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THE ACOUSTICS OF ILR STUDIOS

C P DAUBNEY

IBA

Introduction

The IBA Act lays many requirements on the Independent Broadcasting Authority. One of those requirements concerns the maintenance of a high standard of technical quality in both its television and radio services. The IBA takes the view that the best way it can discharge that obligation is by concerning itself with the day-to-day standards which need to be met in all parts of the broadcasting chain. In this way its standards should relate to the technical quality of normal programmes made under real conditions and as they are transmitted.

As always, the ideal would be for such standards to be set entirely subjectively; after all, how many people sit at home listening to the radio not with the ears, but with eyes on the meters of test equipment?! However, such an ideal, whilst it has its right and, indeed, ultimate place, is essentially unachievable because of the vagaries of even professional broadcasting engineers in making consistent subjective judgements! Therefore there is a resort to objective testing and so begins the battle to relate the objective measurement of performance to that which the ear and brain perceive.

The manifestation of these objective tests is realised in the famous Code of Practice as far as the IBA is concerned. From the number of misunderstandings which occur, it is not possible to believe that anybody reads the first section of any of the Codes of Practice carefully enough, because in that section it says quite unequivocably "It is not for use as an equipment specification ... the Code specifies parameters which should be met (on a day-to-day basis) to ensure satisfactory quality for listeners."

Although, perhaps, acoustics do not change in quite the same way as the performance of electrical equipment, the acoustics of radio studios are included within the Radio Code of Practice for a number of reasons.

Firstly, it is radio and therefore the message has to be conveyed purely by the sound; quality of sound is therefore of the essence.

Secondly, the pure economics of an independent, commercially financed radio service mean that the number of staff and facilities will be kept to a minimum, and that some of the controlling of microphone signal positions and levels will not be quite as carefully exercised as in other broadcasting organisations - where certain staff are specifically charged with overseeing those tasks.

Thirdly, as part of the contract between the IBA and each radio programme contractor, there is agreement that the obligation on the IBA to monitor

the technical quality is carried out by the programme companies themselves. It is, therefore, clear that the environment(s) in which the programme companies monitor the transmissions should be carefully controlled acoustically.

So what is actually specified in the Code of Practice?

Before considering the details, there is one critical factor. The Code of Practice is a legal document because it forms part of the contract between the IBA and each programme company. Inherently, therefore, there is a kind of "pass" or "fail" aspect involved and a consequent requirement for a level of precision which is not normally associated with acoustics.

Predictably the Code concerns itself with those two wellknown facets - the control of the wanted sound within the studio or control room and, equally, the control of the unwanted sounds, whether they be generated within the studio or are induced from without. The Radio Code of Practice has been revised recently and the remainder of this paper will refer in the main to that document.

The Wanted Sound

Whilst, perhaps more by implication than explicitly, parameters such as diffusion are considered, the main criterion used in the control of the wanted sound is the reverberation time. The older Codes of Practice were written before ILR started and in some ways, therefore, reflected aspirations and possibilities of a style of radio service which had yet to be born. It has become clear over the ten years in which ILR has been operating that, particularly in view of the economic climate over those years, the system has settled down to some fairly standard studio "modules" which provide the backbone of ILR - with the number of specialist studio facilities being relatively small. As a consequence the new Code concentrates on those regularly occurring types of studio, and simply requires that any programme contractor who is considering building a music or drama studio should discuss the acoustical requirements for such with the IBA on each occasion. The standard "modules" are, of course, the basic "on-air" studio - in which the presenter is usually operating the presentation equipment as well as providing the linking material, and in which there is typically space for one or two interviewees - and the standard "talks" studio - a very conventional studio without any equipment other than microphones. In terms of their size, the economics as well as usage have tended to dictate a floor area of 15 to 20 square metres typically, with ceiling height varying between two and a half and three and a half metres. When it came to choosing the tolerances for reverberation time, a number of factors were involved.

Firstly, the only sources of live material generated in those studios would be speech.

Secondly, that speech would come from both trained presenters and from untrained (at least as far as control of voice production is concerned) interviewees. The presenters could probably be relied upon to sit at a

reasonably constant distance from a microphone, whereas the interviewee could easily swing between two extremes. There is the oft quoted fictitious local councillor who, when on the offensive, will sit up very close to the microphone and shout, but when on the defensive, will lean well back from the microphone - as much as half a metre - and whisper! In self-operation, even with the best will in the world, the level control in the electronic domain from variable sources such as the fictitious councillor will not be as good as one might wish. Consequently the dynamic range which will be transmitted will be rather wider than would be totally desirable . If one postulates a fictitious Aunt Ethel as a listener, who knows nothing about the problems of broadcasting but must be able to hear clearly the words spoken by both the presenter and the interviewee if she is to enjoy the programme and stay listening, one is most likely to specify the reverberation characteristics in the studio as being as dead as possible in order to maximise clarity and intelligibility.

