



FCC MEASUREMENT REPORT

PUESUANT TO PART 15, SUBPART B & C
(KEYLESS ENTRY DEVICE)

TRADE NAME : HYUNDAI Electronics Industries Co., Ltd.

MODEL NO. : EF

FCC ID : CKLEFTX

APPLICANT : HYUNDAI Electronics Industries Co., Ltd.

MANUFACTURE : HYUNDAI Electronics Industries Co., Ltd.

ADDRESS : San 136-1, Ami-Ri, Bubal-Eub,
Ichon-Si, Kyoungki-Do,
467-701, Korea

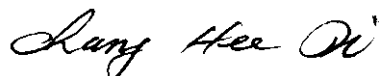
S/N : HEIEFT001

DATE OF REPORT : JUNE 16, 1998

TEST SITE : HYUNDAI Electronics Industries Co., Ltd.

SIGNATURE

I ATTEST TO THE ACCURACY OF THIS REPORT :

SIGN : 

PRINT NAME : Chang Hee, Ji

TITLE : General Manager of QA Office

I . Introduction

This report is designed to show compliance with part 15 of the FCC rules, for a keyless entry device in accordance with the reporting requirements of rule 15.31, 15.33, 15.101 and 15.231.

II . Description of test site

The measurement facilities are shielded enclosure and open field test site for verification or preparation of applications for certification. The open field test site have been filed with the FCC, as required by FCC rule, section 2.948.

The open field test site is situated in open field with ground screen whose site attenuation characteristics meet that required by ANSI C63.4/1992.

A mast capable of lifting the receiving antenna from a height of one to four meters is used together with a rotatable wooden platform mounted at three meters from the antenna mast. The power line RFI measurements and the radiated RFI preliminary testing and monitoring are performed in a RFI shielded room. The equipment is placed on a wooden support table of 80cm height. The LISN is electrically bonded to the shielded room wall.

The address of the site is :

254-1, Mackok-Ri, Hobup-Myun,
Ichon-Si, Kyounggi-Do, 467-701, Korea.

III. Description of Test Methods.

A. Transmitter Portion(Certification)

1. Field Strength of the Carrier.

The field strength of the carrier frequency shall be tested at open field test site with normal supply voltage. In addition, the variation of the fundamental transmitted by the device is shown for variation in supply voltage to 85% and 115% of the normal supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

2. Spurious Emissions.

During this test, which is conducted at the HYUNDAI test site described above, the unit is mounted on a wooden table $1.5\text{m} \times 1.0\text{m} \times 0.8\text{m}$ which is placed on the ground floor. During the emission test, the turntable is rotated to find the configuration resulting in maximum emissions. The antenna height and polarization are also varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Detector function is in PEAK mode. The 6dB bandwidth of the measuring instrument is set to 120KHz for field strength measurements over the frequency range of 30 to 1000MHz. Above 1000MHz, the measurement bandwidth is set to 1MHz. Radiated emission are taken at three meter open field test site.

3. Bandwidth of the Emission.

This measurement is performed with the antenna located close enough to give a full scale deflection of the modulated carrier on the spectrum analyzer. The plot is taken at 10KHz/division frequency span, 1KHz resolution bandwidth and 10dB/division logarithmic display from an HP8591EM spectrum analyzer. Bandwidth is determined at the point 20dB down from the modulated carrier.

IV. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF$$

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

Assume a receiver reading of 20 dBuV is obtained. The Antenna Factor of 10 and a Cable Factor of 2 is added. The 32 dBuV/m value was mathematically converted to its corresponding level in uV/m.

$$FS = 20 + 10 + 2 = 32 \text{ dBuV/m}$$

$$\text{Level in uV/m} = \text{Common Antilogarithm} [(32 \text{ dBuV/m})/20] = 39.81 \text{ uV/m}$$

V. TEST DATA

Model : EF (Transmitter unit)

1. Field Strength of carrier.

Supply Voltage(V)	Field Strength(uV/m)	Limit (uV/m)	Change(dB) relative to normal voltage
=====	=====	=====	=====
(85%)			
-----	-----	-----	-----
6 (100%)	3396.25	60394.9	-
-----	-----	-----	-----
(115%)			
-----	-----	-----	-----

Note : Battery operated

Refer to Appendix 1 test data in the next page.

