MEASUREMENT AND TECHNICAL REPORT

SAIC - WEST BERNARDO
16701 West Bernardo Drive
San Diego, CA 92127

DATE: 03 May 2002

This Report Concerns:	Original Grant: X	Class II Change:
Equipment Type:	RTR-4 Wireless Option, Model 120746 Rev A	
Deferred grant requested per 47 CFR 0.457(d)(1)(ii)?	Yes: **Defer until:**	No: X
Company Name **agrees to notify the Commission by:** **of the intended date of announcement of the product so that the grant can be issued on that date.**	N/A	
Transition Rules Request per 15.37?	Yes:	*No: X

(*) FCC Part 15, Paragraphs 15.231(a), (b), (c); 15.107(a); 15.209(a)

Report Prepared by:

TÜV PRODUCT SERVICE
10040 Mesa Rim Road
San Diego, CA 92121-2912
Phone: 858 546 3999
Fax: 858 546 0364

TABLE OF CONTENTS

TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone 858 546 3999 FAX 858 546 0364

1 GENERAL INFORMATION

1.1 Product Description

RTR-4 Power/Transceiver

EUT Name: RTR-4 WIRELESS OPTION

Model No.: 120746 Rev A Serial No.: 0327

Power Requirements

Voltage: None

Other: Battery Powered

Typical Installation and/or Operating Environment

This optionally package is for use with the SAIC RTR-4 real-time radiography system. The typically user will be a law enforcement individual such as a bomb. The system is designed to be transported to a usage site, setup, used, and stored away until it is next needed.

EUT Power Cable: N/A

EUT Interface Ports and Cables

Interface				Shielding								
Type	Analog	Digital	Qty	Yes	No	Type	Termination	Connector Type	Port Termination	Length (in meters)	Removable	Permanent
Ethernet/Power cable	☒	☒	1	☐	☒	CAT-5 UTP		LEMO Circular	N/A	3.4	☒	☐
X-ray Trigger	☒	☐	1	☐	☒	Unshielded 3 conductor		LEMO Circular	N/A	3.4	☒	☐

TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone 858 546 3999 FAX 858 546 0364

EUT Software.

Revision Level:

Description: Firmware disables unit from powering up until a preset time has elapse since the power switch was placed in the on position. Firmware also monitors battery status to warn the user, via flashing LED, that the battery is nearly exhausted. Firmware also disconnects battery from the load to prevent damage to the battery from excessive discharge.

EUT Operating Modes to be Tested

1. Emission testing conducted using non-user accessible "Acquire Many Images" mode to maximizes on time of the 418MHz transmitter.

EUT System Components

Description	Model #	Serial #	FCC ID #
RTR-4 Power/Transceiver	120746 Rev A	0327	After approval, LPR418M1

Support Equipment -

Description	*Model #*	*Serial #*	*FCC ID #*
Notebook PC	Acer TravelMate 520 Series model 1904	914H01CQ514800 705K000	None
RTR-4 Imager	120312-2	None	None

Oscillator Frequencies

Frequency	*Derived Frequency*	*Component # / Location*	*Description of Use*
418MHz	N/A	POWER/TRANSCEIVER UNIT	On-Off Shift Keying Transmitter.
3.6864MHz	N/A	POWER/TRANSCEIVER UNIT	Embedded Microprocessor

Power Supply: None

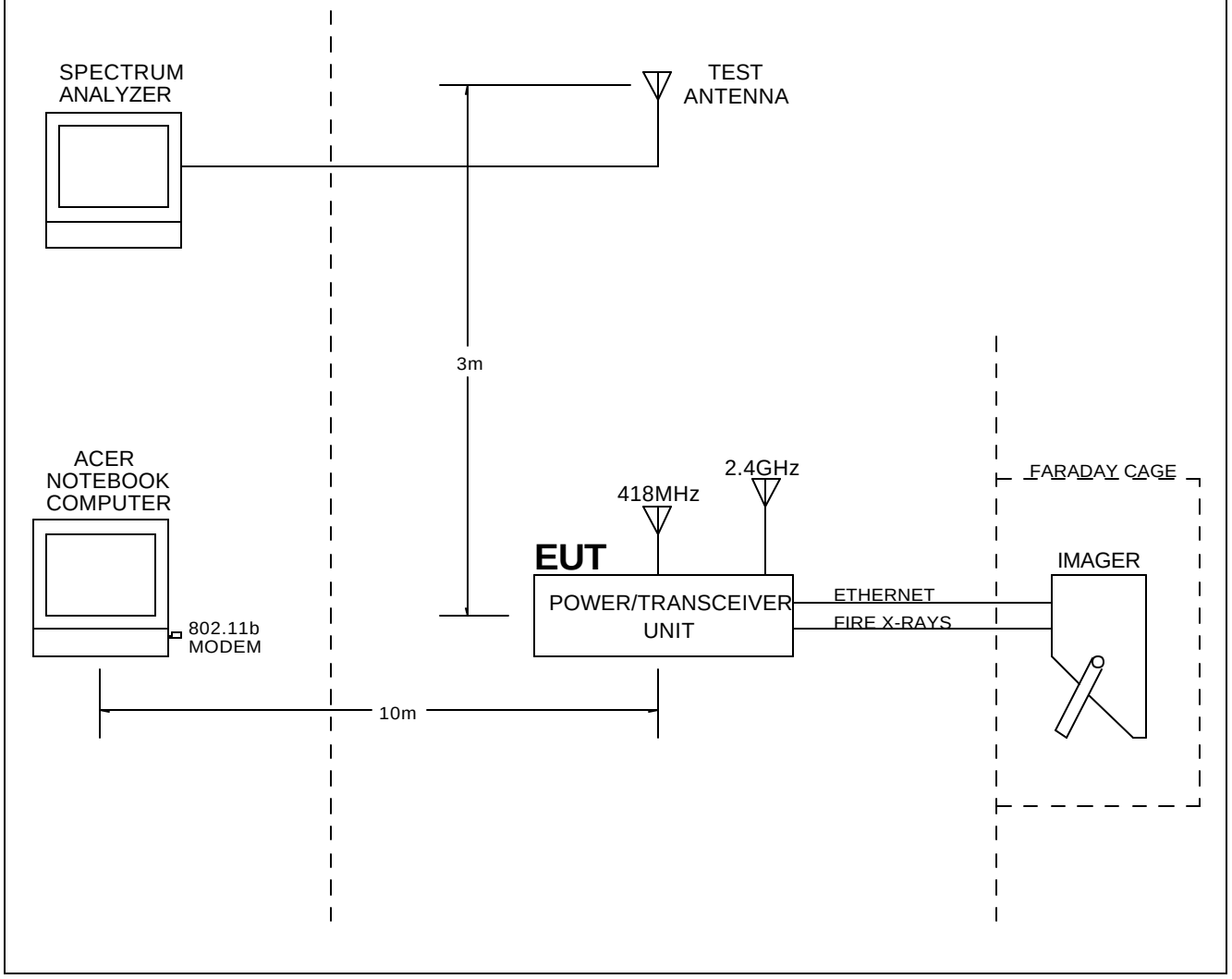
Power Line Filters: None

Critical EMI Components (Capacitors, ferrites, etc.): None

EMC Critical Detail: None

TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone 858 546 3999 FAX 858 546 0364

System Configuration Block Diagram -



TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone 858 546 3999 FAX 858 546 0364

1 GENERAL INFORMATION (continued)

1.2 Related Submittal/Grant

None

1.3 Tested System Details

The FCC IDs for all equipment, plus descriptions of all cables used in the tested system are:

None

1.4 Test Methodology

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

TEST	FCC CFR 47 #	PASS/FAIL
Radiated	15.231(a)	Pass
Deactivation	15.231(b)	Pass
Emission Bandwidth	15.231(c)	Pass
Duty Cycle Measurements	ANSI C63.4, Appendix 14, Para. 10	Pass
Conducted Emissions	15.107(a)	Not performed
Radiated Emissions	15.109(a)	Pass

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 - 25 GHz).

1.5 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: 858 546 3999
Fax: 858 546 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 was initially tested for FCC emission in the following configuration:

See Block Diagram.

