

FCC Part 95(B) Test Report
for
Continental Conair Limited
on the
Family Radio
Model: FRS200

Test Report: J99027350
Date of Report: November 12, 1999



NVLAP Laboratory Code 200201-0
Accredited for testing to FCC Parts 15

Tested by:	Xi-Ming Yang Test Engineer	<i>Xi-Ming Yang</i>
Reviewer:	David Chernomordik EMC Site Manager	<i>David Chernomordik</i>

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1 JOB DESCRIPTION**1.1 Client Information**

The EUT has been tested at the request of

Company: Continental Conair Limited
15/F, Tower II, World Trade Square
123 Hoi Bun Road, Kwun Tong

Name of contact: David Ng
Telephone: (02) 851-2780
Fax: (02) 857-9583

1.2 Equipment under test (EUT)

Equipment type: Family Radio Face-Held Transceiver

Model number(s): FRS200

Part or serial number: FCC ID: LBBFRS200

Manufacturer: SAME as above.

Use of Product : Voice communications

Production is planned: ☒ Yes, ☐ No

Technical Specifications:

Type of Emission	11K0F3E
Max. Allowed modulation (M)	3.0 kHz
Max. Allowed deviation (D)	2.5 kHz
Range of RF Output	0.5 W (ERP)
Means for variation of operating power	None
The dc voltage applied to and current into the several elements of the final RF amplifying device	Collector Voltage: 6 Vdc Collector Current: 300 mA
Frequency Range	462 to 468 MHz
Max. number of Channels	14
Antenna	Monopole
Detachable antenna ?	No
External input	Audio

EUT receive date: 11/9/99
EUT received condition: Good condition prototype
Test start date: 11/10/99
Test end date: 11/10/99

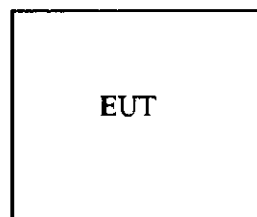
1.3 Test plan reference

FCC Part 2.1033, FCC Part 95 (B)

1.4 System test configuration

1.4.1 System block diagram & Support equipment

For tabletop systems, the EUT shall be centered laterally on the tabletop and its rear shall be flush with the rear of the table. If the EUT is a stand-alone unit, it shall be placed in the center of the tabletop.



Support equipment					
Equip. #	Equipment	Manufacturer	Model #	S/N #	FCC ID
None.					

1.4.2 Justification

The system was configured for testing in a typical manner in accordance with ANSI C63.4 standard. During testing, the peripheral locations were varied with respect to the EUT.

1.4.3 Mode(s) of operation

The EUT was powered and fully operational with option speaker/microphone connected. The unit was powered from 4 fully charged AAA batteries.

1.5 Modifications required for compliance

No modifications were implemented by Intertek Testing Services.

2 TEST SUMMARY

FCC RULE	DESCRIPTION OF TEST	RESULT	PAGE
Transmitter Section			
2.1046 95.639(d)	Effective Radiated Power	0.5 W	8
2.1047 95.631(d) 95.637(a)	Modulation Characteristics F3E analogy voice Peak frequency deviation Audio frequency response	2.5 kHz 3.0 kHz	9
2.1049 95.633(c)	Occupied Bandwidth	11 kHz	12
2.1053 15.109(a)	Field Strength of Spurious Radiation	Worst case Freq.: 2806.27 MHz Margin: 3.1 dB	14
15.107	Line Conducted Emissions	N/A	N/A
2.1055	Frequency Stability Vs. Temperature Vs. Voltage	2.2 ppm 0.096 ppm	20
Receiver Section			
15.109(a)	Radiated Emissions	Worst case Freq.: 440.87 MHz Margin: 4.0 dB	16

3 EFFECTIVE RADIATED POWER

3.1 Test Description

Parameter:	FCC § 2.1046
Requirement:	FCC § 95.639
Effective Radiated Power (ERP):	< 0.5 watts

3.2 Test Procedure

The EUT was positioned on a non-conductive turntable, 0.8m above the ground plane on an open test site.

The radiated emission at the fundamental frequency was measured at 3m distance with a test antenna and spectrum analyzer. During the measurement, the resolution and video bandwidth of the spectrum analyzer were set to 100 kHz. To maximize emissions, the system was rotated through 360°, the antenna height was varied from 1m to 4m, and the antenna polarization was changed.

The ERP was calculated using equation:

$$E = \frac{\sqrt{30 \cdot P \cdot G}}{D}$$

Where E = Field Strength (V/m),

G = Antenna Gain (1.64 for a half-wave dipole),

P = ERP (W)

D = Distance (m)

3.3 Test Results

Test Conditions:		Antenna Gain, G = 1.64			Distance, D = 3	
Frequency MHz	Reading dB(μV)	Antenna Factor dB(1/m)	Preamp Gain dB	Cable Loss DB	Field Strength dB(μV/m)	ERP W
462.6	104.8	17.7	0	2.0	124.5	0.492
467.7	104.5	17.7	0	2.0	124.2	0.481

Note: Field Strength = Reading + Antenna Factor – preamp + Cable loss

3.4 Modifications made during testing

None

3.5 Test Instrumentation

[x] Hewlett Packard HP8566B Spectrum Analyzer (S.A.)

