

Fiber Acceptance Protocol for the Universities Research and Learning Network

Final Report

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Data Page

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0. GENERAL REQUIREMENTS

Tools and test instruments required for the acceptance shall be fully described and identified by:

- Manufacturer
- Type
- Option(s) installed
- Serial number
- Last date of calibration

The test instruments shall be adequate in both performance and quantity for the required acceptance testing. The offered test instruments shall conform to the O-Series of ITU-T Recommendations.

A copy of the instruction manual shall be provided with each test instrument during the acceptance testing. The manuals shall contain all the relevant information for each type of the test instruments offered, including operation, fault diagnosis and correction, recalibration test, standards and recalibration instruments required.

The test instruments shall include all necessary power cords, patch cords, attenuators, test probes and accessories to carry out all the tests. All accessories required for performing the acceptance test should have been included in the calibration procedure.

1. TESTS OF CABLE AND MEASUREMENTS OF SIGNAL ATTENUATION

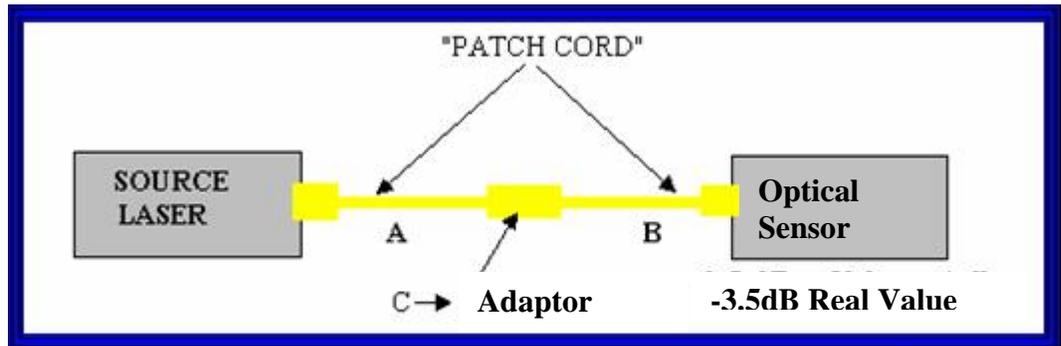
General

All adjustments to the costs for the installation of the outside plant fibre optic cables will be performed from physical segment lengths, explicitly excluding losses due to cable installation and or other manipulation. This shall make it possible to validate installed segment lengths against optical lengths from the test equipment

Acceptance tests

The optical fibre acceptance tests are comprised of measurements of signal strength through signal reflection (optical time domain reflectometer) and signal insertion and detection. The contractor shall perform all acceptance tests and compile them on the required form presented in Appendix IV. The contractor shall remit to the Engineer all forms necessary to detail the performance of each fibre. The contractor shall invite the Engineer to assist in the final tests.

Laser source verification procedure with simple signal insertion and detection tester



NOTE : No two lasers have the same output value. It is necessary to precisely measure this output value in order to determine the signal loss caused by the patch cords and the connectors. In knowing the precise output value, it is then possible to subtract it from the final read out. The readings must be performed on both the transmit (Tx) and receive (Rx) fibre strands, and in both directions by inverting the source and the sensor. This calibration test must be performed prior to any measurement being taken.

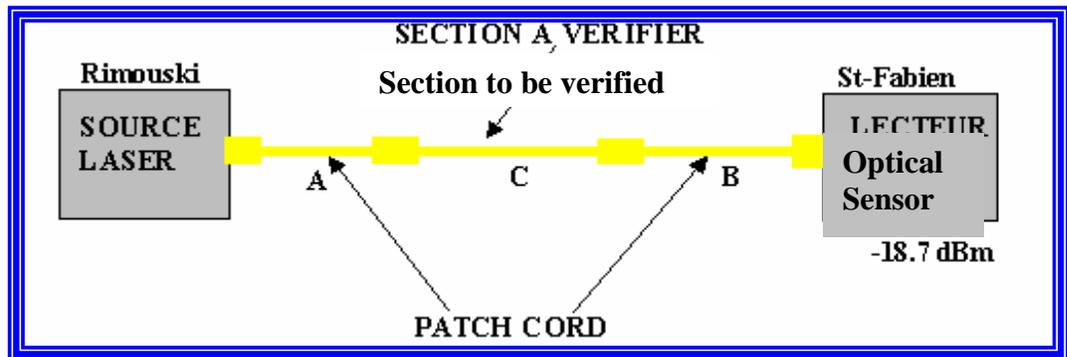
EXAMPLE:

A = Reference signal of the source
B = Reference signal of the sensor
C = Adaptor

Step 1 = First reading composed of: $A + C + B = -3.5 \text{ dBm}$
Step 2 = Inversion of source and sensor
Step 3 = Second reading composed of: $B + C + A = -2.8 \text{ dBm}$
Step 4 = $(-3.5) + (-2.8) = -6.3 \text{ dBm}$ divided by 2 = -3.15 dBm

Therefore, we have a reference loss of: -3.15 dBm (example value)

Example of measurement on a section



NOTE : Each reading must be performed in both directions. The result is divided by two (2) to obtain the real value.

EXAMPLE:

Amman-South towards Karak = **-18.7 dBm**
18.7 - 3.15 (see previous section) = **-15.55 dBm**
Karak towards Amman = **-19.5 dBm**
19.5 - 3.15 = **-16.35 dBm**

$(-15.5) + (-16.35) = -31.85$ dBm divided by two =

Therefore, the real loss on this section is -15.93 dBm (example value)

Examples of signal attenuation readings records (loss in dB)

These readings shown in the table below have been taken only in one direction and should be repeated in the other direction.

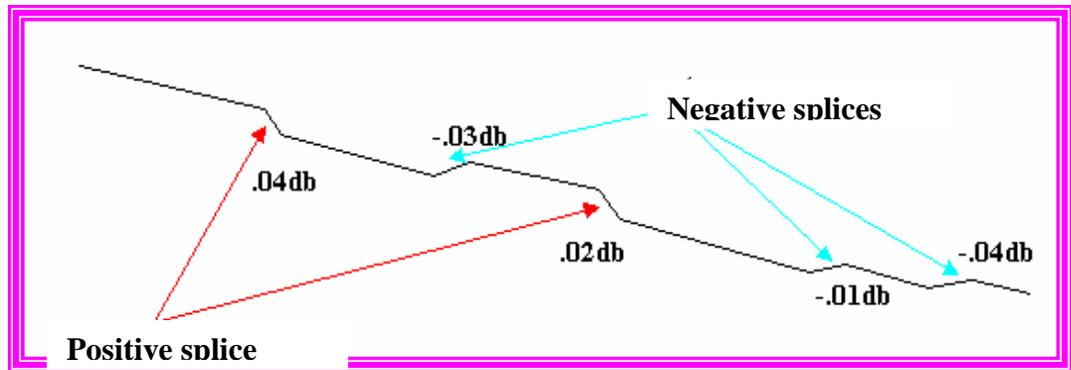
OUTPUT SOURCE POWER: (example)				
At 1310nm = -1dbm At 1550nm = -3dbm				
A to B	Measure at 1310	Measure at 1550	Real loss at 1310	Real loss at 1550
F # 1	-15.7	-11.8	-14.7	-8.8
F # 2	-15.7	-12.09	-14.7	-9.09
F # 3	-15.99	-11.48	-14.99	-8.48
F # 4	-15.62	-11.96	-14.62	-8.96
F # 5	-15.82	-11.8	-14.82	-8.8
F # 6	-15.81	-11.72	-14.81	-8.72
F # 7	-15.85	-12.16	-14.85	-9.16
F # 8	-15.71	-12.06	-14.71	-9.06
F # 9	-15.71	-12.06	-14.71	-9.06
F # 10	-15.71	-12.06	-14.71	-9.06
F # 11	-15.71	-12.06	-14.71	-9.06
F # 12	-15.71	-12.06	-14.71	-9.06
F # 13	-15.71	-12.06	-14.71	-9.06
F # 14	-15.71	-12.06	-14.71	-9.06
F # 15	-15.71	-12.06	-14.71	-9.06
F # 16	-15.71	-12.06	-14.71	-9.06

All measurements must be saved on paper and in electronic copy in Microsoft Excel format. The real loss data should be entered in the attached MS Excel spreadsheet. The acceptance criteria for cable loss measurement are detailed on this sheet.

