

Figure 1. 30.3-GHz wideband transmitter.

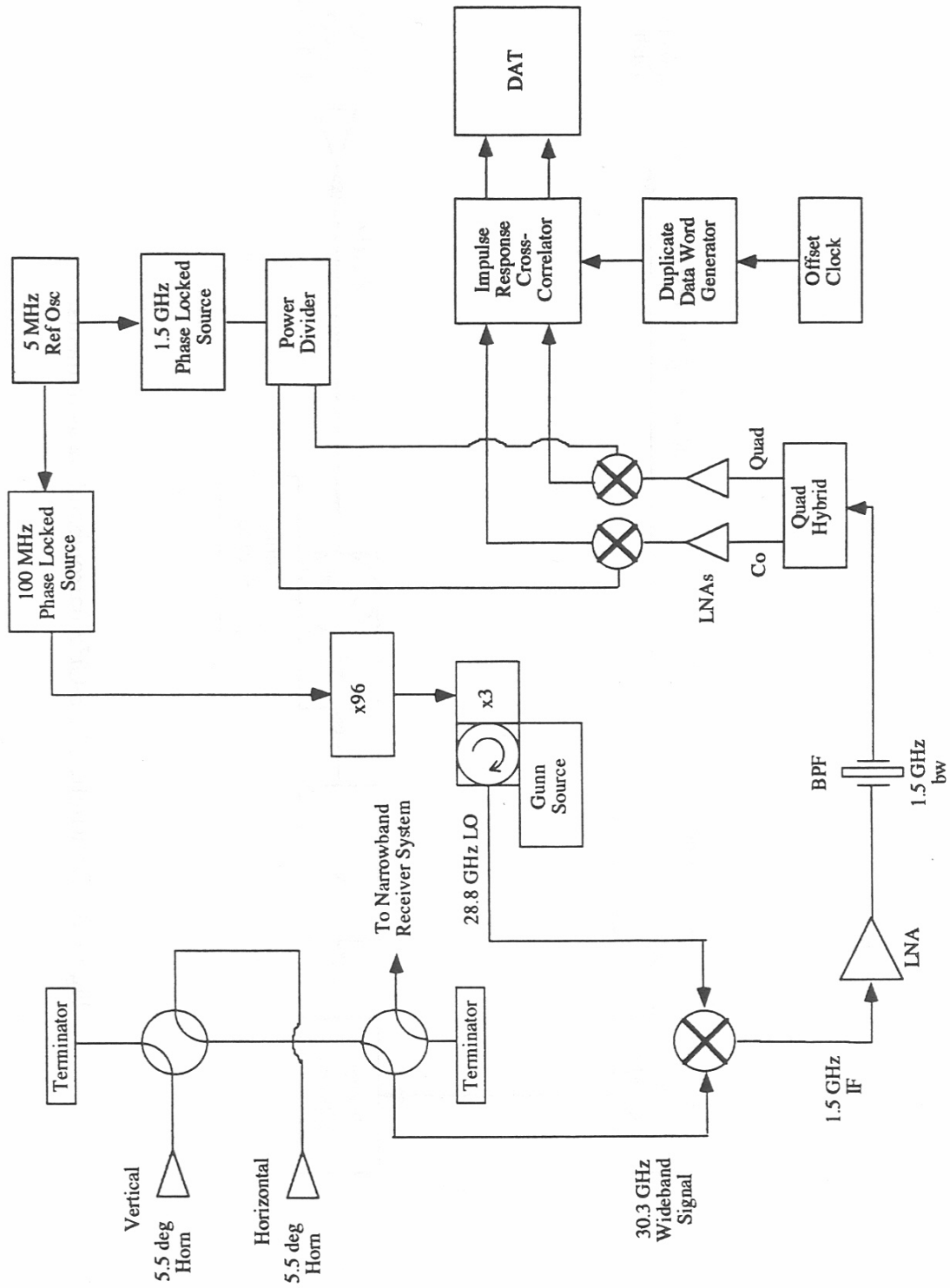


Figure 2. 30.3-GHz wideband receiver.

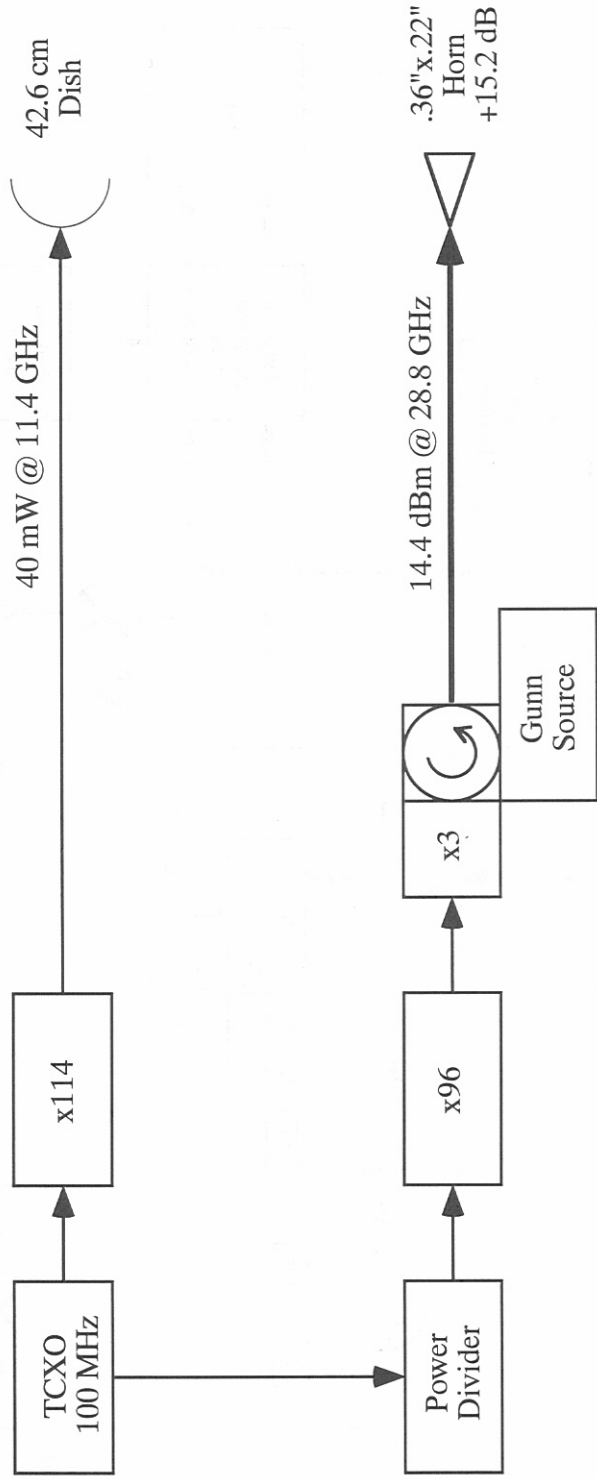


Figure 3. Transmitter, 28.8-GHz narrowband measurements.

