



# PCTEST ENGINEERING LABORATORY, INC.

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<http://www.pctestlab.com>



## CERTIFICATE OF COMPLIANCE FCC Part 90 Certification

**Applicant Name:**

Motorola Inc.  
1301 East Algonquin Road  
Schaumburg, IL 60196

**Date of Testing:**

12/29/06 - 1/17/07

**Test Site/Location:**

PCTEST Lab, Columbia, MD, USA

**Test Report Serial No.:**

0611291074.ABZ

**FCC ID:** ABZ89FT7619

**APPLICANT:** Motorola Inc.

**Model(s):** ML900

**EUT Type:** Mobile Computer with WLAN Module (802.11 a/b/g)

**Max. RF Output Power:** 0.126 W (21.0 dBm) Conducted (802.11a)

**Frequency Range:** 4950 – 4965 MHz

**FCC Classification:** Licensed Non-Broadcast Station Transmitter (TNB)

**FCC Rule Part(s):** Part 90 Subpart Y (a)

**Test Device Serial No.:** 602CB2CD

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947 and RSS-119.



I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

*Grant Conditions: Listed output power is conducted.*

*PCTEST certifies that no party to this application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 862.*



  
Randy Ortanez  
President

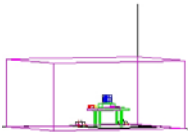


<b>FCC ID:</b> ABZ89FT7619		<b>FCC Part 90(Y) 802.11a TEST REPORT (CERTIFICATION)</b>		<b>Reviewed by:</b> Quality Manager
<b>Test Report S/N:</b> 0611291074.ABZ	<b>Test Dates:</b> 12/29/06 - 1/17/07	<b>EUT Type:</b> Mobile Computer with WLAN Module		Page 1 of 14

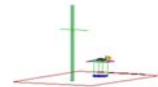
# TABLE OF CONTENTS

FCC PART 90 MEASUREMENT REPORT.....	3
1.0 INTRODUCTION .....	4
1.1 EVALUATION PROCEDURE .....	4
1.2 SCOPE .....	4
1.3 PCTEST TEST LOCATION .....	4
2.0 PRODUCT INFORMATION .....	5
2.1 EQUIPMENT DESCRIPTION .....	5
2.2 EMI SUPPRESSION DEVICE(S)/MODIFICATIONS.....	5
3.0 DESCRIPTION OF TEST .....	6
3.1 CONDUCTED EMISSIONS .....	6
3.2 RADIATED EMISSIONS.....	7
4.0 ANTENNA DESCRIPTION AND FREQUENCY LIST .....	8
5.0 TEST EQUIPMENT CALIBRATION DATA .....	9
6.0 TEST RESULTS .....	10
6.1 RADIATED SPURIOUS EMISSIONS MEASUREMENTS 802.11A MODE .....	11
7.0 CONCLUSION .....	14

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<b>Test Report S/N:</b> 0611291074.ABZ	<b>Test Dates:</b> 12/29/06 - 1/17/07	<b>EUT Type:</b> Mobile Computer with WLAN Module	Page 2 of 14	



## MEASUREMENT REPORT



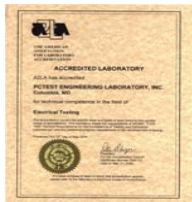
### FCC Part 90(Y)

#### A. § 2.1033 General Information

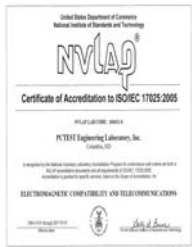
**APPLICANT:** Motorola Inc.  
**APPLICANT ADDRESS:** 1301 East Algonquin Road  
 Schaumburg, IL 60196  
**TEST SITE:** PCTEST ENGINEERING LABORATORY, INC.  
**TEST SITE ADDRESS:** 6660-B Dobbin Road, Columbia, MD 21045 USA  
**FCC RULE PART(S):** Part 90 Subpart Y  
**MODEL NAME:** ML900  
**FCC ID:** ABZ89FT7619  
**Test Device Serial No.:** 602CB2CD ☐ Production ☒ Pre-Production ☐ Engineering  
**FCC CLASSIFICATION:** Licensed Non-Broadcast Station Transmitter (TNB)  
**DATE(S) OF TEST:** 12/29/06 - 1/17/07  
**TEST REPORT S/N:** 0611291074.ABZ



### A.1 Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21045, U.S.A.



- PCTEST facility is an FCC registered (PCTEST Reg. No. 90864) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (IC-2451).
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing Aid Compatibility (HAC) testing, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (IC-2451) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS, CDMA, and EvDO wireless devices and for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.



