1.2 Related Submittal(s) Grants

This is a single Application for Certification. There are no simultaneous filings under Part 15.

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 4317-A Park Drive NW, Norcross, Georgia. This test facility has been fully described in a report dated Jan. 8, 1993 submitted to your office. Please reference the site filing number: 31040/SIT 1300F2, dated April 26, 1996. This facility is accredited by the NVLAP program (NVLAP Code: 100409-0).

1.4 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.4 (1992). All measurements were performed in Open Area Test Sites. Preliminary scans were performed in the Open Area Test Sites only to determine worst case modes. For each scan, the procedure for maximizing emissions in Appendices D and E were followed. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

1.5 Field Strength Calculation

For radiated emissions testing, the field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

where FS = Field Strength in dBμV/m

RA = Receiver Amplitude (including preamplifier) in dB(μV)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB(1/m)

AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dB(μV)

AF = 7.4 dB

CF = 1.6 dB(1/m)

AG = 29.0 dB

FS = 52.0 + 7.4 + 1.6 - 29.0 = 32 dB(μV/m)

Level in μV/m = Common Antilogarithm [(32 dBμ/V/m)/20] = 39.8 μV/m

EXHIBIT 2

SYSTEM TEST CONFIGURATION

2.0 System Test Configuration

2.1 Justification

The system was configured according to the procedures in ANSI C63.4 (1992), for testing in a typical fashion. Placement of the EUT consisted of three orthogonal axis. Each axis was rotated 380 degrees in order to determine a maximum emission level. Antenna height varied from 1 to 4 meters.

2.2 EUT Exercising Software

Detailed specialized software was provided by Hand Held Products. Refer to Appendix A for RF test Scripts.

2.3 Special Accessories

There are no special accessories for compliance of this product.

Confirmed by:

David J. Schramm
EMI Technical Supervisor
Intertek Testing Services
Agent for Hand Held Products

_____ Signature

4/27/98 Date

2.4 Equipment Modification

Any modifications installed previous to testing by Hand Held Products will be incorporated in each production model sold/leased in the United States.

No modifications were installed by Intertek Testing Services, Inc.

Confirmed by:

David J. Schramm
EMI Technical Supervisor
Intertek Testing Services
Agent for Hand Held Products

_____ Signature

4/27/98 Date

2.5 Support Equipment List and Description

The FCC ID's for all equipment, plus descriptions of all cables used in the tested system (included inserted cards, which have grants) are:

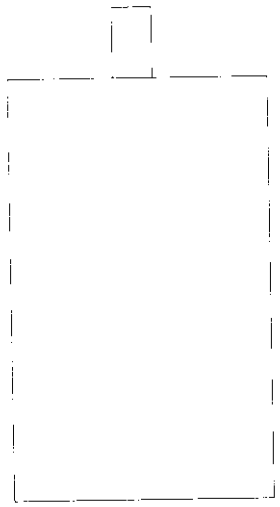
During the all tests, with the exception of the Occupancy Time testing, no support equipment was used. For the Occupancy Time testing, a master base station was used to allow the EUT to operate in its typical manner.

Cables:

None

2.6 Test Configuration Block Diagram

Figure 2.6 Configuration of Tested System



EUT

EXHIBIT 3

EMISSION RESULTS

3.0 Test Results

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs, data tables and plots of the emissions are included.

3.1 Emission Bandwidth

§15.247(a)(1) specifies that frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The channel spacings are specified to be 1 MHz.

§15.247(a)(1)(ii) specifies bandwidth requirements for frequency hopping spread spectrum transmitters. The maximum 20 dB bandwidth for these devices shall be 1 MHz.

From the plot shown below, the emission bandwidth was determined to be 975 kHz. For the measurement, the spectrum analyzer resolution bandwidth (RBW) was set to 100 kHz and the frequency span set to 5 MHz.

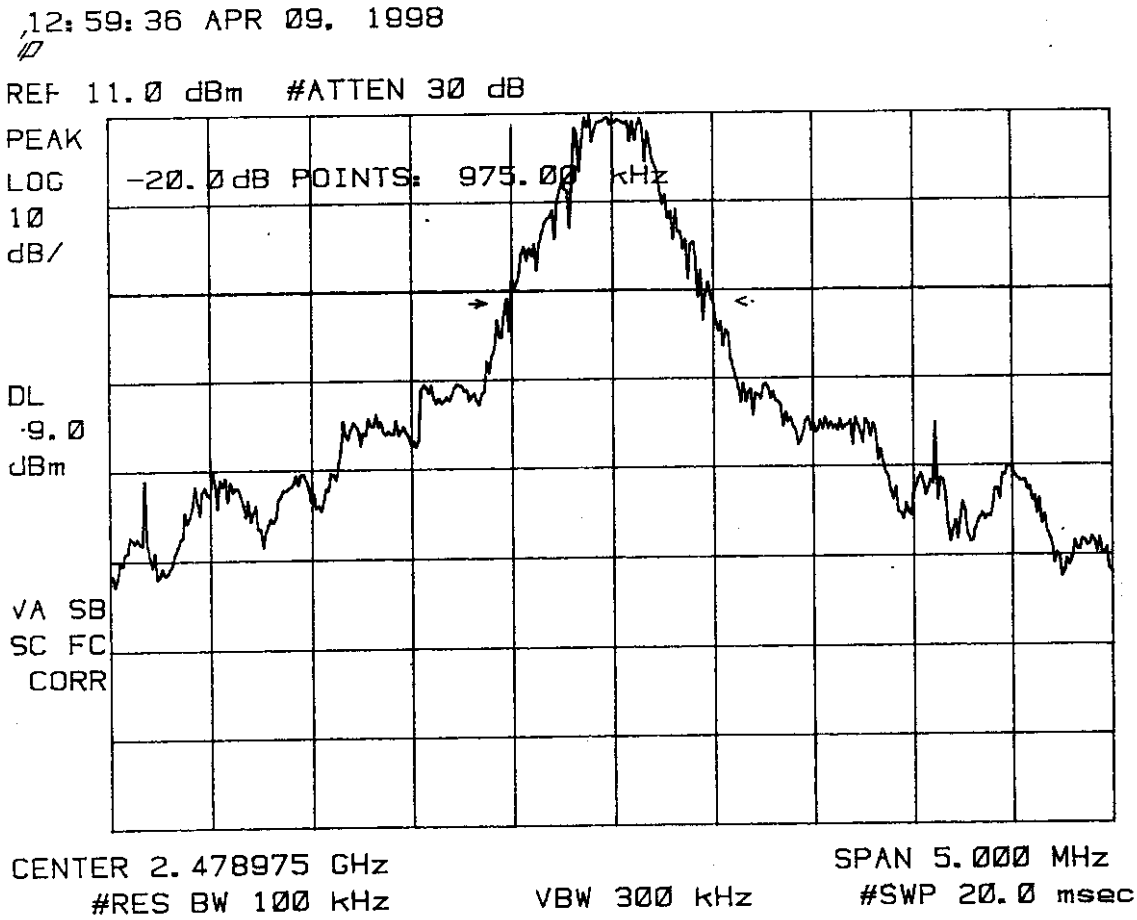


Figure 3.1-1: Emission Bandwidth Plot

3.2 Occupancy Time

§15.247(a)(1)(ii) also specifies the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

From the plots on the next three pages, the occupancy time was measured to be 72 milliseconds. For the measurement, the spectrum analyzer resolution bandwidth (RBW) was set to 1 MHz, the frequency span set to 0 Hz, and the sweep time increased to 30 seconds. Please note that the lower amplitude emissions were determined to be coming from the master base station which was being used as support equipment for this test.

