CLASS II PERMISSIVE CHANGE
of
Type Accepted Equipment

for

AMTECH SYSTEMS CORPORATION
8600 Jefferson Street, NE
Albuquerque, NM 87113
Phone: (505)856-8054

MODEL: AI 1620

NAME: LMS Transmitter

FREQUENCY: 902-928 MHz
FCC ID: FIH 162105272

Test Date: April 30, 1998

Certifying Engineer: Scot D. Rogers

Scot D. Rogers
ROGERS CONSULTING LABS, INC.
11701 Craig
Overland Park, Kansas 66210
Phone: (913)339-6072
FAX: (913)339-6072

TABLE OF CONTENTS

FORWARD:

In accordance with the Federal Communications Code of Federal Regulations, dated October 1, 1997, Part 2 Subpart J, Paragraphs 2.905, 2.911, 2.913, 2.925, 2.926, 2.981 through 2.1005, 90.201 through 90.217, and 90.350 through 90.363; the following is submitted:

2.1001 Changes to Type Accepted Equipment

Per 2.1001(b)(2) a Class II Permissive Change is being requested for the AI 1620 (FCC ID#: FIH 162105272). The change to the unit has been in software allowing the unit to also transmit in the 902.25-903.75 MHz frequency band, along with the band already authorized. This change does not require any hardware change to the unit. The Grant of Certification issued previously is still applicable. Additional data has been taken to support the change follows in this report.

2.983 Application for Type Acceptance

a. Manufacturer: AMTECH Systems Corporation
8600 Jefferson Street, NE
Albuquerque, NM 87113

b. Identification: Model: AI 1620
FCC I.D.: FIH 162105272

c. Plan to produce quantity production.

d. (1) Emission Type:

Continuous Wave (CW).

Emission Designator. NON

(2) Frequency Range:

902.25-903.75 and 910.0-921.5 MHz.

(3) Operating Power Level:

i) 0.5 Watts
ii) 2.0 Watts
Factory Set Not Adjustable.

(4) Max P_o:

2.0 Watts

(5) Power into final amp:

+12 Vdc @ 1.5 amps (18 Watts)

(6) Refer to original Grant for function of semiconductors and other active devices.

(7) Refer to original Grant for Circuit Diagrams.

(8) Refer to original Grant for Preliminary Instruction Manual.

(9) Tune Up Procedure: Refer to original Grant.

(10) Frequency Stabilizing: Refer to original Grant.

(11) Spurious and Harmonic Suppression: Refer to original Grant.

(12) Modulation:
Not applicable. Operates CW only.

e. Measurement Procedure: Standard Engineering Practices were used in collecting the test data.

Reference Material: ANSI - 63.4-1992.

List of Test Equipment used: Refer to Appendix for Test Equipment List.

f. Refer to original Grant for Identification plate data.

g. Refer to Appendix for photos of equipment.

2.985 RF Power Output

Measurements Required:

Measurements shall be made to establish the radio frequency power delivered by the transmitter into the standard output termination. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun, except as noted below:
If the power output is adjustable, measurements shall be made for the highest and lowest power levels.

Test Arrangement:

The r.f. power output was measured at the antenna terminals by replacing the antenna with a spectrum analyzer. The spectrum analyzer had an impedance of 50Ω to match the impedance of the standard antenna. An HP 8591EM Spectrum Analyzer was used to measure the r.f. power at the antenna port. The data was taken in dBm and converted to watts as shown in the following Table. Refer to Plots 1 and 2 showing the output power of the transmitter. Data taken per Paragraph 2.985(a) and applicable parts of Part 90.

P_{dBm} = power in dB above 1 milliwatt.

$$\text{Milliwatts} = 10^{(PdBm/10)}$$

$$\text{Watts} = (\text{Milliwatts})(0.001)(W/mW)$$

Results:

