U.S. TECH

A TRADITION IN TESTING SERVICES

July 31, 2003

Mr. Stephen P. Hart
American Signal Company
2755 Bankers Industrial Drive
Atlanta, GA 30360

Dear Mr. Hart:

Enclosed please find American Signal Company's file copy of the FCC Part 90 Certification Report for the 10 Watt Travelers Information Station AM Radio Transmitter.

Please sign the signature page of the report and keep it in your files as proof that the product has been tested.

If you have any questions, please don't hesitate to call. Thank you for your business.

Sincerely,

Timothy R. Johnson
NARTE Certified EMC Engineer
No. EMC-002205-NE

U.S. TECH

A TRADITION IN TESTING SERVICES

American Signal Company
FCC Part 90, Certification Application
10 Watt Travelers Information Station AM Radio Transmitter

July 31, 2003

MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: **American Signal Company**

MODEL: **10 Watt Travelers Information Station AM Radio Transmitter**

FCC ID: **QDCHAR100**

DATE: **July 31, 2003**

This report concerns (check one): Original grant_X_
Class II change_____

Equipment type: **___Travelers Information Station___**

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes_____ No_X_

If yes, defer until:_____
date

__N.A.__ agrees to notify the Commission by__N.A.____
date
of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

United States Technologies, Inc.
3505 Francis Circle
Alpharetta, GA 30004

Phone Number: (770) 740-0717
Fax Number: (770) 740-1508

Report Reviewed By:

Name: __Timothy R. Johnson_____
__NARTE Certified Engineer_____
__EMC-002205-NE_____

_____

TABLE OF CONTENTS

SECTION 1

GENERAL INFORMATION

GENERAL INFORMATION

1.1 Product Description

The Equipment Under Test (EUT) is a 10 Watt AM Radio Transmitter for use under 90.242 as a Travelers Information Station. The device is a crystal controlled, solid-state, high efficiency AM transmitter. It is continuously variable from 0.1 watt to 10 watts. The device may be operated from 530 kHz to 1.7 MHz per 90.242.

The unit is manufactured by the following company:

Venture Engineering
2755 D Bankers Industrial Drive
Atlanta, GA 30360

1.2 Related Submittal(s)/Grant(s)

The EUT will be used to send audio transmissions. The transmitter presented in this report operates with typical AM radio receivers.

The EUT is subject to the following authorization:

a) Certification as a transmitter as specified by Part 90.242.

The information contained in this report is presented for the certification authorization for the EUT.

SECTION 2

TESTS AND MEASUREMENTS

TEST AND MEASUREMENTS

2.1 Configuration of Tested System

Prepared in accordance with the requirements of the FCC Rules and Regulations Part 90.242. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process. Interconnecting cables were manipulated as necessary to maximize emissions. A block diagram of the tested system is shown in Figure 1. Test configuration photographs for spurious and fundamental emissions are shown in Figure 2.

The sample used for testing was received by U.S. Technologies on November 21, 2002 in good condition. New samples were received July 25 for additional testing.

2.2 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA.

2.3 Test Equipment

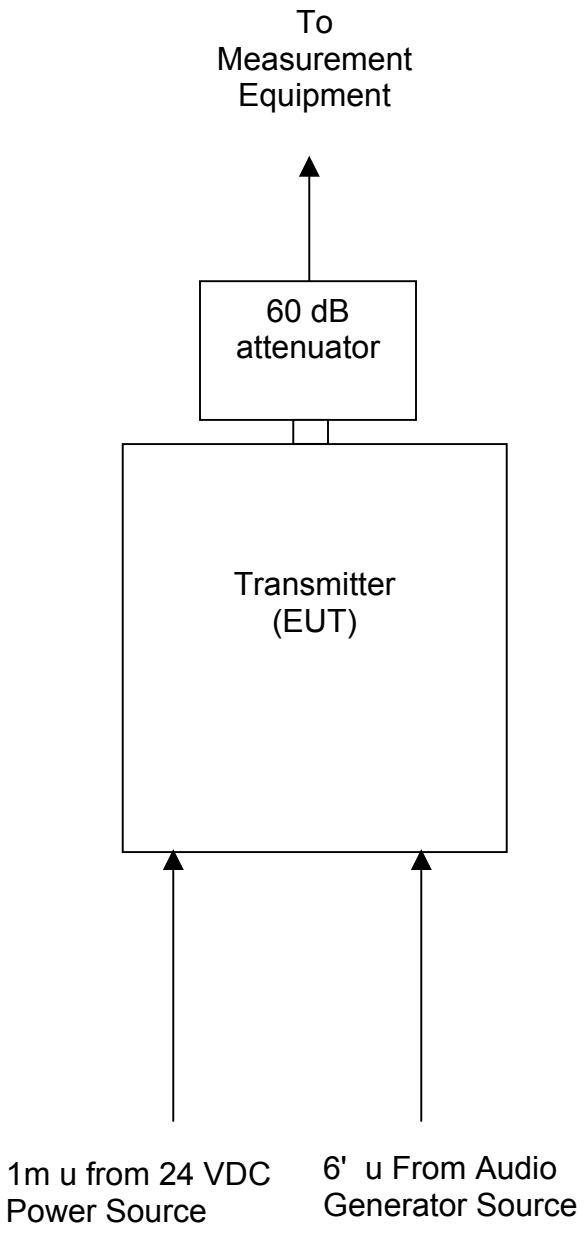
Table 2 describes test equipment used to evaluate this product.

2.4 Modifications

No modifications were made by US Tech, to bring the EUT into compliance with FCC Part 90 limits for the transmitter portion of the EUT.

