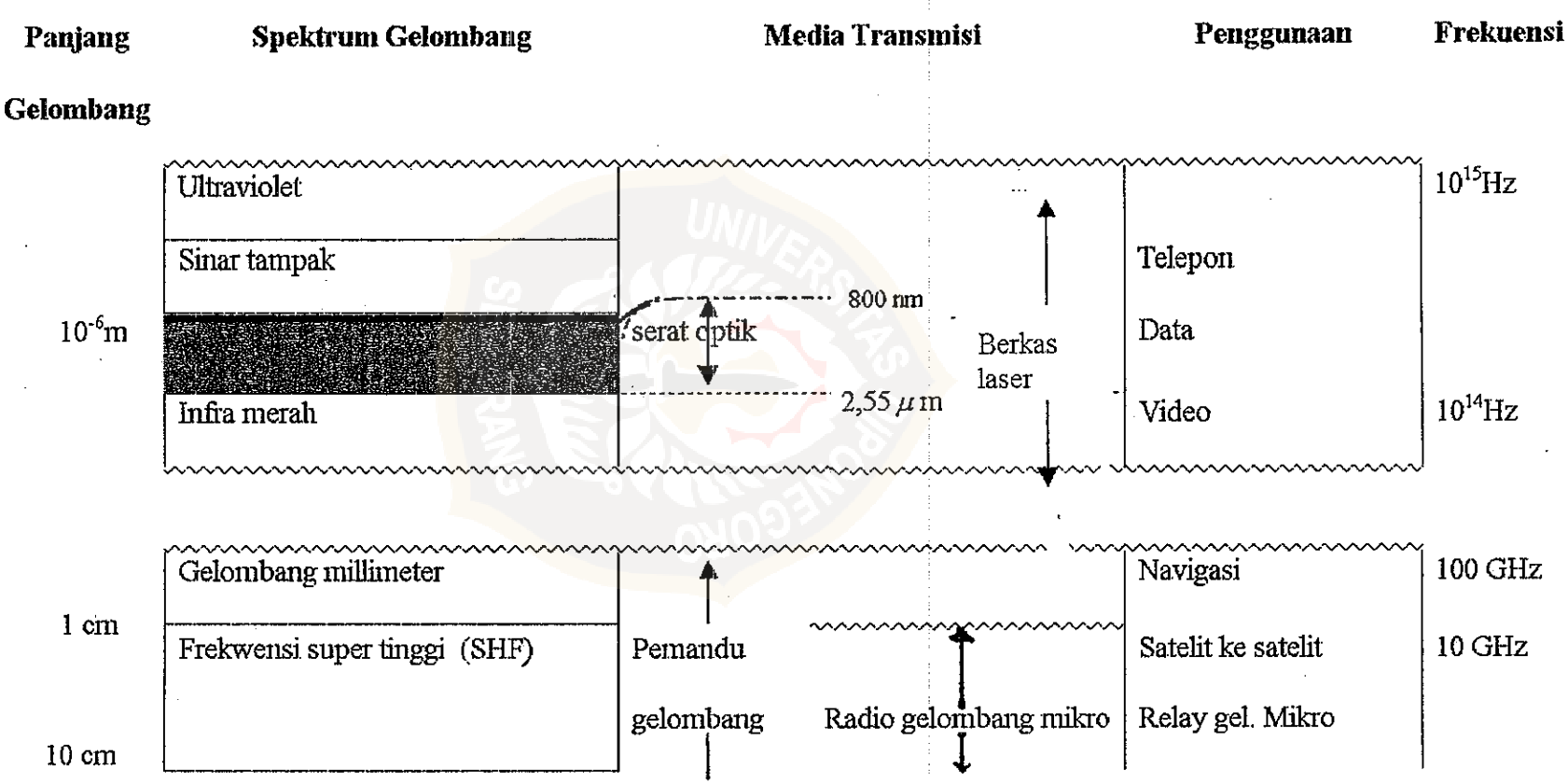
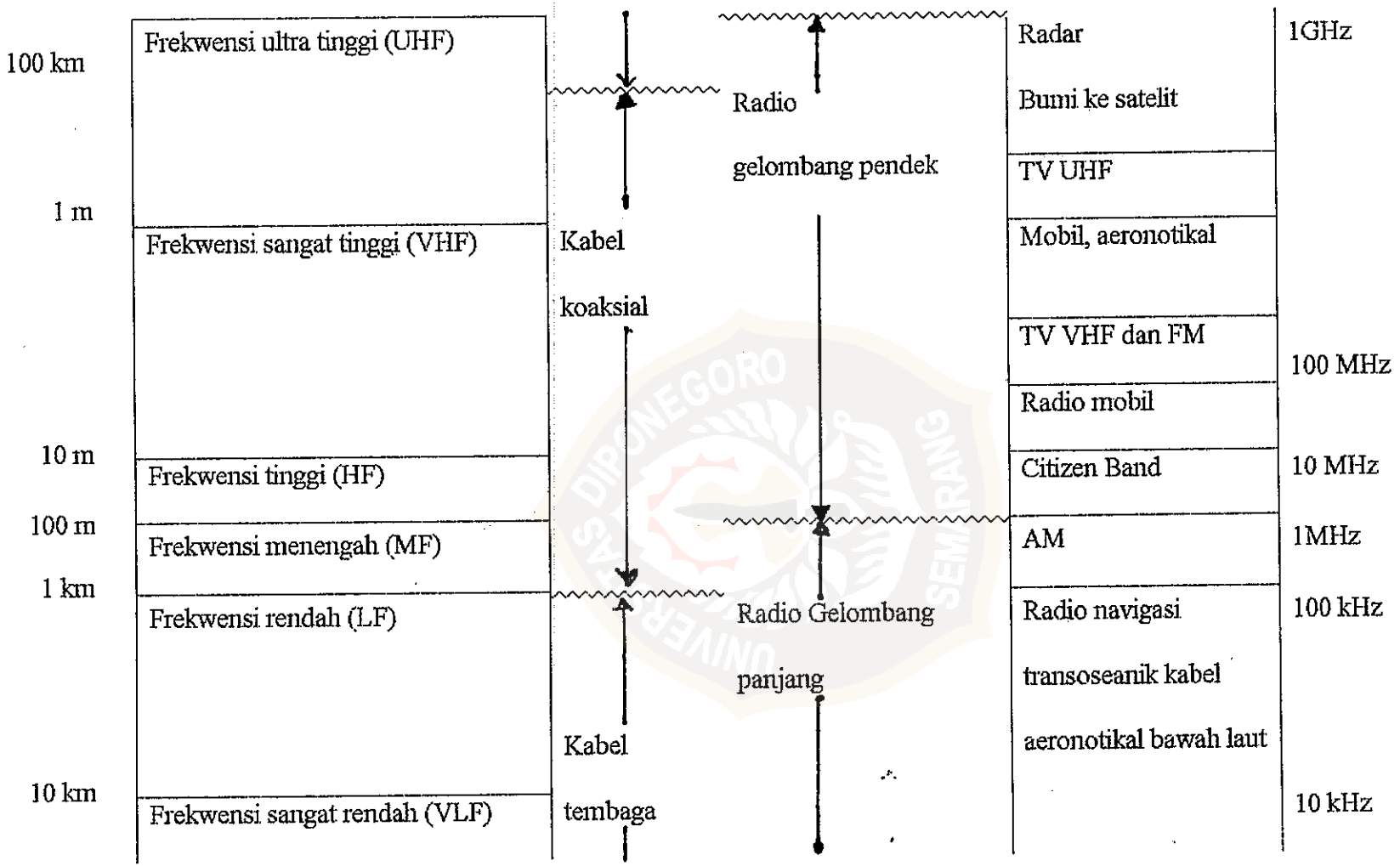
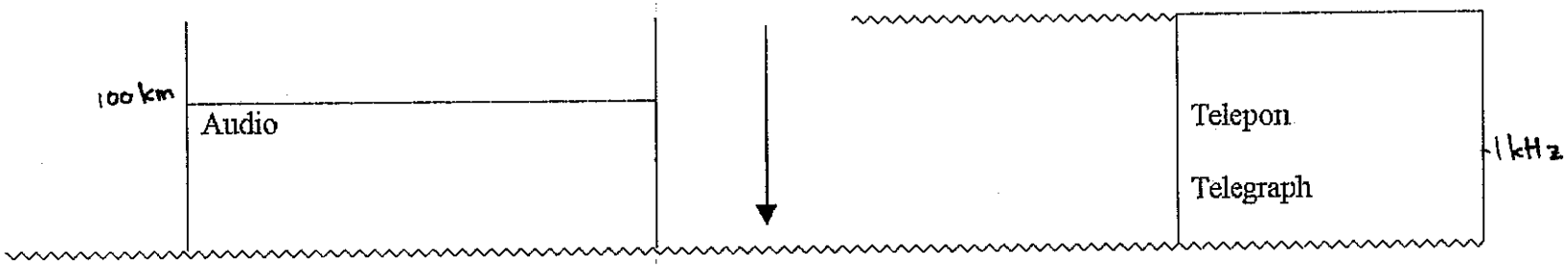
LAMPIRAN I

