# Tesla Motors, Inc.

**EMC TEST REPORT FOR**

## UMC 315 MHz
## Model: 1023049-02-D rev02

**Tested To The Following Standards:**

**FCC Part 15 Subpart C Section(s)**
**15.207 & 15.231**

**Report No.: 95630-10**

**Date of issue: April 16, 2015**

ACCREDITED
Testing Certificates:
803.01, 803.02, 803.05, 803.06

**This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of EMC testing for CKC Laboratories, Inc.**

**We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.**

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Testing the Future
CKC LABORATORIES, INC.

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# ADMINISTRATIVE INFORMATION

## Test Report Information

**REPORT PREPARED FOR:**

Tesla Motors, Inc.
3500 Deer Creek
Palo Alto, CA 94304

Representative: Robert Cooper
Customer Reference Number: 4700057777

**REPORT PREPARED BY:**

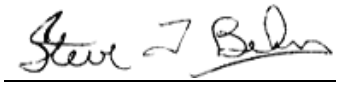
Morgan Tramontin
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 95630

**DATE OF EQUIPMENT RECEIPT:** March 25, 2015
**DATE(S) OF TESTING:** March 25, 2015

## Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



***Steve Behm***
***Director of Quality Assurance & Engineering Services***
***CKC Laboratories, Inc.***

# Test Facility Information

Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
1120 Fulton Place
Fremont, CA 94539

# Software Versions

| CKC Laboratories Proprietary Software | Version |
|---|---|
| EMITest Emissions | 5.00.14 |
| Immunity | 5.00.07 |

# Site Registration & Accreditation Information

| Location | CB # | TAIWAN | CANADA | FCC | JAPAN |
|---|---|---|---|---|---|
| Fremont | US0082 | SL2-IN-E-1148R | 3082B-1 | 958979 | A-0149 |

# SUMMARY OF RESULTS

## Standard / Specification: FCC Part 15 Subpart C

| Test Procedure | Description | Modifications* | Results |
|---|---|---|---|
| 15.31(e) | Voltage Variation | NA | Pass |
| | | | |
| 15.207 | Conducted Emissions | NA | Pass |
| | | | |
| 15.231(a) | Periodic Operation | NA | Pass |
| | | | |
| 15.231(b) | RF Output Power | NA | Pass |
| | | | |
| 15.231(b) | Field Strength of Radiated Spurious Emissions | NA | Pass |
| | | | |
| 15.231(c) | Occupied Bandwidth | NA | Pass |
| | | | |

# Modifications* During Testing

This list is a summary of the modifications made to the equipment during testing.

| Summary of Conditions |
|---|
| No modifications were made during testing. |
| |

***Modifications listed above must be incorporated into all production units.**

# Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

| Summary of Conditions |
|---|
| The EUT is an electrical vehicle charge cable handle used for UMC (Universal Mobile Connector), HPC (High Power Wall Connector), and Superchargers. The button on the handle sends a signal to the Model S to open the charge port for charging. The EUT is powered up with 3.3 VDC.<br>The EUT is placed on the 80 cm Styrofoam table. The EUT is turn ON and OFF by an external 555 timer circuit. The EUT is set in continuously transmit mode at 50% Duty Cycle. |
| |

# EQUIPMENT UNDER TEST (EUT)

## EQUIPMENT UNDER TEST

**UMC 315 MHz**
Manuf: Tesla Motors, Inc.
Model: 1023049-02-D rev02
Serial: 0314IG0007190

## PERIPHERAL DEVICES

The EUT was tested with the following peripheral device(s):

**555 Timer Circuit**
Manuf: Tesla Motors, Inc.
Model: None
Serial: None

**Charging Cable**
Manuf: Tesla Motors, Inc.
Model: None
Serial: None

**DC Power Supply**
Manuf: Protek
Model: 3006B
Serial: AG4070

Note: The above DC Power Supply was supplied by CKC Laboratories.

# FCC PART 15 SUBPART C

## 15.31(e) Voltage Variations

### Test Data

Test Location: CKC Laboratories, Inc. • 1120 Fulton Places • Fremont, CA 94539 • (510) 249-1170

Customer: **Tesla Motors, Inc.**
Specification: **15.31(e)**
Work Order #: **95630** Date: 3/25/2015
Test Type: **Maximized Emissions** Time: 15:49:31
Equipment: **UMC 315 MHz** Sequence#: 6
Manufacturer: Tesla Motors, Inc. Tested By: Daniel Bertran
Model: 1023049-02-D rev02
S/N: 0314IG0007190

***Test Equipment*:**

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | AN00852 | Biconilog Antenna | CBL 6111C | 11/24/2014 | 11/24/2016 |
| T2 | AN00686 | Preamp | 8447D Opt 010 | 5/27/2014 | 5/27/2016 |
| T3 | ANP00880 | Cable | RG214U | 6/13/2014 | 6/13/2016 |
| T4 | ANP05300 | Cable | RG214/U | 3/25/2013 | 3/25/2015 |
| T5 | ANP01183 | Cable | CNT-195 | 9/3/2013 | 9/3/2015 |
| | AN03471 | RF Characteristics Analyzer | E4440A | 12/19/2013 | 12/19/2015 |
| | AN00432 | Loop Antenna | 6502 | 4/2/2013 | 4/2/2015 |
| T6 | AN02157 | Horn Antenna-ANSI C63.5 Calibration | 3115 | 12/2/2014 | 12/2/2016 |
| T7 | ANP06712 | Cable | 32022-29094K-29094K-48TC | 9/18/2014 | 9/18/2016 |
| T8 | AN02754 | High Pass Filter | 6IH40-500/T3000-O/O | 1/15/2014 | 1/15/2016 |
| T9 | AN03114 | Preamp | AMF-7D-00101800-30-10P | 4/11/2013 | 4/11/2015 |
| T10 | ANP01210 | Cable | FSJ1P-50A-4A | 1/15/2015 | 1/15/2017 |
| T11 | AN03302 | Cable | 32026-29094K-29094K-72TC | 3/24/2014 | 3/24/2016 |

***Equipment Under Test* (* = EUT):**

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| UMC 315 MHz* | Tesla Motors, Inc. | 1023049-02-D rev02 | 0314IG0007190 |

***Support Devices:***

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| 555 timer circuit | Tesla Motors, Inc. | None | None |
| Charging cable | Tesla Motors, Inc. | None | None |
| DC Power Supply | Protek | 3006B | AG4070 |

***Test Conditions / Notes:***

15.31e Setup

Firmware Used: None
Temperature: 21.4°C
Humidity: 45 %
Atmospheric Pressure: 102 kPa

Test Method: ANSI C 63.4 (2009)

Transmitting operating frequency= 315MHz
RF Output= 0dBm

The EUT is an electrical vehicle charge cable handle used for UMC (Universal Mobile Connector), HPC (High Power Wall Connector), and Superchargers. The button on the handle sends a signal to the Model S to open the charge port for charging. The EUT is powered up with 3.3 VDC.
The EUT is placed on the 80 cm Styrofoam table. The EUT is turn ON and OFF by an external 555 timer circuit. The EUT is set in continuously transmit mode at 50% Duty Cycle.

Note: No change observed on the radiated signal level of the fundamental while voltage was varied between 97% and 103% of the 3.3VDC nominal voltage specified by manufacturer.

# 15.207 AC Conducted Emissions

## Test Data

Test Location: CKC Laboratories, Inc. • 1120 Fulton Places • Fremont, CA 94539 • (510) 249-1170

Customer: **Tesla Motors, Inc.**
Specification: **15.207 AC Mains - Average**
Work Order #: **95630** Date: 3/25/2015
Test Type: **Conducted Emissions** Time: 9:31:28 AM
Equipment: **UMC 315 MHz** Sequence#: 1
Manufacturer: Tesla Motors, Inc. Tested By: Daniel Bertran
Model: 1023049-02-D rev02 120V 60Hz
S/N: 0314IG0007190

***Test Equipment*:**

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | AN00493 | 50uH LISN-L1 (L) Loss W/O European Adapter | 3816/NM | 3/4/2015 | 3/4/2017 |
| | AN00493 | 50uH LISN-L(2) N Loss W/O European Adapter | 3816/NM | 3/4/2015 | 3/4/2017 |
| T2 | ANP05258 | High Pass Filter | HE9615-150K-50-720B | 11/14/2014 | 11/14/2016 |
| T3 | ANP00880 | Cable | RG214U | 6/13/2014 | 6/13/2016 |
| T4 | ANP05300 | Cable | RG214/U | 3/25/2013 | 3/25/2015 |
| T5 | ANP01211 | Attenuator | PE7002-10 | 4/2/2013 | 4/2/2015 |
| | AN03470 | Spectrum Analyzer | E4440A | 12/2/2013 | 12/2/2015 |

***Equipment Under Test* (* = EUT):**

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| UMC 315 MHz* | Tesla Motors, Inc. | 1023049-02-D rev02 | 0314IG0007190 |

***Support Devices:***

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| 555 timer circuit | Tesla Motors, Inc. | None | None |
| Charging cable | Tesla Motors, Inc. | None | None |
| DC Power Supply | Protek | 3006B | AG4070 |

***Test Conditions / Notes:***

Conducted Emissions
Frequency Range: 150kHz to 30MHz

Firmware Used: None
Temperature: 21.4°C
Humidity: 45 %
Atmospheric Pressure: 102 kPa
High Clock: 10MHz

Test Method: ANSI C 63.4 (2009)

Transmitting operating frequency= 315MHz
RF Output= 0dBm

The EUT is an electrical vehicle charge cable handle used for UMC (Universal Mobile Connector), HPC (High Power Wall Connector), and Superchargers. The button on the handle sends a signal to the Model S to open the charge port for charging. The EUT is powered up with 3.3 VDC.
The EUT is placed on the 80 cm Styrofoam table. The EUT is turn ON and OFF by an external 555 timer circuit. The EUT is set in continuously transmit mode at 50% Duty Cycle.

