

EMI - TEST REPORT

- FCC Part 15B -



Deutsche
Akkreditierungsstelle
D-PL-12030-01-01

Test Report No. : T36291-00-01HS	17. December 2012 Date of issue
---	------------------------------------

Type / Model Name : McAIRE

Product Description : AV product with WLAN Module

Applicant : McIntosh Laboratory, Inc.

Address : 2 Chambers Street

BINGHAMTON, NY 13903, USA

Manufacturer : McIntosh Laboratory, Inc.

Address : 2 Chambers Street

BINGHAMTON, NY 13903, USA

Licence holder : McIntosh Laboratory, Inc.

Address : 2 Chambers Street

BINGHAMTON, NY 13903, USA

Test Result according to the standards listed in clause 1 test standards:	POSITIVE
--	-----------------



The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

Contents

1	<u>TEST STANDARDS</u>	3
2	<u>SUMMARY</u>	4
2.1	General remarks	4
2.2	Final assessment	5
3	<u>EQUIPMENT UNDER TEST</u>	6
3.1	Photo documentation of the EUT – Detailed photos see attachment A, T36291-00	6
3.2	Power supply system utilised	6
3.3	Short description of the equipment under test (EUT)	6
4	<u>TEST ENVIRONMENT</u>	7
4.1	Address of the test laboratory	7
4.2	Environmental conditions	7
4.3	Statement of the measurement uncertainty	7
4.4	Measurement protocol for FCC	8
4.5	Determination of worst case measurement conditions	9
5	<u>TEST CONDITIONS AND RESULTS</u>	10
5.1	Conducted emission	10
5.2	Radiated emission	13
6	<u>USED TEST EQUIPMENT AND ACCESSORIES</u>	15

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15 Subpart A - General (September, 2012)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15 Subpart B - Unintentional Radiators (September, 2010)

Part 15, Subpart B, Section 15.107	AC Line conducted emission <input type="checkbox"/> Class A device <input checked="" type="checkbox"/> Class B device
Part 15, Subpart B, Section 15.109	Radiated emission, general requirements
Part 15, Subpart B, Section 15.111	Antenna power conduction

ANSI C63.4: 2009	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
------------------	---

CISPR 16-4-2: 2003	Uncertainty in EMC measurement
--------------------	--------------------------------

CISPR 22: 2005 EN 55022: 2006	Information technology equipment
----------------------------------	----------------------------------

2.2 Final assessment

The equipment under test **fulfills** the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 19 November 2012

Testing concluded on : 22 November 2012

Checked by:

Tested by:

Klaus Gegenfurtner
Dipl.-Ing.(FH)
Manager: Radio Group

Hermann Smetana
Dipl.-Ing.(FH)
Radio Expert

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EUT – Detailed photos see attachment A, T36291-00

3.2 Power supply system utilised

Power supply voltage : 100 VAC to 240 VAC

3.3 Short description of the equipment under test (EUT)

The EUT has different ways to support audio files. One of the important is internet radio per WLAN.

Number of tested samples: 1
Serial number: ACE1002

EUT operation mode:

The equipment under test was operated during the measurement under the following conditions:

- RX continuous mode

EUT configuration:

(The CDF filled by the applicant can be viewed at the test laboratory.)

The following peripheral devices and interface cables were connected during the measurements:

- _____ Model : _____
- _____ Model : _____
- _____ Model : _____

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

mikes-testingpartners gmbh
Ohmstrasse 2-4
94342 STRASSKIRCHEN
GERMANY

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15-35 °C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader may notice that tolerances within the calibration of the equipment and facilities may cause additional uncertainty. The measurement uncertainty is calculated for all measurements listed in this test report acc. to CISPR 16-4-2 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurement“ and documented in the mikes-testingpartners gmbh quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, mikes-testingpartners gmbh, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component diversity and modifications in production processes may result in additional deviation. If necessary, refer to the test lab for the actual measurement uncertainty for specific tests. The manufacturer has the sole responsibility of continued compliance of the EUT.

