

MEASUREMENT AND TECHNICAL REPORT

SINGLE CHIP SYSTEMS
10905 Technology Place
San Diego, CA 92127

DATE: 28 January 2000

This Report Concerns:	Original Grant:	Class II Change: X
Equipment Type:	InstaScan Scanner, Model S512, S/N 00002	
Transition Rules Request per 15.37?	Yes:	*No:
(*) FCC Part 15, Paragraph 15.247(a)(b)(c)		
<i>Report Prepared by:</i> TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 619 546 3999 Fax: 619 546 0364		

TABLE OF CONTENTS

	Pages
1 GENERAL INFORMATION	3
1.1 Product Description	3
1.2 Test Methodology	7
1.3 Test Facility	7
2 SYSTEM TEST CONFIGURATION	7
3.1 Justification	7
3.2 EUT Exercise Software	7
3.3 Special Accessories	7
3.4 Equipment Modifications	7
3.5 Configuration of Tested System	7
3 TEST REPORT	8
RADIATED MEASUREMENT	8
RADIATED MEASUREMENT EQUIPMENT/TEST SETUP/DATA	8
FIELD STRENGTH CALCULATION	11
CONDUCTED MEASUREMENT	14
CONDUCTED MEASUREMENT EQUIPMENT/TEST SETUP/DATA	15
4 GENERAL SUMMARY	25

1 GENERAL INFORMATION

1.1 Product Description
InstaScan Scanner, Model S512, S/N 00002

The EUT is a Transceiver for RFID purposes, designed to operate under FCC part 15.247 rules in the 2.4 to 2.483 GHz ISM band.

Equipment Specifications: Frequency Range: 2401-2475 MHz;
Rated RF Output Power: 0.70 Watts
Frequency Tolerance: ±100 ppm
Emissions Designator: 714KK1D
Micro. Model No.: 80C52

1.1.1 Components of EUT
(List each one separately. Add attachment if necessary. NOT TO INCLUDE PERIPHERALS.)

Description	Model Number	Serial Number	FCC ID Number
InstaScan Scanner	S512	00002	MKRS512
Power Supply	N2UFS7.5V2A	4850	--
Dual Antenna	100157-1	00001	--
	100158-1		

1.2 Operating modes:

The scanner operates in one of 2 modes. Transmit from one antenna, or alternate transmission from 2 antennas at a 50% duty cycle.

1.3 EUT I/O Ports and Cables:

1.3.1 I/O Cables (Add attachment if necessary.)

CONNECTION:	DC Power
SHIELD:	none
CONNECTORS:	2.1mm power connector
TERMINATION TYPE:	none
LENGTH:	6 ft.
REMOVABLE:	yes

CONNECTION:	RS-232
SHIELD:	none
CONNECTORS:	DB-9F
TERMINATION TYPE:	none
LENGTH:	6 to 20 ft
REMOVABLE:	yes

CONNECTION:	RF Transmit Port 1 and Port 2
SHIELD:	coax cable
CONNECTORS:	Reverse polarity SMA in production
TERMINATION TYPE:	Coax shield to SMA connector
LENGTH:	6 ft.
REMOVABLE:	yes

CONNECTION:	RF Receive Port 1 and Port 2
SHIELD:	coax cable
CONNECTORS:	Reverse polarity SMA in production
TERMINATION TYPE:	Coax shield to SMA connector
LENGTH:	6 ft.
REMOVABLE:	yes

1.3.2 Power Cords

UNIT:	N2UFS7.5V2A
MANUFACTURER:	Power Components International
SHIELDED:	no
LENGTH:	6 ft.

1.3.3 Power requirements:

X 120 VAC 60Hz -- single phase 0.5 Amps

1.4 Oscillator Frequencies

Frequency	EUT Location	Description of use
20 MHz	on PCB	clock for microprocessor

1.5 Power Supply

Description	Manufacturer	Model #	Serial #	Switching frequency or linear
Wall mount 7.5 V, 2.0 A	Power Components International	N2UFS7.5V2A	4850	--

1.6 Power Line Filters

Manufacturer	Model #	Qty	LOCATION ON EUT
Metuchen Capacitors	56-504-014-GBL	1	Housing
Metuchen Capacitors	56-524-014-GBL	1	Housing
K&L	SL-2750	2	Housing

1.7 Critical EMI Components (Capacitors, ferrites, etc.)

Description	Manufacturer	Part # or value	Qty	LOCATION ON EUT
L14	Samsung	0.5 pF	1	Between coupler and SPDT switch
C27	Toko	1.5 nH	1	Between coupler and SPDT switch

