Jammertest 2025

Information Meeting May 26th 2025

Nasjonal kommunikasjons-myndighet

Statens vegvesen

FFI Norwegian Defence Research Establishment

Justervesenet

Norsk Romsenter Norwegian Space Agency

Kartverket

AVINOR

TESTNOR

Agenda

- Jammertest 2025
- Program
- Locations
- Communication
- Safety
- Practical information

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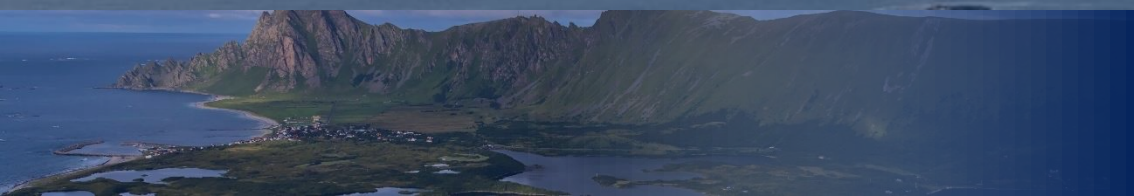
Project leader,
Testnor

Jammertest 2025

Jammertest is the largest open satellite signal resilience test in the world. Sophisticated attacks allow industry and authorities to test their systems and products for potential weaknesses against realistic and extreme signal disturbance attacks.



Why Jammertest?

- The geography
- The rig
- The capabilities
- The people


LIVERPOOL
STRØM
TERSKO
Polar Quality

What’s in it for us?

- Increase public awareness
- Increase expertise
- Increase cooperation
- Regulatory preparedness

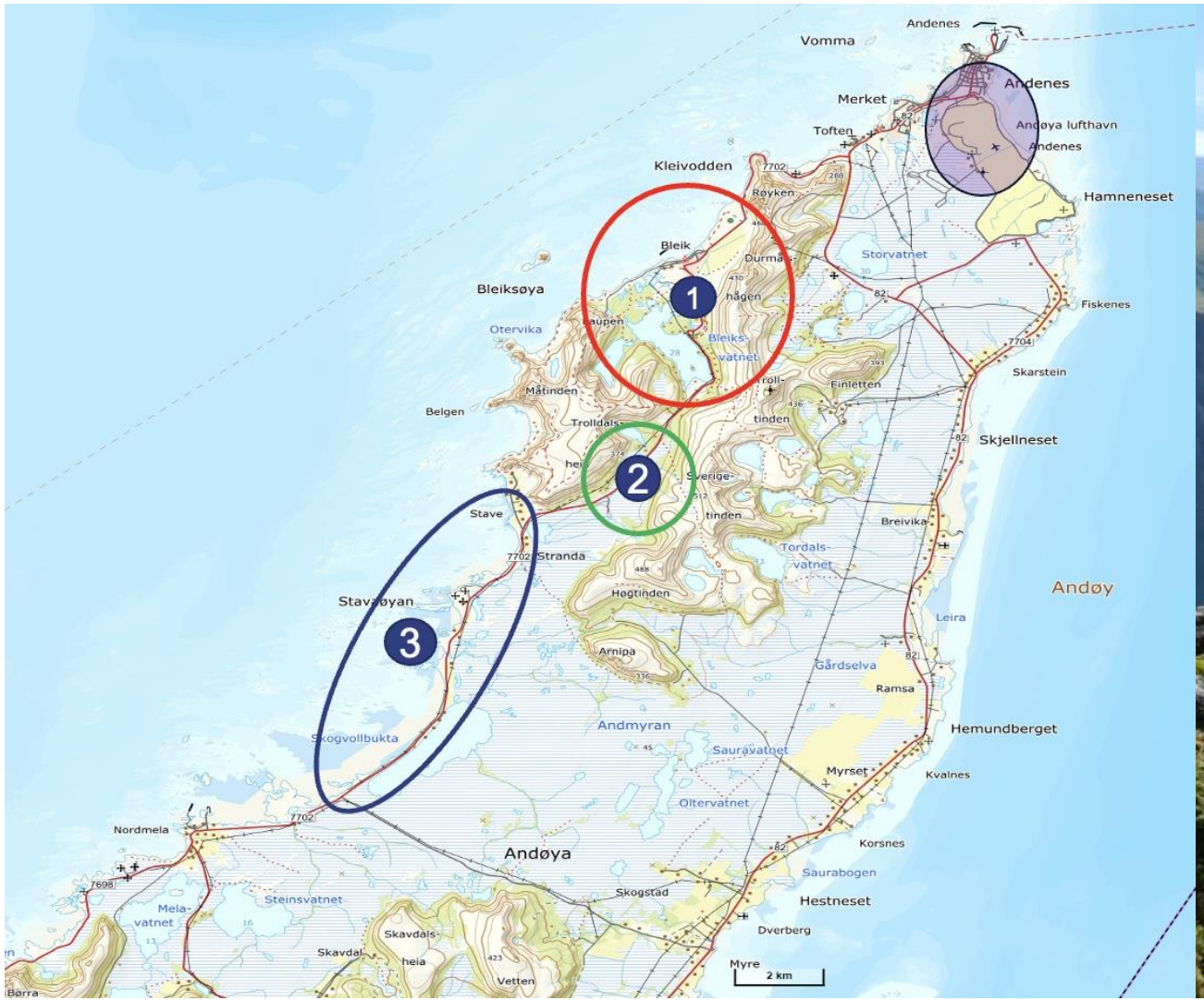
The end game:

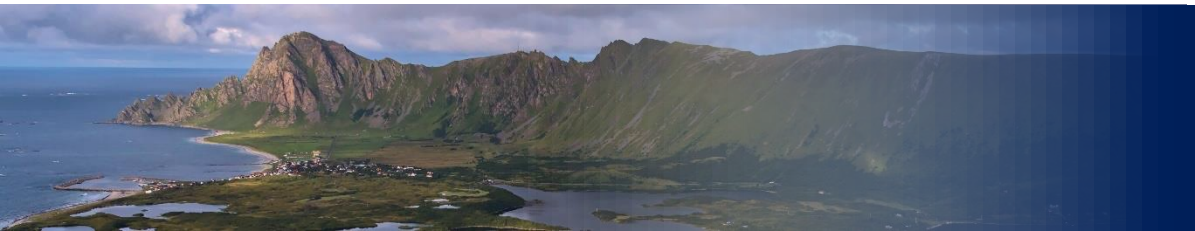
<u>More robust and resilient products</u>

Jammertest 2025

- 15.-19. September
- Applications from 150 organizations and 24 countries
- Capabilities for over 250 unique tests
- 4 different test areas
- A big variation of participants


Image © 2021 CNES / Copernicus
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image U.S. Geological Survey
Image IBCAO





JAMMERTEST 2025 – September 15th – 19th

High Power Jammer

The high power jammer at test site 1 is located high in the hillside to cover a large area on both land, sea and in the air

1

2

JAMMERTEST

1

Test Site 2

This smaller and most remote site is suitable for isolated low-power jamming activities.

