

FCC Part 15 Subpart C
EMI TEST REPORT
of

E.U.T. : Wireless Hands-free Hand Set

FCC ID. : NWH1101102B

MODEL : WHH102B

Working Frequency : 49.860 MHz

for

APPLICANT : Innovative Wireless Products

ADDRESS : 5673 W. Las Positas Bl. #206 Pleasanton CA
94588 U.S.A.

Test Performed by

ELECTRONICS TESTING CENTER, TAIWAN

NO. 34, LIN 5, DING FU TSUN, LINKOU HSIANG,
TAIPEI HSIEN, TAIWAN, R.O.C.

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Report Number : ET90R-11-044-01

TEST REPORT CERTIFICATION

Applicant : Innovative Wireless Products
5673 W. Las Positas Bl. #206 Pleasanton CA 94588 U.S.A.

Manufacturer : Aero Communication Co., Ltd.
2F, No. 121, Shing De Rd., San Chung City, Taipei Hsien, Taiwan,
R.O.C.

Description of EUT :

a) Type of EUT : Wireless Hands-free Hand Set
b) Trade Name : ----
c) Model No. : WHH102B
d) FCC ID : NWH1101102B
e) Working Frequency : 49.860 MHz
f) Power Supply : (1) Internal: DC 3.6V Li-ion Battery or
(2) External: AC Adaptor Charger Only
(Model: KAD12D0600300;
I/P: 120VAC, 60Hz,
O/P: 6VDC, 300mA)

Regulation Applied : FCC Rules and Regulations Part 15 Subpart C (1999)

I HEREBY CERTIFY THAT; The data shown in this report were made in accordance with the procedures given in ANSI C63.4 and the energy emitted by the device was founded to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

Issued Date : Dec. 20, 2001

Test Engineer : Tien Lu Liao
(Tien Lu Liao)

Approve & Authorized Signer : Will Yauo
Will Yauo, Manager
EMC Dept. II of ELECTRONICS
TESTING CENTER, TAIWAN

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1. GENERAL INFORMATION

1.1 Product Description

a) Type of EUT	: Wireless Hands-free Hand Set
b) Trade Name	: ----
c) Model No.	: WHH102B
d) FCC ID	: NWH1101102B
e) Working Frequency	: 49.860 MHz
f) Power Supply	: (1) Internal: DC 3.6V Li-ion Battery or (2) External: AC Adaptor Charger Only (Model: KAD12D0600300; I/P: 120VAC, 60Hz, O/P: 6VDC, 300mA)

1.2 Characteristics of Device:

1. Handsfree & duplex operation.
2. RF Wireless ID design, high quality and plug-in mini kit.
3. Automatic channel scanner.
4. Including basic & simple, mini, delicate and lightweight models.
5. Hook-on and backpneck style designs are in rogue, suit for all type.
6. The headband is designed to convert into ear-hooks.
7. The ear-hooks design that fits over the ear and comfortable to wear.

1.3 Test Methodology

Both conducted and radiated testing was performed according to the procedures in chapter 13 of ANSI C63.4.

The Wireless Hands-free Hand Set under test was operated in its normal operating mode for the purpose of the measurements.

The receiving antenna polarized horizontally was varied from 1 to 4 meters and the wooden turntable was rotated through 360 degrees to obtain the highest reading on the field strength meter or on the display of the spectrum analyzer. And also, each emission was to be maximized by changing the orientation of the Wireless Hands-free Hand Set under test.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the roof top of Building at No. 34, Lin 5, Ding Fu Tsun, Linkou Hsiang, Tapei Hsien, Taiwan 244, R.O.C.

This site has been fully described in a report submitted to your office, and accepted in a letter dated Feb. 10, 2000.

2. DEFINITION AND LIMITS

2.1 Definition

Intentional radiator:

A device that intentionally generates and emits radio frequency energy by radiation or induction.

2.2 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.25
0.495 - 0.505 **	16.69475 - 16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425 - 16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475 - 156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3360-4400	Above 38.6
13.36-13.41			

Remark “**” : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

2.3 Limitation

(1) Conducted Emission Limits :

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the conducted limit is the following:

Frequency (MHz)	Emission (μ V)	Emission (dB μ V)
0.45 - 30.0	250	48.0

(2) Radiated Emission Limits :

According to 15.235 the field strength of emissions from intentional radiators operated under these frequency bands shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental	
	$\mu\text{V}/\text{meter}$	$\text{dB}\mu\text{V}/\text{meter}$
49.82-49.90	10000	80

Field strength limits are at the distance of 3 meters, emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209, as following table:

Other Frequencies (MHz)	Field Strength of Fundamental	
	$\mu\text{V}/\text{meter}$	$\text{dB}\mu\text{V}/\text{meter}$
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

(3) Antenna Requirement :

For intentional device, according to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

(4) Emissions Band Limits :

According to 15.235(b), the field strength of any emissions appearing between the band edges and up to 10 kHz above and below the band edges shall be attenuated at least 26 dB below the level of the unmodulated carrier or to the general limits in § 15.209, whichever permits the higher emission levels

2.4 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device :

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

2.5 User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

3. RADIATED EMISSION MEASUREMENT

3.1 Applicable Standard

1. The field strength of any emission within this band shall not exceed 250 microvolts/meter at 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.
2. The field strength of any emissions which appear outside of this band shall not exceed the general radiated emission limits in Section 15.209.

3.2 Measurement Procedure

A. Preliminary Measurement For Portable Devices

For portable devices, the following procedure was performed to determine the maximum emission axis of EUT:

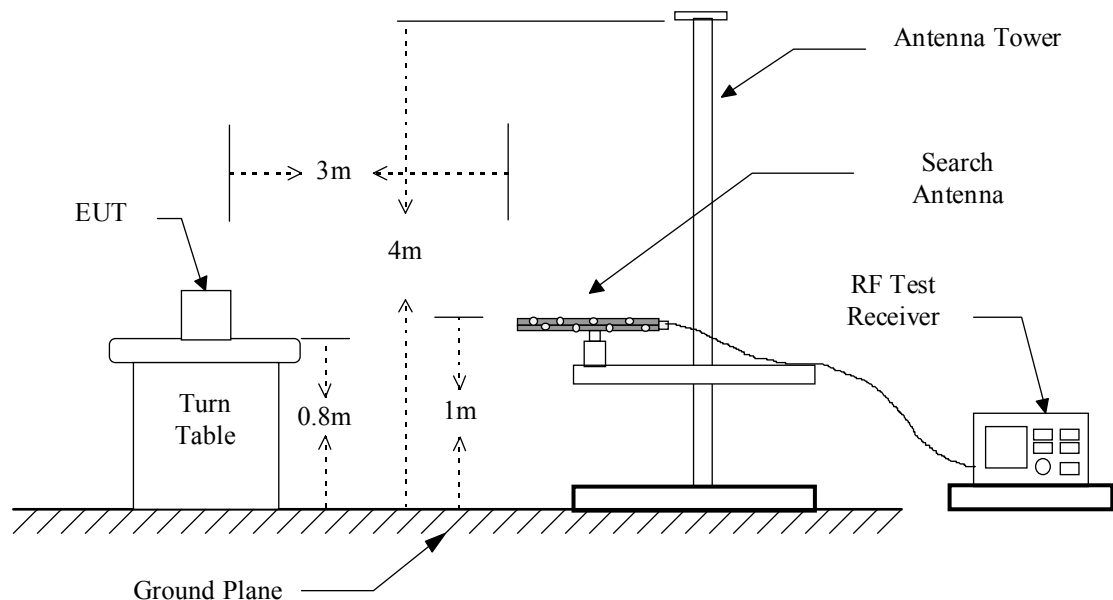
1. With the receiving antenna is H polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
2. With the receiving antenna is V polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
3. Compare the results derived from above two steps. So, the axis of maximum emission from EUT was determined and the configuration was used to perform the final measurement.

B. Final Measurement

1. Setup the configuration per figure 1 and 2 for frequencies measured below and above 1 GHz respectively. Turn on EUT and make sure that it is in normal function.
2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.
3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.
4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0 ° to 360 ° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.
5. Repeat step 4 until all frequencies need to be measured were complete.

6. Repeat step 5 with search antenna in vertical polarized orientations.
7. Check the three frequencies of highest emission with varying the placement of cables (if any) associated with EUT to obtain the worse case and record the result.

Figure 1 : Frequencies measured below 1 GHz configuration



3.3 Test Data

A. Fundamental Frequency

Operation Mode : TX/RX

Operation Frequency : TX: 49.860 MHz, RX: 40.680 MHz

Test Date: Dec. 20, 2001 Temperature : 22 °C Humidity: 68 %

Frequency (MHz)	Reading (dBUV)				Factor (dB) Corr.	Result @3m (dBUV/m)		Limit @3m (dBUV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H Peak	H Ave	V Peak	V Ave		Peak	Ave	Peak	Ave.			
49.860	82.4	81.3	95.2	93.4	-14.1	81.1	79.3	100.0	80.0	-0.7	180	1.00

Note : 1. Item of margin shown in above table refer to average limit.

