

Link Line Up

This chapter gives information about the start-up of ADM-1 and about tests to be performed in order to check the correct operation of the equipment.

All the used instruments will be identified by the letters 'TE' followed by a number.

Instruments and Accessories

The following table defines the labels used to indicate each test equipment.

Ref.	Instruments	Characteristics
TE1	Plesiochronous signal generator and error-rate tester	2 to 140Mbit/s
TE2	STM-1 synchronous frame generator/analyzer	155Mbit/s
TE3	<u>Local Controller</u> Personal Computer with an INTEL 80486, or higher, microprocessor and dedicated software	(1)
TE4	Frequency meter	
TE5	Voltmeter	
TE6	Oscillator	
TE7	Optical Power Meter	
TE8	Optical Variable Attenuator	
TE9	Optical Fixed Attenuator	≥ 8dB
	Fiber optic cable (for loops)	FC-PC/FC-PC or SC/SC connections

NOTE (1) Refer to the Volume "Local Operator's Handbook".

Tab. 3.4-1 Instruments used for the initial set-up

Power Supply Voltages Check

Description

This test must be performed in order to check that power supply is correctly provided to all units.

Procedure

- 1.** Power-on the equipment by connecting the power supply lines to the Power Supply Connection Unit.
- 2.** Check that no red LEDs indicating card's internal fault light up.
- 3.** Check that, on MOST Unit, the green LED indicating the presence of power supply light up.

Commissioning

The ADM-1 equipment commissioning procedures are mainly performed using Local Controller software. The first operations to carry out will therefore be connection of the Personal Computer.

Procedure

Carry out the following operations referring to the –Local Operator's Handbook:

- ◆ *install the Local Controller Software on the Personal Computer;*
- ◆ *connect the Personal Computer to the equipment;*
- ◆ *start the first equipment commissioning (physical configuration of the subrack);*
- ◆ *check if the equipment is fitted with the correct unit firmware and software;*
- ◆ *check the Local Controller Software revision.*

————— See Volume Local Operator's Handbook for more details about these operations.

Internal Fault Check

Description

This test is performed in order to check if there are any faults internally detected by the equipment.

Procedure

1. Loop connect all STM-1 lines or tributaries (Electrical as well Optical), see Fig. 3.4-1.

If the Optical Unit is fitted with Long Haul laser, carry out the loop between the Tx and Rx connectors inserting at least 8dB optical attenuator.

2. Disable the DCC management on the lines under test.
3. Set the synchronization in free-running mode.
4. Check that no alarm LEDs are lit on the equipment.

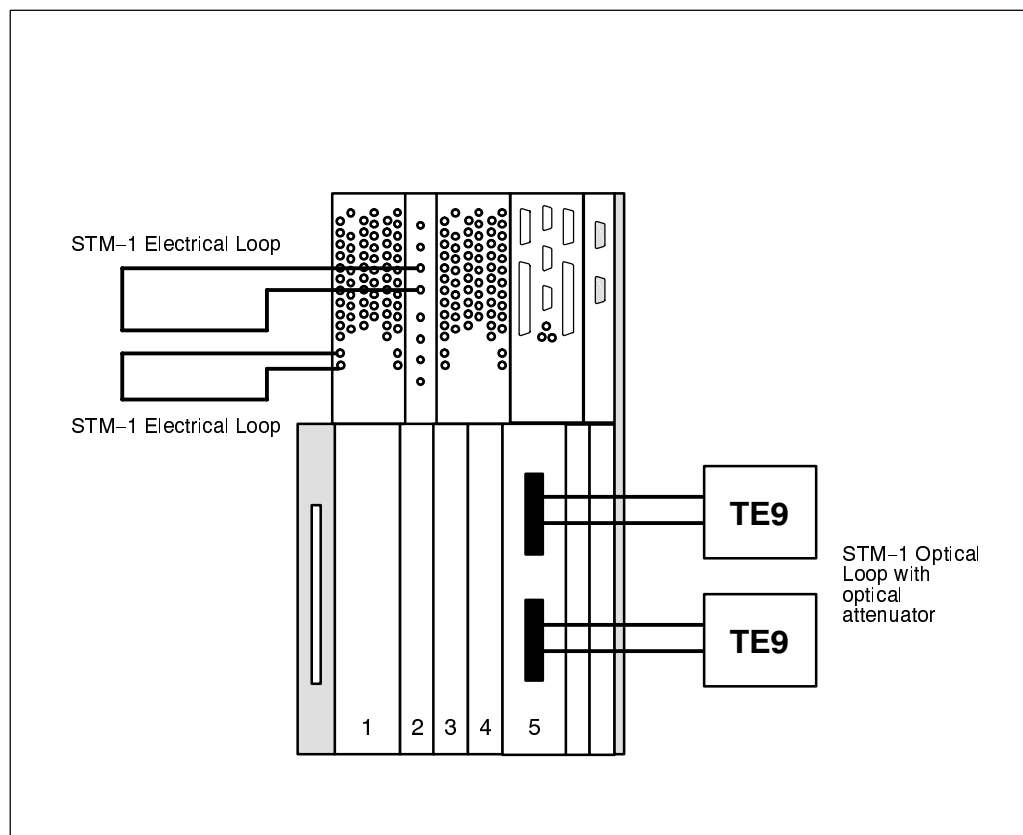


Fig. 3.4-1 Optical and electrical loop connections

Bit Error Rate Check

Description

In this test the basic cross-connection of the Tributary Units and the switch circuit of the MOST Unit are tested.

