

# TECHNICAL COMMITTEE REPORTS

## REPORT OF THE MEETING OF THE TECHNICAL COMMITTEE ON DIGITAL AUDIO

*Date:* 1984 March 26

*Time:* 0930 Hours

*Place:* Meridien Hotel, Paris, France

*Present:* Bart Locanthi (Pioneer North America) *chairman*, K. Altmann (IRT), W. Aubert (RTBF), G. Barton (Consultant), B. Bernfeld (Harmonia Mundi), R. Blinn (Capitol Records), B. Blüthgen (Polygram), T. Doi (Sony), R. Finger (CBS Technology), H. Ford (H. F. Engineering), N. Gilchrist (BBC), T. Griffiths (Decca), G. Hali (EMI Holland), M. Jones (Neve), T. Kogure (Matsushita Electric), P. Ladegaard (Brüel & Kjaer), R. Lagadec (Willi Studer AG), L. Martin (AEG-Telefunken), G. McNally (BBC), T. Mori (JVC), J. Nunn (BBC), T. Shelton (BBC), K. Tanaka (Mitsubishi Electric), H. Tendeloo (Polygram), E. Torick (CBS Technology), A. Weisser (TDF/EBU), T. Yamamoto (Pioneer Elec. Corp.)

The chairman opened the meeting by asking the chairmen of the working groups to report on their respective activities:

**1** Roger Lagadec, chairman of the measurement techniques working group, reported the results of an investigation of possible audible effects caused by filters used in digital audio equipment for anti-aliasing and anti-imaging purposes. The filters investigated had very sharp cut-off characteristics, more than 300 dB per octave, negligible ripple ( $\pm 0.05$  dB) and linear phase. The effects were studied by examining the impulse response of such filters and these were named dispersion of the impulse. The principal effects were: a) spreading of the impulse function in the time domain, and b) generation of paired echoes leading and lagging the impulse by times of up to several hundred digital samples with amplitudes of 15 to 30 dB below the level of the impulse.

Dr. Lagadec reported that he and Thomas G. Stockholm were presenting a paper on the subject at the 75th AES Convention titled "Dispersive Models for A-to-D and D-to-A Conversion Systems." The paper lists guidelines for minimizing these dispersive effects. This study will continue.

He also reported that he would have ready for distribution at the upcoming New York working group

meeting documents listing guidelines for the measurement of A-to-D and D-to-A conversion systems, and the definition of digital audio levels with respect to analog audio levels.

The working group received reports from the three sub-working groups on "large signals," "small signals," and "intermodulation." Klaus Altmann submitted to Dr. Lagadec's working group a paper on the measurement practice in the digital area as used at the IRT in Munich.

**2** The committee chairman, acting on behalf of C. Renatta who heads the working group on terminology, presented a report listing terms which needed definition. Han Tendeloo and Björn Blüthgen offered their assistance, and more progress is expected by the New York meeting.

**3** Tim Shelton reported on his working group concerning system synchronization.

**3.1** Bruce Waggoner of the Grass Valley Group submitted, in absentia, a paper, "Linking Together a Digital Audio Studio."

**3.2** Tim Shelton presented his BBC paper, "Proposals for Synchronizing Digital Audio Signals."

The ensuing discussion concerned two technical tasks: a) aligning signals from independent asynchronous sources, and b) alignment of co-sited signal sources.

Mr. Blüthgen requested that consideration be given to the possible problems of synchronizing signals from the 32-kHz sample rate domain, as well as signals from the 48-kHz sample rate domain. It was recognized that the process of synchronizing digital audio signals from several sources should not degrade the signals below acceptable limits.

Dr. Lagadec suggested that ideas were necessary to make possible the safe transmission of channel status and user data across the synchronizing processor. He also suggested the possibility of presenting a document at the next meeting describing equipment with high-grade performance which would provide for signal synchronization.

Mr. Shelton asked for criteria for measuring the performance of a synchronizing mechanism. He also requested consideration of the possibility of establishing boundaries to parts of a distribution system, one of which would carry audio data, and another audio data with user data and channel-status data to simplify the synchronizing process.

