



Salient features of NG SDH Radio Network

- Ø **Radio Type:** All Indoor type for Backbone trunk network and Split Mount (IDU-ODU) type for spur links.
- Ø **Link Capacity:** 1+1 to 7+1 (Split mount: max. 4+4 and All indoor: max. 7+1) i.e. 63 E1 to 441 E1 with Ethernet interface (FE/GE). For the links with traffic less than 40E1s Super PDH (SPDH) will be used (yet to be tendered).
- Ø **Frequency Band of operation:** U 6 GHz (6.4-7.1 GHz)
- Ø **Total number of Radio links:** In Phase-I 57 SDH Radio links and in Phase-II no additional links. In Phase-II only up gradation of 36 links will be done to various capacity as shown below:

- Ø **Ethernet interface:** All stations will have FE/GE interface with L2 switching function.
- Ø **NMS work stations:** in every region
- Ø **Antenna size:** 1.2m, 1.8m, 2.4m and 3.0m (All high performance dual polarized HPX type)
- Ø **Design Consideration:** Link availability: 99.999% , FM=min. 30 dB (considering 4dB miscellaneous loss)
- Ø **Mux cross connection capacity:** Type-I:16x16 STM-1 fully low order non blocking at VC12 level and Type-II: 128x128 STM-1 fully low order non blocking at VC12 level (for the station where more than 16xSTM-1 allocation per equipment is required viz. Buretola, Dhangadhi, Nepalgunj, Bhairahawa, Pokhara, Dagam, Patan and Birgunj).

various capacity as shown below:

Type of Radio Link	No. of Link in PH I	No. of Link in PH II	E1 Capacity	Break down of PH II (only Upgradation)									
				All Indoor	2+1	3+1	4+1	5+1	6+1	7+1	No change	Total	
1+1	45	-	63										
2+1	7	19	126	1+1 to	-	1	-	-	-	-	-	1	2
3+1	5	8	189	2+1 to	-	-	2	-	-	-	-	4	6
4+1	0	4	252	3+1 to	-	-	-	-	1	4	-	-	5
5+1	0	0	315	Total	0	1	2	0	1	4	5	13	
6+1	0	1	378	Split Mount	← 8 →								
7+1	0	4	441	1+1 to	19	7	1	-	-	-	16	43	
Total Links	57	36		2+1 to	-	-	1	-	-	-	-	1	
Split Type	44	28		Total	19	7	2	0	0	0	16	44	
Indoor type	13	8			← 28 →								

- Ø **Total number of stations to be installed:** 68 (Dhangadhi Region: 13 stations, Nepalgunj Region:13 stations, Bhairahawa Region: 9 stations, Pokhara : 8 stations, Kathmandu Region: 8 stations, Birgunj Region: 5 stations and Biratnagar Region: 12 stations)
- Ø **Longest Hop length:** All indoor: 73.6 Km (Chamere-Bhajani) & Split Mount: 80.8 Km(Phulchowki-Birgunj)
- Ø **Radio Protection:** All Indoor: N+1 and Split Mount: N+N

- Ø **Number of Racks Required per station:** Average one ETSI (2200 mm x 600 mm x 300 mm) Rack is required and Max. 2xETSI Racks.
- Ø **Project Status:** Contract for supply and delivery of SDH Radio equipment is expected to be done within February 2008 and the equipment is expected to reach at each regional store within June 2008. SPDH in another tender (in the process of tendering).
- Ø **Manufacturer of the major components:** All indoor radio: Fujitsu, Split Mount radio: Harris



Stratex, ADM: Tejas, Antenna: Andrew, Vehicle: Nissan, Testing equipments: Anritsu).

Can this Radio Network cater the forthcoming GSM, CDMA and NGN traffic?

As per the information gathered from various departments (for the next 3 years) all foreseen traffic has been considered. For the safety factor, additional 25% traffic has also been considered. If the traffic grows beyond that limit, even in that case, since all the Radio links are expandable type it can be easily upgraded to N+1/N+N. It is to be noted that all the Regional traffic will be carried by the Optical fiber network and the SDH/SPDH radio network will carry only the North-South traffic, **2xSTM-1 backup traffic for Optical backbone** and some high traffic spur links.

