Intertek Testing Services NA Inc.
70 Codman Hill Road
Boxborough, MA 01719
Telephone (978) 263-2662
Fax (978) 263-7086

ERS International, Inc.

Emissions Testing
Performed
on the
Active Cell Antenna
Model: SN-ACATR-11
FCC Part 15, Subpart C, §15.247

Date of Test: June 15, 1999

WO#J98015767A
KPS/Rbt
ERS5767A.KPS
June 25, 1999
DOT: June 15, 1999
Contact: Mr. Aron Viner

Total No. of Pages Contained in this Report: ___

INTERTEK TESTING SERVICES NA INC.

TO: Electronic Retail Systems
Mr. Aron Viner
FROM: Kouma P. Sinn
DATE: June 15, 1999

RE: Emissions testing of the ShelfNet Active Cell Antenna, Model SN-ACATR-11

On June 15, 1999, we tested the ShelfNet Active Cell Antenna, Model: SN-ACATR-11 to determine if it was compliant with the FCC Part 15 Subpart C Section §15.247 emission requirements. We found that the unit met the requirements when tested as received.

Worst-case emissions results are as follows:

FCC Part 15 Subpart C Section §15.247

Table #	Test	Frequency (MHZ)	Margin (dB)	Next Highest Margin (dB)	Detector	Pass/Fail
	Transmitting at 2410 MHZ					
1	Radiated	4819.6	-22	-66	Peak	Pass
	Transmitting at 2440 MHZ					
2	Radiated	7319.4	-12	-23	Peak	Pass
	Transmitting at 2470 MHZ					
3	Radiated	7409.4	-9	-23	Peak	Pass

	FCC Part 15 Subpart C Section §15.207					
4	Line-Conducted	20.00	-18.2	-21.2	Quasi-Peak	Pass

Notes: An average factor of 3 dB was determined and applied to the readings prior comparing to the limit.

See Derivation of Averaging Factor on Page 9.

INTERTEK TESTING SERVICES NA INC.

TO: Electronic Retail Systems
Mr. Aron Viner
FROM: Kouma P. Sinn
DATE: June 15, 1999

RE: Emissions testing of the ShelfNet Active Cell Antenna, Model SN-ACATR-11

Measurements Of Output Power

Frequency (MHZ)	Distance (Meters)	Net Reading (dBuv)	Calculated Power (Watts)	Limit (Watts)	Pass/Fail
2409.80	3	130	0.750	1.0	Pass
2439.80	3	131	0.940	1.0	Pass
2469.80	3	130	0.750	1.0	Pass

Output power was measured by recording the field strength for low, mid and high transmit frequencies. Peak measurements were taken at 3 meters test distance. Due to a lack of an RF port for the antenna, the field strength measurements were converted to a power level at the antenna terminal using the following formula:

$P = (E * d)^2 / (30 * G)$

Where:

P = Power in Watts
E = Measured Field Strength in Volts/meter
d = Measuring distance in meters
G = Numeric gain of the transmit antenna

For the worst-case field strength the power was calculated as follows:

$P = ((10^{(131/20)} / 1E6) * 3)^2 / (30 * 4.0) = 0.940$ Watts

Notes:
The gain of the transmit antenna is 6.0 dBi, which is numerically expressed as 4.0.
The output power is expressed as peak measurements, without an averaging factor applied.
The resolution bandwidth of the measuring receiver is 1 MHZ during power measurements.
The video bandwidth of the measurement receiver is 300 KHZ during the power measurements.

LABORATORY MEASUREMENTS

LABORATORY MEASUREMENTS
Pursuant To
Part 15, Subpart C
For
Intentional Radiators

Manufacturer	Electronic Retail Systems
(Name and Address):	Electronic Retail Systems 488 Main Street Norwalk, CT 06851
Attention:	Mr. Aron Viner
Model Number:	SN-ACATR-11
Serial Number:	Not Labelled

Certification

I attest to the accuracy of this report:

Engineer:	Andrew J. Bellezza
Signature:	Andrew J. Bellezza
Title:	Staff Engineer/Emissions
Date:	6/28/99

Introduction

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under Part 15, Subpart C, General Requirements.

A. **Test Set-Up**: The test set-up and procedures described below are designed to meet the requirements of ANSI C63.4 (1992).

1. Site 2C (Middle Site) is a 3m and 10m sheltered EMI measurement range located in a light commercial environment in Boxborough, Massachusetts. It meets the technical requirements of ANSI C63.4-1992 and CISPR 22:1997/EN 55022:1994 for radiated and conducted emission measurements. The shelter structure is entirely fiberglass and plastic, with outside dimensions of 33 ft x 57 ft. The structure resembles a quonset hut with a center ceiling height of 16.5 ft.

   The testing floor is covered by a galvanized sheet metal groundplane that is earth-grounded via copper rods around the perimeter of the site. The joints between individual metal sheets are bridged with a 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets of metal are screwed in place with stainless steel, round-head screws every three inches. Site illumination and HVAC are provided from beneath the ground reference plane through flush entry ports, the port covers are electrically bonded to the ground plane.

   A flush metal turntable with 12 ft. diameter and 5000 lb. load capacity is provided for floor-standing equipment.

A. **Test Set Up (cont'd)**

A wooden table 80 cm high is used for table-top equipment. The turntable is electrically connected to the ground plane with three copper straps. The straps are connected to the turntable at the center of it with ground braid. It is copper strap is directly connected to the groundplane at the edges of the turntable. The turntable is located on the south end of the structure and the antennas are mounted 3 and 10 meters away to the north.

The antenna mast is a non-conductive with remote control of antenna height and polarization. The antenna height is adjustable from 1 to 4 meters.

All final radiated emission measurements are performed with the testing personnel and measurement equipment located below the ground reference plane. The site has a full basement underneath the turntable where support equipment may be remotely located. Operation of the antenna, turntable and equipment under test is controlled by remote controls that manipulate the antenna height and polarization and with a turntable control. Test personnel are located below the elipse when measurements are performed, however the site maintains the ability of having personnel manipulate cables while monitoring test equipment. Ambient radiated emissions are 6 dB or more below the relevant FCC emission limits.

AC mains power is brought to the equipment under test through a power line filter, to remove ambient conducted noise. 50 Hz (240 VAC single phase), 60 Hz power (120 VAC single phase, 208 VAC three phase), and 60 Hz (480 VAC three phase) are available.

A. **Test Set Up (cont'd)**

Conducted emission measurements are performed with a Line Impedance Stabilization Network (LISN) or Artificial Mains Network (AMN) bonded to the ground reference plane. A removable vertical groundplane (2 meter X 2 meter area) is used for line-conducted measurements for table top equipment. The vertical groundplane is electrically connected to the reference groundplane.

2. Power to the site is nominal line voltage of 117 V_{AC} and 230 V_{AC}, 60 Hz.

3. The equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately one meter in height above the groundplane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The antenna height and polarization are also varied during the search for maximum signal levels. The height of the antenna is varied from one meter to four meters.

4. Detector function for radiated emissions is in peal or quasi-peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings according to the following formula:

Averaging Factor in dB = 20 LOG (duty cycle)

A. **Test Set Up (cont'd)**

The time period over which the duty cycle is measured is 100 msec. The worst-case (highest percentage on) duty cycle is used and described specifically in the data section. The duty cycle is measured by placing the spectrum analyzer in zero scan (receiver mode) and linear mode at maximum bandwidth (3 MHZ at 3 dB down) and viewing the resulting time domain signal output from the analyzer on a Tektronix 465 Oscilloscope. The oscilloscope is used because of its superior time base and triggering facilities. A drawing or photograph of the worst-case duty cycle as detected in this manner is included as an attached page.

5. Antennas used below 1000 MHZ were Compliance Design, Inc. Roberts B-1000 Biconical Antennas. For measurements between 1000 MHZ and 18000 MHZ, where required, an Emco Double-Ridge Guide Horn Antenna was used. Alternately, for measurements above 1 GHz, an EMCO M/N 3115 Horn Antenna may have been used.

6. The field strength measuring equipment used included:

Spectrum Analyzer:	Hewlett Packard 8593A
Preamplifier:	CDI P-950
LISN:	Solar Electronics

Additional equipment or comments:

See equipment list and accompanying tables starting on page 13.

Equipment is calibrated at frequent intervals.

A. **Test Set Up (cont'd)**

7. The frequency range to be scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency, or 40 GHz, whichever is lower. For line-conducted emissions, the range scanned is 450 kHz to 30 MHZ.

8. The EUT is warmed up for 15 minutes prior to the test. AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new battery is used.

9. Conducted measurements were made as described in ANSI C63.4 (1992). An IF bandwidth of 10 kHz is used, and peak or quasi-peak detection is employed.

