

The planning, coordination, standardisation and regulation aspects of the digital FM Band

AGENDA

- Introduction
- Theoretical evaluations and planning examples for FM HD Radio™
- The differences („field to theory“) and where they come from
- Is it everywhere in Europe the same frequency density ?
- The Airline safety issue
- Conclusions/What has to be done?

EHDRA HD Radio Day, 2009 Lucerne - Switzerland

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Introduction

- As we learned this morning.....there are huge differences between field and theory!
- I only can highlight a few and the most common findings of the different evaluations
- Therefore it is recommended to read some of the detailed report for better understanding and to get a more complete picture.
- **Download:** <http://www.ehdra.eu/ehdradocuments/index.php>
- **Credentials:** **ID: hdradio** **PW: ehdra**
- Most public broadcasters (supported and pushed by the DMB-Forum and administrations) want to leave FM soon and a lot of them want to set FM Switch off dates! and go to DAB+ in Band III, that's fine!
- But why the same people want to „teach the private broadcasters“ what we should do or not do with the FM Band?
- Before we started the FM Digitalization Issues, FM was seen as a bad and outdated system. Now everybody claims it is the best and most perfect system in the world, so do not touch it!
- Nobody wants to talk about the characteristics of the receiver universe, what is our main source for listenership and revenue !

Theoretical Evaluations and planning examples for HD-Radio™

- **Several theoretical evaluations and planning studies were made, based on the GE84/ITU-412-9 planning recommendations for analogue FM transmissions and estimated parameters for the digital components.** Some of the studies also cover DRM+ and FMeXtra aspects.
- **LS Telecom, Germany** (with Heidelberg field trial set up, up to 18dB missing)
- **LFK on Protection Ratios** (Some Explanations are given for the main issues where the difference between “subjective field results” and planning methods may come from.)
- **FHK-LMK on digital transmissions in the FM Band** (overview of proposed tasks for reviewing the existing FM-analog rules for the future)
- **iBiquity Digital Corporation** on ITU-R-412-9 compatibility „HD Radio Performance +ITU-R-412-9-Compatibility.pdf complete set of rules
- **BR-FKT HD for Europe?** (US –Europe Planning comparison)

Common findings:

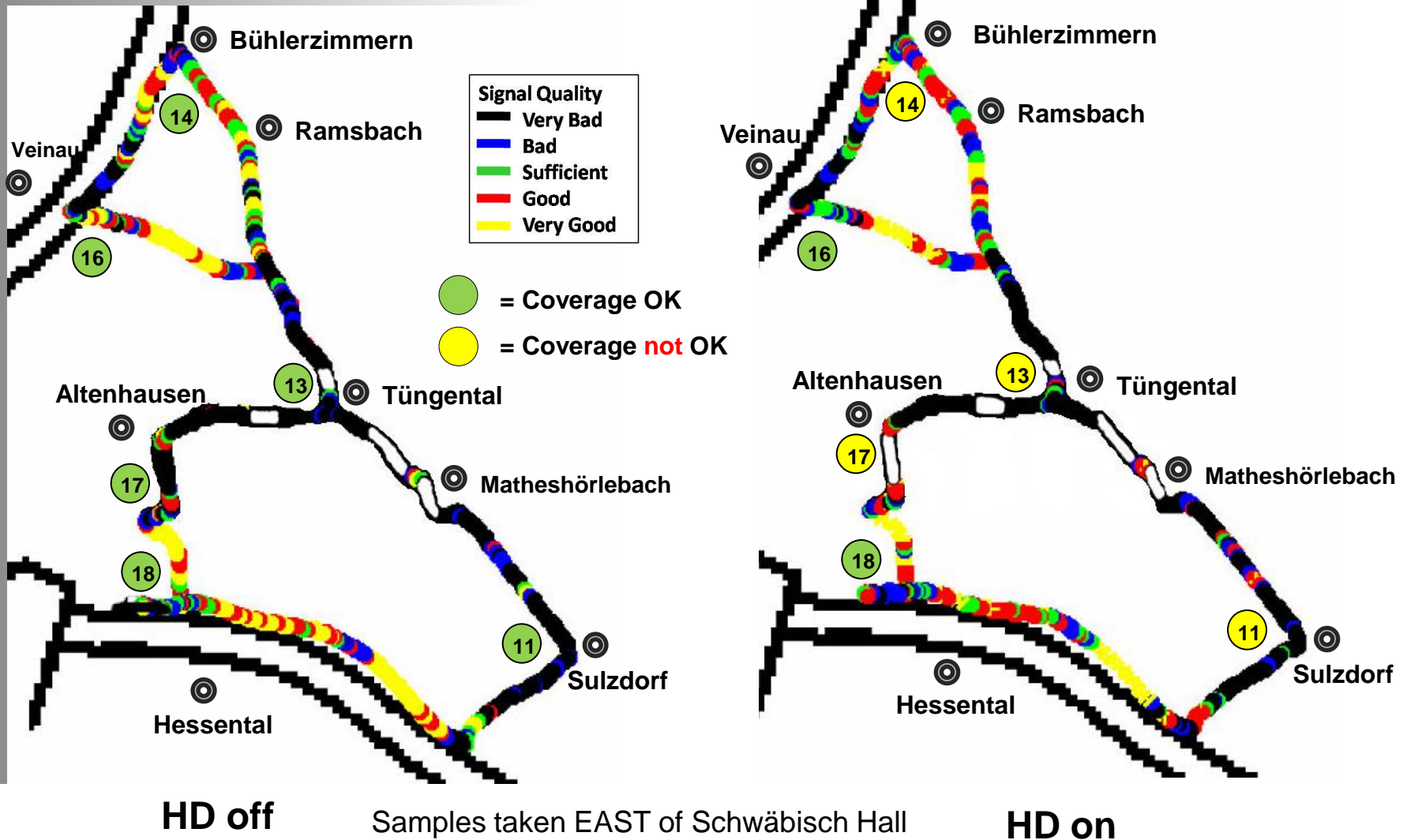
- **HD Radio needs, depending in the frequency separation other protection ratios, especially at 200Kc frequency separation.** Other separations do not need additional protection
- **No consensus about the “absolute” values for digital to analogue interference, more basic work recommended**
- **What reference receiver specification, was taken is crucial, non representative receiver samples were used**
- **The question for review of existing rules is raised**
- **The differences between “rules” and field results are obvious!**

The differences („field to theory“) and where they comes from

(Some of explanations for the difference of „listener reactions “and subjective evaluation compared with measuring point results, prognosis and theory)

1. **The protection ratios empirically determined with subjective audio evaluation, about 30 years ago, do not reflect nowadays parameters on the transmit (without sound processing) and receiver side (user habits)**
2. **Some of the reference methods (10m / 5R4 directional antenna) do not reflect what the listeners really get**

