ELECTROMAGNETIC EMISSIONS TEST REPORT

Apple, Inc.

iPhone
Model #A1349

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Section 1 General EUT Information

1 General Information

1.1 Introduction

This report documents the Class B conducted and radiated emissions and immunity test results for the iPhone, model A1349.

1.2 Product General and Technical Descriptions

The Apple iPhone, Model A1349 is a smart phone with iPod functions (audio, video and user applications), cellular CDMA radio, 802.11b/g/radio, and Bluetooth.

The Apple iPhone, Model A1349 has two input/output ports: 1) a 30 pin multiple function docking connector on the bottom; and 2) a 3.5mm audio connector at the top. On the left side of the device are two buttons for volume up and down and a switch for audio mute on and off. On the top of the device there is a button for On/Off and sleep. On the front of the device there is a single “Menu” button to wake the device up when asleep and to return to the main menu from within any application. The display is touch sensitive so that the rest of the controls are virtual controls which can be set by each application. The display is a LCD panel of 960 pixels x 480 pixels and measures about 76.2 mm (3.0 inches) tall x 50 mm (1.97 inches) wide.

The 30 pin docking connector is used for charging through the 30 pin to USB cable supplied with the device. Composite, component and digital video are supported through the 30 pin I/O using accessory cables sold by Apple Inc. Audio in and out are also supported through this port.

The Apple iPhone, Model A1349 comes with one of two memory configurations; 16, or 32G Bytes. This device is fully compatible with Apple’s iTunes music and application software. The in box materials include the iPhone, 5 watt power adapter, and a 30 pin to USB cable.

The iPhone feature set includes:

Processor (CPU) Max Speed:	1000 MHz max
Memory Configurations:	16GB or 32GB of flash storage
Wireless:	802.11 B/G /Bluetooth Card Mobile telephone
I/O Ports:	Multifunction 30 port which includes: USB 2.0, Stereo audio in/out, composite, component and display port video out, accessory communications, accessory power out, +5Vdc power in 3.5mm audio headphone and microphone

1.3 Product Photos – The exterior product photos have been submitted separately as an Exhibit.

1.4 Product Block Diagram & Functional Block Diagram have been submitted separately as an Exhibit.

1.5 Product Label

Product Exterior Label

SECTION 2 Electromagnetic Emissions

FCC CFR 47, Part 15, Subpart B, Class B

2 Emissions Report

2.1 Test Facilities Used for Emissions Testing

Conducted Emissions Facilities: Conducted Emissions were performed at:
Apple, Inc. EMC Compliance Laboratory
123 East Evelyn, Mountain View, California 94041
This facility is described in Apple procedure EMC04.
NVLAP Accredited Lab # 200071-0

Radiated Emissions Facilities: Radiated Emission measurements were performed at:
Apple, Inc. Test Site ALTS #1
123 East Evelyn Ave., Mountain View, California 94041.
This facility is described in Apple procedure EMC03.
NVLAP Accredited Lab # 200071-0

Note: The emissions data in this report was recorded at the Apple, Inc. EMC facilities listed above. If data were recorded at a subcontracted test laboratory it would be noted in this test report with the name, contact information, Accreditation Numbers, and location of the subcontracted test facility.

2.2 Measurement Equipment Used for Emissions

2.2.1 Measurement Equipment Used for Conducted Emissions

Description	Manufacturer	Model No.	Identification No.	Last Cal	Next Cal
Spectrum Analyzer	R&S	ESCI	100773	05/10	05/11
RF Receiver	R&S	ESCI	100773	05/10	05/11
Digital Multimeter	Agilent	34401A	M62073	07/08	07/13
LISN	Fischer	50/250-16-2-07	2002	07/10	07/11
Cable		RG214	E2CE	11/10	11/11

Notes: R&S is an abbreviation for Rohde & Schwarz.
The above equipment is traceable to NVLAP calibration standards.

2.2.2 Measurement Equipment Used for Radiated Emissions

Description	Manufacturer	Model No.	Identification No.	Last Cal	Next Cal
Spectrum Analyzer	R & S	ESIB 40	100105	05/10	05/11
RF Receiver	R & S	ESIB 40	100105	05/10	05/11
Spectrum Analyzer	Agilent	E4403B	MY44212800	10/10	10/11
Antenna	Sunol	JB1	A031705	06/10	06/11
Antenna	Sunol	JB1	A031805	06/10	06/11
Amplifier	AR	LN100B	306955	03/10	03/11
Amplifier	AR	LN100B	306954	03/10	03/11
Cable	Semflex	LMR400	E1T1	12/11	12/12
Cable	Semflex	LMR400	E1T2	12/11	12/12
Antenna	ETS-Lindgren	3117	35933	05/10	05/11
Amplifier	Advanced Micro	WLA614-4	Amp1	03/10	03/11
Cable	Semflex	LA290	E1T3	03/10	03/11

Notes: R& S is an abbreviation for Rohde & Schwarz.
The above equipment is traceable to NVLAP calibration standards.

