



Report ITU-R BS.2208
(10/2010)

Possible use of VHF band I for digital sound broadcasting services

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***Note:** This ITU-R Report was approved in English by the Study Group under the procedure detailed in Resolution ITU-R 1.*

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1 Introduction

Radio and television broadcasting is in the process of migrating to digital modulation schemes to better exploit the possibilities offered by existing and new delivery platforms. Digital modulation offers significant advantages in being able to give:

- consistent quality which is less dependent on variations in the channel;
- more effective use of channel capacity through resilient coding and advanced compression techniques;
- easier access through automatic or assisted tuning;
- versatility by including audiovisual and data information in the same channel.

Recognizing that analogue broadcasting technologies still find significant use and will continue to do so for some time to come, this Report will restrict itself to consideration of digital systems.

While the Internet and associated systems are playing an increasingly important role in the delivery of sound broadcasting services, conventional terrestrial radio still plays a very important part in delivering radio to its audiences. Demand for services outstrips the channel capacity and so there is pressure to increase that capacity. More efficient digital formats play a major part in this quest. However, this document examines the possibility of using digital formats in parts of the spectrum that are, have been, or can be made available for broadcasting but are not very much used at the moment.

VHF Band I is taken to include frequencies between 47 MHz and 68 MHz. From a technical point of view, there is no reason why this should not be extended to include the OIRT Bands (see Article 5 of the Radio Regulations (RR)) used in certain countries for FM analogue broadcasting. While this band may not be available in all locations it is a valuable broadcasting resource where it is available and the technical arguments are the same as for the frequency bands immediately below it.

2 Why consider the use of these bands for digital sound broadcasting?

Traditionally sound broadcasting has been carried out in the LF, MF, HF and VHF (Band II) bands. More recently, digital (DAB) sound services in VHF (Band III) have been broadcast in certain parts of the world. With the exception of the HF bands, where the unique propagation characteristics are vital to long distance international sound services, VHF Band II has become predominant among them. So much so that in many parts of the world the 88 to 108 MHz band has become crowded and there is little or no opportunity for new services to be introduced.

For various reasons – not least, better use of spectrum – some countries are considering, or are in the process of introducing, digital sound broadcasting systems. At the present time the majority of such services are located in VHF Band III using the DAB system. It has not been possible to introduce DAB services into Band II because the band is already heavily used and the introduction of a single DAB multiplex would require eight existing services to be switched off to make space.

Past experience has shown that it can take a long time for a new broadcasting format to establish itself. FM in Band II was around for a very long time before it became the predominant sound broadcasting system, AM in the MF band was displaced from this predominant role. It is therefore to be expected that any radio service will have to be simultaneously broadcast in both the old, analogue, and new, digital, formats until such time as the bulk of the audience has migrated. Obviously this will make a further demand on spectrum and further inhibit the ability to introduce new services.

The restricted quality of sound broadcasting in the LF and MF bands means that it has fallen from favour with a large part of its traditional users; both broadcasters and audiences. Despite this there is still a large residual use. In certain parts of the world, including Europe, the LF and MF bands are still crowded. Even if channels were available, their perceived low – analogue – quality and wide area propagation characteristics make them unattractive to local and community broadcasters.

There is a high demand for radio services to small, local and even community service areas. Such service areas are usually limited to a radius of less than a few kilometres covering just a small part of a town or city. The cost of setting up such a local station, the ongoing running costs and quality of coverage are important issues to be considered. Use of digital modulation techniques would certainly provide the quality of coverage while requiring low transmitter power and hence low cost.

The DAB system is good for covering large audiences. This is particularly true where a number of broadcasters have the same geographical coverage aspiration and where several high-power

transmitters can be synchronized into a large single frequency network. DAB is very good at national and regional coverage. It is less good where the coverage aspirations of the participating broadcasters in a given multiplex are not the same which is frequently the case with small, local or community broadcasters. Conventional DAB only becomes efficient in its use of spectrum when multiple transmitters can use the same channel to cover a large area. It can therefore be unattractive to local broadcasters who wish neither to reach, nor pay the transmission fees, to cover larger audiences. The DAB+ system partly addresses this by having more stations in the multiplex, thereby offering better spectral efficiency without the need for single frequency networks. However, this implies that an even greater number of stations will have to be found which are seeking identical coverage. In turn this limits its attractiveness to small broadcasters who would be better served by a transmitter designed to match their unique coverage requirements.

3 What digital broadcasting systems might be considered in Band I?

VHF Band I is currently little used and offers the possibility to find spectrum for new radio services. The most appropriate digital modulation scheme currently available for these bands appears to be the DRM30/DRM+¹ family. The HD Radio specification does not include modes which allow it to work in the HF band or in VHF Band I. While HD Radio operation in these bands is a technical possibility, the EBU is not aware of any tests having been carried out. DRM was originally conceived as a digital medium for use in the LF, MF and HF bands below 30 MHz. Propagation conditions in the HF band can be hostile; much development effort was expended in making DRM work in these hostile conditions. DRM+ has been more recently developed, and standardized² to facilitate a system offering the benefits of DRM in the broadcast bands between 30 MHz and 174 MHz. It uses a wider-band multiplex. While DRM30 has been shown to work³ in VHF Band I, a bigger multiplex offers a greater correlation bandwidth and hence better defence against flat fading. Further, higher bit rates are possible to give better audio quality and/or more services in the multiplex.

While able to offer line-of-sight services to small communities, VHF Band I might better be used to provide services to somewhat wider areas. This is perfectly feasible as evidenced by its traditional use for television. Band I is now little used for television and so large parts of it are free in many parts of the world. It is worth noting that where parts of Band I have been used by administrations for other purposes there is little coordination. Different parts are used in different countries for different applications (see § 5). However, the band is wide and space is usually available in parts of the band, albeit different parts of the band in different parts of the world.

Line-of-sight transmission and a relatively large amount of available spectrum offer the opportunity to use higher quality, wide channel modes with the DRM30 system. In VHF Band I, the DRM+ system is perhaps the better option as it can offer up to four high-quality audio services in a 100 kHz multiplex. The trade-off between the number of streams and the audio quality – fewer streams higher quality – should be noted.

¹ DRM30 is the DRM system initially designed for use in the frequency bands below 30 MHz. DRM+ is the extension of this system for use in the frequency bands between 30 and 174 MHz.

² The DRM system specification was revised to incorporate an additional mode designed for the lower VHF band (i.e. broadcast frequencies between 30 MHz and 174 MHz) allowing operation in Bands I and II (the FM band). This standard enhancement is called DRM+. A download version of the DRM system specification (ESTI ES 201 980 V3.1.1) is available on the ESTI website at <http://www.etsi.org>.

³ The technical feasibility of using Band I for DRM, and consequently for DRM+, has been proven by trials carried out by TDF in Rennes.