

DAB automotive test tracks in Norway

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Håvard Wien: e-mail: havard.wien@nrk.no Mobile: +47 90983472

Jørn Jensen: e-mail: jorn.erik.jensen@nrk.no Mobile: +47 90502802

Michel Gascoin: e-mail: michel.gascoin@nrk.no Mobile: +47 48300362

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1. About the Norwegian DAB network

The Norwegian DAB network consists of two national layers (NRK regional ensembles “REG ensemble” with public - service NRK channels; and “RIKS ensemble” with national commercial channels) and local ensembles.

The REG ensembles (NRK) cover approximately 99,8% of the population. Norway is divided in seven DAB regions, each having its “REG ensemble”, which assumes SF support in the automotive receivers (details below). The testing area spans over three regions with respectively the three ensembles 12C (“NRK Reg1 OsAkØs” - Oslo city, eastwards and southwards), 13A (“NRK Reg2 BuTeVe” - west of Oslo), 13E (“NRK Reg5 HeOp” - north of Oslo) – cf. annex A. Note the different DAB regions are overlapping in some areas, especially around Oslo.

The RIKS ensemble covers approximately 92,8% of the population and consists in one national layer on 12D.

When testing, we advise not to use local ensembles, since they might be prone to changes over time in both content and coverage. Still, a test route is suggested for local ensemble 8B, since this is the only low - frequency ensemble near Oslo and because this particular one is not expected to be subject to changes in the near future.

2. DAB features on air

The following features are present on NRK regional ensembles “REG ensembles” in Norway and the national ensemble “RIKS”.

- DAB+ audio (all channels except “P4” and “Radio Norge”)
- DAB audio (only “P4” and “Radio Norge” on RIKS ensemble 12D)
- Service following (mainly NRK stations on REG ensembles; details below)
- DLS and DL+
- Dynamic slideshow. NRK are also broadcasting categorized slideshows on most stations

- Announcements. Traffic and Transport announcement on the NRK ensembles. NRK will start testing Alarm announcement on air from Q3 2018 and are also considering other announcement types such as Weather, Warning and News
- SPI. EPG (Electronic Program Guide) with 4 different station logos on both the national commercial network and the NRK networks.
- Dynamic reconfiguration with a change of subchannel and bitrate for the NRK P1+ stations at 07:00 – 07:05, 08:00 – 08:05, 10:00 – 10:05; 11:00 – 11:05 and 12:00 – 12:05 Monday to Friday.
- TPEG. There are two TPEG services on air.
 - There is one encrypted TPEG stream on the commercial network (RIKS).
 - The TPEG service on the NRK networks is open and unencrypted with the TEC TPEG application. TFP (Traffic Flow predicament) and weather applications will be available in Q4 2018.
- Radio DNS: NRK are participating in Project logo through the EBU Radio DNS server and have logos and service linking to internet radio if you lose DAB coverage. The commercial stations support Radio DNS through the Radioplayer.

3. Detailed information about service following

About NRK Regional ensembles

- National services ("NRK P1", "NRK P2", "NRK P3"...etc.) in all regions with the same SIDS, **Implicit linking**. FIG 0/24 + FIG 0/21 are being used to determine which frequencies to check when a receiver loses reception.
- One to three regional versions of "NRK P1 xx" stations, with different contents at certain times of the day/week and sharing the same content as "P1" the rest of the time. The regional version of NRK P1 xx does **NOT** have any linking.
- Seven different Traffic stations ("NRK Tr..."; one in each region) which use **soft linking**, FIG 0/6.
- In the ensemble NRK Reg7 NoTrFi in norther Norway, there is an MFN network, which is specifically signalled in FIG 0/21.

The National ensemble is a single frequency network, with therefore no service following.

Local ensembles. The ensembles contain some services that are only available locally in a single ensemble, but also other services that are available in several neighbouring ensembles. The configuration assumes support of Service Following in the automotive receivers. Both implicit linking, FM linking, and hard linking are being used.