2.2 EUT Exercise Software

None

2.3 Special Accessories

None

2.4 Modification

None

2.5 Configuration of Tested System

See Block Diagram.

TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone 858 546 3999 FAX 858 546 0364

3 DEACTIVATION EQUIPMENT/DATA

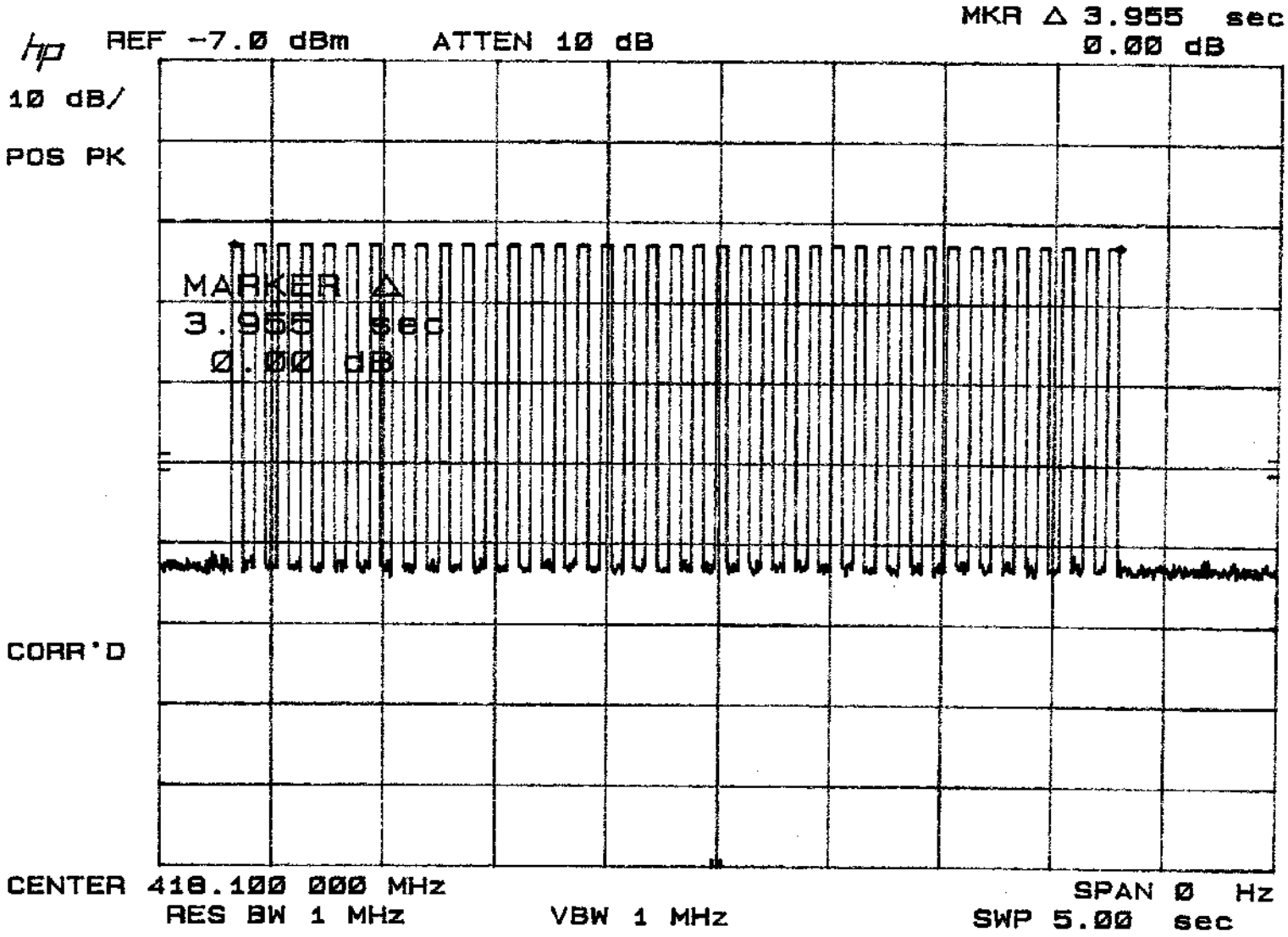
Test Equipment

TYPE	PROP #	MANUFACTURER	MODEL #	CAL DATE
Spectrum Analyzer	744	Hewlett Packard	8566B	12/17/02
Multimeter	6709	Hewlett Packard	3440A	08/21/02
Power Supply	6455	Hewlett Packard	E3611A	NCR

CUSTOMER: SAIC – W Bernardo
EUT: RTR-4 Wireless Notebook
TEST: FCC Subpart C Part 15.231(a)

Report No.: SC201962
Mode: DIAGNOSTIC MODE, 003KAM

Apr.19, 2002
TECH/ENGR.

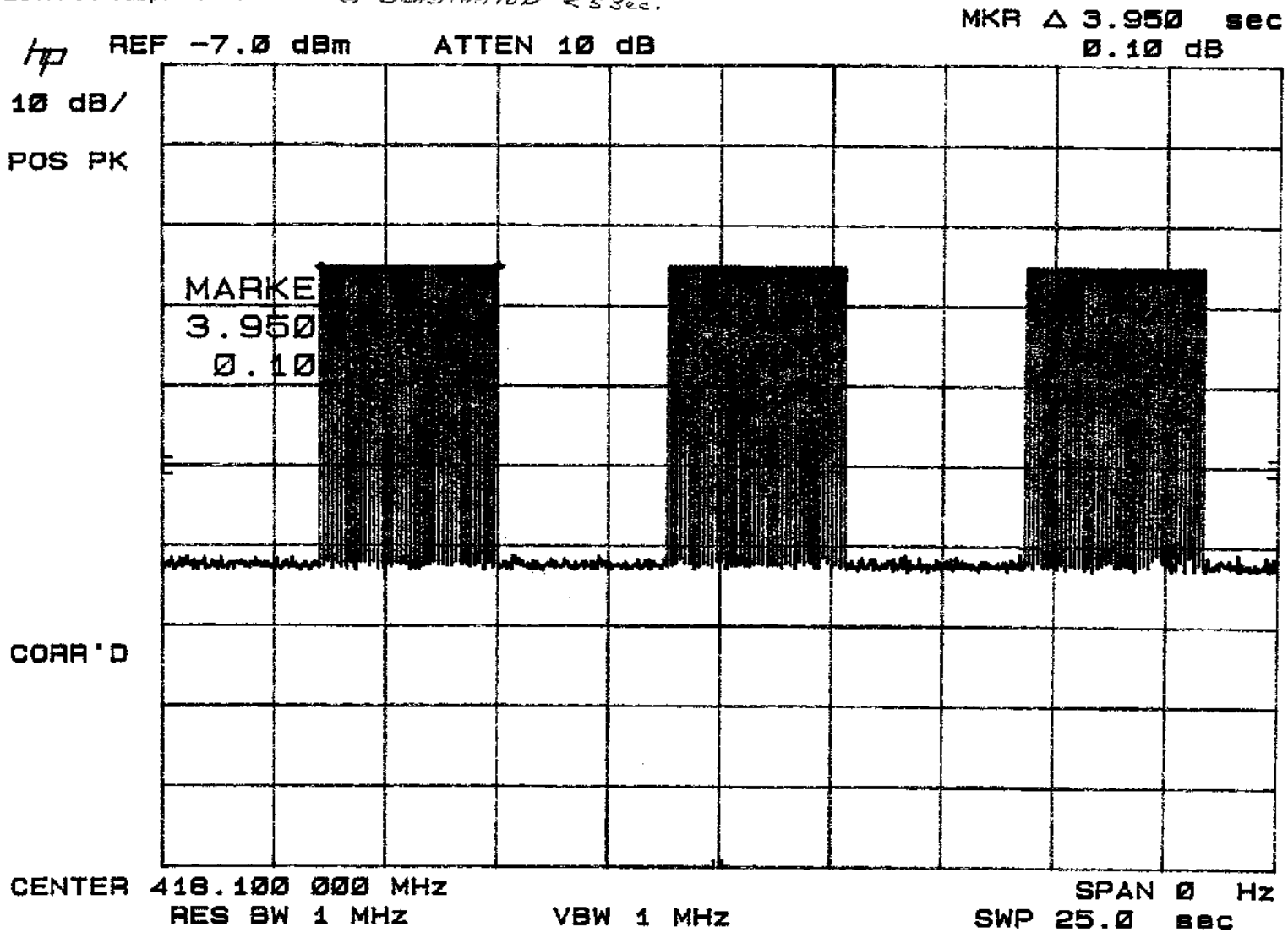


DEACTIVATION < 5 sec.

