MEASUREMENT AND TECHNICAL REPORT

SINGLE CHIP SYSTEMS

DATE: 05 May 1999

This Report Concerns:	Original Grant: X	Class II Change:
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)

Report Prepared by:

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

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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	
Power Supply	N2UFSW CSC15-1000 PS7520AWP5	4850 9632	
Dual Antenna	100157-1 100158-1	00001	

1.2 Operating modes: (list and describe)

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:	**Currently SMA, 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:	**Currently SMA, Reverse polarity SMA in production**
TERMINATION TYPE:	**Coax shield to SMA connector**
LENGTH:	**6 ft.**
REMOVABLE:	**yes**

1.3.2 Power Cords (Add attachment if necessary.)

UNIT:	**N2UFSW**
MANUFACTURER:	**Egston**
SHIELDED:	**no**
LENGTH:	**6 ft.**

UNIT:	**CSC15-1000**
MANUFACTURER:	**Cortech**
SHIELDED:	**no**
LENGTH:	**6 ft.**

UNIT:	**PS7520AWPS**
MANUFACTURER:	**Sceptre**
SHIELDED:	**no**
LENGTH:	**6 ft.**

1.3.3 Power requirements:

***Note: European power is typically 230 VAC 50Hz or 400 VAC 50Hz, single and three phase, respectively. FCC requires testing to be performed at typical US power ratings at 60Hz.**

230 VAC 50Hz -- single phase Amps

400 VAC 50Hz -- three phase Amps per phase

X 120 VAC 60Hz -- single phase 0.5 Amps

VDC Amps

Battery: VDC Expected life: Hours

Other: (describe)

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	Egston	N2UFSW	4850	
Wall mount 7.5 V, 2.0 A	Cortech	CSC15-1000		100 KHz
Wall mount 7.5 V, 2.0 A	Sceptre	PS7520AWP5	9632	

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

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

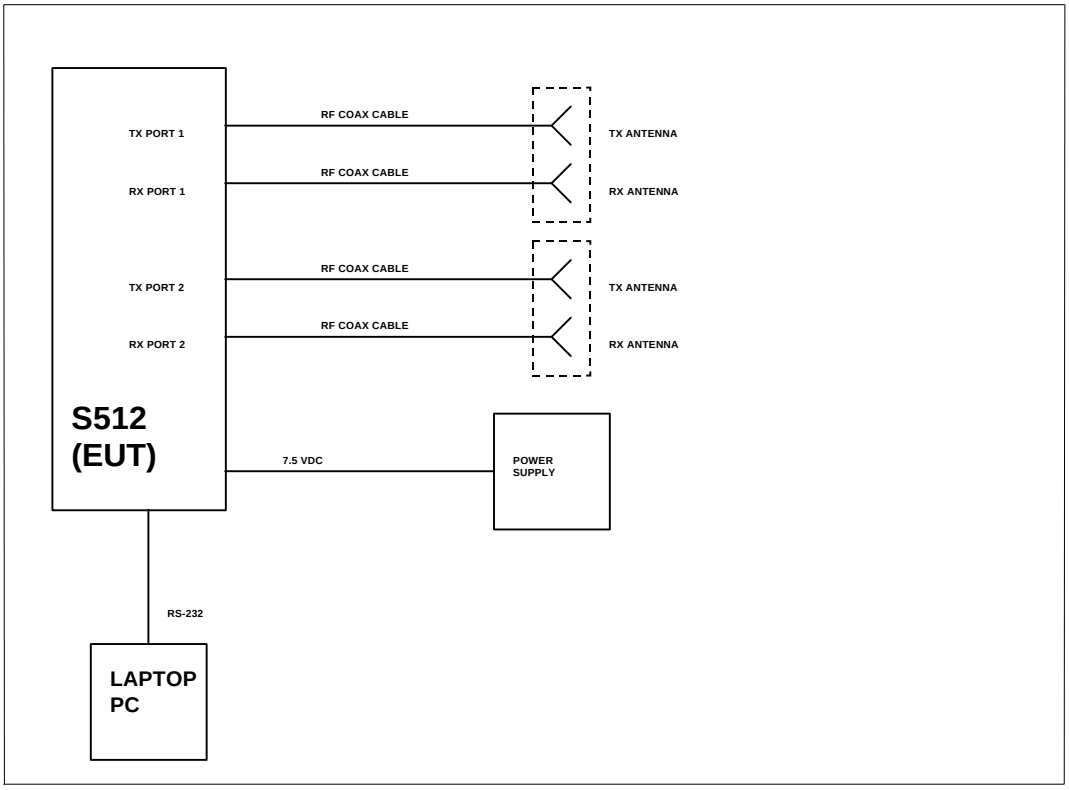
Aluminum housing comprised of a 5 sided box with a screw-on face plate.

1.9 Interfacing and/or Simulators Peripheral Equipment

(***Please provide a complete description of all peripherals to be used during testing, please note that all I/O ports must be appropriately loaded)***

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 Block Diagram, page 7.

2.2 EUT Exercise Software

None

2.3 Special Accessories

None

2.4 Modification

None

2.5 Configuration of Tested System

See Block Diagram, page 7.

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:

■- 1 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	2112A02185	03/99

Remarks: See test setup photos for 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:

Corrected Meter Reading Limit (CMRL) = SAR + AF + CL - AG - 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:

CMRL = 29.4 dBuV + 9.2dB = 1.4 dB - 20 dB/M - 0.0 dB

CMRL = 20.0 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.

REPORT No: S9177 TESTED BY: dm SPEC: FCC Part 15, Paragraph 247(c)

CUSTOMER: Single Chip Systems, Inc. TEST DIST: 1

E U T: InstaScanner Model S512, S/N 00002 TEST SITE: 3

EUT MODE: Tx, multiplexing, not frequency hopping BICONICAL: N/A

DATE: 23-Apr-99 LOG: N/A

NOTES: Duty Cycle= 100% OTHER: 453

RBW and VBW = 1 MHz for peak.

RBW = 1 MHz and VBW = 10 Hz for average.

v.beta

FREQ (MHz)	VERTICAL (dBuv) pk	av	HORIZONTAL (dBuv) pk	av	CORRECTION FACTOR (dB/m)	MAX LEVEL (dBuV/m) pk	av	SPEC LIMIT (dBuV/m) pk	av	MARGIN (dB) pk	av	EUT Rotation	Antenna Height
2401	75.6		78		32.7	**110.7**	**32.7**						
4802	1.7		0.7		41.3	**43.0**	**41.3**	74	54	-31	-13	0	1
7203	5.2		6.4		45.6	**52.0**	**45.6**	74	54	-22	-8.4		
9604	-0.4		-1.2		48.4	**48.0**	**48.4**	74	54	-26	-5.6		
12005			-2.1		52.4	**52.4**	**52.4**	74	54	-21.6	-1.6		
2437	75.6		81		34.5	**115.5**	**34.5**			115.5	34.5		
4874	0.1		-2		41.6	**41.7**	**41.6**	74	54	-32.3	-12		
7310	6		7.2		45.7	**52.9**	**45.7**	74	54	-21.1	-8.3		
9748	1.4		-1.6		48.7	**50.1**	**48.7**	74	54	-23.9	-5.3		
2475	75.7		81.6		34.6	**116.2**	**34.6**			116.2	34.6		
4950	-0.3		-1.8		42.0	**41.7**	**42.0**	74	54	-32.3	-12		
7425	3.5		6.6		45.9	**52.5**	**45.9**	74	54	-21.5	-8.1		
9900	-0.6		-1.9		49.1	**48.5**	**49.1**	74	54	-25.5	-4.9		

REPORT No: S9177 TESTED BY: dm SPEC: FCC Part 15, Paragraph 247(c)

CUSTOMER: Single Chip Systems, Inc. TEST DIST: 1

E U T: InstaScanner Model S512, S/N 00002 TEST SITE: 3

EUT MODE: Tx, no antenna multiplexing BICONICAL: N/A

DATE: 23-Apr-99 LOG: N/A

NOTES: Duty Cycle= 100% OTHER: 453

RBW and VBW = 1 MHz for peak.