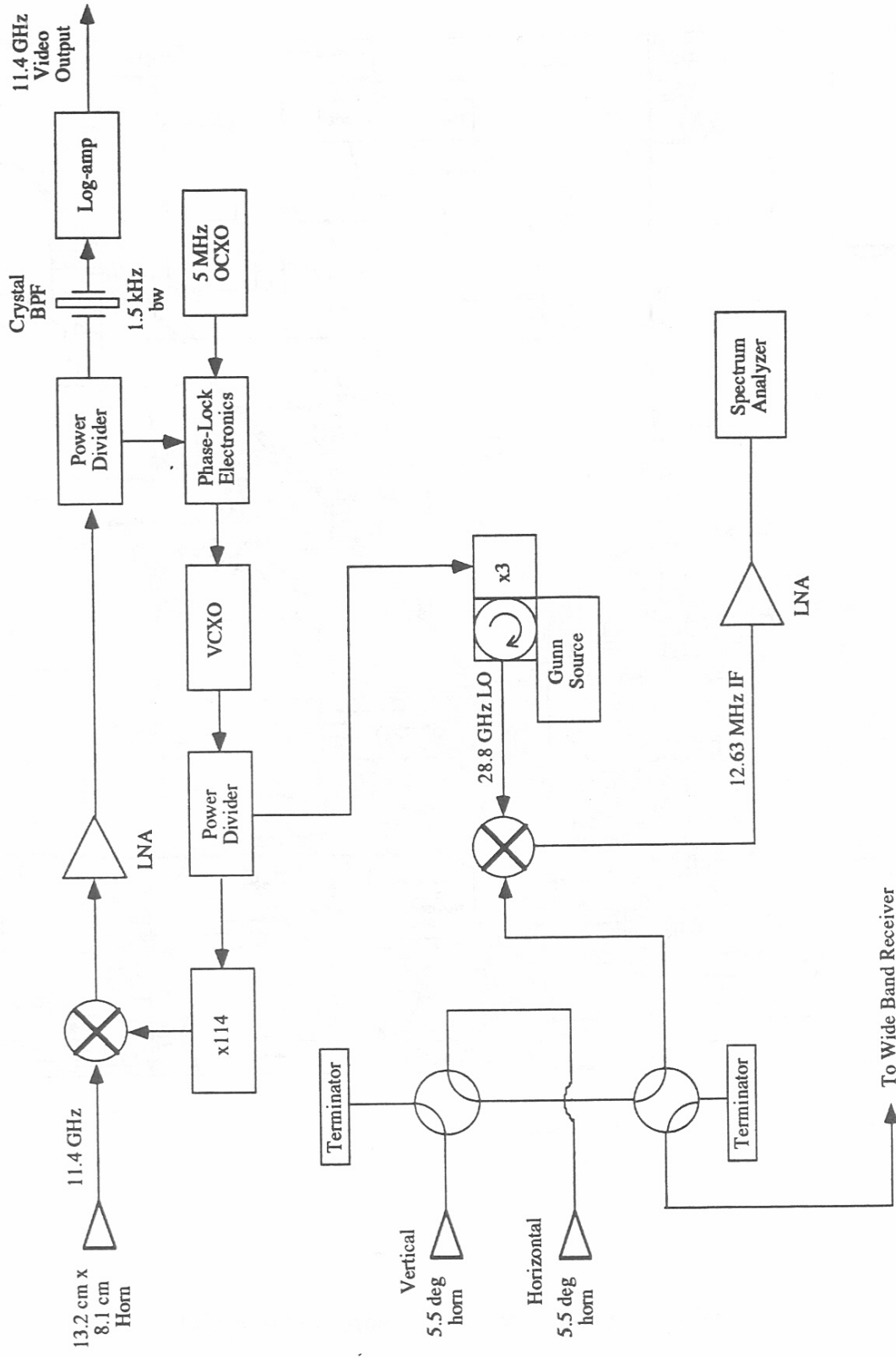
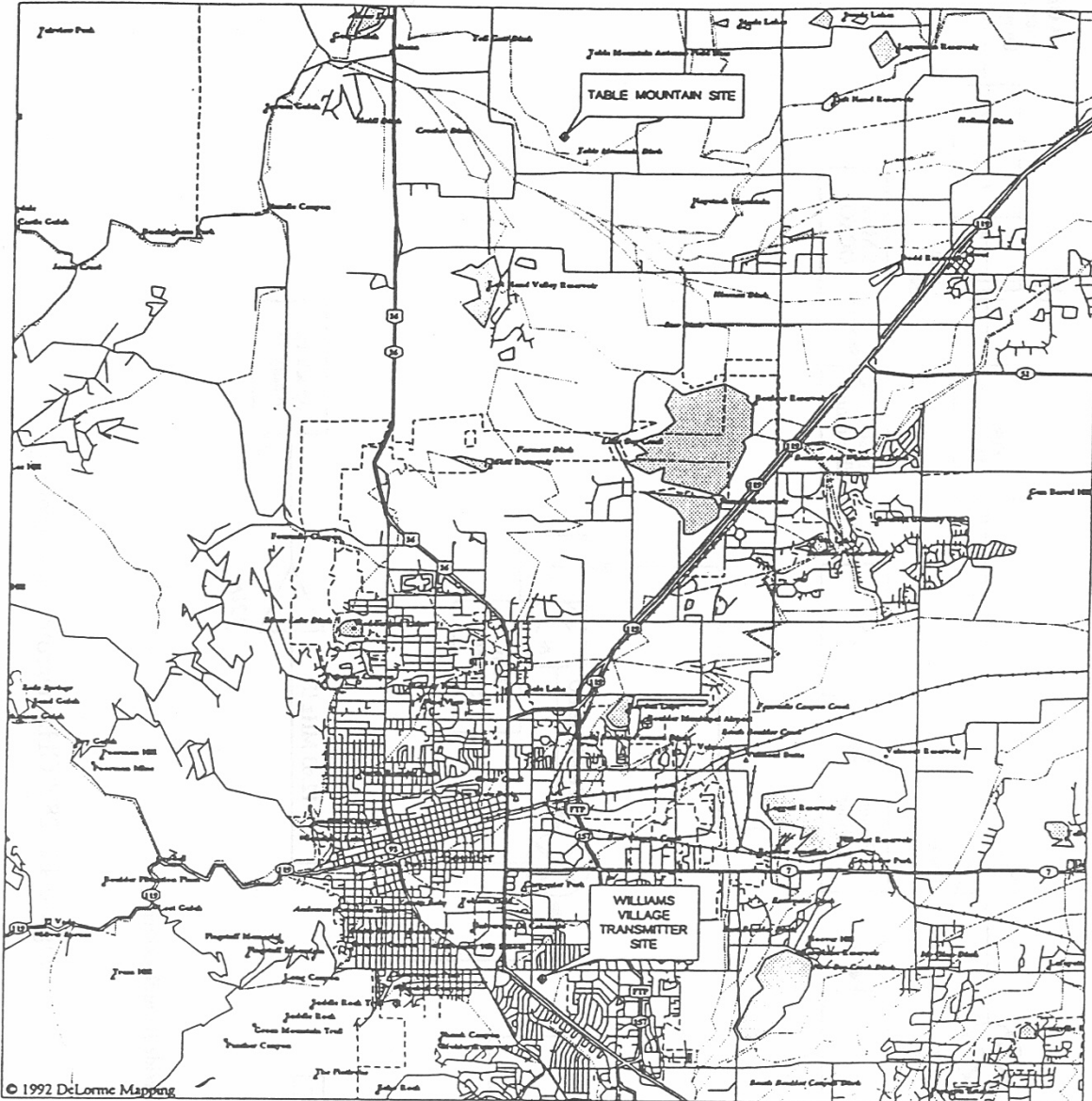


Figure 4. 28.8-GHz narrowband receiver.