CUSTOMER: SAIC – W Bernardo
EUT: RTR-4 Wireless Notebook
TEST: FCC Subpart C Part 15.231 (a)

Report No.: SC201962
Mode: DIAGNOSTIC MODE, 100 PK AM
DEACTIVATION < 5 Sec.

Apr.19, 2002
TECH/ENGR. DBK



4 RADIATED EMISSION EQUIPMENT/DATA

The following data lists the significant emission frequencies, measured levels, correction factor (which includes cable and antenna corrections), the corrected reading, and the limit.

See following page(s).

See test setup photos for radiated emissions test setup.

TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone 858 546 3999 FAX 858 546 0364

REPORT No: SC201962 TESTER: Dave Bernardin SPEC: FCC Part 15 para 15.231(b)

CUSTOMER: SAIC - W Bernardo TEST DIST: 3 Meters

E U T: RTR-4 Wireless Notebook TEST SITE: Roof

EUT MODE: OOSK AM BICONICAL: N/A

DATE: 09 April,2002 LOG: 244

NOTES: Duty Cycle= 20% OTHER: 251

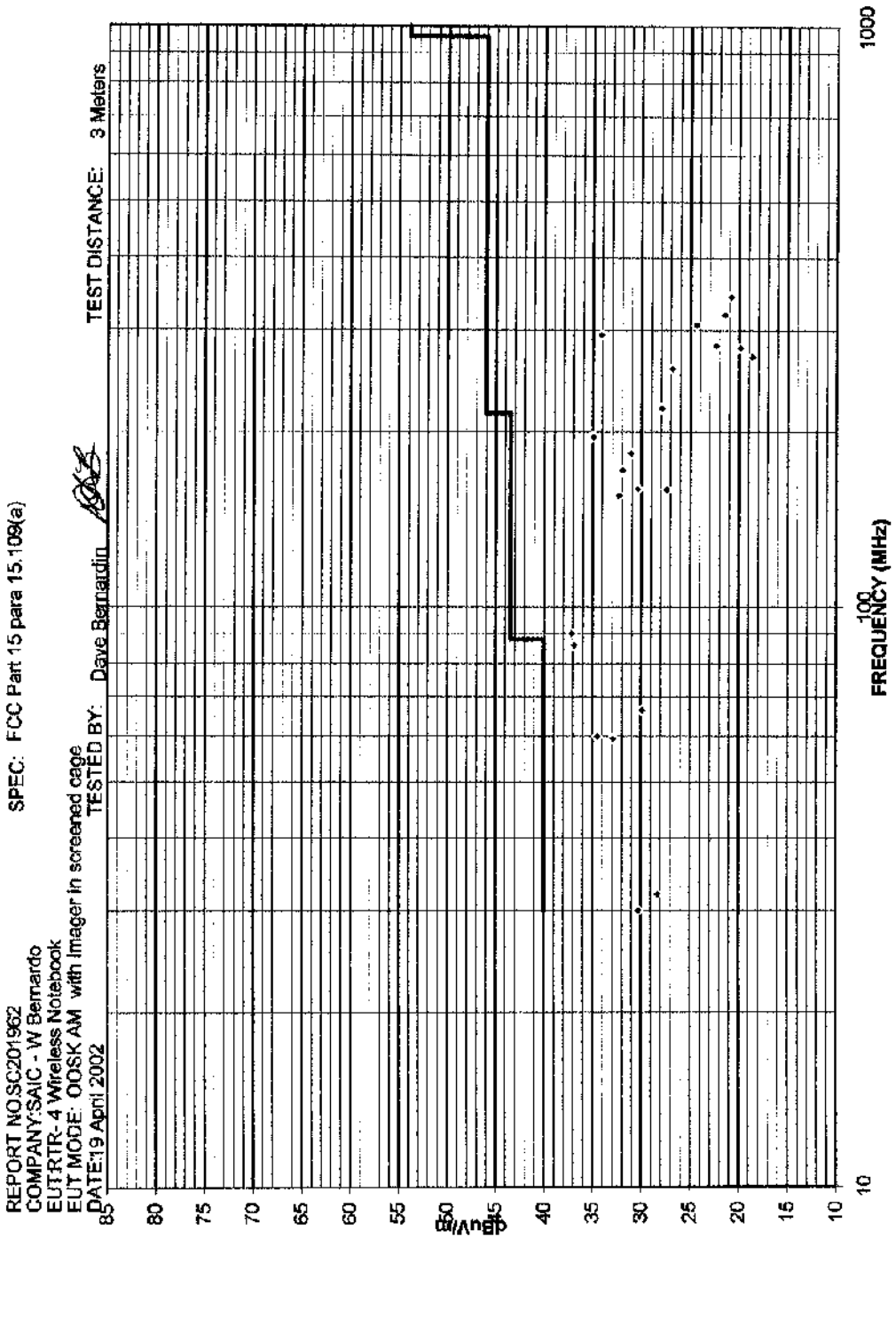
above 1GHz: RBW & VBW 1 MHz for Pk; AVG = PK - 20LOG(Duty Cycle)

below 1GHz: RBW & VBW 100 kHz for Pk; AVG = PK - 20LOG(Duty Cycle)

CF = Antenna Factor + Cable Loss - Preamplifier Gain + Preselector Loss

v.beta231

FREQ (MHz)	VERT. (dBuv) pk	VERT. (dBuv) DCav	HORIZ (dBuv) pk	HORIZ (dBuv) DCav	CF (dB/m)	MAX LEVEL (dBuV/m) pk	MAX LEVEL (dBuV/m) av	SPEC LIMIT (dBuV/m) pk	SPEC LIMIT (dBuV/m) av	MARGIN (dB) pk	MARGIN (dB) av	EUT Rotation	Antenna Height	Notes
418.000	76.7	62.7	71.5	57.5	16.1	**92.8**	**78.8**	100.3	80.3	-7.5	-1.5	180	1.5	Fundamental
836.000	25.0	11.0	30.9	16.9	22.1	**53.0**	**39.0**	80.3	60.3	-27.3	-21.3	140	1.4	Noise level
1254.000	43.2	29.2	42.9	28.9	-11.2	**32.0**	**18.0**	80.3	60.3	-48.3	-42.3	107	1	Noise level
1672.000	43.0	29.0	42.9	28.9	-6.2	**36.8**	**22.8**	80.3	60.3	-43.5	-37.5	161	1	Noise level
2090.000	43.3	29.3	43.9	29.9	0.0	**43.9**	**29.9**	80.3	60.3	-36.4	-30.4	116	1	Noise level
2508.000	45.3	31.3	43.3	29.3	1.2	**45.5**	**32.6**	80.3	60.3	-33.7	-27.7	120	1	Noise level
2926.000	40.3	26.3	43.5	29.5	3.3	**46.8**	**32.9**	80.3	60.3	-33.5	-27.4	22	1.5	Noise level
3344.000	40.0	26.0	41.8	27.8	4.5	**46.3**	**32.3**	80.3	60.3	-34.0	-28.0	22	1.5	Noise level
3762.000	42.7	28.7	42.6	28.6	5.6	**48.3**	**34.4**	80.3	60.3	-31.9	-25.9	152	1	Noise level
4180.000	42.8	28.8	42.8	28.8	5.7	**48.5**	**34.5**	80.3	60.3	-31.8	-25.7	174	1.5	Noise level


REPORT NO:SC201962
COMPANY:SAIC - W Bernardo
EUT:RTR- 4 Wireless Notebook
EUT MODE: OOSK AM with Imager in screened cage
DATE:19 April 2002
SPEC: FCC Part 15 para 15.109(a)
TESTED BY: Dave Bernardin
TEST DISTANCE: 3 Meters
dBuV/m
FREQUENCY (MHz)
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
10
100
1000

REPORT No: SC201962 SPEC: FCC Part 15 para 15.109(a)