FCC ID: ABZ89FT7619	 <b>FCC Part 90(Y) 802.11a TEST REPORT (CERTIFICATION)</b>		 <b>Reviewed by:</b> Quality Manager
Test Report S/N: 0611291074.ABZ	Test Dates: 12/29/06 - 1/17/07	EUT Type: Mobile Computer with WLAN Module	Page 3 of 14

## 1.0 INTRODUCTION

### 1.1 Evaluation Procedure

The measurement procedure described in ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004 and FCC Part 90 were used in the measurement of **Motorola Inc. Mobile Computer with WLAN Module FCC ID: ABZ89FT7619**.

Deviation from measurement procedure.....None

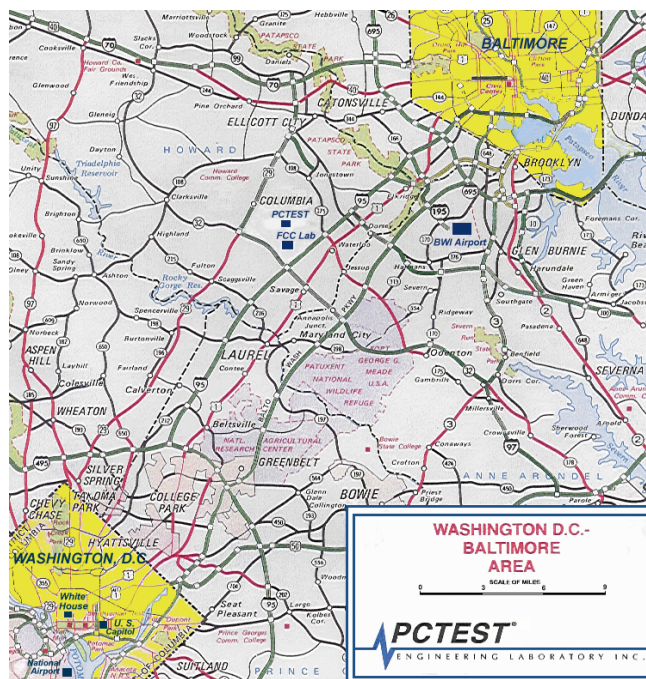
### 1.2 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.



### 1.3 PCTEST Test Location

The map at the right shows the location of the PCTEST LABORATORY, its proximity to the FCC Laboratory, the Columbia vicinity are, the Baltimore-Washington Intern'l (BWI) airport, the city of Baltimore and the Washington, DC area. (see Figure 1.3-1).

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility in New Concept Business Park, Guilford Industrial Park, Columbia, Maryland. The site address is 6660-B Dobbin Road, Columbia, MD 21045. The test site is one of the highest points in the Columbia area with an elevation of 390 feet above mean sea level. The site coordinates are 39° 11'15" N latitude and 76° 49'38" W longitude. The facility is 1.5 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. There are no FM or TV transmitters within 15 miles of the site. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2003 on January 27, 2006 and Industry Canada.



**Figure 1.3-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area**

FCC ID: ABZ89FT7619		FCC Part 90(Y) 802.11a TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0611291074.ABZ	Test Dates: 12/29/06 - 1/17/07	EUT Type: Mobile Computer with WLAN Module		Page 4 of 14

## 2.0 PRODUCT INFORMATION

### 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Motorola Inc. Mobile Computer with WLAN Module FCC ID: ABZ89FT7619**. The EUT is a mobile computer platform used for rugged environments and contains a WLAN 802.11 a/b/g module. The module has been previously FCC certified as a module (FCC ID: AZ489FT7023). The module is being integrated into the ML900 notebook. This test report covers test data for the radiated spurious emissions measurements for the module operating in the 802.11a mode. As no changes have been made to the original module the data at the antenna terminal remains valid and is covered by a separate test report.