10. The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater below 1000 MHZ. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application No. 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report. Above 1000 MHZ, a bandwidth of 1 MHZ is generally used.

11. Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the restricted bands and above 1 GHz (where no preamplifier is used), signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, but those measurements taken at a closer distance are so marked.

A. **Test Set Up (cont'd)**

12. For measurements made in the 9 kHz to 30 MHZ range, a distance of 30 meters was used unless a good signal-to-noise ratio could not be obtained. In that case, a closer distance was used and that distance is so marked in the data table.

B. This transmitter was found to meet the requirements of Part 15, Subpart C, Section §15.209, General Requirements.

1. The emissions of the transmitter will not exceed the levels defined in §15.209(b).
2. Line-conducted emissions will be below the requirements of Rule §15.207.
3. The device does not operate in any of the restricted bands listed in §15.205(a).

C. **Miscellaneous Information**

1.	**Manufacturer**:	Electronic Retail Systems
2.	**Grantee**:	Electronic Retail Systems
3.	**Model No.**:	SN-ACATR-11
4.	**Trade Name**:	ShelfNet Active Cell Antenna
5.	**Serial No.**:	Not labeled
6.	**Date of Test**:	June 15, 1999
7.	**Frequencies to which device can be tuned**:	Not Applicable
8.	**Can customer tune device?**	No
9.	**Applicable emissions limits**:	15.247, 15.205, 15.209 and 15.207

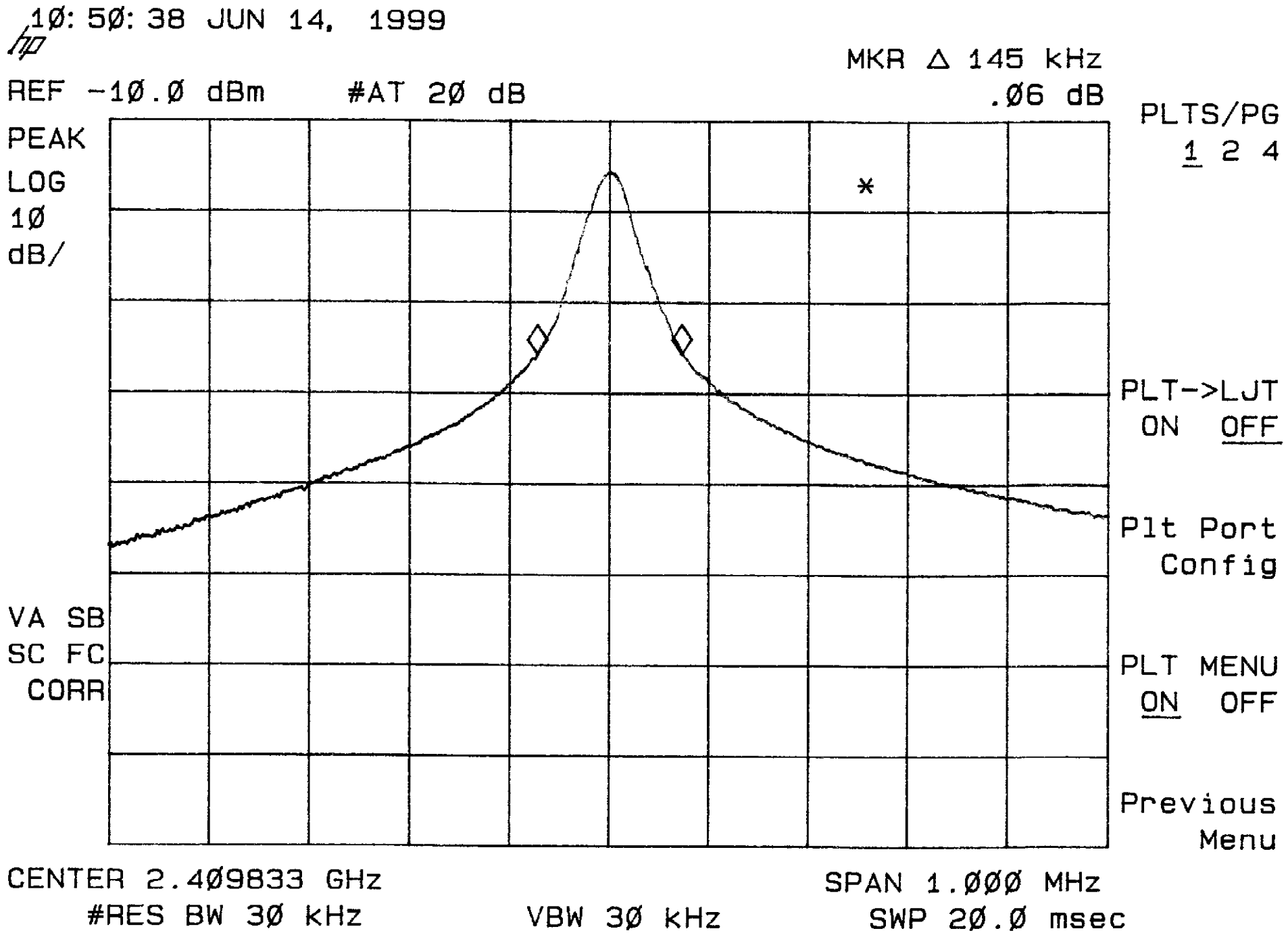
10. **Additional Comments**:

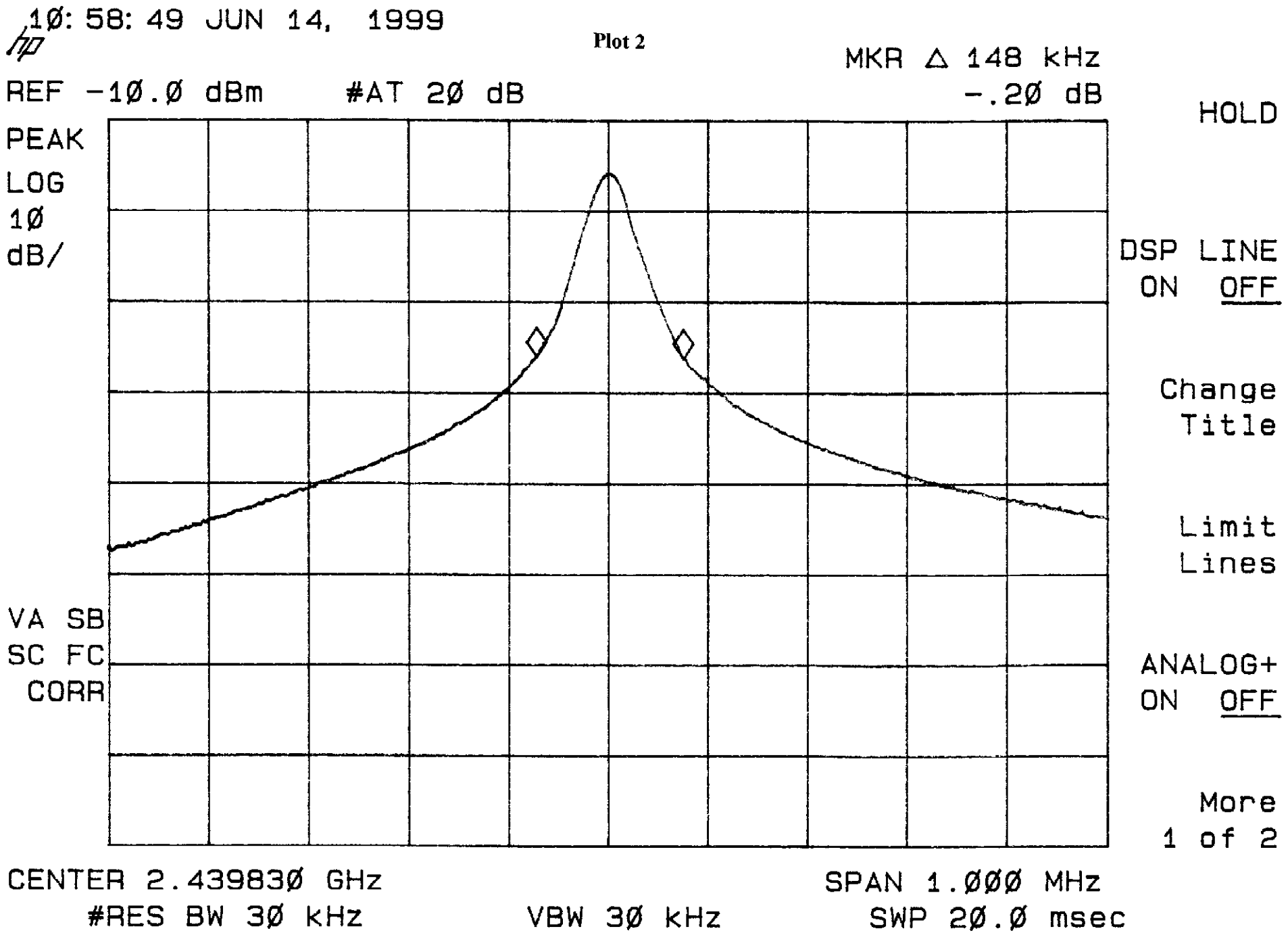
All transmitter measurements were made with hop stopped on three frequencies, a high, middle and low.

