# Electromagnetic Compatibility Test Report

*Applicable Requirements*:

**FCC 47 CFR Part 15 Subpart C (§15.247) –**
**Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz**

| | |
|---|---|
| Equipment Under Test: | Universal Remote Control |
| Model Number: | 9750BC0-XXX-R |
| Serial Number: | N/A |
| Prepared for: | Universal Electronics, Inc.<br>201 East Sandpointe Road, 8th Floor<br>Santa Ana, CA 92707 |
| Tested by: | Bob Cole |
| Prepared by: | Amy Jones |
| Verified and Approved by: | Bob Cole |
| Authorized Signatory | Bob Cole |

EMCE Engineering, Inc.
44366 S. Grimmer Blvd.
Fremont, CA 94538

NVLAP Testing Lab Code 200092-0

ACCREDITED BY THE NATIONAL VOLUNTARY LABORATORY
ACCREDITATION PROGRAM FOR THE SPECIFIC SCOPE
OF ACCREDITATION UNDER TESTING LAB CODE #: 200092-0

Note:

- This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.
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## Test Report Revision History

| Report Format | Report Version | Description | Issue Date |
|---|---|---|---|
| EMCE-TRF-FCC_B | 1.0 | Original Release | Feb. 18, 2016 |
| EMCE-TRF-FCC_B | 2.0 | Updated Template (Obsolete) | Aug. 09, 2016 |
| EMCE-TRF-FCC_B | 3.0 | Updated Template (Obsolete) | Jan. 13, 2017 |

# ADMINISTRATIVE INFORMATION

| | |
|---|---|
| Test Laboratory:<br><br><br>Facility No. registered through NVLAP:<br>Test Site: | EMCE Engineering<br>44366 S. Grimmer Blvd.<br>Fremont, CA 94538 USA<br>Tel : 510-490-4307 Fax : 510-490-3441<br>NVLAP Lab Code: 200092-0<br>FCC : US5291 IC : 3324A |
| Applicant Company Name :<br>Applicant Contact Name : | Universal Electronics, Inc.<br>Jesse Mendez |
| Application Purpose : | Original |
| EUT Description : | This product is a RF4CE Smart Controller. |
| Product Name : | Universal Remote Control |
| Model Number : | 9750BC0-XXX-R |
| Serial Number : | N/A |
| Applied Requirements : | **FCC 47 CFR Part 15 Subpart C (§15.247) –** Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz. |
| Measurement Distance : | 10 m up to 1 GHz, 3 m above 1 GHz |
| Classification of EUT : | Class B |
| RF Operating Frequencies : | 2425 MHz, 2450 MHz, 2475 MHz : Per RF4CE protocol |
| Modulation : | O-QPSK (Offset-Quadrature Phase Shift Keying) |
| Type of Equipment : | Intentional Radiator |
| Testing Configuration : | The EUT was setup per applicable specifications during testing. |
| Operating Condition (Temp) : | Ambient |
| Supply Power to EUT :<br>(If Battery supply details) | 2x (AAA) Alkaline Batteries |
| Supply Voltage : | 3V (2x 1.5V) |
| Receipt of EUT : | 12-17-2016 |
| Date of Testing : | 12-18-2016 |
| Tested By : | Bob Cole |
| Approved By (CTO) : | Bob Cole |
| Test Report Number : | 4274 |
| Test Report Issue Date : | 1-23-2017 |
| Test Report Prepared By: | Amy Jones |
| Test Report Reviewed By: | Bob Cole |

Additional Items Provided

| | |
|---|---|
| Spare Batteries | N/A |
| Battery Charging Device | N/A - Power to EUT is provided by 2x (AAA) Alkaline Batteries |
| External Power Supply or AC Adapter | N/A |
| Test Jig of Interface Box | N/A |
| RF Test Fixture (for integrated Antennas) | N/A |
| Host System | N/A |
| User Manual | Reviewed |
| Technical Documentation | Reviewed |

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# ATTACHMENTS

## Accreditation

EMCE Engineering, has been placed on the Federal Communications Commission's list of recognized facilities for Parts 15 and 18 DoC approvals. Per the request of EMCE Engineering, the facility has been added to the list of those who perform Measurement Services for the public on a fee basis. This list is published periodically and is also available on the FCC Website. Additionally, EMCE Engineering has been accredited by the National Institute for Standards and Technology under the NVLAP program (Testing Lab Code 200092-0).

## Disclaimer

EMCE Engineering, Inc., assumes no responsibility for the continuing validity of test data when the Equipment under Test is not under the continuous physical control of EMCE. The signature below attests to the fact that all measurements reported herein were performed by myself or were made under my supervision, and are correct to the best of my knowledge and belief as of the date specified. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. Tests were conducted by qualified EMCE Engineering, Inc. personnel utilizing test equipment maintained in a "current" state of calibration with traceability to NIST.

- This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.
- This report or certificate shall not be reproduced except in full without the written approval of the issuer.

## Modifications

There were no modifications installed by EMCE Engineering. The manufacturer may declare the EUT as complying with the CE Mark EMC Directive requirements.

Any modifications installed previous to testing by the Manufacturer will be incorporated into each production model, sold or leased.

# Statement of Compliance

We, EMCE Engineering, declare under our sole responsibility that the product tested complies with the following listed standards:

| | |
|---|---|
| Equipment Under Test: | Universal Remote Control |
| Model Number: | 9750BC0-XXX-R |
| Serial Number: | N/A |
| Report Number: | 4274 |
| Test Date: | 12-18-2016 |
| | |
| Company: | Universal Electronics, Inc. |
| Street Address: | 201 East Sandpointe Road, 8th Floor<br>Santa Ana, CA 92707 |

This Statement of Compliance is based upon compliance of the product with the following FCC Rules:

| | |
|---|---|
| FCC 47 CFR Part 15 SUBPART C (§15.247) | Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz. |

Issued by Test Laboratory:

Testing Lab Code: 200092-0

EMCE Engineering
44366 S. Grimmer Blvd.
Fremont, CA 94538

Verified By:

Bob Cole
Authorized Signatory

# Test Location

## Test Facility

All EMC Testing was performed at:

EMCE Engineering, Inc.
44366 S. Grimmer Blvd.
Fremont, CA 94538

This laboratory has one semi-anechoic chamber, one electromagnetic shielded enclosure, one conducted immunity test station and a 3-meter and 10-meter Open Area Test Site (OATS). A computer controlled spectrum analyzer with quasi-peak adapter, and printer were used for gathering and recording test data.

## Description of Open Area Test Site (OATS)

The 3 and 10 meter site is located out-of-doors in an open field whose size is 95 feet long by 65 feet wide. The dimensions of the test area are 68 x 28 ft. The description of the 3 and 10-meter site is on file with the FCC and ISED according to the requirements of Part 2.948.

## Site Attenuation

The site attenuation for radiated measurements has been determined for this test site using the method described in ANSI C63.4 Paragraph 5.4.6 and sub paragraphs. The site attenuation is measured annually.

## Ground Plane (Ground Screen)

The site has a 1900 square foot floor area of poured reinforced concrete, 6 to 8 inches thick. A (68ft x 28ft) 24 gauge galvanized ¼ inch wire mesh ground plane is centered on the test area with its long dimension along the major axis of the test site. The antenna mast and turntable are located 3/10 meters apart on the centerline of the major axis. The ground plane is connected to a nine-foot long earth ground rod at each end of the ground plane.

## Input Power for EUT

Electricity for the EUT is provided through buried power lines in metallic conduit with an outlet box placed near the EUT. Power for the EUT is taken from the outlet box of either of two “shielded enclosure” quality power line filters located on the ground plane near the EUT. The filters are electrically bonded to the ground plane.

## Accessory Equipment Precautions

Care was taken that accessory equipment or adjacent equipment did not produce unacceptable interference so as to contaminate the final test data. The EMI receiver and its associated computer, printer and plotter were located greater than 15 meters away from the EUT during testing and were powered from a separately filtered power source.

## Ambient Interference

Ambient interference from radio and television stations, vehicles, mobile radio, etc. was present at the open test site during testing. Therefore, preliminary radiated emissions testing was performed in the semi-anechoic chamber to identify all EUT related emissions. Care was taken to assure that ambient interference did not overload the measurement receiver or mask emissions from the EUT.

## Personnel

All testing was performed by EMCE Engineering personnel who are properly trained for the instruments and procedures used.

## Use of Interference Measurement Equipment

All of the emission measurements and field strength measurements were performed utilizing various EMC measurement equipment. The Emissions Measurement Lab utilizes the following basic instruments:

1. Toshiba Satellite Laptop Computer
2. EMI Test v4.1 measurement software
3. Rohde & Schwarz FSV40 Spectrum Analyzer
4. HP 8477F Pre Amp
5. HP 8449B Pre Amp
6. Sunol Sciences JB-6 Hybrid Antenna
7. EMCO 3110 Horn Antenna

Test results are recorded on tabular data sheets and show final corrected values compared to the specification limit. Sample calculations show how the antenna factors, cable losses, amplifier gain, etc. are combined in the automatic analyzer program to produce the final corrected values shown on the graphs and data sheets.

## Calibration of Measuring Equipment

The EMI Receiver (spectrum analyzer) is calibrated by an ISO 17025 Accredited calibration laboratory on an annual basis. The laboratory provides certification accredited to ISO 17025. Antenna factors are measured on an annual basis by an ISO 17025 Accredited Antenna Calibration Facility. Cable losses as well as amplifier gains are swept at least every month to verify accurate values.

