

FCC CLASS II CHANGE EMI TEST REPORT

of

E.U.T. : RF Modulator

MODEL : 15-1214

FCC ID. : AAO1501214

for

APPLICANT : RADIO SHACK A DIVISION OF TANDY
CORPORATION

ADDRESS : 100 THROCKMOTRON ST., STE. 1300, FORT
WORTH TEXAS, U.S.A.

Test Performed by

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Report Number : ET91R-02-027

TEST REPORT CERTIFICATION

Applicant : RADIO SHACK A DIVISION OF TANDY CORPORATION
100 THROCKMOTRON ST., STE. 1300, FORT WORTH TEXAS,
U.S.A.

Manufacturer : GOOD MIND ELECTRONICS (SHEN ZHEN) CO., LTD.
TUNG FANG INDUSTRIAL DISTRICT, SHUNG KANG ZHEN,
BAO AN AREAN, SHEN ZHEN, CHINA

Description of EUT :

- a) Type of EUT : RF Modulator
- b) Trade Name : RADIO SHACK
- c) Model No. : 15-1214
- d) Power Supply : 120Vac, 60Hz, 4.5W

Regulation Applied : FCC Rules and Regulations Part 15 Subpart B (2001)

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.

Note: 1. The result of the testing report relate only to the item tested.
2. The testing report shall not be reproduced expect in full, without the written approval of ETC.

Issued Date : Feb. 19, 2002

Test Engineer : S S Liou
(S. S. Liou)

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

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1 GENERAL INFORMATION

1.1 Product Description

- a) Type of EUT : RF Modulator
- b) Trade Name : RADIO SHACK
- c) Model No. : 15-1214
- d) Power Supply : 120Vac, 60Hz, 4.5W

1.2 Characteristics of Device

The RF Modulator is intended for reception of video transmission. It modulates video signal to the standard out channel 3 or 4. And it can auto switch the input signals to TV, that is, when there is a AV signal coming into the AV terminal, it will auto switch to this terminal, otherwise, it will be at “antenna in” position.

1.3 Test Methodology

For RF Modulator, both conducted and radiated emissions were performed according to the procedures illustrated in ANSI C63.4 (1992). Other required measurements were illustrated in separate sections of this test report for details.

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, Taipei Hsien, Taiwan, 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 LIMITATIONS AND LABELING REQUIREMENT

2.1 Definition

Unintentional radiator:

A device that intentionally generates and radio frequency energy for use within the device, or that sends radio frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction.

Class A Digital Device:

A digital device which is marketed for use in commercial or business environment; exclusive of a device which is market for use by the general public, or which is intended to be used in the home.

Class B Digital Device :

A digital device which is marketed for use in a residential environment notwithstanding use in a commercial, business or industrial environment. Example of such devices that are marketed for the general public.

Note : A manufacturer may also qualify a device intended to be marketed in a commercial, business, or industrial environment as a Class B digital device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B Digital Device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B Digital Device, Regardless of its intended use.

2.2 Limitation Requirement

(1) Conducted Emission Limits

For unintentional device, according to § 15.107, Line Conducted Emission Limits is as following:

Class B Line Conducted Emission Limits :

Frequency MHz	Emissions μV	Emissions dB μV
0.45 - 30.0	250	48.0

Class A Line Conducted Emission Limits :

Frequency MHz	Emissions μ V	Emissions dB μ V
0.45 - 1.705	1000	60.0
1.705 - 30.0	3000	69.5

(2) Radiated Emission Requirement**Class B Radiated Emission Limits :**

Frequency MHz	Distance Meters	Radiated dB μ V/m	Radiated μ V/m
30 - 88	3	40.0	100
88 - 216	3	43.5	150
216 - 960	3	46.0	200
Above 960	3	54.0	500

For unintentional class A devices, according to § 15.109(a), the field strength of radiated emissions from unintentional radiators at a distance of 10 meters shall not exceed the following values:

Class A Radiated Emission Limits :

Frequency MHz	Distance Meters	Radiated dB μ V/m	Radiated μ V/m
30 - 88	10	39.0	90
88 - 216	10	43.5	150
216 - 960	10	46.4	210
Above 960	10	49.5	300

(3) RF Output Signal Requirement

For TV interface devices, according to § 15.115(b)(1), At any RF output terminal, the maximum measured RMS voltage, in microvolt, corresponding to the peak envelope power of the modulated signal across a resistance (R in Ohms) matching the rated output impedance of the TV interface device, shall not exceed the following :

- a). For cable system terminal device or a TV interface device used with a master antenna, 692.8 times the square root of R for video signal and 155 times the square root R for audio signal.
- b). For all other TV interface devices, 346.4 times the square root of R for video signal and 77.5 times the square root of R for audio signal.

(4) RF Output Spurious Requirement

For TV interface devices, according to § 15.115(b)(2), at any RF output terminal, peak power envelope, across R (same as the R in RF output signal), of any emission appearing on frequencies removed by more than 4.6 MHz below or 7.4 MHz above the video carrier frequency shall not exceed the following :

- a). For cable system terminal device or a TV interface device used with a master antenna, 692.8 times the square root of R .
- b). For all other TV interface devices, 10.95times the square root of R .

