

TESTED BY ORTEL CORPORATION
CONDUCTED MEASUREMENT INFORMATION

Test Equipment Used:

Signal Generator HP8648C, Hewlett Packard
Spectrum Analyzer HP8563E, Hewlett Packard
-RF cables (with SMA connectors), 7/16 to N connectors, N to SMA connectors, attenuation pad (for
repeater output), and passive external combiner used for two tone testing.

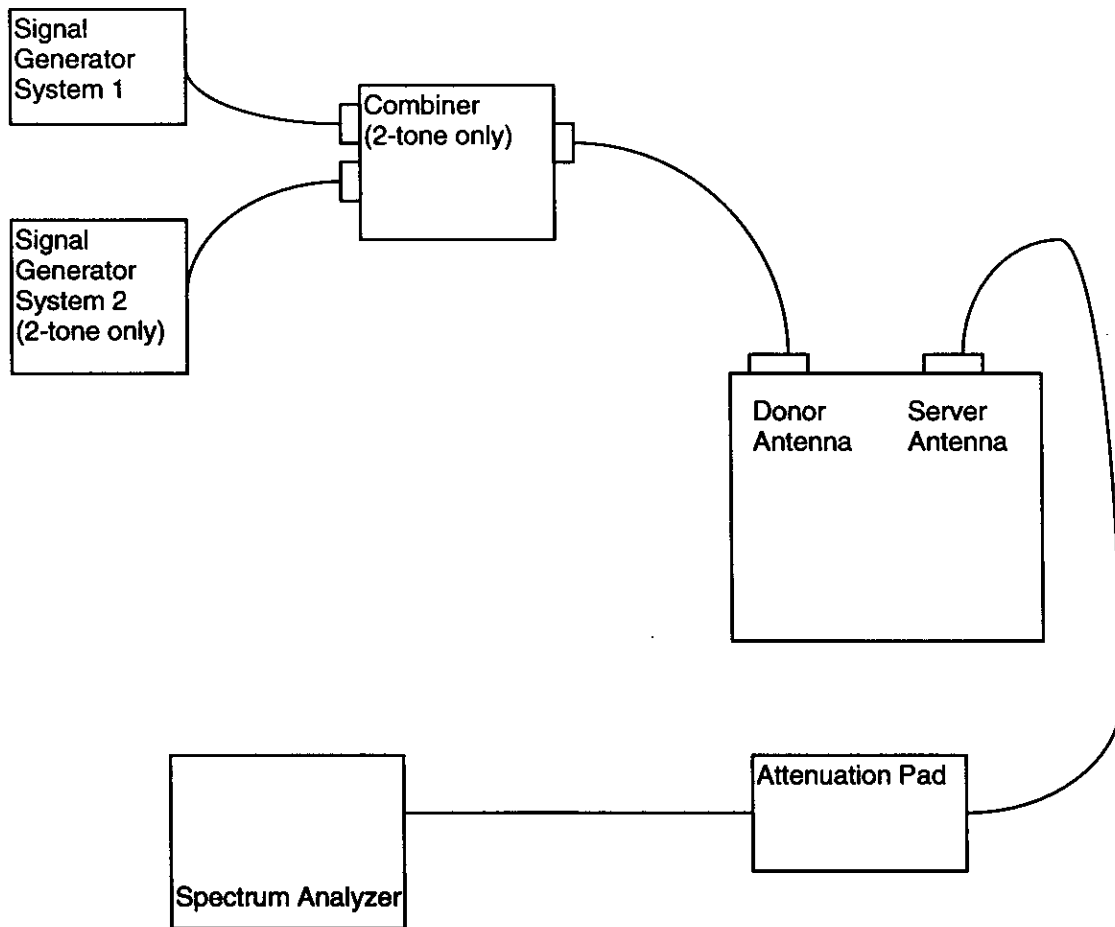
Tests performed for D-band

2.985, 2.989, 2.991, and 24.238, In/Out and 3-tone

Test setup on next page.

CONDUCTED MEASUREMENT TEST SETUP

TESTED BY ORTEL CORPORATION



Downlink mode shown. For uplink, swap antenna connections at the repeater.

