




Nemko Test Report: 10211699RUS3

Applicant: Texas Instruments, Inc.
12500 TI Blvd.
Dallas, TX 75243
USA

**Equipment Under Test:
(E.U.T.)** TRF7960AEVM
FCC ID.: Z64TRF7960AEVM

In Accordance With: **FCC Part 15, Subpart C, Paragraph 15.225**
Operation within the band 13.110-14.010 MHz

Tested By: Nemko USA Inc.
802 N. Kealy
Lewisville, TX 75057

TESTED BY: 
David Light, Senior Wireless Engineer **DATE:** 28-Sept-2012
Date

APPROVED BY: 
Mike Cantwell, Engineering Manager **DATE:** 28-Sep-2012
Date

Total Number of Pages: 17

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Section 1. Summary Of Test Results

Manufacturer: Texas Instruments, Inc.

Model No.: TRF7960AEVM

Serial No.: None

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15, Subpart C, Paragraph 15.225 for operation in the band 13.110-14.010 MHz. All tests were conducted using measurement procedure ANSI C63.4-2003.

New Submission

Production Unit

Class II Permissive Change

Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.

See " Summary of Test Data".



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Summary Of Test Data

| NAME OF TEST | PARA. NO. | RESULT |
|-------------------------------|------------------|---------------|
| Powerline Conducted Emissions | 15.207 | Complies |
| Field Strength | 15.225(a) | Complies |
| Radiated Emissions | 15.225(d)/15.209 | Complies |
| Frequency Stability | 15.225(e) | Complies |

Footnotes:

Section 2. General Equipment Specification

Frequency Range: 13.56 MHz Fixed

Operating Frequency(ies) of Sample: 13.56 MHz Fixed

Supply Power: 3.3 Vdc via USB

Integral Antenna: Yes No

Description of EUT

13.56 MHz RFID evaluation module. The unit was tested with both the Texas Instruments MSP-EXP430F5438 and the Stellaris DK-LM3S9B96 development boards.

Section 3. Powerline Conducted Emissions

| | |
|---|---------------------|
| NAME OF TEST: Powerline Conducted Emissions | PARA. NO.: 15.207 |
| TESTED BY: Brian Boyea | DATE: 28 Sept. 2012 |

Test Results: Complies. The worst case emission was 54.4 dB μ V at 656 kHz. This is 1.6 dB below the quasi-peak specification limit of 56.0 dB μ V.

Test Data: Refer to attached plots

Equipment Used: 674-704-1258-1663-1988-1548

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 35 %

Test Data – Powerline Conducted Emissions

| Frequency MHz | FCCB QP LIMIT | FCCB AVG LIMIT | AVG Meas | AVG Margin | QP Meas | QP Margin |
|------------------|---------------------|----------------------|-------------|---------------|------------|--------------|
| 0.328 | 60.9 | 50.9 | 42.6 | -8.4 | 54.8 | -6.1 |
| 0.343 | 60.5 | 50.5 | 40.7 | -9.8 | 54.2 | -6.3 |
| 0.356 | 60.1 | 50.1 | 39.2 | -10.9 | 55.7 | -4.5 |
| 0.369 | 59.7 | 49.7 | 40.8 | -9.0 | 55.9 | -3.9 |
| 0.376 | 59.5 | 49.5 | 42.5 | -7.1 | 56.4 | -3.1 |
| 0.379 | 59.5 | 49.5 | 42.8 | -6.6 | 56.8 | -2.6 |
| 0.383 | 59.3 | 49.3 | 43.1 | -6.2 | 57.3 | -2.1 |
| 0.395 | 59.0 | 49.0 | 42.2 | -6.8 | 56.1 | -2.9 |
| 0.656 | 56.0 | 46.0 | 41.3 | -4.7 | 54.4 | -1.6 |
| 0.685 | 56.0 | 46.0 | 39.5 | -6.5 | 53.0 | -3.0 |
| 0.83 | 56.0 | 46.0 | 36.0 | -10.0 | 44.8 | -11.2 |
| 0.91 | 56.0 | 46.0 | 38.5 | -7.5 | 52.7 | -3.3 |
| 0.94 | 56.0 | 46.0 | 38.8 | -7.2 | 52.8 | -3.2 |
| 1.21 | 56.0 | 46.0 | 39.4 | -6.7 | 50.6 | -5.4 |
| 1.92 | 56.0 | 46.0 | 38.8 | -7.2 | 47.4 | -8.6 |
| 2.1 | 56.0 | 46.0 | 38.3 | -7.7 | 46.6 | -9.4 |
| 2.1 | 56.0 | 46.0 | 38.2 | -7.9 | 46.4 | -9.6 |
| 2.1 | 56.0 | 46.0 | 38.2 | -7.8 | 46.5 | -9.5 |
| 2.11 | 56.0 | 46.0 | 38.1 | -7.9 | 46.7 | -9.3 |
| 2.12 | 56.0 | 46.0 | 35.9 | -10.2 | 44.4 | -11.6 |
| 2.13 | 56.0 | 46.0 | 38.1 | -7.9 | 46.4 | -9.6 |
| 2.15 | 56.0 | 46.0 | 37.2 | -8.8 | 43.8 | -12.3 |
| 2.16 | 56.0 | 46.0 | 37.9 | -8.1 | 45.6 | -10.4 |
| 2.29 | 56.0 | 46.0 | 37.9 | -8.1 | 46.9 | -9.1 |
| 2.31 | 56.0 | 46.0 | 37.3 | -8.7 | 46.5 | -9.5 |

