EBU – TECH 3313

Band I Issues

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Band I Issues

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1 SPECTRUM AVAILABILITY

1.1 Present situation

The VHF Band I is the frequency band 47 to 68 MHz. In Region 1, this Band is allocated to the broadcasting service on a primary basis in the ITU Radio Regulations. In the European Broadcasting Area (EBA), the broadcast use is analogue television and FM sound broadcasting; SAB/SAP applications are also included on a secondary basis.

In some European countries, the broadcasting usage of that band has stopped.

The SAB/SAP usage of Band I only represents around 1% of the total usage for SAB/SAP of the VHF and UHF bands, the main applications being: radio microphones, telemetry, audio OB, audio fixed and talkback equipment.

Band I is not exclusive to broadcasting and there is sharing with land mobile and some other services (for example, the amateur service) in a number of countries. Parts of Band I are also allocated to the fixed service on a secondary basis in certain countries.

Within Band I (a similar situation can be found in Band III) there are several channel/frequency assignment arrangements. In Eastern Europe, in France and in Ireland, channels are 8 MHz wide, in other countries the channel width is 7 MHz. In addition, there are several possible vision frequencies for a given channel within the countries using 7 MHz channels or those using 8 MHz channels and there is, of course, no alignment of channel edges between countries using 7 MHz channels and those using 8 MHz channels.

The channel positions and situation in Band I are shown in Figure 1 in the Annex.

1.2 Limitations

Not all of the spectrum identified above is actually available for broadcasting in all European countries

Details about the spectrum availability in a number of countries are given in Table 1 in the Annex. It should be noted that some of the information given in Table 1 can be expected to vary with time. It is for this reason that a date reference is given. It should also be noted that there is no entry for those countries for which no current information is available.

It should also be noted that the overlapping channel systems in Band I result in a very complex situation.

2 TECHNICAL LIMITATIONS

2.1 Antenna dimensions

At the wavelengths found in Band I (very long), very large receiving antenna sizes are usually required. For example, at 60 MHz a quarter-wavelength whip antenna is around 1.25 m high and a two-element Yagi antenna is about 2.5 m high and some 1 m long. In both of these cases, the term 'high' assumes that vertical polarisation is being used. Where horizontal polarisation is used, the same antenna size would apply but with both dimensions in the horizontal plane.

A Band I transmitting antenna will add considerable wind loading to a support structure and the necessary mast aperture for even a medium gain antenna is likely to be rare and expensive. These factors may make it difficult to introduce new transmitting antennas that have high gain (to minimise the transmitter power) or which are directional (to reduce interference). Of course, existing transmitting antennas could continue in use without any such concerns.

In addition, due to the long wavelength involved clearance of the first Fresnel zone is almost never achieved.

2.2 Man-made noise

Band I is also characterised by high levels of man-made noise. There is not, however, much data available on the statistics of man-made noise. ITU-R Recommendation P. 372-8 presents some median values of man-made noise that were measured in the USA in the 1970s but which do not take account of the amplitude or temporal distribution of the noise, nor of the enormous growth in interference due to radiation from digital circuits.

As an illustration, for DVB-T planning in Band I a man-made noise of 6 dB has been assumed. In Band III the noise level assumed is 2 dB and in Bands IV/V it is 0 dB. However, since very few facts are communicated, some of the assumptions may turn out to be wrong, and further studies are necessary.

2.3 Ionospheric interference

The lower frequencies of Band I are particularly susceptible to sporadic-E propagation. This results in interference caused by propagation, via sporadic ionisation of the E-layer, of signals from co-channel transmitters located at very long distances, in excess of 1000 km. This means that very large separation distances between co-channel transmitters need to be maintained.

3 TECHNICAL ADVANTAGES

3.1 Minimum field strength

The dipole conversion factor in Band I is much lower compared to the higher frequency bands. This results in a larger effective antenna area in spite of the lower antenna gain. The minimum field strength for good reception in Band I, in the absence of sporadic-E (ionospheric) interference and excluding consideration of the impact of additional man-made noise is considerably lower than for VHF Band III and the UHF bands.

3.2 Propagation losses

The propagation loss is lower in the VHF bands compared with UHF. In Band I the diffraction losses are smaller compared to higher frequency bands. As a result, other factors being equal, a television transmitter operating in Band I can cover a larger area than one operating in higher frequency

bands. This can be attractive in an environment where the deployment of transmitter infrastructure is very costly.

