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**Report of Measurements  
Of Electromagnetic Compatibility Testing**

Test Report File No.: NC4557      Date of issue: 7/7/03  
Applicant:                              Timex Corporation  
Model / Serial No.:                      M568/850  
Product Type:                              GPS Speed and Distance System  
Power Supply:                              4.5 Volt (Battery)  
Manufacturer:                              Same As Applicant  
License holder:                              Same As Applicant  
Address:                                      555 Christian Road  
    Middlebury, CT 06762  
Test Type:                                      **Compliance Investigation**  
Test Project Number:                      03ME09617  
References(s)                              FCC ID: EP9TMXM850 (Permissive 2 change)

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## **1.0 GENERAL - Product Description**

The GPS speed and distance system is composed of two units a transceiver (M850) and a receiver (M568) watch.

The EUT (Equipment under Test) was configured in a typical user configuration. The Timex M850 is a 137.5KHz mark and 141KHz space radio transmitter used in conjunction with the receiver located inside a wristwatch (M568). The receiver receives the transmitted radio signals, decodes it and displays the information on the LCD screen of the watch. The system uses an FSK (frequency shift keying) based simplex data communication scheme. The data rate does not exceed 1024 baud. The system is designed to function up to a maximum distance of 1 meter between transmitter and receiver.

The Transmit antenna is permanently attached to the M850 Transceiver.

## 1.1 Device Configuration During Test

The transceiver is a new version of the existing M850 Speed + Distance transmitter. This new version operates exactly the same as the existing transceiver and will be marketed with our existing watch receivers. It has the same RF transmitting characteristics; however the differences include changes to the PCB, case, and tuning circuitry. The testing is to verify the Fundamental Frequency output power at the antenna port has not change In addition, all spurious emission are still in compliance with the applicable limits. This change to the product would fall under FCC a Class 2 Permissive change.

1. Simply pressing and releasing the button on the front of the unit turned on the GPS unit. A red LED will begin flashing which indicates the unit is trying to acquire a satellite signal. Because of testing indoors you won't be able to sync to a satellite signal, however the unit will be transmitting RF data to the watch.

Pressing the S+D button on the watch turned on the RF operation of the watch receiver. As long as the watch is within approximately 1 meter from the transmitter the message "SEARCHING" will appear on the top line of the watch display. As long as the flashing red light on the GPS transceiver and the SEARCHING message on the watch appear the system is in a normal operating state, i.e. the GPS box is transmitting RF data to the watch every 3.57 seconds.

Device	Manufacturer	Model Number	Serial Number	FCC ID
Transceiver	Timex	M850	Prototype	EP9TMXM850
Receiver	Timex	M568	CR 2025	-----

**Note:** The EUT was investigated and the orientation and position depicted in the report was deemed worst-case emissions.

"The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report"

## 1.2 Deviations from ANSI C63.4

Not Applicable

## 1.3 Device Modifications Necessary for Compliance

NA

## 1.4 Test Summary

Test	Basic Standard	Considered	Tested	In Compliance
Conducted Voltage Emissions	FCC Subpart C, Class B	Yes	Not applicable EUT operates on batteries	Yes
Radiated Emissions	FCC Subpart C, Class B	Yes	Yes	Yes

### Environmental conditions in the lab:

	<u>Range</u>
Temperature:	20-25°C
Relative Humidity	30 - 65 %
Atmospheric pressure	680 - 1060 mbar

## **1.5 FCC Labeling Information**

Not requested by the applicant

## **2.0 EMISSIONS TEST REGULATIONS**

FCC Part 15, Subpart B (15.109).  
FCC Part 15, Subpart C; (15.209).  
Mark Frequency 137.5 KHz  
Space Frequency 141.0 KHz

## **2.1 EUT OPERATION MODE - EMISSIONS TESTS**

As per manufacturer's instructions: The receiver receives the transmitted radio signals, decodes it and displays the information on the LCD screen of the watch. The system uses an FSK (frequency shift keying) based simplex data communication scheme. The data rate does not exceed 1024 baud. The system is designed to function up to a maximum distance of 1 meter between transmitter and receiver.

### **2.1.1 Conducted Click Emissions Tests**

Test Not Applicable

The EUT does not contain devices, which produce transient emissions as defined by the standard.

### **2.1.2 Conducted Emissions Tests**

Test Not Applicable

The GPS Transceiver operates on three 1.5-volt DC batteries.

