps

4fsc → NTSC: 143Mbps PAL: 177Mbps



	f clock	2fc	3fc	4fc
NTSC 4Fsc 10bit	143.2	286.4	429.6	572.8
PAL 4Fsc 10bit	177.3	354.6	531.9	709.2
4:1:1 10bit	202.5	405.0	607.5	810.0
4:2:2 10bit	270.0	540.0	810.0	1080.0
4:4:4 10bit	405.0	810.0	1215.0	1620.0
525/60 16/9 10bit	360.0	720.0	1080.0	1440.0

Figure 7.2 Bit-serial digital spectrum of several formats.

Codificación de canal

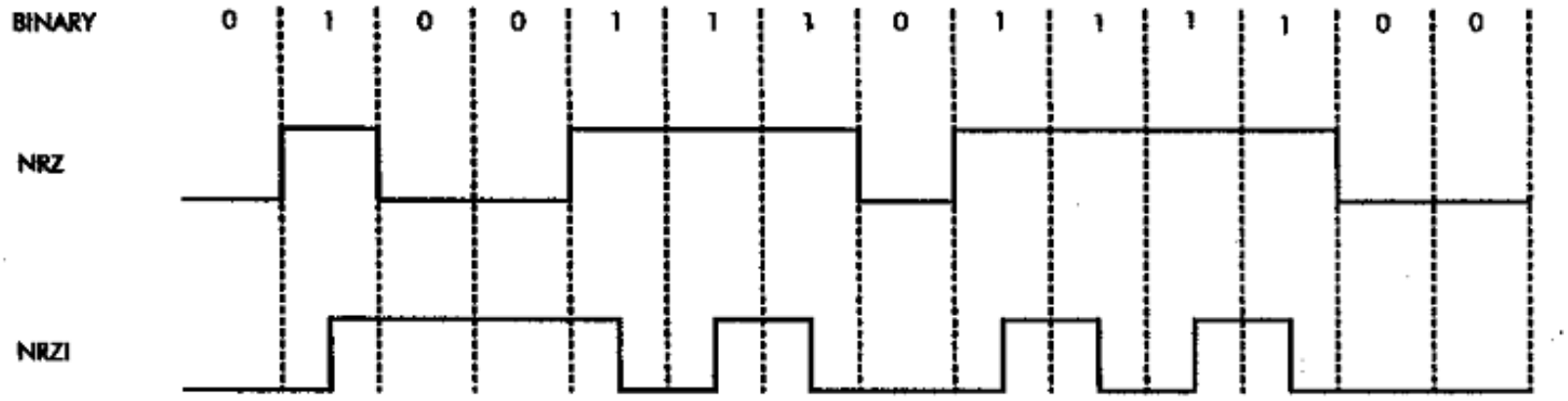


Figure 7.3 NRZ and NRZI channel coding characteristics.

NRZI incorpora más transiciones, necesarias para enganchar PLL del receptor para regeneración del reloj.

Para evitar secuencias largas de 0s se reserva la palabra 0000000000 para sincronismo.

Aún tiene componente DC.

- “Scrambler”: hace “aleatoria” la salida, eliminando secuencias largas de 0s y 1s y patrones de datos repetitivos.
- Ayuda a sacar la componente DC.
- $G1(X) = X^9 + X^4 + 1$ polinomio característico
- $G2(X) = X + 1$

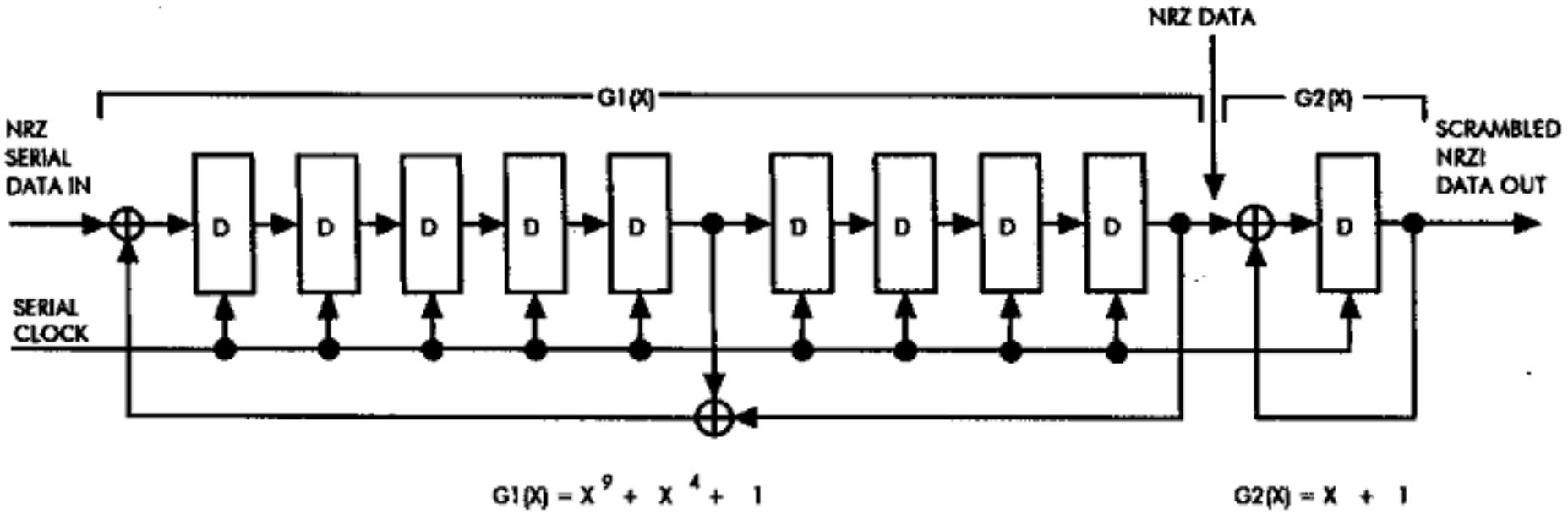


Figure 7.4 Block diagram of a scrambler.

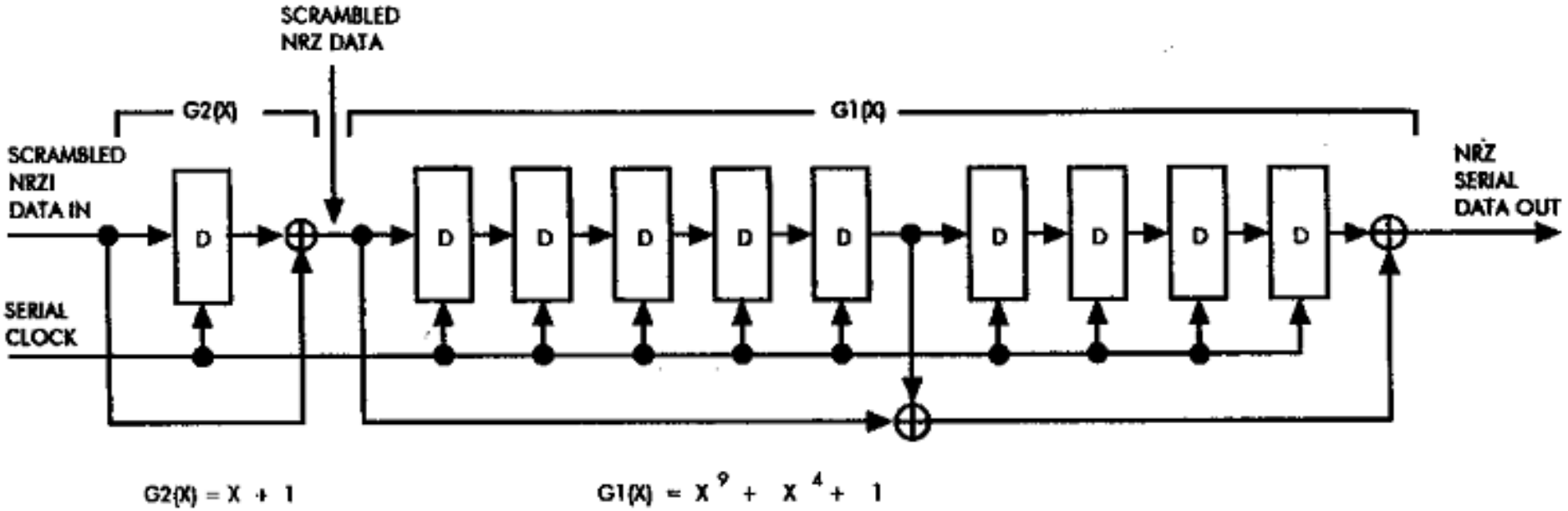


Figure 7.5 Block diagram of a descrambler.

Diagrama de ojo

- Si BW $= \infty$ → transiciones instantáneas
- Si no:

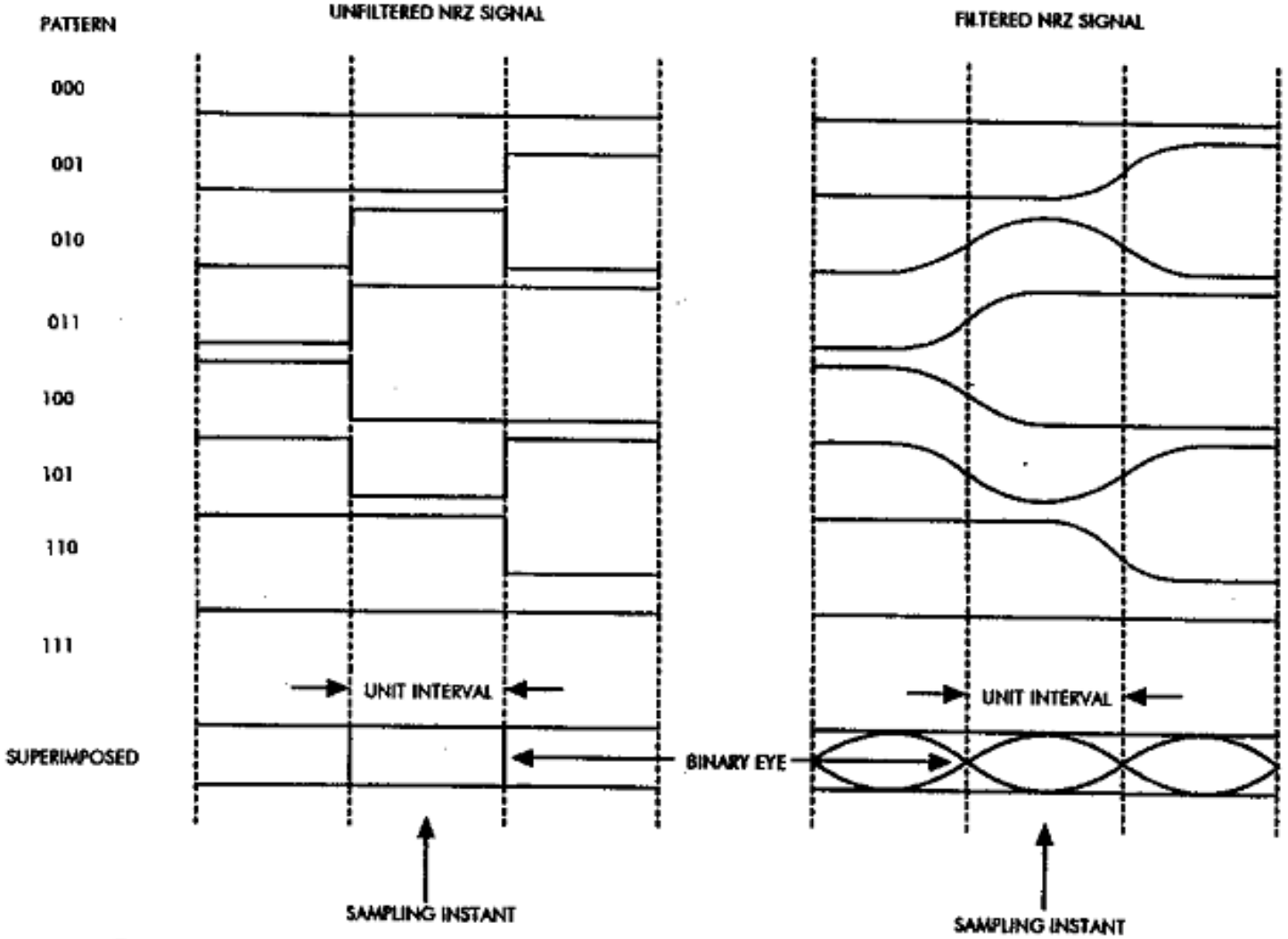


Figure 7.6 Formation of the eye-pattern from superimposed binary patterns.

