

Data Book B

Radio Wave Propagation Test

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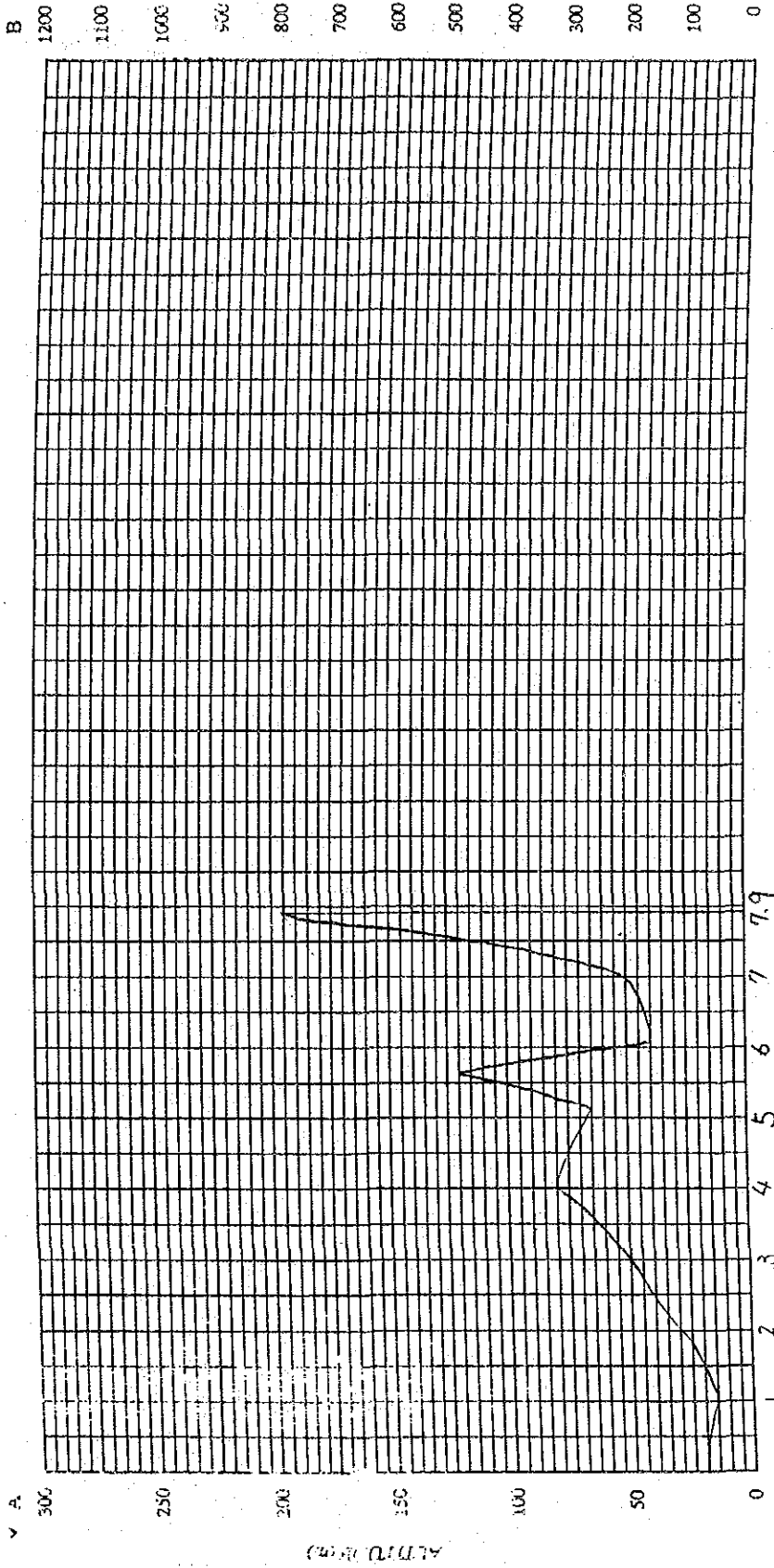
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1. Terrain Profile for Multiplex Radio Link

TERRAIN PROFILE

k = 4/3

MAP No. N34-C4



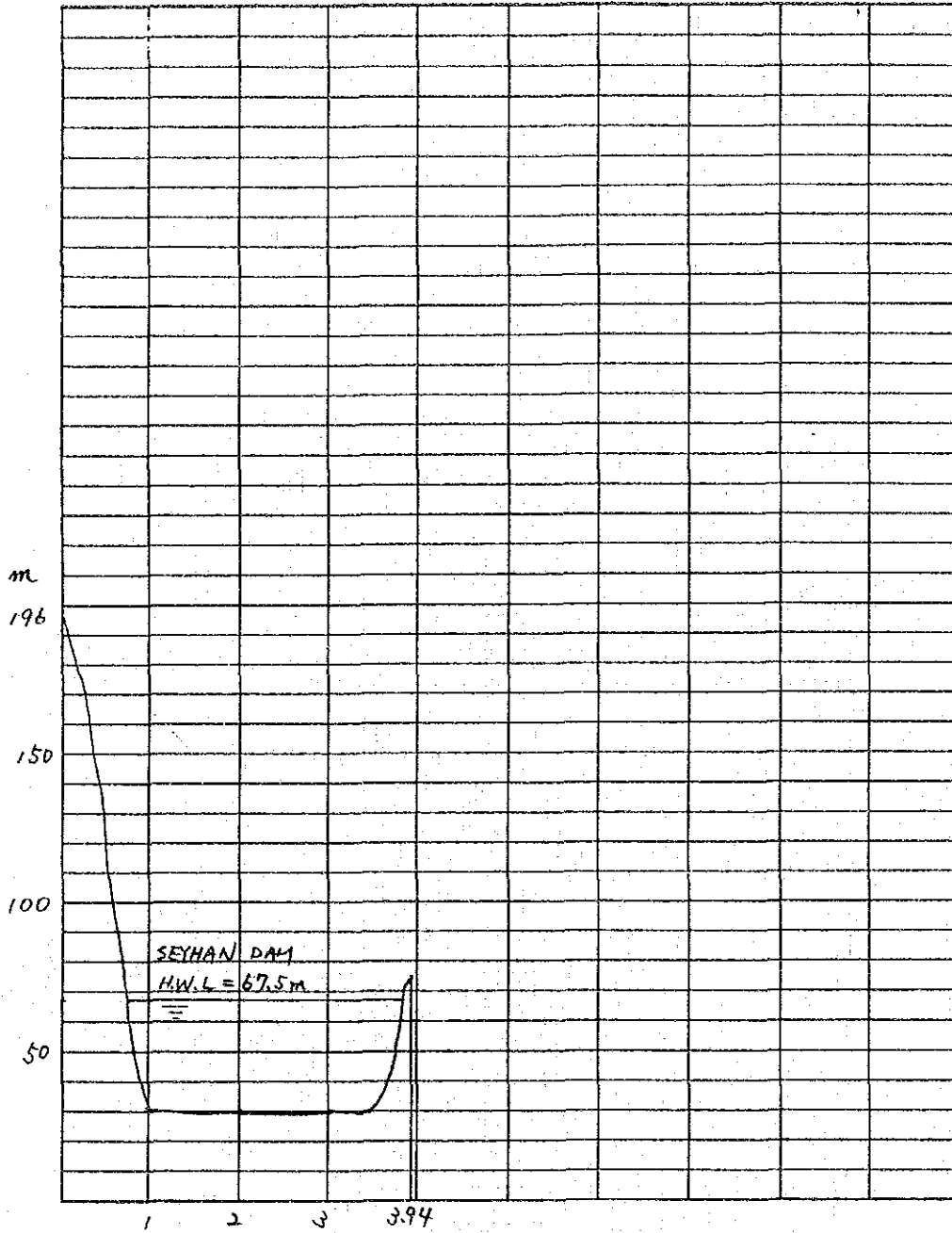
DISTANCE (km)

SCALE:
 √ A = 20km
 B = 40km

STATION NAME	PSI ADANA	ZIYARET I.
ALTITUDE	20 m	196 m
ANTENNA HEIGHT		
LOCATION	N 37° 00' 18"	E 37° 04' 30"
	35° 19' 54"	35° 20' 53"
DISTANCE	7.9 km	

TERRAIN PROFILE

MAP No. N34-C4



		DISTANCE (km)	
STATION NAME		ZİYARET T.	SEYHAN DAM
ALTITUDE		196 m	75 m
ANTENNA HEIGHT			
LOCATION	N	37° 04' 30"	37° 02' 32"
	E	35° 20' 53"	35° 19' 52"
(WITHIN 10km)	DISTANCE	3.94 km	