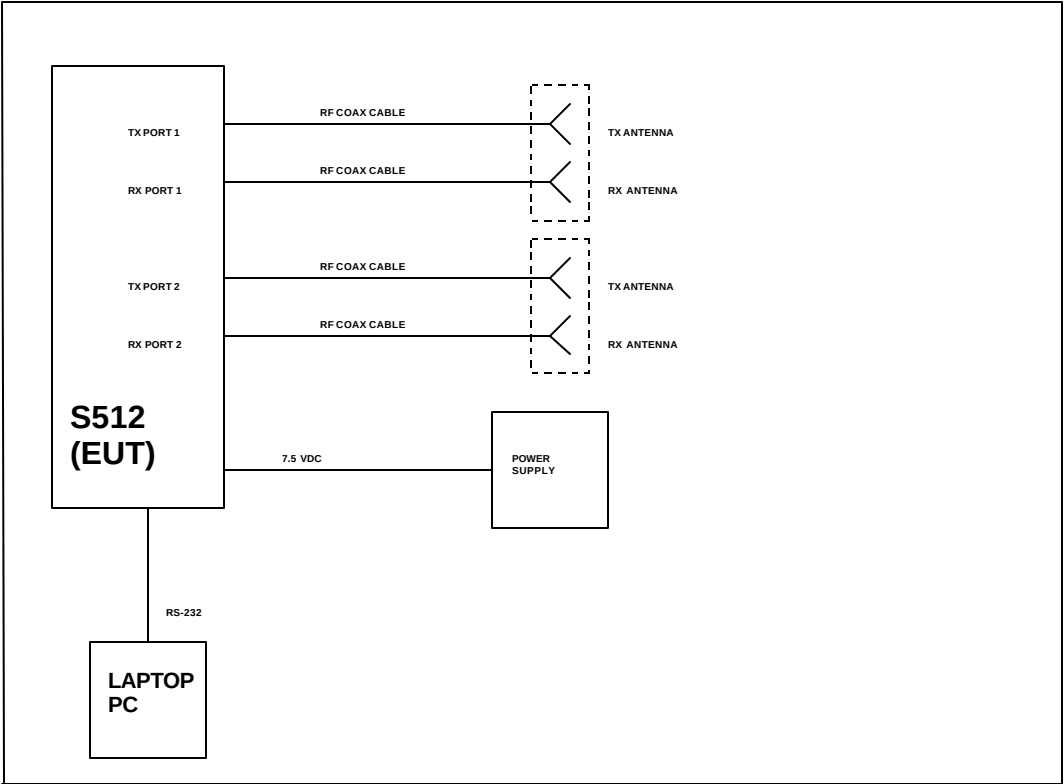
1.8 Description of Enclosure: (including Gasketing, Coatings, Bonding, etc.)

Aluminum housing comprised of a 5 sided box with a screw-on face plate.

1.9 Interfacing and/or Simulators Peripheral Equipment

DESCRIPTION:	Laptop Computer
MANUFACTURER:	Compaq
MODEL NUMBER:	1210 Presario
SERIAL NUMBER:	--
FCC ID:	--

1.10 System Configuration Block Diagram



1.11 Test Methodology

Purpose of Test: To demonstrate compliance with the ANSI C63.4 setup.

Test Performed: X 1. Conducted Emissions, FCC Part 15, Paragraph 15.247(a)(b)(c)
2. Radiated Emissions EN55022: 1992 Class B limit, 30 - 1,000 MHz, 10 meters
X 3. Radiated Emission per FCC Part 15, Paragraph 15.247(c)
4. Engineering evaluations

Both Conducted and radiated testing were performed according to the procedures in FCC/ANSI C63.4 and CSA 108.8 - M1983. Radiated testing was performed at an antenna-to-EUT distance of 3 meters (1 - 10 GHz).

1.12 Test Facility

The open area test site and conducted measurement data were tested by:

TÜV PRODUCT SERVICE
10040 Mesa Rim Road
San Diego, CA 92121-2912
Phone: 619 546 3999
Fax: 619 546 0364

The Test Site Data and performance comply with ANSI 63.4 and are registered with the FCC, 7435 Oakland Mills Rd, Columbia Maryland 21046. All Measurement Data is acquired according to the content of FCC Measurement Procedure and ANSI C63.4, unless supplemented with additional requirements as noted in the test report.

2. SYSTEM TEST CONFIGURATION

2.1 Justification

The EUT InstaScan Scanner was initially tested for FCC emission in the following configuration:

See photos and test setup drawings.

2.2 EUT Exercise Software

None

2.3 Special Accessories

None

2.4 Modification

None

2.5 Configuration of Tested System

See photos and test setup drawings.

3 TEST REPORT

3.1 Emissions Test Conditions: RADIATED EMISSIONS, FCC Part 15, Paragraph 15.247(c)

The *RADIATED EMISSIONS* measurements were performed at the following test location :

☐ - Test not applicable

■ - Roof (Small Open Area Test Site)

Testing was performed at a test distance of:

■- 3 meters

Test Equipment Used :

Model No.	Prop. No.	Description	Manufacturer	Serial No.	Cal Date
3115	453	Antenna, Double Ridge Guide	EMCO	9412-4363	10/99
8566B	720	Spectrum Analyzer	Hewlett Packard	211500842	03/99
8566B	721	Spectrum Analyzer Display	Hewlett Packard	2112A0218	03/99
				5	
AFD3-0208-40-ST	367	Pre-Amplifier (30 dB gain), 2 to 8 Miteq, Inc.		155382	01/00
		GHz			
Type code SH026	--	High Pass Filter	Filtronic Components Ltd.	--	*