The EUT consisted of the following component(s):

Manufacturer / Model	FCC ID	Description
Motorola Inc. / Model: ML900	ABZ89FT7619	Mobile Computer with WLAN Module

**Table 2-1. EUT Equipment Description**

The ML900 may consist of one or more of the following additional modules:



- |                |                     |
|----------------|---------------------|
| 1) GSM/ UMTS   | FCC ID: ABZ89FT7618 |
| 2) CDMA/ EvDO  | FCC ID: ABZ89FT7617 |
| 3) MOTOMESH    | FCC ID: ABZ89FT7616 |
| 4) Bluetooth   | FCC ID: ABZ89FT7620 |
| 5) 802.11a/b/g | FCC ID: ABZ89FT7615 |

- To comply with Oct02 TCB Q/A Feb04 TCB training notes, the unit was tested with both simultaneous and single transmission and the worst case data was reported.

### 2.2 EMI Suppression Device(s)/Modifications

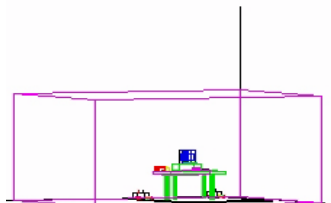
EMI suppression device(s) added and/or modifications made during testing.

- None

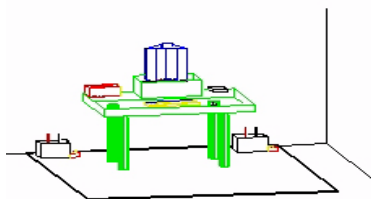
FCC ID: ABZ89FT7619		FCC Part 90(Y) 802.11a TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0611291074.ABZ	Test Dates: 12/29/06 - 1/17/07	EUT Type: Mobile Computer with WLAN Module		Page 5 of 14

## 3.0 DESCRIPTION OF TEST

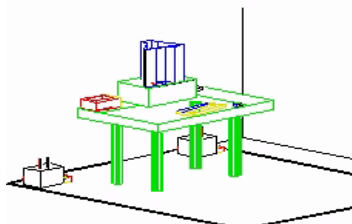
### 3.1 Conducted Emissions



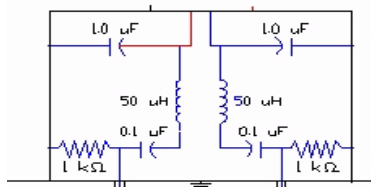
**Figure 3.1-1. Shielded Enclosure Line-Conducted Test Facility**



**Figure 3.1-2. Line Conducted Emission Test Set-Up**





**Figure 3.1-3. Wooden Table & Bonded LISNs**



**Figure 3.1-4. LISN Schematic Diagram**

The line-conducted facility is located inside a 16'x20'x10' shielded enclosure, manufactured by Ray Proof Series 81 (see Figure 3.1-1). The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-5. A 1m x 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 1.5m away from the sidewall of the shielded room (see Figure 3.1-2). Solar Electronics and EMCO Model 3725/2 (10kHz-30MHz) 50Ω/50μH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room (See Figure 3.1-3). The EUT is powered from the Solar LISN and the support equipment is powered from the EMCO LISN. Power to the LISNs are filtered by a high-current high-insertion loss Ray Proof power line filter (100dB 14Hz-10GHz). The purpose of the filter is to attenuate ambient signal interference and this filter is also bonded to the shielded enclosure. All electrical cables are shielded by braided tinned copper zipper tubing with an inner diameter of ½". If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the Solar LISN. The LISN schematic diagram is shown (See Figure 3.1-4). All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion). Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME from the EUT.