## Equipment Calibration Data

| Equipment | Serial Number | Last Calibration Date | Calibration Due Date |
|---|---|---|---|
| Omega-IBTHXBP | 14490199 | 7/8/2016 | 7/8/2017 |
| Schaffner-NSG435 | 5892 | 7/8/2016 | 7/8/2017 |
| Fluke-87 | 64920001 | 6/28/2016 | 6/28/2017 |
| Sunol Sciences-JB1 | A061416 | 6/27/2016 | 6/27/2017 |
| EMCO-3816-2 | 9809-1089 | 8/12/2016 | 8/12/2017 |
| Rohde & Schwarz-FSV40 | 101424 | 6/20/2016 | 6/20/2017 |
| Sunol Sciences-JB6 | A042610 | 6/15/2016 | 6/15/2017 |
| A. H. Systems-SAS-571 | 236 | 6/13/2016 | 6/13/2017 |
| Com-Power-C50E | 561034 | 2/22/2016 | 2/22/2017 |
| Com-Power-M225E | 511107 | 2/22/2016 | 2/22/2017 |
| Com-Power-T8SE | 511402 | 2/22/2016 | 2/22/2017 |

# MEASUREMENT UNCERTAINTY

## Measurement Uncertainty Budget
## Conducted Emissions 150 kHz – 30 MHz
## Per CISPR 16-4-2

| *Input Quantity* | *Uncertainty of $x_1$* | | *$u(x_i)$ dB* | *$c_i$* | *$c_1 u(x_i)$ dB* |
|---|---|---|---|---|---|
| | *dB* | *Probability Distribution Function* | | | |
| *Receiver Reading* | *+/• 0.1* | *K = 1* | *0.1* | *1* | *0.1* |
| *Attenuation: AMN – Receiver* | *+/• 0.1* | *K = 2* | *0.05* | *1* | *0.05* |
| *AMN Voltage Division Factor* | *+/• 0.2* | *K = 2* | *0.1* | *1* | *0.1* |
| *Receiver Corrections* | | | | | |
| *Sine Wave Voltage* | *+/• 1.0* | *K = 2* | *0.5* | *1* | *0.5* |
| *Pulse Amplitude Response* | *+/• 1.5* | *Rectangular* | *0.87* | *1* | *0.87* |
| *Pulse Rep Rate Response* | *+/• 1.5* | *Rectangular* | *0.87* | *1* | *0.87* |
| *Noise Floor Proximity* | *+/• 0.0* | | *0.0* | *1* | *0.0* |
| *Mismatch: AMN – Receiver* | *+/• 0.75* | *U•shaped* | *0.53* | *1* | *0.53* |
| *AMN Impedance* | *+/• 2.65* | *Triangular* | *1.08* | *1* | *1.08* |
| *Total Measurement uncertainty – Conducted Emissions 150 kHz – 30 MHz $2u_c(P)$ = 4.45 dB* | | | | | *4.45 dB* |

# Measurement Uncertainty Budget
# Radiated Emissions @ 10 Meters

| *Input Quantity* | *Uncertainty of $x_i$* | | *U(x)* | *$C_i$* | *$C_i$ u ($x_i$)* |
|---|---|---|---|---|---|
| | *dB* | *Probability Distribution Function* | *dB* | | *dB* |
| *Receiver Reading* | *+/- 0.1* | *K = 1* | *0.1* | *1* | *0.1* |
| *Attenuation, Antenna - receiver* | *+/- 0.1* | *K = 2* | *0.05* | *1* | *0.05* |
| *Antenna Factor* | *+/- 2.0* | *K = 2* | *1.0* | *1* | *1.0* |
| *Receiver Corrections* | | | | | |
| *Sine Wave Voltage* | *+/- 1.0* | *K = 1* | *0.5* | *1* | *0.5* |
| *Pulse Amplitude Response* | *+/- 1.5* | *Rectangular* | *0.87* | *1* | *0.87* |
| *Pulse Rep Rate Response* | *+/- 1.5* | *Rectangular* | *0.87* | *1* | *0.87* |
| *Noise Floor Proximity* | *+/- 0.5* | *K = 2* | *0.25* | *1* | *0.25* |
| *Mismatch Antenna – Receiver* | *+/- 0.9* | *U shaped* | *0.67* | *1* | *0.67* |
| *Antenna Corrections* | | | | | |
| *AF Freq Interpolation* | *+/- 0.3* | *Rectangular* | *0.17* | *1* | *0.17* |
| *AF Height Deviations* | *+/- 0.5* | *Rectangular* | *0.29* | *1* | *0.29* |
| *Balance* | *+/- 0.3* | *Rectangular* | *0.17* | *1* | *0.17* |
| *Site Corrections* | | | | | |
| *Site Imperfections* | *+/- 3.0* | *Rectangular* | *1.22* | *1* | *0.82* |
| *Separation distance* | *+/- 0.1* | *Rectangular* | *0.06* | *1* | *0.06* |
| *Table Height* | *+/- 0.1* | *K = 2* | *0.05* | *1* | *0.05* |
| *Total Measurement Uncertainty - Radiated Emissions @ 10 Meters* | | | | | *5.87* |

**ANSI C63.4-2009, Section 10.2.8.2 states:**
"For ITE unintentional radiators, the Frequency and Amplitude of the six highest radiated emissions relative to the limit and independent of antenna polarization shall be reported, unless such emissions are more than 20 dB below the limit. If less than the specified number (less than six) of emissions are within 20 dB of the limit, the noise level of the measuring instrument at representative frequencies shall be reported.

# Sample Calculations

***Conducted Spurious Emissions***

Measurements are compared directly to the applicable limits. The calculation is a s follows:

$$R_r - S = M$$

Where:

$R_r$ = Measured value in dBm
S = Specification Limit
M = Margin

***Radiated Spurious Emissions***

Receiver readings are compared directly to a converted specification limit (dB form), the conversion uses the effective radiated power limit specified in the standard to calculate the expected field strength in free space using the following formula:

$$E = \sqrt{30*P*G} / d$$

Where:

E = Field Strength in V/M
P = Power in Watts
G = Gain of antenna in dB
D = Distance in meters

The field strength limit is then converted to decibel form (dBuV/M) and the margin of a given peak is calculated as follows:

$$M = R_c - L_s$$

Where:

M = Margin
$R_c$ = Corrected Reading in dBuV/M
$L_s$ = Calculated Specification Limit in dBuV/M

When substitution measurements are required (all signals with <6 dB margin relative to the Specification limit) the margin of the emission relative to the effective radiated power is calculated as follows:

$$P_s - S = M$$

Where:

$P_s$ = ERP determined from antenna substitution (dBm)
S = Specification limit in dBm
M = Margin

# PREPARATION OF EUT FOR TEST

## Setup of EUT

Power to EUT: 2x (AAA) Alkaline Batteries
Grounding of EUT: N/A
Software: TeraTerm / TI Smart RF Flash Programmer 1.12.8

No Support Equipment was used.

| Support Equipment | | | | |
|---|---|---|---|---|
| **Description** | **Model Number** | **Serial Number** | **Manufacturer** | **Power Cable Description** |
| **N/A** | | | | |
| **Cable Description** | | | | |
| **From** | **To** | **Length (Meters)** | **Shielded (Y/N)** | **Ferrite Loaded (Y/N)** |
| **N/A** | | | | |

# ATTACHMENT 1

# NVLAP ISO 17025:2005

# Accreditation Certificate

# 1.0 Certificate of Accreditation

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

## Certificate of Accreditation to ISO/IEC 17025:2005

**NVLAP LAB CODE: 200092-0**

**Universal Compliance Labs dba EMCE Engineering**
Fremont, CA

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:*

**Electromagnetic Compatibility & Telecommunications**

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

2016-12-28 through 2017-12-31
*Effective Dates*

*For the National Voluntary Laboratory Accreditation Program*

# ATTACHMENT 2

# Measurement Data

## 2.0 Summary of Test Results

**The EUT has been tested according to the following specifications:**

| Test Standard | | Description of Test | Result (Pass / Fail) |
|---|---|---|---|
| FCC 47 CFR Part 15 | RSS 247 Issue 1, RSS-Gen, Issue 4 | | |
| 15.205, 15.209 15.247 | N/A | Radiated Spurious Emissions, Radiated Restricted Bandedge | **Pass** |
| 15.247(a)(2) | N/A | 6dB Bandwidth | **Pass** |
| 15.247(6)(3) | N/A | Conducted Maximum Peak Output Power | **Pass** |
| 15.247(e) | N/A | Power Spectral Density | **Pass** |
| 15.247(d) | N/A | Conducted Bandedge (Out of Band Emissions) | **Pass** |
| 15.207 | N/A | AC Power Line Conducted Emissions | **N/A** |
| N/A | N/A | 99% Bandwidth | **N/A** |
| ANSI C63.4: 2014 / FCC KDB 558074 D01 DTS Meas. Guidance v03r03 dated June 09, 2015<br><br>PS: All measurement uncertainties are not taken into consideration for all presented test result. | | | |

**PASS - The EUT passed that particular test.**
**FAIL- The EUT failed that particular test.**
**N/A - Not Applicable – NO IC Application.**

## 2.1 Test Results

### 2.1.1 Transmitter Radiated Spurious Emissions

**LIMITS**

§15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.
(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

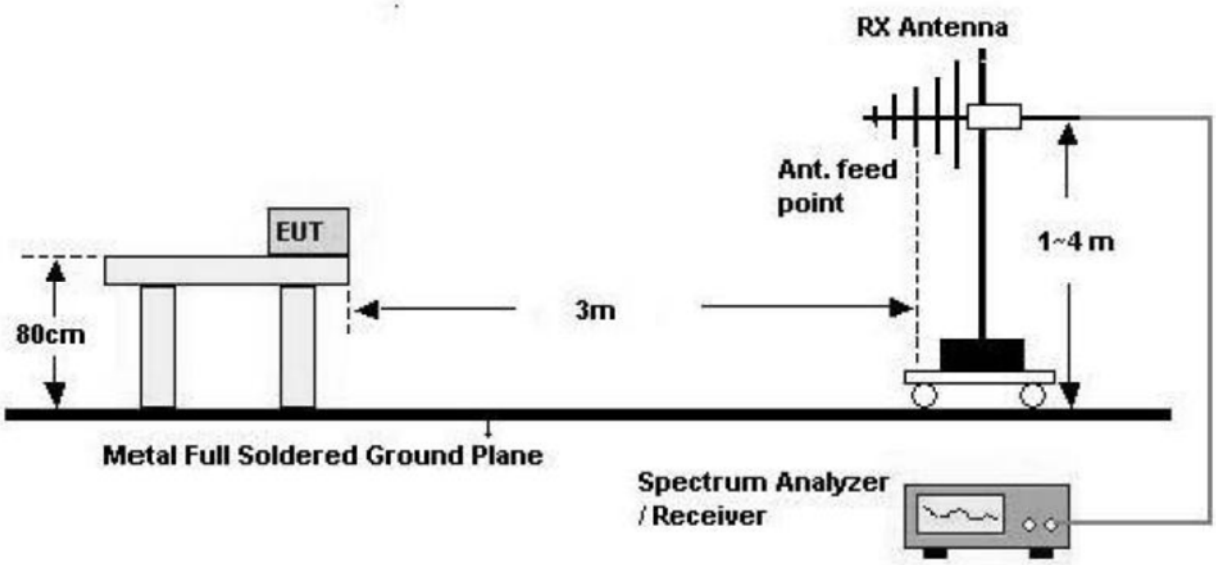
§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table;

| *Frequency (MHz)* | *Field Strength (uV/m)* | *Field Strength (dBuV/m)* |
|---|---|---|
| *30-88* | *100* | *40.0* |
| *88-216* | *150* | *43.5* |
| *216-960* | *200* | *46.0* |
| *Above 960* | *500* | *54.0* |