In the case a 16 fibre cable of Unico is spliced to a 2 or 4 fibre path of NEPCO the loss will only be measured from ODF to ODF on the complete 2 or 4 fibre section. The remaining fibres (12 or 14) will be measured by OTDR measurement on the ODF at the University termination point.

2. READINGS WITH OPTICAL TIME DOMAIN REFLECTOMETER (OTDR)

When measuring attenuation, it is necessary to consider splices, which increase the signal (positive splices), and splices, which decrease the signal (negative splices).



Ex: (.08db) positive and (-.05db) negative

In order to obtain the net loss value of a splice, it is necessary to measure the signal in both directions, add the two (2) values and divide by two (2).

In the aforementioned example, the final result would be:

$$(.08) + (-.06) = .02\text{dB} \text{ divided by two} = \underline{.01\text{dB}}$$

Maximum attenuation of a fusion

The maximum attenuation for a fusion shall be of **0.1 dB** at a **1310** nanometre wavelength and of **0.06 dB** at a **1550** nanometre wavelength.

- The total attenuation for a kilometre of network shall correlate with the specifications of the fibre optic cable manufacturer

The true optical distance (including all slack in the cable) must be specified for each measurement, in all attenuation test reports (see Excel spreadsheet).

Paper print out of the OTDR measurements showing the complete distance and electronic files (taken from both directions on the fiber section) should be included in the acceptance report. The electronic files should be supplied with the software to run on a standard PC to open and read and display the files.

3. ADDITIONAL OPTICAL AND DISPERSION MEASUREMENTS

Dispersion measurements shall be made within the dynamic range of the test equipment.

3.1.

Each fiber in each cable delivery length shall have a zero-dispersion over the range 1300-1324 nm (<3.5 ps/nm.km). Maximum dispersion at the wavelength 1550 nm shall not exceed 18 ps/nm.km or as pair ITU-T recommendation G.655.

3.2

Polarization Mode Dispersion should also be verified to guarantee future extreme high bit-rate operation (>10Gb/s). The PMD should have be less than 0.1ps/sqrt(km) at 1550 nm.

In case the tests can not be executed due to test equipment not being available in country, the Factory Acceptance Test sheets of the cable installed should be provided.

4. AS-BUILT DRAWINGS

“As-Built” is defined as the drawings and document showing the final configuration of optical fiber cables and accessories.

4.1

For each site (ODF) and route “As-Built” Drawing shall be supplied.

4.2

Three copies of “As-Built” drawings for:

- Optical fiber cable routes, including manholes.
- Optical fiber distribution plan.

In addition to an electronic copy in Shape-format or Autocad-format

4.3

The “As-Built” drawings and document of each site and route shall be composed of at least the following:

4.3.1

The routing and location of the O.F. cable showing identification points, marks...etc.

4.3.2

The distance of the cable from the center of the route and from main identification marks.

4.3.3

Location of joints with marks to facilitate locations of joints.

4.3.4

Fiber distribution and detailed ODF connectors and configurations.

4.3.5

Routing of the cable within the duct system showing the position of the PVC pipes used and route as a whole.

4.3.6

ODFs & joints configuration and distribution of the fiber within the joints and the ODFs.

4.3.7

An inventory of all installed and spare items at each site and route including equipment and module serial number.

4.4

“As built” drawings and documents shall be provided in soft and hard copy suitable for producing dye-line prints.

