

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.

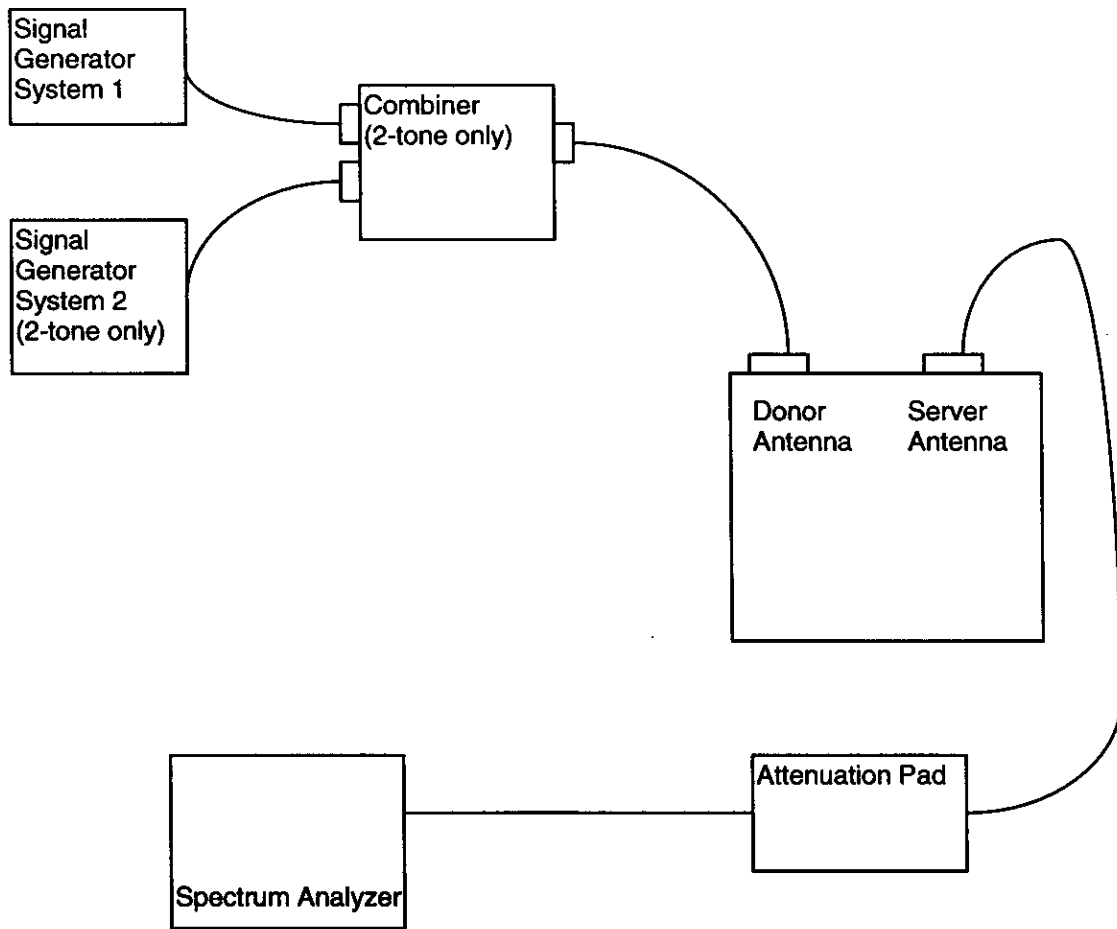
Tests performed for D-band

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

DL Low  
D-band

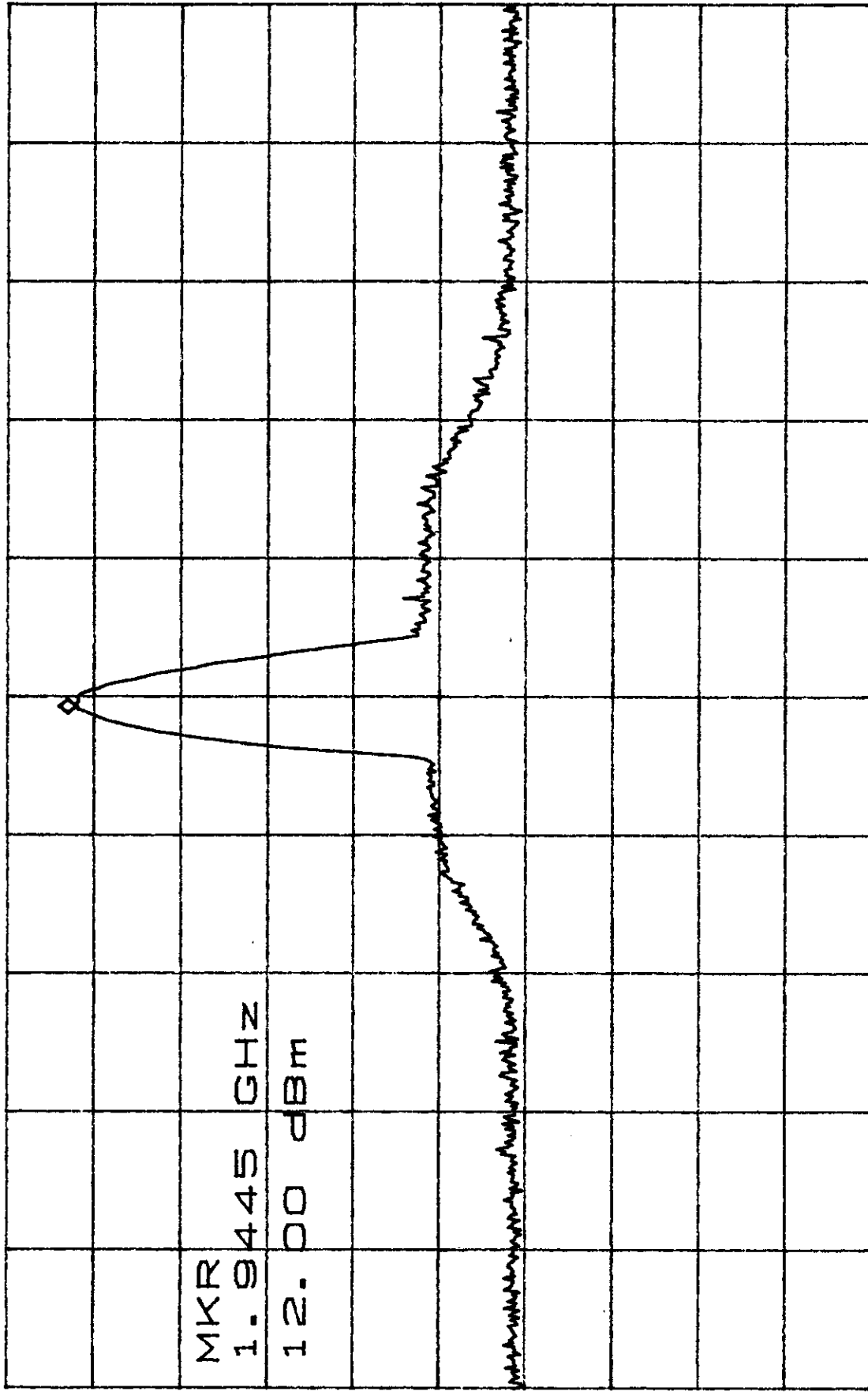
10/1/98  
LB45800PCS

Output

CW SOURCE

ATTEN 30dB  
RL 20.00dBm

MKR 12.00dBm  
1.9445GHZ



2.985

D R

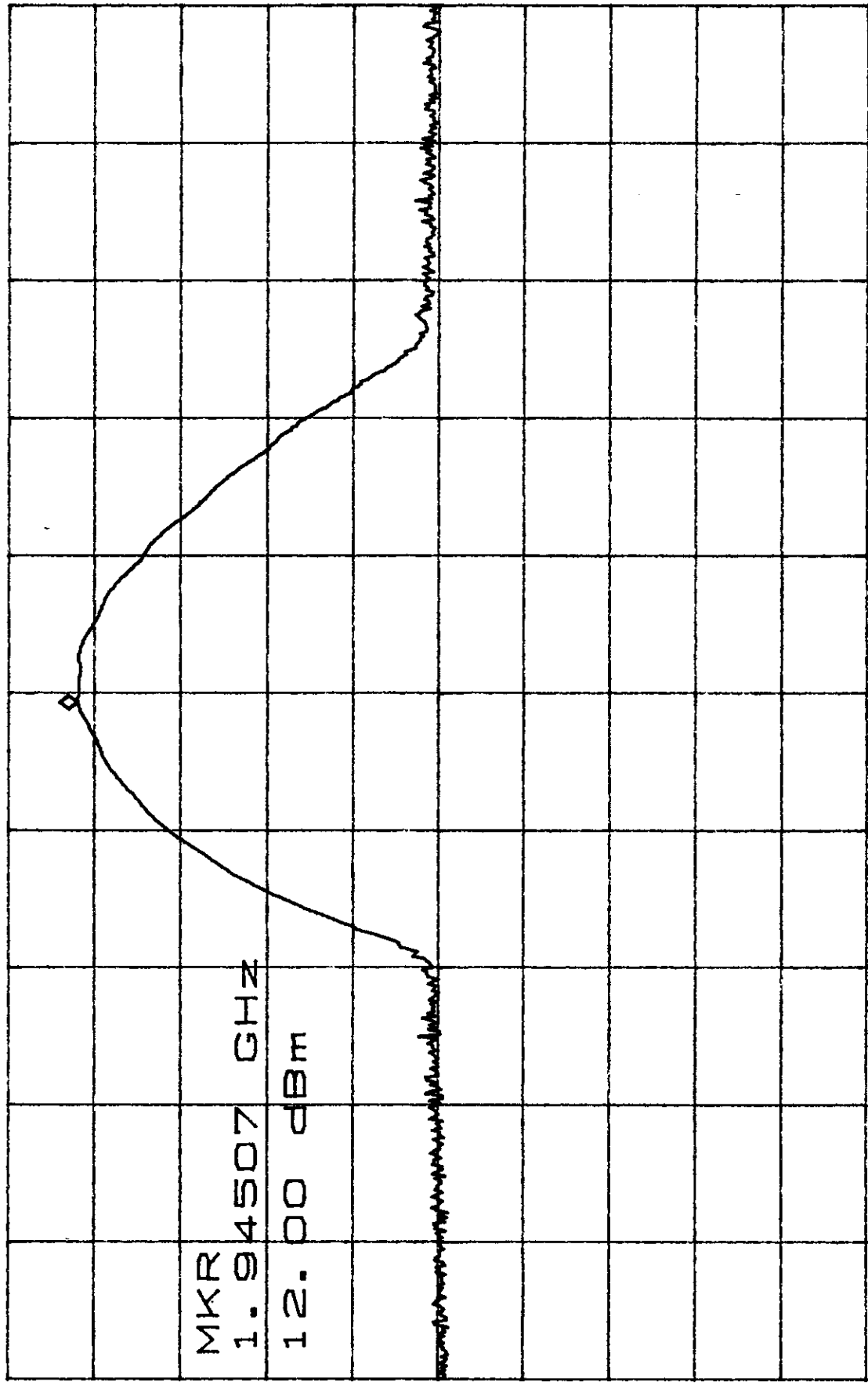
CENTER 1.9452GHZ SPAN 100.0MHz  
\*RBW 2.0MHz VBW 3.0MHz SWP 50.0ms