2. Spurious Emissions.

Note : Refer to Appendix 1 test data in the next page.

* Spurious emission testing configuration.



APPENDIX 1.

TEST TYPE : FIELD STRENGTH OF CARRIER AND SPURIOUS EMISSIONS

EUT : KEYLESS ENTRY DEVICE(TX) (FCC ID : CKLEFTX)

TEST DATE : 1998. 06. 12.

DETECTOR : PEAK MODE

FCC RULES : FCC PART 15.35(b)

75.6

EMISSION FREQUENCY (MHz)	ANTENNA POLARITY (H,V)	EMISSION LEVEL (dBuV)	ANT FACTOR &CABLELOSS (dB/m)	EMISSION LEVEL (dBuV/m)	EMISSION LEVEL (uV/m)	LIMIT (uV/m)
=====	=====	=====	=====	=====	=====	=====
315.0	H	53.7	16.92	70.62	3396.25	60394.9
630.0	H	28.0	23.63	51.63	381.50	6039.5
945.0	H	12.0	28.96	40.96	111.68	6039.5

(AVERAGE LIMIT(dBuV/m) + 20dB)

* LIMIT(uV/m) = 10[^]

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DETECTOR : PEAK MODE

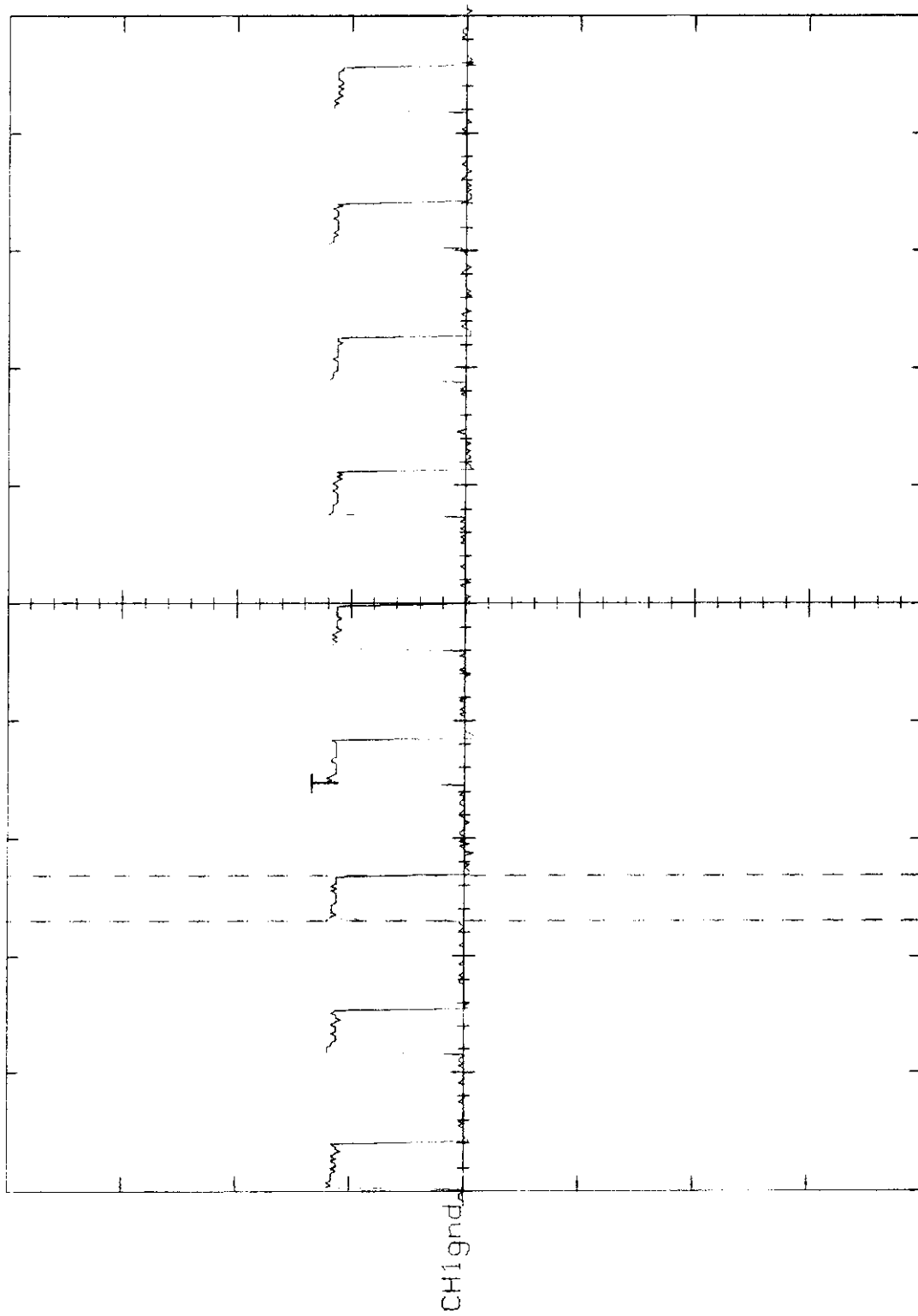
FCC RULES : FCC PART 15.35(c)