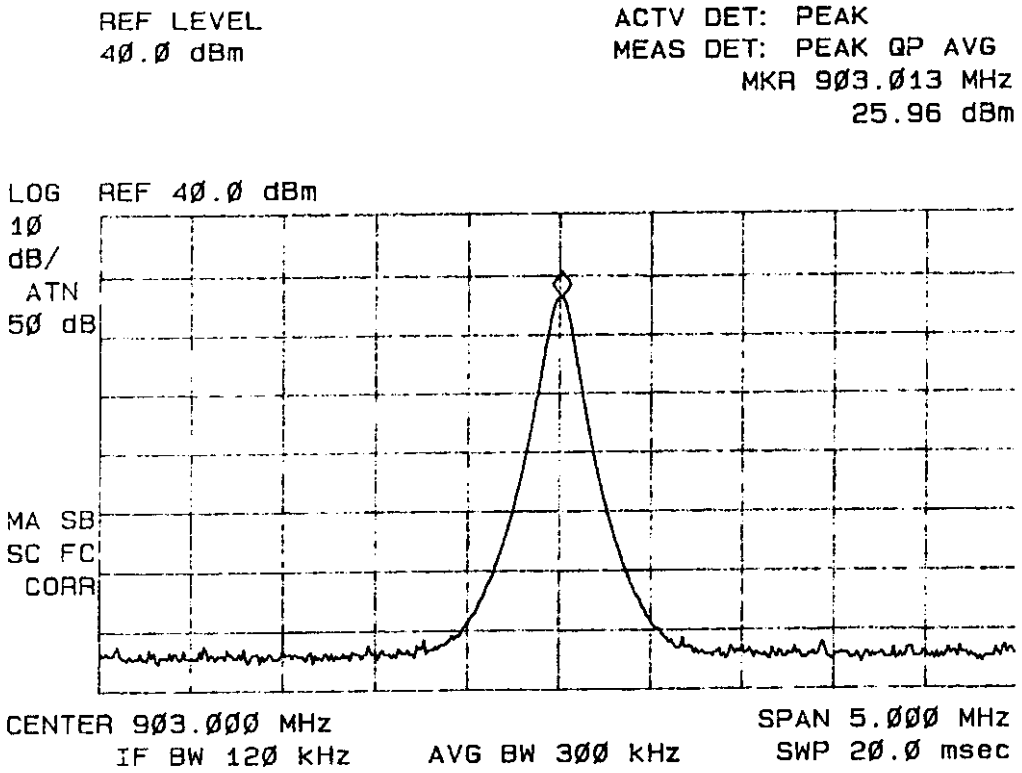
Low Power

FREQUENCY	P_{dBm}	P_{mw}	P_w
903.0	25.9	389.0	0.39

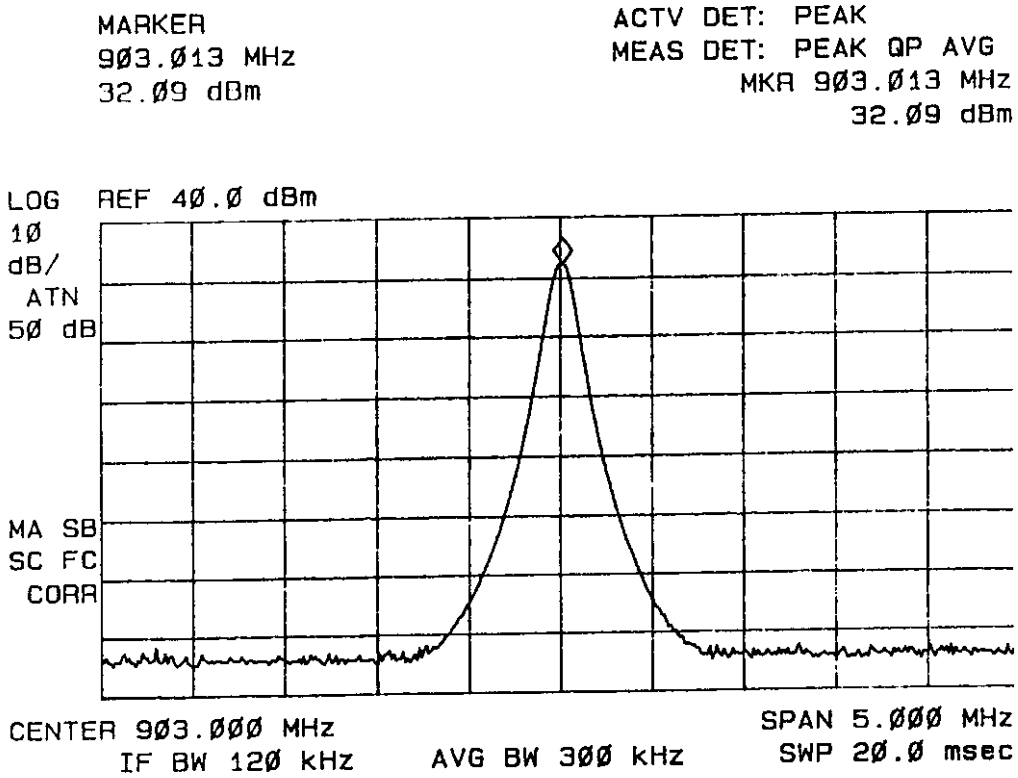
High Power

FREQUENCY	P_{dBm}	P_{mw}	P_w
903.0	32.1	1621.8	1.62

The specifications of Paragraph 2.985(a) and 90.205 are met. There are no deviations to the specifications.



Plot 1 Output of Transmitter Low Power



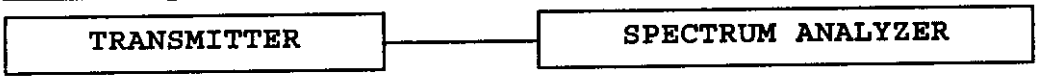
Plot 2 Output of Transmitter High Power

2.987 Modulation Characteristics

Measurements Required:

A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed shall be submitted.

Test Arrangement:



The r.f. output was coupled to a HP 8591EM Spectrum Analyzer. The spectrum analyzer was used to observe the r.f. spectrum with the transmitter operating in its normal mode.

Results:

The transmitter operates continuous wave (CW) mode only and therefore no modulation characteristics were measured. Specifications of Paragraphs 2.987(d) and 90.211 are met. There are no deviations to the specifications.