RBW = 1 MHz and VBW = 10 Hz for average.

v.beta

FREQ (MHz)	VERTICAL (dBuv) pk	av	HORIZONTAL (dBuv) pk	av	CORRECTION FACTOR (dB/m)	MAX LEVEL (dBuV/m) pk	av	SPEC LIMIT (dBuV/m) pk	av	MARGIN (dB) pk	av	EUT Rotation	Antenna Height
2401	80		79.6		32.7	**112.7**	**32.7**						
4802	4.1		1.4		41.3	**45.4**	**41.3**	74	54	-28.6	-13	0	1
7203	2.6		2.4		45.6	**48.2**	**45.6**	74	54	-25.8	-8.4		
9604	-0.4		-1.2		48.4	**48.0**	**48.4**	74	54	-26	-5.6		
								74	54				
2437	78.9		85.5		34.5	**120.0**	**34.5**			120	34.5		
4874	4.1		6.9		41.6	**48.5**	**41.6**	74	54	-25.5	-12		
7310	4.9		5		45.7	**50.7**	**45.7**	74	54	-23.3	-8.3		
9748	1.4		-1.6		48.7	**50.1**	**48.7**	74	54	-23.9	-5.3		
2475	76.4		83.3		34.6	**117.9**	**34.6**			117.9	34.6		
4950	6.6		-1.8		42.0	**48.6**	**42.0**	74	54	-25.4	-12		
7425	2.3		3.2		45.9	**49.1**	**45.9**	74	54	-24.9	-8.1		
9900	-0.6		-1.9		49.1	**48.5**	**49.1**	74	54	-25.5	-4.9		

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3.2 CONDUCTED EMISSION DATA

See following page(s).

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

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

☐ **- Test not applicable**

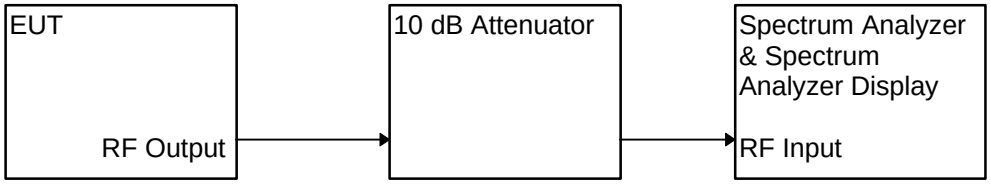
■ - Roof (Small Open Area Test Site)

Test Equipment Used :

Model No.	Prop. No.	Description	Manufacturer	Serial No.	Cal Date
8491A	595	10 dB Attenuator	Hewlett Packard	--	*
8566B	720	Spectrum Analyzer	Hewlett Packard	211500842	03/99
8566B	721	Spectrum Analyzer Display	Hewlett Packard	2112A02185	03/99

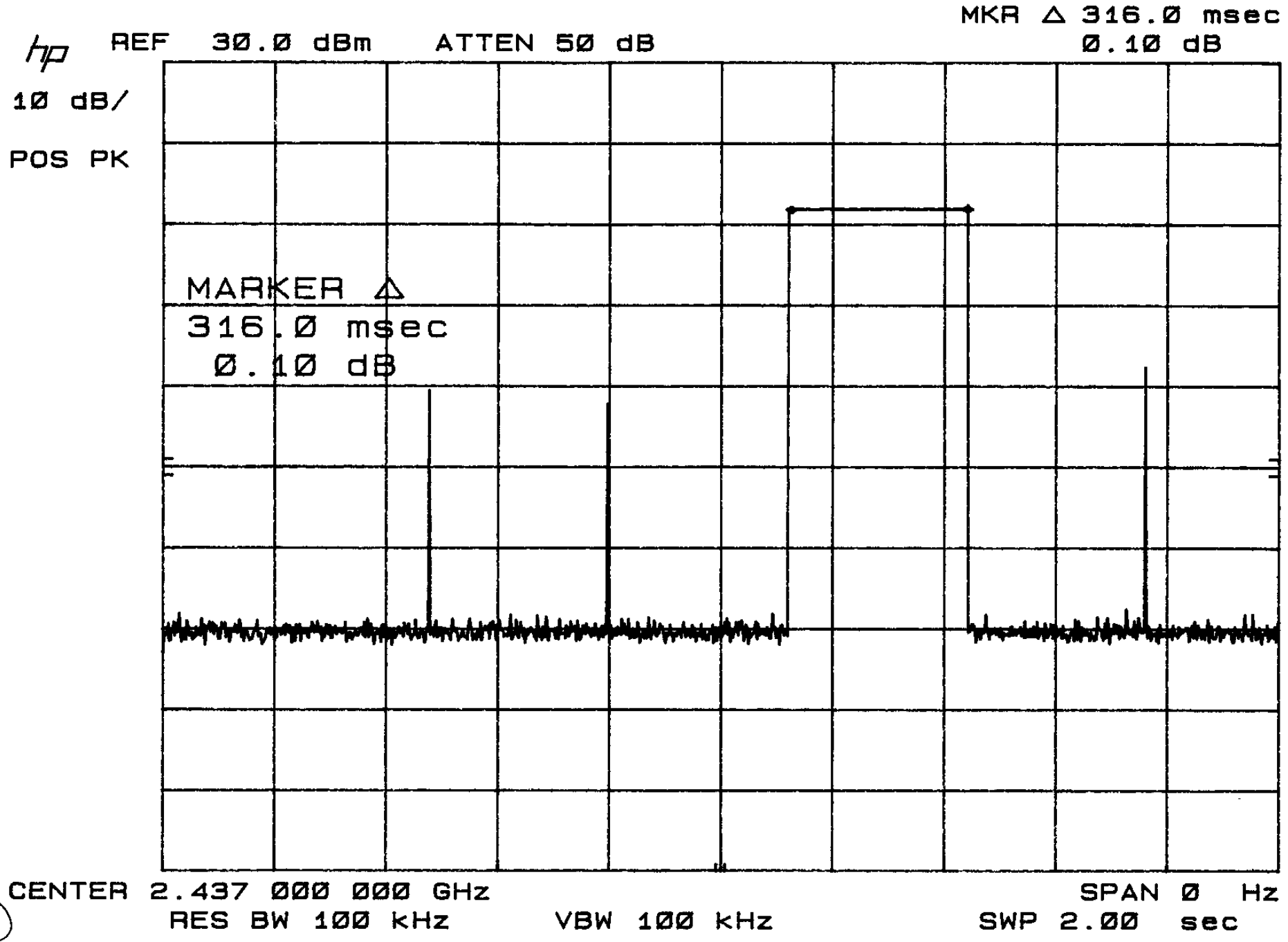
Remarks: (*) Verified prior to testing.

