





My name is Walid Sami, I work in the Technology & Innovation department of the European broadcasting Union in Geneva.

I would like to thank the DG Enterprise and Industry and DG Connect for inviting me to speak at this workshop. I will try to express the EBU views with regard to the coexistence challenges in the UHF band, in particular in the 700 MHz band.

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I will deal in my presentation with the following coexistence cases

The LTE 800 MHz case, the LTE 700 MHz case, the PPDR 400 MHz case and the PPDR 700 MHz case and will give some conclusions

These cases are illustrated in a simplified way in the picture shown here.

## 1. THE LTE 800 MHZ CASE

### PREVENTIVE MEASURES

Coexistence	Measure	Type	Implemented by
Adjacent channel	Reverse Duplex with 1 MHz guard band	Harmonized decision	Administrations
Adjacent channel	Base Station BEM*	Harmonized decision	Administrations
Adjacent channel	User Equipment BEM	Harmonized standard	Manufacturers
Adjacent channel	Base Station case by case verification	National Regulation	Administrations
Co-channel	Harmonized deadline for band release	Harmonized decision	Administrations

\* BEM: Block Edge Mask

The LTE 800 MHz system is being deployed in several European countries. The technical and regulatory conditions for the use of the concerned band have been defined on the basis of the sharing studies done by the CEPT.

These conditions included a set of preventive measures summarized in this table. The reverse duplex was one major decision. A guard band of 1 MHz and a set of In-Band and Out-Of Band emission limits were specified, through the term BEM (for Band Edge Mask) to minimize the risk of interference. It was however recognized that additional measures would be needed by the national Administrations. Effectively, as the base stations are professionally installed and have to go through an authorization procedure before being brought into operation, the national Administrations are able to predict beforehand their impact on a case by case basis.

Another important measure has been the decision of a harmonized deadline for the release of the 800 MHz band by the broadcasting transmissions. From the coexistence point of view this prevents cross border problems due to the difficult co-channel sharing between the broadcasting networks and the LTE networks, especially the uplink reception part at the base station.

## 1. THE LTE 800 MHZ CASE

### CURATIVE MEASURES

Coexistence	Measure	Type	Implemented by
Adjacent channel	Mitigation techniques on a case by case basis	National Regulation	Administrations

In addition to the preventive measures, a set of curative measures were also defined as result of the studies. These consist in the use of mitigation techniques by the national Administrations to solve the interference on a case by case basis. The most effective technique being the insertion of a rejection filter between the antenna and the receiver or between the antenna and the mast head amplifier, if possible.

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## 1. THE LTE 800 MHZ CASE

### OUTCOME

Coexistence	Measure	Results	Conclusion
Adjacent channel	Reverse Duplex	Small guard band, efficient spectrum use	Right decision
Adjacent channel	Base Station and User Equipment BEM	No issues	Realistic and achieved
Adjacent channel	Base Station case by case verification	Under control in most cases	Feasible in various ways
Adjacent channel	Filters in DTT installation	Mostly for active receiving installations	Manageable in most cases
Co-channel	Harmonized deadline for band release	Difficult in some cases	Harmonized release is important

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The deployment of the LTE800 MHz networks is still ongoing. However from the available information about the interference cases we can formulate a few preliminary conclusions:

1- The reverse duplex and the BEM defined for the base stations and the User Equipments proved to be suitable and have been implemented without major issues.

2- The verification of the risk and the resolution of the interference cases by the national Administrations proved to be feasible, noting however some differences from one country to the other in the adopted procedures, with a resulting difference in the impact on the DTT viewers in the concerned cases.

We can note some serious difficulties of co-channel cross border interference when LTE 800 was deployed in one country while DTT was still using the 800 MHz band in a neighbouring country. This confirms that sharing the same band between LTE and DTT is very difficult. In this context a harmonized release is important.

**EBU 2. THE LTE 700 MHZ CASE**

**PREVENTIVE MEASURES**

Coexistence	Measure	Type	Implemented by
Adjacent channel	Conventional Duplex with 9 MHz guard band	Harmonized decision	Administrations
Adjacent channel	User Equipment BEM	Harmonized standard	Manufacturers
Adjacent channel	Improvement of DTT receiver performance	Harmonized standard	Manufacturers
Co-channel	Harmonized deadline for band release	Harmonized decision ?	Administrations

- Long technical debates
- Does not consider the protection of portable DTT reception

- Legacy issues
- Active receiving installations not covered

Different time tables:  
France vs (UK, Italy, Spain)  
Finland vs. Russian Federation

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We come now to the LTE 700 MHz case.

Following the same principle as for the LTE 800 MHz, a set of preventive measures has been defined: A conventional duplex was required for reasons related to the compatibility between LTE800 and LTE700. A guard band of 9 MHz was defined between the uplink frequency block and the highest DTT channel below the 700 MHz band, i.e. channel 48.

The LTE 700 User equipment BEM, in particular its out-of-band emission limits have been subject to long technical debates, and has finally been agreed by referring to the best effort from the manufacturers. While it takes into account the protection of DTT fixed roof top reception, it does not consider the protection of portable DTT reception, which would require a more stringent BEM of the LTE UE.