Measurement Of Bandwidth - See Attached Graphs/Tables

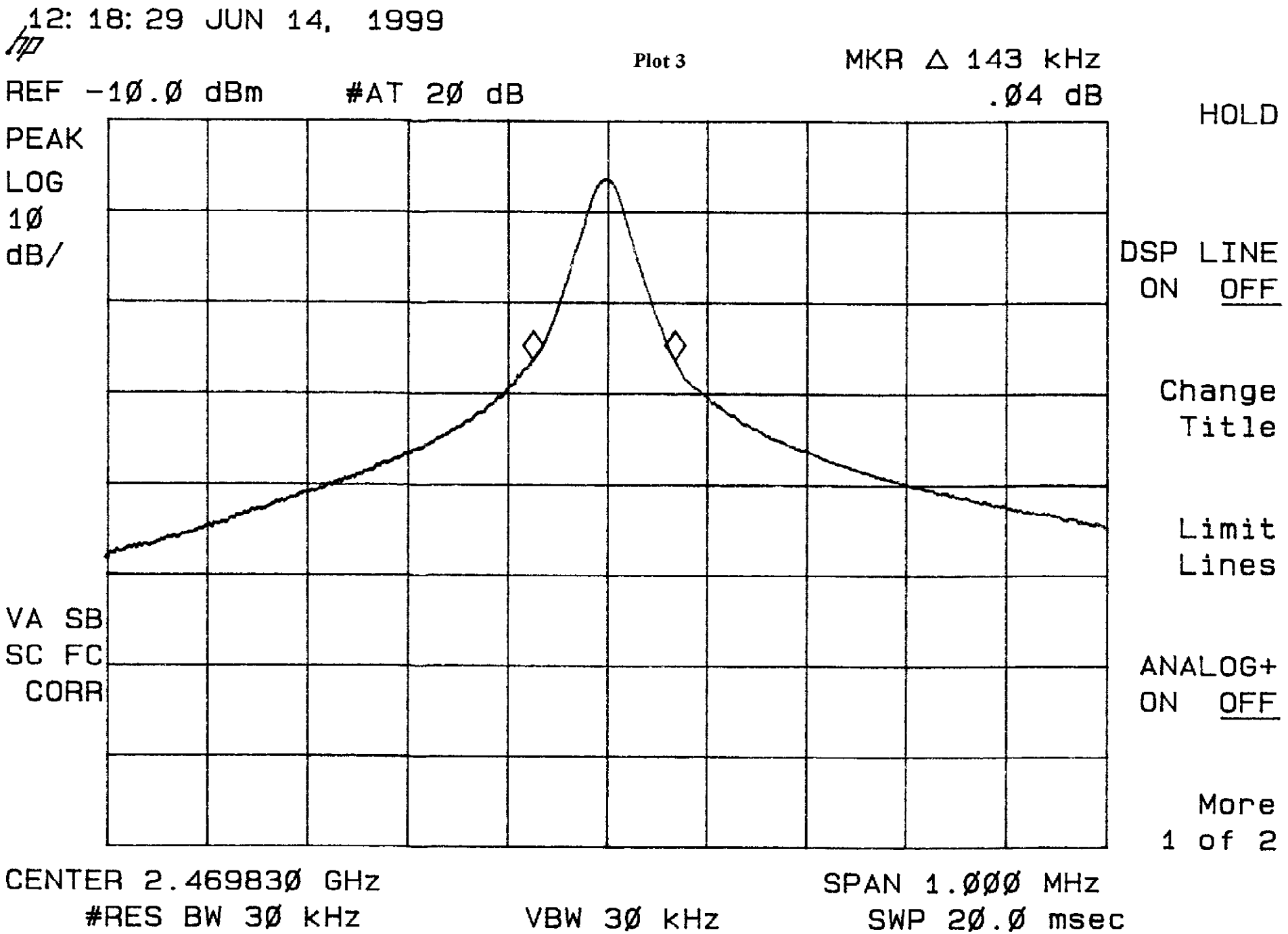
Frequency (MHZ)	Span (MHZ)	RBW (kHz)	Bandwidth (kHz)	Limit (kHz)	Pass/Fail
2400-2483.5	N/A	100	74,730	N/A	Pass
2409.83	1.00	30.00	145.00	1000	Pass
2439.83	1.00	30.00	148.00	1000	Pass
2469.83	1.00	30.00	143.00	1000	Pass

