The most expensive GPS-antenna installation ever?

Testing multiple GSM-R-rings deep inside a mountain

Tomas Johansson

Telecom Engineer
The Swedish National Rail Administration

BANVERKET

BANVERKET

- **The Swedish National Rail Administration**

  (Swedish railway authority)

- **Infrastructure owner**

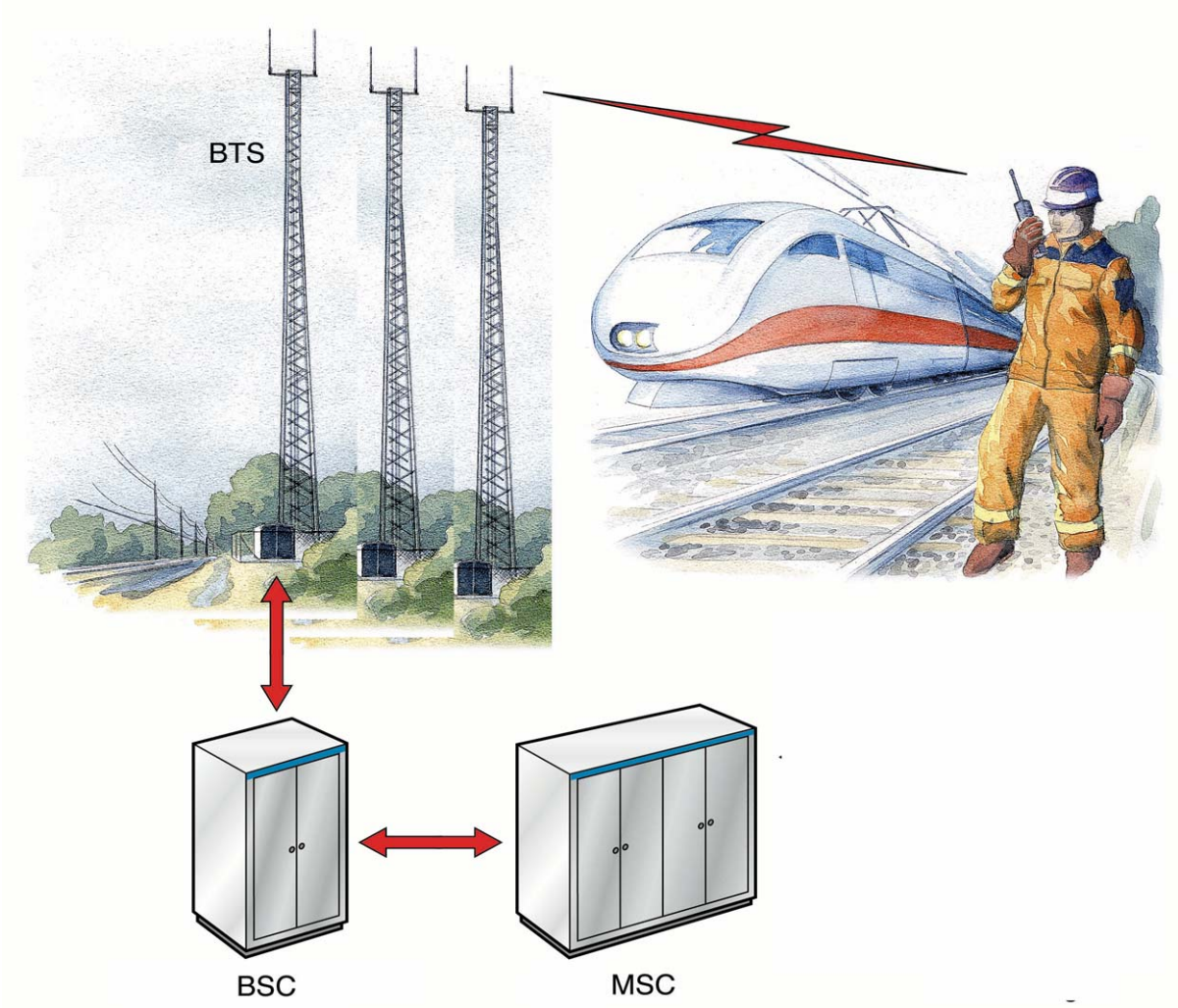
  (We don't run any train services.)

- **11 700 km of railway**

- **Telecom operator as well**
  - GSM-R: 1,100 sites
  - Fibre optic network: 12,000 km
  - Intra phone network: 90 switches

