

Spectrum for LTE-based 5G Terrestrial Broadcast

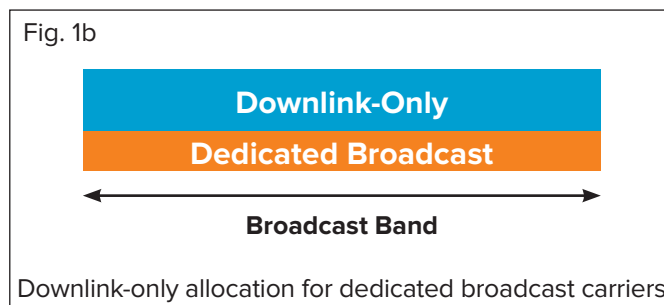
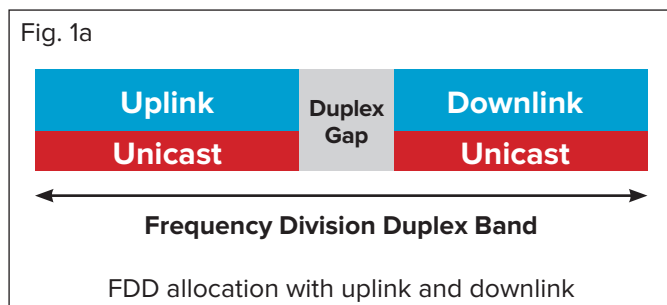
LTE-based 5G Terrestrial Broadcast is a broadcast system defined by 3GPP that can be deployed in unpaired downlink-only spectrum (i.e. without the need for an uplink), with dedicated broadcast carriers. Current broadcast allocations in the UHF band may therefore be suitable for the deployment of LTE-based 5G Terrestrial Broadcast services.

What spectrum is required to deploy LTE-based 5G Terrestrial Broadcast?

Conventional mobile networks require both a downlink and an uplink. The uplink can use either a different frequency (with a frequency division duplex allocation, Fig. 1a) or the same frequency but at a different time (with a time division duplex allocation). In contrast, LTE-based 5G Terrestrial Broadcast is a downlink-only system. It is therefore similar to any existing broadcast standard (Fig. 1b).

LTE-based 5G Terrestrial Broadcast has the following main features, which enable operation without uplink:

- Dedicated broadcast carriers: up to 100% of each radio frame may be configured to carry broadcast services and related signalling. No user data nor any other information related to unicast is transmitted.
- Receive-only mode: user equipment requires neither connectivity nor registration to any network. All the necessary signalling and contextual information is self-contained in the downlink carrier.



LTE-based 5G Terrestrial Broadcast could be deployed in any mobile downlink band including SDL (supplemental downlink) bands, for example the L-band (1452–1492 MHz).

The UHF broadcast bands, from around 470 MHz to 694/698 MHz, depending on the geographical region, may be suitable for LTE-based 5G Terrestrial Broadcast as well. However, the channel bandwidth allocations in that portion of the spectrum (6, 7 or 8 MHz depending on the region) do not comply with those currently specified in the 3GPP specifications, i.e., 3, 5, 10, 15 and 20 MHz. Using the same bandwidths as other broadcasting systems would maximize compatibility and facilitate the introduction of LTE-based 5G Terrestrial Broadcast.

As a consequence, new work items (in Rel-17 and Rel-18) have been approved in 3GPP to enable the operation of LTE-based 5G Terrestrial Broadcast in UHF broadcast spectrum, potentially alongside existing digital terrestrial television (DTT) systems. To this end, bandwidths of 6, 7 and 8 MHz will be defined.

Spectrum options for LTE-based 5G Terrestrial Broadcast

The Radiocommunication Sector of the International Telecommunication Union (ITU-R) is responsible for setting out how radio spectrum is used throughout the world. The regulations are updated by World Radiocommunication Conferences (WRCs) every three to five years. The regulations are legally binding on ITU member states.