2.989 Occupied Bandwidth

Measurements Required:

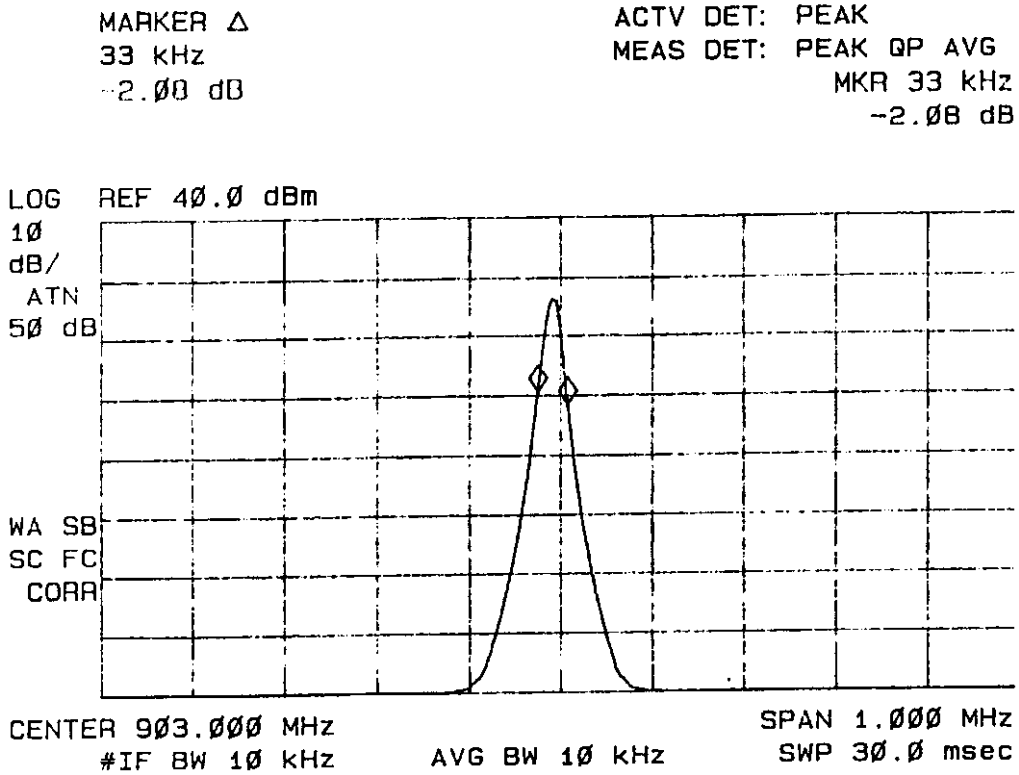
The occupied bandwidth, that is the frequency bandwidth such that below its lower and above its upper frequency limits, the mean powers radiated are equal to 0.5 percent of the total mean power radiated by a given emission. Refer to Plot 3 and 4 showing Occupied Bandwidth measurements.

Test Arrangement:

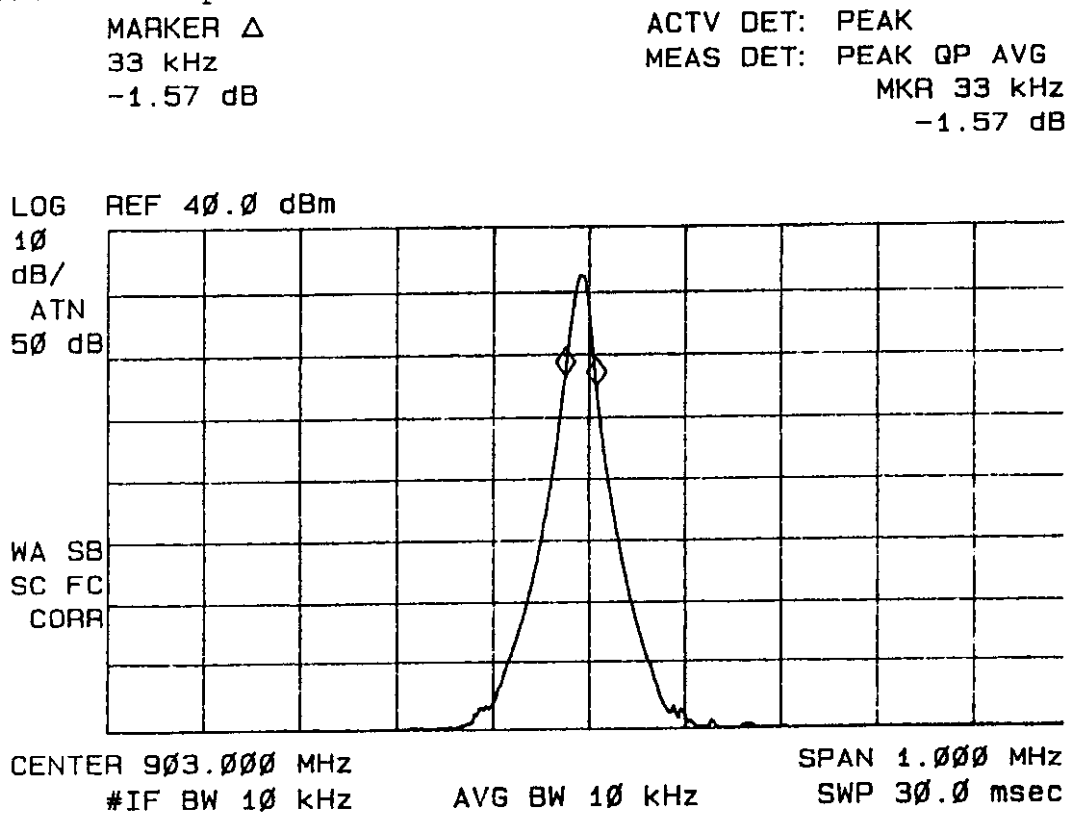
Results:

MODEL	f_o	O.B. kHz
Low Power	903.0	33
High Power	903.0	33

Requirements of 2.988 and applicable parts of Paragraph 90 are met . There are no deviations to the specifications.