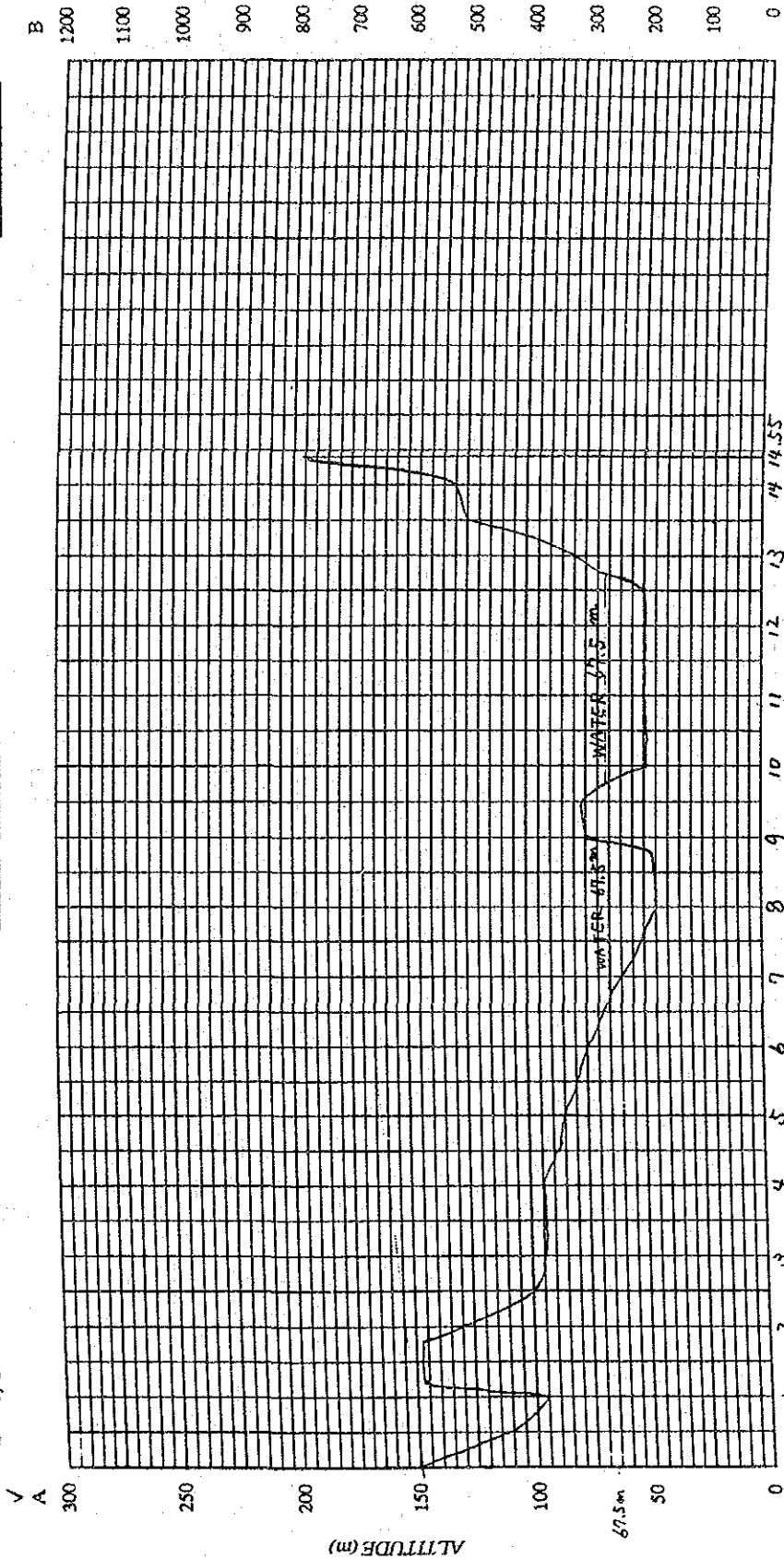
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7

MAP No. " N34-C1
" -C4

TERRAIN PROFILE

k=4/3



DISTANCE (km)

SCALE:
V A = 20km
B = 40km

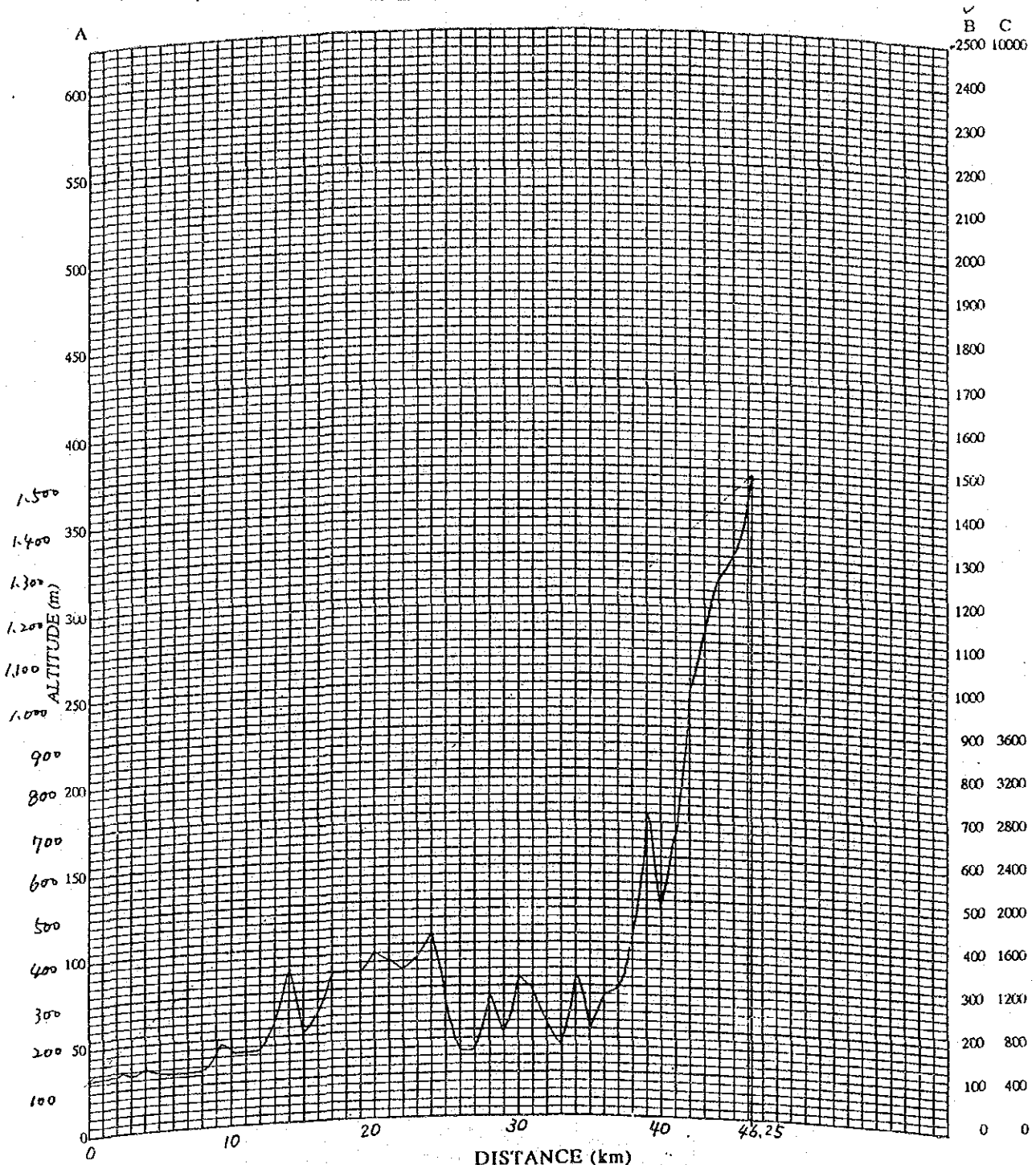
STATION NAME	CATALAN DAM	ZIYARET I
ALTITUDE	150 m	196 m
ANTENNA HEIGHT		
LOCATION	N 37° 11' 50"	37° 04' 30"
	E 35° 17' 19"	35° 20' 53"
DISTANCE		14.55 Km

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k=4/3

TERRAIN PROFILE

N34 - c1
MAP No. M35 - d4



SCALE:
 A = 30km
 √ B = 60km
 C = 120km

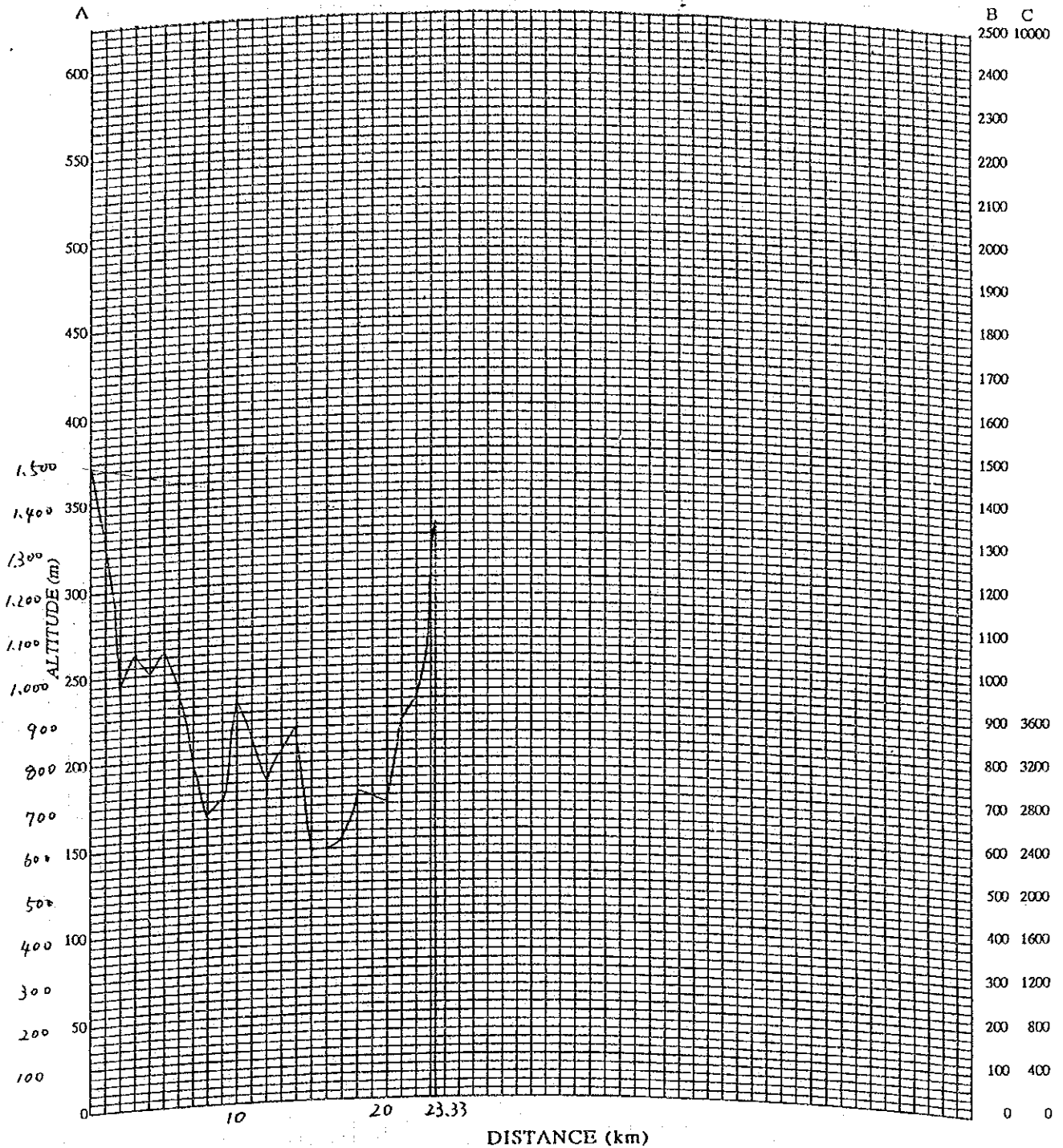
STATION NAME		CATALAN DAM	KARLIK T.
ALTITUDE		150 m	1.490 m
ANTENNA HEIGHT			
LOCATION	N	37° 33' 08"	37° 33' 08"
	E	35° 33' 44"	35° 33' 44"
DISTANCE		46.25 km	