(5) Isolation of Transfer Switch Requirement

For TV interface devices, according to § 15.115(c)(ii), isolation of transfer switch shall not exceed 0.346 times the square root of R (same as the R in RF output signal).

2.3 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.

2.4 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.

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual.

The Federal Communications Commission Radio Frequency Interference Statement includes the following paragraph.

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio / TV technician for help.

3 SYSTEM TEST CONFIGURATION

3.1 Justification

All measurement were intentional to maximum the emissions from EUT by varying the connection cables, therefore, the test result is sure to meet the applicable requirement.

3.2 Devices for Tested System

Device	Manufacture	Model / FCC ID.	Description
RF Modulator*	RADIO SHACK ELECTRONICS CO., LTD.	15-1214 AAO1501214	1.92m Unshielded AC Power Cord 1.8m Unshielded AV Cable Line 0.92m Shielded Coaxil Cable × 2 1.5m Shielded S Terminal Cable Line
TV	ACTION	ACN-9108	1.8m Unshielded Power Cord
Video Cassette Player	TATUNG CO.	VRH-110U	1.8m Unshielded Power Cord

Remark “*” means equipment under test.

4 RADIATED EMISSION MEASUREMENT

4.1 Applicable Standard

For unintentional radiator, the radiated emission shall comply with § 15.109(a).

4.2 Measurement Procedure

1. Setup the configuration per figure 5 and 6 for frequencies measured below and above 1 GHz respectively.
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 associated with EUT to obtain the worse case and record the result.

Figure 1 : Frequencies measured below 1 GHz configuration

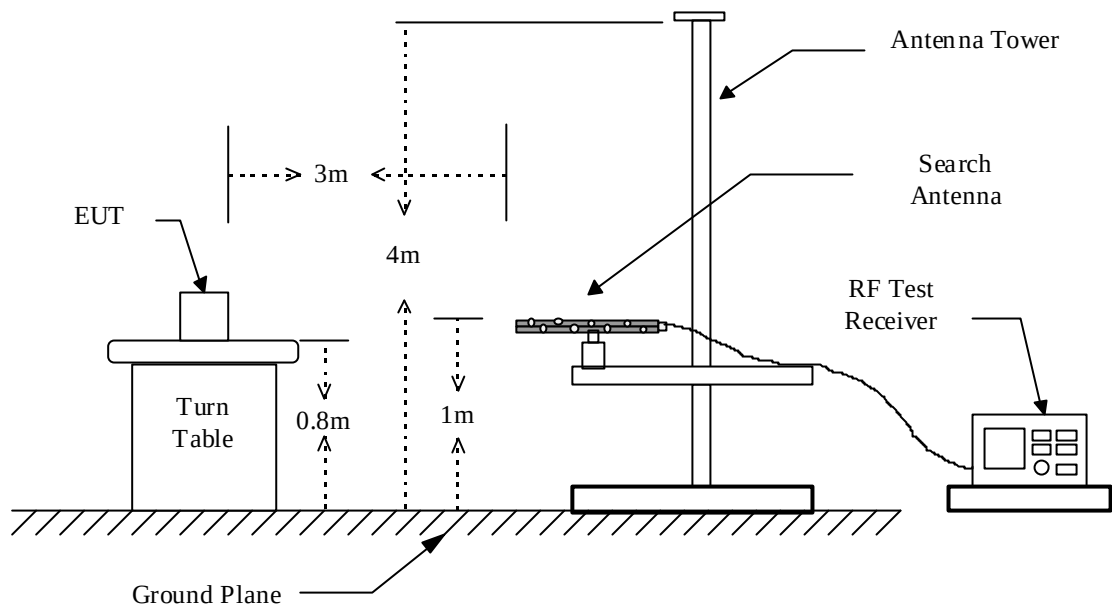
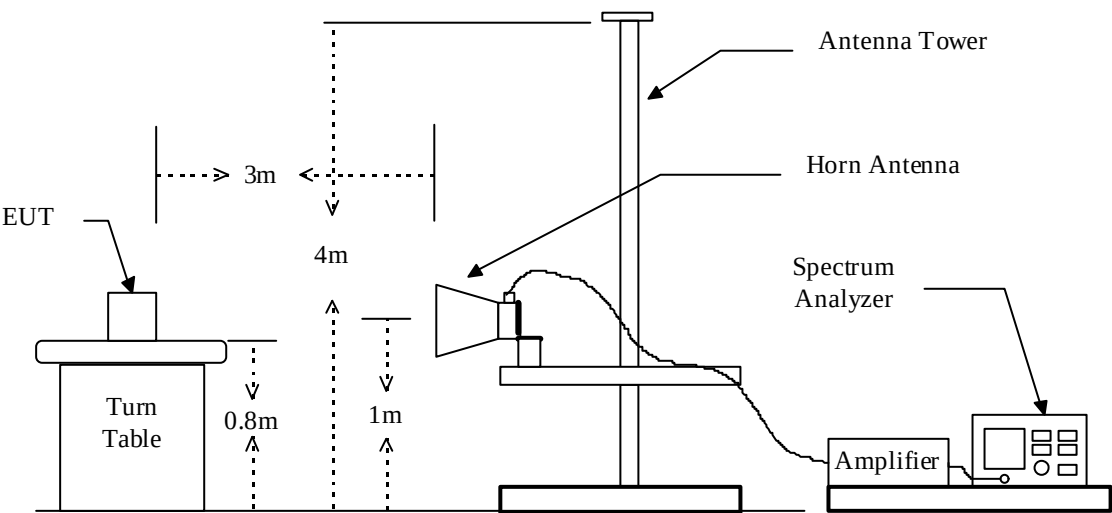


