

# **ACLARA TECHNOLOGIES LLC**

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# **ENGINEERING TEST REPORT**

RADIO-FREQUENCY EMISSIONS TEST REPORT FOR

HIGH READ-RATE GAS METER TRANSMITTING UNIT

OCCUPIED BANDWIDTH TRANSIENT BEHAVIOR

Model 2011-005, Rev. C FCC ID: LLB11005S

March 28, 2012

Report Prepared by

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### **TEST REPORT**

### **INTRODUCTION**

The Aclara Model 2011-005 transceiver is a "Meter Transmitting Unit" (MTU) designed to provide remote meter reading capability for a gas meter. The transceiver is self-powered and mounts directly on a gas meter. On board batteries provide power. The transmitter provides a very short, intermittent radio frequency transmission to send a remote reading of the meter to a data collector unit. A microprocessor provides timing, control and data processing functions. The internal antenna is inaccessible to the user and no external antenna is provided. Two identical units were used as a test subjects for this report. The unit used for each test is identified under the test procedure. This report presents the data obtained in support of an application for Certification under Part 90 of the FCC rules.

### MEASUREMENTS PERFORMED

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### **OCCUPIED BANDWIDTH**

The emissions close to the center of the specified channel are limited by the emissions masks described in 90.210. For the frequency range of the 2011-005 transmitter, Mask D is specified. From the center frequency of the band  $\pm 5.625$  kHz, 0 dB of attenuation is required. From 5.625 kHz to 12.5 kHz from the center frequency, attenuation must be at least 7.27(f<sub>d</sub> – 2.88 kHz) dB, where f<sub>d</sub> is the displacement frequency from the center of the band in kHz.

At more than 12.5 kHz from the band center, the attenuation must be 70 dB or  $50 + 10 \log(P)$ , whichever is less. The maximum dipole equivalent power was determined to be 23.5 dBm or 0.224 W and  $50 + 10 \log(0.224)$  equals 43.5 dB. The mask measurement was a conducted measurement, and as seen in Fig. 1, the measured output power was 25.1 dBm so the maximum allowed is shown on the plot as -20 dBm or 45.1 dB below the measured level.

Both modulated and unmodulated transmissions were stored on the spectrum analyzer display. The plot of Fig. 1 shows both signals with Mask D superimposed on the plot. The plot indicates that the modulated emission does comply with the requirement for occupied bandwidth as found in 90.210.

For purposes of this test, the modulated signal was PN9 modulated at the specified 7200 bits per second data rate.

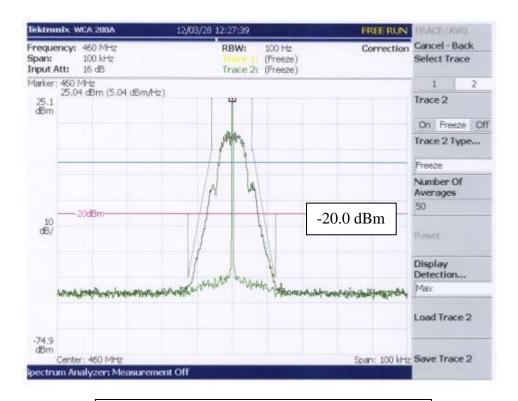


Fig. 1 Hexagram Model 2011-005 Emissions Mask

# TEST EQUIPMENT USED

Spectrum Analyzer Tektronix Model WCA 280A

SN: J300168 Cal Due: 4/26/2012

Antenna Direct Measurement

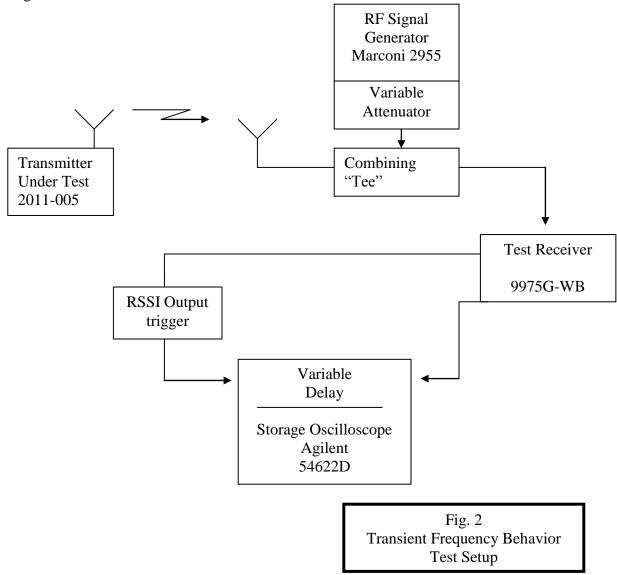
<u>Test Performed</u> March 28. 2012

Unit Tested: 2011-005 Rev. C SN: 80003090

# TRANSIENT STABILITY

The transient stability measurements indicate the variation in tuned frequency during the brief interval of time during the start of the transmission and at the end of the transmission.