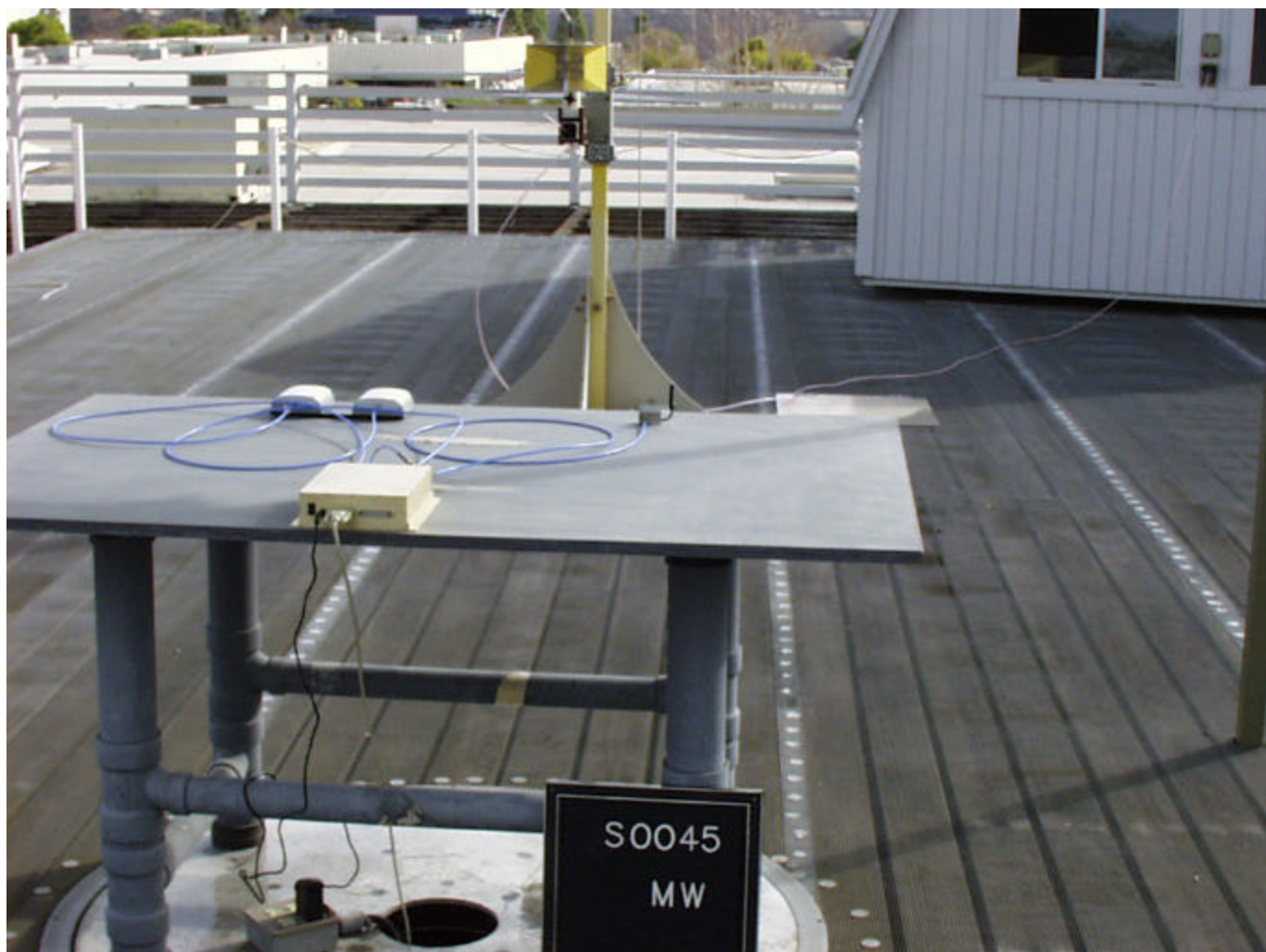
Remarks: See test setup photos for test setup.

(*) Verified

Photograph of Test Setup



Photograph of Test Setup



Field Strength Calculation

If a preamplifier was used during the Radiated Emission Testing, it is required that the amplifier gain must be subtracted from the Spectrum Analyzer (Meter) Reading. In addition, a correction factor for the antenna , cable used and a distance factor, if any, must be applied to the Meter Reading before a true field strength reading can be obtained. In the automatic measurement, these considerations are automatically presented as a part of the print out. In the case of manual measurements and for greater efficiency and convenience, instead of using these correlation factors for each meter reading, the specification limit was modified to reflect these correlation factors at each frequency value so that the meter readings can be compared directly to the modified specification limit. This modified specification limit is referred to as the "Corrected Meter Reading Limit" or simply the CMRL, which is the actual field strength present at the antenna. The quantity can be derived in the following manner:

$$\text{Corrected Meter Reading Limit (CMRL)} = \text{SAR} + \text{AF} + \text{CL} - \text{AG} - \text{DC}$$

Where, SAR = Spectrum Analyzer Reading

AF = Antenna Factor

CL = Cable Loss

AG = Amplifier Gain (if any)

DC = Distance Correction (if any)

Assume the following situation: A meter reading of 29.4 dBuV was obtained from a Class A computing device measured at 83 MHz. Assume an antenna factor of 9.2 dB, a cable loss of 1.4 dB and amplifier gain of 20.0 dB at 83 MHz. The final field strength would be determined as follows:

$$\text{CMRL} = 29.4 \text{ dBuV} + 9.2 \text{ dB} - 1.4 \text{ dB} - 20 \text{ dB/M} - 0.0 \text{ dB}$$

$$\text{CMRL} = 20.0 \text{ dBuV/M}$$

This result is well below the FCC and CSA Class A limit of 29.5 dbuV/m at 83 MHz.

For the manual mode of measurement, a table of corrected meter reading limit was used to permit immediate comparison of the meter reading to determine if the measure emission amplitude exceeded the specification limit at that specific frequency.

NOTES: Huber Suhner - 1 Tx & 1 Rx & Yagi antennas. OTHER: 453
 RBW and VBW = 1 MHz for peak. RBW = 1 MHz and VBW = 10 Hz for average.
 No emissions detectable except as noted below.

y.beta1

REPORT No: S0045 TESTED BY: Mary Washington SPEC:
 CUSTOMER: Single Chip Systems, Inc. TEST:

CUSTOMER: Single Chip Systems, Inc. *Washington*

E U T: InstaScan Scanner Model S512 TEST SITE: 3

EUT MODE: Tx from one antenna, modulation on BICONICAL: N/A

DATE: 27-Jan-00 LOG: N/A

NOTES: Huber Suhner antenna. OTHER: 453
 RBW and VBW = 1 MHz for peak. RBW = 1 MHz and VBW = 10 Hz for average
 No emissions detectable except as noted below.

y.beta1

3.2 CONDUCTED EMISSION DATA

See following page(s).

