

EMISSIONS TEST REPORT FOR A LOW POWER TRANSMITTER

I. GENERAL INFORMATION

Requirement: Federal Communications Commissions
 Test Requirements: 15.205, 15.207, 15.209, 15.247

Applicant: RadioLAN Marketing Group
 185 Lewis Road - Suite 30
 San Jose, CA 95111

FCC ID: MCI-377

II. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

RadioLAN FCC ID: MCI-377 is a DTS transceiver in the 5,725 - 5,850 MHz band.

Output power : 50 mW (17 dBm) nominal
 63 mW (18dBm) maximum

Center frequency: 5.775 GHz (single channel)
 6 dB BW 26.6 MHz
 20 dB BW: 43 MHz

The product consists of the Campus BridgeLINK-II ethernet bridge processor unit , the CBL-II radio section, and one of several kinds of antennas connected to the CBL-II via N-type coaxial cable. Antennas tested with this transceiver:

| Antenna type | Mfr | Model ID | Gain (dBi) |
|-------------------|-------------------|-------------|------------|
| Flat panel | European Antennas | FPA 19-58V | 18 |
| Yagi | Telex | 5816AB | 16.5 |
| Sector | RadioWaves | SEC-5H-90CS | 18 |
| 4 ft. Dish | RadioWaves | SP4-5.8 | 34.8 |

A separately certificated product, FCC ID: MCI-387, is an integrated unit consisting of the Campus BridgeLINK-II, CBL-II, and the EA flat panel antenna.

III. TEST LOCATION

All emissions tests were performed at:

Compliance Certification Services
 571F Monterey Road
 Morgan Hill, CA 95037

T.N. Cokenias
 EMC Consultant/Agent for RadioLAN Marketing Group

15 Sept 2002

TEST PROCEDURES

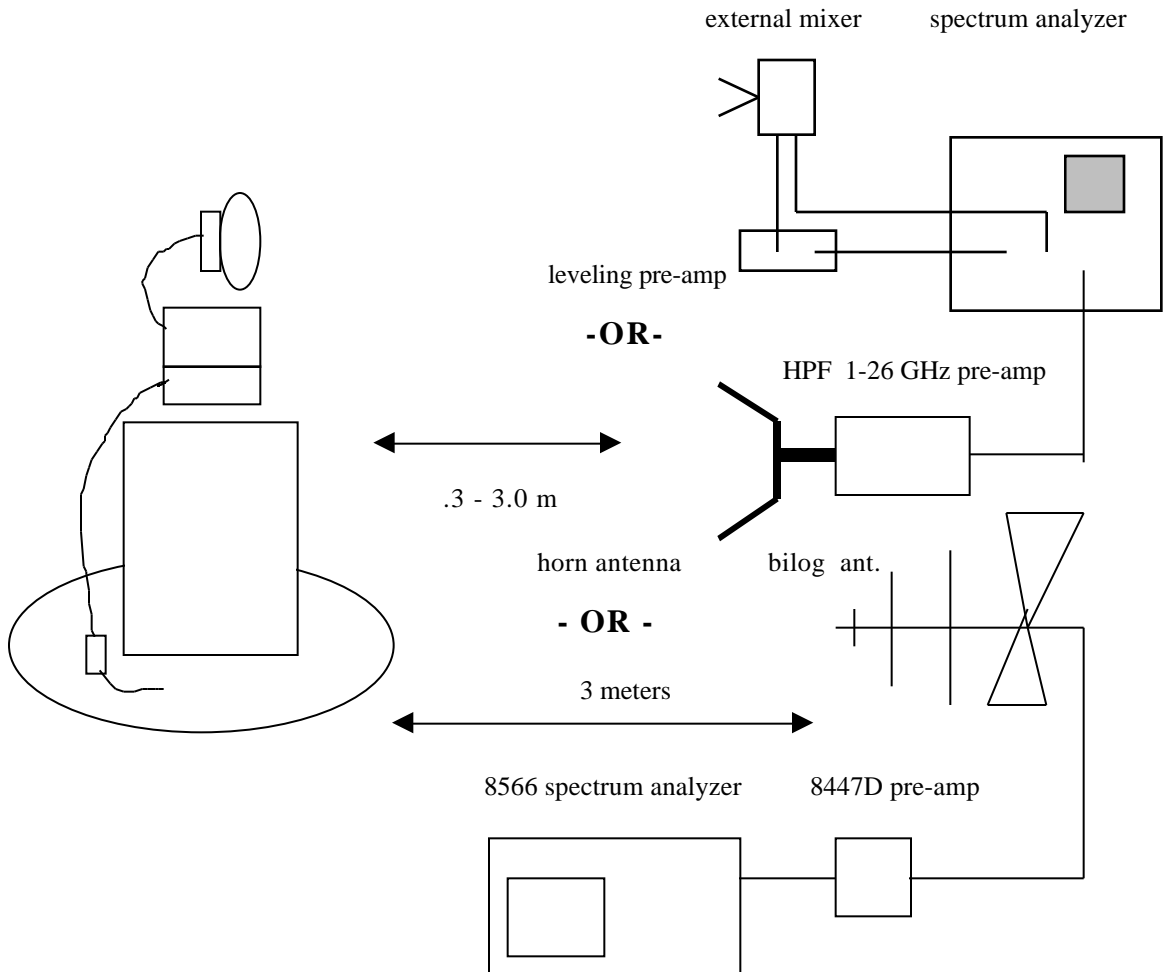
Radiated Emissions

Test Requirement: 15.109, 15.205, 15.209, 15.247

Measurement Equipment Used:

- HP 8566 Spectrum Analyzer
- HP 8447D pre-amplifier
- Miteq NSP2600-44 Preamp, 1- 26 GHz
- HP 11975A Preamplifier, 2 - 8 GHz (used with HP11970 external mixers)
- Schaffner Chase Bilog antenna, 30 - 2000 MHz
- EMCO Double Ridge Waveguide Horn, 1 - 18 GHz
- Antenna Research Associates MWH 1826/B, 18 - 26.5 GHz
- HP 11970A Harmonic mixer, 26.5 - 40 GHz
- HP 11970Q Harmonic mixer, 33 - 50 GHz
- HP 11970V Harmonic mixer, 50 - 75 GHz
- HP 11970W Harmonic mixer, 75 - 110 GHz
- Low loss antenna cable (0.7 dB/ft @ 24 GHz)

Test Set-Up



Test Method

With the transmitter operating, the EUT was rotated 360° and the search antenna was raised and lowered in both polarities, all in an attempt to maximize the levels of the received emission for each harmonic and spurious emission up to 40 GHz. Testing was performed for each of four different types of antennas.

| Antenna type | Mfr | Model ID | Gain (dBi) |
|--------------|-------------------|-------------|------------|
| Flat panel | European Antennas | FPA 19-58V | 18 |
| Yagi | Telex | 5816AB | 16.5 |
| Sector | RadioWaves | SEC-5H-90CS | 18 |
| 4 ft. Dish | RadioWaves | SP4-5.8 | 34.8 |

Test Results, 1- 40 GHz

Refer to test results in separate Excel spreadsheets for each antenna

NOTE: For radiated emissions that fall on restricted bands per 15.205, emissions limit is 54 dBuV/m at 3 m for emissions above 960 MHz.

Per 15.247(c) all other undesired emissions must be 20 dB below the highest in-band emission when measured in a 100 kHz bandwidth. From antenna conducted data below, in a 100kHz bandwidth, maximum in-band emission is 3.2 dBm

3.2 - 20 = -16.8 dBm limit, 30 - 40,000 MHz.

Using the relationship between RF power, antenna gain, distance, and field strength

$E \text{ v/m} = \text{SQRT}(P_{\text{watts}} * 30 * \text{Gain}) / d \text{ meters}$

converting to dB, assuming 1ft (0.3m) distance:

$E \text{ dBuV/m} = 115.24 + P \text{ dBm} + G \text{ dBi}$. For strictest emission level, assume $G = 0 \text{ dBi}$:

$E_{\text{max}}, \text{ dBuV/m} = 115.24 - 16.8 = 98.4 \text{ dBuV/m}$ at 1 ft for non-restricted bands.

Test Results, 30 - 1000 MHz

Refer to separate Excel spreadsheet.

AC Line Conducted Emissions Test Requirement: 15.107, 15.207

Measurement Equipment Used:

Rohde & Schwarz EMI Receiver ESHS-20

Fischer Custom Communication LISN, FCC-LISN-50/250-25-2

Test Set-up

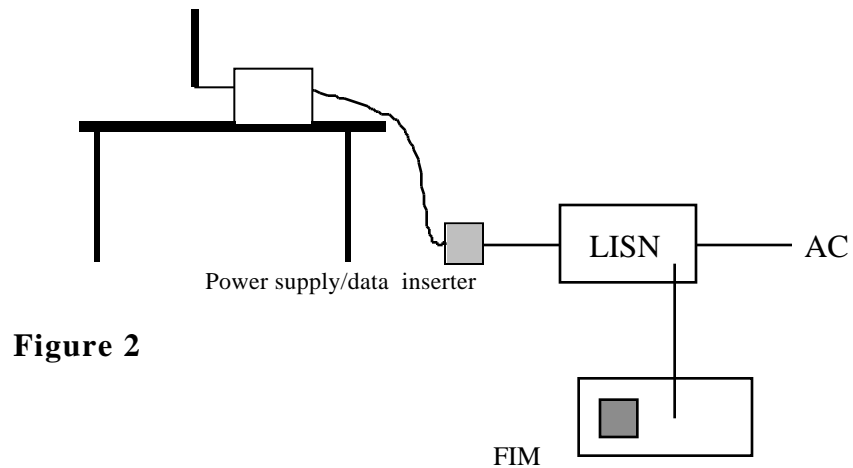


Figure 2

Test Procedure

1. The EUT was placed on a wooden table 40 cm from a vertical ground plane and approximately 80 cm above the horizontal ground plane on the floor. The EUT was set to transmit in normal mode.
2. Line conducted data was recorded for both NEUTRAL and HOT lines.

Test Results

Refer to separate graphs and tabulated data sheets.

Minimum 6 dB Bandwidth
Test Requirement: 15.247(a)2

Measurement Equipment Used:

HP 8593EM Spectrum Analyzer
6' length low loss coaxial cable

Test Procedures

The EUT was configured on a test bench. The EUT was set for continuous operation. While the transmitter broadcast a steady stream of digital data, the analyzer MAX HOLD function was used to capture the envelope of the transmission occupied bandwidth.