NOTE: All cables, connectors, and the attenuation pad are calibrated out at the

OL Low
D-band

10/1/98

LB45800PCS

Output

CW source

ATTEN 30dB

MKR 12.00dBm

RL 20.00dBm

10dB/ 1.9445GHz

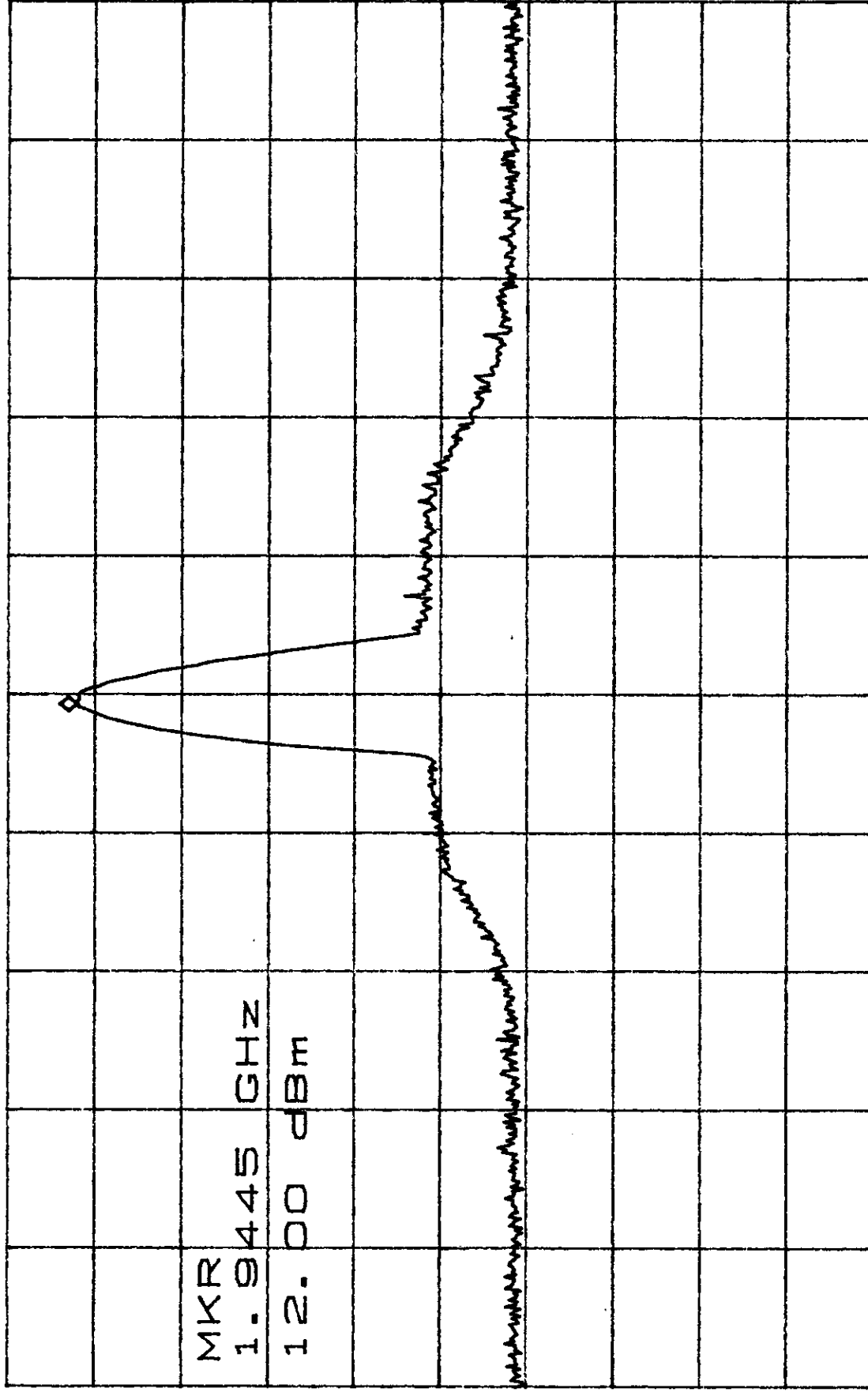
MKR
1.9445 GHz

12.00 dBm

2.985

D

R



CENTER 1.9452GHz

SPAN 100.0MHz

*RBW 2.0MHz

VBW 3.0MHz

SWP 50.0ms

10/1/98

LB45800PCS

DL Low
P-band

Output

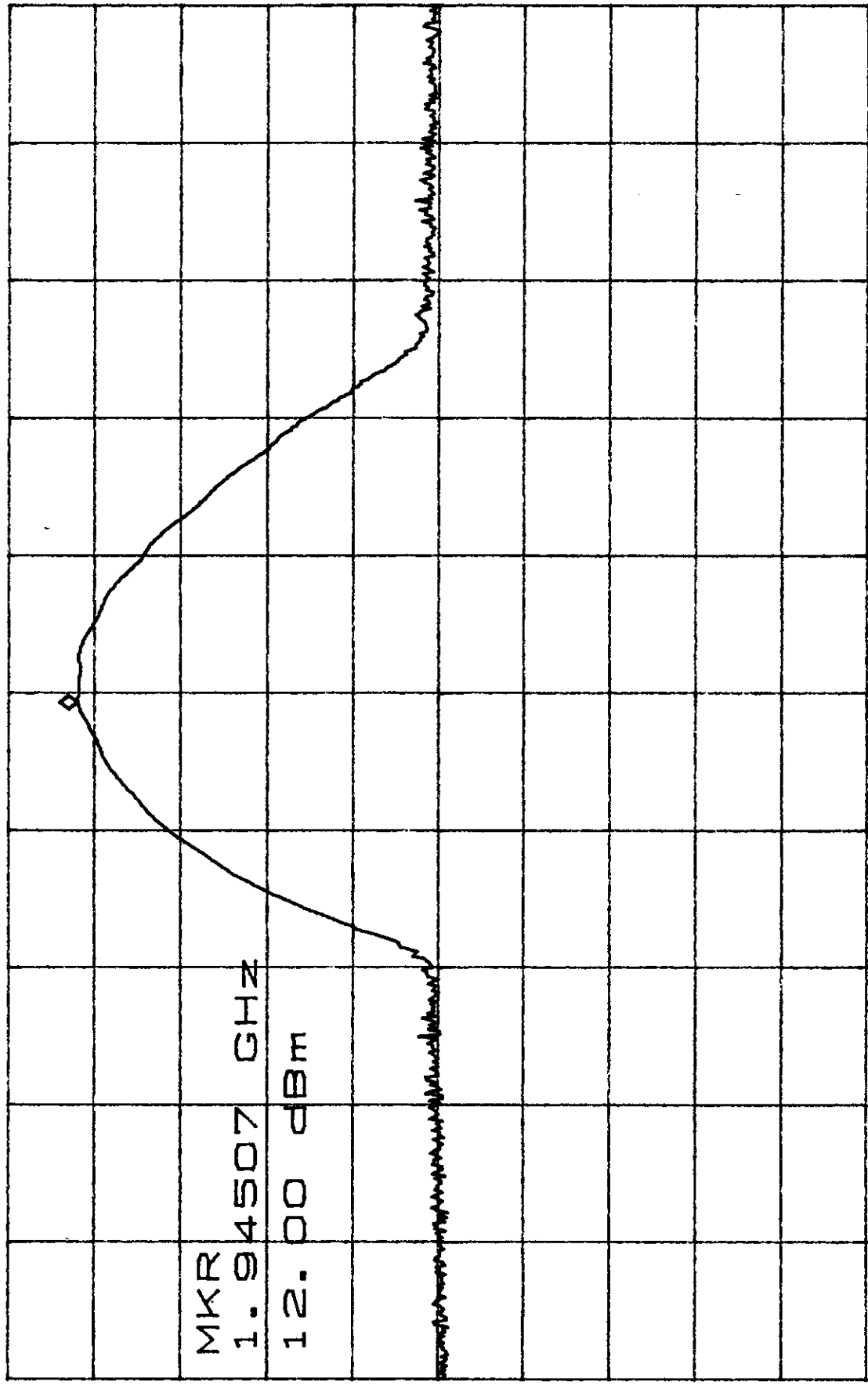
CW source

ATTEN 30dB MKR 12.00dBm
RL 20.00dBm 1.94507GHZ
10dB/

MKR
1.94507 GHZ
12.00 dBm

D R

2.985



CENTER 1.94520GHZ SPAN 20.00MHZ
*RBW 2.0MHZ VBW 3.0MHZ SWP 50.0ms

DL Mid
D-band

10/1/98
LB4580PCS

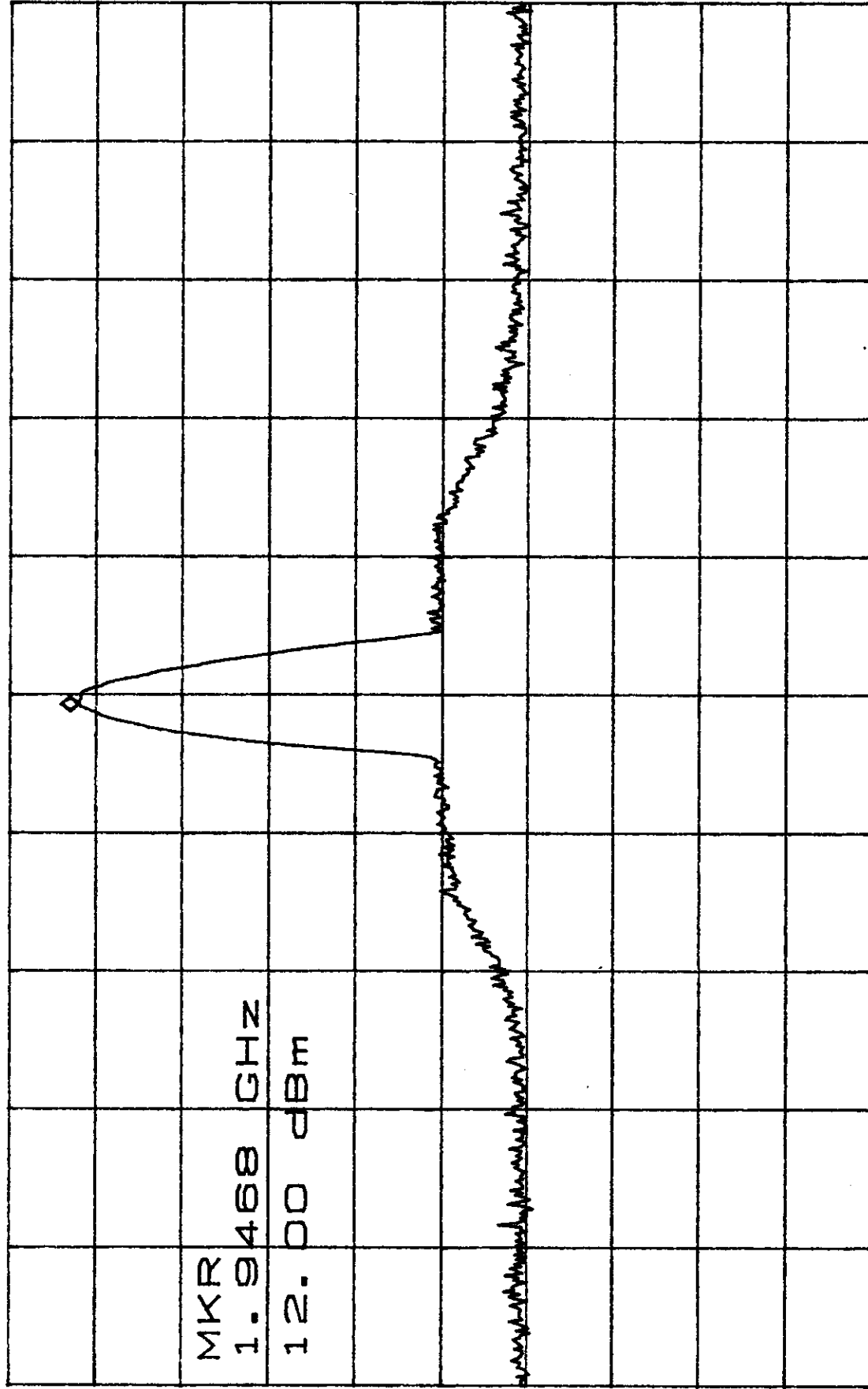
Output

cw source

ATTEN 30dB
RL 20.00dBm

MKR 12.00dBm
1.9468GHz

10dB/



CENTER 1.9475GHz
*RBW 2.0MHz

SPAN 100.0MHz
SWP 50.0ms

VBW 3.0MHz

DL Mid
P-band

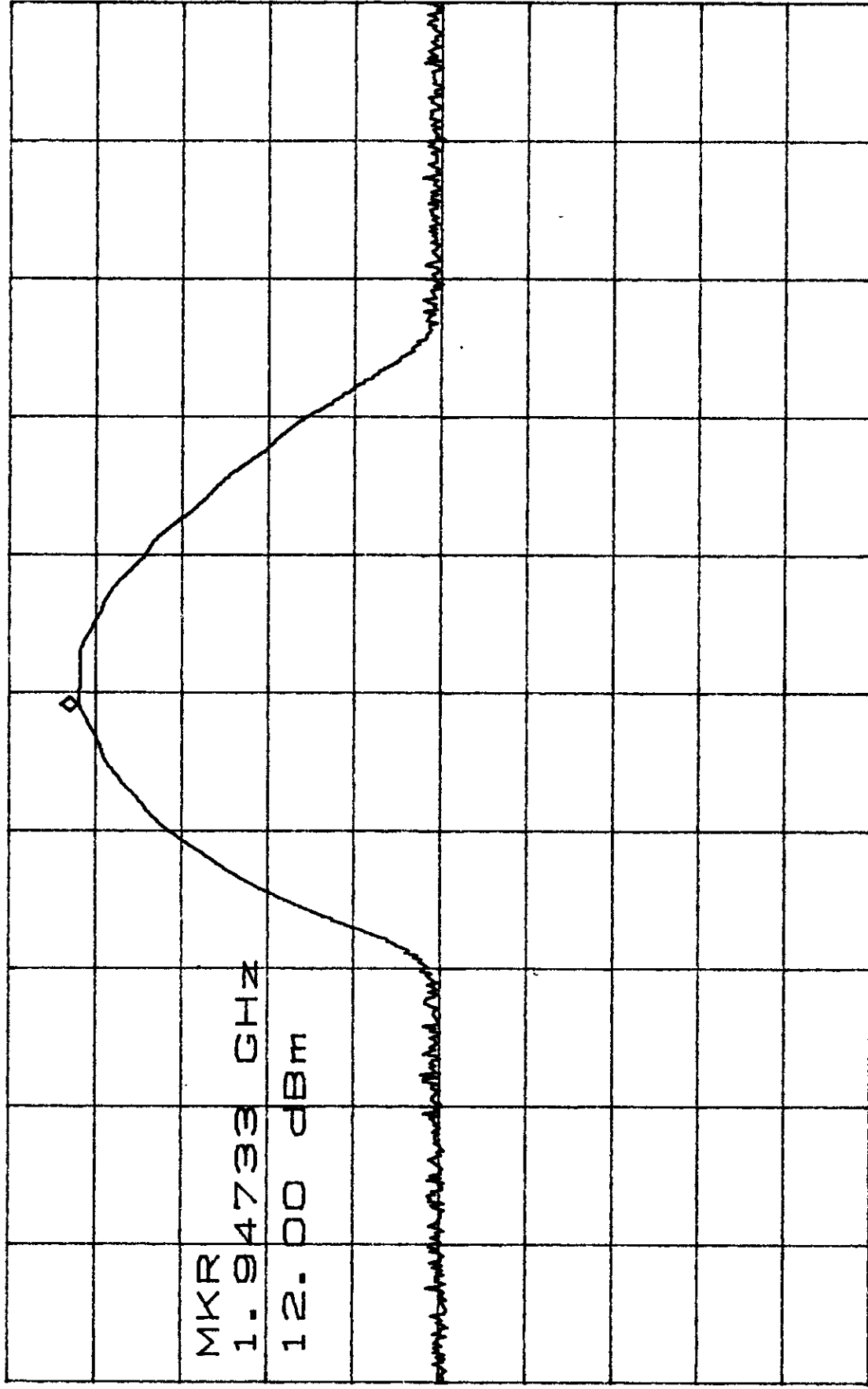
10/1/98
LB45800PCS

Output
CW-Source

ATTEN 30dB
RL 20.0dBm

MKR 12.00dBm
1.94733GHz

10dB/



2.985

MKR
1.94733 GHz
12.00 dBm

CENTER 1.94750GHz
*RBW 2.0MHz VBW 3.0MHz SWP 50.0ms
SPAN 20.00MHz

