EBU **TECHNICAL**

Harmonized technical conditions for the use of the 800 MHz Band in Europe

ECS - Workshop

Geneva, 7 October 2010

Walid Sami

Senior Engineer

European Broadcasting Union

EBU·UER

Programme

1. Introduction
2. Main features of the harmonized technical conditions
3. Conclusion

Relevant documents

- **CEPT Report 30** (11/11/2009)The identification of common and minimal (least restrictive) technical conditions for 790 - 862 MHz for the digital dividend in the European Union.
- Other related and useful documents:

  CEPT Report 31 (09/11/2009) Frequency (channelling) arrangements for the 790-862 MHz band" (Task 2 of the 2nd Mandate to CEPT on the digital dividend)

  ECC decision (09)03 (05/11/2009)Harmonised conditions for MFCN in the band 790-862 MHz

  CEPT Report 29 (07/07/2009) Guideline on cross border coordination issues between mobile services in one country and broadcasting services in another country

  CEPT Report 21 (07/07/2008) Compatibility between "cellular / low power transmitter" networks and "larger coverage / high power / tower" networks

  EC communication, Recommedation and Decision (ongoing) on Digital Dividend

  ECC Report 138 (30/09/2009) DVB-T performance in the presence of UMTS

  ECC Report 148 (09/06/2010) DVB-T performance in the presence of LTE

- Link: http://www.erodocdb.dk

Programme

1. Introduction
2. Main features of the harmonized technical conditions
3. The open questions

Channelling arrangements

790-791	791-796	796-801	801-806	806-811	811-816	816-821	821 – 832	832-837	837-842	842-847	847-852	852-857	857-862
Guard band	Downlink						Duplex gap	Uplink					
1MHz	30 MHz (6 blocks of 5 MHz)						11 MHz	30 MHz (6 blocks of 5 MHz)					

Preferred harmonised channelling arrangement for the band 790-862 MHz

790-797	797-802	802-807	807-812	812-817	817-822	822-827	827-832	832 – 837	837 – 842	842 – 847	847-852	852-857	857-862
Guard band	Unpaired												
7 MHz	65 MHz (13 blocks of 5 MHz)												

TDD channelling arrangement for the band 790-862 MHz

Reverse duplex, why ?

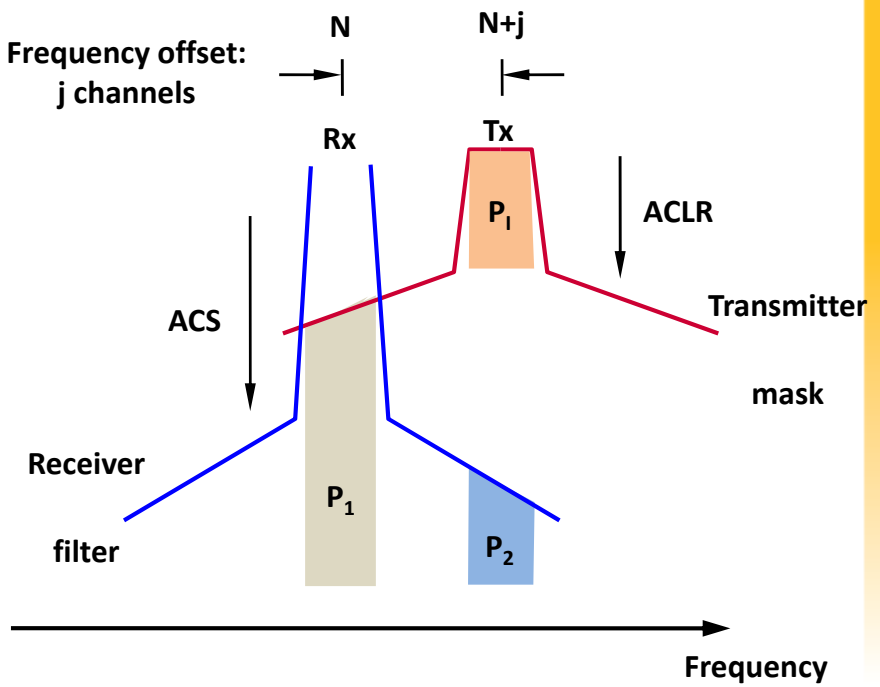
- Adjacent channel interference from mobile handhelds into portable DTT reception at short distances is critical. Offsetting the Uplink further from the broadcasting channels can help;
- Also adjacent channel interference from DTT high power transmitters into reception of uplink signals at the mobile service base stations is an issue;
- There are more technical measures to improve the compatibility between downlink and broadcasting than between uplink and broadcasting, so less guard band is needed with reverse duplex and consequently more efficient spectrum usage;
- However, this is possible only for FDD systems. TDD systems require a larger guard band.

The block-edge mask (BEM) approach

- The block-edge mask (BEM) approach consists of in-block and out-of-block limits depending on frequency offset