2. It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.

3. Remark "---" means that the emissions level is too low to be measured.

4. Item "Margin" referred to Average limit while there is only peak result.

5. The expanded uncertainty of the radiated emission tests is 3.53 dB.

B. Harmonic & Spurious

Operation Mode : TX/RX

Test Date : Dec. 20, 2001

Temperature : 22 °C

Humidity: 68 %

Frequency (MHz)	Meter Reading (dBuV) H V		Corrected Factor (dB)	Result @3m (dBuV/m)	Limit @3m (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (m)
*40.681	---	---	-12.0	---	40.0	---	---	---
*81.362	---	---	-14.9	---	40.0	---	---	---
*122.043	---	---	-10.9	---	43.5	---	---	---
*162.724	---	---	-9.4	---	43.5	---	---	---
*203.405	---	---	-6.9	---	43.5	---	---	---
*244.086	---	---	-4.3	---	46.0	---	---	---
*284.767	---	---	-2.4	---	46.0	---	---	---
*325.448	---	---	-6.8	---	46.0	---	---	---
*366.129	---	---	-7.5	---	46.0	---	---	---
*406.810	---	---	-6.2	---	46.0	---	---	---
99.720	---	---	-13.9	---	43.5	---	---	---
149.580	---	---	-10.0	---	43.5	---	---	---
199.440	---	---	-7.2	---	43.5	---	---	---
249.300	---	---	-3.9	---	46.0	---	---	---
299.160	---	---	-0.9	---	46.0	---	---	---
349.020	---	---	-10.4	---	46.0	---	---	---
398.880	---	---	-6.4	---	46.0	---	---	---
448.740	---	---	-5.6	---	46.0	---	---	---
498.600	---	---	-4.4	---	46.0	---	---	---

Note :

1. Remark “---” means that the emissions level is too low to be measured.
2. Item “Margin” referred to Average limit while there is only peak result.
3. Remark “*” means that the emission frequency is produced from local oscillator.
4. The expanded uncertainty of the radiated emission tests is 3.53 dB.

C. Other Emission

Operation Mode : Charging

Test Date: Dec. 20, 2001

Temperature : 22 °C

Humidity: 68 %

Frequency (MHz)	Meter Reading (dBuV) H V		Corrected Factor (dB)	Result @3m (dBuV/m)	Limit @3m (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (m)
30.000	---	---	-9.8	---	40.0	---	---	---
50.000	---	---	-14.1	---	40.0	---	---	---
80.000	---	---	-15.0	---	40.0	---	---	---
150.000	---	---	-10.0	---	43.5	---	---	---
250.000	---	---	-3.9	---	46.0	---	---	---
350.000	---	---	-10.5	---	46.0	---	---	---
500.000	---	---	-4.4	---	46.0	---	---	---
800.000	---	---	0.7	---	46.0	---	---	---

Note :

1. Remark “---” means that the emissions level is too low to be measured.
2. The expanded uncertainty of the radiated emission tests is 3.53 dB.

3.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

$$\text{Peak} = \text{Reading} + \text{Corrected Factor}$$

where

Corr. Factor = Antenna Factor + Cable Factor - Amplifier Gain (if any)

3.5 Radiated Test Equipment

Equipment	Manufacturer	Model No.	Next Cal. Date
Spectrum Analyzer	Hewlett-Packard	8568B	12/21/2001
Pre-selector	Hewlett-Packard	85685A	01/01/2002
Quasi Peak Detector	Hewlett-Packard	85650A	01/01/2002
RF Test Receiver	Rohde & Schwarz	ESVS 30	08/06/2002
Log periodic Antenna	EMCO	3146	11/02/2001
Biconical Antenna	EMCO	3110B	11/02/2001
Preamplifier	Hewlett-Packard	8447D	12/29/2001
Spectrum Analyzer	Hewlett-Packard	8564E	04/22/2002

3.6 Measuring Instrument Setup

Explanation of measuring instrument setup in frequency band measured is as following:

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	RF Test Receiver	Quasi Peak	120 kHz	N/A
	Spectrum Analyzer	Peak	100 kHz	100 kHz

3.7 Radiated Measurement Photos

Please see setup photos in Exhibit F.