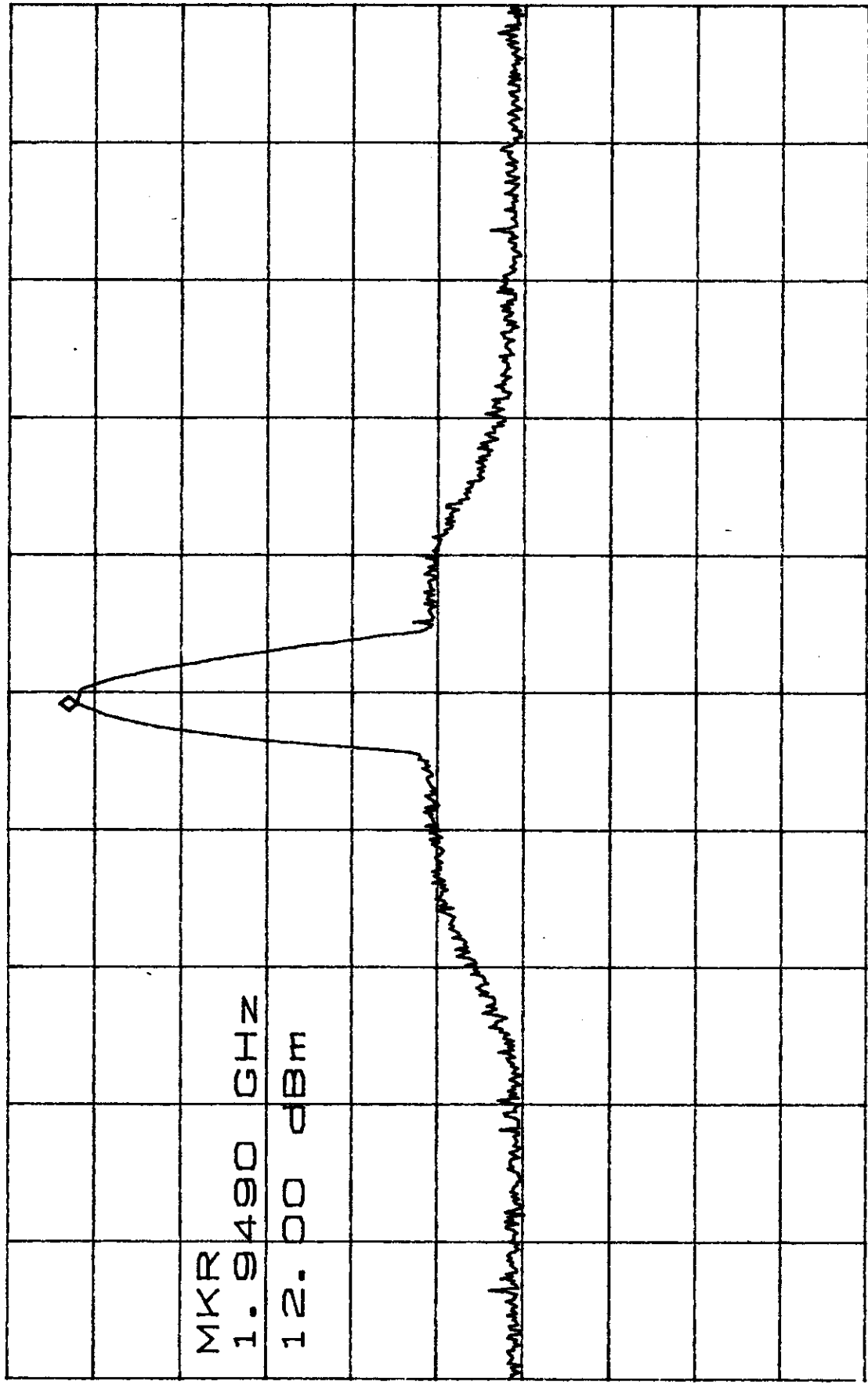
DL High
D-band

Output

10/1/98
LB4580PCS

CW - Source

ATTEN 30dB MKR 12.00dBm
RL 20.00dBm 1.9490GHz
10dB/



CENTER 1.9498GHz SPAN 100.0MHz
*RBW 2.0MHz VBW 3.0MHz SWP 50.0ms

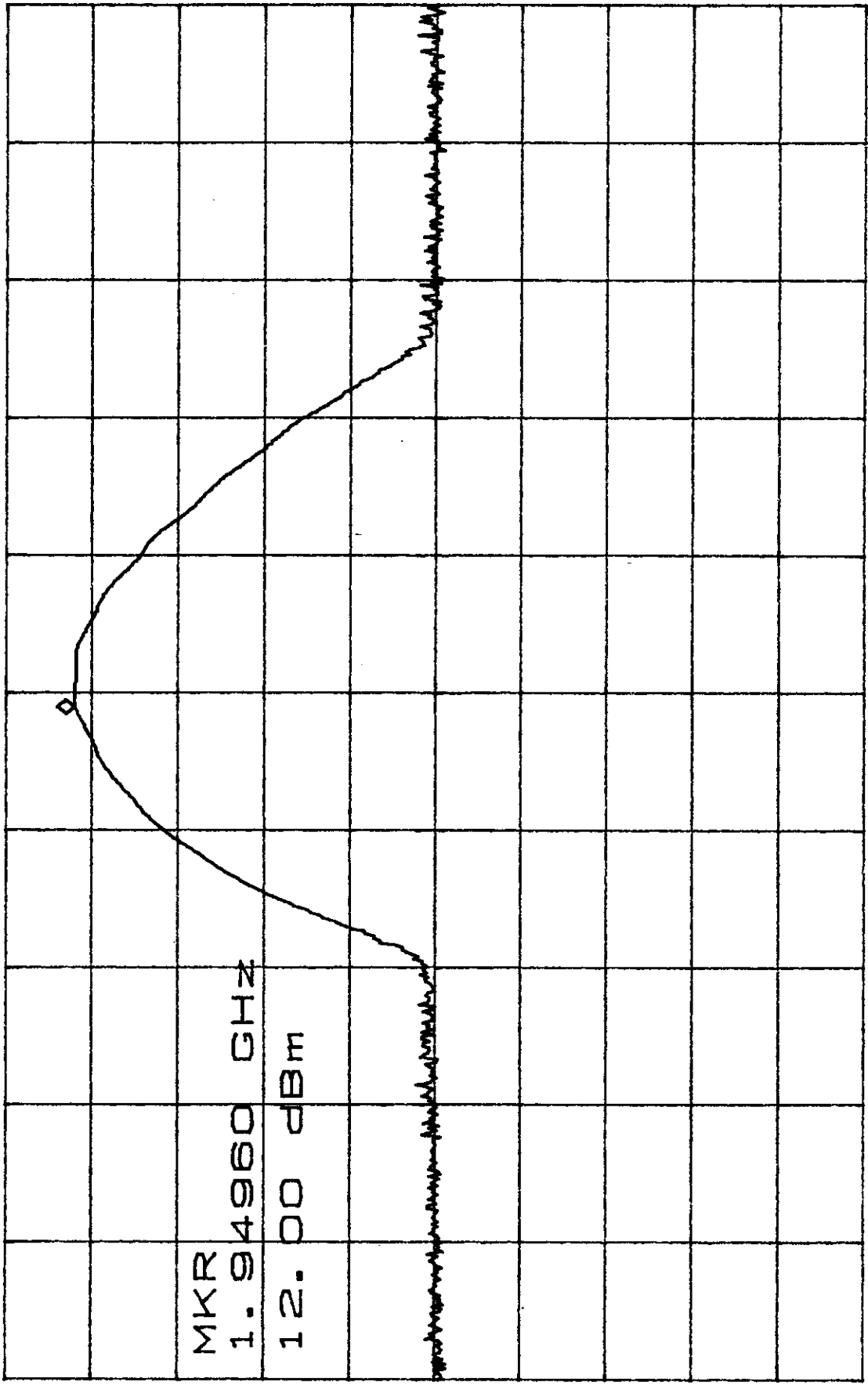
DL High
9-band

10/1/98
LB45800PCS

Output
CW Source

ATTEN 30dB
RL 20.00dBm

MKR 12.00dBm
1.94960GHz



CENTER 1.94980GHz SPAN 20.00MHz
*RBW 2.0MHz VBW 3.0MHz SWP 50.0ms

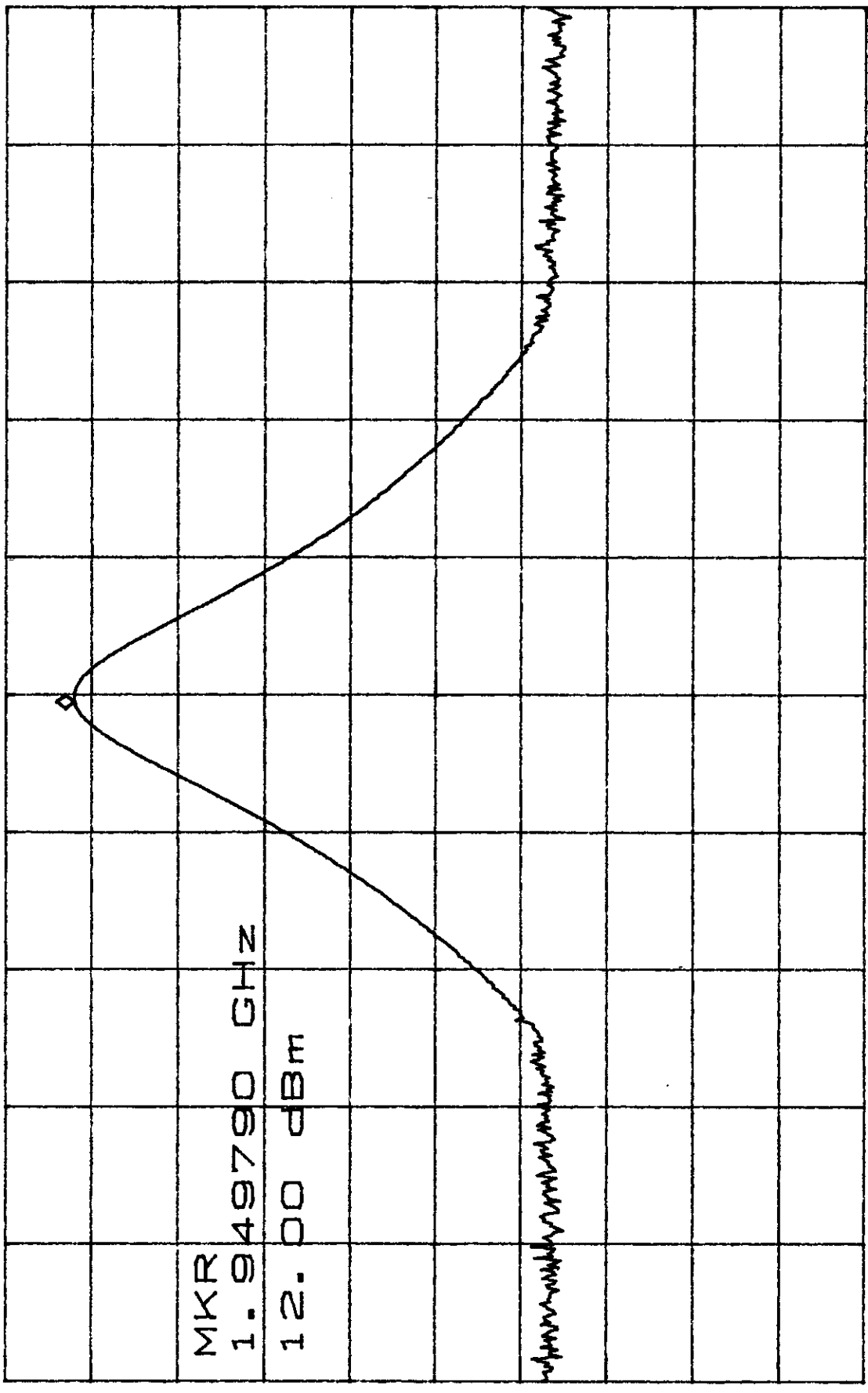
DL High
D-band

10/1/97
LB45800PCS

Occupied BW
CW source

ATTEN 30dB
RL 20.00dBm

MKR 12.00dBm
1.949790GHZ



CENTER 1.949800GHZ SPAN 2.000MHZ
*RBW 100KHZ VBW 100KHZ SWP 50.0ms

DL Mid
D-band

Occupied BW

CW Source

ATTEN 30dB

RL 20.0dBm

MKR 12.00dBm

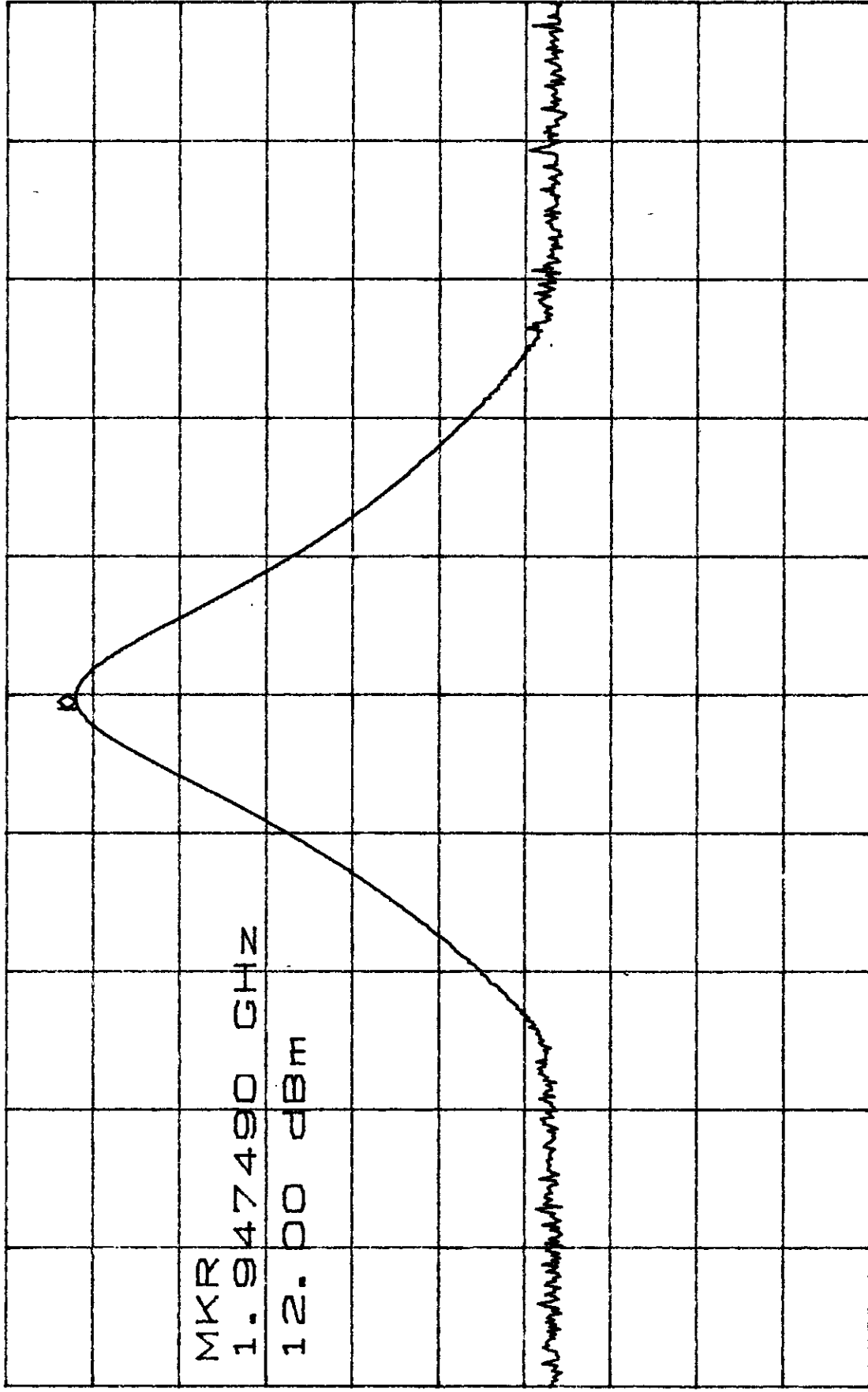
1.947490GHZ

2.989

MKR

1.947490 GHZ

12.00 dBm



CENTER 1.947500GHZ

*RBW 100KHZ

VBW 100KHZ

SPAN 2.000MHZ

SWP 50.0ms

10/1/978
LB45800PCS

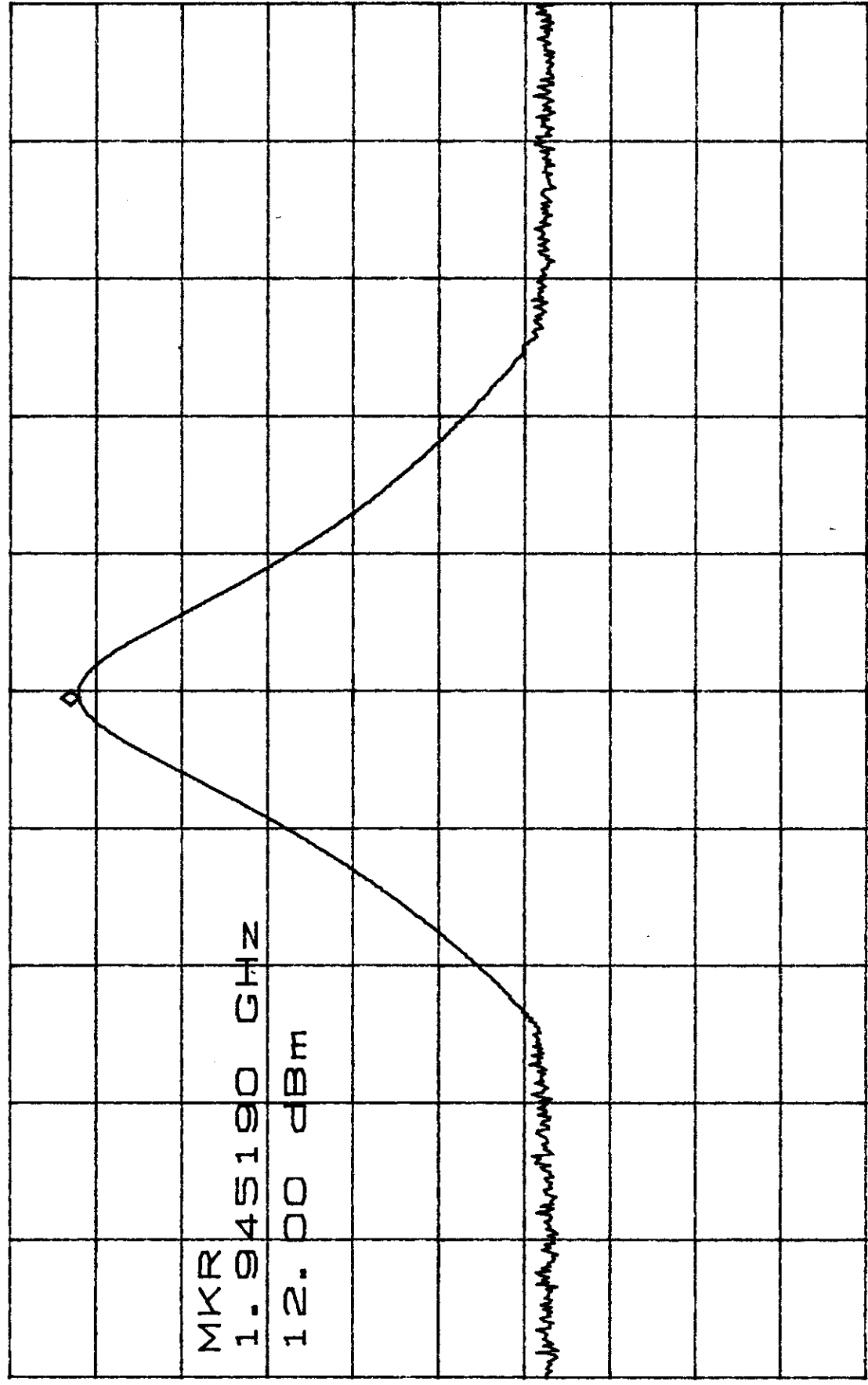
DL Low
D-band

Occupied BW

10/11/97
LB45800PCS

ATTEN 30dB
RL 20.0dBm

MKR 12.00dBm
1.945190GHZ