Figure 2 : Frequencies measured above 1 GHz configuration



4.3 Measuring Instrument

The following instrument are used for radiated emissions measurement :

Equipment	Manufacturer	Model No.	Next Cal. Date
Spectrum Analyzer	Hewlett-Packard	8568B	12/21/2002
Pre-selector	Hewlett-Packard	85685A	01/10/2003
Quasi Peak Detector	Hewlett-Packard	85650A	01/10/2003
RF Test Receiver	Rohde & Schwarz	ESVS 30	08/06/2002
RF Test Receiver	Rohde & Schwarz	ESBI	05/15/2002
Log periodic Antenna	EMCO	3146	11/02/2002
Biconical Antenna	EMCO	3110B	11/02/2002
Horn Antenna	EMCO	3115	05/14/2002
Preamplifier	Hewlett-Packard	8449B	05/10/2002
Preamplifier	Hewlett-Packard	8447D	04/09/2002
Spectrum Analyzer	Hewlett-Packard	8564E	04/22/2002

Measuring instrument setup in measured frequency band when specified detector function is used :

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
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	300 Hz

4.4 Radiated Emission Data

A. Channel 3 (frequency : 61.25 MHz)

Operation Mode : Normal

Test Date : Feb. 18, 2002

Temperature : 25 °C

Humidity : 60 %

Frequency (MHz)	Meter Reading (dBuV)	Corrected Factor (dB)	Result @3m (dBuV/m)	Limit @3m (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (m)
61.250	H/V	---	-16.2	---	40.0	---	---
122.500	H/V	---	-11.0	---	43.5	---	---
183.750	H/V	---	-8.8	---	43.5	---	---
245.000	H/V	---	-4.2	---	46.0	---	---
306.250	H/V	---	-6.9	---	46.0	---	---
367.500	H/V	---	-7.3	---	46.0	---	---
428.750	H/V	---	-5.5	---	46.0	---	---
490.000	H/V	---	-4.4	---	46.0	---	---
551.250	H/V	---	-5.2	---	46.0	---	---
612.500	H/V	---	-3.9	---	46.0	---	---

Note :

1. Remark “---“ means that the emissions from EUT are too weak to be measured.
2. The system amplitude accuracy of the measurement made during the radiated emission tests was ± 4 dB.

B. Channel 4 (frequency : 67.25 MHz)

Operation Mode : Normal

Test Date : Feb. 18, 2002

Temperature : 25 °C

Humidity : 60 %

Frequency (MHz)	Meter Reading (dBuV)	Corrected Factor (dB)	Result @3m (dBuV/m)	Limit @3m (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (m)
67.250	H/V	---	-16.4	---	40.0	---	---
134.500	H/V	---	-11.2	---	43.5	---	---
201.750	H/V	---	-7.0	---	43.5	---	---
269.000	H/V	---	-3.6	---	46.0	---	---
336.250	H/V	---	-8.4	---	46.0	---	---
403.500	H/V	---	-6.3	---	46.0	---	---
470.750	H/V	---	-4.7	---	46.0	---	---
538.000	H/V	---	-5.1	---	46.0	---	---
605.250	H/V	---	-4.2	---	46.0	---	---
672.500	H/V	---	-1.2	---	46.0	---	---

Note :

1. Remark “---“ means that the emissions from EUT are too weak to be measured.
2. The system amplitude accuracy of the measurement made during the radiated emission tests was ± 4 dB.

4.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss(if used) and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

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

where Corrected Factor

$$= \text{Antenna FACTOR} + \text{Cable Loss} - \text{Amplifier Gain}$$

4.6 Photos of Radiation Measuring Setup

Please see Setup Photos in Exhibit F.