The sub-700 MHz band (470–694 MHz) is allocated to broadcast services in Region 1 (Europe, Africa and the Middle East). In some countries of Region 2 and in Region 3 the band, or part of the band, is allocated to both broadcast and mobile services, with usage differing between countries. Furthermore, Region 1 uses 8 MHz channel bandwidths for broadcast services, whereas Regions 2 and 3 use a range of different bandwidths (6/7/8 MHz). For instance, the USA uses 6 MHz, while China and India use 8 MHz.

ITU Region 1	470-694 (PRIMARY)		694-890 (CO-PRIMARY)
ITU Region 2	470-608 (PRIMARY/CO-PRIMARY)	614-698 (PRIMARY/CO-PRIMARY)	694-890 (CO-PRIMARY)
ITU Region 3	470-610 (CO-PRIMARY)		610-890 (CO-PRIMARY)

“Primary” here refers to broadcast services. In Region 2, the allocations differ from country to country.

ITU Region 1

In Europe, Africa and the Middle East, the use of the UHF band for broadcast services is governed by the Geneva 2006 agreement (GE06), which sets out the rights each country has to deploy a number of DTT services (called layers) in a country. These rights also grant that each service is protected from interference from neighbouring countries. The European Commission made a Decision in 2017 ((EU) 2017/899) to allow the sub-700 MHz band to continue to be made available for broadcast use until at least 2030.

Assuming appropriate features are developed for LTE-based 5G Terrestrial Broadcast to operate in the portion of UHF spectrum allocated to broadcast systems (e.g., with 8 MHz channels) and that the GE06 out-of-band emissions limits can be respected, the deployment options for LTE-based 5G Terrestrial Broadcast services within ITU Region 1 would be as follows:

- **Reuse existing DTT GE06 assignments/allotments** – LTE-based 5G Terrestrial Broadcast could be used in any existing GE06 assignment/allotment or equivalent, subject to conformity with the GE06 rules.
- **New assignments/allotments in addition to existing DTT GE06 assignments/allotments** – new assignments/allotments for LTE-based 5G Terrestrial Broadcast could be created alongside existing DTT assignments/allotments under the GE06 framework and new inter-country frequency coordination agreements. Given that the band is already occupied by existing GE06 plan entries, any new assignment/allotments may be of limited utility, especially near international borders.

ITU Regions 2 and 3

In the rest of the world, there is no equivalent to the GE06 agreement. Each country must negotiate with its neighbours to assign spectrum for broadcasting use, and these negotiations will generally be conducted according to bilaterally-agreed rules and conventions. These negotiations can often be complex, especially in countries whose neighbours use different channel rasters and/or bandwidths. The availability of a wider choice of bandwidths can bring flexibility when it comes to the introduction of new systems.

In the United States (Region 2), ATSC 3.0 is the approved voluntary DTT standard being deployed to eventually replace ATSC 1.0. However, regulatory flexibility may permit non-ATSC 3.0 waveforms such as LTE-based 5G Terrestrial Broadcast to share the DTT spectrum to provide ancillary and supplementary downlink services (e.g., so-called “Broadcast Internet”). In Brazil (Region 2), LTE-based 5G Terrestrial Broadcast is a candidate for the physical layer for the next generation “TV 3.0 Project”. In India (Region 3), the public broadcaster has exclusive use of the allocated DTT spectrum and is evaluating options for its future digital standard for direct-to-mobile broadcast and offload from unicast. This may present an opportunity to use LTE-based 5G Terrestrial Broadcast.

Useful Links

- ETSI TS 103 720 V1.1.1 (2020-12), 5G Broadcast System for linear TV and radio services; LTE-based 5G terrestrial broadcast system [↗](#)
- World Radiocommunication Conference 2015 (WRC-15), Geneva, Switzerland, November 2015 [↗](#)
- Regional Radiocommunications Conference (RRC-06), Geneva, Switzerland May/June 2006 [↗](#)