To measure the pulse width, the sweep time was decreased to 500 msec amd then to 20 msec.

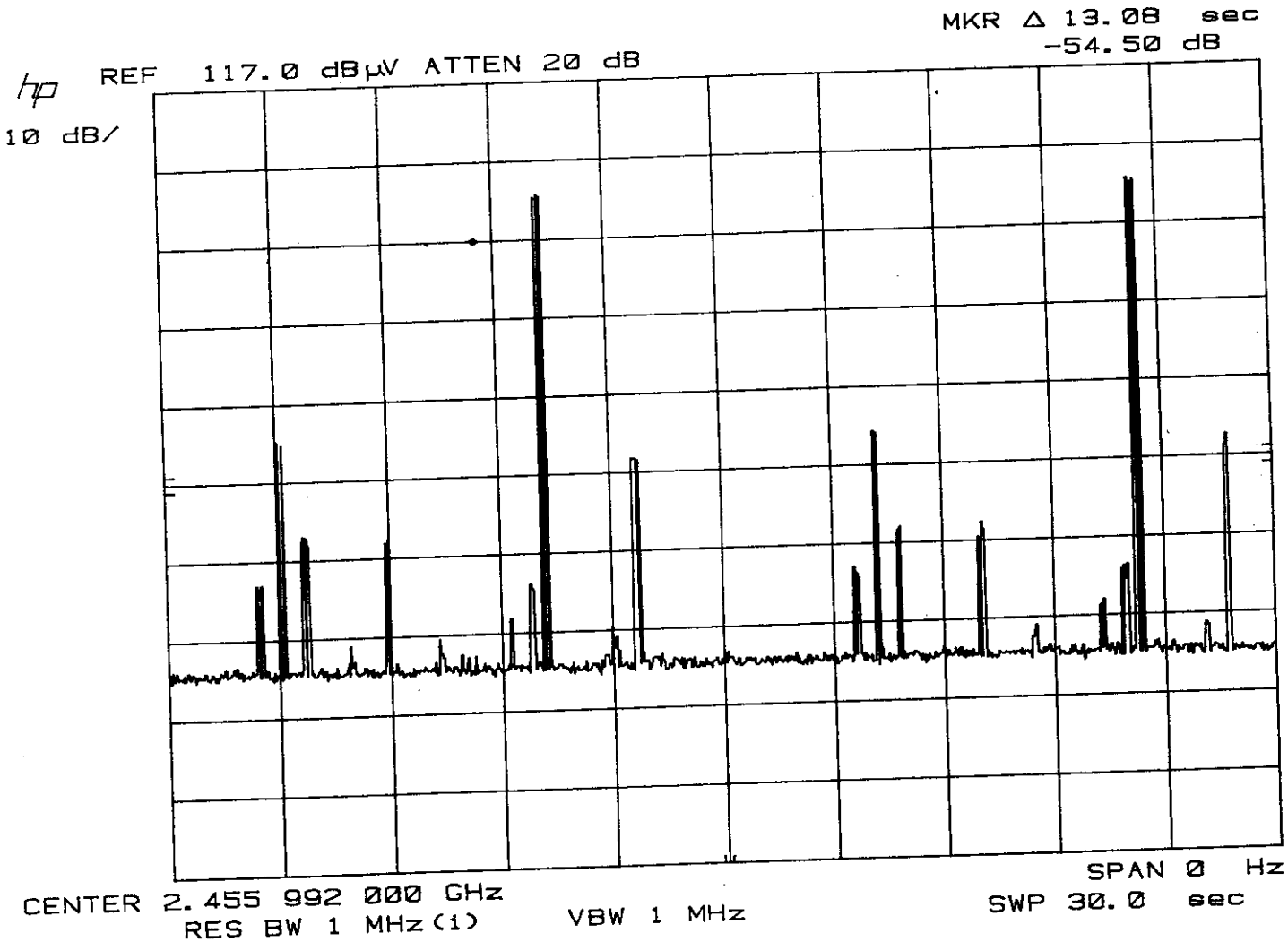


Figure 3.2-1: Occupancy Time - 30 seconds

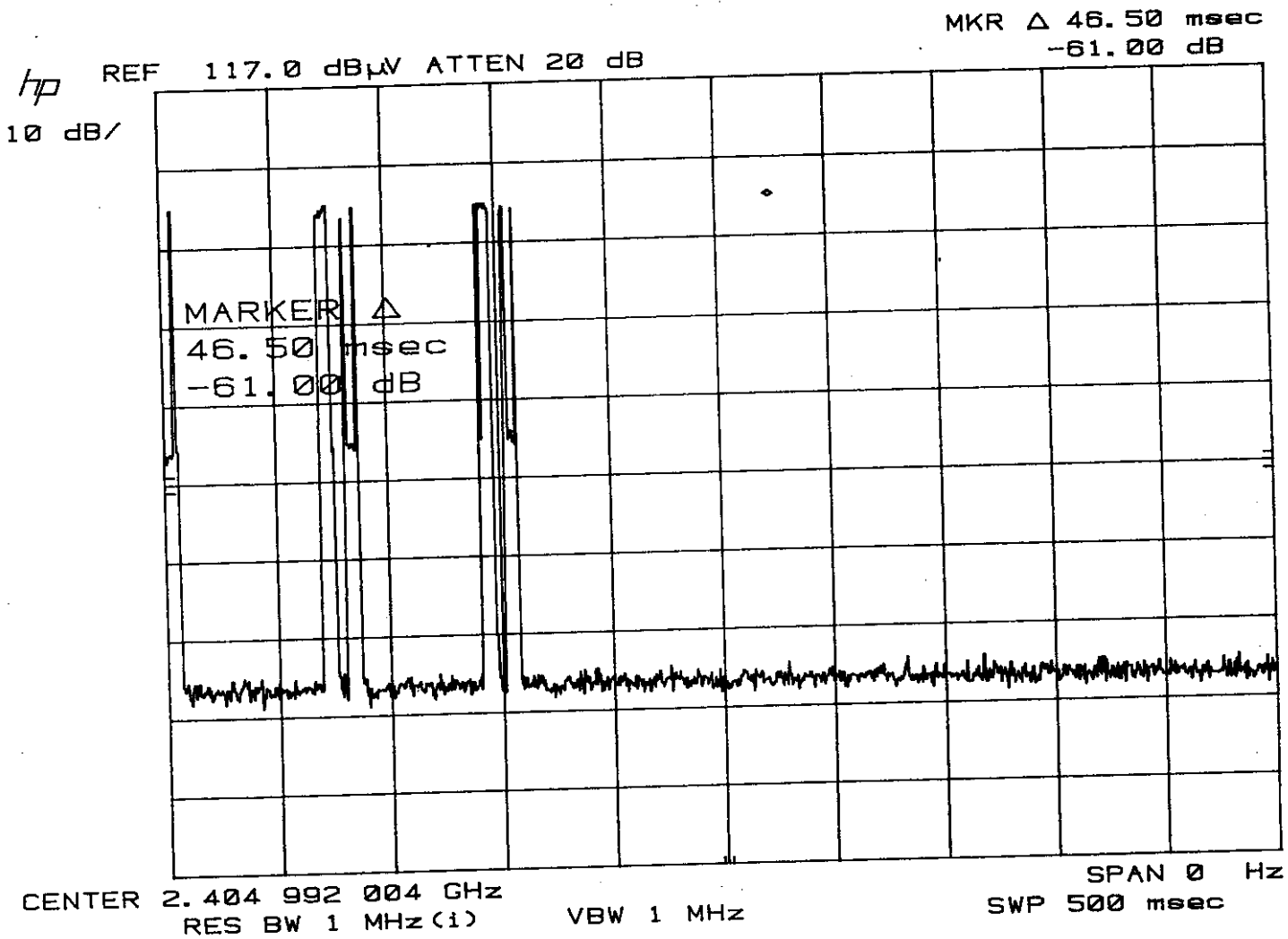


Figure 3.2-2: Occupancy Time - 500 milliseconds

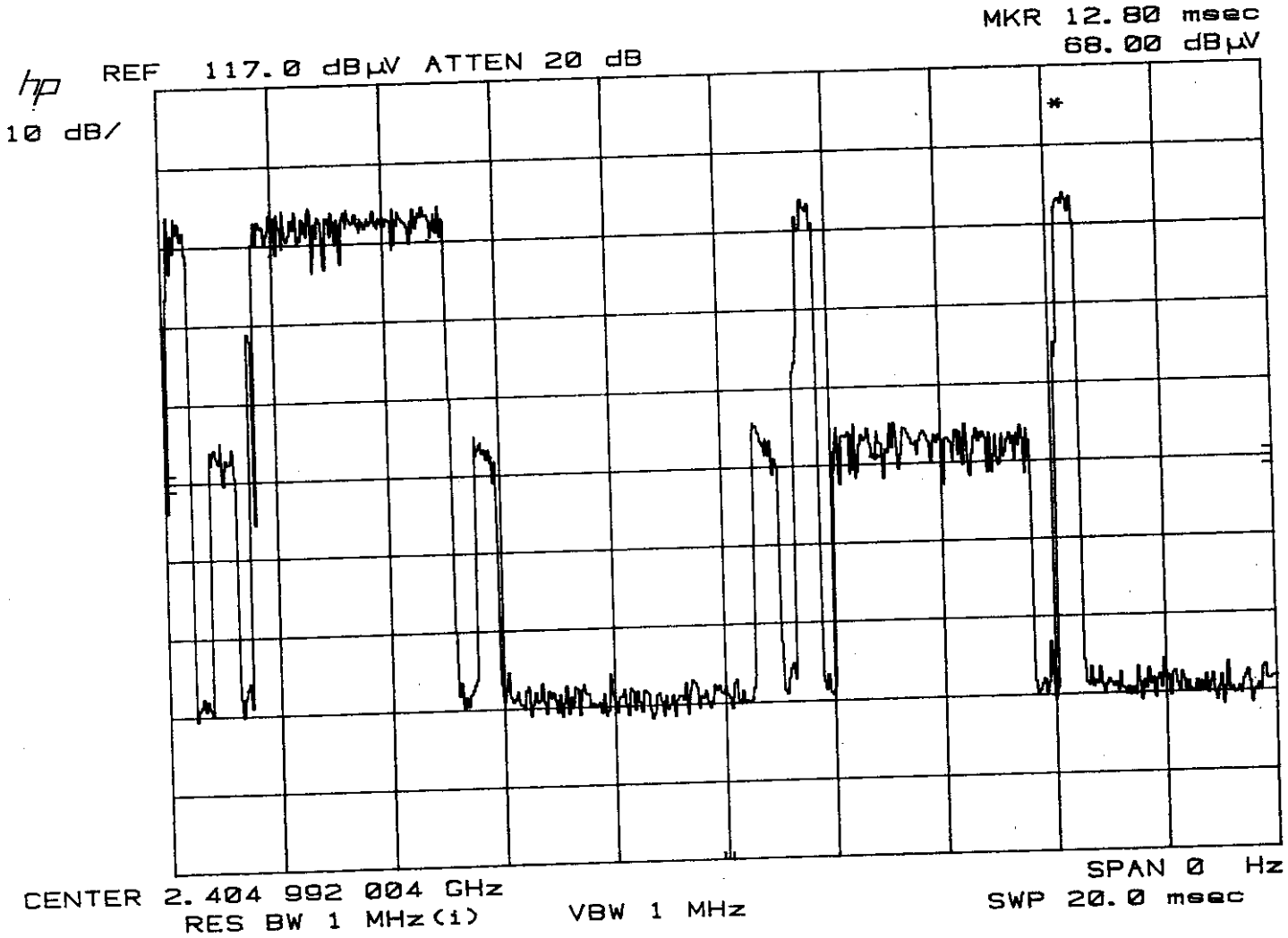


Figure 3.2-3: Occupancy Time - 20 milliseconds

3.3 Power Output

§15.247(b)(1) specifies power output requirements for frequency hopping spread spectrum transmitters. The maximum peak output power for these devices shall not exceed one watt. If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

From the plot on the next page, the peak output power was determined to be 19.0 dBm (79 mW). This is within the 2 dB manufacturer's tolerance.

The readings were taken using a direct connection between the antenna port of the transmitter and a peak power meter. The level was also verified using a spectrum analyzer. The spectrum analyzer resolution bandwidth (RBW) was set to 3 MHZ and video bandwidth (VBW) were set to 3 MHZ (this is the maximum VBW setting for the test equipment). The spectrum analyzer gave the same power level as the power meter.

3.4 Transmitter Spurious Emissions

§15.247(c) specifies requirements for spurious emissions from direct sequence spread spectrum transmitters. In any 100 kHz bandwidth outside the frequency bands listed in §15.247, the radio frequency power that is produced by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in §15.209(a), whichever results in the lesser attenuation. All other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a).

Two separate tests (described below) were performed to determine the spurious emissions from the device:

(1) The first test was performed using a direct connection between the antenna port of the transmitter and the spectrum analyzer. The resolution bandwidth was set to 100 kHz, and the video bandwidth (VBW) was set > RBW. A scan was performed up to the tenth harmonic to ensure that all harmonics/spurs were at least 20 dB down from the highest emission level within the authorized frequency bands. There were no emissions detected above the measuring equipment noise floor. Please refer to Figure 3.4-1: Antenna Conducted Spurios Emissions Plot.

(2) The second test was a radiated emission test to determine the amplitude of harmonics/spurs which fall in the restricted bands listed in §15.205. The limits for emissions in these restricted bands are listed in §15.209. For measurements above 1 GHz a RBW of 1 MHZ and a VBW of 10 Hz were used. The results of this test are shown in Table 3.4-1.

3.4.1 Data: Antenna Conducted Test

The plot below shows that with the highest carrier turned on full power CW, there were no emissions detected.

