

Broadcast engineers have been meeting in the US and in Europe to discuss advances in digital sound broadcasting technologies. **Bob Greeney**, Director Engineering, Planning Branch reports.

## Digital sound broadcasting developments

Meetings of the working parties of the International Telecommunications Union (ITU) considered world-wide standards for digital sound broadcasting (DSB) in Rome during September. They studied both satellite and terrestrial DSB systems.

The main systems being considered are the European-developed Eureka 147 (or digital system A) and US developed alternatives for satellite and terrestrial DSB.

### Satellite digital sound broadcasting

The 1994 ITU working party studying satellite DSB considered submissions from the proponents of a number of alternative systems. At the time, the studies concluded that only the Eureka 147 system was sufficiently proven to warrant inclusion in a world-wide recommendation for satellite DSB services. An alternative system, proposed by Voice of America in conjunction with the Jet Propulsion Laboratories, was also mentioned in the recommendation.

The ITU's *Digital Sound Broadcasting Handbook*, produced as a result of the meeting, outlined the preferred system with reference to development of alternatives.

This year's meetings reviewed developments in satellite DSB technology and worked towards a single world-wide standard for satellite DSB systems.

### **US developments**

The main development has been the enhancement of the proposed system, digital system B, to provide for in-fill translators on the same channel as the parent transmitter. However, the technique (adaptive equalisation) has only been simulated, it has not been fully implemented and tested in the field. The *DSB Handbook* has not been amended at this stage to include this system.

### **Australian developments**

The Australian delegation reported on the successful satellite trials of the Eureka 147 DSB system conducted by the Department of Communications and the Arts' Communications Laboratory in June 1995. The trials operated in the 1500 MHz band using the Optus B3 satellite, with test receivers in Canberra. The Australian report will be included in a new report to supplement the *DSB Handbook*.

These trials showed that the satellite DSB system works very well in both urban and rural environments despite the fact that the configuration of the satellite transponder required the system to operate at a lower power level than is normally planned for satellite DSB. The collated results of the Australian tests are to be submitted to the next meeting of this group.

### **UK**

The UK submitted a report of similar trials conducted by the BBC in July 1995 in Mexico. The trials used the Solidaridad satellite, with similar results to the Australian trials. The results of the UK trial are also to be included in the new report on recent developments in DSB (digital system B).

### **Canada**

Canada has conducted extensive studies of the Eureka 147 system and provided information about a new mode of operating the system. The new mode provides good quality digital sound at higher vehicle speeds. Sometimes called Mode 1.5, the new mode looks to be the best practical compromise between data rates, sound quality and vehicle speeds as the aim is to maintain good quality sound at highway speeds, typically 100 kilometres per hour.

### **Other issues**

Other issues covered at these meetings were the frequency allocation made for Europe and Asia/Pacific regions which

is in the 1500 MHz band, and the different allocation made for the Americas, at 2200 MHz. This difference is not seen as a major obstacle to developments but does present some co-ordination problems, particularly for the US, Mexico and their neighbours.

The development of the *DSB Handbook* and its supplementary new report on recent developments, has been in conjunction with the parallel ITU group which is considering recommendations for standards for terrestrial DSB services.

### Terrestrial digital sound broadcasting

The 1994 meetings of this group completed the drafting of the *DSB Handbook* which was published earlier in 1995. At that time only one system was considered sufficiently developed for consideration in the handbook. Other systems submitted for consideration included the VOA/JPL system, and in-band digital sound systems. Neither was sufficiently developed in 1994 for inclusion in the ITU recommendation for terrestrial DSB or in the *DSB Handbook*, although each is mentioned as being under development.

At the 1995 meetings, reports on the VOA/JPL system were updated to indicate the possibility of in-fill translators on the same frequency as the main transmitter (as do satellite DSB systems). A number of reports were provided on developments of the in-band on channel, in-band adjacent channel and a new in-band reserve channel systems that use the existing AM and FM radio broadcasting bands.

The Federal Communications Commission (FCC) in the US had sought test results for each proponent system before making any decision on standardisation for the United States.

Initial US trials of each system, including the Eureka 147 system for

comparison, were completed just before the September meetings. The status of the test results is not clear. They were made available at meetings in the US and the results outlined at the International Broadcasting Convention in Amsterdam in early September 1995, but were not made available at the ITU meetings. Reports indicate that the trials did not prove that the in-band systems can operate satisfactorily within the objectives set by the FCC (i.e. without causing interference to the host channel). As the results were not presented at the ITU meetings, the working party was unable to include an amendment to the recommendation for terrestrial DSB or in the new *DSB Handbook*. The new information presented by the US delegation was included in a report for consideration at the next meeting of this group.