Direct Connect Test Setup, Part 15, Paragraph 15.247(a)(b)(c) Conducted Measurement



CUSTOMER: SINGLE CHIP SYSTEMS, INC.
TEST: Hop Duration
EUT: InstaScan Scanner, Model S512, S/N 00002

DATE: 23 April 1999 FCC ID: MKRS512
SPECIFICATION: FCC Part 15, Paragraph 15.247(a)

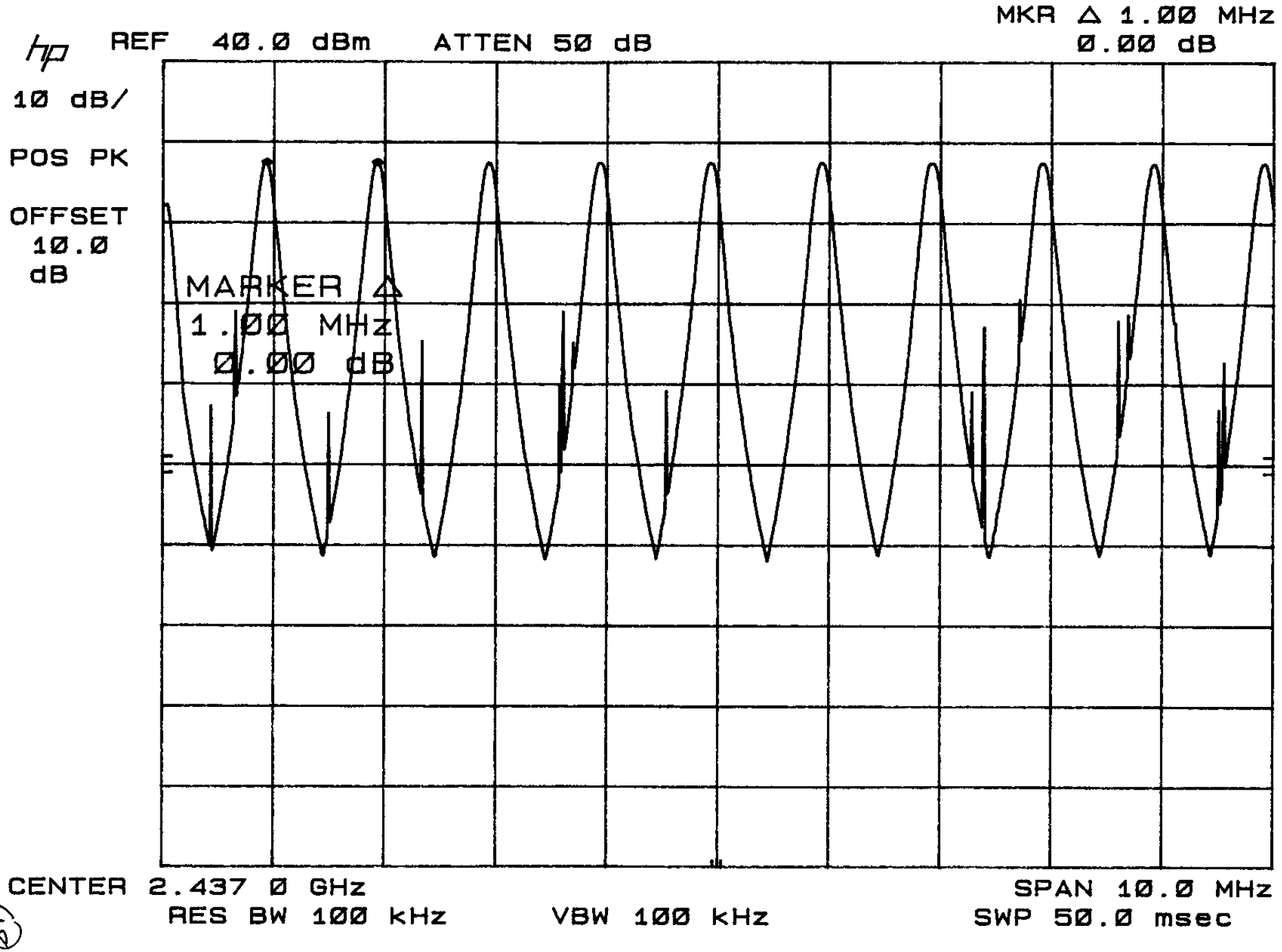


(1)

CUSTOMER: SINGLE CHIP SYSTEMS, INC.
TEST: Hop Frequency Spacing
EUT: InstaScan Scanner, Model S512, S/N 00002

DATE: 23 April 1999
SPECIFICATION: FCC Part 15, Paragraph 15.247(a)

FCC ID: MKRS512



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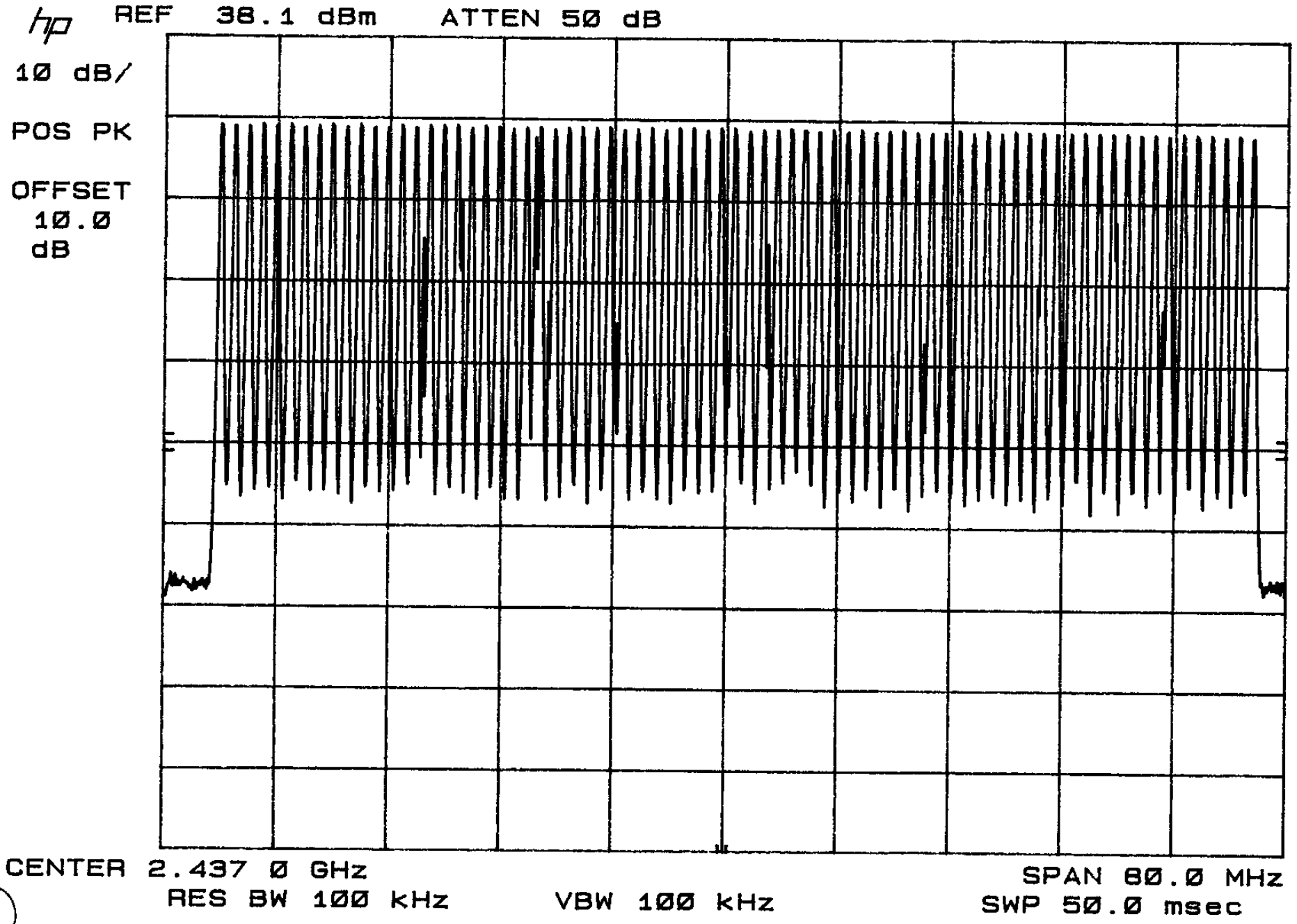
CUSTOMER: SINGLE CHIP SYSTEMS, INC.
TEST: Number of Hop Frequencies
EUT: InstaScan Scanner, Model S512, S/N 00002

