

EXHIBIT 2  
MEASUREMENT REPORT

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MEASUREMENT REPORT  
FCC ID: NZV-SM-3720

EXHIBIT 2

## TEST FACILITY

The testing was conducted at the Hyak Laboratories, Inc., three meter open field site located in Spotsylvania, Virginia. A complete description of the site is on file with the FCC Laboratory Division, Ref. 31040/SIT/HYAK.

## TEST PROCEDURE

Testing was conducted using ANSI 63.4 (1992) as the measurement procedure.

## INSTRUMENTATION

From the list of test equipment; the following instruments were used to conduct the tests:

EMCO 3120 Dipole Antenna Set	S/N 0040
EMCO 3115 Double Ridge Guide Horn	S/N 8903-3114
HP 8563E Spectrum Analyzer	S/N 3416A02224
HP 8596E Spectrum Analyzer	S/N 3235A00144
Compliance Design LISN	S/N 8379584

## TEST REPORT

### A. DEVICE UNDER TEST

The device is a low power remote control transmitter operating under the provisions of Part 15.231 of the FCC rules. The frequency of transmission is 418 MHz. nominal. The modulation mode is on/off keying, using a pulse position format described in the data sheet.

The device is powered directly from the 115 volt AC line of a residential building. In normal use the transmitter module is plugged into a switched wall outlet and may or may not have a lamp or other appliance plugged into the receptacle that is integral to the module. The device is activated when the outlet is switched on or off.

When the outlet is switched on, the regulator circuit charges up and enables the logic circuitry to initialize. Approximately 110ms. after turn on transmission starts. The on command code transmission packet is sent three times and then repeated again after a 3.5 second quiet period. The total transmission sequence is completed in 4.25 seconds which fullfills the requirements of 15.231(a-2). After the transmission sequence is completed, the device remains quiet until the outlet is switched off.

When the outlet is switched off the device immediately transmits the off command code twice and then stops before the charge in the regulator circuit is exhausted.

### B. MEASUREMENT PROCEDURE : RADIATED EMISSIONS

Transmitter field strength measurements were conducted according to the procedures set out in ANSI C63.4 (1992). The device under test was placed on a reversible rotating turntable 0.8 meters high, centered at 3 meters distant from the measurement antenna. The device was placed in the center of the turntable and tested in the two logical positions as shown in the photographs. .

The device was powered an ONEAC CB1120 powerline signal isolator/conditioner supply located directly under the turntable, connected through slip rings mounted under the turntable base. To facilitate testing, the device was locked in a constant on command transmit sequence.

The field strength measurements were taken using an HP8596E spectrum analyzer, an EMCO 3121C dipole set and an EMCO 3115 DRG horn. The device was scanned from 30MHz. to 4.2GHz. and all emissions were noted. In this case the only emissions detected were those harmonically related to the fundamental transmit frequency.

At each detected emission frequency, the device was measured by rotating the turntable and adjusting the antenna height over a range of 1 to 4 meters to obtain the maximum output level. This procedure was performed with both horizontal and vertical antenna polarizations with the device in the positions described above. The peak reading for each frequency was recorded in column 2 on the data sheet. The readings for the 7th, 8th and 9th harmonics were obtained by reducing the distance from the measurement antenna to 1 meter and entering a -9.5dB distance correction factor into the final calculation for those measurements. The 10th harmonic was not detectable.

The device was examined in the time domain to establish a duty cycle correction factor per 15.35. This was accomplished by plotting the radiated signal in zero span mode at various sweep rates to capture the individual bit envelopes as well as the packet repeat rate. A duty cycle correction was derived from the time domain analysis and this factor was applied to the calculations for radiated emissions.

### C. PLOTS

The plots for time domain, occupied bandwidth and line conducted measurements were made using an HP8594E spectrum analyzer equipped with a precision frequency reference. Line conducted measurements were taken through a Compliance Design 50uH LISN. The LISN was powered through an ONEAC CB1120 powerline signal isolator/conditioner.

RADIATED EMISSIONS				FCC ID: NZV-SM-3720			page 1 of 1	
client    Lectronic Solutions				model    SM-3720			project # 0622	
device    control transmitter						Test date    03-26-98		
CFR V47    15.231			antenna    Dipoles/DRG horn				temp. = 33C	
Frequency Radiated MHz.	Peak Reading dBm	Ant Factor dB	Ant Polar	Field 1 Intensity uV/m @ 3m	Duty Cycle -dB	Field 2 Intensity uV/m @ 3m	FCC Limit	
418.051	-40.07	20.7	H	24027	-9.71	7870	10333	
836.102	-68.61	27.3	H	1925	-9.71	629	1033	
1254.053	-76.28	25.8	H	670	-9.71	219	1033	
1672.205	-80.13	27.7	V	535	-9.71	175	* 500	
2090.256	-83.43	29.4	V	445	-9.71	146	1033	
2508.307	-92.11	30.9	V	195	-9.71	64	1033	
2926.358	-100.04	31.7	H	86	-9.71	28	1033	
3344.410	-106.92	32.6	H	43	-9.71	14	1033	
3762.459	-105.64	33.8	V	57	-9.71	19	* 500	

This device is pulse code modulated according to the format below:

The data is transmitted in packets of three words issued once every 123 ms. Each word consists of one start bit (420 us. nominal) followed by twelve address bits (420 or 840 us. nominal) with at least one of the last four bits forced to the shorter duration for any given address. Preceding each three word packet is a two bit preamble of 840 us. per bit nominal. The worst case on time for any 100 ms. period is calculated as follows:

1) 2 preamble bits	2 X 840 us. =	1.680 ms.
2) 3 start bits	3 X 420 us. =	1.260 ms.
3) 33 address bits (840 us. worst case)	33 X 840 us. =	27.720 ms.
4) 3 address bits (420 us. forced)	3 X 420 us. =	1.260 ms.
Total on time =		31.920 ms.

