

TUV Rheinland of North America, Inc.

12 Commerce Road, Newtown, CT 06470
(203)426-0888 * FAX (203)270-8883

TUV Rheinland Proj # P33634.DOC

FCCID: KH5ASW-9904-8801 Page 1 of 25

**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**

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Test Report Number: P9872688.E01 Prübericht Nr.		Test Report Summary		
Applicant: Auftraggeber		Microtek Lab, Inc. 3715 Doolittle Drive Redondo Beach, CA 90278-1226		Tel: (310) 297-5711 Maw-Rong Chin Fax: (310) 297-5050
Type of Equipment: Automotive Safety Warning System Gegenstand der Prüfung				
Model Number: Bezeichnung:		MicroRadar Trademark: MicroTek Ursprungszeichen		
Standards: Prüfgrundlage		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: Prüfort TUV Rheinland of North America, 12 Commerce Road, Newtown, CT 06470 USA E-mail: info-new@tuv.com Web: http://www.tuv.com 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: Prüfergebnis		The unit presented for testing complied with criteria shown above. Additional Information is contained in the following pages.		
Tested By: Der Sachverständige		Timothy M. Dwyer Checked By: Bruce Fagley geprüft		
Date, Signature Datum, Unterschrift		Date, Signature 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 of 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

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1.6 Block Diagram Showing Oscillators

Refer to exhibits filed separately.

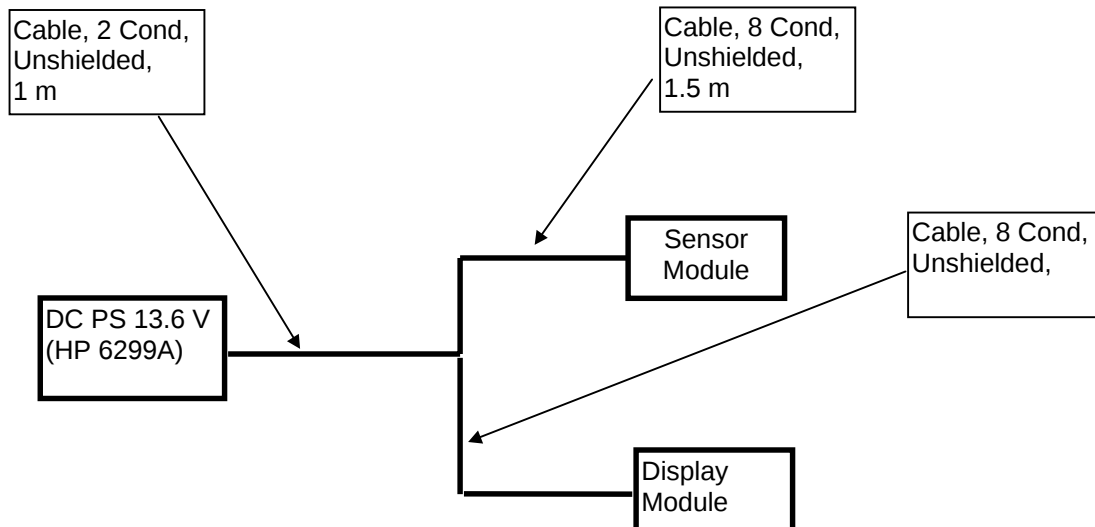
2. Measurement Equipment Used

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



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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

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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)																			
Me as #	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)	
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Tel:(203) 270-1151 Fax: (203) 270-8883																								

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.

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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.

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5. Measurement Data Plots

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

TUV Rheinland of North America, Inc.
North American Headquarters
Web: <http://www.tuv.com> E-mail: info-new@tuv.com

16:38:47 03 MAR 1999
MFR: MICRO TEK

MODEL MICRO RADAR

ADRS / OPERATION

NOTES

MEAS TYPE:
☒ Radiated Prescan
☐ Radiated Final
☐ Conducted
☐ Disturbance Power
☐ Other

ANTENNA/COUPLER:
☐ 9124 Bicon
☐ 3146 Log Per
☐ 3106 Horn
☒ 3109 Bicon
☐ 3115 Horn
☐ CBL6140 X-Wing
☐ MDS-21 Clamp
☐ NSLK 8126 LISN
☐ NNB-463TL LISN