Emissions Test Conditions: CONDUCTED EMISSIONS, FCC Part 15, Paragraph 15.247(a)(b)

The *RADIATED EMISSIONS* measurements were performed at the following test location :

☐ - Test not applicable

☒ - Roof (Small Open Area Test Site)

Test Equipment Used :

Model No.	Prop. No.	Description	Manufacturer	Serial No.	Cal Date
8491A	748	10 dB Attenuator	Hewlett Packard	--	*
AA-190-06.00.0	728	High Frequency Cable	United Microwave	--	01/00
8566B	720	Spectrum Analyzer	Hewlett Packard	211500842	03/99
8566B	721	Spectrum Analyzer Display	Hewlett Packard	2112A02185	03/99
437B	572	Power Meter	Hewlett Packard	3125U19308	03/00
8481A	554	Power Sensor	Hewlett Packard	1926A27807	09/00

Remarks: (*) Verified prior to testing.

DATE: 27 January 2000

TEST: RF Output

CUSTOMER: SCS

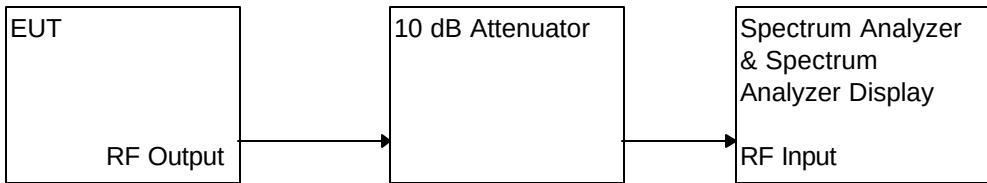
EUT: InstaScan Scanner, Model S512

SPECIFICATION: FCC Part 15, Paragraph 15.247(b)

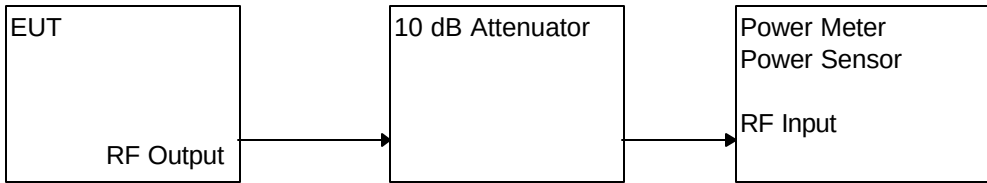
Frequency (MHz)	Output Power (dBm)	Output Power (1W)
2401	28.15	0.7
2437	27.99	0.63
2475	27.85	0.61

NOTES: 1. Modulation off.
 2. Frequency hopping off.

Direct Connect Test Setup, Part 15, Paragraph 15.247(a)



Part 15, Paragraph 15.247(b)