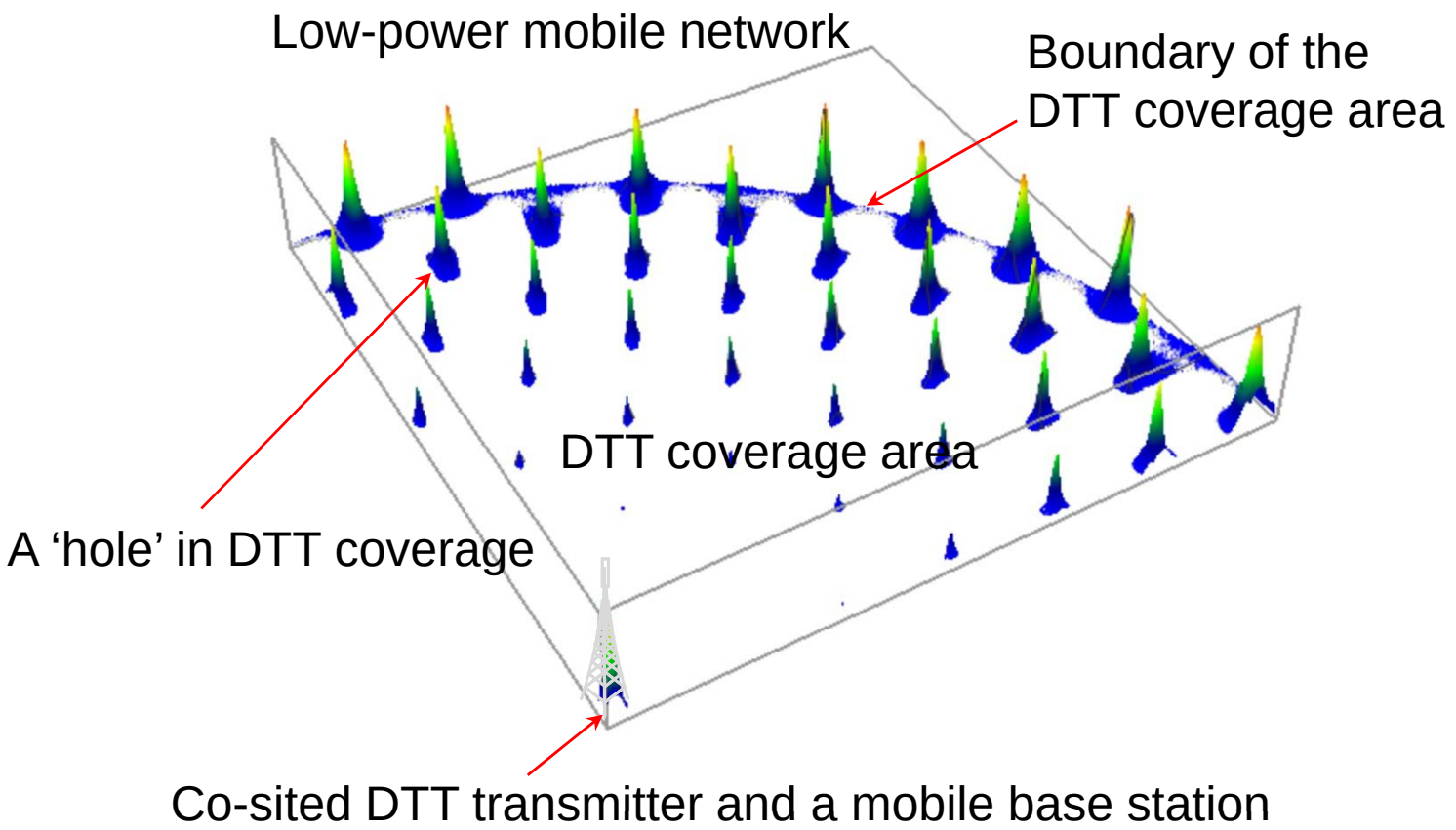
ACLR: Adjacent channel leakage ratio, characterises the out of band emission of the interfering signal (base station or mobile terminal)

ACS: Adjacent channel selectivity, characterises the selectivity of the victim receiver (DTT receiver)