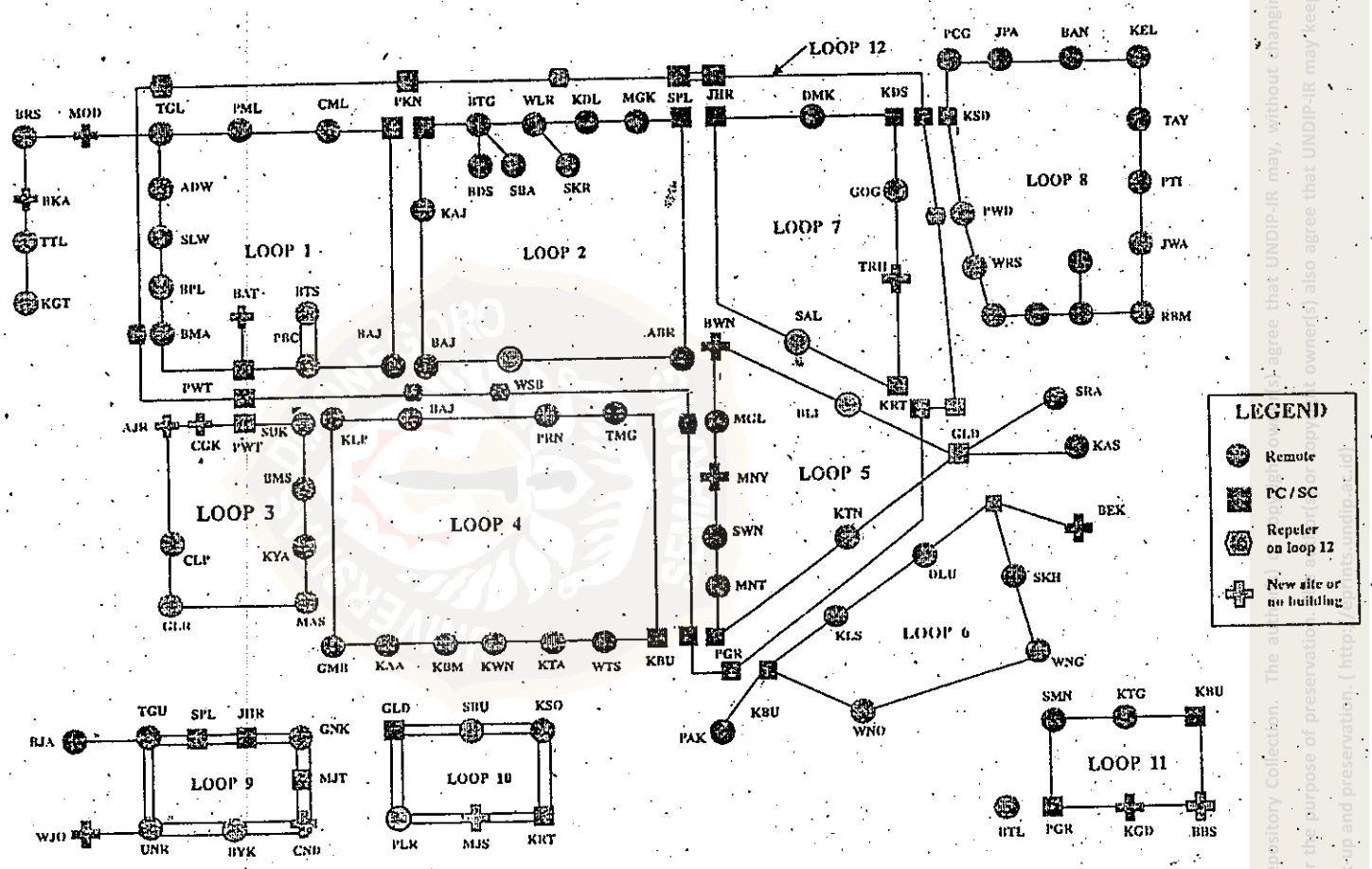
Penggunaan Sistem Komunikasi Dalam Spektrum Gelombang Elektromagnetik (Keiser, 1991)







