MFA M. Flom Associates, Inc. - Global Compliance Center
3356 North San Marcos Place, Suite 107, Chandler, Arizona 85224-1571
www.goodnet.com/~mflom, (602) 926-3100, FAX: 926-3598

Sub-part
2.983 (f):

EQUIPMENT IDENTIFICATION

FCC ID: K66VX-510L-2

NAMEPLATE DRAWING

ATTACHED, EXHIBIT 1.

LOCATION

AS PER LABEL DRAWING(S)

DATE OF REPORT

April 13, 1998

MORTON FLOM, P. Eng.

SUPERVISED BY:
MF:glk

THE APPLICANT HAS BEEN CAUTIONED AS TO THE FOLLOWING:

15.21 INFORMATION TO USER.

The users manual or instruction manual for an intentional 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.

15.27(a) SPECIAL ACCESSORIES.

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

TABLE OF CONTENTS

K66VX-510L-2

LIST OF GENERAL INFORMATION REQUIRED FOR TYPE ACCEPTANCE

IN ACCORDANCE WITH FCC RULES AND REGULATIONS,
VOLUME II, PART 2 AND TO

90

Sub-part
2.983(a): NAME AND ADDRESS OF APPLICANT:

Yaesu Musen Co., Ltd.
20-2, Shimomaruko 1-chome, Ota-ku
Tokyo Japan 146

VENDOR:

Yaesu U.S.A.
17210 Edwards Rd.
Cerritos, CA 90703

2.983(b): FCC ID: K66VX-510L-2

MODEL NO: Vertex VX-510L, Type B

2.983(c): QUANTITY PRODUCTION PLANNED.

2.983(d): TECHNICAL DESCRIPTION: SEE ATTACHED EXHIBITS

(1): TYPE OF EMISSION: 16KOF3E

(2): FREQUENCY RANGE, MHz: 38 to 50

(3): POWER RATING, Watts: 1, 5
SWITCHABLE _x_ ADJUSTABLE ___ N/A ___

(4): MAXIMUM POWER RATING, Watts: 300

2.983(d)
(5): VOLTAGES & CURRENTS IN ALL ELEMENTS IN FINAL R. F. STAGE, INCLUDING FINAL TRANSISTOR OR SOLID STATE DEVICE:

COLLECTOR CURRENT, A = per manual
COLLECTOR VOLTAGE, Vdc = per manual
SUPPLY VOLTAGE, Vdc = 7.2

(6): FUNCTION OF ACTIVE CIRCUIT DEVICES:

PLEASE SEE ATTACHED EXHIBITS

(7): CIRCUIT DIAGRAM:

PLEASE SEE ATTACHED EXHIBITS

(8): MANUAL:

PLEASE SEE ATTACHED EXHIBITS

(9): TUNE-UP PROCEDURE:

PLEASE SEE ATTACHED EXHIBITS

(10): DESCRIPTION OF CIRCUITRY & DEVICES PROVIDED FOR DETERMINING AND STABILIZING FREQUENCY:

PLEASE SEE ATTACHED EXHIBITS

(11): DESCRIPTION OF CIRCUITS OR DEVICES EMPLOYED FOR
(a) SUPPRESSION OF SPURIOUS RADIATION,
(b) LIMITING MODULATION,
(c) LIMITING POWER:

PLEASE SEE ATTACHED EXHIBITS

(12): DIGITAL MODULATION DESCRIPTION:

ATTACHED EXHIBITS ____
N/A __x__

2.983(e): TEST AND MEASUREMENT DATA:

FOLLOWS

2.983(f): LABEL INFORMATION:

PLEASE SEE ATTACHED EXHIBITS

2.983(g): PHOTOGRAPHS:

PLEASE SEE ATTACHED EXHIBITS

Sub-part
2.983(e): TEST AND MEASUREMENT DATA

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II; Part 2, Sub-part J, Sections 2.981, 2.983, 2.985, 2.987, 2.989, 2.991, 2.993, 2.995, 2.997, 2.999 and the following individual Parts:

___ 21 - Domestic Public Fixed Radio Services
___ 22 - Public Mobile Services
___ 22 Subpart H - Cellular Radiotelephone Service
___ 22.901(d) - Alternative technologies and auxiliary services
___ 23 - International Fixed Public Radiocommunication services
___ 24 - Personal Communications Services
___ 74 Subpart H - Low Power Auxiliary Stations
___ 80 - Stations in the Maritime Services
___ 80 Subpart E - General Technical Standards
___ 80 Subpart F - Equipment Authorization for Compulsory Ships
___ 80 Subpart K - Private Coast Stations and Marine Utility Stations
___ 80 Subpart S - Compulsory Radiotelephone Installations for Small Passenger Boats
___ 80 Subpart T - Radiotelephone Installation Required for Vessels on the Great Lakes
___ 80 Subpart U - Radiotelephone Installations Required by the Bridge-to-Bridge Act
___ 80 Subpart V - Emergency Position Indicating Radiobeacons (EPIRB'S)
___ 80 Subpart W - Global Maritime Distress and Safety System (GMDSS)
___ 80 Subpart X - Voluntary Radio Installations
___ 87 - Aviation Services
_x_ 90 - Private Land Mobile Radio Services
___ 94 - Private Operational-Fixed Microwave Service
___ 95 Subpart A - General Mobile Radio Service (GMRS)
___ 95 Subpart C - Radio Control (R/C) Radio Service
___ 95 Subpart D - Citizens Band (CB) Radio Service
___ 95 Subpart E - Family Radio Service
___ 95 Subpart F - Interactive Video and Data Service (IVDS)
___ 101 - Fixed Microwave Services

STANDARD TEST CONDITIONS
and
ENGINEERING PRACTICES

Except as noted herein, the following conditions and procedures were observed during the testing:

ROOM TEMPERATURE	= 25±5°C
ROOM HUMIDITY	= 20-50%
D.C. SUPPLY VOLTAGE, Vdc	= 7.2
A.C. SUPPLY VOLTAGE, Vac	= N/A
A.C. SUPPLY FREQUENCY, Hz	= N/A

Prior to testing, the EUT was tuned up in accordance with the manufacturer's alignment procedures. All external gain controls were maintained at the position of maximum and/or optimum gain throughout the testing.

Measurement results, unless otherwise noted, are worst case measurements.

NAME OF TEST:	Carrier Output Power (Conducted)
SPECIFICATION:	FCC: 47 CFR 2.985(a) IC: RSS-119, Section 6.2
GUIDE:	TIA/EIA-603, Paragraph 2.2.1
TEST CONDITIONS:	Standard Temperature and Humidity (S. T. & H.)
TEST EQUIPMENT:	As per attached page

MEASUREMENT PROCEDURE

1. The EUT was connected to a resistive coaxial attenuator of normal load impedance, and the unmodulated output power was measured by means of an R. F. Power Meter.

2. Measurement accuracy is ±3%.

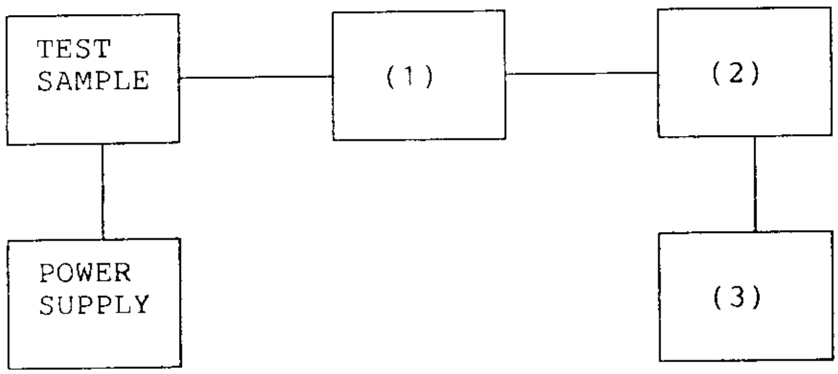
MEASUREMENT RESULTS

NOMINAL, MHz	R.F. POWER OUTPUT, WATTS
44.025	1 5
38.025	1 5
49.975	1 5

SUPERVISED BY: MORTON FLOM, P. Eng.

TRANSMITTER POWER CONDUCTED MEASUREMENTS

TEST 1: R. F. POWER OUTPUT
TEST 2: FREQUENCY STABILITY



(1) COAXIAL ATTENUATOR

NARDA 766-10	
SIERRA 661A-30	x
BIRD 8329 (30 dB)	

(2) POWER METERS

HP 435A	
HP 436A	x
HP 8901A POWER MODE	x

(3) FREQUENCY COUNTER

HP 5383A	
HP 5334B	x
HP 8901A FREQUENCY MODE	x

PAGE NO.	8.
NAME OF TEST:	Unwanted Emissions (Transmitter Conducted)
SPECIFICATION:	FCC: 47 CFR 2.991 IC: RSS-119, Section 6.3
GUIDE:	TIA/EIA-603, Paragraph 2.2.13
TEST CONDITIONS:	S. T. & H.
TEST EQUIPMENT:	As per attached page

MEASUREMENT PROCEDURE

1. The emissions were measured for the worst case as follows:

   (a): within a band of frequencies defined by the carrier frequency plus and minus one channel.

   (b): from the lowest frequency generated in the EUT and to at least the 10th harmonic of the carrier frequency, or 40 GHz, whichever is lower.

2. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

3. MEASUREMENT RESULTS: ATTACHED FOR WORST CASE

FREQUENCY OF CARRIER, MHz	= 44.025, 38.025, 49.975
SPECTRUM SEARCHED, GHz	= 0 to 10 x F_C
MAXIMUM RESPONSE, Hz	= 2820
ALL OTHER EMISSIONS	= ≥ 20 dB BELOW LIMIT
LIMIT, dBc: $-(43 + 10 \text{ LOG } P_0)$	= -43 (1 Watt) -50 (5 Watts)

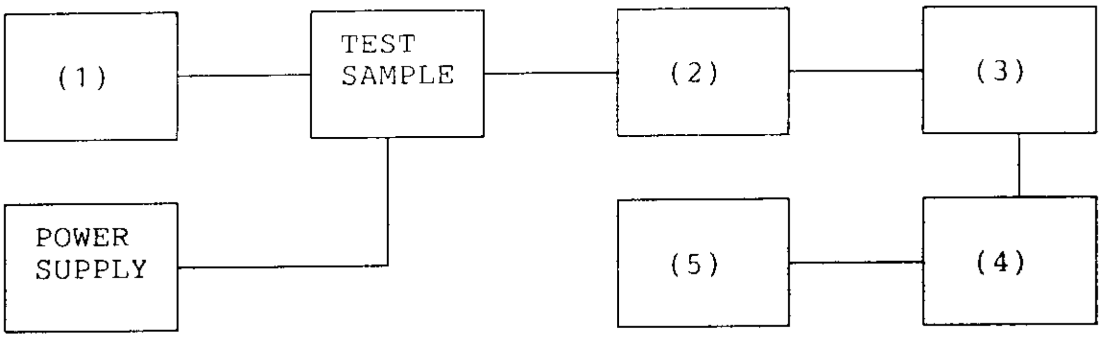
SUPERVISED BY:

M.Flom P.Eng

MORTON FLOM, P. Eng.

