



ELECTROMAGNETIC EMISSIONS TEST REPORT

Apple, Inc.

Apple Watch Magnetic Charging Cable
Model No A1570

12 February 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 Watch Magnetic Charging Cable, model no. A1570.

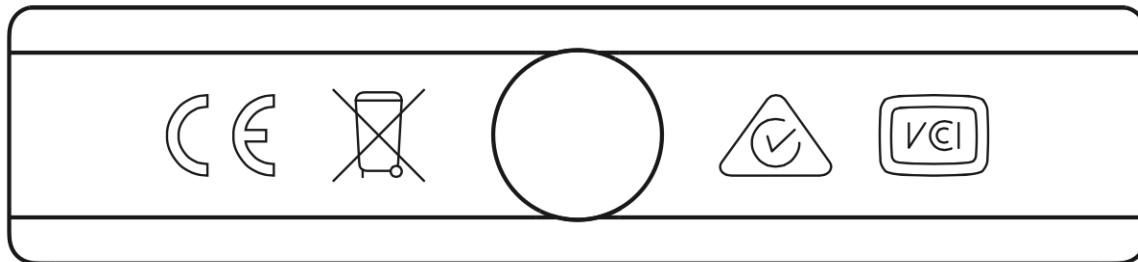
1.2. Test Information

Both emissions and immunity 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 sections 2 and 3. All testing is NVLAP accredited - NVLAP Accredited Lab # 200071-0.

1.3. Product Photographs

See Appendix C

1.4. Product Label



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

2.1. Test Facilities Used for Emissions Testing

Conducted Emissions Facilities

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 |
|-------------------|--------------------|----------------|-------------------|----------|----------|
| Spectrum Analyzer | R&S | ESR | 101665 | 5/2014 | 5/2015 |
| EMI Receiver | R&S | ESR | 101665 | 5/2014 | 5/2015 |
| AC Voltmeter | HP | 34401-A | MY47012468 | 5/2014 | 5/2015 |
| LISN | Fischer | 50/250-16-2-07 | 4003 | 5/2014 | 5/2015 |
| Cable | Pasternack/Fischer | RG223 | FG3-CE | 1/2014 | 1/2015 |

2.2.2. Measurement Equipment Used for Radiated Emissions

| Description | Manufacturer | Model No | Identification No | Last Cal | Next Cal |
|-------------------|--------------|----------|-------------------|----------|----------|
| Spectrum Analyzer | R&S | ESU | 100374 | 5/2014 | 5/2015 |
| Receiver | R&S | ESU | 100374 | 5/2014 | 5/2015 |
| Spectrum Analyzer | R&S | ESU | 100354 | 5/2014 | 5/2015 |
| Antenna | Sunol | JB1 | A122302-1 | 2/2014 | 2/2015 |
| Antenna | Sunol | JB1 | A122302-2 | 2/2014 | 2/2015 |
| Amplifier | AR | LN1000B | 306955 | 4/2014 | 4/2015 |
| Amplifier | AR | LN1000B | 306954 | 4/2014 | 4/2015 |
| Cable | RU | 214-N | E1T2 | 12/2014 | 12/2015 |

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

Pre-Testing Component List

| Component Type | Vendor | Part No |
|---|-------------|---------|
| Apple Watch Magnetic Charging Cable (EUT) | Apple, Inc. | A1570 |
| Apple Watch 42MM | Apple, Inc. | A1554 |
| Apple Watch 38MM | Apple, Inc. | A1553 |
| Stainless Steel Link Bracelet | Apple, Inc. | N/A |
| Stainless Steel Milanese Loop | Apple, Inc. | N/A |
| Fluoroelastomer Sport Band | Apple, Inc. | N/A |
| Classic Buckle Leather Band | Apple, Inc. | N/A |
| Modern Buckle Leather Band | Apple, Inc. | N/A |
| Leather Loop | Apple, Inc. | N/A |
| Apple MacBook Pro 15" | Apple, Inc. | A1286 |
| Apple MagSafe Power Adapter | Apple, Inc. | A1343 |
| Apple ac Power Adapter (US) | Apple, Inc. | A1385 |

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.

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 |

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

The Apple Watch Magnetic Charging Cable was tested using the preloaded firmware, which charges the Apple Watch after authentication. The radiated and conducted emissions measurements were made while the system was exercised in this manner.

2.8. Special Accessories

There were no special accessories used during these tests.

