2.983(e)(5) Measurement of Radiated Spurious Emissions per 2.993

Definition:

Emissions from the equipment when connected into a non-radiating load on a frequency or frequencies which are outside an occupied band sufficient to ensure transmission of information of required quality for the class of communication desired. The reduction in the level of these spurious emissions will not affect the quality of the information being transmitted.

Test Method: Per EIA RS 152-B.

Connect the equipment and follow the procedure described in paragraph 2.2.1.1 and paragraph 5.0. Measure the amplitude of each spurious radiated signal through the 10th harmonic. The level in dBuV/m is calculated on the following page. The spurious signals are then measured on the 3 meter range.

$$\text{Spurious attenuation dB} = 10 \log \frac{\text{Po Watts}}{\text{Calc. Spurious power}}$$

Test Results: See TABLE I on following Page.

All radiated spurious emissions are below the FCC Specifications.

SPURIOUS RADIATED SIGNAL MEASUREMENTS

(Ref: Part 2, Subpart J, 2.991 & 2.993)

Date __7-23-99__   Pass __✓__   Fail _____ (at Freq. _____)

EUT __RF POWER AMPLIFIER__   Operating Power __45 WATTS__

Part No. __PA6-1ABL-M__   Operating Mode __SATURATED__

Serial No. __0001__.   Test Engineer __CHI CAI__

FREQUENCY TUNED TO __420__ MHz

ANT POL	FREQ MHz	SPECTRUM ANALYZER (dBµV)	ANT. FACTOR (dB)	CABLE LOSS (dB)	AMP GAIN (dB)	dBµV/m	FUND FIELD STRENGTH dBµV/m	SPUR BELOW CARRIER (dBc)
H	840	52.4	22.5	2.0	22	54.9	143.9	89
H	1260	48.6	27.0	5.0	22	58.6	↑	85.3
H	1680	22.4	30.0	6.0	22	46.4		97.5
H	2100	46.9	29.0	6.5	42	40.4		103.5
H	2520	55.1	30.0	7.5	42	50.6		93.3
H	2940	40.7	31.0	8.0	42	37.7		106.2
H	3360	48.9	32	9.0	42	47.9		96.0
H	3780	46.2	2.3	10.0	42	47.2	↓	96.7
H	4200	39.1	33.5	10.5	42	41.1	143.9	102.8

Fundamental Field Strength (V/m) = $\frac{1}{3}(R_o \times P_o)^{1/2}$ = $\frac{1}{3}(50 \times 45)^{1/2}$

R_o = Amplifier Output Impedance (Ohms) = 50 Ω   = 15.8 V/m

P_o = Amplifier Output Power (Watts) = 45 W   = 143.9 dBµV/m

Conversion from µV/m to dBµV/m = $(µV/m)^{\log} \times 20$

FCC LIMIT = 43 + 10 log (45) = 60 dBC

SPURIOUS RADIATED SIGNAL MEASUREMENTS

(Ref: Part 2, Subpart J, 2.991 & 2.993)

Date __7-23-99__   Pass __✓__   Fail ____ (at Freq. ____)

EUT __RF POWER AMPLIFIER__   Operating Power __45 WATTS__

Part No. __PA6-1ABL-M__   Operating Mode __SATURATED__

Serial No. __0001__   Test Engineer __CHI CAI__

FREQUENCY TUNED TO __420__ MHz

ANT POL	FREQ MHz	SPECTRUM ANALYZER (dBµV)	ANT. FACTOR (dB)	CABLE LOSS (dB)	AMP GAIN (dB)	dBµV/m	FUND FIELD STRENGTH dBµV/m	SPUR BELOW CARR-IER (dBc)
V	840	54.6	22.5	2.0	22	57.1	143.9	86.8
V	1260	48.3	27.0	5.0	22	58.3	↑	85.6
V	1680	37.5	30.0	6.0	22	51.5		92.4
V	2100	53.1	29.0	6.5	42	46.6		97.3
V	2520	59.6	30.0	7.5	42	55.1		88.8
V	2940	40.7	31.0	8.0	42	37.7		106.2
V	3360	51.8	32.0	9.0	42	50.8		93.1
V	3780	45.6	33.0	10.0	42	46.6	↓	97.3
V	4200	32.9	33.5	10.5	42	24.9	143.9	109.6