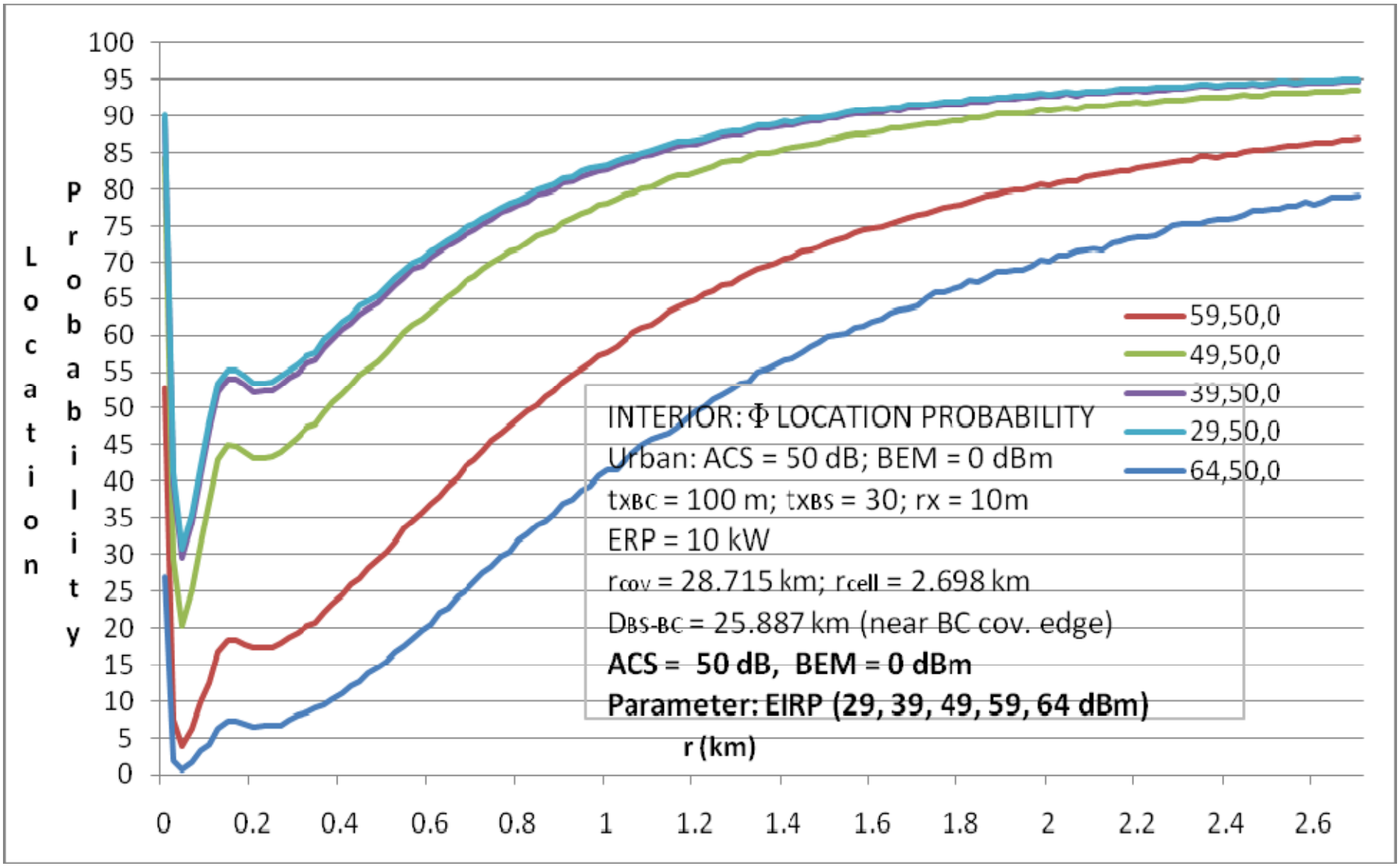


Interference from a network of base stations

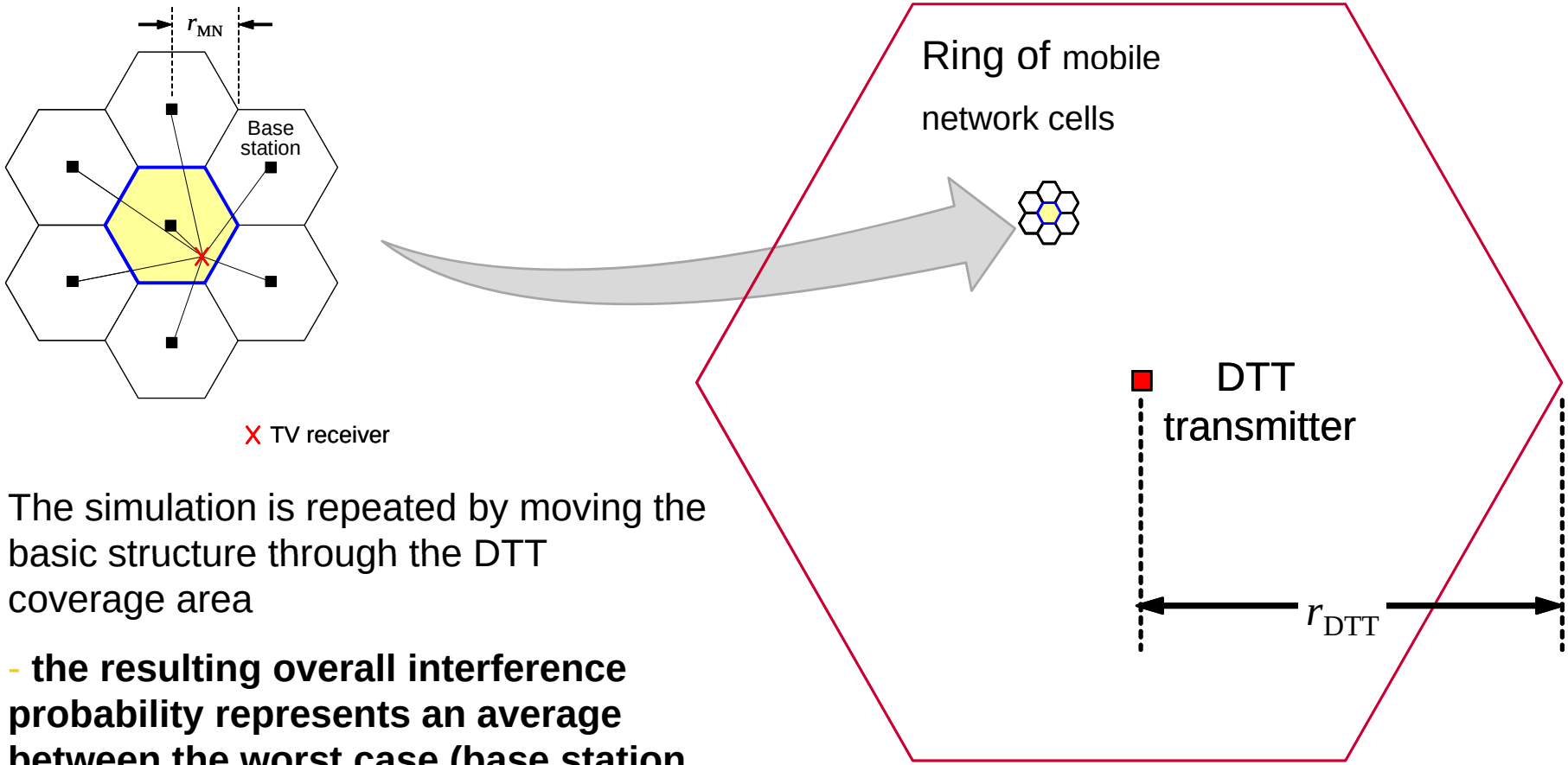
Interference probability= complement to 1 of coverage location probability