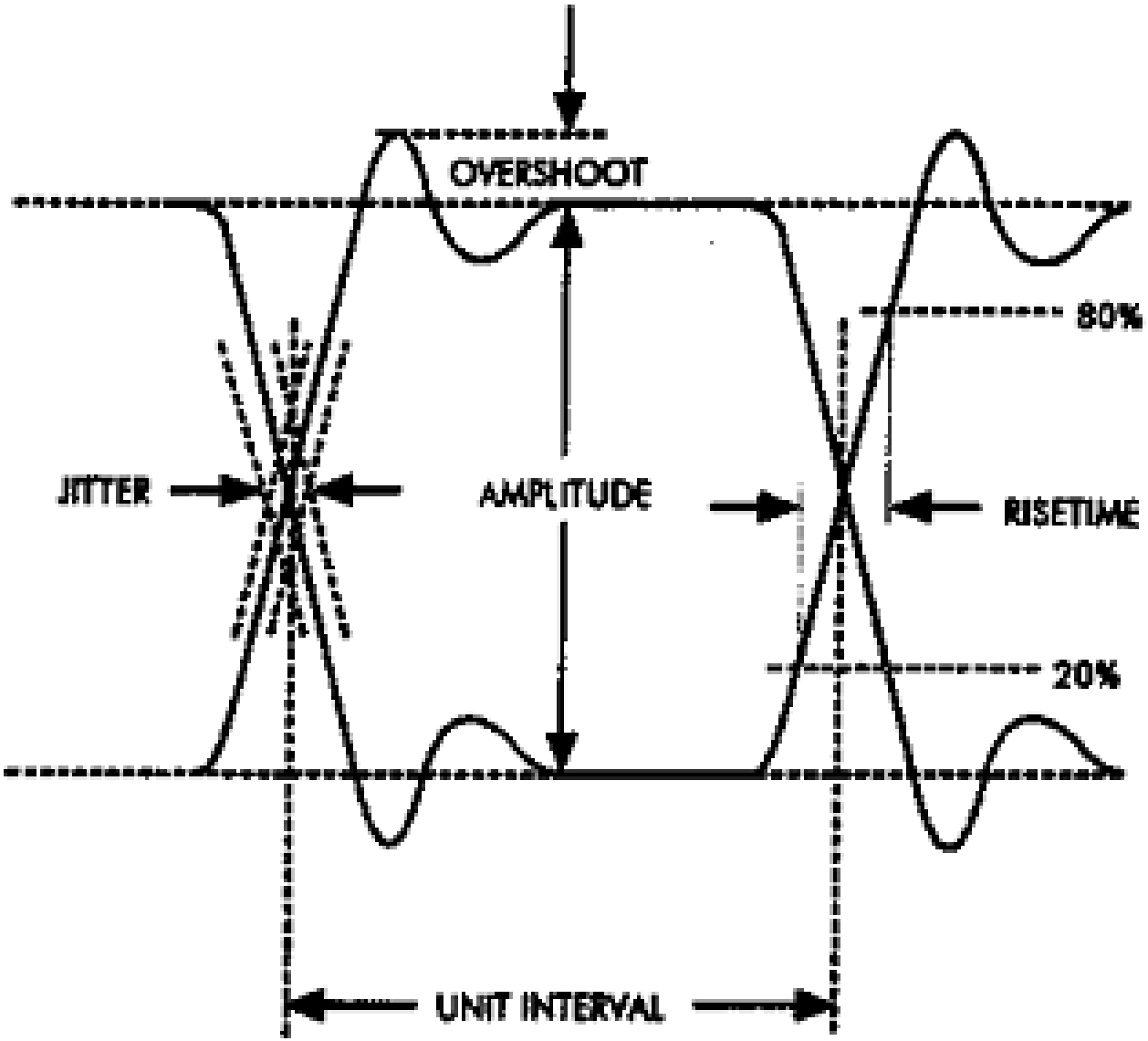


Figure 7.7 Eye diagram measurement dimensions.

TABLE 7.1 Characteristics of Bit-Serial Interfaces

Channel coding	Transmitter characteristics (see Fig. 7.7)	Receiver characteristics
Scrambled NRZI	Unbalanced output	Unbalanced input
Input signal polarity: Positive logic	Source impedance: 75 ohms nominal	Input impedance: 75 ohms nominal
Generator polynomials: $G_1(X) = X^9 + X^4 + 1$ $G_2(X) = X + 1$	Return loss: ≥15 dB (5 MHz to clock frequency of signal)	Return loss: ≥15 dB (5 MHz to clock frequency of signal)
Data word length: 10 bits	Output signal amplitude: 800 mV_{p-p} ±10%	Optional cable loss equalization: 30 dB at clock frequency of signal
Transmission order: LSB of any data word transmitted first	DC offset: 0.0 V ±0.5 V with reference to midamplitude of signal	
	Rise time and fall time: 0.4 to 1.5 ns between 20% and 80% of signal amplitude points. Differences not to exceed 0.5 ns	
	Overshoot of rising and falling signal edges: <10% of signal amplitude	
	Jitter: See Table 7.2	

Distribución de bits serial 4:2:2

- Son 270 Mbps

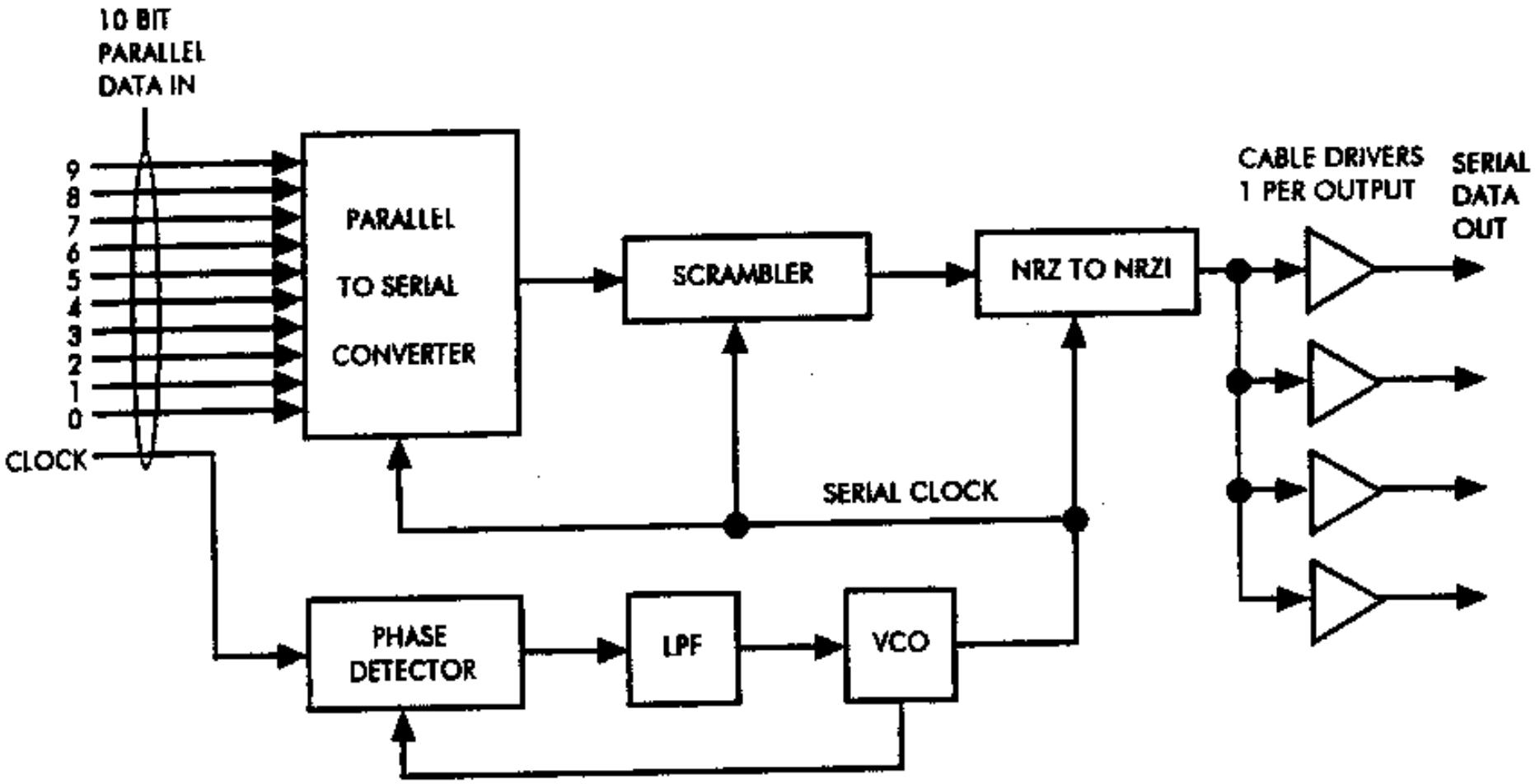


Figure 7.18 Block diagram of a 4:2:2 component digital serializer.

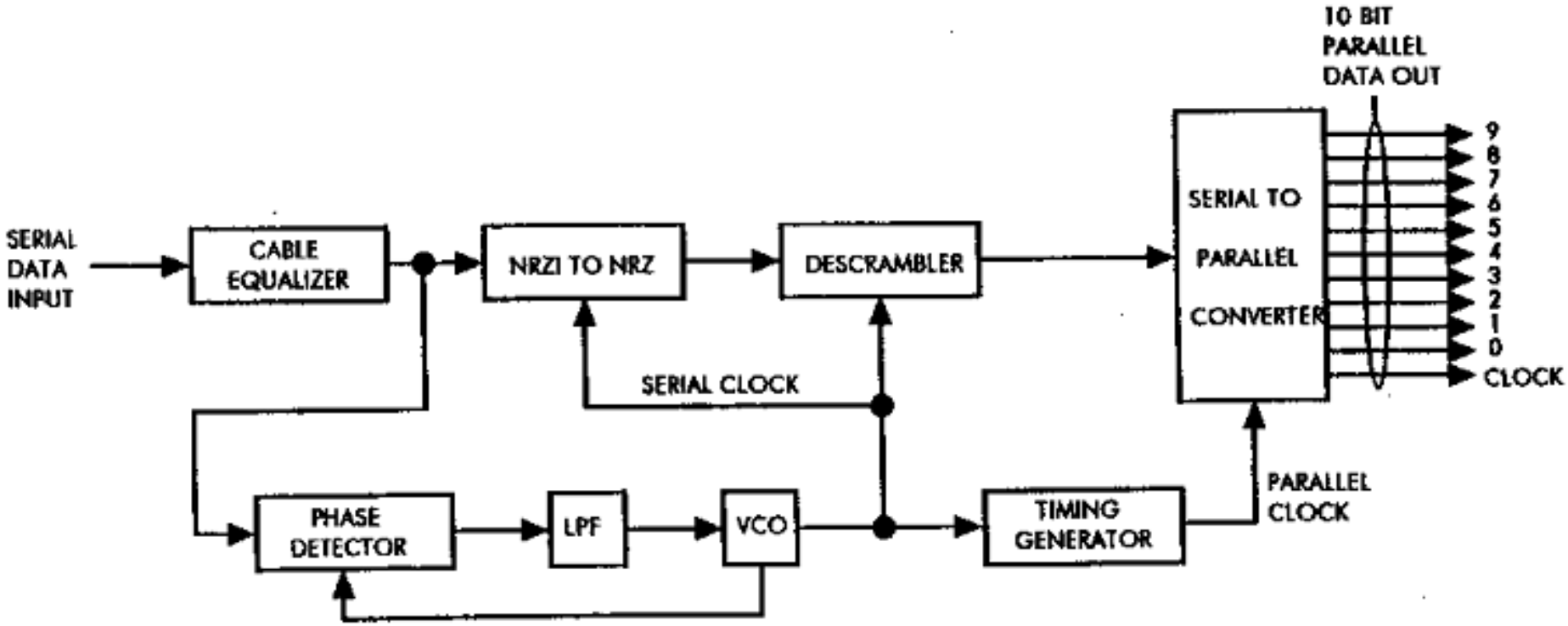


Figure 7.20 Block diagram of a 4:2:2 component digital deserializer.