Section 4. Field Strength

| | |
|------------------------------|----------------------|
| NAME OF TEST: Field Strength | PARA. NO.: 15.225(a) |
| TESTED BY: David Light | DATE: 28 Sept. 2012 |

Test Results: Complies.

Measurement Data:

| Freq. (MHz) | Meter Reading (dBuV) | Antenna Factor (dB) | Cable Loss (dB) | | Corrected Reading (dBuV/m) | Spec. Limit (dBuV/m) | Pol. | Comments: |
|-------------|----------------------|---------------------|-----------------|--|----------------------------|----------------------|------|-----------------------|
| | | | | | | | | TI MSP-EXP430F5438 |
| 13.56 | 43.9 | 17.4 | 0.1 | | 61.4 | 124 | Loop | |
| | | | | | | | | Stellaris DK-LM3S9B96 |
| 13.56 | 46.6 | 17.4 | 0.1 | | 64.1 | 124 | Loop | |

Measurement Distance: 3 meters

Detector Bandwidth: 10 kHz/10 kHz

Detector Function: Peak

The specification limit was adjusted at 40 dB per decade from 30 meter limit.

Notes:

- For handheld devices, the EUT was tested on three orthogonal axis'
- The device was tested from 30 MHz to the tenth harmonic of the highest fundamental frequency per 15.33
- The device was tested on three channels per 15.31(l).

Test Equipment Used: 1733-1767-1783

Measurement Uncertainty: +/-3.6 dB

Temperature: 22 °C

Relative Humidity: 45 %

Section 5. Radiated Emissions

| | |
|----------------------------------|-----------------------------|
| NAME OF TEST: Radiated Emissions | PARA. NO.: 15.225(d)/15.209 |
| TESTED BY: David Light | DATE: 28 Sept. 2012 |

Test Results: Complies

Test Equipment Used: 1767-1733-1763-1783-791

Measurement Uncertainty: +/-3.6 dB

Temperature: 22 °C

Relative Humidity: 45 %

Measurement Data: Refer to data on following page.

Test Data – Radiated Emissions

Texas Instruments MSP-EXP430F5438

| Frequency MHz | FCC B Limits | Peaks H_Peaks | Peaks Margin |
|------------------|-----------------|------------------|-----------------|
| 32.4 | 40.0 | 32.2 | -7.8 |
| 40.0 | 40.0 | 27.8 | -12.2 |
| 103.8 | 43.5 | 20.8 | -22.8 |
| 162.7 | 43.5 | 29.6 | -13.9 |
| 199.9 | 43.5 | 26.6 | -16.9 |
| 247.0 | 46.0 | 32.5 | -13.5 |
| 332.9 | 46.0 | 33.7 | -12.3 |
| 393.1 | 46.0 | 31.8 | -14.3 |
| 420.3 | 46.0 | 36.8 | -9.2 |
| 900.2 | 46.0 | 32.5 | -13.5 |
| | | | |
| | | | |
| | | | |
| | | | |

| Frequency MHz | FCC B Limits | Peaks V_Peaks | Peaks Margin |
|------------------|-----------------|------------------|-----------------|
| 96.9 | 43.5 | 29.0 | -14.5 |
| 162.7 | 43.5 | 26.6 | -16.9 |
| 271.1 | 46.0 | 35.3 | -10.8 |
| 420.3 | 46.0 | 36.4 | -9.6 |
| 705.3 | 46.0 | 35.3 | -10.7 |
| 732.5 | 46.0 | 36.8 | -9.2 |
| 772.7 | 46.0 | 35.9 | -10.1 |
| | | | |
| | | | |
| | | | |
| | | | |