4. Suggested test routes

We have divided test routes in two categories:

- Short-range routes for specific **testing of sensitivity**

- Long-range routes for **overall automotive user experience** (sensitivity and service following)

Short-range test routes (cf. annex B) – Sensitivity testing

Any sensitivity testing is (and must be) **carried out on signals from distant** (normally wrong) **regions**. In practice, this means testing on the service NRK P1 for region 2 (13A) while you are driving in region 1 (12C). This is because local signals in the greater Oslo area have too high a field of strength (usually way above 54 dBµV/m), which makes it irrelevant for sensitivity testing. In addition, we strongly advise to opt for the following services when testing on a specific ensemble so that service following doesn't impair the test:

- **13A (230.784 MHz): “NRK P1 VESTFOLD” (long label), “NRK VSTF” (short label)**
- **13E (237.488 Mhz): “NRK P1 HED&OP” (long label), “NRK H&OP” (short label)**
- **8B (199.360 Mhz): “RADIO ØST” (long label)**

On the suggested routes, the typical field strength is between 54 dBµV/m and 42 dBµV/m (minimum requirement), sometimes below.

Long - range routes (cf. annex C) – Overall user experience

These routes should reflect the overall user experience of the receiver (“normal driving conditions”), where both sensitivity and service following are put to the test.

Provided that the receivers have sufficient sensitivity and the service following works, no substantial or annoying disruption of service should occur on these routes:

- Suggested long-range test route 1:
<https://goo.gl/maps/xM5dar71mCy> (257 km; 4 hour' drive; cf. annex C)
- Suggested long-range test route 2:
<https://goo.gl/maps/gVtDrLMMh7U2> (429 km; 6 hours and 15min drive)

About coverage maps as available for end - users (for reference or additional testing)

- Coverage maps are available at: <https://radio.no/dekning/> (annex A).
 - On the top left it says “**DAB - nett**”. There you can choose the NRK network with 7 regions, the national commercial network or the local networks. If you choose the NRK network, you will see that each DAB region has different colours.
 - Below where it says “Region”, you can turn off the colours for each region if you needed. If you click where it says “Tunneller”, you can see which road tunnels have DAB coverage. There are road tunnels with DAB coverage on these test routes.

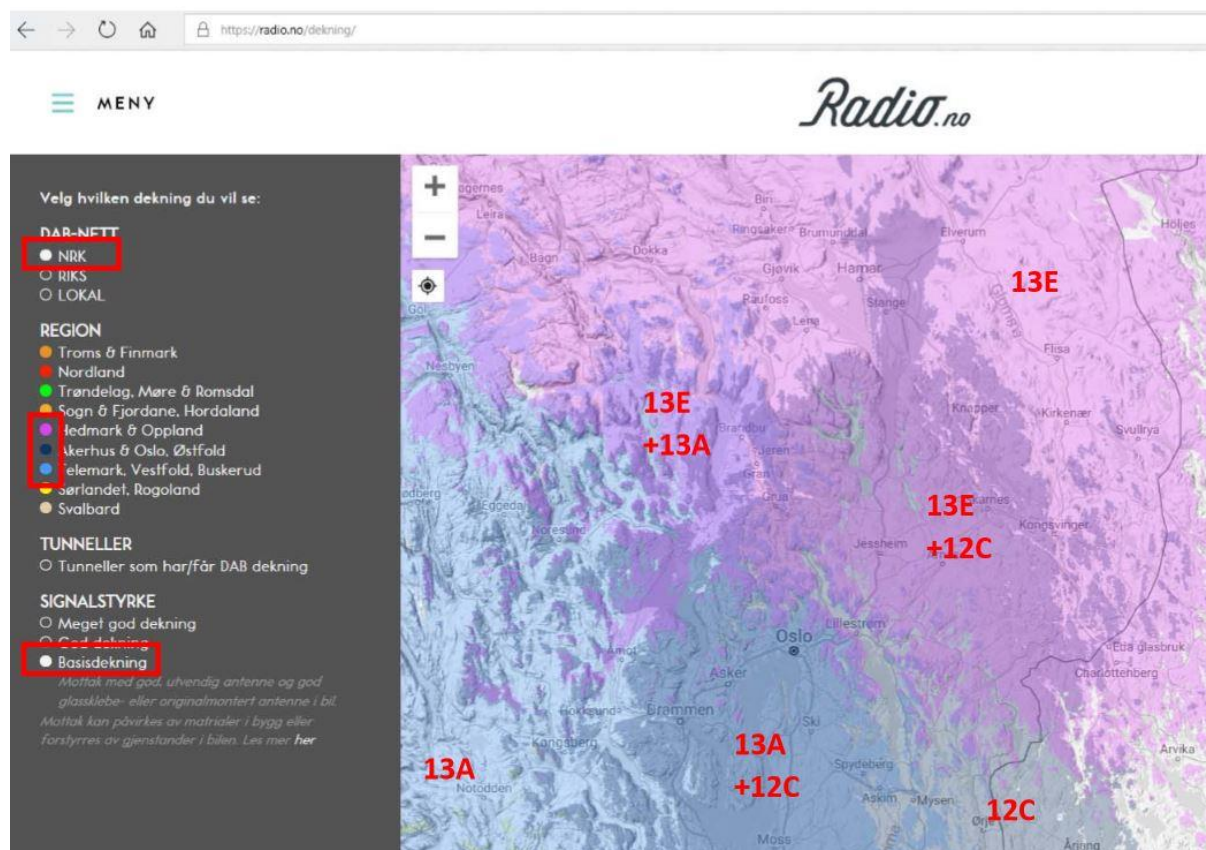
- Where it says “Signalstyrke” (Signal strength) you can choose between the levels of coverage:
 - “Meget god dekning” (expected indoor coverage - cities) – 54d BμV/m
 - “God dekning” (expected indoor coverage - countryside) – 48 dBμV/m
 - “Basisdekning” (expected automotive coverage) – 42 dBμV/m (min. req.)

