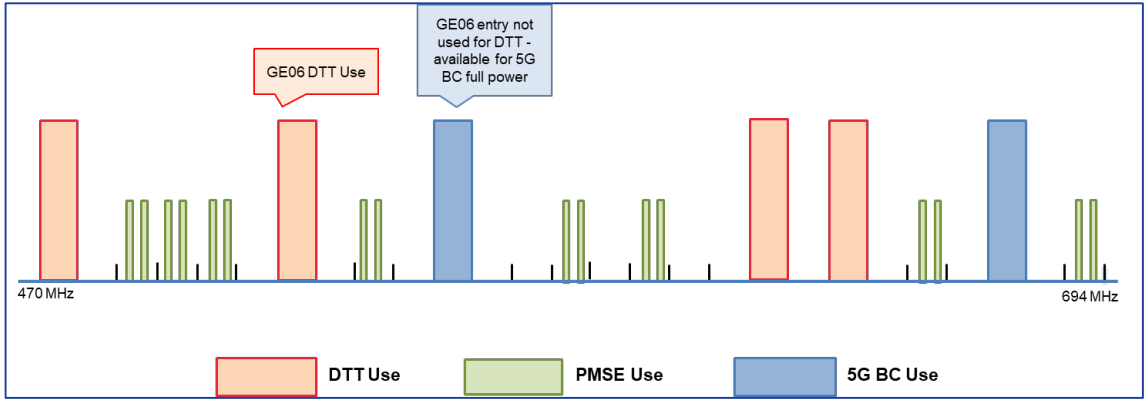
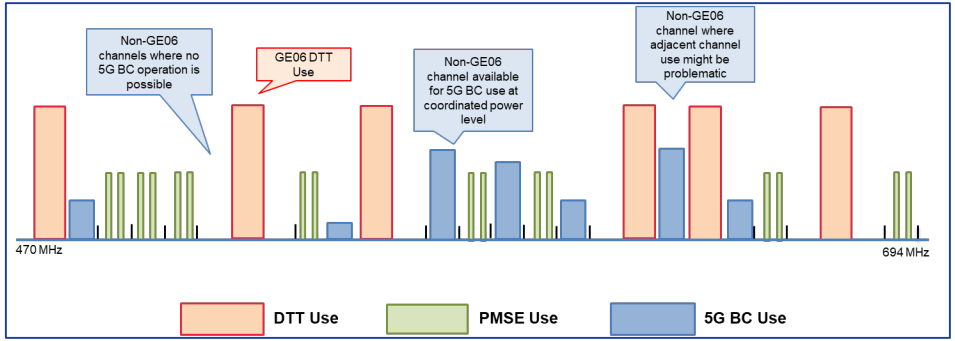
4. Compatibility between 5G Broadcast and other DTT systems

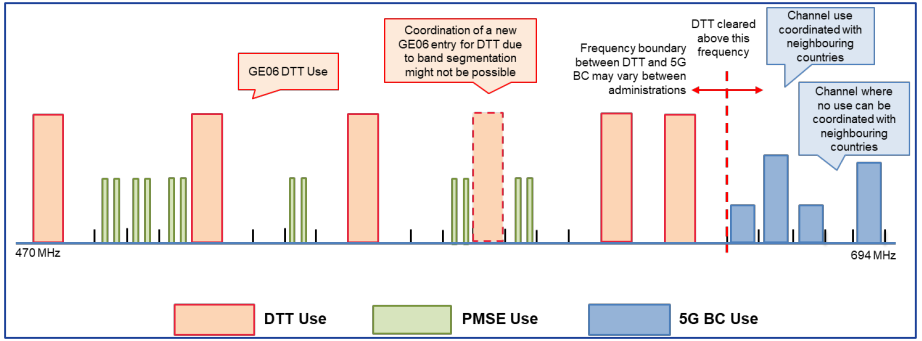
Scenarios of introduction in the sub-700 MHz band



