**TUV Rheinland of North America, Inc.**
**12 Commerce Road, Newtown, CT 06470**
**(203)426-0888 * FAX (203)270-8883**



# Report of Measurements
**for**
**Automotive Safety Warning System**
**Model MicroRadar**
**Applicant:**
**Microtek Lab, Inc.**
**3715 Doolittle Drive**
**Redondo Beach, CA 90278**

**Report of Measurements**
**by**
**TUV Rheinland of North America, Inc.**
**12 Commerce Road**
**Newtown, CT 06470**

**TIMOTHY M. DWYER**
**Senior Specialist, EMC**

**Date of Test: 3 - 5 March 1999**
**Date of Report: 13 April 1999**

| **Test Report Number**: P9872688.E01<br>Prübericht Nr. | **Test Report Summary** |
|---|---|

| | | |
|---|---|---|
| **Applicant:**<br>Auftraggeber | **Microtek Lab, Inc.**<br>**3715 Doolittle Drive**<br>**Redondo Beach, CA 90278-1226** | Tel: (310) 297-5711 Maw-Rong Chin<br>Fax: (310) 297-5050 |
| **Type of Equipment:**<br>Gegenstand der Prüfung | Automotive Safety Warning System | |
| **Model Number:**<br>Bezeichnung: | **MicroRadar** | **Trademark:** MicroTek<br>Ursprungszeichen |
| **Standards:**<br>Prufgrundlage | | **Date of Test:** 3 - 5 March 1999 |

| Standard Number | Description | Severity Level or Limit | Minimum Acceptable Performance Criteria | Summary Result |
|---|---|---|---|---|
| FCC Part 15 Subpart B | Radiated Emissions | Sections 15.245 and 15.209 | NA | Complies |

| | | |
|---|---|---|
| **Place of Test:**<br>Prüfort | TUV Rheinland of North America,<br>12 Commerce Road,<br>Newtown, CT 06470 USA<br><br>E-mail: info-new@tuv.com<br>Web: http://www.tuv.com<br>Phone: (203) 426-0888 Fax: (203) 270-8883 | Accredited by the National Voluntary Laboratory Accreditation Program for FCC Part 15 and CISPR 22 under Lab Code 200111 |

| | |
|---|---|
| **Test Result:**<br>Prüfergebnis | The unit presented for testing complied with criteria shown above. Additional Information is contained in the following pages. |

| | |
|---|---|
| **Tested By:** **Timothy M. Dwyer**<br>Der Sachverständige | **Checked By:** **Bruce Fagley**<br>geprüft |
| _____<br>**Date, Signature**<br>Datum, Unterschrift | _____<br>**Date, Signature**<br>Datum, Unterschrift |

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# 1. General

## *1.1 Equipment Tested*

**Automotive Safety Warning System**
**Model: MicroRadar**

## *1.2 Applicant/Manufacturer*

**Microtek Lab, Inc.**
**3715 Doolittle Drive**
**Redondo Beach, CA 90278-1226**

## *1.3 FCCID: KH5ASW-9904-8801*

## *1.4 Description*

The MicroRadar is a low cost Automotive Safety warning System the alerts motorists to unseen proximity objects. It is a microwave (5.8 GHz) distance-measuring and proximity warning system which provides the vehicle operator with audio and visual warning or a person or other object behind a reversing vehicle.

### 1.4.1 Physical:

The MicroRadar consists of a bumper mounted microwave module, a dashboard mounted display module and connecting cables.

### 1.4.2 Functional:

The Microwave module contains a 5.8 GHz transmitter/receiver and circuits for proximity detection. The display module contains LED's, a beeper, and a voice synthesizer to alert the driver.

### 1.4.3 Electrical and EMC Related:

Both units are powered from 13.6 VDC provided by the automobile in which they are installed.

## *1.5 Description of Circuit Function*

Refer to exhibits filed separately

### *1.6 Block Diagram Showing Oscillators*

Refer to exhibits filed separately.

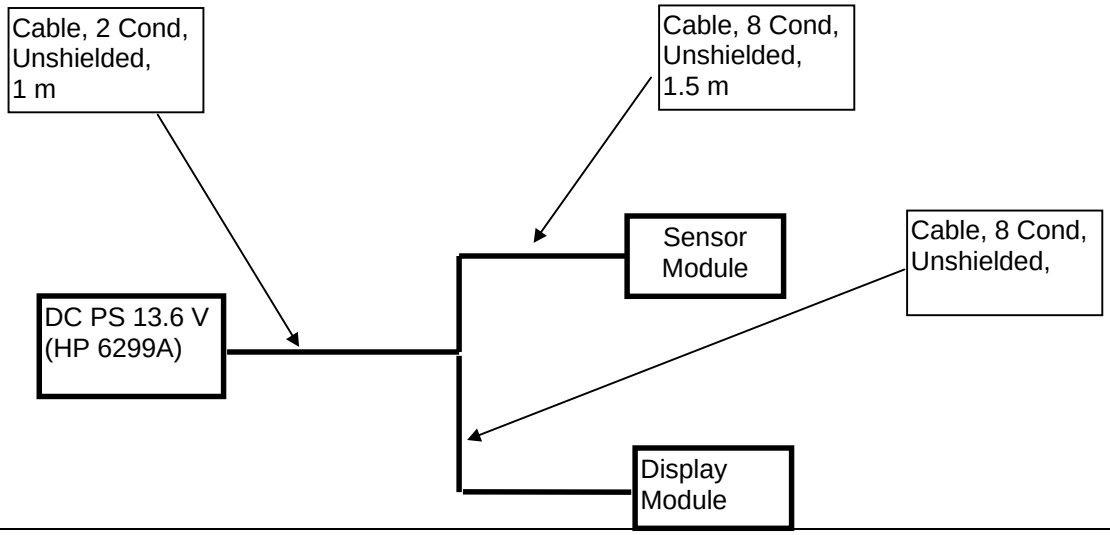
## 2. Measurement Equipment Used

The measuring equipment used for measurements is shown in the following tables.

| Equipment | Frequency Range | Manufacturer and Model | Calibration Last |
|---|---|---|---|
| EMI Receiver | 30 - 1000 MHz | HP8546A | Jun 98 |
| Antenna, Biconical | 30-300 MHz | Schwarzbeck VHBB9124 | Sep 98 |
| Antenna, Log Periodic | 300-1000 MHz | EMCO | Sep 98 |
| Spectrum Analyzer | 1 - 26 GHz | HP 8593EM | Feb 99 |
| Antenna, Ridged Horn | 1 - 18 Ghz | EMCO 3115 | Sep 98 |
| Preselector | 1 - 18 GHz | HP 8445B | Feb 99 |
| Preamplifier, 30 dB | 1 - 26 GHz | HP 8449E | Dec 98 |

# 3. Report of Measurements

## *3.1 Test Configuration Block Diagram*



## *3.2 Conducted Emissions*

Conducted emissions measurements were not performed as the MicroRadar has no provision for connection to the AC mains.

## *3.3 Radiated Emissions*

### 3.3.1 MODE OF OPERATION:

The MicroRadar was exercised during the tests in its normal operating mode.

### 3.3.2 PROCEDURE:

Preliminary radiated measurements below 1000 MHz were made at a distance of 3 meters in a semi-anechoic chamber. The preliminary plots are included in the test data section. Final radiated measurements were performed on an Open Area Test Site (OATS) at a measurement distance of 3 meters.

Radiated measurements above 1000 MHz were performed in the semi-anechoic chamber at a distance of 3 meters.

