SECTION 10/11R-A: SOUND RECORDING

RECOMMENDATION ITU-R BR.777-2

INTERNATIONAL EXCHANGE OF DIGITAL AUDIO RECORDINGS

(Question ITU-R 91/10)

(1992-1994-1995)

The ITU Radiocommunication Assembly,

considering

a) that the digital audio tape (DAT) cassette system has been standardized by the International Electrotechnical Commission (IEC) in Publication 1119, and the DAT cassette system is available from several manufacturers;

b) that the European Broadcasting Union (EBU) has recently recommended the use of the same digital audio recording format commonly known as R-DAT for the exchange of digital audio recordings of finished programmes among its Member organizations;

c) that, since the R-DAT format only uses a 16 bit/sample a compromise between level, headroom and noise performance must be established; according to the EBU for finished programmes this is obtained when the reference level is recorded 18 dB below maximum digital level; the Society of Motion Picture and Television Engineers (SMPTE) recommends a value of 20 dB;

d) that tests carried out by EBU Members have shown that tapes conforming to the R-DAT format can be interchanged reliably between different machines from different manufacturers, although the tape used may have to be selected with care;

e) that both machines and tapes for the R-DAT format are available from different manufacturers;

f) that manufacturers have stated that they will support the R-DAT format for many years;

g) that the use of the compact disc (CD) has gained very wide acceptance in the consumer market for recordings of finished audio programmes in digital form and such recordings offer high audio quality;

h) that CD recordings are often used in broadcasters' operation as a source of high quality commercial material, and several broadcasters commercially release their audio productions using the CD format;

j) that, although the CD format uses a sampling frequency different from the one recommended by the ITU-R for application in broadcasting, this does not cause major difficulties in broadcasters' operation since methods for sampling-rate conversion are readily available,

recommends

1 that the format commonly known as R-DAT, and specified in IEC Publication 1119, be used for the international exchange of finished audio programmes in digital form;

NOTE 1 – Two formats for longitudinal recording of digital audio on 6.3 mm tape known as "DASH" and "Prodigi" are available and can be used for the same application.

2 that R-DAT recordings used for programme exchange should conform to the parameters given in Table 1;

3 that, for the international exchange of finished audio programmes in digital form, the CD format can be used for those programmes for which recordings in this format are commercially released by the sending organization for consumer use;

4 that when the CD format is used in broadcasters' operation due care should be taken of the fact that it uses a sampling frequency different from the one recommended by the ITU-R for application in broadcasting.

TABLE 1

Parameters for DAT tapes used for the exchange of finished programme

Parameter	Value
Sampling frequency	48 kHz
Signal coding	Linear, 16 bit, 2 s complement
Pre-emphasis	None
Alignment level	See Note 1 for a possible example
Auxiliary data	See Note 2
Time code	Optional, but if present it should be recorded in accordance with IEC Publication 1119-5

NOTE 1 – The EBU recommends that the alignment level, as defined in ITU-R Recommendation BS.645, should correspond to a digital coding level 18 dB below the maximum.

The SMPTE recommends that the alignment signal shall be 20 dB below the maximum.

NOTE 2 – Attention is drawn to the requirements of EBU Statement D45-1991.

ANNEX 1

EBU alignment level in digital audio production equipment and in digital audio recorders

1 Introduction

The EBU has studied the needs of signal levels in digital equipment and recorders used in broadcasting. It is of the opinion that recordings should be made with linear coding using no pre-emphasis and with a resolution of at least 16 bits (see Note 1) in accordance with Recommendation ITU-R BS.646 (corresponding to a ratio of 1:8 (18.06 dB)). The EBU considers that it is desirable to recommend a signal coding level so that signals can easily be exchanged between equipment.

The EBU has considered various ways of specifying an audio level in digital form and has taken into account:

– that the only reliable method to specify a level in a digital signal is by reference to the maximum digital codes allowed by the number of bits in use;

– that an audio signal level can be defined in terms of an alignment signal that is a sine-wave signal which has a level (the alignment level) which is 9 dB (or 8 dB in some organizations) below the permitted maximum level of the audio programme (the terms “alignment level” and “permitted maximum level” are defined in Recommendation ITU-R BS.645);

– that an alignment signal can be specified relative to the maximum sine-wave signal that can be coded by the digital coding levels;

– that, due to the characteristics of quasi-peak programme meters used by broadcasters, the true programme peaks can be 3 dB greater than those indicated. When operator errors are taken into account the true peaks may occasionally be 6 dB greater than indicated or 15 dB above alignment level;

– that the signal-to-noise ratio in a digital audio system is directly related to the number of bits used and the alignment level chosen;

– that it is desirable in practical operations to have all equipment and recorders aligned to the same level.

NOTE 1 – 16-bit recordings may not meet the requirements of some organizations regarding the signal-to-noise in production equipment depending on the performance of the A/D and D/A convertors.

2 Recommendation

The EBU recommends that, in digital audio equipment, its Members should use coding levels for digital audio signals which correspond to an alignment level which is 18 dB (corresponding to a ratio of 1:8 (18.06 dB)) below the maximum possible coding level of the digital system, irrespective of the total number of bits available. The digital codes for maximum coding levels and alignment levels for 16, 18 and 20-bit audio systems are shown in Table 2 below.

TABLE 2

Digital codes for maximum levels and alignment levels

	Maximum coding level		Audio alignment level	
Number of bits	Negative peaks	Positive peaks	Negative peaks	Positive peaks
16(1)	8000	7FFF	F000	0FFF
18	20000	1FFFF	3C000	03FFF
20	80000	7FFFF	F0000	0FFFF

(1) 16-bit recordings may not meet the requirements of some organizations regarding the signal-to-noise in production equipment depending on the performance of the A/D and D/A convertors.