POLARIZATION:
☐ Horizontal
☒ Vertical
☐ NA

DISTANCE:
☒ 3 Meter
☐ 10 Meter
☐ Meter
☐ NA

LOCATION:
☐ OATS
☒ Semi-Anechoic
☐ Shielded Room
☐ Factory Floor
☐ Other

PRELIM/FINAL

FREQ 32.01 MHz
PEAK 35.4 dBμV/m
QP 33.5 dBμV/m
AVG 32.9 dBμV/m

PREAMP ON

LOG REF 60.0 dBμV/m

10 dB/ #ATN 0 dB

VA SB
SC FC
ACORR

CENTER 165.0 MHz
IF BW 120 kHz
SPAN 270.0 MHz
SWP 253 msec

AUG BW 300 kHz

TÜV

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

NOTES

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North American Headquarters
Web: <http://www.tuv.com> E-mail: info-nam@tuv.com

16:42:19 03 MAR 1999
MFR: *MICROTEK* MODEL: *4152222222*

STOP
1.0000 GHz

MEAS TYPE:
☐ Radiated PreScan
☐ Radiated Final
☐ Conducted
☐ Disturbance Power
☐ Other

ANTENNA/COUPLER:
☐ B124 Bicon
☒ 3146 Log Per
☐ 3106 Horn
☐ 3108 Bicon
☐ 3115 Horn
☐ CBL6140 X-Wing
☐ MDS-21 Clamp
☐ NSLK 8126 LISN
☐ NNB-493TL LISN