3.3 Anomalous propagation

The effect of sporadic-E interference has been a major limiting factor for planning analogue television services in Band I. This effect, together with the fact that analogue transmissions require a very high protection ratio, hinders the planning of analogue transmissions. However, planning for digital technologies, which in some cases require lower protection ratios, could improve the situation. Another factor to take into account is that there is much less tropospheric ducting and that will ease the situation regarding interference from nearby stations.

For certain non-broadcasting applications, the sporadic-E propagation could be an advantage, for example for radio amateurs.

3.4 Simplicity in equipment

At these low frequencies, the transmitter power is easy to produce and the losses in feeder systems are low. The RF filtering is simple and the insertion losses are also low

Low-noise devices with very good dynamic range are already available for use in receivers.

4 POTENTIAL TECHNICAL SOLUTIONS

One possible solution to overcome the problem of the receiving antenna size is to use electrically-loaded elements or H-field antennas, based around suitable ferrite cores. In both cases there will be a penalty in terms of efficiency and for tuning which also requires frequency agility.

To overcome the transmitting antenna aperture problem, some broadcasters have been using dual-band aerials systems that minimise demands on mast space.

The impact of intermittent interference via sporadic-E propagation, which is likely to be present for only a few weeks in the middle of summer, may possibly be avoided using appropriate time or frequency diversity techniques.

5 FUTURE BROADCASTING IN BAND I?

The major advantage of Band I is that it can offer cost-effective wide area coverage, particularly in rural areas where the man-made noise levels are lower. It is a band suitable for applications that require more reliability than bandwidth and which can work in a 'polluted' spectrum.

This Band is currently used in many EBA countries for television broadcasting in conformity with ST 61. In many countries it is foreseen that this usage will cease and the services will be transferred to other bands, or will be replaced by digital television in other bands. It is recommended that Band I is the last band where analogue transmissions are switched off because this band does not influence the transition.

When existing television transmitters eventually cease their operation administrations could re-allocate this Band to other services. Since Band I has not been specified for T-DAB (Eureka 147) or DVB-T, further studies are needed before any firm conclusion can be drawn on whether it could be interesting for T-DAB or DVB-T (or even for DVB-RCT or DRM).

Many countries will have a number of analogue TV stations that will remain active for many years to come. For example in Russia and other eastern European countries, they constitute a main part of the network. In some western European countries also, stations in Band I may remain for some time.

Band I could be used to transmit some DVB-T applications that could be stored in a DVB-T receiver (as for example certain MHP applications or even software updates for the DVB-T receivers). However, in countries where Band I is not in use for broadcasting, current antennas for terrestrial television reception cannot receive in Band I frequencies. In addition, current DVB-T receivers cannot receive in Band I frequencies.

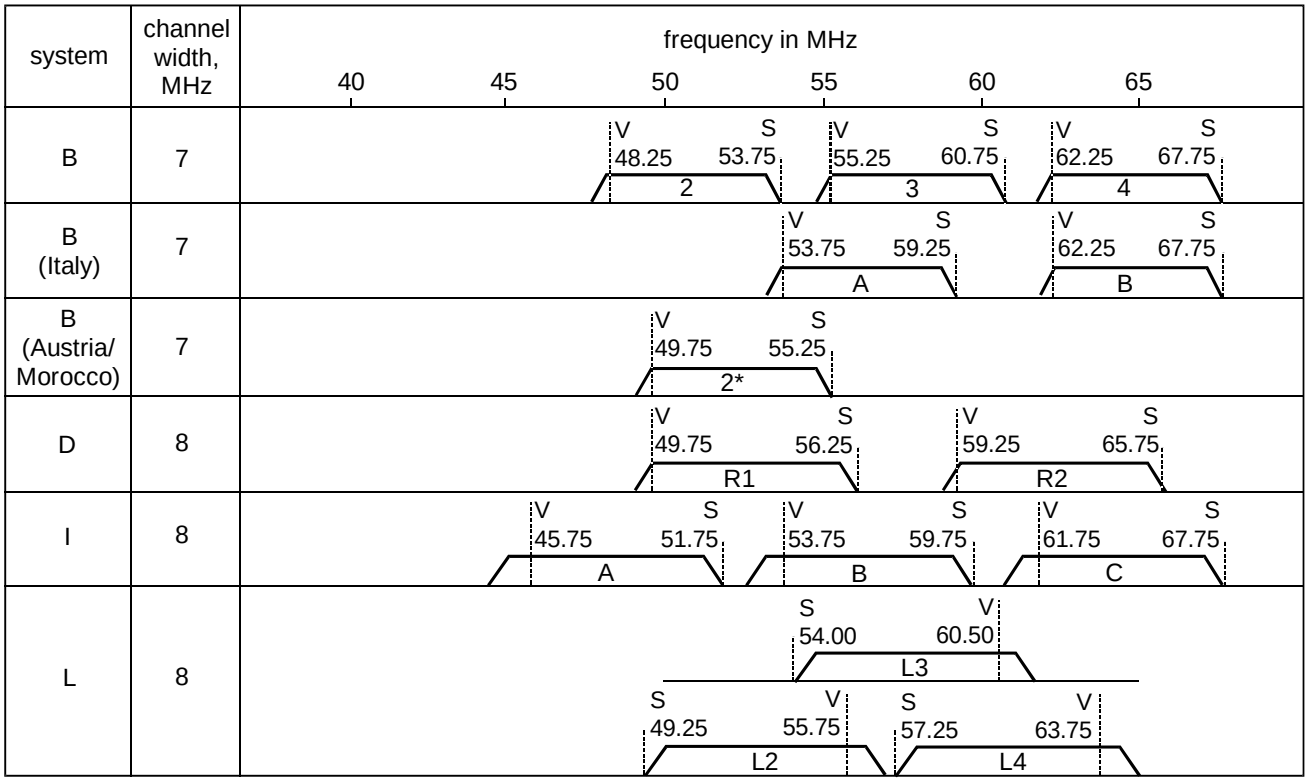
Regarding DRM (for example for local radio services) or DVB-H, requiring new types of receivers, future use of Band I might be considered favourable.