4 CONDUCTED EMISSION MEASUREMENT

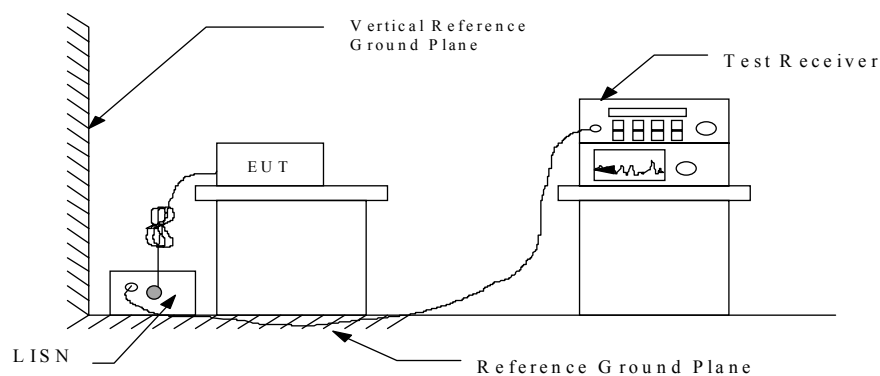
4.1 Standard Applicable

For intentional device, Line Conducted Emission Limits are in accordance to § 15.207(a), any emissions level shall not exceed 48 dBuV.

4.2 Measurement Procedure

1. Setup the configuration per figure 3.
2. A preliminary scan with a spectrum monitor is performed to identify the frequency of emission that has the highest amplitude relative to the limit by operating the EUT in selected modes of operation, typical cable positions, and with a typical system configuration.
3. Record the 6 or 8 highest emissions relative to the limit.
4. Measure each frequency obtained from step 3 by a test receiver set on quasi peak detector function, and then records the accuracy frequency and emission level. If all emissions measured in the specified band are attenuated more than 20 dB from the limit, this step would be ignored, and the peak detector function would be used.
5. Confirm the highest three emissions with variation of the EUT cable configuration and record the final data.
6. Repeat all above procedures on measuring each operation mode of EUT.

Figure 3 : Conducted emissions measurement configuration



4.3 Conducted Emission Data

Operation Mode : Charging

Test Date : Dec. 20, 2001

Temperature : 21 °C

Humidity: 70 %

Frequency (MHz)	Reading (dBuV)		Factor (dB)	Result (dBuV)		Limit (dBuV)	Margin (dB)
	N	L1		N	L1		
0.452	25.8	22.2	0.2	26.0	22.4	48.0	-22.0
0.480	27.6	23.8	0.2	27.8	24.0	48.0	-20.2
0.584	26.6	19.6	0.2	26.8	19.8	48.0	-21.2
0.672	26.8	18.6	0.2	27.0	18.8	48.0	-21.0
0.873	24.4	24.2	0.3	24.7	24.5	48.0	-23.3
1.392	27.0	27.6	0.3	27.3	27.9	48.0	-20.1
4.661	19.6	19.4	0.3	19.9	19.7	48.0	-28.1
17.299	20.2	20.0	0.8	21.0	20.8	48.0	-27.0

Note :

1. Please see appendix 1 for Plotted Data.
2. The expanded uncertainty of the conducted emission tests is 2.45 dB.

4.4 Result Data Calculation

The result data is calculated by adding the LISN Factor to the measured reading. The basic equation with a sample calculation is as follows:

$$\text{RESULT} = \text{READING} + \text{LISN FACTOR}$$

Assume a receiver reading of 22.5 dB μ V is obtained, and LISN Factor is 0.1 dB, then the total of disturbance voltage is 22.6 dB μ V.

$$\text{RESULT} = 22.5 + 0.1 = 22.6 \text{ dB } \mu \text{ V}$$

$$\begin{aligned} \text{Level in } \mu \text{ V} &= \text{Common Antilogarithm}[(22.6 \text{ dB } \mu \text{ V})/20] \\ &= 13.48 \mu \text{ V} \end{aligned}$$

4.5 Conducted Measurement Equipment

The following test equipment are used during the conducted test.

Equipment	Manufacturer	Model No.	Next Cal. Date
RF Test Receiver	Rohde and Schwarz	ESH3	01/03/2002
Spectrum Monitor	Rohde and Schwarz	EZM	N.C.R.
Line Impedance Stabilization network	Rohde and Schwarz	ESH2-Z5	08/05/2002
Plotter	Hewlett-Packard	7440A	N/A
Shielded Room	Riken	N/A	N.C.R.

4.6 Photos of Conduction Measuring Setup

Please see setup photos in Exhibit F.

5 ANTENNA REQUIREMENT

5.1 Standard Applicable

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

5.2 Antenna Construction

The antenna is permanently mounted on PCB, no consideration of replacement.

