Digitization of the Eurovision network

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The EBU plans to operate a digital transmission network for Eurovision, using 34 Mbit/s codecs, from 1995.

This new network will be operated in conjunction with existing analogue sections of the Eurovision network, and this will lead to specific operational constraints and requirements.

1. Introduction

Eurovision is certainly the most widely known aspect of the EBU. The network is intensively used to exchange programme material between EBU Members and, more recently, it has also been made available to non–member broadcasters on a commercial basis.

Eurovision deals exclusively with contribution signals. All television signals that pass through the network are destined for professional users, who process the signals further before broadcasting them as part of a complete programme to their domestic audiences.

Over the years, the Eurovision network has been evolving steadily, and sometimes changing spectacularly, such as in 1984 when the Eutelsat I–F2 satellite was added to its transmission options.

Whilst the changes in the network need not be detailed here, it can be stated that their overall effect has been to decrease the dependency of Eurovision on terrestrial circuits, and to intensify its use of leased satellite capacity.

This network evolution has been designed to keep operating costs down, whilst creating an environment which will be as flexible as possible to accommodate future requirements.

Presently the network is capable of supporting a full broadcast–specification PAL or SECAM analogue composite vision signal, together with its associated monophonic sound–in–syncs (SIS) audio signal, insertion test signals (ITS) and identification data signals (IDS).

The terrestrial network is predominantly based on international analogue SHF radio–links having, in the great majority of cases, a baseband capability of about 5.0 MHz.

The satellite network consists of about 50 broadcaster–owned or leased earth stations working through four leased wideband transponders (numbers 20, 21, 25 and 26) on the Eutelsat II–F4M satellite orbiting at 7° east. Capacity is also leased on Intelsat 601 to provide a trans–Atlantic television channel, through which material is injected into the Eurovision network from the EBU New York and Washington bureaux.

There will be a continuing presence of satellites in the Eurovision network. Satellite news–gathering (SNG) will certainly require satellite capacity in the future, and it is the long–term expectation that satellites will form an integral and transparent part of a public broadband integrated–services digital network (B–ISDN) when this becomes available.

2. Analogue transmission

The existence of the PAL, SECAM and NTSC formats makes international programme transfer a more laborious process than would otherwise be necessary. The additional processing that the signal can undergo after it has left the Eurovision network can include standards conversion as well as videotape editing and chroma–key or other video–effects manipulation; all these processes involve a small but inevitable loss in picture quality. In addition, the deficiencies of video coding systems based on frequency–division multiplex (FDM) techniques, not least their vulnerability in transmission, are well known and documented extensively. It is essential, with such signals on the network, that they are delivered to the broadcaster with a minimum of transmission degradation. Important aspects of network operation are therefore the regular monitoring of the technical quality of the vision network and the elimination of faults when necessary.

For this purpose, insertion test signals (ITS) are placed on lines 17, 18, 330, and 331 in the frame blanking period of the composite video signal, and line 22 is maintained as a "quiet line" for noise measurements. These test signals may be examined by technicians at monitoring points throughout the network (national technical coordination centres – CNCT, international technical coordination centres – CICT, international television centres – ITC), and a quantitative assessment made of the signal–bearing performance of the circuits in question.

Insertion data signals (IDS) are used to assist in network maintenance and operations. These data are introduced on lines 16 and 329, also in the frame blanking period, and IDS decoders installed in ITCs and CNCTs enable the display of source identification information in a corner of the displayed picture. Neither ITS nor IDS signals are normally visible on domestic television screens.

The transmission capacity of the Eurovision network is monaural but the importance of carrying stereo sound is rapidly growing. Many broadcasters in Europe now provide a stereo television service, and use either an analogue twin–subcarrier system or a derivative of the digital NICAM system. Professional two–channel SIS systems are available on the market but EBU tests have shown that the coding used to fit the data inside the line–synchronizing pulses of the vision signal make these systems more vulnerable to analogue distortions and noise in the transmission path than the mono version. Consequently it has been decided not to equip the Eurovision network with this technology.

A recent decision by the Bureau of the Technical Committee means that the EBU Members' use of subcarriers to generate extra audio channels over Eurovision satellite links will be tolerated for unilateral and SNG activities. The situation will be improved when 34 Mbit/s digital transmission is used because the system specification (see *Section 4*) allows for up to two 2 Mbit/s channels for use by audio to be inserted in the digital multiplex.