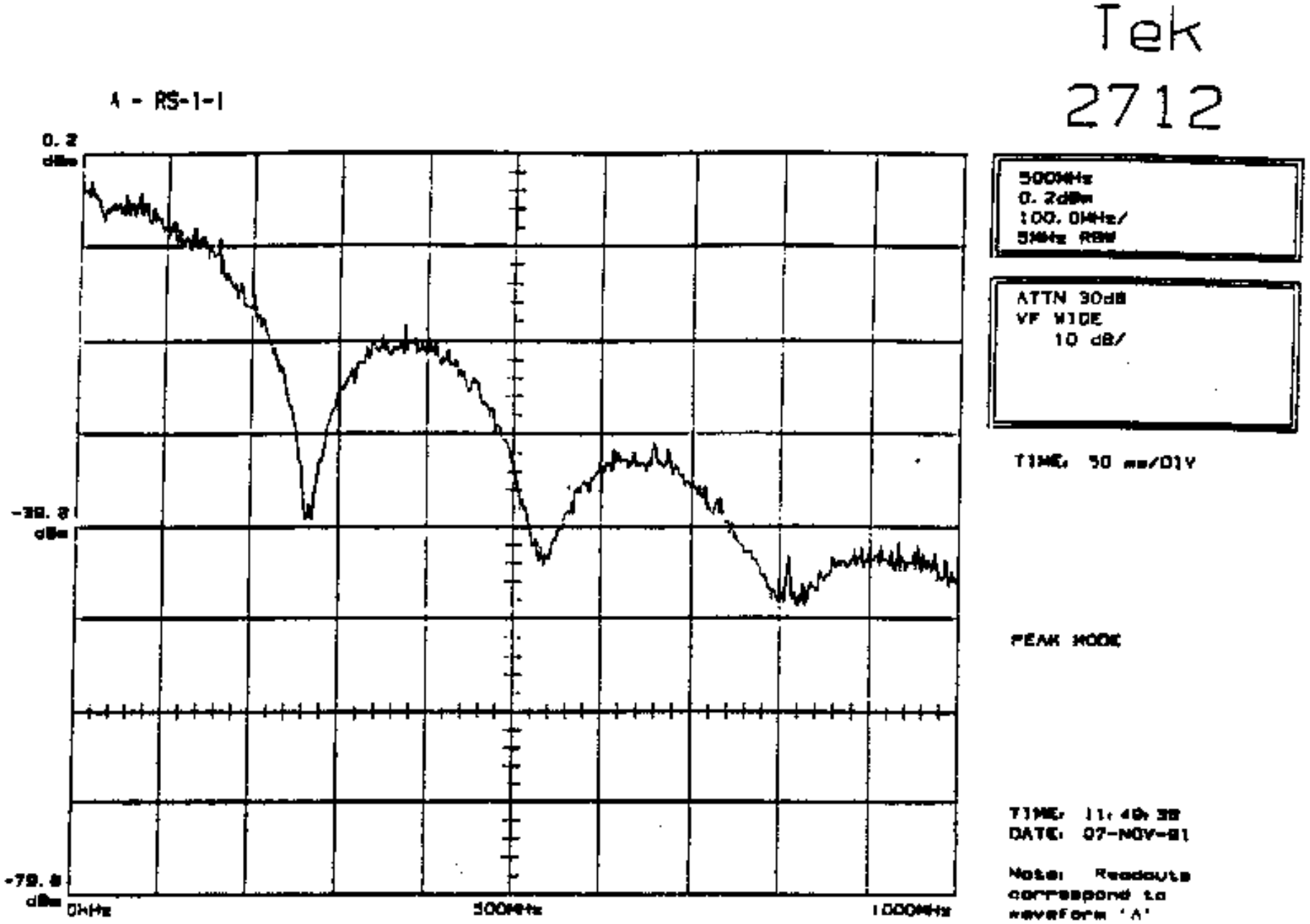
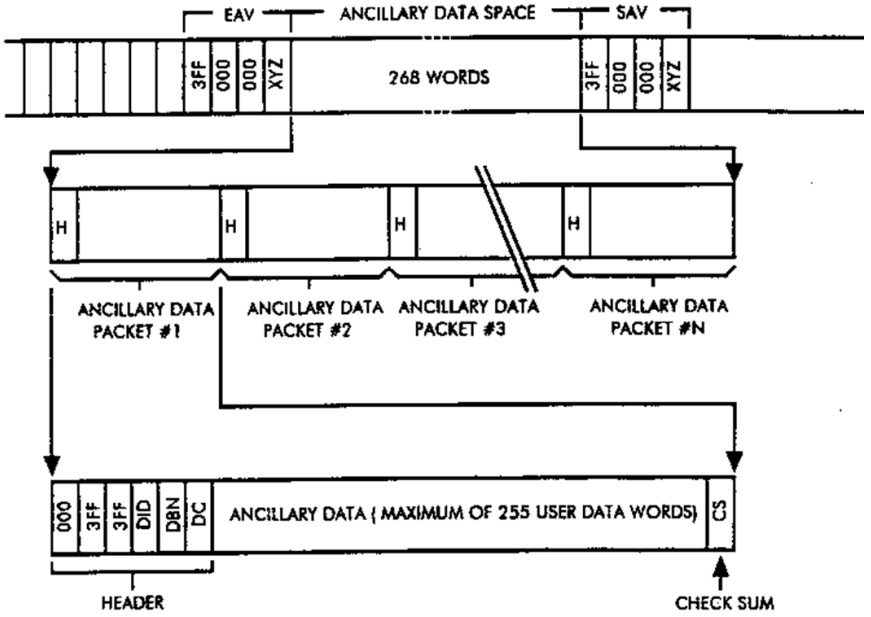


Figure 7.19 Spectrum of 270 Mbps 4:2:2 component digital bit-serial signal.

Capacidad de datos auxiliares

- Audio digital
- Time code
- *Error Detection and Handling (EDH)*
- Datos de control para uso futuro



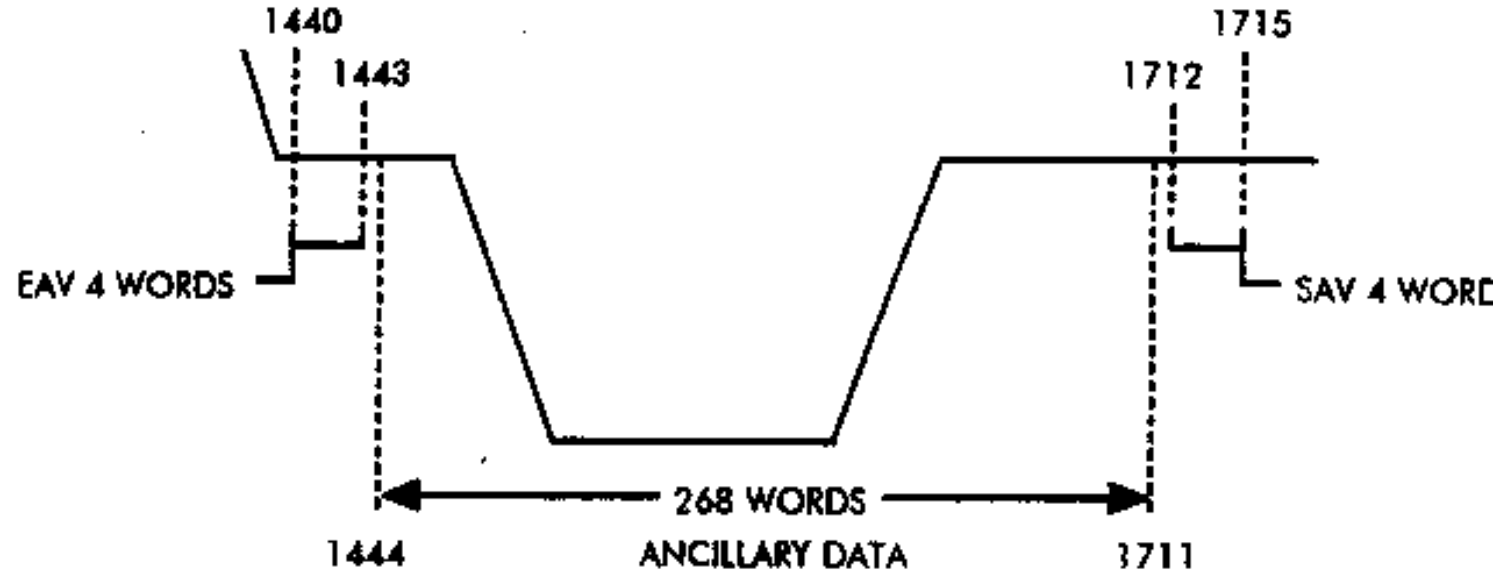


Figure 7.21 4:2:2 525/60 horizontal blanking ancillary data location.

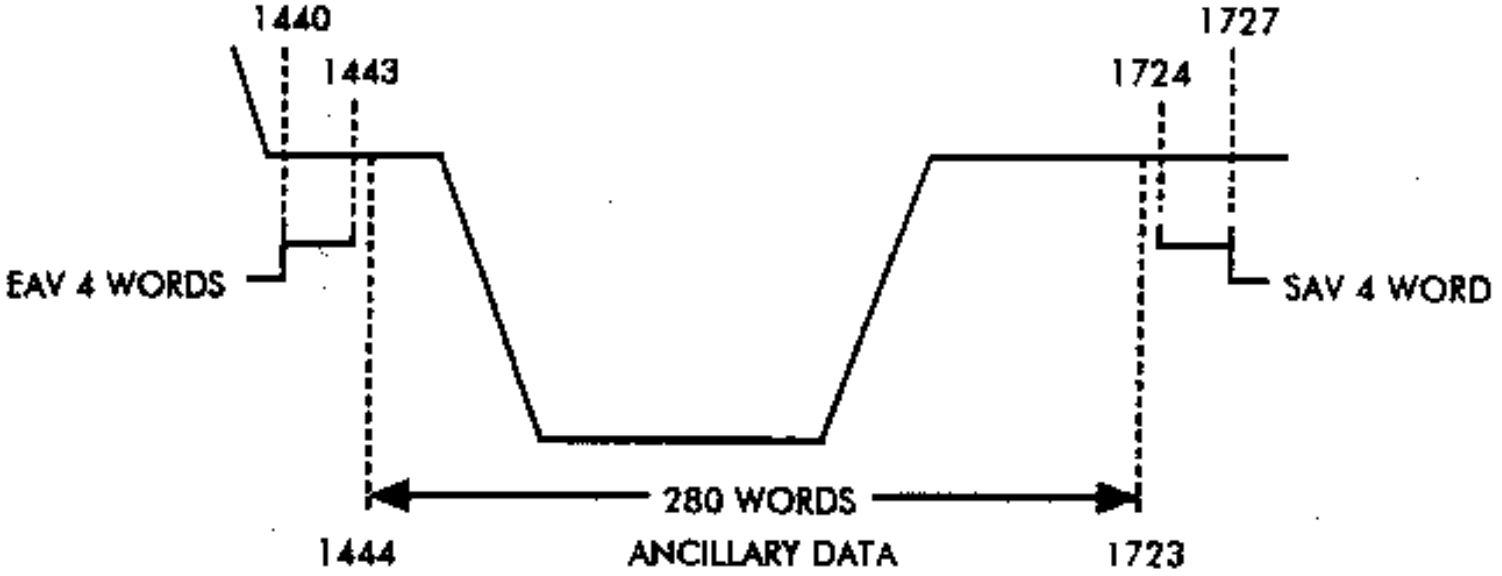


Figure 7.22 4:2:2 625/50 horizontal blanking ancillary data location.

