Overview of TS-1000

-- TTC specification for FTTH --

TTC working group 21

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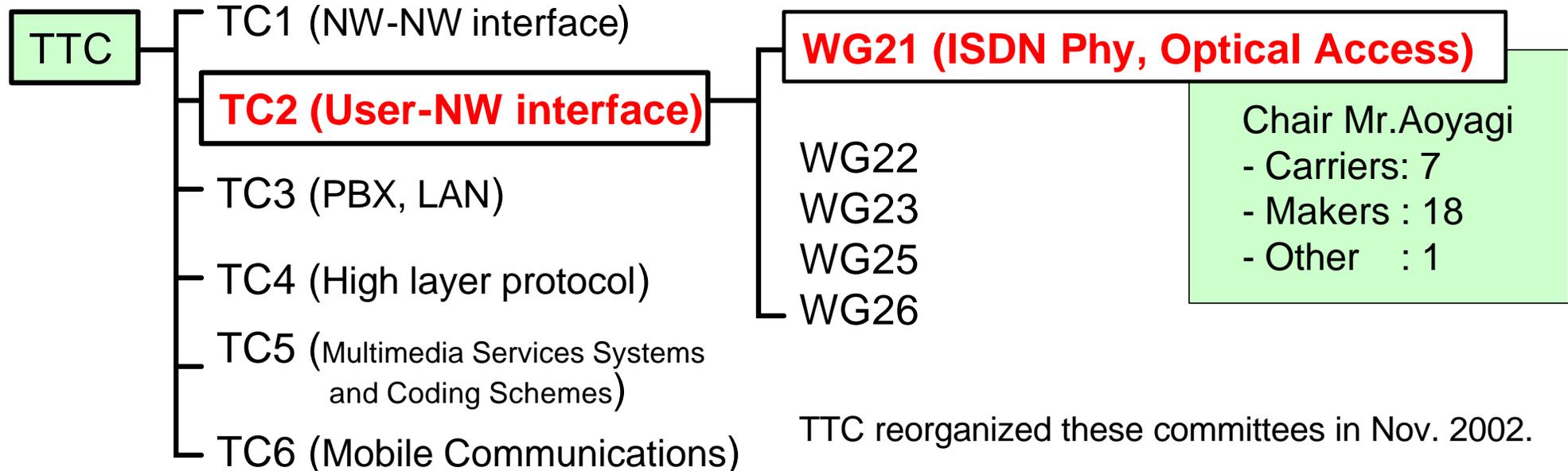Status of TTC for the Liaison from IEEE802.3ah

What is TTC?

TTC: Telecommunication Technology Committee

Established in 1985 as a non-profit standardization organization in Japan.
Members include;

Agilent Technologies Japan, Alcatel Japan, Allied Telesis, Broadcom Japan,
Compaq Computer, Fujitsu, Hitachi, Hitachi Cable, IBM Japan, Intel K.K.,
Lucent Technologies Japan, Matsushita, Mitsubishi, Motorola Japan, NEC,
Nippon Ericson, NTT, Nokia Japan, Nortel Networks, Siemens K.K., SONY,
Sumitomo Electric Industries, TI Japan ……

TTC
- TC1 (NW-NW interface)
- **TC2 (User-NW interface)**
- TC3 (PBX, LAN)
- TC4 (High layer protocol)
- TC5 (Multimedia Services Systems and Coding Schemes)
- TC6 (Mobile Communications)

WG21 (ISDN Phy, Optical Access)
WG22
WG23
WG25
WG26

Chair Mr.Aoyagi
- Carriers: 7
- Makers : 18
- Other   : 1

TTC reorganized these committees in Nov. 2002.

http://www.ttc.or.jp/e/index.html

Background of TS-1000

Situation in Japan

➢ 100 Mb/s Ethernet service for mass market have already started since early 2001.
- 110K FTTH subscribers in Sep. 2002. (x10 growth in 1 year)
- monthly charge is about x1~x3 of ADSL.