2.9. Equipment Modifications and Deviations

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

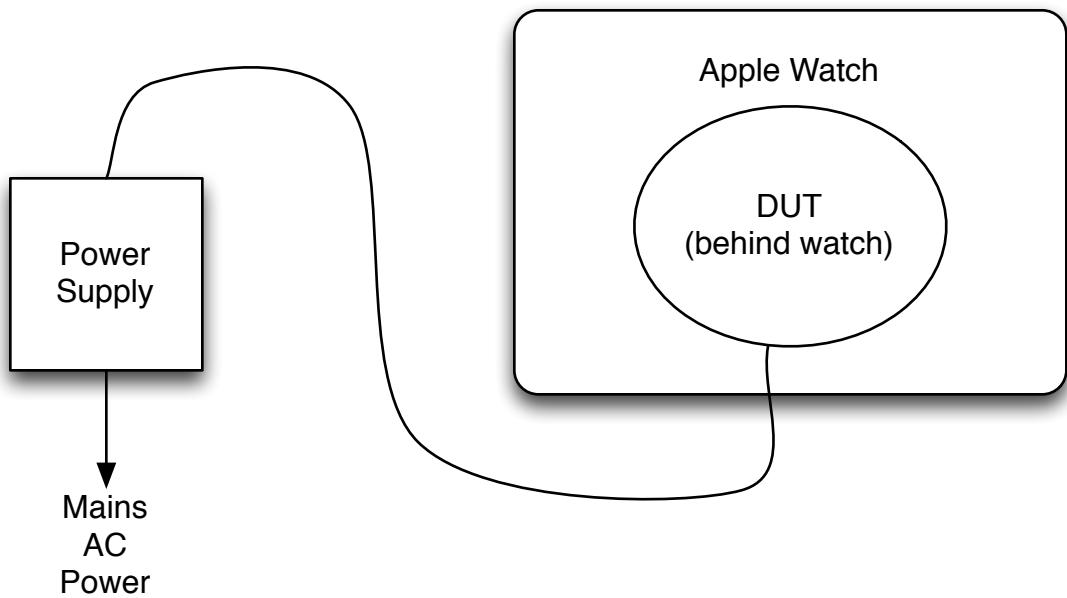
2.10. EUT Test Configuration

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

Final Testing (worst case) EUT Description

| Component | Vendor | Part Number |
|-------------------------------------|-------------|-------------|
| Apple Watch Magnetic Charging Cable | Apple | A1570 |
| Apple Watch 42MM | Apple | A1554 |
| Stainless Steel Link Bracelet | Apple | N/A |
| Apple ac Power Adapter (Int.) | Apple, Inc. | A1400 |

Diagram of Test Configuration



Equipment Key

| | Description | Model No |
|---|---|-----------------|
| 1 | Apple Watch Magnetic Charging Cable (DUT) | A1570 |
| 2 | Apple Watch | A1554 |
| 3 | Apple ac Power Adapter (Int.) | A1400 |

2.11. Test Setup Photos

2.11.1. Conducted and Radiated Emissions Test Setup Photos

See Appendix D

2.12. Emissions Data

2.12.1. Conducted Emissions Data

The following data was collected with a spectrum analyzer in Peak detection mode, unless otherwise noted. Test Date: 12 February 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) |
|-----------------|------------------------------|---------------------------|-----------------|------------------------------|---------------------------|
| 0.278 | 41.5 QP | 60.9 | 0.548 | 37.6 QP | 56.0 |
| 0.278 | 25.8 Av | 50.9 | 0.548 | 28.9 Av | 46.0 |
| 0.683 | 29.9 QP | 56.0 | 0.978 | 36.3 QP | 56.0 |
| 0.654 | 25.9 Av | 46.0 | 0.978 | 28.3 Av | 46.0 |
| 1.115 | 26.1 QP | 56.0 | 4.245 | 20.6 QP | 56.0 |
| 0.978 | 23.6 Av | 46.0 | 4.245 | 19.3 Av | 46.0 |

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 | 26.1°C | 26.1°C |
| Humidity | 41% | 41% |

CISPR 240VAC 50Hz 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) |
|-----------------|------------------------------|---------------------------|-----------------|------------------------------|---------------------------|
| 0.654 | 27.2 QP | 56.0 | 0.276 | 32.9 QP | 60.9 |
| 0.654 | 26.1 Av | 46.0 | 0.325 | 22.3 Av | 49.6 |
| 0.980 | 25.6 QP | 56.0 | 0.697 | 30.6 QP | 56.0 |
| 0.980 | 23.0 Av | 46.0 | 0.654 | 26.3 Av | 46.0 |
| 2.611 | 22.7 QP | 56.0 | 1.093 | 28.2 QP | 56.0 |
| 2.611 | 22.5 Av | 46.0 | 1.095 | 23.5 Av | 46.0 |

Note: Conducted emissions data was also taken at 220VAC, 60Hz. This data was found to be equivalent to or lower than the data listed above.