CENTER 1.945200GHZ SPAN 2.000MHZ
*RBW 100KHZ VBW 100KHZ SWP 50.0ms

2989

DL Low
D-band

Spurs @ Antenna

10/1/98

LB45800PCS

*ATTEN 30dB

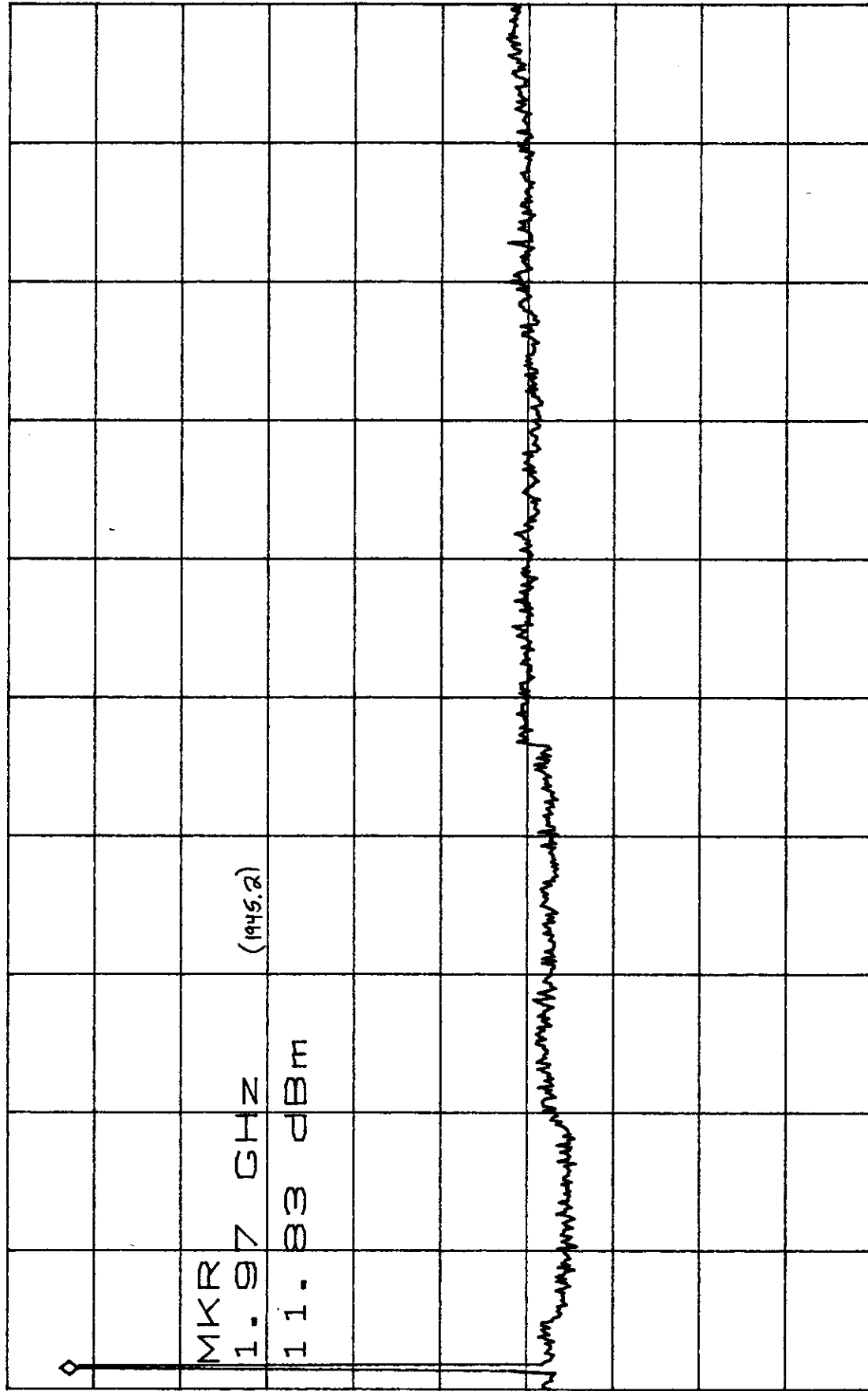
CW source

MKR 11.83dBm

RL 20.0dBm

10dB/

1.97GHz



2.991

START 1.60GHz

STOP 26.50GHz

RBW 1.0MHz

*VBW 1.0MHz

SWP 500ms

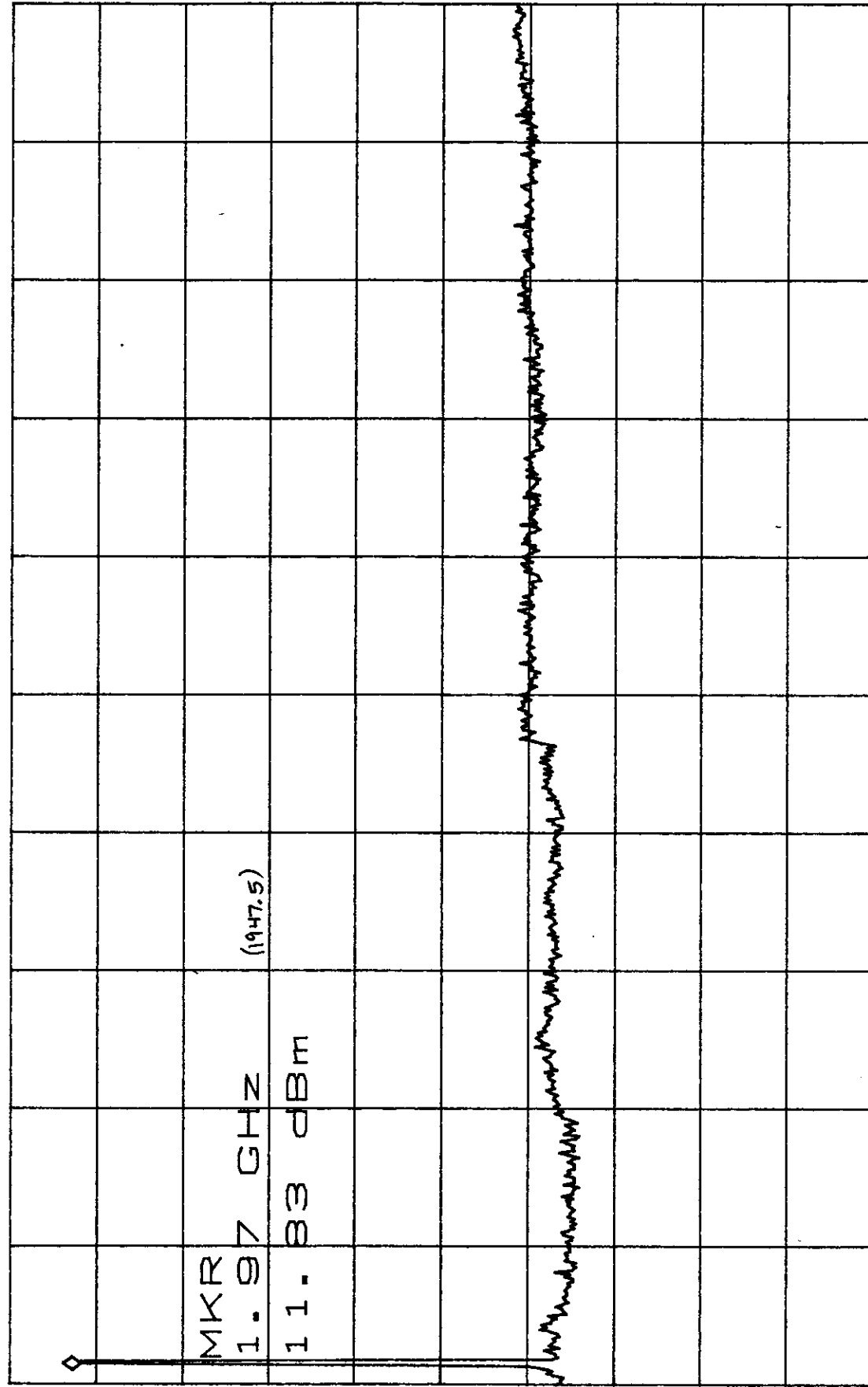
DL Mid
D-band

10/1/98
LB45800PCS
Spurs @ Antenna

*ATTEN 30dB
RL 20.0dBm

MKR 11.83dBm
1.97GHz

cr source
10dB/



2.991

START 1.60GHz

STOP 26.50GHz

*RBW 1.0MHz

*VBW 1.0MHz

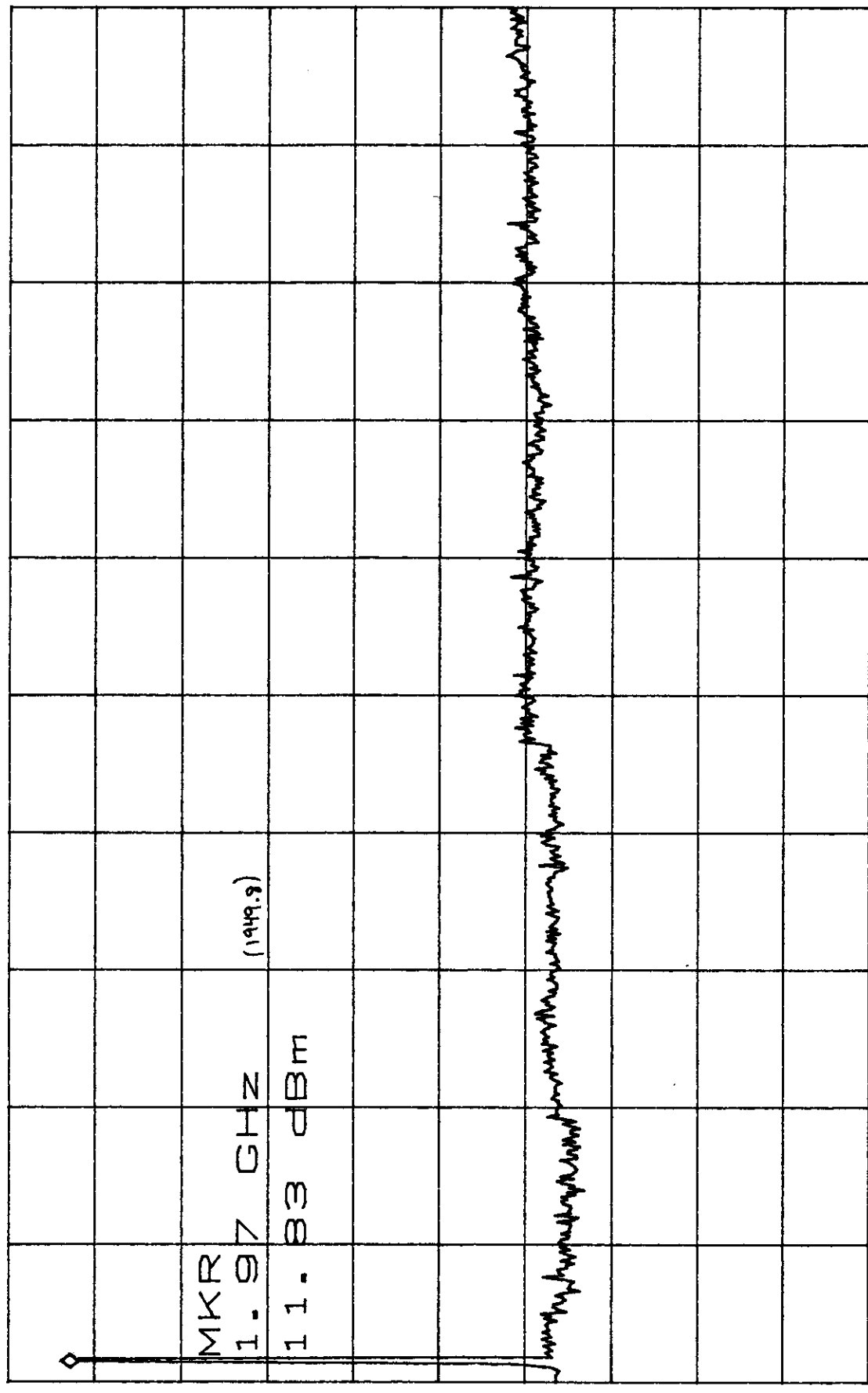
SWP 500ms

DL High
D-band

Spurs @ Antenna

10/1/98
LB45800PCS

*ATTEN 30dB CW source MKR 11.83dBm
RL 20.0dBm 10dB/ 1.97GHz



START 1.60GHz STOP 26.50GHz
*RBW 1.0MHz *VBW 1.0MHz SWP 500ms

DL Low
D-band

Input Signal Into Hub
1:8 Splitter

10/1/98
LB#5800PCS

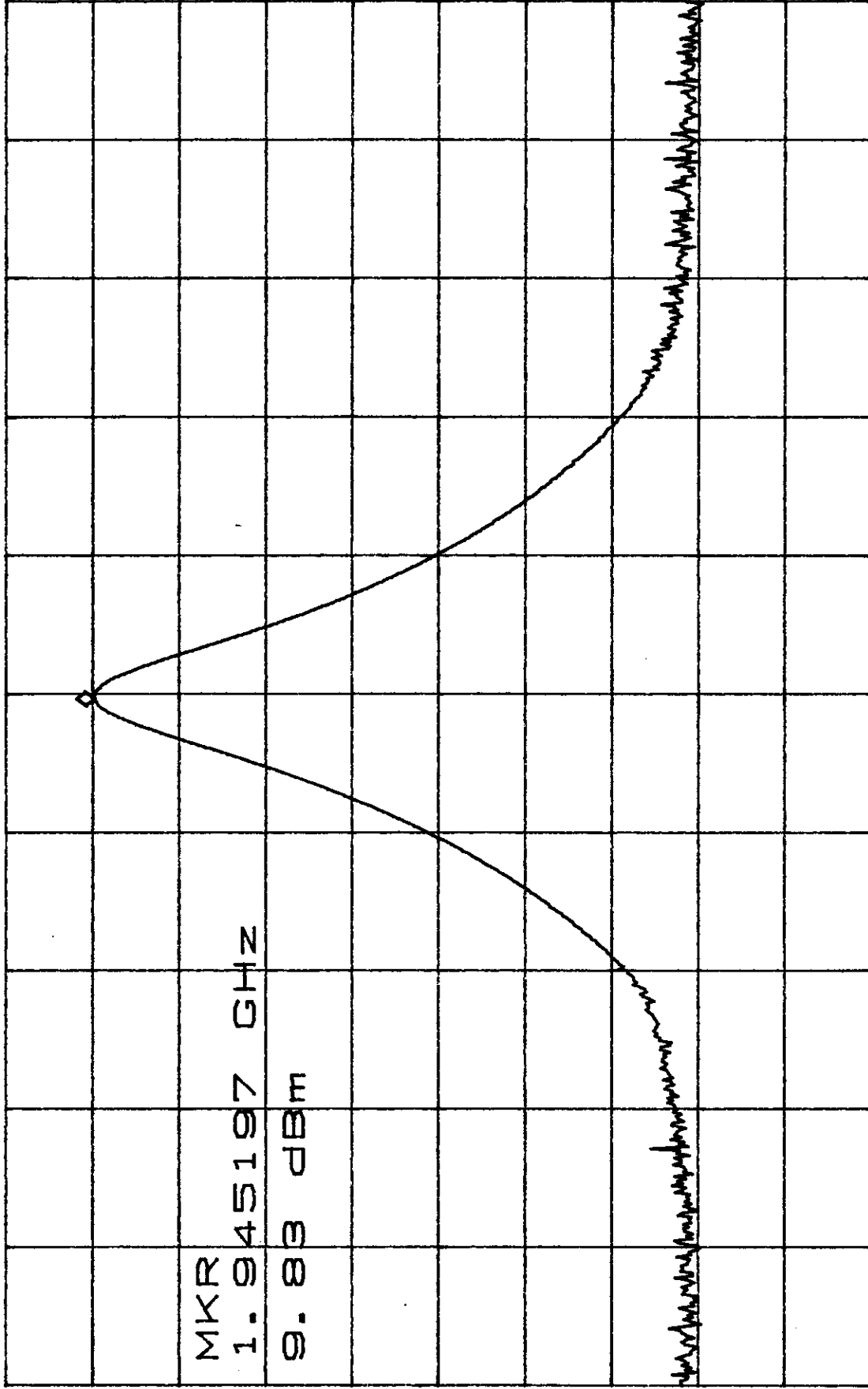
ATTEN 30dB
RL 20.0dBm

MKR 9.83dBm
1.945197GHz

cw source
10dB/

In/out

MKR
1.945197 GHz
9.83 dBm



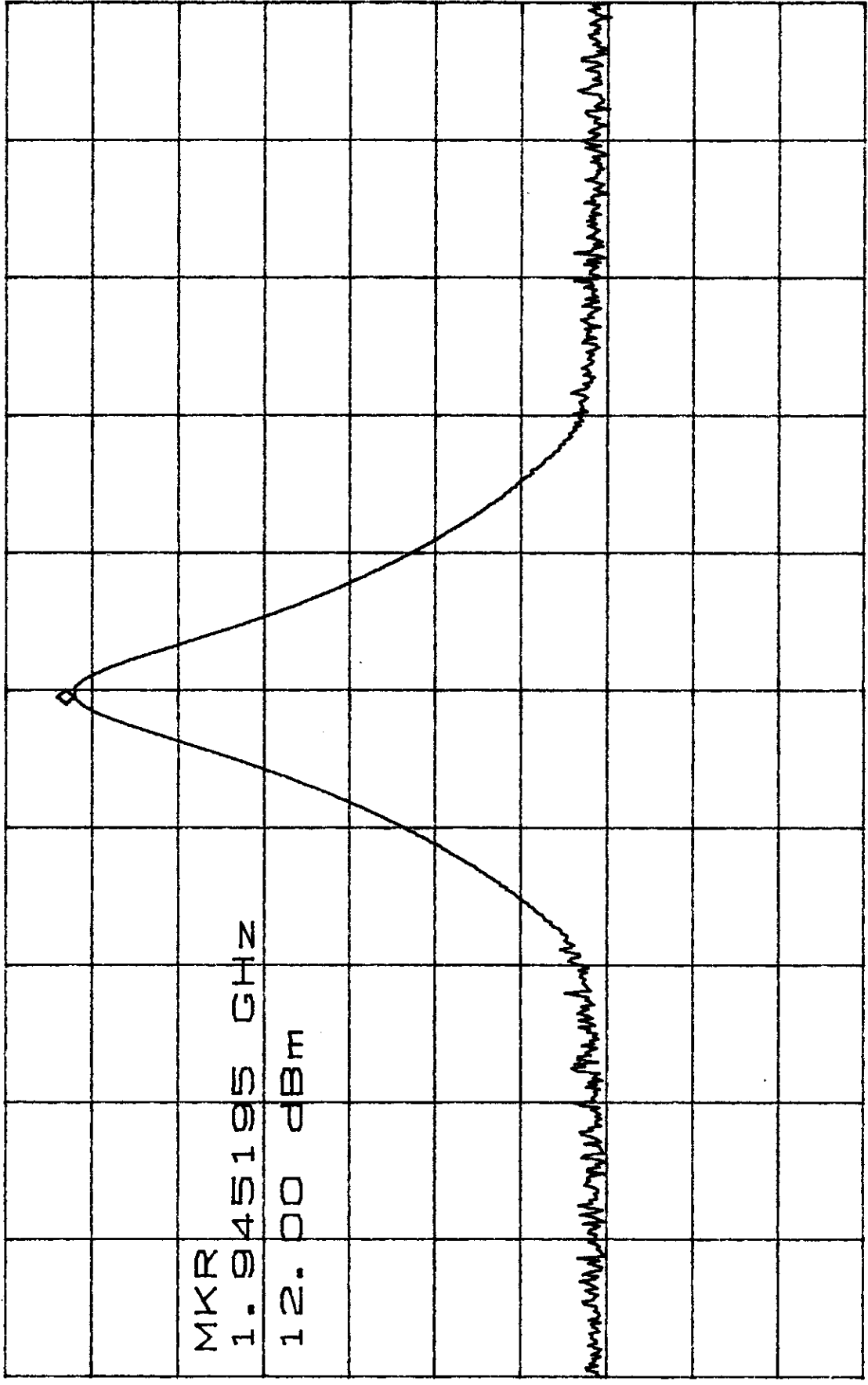
CENTER 1.945200GHz
*RBW 30kHz *VBW 30kHz SWP 50.0ms
SPAN 1.000MHz

