



## MEMORANDUM

|                 |  |
|-----------------|--|
| <b>Date:</b>    | 29-Feb-00  |
| <b>To:</b>      | Nico Wauters   |
| <b>CC:</b>      | Pedro Falcao   |
| <b>From:</b>    | Kris Struyve   |
| <b>Subject:</b> | Additional info for Austria licence: interface specs |

### 1 Point-to-Point Transmission Capacity

All circuits are carried on an end-to-end SDH infrastructure. Depending on the customer's requirements, they could be delivered through PDH interfaces (E1, E3, T3, E4) or SDH interfaces (STM-1/VC-xx). With the E1/E3/T3/E4 presentations, the customer receives the 2/34/45/140 Mbps payload capacity only. With the VC-12/VC-3/VC-4 presentations, the customer receives the corresponding payload capacity and the SDH Path Overhead (POH)<sup>1</sup>.

Table 1 describes the different bandwidth configurations available to the customer.

According to that table, the bandwidth can be provided between the circuit end-points within a single circuit (*unstructured* offer) or in a bundle of sub-bit-rate circuits (*structured* offer). In a structured offer, all the sub-bit-rates are implemented between the same end-points. For example, in a structured 34 Mbps circuit, all the 16 E1 sub-bit-rates will be presented at the same termination points.

Interfaces can be electrical (G.703 normalized) or optical (G.957 normalized). SDH standard interfaces are at 155 Mbps bit-rate. Higher bit-rate SDH interfaces (STM-4) are considered on a project-to-project basis.

“Structured” or “Channelized” services are implemented between the same end-points and are presented to the customer through multiple interfaces.

| Bandwidth         | Presentation   | Customer interfacing (“ <i>backbone</i> ” offer)    | Customer interfacing (“ <i>integrated</i> ” offer)    |
|-------------------|----------------|---|---|
| <b>2,048 kbps</b> |                |   |   |
| PDH, unstructured | E1             | 1 x G.703 @ 2,048 kbps (electrical)                 | 1 x G.703 @ 2,048 kbps (electrical)                   |
| SDH, unstructured | VC-12          | 1 x G.703 @ 155 Mbps (electrical STM-1/VC-12)       | 1 x G.703 @ 155 Mbps (electrical STM-1/VC-12)         |
| <b>34 Mbps</b>    |                |   |   |
| PDH, unstructured | E3             | 1 x G.703 @ 34 Mbps (electrical)                    | 1 x G.703 @ 34 Mbps (electrical)                      |
| PDH, structured   | 16 x E1 (*)    | 16 x G.703 @ 2,048 kbps (electrical)                | 16 x G.703 @ 2,048 kbps (electrical)                  |
| SDH, structured   | 16 x VC-12 (*) | 1 x G.703 @ 155 Mbps (electrical STM-1/ 16 x VC-12) | 1 x G.703 @ 155 Mbps (electrical STM-1/ 16 x VC-12)   |
| <b>45 Mbps</b>    |                |   |   |
| PDH,              | T3             | 1 x G.703 @ 45 Mbps (electrical)                    | non standard, available on a project-to-project basis |

<sup>1</sup> The full SDH/STM-1 frame (155 Mbps) comprises a VC-4 path (150 Mbps) and a Section OverHead (SOH, 5Mbps). The SDH VC-4 path is built with a Path OverHead (POH, 576 kbps) and a payload bandwidth which could transport a PDH 140 Mbps E4 signal, a mix of VC-12/VC-3 SDH sub-bitrates, ATM cells, IP packets, etc. The same concept applies to VC-12 and VC-3 with the SDH limitations underlined on page 2. With VC-12/VC-3/VC-4 services offer (respectively 2.2kbps, 49Mbps and 150 Mbps), the full payload and POH bandwidth are transported transparently on the GTS CS network.