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$k=4/3$

TERRAIN PROFILE

MAP No. M35-d4
d3
c4



SCALE:
A = 30km
✓ B = 60km
C = 120km

STATION NAME		KARLIK T.	NER NEC T.
ALTITUDE		1.490 m	1.312 m
ANTENNA HEIGHT			
LOCATION	N	37° 33' 08"	37° 37' 22"
	E	35° 33' 44"	35° 48' 40"
DISTANCE		23.33 km	

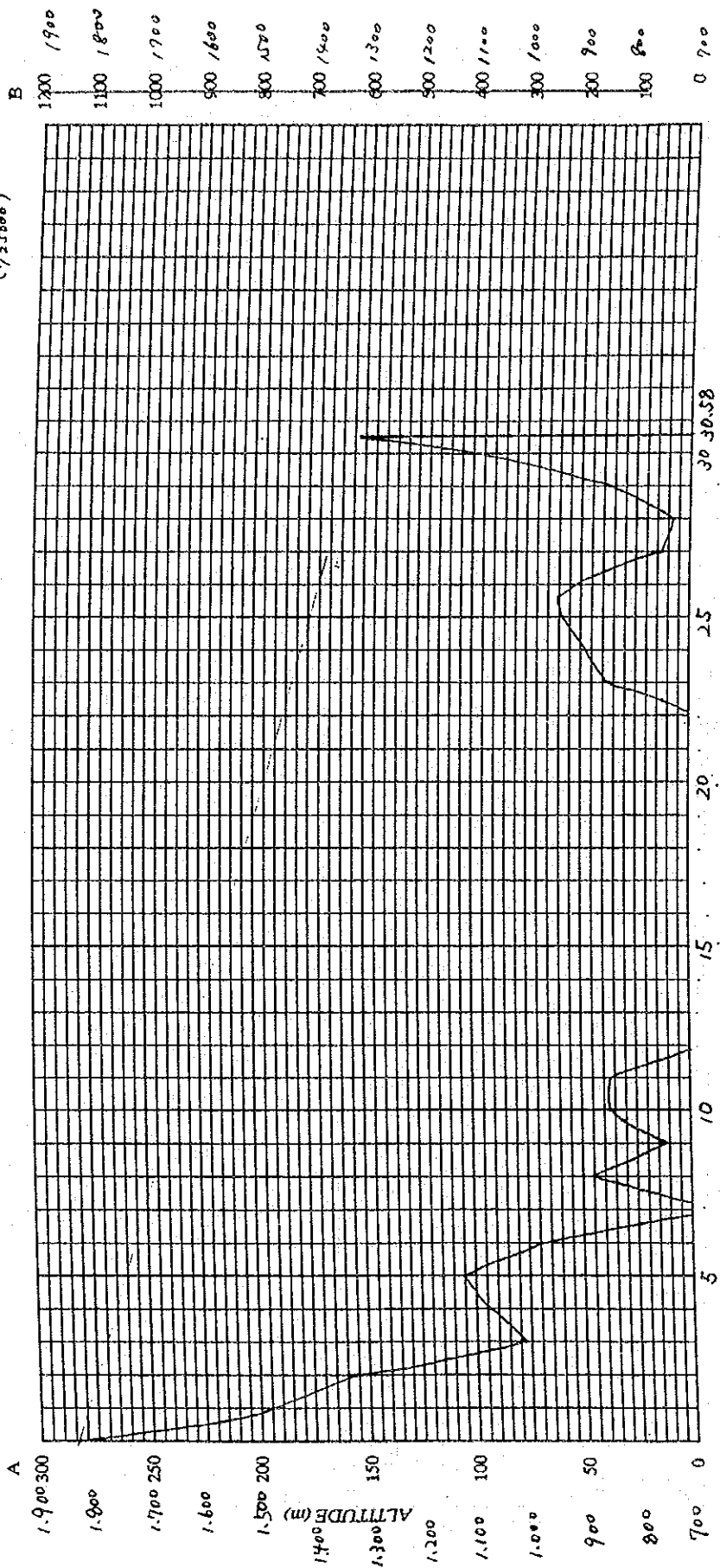
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M35-b2
 " .b3
 " .b4
 " .c1
 " .c2
 " .c3
 " .c4
 " .c5
 " .c6
 " .c7
 " .c8
 " .c9
 " .c0

TERRAIN PROFILE

k = 4/3

MAP No. (1/25000)



STATION NAME	FEKE DAĞI	KERNEC T.
ALTITUDE	1.838 m.	1.372 m.
ANTENNA HEIGHT		
LOCATION	N 37° 52' 55"	37° 37' 32"
	E 35° 58' 44"	35° 48' 40"
DISTANCE	30.58 km.	

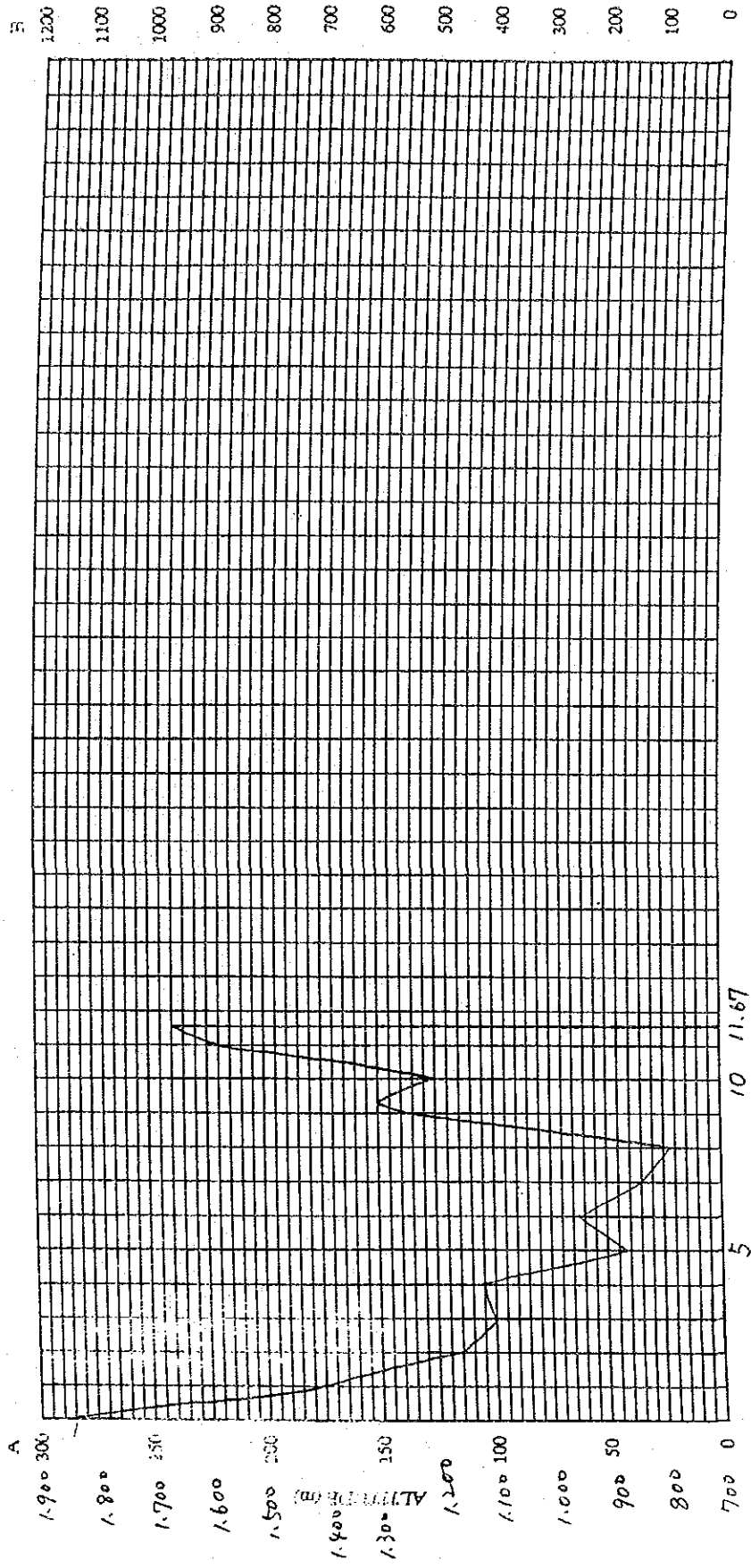
SCALE:
 A = 20km
 B = 40km

M35-62
M36-a1

MAP No.