Radiated emissions measurements were performed using the ANSI C63.4-1992 measurement procedures as specified in paragraph 15.31(a)(6).

| | |
|---|---|
| Dates of Test: | 3 - 5 March 1999 |
| Frequency Range: | 30 MHz - 24 GHz |
| Detectors: | Peak, Quasi Peak and Average |
| Peak Measurement Bandwidth: | 120 kHzBW < 1GHz, 1 MHzBW > 1GHz |
| Quasi-Peak Measurement Bandwidth: | 120 kHz |
| Average Measurement Bandwidth: | 300 kHzBW < 1GHz, 1MHzBW >1GHz |

### 3.3.3 CRITERIA

CFR 47 (FCC) 15.245 and 15.209

### 3.3.4 MEASUREMENT DATA

### 3.3.5 CALCULATION

#### *3.3.5.1 For measurements below 1000 MHz*

*Measured Level (dBµV) + Cable Loss (dB)+ Antenna Factor (dB) = Field Strength (dBµV/m)*

#### *3.3.5.2 For measurements above 1000 MHz*

*Measured Level (dBµV) + Cable Loss (dB) + Preamplifier Gain (dB) + Preselector Factor (dB) + Antenna Factor (dB) = Field Strength (dBµV/m)*

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| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Radiated Emissions Measurements*** | | | | ***PRESCAN or FINAL:*** | | Final | | | | | | |
| ***Standard: 47 CFR 15.209*** | | | | ***Distance:*** | | 3 m | | ***Date/Time:*** | | 3/5/99 8:26 | | |
| ***Device Tested:*** | Microtek MicroRadar | | | | | | | ***File:*** | | 99030501.xlz | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | Measured Levels (include correction factors) | | | | | | | | | |
| Meas # | Freq (MHz) | Peak (dBµV/m) | Quasi-Peak (dBµV/m) | Average (dBµV/m) | Quasi-Peak Limit <= 1000 MHz, Avg Limit >1000 MHz (dBµV/m) | Quasi-Peak Δ (Avg Δ > 1000 Mhz) | Antenna + Cable + Preselector Correction Factor (included in measured levels) | Result | Polarization | Antenna Height (m) | Angle (°) | Comment |
| 1 | 32.0192 | 36.13 | 33.13 | 32.67 | 40.00 | -6.87 | 13.26 | **Complied** | V | 1.5 | 90 | 15.209(a) |
| 2 | 37.1377 | 28.17 | 26.22 | 25.1 | 40.00 | -13.78 | 12.53 | **Complied** | V | 1.5 | 90 | 15.209(a) |
| 3 | 38.9108 | 27.11 | 24.97 | 23.74 | 40.00 | -15.03 | 12.33 | **Complied** | V | 1.5 | 90 | 15.209(a) |
| 4 | 40.8502 | 32.59 | 30.84 | 30.26 | 40.00 | -9.16 | 12.13 | **Complied** | V | 1.5 | 90 | 15.209(a) |
| 5 | 44.5702 | 26.56 | 24.71 | 23.5 | 40.00 | -15.29 | 11.83 | **Complied** | V | 1.5 | 90 | 15.209(a) |
| 6 | 48.2912 | 28.06 | 26.31 | 25.47 | 40.00 | -13.69 | 11.75 | **Complied** | V | 1.5 | 90 | 15.209(a) |
| 7 | 107.709 | 26.02 | 24.32 | 23.05 | 43.50 | -19.18 | 11.93 | **Complied** | V | 1.5 | 90 | 15.209(a) |
| 8 | 88.111 | 23.97 | 21.87 | 19.16 | 43.50 | -21.63 | 11.00 | **Complied** | H | 3.5 | 0 | 15.209(a) |
| 9 | 107.704 | 26.09 | 24.11 | 22.9 | 43.50 | -19.39 | 11.93 | **Complied** | H | 3.5 | 0 | 15.209(a) |
| 10 | 5800 | 85.6 | 84.6 | 78.4 | 114.00 | -35.60 | 49.00 | **Complied** | V | 1.5 | 90 | 15.245(b) |
| 11 | 5800 | 108.5 | 107.5 | 101.7 | 114.00 | -12.30 | 49.00 | **Complied** | H | 3.5 | 0 | 15.245(b) |
| 12 | 11600 | 64.3 | 55.9 | 52.7 | 64.10 | -11.40 | 52.50 | **Complied** | V | 1.2 | 0 | 15.245(b) |
| 13 | 11600 | 65.3 | 56.2 | 52.7 | 64.10 | -11.40 | 52.50 | **Complied** | H | 1.2 | 0 | 15.245(b) |
| 14 | 17400 | 74.4 | 65.2 | 61.7 | 77.50 | -15.80 | 61.00 | **Complied** | V | 1.2 | 0 | 15.245(b)(1)(ii) |
| 15 | 17400 | 74.1 | 65.4 | 61.8 | 77.50 | -15.70 | 61.00 | **Complied** | H | 1.2 | 0 | 15.245(b)(1)(ii) |
| | | | | | | | | | | | | |
| TUV Rheinland of North America, Inc. 12 Commerce Road Newtown, CT 06470 Tel:(203) 270-1151 Fax: (203) 270-8883 | | | | | | | | Tested by: | T. Dwyer | | | |

*No measurable emissions were observed at 11.6 an 17.4 GHz, but measurements were performed at the instrumentation noise floor for demonstration purposes. No emissions ere observed above 17.4 GHz.*

### 3.3.6 RESULT

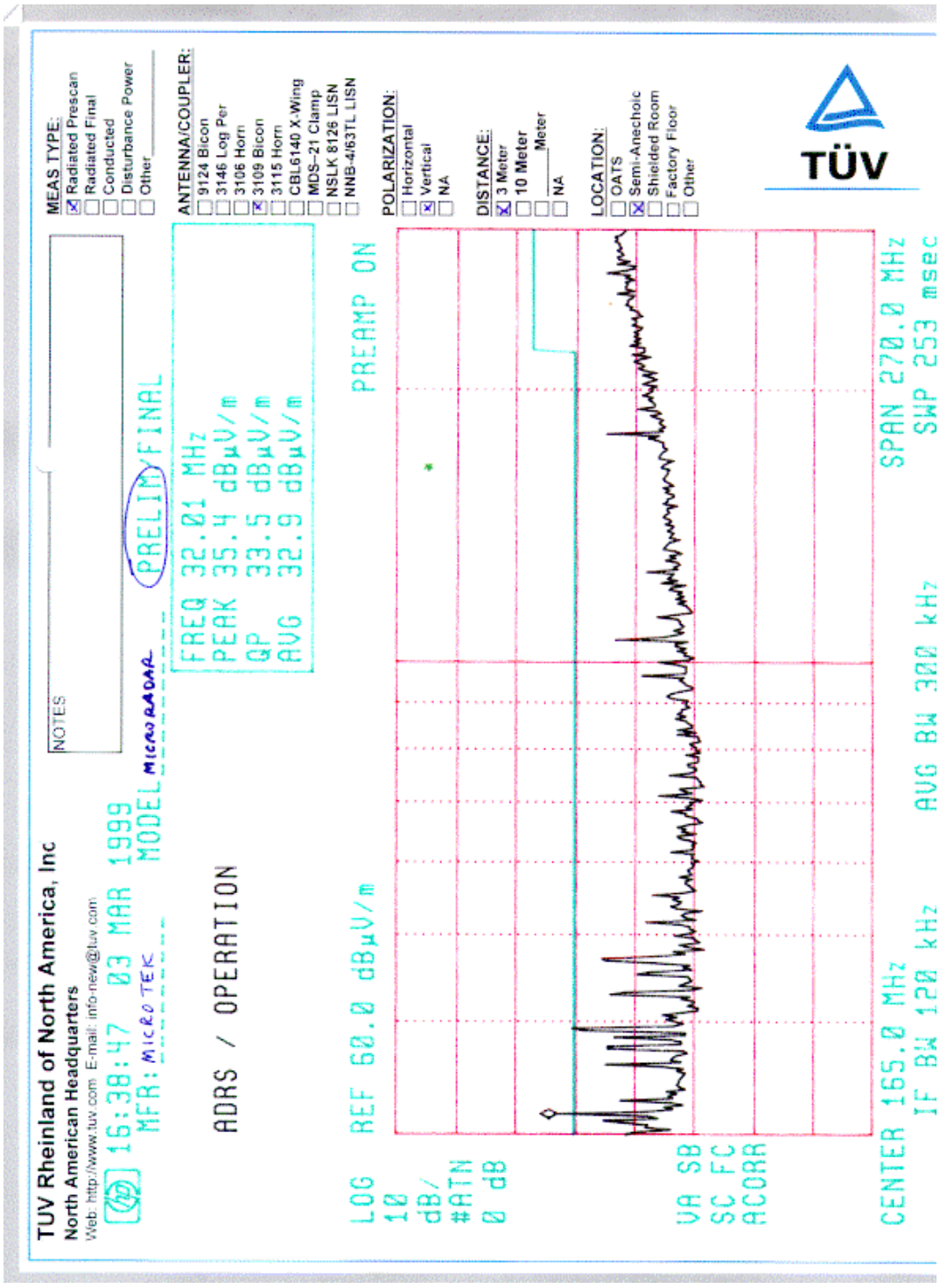
The radiated emissions of the MicroRadar were below the limits specified in paragraphs 15.245 and 15.209.