DTT Location probability vs distance from the Base station



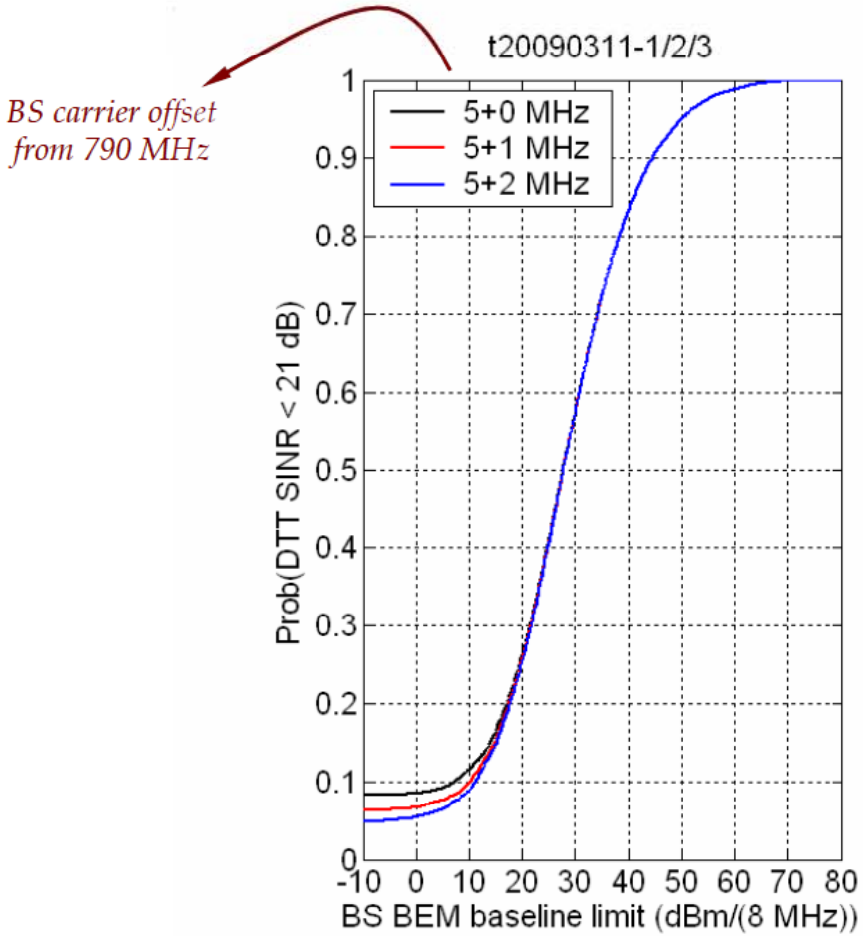
Averaging through the DTT coverage area

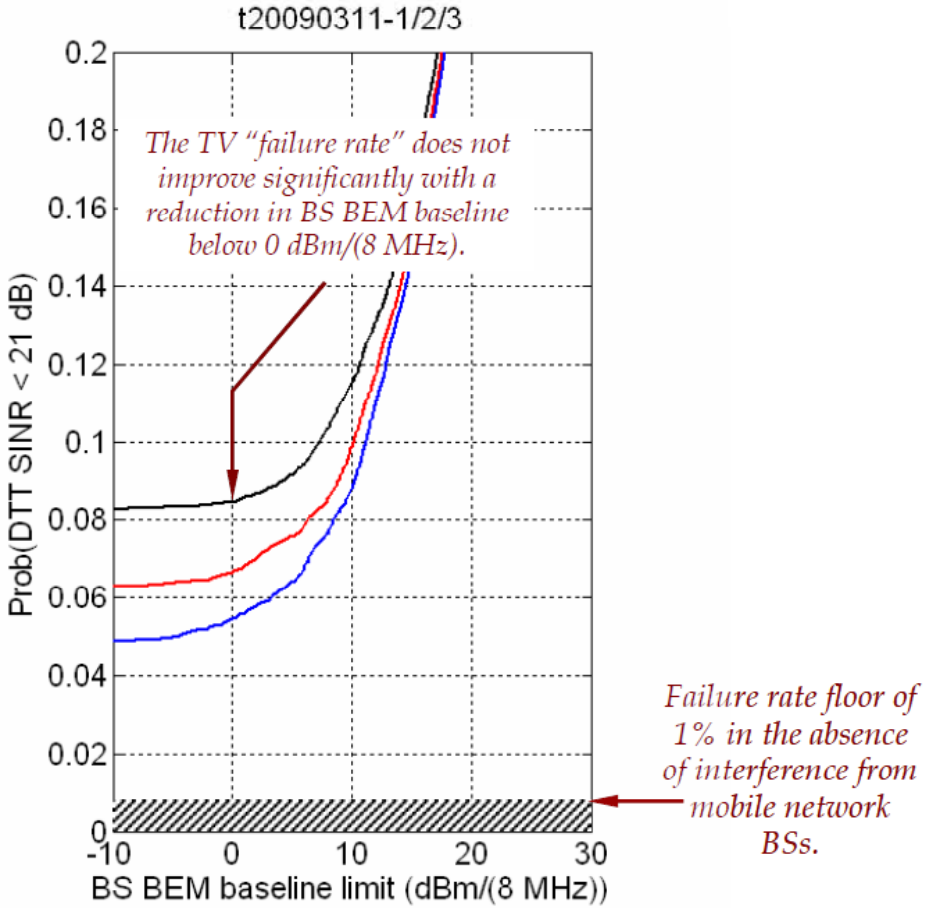


The simulation is repeated by moving the basic structure through the DTT coverage area