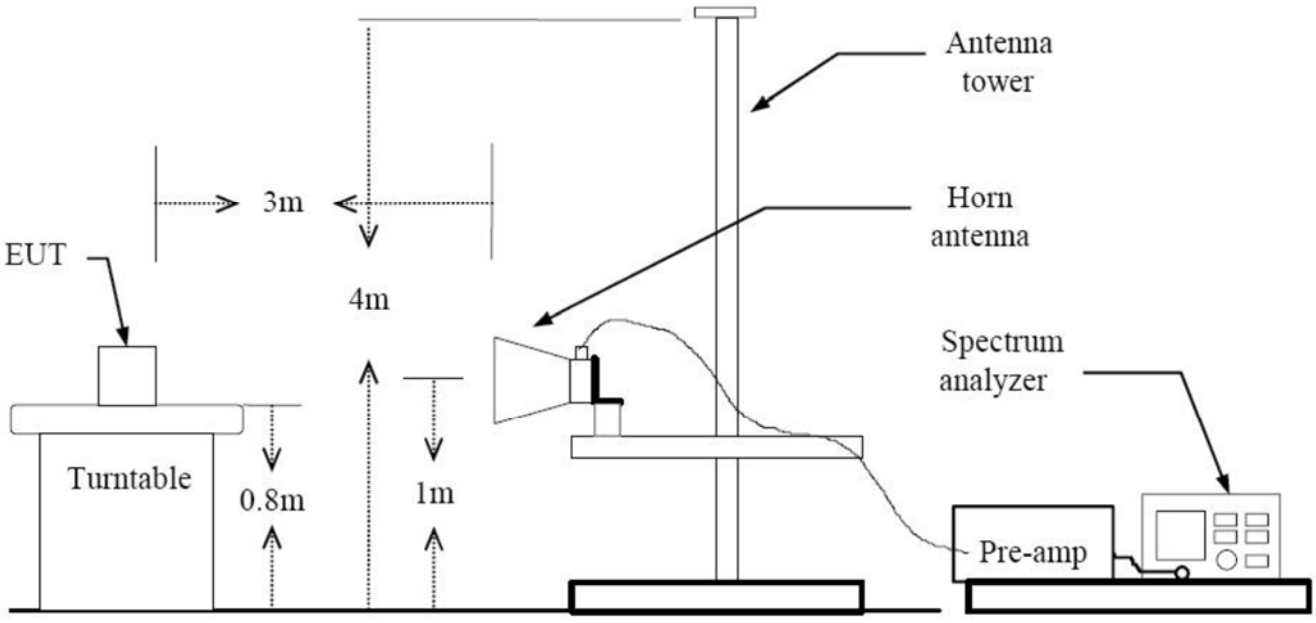
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz However, operation within these frequency bands is permitted under other sections of this part, e.g., Sections 15.231 and 15.241

## TEST CONFIGURATION

**[30 MHz - 1 GHz]**




**[ Above 1 GHz]**



## TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 10 meters. The EUT is configured in accordance with ANSI C63.4 The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 KHz for peak detection measurements or 120 KHz or quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and VBW of 10 Hz for average measurements.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

**RESULTS:**

NO non-compliance noted.

*Note*
1. The antenna is manipulated through typical positions, polarity and length during the testing
2. The frequency range was scanned from 30 MHz to 1 GHz and the worst-case emissions are reported.
3. There is detected level above reference noise floor spectrum analyzer.

## FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor.
The basic equation with a sample calculation is as follows:

FS = RA + AF + CF

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

Assume a receiver reading of 21.5 dBuV is obtained. The Antenna Factor of 7.4 dB/m and a Cable Factor of 1.1
dB is added. The 30 dBuV/m value is mathematically converted to its corresponding level in uV/m.

FS = 21.5 + 7.4 + 1.1 = 30 dBuV/m

## Radiated Emissions < 1 GHz – EUT Receiver at 10 Meter Distance

Test Location: EMCE Engineering •44366 S. Grimmer Blvd • Fremont, CA 94538 •

Customer: **UNIVERSAL ELECTRONICS, INC.**
Specification: **EN55022B RADIATED**
Work Order #: **4274** Date: 1/10/2017
Test Type: **Radiated Scan** Time: 11:58:47
Equipment: **Universal Remote Control** Sequence#: 1
Manufacturer: Universal Electronics, Inc. Tested By: Bob Cole
Model: 9750BC0-XXX-R
S/N: N/A

***Test Equipment*:**

| Function | S/N | Calibration Date | Cal Due Date | Asset # |
|---|---|---|---|---|

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

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| Universal Remote Control* | Universal Electronics, Inc. | 9750BC0-XXX-R | N/A |

***Support Devices:***

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|

***Test Conditions / Notes:***

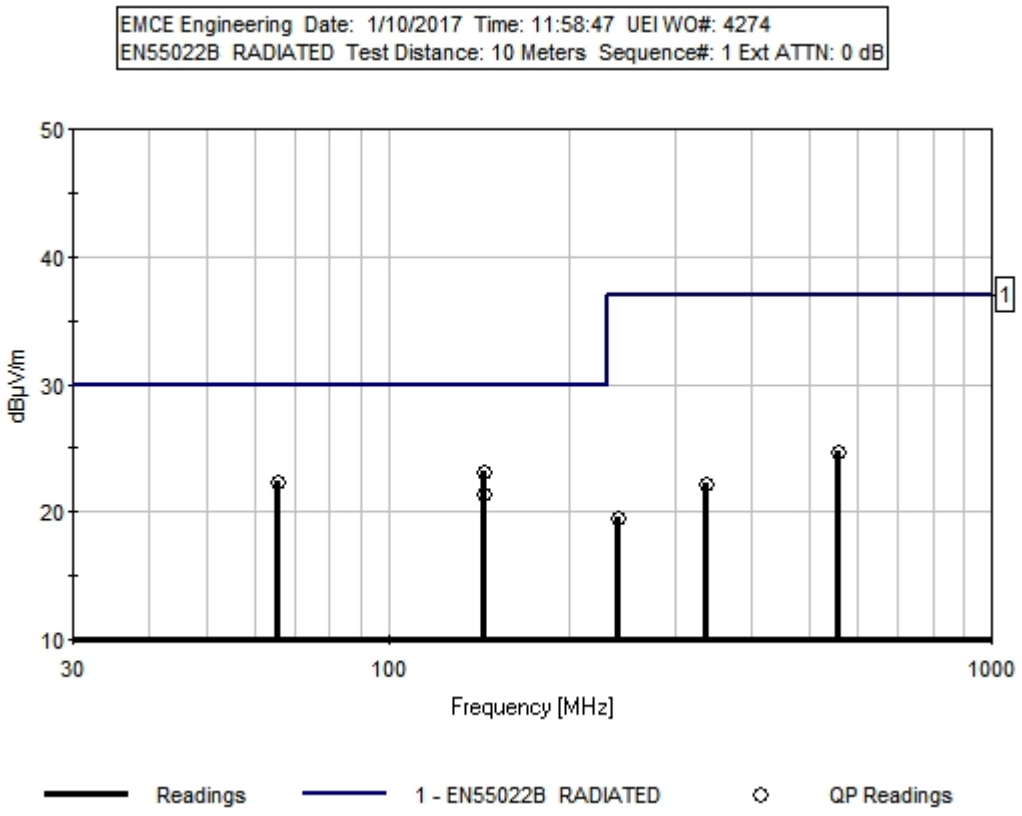
***Transducer Legend:***

T1=100' LMR 900 Rad Cable T2=8447 Pre-Amp Asset 377
T3=Sunol JB6 S/N A42610 2016

Ext Attn: 0 dB

***Measurement Data:*** Reading listed by margin. Test Distance: 10 Meters

| # | Freq MHz | Rdng dBµV | T1 dB | T2 dB | T3 dB | dB | Dist Table | Corr dBµV/m | Spec dBµV/m | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 144.017M QP | 36.9 | -0.1 | +26.7 | +13.0 | | +0.0 180 | 23.1 | 30.0 | -6.9 | Horiz 128 |
| 2 | 65.203M QP | 41.6 | -0.1 | +26.9 | +7.8 | | +0.0 180 | 22.4 | 30.0 | -7.6 | Horiz 120 |
| 3 | 336.112M QP | 36.0 | -0.1 | +26.7 | +13.0 | | +0.0 94 | 22.2 | 30.0 | -7.8 | Vert 122 |
| 4 | 144.028M QP | 35.2 | -0.1 | +26.7 | +13.0 | | +0.0 177 | 21.4 | 30.0 | -8.6 | Vert 122 |
| 5 | 239.996M QP | 33.4 | -0.1 | +26.7 | +13.0 | | +0.0 88 | 19.6 | 30.0 | -10.4 | Vert 125 |
| 6 | 554.212M QP | 32.5 | +1.1 | +27.0 | +18.2 | | +0.0 271 | 24.8 | 37.0 | -12.2 | Horiz 182 |


EMCE Engineering Date: 1/10/2017 Time: 11:58:47 UEI WO#: 4274
EN55022B RADIATED Test Distance: 10 Meters Sequence#: 1 Ext ATTN: 0 dB
50
40
30
20
10
dBµV/m
30
100
1000
Frequency [MHz]
1
Readings
1 - EN55022B RADIATED
QP Readings

## Radiated Emissions > 1 GHz – EUT Receiver at 3 Meter Distance

Test Location: EMCE Engineering •44366 S. Grimmer Blvd • Fremont, CA 94538 •

Customer: **UNIVERSAL ELECTRONICS, INC.**
Specification: **FCC 15.209 Average Limits 1 - 25 G**
Work Order #: **4274** Date: 1/11/2017
Test Type: **Radiated Scan** Time: 14:34:26
Equipment: **Universal Remote Control** Sequence#: 2
Manufacturer: Universal Electronics, Inc. Tested By: Bob Cole
Model: 9750BC0-XXX-R
S/N: N/A