Analogue signals are notoriously difficult to scramble securely without introducing unacceptable levels of distortion in the descrambled image. The need for secure transmission through the Eurovision network has been becoming more apparent for several years, and especially since the use of satellite transmission has expanded. The recent inclusion of third party (non–Member) traffic on the network has increased this need.

The possibilities for distortion–free, secure transmission will be enhanced when signals are transmitted in a digital format, and preferably in the same physical transmission medium from one end of the network to the other (without optical – electrical – optical conversion and switching, for example).

This situation will not arise for several years, and in practice, all planning must take into account a mixed network environment of satellite links, terrestrial radio–links and optical fibre links and their respective transmission characteristics and bit–rate capacities.

3. Satellite transmission

3.1. Practical constraints

In principle, there is no absolute limit to the bit–rate which can be carried on any carrier system. By using multi–level and multi–phase modulation, the bit–rate in a given bandwidth can theoretically be made arbitrarily high. There are, of course, problems of signal ruggedness to be overcome, and the greater transport data overheads such as error protection and framing information in turn have implications on equipment complexity, reliability and cost.

There is, however, another constraint to be taken into account when dimensioning satellite networks. This is the fact that satellite bit–rate must be traded against noise margin. The inevitable consequence of this is that, for a given satellite EIRP or G/T, the bit–rate must be traded against antenna gain (and therefore antenna size) at the earth station.

The EBU currently derives six analogue television channels on its leased capacity on Eutelsat II–F4M (*Fig. 1*). Earth stations that are capable of working with this configuration range from about 6 m to about 13 m in diameter, depending on where in the satellite service area they are situated.

Using these same earth stations for digital transmission and reception means that the satellite bit–rate is effectively a predetermined factor in the network.

It has been demonstrated that using a bit–rate of 34 Mbit/s per television channel, and modulation parameters conforming with the Intelsat intermediate data rate (IDR) specification [1], two television channels can be carried in each Eutelsat wideband transponder. This will give the EBU access to eight digital television channels on its two pairs of wideband transponders on Eutelsat II–F4M (*Fig. 2*), and there will also be capacity for four Euroradio channels at 2 Mbit/s each, and several SCPC communications channels on the satellite.

3.2. Earth stations

The complete specification for earth stations to be used for Eurovision purposes through EBU leased capacity on Eutelsat II is given in document Tech. 3265 [2]. This specification deals with earth station for use both in analogue and digital environments and, as a rule, these stations are typically of the order of 9 m diameter compared with the 18 m diameter of PTT standard telephony earth stations.

Eurovision earth stations must be able, simultaneously, to transmit on any two channels and to receive on any four channels of the EBU's leased capacity. Consequently, the earth stations must be able quickly to re–tune their transmission and reception chains to any of the eight channels to

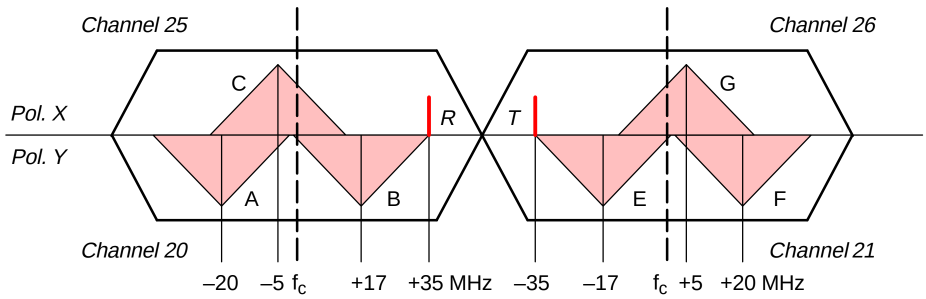

Figure 1
Analogue configuration.