5)  $31.92/100 = .3192$  (20log) = -9.92dB duty cycle correction factor

The bit times of the device tested were slightly longer than the nominals shown (refer to time domain plots) and yielded an actual correction factor of only -9.71dB. This was used for the radiated emissions calculations in the chart above.

\* denotes restricted band

16: 48: 20 AUG 27, 1998

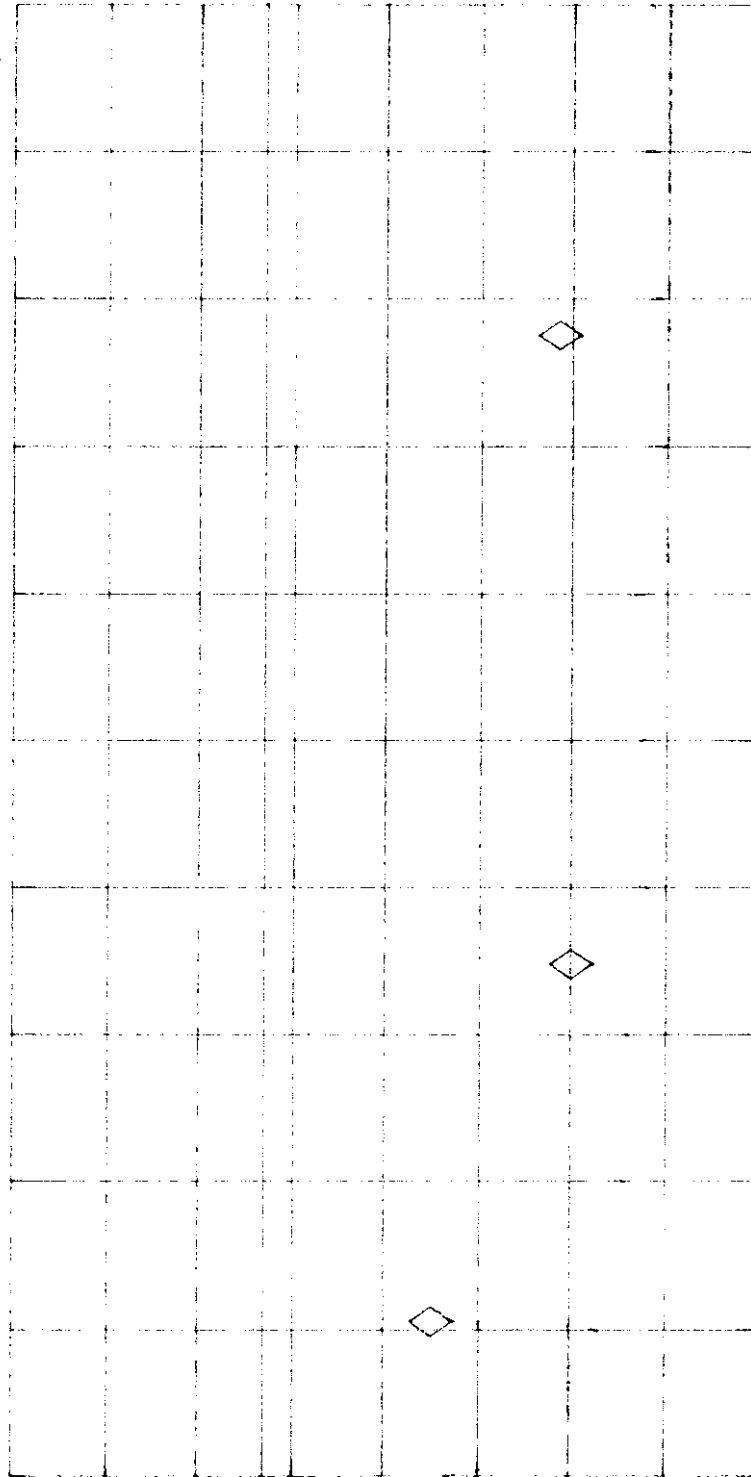
SM-3720 CONDUCTED LINE 1

MKR 3.55 MHz

REF 75.0 dBμV #AT 0 dB

27.56 dBμV

TABLE  
ΔDL NRM



PEAK  
LOG  
10  
dB/

DL  
48.0  
dBμV

CNT RES  
AUTO MAN

DSP LINE  
ON OFF

More  
2 of 2

Marker	Frequency (MHz)	Amplitude (dBμV)
1: (A)	3.55 MHz	27.56 dBμV
2: (A)	12.72 MHz	21.67 dBμV
3: (A)	13.67 MHz	14.21 dBμV
4: (A)	14.21 MHz	