Plot 3 Occupied Bandwidth Low Power



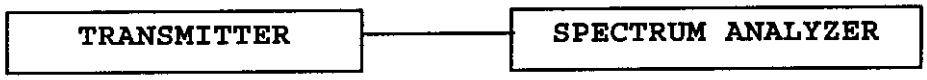
Plot 4 Occupied Bandwidth High Power

2.991 Spurious Emissions at Antenna Terminals

Measurements Required:

The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna.

Test Arrangement:



The r.f. output was coupled to an HP 8562A Spectrum Analyzer. The spectrum analyzer was used to observe the r.f. spectrum with the transmitter operating in its normal mode. The frequency spectrum from 0 to 10 GHz was observed and plots produced of the frequency spectrum. Plots 5 and 6 represent data for the low power unit and Plots 7 and 8 represent date for the high power unit. Data taken per 2.991 and applicable parts of Part 90.

Results:

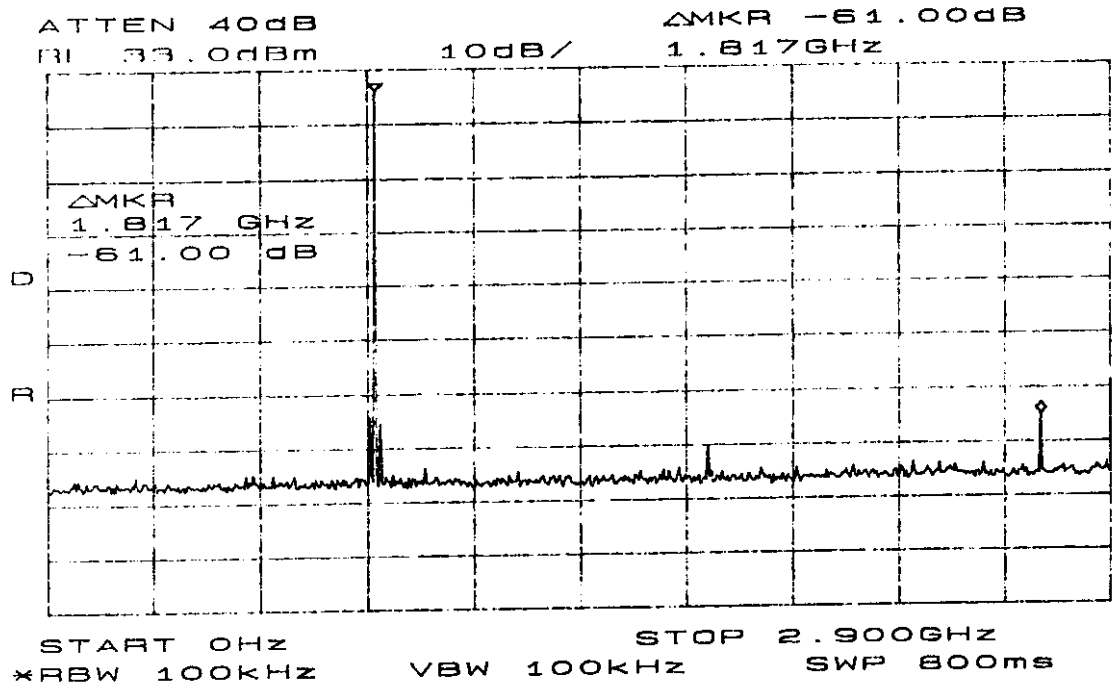
Data taken per 2.991 and applicable parts of Part 90. Specifications of Paragraphs 2.991, 2.997 and 90.211(3) are met. There are no deviations to the specifications.

Low Power

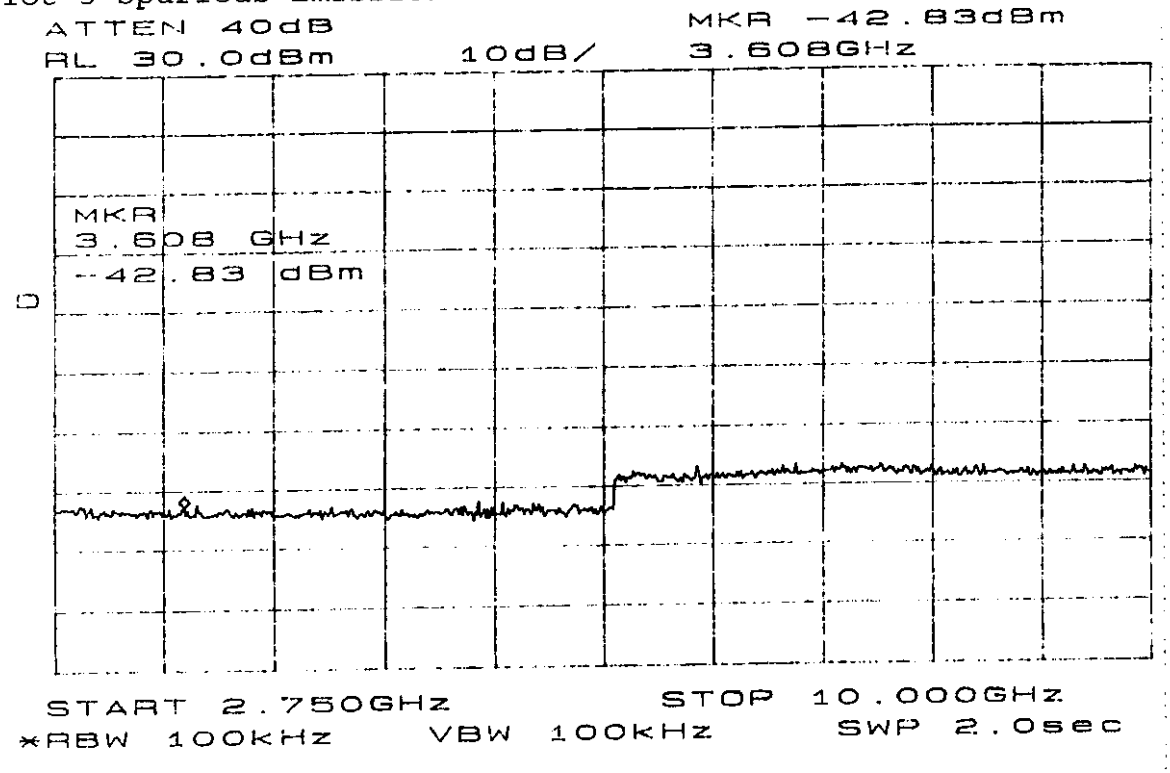
FREQUENCY MHz	SPURIOUS FREQUENCY MHz	LEVEL BELOW CARRIER (dB)
903.0 @ 25.9 dBm	1806.0	65.9
	2709.0	60.7
	3612.0	68.7

