

Nemko Test Report: 2L0612RUS1

Applicant: EMR Corporation
5 Circle Freeway Drive
Cincinnati, OH 45246

Equipment Under Test: 264424C Series
(E.U.T.)

In Accordance With: FCC Part 90, Subpart I & Part 22, Subpart E
Amplifier

Tested By: Nemko Dallas Inc.
802 N. Kealy

Authorized By:



Tom Tidwell, Frontline Manager

Date: 5/6/03

Total Number of Pages: 27

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Section 1. Summary of Test Results

Manufacturer: EMR Corporation

Model No.: 264424C

Serial No.: None

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 90, Subpart I and Part 22, Subpart E.

| | | | |
|-------------------------------------|----------------------------|-------------------------------------|---------------------|
| <input checked="" type="checkbox"/> | New Submission | <input checked="" type="checkbox"/> | Production Unit |
| <input type="checkbox"/> | Class II Permissive Change | <input type="checkbox"/> | Pre-Production Unit |
| A M P | Equipment Code | | |

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE. NONE

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Summary Of Test Data

| RF Power Output | 90.205 22.565 | Complies |
|--|-----------------------|----------|
| Audio Frequency Response | TIA EIA- 603.3.2.6 | N/A |
| Audio Low-Pass Filter Response | TIA EIA- 603.3.2.6 | N/A |
| Modulation Limiting | TIA EIA- 603.3.2.6 | N/A |
| Occupied Bandwidth | 90.210 22.561 | Complies |
| Spurious Emissions at Antenna Terminals | 90.210 | Complies |
| Field Strength of Spurious Emissions | 90.210 | Complies |
| Frequency Stability | 90.213 | N/A |
| Transient Frequency Behavior | 90.214 | N/A |

Footnotes For N/A's:

- (1) Since the E.U.T. does not contain modulation circuitry modulation testing was not performed.
- (2) Since the E.U.T. is not a keyed carrier system, Transient Frequency Behavior was not performed.
- (3) Since the E.U.T. processes but does not produce a signal, frequency stability was not tested.

Section 2. General Equipment Specification

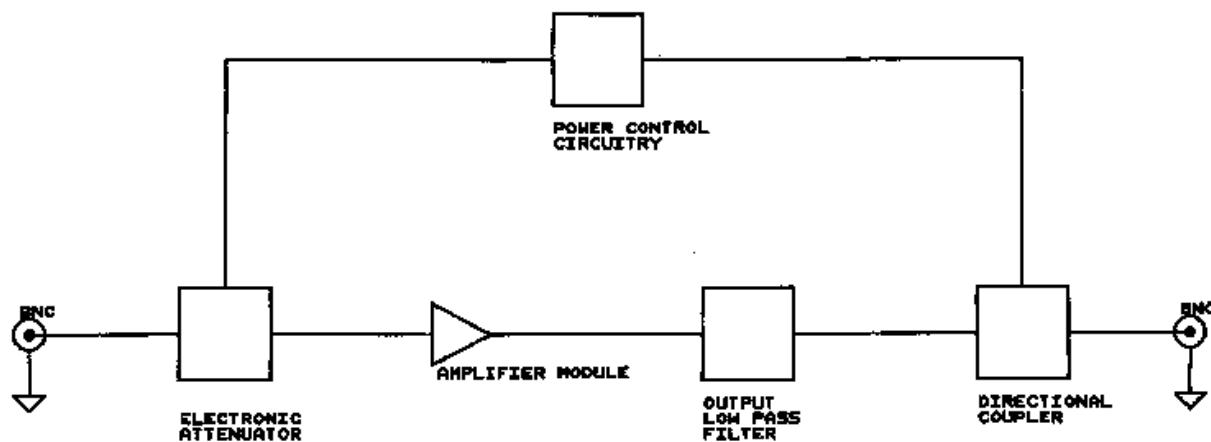
Transmitter

| | | | | | | |
|---|-------------------------------------|---|--------------------------|--------------------------|--------------------------|--|
| Supply Voltage Input: | 13.6 Vdc | | | | | |
| Frequency Range: | 150.0105 to 174.9895 MHz | | | | | |
| Type(s) of Modulation: | F3E | F1D | F2D | D7W (QAM) | Other | |
| | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Emission Designator: | 25K0F3E | | | | | |
| Output Impedance: | 50 ohms | | | | | |
| RF Power Output (rated): | Single: Composite: | 6 Watts N/A <i>(The EUT will have channel filters installed upon installation)</i> | | | | |
| Operator Selection of Operating Frequency: | Channel filter (end user) | | | | | |
| Power Output Adjustment Capability: | None | | | | | |
| Frequency Translation: | F1-F1 | F1-F2 | N/A | | | |
| | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | |
| Band Selection: | Software | Duplexer Change | Fullband Coverage | | | |
| | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | | |

Theory of Operation

The 264424C Series of EMR amplifiers are intended for use in low power amplification and reamplification systems. Applications include land mobile radio bi- and uni directional signal booster systems.

System Diagram



Section 3. RF Power Output

| | |
|-------------------------------|-------------------|
| NAME OF TEST: RF Power Output | PARA. NO.: 2.1046 |
| TESTED BY: David Light | DATE: 4/21/03 |

Test Results: Complies.**Measurement Data:**

| Frequency (MHz) | Measured Power (dBm/Watts) | Rated Power (dBm/Watts) |
|--------------------|-------------------------------|----------------------------|
| 162.5 | 37.8 / 6.0 | 37.8 / 6.0 |

Note- Tested at +/- 15% voltage variation with no effect on output power.