TERRAIN PROFILE

k=4/3



DISTANCE (km)

SCALE:
A = 20km
V B = 40km

STATION NAME	FEKE DAĞI	MEYDANCIK
ALTITUDE	1.838m	1.660m
ANTENNA HEIGHT		
LOCATION	N 37° 52' 55"	37° 55' 13"
	E 35° 55' 44"	36° 03' 09"
DISTANCE	11.67 km	

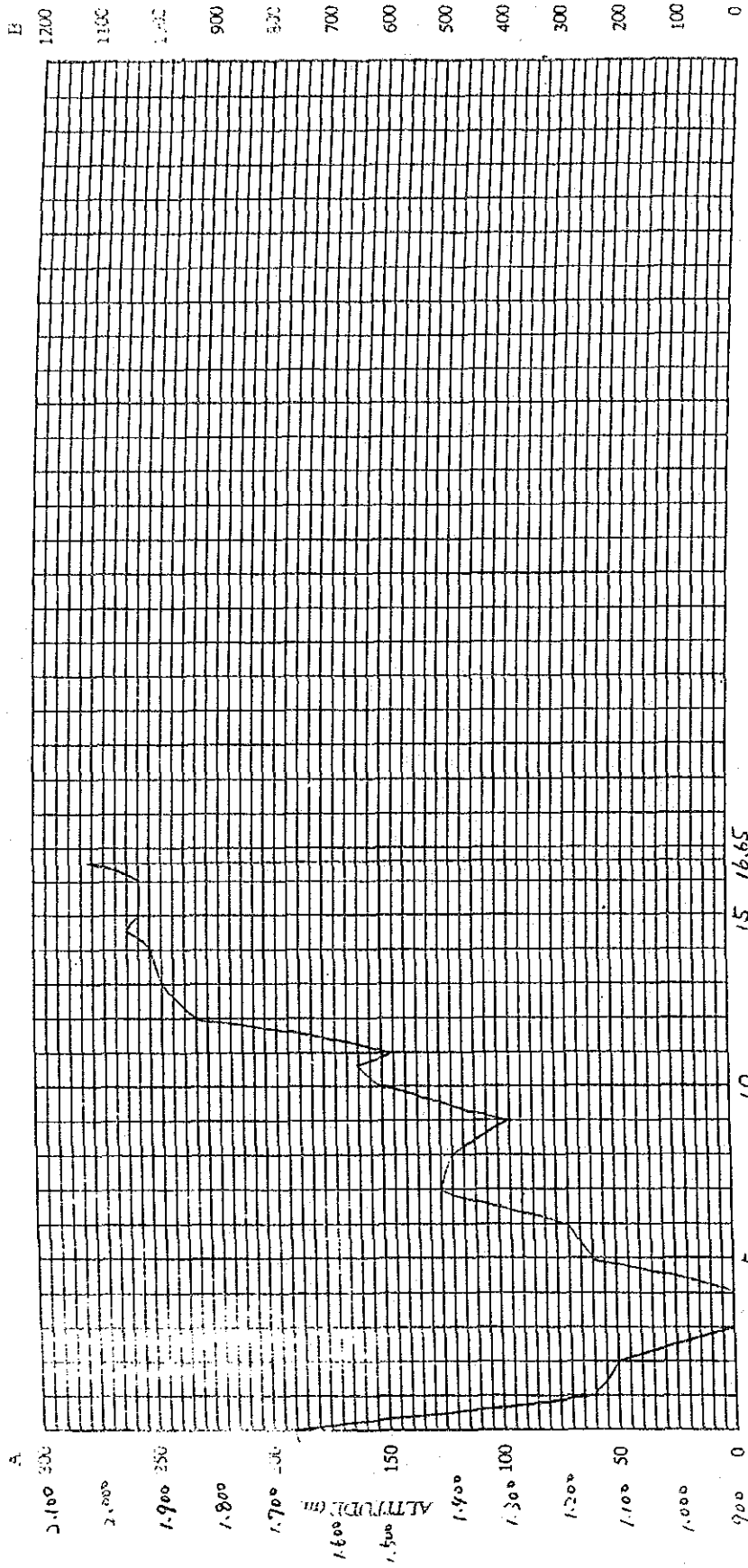
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M36-a1
a2

MAP No. 736

TERRAIN PROFILE

k=4/3



SCALE:
A = 20km
V B = 40km

STATION NAME	MEYDANCIK	SÜT TEPE
ALTITUDE	1.660m	2.013m
ANTENNA HEIGHT		
LOCATION	N 37° 55' 13"	38° 02' 02"
	E 36° 03' 09"	36° 10' 24"
DISTANCE	16.65 km	

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**2. Radio Path Data Calculation Sheet for 2000 MHz
Band Digital Radio Link**

RADIO PATH DATA CALCULATION SHEET

2000 MHz Band PCM-QPSK Digital Radio Link

Span				a	b
				DSİ Adana	Ziyaret T.
Altitude				20m	196m
Antenna height				40m	20m
Radio path length				7.90km	
Path type				Plain C= 1.0	
Feeder Type				WF-H50-7	WF-H50-7
Sub Coaxial Cable				65m 8D-2W 1m	45m 8D-2W 1m
Antenna Type				0.9mØ GPA	0.9mØ GPA
Model of Equipment				2GHz-4PSK-2Mb/s 1W (ATT 0dB)	
1	Feeder Loss	a	dB	-5.1	
		b	dB	-3.7	
2	Duplexer Loss	T	dB	-3.5	
		R	dB	-6.0	
3	RF Hybrid Loss		dB		
4	Antenna Gain	A	dB	23.0	
		B	dB	23.0	
5	Reflector Gain	A	dB		
		B	dB		
6	Free Space Loss	A	dB	-116.4	d1= 7.90 km
		B	dB		
		C	dB		
7	Azimuth Loss of Reflector	A	dB		
		B	dB		
8	Azimuth Loss of Antenna		dB		
9	Loss of Splitting Power		dB		
10	Shadow Loss	A	dB		
		B	dB		
		C	dB		
11	Additional Loss	A	dB		
		B	dB		
		C	dB		
12	Span Loss	Loss	dB	-134.7	
		Gain	dB	46.0	
		Total	dB	-88.7	
13	Transmitting Power		dBm	30.0	1.0W (ATT 0.0 dB)
14	Receiving Power		dBm	-58.7	
15	Receiver Noise		dBm	-104.5	F= 3.0 dB B= 1.1 MHz
16	C/N in median		dB	51.8	
17	Interference		dB	49.3	Presumed
18	City Noise		dB	49.3	Presumed
19	Others		dB	55.8	Presumed
20	Variable Factor Total		dB	44.8	
21	C/N for Variable Factor		dB	14.3	BER = 1 E-3
22	Fading Margin		dB	30.5	
23	Pr			Pr = 3.2E- 06	
24	Pre Considering Reflection			Pre = 3.2E- 06	
25	Diversity Improvement			Isd = 1.0E+ 00	
26	Outage Time Due to Fading		%	Pm = 2.8E- 07	
27	Outage Margin		dB	27.5	

RADIO PATH DATA CALCULATION SHEET

2000 MHz Band PCM-QPSK Digital Radio Link

Span				a	b
				Seyhan Dam	Ziyaret T.
Altitude				75m	196m
Antenna height				20m	20m
Radio path length				3.94km	
Path type				Sea C= 5.6	
Feeder Type				WF-H50-7	WF-H50-7
Sub Coaxial Cable				45m	45m
				8D-2W	8D-2W
				1m	1m
Antenna Type				0.9mØ GPA	0.9mØ GPA
Model of Equipment				2GHz-4PSK-2Mb/s	
				1W	
				(ATT	0dB)
1	Feeder Loss	a	dB	-3.7	
		b	dB	-3.7	
2	Duplexer Loss	T	dB	-3.5	
		R	dB	-6.0	
3	RF Hybrid Loss		dB	0.0	
4	Antenna Gain	A	dB	23.0	
		B	dB	23.0	
5	Reflector Gain	A	dB		
		B	dB		
6	Free Space Loss	A	dB	-110.4	d1= 3.94 km
		B	dB		
		C	dB		
7	Azimuth Loss of Reflector	A	dB		
		B	dB		
8	Azimuth Loss of Antenna		dB		
9	Loss of Splitting Power		dB		
10	Shadow Loss	A	dB		
		B	dB		
11	Additional Loss	A	dB		
		B	dB		
		C	dB		
12	Span Loss	Loss	dB	-127.3	
		Gain	dB	46.0	
		Total	dB	-81.3	
13	Transmitting Power		dBm	30.0	1.0W (ATT 0.0 dB)
14	Receiving Power		dBm	-51.3	
15	Receiver Noise		dBm	-110.5	F= 3.0 dB B= 1.1 MHz
16	C/N in median		dB	59.2	
17	Interference		dB	62.7	Presumed
18	City Noise		dB	62.7	Presumed
19	Others		dB	69.2	Presumed
20	Variable Factor Total		dB	56.2	
21	C/N for Variable Factor		dB	14.3	BER = 1 E-3
22	Fading Margin		dB	41.9	
23	Pr			Pr = 1.6E- 06	
24	Pre Considering Reflection			Pre = 1.6E- 06	
25	Diversity Improvement			I = 1.0E+ 00	
26	Outage Time Due to Fading		%	Pm = 3.3E- 08	
27	Outage Margin		dB	38.8	