- **Third largest land mass in Europe!**

MobiSIR - system



GSM-R Infrastructure

1 MSC

11 BSC

ca 1,100 BTS

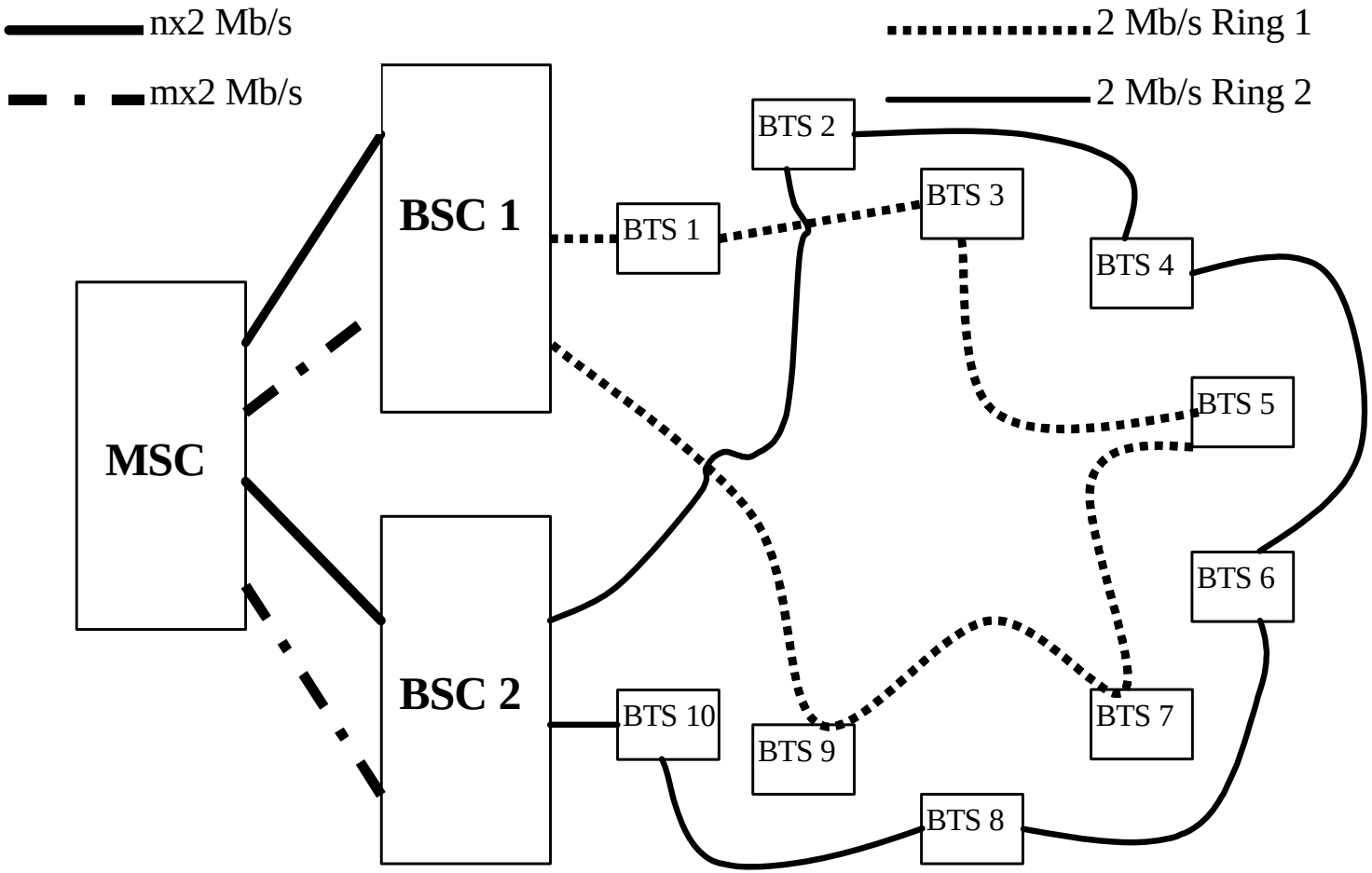
GSM-R or MobiSIR

- Frequency is 876-880 Mhz for the uplink and 921-925 for the downlink
- Roaming to public 900 MHz is designed and possible
- Voice group calls
- Voice broadcast services
- Location dependent addressing
- Functional addressing (”follow me”)
- Enhanced Multi-level Precedence and Preemption

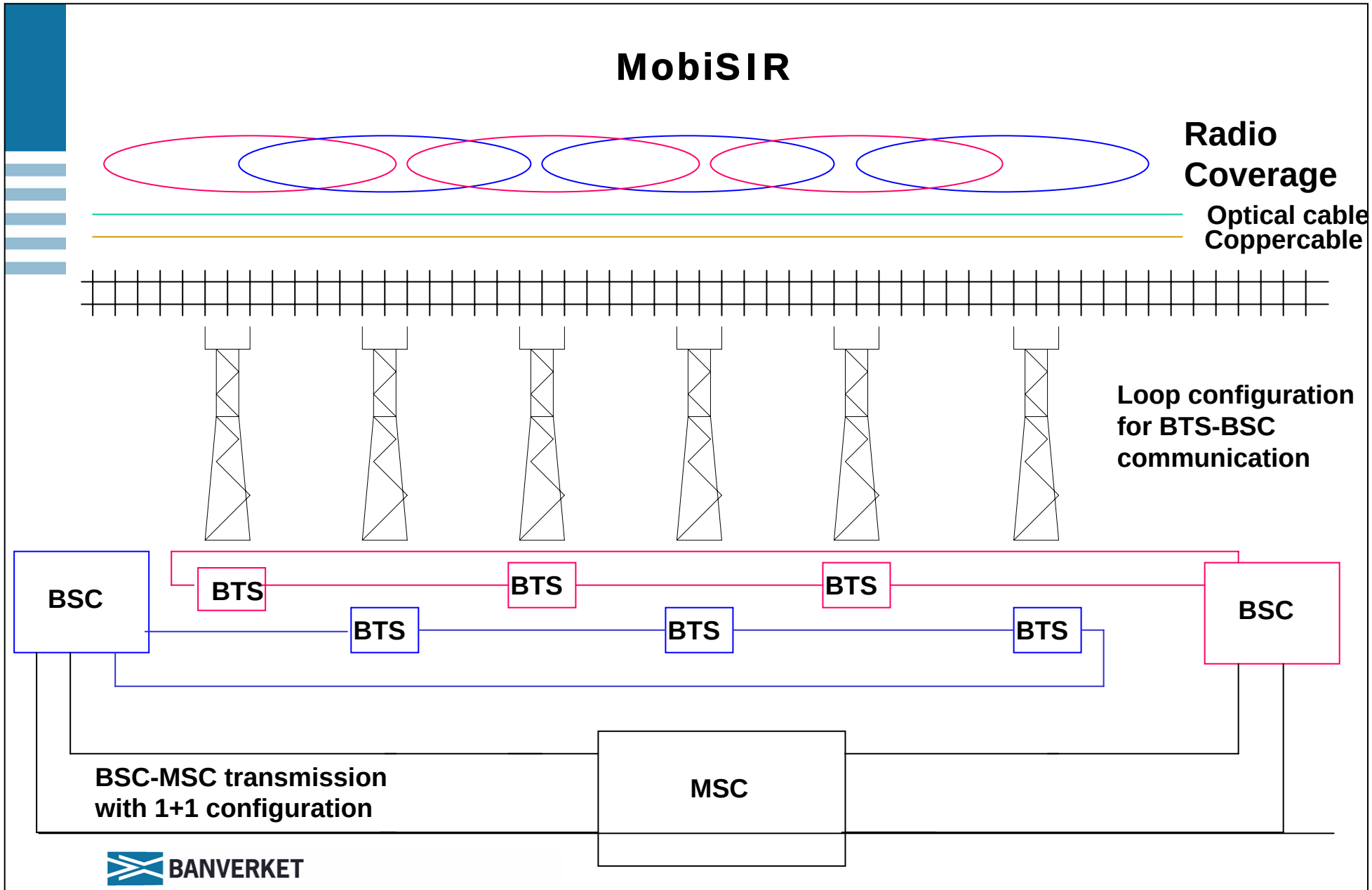
Designed for high availability and reliability

