On the Acceptable Perturbation Level of CATV Distribution Amplifiers for Mobile DVB-T Reception

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Overview

- Analog switch-off in television (ASO)
- Digital transmission
- DVB-T trial
- Cable networks in TV distribution
- Simulation
- Conclusions

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Analog switch-off in television (ASO)

- Analog switch-off – total interruption of analog TV (PAL/SECAM) aerial transmission (broadcasting)
- Analog switch-off is mandatory for EU countries but agreed for non-EU countries
- Performed already for satellite transmission (since 2012) and previewed for 2015 for all EU countries
- After June 2015, the analog TV transmission will remain only for a limited time in limited TV band frequencies (eg. In Romania in VHF domain until 31 Dec. 2016)
- Analog transmission will remain possible in cable networks (most cable operators are private actors) in parallel with digital transmission (DVB-C)

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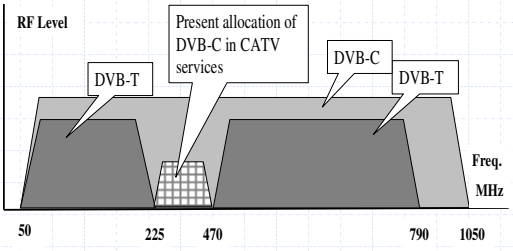
Digital TV transmission

- All DVB transmission are replacing the old TV services
- DVC-T/T2 are replacing the terrestrial transmissions
- DVB-C are replacing analog channels in cable TV networks
- Typical spectrum is presented below



- Presented typical allocation is used by major cable TV operators (UPC, RDS/RCS) is most netwoeks, but also by some small local operators
- Expanding the number of channels is possible only by digitalization
- A full digital network would be capable to carry up to 100 SD (standard definition) channels
- Digitalization is the only way to carry HD (high definition) channels

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DVB trial - equipment

- Evaluations realized with portable equipment
- Portable computer, DVB-T modules, Cable portable analyzer (MC577)
- Many chipsets used in DVB modules - driver compatibility was an issue

No.	Module name	Interface	Chipset
1.	LR502 NTA	CardBus	Philips SAA7134
2.	WinTV-Nova T	USB	DIBCOM- dib0700
3.	WinTV-MiniStick	USB	Siano SMB
4.	X3mTV-Tu1100	USB	DIBCOM- dib7070

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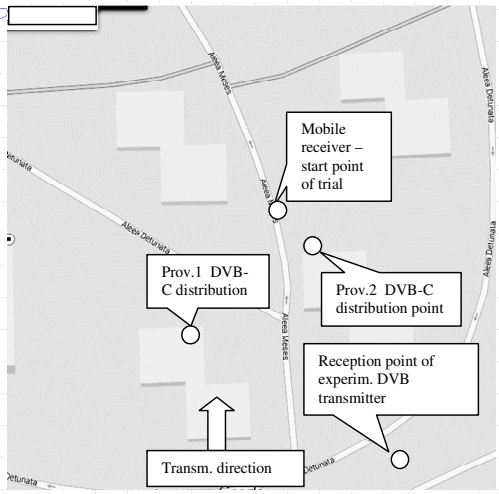
DVB trial - map



- Realized during 2013-2014 to evaluate the future DVB regular transmission
- Several transmissions evaluated including the experimental DVB-T transmission
- Measurements performed in different areas of the city
- An example (scenario) in attached image (map)

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DVB-trial results

- The power of the experimental DVB transmitter is around 100W
- The reception is poor (or impossible) in most shaded zones of dense areas
- Not only the local analog stations were influenced the reception
- **In some areas the signals manipulated by local cable TV operators are found to influence the reception**
- **This encouraged us to extend the trial in this direction**
- **The interference sources were identified and evaluated, as possible influencing the future DVB mobile reception**

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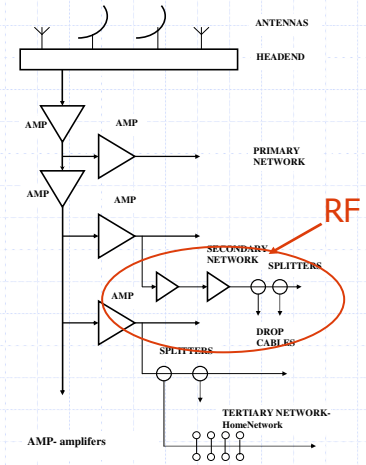
Cable networks in TV distribution