[x] EMCO Bi-Log Antenna

[] HP Pre-amp

4 MODULATION CHARACTERISTICS

4.1 Test Description

Parameter:	FCC § 2.1047
Requirement:	FCC § 95.637
Peak Frequency Deviation:	Less than ± 2.5 kHz
Audio Frequency Response:	≤ 3.125 kHz

4.2 Test Procedure

4.2.1 Audio Frequency Response

The RF output of the transceiver was connected to the input of a FM deviation meter through sufficient attenuation so as not to overload the meter or distort the readings. An audio signal generator was coupled into the external microphone jack of the transceiver, or alternatively, the microphone element was removed and the generator output was connected to the microphone connectors.

The audio signal input level was adjusted to obtain 20% of the maximum rated system deviation at 1 kHz, and recorded as DEV_{REF} . With the audio signal generator level unchanged, set the generator frequency between 300 Hz to 5000 Hz. The transmitter deviations (DEV_{FREQ}) were measured and the audio frequency response was calculated as

$$20\log_{10} \left[\frac{DEV_{FREQ}}{DEV_{REF}} \right]$$

4.2.2 Audio Low-Pass Filter Response

An audio signal generator and an audio spectrum analyzer were connected to the input and output of the post limiter low pass filter respectively. The audio signal generator frequency was set between 1000 Hz and the upper low pass filter limit. The audio frequency response at test frequency was calculated as

$$LEV_{FREQ} - LEV_{REF}$$

4.2.3 Modulation Limiting

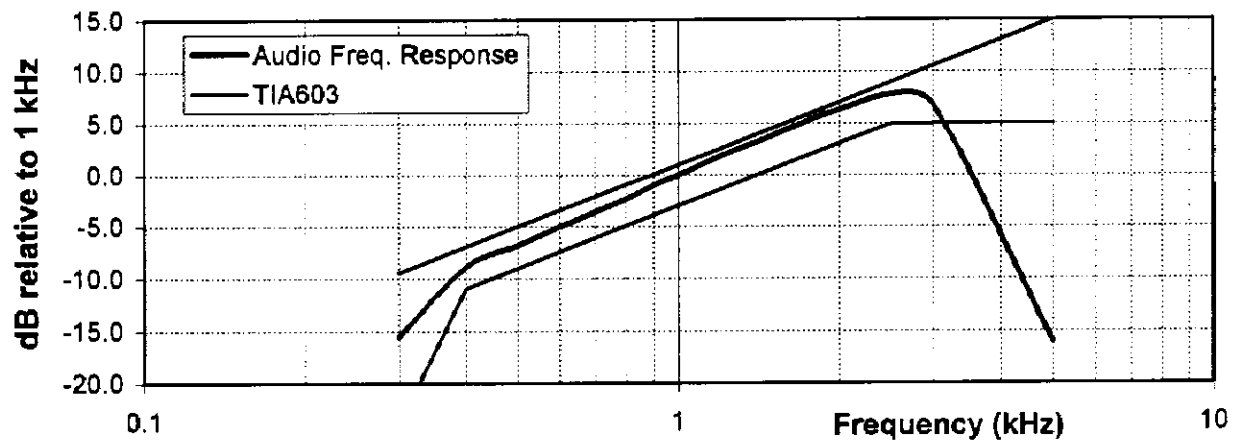
With the same setup as section 4.2.1 above, at three different modulating frequencies, the output level of the audio generator was varied and the FM deviation level was recorded.

4.3 Test Results

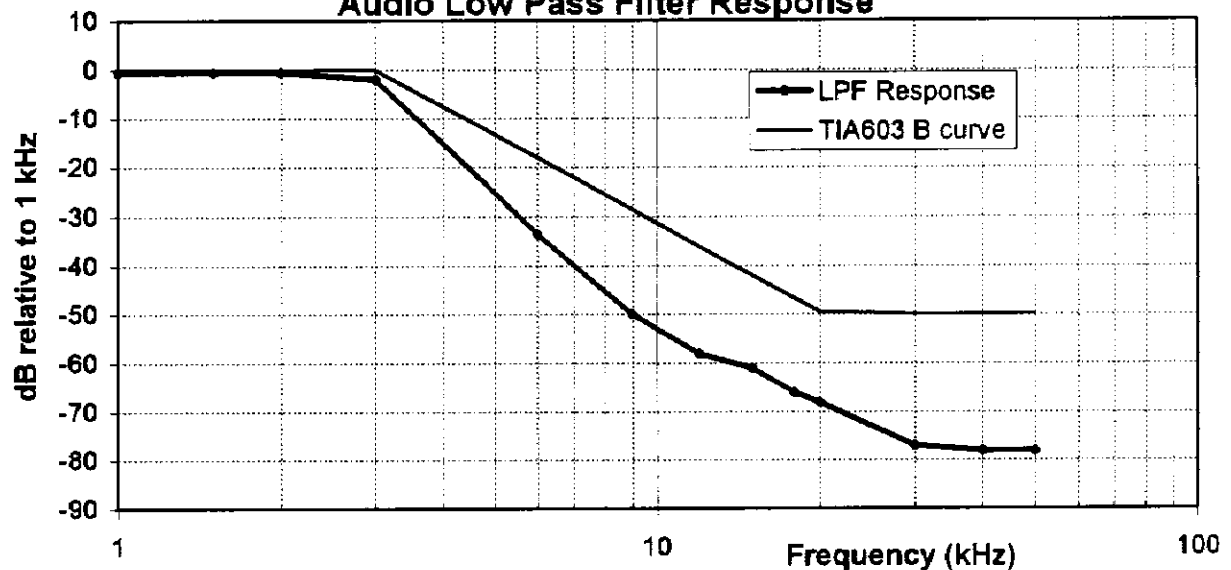
X	See below.
	There were no changes in the schematics and PCB layout of the already granted unit.