## 4. Modifications to Equipment Tested

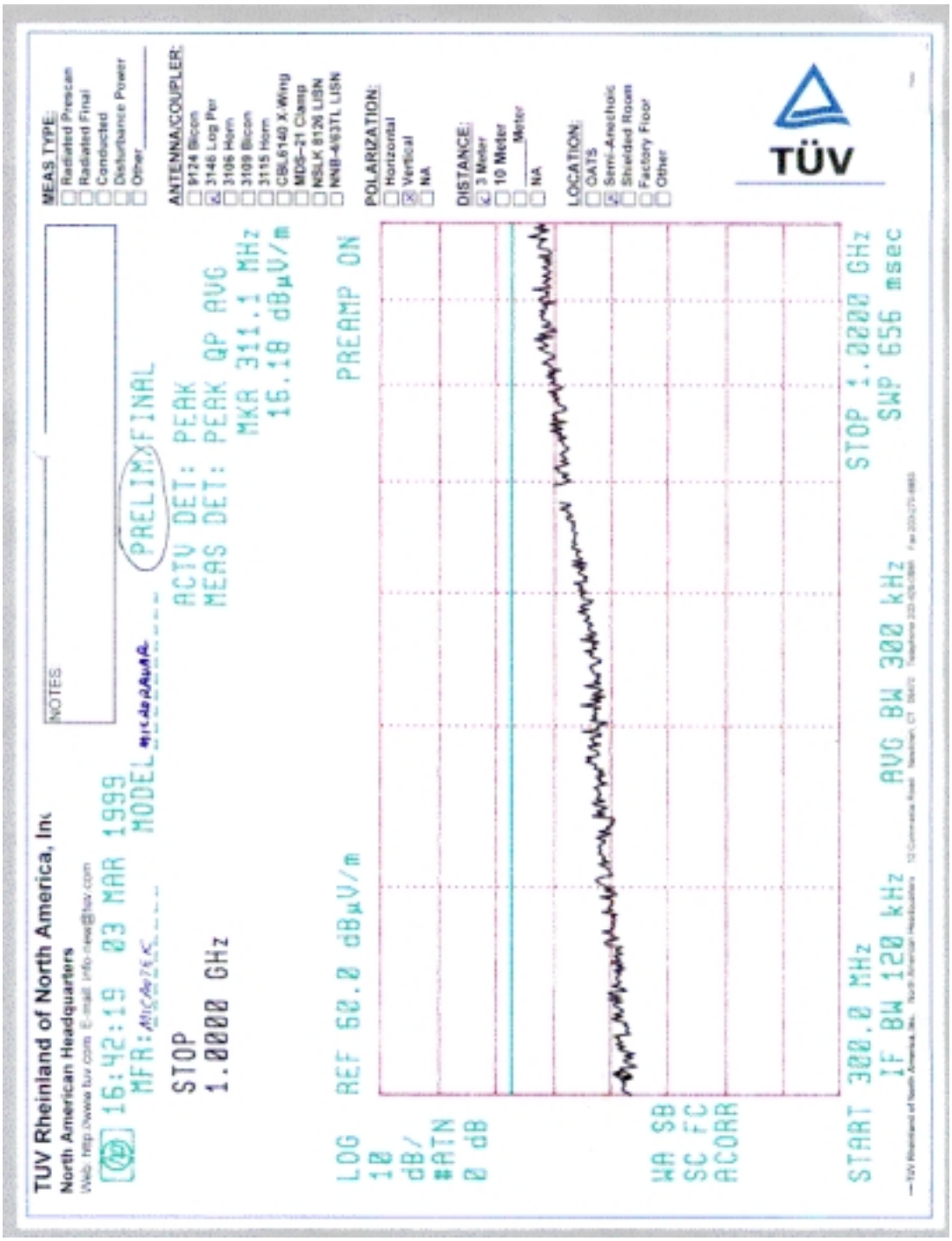
No modifications of any kind were made to the test samples. The samples were tested as received.

