NAME OF TEST: OCCUPIED BANDWIDTH

PARAGRAPH: 47 CFR 2.989 (c)(1)

GUIDE: EIA STANDARD RS 152B, Paragraph 17

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: AS PER ATTACHED PAGE

MEASUREMENT PROCEDURE

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

2. For E.U.T.s 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.

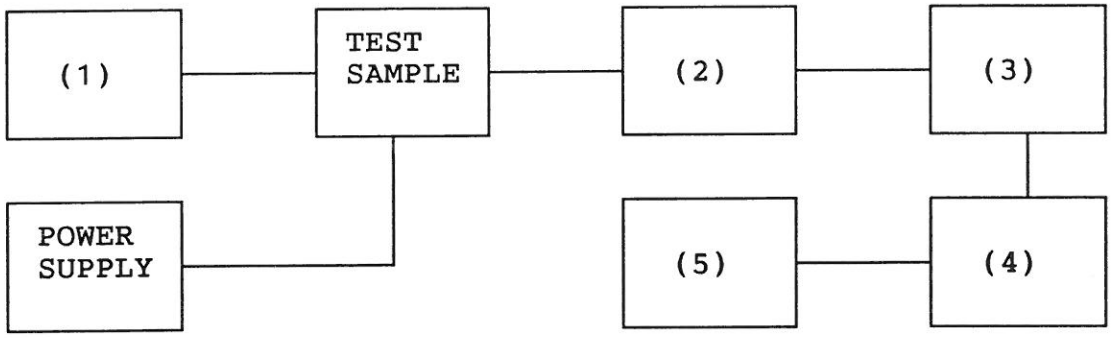
3. For E.U.T.s supporting digital modulation, the digital modulation mode was operated to its maximum extent.

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

5. MEASUREMENT RESULTS: ATTACHED

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

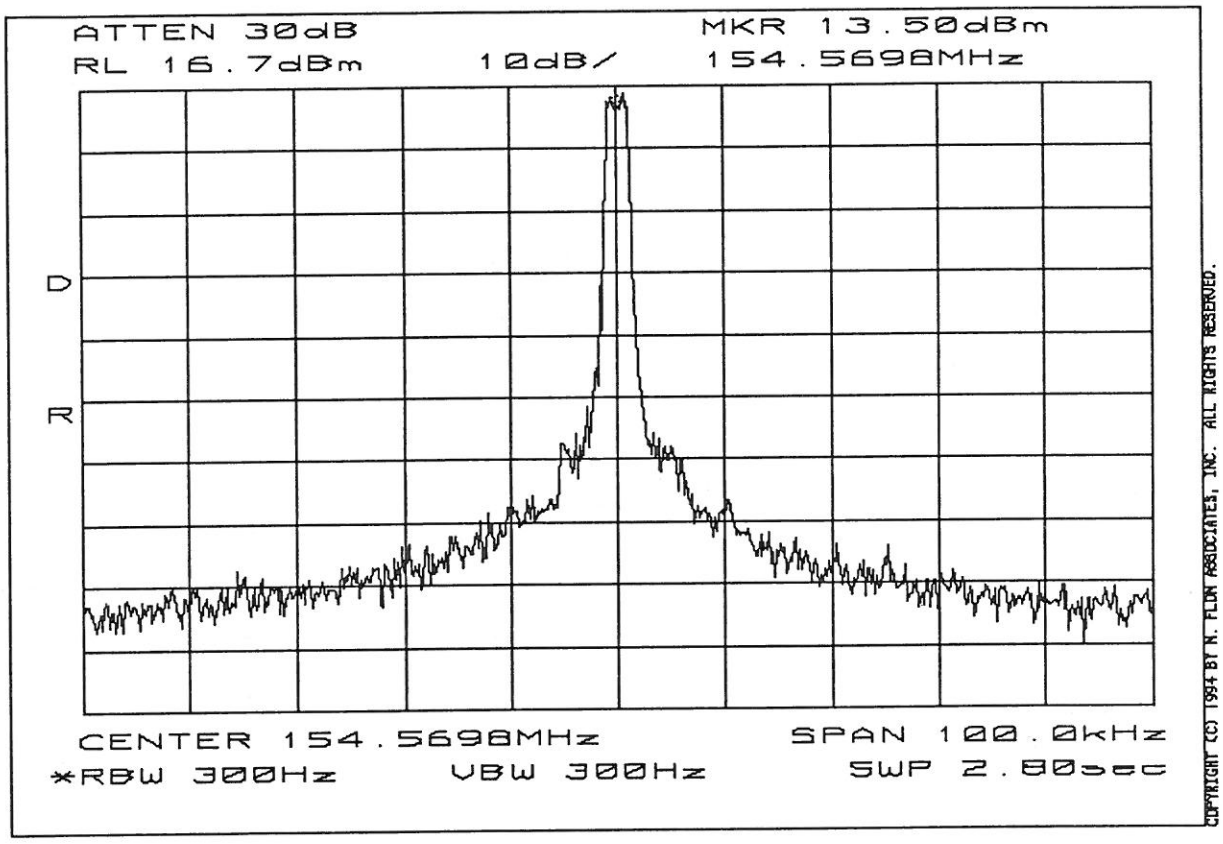
HP 8566B	x
HP 8558B	___
HP 8557A	___
_____	___