***Test Equipment*:**

| Function | S/N | Calibration Date | Cal Due Date | Asset # |
|---|---|---|---|---|

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

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| Universal Remote Control* | Universal Electronics, Inc. | 9750BC0-XXX-R | N/A |

***Support Devices:***

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|

***Test Conditions / Notes:***

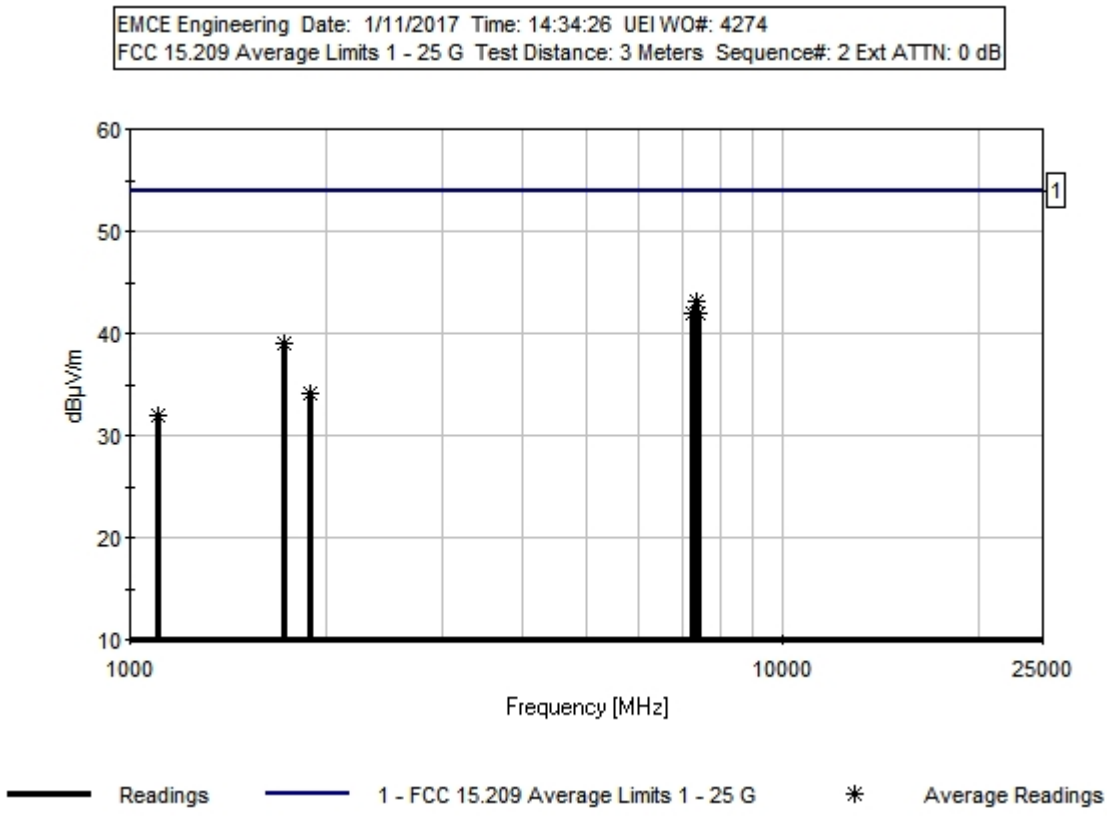
***Transducer Legend:***

T1=25' LMR #001 T2=8449B Preamp
T3=A.H. SAS-200/571 Horn

Ext Attn: 0 dB

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

| # | Freq MHz | Rdng dBµV | T1 dB | T2 dB | T3 dB | dB | Dist Table | Corr dBµV/m | Spec dBµV/m | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 7350.117M Ave | 32.9 | +4.2 | +30.9 | +36.9 | | +0.0 89 | 43.1 | 54.0 2450 Xmit | -10.9 | Horiz 255 |
| 2 | 7275.194M Ave | 31.8 | +4.2 | +30.9 | +36.9 | | +0.0 281 | 42.0 | 54.0 2425 Xmit | -12.0 | Vert 175 |
| 3 | 7424.928M Ave | 31.7 | +4.2 | +30.9 | +36.9 | | +0.0 108 | 41.9 | 54.0 2475 Xmit | -12.1 | Horiz 249 |
| 4 | 1722.104M Ave | 39.4 | +1.2 | +29.7 | +28.2 | | +0.0 219 | 39.1 | 54.0 2450 Xmit | -14.9 | Vert 197 |
| 5 | 1881.483M Ave | 34.3 | +1.3 | +29.8 | +28.4 | | +0.0 171 | 34.2 | 54.0 2475 Xmit | -19.8 | Horiz 254 |
| 6 | 1104.347M Ave | 32.8 | +0.9 | +29.4 | +27.6 | | +0.0 184 | 31.9 | 54.0 2425 Xmit | -22.1 | Horiz 225 |


EMCE Engineering Date: 1/11/2017 Time: 14:34:26 UEI WO#: 4274
FCC 15.209 Average Limits 1 - 25 G Test Distance: 3 Meters Sequence#: 2 Ext ATTN: 0 dB
60
50
40
30
20
10
dBµV/m
1
1000
10000
25000
Frequency [MHz]
Readings
1 - FCC 15.209 Average Limits 1 - 25 G
Average Readings

## 2.1.2 Radiated Spurious Emissions - Bandedge

15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. **In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).**

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090-0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.15 |
| [1]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 | ([2]) |
| 13.36-13.41 | | | |

# Radiated Bandedge Data

## 2425 MHz

Test Location: EMCE Engineering •44366 S. Grimmer Blvd • Fremont, CA 94538 •

| | | | |
|---|---|---|---|
| Customer: | **UNIVERSAL ELECTRONICS, INC.** | | |
| Specification: | **15.247 2390-2400 ave** | | |
| Work Order #: | **4274** | Date: | 1/12/2017 |
| Test Type: | **Radiated Scan** | Time: | 13:20:56 |
| Equipment: | **Universal Remote Control** | Sequence#: | 1 |
| Manufacturer: | Universal Electronics, Inc. | Tested By: | Bob Cole |
| Model: | 9750BC0-XXX-R | | |
| S/N: | N/A | | |

***Test Equipment*:**

| Function | S/N | Calibration Date | Cal Due Date | Asset # |
|---|---|---|---|---|

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

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| Universal Remote Control* | Universal Electronics, Inc. | 9750BC0-XXX-R | N/A |

***Support Devices:***

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|

***Test Conditions / Notes:***

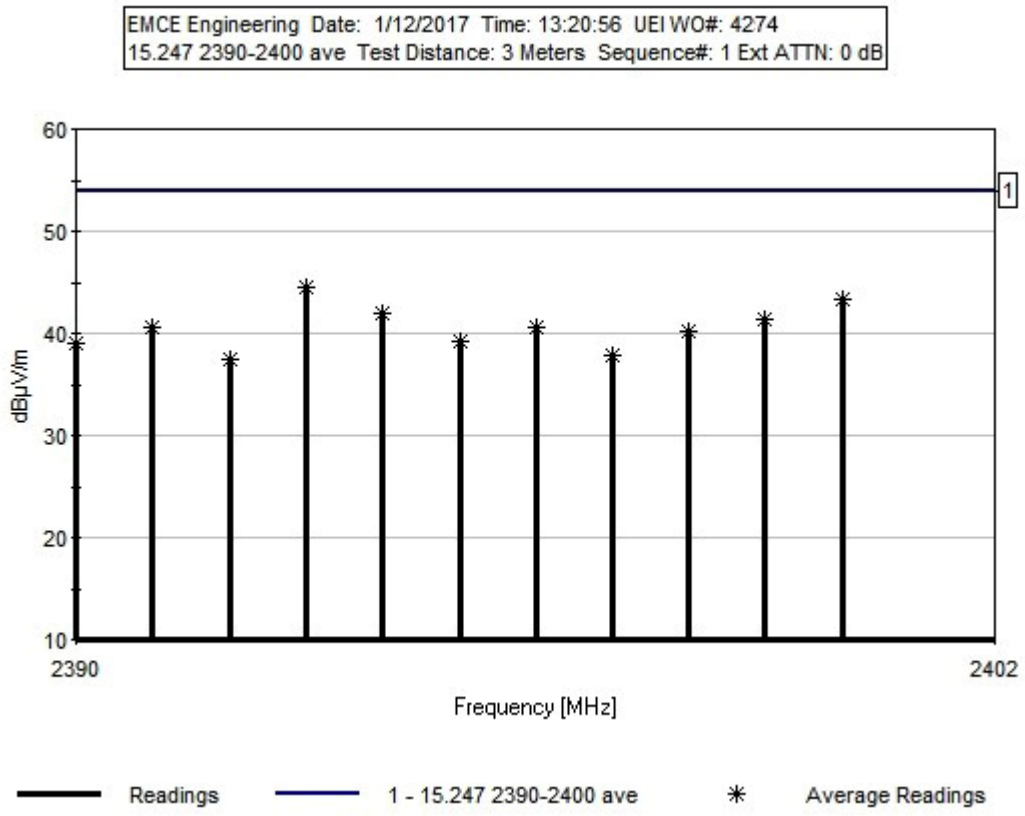
***Transducer Legend:***

| | |
|---|---|
| T1=25' LMR #001 | T2=8449B Preamp |
| T3=A.H. SAS-200/571 Horn | |

Ext Attn: 0 dB

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

| # | Freq MHz | Rdng dBµV | T1 dB | T2 dB | T3 dB | dB | Dist Table | Corr dBµV/m | Spec dBµV/m | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2390.003M Ave | 38.8 | +1.3 | +30.1 | +29.1 | | +0.0 180 | 39.1 | 54.0 2425 Xmit | -14.9 | Horiz 185 |
| 2 | 2391.000M Ave | 40.3 | +1.3 | +30.1 | +29.1 | | +0.0 180 | 40.6 | 54.0 2425 Xmit | -13.4 | Horiz 185 |
| 3 | 2392.000M Ave | 37.2 | +1.3 | +30.1 | +29.1 | | +0.0 180 | 37.5 | 54.0 2425 Xmit | -16.5 | Horiz 185 |
| 4 | 2393.000M Ave | 44.3 | +1.3 | +30.1 | +29.1 | | +0.0 180 | 44.6 | 54.0 2525 Xmit | -9.4 | Horiz 185 |
| 5 | 2394.000M Ave | 41.6 | +1.3 | +30.1 | +29.1 | | +0.0 180 | 41.9 | 54.0 2425 Xmit | -12.1 | Horiz 185 |
| 6 | 2395.000M Ave | 39.0 | +1.3 | +30.1 | +29.1 | | +0.0 180 | 39.3 | 54.0 2425 Xmit | -14.7 | Horiz 185 |