2

1

Test Site 3 - Start

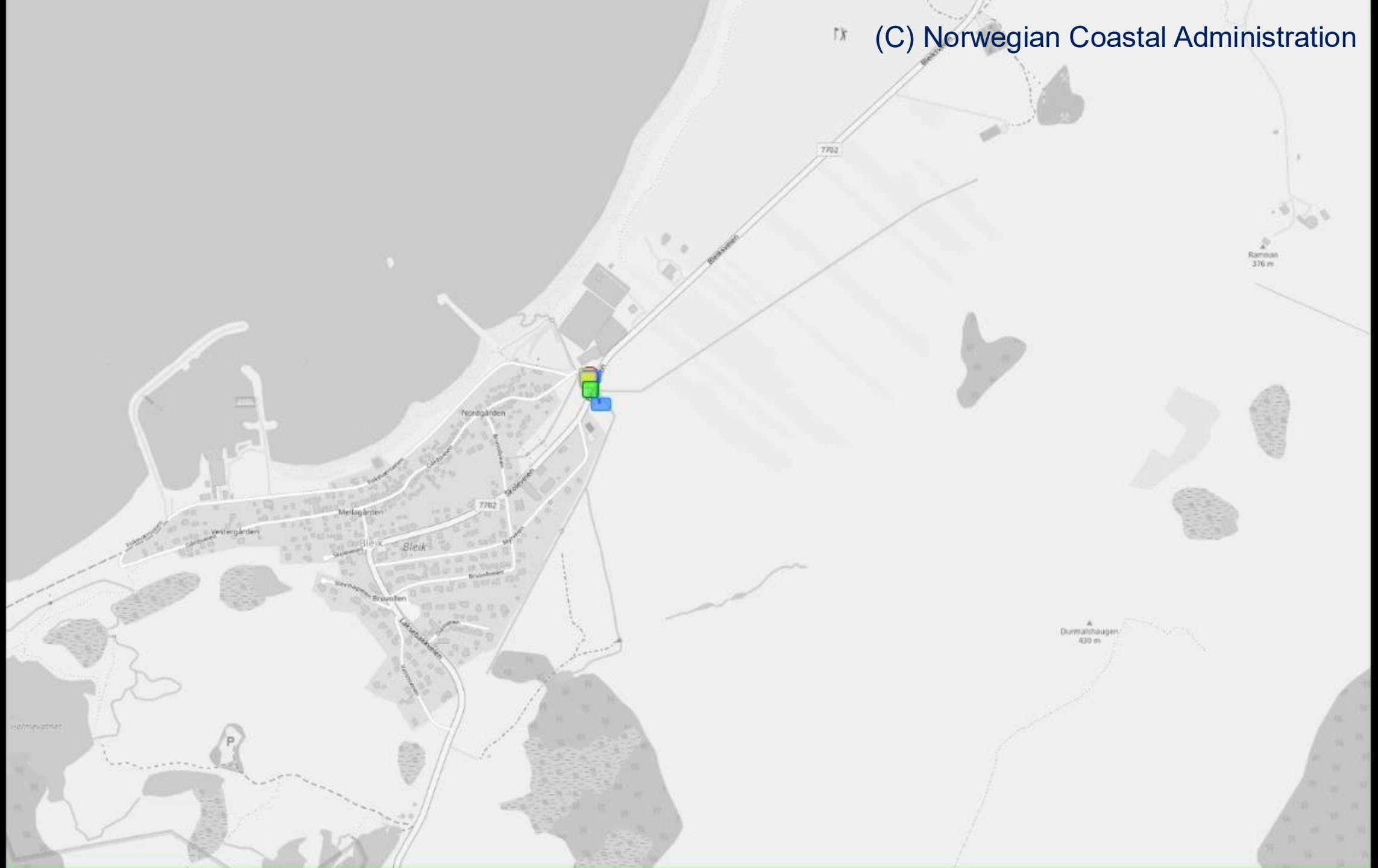
This site is ideal for motorcade testing, with excellent visibility across a long road stretch.

JAMMERTEST

What organizers expect from test participants in 2025?

IMPROVEMENTS!

Different GNSS clock card responses to large time jump spoofing in 2024


(C) Norwegian Coastal Administration
7702
Bleiksveien
Nordgården
Merlagården
Vestergården
Bleik
Bruvollen
Ramnan
376 m
Durmalshaugen
430 m

What to expect at Jammertest 2025?

- Same test areas and quite similar transmission plan as 2024
  - Improvements from participants
  - Support from Finnish Defence Forces
  - Some new concepts
- All domain testing (maritime, land, air, cyber and space)
- Jamming, spoofing and meaconing of GNSS signals

Program overview

Time Schedule

Monday

- ❑ 09.00 – 11.00 Arrival, registration and equipment deployment
- ❑ 11.00 – 13.00 Welcome and safety brief
- ❑ 13.00 – 14.00 Lunch at HQ (Bleik)
- ❑ 14.00 – 18.00 Afternoon test block
- ❑ 18.10 – 18.30 Evening debrief; safety and potentially sharing results
- ❑ 20.00 – 22.00 Networking dinner

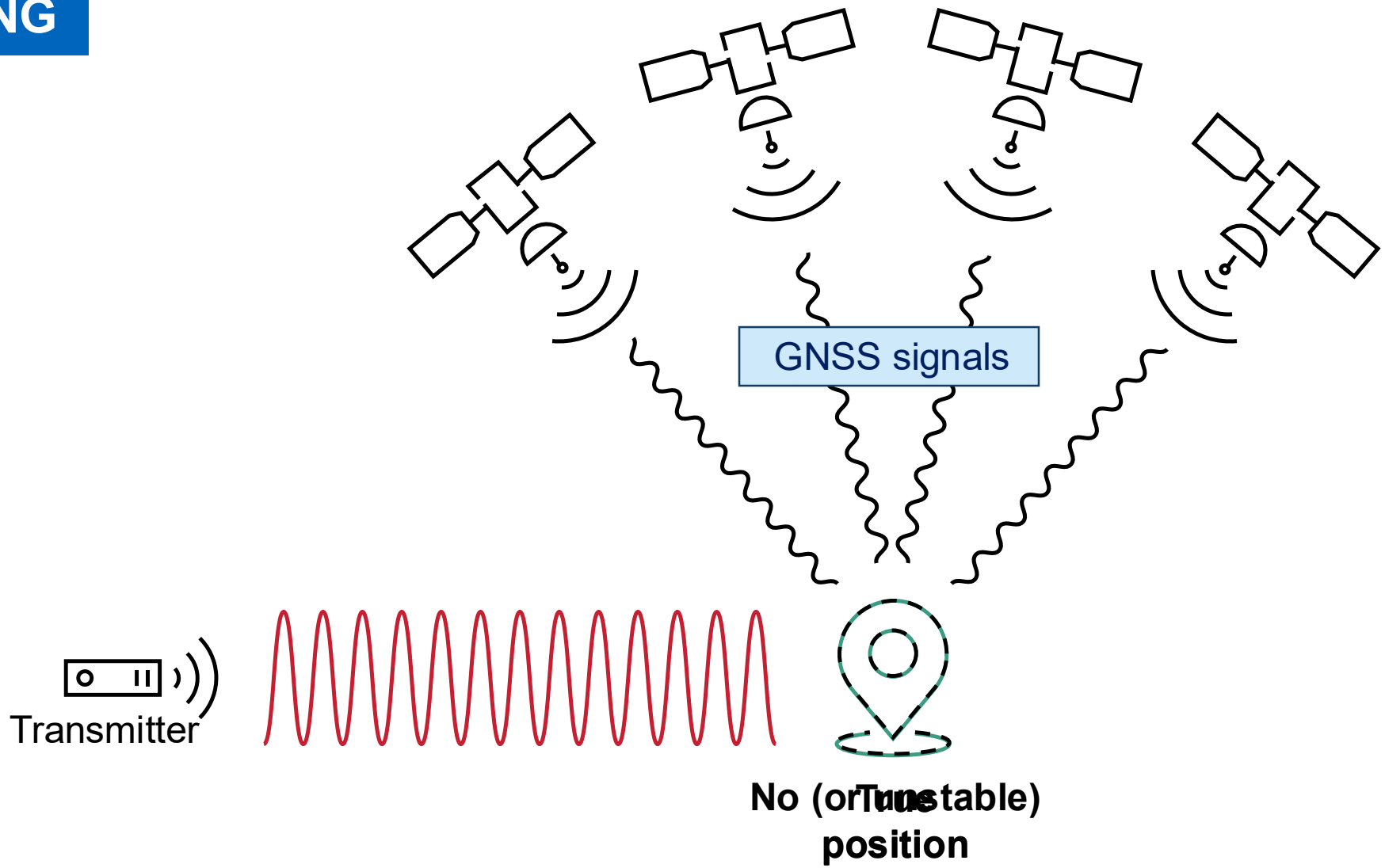
Tuesday, Wednesday, Thursday

- ❑ 08.00 – 08.30 Morning safety brief
- ❑ 09.00 – 13.00 Morning test block
- ❑ 13.00 – 14.00 Lunch at HQ (Bleik) and Stave
- ❑ 14.00 – 18.00 Afternoon test block
- ❑ 18.10 – 18.30 Evening debrief; safety and potentially sharing results