(5) SCOPE

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

PAGE 17.1.

SPECTRUM ANALYZER PRESENTATION
HME, COM2000S (PORTABLE)
10 OCT 1994, 14:19

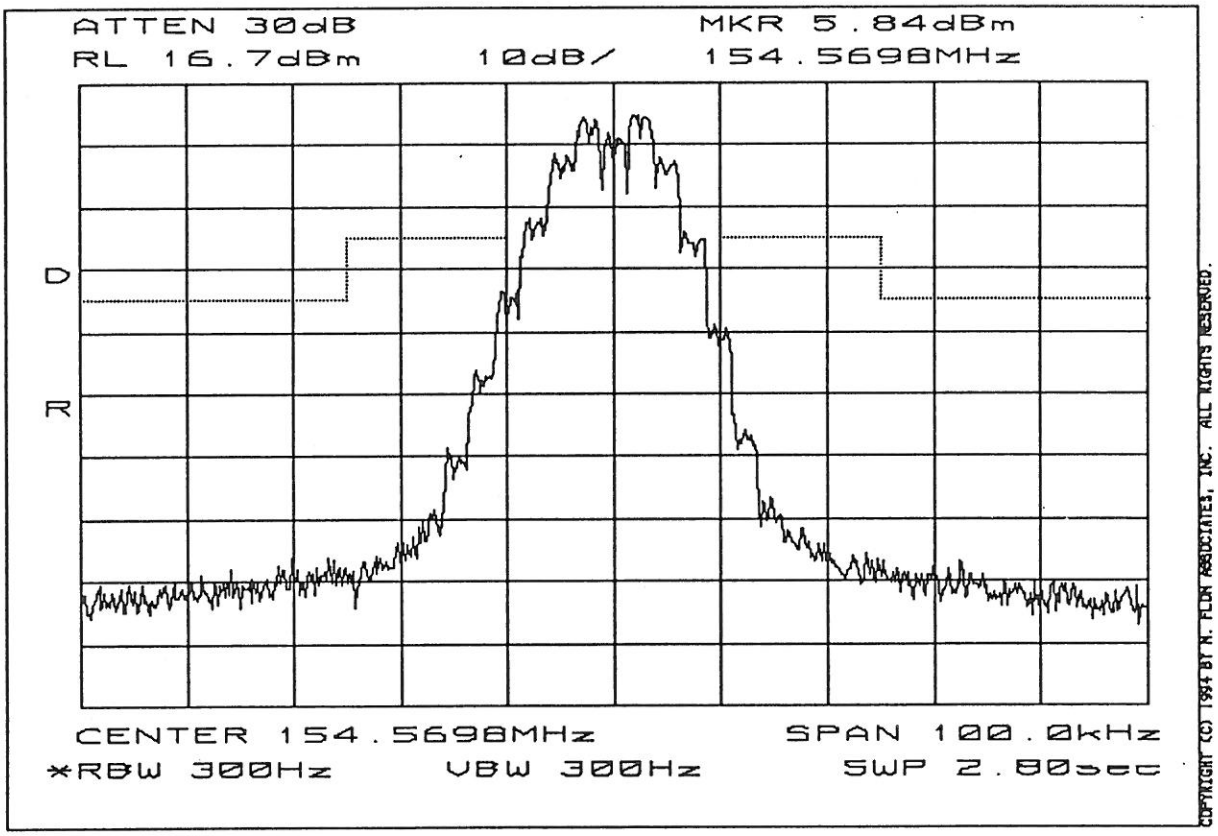


POWER: HIGH

MODULATION: NONE

SUPERVISED BY: MORTON FLOM, P. Eng.

SPECTRUM ANALYZER PRESENTATION
HME, COM2000S (PORTABLE)
10 OCT 1994, 14:22



POWER: HIGH

MODULATION: VOICE + TONE

SUPERVISED BY: MORTON FLOM, P. Eng.

NAME OF TEST: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

PARAGRAPH: 47 CFR 2.991

GUIDE: EIA STANDARD RS 152B, Paragraph 17

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 E.U.T. 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

FREQUENCY OF CARRIER, MHz	= 154.57
SPECTRUM SEARCHED, GHz	= 0 to 10 x F_C
MAXIMUM RESPONSE, Hz	= 2000
ALL OTHER EMISSIONS	= ≥ 20 dB BELOW LIMIT
LIMIT, dBc: -(43 + 10 LOG P_0)	= -30 (0.05 Watts)

SUPERVISED BY: MORTON FLOM, P. Eng.

TRANSMITTER SPURIOUS EMISSIONS (CONDUCTED)
POWER: HIGH

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	LEVEL, dBm	LEVEL, dBc	LEVEL, µW
154.570	309.128	-38.2	-54.9	0