### 2.1.3 Radiated Emissions Test (10 Meter Semi-Anechoic Chamber)

#### Test Applicable

Temperature:	21.0°C	
Humidity:	41.1 %RH	
Pressure:	1015 mbar	
Date test performed:	17 June 03	
Measurement distance:	3 Meters	
Frequency Range:	9kHz - 30MHz	Electric
	30MHz - 1000MHz	Electric
	1GHz - 7.5GHz	Electric

9kHz – 30MHz a Magnetic Loop Antenna was utilized. The limit was adjusted using the 40dB/decade-limit extrapolation method. In addition, the electric field strengths when measured with the loop antenna were maximized about the antenna full azimuth during test.

30MHz – 7.5GHz the measurement was made throughout the frequency banned on the EUT.

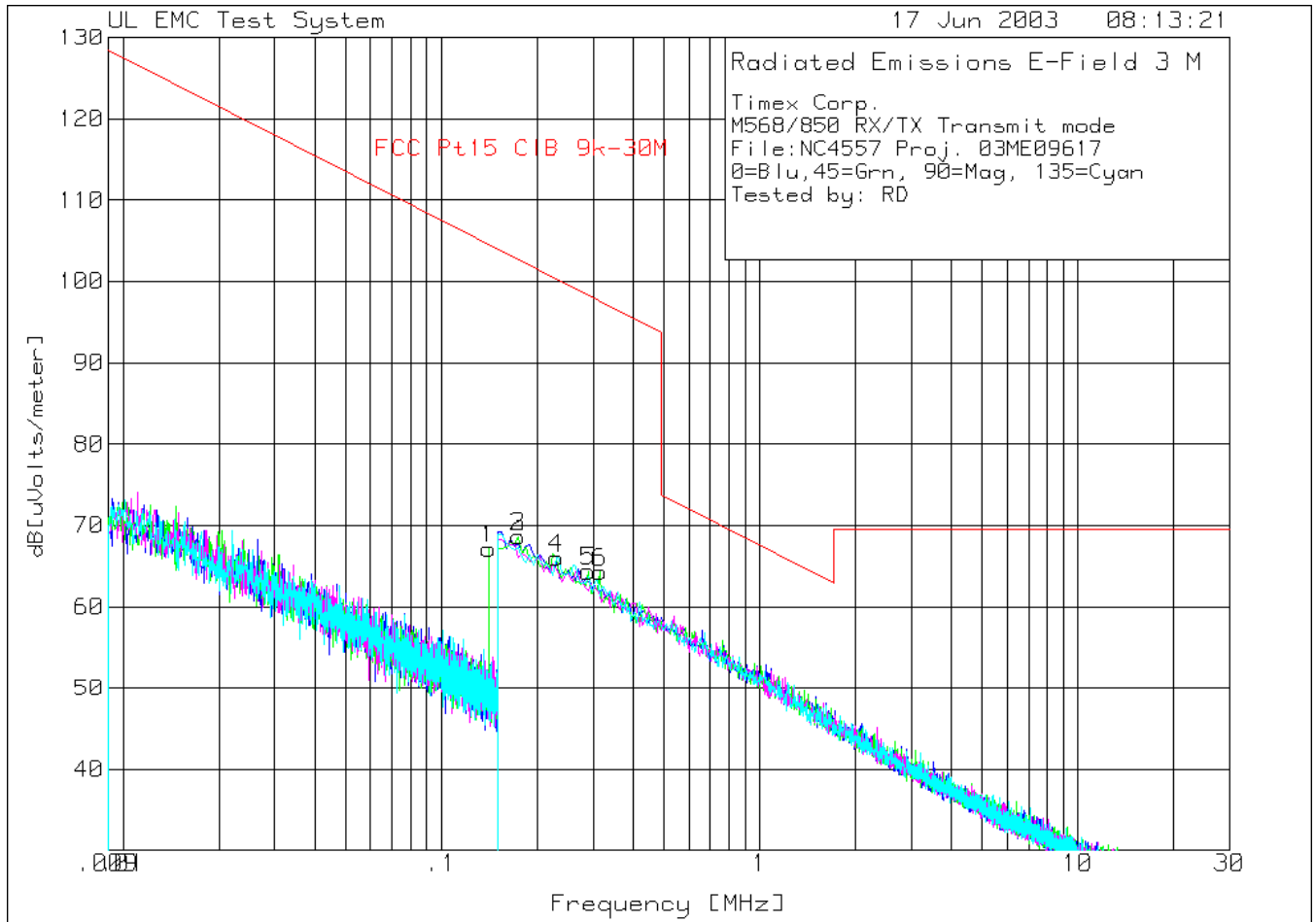
Tests were performed on the transmitter in accordance with the limitation set forth by CFR47 FCC Part 15 Subpart C Paragraph 15.209 and tested in accordance with the test procedures and methodologies in ANSI C63.4: 2001.