EMCE Engineering Date: 1/12/2017 Time: 13:20:56 UEI WO#: 4274
15.247 2390-2400 ave Test Distance: 3 Meters Sequence#: 1 Ext ATTN: 0 dB
60
50
40
30
20
10
dBµV/m
1
2390
2402
Frequency [MHz]
Readings
1 - 15.247 2390-2400 ave
Average Readings

# 2475 MHz

Test Location: EMCE Engineering •44366 S. Grimmer Blvd • Fremont, CA 94538 •

| | | | |
|---|---|---|---|
| Customer: | **UNIVERSAL ELECTRONICS, INC.** | | |
| Specification: | **15.247 2483.5 - 2500 Average** | | |
| Work Order #: | **4274** | Date: | 1/12/2017 |
| Test Type: | **Radiated Scan** | Time: | 13:27:22 |
| Equipment: | **Universal Remote Control** | Sequence#: | 2 |
| Manufacturer: | Universal Electronics, Inc. | Tested By: | Bob Cole |
| Model: | 9750BC0-XXX-R | | |
| S/N: | N/A | | |

***Test Equipment*:**

| Function | S/N | Calibration Date | Cal Due Date | Asset # |
|---|---|---|---|---|

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

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| Universal Remote Control* | Universal Electronics, Inc. | 9750BC0-XXX-R | N/A |

***Support Devices:***

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|

***Test Conditions / Notes:***

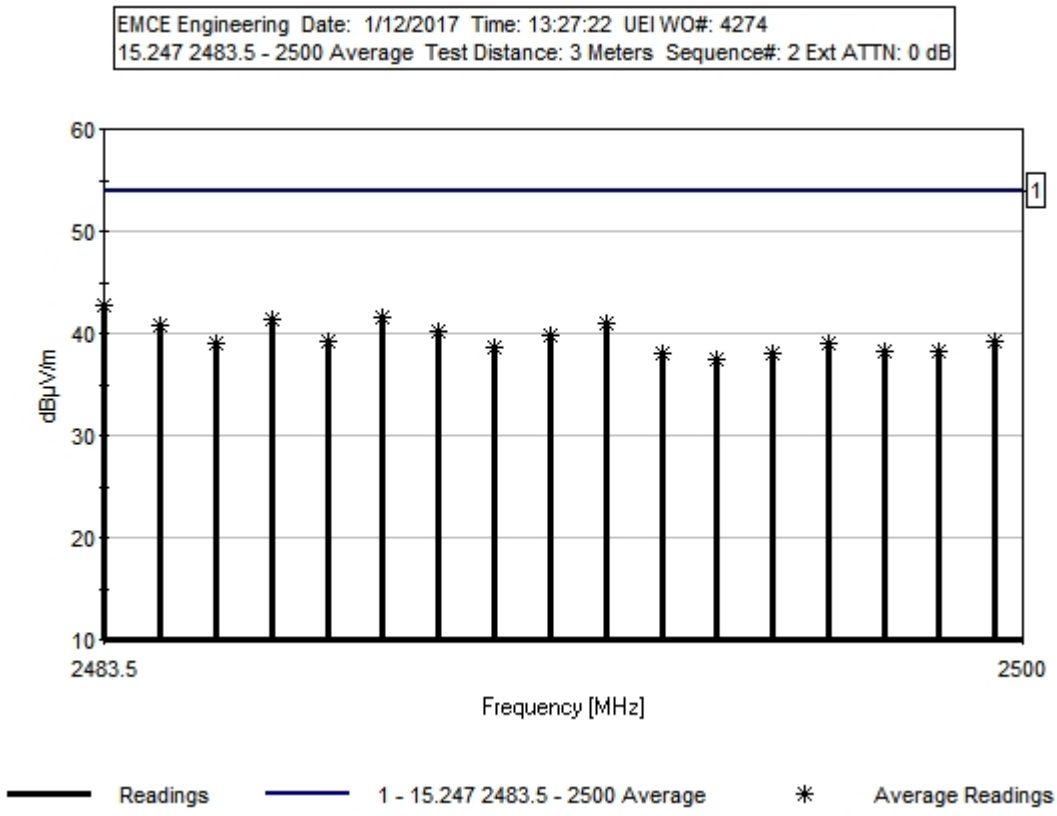
***Transducer Legend:***

| | |
|---|---|
| T1=25' LMR #001 | T2=8449B Preamp |
| T3=A.H. SAS-200/571 Horn | |

Ext Attn: 0 dB

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

| # | Freq | Rdng | T1 | T2 | T3 | | Dist | Corr | Spec | Margin | Polar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBµV | dB | dB | dB | dB | Table | dBµV/m | dBµV/m | dB | Ant |
| 1 | 2483.500M | 42.2 | +1.4 | +30.2 | +29.3 | | +0.0 | 42.7 | 54.0 | -11.3 | Horiz |
| | Ave | | | | | | 180 | | 2475 Xmit | | 185 |
| 2 | 2484.500M | 40.2 | +1.4 | +30.2 | +29.3 | | +0.0 | 40.7 | 54.0 | -13.3 | Horiz |
| | Ave | | | | | | 180 | | 2475 Xmit | | 185 |
| 3 | 2485.500M | 38.6 | +1.4 | +30.2 | +29.3 | | +0.0 | 39.1 | 54.0 | -14.9 | Horiz |
| | Ave | | | | | | 180 | | 2475 Xmit | | 185 |
| 4 | 2486.500M | 40.9 | +1.4 | +30.2 | +29.3 | | +0.0 | 41.4 | 54.0 | -12.6 | Horiz |
| | Ave | | | | | | 180 | | 2475 Xmit | | 185 |
| 5 | 2487.500M | 38.7 | +1.4 | +30.2 | +29.3 | | +0.0 | 39.2 | 54.0 | -14.8 | Horiz |
| | Ave | | | | | | 189 | | 2475 Xmit | | 185 |
| 6 | 2488.500M | 41.0 | +1.4 | +30.2 | +29.3 | | +0.0 | 41.5 | 54.0 | -12.5 | Horiz |
| | Ave | | | | | | 180 | | 2475 Xmit | | 185 |


EMCE Engineering Date: 1/12/2017 Time: 13:27:22 UEI WO#: 4274
15.247 2483.5 - 2500 Average Test Distance: 3 Meters Sequence#: 2 Ext ATTN: 0 dB
60
50
40
30
20
10
dBµV/m
1
2483.5
2500
Frequency [MHz]
Readings
1 - 15.247 2483.5 - 2500 Average
Average Readings

## 2.1.3 6 dB BANDWIDTH

**LIMIT:**

FCC 47 CFR Part 15

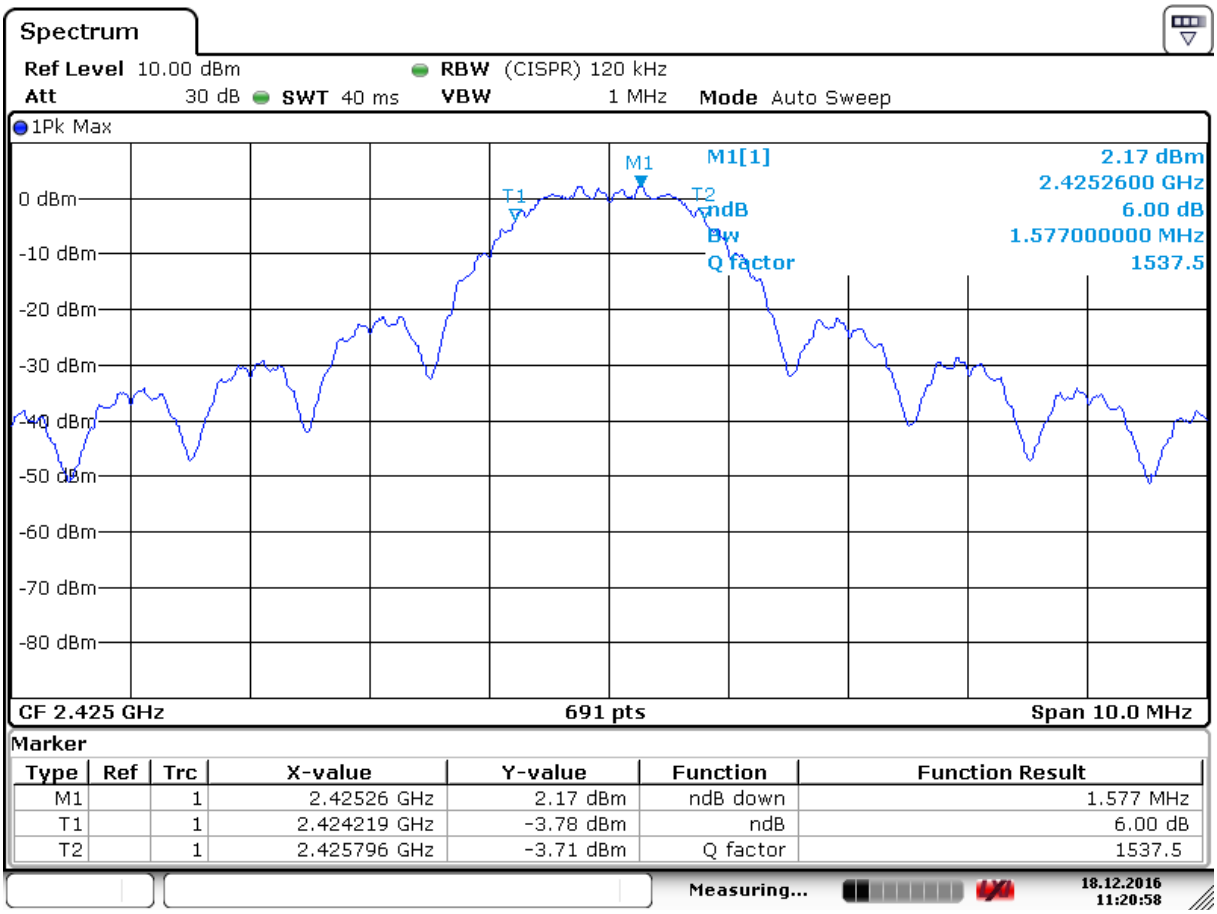
§15.247(a) (2)
Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

**TEST PROCEDURE:**

- The transmitter output is connected to the spectrum analyzer
- The RBW is set to 100KHz. The VBW is set to 100KHz. The sweep time is coupled.
- Signal Peak is detected
- Bandwidth is determined at the points 6 dB down from the peak value of the modulated carrier.