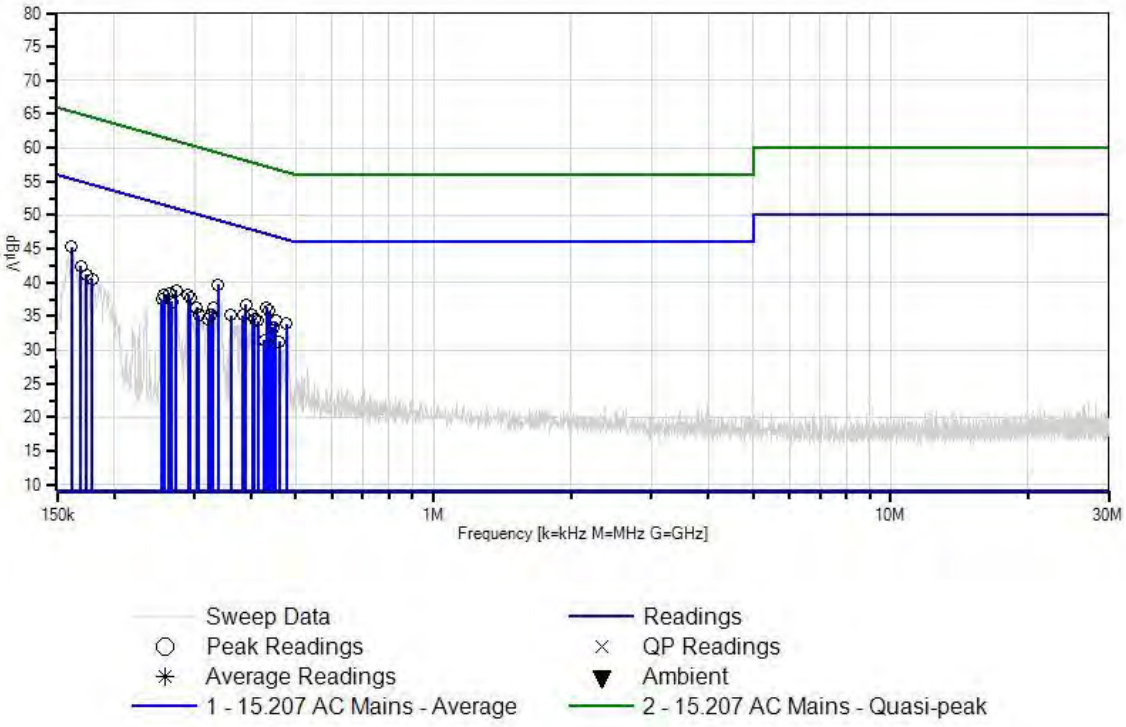
Ext Attn: 0 dB

***Measurement Data:*** Reading listed by margin. Test Lead: Black

| # | Freq | Rdng | T1<br>T5 | T2 | T3 | T4 | Dist | Corr | Spec | Margin | Polar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBµV | dB | dB | dB | dB | Table | dBµV | dBµV | dB | Ant |
| 1 | 338.346k | 29.9 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 39.7 | 49.2 | -9.5 | Black |
| 2 | 161.635k | 35.1 | +0.1<br>+9.6 | +0.5 | +0.0 | +0.0 | +0.0 | 45.3 | 55.4 | -10.1 | Black |
| 3 | 431.429k | 26.5 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 36.3 | 47.2 | -10.9 | Black |
| 4 | 437.246k | 26.0 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 35.8 | 47.1 | -11.3 | Black |
| 5 | 388.524k | 26.9 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 36.7 | 48.1 | -11.4 | Black |
| 6 | 273.625k | 29.0 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 38.8 | 51.0 | -12.2 | Black |
| 7 | 290.351k | 28.4 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 38.2 | 50.5 | -12.3 | Black |
| 8 | 401.613k | 25.5 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 35.3 | 47.8 | -12.5 | Black |
| 9 | 451.790k | 24.4 | +0.1<br>+9.6 | +0.2 | +0.0 | +0.0 | +0.0 | 34.3 | 46.8 | -12.5 | Black |
| 10 | 475.788k | 24.0 | +0.1<br>+9.6 | +0.2 | +0.0 | +0.0 | +0.0 | 33.9 | 46.4 | -12.5 | Black |
| 11 | 168.907k | 32.3 | +0.1<br>+9.6 | +0.4 | +0.0 | +0.0 | +0.0 | 42.4 | 55.0 | -12.6 | Black |
| 12 | 293.987k | 27.9 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 37.7 | 50.4 | -12.7 | Black |
| 13 | 263.444k | 28.6 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 38.4 | 51.3 | -12.9 | Black |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | 383.433k | 25.4 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 35.2 | 48.2 | -13.0 | Black |
| 15 | 405.249k | 24.8 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 34.6 | 47.7 | -13.1 | Black |
| 16 | 257.626k | 28.4 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 38.2 | 51.5 | -13.3 | Black |
| 17 | 328.893k | 26.4 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 36.2 | 49.5 | -13.3 | Black |
| 18 | 412.521k | 24.5 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 34.3 | 47.6 | -13.3 | Black |
| 19 | 173.998k | 31.1 | +0.1<br>+9.6 | +0.4 | +0.0 | +0.0 | +0.0 | 41.2 | 54.8 | -13.6 | Black |
| 20 | 360.890k | 25.3 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 35.1 | 48.7 | -13.6 | Black |
| 21 | 445.246k | 23.6 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 33.4 | 47.0 | -13.6 | Black |
| 22 | 303.440k | 26.5 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 36.3 | 50.1 | -13.8 | Black |
| 23 | 179.088k | 30.5 | +0.1<br>+9.6 | +0.3 | +0.0 | +0.0 | +0.0 | 40.5 | 54.5 | -14.0 | Black |
| 24 | 267.807k | 27.4 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 37.2 | 51.2 | -14.0 | Black |
| 25 | 254.718k | 27.7 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 37.5 | 51.6 | -14.1 | Black |
| 26 | 324.529k | 25.5 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 35.3 | 49.6 | -14.3 | Black |
| 27 | 307.076k | 25.3 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 35.1 | 50.0 | -14.9 | Black |
| 28 | 320.893k | 24.7 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 34.5 | 49.7 | -15.2 | Black |
| 29 | 459.063k | 21.3 | +0.1<br>+9.6 | +0.2 | +0.0 | +0.0 | +0.0 | 31.2 | 46.7 | -15.5 | Black |
| 30 | 427.065k | 21.6 | +0.1<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 31.4 | 47.3 | -15.9 | Black |

CKC Laboratories, Inc Date: 3/25/2015 Time: 9:31:28 AM Tesla Motors, Inc WO#: 95630
Test Lead: Black 120V 60Hz Sequence#: 1



Test Location: CKC Laboratories, Inc. • 1120 Fulton Places • Fremont, CA 94539 • (510) 249-1170

Customer: **Tesla Motors, Inc.**
Specification: **15.207 AC Mains - Average**
Work Order #: **95630** Date: 3/25/2015
Test Type: **Conducted Emissions** Time: 9:35:02 AM
Equipment: **UMC 315 MHz** Sequence#: 2
Manufacturer: Tesla Motors, Inc. Tested By: Daniel Bertran
Model: 1023049-02-D rev02 120V 60Hz
S/N: 0314IG0007190

***Test Equipment*:**

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| | AN00493 | 50uH LISN-L1 (L) Loss W/O European Adapter | 3816/NM | 3/4/2015 | 3/4/2017 |
| T1 | AN00493 | 50uH LISN-L(2) N Loss W/O European Adapter | 3816/NM | 3/4/2015 | 3/4/2017 |
| T2 | ANP05258 | High Pass Filter | HE9615-150K-50-720B | 11/14/2014 | 11/14/2016 |
| T3 | ANP00880 | Cable | RG214U | 6/13/2014 | 6/13/2016 |
| T4 | ANP05300 | Cable | RG214/U | 3/25/2013 | 3/25/2015 |
| T5 | ANP01211 | Attenuator | PE7002-10 | 4/2/2013 | 4/2/2015 |
| | AN03470 | Spectrum Analyzer | E4440A | 12/2/2013 | 12/2/2015 |

***Equipment Under Test* (* = EUT):**

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| UMC 315 MHz* | Tesla Motors, Inc. | 1023049-02-D rev02 | 0314IG0007190 |

***Support Devices:***

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| 555 timer circuit | Tesla Motors, Inc. | None | None |
| Charging cable | Tesla Motors, Inc. | None | None |
| DC Power Supply | Protek | 3006B | AG4070 |

***Test Conditions / Notes:***

Conducted Emissions
Frequency Range: 150kHz to 30MHz
Firmware Used: None
Temperature: 21.4°C
Humidity: 45 %
Atmospheric Pressure: 102 kPa
High Clock: 10MHz

Test Method: ANSI C 63.4 (2009)
Transmitting operating frequency= 315MHz
RF Output= 0dBm

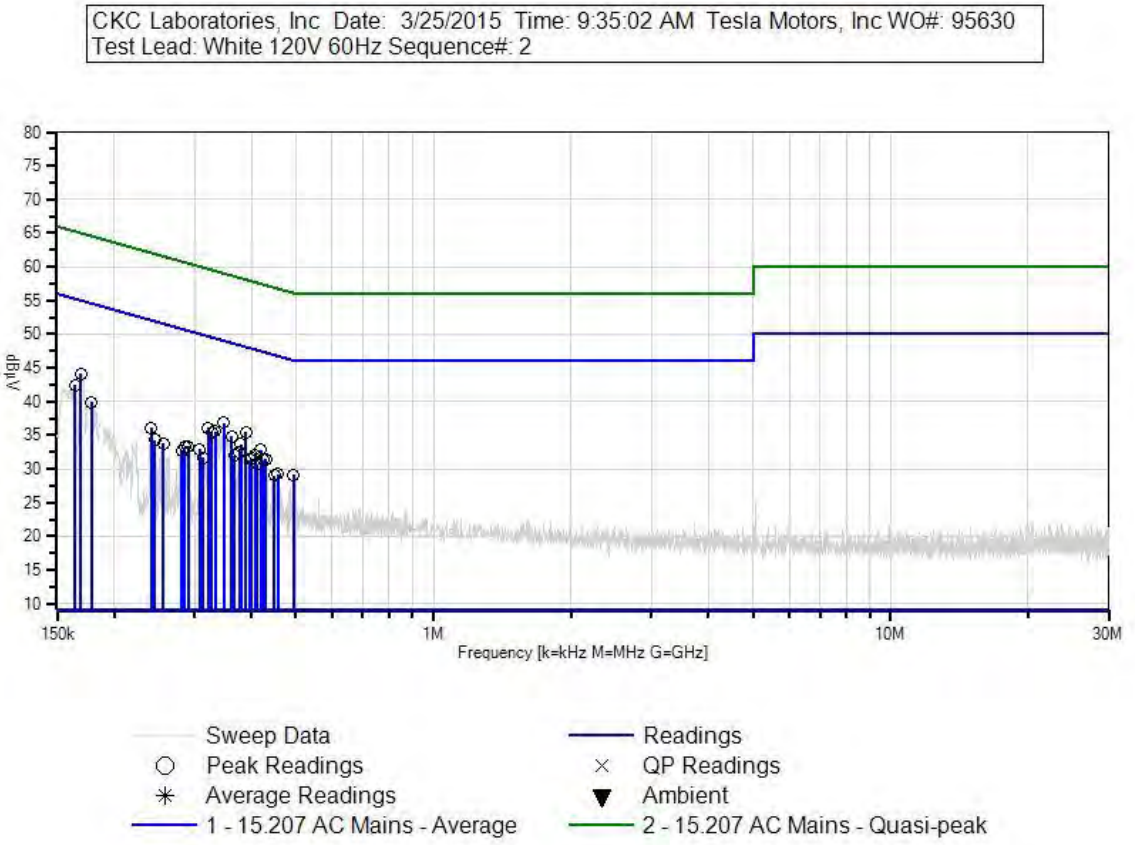
The EUT is an electrical vehicle charge cable handle used for UMC (Universal Mobile Connector), HPC (High Power Wall Connector), and Superchargers. The button on the handle sends a signal to the Model S to open the charge port for charging. The EUT is powered up with 3.3 VDC.
The EUT is placed on the 80 cm Styrofoam table. The EUT is turn ON and OFF by an external 555 timer circuit. The EUT is set in continuously transmit mode at 50% Duty Cycle.

Ext Attn: 0 dB

***Measurement Data:*** Reading listed by margin. Test Lead: White

| # | Freq | Rdng | T1<br>T5 | T2 | T3 | T4 | Dist | Corr | Spec | Margin | Polar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBµV | dB | dB | dB | dB | Table | dBµV | dBµV | dB | Ant |
| 1 | 168.907k | 33.4 | +0.7<br>+9.6 | +0.4 | +0.0 | +0.0 | +0.0 | 44.1 | 55.0 | -10.9 | White |
| 2 | 347.800k | 26.4 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 36.8 | 49.0 | -12.2 | White |
| 3 | 388.524k | 25.1 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 35.5 | 48.1 | -12.6 | White |
| 4 | 164.544k | 31.7 | +0.7<br>+9.6 | +0.4 | +0.0 | +0.0 | +0.0 | 42.4 | 55.2 | -12.8 | White |
| 5 | 320.893k | 25.6 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 36.0 | 49.7 | -13.7 | White |
| 6 | 333.256k | 25.2 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 35.6 | 49.4 | -13.8 | White |
| 7 | 361.617k | 24.4 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 34.8 | 48.7 | -13.9 | White |
| 8 | 326.711k | 25.1 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 35.5 | 49.5 | -14.0 | White |
| 9 | 378.343k | 23.3 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 33.7 | 48.3 | -14.6 | White |
| 10 | 178.361k | 29.3 | +0.7<br>+9.6 | +0.3 | +0.0 | +0.0 | +0.0 | 39.9 | 54.6 | -14.7 | White |
| 11 | 418.339k | 22.4 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 32.8 | 47.5 | -14.7 | White |
| 12 | 407.431k | 21.6 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 32.0 | 47.7 | -15.7 | White |
| 13 | 429.247k | 21.0 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 31.4 | 47.3 | -15.9 | White |
| 14 | 240.901k | 25.7 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 36.1 | 52.1 | -16.0 | White |
| 15 | 376.161k | 22.0 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 32.4 | 48.4 | -16.0 | White |
| 16 | 424.157k | 20.9 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 31.3 | 47.4 | -16.1 | White |
| 17 | 400.159k | 21.2 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 31.6 | 47.9 | -16.3 | White |
| 18 | 366.707k | 21.6 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 32.0 | 48.6 | -16.6 | White |
| 19 | 396.523k | 20.9 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 31.3 | 47.9 | -16.6 | White |
| 20 | 411.794k | 20.3 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 30.7 | 47.6 | -16.9 | White |
| 21 | 494.696k | 18.6 | +0.7<br>+9.6 | +0.2 | +0.0 | +0.0 | +0.0 | 29.1 | 46.1 | -17.0 | White |
| 22 | 290.351k | 23.0 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 33.4 | 50.5 | -17.1 | White |
| 23 | 307.804k | 22.5 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 32.9 | 50.0 | -17.1 | White |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | 285.260k | 22.9 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 33.3 | 50.7 | -17.4 | White |
| 25 | 456.881k | 18.7 | +0.7<br>+9.6 | +0.2 | +0.0 | +0.0 | +0.0 | 29.2 | 46.7 | -17.5 | White |
| 26 | 245.264k | 23.9 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 34.3 | 51.9 | -17.6 | White |
| 27 | 256.172k | 23.4 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 33.8 | 51.6 | -17.8 | White |
| 28 | 448.154k | 18.5 | +0.7<br>+9.6 | +0.2 | +0.0 | +0.0 | +0.0 | 29.0 | 46.9 | -17.9 | White |
| 29 | 281.624k | 22.2 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 32.6 | 50.8 | -18.2 | White |
| 30 | 313.621k | 21.3 | +0.7<br>+9.6 | +0.1 | +0.0 | +0.0 | +0.0 | 31.7 | 49.9 | -18.2 | White |



## Test Setup Photo(s)

# 15.231(a) Periodic Operations

## Test Conditions / Setup

Test Location: CKC Laboratories, Inc. • 1120 Fulton Places • Fremont, CA 94539 • (510) 249-1170

Customer: **Tesla Motors, Inc.**
Specification: **15.231(a)**
Work Order #: **95630** Date: 3/25/2015
Test Type: **Radiated Scan** Time: 15:49:31
Equipment: **UMC 315 MHz** Sequence#: 6
Manufacturer: Tesla Motors, Inc. Tested By: Daniel Bertran
Model: 1023049-02-D rev02
S/N: 0314IG0007190