DL Low
D-band

10/1/98
LB4580PCS

Output Signal

ATTEN 30dB CW Source MKR 12.00dBm
RL 20.00dBm 10dB/ 1.945195GHz



CENTER 1.945200GHz SPAN 1.000MHz
*RBW 30kHz *VBW 30kHz SWP 50.0ms

DL Mid
D-band

Input Signal Into Hub
1:8 Splitter

10/1/98
LB45800PCS

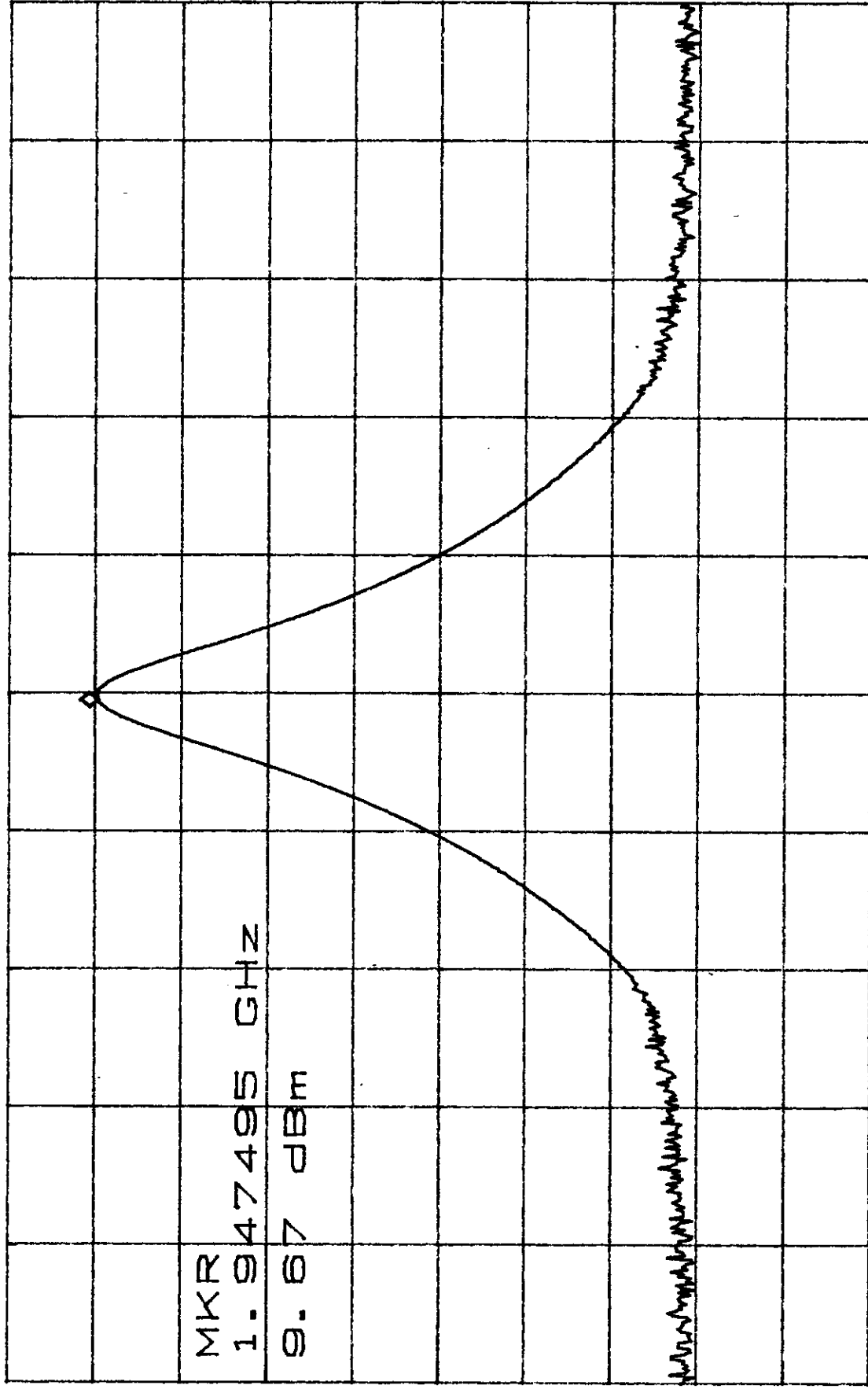
ATTEN 30dB
RL 20.0dBm

MKR 9.67dBm
1.947495GHz

CW Source
10dB/

MKR
1.947495 GHz
9.67 dBm

In/out



CENTER 1.947500GHz

SPAN 1.000MHz

*RBW 30kHz

*VBW 30kHz

SWP 50.0ms

DL Mid
D-band

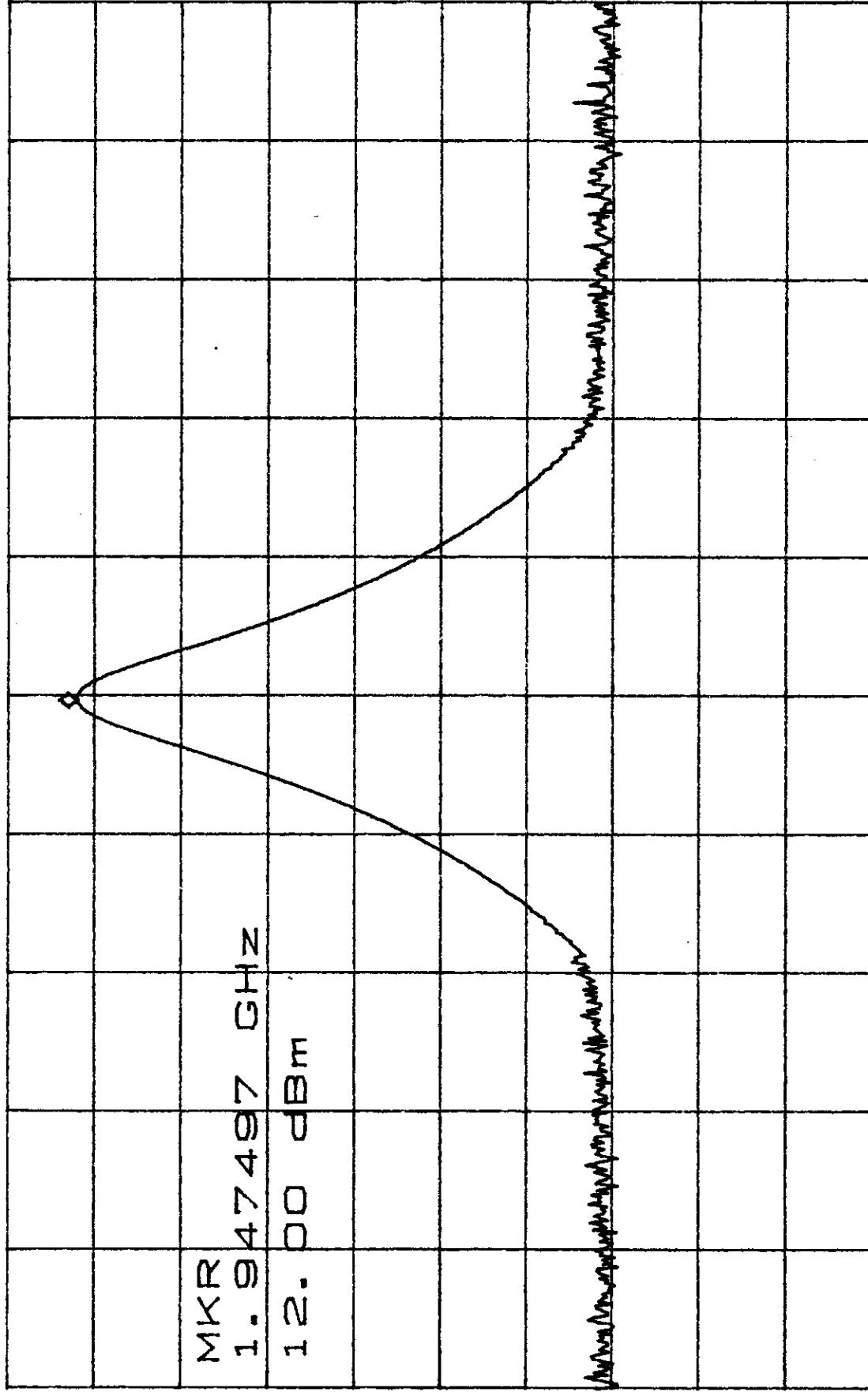
10/1/98
L845800PES

Output Signal

ATTEN 30dB
RL 20.00dBm

MKR 12.00dBm
1.947497GHz

CW source
10dB/



In/Out

MKR
1.947497 GHz
12.00 dBm

D

R

CENTER 1.947500GHz SPAN 1.000MHz
*RBW 30kHz *VBW 30kHz SWP 50.0ms

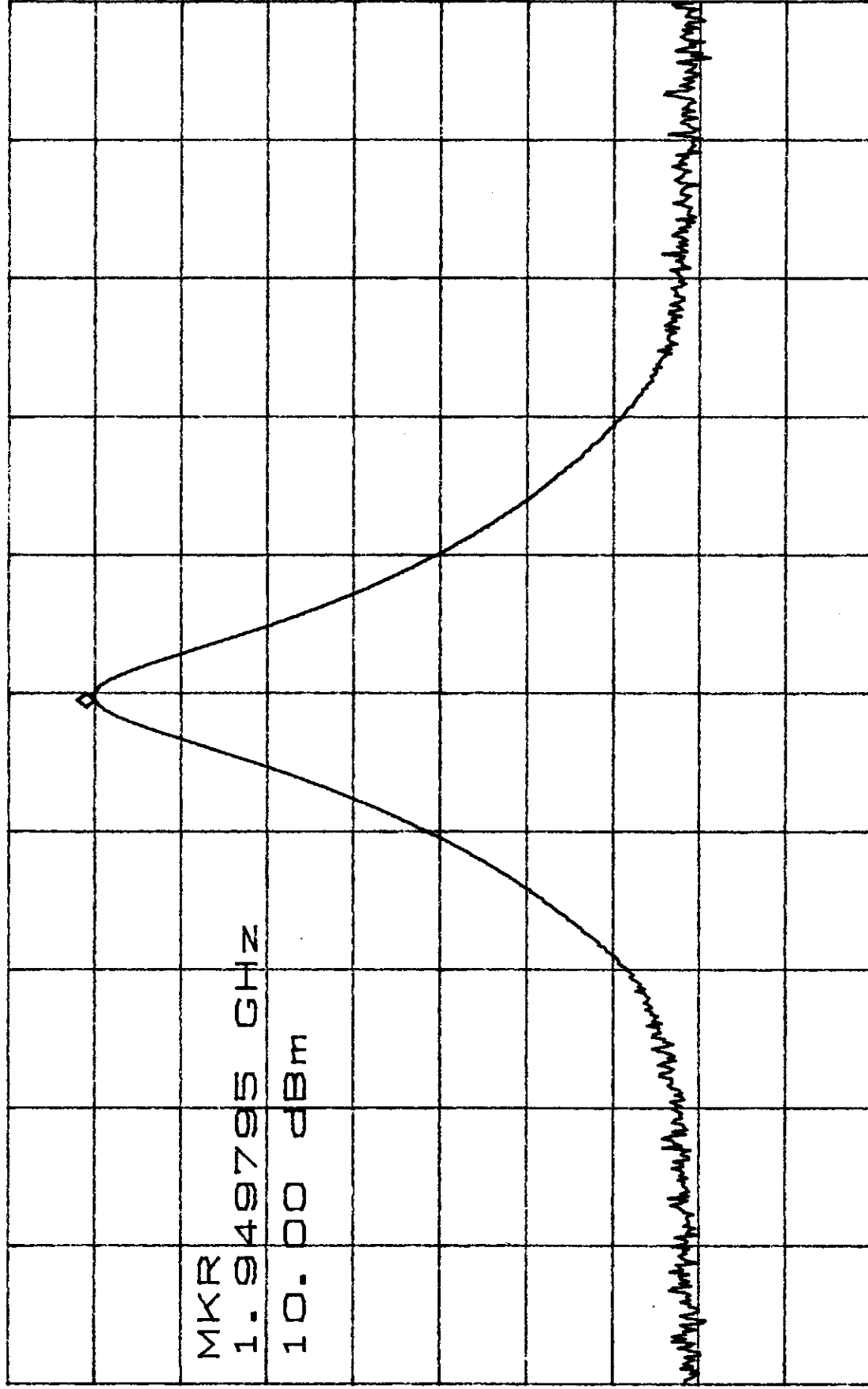
DL High
D-band

Input Signal Into Hub
1:8 Splitter

10/1/98
LB45800PCS

ATTEN 30dB
RL 20.0dBm

MKR 10.00dBm
1.949795GHz



CENTER 1.949800GHz
*RBW 30kHz

SPAN 1.000MHz
SWP 50.0ms

DL High
D-band

Output Signal

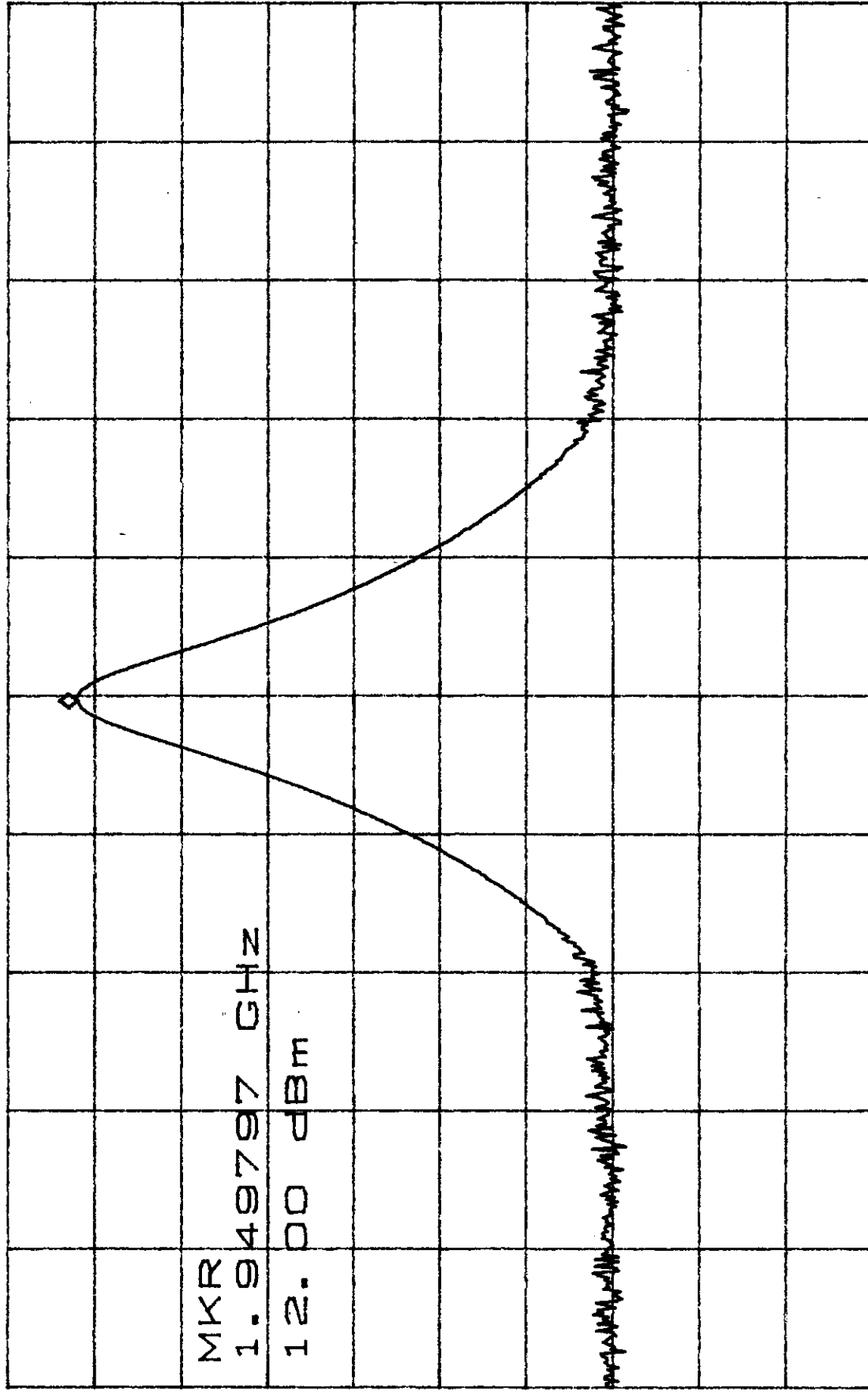
10/1/98
LB45800PCS

ATTEN 30dB
RL 20.0dBm

MKR 12.00dBm
1.949797GHZ

CW - Source

10dB/



CENTER 1.949800GHZ

SPAN 1.000MHZ

*RBW 30KHZ

*VBW 30KHZ

SWP 50.0MHz

DL Low
D-Band

10/1/98
LB4580PCS

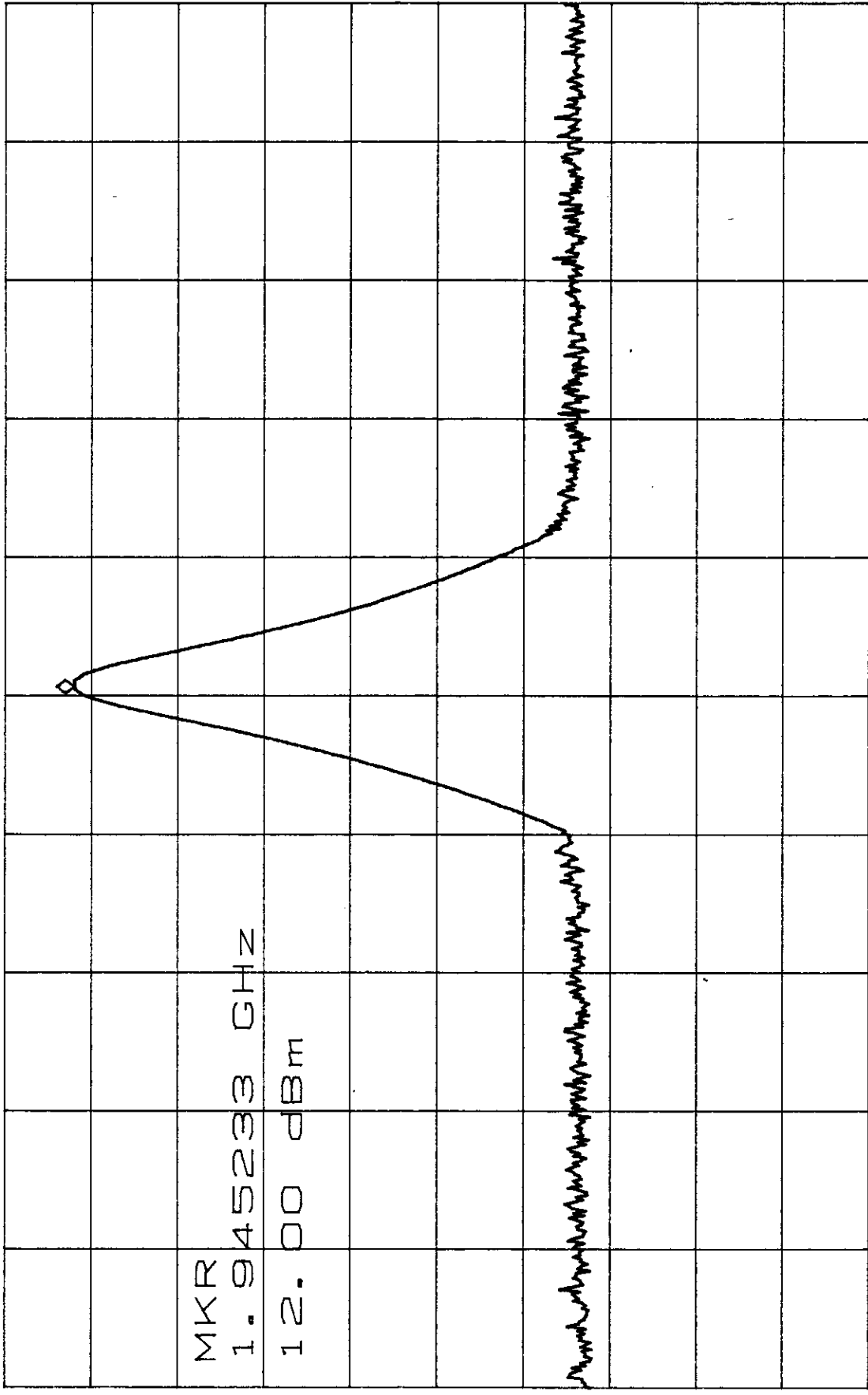
Output

CW Source

ATTEEN 30dB MKR 12.00dBm
RL 20.00dBm 1.945233GHz

24.238

MKR
1.945233 GHz
12.00 dBm



CENTER 1.945200GHZ SPAN 5.000MHZ
*RBW 100KHZ *VBW 30KHZ SWP 50.0ms

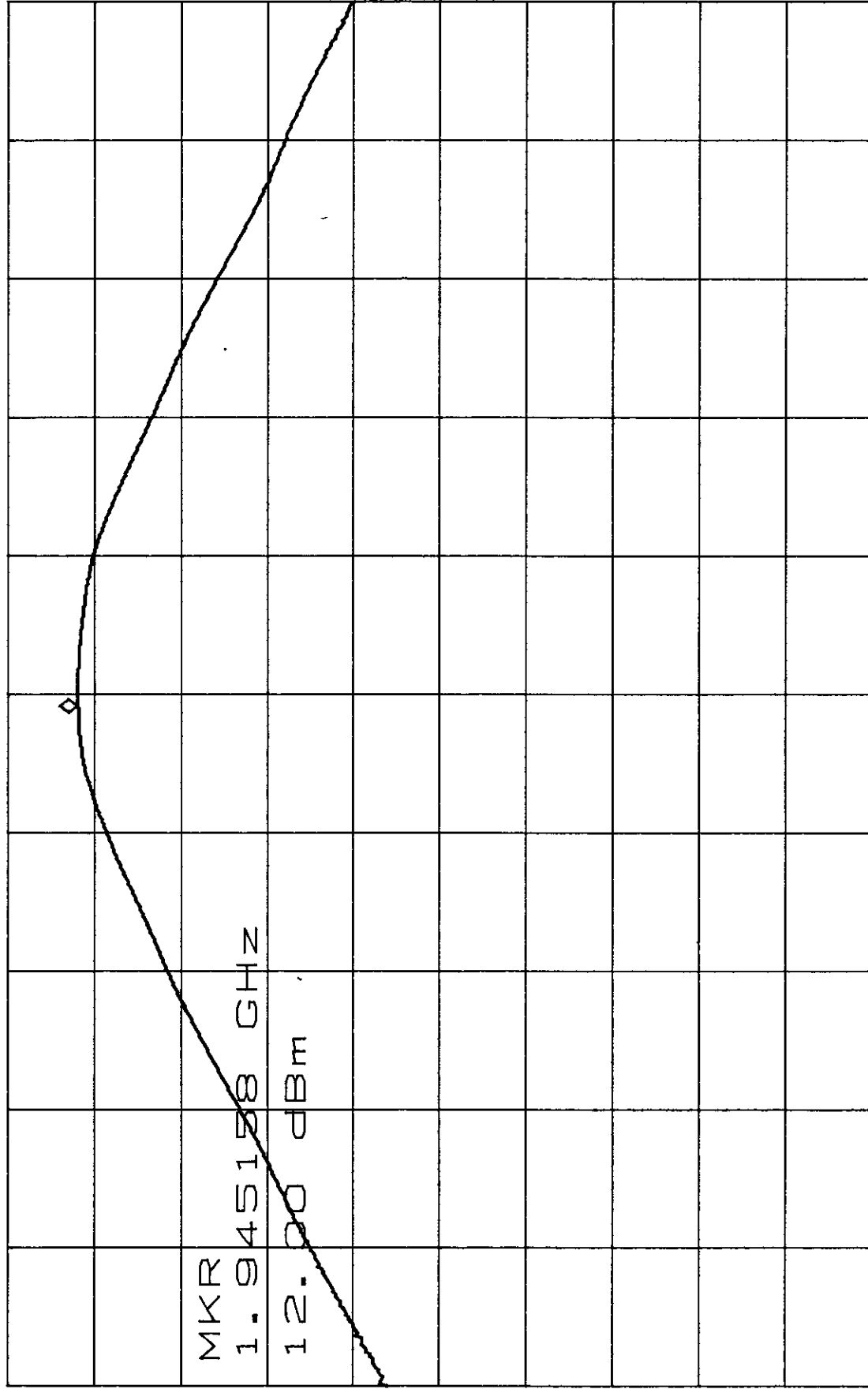
DL Low
D-band

10/1/98
LB45800PCS

Output

ATTE 30dB MKR 12.00dBm
RL 20.00dBm 1.945158GHz

cw source



CENTER 1.945200GHz SPAN 5.000MHz
*RBW 1.0MHz *VBW 1.0MHz SWP 50.0ms

DL Low
D-Band

Output

CW Source

10/1/98
LB4580PCS

ATTEN 30dB

MKR 12.00dBm

RL 20.00dBm

1.945275GHz

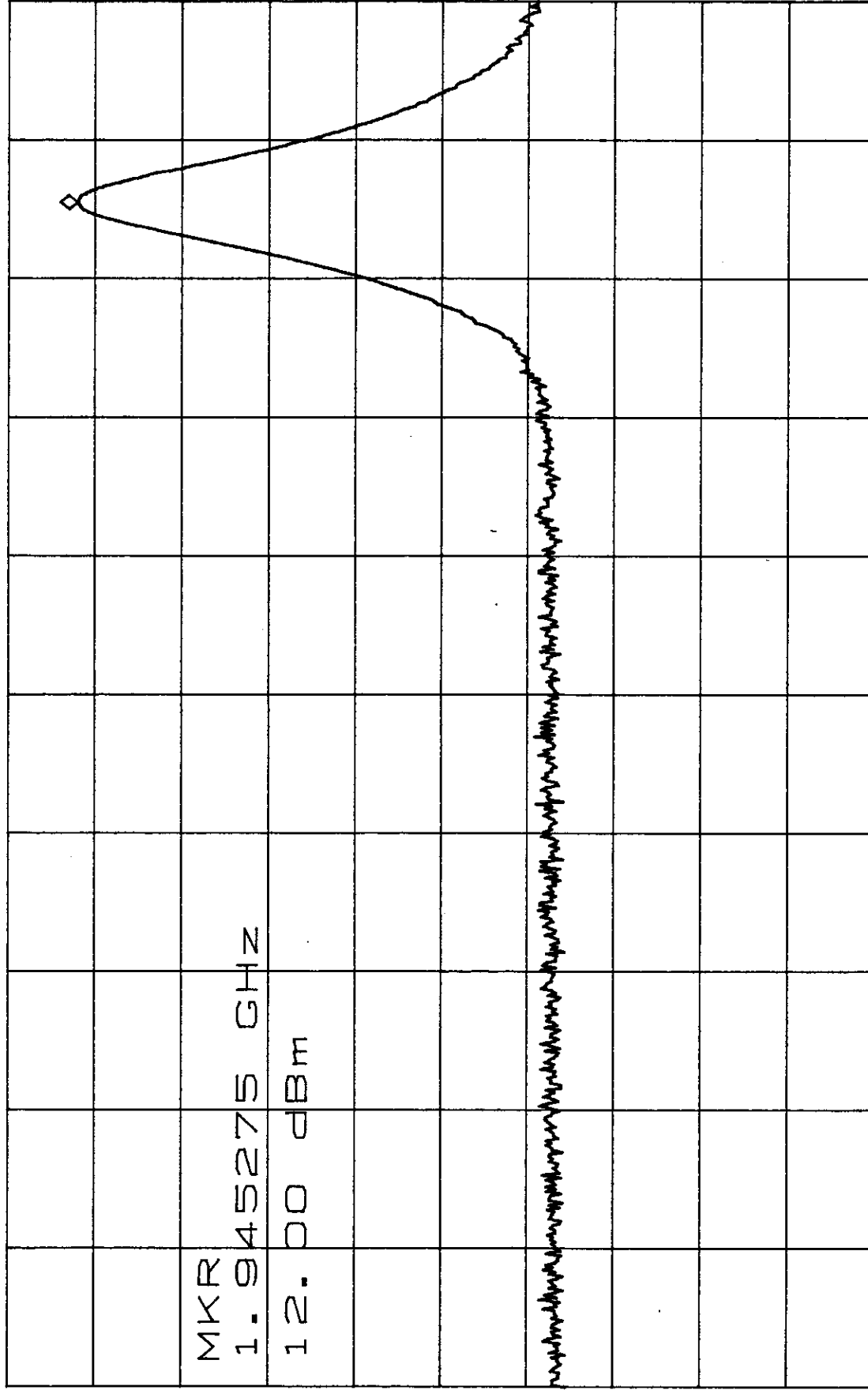
10dB/

24.238

MKR
1.945275 GHz
12.00 dBm

D

R



START 1.941000GHz STOP 1.946000GHz
*RBW 100kHz *VBW 1.0MHz SWP 50.0ms

DL Low
D-band

10/1/98
LB45800PCS

Output

cw source

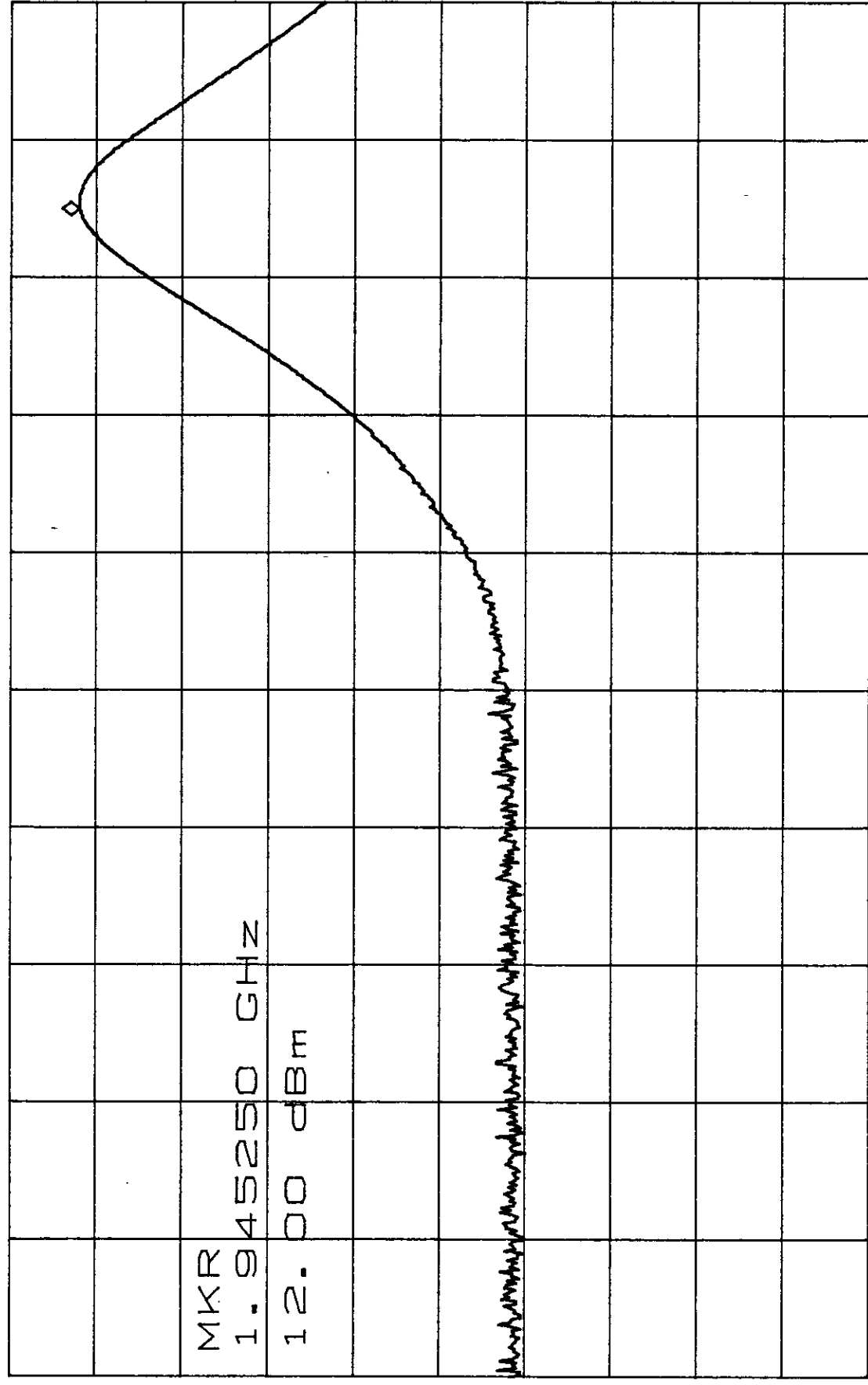
ATTEN 30dB

MKR 12.00dBm

RL 20.00dBm

1.945250GHz

10dB/



24.238

D

R

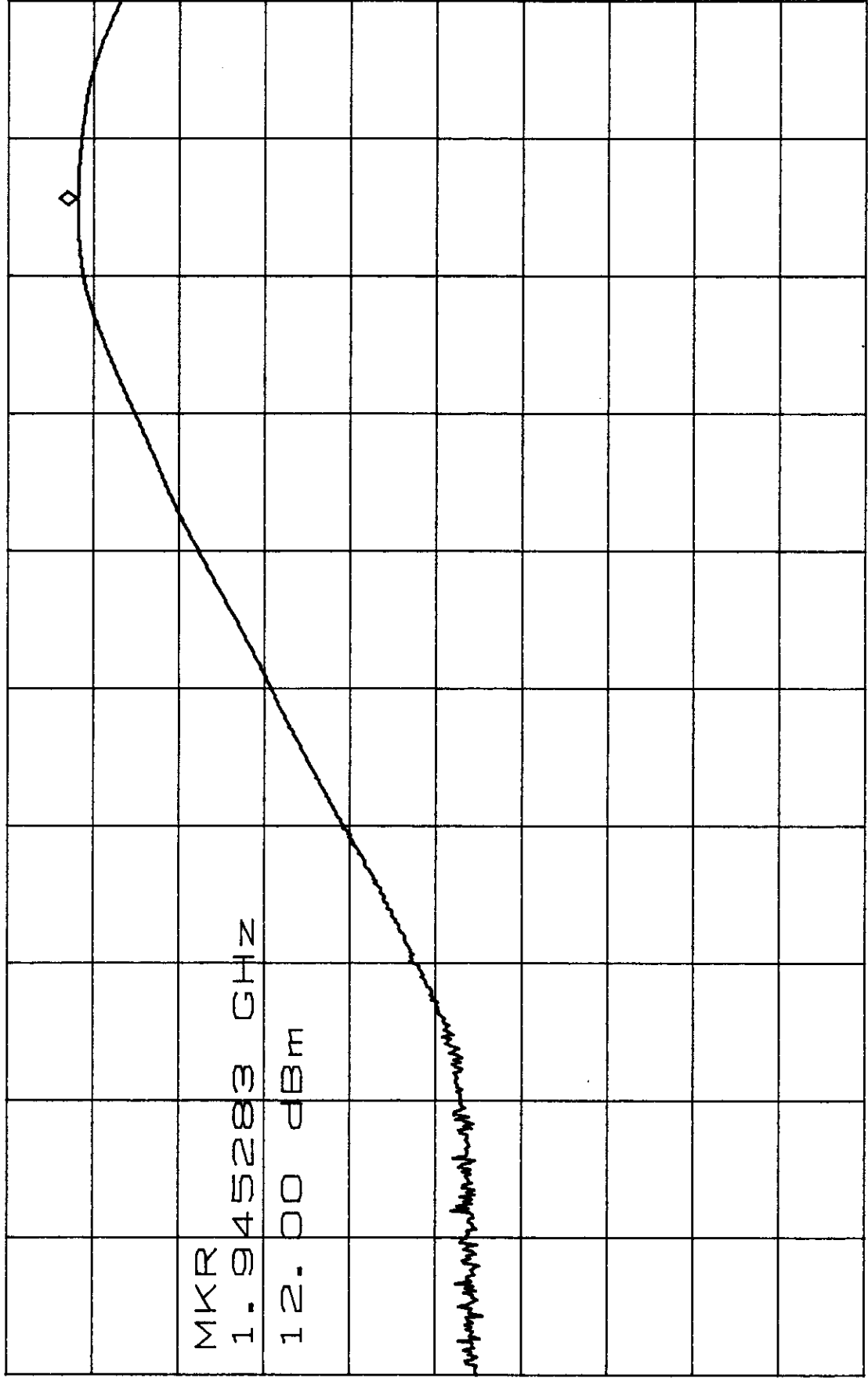
START 1.941000GHz STOP 1.946000GHz
*RBW 300kHz *VBW 1.0MHz SWP 50.0ms

10/1/98
LB45800PCS

Output
CW Source

DL Low
D-band

ATTEN 30dB MKR 12.00dBm
RL 20.00dBm 1.945283GHz



START 1.941000GHz STOP 1.946000GHz
*RBW 1.0MHz *VBW 1.0MHz SWP 50.0ms

10/1/98
LB45800PCS

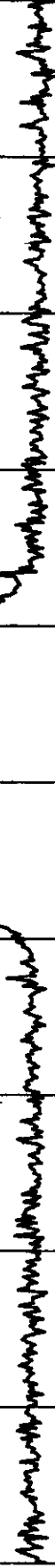
Source.