Test equipment used: 1036**Measurement uncertainty:** +/- 1.7 dB**Temperature:** 22°C**Relative humidity:** 40%

Section 4. Occupied Bandwidth

| | |
|----------------------------------|-------------------|
| NAME OF TEST: Occupied Bandwidth | PARA. NO.: 2.1049 |
| TESTED BY: David Light | DATE: 4/21/03 |

Test Results: Complies.**Test Data:** See attached graph(s).**Test equipment used:** 1036-1604-1064-1627**Measurement uncertainty:** +/- 1.7 dB**Temperature:** 22°C**Relative humidity:** 40%

Test Data – Occupied Bandwidth



Nemko Dallas, Inc.

Dallas Headquarters:

 802 N. Kealy
 Lewisville, TX 75057
 Tel: (972) 436-9600
 Fax: (972) 436-2667

| Data Plot | | Occupied Bandwidth | | |
|--|----------------------|-----------------------|-------------|----------------|
| Page 1 of 2 | | | | |
| Job No.: | 2L0612R | Date: | 1/8/2003 | |
| Specification: | Parts 22 & 90 | Temperature(°C): | 22 | |
| Tested By: | David Light | Relative Humidity(%): | 40 | |
| E.U.T.: | VHF 6 WATT AMPLIFIER | | | |
| Configuration: | Tx full power | | | |
| Sample Number: | 1 | | | |
| Location: | Lab 1 | | RBW: | Refer to plots |
| Detector Type: | Peak | | VBW: | Refer to plots |
| | | | Measurement | Distance: NA m |
| Test Equipment Used | | | | |
| Antenna: | Directional Coupler: | | | |
| Pre-Amp: | Cable #1: 1627 | | | |
| Filter: | Cable #2: | | | |
| Receiver: | Cable #3: 1036 | | | |
| Attenuator #1 | Cable #4: | | | |
| Attenuator #2: | Mixer: 1064 | | | |
| Additional equipment used: | | | | |
| Measurement Uncertainty: +/- 1.7 dB | | | | |
| | | | | |
| Ref Lvl 40 dBm 40 dBm RBW 300 Hz VBW 300 Hz SWT 3.5 s Unit dBm | | | | |
| | | | | |
| 39.6 dB Offset 162.5 MHz 6.25 kHz Span 62.5 kHz | | | | |
| 1 View 1 MA EXT | | | | |
| Date: 08.JAN.2003 14:15:44 | | | | |
| Notes: OUTPUT SIGNAL 2.5 kHz Input w/ 3 kHz Deviation | | | | |

Test Data – Occupied Bandwidth



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Nemko Dallas, Inc.

Data Plot **Occupied Bandwidth**

Page 2 of 2

Job No.: 2L0612R Date: 1/8/2003

Specification: Parts 22 & 90 Temperature(°C): 22

Tested By: David Light Relative Humidity(%) 40

E.U.T.: VHF 6 WATT AMPLIFIER

Configuration: Tx full power

Ref Lvl
-19.6 dBm

RBW 300 Hz RF Att 10 dB
VBW 300 Hz
SWT 3.5 s Unit dBm

19.6

-30

-40

-50

-60

-70

-80

-90

-100

-110

-119

162.5 MHz

6.25 kHz

Span 62.5 kHz

1 VIEW

EXT

Date: 08.JAN.2003 14:19:03

Notes: INPUT SIGNAL

Section 5. Spurious Emissions at Antenna Terminals

| | |
|--|-------------------|
| NAME OF TEST: Spurious Emissions @ Antenna Terminals | PARA. NO.: 2.1051 |
| TESTED BY: David Light | DATE: 4/21/03 |