***Test Equipment*:**

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | AN00852 | Biconilog Antenna | CBL 6111C | 11/24/2014 | 11/24/2016 |
| T2 | AN00686 | Preamp | 8447D Opt 010 | 5/27/2014 | 5/27/2016 |
| T3 | ANP00880 | Cable | RG214U | 6/13/2014 | 6/13/2016 |
| T4 | ANP05300 | Cable | RG214/U | 3/25/2013 | 3/25/2015 |
| T5 | ANP01183 | Cable | CNT-195 | 9/3/2013 | 9/3/2015 |
| | AN03471 | RF Characteristics Analyzer | E4440A | 12/19/2013 | 12/19/2015 |
| | AN00432 | Loop Antenna | 6502 | 4/2/2013 | 4/2/2015 |
| T6 | AN02157 | Horn Antenna-ANSI C63.5 Calibration | 3115 | 12/2/2014 | 12/2/2016 |
| T7 | ANP06712 | Cable | 32022-29094K-29094K-48TC | 9/18/2014 | 9/18/2016 |
| T8 | AN02754 | High Pass Filter | 6IH40-500/T3000-O/O | 1/15/2014 | 1/15/2016 |
| T9 | AN03114 | Preamp | AMF-7D-00101800-30-10P | 4/11/2013 | 4/11/2015 |
| T10 | ANP01210 | Cable | FSJ1P-50A-4A | 1/15/2015 | 1/15/2017 |
| T11 | AN03302 | Cable | 32026-29094K-29094K-72TC | 3/24/2014 | 3/24/2016 |

***Equipment Under Test* (* = EUT):**

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| UMC 315 MHz* | Tesla Motors, Inc. | 1023049-02-D rev02 | 0314IG0007190 |

***Support Devices:***

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| 555 timer circuit | Tesla Motors, Inc. | None | None |
| Charging cable | Tesla Motors, Inc. | None | None |
| DC Power Supply | Protek | 3006B | AG4070 |

***Test Conditions / Notes:***

15.231a

Temperature: 21.4°C
Humidity: 45 %
Atmospheric Pressure: 102 kPa

Test Method: ANSI C 63.4 (2009)

Transmitting operating frequency= 315MHz
RF Output= 0dBm
Firmware Used: None

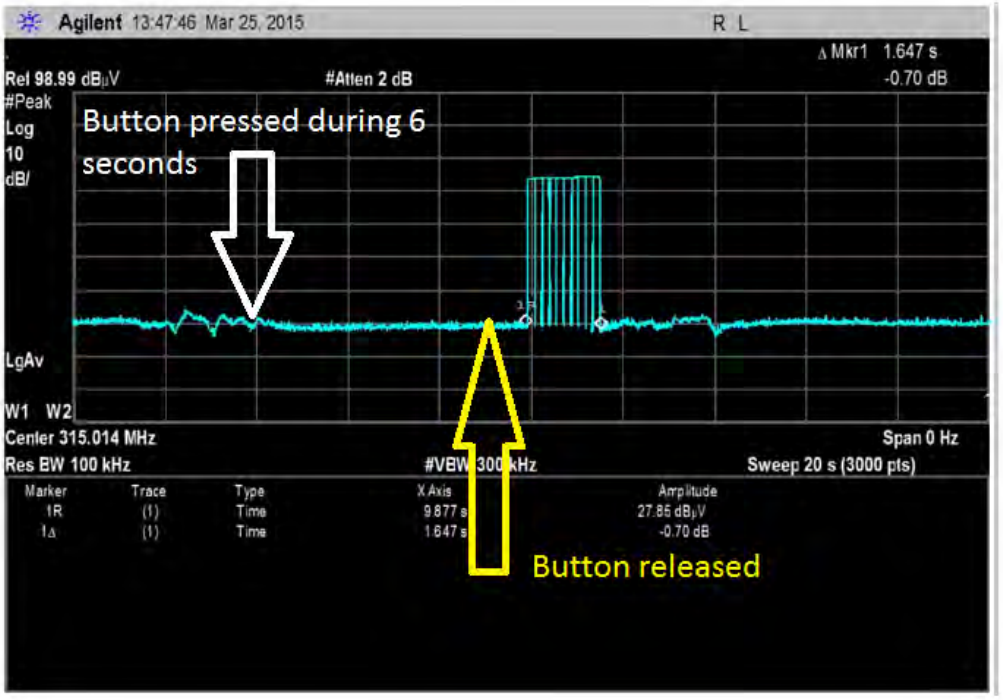
The EUT is an electrical vehicle charge cable handle used for UMC (Universal Mobile Connector), HPC (High Power Wall Connector), and Superchargers. The button on the handle sends a signal to the Model S to open the charge port for charging. The EUT is powered up with 3.3 VDC.
The EUT is placed on the 80 cm Styrofoam table. The EUT is turn ON and OFF by an external 555 timer circuit. The EUT is set in continuously transmit mode at 50% Duty Cycle.

Note: No change observed on the radiated signal level of the fundamental while voltage was varied between 85% and 115% of the 3.3VDC nominal voltage specified by manufacturer.

# Test Data

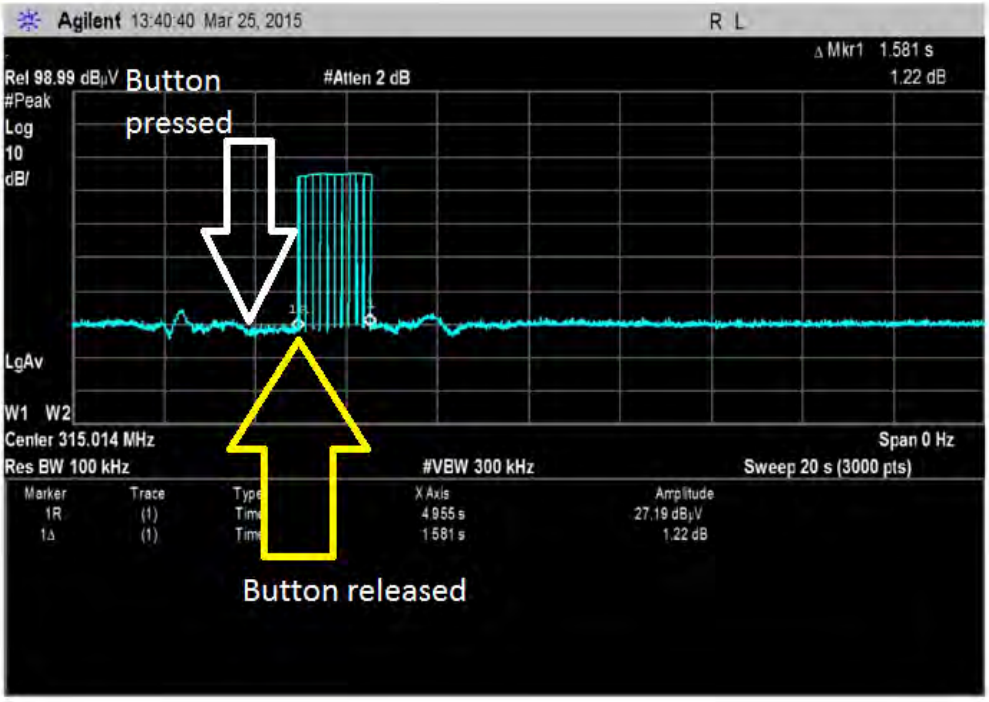
**15.231a**

a) The provisions of this section are restricted to periodic operation within the band 40.66-40.70 MHz and above 70MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:
(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.



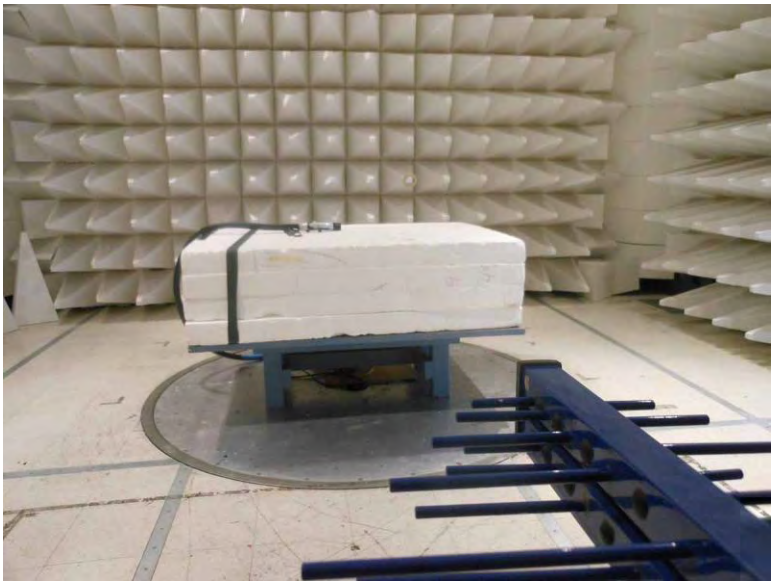

Note: Transmitter does not operate until the button is released. Transmitter operates only during 1.6 seconds.

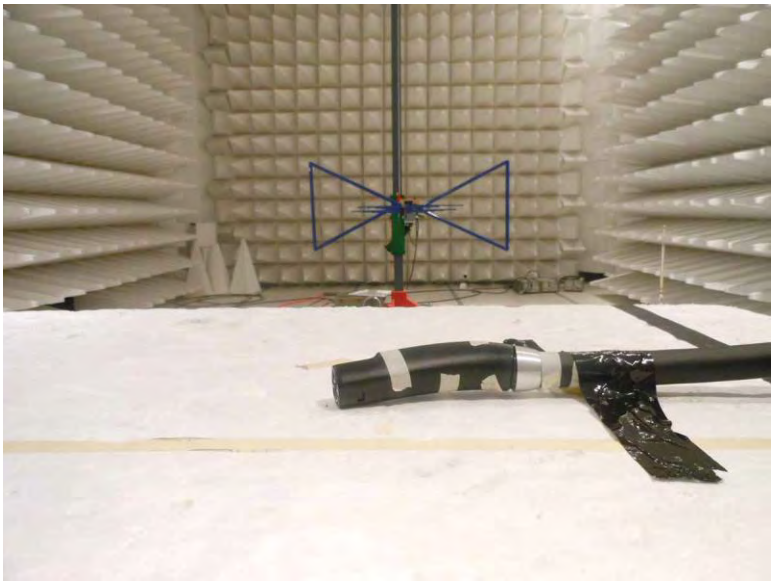
2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.




Note: Transmitter does not operate until the button is released. Transmitter operates only during 1.6 seconds.

## Test Setup Photo(s)





# 15.231(b) RF Output Power

## Test Conditions / Setup

Test Location: CKC Laboratories, Inc. • 1120 Fulton Places • Fremont, CA 94539 • (510) 249-1170

Customer: **Tesla Motors, Inc.**
Specification: **15.231(b) Fundamental Field Strength**
Work Order #: **95630** Date: 3/25/2015
Test Type: **Maximized Emissions** Time: 11:48:59
Equipment: **UMC 315 MHz** Sequence#: 5
Manufacturer: Tesla Motors, Inc. Tested By: Daniel Bertran
Model: 1023049-02-D rev02
S/N: 0314IG0007190

***Test Equipment*:**

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | AN00852 | Biconilog Antenna | CBL 6111C | 11/24/2014 | 11/24/2016 |
| T2 | AN00686 | Preamp | 8447D Opt 010 | 5/27/2014 | 5/27/2016 |
| T3 | ANP00880 | Cable | RG214U | 6/13/2014 | 6/13/2016 |
| T4 | ANP05300 | Cable | RG214/U | 3/25/2013 | 3/25/2015 |
| T5 | ANP01183 | Cable | CNT-195 | 9/3/2013 | 9/3/2015 |
| | AN03470 | Spectrum Analyzer | E4440A | 12/2/2013 | 12/2/2015 |

***Equipment Under Test* (* = EUT):**

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| UMC 315 MHz* | Tesla Motors, Inc. | 1023049-02-D rev02 | 0314IG0007190 |

***Support Devices:***

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| 555 timer circuit | Tesla Motors, Inc. | None | None |
| Charging cable | Tesla Motors, Inc. | None | None |
| DC Power Supply | Protek | 3006B | AG4070 |

***Test Conditions / Notes:***

Fundamental of the EUT

Firmware Used: None
Temperature: 21.4°C
Humidity: 45 %
Atmospheric Pressure: 102 kPa

Test Method: ANSI C 63.4 (2009)

RBW=100kHz
VBW=300kHz

Transmitting operating frequency= 315MHz
RF Output= 0dBm

The EUT is an electrical vehicle charge cable handle used for UMC (Universal Mobile Connector), HPC (High Power Wall Connector), and Superchargers. The button on the handle sends a signal to the Model S to open the charge port for charging. The EUT is powered up with 3.3 VDC.
The EUT is placed on the 80 cm Styrofoam table. The EUT is turn ON and OFF by an external 555 timer circuit. The EUT is set in continuously transmit mode at 50% Duty Cycle.