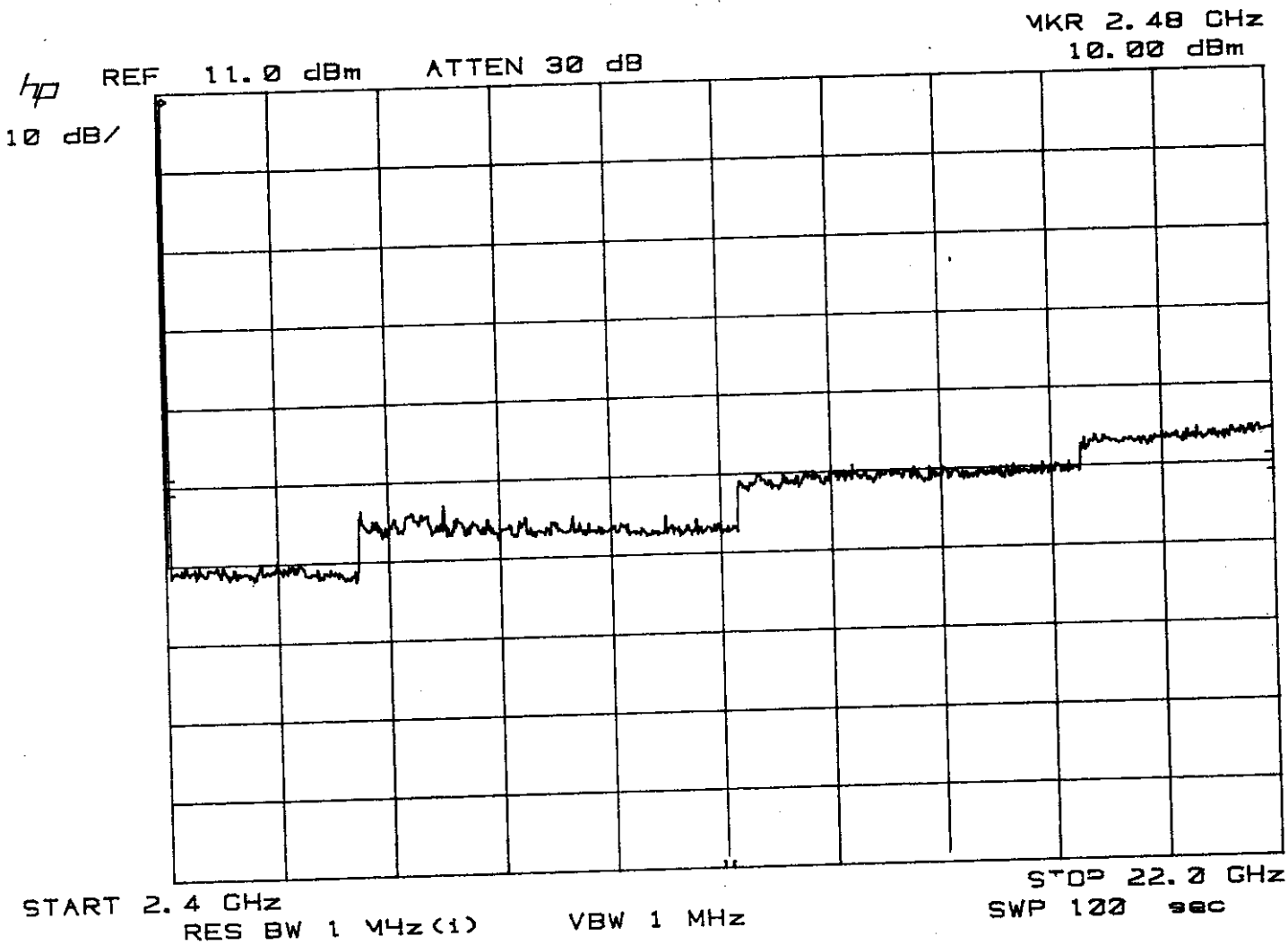


Figure 3.4-1: Antenna Conducted Spurious Emissions Plot

3.4.2 Data: Radiated Emission Test

The data shown below lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit. A nf beside the antenna polarity indicates a noise floor reading.

Table 2: Radiated Spurious Emissions

Company: Hand Held Products
Model: Dolphin RF Terminal

Notes: Initial Results

Date: 04/09/98
Tested by: Candy L. Campbell
Test Distance: 3
Job Number: J98*9299

Standard: FCC Part 15
Class B

Antenna Polarity	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Net Factor dB(uV/m)	dB below Carrier dBc	Limit dBc	Margin dB
v	2480	106.0	30.2	2.2	26.8	111.6	-	-	-
v	4959	59.4	34.9	3.5	26.2	71.6	40.1	20.0	-20.1
v	7439	56.0	36.5	4.7	26.3	70.9	40.8	20.0	-20.8
v	9920	48.1	38.8	6.0	27.2	65.7	46.0	20.0	-26.0
v	12399	49.3	41.1	7.3	36.8	60.9	50.8	20.0	-30.8
v - nf	14878	40.9	40.9	8.3	35.6	54.5	57.1	20.0	-37.1
v - nf	17358	40.3	41.0	9.9	35.9	55.3	56.3	20.0	-36.3
v - nf	19837	43.5	43.3	11.0	36.1	61.6	50.0	20.0	-30.0
v - nf	22316	44.6	42.7	12.5	36.2	63.6	48.0	20.0	-28.0

Test Personnel:

Candy L. Campbell / EMI Technician

4-27-98
Date

3.5 AC Power Line-Conducted Emissions per §15.207

For AC powered devices, line-conducted emissions testing is performed based on the requirements in §15.207. The hand held transmitter portion of this device is battery powered, therefor no conducted emissions testing was required.

Test Personnel:

Candy L. Campbell / EMI Technician

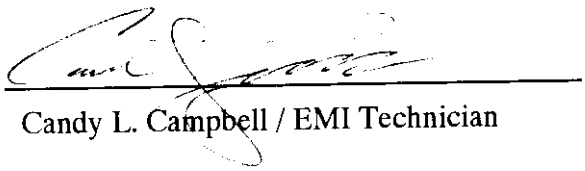
4-27-98

Date

3.6 Radiated Emissions, Part 15, Subpart B

The digital portion of this product complies with the emission requirements of FCC Part 15, Subpart B for a Class B device. Please refer to the report HAN09299.15B for specific data and details of testing.

Test Personnel:



Candy L. Campbell / EMI Technician

1-27-98

Date

3.7 Maximum Permissible Exposure

The calculations for maximum transmitted power to be compared to the MPE limits are based on OET 65 (97-01). The Dolphin RF Terminal is designed for a maximum transmit power of 20 dBm (100 mW). The antenna has a gain of 2 dBi (1.585). This is the only antenna that is approved for this device.

Using the equation for power density $S=PG/4\pi R^2$
Where S = power density in mW/cm^2
P = transmit power in milliwatts
G = numeric gain of transmit antenna
R = distance (cm)
$S = \{(100)(1.585)\}/\{4\pi(100)^2\}$
$S = 0.0013\ mW/cm^2$ at a distance of 1 meter.

This power density is for the worst case with maximum beam exposure. This level is well below the 5 mW/cm2 MPE for Occupational Controlled Access.

3.10 Radiated and Line-Conducted Emission Configuration Photographs (continued)

Worst Case Line-Conducted Emission

Front View

No photograph required. Test is not applicable.

