

**Nemko Test Report:** 1L0388RUS2

**Applicant:** Allen Telecom  
140 Vista Center Drive  
Forest, VA 24551

**Equipment Under Test:  
(E.U.T.)** Repeater MR303 Varia

**In Accordance With:** **FCC Part 90, Subpart I**  
Private Land Mobile Repeater

**Tested By:** Nemko Dallas Inc.  
802 N. Kealy  
Lewisville, TX 75057-3136

**Authorized By:**



Tom Tidwell, Wireless Group Manager

**Date:** 10/18/01

**Total Number of Pages:** 60

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EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2

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**Section 1. Summary of Test Results**

Manufacturer: Allen Telecom

Model No.: 149110

Serial No.: 1576

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.



New Submission



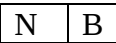
Production Unit



Class II Permissive Change



Pre-Production Unit



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.

See " Summary of Test Data".

**NVLAP LAB CODE: 100426-0**

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**EQUIPMENT: MR303 Varia****PROJECT NO.: 1L0388RUS2**

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**Summary Of Test Data**

| NAME OF TEST                            | PARA. NO.         | SPEC.        | RESULT   |
|-----------------------------------------|-------------------|--------------|----------|
| RF Power Output                         | 90.205            | $\leq$ Rated | Complies |
| Audio Frequency Response                | TIA EIA-603.3.2.6 | N/A          | N/A      |
| Audio Low-Pass Filter Response          | TIA EIA-603.3.2.6 | N/A          | N/A      |
| Modulation Limiting                     | TIA EIA-603.3.2.6 | N/A          | N/A      |
| Occupied Bandwidth                      | 90.210            | Plots        | Complies |
| Spurious Emissions at Antenna Terminals | 90.210            | Plots        | Complies |
| Field Strength of Spurious Emissions    | 90.210            | $\leq$ Rated | Complies |
| Frequency Stability                     | 90.213            | N/A          | N/A      |
| Transient Frequency Behavior            | 90.214            | N/A          | 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. is a repeater there was no need for frequency stability.
- .

**Section 2. General Equipment Specification****Transmitter**

Supply Voltage Input: 115 Vac

|                  |                 |             |
|------------------|-----------------|-------------|
| Frequency Range: | <b>Uplink</b>   | 896-901 MHz |
|                  | <b>Downlink</b> | 935-940 MHz |

Tunable Bands: Complete coverage

|                        |                                     |                                     |                                     |                                     |                          |
|------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|--------------------------|
| Type(s) of Modulation: | <b>2FSK</b>                         | <b>4FSK</b>                         | <b>F2D<br/>(Voice)</b>              | <b>D7W<br/>(QAM)</b>                | <b>Other</b>             |
|                        | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

Gain: 58 dB

Maximum Input: +10 dBm without damage

Output Impedance: 50 ohms

|                          |                 |         |
|--------------------------|-----------------|---------|
| RF Power Output (rated): | <b>Uplink</b>   | +24 dBm |
|                          | <b>Downlink</b> | +8 dBm  |

Channel Spacing(s): 12.5 kHz

Operator Selection of Operating Frequency: Complete band coverage

Power Output Adjustment Capability: Manual

|                        |                                     |                          |                          |
|------------------------|-------------------------------------|--------------------------|--------------------------|
| Frequency Translation: | <b>F1-F1</b>                        | <b>F1-F2</b>             | <b>N/A</b>               |
|                        | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

|                 |                          |                            |                                     |
|-----------------|--------------------------|----------------------------|-------------------------------------|
| Band Selection: | <b>Software</b>          | <b>Duplexer<br/>Change</b> | <b>Fullband<br/>Coverage</b>        |
|                 | <input type="checkbox"/> | <input type="checkbox"/>   | <input checked="" type="checkbox"/> |

**Nemko Dallas**

FCC PART 90, SUBPART I  
PRIVATE LAND MOBILE REPEATER

*EQUIPMENT:* **MR303 Varia**

PROJECT NO.: **1L0388RUS2**

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**Description of Modifications For Class II Permissive Change**

**Not Applicable**

**Modifications Made During Testing**

**Not Applicable**

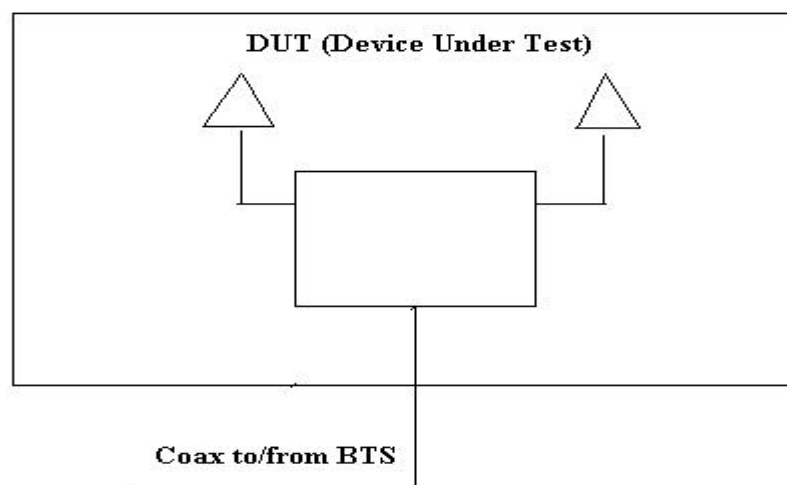
## Theory of Operation

The repeater MR303 Varia is a bi-directional amplifier with adjustable RF-bandwidth. The first and the last channel of the transmission bandwidth can be set manually by means of rotary switches. The repeater has been designed for applications in medium sized rooms such as suites, offices and basements. A quality connection with a mobile phone can usually not be established in these rooms.

The repeater is equipped with a connector for an external receiving/transmitting antenna which provides the RF connection to the mobile. Connection to the BTS can be established via an outdoor antenna. Other components of the D.I.C.E. COAX system can also be connected to the repeater.

The final amplifiers are protected by individual level limiters, which allow the mobile unit to be operated in close proximity to the repeater. Third order intermodulation products are kept below the CEPT limit of -36 dBm constantly, even if the repeater receives the signals of more than one mobile unit.

## System Diagram



*EQUIPMENT:*    **MR303 Varia**PROJECT NO.:    **1L0388RUS2**

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**Section 3.            RF Power Output**

|                               |                  |
|-------------------------------|------------------|
| NAME OF TEST: RF Power Output | PARA. NO.: 2.985 |
| TESTED BY: Lance Walker       | DATE:10/16/2001  |

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

| <b>Modulation</b> | <b>Frequency<br/>(MHz)</b> | <b>Rated Power<br/>(dBm)</b> | <b>Measured/Rated</b> |
|-------------------|----------------------------|------------------------------|-----------------------|
| 2FSK              | 898.5                      | 24.5                         | 0.283                 |
| 4FSK              | 898.5                      | 24.5                         | 0.283                 |
| iDEN              | 898.5                      | 24.0                         | 0.254                 |
| Voice             | 898.5                      | 24.0                         | 0.254                 |
| 2FSK              | 937.5                      | 7.7                          | 0.006                 |
| 4FSK              | 937.5                      | 7.7                          | 0.006                 |
| iDEN              | 937.5                      | 8.0                          | 0.006                 |
| Voice             | 937.5                      | 7.8                          | 0.006                 |

Measurement Uncertainty:    +/- 0.7 dB

Test Equipment: 1029-1030

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PRIVATE LAND MOBILE REPEATER

*EQUIPMENT:*    **MR303 Varia**

PROJECT NO.:    **1L0388RUS2**

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## **Section 4.        Occupied Bandwidth**

|                                  |                  |
|----------------------------------|------------------|
| NAME OF TEST: Occupied Bandwidth | PARA. NO.: 2.989 |
| TESTED BY: Lance Walker          | DATE:10/16/2001  |

**Test Results:**                Complies.

**Test Data:**                 See attached graph(s).

Measurement Uncertainty:    +/-1.7 dB

EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2



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## Data Plot

## OBW 2FSK

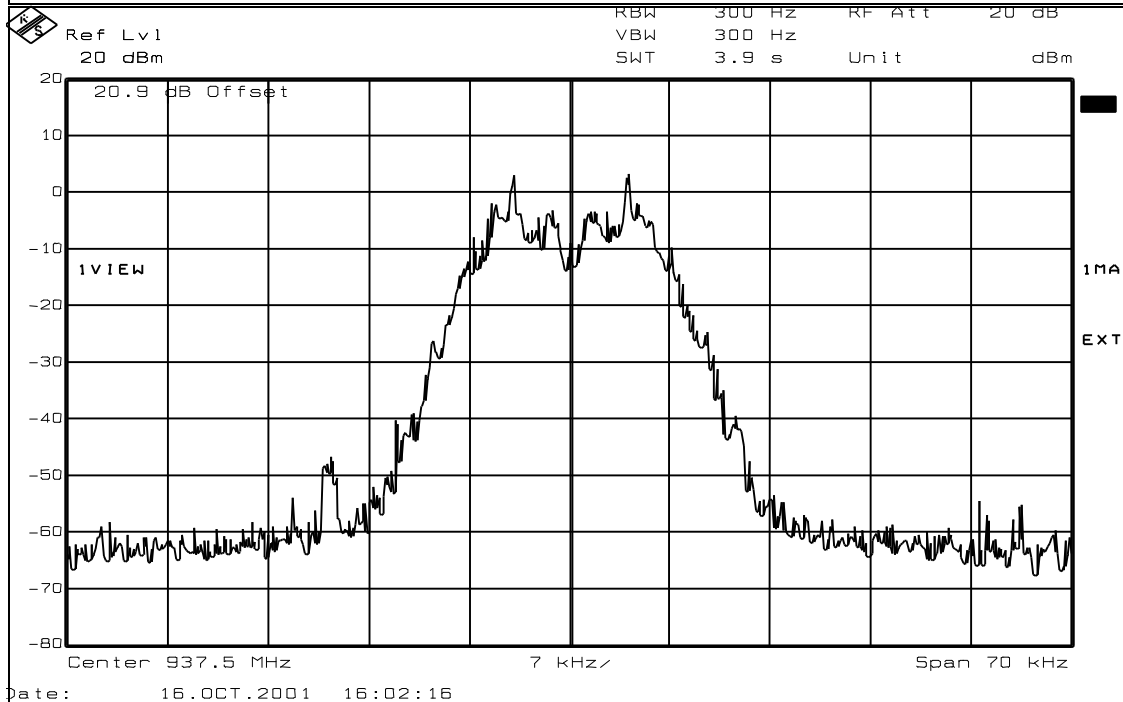
Page 1 of 4

Job No.: 1L0388R Date: 10/16/2001  
Specification: FCC Part 90 Temperature(°C): 22  
Tested By: Lance Walker Relative Humidity(%) 50  
E.U.T.: Varia Repeater  
Configuration: Normal  
Sample Number: 1  
Location: Lab 1  
Detector Type: Peak

Complete X  
Preliminary \_\_\_\_\_RBW: Refer to plots  
VBW: Refer to plotsMeasurement  
Distance: N/A m

## Test Equipment Used

Antenna: \_\_\_\_\_ Directional Coupler: \_\_\_\_\_  
Pre-Amp: \_\_\_\_\_ Cable #1: 1082  
Filter: \_\_\_\_\_ Cable #2: \_\_\_\_\_  
Receiver: 1464 Cable #3: \_\_\_\_\_  
Attenuator #1: 1477 Cable #4: \_\_\_\_\_  
Attenuator #2: \_\_\_\_\_ Mixer: \_\_\_\_\_  
Additional equipment used: \_\_\_\_\_  
Measurement Uncertainty: +/-3.6 dB



Notes: Downlink - Output Signal

EQUIPMENT: MR303 Varia

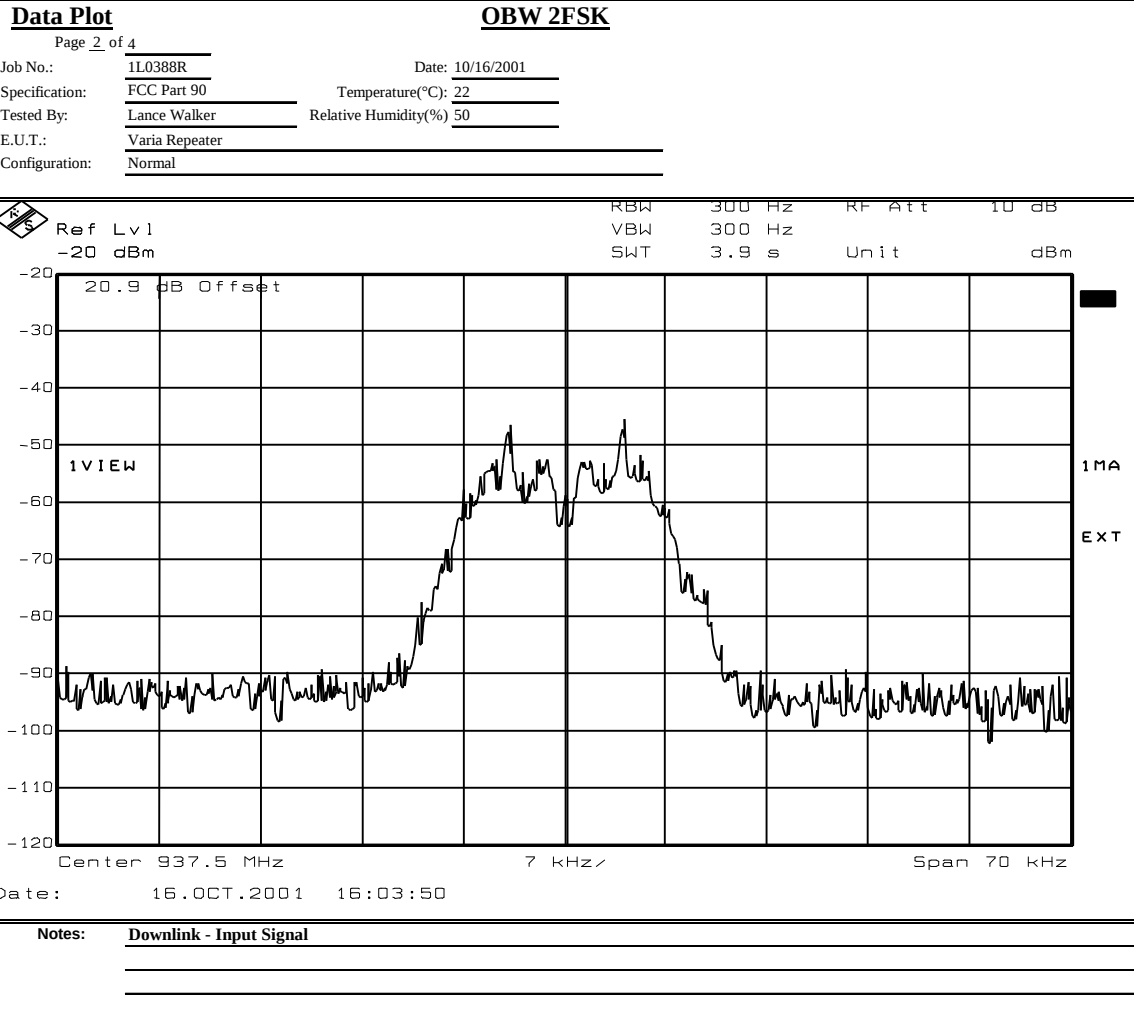
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PROJECT NO.: 1L0388RUS2



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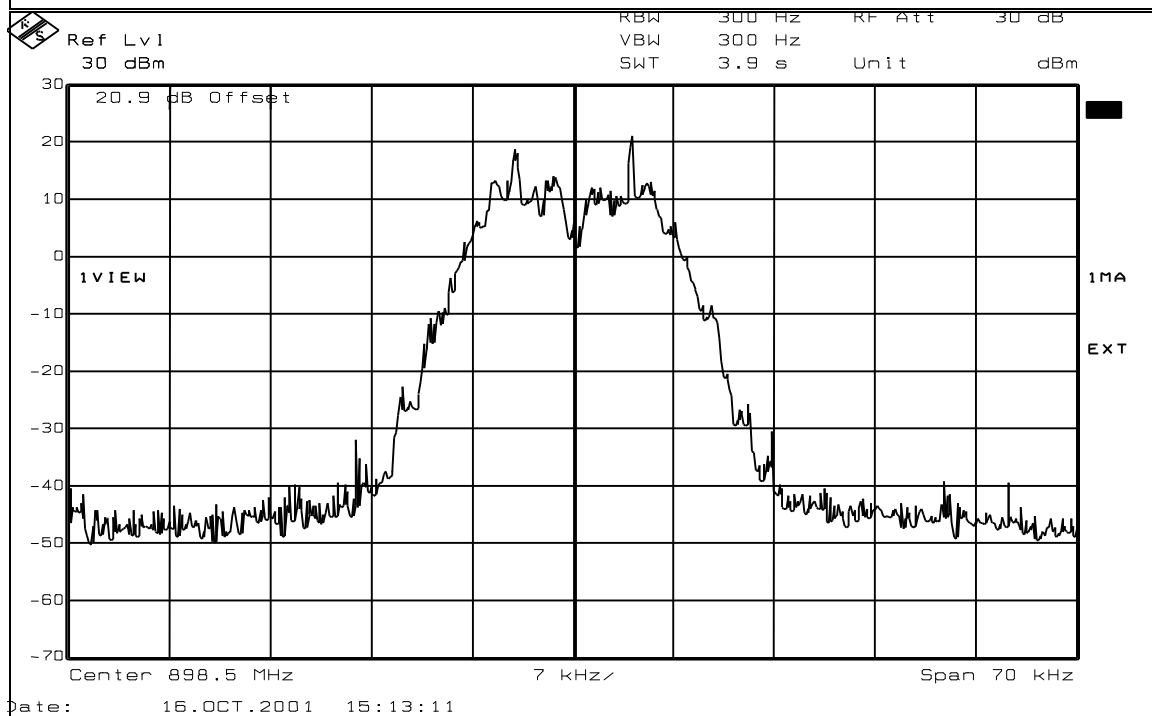
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Data Plot

OBW 2FSK

Page 3 of 4

Job No.: 1L0388R Date: 10/16/2001  
Specification: FCC Part 90 Temperature(°C): 22  
Tested By: Lance Walker Relative Humidity(%) 50  
E.U.T.: Varia Repeater  
Configuration: Normal