# 5. Measurement Data Plots

*5.1 Preliminary Emissions (SAR) 26-300 MHz, Vertical Polarization*



*5.2 Preliminary Emissions (SAR) 300 - 1000 MHz, Vertical Polarization*



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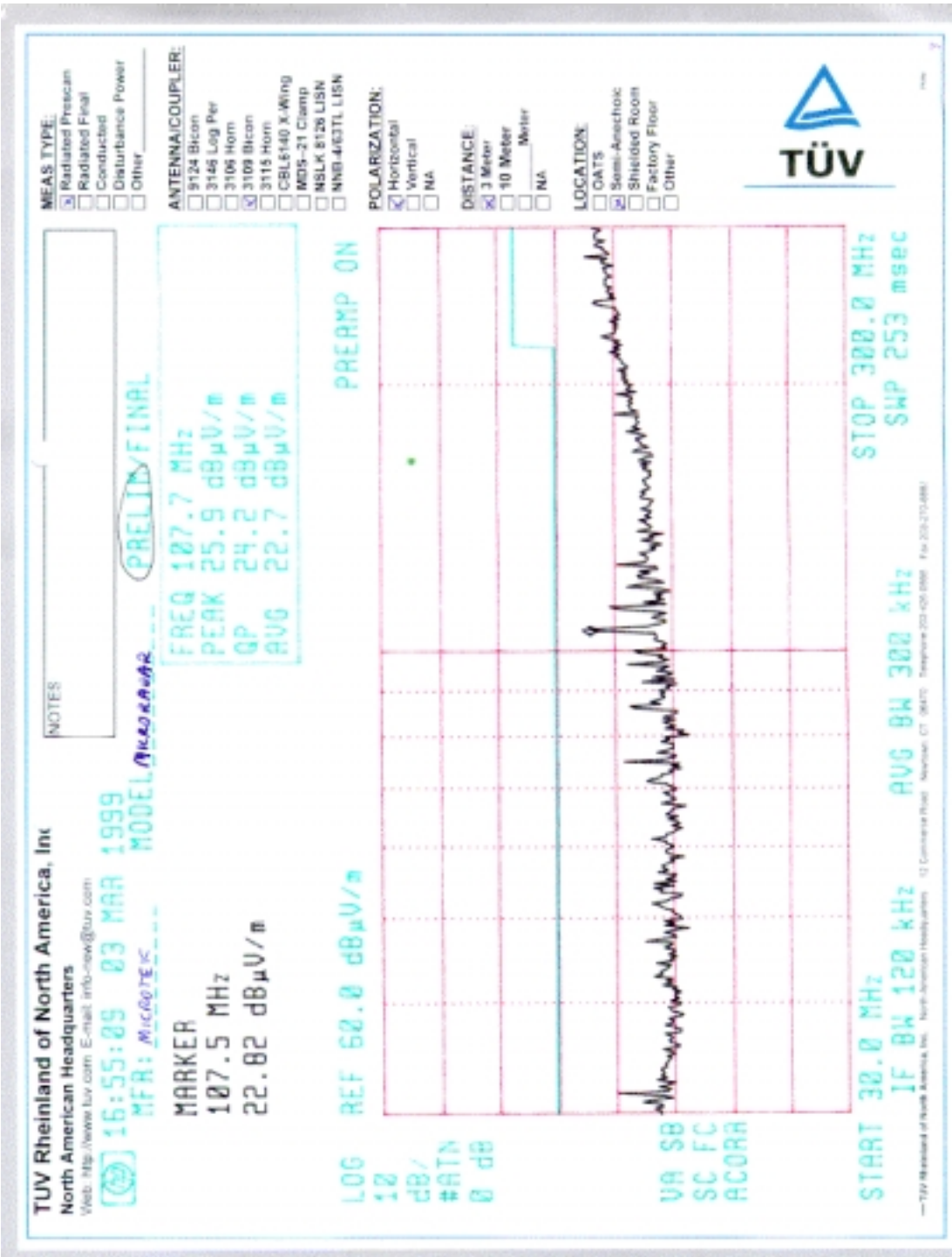
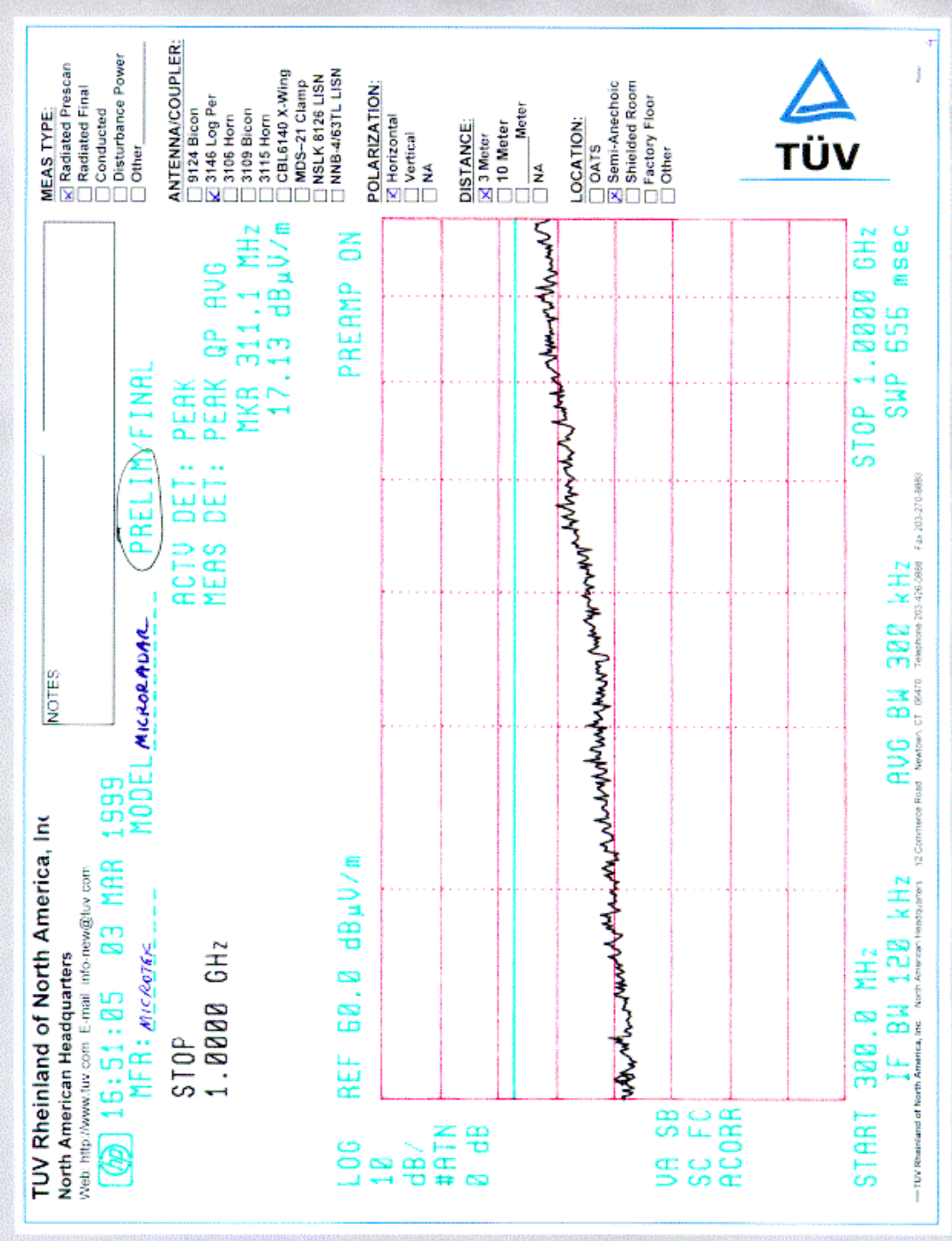
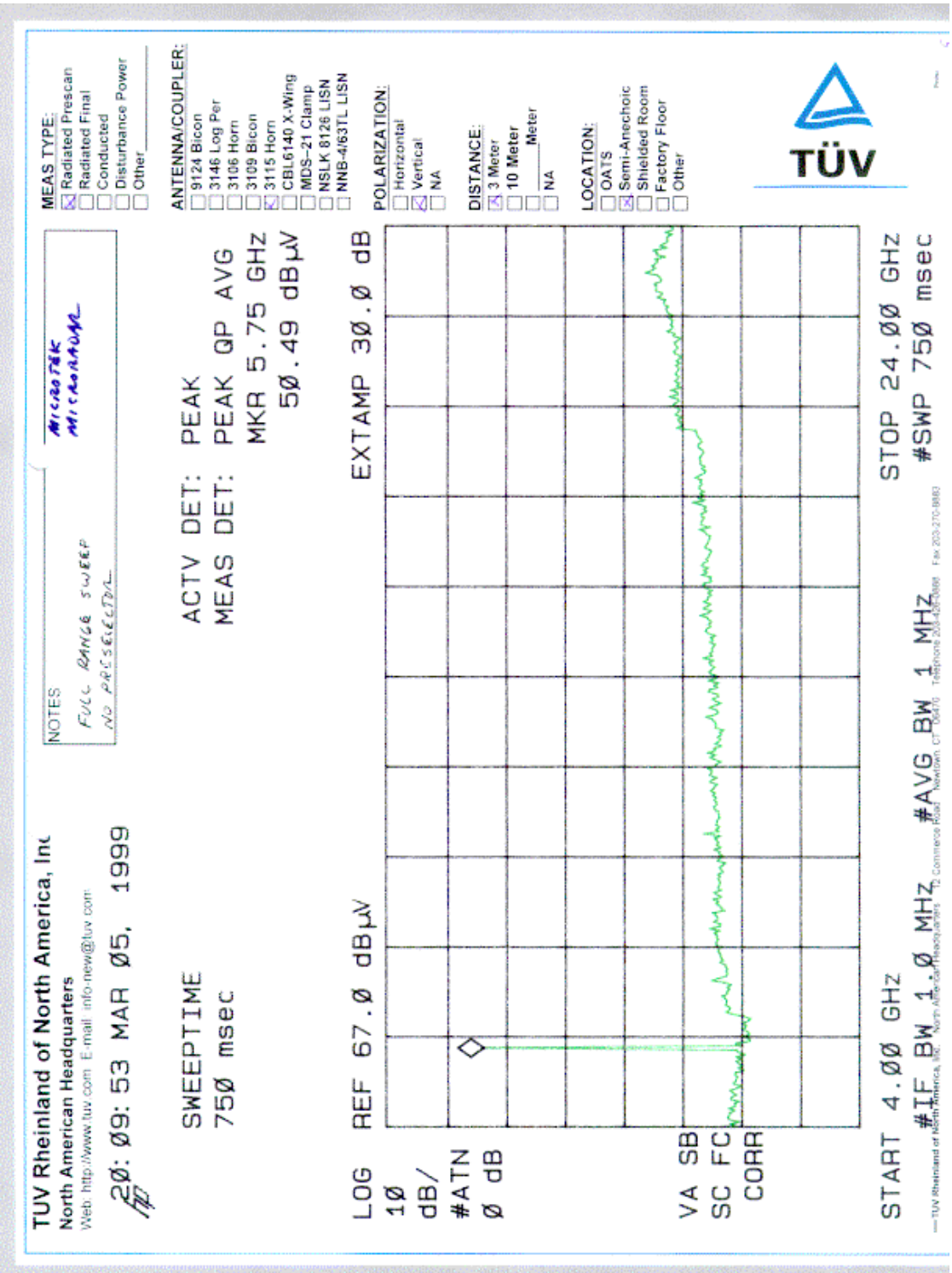
*5.3 Preliminary Emissions (SAR) 30 - 300 MHz, Horizontal Polarization*