- Central system located inside a mountain
- The hardware in the central systems is fully redundant
- The transmission system is fully redundant
- Mulitple transmitters in the BTS's
- Multiple antenna systems at each site
- Central system availability is 99,998%
- BTS availability target is 99,8 %
- Centralised surveillance

2 BTS-rings for redundancy on 1 railwaytrack

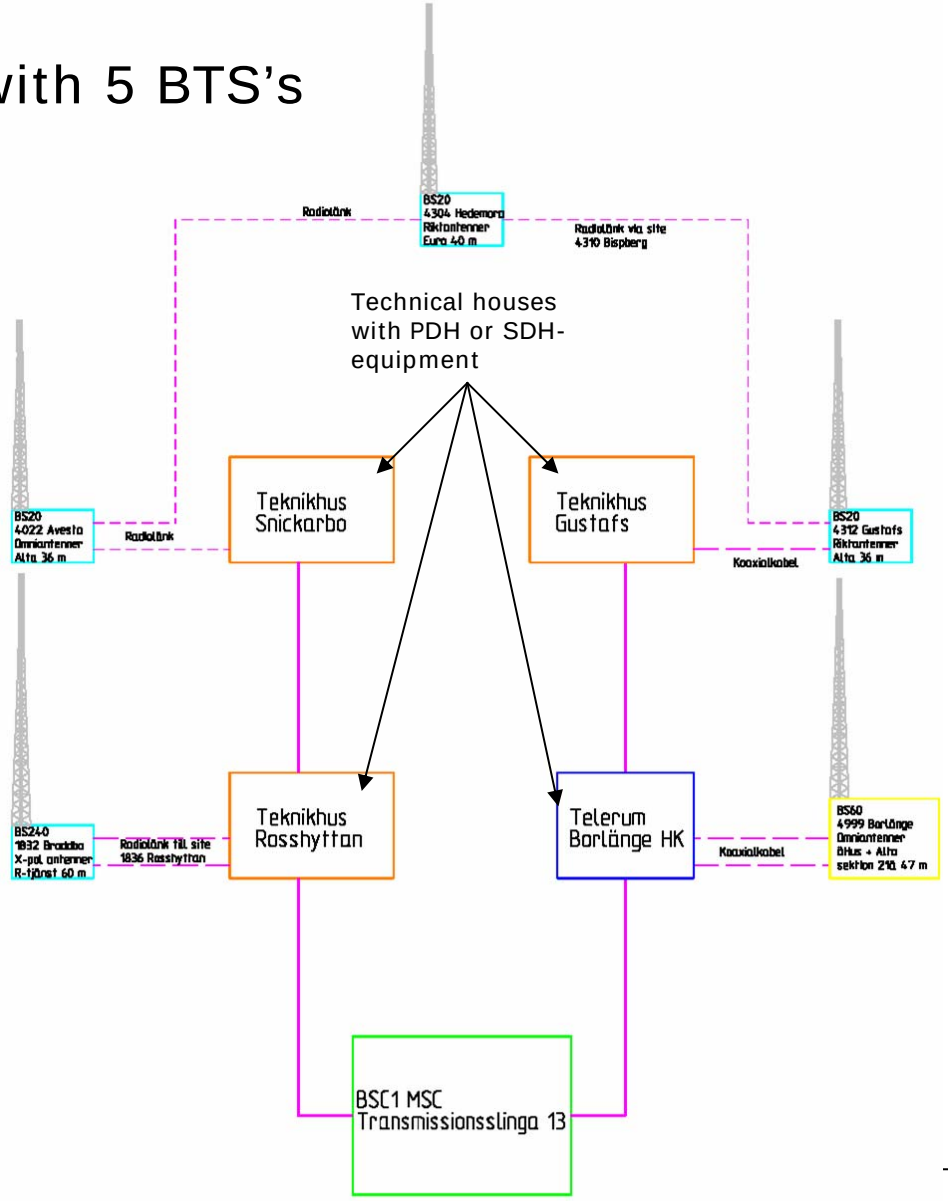


MobiSIR



BANVERKET

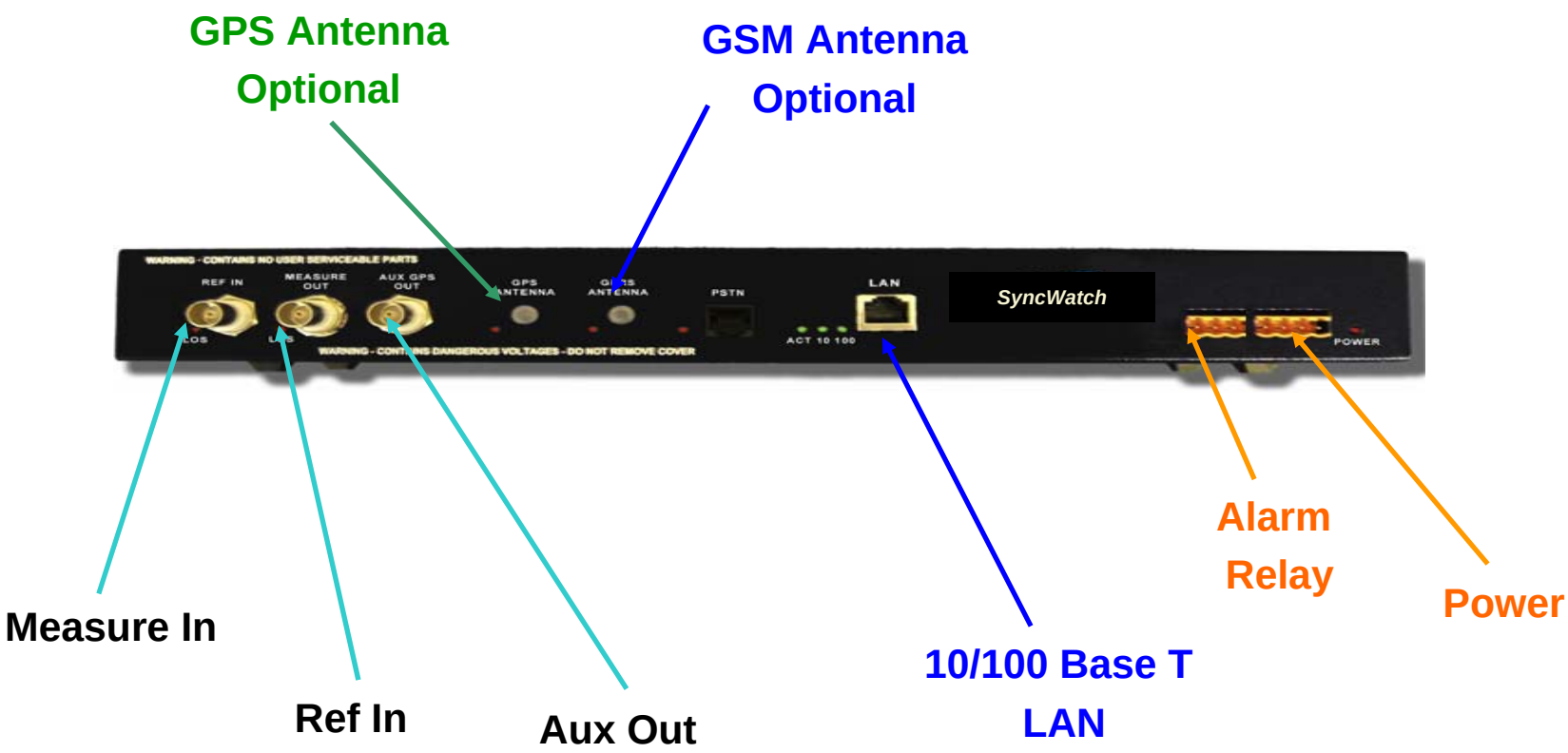
GSM-R-ring with 5 BTS's



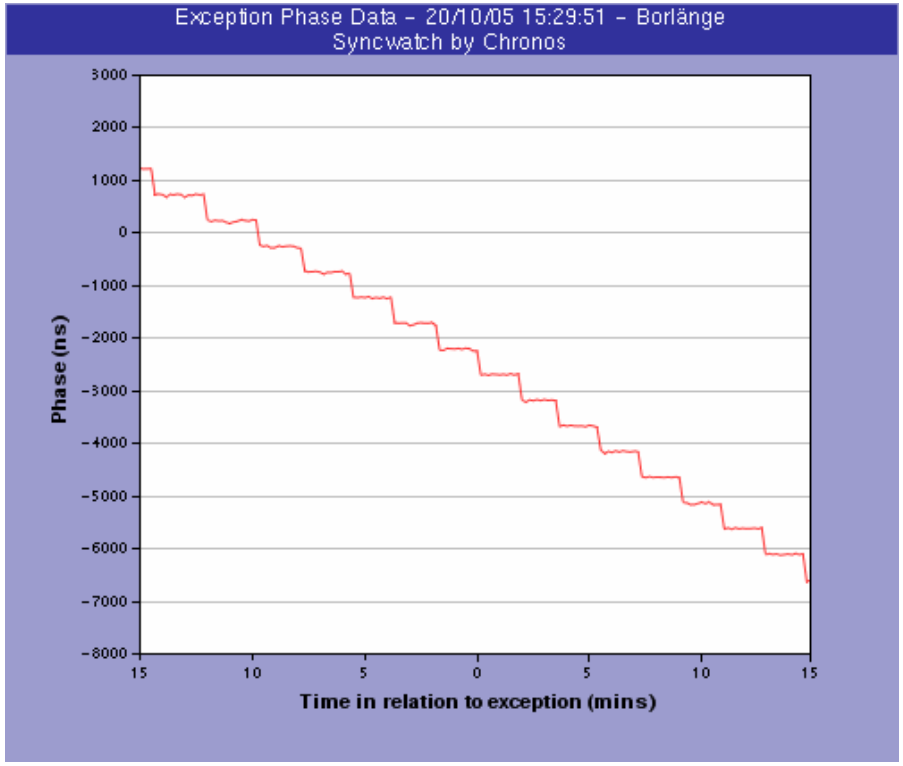