Scenario 1: Use of coordinated GE06 DTT entries by 5G Broadcast



Scenario 2: Interleaved use in GE06



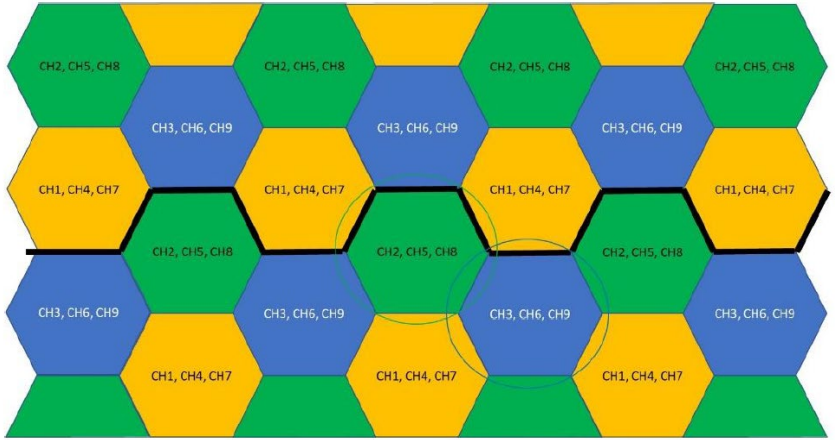
Scenario 3: Band segmentation

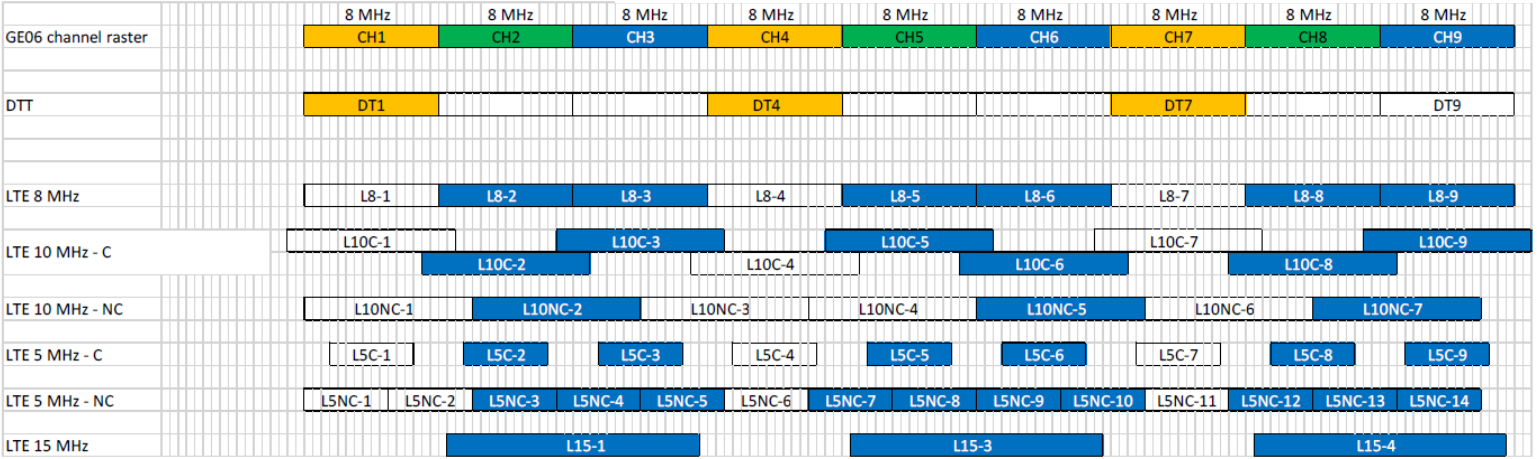
Use of GE06 DTT entries - compatibility

- The 5G Broadcast signal needs to respect the conditions of the DTT entry (envelop concept)
- Co-channel case:
  - Coverage area of 5G Broadcast might not be the same as DTT depending on system parameters and network configurations used
- Adjacent channel case:
  - **Impact on DTT** - hole punching if sites not co-sited and different antennas. Solutions:
    - Appropriate antenna patterns and power design from 5G Broadcast to avoid interference to DTT
    - Appropriate filtering of 5G Broadcast transmitter
    - In some cases, notch filters in antenna feeder at DTT reception
  - **Impact on 5G Broadcast receivers** - large power differences of signals received (ACS issue). Solutions:
    - Co-siting 5G Broadcast and DTT transmitters
    - Adding notch filters in 5G Broadcast receivers - feasible but impractical