The Tributary Units to be checked, can be of the following kind:

- ◆ *STM-1 G.703 Electrical/Mux Unit;*
- ◆ *STM-1 Optical/Mux Unit;*
- ◆ *1x140Mbit/s / STM-1 (with VC-12 handling) G.703 Tributary Unit;*
- ◆ *63x1.5/2Mbit/s G.703 Tributary Unit;*
- ◆ *32x1.5/2Mbit/s G.703 Tributary Unit;*
- ◆ *3x34Mbit/s Tributary Unit;*
- ◆ *3x45Mbit/s Tributary Unit;*
- ◆ *16x1.5/2Mbit/s Tributary Sub-unit;*
- ◆ *32x1.5/2Mbit/s Tributary Sub-unit;*
- ◆ *1x34Mbit/s G.703 Tributary Sub-unit.*

The traffic is routed from one Tributary Unit via the Switch Unit to one of the line.

A bit error rate is performed for ten minutes per Tributary Unit with all the ports looped.

Procedure

In the following, the tests are realised by using an example of equipment composition:

- ◆ *slot 1 . . . MOST Unit, fitted with:*
 - *STM-1 electrical line interfaces (line 0 and line 1)*
 - *32x1.5/2Mbit/s Tributary Sub-unit;*
- ◆ *slot 2 . . . 1x140Mbit/s / STM-1 (with VC-12 handling) G.703 Tributary Unit;*
- ◆ *slot 3 . . . 3x34Mbit/s Tributary Unit or 3x45Mbit/s Tributary Unit*
- ◆ *slot 4 . . . MOST Unit, fitted with:*
 - *STM-1 optical line interfaces (line 0 and line 1).*

To check stream routing, the following connections must be made:

1. Connect the receive and transmit sides of the plesiochronous signal generator and error-rate tester (TE1) respectively to the TX and RX sides of the PDH tributary ports (or on the DDF).
2. Connect the receive and transmit sides of the STM-1 frame generator/analyzer (TE2) respectively to the TX and RX sides of the STM-1 tributary port (or on the DDF).
3. Connect the optical receive and transmit sides of the STM-1 frame generator/analyzer (TE2) with the TX and RX sides of line 0 interface of the MOST Unit A.
4. Using a proper optical cable loop the TX and RX sides of line interfaces (line 0 and line 1) of MOST Unit B.

If the Optical Unit is fitted with Long Haul laser, carry out the loop between the Tx and Rx connectors inserting at least 8dB optical attenuator.

5. Using a proper coaxial cable loop the TX and RX sides of line 1 of MOST Unit A.
6. Set the 32x1.5/2Mbit/s G.703 Tributary Unit for working with the desired bit rate (1.5 or 2Mbit/s).
7. Set the 1x140Mbit/s / STM-1 (with VC-12 handling) G.703 Tributary Unit for working with the desired bit rate (140 or 155Mbit/s).
8. Issue a pseudo-random pattern towards the tributary port, using the plesiochronous signal generator (TE1) according to the different tributary unit:
 - ◆ **2Mbit/s HDB3 or 1.5Mbit/s AMI or B8ZS with a pseudo-random pattern ($2^{15}-1$) for the:**
 - 63x1.5/2Mbit/s G.703 Tributary Unit
 - 32x1.5/2Mbit/s G.703 Tributary Unit
 - 16x1.5/2Mbit/s Tributary Sub-unit
 - 32x1.5/2Mbit/s G.703 Tributary Unit;
 - ◆ **34Mbit/s HDB3 with a pseudo-random pattern ($2^{23}-1$) for the:**
 - 3x34Mbit/s Tributary Unit
 - 1x34Mbit/s G.703 Tributary Sub-unit;
 - ◆ **45Mbit/s B3ZS with a pseudo-random pattern ($2^{23}-1$) for the:**
 - 3x45Mbit/s Tributary Unit;
 - ◆ **140Mbit/s CMI with a pseudo-random pattern ($2^{23}-1$) for the:**
 - 1x140Mbit/s / STM-1 (with VC-12 handling) G.703 Tributary Unit (when it is set working as PDH 140 interface).

9. Issue a pseudo-random pattern towards the tributary port, using the synchronous signal generator (TE2) according to the different tributary unit:
 - ◆ *155Mbit/s CMI structured into TU-12 or TU-3 or AU-4 for the:*
 - *STM-1 G.703 Electrical/Mux Unit*
 - *1x140Mbit/s / STM-1 (with VC-12 handling) G.703 Tributary Unit (when it is set working as SDH 155Mbit/s interface).*
 - ◆ *155Mbit/s NRZ Optical structured into TU-12 or TU-3 or AU-4 for the STM-1 Optical/Mux Unit.*
10. By means of the Local Controller (TE3), activate the connection between the tributary port and one virtual channel inside the STM-1 signal issued over the MOST A line 0.
11. By means of the RX side of the plesiochronous signal generator/error-rate tester (TE1), check reception of the 1.5 or 2 or 34 or 45 or 140Mbit/s signal routed in the equipment and check the absence of errors.
12. By means of the RX side of the synchronous signal generator/error-rate tester (TE2), check reception of the 155Mbit/s signal routed in the equipment and check the absence of errors.
13. By means of the STM-1 frame analyzer (TE2), check the position of the signal inside the frame and check the absence of errors