Pendulum WM-11 Wandermeter

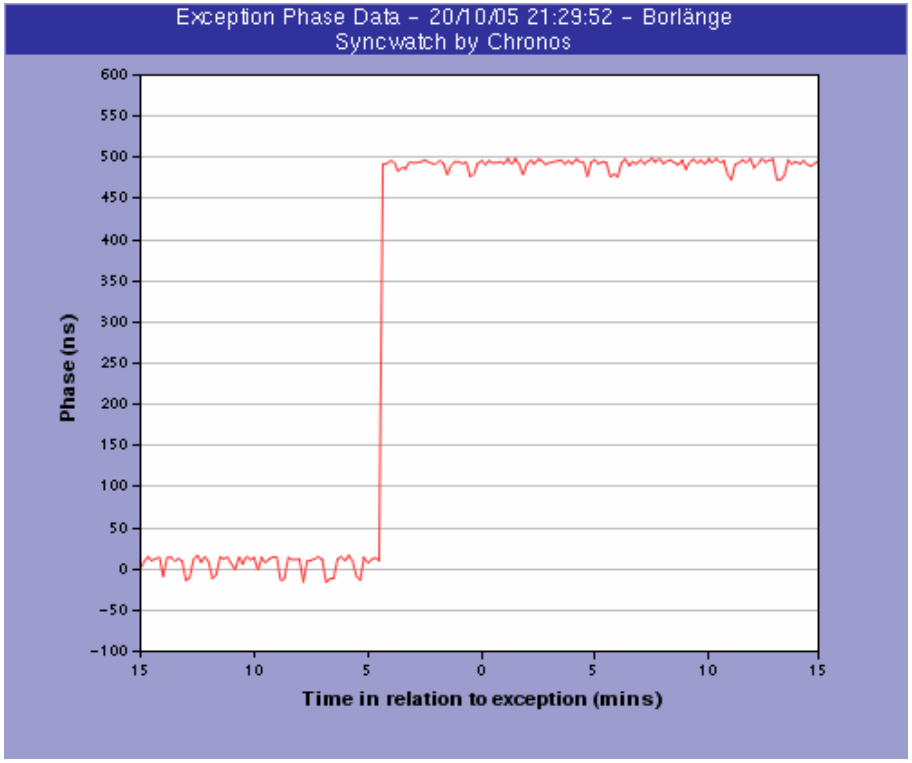
- Built-in Rubidium reference
- One channel measurement at a time
- Portable and runs on both 230 VAC or 48 VDC
- Good for on-site faultfinding
- For longer observation times, connection to a PC is recommended

SyncWatch


GPS Antenna
Optional
GSM Antenna
Optional
REF IN
MEASURE OUT
AUX GPS OUT
PSTN
LAN
SyncWatch
POWER
Alarm
Relay
Power
Measure In
Ref In
Aux Out
10/100 Base T
LAN

Problems experienced in GSM rings.





The SSU that's now a multi-channel sync. Tester!