MR 12.00B3H

1. HIGH 33040 N

24.238

1



SPAN 5.000MHZ

*VBW 30KHN

SWP 50.0 EE 0

DL High
D-band

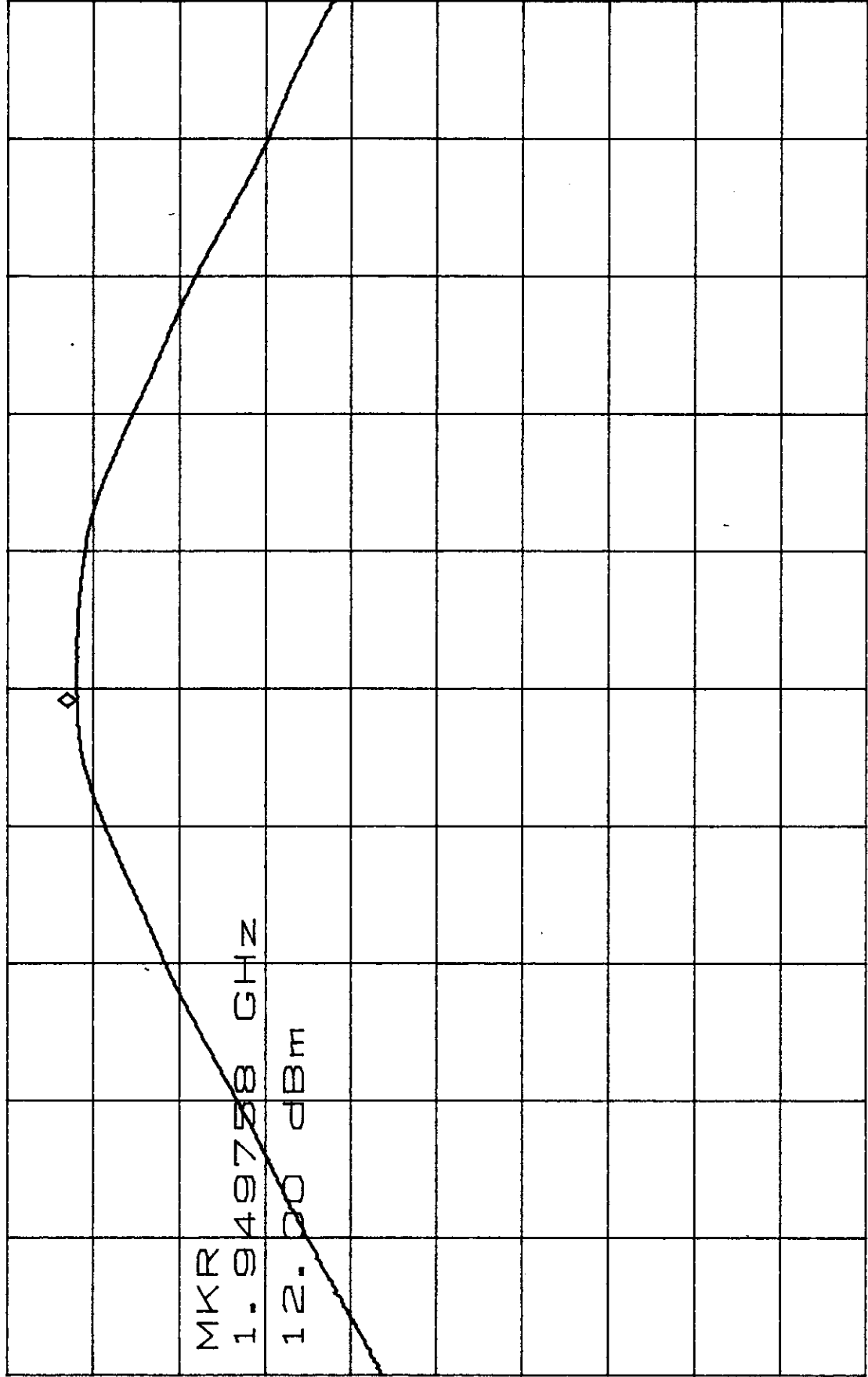
Output

10/1/98
LB45800PCS

cw source

ATTEN 30dB
RL 20.00dBm

MKR 12.00dBm
1.949758GHz



CENTER 1.949800GHz SPAN 5.000MHz
*RBW 1.0MHz VBW 1.0MHz SWP 50.0ms

DL High
0-band

Output

CW-Source

10/1/98

LB45800PCS

ATTEN 30dB

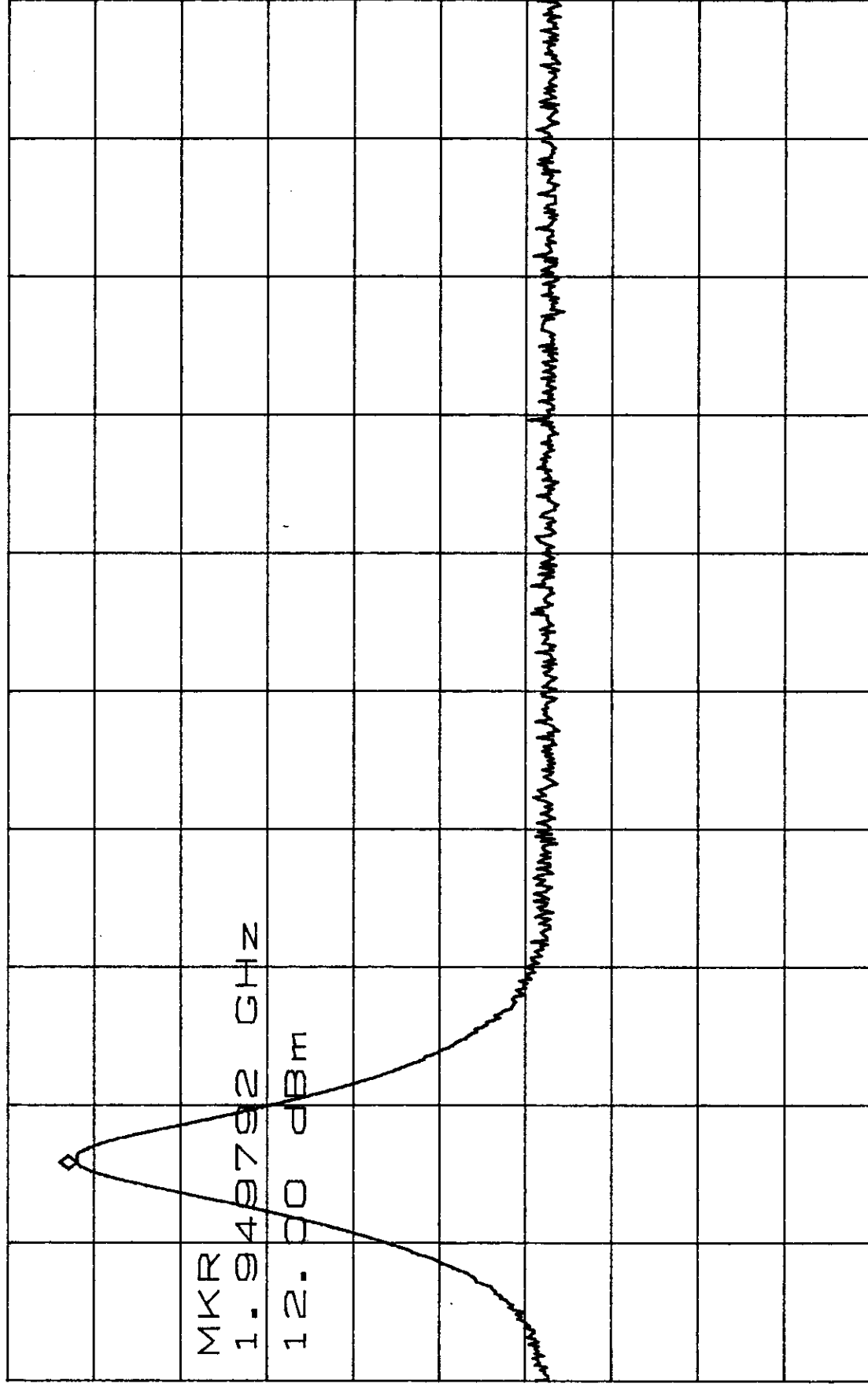
MKR 12.00dBm

RL 20.00dBm

1.949792GHz

24.298

MKR
1.949792 GHz
12.00 dBm



START 1.949000GHZ STOP 1.954000GHZ
*RBW 100KHZ *VBW 1.0MHZ SWP 50.0ms

DL High
D-band

Output
CW-Source

10/1/98
LB4580RCS

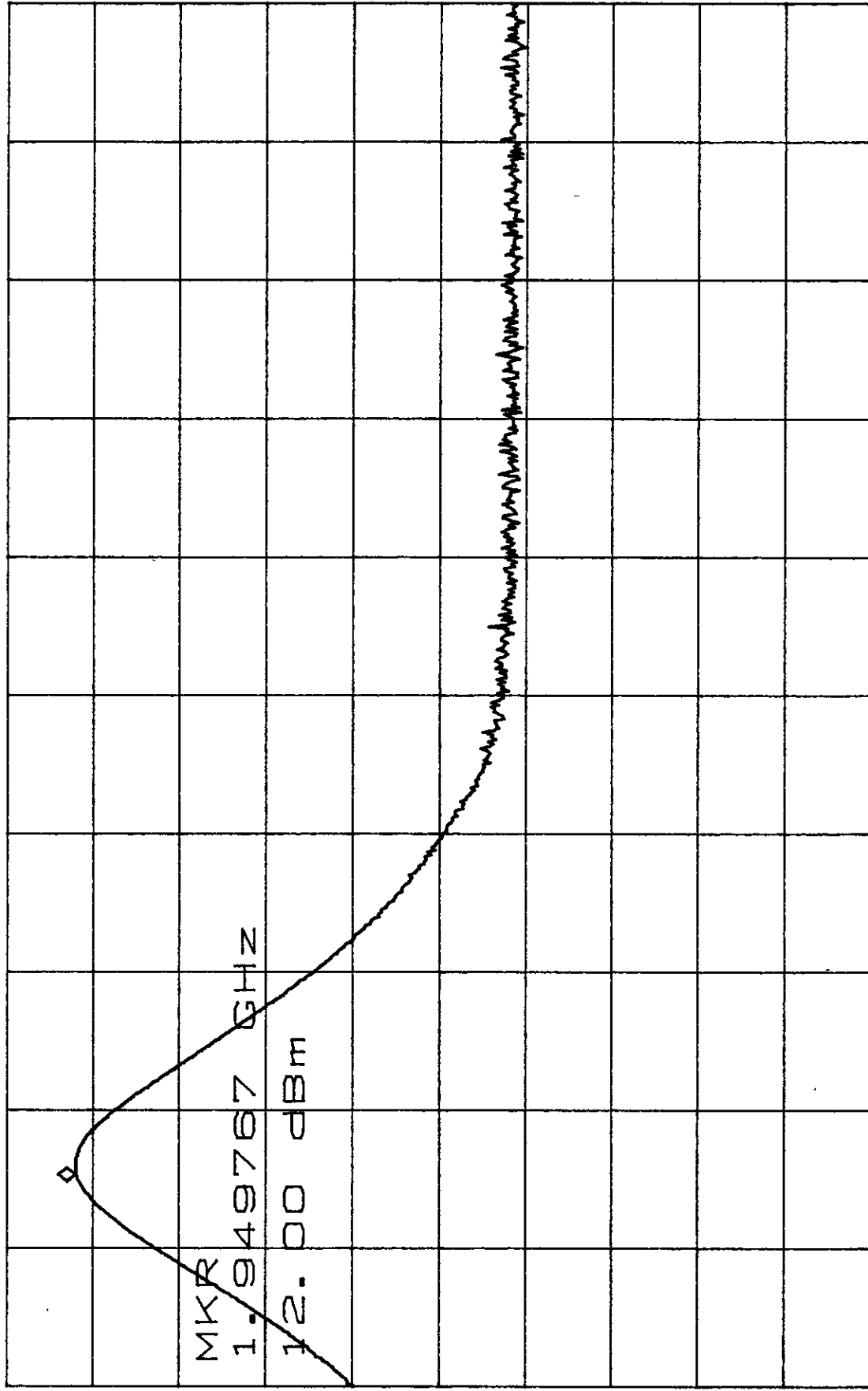
ATTEN 30dB
RL 20.00dBm

MKR 12.00dBm
1.949767GHz

10dB/

24.238

MKR
1.949767 GHz
12.00 dBm



START 1.949000GHz STOP 1.954000GHz
*RBW 300kHz *VBW 1.0MHz SWP 50.0ms

DL High
D-band

10/1/98
LB45800PCS

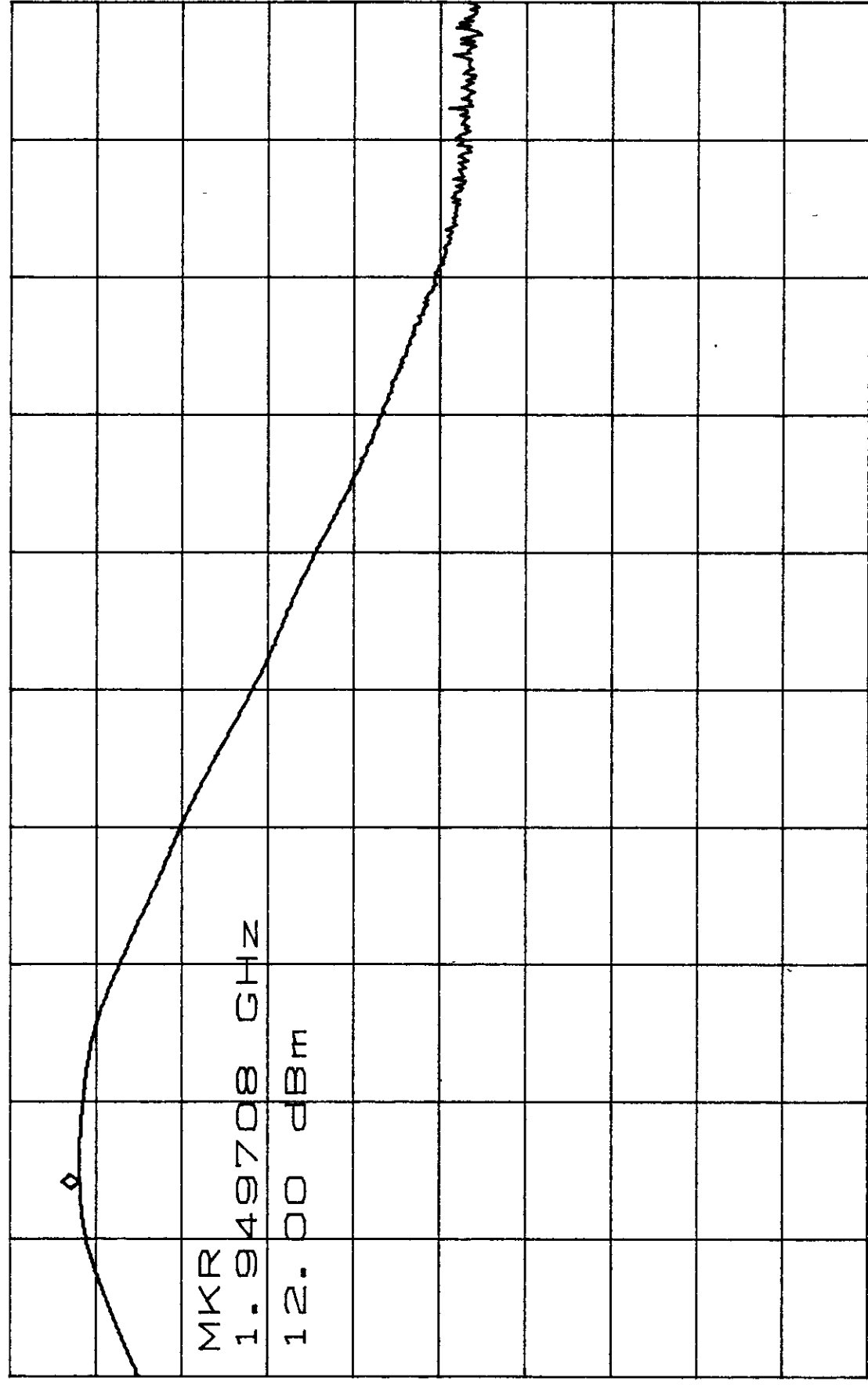
ATTEN 30dB
RL 20.0dBm

MKR 12.00dBm
1.949708GHZ

10dB/

24.238

MKR
1.949708 GHZ
12.00 dBm



START 1.949000GHZ STOP 1.954000GHZ
*RBW 1.0MHz *VBW 1.0MHz SWP 50.0ms

DL Inputs: ** 1945.2 MHz) A
 1946.2 MHz)
 1949.8 MHz) B

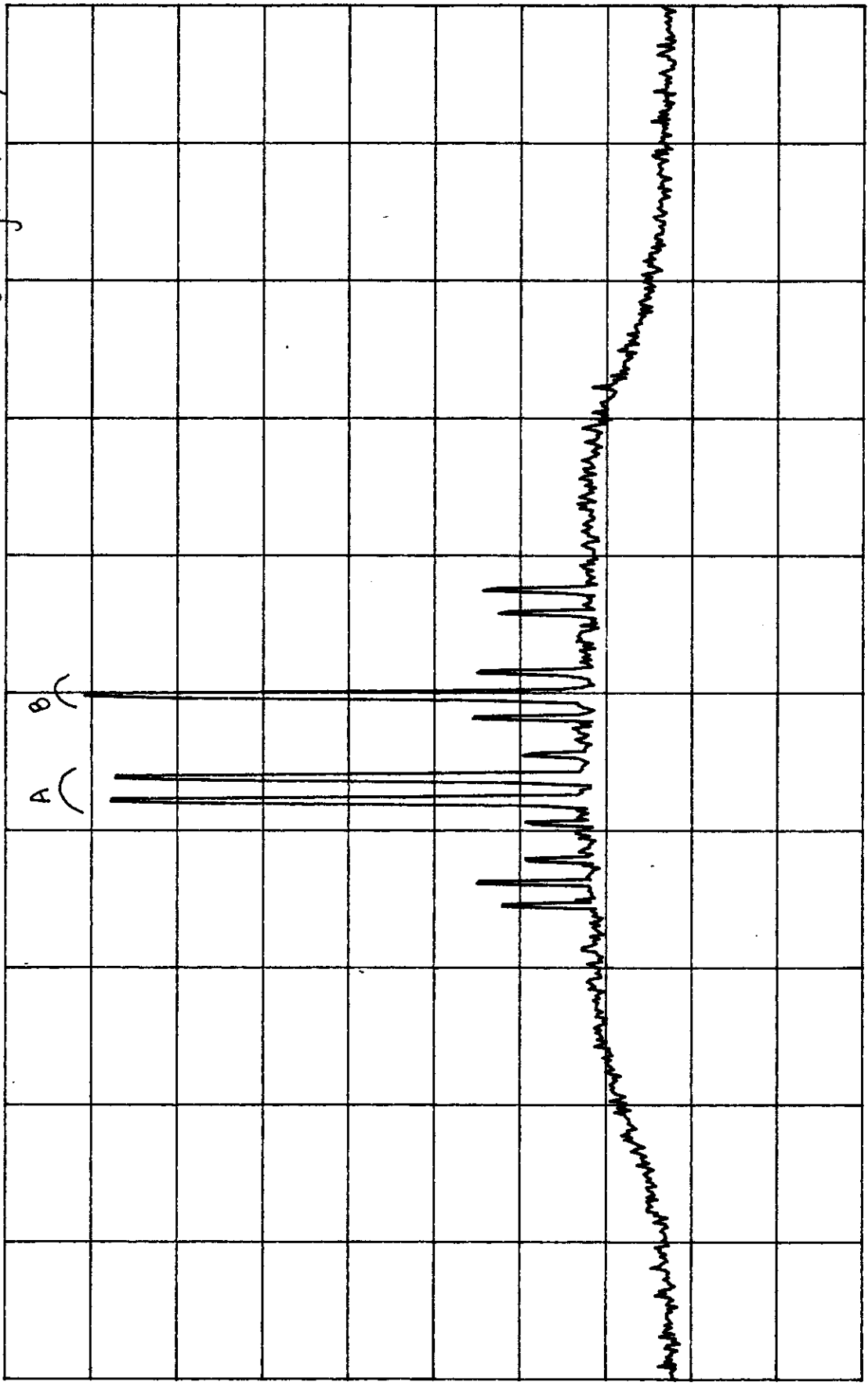
Intermods Over
 D-band
 CW-Sources
 10dB/

Note: Different input levels were used to yield ~12dBm composite power for input frequencies A and input frequency B (shown on following) separately

10/1/98
 LB4580092.5

*ATTEN 30dB
 RL 20.0dBm