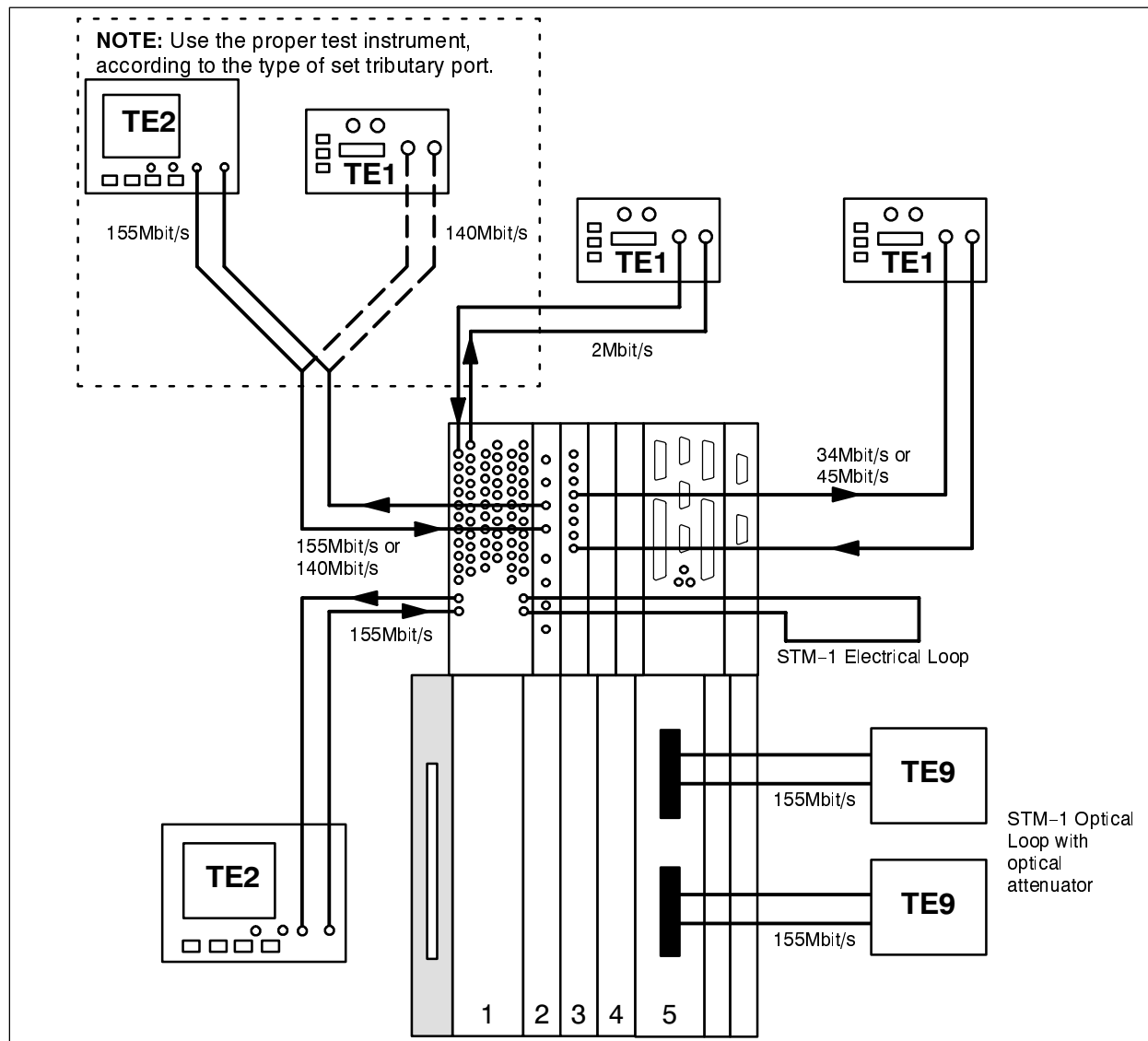


Fig. 3.4-2 Connections to make for the stream routing check

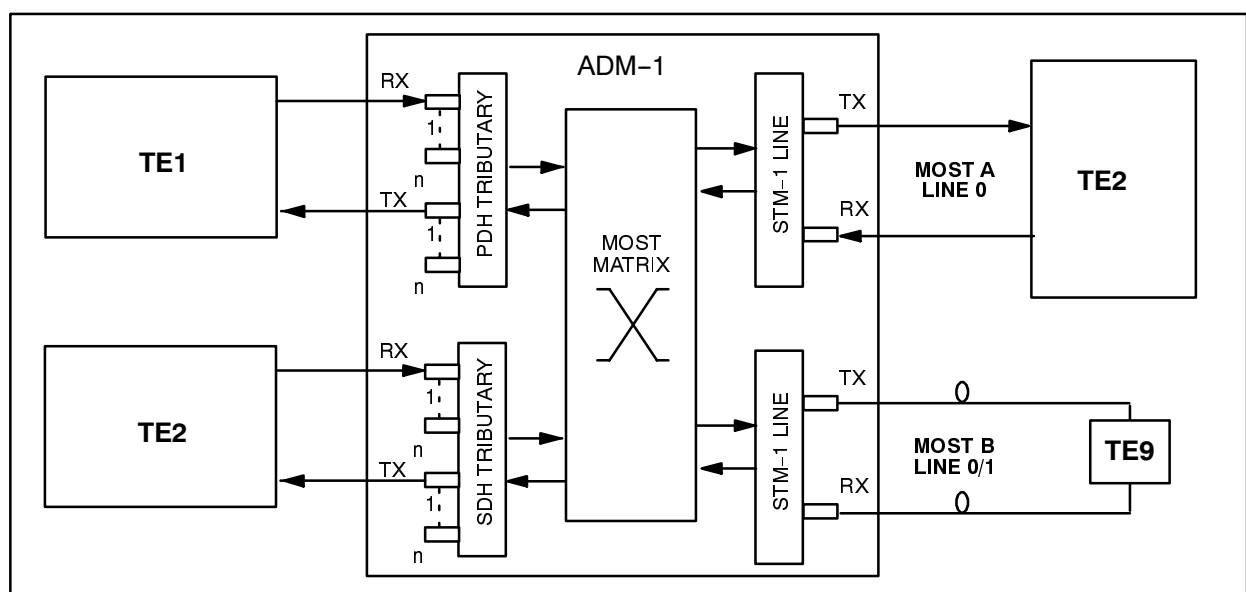


Fig. 3.4-3 Check of routing between tributary ports and the line

Alarm Check

Description

This check involves simulating some alarms and checking that they are reported to the Local Controller and also that the right consequent actions are performed by the equipment.