- A standard solution in A/V distribution
- Using partially optical fiber for distribution in HFC (Hybrid Fiber Coaxial) configurations
- The level of interference is reduced in hybrid networks, but optical/RF conversion points are problematic
- Secondary network is realized using RF amplifiers
- This point is a weak point for parasitic radiation

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Simulation - model

$$E_{[dB\mu V/m]} = 20\lg E_{[\mu V/m]}$$

$$E_{[\mu V/m]} = 10^{(E_{[dB\mu/m]}/20)}$$

- A simple model implemented in Matlab is used to evaluate the influence of Cable TV parasitic radiation
- A 10mW parasitic radiated power is assumed
- The 100W transmitter is located at 9km
- Local parasitic sources are placed at 10-50m from receiver

field strength E

$$E_{[dB\mu V/m]} = 106.5 + P_{KW} + G_{[dB]} - 20\lg R_{[Km]}$$

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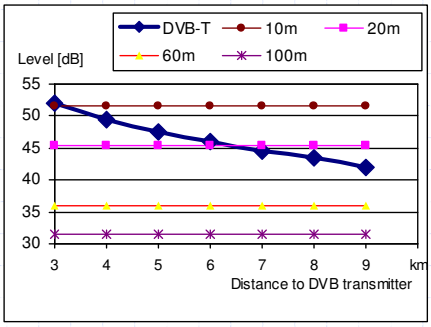
Simulation - results

TABLE III. COMPUTED FIELD LEVELS (DVB EXPERIM. AND LOCAL INTERFERENCE)

Distance from transmitter [km]	Field [dB]	Distance from interference source[m]	Field [dB]
3,5	80.62	60	35.94
4	79.46	70	34.6
4,5	78.44	90	32.42
5	77.52	100	31.5
5,5	76.69	200	25.48
6	75.94	300	21.96
6,5	75.24	400	19.46
9	72.42		



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DVB trial – RF interference is real

- cable/aerial interference - a real issue
- Left – a local TV station (analog) located at 8km
- Right – a parasitic radiation captured from a cable TV operator at ~10m from amplifier in the same place with the same antenna

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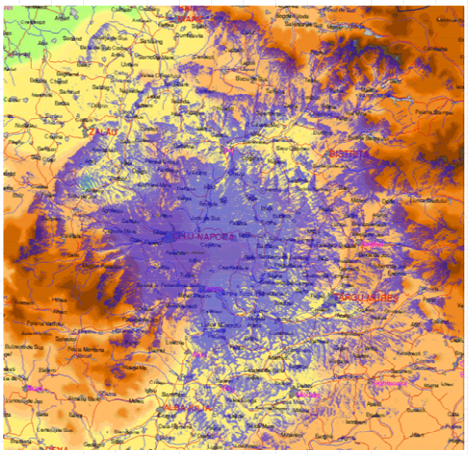
Present scenario



- The experimental transmission is replaced by a new (2nd) experimental configuration on channel 26 (for Cluj-Napoca)
- The estimated coverage map is presented
- The parameters of the transmission and the location are improved to professional conditions
- A new set of measurements and evaluations is previewed until the final configuration is reached (later this year)

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Future research

- Evaluation of the real coverage area for the 2nd experimental transmitter
- New scenarions for DVB mobile reception
- Evaluation of the real mobile (in vehicle) reception
- Extension of measurements for different transmission media (cable) where analog transmission is still active, and DVB-C/DVB-T interference
- Evaluation of services carried by the newest configurations (FTTH- fiber to the Home) that contain CATV transmissions

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Conclusions

The most important conclusions :

- The mobile DVB-T is influenced in environments at the border of reception area, where local cable networks are radiating over admitted levels (in our case the typical radiated power is considered to be 10mW, but we found values over this level);
- Moving of CATV networks in underground did not solve the problem, the CATV distribution points becoming the main sources of interferences;
- Only a proper planning and allocation of the transmitters (position, power) will make possible to avoid the poor reception in crowded urban areas;
- The sources of perturbations from cable TV are often unpredictable, both in position and technical parameters (power, channel allocation), since the cable operators are upgrading and modifying constantly their networks.

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Thank You!