Fundamental Field Strength (V/m) = 1/3 (Ro x Po)^{½} $= \frac{1}{3} (50 \times 45)^{½}$

Ro = Amplifier Output Impedance (Ohms) $= 50\,\Omega$ $= 15.8\ V/m$

Po = Amplifier Output Power (Watts) $= 45W$ $= 143.9\ dB\mu V/m$

Conversion from µV/m to dBµV/m = (µV/m)^{log} x 20

FCC LIMIT = $43 + 10\log(45) = 60\ dBC$

2.983(e)(6) Measurement of Frequency Stability per 2.995

The EUT is a power amplifier and contains no circuitry for generating or stabilizing the RF signal. The driver will be responsible for this task.

2.983(e)(7) Frequency Spectrum to be investigated per 2.997

The Frequency was searched from the lowest radio frequency generated in the equipment through the 10th harmonic of the carrier frequency.

2.983(e)   Test Data

Refer to 2.983(e) (1) through 2.983(e) (7).

2.983(e)(1) Measurement of RF Power Output per 2.985

Definition: For RF Power Amplifiers.

Test Method: See FIGURE 2.

Output Power Is measured across a precision 50 ohm load with a wide band sampling RF Voltmeter.

Test Results:

POWER OUTPUT

FREQUENCY	NOMINAL VOLTAGE 13.8 VDC	85% VOLTAGE 11.73 VDC	115% VOLTAGE 15.87 VDC
420 MHz	45 Watts	37 Watts	50 Watts

2.983(e)(2) Measurement of Modulation Characteristics per 2.987(b) (1)

This EUT is a Power Amplifier and contains no circuitry to modify the RF signal provided by the driver except to raise the power level.

2.983(e)(3) Measurement of Occupied Bandwidth per 2.989

<u>Definition:</u>
Occupied Bandwidth, that is the frequency bandwidth such that, below its upper frequency limits, the mean power radiated by a given emission.

<u>Test Method:</u> Connect the Equipment per FIGURE 3.
Measurements were made with the modulating signal at 2.5 kHz with 5 kHz of FM deviation.

<u>Test Results:</u> See Plots following FIGURE 3.

The center frequency of the signal did not shift with modulation. The Spectrum Bandwidth was well within the limits specified in the FCC Regulations.

2.983(h)   Description and Test Data for Encoding Device(s)

This section does not apply to the EUT.

2.983(i)   Type Acceptance Data for an External Power Amplifier used in Amateur Radio Service – Part 97

This section does not apply to the EUT.