Junction loop in Central Jawa



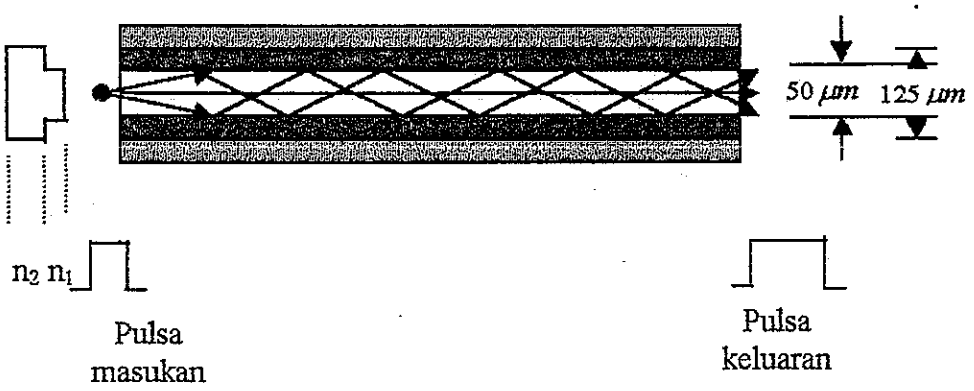
LAMPIRAN II

KARAKTERISTIK SILIKA MURNI (CSELT, 1990)

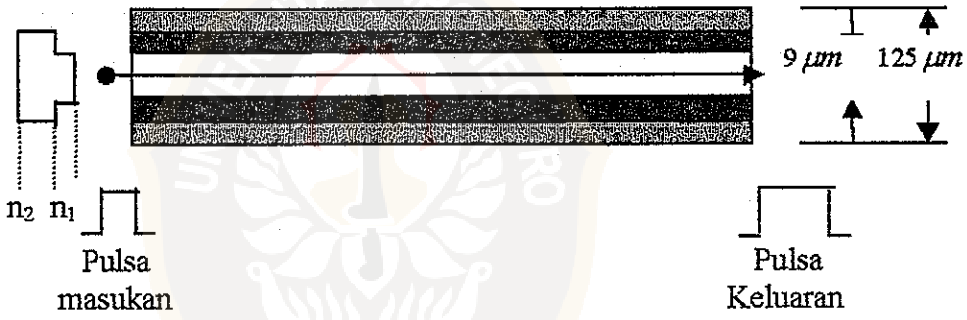
No.	Parameter	Nilai	Satuan
1.	Kerapatan	2,2	g/cm^3
2.	Indeks bias	1,4585	-
3.	Koefisien muai panjang pada suhu $20^0 - 320^0C$	$5,5 . 10^{-7}$	$^0C^{-1}$
4.	Konduktifitas panas pada 20^0 C	$3,3 . 10^{-3}$	$Kal.cm^{-1}.s^{-1}.^0C^{-1}$
5.	Panas jenis pada $0 - 100^0C$	0,18	$Kal.g^{-1}$
6.	Titik leleh	~1665	^0C
7.	Modulus curah (*bulk modulus*)	~ 36,5	GPa
8.	Modulus tegar (*rigidity modulus*)	31,03	GPa
9.	Modulus Young	71,7	GPa
10.	Modulus geser (*shear modulus*)	31,1	GPa
11.	Titik regang	1070	^0C
12.	Kekuatan tarik	48	MPa
13.	Kekuatan pemampatan (*compressive strength*)	>1100	MPa
14.	Resistivitas pada 20^0C	10^{18}	Ω . cm
15.	Konstanta dielektrik pada $20\ ^0C$	3,75	MHz