DATE: 23 April 1999

FCC ID: MKRS512
SPECIFICATION: FCC Part 15, Paragraph 15.247(a)



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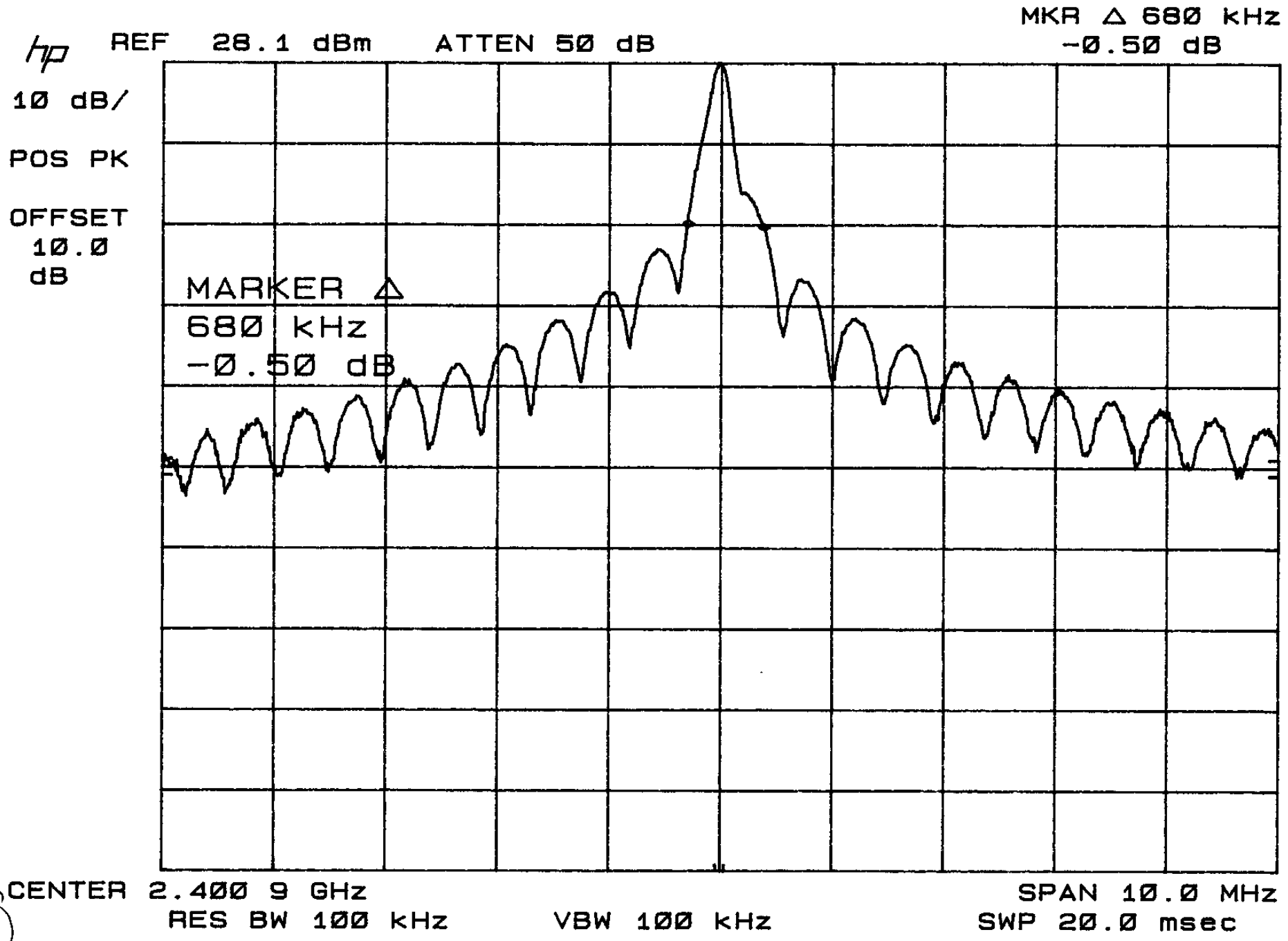
CUSTOMER: SINGLE CHIP SYSTEMS, INC.
TEST: 20 dB Bandwidth
EUT: InstaScan Scanner, Model S512, S/N 00002

DATE: 23 April 1999 FCC ID: MKRS512
SPECIFICATION: FCC Part 15, Paragraph 15.247(a)