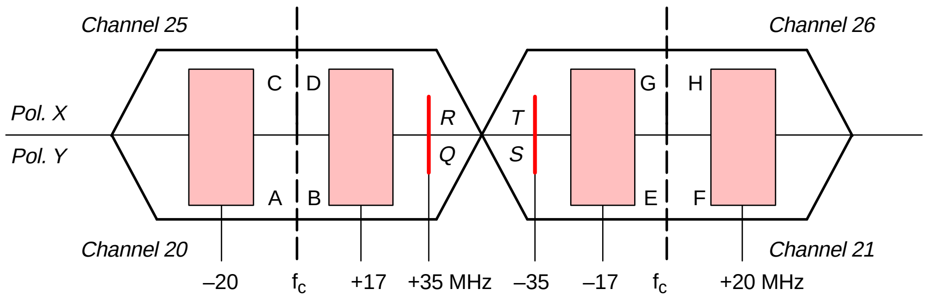

Figure 2
Digital configuration.

which Eurovision will have access in a digital transmission environment.

4. Choice of a transmission codec

The process of digitization was started with some preliminary experiments on satellite modems in 1991. The primary target is that all the satellite earth stations in the Eurovision network should be equipped for digital transmission and operational in 1995. Ultimately, the entire mixed Eurovision network should be digital.

European Standard ETS 300 174 [3] specifies a 34–45 Mbit/s transmission codec for digital component signals at the 4:2:2 level of the CCIR Recommendation 601 family of coding structures [4]. The same codec has also been adopted internationally as set out in CCIR Recommendation 723 [5].

It is planned to use the ETSI/CCIR 34–45 Mbit/s digital system for all Eurovision transmission purposes on its mixed network. The codecs can be equipped with interfaces to composite signals, so that PAL, SECAM or NTSC signals can continue to be used as production formats for as long as necessary to meet broadcasters' production requirements.

To complement the Standard, the EBU drew up a list of user requirements (external specifications) which should apply to 34 Mbit/s codecs operating in its future network. This list was sent to equipment manufacturers in November 1991, and their comments regarding the feasibility and the extra cost resulting from their implementation were noted. The current, revised list (see box on *pages 18/19*) takes into account the comments received and incorporates techno–economic trade–offs that the EBU considers as reasonable. It will serve as a basis for a future call for tenders.

During the evolution of these user requirements, the EBU confirmed its need for certain specific requirements which will be regarded as key to the acceptance of products. Some requirements have been abandoned and will not be considered of significant importance in the evaluation of codecs. Others are regarded as options which would be useful to network operations but which are not mandatory. Their availability will be considered in the comparison of products.

The first prototype versions of ETSI/CCIR 34–45 Mbit/s television codecs recently became available. Tests are in progress to verify the correct interworking of samples from different manufacturers' samples, and their adherence to the user requirements.

Several examples of IDR satellite modems from different manufacturers have been purchased by TDF, Eutelsat and the EBU, and these have been subjected to a series of tests which largely verified their interworking capabilities and their suitability for Eurovision use.

5. Evolution of the Eurovision network

While attempting to evolve towards an international digital Eurovision network, the most difficult phase is the period when :

a) not all broadcasters are operating in a digital domain, and

b) not all network elements operate in a digital domain.

Any number of combinations of a) and b) can be imagined, depending on the degree of digital penetration in either area.

Most broadcasters are already using some equipment that handles and processes signals in the digital domain, and in so doing are gaining valuable experience with the new techniques that have to be mastered in operating a digital studio environment. The timescale for the widespread acceptance of digital video in studios is dominated primarily by economics, and the process of change is well under way.

5.1. Evolution scenario

The following scenario serves as a basis for the relevant decision–making processes:

First phase

Earth stations are being installed at Members' premises. These stations are capable of working simultaneously with two transmit channels and four receive channels, and when fully implemented there will be at least one in every country in which the EBU has a Member or Members. In practice, some Members might choose to operate more than one earth station in their country.

EBU user requirements for ETS 300 174 codecs

Video inputs

Access to the video channel shall be either via digital interfaces at the CCIR Recommendation 601 4:2:2 level or via one single composite analogue input. The selection between the digital inputs and the analogue input shall be done via a remote control switch.

The digital interfaces will be available both in bit–parallel and bit–serial formats (see EBU document Tech. 3267–E [6]). The selection between the formats shall be made automatically :

– if only one input is active, this is selected;

– if both are active, the serial input is selected.

When accessed through a digital interface, the codec will automatically support 625 and 525–line systems.