TRANSMITTER SPURIOUS EMISSION

TEST A. OCCUPIED BANDWIDTH (IN-BAND SPURIOUS)
TEST B. OUT-OF-BAND SPURIOUS



(1) AUDIO OSCILLATOR/GENERATOR

HP 204D	
HP 8903A	
HP 3312A	x
	x

(2) COAXIAL ATTENUATOR

NARDA 766-10	
SIERRA 661A-30	x
BIRD 8329 (30 dB)	x

(3) FILTERS; NOTCH, HP, LP, BP

CIRQTEL FHT	
EAGLE TNF-1	x
PHELPS DODGE PD-495-8	

(4) SPECTRUM ANALYZER

HP 8566B	x
HP 8563E	

(5) SCOPE

HP 1741A	
HP 181T	
TEK 935	
HP 54502A	

G830002
TRANSMITTER SPURIOUS EMISSIONS (CONDUCTED)
POWER: LOW

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	LEVEL, dBm	LEVEL, dBc	LEVEL, µW
44.025	88.051	-38.3	-68.3	0
44.025	132.260	-28.8	-58.8	1
44.025	176.090	-41.3	-71.3	0
44.025	220.125	-36.6	-66.6	0
44.025	264.155	-34.8	-64.8	0
44.025	308.185	-29.7	-59.7	1
44.025	352.187	-30.7	-60.7	1
44.025	396.255	-32.1	-62.1	1
44.025	440.293	-42.0	-72.0	0
44.025	484.236	-36.1	-66.1	0
44.025	528.311	-40.5	-70.5	0
44.025	572.345	-44.2	-74.2	0
44.025	616.572	-45.1	-75.1	0
44.025	660.411	-43.2	-73.2	0

G830001

TRANSMITTER SPURIOUS EMISSIONS (CONDUCTED)

POWER: HIGH

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	LEVEL, dBm	LEVEL, dBc	LEVEL, µW
44.025	88.055	-21.3	-58.2	7
44.025	132.082	-31.1	-68.0	1
44.025	176.097	-36.1	-73.0	0
44.025	220.116	-26.1	-63.0	2
44.025	264.143	-28.2	-65.1	2
44.025	308.157	-23.7	-60.6	4
44.025	352.212	-22.9	-59.8	5
44.025	396.191	-23.1	-60.0	5
44.025	440.245	-33.9	-70.8	0
44.025	484.310	-26.7	-63.6	2
44.025	528.337	-34.4	-71.3	0
44.025	572.363	-42.5	-79.4	0
44.025	616.327	-37.4	-74.3	0
44.025	660.378	-37.5	-74.4	0

NAME OF TEST: Field Strength of Spurious Radiation

SPECIFICATION: FCC: 47 CFR 2.993(a)
IC: N/A

GUIDE: TIA/EIA-603, Section 2.2.12

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: AS PER ATTACHED PAGE

MEASUREMENT PROCEDURE

1. A description of the measurement facilities was filed with the FCC and was found to be in compliance with the requirements of Section 15.38, by letter from the FCC dated March 3, 1997, FILE 31040/SIT. All pertinent changes will be reported to the Commission by up-date prior to March 2000.

2. At first, in order to locate all spurious frequencies and approximate amplitudes, and to determine proper equipment functioning, the test sample was set up at a distance of three meters from the test instrument. Valid spurious signals were determined by switching the power on and off.

3. In the field, the test sample was placed on a wooden turntable above ground at three (or thirty) meters away from the search antenna. The test sample was connected to an R.F. Wattmeter and a 50 ohm dummy load, and adjusted to its rated output.

   In order to obtain the maximum response at each spurious frequency, the turntable was rotated. Also, the Search Antennas were raised and lowered vertically, and all cables were oriented. Excess power lead was coiled near the power supply.

4. A signal generator, connected with a non-radiating cable to a vertically polarized half-wave antenna (for each frequency involved) was substituted for the transmitter. The Search Antenna was raised and lowered to obtain maximum indicated.

5. The signal generator output was adjusted until a signal level indication equal to that from the transmitter was obtained.

6. Steps 4 and 5 were repeated, using a horizontally polarized half-wave antenna. The higher of the two observations was noted.

NAME OF TEST: Field Strength of Spurious Radiation

SPECIFICATION: FCC: 47 CFR 2.993(a)
IC: N/A

MEASUREMENT PROCEDURE (CONT.)

7. Power into the half-wave antenna was calculated from the characteristic impedance of the line, and the voltage output from the signal generator.

8. The level of each spurious radiation with reference to the transmitter power in dB, was calculated from:

$$\text{SPURIOUS LEVEL, dB} = 10 \text{ LOG } \frac{\text{(Calculated Spurious Power) [from para. 7].}}{\text{Tx Power (Wattmeter)}}$$

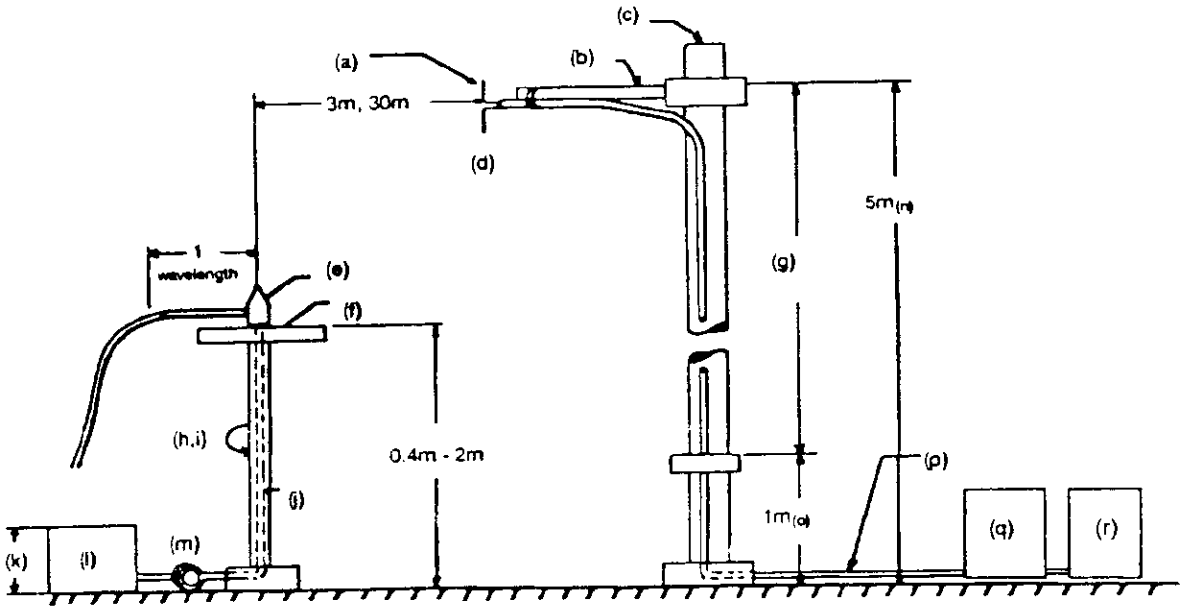
9. The worst case for all channels is shown.

10. Measurement summary:

FREQUENCY OF CARRIER, MHz	= 44.025, 38.025, 49.975
SPECTRUM SEARCHED, GHz	= 0 to 10 x F_C
ALL OTHER EMISSIONS	= ≥ 20 dB BELOW LIMIT
LIMIT, dBc	= -50 (5 Watts) -43 (1 Watt)

11. Measurement results: ATTACHED FOR WORST CASE

RADIATED TEST SETUP



NOTES:

(a) Search Antenna - Rotatable on boom.
(b) Non-metallic boom.
(c) Non-metallic mast.
(d) Adjustable horizontally.
(e) Equipment Under Test.
(f) Turntable.
(g) Boom adjustable in height.
(h) External control cables routed horizontally at least one wavelength.
(i) Rotatable.
(j) Cables routed through hollow turntable center.
(k) 30 cm or less.
(l) External power source.
(m) 10 cm diameter coil of excess cable.
(n) 25 cm (V), 1 m-7 m (V, H).
(o) 25 cm from bottom end of 'V', 1 m normally.
(p) Calibrated Cable at least 10 m in length.
(q) Amplifier (optional).
(r) Spectrum Analyzer.

TRANSMITTER SPURIOUS EMISSIONS (RADIATED FIELD STRENGTH)

ALL OTHER EMISSIONS = ≥ 20 dB BELOW LIMIT

EMISSION, MHz/HARMONIC	SPURIOUS LEVEL BELOW CARRIER, dBc Lo	Hi
2nd to 10th	<-55	<-55

SUPERVISED BY: MORTON FLOM, P. Eng.

NAME OF TEST: Emission Masks (Occupied Bandwidth)

SPECIFICATION: FCC: 47 CFR 2.989(c)(1)
IC: RSS-119, Section 6.4

GUIDE: TIA/EIA-603, Paragraph 2.2.11

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: As per previous page

MEASUREMENT PROCEDURE

1. The EUT and test equipment were set up as shown on the following page, with the Spectrum Analyzer connected.

2. For EUTs supporting audio modulation, the audio signal generator was adjusted to the frequency of maximum response and with output level set for ±2.5 kHz deviation (or 50% modulation). With level constant, the signal level was increased 16 dB.