LAMPIRAN III

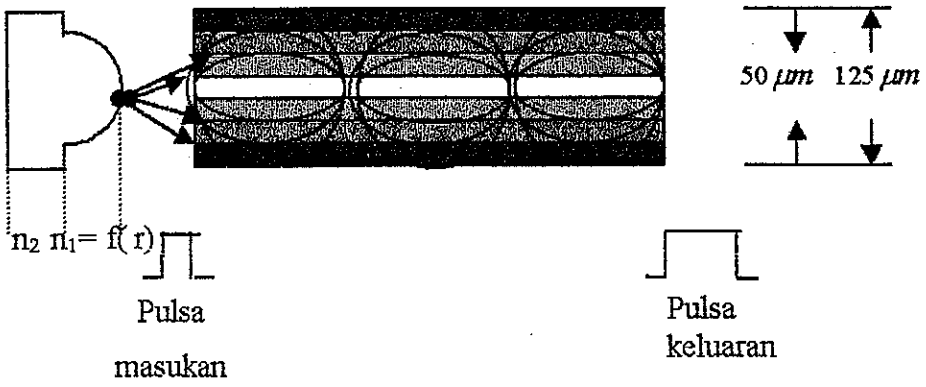
TIPE-TIPE SERAT OPTIK



Gambar L3- 1. Serat optik *step indeks multimoda*



Gambar L3-2. Serat optik *step indeks single moda*



Gambar L3-3. Serat optik *graded indeks multimoda*

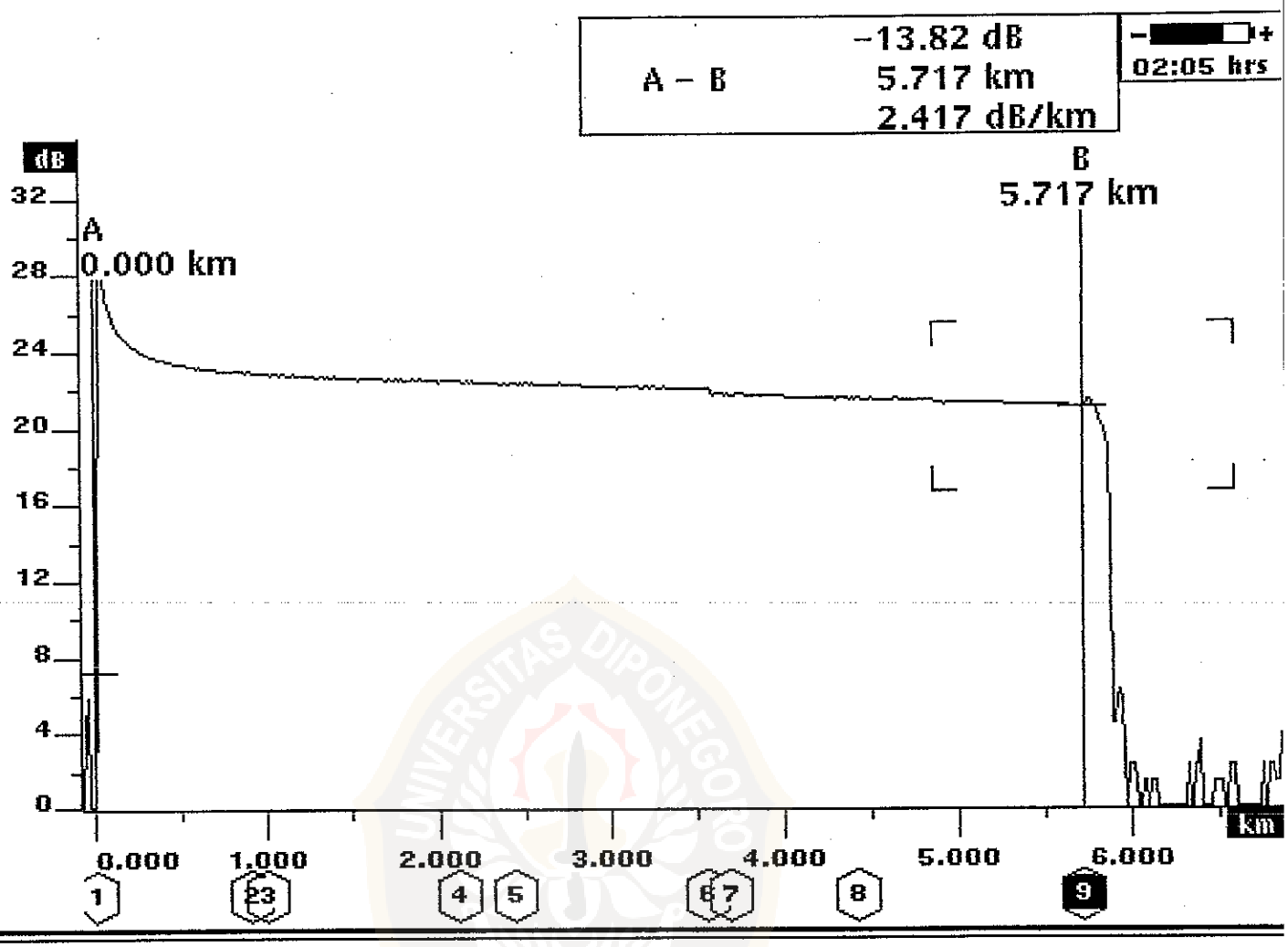
LAMPIRAN IV

Event Table Hasil Pengukuran

Lokasi Pengukuran	*Event*	Jarak (km)	Rugi (dB)	Reflektansi (dB)	Redaman (dB/km)
STO Weleri (WLR)	1	0,000	0,499	(n/a)	0,000
-STO Sukorejo (SKR)	2	0,909	0,061	(n/a)	0,604
	3	1,003	0,103	(n/a)	0,055
	4	2,115	0,058	(n/a)	0,295
	5	2,435	0,078	(n/a)	0,285
	6	3,560	0,281	(n/a)	0,337
	7	3,693	-0,063	(n/a)	1,526
	8	4,414	0,119	(n/a)	0,404
	9	5,717	>16,41	-56,0	0,321
STO Simpang Lima	1	0,000	0,499	(n/a)	0,000
(SPL) – STO	2	1,979	0.232	(n/a)	0,005
Majapahit (MJP)	3	5,084	13,236	>-47,4	0,536
STO Johar (JHR) –	1	0,000	0,499	(n/a)	0,000
STO Salatiga (SAl)	2	0,578	0,077	(n/a)	1,635
	3	2,000	0,061	(n/a)	0,359
	4	6,790	0,054	(n/a)	0,482
	5	8,849	0,063	(n/a)	0,379
	6	12,773	0,089	(n/a)	0,382
	7	14,022	0,101	(n/a)	0,345
	8	14,919	0,070	(n/a)	0,271
	9	28,966	0,225	(n/a)	0,354
	10	31,335	0,174	(n/a)	0,345
	11	34,850	0,349	(n/a)	0,572
	12	44,391	0,670	(n/a)	0,365
	13	59,273	>-,932	-24,1	0,581

STO Johar (JHR) – STO Kudus (KS)	1	0,000	0,499	(n/a)	0,000
	2	0,655	0,065	(n/a)	0,399
	3	0,808	0,066	(n/a)	0,813
	4	0,906	0,078	(n/a)	0,516
	5	0,974	0,065	(n/a)	0,556
	6	1,194	0,063	(n/a)	0,768
	7	1,245	0,092	(n/a)	1,118
	8	1,447	0,070	(n/a)	0,689
	9	1,516	0,070	(n/a)	-0,207
	10	1,695	0,134	(n/a)	0,853
	11	3,463	0,187	(n/a)	0,334
	12	5,222	0,173	(n/a)	0,334
	13	9,076	0,211	(n/a)	0,376
	14	13,348	2,377	(n/a)	0,187
	15	21,380	0,277	(n/a)	0,345
	16	28,561	10,518	(n/a)	0,358

Tektronix TFS3031 TekRanger File: WLR-SKR6.28A



Test Setup

Fiber Scan: IntelliTrace	Test Range: < Auto >
Pulsewidth: < Auto >	Averages: < Auto >
Splice Threshold: 0.05 dB	Reflectance Threshold: -40.0 dB
Scan For: Events Above Threshold	End of Fiber Threshold: 3 dB
Refractive Index: 1.4680	
Test Port: Lower (SM)	Module: 1310XR
Distance Units: meters	

