

CAN LTE SHARE SPECTRUM WITH DTT?

Mobile vendors predict an unstoppable rise in Mobile data consumption, and have already obtained mobile allocations in the 700 MHz and 800 MHz bands. Administrations are now being asked to consider a further allocation in the remaining part of the UHF band, below 694 MHz, which is used in most countries for DTT. Some Mobile proponents claim that they can share the band with broadcasting. However, technical studies carried out in ITU-R - and confirmed by recent real cases - do not support this claim.

BACKGROUND

In 2007 and 2012, the ITU made two allocations to the mobile service in parts of the UHF band used by DTT: the 800 MHz band (790-862 MHz) and the 700 MHz band (694-790 MHz). Both allocations have resulted in the need to clear broadcasting and other services from these bands. The allocations, including the required guard bands and duplex gaps, have reduced the amount of UHF spectrum available for DTT by 43% (21 channels of 8 MHz each taken out of 49 channels initially available for broadcasting).

Agenda item 1.1 at the 2015 World Radiocommunications Conference deals with the allocation of further spectrum for the mobile service, with identification for use by International Mobile Telecommunication (IMT) applications. In preparation for this agenda item, in February 2012, the Joint Task Group (JTG4-5-6-7) of ITU was given the task of studying the technical conditions of sharing the UHF band between IMT and Digital Terrestrial Television (DTT). The aim was to assess the possibility of allocating the remaining part of the UHF band, i.e. 470-694 MHz, to the mobile service on a co-primary basis with the broadcasting service.

The mobile system considered in these studies was the Long Term Evolution (LTE) mobile system (part of the IMT family, standardized in 3GPP¹), which uses similar characteristics to those systems implemented in the 800 MHz band and foreseen in the 700 MHz band. In particular, these mobile systems use a cellular network structure with a density of base stations that is considerably higher than the density of broadcasting transmitters. They require frequencies for both their downlink (DL) and uplink (UL).

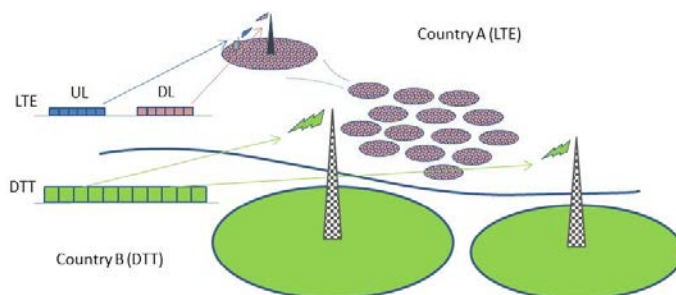


Figure 1. Illustration of the main differences between DTT and LTE features relevant for sharing studies

These frequencies can either be separate (as shown in Figure 1), referred to as Frequency Division Duplex (FDD), or identical and time shared, referred to as Time Division Duplex (TDD). The bandwidth of a downlink or uplink block is different from the bandwidth of a DTT signal. Each downlink or uplink block is used through large areas that cover entire countries or regions. These features are illustrated in Figure 1.

Technical sharing studies were carried out between February 2012 and July 2014. They covered co-channel and adjacent channel cases and considered protection of DTT from LTE and vice versa.

The results of these studies related to the 470-694 MHz band are included, with detailed assumptions and methodologies, in Report ITU-R BT.2337, published in November 2014. These results are summarized in the following section.

WHAT DO THE STUDIES CONCLUDE?

From an international perspective, the main issue about sharing a given frequency band by two different services is that two neighbouring countries may wish to use the same frequencies on either side of the border for different services. An example could be the use of the band for DTT in Spain while using the same band for LTE in Portugal.

¹ See TS 36.101 v12.9 and 36.104 v12.9

This corresponds to co-channel operation, for which each system needs to operate in presence of interfering signals from the other system. Ideally, this needs to be made possible in the entire territory of each country, but practically a separation distance will be required. The difficulty of sharing is therefore evaluated by assessing the required separation distance from the border beyond which no coordination is needed between the two administrations.