Notes: Uplink - Output Signal

EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2



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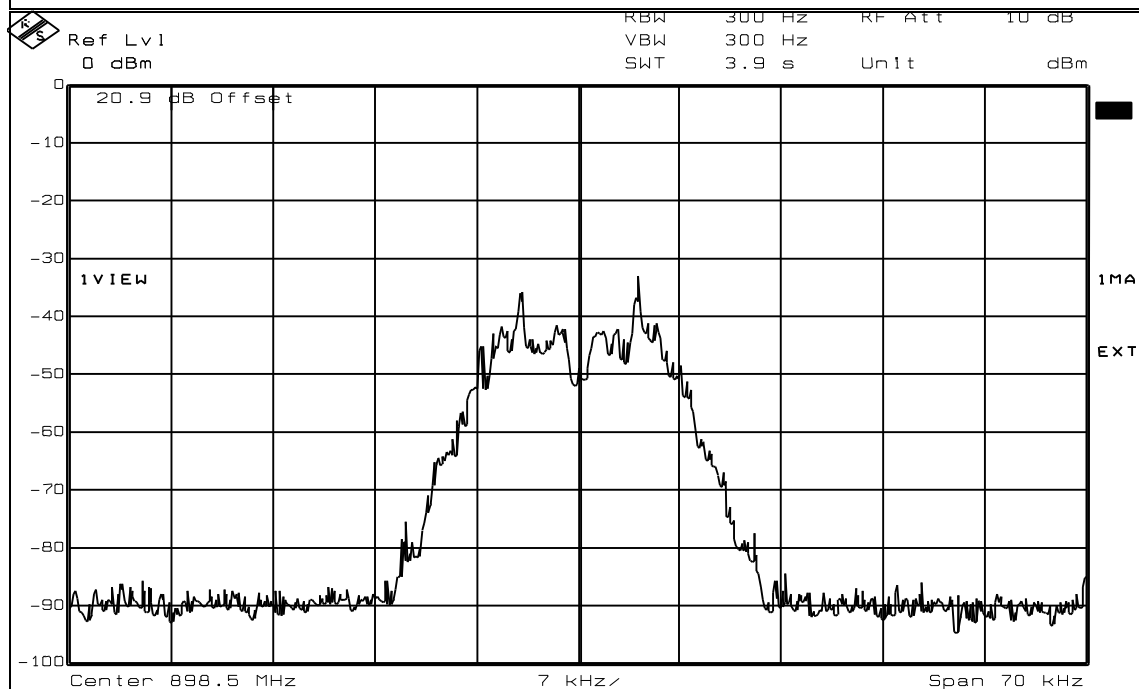
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Test Plot:

OBW 2FSK

Page 4 of 4

Job No.: 1L0388R Date: 10/16/2001  
Specification: FCC Part 90 Temperature(°C): 22  
Tested By: Lance Walker Relative Humidity(%) 50  
E.U.T.: Varia Repeater  
Configuration: Normal



Date: 16.OCT.2001 15:30:06

Notes: Uplink - Input Signal

EQUIPMENT: MR303 Varia

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## Data Plot

## OBW 4FSK

Page 1 of 4

Job No.: 1L0388R Date: 10/16/2001 Complete X  
Preliminary \_\_\_\_\_

Specification: FCC Part 90 Temperature(°C): 22  
Tested By: Lance Walker Relative Humidity(%) 50

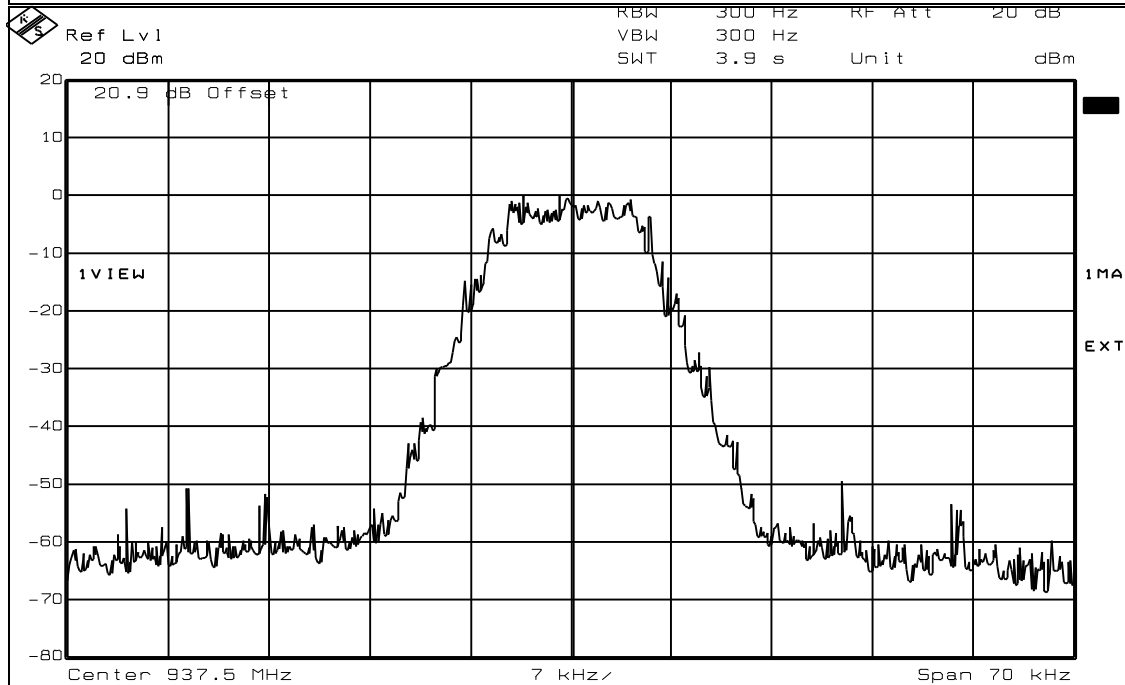
E.U.T.: Varia Repeater  
Configuration: Normal

Sample Number: 1

Location: Lab 1 RBW: Refer to plots Measurement  
Detector Type: Peak VBW: Refer to plots Distance: N/A m

## Test Equipment Used

Antenna: \_\_\_\_\_ Directional Coupler: \_\_\_\_\_  
Pre-Amp: \_\_\_\_\_ Cable #1: 1082  
Filter: \_\_\_\_\_ Cable #2: \_\_\_\_\_  
Receiver: 1464 Cable #3: \_\_\_\_\_  
Attenuator #1: 1477 Cable #4: \_\_\_\_\_  
Attenuator #2: \_\_\_\_\_ Mixer: \_\_\_\_\_  
Additional equipment used: \_\_\_\_\_  
Measurement Uncertainty: +/-3.6 dB



Date: 16.OCT.2001 15:48:54

Notes: Downlink - Output Signal

EQUIPMENT: MR303 Varia

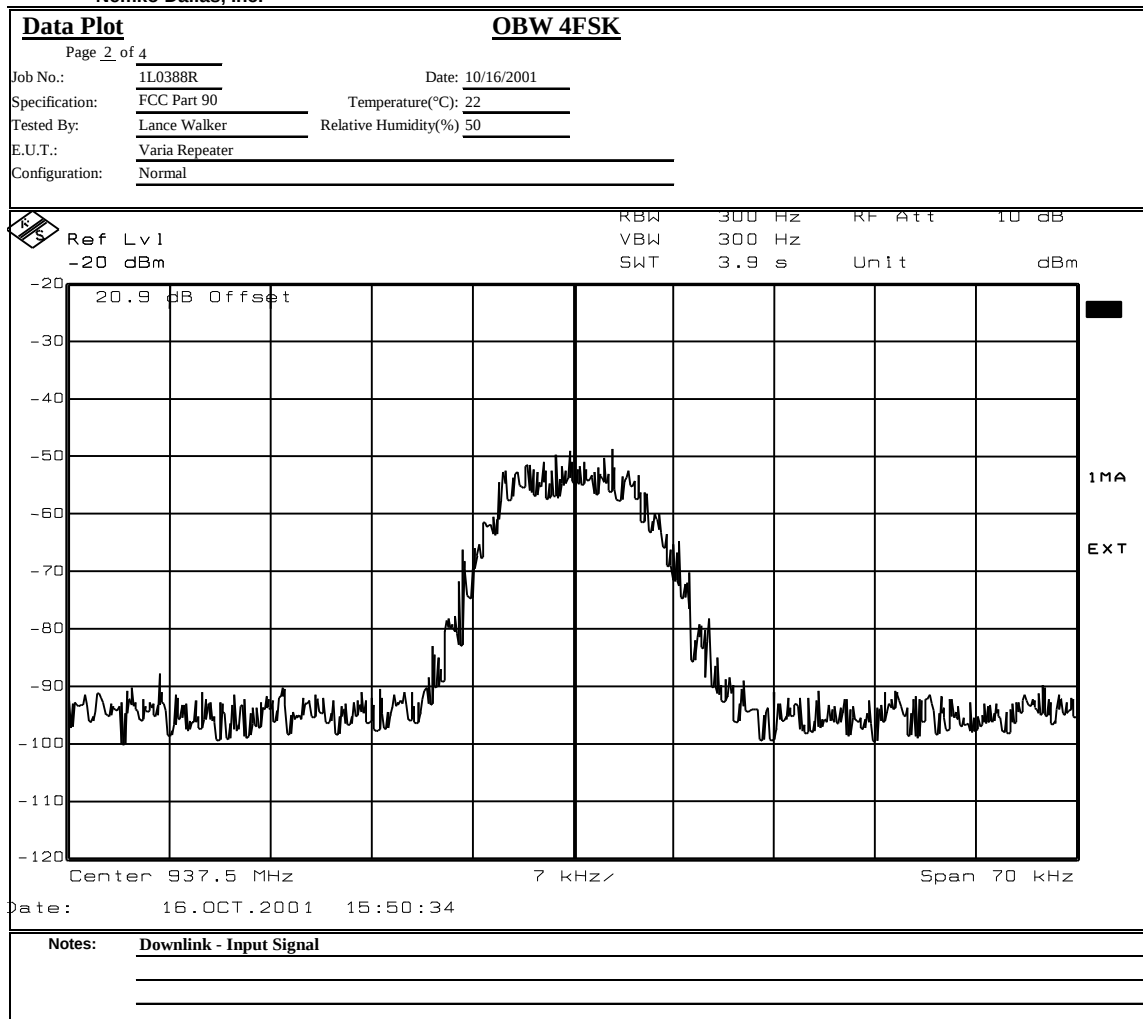
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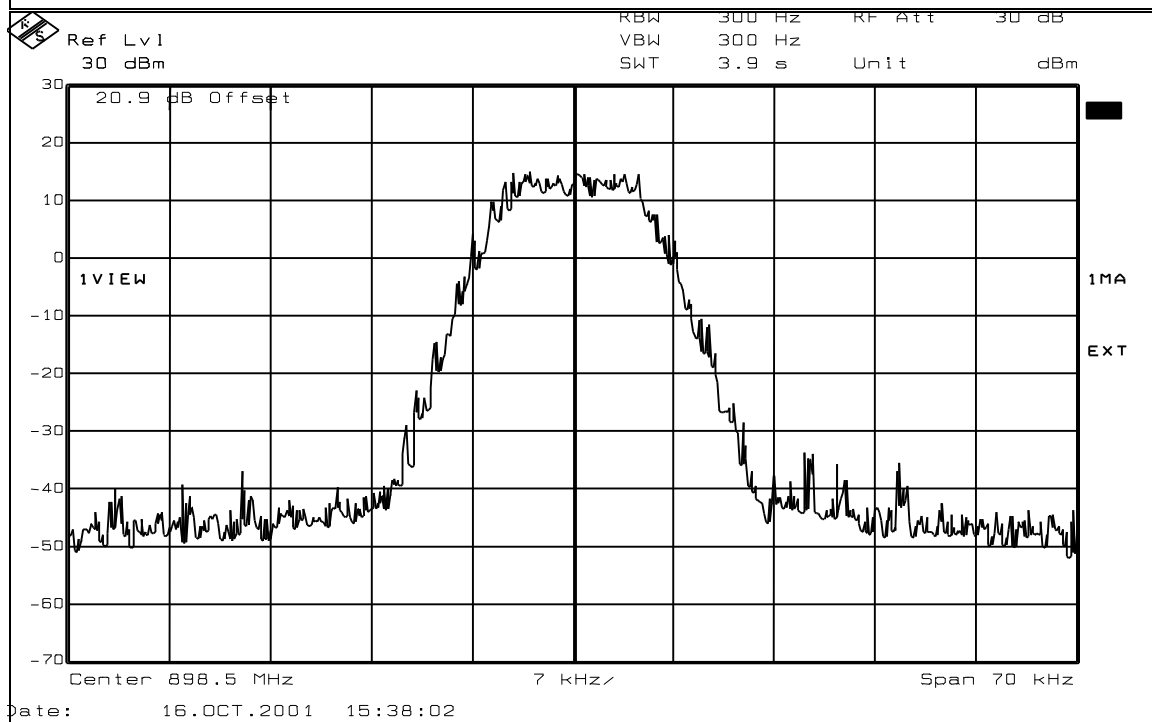
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Data Plot

OBW 4FSK

Page 3 of 4

Job No.: 1L0388R Date: 10/16/2001  
Specification: FCC Part 90 Temperature(°C): 22  
Tested By: Lance Walker Relative Humidity(%) 50  
E.U.T.: Varia Repeater  
Configuration: Normal



Notes: Uplink - Output Signal

EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2



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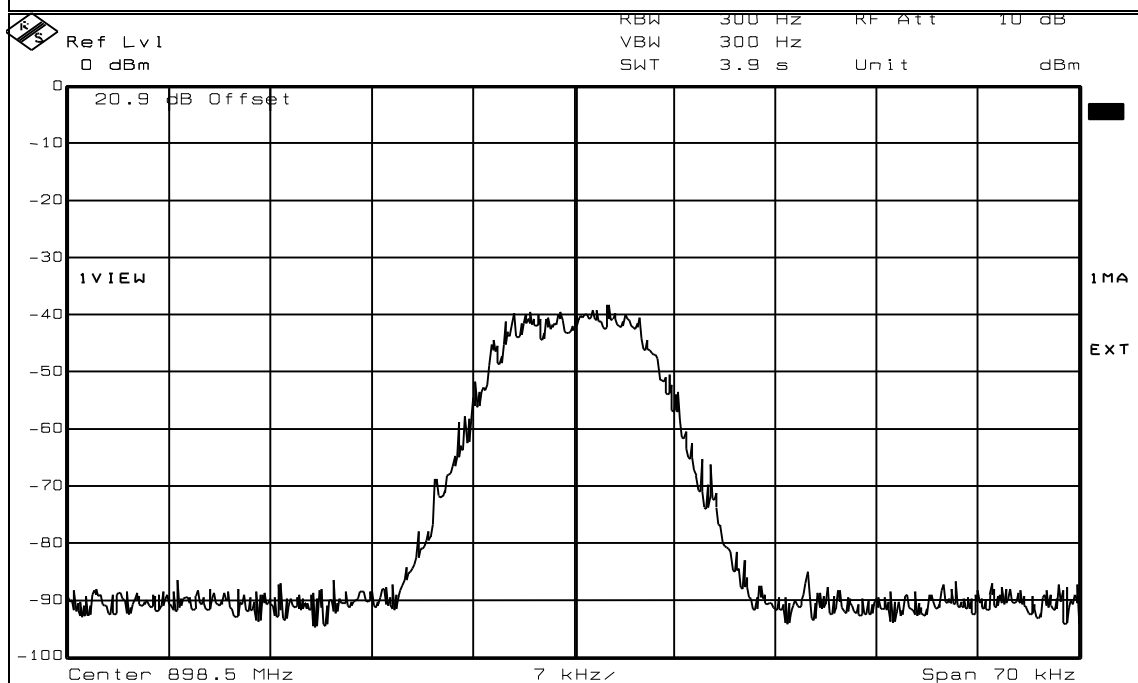
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**Test Plot:**

**OBW 4FSK**

Page 4 of 4

Job No.: 1L0388R Date: 10/16/2001  
Specification: FCC Part 90 Temperature(°C): 22  
Tested By: Lance Walker Relative Humidity(%) 50  
E.U.T.: Varia Repeater  
Configuration: Normal



