ALCATEL

COVER SHEET

CONFIDENTIAL

ENGINEERING TEST SPECIFICATION

Title 1	**ETS for MARS CTA**
Title 2	
Title 3	
Class 1	**MARS CTA**
Class 2	
Class 3	
Class 4	

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SCOPE

The MARS housed Cable Termination Assembly (CTA) is based upon qualified repeater and branching unit products. The purpose of this Engineering Test Specification is to define the manufacturing and performance test limits of the MARS CTA.

Under the terms of the Optical Networks Division's Product Life Cycle [Ref 1], this Engineering Test Specification will be classified as a 'Maintenance Release' and will therefore be required to satisfy a DR2 and a DR4 as defined at Reference 1.

1 REFERENCED DOCUMENTS

[1]	8BU 93003 0000 QRZZA	Optical Networks Division - Product Life Cycle
[2]	29D RD00 001 AAE	Fibre colour scheme for use with 14/14.5mm PE tube
[3]	8BU 96007 0005 DSZZA	Technical Functional Specification MARS CTA
[4]	8BU 96007 0005 FLZZA	Feature List
[5]	29C QD00 800 AAA	ODI Optical wet mate harness specification
[6]	29C QD00 800 BAA	ODI Electrical wet mate harness specification
[7]	8BU 96007 0005 QAZZA	Qualification Plan

2 RELATED DOCUMENTS

3CK 24067 0403 ASZZA	Decision Review Guidelines
8BU 93003 0003 QRZZA	OND Product Life Cycle Documentation Guidelines
8BU 96007 0005 DPZZA	Development Plan

3 GENERAL

This specification covers the basic performance parameters for the as received optical and electrical wet mate harnesses (references 4 and 5) and the fully housed MARS CTA.

The parameters specified in the following sections apply to the test stage quoted in those sections only.

Measurement uncertainty on all optical through loss measurements is to be +/- 0.01 dB

Measurement uncertainty on Electrical leakage measurements is to be +/- 0.2%

The CTA's that leave the Greenwich repeater factory prior to termination are coded:

29E-CT00-800-AAA (final Housed CTA)

The CTA housings will be engraved MARS/CTA/001 and MARS/CTA/002 respectively.

The temperature of 22°C is defined as Room temperature.

Tolerance on all temperatures is +/- 2°C.

For leakage current measurements the ambient relative humidity shall be less than 30%.

3.1 Fibre and wire identification

The externally accessible fibres at the CTA bulkhead will comply with the standard gland colour scheme for 14 way composite glands (reference 2) and will be identified as shown below:

Note: The fibres of both CTA and node optical penetrators will initially be coded with numerical tags on receipt from ODI. During the ODI bulkhead assembly the fibres on the CTA penetrator may be hand coloured to match those of the interfacing composite gland. Fibres on the node penetrator, from which through loss measurements of the complete assembly will be taken, will maintain their numeric identification. If a loop back test box is used refer to section 5.

ROV Test box & connector	**Sea case ODI Bulkhead**	**Sea case cable Bulkhead**	**OAL C7 cable tail**	**OAL C4 line cable**
SMF-28	**SMF-28**	**PSCF**	**RS/LEA/LS**	**LS (S9 Portland)**
Code Ref	**Code Ref**	**Fibre colour**	**Fibre colour**	**Fibre colour**
1	1	Black	Black (LEA)	Black
2	2	Yellow	Yellow (LEA)	Yellow
3	3	Red	Red (RS)	Red
4	4	Brown	Red+1 ring (RS)	Brown
5	5	Blue	Blue+1 ring (RS)	Blue
6	6	Orange	Orange+1 ring(RS)	Orange
7	7	Green	Turquoise (LS)	Green
8	8	Pink	Pink (LS)	Pink

The wires of both CTA and node electrical penetrators will initially be coded with numerical tags on receipt from ODI carrying the numbers 1 and 2. Number 1 will be nominated as the live feed whilst number 2 will be designated the earth return. Once the CTA power penetrator has been housed, wires on the node penetrator or test connector, from which electrical measurements of the complete assembly will be taken, will maintain their numeric identification. Colouring of the wires will be as detailed below.

