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Test report

FCC-15.209 and RSS-210 #291261

Date of issue: February 23, 2016

Applicant: MoJoose Inc.

Product: Cellular Phone Signal Receiver

Model: MJ-I6B-1001 Model variant: N/A

FCC ID: 2AFV8-CAMJPI6B1001 IC Registration number: 20621-MJPI6B1001

Specifications:

- FCC 47 CFR Part 15.209

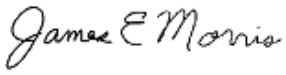
  Radiated emission limits; general requirements.

- IC RSS-210 Issue 8

  Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

Test location

Company name	Nemko USA Inc.
Address	2210 Faraday Ave., Suite 150
City	Carlsbad
Province	CA
Postal code	92008-7226
Country	USA
Telephone	+1 858-755-5525
Website	www.nemko.com
Site number	FCC: US5058; IC: 2040B

Tested by:	Feng You, Sr. Wireless Engineer
Reviewed by:	James Morris
Date:	February 23, 2016
Signature:	

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko USA's ISO/IEC 17025 accreditation.

Copyright notification

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Section 1. Report summary

1.1 Applicant and manufacturer

Company name:	MoJoose Inc.
Address:	27821 Trellis Way
City:	Laguna Niguel
Province/State:	CA
Postal/Zip code:	92677
Country:	U.S.A.

1.2 Test specifications

FCC 47 CFR Part 15.209	Radiated emission limits; general requirements.

1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

1.4 Exclusions

None

1.5 Test report revision history

Revision #	Details of changes made to test report
1	Original report issued
2	Editorial Update.
3	Added information on page 6 to support certification filing

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Not applicable
§15.31(e)	Variation of power source	Not applicable[1]
§15.203	Antenna requirement	Pass[2]
§15.209	Radiated emission limits; general requirements	Pass

Notes: [1] Tested with freshly charge battery.

[2] The Antennas are located within the enclosure of EUT and not user accessible.

2.2 IC RSS-210, Issue 8, test results

Part	Test description	Verdict
2.1	RSS-Gen Compliance	Pass
2.2	Emissions Falling Within Restricted Frequency Bands	Pass
2.3	Receivers	Not applicable[1]
2.5	General Field Strength Limits	Pass
2.5.1	Transmitters with Wanted Emissions that are Within the General Field Strength Limits	Pass

Notes: [1] No stand-alone receiver in EUT.

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	August 20, 2015
Nemko sample ID number	1

3.2 EUT information

Product name	Cellular Phone Signal Amplifier
Model	MJ-i6B-1001
Model variant	N/A
Serial number	MJ150901A1010

3.3 Technical information

Operating bands	LTE FDD 2/4/5/13/17/25/26, WCDMA 2/4/5, CDMA BC0/1, GSM 850/1900 734-746MHz, 746-756MHz, 869-894MHz, 1930-1990MHz, 2110-2155MHz, 1930-1995MHz, 859-894MHz
Operating frequency	734-746MHz, 746-756MHz, 869-894MHz, 1930-1990MHz, 2110-2155MHz, 1930-1995MHz, 859-894MHz
Modulation type	AMP *
Occupied bandwidth (99 %)	AMP *
Emission designator	D7W, F9W, G7W
Power requirements	Internal Lithium Polymer Battery
Antenna information	The EUT uses a unique antenna coupling/ non-detachable antenna for the transmission to the intentional radiator.

* Not internal generated, only amplifies downlink signal received by host phone's antenna.

3.4 Product description and theory of operation

Product description: This product is an iPhone 6 protective case with extra battery and very low power cellular signal amplifier (LNA) to increase the downlink signal for the device users.

Theory of operation: This product has three main functions:

1. Protective case.
2. A built in battery extender which charges the phone and gives the phone over 100% more battery life.
3. The product receives very low level cellular downlink signal with its donor receive antenna and then amplifies the signal with its low noise amplifier (LNA), which is then wirelessly coupled to the phone's internal antenna.