A press release dated March 2005 from the DRM consortium announced an extension up to 120 MHz. (Note: the broadcasting Band in this frequency region stops at 108 MHz; the frequencies 108 - 120 MHz are used by the aeronautical services.)

Further studies could also include considerations on digital technologies that make use of frequency or time-diversity modulation techniques.

In the long term, there may be options to exchange Band I for Channel 13 in some countries where the latter is not currently available for broadcasting. This matter will need to be further examined.

ANNEX



NOTE that Morocco needs to be suppressed from the list and that the system I channels are labelled as IA, IB and IC, in the following table.

Figure 1: Channel positions in television Band I

TABLE 1
Details about spectrum availability in a number of countries in the EBA (as of 27-03-97)

Code	Country	Band I 47 - 68 MHz	
		Channels	**Remarks**
AUT	Austria	2, 2 - 4	Shared with land mobile.
BEL	Belgium	2 – 4	Channel 2 (47 - 54 MHz) unavailable - reserved for land mobile services.
BUL	Bulgaria	R1 - R2	Television
CZE	Czech Republic	R1 - R2	Television
D	Germany	2 – 4	Shared with land mobile: not available for DVB-T.
DNK	Denmark	2 – 4	Channel 2 (47 - 54 MHz): unavailable. Channel 3 and 4 shared with land mobile service.
EST	Estonia	R1 - R2	Shared with land-mobile service and radiometers.
F	France	L2 - L4	Band used on a secondary basis by fixed and mobile links for broadcasting and by radio amateur service (50.2 - 51.2 MHz) and is claimed (near 50 MHz) by wind-profiler radar.
FIN	Finland	2 – 4	Channel 2 (47 - 54 MHz): not in use (50.0 - 50.5 MHz radio amateur service).
G	United Kingdom Gibraltar	2 – 4	Unavailable. Television
GRC	Greece	2 – 4	Television
HNG	Hungary	R1 - R2	Television
HOL	Netherlands	2 – 3 4	47 - 61 MHz: unavailable, nationally allocated to fixed and mobile services, no TV transmitters exist on these channels. Television
HRV	Croatia	2 – 4	Television
I	Italy	A – C	Television
IRL	Ireland	IB - IC	Broadcasting to be phased out.
ISL	Iceland	2 – 4	Television
LIE	Liechtenstein	2 – 4	Television
LTU	Lithuania	R1 - R2	Television
LUX	Luxembourg	2 – 4	Television
LVA	Latvia	R1 - R2	Television
MCO	Monaco	2 – 4	Television
MDA	Moldova	R1 – R2	Television
NOR	Norway	2 – 4	Television
POL	Poland	R1 - R2	Mobile and Amateur Service
POR	Portugal	2 – 4	Television
ROU	Romania	R1 - R2	Television
RUS	Russian Federation	R1 - R2	Television
S	Sweden	2 – 4	Television
SUI	Switzerland	2 – 4	Television
SVK	Slovak Republic	R1 - R2	Television
SVN	Slovenia	2 – 4	Television
TUR	Turkey	2 – 4	Television Also allocated to Land Mobile Services. Not available for DVB-T
UKR	Ukraine	R1 - R2	Television