APPENDIX A
TEST EQUIPMENT

TEST EQUIPMENT LOG

TYPE OF TEST : FCC TYPE ACCEPTANCE

DATE _08-03-99_   TEST PROCEDURE _PART 2, 22, &90_

EUT _RF AMP_   OTHER _____
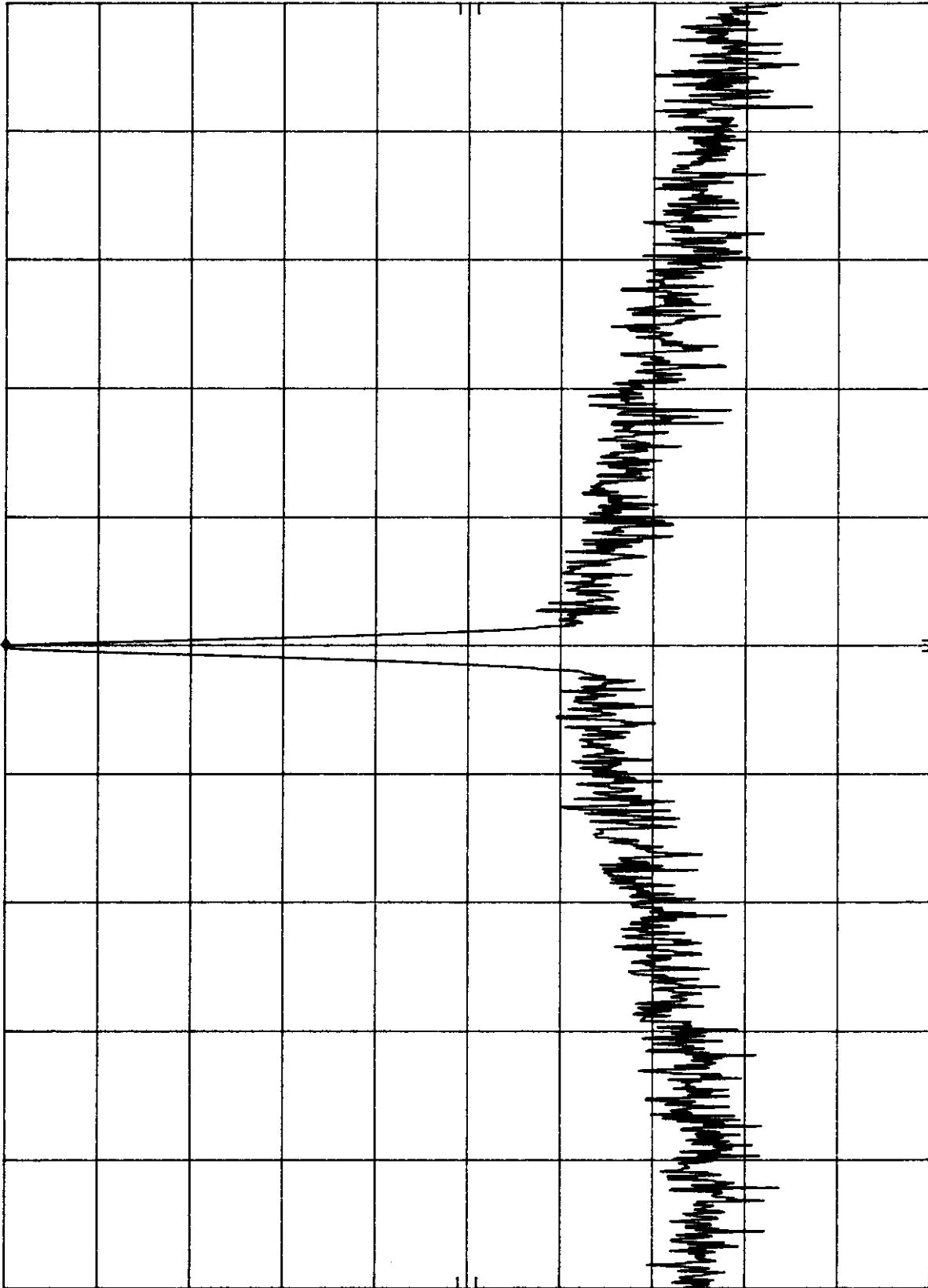
MODEL # / SERIAL # _PA6-1ABL-M_

TEST ENGINEER _CHI CAI_

DESCRIPTION	MANUFACTURER	MODEL # / SERIAL #	CAL. DUE DATE
SIGNAL GEN.	MARCONI	2024 / 112236-002	3-17-2000
SPEC. ANALYZER	HP	8566B/2403A06307&2407A03212	2-10-2000
PLOTTER	HP	7070A	N/R
DUAL DIR. COUPLER	HP	778D	CAL @ TIME OF TEST
50 OHM LOAD	ELECTRO IMPULSE LAB.	DA-242A/4/7940097	CAL @ TIME OF TEST
50 OHM LOAD	TERMALINE	8053 / 8945	CAL @ TIME OF TEST
50 OHM LOAD	INMET	IN020M-100W	CAL @ TIME OF TEST
40 Db ATT.	INMET	18N50W-40Db	CAL @ TIME OF TEST
POWER SUPPLY	ACOPIAN	28PT10AFHP / 6	N/R
MULTI-VOLTMETER	GOLDSTAR	DM-333 / S61004151	4-1-2000
LOG PERIODIC ANT.	A.H. SYSTEMS.	SAA-200-512 / 347	10-10-1999
DRG ANT.	EMCO	3115 / 2280	1-8-2000
WIDEBAND AMP.	IFI	5500	N/R
PREAMP.	MINI-CIRCUITS	ZFL-2000 / 001	5-7-2000
PREAMP.	AVANTEK	SWL88-6176 / 1847	5-7-2000