CUSTOMER: SAIC - W Bernardo TEST DIST: 3 Meters

E U T: RTR- 4 Wireless Notebook TEST SITE: 2

EUT MODE: OOSK AM with Imager in screened cage BICONICAL: 739

DATE: 19 April 2002 TESTED BY: Dave Bernardin LOG PERIODIC: 739

NOTES: Quasi-Peak with 120 KHz measurement bandwidth. RCVR: 427

Temperature: 18 C Relative Humidity: 48%

EUT MARGIN -3.1 dB at 85.9 MHz ver 1.8a

FREQUENCY (MHz)	VERTICAL measured (dBuv)	HORIZONTAL measured (dBuV)	CORRECTION FACTOR (dB/m)	MAXIMUM CORRECTED (dBuV/m)	SPECIFIED LIMIT (dBuV/m)	EUT MARGIN (dB)	EUT ROTATION (degrees)	ANTENNA HEIGHT (meters)
30.00	10	1.8	20.3	**30.3**	40	-9.7	0	1
32.00	8	2.6	20.3	**28.3**	40	-11.7	0	1
59.35	19.21	8.3	13.7	**32.9**	40	-7.1	333	1
59.90	21.1	9.6	13.4	**34.5**	40	-5.5	253	1
66.47	19.5	8	10.4	**29.9**	40	-10.1	172	1
85.90	26.7	18	10.2	**36.9**	40	-3.1	6	1.4
89.90	24.3	26.2	11.0	**37.2**	43.5	-6.3	253	2
155.60	21	18.5	11.4	**32.4**	43.5	-11.1	0	1
159.55	16	9	11.4	**27.4**	43.5	-16.1	0	1
160.00	19	13	11.4	**30.4**	43.5	-13.1	333	1
171.82	17.1	20	12.0	**32.0**	43.5	-11.5	236	1.9
184.09	18.6	18	12.5	**31.1**	43.5	-12.4	0	1
196.36	13.4	21.6	13.3	**34.9**	43.5	-8.6	394	1.6
220.00	12.6	11.5	15.3	**27.9**	46	-18.1	245	1.7
257.73	2	10.2	16.7	**26.9**	46	-19.1	223	1.2
270.00	2	1.6	16.7	**18.7**	46	-27.4	0	1
280.00	1	3.3	16.6	**19.9**	46	-26.1	121	1
282.27	1.7	5.7	16.7	**22.4**	46	-23.6	0	1
294.54	1.3	17	17.2	**34.2**	46	-11.8	206	1
306.80	1	6.8	17.6	**24.4**	46	-21.6	214	1
319.09	0	3.6	17.9	**21.5**	46	-24.5	135	1
343.00	2	0	18.9	**20.9**	46	-25.1	257	1

TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone 858 546 3999 FAX 858 546 0364

Emissions Test Conditions: RADIATED SPURIOUS EMISSIONS

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

☐ - Test not applicable

Canyon #2 (3- and 10-Meter Open Area Test Site), Carroll Canyon, San Diego
Roof Site

Testing was performed at a test distance of:

☐ - 1 meters
■ - 3 meters
☐ - 10 meters

Test Equipment Used :

Model No.	Prop. No.	Description	Manufacturer	Serial No.	Cal Date
3115	453	Antenna, Horn	EMCO	5412-4364	21/01/02
3146	6670	Antenna, Log Periodic Dipole	EMCO	1063	05/21/02
8566B	823	Spectrum Analyzer	Hewlett Packard	--	07/24/02
3115	251	Antenna, Horn	EMCO	2595	10/20/02
AA-190-30.00.0	733	Cable	United Microwave	--	N/A
AA-190-30.00.0	656	Cable	United Microwave	-	N/A
AA-190-30.00.0	657	Cable	United Microwave	--	N/A
83592C	186	Generator	Hewlett Packard	2328A00112	04/20/02
8445B	809	Preselector	Hewlett Packard	1442A01127	N/A
AMF-5D-010180-35-10P	719	Pre-amplifier	Miteq	--	N/A
LPB2520/A	739	Log Periodic	Antenna Research	--	04/21/02
ESVS30	427	Receiver	Rohde & Schwarz	--	12/08/02

Remarks: _____

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.

TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone 858 546 3999 FAX 858 546 0364

5 BANDWIDTH EQUIPMENT/DATA

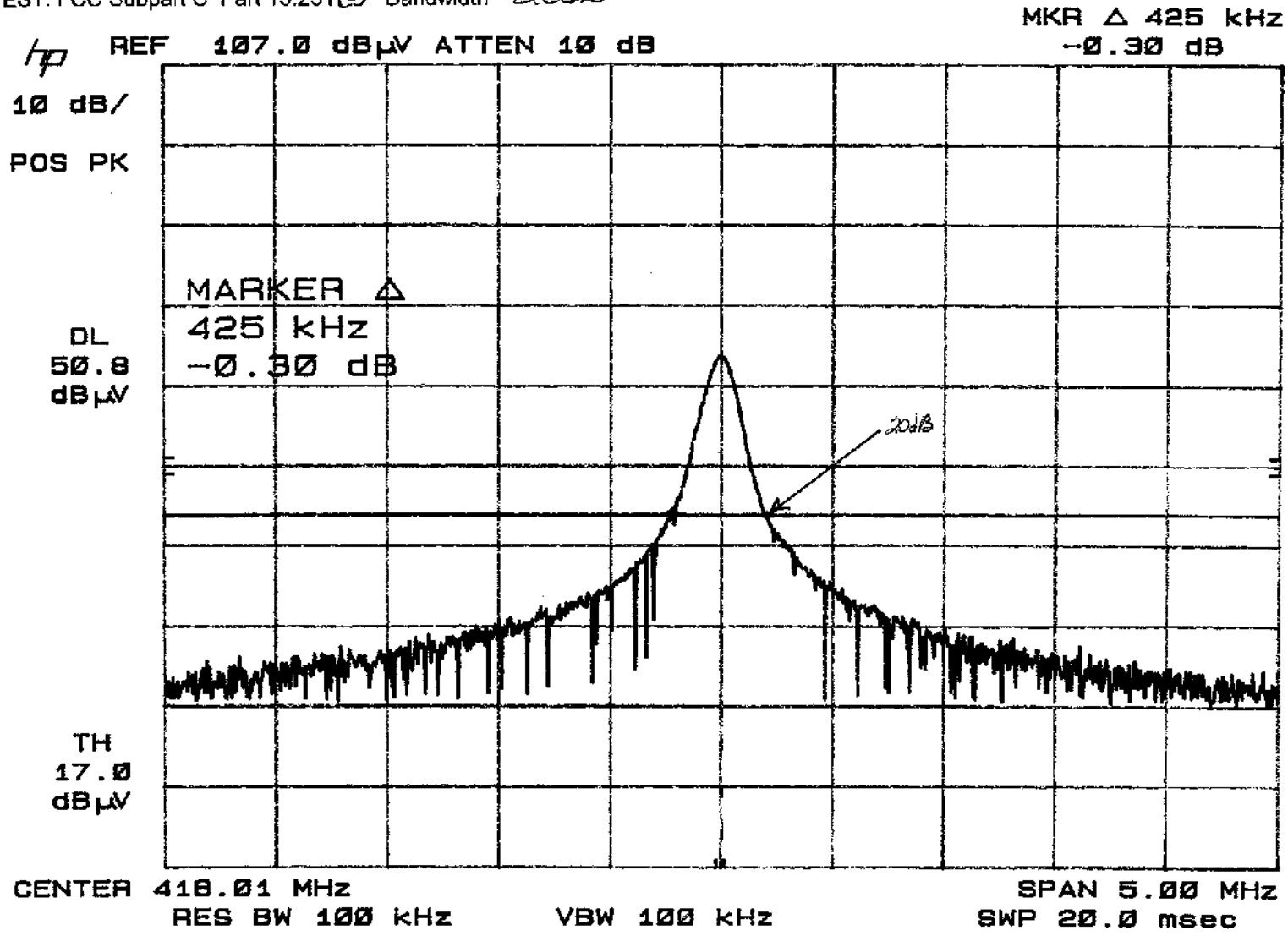
Test Equipment

MODEL	PROP #	EQUIPMENT TYPE	MANUFACTURER	S/N	CAL DATE
8566B	823	Spectrum Analyzer	Hewlett Packard	--	07/24/02