2.3 Measurement Procedures Utilized for Emissions Testing

2.3.1 Pre-testing

Prior to taking the formal emissions data collected in this report many hours of pre-testing have been performed. The selection of the worst case system documented in this report was based upon this pre-testing.

During pretests the iPhone A1349 was exercised in the audio/video mode and in data mode in conjunction with a personal computer. In the audio/video mode the iPhone was configured independently and exercised by playing video and audio files using the iPod application. The EUT was tested both with an external ac power adapter and with internal battery power. In the data mode, the iPhone was connected to a personal computer and data transferred to and from the iPhone using the iTunes 10.1.1 application on the host computer. The worst-case mode was discovered to be the data mode for radiated emissions and music mode with ac Power Adapter for conducted emissions. The data recorded in this report reflects these test configurations.

Pre Testing Component List

Component Type	Vendor	Part Number
iPhone 16GB	Apple, Inc.	A1349
iPhone 32GB	Apple, Inc.	A1349
iPhone USB cable	Apple, Inc.	MA591
iPhone Earbuds	Apple, Inc.	MA814
120Vac power adapter	Apple, Inc.	A1265
MacBook Pro laptop computer	Apple, Inc.	A1286
MacBook ac power adapter	Apple, Inc.	A1222

2.3.2 Measurement Procedures Utilized for Conducted Emissions

The EUT was placed on a non-metallic table, 80 cm above the floor. Power to the EUT was supplied through 50 μH LISNs bonded to the ground-plane 80 centimeters from the EUT. The ground-plane was electrically bonded to the shield room ground system and all power-lines entering the shielded room were filtered. Mains power was supplied for various voltage levels and power-line frequencies. A more detailed description can be found in a document called EMC01 on file at Apple Inc.

2.3.3 Measurement Procedures Utilized for Radiated Emissions

The EUT was placed on a non-metallic table, 80 cm above the metallic ground-plane. The EUT and peripherals were powered from a filtered main supply.

The frequency spectrum from 30MHz to 7GHz (for the wireless radio testing scans were taken above 7 GHz) was scanned and the emission levels maximized at each frequency recorded. The antenna was varied in height between 1.0 and 4.0 meters and the system was rotated 360 degrees while scanning for maximum emission amplitudes. This

procedure was performed for both horizontal and vertical polarization of the receiving antenna.

During maximization the position of the cables was varied and the scanning repeated until the worst case emission was found. The data recorded in this report are the maximum emission levels measured. A more detailed description can be found in a document called EMC01 on file at Apple Inc.

2.4 Radiated Emissions Measurement Distance

FCC Part 15 measurements were performed at an EUT to antenna distance of 10 meters.

2.5 Emissions Measurement Uncertainty

The measurement uncertainty (see Apple procedure 080-0835) has been determined to be the following:

Emissions Tests	Frequency Range	Polarization	Measurement Uncertainties
Conducted	150 kHz – 30 MHz		3.50 dB
Radiated	30 – 200MHz	Horizontal	4.48 dB
Radiated	30 – 200MHz	Vertical	4.60 dB
Radiated	0.2 – 1 GHz	Horizontal	4.60 dB
Radiated	0.2 – 1 GHz	Vertical	4.60 dB
Radiated	1 – 6 GHz		4.80 dB

The Apple procedure 080-0835, ensures uncertainty has been calculated in accordance with CISPR 16-4-2:2003. Measurement uncertainty is not used in determining pass / fail criteria of the EUT.

2.6 Emissions Test Information

Both conducted and radiated testing were performed using NVLAP accredited processes according to the procedures depicted in Apple, Inc. procedure number EMC01, FCC CFR47 Part 15, Subpart B, Class B, ANSI C63.4 – 2003.

2.7 Related Submittals and Grants of Certification

Wireless Radio Grant FCC ID: BCG-E2422A and BCG-E2422B

2.8 EUT Exercise Software

The iPhone Model 1349 was exercised using iPhone operating system software version 4.0 and the included iPod application on the iPhone and iTunes version 10.1.1 on the host computer. During testing of the iPhone stand alone, a video was played on the display with the brightness and volume set at maximum. When connected to the host computer, iTunes 9.1 was used to download audio, video, image, and application files. In this was the iPhone model 13xx was exercised in a way typical of its actual use.