Annex A – coverage maps around Oslo with overlapping regions

The map below shows DAB coverage at 42 dBμV/m (minimum automotive required level in Norway) with three regions and overlapping areas.

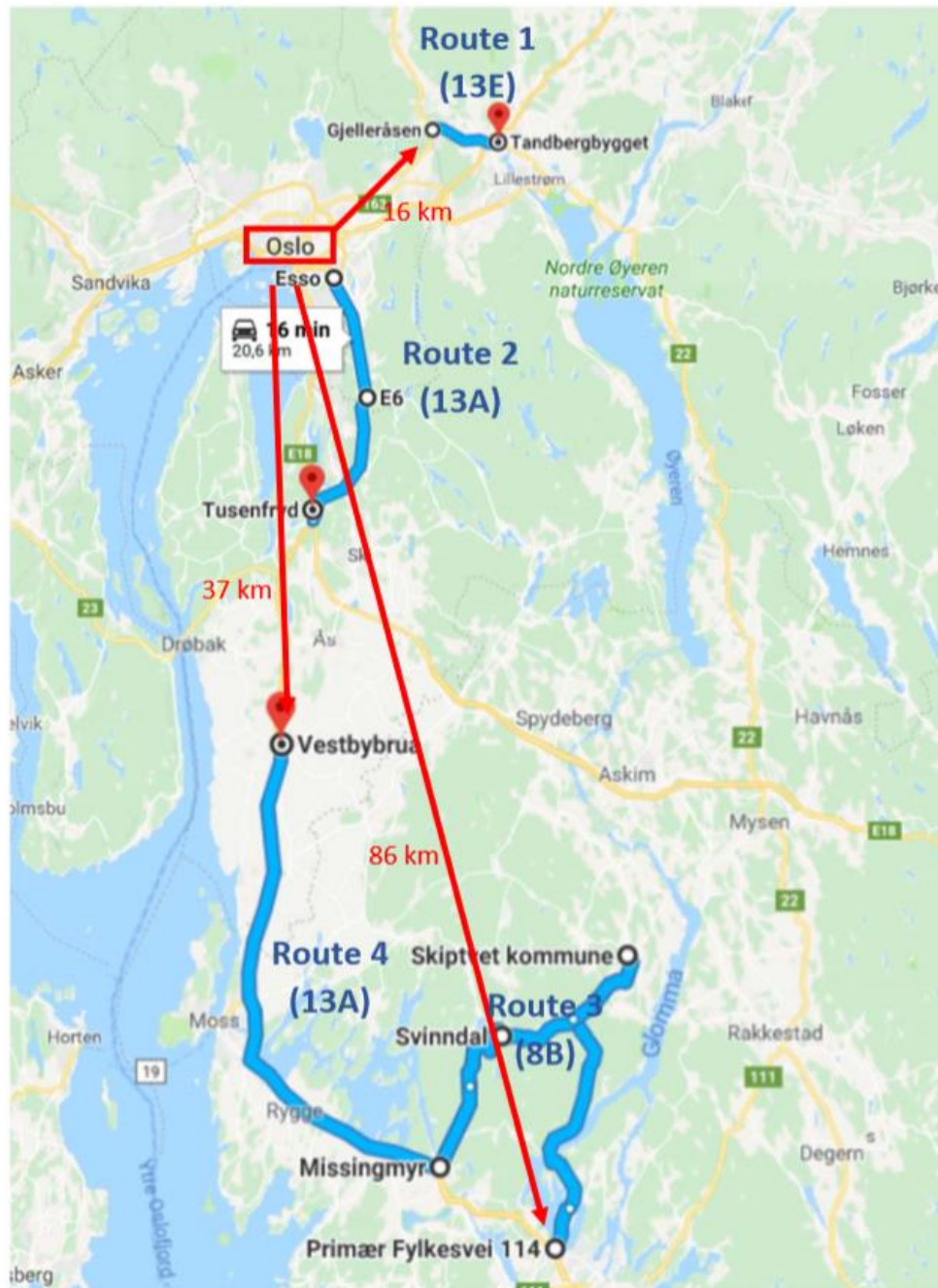
The coverage map is available at www.radio.no/dekning/