4.4 Measurement protocol for FCC

4.4.1 General information

4.4.1.1 Test methodology

Conducted and radiated disturbance testing is performed according to the procedures set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

4.4.1.2 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.4.2 Details of test procedures

4.4.2.1 General standard information

The test methods used comply with CISPR Publication 22, EN 55022 - "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.4 - "Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.4.3 Conducted emission

4.4.3.1 Description of measurement

The final level, expressed in dB μ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit or to the CISPR limit.

To convert between dB μ V and μ V, the following conversions apply:

$$\begin{aligned} \text{dB}\mu\text{V} &= 20 \cdot \log(\mu\text{V}) \\ \mu\text{V} &= 10^{(\text{dB}\mu\text{V}/20)} \end{aligned}$$

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a Line Impedance Stabilization Network (LISN) with 50 Ω / 50 μ H (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

4.4.4 Radiated emission (electrical field 30 MHz - 1 GHz)

4.4.4.1 Description of measurement

Spurious emission from the EUT is measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarised antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 m non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is established in accordance with ANSI C63.4. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the centre in a serpentine fashion so that they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the centre of the table and to a screened room located outside the test area. The antenna is positioned in horizontal polarisation and is repeated vertically. To locate maximum emission from the test sample the antenna is varied in height from 1 to 4 metres and the EUT is rotated 360 degrees.

The final level in dB μ V/m is calculated by add the antenna correction factor and cable loss factor (dB) on the reading from the EMI receiver (dB μ V). The FCC or CISPR limit is subtracted from this result in order to provide the delta to limit listed in the measurement protocol.

Example:

Frequency (MHz)	Reading level (dB μ V)	+	Correction Factor (dB/m)	=	Level (dB μ V/m)	-	CISPR Limit (dB μ V/m)	=	Delta (dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

4.4.5 Radiated emission (electrical field 1 GHz - 40 GHz)

4.4.5.1 Description of measurement

Radiated emission from the EUT are measured in the frequency range 1 GHz up to the maximum frequency as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a 1.0 X 1.5 metre non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is following set out in ANSI C63.4. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the centre in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the centre of the table and to a screened room located outside the test area. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyser set to max peak detector function and a resolution 1 MHz and video bandwidth 3 MHz for peak and 10 Hz for average measurement. The conditions determined as worst case will then be used for the final measurements. When the EUT is larger than the beam width of the measuring antenna it will be moved over the surface for the four sides of the equipment. Where appropriate, the test distance may be reduced in order to detect emission under better uncertainty and is calculated to the specified test distance.

4.5 Determination of worst case measurement conditions

Measurements are made in all practical axes and the settings of the EUT are changed to locate at which position and at what setting of the EUT produce the maximum of the emission. For the further measurement the EUT is set in X position with the following settings: RX continuous.

5 TEST CONDITIONS AND RESULTS

5.1 Conducted emission

For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up – Detailed photos see attachment B, T36291-00

5.1.3 Applicable standard

According to FCC Part 15, Section 15.107(a):

Except for Class A devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the given limits.

5.1.4 Description of Measurement

The measurements are performed following the procedures set out in ANSI C63.4 described under item 4.4.3. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emission are re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin: -11.5 dB at 1.255 MHz

Limit according to FCC Part 15, Section 15.107(a):

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

The requirements are **FULFILLED**.

Remarks: For detailed test result please refer to following test protocols.