The Model 2011-005 transmitter was tested for transient frequency behavior using the test method of TIA/EIA-603-C. A block diagram of the test setup is seen in Fig. 2. A Hexagram model 9975G-WB receiver was used. The storage oscilloscope was triggered by the output of the RSSI output of the receiver. Appropriate delay was provided by the digital delay circuitry of the oscilloscope. The 1 kHz test signal was provided by the Marconi signal generator. The generator's output control was used to insure that the test signal was at least 50 dB below the received signal level from the 2011-005.



## **Test Requirements**

The test requirements per 90.214 are:

- 1. Frequency deviation during  $t_1$  (10 ms duration after  $t_{on}$ ) may be greater than  $\pm 12.5$  kHz because the output power is less than 6 Watts.
- 2. Frequency deviation during  $t_2$  (25 ms duration after  $t_1$ ) must be less than  $\pm 6.25$  kHz.
- 3. Frequency deviation after  $t_2$  must be less than  $\pm 2.5$  ppm, or  $\pm 1150$  Hz at 460 MHz.
- 4. Frequency deviation during  $t_3$  (10 ms duration after transmitter is turned off) may exceed  $\pm 12.5$  kHz because output power is less than 6 Watts.

#### **Test Data**

Figures 3 through 7 show the Model 2011-005 transient frequency characteristics. The limit masks are indicated on each of the figures.

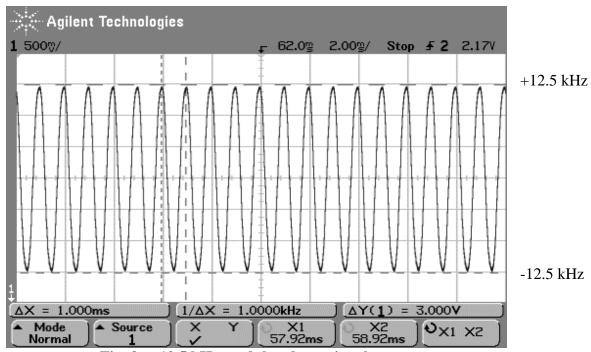


Fig. 3  $\pm 12.5$  kHz modulated test signal

 $\pm 12.5 \text{ kHz} = 3.00 \text{ V}$ 

 $\pm 6.25 \text{ kHz} = 1.50 \text{ V}$ 

 $\pm 1.15 \text{ kHz} = 276 \text{ mV}$ 

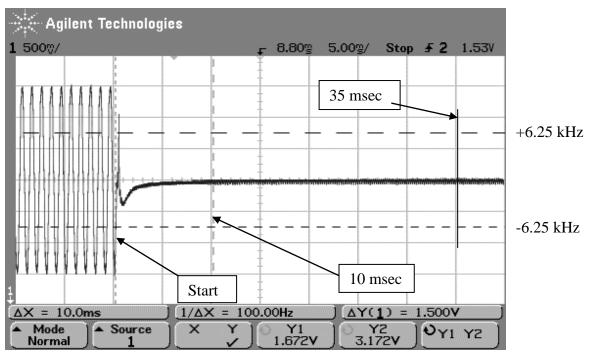


Fig. 4 Start of Transmission

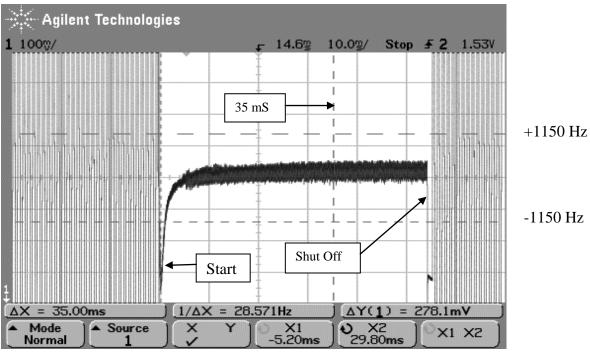


Fig. 5 Full Transmission

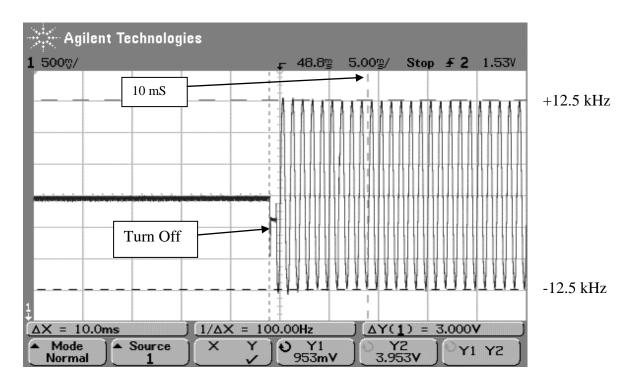


Fig. 6 Turn Off Transient

The modulated signal appears well within the allowed 10 ms and does not exceed  $\pm 12.5$  kHz beyond 10 ms.

### TEST EQUIPMENT USED

Signal Generator Marconi Model 2955 RF Test Set

S/N 132061

Cal Due: 2/25/2012

**Test Receiver** Hexagram 9975G-WB w/

RSSI trigger output

Oscilloscope Agilent Model 54622D

SN: MY40003551 Cal Due: 2/28/12

**Test Performed** November 30, 2011

Unit Tested: 2011-005 Rev. C SN: 80003090