



ELECTROMAGNETIC EMISSIONS TEST REPORT

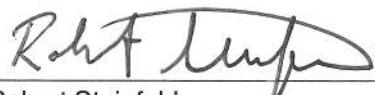
Apple, Inc.

Apple Pencil
Model No A1603

August 23, 2015

Engineering Contact:

Apple, Inc
1 Infinite Loop M/S 91-1EMC
Cupertino, CA 95014
USA



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EMC Design Engineering Manager

Date SEPTEMBER 14, 2015



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Date 09-14-2015

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1. General EUT Information

1.1. Introduction

This report documents the Class B conducted and radiated emissions test results for the Apple Pencil.

1.2. Test Information

Emissions testing were performed using NVLAP accredited processes according to the procedures described in Apple, Inc. procedure number 080-0811 and the relevant standards listed in section2. All testing is NVLAP accredited - NVLAP Accredited Lab # 200071-0.

1.3. Product General and Technical Descriptions

* See Technical Information, Appendix D

1.4. Product Photographs

*** See Technical Information, Appendix D**

1.5. Product Block Diagram

*** See Technical Information, Appendix D**

1.6. Product Label

Model A1603
5V 1.3A max
Serial: PPPY
WSSSCCCC

FCC ID:
BCGA1603
IC: 579C-
A1603

China

2. Electromagnetic Emissions

All references to standards in Section 2 of this report are to the dated versions in the following list:
FCC CFR 47, Part 15.

ICES-003, Issue 5, CAN/CSA-CEI/IEC CISPR 22-10
CISPR 22:2008
ANSI C63.4,2009

2.1. Test Facilities Used for Emissions Testing

Conducted Emissions Facilities

Apple, Inc. EMC Compliance Laboratory
123 East Evelyn, Mountain View, California 94041
NVLAP Accredited Lab # 200071-0
VCCI Registration No. A-0016

AND/OR

Apple, Inc. EMC Compliance Laboratory
18920 Forge Drive, Cupertino, California 95014
NVLAP Accredited Lab # 200071-0
VCCI Registration No. A-0016

Radiated Emissions Facilities

Apple, Inc. Test Site ALTS #1 OR #2
123 East Evelyn Ave., Mountain View, California 94041.
NVLAP Accredited Lab # 200071-0
VCCI Registration No. A-0016

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, 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 |
|-------------|--------------|---------------------|-------------------|------------|------------|
| Receiver | R&S | ESR | 101669 | 4/15/2015 | 4/15/2016 |
| LISN | Fischer | LISN-50/250-16-2-07 | 4003 | 5/11/2015 | 5/11/2016 |
| Cable | Pasternack | RG223 | E2-CE | 12/10/2014 | 12/10/2015 |

2.2.2. Measurement Equipment Used for Radiated Emissions

| Description | Manufacturer | Model No | Identification No | Last Cal | Next Cal |
|-------------|--------------|----------|-------------------|-----------|-----------|
| Receiver | R&S | ESU | 100354 | 4/15/2015 | 4/15/2016 |
| Receiver | R&S | ESIB | 100105 | 4/21/2015 | 4/21/2016 |
| Antenna | Sunol | JB1 | A031705 | 7/29/2015 | 7/29/2016 |
| Antenna | Sunol | JB1 | A031805 | 7/29/2015 | 7/29/2016 |
| Amplifier | Sonoma | 310N | 186758 | 7/29/2015 | 7/29/2016 |
| Amplifier | Sonoma | 310N | 186761 | 7/29/2015 | 7/29/2016 |
| Cable | Pasternack | RG214 | E2T2 | 12/1/2014 | 12/1/2015 |
| Cable | Huber Suhner | Sucoflex | E2T1 | 12/1/2014 | 12/1/2015 |

Notes: HP is an abbreviation for Hewlett Packard.
 AR is an abbreviation for Amplifier Research.
 R&S is an abbreviation for Rohde & Schwarz.
 Ca. Inst. is and abbreviation for California Instruments
 N/A is an abbreviation for Not Applicable.

