The most expensive GPS-antenna installation ever?

Testing multiple GSM-R-rings deep inside a mountain

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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
- Multiple 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

MSC

BSC 1

BTS 1

BTS 2

BTS 3

BTS 4

BTS 5

BTS 6

BTS 7

BTS 8

BTS 9

BTS 10

BSC 2

nx2 Mb/s

mx2 Mb/s

2 Mb/s Ring 1

2 Mb/s Ring 2
MobiSIR

Radio Coverage

Optical cable
Copper cable

Loop configuration for BTS-BSC communication

BSC

BTS

BTS

BTS

BTS

BTS

BSC

BSC-MSC transmission with 1+1 configuration

MSC

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)
- Measure In
- Ref In
- Aux Out
- 10/100 Base T LAN
- Alarm Relay
- Power

SyncWatch
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
- Superior holdover performance
- We use 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 the SynCraft software
2-Mb/s-trib after a soft reset of a SDH-node
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
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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
The remains of the old cable ducting
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