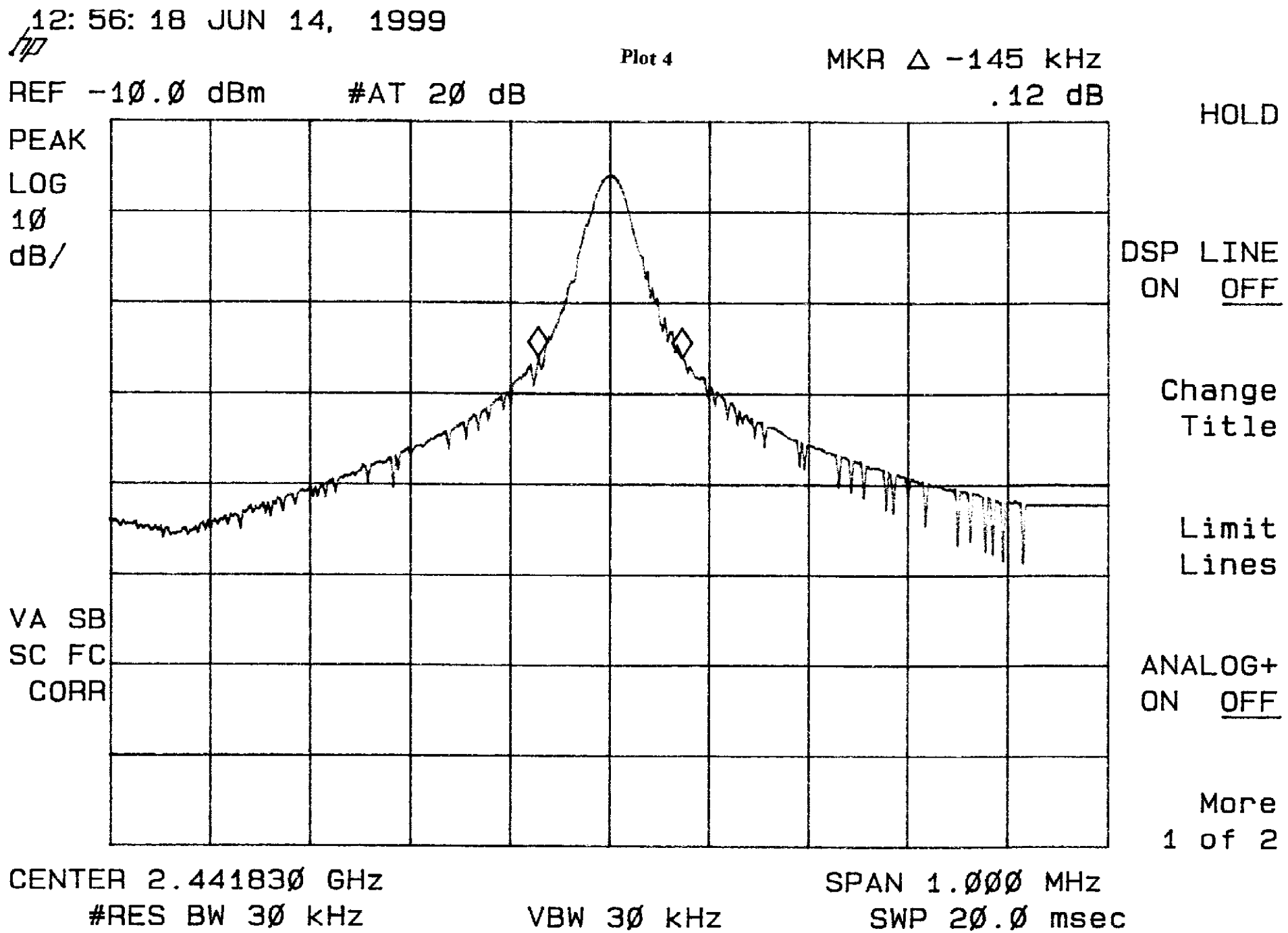
Plot 1

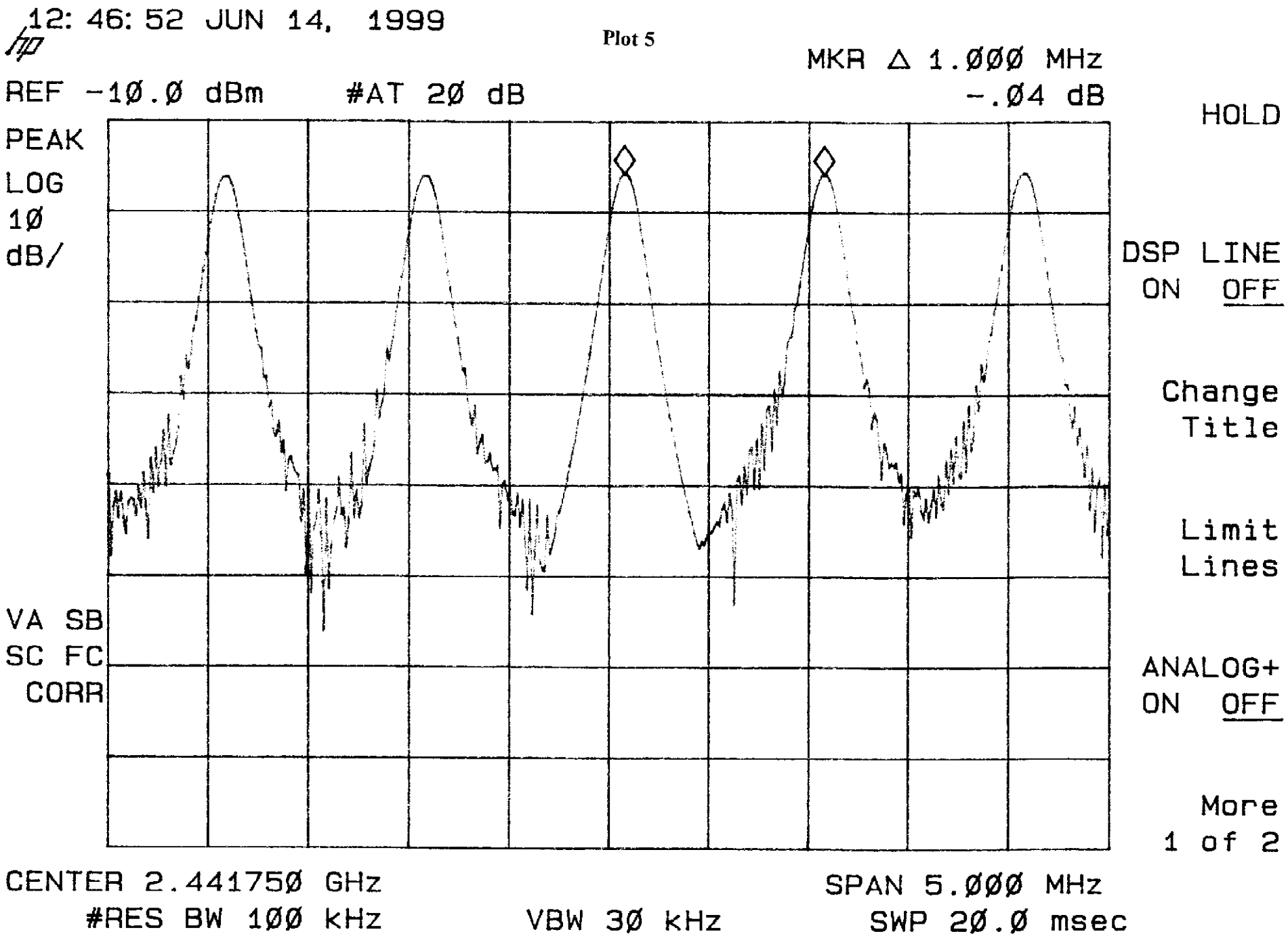

10: 50: 38 JUN 14, 1999
MKR Δ 145 kHz
.06 dB
REF -10.0 dBm
#AT 20 dB
PEAK
LOG
10
dB/
PLTS/PG
1 2 4
PLT->LJT
ON OFF
Plt Port
Config
VA SB
SC FC
CORR
PLT MENU
ON OFF
Previous
Menu
CENTER 2.409833 GHz
#RES BW 30 kHz
VBW 30 kHz
SPAN 1.000 MHz
SWP 20.0 msec


10: 58: 49 JUN 14, 1999
Plot 2
MKR Δ 148 kHz
REF -10.0 dBm
#AT 20 dB
-.20 dB
HOLD
PEAK
LOG
10
dB/
DSP LINE
ON OFF
Change
Title
Limit
Lines
VA SB
SC FC
CORR
ANALOG+
ON OFF
More
1 of 2
CENTER 2.439830 GHz
SPAN 1.000 MHz
#RES BW 30 kHz
VBW 30 kHz
SWP 20.0 msec

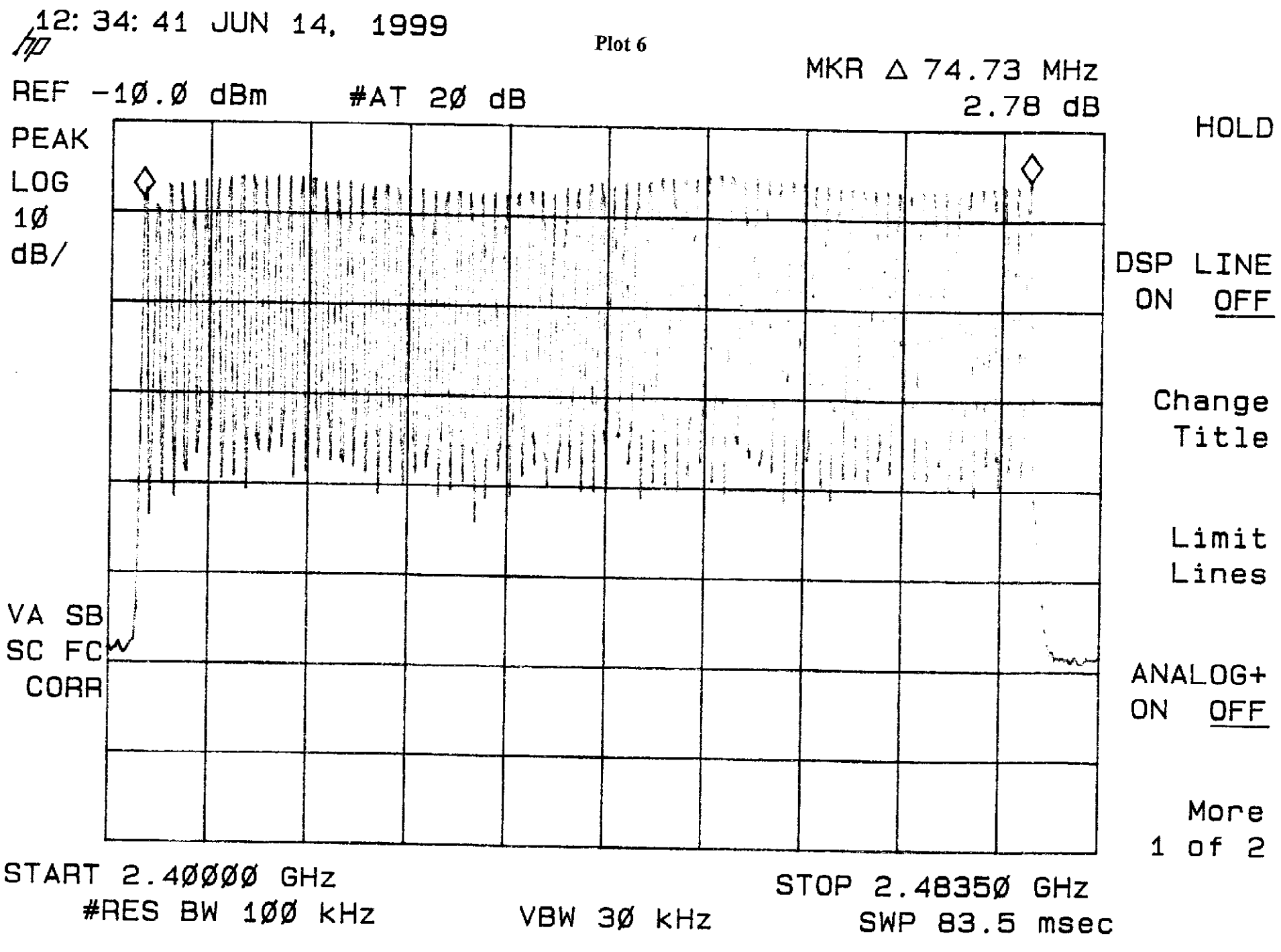
9B


12: 18: 29 JUN 14, 1999
Plot 3
MKR Δ 143 kHz
.Ø4 dB
REF -1Ø.Ø dBm
#AT 2Ø dB
HOLD
PEAK
LOG
1Ø
dB/
DSP LINE
ON OFF
Change
Title
Limit
Lines
VA SB
SC FC
CORR
ANALOG+
ON OFF
More
1 of 2
CENTER 2.469830 GHz
SPAN 1.ØØØ MHz
#RES BW 3Ø kHz
VBW 3Ø kHz
SWP 2Ø.Ø msec