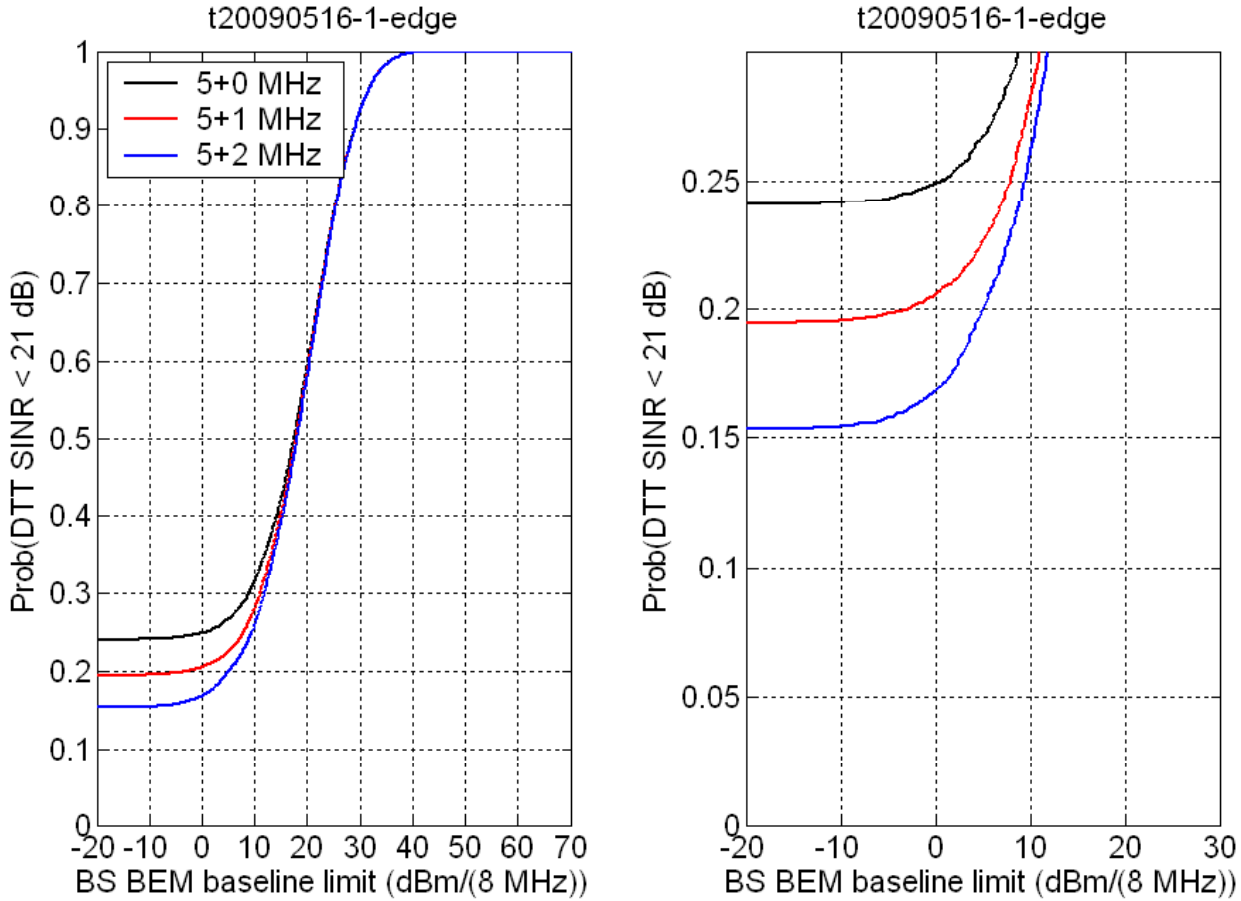
- **the resulting overall interference probability represents an average between the worst case (base station at the edge of DTT coverage) and the best case (base station close to the DTT transmitter);**