154.570	463.700	-55.0	-71.7	0
154.570	618.295	-57.9	-74.6	0
154.570	773.152	-56.3	-73.0	0
154.570	926.962	-56.9	-73.5	0
154.570	1082.008	-55.0	-71.7	0
154.570	1236.508	-56.0	-72.6	0
154.570	1391.330	-56.1	-72.7	0
154.570	1545.562	-55.3	-72.0	0
154.570	1700.287	-54.6	-71.3	0
154.570	1855.122	-54.8	-71.4	0
154.570	2009.132	-55.4	-72.1	0
154.570	2163.737	-56.1	-72.8	0
154.570	2318.853	-55.4	-72.1	0

NAME OF TEST: FIELD STRENGTH OF SPURIOUS RADIATION

PARAGRAPH: 47 CFR 2.993 (a)

GUIDE: SEE MEASUREMENT PROCEDURE BELOW

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: AS PER ATTACHED PAGE

MEASUREMENT PROCEDURE

1. A description of the measurement facilities was filed with the F.C.C. and was found to be in compliance with the requirements of Section 15.38, by letter from the F.C.C. dated February 4, 1994, FILE 31040/SIT. All pertinent changes will be reported to the Commission by up-date prior to February 1997.

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

PARAGRAPH: 47 CFR 2.993 (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:

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

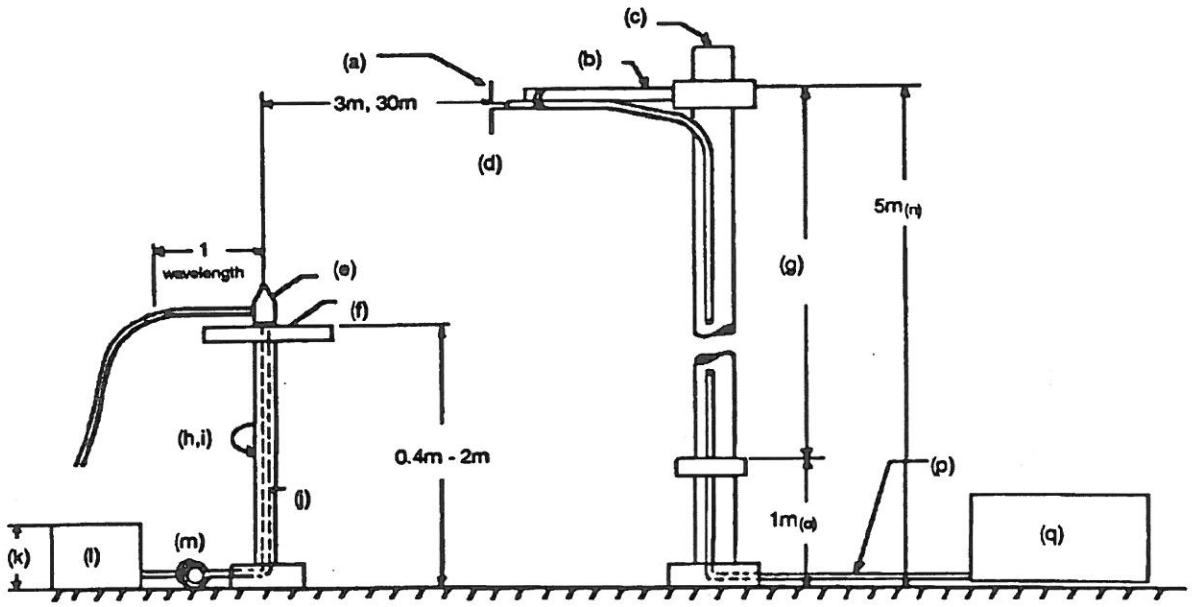
9. The worst case for all channels is shown.

10. Measurement summary:

FREQUENCY OF CARRIER, MHz	= 154.57
SPECTRUM SEARCHED, GHz	= 0 to 10 x F_C
ALL OTHER EMISSIONS	= ≥ 20 dB BELOW LIMIT
LIMIT, dBc	= -30 (0.05 Watts)

11. Measurement results: ATTACHED

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) Spectrum Analyzer.

TRANSMITTER SPURIOUS EMISSIONS (RADIATED FIELD STRENGTH)

EMISSION, MHz/HARMONIC	SPURIOUS LEVEL BELOW CARRIER, dBc Lo	Hi
2nd to 10th		<-50

SUPERVISED BY:

MORTON FLOM, P. Eng.

NAME OF TEST: FREQUENCY STABILITY - TEMPERATURE VARIATION

PARAGRAPH: 47 CFR 2.995 (a)(1)

GUIDE: EIA STANDARD RS 152B, Paragraph 10

TEST CONDITIONS: AS INDICATED

TEST EQUIPMENT: AS PER ATTACHED PAGE

MEASUREMENT PROCEDURE

1. The E.U.T. 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.

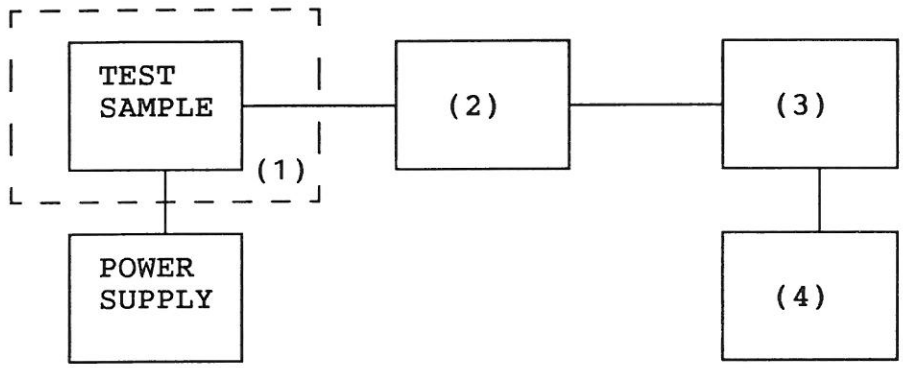
3. With power OFF, the temperature was raised in 10°C steps. The sample was permitted to stabilize at each step for at least one-half hour. Power was applied and the maximum frequency change was noted within one minute.