CLIENT: SINGLE CHIP SYSTEMS

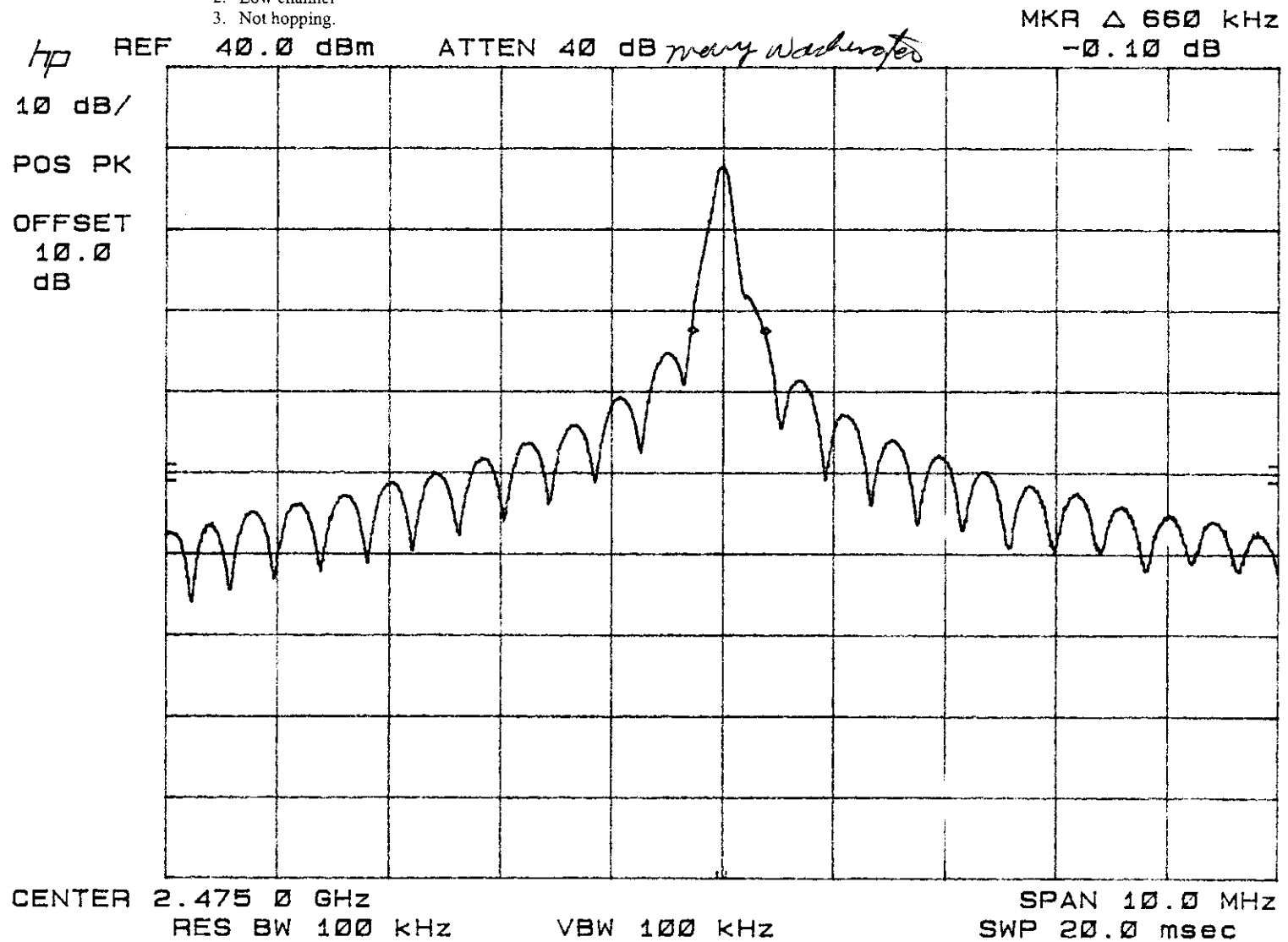
REPORT NO. 0045

DATE: 27 January 2000

SPECIFICATION: FCC Part 15, Paragraph 15.247(a)

EUT: InstaScan Scanner, Model S512

- NOTES:
1. Modulation on
 2. Low channel
 3. Not hopping.



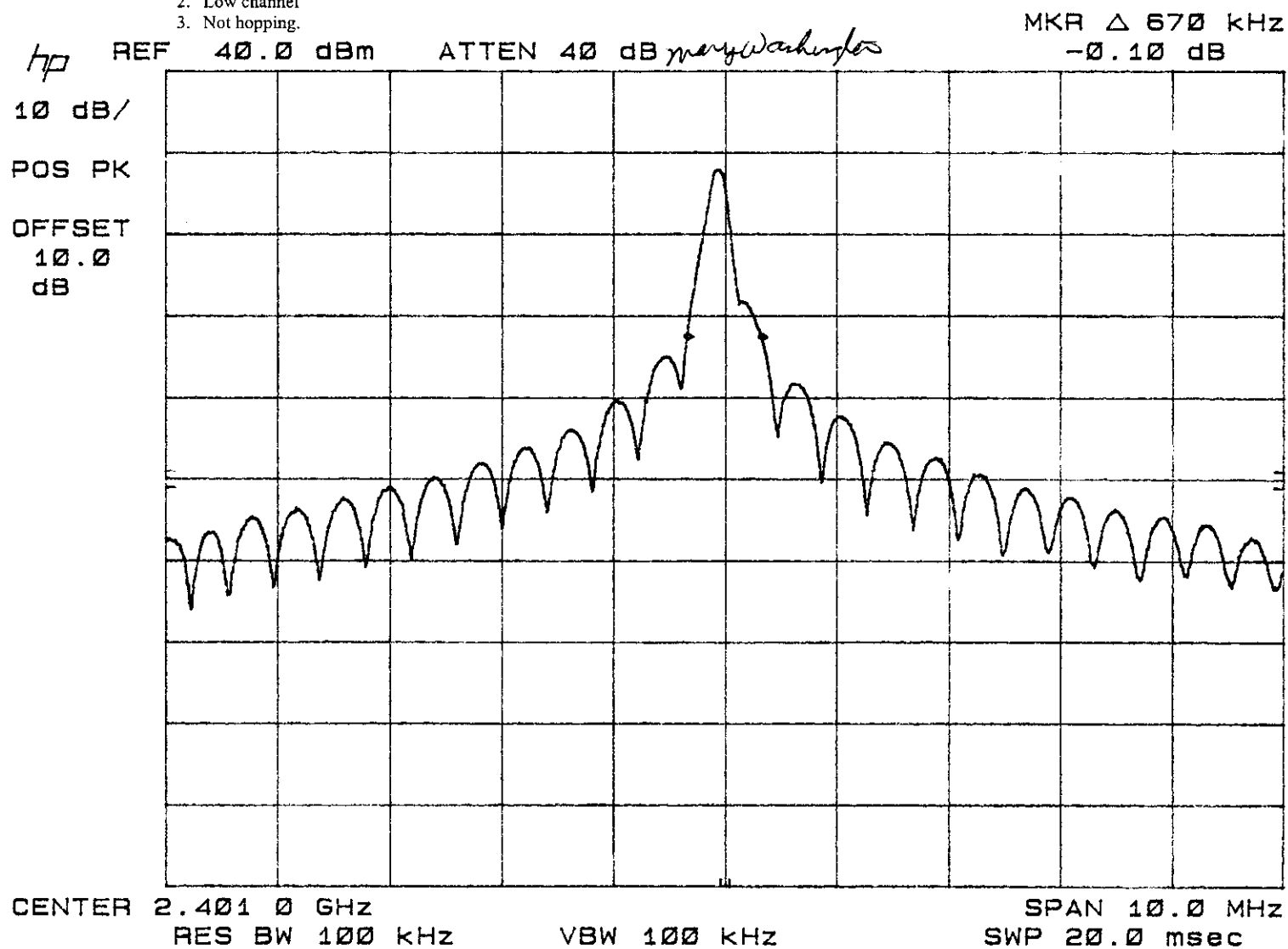
CLIENT: SINGLE CHIP SYSTEMS
SPECIFICATION: FCC Part 15, Paragraph 15.247(a)