RADIO PATH DATA CALCULATION SHEET

2000 MHz Band PCM-QPSK Digital Radio Link

Span				a	b
				Ziyaret T.	Çatalan Dam
Altitude				196m	150m
Antenna height				20m	25m
Radio path length				14.55km	
Path type				Sea C= 5.0	
Feeder Type				WF-H50-7	WF-H50-7
Sub Coaxial Cable				45m	50m
				8D-2W	8D-2W
				1m	1m
Antenna Type				1.2mØ GPA	0.9mØ GPA
Model of Equipment				2GHz-4PSK-2Mb/s	
				1W	
				(ATT	0dB)
1	Feeder Loss	a	dB	-3.7	
		b	dB	-4.1	
2	Duplexer Loss	T	dB	-3.5	
		R	dB	-6.0	
3	RF Hybrid Loss		dB	0.0	
4	Antenna Gain	A	dB	26.0	
		B	dB	23.0	
5	Reflector Gain	A	dB		
		B	dB		
6	Free Space Loss	A	dB	-121.7	d1= 14.55 km
		B	dB		
		C	dB		
7	Azimuth Loss of Reflector	A	dB		
		B	dB		
8	Azimuth Loss of Antenna		dB		
9	Loss of Splitting Power		dB		
10	Shadow Loss	A	dB		
		B	dB		
11	Additional Loss	A	dB		
		B	dB		
		C	dB		
12	Span Loss	Loss	dB	-139.0	
		Gain	dB	49.0	
		Total	dB	-90.0	
13	Transmitting Power		dBm	30.0	1.0W (ATT 0.0 dB)
14	Receiving Power		dBm	-60.0	
15	Receiver Noise		dBm	-110.5	F= 3.0 dB B= 1.1 MHz
16	C/N in median		dB	50.5	
17	Interference		dB	51	Presumed
18	City Noise		dB	51	Presumed
19	Others		dB	57.5	Presumed
20	Variable Factor Total		dB	45.8	
21	C/N for Variable Factor		dB	14.3	BER = 1 E-3
22	Fading Margin		dB	31.5	
23	Pr			Pr = 1.4E- 04	
24	Pre Considering Reflection			Pre = 1.4E- 04	
25	Diversity Improvement			Isd = 1.0E+ 00	
26	Outage Time Due to Fading	%		Pm = 1.0E- 05	
27	Outage Margin		dB		14.6

RADIO PATH DATA CALCULATION SHEET

2000 MHz Band PCM-QPSK Digital Radio Link

Span			a	b	
			Çatalan Dam	Karlık T.	
Altitude			150m	1490m	
Antenna height			25m	20m	
Radio path length			46.25km		
Path type			Plain C= 1.0		
Feeder Type			WF-H50-7	WF-H50-7	
Sub Coaxial Cable			55m	45m	
			8D-2W	8D-2W	
			1m	1m	
Antenna Type			3.0mØ GPA	3.0mØ GPA	
Model of Equipment			2GHz-4PSK-2Mb/s		
			1W		
			(ATT	OdB)	
1	Feeder Loss	a	dB	-4.4	
		b	dB	-3.7	
2	Duplexer Loss	T	dB	-3.5	
		R	dB	-6.0	
3	RF Hybrid Loss		dB	0.0	
4	Antenna Gain	A	dB	33.3	
		B	dB	33.3	
5	Reflector Gain	A	dB		
		B	dB		
6	Free Space Loss	A	dB	-131.8	d1= 46.25 km
		B	dB		
		C	dB		
7	Azimuth Loss of Reflector	A	dB		
		B	dB		
8	Azimuth Loss of Antenna		dB		
9	Loss of Splitting Power		dB		
10	Shadow Loss	A	dB		
		B	dB		
11	Additional Loss	A	dB		
		B	dB		
		C	dB		
12	Span Loss	Loss	dB	-149.4	
		Gain	dB	66.6	
		Total	dB	-82.8	
13	Transmitting Power		dBm	30.0	1.0W (ATT 0.0 dB)
14	Receiving Power		dBm	-52.8	
15	Receiver Noise		dBm	-110.5	F= 3.0 dB B= 1.1 MHz
16	C/N in median		dB	57.7	
17	Interference		dB	60	Presumed
18	City Noise		dB	60	Presumed
19	Others		dB	66.5	Presumed
20	Variable Factor Total		dB	54.1	
21	C/N for Variable Factor		dB	14.3	BER = 1E-3
22	Fading Margin		dB	39.8	
23	Pr			Pr = 1.5E- 03	
24	Pre Considering Reflection			Pre = 6.0E- 03	
25	Diversity Improvement			Isd = 1.0E+ 00	
26	Outage Time Due to Fading		%	Pm = 6.3E- 05	
27	Outage Margin		dB	11.7	

RADIO PATH DATA CALCULATION SHEET

2000 MHz Band PCM-QPSK Digital Radio Link

Span				a	b
				Karlík T.	Nervec T.
Altitude				1490m	1312m
Antenna height				20m	20m
Radio path length				23.33km	
Path type				Mountain C= 0.4	
Feeder Type				WF-H50-7 45m	WF-H50-7 45m
Sub Coaxial Cable				8D-2W 1m	8D-2W 1m
Antenna Type				1.8mØ GPA	1.8mØ GPA
Model of Equipment				2GHz-4PSK-2Mb/s 1W (ATT OdB)	
1	Feeder Loss	a	dB	-3.7	
		b	dB	-4.1	
2	Duplexer Loss	T	dB	-3.5	
		R	dB	-6.0	
3	RF Hybrid Loss		dB	0.0	
4	Antenna Gain	A	dB	28.9	
		B	dB	28.9	
5	Reflector Gain	A	dB		
		B	dB		
6	Free Space Loss	A	dB	-125.8	d1= 23.33 km
		B	dB		
		C	dB		
7	Azimuth Loss of Reflector	A	dB		
		B	dB		
8	Azimuth Loss of Antenna		dB		
9	Loss of Splitting Power		dB		
10	Shadow Loss	A	dB		
		B	dB		
11	Additional Loss	A	dB		
		B	dB		
		C	dB		
12	Span Loss	Loss	dB	-143.1	
		Gain	dB	57.8	
		Total	dB	-85.3	
13	Transmitting Power		dBm	30.0	1.0W (ATT 0.0 dB)
14	Receiving Power		dBm	-55.3	
15	Receiver Noise		dBm	-110.5	F= 3.0 dB B= 2.2 MHz
16	C/N in median		dB	55.2	
17	Interference		dB	59.5	Presumed
18	City Noise		dB	59.5	Presumed
19	Others		dB	66.0	Presumed
20	Variable Factor Total		dB	52.6	
21	C/N for Variable Factor		dB	14.3	BER = 1E-3
22	Fading Margin		dB	38.3	
23	Pr			Pr = 5.5E- 05	
24	Pre Considering Reflection			Pre = 5.6E- 05	
25	Diversity Improvement			Isd = 1.0E+ 00	
26	Outage Time Due to Fading		%	Pm = 8.3E- 07	
27	Outage Margin		dB	27.5	

RADIO PATH DATA CALCULATION SHEET

2000 MHz Band PCM-QPSK Digital Radio Link

Span				a	b
				Nervec T.	Feke Dağı
Altitude				1312m	1838m
Antenna height				20m	20m
Radio path length				30.58km	
Path type				Mountain C= 0.4	
Feeder Type				WF-H50-7	WF-H50-7
Sub Coaxial Cable				45m	45m
				8D-2W	8D-2W
				1m	1m
Antenna Type				2.4mØ GPA	1.8mØ GPA
Model of Equipment				2GHz-4PSK-2Mb/s	
				1W	
				(ATT	0dB)
1	Feeder Loss	a	dB	-3.7	
		b	dB	-3.7	
2	Duplexer Loss	T	dB	-3.5	
		R	dB	-6.0	
3	RF Hybrid Loss		dB	0.0	
4	Antenna Gain	A	dB	31.4	
		B	dB	28.9	
5	Reflector Gain	A	dB		
		B	dB		
6	Free Space Loss	A	dB	-128.2	d1= 30.58 km
		B	dB		
		C	dB		
7	Azimuth Loss of Reflector	A	dB		
		B	dB		
8	Azimuth Loss of Antenna		dB		
9	Loss of Splitting Power		dB		
10	Shadow Loss	A	dB		
		B	dB		
11	Additional Loss	A	dB		
		B	dB		
		C	dB		
12	Span Loss	Loss	dB	-145.1	
		Gain	dB	60.3	
		Total	dB	-84.8	
13	Transmitting Power		dBm	30.0	1.0W (ATT 0.0 dB)
14	Receiving Power		dBm	-54.8	
15	Receiver Noise		dBm	-110.5	F= 3.0 dB B= 1.1 MHz
16	C/N in median		dB	55.7	
17	Interference		dB	58.7	Presumed
18	City Noise		dB	58.7	Presumed
19	Others		dB	65.2	Presumed
20	Variable Factor Total		dB	52.5	
21	C/N for Variable Factor		dB	14.3	BER = 1 E-3
22	Fading Margin		dB	38.2	
23	Pr			Pr = 1.4E- 04	
24	Pre Considering Reflection			Pre = 1.6E- 04	
25	Diversity Improvement			Isd = 1.0E+ 00	
26	Outage Time Due to Fading		%	Pm = 2.4E- 06	
27	Outage Margin		dB	24	