The spectrum was scanned from 150kHz to 30MHz with a spectrum analyzer. The detector function was set to CISPR quasi-peak and average mode. The bandwidth of the analyzer was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission. Each emission was maximized by: switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and/or support equipment, and powering the monitor from the floor mounted outlet box and the computer aux AC outlet, if applicable; whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in Exhibit B. Each EME reported was calibrated using the Agilent E8257D (250kHz – 20GHz) PSG Signal Generator.

FCC ID: ABZ89FT7619		FCC Part 90(Y) 802.11a TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0611291074.ABZ	Test Dates: 12/29/06 - 1/17/07	EUT Type: Mobile Computer with WLAN Module		Page 6 of 14



## 3.2 Radiated Emissions

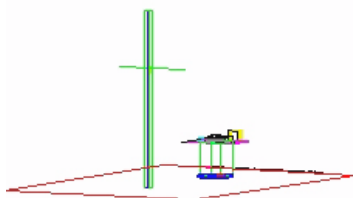


Figure 3.2-1. 3-Meter Test Site

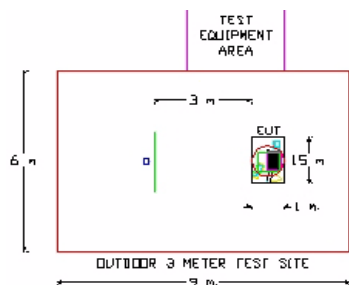


Figure 3.2-2. Dimensions of Outdoor Test Site

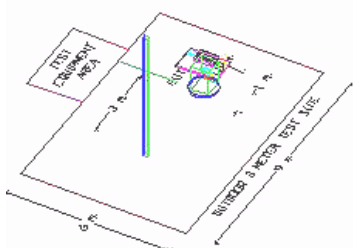


Figure 3.2-3. Turntable and System Setup

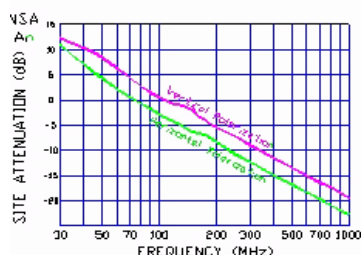




Figure 3.2-4. Normalized Site Attenuation Curves (H&V)

Preliminary measurements were made indoors at 1-meter using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, and turntable azimuth with respect to the antenna was noted for each frequency found. The spectrum was scanned from 30 to 200 MHz using a bi-conical antenna and from 200 to 1000 MHz using a log-spiral antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used.

Final measurements were made outdoors at 3-meter test range using Roberts<sup>TM</sup> Dipole antennas or horn antennas (see Figure 3.2-1). The test equipment was placed on a wooden and plastic bench situated on a 1.5m x 2m area adjacent to the measurement area (see Figure 3.2-2). Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The detector function was set to CISPR quasi-peak mode and the bandwidth of the spectrum analyzer was set to 100kHz for frequencies below 1GHz or 1MHz for frequencies above 1GHz. Above 1GHz the detector function was set to average mode (RBW = 1MHz, VBW = 10Hz).

The half-wave dipole antenna was tuned to the frequency found during preliminary radiated measurements. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1 x 1.5 meter table (see Figure 3.2-3). The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each EME emission. The turntable containing the system was rotated and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by: varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and/or support equipment, and powering the monitor from the floor mounted outlet box and the computer aux AC outlet, if applicable; and changing the polarity of the antenna, whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in Exhibit B. Each EME reported was calibrated using the Agilent E8257D (250kHz – 20GHz) PSG Signal Generator. The Theoretical Normalized Site Attenuation Curves for both horizontal and vertical polarization are shown in Figure 3.2-4.

FCC ID: ABZ89FT7619		FCC Part 90(Y) 802.11a TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0611291074.ABZ	Test Dates: 12/29/06 - 1/17/07	EUT Type: Mobile Computer with WLAN Module		Page 7 of 14

## 4.0 ANTENNA DESCRIPTION AND FREQUENCY LIST

### Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”



- The antennas of the Mobile Computer with WLAN Module are **permanently attached**.