TABLE 7.8 4:2:2 525/60 Ancillary Data Space

Horizontal ancillary data space (HANC)	268 Words/line × 525 lines/frame = 140,700 words/frame 140,700 Words/frame × 29.97 frames/s = 4.216779 Mwords/s 4.216779 Mwords/s × 10 bits/word = 42.16779 Mbps
Vertical ancillary data space (VANC)	1440 Words/line × 38 vertical-interval lines = 54,720 words/frame 54,720 Words/frame × 29.97 frames/s = 1.6399584 Mwords/s 1.6399584 Words/s × 8 bits/word = 13.1196672 Mbps
Total ancillary data space	42.16779 Mbps (HANC) + 13.1196672 Mbps (VANC) = 55.3 Mbps Data formatting and exclusions may reduce this value by 10% to 20%
Total bit rate	1716 Words/total line × 525 lines/frame × 29.97 frames/s × 10 bits/word = 270 Mbps
Essential bit rate	270 Mbps − 55.3 mbps = 214.7 Mbps

TABLE 7.9 4:2:2 625/50 Ancillary Data Space

Horizontal ancillary data space (HANC)	280 Words/line × 625 lines/frame = 175,000 words/frame 175,000 Words/frame × 25 frames/s = 4.375 Mwords/s 4.375 Mwords/s × 10 bits/word = 43.75 Mbps
Vertical ancillary data space (VANC)	1440 Words/line × 48 vertical-interval lines = 69,120 words/frame 69,120 Words/frame×25 frames/s = 1.728 Mwords/s 1.728 Mwords/s × 8 bits/word = 13.824 Mbps
Total ancillary data space	43.75 Mbps (HANC) + 13.824 Mbps (VANC) = 57.574 Mbps Data formatting and exclusions may reduce this value by 10% to 20%
Total bit rate	1728 Words/total line × 625 lines/frame × 25 frames/s × 10 bits/word = 270 Mbps
Essential bit rate	270 Mbps − 57.574 Mbps = 212.426 Mbps

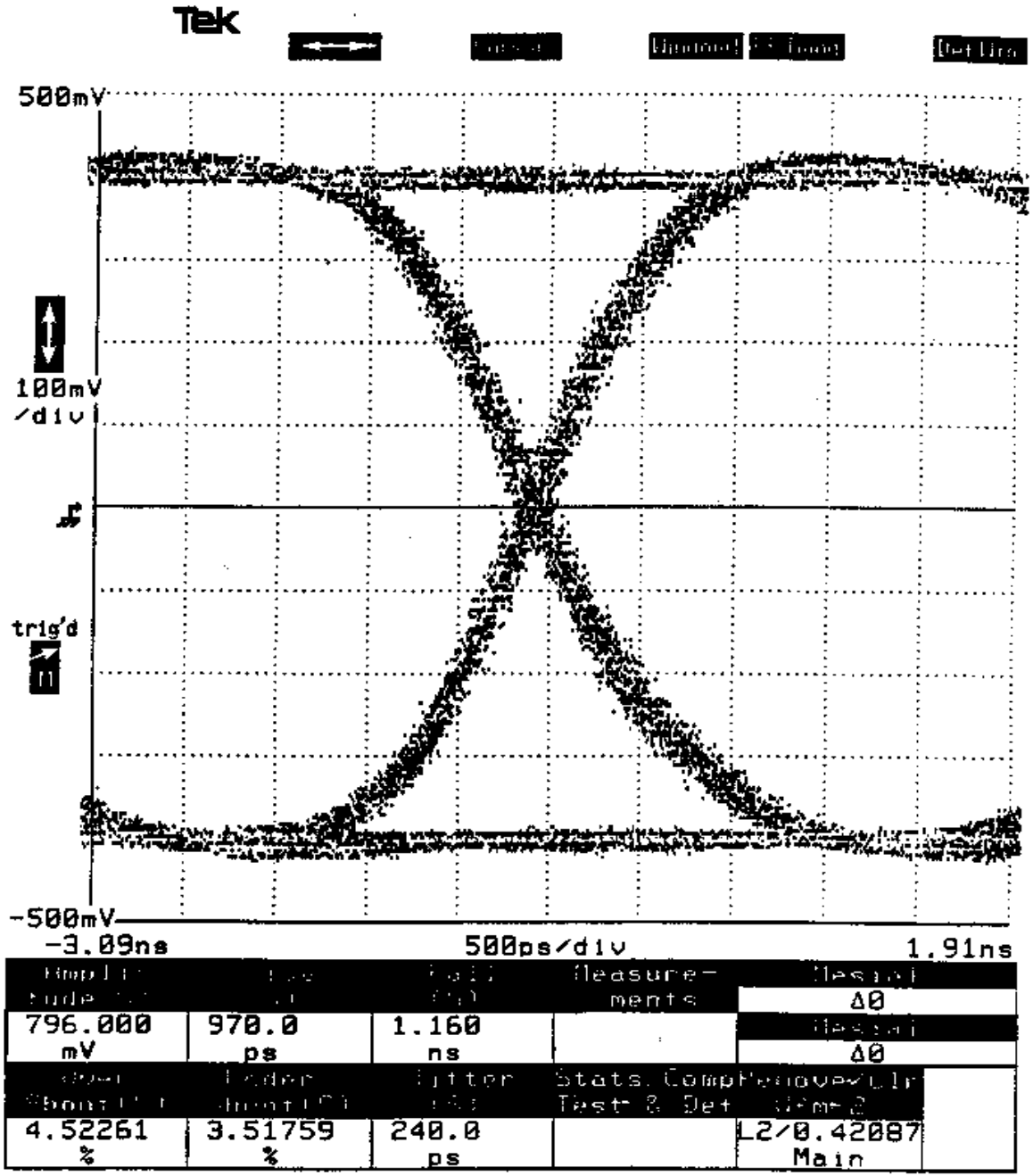


Figure 7.24 TEKTRONIX 11403 digitizing oscilloscope display printout of a good 270 Mbps bit-serial waveform.

- Señal Normal

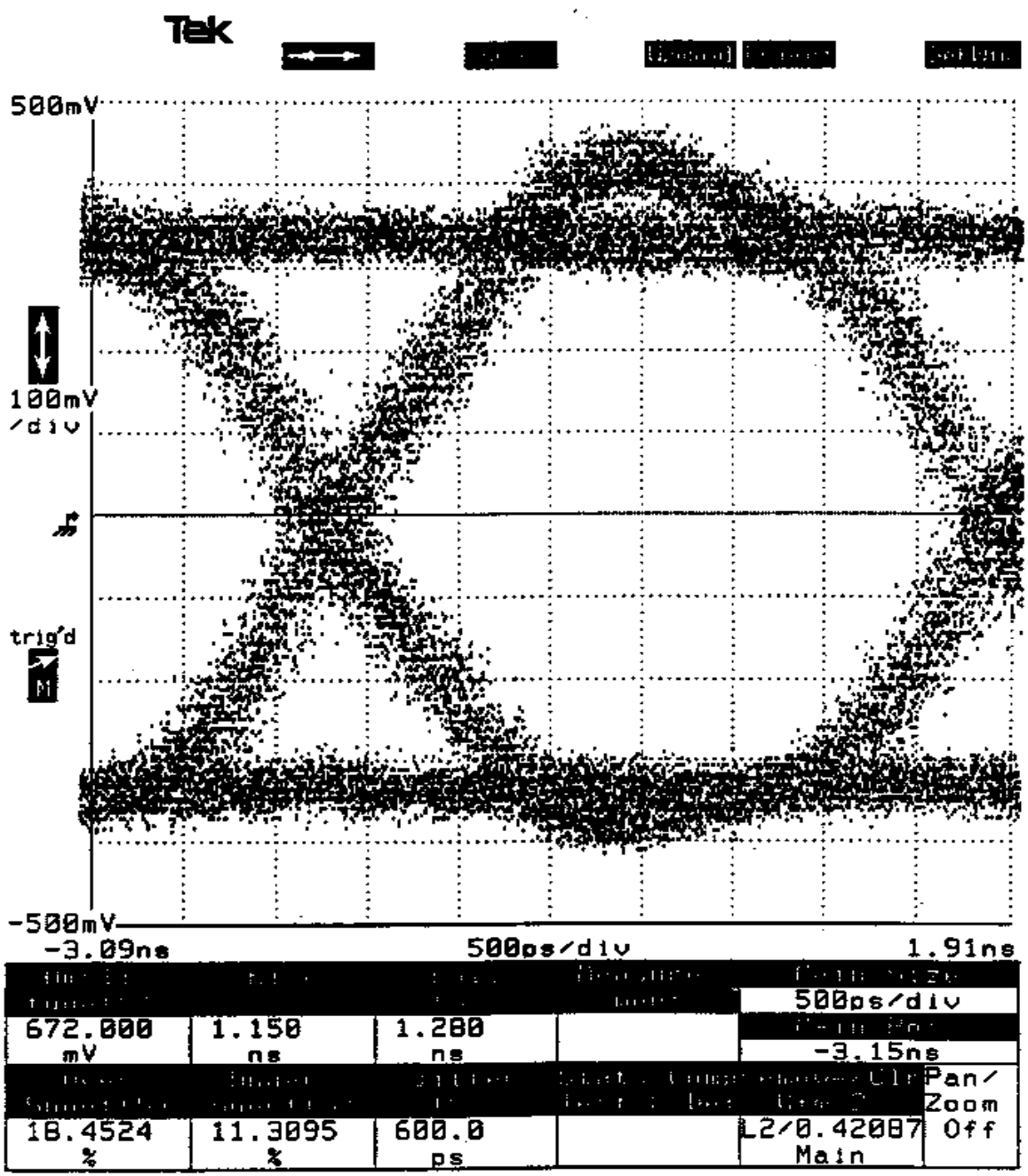


Figure 7.25 Tektronix 11403 digitizing oscilloscope display printout of a 270 Mbps bit-serial waveform with excessive overshoot and low amplitude.

- Señal con mucho overshoot y poca amplitud. Problemas con cables cortos.