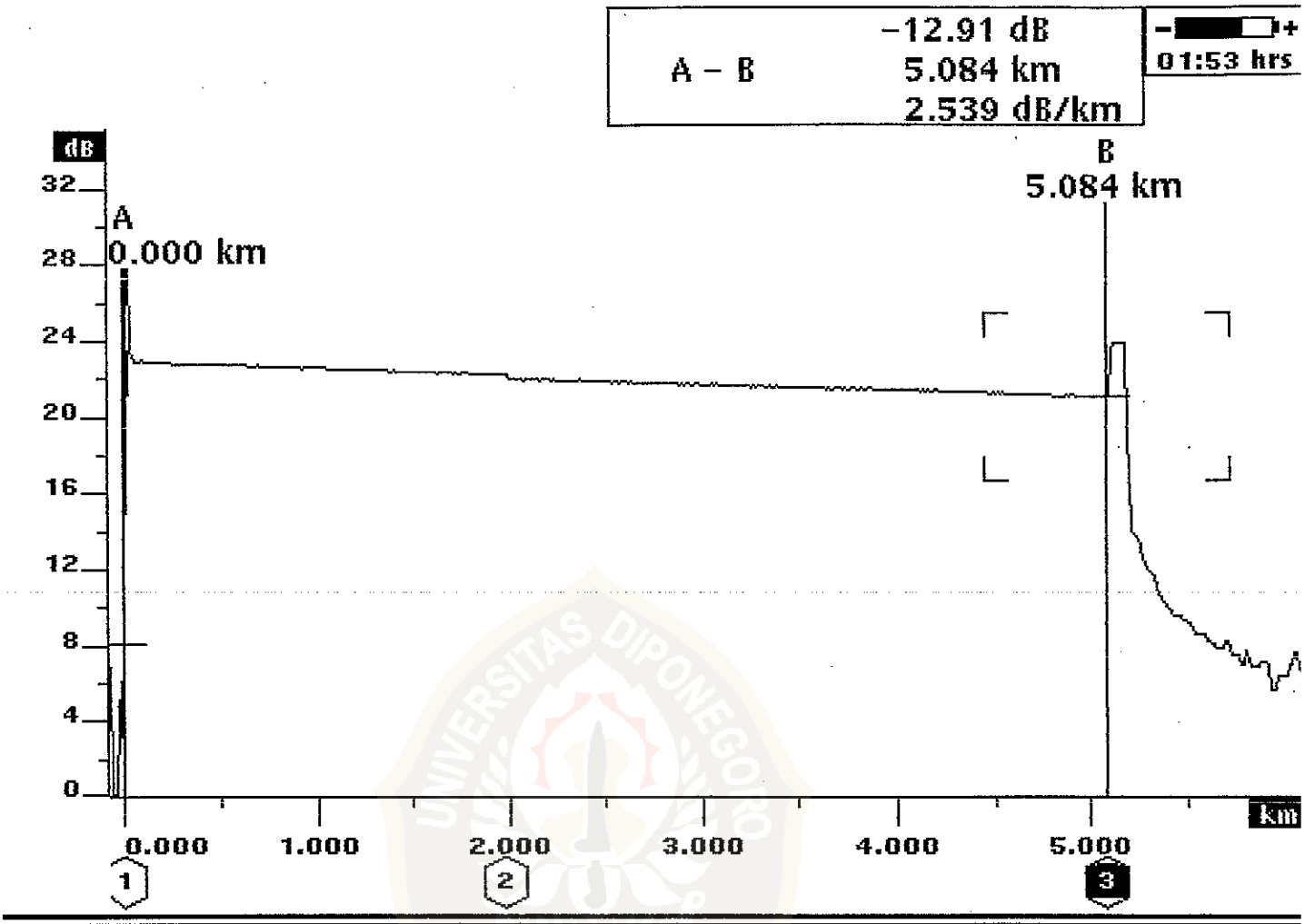
Tektronix TFS3031 TekRanger

File: WLR-SKR6.251

Event #	Flags	Distance (km)	Loss (dB)	Reflectance (dB)	Slope (dB/km)	Dead Zone (km)	Cumulative Loss (dB)	Loss Tolerance (dB)	Loss Delta (dB)	Distance Tolerance (km)	Distance Delta (km)
1		0.000	0.499*	(n/a)	0.000	0.005	0.000	+/- 0.02	(n/a)	+/- 0.002	(n/a)
2		0.909	0.061*	(n/a)	0.604	0.005	1.479	+/- 0.02	1.48	+/- 0.002	0.909
3		1.003	0.103*	(n/a)	0.055	0.005	1.529	+/- 0.02	0.05	+/- 0.002	0.094
4		2.115	0.058*	(n/a)	0.295	0.005	1.896	+/- 0.02	0.37	+/- 0.002	1.112
5		2.435	0.078*	(n/a)	0.285	0.005	2.044	+/- 0.02	0.15	+/- 0.002	0.320
6		3.560	0.281*	(n/a)	0.337	0.005	2.485	+/- 0.02	0.44	+/- 0.002	1.125
7		3.693	-0.063*	(n/a)	1.526	0.005	2.717	+/- 0.02	0.23	+/- 0.002	0.133
8		4.414	0.119*	(n/a)	0.404	0.005	2.820	+/- 0.02	0.10	+/- 0.002	0.721
9		5.717	>16.417*	-56.0	0.321	0.168	3.347	(n/a)	0.53	+/- 0.010	1.303

* - Above Threshold

Tektronix TFS3031 TekRanger File: SPL-MJP7.05A



Test Setup

Fiber Scan: IntelliTrace
Pulsewidth: < Auto >
Splice Threshold: 0.05 dB
Scan For: Events Above Threshold
Refractive Index: 1.4680
Test Port: Lower (SM)
Distance Units: meters

Test Range: < Auto >
Averages: < Auto >
Reflectance Threshold: -40.0 dB
End of Fiber Threshold: 3 dB