The single composite input shall accept PAL and SECAM, and must recognise the input standard and automatically decode to 4:2:2 components. The video format is signalled in the video multiplex (see ETS 300 174, Sub–clause 8.1.3).

[Option 1: The ability to accept NTSC, as well, would be appreciated, because if signals must be inserted by means of an external NTSC to 4:2:2 decoder, ITS and IDS signals will be lost.]

Video outputs

Digital outputs, both serial and parallel, will be available, and should support both 625 and 525–line systems.

In addition, the following analogue outputs shall be present, automatically providing PAL or SECAM on a single connector according to the following rules :

– if the original signal is PAL, the output is forced to PAL;

– if the original signal is SECAM, the output is forced to SECAM;

– if the original signal is 625–line component, the output is forced to a predefined format, PAL or SECAM, set at the time of decoder configuration.

[The following options would be welcomed:

Option 2: Having NTSC signals on the same composite output; NTSC signals may be produced by means of an external 4:2:2 to NTSC encoder, but ITS and IDS signals will be lost.

Either:

Option 3: A second output, providing 625–line signals in a predefined format, PAL or SECAM, set at the time of decoder configuration, independent of the mandatory output, which shall follow the above rule; this output could save an external stage of composite transcoding. If this is not available, broadcasters may produce a composite signal in their own local standard by means of an external 4:2:2 to composite encoder, but ITS and IDS will be lost.

or:

Option 4: In the absence of Option 3, and where it is known that no further feed into the EBU network is possible (e.g. in Iceland), the ability to override the rules governing the mandatory output and force a predefined output format, set at the time of decoder configuration.]

The EBU network will be components–based and it is expected that composite sources may feed destinations operating in components mode or in another composite format. In this context, complementary PAL decoding as used for PAL to PAL applications is not suited for the EBU network, unless adequate luminance/chrominance separation is provided, e.g. by means of comb–filters. The attention of all manufacturers has been specifically drawn to this consideration.

Also, composite coders in the 34 Mbit/s decoders must be protected against wide–bandwidth chrominance signals from component sources.

Audio inputs/outputs

A stereo/2–channel audio codec conforming to CCIR Recommendation 724 [7] shall be integrated in the 34 Mbit/s codec frame. It is a requirement that the sampling frequency used for audio analogue–to–digital conversion at the encoder is locked to the video time–base (it shall not be free–running or locked directly to the transmission network).

The equipment must be configurable to accept signals in the AES/EBU digital format. However the analogue format will be used initially and the equipment must accept analogue signals.

Evolution from analogue to AES/EBU formats should be possible at marginal cost.

EBU user requirements for ETS 300 174 codecs (contd.)

ITS

The transportation of ITS signals is described in Subclause 9.4 of ETS 300 174. The following is an additional requirement:

When the encoder detects the absence of ITS signals in the incoming signal, (composite or components), new ITS should be generated in the encoder. ITS signals are defined in CCIR Recommendation 473 [8]. However, it is now also common practice to consider line 22 as a "test line" where the S/N ratio is measured. Therefore, lines 17, 18, 330, 331 and 22 should be carried.

Remark: a possible relaxation can be accepted if the codec has a test–line capacity of four lines only, provided that the presence of more lines in the input signal does not disrupt the coding of the desired four test–lines. In this case, line 18 should be discarded and lines 17, 330, 331 and 22 preserved.

IDS

The IDS signal is described in EBU document Tech. 3217 [9]. In practice the information is limited to eight ASCII characters. This information should not be transmitted via the teletext channel of the codec but instead demodulated and inserted into the codec supervision channel, in the source identification field, defined in Subclause 9.2.2.3. of ETS 300 174. If there is no IDS present in the input signal, then the coder should transfer its own identification (coder identification field, Subclause 9.2.2.5) into the source identification. The information recovered at the decoder shall be reinserted in the output video signal, according to EBU document Tech. 3217.

Supervision channel

The use of coder and source identification fields are described for IDS, above.

Access should be provided in each coder for the insertion of its identification, with up to the fifteen ASCII characters available in the field (see ETS 300 174, Subclause 9.2.2.5).

Scrambling

Scrambling, as defined in ETS 300 174, Clause 12, shall be implemented. For Eurovision purposes, all components should be scrambled together. Conditional access is for further study.