POLARIZATION:
☐ Horizontal
☒ Vertical
☐ NA

DISTANCE:
☒ 3 Meter
☐ 10 Meter
☐ Meter
☐ NA

LOCATION:
☐ CATS
☒ Semi-Anechoic
☐ Shielded Room
☐ Factory Floor
☐ Other

PRELIM FINAL

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKA 311.1 MHz
16.18 dBμV/m

PREAMP ON

LOG REF 60.0 dBμV/m

10 dB/ #ATN 0 dB

WA SB
SC FC
ACORR

START 300.0 MHz
IF BW 120 kHz
AUG BW 300 kHz
STOP 1.0000 GHz
SWP 656 msec

TÜV

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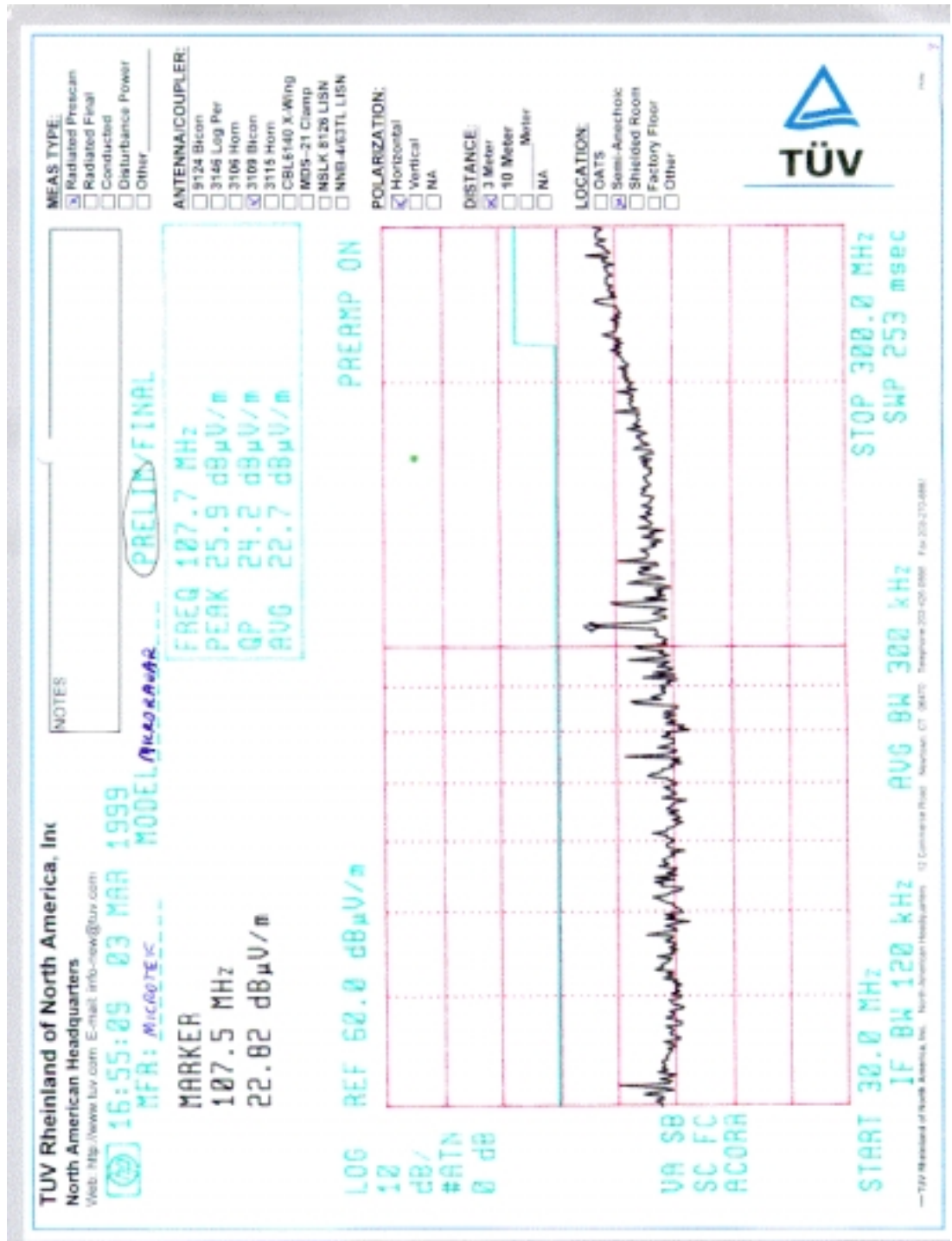
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5.3 Preliminary
Emissions (SAR)
30 - 300 MHz,
Horizontal
Polarization



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

TUV Rheinland of North America, Inc. North American Headquarters Web: http://www.tuv.com E-mail: info-new@tuv.com		NOTES
16:51:05 03 MAR 1999 MFR: MICROTICS MODEL MICRO2ADAC		MEAS TYPE: ☒ Radiated PreScan ☐ Radiated Final ☐ Conducted ☐ Disturbance Power ☐ Other
STOP 1.0000 GHz		ANTENNA/COUPLER: ☐ 9124 Bicon ☒ 3146 Log Per ☐ 3106 Horn ☐ 3109 Bicon ☐ 3115 Horn ☐ CBL6140 X-Wing ☐ MDS-21 Clamp ☐ NSLK 8126 LISN ☐ NNB-463TL LISN
ACTV DET: PEAK MEAS DET: PEAK QP AVG MKR 311.1 MHz 17.13 dBμV/m		POLARIZATION: ☒ Horizontal ☐ Vertical ☐ NA
LOG REF 60.0 dBμV/m		DISTANCE: ☒ 3 Meter ☐ 10 Meter ☐ Meter
10 dB/ #ATN 0 dB		LOCATION: ☐ OATS ☒ Semi-Anechoic ☐ Shielded Room ☐ Factory Floor ☐ Other
VA SB SC FC ACORR		
START 300.0 MHz IF BW 120 kHz AUG BW 300 kHz STOP 1.0000 GHz SWP 656 msec		