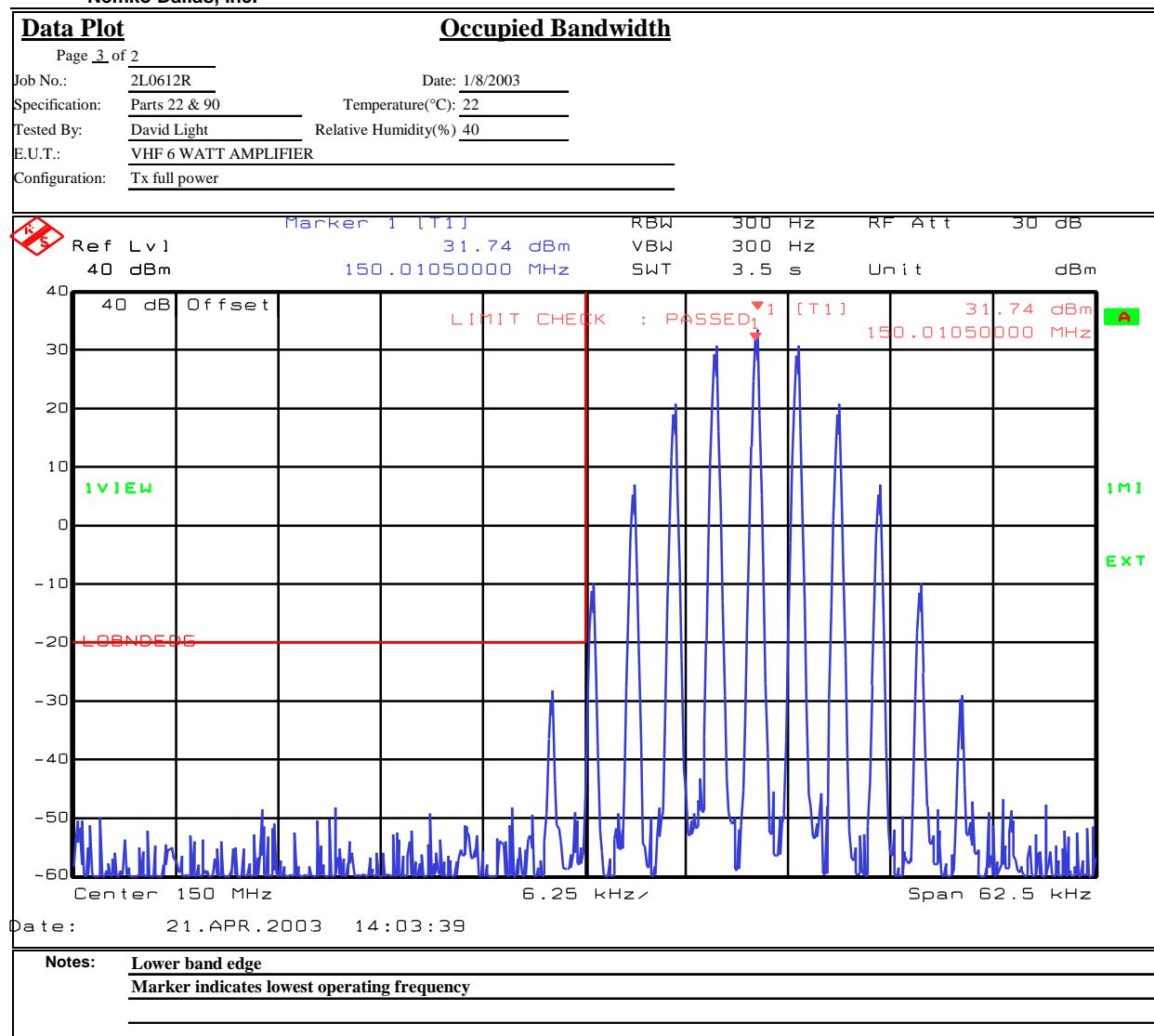
Test Results: Complies.**Test Data:** See attached graph(s).**Test equipment used:** 1036-1604-1064-1627**Measurement uncertainty:** +/- 1.7 dB**Temperature:** 22°C**Relative humidity:** 40%

Test Data – Spurious Emissions at Antenna Terminals



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Dallas Headquarters:

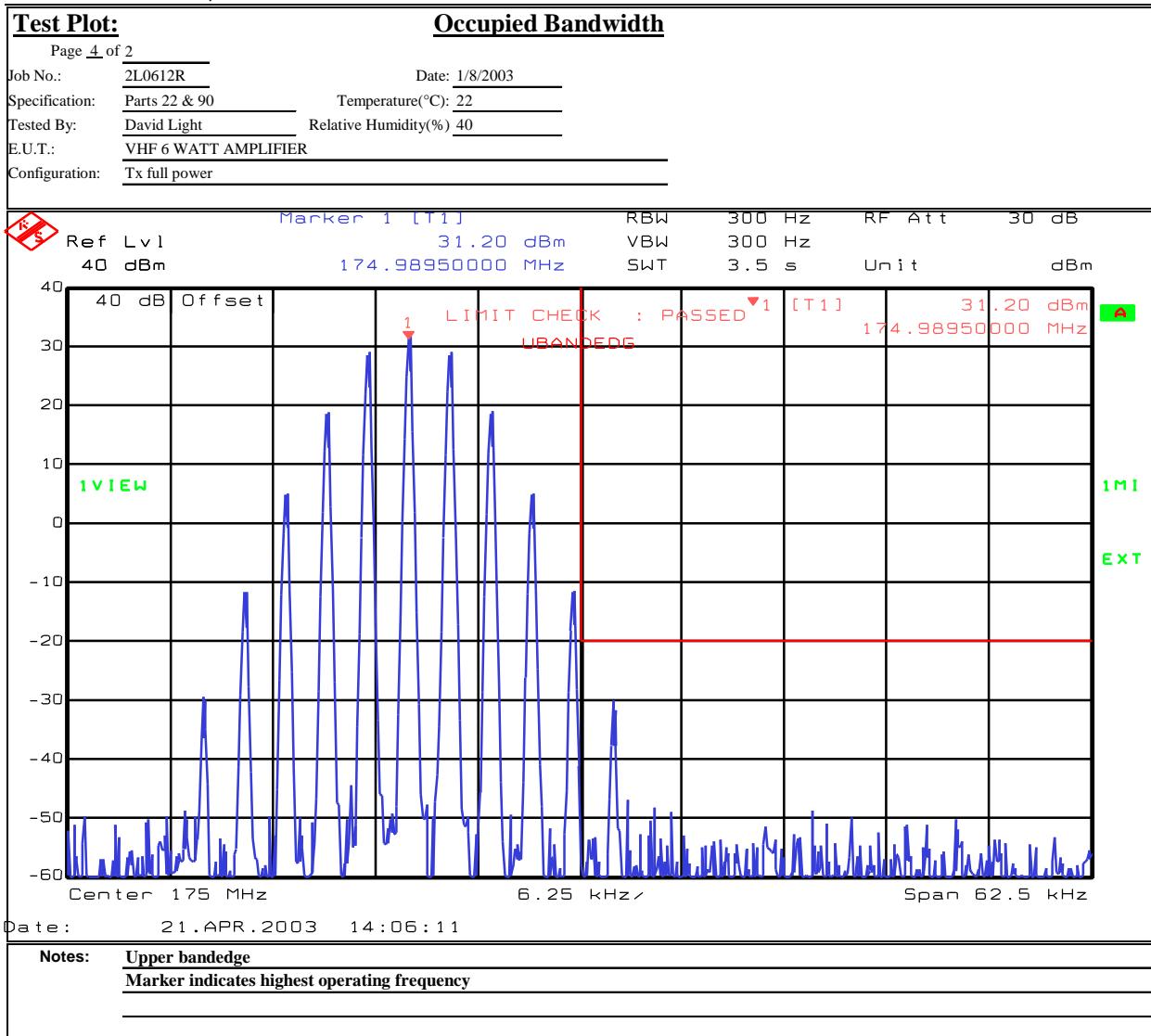
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 Fax: (972) 436-2667


