

INTERFERENCE TO DAB RECEPTION

ITU WORKSHOP

MEASUREMENTS AND TESTS IN NORWAY

Geneva October 18th 2018
Bjørnar Langen, NRK

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



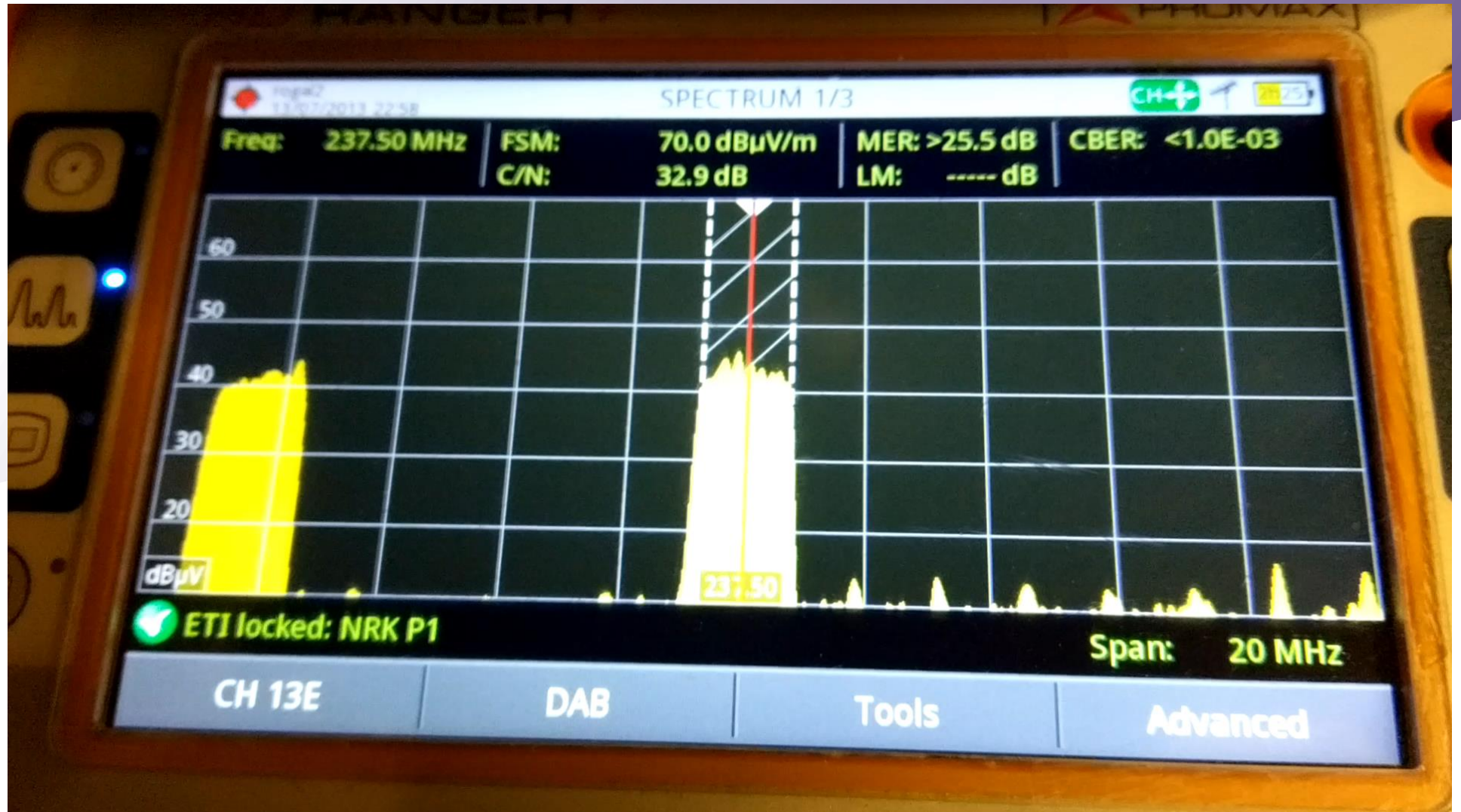
Automotive issues



Automotive issues



Automotive issues



Automotive issues

LED light in vehicles

SYMPTOMS: 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 from retailers; “Ali Baba” direct import

MITIGATION:

- Replacement to a better LED solution
- Tedious for normal people

Automotive issues

LED light in



Automotive issues

LED light in



Automotive issues

LED light in vehicles



Very few products from professional retailers (construction vehicles); mainly the cheapest

Automotive issues

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

Automotive issues

Electronics in industry vehicles

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*

Automotive issues

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 eg. commuters*

MITIGATION:

- *Difficult*
- *Involving the regulator?*

Automotive issues

External EMC impairing reception



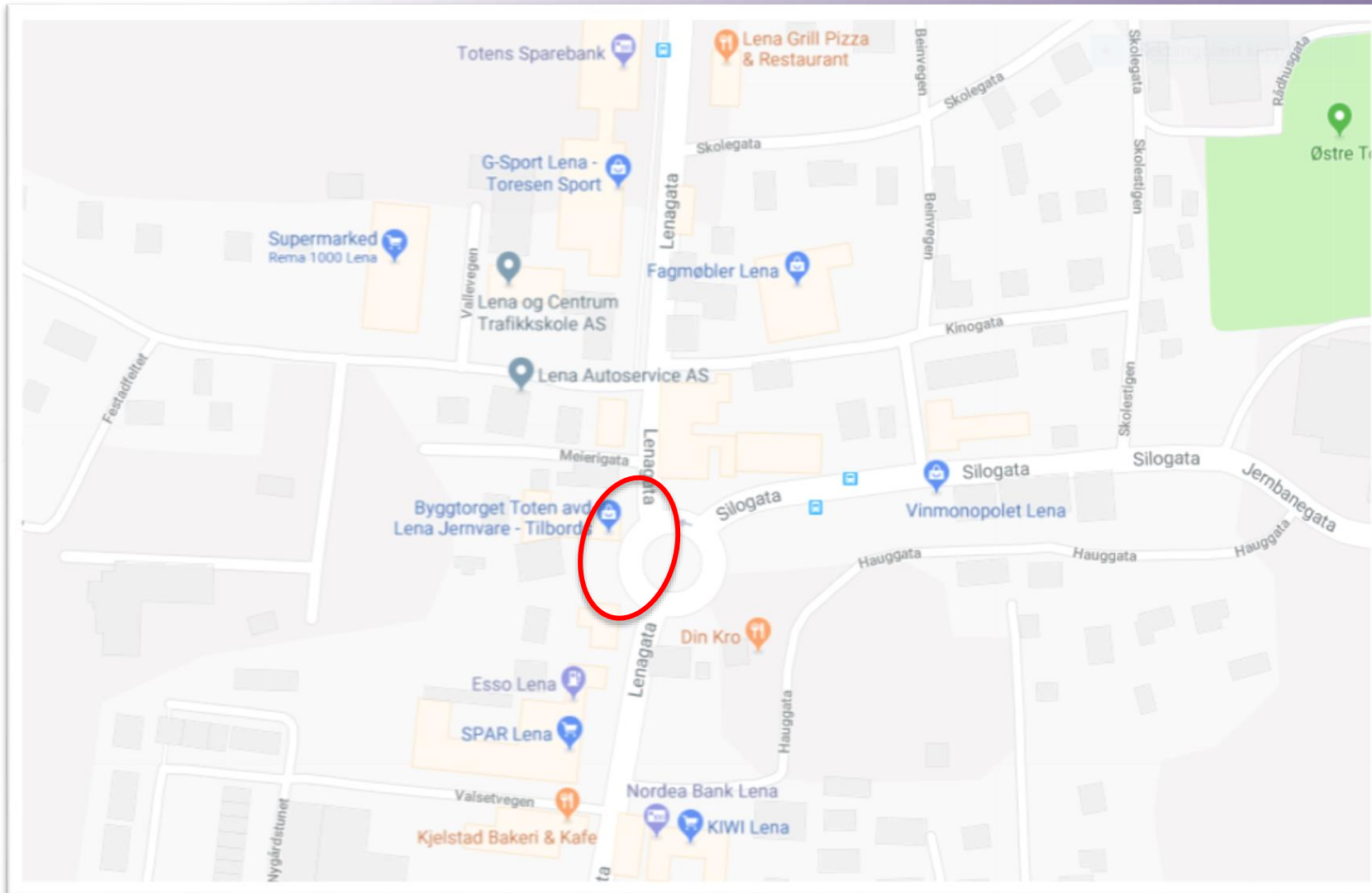
Reception loss at the heart of the small town
(main road, the ONLY roundabout)



Interference from the local meat processing factory (A-road)