FCC/TA

PA6-1ABL-M UNMODULATED CARRIER

MKR 420.000 1 MHz
46.50 dBm

hp

REF 46.5 dBm   ATTEN 10 dB

10 dB/

POS PK

OFFSET
60.0
dB

CENTER 420.000 MHz   SPAN 100 kHz
RES BW 300 Hz   VBW 1 kHz   SWP 3.00 sec
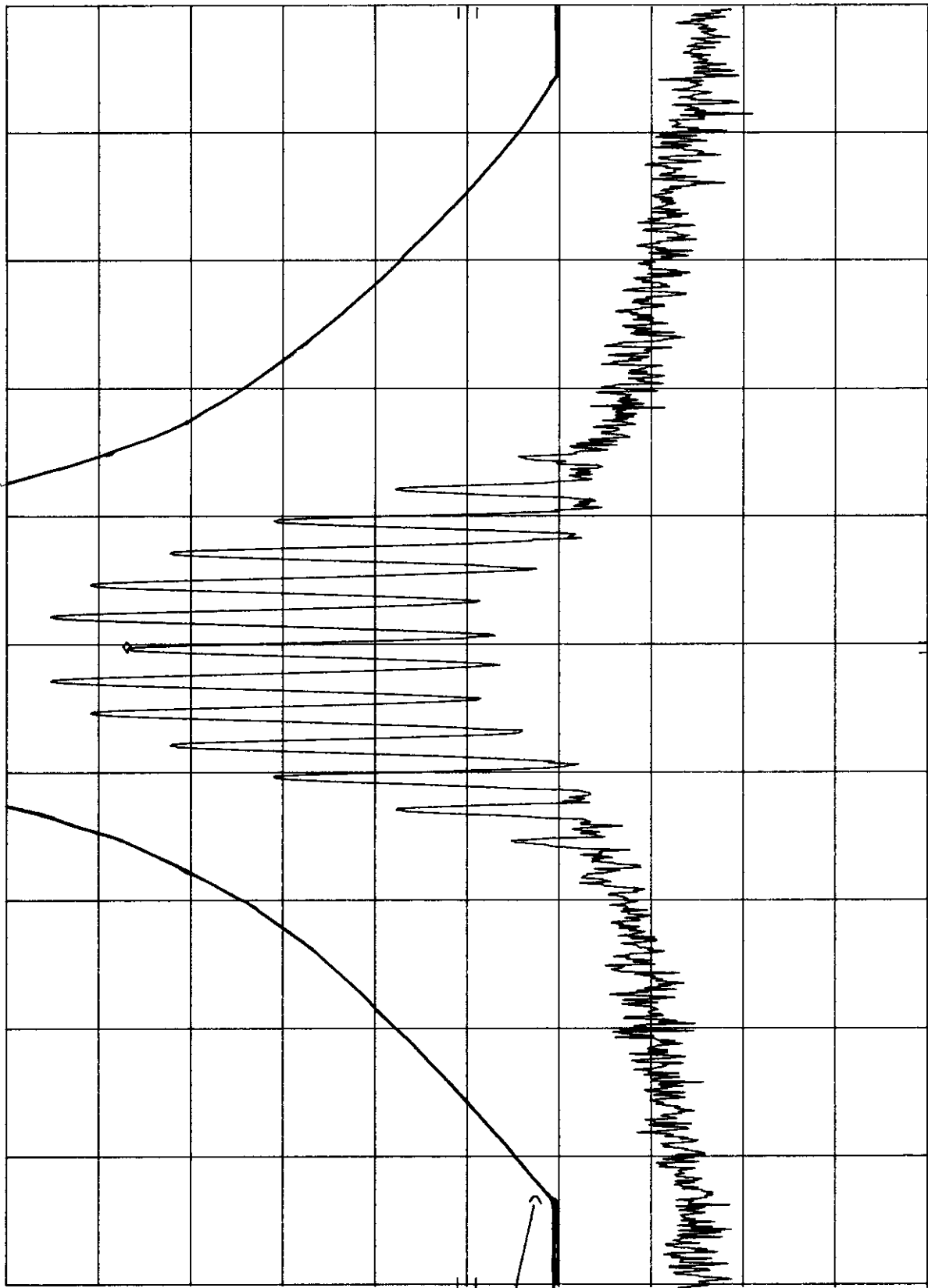
SHEET 12

