Repeater Site Survey

Site: Sandhamn

System: GSM900

1.0 Scope

The site is an island called Sandhamn (Sand Harbor). The island is very famous for it's marine harbor and is crowded with tourists and boaters during the summer months. The entire population of the island is about 60, which means during the winter months the amount of traffic is extremely low.

A repeater site seemed to be a feasible solution considering the financial aspect for a BTS and the low traffic period during 6 months of wintertime.

The scope was to cover the marine harbor and the surrounding area.

2.0 Site description

The island is quite flat but unfortuantely the marine habor is located behind a hilly, forest terrain, which causes a shadowed area. The BTS located on the mainland is situated so that it is not in the line of sight of the marine harbor.

The island has a marine rescue radio communication center located on the hightest point on the island, which has a suitable tower for their antennas. This tower could also be used for the repeater site. The tower is located in such a way that the donor antenna and the mobile antenna could be placed back to back 180°

Fig 1. The tower with both antennas

Prior to the addition of the repeater, the site has following data:

Received signal from the BTS:	> -46dBm
Signal in the marine habour:	< -98 dBm
Distance to the BTS:	0.6-1.2' (1-2 km)
Timing advance:	2
BER (without repeater):	0
Distance to the marine harbour:	0.6-1.2' (1-2 km)
Height from ground level: Donor antenna:	49.2' (15 m)
Height from ground level: Service antenna:	72.2' (22 m)
Feeder to Donor antenna RG214	49.2' (15 m)
Feeder to service antenna RG214	65.6' (20 m)
Distance between the antennas:	16.4' (5 m) vertical
	4.6' (1.4 m) horizontal

Tower type : Approx. 180.5' (55 m) high, triangle type, 4.9' (1. 5 m) wide.

Fig 2. The view towards the BTS

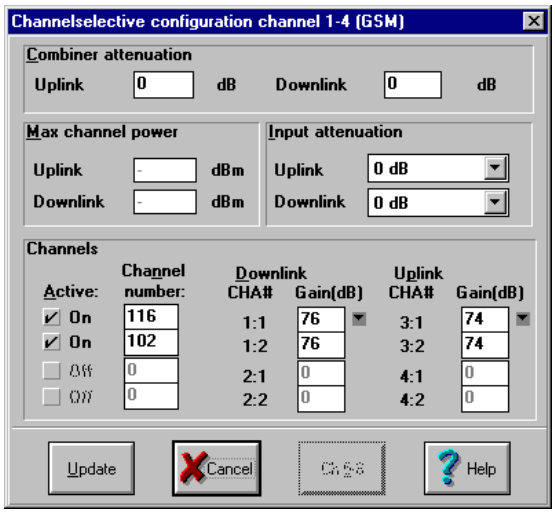

Fig 3. OMT window, channel and gain settings

3.0 Antenna selected for the site

The following conditions must be considered:

The donor and the service antenna are mounted on the same tower. This could cause antenna isolation problems, but if the link budget is carefully studied, and antennas with a narrow opening angle and good F/B ratio are used, this can be handled easily. The distance between the antennas, both vertically and horizontally, as well as the gain setting, are also important factors to consider.

It is a short distance to the marine harbor. The downtilt of the service antenna is decided to avoid interference and concentrate the radiated energy towards the marine harbour. (Approx: 6° downtilt mechanically)

On this site, high gain antennas are not really needed for maximizing the output power in uplink and downlink, but probably could be used to compensate for the feeder losses. Cable type RG214 was used.

The same type of antenna are used both for the donor and the service antenna.

Antenna type:	Gain:	F/B	Hbw	Vbw	Side lobe
Donor antenna Type: **City** Product number: 7143.38	18,0 dBi	> 30 dB	65°	7°	> 17 dB
Service antenna Type: **City** Product number: 7143.38	18,0 dBi	> 30 dB	65°	7°	> 17 dB

4.0 Link budget

Downlink:

The calculated link budget for the downlink path is as follows:

EIRP from the BTS site	**43 dBm**
Path loss	-93 dB
Antenna gain	18 dBi
Feeder loss (15 meter of RG214)	-3 dB
Repeater input	**-35 dBm**
Repeater downlink gain setting	76 dB
Repeater output power	**30 dBm**
Feeder loss (RG214/XXdb_100m)	-4 dB
Antenna gain	18 dB
EIRP repeater downlink	**44 dBm**
Path loss	-90 dB
MS input level	-46 dBm
Fading margin	-20 dB
Received signal at mobile	**-66 dBm**

Fig. 4. Link budget Downlink from the BTS > repeater > MS

Uplink:

MS output power	**33 dBm**
Antenna gain	0 dBi
Path loss	-90 dB
Antenna gain	18 dBi
Feeder loss (RG214/XXdb_100m)	-4 dB
Repeater input	**-43 dBm**
Repeater uplink gain	74 dB
Repeater output power	**30 dBm**
Feeder loss (RG214/XXdb_100m)	-4 dB
Antenna gain	18 dBi
EIRP repeater Uplink	**44 dBm**
Path loss	-93 dB
Fading margin	-20 dB
Received signal at BTS	**-69 dBm**

Fig 5. Link budget uplink from the MS > repeater > BTS

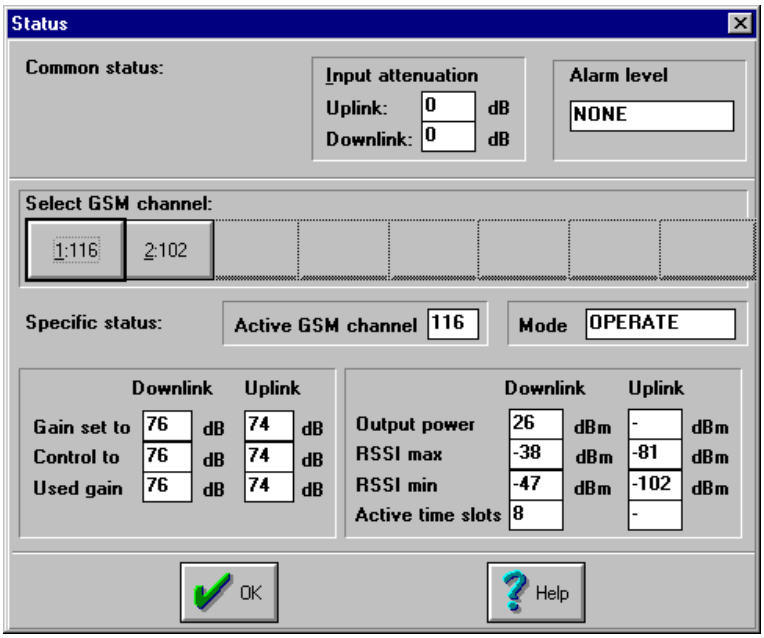

Fig. 6. OMT window, RSSI measures and antenna isolation test

5.0 Result

6.0 References