EMISSION FREQUENCY (MHz)	ANTENNA POLARITY (H,V)	EMISSION LEVEL (dBuV/m)	EMISSION LEVEL (uV/m) (1)	DUTY CYCLE CORRECTION FACTOR(*) (2)	EMISSION LEVEL (uV/m) (1) × (2)	LIMIT (uV/m)
=====	=====	=====	=====	=====	=====	=====
315.0	H	70.62	3396.25	0.33	1120.76	6041.67
630.0	H	51.63	381.50	0.33	125.89	604.17
945.0	H	40.96	111.68	0.33	36.85	604.17

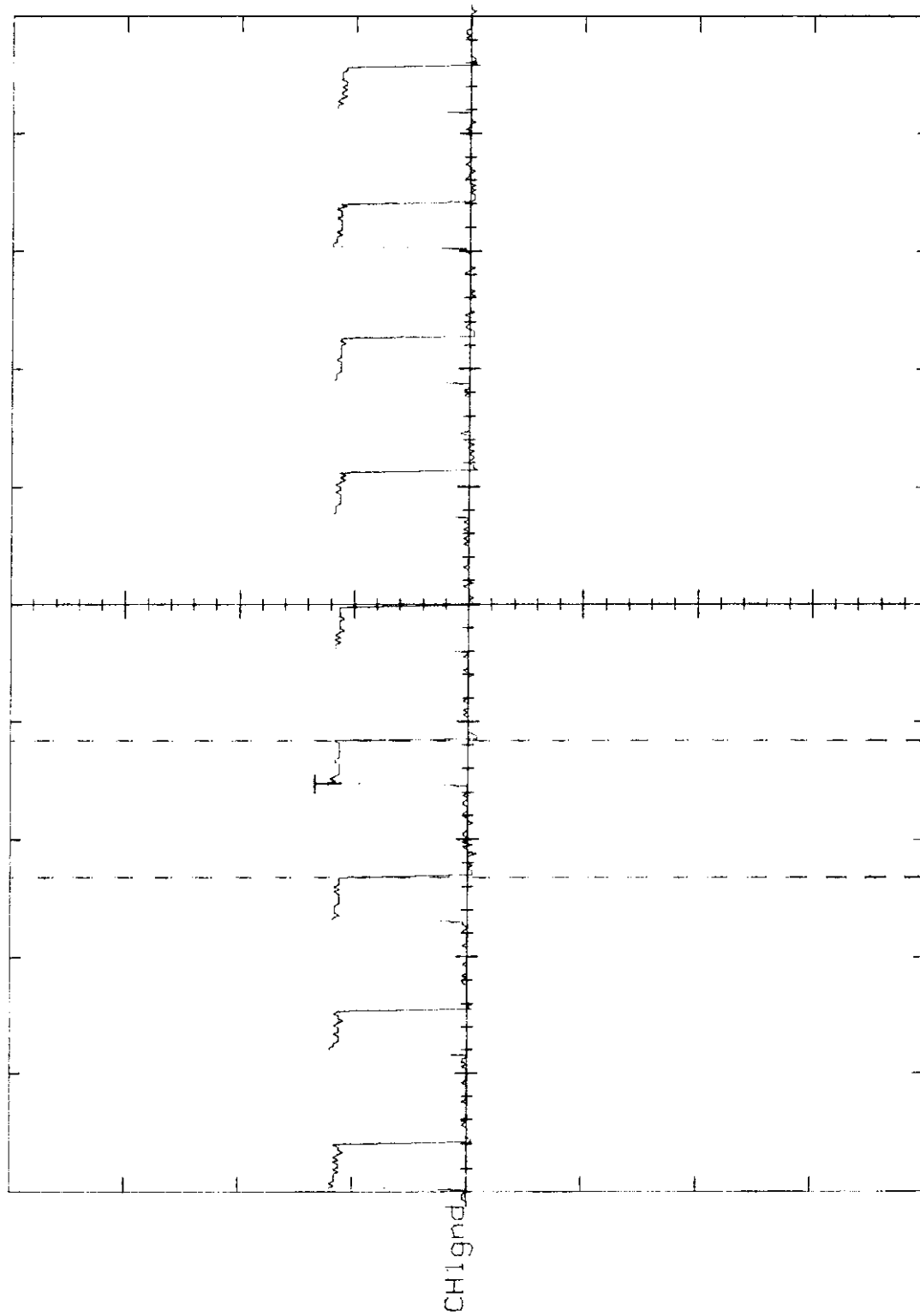
* There is no emissions between 1GHz to 2GHz.

