Signal Format for Common Carrier and SONET

(Common Carrier, 1, 2)

Contribution: Compressed 240M with 120 Mbps

Distribution: Compressed 240M with 60 Mbps
Compressed N-MUSE with 40 Mbps

These signals fit well into a 360 Mbps SONET channel.

N-MUSE 40 Mbps: 9 programs/channel
240M 60 Mbps: 6 programs/channel
240M 120 Mbps: 3 programs/channel

NHK

Consumer VCR (Consumer, 1)

Analog VCR will be available within two years after FCC's selection.

No new technology development is required.

- FM recording
- TBC necessary
- Sync circuit needs modification
- Chroma circuit can be removed

Digital VCR will be available within two years after FCC's selection.

Technology for consumer VCR that can record 40 Mbps for two hours is already available.

NHK

ATV and NTSC on the same Transponder

(Satellite, 1)

ATV	NTSC	Total bit rate	Bandwidth
40 Mbps (Compressed Narrow-MUSE)	17 Mbps	57 Mbps	34 MHz
60 Mbps (Compressed 240M, Distribution)	17 Mbps	77 Mbps	46 Mbps
120 Mbps (Compressed 240M, Contribution)	34 Mbps	144 Mbps	92 Mbps

NHK

Comments on General Assumptions for PERT Chart

Origination Format, Interim format or True HDTV

Very first implementation in local stations

Interface between studio equipment

NHK

Comments on General Assumptions for PERT Chart (Origination format)

It is desirable to introduce true HDTV, not an interim format, for program production.

Interim format cannot bring out full capability of Narrow-MUSE.

Broadcasters and production houses might have to replace interim equipment with true HDTV equipment in the future, resulting extra financial burden.

NHK

Comments on General Assumptions for PERT Chart (First implementation)

The very first implementation might be as follows:

Distribution signal format is ATV transmission format.
Operation in local stations is only commercial insertion.
Only downconverter from ATV to NTSC is used for simulcasting.

NHK

Comments on General Assumptions for PERT Chart (Interface)

Interface between studio equipment

- Analog component (NTSC, ATV)
- Analog composite (NTSC)
- Digital component, parallel (525, ATV)
- Digital component, serial (525, ATV)
- Digital composite (NTSC)

NHK

IS/WPL-080
25 MAR 92

March 25, 1992
NHK

Answers to Follow-up Questions

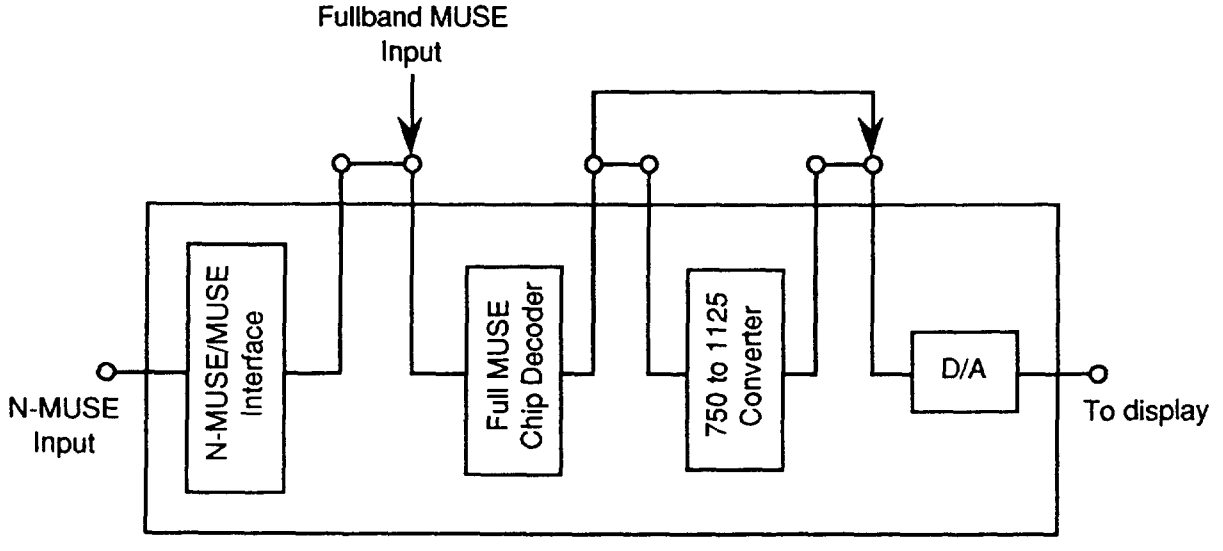
General

1. Regarding answer 1): What provision will you make in the initial implementation to make the use of additional motion vectors possible? What will receivers have to include? What if anything do you give up to add the motion vectors?