RADIO PATH DATA CALCULATION SHEET

2000 MHz Band PCM-QPSK Digital Radio Link

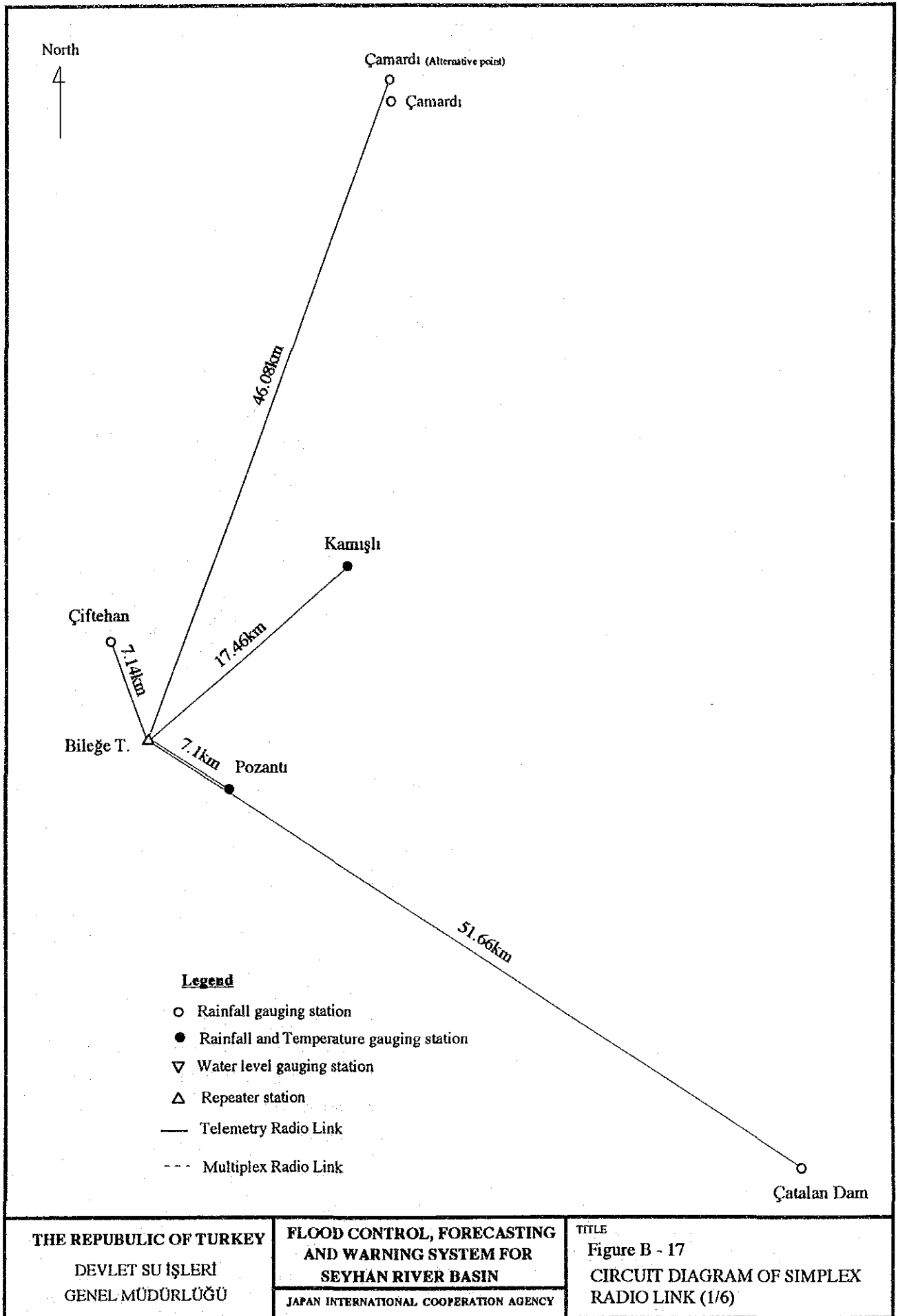
Span				a	b
				Feke Dağı	Meydanık
Altitude				1838m	1660m
Antenna height				20m	20m
Radio path length				11.67km	
Path type				Mountain C= 0.4	
Feeder Type				WF-H50-7	WF-H50-7
				45m	45m
Sub Coaxial Cable				8D-2W	8D-2W
				1m	1m
Antenna Type				0.9mØ GPA	0.9mØ GPA
Model of Equipment				2GHz-4PSK-2Mb/s	
				1W	
				(ATT	0dB)
1	Feeder Loss	a	dB	-3.7	
		b	dB	-3.7	
2	Duplexer Loss	T	dB	-3.5	
		R	dB	-6.0	
3	RF Hybrid Loss		dB	0.0	
4	Antenna Gain	A	dB	23.0	
		B	dB	23.0	
5	Reflector Gain	A	dB		
		B	dB		
6	Free Space Loss	A	dB	-119.8	d1= 11.67 km
		B	dB		
		C	dB		
7	Azimuth Loss of Reflector	A	dB		
		B	dB		
8	Azimuth Loss of Antenna		dB		
9	Loss of Splitting Power		dB		
10	Shadow Loss	A	dB		
		B	dB		
11	Additional Loss	A	dB		
		B	dB		
		C	dB		
12	Span Loss	Loss	dB	-136.7	
		Gain	dB	46.0	
		Total	dB	-90.7	
13	Transmitting Power		dBm	30.0	1.0W (ATT 0.0 dB)
14	Receiving Power		dBm	-60.7	
15	Receiver Noise		dBm	-110.5	F= 3.0 dB B= 1.1 MHz
16	C/N in median		dB	49.8	
17	Interference		dB	53.3	Presumed
18	City Noise		dB	53.3	Presumed
19	Others		dB	59.8	Presumed
20	Variable Factor Total		dB	46.8	
21	C/N for Variable Factor		dB	14.3	BER = 1 E-3
22	Fading Margin		dB	32.5	
23	Pr			Pr = 4.9E- 06	
24	Pre Considering Reflection			Pre = 4.9E- 06	
25	Diversity Improvement			Isd = 1.0E+ 00	
26	Outage Time Due to Fading		%	Pm = 2.8E- 07	
27	Outage Margin		dB	29.6	

Radio Circuit Design Table

2000 MHz Band PCM-QPSK Digital Radio Link

Span				a	b
Altitude				1660m	2013m
Antenna height				20m	20m
Radio path length				16.65km	
Path type				Mountain/C= 0.4	
Feeder Type				WF-H50-7 45m	WF-H50-7 45m
Sub Coaxial Cable				8D-2W 1m	8D-2W 1m
Antenna Type				1.2mØ GPA	
Model of Equipment				2GHz-4PSK-2Mb/s 1W (ATT OdB)	
1	Feeder Loss	a	dB	-3.7	
		b	dB	-3.7	
2	Duplexer Loss	T	dB	-3.5	
		R	dB	-6.0	
3	RF Hybrid Loss		dB	0.0	
4	Antenna Gain	A	dB	26.0	
		B	dB	26.0	
5	Reflector Gain	A	dB		
		B	dB		
6	Free Space Loss	A	dB	-122.9	d1= 16.65 km
		B	dB		
		C	dB		
7	Azimuth Loss of Reflector	A	dB		
		B	dB		
8	Azimuth Loss of Antenna		dB		
9	Loss of Splitting Power		dB		
10	Shadow Loss	A	dB		
		B	dB		
11	Additional Loss	A	dB		
		B	dB		
		C	dB		
12	Span Loss	Loss	dB	-139.8	
		Gain	dB	52.0	
		Total	dB	-87.8	
13	Transmitting Power		dBm	30.0	1.0W (ATT 0.0 dB)
14	Receiving Power		dBm	-57.8	
15	Receiver Noise		dBm	-110.5	F= 3.0 dB B= 1.1 MHz
16	C/N in median		dB	52.7	
17	Interference		dB	56.2	Presumed
18	City Noise		dB	56.2	Presumed
19	Others		dB	62.7	Presumed
20	Variable Factor Total		dB	49.7	
21	C/N for Variable Factor		dB	14.3	BER = 1 E-3
22	Fading Margin		dB	35.4	
23	Pr			Pr = 1.7E- 05	
24	Pre Considering Reflection			Pre = 1.7E- 05	
25	Diversity Improvement			Isd = 1.0E+ 00	
26	Outage Time Due to Fading		%	Pm = 4.9E- 07	
27	Outage Margin		dB	28.7	