3.5 EUT exercise details

EUT was tested with iPhone 6 when registered to LTE 2. The results was compared to baseline without the EUT (iPhone 6 Only).
The device was in its normal active state amplifying signals received from the base station simulator as described in the test plan agreed to in KDB filing.
EUT (with iPhone 6) was tested in 3 orthogonal positions.

3.6 EUT setup diagram

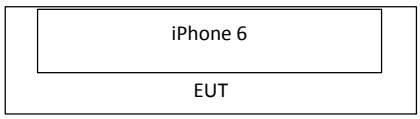

Figure 3.6-1: *Setup diagram*

Figure 3.6-2: *EUT in 3 Orthogonal Positions*

3.7 EUT sub assemblies

Table 3.7-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number
Cellular Phone Signal Amplifier	MoJoose	MJ-i6B-1001	MJ150901A1010
Lithium Polymer Battery (Internal)	MoJoose	ASP-1S1P-4446A1	N/A
Cellphone (Host)	Apple	iPhone A1549	358369061945322

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Lithium Polymer Battery 3.7V.

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

Nemko USA Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 “Uncertainty in EMC measurements.” Measurement uncertainty was calculated using the methods described in CISPR 16-4 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC measurements; as well as described in UKAS LAB34: The expression of Uncertainty in EMC Testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Frequency/Time Uncertainty <=0.2ms
Amplitude Uncertainty <=1.7dB

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: *Equipment list*

Asset Tag	Description	Manufacturer	Model	Serial #	Last Cal	Next Cal
877	Antenna, DRG Horn, .7-18GHz	AH Systems	SAS-571	688	25-Nov-2014	25-Nov-2016
1480	Antenna, Bilog	Schaffner-Chase	CBL6111C	2572	18-May-2015	18-May-2016
1733	Antenna, Active Loop	EMCO	6507	45939	21-Oct-2014	21-Oct-2015
1767	Receiver, EMI Test 20Hz - 26.5 GHz - 150 - +30 dBm LCD	Rohde & Schwartz	ESIB26	837491/0002	04-Nov-2014	04-Nov-2015
E1064	Spectrum Analyzer	Agilent	E4440A	US42221762	22-Dec-2014	22-Dec-2015
Client	Basestation Simulator	Rohde & Schwartz	CMW500	CMW50050-140665	N/A*	N/A*

*Device from client, provide basestation signal for Phone to register only.

Section 8. Testing data

8.1 FCC 15.209 Radiated emission limits; general requirements. RSS-210-I8 2.5 General Field Strength Limits.

8.1.1 Definitions and limits

FCC: The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:
RSs-Gen: The emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table:

Table 8.1-1: *FCC §15.209 and RSS-Gen 8.9 – Radiated emission limits*

Frequency, MHz	Field strength of emissions µV/m	dBµV/m	Measurement distance, m
0.009–0.490	2400/F	$67.6 - 20 \times \log_{10}(F)$	300
0.490–1.705	24000/F	$87.6 - 20 \times \log_{10}(F)$	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges. For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test

Table 8.1-2: *FCC §15.205 and RSS-Gen 8.10 - Restricted frequency bands*

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

8.1.2 Test summary

Test date:	August 27, 2015	Temperature:	24 °C
Test engineer:	Feng You	Air pressure:	1002 mbar
Verdict:	Pass	Relative humidity:	55 %

No degradation detected by adding the EUT to the iPhone 6.

8.1.3 Observations, settings and special notes

The spectrum was searched from 9kHz to the 18GHz. Radiated measurements were performed at a distance of 3 m.
EUT was tested with iPhone 6 when registered to LTE 2. The results was compared to baseline without the EUT (iPhone 6 Only).
EUT (with iPhone 6) was tested in 3 orthogonal positions.