Automotive issues

The village of Lena



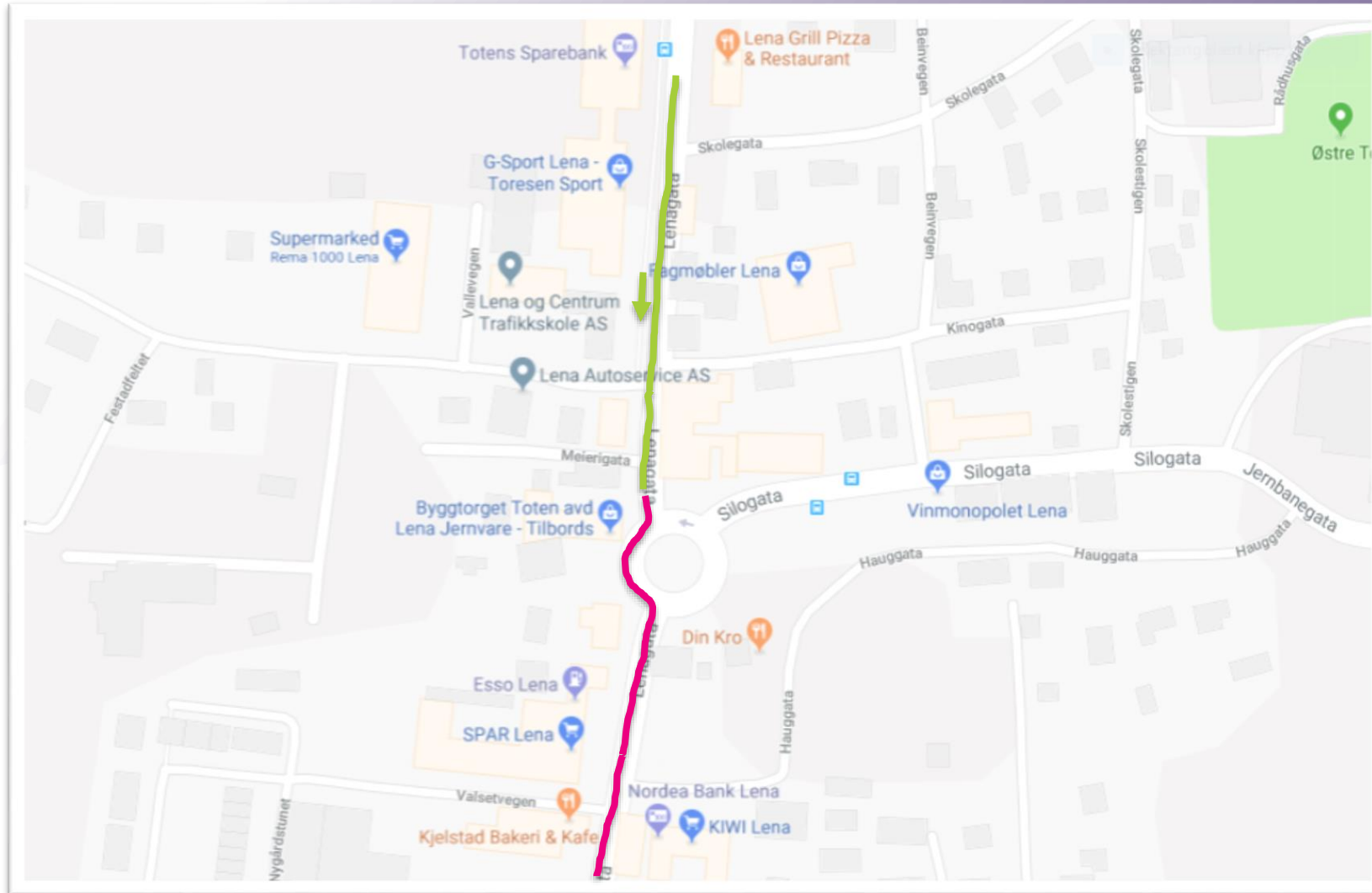
Automotive issues

The village of Lena



Automotive issues

The village of Lena



Automotive issues

The village of Lena



Indoor issues



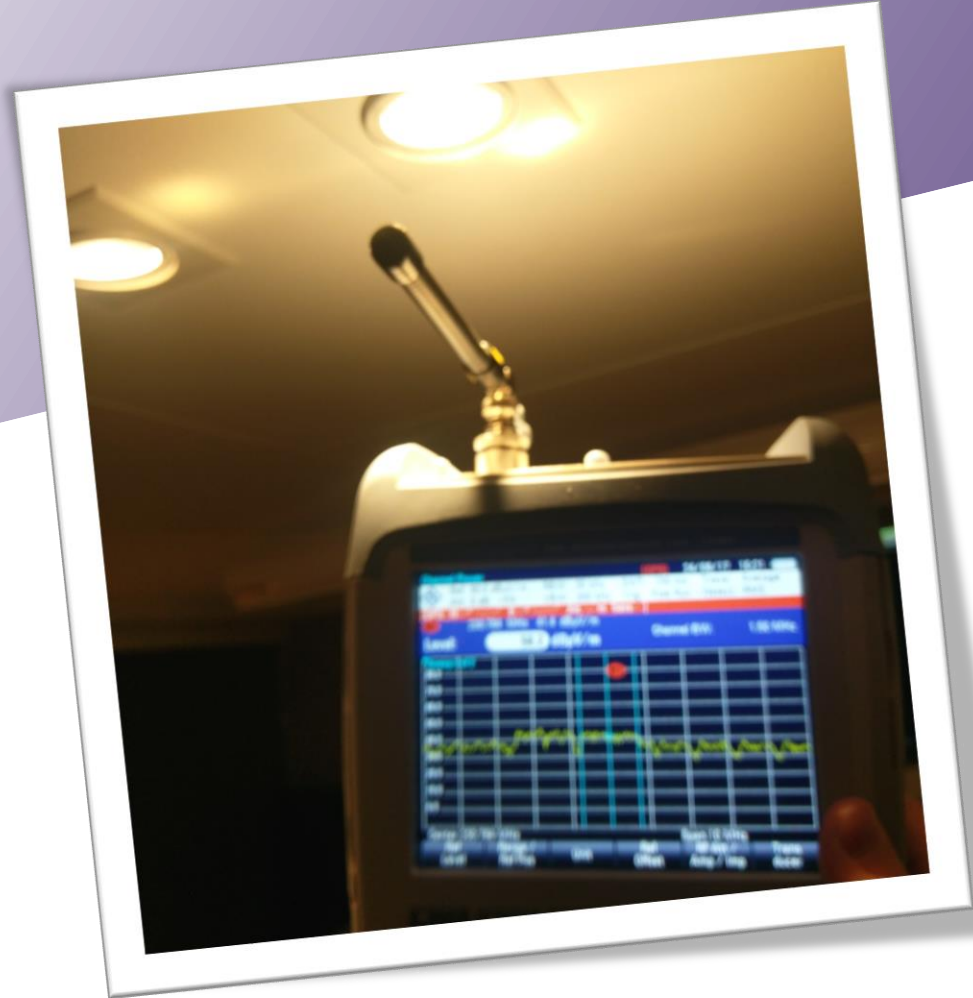
LED



« 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**

«Reception problems started when I switched to LED»



Indoor issues

LED

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



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.