Date: 16.OCT.2001 15:32:35

Notes: Uplink - Input Signal

EQUIPMENT: MR303 Varia

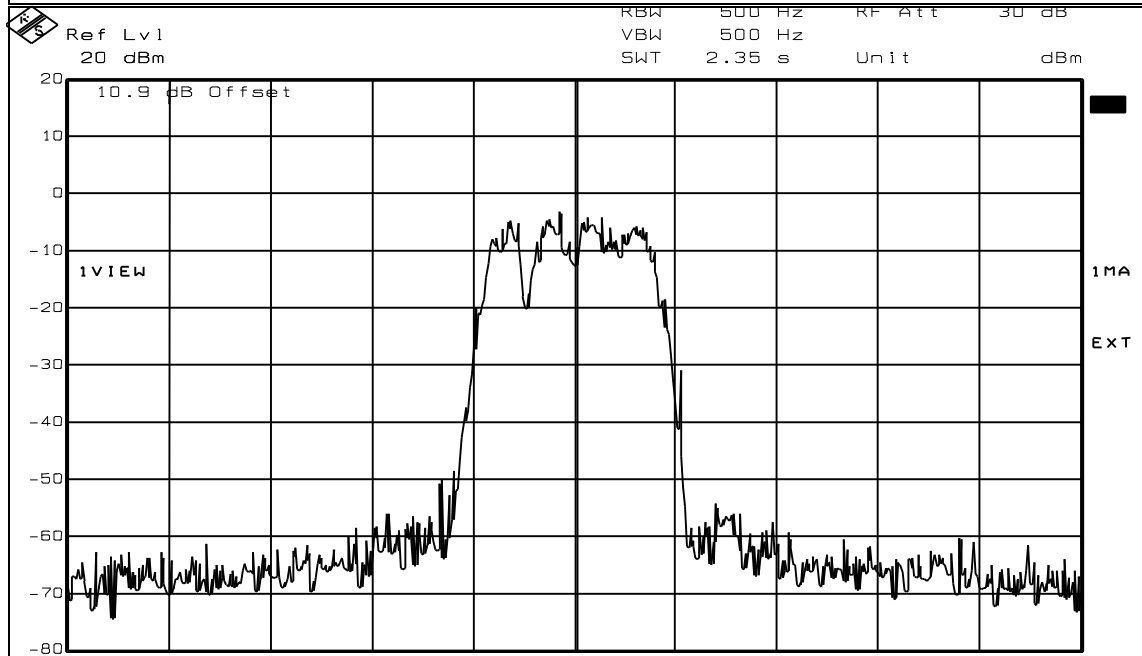
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| Data Plot                                                                           |                  | OBW QAM               |                        |
|-------------------------------------------------------------------------------------|------------------|-----------------------|------------------------|
| Page <u>1</u> of <u>4</u>                                                           |                  |                       |                        |
| Job No.:                                                                            | 1L0388R          | Date:                 | 10/17/2001             |
| Specification:                                                                      | FCC Part 90      | Temperature(°C):      | 22                     |
| Tested By:                                                                          | Lance Walker     | Relative Humidity(%): | 50                     |
| E.U.T.:                                                                             | Varia Repeater   |                       |                        |
| Configuration:                                                                      | Normal           |                       |                        |
| Sample Number:                                                                      | 1                |                       |                        |
| Location:                                                                           | Lab 1            | RBW:                  | Refer to plots         |
| Detector Type:                                                                      | Peak             | VBW:                  | Refer to plots         |
|                                                                                     |                  | Measurement           | Distance: <u>N/A</u> m |
| <b>Test Equipment Used</b>                                                          |                  |                       |                        |
| Antenna:                                                                            |                  | Directional Coupler:  |                        |
| Pre-Amp:                                                                            |                  | Cable #1:             | 1082                   |
| Filter:                                                                             |                  | Cable #2:             |                        |
| Receiver:                                                                           | 1464             | Cable #3:             |                        |
| Attenuator #1:                                                                      | 1477             | Cable #4:             |                        |
| Attenuator #2:                                                                      |                  | Mixer:                |                        |
| Additional equipment used:                                                          |                  |                       |                        |
| Measurement Uncertainty:                                                            | <u>+/-3.6 dB</u> |                       |                        |
|  |                  |                       |                        |
| Ref Lvl 20 dBm<br>RBW 500 Hz RF Att 30 dB<br>VBW 500 Hz<br>SWT 2.35 s Unit dBm      |                  |                       |                        |
| Center 937.0004125 MHz 11.71875 kHz Span 117.1875 kHz                               |                  |                       |                        |
| Date: 17.OCT.2001 9:19:43                                                           |                  |                       |                        |
| Notes: <u>Downlink - Output Signal</u>                                              |                  |                       |                        |
|                                                                                     |                  |                       |                        |
|                                                                                     |                  |                       |                        |

EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2



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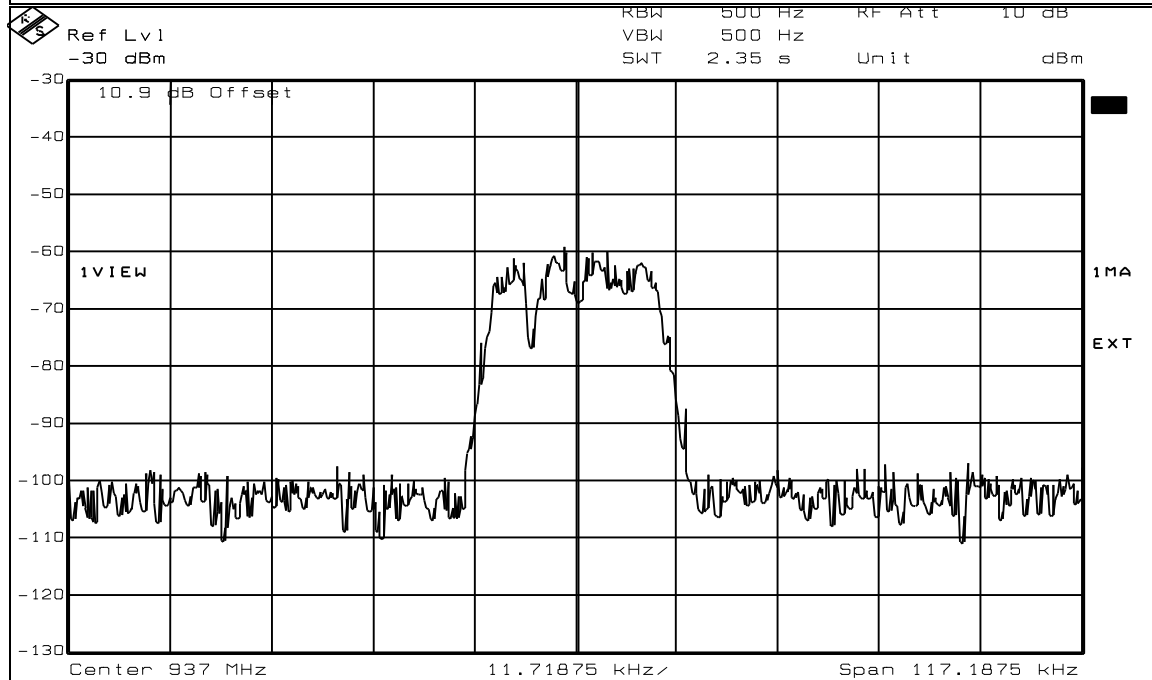
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Data Plot

Page 2 of 4

OBW QAM

Job No.: 1L0388R Date: 10/17/2001  
Specification: FCC Part 90 Temperature(°C): 22  
Tested By: Lance Walker Relative Humidity(%) 50  
E.U.T.: Varia Repeater  
Configuration: Normal



Date: 17.OCT.2001 9:26:01

Notes: Downlink - Input Signal

EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2



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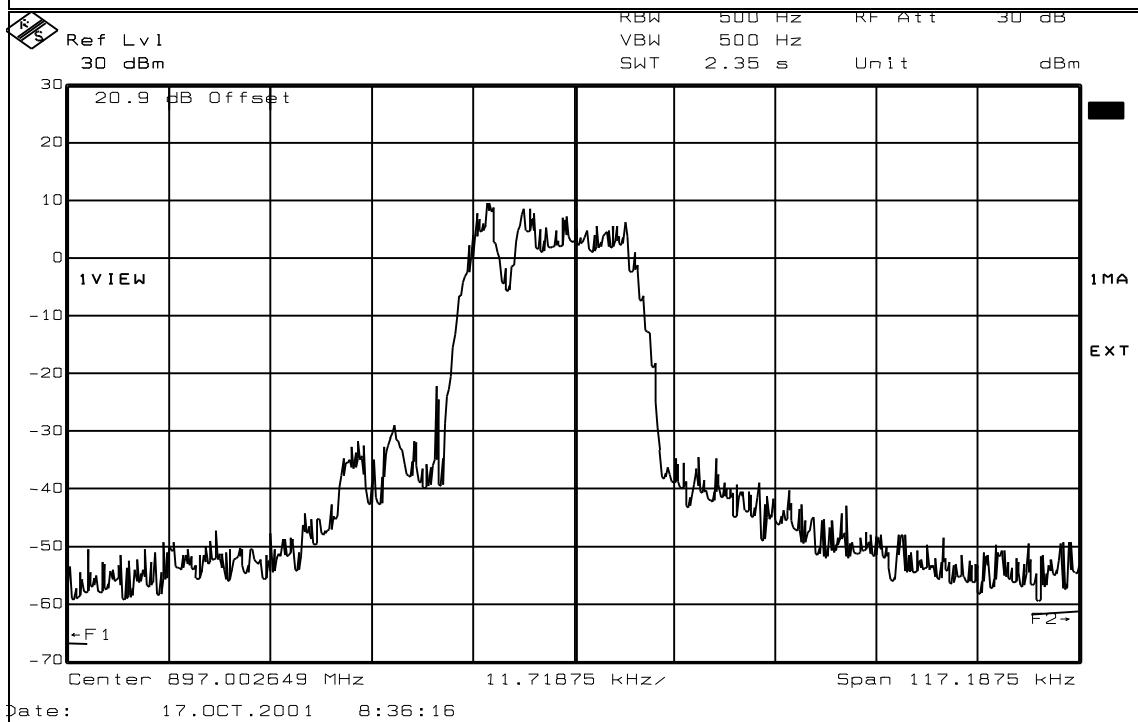
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Data Plot

OBW QAM

Page 3 of 4

Job No.: 1L0388R Date: 10/17/2001  
Specification: FCC Part 90 Temperature(°C): 22  
Tested By: Lance Walker Relative Humidity(%) 50  
E.U.T.: Varia Repeater  
Configuration: Normal



Notes: Uplink - Output Signal

EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2



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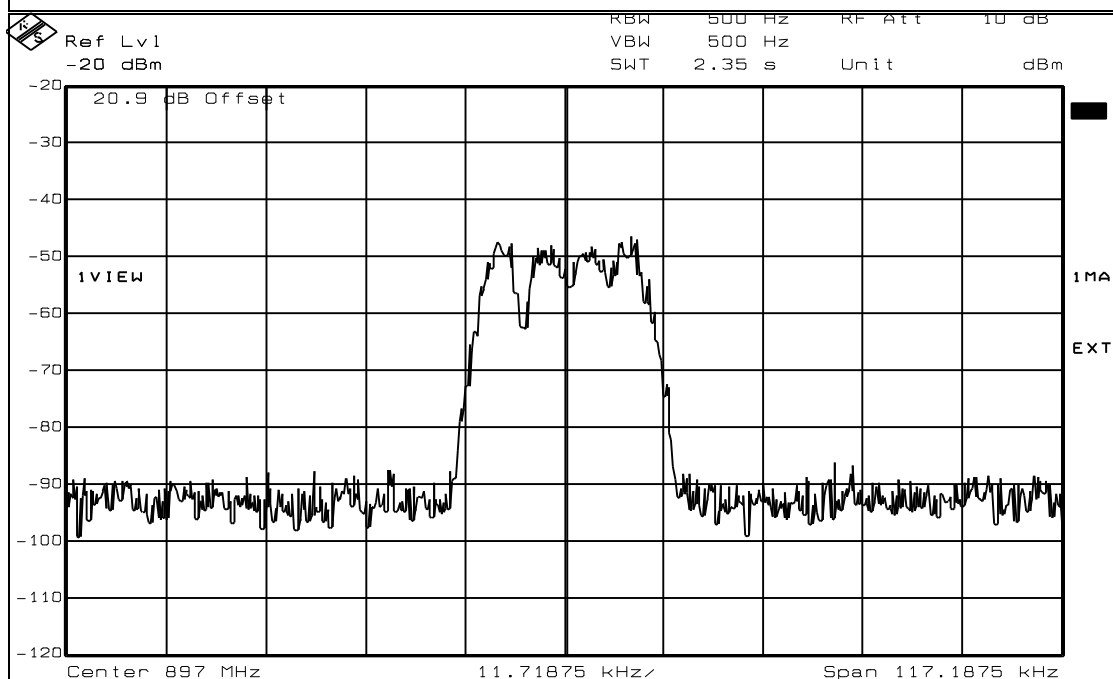
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Test Plot:

OBW QAM

Page 4 of 4

Job No.: 1L0388R Date: 10/17/2001  
Specification: FCC Part 90 Temperature(°C): 22  
Tested By: Lance Walker Relative Humidity(%) 50  
E.U.T.: Varia Repeater  
Configuration: Normal



Date: 17.OCT.2001 8:49:01

Notes: Uplink - Input Signal

EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2



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## Data Plot

## OBW VOICE

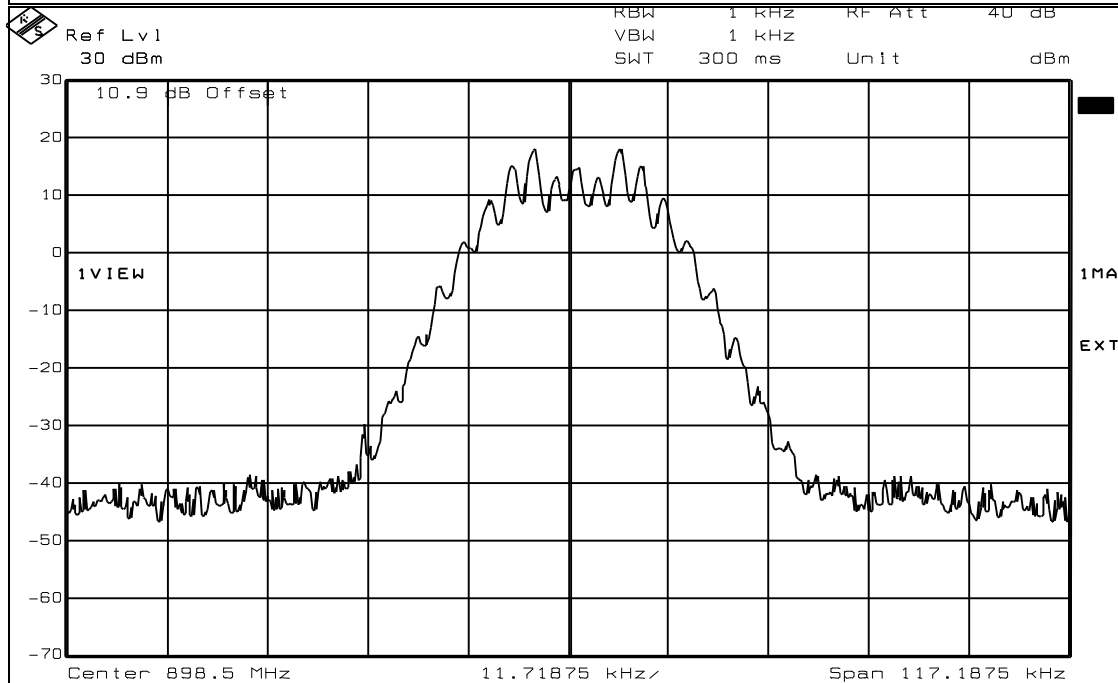
Page 1 of 4

Job No.: 1L0388R Date: 10/17/2001 Complete X  
Preliminary \_\_\_\_\_

Specification: FCC Part 90 Temperature(°C): 22  
Tested By: Lance Walker Relative Humidity(%) 50  
E.U.T.: Varia Repeater  
Configuration: Normal  
Sample Number: 1  
Location: Lab 1 RBW: Refer to plots Measurement  
Detector Type: Peak VBW: Refer to plots Distance: N/A m

## Test Equipment Used

Antenna: \_\_\_\_\_ Directional Coupler: \_\_\_\_\_  
Pre-Amp: \_\_\_\_\_ Cable #1: 1082  
Filter: \_\_\_\_\_ Cable #2: \_\_\_\_\_  
Receiver: 1464 Cable #3: \_\_\_\_\_  
Attenuator #1: 1477 Cable #4: \_\_\_\_\_  
Attenuator #2: \_\_\_\_\_ Mixer: \_\_\_\_\_  
Additional equipment used: \_\_\_\_\_  
Measurement Uncertainty: +/-3.6 dB



Date: 17.OCT.2001 14:36:03

Notes: Downlink - Output Signal

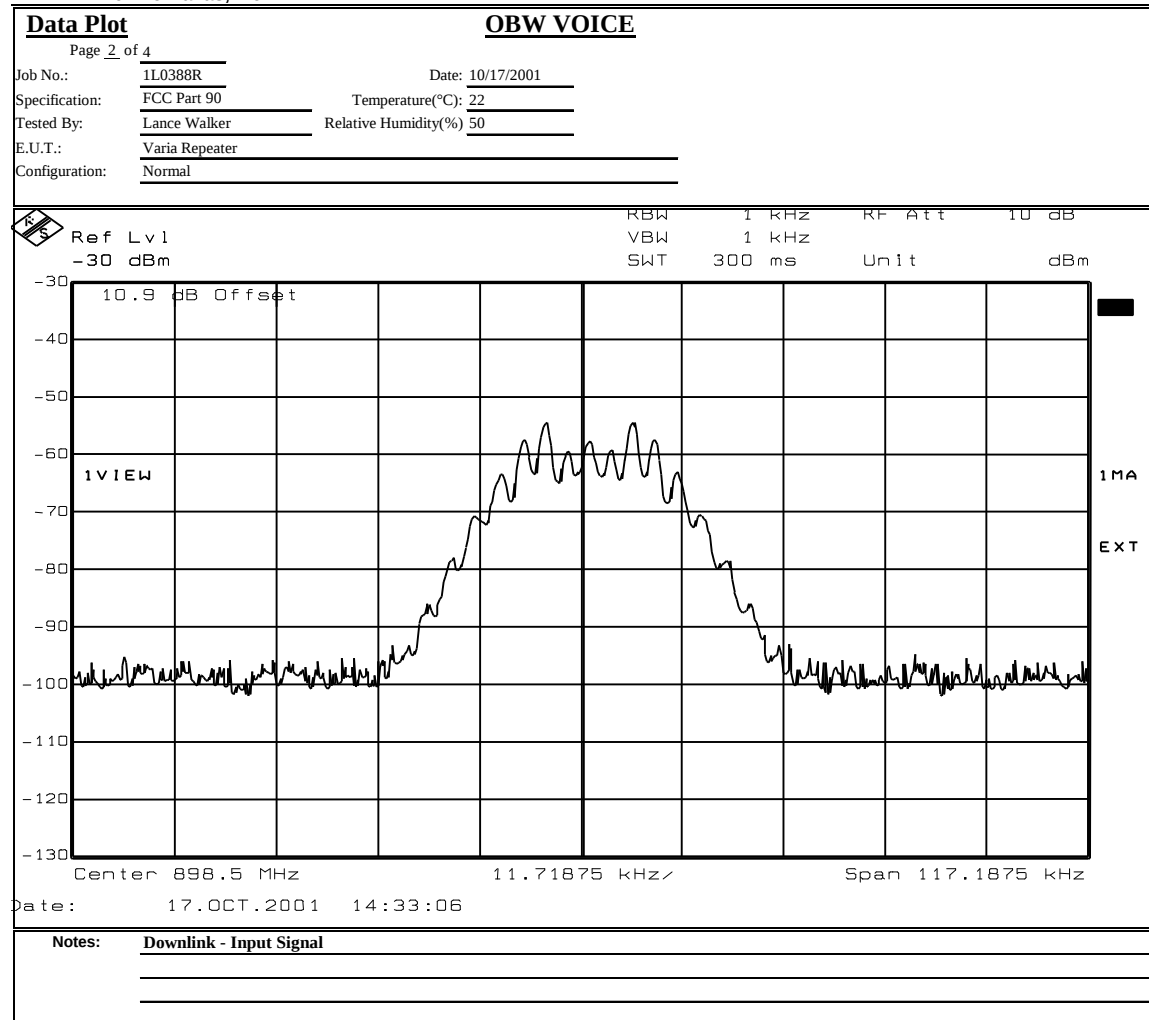
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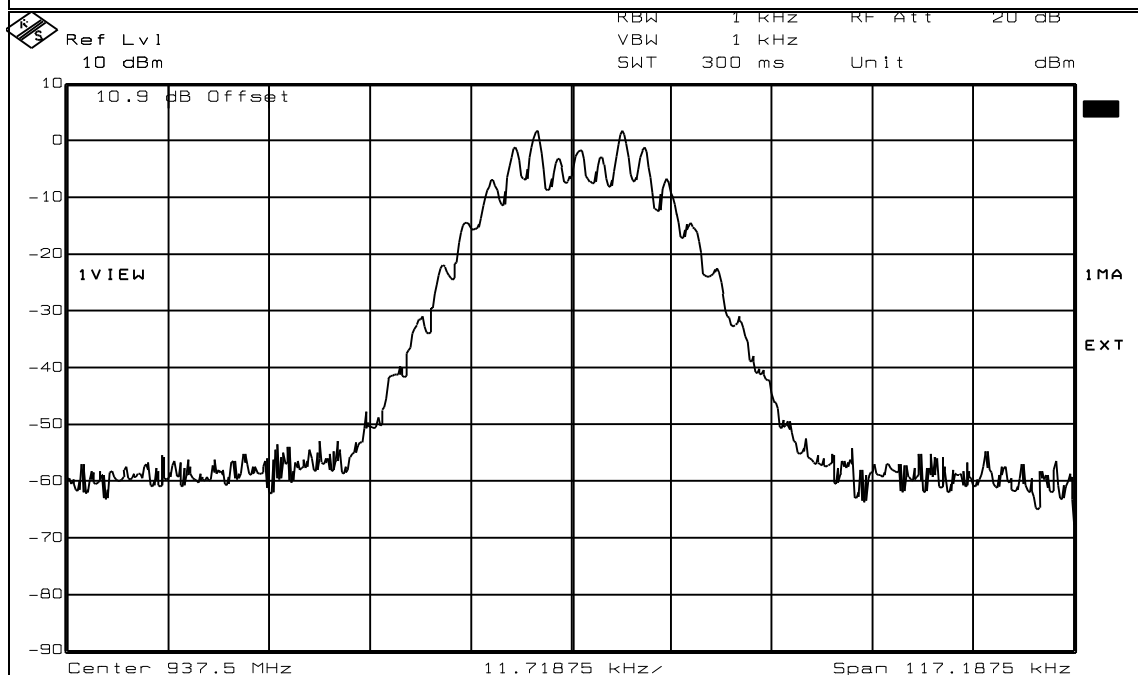
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Data Plot