Spectrum analyzer settings for frequencies 9-150 kHz:

Detector mode	Peak
Resolution bandwidth	200 Hz
Video bandwidth	1 kHz
Trace mode	Max Hold
Measurement time	Auto

Spectrum analyzer settings for frequencies 150kHz-30 MHz:

Detector mode	Peak
Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Trace mode	Max Hold
Measurement time	Auto

Spectrum analyzer settings for radiated measurements from 30-1000MHz:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyzer settings for radiated measurements above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

8.1.4 Test data

Table 8.1-3: *Radiated field strength measurement results for EUT with iPhone 6*

Position	Frequency, MHz	Peak Field strength, dBµV/m		Margin, dB	
		Measured	Limit		
Horizontal	2440.5	**49.4**	**54.00**	**5.6**	**Wifi/BT Signal**
Vertical	2440.5	**49.8**	**54.00**	**5.2**	**Wifi/BT Signal**

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.

Table 8.1-3: *Radiated field strength measurement results for iPhone 6 Baseline*

Position	Frequency, MHz	Peak Field strength, dBµV/m		Margin, dB	Note
		Measured	Limit		
Horizontal	2437.5	**51.2**	**54.00**	**2.8**	**Wifi/BT Signal**
Vertical	2432.5	**45.7**	**54.00**	**8.3**	**Wifi/BT Signal**

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.

8.1.4 Test data, continued

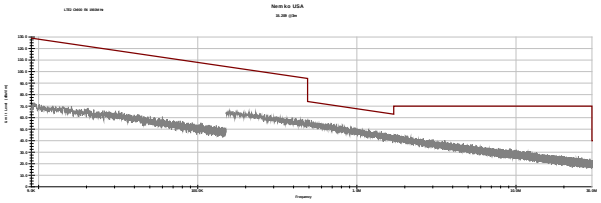

Figure 8.1-1: *Radiated spurious emissions <30MHz for EUT with iPhone 6*

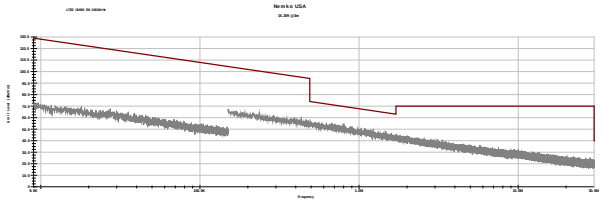

Figure 8.1-2: *Radiated spurious emissions <30MHz for iPhone 6 only (Baseline)*

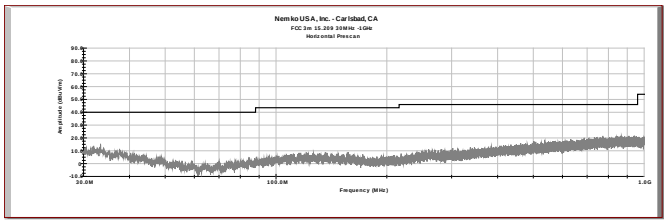

Figure 8.1-3: *Radiated spurious emissions 30-1000MHz for EUT with iPhone 6 (Horizontal)*

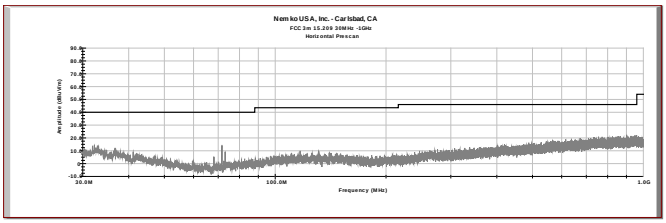

Figure 8.1-4: *Radiated spurious emissions 30-1000MHz for iPhone 6 only (Baseline Horizontal)*

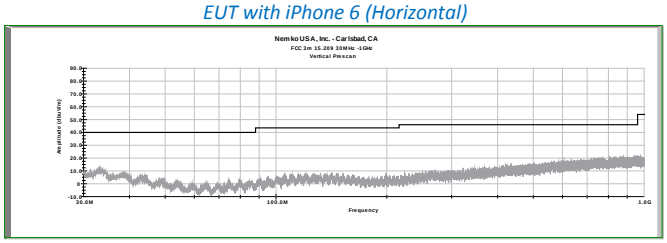

Figure 8.1-5: *Radiated spurious emissions 30-1000MHz for EUT with iPhone 6 (Vertical)*