Module: 1310XR

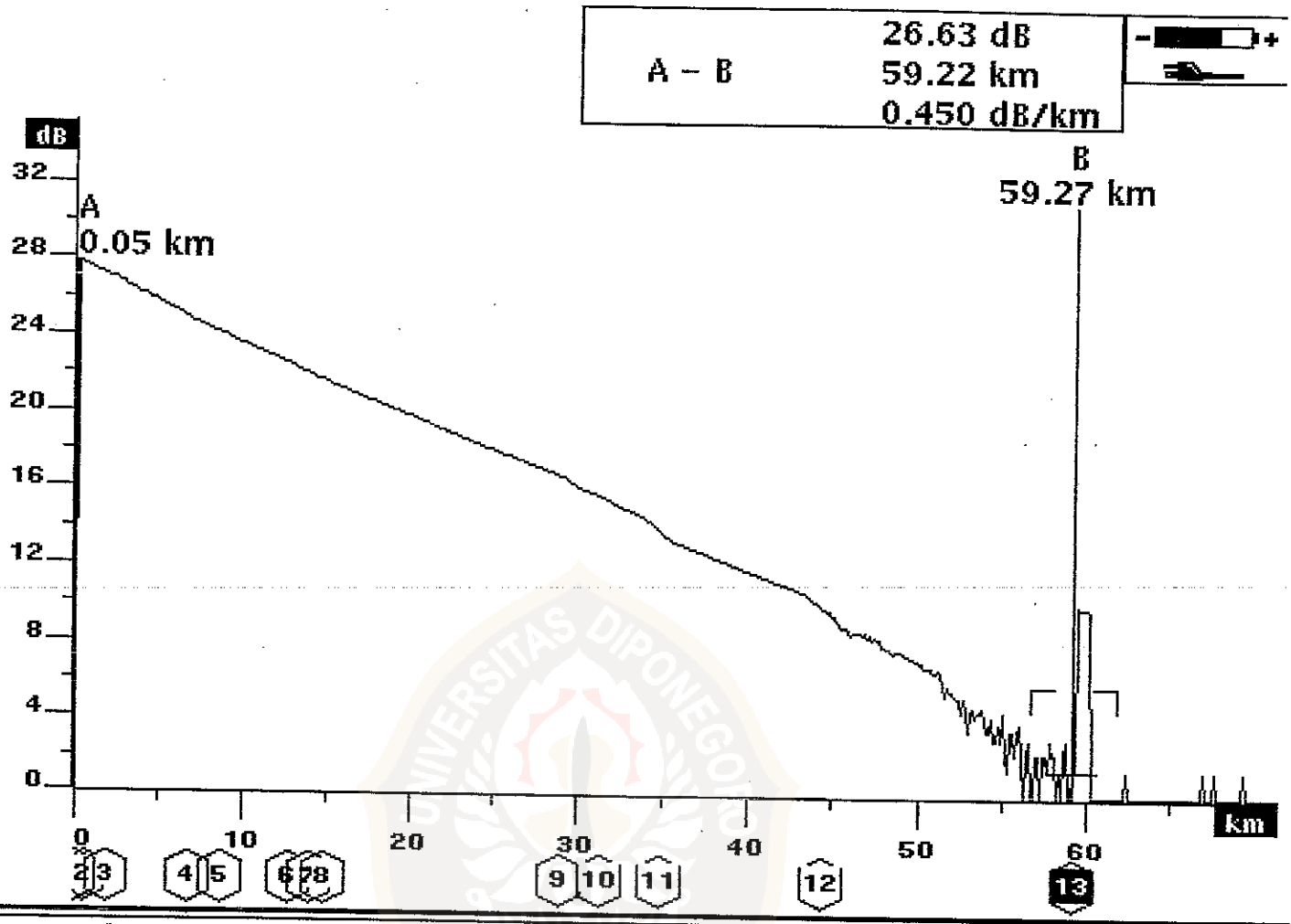
Tektronix TFS3031 TekRanger

File: SPL-MJP7.05A

Event #	Flags	Distance (km)	Loss (dB)	Reflectance (dB)	Slope (dB/km)	Dead Zone (km)	Cumulative Loss (dB)	Loss Tolerance (dB)	Loss Delta (dB)	Distance Tolerance (km)	Distance Delta (km)
1		0.000	0.499*	(n/a)	0.000	0.005	0.000	+/- 0.02	(n/a)	+/- 0.002	(n/a)
2		1.979	0.232*	(n/a)	0.329	0.005	0.645	+/- 0.02	0.65	+/- 0.002	1.979
3		5.084	13.263*	>-47.4*	0.392	0.536	1.882	+/- 1.33	1.24	+/- 0.010	3.105

* - Above Threshold

Tektronix TFS3031 TekRanger File: JHR-SA13.001



Test Setup

Fiber Scan: IntelliTrace
Pulsewidth: < Auto >
Splice Threshold: 0.05 dB
Scan For: Events Above Threshold
Refractive Index: 1.4680
Test Port: Lower (SM)
Distance Units: meters

Test Range: < Auto >
Averages: < Auto >
Reflectance Threshold: -40.0 dB
End of Fiber Threshold: 3 dB

