

File Number: NC4557
Project Number: 02ME14144
Model Number: M515
FCC ID: EP9TMXM515

Issued: 9/9/2002

Underwriters Laboratories Inc.
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**Report of Measurements
of Electromagnetic Compatibility Testing**

Test Report File No. :	NC4557	Date of issue: 9/9/2002
Applicant :	Timex Corporation	
Model Number	M515	
Product Type :	Heart Rate Monitor	
Power Supply :	3.0 VDC (Battery)	
Manufacturer :	Same As Applicant	
License holder :	Same As Applicant	
Address :	P.O Box 310	
	Middlebury, CT 06762	
Test Type :	☒ Compliance Investigation ☐ Manufacturer's Specification	
Test Project Number :	02ME04169	
References(s)	FCC ID: EP9TMXM515	

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1.0 G E N E R A L - Product Description

The Fitness System is a combination of heart rate monitor (M515) and a sports watch (M516). The heart rate monitor senses your heart rate on the chest. It calculates your heart rate and transmits it to the watch. One will simple glance at the watch display during exercise/training to make sure you are in the appropriate heart rate range this will help maintain or improve your fitness level. If set, an out of zone alarm will automatically alert you when you are not in your selected heart rate range.

The Transmit antenna is permanently attached to the M515 Transmitter.

1.1 Device Configuration During Test

Device	Manufacturer	Model Number	Serial Number	FCC ID
Watch (Receiver)	Timex	M516	N/A	-----
Body Simulator	Timex	HC841	Prototype	-----
Transmitter	Timex	M515	17	EP9TMXM515
Cable	Manufacturer	Shielding	Shield Bonding	Type
Coaxial Cable	Timex	Yes	-----	-----

Note: The EUT orientation was tested in a vertical axis, which 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"

Per FCC Part 2.1093 (C) this device is not required to undergo testing for radio-frequency radiation exposure.

In the frequency range 9 KHz to 70 KHz inherent instrument peak noise was observed and measured.

1.2 Deviations from ANSI C63.4

☒ Not Applicable

☐ As described below:

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1.3 Device Modifications Necessary for Compliance

☒ N/A

☐ As described below:

1.4 Test Summary

Test	Basic Standard	Considered	Tested	In Compliance
Conducted Voltage Emissions	FCC Subpart C, Paragraph 15.207	Yes	Not applicable EUT operates on batteries	N/A
Radiated Emissions	FCC Subpart C, Paragraph 15.209	Yes	Yes	Yes

Environmental conditions in the lab:

Temperature:	<u>Range</u> 20-25°C
Relative Humidity	30 - 60 %
Atmospheric pressure	680 - 1060 mbar

2.0 EMISSIONS TEST REGULATIONS

FCC Part 15, Subpart C; (15.209).
The Mark Frequency 137.5KHz
The Space Frequency 141.03KHz

2.1 EUT OPERATION MODE - EMISSIONS TESTS

- ☐ Standby
- ☐ Test program (H-Pattern)
- ☐ Test program (color bar)
- ☐ Test program (customer specific)
- ☐ Practice operation
- ☐ Normal operation Mode:
- ☒ 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 Emissions Tests

☐ Test Applicable ☒ Test Not Applicable

The Transmitter operates on a 3Volt Nicad battery.

2.1.2 Radiated Emissions Test (10 Meter Semi-Anechoic Chamber)

☒ Test Applicable

☐ Test Not Applicable

Measurement distance: ☒ 3 ☐ 10 meters

Frequency Range: ☐ 50Hz – 10kHz ☐ Magnetic
Measurement Distance for 50Hz – 10kHz
☐ 10cm (Rack mount Equipment)
☐ 1m (Equipment not intended to be rackmounted.)
☒ 9kHz - 30MHz ☐ Magnetic ☒ Electric
☒ 30MHz - 1000MHz ☒ Electric
☐ 1GHz - 2GHz ☐ Electric
☐ 1GHz - 5GHz ☐ Electric
☐ 1GHz - 7.5GHz ☐ Electric
☐ 1GHz - 10GHz ☐ Electric

9kHz – 30MHz a Magnetic Loop Antenna was utilized. The measurement antennas distance 3 meters from the EUT. The limit was adjusted using the 40dB/decade-limit extrapolation method.