Few district HQs are not shown in the above network diagram. Will it be installed in another phase?

As per network design, the stations where traffic requirement is more than 40E1 is going to be installed as STM-1 link, as shown in the above diagram and the M/W sites with Moderate traffic (>16E1 but \leq 40E1) will be linked by Super PDH (SPDH). But the very Remote HQ e.g. Manang, Jomsom, Dunai, Gamgadhi, Simikot etc. where it is not feasible to link up by M/W links will be linked up by VSAT. For VSAT the procurement process has already been started and the SPDH links tender will be floated shortly. Those links are not shown in above diagram.

Just 2xSTM-1 Radio link's backup for STM-64 Backbone is not sufficient !

Of course just 3% backup by Radio links is very less. But the radio links has limitation of capacity due to limited frequency spectrum. Till date the most of the radio manufacturers have only 7+1/8+0 i.e. 2xSTM-4

capacity, though few are having max possible capacity as up to (16+0) i.e. Max.STM-16 link. Thus OF network shall be primarily be backed up by another parallel OPGW/ADSS type OF network. NT is trying to explore this possibility with Nepal Electricity Authority (NEA) and Power Grid Corporation of India Ltd.

Why all the links are not Split-Mount type?

Though Split-Mount type of radio (ODU-IDU) has many advantages like Cost effective, Less Power consumption, Ease of installation etc. but it has the limitation of capacity. The max capacity of a split mount type of radio is 4xSTM-1 where as All-indoor type of radio can reach up to 16xSTM-1. So depending upon the link capacity requirement even for the spur links like Bureto-la-Kaphali and Pokhara-Dagam All-Indoor type of radio equipment will be used. For the shake of high link availability all the Back bone link has been designed with only All-Indoor type.

What measure will be taken to minimize the interference in the Backbone links?

To minimize the interference problem NT has planned to operate all the SDH and SPDH links in U6GHz band. This will minimize the interference problem with thousands of 8 GHz and 15 GHz links in future. In addition to this the network will also use Cross Polar Interference Canceller (XPIC), Automatic Transmit Power Controlled (ATPC), Dual Polarized Antenna etc. **What is the Average DC Power Consumption of a SDH Radio?**

Depending upon manufacturer, site configuration & type of radio (All-indoor or Split Mount type) the power consumption varies. A typical power consumption table of Split-Mount and All-Indoor type of radio equipment is shown below:

S.No.	Configuration	Power consumption of a Split Mount Type Radio (Watt)	Power consumption of a All-Indoor Type Radio (Watt)
1	1+1	97 W	250 W
2	2+1	97 W	365 W
3	3+1	194 W	480 W
4	4+1	194 W	580 W
5	5+1	N/A	690 W
6	6+1	N/A	810 W
7	7+1	N/A	930 W