High Power

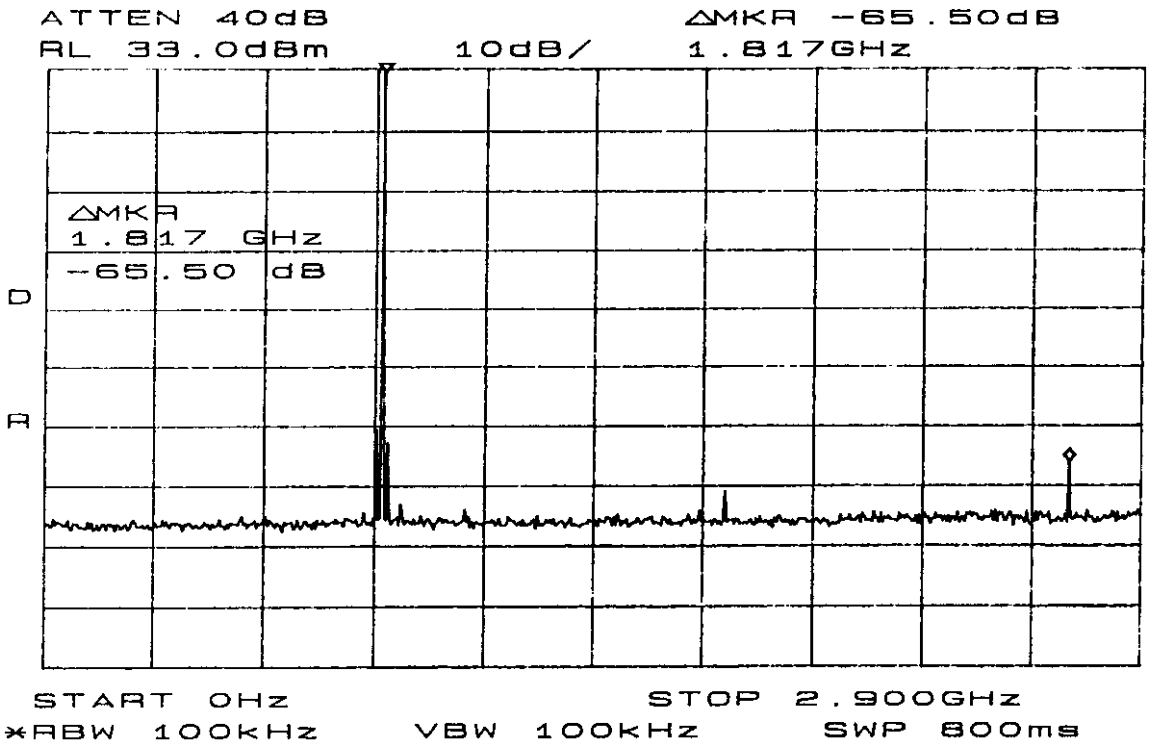
FREQUENCY MHz	SPURIOUS FREQUENCY MHz	LEVEL BELOW CARRIER (dB)
903.0 @ 32.1 dBm	1806.0	69.9
	2709.0	65.1
	3612.0	72.9