10/1/98  
LB45800PCS

DL Low  
P-band

Output  
CW source

ATTEN 30dB MKR 12.00dBm  
RL 20.00dBm 1.94507GHZ



2.985

D R

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

DL Mid  
D-band

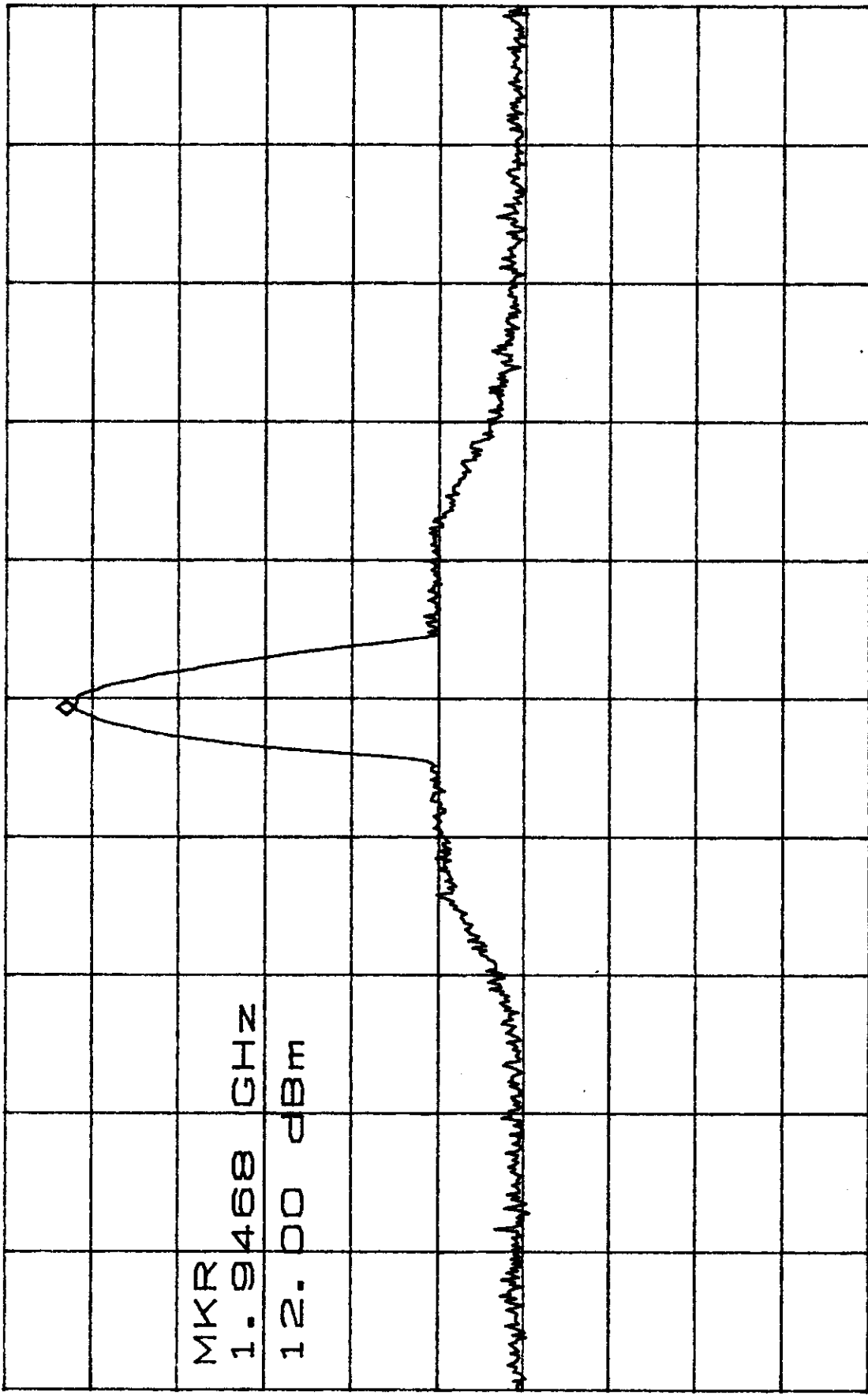
10/1/98  
LBY580PCS

Output  
CW Source

ATTEN 30dB  
RL 20.0dBm

MKR 12.00dBm  
1.9468GHZ

10dB/



MKR  
1.9468 GHZ  
12.00 dBm

D R

2.985

CENTER 1.9475GHZ SPAN 100.0MHZ  
\*RBW 2.0MHZ VBW 3.0MHZ SWP 50.0ms

DL Mid  
P-band

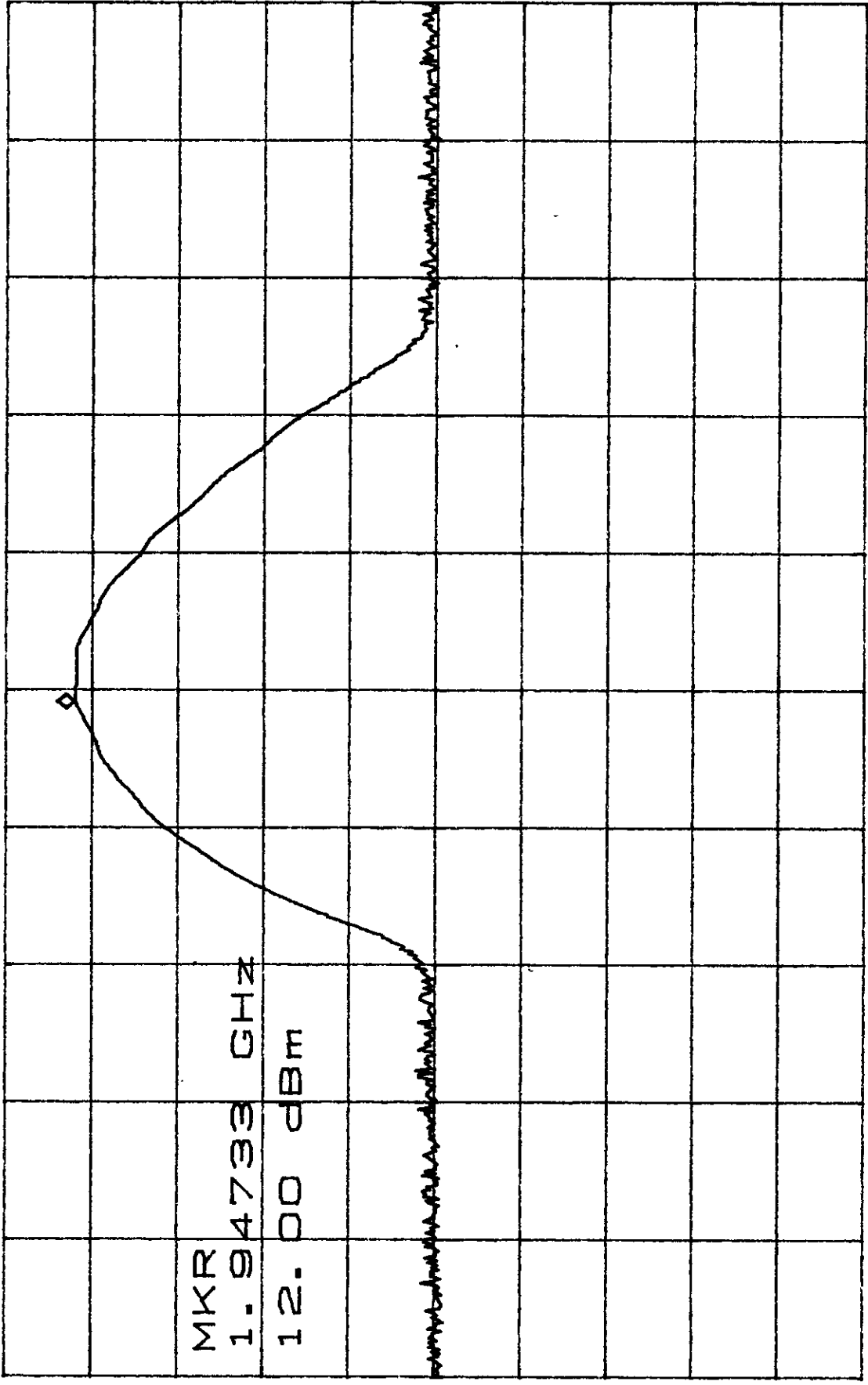
10/1/98  
LB45800PCS

Output  
CUR-SOURCE

ATTEN 30dB  
RL 20.0dBm

MKR 12.00dBm  
1.94733GHZ

10dB/



2.985

D R

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

DL High  
D-band

Output

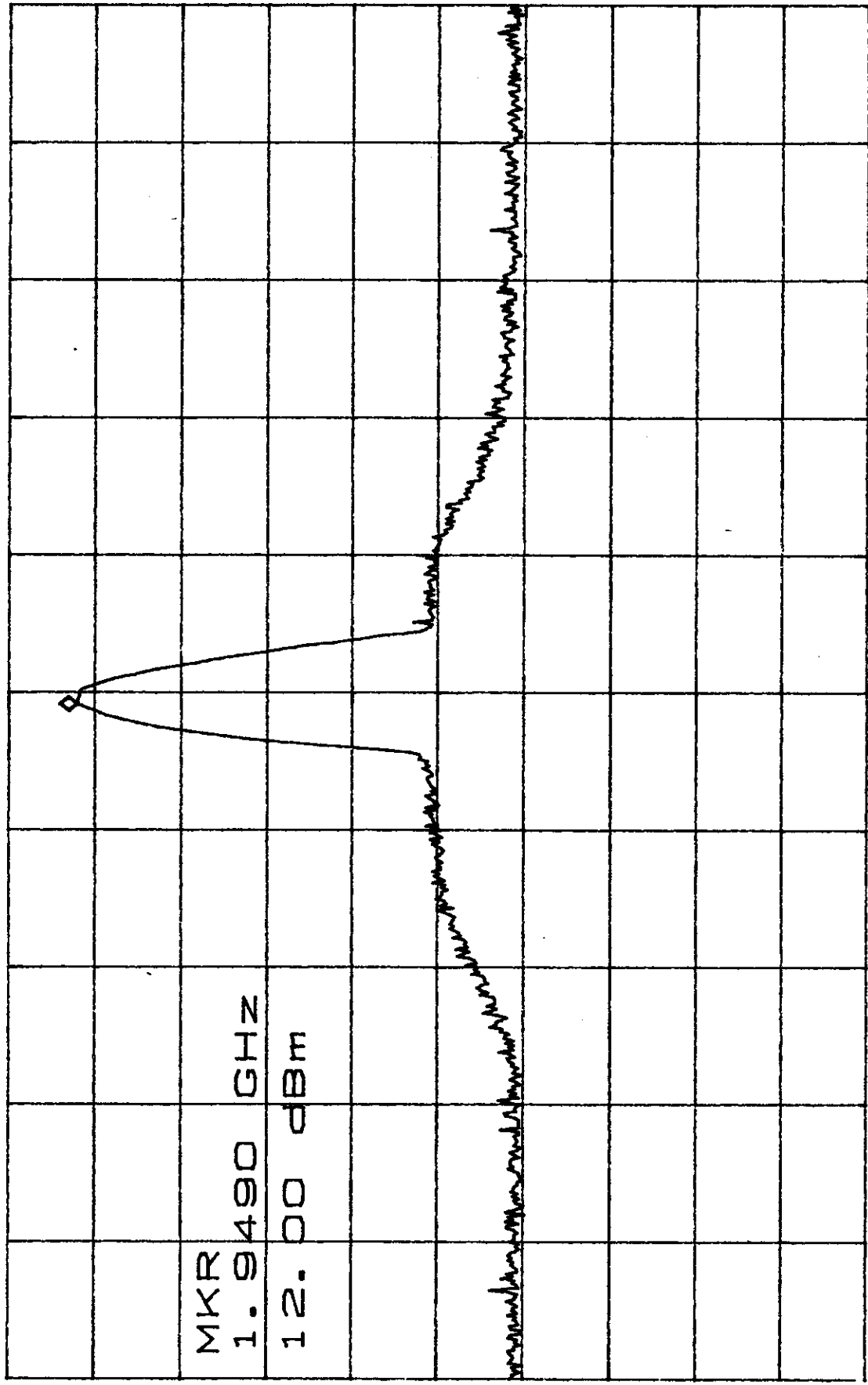
10/1/98  
LB4580PCS

CW - Source

ATTEN 30dB  
RL 20.0dBm

MKR 12.00dBm  
1.9490GHZ

10dB/



2.985

MKR  
1.9490 GHZ  
12.00 dBm

D R

CENTER 1.9498GHZ SPAN 100.0MHZ  
\*RBW 2.0MHZ VBW 3.0MHZ SWP 50.0ms

DL High  
D-band

10/1/98  
LB45800PCS

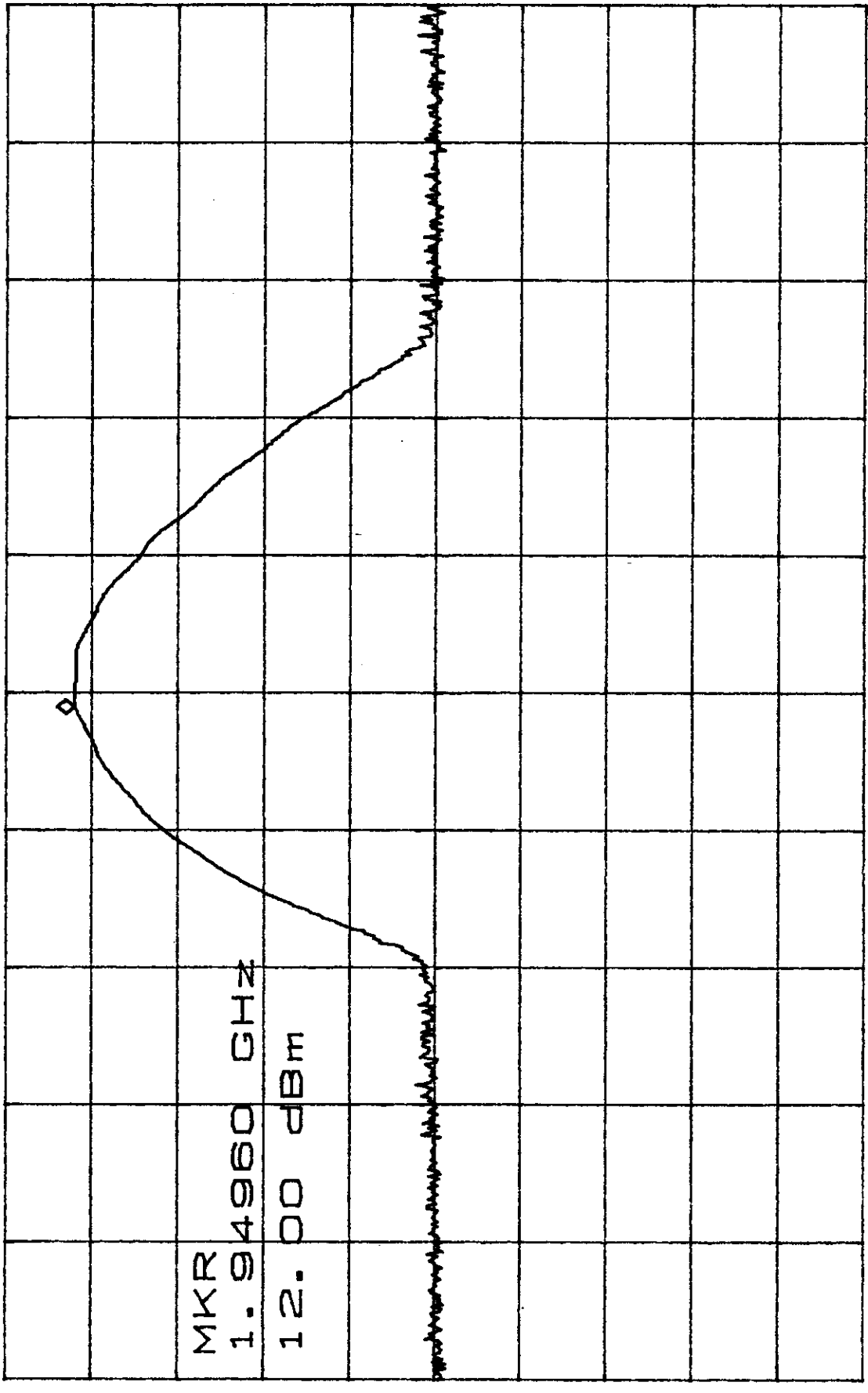
Output  
CW source.