➢ Japanese gov. "e-Japan" targets at least 10 million ultra-high speed Internet access (optical access) subscribers in 5 years. (issued in March 2001)

➢ To meet Japanese FTTH market, it was important to create multi-vender environment for the 100 Mb/s P2P optical Ethernet link.
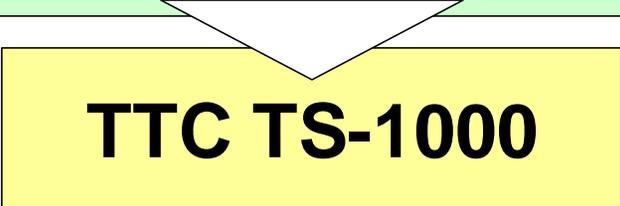
TTC TS-1000

What is TS-1000?

TS-1000

➢ TS-1000 is a technical specification for 100 Mb/s P2P optical Ethernet link,
  "Optical Subscriber Line Interface – 100 Mbit/s Single-fiber Bi-directional
  Interface by WDM –".
  (English edition of TS-1000/draft is on the EFM web site.)

➢ Schedule
          Sep. 01:   TTC WG21 started discussion.
          May 02:   TTC issued TS-1000.

          Soon after TS-1000 was issued,
                    Products based on TS-1000 started to ship.
                    Carriers in Japan have started to install TS-1000
                      based system.

Requirements and Approach

➢ Early and easy implementation
- 100 Mb/s P2P on Single-fiber (SMF).
- use conventional Standards and Recommendations, such as G.957(SDH), G.983(PON) etc.

➢ Carriers requirements for cost is very severe.
- Un-cooled FP-LASER for both 1310 nm/1550 nm.

➢ Common requirements from Japanese carriers
- 15 dB of loss (Class S)
- 14 dB of minimum optical return loss

The relationship between the loss budget and distance is based on carriers' own design rules and these are not open.
The design rule includes loss margin for
- fiber connection/splicing methods and numbers,
- fiber test method (OTDR) and optical devices,
- fiber cable re-routing,   and so on.

Detail Specification of TS-1000 (1)

Class S: 15 dB budget
Class A and B for longer reach are for further study.

Wavelength
Upstream: 1260 – 1360 nm
Downstream: 1480 – 1580 nm

➢ Wavelength is based on ITU-T G.983, because carriers have already installed access fibers based on ITU-T Recommendations, such as G.983 series (PON), L.41(maintenance wavelength) etc.

➢ This specification has 100 nm range, therefore un-cooled FP-LD can be available.

Detail Specification of TS-1000 (2)

Spectral width(RMS)

1310 nm range: 7.7 nm

1550 nm range: 6.0 nm

(measured with pseudo-random pattern)

➢For 1310 nm range, G.957 STM-1 S-1.1 (155 Mb/s) is suitable.

➢For 1550 nm range, there are no suitable Standards or Recommendations for FP-LD. Therefore, we discussed a new specification.

➢The typical value of RMS is less than 3 nm, so we adopted 6 nm for easy availability and low cost.

➢With RMS of 6 nm, maximum reach is limited to 7.3 km by dispersion, when all parameters become worst. However, maximum reach may be more than 10 km with typical values.
And carriers who want to get guaranteed reach can purchase with sever RMS specification, because influence of RMS is restricted in OLT.

Detail Specification of TS-1000 (3)

Tx and Rx level
Tx: -8 ~ -14 dBm

Rx: -8 ~ -30 dBm

(measured with pseudo-random pattern)

➢ The modification on G.957 S-1.1 (STM-1, with Tx of –8 to –15 dBm and Rx of –8 to –30 dBm) was discussed.

➢ For low cost realization, minimum value of Tx and Rx were changed to achieve 15 dB loss budget and 1 dB penalty, because conventional STM-1/OC-3 optical modules have such sensitivity.

Detail Specification of TS-1000 (4)

SX, Reflection and Signal Detect

Minimum ORL: 14 dB

Bit error rate: 1×10^{-10} with max. reflection and min. Rx

SD: Do not make false link-up by reflection. (value is not defined)

➢Maximum value of ORL is carriers requirements.

➢It is consistent with the high-reflectance at FP-LD.