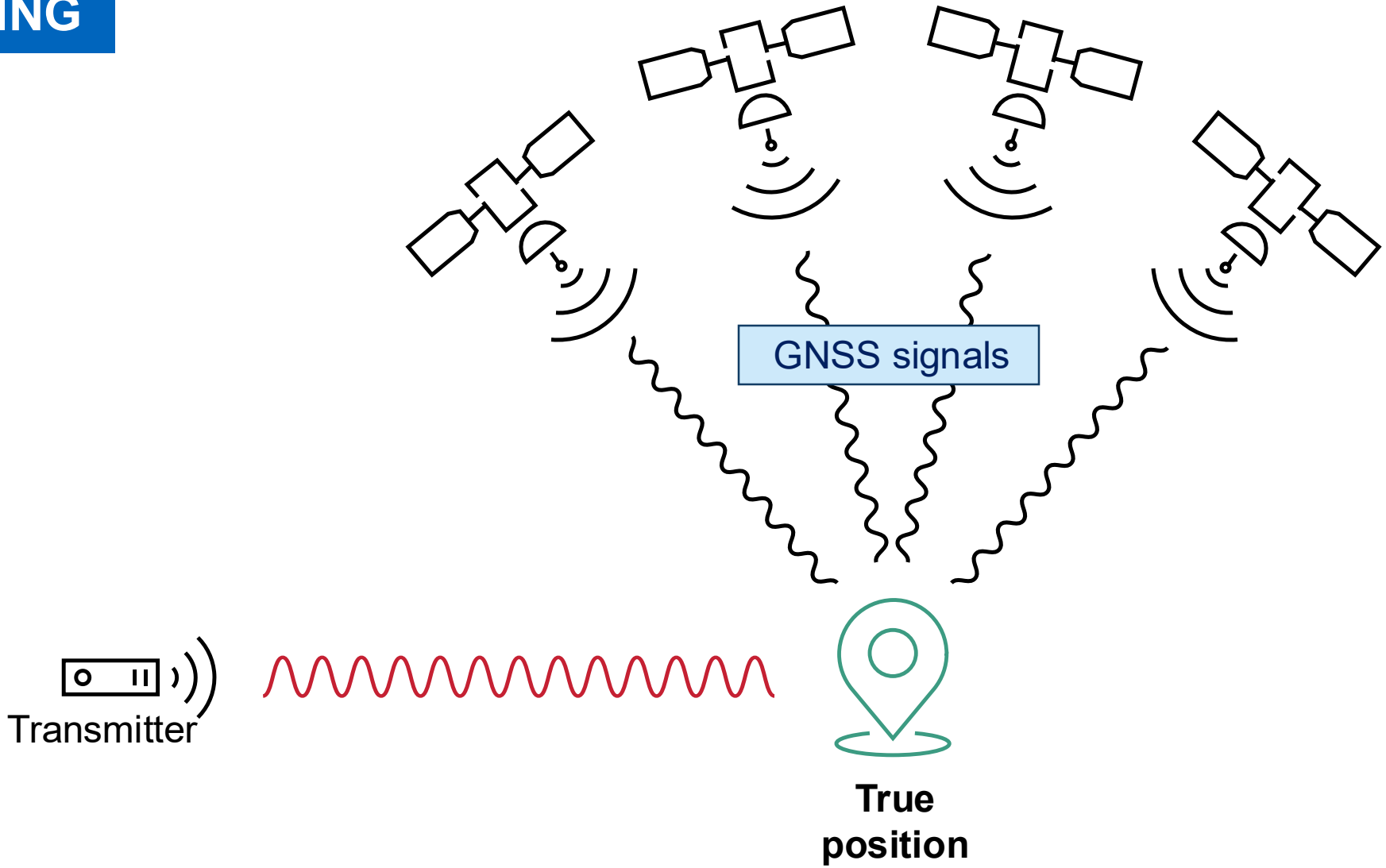
Friday

- ❑ 08.00 – 08.30 Morning safety brief
- ❑ 09.00 – 13.00 Morning test block
- ❑ 13.00 – 14.00 Lunch at HQ (Bleik) and potentially sharing results
- ❑ 14.00 – 16.00 Down rigg of equipment, goodbyes and departure