Interference probability through the whole DTT area

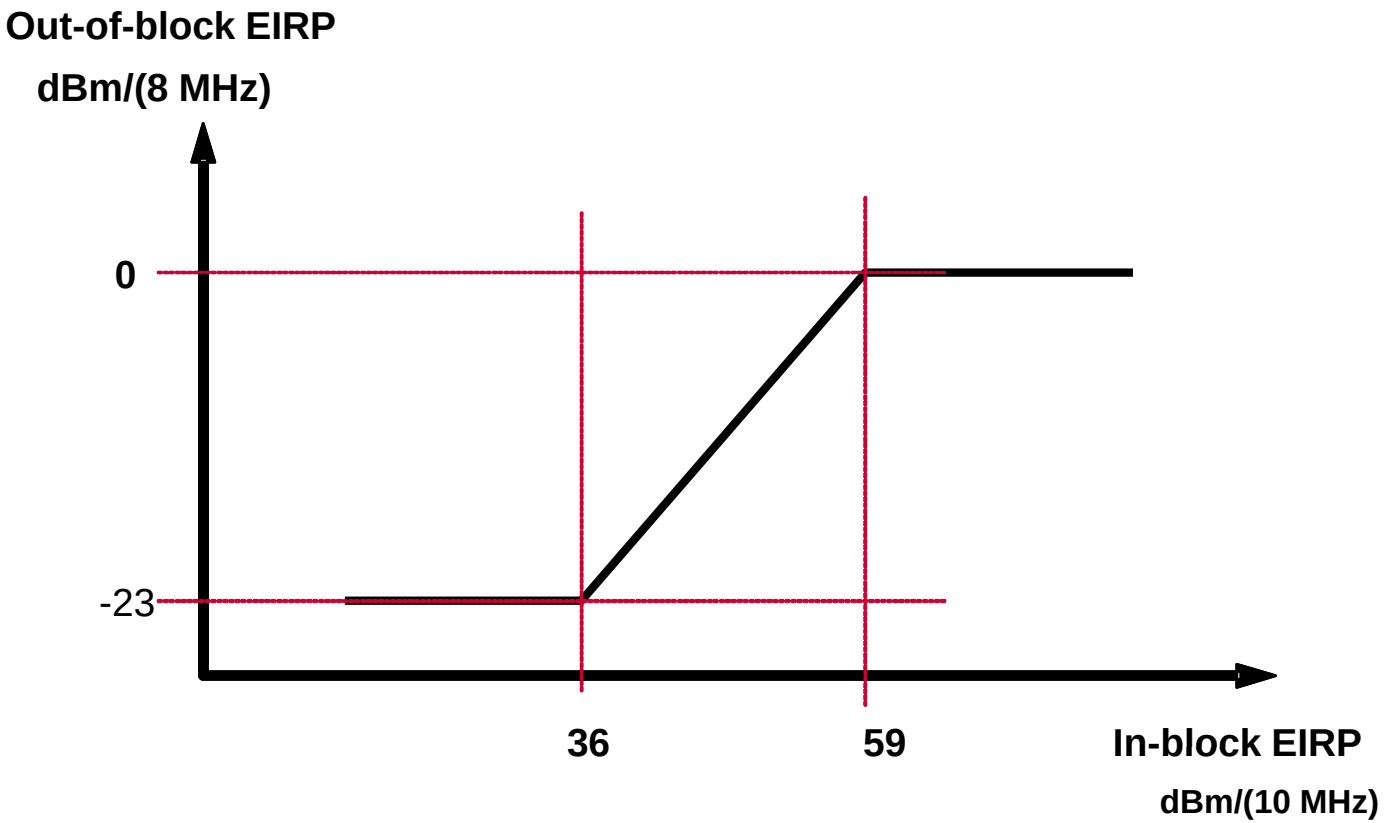




Interference probability at the edge of the DTT area



Out-of-block power limits for base stations



Different cases

Case	Frequency range of out-of-block emissions	Condition on base station in-block E.I.R.P., P (dBm/10MHz)	Maximum mean out-of-block EIRP	Measurement bandwidth
A	For DTT frequencies where broadcasting is protected	P ≥ 59	0 dBm	8 MHz
		36 ≤ P < 59	(P-59) dBm	8 MHz
		P < 36	- 23 dBm	8 MHz
B	For DTT frequencies where broadcasting is subject to an intermediate level of protection	P ≥ 59	10 dBm	8 MHz
		36 ≤ P < 59	(P-49) dBm	8 MHz
		P < 36 dBm	-13 dBm	8 MHz
C	For DTT frequencies where broadcasting is not protected	No condition	22 dBm	8 MHz

Baseline requirements – BS BEM out-of-block EIRP limits over frequencies occupied by broadcasting

Comments on the Block-Edge-Mask approach

- It is based on average case, real cases might be on the worst side of the average (example a mobile network implemented in an urban area which is located near the DTT coverage edge)
- “It should be understood that block edge masks do not always provide the required level of protection of victim services” (CEPT Report 30)
- In order to resolve the remaining cases of interference additional mitigation techniques would need to be applied
- Possible obligations related to the application of mitigation techniques and responsibility for their cost are left to individual Administrations

Mitigation techniques

- **Co-site Base Stations and DTT transmitters**
- **Cross polarisation**
- **Reducing the power of interfering transmitter (Base Station)**
- **Improved filters in Base Station transmitters (at 790 MHz), beyond the baseline specified in the CEPT report 30**
- **Adjusting the Base Station transmitter antenna characteristics (height, pattern, tilt and direction) taking into account local conditions**
- **Rejection filters in DTT receivers,**
- **Increasing the power of DTT transmitters (or adding On-Channel-Repeaters on the base stations sites)**

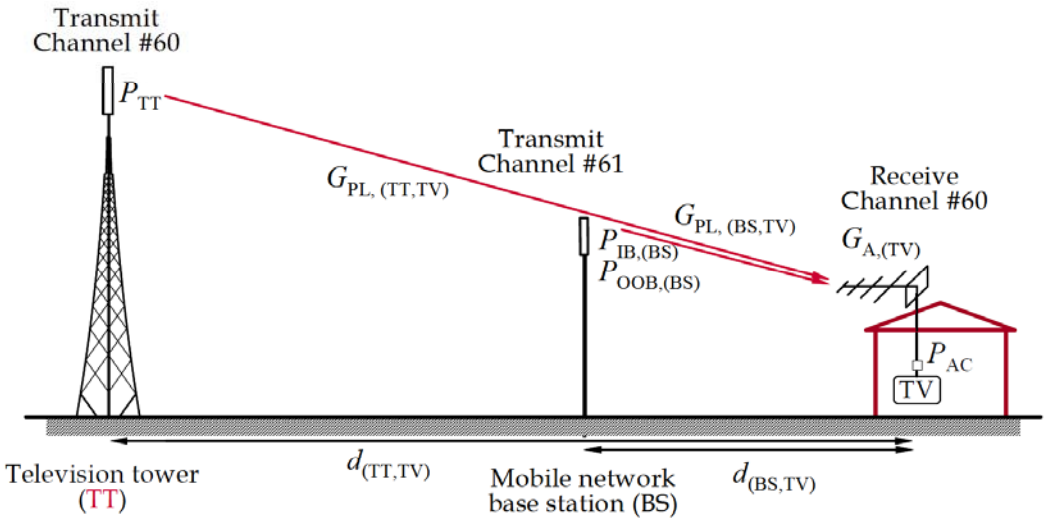
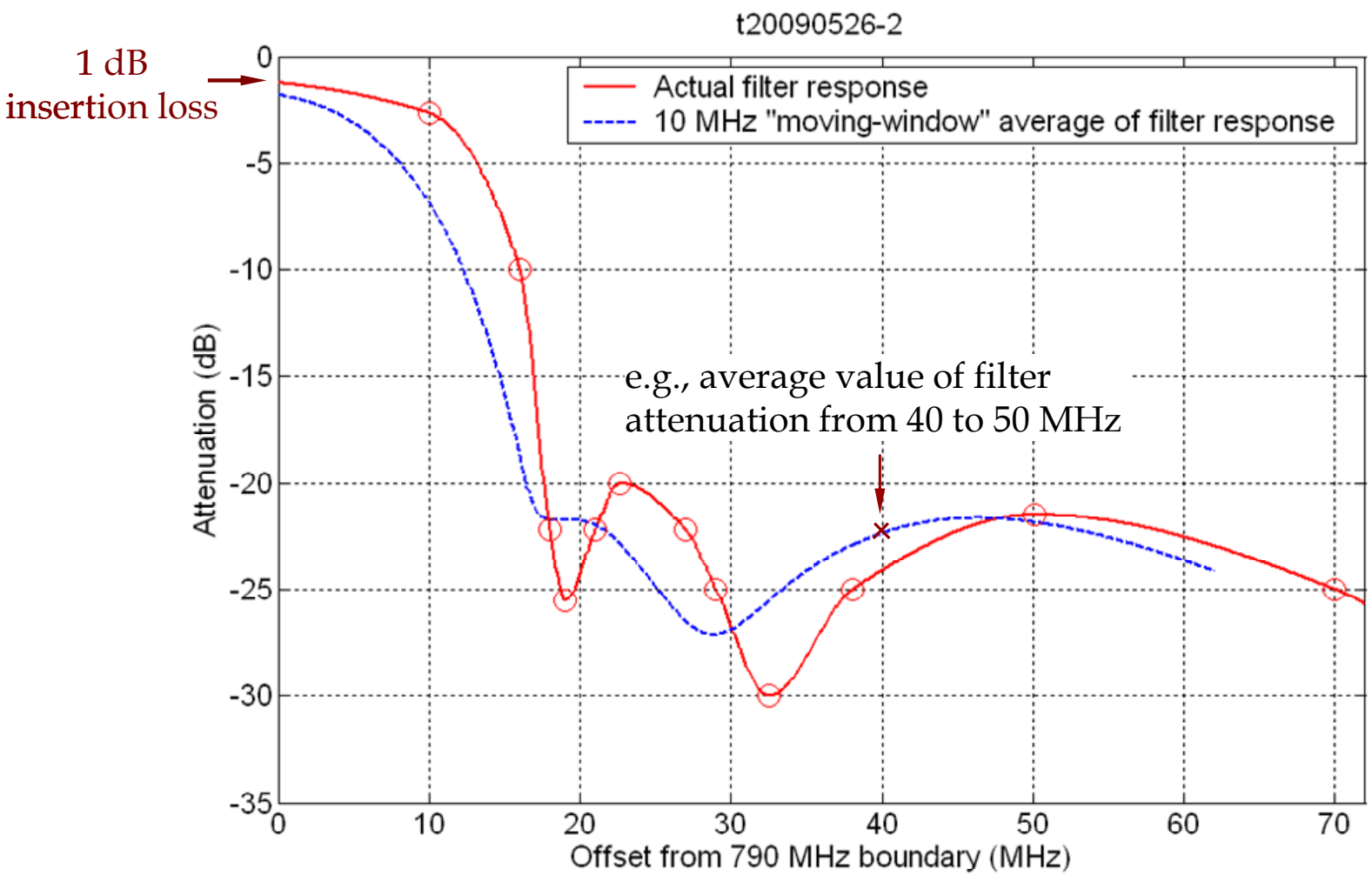