3. For EUTs supporting digital modulation, the digital modulation mode was operated to its maximum extent.

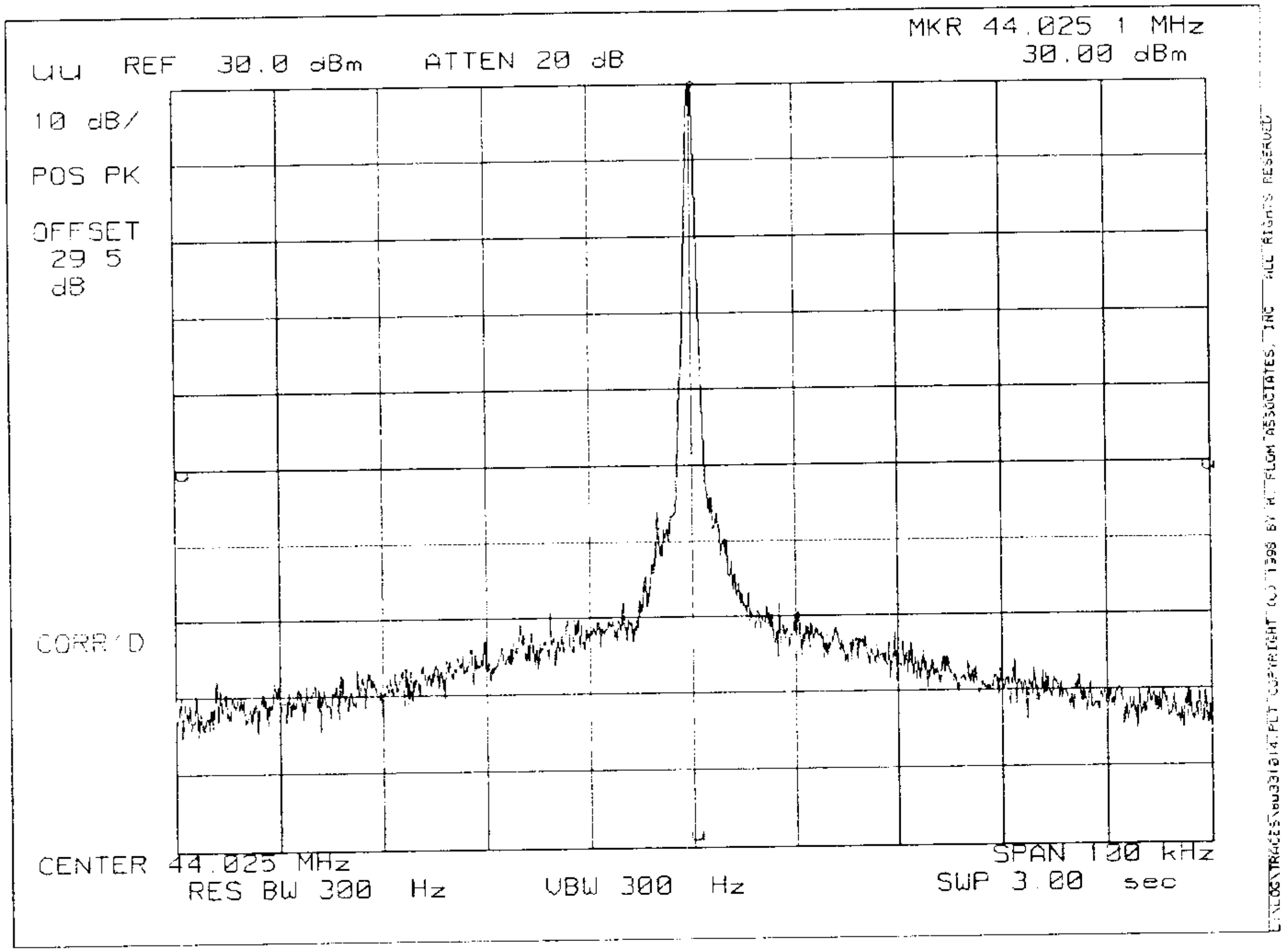
4. The Occupied Bandwidth was measured with the Spectrum Analyzer controls set as shown on the test results.