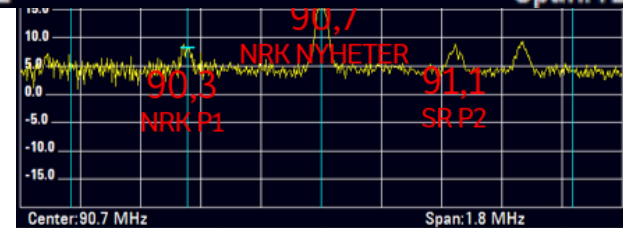
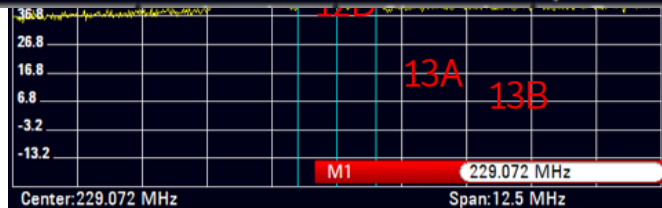
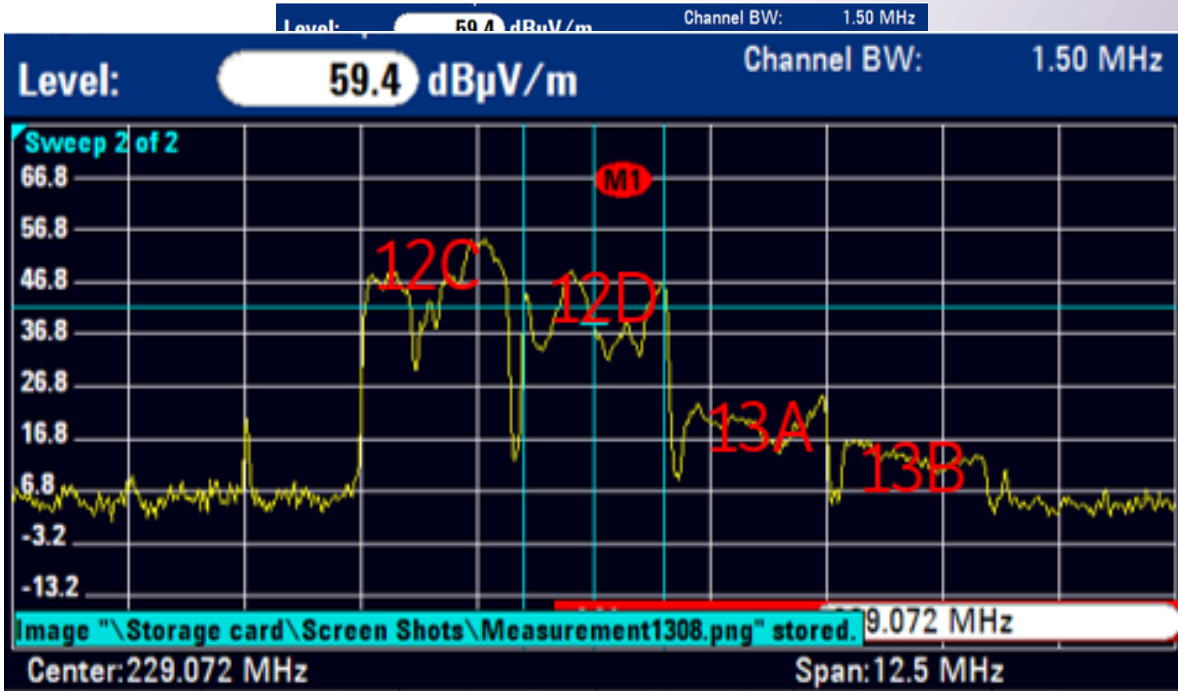


Pocket radio
(or radio with
low-quality
sound)

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

Well shielded
portable
speaker

Some examples




OFF

ON



Some examples

Direct import through Internet



6-24V 12V/24V to 5V 3A CAR USB Charger Module DC Buck step down Converter
 ★★★★★ 2 product ratings

Condition: **New**

Quantity: More than 10 available
299 sold / See feedback

Price: **AU \$1.01**
Approximately NOK 6.21

[Buy It Now](#)
[Add to cart](#)
[Add to watch list](#)
[Add to collection](#)

100% buyer satisfaction

Shipping: **FREE** International
 Item location: Hong Kong, Hong Kong
 Ships to: Worldwide

Delivery: **Estimated**
 Seller ships within 2 days after receiving cleared payment

Payments: **PayPal**

3 Pcs



3Pcs Black Plastic Dual USB Car Vehicle Charger Adapter Connector for Car Cigarette Lighter
 ★★★★★ Be the first to write a review.

Condition: **New**

Price: **US \$3.73**
Approximately NOK 29.25

Shipping: **\$0.50 (approx. NOK 3.92)** Standard International Shipping | [See details](#)
 International items may be subject to customs processing and additional charges.
 Item location: Hong Kong, Hong Kong
 Ships to: Worldwide | [See exclusions](#)

Delivery: **Estimated between Tue, Mar. 13 and Wed, Apr. 11**
 Seller ships within 2 days after receiving cleared payment

Payments: **PayPal**

Returns: 30 day returns. Buyer pays for return shipping | [See details](#)
 Guarantee: **ebay** MONEY BACK GUARANTEE | [See details](#)
 Covers your purchase price and original shipping.

DC 12V-24V




DC 12V-24V Input to 5V 1A USB Port Car Charger Adapter Pink for Cell Phone
 ★★★★★ Be the first to write a review.

Condition: **New**

Price: **US \$2.38**
Approximately NOK 18.66

Shipping: **\$0.50 (approx. NOK 3.92)** Standard International Shipping | [See details](#)
 International items may be subject to customs processing and additional charges.
 Item location: Hong Kong, Hong Kong
 Ships to: Worldwide | [See exclusions](#)

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 Get the item you ordered or get your money back.
 Covers your purchase price and original shipping.