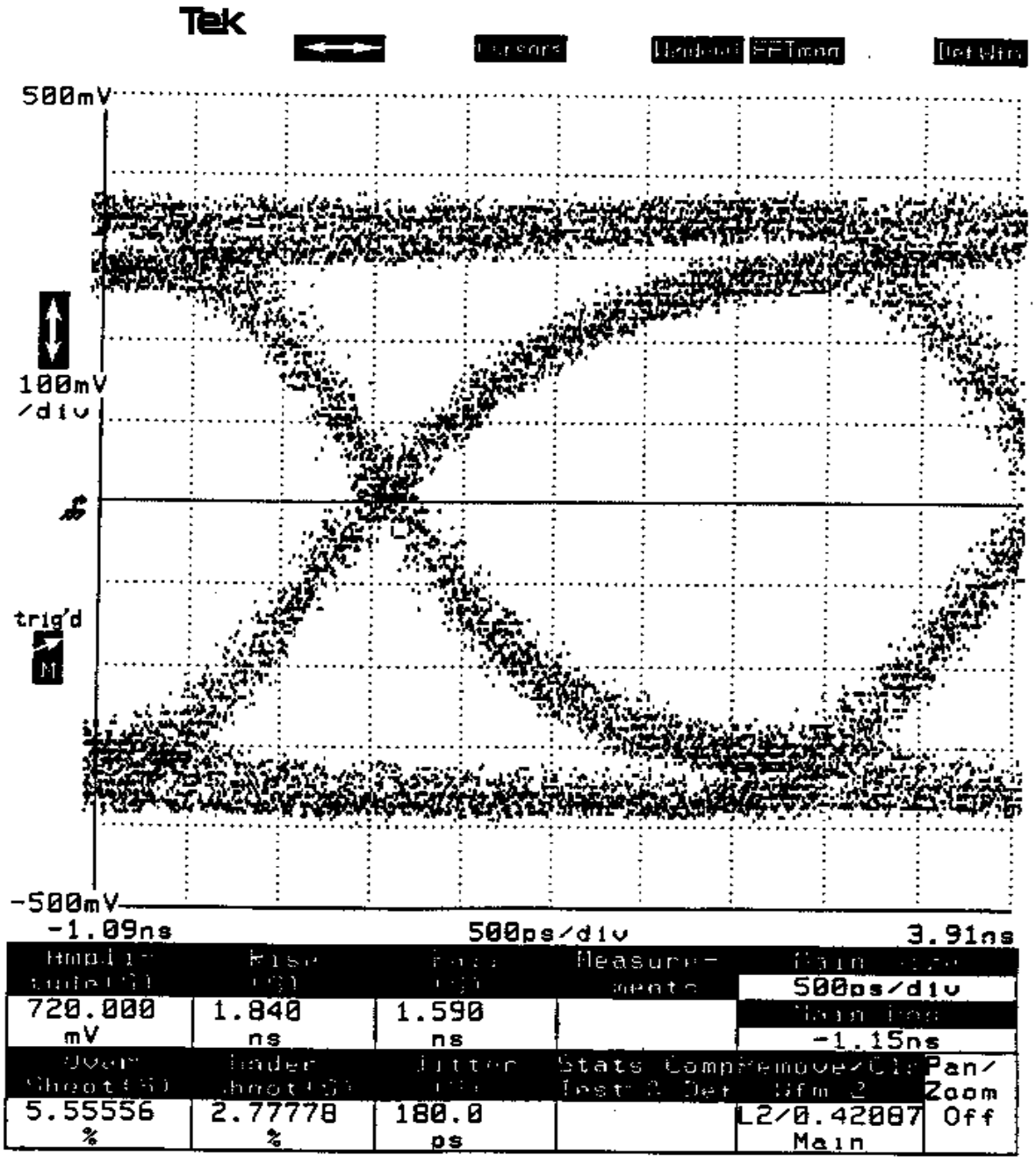


Figure 7.26 Tektronix 11403 digitizing oscilloscope display printout of a 270 Mbps bit-serial waveform at the end of a 30 meter cable.

- Señal al final de un cable de 30 m. Aumenta rise-time y fall-time. Disminuye amplitud

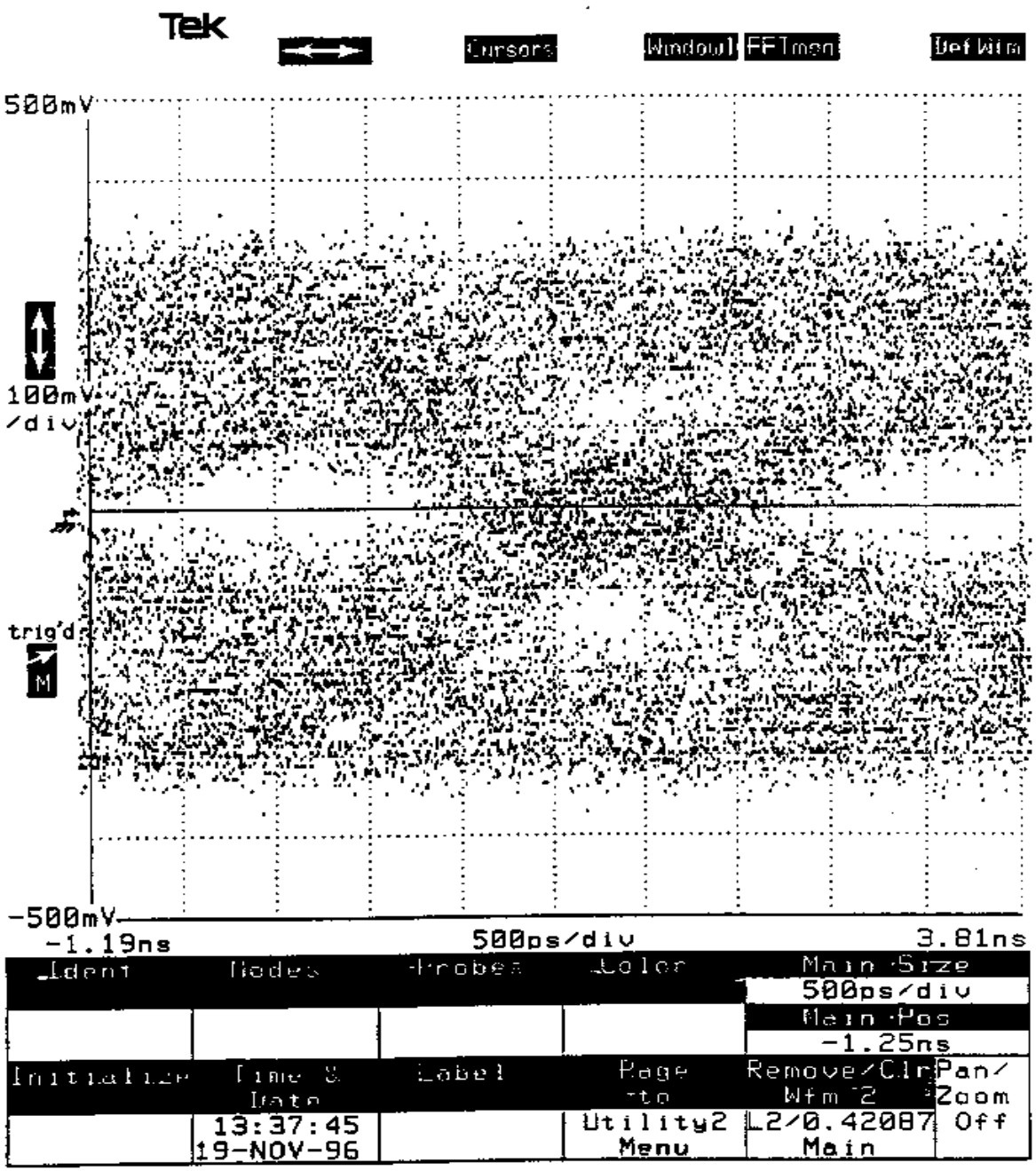


Figure 7.27 Tektronix 11403 digitizing oscilloscope display printout of a 270 Mbps bit-serial waveform at the end of a 100 meter cable.

- Señal al final de un cable de 100 m. Esta señal puede ser regenerada por la mayor parte del equipamiento comercial disponible.

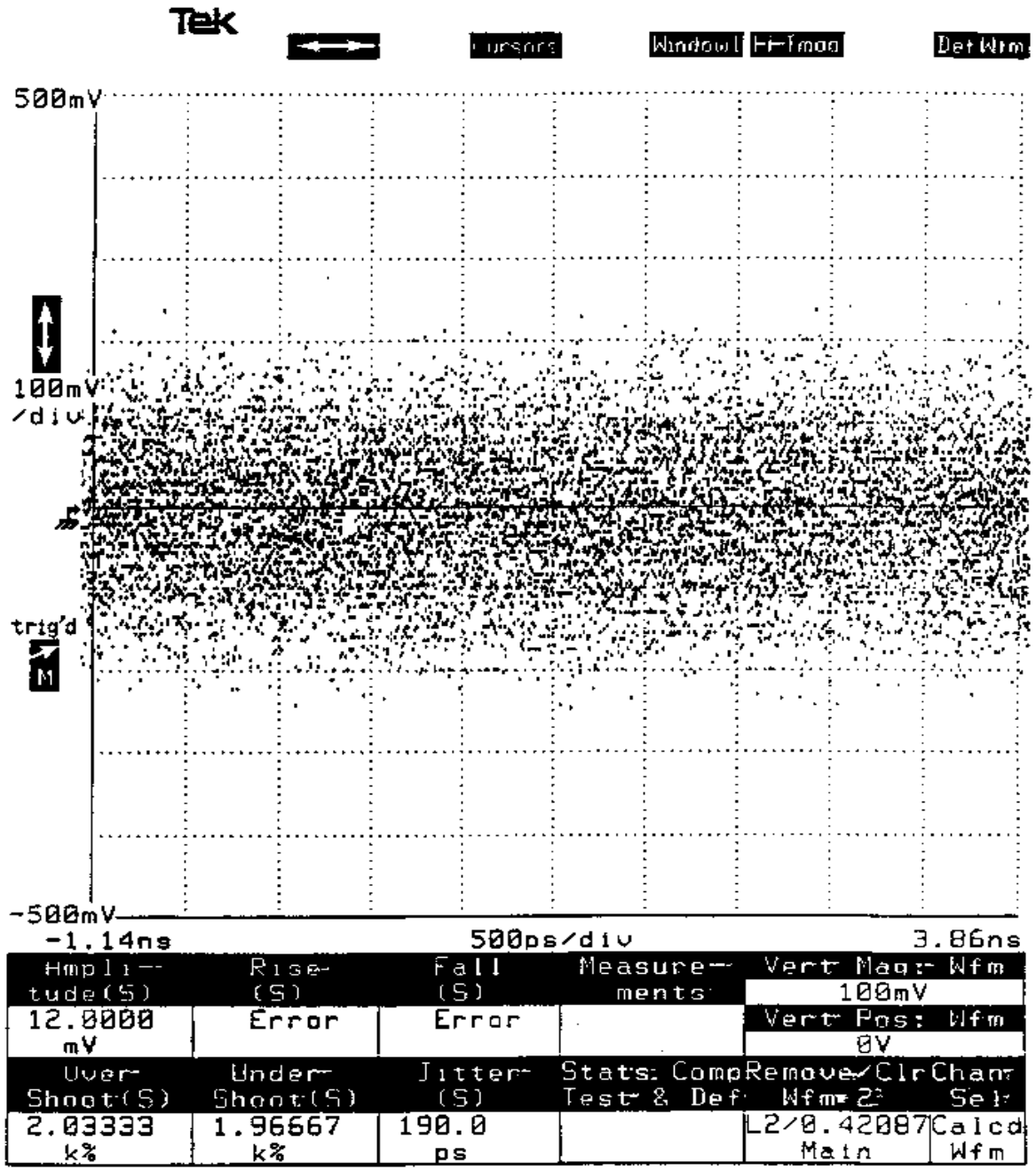


Figure 7.28 Tektronix 11403 digitizing oscilloscope display printout of a 270 Mbps bit-serial waveform at the end of a 300 meter cable.

- Señal al final de cable de 300 m. Algunos equipos pueden regenerarla.
- Para 270 Mbps límite normalmente entre 200 m y 300 m.

- Multiplexor de audio

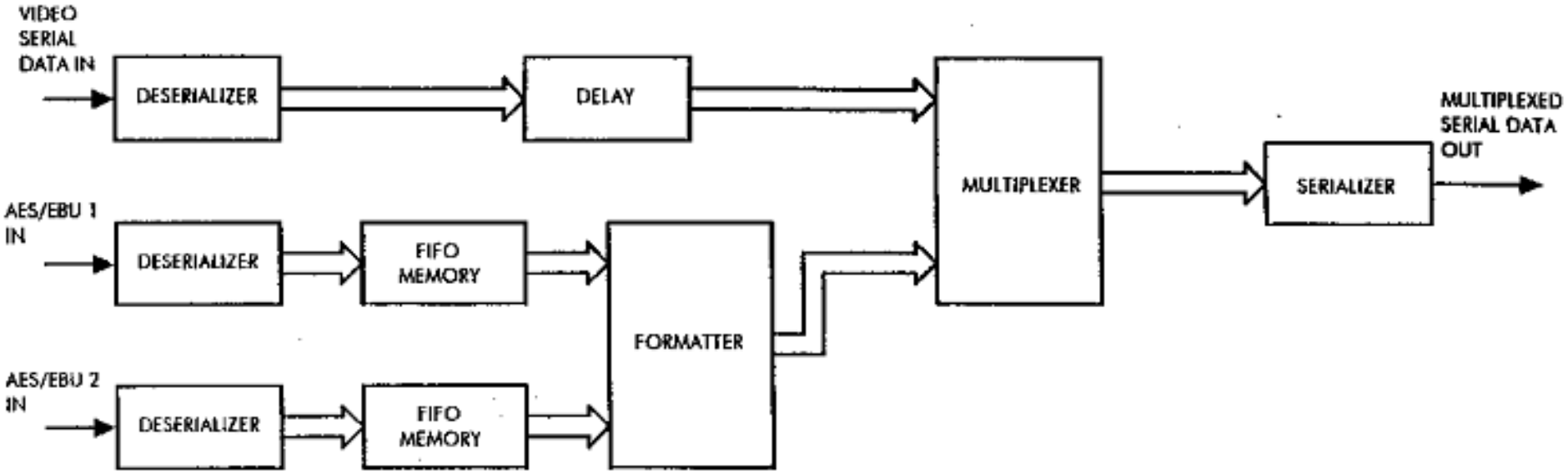


Figure 7.43 Simplified block diagram of audio multiplexer.