6 EMISSION BAND MEASUREMENT

6.1 Standard Applicable

According to 15.235(b), the field strength of any emissions appearing between the band edges and up to 10 kHz above and below the band edges shall be attenuated at least 26 dB below the level of the unmodulated carrier or to the general limits in § 15.209, whichever permits the higher emission levels

6.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 1 and measurement the turn on the EUT. Then have the EUT activating in normal operation and make sure the instrument is operated in its linear range.
3. Adjust the measurement frequency range to contain the signal radiated from the Eut. Set both RBW and VBW of spectrum analyzer to 10 kHz and 100kHz respectively with a convenient frequency span including 200kHz bandwidth of the emission.
4. Mark the bandwidth of 200kHz points and plot the graph on spectrum analyzer.

6.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	ESBI	05/15/2002
Plotter	Hewlett-Packard	7440A	N/A

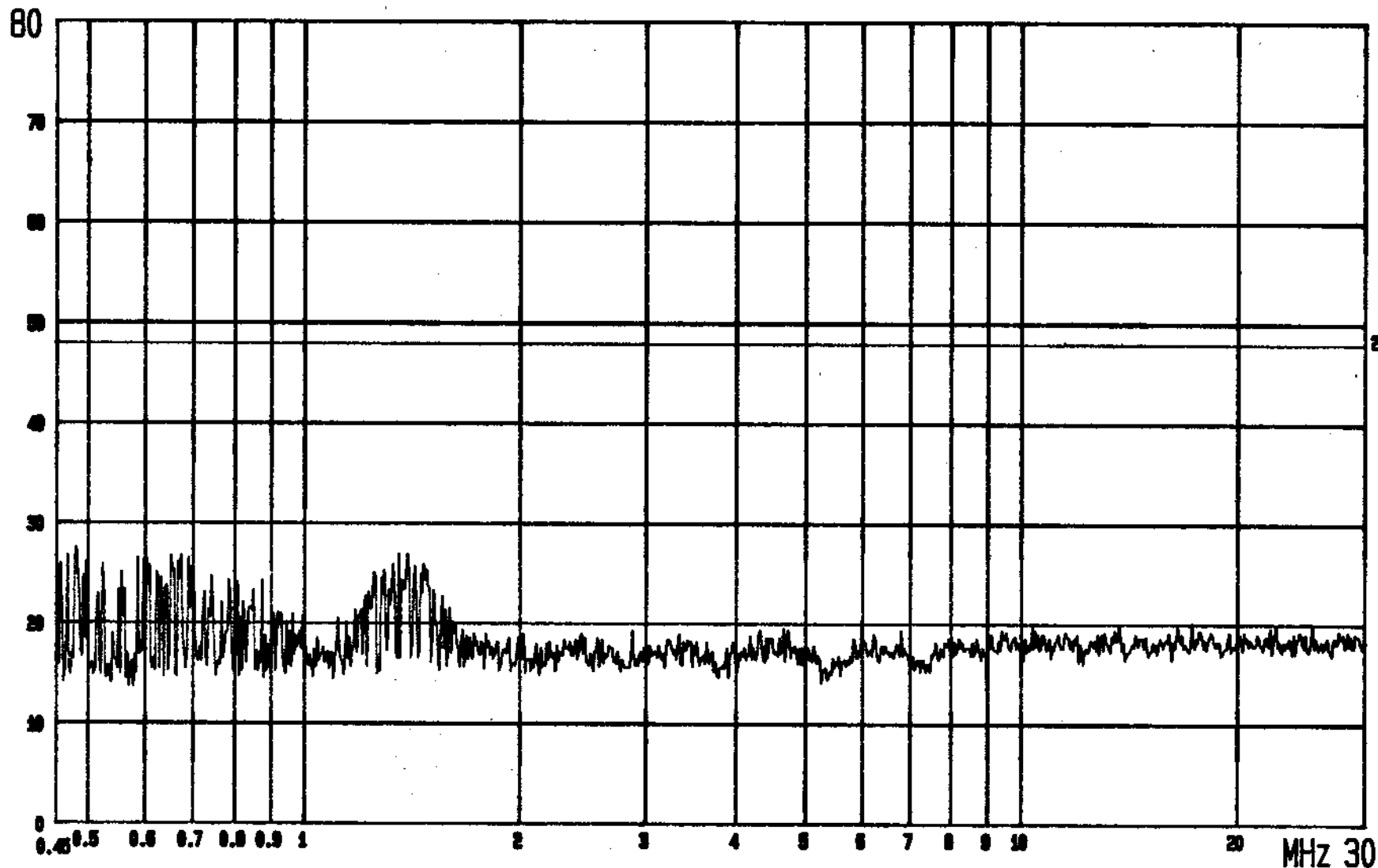
6.4 Measurement Data

Test Date : Dec. 20, 2001 Temperature : 21 °C Humidity: 71 %

Test Result: Please see appendix 2 for Plotted Data

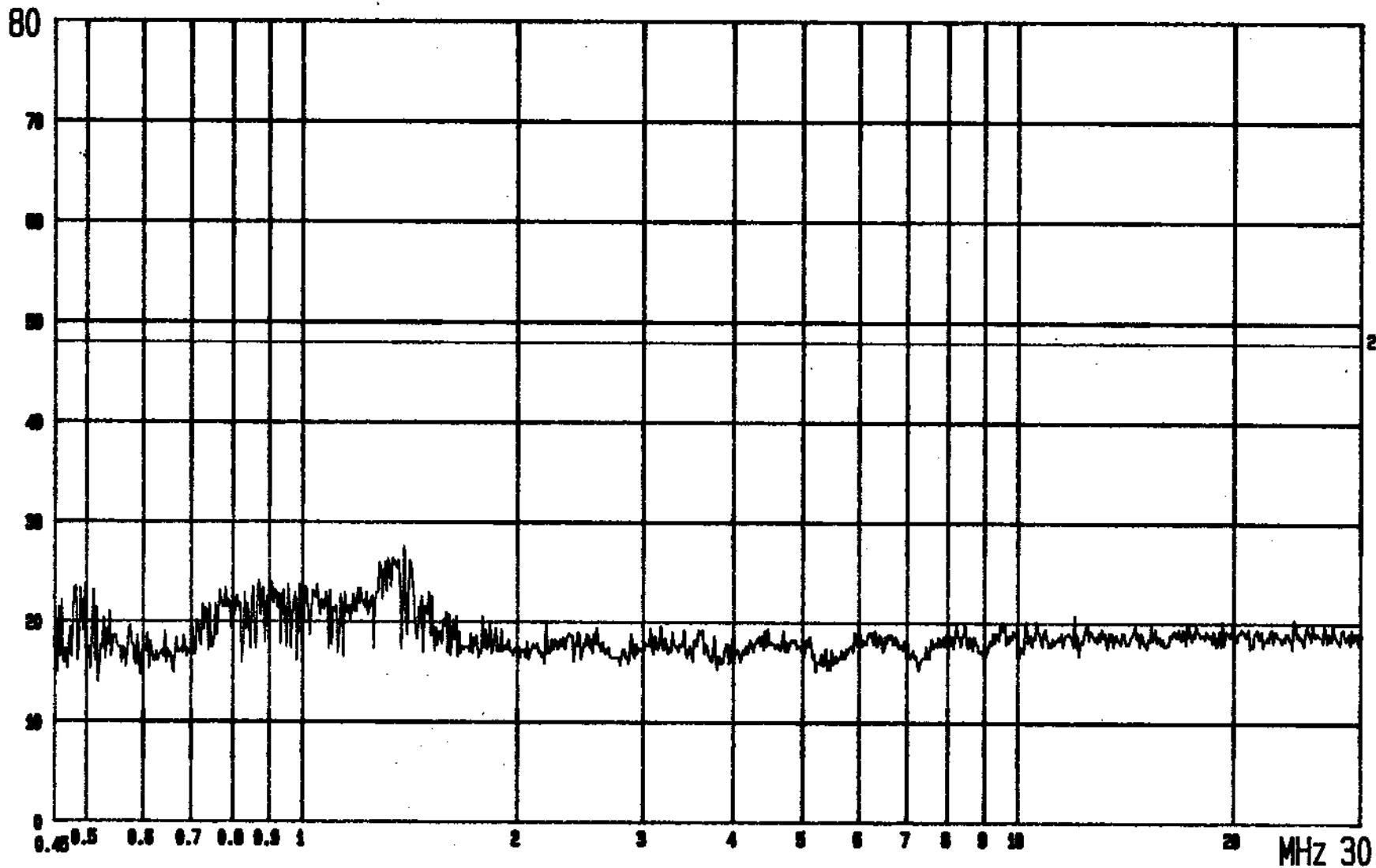
Appendix 1 : Plotted Data For Conducted Emission

dBuV



FCC CONDUCTED TEST EUT: Base Unit LISN: N 2: QP., CLASS B LIMIT
MODEL: WHH102B MODE: Charge AC ADAPTOR: I/P=120Vac/60Hz; O/P=6VDC ETC EMI LAB.

dBuV



FCC CONDUCTED TEST EUT: Base Unit LISN: L1 2: GP., CLASS B LIMIT
MODEL: WHH102B MODE: Charge AC ADAPTOR: I/P=120Vac/60Hz; O/P=6VDC ETC EMI LAB.

