RECOMMENDATION ITU-R BT.1675

System design and operational practices for minimizing disturbance from loop delay in broadcast systems

(Question ITU-R 35/6)

(2004)

The ITU Radiocommunication Assembly,

considering

a) that sound or television broadcast programmes can include interviews or other interactive situations which involve inserts shot at different physical locations, linked together at a base location;

b) that such inserts can be delayed due to propagation time or due to signal processing in codecs;

c) that Question ITU-R 35/6 – Tolerable round-trip time delay for sound programme and television broadcast programme inserts, has requested submissions on delay models for programme contribution loops and on tolerable limits for delay around such loops,

recommends

1 that the signal path model in Annex 1 should be used as a basis for modelling delay in programme contribution loops.

Annex 1

System design and operational practices for minimizing disturbance from loop delay in broadcast systems

1 Introduction

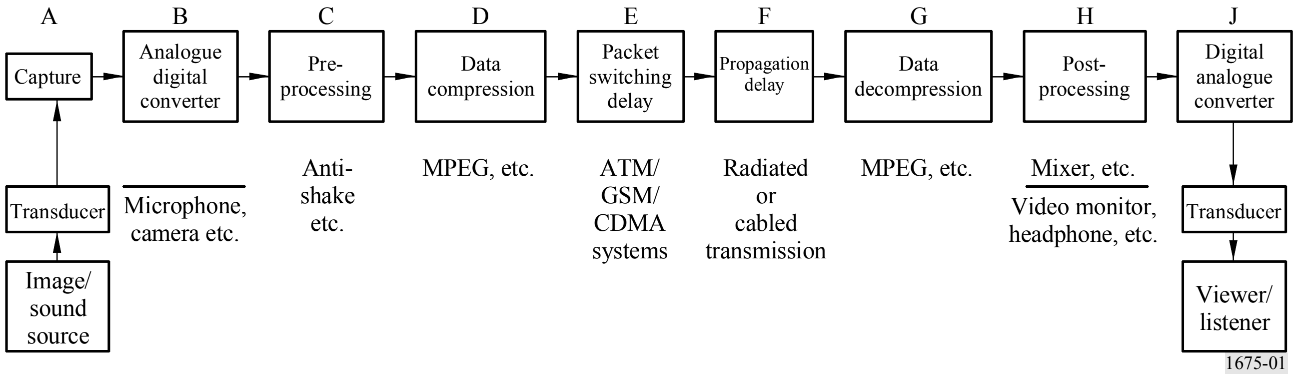
This Annex outlines a model for calculating signal delay in programme contribution loops and outlines system design guidelines and operational practices which can be used to minimize the loop delay, minimize the programme degradation arising from loop delay and echo as well as minimize the disturbance to the programme participants from loop delay and echo.

2 System modelling

One half of the insert loop may be modelled as shown in Fig. 1.

FIGURE 1

Model of audio/video production chain for calculating half-loop delay



Typical delays in the stages of this half-loop are shown in Table 1. Note that more than one row of Table 1 may apply to a given link e.g. calculation of delay for digital video with MPEG-2 encoding transmitted via an asynchronous transfer mode (ATM) carrier needs information from two rows of the Table. These values are examples only. Measured or calculated values for the system under study should be used to determine the actual delay in that system.

TABLE 1

Typical delays of loop components using the half-loop model of Fig. 1*

Stage	A/B	C	D	E	F	G	H	J
System								
Analogue audio	0		0	0	~5 µs/km cabled, 3.3 µs/km radiated	0		
Telephone audio, GSM	125 µs		10-15 ms		~5 µs/km cabled, 3.3 µs/km radiated	10-15 ms		125 µs
Telephone audio, code division multiple access (CDMA)	125 µs		20 ms		~5 µs/km cabled, 3.3 µs/km radiated	3 ms		125 µs
Telephone audio, low-Earth orbit (LEO) satellite			20 ms		5-13 ms	20 ms		
Telephone audio, GSO satellite			20 ms		240-280 ms	20 ms		

TABLE 1 (*end*)

Stage	A/B	C	D	E	F	G	H	J
System								
Digital audio, 20 kHz BW, ISDN	21 µs		<10-200 ms		~5 µs/km cabled, 3.3 µs/km radiated	<10-200 ms		21 µs
Digital audio, ATM, AAL5				Typical up to 150 µs per node, up to 40 nodes	~5 µs/km cabled, 3.3 µs/km radiated			
Analogue video	Maximum 33 ms				~5 µs/km cabled, 3.3 µs/km radiated			
Digital videophone	To be developed				~5 µs/km cabled, 3.3 µs/km radiated			
SD digital video MPEG	1 frame (33-40 ms)		1-4 frames (33-160 ms)		~5 µs/km cabled, 3.3 µs/km radiated	1-4 frames (33-160 ms)		77 ns
GSO satellite link					240-280 ms			

* Additional network delays may be incurred, see text in § 2.

3 System design and configuration factors

Three general principles should be observed in designing and configuring facilities for programme contribution loops:

3.1 Number of encode/decode stages

The number of encode/decode processes within each half-loop should be minimized. This minimizes the encode/decode delay and has the added benefit of reducing other forms of signal degradation such as group delay and non-linear distortion.

3.2 Differential audio-video delay

The differential sound-to-picture delays should be kept within the limit of +25 ms to –100 ms as specified in Recommendation ITU-R BT.1359 – Relative timing of sound and vision for broadcasting. This may generally be done by judicious selection of audio and video codecs and by compensation with audio delay units if necessary.