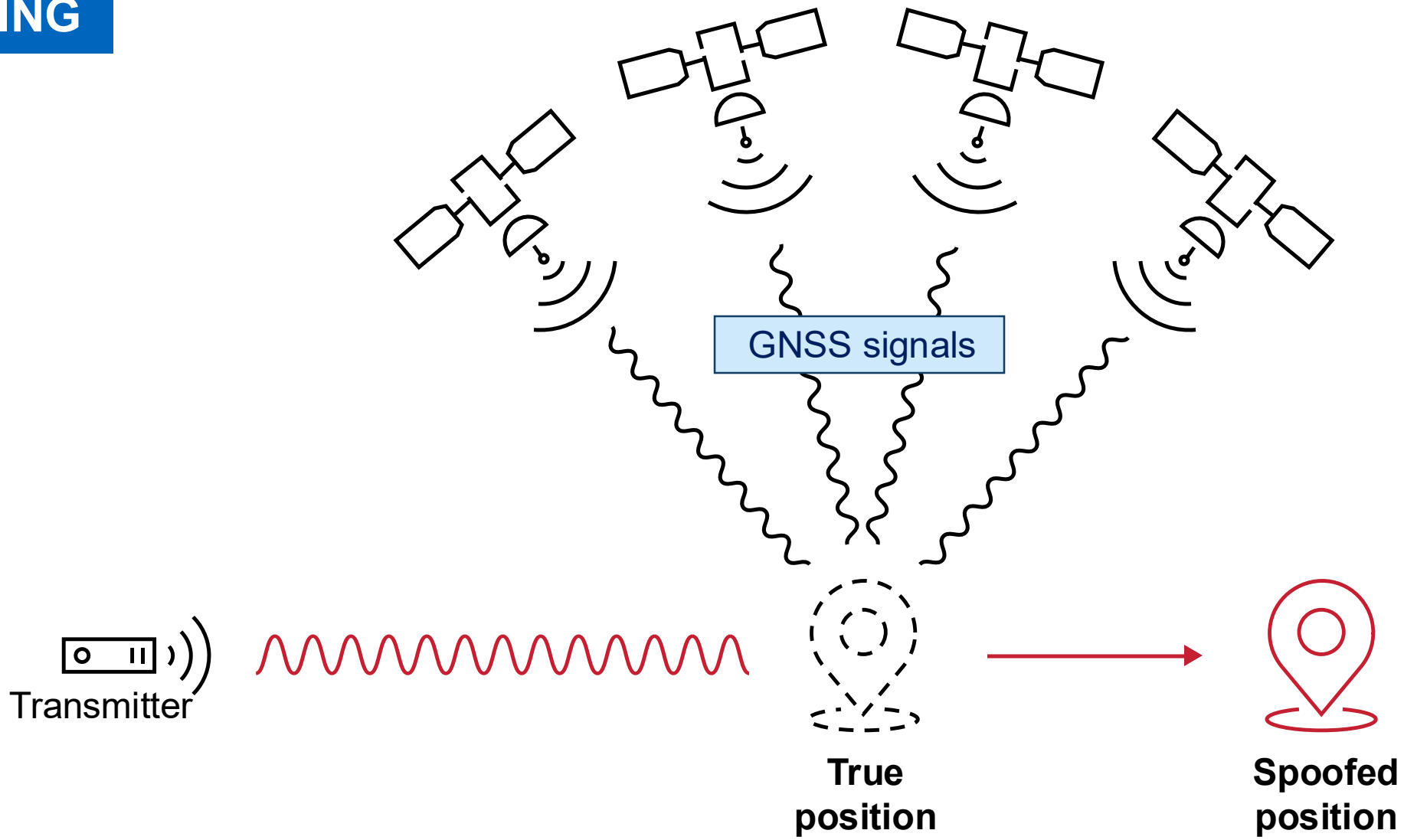
JAMMING


GNSS signals
Transmitter
No (or unstable) position
True position

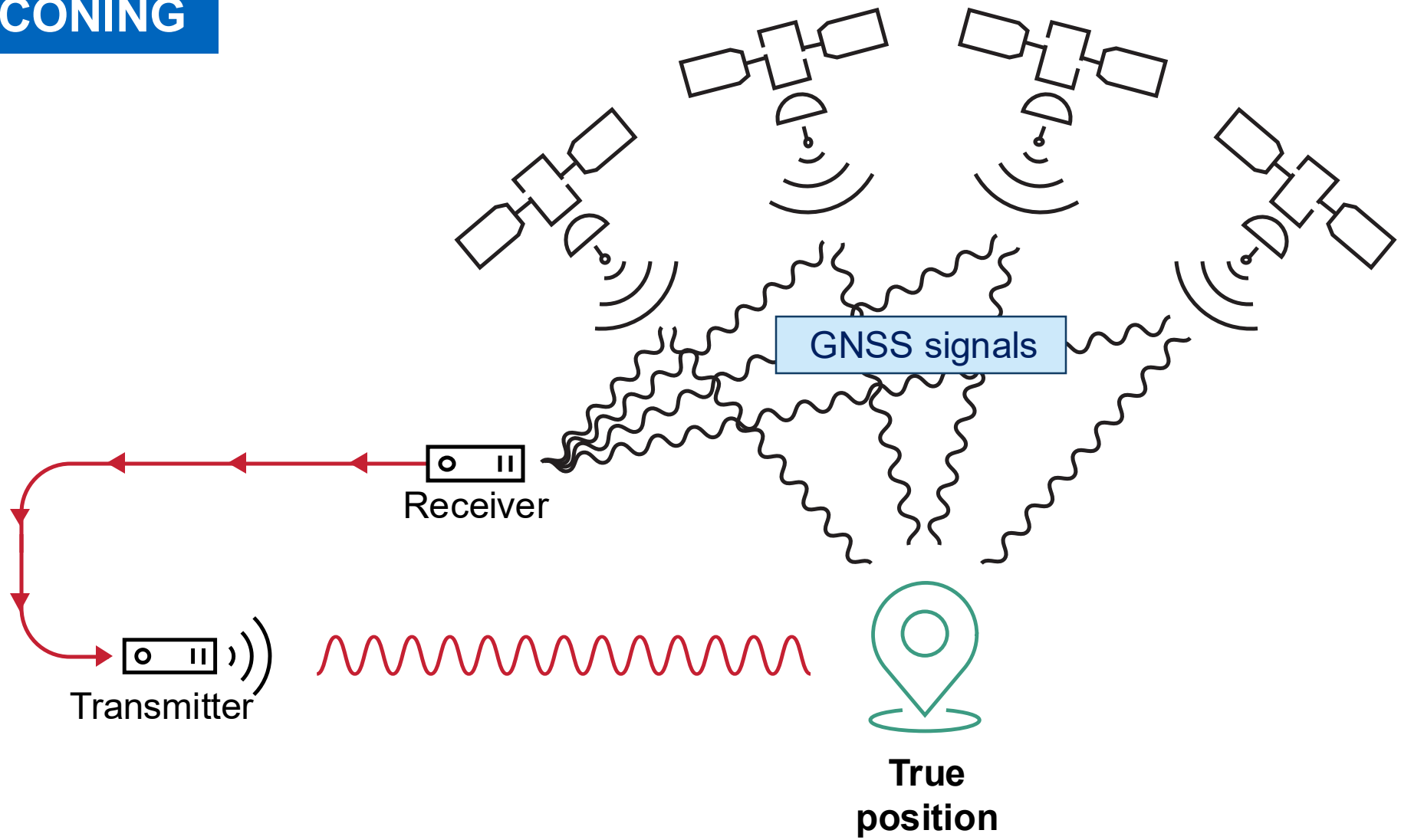
SPOOFING



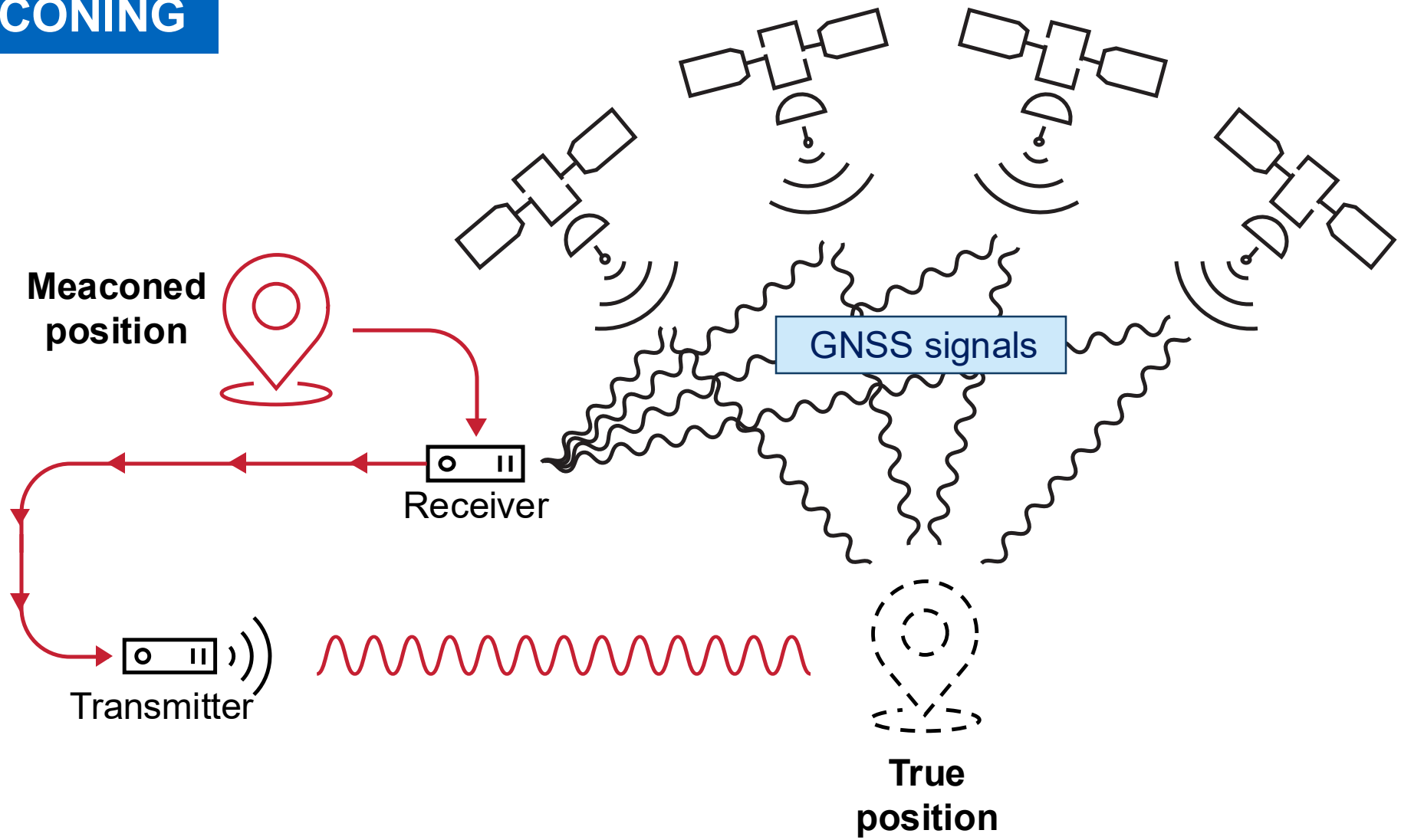
SPOOFING



MEACONING



MEACONING


Meaconed position
GNSS signals
Receiver
Transmitter
True position

Jammertest: Test catalogue, transmission plan and test log

Test catalogue of GNSS interference scenarios

2.4: Incoherent time spoofing from stationary spoofer using synthetic ephemerides 92
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2.4.13 Static + Pseudorange error, with initial and continous jamming 98

A subset of catalogued tests are actually transmitted

Transmission plan 2024

09:00	**09:00-09:25 - 2.4.2** **Time offset 15 minutes from real time, with power ramp** Power: 0.0316W Contact: Nicolai Gerrard (NKOM) **09:40-09:55 - 2.4.3** **Time offset -3 minutes from real time, with power jump** Power: 0.0316W Contact: Nicolai Gerrard (NKOM)
10:00	**10:10-10:25 - 2.4.12** **Static + Pseudorange error** Power: 0.0316W Contact: Nicolai Gerrard (NKOM) **10:40-10:55 - 2.4.13** **Static + Pseudorange error, with initial and continous jamming** Power: 0.001W Contact: Nicolai Gerrard (NKOM)

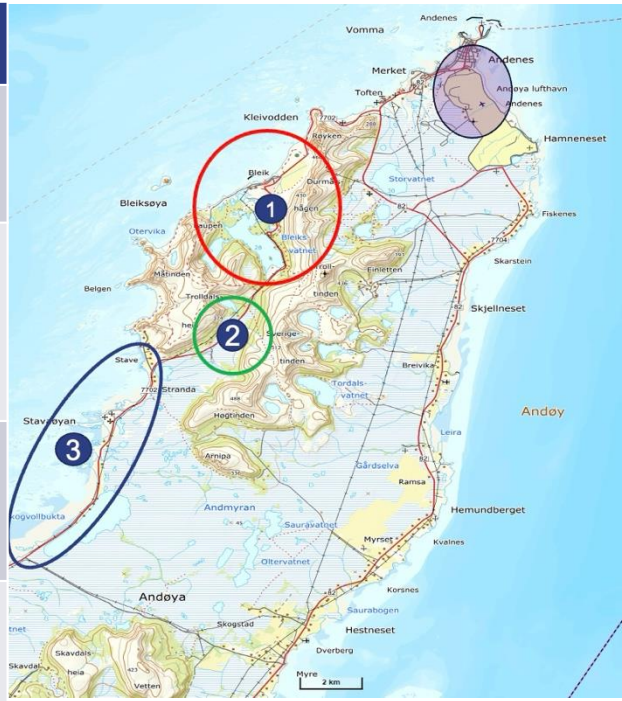
Test documents are machine readable (.json + .xls) to help automated data collection and analysis

2.4.13	Static + Pseudorange error, with initial and continous jamming	2024-09-12	10:50:08	10:50:21	Initial jamming (E6, L2, E5b, L5)
2.4.13	Static + Pseudorange error, with initial and continous jamming	2024-09-12	10:50:21	10:55:19	Jamming of L1, G1, B1I activated
2.4.13	Static + Pseudorange error, with initial and continous jamming	2024-09-12	10:55:19	10:55:23	Spoofing activated. Spoofing power different than TP
