INTERFERENCE TO DAB RECEPTION
ITU WORKSHOP
MEASUREMENTS AND TESTS IN NORWAY

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The focus…

• Interference – a practical approach
• What we have seen during the FM-switch-off in Norway
• The radio listeners view
Feedback from end-users:

«DAB doesn’t work. Coverage is bad»

Bad «DAB coverage»? or Bad «DAB reception»? Interference problems?
Automotive issues
Automotive issues
Automotive issues
Automotive issues
SYMPHOMS: no radio reception when LED lighting is turned on (floodlights, LED bars, strobe warning lights...)

CAUSE: low-quality solutions emitting radiated or conducted interference through cables, vehicle body... Usually aftermarket products

SCOPE:
• **Industry**: 5-10% of products at professional retailers; usually the cheapest. Good awareness from retailers
• **Private cars**: low-cost products form retailers; “Ali Baba” direct import

MITIGATION:
• Replacement to a better LED solution
• Tedious for normal people
Automotive issues

LED light in vehicles
Automotive issues

LED light in vehicles

22.10.2018
Automotive issues

LED light in vehicles

Very few products from professional retailers construction vehicles; mainly the cheapest
**Consumer electronics in vehicles**

**SYMPTOMS:** poor radio reception *when ignition is turned on*

**CAUSE:** one or several consumer electronics devices emitting radiated or conducted interference through cables, vehicle body... (12V-to-5V USB adapters, GPS, dashcams...)

**SCOPE:** unknown; could be any product. Difficult fault-finding

**MITIGATION:**
- Replacement to a better solution
- Replace glass antenna to a rooftop reception antenna
**SYMPTOMS:** poor radio reception *unless battery is disconnected*

**CAUSE:** various onboard professional equipment, e.g. GPS device for fleet management, and other unknown interference sources(!!)

**SCOPE:** unknown

**MITIGATION:**
- Replacement to a better solution
- Replace glass antenna to a rooftop reception antenna
Automotive issues

Electronics in industry vehicles

Interfering module for tracking and fleet management even with ignition off
External EMC impairing reception

**SYMPTOMS:** poor radio reception driving by or close to lighting shop, industry hall,

**CAUSE:** man-made noise

**SCOPE:** few cases reported, but highly frustrating for e.g. commuters

**MITIGATION:**
- Difficult
- Involving the regulator?
Automotive issues

External EMC impairing reception

Reception loss at the heart of the small town (main road, the ONLY roundabout) Interference from the local meat processing factory (A-road)
Automotive issues

The village of Lena
Automotive issues

The village of Lena
Automotive issues

The village of Lena
Automotive issues

The village of Lena
Indoor issues
«Reception problems started when I switched to LED»

«One could experience radio interference on consumer electronics from compliant LED bulbs, especially if you use several at the same time»

Norwegian Directorate for Civil Protection
Indoor issues

LED

«Reception with our ceiling-mounted DAB receiver is jammed by ceiling-mounted LED lighting.»
Indoor issues

LED

Mitigation

• Find a better place for the radio (or the reception antenna)
• Replacement to a better LED product
• Raising awareness of members of the public
• Working with retailers; testing some of their products
• Certification? (difficult)
• Involving the regulator
Some examples
Some examples

Battery-driven speaker whose cable is radiating interference.

Pocket radio (or radio with low-quality sound)

Cable for DAB reception. Is also acting as a radiator for EMI from the speaker

Well shielded portable speaker
Some examples
Some examples

Direct import through Internet
Some examples

Industry workers, craftsmen

«Poor reception at some locations only, when using electric tools...»

Tests showed reception issues with some tools, but not all
Some examples

Start your car, charge your phone, …and loose your radio reception…
Some examples

DashCam

22.10.2018
The usual suspect…
The usual suspect...

**AC-DC conversion and DC-DC conversion (up or down)**
Some LED lighting products have been reported to emit noise, interfering with FM radio and DAB signals. The radiated noise signals would most likely be the result of the electronic transformers driving them rather than the (LED) lights themselves.

Electronic transformers are really switched mode power supplies that switch the forward current on and off at high frequencies to minimize power dissipation. When these higher frequencies are not properly filtered, it can result in RFI emission. Signals most likely to suffer as a result of radiated noise include FM radio (broadcast band 87.5 to 108.0 MHz) and DAB radio (broadcast band 174 to 230 MHz).
The usual suspect...

1. Conducted EMI through the mains
2. Radiated EMI from the power supply
3. Radiated EMI from the mains
4. Conducted EMI from the low-voltage power cord
5. Radiated EMI from the bulb
The usual suspect…

The manufacturer COULD do a good job

• “In power supplies, the two prominent types of EMI are conducted EMI and radiated EMI. (…) The new (modern) switches have significantly reduced switching times, leading to faster and faster rise and fall times for the voltage and current waveforms. These fast edges produce significant energy at surprisingly high frequencies, and are the root cause of all EMI problems in switched-mode power supplies. (…).

Given these new developments, it is clear that EMI performance (…) needs to be designed into the power supply right from the start at specification level.”

The usual suspect…

End-users mitigating themselves?

- Ferrits and filters are available at retailers
- Difficult to get rid of EMI (especially radiated from the cords)
- No way to shield the power supply properly

Solution:
- Replacement
- Certification of imported products
Unexpected issues
Unexpected issues
Unexpected issues
Unexpected issues

Quality award, though bad sensitivity due to self-created EMI
Unexpected issues

Cheapest on the market
13 500 LED bulbs!
LED wall impairing aviation communication

What about DAB reception in this second largest Norwegian city?
A bright spot…
Video from a Toyota in Finnmark
Thank you

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