Test Results: Refer to attached spectrum analyzer charts. Data taken with RES BW of 100 kHz shows minimum 6 dB BW of 26.6MHz.

Minimum 6 dB Bandwidth

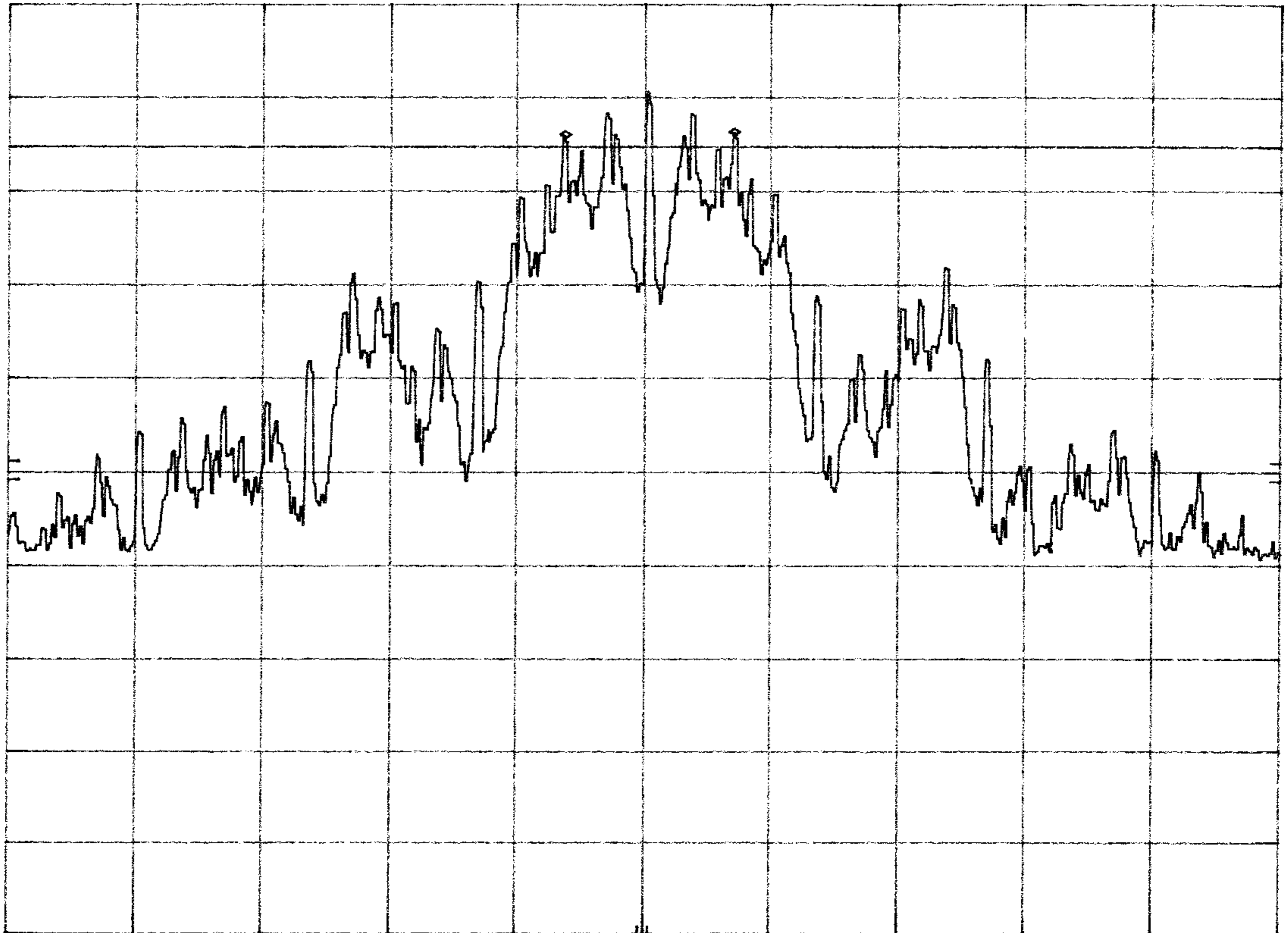
hp

CBL II 6dB BW
REF 11.4 dBm ATTN 30 dB

MKR Δ 26.6 MHz
0.30 dB

10 dB/

DL
-4.0
dBm



CENTER 5.774 GHz
RES BW 300 kHz

VBW 300 kHz

SPAN 200 MHz
SWP 20.0 msec

RF Power Output**Test Requirement: 15.247(b)****Measurement Equipment Used:**

HP 8566B Spectrum Analyzer
2 ft low loss RF cable

Test Procedures

1. The EUT was configured on a test bench.
2. The pulse position modulation of the EUT was disabled. Pulse position modulation is achieved by switching RF output ON and OFF in a pre-determined time sequence. When the modulation is turned off, the resulting CW signal is the peak power output of the transmitter.

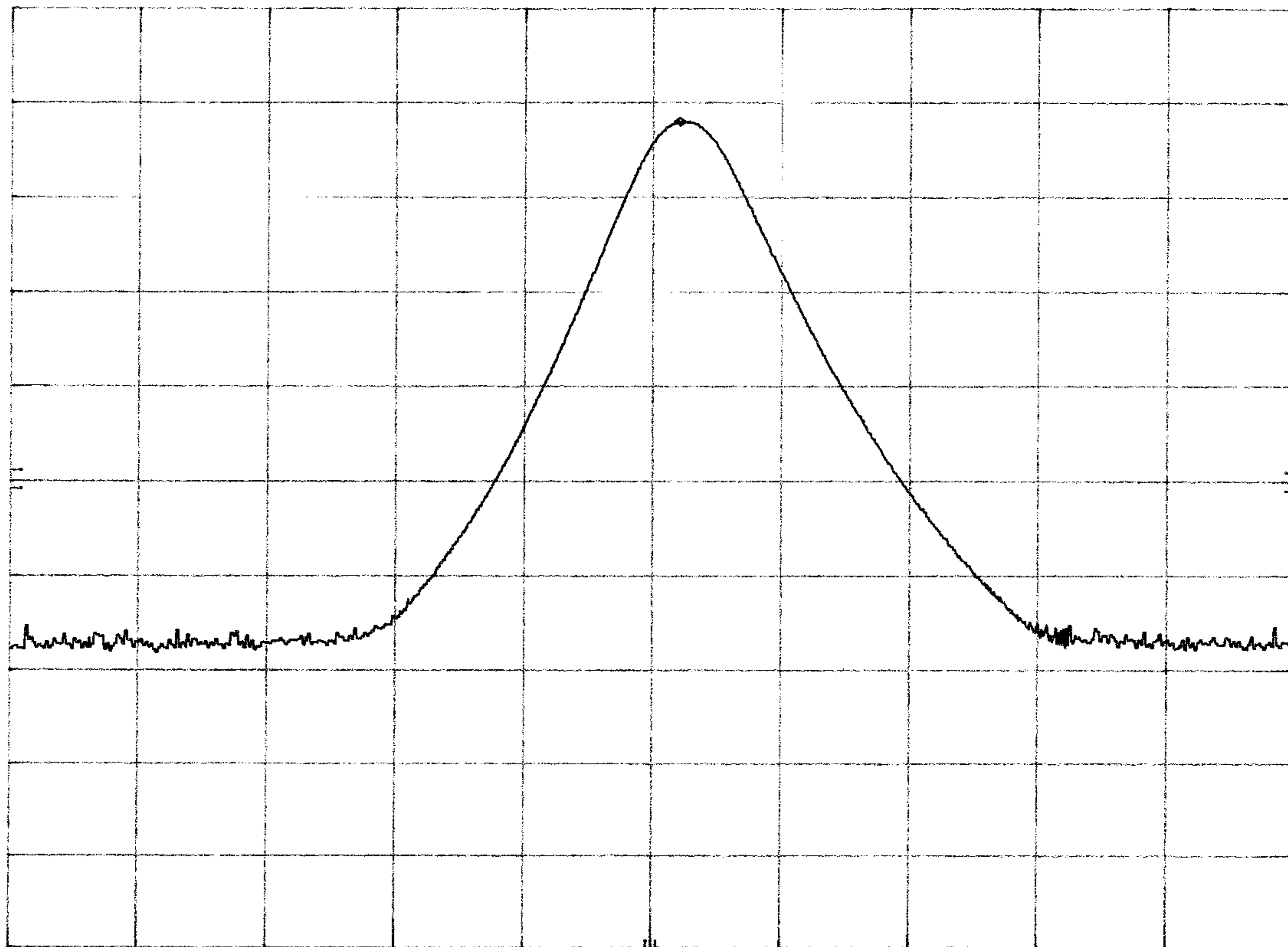
Test Results

Maximum output power is 18 dBm. Refer to attached spectrum analyzer chart.

CBL II 15.247b3 PEAK POWER (PM OFF)
REF 30.0 dBm ATTEN 40 dB

MKR 5.774 79 GHz
18.00 dBm

hp
10 dB/



CENTER 5.774 3 GHz
RES BW 1 MHz

VBW 3 MHz

SPAN 20.0 MHz
SWP 22.9 msec

Spurious Emissions, Conducted Test Requirement: 15.247(c)

Measurement Equipment Used:

HP 8566 Spectrum Analyzer
2 ft length low loss A coaxial RF cable

Test Procedure

1. The EUT was configured on a test bench. The cable was connected between the EUT antenna port and the spectrum analyzer input port.

Spectrum analyzer RES BW was set to 100 kHz. While the transmitter broadcast a steady stream of digital data, the analyzer MAX HOLD function was used to capture the envelope of the transmission.

Readings were taken out to 22 GHz, the upper limit of the spectrum analyzer. For emissions 22-40 GHz, radiated emissions measurements indicated the out of band levels to be well below the -20 dBc level:

Using the relationship between RF power, antenna gain, distance, and field strength

$$E \text{ v/m} = \text{SQRT}(P_{\text{watts}} * 30 * \text{Gain}) / d \text{ meters}$$

converting to dB, assuming 1ft (0.3m) distance:

$$E \text{ dBuV/m} = 115.24 + P \text{ dBm} + G \text{ dBi} .$$

From antenna port conducted emissions data below , -20 dBc = -16.8 dBm.
For strictest emission level, assume G = 0 dBi:

$$E_{\text{max}}, \text{ dBuV/m} = 115.24 - 16.8 = 98.4 \text{ dBuV/m at 1 ft for non-restricted bands.}$$

Radiated data presented above for 22-40 GHz shows all emissions well below this limit.

Test Results

Refer to attached data sheets for conducted emissions 30 MHz - 22 GHz. . Data shows out of band emissions are suppressed well below the -20 dBc minimum required by the Rules.

