*Extract from Ericsson's proposal to SE5 March 2017 as Revision to the DTT related part of this draft ECC report*

*Compatibility studies related to the introduction of LTE* systems in the 410-430 MHz and 450-470 MHz bands

ECC Report [LTEin400]

Approved Day Month Year

# Executive summary

This report aims at analysing the impact of introducing LTE technology for PMR, PAMR, and MFCN (with channel bandwidth of 1.4 MHz, 3 MHz and 5 MHz) within the 410-430 MHz and 450-470 MHz sub-bands based on 3GPP Release 12. Further it aims to analyse Broadband PPDR in the band 410-430 MHz with a view to give protection to radiolocation and radioastronomy services. Compatibility studies between LTE based PPDR systems at 410-430 MHz and 450-470 MHz and others services were carried out in ECC Report 240.

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# LTE400 impact on DTT reception above 470 MHz

## Frequency allocation

For this study, LTE uplink band is starting at 452.5 MHz and downlink band at 462.5 MHz as illustrated by the following Figure 41. The basis is LTE Band 31.



Figure 41: Illustrative frequency allocation of the 450-470 MHz

## LTE400 BS into DTT

### Fixed DTT Reception

Studies on the protection of DTT above 470 MHz from LTE BS in the 450 – 470 MHz range were carried out in ECC Report 240 section 3.5.3.1 (Minimum Coupling Loss) and 3.5.1.4 (Monte Carlo).

Especially for the Monte Carlo simulations the absolute level of the interference probability is likely to be different. However, using the same method of interpreting the results, the same conclusion can be drawn.

In particular, the following text, quoted from ECC Report 240 related to PPDR Base station impact on DTT above 470 MHz, applies to LTE450 base station impact to DTT above 470 MHz:

"The results of the theoretical co-existence analyses with DTT demonstrate interferences from the PPDR LTE400 system to DTT reception when the PPDR system is adjacent in the frequency domain to the lower DTT Channel, i.e. Channel 21. Nevertheless, the risk of interference can be reduced by at a set of technical measures including a guard band of up to 3 MHz between DTT and PPDR BSs and an appropriate limit of the corresponding PPDR BS out-of-band emissions. Furthermore additional mitigation measures may be required to solve possible residual interference from PPDR BSs on a case by case basis in a manner similar to the situation between LTE800 and DTT".

LTE 400 Base Station OOBE e.i.r.p. levels for protection of DTT above 470 MHz are given in Table 16 below.

Table 16: PPDR 400 Base Station OOBE e.i.r.p. levels for protection of DTT above 470 MHz

| **Frequency range** | **Condition on Base station in-block e.i.r.p,P (dBm/cell)** | **Maximum mean OOBE e.i.r.p (dBm/cell)** | **Measurement bandwidth** |
| --- | --- | --- | --- |
| For DTT frequencies above 470 MHz where broadcasting is protected | P ≥ 60 | -7 | 8 MHz |
| P < 60 | ( P – 67 ) | 8 MHz |

For a list of possible mitigation techniques see ANNEX 2: (list of mitigation measures).

### Portable DTT Reception

Studies carried out for compatibility between LTE800 and portable DTT reception concluded that portable DTT reception is less susceptible to interference from base stations[[1]](#footnote-1). Additional studies are not required. If fixed DTT reception is protected from base station interference, portable DTT reception is automatically protected.

## LTE400 UE into DTT

ECC Report 240 considered LTE UE unwanted emission level of -42dBm/8MHz as this level was initially agreed for the protection of DTT below 694MHz from UE emissions above 703MHz. Furthermore, ECC Report 240 concluded that Monte-Carlo simulations demonstrated limited interferences to DTT for high power UE (37 dBm) with improved ACLR (79 dB, i.e. OOBE of -42 dBm / 8 MHz) in Channel 21.

### UE out-of-band emissions level to protect fixed DTT reception based on MCL calculations

The UE out-of-band emissions level necessary to protect a TV receiver using a fixed rooftop antenna from interference from a UE located outdoors is calculated in the following chapters using a MCL analysis.

In some studies, the effect of body loss was taken into account for the LTE UE by an additional attenuation of 4 dB (taken from Report ITU-R M.2292), in order to simulate e.g. handheld devices (mobile terminals). In other studies, this effect was not applied in order to simulate devices not used very close to the human body, e.g. Wifi Routers or nomadic installations.

#### Assumptions (fixed reception)

The following assumptions have been used in the analysis of the out-of-band emissions level needed to protect fixed DTT reception.