However, there is a third point, and that is the difficulty, particularly at low frequencies, of controlling very short reverberation times in small rooms.

With all of those considerations in mind, the Code specifies a maximum and a minimum reverberation time - namely 0.3 seconds and 0.16 seconds respectively - between which times all such studios must lie. However, because there is a ratio of nearly two to one between the minimum and maximum, steps have also been taken to ensure that the spread across the frequency spectrum of reverberation time is kept within a tighter bound than the maximum range of 0.14 of a second. Over the speech band, which is defined as being between the third octaves centred at 125 Hz and 5 kHz, the maximum spread of time must be within 0.06 seconds. However, even a change of as much as 0.06 seconds would be unsatisfactory if it occurred between adjacent octaves. Therefore, two other criteria are added to ensure that any changes that do occur only happen in relatively small steps. The change between adjacent octave centres should not be greater than 0.04 seconds and, between adjacent third octave centres, less than 0.04 seconds. Those criteria for speech have to be met around each place where microphones are typically used.

In those areas, or positions in certain rooms, in which monitoring of both speech and music is carried out, the range of interest in reverberation time is extended down to the 63 Hz third octave.

The other main reverberation concern is in the control of decays with a secondary slope. This is relatively uncharted water, but it was felt necessary to include something in the Codes because of the potential sources of unwanted vibration in studio areas. The latest revision of the Code has hopefully clarified the IBA's definition of a secondary decay as well as when it would be deemed to be significant. A secondary decay will only be classified as such if the reverberation time of the second part is at least three times that of the primary.

Unwanted Sounds

That wellknown listener, the fictitious Aunt Ethel, certainly will not discriminate between distracting sounds that are generated in the studio and

those that creep through the walls from noisy sources outside. All she is interested in is the total amount of distraction to her enjoyment of the programme. Therefore the ultimate concern is to ensure that the total level of unwanted sound does not exceed certain limits. What limits?

At the beginning of ILR, NC20 was chosen as the limit for studios from which sounds would be broadcast and NC30 for areas in which only monitoring would take place. Originally that was all that was specified and, of course, in an ideal world that is all that would ever have to be specified. However, with the experience of 10 years of ILR, a third criterion for the total level of unwanted noise seemed to have a useful place.

Reflecting on the earlier comments about the style of programme generated live within typical ILR studios, it was clear that there was a lower frequency limit in the wanted speech signals below which there was almost no significant information. Therefore it seemed reasonable that the limit on unwanted noise at the lowest frequencies could be eased if an equivalent high pass filter was introduced into the microphone channels, and that this could be done without any significant deterioration in quality. The IBA has not, of course, insisted that all broadcasting studios in ILR shall adopt this filter. The programme companies have the option of meeting NC20 with "flat" electronic response or the new criterion with the filtered response. Hopefully the extra 8 dB of unwanted noise which can be possible in the 63 Hz band will provide a small but useful contribution to economy in studio design.

When it came to likely levels and spectra of interfering signals, and particularly when these had to be generated to represent future usage, some detailed changes have also been made - especially where monitoring loudspeakers are the interfering source. Needless to say, this was the subject of much tortuous discussion! The evidence obtained by IBA staff measuring real monitoring levels used in ILR, as well as information from other broadcasters - not to mention the record industry - suggested that these real monitoring levels were considerably higher than the minimum quoted in the older Code. However, the IBA took the view that it required the programme contractors to be able to monitor adequately but that this did not have to imply enormously high listening levels. Conversely, it was also felt that there was a minimum below which it was not possible to go, and so the revised Code specifies a recommended level for monitoring and a minimum level (which happens to be 5 dB less across the entire spectrum); this latter can be used where the recommended level could give rise to isolation problems. These levels were arrived at from experience, but it was pleasing to see that the total sound pressure levels from the recommended and minimum condition, when calculated according to CCIR procedures using A-weighting, lay 2 dB either side of the CCIR specified level for sound quality assessments. It would be naive to suppose that people will ever be inhibited from monitoring at higher levels, but the companies are made aware of the consequence of so doing if the isolation performance is only marginally within the requirements of the Code.

The other major change in the latest revision of the Code concerns impulsive interference. Originally, the levels of sound in a studio produced by any external impulsive source had to meet the appropriate criterion. From work

carried out at one or two stations, as well as from general experience, it seemed that that requirement could be relaxed so long as the impulsive sources were not recognisably rhythmical, and so long as the frequency of occurrence was fairly low. The new requirement allows a relaxation of 5 dB in the 63 Hz and 125 Hz octave bands over the appropriate criterion, so long as the sources do not occur for more than 10 seconds every five minutes. Even with a revised "more precise" measurement method, there will always be an area of uncertainty in this test.

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