5 CONDUCTED EMISSION MEASUREMENT

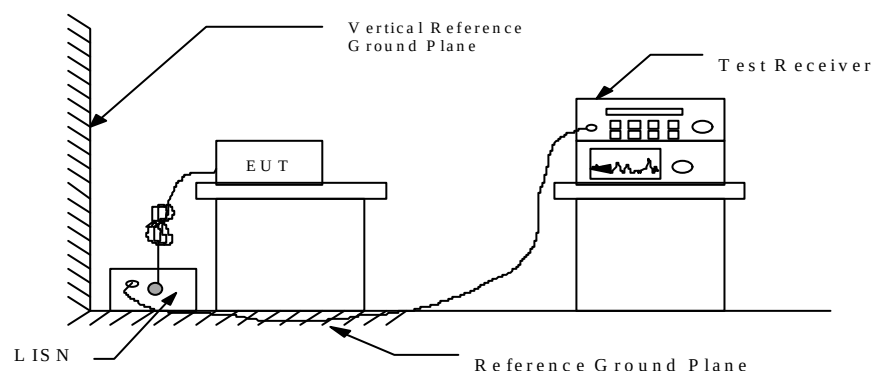
5.1 Standard Applicable

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

5.2 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 record 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



5.3 Conducted Emission Data

A. Channel 3 (frequency : 61.25 MHz)

Test Date : Feb. 18, 2002

Temperature : 25 °C

Humidity: 60 %

Frequency (MHz)	Reading (dBuV)		Factor (dB)	Result (dBuV)		Limit (dBuV)	Margin (dB)
	Va	Vb		Va	Vb		
0.4500	22.4	26.4	0.2	22.6	26.6	48.0	-21.4
16.8984	27.2	27.7	0.8	28.0	28.5	48.0	-19.5
18.8322	26.1	25.5	0.9	27.0	26.4	48.0	-21.0
20.2803	32.0	32.2	0.9	32.9	33.1	48.0	-14.9
25.3497	34.4	32.2	1.0	35.4	33.2	48.0	-12.6
27.0392	39.4	37.1	1.0	40.4	38.1	48.0	-7.6

B. Channel 4 (frequency : 67.25 MHz)

Test Date : Feb. 18, 2002

Temperature : 25 °C

Humidity: 60 %

Frequency (MHz)	Reading (dBuV)		Factor (dB)	Result (dBuV)		Limit (dBuV)	Margin (dB)
	Va	Vb		Va	Vb		
0.4500	22.2	26.4	0.2	22.4	26.6	48.0	-21.4
18.8117	26.5	26.2	0.9	27.4	27.1	48.0	-20.6
20.2813	31.4	31.4	0.9	32.3	32.3	48.0	-15.7
23.6603	27.7	27.0	1.0	28.7	28.0	48.0	-19.3
25.3499	33.8	32.1	1.0	34.8	33.1	48.0	-13.2
27.0376	38.2	36.1	1.0	39.2	37.1	48.0	-8.8

Note :

1. The system amplitude accuracy of the measurement made during the conducted emission test was $\pm 3\text{dB}$.
2. Please see appendix 1 for Ploted Datas.

5.4 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.

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

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

5.5 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	12/29/2002
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.

5.6 Photos of Conduction Measuring Setup

Please see Setup Photos in Exhibit F.

6 RF OUTPUT LEVEL MEASUREMENT

6.1 Measurement Description

According to section 12.2.5 of ANSI C63.4, the output signal level is the maximum voltage level present at the output terminal of a TV interface device on a particular frequency during normal use of the device.

A VITS test signal of 5V is applied.

6.2 Data of Measurement

Operation Condition : VITS 5V

Channel	Frequency Measured (MHz)		Meter Reading (dBm)		Pad Loss (dB)	Result (uV)		Limit (uV)	
	Visual	Aural	Visual	Aural		Visual	Aural	Visual	Aural
CH 3	61.243	56.754	-40.97	-56.97	1.0	2748.1	435.5	3000	671
CH 4	67.233	62.757	-41.87	-58.22	1.0	2477.6	377.2	3000	671

Note : The audio channel showed above table is the one generating higher output level of tow audio channels.

6.3 Calculation of Data Measured

The measuring data for output signal level is calculated as following formula :

$$\text{Result (uV)} = \left[10^{\frac{(\text{Reading} + \text{Insertion Loss})}{10}} \times 75 \times 10^{-3} \right]^{\frac{1}{2}} \times 10^6$$

6.4 Equipment for RF Output Level Measurement

Equipment	Manufacturer	Model No.	Cal. Date
Spectrum Analyzer	Hewlett-Packard	8568B	12/21/2002
Quasi Peak Adapter	Hewlett-Packard	85650A	01/10/2003
Pre-selector	Hewlett-Packard	85685A	01/10/2003
Amplifier	Hewlett-Packard	8447D	04/09/2002

The parameters of instrument is set as following while measurement is performed :

Resolution Bandwidth : 100 KHz
Video Bandwidth : 100 KHz
Frequency Span : 10 MHz
Sweep Time : 200 ms
Function : Peak

7 CONDUCTED SPURIOUS EMISSION MEASUREMENT

7.1 Description of Measurement

According to section 12.2.5 of ANSI C63.4, the output signal level is the maximum voltage level present at the output terminal of a TV interface device on a particular frequency during normal use of the device.