OBW VOICE

Page 3 of 4

Job No.: 1L0388R Date: 10/17/2001  
Specification: FCC Part 90 Temperature(°C): 22  
Tested By: Lance Walker Relative Humidity(%) 50  
E.U.T.: Varia Repeater  
Configuration: Normal



Date: 17.OCT.2001 14:30:43

Notes: Uplink - Output Signal

EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2



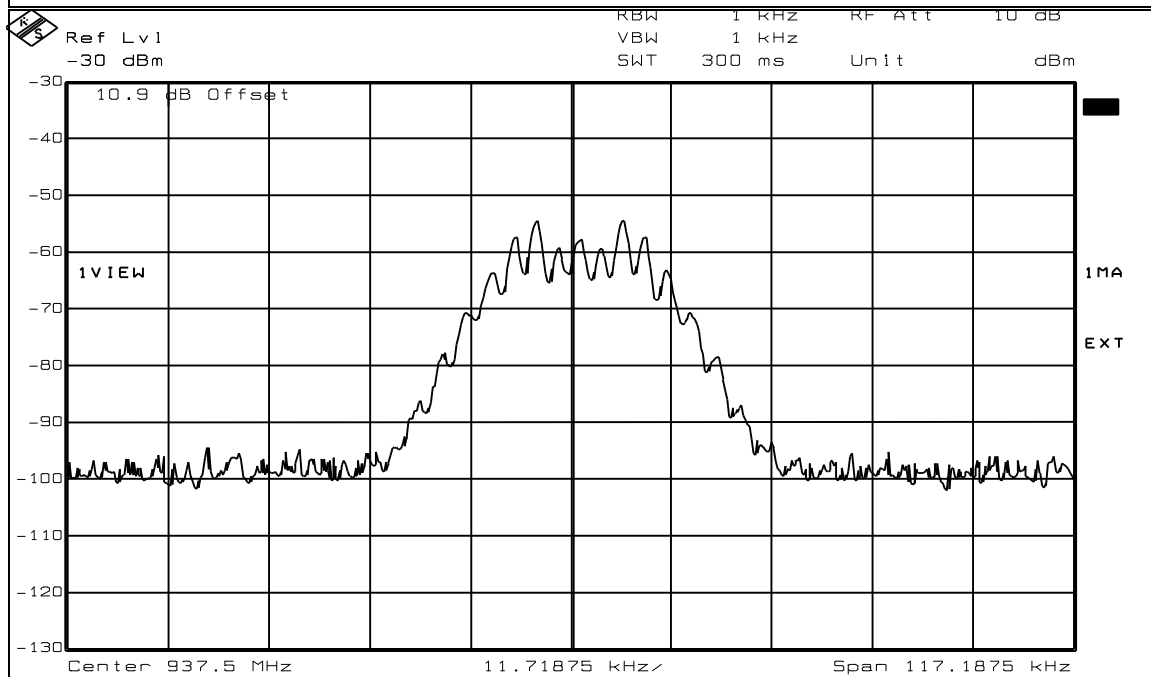
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**Test Plot:**

**OBW VOICE**

Page 4 of 4  
Job No.: 1L0388R Date: 10/17/2001  
Specification: FCC Part 90 Temperature(°C): 22  
Tested By: Lance Walker Relative Humidity(%) 50  
E.U.T.: Varia Repeater  
Configuration: Normal



Notes: Uplink - Input Signal

*EQUIPMENT:*    **MR303 Varia**

PROJECT NO.:    **1L0388RUS2**

---

## **Section 5.            Spurious Emissions at Antenna Terminals**

|                                                      |                  |
|------------------------------------------------------|------------------|
| NAME OF TEST: Spurious Emissions @ Antenna Terminals | PARA. NO.: 2.991 |
| TESTED BY: Lance Walker                              | DATE:10/16/2001  |

**Test Results:**                      Complies.

**Test Data:**                        See attached graph(s).

Measurement Uncertainty:    +/- 1.7 dBm

EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2



Nemko Dallas, Inc.

## Dallas Headquarters:

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

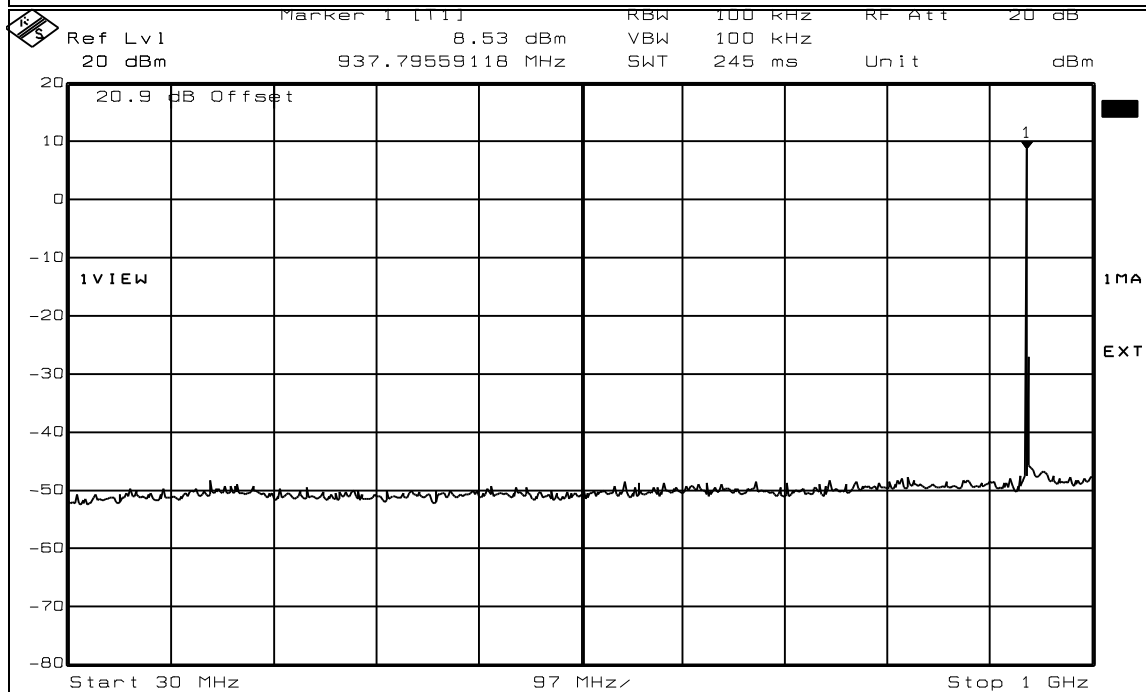
## Data Plot

## APSE 2FSK

Page 1 of 4  
Job No.: 1L0388R Date: 10/16/01 Complete X  
Specification: FCC Part 24 Temperature(°C): 22 Preliminary \_\_\_\_\_  
Tested By: Lance Walker Relative Humidity(%) 50  
E.U.T.: Repeater  
Configuration: Normal  
Sample Number: 1  
Location: Lab 1 RBW: Refer to plots Measurement  
Detector Type: Peak VBW: Refer to plots Distance: N/A m

## Test Equipment Used

Antenna: \_\_\_\_\_ Directional Coupler: \_\_\_\_\_  
Pre-Amp: \_\_\_\_\_ Cable #1: 1082  
Filter: \_\_\_\_\_ Cable #2: \_\_\_\_\_  
Receiver: 1036 Cable #3: \_\_\_\_\_  
Attenuator #1: 1477 Cable #4: \_\_\_\_\_  
Attenuator #2: 1469 Mixer: \_\_\_\_\_  
Additional equipment used: \_\_\_\_\_  
Measurement Uncertainty: +/-3.6 dB



Date: 16.OCT.2001 15:58:02

Notes: DOWNLINK  
MARKER INDICATES CARRIER

EQUIPMENT: MR303 Varia

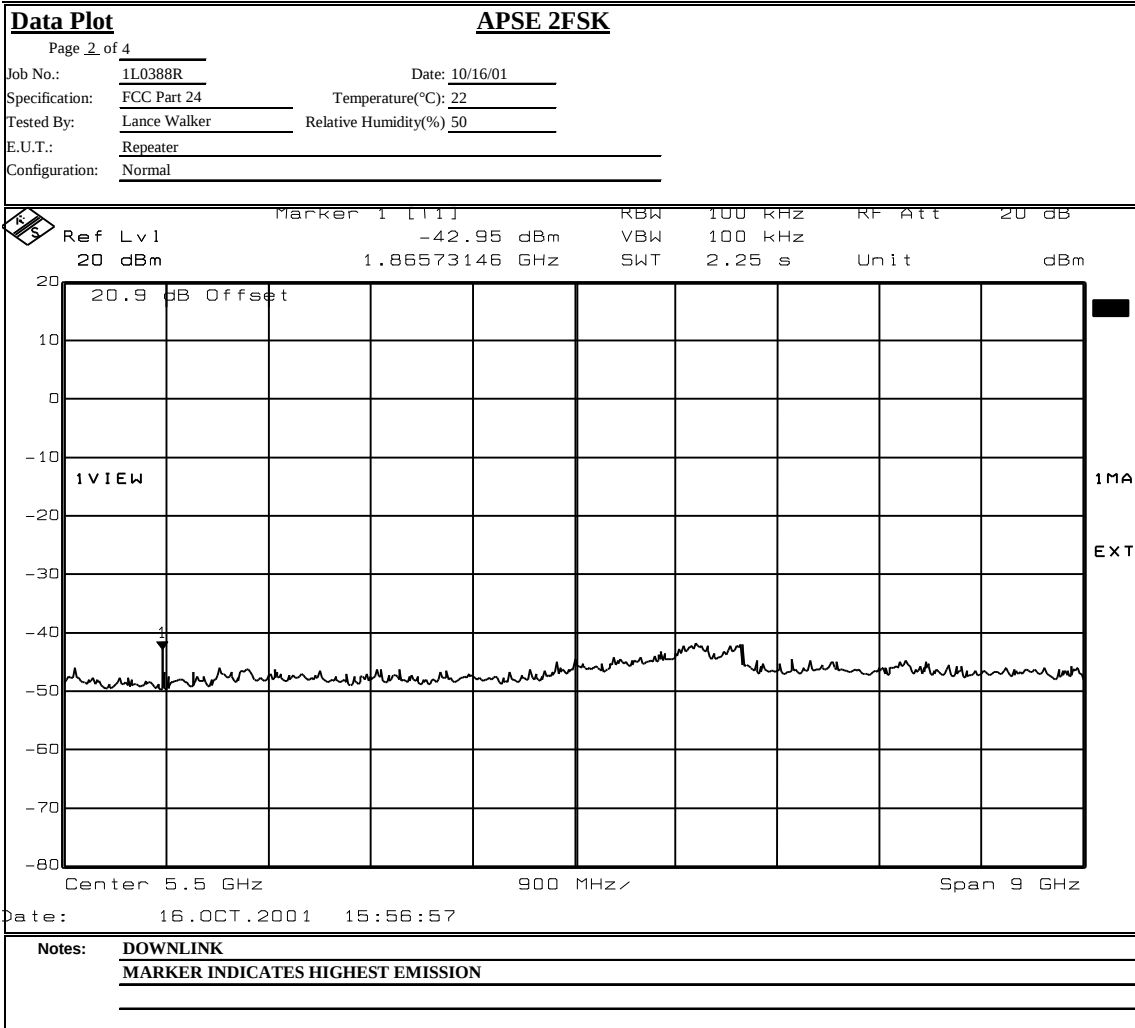
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EQUIPMENT: MR303 Varia

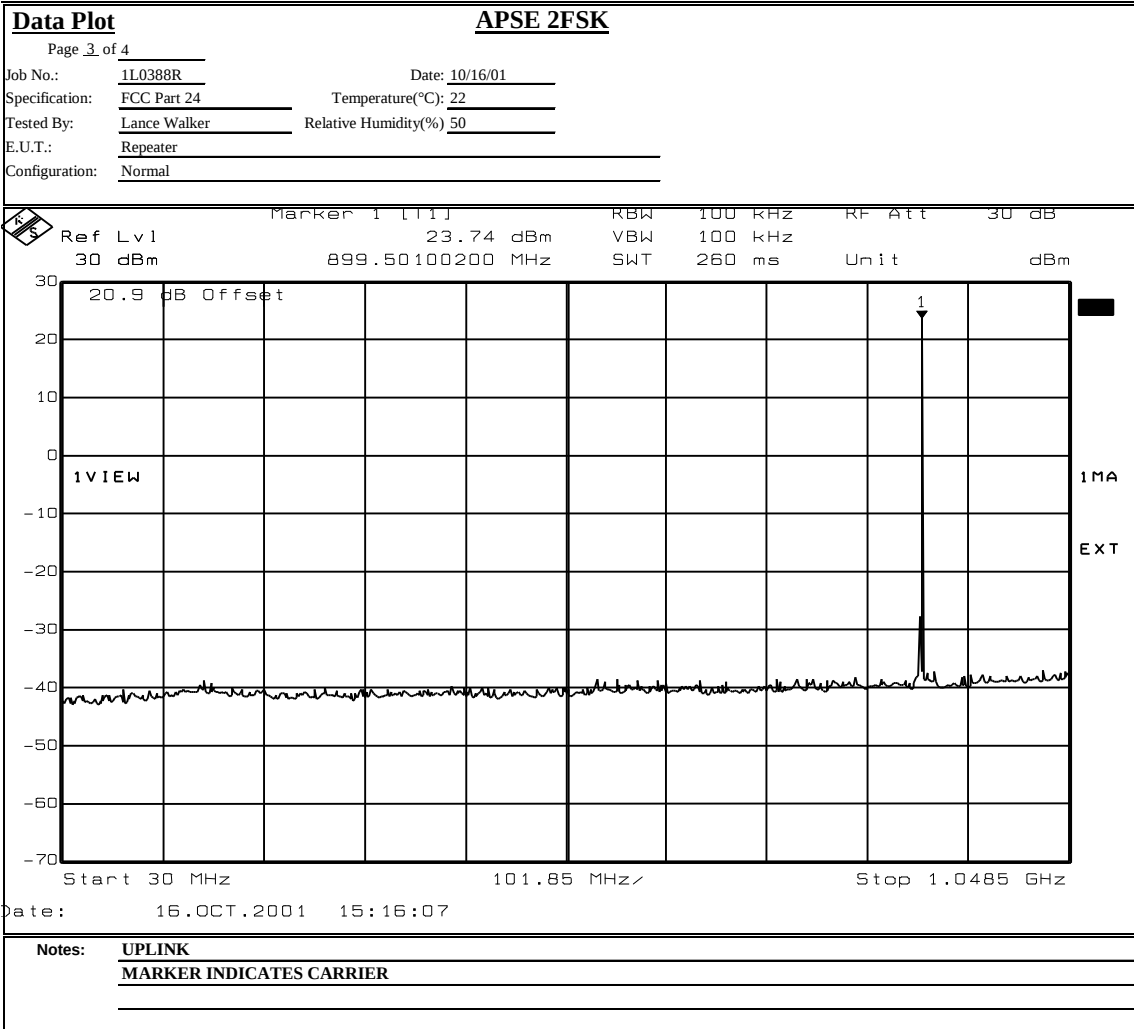
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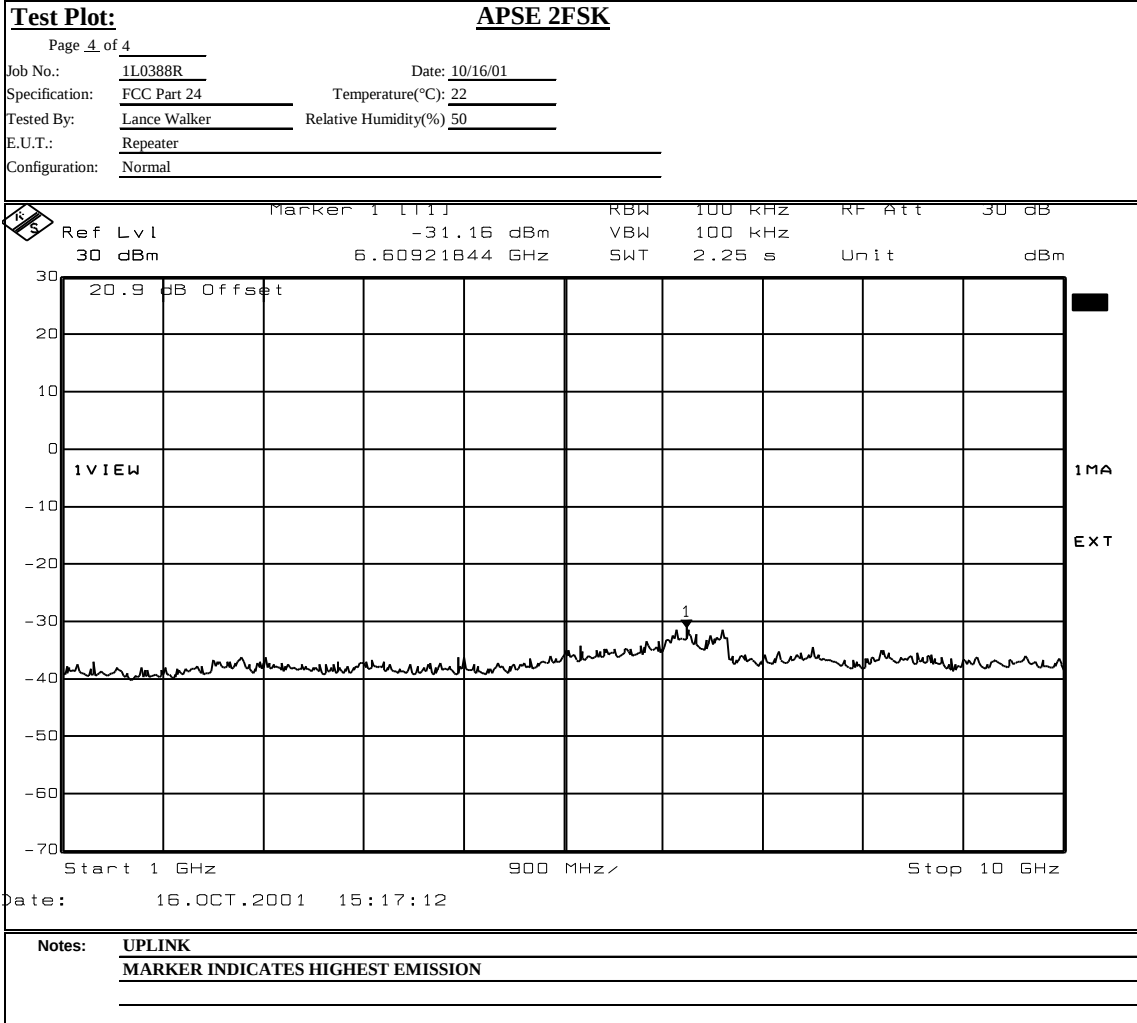
EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2