Table 17: TV receiver parameters

| **TV Receiver** |
| --- |
| Parameter | Value | Unit |
| Noise figure | 6 | dB |
| Noise equivalent bandwidth | 7.6 | MHz |
| Antenna gain (including feeder loss) | 9.15 | dBi |
| Antenna height | 10 | m |
| Antenna pattern | See pattern below |

Note that the same directional pattern is used both in azimuth and elevation, i.e., the curves represent gθ,(TV)(θδ) or gϕ,(TV)(ϕδ) where θδ and φδ are azimuth and elevation offsets from bore sight.



Figure 42: TV receiver antenna pattern

Table 18: LTE UE transmitter parameters

| **UE Transmitter** |
| --- |
| Parameter | Value | Unit |
| EIRP (max) | 23 | dBm/(5 MHz) |
| Antenna height | 1.5 | m |
| Antenna pattern | Omni-directional |

Table 19: General parameters

| **UE Transmitter** |
| --- |
| Parameter | Value | Unit |
| Frequency | 455 | MHz |

In some studies, the effect of body loss was taken into account for the LTE UE by an additional attenuation of 4 dB, in order to simulate e.g. handheld devices (mobile terminals). In other studies, this effect was not applied in order to simulate devices not used very close to the human body, e.g. broadband wireless terminals and mobile TV receivers.

#### Methodology

A MCL analysis is used for evaluating the impact of adjacent-channel interference from UEs to DTT receivers. The situation is considered where the DTT signal is received at the reference sensitivity level, the worst case separation distance between the TV antenna and the UE is established, accounting for both the path-loss and the elevation pattern of a typical TV antenna, and the out-of-band emissions level which would result in a 1 dB desensitization of the TV receiver is then evaluated.

It is assumed that the TV antenna is roof mounted (at a height of 10 m) and that the UE is outdoors (at a height of 1.5 m).



Figure 43: Overview of the MCL analysis

#### Worst-case UE to TV antenna horizontal separation distance

The worst-case UE to TV antenna horizontal separation distance is established by considering both the path-loss between the UE and the TV antenna and the elevation pattern of the TV antenna.

For the path-loss the free-space model is used together with the TV antenna elevation pattern from ITU-R BT.419-3 [11], see below.

The path gain between the UE and the TV receiver is calculated as follows:



where:

* GPG,(UE,TV) = Path gain (dB), between UE and TV receiver;
* GPL,(UE,TV) = Path-loss (dB), calculated using the free-space model;
* GA,(TV) = TV antenna bore-sight gain (dB), including cable losses (9.15 dB);
* gφ,(TV)δφ = TV antenna elevation gain (dB).



Figure 44: Pathloss of the MCL analysis

As can be seen, the worst-case occurs at a horizontal separation distance of 22 m, where the total coupling gain between the UE and the TV receiver is 44.3 dB.

#### Out-of-band emissions calculation

Having established the total path gain for the worst-case horizontal separation between the UE and TV antenna, the out-of-band emissions needed to meet the 1 dB desensitisation criteria is calculated.

The noise power (PN) at the TV receiver is given by:



where:

* k = Boltzmann’s constant
* T = Temperature (290 °K)
* B = Noise equivalent bandwidth of the TV receiver (7.6 MHz)
* NF = DVB-T2 receiver noise figure (6 dB)

For a 1 dB desensitisation, the target interference level is:



The interference power in the TV receiver adjacent channel is calculated from a combination of the UE in-band power (23 dBm) and the total path gain (including 4 dB body loss at the UE) at the worst-case distance as follows:



From the above the adjacent-channel interference ratio (ACIR) can be established as follows:



Without body loss (e.g. for a broadband wireless internet terminal) this would be 83.74 dB.

ACIR is related to the adjacent channel selectivity (ACS) of the victim and to the adjacent-channel interference ratio (ACLR) of the interferer via the following expression (linear units):



ACS of the DTT receiver without additional filter is 70 dB.

However, with an assumption about reasonable improvement in TV receiver ACS by means of additional external filtering in the antenna down lead it can be concluded that an ACS figure of 80 dB or better is achievable. Also measurement as reported in ECC Report 240 showed that 80 dB is achievable with current receiver design.

Thus for the purposes of this calculation an ACS value of 80 dB has been used.



Thus for a UE transmitting at 23 dBm EIRP the out-of-band emissions will be:



This value can be rounded to -70 dBm /8 MHz. This means that an LTE user equipment BEM out-of-band emissions limit of -70 dBm/(8 MHz) for frequencies below 790 MHz is necessary to protect fixed DTT reception.