LOG REF 60.0 dBμV/m

10 dB/ #ATN 0 dB

VA SB
SC FC
ACORR

START 300.0 MHz
IF BW 120 kHz
AUG BW 300 kHz
STOP 1.0000 GHz
SWP 656 msec

PRELIMINARY

PREAMP ON

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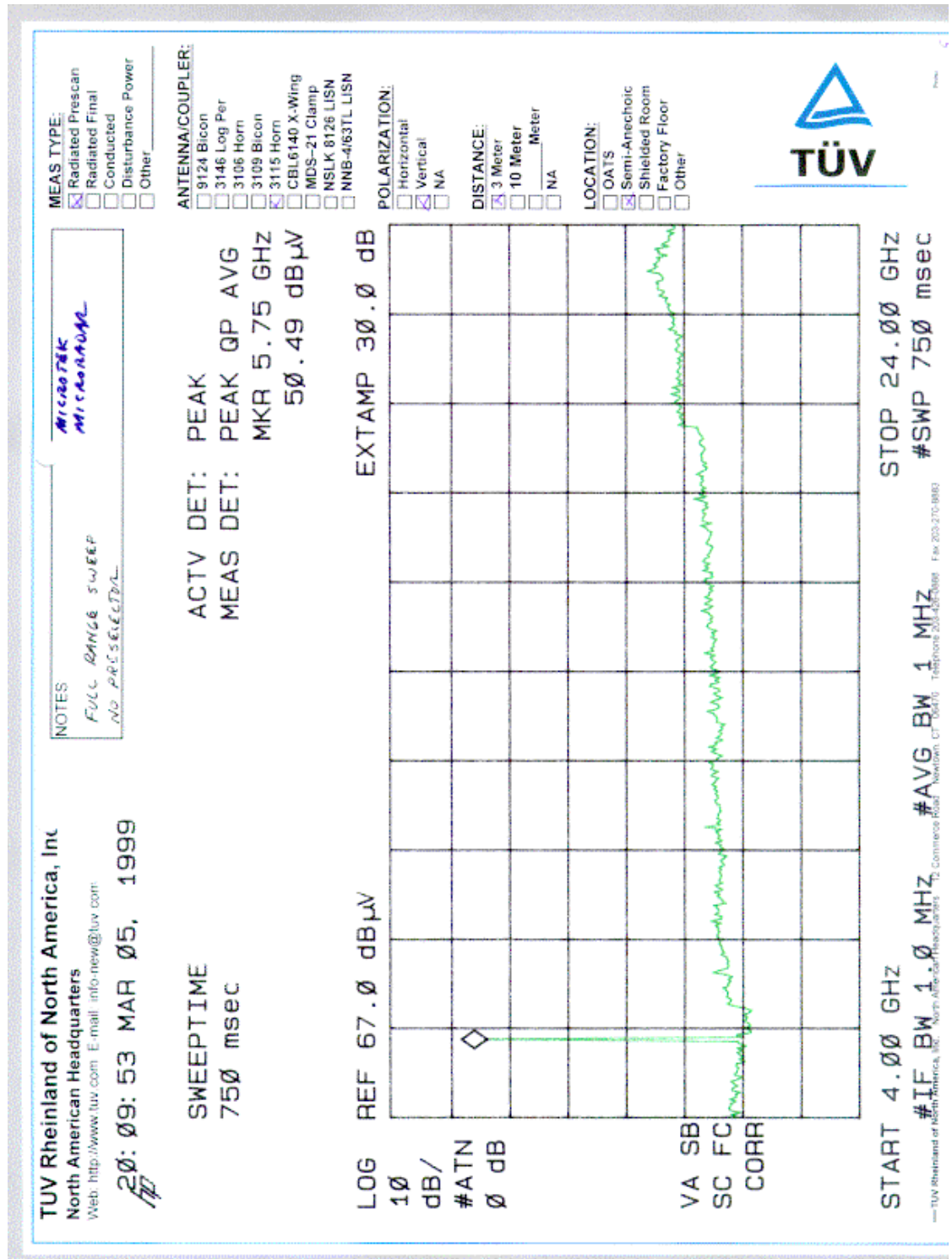
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5.5 Full
Sweep 4 - 24
GHz Vertical