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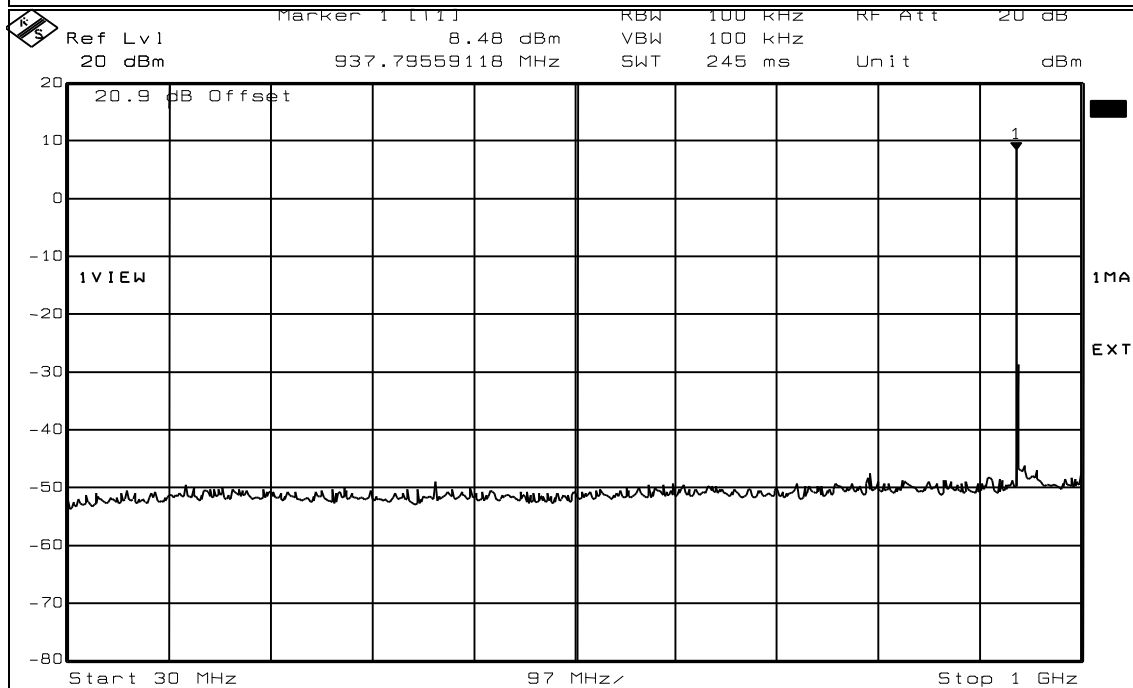
## Data Plot

## APSE 4FSK

Page 1 of 4  
Job No.: 1L0388R Date: 10/16/01 Complete X  
Specification: FCC Part 24 Temperature(°C): 22 Preliminary \_\_\_\_\_  
Tested By: Lance Walker Relative Humidity(%) 50  
E.U.T.: Repeater  
Configuration: Normal  
Sample Number: 1  
Location: Lab 1 RBW: Refer to plots Measurement  
Detector Type: Peak VBW: Refer to plots Distance: N/A m

## Test Equipment Used

Antenna: \_\_\_\_\_ Directional Coupler: \_\_\_\_\_  
Pre-Amp: \_\_\_\_\_ Cable #1: 1082  
Filter: \_\_\_\_\_ Cable #2: \_\_\_\_\_  
Receiver: 1036 Cable #3: \_\_\_\_\_  
Attenuator #1: 1477 Cable #4: \_\_\_\_\_  
Attenuator #2: 1469 Mixer: \_\_\_\_\_  
Additional equipment used: \_\_\_\_\_  
Measurement Uncertainty: +/-3.6 dB



Date: 16.OCT.2001 15:53:13

Notes: DOWNLINK  
MARKER INDICATES CARRIER

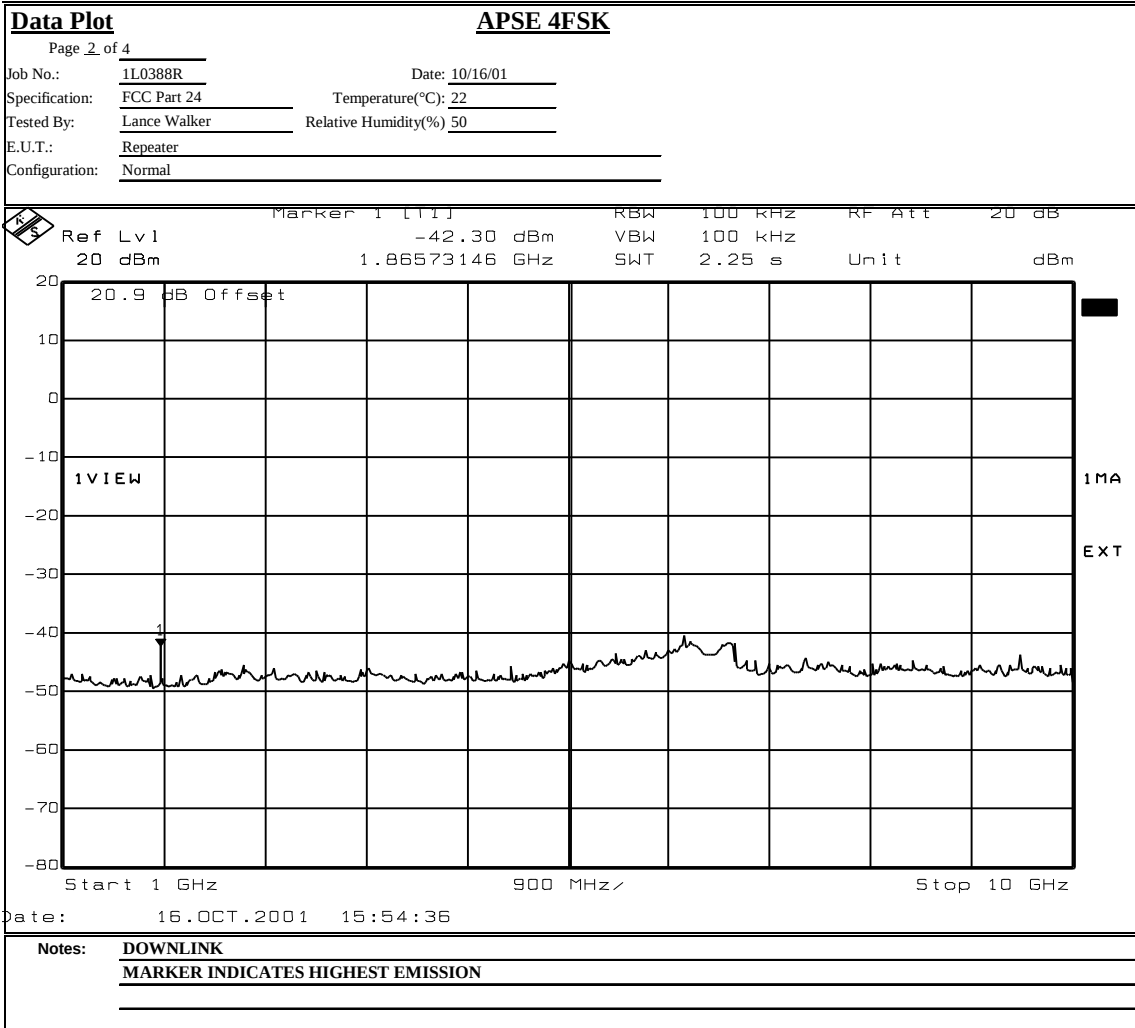
EQUIPMENT: MR303 Varia

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EQUIPMENT: MR303 Varia

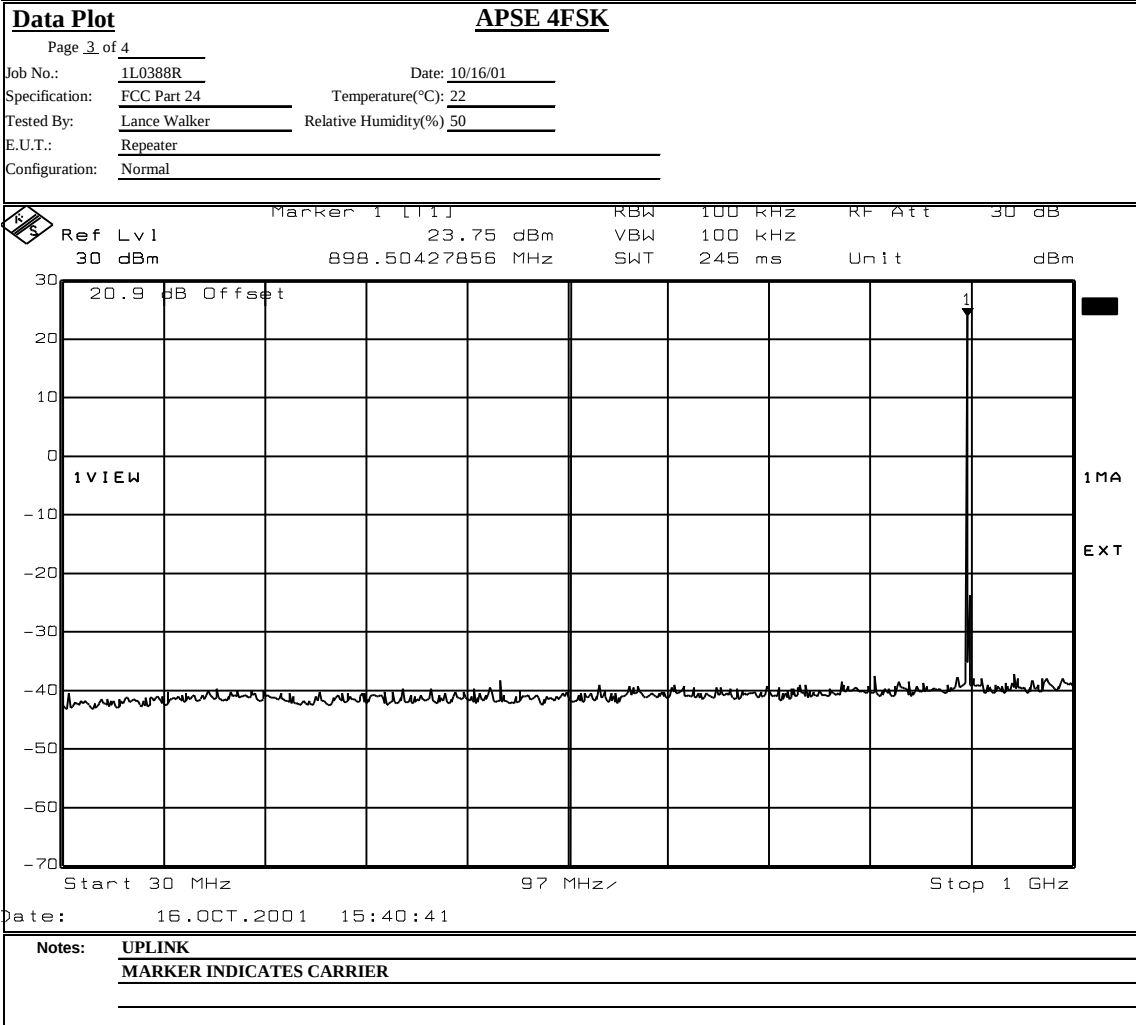
PROJECT NO.: 1L0388RUS2



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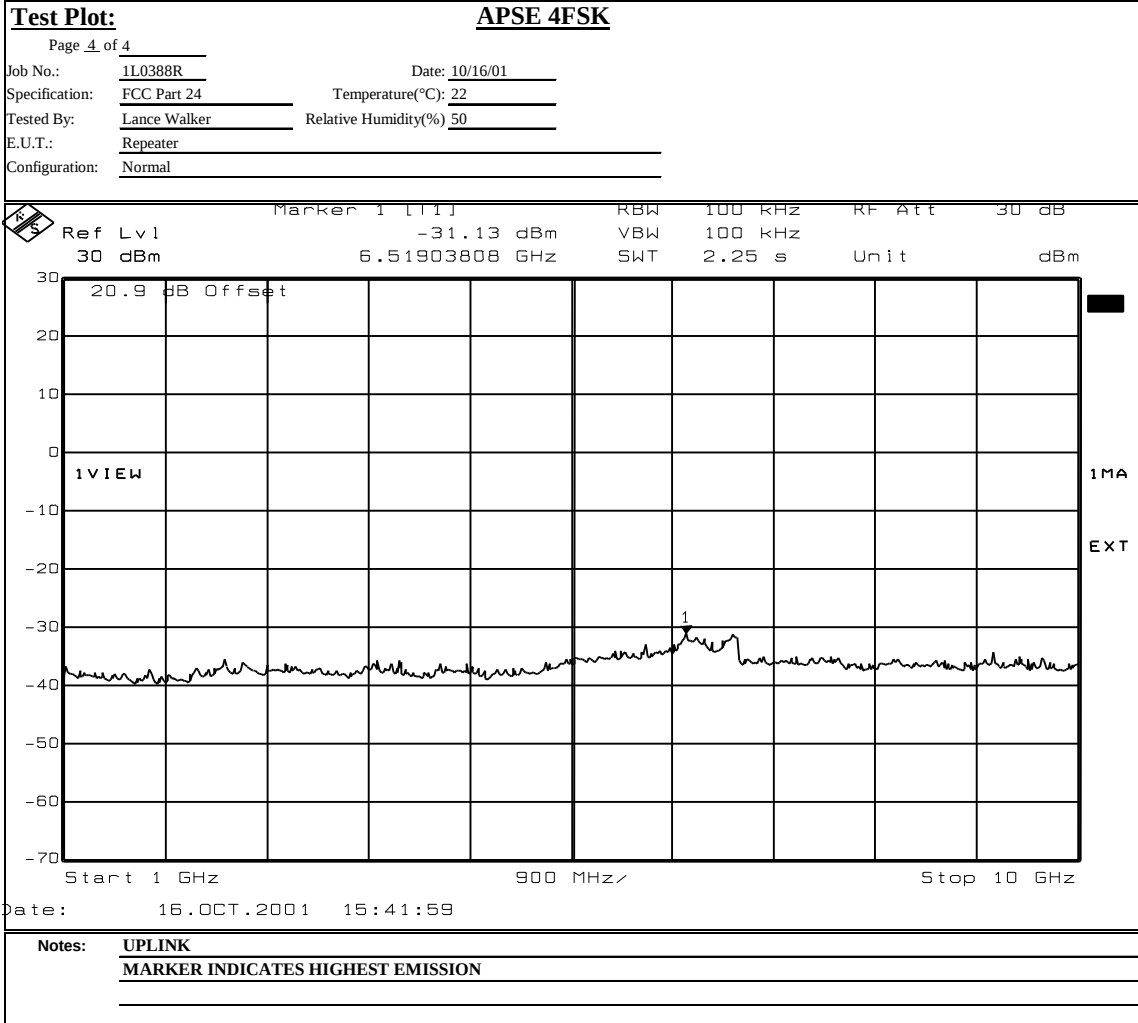
EQUIPMENT: MR303 Varia

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EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2