Module: 1310XR

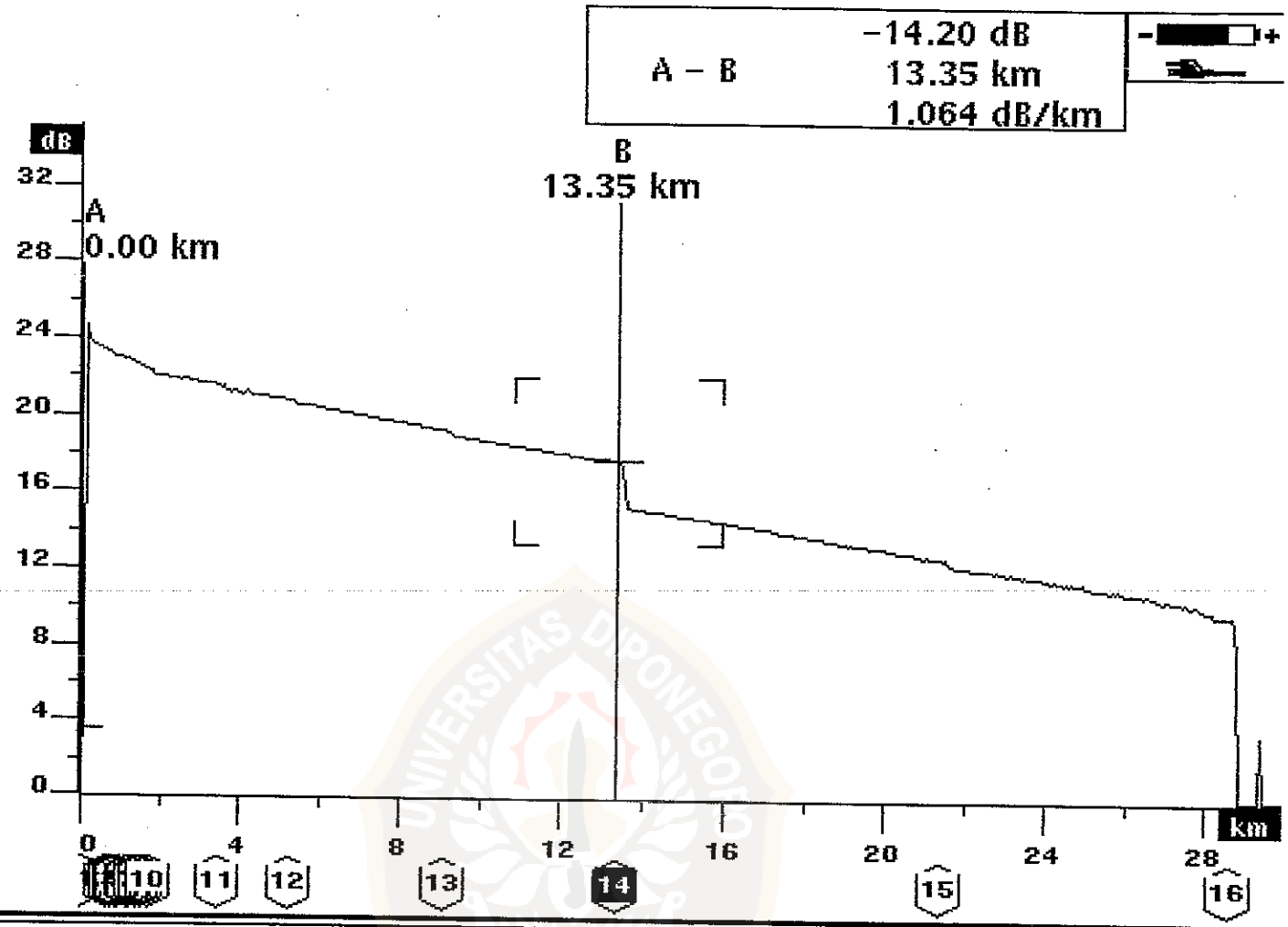
Tektronix TFS3031 TekRanger

File: JHR-SA13.001

Event #	Flags	Distance (km)	Loss (dB)	Reflectance (dB)	Slope (dB/km)	Dead Zone (km)	Cumulative Loss (dB)	Loss Tolerance (dB)	Loss Delta (dB)	Distance Tolerance (km)	Distance Delta (km)
1		0.000	0.499*	(n/a)	0.000	0.005	0.000	+/- 0.02	(n/a)	+/- 0.002	(n/a)
2		0.578	0.077*	(n/a)	1.635	0.005	0.176	+/- 0.02	0.18	+/- 0.002	0.578
3		2.000	0.061*	(n/a)	0.359	0.005	0.732	+/- 0.02	0.56	+/- 0.002	1.422
4		6.790	0.054*	(n/a)	0.482	0.082	2.963	+/- 0.02	2.23	+/- 0.010	4.790
5		8.849	0.063*	(n/a)	0.379	0.082	3.767	+/- 0.02	0.80	+/- 0.010	2.060
6		12.773	0.089*	(n/a)	0.382	0.082	5.307	+/- 0.02	1.54	+/- 0.010	3.924
7		14.022	0.101*	(n/a)	0.345	0.082	5.816	+/- 0.02	0.51	+/- 0.010	1.249
8		14.919	0.070*	(n/a)	0.271	0.082	6.173	+/- 0.02	0.36	+/- 0.010	0.897
9		28.966	0.225*	(n/a)	0.354	0.817	11.069	+/- 0.02	4.90	+/- 0.020	14.046
10		31.335	0.174*	(n/a)	0.345	0.817	12.136	+/- 0.02	1.07	+/- 0.020	2.369
11		34.850	0.349*	(n/a)	0.572	0.817	14.107	+/- 0.02	1.97	+/- 0.020	3.516
12		44.391	0.670*	(n/a)	0.365	0.817	17.926	+/- 0.02	3.82	+/- 0.020	9.541
13		59.273	>-2.932*	-24.1*	0.581	0.848	26.286	(n/a)	8.36	+/- 0.020	14.882

* - Above Threshold

Tektronix TFS3031 TekRanger File: JHR-KS36.35A



Test Setup

Fiber Scan: IntelliTrace
Pulsewidth: < Auto >
Splice Threshold: 0.05 dB
Scan For: Events Above Threshold
Refractive Index: 1.4680
Test Port: Lower (SM)
Distance Units: meters

Test Range: < Auto >
Averages: < Auto >
Reflectance Threshold: -40.0 dB
End of Fiber Threshold: 3 dB

Module: 1310XR

Tektronix TFS3031 TekRanger

File: JHR-KS36.35A

Event #	Flags	Distance (km)	Loss (dB)	Reflectance (dB)	Slope (dB/km)	Dead Zone (km)	Cumulative Loss (dB)	Loss Tolerance (dB)	Loss Delta (dB)	Distance Tolerance (km)	Distance Delta (km)
1		0.000	0.499*	(n/a)	0.000	0.005	0.000	+/- 0.02	(n/a)	+/- 0.002	(n/a)
2		0.655	0.065*	(n/a)	0.399	0.005	0.501	+/- 0.02	0.50	+/- 0.002	0.655
3		0.808	0.066*	(n/a)	0.813	0.005	0.677	+/- 0.02	0.18	+/- 0.002	0.154
4		0.906	0.078*	(n/a)	0.516	0.005	0.715	+/- 0.02	0.04	+/- 0.002	0.098
5		0.974	0.065*	(n/a)	0.556	0.005	0.809	+/- 0.02	0.09	+/- 0.002	0.068
6		1.194	0.063*	(n/a)	0.768	0.005	1.011	+/- 0.02	0.20	+/- 0.002	0.220
7		1.245	0.092*	(n/a)	1.118	0.005	1.092	+/- 0.02	0.08	+/- 0.002	0.051
8		1.447	0.070*	(n/a)	0.689	0.005	1.259	+/- 0.02	0.17	+/- 0.002	0.202
9		1.516	0.070*	(n/a)	-0.207	0.005	1.362	+/- 0.02	0.10	+/- 0.002	0.069
10		1.695	0.134*	(n/a)	0.853	0.005	1.526	+/- 0.02	0.16	+/- 0.002	0.179
11		3.463	0.187*	(n/a)	0.334	0.005	2.283	+/- 0.02	0.76	+/- 0.002	1.768
12		5.222	0.173*	(n/a)	0.334	0.102	2.965	+/- 0.02	0.68	+/- 0.010	1.759
13		9.076	0.211*	(n/a)	0.376	0.102	4.503	+/- 0.02	1.54	+/- 0.010	3.853
14		13.348	2.377*	(n/a)	0.187	0.102	6.034	+/- 0.02	1.53	+/- 0.010	4.272
15		21.380	0.277*	(n/a)	0.345	0.102	11.065	+/- 0.02	5.03	+/- 0.010	8.032
16		28.561	10.518*	(n/a)	0.358	0.102	14.297	+/- 0.02	3.23	+/- 0.010	7.181

* - Above Threshold

LAMPIRAN V

KARAKTERISTIK SERAT OPTIK STEP INDEKS

(direkomendasikan oleh CCITT) (CSELT, 1990)

No.	Parameter (satuan)	Pada λ = 1,3 μm		Pada λ = 1,55 μm	
		Nilai	Toleransi	Nilai	Toleransi
1.	MFD (μm)	9 - 10	± 10 %	7 – 8,3	± 10 %
2.	Diameter kulit (μm)	125	± 3	125	± 3
3.	Ketidak konsentrisan MFD (μm)	≤ 1		≤ 1	
4.	Ketidak bulatan kulit (%)	< 2		< 2	
5.	Panjang Gelombang Cut-off (nm)	>1100;<1280		Dalam penelitian	
6.	Koefisien redaman pada λ 1300 nm (dB/km)	< 1		< 1	
7.	Koefisien redaman pada λ 1300 nm (dB/km)	< 0,5		< 0,5	

KARAKTERISTIK SERAT OPTIK GRADED INDEKS

(direkomendasikan oleh CCITT) (CSELT, 1990)