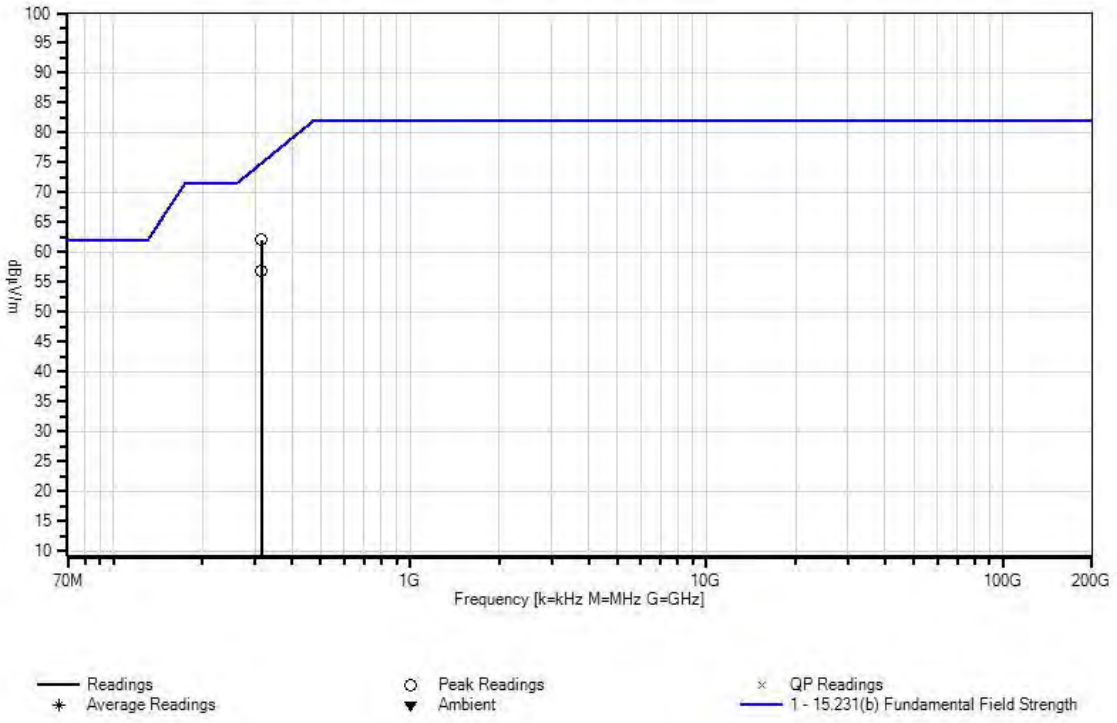
Note: X axis

Ext Attn: 0 dB

***Measurement Data:*** Reading listed by margin. Test Distance: 3 Meters

| # | Freq | Rdng | T1<br>T5 | T2 | T3 | T4 | Dist | Corr | Spec | Margin | Polar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBµV | dB | dB | dB | dB | Table | dBµV/m | dBµV/m | dB | Ant |
| 1 | 315.008M | 74.1 | +13.8<br>+0.5 | -28.5 | +1.7 | +0.5 | +0.0 | 62.1 | 74.9<br>X | -12.8 | Horiz |
| 2 | 315.008M | 69.0 | +13.8<br>+0.5 | -28.5 | +1.7 | +0.5 | +0.0 | 57.0 | 74.9<br>X | -17.9 | Vert |

CKC Laboratories, Inc Date: 3/25/2015 Time: 11:48:59 Tesla Motors, Inc WO#: 95630
Test Distance: 3 Meters Sequence#: 5



Test Location: CKC Laboratories, Inc. • 1120 Fulton Places • Fremont, CA 94539 • (510) 249-1170

Customer: **Tesla Motors, Inc.**
Specification: **15.231(b) Fundamental Field Strength**
Work Order #: **95630** Date: 3/25/2015
Test Type: **Maximized Emissions** Time: 11:48:59
Equipment: **UMC 315 MHz** Sequence#: 5
Manufacturer: Tesla Motors, Inc. Tested By: Daniel Bertran
Model: 1023049-02-D rev02
S/N: 0314IG0007190

***Test Equipment*:**

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | AN00852 | Biconilog Antenna | CBL 6111C | 11/24/2014 | 11/24/2016 |
| T2 | AN00686 | Preamp | 8447D Opt 010 | 5/27/2014 | 5/27/2016 |
| T3 | ANP00880 | Cable | RG214U | 6/13/2014 | 6/13/2016 |
| T4 | ANP05300 | Cable | RG214/U | 3/25/2013 | 3/25/2015 |
| T5 | ANP01183 | Cable | CNT-195 | 9/3/2013 | 9/3/2015 |
| | AN03470 | Spectrum Analyzer | E4440A | 12/2/2013 | 12/2/2015 |

***Equipment Under Test* (* = EUT):**

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| UMC 315 MHz* | Tesla Motors, Inc. | 1023049-02-D rev02 | 0314IG0007190 |

***Support Devices:***

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| 555 timer circuit | Tesla Motors, Inc. | None | None |
| Charging cable | Tesla Motors, Inc. | None | None |
| DC Power Supply | Protek | 3006B | AG4070 |

***Test Conditions / Notes:***

Fundamental of the EUT

Firmware Used: None
Temperature: 21.4°C
Humidity: 45 %
Atmospheric Pressure: 102 kPa

Test Method: ANSI C 63.4 (2009)

RBW=100kHz
VBW=300kHz

Transmitting operating frequency= 315MHz
RF Output= 0dBm

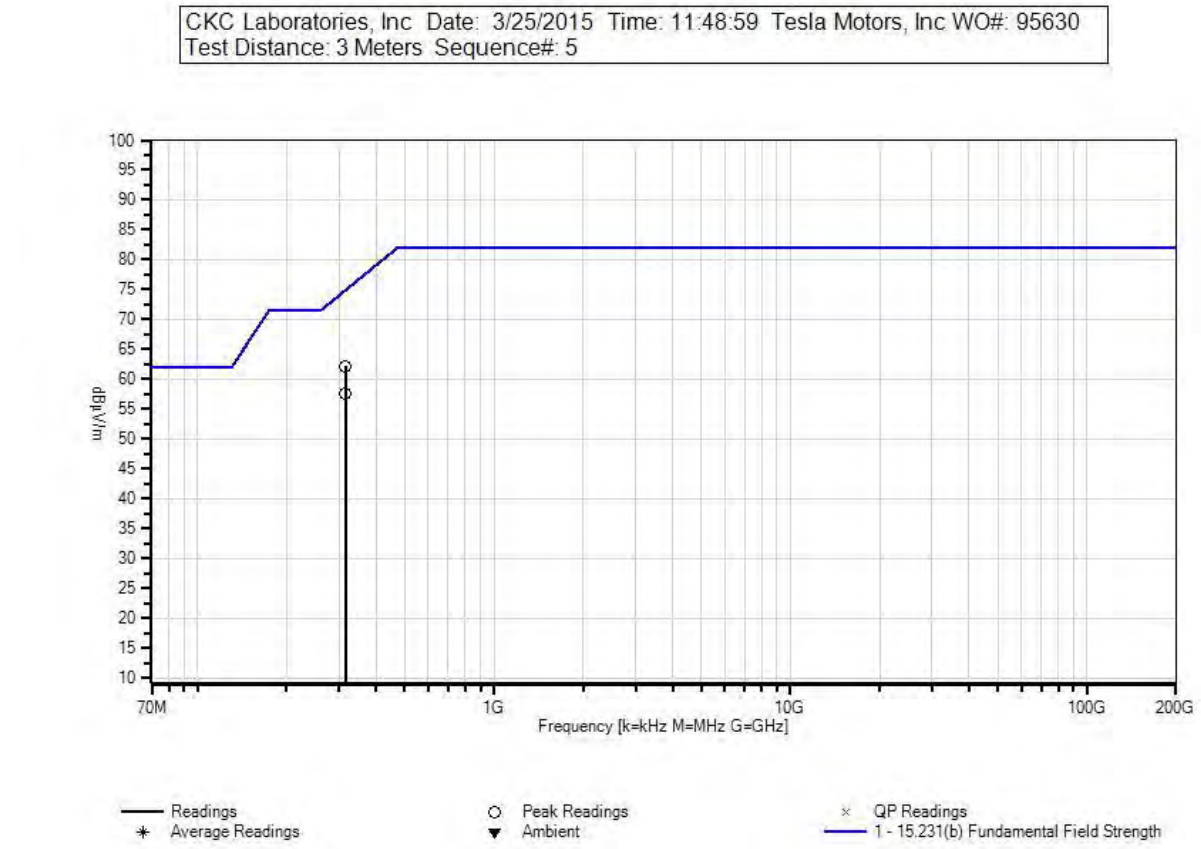
The EUT is an electrical vehicle charge cable handle used for UMC (Universal Mobile Connector), HPC (High Power Wall Connector), and Superchargers. The button on the handle sends a signal to the Model S to open the charge port for charging. The EUT is powered up with 3.3 VDC.
The EUT It is placed on the 80 cm Styrofoam table. The EUT is turn ON and OFF by an external 555 timer circuit. The EUT is set in continuously transmit mode at 50% Duty Cycle.

Note: Y axis

Ext Attn: 0 dB

***Measurement Data:*** Reading listed by margin. Test Distance: 3 Meters

| # | Freq | Rdng | T1<br>T5 | T2 | T3 | T4 | Dist | Corr | Spec | Margin | Polar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBµV | dB | dB | dB | dB | Table | dBµV/m | dBµV/m | dB | Ant |
| 1 | 315.008M | 74.2 | +13.8<br>+0.5 | -28.5 | +1.7 | +0.5 | +0.0 | 62.2 | 74.9<br>Y | -12.7 | Horiz |
| 2 | 315.008M | 69.7 | +13.8<br>+0.5 | -28.5 | +1.7 | +0.5 | +0.0 | 57.7 | 74.9<br>Y | -17.2 | Vert |



Test Location: CKC Laboratories, Inc. • 1120 Fulton Places • Fremont, CA 94539 • (510) 249-1170

Customer: **Tesla Motors, Inc.**
Specification: **15.231(b) Fundamental Field Strength**
Work Order #: **95630** Date: 3/25/2015
Test Type: **Maximized Emissions** Time: 11:48:59
Equipment: **UMC 315 MHz** Sequence#: 5
Manufacturer: Tesla Motors, Inc. Tested By: Daniel Bertran
Model: 1023049-02-D rev02
S/N: 0314IG0007190

***Test Equipment*:**

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | AN00852 | Biconilog Antenna | CBL 6111C | 11/24/2014 | 11/24/2016 |
| T2 | AN00686 | Preamp | 8447D Opt 010 | 5/27/2014 | 5/27/2016 |
| T3 | ANP00880 | Cable | RG214U | 6/13/2014 | 6/13/2016 |
| T4 | ANP05300 | Cable | RG214/U | 3/25/2013 | 3/25/2015 |
| T5 | ANP01183 | Cable | CNT-195 | 9/3/2013 | 9/3/2015 |
| | AN03470 | Spectrum Analyzer | E4440A | 12/2/2013 | 12/2/2015 |

***Equipment Under Test* (* = EUT):**

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| UMC 315 MHz* | Tesla Motors, Inc. | 1023049-02-D rev02 | 0314IG0007190 |

***Support Devices:***

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| 555 timer circuit | Tesla Motors, Inc. | None | None |
| Charging cable | Tesla Motors, Inc. | None | None |
| DC Power Supply | Protek | 3006B | AG4070 |

***Test Conditions / Notes:***

Fundamental of the EUT

Firmware Used: None
Temperature: 21.4°C
Humidity: 45 %
Atmospheric Pressure: 102 kPa

Test Method: ANSI C 63.4 (2009)

RBW=100kHz
VBW=300kHz

Transmitting operating frequency= 315MHz
RF Output= 0dBm

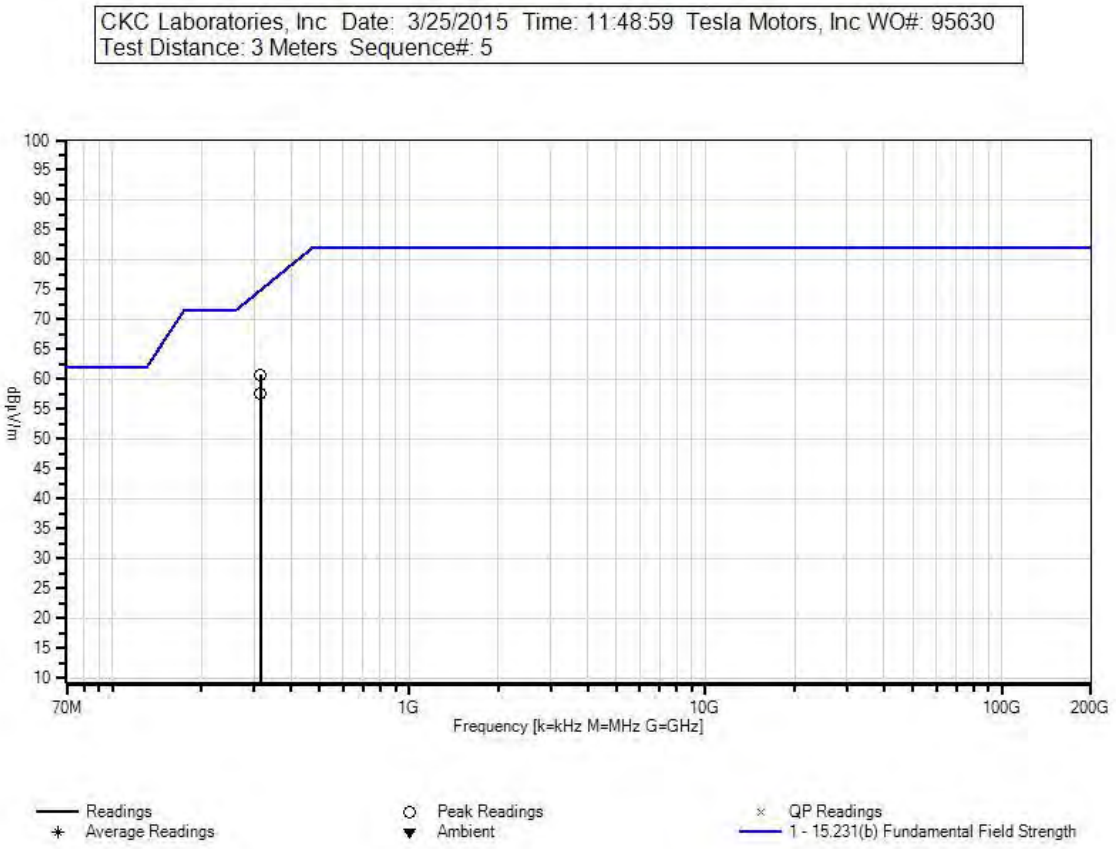
The EUT is an electrical vehicle charge cable handle used for UMC (Universal Mobile Connector), HPC (High Power Wall Connector), and Superchargers. The button on the handle sends a signal to the Model S to open the charge port for charging. The EUT is powered up with 3.3 VDC.
The EUT is placed on the 80 cm Styrofoam table. The EUT is turn ON and OFF by an external 555 timer circuit. The EUT is set in continuously transmit mode at 50% Duty Cycle.