REPORT NO. 0045

DATE: 27 January 2000

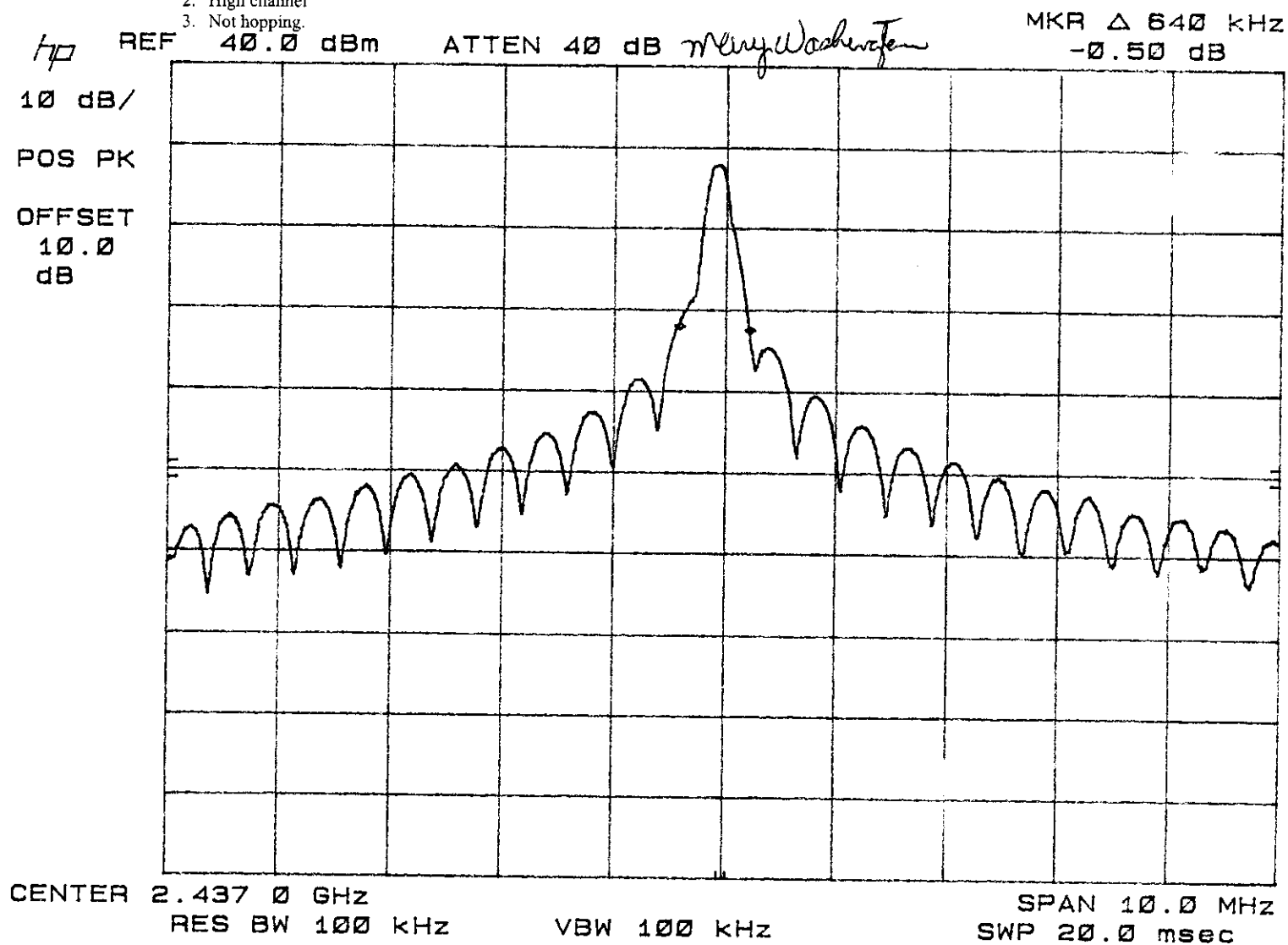
EUT: InstaScan Scanner, Model S512

- NOTES:
1. Modulation on
 2. Low channel
 3. Not hopping.



CLIENT: SINGLE CHIP SYSTEMS
SPECIFICATION: FCC Part 15, Paragraph 15.247(a)
NOTES: 1. Modulation on
2. High channel
3. Not hopping.