➢SD level is related to WDM isolation and reflection.

➢These relationship can be defined independent from the other side. Therefore, these values should not be defined to allow wide selection of WDM devices.

WDM	SD range
High	wide
Low	narrow

Tx   Rx   -8 dBm

ORL >14dB

-14 dBm

max. reflection -22 dBm

WDM isolation

-30 dBm

SD range
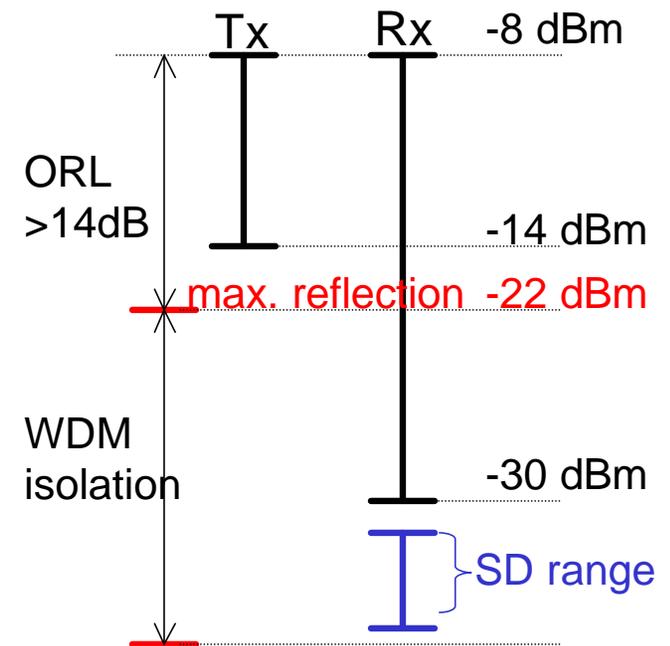
Detail Specification of TS-1000 (5)

Extinction Ratio

more than 8.2 dB
(measured with pseudo-random pattern)

➢We did not accept any reasons to change ER from STM-1.
   (We think that changing from STM-1 does not make cost reduction)

Pulse mask

STM-1.(measured with pseudo-random pattern)

➢We did not accept any reasons to change pulse mask from STM-1.
   (We think that changing from STM-1 does not make cost reduction)

Detail Specification of TS-1000 (6)

Jitter
less than 2.5 ns is recommended

➢Jitter is very difficult to evaluate for MLM LASER. So we show some recommendation from the typical value of PHY LSIs.

Connecter
Not defined

➢The connecter is not defined not to limit any application.

Test pattern
Not defined (pseudo-random pattern)

➢These optical specification is based on STM-1, so pseudo-random pattern is prefer to measure these items. We show one sample of test pattern.

Comments for IEEE802.3ah D1.1

Loss budget

➢ 15 dB is common requirement from carriers.
➢ Relationship between loss and distance is not open.
➢ We do not think that relax of loss budget causes effective cost reduction.

Extinction Ratio

➢ ER in TS-1000 is defined for pseudo-random pattern.
➢ We understand that definition of ER for 4B/5B is different from that for pseudo-random pattern.

Signal Detect

➢ To prevent false link-up by reflection, SD level and WDM isolation should satisfy following expression;

$$max(Tx) - max(ORL) - WDM\_isolation < SD\_deassertion\_level$$

➢ We think that limitation of SD level is not necessary, however minimum SD level of –45 dBm is practically no problem.

Status of TTC for the Liaison from IEEE802.3ah

- ➢ TTC wants to keep the liaison statement between TTC and IEEE802.3ah.

- ➢ TTC thinks that it is important for TTC and IEEE to make specifications for which same optical devices can be applied.

- ➢ TTC does not want to change TS-1000 specification in a few years, because it is an effective specification and installation of the systems based on TS-1000 have already been started widely in Japanese FTTH.

- ➢ TTC may discuss how TS-1000 should be changed, when TTC understands the necessity of specification change depending on the discussion in IEEE802.3ah.

Thank You!

I am Aoyagi, Chair of TTC WG21.

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