The following table summarises the above calculation:

Table 20: Summary of the calculations

| **Parameter** | **Unit** | **Value** | **Comment** |
| --- | --- | --- | --- |
| Frequency | MHz | 450 | F0 |
| Receiver NF | dB | 6.00 | NF |
| Thermal Noise floor (8 MHz) | dBm | -99.19 | Pn= 10 log(kTB) + NF + 30 |
| In-block transmit power | dBm | 23.00 | PTx |
| Interferer antenna gain | dBi | 0.00 | GTx |
| EIRP | dBm | 23.00 | P(EIRP) = RTx + GTx |
| Rx Tx horizontal distance | m | 22 | dh worst case separation |
| Tx height | m | 1.5 | hTx |
| Rx height  | m | 10 | hRx |
| Path distance | m | 23.6 | D=sqrt(dh2+(hRx-hTx)2) |
| Free space propagation | dB | 52.96 | LFS |
| Rx antenna elevation discrimination | dB | 0.45 | GDir |
| Rx antenna bore-sight gain | dB | 9.15 | GRx |
| Body loss | dB | 4 | LBody |
| Wall loss | dB | 0 | LWall |
| Total coupling gain | dB | 48.25 | Gtot = -LFS+GDir+GRx-LBody-LWall |
| I/N | dB | -5.87 |  |
| Receiver desensitisation (C/N degradation) | dB | 1.00 | D=10log(1+10(I/N)/10) |
| ACS | dB | 70.00 |  |
| Additional filtering | dB | 10 |  |
| Total ACS | dB | 80.00 |  |
| ACIR | dB | 79.78 |  |
| Interference power | dBm | -105.04 | PI=Pn+I/N |
| ACLR | dB | 92.84 |  |
| OOBE (TX) | dBm/8 MHz | -69.84 | OOBE=PTx-ACLR |

#### UE out-of-band emissions level to protect portable DTT reception based on MCL calculations

The UE out-of-band emissions level necessary to protect portable TV reception from interference from a UE is calculated in the chapters below using MCL analysis.

#### Assumptions (portable indoor reception)

Table 21: TV receiver parameters

| **TV Receiver** |
| --- |
| Parameter | Value | Unit |
| Noise figure | 6 | dB |
| Noise equivalent bandwidth | 7.6 | MHz |
| Antenna gain (including feeder loss) | 2.15 | dBi |
| Antenna height | 1.5 | m |
| Antenna pattern | Omni-directional |

Table 22: UE transmitter parameters

| **UE Transmitter** |
| --- |
| Parameter | Value | Unit |
| EIRP (max) | 23 | dBm/(5 MHz) |
| Antenna height | 1.5 | m |
| Antenna pattern | Omni-directional |

Table 23: General parameters

| **General** |
| --- |
| Parameter | Value | Unit |
| Frequency | 455 | MHz |
| Wall loss (taken from ITU-R P.1812) | 10.4 | dB |

#### Methodology

An MCL analysis is used for evaluating the impact of adjacent-channel interference from UEs to DTT receivers. The situation is considered where the DTT signal is received at the reference sensitivity level. The victim TV antenna and the interfering UE are assumed to be in the same building. Some of the MCL calculations assume that they are separated by one internal wall. It can be argued that if the victim and interferer are in the same room then the users of both devices can negotiate a local solution in case of interference, e.g. one of them can move to increase the distance between the victim and interferer, or, if necessary, move to another room. For various assumed values of the UE out-of-band emissions level, the separation distance needed to meet the 1 dB desensitisation criteria is evaluated (taking account of the wall loss). A value for the out-of-band emissions level is then chosen which balances the need to minimise the separation distance and be achievable in a realistic terminal design.

#### Out-of-band emissions calculation

The out-of-band emissions are calculated as follows.

The noise power (PN) at the TV receiver is given by:



where:

* k = Boltzmann’s constant
* T = Temperature (290 °K)
* B = Noise equivalent bandwidth of the TV receiver (7.6 dB)
* NF = TV receiver noise figure (6 dB)

For a 1 dB desensitisation, the target interference level (PI) is:



The interference power at the source UE (PI,(UE)) is a combination of the UE in-band power (PIB,(UE) = 23 dBm) the ACS of the victim TV receiver and out-of-band emission power of the UE (POOB,(UE)) within the victim receivers channel as follows:



For the purposes of this calculation a minimum achievable ACS value of 85 dB has been assumed. This takes into account that an ACS is achievable with current receiver design as shown in ECC Report 240 and some rejection in the TV receiver antenna.