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

DashCa

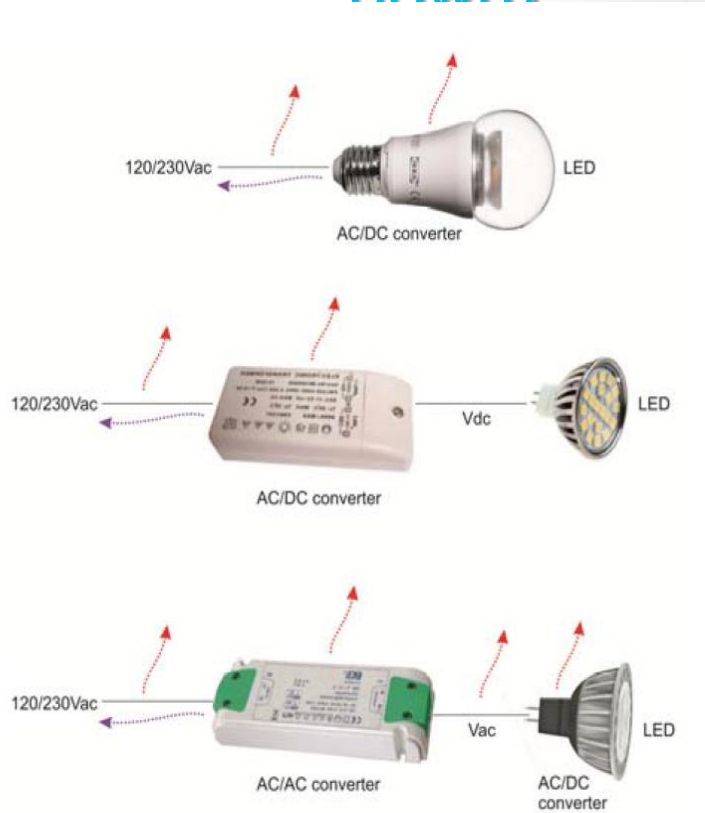


The usual suspect...



The usual suspect...

AC-DC conversion and DC-DC conversion (up or down)



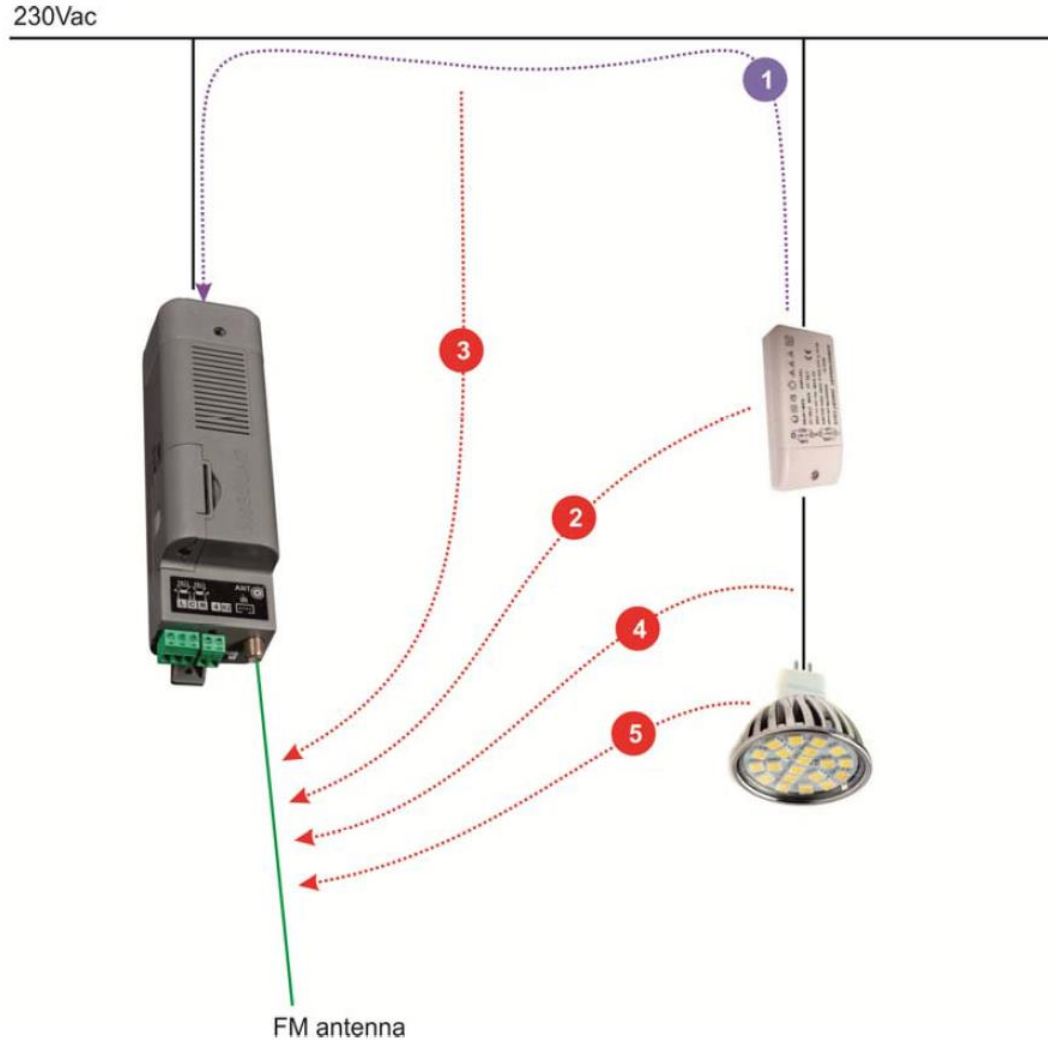
The usual suspect...