CUSTOMER: SAIC – W Bernardo
EUT: RTR-4 Wireless Notebook
TEST: FCC Subpart C Part 15.231(c)

Report No.: SC201962
Mode: OOK AM
Bandwidth 20dB

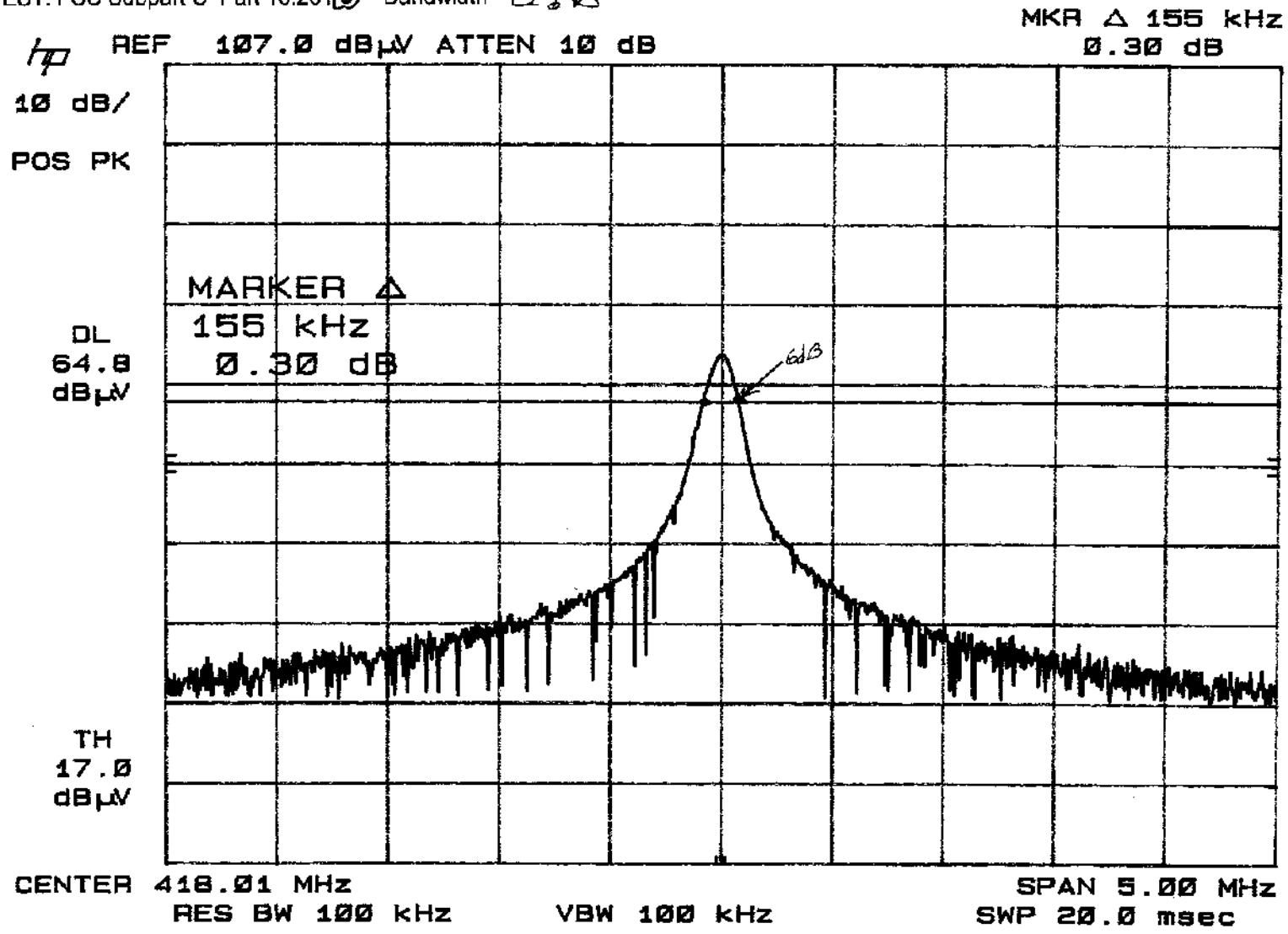
Apr 08, 2002
TECH/ENGR. DBS



CUSTOMER: SAIC – W Bernardo
EUT: RTR-4 Wireless Notebook
TEST: FCC Subpart C Part 15.231(c)

Report No.: SC201962
Mode: 00SK AM
Bandwidth 6dB

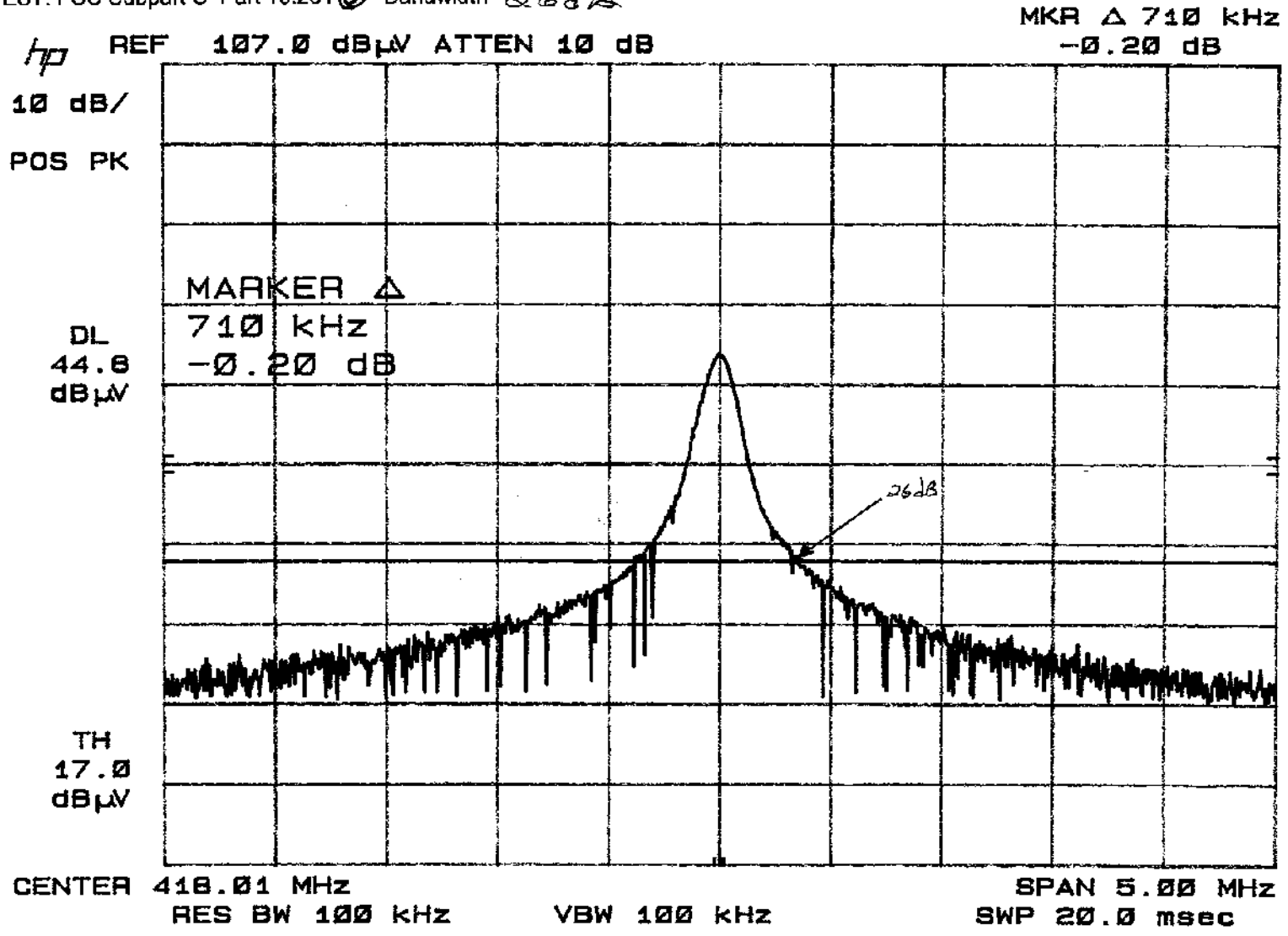
Apr 08, 2002
TECH/ENGR.