Test Condition	
Frequency (MHz)	mid channel

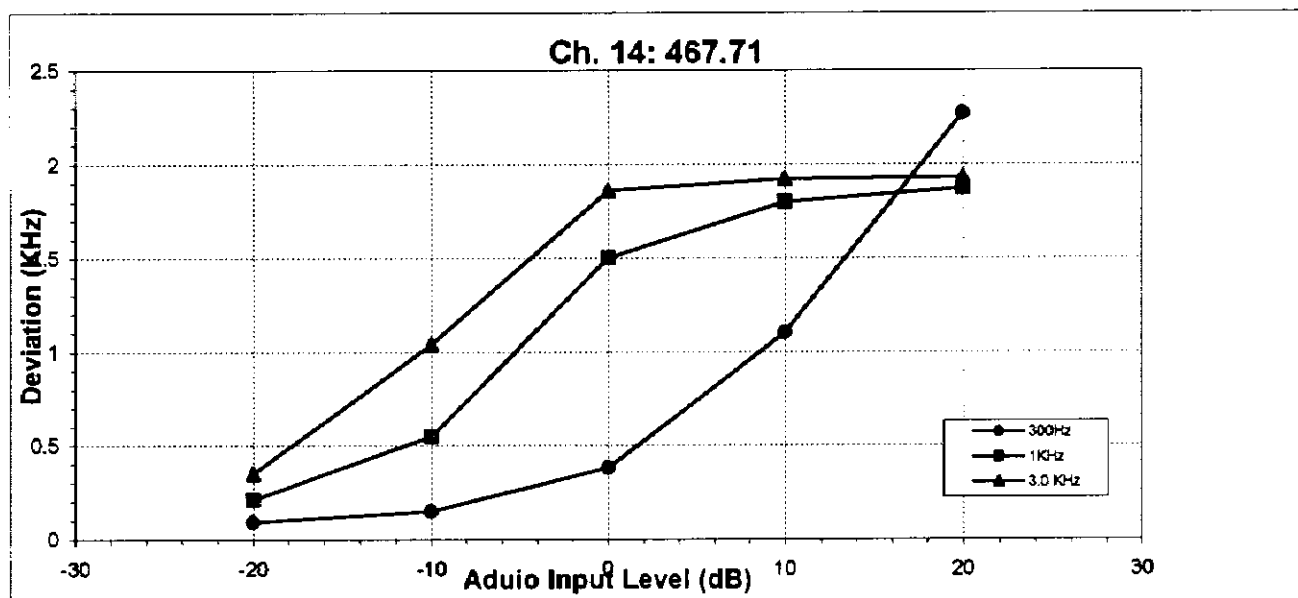
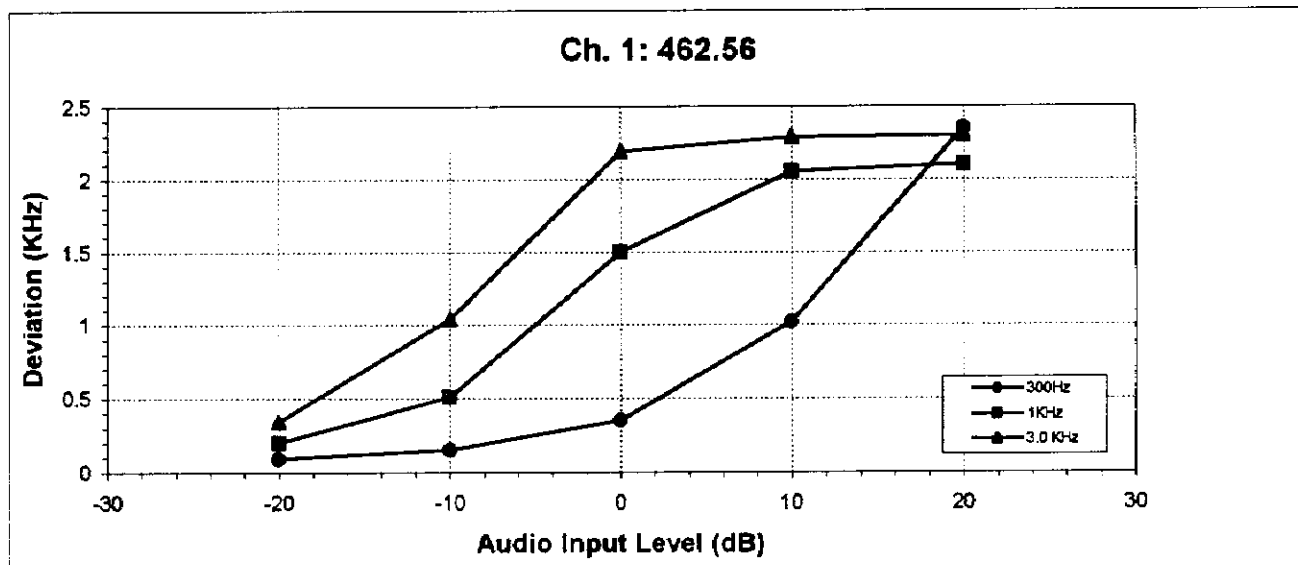
Transmitter Audio Frequency Response