5. MEASUREMENT RESULTS: ATTACHED

K66VX-510L-2

PAGE 15.1.
SPECTRUM ANALYZER PRESENTATION
YAESU, VX-510L TYPE B
1998-MAR-31, 14:47, TUE

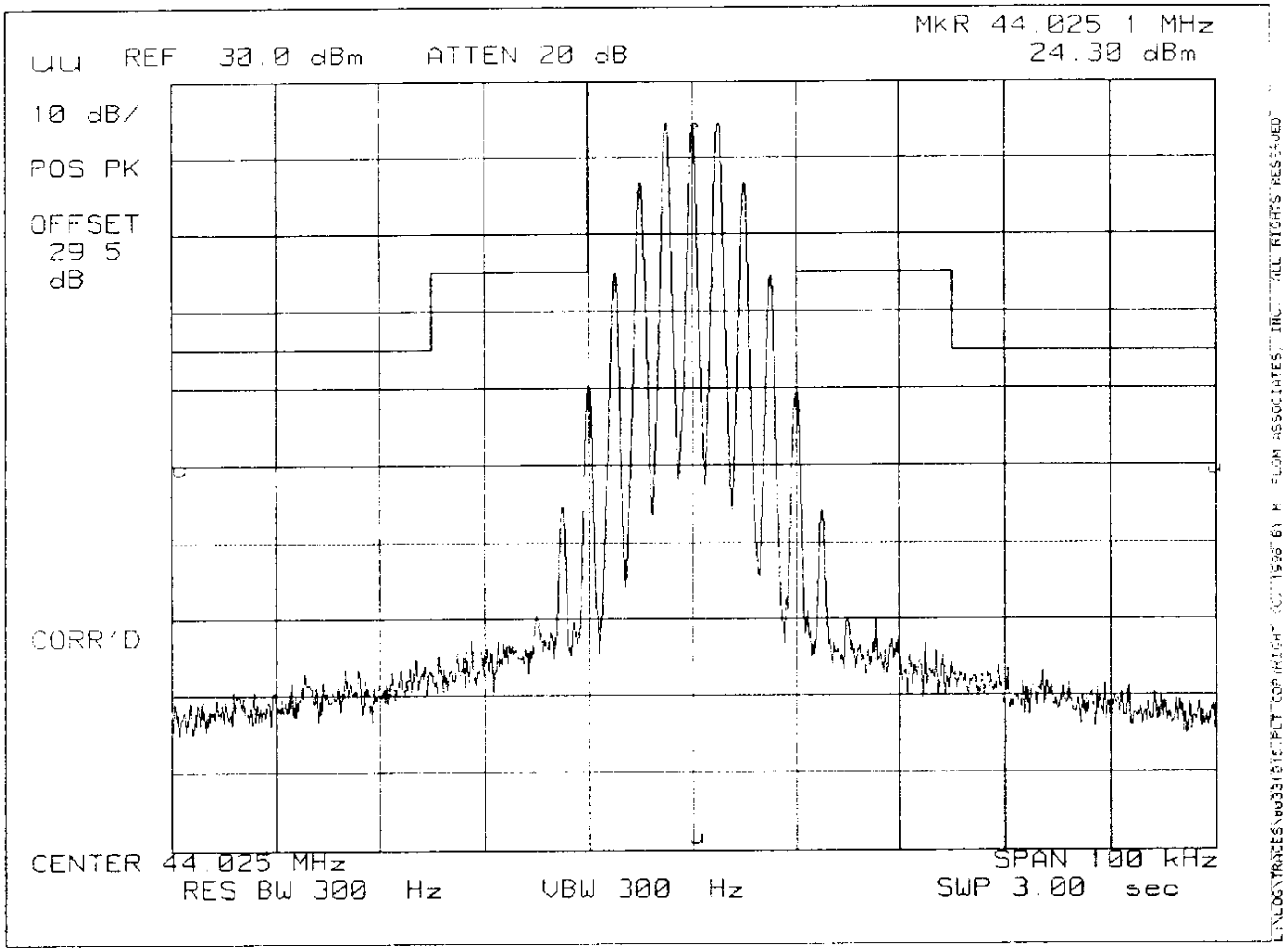
POWER: LOW
MODULATION: NONE



PAGE 15.2. K66VX-510L-2

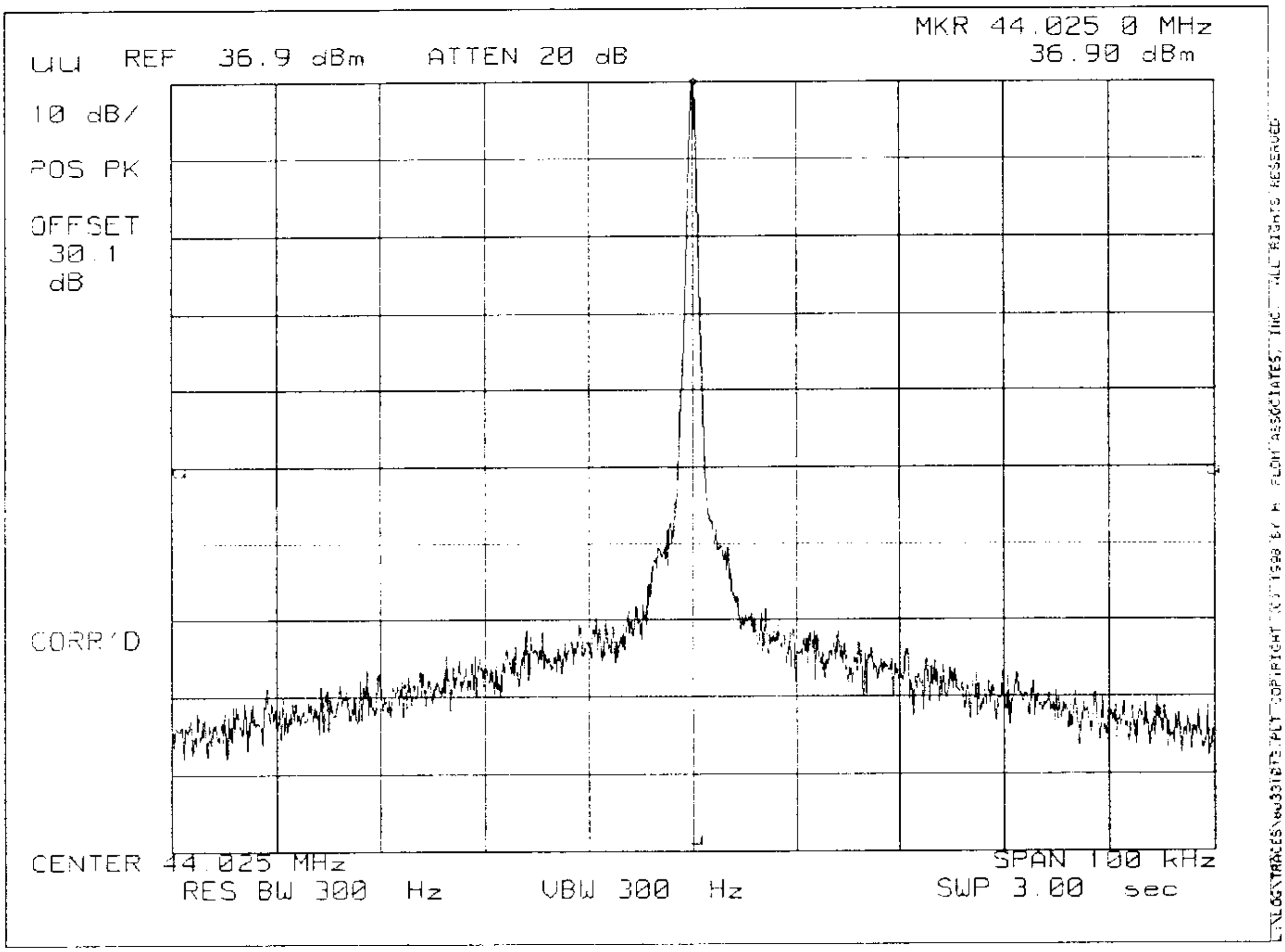
SPECTRUM ANALYZER PRESENTATION
YAESU, VX-510L TYPE B
1998-MAR-31, 14:52, TUE

POWER: LOW
MODULATION: VOICE: 2500 Hz SINE WAVE
MASK: B, VHF/UHF 25kHz, w/LPF



SPECTRUM ANALYZER PRESENTATION
YAESU, VX-510L TYPE B
1998-MAR-31, 14:43, TUE

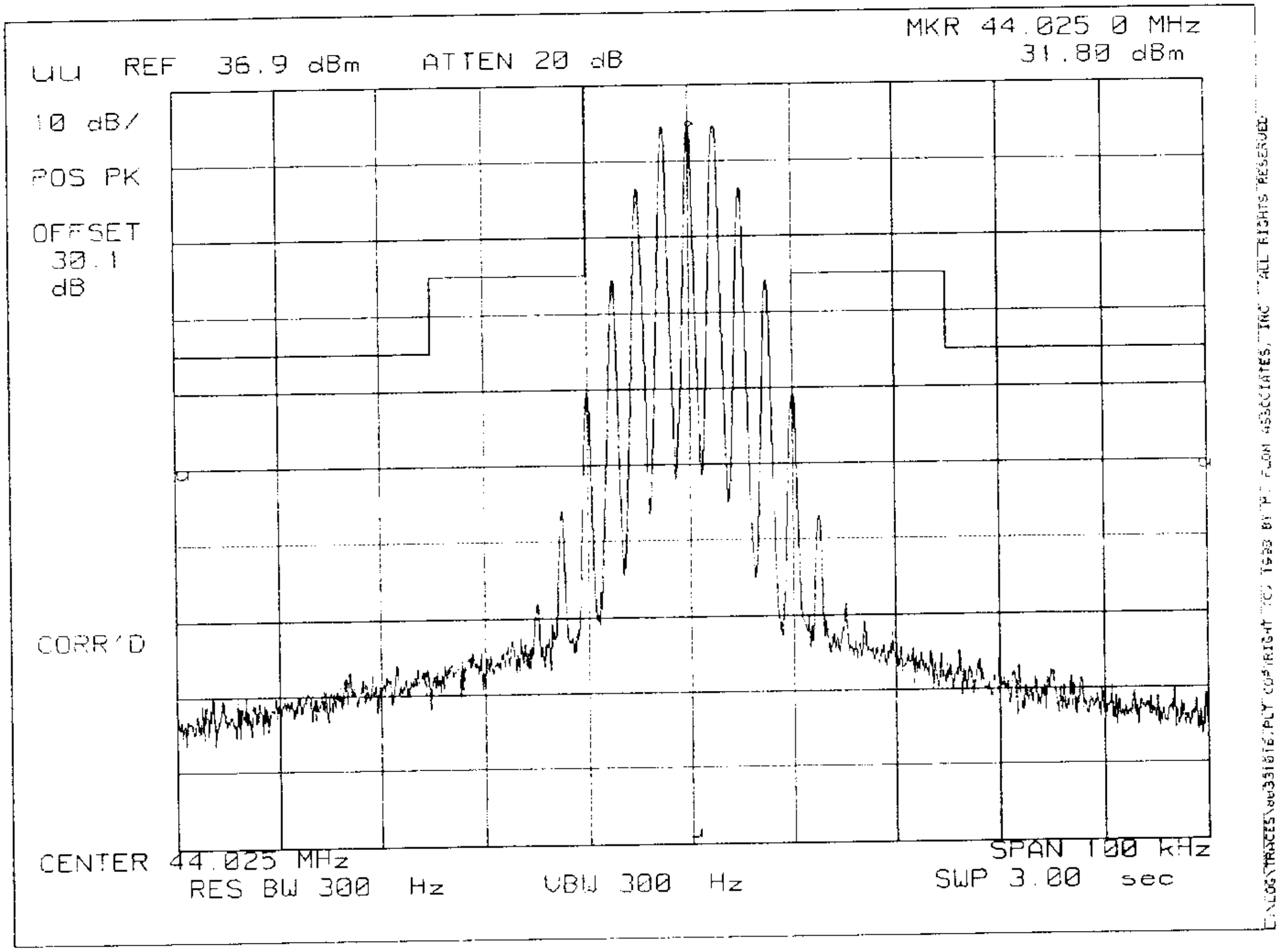
POWER: HIGH
MODULATION: NONE



K66VX-5101-2

PAGE 15.4.
SPECTRUM ANALYZER PRESENTATION
YAESU, VX-510L TYPE B
1998-MAR-31, 14:53, TUE

POWER: HIGH
MODULATION: VOICE: 2500 Hz SINE WAVE
MASK: B, VHF/UHF 25kHz, w/LPF



FCC ID: K66VX-510L-2

TRANSIENT FREQUENCY BEHAVIOUR

(NOT REQUIRED FORFREQUENCY BELOW 150 MHz)

PAGES 16 to 18

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NAME OF TEST: Audio Low Pass Filter (Voice Input)

SPECIFICATION: FCC: 47 CFR 2.987(a)
IC: RSS-119, Section 6.6

GUIDE: TIA/EIA-603, Paragraph 2.2.15

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: As per attached page

MEASUREMENT PROCEDURE

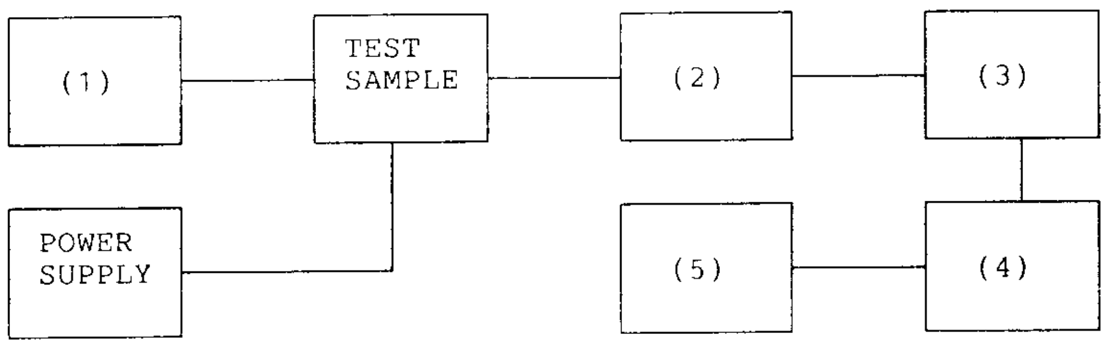
1. The EUT and test equipment were set up such that the audio input was connected at the input to the modulation limiter, and the modulated stage.

2. The audio output was connected at the output to the modulated stage.

3. MEASUREMENT RESULTS: ATTACHED

TRANSMITTER TEST SET-UP

TEST A. MODULATION CAPABILITY/DISTORTION
TEST B. AUDIO FREQUENCY RESPONSE
TEST C. HUM AND NOISE LEVEL
TEST D. RESPONSE OF LOW PASS FILTER
TEST E. MODULATION LIMITING



(1) AUDIO OSCILLATOR/GENERATOR

HP 204D	___
HP 8903A	___
HP 3312A	x
______________	x

(2) COAXIAL ATTENUATOR

NARDA 766-10	___
SIERRA 661A-30	x
BIRD 8329 (30 dB)	___
______________	___

(3) MODULATION ANALYZER

HP 8901A	x
______________	___

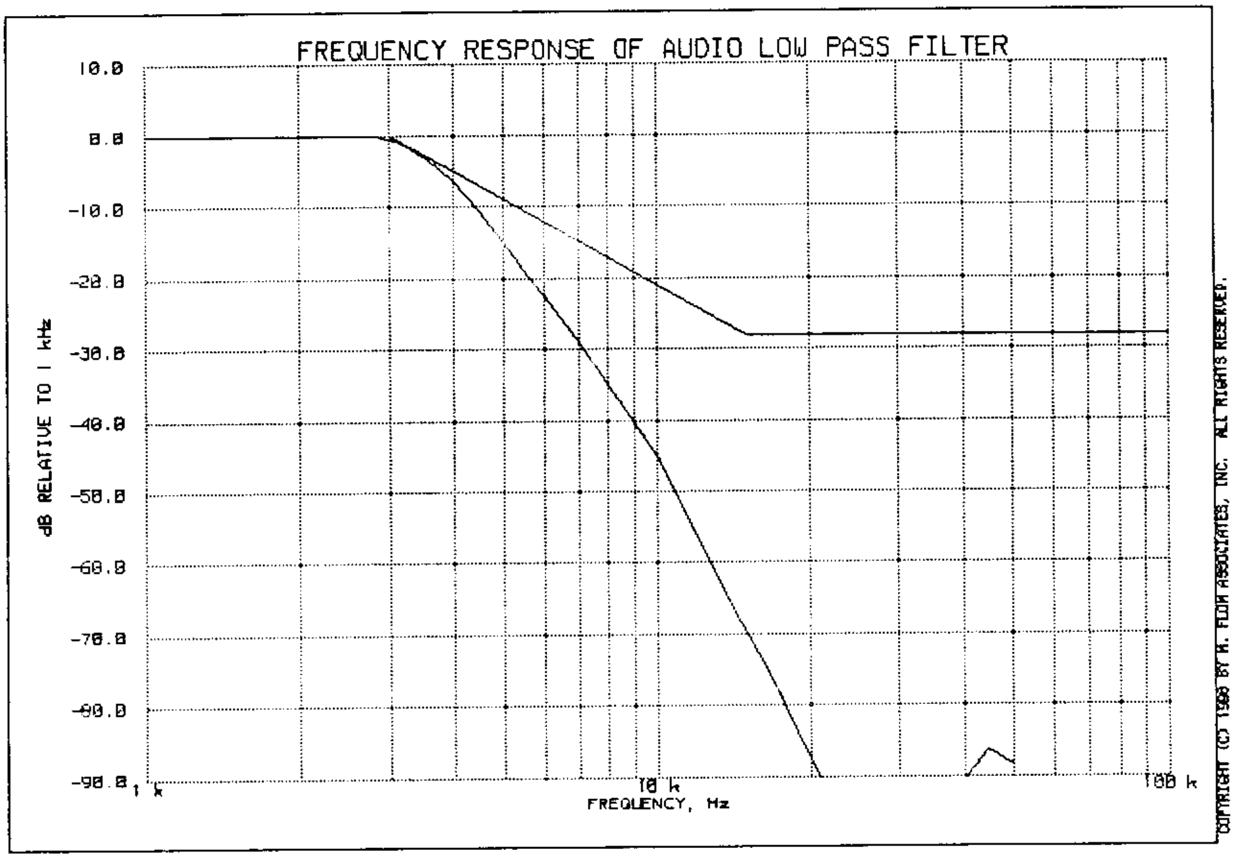
(4) AUDIO ANALYZER

HP 8903A	x
______________	___

(5) SCOPE

HP 1741A	___
HP 181T	___
TEK 935	___
______________	___

FREQUENCY RESPONSE OF AUDIO LOW PASS FILTER
YAESU, VX-510L TYPE B
31 MAR 1998, 12:48



PEAK AUDIO FREQUENCY, Hz: 2820

SUPERVISED BY:

MORTON FLOM, P. Eng.