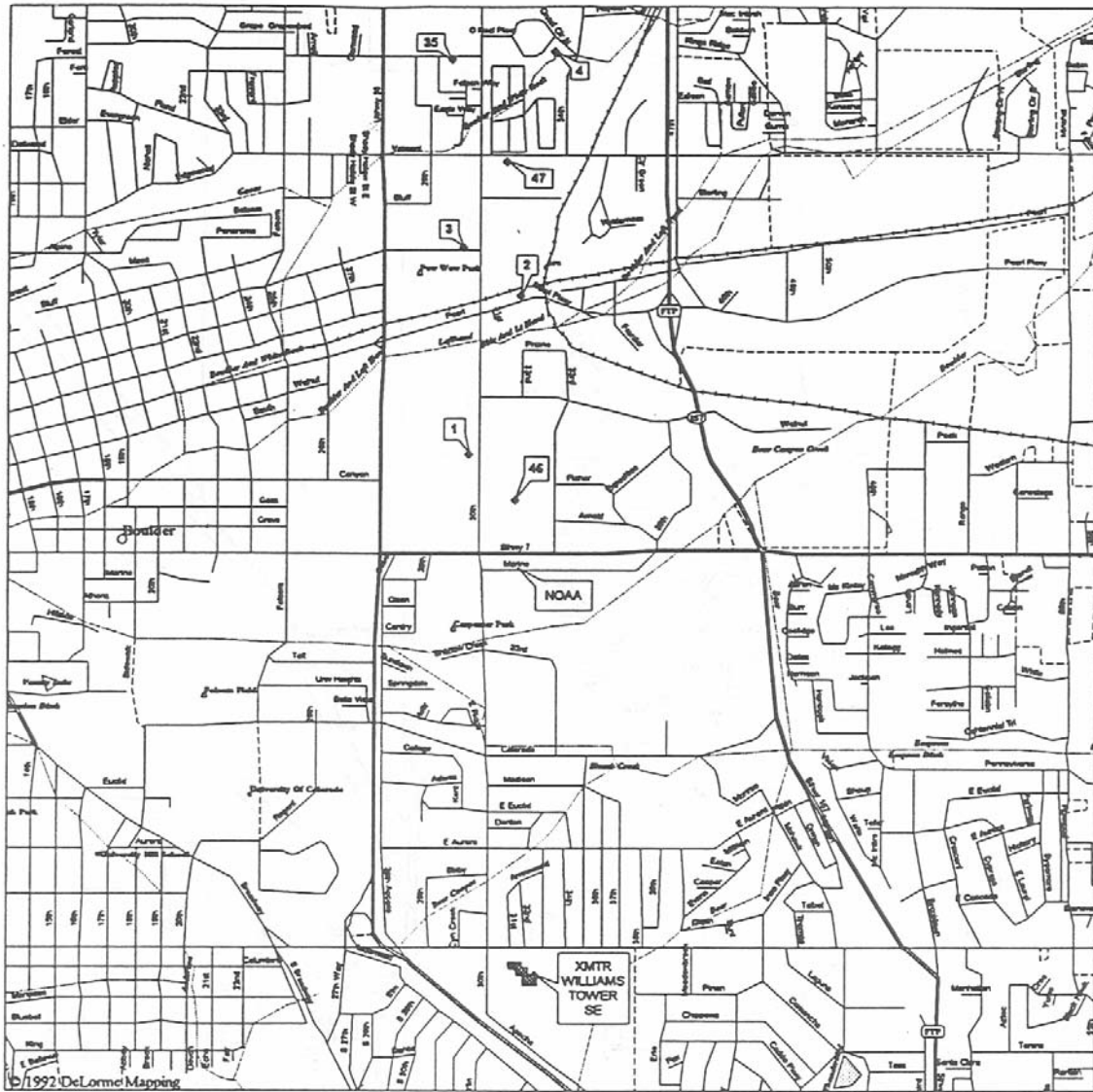


Scale 1:100,000 (at center)

2 Miles

2 KM

Figure 5. LMDS area coverage survey map, Boulder, CO.



Scale 1:25,000 (at center)

2000 Feet

500 Meters

Figure 6. LMDS area coverage survey, receiver station location map, south area.

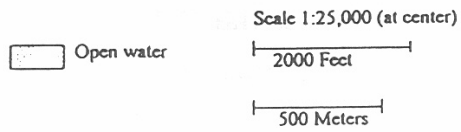
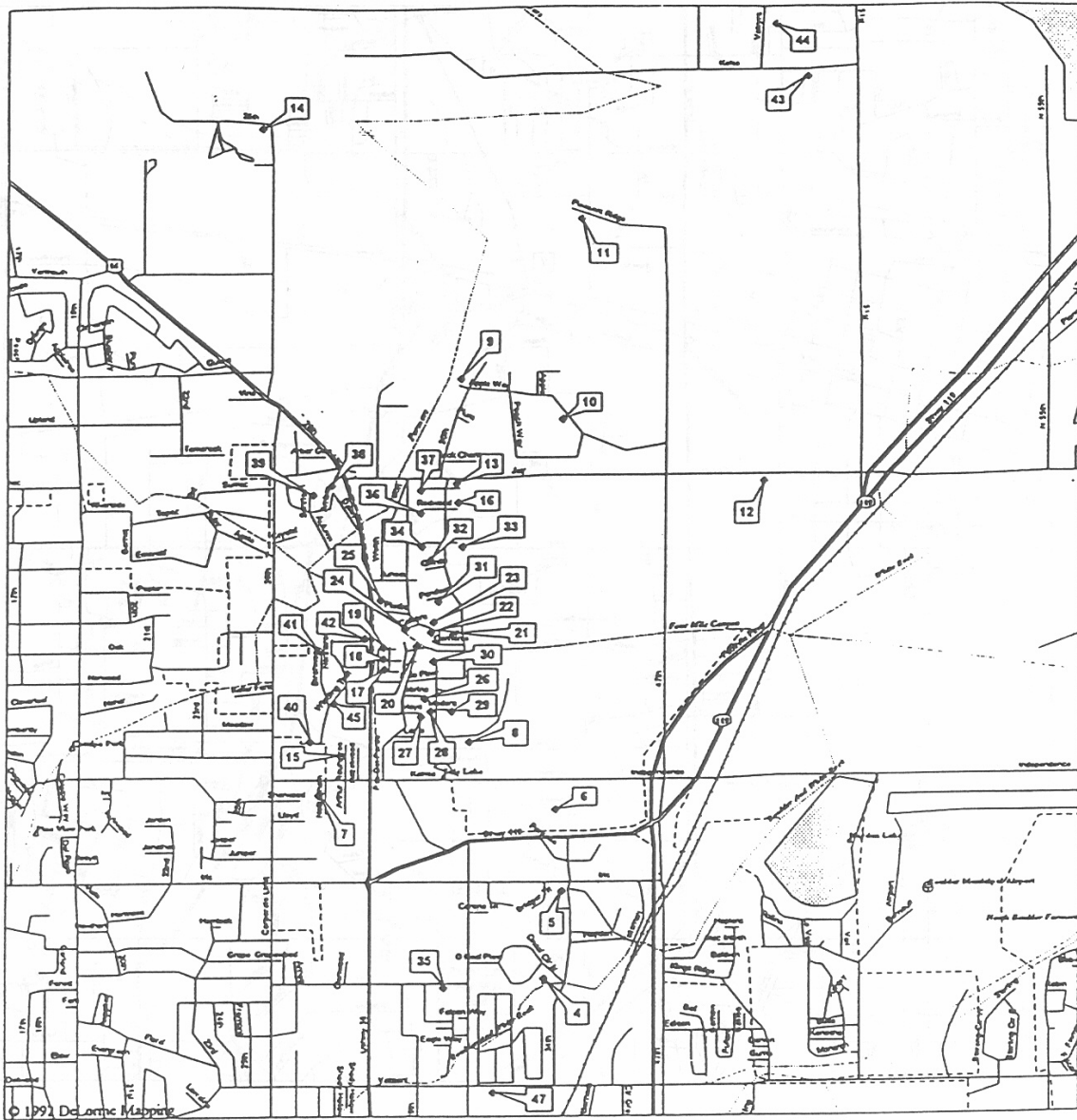


Figure 7. LMDS area coverage survey, receiver station location map, north area.