3.10 Radiated and Line-Conducted Emission Configuration Photographs (continued)

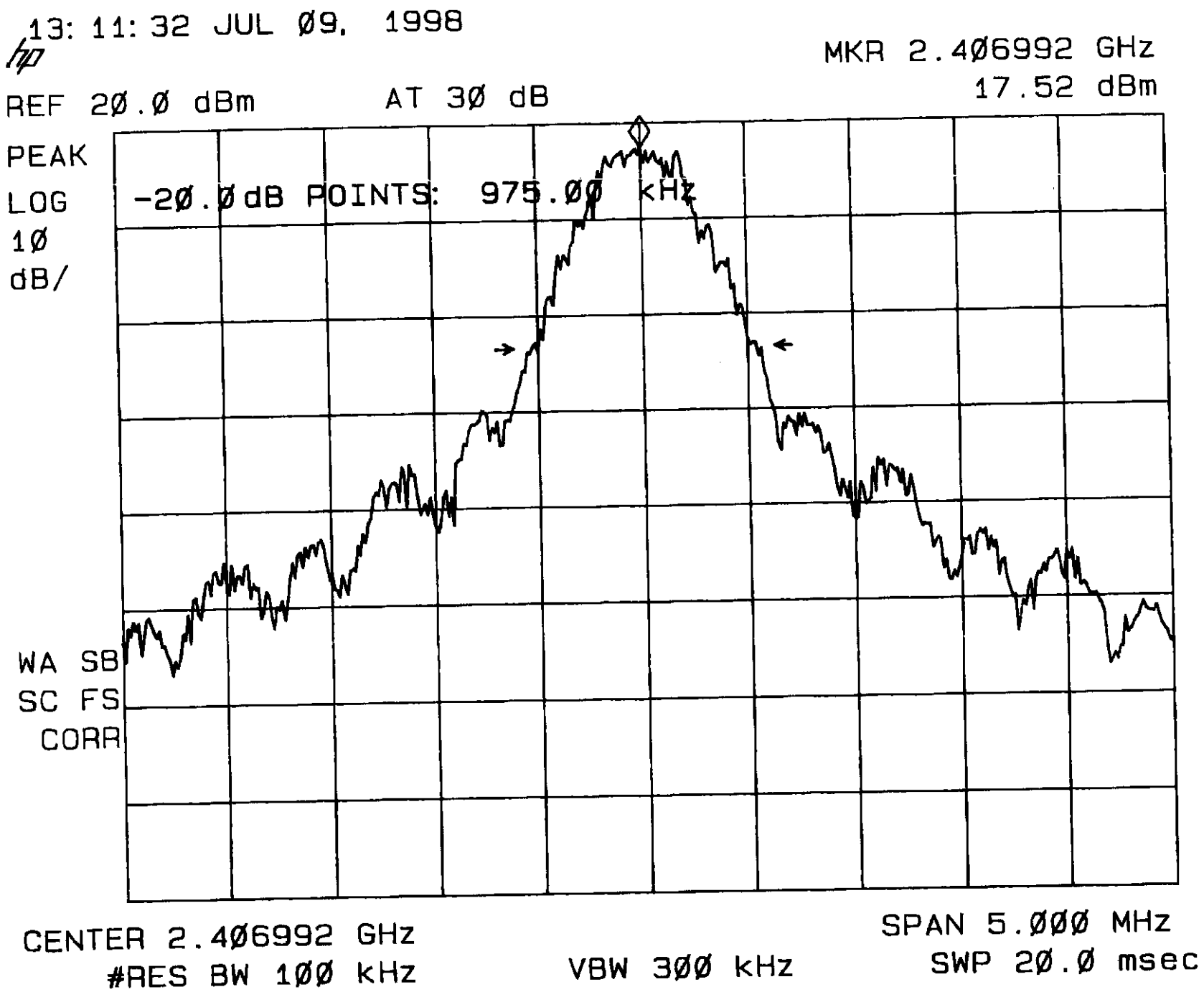
Worst Case Line-Conducted Emission

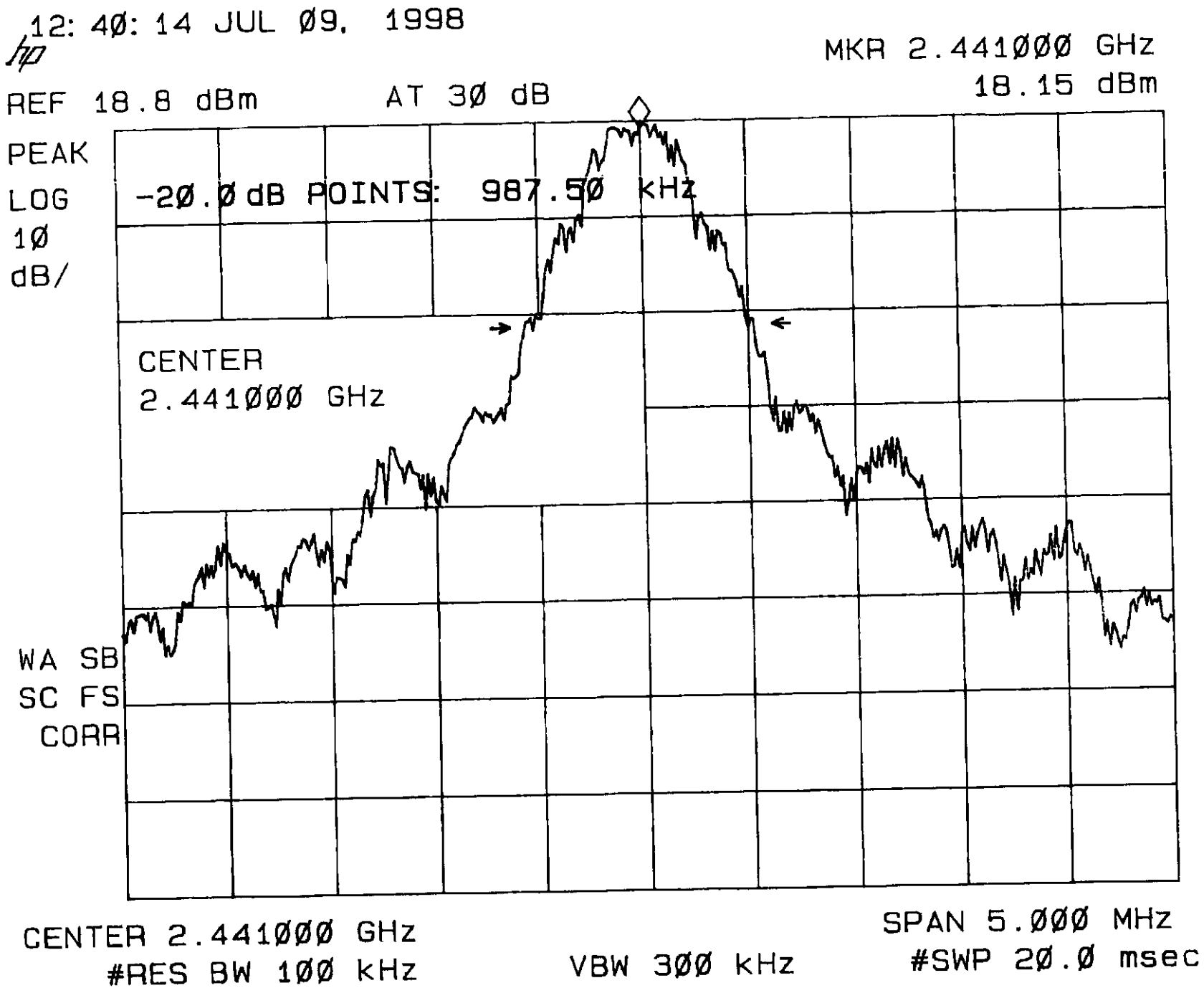
Rear View

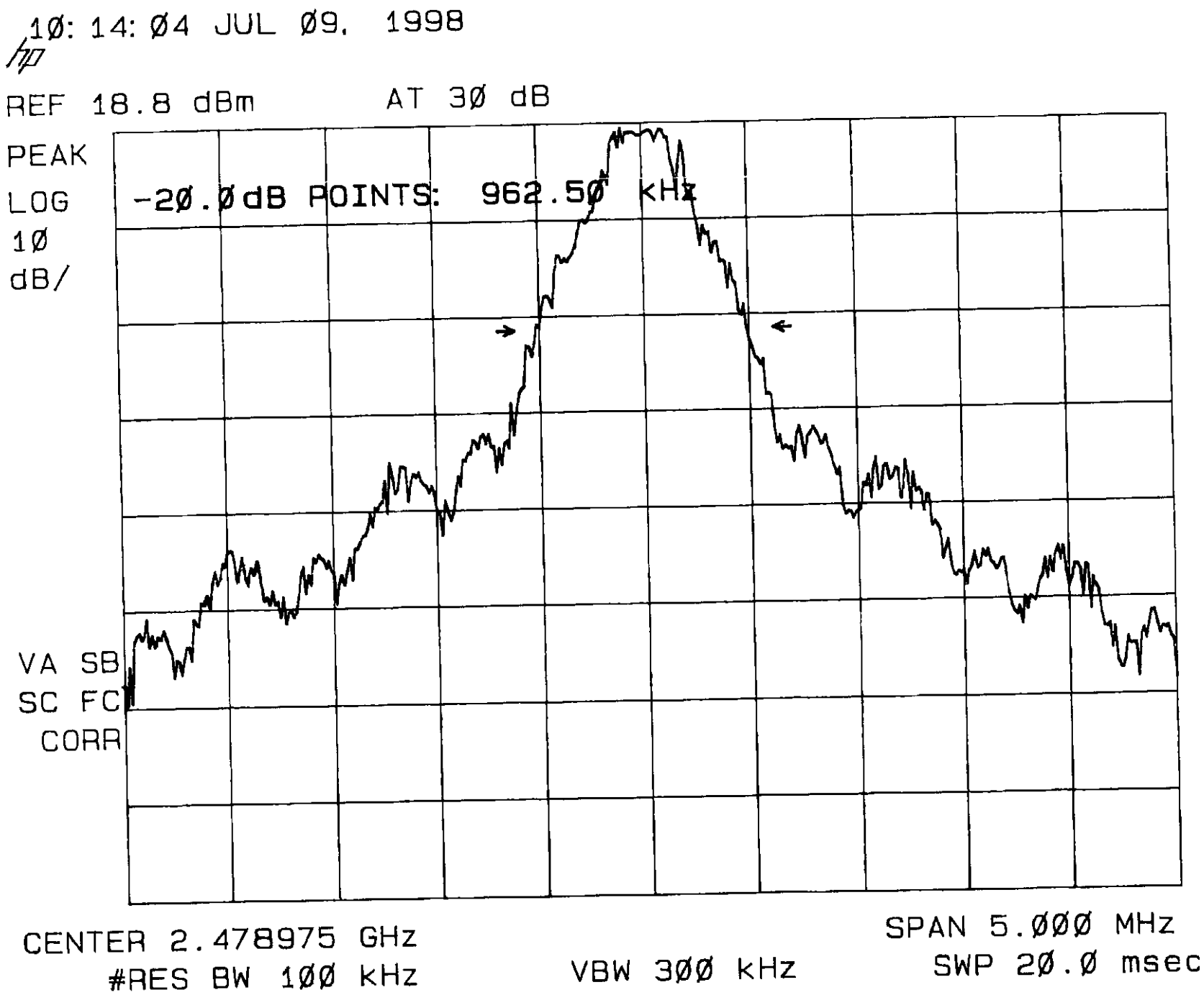
No photograph required. Test is not applicable.

The following three pages contain the bandwidth plots per Section 15.31(m) of the FCC Rules of the high, middle and low channels with the maximum data rate of 1.6 MH/S.

The transmitter was set to a specific channel. The N-dB function of the HP 8595E was used to measure the 20 dB points of the emission. The RBW was set to 100 kHz, the VBW was set to 300 kHz, and the span was set to 5 MHz, which is much greater than the RBW.







The following 2 pages contain the radiated field strength measurements in the restricted bands. The two plots after that contain the "hopping duty cycle". The duty cycle was determined to be 44.1% or 7.1 dB.

Peak readings were taken with a RBW of 1 MHz and a VBW of 1 MHz.

Average readings were taken with a RBW of 1 MHz and a VBW of 10 Hz. The duty cycle factor (shown on the data table as "Hop/Avg Factor") was subtracted from the spectrum analyzer reading (along with appropriate antenna, preamp, and cable factors).