START 450 KHz

#RES BW 9.0 KHz

STOP 30.00 MHz

#SWP 100 sec

VBW 30 KHz

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SM-3720 CONDUCTED LINE 2

MKR 3.55 MHz

REF 75.0 dBμV #AT 0 dB

30.12 dBμV

TABLE  
ΔDL NRM

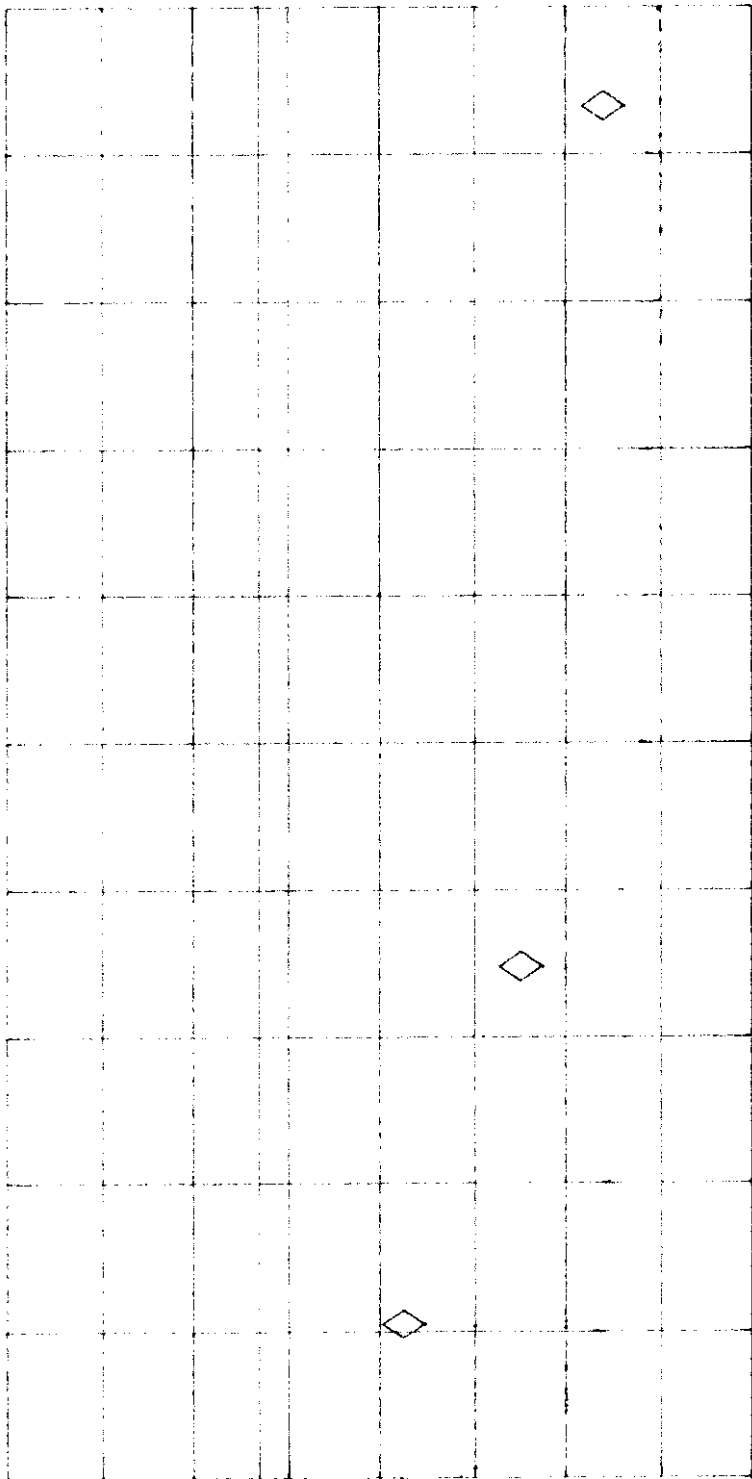
PEAK

LOG

10

dB/

CNT RES  
AUTO MAN



DL

48.0

dBμV

DSP LINE  
ON OFF

More  
2 of 2

Marker Table (dBμV)      Frequency Table (MHz)      Attenuation Table (dB)