Penetrator pin Number	**Test Connector or Node penetrator**	**ODI Bulkhead penetrator**	**CTA Bulkhead penetrator**	**Connection description**
1	Red or (white+red marking)	Red	White + Red marking	10 KV (DC) live feed
2	White	White	White	System Ground

3.2 Nominal conditions

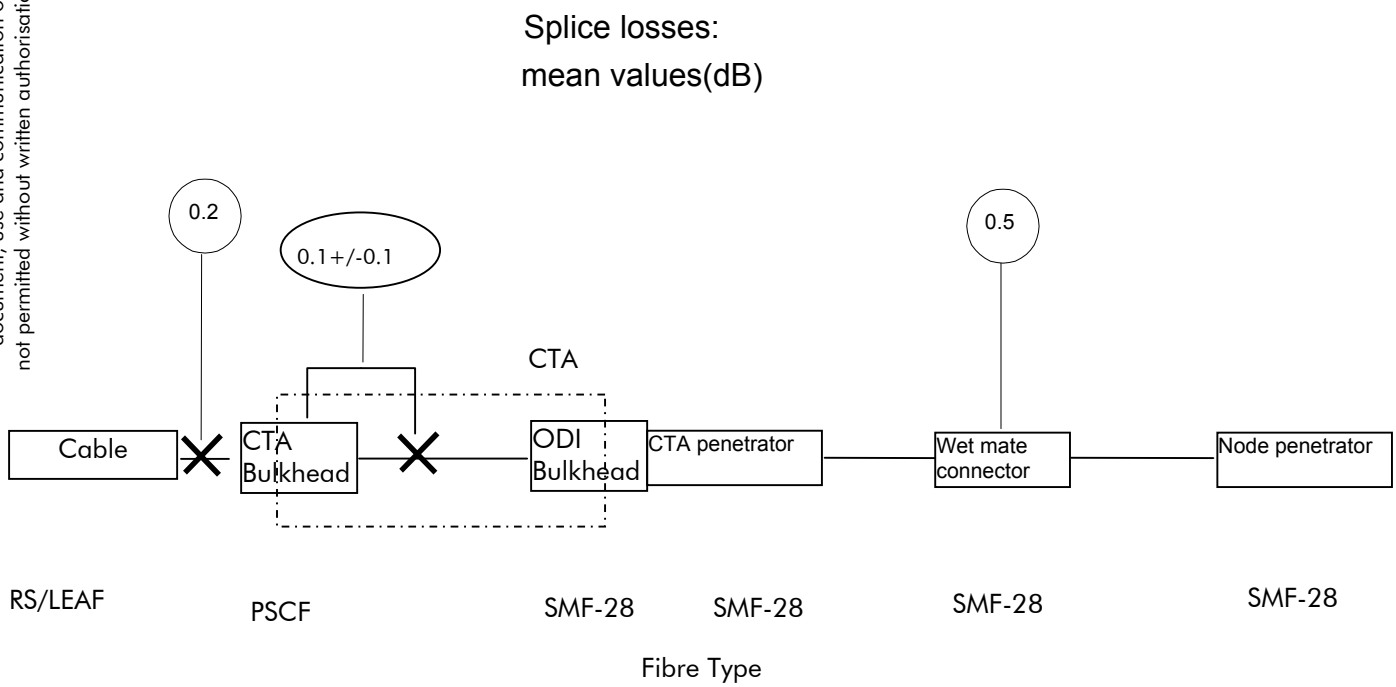
The nominal line current for the CTA is 1A. The maximum current is 2A. No minimum current is defined.

The optical fibre will be suitable for transmission across the ITU 692 C band, covering the transmission window of 1534 to 1568nm as well as 1510nm.