Please select the NRK DAB network (“NRK DAB-NETT”) and the coverage equivalent to automotive reception (“Basisdenking”). A coverage map for a specific region can be turned off by clicking on the respective colour dot on the side bar.

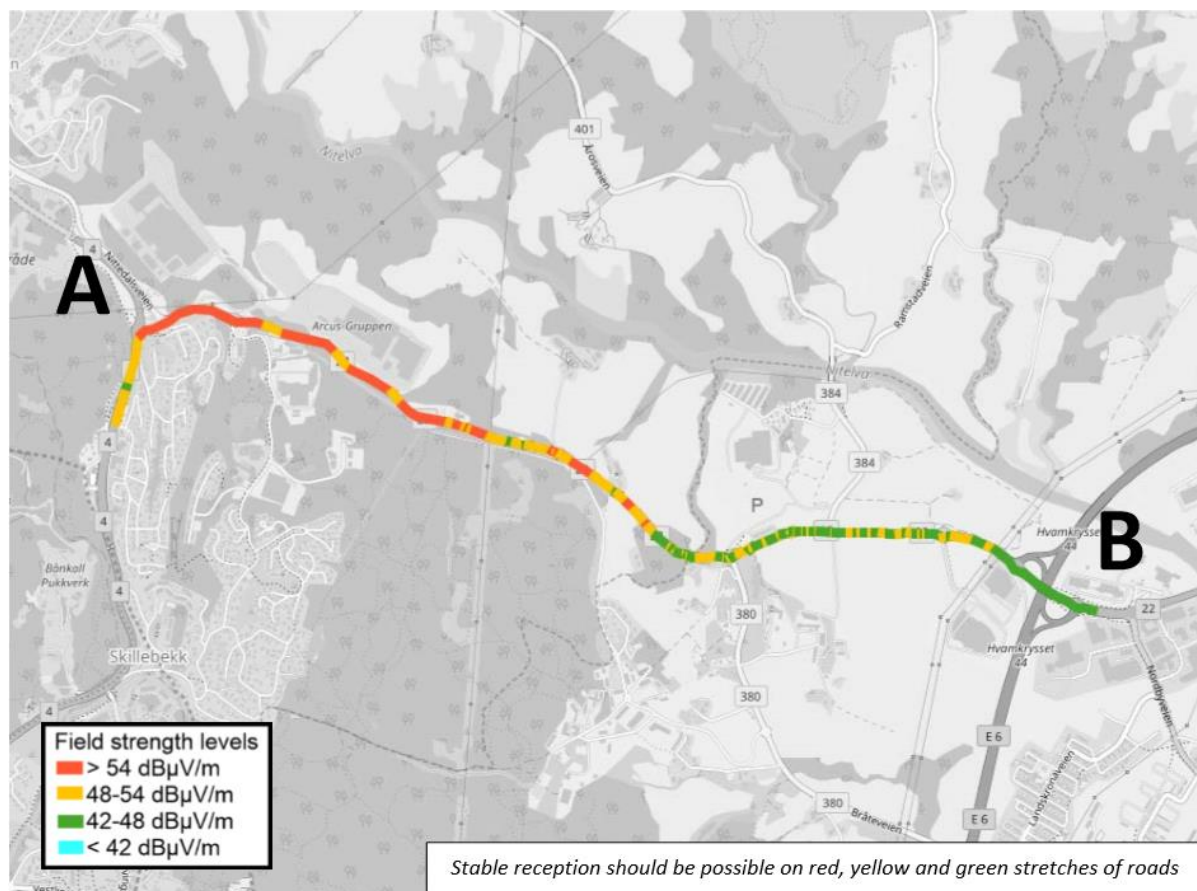


Annex B – Short range routes for sensitivity

Overview of routes for sensitivity testing



1. Sensitivity testing at 13E (237.488 Mhz)



Test route length: **5.6 km**

Distance from Oslo city: **16 km (min) to 20 km (max)**

Coordinate A / Google map name: **59.9891N, 10.9306E / "Gjelleraasen"**

Coordinate B / Google map name: **59.9804N, 11.0119E / "Tandbergbygget, Kjeller"**

Service used for testing on 13E: **"NRK P1 HED&OP" (long label), "NRK H&OP" (short label)**

Direction of the main 13E beam: **from north - west**

Description of the test route:

A is the highest point of the route and signal strength is above 54 dBuV/m. On the way down signal strength goes down to 48-50 dBuV/m. on the flat area, signal strength dropses several times under 48 dBuV/m, only reaching 42 at the very end, after crossing the motorway, reaching B.

Why this route is interesting: **if no drop is occurring in either direction, then the overall sensitivity of the receiver matches the Norwegian minimum requirement of 42 dBuV/m. The probability of man-made noise along the route is low (not detected).**