1: 75.0	3.55	30.12
2: 75.0	3.55	30.12
3: 75.0	3.55	30.12
4: 75.0	3.55	30.12

START 450 KHZ

STOP 30.00 MHz

#RES BW 9.0 KHZ

VBW 30 KHZ

#SWP 100 sec

15: 10: 05 AUG 27. 1998

77 OCCUPIED BANDWIDTH 1

REF -20.0 dBm #AT 0 dB

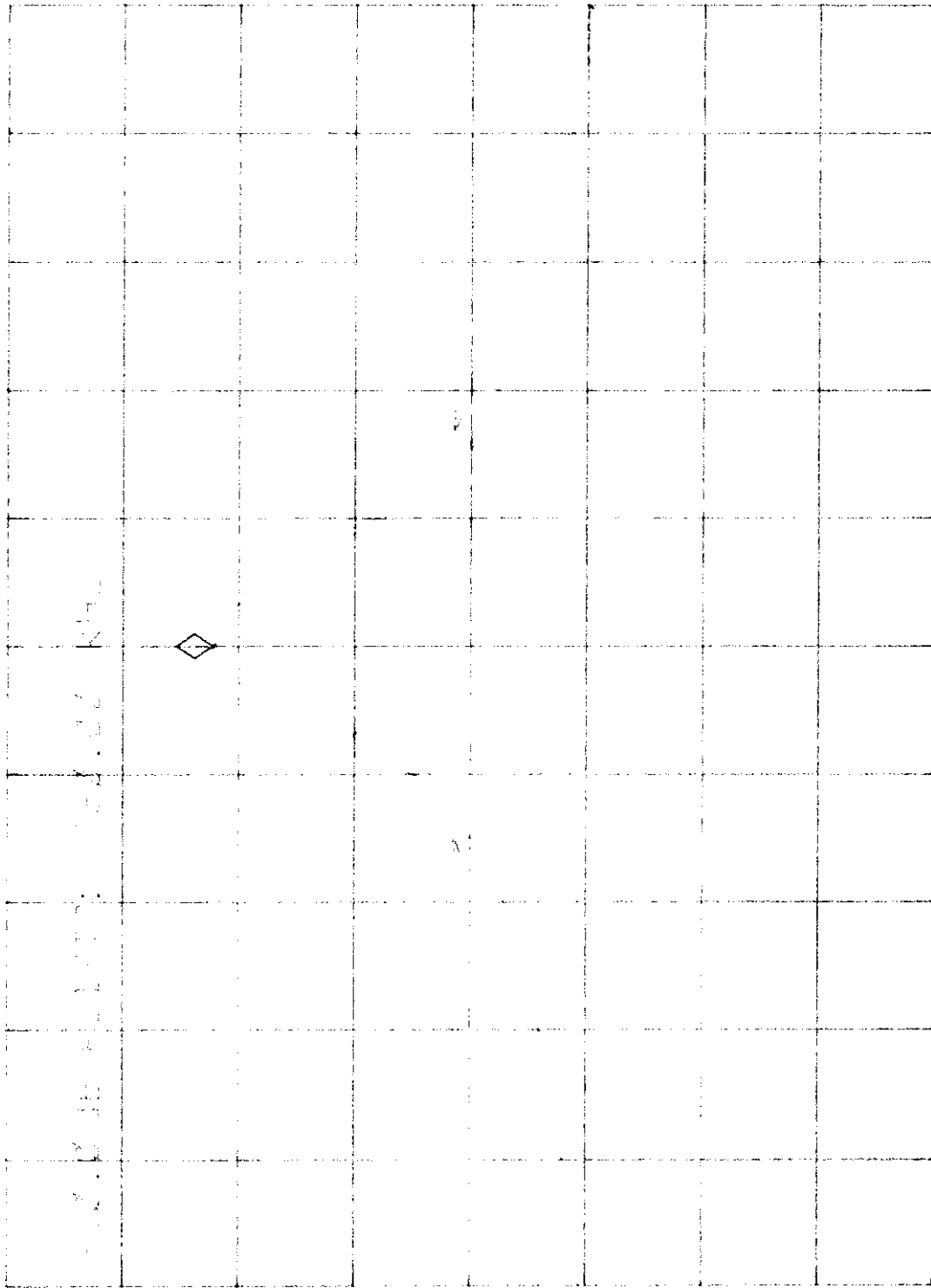
MKR 418.055 MHz  
-37.78 dBm

PEAK

LOG

10

dB/



WA SB  
SC FS  
CORR

CENTER 418.055 MHz

#RES BW 100 KHz

#VBW 100 KHz

SPAN 2.000 MHz  
#SWP 10.0 sec



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77 OCCUPIED BANDWIDTH 2

REF -20.0 dBm #AT 0 dB

MKR 418.06 MHz  
-37.65 dBm

PEAK

LOG

10

dB/

418.06 MHz



WA SB

SC FS

CORR

CENTER 418.06 MHz

#RES BW 100 KHz

SPAN 20.00 MHz

#SWP 10.0 sec

#VBW 100 KHz

10:55:05 AUG 27, 1998

TIME DOMAIN 1 (SHORT PULSE)