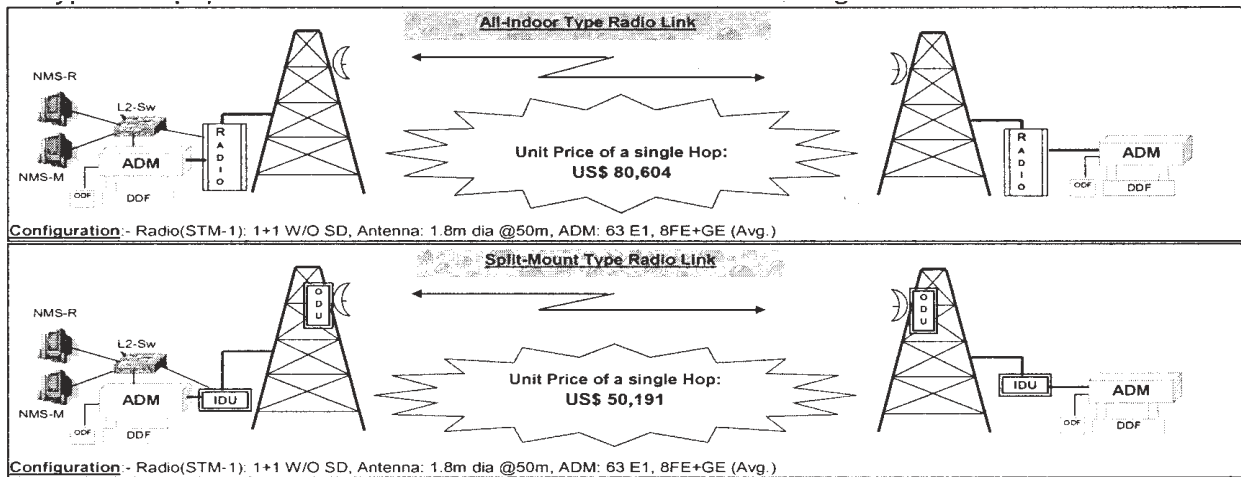
Note: For All indoor type of radio Power consumption of Dehydrator (approx. 150W) not considered above. Power consumption of Type-I ADM (STM-4) is 168W and Type-II ADM (STM-16) is 275W. Here Average DC power consumption of a station is **265 W** (1+1 Radio & 63 E1 ADM). Max. DC power consumption is **4,289 W** (Nepalgunj, 2x7+1 & 1+1 Radio and 479 E1 ADM).

Why Super PDH (SPDH) for few links?

Though NT has been using 34+34 Mb/s (32E1) Nokia links but now a days the max. capacity available with a PDH radio link is 34Mb/s (16E1). Thus to have a link with capacity more than 16E1 and less than a STM-1 the SPDH Radio link is the best way (both technically and financially). Depending upon the manufacturer, the max. capacity that is software configurable with a SPDH link is 75E1.

What is the average cost of a SDH Radio link?

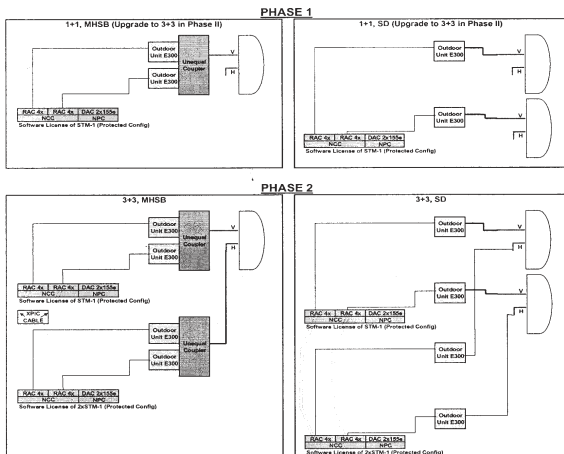
A Typical Equipment Cost of a STM-1 Radio Link in US\$ is given below:



Note: Power, Tower, Shelter, Installation cost, Man Power etc. not included in the above cost.

How Split type of Radio link are upgraded?

It depends on the manufacturer's radio type i.e. whether it supports 1+1 or 2+2 STM-1 interfaces. A typical example of 1+1 to 3+1 up gradation under this project is shown below, without using any additional antenna:



Note: here 2+2 radio type has been used.

Challenges for this project

- ◆ Out of 19 existing Fujitsu and Siemens SDH Radio links 11 links (Fujitsu:2+Siemens:9) required to be upgraded and for the remaining 8 links (Fujitsu:1+Siemens:7) no need of up gradation.
- ◆ Since the existing backbone links (Nera, Nokia, Fujitsu & Siemens) and the upcoming SDH and SPDH links will operate in the same U6GHz band, a very careful frequency planning need to be done.
- ◆ While installing the new SDH and SPDH links, due to space limitation on the tower, at few sites, step wise shifting (Main & SD) from existing to new will be required. At few sites new tower may be required.
- ◆ At few repeater sites, space available for installation of new equipment is not enough. So, necessary arrangement for building/shelter is required.
- ◆ Due to high power consumption at few sites e.g. Kaphali, Rajkot & Sineghas, 3-Phase AC power line shall be arranged. DC Power available is also not sufficient for at few stations. Thus necessary power arrangement (Solar, Battery, Rectifier etc.) shall be done.