15.247(c): Spurious Emissions, Conducted

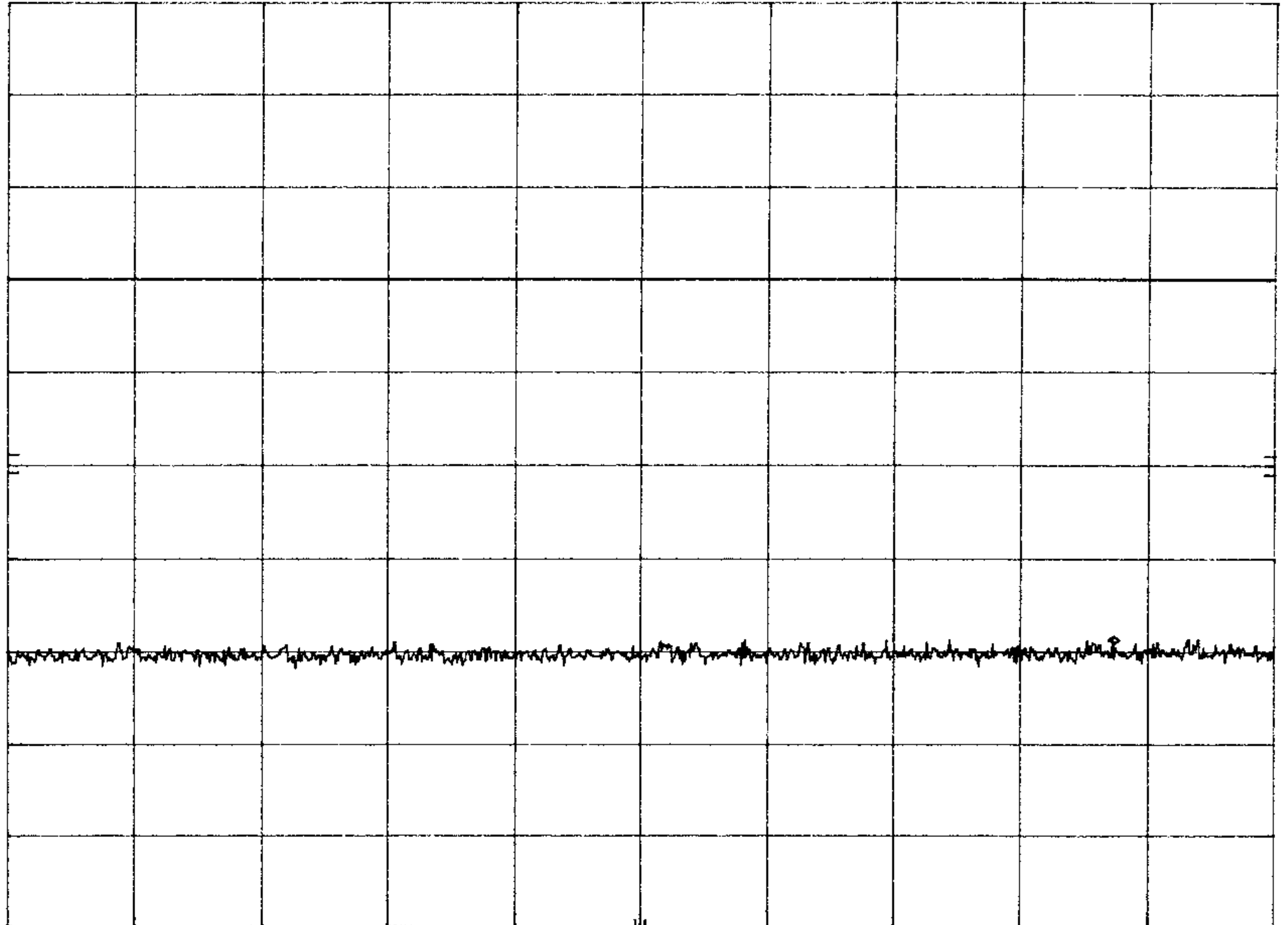
CBL II 15.247c
REF 13.1 dBm ATTEN 30 dB

MKR 875.8 MHz
-55.60 dBm

hp
10 dB/

DL
-16.8
dBm

CORR'D



START 30 MHz

RES BW 100 kHz

VBW 100 kHz

STOP 1.000 GHz

SWP 291 msec

CBL II 15.247c
REF 13.1 dBm ATTEN 30 dB

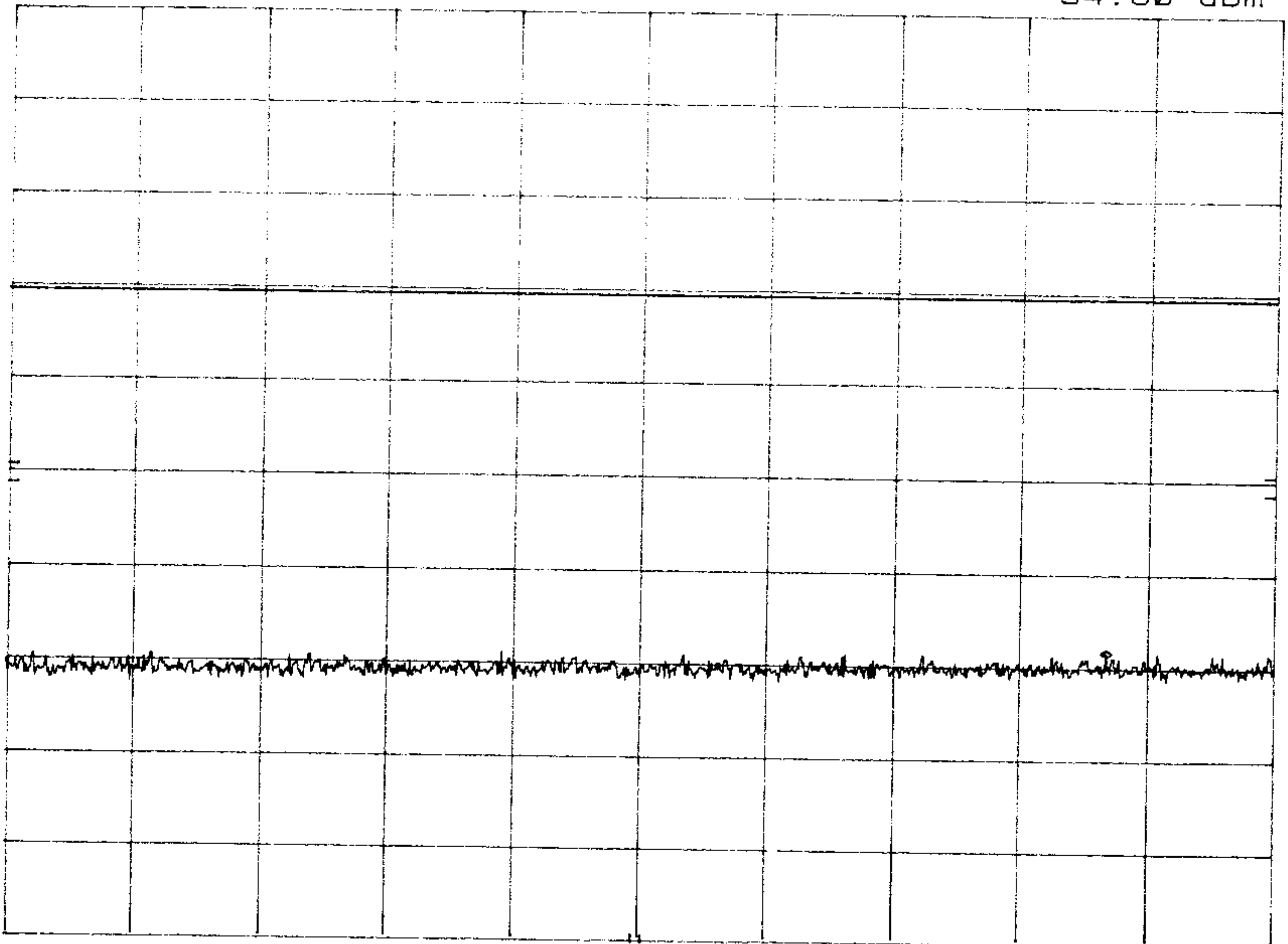
MKR 1.868 GHz
-54.60 dBm

hp
10 dB/

DL
-16.8
dBm

CORR'D

START 1.00 GHz STOP 2.00 GHz
RES BW 100 KHz VBW 100 KHz SWP 300 msec



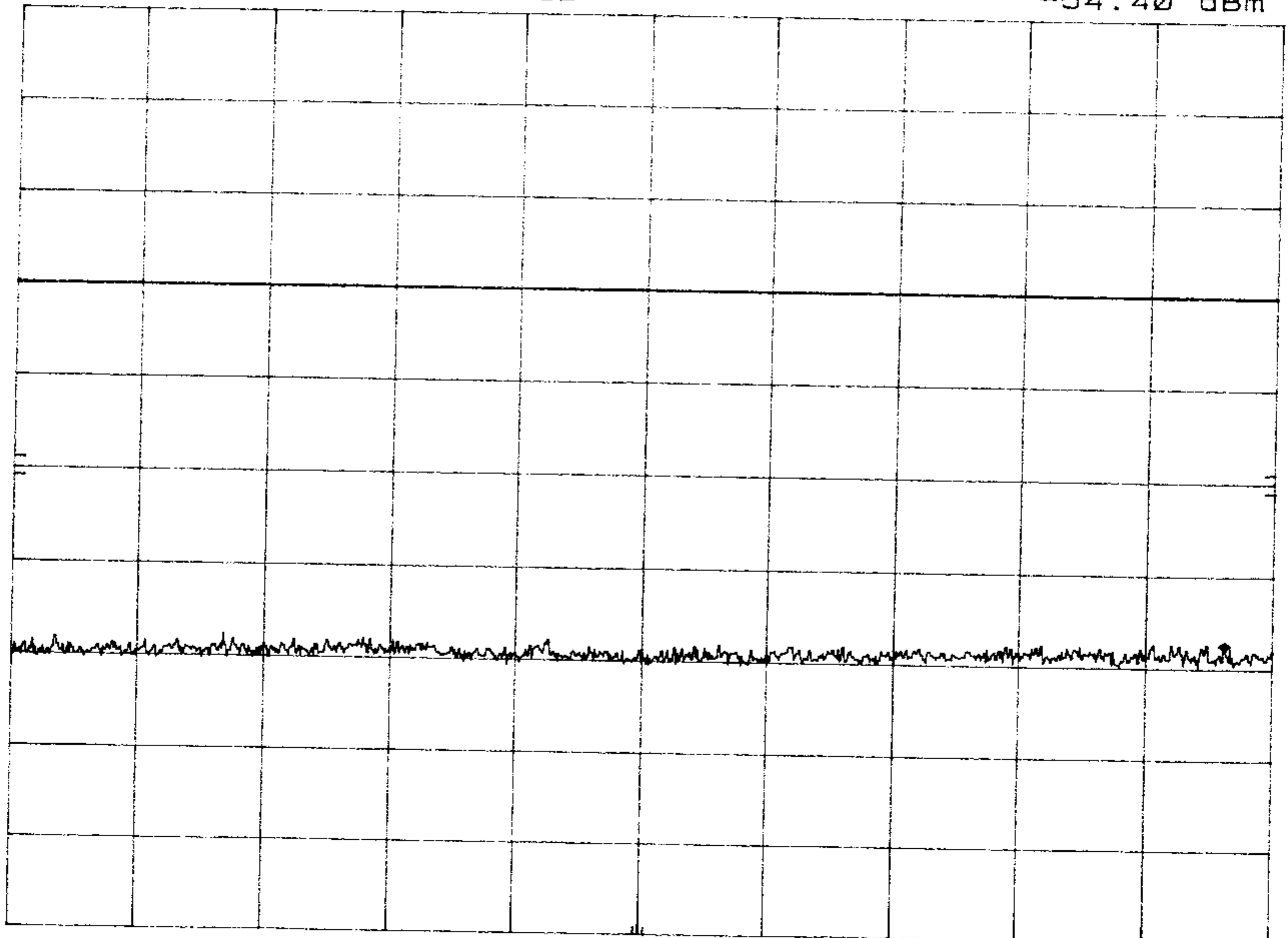
CBL II 15.247c
REF 13.1 dBm ATTEN 30 dB

MKR 4.883 GHz
-54.40 dBm

hp
10 dB/

DL
-16.8
dBm

CORR'D