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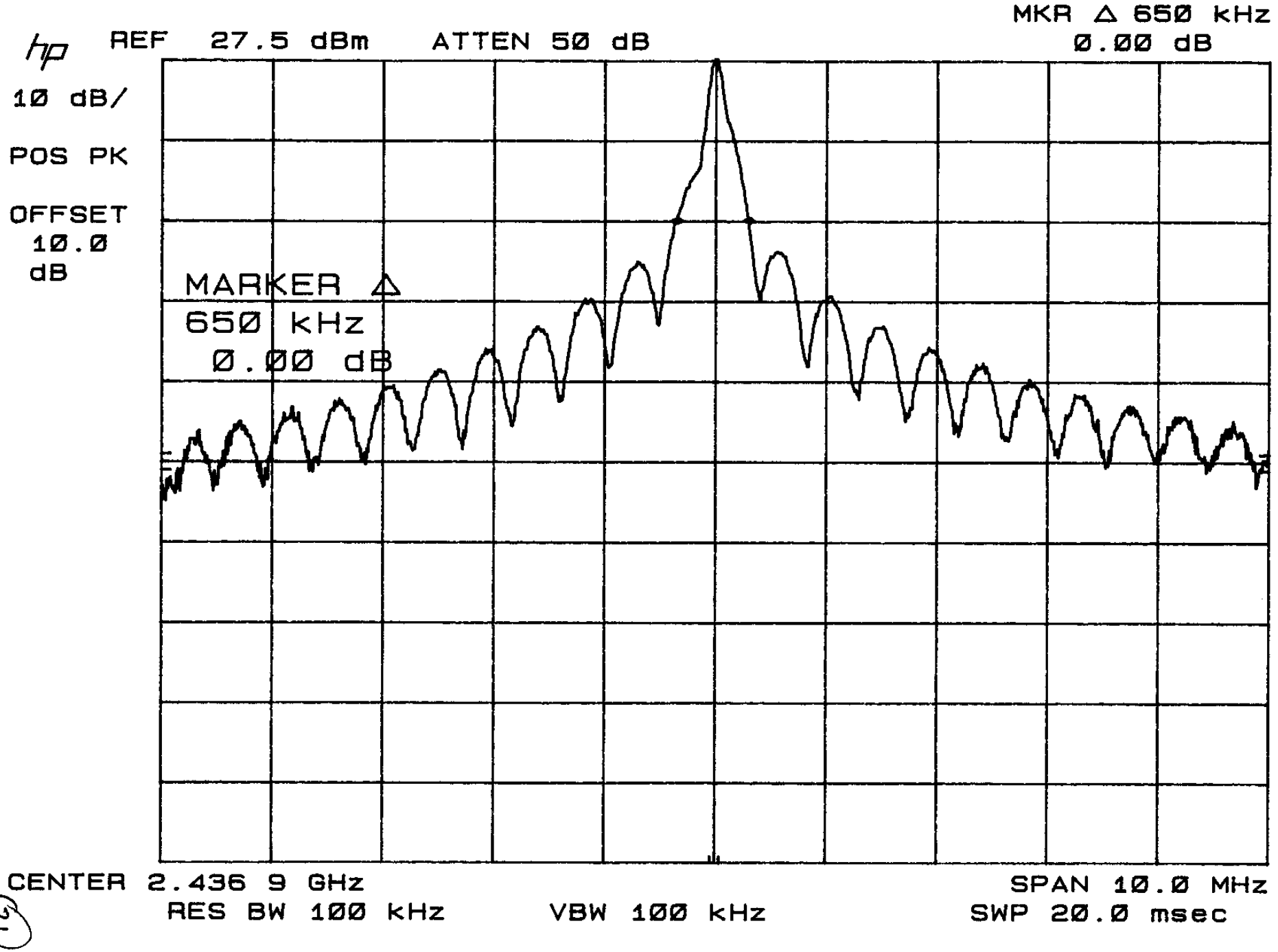
CUSTOMER: SINGLE CHIP SYSTEMS, INC.
TEST: 20 dB Bandwidth
EUT: InstaScan Scanner, Model S512, S/N 00002

DATE: 23 April 1999 FCC ID: MKRS512
SPECIFICATION: FCC Part 15, Paragraph 15.247(a)



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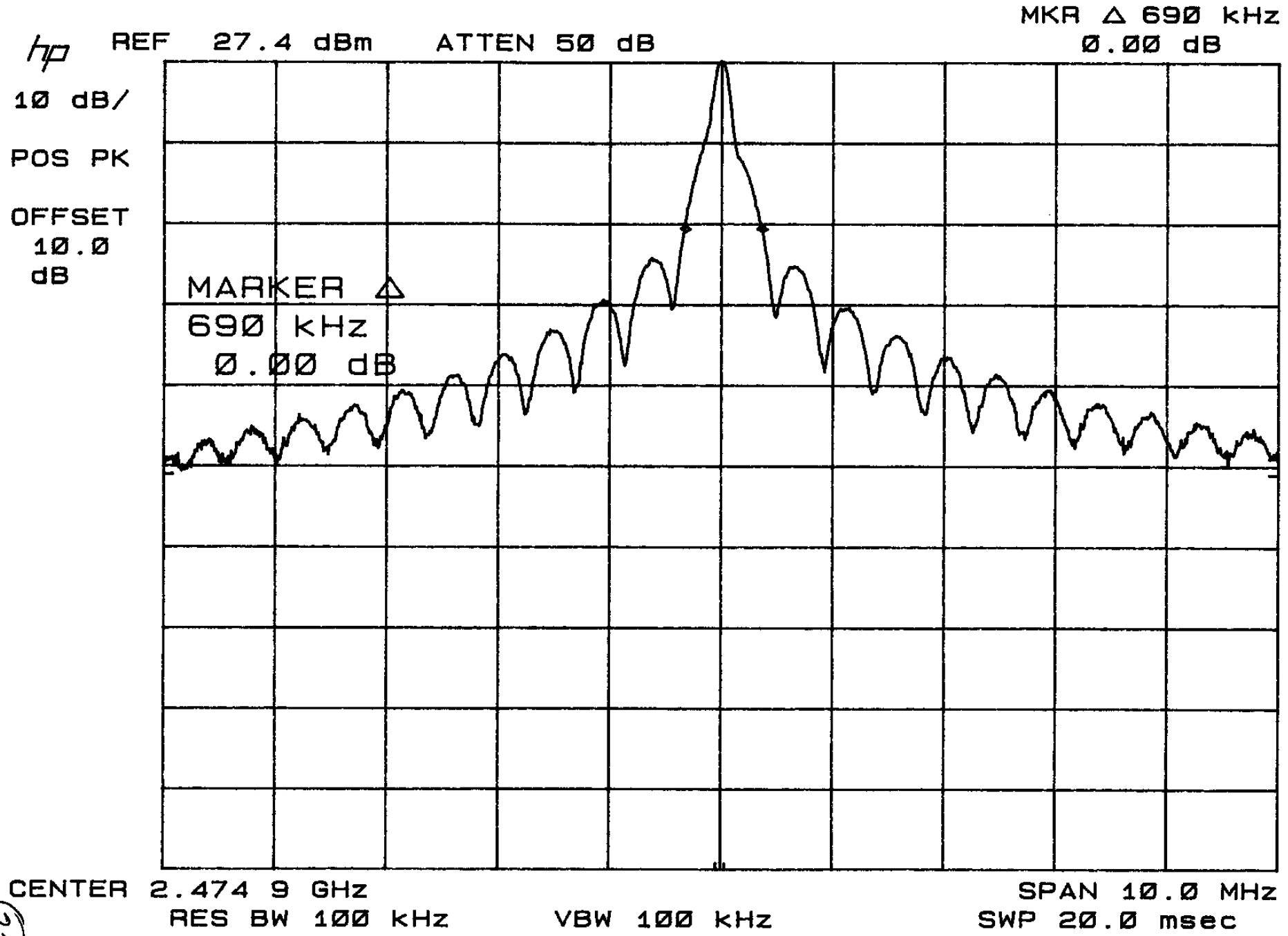
CUSTOMER: SINGLE CHIP SYSTEMS, INC.
TEST: 20 dB Bandwidth
EUT: InstaScan Scanner, Model S512, S/N 00002

DATE: 23 April 1999 FCC ID: MKRS512
SPECIFICATION: FCC Part 15, Paragraph 15.247(a)