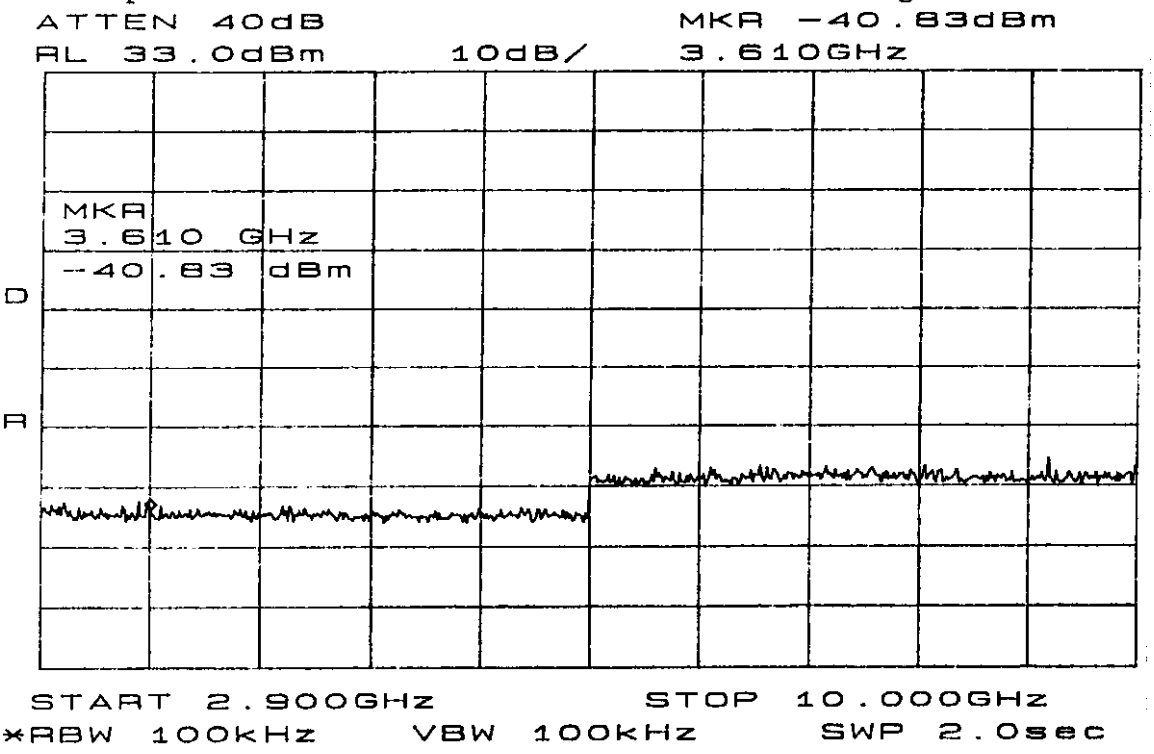
Plot 5 Spurious Emissions at Antenna Terminal Low Power



Plot 6 Spurious Emissions at Antenna Terminal Low Power



Plot 7 Spurious Emissions at Antenna Terminal High Power



Plot 8 Spurious Emissions at Antenna Terminal High Power

2.993 Field Strength of Spurious Radiation

Measurements Required:.

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation.

Test Arrangement:

The transmitter was placed on a wooden turntable 0.8 meters above the ground plane and at a distance of 3 meters from the FSM antenna. The transmitter was activated and the frequency spectrum of the fundamental was observed. The turntable was rotated though 360 degrees to locate the position registering the highest amplitude emission. The amplitude of the fundamental frequency was measured and recorded. Both horizontal and vertical polarization of the FSM antenna were investigated. The frequency spectrum was then searched for spurious emissions generated from the transmitter. The amplitude of each spurious emission was maximized by raising and lowering the FSM antenna and rotating the turntable before data was recorded. A log periodic antenna was used for frequencies of 200 MHz to 5 GHz and pyramidal horn antennas were used for frequencies of 5 GHz to 40 GHz. Emission levels were measured and recorded from the spectrum analyzer in dBµV. This level was then added to the antenna factor less the amplifier gain to calculate the field strength at 3 meters. Data was taken at the ROGERS CONSULTING LABS, INC. 3 meters open area test site (OATS) located in Paola, KS. A description of the test facility is on file with the FCC, Reference: 31040/SIT, 1300F2, dated October 15, 1996. The testing procedures used conforms to the procedures stated in the ANSI 63.4-1992 document.

Calculations made are as follows:

CFS = Calculated Field Strength

FSM = Field Strength Measurement
CFS = FSM + Antenna Factor - Amplifier Gain
CFS = 127.9 + 22.4 - 25
CFS = 125.3

The limit for emissions are defined by the following equations:

Limit = Amplitude of spurious emission must be attenuated by this amount below the level of the fundamental.

Low Power Limit $= 55 + 10 \text{ Log}_{10}(P_w)$
$= 55 + 10 \text{ Log}_{10}(0.5)$
$= 52$ dB
Limit $= 115.6 - 52$
$= 63.6$
High Power Limit $= 55 + 10 \text{ Log}_{10}(P_w)$
$= 55 + 10 \text{ Log}_{10}(2)$
$= 58$ dB
$= 122.9 - 58$
$= 64.9$

Results:

Low Power

Freq. (MHz)	FSM Hor. (dBµV)	FSM Vert. (dBµV)	Ant. Fact. (dB)	Amp. Gain (dB)	CFS Hor. dBµV/m @ 3 M	CFS Vert. dBµV/m @ 3M	Limit
903.0	127.9	118.2	22.4	25.0	125.3	115.6	--
1806.0	36.0	40.5	27.7	25.0	38.7	43.2	63.6
2709.0	40.0	40.5	33.5	25.0	48.5	49.0	63.6
3612.0	41.2	41.6	38.4	25.0	54.6	55.0	63.6
4515.0	41.0	41.7	40.8	25.0	56.8	57.5	63.6

Specifications of Paragraph 2.993, 2.997 and 90.211 are met. There are no deviations to the specifications.

High Power

Freq. (MHz)	FSM Hor. (dBµV)	FSM Vert. (dBµV)	Ant. Fact. (dB)	Amp. Gain (dB)	CFS Hor. dBµV/m @ 3 M	CFS Vert. dBµV/m @ 3M	Limit
903.0	135.0	125.5	22.4	25.0	132.4	122.9	--
1806.0	38.0	42.3	27.7	25.0	40.7	45.0	64.9
2709.0	42.0	42.8	33.5	25.0	50.5	51.3	64.9
3612.0	43.0	44.6	38.4	25.0	56.4	58.0	64.9
4515.0	43.0	45.1	40.8	25.0	58.8	60.9	64.9

Specifications of Paragraph 2.993, 2.997 and 90.211 are met. There are no deviations to the specifications.