FIGURE 1

TEST CONFIGURATION



Test Date: November 21, 2002
UST Project: 02-0414
Customer: American Signal Company
Model: HAR100

FIGURE 2a

Photograph(s) for Spurious Emissions

Since this test is required only for transmitters operating > 25 MHz, this test was not performed.

TABLE 1

EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
Transmitter (EUT) American Signal Company	10 Watt Travelers Information Station	Unknown	QDCHAR100 (Pending)	1m u 6' u
60 dB Attenuator Provided by American Signal Company	None	None	None	

TABLE 2
TEST INSTRUMENTS

TYPE	MANUFACTURER	MODEL	SN.
SPECTRUM ANALYZER	HEWLETT-PACKARD	8593E	3205A00124
TEMPERATURE CHAMBER	THERMOTRON	SM16	17095

Note: An external attenuator was provided by American Signal Company. Insertion Loss measurements over the frequency range measured were made by U.S. Technologies.

2.5 Antenna Description (FCC Section 90.242)

90.242(b)(3) For a station employing a cable antenna, the following restrictions apply:

(i) The length of the cable antenna shall not exceed 3.0 km (1.9 miles).
(ii) Transmitter RF output power shall not exceed 50 watts and shall be adjustable downward to enable the user to comply with the specified field strength limit.
(iii) The field strength of the emission on the operating frequency shall not exceed 2 mV/m when measured with a standard field strength meter at a distance of 60 meters (197 feet) from any part of the station.

90.242(b)(4) For a station employing a conventional radiating antenna(s) (ex. vertical monopole, directional array) the following restrictions apply:

(i) The antenna height above ground level shall not exceed 15.0 meters (49.2 feet).
(ii) Only vertical polarization of antennas shall be permitted.
(iii) Transmitter RF output power shall not exceed 10 watts to enable the user to comply with the specified field strength limit.
(iv) The field strength of the emission on the operating frequency shall not exceed 2 mV/m when measured with a standard field strength meter at a distance of 1.50 km (0.93 miles) from the transmitting antenna system.

Note: Antennas and <u>installation</u> field strength limitations are the responsibility of the Licensee and review of this information should be handled during review of the application for the station submitted by the Licensee.

2.6 RF Power Output (FCC Section 2.1046 & 90.242(b))

Peak power has been measured with a spectrum analyzer by connecting the spectrum analyzer directly via a short cable to the antenna output as specified by the manufacturer. The EUT was modulated by applying an external 2500 Hz tone at an input level 16 dB greater than that necessary to produce a 50 percent modulation. The spectrum analyzer was set for a 50 Ω impedance a RBW = 100 kHz. The results of the measurements are given in Table 3 and Figure 3a & Figure 3b.

Since the type of antenna is determined by the installation and is not the control of the manufacturer, they have selected to ensure that the power meets the more stringent limits of 90.242 (b)(4) of 10 Watts.

FCC Minimum Standard

90.242(b)(3) For a station employing a cable antenna, the following restrictions apply:

(ii) Transmitter RF output power shall not exceed 50 watts and shall be adjustable downward to enable the user to comply with the specified field strength limit.

90.242(b)(4) For a station employing a conventional radiating antenna(s) (ex. vertical monopole, directional array) the following restrictions apply:

(i) Transmitter RF output power shall not exceed 10 watts to enable the user to comply with the specified field strength limit.

(ii) The field strength of the emission on the operating frequency shall not exceed 2 mV/m when measured with a standard field strength meter at a distance of 1.50 km (0.93 miles) from the transmitting antenna system.

TABLE 3
RF POWER OUTPUT

Test Date: July 28, 2003
UST Project: 02-0414
Customer: American Signal Company
Model: HAR100

Frequency of Fundamental (MHz)	Uncorrected Measurement (dBuV)	Correction for Attenuator Insertion Loss and Cable Loss (dB)	Corrected Measurement (dBuV)	Corrected Measurement (Watt)	FCC Limit (Watt)
0.530	86.40	60.43	146.83	9.62	10.0
1.700	86.37	60.61	146.98	9.96	10.0