PA6-1ABL-M OCCUPIED BANDWIDTH PART 22   MKR 420.000 1 MHz
REF 46.5 dBm   ATTEN 10 dB   33.50 dBm

hp
10 dB/

POS PK

OFFSET
60.0
dB

Fcc LimiT
59.5 dBC

SHEET 13

CENTER 420.000 MHz   SPAN 100 kHz
RES BW 300 Hz   VBW 1 kHz   SWP 3.00 sec

PA6-1ABL-M OCCUPIED BANDWIDTH PART 90
REF 46.5 dBm ATTEN 10 dB
MKR 420.000 1 MHz
33.50 dBm

10 dB/

POS PK
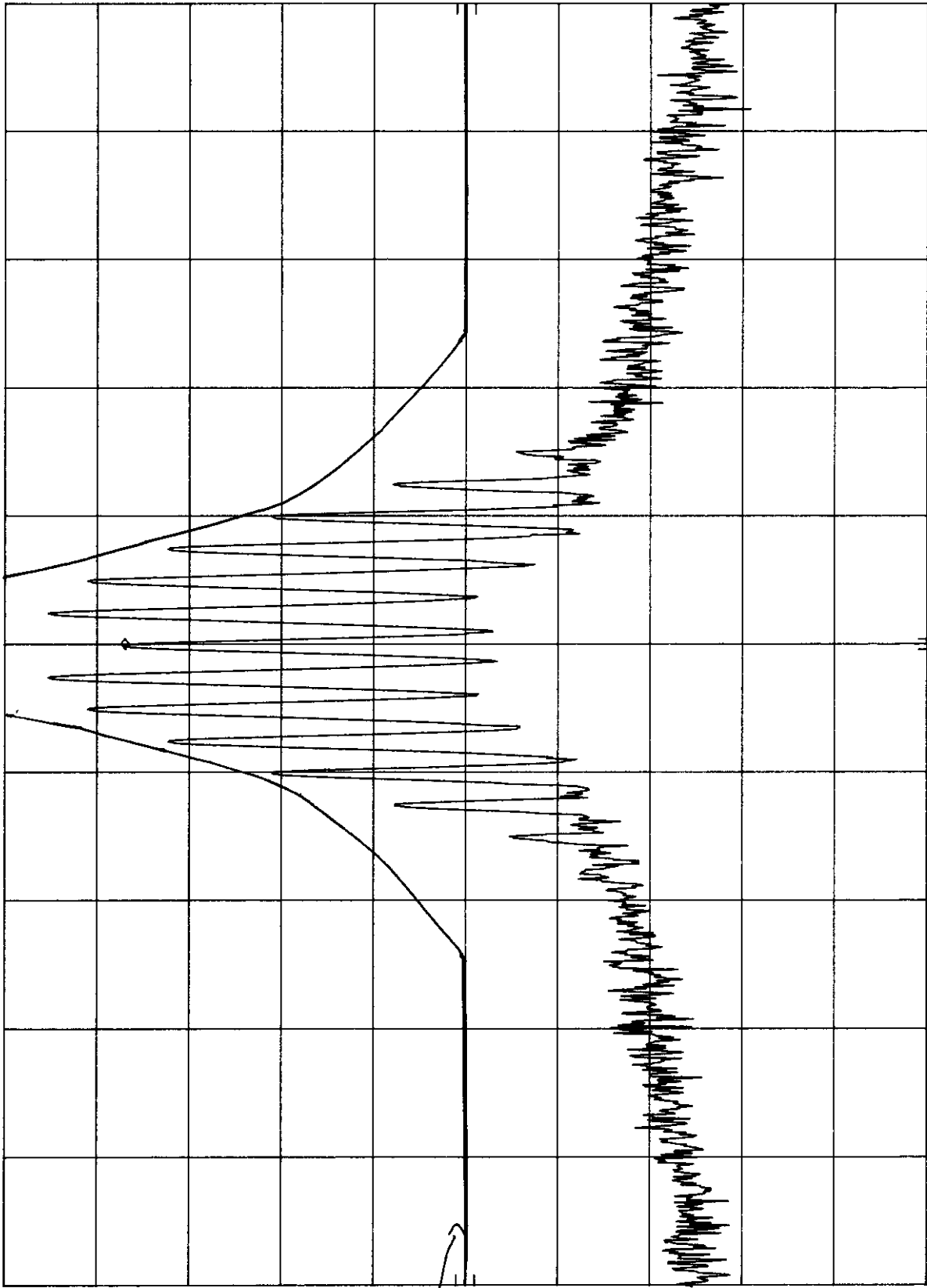
OFFSET
60.0
dB

FCC LIMIT
0 dBC

SHEET 14

CENTER 420.000 MHz
RES BW 300 Hz
VBW 1 kHz
SPAN 100 kHz
SWP 3.00 sec

2.983(e)(4)   Measurement of Antenna Conducted Spurious Emissions per 2.991

Definition:

Conducted Spurious Emissions are emissions at the antenna terminals on a frequency or frequencies which are outside an occupied band sufficient to ensure transmission of information of required quality for the class of communication desired. The reduction in the level of these spurious emissions will not affect the quality of the information being transmitted.

Conducted Spurious Emissions shall be attenuated below the maximum level of the carrier frequency in accordance with the following formula:

Spurious attenuation in dB = $43 + 10 \log_{10} Po$

Where Po = Output in Watts

$= 43 + 10 \log_{10} (45)$

$= 60$ dB

Test Method: Per EIA RS 152-B, Paragraph 4.

Connect the equipment as shown in FIGURE 4.

Adjust the Audio Oscillator so that the frequency deviation of the transmitter is a 5 kHz at a modulation frequency of 2.5 kHz. Adjust the Spectrum Analyzer to display the Modulated Carrier.

Scan the frequency spectrum from the lowest radio frequency generated in the equipment through the 10th harmonic of the carrier frequency.

Test Results: See Plots following FIGURE 4.

All spurious antenna conducted emissions are below the FCC Specifications.