5.1.6 Test protocol

Test point: L1
 Operation mode: RX continuous mode
 Remarks:

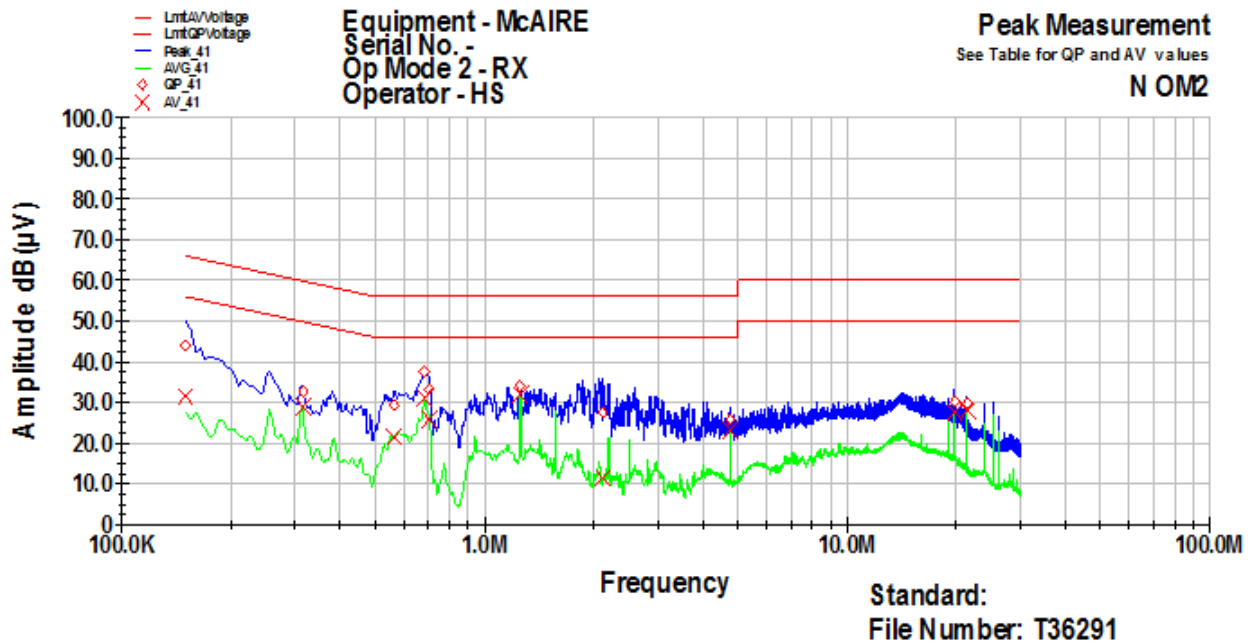
Result: passed



Frequency MHz	QP Level dB(µV)	QP Margin dB	QP Limit dB	AV Level dB(µV)	AV Margin dB	AV Limit dB
0.15	45.5	-20.5	66.0	31.5	-24.5	56.0
0.315	32.7	-27.2	59.8	28.3	-21.5	49.8
0.685	37.1	-18.9	56.0	30.2	-15.8	46.0
0.705	34.6	-21.4	56.0	27.5	-18.5	46.0
0.995	28.4	-27.6	56.0	21.0	-25.0	46.0
1.255	36.1	-19.9	56.0	34.5	-11.5	46.0
2.1	26.1	-29.9	56.0	10.2	-35.8	46.0
4.755	26.2	-29.8	56.0	23.7	-22.3	46.0
19.755	29.3	-30.7	60.0	27.1	-22.9	50.0
21.4	29.1	-30.9	60.0	27.7	-22.3	50.0

Test point: N
 Operation mode: RX continuous mode
 Remarks:

Result: passed



Frequency MHz	QP Level dB(µV)	QP Margin dB	QP Limit dB	AV Level dB(µV)	AV Margin dB	AV Limit dB
0.15	44.2	-21.8	66.0	31.6	-24.4	56.0
0.315	32.9	-26.9	59.8	28.8	-21.0	49.8
0.565	29.5	-26.5	56.0	21.5	-24.5	46.0
0.685	37.5	-18.5	56.0	31.0	-15.0	46.0
0.705	33.1	-22.9	56.0	25.7	-20.3	46.0
1.255	34.0	-22.0	56.0	32.1	-13.9	46.0
2.12	27.4	-28.6	56.0	11.4	-34.6	46.0
4.755	26.0	-30.0	56.0	23.3	-22.7	46.0
19.755	30.1	-29.9	60.0	27.6	-22.4	50.0
21.4	29.7	-30.3	60.0	27.9	-22.1	50.0

5.2 Radiated emission

For test instruments and accessories used see section 6 Part **SER 2, SER 3**.