The EUT was checked throughout the frequency band 9kHz to 7.5GHz. The transmitter operated at 137.5 -141kHz. The allowable field strength limits in accordance with 15.209 were applied to the fundamental frequency. All other emissions were tested in accordance with the general limitations 15.209.

All frequencies were evaluated and the plots enclosed show worst-case emissions.







File Number: NC4557  
 Project Number: 03ME09617  
 Model Number: M568/850  
 FCC ID: EP9TMXM850

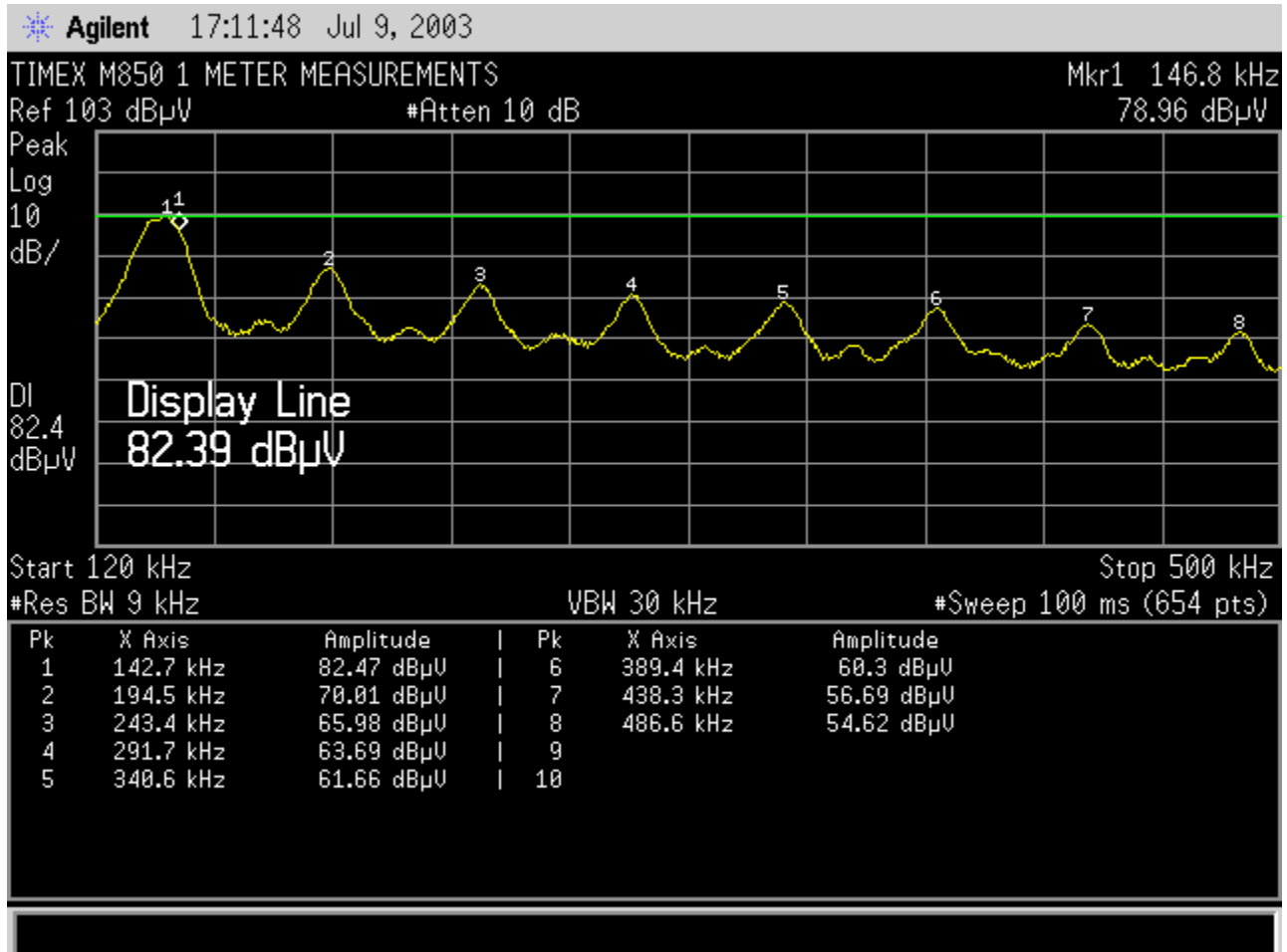
Issued: 7/7/03

Timex Corp.  
 M568/850 RX/TX Transmit mode  
 File:NC4557 Proj. 03ME09617  
 0=Blu,45=Grn, 90=Mag, 135=Cyan  
 Tested by: RD

No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1
=====						
.009 - .15MHz -----						
1	.14097 Azimuth:184	50.83 pk Height:122	.1 Horz	16.2 Margin [dB]	67.13	104.6 -37.47
.15 - 30MHz -----						
2	.17488 Azimuth:276	52.62 pk Height:122	.1 Horz	15.9 Margin [dB]	68.62	102.7 -34.08
3	.17488 Azimuth:276	52.62 pk Height:122	.1 Horz	15.9 Margin [dB]	68.62	102.7 -34.08
4	.22961 Azimuth:19	50.42 pk Height:122	.1 Horz	15.5 Margin [dB]	66.02	100.4 -34.38
5	.28932 Azimuth:2	49.06 pk Height:122	.1 Horz	15.2 Margin [dB]	64.36	98.4 -34.04