4.5

The symbols used by the Contractor on as built drawings shall comply with the legend and symbols and layer mapping as shown in the specification provided by MoICT. In case MoICT has not provided these specifications NEPCO is authorized to use their internal specifications.

4.6

Samples of as-built drawings and documents are to be submitted to the Project Manager of MoICT and NEPCo for approval prior to production of the final as- built.

4.7

Sufficient identification marks and information are to be used to facilitate and indicate the exact location of the manholes, joints and the cable routes.

4.8

Manholes offset is to be clearly shown in the as built document.

UNIVERSITIES ACCEPTANCE

Section Balqa Univ. Marka (A) **To** Amman-South Substation (B)

cable ID	CTI
ODF ID	Balqa Univ. Marka

cable ID	
ODF ID	A/S NEPCO

Fibre No.	1550 nm				1310 nm			
	A-B (dB)	B-A (dB)	Difference Loss (dB)	Average (dB)	A-B (dB)	B-A (dB)	Difference Loss (dB)	Average (dB)
1	8.77	8.18	0.59	8.48	14.48	13.62	0.86	14.05
2	9.08	8.44	0.64	8.76	15.02	14.32	0.70	14.67
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

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16								
Averaged	8.93	8.31	0.62	8.62	14.75	13.97	0.78	14.36
Mean	8.62		0.62		14.36		0.78	

Physical cable length as obtained by OTDR	36855.00	m
Number of splices from ODF to ODF	0.00	pcs

Acceptance criteria

all averaged values per fibre (column G and K) below required total allowable

- 1 loss
- 2 differences of measurements in both directions may not differ more than 0.5 dB at 1550 nm and not more than 0.7 dB at 1310 nm for each fiber

Requirements:	1550 nm	1310 nm
Cable Attenuation per km (dB):	0.25	0.40
Total Physical Cable Length (km):	36.86	36.86
Splice Loss Mean Value (dB):	0.05	0.05
Total Number of Splices:	0	0
Maximum Connector Loss (dB):	0.50	0.50
Total Number of Connectors:	2	2
Allowance for short section (dB):	0.00	0.00
Total Allowable Loss (dB):	10.21	15.74

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Witnessed and signed NEPCO Representative:	Witnessed and signed MoICT Representative	Accepted and signed University Co. Representative
Signature: _____	Signature: _____	Signature: _____
Name: _____	Name: _____	Name: _____
Date: _____	Date: _____	Date: _____

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Section

Jordan University

To

Tareq

cable ID	
ODF ID	JU

cable ID	
ODF ID	NEPCO-TAREQ

Fibre No.	1550 nm				1310 nm			
	A-B (dB)	B-A (dB)	Difference Loss (dB)	Average (dB)	A-B (dB)	B-A (dB)	Difference Loss (dB)	Average (dB)
1	1.39	1.81	0.42	1.60	2.33	2.70	0.37	2.52
2	1.77	1.56	0.21	1.67	2.90	2.45	0.45	2.68
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								

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Averaged	1.58	1.69	0.32	1.63	2.62	2.58	0.41	2.60
Mean	1.63		0.32		2.60		0.41	

Physical cable length as obtained by OTDR	5000.00	m
Number of splices from ODF to ODF	3.00	pcs

Acceptance criteria

all averaged values per fibre (column G and K) below required total allowable

- 1 loss
- 2 differences of measurements in both directions may not differ more than 0.5 dB at 1550 nm and not more than 0.7 dB at 1310 nm for each fiber

Requirements:	1550 nm	1310 nm
Cable Attenuation per km (dB):	0.25	0.40
Total Physical Cable Length (km):	5.00	5.00
Splice Loss Mean Value (dB):	0.05	0.05
Total Number of Splices:	3	3
Maximum Connector Loss (dB):	0.50	0.50
Total Number of Connectors:	2	2
Allowance for short section (dB):	1.00	1.00
Total Allowable Loss (dB):	3.40	4.15