Comparison Static (10m) to dynamic (OBB) measurement with HD ON and HD OFF



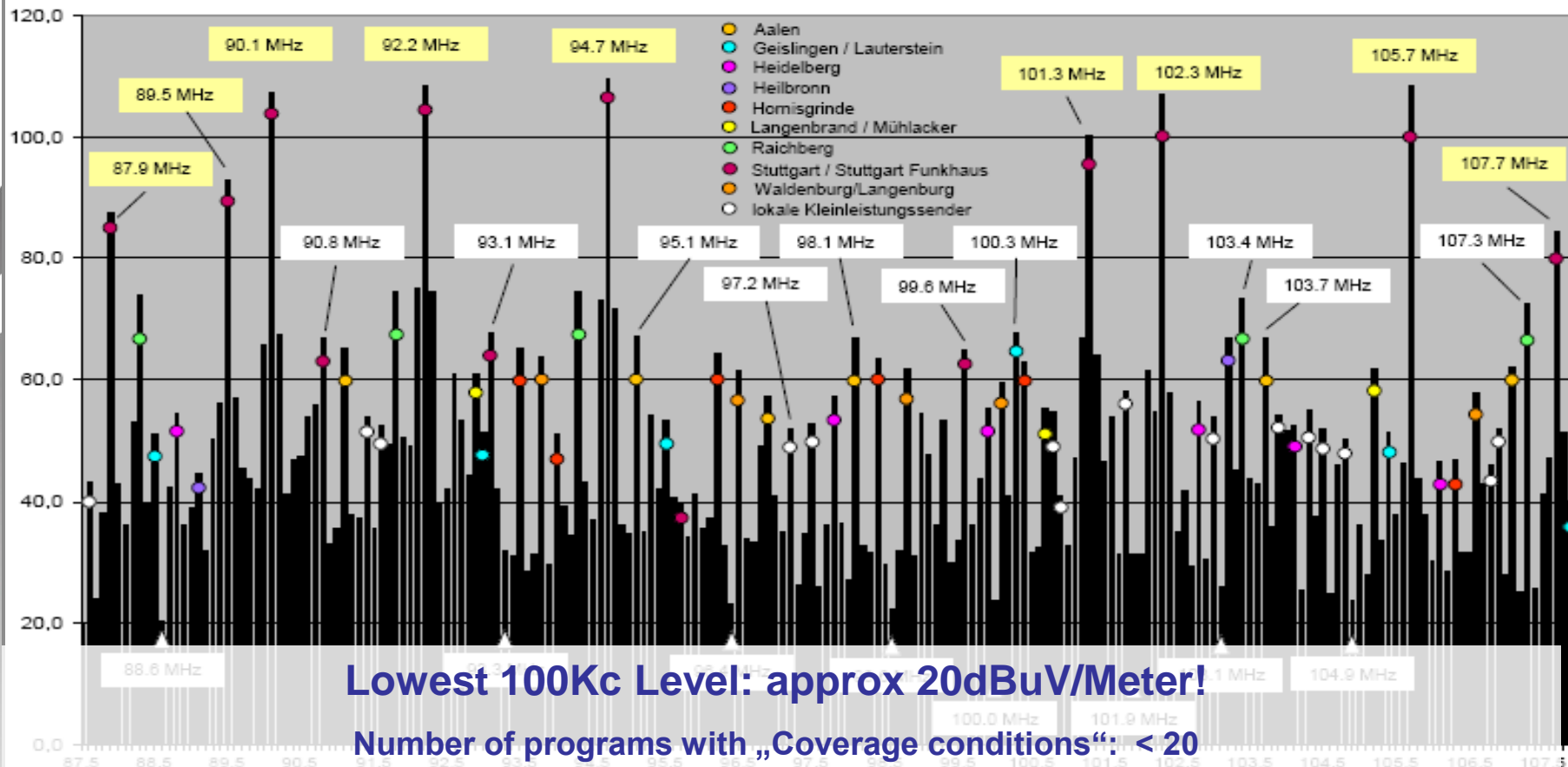
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2. Some of the reference methods (10m / 5R4 directional antenna) do not reflect what the listeners really get
3. The amount of effective affected listeners in the critical (overspill ?) areas are often overrated, and the effect due to “multi reception” is underrated
4. CAR-radios switch to mono! (can make up near 20dB in SNR)
5. Nowadays the FM-Networks are largely interference and not noise limited!

Interference limited networks versus noise limited laboratory testing example: FM-Spectrum around Stuttgart?

Frequenzbandbelegung FM (Beispiel)



Laboratory reference measurements are made at up to 20-30dB lower levels!
(with good receivers)