Test Data – Spurious Emissions at Antenna Terminals



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Dallas Headquarters:

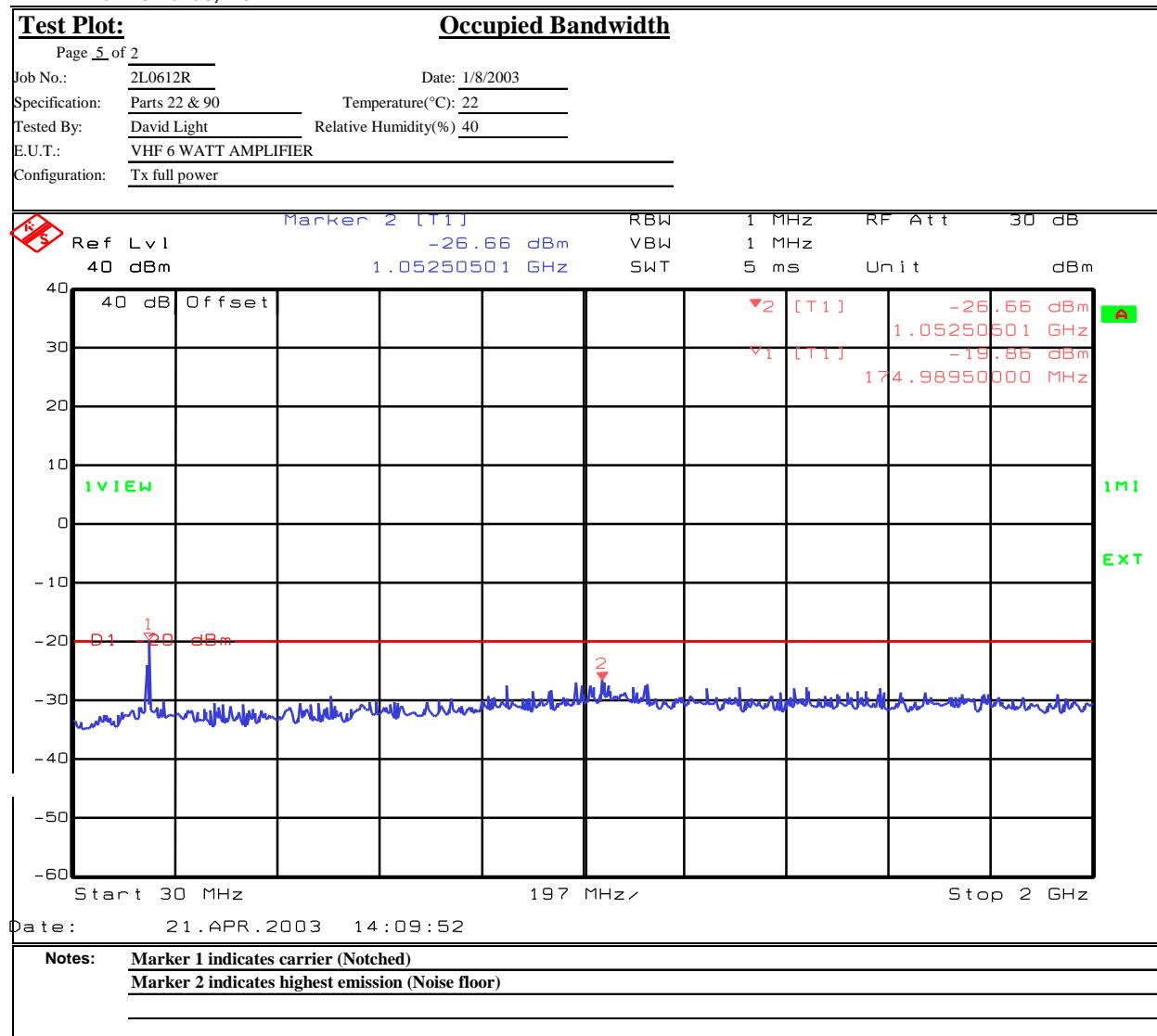
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Test Data – Spurious Emissions at Antenna Terminals



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FCC PART 90, Subpart I & Part 22, Subpart E
Amplifier

EQUIPMENT: 264524C Series

Test Report Number **2L0612RUS1**

Section 6. Field Strength of Spurious Emissions

| | |
|--|-------------------|
| NAME OF TEST: Field Strength of Spurious Emissions | PARA. NO.: 2.1053 |
| TESTED BY: David Light | DATE: 4/21/03 |

Test Results:

Complies.