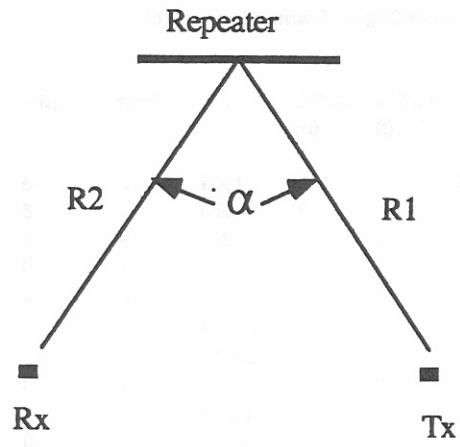


Figure 8. Passive repeater test geometry.

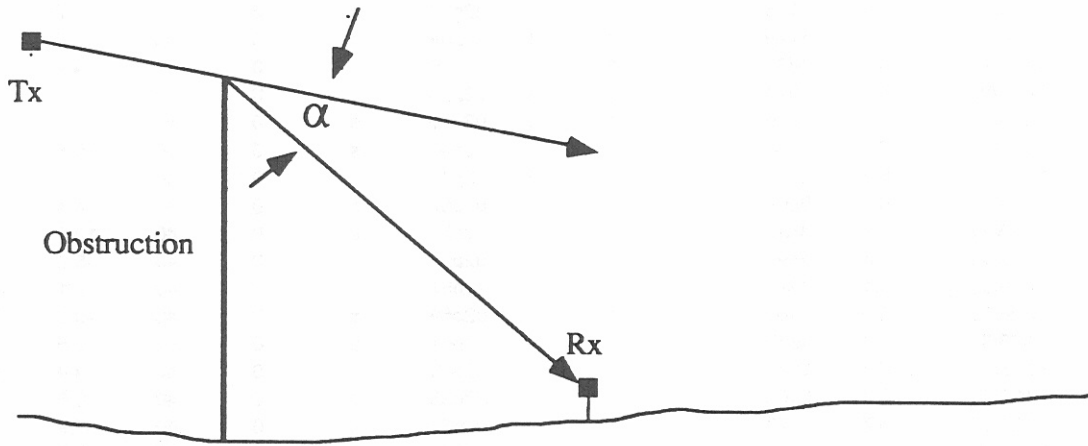


Figure 9. Diffraction study test geometry.

Table 1. 30.3 GHz Broadband Area Coverage Data

Calibration Files

Station	Date	Rx D(m)	LOS	OLOS (t)	OLOS (b)	File	Code	A(db)	G(db)	Rcl (dB)	RxG (dB)
DOC SF	12/11/92	1051	1			c4p4	s	19	35	-10.1	5.9
DOC SF	12/11/92	1051	1			c4p5	l	19	35	-10.1	5.9

Stations Grouped According to Transmitter Height

Transmitter Williams Towers 13th Floor

Station	Date	Rx H(m)	Rx D(m)	LOS	OLOS (t)	OLOS (b)	File	Code	A(db)	G(db)	Rcl (dB)	RxG (dB)
1	12/23/92	3.4	1981	1			u1p81	s	13	40	-10.1	16.9
2	12/23/92	3.4	2743			1	u1p84	s	6	40	-10.1	23.9
3	12/23/92	6.8	2819		1		u2p1	s	6	40	-0.6	33.4
4	12/23/92	3.4	3749		1		u2p3	s	0	40	-10.1	29.9
4	12/23/92	8.5	3749		1		u2p6	s	0	40	-5.6	34.4
5	12/23/92	3.4	4084		1		u2p15	s	0	40	4.4	44.4
6	12/23/92	3.4	4435	1			u2p16	s	13	40	-15.6	11.4
7	12/23/92	6.8	4252		1		u2p24	s	0	40	2.1	42.1
8	12/22/92	3.4	4627		1		u1p54	s	0	40	-10.1	29.9
9	12/22/92	6.8	5437		1		u1p61	s	0	40	4.4	44.4
10	12/22/92	6.8	5588		1		u1p64	s	0	40	4.4	44.4
11	12/22/92	6.8	6377		1		u1p66	s	0	40	2.1	42.1
12	12/22/92	3.4	5452		1		u1p68	s	0	40	-15.7	24.3
13	12/22/92	6.8	5351		1		u1p58	s	0	40	-3.1	36.9
14	12/22/92	3.4	6855	1			u1p70	s	0	40	-15.7	24.3
15	12/23/92	6.8	4431		1	1	u2p26	s	0	40	-7.9	32.1
16	12/22/92	6.8	5258		1		u1p56	s	0	40	-7.9	32.1
17	12/24/92	6.8	4707		1		u2p28	s	0	40	-3.1	36.9
18	12/24/92	6.8	4758		1	1	u2p30	s	0	40	-3.1	36.9
19	12/24/92	6.8	4798	1			u2p32	s	6	40	-15.7	18.3
20	12/24/92	6.8	4749		1	1	u2p34	s	0	40	-0.6	39.4
21	12/24/92	6.8	4873		1		u2p36	s	0	40	4.4	44.4
22	12/24/92	6.8	4873		1	1	u2p38	s	0	40	6.1	46.1
23	12/24/92	6.8	4946		1	1	u2p40	s	0	40	-5.6	34.4
24	12/24/92	6.8	4940		1		u2p44	s	0	40	-0.6	39.4
25	12/24/92	6.8	5004		1	1	u2p47	s	0	40	7.7	47.7
25	12/24/92	6.8	5004		1	1	u2p52	s	0	40	4.4	44.4
26	12/28/92	6.8	4495	1			u2p53	s	0	40	-10.1	29.9
27	12/28/92	6.8	4497	1			u2p55	s	0	40	-5.6	34.4
28	12/28/92	5.1	4497				u2p57	s	0	40	2.1	42.1
29	12/28/92	5.7	4489		1		u2p59	s	0	40	-0.6	39.4
30	12/28/92	6.0	4656				u2p61	s	0	40	-0.6	39.4
31	12/28/92	6.8	5033				u2p63	s	0	40	4.4	44.4
32	12/28/92	6.8	5105				u2p65	s	0	40	-0.6	39.4
33	12/28/92	5.7	5143	1			u2p67	s	0	40	-7.9	32.1
34	12/28/92	6.8	5174				u2p69	s	0	40	-5.6	34.4
35	12/23/92	8.5	3485		1		u1p79	s	0	40	-10.1	29.9
35	12/23/92	6.8	3485		1		u2p7	s	0	40	-0.6	39.4
35	12/23/92	8.5	3485	1			u2p10	s	0	40	-10.1	29.9
35-r	12/23/92	8.5	3485	1			u2p11	s	0	40	-10.1	29.9

Table 1. 30.3 GHz Broadband Area Coverage Data, (cont.)