Audio Low Pass Filter Response



Modulation Limiting Test Condition	
Frequency (MHz)	462.56 and 467.7125
V _{mp} (mV)	15 mV
Reference Deviation	1.5 kHz at 1 kHz modulating frequency



4.4 Modifications made during testing

None

4.5 Test instrumentation

[X] Marconi 2955A Radio Communication Test Set
[X] Leader LFG-1300S Function Generator
[X] LMV-182 AC Millivoltmeter

5 OCCUPIED BANDWIDTH**5.1 Test description**

Parameter:	FCC §2.1049
Requirement:	FCC § 95.633(c)
Emission Bandwidth:	12.5 kHz

5.2 Test Procedure

The antenna was disconnected from the transmitter and the short cable was connected to the transmitter RF output.

The RF output was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set up at least 10 times higher than the authorized bandwidth of the transmitter. With the transmitter keyed, the level of the unmodulated carrier was set to the full scale reference line of the spectrum analyzer. This is used as a 0dB reference for emission mask measurements.

The transmitter was then modulated with a 2500 Hz tone at an input level 16 dB greater than the necessary to produce 50% of rated system deviation. The resolution bandwidth of the spectrum analyzer was set up to 100 Hz and the spectrum of the transmitting signal was recorded. This spectrum was compared to the required emission mask.

5.3 Test Results

Please see **Exhibit 9** for the occupied bandwidth plots:

Plot Number	Description
10-1	Full Power, reference level
10-2	Occupied bandwidth, scan 62.5 kHz

5.4 Modifications made during testing

None.

5.5 Test instrumentation

☒ Leader LFG-1300S Function Generator

☒ HP 8566B Spectrum Analyzer

☒ HP 7470A Plotter

6 RADIATED SPURIOUS EMISSIONS

6.1 Test description

Parameter:	FCC §2.1053
Requirement:	FCC § 15.109

6.2 Test Procedure

The transmitter was placed on a wooden turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3 orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

The spurious harmonic attenuation was calculated as the difference between E in dB(uV/m) at the fundamental frequency and at the spurious emission frequency.

Spurious attenuation limit in dB = $43 + 10\log_{10}(\text{power out in Watts})$

6.3 Test Results

Please see the attached pages for the following:

- ☒ Spurious harmonic attenuation
- ☒ FCC Part 15.109 Radiated Emission

Radiated Emissions Test Data

Company:	Telson	Model #:	LBBFRS200	Req:	FCC 2.993
EUT:		S/N or FCC #:		Test Dist:	3 meter
Project #:		Test Date:	NOVEMBER 10, 1999	TP:	0.50 Watt
Test Mode:	Tx@462.56MHz	Engineer:	Xi Ming Y.	Min. Attn:	38.99 dBc

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	2	8	14	0	8	13	0	0	1	0
Model:	EMCO 3143	EMCO 3115	EMCO 3115	None	CDL_P1000	ACC400	None	None	SRA-1	None

[illegible]

NOTES

- O.C.F.: Other Correction Factor
- Insert. Loss = Cable A + Cable B + Cable C + Transducer.
- Net = Reading + Antenna Factor - Pre-Amp + Insert. Loss.
- Attn. = Field Strength (Fundamental) - Field Strength (Harmonics).
- Negative signs (-) in Margin column signify levels below the limits.

Radiated Emissions Test Data

Company:	Telson	Model #:	LBBFRS200	Reg:	FCC 2.993
EUT:		S/N or FCC #:		Test Dist:	3 meter
Project #:		Test Date:	NOVEMBER 10, 1999	TP:	0.50 W/m ²
Test Mode:	Tx@467.71MHz	Engineer:	Xi Ming Y.	Min. Attn:	39.02 dBc

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	2	8	14	0	8	13	0	0	1	0
Model:	EMCO 3145	EMCO 3115	EMCO 3115	None	ODI_P1000	ACOM400	None	None	SMA1	None

Frequency MHz	Reading dB(μV)	Detector P/A/Q	Ant #	Amp #	Ant. Pol. H/V	Ant. Factor dB(1/m)	Pre-Amp dB	Insert. Loss dB	Net dB(μV/m)	ERP mW	Attn. dBc	Margin dB
467.71	104.5	Peak	2	0	H	17.7	0.0	2.0	124.2	4.81E+02	0.0	N/A
935.43	51.7	Peak	2	0	H	23.0	0.0	3.3	78.0	1.15E-02	46.2	-6.2
1403.14	45.5	Ave.	8	0	V	24.7	0.0	3.4	73.6	4.19E-03	50.6	-10.6
1870.85	36.3	Ave.	8	0	V	27.2	0.0	3.9	67.4	1.01E-03	56.8	-16.8
2338.56	45.5	Ave.	8	0	V	29.6	0.0	4.5	79.6	1.67E-02	44.6	-4.6
2806.27	45.4	Ave.	8	0	H	30.7	0.0	5.0	81.1	2.35E-02	43.1	-3.1
3273.99	37.4	Ave.	8	0	H	31.7	0.0	5.5	74.6	5.28E-03	49.6	-9.6
3741.70	36.6	Ave.	8	0	H	33.5	0.0	5.7	75.8	6.95E-03	48.4	-8.4
4209.41	40.3	Ave.	8	0	H	32.9	0.0	5.9	79.1	1.49E-02	45.1	-5.1
4677.12	33.6	Ave.	8	0	V	33.5	0.0	6.4	73.5	4.06E-03	50.7	-10.8