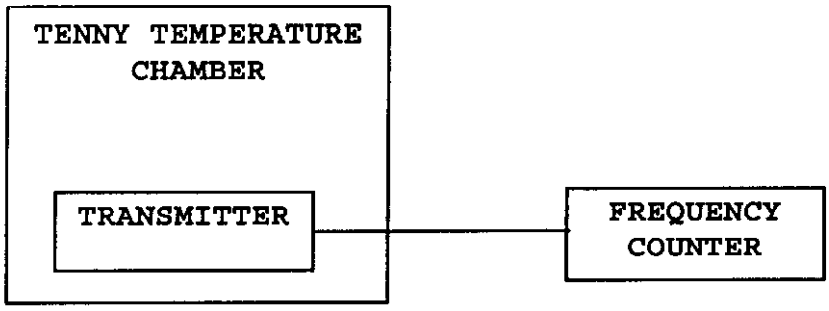
2.995 Frequency Stability

Measurements Required:

The frequency stability shall be measured with variations of ambient temperature from -30° to +50° centigrade. Measurements shall be made at the extremes of the temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. In addition to temperature stability the frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
(2) For hand carried, batteries powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.
(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided.

Test Arrangement:



The measurement procedure outlined below shall be followed:

Step 1: The transmitter shall be installed in an environmental test chamber whose temperature is controllable. Provision shall be made to measure the frequency of the transmitter.
Step 2: With the transmitter inoperative (power switched "OFF"), the temperature of the test chamber shall be adjusted to +25°C. After a temperature stabilization period of one hour at +25°C, the transmitter shall be switched "ON" with standard test voltage applied.
Step 3: The carrier shall be keyed "ON", and the transmitter shall be operated unmodulated at full r.f. power output at the duty cycle for which it is rated, for a duration of at least 5 minutes. The r.f. carrier frequency shall be monitored and measurements shall be recorded.
Step 4: The test procedures outlined in Steps 2 and 3, shall be repeated after stabilizing the transmitter at the environmental temperatures specified, -30°C to 50°C in 10 degree increments.

The frequency stability was measured with variations in the power supply voltage from 85 to 115 percent of the nominal value. An Elgar AC Power Source was used to vary the ac voltage for the power input from 102 Vac to 138 Vac. The frequency was measured and the variation in parts per million was calculated. Data was taken per Paragraphs 2.995 and 90.213.

Results:

Refer to original Grant for frequency stability.

Specifications of Paragraphs 2.995 and 90.213 are met. There are no deviations to the specifications.

APPENDIX

Model: AI 1620

1. Photos of Radiated Emissions Test Set Up
2. Test Equipment List.
3. Rogers Qualifications.
4. FCC Site Approval Letter.
5. Photos of Equipment Per 2.983(g).

TEST EQUIPMENT LIST FOR ROGERS CONSULTING LABS, INC.

The equipment is used daily and kept in good calibration and operating condition. Calibration of critical items are checked for accuracy each time used.

List of Test Equipment:	Calibration Date:
Scope: Tektronix 2230	2/98
Wattmeter: Bird 43 with Load Bird 8085	2/98
Power Supplies: Sorensen SRL 20-25, DCR 150, DCR 140	2/98
H/V Power Supply: Fluke Model: 408B (SN:573)	2/98
R.F. Generator: Boonton 102F	2/98
R.F. Generator: HP 606A	2/98
R.F. Generator: HP 8614A	2/98
R.F. Generator: HP 8640B	2/98
Spectrum Analyzer: HP 8562A, Mixers: 11517A, 11980A & 11980K HP Adapters: 11518, 11519, 11520	2/98
Spectrum Analyzer: HP 8591 EM	6/97
Frequency Counter: Weston 1255	2/98
Frequency Counter: Leader LDC 825	2/98
Antenna: EMCO Log Periodic	9/97
Antenna: BCD 235/BNC Antenna Research	9/97
Antenna: EMCO Dipole Set 3121C	2/98
Antenna: C.D. B-100	2/98
Antenna: Solar 9229-1 & 9230-1	2/98
Antenna: EMCO 6509	2/98
Microline Freq. Meter: Model 27B	2/98
Dana Modulation Meter: Model 9008	2/98
Audio Oscillator: H.P. 200CD	2/98
R.F. Power Amp 65W Model: 470-A-1000	9/97
R.F. Power Amp 50W M185- 10-500	9/97
R.F. PreAmp CPPA-102	9/97
Shielded Room 5 M x 3 M x 2.5 M (100 dB Integrity)	
LISN 50 µHy/50 ohm/0.1 µf	9/97
LISN Compliance Eng. 240/20	2/98
SCS Power Amp Model: 2350A	2/98
Power Amp A.R. Model: 10W 1000M7	2/98
Linear Amp Mini Circuits: ZHL-1A (2 Units)	2/98
Combiner Unit Mini Circuits: ZSC-2-1 (2 Units)	2/98
ELGAR Model: 1751	2/98
ELGAR Model: TG 704A-3D	2/98
ELGAR Model: 400SD (PB)	2/98
ESD Test Set 2000i	10/95
Fast Transient Burst Generator Model: EFT/B-100	10/95
Current Probe: Singer CP-105	8/97
Current Probe: Solar 9108-1N	8/97
Field Intensity Meter: EFM-018	10/95

02/01/98

QUALIFICATIONS

of

SCOT D. ROGERS, ENGINEER

ROGERS CONSULTING LABS, INC.