Station	Date	Rx H(m)	Rx D(m)	LOS	OLOS (t)	OLOS (b)	File	Code	A(db)	G(db)	Rcl (dB)	RxG (dB)
36	12/28/92	6.0	5241		1		u2p73	s	0	40	6.1	46.1
37	12/28/92	6.0	5316		1		u2p77	s	0	40	6.1	46.1
38	12/28/92	6.8	5279		1		u2p81	s	0	40	6.1	46.1
39	12/28/92	6.8	5293				u2p79	s	0	40	-10.1	29.9
40	12/29/92	8.5	4570				u2p83	s	0	40	9.5	49.5
41	12/29/92	8.5	5134		1		u2p85	s	0	40	6.1	46.1
41	12/29/92	6.8	5134		1		u2p88	s	0	40	6.1	46.1
42	12/29/92	8.5	4844			1	u2p91	s	0	40	-0.6	39.4
42-n	12/29/92	7.7	4844			1	u2p89	s	0	40	-7.8	32.2
42-r	12/29/92	8.5	4844			1	u3p1	s	0	40	-0.6	39.4
43	12/29/92	6.8	6927		1		u3p3	s	0	40	7.7	47.7
43	12/29/92	8.5	6927		1		u3p5	s	0	40	7.7	47.7
44	12/29/92	8.5	7231				u3p7	s	0	40	12.3	52.3
45	12/22/92	6.8	4642		1		u1p72	s	0	40	-10.1	29.9
Transmitter Williams Towers 5th Floor												
Station	Date	Rx H(m)	Rx D(m)	LOS	OLOS (t)	OLOS (b)	File	Code	A(db)	G(db)	Rcl (dB)	RxG (dB)
1	12/17/92	3.4	1981	1			u1p2	l	13	35	-10.1	11.9
1	12/31/92	3.4	1981	1			u3p37	s	13	40	-15.7	11.3
2	12/18/92	3.4	2743			1	u1p4	l	0	35	11.9	46.9
2	1/5/93	5.2	2743				u4p18	s	0	40	2.1	42.1
3	12/18/92	8.5	2819		1		u1p8	l	0	35	11.2	46.2
3	12/18/92	8.5	2819		1		u1p7	s	0	35	8.6	43.6
4	12/18/92	3.4	3749		1		u1p10	s	0	40	9.5	49.5
4	12/18/92	8.5	3749		1		u1p11	s	0	40	-0.6	39.4
5	12/18/92	8.5	4084		1		u1p14	s	0	40	-0.6	39.4
6	12/18/92	3.4	4435	1			u1p17	s	0	40	-10.1	29.9
7	12/18/92	8.5	4252		1		u1p20	s	0	40	12.3	52.3
8	12/18/92	3.4	4627		1		u1p22	s	0	40	2.1	42.1
8	12/21/92	3.4	4627		1		u1p25	s	0	40	-14.5	25.5
9	12/21/92	7.7	5437		1		u1p32	s	0	40	9.5	49.5
10	12/21/92	3.6	5588		1		u1p35	s	0	40	-5.6	34.4
11	12/21/92	3.4	6377		1		u1p38	s	0	40	-10.1	29.9
12	12/21/92	3.4	5452		1		u1p42	s	0	40	-5.6	34.4
13	12/21/92	6.8	5351		1		u1p46	s	0	40	2.1	42.1
14	12/21/92	3.4	6855	1			u1p44	s	0	40	-15.7	24.3
15	1/4/93	6.8	4431		1		u3p80	s	0	40	2.1	42.1
16	12/21/92	6.8	5258		1		u1p29	s	0	40	-10.1	29.9
17	12/30/92	6.8	4707		1		u3p8	s	0	40	-10.1	29.9
18	12/30/92	7.8	4758		1		u3p10	s	0	40	2.1	42.1
19	12/30/92	7.8	4798	1			u3p12	s	0	40	-10.1	29.9
20	12/30/92	6.8	4749		1		u3p14	s	0	40	2.1	42.1
21	12/30/92	6.8	4873		1		u3p16	s	0	40	-0.6	39.4
22	12/30/92	6.8	4873		1		u3p18	s	0	40	2.1	42.1
23	12/30/92	6.8	4946		1		u3p20	s	0	40	9.5	49.5
24	12/30/92	6.8	4940		1		u3p22	s	0	40	2.1	42.1
25	12/30/92	6.7	5004		1		u3p24	s	0	40	2.1	42.1
25	12/30/92	7.7	5004		1		u3p26	s	0	40	2.1	42.1

Table 1. 30.3 GHz Broadband Area Coverage Data, (cont.)

Station	Date	Rx H(m)	Rx D(m)	LOS	OLOS (t)	OLOS (b)	File	Code	A(db)	G(db)	Rcl (dB)	RxG (dB)
26	12/30/92	6.8	4495	1			u3p28	s	0	40	-5.6	34.4
27	12/30/92	6.0	4497	1			u3p30	s	0	40	2.1	42.1
28	12/30/92	6.0	4497				u3p32	s	0	40	4.4	44.4
29	12/30/92	6.0	4489		1		u3p35	s	0	40	3.0	43.0
30	12/31/92	6.8	4656				u3p42	s	0	40	2.1	42.1
31	12/31/92	6.8	5033				u3p45	s	0	40	-5.6	34.4
32	12/31/92	6.8	5105				u3p47	s	0	40	-7.8	32.2
33	12/31/92	6.0	5143				u3p50	s	0	40	2.1	42.1
34	12/31/92	6.8	5174				u3p53	s	0	40	6.1	46.1
35	12/21/92	8.5	3485		1		u1p51-n	s	0	40	10.5	50.5
35	12/21/92	8.5	3485		1		u1p52	s	0	40	-10.1	29.9
36	1/4/93	6.8	5241		1		u3p55	s	0	40	6.1	46.1
37	1/4/93	6.8	5316		1		u3p58	s	0	40	9.5	49.5
38	1/4/93	6.8	5279		1		u3p64	s	0	40	2.1	42.1
39	1/4/93	6.8	5293	1			u3p62	s	0	40	-7.4	32.6
40	1/4/93	6.8	4570				u3p66	s	0	40	-0.6	39.4
40	1/4/93	8.5	4570	1			u3p73	s	0	40	-15.7	24.3
41	1/4/93	6.8	5134		1		u3p74	s	0	40	0.5	40.5
42	1/4/93	8.5	4844			1	u3p78	s	0	40	-0.6	39.4
43	1/4/93	8.5	6927		1		u3p82	s	0	40	9.5	49.5
45	12/21/92	8.5	4642		1		u1p49	s	0	40	6.1	46.1
46	1/5/93	8.5	1808			1	u4p1	s	0	40	6.1	46.1
47	1/5/93	8.5	3080			1	u4p7	s	0	40	6.1	46.1
47	1/5/93	6.8	3080			1	u4p10	s	0	40	11.2	51.2
2-h	1/5/93	6.8	2743				u4p19	s	0	40	6.1	46.1

Transmitter Table Mountain												
Station	Date	Rx H(m)	Rx D(m)	LOS	OLOS (t)	OLOS (b)	File	Code	A(db)	G(db)	Rcl (dB)	RxG (dB)
1-hD	1/15/93	8.5	1981				u4p37	s	0	40	9.5	49.5
1-vD	1/15/93	8.5	1981				u4p36	s	0	40	9.5	49.5
1-vR	1/15/93	8.5	1981				u4p34	s	0	40	10.5	50.5
1-vWT	1/15/93	8.5	1981				u4p35	s	0	40	10.5	50.5
6-vD	1/15/93	8.5	4435				u4p32	s	0	40	9.5	49.5
6-vWT	1/15/93	8.5	4435				u4p31	s	0	40	9.5	49.5
8-hD	1/15/93	8.5	4627				u4p28	s	0	40	10.5	50.5
8-vD	1/15/93	8.5	4627				u4p30	s	0	40	-3.1	36.9
8-vWT	1/15/93	8.5	4627				u4p31	s	0	40	9.5	49.5
14-hD	1/15/93	6.8	6855				u4p27	s	0	40	-0.6	39.4
14-v	1/15/93	6.8	6855				u4p25	s	0	40	-7.9	32.1
14-vD	1/7/93	6.7	6855				u4p20	s	0	40	-10.1	29.9
14-vM	1/7/93	6.8	6855				u4p22	s	0	40	3.3	43.3
14-vWt	1/7/93	6.8	6855				u4p24	s	0	40	12.3	52.3

* Note - Transmitter Height = 40 m for Williams Village Towers 13th floor.