Note: Z axis

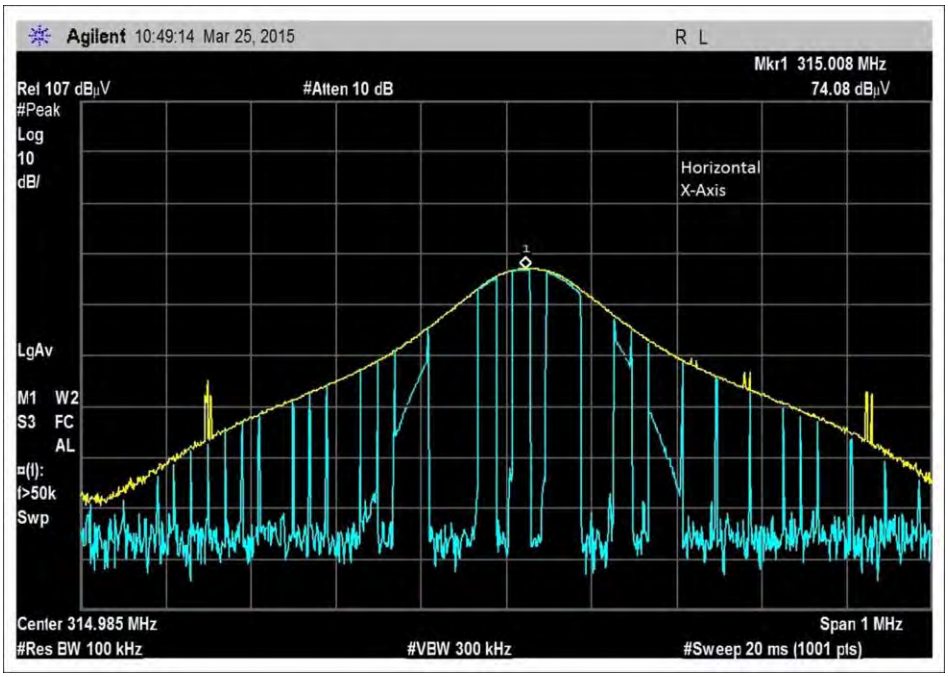
Ext Attn: 0 dB

***Measurement Data:*** Reading listed by margin. Test Distance: 3 Meters

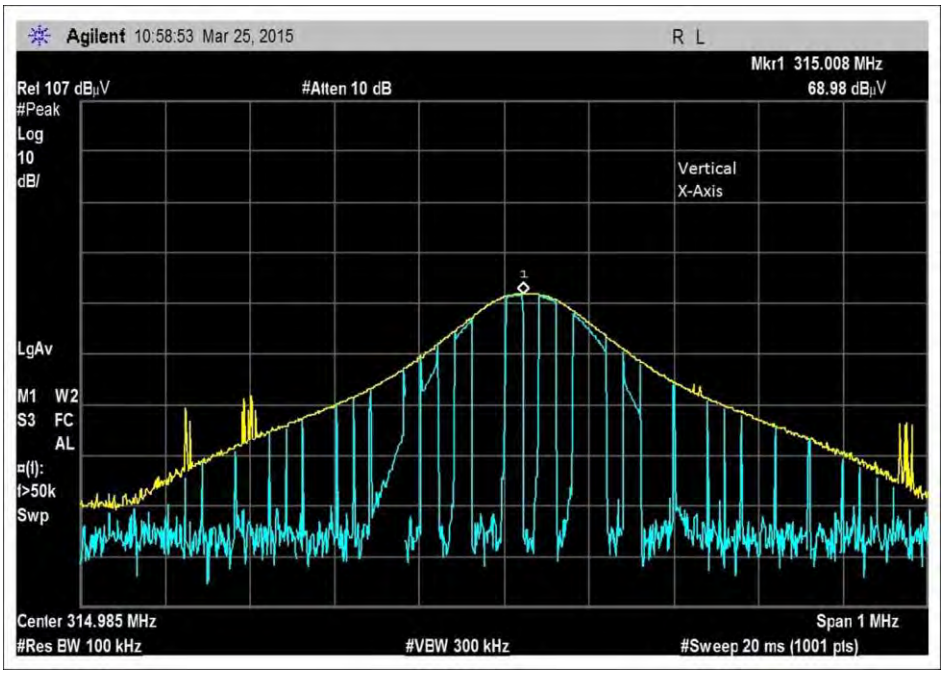
| # | Freq | Rdng | T1<br>T5 | T2 | T3 | T4 | Dist | Corr | Spec | Margin | Polar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBµV | dB | dB | dB | dB | Table | dBµV/m | dBµV/m | dB | Ant |
| 1 | 315.008M | 72.8 | +13.8<br>+0.5 | -28.5 | +1.7 | +0.5 | +0.0 | 60.8 | 74.9<br>Z | -14.1 | Vert |
| 2 | 315.008M | 69.6 | +13.8<br>+0.5 | -28.5 | +1.7 | +0.5 | +0.0 | 57.6 | 74.9<br>Z | -17.3 | Horiz |