2.4.13	Static + Pseudorange error, with initial and continous jamming	2024-09-12	10:55:23	10:55:24	Jamming of E5b deactivated
2.4.13	Static + Pseudorange error, with initial and continous jamming	2024-09-12	10:55:24	10:55:25	Jamming of L5 deactivated
2.4.13	Static + Pseudorange error, with initial and continous jamming	2024-09-12	10:55:25	10:55:26	Jamming of L2 deactivated
2.4.13	Static + Pseudorange error, with initial and continous jamming	2024-09-12	10:55:26	11:05:21	Jamming of L1 deactivated. Time error of 9 ns/s. A total accumulated time error of 6 µs

Log of actual transmissions

Test block view of transmission plan

Day	Test area 1	Test area 2	Test area 3
Monday	**High power stationary jamming**	**Low power stationary jamming**	**Mobile spoofing in motorcade (mainly position, navigation)**
Tuesday	**Meaconing** **High power unintentional RFI** **Long-time high-power jamming (evening)**	**Circular multi-jammer scenarios** **Drone scenarios**	**Motorcade (with low-power jammers)**
Wednesday	**Stationary spoofing (mainly position, navigation)** **Long-time spoofing (evening)**	**Stationary spoofing and circular multi-jammer scenarios**	**Motorcade (with low-power jammers)**
Thursday*	**Stationary spoofing (mainly timing)**	**Circular multi-jammer scenarios** **Drone scenarios**	**Mobile spoofing in motorcade (mainly position, navigation)**
Friday	**Repetitions, variations of previous tests, special attacks**	**Site is closed!**	Possible repetition of **Motorcade (with low-power jammers)** TBD



**Thursday's test blocks also has airport jamming transmissions*

Test area 1: Main test area

High power jamming

Meaconing

Spoofing

Jammertest HQ at Bleik community house:

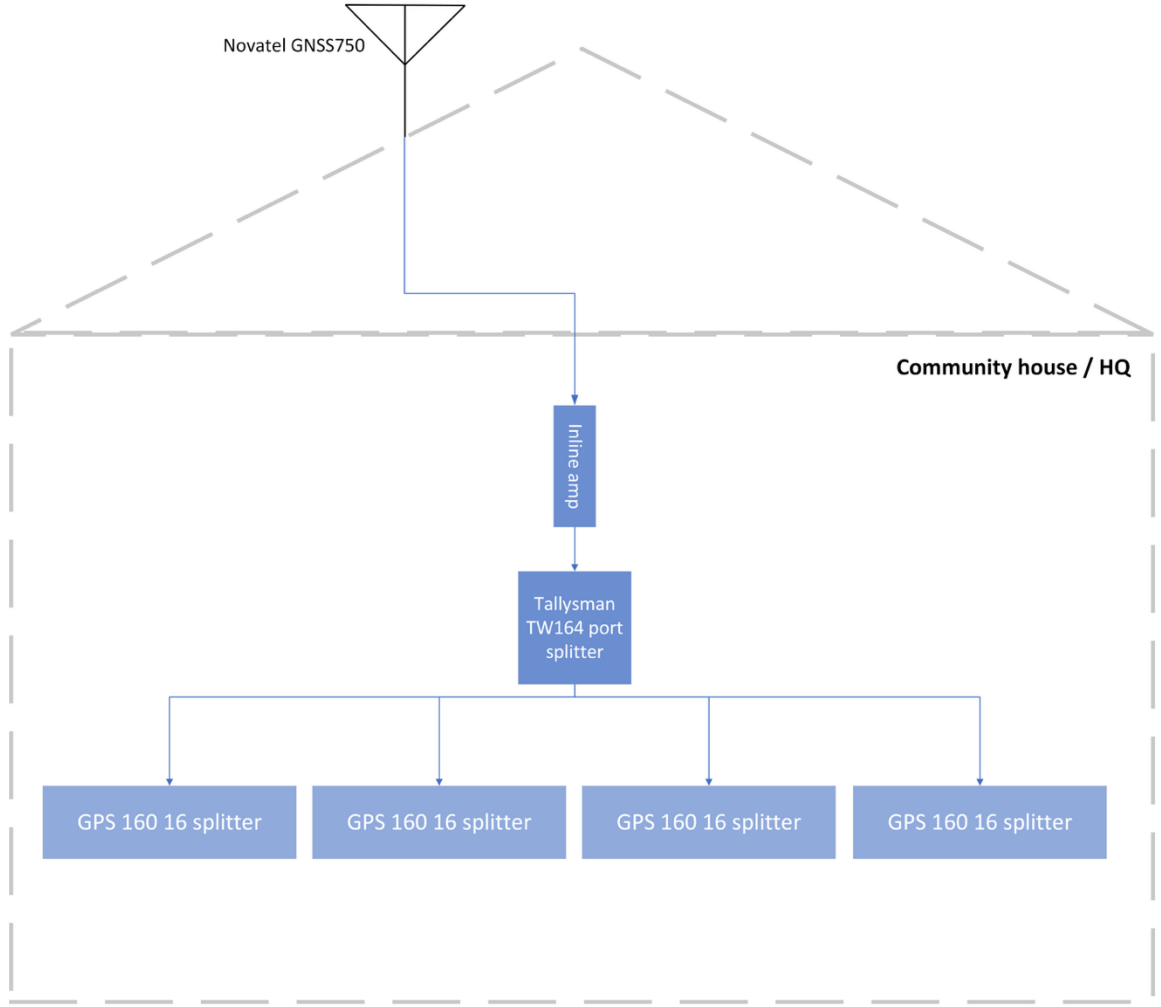
- Shared RF feed
- Reference timing

RF feed

A RF feed from a GNSS antenna will be set up to distribute signals to participants (who doesn't necessarily need their own antenna).

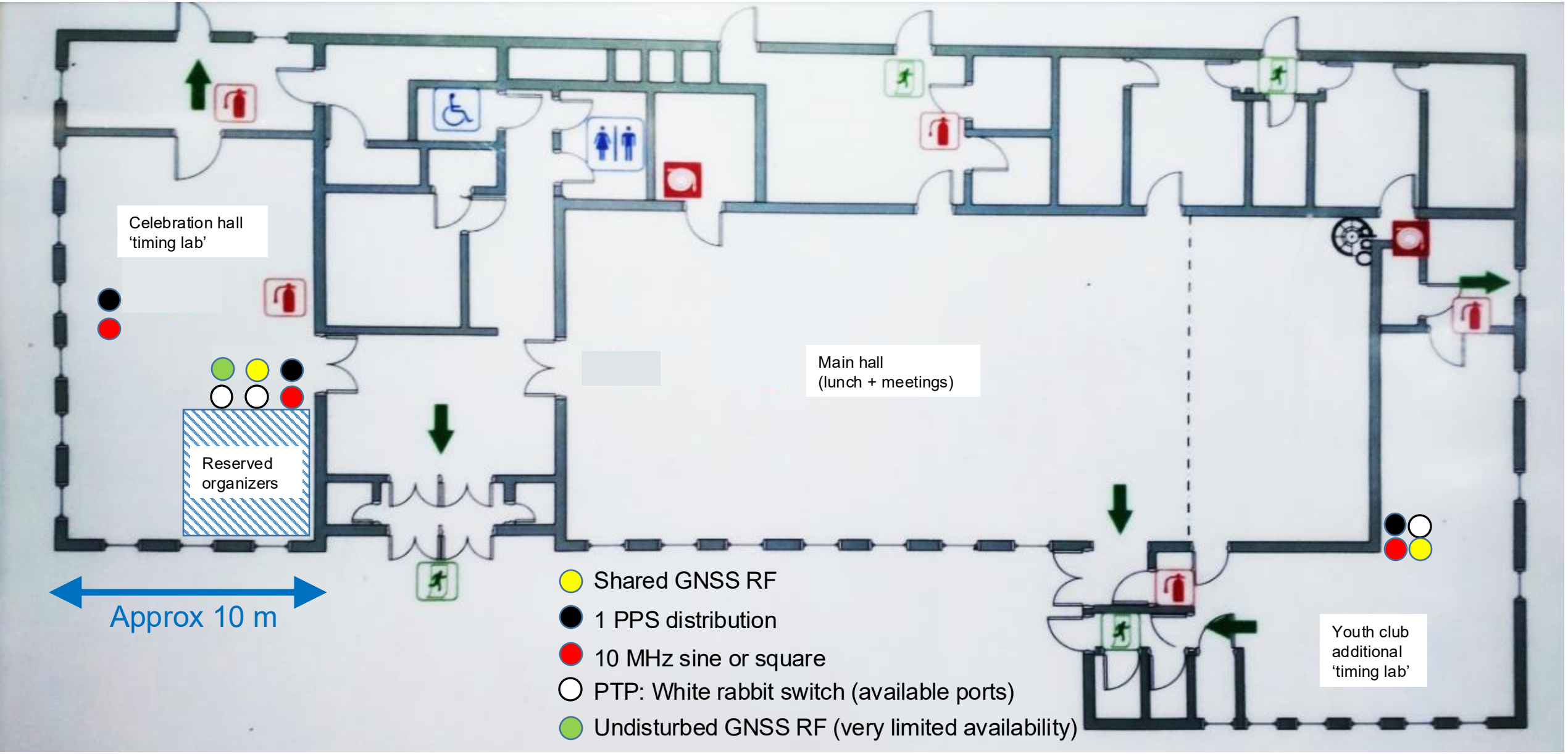
Amplifier will be applied to ensure that the signal strength at the splitters are approximately the same as received signal at the antenna

Splitter connectors will be N female.



There will be no bias voltage. If participants connect with DC to the feed, the ports are DC-filtered and terminated with 200 Ω (to simulate a GPS antenna)