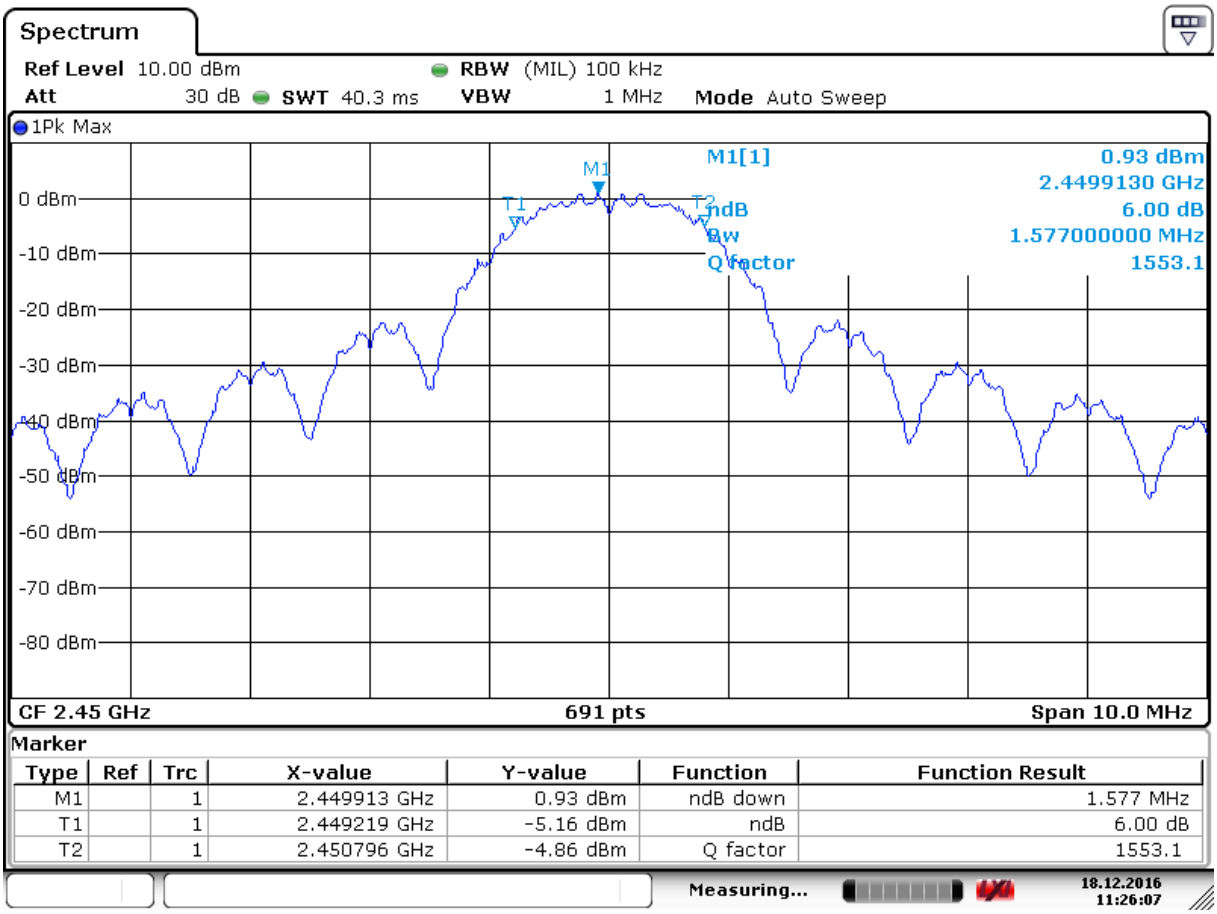
| Operating Frequency (MHz) | 6dB Bandwidth (KHz) | Limit (KHz) | Result |
|---|---|---|---|
| 2425 | 1.58 MHz | >500 | **PASS** |
| 2450 | 1.58 MHz | >500 | **PASS** |
| 2475 | 1.69 MHz | >500 | **PASS** |

## 2425 MHz



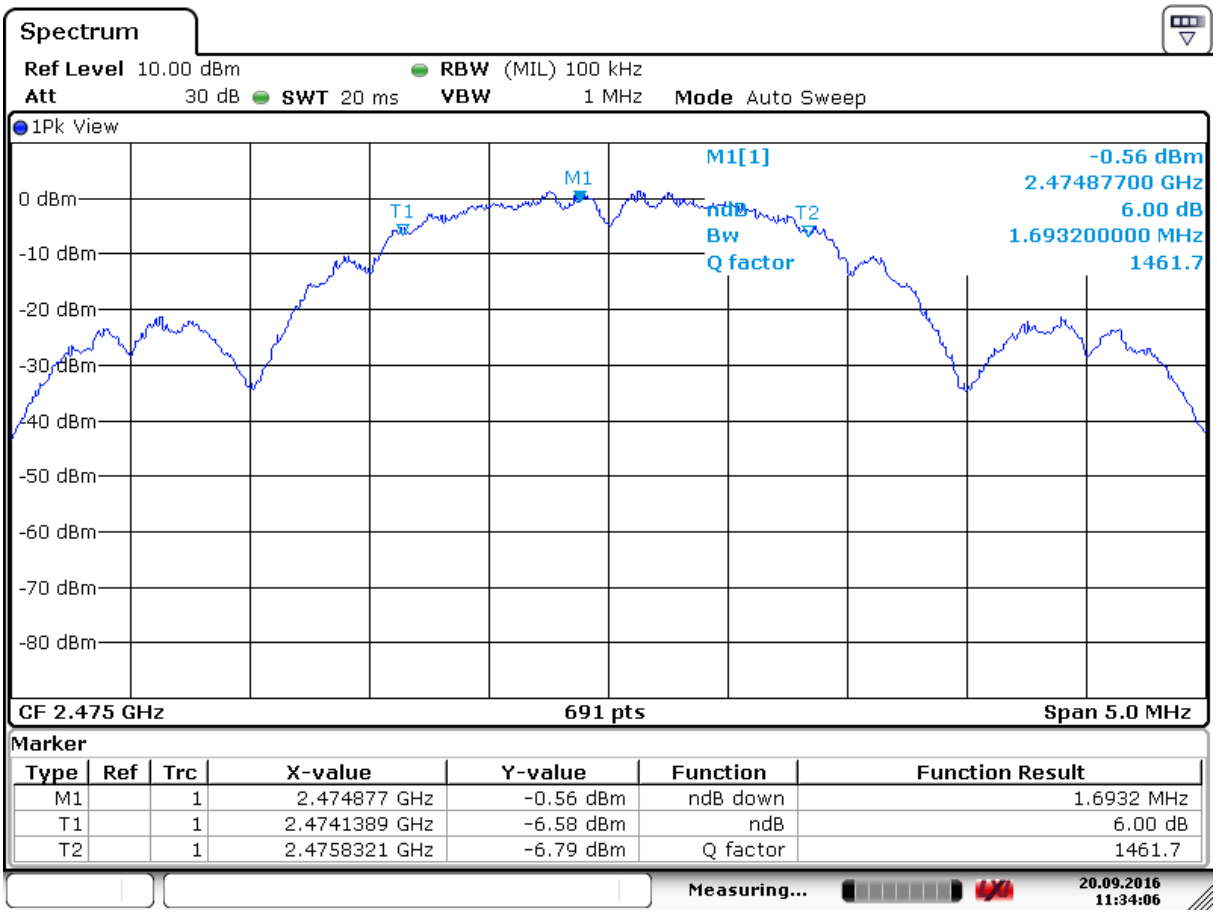

Date: 18.DEC.2016 11:20:58

## 2450 MHz




Date: 18.DEC.2016 11:26:08

## 2475 MHz




Date: 20.SEP.2016 11:34:06

## 2.1.4 Conducted Maximum Peak Output Power

**LIMIT:**

FCC 47 CFR Part 15

§15.247(d)

1 Watt / 30dBm / 137 dBuV (50 Ohms conversion)

**TEST PROCEDURE:**

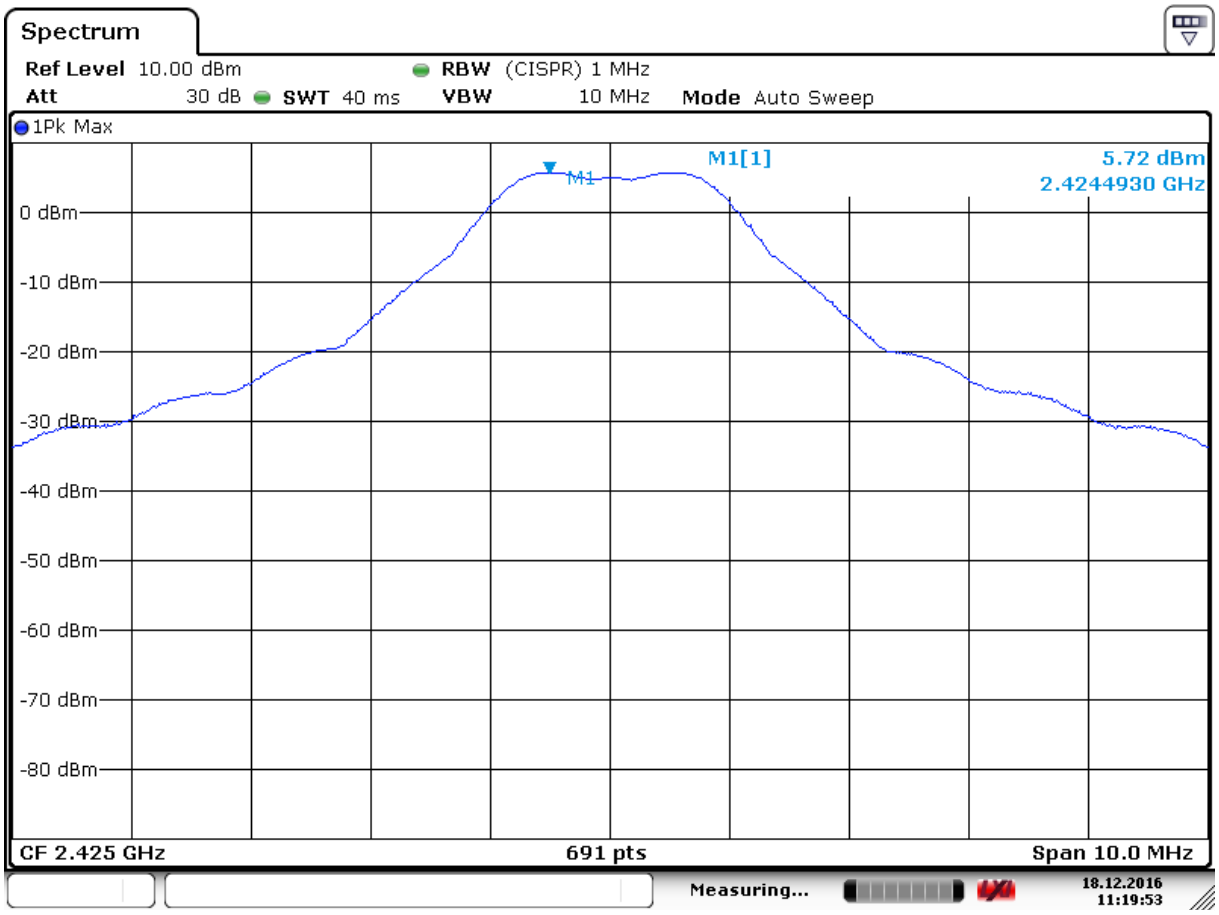
The transmitter output to the antenna is connected to a spectrum analyzer. The RBW / VBW is set to 1. The sweep time is coupled and the span is set to 5 MHz.