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## Data Plot

## APSE QAM

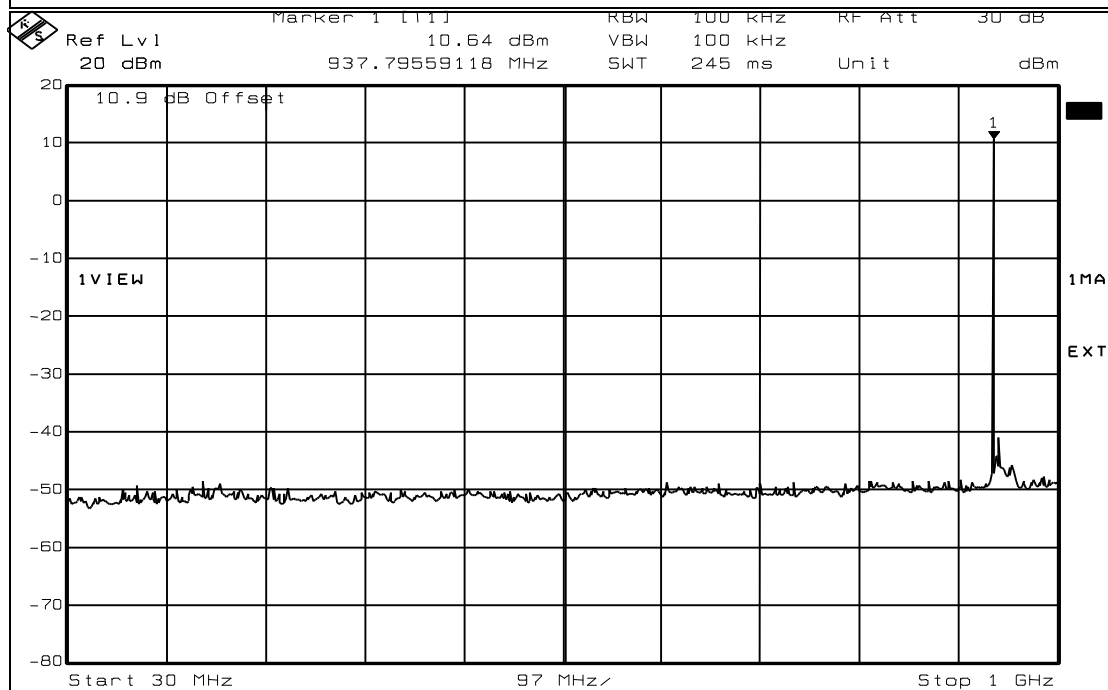
Page 1 of 4

Job No.: 1L0388R Date: 10/17/01 Complete X  
Preliminary \_\_\_\_\_

Specification: FCC Part 24 Temperature(°C): 22  
Tested By: Lance Walker Relative Humidity(%) 50  
E.U.T.: Repeater  
Configuration: Normal  
Sample Number: 1  
Location: Lab 1 RBW: Refer to plots Measurement  
Detector Type: Peak VBW: Refer to plots Distance: N/A m

## Test Equipment Used

Antenna: \_\_\_\_\_ Directional Coupler: \_\_\_\_\_  
Pre-Amp: \_\_\_\_\_ Cable #1: 1082  
Filter: \_\_\_\_\_ Cable #2: \_\_\_\_\_  
Receiver: 1036 Cable #3: \_\_\_\_\_  
Attenuator #1: 1477 Cable #4: \_\_\_\_\_  
Attenuator #2: 1469 Mixer: \_\_\_\_\_  
Additional equipment used: \_\_\_\_\_  
Measurement Uncertainty: +/-3.6 dB



Date: 17.OCT.2001 9:21:13

Notes: DOWNLINK  
MARKER INDICATES CARRIER

EQUIPMENT: MR303 Varia

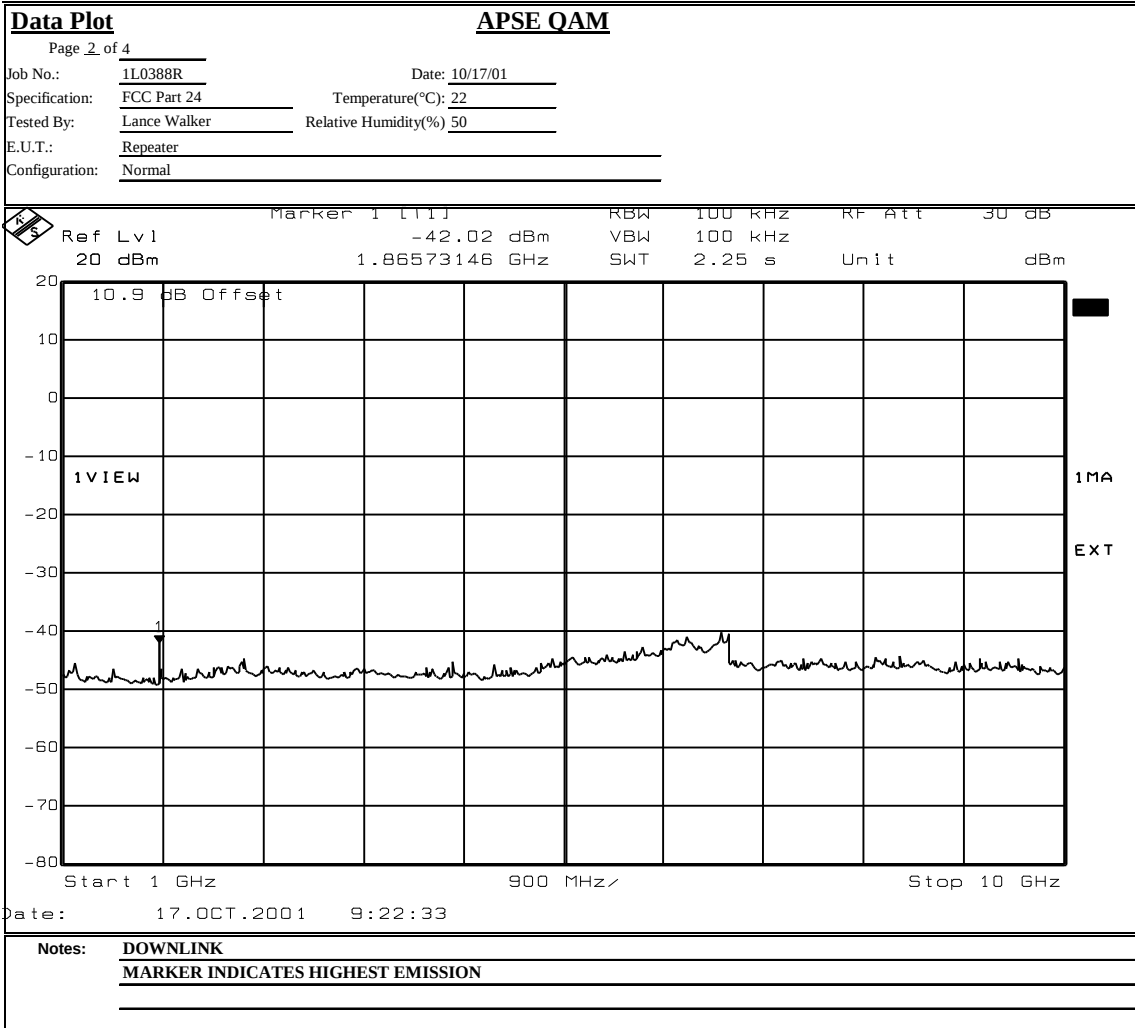
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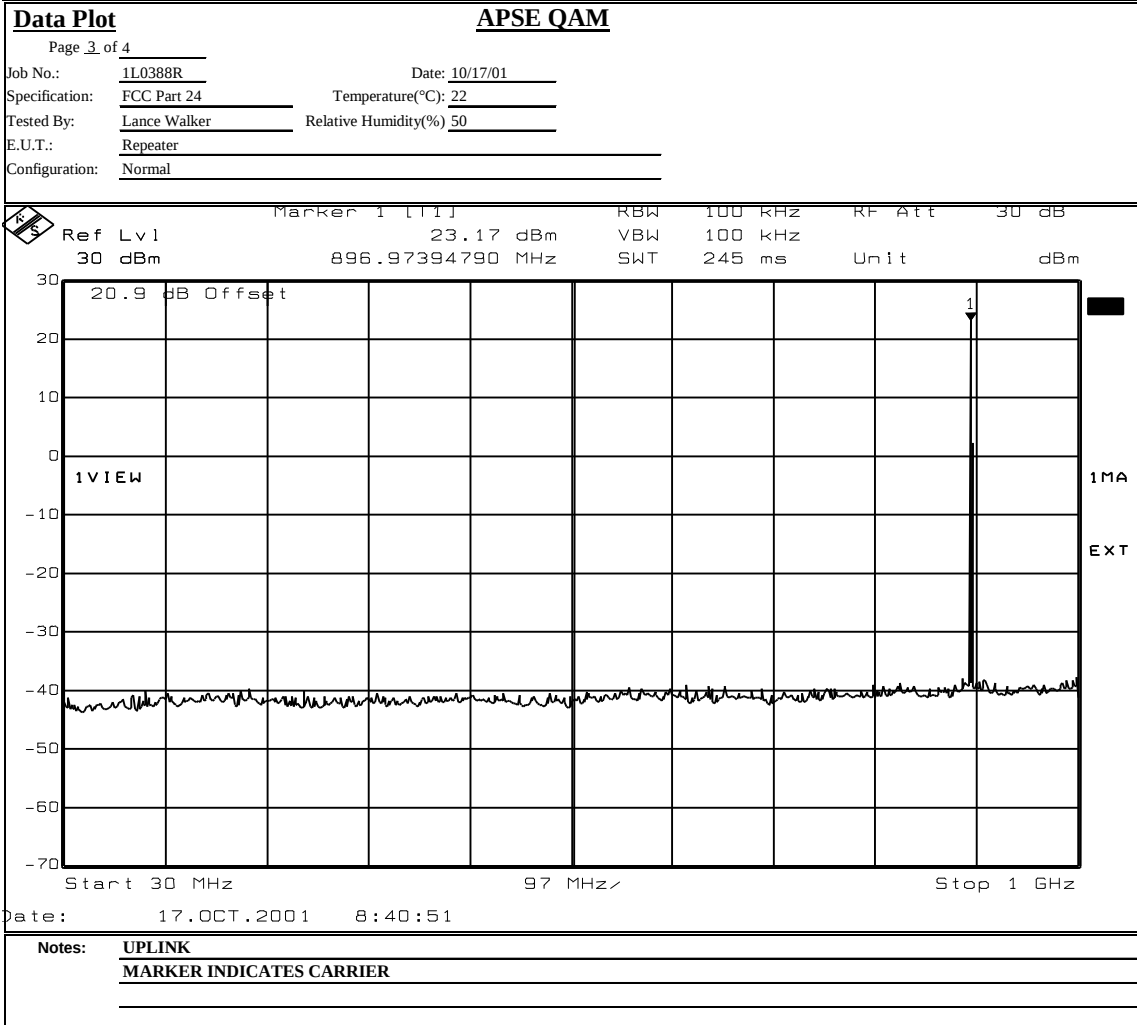
EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2



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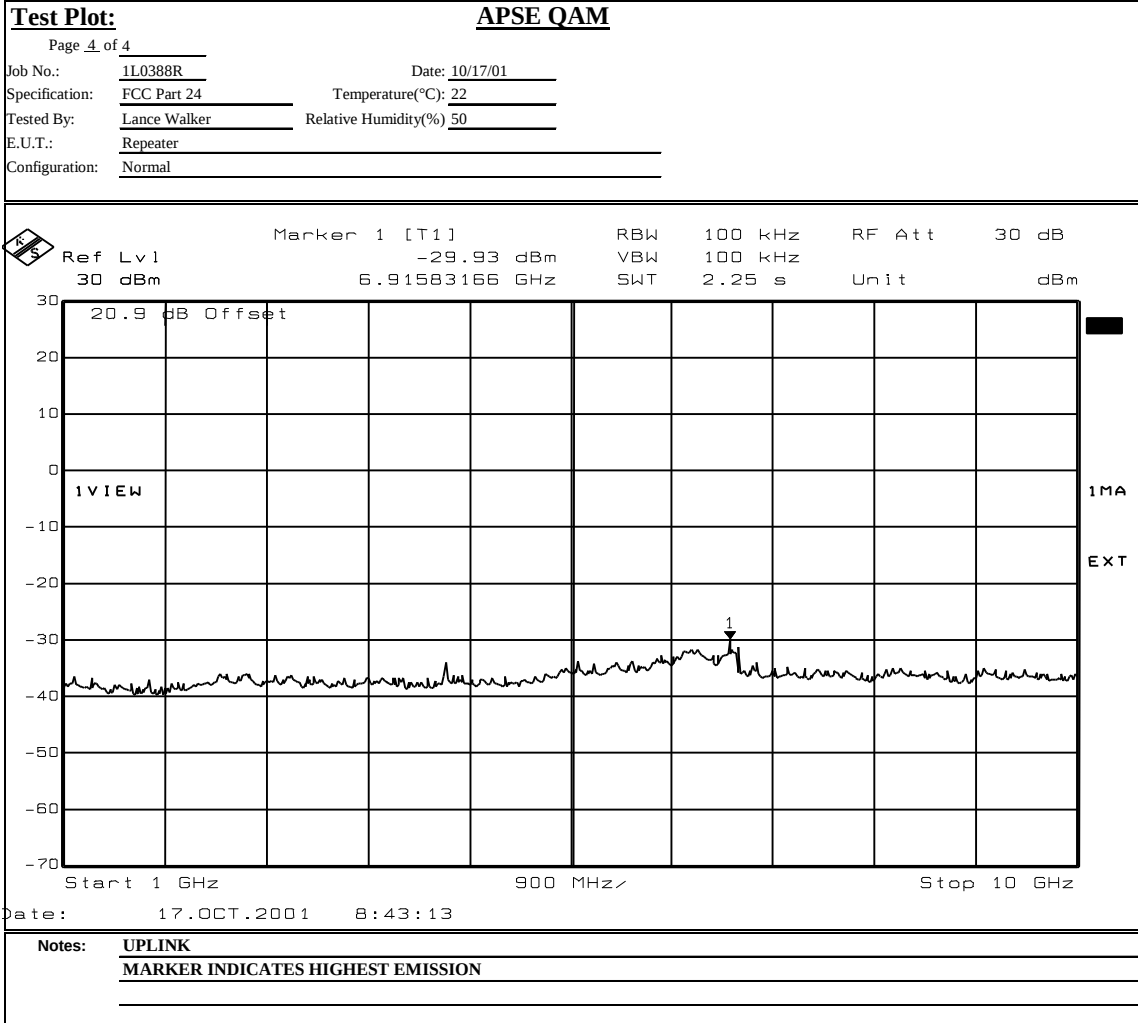
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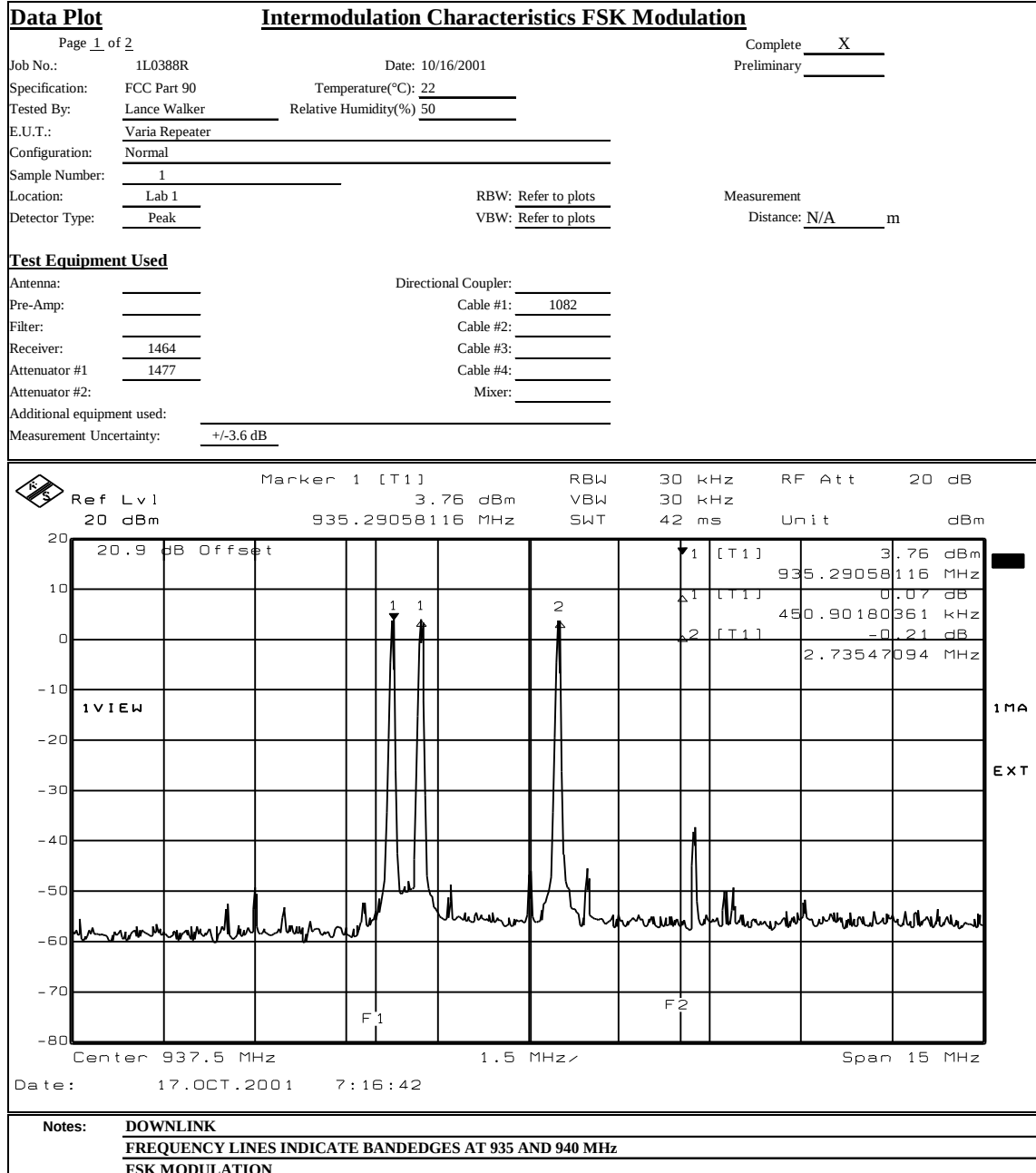
EQUIPMENT: MR303 Varia