Tester Signature: David B. Blethen **Name:** David Blethen

Figure 3a.
RF Power Output

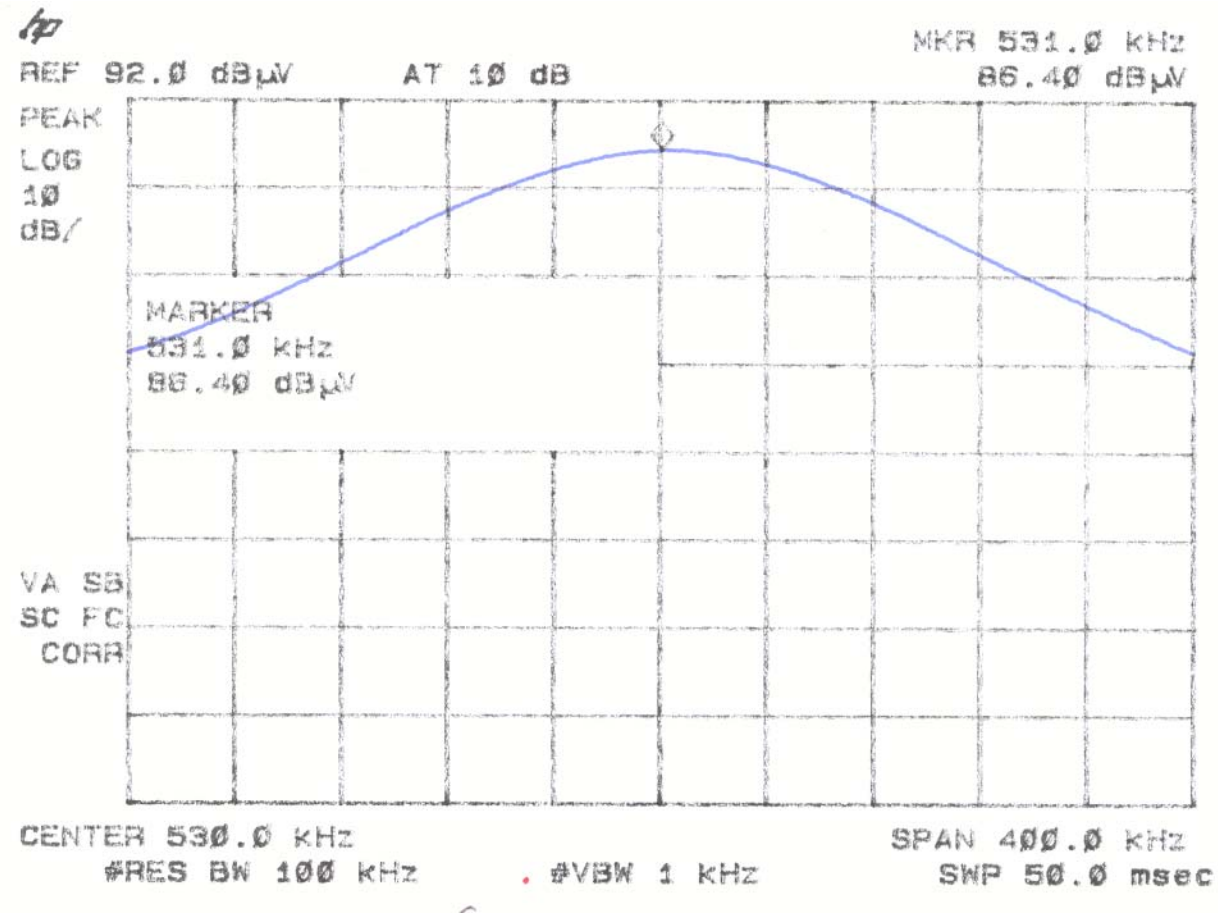
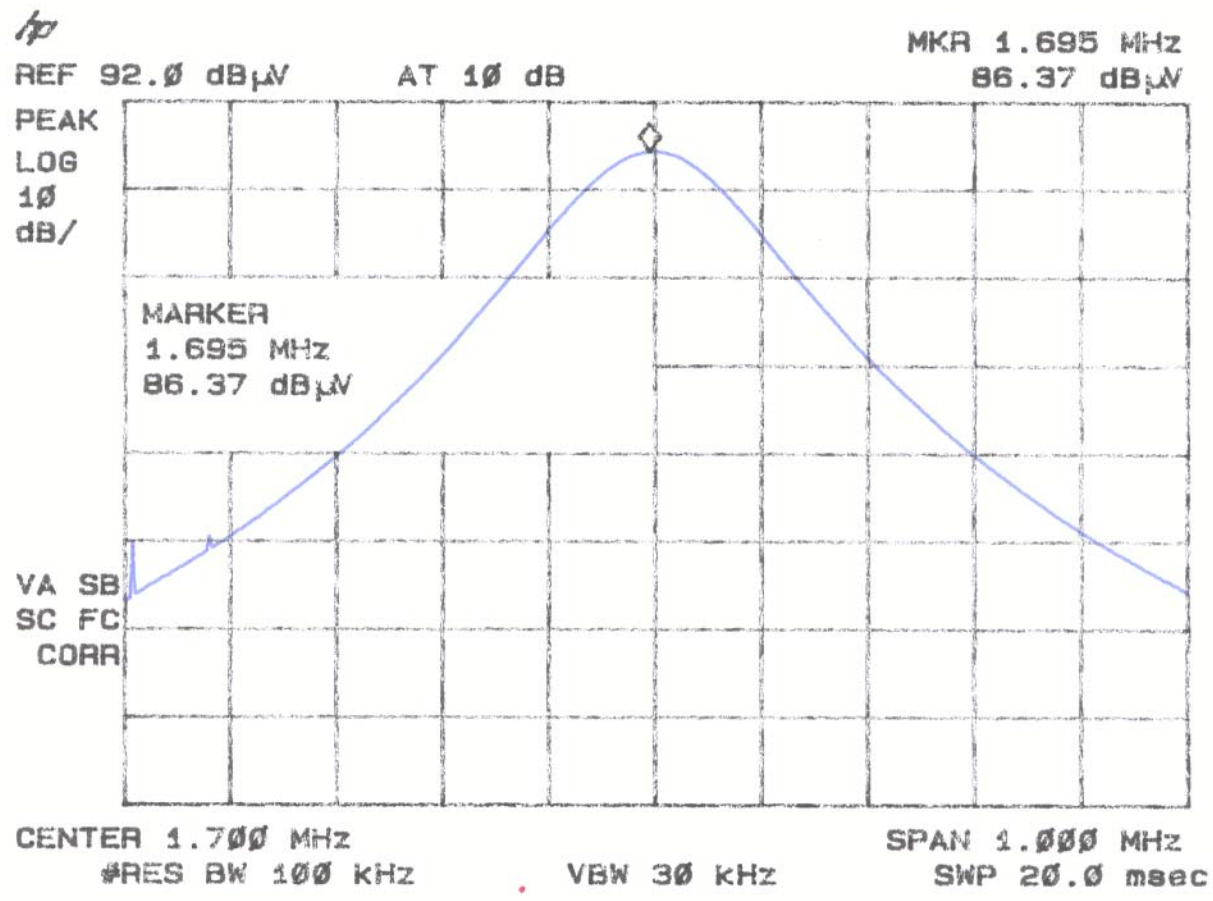