**RESULTS:**

**Peak Output Power**

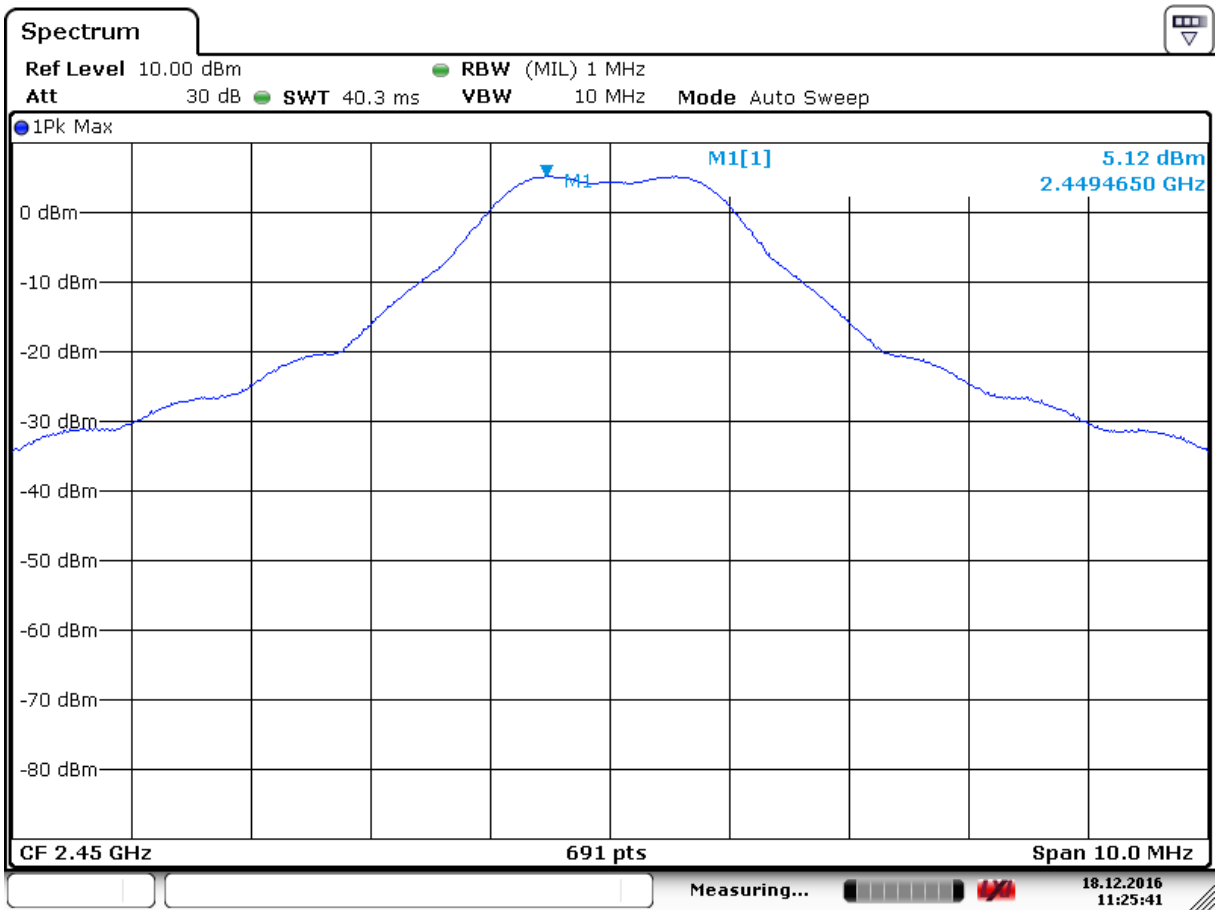
| Frequency (MHz) | Peak Output Power(dBm) | Limit (dBm) | Results |
|---|---|---|---|
| 2425 | 5.72 | 20 | **PASS** |
| 2450 | 5.12 | 20 | **PASS** |
| 2475 | 4.79 | 20 | **PASS** |

## 2425 MHz



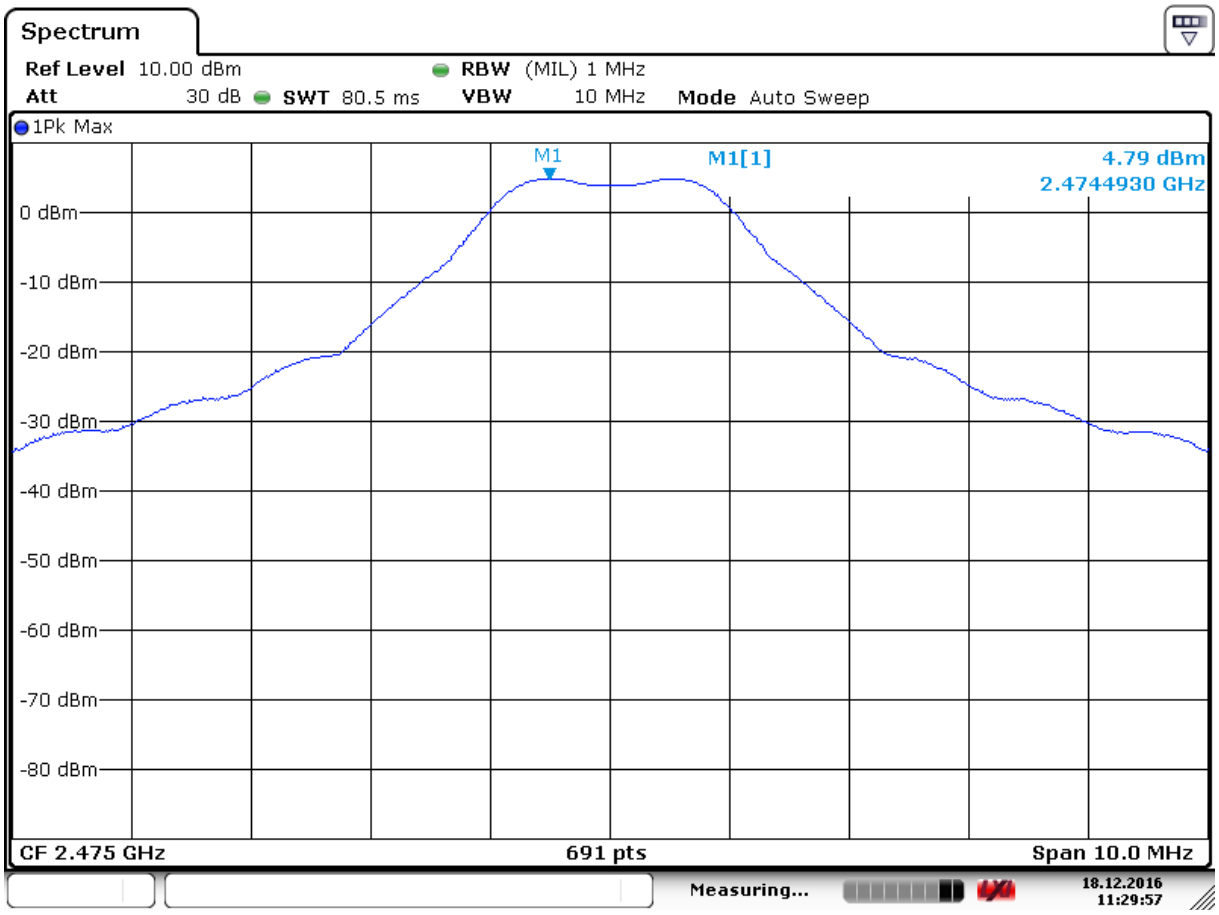

Date: 18.DEC.2016 11:19:54

## 2450 MHz




Date: 18.DEC.2016 11:25:41

## 2475 MHz




Date: 18.DEC.2016 11:29:57

## 2.1.5 Power Spectral Density

**LIMIT:**

FCC 47 CFR Part 15

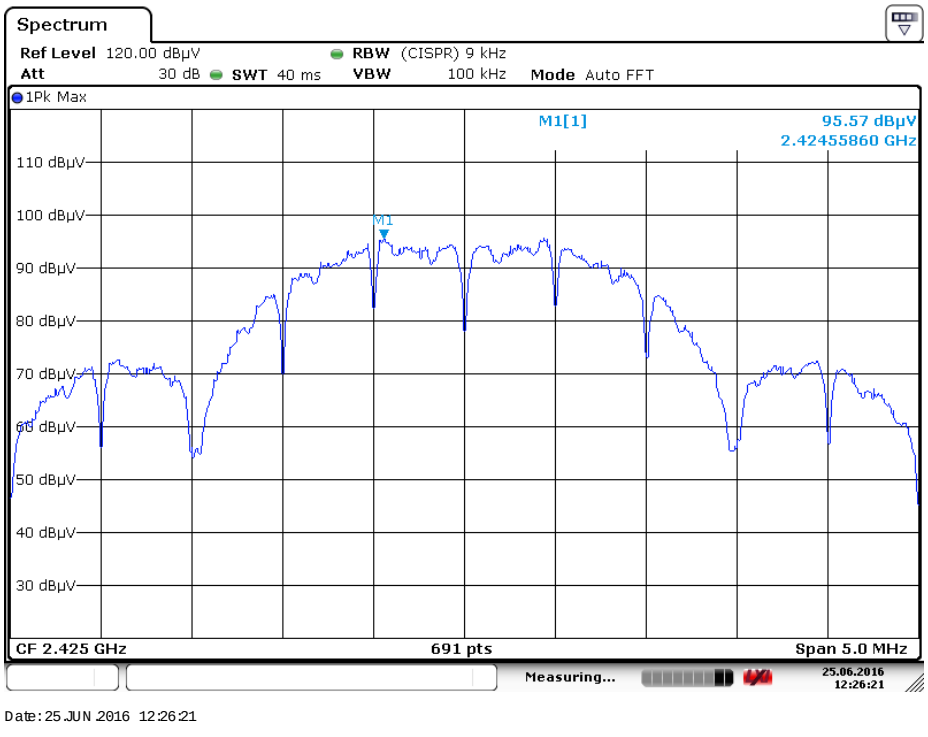
**TEST PROCEDURE:**

The transmitter antenna output is connected to a spectrum analyzer. The RBW is set to 3 KHz and the VBW is set to 10 KHz.