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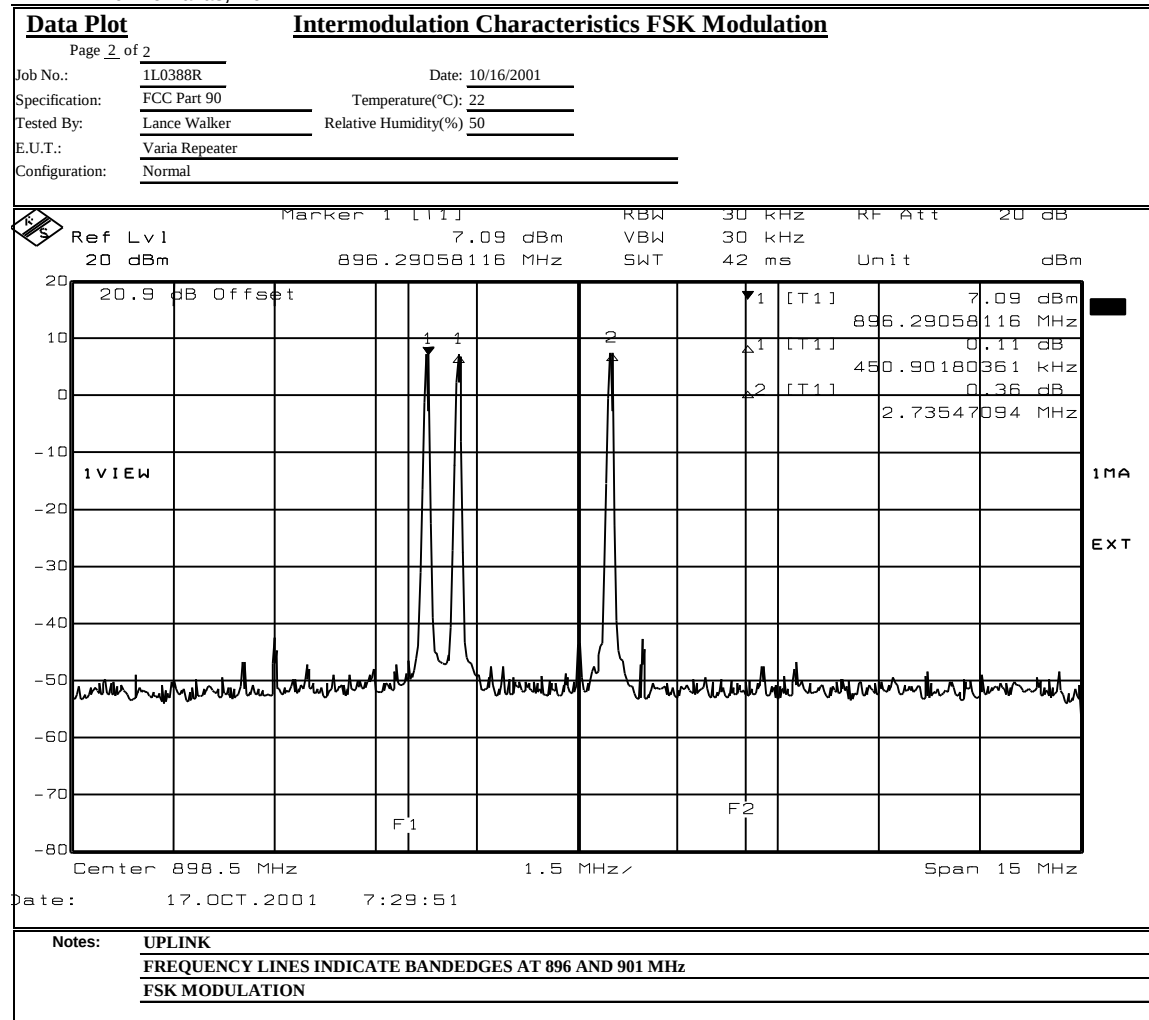
EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2



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EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2



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| Data Plot                                     |                | Intermod QAM          |                 |
|-----------------------------------------------|----------------|-----------------------|-----------------|
| Page 1 of 4                                   |                |                       |                 |
| Job No.:                                      | 1L0388R        | Date:                 | 10/17/2001      |
| Specification:                                | FCC Part 90    | Temperature(°C):      | 22              |
| Tested By:                                    | Lance Walker   | Relative Humidity(%): | 50              |
| E.U.T.:                                       | Varia Repeater |                       |                 |
| Configuration:                                | Normal         |                       |                 |
| Sample Number:                                | 1              |                       |                 |
| Location:                                     | Lab 1          | RBW:                  | Refer to plots  |
| Detector Type:                                | Peak           | VBW:                  | Refer to plots  |
|                                               |                | Measurement           | Distance: N/A m |
| <b>Test Equipment Used</b>                    |                |                       |                 |
| Antenna:                                      |                | Directional Coupler:  |                 |
| Pre-Amp:                                      |                | Cable #1:             | 1082            |
| Filter:                                       |                | Cable #2:             |                 |
| Receiver:                                     | 1464           | Cable #3:             |                 |
| Attenuator #1:                                | 1477           | Cable #4:             |                 |
| Attenuator #2:                                |                | Mixer:                |                 |
| Additional equipment used:                    |                |                       |                 |
| Measurement Uncertainty:                      | +/-3.6 dB      |                       |                 |
|                                               |                |                       |                 |
| Date: 17.OCT.2001 9:45:40                     |                |                       |                 |
| <b>Notes:</b> Downlink - Low End              |                |                       |                 |
| Marker indicates signal from signal generator |                |                       |                 |
| F1 and F2 represent bandedges                 |                |                       |                 |

EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2



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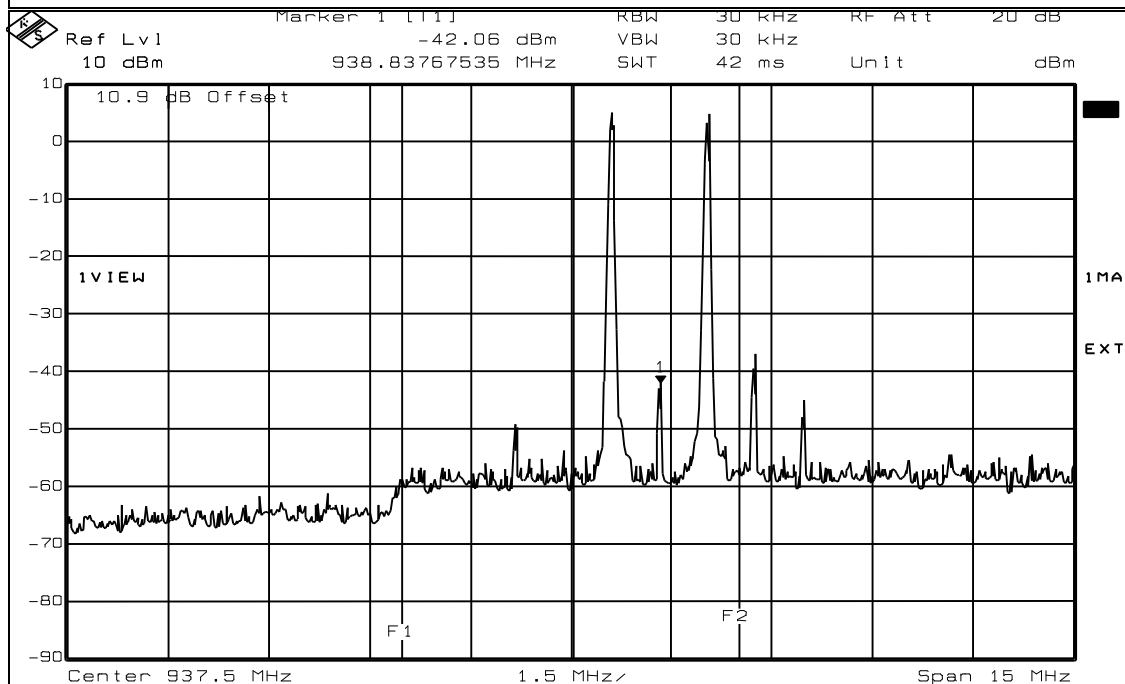
Nemko Dallas, Inc.

Data Plot

Intermod QAM

Page 2 of 4

Job No.: 1L0388R Date: 10/17/2001  
Specification: FCC Part 90 Temperature(°C): 22  
Tested By: Lance Walker Relative Humidity(%) 50  
E.U.T.: Varia Repeater  
Configuration: Normal



Date: 17.OCT.2001 9:48:57

Notes: Downlink - High End

Marker indicates signal from Signal Generator



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Dallas Headquarters:

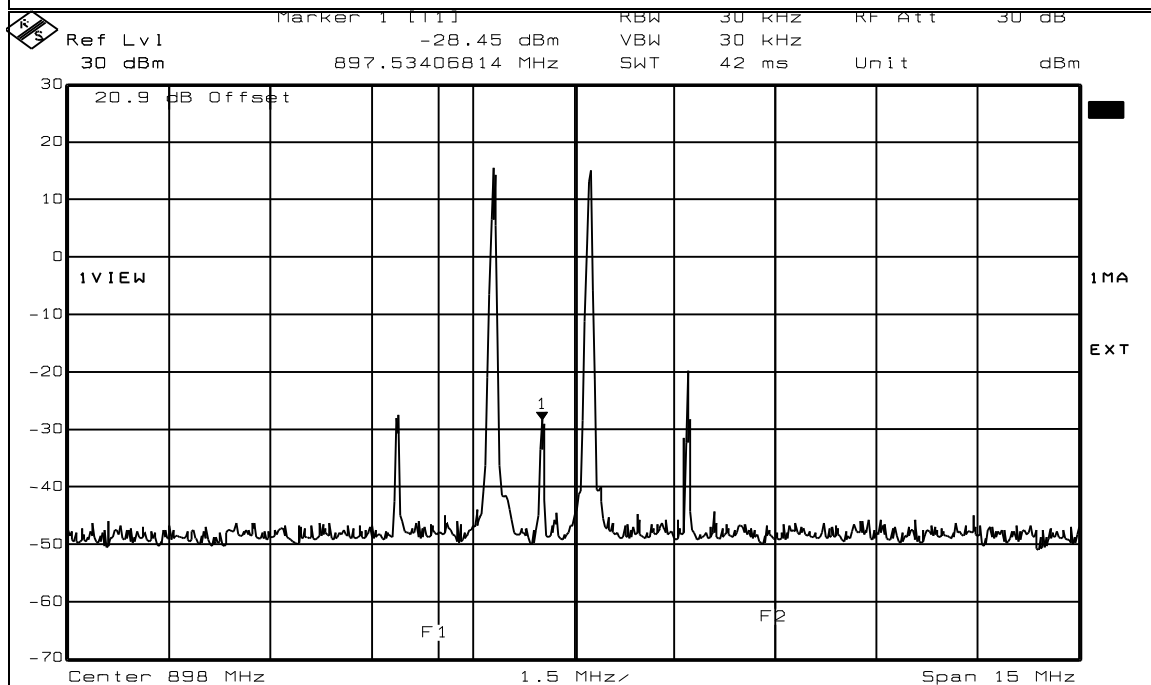
802 N. Kealy  
Lewisville, TX 75057  
Tel: (972) 436-9600  
Fax: (972) 436-2667

Data Plot

Intermod QAM

Page 3 of 4

Job No.: 1L0388R Date: 10/17/2001  
Specification: FCC Part 90 Temperature(°C): 22  
Tested By: Lance Walker Relative Humidity(%) 50  
E.U.T.: Varia Repeater  
Configuration: Normal



Date: 17.OCT.2001 9:59:53

Notes: Uplink - Low End

Marker indicates signal from signal generator

F1 and F2 represent bandedges



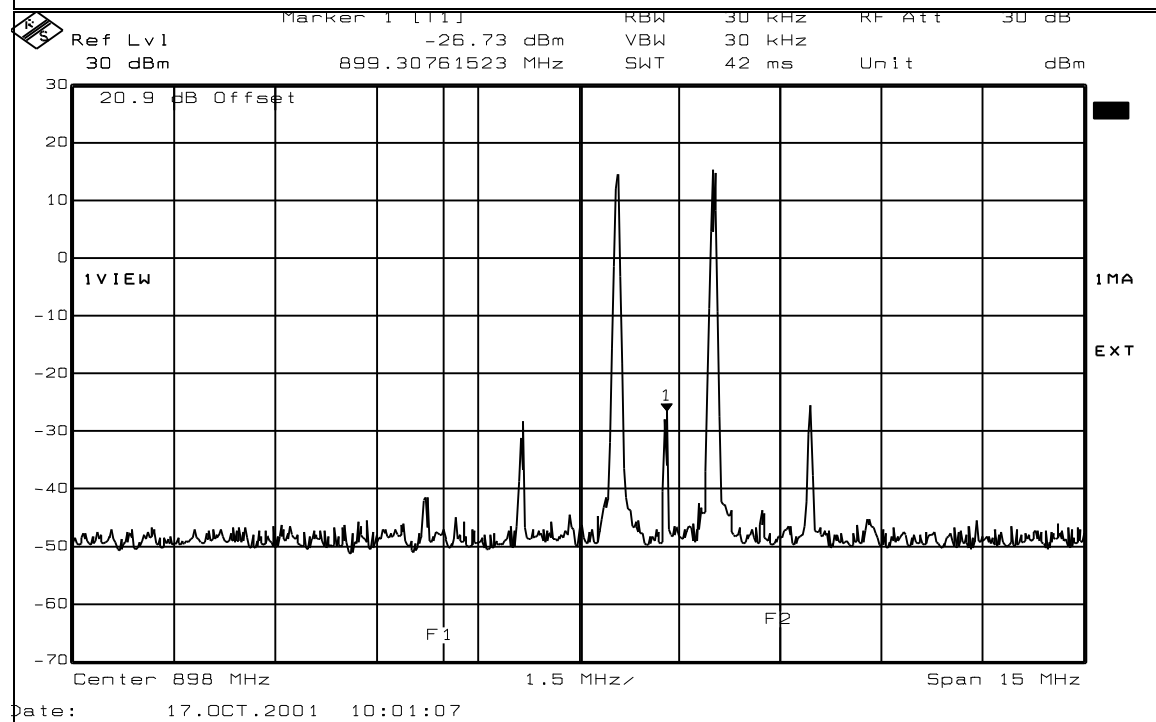
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**Test Plot:**

**Intermod QAM**

Page 4 of 4  
Job No.: 1L0388R Date: 10/17/2001  
Specification: FCC Part 90 Temperature(°C): 22  
Tested By: Lance Walker Relative Humidity(%) 50  
E.U.T.: Varia Repeater  
Configuration: Normal



Notes: Downlink - Low End  
Marker indicates signal from signal generator  
F1 and F2 represent bandedges

*EQUIPMENT:*    **MR303 Varia**

PROJECT NO.:    **1L0388RUS2**

---

## **Section 6.            Field Strength of Spurious Emissions**

|                                                    |                  |
|----------------------------------------------------|------------------|
| NAME OF TEST: Field Strength of Spurious Emissions | PARA. NO.: 2.993 |
| TESTED BY: Lance Walker                            | DATE:08/31/2001  |

**Test Results:**                      Complies.

**Test Data:**                        See attached table.

**Note:**                                See page A5 for applicable limit.

*EQUIPMENT:*    **MR303 Varia**

PROJECT NO.: 1L0388RUS2

## Test Data - Radiated Emissions



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[illegible]

EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2



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**Field Strength of Spurious Emissions**

Page 1 of 1

Job No.: 1L0388R Date: 8/31/01 Complete X  
Preliminary       

Specification: Temperature(°C): 22

Tested By: Lance Walker Relative Humidity(%) 50

E.U.T.: Repeater

Configuration: Normal Downlink

Sample No: 1

Location: AC 3 RBW: 1 MHz Measurement

Detector Type: Peak VBW: 1 MHz Distance: 3 m

**Test Equipment Used**

Antenna: 993 Directional Coupler:       

Pre-Amp: 1016 Cable #1: 1043

Filter: Cable #2: 1082

Receiver: 1464 Cable #3: 1484

Attenuator #1: 1470 Cable #4: 1485

Attenuator #2: Mixer:       

Additional equipment used: 1053

Measurement Uncertainty: +/-3.6 dB

| Frequency<br>(MHz) | Meter<br>Reading<br>(dBm) | Correction<br>Factor<br>(dB) |  | Pre-Amp<br>Gain<br>(dB) | Substitution<br>Antenna Gain<br>(dBd) | Limit<br>(dBm) | ERP<br>(dBm) | ERP<br>(mW) | Polarity | Comments        |
|--------------------|---------------------------|------------------------------|--|-------------------------|---------------------------------------|----------------|--------------|-------------|----------|-----------------|
|                    |                           |                              |  |                         |                                       |                |              |             |          | Tx at 947.5 MHz |
| 1895               | -59.5                     | 32.7                         |  | 33.3                    | 6.4                                   | -13            | -53.8        | 0.000004    | H        | Noise floor     |
| 2842.5             | -60.3                     | 34.6                         |  | 33.5                    | 8.0                                   | -13            | -51.2        | 0.000008    | H        | Noise floor     |
| 3790               | -61.5                     | 34.3                         |  | 33.7                    | 8.0                                   | -13            | -52.9        | 0.000005    | H        | Noise floor     |
| 4737.5             | -62.5                     | 35.5                         |  | 33.7                    | 9.2                                   | -13            | -51.5        | 0.000007    | H        | Noise floor     |
| 5685               | -63.8                     | 36.0                         |  | 33.3                    | 9.1                                   | -13            | -52.0        | 0.000006    | H        | Noise floor     |
| 6632.5             | -62.3                     | 37.8                         |  | 33                      | 10.1                                  | -13            | -47.3        | 0.000019    | H        | Noise floor     |
| 7580               | -61.3                     | 39.8                         |  | 33                      | 9.4                                   | -13            | -45.1        | 0.000031    | H        | Noise floor     |
| 8527.5             | -62.6                     | 41.8                         |  | 34.3                    | 9.9                                   | -13            | -45.1        | 0.000031    | H        | Noise floor     |
| 9475               | -62.1                     | 41.4                         |  | 35.7                    | 10.1                                  | -13            | -46.4        | 0.000023    | H        | Noise floor     |
| 10422.5            | -61.8                     | 42.5                         |  | 35.7                    | 10.5                                  | -13            | -44.5        | 0.000036    | H        | Noise floor     |
|                    |                           |                              |  |                         |                                       |                |              |             |          |                 |
| 1895               | -59.5                     | 29.9                         |  | 33.3                    | 6.4                                   | -13            | -56.6        | 0.000002    | V        | Noise floor     |
| 2842.5             | -60.3                     | 35.6                         |  | 33.5                    | 8.0                                   | -13            | -50.3        | 0.000009    | V        | Noise floor     |
| 3790               | -61.5                     | 40.4                         |  | 33.7                    | 8.0                                   | -13            | -46.8        | 0.000021    | V        | Noise floor     |
| 4737.5             | -62.5                     | 41.2                         |  | 33.7                    | 9.2                                   | -13            | -45.9        | 0.000026    | V        | Noise floor     |
| 5685               | -63.8                     | 38.5                         |  | 33.3                    | 9.1                                   | -13            | -49.5        | 0.000011    | V        | Noise floor     |
| 6632.5             | -62.3                     | 38.3                         |  | 33                      | 10.1                                  | -13            | -46.9        | 0.000021    | V        | Noise floor     |
| 7580               | -61.3                     | 40.4                         |  | 33                      | 9.4                                   | -13            | -44.4        | 0.000036    | V        | Noise floor     |
| 8527.5             | -62.6                     | 40.3                         |  | 34.3                    | 9.9                                   | -13            | -46.7        | 0.000022    | V        | Noise floor     |
| 9475               | -62.1                     | 39.3                         |  | 35.7                    | 10.1                                  | -13            | -48.5        | 0.000014    | V        | Noise floor     |
| 10422.5            | -61.8                     | 41.0                         |  | 35.7                    | 10.5                                  | -13            | -46.0        | 0.000025    | V        | Noise floor     |
|                    |                           |                              |  |                         |                                       |                |              |             |          |                 |
|                    |                           |                              |  |                         |                                       |                |              |             |          |                 |
|                    |                           |                              |  |                         |                                       |                |              |             |          |                 |
|                    |                           |                              |  |                         |                                       |                |              |             |          |                 |
|                    |                           |                              |  |                         |                                       |                |              |             |          |                 |
|                    |                           |                              |  |                         |                                       |                |              |             |          |                 |
|                    |                           |                              |  |                         |                                       |                |              |             |          |                 |
|                    |                           |                              |  |                         |                                       |                |              |             |          |                 |