- Demultiplexor de audio

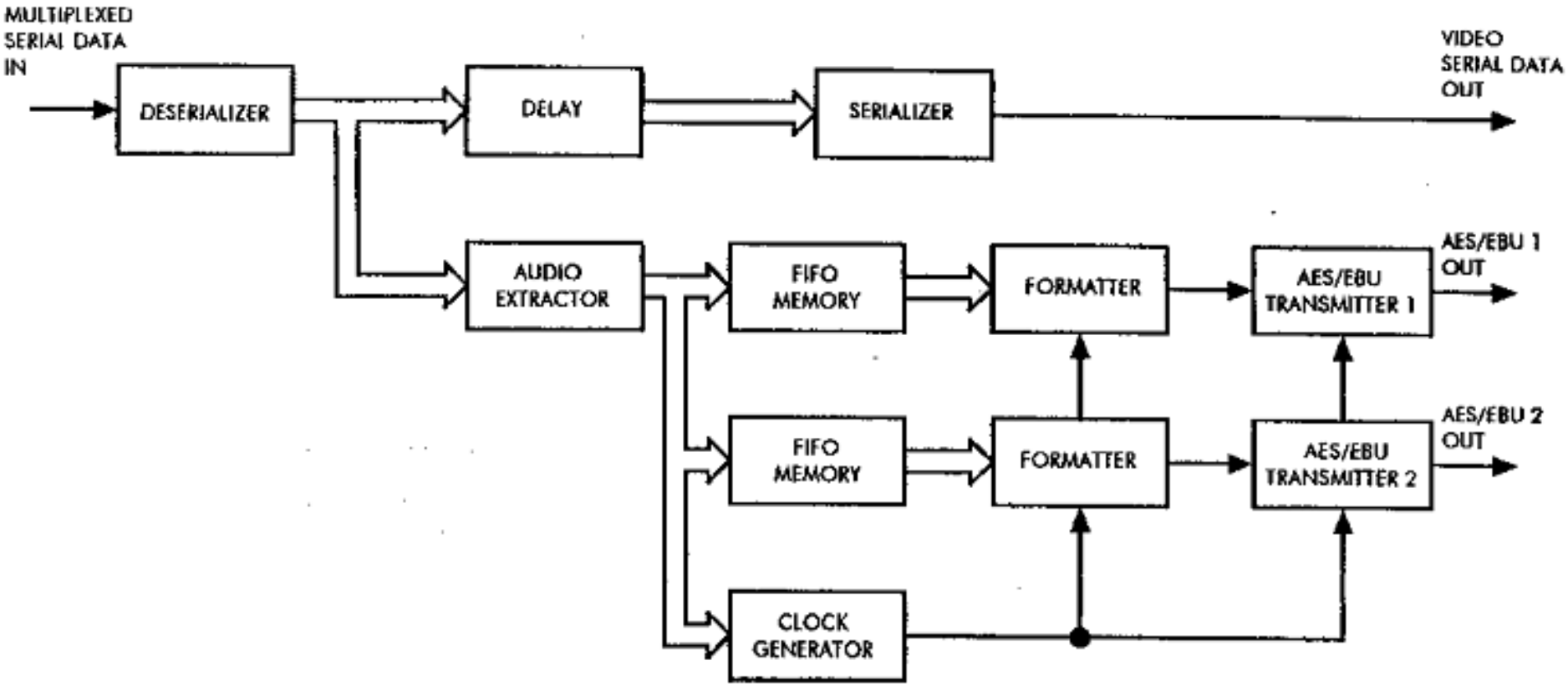


Figure 7.44 Simplified block diagram of audio demultiplexer.

Estándares

Estándar	Nombre	Bitrates	Formatos de Video
SMPTE 259M	SD-SDI	270 Mbit/s, 360 Mbit/s, 143 Mbit/s, and 177 Mbit/s	480i, 576i
SMPTE 344M	ED-SDI	540 Mbit/s	480p, 576p
SMPTE 292M	HD-SDI	1.485 Gbit/s, and 1.485/1.001 Gbit/s	720p, 1080i
SMPTE 372M	Dual Link HD-SDI	2.970 Gbit/s, and 2.970/1.001 Gbit/s	1080p
SMPTE 424M	3G-SDI	2.970 Gbit/s, and 2.970/1.001 Gbit/s	1080p
TBA	6G-SDI	TBA	4K

Four Cards in One!

Now software developers have the perfect broadcast quality multi channel SDI capture and playback solution tha

DeckLink Quad

Technical Specifications

Description

DeckLink Quad is four independent DeckLink SDI style capture and playback cards in one! Includes four SDI inputs and four 4 SDI outputs that can be independently switched between SD and HD video formats, as well as a common black burst/tri-sync input for all four channels. DeckLink Quad appears as four independent SDI cards to the computer, but only uses a single PCI Express slot. DeckLink Quad includes a built in watchdog timer under API control with bypass relays for a robust broadcast solution that automatically switches to bypass if power is lost, or software crashes. That's perfect for broadcast servers! Each SDI input and output can be a different video standard as they are all completely independent.

Price

$995

Connections

SDI Video Input
4 x 10-bit SD/HD independently switchable.

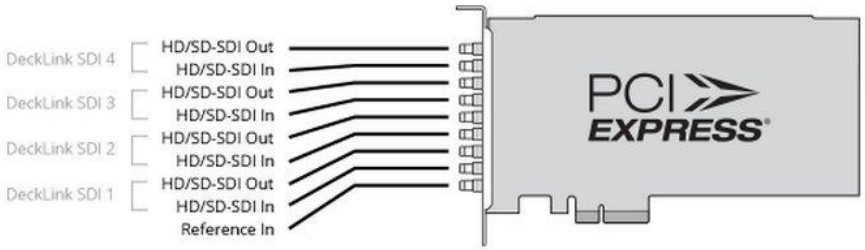
SDI Video Output
4 x 10 bit SD/HD independently switchable.

SDI Audio Input
8 Channels per input, embedded in SD and HD.

SDI Audio Output
8 Channels per output, embedded in SD and HD.

Sync Input
Blackburst in SD, 720p50, 720p59.94, 1080i50 and 1080i59.94 formats or Tri-Sync in any HD format.

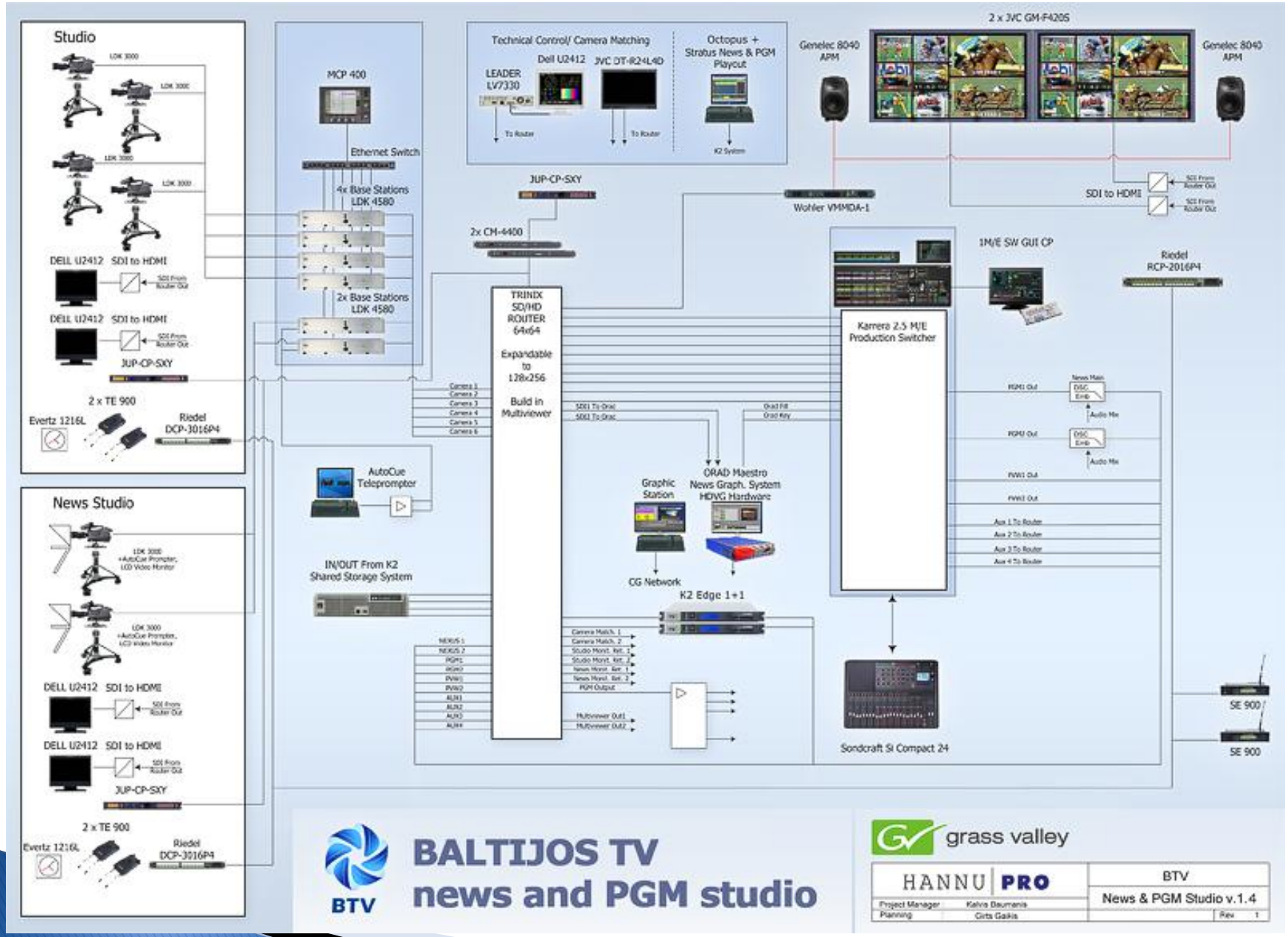
Computer Interface
PCI Express 4 lane, compatible with 4, 8 and 16 lane PCIe slots.



Codecs

Supports: AVC-Intra, AVCHD, Canon XF MPEG2, Digital SLR, DV-NTSC, DV-PAL, DVCPRO50, DVCPROHD, DPX, HDV, XDCAM EX, XDCAM HD, XDCAM HD422, Apple ProRes 4444, Apple ProRes 422 (HQ), Apple ProRes 422, Apple ProRes (LT), Apple ProRes 422 (Proxy), Uncompressed 8-bit 4:2:2, Uncompressed 10-bit 4:2:2.