Stellaris DK-LM3S9B96

| Frequency MHz | FCC B Limits | Peaks H_Peaks | Peaks Margin |
|------------------|-----------------|------------------|-----------------|
| 100.1 | 43.5 | 25.5 | -18.0 |
| 119.8 | 43.5 | 27.6 | -15.9 |
| 150.0 | 43.5 | 41.8 | -1.8 |
| 168.3 | 43.5 | 32.8 | -10.7 |
| 199.9 | 43.5 | 29.2 | -14.3 |
| 327.2 | 46.0 | 35.1 | -11.0 |
| 487.7 | 46.0 | 34.3 | -11.7 |
| 515.0 | 46.0 | 34.0 | -12.0 |
| 720.2 | 46.0 | 36.2 | -9.8 |

| Frequency MHz | FCC B Limits | Peaks V_Peaks | Peaks Margin |
|------------------|-----------------|------------------|-----------------|
| 96.1 | 43.5 | 28.3 | -15.2 |
| 150.2 | 43.5 | 34.7 | -8.9 |
| 345.7 | 46.0 | 37.9 | -8.2 |
| 596.7 | 46.0 | 34.8 | -11.2 |
| 599.8 | 46.0 | 37.5 | -8.5 |
| 624.0 | 46.0 | 36.1 | -10.0 |
| | | | |
| | | | |
| | | | |

Section 6. Frequency Stability

| | |
|-----------------------------------|-------------------------|
| NAME OF TEST: Frequency Stability | PARA. NO.: 15.225(e) |
| TESTED BY: David Light | DATE: 28 September 2012 |

Test Results: Complies

Test Equipment Used: 1767-1733-1763

Measurement Uncertainty: +/-3.6 dB

Temperature: 22 °C

Relative Humidity: 45 %

Measurement Data:

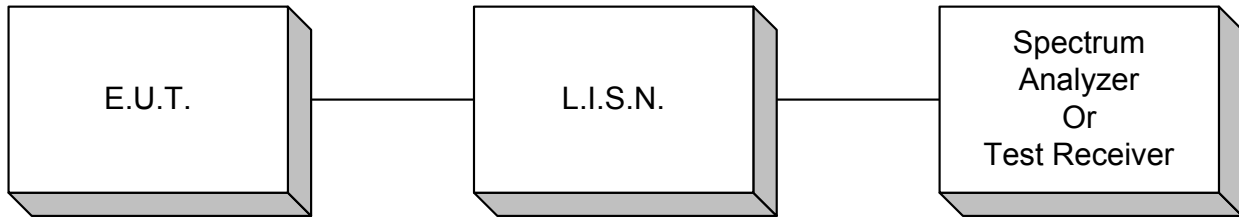
| Temp (°C) | Measured Frequency (MHz) | Test Voltage | Freq. Error (Hz) | Freq. Error (%) | Limit (±Hz) | Pass/Fail |
|-----------|--------------------------|--------------|------------------|-----------------|-------------|-----------|
| 20 | 13.560230 | 3.3 | 230 | 0.0017 | 1356 | P |
| 20 | 13.560211 | 2.8 | 211 | 0.0016 | 1356 | P |
| 20 | 13.560205 | 3.8 | 205 | 0.0015 | 1356 | P |
| -20 | 13.560199 | 3.3 | 199 | 0.0015 | 1356 | P |
| 50 | 13.560241 | 3.3 | 241 | 0.0018 | 1356 | P |