A problem known by manufacturers

(internal report from EISSOUND)

- 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.»*

*Electromagnetic Interference (EMI) in Power Supplies, Alfred Hesener,
<https://www.fairchildsemi.com/technical-articles/Electromagnetic-Interference-EMI-in-Power-Supplies.pdf>*

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**



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EMC-filter for LED



Unexpected issues



Unexpected issues

Sangean DPR67

Rød, DAB+

Produktnr.: 340067 / Varenummer: 816075



1/2 [Skriv produktanmeldelse](#) [SANGEAN](#)
 Se alt fra SANGEAN

FRI RETUR • 45 DAGER ÅPENT KJØP

890,-
 + frakt fra 49,-

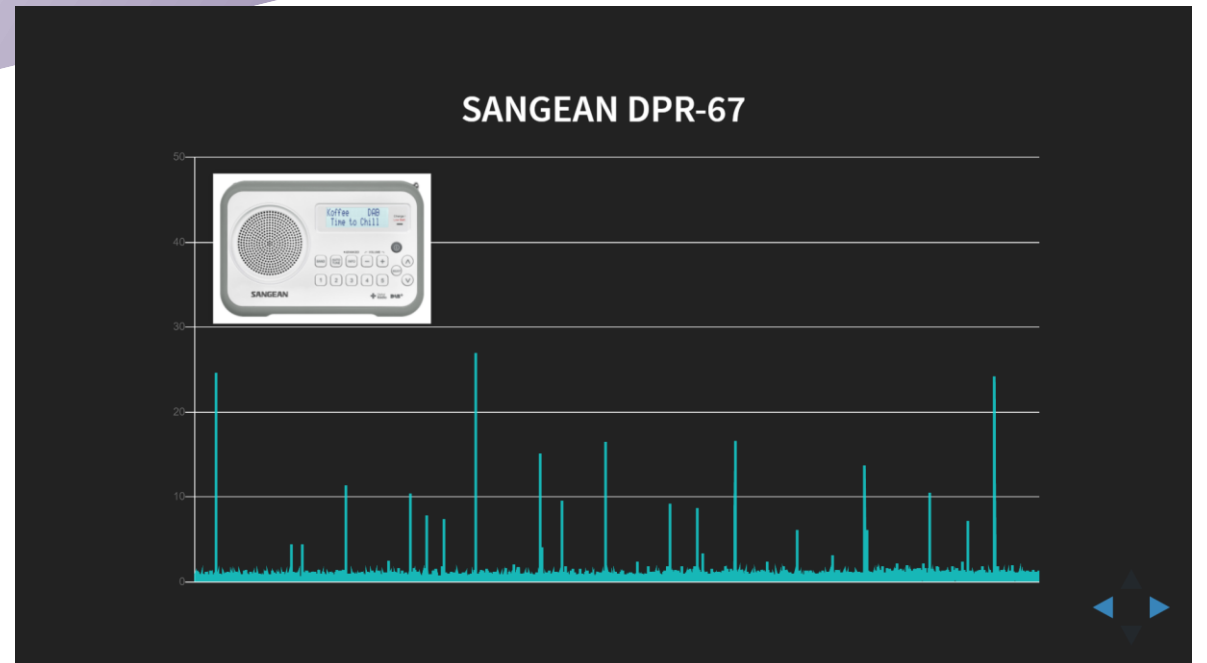
LEGG I HANDLEVOGN

Kjøp fra Komplet
 4 stk. på lager. (1-2 dager leveringstid)

Kjøp dette produktet fra andre [Se alle \(2\)](#)

Kjøp fra: [Elektroimportøren AS](#) **899,-** [KJØP](#)
 ★★★★★ (70)

[Sammenlign](#) [Ønskeliste](#)



Unexpected issues

Geneva Touring S DAB+ bærbar radio

DAB+/FM-radio Bluetooth, oppladbart batteri. Rød

Produktnr.: 102301 / Varenummer: 915987



1 / 1 [Skriv produktanmeldelse](#) **GENEVA** [Se alt fra Geneva](#)

FRI RETUR • 45 DAGER ÅPENT KJØP

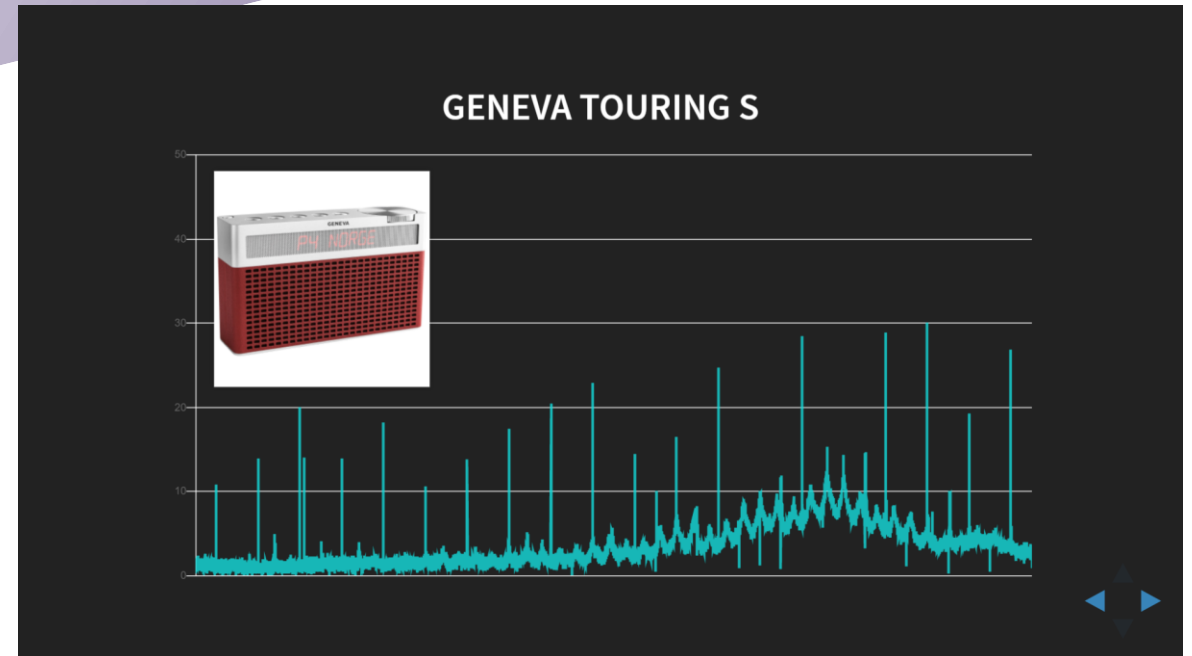
1 990,- Delbetal fra 263,- i mnd [se priser](#)
+ frakt fra 49,- [Trygghetsavtale](#) fra 13,-/mnd.