**Photographs of Test Setup**

FRONT VIEW



REAR VIEW



**Nemko Dallas**

FCC PART 90, SUBPART I  
PRIVATE LAND MOBILE REPEATER

*EQUIPMENT:*    **MR303 Varia**

PROJECT NO.:    **1L0388RUS2**

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## **Section 7. Frequency Stability**

|                                   |                 |
|-----------------------------------|-----------------|
| NAME OF TEST: Frequency Stability | PARA. NO. 2.995 |
| TESTED BY:                        | DATE:           |

**Test Results:**                      Complies/Does Not Comply.

**Measurement Data:**            See attached tables.

**Not Applicable**

EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2

**Section 8. Test Equipment List**

| ASSET | Description                    | Manufacturer<br>Model Number       | Serial Number | Cal.<br>Date |
|-------|--------------------------------|------------------------------------|---------------|--------------|
| 1036  | SPECTRUM ANALYZER              | ROHDE & SCHWARZ<br>FSEK30          | 830844/006    | 09/17/01     |
| 1477  | 20db Attenuator DC 18 Ghz      | MCL Inc.<br>BW-S20W5               | NONE          | CBU          |
| 1469  | 10 db Attenuator DC 18 Ghz     | MCL Inc.<br>BW-S10W2 10db-2WDC     | NONE          | CBU          |
| 993   | Horn antenna                   | A.H. Systems<br>SAS-200/571        | XXX           | 07/16/99     |
| 1016  | Pre-Amp                        | HEWLETT PACKARD<br>8449A           | 2749A00159    | 05/30/01     |
| 1464  | Spectrum analyzer              | Hewlett Packard<br>8563E           | 3551A04428    | 01/02/01     |
| 1470  | 10 db Attenuator DC 18 Ghz     | MCL Inc.<br>BW-S10W2 10db-2WDC     | NONE          | CBU          |
| 1043  | Flexible cable 1m              | Astrolab Inc.<br>32027-2-29094K-1M | 0             | 01/29/01     |
| 1484  | Cable 2.0-18.0 Ghz             | Storm<br>PR90-010-072              | N/A           | 06/01/01     |
| 1485  | Cable 2.0-18.0 Ghz             | Storm<br>PR90-010-216              | N/A           | 06/01/01     |
| 1063  | Low Noise Amplifier 20-1000mhz | MiteQ<br>AM-1430                   | 422057        | 02/27/01     |
| 1029  | PEAK POWER METER               | HP<br>8900D                        | 3303U0012     | 03/12/01     |
| 1030  | PEAK POWER SENSOR              | HP<br>84811A                       | 2539A03573    | 03/12/01     |

**Nemko Dallas**

FCC PART 90, SUBPART I  
PRIVATE LAND MOBILE REPEATER

*EQUIPMENT:* **MR303 Varia**

PROJECT NO.: **1L0388RUS2**

---

## **ANNEX A - TEST METHODOLOGIES**

**NAME OF TEST: RF Power Output****PARA. NO.: 2.985**

**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).

**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:

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation  $GP/4\pi R^2 = E^2/120\pi$  and proceeding as follows:

$$P = \frac{E^2 R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator

FCC PART 90, SUBPART I  
PRIVATE LAND MOBILE REPEATER

PROJECT NO.: 1L0388RUS2

**PARA. NO.: 2.991**

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

VBW:  $\Rightarrow$  RBW

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

**EQUIPMENT: MR303 Varia****PROJECT NO.: 1L0388RUS2**

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**NAME OF TEST: Occupied Bandwidth****PARA. NO.: 2.989****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.: 2.993****Minimum Standard:** Para. No. 90.210, see table 1 for applicable mask.**Calculation of Field Strength Limit**

An example of attenuation requirement of  $50 + 10 \log P$  is equivalent to -20 dBm ( $1 \times 10^{-5}$  Watts) at the antenna terminal. We determine the field strength limit by using the plane wave relation.

$$GP/4\pi R^2 = E^2/120\pi$$

For emissions  $\leq 1$  GHz:

G = 1.64 (Dipole Gain)

P =  $10^{-5}$  Watts (Maximum spurious output power)

R = 3m (Measurement Distance)

$$E = \frac{\sqrt{30GP}}{R} = E = \frac{\sqrt{30 \times 1.64 \times 10^{-5}}}{3} = 0.00739 \text{ V / m} = 77.4 \text{ dBmV / m}$$

For emissions  $> 1$  GHz:

G = 1 (Isotropic Gain)

P =  $1 \times 10^{-5}$  Watts (Maximum spurious output power)

R = 3m (Measurement Distance)

$$E = 77.4 - 20 \log \sqrt{1.64} = 75.2 \text{ dBmV / m@3m}$$

| MASK        | Spurious Limit | FS Limit Below 1 GHz | FS Limit Above 1 GHz |
|-------------|----------------|----------------------|----------------------|
| A,B,C,G,H,I | -13dBm         | 84.4 dBμV/m@3m       | 82.2 dBμV/m@3m       |
| D,J         | -20dBm         | 77.4 dBμV/m@3m       | 75.2 dBμV/m@3m       |
| E,F,K       | -25dBm         | 72.4 dBμV/m@3m       | 70.2 dBμV/m@3m       |

EQUIPMENT: MR303 Varia

PROJECT NO.: 1L0388RUS2

**NAME OF TEST: Frequency Stability****PARA. NO.: 2.995**

**Minimum Standard:** Para. No. 990.213. The transmitter carrier frequency shall remain within the assigned frequency below in ppm.

**Table 2**

| Frequency Band<br>(MHz) | Fixed And Base<br>Stations | Mobile Stations   |                   |
|-------------------------|----------------------------|-------------------|-------------------|
|                         |                            | > 2 Watts o/p pwr | < 2 Watts o/p pwr |
| Below 25                | 100                        | 100               | 200               |
| 25 - 50                 | 20                         | 20                | 50                |
| 72 - 76                 | 5                          | -                 | 50                |
| 150 - 174               | 5                          | 5                 | 5                 |
| 220 - 222               | 0.1                        | 1.5               | 1.5               |
| 421 - 512               | 2.5                        | 5                 | 5                 |
| 806 - 821               | 1.5                        | 2.5               | 2.5               |
| 821 - 824               | 1.0                        | 1.5               | 15                |
| 851 - 866               | 1.5                        | 2.5               | 2.5               |
| 866 - 869               | 1.0                        | 1.5               | 1.5               |
| 869 - 901               | 0.1                        | 1.5               | 1.5               |
| 902 - 928               | 2.5                        | 2.5               | 2.5               |
| 929 - 930               | 1.5                        | -                 | -                 |
| 935 - 940               | 0.1                        | 1.5               | 1.5               |
| 1427 - 1435             | 300                        | 300               | 300               |
| Above 2450              | -                          | -                 | -                 |

**Nemko Dallas**

FCC PART 90, SUBPART I  
PRIVATE LAND MOBILE REPEATER

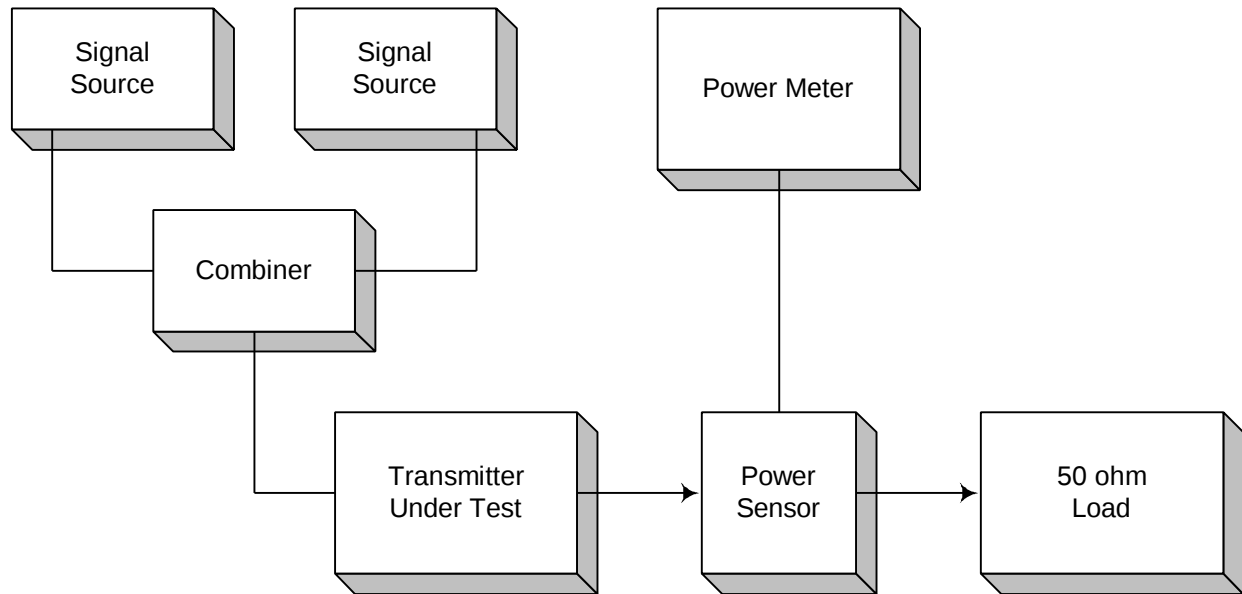
*EQUIPMENT:*    **MR303 Varia**

PROJECT NO.:    **1L0388RUS2**

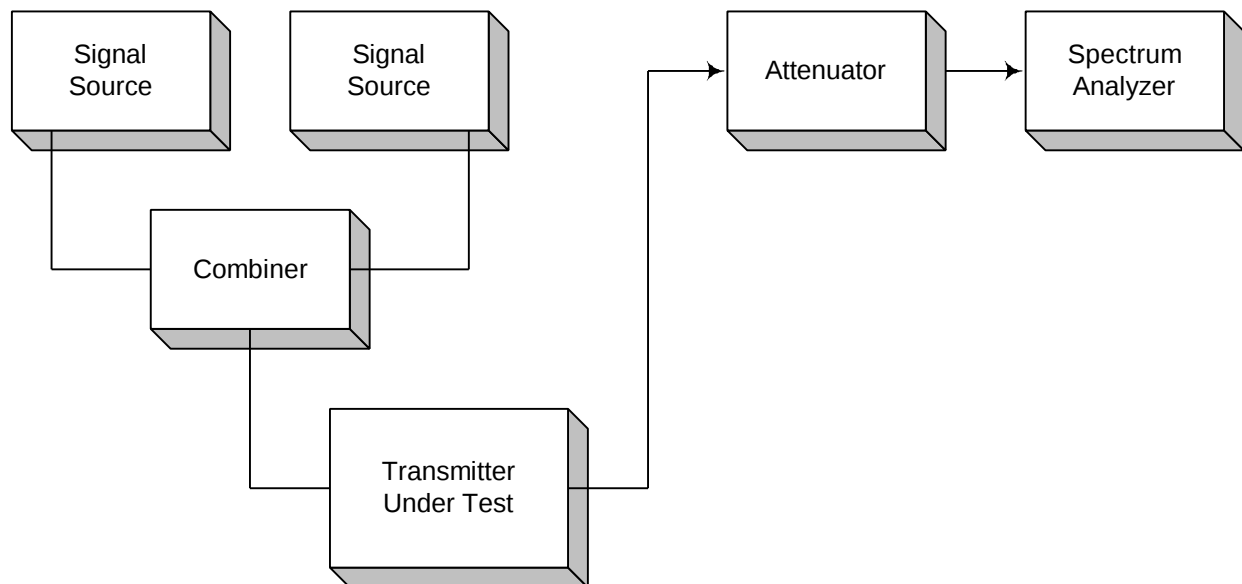
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## **ANNEX B - TEST DIAGRAMS**

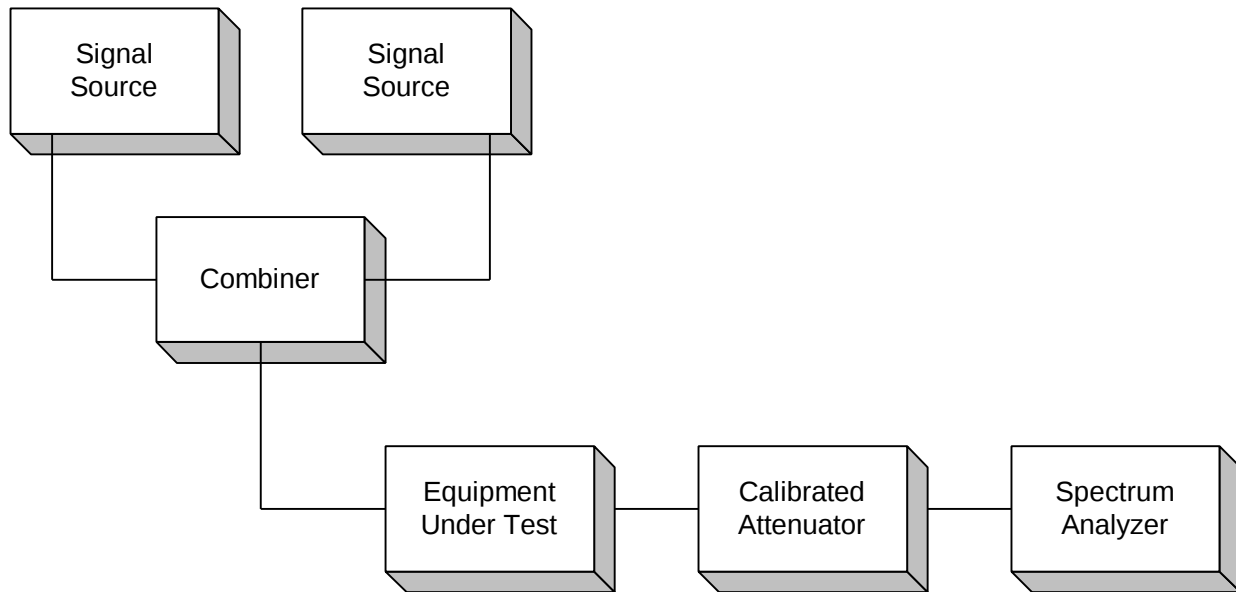
**Para. No. 2.985 - R.F. Power Output**



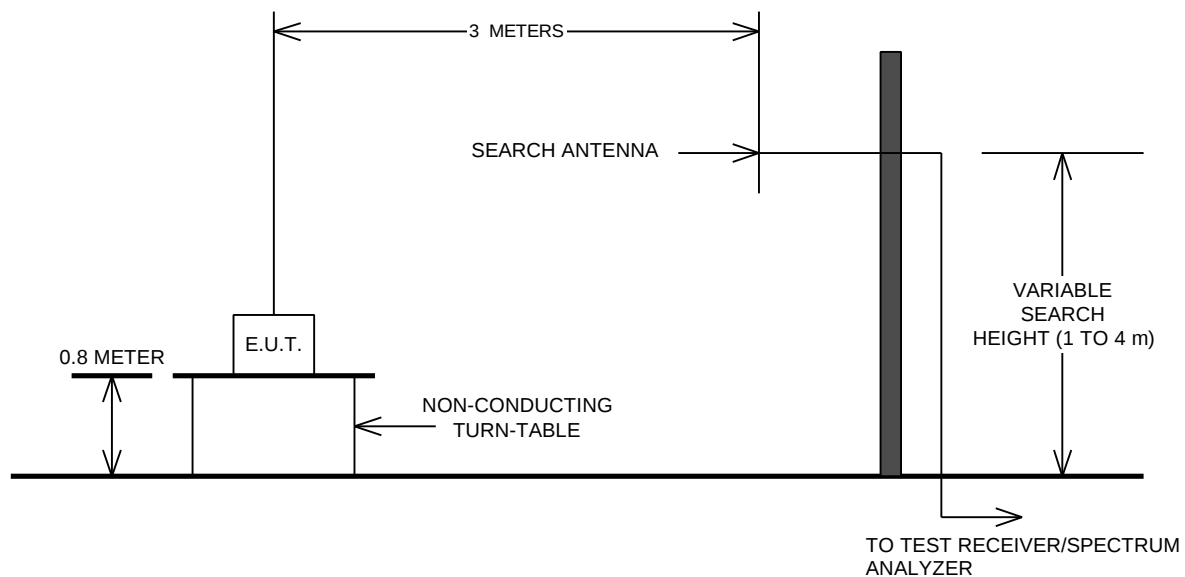
**Para. No. 2.989 - Occupied Bandwidth**



**Para. No. 2.991 - Spurious Emissions at Antenna Terminals**



**Para. No. 2.993 - Field Strength of Spurious Radiation**



**Para. No. 2.995 - Frequency Stability**