A VITS test signal of 5V is applied.

7.2 Data of Measurement

A. CH 3

Frequency (MHz)	Meter Reading (dBm)	Pad Loss (dB)	Limit (uV)	Result (uV)
47.74	-81.45	1.0	95	26.0
74.73	-81.35	1.0	95	26.3
122.57	-82.22	1.0	95	23.8
183.77	-81.52	1.0	95	25.8

B. CH 4

Frequency (MHz)	Meter Reading (dBm)	Pad Loss (dB)	Limit (uV)	Result (uV)
53.80	-81.52	1.0	95	25.8
80.84	-83.25	1.0	95	21.1
134.51	-83.20	1.0	95	21.3
201.84	-83.60	1.0	95	20.3

7.3 Calculation of Data Measured

The measuring data for output signal level is calculated as following formula :

$$\text{Result (uV)} = \left[10^{\frac{(\text{Reading} + \text{Pad Loss} - \text{Amplifier Gain} + \text{Att.})}{10}} \times 75 \times 10^{-3} \right]^{\frac{1}{2}} \times 10^6$$

7.4 Equipment for Conducted Spurious Measurement

Equipment	Manufacturer	Model No.	Cal. Date
Spectrum Analyzer	Hewlett-Packard	8568B	12/21/2002
Quasi Peak Adapter	Hewlett-Packard	85650A	01/10/2003
Pre-selector	Hewlett-Packard	85685A	01/10/2003
Pre-Amplifier	Hewlett-Packard	8447D	04/09/2002
Pre-Ampifier	Hewlett-Packard	8449B	05/10/2002

The parameters of Spectrum Analyzer is set as following while measurement is performed:

Resolution Bandwidth : 100 KHz
Video Bandwidth : 100 KHz
Frequency Span : 10 MHz
Sweep Time : 200 ms
Function : Peak

8 ANTENNA TRANSFER SWITCH MEASUREMENT

8.1 Description for Measurement

For TV interface device, according to § 15.115(c)(ii), isolation of transfer switch shall not exceed 0.346 times the square root of R (same as the R in RF output signal.)

8.2 Data of Measurement

Channel	Frequency (MHz)	Meter Reading (dBm)	Amp. Loss (dB)	Pad Loss (dB)	Result (uV)	Limit (uV)
3	61.269	-78.2	26.0	1.0	1.89	3.0
4	67.269	-79.52	26.0	1.0	2.30	3.0

8.3 Calculation of Data Measured

$$\text{Result (uV)} = \left[10^{\frac{(\text{Reading} + \text{Pad Loss} - \text{Amplifier Gain} + \text{Att.})}{10}} \times 75 \times 10^{-3} \right]^{\frac{1}{2}} \times 10^6$$

8.4 Equipment for Conducted Spurious Measurement

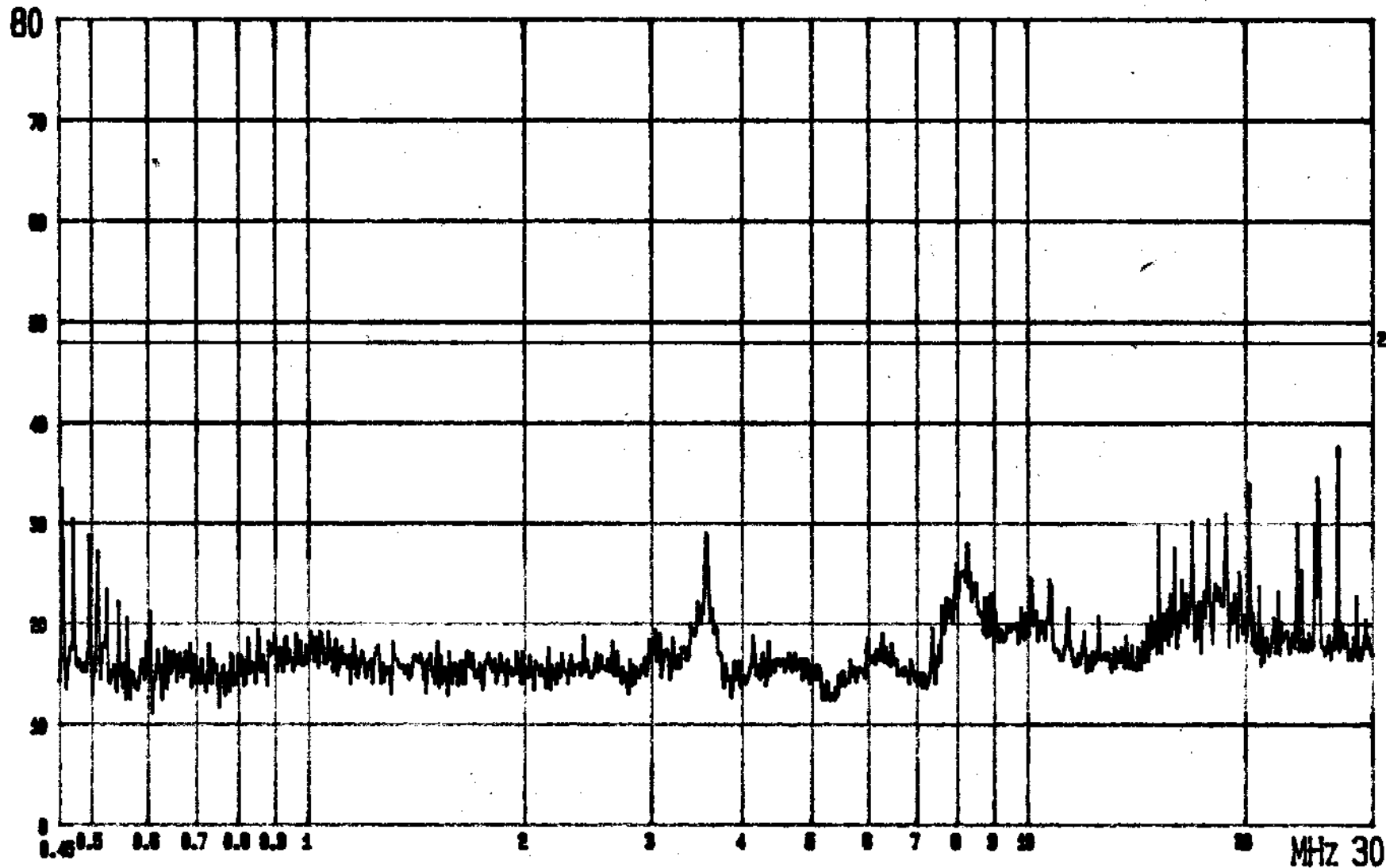
Equipment	Manufacturer	Model No.	Cal. Date
EMI Test Receiver	Rhode & Schwarz	ESBI	05/15/2002
Amplifier	Hewlett-Packard	8447D	04/09/2002