Transmitter Height = 16 m for Williams Village Towers 5th floor.

Transmitter Height = 1 m for Table Mountain

t = trees

b = building

code : s = short, l = long

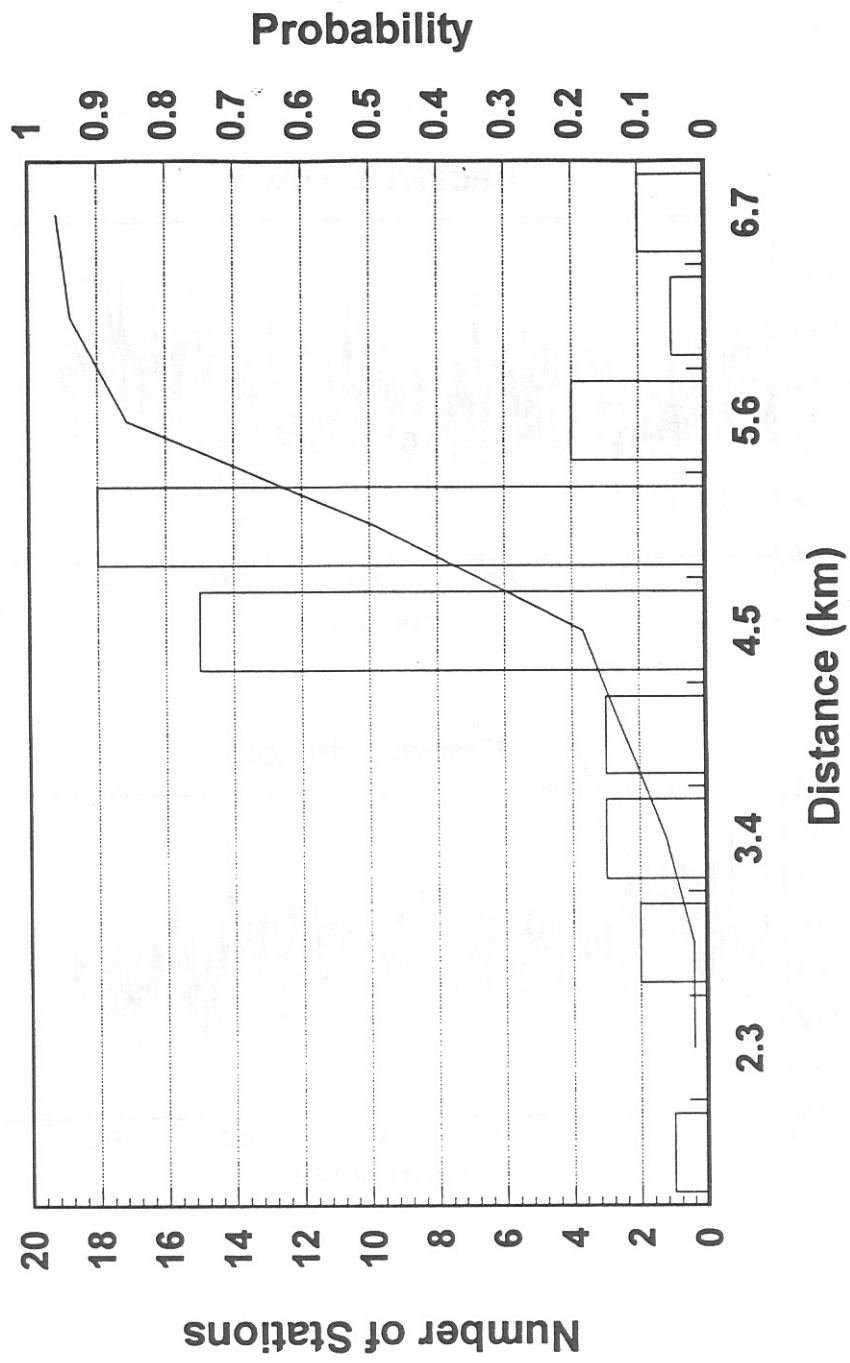


Figure 10. Receiver station path length histogram and cumulative distribution function.

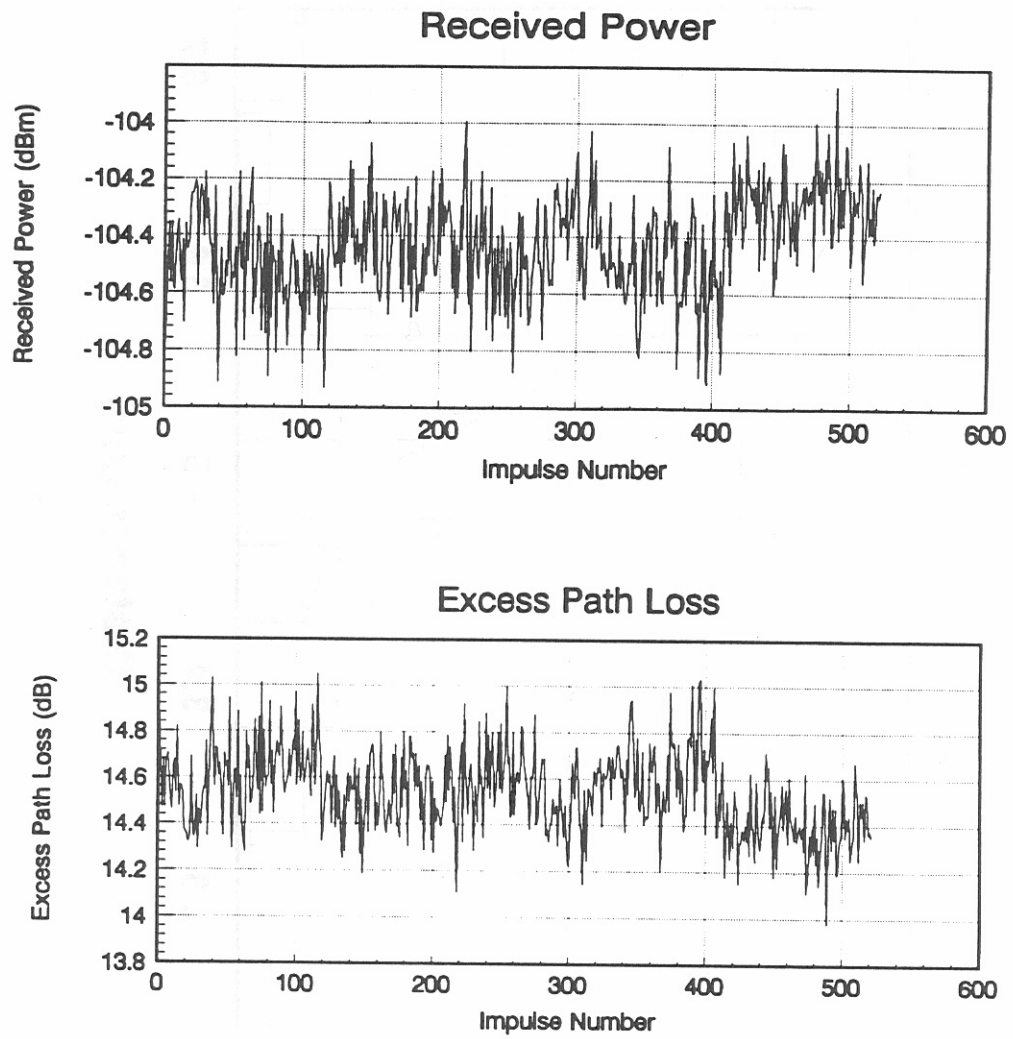


Figure 11. Station 26, recordings using 16-m transmitter, wideband data, time series plots: received power and excess path loss.