Figure 3b.
RF Power Output



2.7 Modulation Characteristics (FCC Section 2.1047 & 90.242(b)(8))

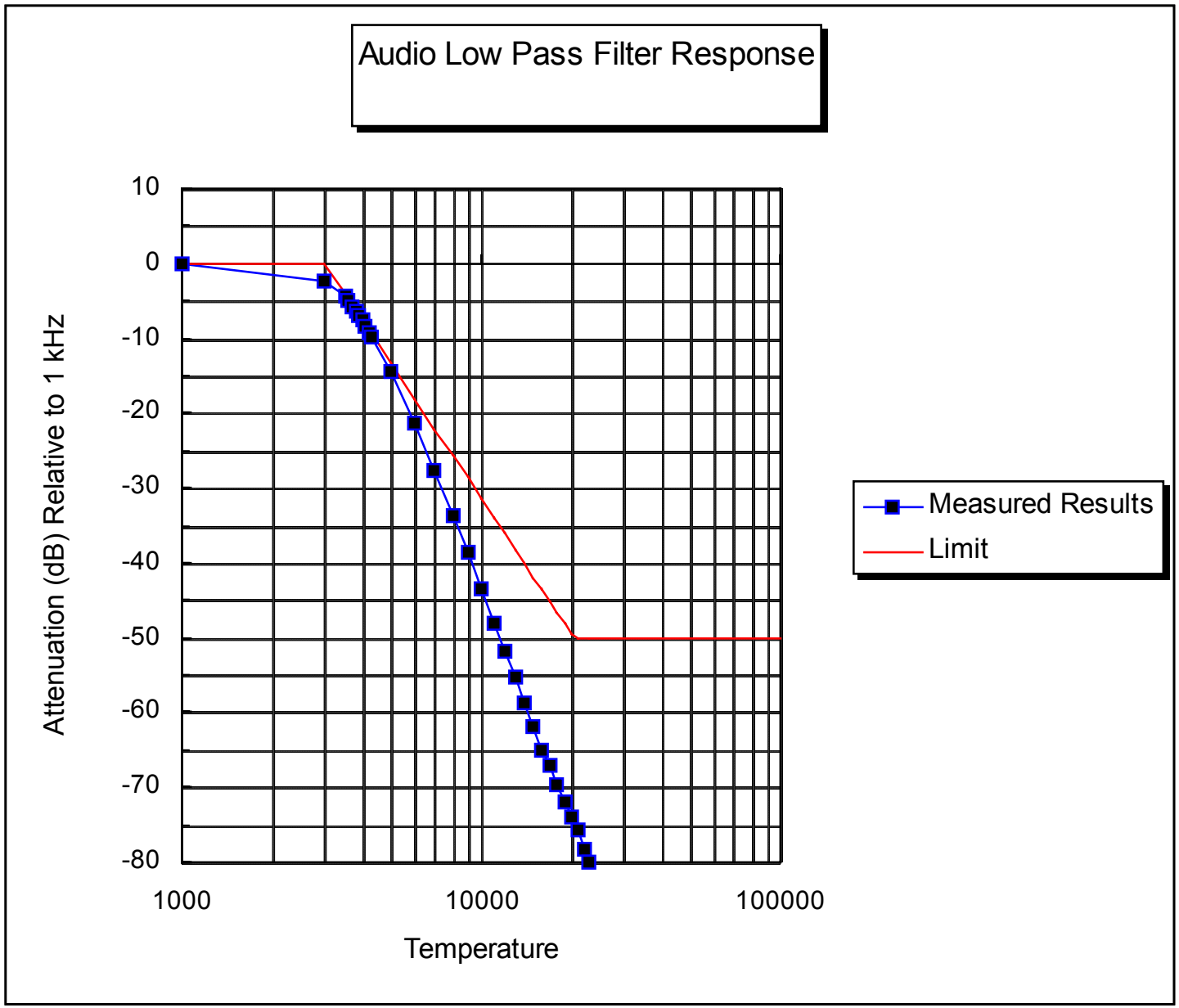
2.1047
(a) *Voice modulated communication equipment.* A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.
(b) *Equipment which employs modulation limiting.* A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.
(c) *Single sideband and independent sideband radiotelephone transmitters which employ a device or circuit to limit peak envelope power.* A curve showing the peak envelope power output versus the modulation input voltage shall be supplied. The modulating signals shall be the same in frequency as specified in paragraph (c) of § 2.1049 for the occupied bandwidth tests.
(d) *Other types of equipment.* 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.

90.242(b)(8) Each transmitter in a Travelers Information Station shall be equipped with an audio low-pass filter. Such filter shall be installed between the modulation limiter and the modulated stage. At audio frequencies between 3 kHz and 20 kHz this filter shall have an attenuation greater than the attenuation at 1 kHz by at least: 60 log10 (f/3) decibels.

where ‘‘f’’ is the audio frequency in kHz. At audio frequencies above 20 kHz, the attenuation shall be at least 50 decibels greater than the attenuation
at 1 kHz.

Please refer to the attached documentation for the Low Pass Filter used in this device.