12: 56: 18 JUN 14, 1999
Plot 4
MKR Δ -145 kHz
.12 dB
REF -1Ø.Ø dBm
#AT 2Ø dB
HOLD
PEAK
LOG
1Ø
dB/
DSP LINE
ON OFF
Change
Title
Limit
Lines
VA SB
SC FC
CORR
ANALOG+
ON OFF
More
1 of 2
CENTER 2.441830 GHz
SPAN 1.ØØØ MHz
#RES BW 3Ø kHz
VBW 3Ø kHz
SWP 2Ø.Ø msec


12: 46: 52 JUN 14, 1999
Plot 5
MKR Δ 1.ØØØ MHz
REF -1Ø.Ø dBm
#AT 2Ø dB
-.Ø4 dB
HOLD
PEAK
LOG
1Ø
dB/
DSP LINE
ON OFF
Change
Title
Limit
Lines
VA SB
SC FC
CORR
ANALOG+
ON OFF
More
1 of 2
CENTER 2.441750 GHz
SPAN 5.ØØØ MHz
#RES BW 1ØØ kHz
VBW 3Ø kHz
SWP 2Ø.Ø msec

Plot 6


12: 34: 41 JUN 14, 1999
MKR Δ 74.73 MHz
2.78 dB
REF -1Ø.Ø dBm
#AT 2Ø dB
PEAK
LOG
1Ø
dB/
HOLD
DSP LINE
ON OFF
Change
Title
Limit
Lines
VA SB
SC FC
CORR
ANALOG+
ON OFF
More
1 of 2
START 2.4ØØØØ GHz
#RES BW 1ØØ kHz
VBW 3Ø kHz
STOP 2.4835Ø GHz
SWP 83.5 msec

Discussion of Pulse Desensitivity

The determination of pulse desensitivity was made in accordance with Hewlett Packard Application Note 150-2, *Spectrum Analysis ... Pulsed RF*.

The ACA did not exhibit characteristics of pulse desensitization.

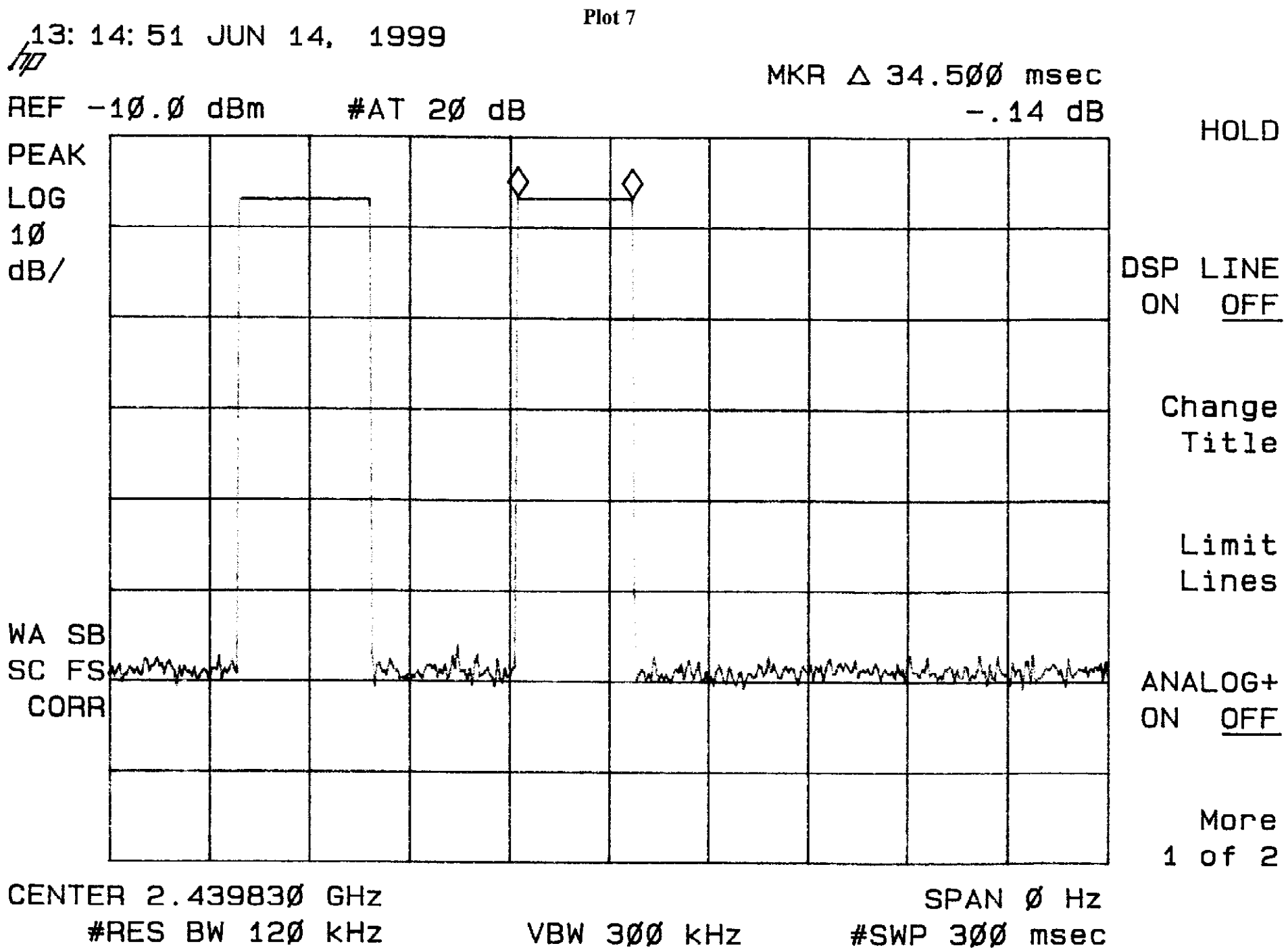
Derivation of Averaging Factor

The repetition cycle of the EUT is greater than 100 ms. The averaging factor is determined as follows:

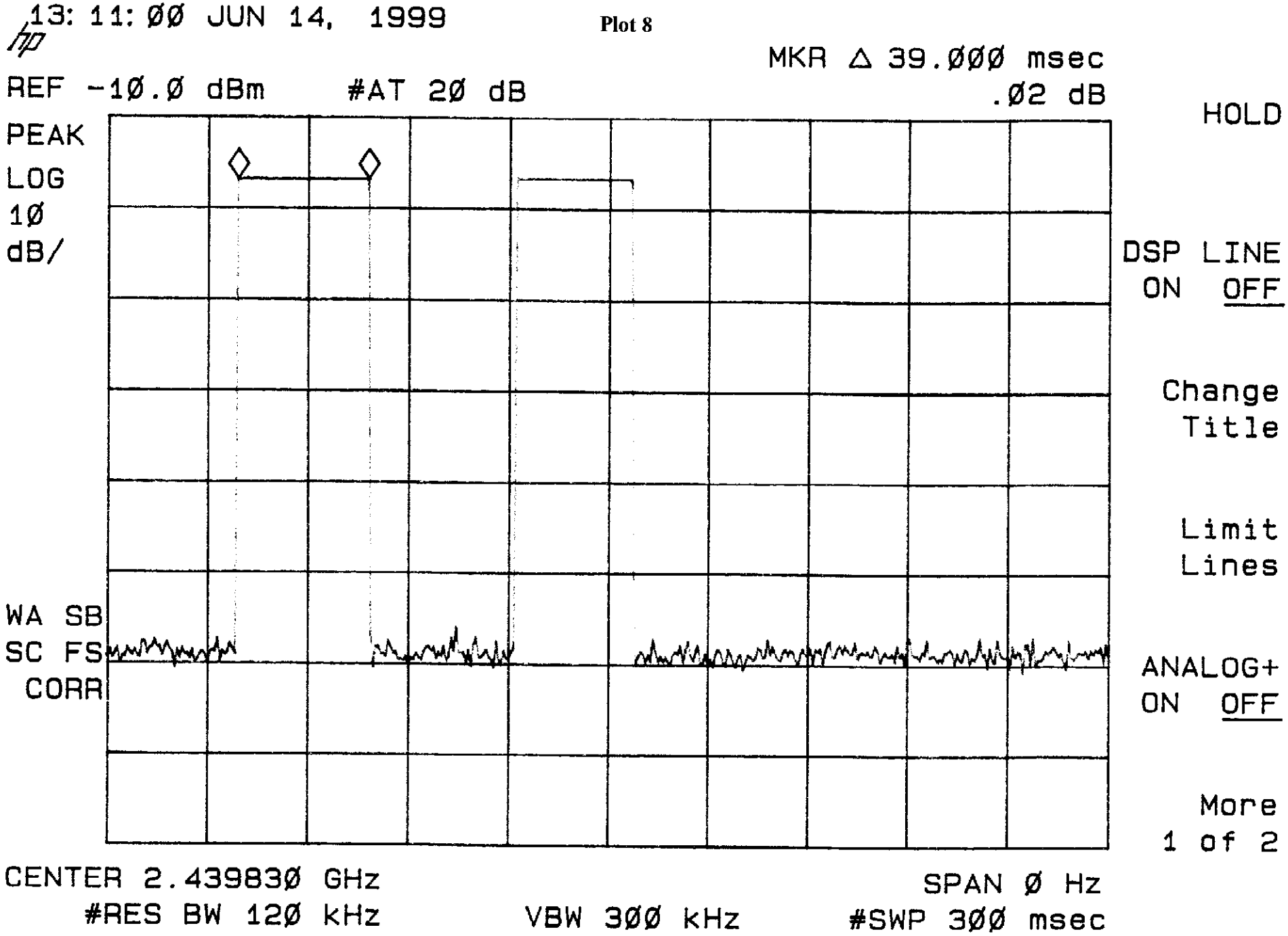
Word Cycle:		100 msec
Effective Period of Word:		73.5 msec
Duty Cycle of Word:		=73.5%
Duty Cycle of a Digital "1":		=100%
Total Duty Cycle:	0.75*1.0	=73.5%
Average Factor = 20 Log [0.75] = duty cycle		-2.7 dB