Procedure

————— *For the test configuration , make reference to step 1 to 5 of "Bit Error Rate Check".*

- 1.** Execute the alarm simulations, in the order given in Tab. 3.4–2
- 2.** Check, for each alarm simulation, that the right consequent actions are performed on test equipment.

ALARM SIMULATION	ADM-1	PDH ANALYZER	SDH ANALYZER
Configure a Tributary Module not fitted	32x2Mbit/s Port Missing (on controller)	LOS	HPA TUAIS
Inject with the SDH analyzer a BER of $\varepsilon \geq 1 \times 10^{-5}$ in the TU-n frame	LPT DEG (on line module) PPI2MB SD (on trib unit)	–	–
Inject with the SDH analyzer a BER of $\varepsilon \geq 1 \times 10^{-3}$ in the TU-n frame	HPT EXC (on line module) PPI2MB EXC (on trib unit)	AIS	LPT RDI
Inject with the SDH analyzer a AIS signal in the TU-n frame	HPA TUAIS (on line module) PPI2MB AIS (on trib unit)	AIS	LPT RDI
Inject with the SDH analyzer a RDI signal in the TU-n frame	PPI2MB RDI (on trib unit)	–	–
Inject with the SDH analyzer a AIS signal in the AU-4 frame	MSA AIS (on line module) PPI2MB AIS (on trib unit)	AIS	PPI2MB RDI LPT RDI
Inject with the SDH analyzer a RDI signal in the AU-4 frame	HPT RDI (on line module)	–	–
Inject with the SDH analyzer a BER of $\varepsilon \geq 1 \times 10^{-5}$ in the STM-1 frame (B2)	MST DEG (on line module)	–	–
Inject with the SDH analyzer a BER of $\varepsilon \geq 1 \times 10^{-3}$ in the STM-1 frame	MST EXC (on line module) PPI2MB AIS (on trib unit)	AIS	MST RDI PPI2MB RDI LPT RDI
Inject with the SDH analyzer a AIS signal in the STM-1 frame	MST AIS and SPI RxChkFail (on line module) PPI2MB AIS (on trib unit)	AIS	MST RDI PPI2MB RDI LPT RDI
Inject with the SDH analyzer a RDI signal in the STM-1 frame	MST RDI (on line module)	–	–
Inject with the PDH analyzer a code BER of $\varepsilon \geq 1 \times 10^{-5}$ in the 2Mbit/s input	PPI2MB DEG	–	–
Inject with the PDH analyzer a code BER of $\varepsilon \geq 1 \times 10^{-3}$ in the TRIB input	PPI2MB EXC	–	–
Inject with the PDH analyzer a AIS signal in the TRIB input	PPI2MB AIS (on trib unit)	–	–

Tab. 3.4-2 Alarm simulation

Protection Check

Description

This test is used to check the correct operation of protection schemes (SNCP, MSP, etc.).

This test is realised by using the same example of configuration given in paragraph "Bit Error Rate Check".

Procedure

1. Loop the interfaces of lines 1 and 0 of MOST Unit A.
2. Loop on the equipment front panel or on the Station Digital Distribution Frame the output of the first port with the input of the second one and so on. Connect the output of the last port to the instrument RX side.
3. By means of the Local Controller, activate the connection between the tributary ports and one of the 63 possible positions inside the STM-1 signal (for the 2Mbit/s tributary signals) issued over the line 1 of the MOST Unit A.
4. Issue a pseudo-random pattern towards the tributary port, using the plesiochronous signal generator (TE1).