6	.3142 Azimuth:2	48.98 pk Height:122	.1 Horz	15.2 Margin [dB]	64.28	97.7 -33.42

LIMIT 1: FCC Pt15 ClB 9k-30M

pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector  
 avlg - denotes average log detection  
 avem - denotes EMI average detection  
 tm - Trace Math Result



Sweep 120khz to 500khz the harmonics frequencies measured at 1 meter

File Number: NC4557  
 Project Number: 03ME09617  
 Model Number: M568/850  
 FCC ID: EP9TMXM850

Issued: 7/7/03

Timex Corp.  
 M568/850 RX/TX Transmit mode  
 File:NC4557 Proj. 03ME09617  
 0=Blu,45=Grn, 90=Mag, 135=Cyan  
 Tested by: JD  
 Data measured at 1 meter and extrapolated back to 3 meters.

No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB [uVolts/meter]	Limit:1
=====						
0.15MHz - 500KHz						
1	.1945	34.19avg	.1	15.4	49.59	104.6
				Margin [dB]		-55.01
2	.2434	35.62avg	.1	15.2	50.92	102.7
				Margin [dB]		-51.78
3	.2917	28.45avg	.1	15.2	43.75	100.4
				Margin [dB]		-56.65
4	.3406	16.22avg	.1	15.2	31.52	98.4
				Margin [dB]		-66.88
5	.3894	24.17avg	.1	15.1	39.37	97.7
				Margin [dB]		-58.33
6	.4866	11.59avg	.1	15.1	26.79	97.7
				Margin [dB]		-70.91