- Notes:**
- a) O.C.F.: Other Correction Factor
 - b) Insert. Loss = Cable A + Cable B + Cable C + Transducer.
 - c) Net = Reading + Antenna Factor - Pre-Amp + Insert. Loss.
 - d) Attn. = Field Strength (Fundamental) - Field Strength (Harmonics).
 - e) Negative signs (-) in Margin column signify levels below the limits.



Radiated Emissions Test Data

Company: Telson					Model #: LBBFRS200	Standard	FCC § 15.207	
EUT:					S/N #:	Limits	3	
Project #:					Test Date:	November 10, 1999	Test Distance	3 meters
Test Mode:	Rx				Engineer:	Xi-Ming Y.	Duty Allocation	0 dB

	Antenne Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	2	8	0	0	10	13	12	0	0	0
Model:	EMCO 3143	EMCO 3113	None	None	APT-5005	ACC-400	Gm M-L	None	None	None

[illegible]

- a) D.C.F.:Distance Correction Factor
b) Insert. Loss (dB) = Cable A + Cable B + Cable C .
c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).
d) Negative signs (-) in Margin column signify levels below the limits.
e) All other emissions not reported are below the equipment noise floor which is at least 20 dB below the limits.

6.4 Modifications made during testing

None

6.5 Test instrumentation

- ☒ CDI B100/200/300 Biconical Antennas
- ☒ EMCO Bi-logcon Antenna
- ☒ EMCO 3115 Horn Antenna
- ☒ HP 8566B Spectrum Analyzer
- ☒ Preamplifiers

7 AC LINE CONDUCTED EMISSIONS**7.1 Test description**

Parameter:	ANSI C63.4
Requirement:	FCC § 15.107

7.2 Test Procedure

The EUT was connected to the DC power supply, that was connected to the AC line through the LISNs.
Both HOT and NEUTRAL leads were tested.

7.3 Test Results

☒ Not applicable, the EUT is battery powered only.

7.4 Modifications made during testing

None

7.5 Test instrumentation

☐ HP 8566B Spectrum Analyzer
☐ LISN

8 FREQUENCY STABILITY

8.1 Test description

Parameter:	FCC §2.1055
Requirement:	FCC § 95.627
Frequency Tolerance:	Within 0.00025% (25ppm)

8.2 Test Procedure

The ppm frequency error of the transmitter was calculated by:

$$ppm\ error = \left(\frac{MCF}{ACF} - 1 \right) \cdot 10^6$$

Where MCF is the Measured Carrier Frequency in MHz
ACF is the Assigned Carrier Frequency in MHz

8.2.1 Frequency Stability vs. Temperature

The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feedthrough attenuators. The EUT was placed inside the temperature chamber.

After the temperature stabilized for approximately 20 minutes, the frequency of the output signal was recorded from the counter.

9.2.2 Frequency Stability vs. Voltage

At room temperature (25 ±5 °C), an external variable DC power supply was connected to the EUT. The frequency of the transmitter was measured for 115%, 100% and 85% of the nominal operating input voltage.

9.3 Test Results

Frequency Stability vs Temperature		
ACF (MHz): 462.5625		Limit: 2.5ppm
Temperature, C	MCF (MHz)	PPM Error
50	462.561482	-2.20
40	462.561510	-2.14
30	462.561839	-1.43
20	462.562310	-0.41
10	462.563092	1.28
0	462.563407	1.96
-10	462.563041	1.17
-20	462.562079	-0.91

Frequency Stability vs Voltage			
ACF (MHz): 462.5625			Limit: 2.5 ppm
%	Voltage	MCF (MHz)	PPM Error
115	6.90	462.562544	0.095
100	6.00	462.562529	0.063
85	5.10	462.562538	0.082
Battery Endpoint	4.00	462.56254	0.086

9.4 Modifications made during testing

None.