NAME OF TEST: Audio Frequency Response

SPECIFICATION: FCC: 47 CFR 2.987(a)
IC: N/A

GUIDE: TIA/EIA-603, Section 2.2.6

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: As per previous page

MEASUREMENT PROCEDURE

1. The EUT and test equipment were set up as shown on the following page.

2. The audio signal generator was connected to the audio input circuit/microphone of the EUT.

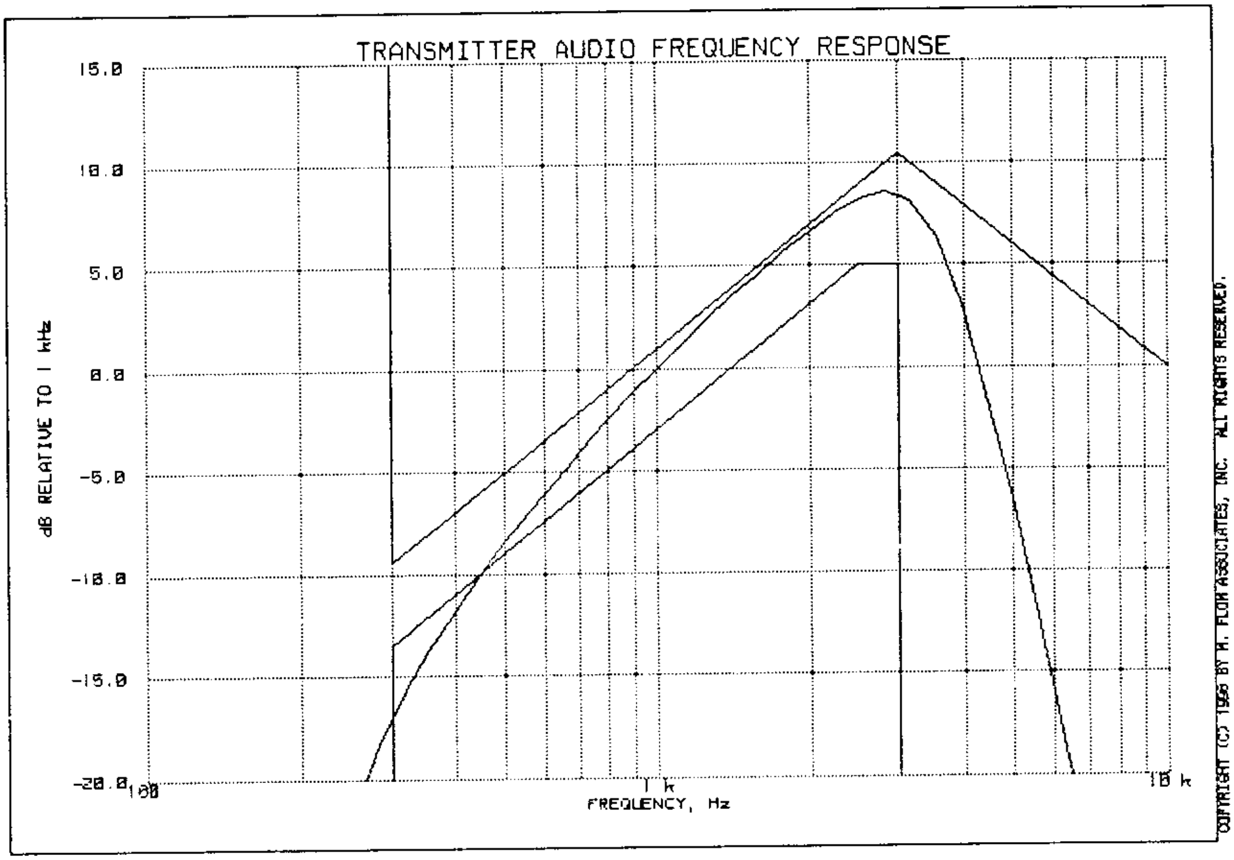
3. The audio signal input was adjusted to obtain 20% modulation at 1 kHz, and this point was taken as the 0 dB reference level.

4. With input levels held constant and below limiting at all frequencies, the audio signal generator was varied from 100 Hz to 50 kHz.

5. The response in dB relative to 1 kHz was then measured, using the HP 8901A Modulation Analyzer.

6. MEASUREMENT RESULTS: ATTACHED

TRANSMITTER AUDIO FREQUENCY RESPONSE
YAESU, VX-510L TYPE B
31 MAR 1998, 12:43



PEAK AUDIO FREQUENCY, Hz: 2820

TABLE VALUES:

FREQUENCY, Hz	LEVEL, dB	FREQUENCY, Hz	LEVEL, dB	FREQUENCY, Hz	LEVEL, dB
300	-16.8	30000	-32.5		
20000	-32.5	50000	-32.4		

SUPERVISED BY:

MORTON FLOM, P. Eng.

NAME OF TEST: Modulation Limiting

SPECIFICATION: IC: RSS-119, Section 6.6
FCC: 47 CFR 2.987(b)

GUIDE: TIA/EIA-603, Paragraph 2.2.3

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: As per attached page

MEASUREMENT PROCEDURE

1. The signal generator was connected to the input of the EUT as for "Frequency Response of the Modulating Circuit."

2. The modulation response was measured for each of three frequencies (one of which was the frequency of maximum response), and the input voltage was varied and was observed on an HP 8901A Modulation Analyzer.

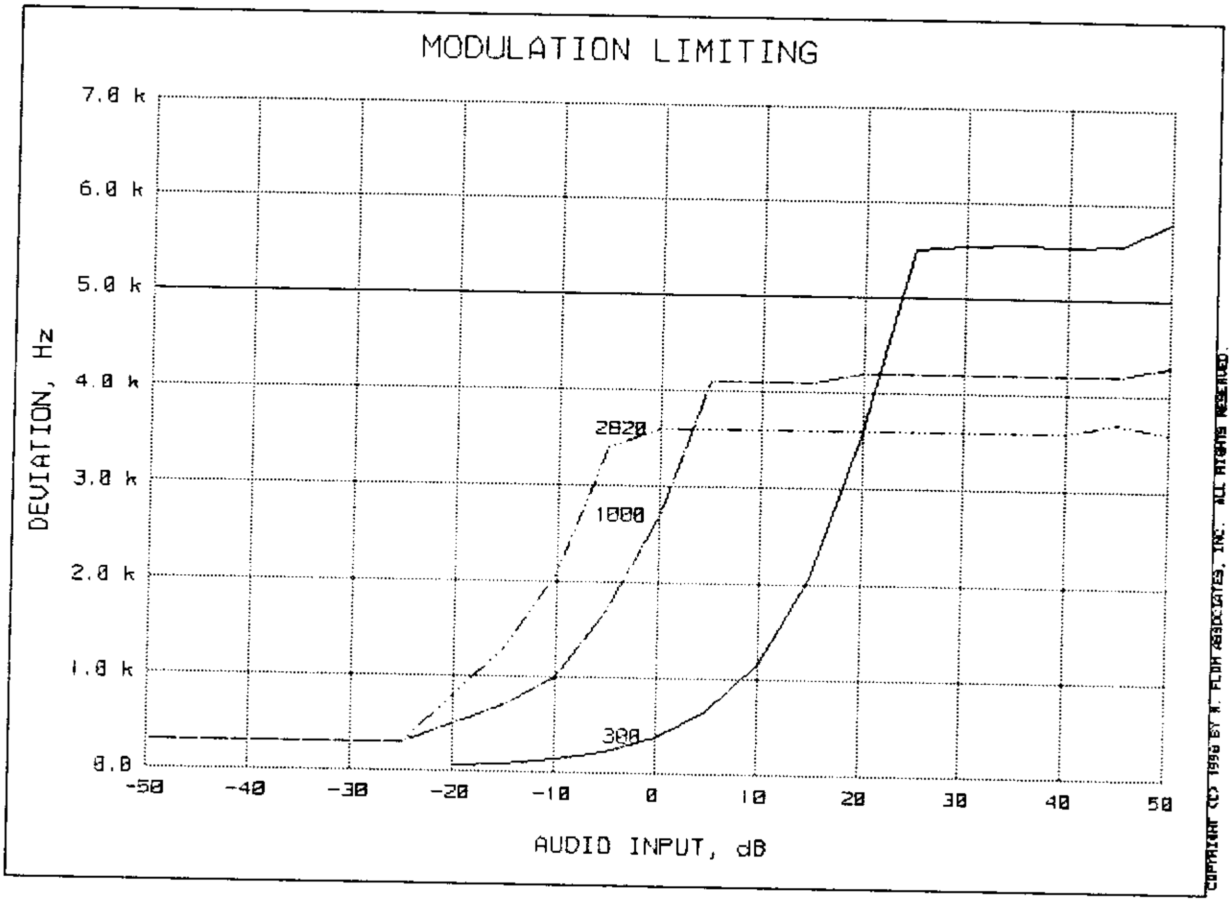
3. The input level was varied from 30% modulation (±1.5 kHz deviation) to at least 20 dB higher than the saturation point.

4. Measurements were performed for both negative and positive modulation and the respective results were recorded.

5. MEASUREMENT RESULTS: ATTACHED

PAGE 25.1.
MODULATION LIMITING
YAESU, VX-510L TYPE B
1998-MAR-31, 12:51

K66VX-510L-2



REFERENCE DEVIATION, kHz = 2.5

REFERENCE MODULATION, Hz = 1000

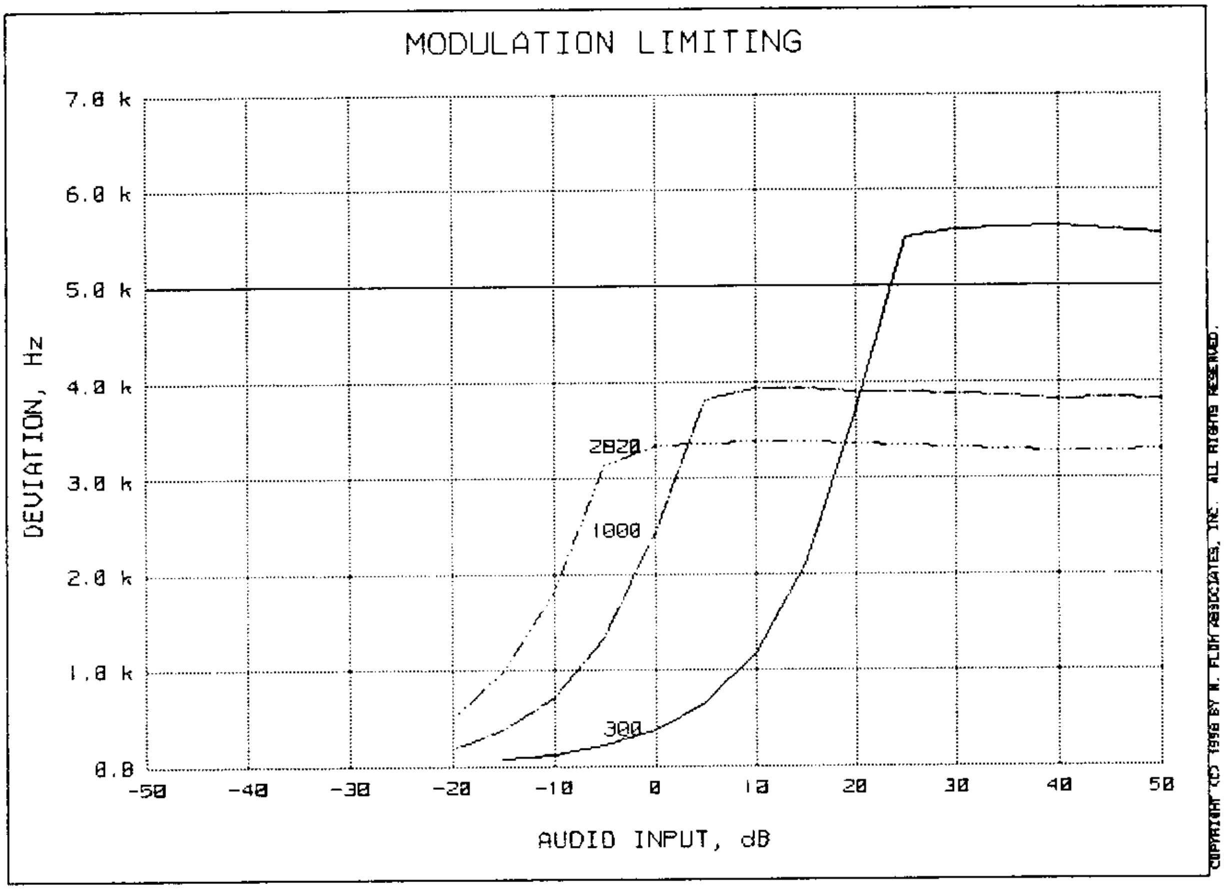
PEAKS = POSITIVE

AUDIO AMPLITUDE, mV = 8.79

SUPERVISED BY:

MORTON FLOM, P. Eng.