**RESULTS:**

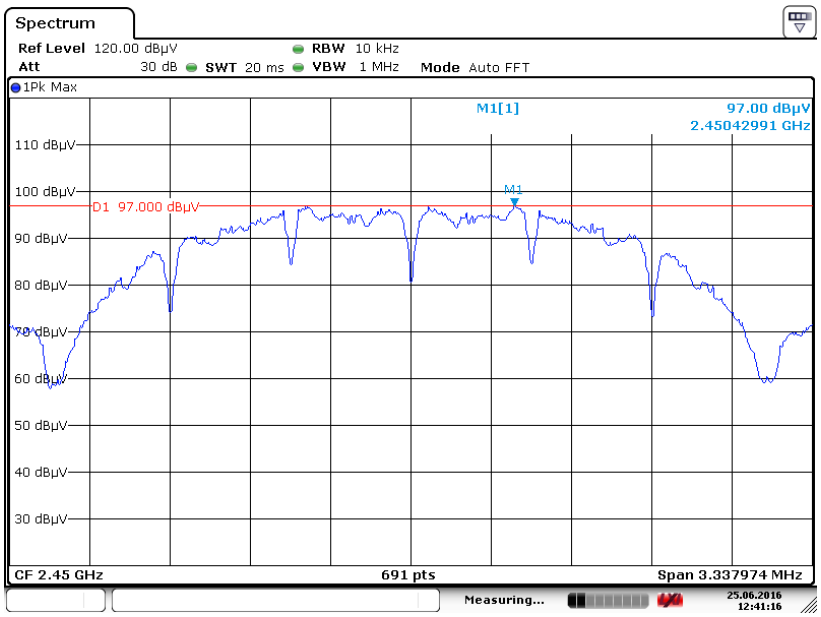
| *Description* | *Channel* | *Measured Value* | *E.I.R.P.* | *Limit* | *Result* |
|---|---|---|---|---|---|
| *Power Spectral Density* | *2425*<br>*2450*<br>*2475* | *-11.43*<br>*-10.00*<br>*-10.85* | *-12.43*<br>*-11.00*<br>*-11.85* | *10 dBM* | *Complies* |

2425



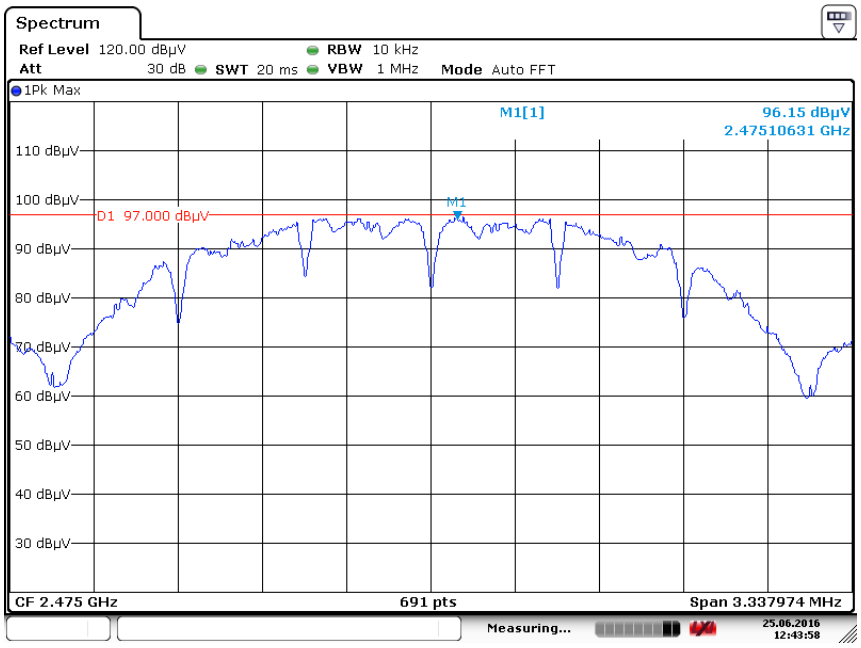

Date: 25.JUN.2016 12:26:21

2450



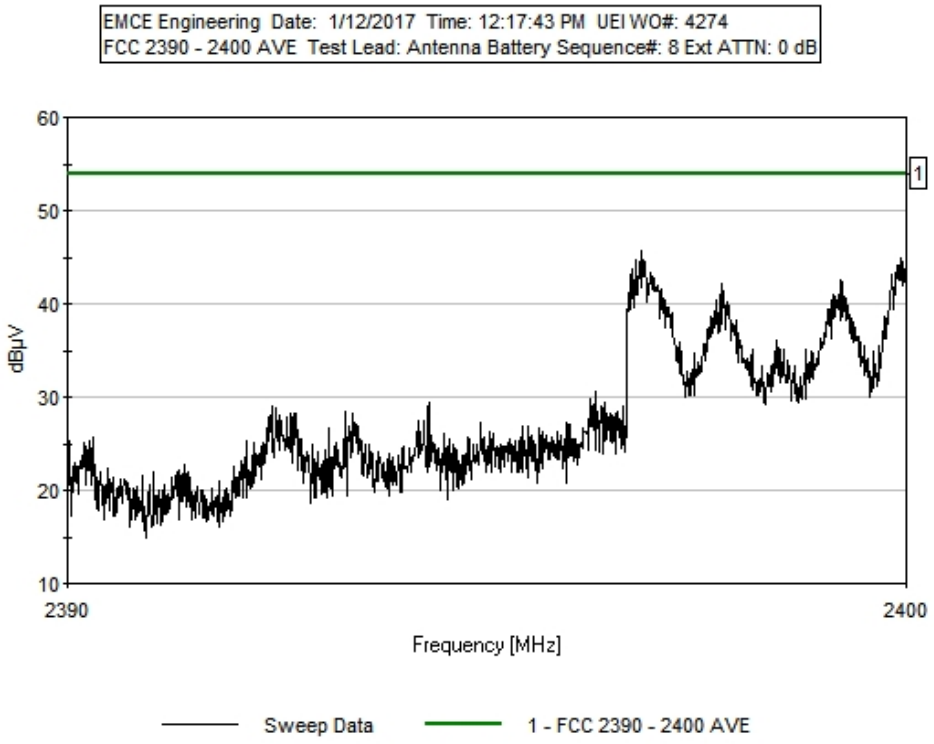

Date: 25.JUN.2016 12:41:17

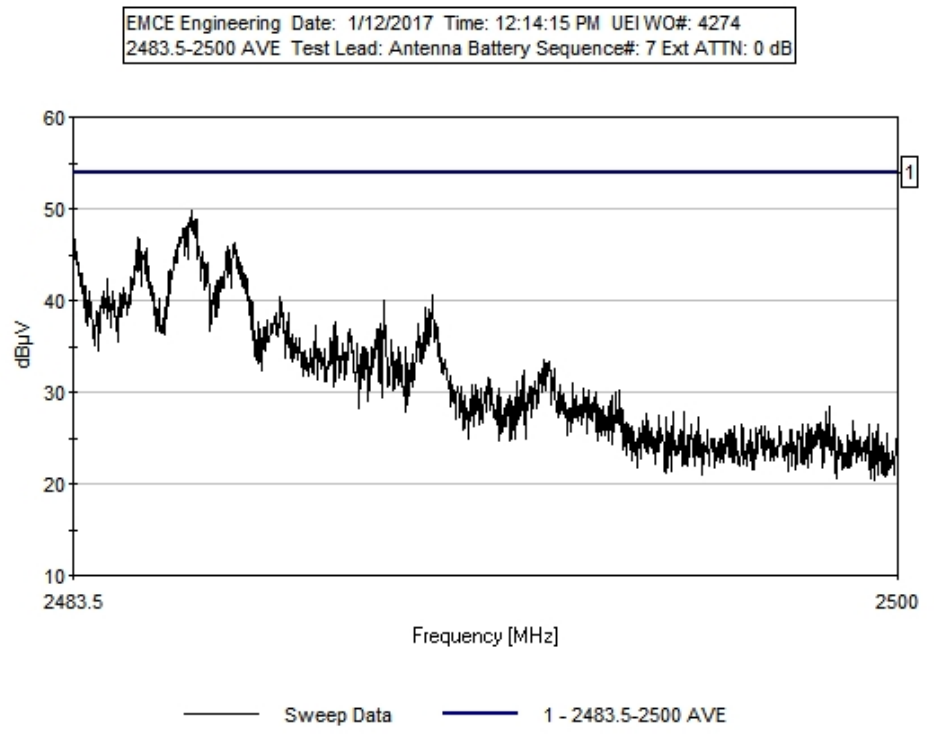
2475




Date: 25.JUN.2016 12:43:58

## 2.1.6 Conducted Bandedge



## 2.1.7 99% Bandwidth

**LIMITS**

**None –** For information purposes only

| *Frequency (MHz)* | *99% BW (MHz)* | *Limit (MHz)* | *Result* |
|---|---|---|---|
| | | | ***N/A*** |

# END OF REPORT