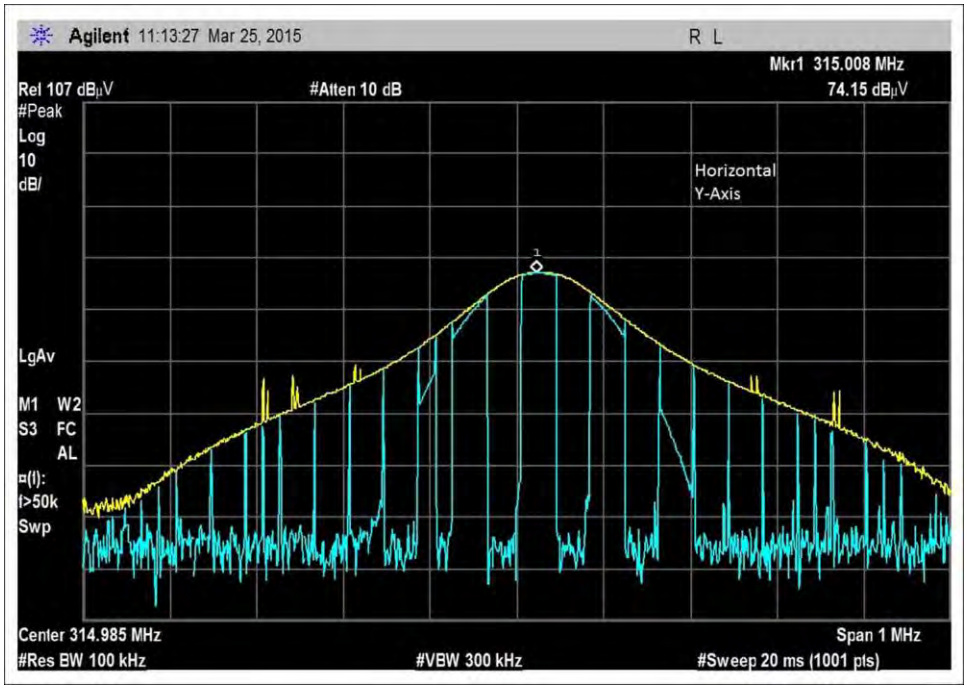
## Test Data



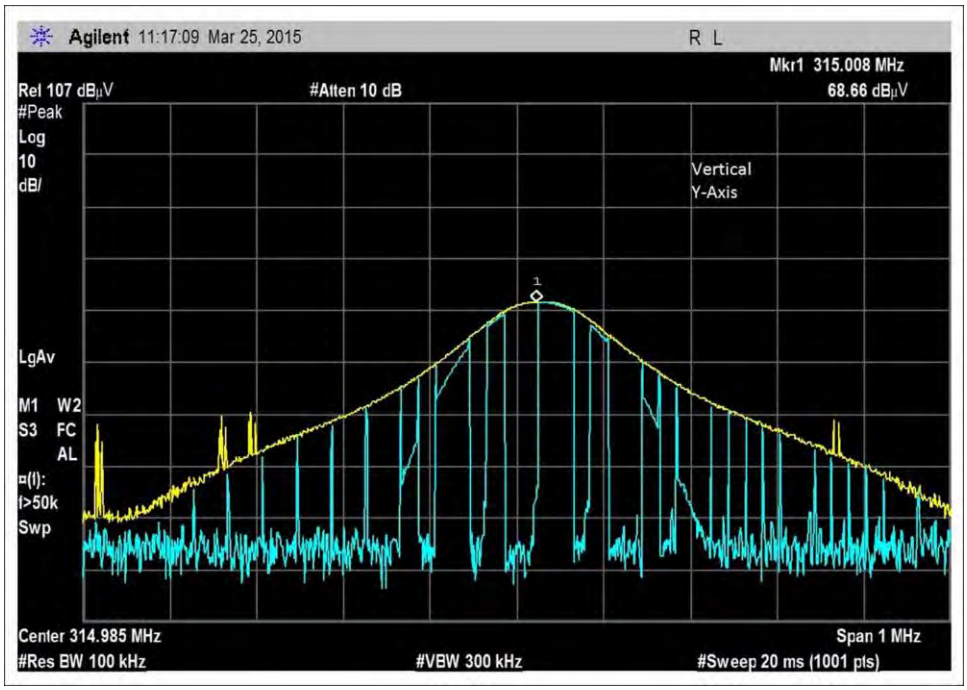

Horizontal Polarization, X-Axis



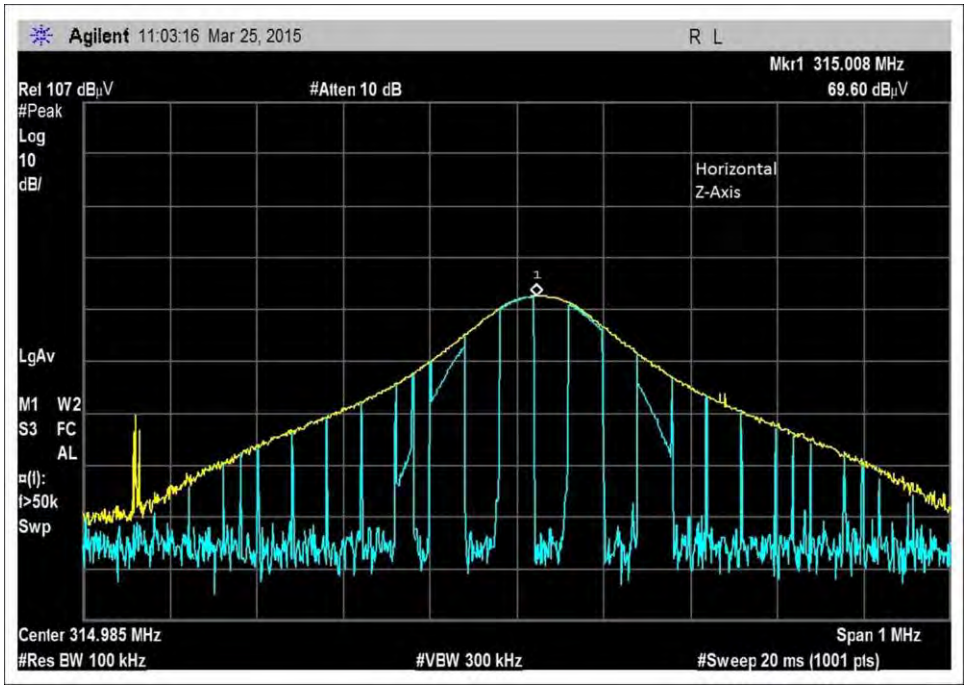

Vertical Polarization, X-Axis



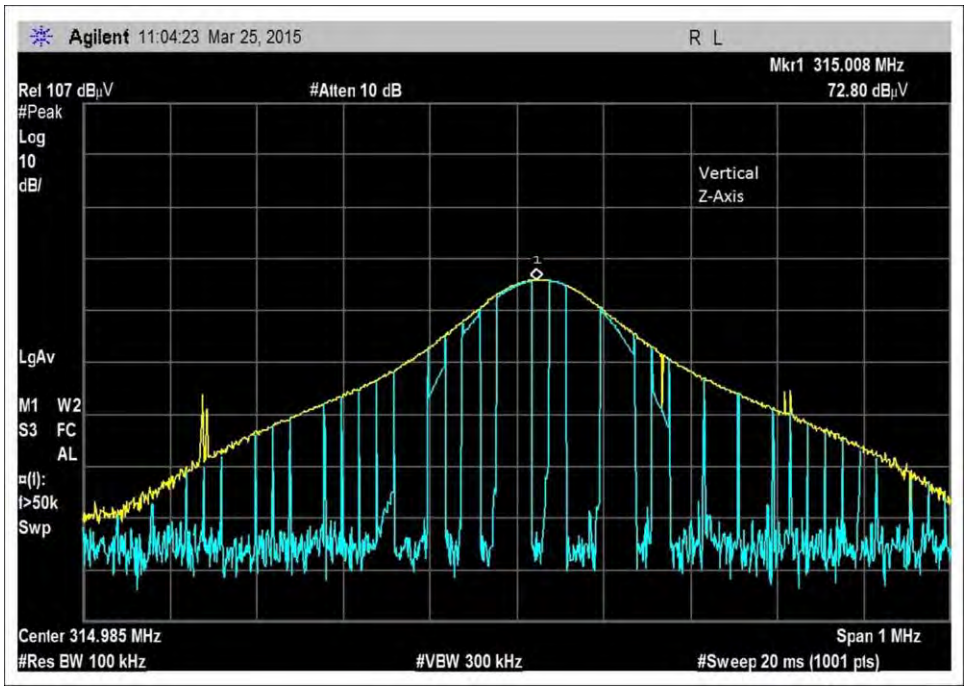

Horizontal Polarization, Y-Axis




Vertical Polarization, Y-Axis

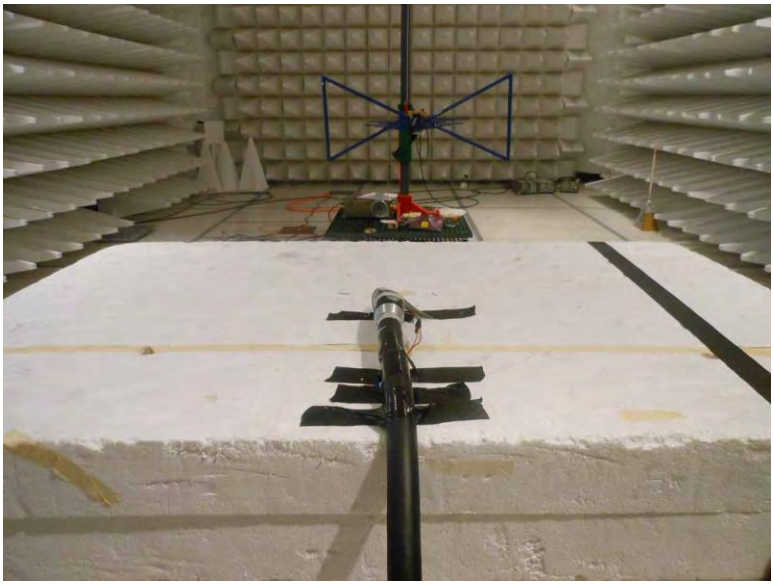



Horizontal Polarization, Z-Axis

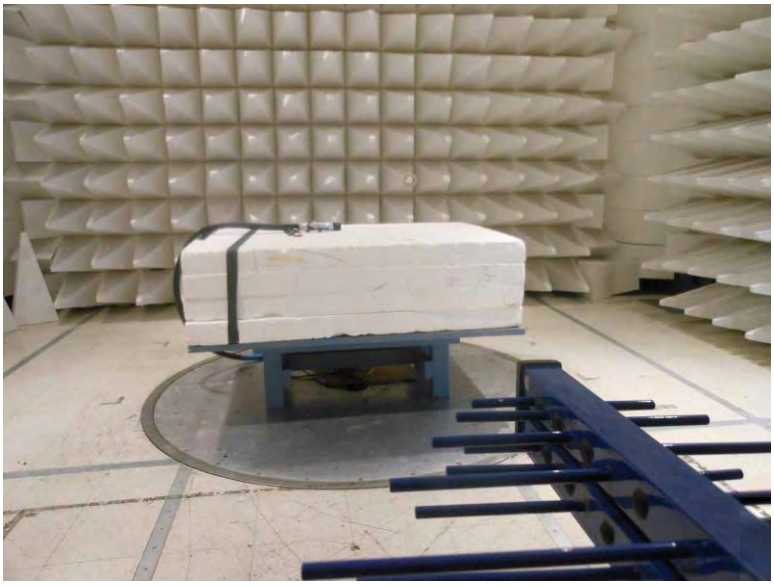



Vertical Polarization, Z-Axis

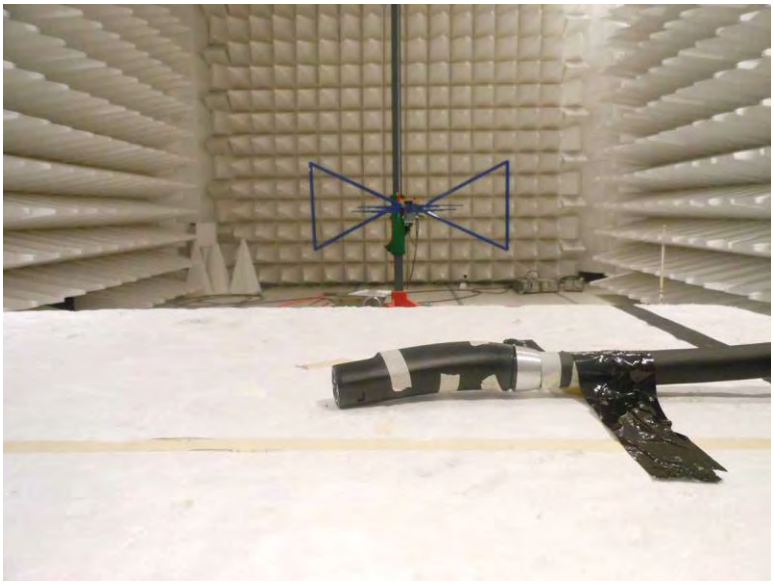
## Test Setup Photo(s)



X-Axis



Front View, Y-Axis



Back View, Y-Axis

Z-Axis

# 15.231(b) Field Strength of Radiated Spurious Emissions

## Test Data

Test Location: CKC Laboratories, Inc. • 1120 Fulton Places • Fremont, CA 94539 • (510) 249-1170

Customer: **Tesla Motors, Inc.**
Specification: **15.231(b) Spurious Field Strength (315 MHz Transmitter)**
Work Order #: **95630** Date: 3/25/2015
Test Type: **Maximized Emissions** Time: 15:49:31
Equipment: **UMC 315 MHz** Sequence#: 6
Manufacturer: Tesla Motors, Inc. Tested By: Daniel Bertran
Model: 1023049-02-D rev02
S/N: 0314IG0007190

***Test Equipment*:**

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | AN00852 | Biconilog Antenna | CBL 6111C | 11/24/2014 | 11/24/2016 |
| T2 | AN00686 | Preamp | 8447D Opt 010 | 5/27/2014 | 5/27/2016 |
| T3 | ANP00880 | Cable | RG214U | 6/13/2014 | 6/13/2016 |
| T4 | ANP05300 | Cable | RG214/U | 3/25/2013 | 3/25/2015 |
| T5 | ANP01183 | Cable | CNT-195 | 9/3/2013 | 9/3/2015 |
| | AN03471 | RF Characteristics Analyzer | E4440A | 12/19/2013 | 12/19/2015 |
| | AN00432 | Loop Antenna | 6502 | 4/2/2013 | 4/2/2015 |
| T6 | AN02157 | Horn Antenna-ANSI C63.5 Calibration | 3115 | 12/2/2014 | 12/2/2016 |
| T7 | ANP06712 | Cable | 32022-29094K-29094K-48TC | 9/18/2014 | 9/18/2016 |
| T8 | AN02754 | High Pass Filter | 6IH40-500/T3000-O/O | 1/15/2014 | 1/15/2016 |
| T9 | AN03114 | Preamp | AMF-7D-00101800-30-10P | 4/11/2013 | 4/11/2015 |
| T10 | ANP01210 | Cable | FSJ1P-50A-4A | 1/15/2015 | 1/15/2017 |
| T11 | AN03302 | Cable | 32026-29094K-29094K-72TC | 3/24/2014 | 3/24/2016 |

***Equipment Under Test* (* = EUT):**

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| UMC 315 MHz* | Tesla Motors, Inc. | 1023049-02-D rev02 | 0314IG0007190 |

***Support Devices:***

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| 555 timer circuit | Tesla Motors, Inc. | None | None |
| Charging cable | Tesla Motors, Inc. | None | None |
| DC Power Supply | Protek | 3006B | AG4070 |

***Test Conditions / Notes:***

Radiated Emissions
Frequency Range: 9kHz-4GHz

Firmware Used: None
Temperature: 21.4°C
Humidity: 45 %
Atmospheric Pressure: 102 kPa

Test Method: ANSI C 63.4 (2009)

Transmitting operating frequency= 315MHz
RF Output= 0dBm

The EUT is an electrical vehicle charge cable handle used for UMC (Universal Mobile Connector), HPC (High Power Wall Connector), and Superchargers. The button on the handle sends a signal to the Model S to open the charge port for charging. The EUT is powered up with 3.3 VDC.
The EUT is placed on the 80 cm Styrofoam table. The EUT is turn ON and OFF by an external 555 timer circuit. The EUT is set in continuously transmit mode at 50% Duty Cycle.

Note: Worst case found on Y orientation (Tesla logo parallel to the chamber walls).