START 2.00 GHz RES BW 100 KHZ VBW 100 KHZ STOP 5.00 GHz
SWP 900 msec

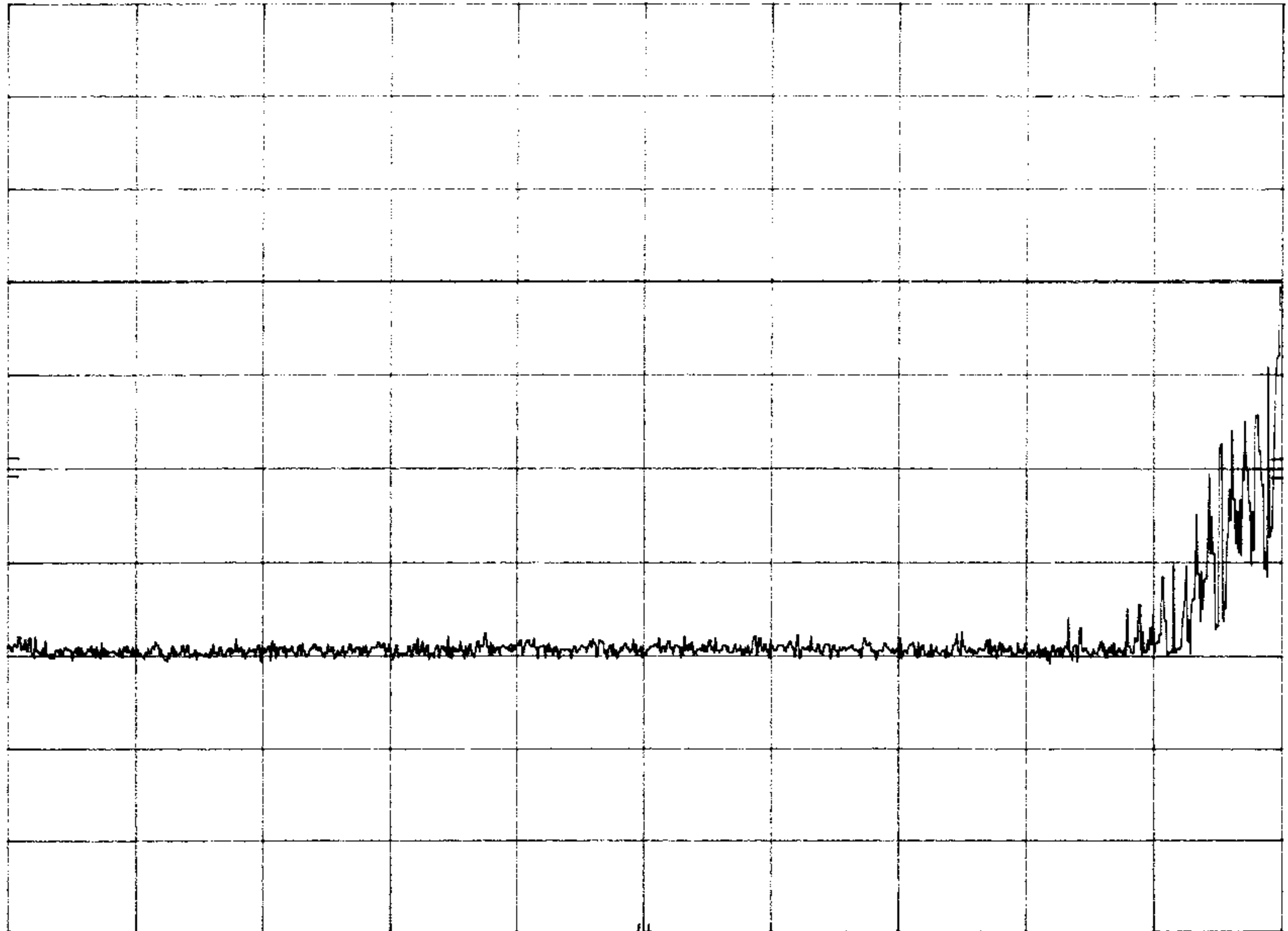
CBL II 15.247c
REF 13.1 dBm ATTEN 30 dB

MKR 5.286 4 GHz
-56.50 dBm

HP
10 dB/

DL
-16.8
dBm

CORR'D



START 5.000 GHz
RES BW 100 kHz

VBW 100 kHz

STOP 5.725 GHz
SWP 218 msec

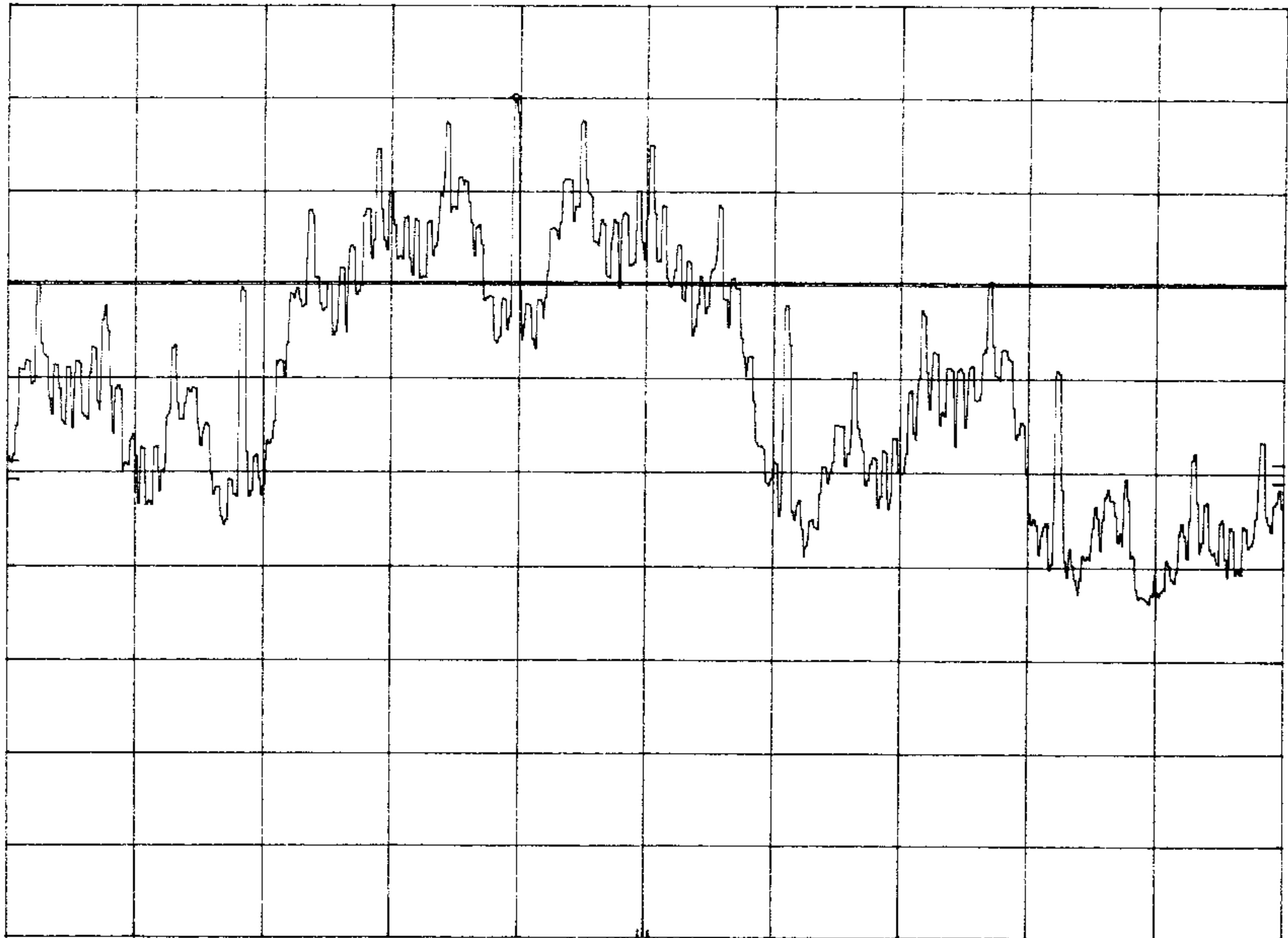
CBL II 15.247c
REF 13.1 dBm ATTEN 30 dB

MKR 5.774 4 GHz
3.20 dBm

hp
10 dB/

DL
-16.8
dBm

CORR'D



START 5.725 GHz STOP 5.850 GHz
RES BW 100 KHz VBW 100 KHz SWP 37.5 msec

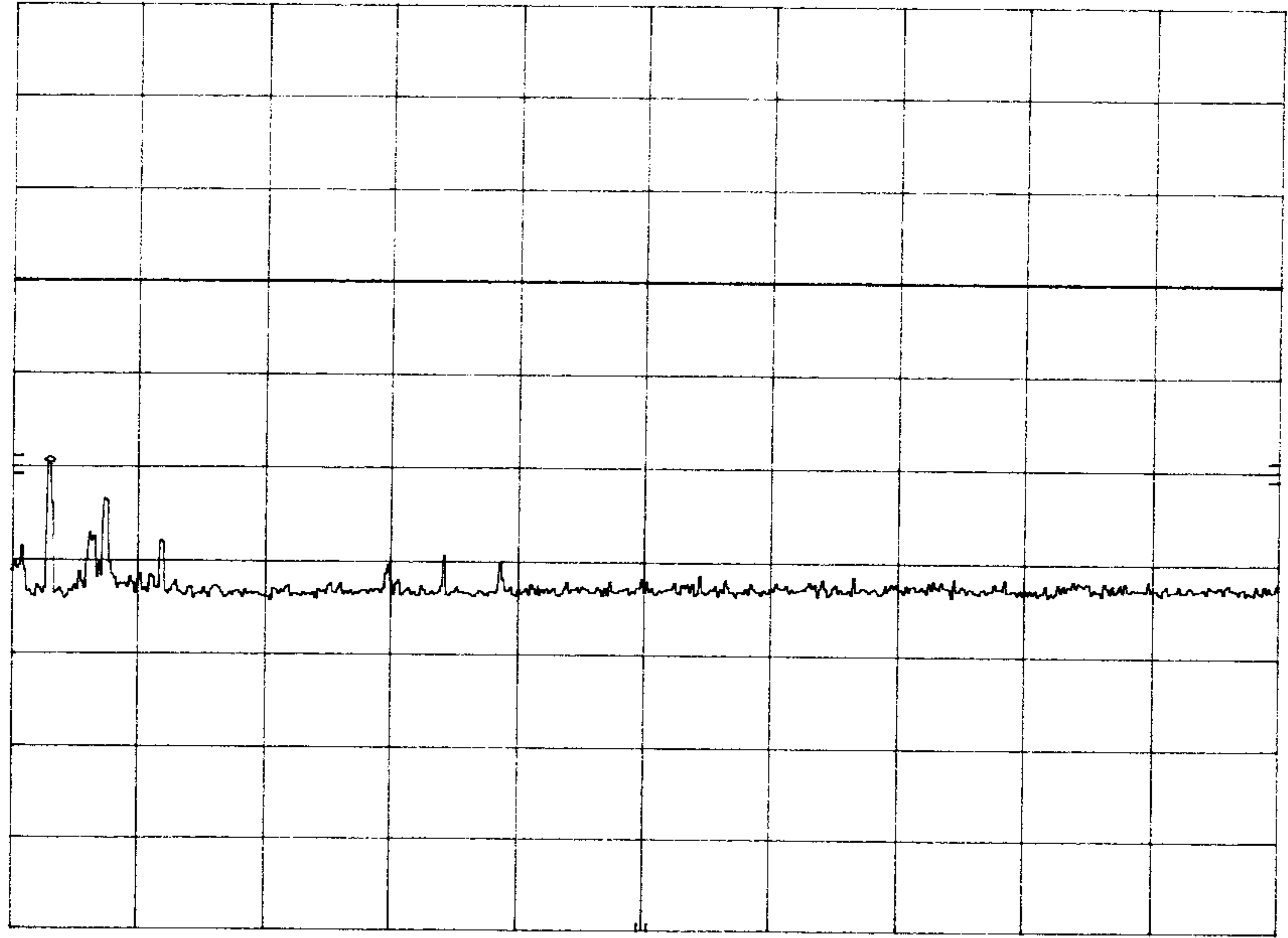
CBL II 15.247c
REF 13.1 dBm ATTEN 30 dB

MKR 5.854 4 GHz
-36.20 dBm

hp
10 dB/

DL
-16.8
dBm

CORR'D