2. Sensitivity testing at 1A (230.784 Mhz)

Test route length: **20km**

Distance from Oslo city: **4km (min) to 24 km**

Coordinate A / Google map name:
59.8943N, 10.8054E / “Esso Ryen”

Coordinate B / Google map name:
59.7489N, 10.7802E / “Tusenfryd”

Service used for testing on 13A:
“NRK P1 VESTFOLD” (long label), “NRK VSTF” (short label)

Direction of the main 13A beam: **from west**

Description of the test route:

From A to Skullerud, only very sensitive receivers would be able to decode a stable signal. From Skullerud to exit 26, signal strength is above 42 and reception should be good. From exit 26 to the tunnel, signal strength is mostly above 54, especially in the higher parts of the road.

Why the route is interesting:

The very first stretch enables to identify very good receiving equipment. After Skullerud, if no drop is occurring, the overall sensitivity of the receiver matches the Norwegian minimum requirement of 42 dBuV/m. The occurrence of man-made noise is possible (populated and industrial areas), though not detected.



3. Sensitivity testing at 8B (199.360 Mhz)

Test route length:

25km (A to B); 24 km (B to C)

Distance from Oslo city:

86km (to A); 75 km (to C)

Coordinate A / Google map name:

59.2963N, 11.0733E “Gralum”

Coordinate B / Google map name:

59.4713N, 11.1673E “Skiptvet”

Coordinate C / Google map name:

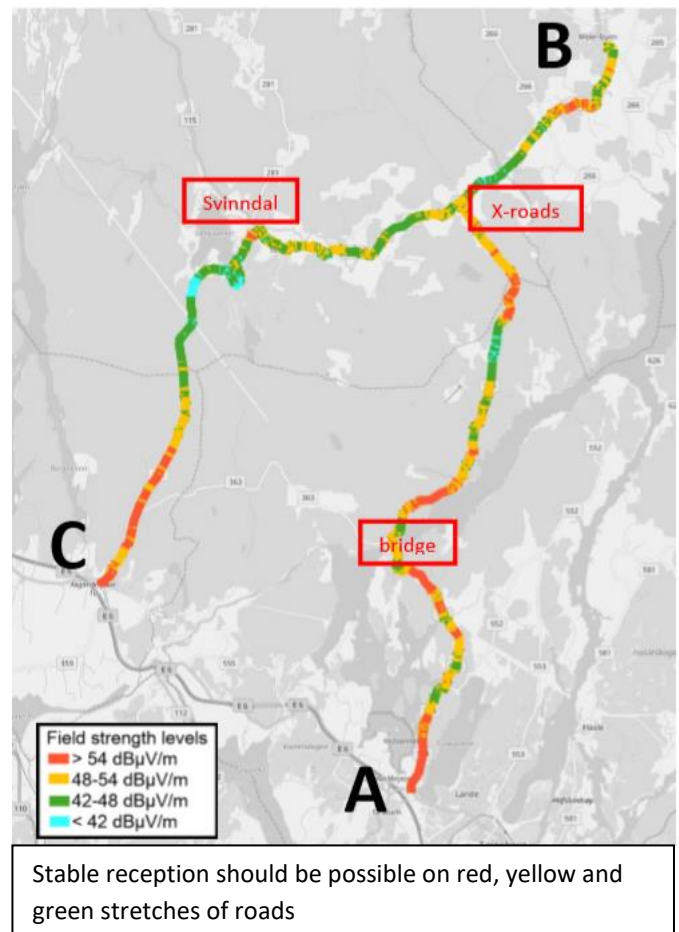
59.3454N, 10.9326E “Missingmyr”

Service used for testing on 8B:

“Radio Øst”

Direction of the main 13A beam:

a mix of east and south (near A), east (near B), west and east (near C)



Description of the test route:

A to B: From A to the bridge, signal strength does barely go under 48 dBμV/m. Until the crossroad, it barely “touches” 42 dBμV/m. Right after the crossroads, on the way to B, the signal strength remains stable just above 42 dBμV/m but not under (green part).

B to C: From B to crossroads at Svinndal, signal strength is everywhere above 42 dBμV/m. Right after Svinndal, signal strength drops a few places under 42 dBμV/m, but is possible to decode with very good receivers.

Why the route is interesting:

It is a good opportunity to test a frequency on the lower part of the DAB spectrum. No drop between A and B in either direction means that the overall sensitivity of the receiver matches the Norwegian minimum requirement of 42 dBμV/m. The same from B to C shows that the receiver is even better. The probability of man-made noise along the route is close to zero. But beware of the moose.

4. (Additional) Sensitivity testing at 13A (237.488 Mhz)

Test route length:

42km (A to B)

Distance from Oslo city:

37km (to A); 79 km (to B)

Google map name A:

“Vestbybrua”

Google map name B:

“Missingmyr” (cf. test route for 8B above)