MKR  $\Delta$  435.00  $\mu$ sec

REF -20.0 dBm #AT 0 dB

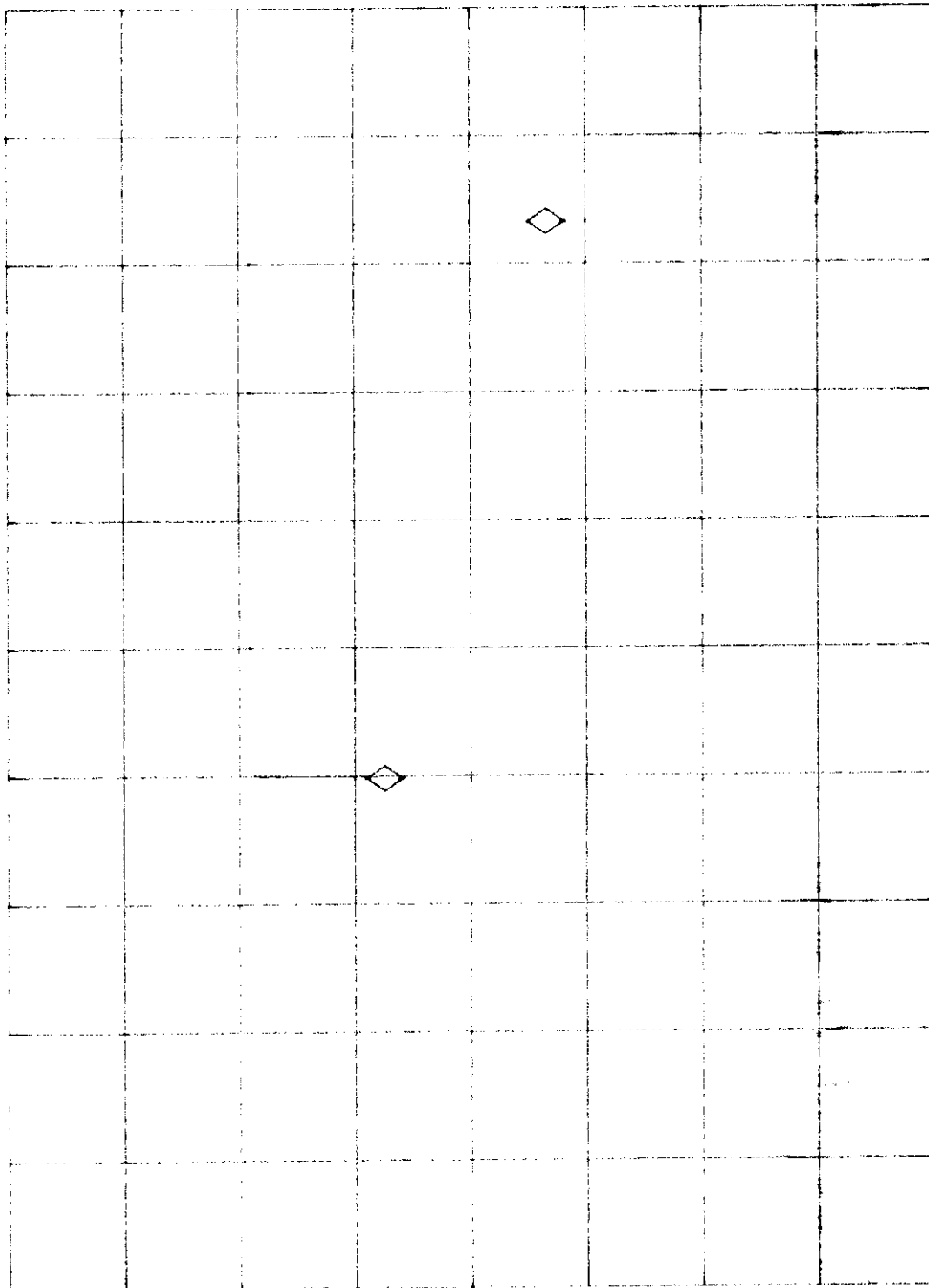
-14.02 dB

PEAK

LOG

10

dB/



WA SB

SC FS

CORR

CENTER 418.050 MHz

#RES BW 300 kHz

#VBW 1 MHz

#SWP 1.00 msec

SPAN 0 Hz

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TIME DOMAIN 2 (LONG PULSE)

MKR  $\Delta$  860.00  $\mu$ sec

REF -20.0 dBm #AT 0 dB

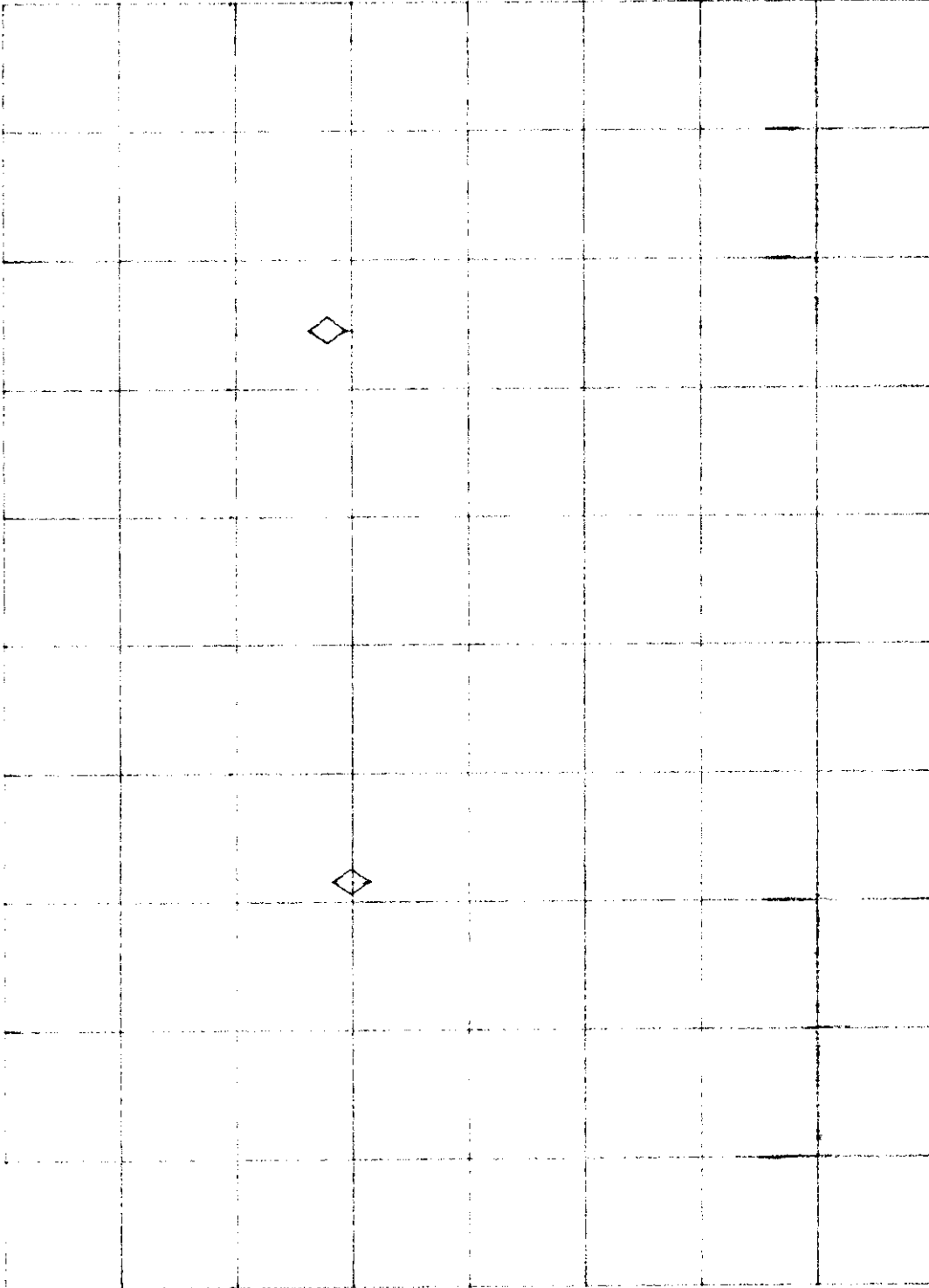
2.01 dB

PEAK

LOG

10

dB/



WA SB  
SC FS  
CORR

CENTER 418.050 MHz

#RES BW 300 kHz

#VBW 1 MHz

SPAN 0 Hz

#SWP 2.00 msec

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TIME DOMAIN 3 (1 WORD FRAME)