3. Circuit Diagram of Simplex Radio Link



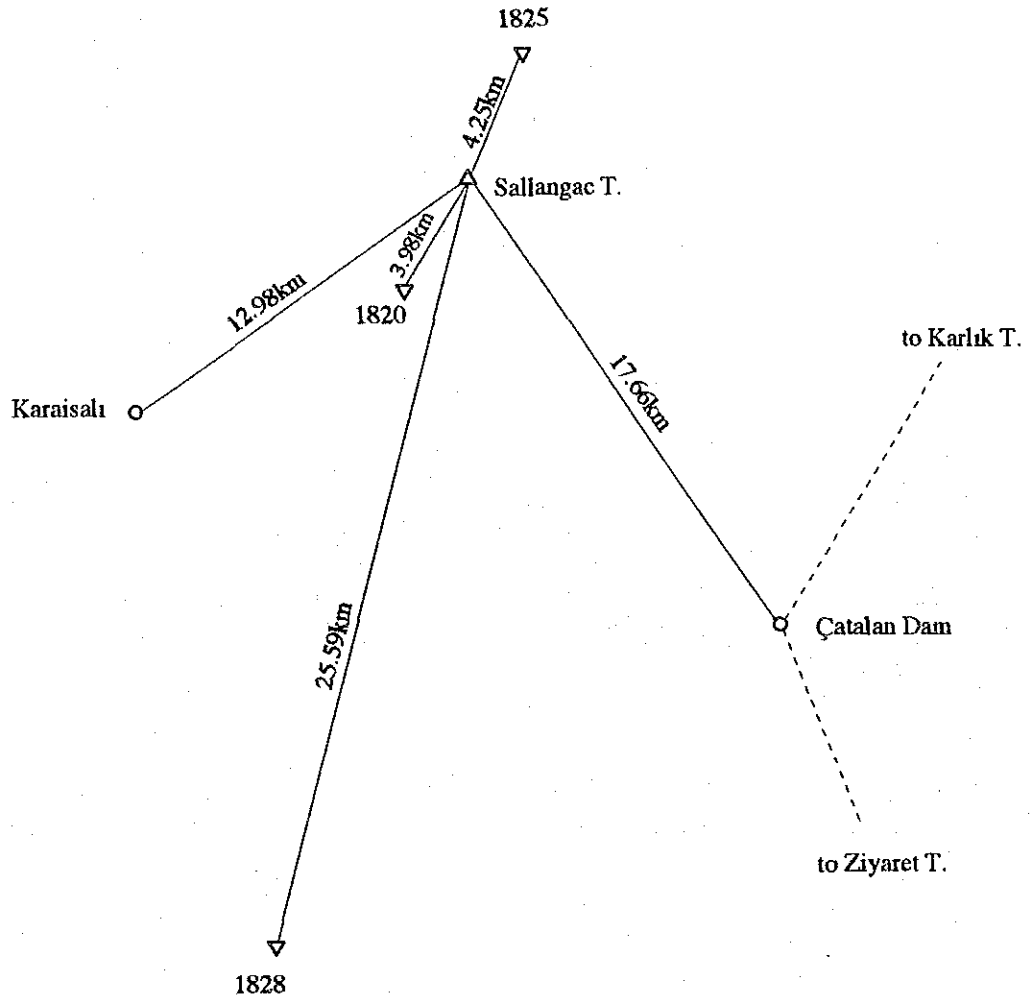
THE REPUBLIC OF TURKEY
DEVLET SU İŞLERİ
GENEL MÜDÜRLÜĞÜ

FLOOD CONTROL, FORECASTING
AND WARNING SYSTEM FOR
SEYHAN RIVER BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE
Figure B - 17
CIRCUIT DIAGRAM OF SIMPLEX
RADIO LINK (1/6)

North



Legend

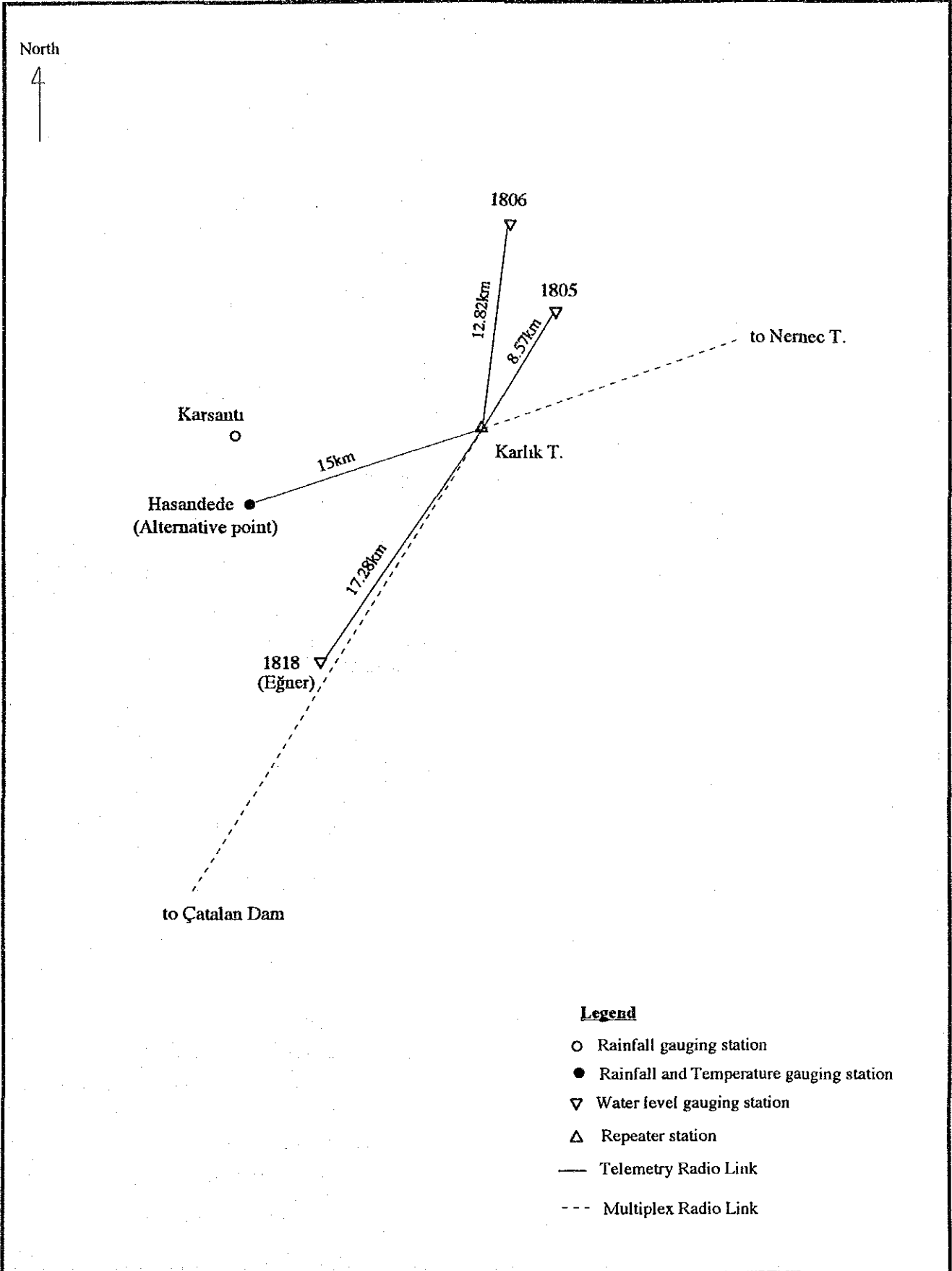
- Rainfall gauging station
- Rainfall and Temperature gauging station
- ▽ Water level gauging station
- △ Repeater station
- Telemetry Radio Link
- - - Multiplex Radio Link

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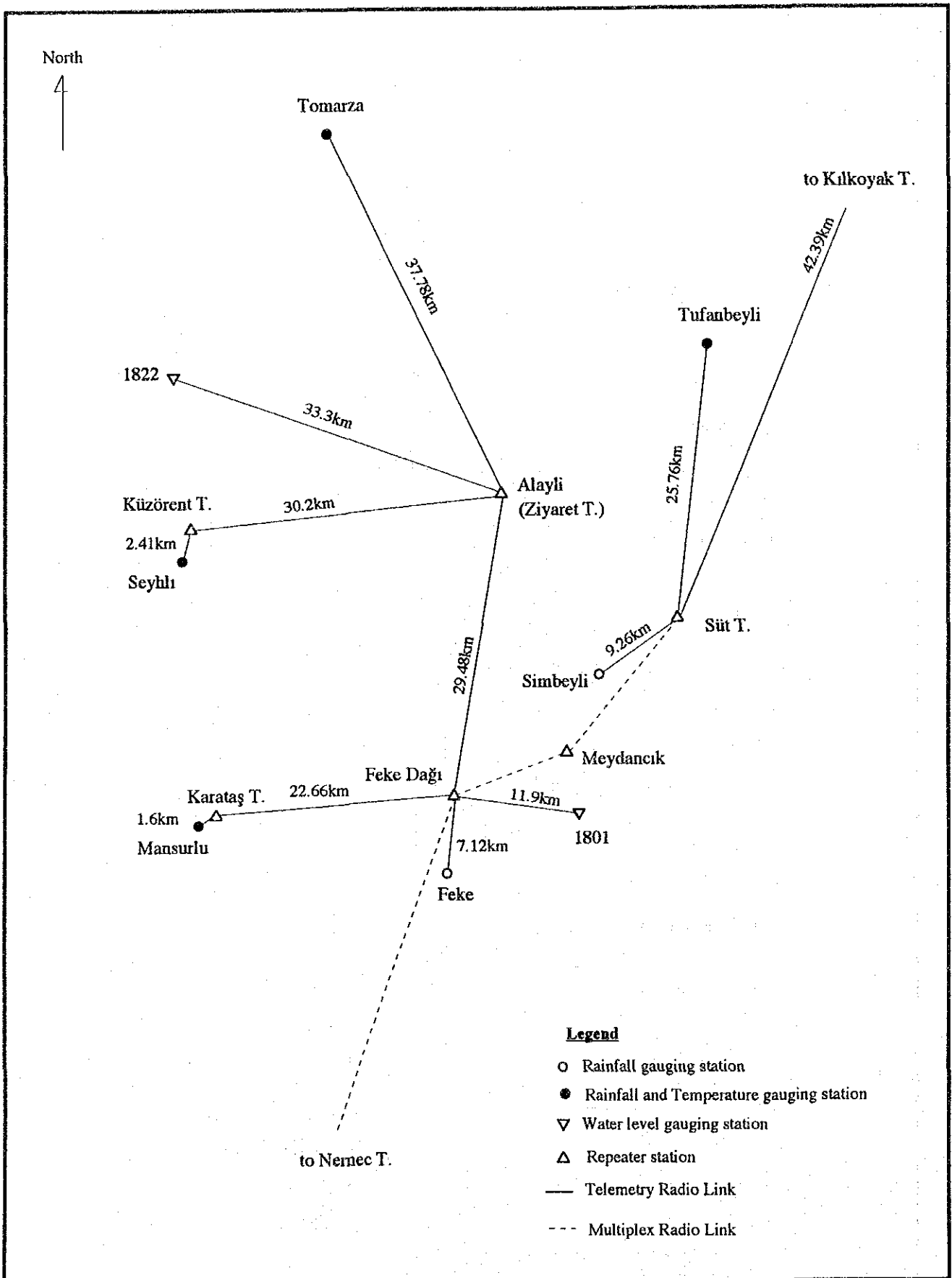
TITLE
Figure B - 18
CIRCUIT DIAGRAM OF SIMPLEX
RADIO LINK (2/6)