LEGG I HANDLEVOGN

Kjøp fra [Komplett](#)

3 stk. på lager. (1-2 dager leveringstid)

[Sammenlign](#) [Ønskeliste](#)



Unexpected issues

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

Best i test
LYD & BILDE
Desember 2016
Radionette Solist

Radionette Solist DAB-radio (sort)
Varekode: RNPDABB14E
★★★★☆ 4.3 (26)

1 695

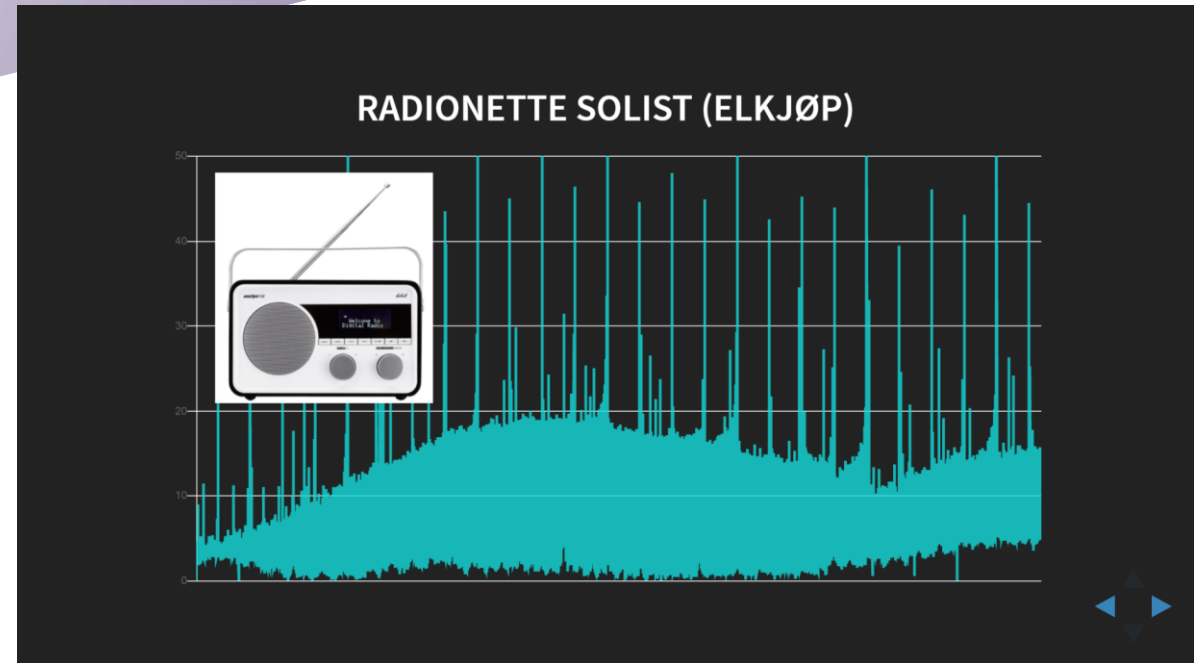
Legg i handlevogn Klikk & hent

På nettlager (100+) Reserver nå, på lager i **128 butikker**

Radionette RNPDABB14E er en DAB+ radio som lar deg strømme via Bluetooth. Kommer med oppladbart Litium-batteri som lar deg spille av musikk i opptil 15 timer.