### IBOC systems

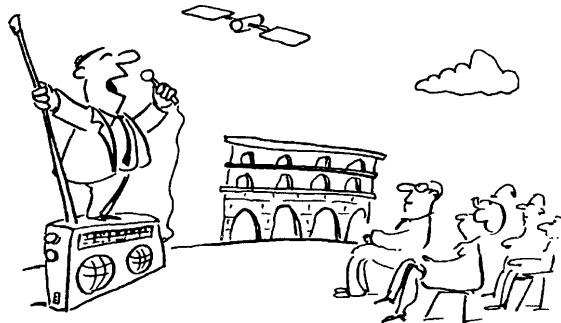
The US provided description of the in-band on channel (IBOC) systems used with FM transmissions. They show the IBOC system leaves the main part of the FM channel free from digital signals and places the digital data outside the main FM channel, but within the FCC mask for FM emissions. Many delegations questioned this technique on the basis that it may not be considered 'on channel' because the modulation is outside the parent channel. One concern raised was the effect of this digital modulation outside the main FM channel on the use of the adjacent channel for other services such as low power FM services or in adjacent service or licence areas. The in-band adjacent channel proposal test results were not made available to the ITU working party and so could not be included in any update of the recommendation for terrestrial DSB.

The AM band IBOC system is incompatible with AM stereo broadcasts and requires the analog service to be broadcast in mono. The AM IBOC system is not expected to achieve the same night time coverage as the AM analog signal.

Another report to this meeting was the development of an in-band reserved channel (IBRC) system. Again, no test results were presented. However, the

basis of this IBRC system seems to be to provide additional capacity for digital services in areas where sufficient capacity cannot be provided using IBOC/IBAC systems, and there are 'spare' FM channels not used for analog FM broadcasting. This technology might be able to provide capacity for some additional digital services in cases where on channel, or adjacent channel capacity is exhausted.

At this stage, there has been little support among US delegates for new band systems such as Eureka 147, which uses the 1500 MHz band. This band has not previously been used for broadcasting. The US developed VOA/JPL system, replacing HF broadcasting, is intended to operate in the 2200 MHz band, because the 1500 MHz band is already used for other services that cannot share their spectrum allocation (mobile aeronautical telemetry).



While the recent round of tests have not proven that the US in-band systems will work satisfactorily, there are further tests scheduled.

### Digital sound broadcasting in Europe and Canada

A number of digital sound broadcasting systems now operate using the Eureka 147 DSB system.

During the September ITU meetings, the BBC announced the start of their DSB services from 27 September 1995 using VHF television channel 12 (223 to 230 MHz). On the same day, the Swedish authorities announced the start of their DSB service, also in VHF television channel 12.

Extensive DSB trials have been conducted in Canada over the past three years, at 1500 MHz. During the ITU meetings, Canada announced that on

5 August 1995, the Canadian Government had proposed the adoption of the Eureka 147 system as their standard for both terrestrial and satellite DSB services operating in the 1500 MHz band.

Over the past two years, Australian trials have been conducted by the Communications Laboratory for both terrestrial and satellite DSB systems using the Eureka 147 system, also at 1500 MHz. In August 1995, the Minister for Communications and the Arts announced further DSB tests to be conducted in Sydney, Melbourne and Brisbane. Trials have also been conducted in France on a number of frequencies and for the past two years in Germany at VHF television channel 12.

Following the conclusion of the T-DAB (terrestrial digital audio broadcasting) Planning Meeting held in Wiesbaden, Germany, in July 1995, agreement was reached on a 'special

arrangement' for the allocation of spectrum blocks in VHF Band III (216 to 240 MHz) and in the 1500 MHz Band for the 42 participating European countries to use for the introduction of digital sound broadcasting. The European countries plan to use the European developed Eureka 147 technology. The plan, agreed in August 1995, assigns blocks of frequencies to each user and will be published through the CEPT in late 1995. The T-DAB 'special arrangement' will enter into force from 1 January 1996.

### The future - a common world-wide standard?

In seeking a world-wide standard for DSB, we should be mindful that for the past 50 years listeners to radio all over the world have used common receivers for listening to LF, HF, MF-AM or VHF-FM broadcasts. Television broadcasting however has three standards and many variants of each. Anything other than a single world-wide standard for digital sound broadcasting could therefore be a big step backwards, a step back of more than 50 years. □

*Copies of specific submissions from these meetings can be obtained from: Planning Branch, PO Box 34, Belconnen ACT 2616, or by faxing the Director Engineering at (06) 253 3277.*