30MHz – 1000MHz the measurement antennas distance 3 meters from 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 1000MHz. The transmitter operated at 137.5 to 141.03 kHz. 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.

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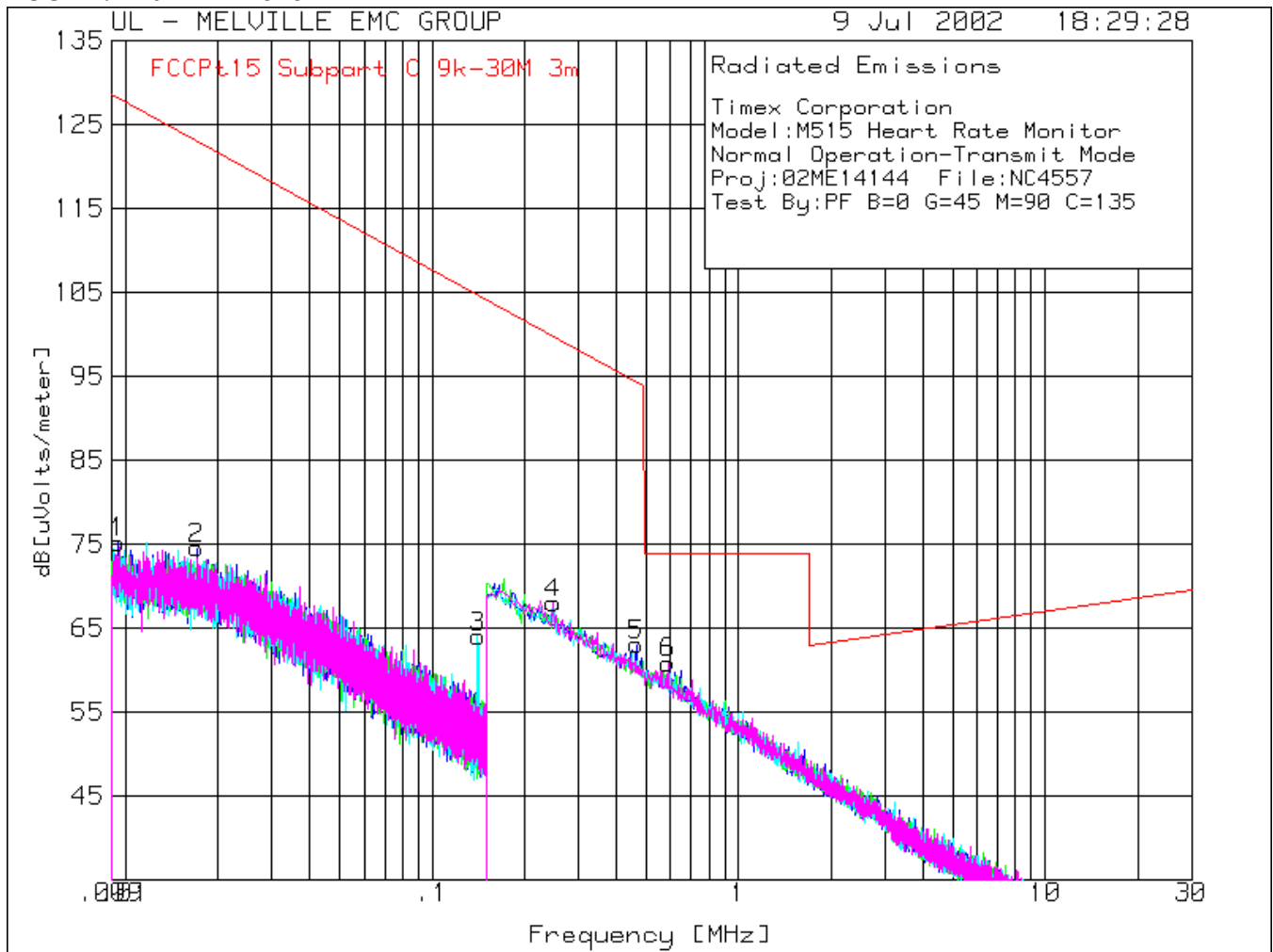
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Test equipment used for final radiated emissions tests:

☒ HP 8574A	Hewlett-Packard	EMI Receiver,	Equipment No.: ME5A-461
Range: 9KHz – 1GHz	Last Calibration Date: 30 April 02	Calibration Due Date: 25Jan 03	
Consisting of:			
HP - 8566B	Hewlett-Packard	Spectrum Analyzer,	
	Resolution BW: 9KHz:	150KHz—30MHz	
	120KHz	30MHz—1000MHz	
	Video BW: 3KHz	9KHz to 150KHz	
		150KHz to 30MHz	
	300KHz	30 – 1000MHz	
	QPBW: 200 Hz	9 to 150KHz	
	9KHz	150KHz to 30MHz	
	120KHz	30 to-1000MHz	
HP - 85662A	Hewlett-Packard	Analyzer Display	
HP - 85650A	Hewlett-Packard	Quasi-Peak Adapter,	
	BW: 120kHz		
HP - 85685A	Hewlett-Packard	Preselector	

Test Accessories for Radiated Emissions:

☒ 94455-1	Ailtech	Biconnical Antenna	Equipment No.: ME5-439
Last Calibration Date: 16 October 01	Calibration Due Date: 16 October 02		
☒ 3146	EMCO	Log Periodic Antenna	Equipment No.: ME5-451
Last Calibration Date: 15 October 01	Calibration Due Date: 15 October 02		
☒ 8447D	Hewlett Packard	10k-1.3GHz Pre-Amp	Equipment No.:ME5A-652
☒ 6507	EMCO	Active Loop Antenna	Equipment No.:ME5A-288
Last Calibration Date: 07 March 02	Calibration Due Date: 07 March 03		
☒ Temp/Pressure	Oakton	Barometer	Equipment No.: ME4-263
Last Calibration Date: 02 April 02	Calibration Due Date: 02 April 03		
☒ 453320	Ex-Tech	Hydro-Thermometer	Equipment No.: ME4-264
Last Calibration Date: 02 April 02	Calibration Due Date: 02 April 03		



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Timex Corporation
Model:M515 Heart Rate Monitor
Normal Operation-Transmit Mode
Proj:02ME14144 File:NC4557
Test By:PF B=0 G=45 M=90 C=135

No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1
=====						
Range: 1 .009 - .15MHz -----						
1	.00944	48.66 pk	.1	26.44	75.2	128.09
	Azimuth:160	Height:102	Horz	Margin [dB]		-52.89
2	.01704	50.19 pk	.1	24.21	74.5	122.96
	Azimuth:18	Height:102	Horz	Margin [dB]		-48.46

Range: 2 .15 - 30MHz -----						
5	.46314	47.51 pk	.15	15.34	63	94.29
	Azimuth:132	Height:102	Horz	Margin [dB]		-31.29

Range: 5 .009 - .15MHz -----						
3	.141	47.81 pk	.12	16.07	64	104.61
	Azimuth:301	Height:148	Horz	Margin [dB]		-40.61

Range: 8 .15 - 30MHz -----						
4	.24842	52.35 pk	.15	15.5	68	99.7
	Azimuth:16	Height:168	Horz	Margin [dB]		-31.7
6	.5884	45.44 pk	.16	15.3	60.9	73.8
	Azimuth:2	Height:168	Horz	Margin [dB]		-12.9

LIMIT 1: FCCPt15 Subpart C 9k-30M 3m						
LIMIT 2: NONE						
LIMIT 3: NONE						
LIMIT 4: NONE						
LIMIT 5: NONE						
LIMIT 6: NONE						

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

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Timex Corporation
M515 System Harmonic Emission
Heart Rate Monitor
Proj: 02ME14144 File:NC4557
Tested By: PF Blue=H Green=V