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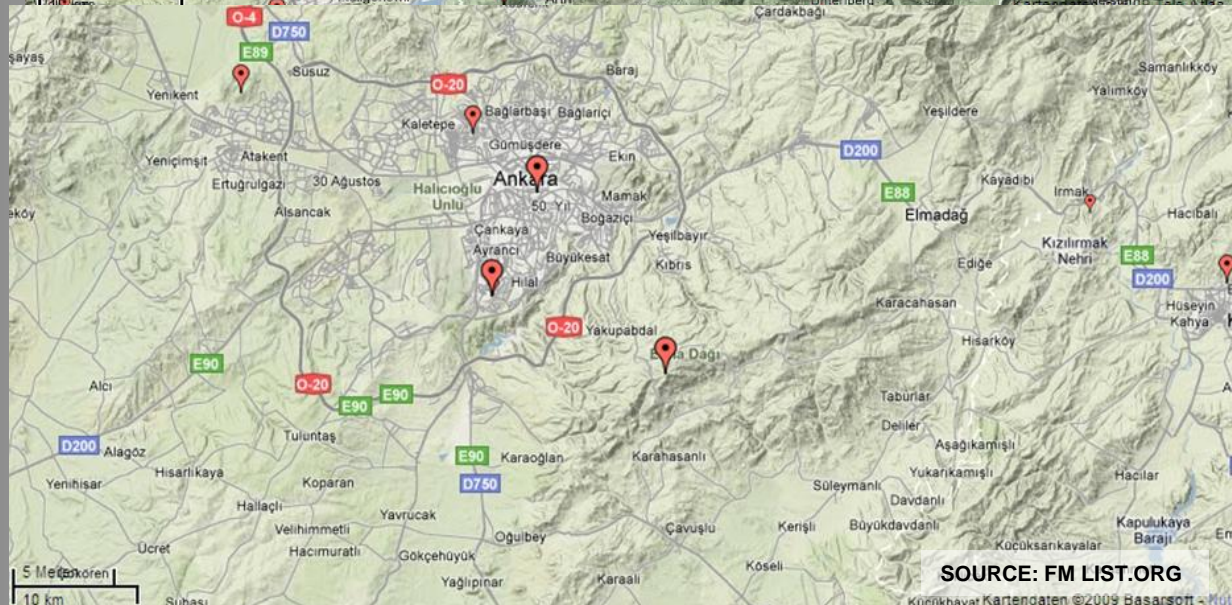
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4. CAR-radios switch to mono! (can make up near 20dB in SNR)
5. Nowadays the FM-Networks are largely interference and not noise limited!
6. **The receiver universe is not like the “theory”** (near best receivers used for testing in a interference free environment, no representative samples)
7. **The differences how the planning rules (ITU-412-9) are respected and interpreted within Europe are very different, as well as the “test procedures” to verify this** (creates also some confusion !)
8. **Not all of Europe has the same spectrum density Issues**

Is it everywhere the same frequency density?



Greater Zurich Area

- 49 Transmitter Sites
- 75 Frequencies
- mostly small power and medium power



Greater Ankara Area

- 7 Transmitter Sites
- 77 Frequencies
- 66 Freq. on 2 Sites !
- mostly high power