Results have also been calculated for an ACS value of 100 dB to demonstrate the impact of additional rejection filters at the portable TV receiver.

The minimum allowed coupling gain between the interfering UE and the victim TV is therefore the difference between the target interference power (PI) and the interference power at the source UE (PI,(UE)).



The total path gain between the interfering UE and the victim TV (GPG,(UE,TV)) is given by the allowed coupling gain GCG minus the wall loss (GWL = -10.4 dB) minus the body loss at the UE (GBL = -4 dB) minus the TV antenna gain (GA,(TV) = 2.15 dBi).



From the total path gain we can then calculate the minimum separation distance needed to meet the 1 dB desensitisation criteria using the free-space path-loss model.

#### Results

As indicated above, for various assumed values of the UE out-of-band emissions level, the separation distance needed to meet the 1 dB desensitisation criteria has been evaluated. Results have been obtained for assumed TV ACS values of both 85 dB and 100 dB (to assess the impact of rejection filters at the portable TV receiver).

* TV ACS = 85 dB

The graph below illustrates the relationship between separation distance and out-of-band emissions. The lower blue curve takes into account -10.4 dB wall loss whereas the upper pink curve does not.

Figure 45: Relationship between separation distance and OOB emissions

As can be seen, the curves have essentially flattened out for a out-of-band emissions level of -75 dBm/(8 MHz) and below i.e. for out-of-band emissions levels lower that -75 dBm/(8 MHz) there is minimal improvement in separation distance. From this it is concluded a UE out-of-band emission level of -75 dBm/(8 MHz) is optimal.

The following table summarises the calculation of separation distance for the situation where the assumed TV receiver ACS is 85 dB and the out-of-band emissions is set to -75 dBm/(8 MHz) for the various combinations of wall loss and body loss.

Table 24: Calculation of separation distances for ACS = 85 dB

| **Parameter** | **Unit** | **Value** | **Value** | **Value** | **Value** | **Comment** |
| --- | --- | --- | --- | --- | --- | --- |
| Frequency | MHz | 455 | 455 | 455 | 455 | F0 |
| Target performance |  |  |  |  |  |  |
| Receiver NF | dB | 6.00 | 6.00 | 6.00 | 6.00 | NF |
| Thermal Noise floor (9 MHz) | dBm | -99.17 | -99.17 | -99.17 | -99.17 | Pn= 10 log(kTB) + NF + 30 |
| INR | dB | -6.00 | -6.00 | -6.00 | -6.00 | INR |
| Target interference power | dBm | -105.17 | -105.17 | -105.17 | -105.17 | PItarget= Pn + INR |
| Victim's performance |  |  |  |  |  |  |
| Receiver selectivity (ACS) | dB | 85.00 | 85.00 | 85.00 | 85.00 |  |
| BEM limits |  |  |  |  |  |  |
| In-block transmit power | dBm/ 10MHz | 23.00 | 23.00 | 23.00 | 23.00 | Pib,tr |
| Interferer antenna gain | dBi | 0.00 | 0.00 | 0.00 | 0.00 | Ga,i |
| EIRP | dBm/ 10MHz | 23.00 | 23.00 | 23.00 | 23.00 | Pib |
| Out-of-block | dBm/ 8MHz | -75.00 | -75.00 | -75.00 | -75.00 | Poob |
| "Total" interference at "source" | dBm | -61.79 | -61.79 | -61.79 | -61.79 | Linear: Px = Pib/ACS + Poob, where PItarget = G Px |
| ACIR calculation |  |  |  |  |  |  |
| ACLR | dB | 98.00 | 98.00 | 98.00 | 98.00 | Pib - Poob |
| ACIR | dB | 98.21 | 98.21 | 98.21 | 98.21 | Linear = 1/((1/ACLR) + (1/ACS)) |
| Coupling calculation |  |  |  |  |  |  |
| Coupling gain | dB | -43.48 | -43.48 | -43.48 | -43.48 | Linear: G = PItarget -Px |
| Link budget |  |  |  |  |  |  |
| Interferer body gain | dB | -4.00 | -4.00 | 0.00 | 0.00 | Gb,I |
| Wall gain | dB | -10.40 | 0.00 | -10.40 | 0.00 | GWl |
| Victim body gain | dB | 0.00 | 0.00 | 0.00 | 0.00 | Gb,v |
| Victim ant. Elevation pattern | dB | 0.00 | 0.00 | 0.00 | 0.00 | gb,v (assumed zero) |
| Victim antenna gain | dB | 2.15 | 2.15 | 2.15 | 2.15 | Ga,v |
| Path gain | dB | -31.13 | -41.53 | -35.13 | -45.53 | GpI = G -Gb,I -GWl -gb,v -Ga,v -Gb,v |
| Geometry |  |  |  |  |  |  |
| Protection distance | m | 1.89 | 6.26 | 3.00 | 9.92 | d, where GpI = 147.56 -20log10(f) - 20log10(d) dB |