Legend

- Rainfall gauging station
- Rainfall and Temperature gauging station
- ▽ Water level gauging station
- △ Repeater station
- Telemetry Radio Link
- Multiplex Radio Link

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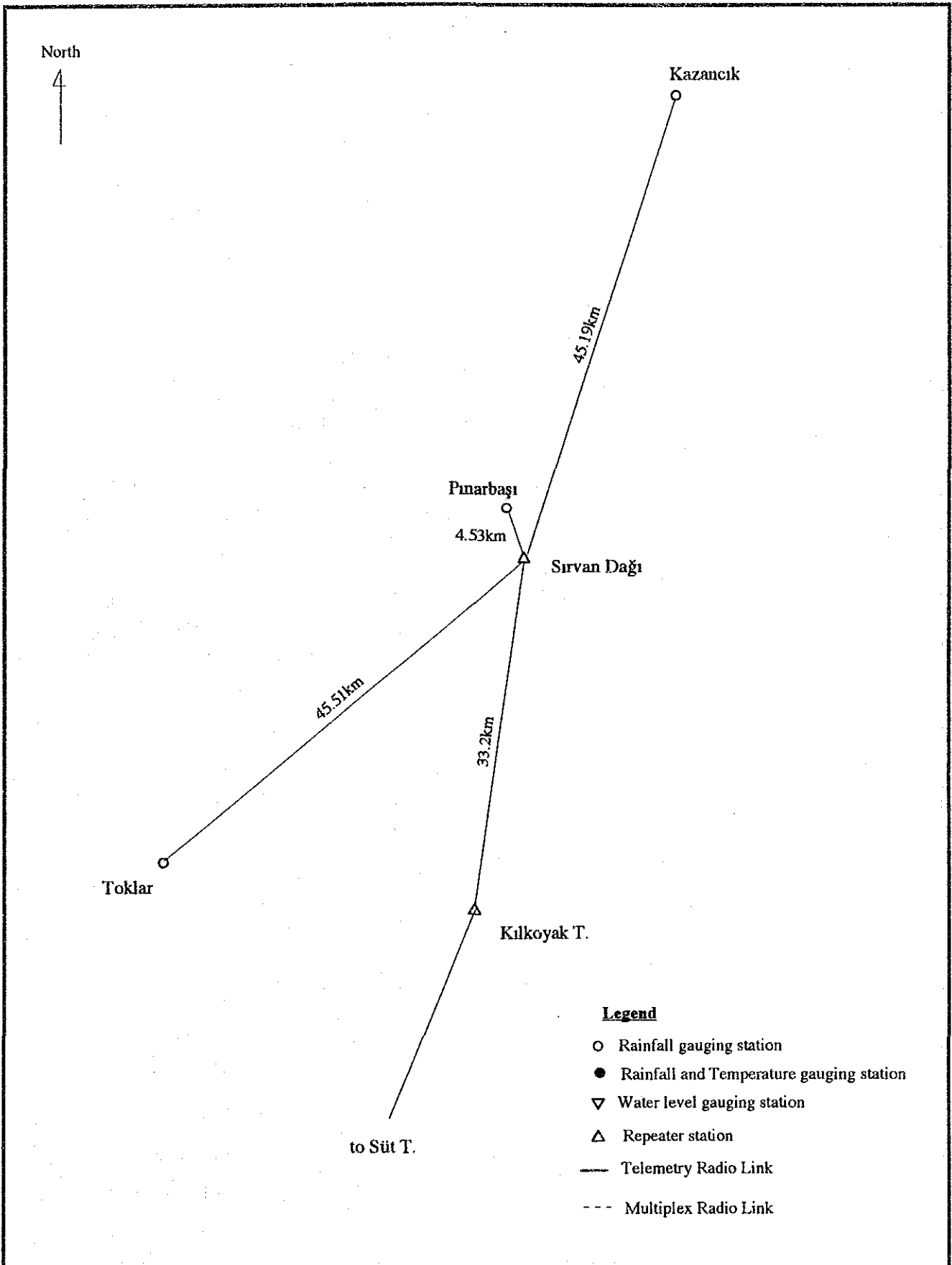


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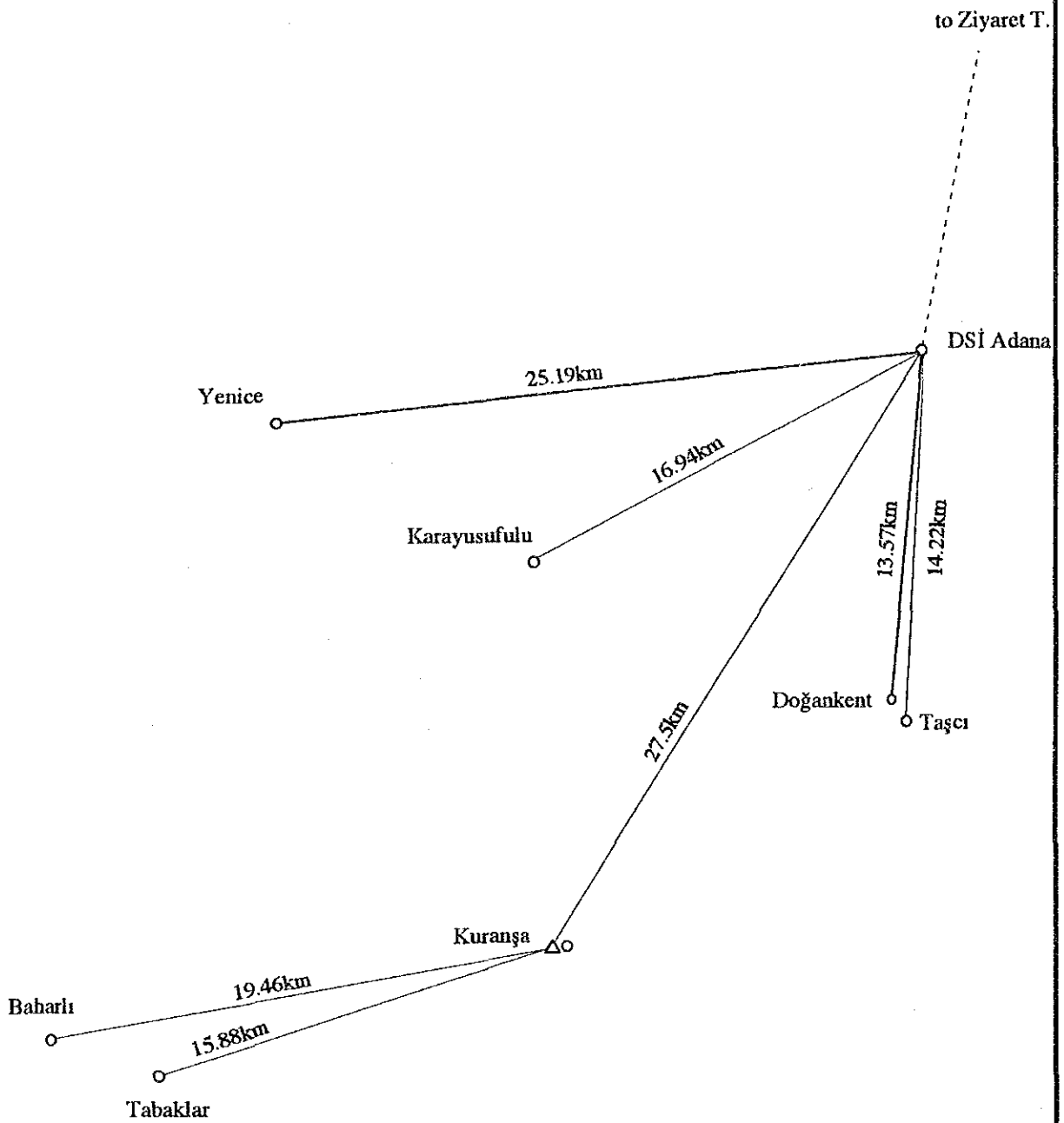
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TITLE
Figure B - 20
CIRCUIT DIAGRAM OF SIMPLEX
RADIO LINK (4/6)



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North



Legend

- Radio Station
- △ Repeater station
- Simplex Radio Link
- Duplex Radio Link
- Multiplex Radio Link

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FLOOD CONTROL, FORECASTING
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TITLE Figure B - 22
CIRCUIT DIAGRAM OF SIMPLEX
RADIO LINK (6/6)