Test Data:

See attached table.

Test Data - Radiated Emissions



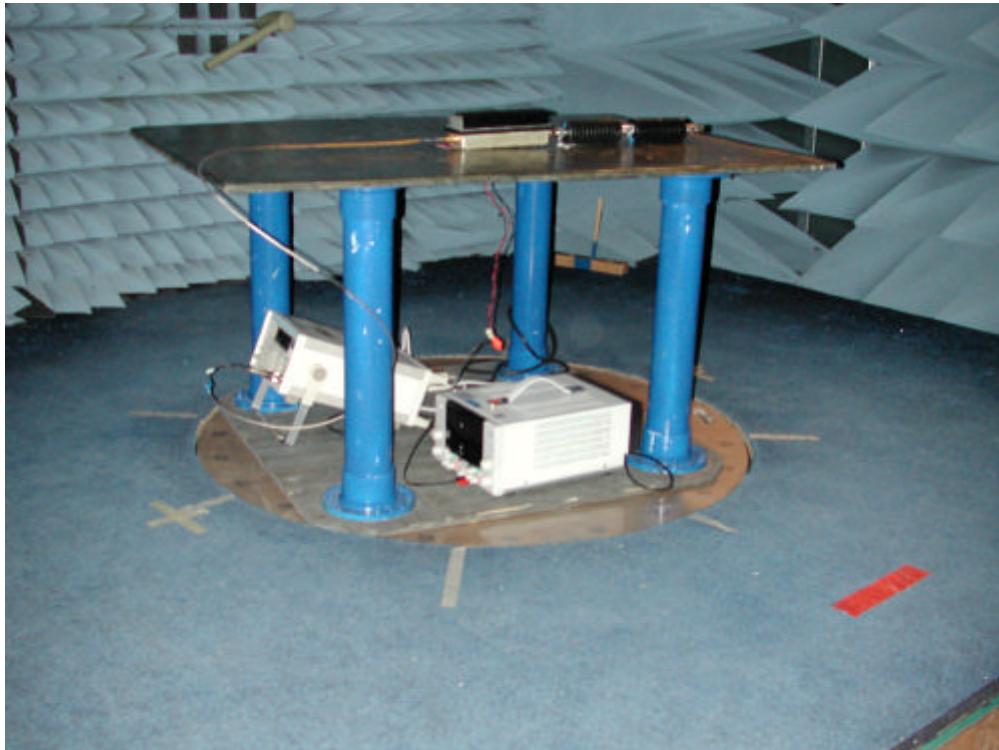
Nemko Dallas, Inc.

Dallas Headquarters:

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 Lewisville, TX 75057
 Tel: (972) 436-9600
 Fax: (972) 436-2667

| <u>ERP Substitution Method</u> | | | | | | | | | | |
|--|---------------------------|--------------------------------|--|-------------------------|---------------------------------------|--------------|----------------|----------------|-------------------------------------|----------------|
| Page <u>1</u> of <u>1</u> | | | | | | | | | | |
| Job No.: | 2L0612R | | | Date: | 4/22/03 | | | Complete | <input checked="" type="checkbox"/> | |
| Specification: | PTS 22 & 90 | | | Temperature(°C): | 22 | | | Preliminary | <input type="checkbox"/> | |
| Tested By: | David Light | | | Relative Humidity(%) | 40 | | | | | |
| E.U.T.: | VHF AMPLIFIER | | | | | | | | | |
| Configuration: | TABLETOP | | | | | | | | | |
| Sample No.: | 1 | | | | | | | | | |
| Location: | Lab 1 | | | RBW: | 1 MHz | | | Measurement | | |
| Detector Type: | Peak | | | VBW: | 1 MHz | | | Distance: | 3 m | |
| Test Equipment Used | | | | | | | | | | |
| Antenna: | 1480 | | | Directional Coupler: | | | | | | |
| Pre-Amp: | 791 | | | Cable #1: | 1484 | | | | | |
| Filter: | | | | Cable #2: | 1485 | | | | | |
| Receiver: | 1464 | | | Cable #3: | | | | | | |
| Attenuator #1 | | | | Cable #4: | | | | | | |
| Attenuator #2: | | | | Mixer: | | | | | | |
| Additional equipment used: | 993 1016 | | | | | | | | | |
| Measurement Uncertainty: | +/-1.7 dB | | | | | | | | | |
| Frequency (MHz) | Meter Reading (dBm) | Substitution Level (dBm) | | Pre-Amp Gain (dB) | Substitution Antenna Gain (dBd) | ERP (dBm) | Limit (dBm) | Margin (dB) | Polarity | Comments |
| 812.5 | -72.3 | -64.2 | | 24.1 | 4.9 | -64.2 | -20.0 | -44.2333 | V | Tx @ 162.5 MHz |
| 975.0 | -72.0 | -66.8 | | 24.1 | 5.0 | -66.8 | -20.0 | -46.7667 | V | Noise floor |
| 1625.0 | | 31.0 | | | 7.3 | 31.0 | -20.0 | 51.0000 | V | Noise floor |
| 812.5 | -72.3 | -66.1 | | 24.1 | 4.9 | -66.1 | -20.0 | -46.0667 | H | Noise floor |
| 975.0 | -72.0 | -65.1 | | 24.1 | 5.0 | -65.1 | -20.0 | -45.1000 | H | Noise floor |
| 1625.0 | -64.8 | -64.7 | | 32.9 | 7.3 | -64.7 | -20.0 | -44.7000 | H | Noise floor |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Notes: Searched spectrum to the 10th harmonic of carrier No emissions were detected above the noise floor which was at least 20 dB below the spec limit of -20 dBm | | | | | | | | | | |