To make the use of additional motion vector possible certain data capacity in the ancillary data channel should be reserved for the additional motion vectors. For example, data capacity of 60 kbps is necessary to send 140 vectors/field (Current system transmit one vector/field). Receivers should include additional control circuit and memories. Required additional memory size is equivalent to six line memories.

Regarding answer 2): What will a Narrow MUSE receiver have to do or have programmed from the beginning to receive a full band MUSE signal?

The Narrow-MUSE receiver must be build using fullband MUSE chips. A digital interface point for fullband MUSE should be provided at between Narrow-MUSE/Fullband MUSE interface block and fullband MUSE chip decoder block for fullband MUSE reception. The output from Fullband MUSE Chip Decoder block bypasses the converter block and is connected to D/A block directly. See the following block diagram.



Narrow-MUSE decoder

2. We take this answer to mean that the manufacturing information will be available during the period of generation of the NPRM. Do you agree?

Yes

3. Does this answer mean that to obtain any information at all about the system the terms and conditions must be agreed to? Or does this only apply to patent licensing and the transfer of manufacturing know-how? Do you plan to offer prototype hardware evaluation service?

Any proprietary information and manufacturing know-how that is necessary to manufacture commercial equipment, such as schematic diagrams, the value of tap coefficients of digital filters, and various kinds of parameters, will be subjects of discussion of terms and conditions. The prototype hardware evaluation service is included in the technology transfer program. If applicants want to receive only the evaluation service, it is possible to make such a contract with NHK Engineering Service Inc.

Incidentally all Information that is necessary to set up a standard will be provided from NHK to any standardization organizations without any restriction.

4. Would the use of Full MUSE IC's in a Narrow MUSE encoder or decoder come at a cost penalty relative to specific Narrow MUSE chips? Would Narrow MUSE chips be more or less expensive than Full MUSE chips? Are there plans to develop specific Narrow MUSE IC's

The use of Full MUSE chips in a Narrow-MUSE decoder will not cause cost penalty, because the difference of the circuit scale between fullband MUSE decoder chips and Narrow-MUSE decoder chips is not big enough to cause the cost difference. The scale of control circuit in a Narrow-MUSE decoder, which is the most complicated part of a decoder, is the same as that of a fullband MUSE decoder. The required memory size for specific Narrow-MUSE chips is approximately 70% that of fullband MUSE chips, and this difference is almost negligible. When fullband MUSE chips are used for a Narrow-MUSE receiver, Narrow-MUSE/Fullband MUSE interface block is an additional parts. The signal processing in these parts is not complicated that it would not cause a big cost penalty.

In addition, to use fullband MUSE chips, which is now available on the market, for Narrow-MUSE receivers will save time and cost for development of new chips. It is also desirable from the extenibility point of view (See answer 1). Therefore, currently we do not have plans to develop specific Narrow-MUSE Ic's.

5. Does this answer mean that only the implementation of the broadcast transmitter facility is on the critical path? Does the 3 year period include the time for alternate media?

Yes. The implementation of the broadcast transmitter facility would be the most critical path. The three year period includes the time for alternate media.

Broadcast

1. Your response indicates an expected improvement of 4-7 dB in receiver noise figure. What is your assumption about the noise figure of current receivers?

   We assumed that the noise figure of current receivers is 12 dB for VHF and 15 dB for UHF.

2. When you suggest upconverting only encoded NTSC as the alternative to full HDTV, do you preclude the use of a widescreen 525-line signal as a source? What production equipment economies could be available specifically for transmission in Narrow MUSE as opposed to the high quality inputs needed for Full MUSE? When could such equipment be available? Why would broadcaster want to upgrade to true HDTV when a lower performance system might be adequate for Narrow MUSE?

   Our answer did not mean to preclude the use of a widescreen 525-line signal as a source. In fact, upconverters from NTSC to 240M format now available on the market can accept a widescreen 525-line signal with very minor modification.

   However, what we meant in our answer is that it is not a desirable approach to establish an intermediate production standard. Broadcasters and production houses might have to replace intermediate equipment with true HDTV equipment in the future to bring out the Narrow-MUSE's full capability, because both the widescreen NTSC and widescreen 525-line component systems have less spatial resolution than the capability of Narrow-MUSE.

   The dual production standard, true HDTV and widescreen 525, will cause the difficulty of program exchange, and might make the cost of production equipment higher. In addition, it will not meet the FCC's preference for true HDTV.