2.9 Special Accessories

There were no special accessories used during these tests.

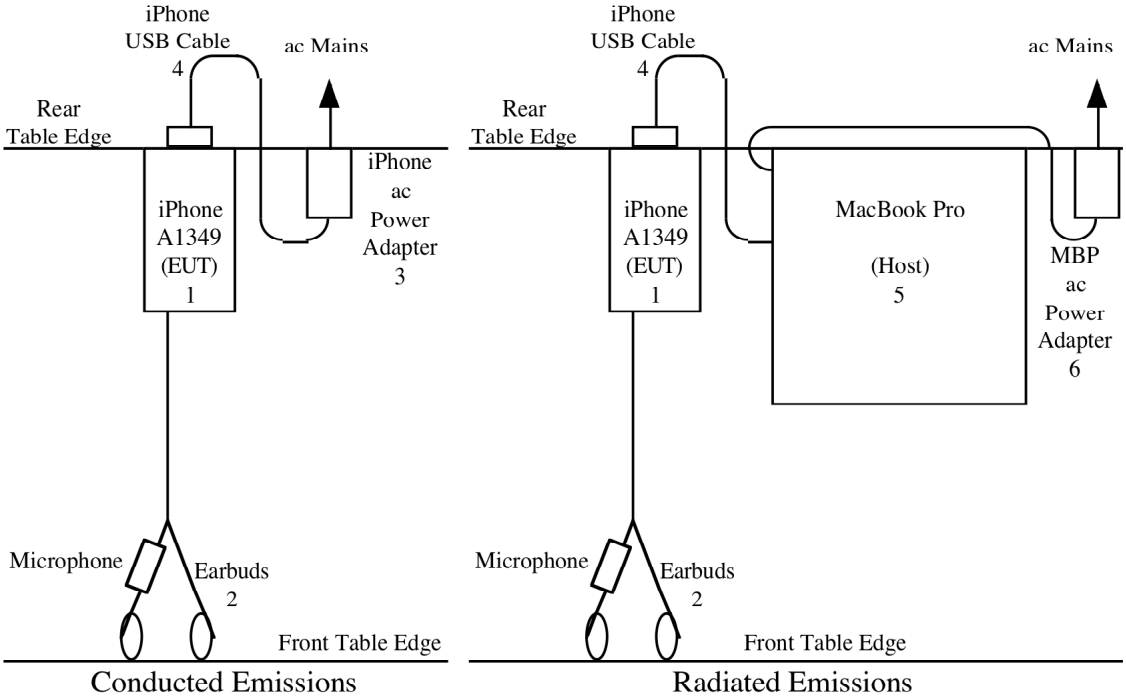
2.10 Equipment Modifications and Deviations

The iPhone, model 1349, achieved compliance with the FCC CFR47 Part 15, Subpart B, Class B, ANSI C63.4 – 2003, with no modifications.

2.11 EUT Test Configuration

The EUT was configured as a worst case system configuration as a result from pre-testing as described in section 2.3.1.

Diagram of Test Configuration



Equipment Key

	Description	Model #
1	iPhone	A1349
2	Apple iPhone 4	A1349
3	Apple iPod Earbuds	MA814
4	Apple iPod ac Power Adapter	A1205 or A1300
5	Sony 40” Bravia HD LCD TV	KDL40V2500

2.12 Cable Description and Information

The following interconnect cables were used as illustrated in the diagram of test configuration:

Cable Type	Shielded	Ferrite
iPhone USB Cable	Yes	No
iPhone Earbuds	No	No
dc Power Cable (captive)	Yes	No
ac Power Cable	No	No

2.13 Conducted Test Setup Photos – The test Set up photos have been submitted separately as an Exhibit.

2.14 Radiated Emissions Test Setup Photos - The test Set up photos have been submitted separately as an Exhibit.

2.15 Conducted Emissions Data

The following data was collected with a spectrum analyzer in peak detection mode, unless otherwise noted.

Table 2.15.1 CISPR 120 VAC 60 Hz. Mains

Frequency	Measured Line 1	Agency Limit	Frequency	Measured Line 2	Agency Limit
MHz	dBμV	dBμV	MHz	dBμV	dBμV
0.274	33.0 Av	51.1	0.283	34.1 Av	50.5
0.285	43.8 QP	60.7	0.253	40.0 QP	61.7
0.432	31.5 Av	47.3	0.429	25.4 Av	46.3
0.430	36.7 QP	57.3	0.427	32.9 QP	57.4
0.571	37.2 Av	46.0	0.572	30.9 Av	46.0
0.572	42.9 QP	56.0	0.571	36.5 QP	56.0

Test date: 11/24/2010.