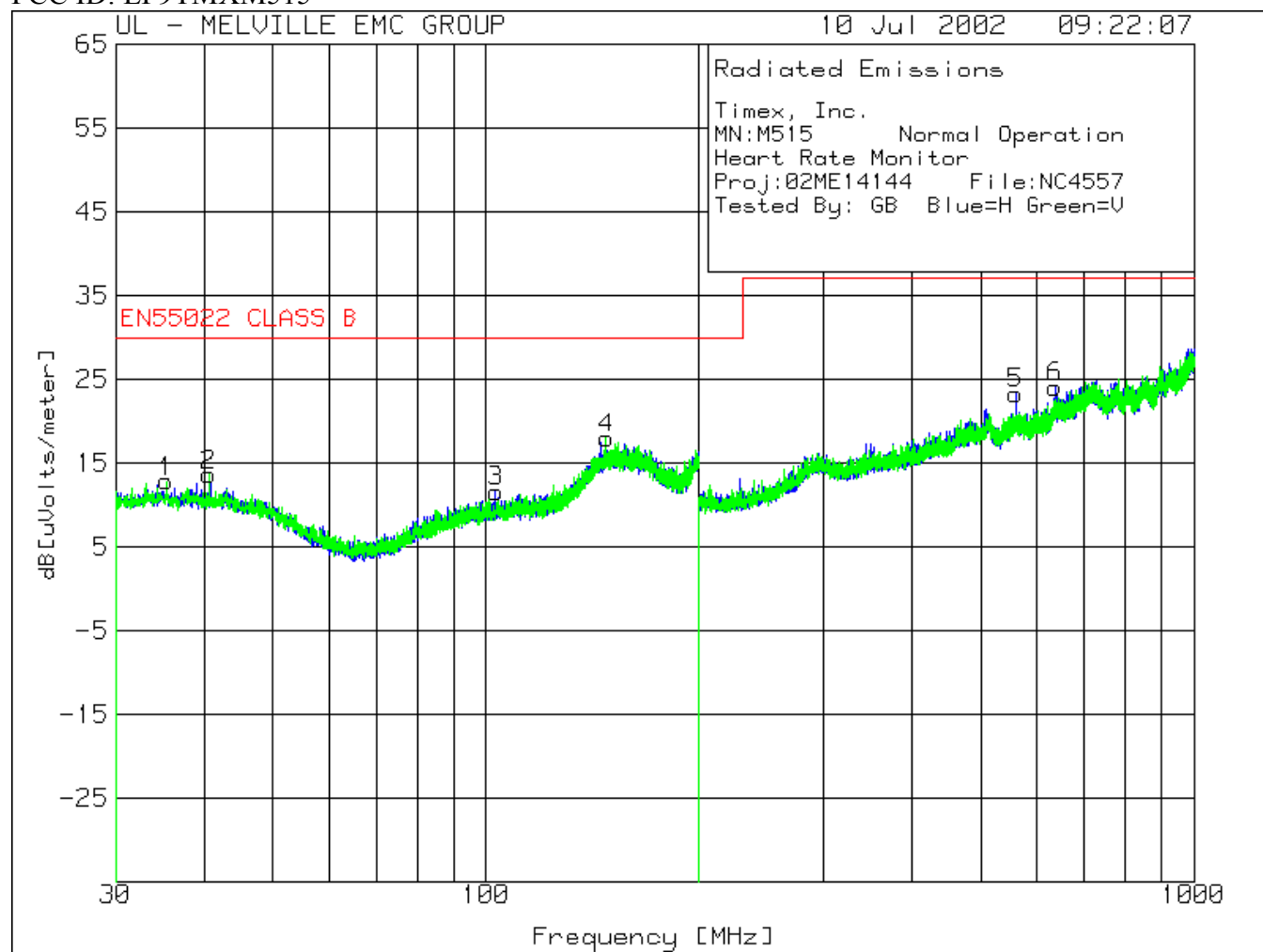
Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1
=====					
Range: 1 .009 - .15MHz					
.141	63.74 av	.12	15.55	79.41	104.75
Azimuth: 0		Height:100 Horz	Margin [dB]:		-25.34
Range: 2 .15 - 30MHz					
.275	56.61 av	-26.85	15.2	44.96	98.99
Azimuth: 0		Height:100 Horz	Margin [dB]:		-54.03
.2757	56.54 av	-26.85	15.2	44.89	98.96
Azimuth: 0		Height:100 Horz	Margin [dB]:		-54.07
.282	56.48 av	-26.85	15.2	44.83	98.77
Azimuth: 0		Height:100 Horz	Margin [dB]:		-53.94
.4117	53.62 av	-26.85	15.09	41.86	95.5
Azimuth: 0		Height:100 Horz	Margin [dB]:		-53.64
.4228	53.43 av	-26.85	15.08	41.66	95.27
Azimuth: 0		Height:100 Horz	Margin [dB]:		-53.61
.5519	52.06 av	-26.84	14.95	40.17	72.96
Azimuth: 0		Height:100 Horz	Margin [dB]:		-32.79
.563	51.82 av	-26.84	14.94	39.92	72.79
Azimuth: 0		Height:100 Horz	Margin [dB]:		-32.87
.705	49.26 av	-26.84	15.11	37.53	70.8
Azimuth: 0		Height:100 Horz	Margin [dB]:		-33.27