Fully manageable Synchronization Supply Unit

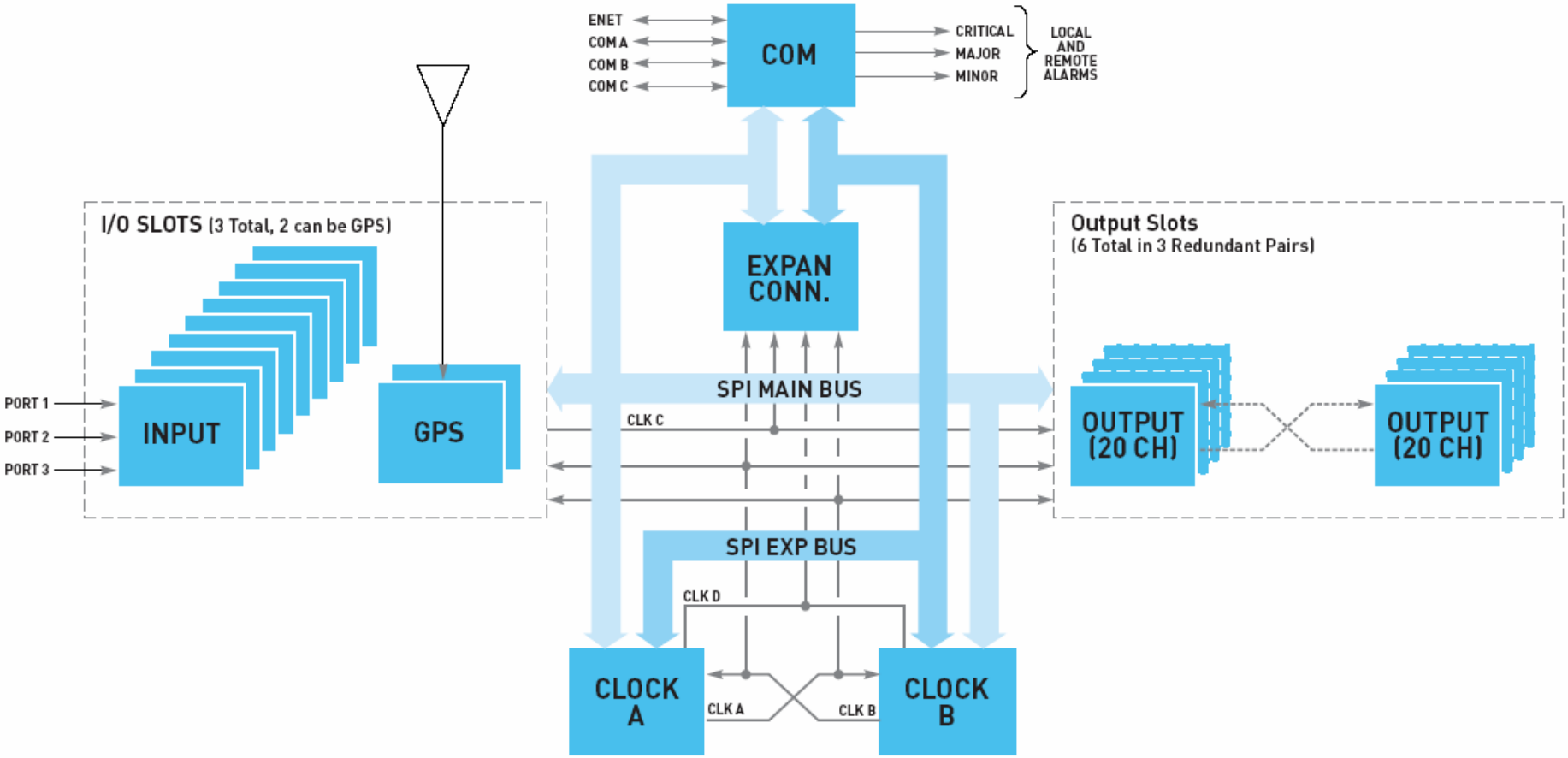
Up to 160 outputs

Single or dual GPS modules t

Superior holdover performance

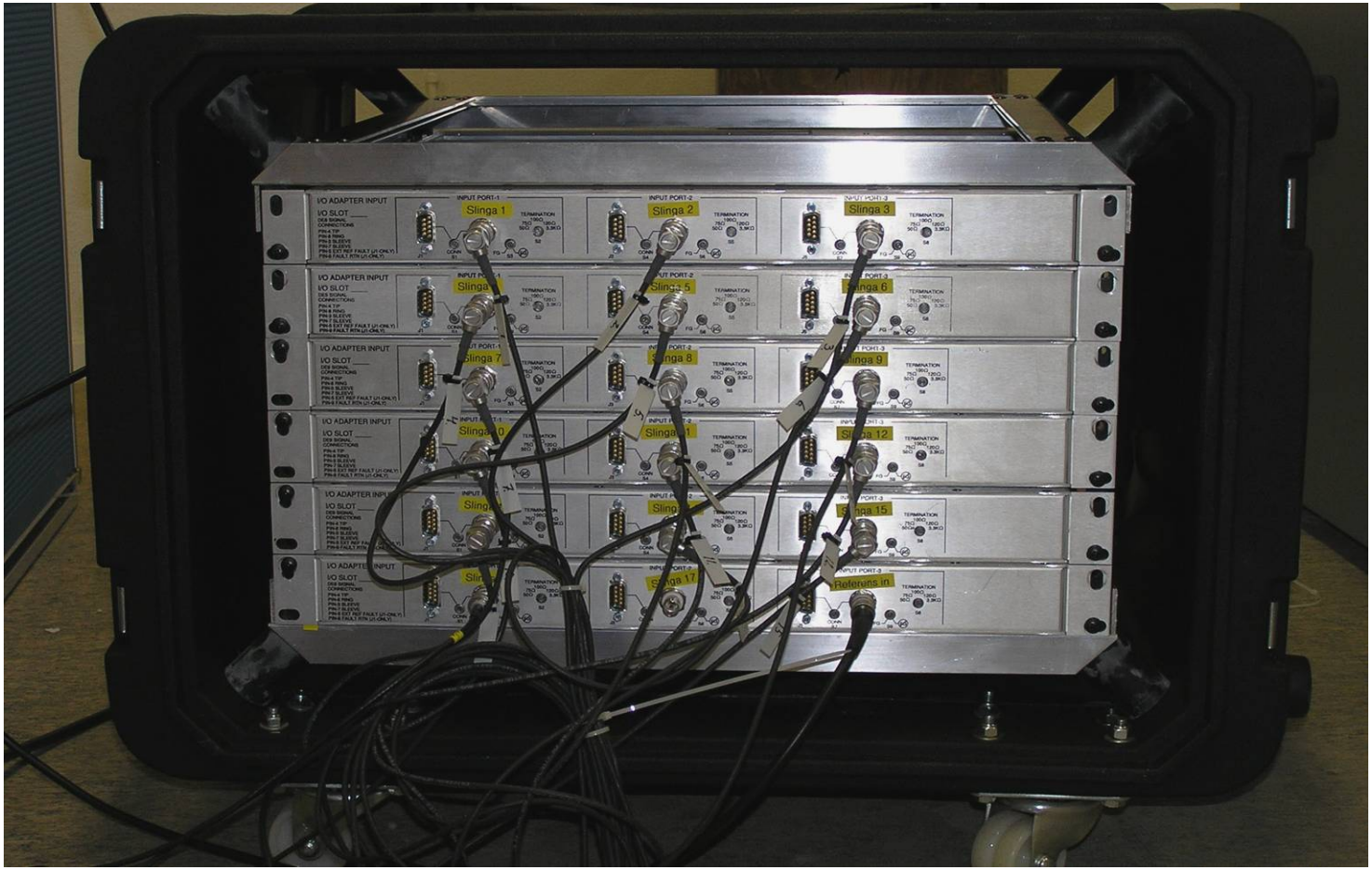
We uses no output cards only 6 input cards you could call it a SMU or Sync Monitoring Unit