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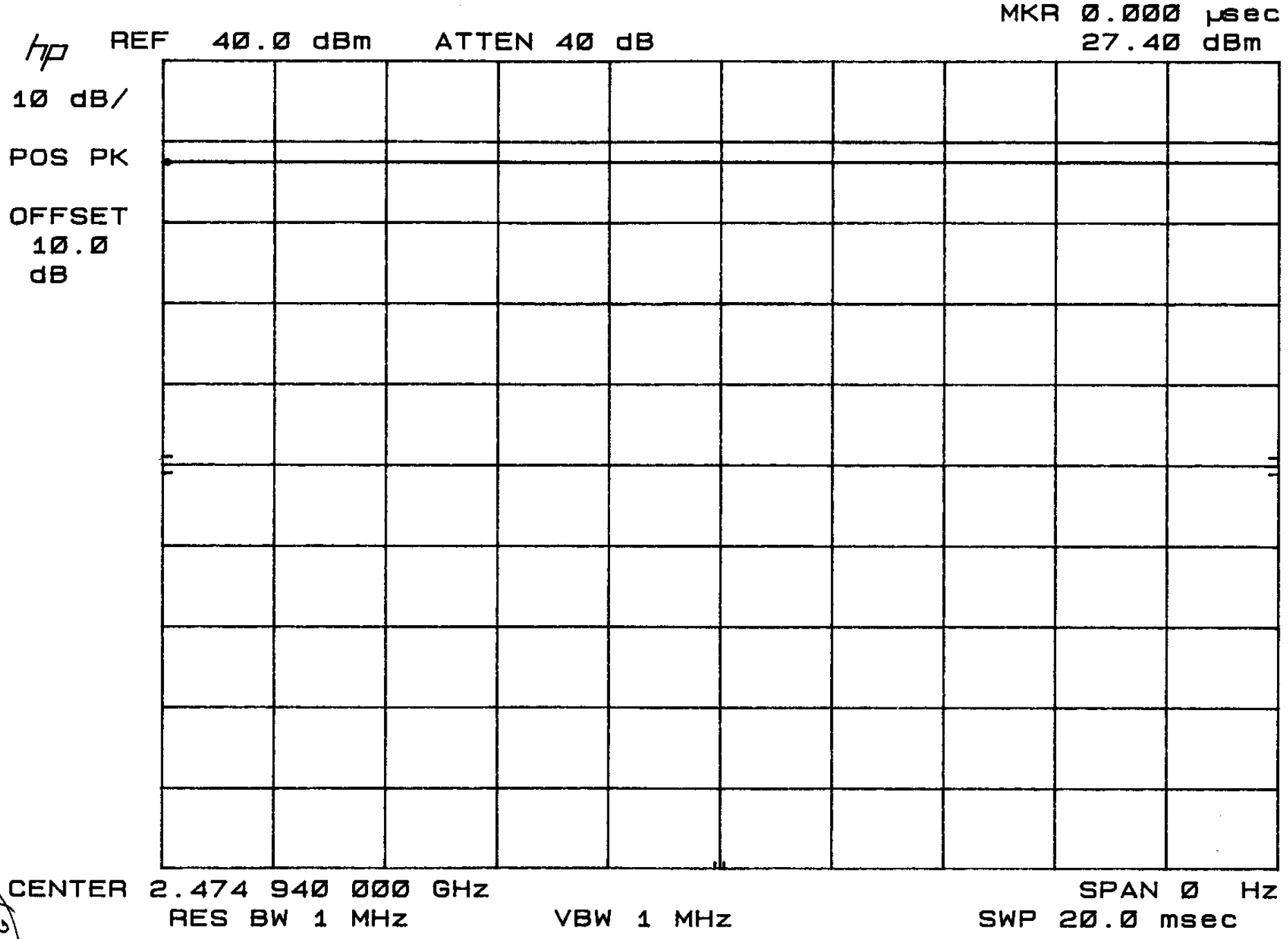
CUSTOMER: SINGLE CHIP SYSTEMS, INC.
TEST: Output Power
EUT: InstaScan Scanner, Model S512, S/N 00002

DATE: 23 April 1999 FCC ID: MKRS512
SPECIFICATION: FCC Part 15, Paragraph 15.247(b)
NOTE: 27.4 dBm = .55 W



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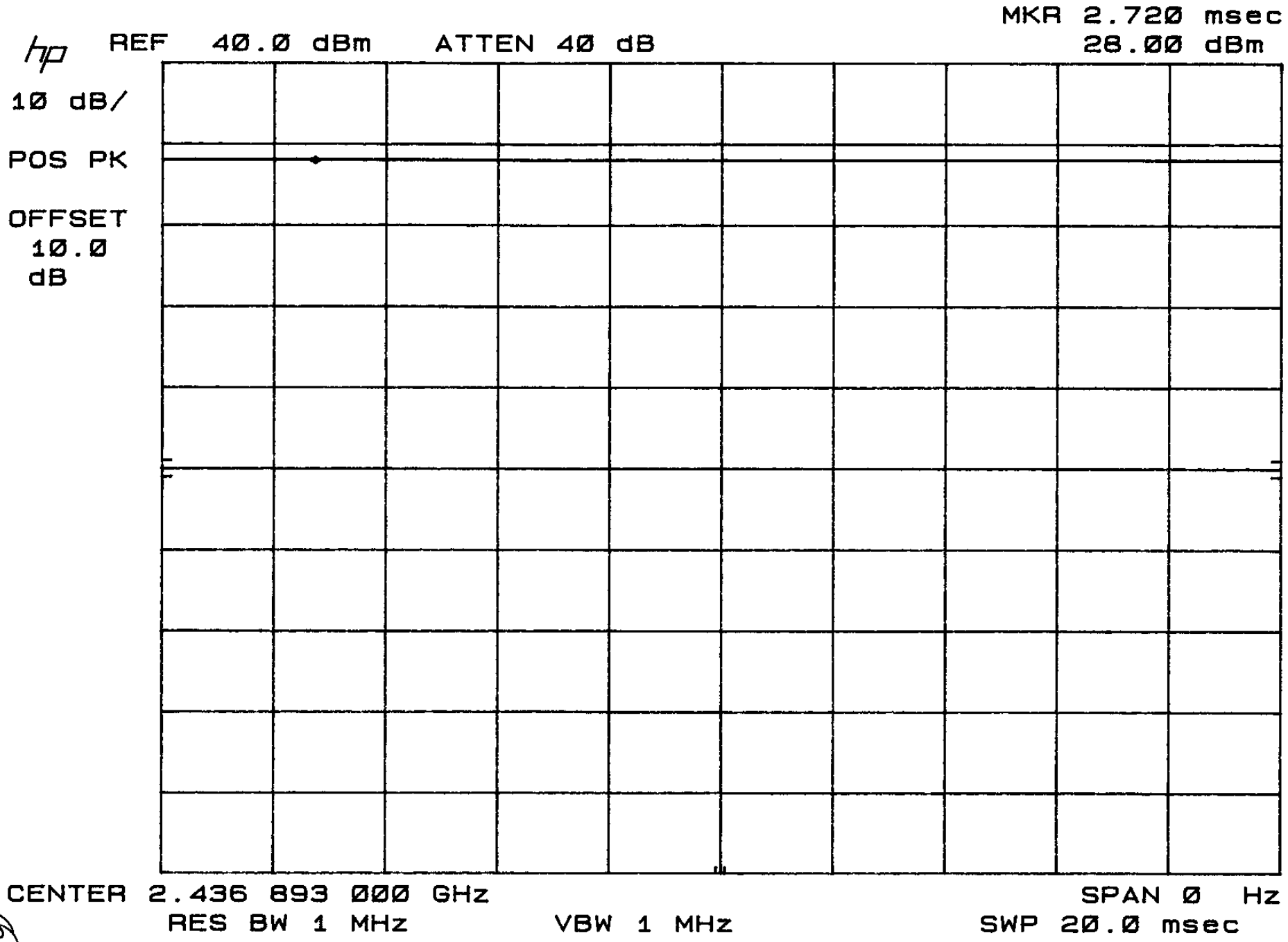
CUSTOMER: SINGLE CHIP SYSTEMS, INC.
TEST: Output Power
EUT: InstaScan Scanner, Model S512, S/N 00002