* TV ACS = 100 dB

In order to assess the impact of a rejection filter fitted to the portable TV receiver a further set of results are calculated but with an ACS value of 100 dB (rather than 85 dB assumed above).

The graph below provides results where the UE body loss is set to 4 dB.

Figure 46: Relationship between separation distance and OOB emissions

The graph below provides results where the UE body loss is set to zero.

Figure 47: Relationship between separation distance and OOB emissions

The following table summarises the calculation of separation distance for the situation where the assumed TV receiver ACS is 100 dB and the out-of-band emissions is set to -75 dBm/(8 MHz) for the various combinations of wall loss and body loss.

Table 25: Calculation of separation distances for ACS = 100 dB

| **Parameter** | **Unit** | **Value** | **Value** | **Value** | **Value** | **Comment** |
| --- | --- | --- | --- | --- | --- | --- |
| Frequency | MHz | 455 | 455 | 455 | 455 | F0 |
| Target performance |  |  |  |  |  |  |
| Receiver NF | dB | 6.00 | 6.00 | 6.00 | 6.00 | NF |
| Thermal Noise floor (9 MHz) | dBm | -99.17 | -99.17 | -99.17 | -99.17 | Pn= 10 log(kTB) + NF + 30 |
| INR | dB | -6.00 | -6.00 | -6.00 | -6.00 | INR |
| Target interference power | dBm | -105.17 | -105.17 | -105.17 | -105.17 | PItarget= Pn + INR |
| Victim's performance |  |  |  |  |  |  |
| Receiver selectivity (ACS) | dB | 100.00 | 100.00 | 100.00 | 100.00 |  |
| BEM limits |  |  |  |  |  |  |
| In-block transmit power | dBm/ 10MHz | 23.00 | 23.00 | 23.00 | 23.00 | Pib,tr |
| Interferer antenna gain | dBi | 0.00 | 0.00 | 0.00 | 0.00 | Ga,i |
| EIRP | dBm/ 10MHz | 23.00 | 23.00 | 23.00 | 23.00 | Pib |
| Out-of-block | dBm/ 8MHz | -75.00 | -75.00 | -75.00 | -75.00 | Poob |
| "Total" interference at "source" | dBm | -72.88 | -72.88 | -72.88 | -72.88 | Linear: Px = Pib/ACS + Poob, where PItarget = G Px |
| ACIR calculation |  |  |  |  |  |  |
| ACLR | dB | 98.00 | 98.00 | 98.00 | 98.00 | Pib - Poob |
| ACIR | dB | 102.12 | 102.12 | 102.12 | 102.12 | Linear = 1/((1/ACLR) + (1/ACS)) |
| Coupling calculation |  |  |  |  |  |  |
| Coupling gain | dB | -32.29 | -32.29 | -32.29 | -32.29 | Linear: G = PItarget -Px |
| Link budget |  |  |  |  |  |  |
| Interferer body gain | dB | -4.00 | -4.00 | 0.00 | 0.00 | Gb,I |
| Wall gain | dB | -10.40 | 0.00 | -10.40 | 0.00 | GWl |
| Victim body gain | dB | 0.00 | 0.00 | 0.00 | 0.00 | Gb,v |
| Victim ant. Elevation pattern | dB | 0.00 | 0.00 | 0.00 | 0.00 | gb,v (assumed zero) |
| Victim antenna gain | dB | 2.15 | 2.15 | 2.15 | 2.15 | Ga,v |
| Path gain | dB | -20.04 | -30.44 | -24.04 | -34.44 | GpI = G -Gb,I -GWl -gb,v -Ga,v -Gb,v |
| Geometry |  |  |  |  |  |  |
| Protection distance | m | 0.53 | 1.75 | 0.84 | 2.77 | d, where GpI = 147.56 -20log10(f) - 20log10(d) dB |

### UE out-of-band emissions level to protect fixed DTT reception based on SEAMCAT simulations

ECC Report 240 concluded that Monte-Carlo simulations demonstrated limited interferences to DTT for high power UE (37 dBm) with improved ACLR (79 dB, i.e. OOBE of -42 dBm / 8 MHz) in Channel 21.