CUSTOMER: SAIC – W Bernardo
EUT: RTR-4 Wireless Notebook
TEST: FCC Subpart C Part 15.231(c)

Report No.: SC201962
Mode: 00 8K AM
Bandwidth 26dB

Apr 08, 2002
TECH/ENGR. DdB



6 DUTY CYCLE EQUIPMENT/DATA

Test Equipment

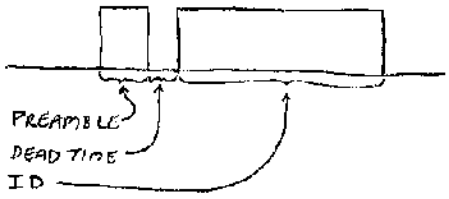
MODEL	PROP #	EQUIPMENT TYPE	MANUFACTURER	S/N	CAL DATE
640a	6710	Scope	Tektronix	--	04/25/03

See following page(s).

TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone 858 546 3999 FAX 858 546 0364

418MHz TRANSMITTER DUTY CYCLE CALCULATIONS (100mS WINDOW)

BASIC WAVEFORM AND SECTION ID



$44\,mS = t_{PREAMBLE} + t_{DEAD\,TIME} + t_{ID}$

$t_{PREAMBLE} = 4.6\,mS$
$t_{DEAD\,TIME} = 1.9\,mS$
$t_{ID} = 37.6\,mS$

PREAMBLE DUTY CYCLE:

PREAMBLE PULSES AND SPACING ARE IDENTICAL

$$DUTY\,CYCLE_{PREAMBLE} = \frac{170\,mS\ ON\ TIME}{380\,mS\ CYCLE\ TIME} = 0.4474$$

ID DUTY CYCLE

ID PULSES VARY IN WIDTH FOR "0" AND "1" DATA. ASSUMING NARROW PULSES ARE "0"...

$$DUTY\,CYCLE_{"0"} = \frac{170\,mS\ ON\ TIME}{580\,mS\ CYCLE\ TIME} = 0.2931$$

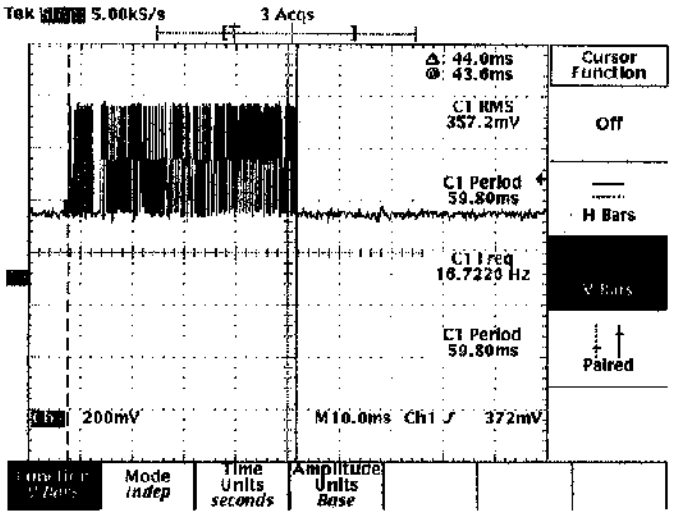
$$DUTY\,CYCLE_{"1"} = \frac{360\,mS\ ON\ TIME}{570\,mS\ CYCLE\ TIME} = 0.6358$$

THE TRANSMITTER MODULATION COMES FROM A MICROCHIP KEELOQ ENCODER. THIS ENCODER USES A ROLLING CODE SCHEME WHICH RESULTS IN 50% "0" AND "50% "1" PULSES IN THE ID PULSE STREAM. TOTAL ON TIME CAN BE CALCULATED AS FOLLOWS

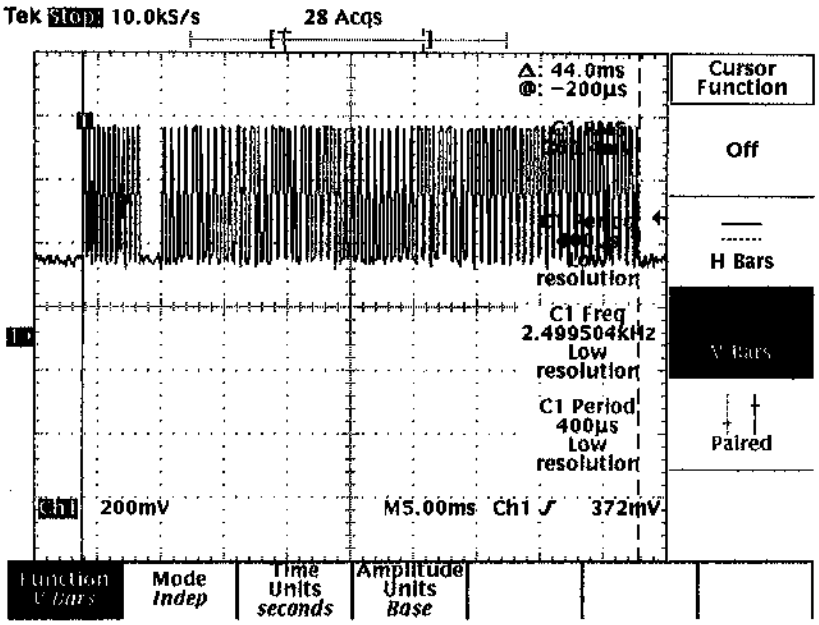
$ON\,TIME_{PREAMBLE} = 4.6\,mS * 0.4474 =$	2.058 mS
$ON\,TIME_{ID\,"0"} = 37.6\,mS * \frac{1}{2} * 0.2931 =$ (50% "0", 50% "1")	5.510 mS
$ON\,TIME_{ID\,"1"} = 37.6\,mS * \frac{1}{2} * 0.6358 =$	11.953 mS
TOTAL ON TIME =	19.521 mS

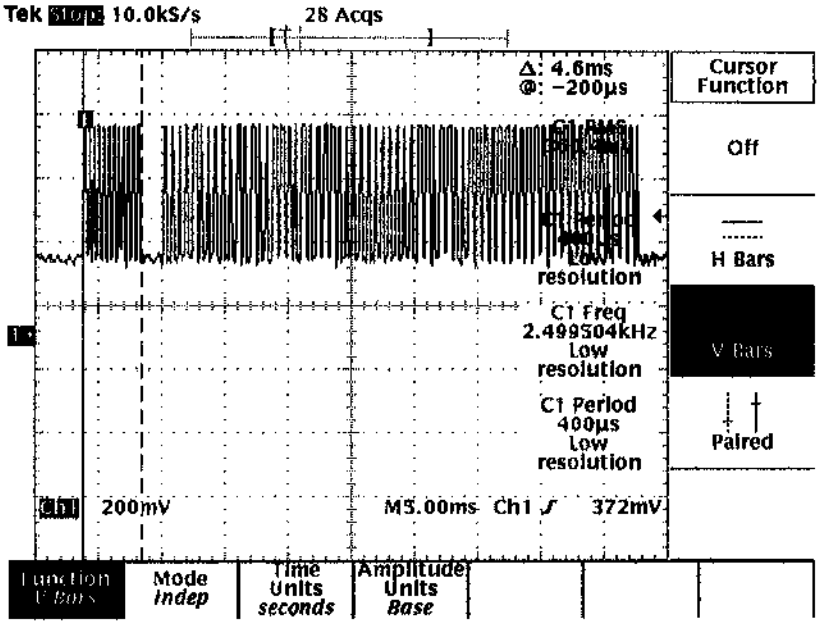
GIVEN THE 100mS WINDOW AND THE TOTAL ON TIME OF 19.521mS THE DUTY CYCLE FOR 15.231 IS 19.521%