The SSU-2000 is a very flexible platform

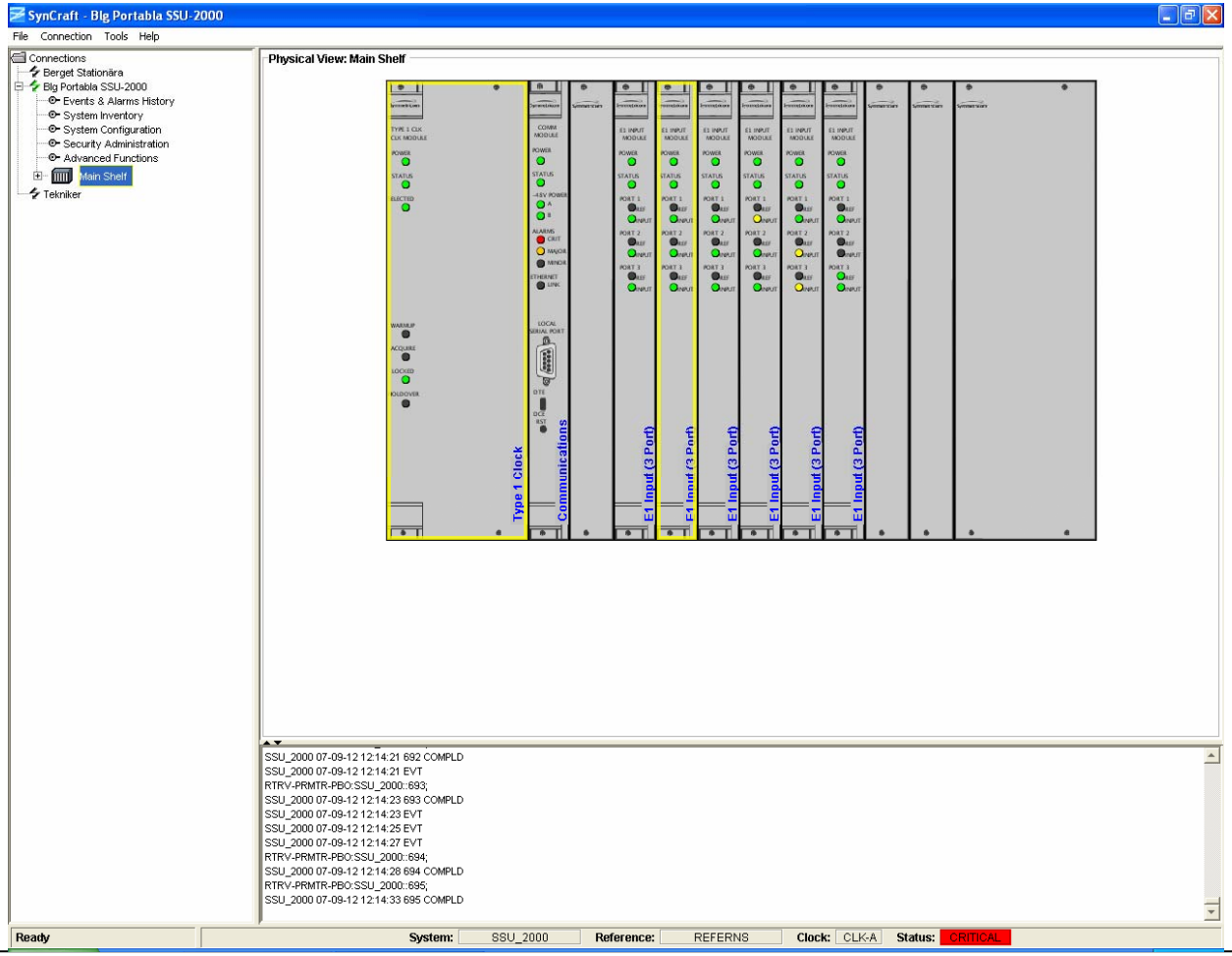


The SSU-2000 is mounted in a transport case.