Ancillary channels

The content of transmission channels reserved for video (V), primary audio (A), access control (CA1, CA2) and test lines is completely defined, as are the associated interfaces.

Channels for teletext (T, T') and time–codes (LTC and VITC) are not presently to be used.

For the second audio channel (A'), future access through an HDB3 interface should be available or should be easy to implement at a later stage.

The supervision channel will be accessed through the remote–control system of the codecs.

In the longer term, part of the above information will be carried with the video in the digital interface. It is expected that the architecture of codecs will be flexible enough to permit such an evolution by means of adding and/or changing specific boards. Manufacturers should provide detailed information on this aspect.

Connectors

The EBU expresses a strong preference for having connectors on the rear panel of codecs.

Second phase

When digital transmission equipment is available in large enough quantities, it will be installed in the network and the digital configuration (*Fig. 2*) will be implemented on Eutelsat II–F4M This should result in a considerable shift in traffic away from terrestrial radio–links, which will then be dealing with residual and overload traffic.

Third phase

Progressive transfer of radio–link traffic onto optical fibres as they become available, with a gradual redistribution of traffic between satellite and

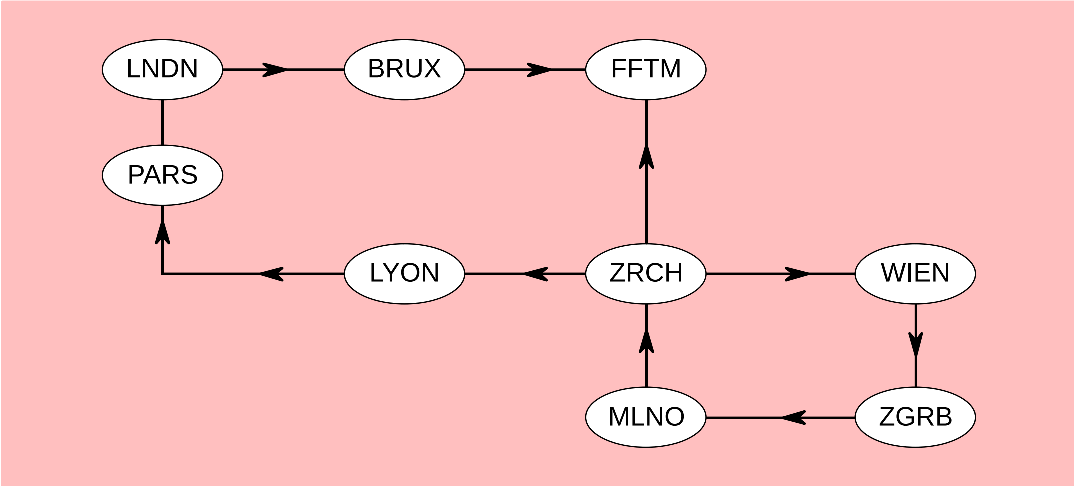

Figure 3
Possible Eurovision permanent terrestrial after 1995.

fibres and an integration of services as the B–ISDN develops internationally and as economics dictate.

5.2. *Considerations and assumptions associated with evolution*

The EBU is not planning to abandon its terrestrial network, but during the second and third phases, and prior to any potential migration to a B–ISDN, the terrestrial portion of the mixed network may contract to form a hub configuration consisting of the loops defined by the network nodes shown in *Fig. 3*.

If these terrestrial circuits are available as 34 Mbit/s links in time for 1995 it will greatly simplify the transition to digital transmission over the complete network. Otherwise, the interworking between a digital satellite network and an analogue terrestrial network will cause much expense and operational complexity, as discussed elsewhere.

From 1995 onwards, all broadcasters who are active in Eurovision will need to be equipped with coders and decoders conforming to the ETSI/CCIR 34–45 Mbit/s specification and with IDR satellite modems working at 34 Mbit/s. Most, and preferably all, Active EBU Members should operate earth stations at their premises. From 1995, earth stations which are remote from broadcasters' premises will have to accept either digital or composite analogue signals, depending on the capability of the terrestrial segment between the nearest CNCT and the earth station. In the former case, any composite–to–digital coding would be done at the CNCT, and in the latter case coding would be effected at the earth station. However, it is very important that these terrestrial segments should be amongst the first circuits to become digital.