4 John Nunn commented on the progress of the working group on labels. He reminded the committee that the original reason for setting up this working group was that the concept of labels has a much wider application than audio. It also spans video and film, and needs coordination with the SMPTE and the EBU, who he hoped would also be represented.

The first meeting of this working group took place on 1984 March 25, the day before the general committee meeting, and was largely exploratory. The first task was to identify the applications of labels and the second was to agree on a standard format. It was agreed at the meeting that the method of recording labels on tape would be outside the scope of the working group. Of the many applications that were discussed, one was for ranging information for extending the dynamic range on tape recorders, another for automation purposes, and a third for encryption of audio information on tape to prevent illegal copying.

Mr. Nunn indicated that his group should be in a better position by the next meeting in New York to have classifications of labels applications, assignment of priority of levels, and methods of linking labels. He indicated that labels of a consumer digital audio cassette tape recorder were outside the scope of his working group.

5 Before proceeding with the report from the I/O working group, the chairman opened the meeting for the discussion of new items.

Mr. Blüthgen mentioned the subject of high-frequency pre-emphasis for professional digital audio recording. This matter polarized the committee into one large group of users and manufacturers, and a small group of tape recorder manufacturers. The large group of users (recording companies, broadcasters, tape recorder manufacturers, and console manufacturers) would like to dispense with the pre-emphasis. A very small group of digital audio tape recorder manufacturers were in favor of keeping a switch on their machines so the recording engineer or producer could have pre-emphasis on an optional basis.

One user—a consulting recording engineer—indicated that some program material benefits from pre-emphasis and some program material is destroyed by pre-emphasis, and expressed his desire to have it optional.

Dr. Lagadec suggested that when really good A-to-D converters become available the need for pre-emphasis may disappear.

The chairman then discussed the subject of dither. He asked if today's equipment is being designed to use a scientifically designed dither; or is dither getting into the system by accident; or is it not being used at all?

Most members agreed that dither was necessary for good digital audio recording practice. If dither is not used, the recordings will be of poor quality. Toshi Doi indicated that optional switching of dither is available on the Sony 3324 recorder. Dr. Lagadec pointed out that excellent ways have been developed in the tele-

communications industry which perhaps can be applied to digital audio systems to improve our overall channel characteristics. He suggested that further study is necessary.

Mr. Tendeloo brought up a subject that had been discussed at the last committee meeting in New York concerning the labeling of Compact Disc packages to show the history of the recording (that is, original analog or digital recording) to reduce the confusion at the distributor and consumer level. Philips is developing a marking system in cooperation with others in the industry.

6 The chairman then read Alastair Heaslett's letter of resignation from the Technical Committee and as chairman of the I/O interface working group. Alastair left Ampex and joined the Shugard Company, where he is involved in magnetic and optical recording but not in audio. Because of this change and because the activities of his new company are outside those of the audio industry, he felt he could no longer support the committee as he had in the past. The chairman noted that Alastair had done a great job in bringing the I/O document to its nearly final form, and that his presence will be missed. He and the committee wished Alastair the best of luck in his new venture.

The "final" I/O interface document prepared by Alastair was discussed at great length at the I/O working group meeting which had been held the previous day, 1984 March 25. Most of the changes that had been proposed were editorial in nature. Ken Davies, representing the SMPTE, Alain Weisser of the EBU, and Neil Gilchrist of the BBC had several comments that appeared to be along the same lines and, since the group had unanimously approved these (which are mostly editorial in nature), Mr. Weisser and Mr. Gilchrist had been charged with modifying the "final" draft for the full committee meeting.

The chairman gave the committee members time to read the modified final draft and obtained their unanimous approval of the document. Since Alastair had the previous draft on his word processor, the chairman indicated that he would prevail upon him to incorporate these changes and prepare the final draft.

The chairman appointed Robert Finger of the CBS Technology Center as chairman of the I/O interface group and charged him with the responsibility of handling the necessary paperwork to bring the serial interface document to the AES Digital Audio Technical Committee before the 76th AES Convention in New York in 1984 October. This, among other items, means distributing it to the working group members two months before the convention and obtaining acknowledgments that the final document represents what was agreed upon in their March 25 meeting in Paris.