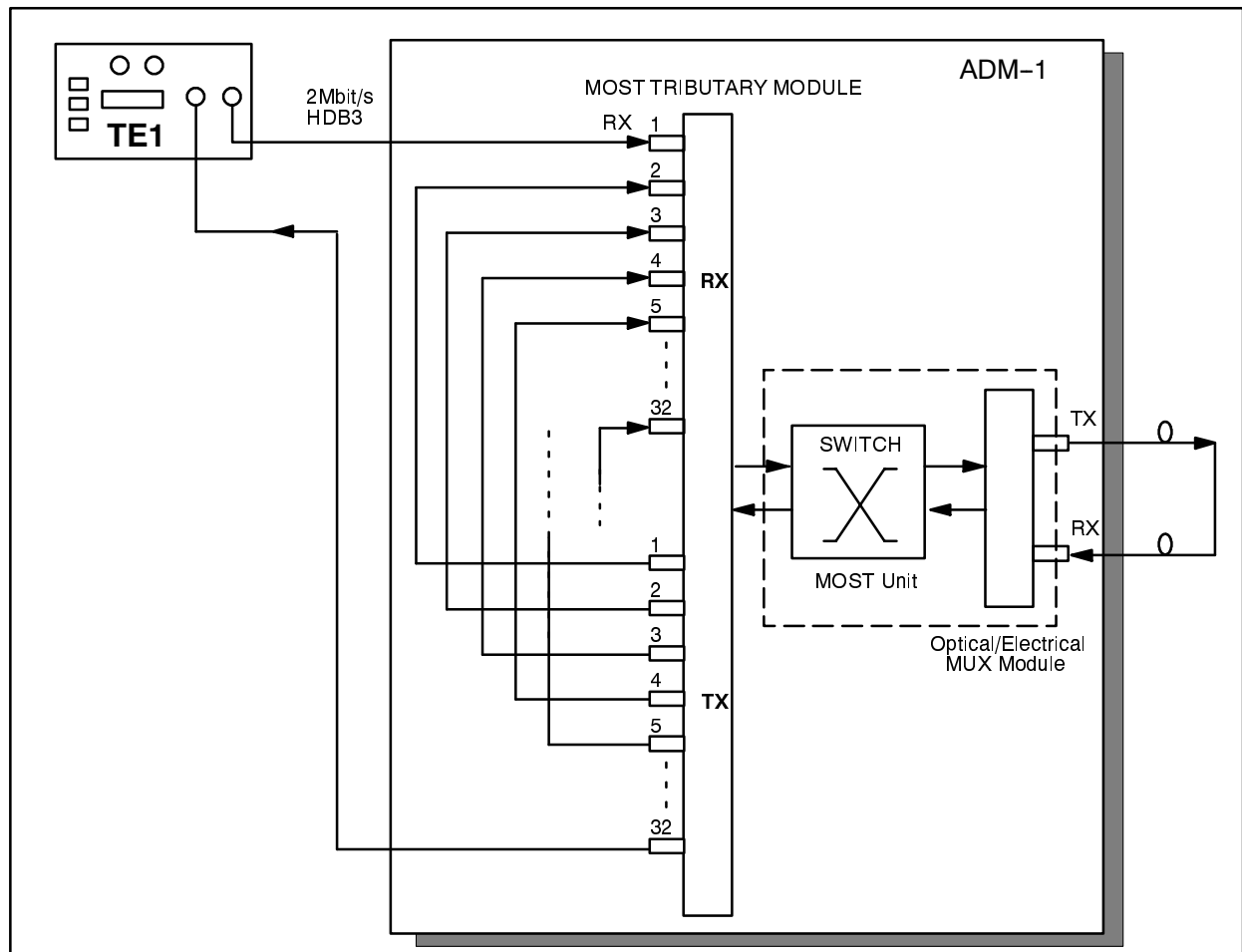


Fig. 3.4-4 Check of routing through a 2Mbit/s Tributary Sub-unit

5. By means of the Local Controller activate the TU-Protection on line east of all the cross-connected channels.

Select a REVERTIVE protection with Wait To Restore time of 0 minutes.

Check of the 1 + 1 Protections on the Switching Matrix

1. Remove MOST Unit A.
2. A short burst of bit errors should occurs.

By means of the RX side of TE1, check reception of the signal routed in the equipment and check the absence of errors.

TU Protection Check

To check the TU protection (SNCP) proceed in the following way:

1. Interrupt the line 1 of the MOST Unit A and check that:

- the TE1 shows a temporary error-rate and then returns to normal operating conditions
- the Local Controller shows that the line 0 is working and that the one on the line 1 is in stand-by.

2. Reconnect again the line 1 of the MOST Unit A and check that:

- the TE1 shows a temporary error-rate and then returns to normal operating conditions
- the Local Controller shows that the line 1 is again working and that the line 0 one is in stand-by.

Check of the 1 + 1 Line Protection (MSP)

1. Remove the TU-protections.

2. Enable (if available) the MSP 1+1 Protection on the line Interfaces.
Select a REVERTIVE protection with Wait To Restore time of 0 minutes.

Use the line 1 on MOST Unit A as *working* and the line 1 on MOST Unit B as *protection*, for example.

3. By means of the RX side of the TE1, check reception of the 2Mbit/s signal routed in the equipment and check the absence of errors.

4. Disconnect line 1 on MOST Unit A.

5. A short burst of bit errors should occurs.

By means of the RX side of the TE1, check reception of the 2Mbit/s signal routed in the equipment and check the absence of errors.

6. Connect again line 1 MOST Unit A.

7. A short burst of bit errors should occurs.

By means of the RX side of the TE1, check reception of the 2Mbit/s signal routed in the equipment and check the absence of errors.

————— Repeat the operations with line 0.

Synchronization Sources Check

Description

This test is used to check that ADM-1 is able to use the available synchronization sources, to generate its internal clock reference.

This test is realised by using the same example of configuration given in paragraph "Bit Error Rate Check".

Procedure

To carry out the synchronization checks, make the following connections:

1. Connect the TE1 to a tributary port and the TE2 to the line 0 of the MOST Unit A and loop back the line 1.
2. Connect a TE4 to the output clock connector No. 1.
3. Connect a TE6 to the external clock input connector No. 1.