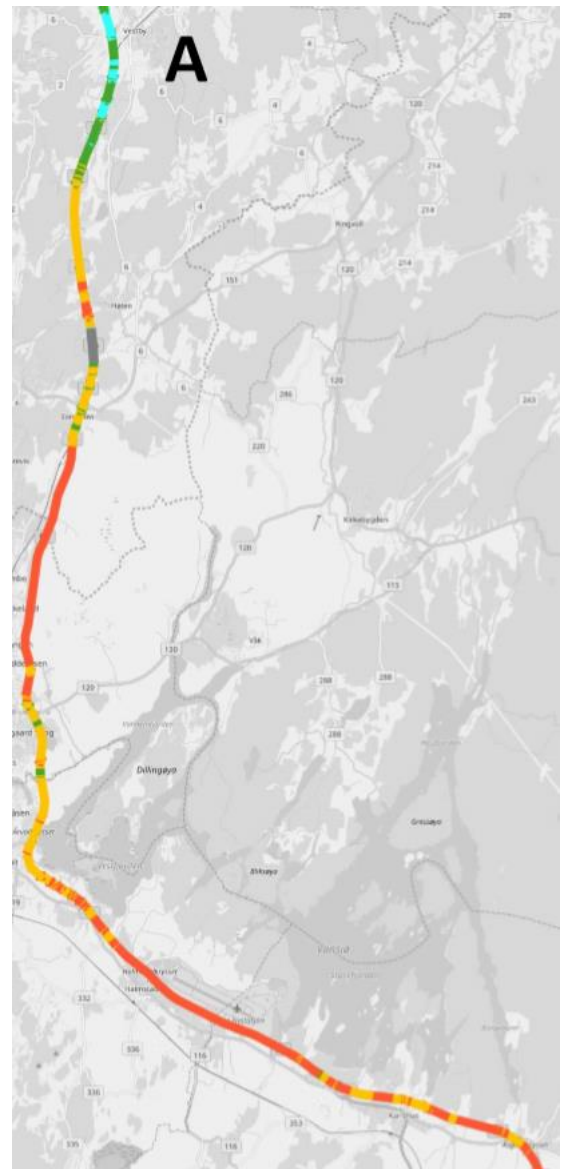
Service used for testing on 13A:

“NRK P1 VESTFOLD” (long label), “NRK VSTF” (short label)

Description of the route:

The very start could be demanding for some receiver, since the field strength drops under 42 dBuV/m on short stretches of road.

Apart from the vicinity of A and one tunnel, reception should be stable all the way to point B.

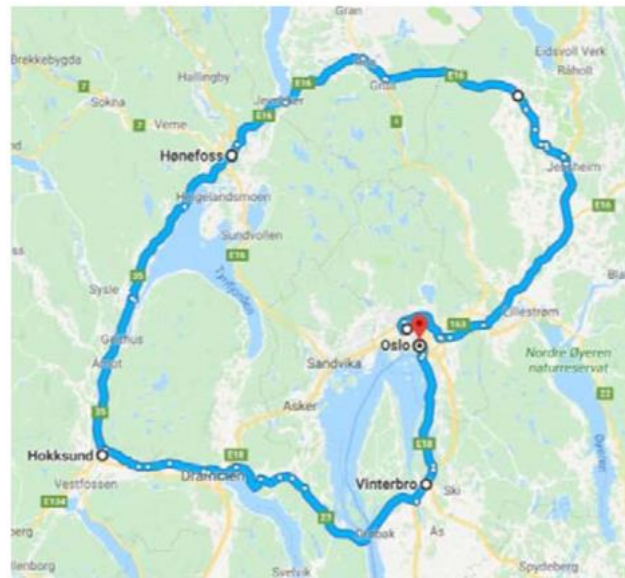
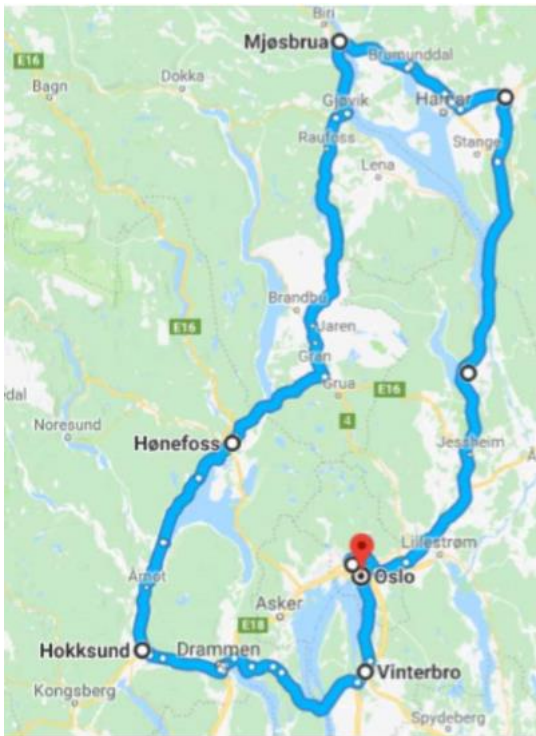