PAGE 25.2. K66VX-510L-2
MODULATION LIMITING
YAESU, VX-510L TYPE B
1998-MAR-31, 12:51



REFERENCE DEVIATION, kHz = 2.5

REFERENCE MODULATION, Hz = 1000

PEAKS = NEGATIVE

AUDIO AMPLITUDE, mV = 8.79

SUPERVISED BY:

MORTON FLOM, P. Eng.

PAGE NO. 26.

NAME OF TEST: Frequency Stability (Temperature Variation)

SPECIFICATION: FCC: 47 CFR 2.995(a)(1)
IC: RSS-119, Section 7.0

GUIDE: TIA/EIA-602, Section 2.2.2

TEST CONDITIONS: As indicated

TEST EQUIPMENT: As per attached page

MEASUREMENT PROCEDURE

1. The EUT and test equipment were set up as shown on the following page.

2. With all power removed, the temperature was decreased to -30°C and permitted to stabilize for three hours. Power was applied and the maximum change in frequency was noted within one minute.

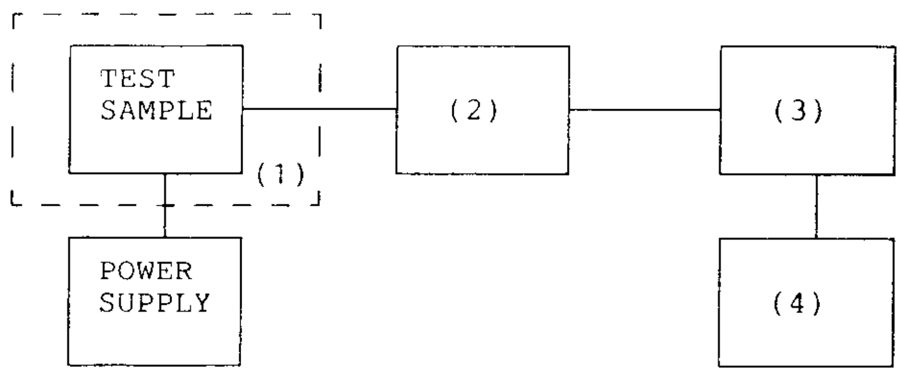
3. With power OFF, the temperature was raised in 10°C steps. The sample was permitted to stabilize at each step for at least one-half hour. Power was applied and the maximum frequency change was noted within one minute.

4. The temperature tests were performed for the worst case.

5. MEASUREMENT RESULTS: ATTACHED

TRANSMITTER TEST SET-UP

TEST A. OPERATIONAL STABILITY
TEST B. CARRIER FREQUENCY STABILITY
TEST C. OPERATIONAL PERFORMANCE STABILITY
TEST D. HUMIDITY
TEST E. VIBRATION
TEST F. ENVIRONMENTAL TEMPERATURE
TEST G. FREQUENCY STABILITY: TEMPERATURE VARIATION
TEST H. FREQUENCY STABILITY: VOLTAGE VARIATION



(1) TEMPERATURE, HUMIDITY, VIBRATION

TENNEY TEMPERATURE CHAMBER	x
WEBER HUMIDITY CHAMBER	
L.A.B. RVH 18-100	

(2) COAXIAL ATTENUATOR

NARDA 766-10	
SIERRA 661A-30	x
BIRD 8329 (30 dB)	x

(3) R.F. POWER

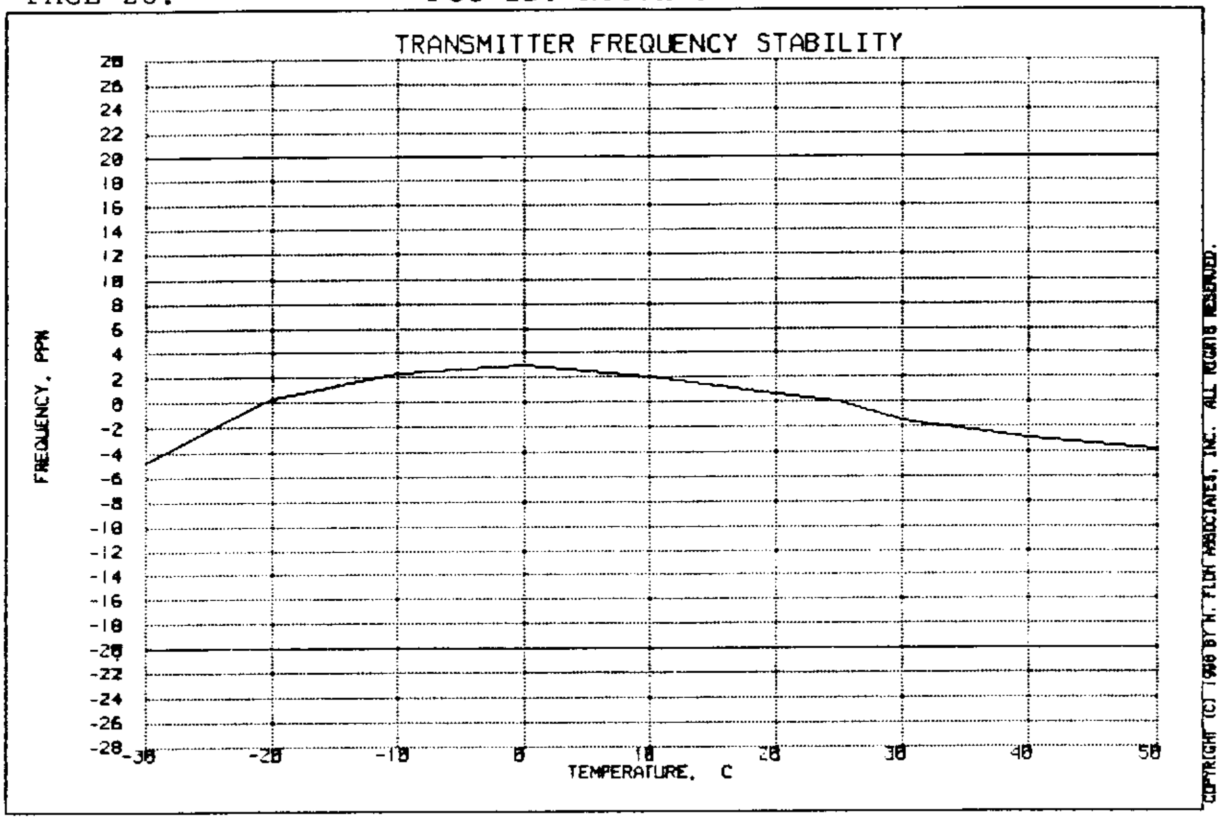
HP 435A POWER METER	
HP 436A POWER METER	x
HP 8901A POWER MODE	x

(4) FREQUENCY COUNTER

HP 5383A	
HP 5334B	x
HP 8901A	x

TRANSMITTER FREQUENCY STABILITY
YAESU, VERTEX VX-510L, Type A & B
14 APR 1998, 10:26

 FCC ID: K66VX-510L-2



FREQUENCY OF CARRIER, MHz = 33.87497

LIMIT, ppm = 20

LIMIT, Hz = 677

SUPERVISED BY: MORTON FLOM, P. Eng.

NAME OF TEST: Frequency Stability (Voltage Variation)

SPECIFICATION: FCC: 47 CFR 2.995 (b)(1)
IC: RSS-119, Section 7.0

GUIDE: TIA/EIA-602, Section 2.2.2

TEST CONDITIONS: As indicated

TEST EQUIPMENT: As per attached page

MEASUREMENT PROCEDURE

1. The EUT was placed in a temperature chamber at 25±5°C and connected as for "Frequency Stability - Temperature Variation" test.
2. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value measured at the input to the EUT.
3. The variation in frequency was measured for the worst case.

MEASUREMENT RESULTS

LIMIT, ppm = 20
LIMIT, Hz = 881

STV, %	Vdc	CHANGE IN FREQUENCY, Hz	
85	6.1	44025000	0
100	7.2	44025000	0
115	8.3	44025010	10
BATTERY END POINT:	5.9	44025010	10

SUPERVISED BY: MORTON FLOM, P. Eng.

NAME OF TEST: Necessary Bandwidth and Emission Bandwidth

PARAGRAPH: 47 CFR 2.202(g)

MODULATION = 16K0F3E

NECESSARY BANDWIDTH CALCULATION:

MAXIMUM MODULATION (M), kHz	= 3
MAXIMUM DEVIATION (D), kHz	= 5
CONSTANT FACTOR (K)	= 1
NECESSARY BANDWIDTH (B_N), kHz	= (2 x M) + (2 x D x K)
	= 16.0

SUPERVISED BY: MORTON FLOM, P. Eng.

TESTIMONIAL
AND
STATEMENTOF CERTIFICATION

K66VX-510L-2

THIS IS TO CERTIFY:

1. THAT the application was prepared either by, or under the direct supervision of, the undersigned.

2. THAT the technical data supplied with the application was taken under my direction and supervision.

3. THAT the data was obtained on representative units, randomly selected.

4. THAT, to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct.

CERTIFYING ENGINEER: MORTON FLOM, P. Eng.

STATEMENT OF QUALIFICATIONS

EDUCATION:

1. B. ENG. in ENGINEERING PHYSICS, 1949, McGill University, Montreal, Canada.

2. Post Graduate Studies, McGill University & Sir George Williams University, Montreal.

PROFESSIONAL AFFILIATIONS:

1. ARIZONA SOCIETY OF PROFESSIONAL ENGINEERS (NSPE), #026 031 821.

2. ORDER OF ENGINEERS (QUEBEC) 1949. #4534.

3. ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOPHYSICISTS & GEOLOGISTS OF ALBERTA #5916.