ATTEN 30dB  
RL 20.00dBm

MKR 12.00dBm  
1.94960GHZ

2.985

MKR  
1.94960 GHZ  
12.00 dBm



D R

CENTER 1.94980GHZ SPAN 20.00MHZ  
\*RBW 2.0MHZ VBW 3.0MHZ SWP 50.0ms



DL High  
D-band

10/1/97B  
LB 45800 PCS

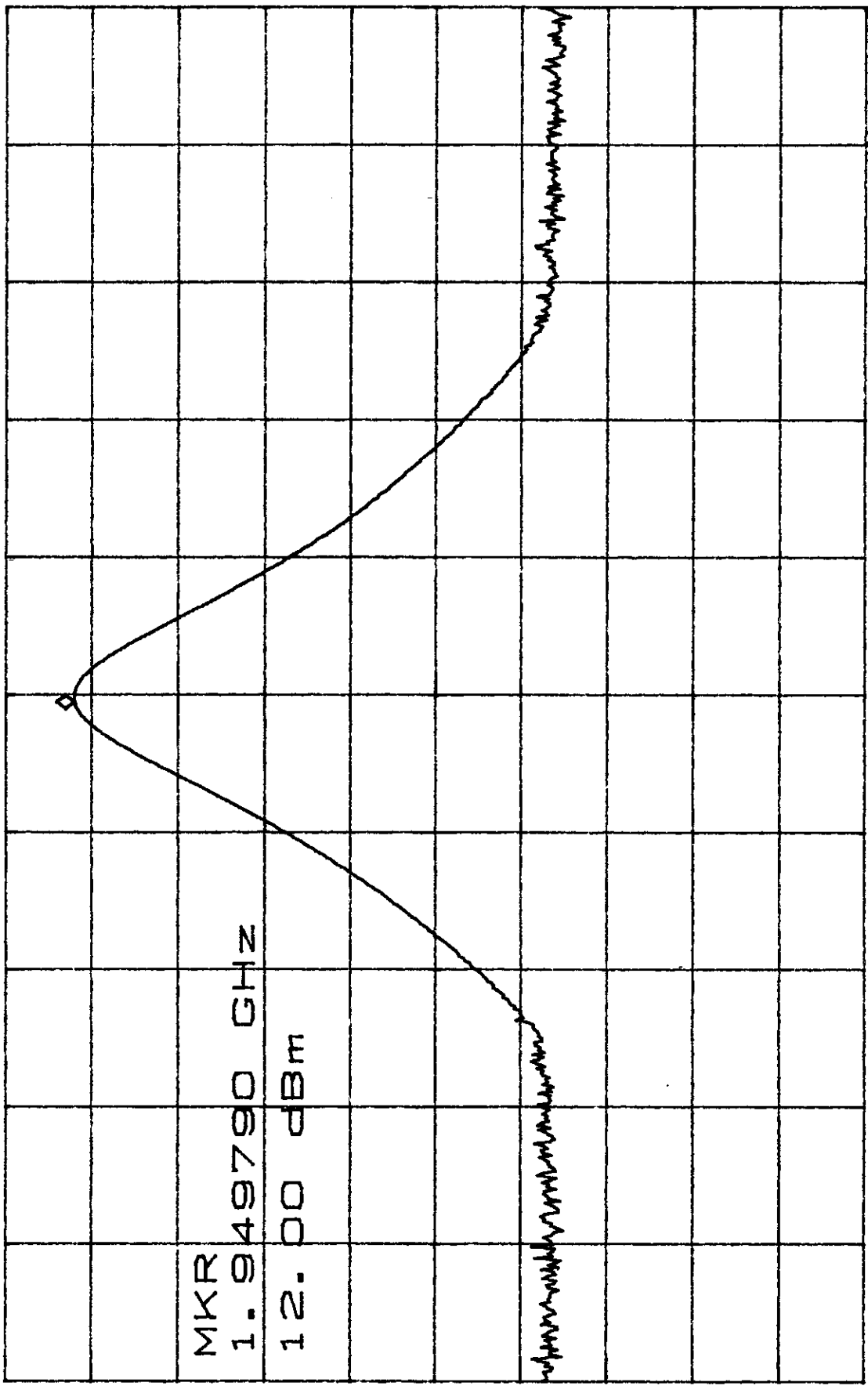
Occupied BW  
CW source

ATTEN 30dB  
RL 20.0dBm

MKR 12.00dBm  
1.949790GHZ

2.989

MKR  
1.949790 GHZ  
12.00 dBm



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

DL Mid  
D-band

10/1/978  
LB45800PCS

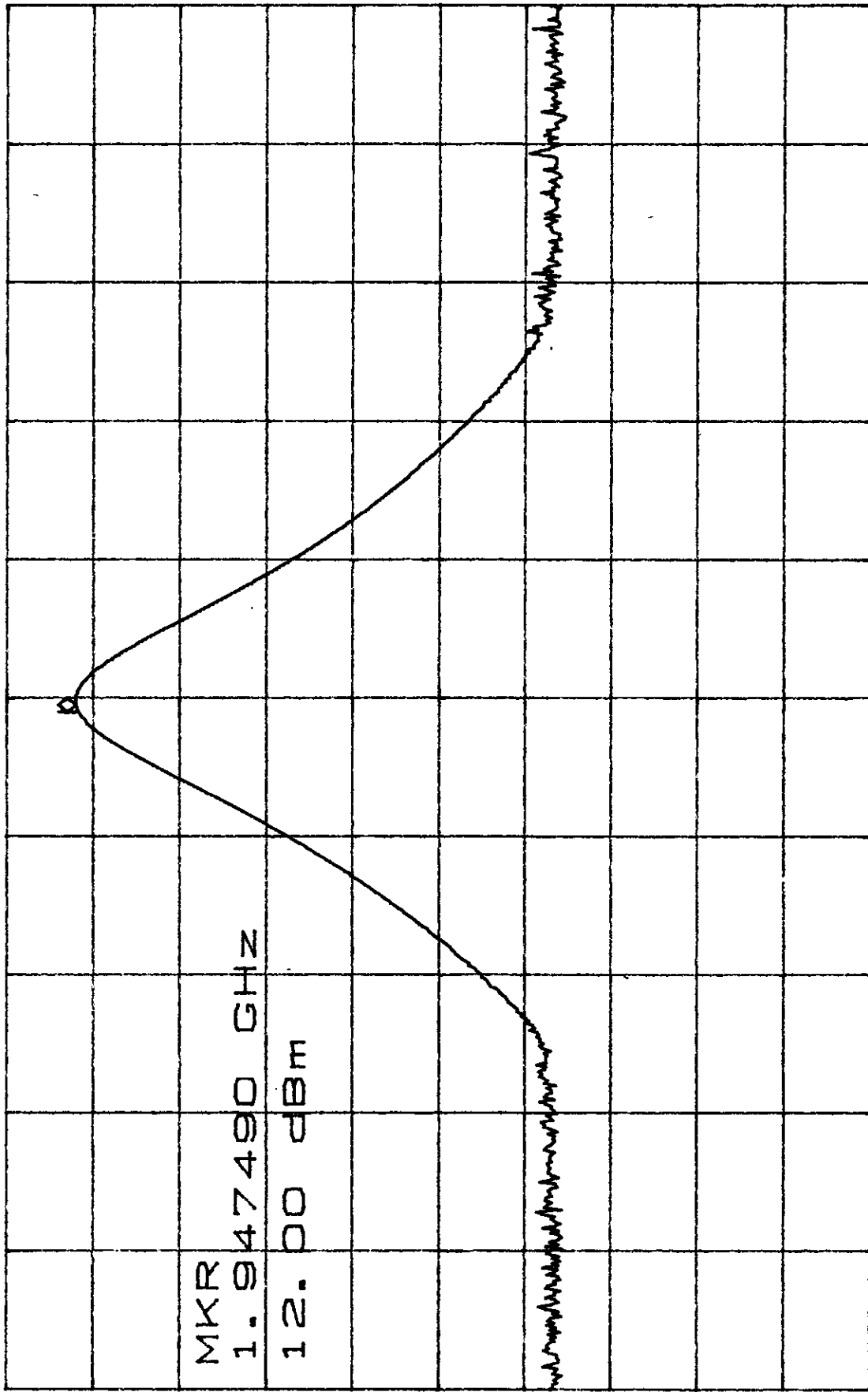
Occupied BW  
CW Source

ATTEN 30dB  
RL 20.0dBm

MKR 12.00dBm  
1.947490GHZ

2.989

MKR  
1.947490 GHZ  
12.00 dBm



CENTER 1.947500GHZ SPAN 2.000MHZ  
\*RBW 100KHZ VBW 100KHZ SWP 50.0ms

DL Low  
D-band

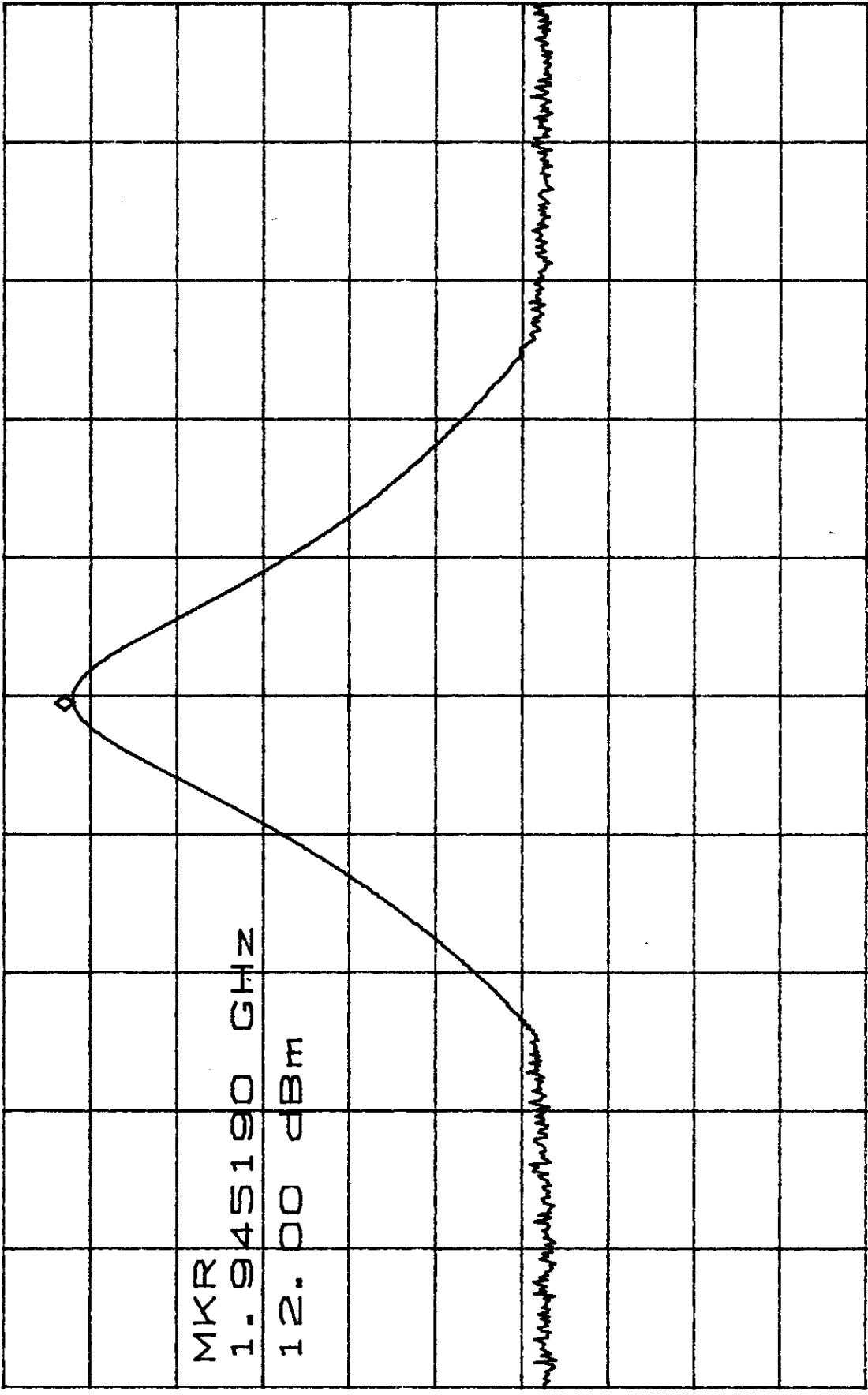
10/1/978  
LB45800PCS

Occupied BW  
CW Source

ATTEN 30dB  
RL 20.0dBm

MKR 12.00dBm  
1.945190GHZ

MKR  
1.945190 GHZ  
12.00 dBm



D R

2989

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

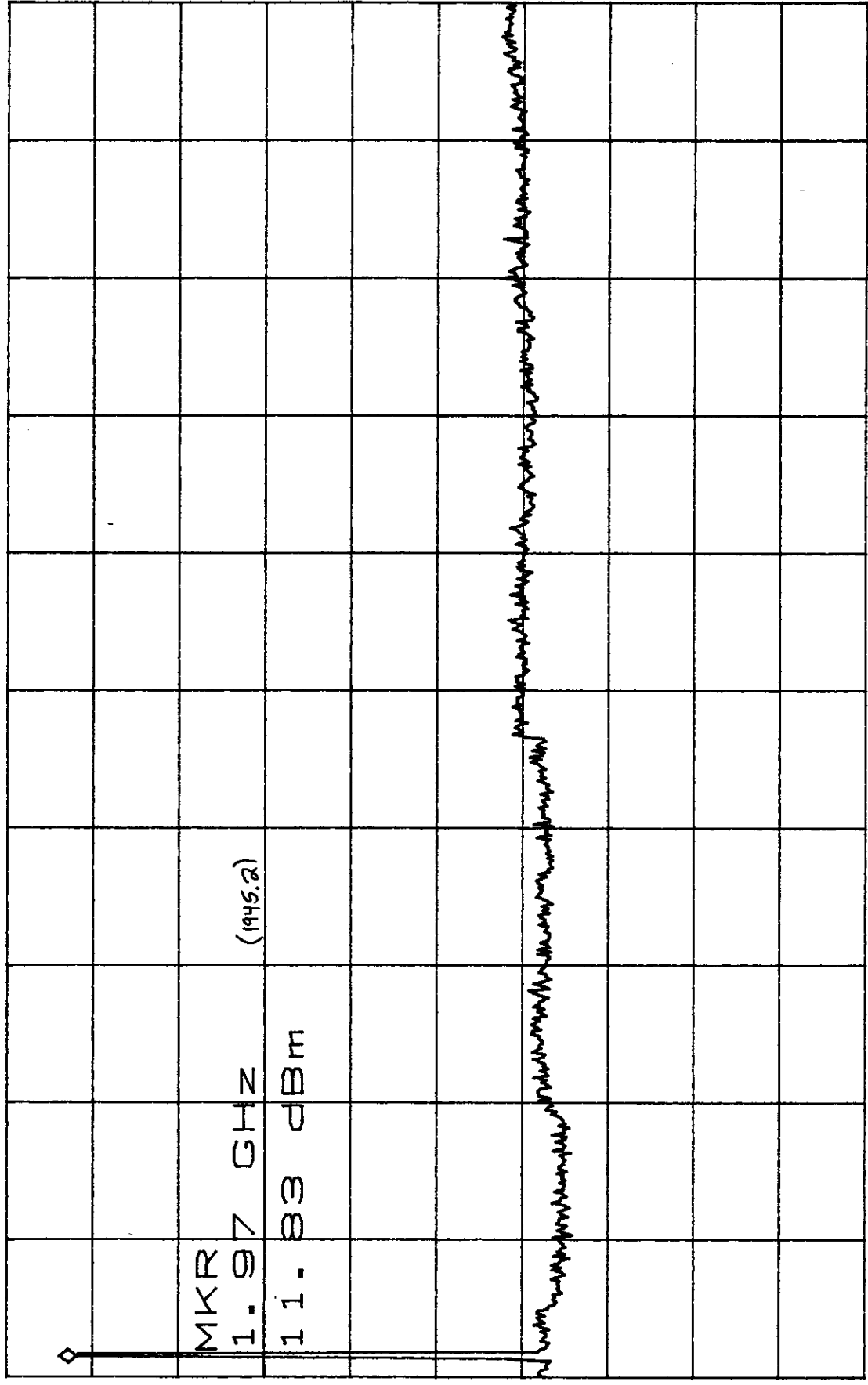
DL Low  
D-band

10/1/98

Spurs @ Antenna

LB45800 PCS

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



2.991

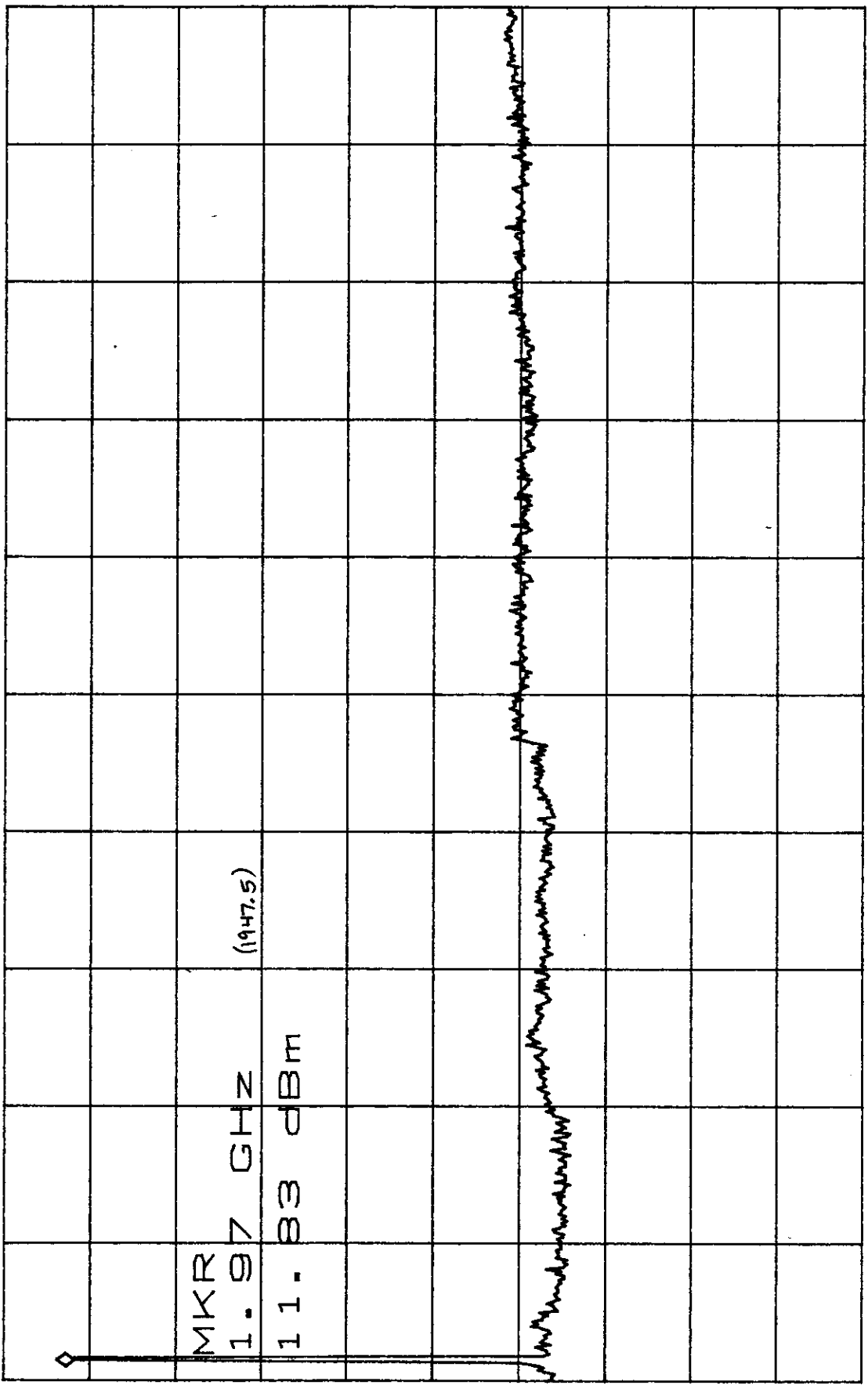
START 1.60GHz      STOP 26.50GHz  
RBW 1.0MHz      \*VBW 1.0MHz      SWP 500ms

DL Mid  
D-band

10/1/98  
LB45800PCS

Spurs @ Antenna

\*ATTEN 30dB      MKR 11.83dBm  
RL 20.0dBm      10dB/      1.97GHZ



2.991

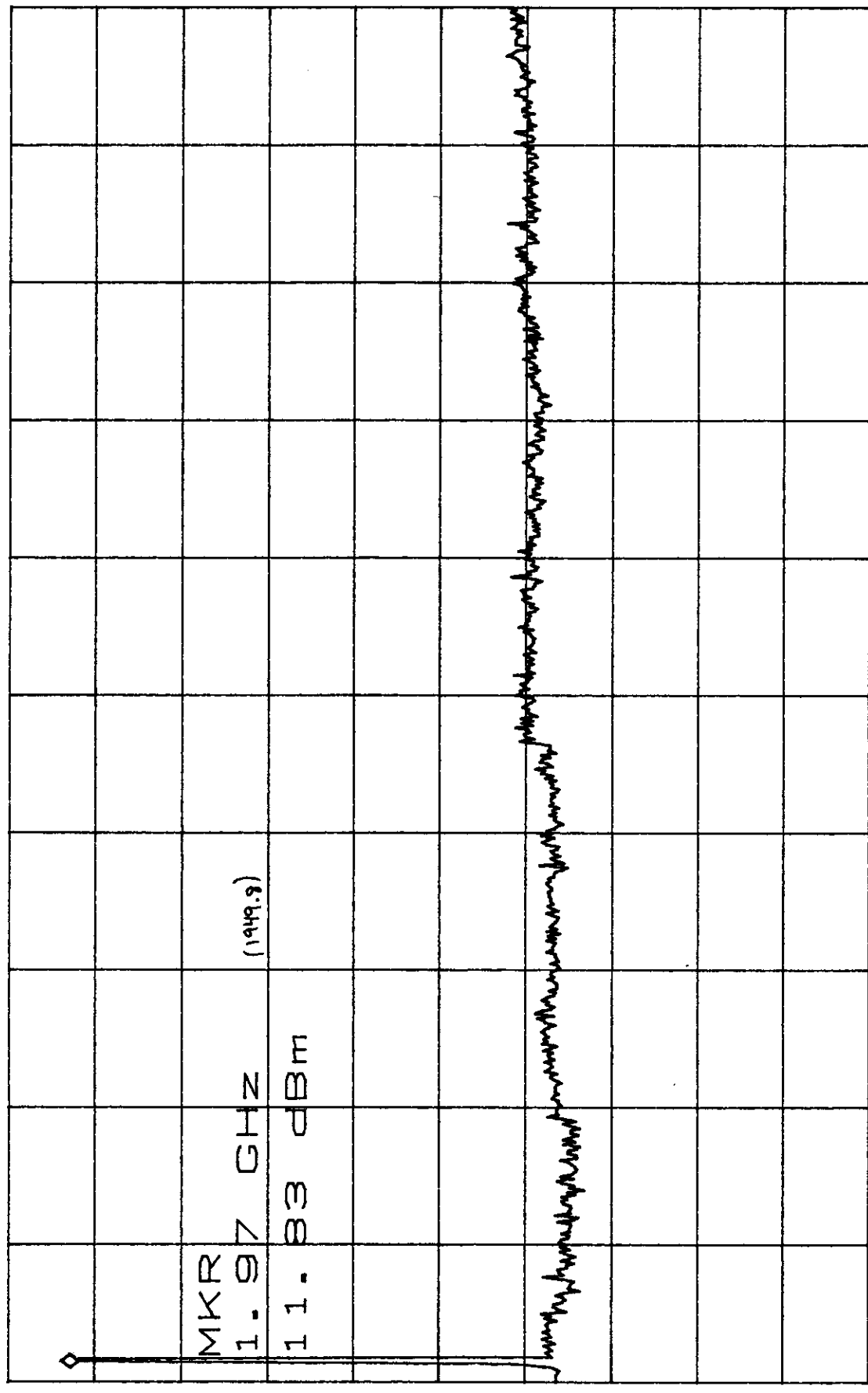
START 1.60GHZ      STOP 26.50GHZ  
\*RBW 1.0MHZ      \*VBW 1.0MHZ      SWP 500ms

DL High  
D-band

10/1/98  
LB45800PCS

Spurs @ Antenna  
CW source

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



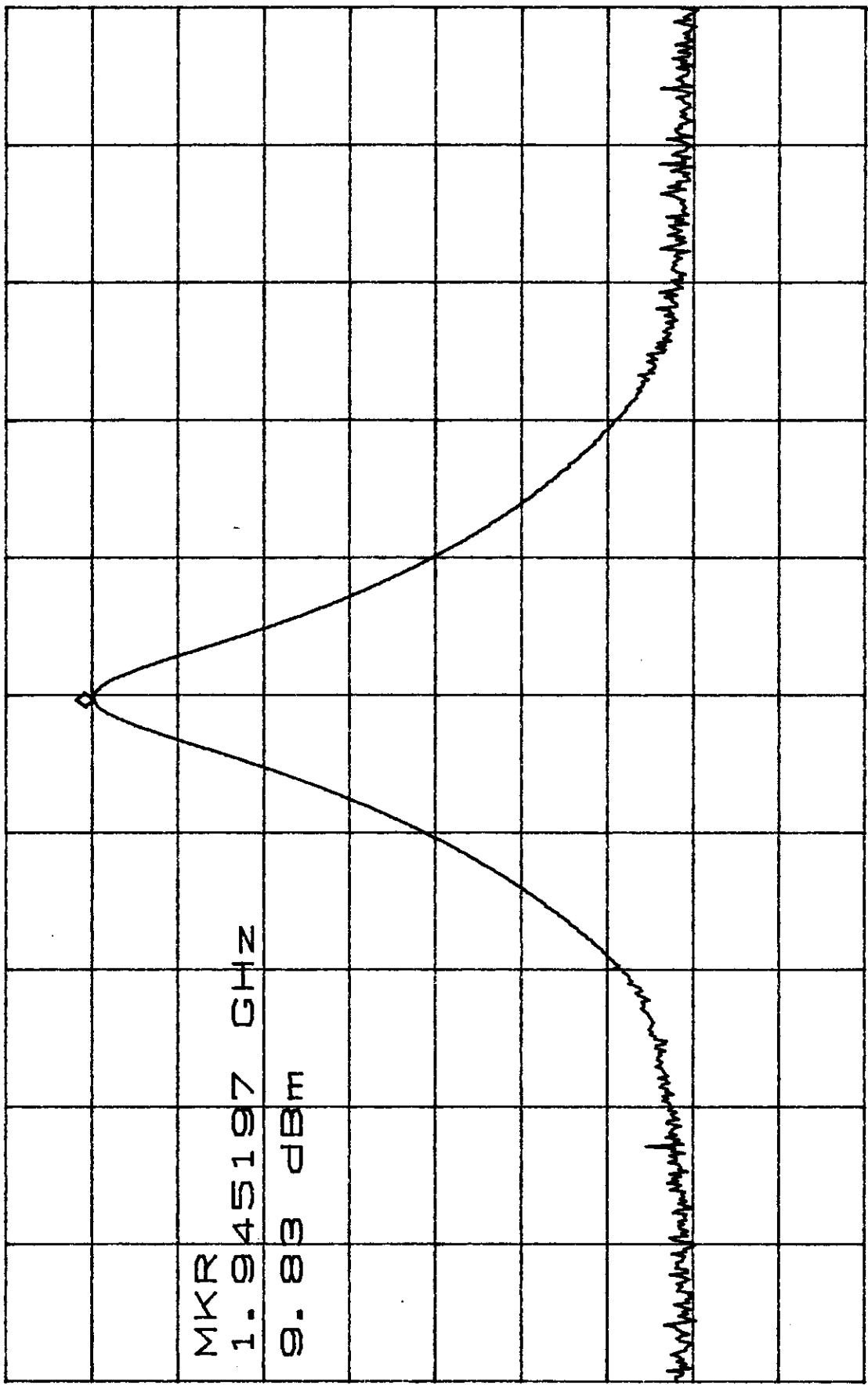
START 1.60GHz STOP 26.50GHz  
\*RBW 1.0MHz \*VBW 1.0MHz SWP 500ms