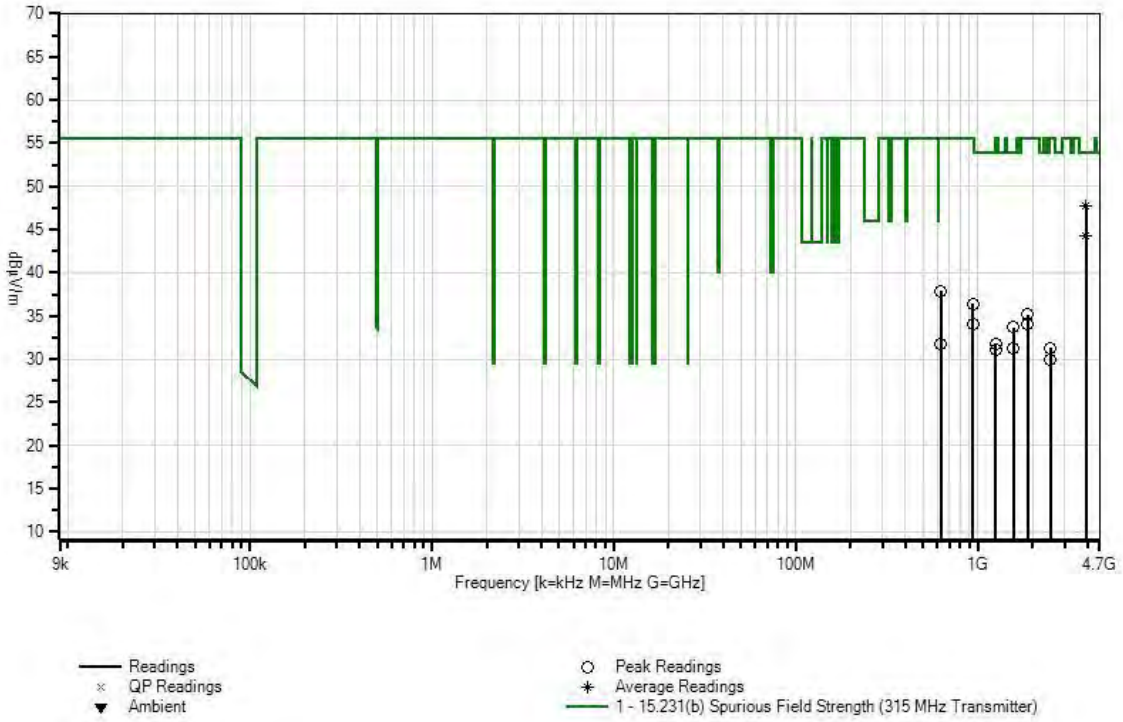
Ext Attn: 0 dB

***Measurement Data:*** Reading listed by margin. Test Distance: 3 Meters

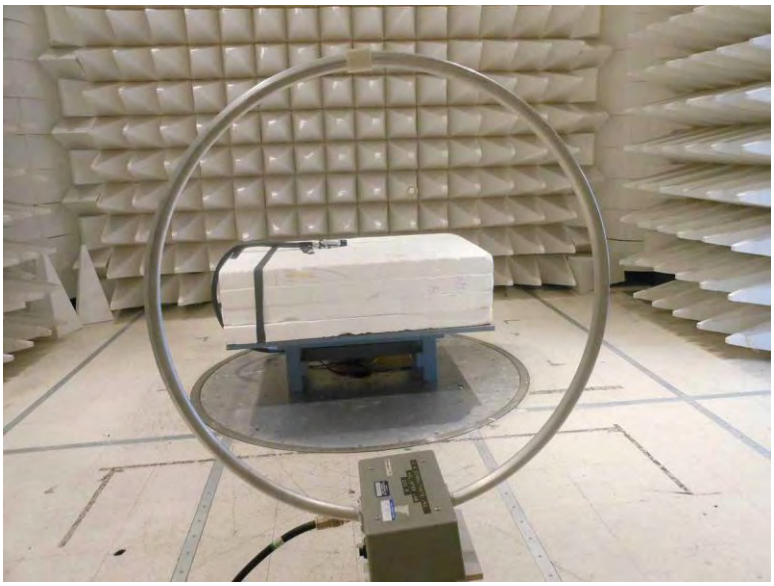
| # | Freq | Rdng | T1<br>T5<br>T9 | T2<br>T6<br>T10 | T3<br>T7<br>T11 | T4<br>T8 | Dist | Corr | Spec | Margin | Polar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBµV | dB | dB | dB | dB | Table | dBµV/m | dBµV/m | dB | Ant |
| 1 | 3937.620M<br>Ave | 68.9 | +0.0<br>+0.0<br>-59.7 | +0.0<br>+32.4<br>+3.3 | +0.0<br>+1.0<br>+1.5 | +0.0<br>+0.3 | +0.0 | 47.7 | 54.0 | -6.3 | Horiz |
| ^ | 3937.620M | 75.1 | +0.0<br>+0.0<br>-59.7 | +0.0<br>+32.4<br>+3.3 | +0.0<br>+1.0<br>+1.5 | +0.0<br>+0.3 | +0.0 | 53.9 | 54.0 | -0.1 | Horiz |
| 3 | 3937.620M<br>Ave | 65.5 | +0.0<br>+0.0<br>-59.7 | +0.0<br>+32.4<br>+3.3 | +0.0<br>+1.0<br>+1.5 | +0.0<br>+0.3 | +0.0 | 44.3 | 54.0 | -9.7 | Vert |
| ^ | 3937.620M | 73.3 | +0.0<br>+0.0<br>-59.7 | +0.0<br>+32.4<br>+3.3 | +0.0<br>+1.0<br>+1.5 | +0.0<br>+0.3 | +0.0 | 52.1 | 54.0 | -1.9 | Vert |
| ^ | 3937.628M | 72.5 | +0.0<br>+0.0<br>-59.7 | +0.0<br>+32.4<br>+3.3 | +0.0<br>+1.0<br>+1.5 | +0.0<br>+0.3 | +0.0 | 51.3 | 54.0 | -2.7 | Vert |
| 6 | 630.019M | 43.6 | +19.9<br>+1.0<br>+0.0 | -29.8<br>+0.0<br>+0.0 | +2.5<br>+0.0<br>+0.0 | +0.7<br>+0.0 | +0.0 | 37.9 | 55.6 | -17.7 | Horiz |
| 7 | 945.038M | 36.2 | +23.8<br>+1.2<br>+0.0 | -29.0<br>+0.0<br>+0.0 | +3.3<br>+0.0<br>+0.0 | +0.9<br>+0.0 | +0.0 | 36.4 | 55.6 | -19.2 | Horiz |
| 8 | 1575.003M | 63.2 | +0.0<br>+0.0<br>-58.8 | +0.0<br>+25.4<br>+2.0 | +0.0<br>+0.6<br>+0.9 | +0.0<br>+0.4 | +0.0 | 33.7 | 54.0 | -20.3 | Vert |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 1890.009M | 62.6 | +0.0 | +0.0 | +0.0 | +0.0 | +0.0 | 35.2 | 55.6 | -20.4 | Horiz |
| | | | +0.0 | +27.3 | +0.7 | +0.2 | | | | | |
| | | | -58.8 | +2.2 | +1.0 | | | | | | |
| 10 | 945.037M | 33.9 | +23.8 | -29.0 | +3.3 | +0.9 | +0.0 | 34.1 | 55.6 | -21.5 | Vert |
| | | | +1.2 | +0.0 | +0.0 | +0.0 | | | | | |
| | | | +0.0 | +0.0 | +0.0 | | | | | | |
| 11 | 1890.008M | 61.5 | +0.0 | +0.0 | +0.0 | +0.0 | +0.0 | 34.1 | 55.6 | -21.5 | Vert |
| | | | +0.0 | +27.3 | +0.7 | +0.2 | | | | | |
| | | | -58.8 | +2.2 | +1.0 | | | | | | |
| 12 | 1575.003M | 60.8 | +0.0 | +0.0 | +0.0 | +0.0 | +0.0 | 31.3 | 54.0 | -22.7 | Horiz |
| | | | +0.0 | +25.4 | +0.6 | +0.4 | | | | | |
| | | | -58.8 | +2.0 | +0.9 | | | | | | |
| 13 | 1260.047M | 62.4 | +0.0 | +0.0 | +0.0 | +0.0 | +0.0 | 31.7 | 55.6 | -23.9 | Vert |
| | | | +0.0 | +25.4 | +0.5 | +0.1 | | | | | |
| | | | -59.3 | +1.8 | +0.8 | | | | | | |
| 14 | 630.019M | 37.4 | +19.9 | -29.8 | +2.5 | +0.7 | +0.0 | 31.7 | 55.6 | -23.9 | Vert |
| | | | +1.0 | +0.0 | +0.0 | +0.0 | | | | | |
| | | | +0.0 | +0.0 | +0.0 | | | | | | |
| 15 | 2520.009M | 56.2 | +0.0 | +0.0 | +0.0 | +0.0 | +0.0 | 31.3 | 55.6 | -24.3 | Horiz |
| | | | +0.0 | +28.9 | +0.7 | +0.6 | | | | | |
| | | | -58.9 | +2.6 | +1.2 | | | | | | |
| 16 | 1260.044M | 61.8 | +0.0 | +0.0 | +0.0 | +0.0 | +0.0 | 31.1 | 55.6 | -24.5 | Horiz |
| | | | +0.0 | +25.4 | +0.5 | +0.1 | | | | | |
| | | | -59.3 | +1.8 | +0.8 | | | | | | |
| 17 | 2520.008M | 54.8 | +0.0 | +0.0 | +0.0 | +0.0 | +0.0 | 29.9 | 55.6 | -25.7 | Vert |
| | | | +0.0 | +28.9 | +0.7 | +0.6 | | | | | |
| | | | -58.9 | +2.6 | +1.2 | | | | | | |

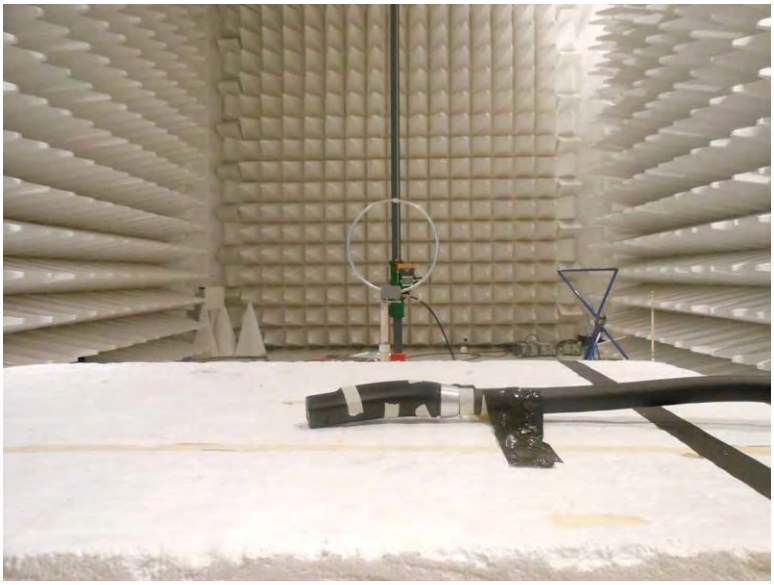
CKC Laboratories, Inc Date: 3/25/2015 Time: 15:49:31 Tesla Motors, Inc WO#: 95630
Test Distance: 3 Meters Sequence#: 6



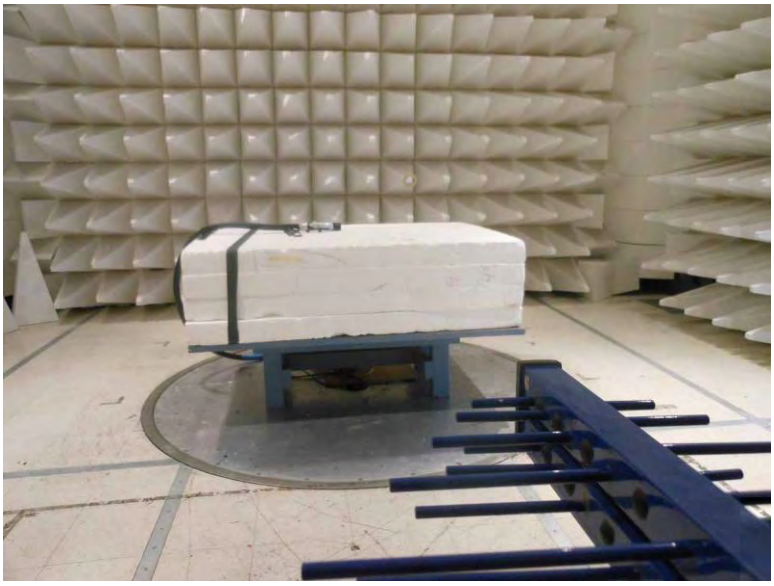
## Test Setup Photo(s)



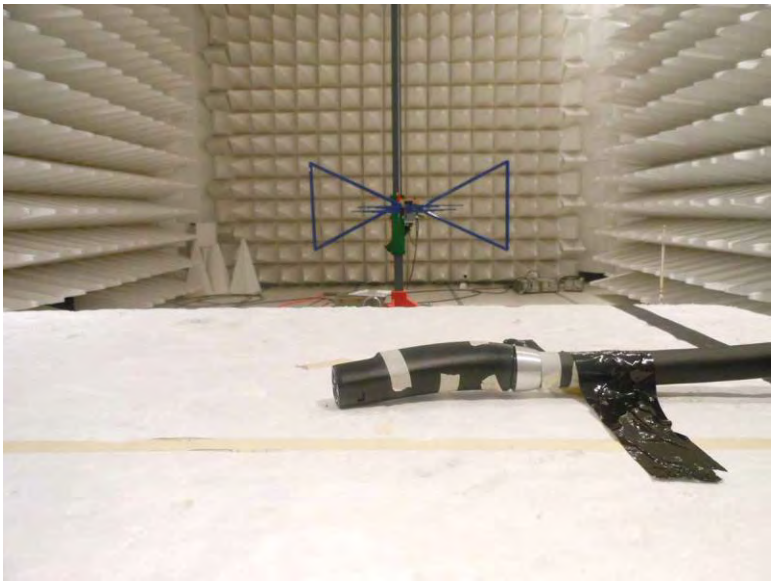
9kHz – 30MHz



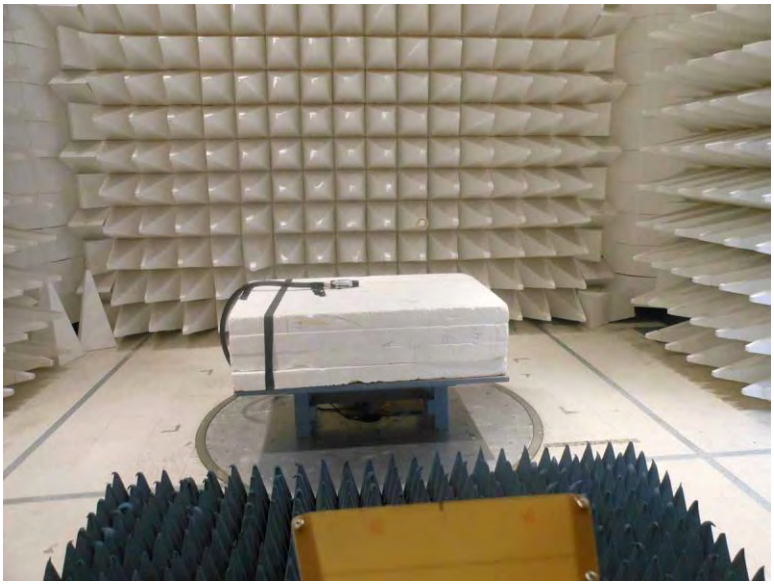
9kHz – 30MHz



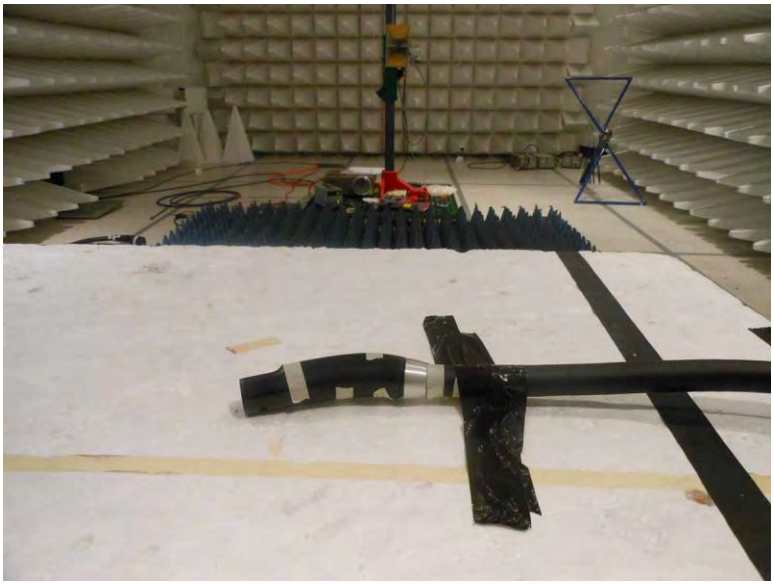
30MHz – 1GHz



30MHz – 1GHz



1 - 4GHz



1 – 4GHz

# 15.231(c) Occupied Bandwidth

## Test Conditions / Setup

Test Location: CKC Laboratories, Inc. • 1120 Fulton Places • Fremont, CA 94539 • (510) 249-1170