No.	Parameter (satuan)	Nilai	Toleransi
1.	Diameter inti (μm)	50	3
2.	Diameter kulit (μm)	125	3
3.	Ketidakbulatan inti (%)	-	6
4.	Ketidakbulatan kulit (%)	-	2
5.	TN maksimum	0,18 – 0,24	0,02
6.	Profil indeks bias	Hampir parabolik	
7.	Koeffisien redaman pada λ = 850 nm (dB/km)	<4	
8.	Koeffisien redaman pada λ = 1300 nm (dB/km)	<2	

Ketentuan Standar Karakteristik Perambatan Gelombang di Serat Optik Step-Indeks sebagai Fungsi Indeks Bias Inti dan Cladding (Anggap $n_1 = 1,5$).(Direkomendasikan oleh CCITT) (CSELT, 1990)

No.	Indek bias Cladding (n_2)	Rasio indek bias (n_1/n_2)	Parameter beda Indeks(Δ)	Tingkap Numeris (TN)	Sudut pemantulan total ((ϕ)	Sudut masuk maksimum ke serat
1	1,500	1,000	0	0	90,0	0,0
2	1,496	1,003	0,003	0,08	85,6	4,4
3	1,493	1.005	0,005	0,10	84,3	5,7
4	1,485	1,010	0,010	0,14	81,9	8,1
5	1,478	1,015	0,015	0,17	80,1	9,9
6	1,471	1,020	0,020	0,20	78,6	11,4
7	1,463	1,025	0,024	0,22	77,3	12,7
8	1,456	1,030	0,029	0,24	76,1	13,9
9	1,449	1,035	0,034	0,26	75,1	14,9
10	1,442	1,040	0,038	0,28	74,1	15,9
11	1,435	1,045	0,043	0,29	73,1	16,9
12	1,429	1,050	0,048	0,31	72,2	17,8

KARAKTERISTIK OTDR

Merk TFS3031 TekRanger

Mini Optical Time Domain Reflectometer

Produksi Tektronic, Inc

No.	Parameter	Nilai	Satuan
1.	Panjang gelombang keluaran optis (*output wavelength*)	850 ± 30 1310 ± 20 1550 ± 20	nm
2.	Resolusi pembacaan minimal (*Readout Resolution*)	25	cm
3.	Satuan jarak pengukuran (*Distance measurrements*)	-	Meter, kaki, mil
4.	Pengeturan rentang jarak pengukuran (*OTDR Distance range Setting*)	Serat optik *Single moda* : 1– 240 *Multimoda* : 1 - 40	km
5.	Ketepatan jarak pengukuran	± 1,25x 10^{-5} jarak terukur	m
6.	Kelinieran bentuk gelombang (*linierity*)	0,02	dB/km
7.	Suhu lingkungan (*Enviromental temperature*)	Operasi 0 – 40 Non-operasi –20 s.d 60	^{0}C

8	Kelembaban (*Enviromental humidity*)	- 5% - 95 %	
9.	Resolusi layar (*Display resolution*)	640 x 480	Piksel
10	Tegangan operasi (*Operation voltage*) Frequensi operasi (*Operation frequency)*	100 – 240 50 - 60	V AC Hz
11	Ukuran fisik	Tinggi = 292 Lebar = 114 Panjang = 41 Massa = 4,2	mm mm mm kg

SETUP OF TEKTRONIX TFS3031 TEKRANGER MINI OPTICAL TIME DOMAIN REFLECTOMETER

1. TEST SETUP MENU

Setup	Parameters	Factory Default
Fiber Scan (Test Mode)	IntelliTrace Manual End of Fiber	IntelliTrace
Test Range	Wavelength dependent	Fiber Scan dependent
Splice Thresold	SM : 0.02 to 5.00 dB MM :0.1 to 5.00 dB 0.01 dB steps	SM : 0.05 dB MM : 0.1 dB
Reflectance Threshold	-60.0 dB to –20.0 dB in 5.0 dB steps	-40.0 dB
Scan For	All Events Events Above Thresold	Events Above Threshold
End of Fiber Threshold	3 dB to 10 dB in 1 dB steps	3 dB
Refractive Index	1.4000 to 1.6000	1.4680 : 1310 SM 1.4685 : 1550 SM 1.4776 : 850 MM 1.4719 : 1300 MM
Distance Units	Meter Feet Miles	Meters

2. FORMAT SETUP MENU

Setup	Parameters	Factory Default
Trace Display		
Event	Event measurement data at bottom screen On, Off	On
Cursor A – B	Cursor A to B Measurrement data at top screen On, Off	On
Splice Loss (at Cursor A and B)	Splice Loss data at top screen On, Off	Off
Reflectance (at cursort A and B)	Reflectance data at top scren On, Off	Off
Table Display		
Distance	Columns 1-10, Off	Column 1
Loss	Columns 1-10, Off	Column 2
Reflectance	Columns 1-10, Off	Column 3
Slope	Columns 1-10, Off	Column 4
Dead Zone	Columns 1-10, Off	Column 5
Cumulative Loss	Columns 1-10, Off	Column 6
Loss Tollerance	Columns 1-10, Off	Column 7
Loss Delta	Columns 1-10, Off	Column 8
Distance Delta	Columns 1-10, Off	Column 9
Ditance Tolerance	Columns 1-10, Off	Column 10

3. SYSTEM SETUP MENU

Setup	Parameters	Factory Default
System Setup		
Backlight Time	Off, 5 minutes to 4 hours in 5 - minute steps, Always On	15 minutes
Contrast Adjust	0 (light) to 255 (dark) in step of 1	128
Sound	On, Off	On
Power Off Time	Off, 15 minutes to 8 hours in 15 minute steps	30 minutes
Time	0:00:00 to 23:59:59	Current time
Date	1/1/1970 to 12/31/2069	Current date
Date Format	Month/Day/Year Day/Month/Year	Month/Day/Year
Language (Foreign Language Instruments)	English, Spanish, Portugese, French, Standard Chinese, PRC Chinese, Japanese, German, Italian, Finnish	Englis
Setup at Power On		
Power On Defaults	User Setup Last Used Factory	Factory

4. I/O – DOC SETUP MENU

Setup	Parameters	Factory Default
RS232C Serial Setup		
Baud Rate	1200, 2400, 4800, 9600, 19200, 38400 bps	19200 bps
Flow Control	None XON/XOFF RTS?CTS DTR	None
Printer Setup		
Printer	Epson Seiko DPU411 HP DeskJet HP LaserJet HP ThinkJet PostScript	Seiko DPU411
External Port	Serial Parallel	Parallel
Print Content	Trace Table Trace and table Setups Fiber Notes	Trace and Table
File Setup		
File Content	Trace Table Trace and table Setups Fiber Notes	Trace and table

File Format	Tektronix Text	Tektronix
Auto Increment	None Name Extension	Name