DATE: 23 April 1999 FCC ID: MKRS512
SPECIFICATION: FCC Part 15, Paragraph 15.247(b)
NOTE: 28 dBm = .63 W



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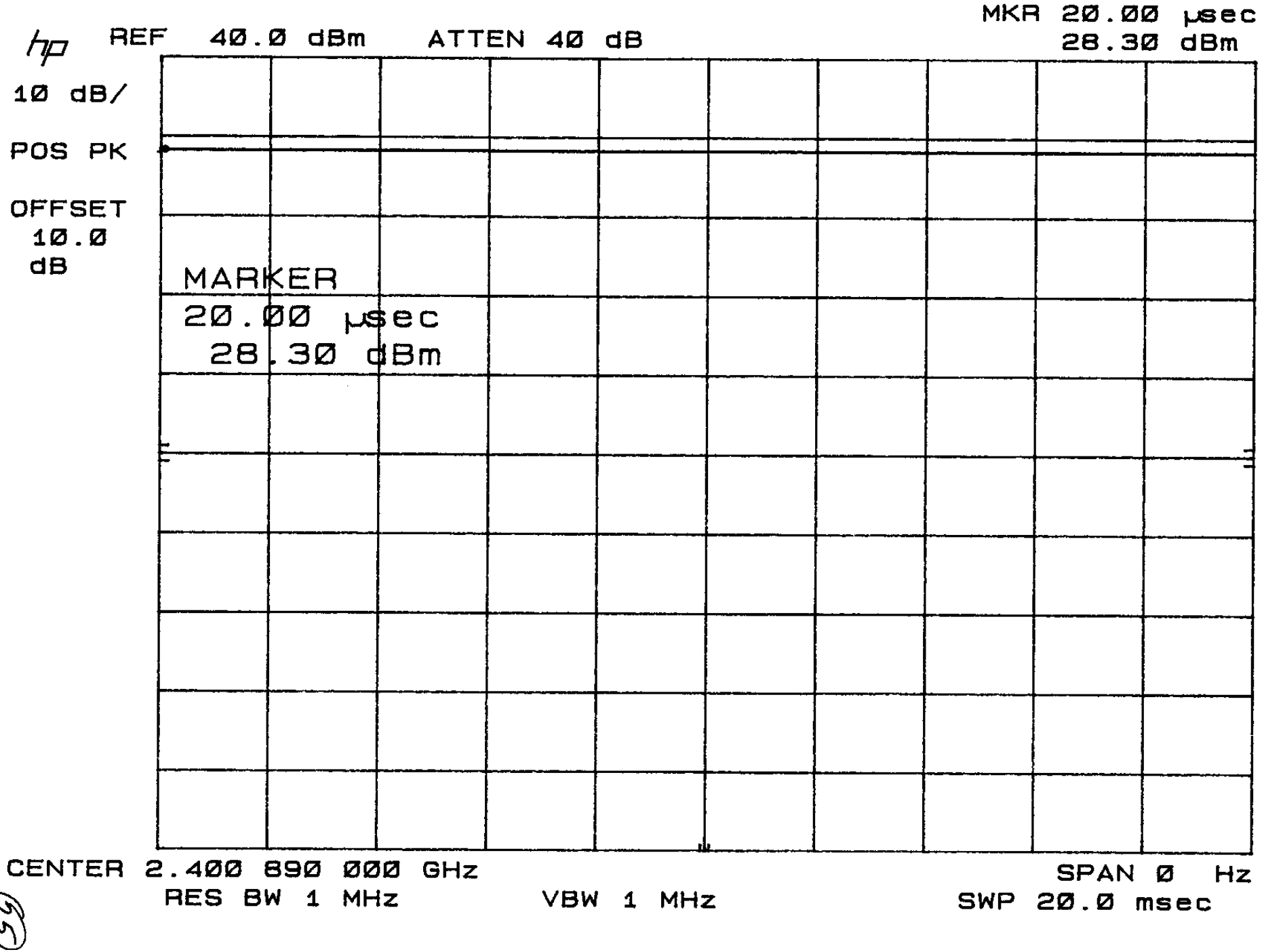
CUSTOMER: SINGLE CHIP SYSTEMS, INC.
TEST: Output Power
EUT: InstaScan Scanner, Model S512, S/N 00002

DATE: 23 April 1999 FCC ID: MKRS512
SPECIFICATION: FCC Part 15, Paragraph 15.247(b)
NOTE: 28.3 dBm = .7 W