PA6-1ABL-M ANT. CONDUCTED SPURRIOUS

MKR △ 420 MHz
-68.00 dB

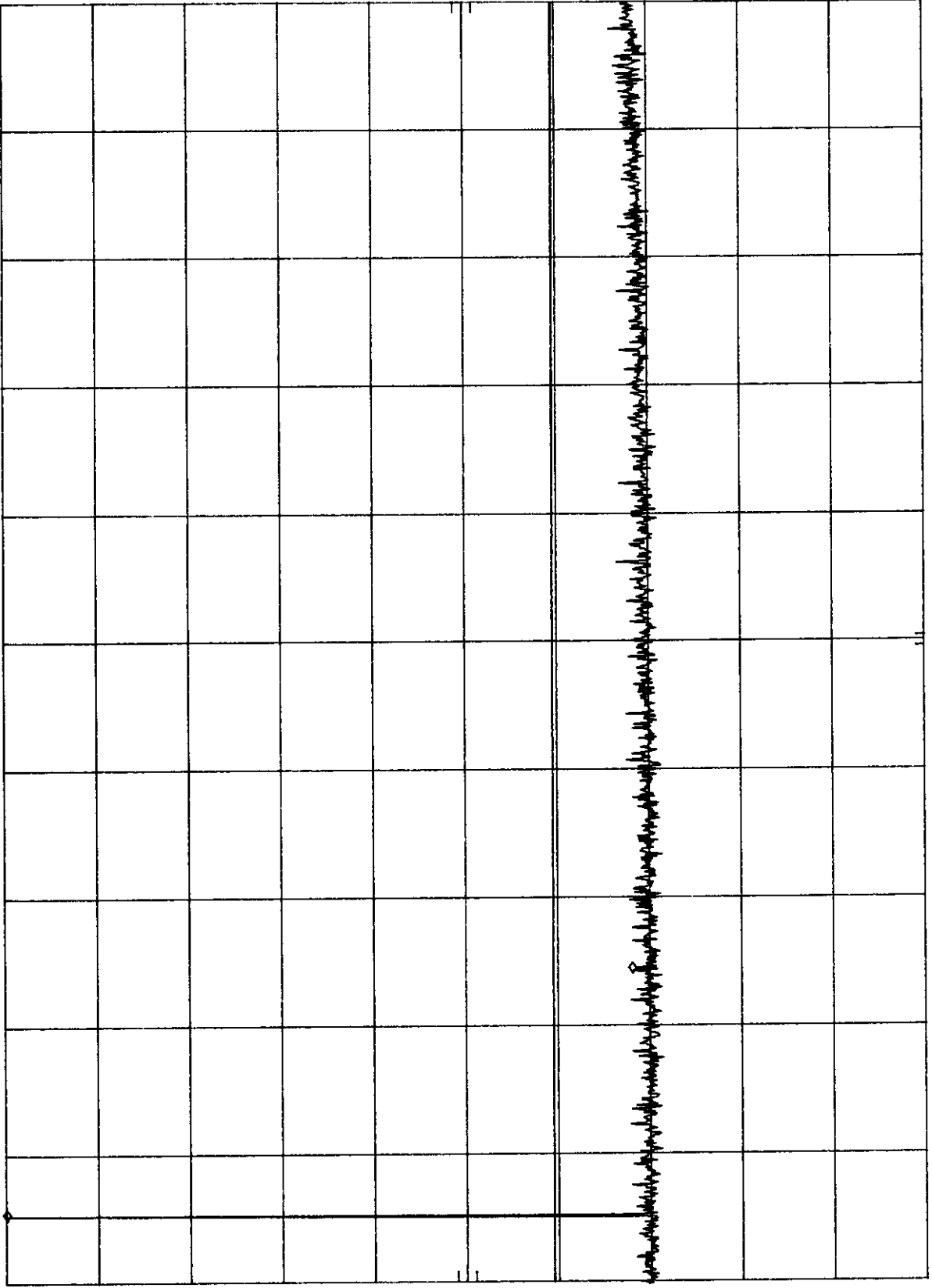REF 46.5 dBm   ATTEN 10 dB

10 dB/

POS PK

OFFSET
60.0
dB

DL
-13.0
dBm

FCC LIMIT

SHEET 17

595 dBc

START 300 MHz   STOP 2.50 GHz
                       SWP 6.60 sec
RES BW 30 kHz   VBW 100 kHz