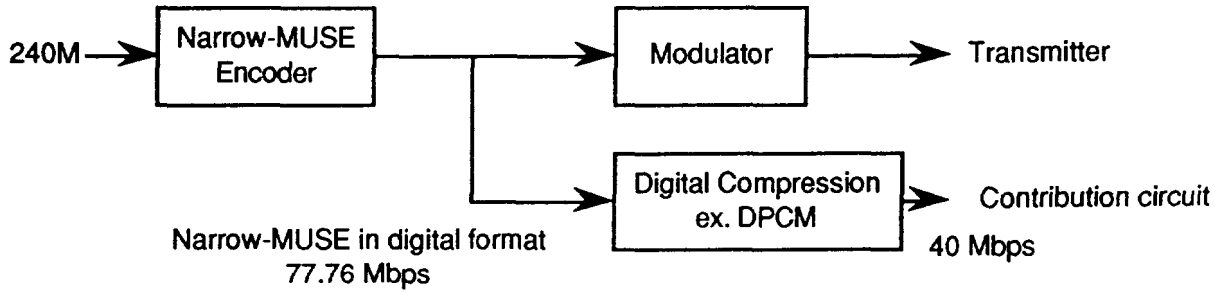
   Therefore technically speaking, although Narrow-MUSE can accept a widescreen 525-line signal as a source through an upconverter, we do not recommend the use of an intermediate system.

   Do you anticipate the use of compression of HDTV source in the studio? What bit rate will be required for high quality production and post production using compression?

   Two to one or four to one compression of the SMPTE 240M signal could be used for the high quality production and post production. At this moment we do not have a clear answer to this question. Further study is necessary and is underway at CCIR.

3. In the second option in your answer, where Narrow MUSE is transmitted digitally, what sources used for the further compression to 40 Mb/s?

HDTV signals that is encoded into the Narrow-MUSE format are further compressed using digital compression technique such as DPCM. The Narrow-MUSE signal is taken out from the interface point between an baseband encoder and a modulator, where the signal is in digital domain with 77.76 Mbps data rate, then is applied digital compressor. The bit rate of the digital Narrow-MUSE is reduced down to 40 Mbps (compression ratio is less than 2:1) and fed to distribution circuits. See the following block diagram.



4. In the case of distribution of a digitally compressed 240M signal, must the signal be fully decoded to permit the three production processes? Or is production done in the compressed domain?

The digitally compressed 240M signal must be decoded to permit the three production processes.

5. How many times can the three processes be applied if the distribution signal is Narrow MUSE and it is decoded?

We assume that when digitally compressed Narrow-MUSE is used for distribution only the digital compression must be decoded and Narrow-MUSE coding is not decoded. Therefore, signal processing is limited only to "cut into the signal." The number of possible concatenations of coding/decoding of the digital compression of Narrow-MUSE is two to keep acceptable picture quality.

6. What would you recommend for carrying both signals in a 25 MHz channel?

To transmit both NTSC and Narrow-MUSE over a 25 MHz channel, a digital transmission is recommended. Digitally compressed Narrow-MUSE and NTSC with bit rates of 40 Mbps and 17 Mbps can be transmitted using 8ϕ PSK. When a slightly higher compression ratio is applied, QPSK can be used.

7. Are these bit rates required only because of the use of true HDTV source? Would lower performance sources permit lower bit rates with adequate quality in post production?

Lower bit rates might be possible for lower performance sources. However, we do not recommend to use lower performance sources because of the same reasons described in answer 2 under Broadcast.

Cable

1. Is the hardware described (one-rack encoder, six-chip decoder) needed in addition to the Narrow MUSE encoder and decoder hardware in order to provide conditional access?

   Yes. The size of encoder will be reduced in the commercial equipment because current equipment is a prototype hardware.

Consumer

1. What is the effect of motion compensation in Narrow MUSE on the ability to provide stunt features in the VCR's, both analog and digital, for example slow motion, still frame, reverse motion, picture in shuttle? Have you verified this experimentally?

   The distinction of moving area and stationary area and the use of motion vector is essential for Narrow-MUSE decoding to obtain its full capability. Whether Narrow-MUSE decoder can perform these functions or not in stunt features of VCR's depends on the decoder design. If decoder is properly designed, the Narrow-MUSE signal in slow motion, still frame, reverse motion can be fully decoded.

Satellite

1. What modulation technique is assumed for carrying digital signals on satellites? QPSK as shown for broadcast microwave?

   QPSK is assumed. 8ϕ PSK can also be used.

IS/WP-2-0181
25 MAR 9-

IS/WP-2 FOLLOWUP QUESTIONS REGARDING ZENITH/AT&T DSC-HDTV

MARCH 25, 1992

AT&T

ZENITH

General

1.
- Data structure is not designed for a general purpose digital communications application.
- Data structure is unique to DSC-HDTV.
- Only ancillary data can conform to data source structure.
- The extended performance referred to in our 3/6/92 answers was in regard to improvements gained with experience requiring no receiver change.