* Refer to Plot #1 of Time Domain in the next two(2) pages.

CH1 500V A 1ms 0.0 V VERT
390.00 μ s WINDOW



CH1 500V A 1ms 0.0 V VERT
1.1600ms WINDOW



3. Bandwidth of the Emission.

dB down from the modulated carrier	Bandwidth of the emission(KHz)	Limit (KHz)	Remark
=====	=====	=====	=====
20	17.2	787.5	
-----	-----	-----	-----

* Refer to Plot #2 of Test Data in the next three(3) pages.

4. Frequency Tolerance

(a) Frequency tolerance at room temperature with normal supply voltage.

Frequency of carrier (MHz)	Measured frequency(KHz)	Tolerance(%)	Limit(%)
=====	=====	=====	=====
-----	-----	-----	-----

(b) Frequency stability for temperature variation.

Temperature degress C	Frequency of carrier(KHz)	Measured frequency(MHz)	Tolerance(%)
=====	=====	=====	=====
-----	-----	-----	-----
-----	-----	-----	-----
-----	-----	-----	-----

(c) Frequency stability for voltage variation.

Temperature degress C	Frequency of carrier(KHz)	Measured frequency(MHz)	Tolerance(%)
=====	=====	=====	=====
-----	-----	-----	-----
-----	-----	-----	-----
-----	-----	-----	-----

Note : N/A (The carrier frequency of this unit is 315.0MHz.)

5. Line Conducted Emission.

Note : N/A (Battery Operated)