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 comprehensive pre-testing has been performed. The selection of the worst case system documented in this report was based upon this pre-testing.

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 μ H 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 procedure document 080-0811 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 30 MHz to \leq 1000 MHz 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.

In the frequency range 1 to 6 GHz, the antenna Beam Width (w) varies from a maximum of 5.79m at 1 GHz to a minimum of 2.92m at 6 GHz.

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 procedure document 080-0811 on file at Apple, Inc.

2.4. Radiated Emissions Measurement Distance

FCC Part 15 measurements were performed at an EUT to antenna distance of 3 meters. Optionally as may be indicated in the report the FCC data may be taken at 10 meters as allowed by the FCC. CISPR 22 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 |

In Apple procedure 080-0835 the 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. Related Submittals and Grants of Certification

None.

2.7. EUT Exercise Software

* See Technical Information, Appendix E

2.8. Special Accessories

There were no special accessories used during these tests.

2.9. Equipment Modifications and Deviations

The Apple Pencil achieved compliance with the FCC CFR47 Part 15, ICES-003, CAN/CSA-CEI/IEC CISPR 22, CISPR 22 with no modifications.

2.10. EUT Test Configuration

The EUT was tested in the worst-case mode as determined from the pre-testing described in section 2.3.1.

Diagram of Test Configuration

***See Technical Information, Appendix F**

2.11. Cable Description and Information

***See Technical Information, Appendix F**

2.12. Test Setup Photos

2.12.1. Conducted Emissions Test Setup Photos

***See Technical Information, Appendix F**

2.12.2. Radiated Emissions Test Setup Photos

***See Technical Information, Appendix F**

2.13. Emissions Data

2.13.1. Conducted Emissions Data

The following data was collected with a spectrum analyzer in Peak detection mode, unless otherwise noted. Test Date: Aug 22, 2015.

CISPR 110VAC 60Hz Mains

| Frequency (MHz) | Measured Line 1 (dB μ V) | Agency Limit (dB μ V) | Frequency (MHz) | Measured Line 2 (dB μ V) | Agency Limit (dB μ V) |
|-----------------|------------------------------|---------------------------|-----------------|------------------------------|---------------------------|
| 0.276 | 26.8 Av | 50.9 | 0.276 | 35.8 Av | 50.9 |
| 1.925 | 14.6 Av | 46.0 | 1.925 | 30.8 Av | 46.0 |
| 0.827 | 25.9 Av | 46.0 | 0.825 | 30.5 Av | 46.0 |
| 1.374 | 13.4 Av | 46.0 | 1.374 | 28.1 Av | 46.0 |
| 0.836 | 30.7 QP | 56.0 | 0.825 | 35.5 QP | 56.0 |
| 0.276 | 36.0 QP | 60.9 | 0.276 | 38.5 QP | 60.9 |

Note: Conducted emissions data was also taken at 100VAC, 60Hz. This data was found to be equivalent or lower than the data listed above.

Conducted Emissions Environmental Conditions

| | EUT Location | Measurement Equipment Location |
|-------------|--------------|--------------------------------|
| Temperature | 22°C | 22°C |
| Humidity | 42% | 42% |

2.13.2. FCC Radiated Emissions Test Data

The following data was collected at a 3 or 10 meter distance ≤ 1 GHz and at a 3 meter distance ≥ 1 GHz with a spectrum analyzer in peak detection mode, unless otherwise noted. Test Date: Aug 22, 2015.