Witnessed and signed

Witnessed and signed

Accepted and signed

Fiber Acceptance Protocol for the Universities Research and Learning Network

NEPCO Representative:	MoICT Representative	University Co. Representative
Signature: _____	Signature: _____	Signature: _____
Name: _____	Name: _____	Name: _____
Date: _____	Date: _____	Date: _____

Fiber Acceptance Protocol for the Universities Research and Learning Network

Section Jordan University (A) **To** Amman-South Substation (B)

cable ID	
ODF ID	JU

cable ID	
ODF ID	A/S NEPCO

Fibre No.	1550 nm				1310 nm			
	A-B (dB)	B-A (dB)	Difference Loss (dB)	Average (dB)	A-B (dB)	B-A (dB)	Difference Loss (dB)	Average (dB)
1								
2								
3	6.97	6.76	0.21	6.87	10.59	10.74	0.15	10.67
4	7.20	6.73	0.47	6.97	10.62	10.64	0.02	10.63
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
Averaged	7.09	6.75	0.34	6.92	10.61	10.69	0.09	10.65

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Mean	6.92	0.34		10.65	0.09	
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Physical cable length as obtained by OTDR	22786.00	m
Number of splices from ODF to ODF	0.00	pcs

Acceptance criteria

all averaged values per fibre (column G and K) below required total allowable

- 1 loss
- 2 differences of measurements in both directions may not differ more than 0.5 dB at 1550 nm and not more than 0.7 dB at 1310 nm for each fiber

Requirements:	1550 nm	1310 nm
Cable Attenuation per km (dB):	0.25	0.40
Total Physical Cable Length (km):	22.79	22.79
Splice Loss Mean Value (dB):	0.05	0.05
Total Number of Splices:	0	0
Maximum Connector Loss (dB):	0.50	0.50
Total Number of Connectors:	4	4
Allowance for short section (dB):	0.00	0.00
Total Allowable Loss (dB):	7.70	11.11

Witnessed and signed
NEPCO
Representative:

Witnessed and signed
MoICT Representative

Accepted and signed
University Co. Representative

Fiber Acceptance Protocol for the Universities Research and Learning Network

Signature: _____	Signature: _____	Signature: _____
Name: _____	Name: _____	Name: _____
Date: _____	Date: _____	Date: _____

Fiber Acceptance Protocol for the Universities Research and Learning Network

Section Hashemeih University **To** Tareq

cable ID	CTI
ODF ID	Hashemeih Univ.

cable ID	
ODF ID	TAREQ NEPCO

Fibre No.	1550 nm				1310 nm			
	A-B (dB)	B-A (dB)	Difference Loss (dB)	Average (dB)	A-B (dB)	B-A (dB)	Difference Loss (dB)	Average (dB)
1	12.33	12.83	0.50	12.58	19.30	18.69	0.61	19.00
2	11.08	11.57	0.49	11.33	17.21	17.89	0.68	17.55
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
Averaged	11.71	12.20	0.50	11.95	18.26	18.29	0.65	18.27

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Mean	11.95	0.50		18.27	0.65	
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Physical cable length as obtained by OTDR	41991.00	m
Number of splices from ODF to ODF	0.00	pcs

Acceptance criteria

all averaged values per fibre (column G and K) below required total allowable

- 1 loss
- 2 differences of measurements in both directions may not differ more than 0.5 dB at 1550 nm and not more than 0.7 dB at 1310 nm for each fiber

Requirements:	1550 nm	1310 nm
Cable Attenuation per km (dB):	0.25	0.40
Total Physical Cable Length (km):	41.99	41.99
Splice Loss Mean Value (dB):	0.05	0.05
Total Number of Splices:	0	0
Maximum Connector Loss (dB):	0.50	0.50
Total Number of Connectors:	6	6
Allowance for short section (dB):	0.00	0.00
Total Allowable Loss (dB):	13.50	19.80

Witnessed and signed
NEPCO
Representative:

Witnessed and signed
MoICT Representative

Accepted and signed
University Co. Representative

Fiber Acceptance Protocol for the Universities Research and Learning Network

Signature: _____	Signature: _____	Signature: _____
Name: _____	Name: _____	Name: _____
Date: _____	Date: _____	Date: _____