Figure A1. 8: Interferer geometry in case of no angular discrimination

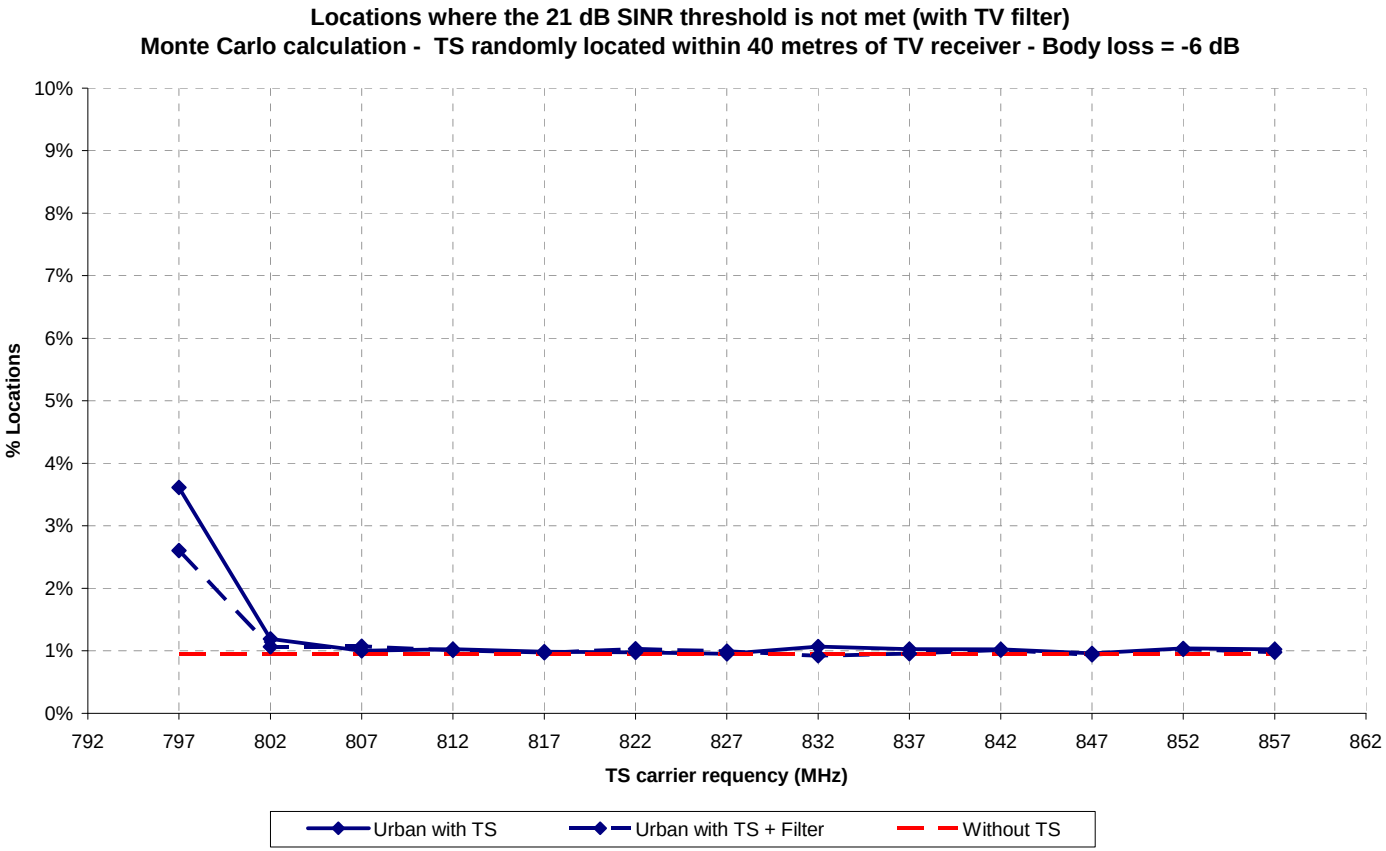
Limitation of filtering as a mitigation technique