6. This unit employs a push button switch that automatically deactivates the transmitter within 0.2ms of being released.

FCC ID: CKLEFTX

MKR 315.02902 MHz

REF -21.0 dBm

#AT 10 dB

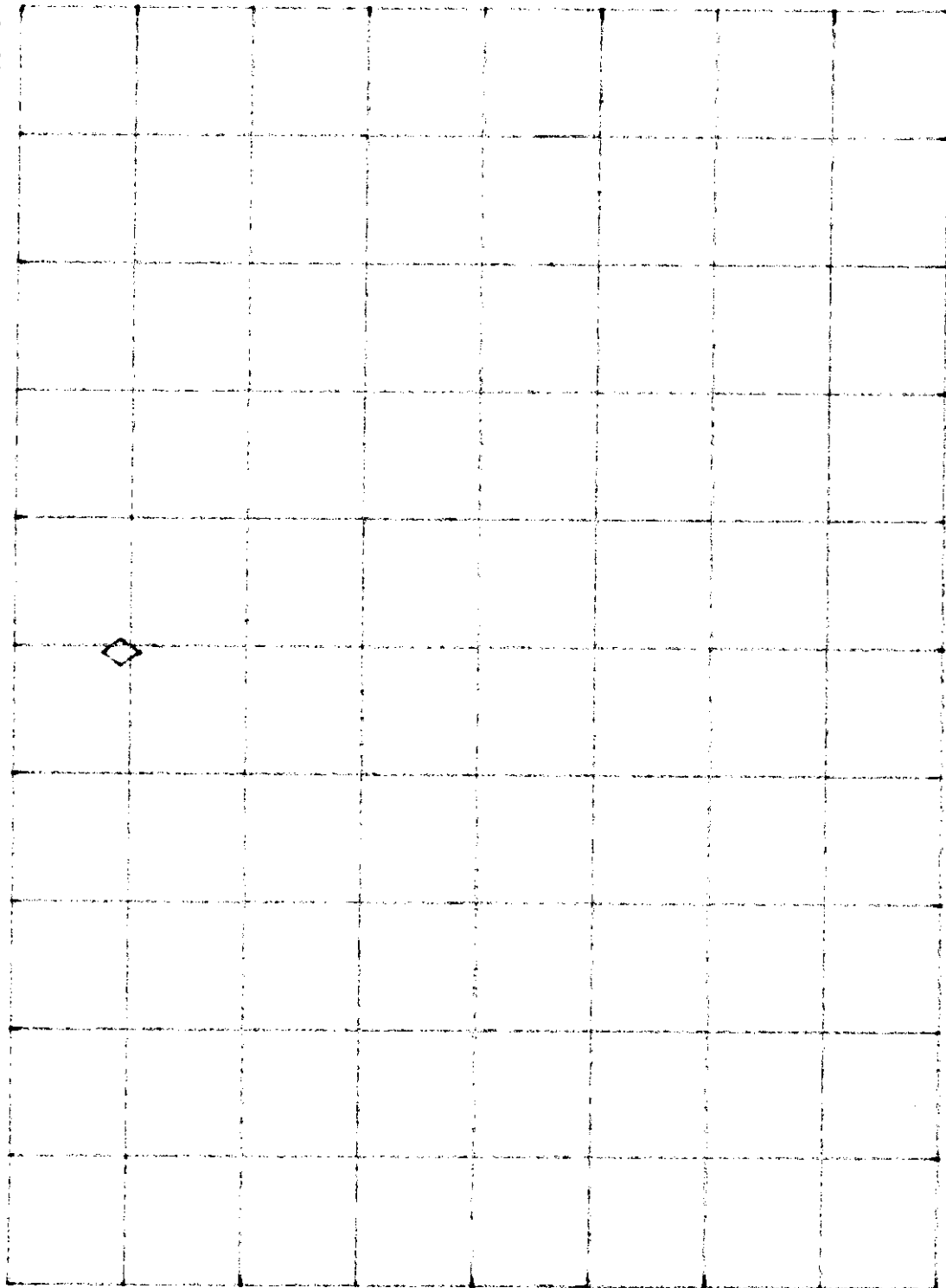
-31.75 dBm

PEAK

LOG

10

dB/



VA SB
SC FC
CORR

CENTER 315.02952 MHz

RES BW 1.0 KHz

SPAN 99.50 KHz

SWP 300 msec

VBW 1 KHz

FCC ID: CKLEFTX

MKR 315.0203 MHz

REF -21.0 dBm