Note: Conducted emissions data was also taken at 110VAC, 60Hz. This data was found to be equivalent or lower than the data listed above.

2.16 FCC Radiated Emissions Test Data

Radiated Emission measurements were performed at Apple, Inc. Alternate Test Site #1 located at 123 East Evelyn Ave., Mountain View, California. This facility is described in Apple procedure EMC03. The data lists the worst case emission frequencies, measured levels, antenna, cable and amplifier corrections, the corrected field strength, and the limit. The data was collected at 10 meters and compared to the CISPR 22, 2005 Class B limits.

Table 2.16.1 FCC Radiated Emissions - 120 VAC 60 Hz. Mains
Vertical Polarization

Frequency	Corrected Level	Limit	Measured Value	Antenna Factor	Cable Factor	Amplifier Gain
MHz	dBµV/m	dBµV/m	dBµV	db/m	dB	dB
107.76	26.1	30.0	37.84	12.45	2.68	26.87
177.74	20.4	30.0	32.23	11.50	3.40	26.69
968.90	26.4	37.0	22.76	23.06	9.68	29.11

Horizontal Polarization

Frequency	Corrected Level	Limit	Measured Value	Antenna Factor	Cable Factor	Amplifier Gain
MHz	dBµV/m	dBµV/m	dBµV	dB/m	dB	dB
102.75	21.0	30.0	39.68	11.00	2.87	32.55
886.03	27.6	37.02	28.84	22.14	8.55	31.90
970.90	30.1	37.0	28.94	22.54	9.01	30.42

Test Date: 12/06/2010

Note: Radiated emissions data was also taken at 110VAC, 60Hz. This data was found to be equivalent or lower than the data listed above.

The data listed in the tables above were collected with a spectrum analyzer in peak detection mode, unless otherwise noted.

Environmental Conditions

	EUT Location	Measurement Equipment Location
Temperature	**22**°C	**21** °C
Rel. Humidity	**57** %	**57** %

2.17 FCC Compliance Summary

Based on the information and test data provided in this report the iPhone, Model A1349, has met the Class B requirements as specified in CFR 47, Part 15, Subpart B for Unintentional Radiators.

2.18 NVLAP Note

The data in this report is based on the sample that was tested and described in this report. The test data has been obtained at a NVLAP accredited facility (200071-0), the United States Government does not certify, approve, or endorse the product described herein.

The scope of the Apple, Inc., NVLAP accreditation number 200071-0 covers Electromagnetic Compatibility and includes; FCC Method 47 CFR Part 15, Subpart B Unintentional Radiators, ANSI C63.4-2003.

APPENDIX A

User Manual EMC Compliance Information

A sample of the Declaration of Conformity is shown below; this information is printed in a prominent location in the product manual shipped with each product.

FCC Compliance Statement

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. See instructions if interference to radio or television reception is suspected.

Radio and Television Interference

This computer equipment generates, uses, and can radiate radio-frequency energy. If it is not installed and used properly—that is, in strict accordance with Apple's instructions—it may cause interference with radio and television reception. This equipment has been tested and found to comply with the limits for a Class B digital device in accordance with the specifications in Part 15 of FCC rules. These specifications are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation.

You can determine whether your computer system is causing interference by turning it off. If the interference stops, it was probably caused by the computer or one of the peripheral devices. If your computer system does cause interference to radio or television reception, try to correct the interference by using one or more of the following measures:

- Turn the television or radio antenna until the interference stops.
- Move the computer to one side or the other of the television or radio.
- Move the computer farther away from the television or radio.
- Plug the computer into an outlet that is on a different circuit from the television or radio. (That is, make certain the computer and the television or radio are on circuits controlled by different circuit breakers or fuses.)

If necessary, consult an Apple-authorized service provider or Apple. See the service and support information that came with your Apple product. Or, consult an experienced radio/television technician for additional suggestions.

Important: Changes or modifications to this product not authorized by Apple, Inc., could void the EMC compliance and negate your authority to operate the product.

This product has demonstrated EMC compliance under conditions that included the use of compliant peripheral devices and shielded cables (including Ethernet network cables) between system components. It is important that you use compliant peripheral devices and shielded cables between system components to reduce the possibility of causing interference to radios, television sets, and other electronic devices.

Responsible party (contact for FCC matters only):

Apple, Inc.
Robert Steinfeld
Product Compliance
1 Infinite Loop M/S 26-A
Cupertino, CA 95014-2084

APPENDIX B

EMC Control Components

Item	Location	Manufacturer	Remarks
Shield Cans over MLB	MLB	Foxconn	4 each
35Ω common mode choke	MLB	TDK	5 each