PA6-1ABL-M ANT. CONDUCTED SPURRIOUS
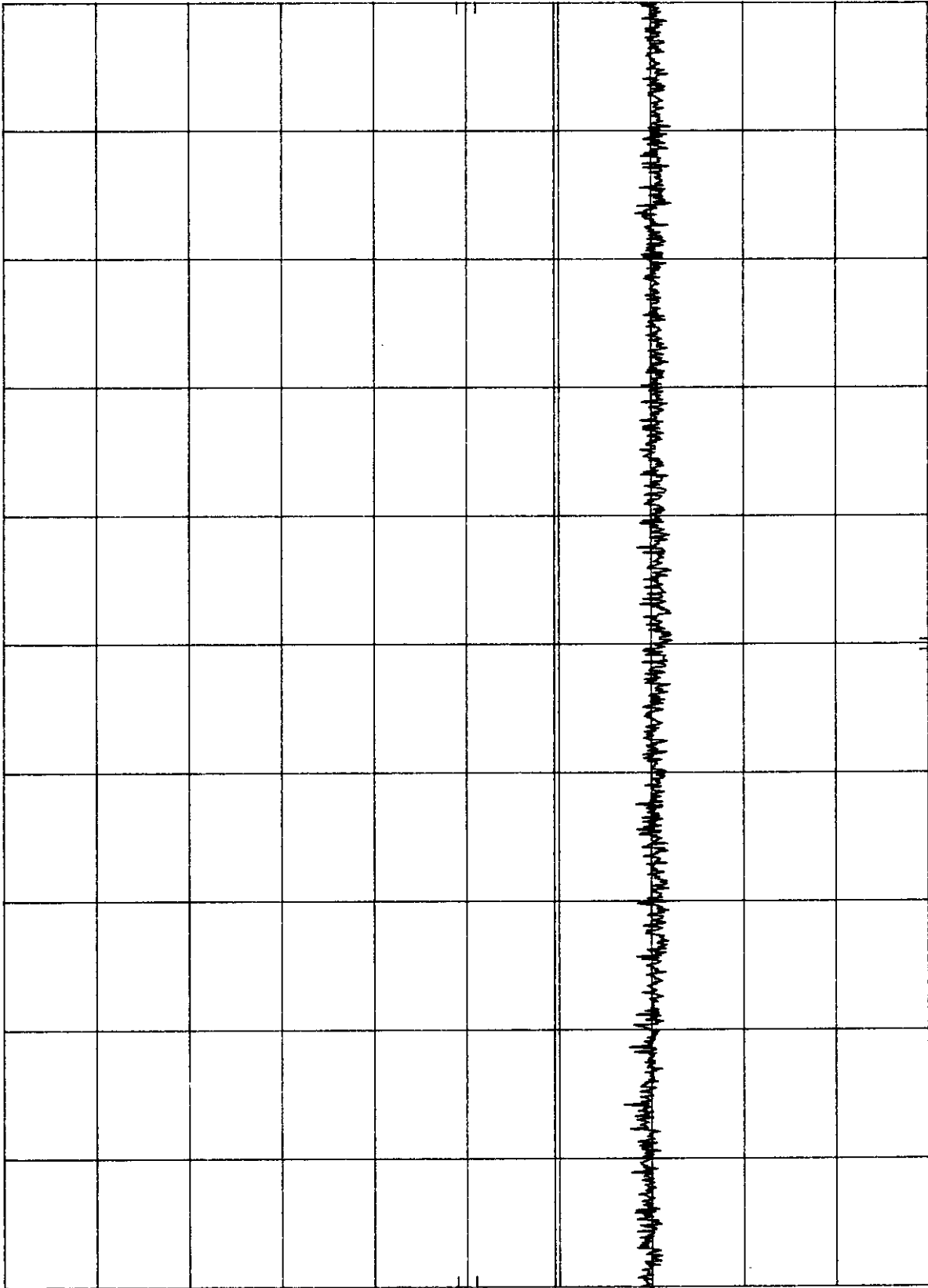REF 46.5 dBm   ATTEN 10 dB

hp

10 dB/

POS PK

OFFSET
60.0
dB

DL
-13.0
dBm

FCC LIMIT
59.5 dBc

SHEET 18

START 2.50 GHz   VBW 100 kHz   STOP 5.00 GHz
RES BW 30 kHz   SWP 7.50 sec