|                   |                        |   |   |
|-------------------|------------------------|---|---|
| unstructured      |                        |   |   |
| PDH, structured   | 21 x E1 (*)            | 21 x G.703 @ 2,048 kbps (electrical)  | 21 x G.703 @ 2,048 kbps (electrical)  |
| SDH, unstructured | VC-3                   | 1 x G.703 @ 155 Mbps (electrical STM-1/VC-3)  | non standard, available on a project-to-project basis                                     |
| SDH, structured   | 21 x VC-12 (*)         | 1 x G.703 @ 155 Mbps (electrical STM-1/ 21 x VC-12)   | 1 x G.703 @ 155 Mbps (electrical STM-1/ 21 x VC-12)                                       |
| <b>155 Mbps</b>   |                        |   |   |
| PDH, unstructured | E4                     | 1 x G.703 @ 140 Mbps (electrical)   | 1 x G.703 @ 140 Mbps (electrical)   |
| PDH, structured   | 3 x E3(*)              | 3 x G.703 @ 34 Mbps (electrical)  | 3 x G.703 @ 34 Mbps (electrical)  |
| PDH, structured   | 3 x T3(*)              | 3 x G.703 @ 45 Mbps (electrical)  | non standard, available on a project-to-project basis                                     |
| PDH, structured   | 63 x E1 (*)            | 63 x G.703 @ 2 Mbps (electrical)  | 63 x G.703 @ 2 Mbps (electrical)  |
| SDH, unstructured | VC-4                   | 1 x G.703 @ 155 Mbps (electrical STM-1/VC-4)<br>1 x G.957 @ 155 Mbps (optical STM-1/VC-4)                           | 1 x G.703 @ 155 Mbps (electrical STM-1/VC-4)<br>1 x G.957 @ 155 Mbps (optical STM-1/VC-4) |
| SDH, structured   | mix of VC-12 / VC-3(*) | 1 x G.703 @ 155 Mbps (electrical STM-1/ mix VC-12 / VC-3)<br>1 x G.957 @ 155 Mbps (optical STM-1/ mix VC-12 / VC-3) | non standard, available on a project-to-project basis                                     |

Table 1 : different bandwidth configurations for the customer

- “***n x G.703 @ 2,048 kbps (electrical)***” means that ‘n’ circuits are provided through ‘n’ G.703 normalized electrical interfaces at 2,048kbps bit-rate.
- “***1 x G.703 @ 155 Mbps (electrical STM-1/ N x VC-12)***” means that N x VC-12 circuits are provided through a single G.703 normalized electrical interface at 155 Mbps bit-rate.
- “***1 x G.703 @ 155 Mbps (electrical STM-1/ mix VC-12/VC-3)***” means that a mix of VC-12 and VC-3 circuits is provided through a single G.703 normalized electrical interface at 155 Mbps bit-rate.

Depending on the Local Access Provider’s specific standards, the range of connectors include electrical BNC 75Ω, Krone 120Ω, Pouyet 120Ω, 1.6/5.6 75Ω, 1.0/2.3 75Ω, RJ45 75Ω, BT43 75Ω; optical E-2000 SC/PC, SC/APC/FC/PC, FC/APC. Services limited to the GTS backbone network only (without local access) are provided to the customer through electrical 1.6/5.6 75Ω or optical SC/PC standard connectors.



## 2 Ring Services

All circuits are carried on an end-to-end SDH infrastructure. Depending on the customer's requirements, they could be delivered through PDH interfaces (E1<sup>2</sup>, E3, T3, E4) or SDH interfaces (STM-1/VC-xx).

According to the following table, the bandwidth can be provided between the path end-points within a single path (*unstructured* offer) or in a bundle of sub-bit-rates paths (*structured* offer). In a structured offer, all the sub-bit-rates are implemented between the same end-points. For example, in a structured 45 Mbps path, all the 21 E1 sub-bit-rates will be presented at the same termination points.