4. REGISTERED ENGINEERING CONSULTANT - GOVERNMENT OF CANADA, DEPARTMENT OF COMMUNICATIONS. Radio Equipment Approvals.

5. IEEE, Lifetime Member No. 0417204 (member since 1947).

EXPERIENCE:

1. Research/Development/Senior Project Engineer, R.C.A. LIMITED (4 years).

2. Owner/Chief Engineer of Electronics. Design/Manufacturing & Cable TV Companies (10 years).

3. CONSULTING ENGINEER (over 25 years).

M. Flom P. Eng

MORTON FLOM, P. Eng.

TEST INSTRUMENTATION LIST

All equipment calibrated within last 90 days

ADAPTER
HP X281 (Coaxial waveguide); HP S281; HP 85659 (Quasi peak)

AMPLIFIER
Pre-amp. HP 10885A (2-1300 MHz); HP 8447D, HP 8447E, HP 8449A

ANTENNA *See end*

ATTENUATOR
Kay 432D; Power, Sierra 661A-30; Narda 76610; Narda 4779-3, -6, -10 dB

AUDIO OSCILLATOR
HP 204D; AIEC DTC-1; Motorola S-1333B; HP 3312A; HP 8903A

BATTERY
Sears Diehard, Stock #4341

CAMERA
Oscilloscope, Tektronix C5A; Polaroid Impulse AF; Kodak DC-50

CAPACITOR
Feed-Thru, 10 µF, Solar 6512-106R; Solar 7525-1

CLOSE FIELD PROBE
HP 11940A, 11941A, HP 11945A

COMPUTER
HP 332; HP Vectra 486/25VL; Various PC COmpatables

CONVERTOR, Down
HP 117 10B

COUPLER
Narda 1080, Waveguide; HP S750E (Cross guide); Waveline 274/40; Solar 7415-3; Solar 7835-891 & -896

CURRENT PROBE
Solar 6741-1

DETECTOR
HP 8470B

DIGITAL MULTIMETER
HP 3476A w/H.F. Probe; Fluke 8030A-01; HP 3478A

DISTORTION ANALYZER
HP 334A; HP 8903A

ELECTRONIC COUNTER
HP 5383A; HP 5334B

FILTER
Cirqtel FHT/7-50-57/ 50-1A/1B (HP); Jerrold TLB-1; THB-1, Piezo 5064; Eagle TNF-I Series, Krohn-Hite 3202; Phelps-Dodge #PD-495-8; Newtone #PD6000 Line Protector; 870-890 MHz (Lab Design); 900 MHz (Lab Design); Solar High-Pass s/n 882029

FREQ. DEV. METER
HP 8901A

FREQ. DOUBLER
HP 11721A

FREQUENCY METER
HP 537A; HP 536A

GENERATOR
Solar 6550-1 (power sweep); HP 8640B, GAW 1012, HP 8656A (signal); Solar 8282-1 (spike)

HUMIDITY CHAMBER
Embem Co FW30; Bowser 0

LIMITER, R.F
HP 11867A; HP 11693A; HP 10509A

LISN
Singer 91221-1; Ailtech 94641-1 (50µH)

LOAD, POWER
Telewave TLW-25; Bird 8329

MILLIAMETER
HP 428B

MIXER
HP 10514A; Mini-Circuits TAK-1H

OPEN FIELD SITE
As filed with FCC & IC and kept up-dated.
TURNTABLES:
Up to 2000# capacity
GROUND SCREEN:
Complies with docket 80-284
ANTENNA MAST:
Complies as above

OSCILLOSCOPE
HP 1741A; HP 181T; Tektronix 7935; HP 54502A

PHANTOM
M.F.A. Labs Left and Right human head

PLOTTER
HP 7470; HP7475A

POWER METER
AF GR 1840A; HP 435A with 8481A & 8482H Power Sensors; HP 436A; HP 8901A

POWER SUPPLY
HP 6286A; Heathkit IP 2711; IP 5220; Honda EM400 (portable gas gen.); HP 6012

PRINTER
Brother HL-8; Brother HL-10V; HP DeskJet 640C

R. F. PRESELECTOR
HP 85685A

RADIATION METER
Narda 8717 w/8010 Amp, 8021B and 8760 probes

RESISTOR, PRECISION
Solar 7144-1.0, 7144-10.0; Solar 8525-1

SCALE
Weigh-Tronix 3632T-50

SCANNER
HP 9190A Scanjet

SCREEN ROOM
Lindgren 22-2/2-0

SIGNAL LEVEL METER
Jerrold 704B

SIGNAL SAMPLER
R. F. Bird 4273-030, 4275-030

SINAD/VOLTMETER
Helper Sinadder

SPECTRUM ANALYZER
HP 8558B, 8557; HP 8563E; HP 853A; HP 8566B/8568B

TEMPERATURE CHAMBER
Tenney, Jr

TEMPERATURE PROBE
Fluke 80T-150C

TERMINATION
Narda 320B Waveguide. Waveline #281

TEST SET
Semi-Automatic: HP 8953A; HP 8954A Interface: Computer / Controller; P.S. Programmer; HP 59501A; RF Communications: HP 8920A

TRANSFORMERS
Audio Isolation: Solar 6220-1A; Impedance: HP 11694A; Isolation: Solar 7032-1; Matching: Solar 7033-1

TRANSMISSION & NOISE MEASURING SET
HP 3555B

VIBRATION CHAMBER
Unholtz-Dickie T 500; Unholtz-Dickie T 4000

VOLTMETER
HP 410C; HP 3478A

WATTMETER
Bird 43, Sierra 174A-2

ANTENNAS

30 - 50 Hz
Emco 7603 M-Field; Emco 7604 M-Field
20 - 200 MHz
Aprel Biconical Model AAB20200
20 - 300 MHz
Emco Biconical H-Field
25 - 1000 MHz
Singer DM-105A; EMCO 3121C
200 - 1000 MHz
Aprel Log Periodic, Model AALP 2001
10 kHz - 30 MHz
Emco 3107B, E-Field; Emco 3101B/1, Rod E-Field
10 kHz - 32 MHz
Singer 94593-1 (Loop)
150 kHz - 32 MHz
Singer 92197-1 (41")
150 kHz - 32 MHz
Singer 93049-1 (9')
1 - 10 GHz
Singer 90794-A Discone
1 - 18 GHz
Horn: Aprel Model AAH-118
18 - 40 GHz
Emco 3116, Horn
40 - 60 GHz
Horn: HP 11970U, HP 11971U, HP 11975A (Lo Drive Amplifier)
50 - 75 GHz
Mixer, HP 11970V, HP 11971V
75 - 110 GHz
Mixer, HP 11970W

VX-510L Circuit Description

Refer to the block diagram when reading this description. For finer details, refer to the schematic diagrams.

Receiver

In coming signals at the antenna are passed through a low pass filter and T/R switching diode on the ANT-SW Unit before delivery to the front-end circuitry on the mother board. Here, RF amplifier FET Q3201 (2SK302Y) boosts the signal prior to filtering by a 3-stage varactor-tuned resonator, and application to the first mixer FET Q3202 (SGM2016AM) along with the first local signal from Local Amplifier Q2402 (2SC4226) on the VCO Unit.

The 16.9 MHz product from the first mixer is delivered through 4-pole monolithic crystal filter XF3201 (± 7.5 kHz BW) to strip away all but the desired signal which is amplified by Q3203 (2SC2714Y) on the mother board. FM receiver sub-system IC Q2302 (MC3372D) on the IF Unit includes local oscillator, mixer, IF limiter amplifier and FM detector circuits. The amplified first IF signal is applied to mixer section, along with the second local signal generated via 17.355 MHz crystal X2301 which produces the 455 kHz 2nd IF when mixed with the 1st IF signal within Q2302. The 2nd IF passes through ceramic filter CF2301 (±7.5 kHz BW) to strip away unwanted mixer products, and is then applied to the limiter amp in Q2302, which remove amplitude variations in the 455 kHz IF before detection of the speech by Q2302 via quadrature resonator CD2301.

Detected audio is delivered to the CTCSS IC Q1001 (FX365CLS) and then passes through the de-emphasis circuitry consisting of R1033 & C1015, via muting gate Q1011 (2SK160-K6) and volume control to audio power amplifier Q2206 (TDA2822D) on the regulator unit, providing up to 0.5 W to the external speaker jack or 16-Ω loudspeaker.

Squelch Control

The squelch control circuit consists of noise amplifier Q2301 (2SC4116GR) and band-pass filter and squelch trigger within Q2302 on the IF Unit, and control circuitry within microprocessor Q1017 (M38063M6) on the control unit.

When no carrier is received, noise at the output of the detector in Q2302 is amplified by Q2301, and band-pass filtered by the noise amplifier section of Q2302 and then rectified by D2302 to provide a DC control voltage for the squelch switching transistor Q2303 (2SA1586Y). With no carrier, the emitter of Q2303 is high. The signal is buffered by Q1013. This SCAN STOP signal is delivered to the microprocessor on the Control Unit, and microprocessor controlled through Q1003 (FMG5) to the **BUSY** indicator on the top panel, which remains off until a carrier is received. The microprocessor causes audio mute gate Q2207 (DTC144EU) & Q2202 (2SB1122S) to open the audio power amplifier power source, thus disabling the audio amplifier and silencing the receiver when no signal is being received, and during transmission. When a carrier appears at the discriminator, noise is removed from the output, causing the emitter of Q2303 to go low, then Q1017 controls the signal high, which in turn causes Q1003 to turn on the **BUSY** indicator. The microprocessor then checks for CTCSS tone information from Q1001, plus Digital Code Squelch information form Q1006 (TA75S393F). If not transmitting and no tone squelch is programmed for the channel, or if the received tone matches that programmed for the channel, the microprocessor switches Q2207 to allow operation of the audio power amplifier.

Transmitter

When the PTT switch is depressed, audio from the microphone is delivered to the Control Unit, where it is high-pass filtered by Q1018 (2SC4116GR), and by one section of microphone audio processing dual op-amp IC Q1008 (NJM2904V). After pre-emphasis by C1074 and R1030, another section of Q1008 serves as an IDC (Instantaneous Deviation Control) amplifier to prevent over-deviation from excessive microphone levels, and the two remaining states provide low-pass filtering to suppress out-of-band modulation, and buffering.

Processed audio from the IDC Unit is delivered to VCO Amplifier Unit where it is applied, along with carefully filtered DC from Q2403 (2SC4116), to varactor diode D2402 (1T362) to modulate (via the SAVE 5V line) VCO Q2401 (2SC4226), on the VCO Unit, which oscillates at the transmit frequency. VCO output is buffered and amplified by Q2402 on the VCO Amplifier Unit before returning to the Main Unit. Buffered, modulated VCO output is applied via T/R switch D3208 to driver Q3206 (2SC3356), and transmit signal is delivered to the PA Unit for amplification by Q6001 (2SC4240).