Mr. Rogers has approximately 10 years experience in the field of electronics. Six years working in the automated controls industry and 4 years working with the design, development and testing of radio communications and electronic equipment.

POSITIONS HELD:

Systems Engineer:	A/C Controls Mfg. Co., Inc. 6 Years
Electrical Engineer:	Rogers Consulting Labs, Inc. 4 Years

EDUCATIONAL BACKGROUND:

1) Bachelor of Science Degree in Electrical Engineering from Kansas State University.

2) Bachelor of Science Degree in Business Administration Kansas State University.

3) Several Specialized Training courses and seminars pertaining to Microprocessors and Software programming.

Scot D. Rogers

Scot D. Rogers

5/4/98

Date

1/1/98

FEDERAL COMMUNICATIONS COMMISSION

7435 Oakland Mills Road
Columbia, MD 21046
Telephone: 301-725-1585 (ext-218)
Facsimile: 301-344-2050

October 15, 1996

IN REPLY REFER TO
31040/SIT
1300F2

Rogers Consulting Labs, Inc.
11701 Craig
Overland Park, KS 66210

Attention: Scot D. Rogers

Re: Measurement facility located at Paola
(3 meter site)

Gentlemen:

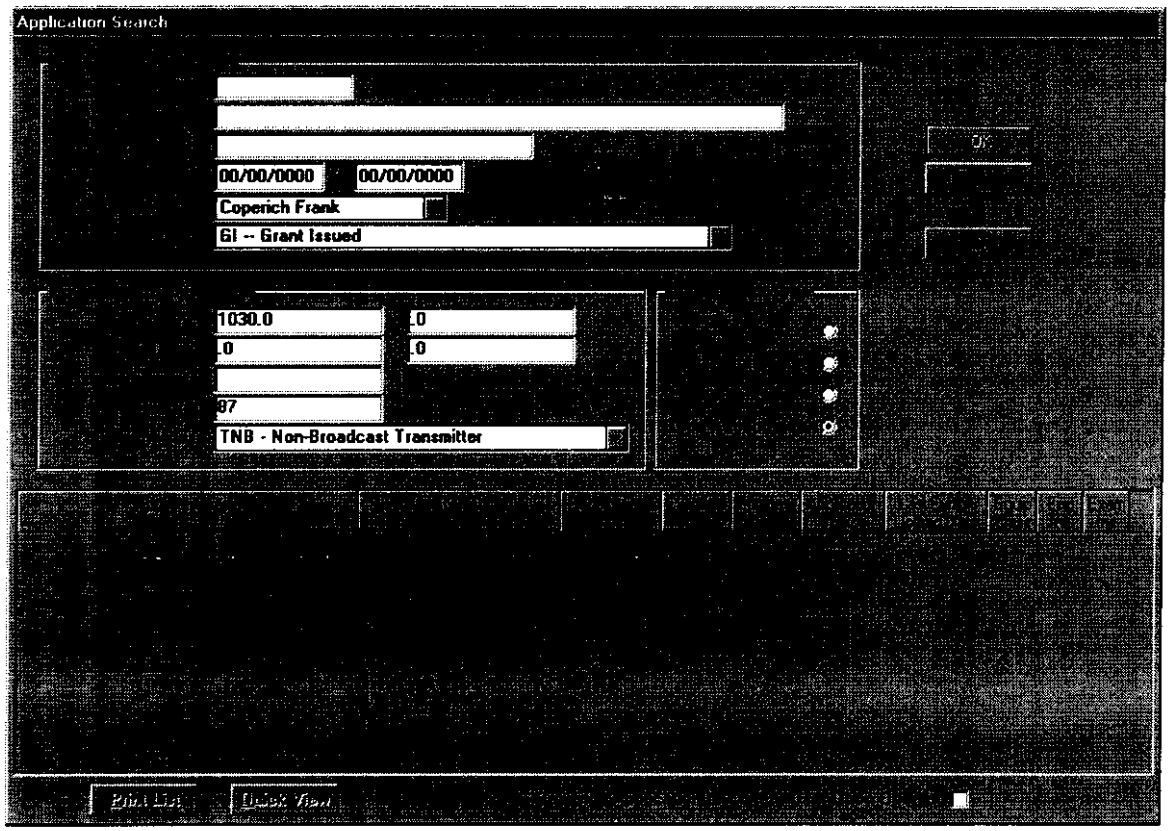
Your submission of the description of the subject measurement facility has been reviewed and found to be in compliance with the requirements of Section 2.948 of the FCC Rules. The description has, therefore, been placed on file and the name of your organization added to the Commission's list of facilities whose measurement data will be accepted in conjunction with applications for certification or notification under Parts 15 or 18 of the Commission's Rules. Our list will also indicate that the facility complies with the radiated and AC line conducted test site criteria in ANSI C63.4-1992. Please note that this filing must be updated for any changes made to the facility, and at least every three years the data on file must be certified as current.

Per your request; the above mentioned facility has been also added to our list of those who perform these measurement services for the public on a fee basis. This list is published periodically and is also available on the Laboratory's Public Access Link as described in the enclosed Public Notice.

Sincerely,

Thomas W. Phillips
Electronics Engineer
Customer Service Branch

Enclosure:
PAL PN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TNB - Non-Broadcast Transmitter
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