Flujo de Trabajo en una estación de TV

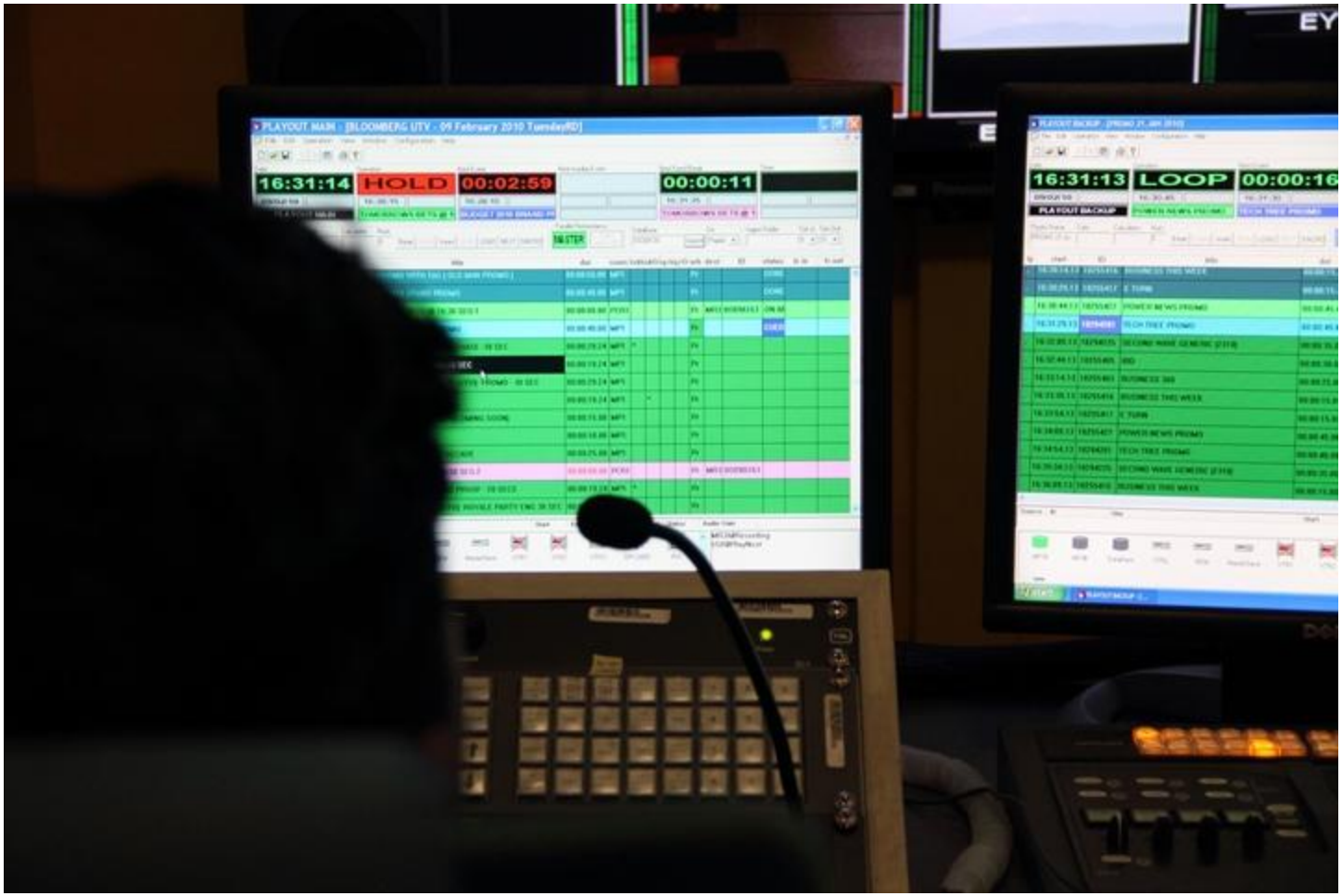

Studio
LDK 3000
DELL U2412 SDI to HDMI
JUP-CP-SXY
2 x TE 900
Evertz 1216L
Riedel DCP-3016P4
News Studio
LDK 3000 +AutoCue Prompter, LCD Video Monitor
DELL U2412 SDI to HDMI
JUP-CP-SXY
2 x TE 900
Evertz 1216L
Riedel DCP-3016P4
MCP 400
Ethernet Switch
4x Base Stations LDK 4580
2x Base Stations LDK 4580
Technical Control/ Camera Matching
Dell U2412
JVC DT-R24L4D
LEADER LV7330
Octopus + Stratus News & PGM Playout
JUP-CP-SXY
2x CM-6400
TRINIX SD/HD ROUTER 64x64
Expandable to 128x256
Build in Multiviewer
AutoCue Teleprompter
IN/OUT From K2 Shared Storage System
Graphic Station
ORAD Maestro News Graph. System HDVG Hardware
CG Network
K2 Edge 1+1
2 x JVC GM-F420S
Genelec 8040 APM
Genelec 8040 APM
Wohler VMMDA-1
SDI to HDMI
1M/E SW GUI CP
Riedel RCP-2016P4
Karrera 2.5 M/E Production Switcher
Sondcraft SI Compact 24
SE 900
SE 900
BALTIJOS TV
news and PGM studio
BTV
grass valley
HANNU PRO
BTV
News & PGM Studio v.1.4
Project Manager Kalvis Baumanis
Planning Gints Gaikis
Rev 1


CO SD
DownConv. PPAL
AIRE HD
CO EMERGENCIA HD
CO HD
PGM PPAL
PROC VID PPAL
PROC AUD PPAL
LOGO1 PGM
LOGO1 PVW


laSexta


TELETEXTE 1.2
K2 EMI1 OUT1
K2 EMI2 – OUT2
PGM LaSexta
19:59:00
HORA LOCAL
19:59:00
HORA GMT
SINFIN LaSexta
carrusel promos
PGM Canarias
EMB. PGM.A
EMB. PGM.B
EMB. PGM CF
VTR1
VTR 2
VTR 3
Monitor Canarias
QUAD IRD'S


PLAYER-1
PLAYOUT MAIN - [BLOOMBERG UTV - 09 February 2010 TuesdayRD]
16:26:02
RUN
00:00:43
00:02:13
PLAYOUT MAIN
MASTER


16:31:14
HOLD
00:02:59
00:00:11
16:31:13
LOOP


TOMORROW'S
BETS


GFX 6 FILL
GFX 2
GFX 4
SS 2
ME1 PGM
16:40:42


04:55:47
13:55:48
04:55:47
EXP5-HDP1
EXP3-EXT5
EXP1-EXT3
EXT1
EXP6-HDP2
EXP4-EXT6
EXP2-EXT4
EXT2
VGA1
HDP1
SER3
SER1
VGA2
HDP2
RTM9-SER4
SER2
SAMSUNG
PVW
PGM
CAM1
CAM2
CAM3
CAM4
CAM5
AUX1-VTR1
AUX2-VTR2
RTM0-VTR3