Stable reception should be possible on red, yellow and green stretches of roads

Annex C – Long range test routes for overall user experience

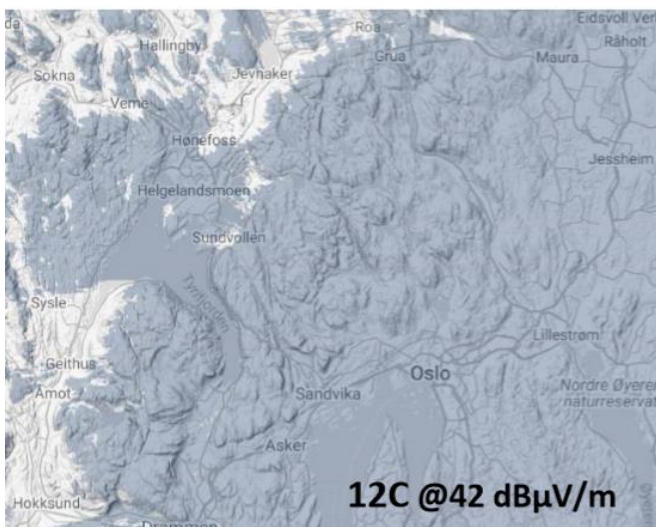
(route maps and coverage maps of the relevant DAB regions)

On this route, we suggest listening to a service which has its equivalent in all regions (same SID), eg: **NRK P3, NRK mP3, NRK Jazz, NRK Klassisk** (pick your favourite)

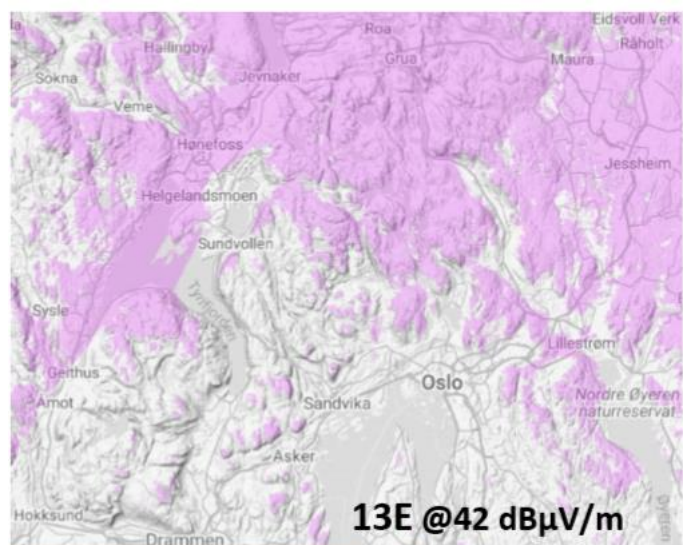


Test route 1 (257 km -4h)

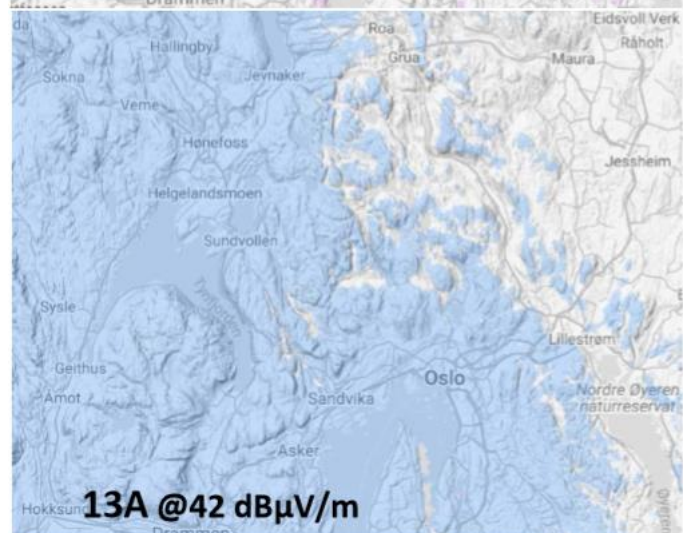
**Test route 2
(429 km -6h15)**



12C @42 dBμV/m



13E @42 dBμV/m



13A @42 dBμV/m