Section 7. Test Equipment List

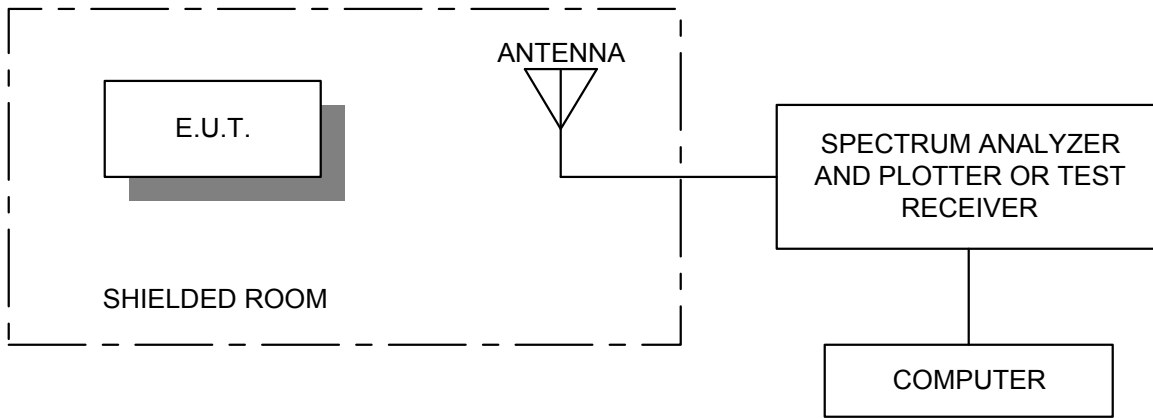
| Asset Tag | Description | Manufacturer | Model | Serial # | Last Cal | Next Cal |
|-----------|--|-------------------|-------------------|-------------|-------------|-------------|
| 674 | Limiter | Hewlett Packard | 11947A | 3107A02200 | 01-Nov-2011 | 01-Nov-2012 |
| 704 | Filter, High Pass, 5KHz | Solar Electronics | 7930-5.0 | 933126 | 13-Feb-2012 | 13-Feb-2013 |
| 1258 | LISN .15mhz-30mhz | EMCO | 3825/2 | 1305 | 31-Oct-2011 | 31-Oct-2012 |
| 1663 | Spectrum Analyzer | Rohde & Schwartz | FSP3 | 100073 | 02-Sep-2011 | 02-Sep-2013 |
| 1733 | Antenna, Active Loop | EMCO | 6507 | 45939 | 08-May-2012 | 08-May-2013 |
| 1763 | Antenna, Bilog | Schaffner | CBL 6111D | 22926 | 21-Feb-2012 | 21-Feb-2013 |
| 1767 | Receiver, EMI Test 20Hz - 26.5 GHz - 150 - +30 dBm LCD | Rohde & Schwartz | ESIB26 | 837491/0002 | 09-Dec-2011 | 09-Dec-2012 |
| 1783 | Cable Assy, 3m Chamber | Nemko | Chamber | | 26-Sep-2012 | 26-Sep-2013 |
| 791 | Watkins Johnson 30MHz to 1GHz Pre Amplifier | Nemko, USA | CRA69 321003 9605 | 119 | 19-Oct-2012 | 19-Oct-2013 |
| 1548 | 0.5m Cable Assy | Nemko USA | RG213 | | 13-Feb-2012 | 13-Feb-2013 |

ANNEX A
TEST DIAGRAMS

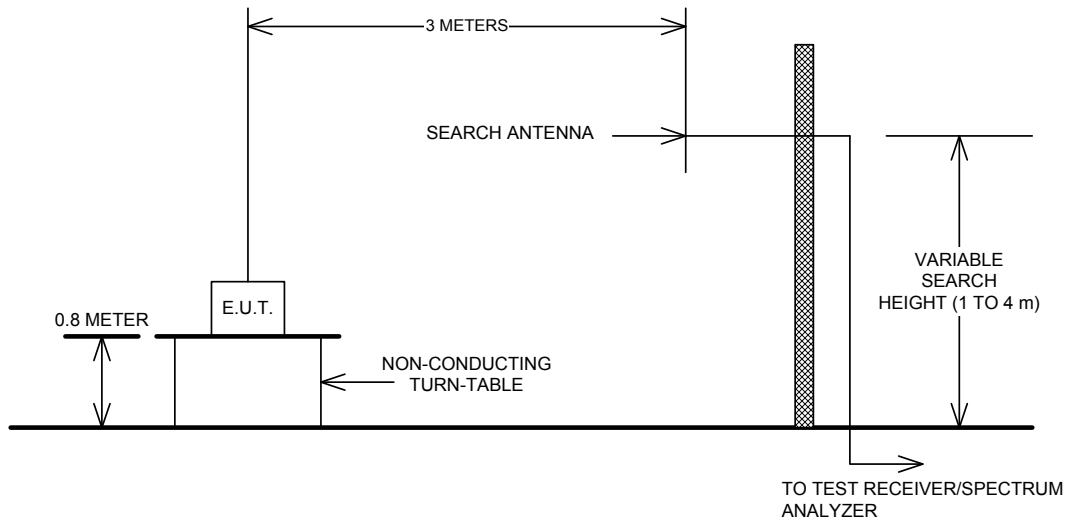
Conducted Emissions



Radiated Prescan



Test Site For Radiated Emissions



ANNEX B

TEST DETAILS

| | |
|---|----------------------|
| NAME OF TEST: Powerline Conducted Emissions | PARA. NO.: 15.207(a) |
|---|----------------------|

Minimum Standard: §15.207 Conducted limits.

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 mH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency of Conducted Emission (MHz) | Limit (dBmV) | |
|---------------------------------------|--------------|-----------|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

* Decreases with the logarithm of the frequency.

(b) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

(1) For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 mV within the frequency band 535-1705 kHz, as measured using a 50 mH/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits as provided in §15.205 and §§15.209, 15.221, 15.223, 15.225 or 15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

| | |
|---|-------------------|
| NAME OF TEST: Operation in the band 13.110-14.010 MHz | PARA. NO.: 15.225 |
|---|-------------------|

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

(e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

(f) In the case of radio frequency powered tags designed to operate with a device authorized under this section, the tag may be approved with the device or be considered as a separate device subject to its own authorization. Powered tags approved with a device under a single application shall be labeled with the same identification number as the device.