DL Low  
D-band

Input Signal Into Hub  
1:8 Splitter

10/1/98  
LB#5800PCS

ATTEN 30dB      MKR 9.83dBm  
RL 20.0dBm      10dB/      1.945197GHZ



MKR  
1.945197 GHz  
9.83 dBm

In/out

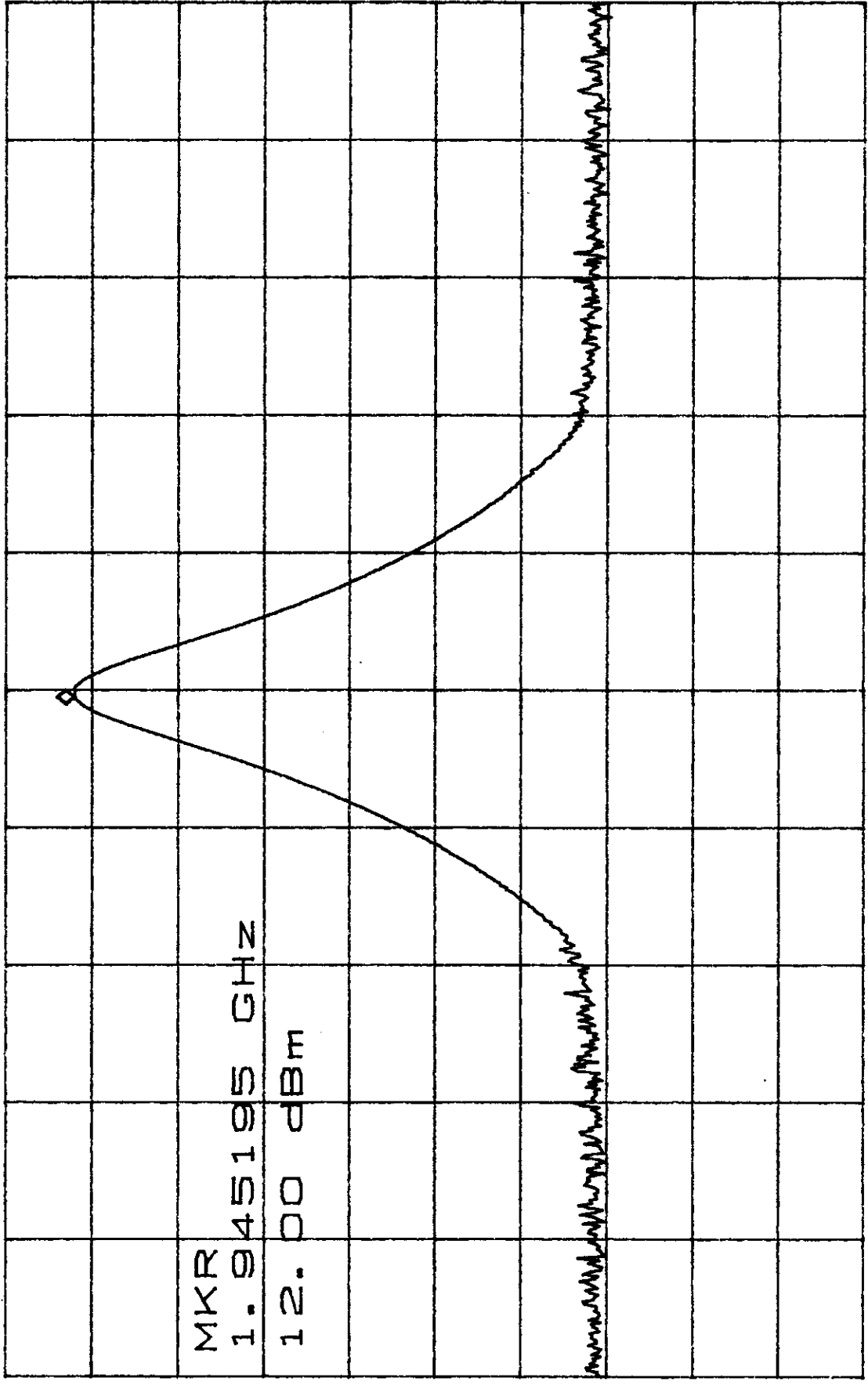
CENTER 1.945200GHZ      SPAN 1.000MHZ  
\*RBW 30kHz      \*VBW 30kHz      SWP 50.0ms