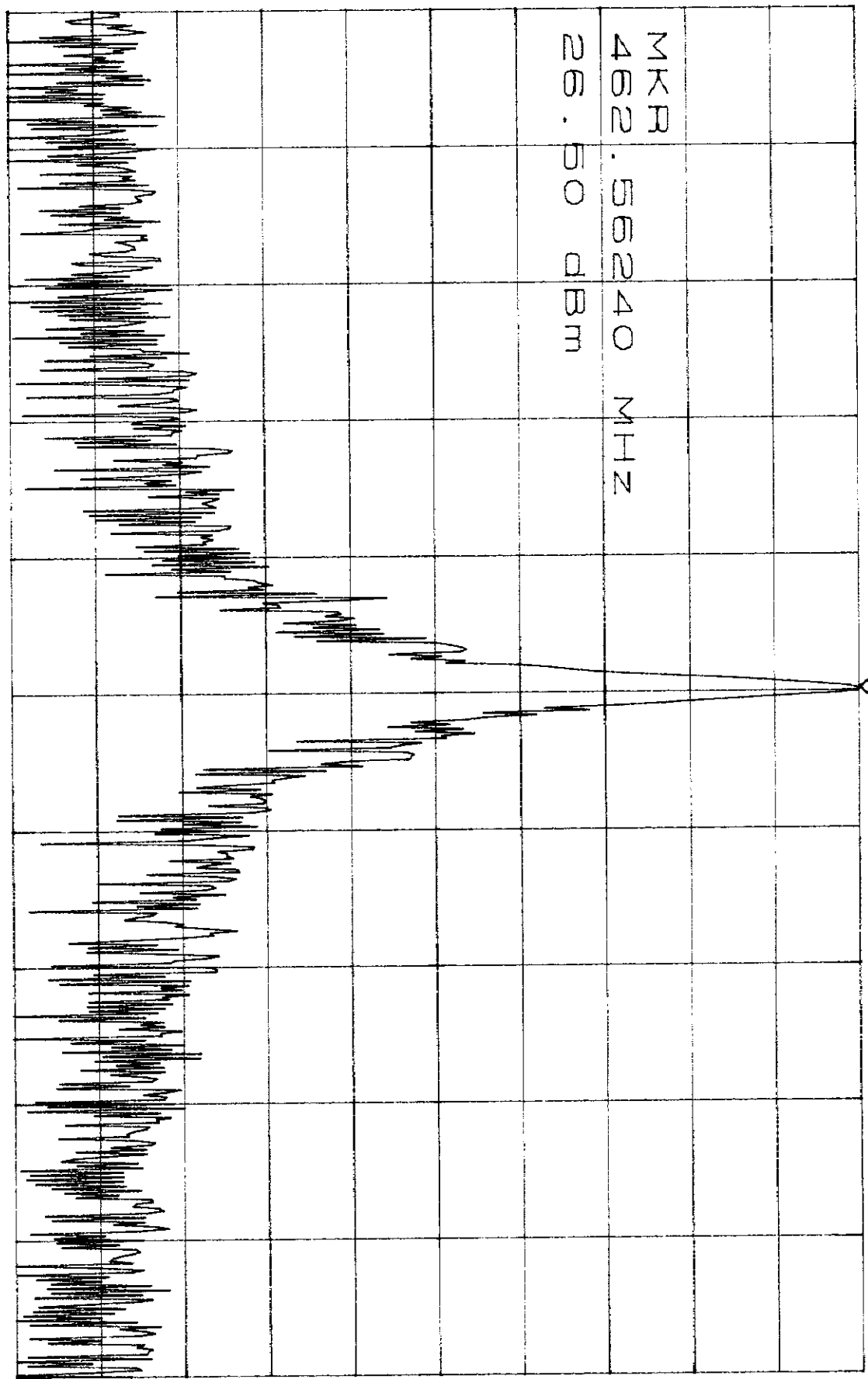
9.5 Test instrumentation

- [X] Temperature Chamber, -50C to +100C
- [X] Hewlett Packard 5383A Frequency Counter
- [X] Tektronix 2784 Spectrum Analyzer
- [X] Goldstar DC Power Supply, GR303

10 PLOTS

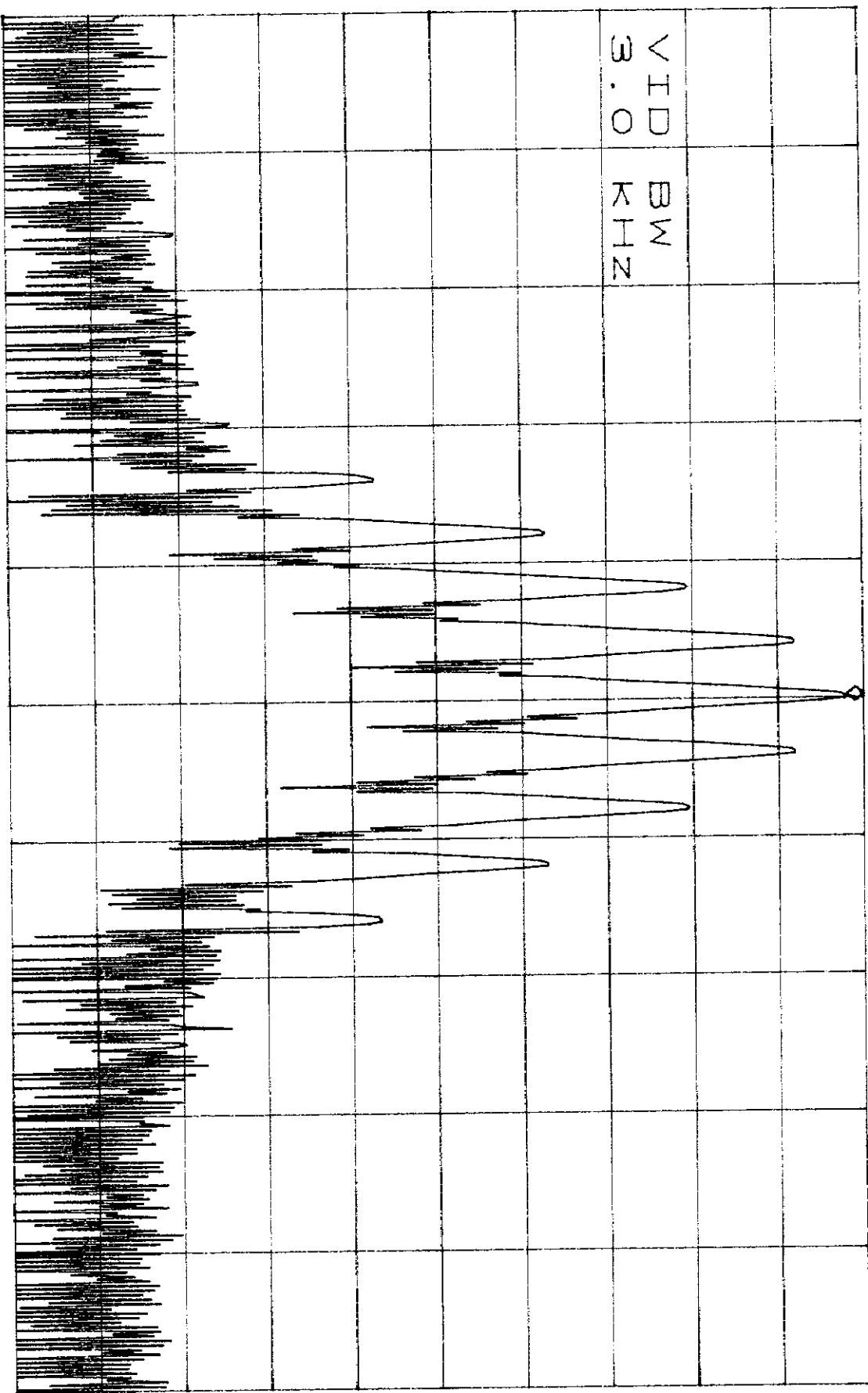
See attached pages.