The SSU-2000 connectors at the rear of the unit

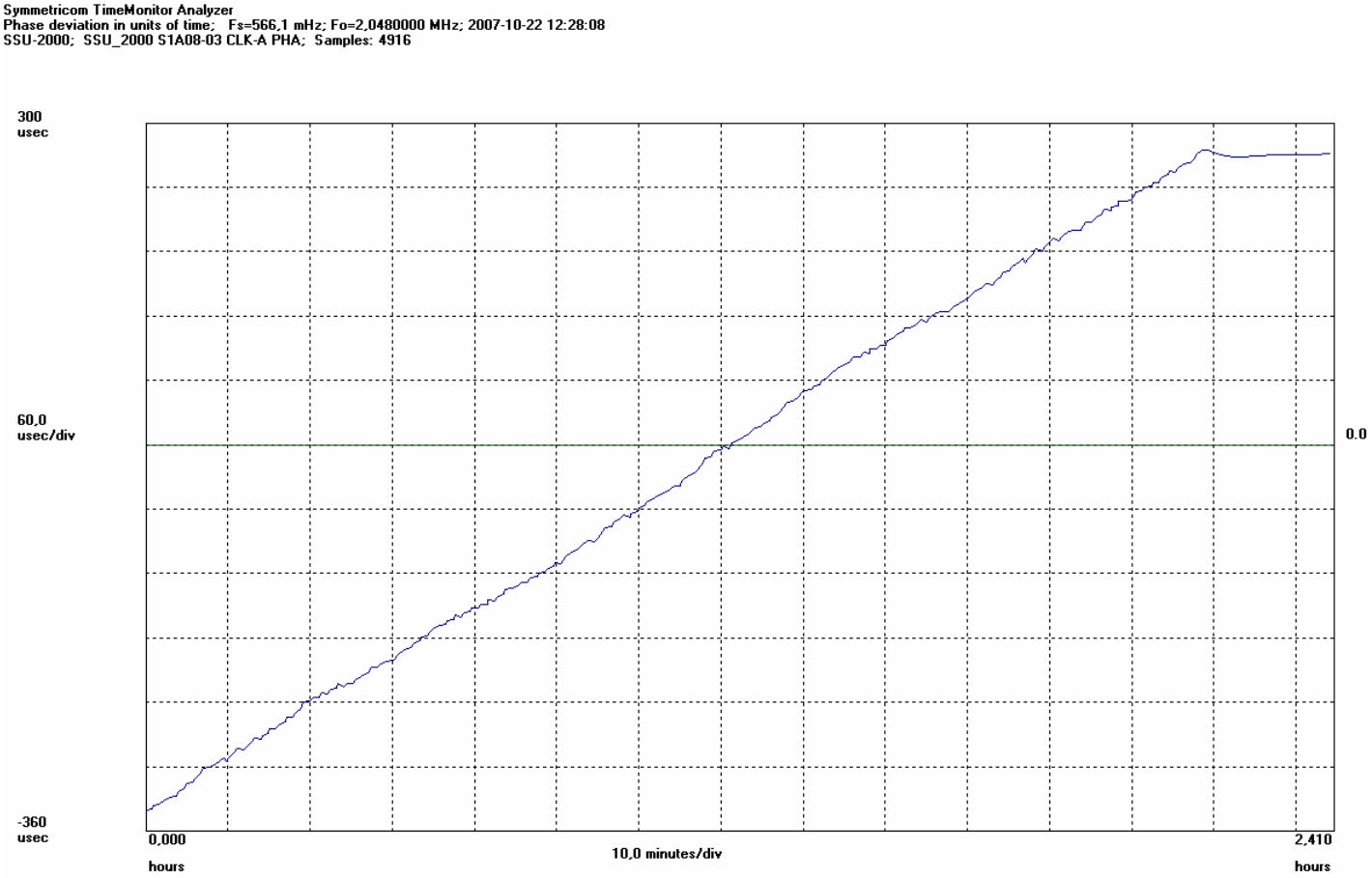


The view of the SSU-2000 in theSynCraft software



BANVERKET

2-Mb/s–trib after a soft reset of a SDH-node



BANVERKET

What problems have we found?

- Faulty oscillator cards in BTS's (a total of 200)
- Mis configured xDSL modems (line timing vs transparent timing)
- SDH elements timing the E1-output cards faulty
- SDH elements squelching outputs when rings re-configure
- BSC not providing revertive switching as required
- BTS´s turned the wrong way
- Return current from the track circuit current disturbing the E1-lines to the BTS´s