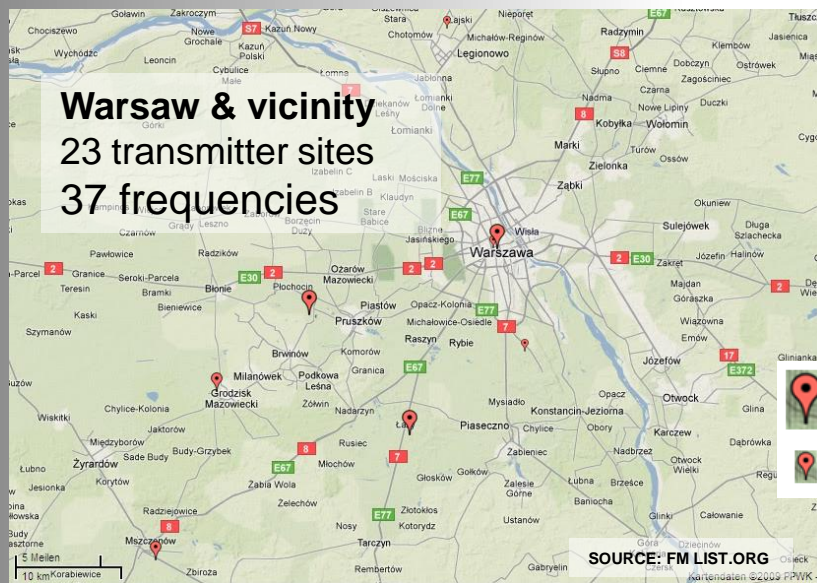
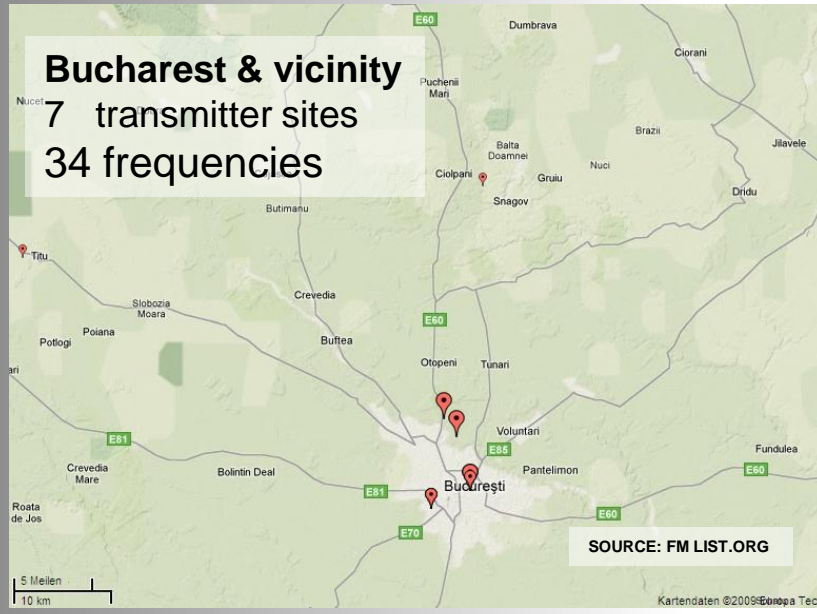


High Power Transmitter



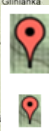
Low Power Transmitter

Is it everywhere in Europe the same frequency density?