Mr. Nunn reminded the committee that while the serial interface document is nearly completed two other matters before the interface working group remain: the parallel interface; and the multichannel interface. Martin Jones suggested that priority be given to a mul-

tichannel serial interface to allow the use of optical-fiber transmission, for which there exists an urgent need in the industry.

7 Having finished with the agenda of reports from working group chairmen, the chairman opened the meeting for new business. After a short pause, he introduced an exploratory discussion of optical direct read after write (DRAW) recorders for professional audio recording, and asked Tony Griffiths of Decca to discuss possible applications to his recording business. Mr. Griffiths indicated that DRAW equipment now reaching the market appears to be attractive with 2 to 6 hours of stereo on one side of a single 12-inch disk (perhaps 10 hours on a 14-inch disk), very short access times compared to that of tape, and low storage space, etc. If disks are to be expensive in comparison to tape, erasable disks would be necessary.

Takeo Yamamoto indicated that for 10 hours of digital recording 12-inch disks are too small, and that 14-inch or larger would be necessary and perhaps very expensive—more expensive than a professional digital tape recorder—perhaps more than \$100 000. The chairman noted that there is at least one DRAW machine on the market that sells for \$6000 and has a capacity of 1.2 gigabytes with about 2 hours of digital recording.

Guy McNally indicated that the BBC has done simulation of digital audio recording on optical-disk machines such as the Optimem and that the results look interesting.

The chairman noted that while some companies are talking about optical DRAW disks at \$800. each, one American company has promised DRAW disks for \$50. each in production quantities and \$100. each one at a time.

Mr. Nunn indicated a possible application of DRAW disks to the broadcasting and film industries for special-effects libraries, provided adjustable speed could be provided.

Dr. Yamamoto noted that while optical devices have very large capacities, there are some limitations for digital audio recording, such as, long access time, limited data rate, and a limit to 2 channels of PCM audio.

Mr. Griffith replied that his company is interested only in 2-channel recording and that access times are long compared to magnetic disk drives and very short compared to tape machines, and that probably they could operate within the limits mentioned by Dr. Yamamoto.

The chairman noted that most makers of DRAW disks are discussing archival lives of at least 10 years, but raised a question about the reliability of accelerated life tests.

Dr. Yamamoto asked Mr. Griffiths about the recording time he would like to have on an optical disk and Mr. Griffith replied that 10 hours would be acceptable.

Mr. McNally reported on some studies that had been done at the BBC in the area of digital audio recording on write only read mostly (WORM) disks. This work was reported at the IEEE/ICAASP meeting held during the week of 1984 March 19 in San Diego, California.

Dr. Doi remarked that the present high cost of DRAW disks may only be temporary and that as production quantities and experience improve the prices will go down.

Mr. Griffiths reported that at a recent Compact Disc symposium Dr. Doi reported that the SMPTE was having difficulty with the 48-kHz sampling frequency because it generated objectionable distortion under some editing conditions. Dr. Doi reported that some SMPTE studies showed that distortion levels could reach -20 dB if special periodic editing procedures are followed, and that some SMPTE people are unhappy. The chairman said that they would check this out with Dr. Stockham, who had made some serious studies in the recent past on that subject, and report back to the committee.

8 Before the meeting was adjourned, it was decided that the next full meeting of the working groups and of the AES Digital Audio Technical Committee would be held just before the 76th AES Convention in New York.

The meeting was then adjourned.

BART LOCANTHI  
*Chairman*

*Technical Committee on Digital Audio*

### MEETING SCHEDULE

The next meeting of the AES Digital Audio Technical Committee will be held 1984 October 7 Sunday at 1930 hours, at the New York Hilton Hotel.

Working groups of the committee will meet on the same day before the full committee, as follows:

Input/Output Interface	0930 to 1100 hours
Measurement Techniques	1100 to 1230 hours
Labels	1400 to 1500 hours
Synchronization Techniques	1500 to 1600 hours
Terminology	1600 to 1700 hours