DL Low  
D-band

10/1/98  
LB4580PCS

Output Signal  
CW source

ATTEN 30dB      MKR 12.00dBm  
RL 20.00dBm    1.945195GHZ



In/out

D R

CENTER 1.945200GHZ      \*RBW 30kHz      \*VBW 30kHz      SPAN 1.000MHZ  
SWP 50.0ms

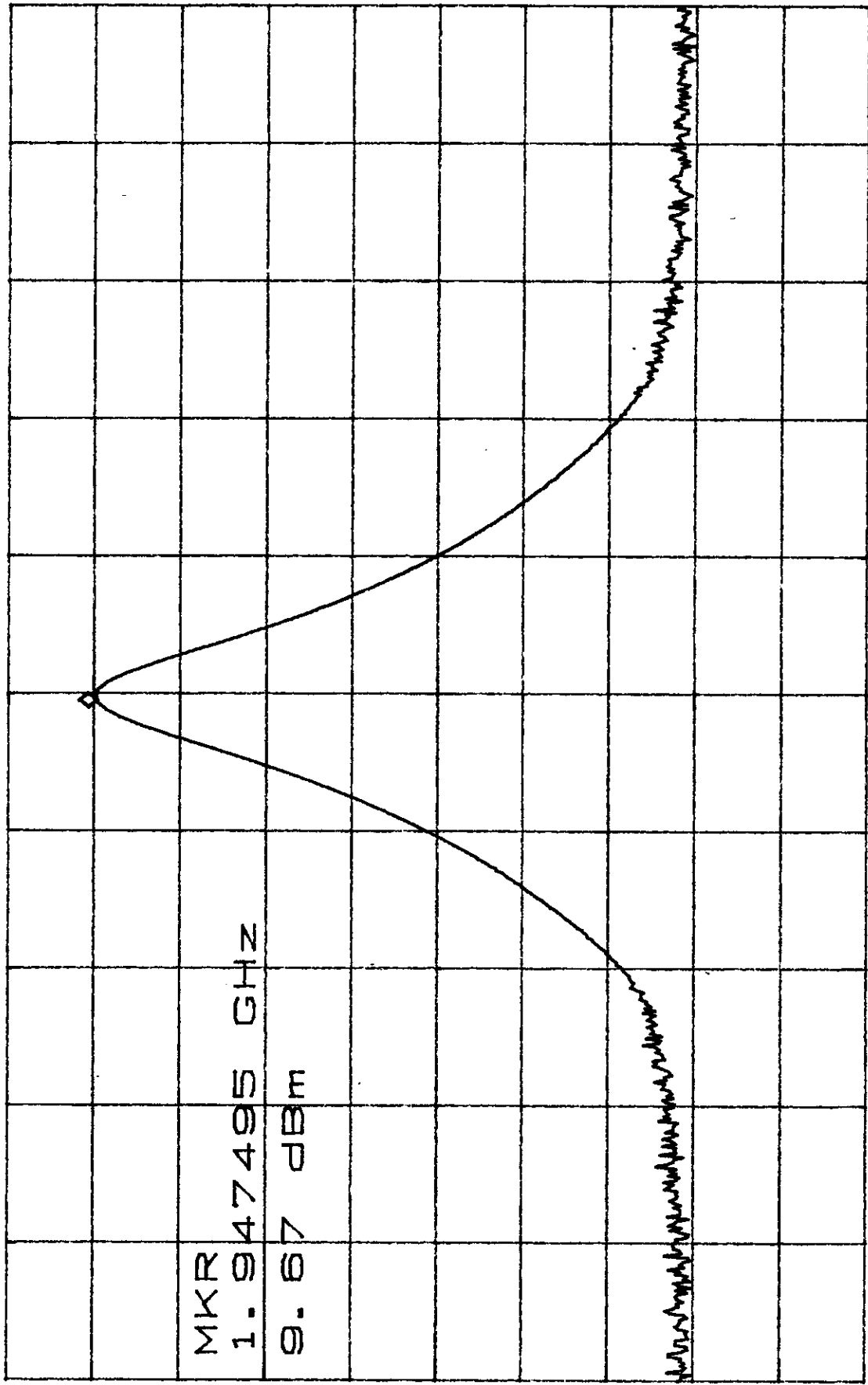


DL Mid  
D-band

Input Signal Into Hub  
1:8 Splitter

10/1/98  
LB45800PCS

ATTEN 30dB MKR 9.67dBm  
RL 20.0dBm 10dB/ 1.947495GHZ



In/out

MKR  
1.947495 GHz  
9.67 dBm

D

R

CENTER 1.947500GHZ SPAN 1.000MHZ  
\*RBW 30KHZ \*VBW 30KHZ SWP 50.0ms

DL Mid  
D-band

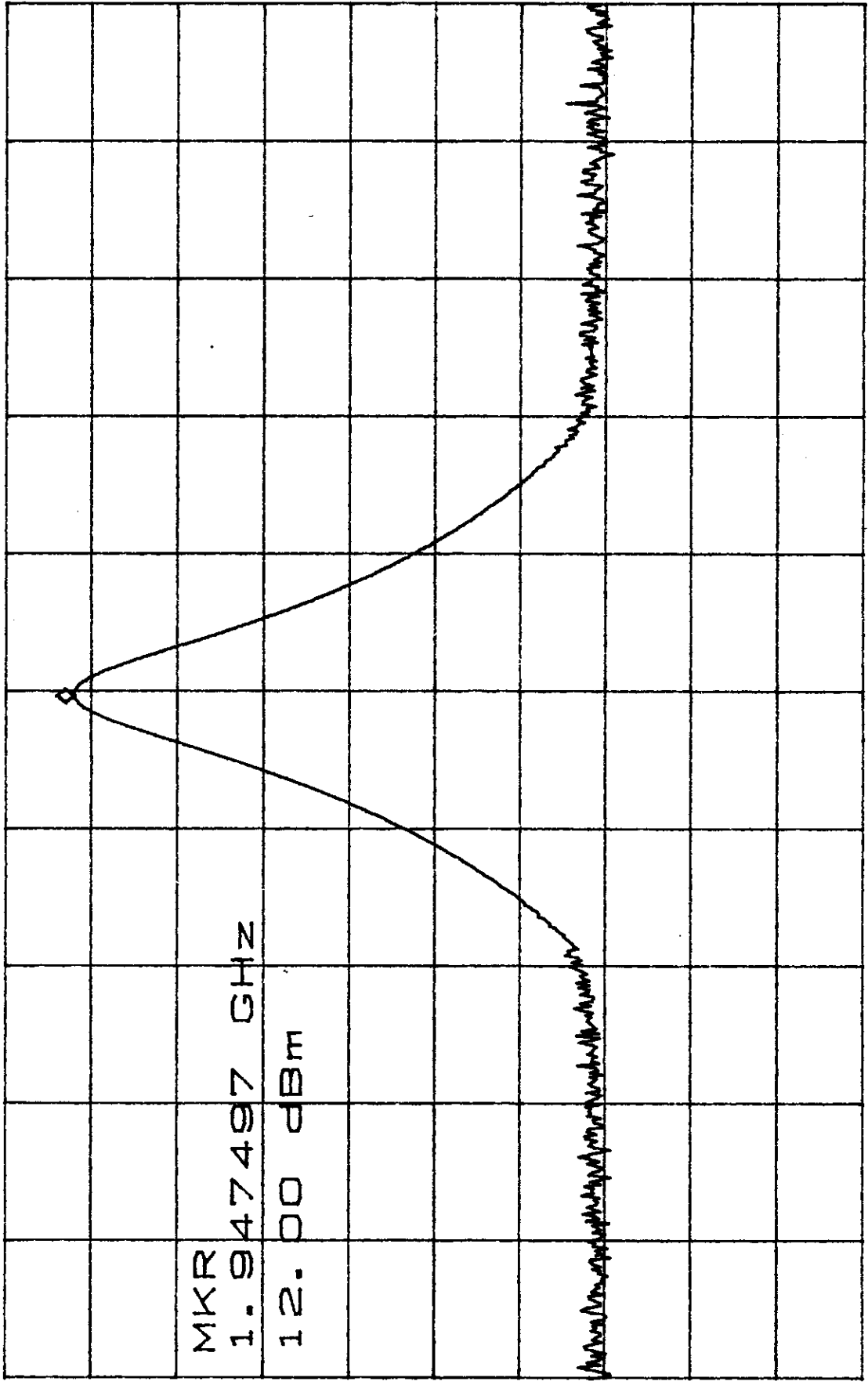
10/1/98  
L845800PES

Output Signal

ATTEN 30dB  
RL 20.0dBm

MKR 12.00dBm  
1.947497GHZ

CW source  
10dB/



CENTER 1.947500GHZ      SPAN 1.000MHZ  
\*RBW 30KHZ      \*VBW 30KHZ      SWP 50.0ms

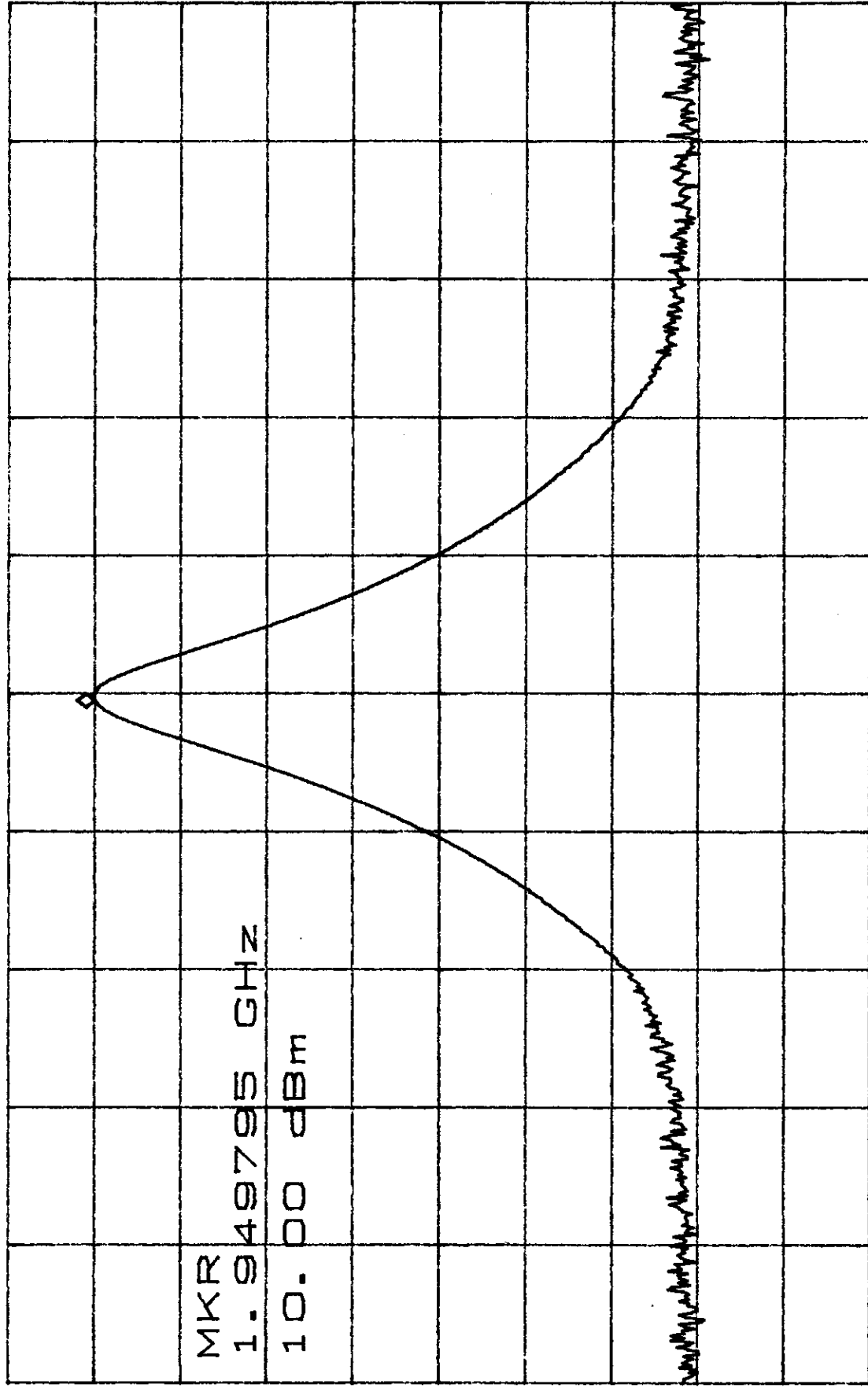
DL High  
D-band

Input Signal Into Hub  
1:8 Splitter

10/1/98  
LB45800PCS

ATTEN 30dB  
RL 20.0dBm

MKR 10.00dBm  
1.949795GHZ



In/Out

MKR  
1.949795 GHz  
10.00 dBm

D R

CENTER 1.949800GHZ SPAN 1.000MHZ  
\*RBW 30KHZ \*VBW 30KHZ SWP 50.0ms

DL High  
D-band

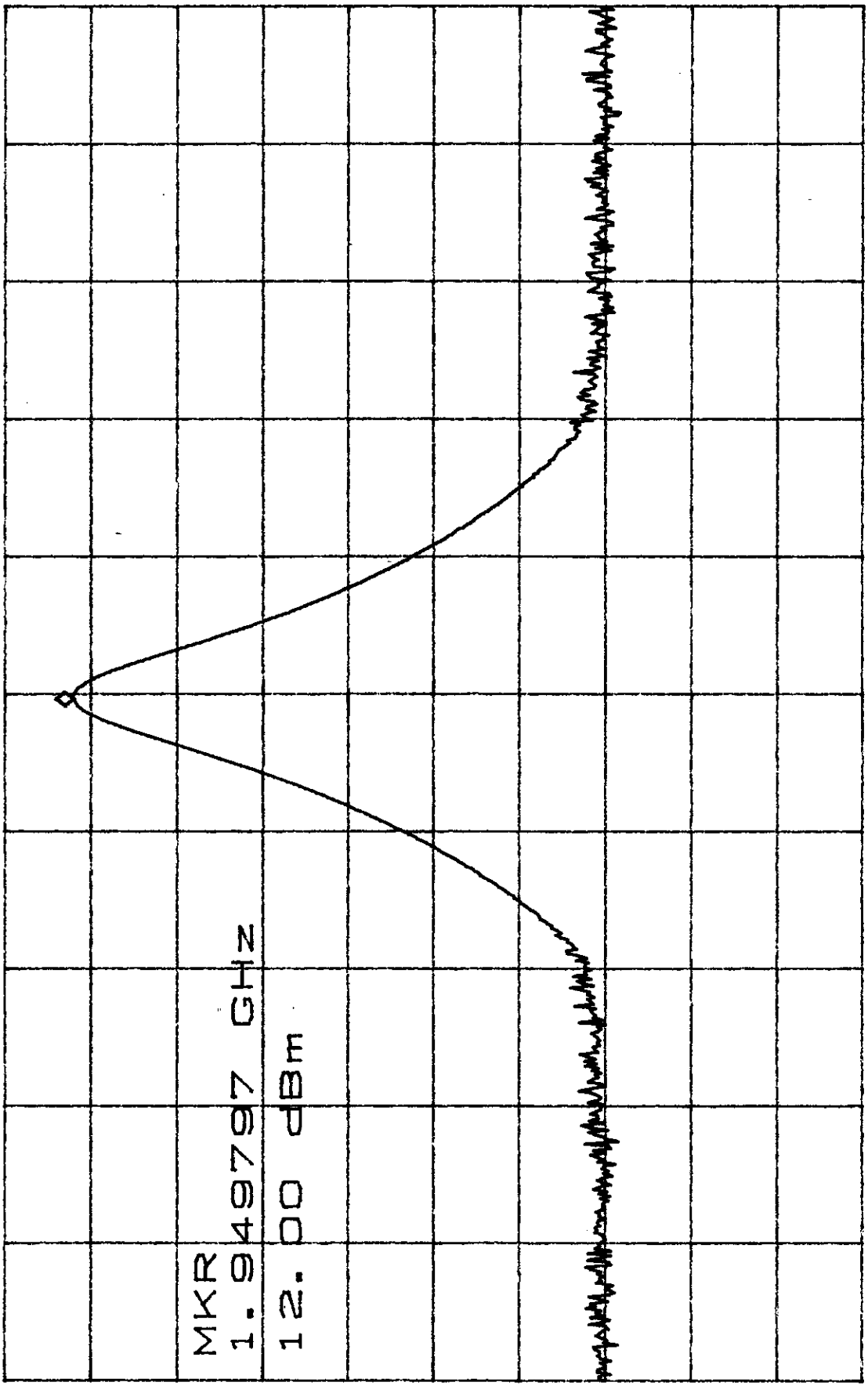
Output Signal

10/1/98  
LB45800PCS

ATTEN 30dB  
RL 20.0dBm

MKR 12.00dBm  
1.949797GHZ

CW - source  
10dB/



In/out

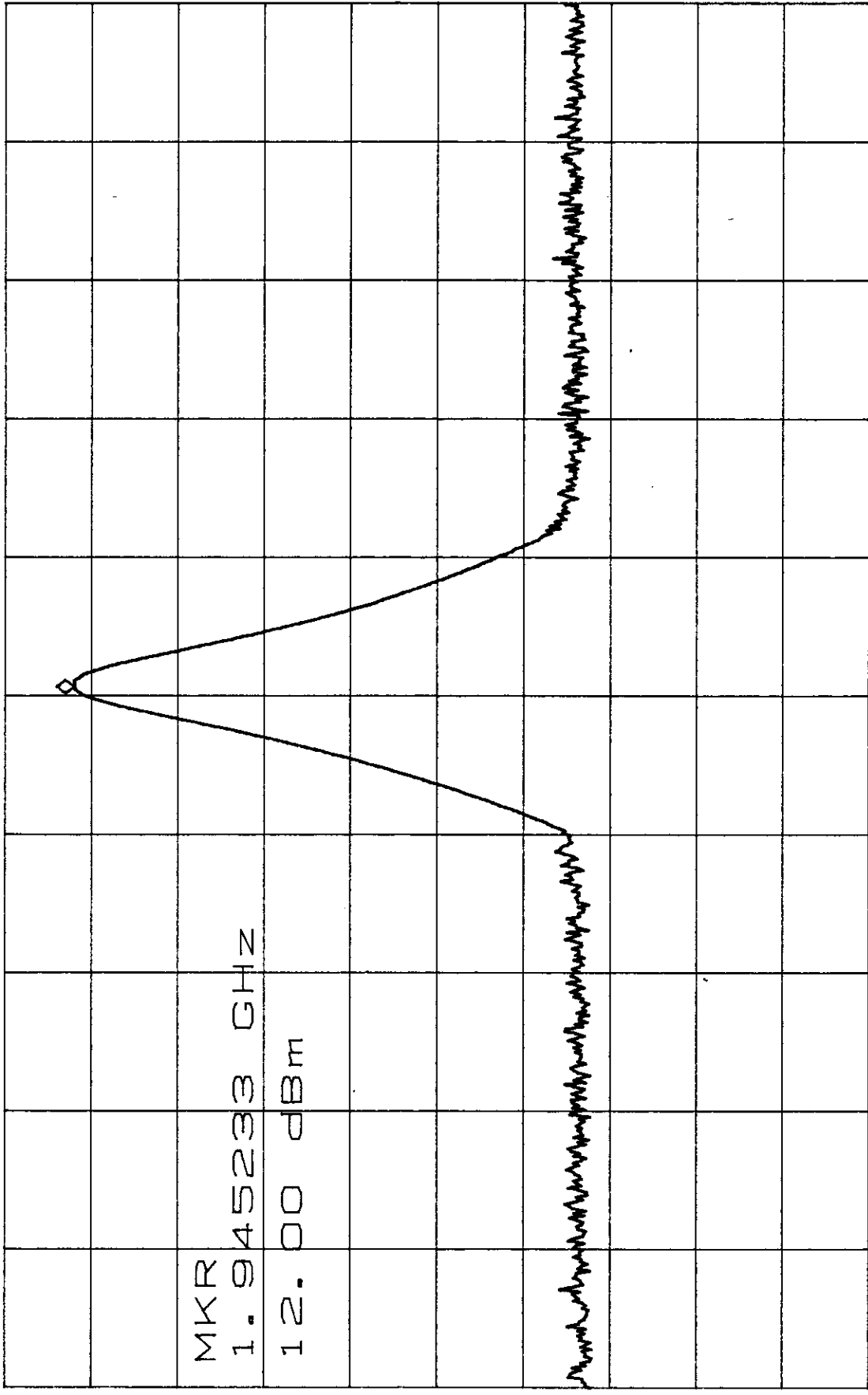
D R

CENTER 1.949800GHZ SPAN 1.000MHZ  
\*RBW 30KHZ \*VBW 30KHZ SWP 50.0ms

DL Low  
D-Band  
10/1/98  
LB45800PCS

Output  
CW Source

ATTN 30dB  
MKR 12.00dBm  
RL 20.00dBm  
1.945233GHz  
10dB/  
1.945233GHz



24.238

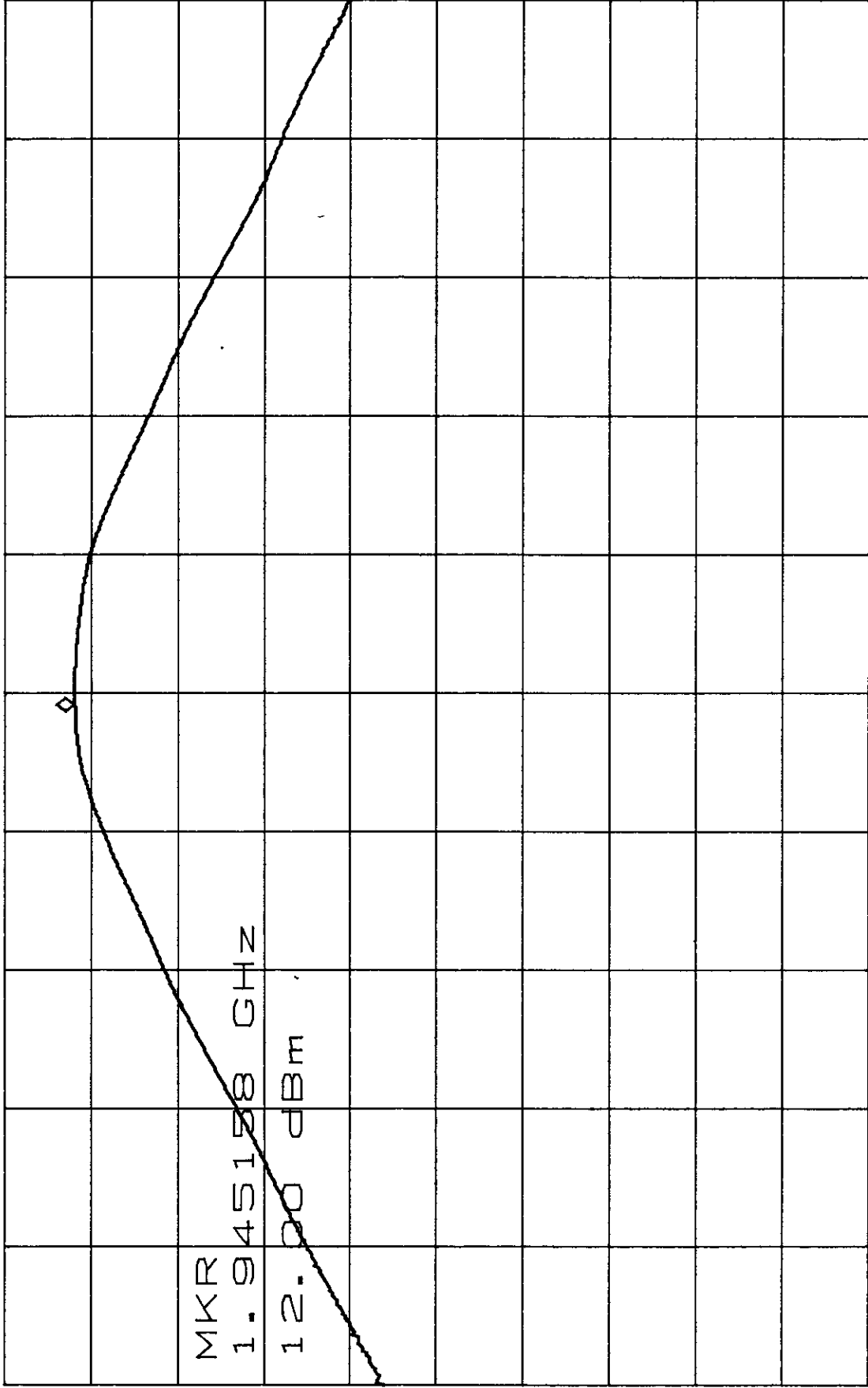
CENTER 1.945200GHZ  
\*RBW 100KHZ \*VBW 30KHZ  
SPAN 5.000MHZ  
SWP 50.0ms