The unpredictable position and movement of the UE prevents from applying the case by case verification used by the Administrations for the base stations in the 800 MHz band. This is why an improvement of the DTT receiver performance with regard to adjacent channel interference becomes necessary. The EBU supports defining a harmonized standard defining ambitious but realistic target performance for the DTT receiver with regard to adjacent channel interference. Nevertheless, this action does not help solving the possible issue of the legacy DTT receivers and does not cover the real issue of active receiving installations (mast head amplifiers and active antennas)

Will there be a harmonized decision for the release of the 700 MHz band ? The

## 2. THE LTE 700 MHZ CASE

### CURATIVE MEASURES

Coexistence	Measure	Type	Implemented by
Adjacent channel	(Undefined)	National Regulation	Administrations

Not many measures are available if interference cases appear, e.g. on Legacy DTT receivers, portable DTT reception, etc.

Concerning the curative measures that would be required to solve any interference cases, they are almost inexistent in the outcome of the studies.

EBU **3. THE PPDR 400 MHZ CASE**

**PREVENTIVE MEASURES**

Coexistence	Measure	Type	
Adjacent channel	Need for a guard band below 470 MHz	Harmonized or national ?	Decision process is unclear — and extremely tight time schedule for the studies
Adjacent channel	Base Station BEM	Harmonized or national ?	
Adjacent channel	User Equipment BEM	Harmonized or national ?	
Adjacent channel	BS Case by case verification	National Regulation	

Impossible to design a rejection filter without any guard band

- High power vehicular user equipment 50 times more powerful than a commercial LTE handheld terminal
- High density of PPDR user equipments in special events

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We go now to the PPDR service which also contemplates the use of the UHF band in different parts. The first use is in the band 460-470 MHz, noted here as PPDR 400 MHz. The downlink is immediately below channel 21, i.e. below 470 MHz. This situation is similar to that of the 800 MHz band.

Sharing studies are ongoing in the CEPT but it is not clear where the decision on the technical and regulatory conditions for PPDR lies and to which mandate it refers. It is also not clear whether any harmonized decision is foreseen or whether it is left for national decisions.

The studies are assessing currently the difficulty of the different options.

We identified some major issues with this regard: The first is the need for a guard band below 470 MHz. Otherwise it would not be possible to design a suitable rejection filter to solve the possible interference cases as in the LTE800 case.

The other major issues are related to the foreseen transmit power of the PPDR User equipment, in particular the vehicular type. They consider a power 50 times higher than the power of a commercial LTE 700 MHz user equipment. The nature of the PPDR missions in special events (like in demonstrations or Emergency cases) requires the gathering of a large number of user equipments in a small area, which leads to an increased potential of interference into DTT.

The time schedule for the studies is extremely tight which does not allow to deal with all these issues in a right manner.



### 3. THE PPDR 400 MHZ CASE

#### CURATIVE MEASURES

Coexistence	Measure	Type	Implemented by
Adjacent channel	Mitigation techniques on a case by case basis	National Regulation	Administrations

Similar technical and regulatory measures to those used for the LTE800 networks deployment. This includes verification of the potential of interference on a case by case basis and the communication and supply of filters to the concerned existing DTT users.

The curative measures in the case of interference from PPDR 400 MHz base stations into channel 21 or above could be similar to those used for the LTE800 MHz base stations. They need to be foreseen by the national Administrations.

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### 3. THE PPDR 700 MHZ CASE (UPLINK IN THE 700 MHZ GUARD BAND)

#### MULTIPLE WARNINGS

1. Reduced guard band with regard to DTT channel 48
2. Higher out of band emission levels
3. Higher User Equipment power
4. High density of PPDR user equipments in special events
5. Possible DTT impact on the PPDR uplink

considerably higher impact from a PPDR user equipment on DTT channel 48: can be more than 1000 times higher than the impact of a commercial LTE 700 user equipment

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Arriving to the PPDR 700 MHz case, the most worrying option is definitely the one where the uplink is introduced in the guard band, i.e. 698-703 MHz.


This option reduces the guard band between an LTE user equipment used for PPDR and channel 48 from 9 MHz (corresponding to LTE700) to 4 MHz. This increases the risk of interference due to a lower selectivity of the DTT receiver and a higher out of band emission levels of the PPDR UE.

Furthermore, the PPDR user equipment is foreseen to operate at higher powers.

The impact of a PPDR UE on DTT in this configuration can be more than 1000 times higher than the impact of a commercial LTE 700 user equipment.

Also a higher density of PPDR UE will be encountered in special event.

Finally, the possible impact of the DTT transmitters (especially the High power ones) on the reception part in the PPDR base station with 4 MHz guard band needs to be assessed.



## 4. CONCLUSIONS

- 1. On LTE 700 MHz**
  1. Improvement of the DTT receiver performance is supported
  2. Possible need for curative measures in case of interference from LTE 700 MHz on DTT (e.g for Legacy DTT receivers and portable DTT reception)
  3. Co-channel coexistence across borders will be an issue with different release time tables
- 2. On PPDR**
  1. Need to clarify the decision process and the roadmap – allocate sufficient time to studies
  2. Avoid PPDR in the 700 MHz guard band – too many warnings – other options for PPDR700 exist

Experts from EBU and EBU member organizations contribute to all technical studies related to sharing and compatibility with the broadcasting service

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To summarize I would recall:

For the 700 MHz band

- The need to improve the DTT receiver performance
- The need for curative measures in the case of interference from LTE 700 MHz impact on DTT
- The potential co-channel cross border issues due to different times tables for the release of the 700 MHz band

For PPDR

- the need to clarify the decision process and the roadmap, and mostly the need to give more time to do the studies
- Too many warnings about PPDR in the 700 MHz guard band, this should be avoided knowing that other options for PPDR exist in the 700 MHz band.

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**Thank you**  
for your attention!

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