START 5.850 GHz

RES BW 100 kHz

VBW 100 kHz

STOP 6.000 GHz

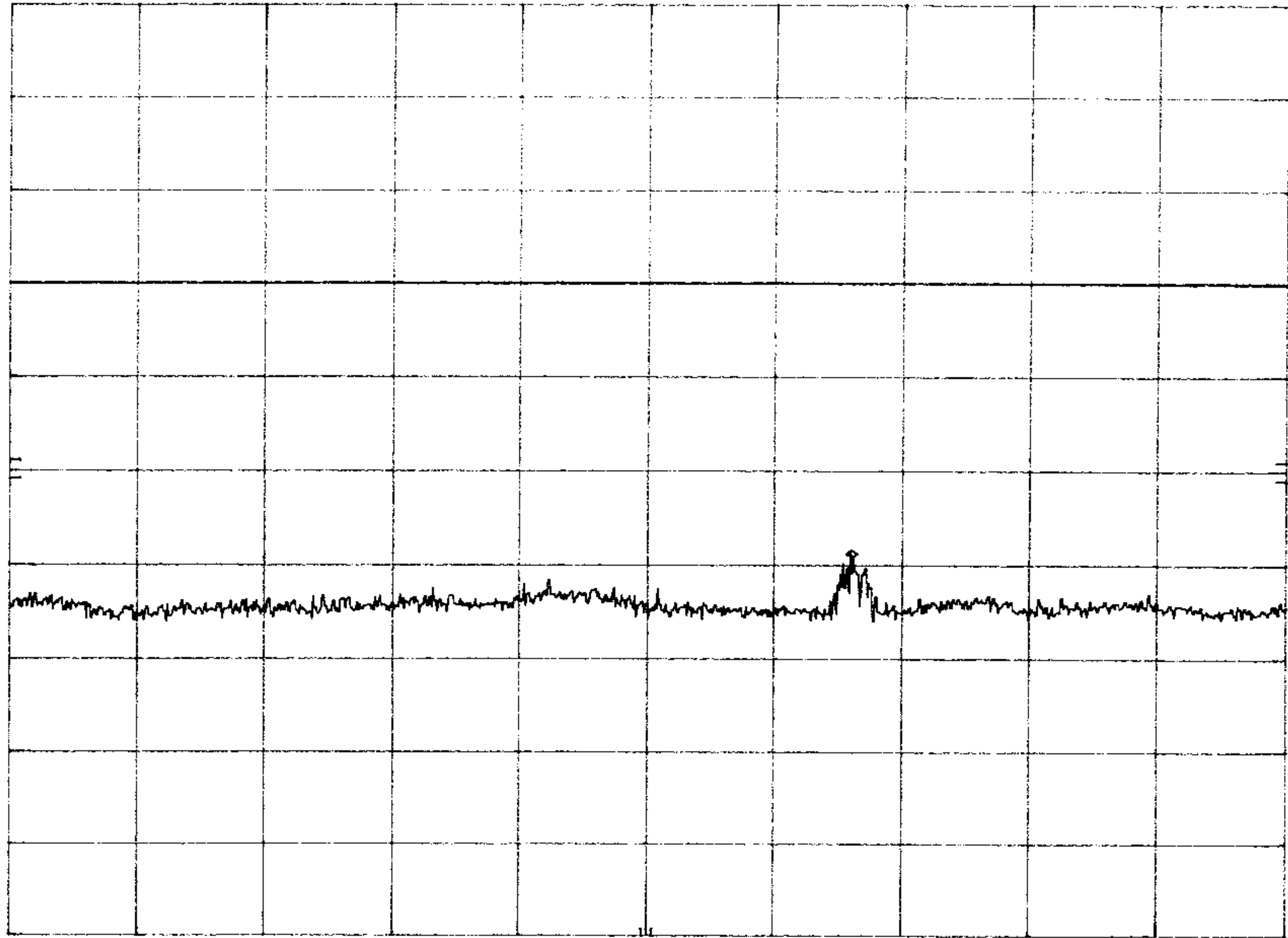
SWP 45.0 msec

CBL II 15.247c
REF 13.1 dBm ATTEN 30 dB

MKR 7.320 GHz
-45.70 dBm

hp
10 dB/

DL
-16.8
dBm



START 6.00 GHz RES BW 100 KHz VBW 100 KHz STOP 8.00 GHz
SWP 600 msec

CBL II 15.247c

MKR 9.510 GHz

hp

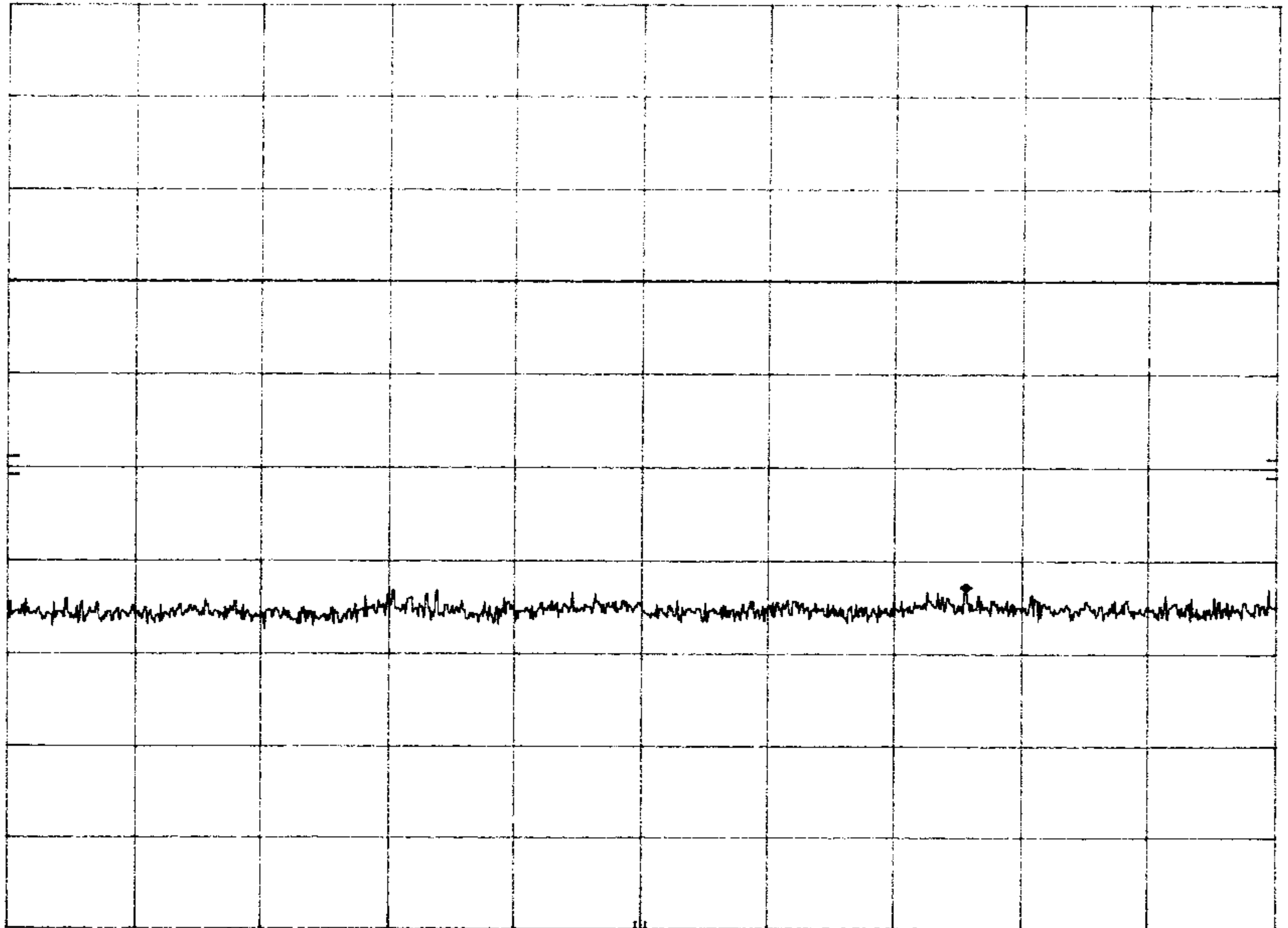
REF 13.1 dBm

ATTEN 30 dB

-49.70 dBm

10 dB/

DL
-16.8
dBm



START 8.00 GHz

STOP 10.00 GHz

RES BW 100 kHz

VBW 100 kHz

SWP 600 msec

CBL II 15.247c

MKR 10.048 GHz

hp

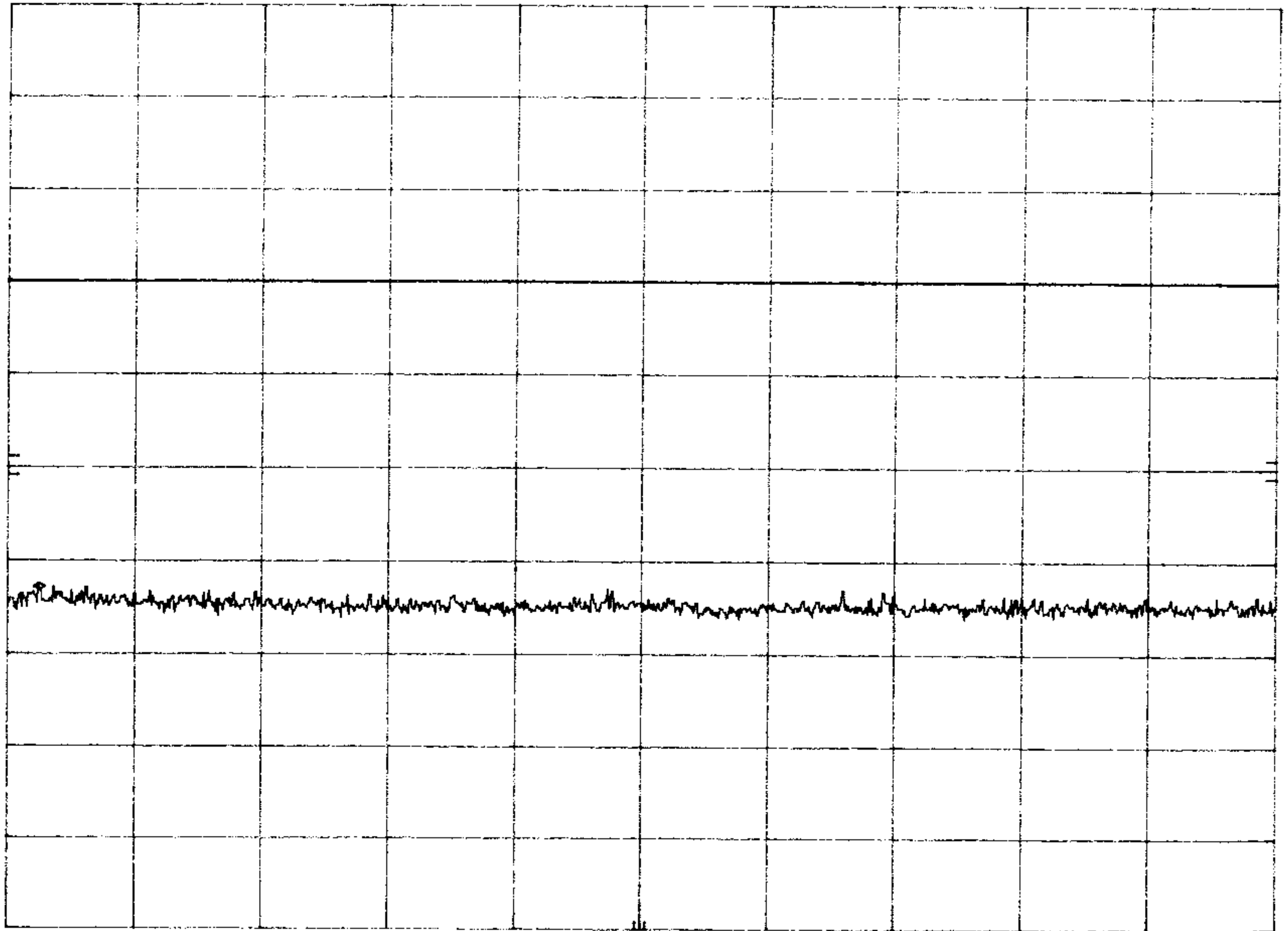
REF 13.1 dBm

ATTEN 30 dB

-49.70 dBm

10 dB/

DL
-16.8