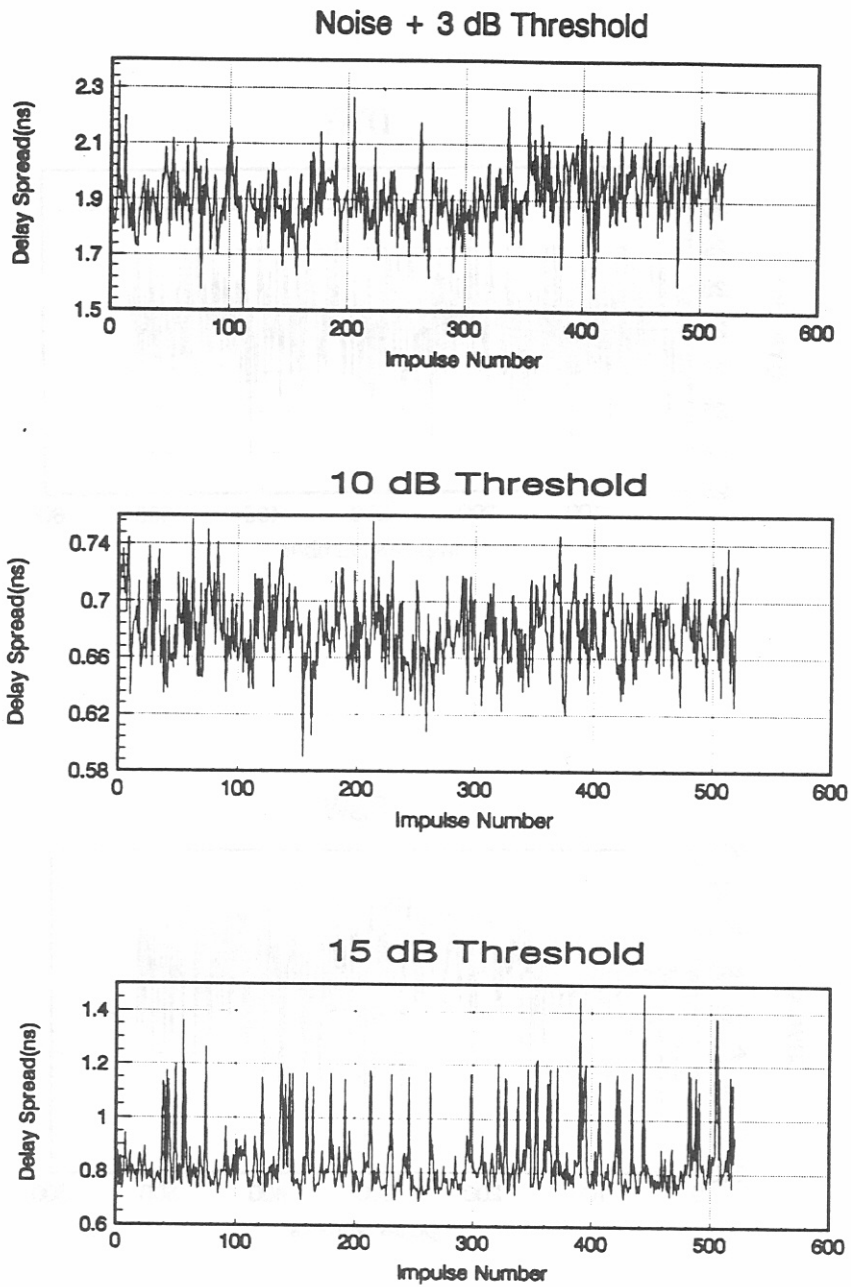


Figure 12. Station 26, recordings using 16-m transmitter, wideband data, time series plots: delay spread using three thresholds.

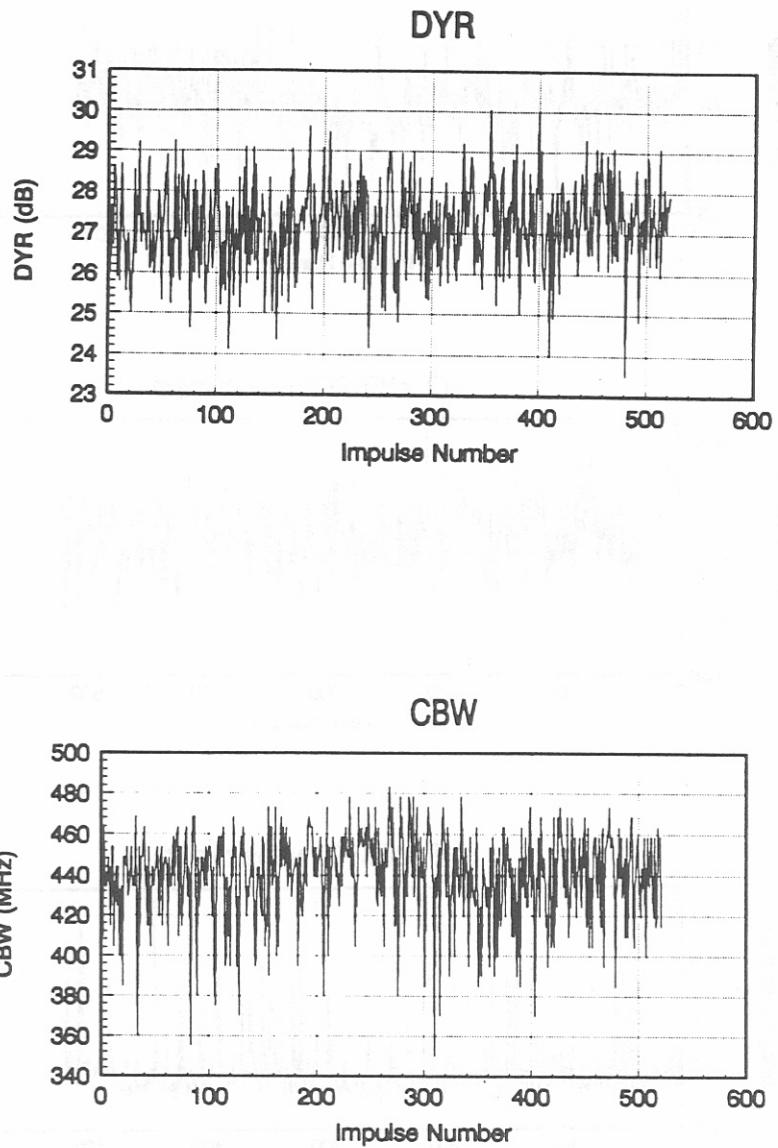


Figure 13. Station 26, recordings using 16-m transmitter, wideband data, time series plots: ratio of PDP peak amplitude to tail amplitude (DYR), and the correlation bandwidth of the PDP.