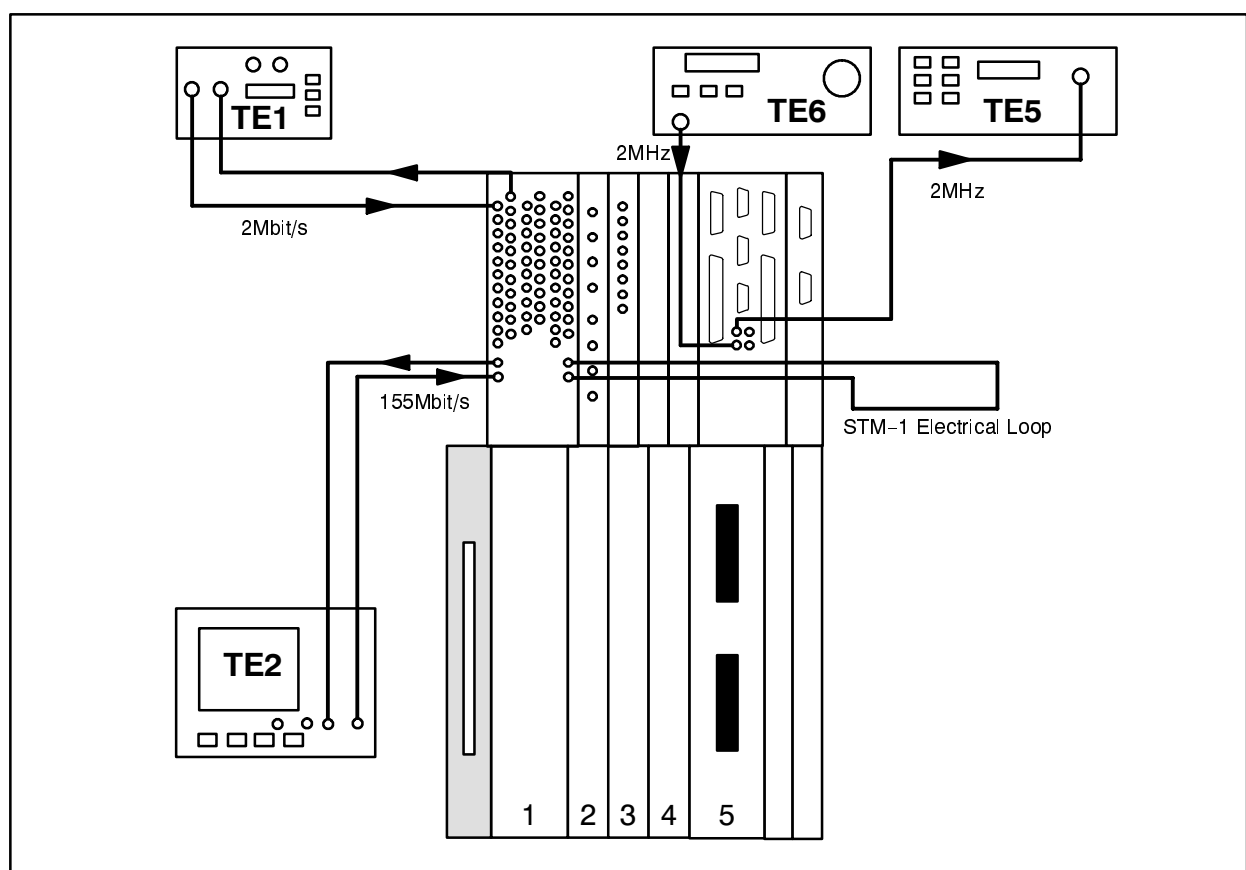


Fig. 3.4-5 Connections to be made for the timing checks

IMPORTANT The internal oscillator is normally already calibrated during the factory testing of the card and the quality is guaranteed with a tolerance of $2048\text{kHz} \pm 4.6 \text{ p.p.m.}$

Synchronism from an External Source

1. Issue a 2.048MHz clock input signal towards the MOST Unit, using the external oscillator (TE6).
2. By means of LC software enable the use of external source 1 as system synchronism source, with priority 1. This external reference will be designed as the system timing reference with a 2.048MHz synchronisation frequency.
3. Configure the synchronization output as 2.048MHz and set the *Protection Mode* as system (the priority table of the system synchronization sources will be used also for the synchronization output).
4. Vary the oscillator frequency and use the TE4 to check that the outgoing clock signal from the MOST Unit follows the incoming signal.

Synchronism from the Line

1. Use the TE2 to issue a 155Mbit/s signal towards the receive side of the MOST A line 0.
2. By means of LC software enable the use of line 1 as system synchronism source, with priority 1. This line reference will be designed as the system timing reference.
3. Configure the synchronization output as 2.048MHz and set the *Protection Mode* as system (the priority table of the system synchronization sources will be used also for the synchronization output).
4. Use the TE2 to vary the timing of the incoming signal on the line 0 and check on the TE4 that the outgoing clock signal from the MOST Unit follows these variations.

If you also wish to check the timing detected by the line 1, repeat the operations described above after connecting the TE2 to the line 1 and looping back the line 0, and enabling the use of line 0 as synchronization source.

Synchronism from a Tributary Port

1. Using the TE1, issue a 2Mbit/s signal in HDB3 code to a tributary port (e.g. port 1) connected to the Tributary Module on MOST A.
2. By means of LC software enable the use of the tributary port connected with the plesiochronous signal generator as system synchronism source (e.g. TRIB 2–PORT 1), with priority 1.
3. Configure the synchronization output as 2.048MHz and set the *Protection Mode* as system (the priority table of the system synchronization sources will be used also for the synchronization output).

4. Use the TE1 to vary the timing of the incoming signal on the tributary port and check on the TE4 that the outgoing clock signal from the MOST Unit follows these variations.

————— *If different Tributary units/modules are available, the timing check can be performed on each of them by acting in the same way described in the previous paragraph.*

Synchronism Protections Check

Description

This test is used to verify the correct switch between the enabled synchronization sources, according to the priority and quality tables.

————— *This test is realised by using the same example of configuration given in paragraph "Bit Error Rate Check".*

Procedure

————— *For the test configuration, make reference to step 1 to 3 of "Synchronization Sources Check"*

Priority Table

1. Use software to set the normal equipment synchronism mode and set the following sources as system synchronism sources in order of priority:

- Priority 1 2.048MHz external source 1
- Priority 2 line 0 on MOST A
- Priority 3 Tributary port.

Also enable the REVERTIVE mode and set the WAIT TO RESTORE time to 0.

2. Disconnect the various sources and check that the system is still automatically timed by the highest priority source available (for the check procedure, refer to the section entitled "Timing Source check").
3. Reconnect the various sources and check that the highest priority source is automatically restored as the system timing source.

Quality Table

4. Use software to set the timing marker ON and the quality (virtual Timing marker) of External 1 as Quality 3 and Tributary Port as Quality 4.
5. Set on the SDH analyzer different values of S1 byte (b5 – b8):

- 0010 Quality 1
- 0100 Quality 3
- 1000 Quality 4
- 1011 Quality 5
- 1111 Quality 6

and verify that the equipment is always using the clock defined with the highest quality independently by the Priority Table.