FCC Radiated Emissions - 110VAC 60 Hz Mains Vertical Polarization

| Frequency (MHz) | Corrected Level (dB μ V/m) | Limit (dB μ V) | Measured Value (dB μ V) | Antenna Factor (dB/m) | Cable Factor | Amplifier Gain (dB) |
|-----------------|--------------------------------|--------------------|-----------------------------|-----------------------|--------------|---------------------|
| 32.91 | 20.7 | 30.0 | 33.03 | 19.47 | 0.87 | 32.68 |
| 990.30 | 27.6 | 37.0 | 30.20 | 23.00 | 6.39 | 32.01 |
| 935.98 | 26.5 | 37.0 | 30.66 | 22.10 | 6.21 | 32.46 |
| 962.17 | 26.5 | 37.0 | 29.61 | 22.76 | 6.34 | 32.20 |
| 880.69 | 26.3 | 37.0 | 31.20 | 21.91 | 5.96 | 32.77 |
| 918.52 | 25.6 | 37.0 | 29.72 | 22.26 | 6.18 | 32.57 |

Horizontal Polarization

| Frequency (MHz) | Corrected Level (dB μ V/m) | Limit (dB μ V) | Measured Value (dB μ V) | Antenna Factor (dB/m) | Cable Factor | Amplifier Gain (dB) |
|-----------------|--------------------------------|--------------------|-----------------------------|-----------------------|--------------|---------------------|
| 996.11 | 31.5 | 37.0 | 33.89 | 23.22 | 5.84 | 31.47 |
| 976.67 | 30.4 | 37.0 | 33.92 | 22.43 | 5.71 | 31.70 |
| 957.23 | 30.1 | 37.0 | 33.91 | 22.44 | 5.62 | 31.87 |
| 916.41 | 29.2 | 37.0 | 33.72 | 22.14 | 5.49 | 32.17 |
| 933.91 | 29.0 | 37.0 | 33.76 | 21.74 | 5.54 | 32.06 |
| 895.03 | 28.0 | 37.0 | 32.79 | 22.10 | 5.41 | 32.28 |

Note: Radiated emissions data was also taken at 100VAC, 60Hz. This data was found to be equivalent to or lower than the data listed above.

Radiated Emissions Environmental Conditions

| | EUT Location | Measurement Equipment Location |
|-------------|--------------|--------------------------------|
| Temperature | 22°C | 23°C |
| Humidity | 42% | 44% |

2.13.3. FCC Compliance Summary

The Apple Pencil has met the Class B requirements as specified in CFR47, Part 15, Subpart B for unintentional radiators.

2.13.4. NVLAP Note

Although the data in this report has been obtained at a NVLAP accredited facility, the United States Government does not certify, approve, or endorse the product described herein.

3. Appendix A

Regulatory Compliance Information

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.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Important: Changes or modifications to this product not authorized by Apple could void the electromagnetic compatibility (EMC) and wireless 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 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, televisions, and other electronic devices. This product was tested for EMC compliance under conditions that included the use of Apple peripheral devices.

Responsible party (contact for FCC matters only):

Apple Inc.
Corporate Compliance
1 Infinite Loop, MS 91-1EMC
Cupertino, CA 95014

4. Appendix B

EMC Control Components

| Item | Location | Manufacturer | Part No | QTY |
|------|----------|--------------|---------|-----|
| | | | | |

5. Appendix C

Revision History Sheet

| | |
|-------------------------|--------------|
| Test Report No | 2922 |
| Model No | A1603 |
| Model Name | Apple Pencil |
| Responsible Engineer | Keong Kam |
| Original Signature Date | Aug 23, 2015 |

Revision History

| Test Report No | Revision Description | Date |
|----------------|--|----------|
| 2922 | Corrected typo in equipment calibration date under section 2.2.2 | 10/01/15 |
| 2922 | Added missing ANSI C63.4,2009 under section 2. | 10/02/15 |
| | | |

Notes:

1. Appendix C documents the original test report and all amendments to the test report. The serial number of the report is the Apple File Number printed on each page of the report. Amended reports will show the Apple File Number and are denoted with a dash (-) followed by the revision letter designation.
2. Revisions or amendments to the Test Report will include the statement "Supplement to the Test Report" in the Revision Description.
3. This report was generated using EMC Report Template 042815-ITE

6. Appendix D

*See Technical Information Document

7. Appendix E

*See Technical Information Document

8. Appendix F

*See Technical Information Document