### Conclusion:

The **Motorola Inc. Mobile Computer with WLAN Module FCC ID: ABZ89FT7619** unit complies with the requirement of §15.203.

Channel Spacing	Channel Center Frequency	Channel Spacing	Channel Center Frequency	Channel Spacing	Channel Center Frequency
5MHz	4942.5	10MHz	4945	20MHz	4950
	4947.5		4950		4955
	4952.5		4955		4960
	4957.5		4960		4965
	4962.5		4965		4970
	4967.5		4970		4975
	4972.5		4975		4980
	4977.5		4980		
	4982.5		4985		
	4987.5				

Table 4.1. Frequency/ Channel Operations, Mode 802.11a

FCC ID: ABZ89FT7619		FCC Part 90(Y) 802.11a TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0611291074.ABZ	Test Dates: 12/29/06 - 1/17/07	EUT Type: Mobile Computer with WLAN Module		Page 8 of 14





## 5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST).

Manufacturer	Model / Equipment	Calibration Date	Cal Interval	Calibration Due	Serial No.
Agilent	E4404B/E4407B ESA Spectrum Analyzer	04/20/06	Annual	04/20/07	US39210313
Agilent	N4010A Wireless Connectivity Test Set	06/11/06	Annual	06/11/07	GB46170464
EMCO	Model 3115 (1-18GHz) Horn Antenna	08/24/06	Biennial	08/23/08	9203-2178
EMCO	Model 3115 (1-18GHz) Horn Antenna	08/25/06	Biennial	08/24/08	9704-5182
Gigatronics	8657A Universal Power Meter	04/07/06	Annual	04/07/07	8650319
Gigatronics	80701A (0.05-18GHz) Power Sensor	04/11/06	Annual	04/11/07	1833460
Rohde & Schwarz	NRVS Power Meter	06/01/05	Biennial	06/01/07	835360/079
Rohde & Schwarz	NRV-Z53 Power Sensor	06/01/05	Biennial	06/01/07	846076/007
Agilent	HP 8566B (100Hz-22GHz)	12/21/06	Annual	12/21/07	3638A08713
Agilent	HP 8591A (9kHz-1.8GHz)	09/20/06	Annual	09/20/07	3144A02458
Agilent	E4448A (3Hz-50GHz)	09/22/06	Annual	09/22/07	US42510244
Gigatronics	8651A (50MHz-18GHz)	07/28/06	Annual	07/28/07	1834052
Gigatronics	80701A (0.05-18GHz) Power Sensor	08/04/06	Annual	08/04/07	1835299
Ailtech/Eaton	NM 37/57A (30MHz-1GHz)	06/07/06	Annual	06/07/07	0805-03334
Agilent	HP 85650A Quasi-Peak Adapter	12/21/06	Annual	12/21/07	2043A00301
Agilent	HP 8449B (1-26.5GHz) Pre-Amplifier	12/12/06	Annual	12/12/07	3008A00985
Agilent	HP 11713A Attenuation/Switch Driver	12/12/06	Annual	12/12/07	N/A
Agilent	HP 85685A (20Hz-2GHz) Preselector	12/12/06	Annual	12/12/07	N/A
Agilent	HP 8566B Opt. 462 Impulse Bandwidth	12/12/06	Annual	12/12/07	3701A22204
EMCO	3115 (1-18GHz) Horn Antenna	04/04/05	Biennial	04/04/07	9205-3874
Compliance Design	A100 Roberts Dipoles	08/31/05	Biennial	08/31/07	5118
EMCO	Dipole Pair	09/21/06	Biennial	09/20/08	23951
SOLAR	8012-50 LISN (2)	11/18/05	Biennial	11/18/07	0313233, 0310234
-	No.165 (30MHz - 1000MHz) RG58 Coax Cable	N/A		N/A	N/A
-	No.166 (1000-26500MHz) Microwave RF Cable	N/A		N/A	N/A
-	No.167 (100kHz - 100MHz) RG58 Coax Cable	N/A		N/A	N/A
EMCO	3116 Horn Antenna (18 - 40GHz)	09/25/05	Biennial	09/25/07	9203-2178

**Table 5-1. Annual Test Equipment Calibration Schedule**

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## 6.0 TEST RESULTS

### Summary

The intentional radiator has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards. The radio was transmitting at highest power on the specified channels and at a data rate(s) specified above. The channels tested are high, middle and low of the allocated bands. Final system data was gathered in a mode that tended to maximize emissions by varying the orientation of the EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.