Jammertest signal distribution at Bleik community house



Test area 2: Grunnvatn

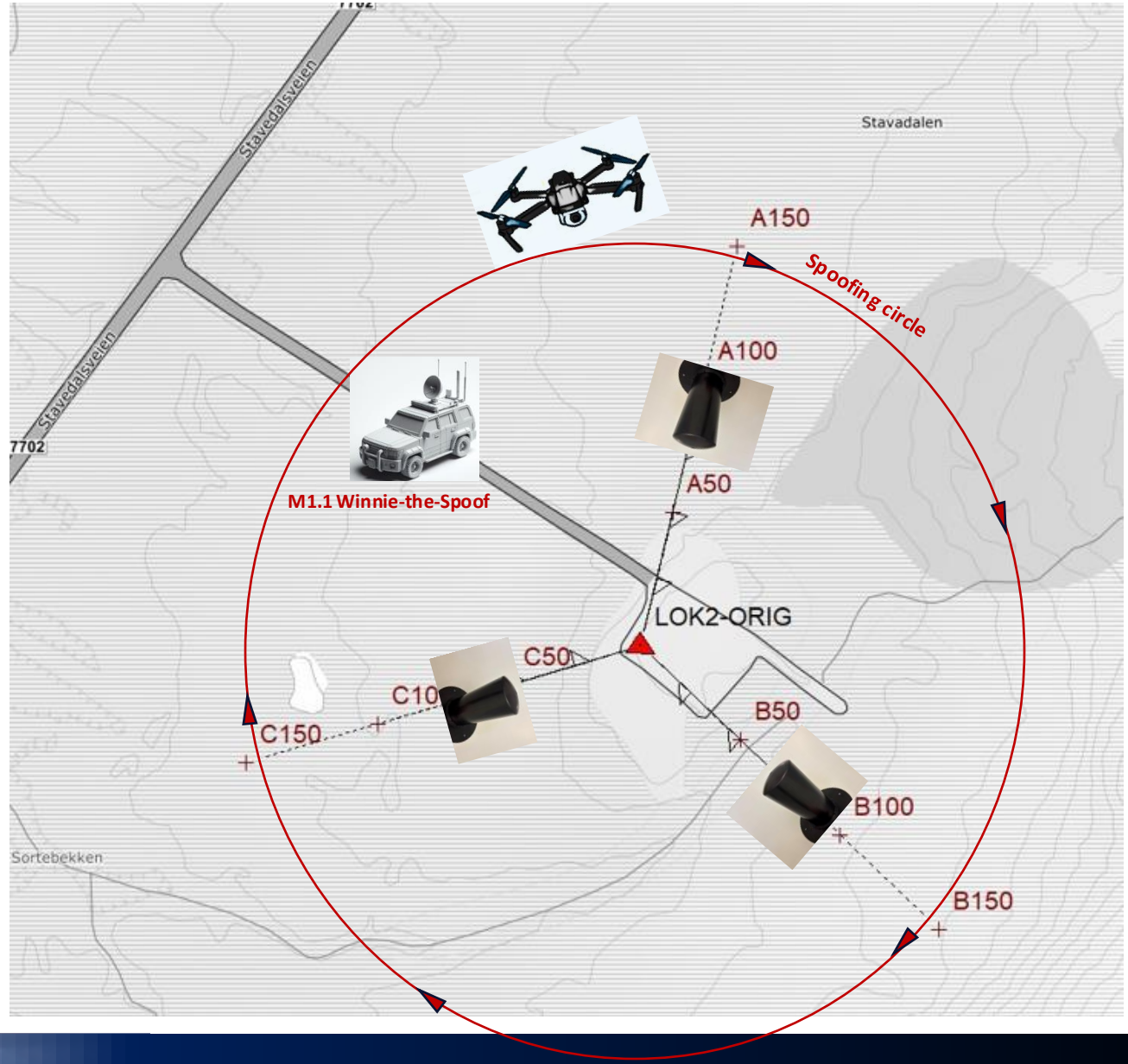
Low power jammers & spoofing

Multi-jammer scenarios

Spoofing & multi-jammer scenarios

Relevant for drones, CRPAs and mobile measurements in cars

(Have a look at testgroup 1.19, 1.20, 2.10 ☺)



Test area 2

Higher power than last year using
directive RHCP helix antennas

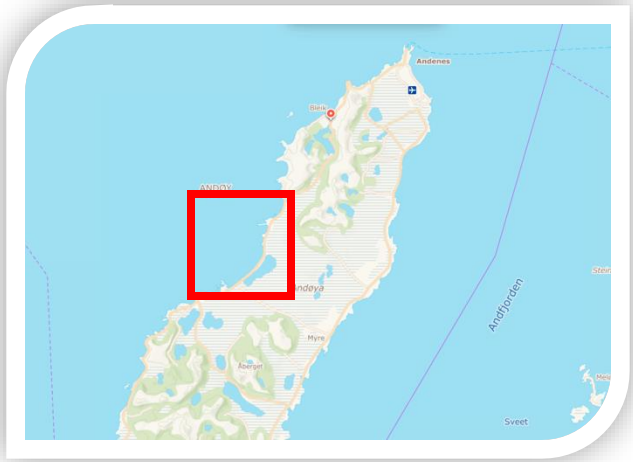
Test area 3: Motorcade

Low power jammers

Mobile spoofing

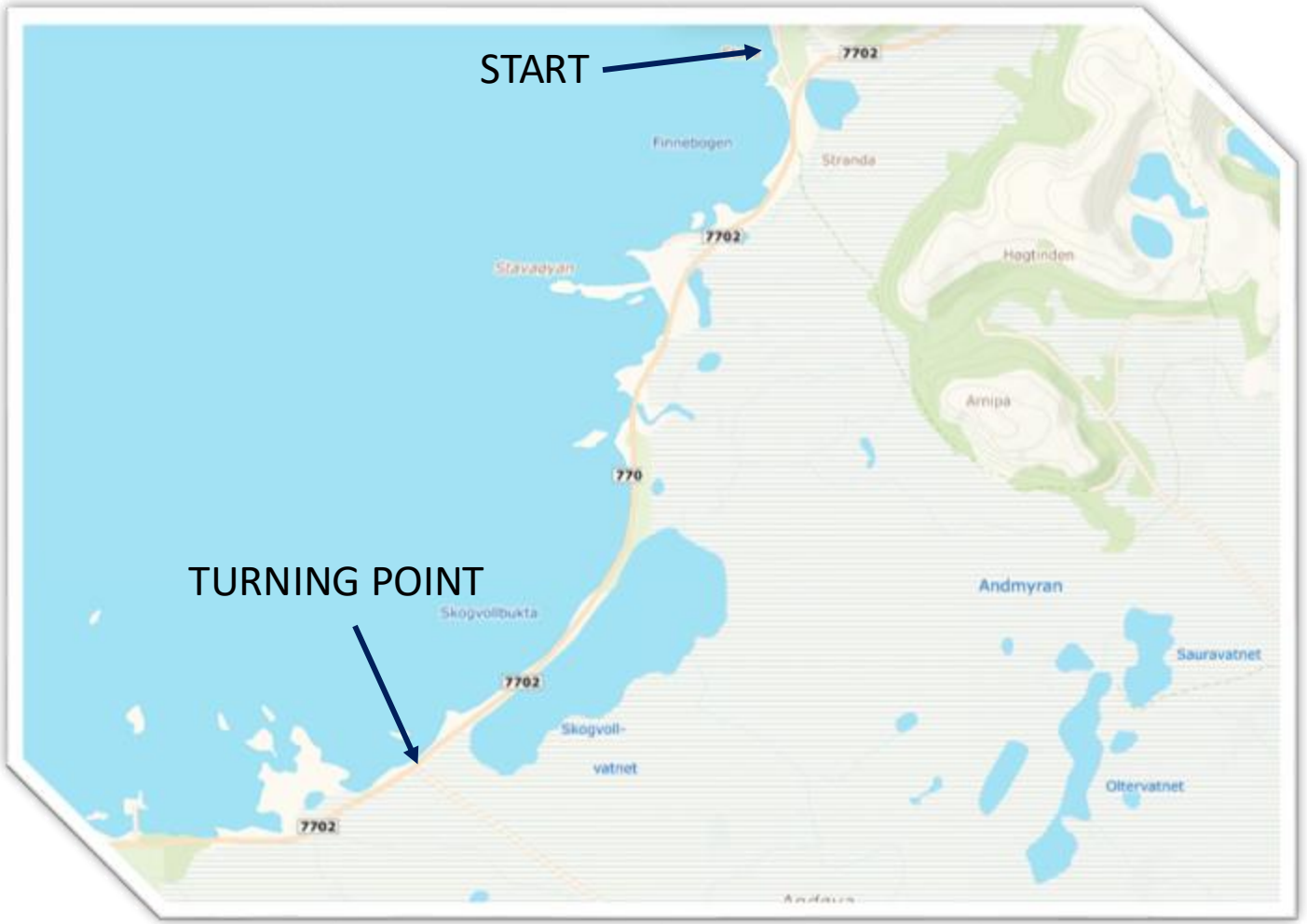
Restricted number of vehicles in motorcade

Test area 3 – a public road



Road number: 770
Distance: Approx 9 km

Start: Stave communal house
Turning point: Intersection



GNSS correction data

The Norwegian Mapping Authority (NMA / Kartverket) provides GNSS reference (correction) data based on geodetic grade receivers free of charge during the Jammertest week.