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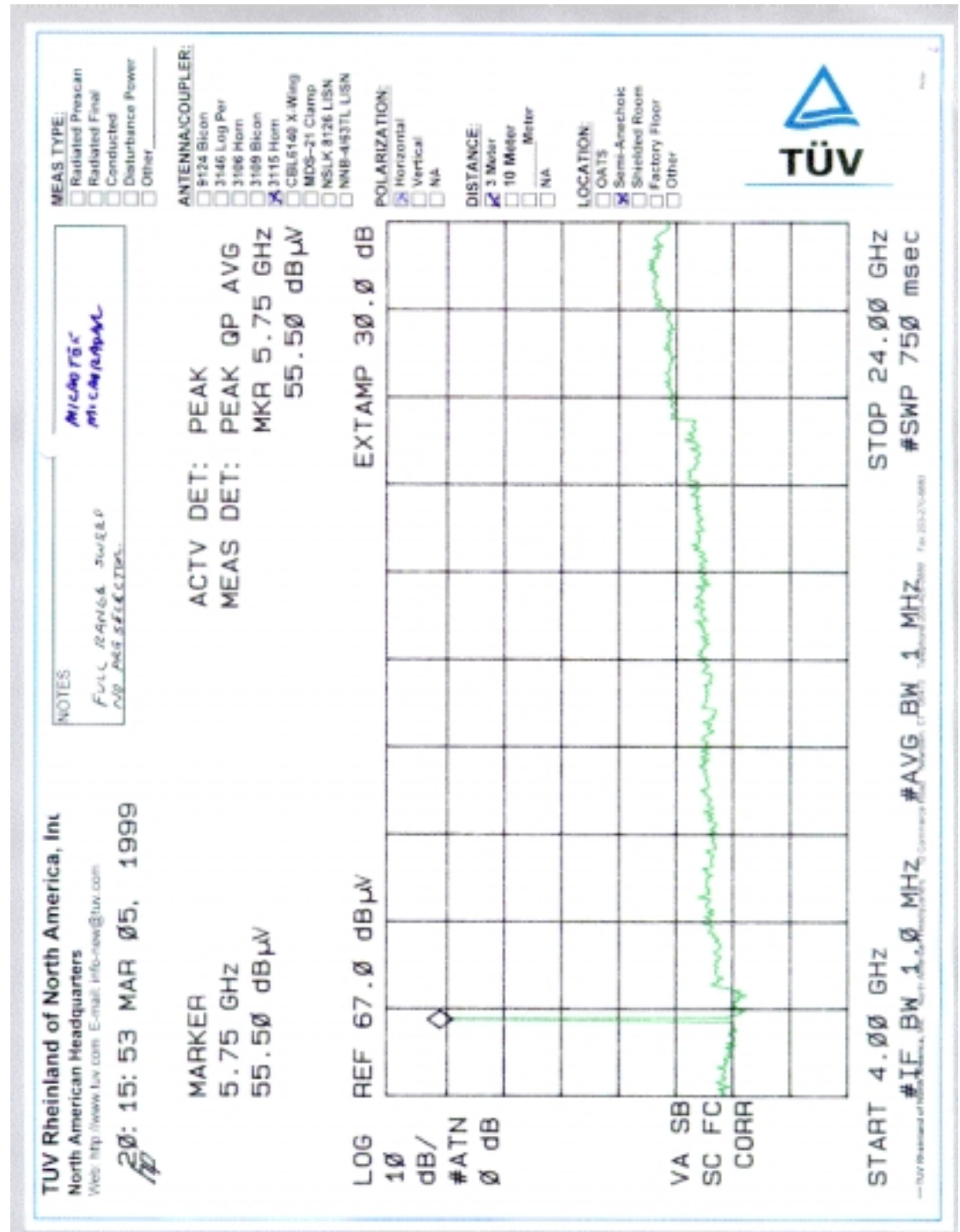
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5.6 Full Sweep
4 - 24 GHz
Horizontal