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
_____	___

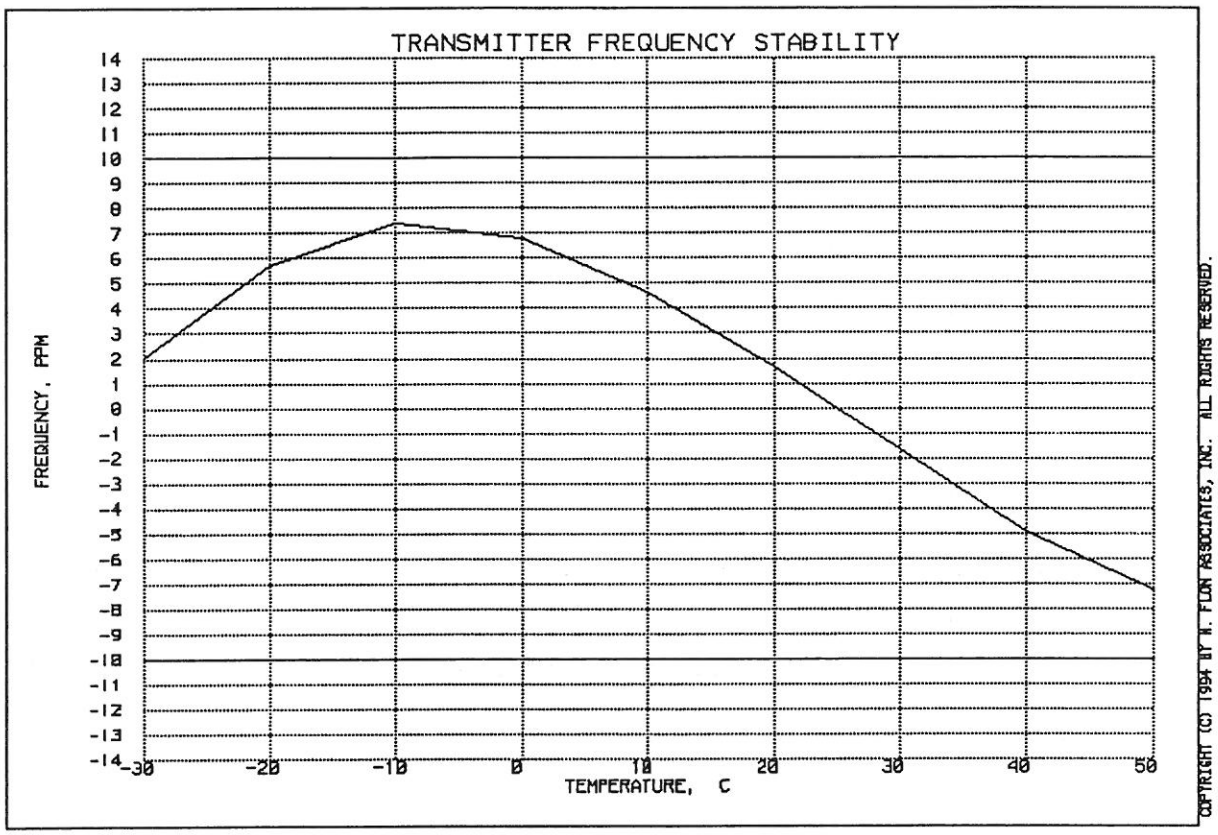
(3) R.F. POWER

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
HME, COM2000S (PORTABLE)
7 OCT 1994, 14:22



FREQUENCY OF CARRIER, MHz = 154.56985

LIMIT, ppm = 10

LIMIT, Hz = 1546

M. Flom P. Eng

SUPERVISED BY: MORTON FLOM, P. Eng.