dBm



START 10.00 GHz

STOP 12.00 GHz

RES BW 100 kHz

VBW 100 kHz

SWP 600 msec

CBL II 15.247c

MKR 13.994 GHz

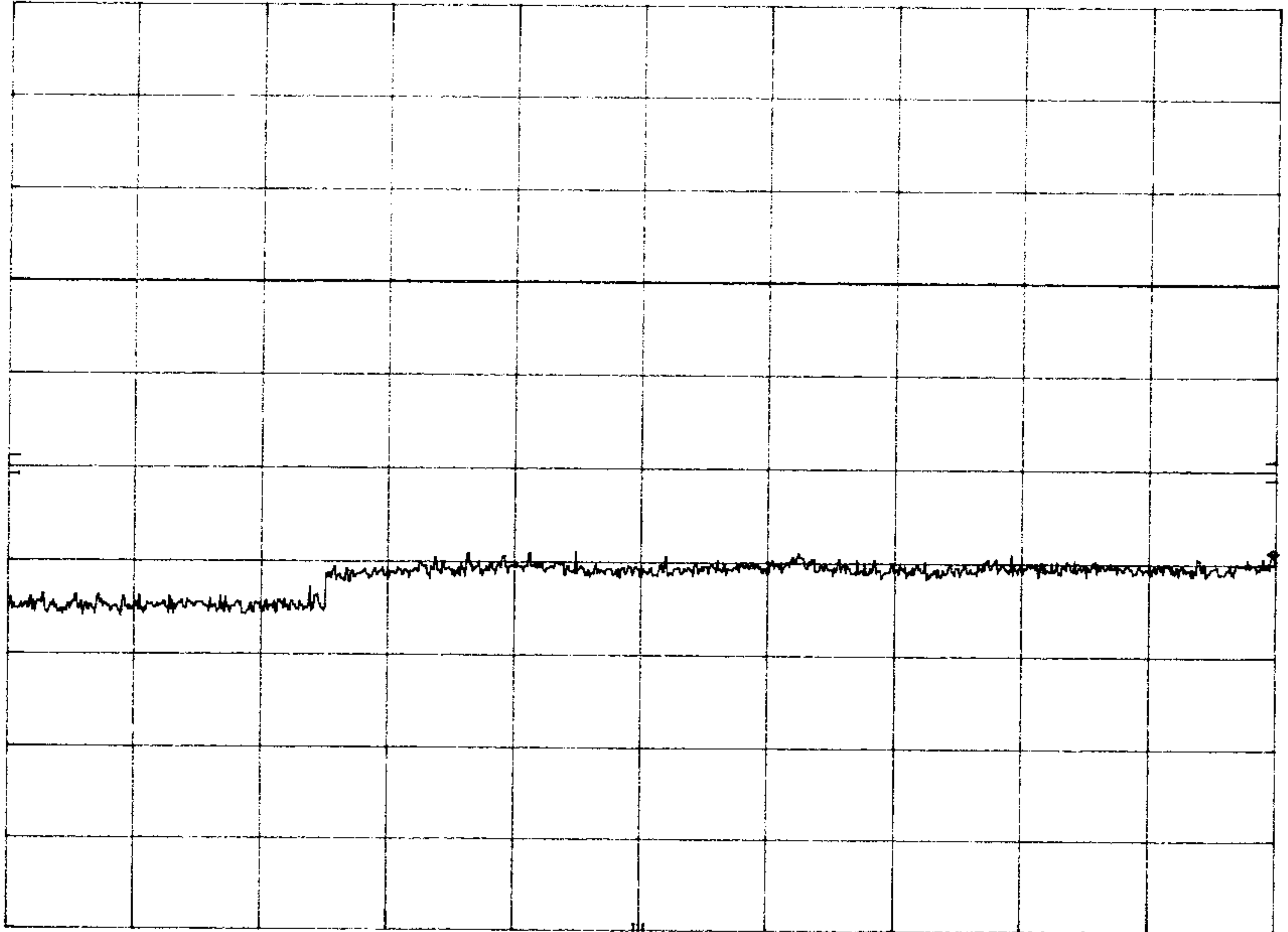
REF 13.1 dBm ATTEN 30 dB

-45.70 dBm

hp

10 dB/

DL
-16.8
dBm



START 12.00 GHz

STOP 14.00 GHz

RES BW 100 kHz

VBW 100 kHz

SWP 600 msec

CBL II 15.247c

MKR 15.478 GHz

hp

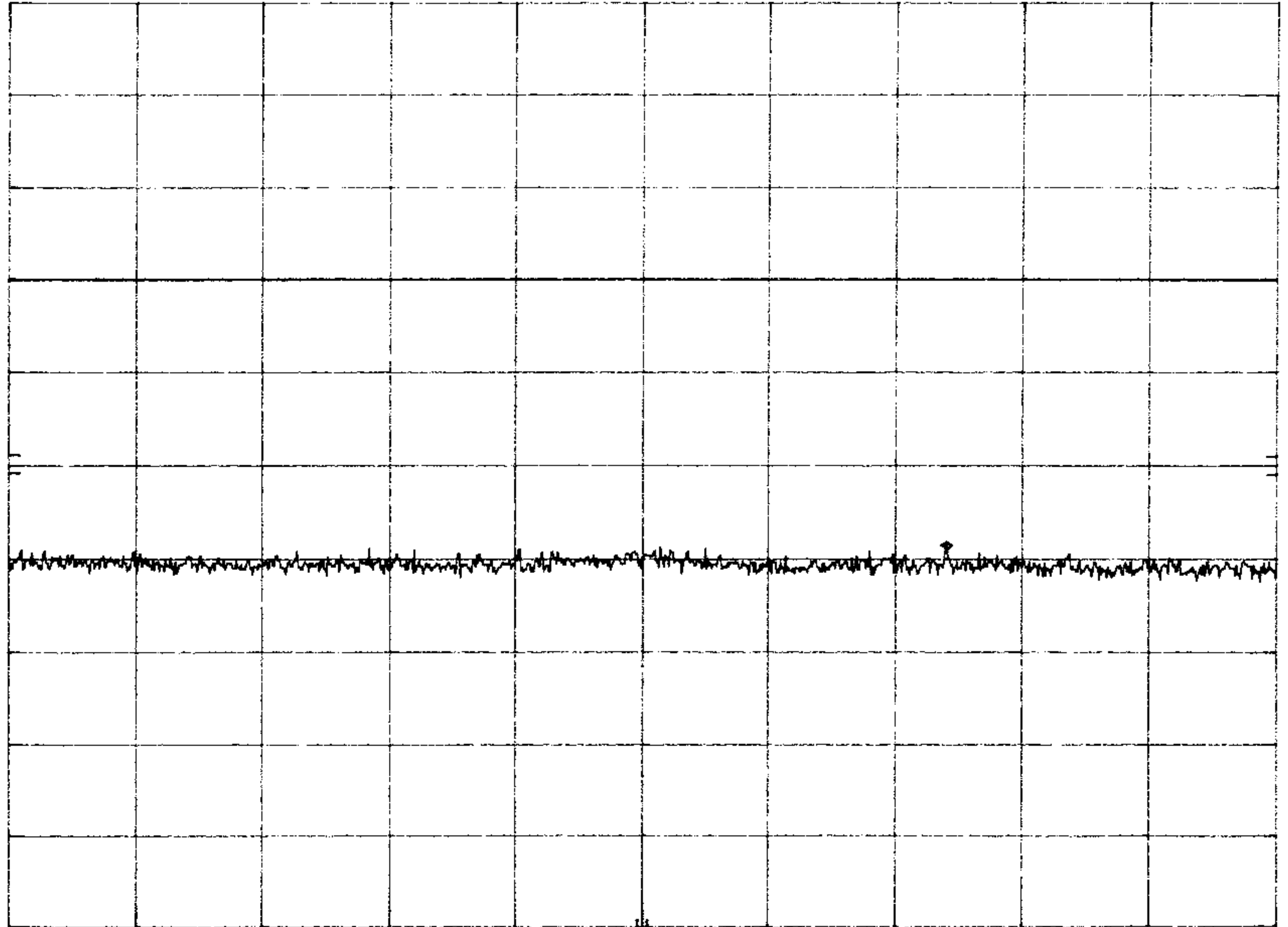
REF 13.1 dBm

ATTEN 30 dB

-45.50 dBm

10 dB/

DL
-16.8
dBm



START 14.00 GHz

STOP 16.00 GHz

RES BW 100 kHz

VBW 100 kHz

SWP 600 msec

CBL II 15.247c

MKR 17.324 GHz

hp

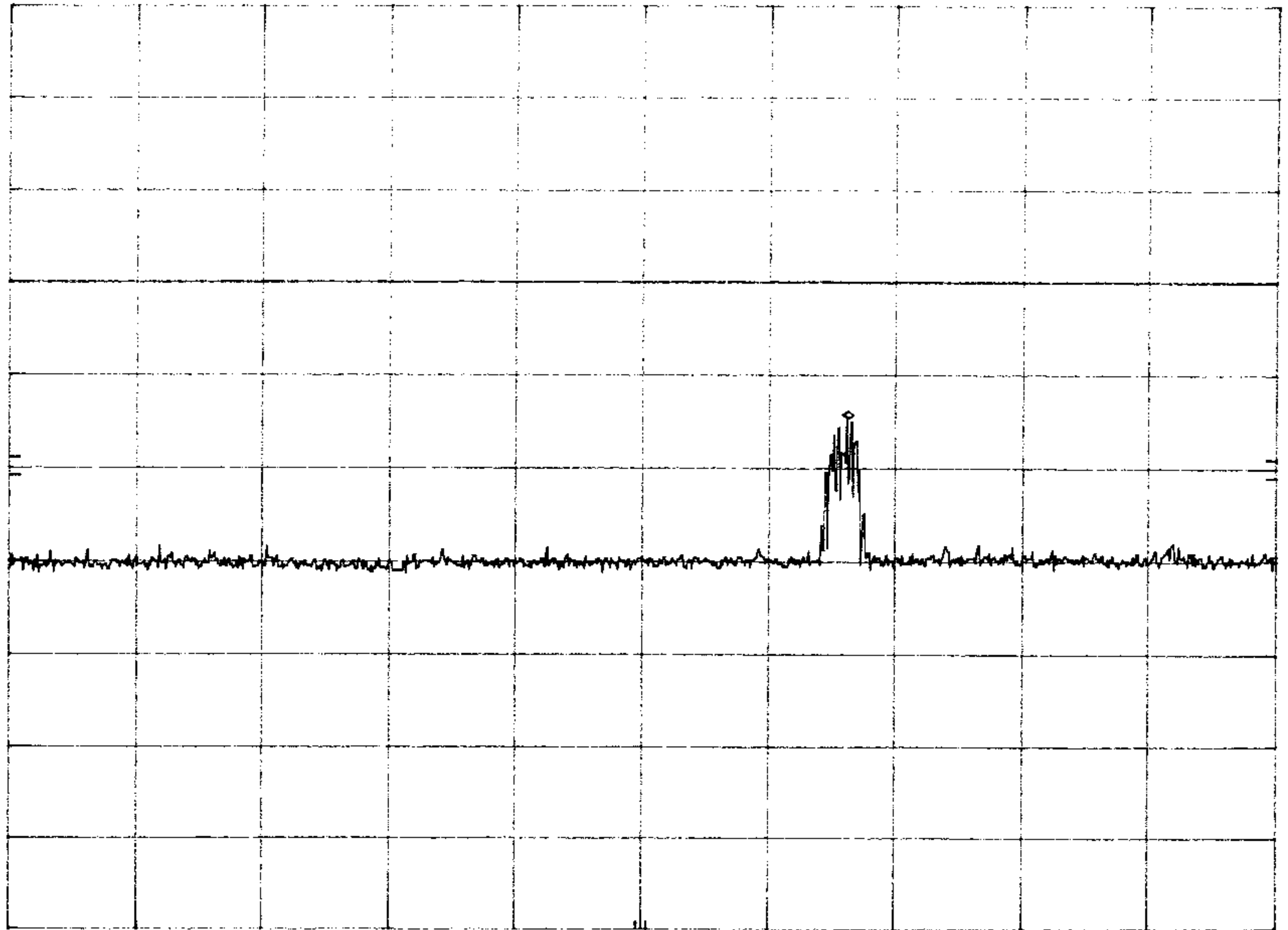
REF 13.1 dBm

ATTEN 30 dB

-31.20 dBm