REF -20.0 dBm #AT 0 dB

PEAK

LOG

10

dB/

ABCDEF

GHIJKL

MNOPQR

STUVWX

WA SB

SC FS

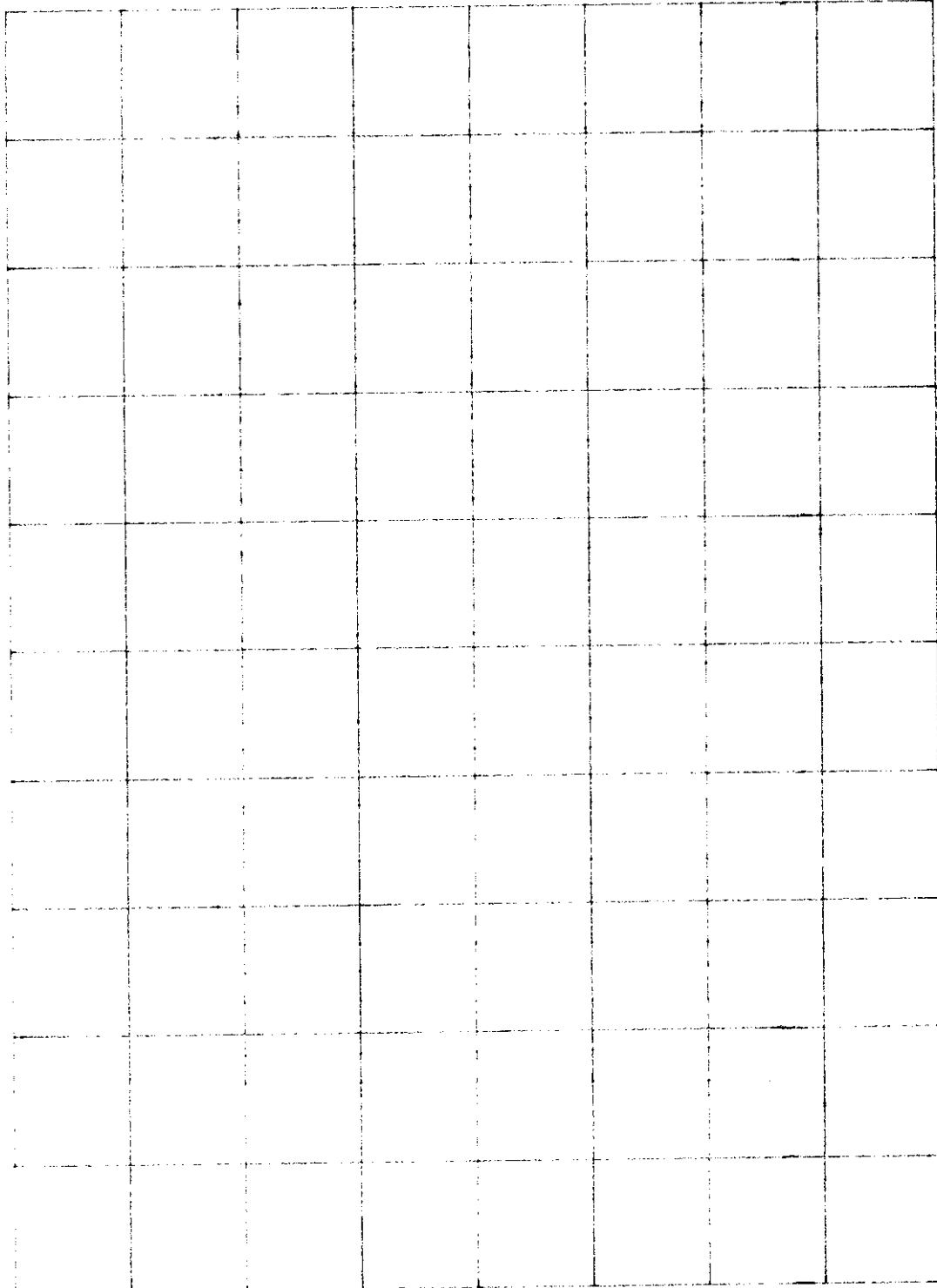
CORR

YZ\_# Spc

Clear

More

1 of 2



CENTER 418.050 MHz

#RES BW 300 kHz

#VBW 1 MHz

#SWP 20.0 msec

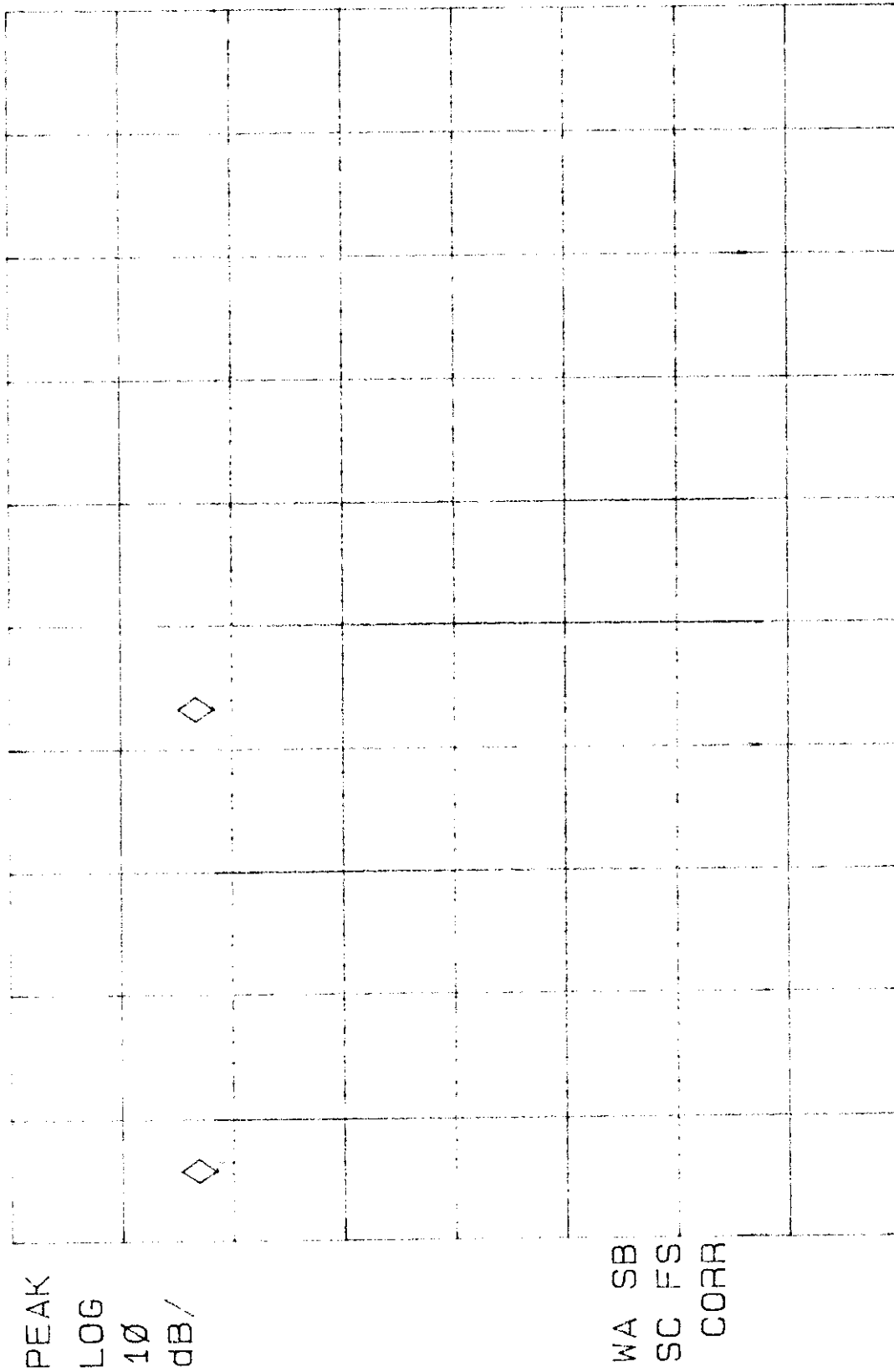
SPAN 0 Hz

14: 22: 09 AUG 27, 1998

TIME DOMAIN 4 (REPEAT RATE)