LIMIT 1: FCC Pt15 ClB 9k-30M

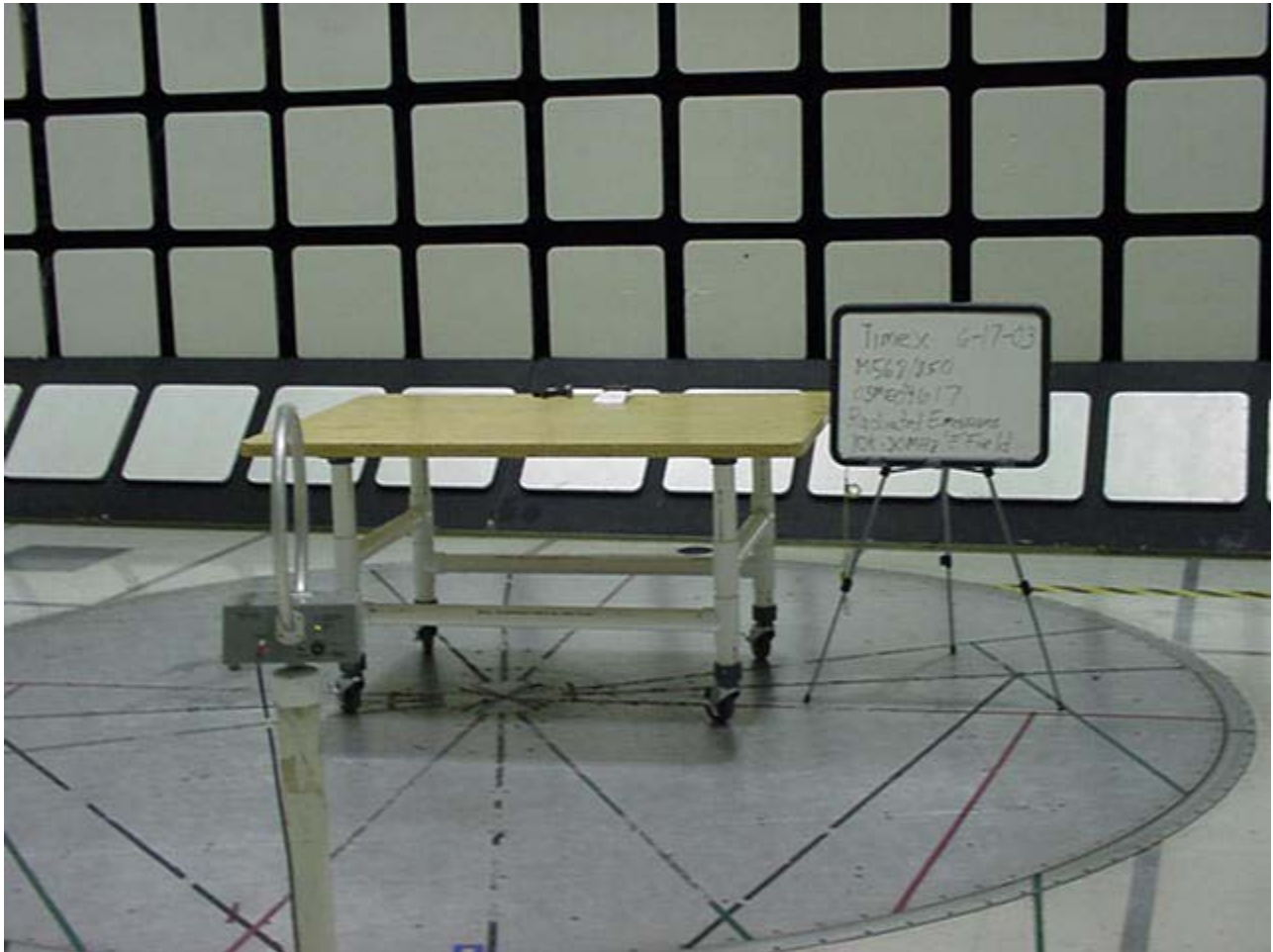
pk - Peak detector  
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 avem - denotes EMI average detection  
 tm - Trace Math Result

The emission where the system noise floor was above the fundamental was checked with the antenna at 1 meter and the data was extrapolated back to 3 meters.

Emissions were measured at 1 meter between 150kHz and 500kHz and the data is shown above.

File Number: NC4557  
Project Number: 03ME09617  
Model Number: M568/850  
FCC ID: EP9TMXM850