Modulation Characteristics
Audio Low Pass Filter Response Measured

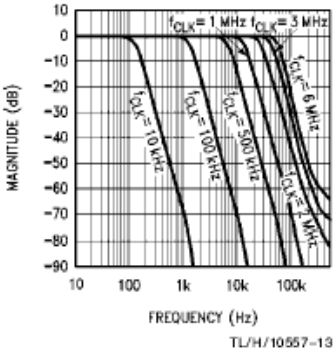


American Signal Company Model HAR100
Audio Low Pass Filter Response

Frequency (Hz)	Measured Attenuation (dB)	Min. Attenuation Limit (dB)	Margin (dB)
1000	0.0	0.00	
3000	-2.42	0.00	2.42
3500	-4.46	-4.02	0.44
3600	-5.00	-4.75	0.25
3700	-5.69	-5.46	0.23
3800	-6.37	-6.16	0.21
3900	-6.90	-6.84	0.06
4000	-7.59	-7.50	0.09
4100	-8.42	-8.14	0.28
4200	-9.21	-8.77	0.44
4300	-9.96	-9.38	0.58
5000	-14.49	-13.31	1.18
6000	-21.35	-18.06	3.29
7000	-27.79	-22.08	5.71
8000	-33.70	-25.56	8.14
9000	-38.67	-28.63	10.04
10000	-43.42	-31.37	12.05
11000	-47.99	-33.86	14.13
12000	-51.83	-36.12	15.71
13000	-55.39	-38.21	17.18
14000	-58.72	-40.14	18.58
15000	-61.83	-41.94	19.89
16000	-64.95	-43.62	21.33
17000	-67.01	-45.20	21.81
18000	-69.56	-46.69	22.87
19000	-71.84	-48.10	23.74
20000	-74.07	-49.43	24.64
21000	-75.67	-50.00	25.67
22000	-78.27	-50.00	28.27
23000	-79.97	-50.00	29.97

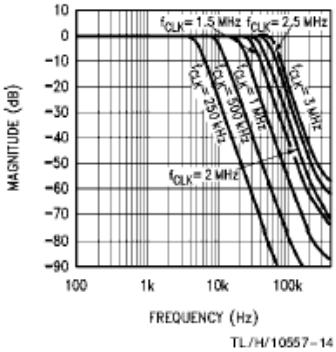
Modulation Characteristics
Audio Low Pass Filter Response from Manufacturer

2.0 Designing with the LMF40 (Continued)



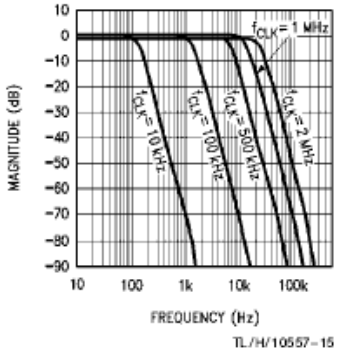
TL/H/10557–13

FIGURE 5a. LMF40-100 Amplitude Response with ±5V Supplies



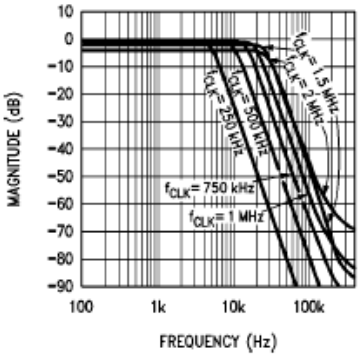
TL/H/10557–14

FIGURE 5b. LMF40-50 Amplitude Response with ±5V Supplies



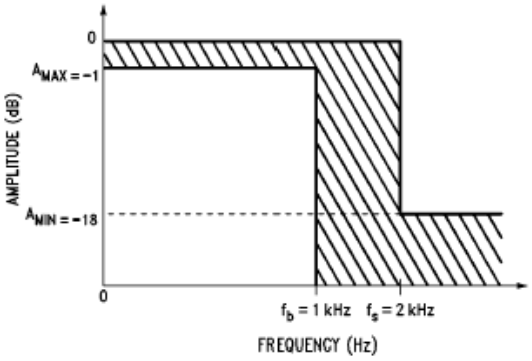
TL/H/10557–15

FIGURE 5c. LMF40-100 Amplitude Response with ±2.5V Supplies



TL/H/10557–16

FIGURE 5d. LMF40-50 Amplitude Response with ±2.5V Supplies



TL/H/10557–17

FIGURE 6. Design Example Magnitude Response Specification. The response of the filter design must fall within the shaded area of the specification.

2.8 Occupied Bandwidth (FCC Section 2.1049 & 90.210)

The bandwidth of the fundamental was measured using a spectrum analyzer. The EUT was modulated by applying an external 2500 Hz tone at an input level 16 dB greater than that necessary to produce a 50 percent modulation. Results are shown in Figure 5a through Figure 5b.

FCC Minimum Standard (FCC Section 90.210)