2.
- The 3 mos. and 6 mos. periods are in parallel, not sequential.

AT&T

ZENITH

Bi–Rate Data Format
Byte Assignment
Data Field 1

171 Bytes/63.5uSec

Data Segment Sync

167 Data Field Sync (Equalizer Training)				1
15 TBM	132 Video Control		20 Parity	2
				3
15 TBM	132 Video Control		20 Parity	4
				5
15 Anc	132 Audio		20 Parity	6
				7
15 Anc	132 Audio		20 Parity	8
				9
15 Anc	132 Audio		20 Parity	10
				11
18 Anc	129 Audio		20 Parity	12
				13
(MIN) 120 x 147 = 17,640 If all sent W1 (MAX) 240 x 147 = 35,280 If all sent W2			2,400 Parity or 4,800 Parity	14

4 x 262 = 1,048

			253
15 Anc	132 Audio	20 Parity	254
15 Anc	132 Audio	20 Parity	255
15 Anc	132 Audio	20 Parity	256
18 Anc	129 Audio	20 Parity	257
147 Anc		20 Parity	258
147 Anc		20 Parity	259
147 Anc		20 Parity	260
147 Anc		20 Parity	261
147 Anc		20 Parity	262

FIG. 6-2a

AT&T

ZENITH

Bi–Rate Data Format
Byte Assignment
Data Field 2

171 Bytes/63.5uSec

Data Segment Sync

167 Data Field Sync (Equalizer Training)				263
15 TBM	132 Video Control		20 Parity	264
				265
15 TBM	132 Video Control		20 Parity	266
				267
15 Anc	132 Audio		20 Parity	268
				269
15 Anc	132 Audio		20 Parity	270
				271
15 Anc	132 Audio		20 Parity	272
				273
18 Anc	129 Audio		20 Parity	274
				275
(MIN) 120 x 147 = 17,640 If all sent W1 (MAX) 240 x 147 = 35,280 If all sent W2			2,400 Parity or 4,800 Parity	276

4 x 263 = 1,052

				515
15 Anc	132 Audio		20 Parity	516
15 Anc	132 Audio		20 Parity	517
15 Anc	132 Audio		20 Parity	518
18 Anc	129 Audio		20 Parity	519
147 Anc			20 Parity	520
147 Anc			20 Parity	521
147 Anc			20 Parity	522
147 Anc			20 Parity	523
147 Anc			20 Parity	524
167 Test Data				525

FIG. 6-2b

AT&T

ZENITH

General

3.
- We have no specific plan at this time.
- When DSC-HDTV is unambiguously chosen a plan will be crafted.
- The plan will include detailed block/ circuit diagrams and seminars, if appropriate.

4.
- Timely information on IC's will be made available to all manufacturers.

5.
- The choice of only the DSC-HDTV system would be unambiguous.
- Estimate of timing to marketplace introduction is under review.

AT&T

ZENITH

Broadcast

2.
- 2-dimensional modest compression (Q. B-7) would also apply to studio production and post production.
- Approximately 200Mb/s.
- We are not yet prepared to show results.

4.
- Several frames of past history partly constitute channel change artifacts.
- Cutting to black removes past history.
- Cutting to a still is similar.
- It might be advantageous to cut at a black or still series of frames.

AT&T

ZENITH

Broadcast

5.

- Artifacts are created with unpredictable motion and when changing scenes, but are perceptually acceptable.
- Cascading the algorithm has not been fully studied.

AT&T

ZENITH

Broadcast

6.

- The analog baseband is frequency multiplexed.
- The frequency multiplexed baseband is frequency modulated on the microwave carrier.
- The microwave bandwidth is dependent on the choice of signalling (i.e., QPSK) and whether other overhead is used (i.e., for error correction).
- This reply and the previous answer are not intended to be a design.

AT&T

ZENITH

Broadcast

7.

- Staying in the digital domain for the compressed signal eliminates the D/A and A/D conversion processes.

- Since 2D compression and de-compression do not involve the temporal domain, there is no past history, therefore no need to decompress for simple cuts.

- Exactly what is desirable for inserts and full image manipulation is under study.

AT&T

ZENITH

Cable

1.

- A stream cypher process is simply one of modulo-2 (or N) adding a known (hopefully secret) pseudo-random number series with the message data stream. Decyphering is the complementary process.
- The picture (and sound) is naturally scrambled when converting from analog to digital (from a recognizable image to noise).

AT&T

ZENITH

Cable

1. (Cont.)
   - Encryption (encypherment) can be done on the image and sound data downstream as well as at the source.
   - Channel synchronizing, clocks, and general timing information is not encrypted for conditional access.

AT&T

ZENITH