- > FM-, DAB-, DAB+ radio
- > Strømming via Bluetooth
- > Oppladbart batteri

Produktinformasjon Spesifikasjoner

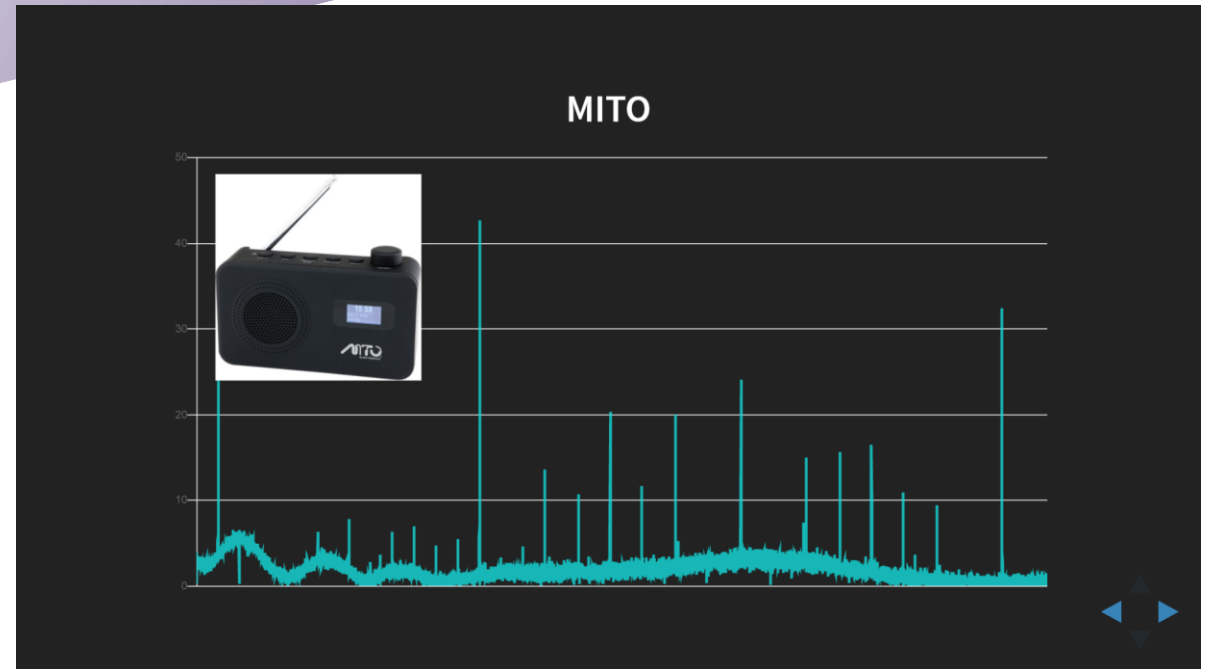


Unexpected issues



175073
Radio DAB+
199,-
 Prisgunstig og kompakt DAB+/FM radio i gummiert finish. LCD Display med klokke. Batteri og strømdrift. Batteri 4XAA (ikke inkludert)
 ♥ Legg til i huskeliste
 Lagerstatus ⓘ EP FURUSET På Lager ▾
[Klikk her for butikkens info](#)

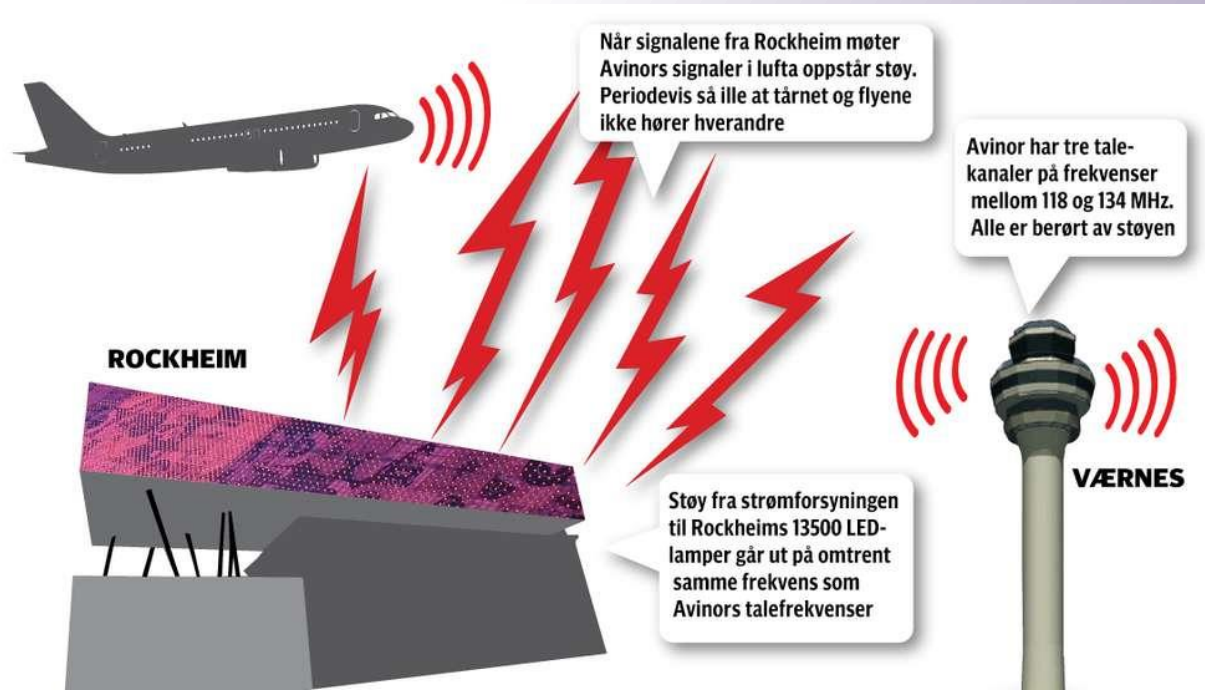
Cheapest on the market



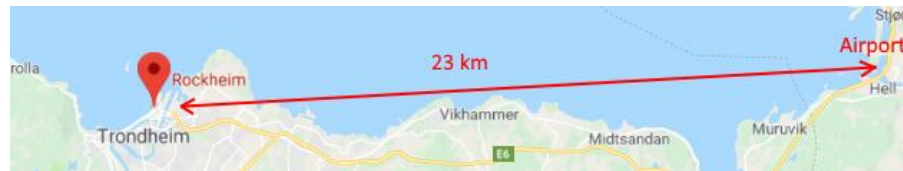
13 500 LED bulbs!



LED wall impairing aviation communication



What about DAB reception in this second largest Norwegian city?



A bright spot...



NIK

Video from a Toyota in Finnmark



Thank you



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