practical 'low cost' band edge TV filter (with an edge at 790 MHz)

Interference from a terminal station into fixed reception

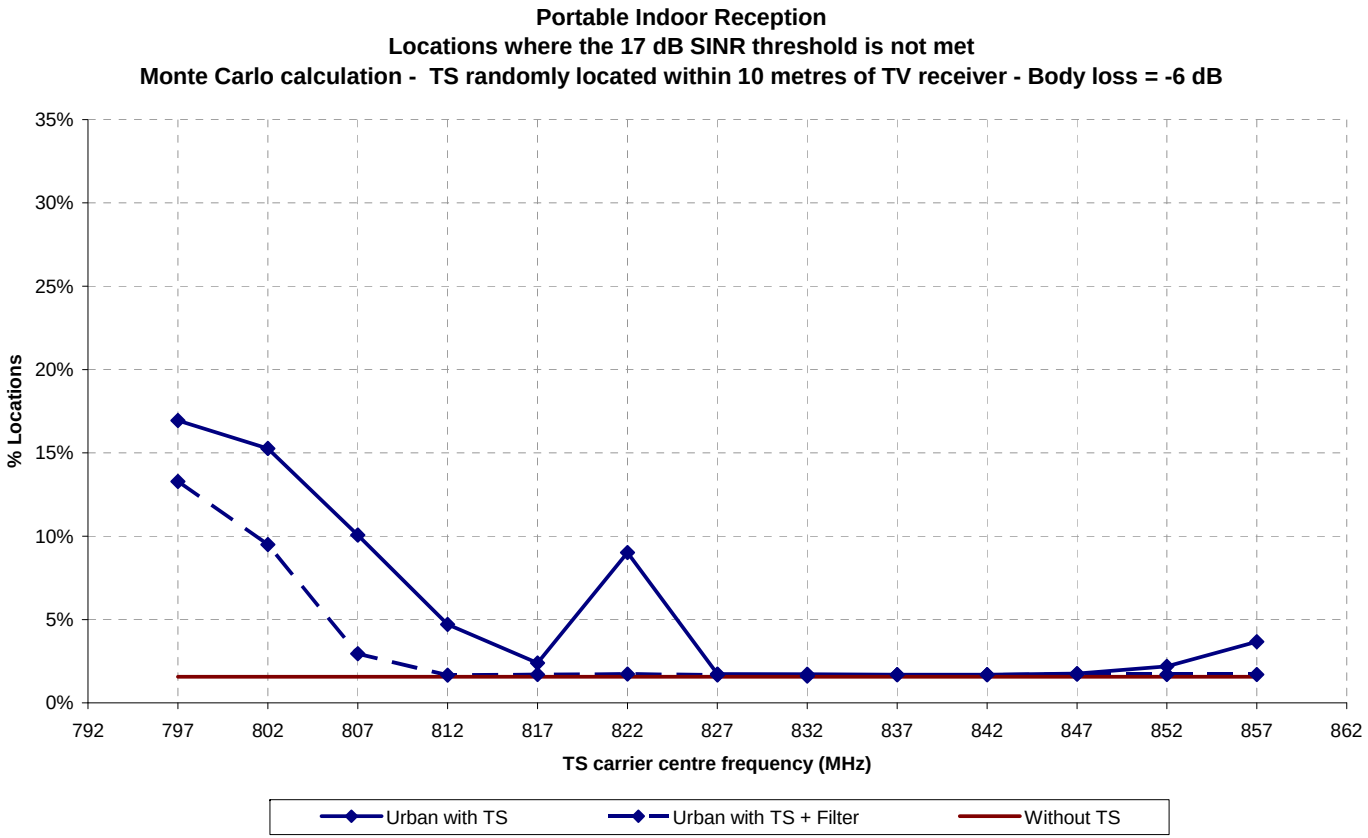
Simulations to assess the impact of terminal station on DTT fixed reception for different frequency offsets with the out-of-block level of -50 dBm/8MHz



for the protection of fixed-rooftop DTT reception a guard band of 7 MHz would require additional filtering at the DTT receiver, while a guard band of 12 MHz or greater would require no additional filtering at the DTT receiver.

Monte Carlo simulation to assess guard band effect

Simulations to assess the impact of terminal station on DTT portable-indoor reception for different frequency offsets with the out-of-block level of -65 dBm/8MHz



for the protection of portable-indoor DTT reception a guard band of greater than 7 MHz would be required. Appropriate guard bands might be 17 MHz with additional filtering at the DTT receiver and 37 MHz without additional filtering at the DTT receiver.

Conclusions

- Need for good understanding of the harmonised technical conditions and the method used to derive them;
- Individual Adminsitartions may chose very unharmonised levels of protection of DTT and of obligations on the new users to solve possible interference cases;
- Need for tests in real conditions to check the actual number of interference cases in typical situations and the efficiency of the mitigation techniques.

We are pleased to learn today more about the situation in some European countries

EBU **TECHNICAL**

Thank you

Walid Sami
spectrum@ebu.ch

EBU·UER