MKR  $\Delta$  18.750 msec

REF -20.0 dBm #AT 0 dB .16 dB



PEAK

LOG

10

dB/

WA SB

SC FS

CORR

CENTER 418.050 MHz

#RES BW 300 KHz

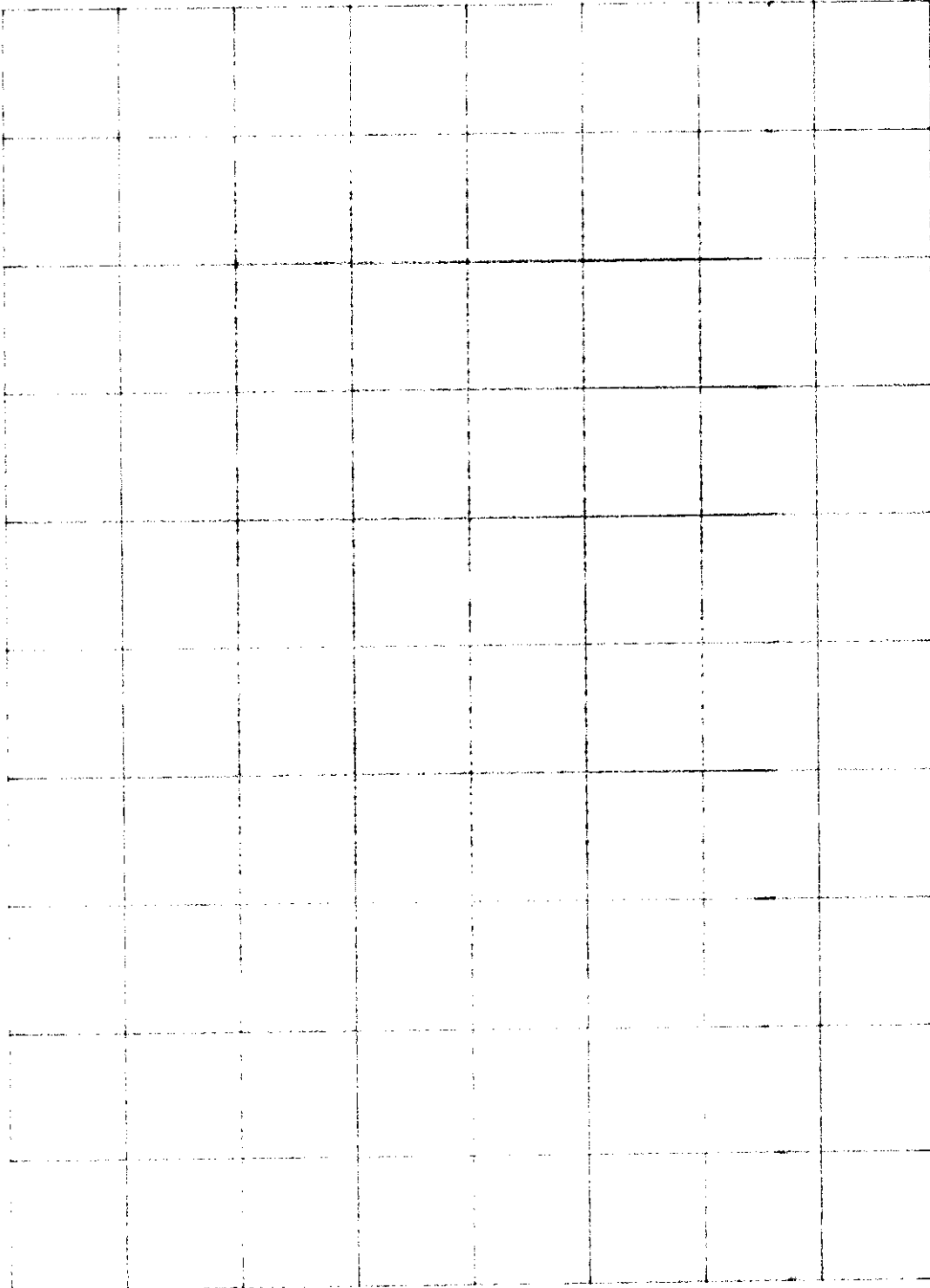
#VBW 1 MHz

#SWP 50.0 msec

SPAN 0 Hz

14: 29: 01 AUG 27, 1998  
TIME DOMAIN 5 (1 TRANSMISSION)  
REF -20.0 dBm #AT 0 dB

PEAK  
LOG  
10  
dB/



WA SB  
SC FS  
CORR

CENTER 418.050 MHz  