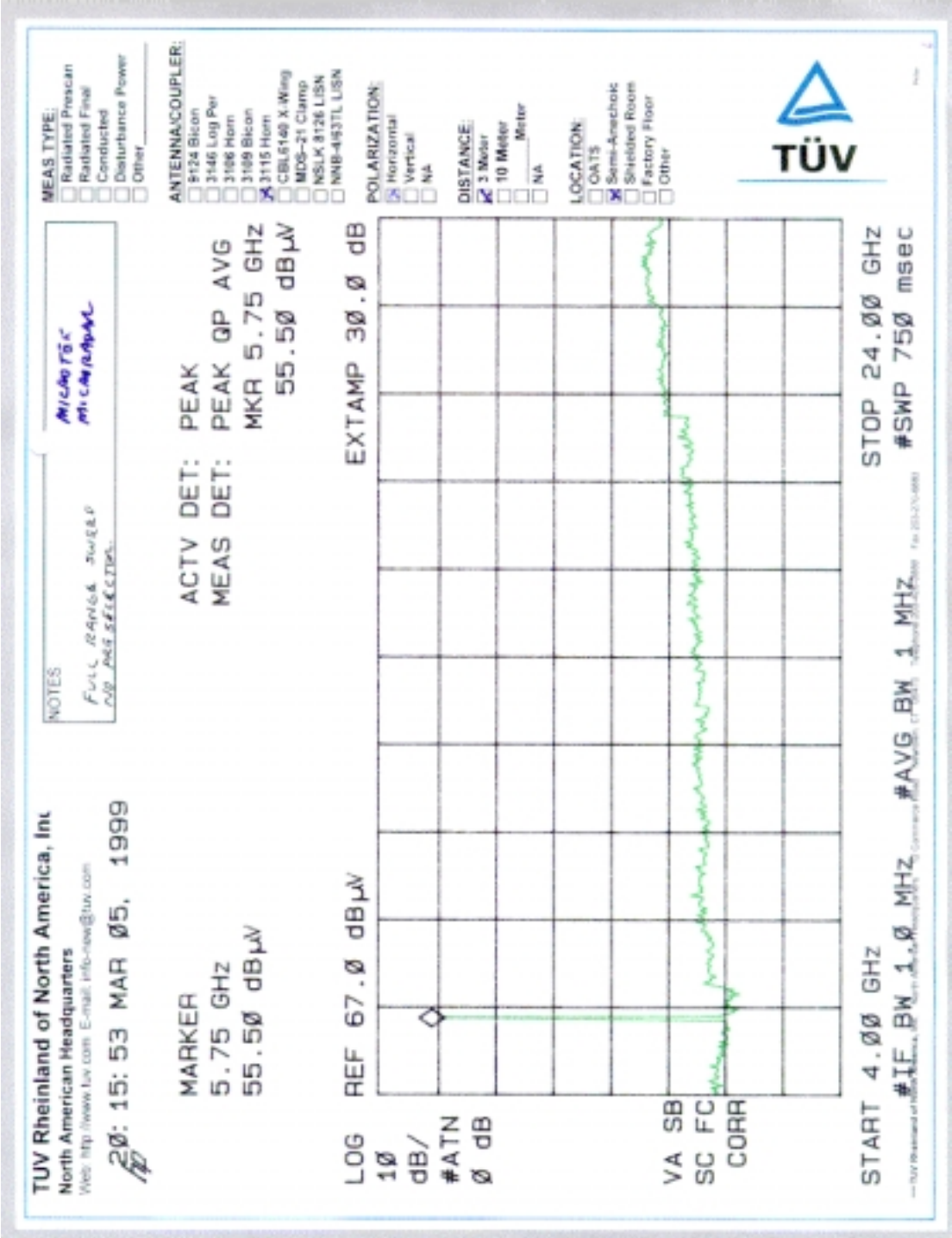
*5.4 Preliminary Emissions (SAR) 300-1000 MHz, Horizontal Polarization*



