Introduction to Digital Radio Spectrum

Summary

Radio Spectrum is a vital resource for broadcasters to distribute services to listeners.

- It allows for a signal to be reached at almost all points in a covered area, including in building and even when a receiver is moving, for instance in a car.
- It is a quick way to distribute a signal and compared to other forms of media (e.g. newspapers, cable), is an inexpensive way of distributing information.
- It is flexible, for instance parameters of signal can be adjusted according conditions and requirements. .

The most important spectrum for digital radio is Band III, which consists of the frequencies from 174 to 230 MHz.

Understanding and measuring Spectrum and Radio Waves

Radio waves are an electromagnetic radiation like the light, sound or infra light and generated by natural sources such as lightning. They can also be generated artificially for radio communication, industry use or e.g. cooking (microwave ovens).

- Radio Waves propagate in free air but in other materials. They go through buildings and can be reflected, absorbed or modified. Different frequencies have different propagation characteristics. Propagation is important feature for communication but for interference issues too. Only one signal can be delivered on the same frequency in the same area and time, otherwise the signals will collide and successful transmission will not be possible.
- Wave length is measured in distance units like meters or kilometres and frequency in units called Hertz.
- Radio Spectrum is a group of electromagnetic waves with wavelengths from 0.1 millimetres to 100 kilometres. Their frequency is inversely proportional to their wavelength and corresponding values are from the 3000 GHz to 3 kHz.
- To utilise spectrum a transmitter is required to broadcast the signal and receiver is required to capture this.
- Long waves are suitable for communication on a long distance (e.g. maritime communication), very short waves for communication transporting big amount of data (e.g. broadband).

The basic division of the radio spectrum

Different parts of radio spectrum have different parameters and are used for different radio transmission technologies and applications. To prevent interference and allow for efficient use of the radio spectrum, different types of services are allocated to specific bands. For example, broadcasting, mobile radio, or navigation devices will be allocated in non-overlapping ranges of frequencies.

Band name	Abbreviation	Range / wave length	Use
Very low frequencies	VLF	3-30 kHz / 100 km-10 km	Communication with submarines, systems for lightning detection, navigation
Low frequencies	LF	30-300 kHz / 10km-1 km	Navigation, time signals, amateur radio, **AM long wave broadcasting**
Medium frequencies	MF	300-3000 kHz / 1km-100m	**AM medium wave broadcasting**
High frequencies	HF	3-30 MHz / 100m-10m	**Shortwave AM / digital broadcasting**, CB radio, amateur, marine communications
Very high frequencies	VHF	30-300 MHz / 10m-1m	**FM broadcasting, Band III digital radio,** mobile communication
Ultra high frequencies	UHF	300-3000 MHz / 1m-10cm	**TV bands IV/V, L-band radio,** mobile networks GSM, UMTS, Wi-Fi, GPS
Super high frequencies	SHF	3-30 GHz / 10cm-1cm	Microwave fixed links, Wi-Fi, radars, **satellite broadcasting**
Extremely high frequencies	EHF	30-300 GHz / 1cm-1mm	Radio astronomy, short fixed links

Frequency bands used for digital radio

Band III (174-230 MHz / 240 MHz in some countries) is the core band designed and used for DAB. Receivers need an external antenna for quality reception but the band allows to cover a large area and enables good penetration of buildings.

L-band (1452-1479.5 MHz) is used in some countries where Band III is not available yet or as the supplemental broadcasting band. It does not need external antenna which is an advantage particularly for handsets like mobile phones. Frequencies are likely to reflect and the L band is very usable in urban areas with high buildings on both sides of the streets. This way there is good reception even not in the line-of-sight to the transmitter. However a characteristic is that there is limited penetration to the buildings and very bad reception inside. On one side it is a disadvantage but is usable for some applications like local information distribution systems inside buildings, e.g. in department store, railway stations.