ProHD Native File Based Workflow

JVC The Perfect Experience

NAB SHOW Where Content Comes to Life

ASI

IEEE-1394

ASI

IEEE-1394

IEEE-1394

ASI

Satellite Microwave

NAS / SAN

ProHD 720p60 QuickTime

Omneon Media Server

Gigabit Network

prg_001.mov prg_002.mov prg_003.mov

Native ProHD 720p60
Mpeg-2 @ 20 Mbps
No re-compression or
generation loss

HD-SDI 1 HD-SDI 2 HD-SDI 3

On-Air Playback

IEEE-1394

HD Production Switcher

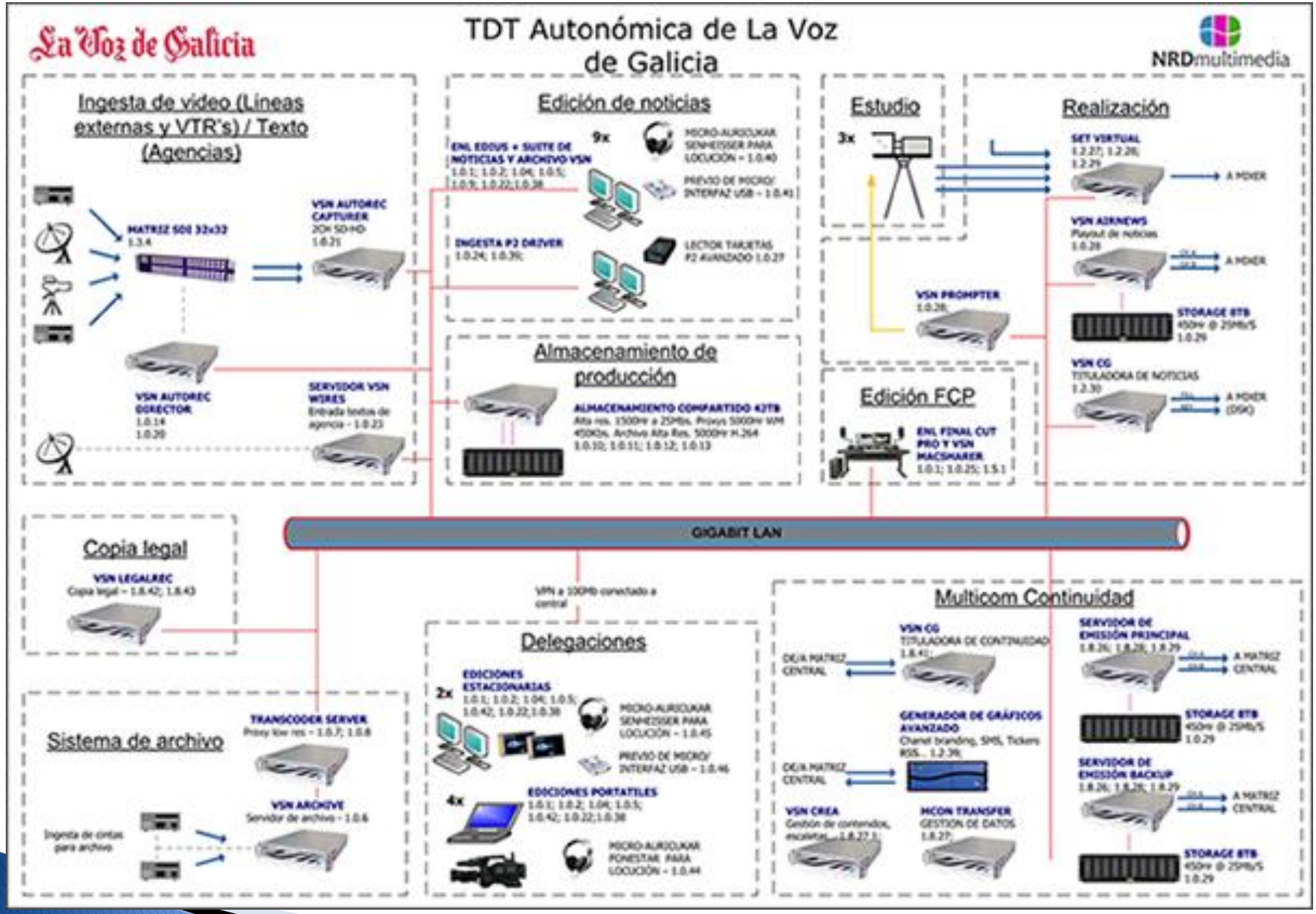
HD-SDI

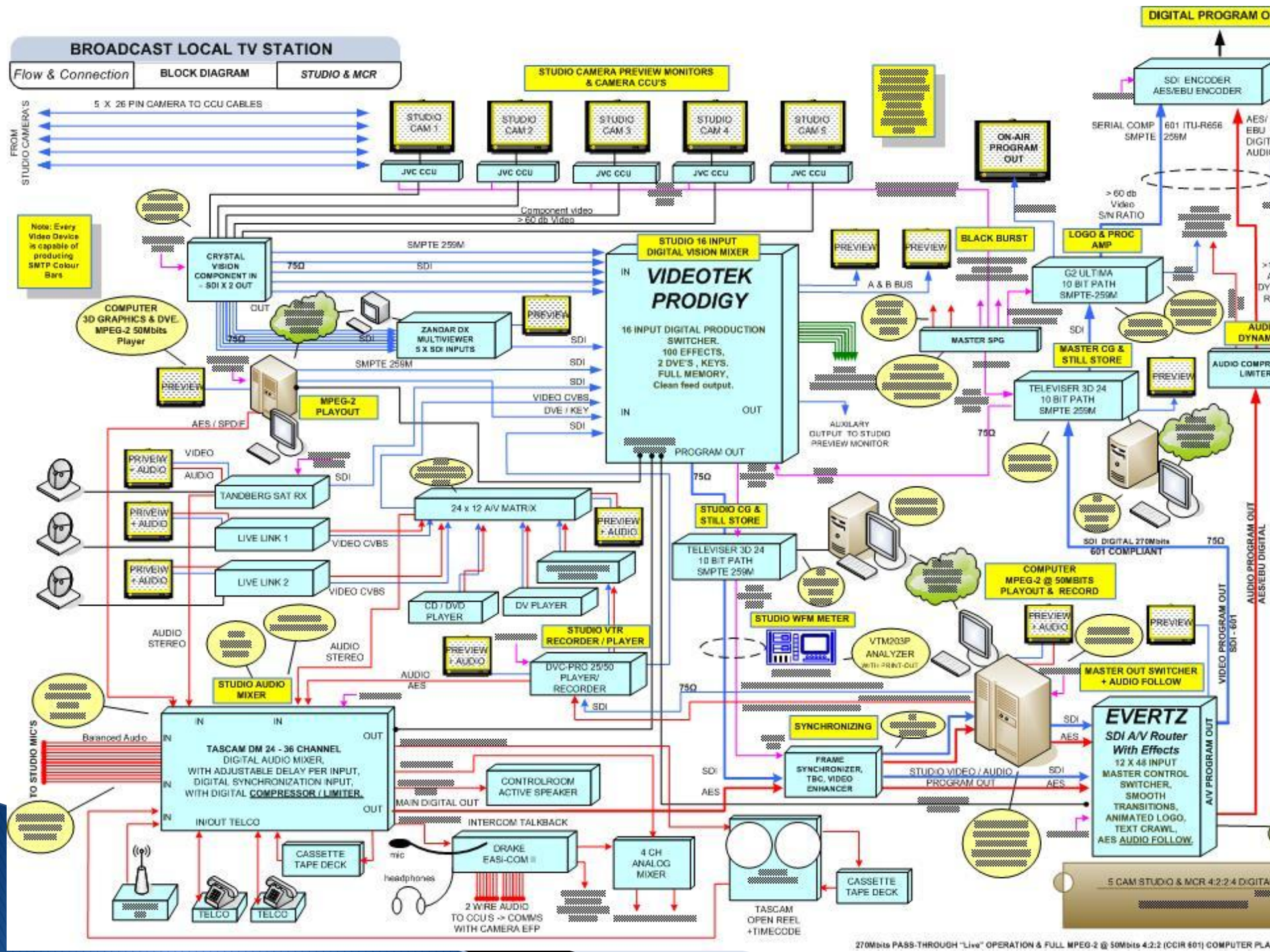
HD-SDI

LIBRE Microwave package

ProHD Workflow Components

Model	Manufacturer	Description
GY-HD200UB	JVC	3-CCD ProHD Camcorder. 720p (1080i with DR-HD100)
GY-HD250U	JVC	3-CCD ProHD Camcorder. 720p / 1080i HD-SDI output
BR-HD50U	JVC	ProHD VTR
DR-HD100	JVC	HD Hard Disc Recorder
KA-HD250U	JVC	Studio Adapter for GY-HD250U
RM-HP250AU	JVC	Remote Camera Control Unit
RM-LP25U	JVC	Local Remote Unit (Shader)
VF-HP840U	JVC	HD Studio Viewfinder
KM-H3000U	JVC	HD Production Switcher
LIBRE	JVC/BMS	Microwave package
HD-Bridge DEC+	Miranda	Firewire / ASI to HD-SDI converter
ASI-Bridge CAM	Miranda	Firewire to ASI converter
VC-300HD	Edirol	Multi-Format HD Encoder
MediaDeck	Omneon	Integrated Media Server
Final Cut Pro	Apple	NLE Software (v. 6.02)


La Voz de Galicia
TDT Autonómica de La Voz de Galicia
NRDmultimedia
Ingesta de vídeo (Líneas externas y VTR's) / Texto (Agencias)
MATRIZ SDI 32x32
1.3.4
VSN AUTOREC CAPTURER
2CH SD-HD
1.0.21
VSN AUTOREC DIRECTOR
1.0.14
1.0.20
SERVIDOR VSN WIRES
Entrada textos de agencia - 1.0.23
Edición de noticias
9x
ENL EDIUS + SUITE DE NOTICIAS Y ARCHIVO VSN
1.0.1; 1.0.2; 1.04; 1.0.5; 1.0.9; 1.0.22; 1.0.38
MICRO-AURICULAR SENNHEISSER PARA LOCUCIÓN - 1.0.40
PREVIO DE MICRO/ INTERFAZ USB - 1.0.41
INGESTA P2 DRIVER
1.0.24; 1.0.39;
LECTOR TARJETAS P2 AVANZADO 1.0.27
Almacenamiento de producción
ALMACENAMIENTO COMPARTIDO 42TB
Alta res. 1500Hr a 25Mbs. Proxys 500Hr WM 450Kbs, Archivo Alta Res. 500Hr H.264
1.0.10; 1.0.11; 1.0.12; 1.0.13
Estudio
3x
VSN PROMPTER
1.0.28;
Realización
SET VIRTUAL
1.2.27; 1.2.28; 1.2.29
A MIXER
VSN AIRNEWS
Playout de noticias
1.0.28
A MIXER
STORAGE 8TB
450Hr @ 25Mb/S
1.0.29
VSN CG
TITULADORA DE NOTICIAS
1.2.30
A MIXER (DSK)
Edición FCP
ENL FINAL CUT PRO Y VSN MACSHARER
1.0.1; 1.0.25; 1.5.1
GIGABIT LAN
Copia legal
VSN LEGALREC
Copia legal - 1.8.42; 1.8.43
VPN a 100Mb conectado a central
Delegaciones
2x
EDICIONES ESTACIONARIAS
1.0.1; 1.0.2; 1.04; 1.0.5; 1.0.42; 1.0.22; 1.0.38
MICRO-AURICULAR SENNHEISSER PARA LOCUCIÓN - 1.0.45
PREVIO DE MICRO/ INTERFAZ USB - 1.0.46
4x
EDICIONES PORTATILES
1.0.1; 1.0.2; 1.04; 1.0.5; 1.0.42; 1.0.22; 1.0.38
MICRO-AURICULAR PONEETJAK PARA LOCUCIÓN - 1.0.44
Sistema de archivo
TRANSCODER SERVER
Proxy low res - 1.0.7; 1.0.8
VSN ARCHIVE
Servidor de archivo - 1.0.6
Ingesta de cintas para archivo
Multicom Continuidad
VSN CG
TITULADORA DE CONTINUIDAD
1.8.41;
DEJA MATRIZ CENTRAL
GENERADOR DE GRÁFICOS AVANZADO
Chanel branding, SMS, Tickers RSS... 1.2.39;
DEJA MATRIZ CENTRAL
VSN CREA
Gestión de contenidos, escaletas... 1.8.27.1;
MCON TRANSFER
GESTION DE DATOS
1.8.27;
SERVIDOR DE EMISIÓN PRINCIPAL
1.8.26; 1.8.28; 1.8.29
A MATRIZ CENTRAL
STORAGE 8TB
450Hr @ 25Mb/S
1.0.29
SERVIDOR DE EMISIÓN BACKUP
1.8.26; 1.8.28; 1.8.29
A MATRIZ CENTRAL
STORAGE 8TB
450Hr @ 25Mb/S
1.0.29


BROADCAST LOCAL TV STATION
Flow & Connection
BLOCK DIAGRAM
STUDIO & MCR
STUDIO CAMERA PREVIEW MONITORS & CAMERA CCU'S
5 X 26 PIN CAMERA TO CCU CABLES
FROM STUDIO CAMERA'S
STUDIO CAM 1
STUDIO CAM 2
STUDIO CAM 3
STUDIO CAM 4
STUDIO CAM 5
JVC CCU
Component video > 60 db Video
Note: Every Video Device is capable of producing SMTP Colour Bars
CRYSTAL VISION COMPONENT IN - SDI X 2 OUT
SMPTE 259M
75Ω
SDI
OUT
COMPUTER 3D GRAPHICS & DVE MPEG-2 50Mbits Player
PREVIEW
ZANDAR DX MULTIVIEWER 5 X SDI INPUTS
MPEG-2 PLAYOUT
AES / SPDIF
STUDIO 16 INPUT DIGITAL VISION MIXER
VIDEOTEK PRODIGY
16 INPUT DIGITAL PRODUCTION SWITCHER.
100 EFFECTS,
2 DVE'S , KEYS.
FULL MEMORY,
Clean feed output.
IN
OUT
PROGRAM OUT
VIDEO CVBS
DVE / KEY
AUXILARY OUTPUT TO STUDIO PREVIEW MONITOR
ON-AIR PROGRAM OUT
BLACK BURST
A & B BUS
G2 ULTIMA 10 BIT PATH SMPTE-259M
LOGO & PROC AMP
MASTER SPG
MASTER CG & STILL STORE
TELEVISER 3D 24 10 BIT PATH SMPTE 259M
SDI ENCODER AES/EBU ENCODER
SERIAL COMP SMPTE 601 ITU-R656 259M
> 60 db Video S/N RATIO
AES/EBU DIGITAL AUDIO
AUDIO DYNAMICS
AUDIO COMPRESSOR LIMITER
SDI DIGITAL 270Mbits 601 COMPLIANT
AUDIO PROGRAM OUT AES/EBU DIGITAL
VIDEO PROGRAM OUT SDI - 601
TANDBERG SAT RX
LIVE LINK 1
LIVE LINK 2
24 x 12 A/V MATRIX
CD / DVD PLAYER
DV PLAYER
STUDIO VTR RECORDER / PLAYER
DVC-PRO 25/50 PLAYER/ RECORDER
STUDIO CG & STILL STORE
TELEVISER 3D 24 10 BIT PATH SMPTE 259M
STUDIO WFM METER
VTM203P ANALYZER WITH PRINT-OUT
COMPUTER MPEG-2 @ 50MBITS PLAYOUT & RECORD
MASTER OUT SWITCHER + AUDIO FOLLOW
AUDIO STEREO
STUDIO AUDIO MIXER
AUDIO AES
TO STUDIO MIC'S
Balanced Audio
TASCAM DM 24 - 36 CHANNEL
DIGITAL AUDIO MIXER,
WITH ADJUSTABLE DELAY PER INPUT,
DIGITAL SYNCHRONIZATION INPUT,
WITH DIGITAL COMPRESSOR / LIMITER.
IN/OUT TELCO
CONTROLROOM ACTIVE SPEAKER
MAIN DIGITAL OUT
INTERCOM TALKBACK
DRAKE EASI-COM II
mic
headphones
2 WIRE AUDIO TO CCU'S -> COMMS WITH CAMERA EFP
4 CH ANALOG MIXER
CASSETTE TAPE DECK
TELCO
TASCAM OPEN REEL +TIMECODE
SYNCHRONIZING
FRAME SYNCHRONIZER, TBC, VIDEO ENHANCER
STUDIO VIDEO / AUDIO PROGRAM OUT
EVERTZ
SDI A/V Router With Effects
12 X 48 INPUT MASTER CONTROL SWITCHER,
SMOOTH TRANSITIONS,
ANIMATED LOGO,
TEXT CRAWL,
AES AUDIO FOLLOW.
A/V PROGRAM OUT
5 CAM STUDIO & MCR 4:2:2:4 DIGITA
270Mbits PASS-THROUGH "Live" OPERATION & FULL MPEG-2 @ 50Mbits 4:2:2 (CCIR 601) COMPUTER PLA

Pantallas publicas en Japon
Super Hi-Vision

Akihabara: pantalla de 300”
Tours para invitados especiales