The wavelength to be adopted for all optical measurements is to be 1550nm.
The temperature of 22°C is defined as Room temperature.

Tolerance on all temperatures is +/- 2°C.
For leakage current testing in air the ambient relative humidity is to be < 30%.

3.3 Input and output splice loss definition



4 ELECTRICAL/OPTICAL AND MECHANICAL PERFORMANCE OF THE CTA

4.1 ODI Electrical wet mate harness (acceptance test)

The HV harness is as detailed in the associated specification (reference 6) and comprises of a node penetrator, through which 2 wire conductors are passed into an umbilical hose up to 3m in length. The hose is then terminated in one half of a wet mateable connection termed the node bulkhead-mounted connector. Attached to this node bulkhead connector is the second half of the harness comprising of either a test harness or an ROV operable connection terminated to a further umbilical hose of up to 5m in length. The end of this hose is terminated with the CTA penetrator or if connected to a test harness, the hose will be terminated with a test box.

The wire type at the CTA side of the harness will be a 20AWG (1.01mm) 19/32 stranded conductor with FEP insulation to 2mm OD and is in accordance with 29MOO00135MDK. On the node penetrator the wire type is Raychem specification 44 with 20 AWG multi-strand conductor and silicone insulation to approximately to approximately 4mm OD.

Where possible the harness will be shipped mated from the supplier and shall be acceptance tested for continuity and leakage current performance prior to housing of the CTA HI –Power penetrator into the ODI bulkhead assembly.

4.1.1 Continuity test

On receipt of the harness a check for continuity (penetrator to penetrator or test box to penetrator) shall be made for each of the conductor paths.

Continuity will be measured using a calibrated multi meter

Continuity shall be less than or equal to 1.2Ohms per conductor path per mated harness (e.g. penetrator to penetrator or penetrator to test box).

4.1.2 Leakage current test

With the external housing of both penetrators or penetrator and test box, both halves of the wet mate connector grounded, the leakage current across the insulation between each conductor and earth shall be measured at 13KV (DC) in air under the ambient conditions stated in section3.2.

The HT voltage shall be applied at a rate no greater than 300V/s up to 500V after all charging currents have died down the steady state leakage current shall be checked to ensure the level is below 120nA, the voltage shall then be increased at the same rate until the 13KV test level is reached. Once the test voltage has been achieved it shall be held for a period of 5 mins. The measured leakage current shall be less than or equal to 120nA.

4.2 ODI Optical wet mate harness (acceptance test)

The optical harness is as detailed in the associated specification (reference 5) and comprises of either a test loop back box (see section 5), or a node penetrator, through which eight SMF –28 fibres are passed into an umbilical hose up to 3m in length. The hose is then terminated in one half of a wet mateable connection termed the node bulkhead-mounted connector. Attached to this node bulkhead connector or loop back box is the second half of the harness comprising of an ROV operable connection terminated to a further umbilical hose of up to 5m in length. The end of this hose is terminated with the CTA penetrator. The fibre type at both ends of the harness will be SMF-28 with 250 micron acrylate coating and will have APC fibre connectors.

The harness will be shipped mated where possible from the supplier and shall be acceptance tested for optical through loss and back reflection performance prior to housing of the CTA penetrator into the ODI bulkhead assembly. Note: no back reflection measurement will be made if the loop back box is present.

4.2.1 Optical through (insertion) loss

Using the supplied APC connectors each fibre path within the fully mated harness (e.g. penetrator to penetrator or penetrator to loop back) shall be measured for optical through loss at 1550nm in both directions of transmission.

Where a loop back box is fitted standard cut back techniques may be used in place of the supplied APC connectors if necessary.