3-tone
 CASE 1



START 1.92000GHZ STOP 1.98000GHZ
 *RBW 30KHZ *VBW 30KHZ SWP 170ms

** Amplified used on 1945.2 MHz signal source in order to increase input level (two 2:1 combiners used) to get required output

DL Inputs: 1945.2 MHz
1946.2 MHz

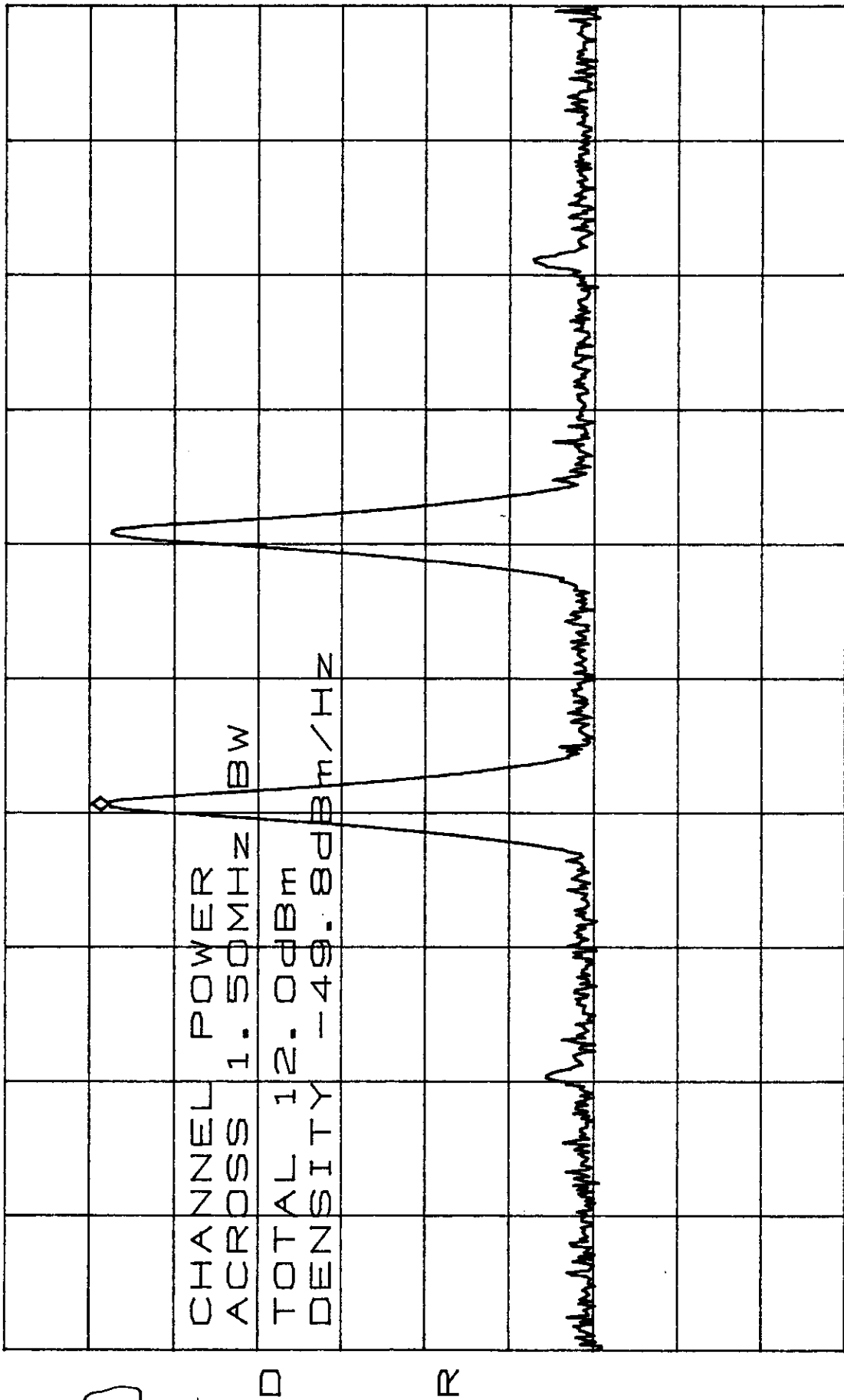
D-band

Output ~~Level~~ Levels for
Set A (composite ~12 dBm)

10/1/98
LB4580PCS

*ATTEN 30dB (set B is off) MKR 7.67 dBm

RL 20.0 dBm 10dB/ 1.945233 GHz



CENTER 1.945700 GHz SPAN 5.000 MHz

*RBW 30 kHz *VBW 30 kHz SWP 50.0 ms

DL Input: 1949.8 MHz

D-band

10/1/98

LB45800925

Output Level for
Set B (composite ~12dBm)

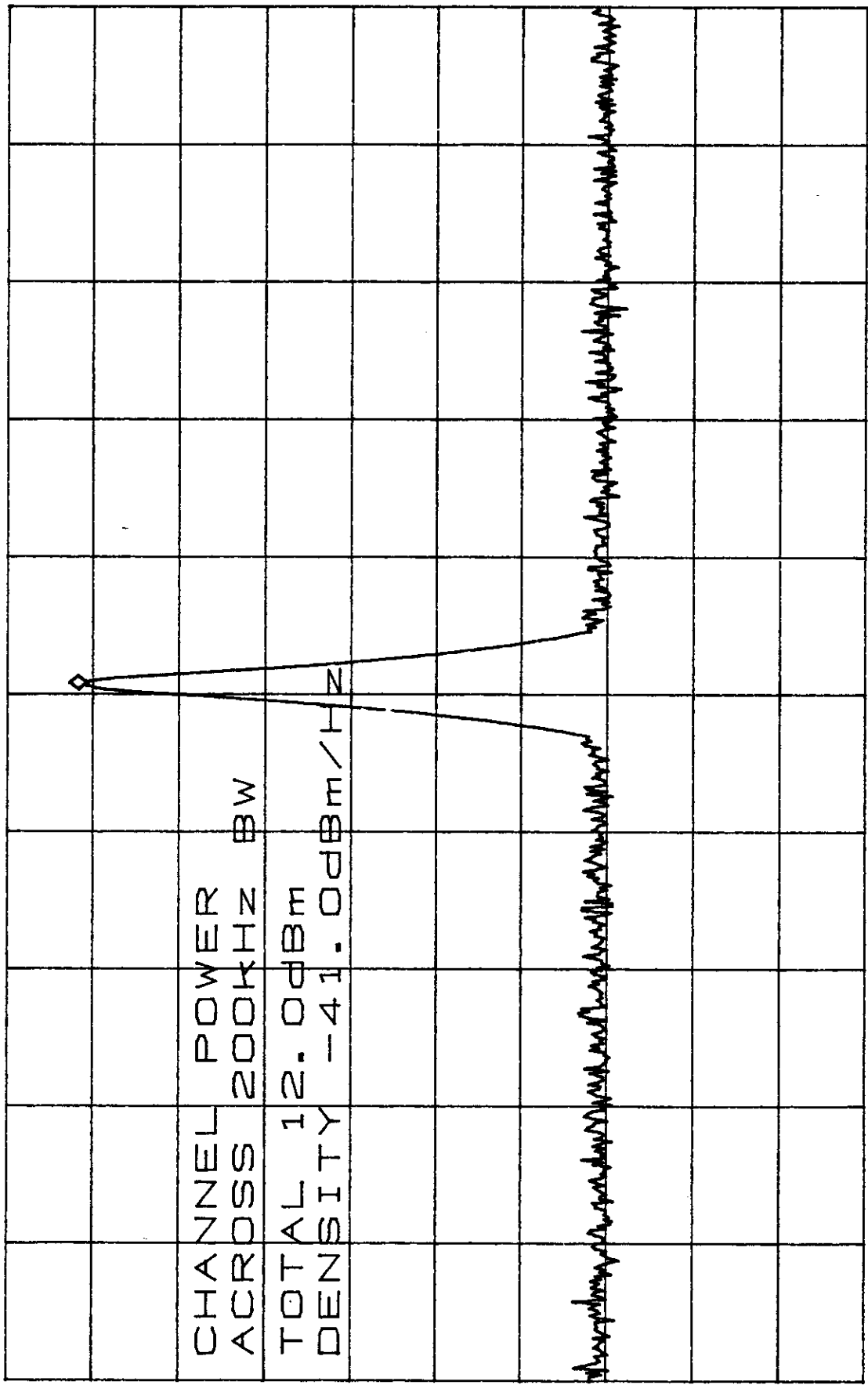
*ATTEN 30dB (Set A is off) MKR 10.67dBm

RL 20.0dBm 10dB/ 1.949842GHz

3-tone

CASE 1

CHANNEL POWER
ACROSS 200KHZ BW
TOTAL 12.0dBm
DENSITY -41.0dBm/Hz



CENTER 1.949800GHz

SPAN 5.000MHz

*RBW 30KHz

*VBW 30KHz

SWP 50.0ms

DL Inputs:

** 1945.2 MHz
1946.2 MHz
1949.8 MHz

Levels of Input Frequencies
D-band

10/1/98
LB45800 PCS

*ATTEN 30dB

MKR 5.67dBm

RL 20.0dBm

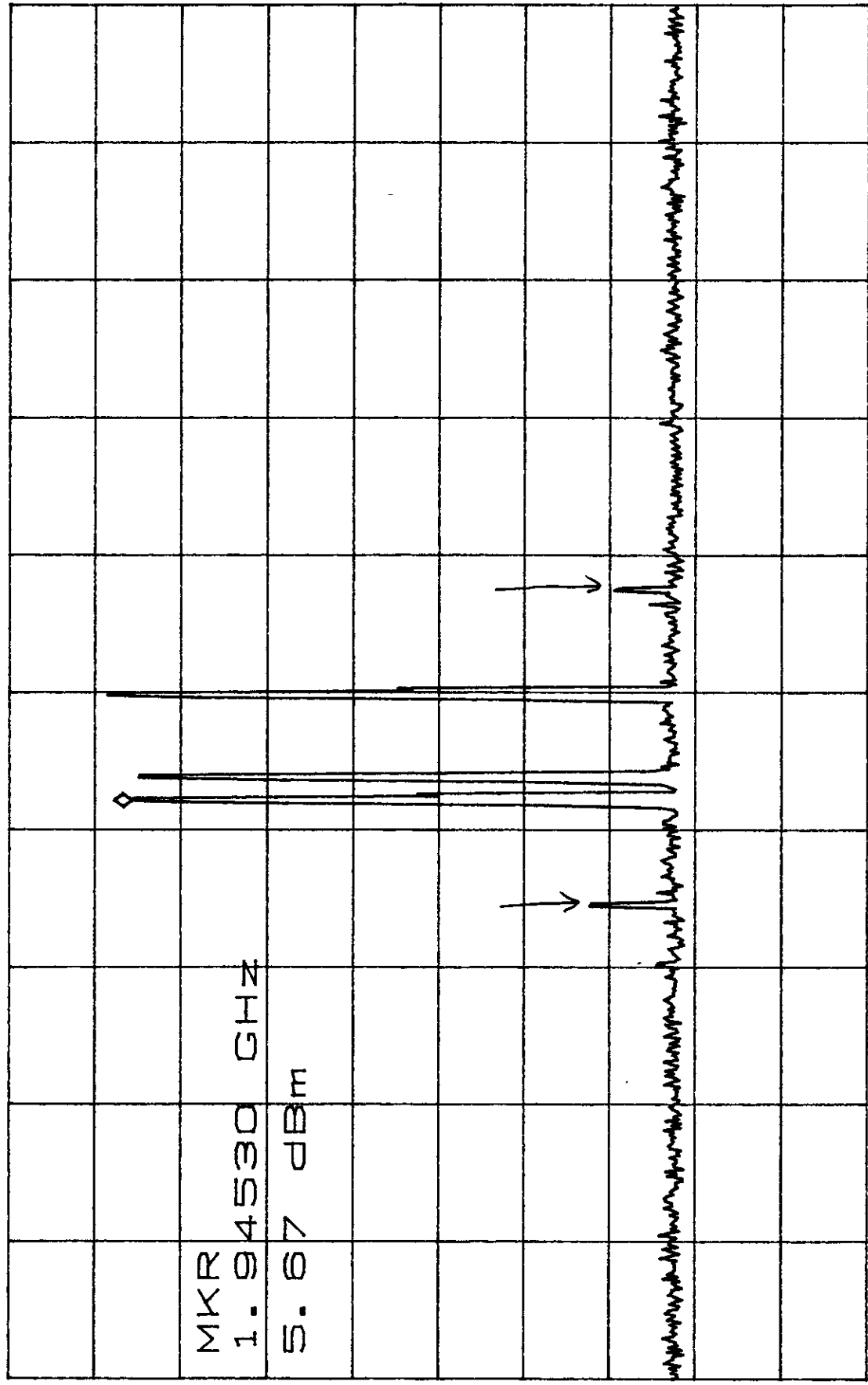
10dB / 1.94530GHZ

3-tone

case 1

MKR
1.94530 GHz

5.67 dBm



START 1.92000GHZ

STOP 1.98000GHZ

*RBW 30KHZ

*VBW 30KHZ

SWP 170ms

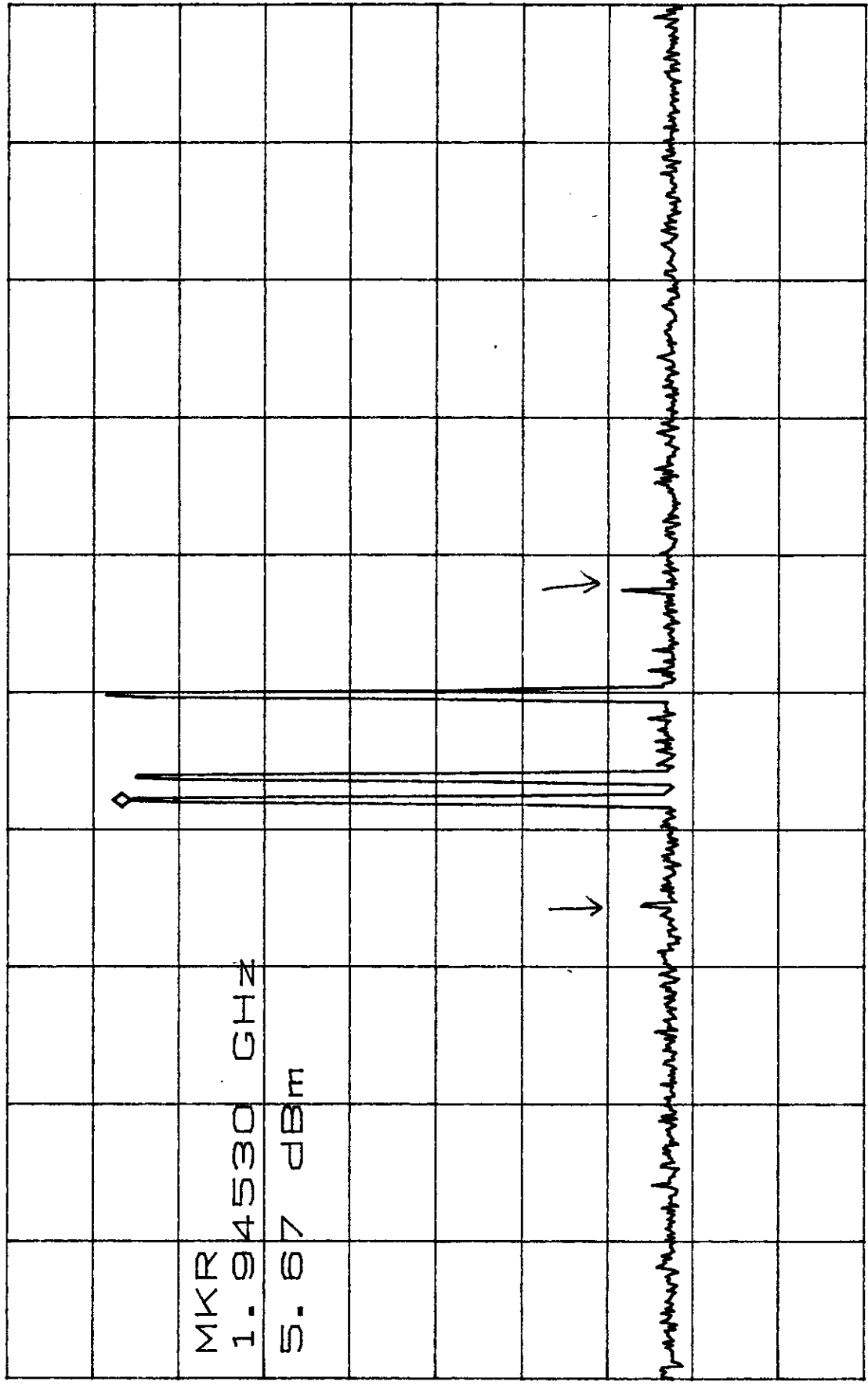
** Amplifier used as in original measurement. Amp model: MiniCircuits ZFL2000 (+20dB)
Plot shown to note intermod boost due to amplifier (see next plot).