2 options for RTCM formatted real-time data:

- CPOS (Network RTK service). Requires NMEA input from user equipment.
- RTCM data streams from individual GNSS reference stations nearby the test areas (distances ~ 10 km - 60 km). Does not require NMEA input from user equipment.

Stored data for post processing:

- RINEX files from individual GNSS reference stations nearby the test areas (distances ~ 10 km - 60 km)
  - 1 Hz data rate
  - Choose between 1hour and 24hour files

More information and access details will be published at https://jammertest.no

See also:

https://www.kartverket.no/en/on-land/posisjon/user-guide-positioning-services

https://www.kartverket.no/en/on-land/posisjon/guide-to-cpos

Safety and security

Testing under real world conditions on open public roads can be dangerous! In order to make Jammertest as safe as possible a few simple requirements are laid down:

- Mandatory safety briefings every morning and afternoon
- Only registered participants are allowed on site – ID and visible name badge is required
- Zero tolerance for driving under the influence of alcohol and drugs
- Existing speed limits are in force during test
- Photography is allowed if you ask first
- Equipment shall be marked with company name
- Listen and conform to the organizer's requests
- Respect of the environment and the local community

Safety and security

- High visibility clothing is **MANDATORY** and shall be used at all times when outside! We recommend full jacket with company logo.

- Test vehicles shall be registered upon arrival and wear visible "Test vehicle" sticker

FM radio:
Radio Noise
99.0MHz

Communication channels

FM radio: *Radio Noise 99.0MHz* – will transmit test number that is running. Receivers with RDS will display test number. Health and safety messages will also be broadcast here. We encourage you to bring your own radio with RDS capabilities.

Site 3 has own radio channel: 95.0 MHz used to coordinate driving (no RDS, voice only)

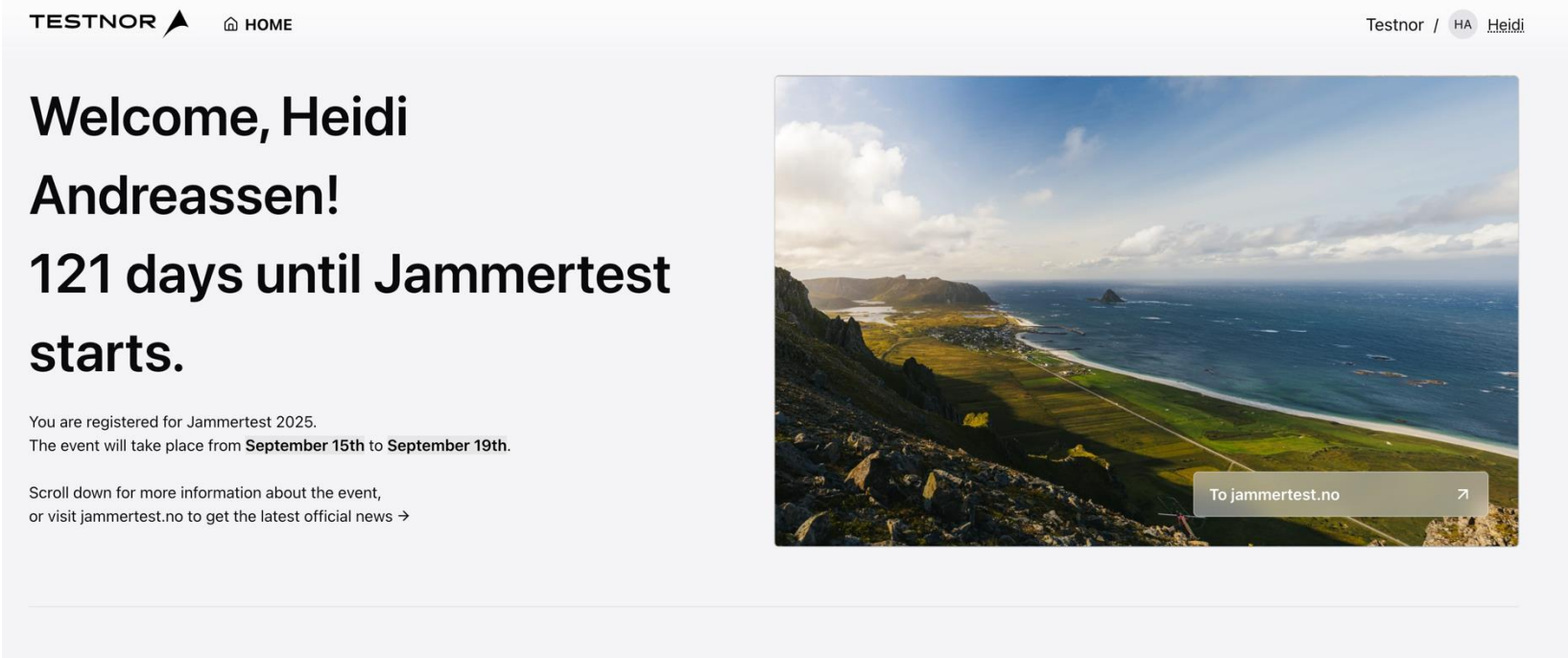
MQTT broker: topics with test running and start and end of tests will be published on Jammertest.no

Chat: we are working on a solution for communication between participants and the organisers. More information will be available on jammertest.no

Two-way radios: All NPRA personnel carry VHF radios that link them with test-leaders, safety officer and organizers. Grab a hold of an NPRA (Statens vegvesen) official for any questions

Live spectrum video feed: A live video stream of the spectrum from a reference antenna will be shown on location and be made available

Portal



In the portal you can

- Manage participation and plan schedule for Jammertest
- Book logistics and export control services (launched 1. June 2025)
- Find information about accommodation
- Get access to test catalogue and test plan
- See who else is attending Jammertest
- Get access to joint meetings

Aviation coordination meeting

Teams meeting: Tuesday June 10 at 4 pm (CEST).
Link will be shared in the portal.

Topics covered in the meeting:

- Coordination of airspace during Jammertest
- Need for Prior Permission Required (PPR)
- Airport activity is by invitation only
- Participants will be informed of necessary requirements and procedures.
- The Civil Aviation Authority of Norway provides an overview of applicable frequency and equipment regulations.

Drone coordination meeting

To fly drones in Norway: All participants are obliged to follow Norwegian drone regulations and guidelines.

Teams meeting: Tuesday June 10 at 5 pm (CEST).
Link will be shared in the portal.

Topics covered in the meeting:

- Procedures and mandatory briefings during Jammertest for drone activity
- Jammertest allow for drone operations up to 120 meters altitude and under 8 kg.
- Emphasis on equipment compliance — CE marking is mandatory.
- In Norway, you are generally allowed to fly in the open category if you are registered as an operator. This does not apply to Russian citizens, as there is a national ban on all Russian flights
- Civil Aviation Authority in Norway's guide for flying drones in Norway https://www.luftfartstilsynet.no/en/drones/

Logistics of equipment

All equipment brought into Norway used for commercial activities must go through customs declaration.

A secure and reliable process for the receipt of goods

- Storage period: September 10th –24th
- Booking opening June 1st
- Booking deadline: July 1st

Test equipment

In need of test equipment to rent?

Send a request to:

support@testnor.com

Q&A

- Questions
- Feedback

Contact points:

Technical questions: Anders Eriksen asn@nkom.no

Registration: support@testnor.com

Practical information and logistics: jammertest@testnor.com

Official website: jammertest.no

Official Jammertest Linkedin account: Jammertest

Share your #jammertest experience on Linkedin


See you in September!
Photo: David Jensen
Nasjonal kommunikasjonsmyndighet
Statens vegvesen
FFI Norwegian Defence Research Establishment
Justervesenet
Norsk Romsenter Norwegian Space Agency
Kartverket
AVINOR
TESTNOR