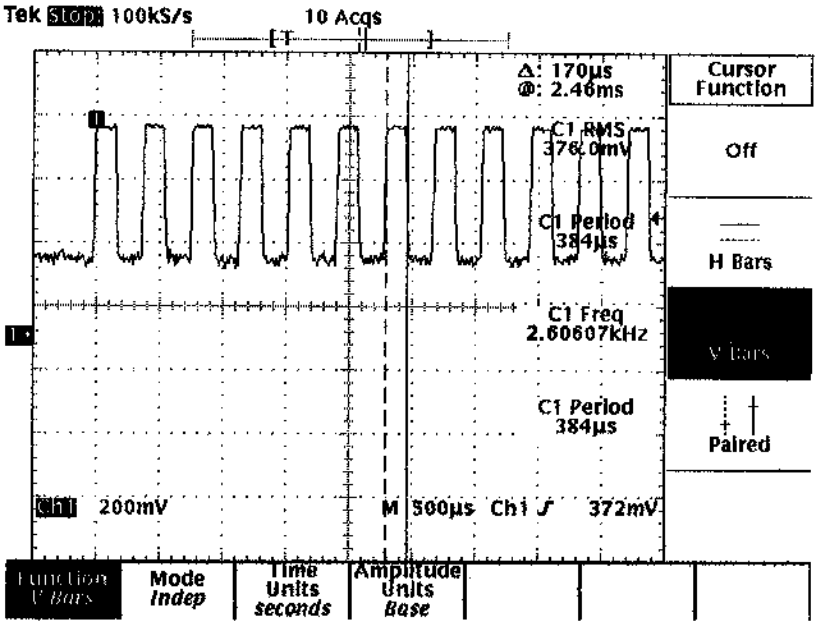
$DUTY\,CYCLE\,FACTOR = 20\log(0.19521) = -14.2\,dB$

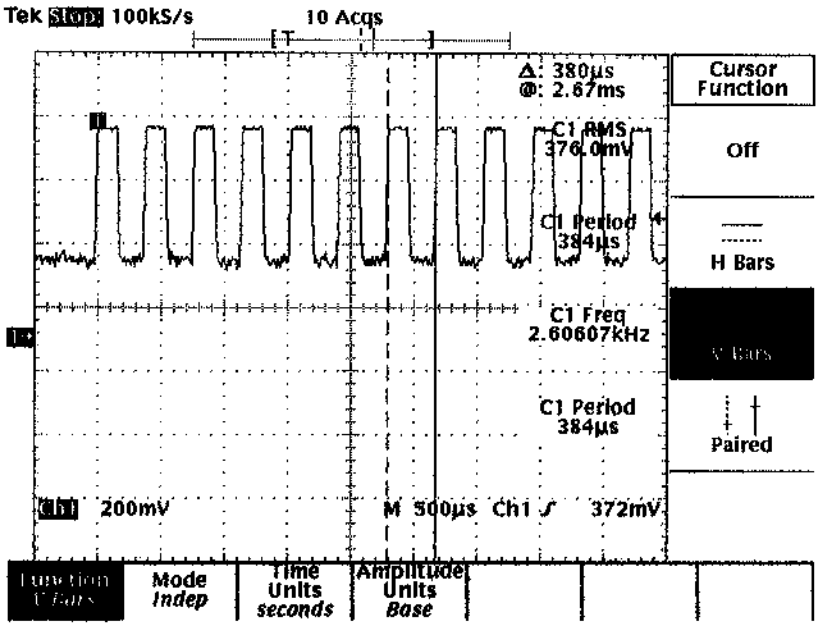


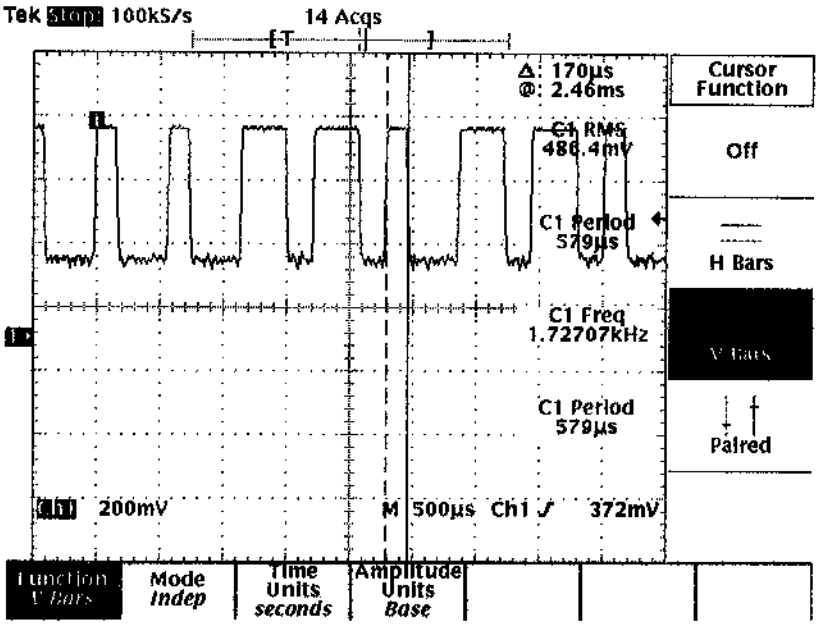
TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone 858 546 3999 FAX 858 546 0364

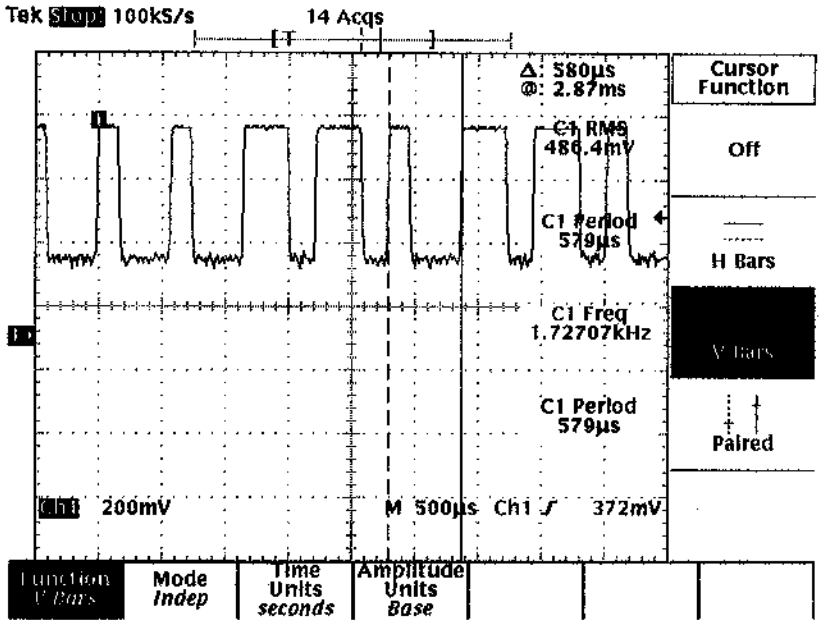

Tek Stop: 10.0kS/s
28 Acqs
Δ: 44.0ms
@: −200µs
Cursor Function
Off
H Bars
V Bars
Paired
C1 Freq
2.499504kHz
Low resolution
C1 Period
400µs
Low resolution
Ch1 200mV
M5.00ms Ch1 ƒ 372mV
Function V Bars
Mode Indep
Time Units seconds
Amplitude Units Base