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FCCID: KH5ASW-9904-8801

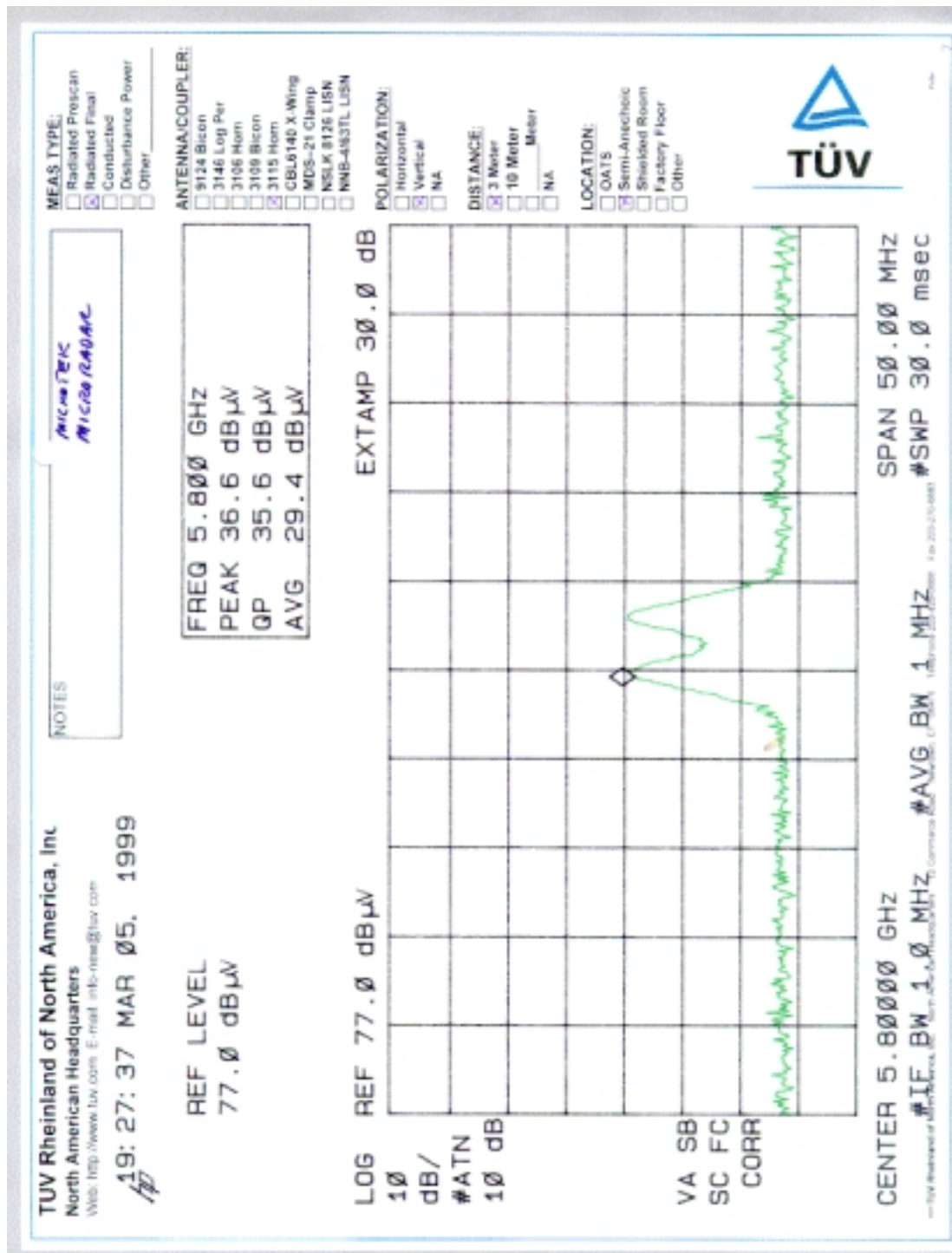
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5.7 Emission
at
Fundamental,
Vertical