The loss per fibre path, excluding APC pig tail connector and external splice losses, shall be less than or equal to the following:

Allowance for penetrator = 0.1 dB/fibre path

Allowance for matched connector interface = 0.5 dB /fibre path

Allowance for unmatched connector interface = 0.75dB/per fibre path

Total allowance for penetrator to penetrator (matched connectors) = 0.7dB/fibre path

Total allowance for penetrator to penetrator (unmatched connectors) = 0.95 dB/fibre path

Total allowance for unmatched connector and loop back box = 1.7 dB/fibre path (2interfaces)

Total allowance for matched connector and loop back box = 1.2 dB/fibre path (2 interfaces)

4.2.2 Connector back reflection

The back reflection of each fibre path through the wet mate connector shall be measured from the node penetrator (fixed plug) direction.

The back reflection shall be greater than or equal to 36 dB.

No back reflection measurement is required when the loop back box is fitted.

4.3 Optical through loss test of housed CTA

On the completion of housing of both the ODI and CTA bulkhead assemblies, the insertion loss of each optical fibre path through the combined mated harness and final housed CTA shall be measured in both directions of transmission at 1550nm.

The loss per fibre path, excluding pig tail connector and external splice losses and including the reinstatement splice at the CTA bulkhead, shall be less than or equal to the following:

Total allowance for matched wet mate connectors = 0.8 dB

Total allowance for unmatched wet mate connectors = 1.05 dB

Total allowance for unmatched connector and loop back box = 1.9 dB

Total allowance for matched connector and loop back box = 1.4 dB

4.4 Continuity test of housed CTA

On completion of housing a check for continuity (penetrator to penetrator or test box to penetrator) shall be made for each of the conductor paths.

Continuity will be measured using a calibrated multi meter

Continuity shall be less than or equal to 1.8Ohms for the live conductor path per mated harness (e.g. node penetrator or test box to composite gland pigtail) or 2.2 Ohms for the system ground conductor path per mated harness (e.g. node penetrator or test box to earth continuity wire gland conductor). Note: continuity of the CTA housed assembly (e.g. ODI bulkhead to CTA bulkhead) is calculated from the subtraction of the acceptance resistance value determined in section 4.1.1 from the above values. Allowance is made for variance that may occur during the mate/demate operation of the test connector.

4.5 HV test of housed CTA

4.5.1 HV soak (leakage current) test

On the completion of the housing of both the ODI and CTA bulkhead assemblies, the leakage current between the line feed conductor and the external mechanics of the CTA housing, connector/penetrator shells and earth return conductor of the housed CTA shall be measured at 13KV (max working voltage plus 30%) for a period of 8 hours in each polarity for the first production unit and then for a period of 30mins for each additional housing. The leakage current shall be monitored automatically throughout the test and shall be recorded every 5 seconds for the 30 minute test and every10 seconds for the initial 8 hour characterisation. The measured steady state leakage current shall be less than or equal to 150nA.

4.6 MECHANCIAL TESTS

4.6.1 CTA Bulkhead Gland Sub Assembly pressure/electrical Test

The hydraulic pressure test on the composite gland assembly is carried out in a suitable pressure test vessel. The vessel is used to subject the whole of the composite gland assembly on the high-pressure side of the Bulkhead to a water pressure of 83MPa for 9 hours. At the end of the 9 hours period, the pressure is released and an electrical test is applied to the assembly. A HV cable is fitted to a Glassman set. With the Glassman test set switched on the voltage is raised in steps of less than 300V/sec until 36kV is reached, and held for one minute.

4.6.2 ODI Bulkhead O-Seal integrity test (ODI Penetrators)

On completion of housing of the ODI Hi-Power and optical penetrators the following test is under taken on the penetrator shell and isolation ring o-seals:

The Pressure is raised to 17.2MPa in steps of 1.4MPa every 15 seconds. The pressure of 17.2MPa is maintained for a period of 10 minutes after which the pressure is reduced to 13.8MPa. Following a 2-hour period for stabilisation, the temperature and the pressure are again monitored, ensuring the latter is greater than 10.3MPa. These values are again monitored after a further 2-hour period ensuring that the pressure has not fallen below 10.3MPa and the temperature is within ±2°C of the temperature at the end of the initial stabilisation period.