Conducted Emissions Environmental Conditions

| | EUT Location | Measurement Equipment Location |
|-------------|---------------------|---------------------------------------|
| Temperature | 26.1°C | 26.1°C |
| Humidity | 41% | 41% |

2.12.2. FCC Radiated Emissions Test Data

The following data was collected at a 10 meter distance with a spectrum analyzer in peak detection mode, unless otherwise noted. Test Date: 12 February 2015.

FCC Radiated Emissions - 110VAC 60 Hz Mains Vertical Polarization

| Frequency | Corrected Level (dB μ V/m) | Limit (dB μ V) | Measured Value (dB μ V) | Antenna Factor (dB/m) | Cable Factor | Amplifier Gain (dB) |
|-----------|--------------------------------|--------------------|-----------------------------|-----------------------|--------------|---------------------|
| 40.02 | 21.6 | 30.0 | 38.80 | 13.59 | 2.05 | 32.81 |
| 102.43 | 17.0 | 30.0 | 35.76 | 10.69 | 2.95 | 32.35 |
| 147.05 | 19.1 | 30.0 | 35.31 | 12.50 | 3.50 | 32.19 |
| 186.17 | 12.8 | 30.0 | 29.90 | 11.20 | 3.86 | 32.15 |
| 229.82 | 13.6 | 30.0 | 30.56 | 10.89 | 4.30 | 32.12 |
| 482.99 | 21.4 | 37.0 | 29.22 | 17.56 | 6.85 | 32.25 |

Horizontal Polarization

| Frequency | Corrected Level (dB μ V/m) | Limit (dB μ V) | Measured Value (dB μ V) | Antenna Factor (dB/m) | Cable Factor | Amplifier Gain (dB) |
|-----------|--------------------------------|--------------------|-----------------------------|-----------------------|--------------|---------------------|
| 31.94 | 17.1 | 30.0 | 27.80 | 20.58 | 1.47 | 32.74 |
| 124.09 | 12.3 | 30.0 | 35.60 | 7.37 | 2.00 | 32.63 |
| 503.36 | 19.2 | 37.0 | 36.46 | 11.30 | 3.56 | 32.11 |
| 559.62 | 19.1 | 37.0 | 36.57 | 10.92 | 3.78 | 32.17 |
| 615.88 | 19.3 | 37.0 | 36.62 | 10.72 | 3.96 | 32.03 |
| 667.29 | 20.4 | 37.0 | 36.81 | 11.55 | 4.14 | 32.07 |

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 | 20.6 °C | 20.6 °C |
| Humidity | 43% | 43% |

2.12.3. FCC Compliance Summary

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

2.12.4. 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

Revision History Sheet

| | |
|-------------------------|-------------------------------------|
| Test Report No | 2872 |
| Model No | A1570 |
| Model Name | Apple Watch Magnetic Charging Cable |
| Responsible Engineer | John Mosy |
| Original Signature Date | 12 February 2015 |

Revision History

| Test Report No | Revision Description | Date |
|----------------|----------------------|------|
| | | |
| | | |
| | | |

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 040414-ITE

4. Appendix B

EMC Control Components

| Item | Location | Manufacturer | Part No | QTY |
|----------------------|----------|------------------------|-----------|-----|
| Ferrite Bead | MLB | Superworld Electronics | 155S0699 | 1 |
| Ferrite Bead | MLB | Taiyo Yuden Co | 155S0824 | 1 |
| Common Mode Choke | MLB | Taiyo Yuden Co | 155S00007 | 1 |
| Transient Suppressor | MLB | On Semiconductor | 377S00016 | 1 |
| Transient Suppressor | MLB | Texas Instruments | 377S00005 | 2 |
| Transient Suppressor | MLB | On Semiconductor | 377S00022 | 2 |