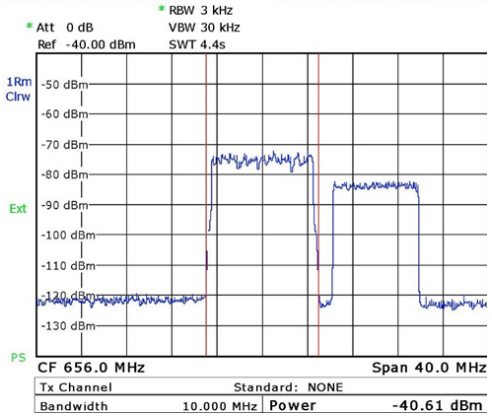
The bandwidth of the 5G Broadcast signal

- GE06 Plan is based on an 8 MHz channel raster. But today 5G Broadcast is specified for 5, 10, 15 MHz
- An assessment of different band plans is made for 5G Broadcast introduction as per GE06 entries: the potential total bandwidth and power reduction compared to DTT entry

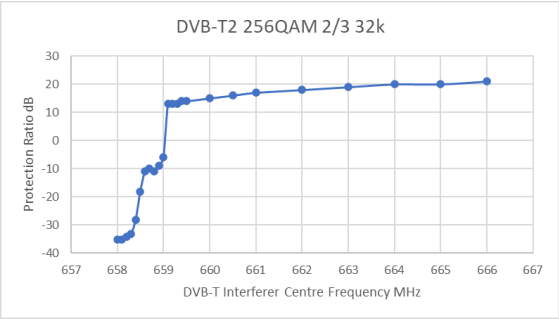


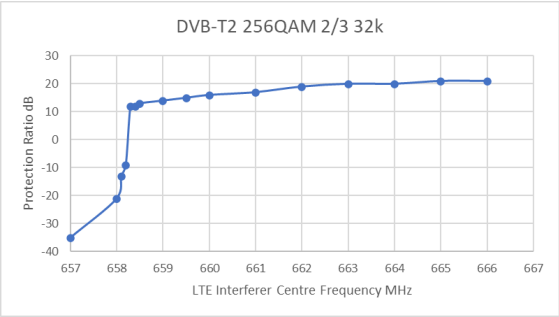


Measurements of adjacent and overlapping channels Protection Ratios



Example of LTE signal at -10 MHz (No overlap with the wanted DVB service)





PR (Protection Ratio) values
function of the DVB-T or LTE interferer centre frequency

Effects of overlapping Interference to DVB signals from LTE and DVB are similar.

- Main differences are due to the effective bandwidth of the signals, DVB-T (or T2) and LTE.

When the overlap is:

- 1 MHz (*), PR is becoming relevant and depends on the bandwidths involved.
- 2 MHz, PR is already greater than 10 dB (typical value 12 dB). This is a condition impractical to use.
- At full overlap, PR is of the order of the Co-Channel PR.

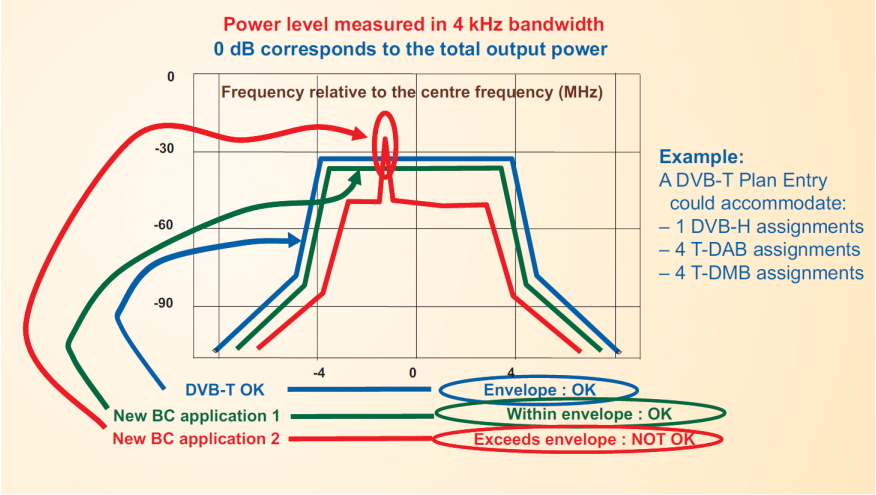
(*) Centre Frequencies are 658 and 666 MHz respectively