#AT 10 dB

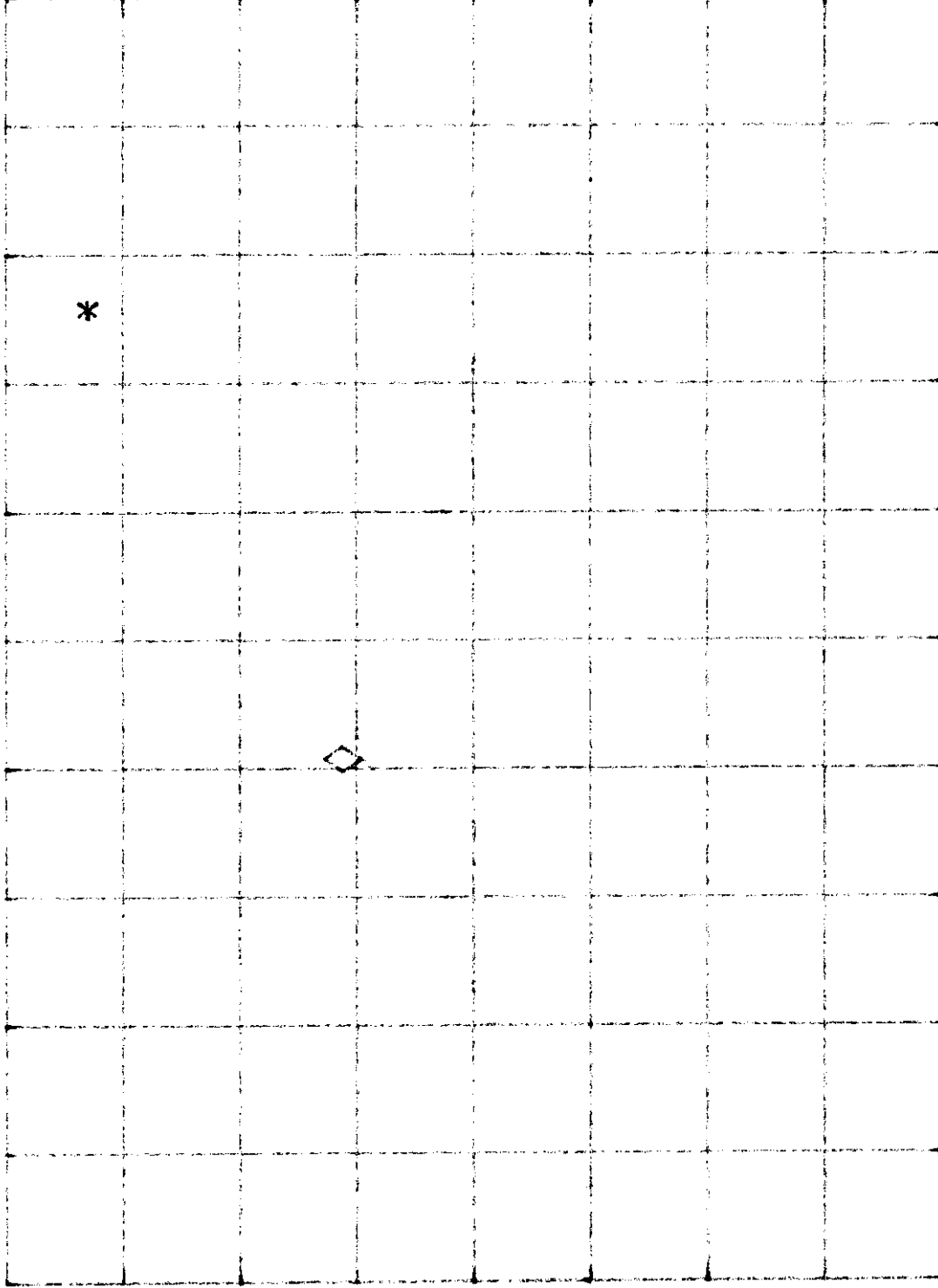
-51.40 dBm

PEAK

LOG

10

dB/



VA SB

SC FC

CORR

CENTER 315.0295 MHz

RES BW 1.0 KHz

SPAN 100.0 KHz

SWP 300 msec

VBW 1 KHz

FCC ID: CKLEFTX

REF -21.0 dBm #AT 10 dB

MKR 315.0375 MHz
-51.73 dBm

PEAK
LOG
10
dB/

MARKER

315.0375 MHz
-51.73 dBm

*

◇

VA SB
SC FC
CORR

CENTER 315.0295 MHz
RES BW 1.0 KHz

SPAN 100.0 KHz
SWP 300 msec

VBW 1 KHz