In the framework of this scenario the great majority of Eurovision material will be conveyed by satellite. The proliferation of small receiving stations in Europe means that the scrambling of Eurovision signals will become essential.

The ETSI/CCIR specification for the 34–45 Mbit/s codec includes provision for the secure scrambling of the transmitted signal and it contains data interfaces to enable the codecs to function within a network management system. This aspect is currently under study within EBU Sub–groups T3 and T4.

The evolution scenario described here does not inevitably mean that a public B–ISDN must be regarded as the target network configuration. The greatest hurdle in international broadcasting is perceived as being the abandonment of analogue signal generation and transmission, and the adoption of satisfactory digital replacements. Once signals are in the digital domain for both generation and transmission, the question of whether a dedicated, overlay network should continue to be used by Eurovision, or whether an integrated services public network should be used instead, will require further investigation.

6. *Euroradio*

Euroradio already has access to an independent digital radio channel on the Eutelsat II–F4M satellite. The Euroradio carrier may be used for transmissions of high quality audio material from any location within the widebeam footprint of the satellite without risk of interference to other operators.

Euroradio currently uses the 2 Mbit/s coding system defined in CCIR Recommendation 724 [7]. The system can function with a C/N ratio of about 6 dB, and this allows the use of antennas of about 4 m diameter for both transmission and reception.

7. Time scale for conversion to digital operation

The decision to commence digital television transmission early in 1995 has been influenced by various factors including:

– the probable availability of digital transmission equipment (codecs and modems);

– the likely availability of a sufficient number of earth stations in the network;

– the avoidance of busy operational periods for Eurovision (Olympics Games and the World Football Cup, for example).

It is absolutely imperative that all new equipment is tested to ensure not only that it functions in accordance with the relevant specifications when used in a "stand–alone" configuration, but that interworking between different manufacturers' products is satisfactory also. The EBU is especially concious of this aspect as its operations stretch far beyond Europe, where it can be expected that some measure of inter–manufacturer collaboration on standards will be maintained. In equipping a network as diverse as that operated by Eurovision it is inevitable – and indeed desirable – that equipment should be multi–sourced, and purchased from local/national manufacturers and suppliers.

8. Interworking digital and analogue network facilities

8.1. Video

The target configuration of the Eurovision network will be an all–digital mixed terrestrial and satellite network operating at 34 Mbit/s, and transporting component signals conforming to CCIR Recommendation 601. Nevertheless, an interim network configuration will be an inevitable consequence of the evolution that Eurovision is undergoing; this will consist of digital satellite circuits interworking with analogue terrestrial circuits. Appropriate operating procedures will therefore need to be identified in order to operate such a network configuration in an efficient and cost–effective manner.

Rules already exist for the treatment of signals as they pass through the Eurovision network. If a signal enters the network as a PAL signal, it must be presented to the destination as a PAL signal; a SECAM source signal must be delivered as SECAM. This principle is known as "signal format transparency".

This transparency rule should still be applicable in a mixed 4:2:2 components/PAL/SECAM environment. Its application is trivial if a signal passes only through a digital satellite path from source to destination. However its application when a satellite path must be extended to the destination by means of an analogue terrestrial circuit becomes more complex, and an appropriate operating procedure has been developed.

If a signal is originated in 4:2:2 component format, and transits a satellite path in this format, then the analogue composite format that will be used to extend this signal along a terrestrial circuit to its destination will be the national transmission format of the broadcaster which initiates the terrestrial injection after the satellite link. This has an implication as regards the design of the interfaces of the codec (see boxed text).

8.2. Component decoding

It is expected that composite sources may need to feed destinations operating in components or in another composite format for some years. The concept of complementary coding/decoding processes for composite signals has been discussed in this connection. For conversions to be complementary, information must be transferred from the 34 Mbit/s coder to the 34 Mbit/s decoder concerning certain signal parameters of the original composite signal format. This information can then be used when rebuilding the composite signal at the 34 Mbit/s decoder. The transmission channels for these information paths are already present in the ETSI/CCIR 34–45 Mbit/s codec.