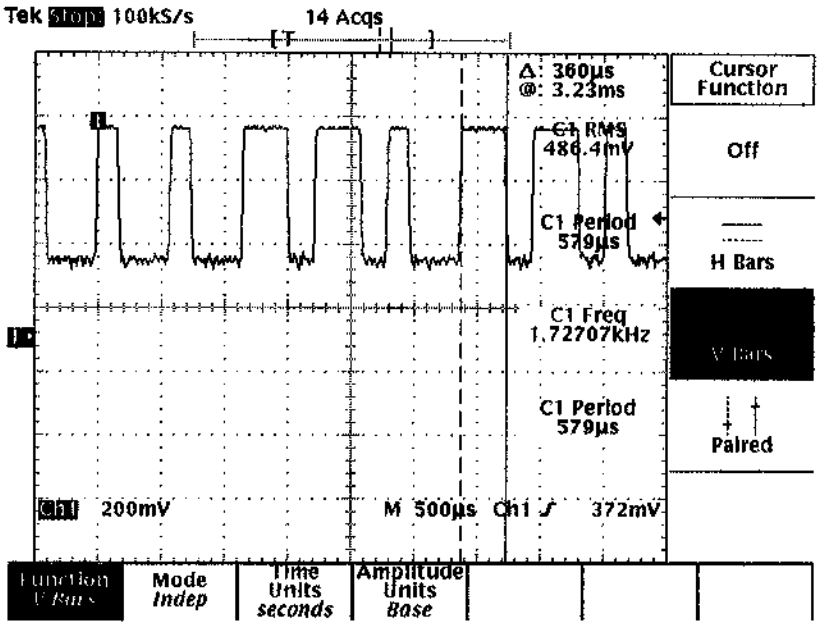

Tek 10.0kS/s
28 Acqs
Δ: 4.6ms
@: −200µs
Cursor Function
Off
H Bars
V Bars
Paired
C1 Freq
2.499504kHz
Low resolution
C1 Period
400µs
Low resolution
200mV
M5.00ms Ch1 ƒ 372mV
Mode
Indep
Time Units
seconds
Amplitude Units
Base

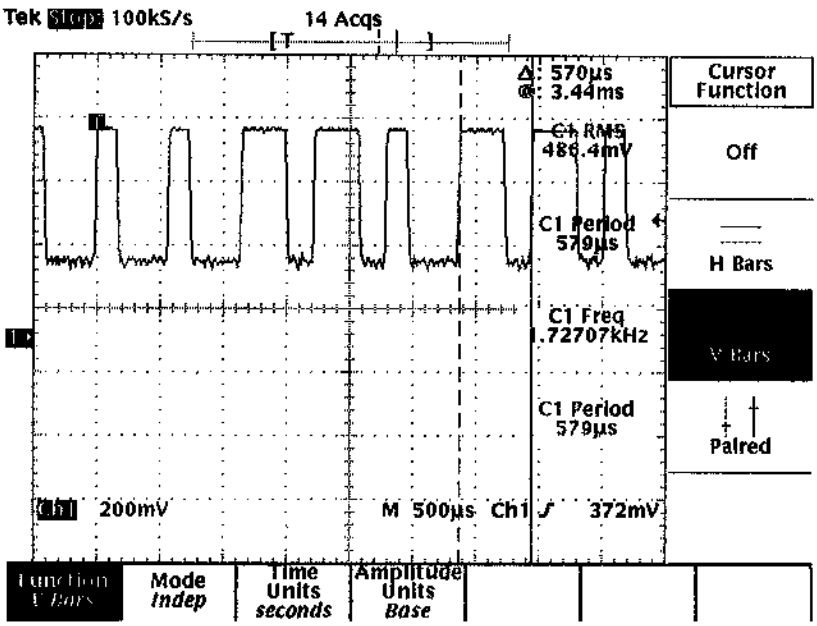

Tek Stop: 100kS/s
10 Acqs
Δ: 170µs
@: 2.46ms
C1 RMS
376.0mV
C1 Period
384µs
C1 Freq
2.60607kHz
C1 Period
384µs
Ch1 200mV
M 500µs Ch1 ƒ 372mV
Function
V Bars
Mode
Indep
Time
Units
seconds
Amplitude
Units
Base
Cursor
Function
Off
H Bars
V Bars
Paired

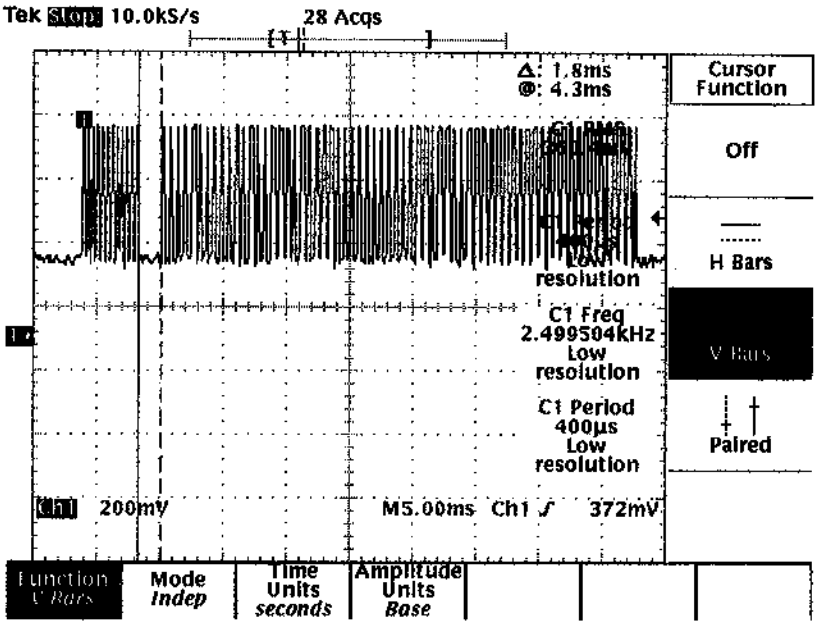

Tek Stop: 100kS/s
10 Acqs
Δ: 380µs
@: 2.67ms
C1 RMS
376.0mV
C1 Period
384µs
C1 Freq
2.60607kHz
C1 Period
384µs
Ch1 200mV
M 500µs Ch1 ƒ 372mV
Mode
Indep
Time
Units
seconds
Amplitude
Units
Base
Cursor
Function
Off
H Bars
Paired


Tek Stop: 100kS/s
14 Acqs
Δ: 170µs
@: 2.46ms
C1 RMS
486.4mV
C1 Period
579µs
C1 Freq
1.72707kHz
C1 Period
579µs
Ch1 200mV
M 500µs Ch1 ƒ 372mV
Function
V Bars
Mode
Indep
Time
Units
seconds
Amplitude
Units
Base
Cursor
Function
Off
H Bars
V Bars
Paired


Tek Stop: 100kS/s
14 Acqs
Δ: 580µs
@: 2.87ms
C1 RMS
486.4mV
C1 Period
579µs
C1 Freq
1.72707kHz
C1 Period
579µs
Ch1 200mV
M 500µs Ch1 ƒ 372mV
Function
V Bars
Mode
Indep
Time
Units
seconds
Amplitude
Units
Base
Cursor
Function
Off
H Bars
V Bars
Paired


Tek Stop: 100kS/s
14 Acqs
Δ: 360µs
@: 3.23ms
C1 RMS
486.4mV
C1 Period
579µs
C1 Freq
1.72707kHz
C1 Period
579µs
Ch1 200mV
M 500µs Ch1 ƒ 372mV
Function
Mode
Indep
Time
Units
seconds
Amplitude
Units
Base
Cursor
Function
Off
H Bars
V Bars
Paired


Tek Stop: 100kS/s
14 Acqs
Δ: 570µs
@: 3.44ms
C1 RMS
486.4mV
C1 Period
579µs
C1 Freq
1.72707kHz
C1 Period
579µs
Ch1 200mV
M 500µs Ch1 ƒ 372mV
Function
V Bars
Mode
Indep
Time
Units
seconds
Amplitude
Units
Base
Cursor
Function
Off
H Bars
V Bars
Paired


Tek Stop: 10.0kS/s
28 Acqs
Δ: 1.8ms
@: 4.3ms
Cursor Function
Off
H Bars
V Bars
Paired
C1 Freq
2.499504kHz
Low resolution
C1 Period
400µs
Low resolution
Ch1 200mV
M5.00ms Ch1 ƒ 372mV
Function V Bars
Mode Indep
Time Units seconds
Amplitude Units Base

7 ATTESTATION STATEMENT

GENERAL REMARKS:

SUMMARY:

All tests were performed per CFR 47, *FCC Part 15, Paragraphs 15.231(a), (b), (c); 15.107(a); 15.209(a)*

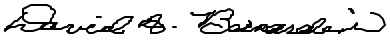
■ - Performed

The Equipment Under Test

■ - **Fulfills** the requirements of CFR 47, *FCC Part 15, Paragraphs 15.231(a), (b), (c); 15.107(a); 15.209(a).*

- TÜV PRODUCT SERVICE, INC. -

Responsible Engineer:



(EMC Engineer)

TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone 858 546 3999 FAX 858 546 0364