4.6.3 Main Bulkhead O-Seal integrity test (Final Housed CTA)

The Pressure is raised to 17.2MPa in steps of 1.4MPa every 15 seconds. The pressure of 17.2MPa is maintained for a period of 10 minutes after which the pressure is reduced to 13.8MPa. Following a 2-hour period for stabilisation, the temperature and the pressure are again monitored, ensuring the latter is greater than 10.3MPa. These values are again monitored after a further 2-hour period ensuring that the pressure has not fallen below 10.3MPa and the temperature is within ±2°C of the temperature at the end of the initial stabilisation period.

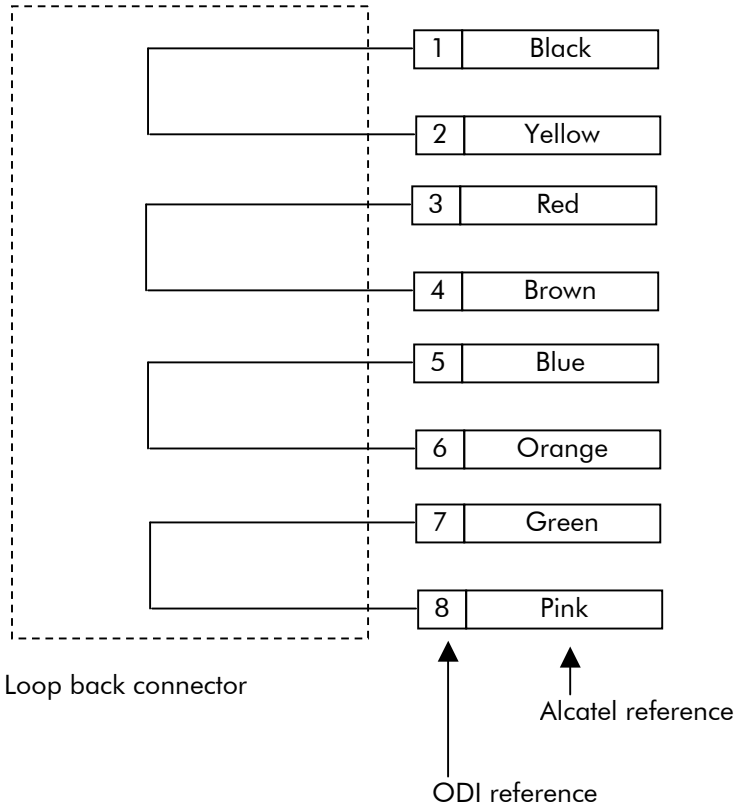
5 OPTIONAL TEST CONFIGURATION

In the event that only the CTA half of the optical and HV harness pairs are shipped for assembly to the CTA, testing may be undertaken using suitable ODI test connectors as follows:

5.1 Optical harness with loop back box.

Where a loop back box is provided by ODI for testing of the optical circuit, the fibres will be paired allowing for through loss and back reflection measurements to be undertaken as detailed in sections 4.2 and 4.3.

The fibre pairing will be as follows:



5.2 HV harness with ROV test plug and box.

Where an ROV test plug and box is provided by ODI for testing of the CTA HV circuit, the wires will be coloured in an identical manner to that of the system harness. In this instance the test end will appear almost identical to that of the system ROV fixed plug half of the harness pair, which it replaces. Here, the test end will have no penetrator with the hose terminated directly to the test box. Access to the wires within the box will be identical to that at the CTA penetrator, being by removal of the box cover. Testing to be undertaken as detailed in sections 4.1 and 4.4.