Appendix 2 : Plotted Data For Emission Band Measurement



Ref.Lvl
87.00 dB μ V

Marker

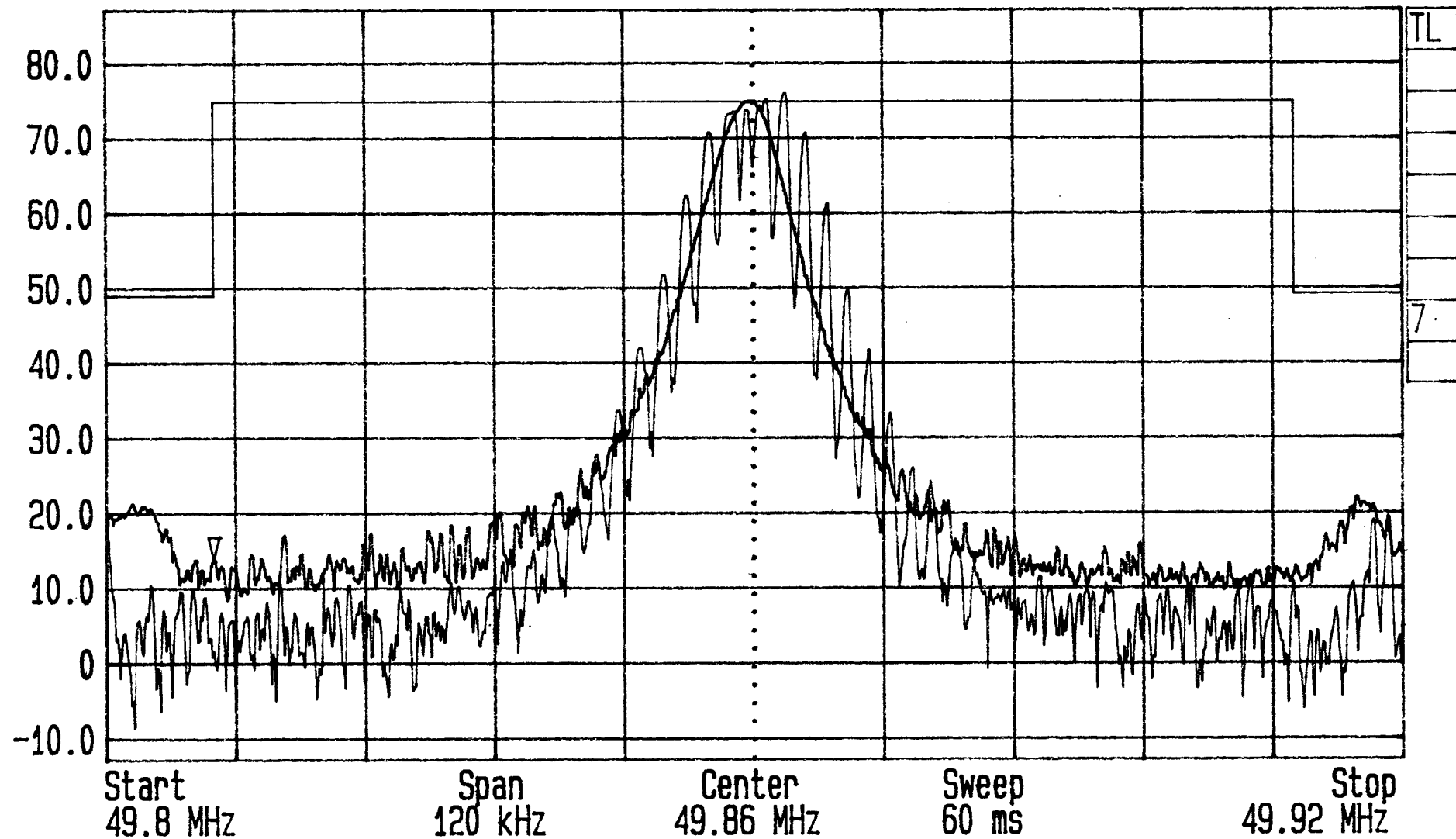
13.82 dB μ V
49.8100 MHz

Res.Bw
TG.Lvl
CF.Stp

3.0 kHz [3dB]
off
12.000 kHz

Vid.Bw
RF.Att
Unit

100 kHz
10 dB
[dB μ V]