Photographs of Test Setup



Section 7. Test Equipment List

| Nemko ID | Description | Manufacturer Model Number | Serial Number | Calibration Date | Calibration Due |
|----------|--------------------|---------------------------|---------------|------------------|-----------------|
| 1464 | Spectrum analyzer | Hewlett Packard 8563E | 3551A04428 | 02/11/03 | 02/11/05 |
| 1016 | Pre-Amp | HEWLETT PACKARD 8449A | 2749A00159 | 07/15/02 | 07/15/03 |
| 993 | Horn antenna | A.H. Systems SAS-200/571 | XXX | 01/08/02 | 01/09/04 |
| 1484 | Cable 2.0-18.0 Ghz | Storm PR90-010-072 | N/A | 07/15/02 | 07/15/03 |
| 1485 | Cable 2.0-18.0 Ghz | Storm PR90-010-216 | N/A | 07/15/02 | 07/15/03 |
| 1036 | SPECTRUM ANALYZER | ROHDE & SCHWARZ FSEK30 | 830844/006 | 12/18/01 | 12/19/03 |
| 1064 | ATTENUATOR | NARDA 776B-20 | NONE | CBU | N/A |
| 1604 | ATTENUATOR | NARDA 776B-20 | NONE | N/A | N/A |

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EQUIPMENT: 264524C Series

FCC PART 90, Subpart I & Part 22, Subpart E
Amplifier

Test Report Number **2L0612RUS1**

ANNEX A - TEST METHODOLOGIES

NAME OF TEST: RF Power Output**PARA. NO.: 2.1046****Minimum Standard:**

Para. No. 90.205(a). The maximum allowable station ERP is dependent upon the stations HAAT and required service area and will be authorized in accordance with Table 1 of 90.205(d).

Para. No. 22.565 Transmitting power limits. - The transmitting power of base, mobile and fixed transmitters operating on the channels listed in §22.561 must not exceed the limits in this section.

(a) Maximum ERP. The effective radiated power (ERP) of base and fixed transmitters must not exceed the applicable limits in this paragraph under any circumstances.

| | Maximum ERP |
|-----------------------|-------------|
| Frequency range (MHz) | (watts) |
| 152-153 | 1400 |
| 157-159 | 150 |
| 454-455 | 3500 |
| 459-460 | 150 |

Method Of Measurement:**Detachable Antenna:**

The peak power at antenna terminals is measured using an in-line peak power meter. Power output is measured with the maximum rated input level.

Integral Antenna:

The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The spurious emissions were measured at a distance of 3 meters. The EUT was then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna was fed with a signal at the spurious frequency. The level of the signal was adjusted to repeat the previously measured level. The resulting erp is the signal level fed to the reference antenna corrected for gain referenced to a dipole.

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FCC PART 90, Subpart I & Part 22, Subpart E
Amplifier

EQUIPMENT: 264524C Series

Test Report Number **2L0612RUS1**

**NAME OF TEST: Spurious Emissions at Antenna
Terminals**

PARA. NO.: 2.1051

Test Method: RBW: 1% of emission bandwidth in the 0 - 1 GHz range.
1 MHz at frequencies above 1 GHz.

VBW: \geq RBW

The spectrum is searched up to 10 times the fundamental frequency.

NAME OF TEST: Occupied Bandwidth**PARA. NO.: 2.1049**

Minimum Standard: Para. No. 90.210, see table 1 below for applicable mask.

Table 1

| Frequency Band (MHz) | Mask for equipment with Low Pass Filter | Mask for equipment without Low Pass Filter |
|----------------------|---|--|
| Below 25 | A or B | A or C |
| 25 - 50 | B | C |
| 72 - 76 | B | C |
| 150 - 174 | B, D or E | C, D or E |
| 150 Paging only | B | C |
| 220 - 222 | F | F |
| 421 - 512 | B, D or E | C, D or E |
| 450 paging only | B | H |
| 806 - 821/ 851 - 866 | B | G |
| 821 - 824/ 866 - 869 | B | H |
| 896 - 901/ 935 - 940 | I | J |
| 902 - 928 | K | K |
| 929 - 930 | B | G |
| Above 940 | B | C |
| All other bands | B | C |

NAME OF TEST: Field Strength of Spurious**PARA. NO.: 2.1053****Minimum Standard:** Para. No. 90.210, see table 1 for applicable mask.**Method of measurement**

The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The spurious emissions were measured at a distance of 3 meters. The EUT was then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna was fed with a signal at the spurious frequency. The level of the signal was adjusted to repeat the previously measured level. The resulting erp is the signal level fed to the reference antenna corrected for gain referenced to a dipole.