| Bandwidth         | Presentation            | Customer interfacing (" <i>backbone</i> " offer)  | Customer interfacing (" <i>integrated</i> " offer)  |
|-------------------|-------------------------|---|---|
| <b>45 Mbps</b>    |                         |   |   |
| PDH, unstructured | T3                      | 1 x G.703 @ 45 Mbps (electrical)  | non standard, available on a project-to-project basis                                     |
| PDH, structured   | 21 x E1(*)              | 21 x G.703 @ 2,048 kbps (electrical)  | 21 x G.703 @ 2,048 kbps (electrical)  |
| SDH, unstructured | VC-3                    | 1 x G.703 @ 155 Mbps (electrical STM-1/VC-3)  | non standard, available on a project-to-project basis                                     |
| SDH, structured   | 21 x VC-12(*)           | 1 x G.703 @ 155 Mbps (electrical STM-1/21 x VC-12)  | 1 x G.703 @ 155 Mbps (electrical STM-1/21 x VC-12)  |
| <b>155 Mbps</b>   |                         |   |   |
| PDH, unstructured | E4                      | 1 x G.703 @ 140 Mbps (electrical)   | 1 x G.703 @ 140 Mbps (electrical)   |
| PDH, structured   | 3 x E3 (*)              | 3 x G.703 @ 34 Mbps (electrical)  | 3 x G.703 @ 34 Mbps (electrical)  |
| PDH, structured   | 3 x T3 (*)              | 3 x G.703 @ 45 Mbps (electrical)  | non standard, available on a project-to-project basis                                     |
| PDH, structured   | 63 x E1 (*)             | 63 x G.703 @ 2 Mbps (electrical)  | 63 x G.703 @ 2 Mbps (electrical)  |
| SDH, unstructured | VC-4                    | 1 x G.703 @ 155 Mbps (electrical STM-1/VC-4)<br>1 x G.957 @ 155 Mbps (optical STM-1/VC-4)                           | 1 x G.703 @ 155 Mbps (electrical STM-1/VC-4)<br>1 x G.957 @ 155 Mbps (optical STM-1/VC-4) |
| SDH, structured   | mix of VC-12 / VC-3 (*) | 1 x G.703 @ 155 Mbps (electrical STM-1/ mix VC-12 / VC-3)<br>1 x G.957 @ 155 Mbps (optical STM-1/ mix VC-12 / VC-3) | non standard, available on a project-to-project basis                                     |

-Table 1 -

The table 1 describes the different bandwidth configurations available to the customer. On a project-to-project basis, interfaces could be different at both ends of the circuit and additional customer interfacing solutions can be achieved.

- "**21 x G.703 @ 2,048 kbps (electrical)**" means that the 21 circuits are provided through 21 G.703 normalized electrical interfaces at 2,048 kbps bit-rate.
- "**1 x G.703 @ 155 Mbps (electrical STM-1/ N x VC-12)**" means that the N x VC-12 circuits are provided through a single G.703 normalized electrical interface at 155 Mbps bit-rate.
- "**1 x G.703 @ 155 Mbps (electrical STM-1/ mix VC-12/VC-3)**" means that the mix of VC-12 and VC-3 circuits is provided through a single G.703 normalized electrical interface at 155 Mbps bit-rate.

Interfaces can be electrical (G.703 normalized) or optical (G.957 normalized).

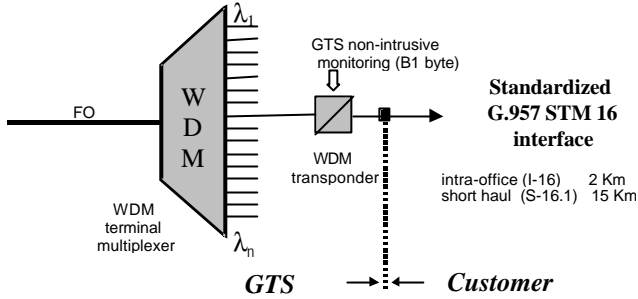
SDH standard interfaces are at 155 Mbps bit-rate. Higher bit-rate SDH interfaces (STM-4) are considered on a project-to-project basis.