The parameters of Spectrum Analyzer is set as following while measurement is performed:

Resolution Bandwidth : 100 KHz
 Video Bandwidth : 100 KHz
 Frequency Span : 10 MHz
 Sweep Time : 200 ms
 Function : Peak

Appendix 1 : Plotted Data of Power Line Conducted Emissions

dBuV



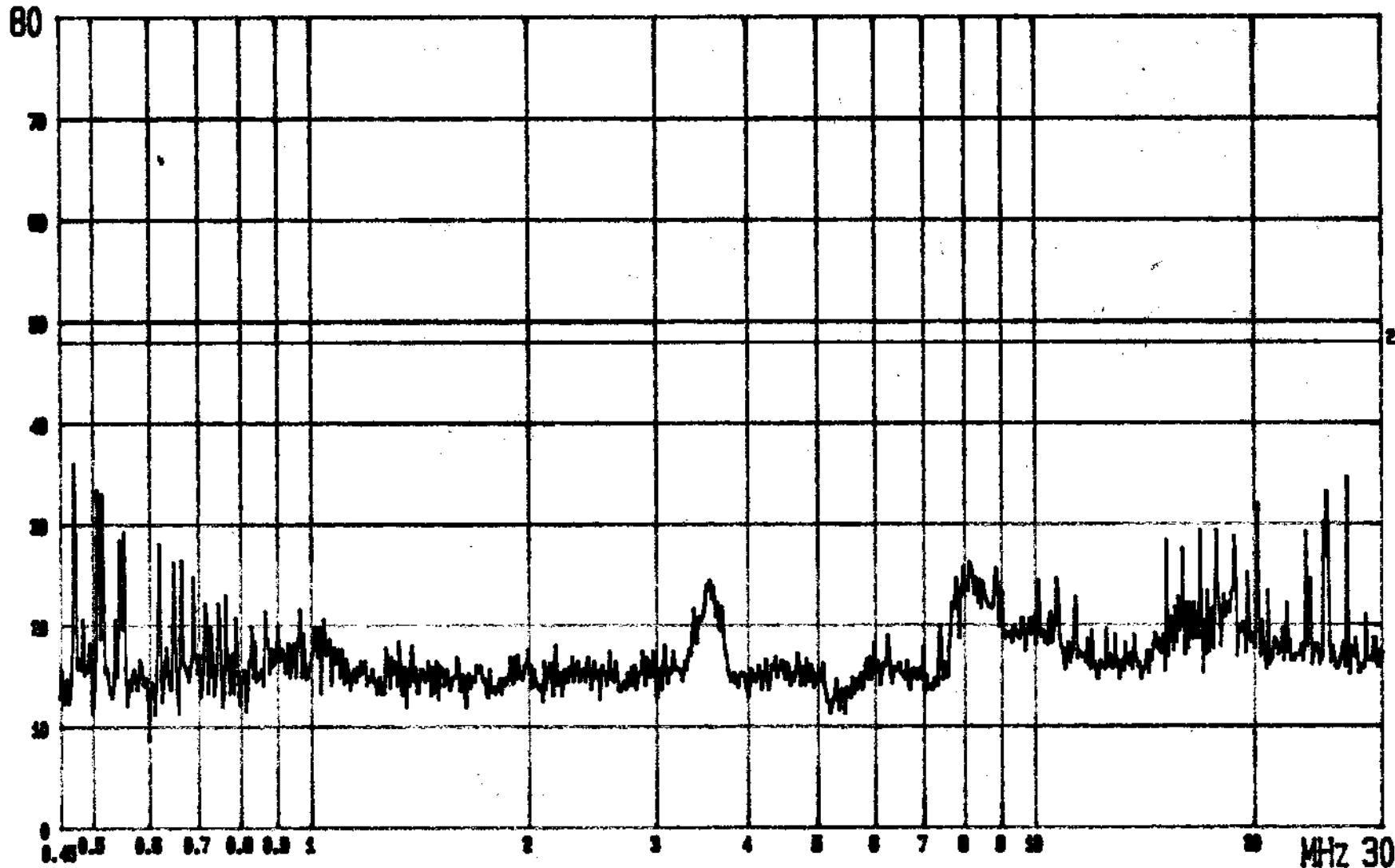