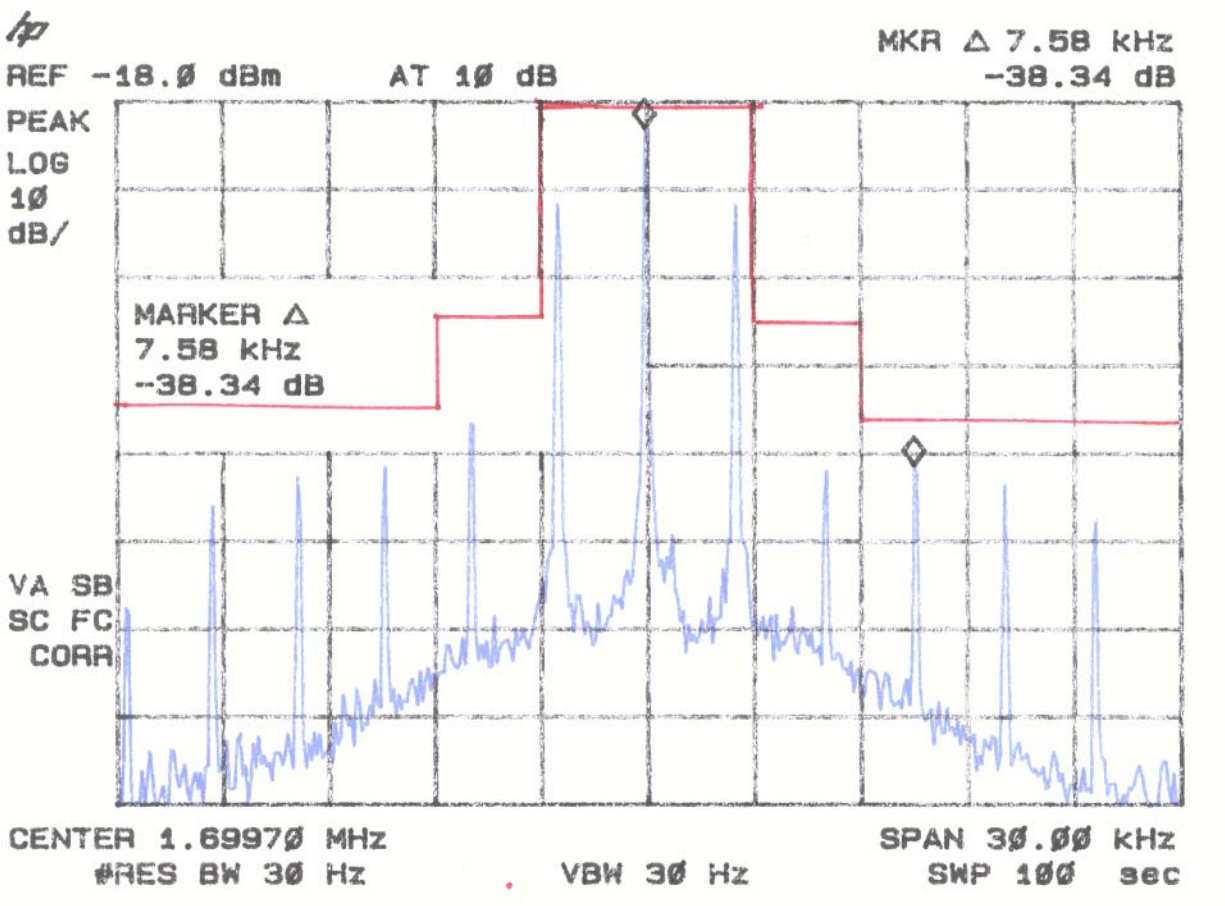
90.210(b) *Emission Mask B.* For transmitters that are equipped with an audio lowpass filter pursuant to § 90.211(a), the power of any emission must be below the unmodulated carrier power (P) as follows:

(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.

(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.

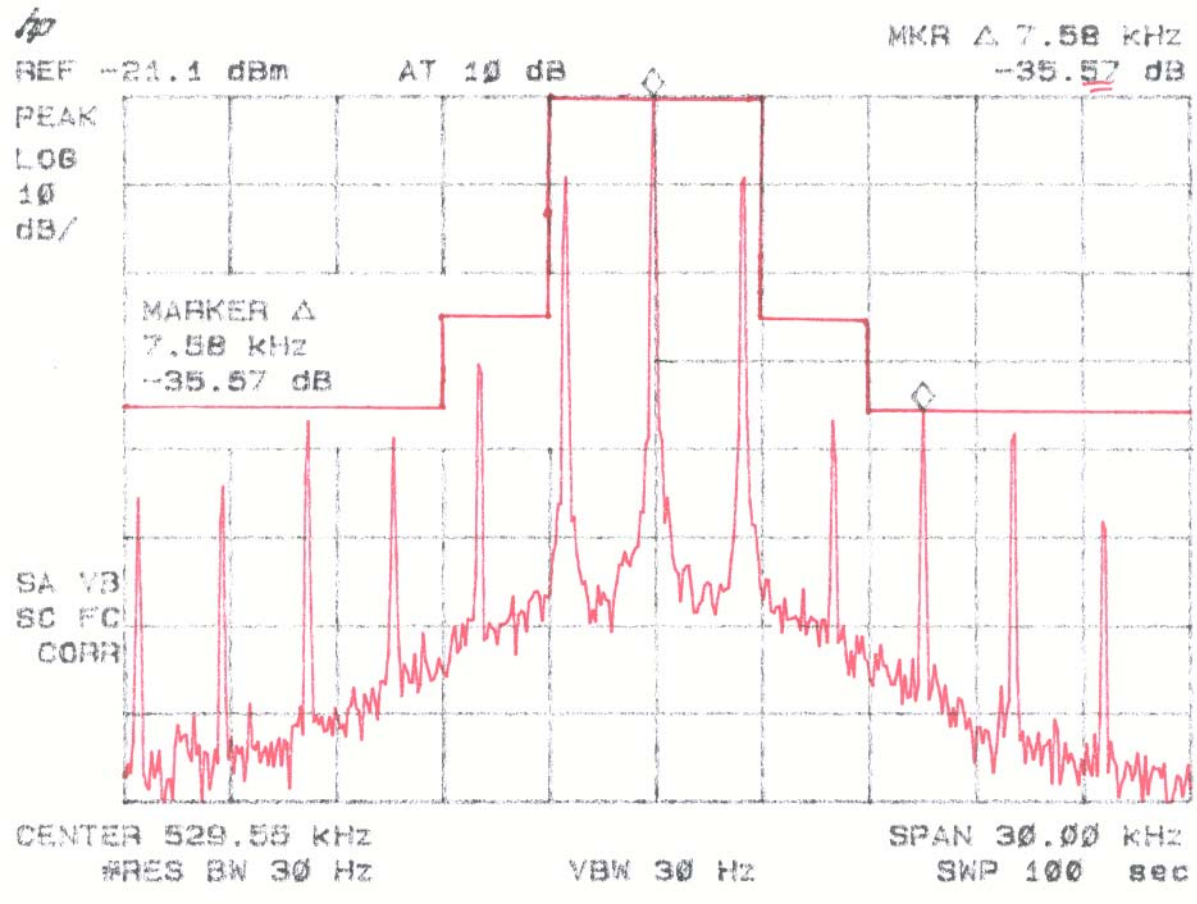
(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

Figure 5a.
Occupied Bandwidth (1700 kHz TX)



The reference line was unaffected by modulated vs. unmodulated output.