ITS Intertek Testing Services

Radiated Emissions / Interference
Table: 2

Company: Hand Held Products
Model: Dolphin RF Terminal

Notes: Initial Results

Date: 07/14/98
Tested by: David J. Schramm
Test Distance: 3
Job Number: J98009299

Standard: FCC Part 15, subpart C
Restricted Bands Field Strength

EUT Orientation	Frequency MHz	Peak Reading dB(uV)	Antenna Factor + dB	Cable Loss + dB	Pre-amp Factor - dB	Net dB(uV/m)	Peak Limit dB(uV/m)	Margin dB
Channel 6								
Z	4813.8	54.2	34.6	3.5	26.2	66.1	74.0	-7.9
Y	7221.4	55.7	36.5	4.7	26.3	70.6	74.0	-3.4
X	9628.4	48.2	38.8	6.0	27.2	65.8	74.0	-8.2
Channel 40								
Z	4882.2	57.5	34.6	3.5	26.2	69.4	74.0	-4.6
Z	7323.3	57.5	36.5	4.7	26.3	72.4 ✓	74.0 ✓	-1.6
X	9764.4	41.5	38.8	6.0	27.2	59.1	74.0	-14.9
Channel 78								
Z	4958.2	53.8	34.9	3.5	26.2	66.0	74.0	-8.0
X	7437.2	49.4	36.5	4.7	26.3	64.3	74.0	-9.7
X	9916.3	44.7	38.8	6.0	27.2	62.3	74.0	-11.7

There were no other emissions detected above the measurement equipment noise floor which is at least 6 dB below the limit.