ATTEN 40 DB ZK 20.50 DBE #1. CH01
RL 20.50 DBE 462.56240 MHZ



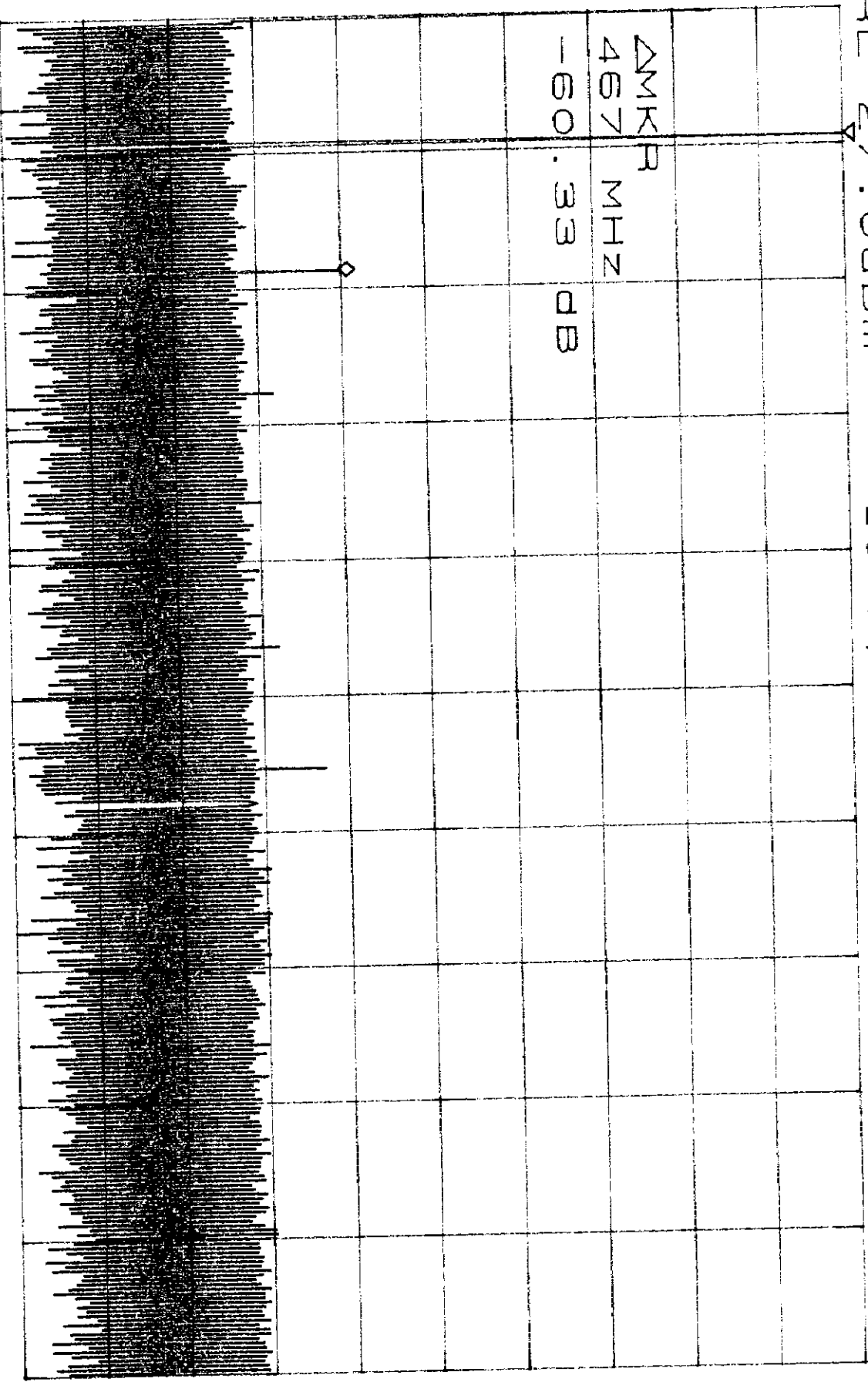
CENTER 462.56250MHZ SPAN 62.50KHZ
*RBW 300HZ VBW 300HZ SWP 1.80sec