5.2.1 Description of the test location

Test location: OATS 1
 Test location: Anechoic chamber 2
 Test distance: 3 m

5.2.2 Photo documentation of the test setup – Detailed photos see attachment B, T36291-00

5.2.3 Applicable standard

According to FCC Part 15B, Section 15.109 (a):

Except for Class A digital devices, the field strength of radiated emission from unintentional radiators at a distance of 3 m shall not exceed the given limit.

5.2.4 Description of Measurement

The radiated power of the spurious emission from the EUT is measured in a test setup following the procedures set out in ANSI C63.4. If the emission level of the EUT in peak mode complies with the average/quasipeak limit is 20 dB lower, then testing will be stopped and peak values of the EUT will be reported, otherwise the emission will be measured in average/quasipeak mode again and reported.

Instrument settings:
 30 MHz – 1000 MHz: RBW: 120 kHz
 1000 MHz – 12500 MHz: RBW: 1 MHz

5.2.5 Test result

f < 1 GHz:

Frequency (MHz)	L: QP (dB μ V)	Correct. (dB/m)	L: QP (dB μ V/m)	Limit (dB μ V/m)	Delta (dB)
124.20	8.1	11.9	20.0	43.5	-23.5
282.23	13.6	15.1	28.7	46.0	-17.3
293.54	8.3	15.6	23.9	46.0	-22.1
304.82	12.7	16.0	28.7	46.0	-17.3
316.11	7.9	16.3	24.2	46.0	-21.8
327.40	6.7	16.6	23.3	46.0	-22.7
338.70	7.0	16.9	23.9	46.0	-22.1
372.55	5.5	17.8	23.3	46.0	-22.7
375.00	14.4	17.9	32.3	46.0	-13.7
666.08	4.0	24.8	28.8	46.0	-17.2
675.00	7.5	24.9	32.4	46.0	-13.6
688.66	6.8	25.0	31.8	46.0	-14.2
711.24	7.3	25.4	32.7	46.0	-13.3
729.00	12.9	25.9	38.8	46.0	-7.2
733.80	6.8	26.0	32.8	46.0	-13.2

f > 1 GHz:

Frequency (MHz)	L: PK (dB μ V)	L: AV (dB μ V)	Correct. (dB)	L: PK (dB μ V/m)	L: AV (dB μ V/m)	Limit AV (dB μ V/m)	Delta (dB)
3892	-	-	-	41.3	-	54.0	-12.7

Limit according to FCC Part 15B, Section 15.109(a):

Frequency (MHz)	Limit (μ V/m)	Limit (dB μ V/m)
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

The requirements are **FULFILLED**.

Remarks: The measurement was performed according to FCC Part 15A, Section 15.33(b), up to 12.5 GHz.

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	ESHS 30	02-02/03-05-002	11/07/2013	11/07/2012		
	NNLK 8129	02-02/20-05-001	09/07/2012	09/01/2012		
	ESH 2 - Z 5	02-02/20-05-004	12/05/2013	12/05/2011	12/03/2013	12/09/2012
	N-4000-BNC	02-02/50-05-138				
	N-1500-N	02-02/50-05-140				
	ESH 3 - Z 2	02-02/50-05-155	02/04/2013	02/10/2012		
SER 2	ESVS 30	02-02/03-05-006	26/06/2013	26/06/2012		
	VULB 9168	02-02/24-05-005	16/03/2013	16/03/2012	08/04/2013	08/10/2012
	S10162-B	02-02/50-05-031				
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N_20m	02-02/50-12-018				
SER 3	FSP 30	02-02/11-05-001	18/10/2013	18/10/2012		
	AFS4-01000400-10-10P-4	02-02/17-05-003				
	AMF-4F-04001200-15-10P	02-02/17-05-004				
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	3117	02-02/24-05-009	16/02/2013	16/02/2012		
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				