High Power Transmitter

Low Power Transmitter



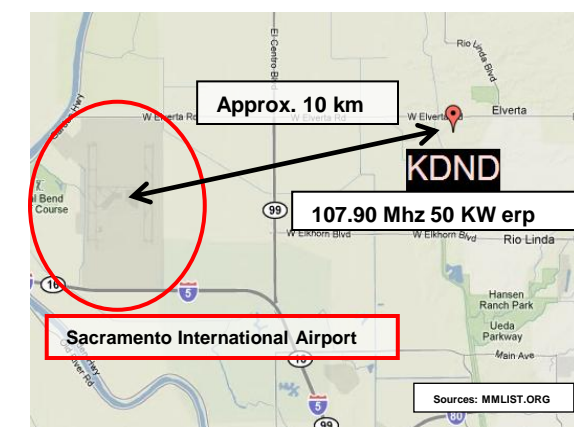
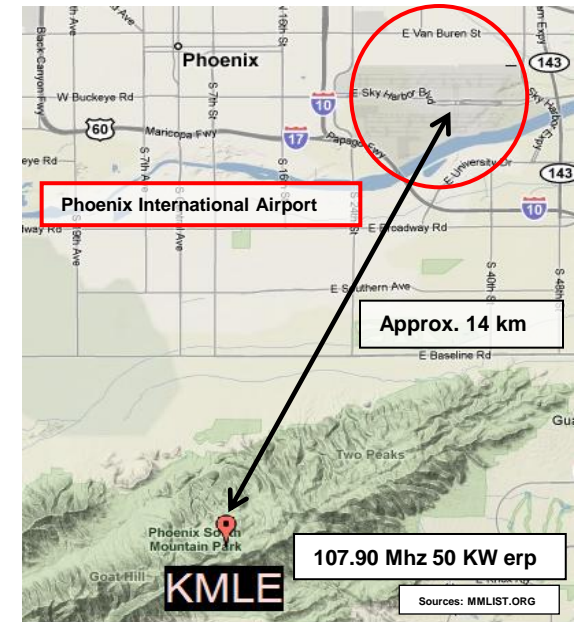
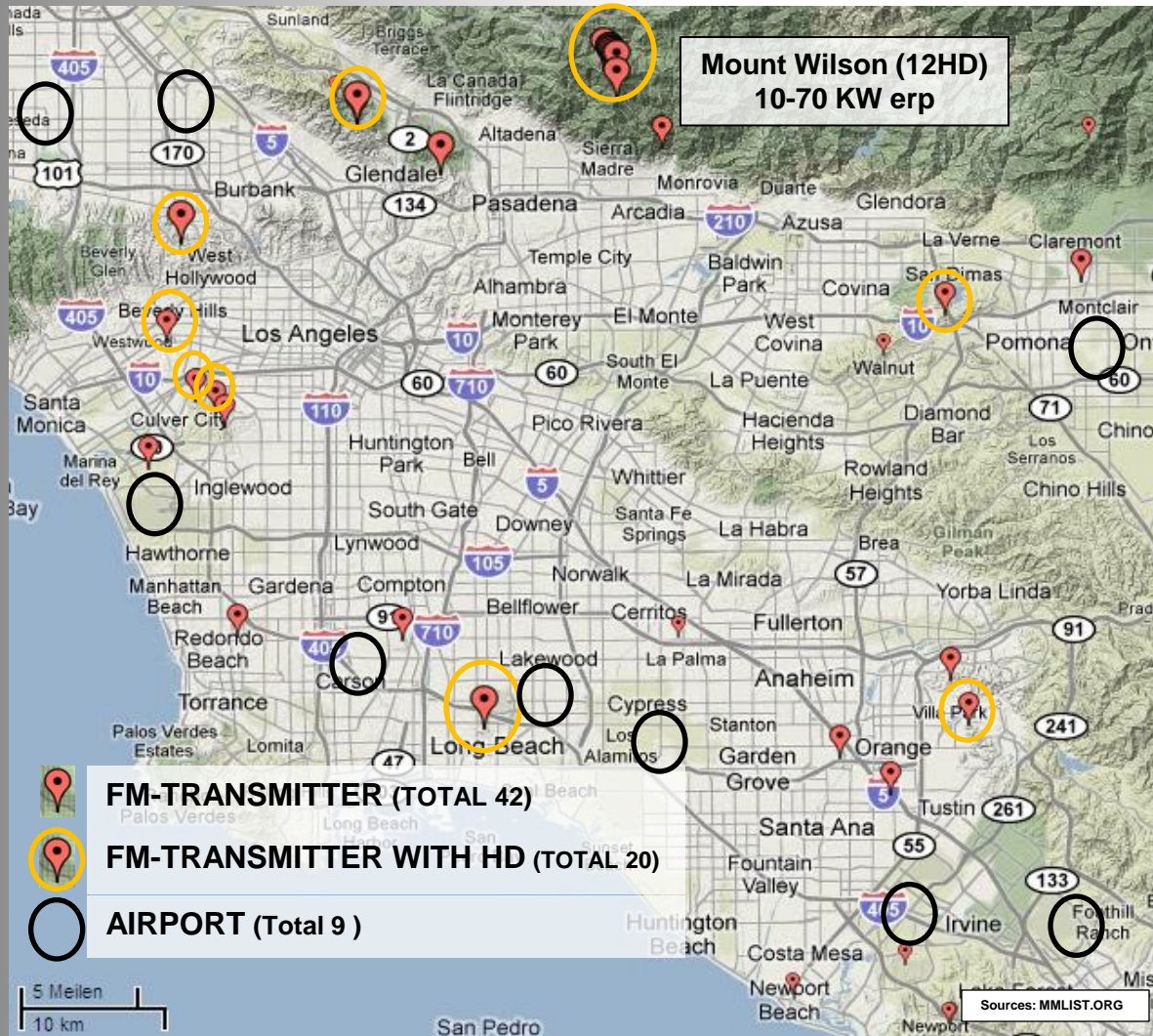
The Airline safety issue

HD-Radio™ interfering potential on to Aeronautical Radio navigation (ILS / VOR)

- **In the United States, (HD Radio implemented some years ago) no interference issues to aeronautical (ILS/VOR) radio navigation till now are known, not even in crowded areas.**