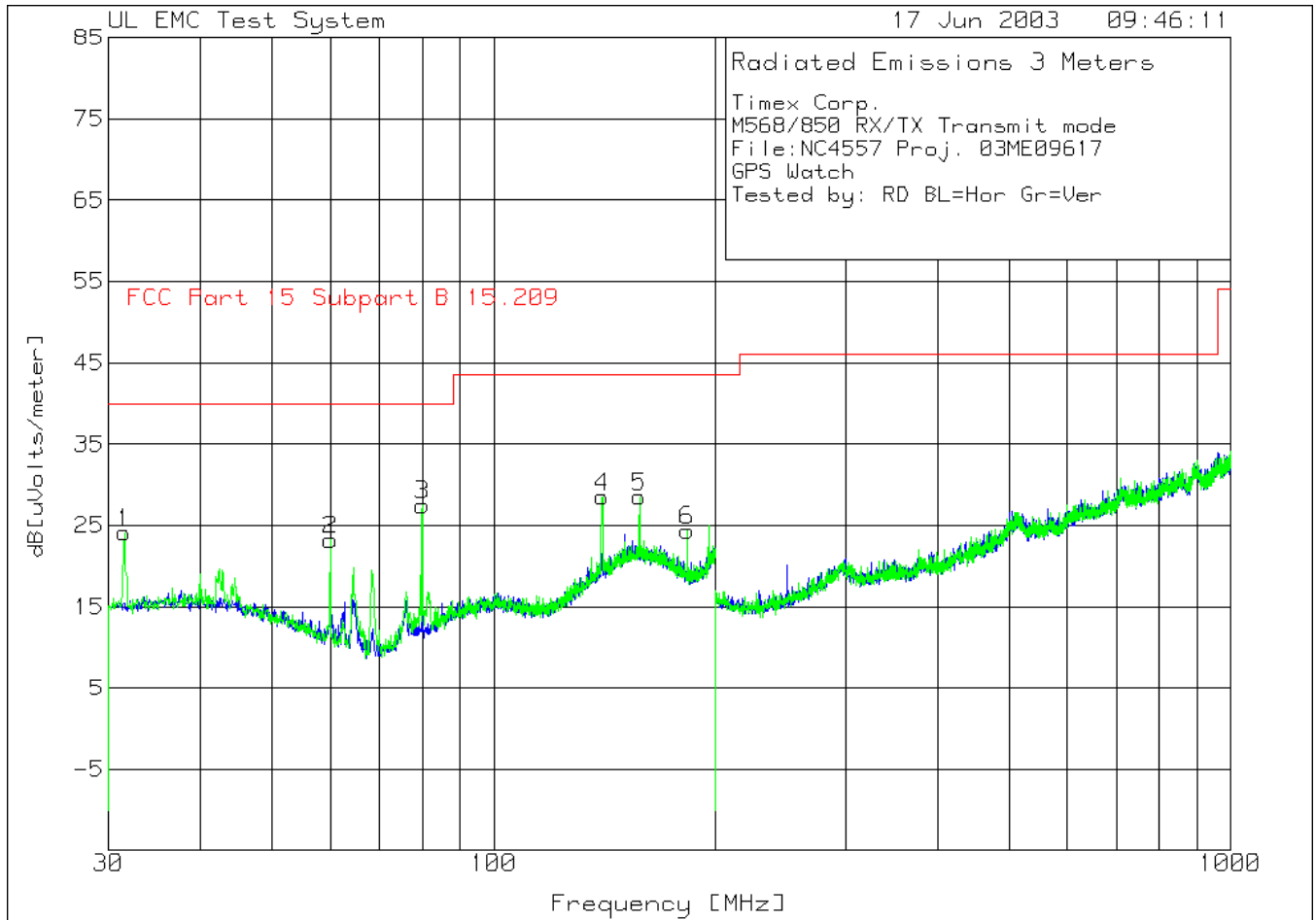
Issued: 7/7/03



Radiated Emission, 9KHz to 30 MHz test Set-up Front View



Radiated Emission, 9KHz to 30 MHz Test Set-Up Rear View



File Number: NC4557  
 Project Number: 03ME09617  
 Model Number: M568/850  
 FCC ID: EP9TMXM850

Issued: 7/7/03

Timex Corp.  
 M568/850 RX/TX Transmit mode  
 File:NC4557 Proj. 03ME09617  
 GPS Watch  
 Tested by: RD BL=Hor Gr=Ver

No.	Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1
-----	--------------------	-------------------------------	-----------------------------	------------------------------	---------------------------	---------

Vertical 30 - 200MHz						
1	31.5308	10 pk	.9	13.2	24.1	40
	Azimuth:358	Height:100	Vert	Margin [dB]		-15.9
2	60.02	14.33 pk	1.1	7.8	23.23	40
	Azimuth:290	Height:122	Vert	Margin [dB]		-16.77
3	80.005	17.8 pk	1.3	8.4	27.5	40
	Azimuth:222	Height:122	Vert	Margin [dB]		-12.5
4	140.3002	11.8 pk	1.7	15	28.5	43.5
	Azimuth:355	Height:122	Vert	Margin [dB]		-15
5	157.6488	9.79 pk	1.8	16.9	28.49	43.5
	Azimuth:357	Height:122	Vert	Margin [dB]		-15.01
6	183.0765	8.26 pk	1.9	14.2	24.36	43.5
	Azimuth:20	Height:122	Vert	Margin [dB]		-19.14