Company Name: Motorola Inc.

FCC ID: ABZ89FT7619

FCC Classification: Licensed Non-Broadcast Station Transmitter (TNB)

FCC Part Section(s)	RSS 111 Section	Test Description	Test Limit	Test Condition	Test Result	Reference
<b>TRANSMITTER MODE (TX)</b>						
90.1215(a)	Section 4.3	Peak Transmit Power	27dBm, 30dBm, 33dBm	Conducted	PASS	Motorola Module Test Report
90.1215(a)	Section 4.3	Peak Power Spectral Density	21dBm		PASS	Motorola Module Test Report
90.210(m)	Section 4.4	Occupied Bandwidth	Emission Mask M		PASS	Motorola Module Test Report
90.210(m)	Section 4.4	Spurious Emissions at the Antenna Terminal	Emission Mask M		PASS	Motorola Module Test Report
90.210(m)	Section 4.4	Radiated Spurious Emissions	Emission Mask M	Radiated	PASS	Section 6-3
2.1055, 90.213	Section 4.2	Frequency Stability	1.0 PPM	Conducted	PASS	Motorola Module Test Report
<b>RECEIVER MODE (RX)/ Digital Emissions</b>						
15.107	RSS-Gen [7.2.2]	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits or < RSS-Gen table 2 limits	Line Conducted	PASS	FCC Part 15 Test Report
15.109	RSS-Gen [7.2.3.2]	General Field Strength Limits (Restricted Bands and Radiated Emissions Limits)	< FCC 15.209 limits or < RSS-210 table 3 limits	Radiated (30MHz-1GHz) (1-25 GHz)	PASS	FCC Part 15 Test Report
<b>RF EXPOSURE (SAR or MPE)</b>						
2.1093/2.1091	RSS-102	SAR Test or MPE	1.6 W/kg (SAR) 1 mW/cm <sup>2</sup> (MPE)	3 Channels	PASS	MPE

Table 6-1. Summary of Test Results

FCC ID: ABZ89FT7619	 <b>FCC Part 90(Y) 802.11a TEST REPORT (CERTIFICATION)</b>			<b>Reviewed by:</b> Quality Manager
<b>Test Report S/N:</b> 0611291074.ABZ	<b>Test Dates:</b> 12/29/06 - 1/17/07	<b>EUT Type:</b> Mobile Computer with WLAN Module	Page 10 of 14	

## 6.1 Radiated Spurious Emissions Measurements 802.11a Mode

### §90.210(m) / RSS-111(4.3)

Mode: 802.11a

Distance of Measurements: 3 Meters



Operating Frequency: 4942.5MHz

Freq MHz	Level dBm	Polarity H/V	Cable dB	AF dB/m	Corr Level dBuV/m	Limit dBuV/m	Margin dB
9885.0	-78.1	V	9.98	38.40	67.66	72.38	-4.72
14827.5	-84.5	V	12.03	40.30	65.21	72.38	-7.17
19770.0	-102.2	H	14.35	43.95	53.48	72.38	-18.90
24712.5	-96.4	H	16.70	45.90	63.58	72.38	-8.80

Table 6-8. Radiated Measurements @ 3 meters

#### **NOTES:**

1. Measurement levels reported are peak. RBW = 1MHz VBW = 1MHz
2. The test antenna was placed at a distance of 3 meters.
3. The antenna is manipulated through typical positions, polarity and length during the tests.
4. The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
5. The spectrum is measured from 9kHz to 40GHz and the worst-case emissions are reported.
6. The Friss transmission formula was used to convert the limits to a radiated field strength level.