The bandwidth of the 5G Broadcast signal

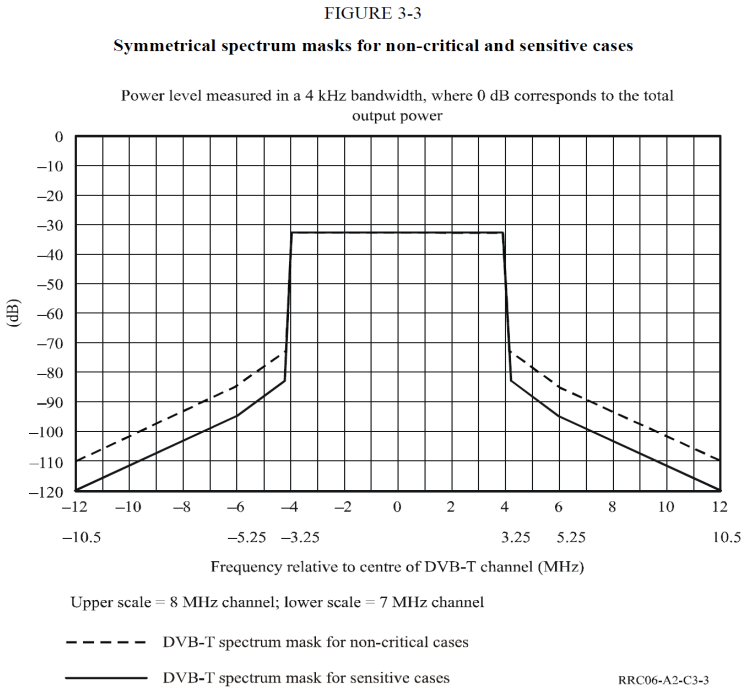
- 5 and 8 MHz signals can be implemented with minimum constraints, 8 MHz being more spectrum efficient
- 10 MHz signal would have several constraints:
  - Power reduction to protect DTT in the adjacent channel (between 26 to 44 dB in most cases)
  - Non-compliance with GE06 provisions, coordination with neighboring countries on a case-by-case would be required
  - Interference from DTT in adjacent channel
- 15 MHz signal (capacity advantage) would have several constraints:
  - Limited availability of two contiguous 8 MHz channels in a given area
  - The position of the 15 MHz channels would need to be flexible to use contiguous 8 MHz channels where available
  - Non-compliance with GE06 provisions, coordination with neighboring countries on a case-by-case basis would be required

Compliance with GE06 provisions

1. The GE06 envelop concept:



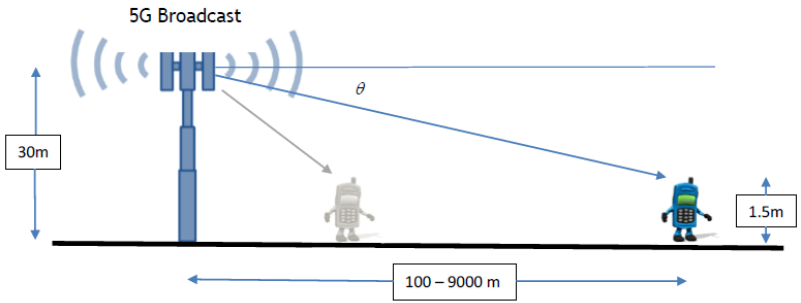
2. The DTT Spectrum Mask:



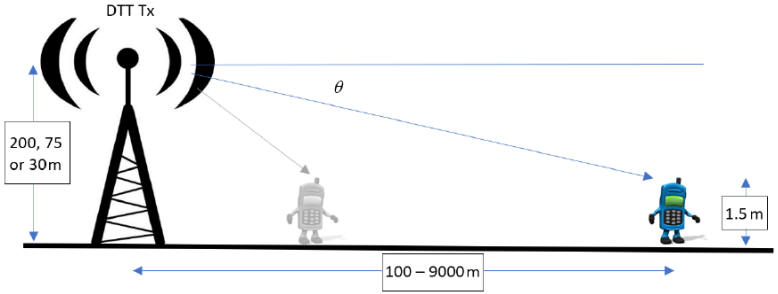
› **Signals larger than 8 MHz would require a power reduction (e.g. more than 40 dB in the whole of a 10 MHz 5G Broadcast signal)**