See Plot 7, 8 and 9.

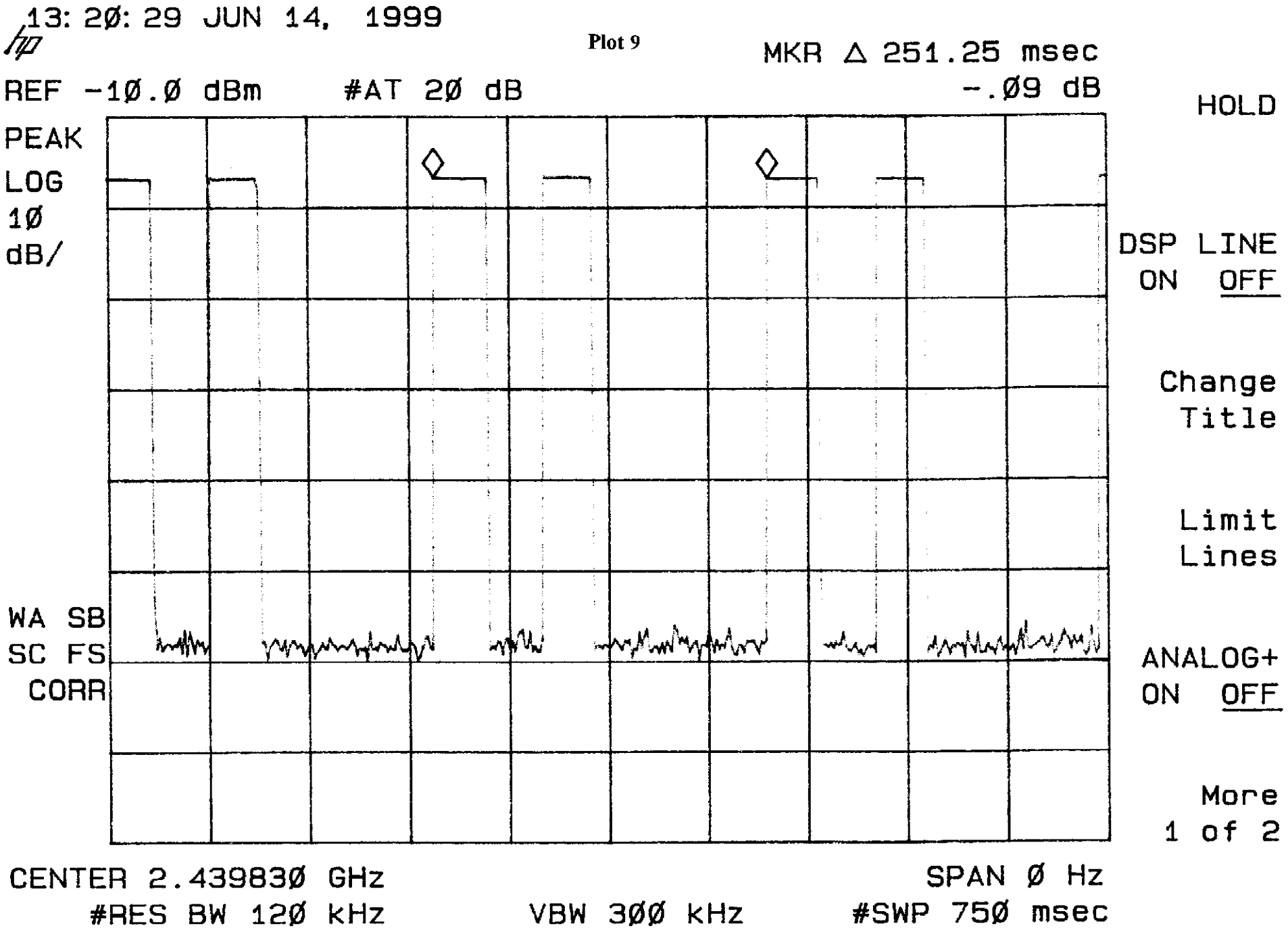
Plot 7


13: 14: 51 JUN 14, 1999
MKR Δ 34.5ØØ msec
REF -1Ø.Ø dBm
#AT 2Ø dB
-.14 dB
HOLD
PEAK
LOG
1Ø
dB/
DSP LINE
ON OFF
Change
Title
Limit
Lines
WA SB
SC FS
CORR
ANALOG+
ON OFF
More
1 of 2
CENTER 2.439830 GHz
SPAN Ø Hz
#RES BW 12Ø kHz
VBW 3ØØ kHz
#SWP 3ØØ msec

Plot 8


13: 11: ØØ JUN 14, 1999
MKR Δ 39.ØØØ msec
REF -1Ø.Ø dBm
#AT 2Ø dB
.Ø2 dB
HOLD
PEAK
LOG
1Ø
dB/
DSP LINE
ON OFF
Change
Title
Limit
Lines
WA SB
SC FS
CORR
ANALOG+
ON OFF
More
1 of 2
CENTER 2.439830 GHz
#RES BW 12Ø kHz
VBW 3ØØ kHz
SPAN Ø Hz
#SWP 3ØØ msec

Plot 9


13: 2Ø: 29 JUN 14, 1999
MKR Δ 251.25 msec
REF -1Ø.Ø dBm
#AT 2Ø dB
-.Ø9 dB
HOLD
PEAK
LOG
1Ø
dB/
DSP LINE
ON OFF
Change
Title
Limit
Lines
WA SB
SC FS
CORR
ANALOG+
ON OFF
More
1 of 2
CENTER 2.439830 GHz
SPAN Ø Hz
#RES BW 120 kHz
VBW 300 kHz
#SWP 750 msec

System Test Configuration

Equipment Under Test: ShelfNet Active Cell Antenna

Model: SN-ACATR-11

Serial No.: Not Labelled

FCC Identifier: NGTSNACATRAA

Support Equipment:

ALL SUPPORT EQUIPMENT REMOTELY LOCATED

Notebook Computer Laptop
M/N: 6200AT
S/N: N6SD72421Z216
FCC ID: L4PK6000T200

ERS Electronic Shelf Label
M/N: SN-EILDN-00
S/N: X7fc9e2f7
FCC ID: Not Labelled

Acculan Hub
M/N: Not Labelled
S/N: Not Labelled
FCC ID: Not Applicable

ERS Microcell Controller
M/N: SN-MCC24-00
S/N: 00-A0-E9-00-01-42
FCC ID: Not Labelled

Cables:

(1) RG58 Cable (10m)
(1) Ethernet (2m, unshielded, plastic hood) - remotely located
(1) RJ45 Cable (15m, unshielded) - remotely located
(1) AC Adapter Cable (2m) - remotely located

INTERTEK TESTING SERVICES NA INC.