Radiated Emissions / Interference
Table: 1

Company: Hand Held Products
Model: Dolphin RF Terminal

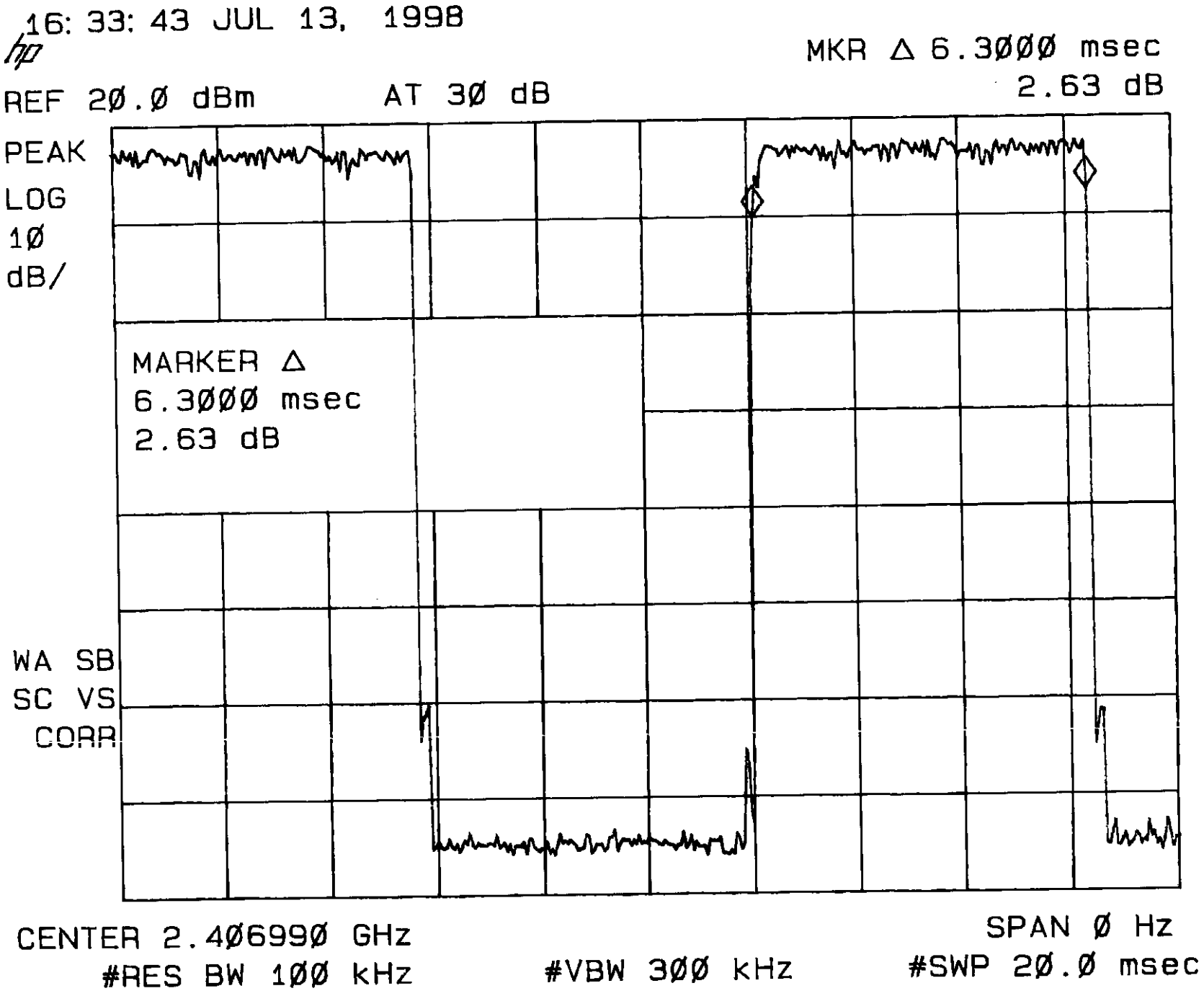
Notes: Initial Results

Date: 07/14/98
Tested by: David J. Schramm
Test Distance: 3
Job Number: J98009299

Standard: FCC Part 15, Subpart C
Restricted Band Field Strength

EUT Orientation	Frequency (MHz)	Average Reading dB(uV)	Antenna Factor + dB	Cable Loss + dB	Pre-amp Factor − dB	Hop/Avg Factor − dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB
Channel 6									
Y	4813.8	41.6	34.6	3.5	26.2	7.1	46.4	54.0	-7.6
Y	7221.4	38.9	36.5	4.7	26.3	7.1	46.7	54.0	-7.3
X	9628.4	33.3	38.8	6.0	27.2	7.1	43.8	54.0	-10.2
Channel 40									
Z	4882.2	44.8	34.6	3.5	26.2	7.1	49.6	54.0 ✓	-4.4
Z	7323.3	44.9	36.5	4.7	26.3	7.1	52.7 ✓	(54.0 ✓	-1.3
X	9764.4	28.4	38.8	6.0	27.2	7.1	38.9	54.0	-15.1
Channel 78									
Z	4958.2	41.2	34.9	3.5	26.2	7.1	46.3	54.0	-7.7
X	7437.2	36.1	36.5	4.7	26.3	7.1	43.9	54.0	-10.1
X	9916.3	30.5	38.8	6.0	27.2	7.1	41.0	54.0	-13.0

There were no other emission detected above the measurement equipment noise floor which is at least 6 dB below the limit.


16: 33: 43 JUL 13, 1998
MKR Δ 6.3ØØØ msec
2.63 dB
REF 2Ø.Ø dBm
AT 3Ø dB
PEAK
LOG
1Ø
dB/
MARKER Δ
6.3ØØØ msec
2.63 dB
WA SB
SC VS
CORR
CENTER 2.4Ø699Ø GHz
#RES BW 1ØØ kHz
#VBW 3ØØ kHz
SPAN Ø Hz
#SWP 2Ø.Ø msec