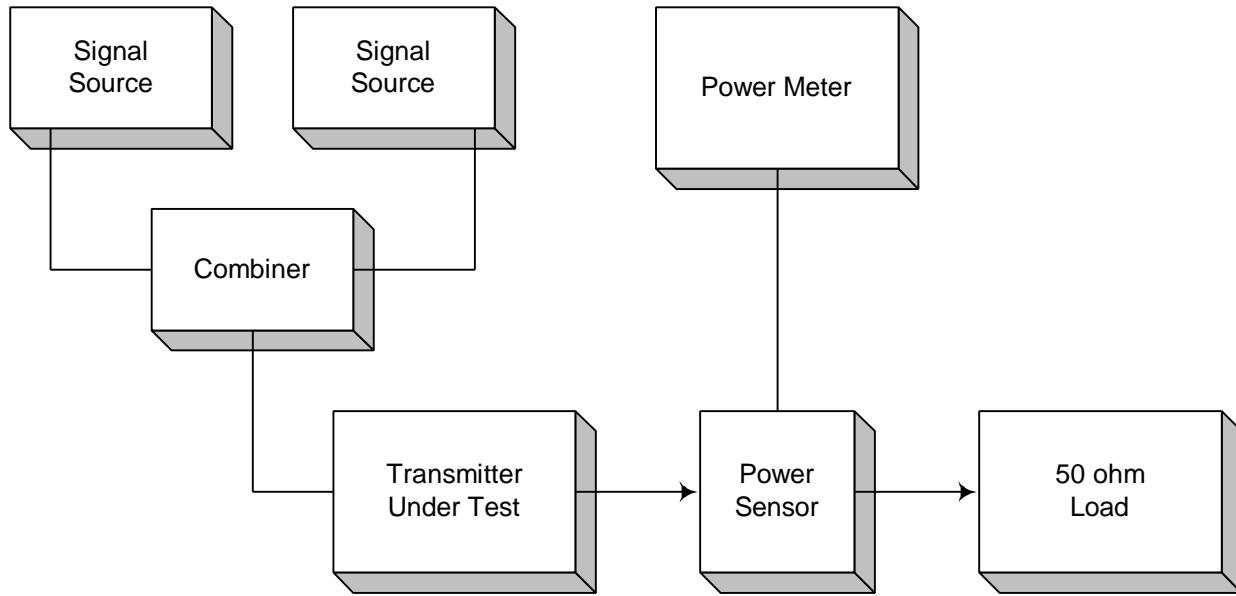
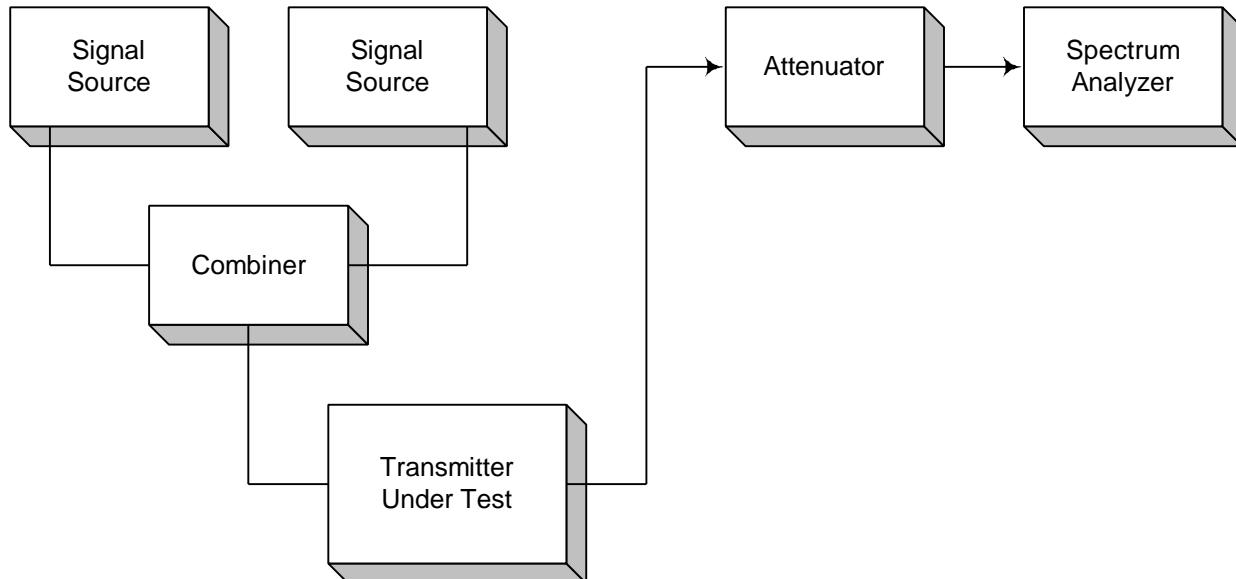
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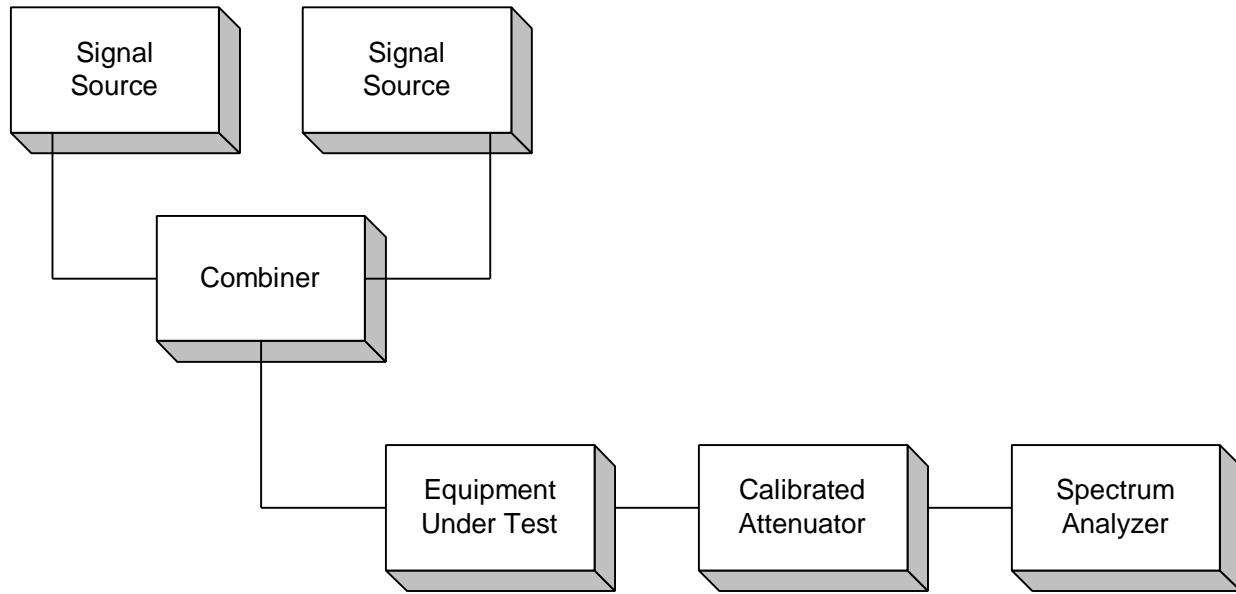
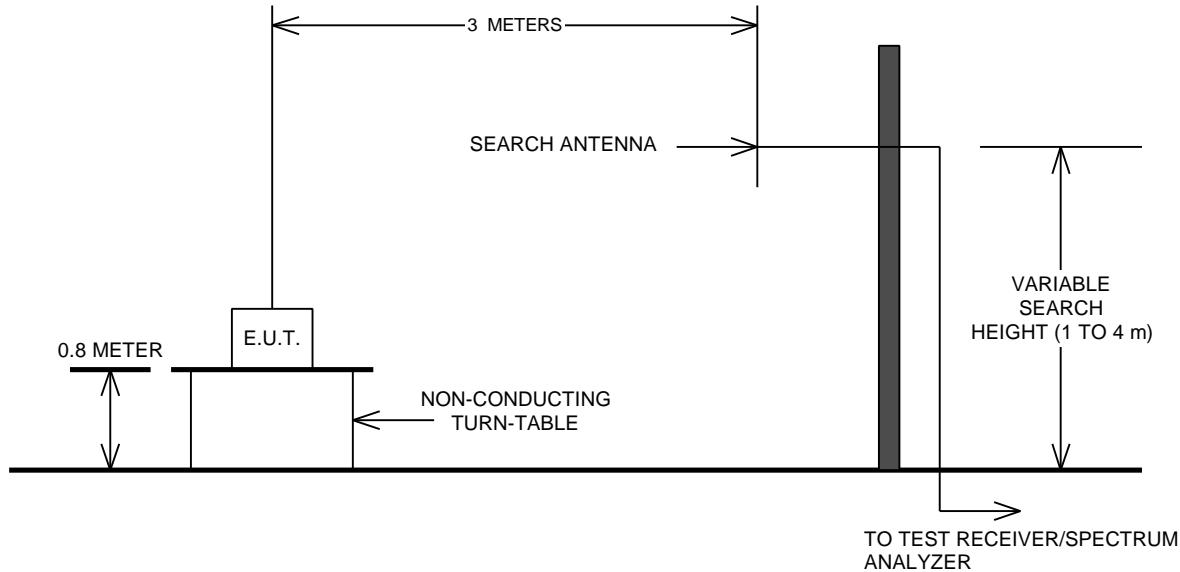
EQUIPMENT: 264524C Series

FCC PART 90, Subpart I & Part 22, Subpart E
Amplifier

Test Report Number **2L0612RUS1**

ANNEX B - TEST DIAGRAMS

Para. No. 2.1046 - R.F. Power Output**Para. No. 2.1049 - Occupied Bandwidth**

Para. No. 2.1051 - Spurious Emissions at Antenna Terminals**Para. No. 2.1053 - Field Strength of Spurious Radiation**

Para. No. 2.995 - Frequency Stability