NAME OF TEST: FREQUENCY STABILITY - VOLTAGE VARIATION

PARAGRAPH: 47 CFR 2.995 (b)(1)

GUIDE: SEE MEASUREMENT PROCEDURE BELOW

TEST CONDITIONS: AS SHOWN

TEST EQUIPMENT: AS PER PREVIOUS PAGE

MEASUREMENT PROCEDURE

1. The E.U.T. 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 E.U.T. was varied from 85% to 115% of the nominal value measured at the input to the E.U.T.

3. The variation in frequency was measured for the worst case.

MEASUREMENT RESULTS

LIMIT, ppm = 10
LIMIT, Hz = 1546

STV, %	Vdc	CHANGE IN FREQUENCY, Hz	
85	5.1	154569980	-20
100	6.0	154570000	0
115	6.9	154570010	10
BATTERY END POINT:	4.3	154569980	-20

SUPERVISED BY: MORTON FLOM, P. Eng.

NAME OF TEST: NECESSARY BANDWIDTH AND EMISSION BANDWIDTH

PARAGRAPH: 47 CFR 2.202(g) & 90.217

GUIDE: N/A

TEST CONDITIONS: N/A

TEST EQUIPMENT: N/A

Rule 2.202(g) Table III-2, LIMIT = ≤ 54 kHz

MAXIMUM MODULATION (M), kHz	= 2.51
MAXIMUM DEVIATION (D), kHz	= 5
CONSTANT FACTOR (K)	= 1
NECESSARY BANDWIDTH (B_N), kHz	= 2 x M + 2 x D x K
	= 15.02

Rule 90.217, LIMIT = ≤ ±40 kHz

NECESSARY BANDWIDTH, kHz	= 15.02
TEMPERATURE VARIATION, ±kHz	= 1.55
VOLTAGE VARIATION, ±kHz	= 0.02
EMISSION BANDWIDTH, ±kHz	= SUM OF ABOVE
	= 16.59

§ 15.205 Restricted Bands of operation. BYMC2KS

(a) Except as shown in paragraph (d) of this section, 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 [1]	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	3600-4400	(2)
13.36-13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

TESTIMONIAL
AND
STATEMENT OF CERTIFICATION

BYMC2KS

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.

LIST OF EXHIBITS

APPLICANT: HM ELECTRONICS, INC.

EQUIPMENT: BYMC2KS

BY APPLICANT:

1. IDENTIFICATION LABEL DRAWING
2. LETTER OF AUTHORIZATION
3. PHOTOGRAPHS
4. DOCUMENTATION: 2.983 (d)

    (d) ADVERTISING BROCHURE & SPECIFICATION SHEET

    (6) LIST OF ACTIVE DEVICES
    BLOCK DIAGRAM
    FREQUENCY CHART
    PARTS LISTS

    (7) SCHEMATIC DIAGRAMS (2)

    (8) OPERATING INSTRUCTIONS
    INSTALLATION INSTRUCTIONS

    (9) ALIGNMENT

    (10) DESCRIPTION OF CIRCUITRY OPERATION
    (11) CIRCUITRY SUPPRESSING S & H EMISSIONS

BY M.F.A. INC.

A. TESTIMONIAL & STATEMENT OF CERTIFICATION

B. STATEMENT OF QUALIFICATIONS

C. LIST OF TEST INSTRUMENTATION

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, Member No. 0417204 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

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

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

COMPUTER
HP 332, Compaq 286, HP 85, Commodore 64, Insight 486/33, Insight 486/50, Cote 386, Micro-1 386, HP Vectra 486/25VL

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

DIP METER
Heath HD 1250

DISTORTION ANALYZER
HP 334A; HP 8903A

ELECTRONIC COUNTER
HP 5383A: Opto-7000; Digimax D2100; 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

MODEM
Everex, Evercom 24E

MOUSE
Logitech P7-3F, 2F-9F

OPEN FIELD SITE
As filed with FCC & DOC 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 T935; HP 54502A

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 1P 2711; 1P 5220; Honda EM400 (portable gas gen.); HP 6012

PRINTER
Brother HL-8

R. F. PRESELECTOR
HP 85685A

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

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 3/S-103

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 HP 85; 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