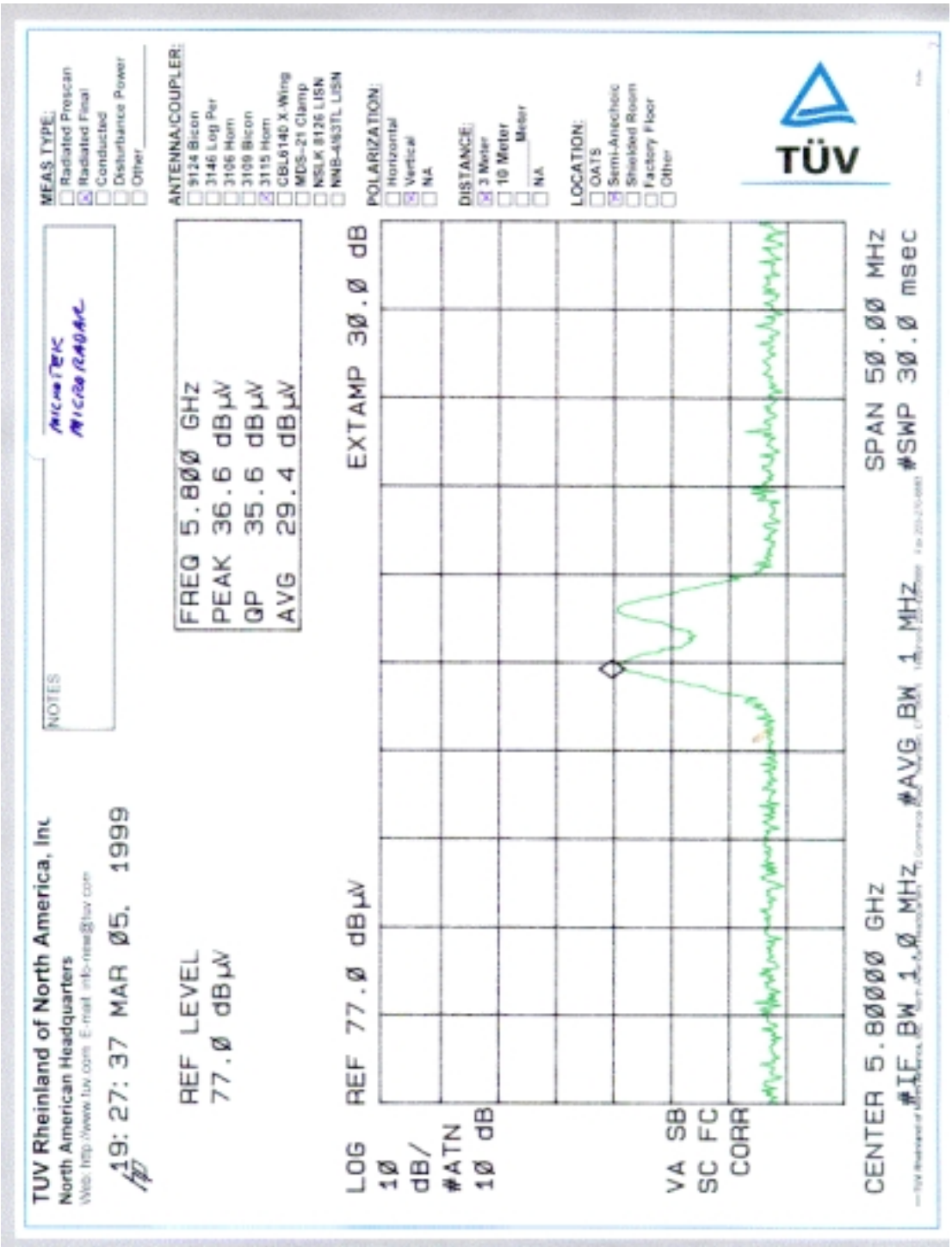
*5.5 Full Sweep 4 - 24 GHz Vertical*



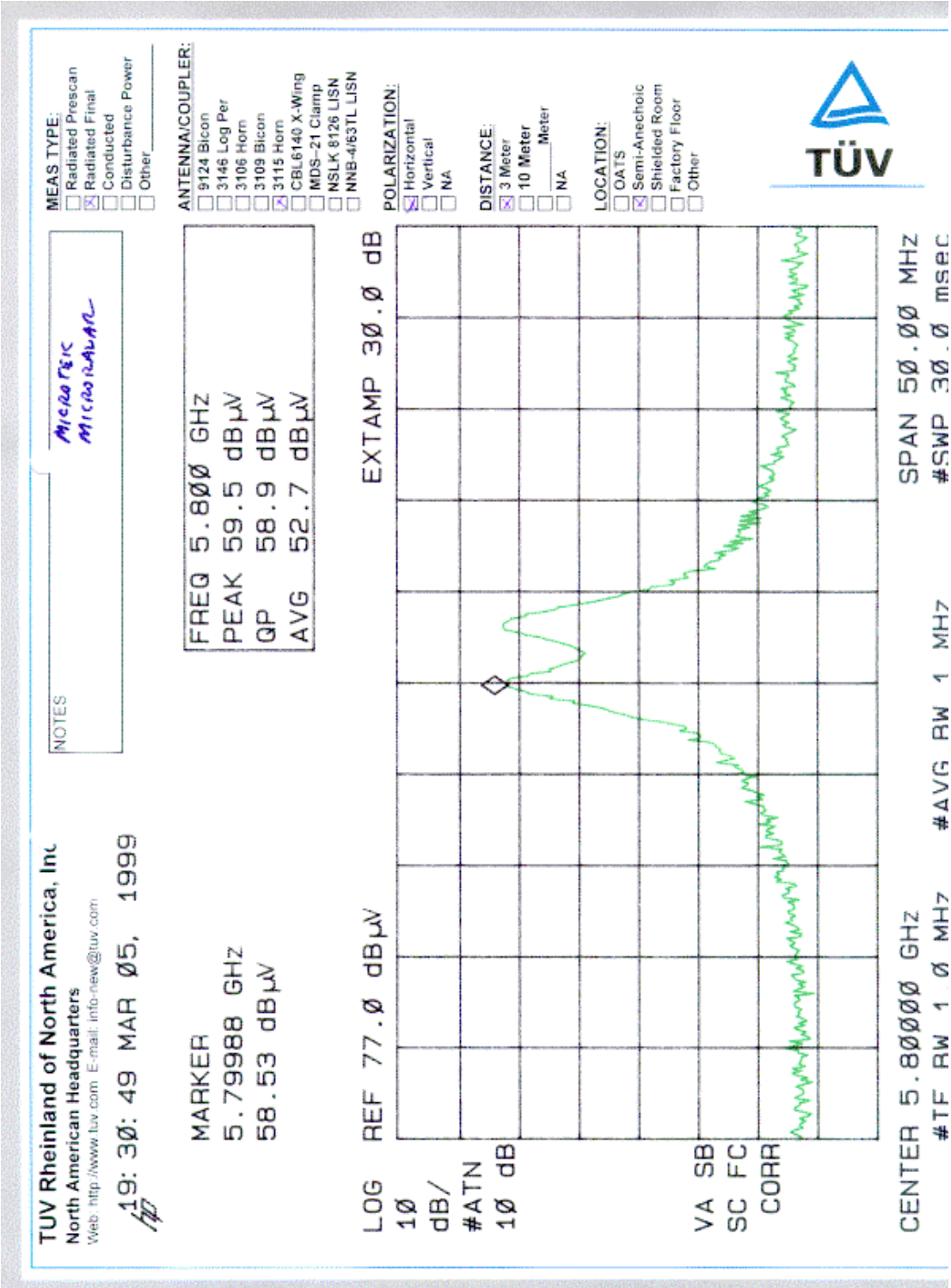
*5.6 Full Sweep*
*4 - 24 GHz*
*Horizontal*