Transmitter output is controlled by Q2001 (2SB1182F5-Q) and Q2002 (FMW1) on the ANT SW Unit. When the TX +B line (from the regulator Unit) is active, bias voltage and driver collector voltage is applied to the PA Unit Q2003 and Q2004, turning it on. A sample of the final transistor collector current in the PA Unit is detected by D2001 (1SS319), passed through RF Power potentiometer VR3201 on the Main Unit back to APC switch Q2001 (2SB1182F5-Q) via one half of Q2002 (FMW1) on the ANT SW Unit. Q2002 passes the Automatic Power Control voltage when enabled by the other (transmit sequencer) half of Q2002. This circuit is also used by the PLL to disable the transmitter when the PLL is unlocked, and by the microprocessor to select low power output.

PLL

PLL circuitry on the PLL Unit consists of PLL subsystem IC Q2105 (MB1505PF), which contains a divider, serial-to-parallel data latch, programmable divider and a phase comparator. Stability is obtained by a regulated 5-V supply via Q2105 and temperature compensating capacitors associated with 12.8 MHz frequency reference crystal X2101.

Receiver VCO Q2404 (2SC4226) on the VCO Unit oscillates between 54.9 and 66.9 MHz according to the programmed receiving frequency. The VCO output is buffered by Q2402 (2SC2759) on the VCO Unit, and then returned to the PLL Unit. There the VCO signal is divided by 64 or 65, according to a control signal from the data latch section of Q2105, before being applied to the programmable divider section of the PLL chip.

The data latch section of Q2105 also receives serial dividing data from microprocessor Q1017 on the Control Unit, which causes the pre divided VCO signal to be further divided by 10,980 ~ 13,380 in the programmable divider section, depending upon the desired receive frequency, so as to produce a 5-kHz derivative of the VCO frequency. Meanwhile, the reference divider section of Q2105 divides the 12.8-MHz crystal reference by 2560 to produce the 5-kHz loop reference (respectively).

The 5-kHz signal from the programmable divider (derived from the VCO) and that derived from the crystal are applied to the phase detector section of Q2105, which produces a dual 5-V pulsed output with pulse duration depending on the phase difference between the input signals. This pulse train is converted to DC by charge pump Q2102 (IMD3), low-pass filtered, then fed back to varactors D2403 and D2404 (HVU306Ax2) on the VCO Unit.

Changes in the level of the DC voltage applied to D2403/D2404 affect the reactance in the tank circuit of VCO Q2404, changing the oscillating frequency according to the phase difference between the signals derived from the VCO and the crystal reference oscillator. The VCO is thus phase-locked to the crystal reference oscillator.

The output of receiver VCO Q2404, after buffering by Q2402 is delivered to the Main Unit before application to the 1st mixer, as described previously.

Transmitter VCO Q2401 (2SC4226) oscillates between 38 and 50 MHz according to the programmed transmit frequency. The remainder of the PLL circuitry is shared with the receiver. However, the dividing data from the microprocessor is such that the VCO frequency is at the actual transmit frequency (rather than offset for IFs, as in the receiving case). Also, the transmitter VCO is modulated by the filtered speech audio applied to modulating varactor D2402, as described previously. If the Digital Coded Squelch option is installed, DCS modulation is applied both to the VCO and to the PLL frequency reference, via varactor D2102/D2103 (HVU300Ax2).

Control Unit & Supply Bus

Microprocessor Q1017 (M38063M6GP) on the Control Unit contains programming in masked ROM to generate serial data to control the Liquid Crystal Display driver IC Q5001 (LC75821E) on the LCD Unit and the programmable divider in the PLL according to channel frequency data stored in externally programmable EEPROM. Q1017 also includes programming for channel frequency scanning. DCS encode/decode, CTCSS IC Control, option unit control, selectable channel steps and frequency range. The microprocessor receives an indication of the condition of the noise squelch from the FM subsystem IC on the IF Unit, by which scanning is activated or deactivated. Q1017 also controls the power saver function and transmit/receive switching by selecting the supply buses on the Regulator Unit Q2209 (DTB123EK), Q2205 (DTA143XK) and Q2210 (DTC144EU) disables the RX 5V bus when the power saver is active.

When the PTT switch is pressed, the impedance change on the microphone line is detected by Q1015 (2SA1586Y) on the Control Unit, which signals the microprocessor that the transmitter is active. The microprocessor then activates LED indicator D5001 to glow red (TX). Voltage comparator Q1012 (RN5VL45AA) controls power-up resetting of the microprocessor.

VX-510L Alignment

The VX-510 has been carefully aligned at the factory for the specified performance across the frequency range specified for each version. Re-alignment should therefore not be necessary except in the event of component failure, or altering version type. All component replacement and service should only be performed by an authorized Yaesu representative, or the warranty policy may be void.

Required Test Equipment

- IBM PC / compatible computer
- Yaesu VPL-1 Cable, or FRB-2 Service Kit, with CE-21 Channel Programming Diskette
- Yaesu CN-1 BNC Adapter plug
- RF Signal Generator with calibrated output level at 60 MHz
- Deviation Meter (Linear Detector)
- Oscilloscope
- AC Voltmeter
- SINAD Meter
- In-Line wattmeter with 5% accuracy at 60 MHz
- Regulated DC Supply adjustable from 4 to 10 V, 3 A
- 50-Ω Non-reactive Dummy Load: 10 W at 60 MHz
- Frequency Counter: ±0.2 ppm accuracy at 60 MHz
- AF Signal Generator
- DC Voltmeter: high impedance

Before beginning alignment, connect the transceiver and PC using the VPL-1 Cable or FRB-2 Set as described in the EEPROM Programming chapter, and download the EEPROM data from the transceiver to the computer.

Then store this data in a disk file so that it can be up-loaded when alignment is finished.

You should find the corresponding data file on the computer disk for the transceiver version you are aligning, containing channel settings for the high edge, middle and low edge of the transceiver's frequency range in channels 1, 2 and 3, respectively. Up-load this file to the transceiver.

PLL & Transmitter

Set up the test equipment as shown for transmitter alignment. Adjust the supply voltage to 7.2 V for all steps where not specified otherwise.

	LOW BAND EDGE CH. (1)	BAND CENTER CH. (2)	HIGH BAND EDGE CH. (3)
ver. A	29.7 MHz	33.9 MHz	38.0 MHz
ver. B	38.0 MHz	44.0 MHz	50.0 MHz

PLL VCV (Varactor Control Voltage)

- Connect the DC voltmeter between C2105 on the PLL Unit and chassis ground.
- Set the transceiver to CH 3 (high band edge), and adjust T2402 on the VCO Unit for 3.4 V ± 0.1 V (ver. A), or 4.0 V ± 0.1 V (ver. B) on the voltmeter.
- Transmit on the high band edge, and adjust T2401 for 3.0 V ± 0.1 V (ver. A), or 3.2 V ± 0.1 V (ver. B).
- Set the transceiver to HC 1 (low band edge), and confirm the low-end VCV is more than 1.0 V while transmitting, and also while receiving.

PLL Reference Frequency

- With CH 2 (band center) selected, key the transmitter and adjust TC2101 on the PLL Unit, if necessary, so the frequency counter displays the band center frequency ± 150 Hz (for the version being aligned) when transmitting.

Transmitter Output Power

- Set the transceiver to band center CH 2, and select high power output.

- Ensure that the supply voltage is precisely 7.2 V, then adjust VR3201 (while the **PTT** switch is pressed) for 5.0 W ± 0.2 W on the wattmeter, and confirm that supply current remains below 2.5 A.
- Press the **A** key on the front panel to select low power output ("**LO**" displayed on the LCD), and adjust VR3202 on the Main Unit for 1.0 W ± 0.1 W on the wattmeter, and confirm that supply current remains below 1.5 A.

Modulation Level

- With the transceiver set to band center CH 2, adjust the AF generator for 77 mVrms output at 1 kHz to the MIC jack.
- Press the **PTT** switch and adjust VR3204 on the Main Unit for a deviation of ± 4.1 kHz (for 20 kHz steps) or ± 2.1 kHz (for 12.5 kHz steps).
- Reduce the AF generator output to 7.7 mVrms.
- Press the **PTT** switch and adjust VR1002 on the Control Unit for a deviation of ± 3.0 kHz (for 20 kHz steps) or ± 1.5 kHz (for 12.5 kHz steps).

Receiver

Set up the test equipment as shown for receiver alignment, and construct the audio test adapter as described in the box below.

- With the transceiver set to high band edge CH 3, and the RF signal generator tuned to the same frequency, set the generator for ± 3.0 kHz deviation with 1 kHz tone modulation, and set the output level for 40 μV at the antenna jack.
- Adjust T3201 through T3204 on the Main Unit for optimum SINAD, reducing the signal generator output level as necessary for proper meter deflection.
- After the previous step, final signal generator level should be better than –6 dBμ for 12 dB SINAD.

Squelch Threshold

- Set the transceiver to CH 2, and turn off the RF signal generator output.
- Turn VR4001 (on the top panel) clockwise until the squelch just closes, and then counter-clockwise very slightly so that it just opens.

Note!

Because of the bridge audio amplifier circuit used in the VX-510, it is necessary to construct and use a simple audio load test adapter as shown in the schematic diagram above, when conducting receiver alignment steps.

*Do not connect either side of the speaker leads to chassis "**ground**".*

Using the CN-1 BNC Adapter

The VX-510 uses a threaded-type antenna jack to match the supplied helical flex antenna. To make power output or sensitivity checks, performing alignment or to connect the VX-510 to an external coaxial-fed antenna, the CN-1 adapter should be used to mate the transceiver with standard BNC connectors.

With the transceiver assembled, the CN-1 in it's place. When performing the alignment procedure, first disassemble the transceiver case as described, then replace the washer and threaded nut removed from antenna jack. Install the CN-1 adapter by carefully threading the unit on the antenna jack nut, then rotating the black knurled collar clockwise until it is finger-tight. Remember to *remove the nut and washer again before assembling the transceiver body halves.*

Installing the channel "stops"

To simplify operation and prevent selecting an unprogrammed/unused channel or group of channels, tiny metal inserts or channel "stops" can be inserted into the top panel beneath the **CH** selector knob. A tiny tab protruding from the bottom skirt of the **CH** selector knob engages the stop(s) as the knob is turned, and prevents further rotation.

To insert the metal stops, remove the **CH** knob, then, using the pair of tweezers or fine needle-nose pliers, insert the tab(s) firmly into the appropriate slot(s), according to the drawing below. For example, to limit **CH** selection to channels 1~3, insert one metal stop at the 9 o'clock position (slot) and the other in the 6 o'clock position.

Note: the use of mechanical channel stops should not be used or relied upon as the sole means to prevent transmission on an invalid or unauthorized channel by users. Channels should be locked-out or Tx-inhibited via programming using the CE-21 Channel Editor software, and stops installed in addition as a user-convenience.

Receiving Squelch Setting

The squelch setting on your VX-510 is preset at the factory, and dose not normally require re-adjustment. However, in the event that this should become necessary, the control can be accessed by pulling off the **VOL** knob, then using a pair of tweezers to rotate the small brass collar at the just above the base of the **VOL** control shaft, as shown below. Be careful not to loosen the larger mounting nut at the base of the control.

Adjustment of this control affects whether your radio can hear distant and nearby stations, or only nearby ones, therefore we recommend leaving the control as set, or having your Yaesu dealer perform the adjustment.