10 dB/

DL
-16.8
dBm



START 16.00 GHz

STOP 18.00 GHz

RES BW 100 kHz

VBW 100 kHz

SWP 600 msec

CBL II 15.247c

MKR 18.782 GHz

REF 13.1 dBm

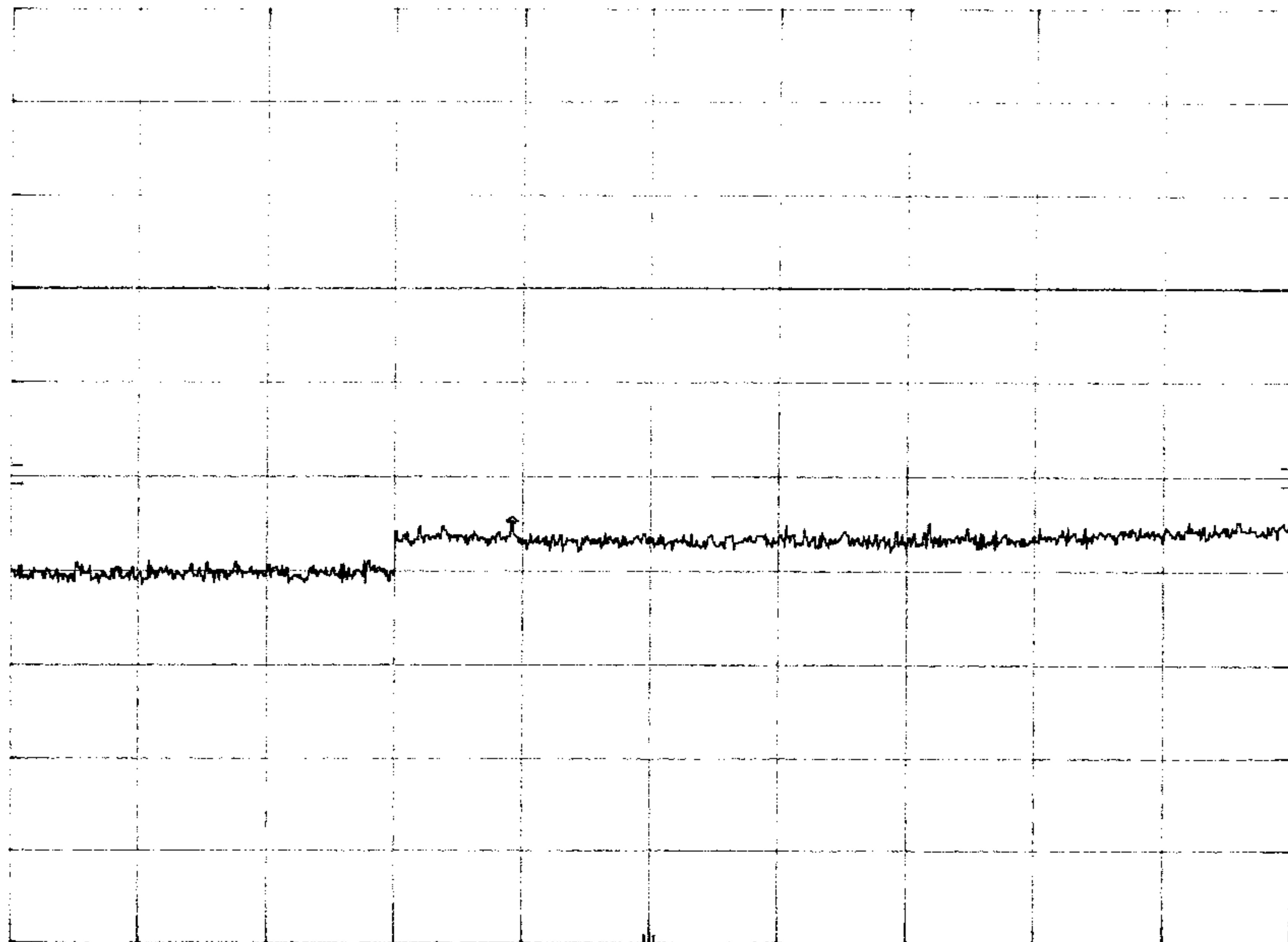
ATTEN 30 dB

-41.60 dBm

HP

10 dB/

DL
-16.8
dBm



START 18.00 GHz

STOP 20.00 GHz

RES BW 100 kHz

VBW 100 kHz

SWP 600 msec

CBL II 15.247c

MKR 21.460 GHz

hp

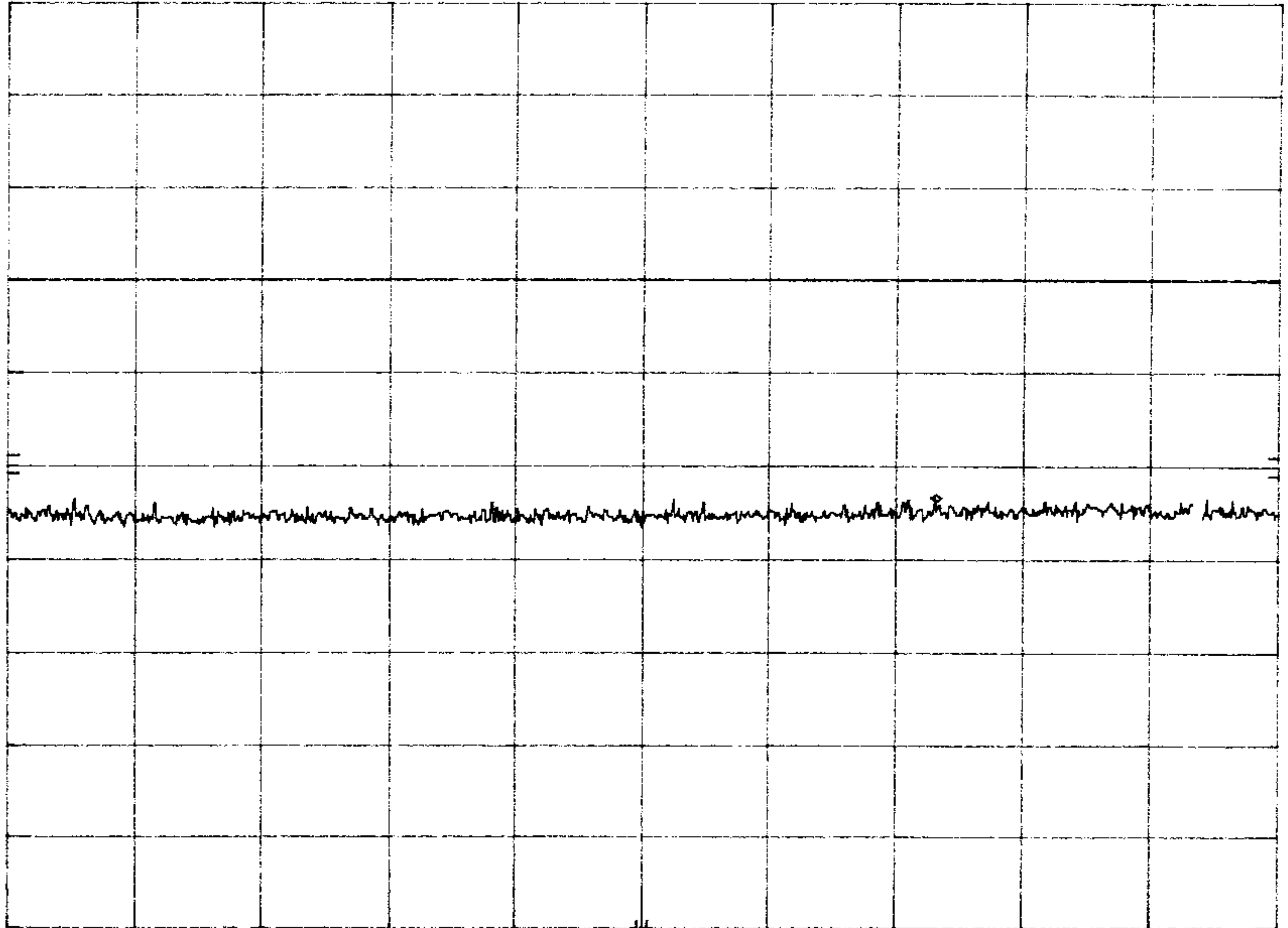
REF 13.1 dBm

ATTEN 30 dB

-40.30 dBm

10 dB/

DL
-16.8
dBm



START 20.00 GHz

STOP 22.00 GHz

RES BW 100 KHz

VBW 100 KHz

SWP 600 msec

Power Spectral Density**Test Requirement: 15.247(d)****Measurement Equipment Used:**

HP 8566 Spectrum Analyzer