FCC CONDUCTED TEST
MODEL: 15-1214 MODE: CH 3

EUT: RF MODULATOR
POWER: 120V/60Hz

2: GP
LISN: Va

CLASS B LIMIT
ETC EMI LAB.

dBuV



FCC
MODEL: 15-1214

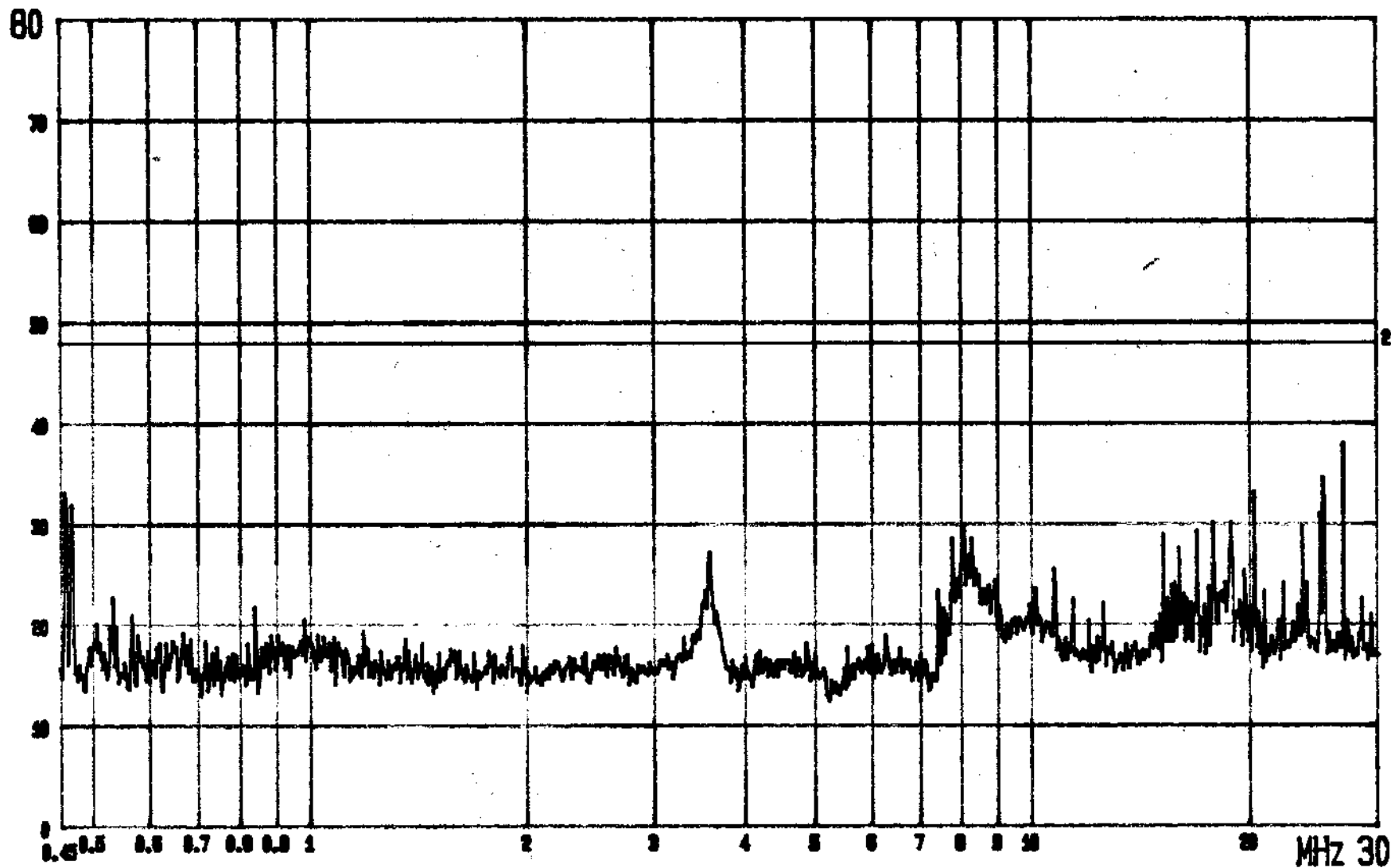
CONDUCTED TEST
MODE: CH 3

EUT: RF MODULATOR
POWER: 120V/60Hz

2: QP
LISN: Vb

CLASS B LIMIT
ETC EMI LAB.