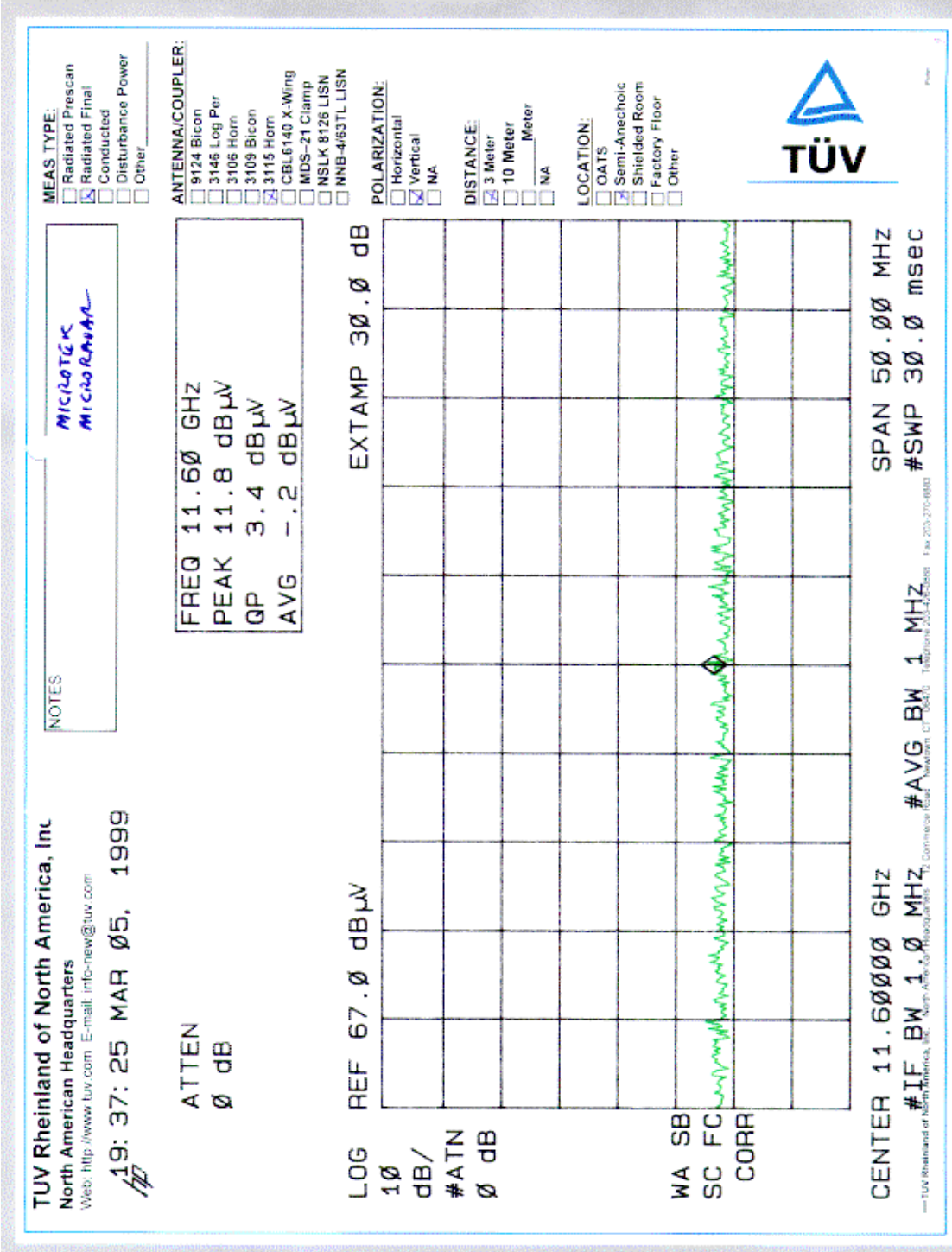
*5.7 Emission at Fundamental, Vertical*



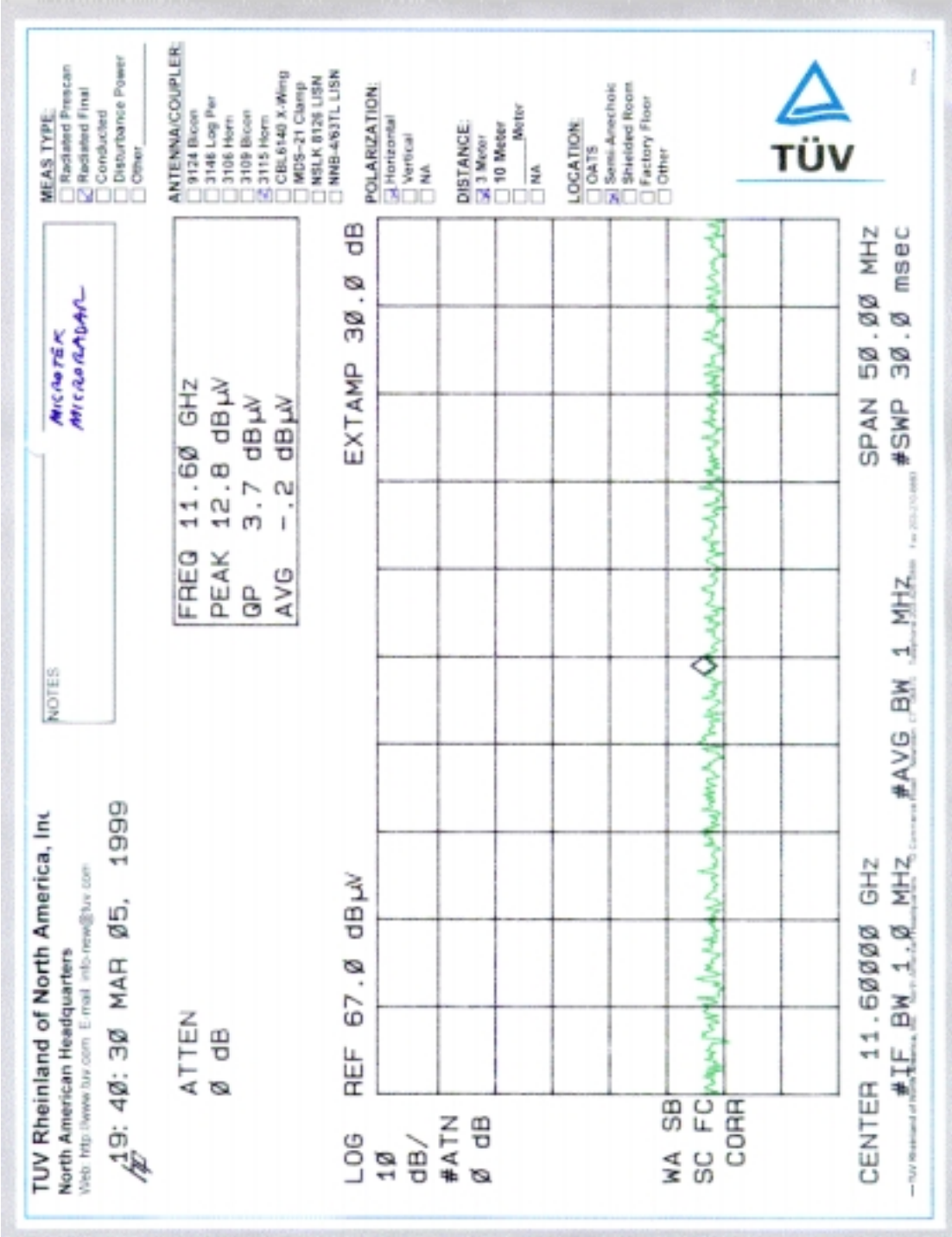
*5.8 Emission at Fundamental, Horizontal*