Customer: **Tesla Motors, Inc.**
Specification: **15.231(c)**
Work Order #: **95630** Date: 3/25/2015
Test Type: **Radiated Scan** Time: 15:49:31
Equipment: **UMC 315 MHz** Sequence#: 6
Manufacturer: Tesla Motors, Inc. Tested By: Daniel Bertran
Model: 1023049-02-D rev02
S/N: 0314IG0007190

***Test Equipment*:**

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | AN00852 | Biconilog Antenna | CBL 6111C | 11/24/2014 | 11/24/2016 |
| T2 | AN00686 | Preamp | 8447D Opt 010 | 5/27/2014 | 5/27/2016 |
| T3 | ANP00880 | Cable | RG214U | 6/13/2014 | 6/13/2016 |
| T4 | ANP05300 | Cable | RG214/U | 3/25/2013 | 3/25/2015 |
| T5 | ANP01183 | Cable | CNT-195 | 9/3/2013 | 9/3/2015 |
| | AN03471 | RF Characteristics Analyzer | E4440A | 12/19/2013 | 12/19/2015 |
| | AN00432 | Loop Antenna | 6502 | 4/2/2013 | 4/2/2015 |
| T6 | AN02157 | Horn Antenna-ANSI C63.5 Calibration | 3115 | 12/2/2014 | 12/2/2016 |
| T7 | ANP06712 | Cable | 32022-29094K-29094K-48TC | 9/18/2014 | 9/18/2016 |
| T8 | AN02754 | High Pass Filter | 6IH40-500/T3000-O/O | 1/15/2014 | 1/15/2016 |
| T9 | AN03114 | Preamp | AMF-7D-00101800-30-10P | 4/11/2013 | 4/11/2015 |
| T10 | ANP01210 | Cable | FSJ1P-50A-4A | 1/15/2015 | 1/15/2017 |
| T11 | AN03302 | Cable | 32026-29094K-29094K-72TC | 3/24/2014 | 3/24/2016 |

***Equipment Under Test* (* = EUT):**

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| UMC 315 MHz* | Tesla Motors, Inc. | 1023049-02-D rev02 | 0314IG0007190 |

***Support Devices:***

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| 555 timer circuit | Tesla Motors, Inc. | None | None |
| Charging cable | Tesla Motors, Inc. | None | None |
| DC Power Supply | Protek | 3006B | AG4070 |

***Test Conditions / Notes:***

15.231c

Temperature: 21.4°C
Humidity: 45 %
Atmospheric Pressure: 102 kPa

Test Method: ANSI C 63.4 (2009)

Transmitting operating frequency= 315MHz
RF Output= 0dBm
Firmware Used: None

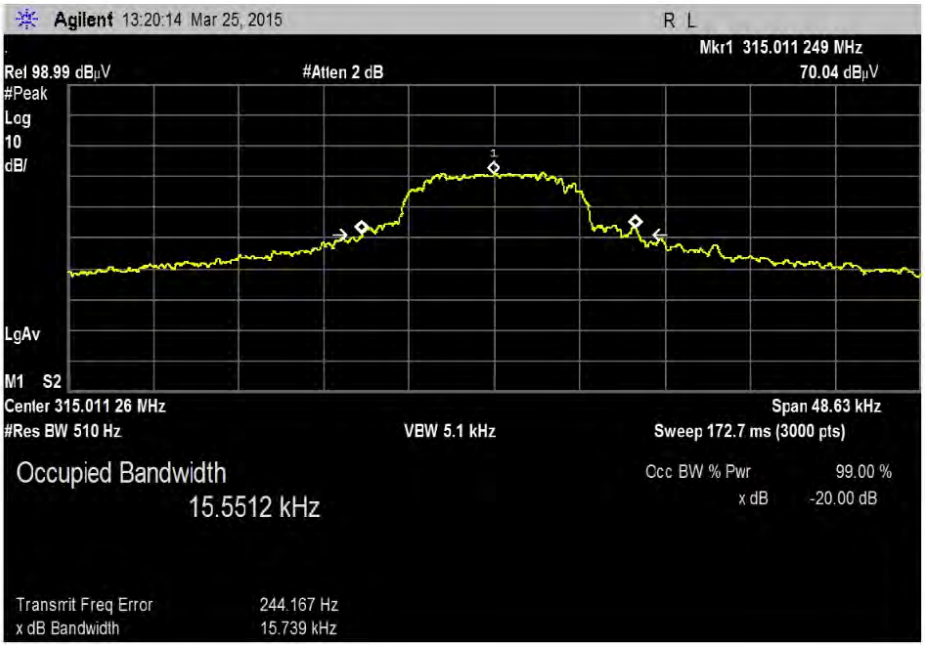
The EUT is an electrical vehicle charge cable handle used for UMC (Universal Mobile Connector), HPC (High Power Wall Connector), and Superchargers. The button on the handle sends a signal to the Model S to open the charge port for charging. The EUT is powered up with 3.3 VDC.
The EUT It is placed on the 80 cm Styrofoam table. The EUT is turn ON and OFF by an external 555 timer circuit. The EUT is set in continuously transmit mode at 50% Duty Cycle.

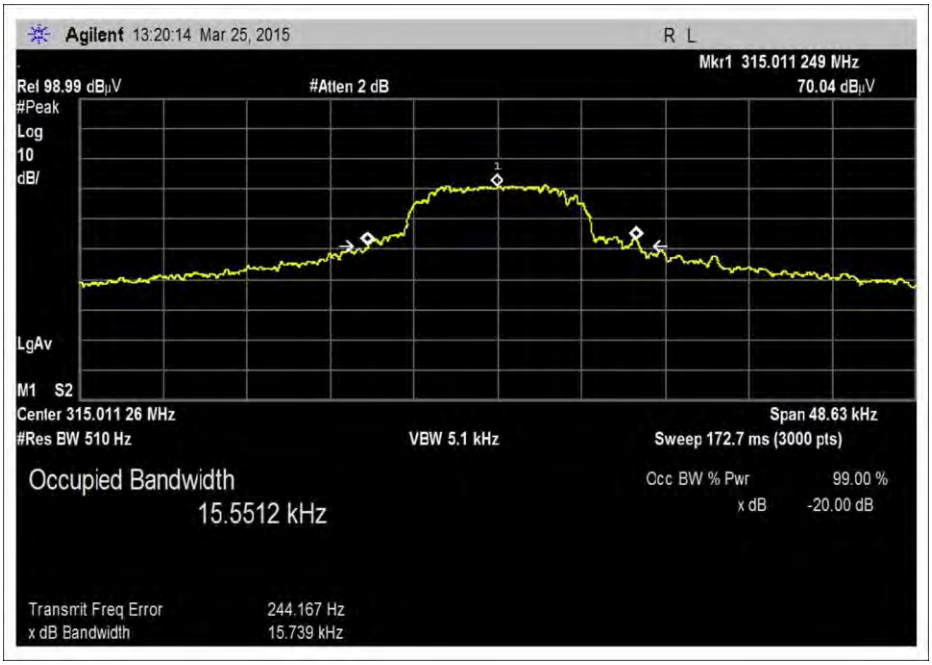
Note: No change observed on the radiated signal level of the fundamental while voltage was varied between 85% and 115% of the 3.3VDC nominal voltage specified by manufacturer.

## Test Data

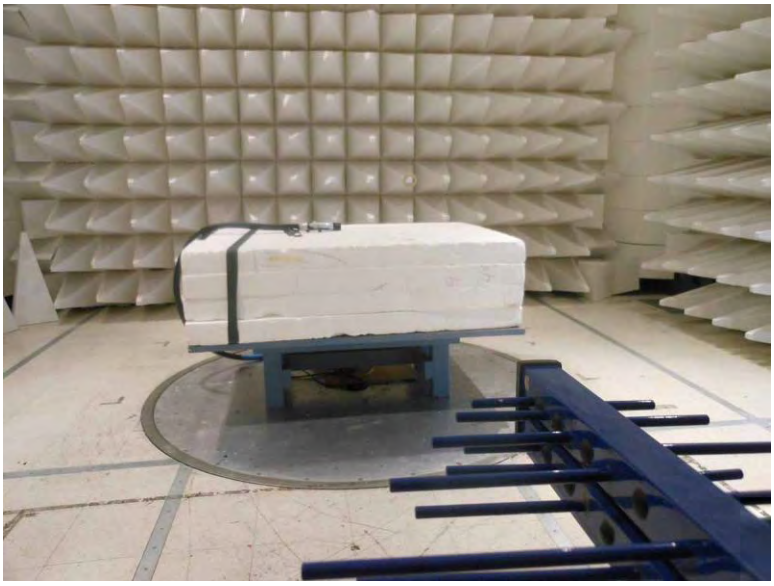
**Limit:**

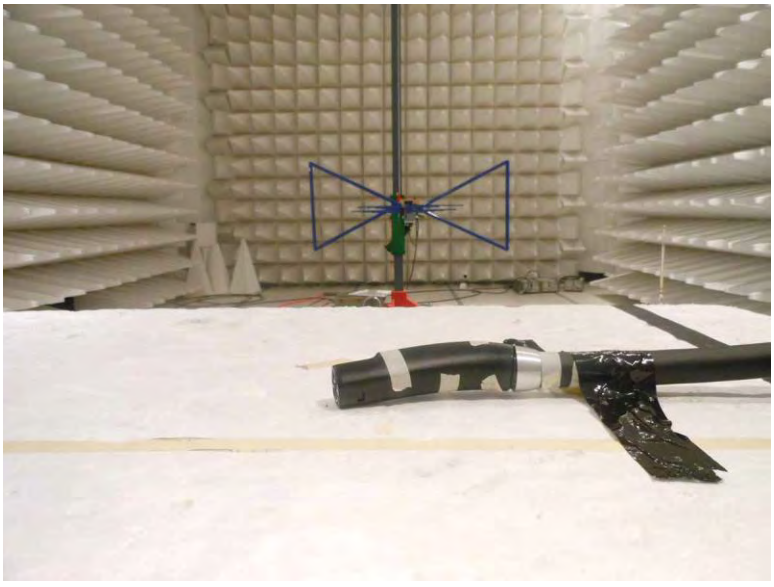
The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.



## Test Setup Photo(s)





# SUPPLEMENTAL INFORMATION

## Measurement Uncertainty

| Uncertainty Value | Parameter |
|---|---|
| 4.73 dB | Radiated Emissions |
| 3.34 dB | Mains Conducted Emissions |
| 3.30 dB | Disturbance Power |

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2.

## Emissions Test Details

**TESTING PARAMETERS**

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

**CORRECTION FACTORS**

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula. This reading was then compared to the applicable specification limit.

| SAMPLE CALCULATIONS | | |
|---|---|---|
| | Meter reading | (dBµV) |
| + | Antenna Factor | (dB) |
| + | Cable Loss | (dB) |
| - | Distance Correction | (dB) |
| - | Preamplifier Gain | (dB) |
| = | Corrected Reading | (dBµV/m) |

**TEST INSTRUMENTATION AND ANALYZER SETTINGS**

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

| MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE | | | |
|---|---|---|---|
| TEST | BEGINNING FREQUENCY | ENDING FREQUENCY | BANDWIDTH SETTING |
| CONDUCTED EMISSIONS | 150 kHz | 30 MHz | 9 kHz |
| RADIATED EMISSIONS | 9 kHz | 150 kHz | 200 Hz |
| RADIATED EMISSIONS | 150 kHz | 30 MHz | 9 kHz |
| RADIATED EMISSIONS | 30 MHz | 1000 MHz | 120 kHz |
| RADIATED EMISSIONS | 1000 MHz | >1 GHz | 1 MHz |

**SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS**

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or carrot ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

**Peak**

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

**Quasi-Peak**

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

**Average**

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point the measuring device is set into the linear mode and the scan time is reduced.