Depending on the Local Access Provider's specific standards, the range of connectors include electrical BNC 75Ω, Krone 120Ω, Pouyet 120Ω, 1.6/5.6 75Ω, 1.0/2.3 75Ω, RJ45 75Ω, BT43 75Ω; optical E-2000 SC/PC, SC/APC/FC/PC, FC/APC. Services limited to the GTS backbone network only (without local access) are provided to the customer through electrical 1.6/5.6 75Ω or optical SC/PC standard connectors.

<sup>2</sup> GTS does not actually offer E1 Ring services, but according to table 1, a 45Mbps Ring service can be presented at the customer's premises through 21xE1 interfaces.



### 3 Optical Sub-Network (OSN)



Each 2.5 Gbps wavelength is delivered to the customer through G.957 normalized STM-16 interface on an optical transponder.

The interfacing with the DWDM transponder is made on a 3 R opaque regeneration basis (Re-shaping, Re-timing, Re-amplification), non intrusive to the SDH layer. To track the performance of each DWDM link of the network, GTS monitors the B1 Byte in the Section OverHead (SOH) of the STM16 frame, but in a non-intrusive way. There is no SDH networking in the transponder. GTS DWDM links are fully transparent to the 2.5 Gbps transport of SDH or other customer's signal type.

Available interfaces are I-16 (2km) or S-16.1 (15km). S-16.2 interfaces are not yet available. Receivers can accept both 1310 and 1550 nm wavelength frequency. The connector type is FC/PC.

The backbone service demarcation point is the GTS Optical Distribution Frame (ODF).

### 4 Ebone IP services

GTS offers a wide range of access bandwidths to meet each customer's specific bandwidth needs. Access speeds and connection types supported are listed in the table below.

| Bandwidth   | Physical interface  |
|---|---|
| <input type="checkbox"/> 64 Kbps<br><input type="checkbox"/> 128 Kbps<br><input type="checkbox"/> 256 Kbps<br><input type="checkbox"/> 512 Kbps<br><input type="checkbox"/> 768 Kbps<br><input type="checkbox"/> 1 Mbps<br><input type="checkbox"/> 2 Mbps (E1) | <input type="checkbox"/> X.21 (DSUB-15)<br><input type="checkbox"/> V.35 (V.35)<br><input type="checkbox"/> G.703 PDH (75 Ω unbalanced BNC)   |
| <input type="checkbox"/> 4 Mbps   | <input type="checkbox"/> 2 x X.21 (DSUB-15) load balanced<br><input type="checkbox"/> 2 x V.35 (V.35) load balanced<br><input type="checkbox"/> 2 x G.703 PDH (75 Ω unbalanced BNC) |



|                                   |   |
|-----------------------------------|---|
| <input type="checkbox"/> ___ Mbps | <input type="checkbox"/> E3 G.703 PDH (75 $\Omega$ unbalanced BNC), CSU clock limited up to 34 Mbps<br><input type="checkbox"/> E3 G.703 PDH (75 $\Omega$ unbalanced BNC), rate limited up to 34 Mbps<br><input type="checkbox"/> T3 G.703 PDH (75 $\Omega$ unbalanced BNC), CSU clock limited up to 45 Mbps<br><input type="checkbox"/> T3 G.703 PDH (75 $\Omega$ unbalanced BNC), rate limited up to 45 Mbps<br><input type="checkbox"/> 10baseT half duplex (RJ45) with rate limit up to 3 Mbps (*)<br><input type="checkbox"/> 100baseT full duplex (RJ45) with rate limit up to 100 Mbps (*)<br><input type="checkbox"/> G.957 STM-1o / OC-3c (SC-PC) with rate limit up to 140 Mbps |
| <input type="checkbox"/> 34 Mbps  | <input type="checkbox"/> E3 G.703 PDH (75 $\Omega$ unbalanced BNC)  |
| <input type="checkbox"/> 45 Mbps  | <input type="checkbox"/> T3 G.703 PDH (75 $\Omega$ unbalanced BNC)  |
| <input type="checkbox"/> 140 Mbps | <input type="checkbox"/> G.957 STM-1o / OC-3c (SC-PC)   |

(\*) Only available when co-located