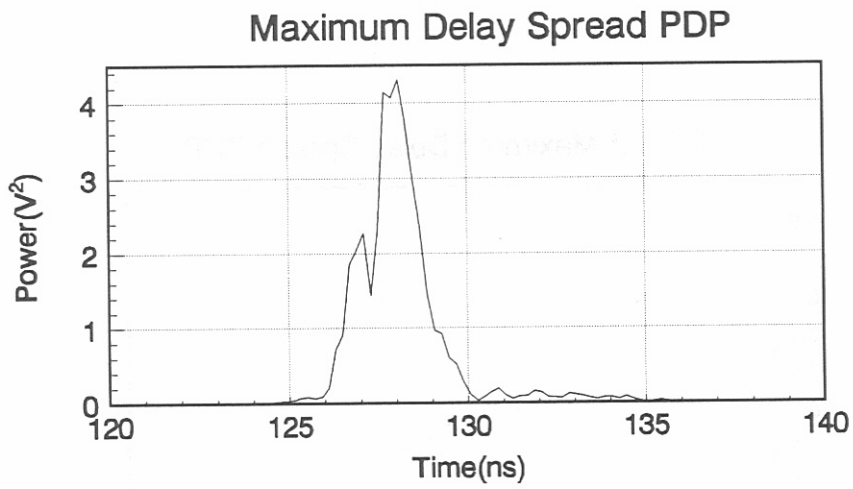
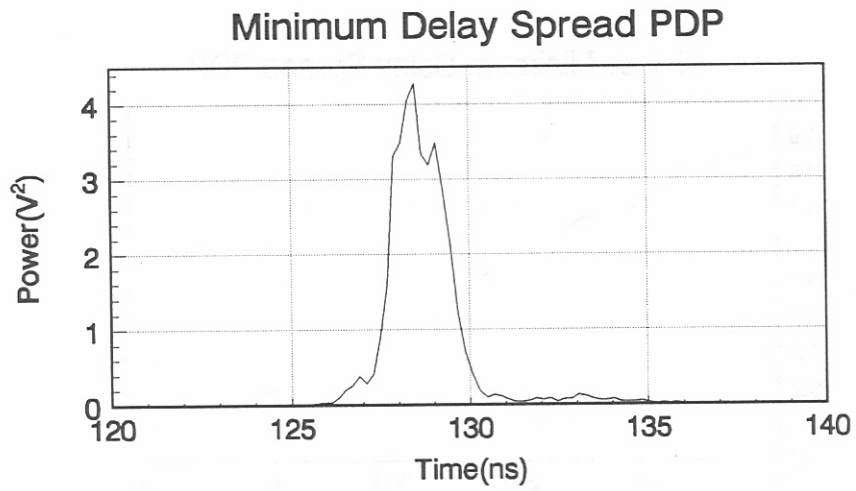


Figure 14. Station 26, recordings using 16-m transmitter: minimum delay spread PDP and maximum delay spread PDP.

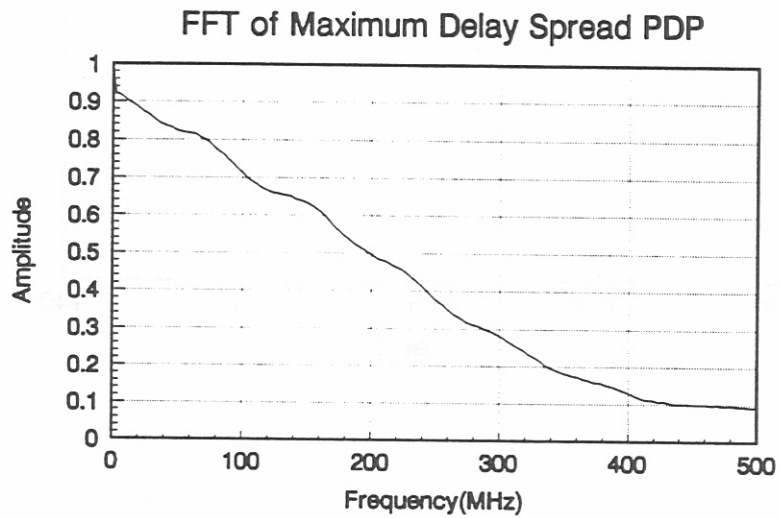
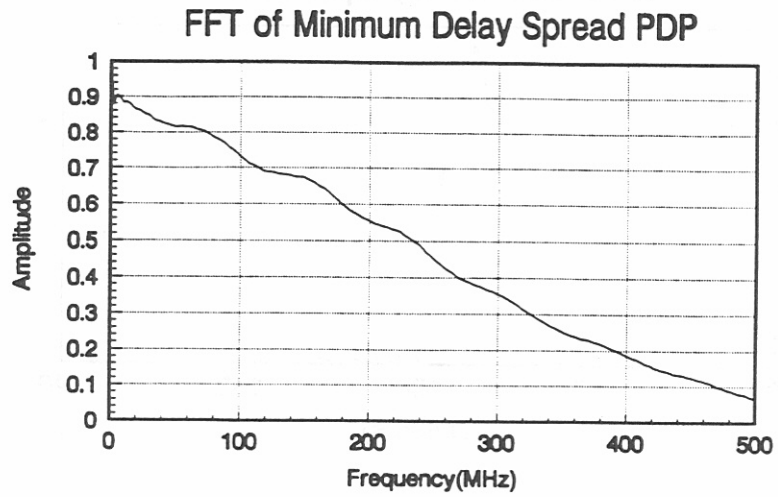


Figure 15. Station 26, recordings using 16-m transmitter: real FFT's used for correlation bandwidth calculations.

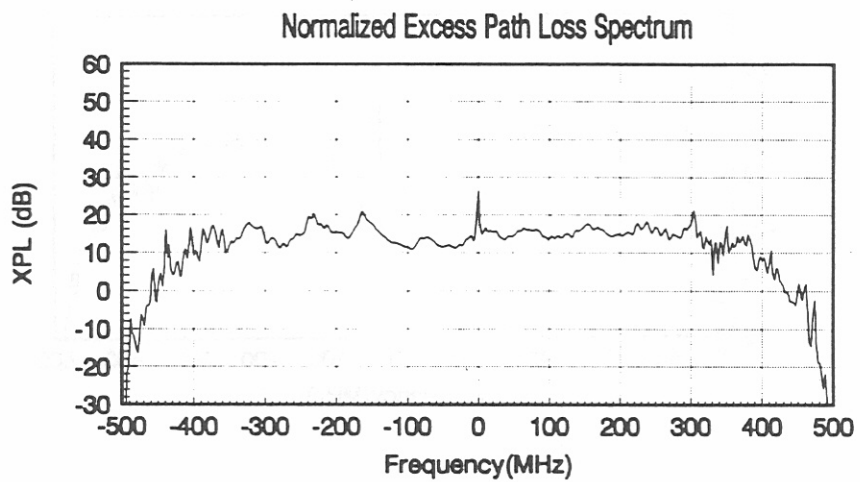
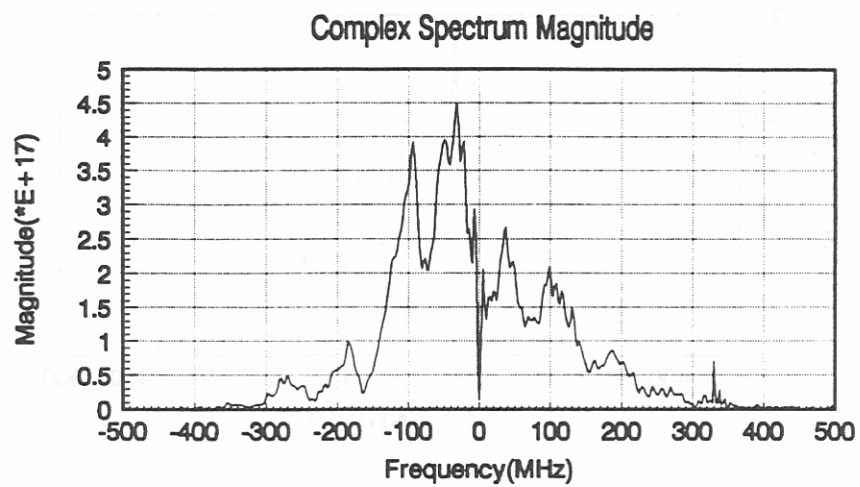


Figure 16. Station 26, 16-m transmitter: magnitude of complex FFT and normalized excess path loss spectrum.