LIMIT 1: FCC Part 15 Subpart B 15.209

pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector  
 avlg - denotes average log detection  
 avem - denotes EMI average detection  
 tm - Trace Math Result

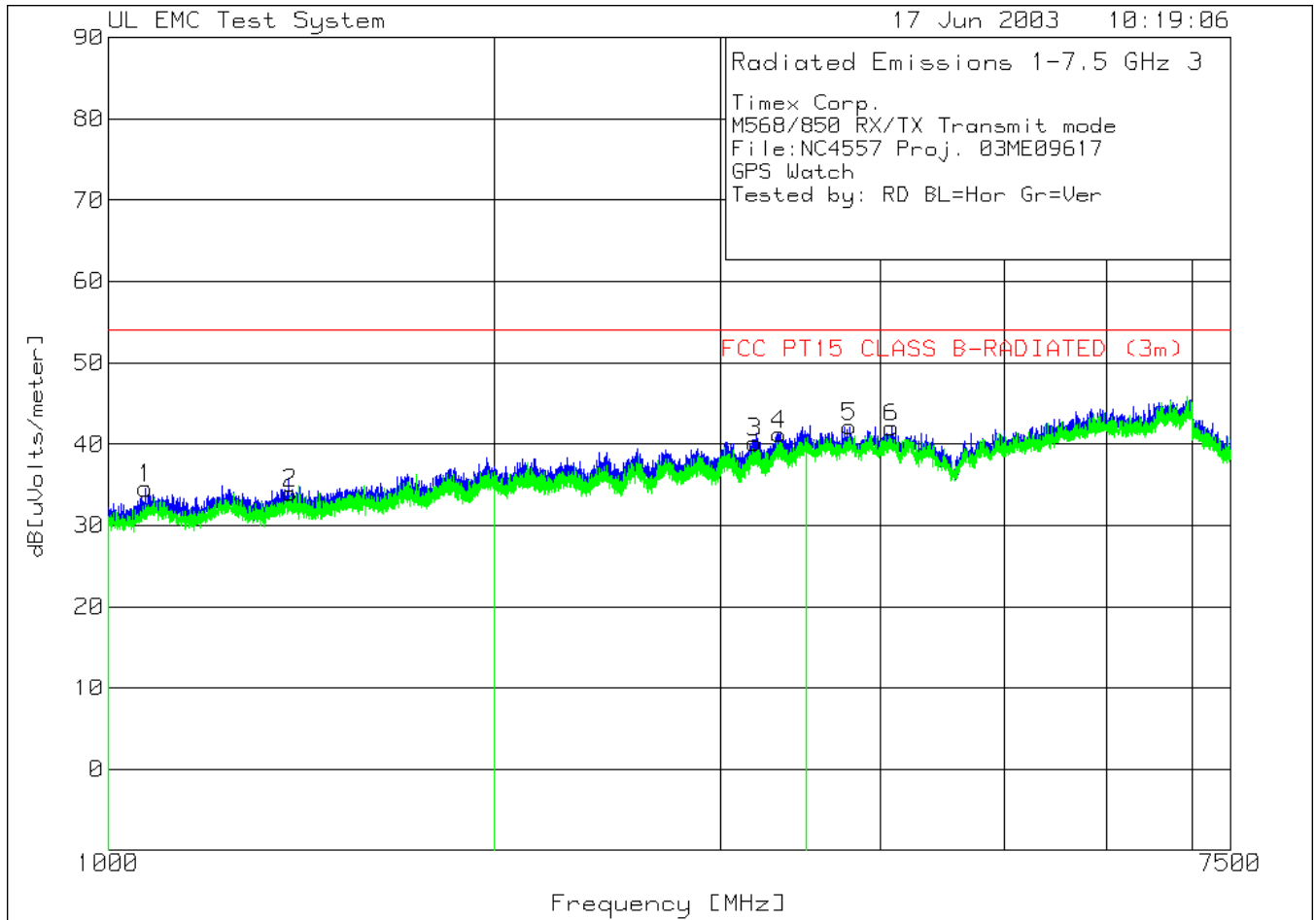




Radiated Emission, 30 MHz to 1000 MHz Test Set-Up Front View



Radiated Emission, 30 MHz to 1000 MHz Test Set-Up Rear View



File Number: NC4557  
 Project Number: 03ME09617  
 Model Number: M568/850  
 FCC ID: EP9TMXM850