10/1/98
LB45800 PCS

Levels of Input Frequencies
D-band

DL Inputs: ** 1945.2 MHz
1946.2 MHz
1949.8 MHz

*ATTEN 30dB MKR 5.67dBm
RL 20.0dBm 10dB/ 1.94530GHz



START 1.920000GHZ STOP 1.980000GHZ
*RBW 30KHZ *VBW 30KHZ SWP 170ms
*** No Amplifier used (input level boosted to same level as with amplifier on generator)
Note reduction in intermod

DL Inputs: ** 1945.2 MHz
1946.2 MHz
1949.8 MHz

Intermods Over
D-band

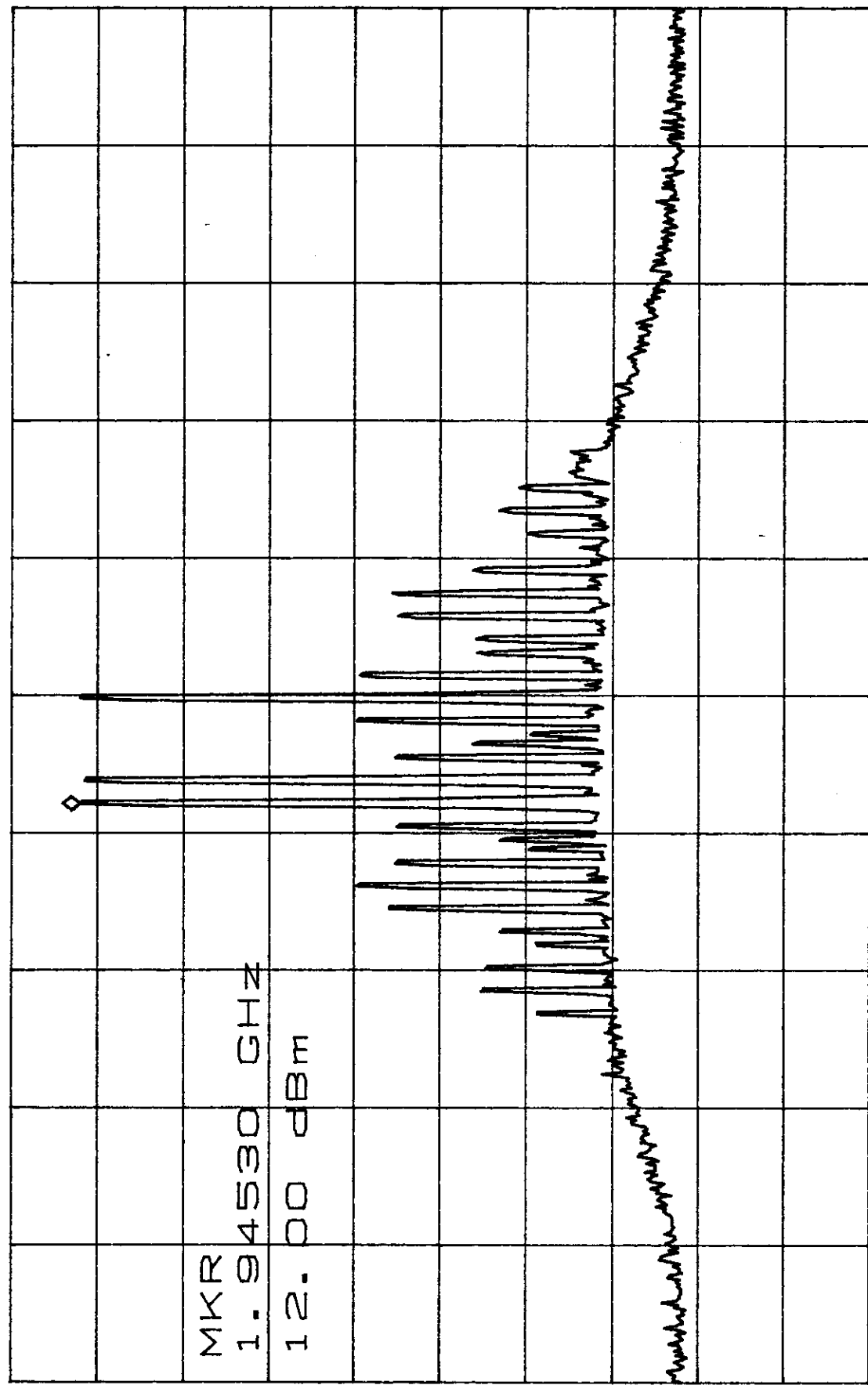
10/1/98

LB45800PCS

Note: Each individual input frequency set to get
+12dBm output.

*ATTEN 30dB
RL 20.0dBm
MKR 12.00dBm
1.94530GHZ
10dB/

3-tone
Case 2



START 1.92000GHZ STOP 1.98000GHZ
*RBW 30KHZ *VBW 30KHZ SWP 170ms

** Amplifier used on 1945.2 MHz signal source in order to increase
input level (two 2:1 combiners used) to get required output

DL Inputs:

** 1945.2 MHz
1946.2 MHz
1949.8 MHz

Intermod over
D-band

(DeHa)

10/1/98

LB45800PCS

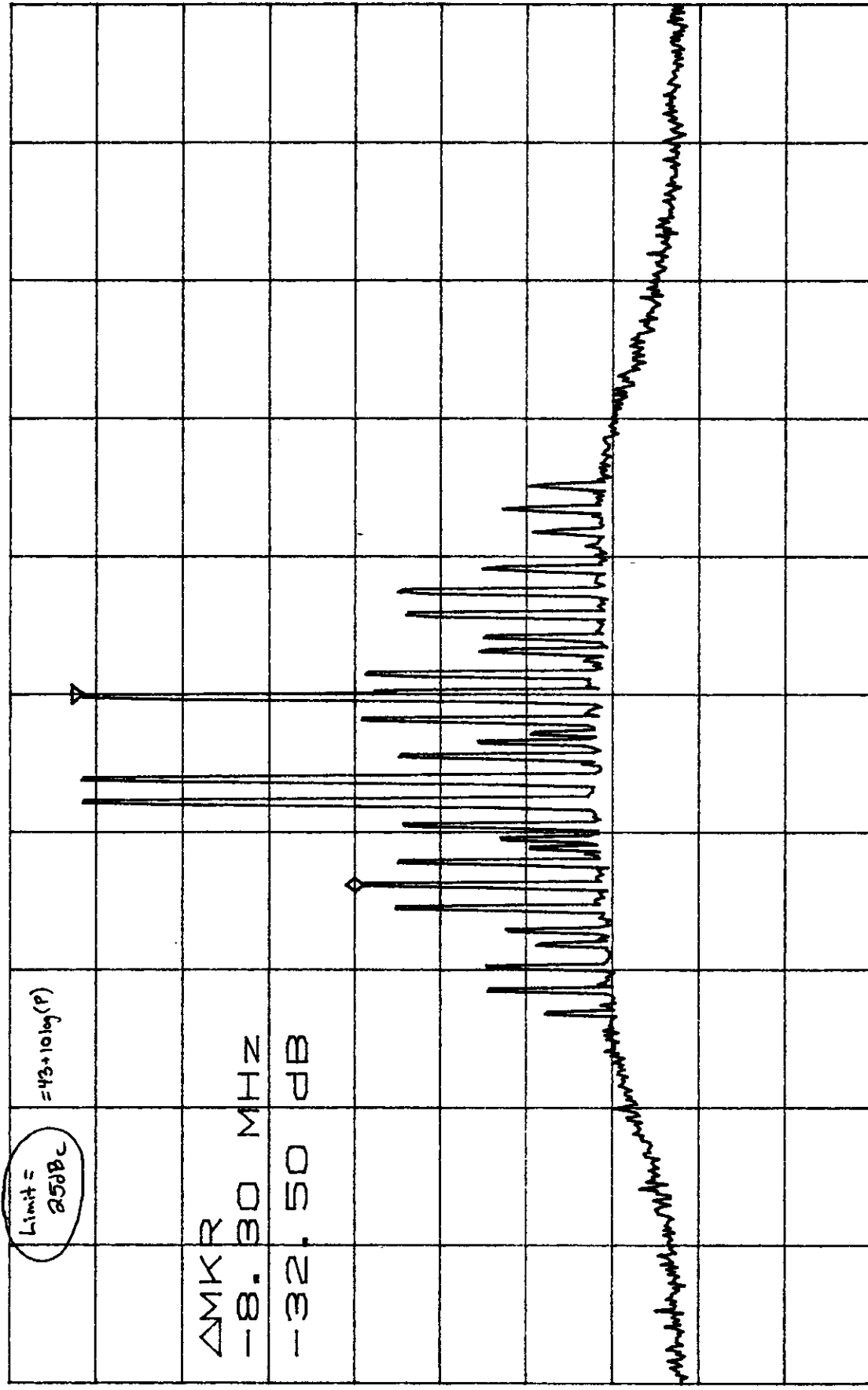
Note: Each individual input freq set to get
+12 dBm output.

* ATTEN 30dB

RL 20.0dBm

ΔMKR -32.50dB

10dB/ -8.30MHz



3-tone

case 2

START 1.92000GHZ

STOP 1.98000GHZ

* RBW 30KHZ

* VBW 30KHZ

SWP 170ms

** Amp used on this frequency in order to increase input level
(L. 2.1 combiners used)

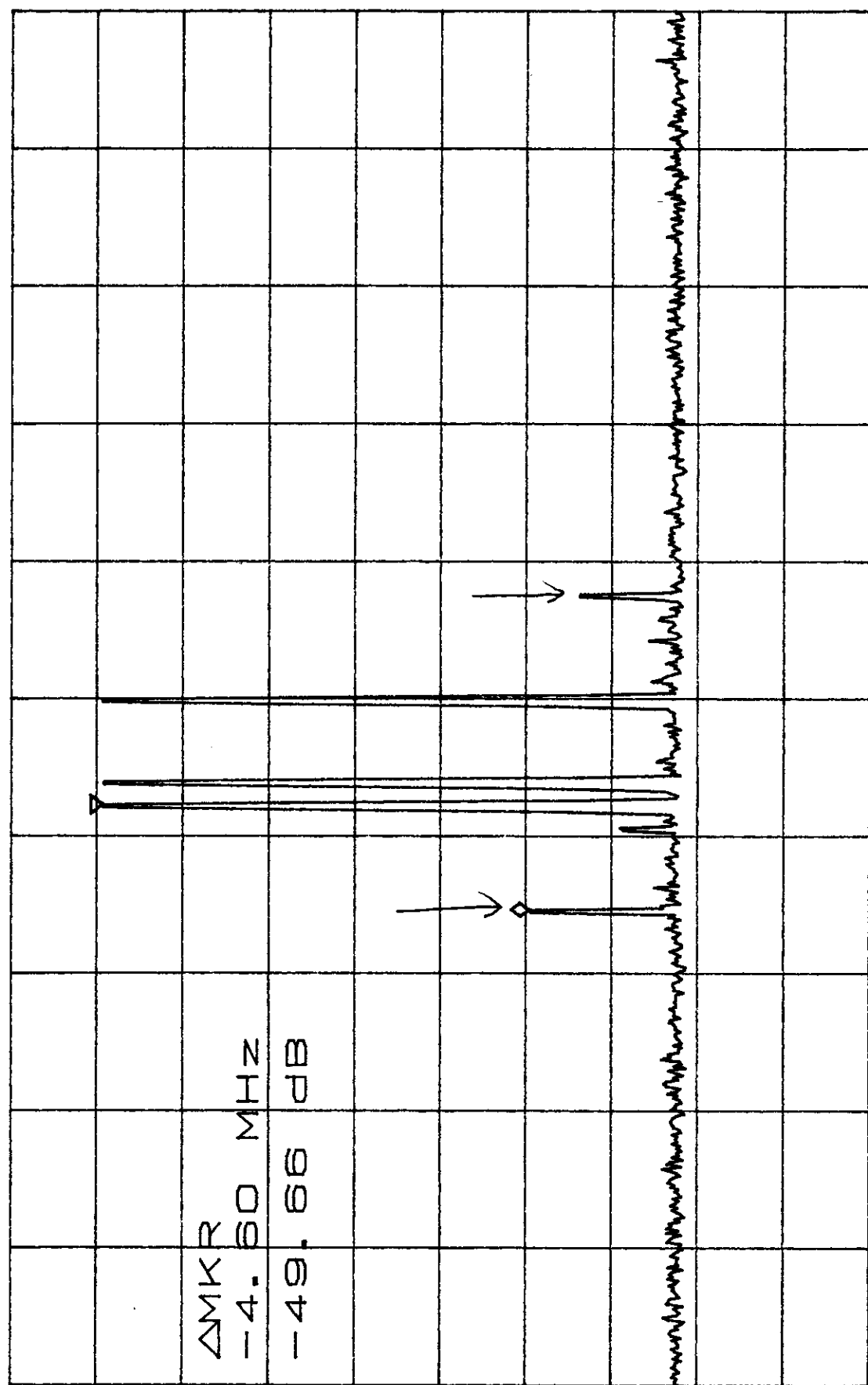
10/1/98
LB45800PCS

Levels of Input Frequencies
D-band

DL Inputs: ** 1945.2 MHz
1946.2 MHz
1949.8 MHz

*ATTEN 30dB CW-sources ΔMKR -49.66dB
RL 20.0dBm 10dB/ -4.60MHz

3-tone
Case 2



START 1.92000GHZ STOP 1.98000GHZ
*RBW 30KHZ *VBW 30KHZ SWP 170ms
** Amp used on this frequency. Model: MiniCircuit, ZFL-2000 (+20dB gain)
Note how Amp boosts intermods (see next graph)

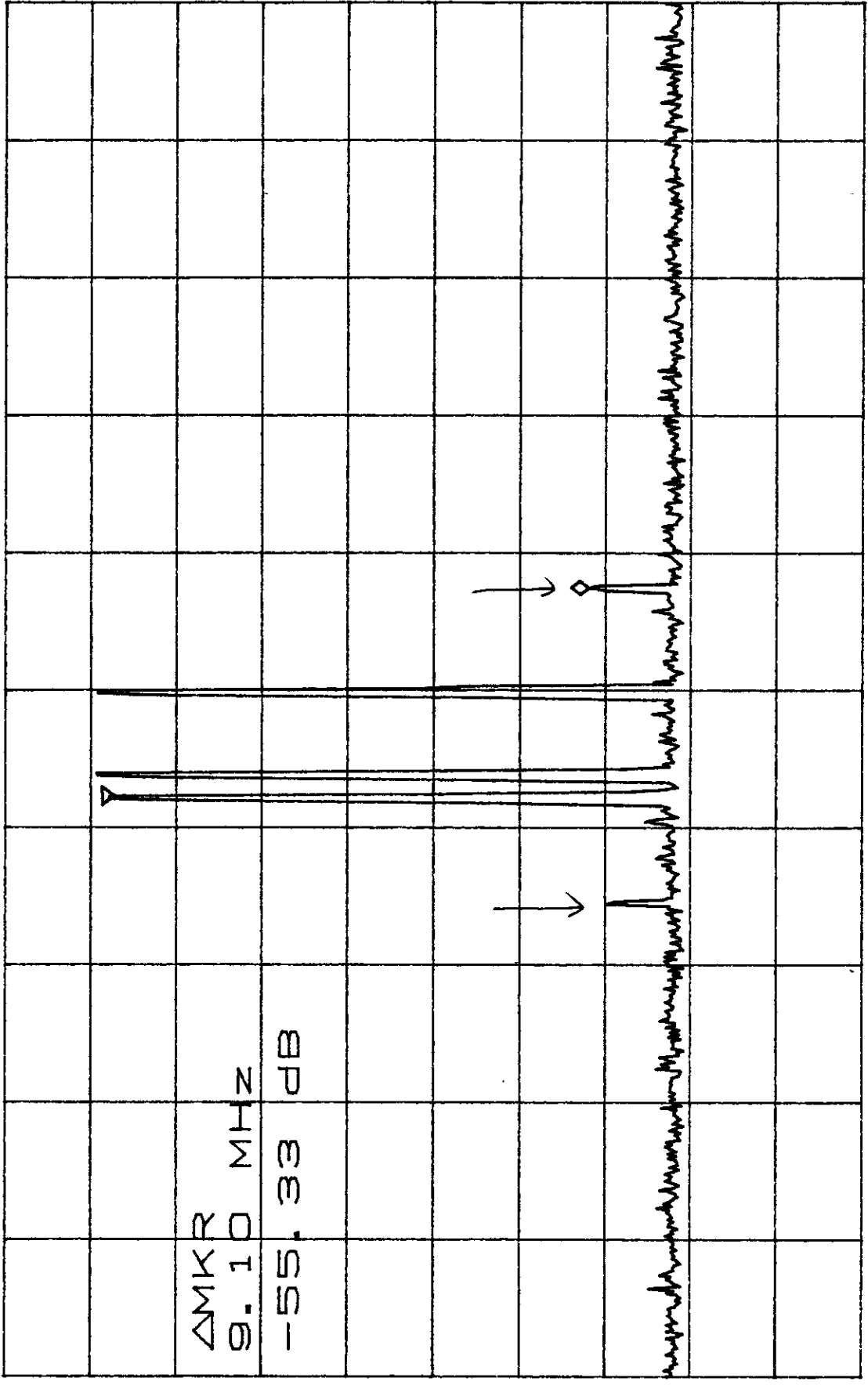
DL Inputs: ** 1945.2 MHz
 1946.2 MHz
 1949.8 MHz

Levels of Input Frequencies
 D-band

10/1/98
 LBH 5800PCS

*ATTEN 30dB CW-source ΔMKR -55.33dB
 RL 20.0dBm 10dB/ 9.10MHz

3-tone
 case 2



START 1.92000GHZ STOP 1.98000GHZ
 *RBW 30KHZ *VBW 30KHZ SWP 170ms

** No Amplifier used (input level set to the maximum the signal generator can output).
 Note reduction in intermods. The signal generator falls ~1.5dB short.