FCC ID: ABZ89FT7619		FCC Part 90(Y) 802.11a TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0611291074.ABZ	Test Dates: 12/29/06 - 1/17/07	EUT Type: Mobile Computer with WLAN Module		Page 11 of 14

# **Radiated Measurements (Cont'd)** **§15.247(d) / §15.205 & §15.209; RSS-210(A8.5)**

Mode: 802.11a

Distance of Measurements: 3 Meters



Operating Frequency: 4962.5MHz

Freq MHz	Level dBm	Polarity H/V	Cable dB	AF dB/m	Corr Level dBuV/m	Limit dBuV/m	Margin dB
9925.0	-77.6	V	9.98	38.40	68.16	72.38	-4.22
14887.5	-86.4	H	12.03	40.20	63.21	72.38	-9.17
19850.0	-100.8	H	14.35	43.95	54.88	72.38	-17.50
24812.5	-97.8	H	16.70	45.90	62.18	72.38	-10.20

**Table 6-9. Radiated Measurements @ 3 meters**

## **NOTES:**

1. Measurement levels reported are peak. RBW = 1MHz VBW = 1MHz
2. The test antenna was placed at a distance of 3 meters.
3. The antenna is manipulated through typical positions, polarity and length during the tests.
4. The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
5. The spectrum is measured from 9kHz to 40GHz and the worst-case emissions are reported.
6. The Friss transmission formula was used to convert the limits to a radiated field strength level.

FCC ID: ABZ89FT7619	 <b>FCC Part 90(Y) 802.11a TEST REPORT (CERTIFICATION)</b>			<b>Reviewed by:</b> Quality Manager
<b>Test Report S/N:</b> 0611291074.ABZ	<b>Test Dates:</b> 12/29/06 - 1/17/07	<b>EUT Type:</b> Mobile Computer with WLAN Module		Page 12 of 14

# **Radiated Measurements (Cont'd)** **§15.247(d) / §15.205 & §15.209; RSS-210(A8.5)**

Mode: 802.11a

Distance of Measurements: 3 Meters



Operating Frequency: 4987.5MHz

Freq MHz	Level dBm	Polarity H/V	Cable dB	AF dB/m	Corr Level dBuV/m	Limit dBuV/m	Margin dB
9975.0	-80.1	V	9.98	38.40	65.66	72.38	-6.72
14962.5	-85.0	V	12.03	40.10	64.51	72.38	-7.87
19950.0	-102.7	H	14.35	43.95	52.98	72.38	-19.40
24937.5	-98.1	H	16.70	45.90	61.88	72.38	-10.50

**Table 6-10. Radiated Measurements @ 3 meters**



## **NOTES:**

1. Measurement levels reported are peak. RBW = 1MHz VBW = 1MHz
2. The test antenna was placed at a distance of 3 meters.
3. The antenna is manipulated through typical positions, polarity and length during the tests.
4. The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
5. The spectrum is measured from 9kHz to 40GHz and the worst-case emissions are reported.
6. The Friis transmission formula was used to convert the limits to a radiated field strength level.

FCC ID: ABZ89FT7619	 <b>FCC Part 90(Y) 802.11a TEST REPORT (CERTIFICATION)</b>			<b>Reviewed by:</b> Quality Manager
<b>Test Report S/N:</b> 0611291074.ABZ	<b>Test Dates:</b> 12/29/06 - 1/17/07	<b>EUT Type:</b> Mobile Computer with WLAN Module		Page 13 of 14

## 7.0 CONCLUSION

The data collected relate only the item(s) tested and show that the **Mobile Computer with WLAN Module** **FCC ID: ABZ89FT7619** is in compliance with Part 90(Y) of the FCC Rules.

FCC ID: ABZ89FT7619		FCC Part 90(Y) 802.11a TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0611291074.ABZ	Test Dates: 12/29/06 - 1/17/07	EUT Type: Mobile Computer with WLAN Module		Page 14 of 14