LIMIT 1: FCC Pt15 C 9kHz-30MHz 3m
LIMIT 2: NONE
LIMIT 3: NONE
LIMIT 4: NONE
LIMIT 5: NONE
LIMIT 6: NONE

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qp - Quasi-Peak detector
av - Average detector
avlg - Average log detector

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Timex, Inc.
MN:M515 Normal Operation
Heart Rate Monitor
Proj:02ME14144 File:NC4557
Tested By: GB Blue=H Green=V

No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1
=====						
Range: 1 30 - 200MHz -----						
3	103.2151	27.61 pk	-27.01	11	11.6	30
	Azimuth:349	Height:300	Horz	Margin [dB]		-18.4

Range: 2 30 - 200MHz -----						
1	35.351	26.87 pk	-27.67	13.6	12.8	30
	Azimuth:191	Height:101	Vert	Margin [dB]		-17.2
2	40.6595	28.06 pk	-27.64	13.18	13.6	30
	Azimuth:73	Height:200	Vert	Margin [dB]		-16.4
4	147.7642	28.24 pk	-26.48	16.24	18	30
	Azimuth:7	Height:200	Vert	Margin [dB]		-12

Range: 3 200 - 1000MHz -----						
5	559.567	30.52 pk	-25.7	18.48	23.3	37
	Azimuth:18	Height:400	Horz	Margin [dB]		-13.7
6	637.2356	29.65 pk	-25.45	19.9	24.1	37
	Azimuth:125	Height:100	Horz	Margin [dB]		-12.9

LIMIT 1: EN55022 CLASS B
LIMIT 2: NONE
LIMIT 3: NONE
LIMIT 4: NONE
LIMIT 5: NONE
LIMIT 6: NONE

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Sample Calculation:

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

Radiated Emissions Limit (dBuV/m) = $20 \cdot \log(uV/m)$
Radiated Emissions Limit (dBuV/m) = $20 \cdot \log(90)$
Radiated Emissions Limit (dBuV/m) = 39.0
Radiated Emissions test data obtained during measurements.

Field strength (dBuV / m) = Measured field strength (dBuV) + Antenna factor (dB) + cable factor (dB).
Field strength (dBuV / m) = 51.1 dBuV/m + 15.8 dB + 0.3 dB.
Field strength (dBuV / m) = 71.3

Radiated Emissions Limit conversion from Uv/m to dBuV/m add 40 dB / Decade.
(Limits in accordance with paragraph 15.209).

Radiated Emissions Limits General Requirements.

Frequency between 0.009-0.490 MHz,
 $2400/F$ (kHz) at 300 meters = Field strength in uV/meter.
Fundamental Frequency = 9KHz.
 $2400/(9KHz)$ at 300 meters
Radiated Emission at 9 kHz at 300 meters = 266.6Uv/meter.
dBuV/m $20 \cdot \log(266.6uV/m)$.
dBuV/M = 48.5 at 300 meters.
Add 40 dB /decade
300meters to 3 meters = 80 dB.
Radiated Emission Limit = dBuV/M + 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 $16.4 + 51.5 = 67.9$.

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3.0 SUMMARY:

The equipment under test has

☒ met the technical requirements as defined under section(s) ☒ 2.0 and ☐ 3.0

☐ not met the technical requirements as defined under section(s) ☐ 2.0 and ☐ 3.0

Test Start Date: 2/4/02

Test Completion Date: 2/7/02

- UNDERWRITERS LABORATORIES, INC. -

Project Engineer



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Reviewer



Bob DeLisi (Ext.22452)
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International EMC Services
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