The most expensive GPS-antenna installation ever?

BANVERKET

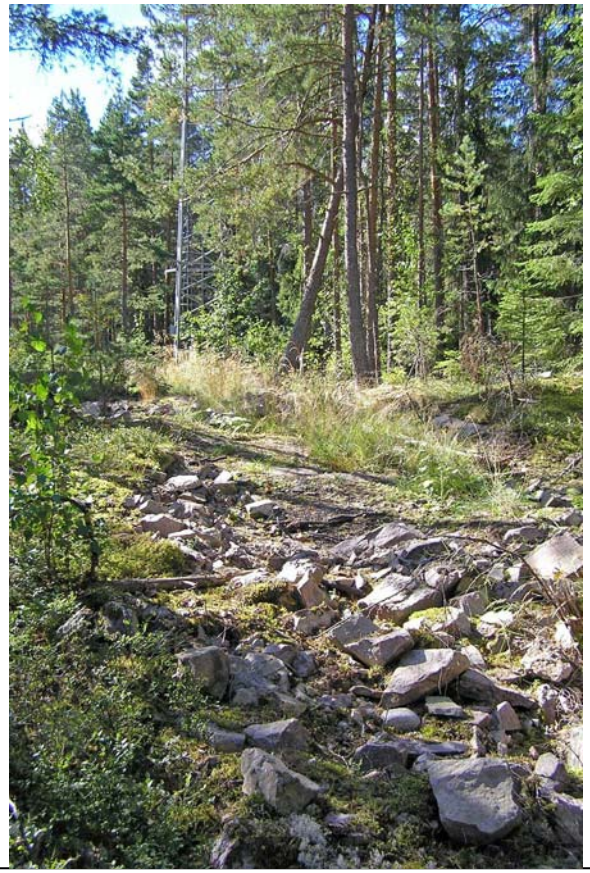
Basic GPS-antenna cable installation tool

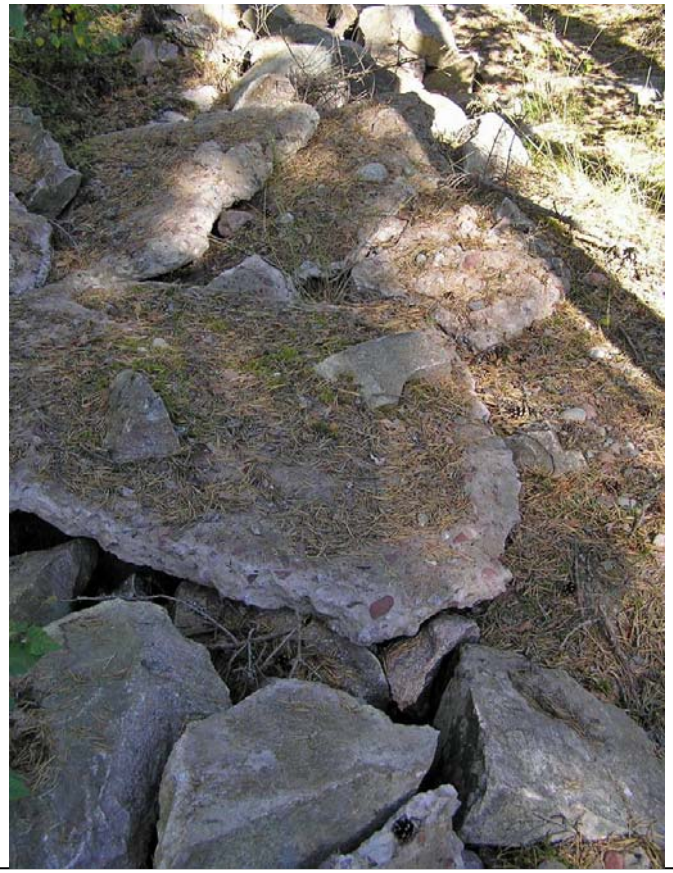
De luxe GPS-antenna cable installation tool

The new “easy-entry” cover on the cable jointing chamber and the remains of the old “civil defence”-type in the background

BANVERKET

The remains of the old cable ducting





BANVERKET

Tomas Johansson
Transmission Engineer

Swedish National Rail Administration
S-781 85 Borlänge
Sweden

T: +46 243 44 57 21
M:+46 707 24 57 21
mailto:tomas.t.johansson@banverket.se

BANVERKET