Figure 2 summarizes the main results of the studies. Concerning the protection of DTT from LTE base stations (downlink), the required separation distance to avoid coordination of a single LTE base station over a land path is between 30 and 90 km, depending on the characteristics of the base station. Over a warm sea path, the required separation distance may increase up to 700 km. Furthermore, a major issue raised by several studies is the possible accumulation of interference

due to the use of the same frequency by a large number of base stations. In other words, while a single LTE base station could be implemented without coordination and without causing cross-border interference to DTT, the geographical extension of the LTE network using the same frequency may end up by causing interference to DTT in the neighbouring country. In order to avoid such a situation, the studies indicate that a separation distance over a land path between 200 and 300 km would in fact be needed. And over a warm sea path, the separation required is more than 1000 km.

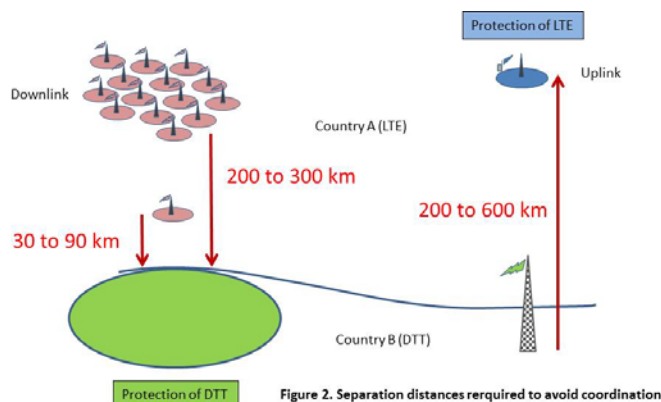


Figure 2. Separation distances required to avoid coordination

Concerning the protection of LTE base stations (uplink) from DTT, the required separation distance over a land path calculated by the studies is of the order of several hundreds of kilometres, between 200 and 600 km, depending on the emission characteristics of the DTT transmitters. This large required separation is explained by the fact that the receiving antenna of the LTE base station is located at 20-50 m height above ground level and the receiver is very sensitive, while DTT transmitters are usually located at high altitudes above sea level (hundreds or even thousands of meters) with large antenna heights above ground level (a few hundred meters). They can also radiate high powers (50 kW or 200 kW e.r.p. in some cases).

This critical aspect of the protection of LTE uplink from DTT has been confirmed in a real situation between Spain and Portugal in the 800 MHz band². This is also expected to be a major difficulty in the implementation of IMT in the 700 MHz band during the transition period, unless a coordinated approach between administrations is defined for the release of the band by broadcasting. At the European level the date of 2020 (+/- 2 years) has been proposed for this release³.

Therefore, with the current characteristics of the LTE system, the answer to the question “Can LTE share spectrum with DTT?” would be “NO”. However, some mobile systems other than LTE are currently and effectively sharing spectrum with DTT; this is the case of Programme Making and Special Events (PMSE) applications which successfully uses the gaps between DTT channels in a given area, called TV white spaces. Various other mobile systems exploiting the TV white spaces on a secondary basis (no interference to and no protection from the primary broadcasting service) are currently being tested in the UHF band in some countries.

An adequate design of a future IMT system which takes into account the required protection of DTT, and doesn't impose restrictions on DTT for its own protection, might change the answer to the above question.

WHAT IS THE EBU DOING?

EBU, with experts from its member organizations, carries out technical studies and contributes to working groups of National, Regional and International organizations (CEPT, EU and ITU). EBU also develops technical notes and reports intended to inform its member organizations about specific issues related to sharing. In addition, EBU coordinates, represents and promotes the views of its member organizations in regional and international forums, in particular in WRCs.

FIND OUT MORE

EBU SDB (Sharing with Digital Broadcasting) group
 EBU SMR (Spectrum Management and Regulation) strategic programme
 ITU-R Report BT.2337 and other reports

tech.ebu.ch/groups/sdb
tech.ebu.ch/groups/sm
<http://www.itu.int/pub/R-REP-BT/en>

² See Reports ITU-R BT.2301-1 and ITU-R BT.2247-3.

³ See the [Lamy report](#) on the future use of the UHF band, including proposed dates for the release of the 700 MHz band.