Out of Frequency Management Check

Description

This test is used to verify the correct detection of a complete loss of synchronization sources.

This test is realised by using the same example of configuration given in paragraph "Bit Error Rate Check".

Procedure

1. Using the plesiochronous signal generator (TE1), issue a 2Mbit/s signal in HDB3 code to a tributary port (e.g. port 1) connected to Tributary Module on MOST A.
2. Use the STM-1 frame generator to issue a 155Mbit/s signal towards the receive side of the line 1 of the MOST Unit.
3. Use LC software to define the following system synchronization sources (*):
 - Tributary Module port 1: priority 1
 - line 0 on the MOST A: priority 2.
4. Connect the frequency meter to the external output connector and use the LC software to disable the Squelch option and to set the *Protection Mode* of synchronization output, as system.
5. Use the Local Controller software to check that the active synchronization source is TRIB port 1 (*).
6. Use the plesiochronous signal generator (TE1) to vary the timing of the incoming signal on the tributary port and check on the frequency meter that the outgoing clock signal from the MOST Unit follows these variations.
7. The out of frequency threshold is **±9.3 ppm**. When the synchronization signal is out of this tolerance the MOST Unit changes over from the higher priority synchronization source to the immediately lower priority one. After this operation has done the frequency meter will detect a **0ppm** synchronization signal (line 1 A).
8. Use the Local Controller software to check that the active synchronization source is line 1 A and that the TRIB port is in **Out of Service** state (*).
9. Use the plesiochronous signal generator to vary the timing of the incoming signal on the tributary port; regulate the signal at **0ppm**.

10. Use the Local Controller to perform the manual switch of synchronization signal from line 1 A to TRIB port 1 (*). The MOST Unit waits the WTR period (if set) before performing the change over the synchronization sources. During this period the TRIB port 1 source is in **No Request** state.

NOTE () See Volume– Local Operator’s Handbook for more details about this operation.*

Emitted Optical Power Check

Description

This test is used to verify that the emitted optical power is compliant with technical specification given in Tab. 3.4–3.

————— *This test is realised by using the same example of configuration given in paragraph "Bit Error Rate Check".*

Procedure

1. Disconnect the TX output optical connector of MOST B line 0 and connect the radiometer by means of an optical single-mode cable.
2. Push the button for the Test Laser Restart for line 0 on the MOST Unit front panel.
3. Check that the optical power emitted is compliant with the values of table Tab. 3.4–3 "Optical performance".
4. Disconnect the radiometer and reconnect the RX input optical connector to the line 0.

————— *Repeat the operation for other equipped optical interfaces*

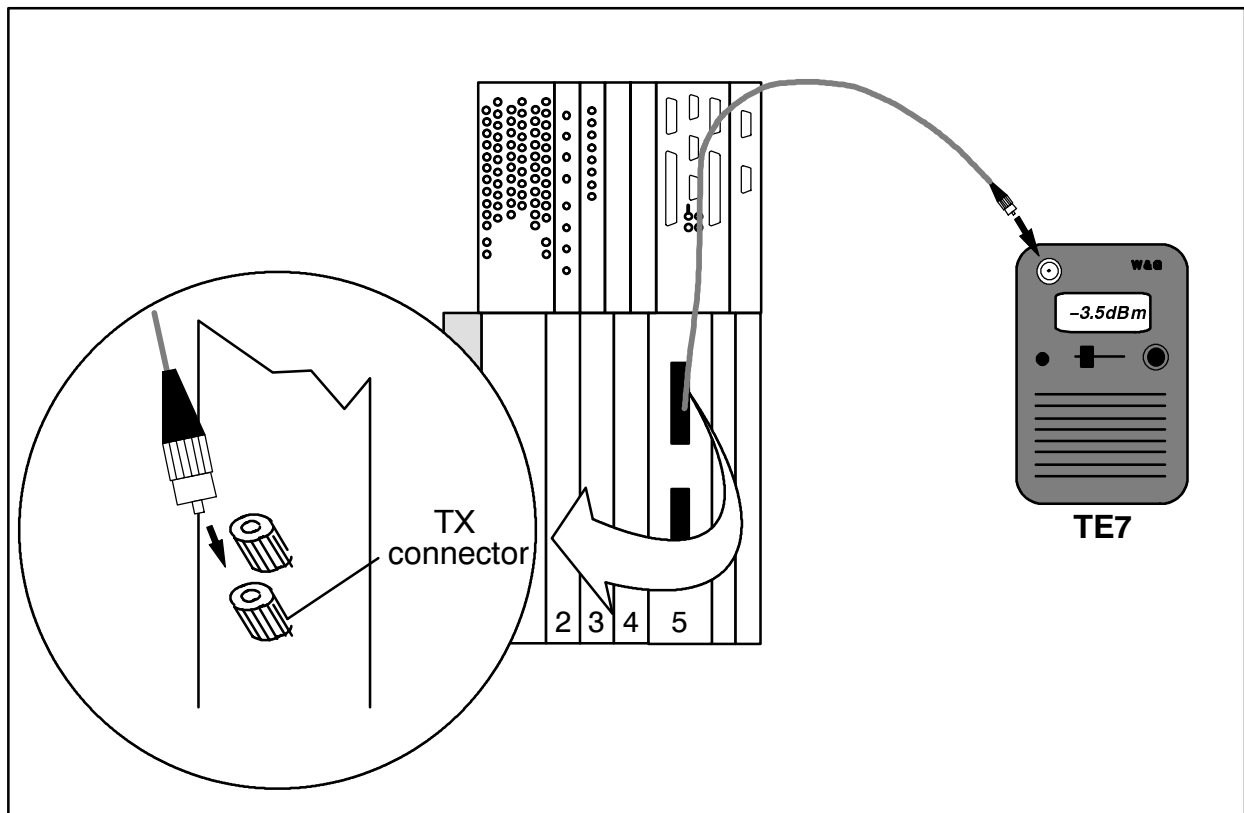


Fig. 3.4-6 *Emitted optical power test*

IMPORTANT Remember that the plastic protection, present on the front panel of MOST Units, must be removed before attempting any connect/iondisconnection of the optical lines

Receiver Sensitivity Check

Description

This test is used to verify if the receiver sensitivity is compliant with technical specification given in Tab. 3.4-3.