The Adjacent Channel selectivity (ACS) of the 5G Broadcast UE

- Minimum Coupling Loss (MCL) approach
- 5G broadcast UE at 100 to 9000m from interferer
- UE receiver Adjacent Channel Selectivity (ACS) = 33 dB as per ETSI TS 136.101 table 7.5.1-1
- The transmitter adjacent channel leakage ratio (ACLR)
  - 45 dB for 5G Broadcast transmitter as per ETSI 36.104
  - 64 dB for DTT transmitter as per DTT Critical mask

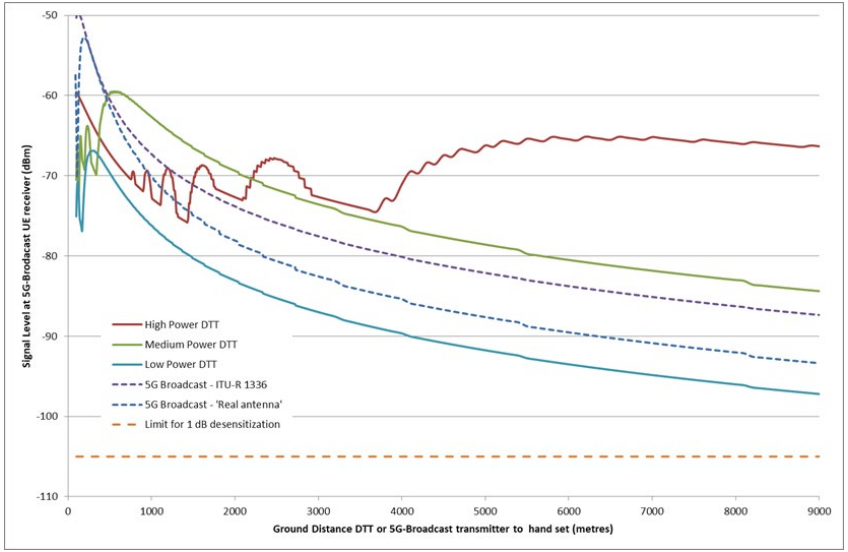


5G Broadcast base station to UE geometry

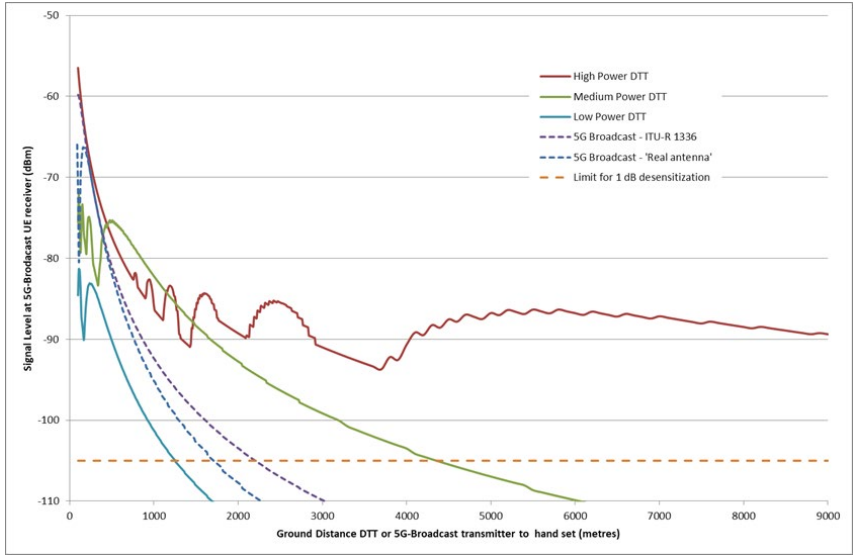


DTT to UE geometry

The Adjacent Channel selectivity (ACS) of the 5G Broadcast UE



DTT and adjacent block 5G Broadcast signal level at 5G Broadcast UE receiver - Free space loss



DTT and adjacent block 5G Broadcast signal level at 5G Broadcast UE receiver - Hata suburban

- ACS of UE terminal to be increased to improve performance with strong adjacent signals
- Co-siting DTT and 5G Broadcast also part of the solution

Conclusions of TR064

1. Reuse of coordinated GE06 DTT frequencies when possible is the way to start with
2. An 8 MHz 5G Broadcast bandwidth has advantages
3. The 5G Broadcast receiver will need suitable RF characteristics to operate in the presence of high level adjacent DTT signals in some areas