Issued: 7/7/03

Timex Corp.  
 M568/850 RX/TX Transmit mode  
 File:NC4557 Proj. 03ME09617  
 GPS Watch

Tested by: RD BL=Hor Gr=Ver

No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1
-----						
Horizontal 1000 - 2000MHz -----						
1	1069.023	42.98 pk	-33.5	25.1	34.58	54
	Azimuth:303	Height:99	Horz	Margin [dB]		-19.42
2	1386.796	40.38 pk	-32.7	26.3	33.98	54
	Azimuth:331	Height:199	Horz	Margin [dB]		-20.02
-----						
Horizontal 2000 - 3500MHz -----						
3	3191.397	36.6 pk	-28.4	32	40.2	54
	Azimuth:10	Height:100	Horz	Margin [dB]		-13.8
4	3334.445	36.61 pk	-27.8	32.4	41.21	54
	Azimuth:200	Height:198	Horz	Margin [dB]		-12.79
-----						
Horizontal 3500 - 7500MHz -----						
5	3784.095	35.76 pk	-27.3	33.7	42.16	54
	Azimuth:358	Height:99	Horz	Margin [dB]		-11.84
6	4078.86	35.16 pk	-27.4	34.3	42.06	54
	Azimuth:306	Height:99	Horz	Margin [dB]		-11.94

LIMIT 1: FCC PT15 CLASS B-RADIATED (3m)

pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector  
 avlg - denotes average log detection  
 avem - denotes EMI average detection  
 tm - Trace Math Result



Radiated Emission, 1GHz to 7.5GHz Test Set-Up Rear View

File Number: NC4557  
Project Number: 03ME09617  
Model Number: M568/850  
FCC ID: EP9TMXM850

Issued: 7/7/03

### **Sample Calculation:**

Radiated Emission Limit Conversion from dBuV/m  
(Limits in accordance with paragraph 15.109)

$$\text{Radiated Emissions Limit (dBuV/m)} = 20 * \log (\text{uV/m})$$

$$\text{Radiated Emissions Limit (dBuV/m)} = 20 * \log (90)$$

$$\text{Radiated Emissions Limit (dBuV/m)} = 39.0$$

Radiated Emissions test data obtained during measurements.

$$\text{Field strength (dBuV / m)} = \text{Measured field strength (dBuV)} + \text{Antenna factor (dB)} + \text{cable factor (dB)}.$$

$$\text{Field strength (dBuV / m)} = 51.1 \text{ dBuV/m} + 15.8 \text{ dB} + 0.3 \text{ dB}.$$

$$\text{Field strength (dBuV / m)} = 71.3$$

Radiated Emissions Limit conversion from uV/m to dBuV/m add 40 dB / Decade.  
(The limits are in accordance with paragraph 15.209).

Radiated Emissions Limits General Requirements.

Frequency 0.009-0.490 MHz,

$2400/F$  (kHz) at 300 meters = Field strength in uV/meter.

Frequency = 9KHz.

$2400/(9)$  at 300 meters

Radiated Emission at 9 kHz at 300 meters = 266.6uV/meter.

$\text{dBuV/m } 20 * \log (266.6\text{uV/m})$ .

$\text{dBuV/M} = 48.5$  at 300 meters.

Add 40 dB /decade

300meters to 3 meters = 80 dB.

Radiated Emission Limit =  $\text{dBuV/m} + \text{dB}$ .

$48.5 + 80$

128.5dBuV/m

Magnetic field conversion of the active loop antenna:

The magnetic field reading was converted to an electrical field reading by adding the electric field factors (dB) to the field strength reading. The electric antenna factors are established at the time of the antenna calibration.

Antenna factor (dB) + constant = Field strength dBuV/m

At 100 kHz  $16.4 + 51.5 = 67.9$

File Number: NC4557  
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Model Number: M568/850  
FCC ID: EP9TMXM850

Issued: 7/7/03

### 3.0 SUMMARY:

The equipment under test has

Met the technical requirements as defined under section(s) 2.0

Test Start Date: 6/16/03

Test Completion Date: 6/16/03

#### - UNDERWRITERS LABORATORIES, INC. -

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