Figure 5b.
Occupied Bandwidth (530 kHz TX)



The reference line was unaffected by modulated vs. unmodulated output.

2.9 Spurious Emissions at Antenna Terminals (FCC Section 2.1051 & 90.210)

Spurious emissions appearing at the antenna terminals were measured with a spectrum analyzer by connecting the spectrum analyzer directly via a short cable to the antenna output terminals as specified by the manufacturer. The EUT was modulated by applying an external 2500 Hz tone at an input level 16 dB greater than that necessary to produce a 50 percent modulation. Results are shown in Tables 4a & 4b.

FCC Minimum Standard (FCC Section 90.210)

90.210(b) *Emission Mask B.* For transmitters that are equipped with an audio lowpass filter pursuant to § 90.211(a), the power of any emission must be below the unmodulated carrier power (P) as follows:

(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.

(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

Table 4a
Spurious Emissions at Antenna Terminals

Limit = 43 + 10 log P = -13 dBm
Transmit Channel = 1700 kHz

Freq. (MHz)	Conducted Measurement (dBm)	Correction Attenuator + Cable Loss	Corrected Measurement (dBm)	Attenuated Level Below Carrier Power (dB)
3.3973	-76.08	60.84	-15.24	2.24
5.0985	-73.64	59.99	-13.65	0.65

Test Date: July 28, 2003

Tester Signature:  **Name: David Blethen**

Table 4b
Spurious Emissions at Antenna Terminals

Limit = 43 + 10 log P = -13 dBm
Transmit Channel = 530 kHz

Freq. (MHz)	Conducted Measurement (dBm)	Correction Attenuator + Cable Loss	Corrected Measurement (dBm)	Attenuated Level Below Carrier Power (dB)
1.0622	-77.06	60.92	-16.54	3.54
1.5895	-86.45	60.23	-26.22	13.22
29.671	-87.28	53.81	-33.47	20.47

Test Date: July 28, 2003

Tester Signature:  **Name: David Blethen**

2.10 Field Strength of Spurious Radiation (FCC Section 2.1053)

This test in is only required on equipment with operating frequencies higher that 25 MHz per FCC 2.1053(b)(2). Since this device operates only on frequencies < 25 MHz, this test was deemed unnecessary.

2.11 Frequency Stability (FCC Section 2.1055 & 90.213)

The frequency tolerance of the carrier signal was measured by while ambient temperature was varied from -30 to 50 degrees centigrade. The frequency tolerance was verified at 10 degree increments at nominal input power. Additionally, the supply voltage was varied from 85% to 115% of the nominal value (except for hand carried, battery powered equipment which was additionally measured at battery endpoint) at 20 degrees C. The data is shown in the following tables and figures.

Since the EUT is designed for constant operation without shutting off, this device was stabilized while powered on. However to ensure proper stabilization, longer soak cycles were employed. Additionally, evaluation over 2, 5, and 10 minute duration was deemed unnecessary for this device.

FCC Minimum Standard

100 Hz (FCC 90.242(b)(2))

FCC Certification
American Signal Company Model HAR100
Frequency Stability vs. Temperature

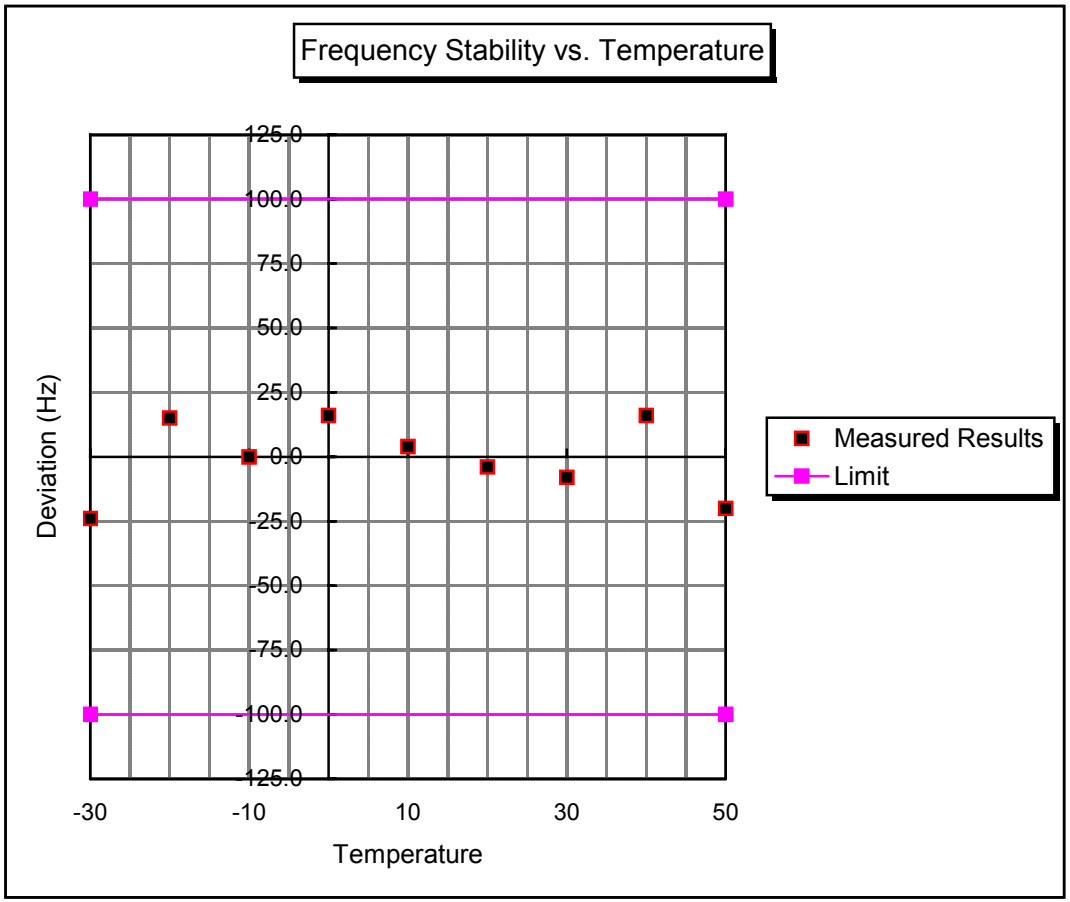
Test Results Reviewed By:

Timothy R. Johnson
NARTE Certified Engineer

Temperature (degrees C)	Measured Frequency (MHz)	Deviation (Hz)
-30	1.699976	-24.0
-20	1.700015	15.0
-10	1.700000	0.0
0	1.700016	16.0
10	1.700004	4.0
20	1.699996	-4.0
30	1.699992	-8.0
40	1.700016	16.0
50	1.699980	-20.0

Actual TX Frequency: 1.700 MHz

Maximum Deviation = 100 Hz



FCC Certification
American Signal Company Model HAR100
Frequency Stability vs. Voltage

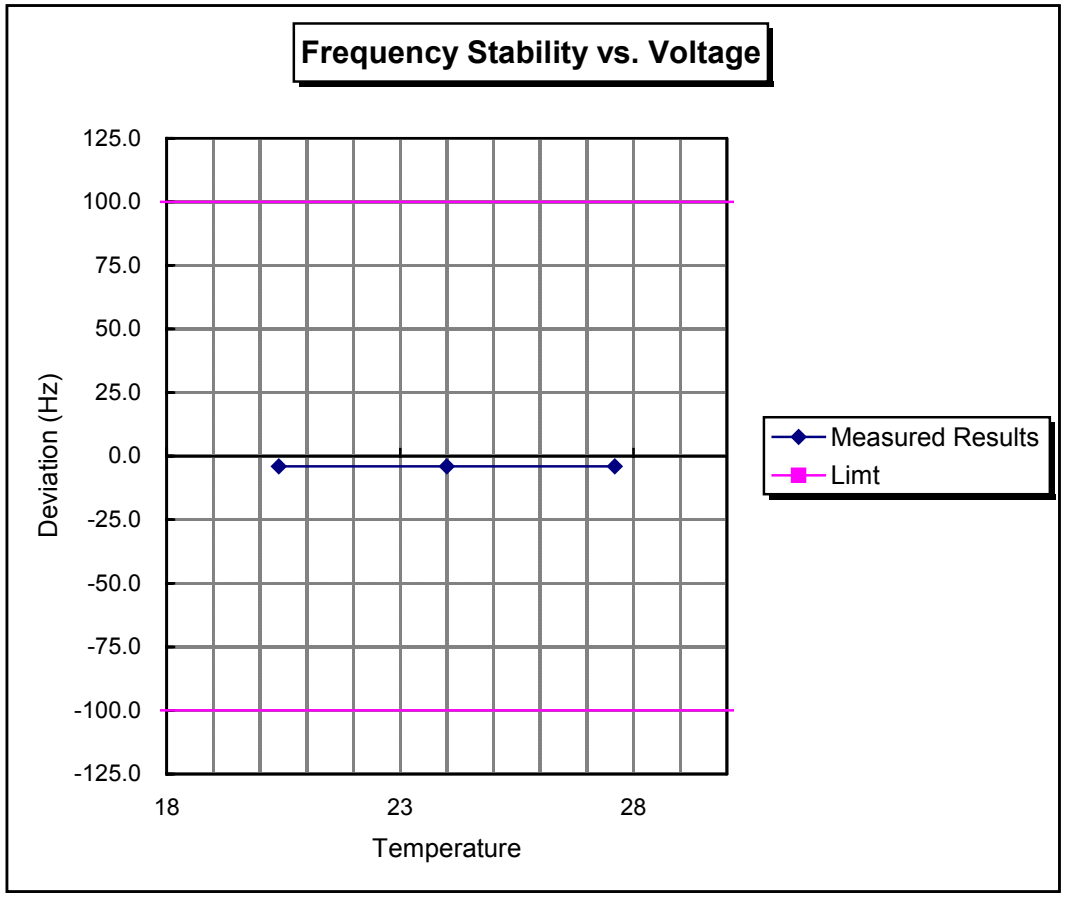
Test Results Reviewed By:

Tim Johnson
NARTE Certified Engineer

Voltage (V DC)	Measured Frequency (MHz)	Deviation (Hz)
20.4	1.699996	-4.0
24	1.699996	-4.0
27.6	1.699996	-4.0

Actual TX Frequency was: 1.700 MHz

Maximum Deviation = 100 Hz



2.12 Emissions Type (47 CFR Section 2.201, 2.202, 90.207, & 90.242(b))

90.242(b) *Technical standards.* (1) The use of 6K00A3E emission will be authorized, however N0N emission may be used for purposes of receiver quieting, but only for a system of stations employing ‘‘leaky’’ cable antennas.

Basic Description of Transmitter Emissions

The transmitter utilizes is Amplitude Modulated using a standard analog audio input for reception of AM signals by standard AM radios. Therefore the emissions designator is A3E.

Necessary Bandwidth Calculations (2.202)

Necessary Bandwidth = 2M, where M = 3000

Necessary Bandwidth = 2 * 3000 = 6000

Emissions Designator (2.201/90.207)

6K00A3E

2.13 Transient Frequency Behavior (47 CFR 90.214)

This test is only necessary for transmitters designed for operation in the 150-174 MHz and 421-512 MHz bands. Therefore this test has not been performed.