2 ft length low loss A coaxial RF cable

Test Procedure

The emission peak was set to the center of the display. The SPAN was set to 300 kHz, the RES BW and VID BW were set to 3 kHz, and SWEEP TIME was set to 100 seconds. The maximum trace was recorded and compared to the 8 dBm limit.

Test Results

Maximum measured PSD was -9.2 dBm. Refer to attached spectrum analyzer chart.

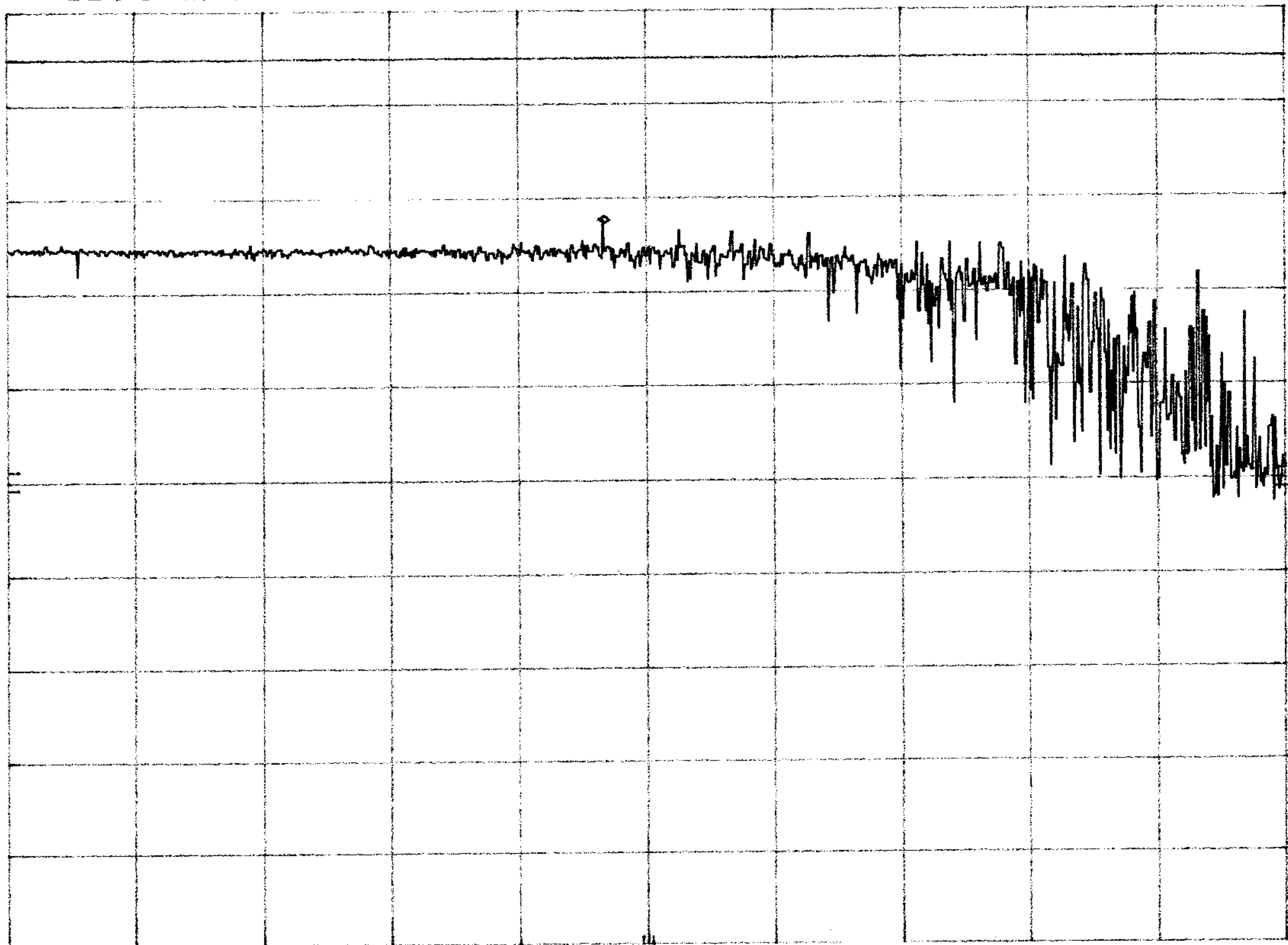
15.247(d): Power Spectral Density

CBL II 15.247d
REF 13.1 dBm ATTN 30 dB

MKR 5.774 381 2 GHz
-9.20 dBm

hp
10 dB/

DL
8.0
dBm



CENTER 5.774 391 GHz
RES BW 3 KHz

VBW 3 KHz

SPAN 301 KHz
SWP 100 sec