However, when the source signal is composite, but the received signal is to be used in a 4:2:2 components format, complementary coding/decoding may have an effect which is in fact detrimental to the quality of the component signal generated at the 34 Mbit/s codec, as this process does not necessarily optimise the chrominance/luminance separation of the generated components. It is for this reason that the EBU insists on optimisation of the quality of the component signals, rather than dwelling on the ultimate quality achievable in regenerated composite formats.

8.3. Ancillary signals

All the insertion signals which accompany the video and audio in a transmitted PAL, SECAM or NTSC signal are normally contained in either the field–blanking or the line–blanking periods. These signals will be transported through a 34 Mbit/s component transmission codec, carried in special digital channels multiplexed into the channels designated for video and audio. If the signal source is composite, these signals will have to be separated from the video at the coder input so that the video signal alone is subjected to the discrete cosine transform process. A corresponding technique will be needed at the decoder in order to deliver a composite video signal (if needed).

Some of these signals (e.g. ITS) have little or no relevance to the 34 Mbit/s components transmission codec, and need to be present only for investigation of a composite signal undergoing analogue transmission processes. Other ancillary data (e.g. IDS) are equally valid in analogue composite and digital component transmission formats. There is at present no widespread consensus regarding the best place for these signals in a digital environment and no ground rules exist yet for their handling in a mixed analogue/digital transmission environment. The requirements of the Eurovision network are discussed in the boxed text.

9. Interim analogue/digital period for the earth segment

The earth segment is the portion of the terrestrial circuit which interconnects the television studio or CNCT/CICT with the earth station. Ideally all earth stations in the Eurovision network will be situated at, or adjacent to, broadcasters' premises. This will not always be the case, and the following considerations apply.

Initially, it is expected that most CNCTs will be equipped so that four analogue video + SIS signals are received from the satellite, and two analogue video + SIS signals are transmitted to the satellite, via the earth station. In a later network configuration (around mid–1995), most CNCTs should be able to receive four 34 Mbit/s signals and transmit two 34 Mbit/s signals via the earth–station.

Of course, codecs could be located at earth stations, thereby using the existing analogue video links between the earth stations and CNCTs. However, this approach relegates the 34 Mbit/s transmission system to little more than an expensive scrambling device for the satellite circuits. As noted above, it is of prime importance that the earth segments are amongst the first terrestrial circuits to become digital. The opinion of the EBU is that the precise location of codecs and modems should be determined on a case–by–case basis, taking into account the location of the earth stations and CNCTs.

During the transition period to digital working there will be a requirement for simultaneous transmission of analogue and digital video signals between the earth stations and the CNCTs. Moreover, if SNG transmissions remain analogue because 34 Mbit/s equipment is too bulky for fly–away operations, this mixed system may be required for a longer term than is currently envisaged.

The EBU is also investigating the viability of using bit–rates around 8–17 Mbit/s for SNG applications. It is thought that with current coding expertise, a quality not inferior to Betacam SP (used widely for news–gathering) can be achieved. There could be price and weight advantages for equipment specifically engineered (and mass–marketed) for SNG.

10. Remote control of earth station facilities

The CNCT/earth station remote control facilities must cope with the analogue and digital operating modes. Remote control also has a bearing on the dimensioning of each earth segment.

The basic requirement is to select each of the four receiving chains to any one of the eight satellite channel downlinks, and to transmit to any satellite channel from each of the two transmit chains, with protection against double illumination (simultaneous co–channel up–links to the same satellite from two earth stations).

If digital and analogue transmission modes need to be available in a flexible manner, to receive from analogue SNG fly–away earth stations for example, additional functionality will be required.

There is not enough basic information available yet to progress very far on remote control requirements, but it is clear that CNCTs must be able to select incoming and outgoing earth station connections in a fast and flexible manner. Computerised control should be possible as part of a future network management system.

11. Communication with transportable earth stations

Transportable earth stations have become an indispensible part of modern news gathering operations.

One of the prime logistical and managerial problems of an earth station located in a remote, often hostile and perhaps devastated environment ill–served by a telecommunications infrastructure, is coordination and integration with the rest of the "established" network. Whilst satellite–borne engineering communications channels are commonly used in the Americas, ad–hoc solutions have generally been adopted in the European Broadcasting Area, for example making use of Inmarsat channels allocated in emergency situations.