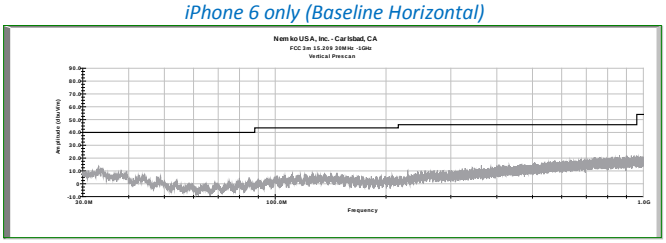

Figure 8.1-6: *Radiated spurious emissions 30-1000MHz for iPhone 6 only (Baseline Vertical)*

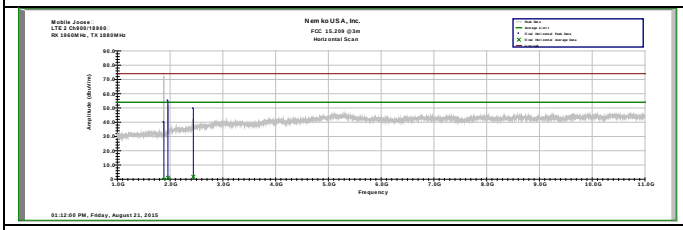

Figure 8.1-7: *Radiated spurious emissions >1GHz for EUT with iPhone 6 (Horizontal)*

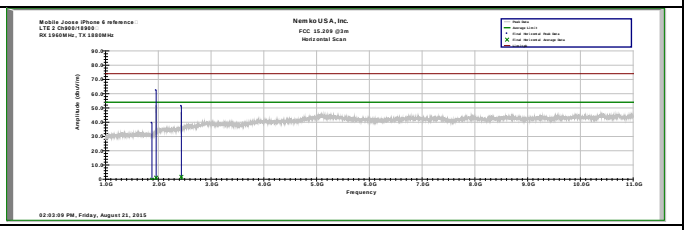

Figure 8.1-8: *Radiated spurious emissions >1GHz for iPhone 6 only (Baseline Horizontal)*

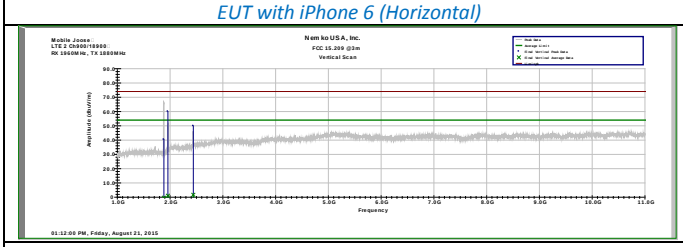

Figure 8.1-9: *Radiated spurious emissions >1GHz for EUT with iPhone 6 (Vertical)*

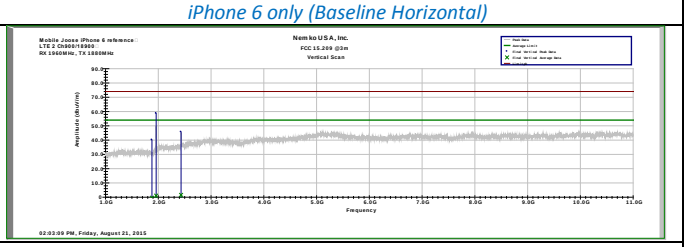

Figure 8.1-10: *Radiated spurious emissions >1GHz for iPhone 6 only (Baseline Vertical)*

1. Emissions at 1880MHz are burst from periodic registration update from iPhone 6. Ignored
2. Emissions at 1960MHz are basestation signal from CMW500. Ignored
3. Emissions at 2.44GHz range are from WiFi/BT interference. Ignored
4. There is no degradation between baseline and tested with EUT. No emissions above noise floor detected (except the 3 items ignored above).

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up