The externally accessible wires of the HV ROV plug test connector harness will be identified as shown below:

System Ground = White
10 KV Live Feed = Red

6 CONNECTOR ACCEPTANCE AND CTA PERFORMANCE REPORT EXAMPLE

Connector Harness Acceptance Report

Sheet: 1 / 1
System: MARS
Connector Harness no: 10133239 - 1
Issue: 01
Test Box / Loopback Box ref No's: 1033243-1 / 1029909-2
Date: 04/10/04
Housed Unit: 29E-HC00-800-AAA
Customer Identification: 01

ETS Ref.		Result	Unit
	Continuity test		
4.1.1	Live Feed resistance		Ohm
4.1.1	System Ground resistance		Ohm
	Leakage Current Test		
4.1.2	HV Leakage (Live Feed)		nA
4.1.2	HV Leakage (System Gnd)		nA
	Optical Insertion Loss at 1550nm (penetrator to penetrator using loopback test box)		
4.2.1	BK-YL (1-2)		dB
4.2.1	YL-BK (2-1)		dB
4.2.1	RD-BN (3-4)		dB
4.2.1	BN-RD (4-3)		dB
4.2.1	BL-OR (5-6)		dB
4.2.1	OR-BL (6-5)		dB
4.2.1	GN-PK (7-8)		dB
4.2.1	PK-GN (8-7)		dB

CTA Performance Report

Sheet: 1 / 1
10133239 - 1

System: MARS

Connector Harness no:

Issue: 01

Test Box / Loopback Box ref No's: 1033243-1 / 1029909-2

Date: 04/10/04

Housed Unit: 29E-HC00-800-AAA

Customer Identification: 01

ETS Ref.		Result	Unit
	Continuity test		
4.4	Live Feed resistance		Ohm
4.4	System Ground resistance		Ohm
	Leakage Current Test		
4.5.1	HV Leakage (Live Feed +ve)		nA
4.5.1	HV Leakage (Live Feed -ve)		nA
	Optical Insertion Loss at 1550nm (penetrator to penetrator using loopback test box)		
4.3	**BK+YL (1+2)** CTA LOSS		dB
4.3	**YL+BK (2+1)** CTA LOSS		dB
4.3	**RD+BN (3+4)** CTA LOSS		dB
4.3	**BN+RD (4+3)** CTA LOSS		dB
4.3	**BL+OR (5+6)** CTA LOSS		dB
4.3	**OR+BL (6+5)** CTA LOSS		dB
4.3	**GN+PK (7+8)** CTA LOSS		dB
4.3	**PK+GN (8+7)** CTA LOSS		dB
	Mechanical Tests		
4.6.1	Gland sub assembly electrical/pressure test		Pass/Fail
4.6.2	ODI penetrator O-seal integrity pressure test		Pass/Fail
4.6.3	Main bulkhead O-seal integrity pressure test		Pass/Fail

Notes:

1. Optical back reflection is not measured at this stage.
2. Leakage current test will be conducted with the sea case, penetrators, connector plug, ROV receptacle and ground conductor earthed.
3. For the first CTA (engraving MARS CTA 01) the leakage current test will be conducted over a test duration of 8 hours per polarity. The remaining CTA (engraving MARS CTA 02) will be tested for a duration of 0.5 hours.
4. Details of test parameters for mechanical tests are detailed in the related manufacturing build sheets.

ABBREVIATIONS

ASN	Alcatel Submarine Networks
AWG	American wire gauge
CTA	Cable termination Assembly
dB	Decibel
DC	Direct current
DR	Design Review
ETS	Engineering Test Specification
FEP	Fluorinated ethylene propylene
HV	High voltage
ITU	International Telecommunication Union
KV	Kilo volt
LEAF	Large effective area fibre
MARS	Monterey Accelerated Research System
mm	Millimetres
MPa	Mega pascal
Nm	Nano metres
OD	Outside diameter
ODI	Ocean Design Incorporated
PSCF	Pure silica core fibre
ROV	Remotely operated vehicle
RS	Reverse slope
SMF	Single mode fibre

END OF DOCUMENT