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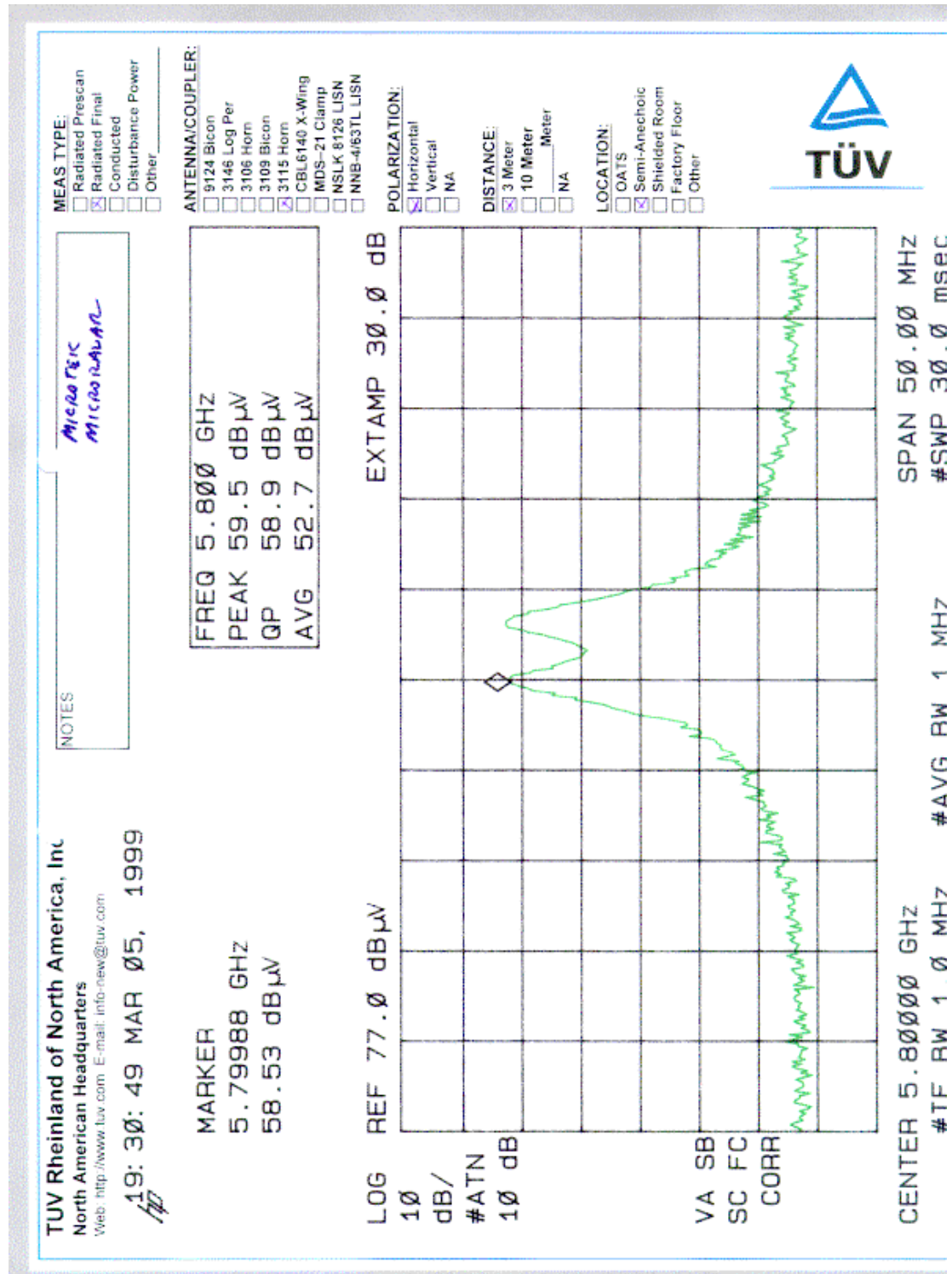
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5.8 Emission
at
Fundamental,
Horizontal



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5.9 Emission
at Second
Harmonic,
Vertical

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North American Headquarters
Web: <http://www.tuv.com> E-mail: info-new@tuv.com
19: 37: 25 MAR 05, 1999
HP

MEAS TYPE:
☐ Radiated Prescan
☒ Radiated Final
☐ Conducted
☐ Disturbance Power
☐ Other

ANTENNA/COUPLER:
☐ 9124 Bicon
☐ 3146 Log Per
☐ 3108 Horn
☐ 3109 Bicon
☒ 3115 Horn
☐ CBL6140 X-Wing
☐ MDS-21 Clamp
☐ NSLK 8126 LISN
☐ MNB-4/63TL LISN