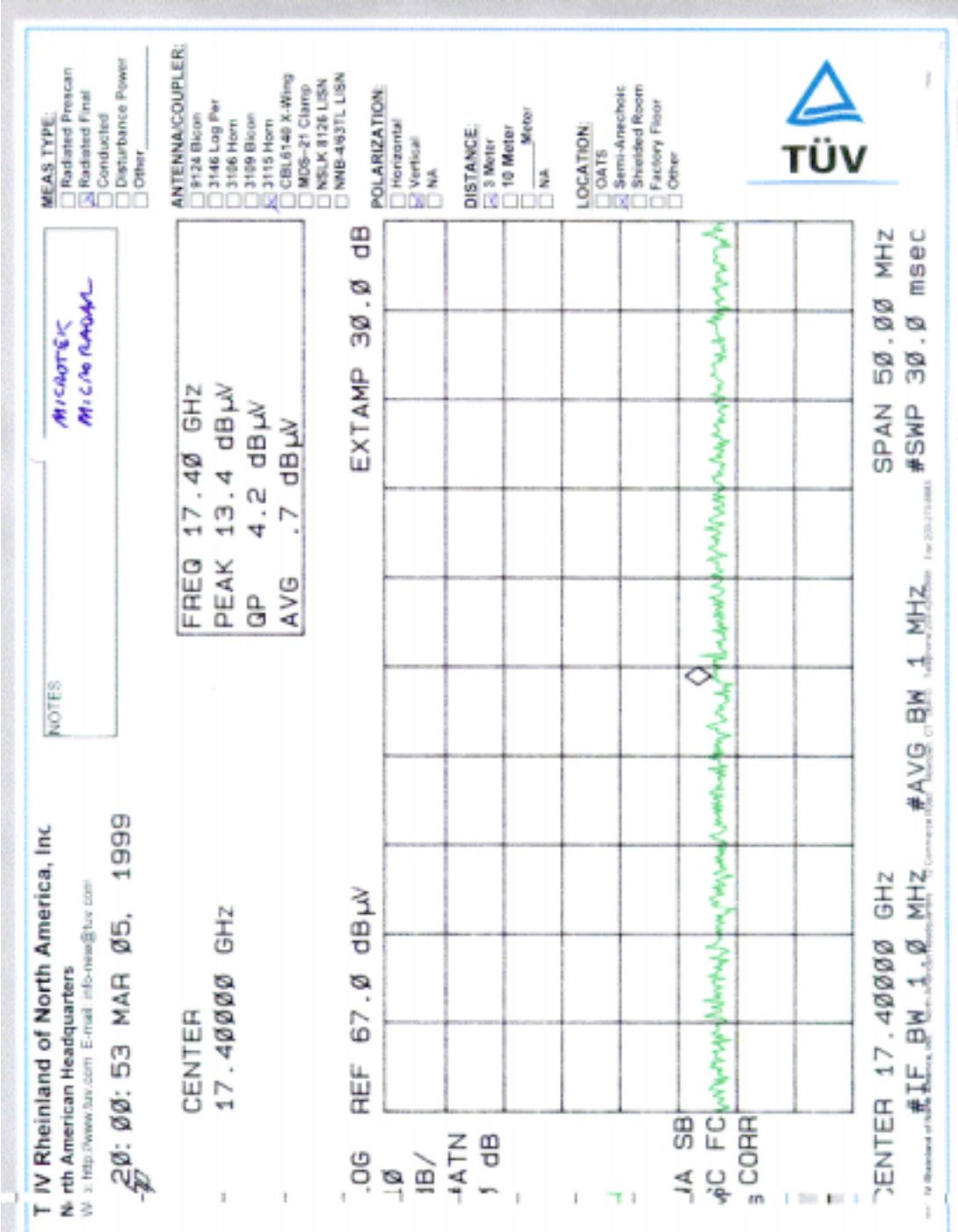
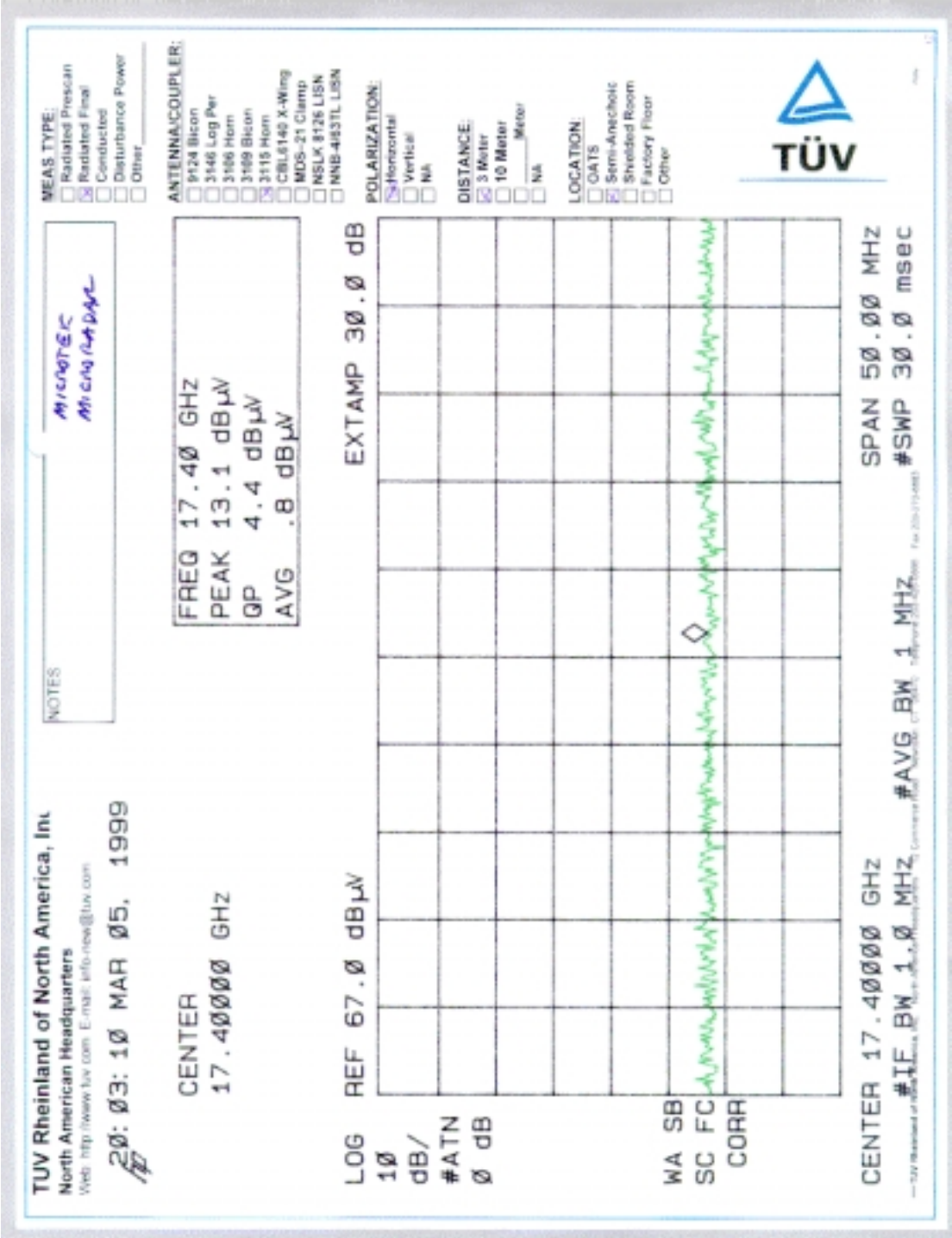
*5.9 Emission at Second Harmonic, Vertical*



*5.10 Emission at Second Harmonic, Horizontal*



*5.11 Emission at Third Harmonic, Vertical*



*5.12 Emission at Third Harmonic, Horizontal*