DL Low  
D-band

10/1/98  
LB45800 PLS

Output

ATTEN 30dB      MKR 12.00dBm  
RL 20.0dBm      1.945158GHZ



24.938

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

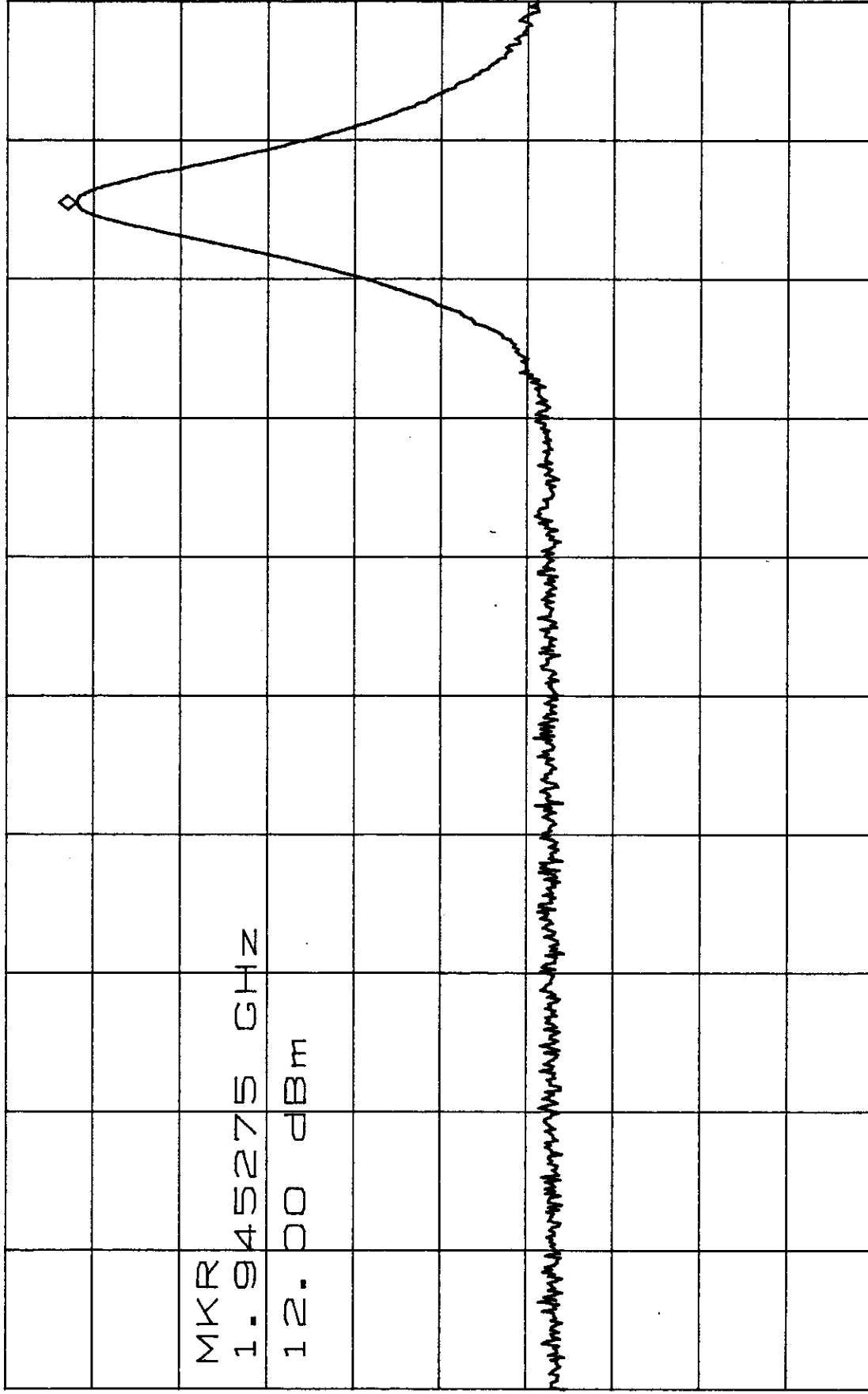
RL 20.0dBm

1.945275GHZ

10dB/

24.238

MKR  
1.945275 GHz  
12.00 dBm



START 1.941000GHZ STOP 1.946000GHZ  
\*RBW 100KHZ \*VBW 1.0MHZ SWP 50.0ms

DL Low  
D-band

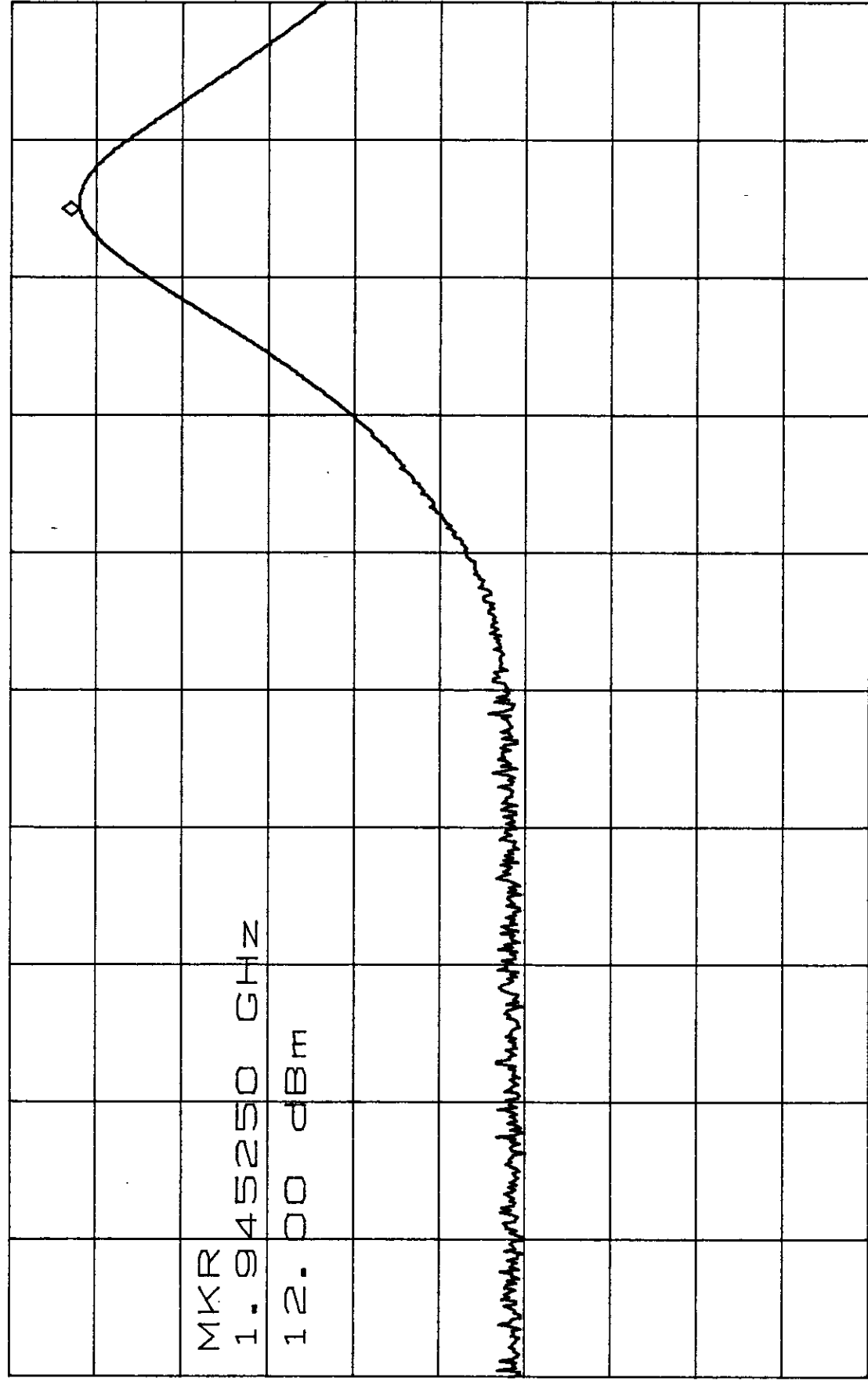
Output  
CW Source

10/1/98  
LB45800PCS

ATTEN 30dB  
RL 20.0dBm

MKR 12.00dBm  
1.945250GHZ

10dB/



24.238

MKR  
1.945250 GHz  
12.00 dBm

START 1.941000GHZ STOP 1.946000GHZ  
\*RBW 300KHZ \*VBW 1.0MHZ SWP 50.0ms



DL Low  
D-band

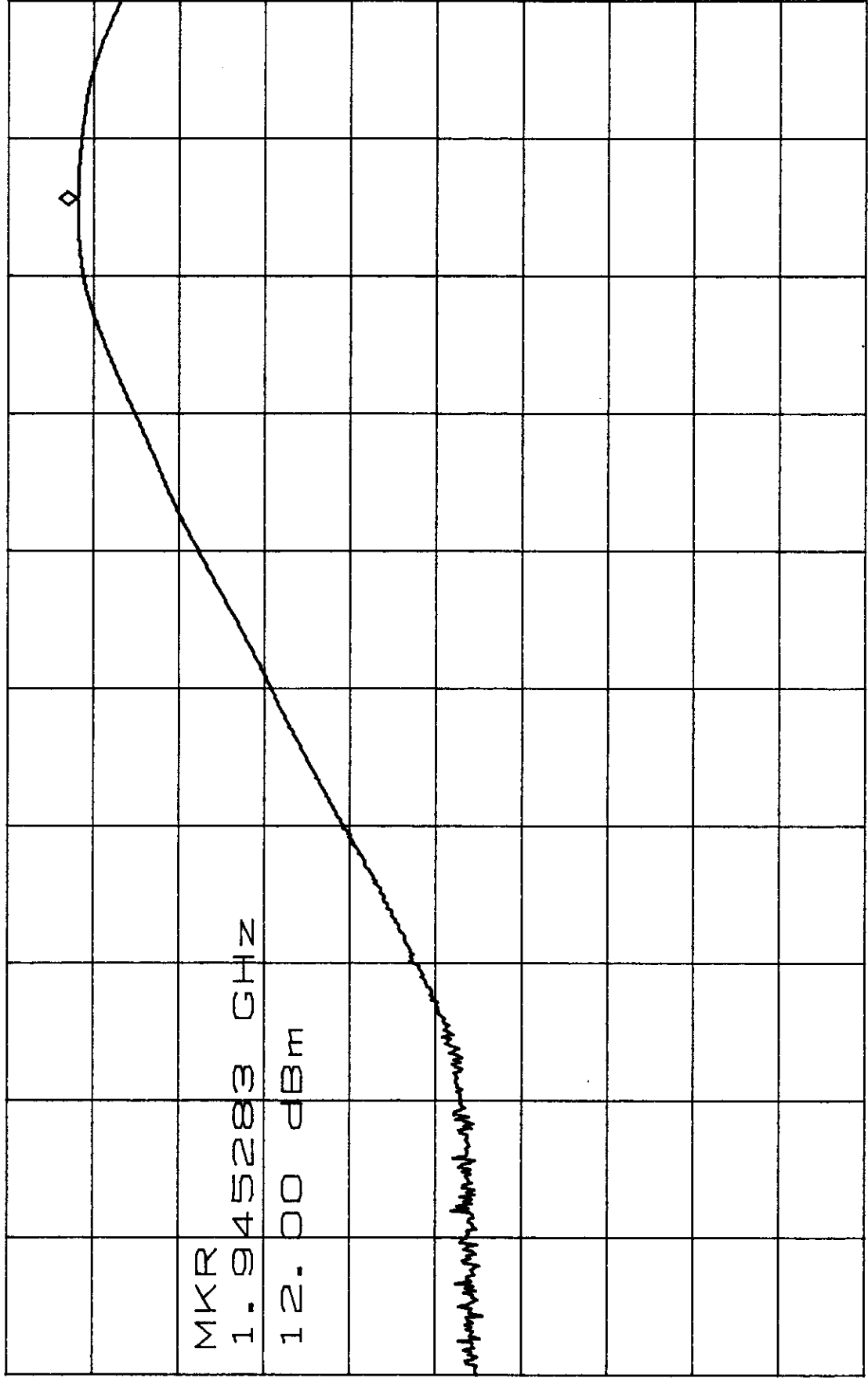
Output  
CW source

10/1/98  
LB45800PCS

ATTEN 30dB  
RL 20.0dBm

MKR 12.00dBm  
1.945283GHZ

10dB/



24.238

D R

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

DL High  
9-band

10/1/98  
LB45800PCS

Output

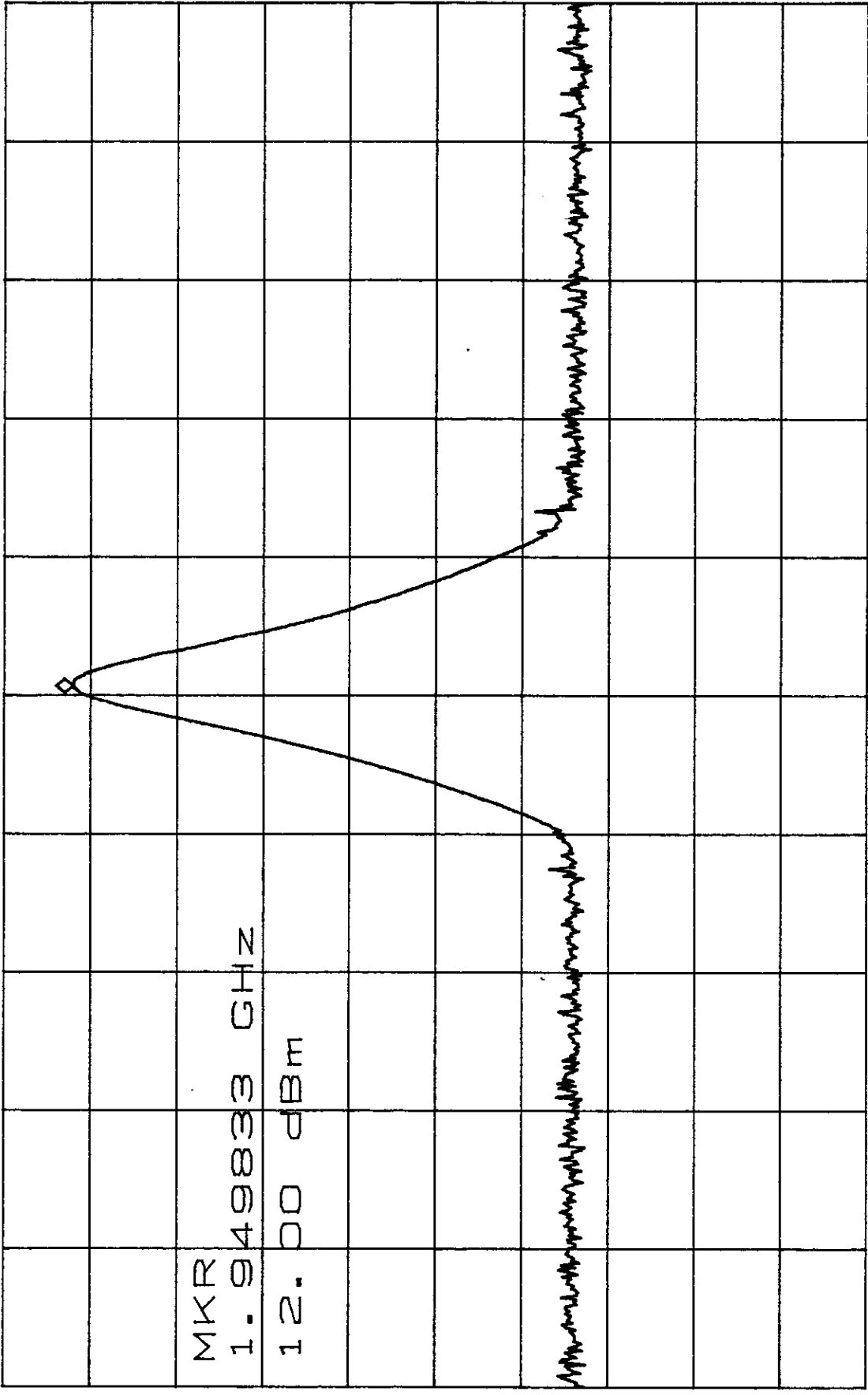
CW source.

ATTEN 30dB  
RL 20.0dBm

MKR 12.00dBm  
1.949833GHZ

24.238

MKR  
1.949833 GHZ  
12.00 dBm



CENTER 1.949800GHZ SPAN 5.000MHZ  
\*RBW 100KHZ \*VBW 30KHZ SWP 50.0ms

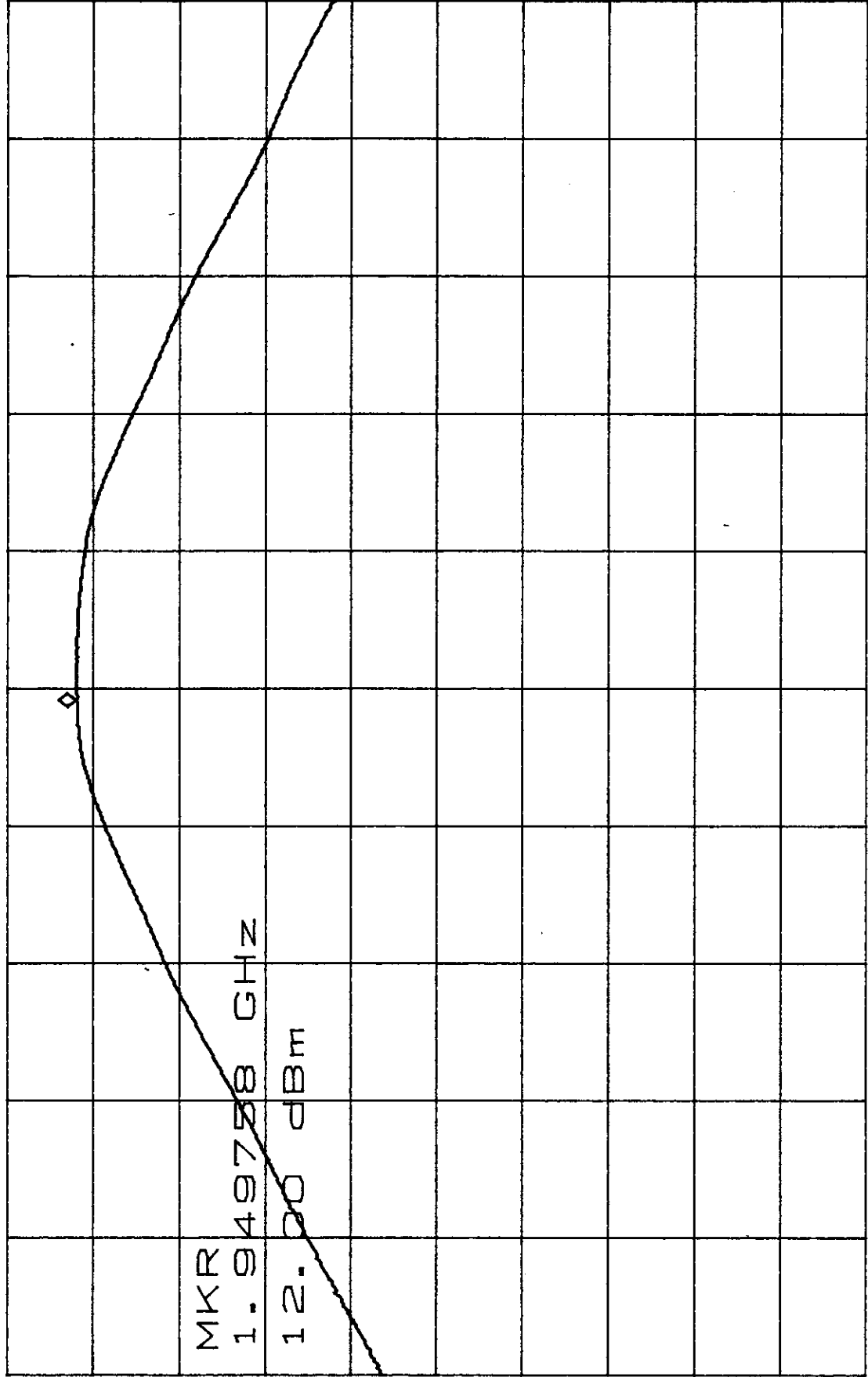
DL High  
D-band

Output  
cw source

10/1/98  
LB45800PCS

ATTEN 30dB  
RL 20.0dBm

MKR 12.00dBm  
1.949758GHZ



24.238

D R

CENTER 1.949800GHZ SPAN 5.000MHZ  
\*RBW 1.0MHZ VBW 1.0MHZ SWP 50.0ms

DL High  
D-band

Output

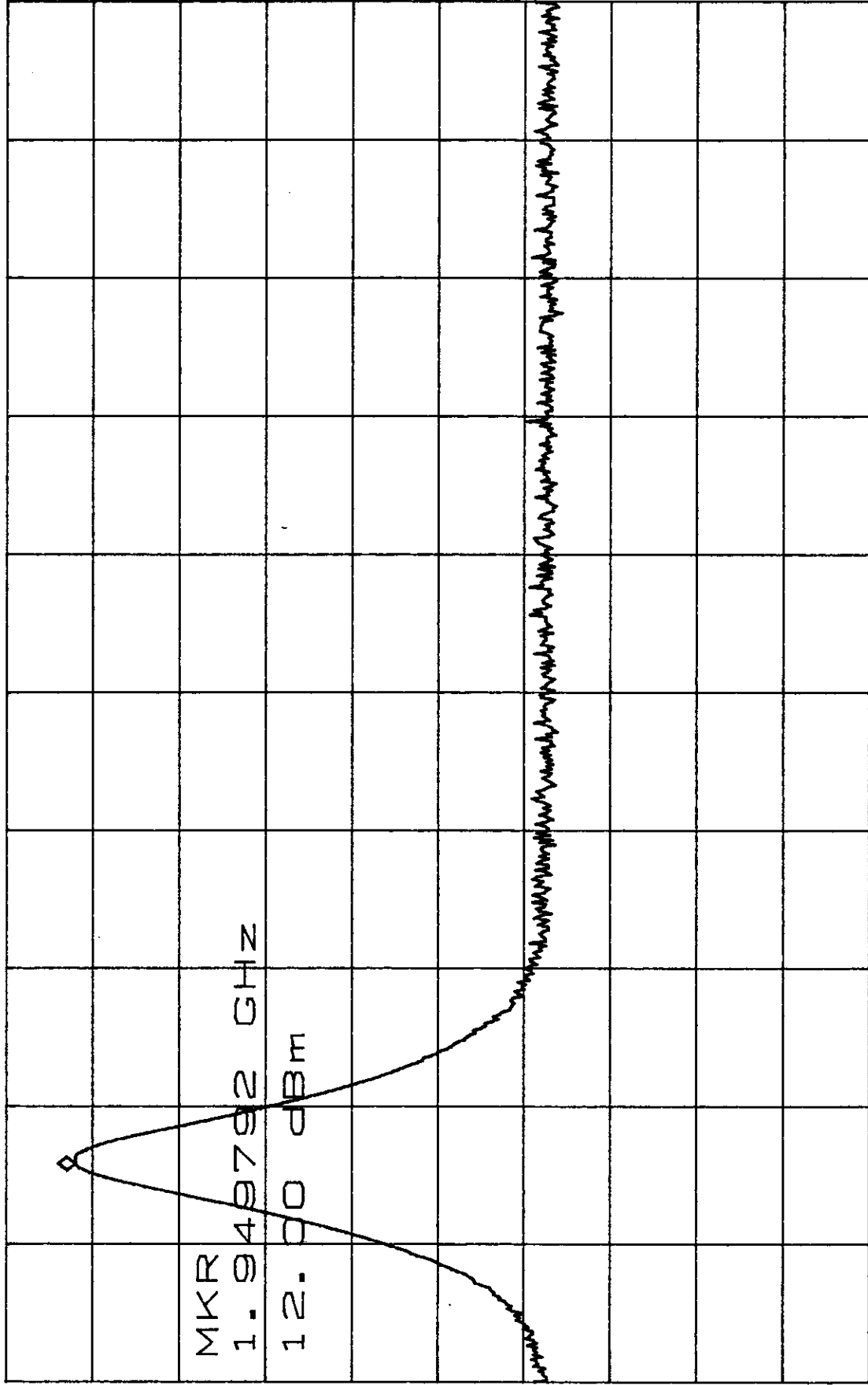
10/1/98

LB45800PCS

CW-Source

ATTEN 30dB  
RL 20.0dBm

MKR 12.00dBm  
1.949792GHZ



24.296

MKR  
1.949792 GHz  
12.00 dBm

D

R

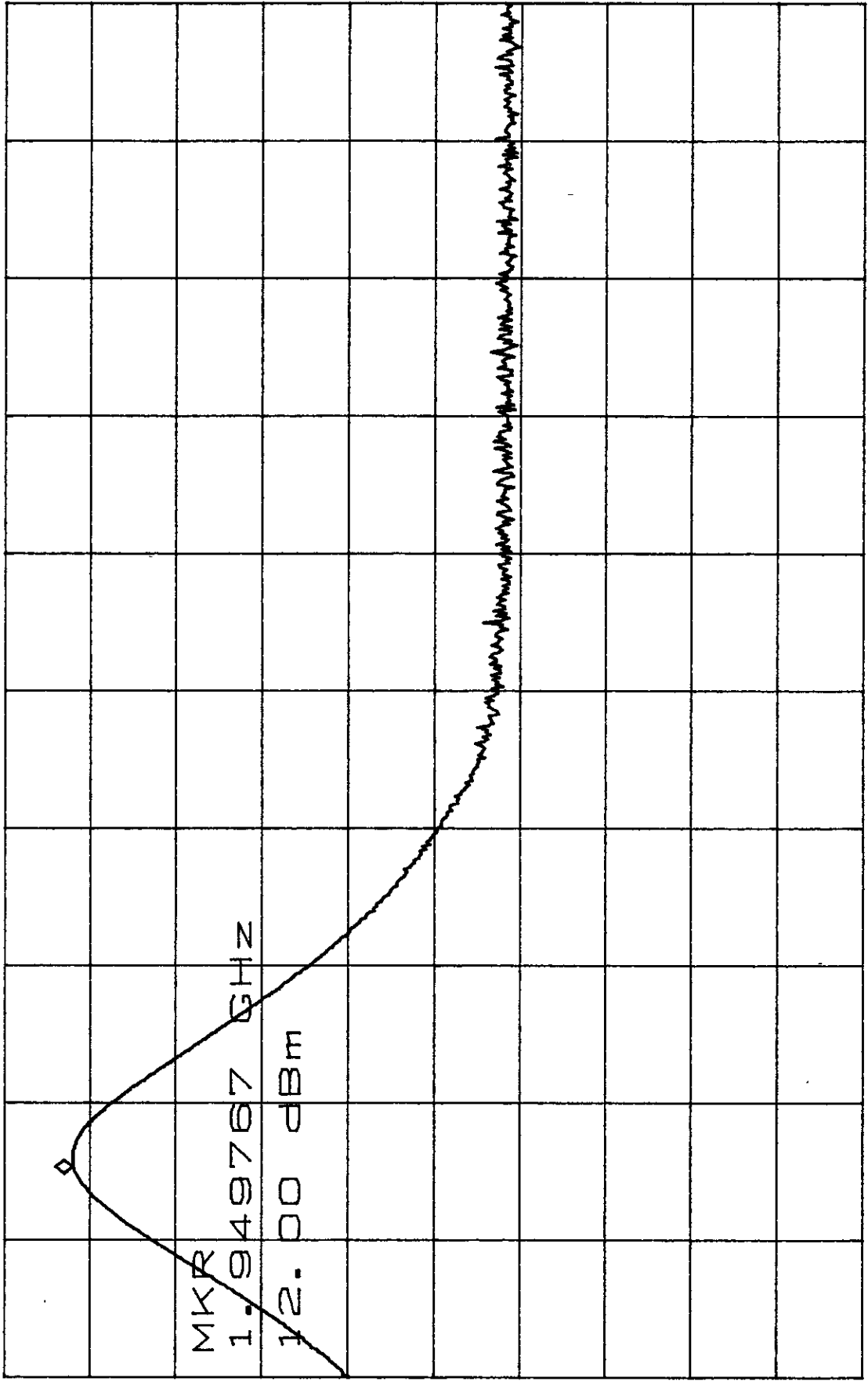
START 1.949000GHZ STOP 1.954000GHZ  
\*RBW 100KHZ \*VBW 1.0MHZ SWP 50.0ms

DL High  
D-band

Output  
CW-Source

10/1/98  
LB4580RCS

ATTEN 30dB MKR 12.00dBm  
RL 20.00dBm 1.949767GHZ  
10dB/



24.238

MKR  
1.949767 GHZ  
12.00 dBm

D R

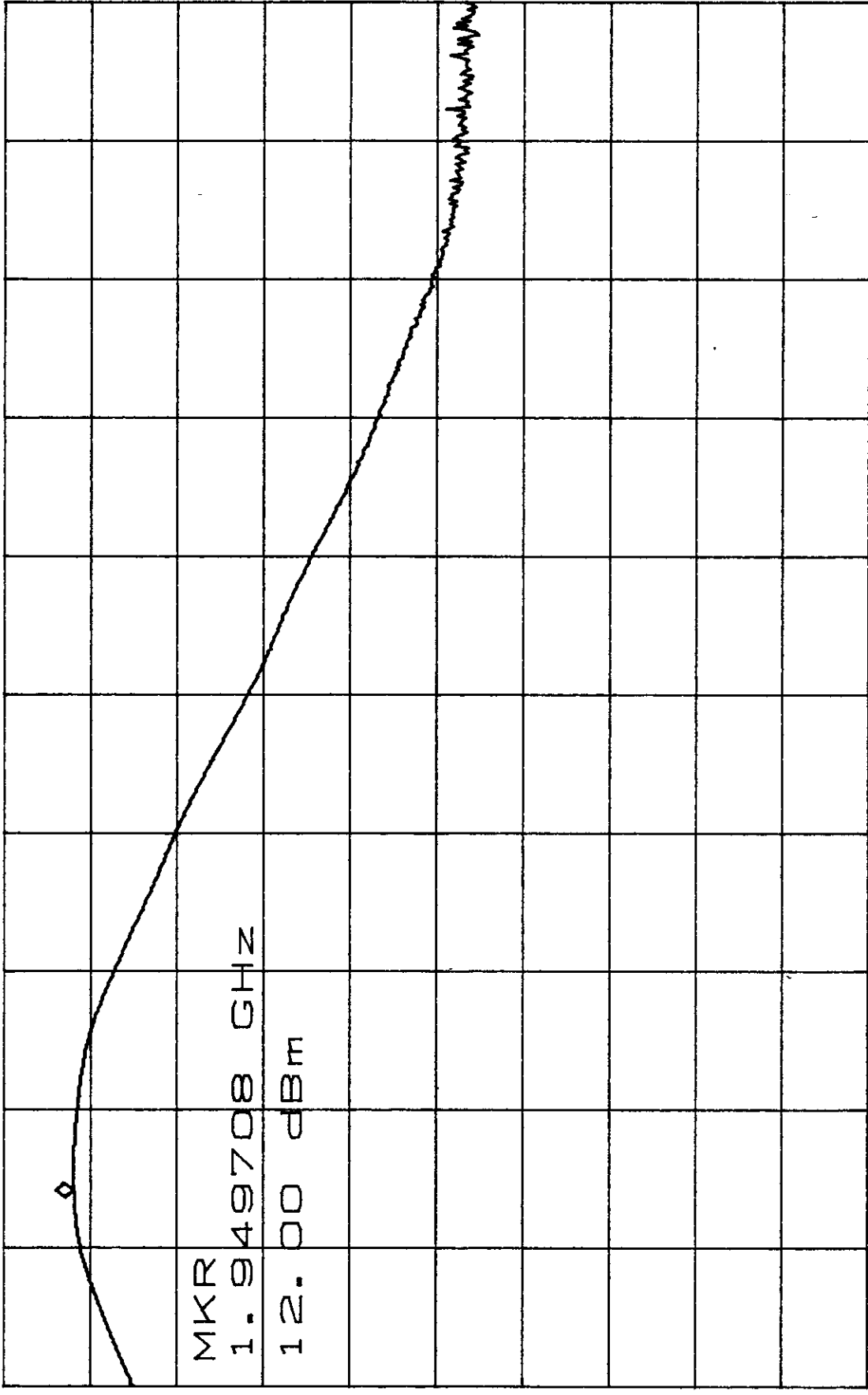
START 1.949000GHZ STOP 1.954000GHZ  
\*RBW 300kHz \*VBW 1.0MHz SWP 50.0ms