dBuV



—

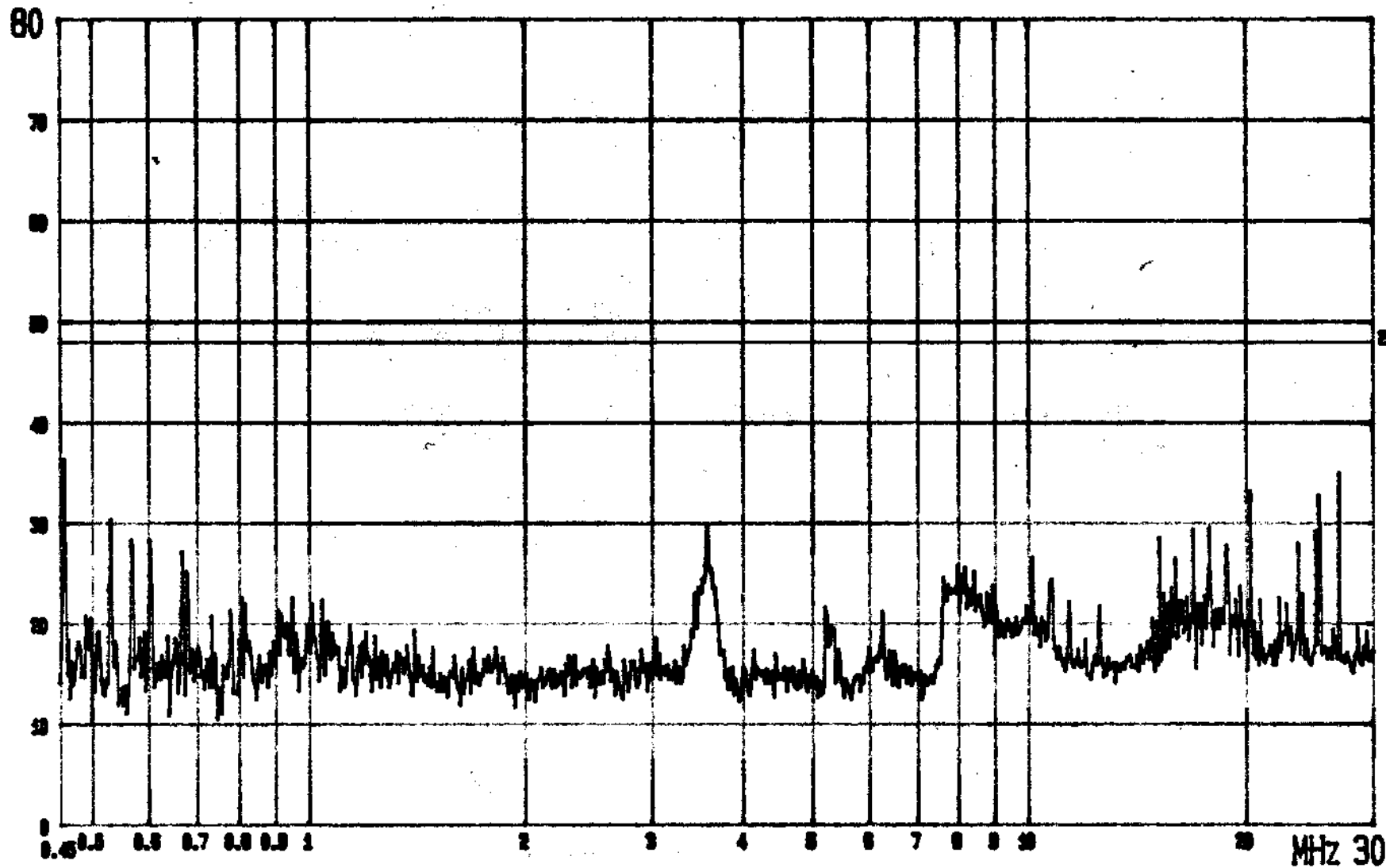
FCC CONDUCTED TEST
MODEL: 15-1214 MODE: CH 4

EUT: RF MODULATOR
POWER: 120V/60Hz

2: QP
LISN: Va

CLASS B LIMIT
ETC EMI LAB.

dBuV



FCC CONDUCTED TEST
MODEL: 15-1214 MODE: CH 4

EUT: RF MODULATOR
POWER: 120V/60Hz

2: GP
LISN: Vb

CLASS B LIMIT
ETC EMI LAB.