ATTEN 40dB
RL 26.50dB
10dB/
MKR 24.50dB
462.56240MHz
#1.ch01



CENTER 462.56250MHz
SPAN 62.50KHz
*RBW 300Hz
*VBW 3.0KHz
SWP 1.80Sec

ATTEN 40dB
RL 27.0dBm
10dB/
467MHz
#1.ch01



START 0Hz
STOP 5.000GHz
*RBW 100kHz
VBW 100kHz
SWP 1.30sec

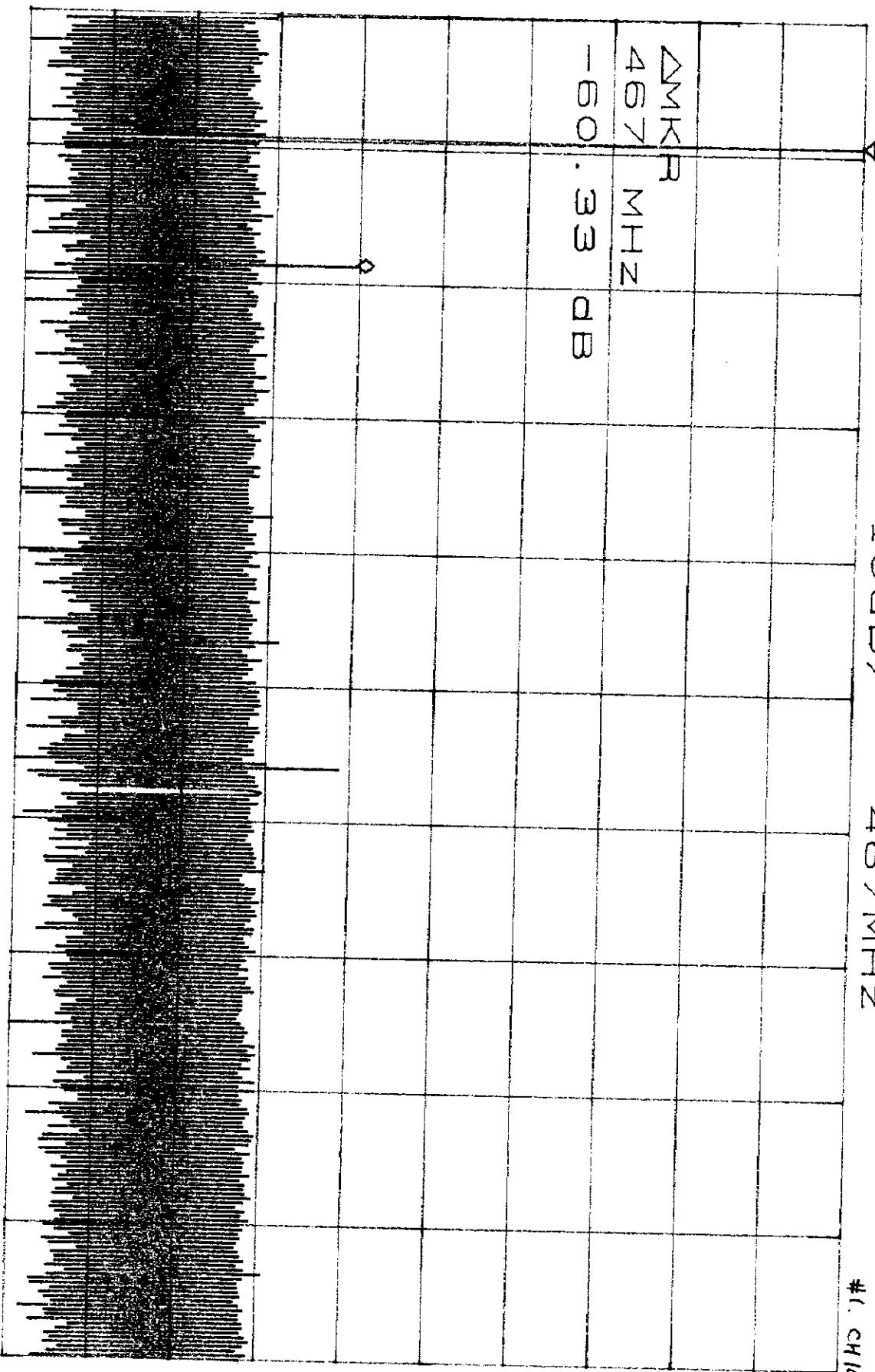
ATTEN 40dB
RL 27.0dBm

10dB/

ΔMKR -60.33dB

#1. CH14

ΔMKR
467
MIN
-60.33 dB



START 0Hz
*RBW 40KHz
VBW 100KHz
STOP 5.000GHZ
SWP 1.30sec