Configuration Photographs

Worst-Case Radiated Emissions

Configuration Photographs

Worst-Case Line-Conducted Emissions

Equipment List

The following equipment was used to make measurements for emissions testing (the equipment abbreviation corresponds to a measuring device on the following calibration list):

LISN1

LOG4

REC2

PRE8

PRE6

Emco Antenna, M/N: 3115, S/N: 9610-4980

K&L Microwave Filter - M/N: 11SH10-40001, X18000-0/0

HORN 2

HP Sepctrum Analyzer, M/N: 8591E, S/N: 3829A03651

EQUIPMENT LIST TABLE 1					
Abbr	**Equipment**	**Manufacturer**	**Model**	**Serial**	**Cal Due**
ANT1	BROADBAND ANTENNA	COMPLIANCE DESIGN	B1000	1649, 1650, 1651	16Jun99
ANT4	BROADBAND ANTENNA	COMPLIANCE DESIGN	B1000	3317, 3245, 3352	16Jun99
ANT5	BROADBAND ANTENNA	COMPLIANCE DESIGN	B1000	1670, 1671, 1672	16Jun99
CLMP1	ABSORBING CLAMP	FISCHER CUSTOM	F-201	122	13Jun99
CLMP2	ABSORBING CLAMP	FISCHER CUSTOM	F-201	297	16Jan99
DIP1	TUNED DIPOLE SET	COMPLIANCE DESIGN	A100	402	30Jan99
DIP2	TUNED DIPOLE SET	COMPLIANCE DESIGN	A100	506	16Jun99
DIP3	TUNED DIPOLE SET	COMPLIANCE DESIGN	A100	3947	23Jan99
HORN1	HORN ANTENNA	EMCO	3115	4632	OUT
HORN2	HORN ANTENNA	EMCO	3115	4675	02Sep98
HORN3	HORN ANTENNA	EMCO	3116	2090	11Feb99
HP1	SPECTRUM ANALYZER	HEWLETT PACKARD	8591	3308A01445	05May99
HP2	SPECTRUM ANALYZER	HEWLETT PACKARD	8591	3346A02319	20Jul99
HP3	SPECTRUM ANALYZER	HEWLETT PACKARD	8593A	3009A00659	30Apr99
LISN1	LISN	SOLAR ELECTRONICS	8012-50-R-24-BNC	871083	15Jan99
LISN10	LISN	SOLAR ELECTRONICS	9252-50-R-24-BNC	941712	15June99
LISN11	LISN	SOLAR ELECTRONICS	9252-50-R-24-BNC	941713	15June99
LISN12	LISN	SOLAR ELECTRONICS	9252-50-R-24-BNC	941714	15Jun99
LISN13	LISN	SOLAR ELECTRONICS	9252-50-R-24-BNC	955107	15Jan99
LISN14	LISN	SOLAR ELECTRONICS	6338-5-TS-50-N	871131	27Jan99
LISN15	LISN	SOLAR ELECTRONICS	8012-50-R-24-BNC	865575	3/31/99
LISN2	LISN	SOLAR ELECTRONICS	6338-5-TS-50-N	871132	27Jan99
LISN3	LISN	SOLAR ELECTRONICS	8012-50-R-24-BNC	8379114	14Jan99
LISN4	LISN	SOLAR ELECTRONICS	8012-50-R-24-BNC	837929	15Jan99
LISN5	LISN	SOLAR ELECTRONICS	8012-50-R-24-BNC	934610	15Jun99
LISN6	LISN	SOLAR ELECTRONICS	8012-50-R-24-BNC	934611	15Jun99
LISN7	LISN	SOLAR ELECTRONICS	8012-50-R-24-BNC	934612	15Jun99
LISN8	LISN	SOLAR ELECTRONICS	8028-50-TS-24-BNC	871047	10Aug99
LISN8	LISN	SOLAR ELECTRONICS	8028-50-TS-24-BNC	871055	10Aug99

EQUIPMENT LIST TABLE 2					
Abbr	**Equipment**	**Manufacturer**	**Model**	**Serial**	**Cal Due**
LISN8	LISN	SOLAR ELECTRONICS	8028-50-TS-24-BNC	883147	10Aug99
LISN8	LISN	SOLAR ELECTRONICS	8028-50-TS-24-BNC	883151	10Aug99
LISN9	LISN	SOLAR ELECTRONICS	8028-50-TS-24-BNC	953947	14Jan99
LISN9	LISN	SOLAR ELECTRONICS	8028-50-TS-24-BNC	953948	14Jan99
LISN9	LISN	SOLAR ELECTRONICS	8028-50-TS-24-BNC	953949	14Jan99
LISN9	LISN	SOLAR ELECTRONICS	8028-50-TS-24-BNC	953950	14Jan99
LOG1	BICONOLOG ANTENNA	EMCO	3142	1116	13Jan99
LOG2	BICONOLOG ANTENNA	EMCO	3142	1223	06Dec98
LOG3	BICONOLOG ANTENNA	EMCO	3142	1224	06Dec98
LOG4	BICONOLOG ANTENNA	EMCO	3142	1225	06Dec98
LOOP1	LOOP ANTENNA	EMPIRE DEVICES	LG105	61	17Jan99
LOOP2	LOOP ANTENNA	EMPIRE DEVICES	LP105	905	17Jan99
LOOP3	LOOP ANTENNA	EMCO	6509	9612-1403	OUT
PRB1	LINE PROBE	SOLAR ELECTRONICS	8614-1	932725	15Jun99
PRB2	LINE PROBE	SOLAR ELECTRONICS	8614-1	932731	10Aug99
PRE1	PREAMPLIFIER	COMPLIANCE DESIGN	P950	1648	18May99
PRE2	PREAMPLIFIER	COMPLIANCE DESIGN	P950	5107	18May99
PRE3	PREAMPLIFIER	COMPLIANCE DESIGN	P950	1828	18May99
PRE4	PREAMPLIFIER	COMPLIANCE DESIGN	P950	1844	18May99
PRE5	PREAMPLIFIER	COMPLIANCE DESIGN	P950	PROTO1	18May99
PRE6	PREAMPLIFIER	HEWLETT PACKARD	8447D	1937A03354	18May99
PRE7	PREAMPLIFIER	HEWLETT PACKARD	8447D	2944A08718	18May99
PRE8	PREAMPLIFIER	MITEQ	NSP4000-NF	507145	25Sep98
REC1	RECEIVER	HEWLETT PACKARD	8542	3520A00125	06Nov98
REC1	RF FILTER	HEWLETT PACKARD	85420	3427A00126	06Nov98
REC2	RECEIVER	HEWLETT PACKARD	85422	3625A00188	04Jan99
REC2	RF FILTER	HEWLETT PACKARD	8542	3427A00177	04Jan99
REC3	RECEIVER	HEWLETT PACKARD	8546A	3325A00160	OUT
REC3	RECEIVER	HEWLETT PACKARD	8546A	3330A00158	OUT
SCOPE1	OSCILLOSCOPE	TEKTRONIX	TDS380	B011379	07Oct98
SIG1	SIGNAL GENERATOR	HEWLETT PACKARD	8648B	3537A01040	10Apr99
TEK1	SPECTRUM ANALYZER	TEKTRONIX	2784	B010153	30Apr99

Emissions Tables

Intertek Testing Services

Boxborough, MA

Company: Electronic Retail Systems
Model: SN-ACATR-11

Table: 1
Date of Test: June 15, 1999

Notes: Transmitting frequency 2410 MHz

Freq. MHz	Read dBuv	Dist. Factor dB	Ant. Factor dB	Pream. Factor dB	Ave. Factor dB	Pulse Desen. dB	Net @ 3m dBuv/m	Net @ 3m uv/m	Limit @ 3m uv/m	Margin dB
4819.6	28	10	39	-22	-3	0	32	40	500	-22
7229.5	33	10	46	-22	-3	0	44	158	320000	-66

Intertek Testing Services NA Inc.
70 Codman Hill Road, Boxborough, MA 01719
Telephone (978) 263-2662 Fax (978) 263-7086

Intertek Testing Services

Boxborough, MA

Company: Electronic Retail Systems
Model: SN-ACATR-11

Table: 2
Date of Test: June 15, 1999

Notes: Transmitting frequency 2440 MHz

Freq. MHz	Read dBuv	Dist. Factor dB	Ant. Factor dB	Pream. Factor dB	Ave. Factor dB	Pulse Desen. dB	Net @ 3m dBuv/m	Net @ 3m uv/m	Limit @ 3m uv/m	Margin dB
4879.6	27	10	39	-22	-3	0	31	35	500	-23
7319.4	31	10	46	-22	-3	0	42	126	500	-12

Intertek Testing Services NA Inc.
70 Codman Hill Road, Boxborough, MA 01719
Telephone (978) 263-2662 Fax (978) 263-7086

Intertek Testing Services

Boxborough, MA

Company: Electronic Retail Systems
Model: SN-ACATR-11

Table: 3
Date of Test: June 15, 1999

Notes: Transmitting frequency 2470 MHz

Freq. MHz	Read dBuv	Dist. Factor dB	Ant. Factor dB	Pream. Factor dB	Ave. Factor dB	Pulse Desen. dB	Net @ 3m dBuv/m	Net @ 3m uv/m	Limit @ 3m uv/m	Margin dB
4939.6	27	10	39	-22	-3	0	31	35	500	-23
7409.4	34	10	46	-22	-3	0	45	178	500	-9