The EBU has been looking for a reliable means of communicating with transportable earth stations, and has developed a system that would place digital ancillary communications channels within the EBU's leased capacity on the Eutelsat system.

The specification for this application draws heavily on internationally–agreed standards. The audio coding is in accordance with CCITT Recommendation G.722 [10], whilst the modulation and radio frequency parameters follow the Intelsat IDR specification [1]. The use of these standards should allow the system to be built using equipment from a number of manufacturers. The EBU has submitted the specification to the CMTT, where, with a slight modification, it has become a Recommendation.

12. Network management strategy

12.1. TPP system

A large part of network management concerns transmission planning. Up until the present, all transmission planning has been done manually, as a paper–based operation. The numbers of transmissions now being dealt with on the network mean that the point is being reached where a computerised system is becoming essential to the continuing existence of the planning function. For several years now, Syntegra (formerly BT Business Communications) has, in collaboration with the Technical Centre of the EBU, been developing the TPP (Transmission Planning Procedures) system.

This system is based around the UNIX operating system and uses RISC graphic workstations, with distributed processing across a 16 Mbit/s Token Ring local area network. An ORACLE database is used, and the system supports full functional multitasking on all connected workstations. There are external links to a CASE Beeline telex system which automatically distributes synopses, containing circuit switching requirements, to the participants in transmissions ans to their PTTs, where appropriate. Future developments will enable Eurovision Members to access the TPP system; in this way they will be able to examine the status of transmission bookings that have been made, and to insert new transmission requests and cancellations which will be presented to the duty planners for action.

The TPP system contains a complete network map which is constantly updated with circuit occupancies, and which can be displayed on graphics terminals. On receipt of a booking request, the duty planner can examine the availability of free circuits and can plan the route of the transmission on the network. A synopsis of the planned transmission is sent by electronically–generated telex to the parties cooperating in the transmission.

TPP is on the verge of becoming operational for the planning of transmissions within a minimum of one week's notice of the scheduled transmission time. Planning inside this timeframe will continue manually for a short time until the TPP becomes fully integrated into operations.

12.2. ENMS

CCITT Recommendation M.30 [11] which covers the management functionalities known generically as TMN (Telecommunication Management Network) has been used as a guideline in the design of a management system known as the Eurovision Network Management System (ENMS) which is adapted to the EBU's specific needs in this area. As a first step, the interactions and interdependencies of ENMS and the TPP project have been considered.

The four main functions of TMN – surveillance, dynamic reconfiguration, charging and security – will take into account the new network infrastructure, the capabilities of the automated TPP system, and the implementation of access management with ETSI/CCIR 34–45 Mbit/s transmission codecs.

13. Conclusion

The EBU intends to operate a private, (as opposed to public or integrated) mixed network for several years, with 34 Mbit/s component digital transmission via Eutelsat II (8 channels), plus composite analogue transmission via the terrestrial network.

As digital radio–link and fibre–optic circuits become available, 34 Mbit/s component digital signals will find their way across a terrestrial network once more, and the change from an analogue mixed network to a digital mixed network will be complete.

After this, the use of a "virtual" Eurovision network carried on a public broadband integrated services digital network will be considered on its merits, notably regarding its feasibility for the international transmission of contribution–quality digital television and radio signals.

The introduction of 34 Mbit/s component digital transmission on the Eurovision network represents a major change, and the transition must pay particular attention to interfacing problems in the network infrastructure. However, when fully operational, the 34 Mbit/s transmission system will increase the usefulness of the EBU leased satellite capacity with secure, enhanced transmission quality and with the potential for simplified network planning and coordination.

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SMPTE

Convergence of imaging media

The 1994 European SMPTE Conference will he held during the Photokina Fair in Cologne, from 22–24 September 1994. The technical sessions will be preceded by a full day of tutorials, under the heading "TV imaging and computer imaging – How to speak together"; these are intended to help create a better understanding between people working in these two fields and will offer useful background knowledge for the main conference sessions having as a central theme the convergence of imaging media.

The SMPTE has issued a Call for papers, for both the conference and the tutorial sessions. A 500–word synposis outlining the content of the proposed papars should reach SMPTE Headquarters by 15 April 1994. The deadline for the submission of complete manuscripts of accepted papers is 14 July 1994.

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