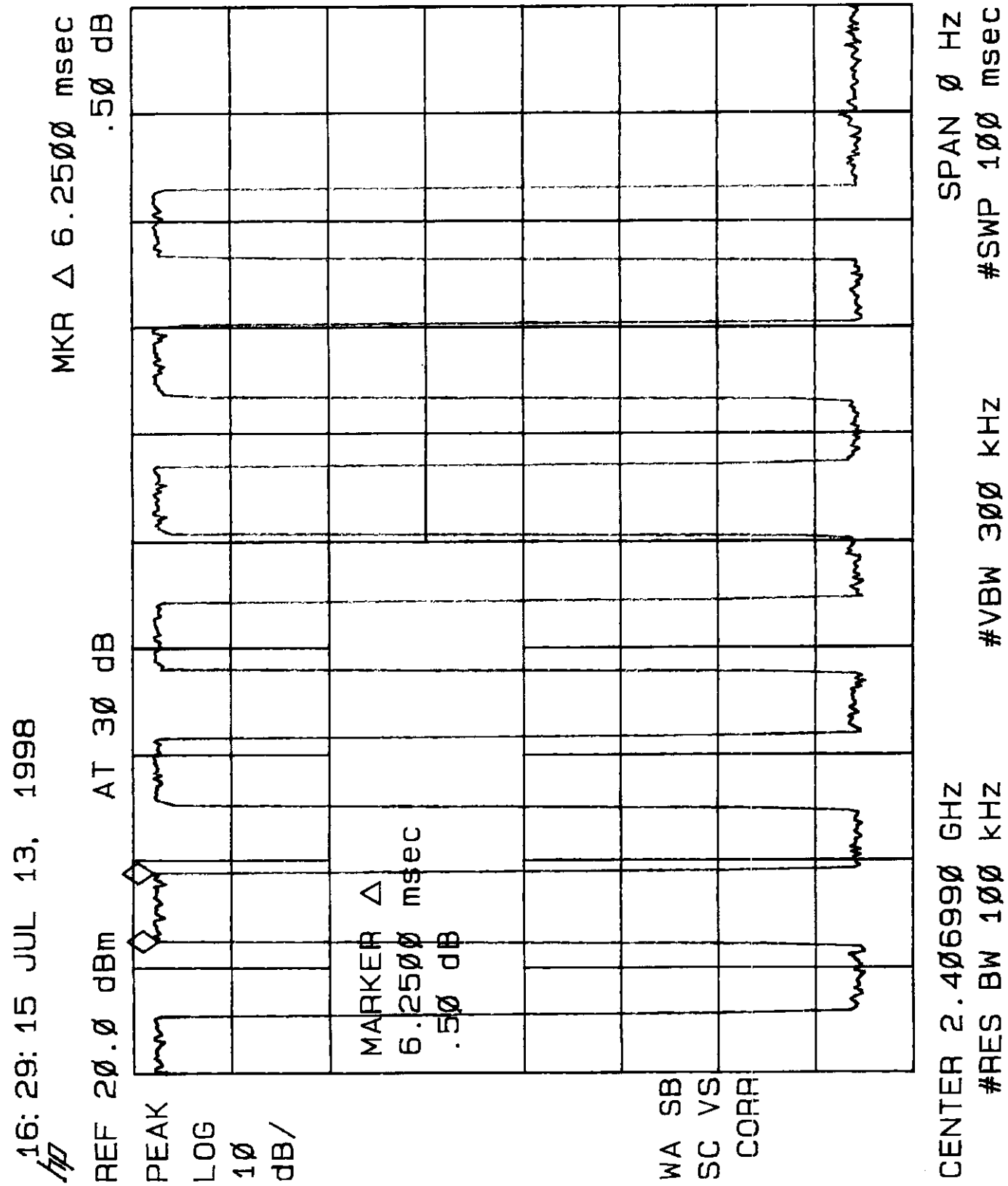

16: 29: 15 JUL 13, 1998
MKR Δ 6.25ØØ msec
.5Ø dB
REF 2Ø.Ø dBm
AT 3Ø dB
PEAK
LOG
1Ø
dB/
MARKER Δ
6.25ØØ msec
.5Ø dB
WA SB
SC VS
CORR
CENTER 2.4Ø699Ø GHz
#RES BW 1ØØ kHz
#VBW 3ØØ kHz
SPAN Ø Hz
#SWP 1ØØ msec

EXHIBIT 4

EQUIPMENT PHOTOGRAPHS

EXHIBIT 8

MISCELLANEOUS INFORMATION

8.0 Miscellaneous Information

This miscellaneous information includes details of the measured bandwidth, the test procedure and calculation of factors such as pulse desensitization and averaging factor.

8.1 Discussion of Pulse Desensitization

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

8.2 Calculation of Average Factor

Detector function for radiated emission measurements is peak 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:

Average Factor in dB = 20 LOG (duty cycle)

The time 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 calculation contained in this section. A plot of the worst case duty cycle, if applicable, is also provided in this report.

Note: No averaging factor was applied and no plot has been included in this report.

8.3 Emissions Test Procedures

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 rules.

The test set-up and procedures described below are designed to meet the requirements of ANSI C63.4:1992.

The transmitting equipment under test (EUT) is placed on a wooden turntable which is 1.0 m x 1.5 m and approximately 0.8 meter in height above the ground plane. 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 testing to search for maximum signal levels. The height of the antenna is varied from one to four meters.

For small, battery powered transmitters, the transmitter is attached to a cardboard box and placed in each of it orthogonal axis during the procedure described above. 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, fully charged battery is used.

Detector function for radiated emissions is in 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. A detailed description for the calculation of the average factor can be found in Exhibit 8.2. Alternatively, the average detector of the receiver may be used. The method of measurement is indicated in the data tables.

The frequency range 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.

The IF bandwidth used for measurement of radiated signal strength was 120 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 Note 150-2. Above 1000 MHz, a resolution bandwidth of 1 MHz is used.

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the restircted bands and above 1 GHz, signals mey be 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.

Appendix A

Testing Modes and Programs

HAND HELD PRODUCTS®

Peter,

The scripts for the FCC testing are complete. There is one major flaw with using the scripts. Once the input is redirected from the keyboard to the script there is no way to redirect the input back to the keyboard. (i.e. you cannot enter a key stroke in the application). If you can live with this, the scripts will work fine. Remember, you will have to Three Key *the Dolphin to get out of* RI2Diag.exe. *The scripts are:*

1. *Tx2hop.bat: This is used for TX mode spurious measurements. The inputs are:*
    A. *(7) selects the radio mode test*
    B. *(4) selects the Hop test*
    C. *(2) the number of hops*
    D. *(6) Hop freq 1*
    E. *(48) Hop freq 2*
    F. *(16) TX time in ms*
    G. *(11) RX time in ms*
    H. *(200) Hop duaration*
    I. *(0) selects BFSK transfer rate*
2. *1CHRXLO.bat and 1CHRXHI.bat: These file are used for single channel RX mode spurious measurements. The inputs are*
    A. *(7) selects the radio mode test*
    B. *(0) selects the RX test*
    C. *(6) Channel number for* 1CHRXLO.bat *or (48) for* 1CHRXHI.bat
    D. *(0) selects BFSK transfer rate*
3. *1CHTXLO.bat and 1CHTXHI.bat: These file are the single channel TX Hop for frequency range measurements. The inputs are*
    A. *(7) selects the radio mode test*
    B. *(4) selects Hop test*
    C. *(2) Number of hops*
    D. *(6) for low channel {* 1CHTXLO.bat *} or (48) for high channel {1CHTXHI.bat}*
    E. *(6) for low channel {* 1CHTXLO.bat *} or (48) for high channel {1CHTXHI.bat} (again)*
    F. *(16) TX time in ms*
    G. *(11) RX time in ms*
    H. *(200) Hop duration*
    I. *(0) selects BFSK transfer rate*

4. *3CHTX.bat:* Three Hop *TX used for power measurements. The inputs are*
    A. *(7) selects the radio mode test*
    B. *(4) selects Hop test*
    C. *(3) Number of hops*
    D. *(6) First freq*
    E. *(28) Second freq*
    F. *(48) Third freq*
    G. *(16) TX time in ms*
    H. *(11) RX time in ms*
    I. *(200) Hop duration*
    J. *(0) selects BFSK transfer rate*
5. *RL2D.bat: This is simply a batch file that starts RI2Diag.exe. Using this method allows you to enter the command input directly into the program. Therefore, the keyboard remains functional.*

NOTE: RI2Diag.exe will not run if the radio or stack drivers are loaded. You must reset the Dolphin if the standard drivers are loaded.

FEDERAL COMMUNICATIONS COMMISSION
UNPROCESSABLE APPLICATION RETURN FORM

DATE: 5-01-98

HAND HELD PRODUCTS
7510 E INDEPENDENCE BLVD
STE 100
CHARLOTTE NC 28227

Dear FCC Customer:

Re: Return of Unprocessable Application

This is to notify you that your application package is being returned for the following reasons:

( ) No application filing accompanied your submission.

( ) Application Form _____ is not accepted in this P.O. Box.

( ) No remittance accompanied your submission or the amount is incorrect. See Appropriate Fee Filing Guide..

( ) Your check is not acceptable for this reason _____.

(✓) Multiple checks for a single application are not accepted. has been corrected

( ) No remittance advice form (FCC 159) accompanied your submission.

( ) The payment type code is incorrect.

( ) The remittance advice form is incomplete or obsolete.

( ) Multiple quantities (quantities greater than 1) are not accepted for this payment type code. Each transaction must be listed separately on FCC 159 Remittance Advice Form.

( ) When paying with a single remittance and filing for more than one applicant, or filing more than one call sign identifier, each item must be listed individually on FCC 159/159C.

( ) Multiple payment type codes listed are not all accepted in this P.O. Box. Please refer to the filing guide and prepare a separate filing for each P.O. Box.

( ) The credit card section of FCC 159 needs __ Expiration Date __ Signature.

( ) Block 3 must be completed to authorize a credit card charge.

Please refer to the enclosed fee filing guide for further instructions, and mail your corrected application, remittance advice form and payment to the appropriate P.O. Box in Pittsburgh, PA.

If you have further questions, please contact the Fee Section at 202-418-1995

Sincerely,
Billings & Collections Branch

Enclosures:
Filing Guide NONE
Check(s)# 26277, 26279
FCC Form(s) FCC 73 TECHNICAL DATA
*PUBLIC NOTICE

For Office Use Only:
Recd in P.O. Box # 315

Proc #1 1499
Proc #2 _____