Ref.Lvl
87.00 dB μ V

Marker

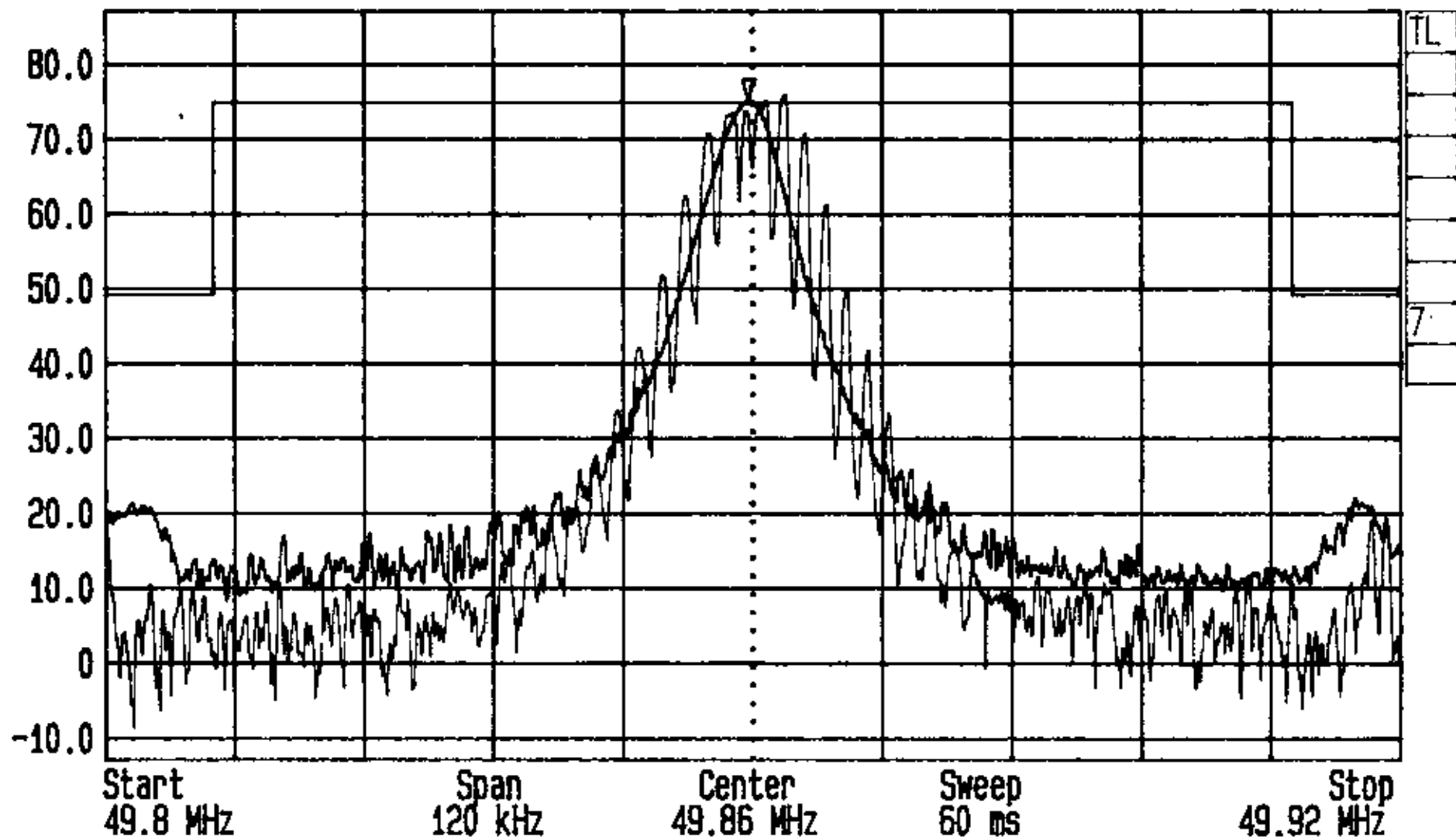
75.02 dB μ V
49.8596 MHz

Res.Bw
T6.Lvl
CF.Stp

3.0 kHz [3dB]
off
12.000 kHz

Vid.Bw
RF.Att
Unit

100 kHz
10 dB
[dB μ V]





D:
Ref.Lvl
87.00 dB μ V

Marker
11.94 dB μ V
49.9100 MHz

Res.Bw
TG.Lvl
CF.Stp

3.0 kHz [3dB]
off
12.000 kHz

Vid.Bw
RF.Att
Unit

100 kHz
10 dB
[dB μ V]