REPORT NO. 0045 DATE: 27 January 2000
EUT: InstaScan Scanner, Model S512



CLIENT: SINGLE CHIP SYSTEMS

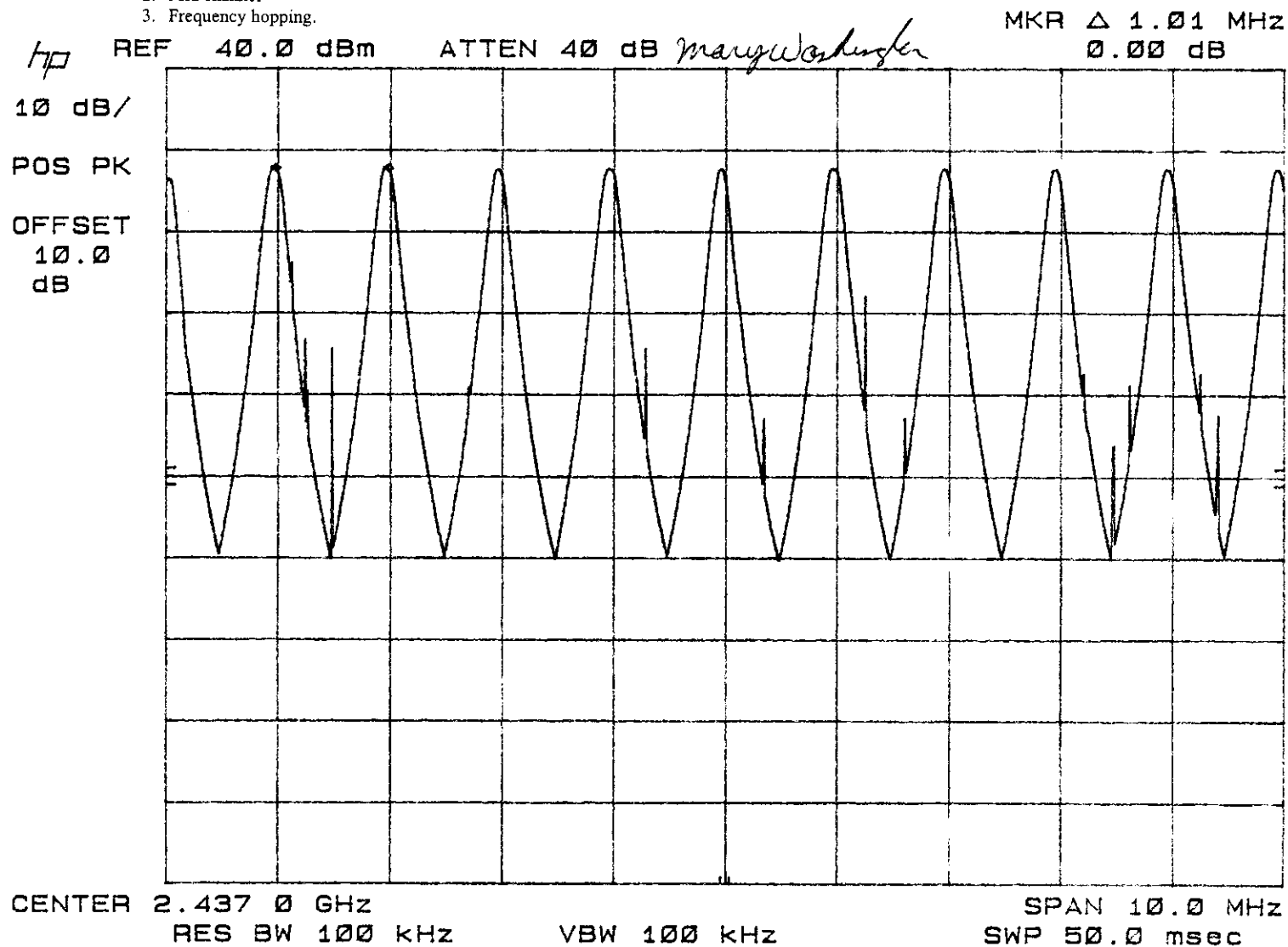
REPORT NO. 0045

DATE: 27 January 2000

SPECIFICATION: FCC Part 15, Paragraph 15.247(a)

EUT: InstaScan Scanner, Model S512

- NOTES:
1. Modulation off
 2. Mid channel
 3. Frequency hopping.



CLIENT: SINGLE CHIP SYSTEMS

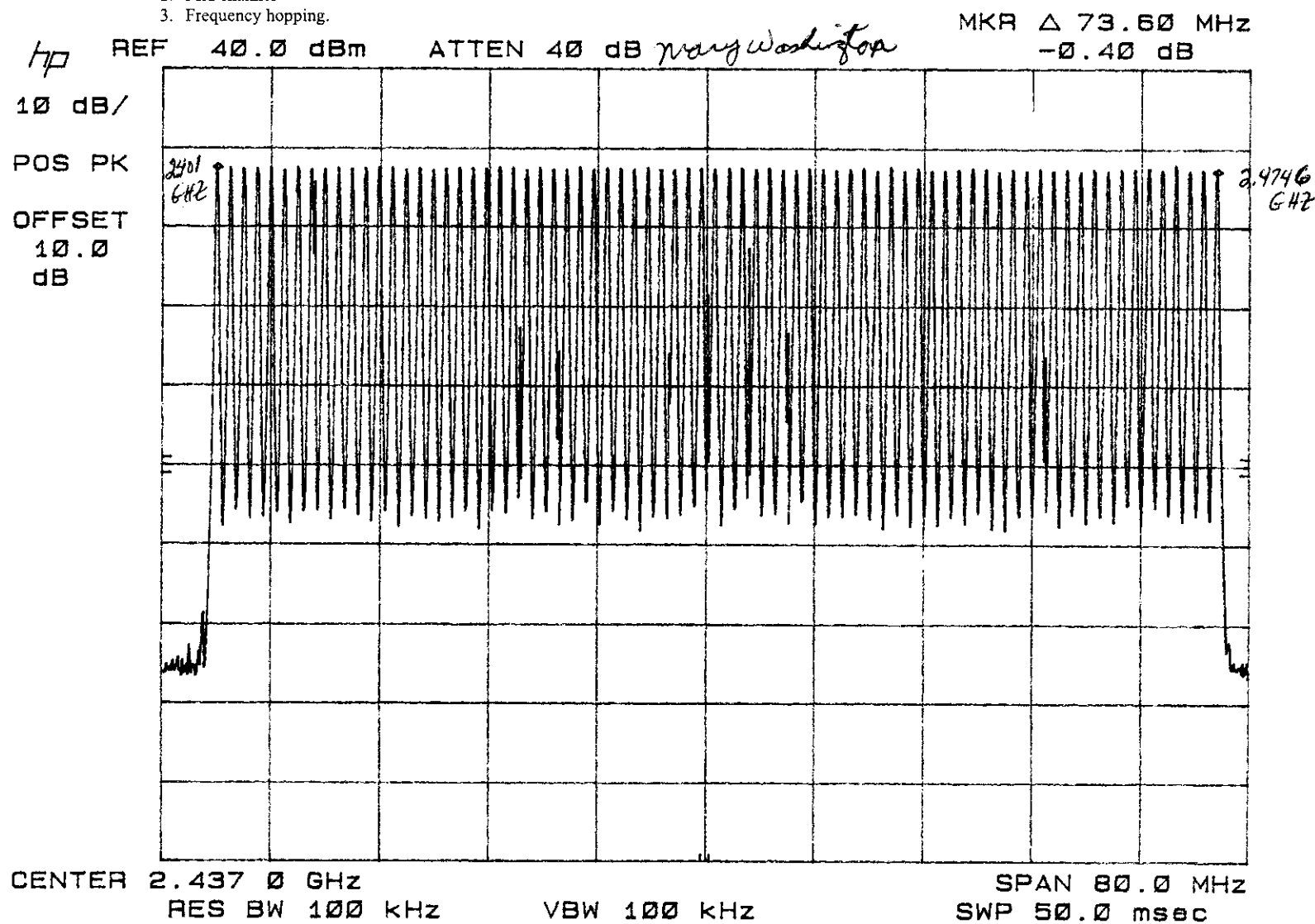
REPORT NO. 0045

DATE: 2 / January 2000

SPECIFICATION: FCC Part 15, Paragraph 15.247(a)

EUT: InstaScan Scanner, Model S512

- NOTES:
1. Modulation off
 2. Mid channel
 3. Frequency hopping.