Intertek Testing Services NA Inc.
70 Codman Hill Road, Boxborough, MA 01719
Telephone (978) 263-2662 Fax (978) 263-7086

Intertek Testing Services

Conducted Emissions / Interference

Table: 4

Company: ERS
Model: SN-ACATR-11
Job No.: J99015767
Date: 06/15/99
Standard: FCC 15
Class: B Group: None
Notes:

Tested by: Michael Ogunleye
Location: Site 2
Detector: HP 8542E
Cable(s): 1 None

Frequency (MHz)	Reading Side A (dB)	Reading Side B (dB)	Attenuator Factor (dB)	Qausi-Peak Net (dBuV)	Qausi-Peak Limit (dBuV)	Qausi-Peak Margin (dB)
8.635	1.6	1.0	20.0	21.6	48.0	-26.4
9.468	3.1	1.0	20.0	23.1	48.0	-24.9
11.600	3.3	3.1	20.0	23.3	48.0	-24.7
14.920	5.0	2.8	20.0	25.0	48.0	-23.0
20.000	5.6	9.8	20.0	29.8	48.0	-18.2
29.010	4.9	6.8	20.0	26.8	48.0	-21.2

Terms and Conditions

INTERTEK TESTING SERVICES NA INC.

Article 1 - Services, LABORATORY will:

1.1 Act for CLIENT in a professional manner, using the degree of care and skill ordinarily exercised by and consistent with the standards of the profession.

1.2 Provide only those services that lie within the technical and professional areas of expertise of LABORATORY and which LABORATORY is adequately staffed and equipped to perform.

1.3 Perform all technical services in substantial accordance with the generally accepted laboratory testing principles and practices.

1.4 Promptly submit formal reports of technical services performed indicating, where applicable, compliance with specification or other contract documents. Such reports shall be complete and factual, citing where appropriate the technical services performed, methods employed, and values obtained.

1.5 Employ instrumentation which has been calibrated within a period not exceeding twelve (12) months from the time of use by devices of accuracy traceable to the National Institute of Standards and Technology of the United States Department of Commerce.

1.6 Consider all reports to be the confidential property of client, and distribute reports only to those persons, organizations or agencies designated by CLIENT or his authorized representative.

1.7 Retain all pertinent records relating to the services performed for a period of three (3) years following submission of the report or the suspension of manufacturing of product subject to follow-up services, whichever is later, during which period the records will be made available to CLIENT upon reasonable request.

Article 2 - Client's Responsibilities, CLIENT or his authorized representative will:

2.1 Provide LABORATORY with all plans, schematics, specifications, addenda, change orders, drawings and other information for the proper performance of technical services.

2.2 Designate a person to act as CLIENT's representative with respect to LABORATORY's services to be performed under this Agreement; such person or firm to have complete authority to transmit instructions, receive information and data, interpret and define CLIENT's policies and decisions with respect to the project and to order, at CLIENT's expense, such technical services as may be required.

2.3 Designate a person who is authorized to receive copies of LABORATORY's test reports.

2.4 To undertake the following:

(a) Secure and deliver to LABORATORY, without cost to LABORATORY, preliminary representative samples of that equipment proposed to require technical analysis, together with any relevant data.

(b) Furnish such labor and equipment needed by LABORATORY to handle samples at the LABORATORY and to facilitate the specified technical analysis.

Article 3 - General Conditions

3.1 LABORATORY, by the performance of services covered hereunder, does not in any way assume any of those duties or responsibilities customarily vested in the CLIENT's employees, or any other party, agency or authority.

3.2 LABORATORY shall not be responsible for acts or omissions of any other party or parties involved in the design, manufacture or maintenance of the equipment or the failure of any employee, contractor or subcontractor to undertake any aspect of equipment's design, manufacture or maintenance.

3.3 LABORATORY is not authorized to revoke, alter, relax, enlarge or release any requirement of the equipment's design, manufacture or maintenance unless specifically authorized by CLIENT or his authorized representative.

3.4 This Agreement may be terminated by either party on ten (10) days written notice or by mutual agreement. If this Agreement is terminated by either party, LABORATORY shall be paid in full for all services performed through the termination date, and the CLIENT shall be provided with a complete report of the results of technical analysis conducted prior to termination.

3.5 Neither CLIENT nor LABORATORY may delegate, assign, sublet or transfer his duties or interest in this Agreement without the written consent of the other party.

3.6 ***The only warranty made by LABORATORY in connection with its service performed hereunder is that it will use that degree of care and skill as set forth in Article 1.1 and 1.3 above. No other warranty, expressed or implied, is made or intended for services provided hereunder.***

3.7 Where the LABORATORY indicates that additional testing is advisable to obtain more valid or useful data, and where such testing has not been authorized in writing, CLIENT agrees to view such test reports as inconclusive and preliminary.

3.8 The LABORATORY shall supply technical service and prepare a report based solely on the sample submitted to the LABORATORY by the CLIENT. The CLIENT understands that application of the data to other devices is highly speculative and should be applied with extreme caution.

3.9 The LABORATORY agrees to exercise ordinary care in receiving, preserving and shipping (F.O.B. Boxborough, Mass.) any sample to be tested, but assumes no responsibility for damages, either direct or consequential, which arise or are alleged to arise from loss, damage or destruction of the samples due to the act of examination, modification or testing, or technical analysis, or circumstances beyond LABORATORY's control.

3.10 The LABORATORY will hold samples for thirty (30) days after tests are completed, or until the CLIENT's outstanding debts to the LABORATORY are satisfied, whichever is later.

3.11 The client recognizes that samples of products subject to LABORATORY's review and test procedures may be damaged or destroyed.

3.12 The CLIENT recognizes that generally accepted error variances apply and agrees to consider such error variances in its use of test data.

3.13 It is agreed between LABORATORY and CLIENT that no distribution of any test, reports or analysis shall be made to any third party without the prior written consent of both parties. The content of all reports, analysis and tests is strictly confidential and shall not be released to any third party without the written consent of the other party.

3.14 The CLIENT acknowledges that all employees of LABORATORY operate under employment contracts with the LABORATORY, and CLIENT agrees not to solicit employment of such employees, or solicit information related to other clients from said employees.

Article 4 - Follow-Up Services (for listed products only)

4.1 If the product is found to be in compliance with the review and test requirements, it is agreed that CLIENT will abide by the Follow-Up Service Procedure.

4.2 It is understood and agreed by the CLIENT that the LABORATORY name or listing mark will not be applied or utilized until authorized representatives of LABORATORY have concluded the procedure set forth in Article 4.1.

4.3 All costs associated with the Follow-Up Service Procedure will be the responsibility of CLIENT. CLIENT's failure to pay these charges will result in the revocation of authorization to use the LABORATORY listing mark.

Article 5 - Insurance

5.1 LABORATORY shall secure and maintain throughout the full period of this Agreement sufficient insurance to protect it adequately from claims under applicable Workmen's Compensation Acts and from claims for bodily injury, death or property damage as may arise from the performance of services under this Agreement.

5.2 The CLIENT hereby warrants that it has sufficient insurance to protect its employees adequately under applicable Workmen's Compensation Acts and for bodily injury, death or property damage as may arise from the acts of its employees pursuant to the Agreement.

5.3 No insurance, of whatever kind or type, which may be carried by LABORATORY is to be considered as in any way limiting any other party's responsibility for damages resulting from their operations or for furnishing work and materials related to the project.

Article 6 - Payment

6.1 CLIENT will pay LABORATORY for services and expenses. LABORATORY's invoices will be presented at the completion of its work or monthly and will be paid within thirty (30) days of receipt by CLIENT or his authorized representative.

6.2 LABORATORY shall be paid in full as described in Article 6.1 and, in addition, shall be paid in full for any services authorized orally or in writing by an employee or agent of the CLIENT pursuant to Article 2.2.

Article 7 - Extent of Agreement

The Agreement, including these Terms and Conditions and the Schedules attached hereto, represent the entire agreement between CLIENT and LABORATORY and supersedes all prior negotiations, representations or agreements, written or oral. The Agreement may be amended only in accordance with this Agreement or by written instrument signed by CLIENT and LABORATORY.

Article 8 - Collection

8.1 CLIENT shall pay LABORATORY interest in the amount of one and one half percent (1.5%) per month on amounts invoiced which are overdue. Invoices which are overdue are defined as those which remain unpaid more than thirty (30) days after presentation.

8.2 CLIENT agrees to pay LABORATORY all amounts incurred by LABORATORY in collecting on invoices which are overdue. Such amounts shall include, but shall not be limited to, reasonable attorneys' fees and court costs.