DL High  
D-band

10/1/98  
LB45800PCS

Output  
Cw-Source

ATTEN 30dB MKR 12.00dBm  
RL 20.00dBm 1.949708GHZ  
10dB/

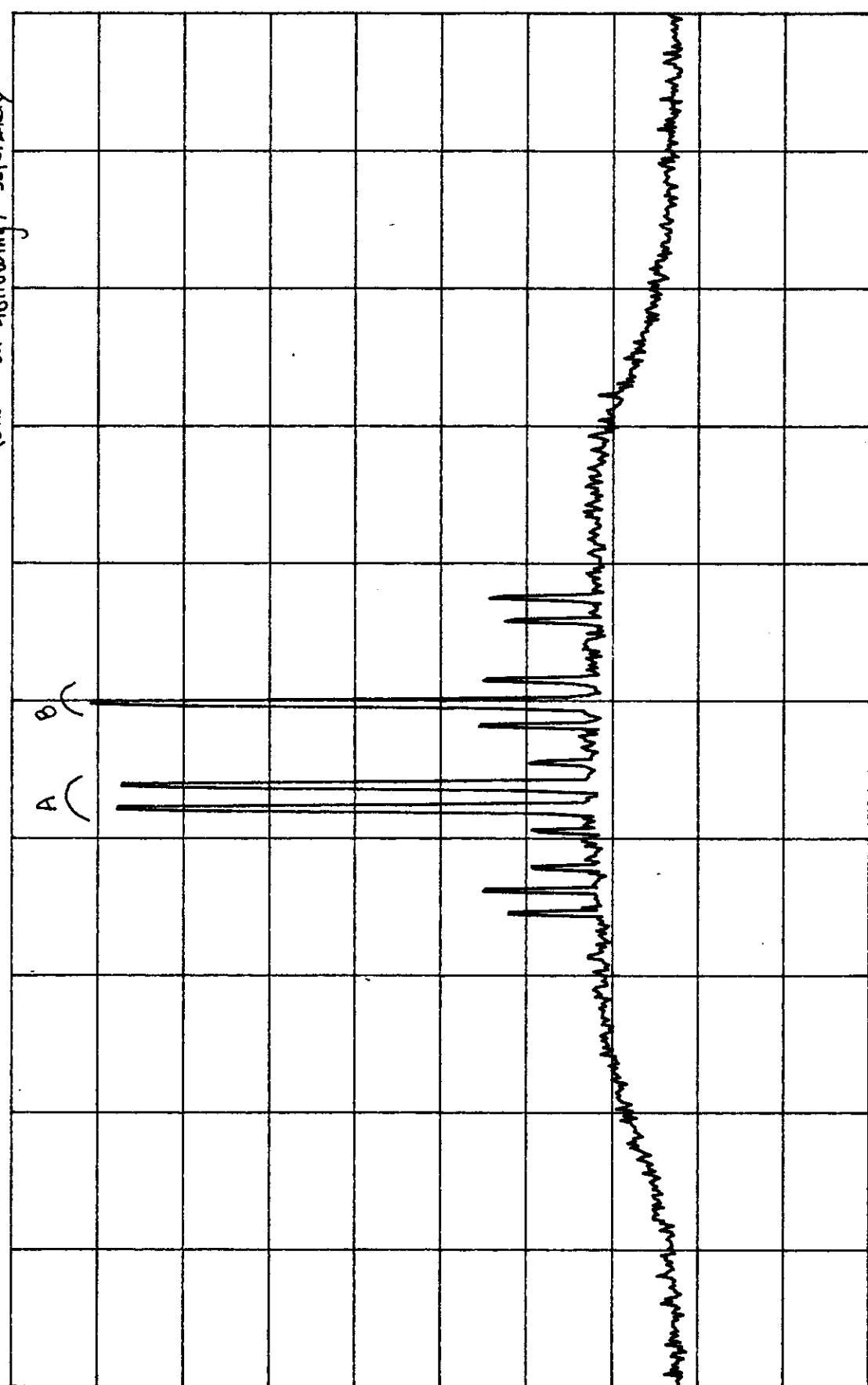


START 1.949000GHZ STOP 1.954000GHZ  
\*RBW 1.0MHZ \*VBW 1.0MHZ SWP 50.0ms

10/1/98  
LB45800P25

Intermods Over  
D-band  
CW-sources  
10dB/

DL Inputs: \*\* 1945.2 MHz ) A  
                  1946.2 MHz )  
                  1949.8 MHz ) B  
\* ATTEN 30dB  
RL 20.0dBm



3-tone  
CASE 1  
D  
R

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

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

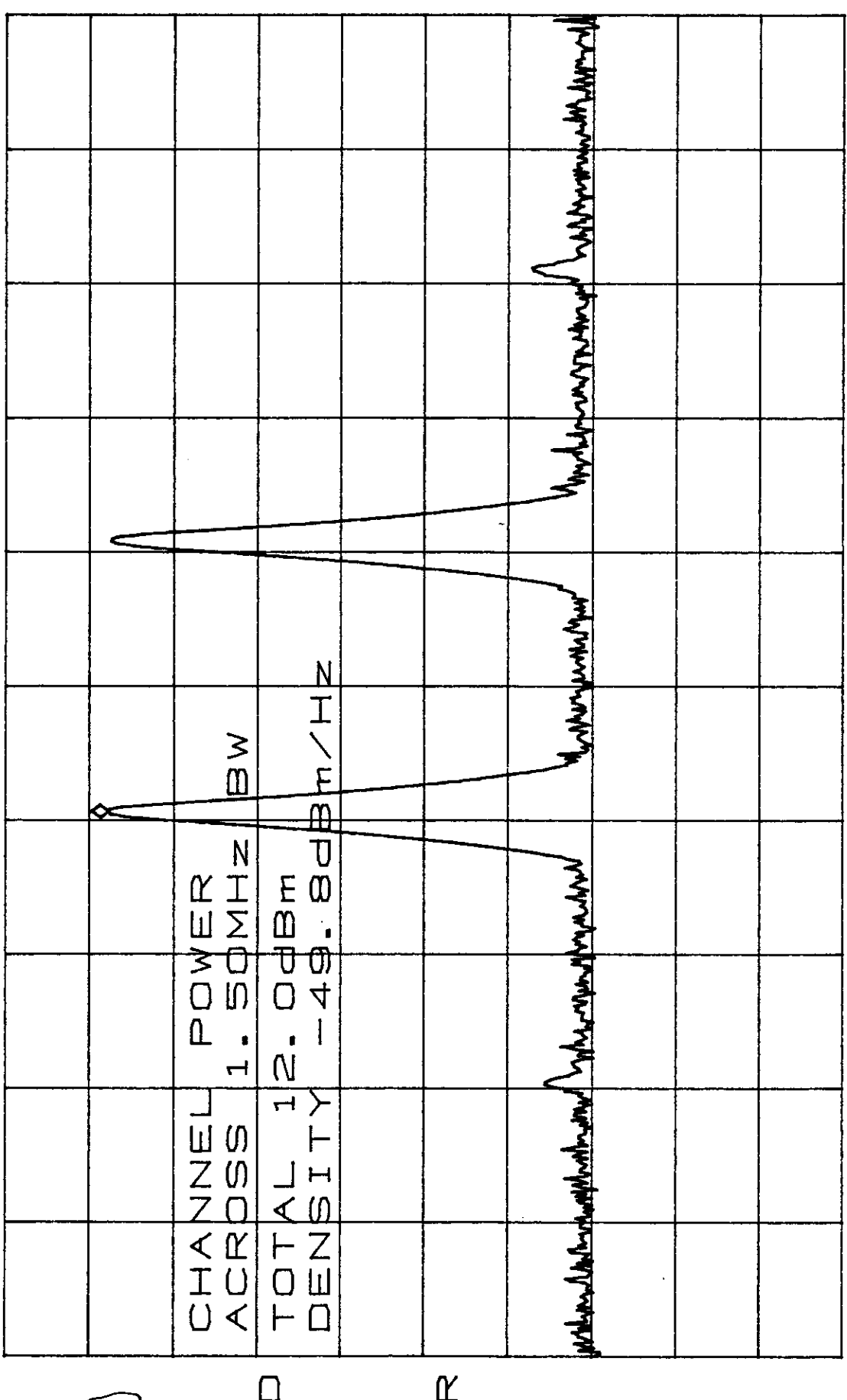
\*\* Amplified used on 1945.2 MHz signal source in order to increase input level (two 2:1 combiners used) to get required output

DL Inputs: 1945.2 MHz  
 1946.2 MHz  
 D-band

Output Levels for  
 Set A (composite ~12 dBm)  
 (set B is off)

10/1/98  
 LB45800PCS

\* ATTN 30dB MKR 7.67 dBm  
 RL 20.0 dBm 10dB / 1.945233 GHz



3-tone  
 case 1

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

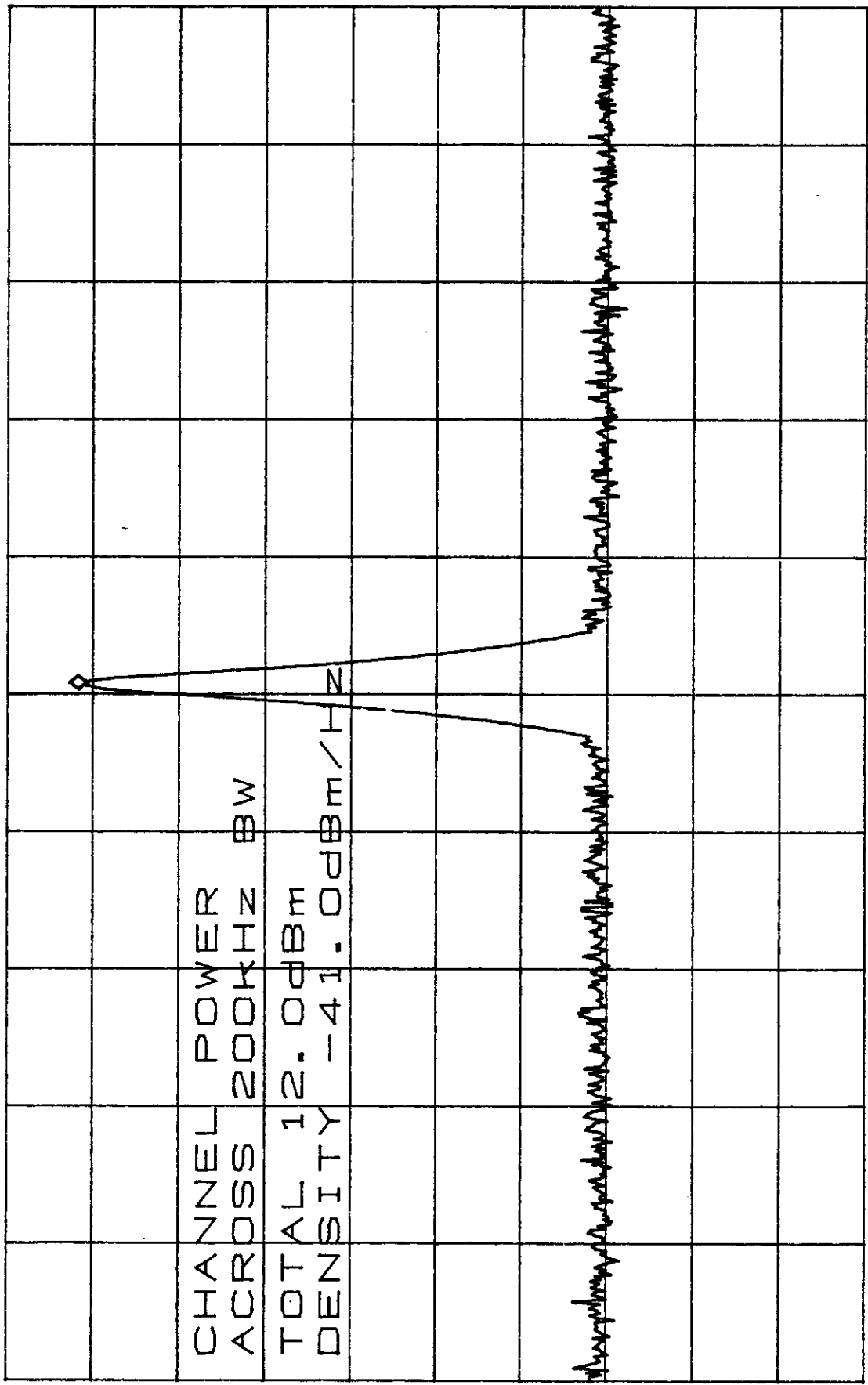
10/1/98

LB45800P.S

Output Level for  
Set B (composite ~12dBm)