NOTES:

*MICROTEK
MICROANAL*

FREQ 11.60 GHz
PEAK 11.8 dBμV
QP 3.4 dBμV
AVG -.2 dBμV

ATTEN
0 dB

EXTAMP 30.0 dB

POLARIZATION:
☐ Horizontal
☒ Vertical
☐ NA

DISTANCE:
☒ 3 Meter
☐ 10 Meter
☐ Meter
☐ NA

LOCATION:
☐ OATS
☒ Semi-Anechoic
☐ Shielded Room
☐ Factory Floor
☐ Other

LOG	REF	67.0 dBμV											EXTAMP	30.0 dB
10														
dB/														
#ATN														
0 dB														
WA SB														
SC FC														
CORR														

CENTER 11.600000 GHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
SPAN 50.00 MHz
#SWP 30.0 msec

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5.10 Emission
at Second
Harmonic,
Horizontal

TUV Rheinland of North America, Inc. North American Headquarters Web: http://www.tuv.com E-mail: info.nna@tuv.com 19:40:30 MAR 05, 1999		MEAS TYPE: ☐ Radiated Prescan ☒ Radiated Final ☐ Conducted ☐ Disturbance Power ☐ Other	
NOTES: MICRO RADIATION		ANTENNA/COUPLER: ☐ 9124 Bicon ☐ 3148 Log Per ☐ 3108 Horn ☐ 3108 Bicon ☒ 3115 Horn ☐ CBL 6140 X-Wing ☐ MDS-21 Clamp ☐ NSLK 8128 LISN ☐ NNB-463TL LISN	
ATTEN 0 dB		FREQ 11.60 GHz PEAK 12.8 dBμV QP 3.7 dBμV AVG -2.2 dBμV	
LOG REF 67.0 dBμV 10 dB/ #ATN 0 dB		EXTAMP 30.0 dB	
WA SB SC FC CORR		POLARIZATION: ☒ Horizontal ☐ Vertical ☐ NA	
DISTANCE: ☒ 3 Meter ☐ 10 Meter ☐ NA		LOCATION: ☐ OATS ☒ Semi-Anechoic ☐ Shielded Room ☐ Factory Floor ☐ Other	
CENTER 11.60000 GHz #IF BW 1.0 MHz #AVG BW 1 MHz SPAN 50.00 MHz #SWP 30.0 msec			

TUV Rheinland of North America, Inc.

12 Commerce Road, Newtown, CT 06470
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5.11 Emission
at Third
Harmonic,
Vertical

TUV Rheinland of North America, Inc.
North American Headquarters
Web: <http://www.tuv.com> E-mail: info-na@tuv.com

20: 00: 53 MAR 05, 1999

NOTES: *MICROT-EX
M: C/A RADI*

MEAS TYPE:
☐ Radiated Prescan
☒ Radiated Final
☐ Conducted
☐ Disturbance Power
☐ Other

ANTENNA/COUPLER:
☐ F124 Bicon
☐ 3146 Log Per
☐ 3156 Horn
☐ 3159 Bicon
☒ 3115 Horn
☐ CBL5148 X-Wing
☐ MOS-21 Clamp
☐ NSLK 8126 LSN
☐ NNB-493TL LSN

POLARIZATION:
☐ Horizontal
☒ Vertical
☐ NA

DISTANCE:
☒ 3 Meter
☐ 10 Meter
☐ Meter
☐ NA

LOCATION:
☐ OATS
☒ Semi-Anechoic
☐ Shielded Room
☐ Factory Floor
☐ Other

FREQ 17.40 GHz
PEAK 13.4 dBμV
QP 4.2 dBμV
AVG .7 dBμV

EXTAMP 30.0 dB

CENTER 17.40000 GHz
REF 67.0 dBμV

SPAN 50.00 MHz
#SWP 30.0 msec

CENTER 17.40000 GHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
#CORR

JA SB
FC FC
CORR

10 Standard of Testing, Inc., 12 Commerce Road, Newtown, CT 06470-1100, USA Tel: 203-426-0888 Fax: 203-270-8883

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