As indicated in ECC Report 240 (section 3.5.1.3), the Monte Carlo simulation method used in this study has been used within CEPT to determine the OOBE emission limits of LTE 800 MHz Base Stations in the UHF broadcasting band. The method is described in detail in ANNEX 4 of ECC Report 240.

Also according to ECC Report 240, for LTE Mobile Stations several different Monte Carlo simulation methods were previously used to determine the OOBE emission limits of LTE800 and LTE700 User equipment. Studies conducted for ITU-R/JTG 4-5-6-7 as well as for CPG/PTD have already recognized the insufficiency of the IP calculation vis-à-vis interference into the broadcasting service and the need to take the time into account when dealing with IMT UE interference.

The need to take the time into account when dealing with IMT UE interference is not considered in the study below. I.e. the result is the probability of interference at any given moment in time. It is not the probability of seeing interference in 1 hour.

SEAMCAT simulations between IoT UE and DTT Channel 21 have been performed using the parameters described in Annex A1.1, A1.8 and assuming a UE IoT unwanted emission level above 470MHz of -42dBm/8MHz. In ECC Report 240 BB PPDR devices were used which in comparison to IoT devices can use many RBs simultaneously, have higher transmit power and are mainly outdoor.

Two scenarios have been simulated. Scenario 1 describes the worst case, on which fixed DTT receivers are located at the DTT cell edge while in scenario 2, the DTT receivers are randomly allocated within the DTT cell area, representing a more realistic scenario. The IoT network is intentionally placed around the DTT receiver to ensure proximity between the IoT UE and the DTT receiver. In both scenarios the IoT UEs are placed within 50 meters of the DTT receivers. 3 MHz bandwidth is used for the LTE base station where 15 UEs are actively transmitting in both of the scenarios with one RB each of 180 kHz. Transmit power for the IoT UEs are power controlled between -40 to 23 dBm.

| Scenario | Pinterference (%) |
| --- | --- |
| Scenario 1 | 4.59 % |
| Scenario 2 | 0.00 % |

## Conclusion

### Conclusion LTE 400 Base stations and DTT

The studies carried out for PPDR base stations in 400 MHz in ECC Report 240 concluded on a set of out-of-band emissions from base stations. The scenario for this report is similar and therefore the same limits should apply. However, additional mitigation measures may be required to solve possible residual interference from LTE400 BSs on a case by case basis in a manner similar to the situation between LTE800 and DTT (see also ANNEX 2: (list of mitigation measures)).

LTE 400 Base Station OOBE e.i.r.p. levels for protection of DTT above 470 MHz are given in Table 26 below.

Table 26: LTE Base Station OOBE e.i.r.p. levels for protection of DTT above 470 MHz (ECC Report 240)

| **Frequency range** | **Condition on Base station in-block e.i.r.p,P (dBm/cell)** | **Maximum mean OOBE e.i.r.p (dBm/cell)** | **Measurement bandwidth** |
| --- | --- | --- | --- |
| For DTT frequencies above 470 MHz where broadcasting is protected | P ≥ 60 | -7 | 8 MHz |
| P < 60 | ( P – 67 ) | 8 MHz |

### Conclusion LTE 400 UE and DTT

The MCL studies have shown that the unwanted emissions above 470 MHz need to be adequately limited in order to minimize interference.

To protect DTT in channel 21 on the criteria of a receiver sensitivity degradation limited to 1 dB, the MCL analysis shows that the LTE unwanted emission level should not exceed -70 dBm/8 MHz for fixed reception and -75 dBm/8 MHz for portable reception. This is derived under the condition of DTT ACS values of 80 dB and 85 dB, respectively.

It should be noted that LTE includes power control for the UEs and that the UEs are moving devices. Monte Carlo simulations may therefore be useful to assess the impact of LTE UE into DTT, provided however that time can be taken into consideration (i.e to assess the probability of seeing interference to a DTT receiver in 1 hour).

SEAMCAT simulations, that do not take time into account, show limited probability of interference assuming a DTT protection level of -42dBm/8MHz. This is in line with the conclusion of BB PPDR UE emissions towards DTT in ECC Report 240.

1. See ”A2.4. Conclusion” of Annex 2 of CEPT Report 30 [↑](#footnote-ref-1)