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

RL 20.0dBm 10dB / 1.949842GHz



3-tone

CASE 1

D

R

CENTER 1.949800GHz

SPAN 5.000MHz

\* RBW 30kHz

\* VBW 30kHz

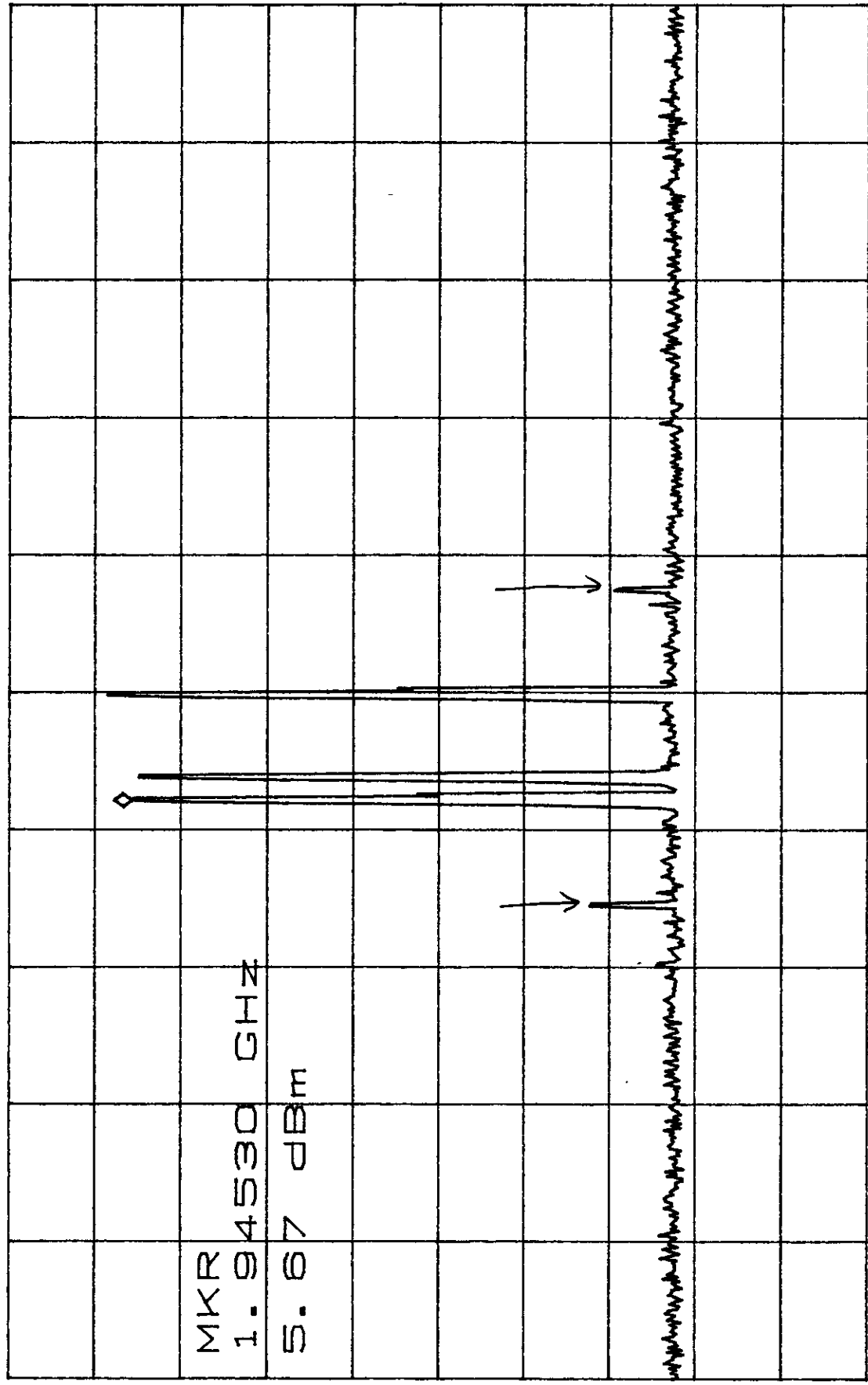
SWP 50.0ms

DL Inputs: \*\* 1945.2 MHz  
 1946.2 MHz  
 1949.8 MHz

Levels of Input Frequencies  
 D-band

10/1/98  
 LB45800 PCS

\*\*ATTEN 30dB  
 RL 20.0dBm  
 MKR 5.67dBm  
 1.94530GHZ



3-tone  
 case 1

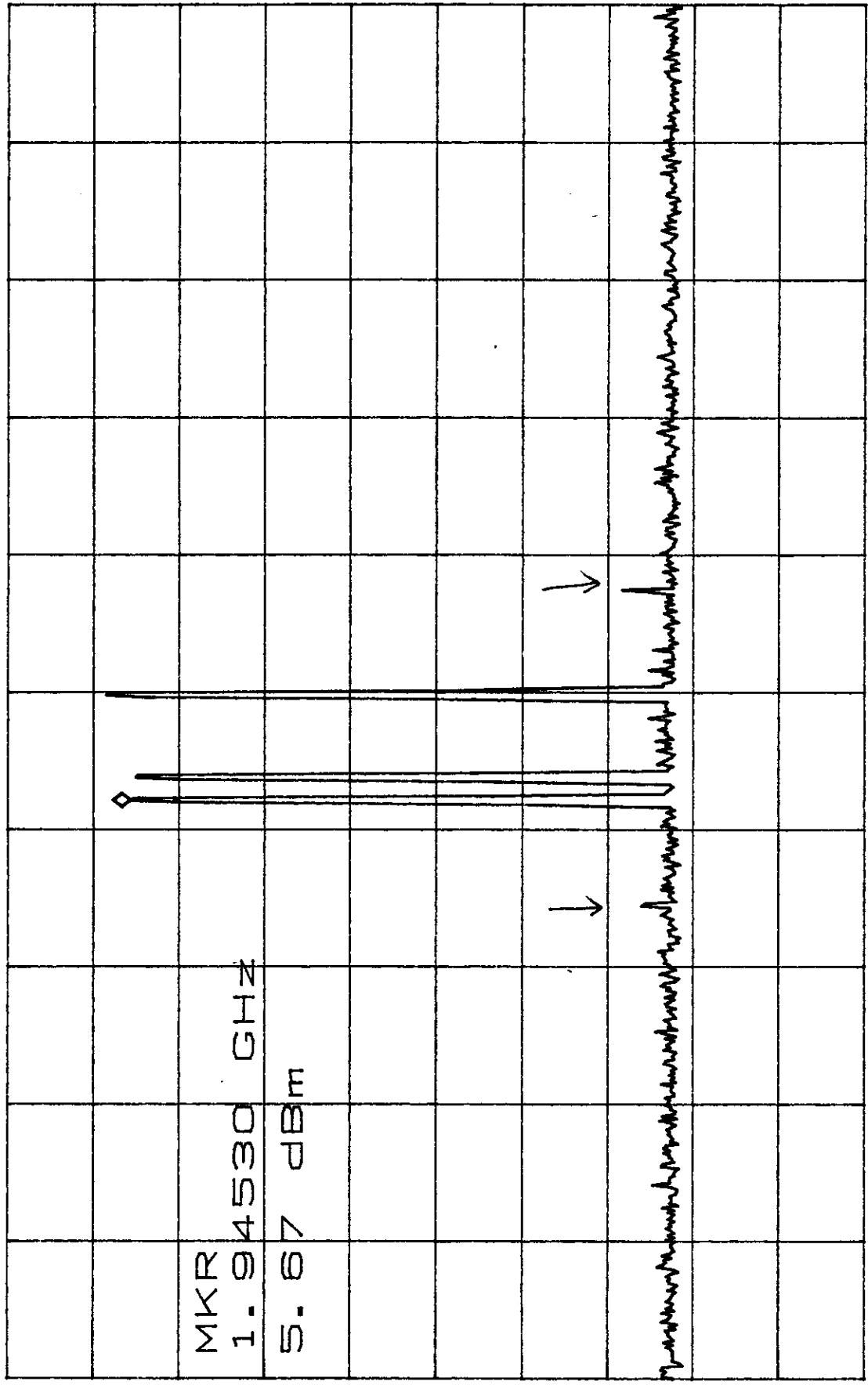
START 1.92000GHZ STOP 1.98000GHZ  
 \*\*RBW 30KHZ \*\*VBW 30KHZ SWP 170MS  
 \*\* Amplifier used as in original measurement. Amp model: MiniCircuits' ZFL2000 (+20dB)  
 Plot shown to note intermod boost due to amplifier (see next plot).

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      1.94530GHz



3-tone  
case 1

START 1.92000GHz      STOP 1.98000GHz  
\*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

10/1/98

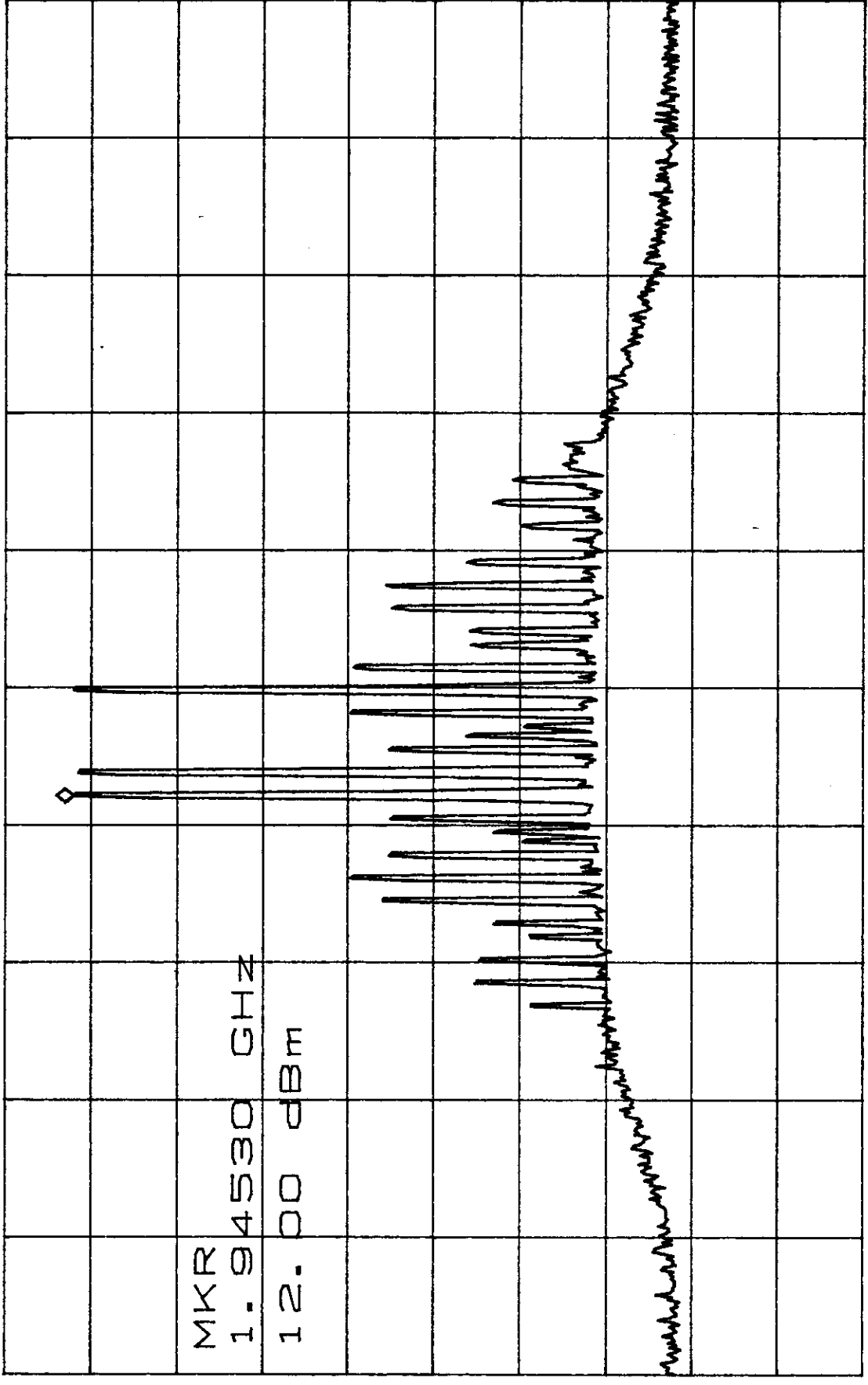
Intermods Over  
D-band

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

LB45800PCS

\* ATTN 30dB  
RL 20.0dBm  
MKR 12.00dBm  
1.94530GHZ  
10dB/  
1.98000GHZ

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

10/1/98

LB45800PCS

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

Intermods over D-band

(DeHA)

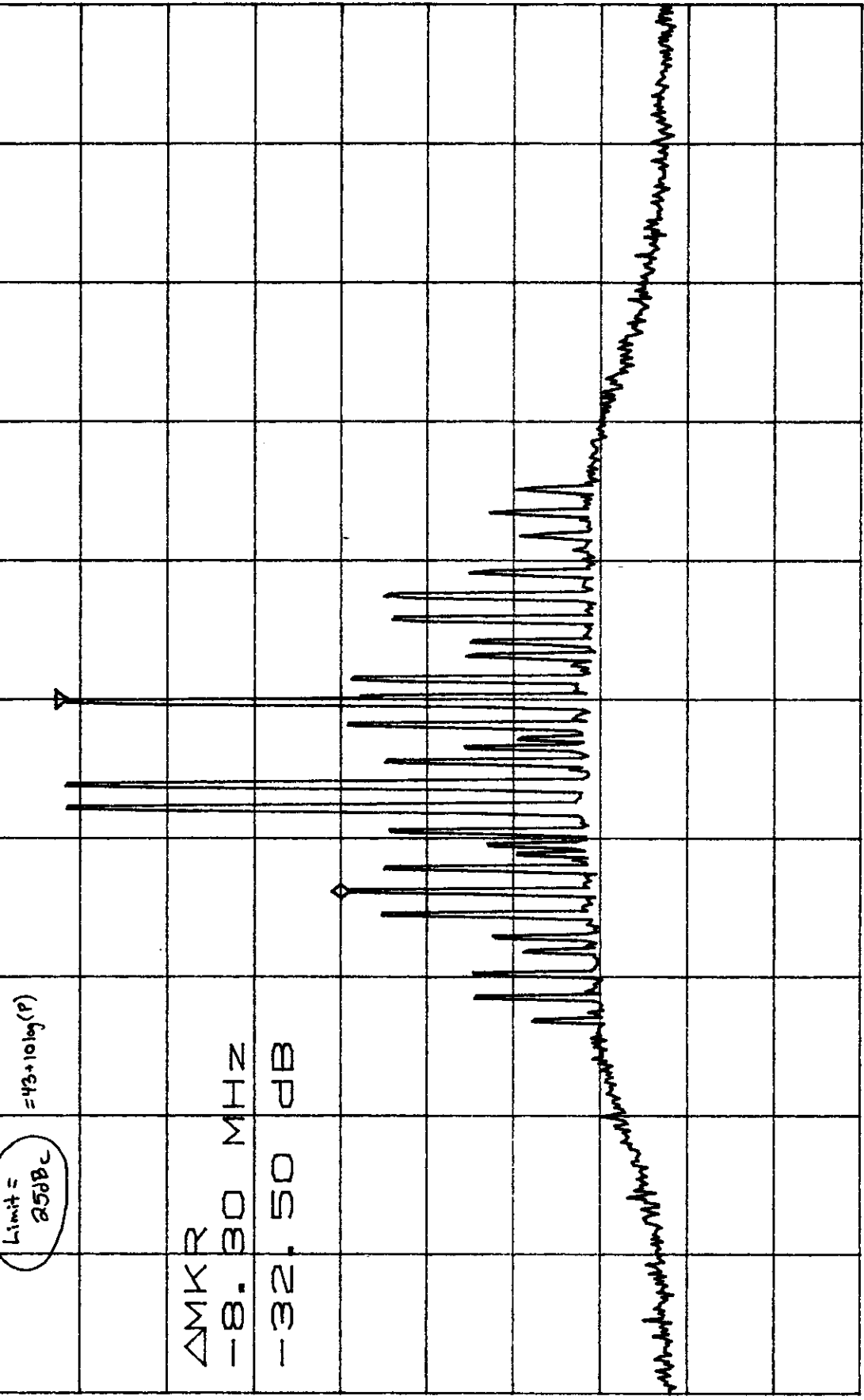
\* ATTEN 30dB

RL 20.0dBm

cw

10dB/

-8.30MHz



3-tone

case 2

ΔMKR

-8.30 MHz

-32.50 dB

D

R

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)

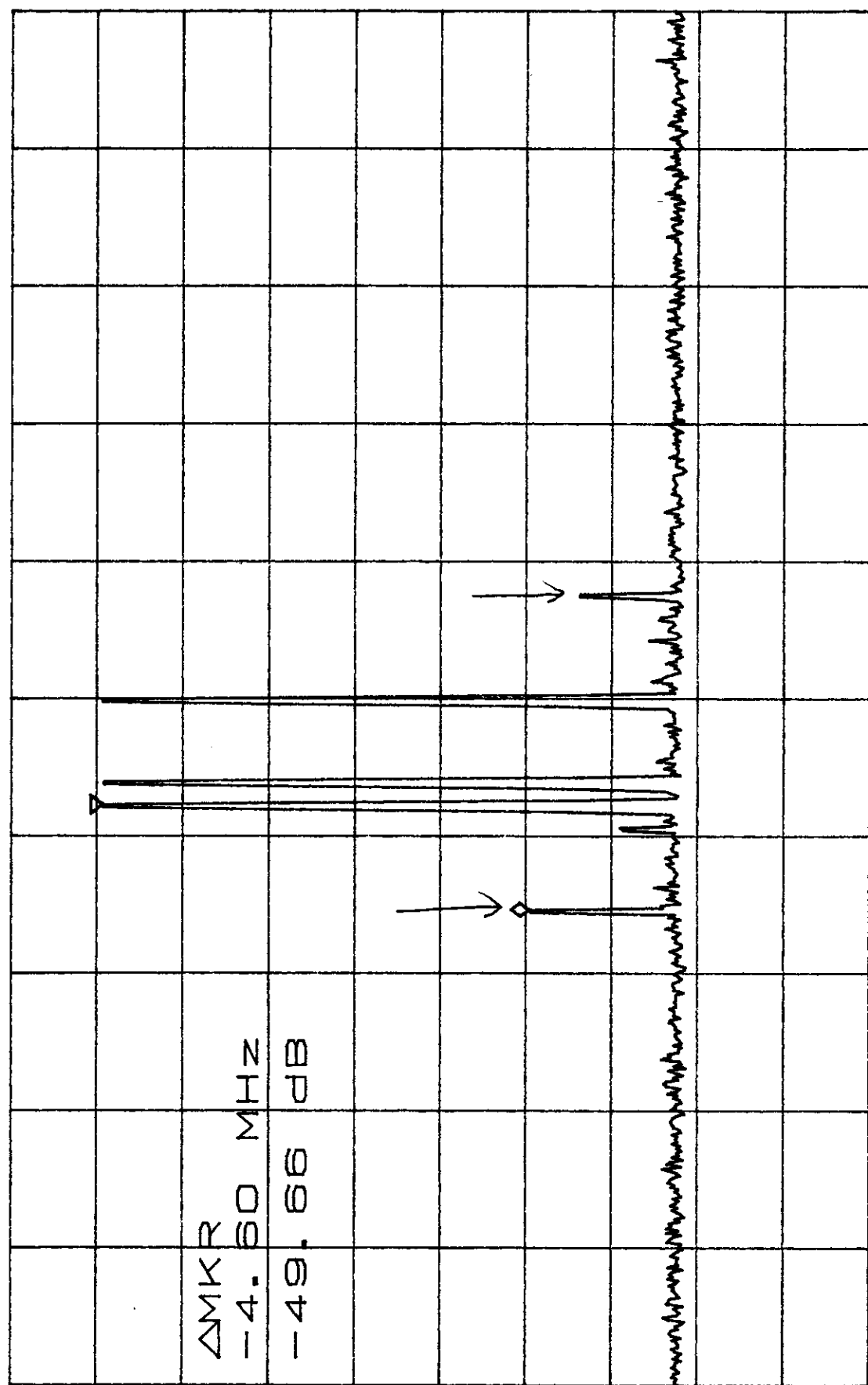
DL Inputs: \*\* 1945.2 MHz  
 1946.2 MHz  
 1949.8 MHz

Levels of Input Frequencies  
 D-band

\* ATTEN 30dB  
 RL 20.0dBm

10/1/98  
 LB45800PCS

\* MKR -49.66dB  
 -4.60MHz  
 10dB/



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

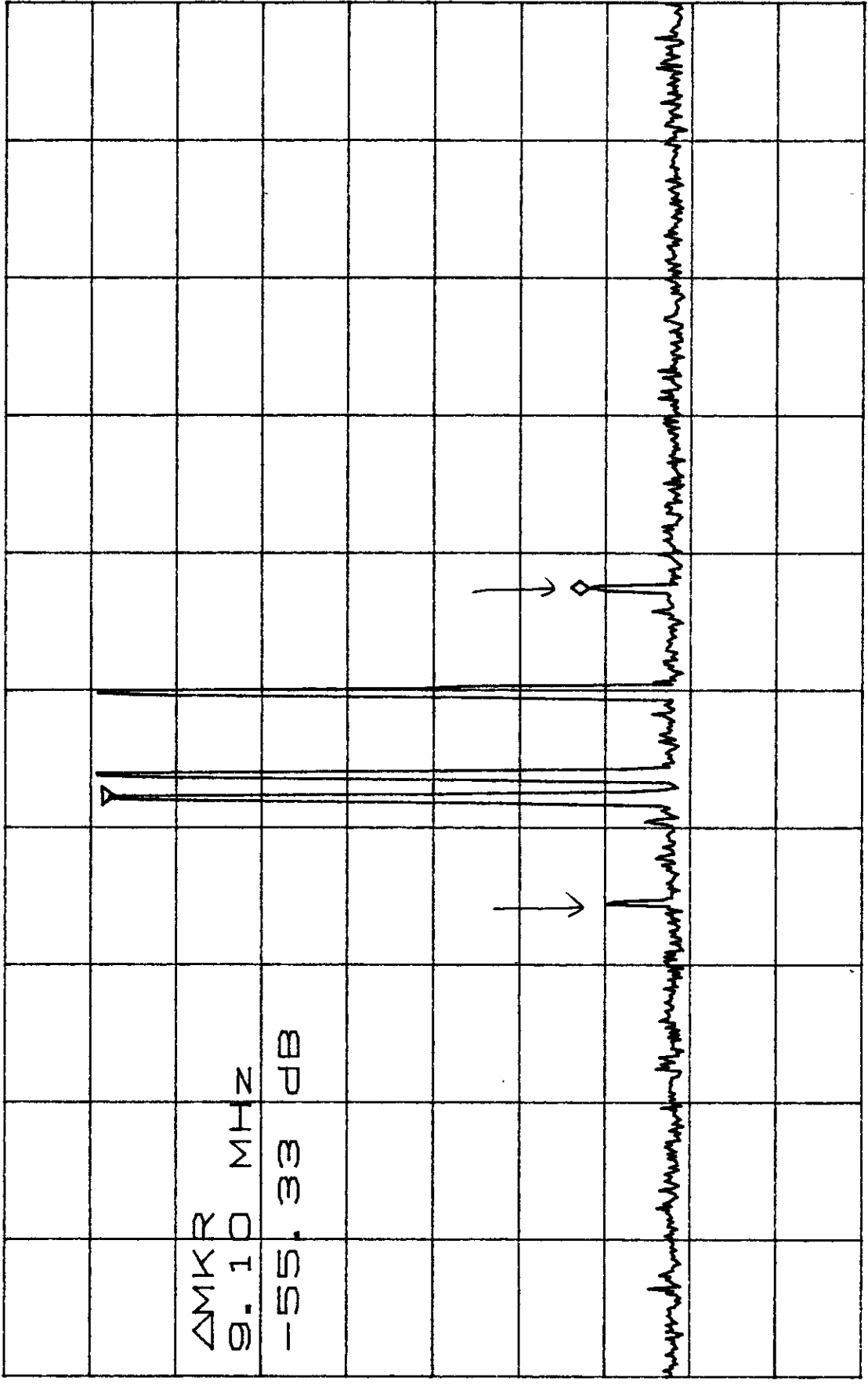
10/1/98

LB4 5800PCS

Levels of Input Frequencies  
D-band

DL Inputs: \*\* 1945.2 MHz  
1946.2 MHz  
1949.8 MHz

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



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 intermod. The signal generator falls ~1.5dB short.