#RES BW 300 kHz  
SPAN 0 Hz  
#SWP 100 msec  
#VBW 1 MHz

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TIME DOMAIN 6 (2 TRANSMISSIONS)

MKR  $\Delta$  123.13 msec

REF -20.0 dBm #AT 0 dB

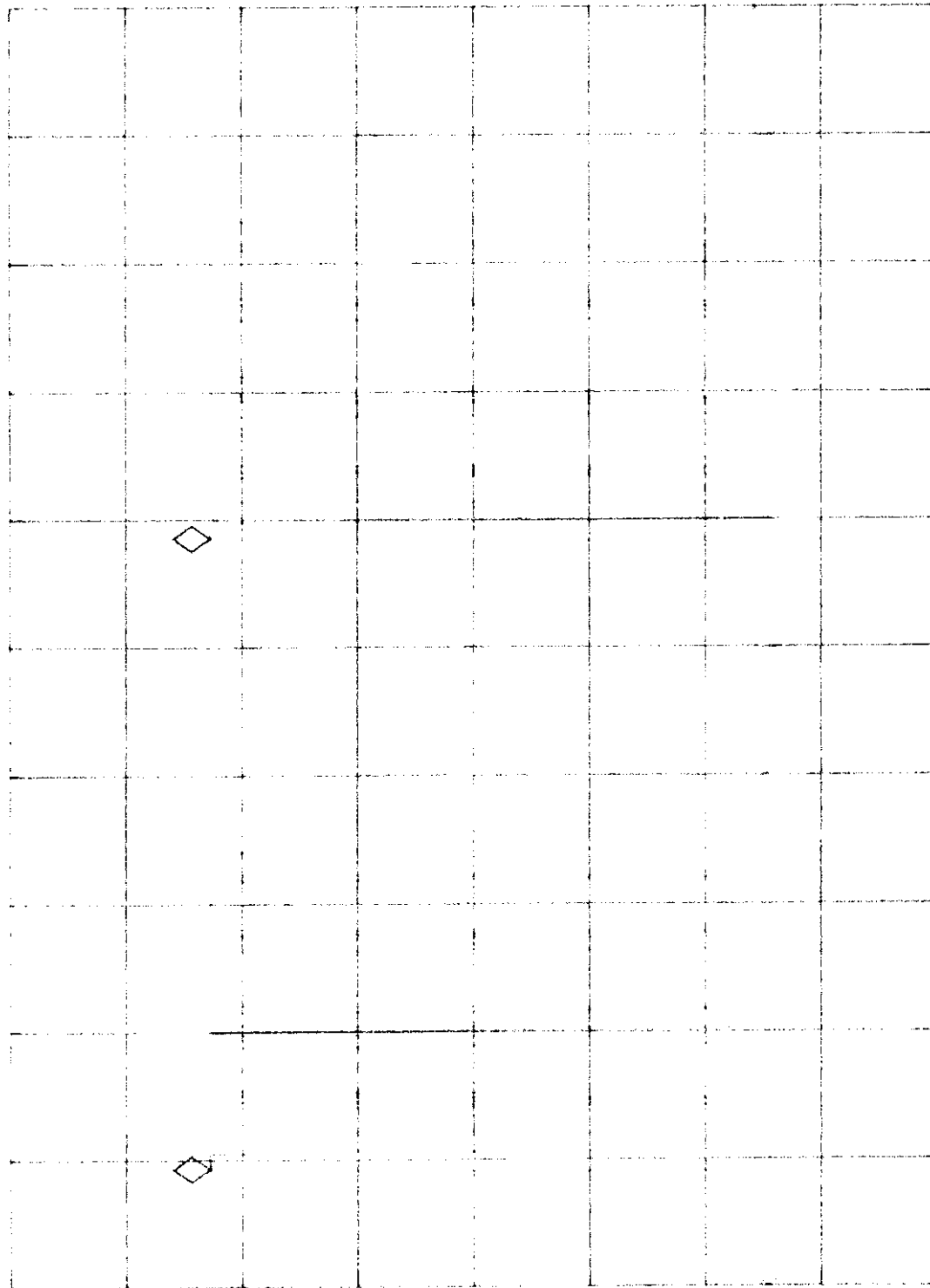
--.02 dB

PEAK

LOG

10

dB/



WA SB  
SC FS  
CORR

CENTER 418.050 MHz

#RES BW 300 KHz

#VBW 1 MHz

SPAN 0 Hz

#SWP 250 msec