CLIENT: SINGLE CHIP SYSTEMS

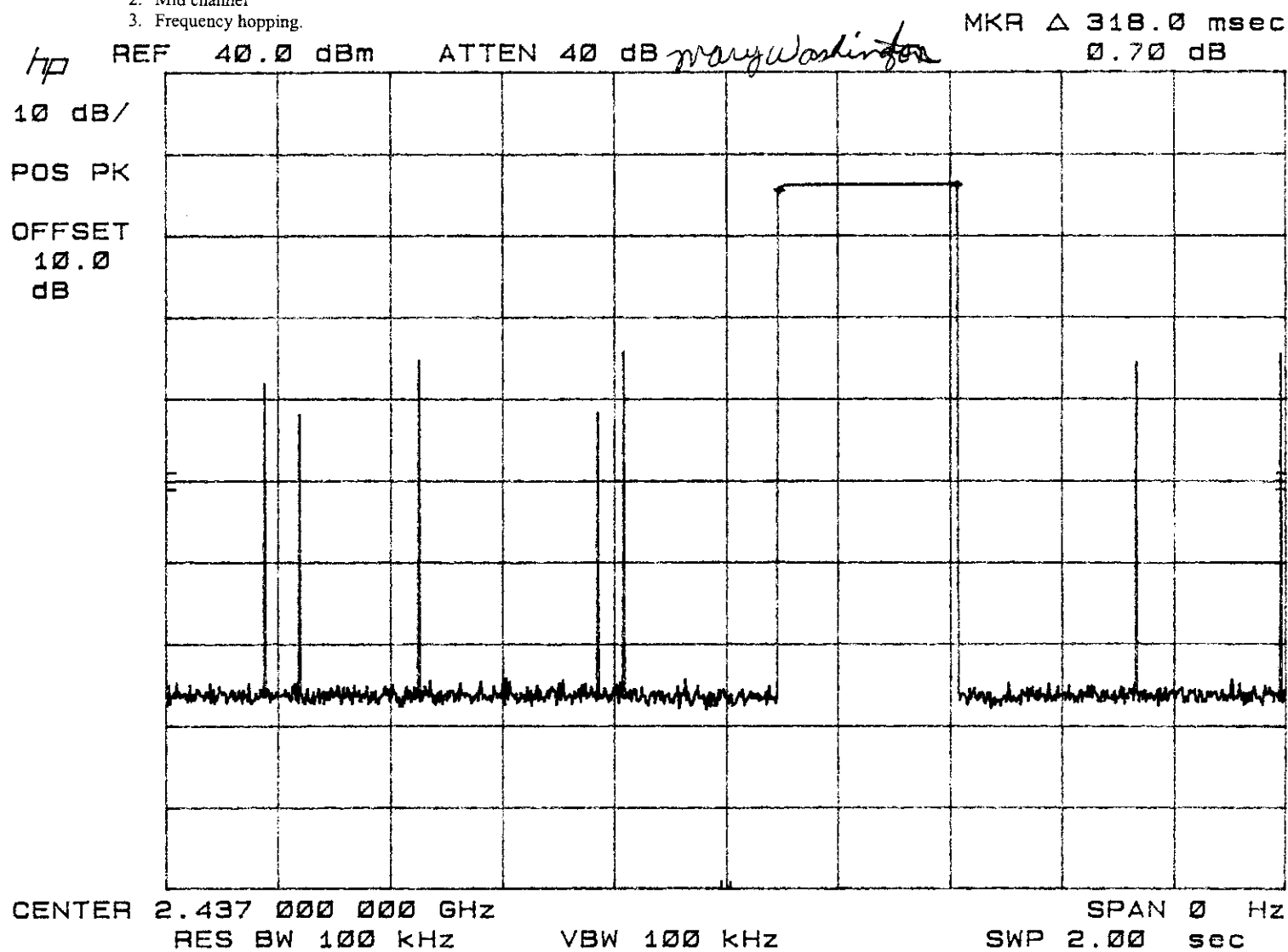
REPORT NO. 0045

DATE: 27 January 2000

SPECIFICATION: FCC Part 15, Paragraph 15.247(a)

EUT: InstaScan Scanner, Model S512

- NOTES:
1. Modulation off
 2. Mid channel
 3. Frequency hopping.



4 SIGNATURE PAGE

GENERAL REMARKS:

SUMMARY:

All tests according to United States Standard 47 CFR Part 15, Paragraph 15.247(a)(b)(c)

☒ - Performed

☐ - **Not** Performed

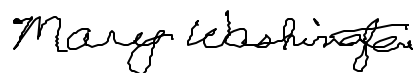
The Equipment Under Test

☒ - **Fulfills** the general approval requirements cited on page 1.

☐ - **Does not** fulfill the general approval requirements cited on page 1.

- TÜV PRODUCT SERVICE, INC. -

Responsible Engineer:



Mary Washington
(EMC Engineer)