HD-Radio™ interfering potential on to Aeronautical Radio navigation (ILS / VOR)

Practical Examples from the US



The Airline safety issue

HD-Radio™ interfering potential on to Aeronautical Radio navigation (ILS / VOR)

- In the United States, (HD-Radio™ implemented some years ago) no interference issues to aeronautical (ILS/VOR) radio navigation till now are known, not even in crowded areas.
- **In Europe, especially in Germany, the feared potential interference** (of the virtually exact same RF-Spectrum of the HD-Radio™ signal) **into the adjacent band of 108.0 to 117.95 Mc seems to be very different.**
- **An ECC input doc has been issued by the BnetzA** (German Federal Network agency) **in conjunction with the FHK** (Fachhochschule Kaiserslautern), **describing the potential issues for HD-Radio™ DRM+ and FMeXtra.**
- **One ILS and one VOR receiver where tested, and the report states that more measurements will be necessary.**

HD-Radio™ potential interfering with Aeronautical Radio navigation (ILS / VOR)



- **The existing software tools to calculate the potential interference onto ILS/VOR is not able to deal with a mixture of analogue and digital carriers.** (In the preparatory period for the field trials like in Switzerland and Germany a number FM analogue carriers at the frequencies of the OFDM Packet where used to simulate the HD Radio hybrid signal for the calculations)
- **The actual LS FM(09) 084 concerning monitoring of FM broadcast emissions deals with potential consequences of excessive deviation and multiplex power it FM broadcasting stations. It is feared that these circumstances may also have a relevant impact on the potential VOR/ILS interference.**
- **Conclusion:**
 - More investigation and a modified software tool will be necessary.
 - Investigations, why it seems to be a non – issue in the US, should take place
 - Everybody agree that the potential interference by digital signals in the FM Band to other services (BOS/VOR/ILS) has to be taken very serious, but no European consensus seems to exists on the steps to be taken to clear up these issues.

Conclusions and what has to be done I

- **Very different standpoints! (between Administrations /.....)**
- **From „ do not touch GE84“ via change the rules to secondary service approach to „The existing planning model does not raise the fact that it is representing real world reception situations“ (portable and mobile reception). All opinions exists!**
- **Protection ratio criteria are the yardstick for planning parameters but not for the reception under real conditions. Changes of the yardstick (planning parameters) do not lead inevitably to a change in the relations of Interferer potential (Quote: LFK)**
- **No clear consensus seems to exist between the different trials (respectively the administrations) concerning the need of review of the GE 84 plan and the existing planning rules. Some calls for adaption and review of the coordination and planning rules, other want absolutely not touch GE84.**
- **There is widespread “silent agreement” that most administrations in Europe use their own interpretations of GE84 and that under the last 20 years of pressure from local media politics on the administrations to give additional frequencies for private commercial broadcasters, lead to a lot of non conformities to the planning recommendations.**
- **GE 84 is based on ITU-R (Recommendations) and not on ETSI standards!**
- **GE 84 does not exclude neighboring countries on „special agreements“**
- **Some of the current FM planning's seems not to obey all „own set rules”**

Conclusions and what has to be done II

Different ITU recommendations as well as some of the coordination and field verification tools seems to need a revision for the future mixed use of the FM band.

The main reference for this work, should be the actual listener behavior (on technical and content respects), with foreseeable future usage trends

The following ITU-R docs to be taken into account for revision:
(Apart from the ETSI Standardization process)

- **ITU-R BS.704: FM reference receiver**
(adjustment of reference receiver to nowadays state of the art, different receiving scenarios and digital receivers)
- **ITU-R BS.641: Determination of protection ratios**
Add interferences from and to digital broadcast systems, , and modify SNR to SINAD with reference to perceptible distortion)
- **ITU- R BS.412-9: Planning standards**
(Protection criteria between analog and digital and digital to digital transmissions. SINAD instead of SNR method, revised BS 641)
- **ITU-R SM.1140: Test procedures for aeronautical receivers**
(Compatibility criteria for digital VHF systems)

The final word of the day:

Why not take the pragmatic approach?

Thank you !

Questions?

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