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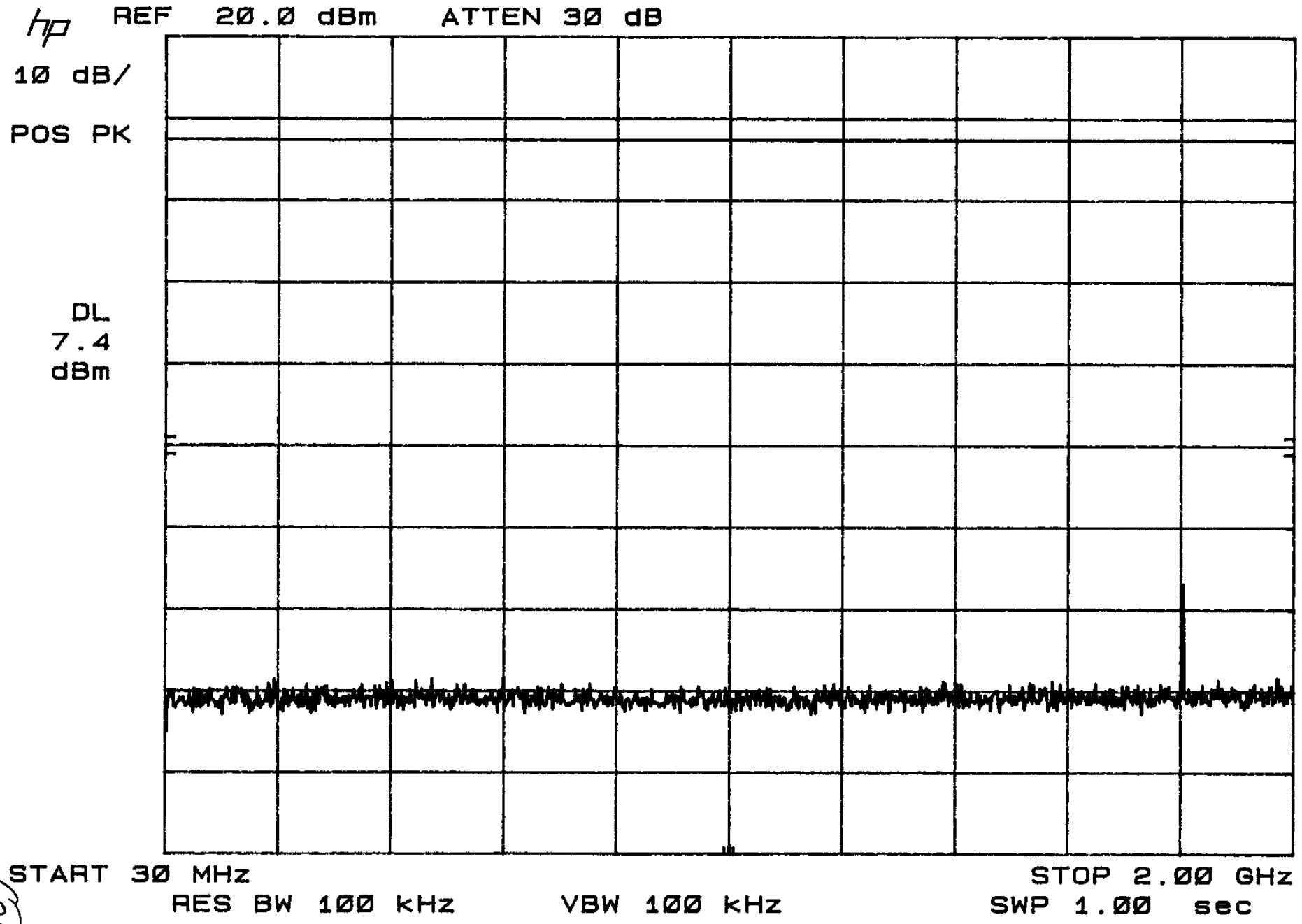
CUSTOMER: SINGLE CHIP SYSTEMS, INC.
TEST: RF Conducted Measurement
EUT: InstaScan Scanner, Model S512, S/N 00002

DATE: 23 April 1999 FCC ID: MKRS512
SPECIFICATION: FCC Part 15, Paragraph 15.247(c)



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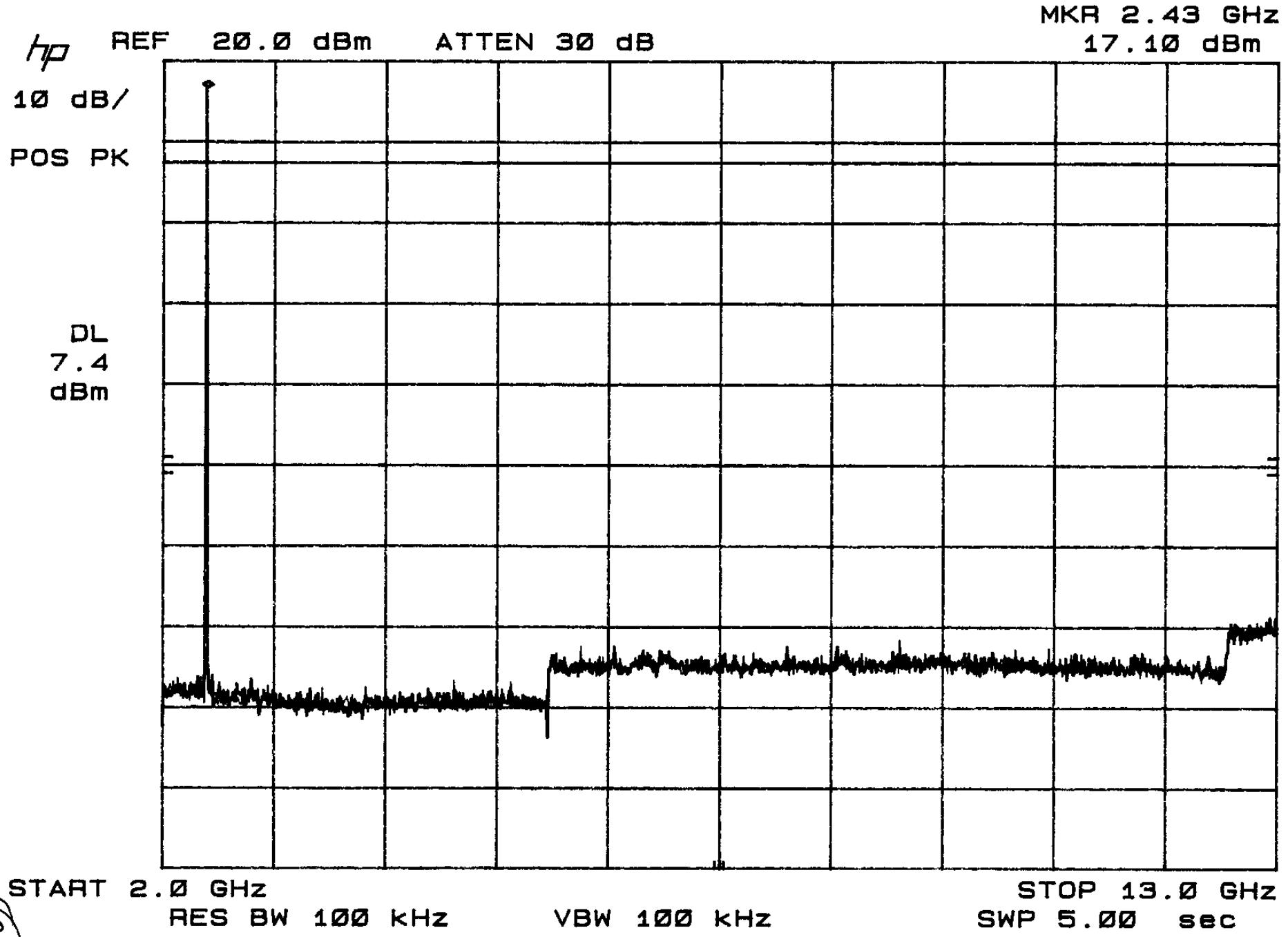
CUSTOMER: SINGLE CHIP SYSTEMS, INC.
TEST: RF Conducted Measurement
EUT: InstaScan Scanner, Model S512, S/N 00002

DATE: 23 April 1999
SPECIFICATION: FCC Part 15, Paragraph 15.247(c)

FCC ID: MKRS512



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4 SIGNATURE PAGE

GENERAL REMARKS:

SUMMARY:

All tests according to United States Standard 47 CFR Part ??, Subpart ??

☐ - Performed

☐ - **Not** Performed

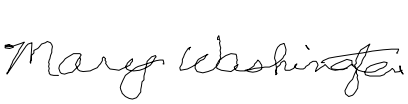
The Equipment Under Test

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

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

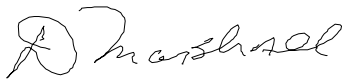
- TÜV PRODUCT SERVICE, INC. -

Responsible Engineer:



Mary Washington
(Senior EMC Engineer)

Responsible Test Engineer:



Dave Marshall
(EMC Test Engineer)