This test is realised by using the same example of configuration given in paragraph "Bit Error Rate Check".

Procedure

1. Issue a pseudo-random pattern towards the tributary port, using the TE1 (PRBS $2^{15} - 1$ for a 2Mbit/s card, PRBS $2^{23} - 1$ for a 155Mbit/s card).
2. Create with the Local Controller a connection between the selected port and a channel of line 1.
3. Disconnect the TX output optical connector of the line 1 and connect the TE8 by means of an optical single-mode cable.
4. Connect the output of the TE8 with the input of TE7.
5. Push the button for the Test Laser Restart for line 1 on the unit front panel.
6. Increase the attenuation value on the TE8 until you can measure -34dBm on the TE7 (see Tab. 3.4-3 'Optical performance').
7. Disconnect the TE7 and connect the TE8 output to the RX connector of the unit to test.
8. By means of the RX side of the TE1, check reception of signal routed in the equipment and check the absence of errors.

Repeat the operation for the line 0

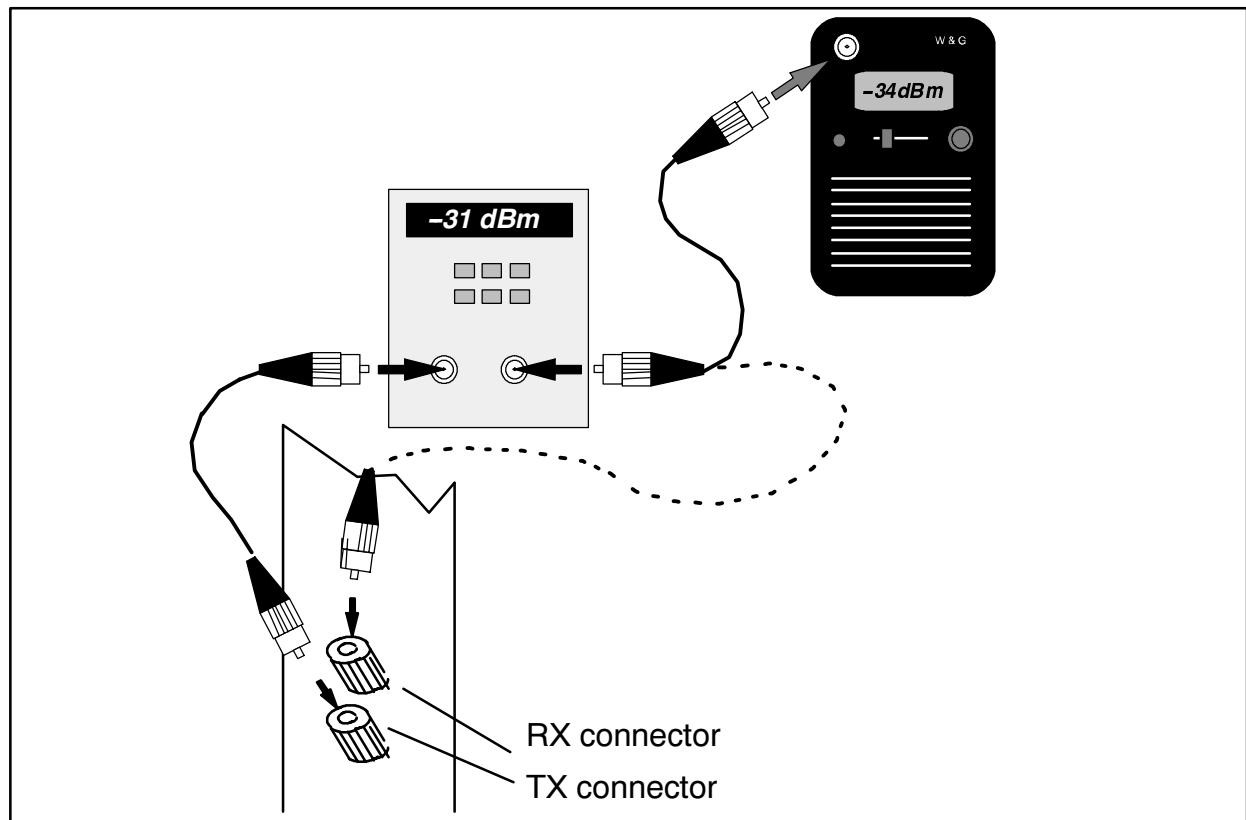


Fig. 3.4-7 Receiver Sensitivity Test

	unit	values			
DIGITAL SIGNAL Nominal bit rate	kbit/s	STM-1 (According to G.707 and G.958): 155 520			
Application code		I-1	S-1.1	L-1.1	L-1.2/L-1.3
Operating wavelength range	nm	(*)	1280/1335	1280/1335	1530/1570
TRANSMITTER AT REFERENCE POINT S					
<i>Mean launched power</i>					
- Maximum	dBm	(*)	- 8	0	0
- Minimum	dBm	(*)	- 15	- 5	- 5
- Typical	dBm	(*)	- 12	- 2.7	- 2.7
RECEIVER AT REFERENCE POINT R					
<i>Minimum sensitivity</i>	dBm	(*)	-34	-34	-34

NOTE (*) Optical performances of I-1 interface are made available using the S-1.1 interface.

Tab. 3.4-3 Optical performance

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