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Section

Hashemeieh University

To

Amman-South

cable ID	
ODF ID	Hashmeieh Univ

cable ID	
ODF ID	NEPCo Amman-S

Fibre No.	1550 nm				1310 nm			
	TX real (dB)	RX real (dB)	Difference Loss (dB)	Average (dB)	TX real (dB)	RX real (dB)	Difference Loss (dB)	Average (dB)
1								
2								
3	10.10	10.69	0.59	10.40	17.36	17.70	0.34	17.53
4	10.00	10.65	0.65	10.33	16.30	16.70	0.40	16.50
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								

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Averaged	10.05	10.67	0.62	10.36	16.83	17.20	0.37	17.02
Mean	10.36		0.62		17.02		0.37	

Physical cable length as obtained by OTDR	46190.00	m
Number of splices from ODF to ODF	0.00	pcs

Acceptance criteria

all averaged values per fibre (column G and K) below required total allowable

- 1 loss
- 2 differences of measurements in both directions may not differ more than 0.5 dB at 1550 nm and not more than 0.7 dB at 1310 nm for each fiber

Requirements:	1550 nm	1310 nm
Cable Attenuation per km (dB):	0.25	0.40
Total Physical Cable Length (km):	46.19	46.19
Splice Loss Mean Value (dB):	0.05	0.05
Total Number of Splices:	0	0
Maximum Connector Loss (dB):	0.50	0.50
Total Number of Connectors:	2	2
Allowance for short section (dB):	0.00	0.00
Total Allowable Loss (dB):	12.55	19.48

Witnessed and signed

Witnessed and signed

Accepted and signed

Fiber Acceptance Protocol for the Universities Research and Learning Network

NEPCO Representative:	MoICT Representative	University Co. Representative
Signature: _____	Signature: _____	Signature: _____
Name: _____	Name: _____	Name: _____
Date: _____	Date: _____	Date: _____

Fiber Acceptance Protocol for the Universities Research and Learning Network

Section Balqa Univ. Marka (A) **To** Amman-North Substation (B)

cable ID	CTI
ODF ID	Balqa Univ. Marka

cable ID	
ODF ID	A/S NEPCO

Fibre No.	1550 nm				1310 nm			
	A-B (dB)	B-A (dB)	Difference Loss (dB)	Average (dB)	A-B (dB)	B-A (dB)	Difference Loss (dB)	Average (dB)
1								
2								
3	4.37	3.90	0.47	4.14	6.62	6.39	0.23	6.51
4	4.34	3.85	0.49	4.10	6.97	6.46	0.51	6.72
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
Averaged	4.36	3.88	0.48	4.12	6.80	6.43	0.37	6.61

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Mean	4.12	0.48		6.61	0.37	
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Physical cable length as obtained by OTDR	14739.00	m
Number of splices from ODF to ODF	0.00	pcs

Acceptance criteria

all averaged values per fibre (column G and K) below required total allowable

- 1 loss
- 2 differences of measurements in both directions may not differ more than 0.5 dB at 1550 nm and not more than 0.7 dB at 1310 nm for each fiber

Requirements:	1550 nm	1310 nm
Cable Attenuation per km (dB):	0.25	0.40
Total Physical Cable Length (km):	14.74	14.74
Splice Loss Mean Value (dB):	0.05	0.05
Total Number of Splices:	0	0
Maximum Connector Loss (dB):	0.50	0.50
Total Number of Connectors:	2	2
Allowance for short section (dB):	0.00	0.00
Total Allowable Loss (dB):	4.68	6.90

Witnessed and signed
NEPCO
Representative:

Witnessed and signed
MoICT Representative

Accepted and signed
University Co. Representative

Fiber Acceptance Protocol for the Universities Research and Learning Network

Signature: _____	Signature: _____	Signature: _____
Name: _____	Name: _____	Name: _____
Date: _____	Date: _____	Date: _____