

TEST REPORT

Report Number: 100086465DAL-001

Project Number: G100086465

Testing performed on the
RT Automated Fuel Control Terminal (2.41GHz)
FCC ID:

to
47 CFR Part 15. 247:2008

For
EJ Ward

Test Performed by:
Intertek
1809 10th Street Suite 400
Plano, TX 75035

Test Authorized by:
EJ Ward
8801 Tradeway St
San Antonio, TX 78217

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Date: June 10, 2010

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Jeremy Pickens, EMC Lab Manager

Date: June 10, 2010

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Report No. 100086465DAL-001

Equipment Under Test:	RT Automated Fuel Control Terminal
Trade Name:	Automated Fuel Control Terminal
Model No.:	RT
FCC ID:	
Applicant:	EJ Ward
Contact:	Mr. Eric Scrivner
Address:	8801 Tradeway St San Antonio, TX 78217
Country	USA
Tel. Number:	210-824-7383
Fax number:	---
Applicable Regulation:	FCC Part 15, Subpart C Section 15.247
Test Site Location:	Intertek 1809 10 th Street Plano, TX 75035
Date of Test:	April 12 to May 28, 2010

We attest to the accuracy of this report:



William Cullen
Assoc EMC Engineer



Jeremy Pickens
EMC Lab Manager



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1.0 Introduction

The Equipment under Test (EUT) is a transceiver operating at 2.41GHz

This report is designed to show compliance of the 2.41GHz transceiver with FCC Part 15.247 requirements.

1.1 Summary of Tests

TEST	REFERENCE FCC 17.247	RESULTS
6-dB Bandwidth	15.247(a)(2)	Complies
20-dB Bandwidth	15.215(c)	Complies
Peak Conducted Output Power (< 1W)	15.247(b)(3)	Complies
Power Spectral Density	15.247(e)	Complies
Out of Band Emissions	15.247(c)	Complies
Restricted Band	15.205 15.209	Complies
AC Conducted Emission	15.207	Complies

2.0 General Description

2.1 Product Description

The RT terminal is an automated fuel management system whose main purpose is to help protect vehicle fleet assets while improving productivity and expense control. The RT Terminal provides all the necessary tools a fleet manager needs to collect, store, and manage a multitude of fleet fueling and vehicle-specific information.

Overview of the EUT (RT Terminal)

Applicant	EJ Ward 8801 Tradeway St San Antonio, TX 78217
Manufacturer name & address	EJ Ward 8801 Tradeway St San Antonio, TX 78217
Trade Name & Part No.	RT Automated Fuel Control Terminal
FCC Identifier	
Use of Product	Automated fuel management system
Type of Transmission	Spread Spectrum, Frequency Hopping
Rated RF Output	2.52 mW
Frequency Range	2.41 GHz
Number of Channel(s)	one
Modulation Type	FSK
Antenna(s) type & Gain	Vertical, 4 dBi

A production version of the sample was received on February 15, 2010 in good condition.

Test start date: April 12, 2010

Test end date: May 28, 2010

2.2 Related Submittal(s) Grants

The FCC Part 15.247 application for digital transmitter with the FCC ID:



2.3 Test Methodology

Radiated and AC Line conducted emissions measurements were performed according to the procedures in ANSI C63.4 (2003). Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Data Sheet**" of this Application. All other measurements were made in accordance with the procedures described in KDB Publication No. 558074.

2.4 Test Facility

Then radiated emission test site and conducted measurement facility used to collect the data is 3m semi-anechoic chamber located in Plano, TX. This test facility and site measurement data have been fully placed on file with the FCC.



3.0 System Test Configuration

3.1 Support Equipment

Item #	Description	Model No.	Serial No.
	None		

3.2 Block Diagram of Test Setup

Test Setup for RF Conducted measurements

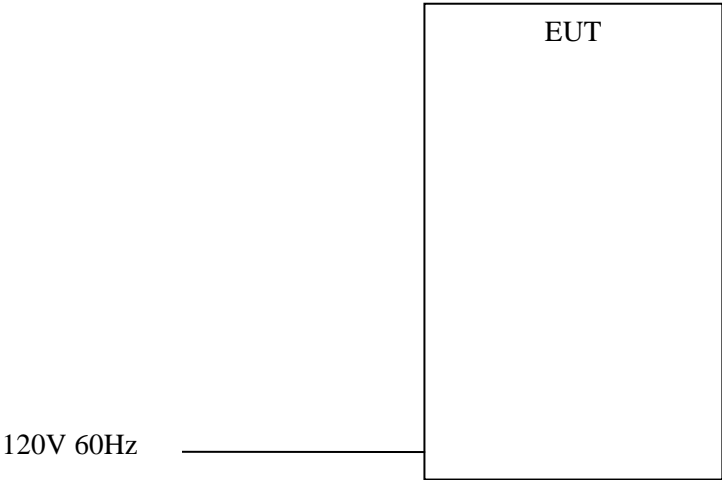


* Client disconnected the antennas and installed cables for all antenna conducted measurements.

S = Shielded U = Unshielded	F = With Ferrite m = Length in Meters
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Test Setup for Radiated measurements



S = Shielded	F = With Ferrite
U = Unshielded	m = Length in Meters



3.3 Justification

For radiated emission measurements the EUT was placed on a wooden pallet, it is a floor standing EUT. The EUT is attached to peripherals and they are connected and operational (as typical as possible). The EUT is wired to transmit full power.

In normal operation, the EUT is powered up and the necessary mode for testing is activated.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was provided by the Applicant.

3.5 Mode of Operation During Test

The EUT was tested in one mode: transmitting at its operating frequency of 2.41GHz.

3.6 Modifications Required for Compliance

There were no modifications needed in order to bring the RT terminal into compliance with the standards called out in this report.



4.0 Measurement Results

4.1 6-dB Bandwidth FCC 15.247(a)(2) and RSS-210 A8.2(a)

Requirements

The 6 dB bandwidth must be greater than 500 kHz.

Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer.

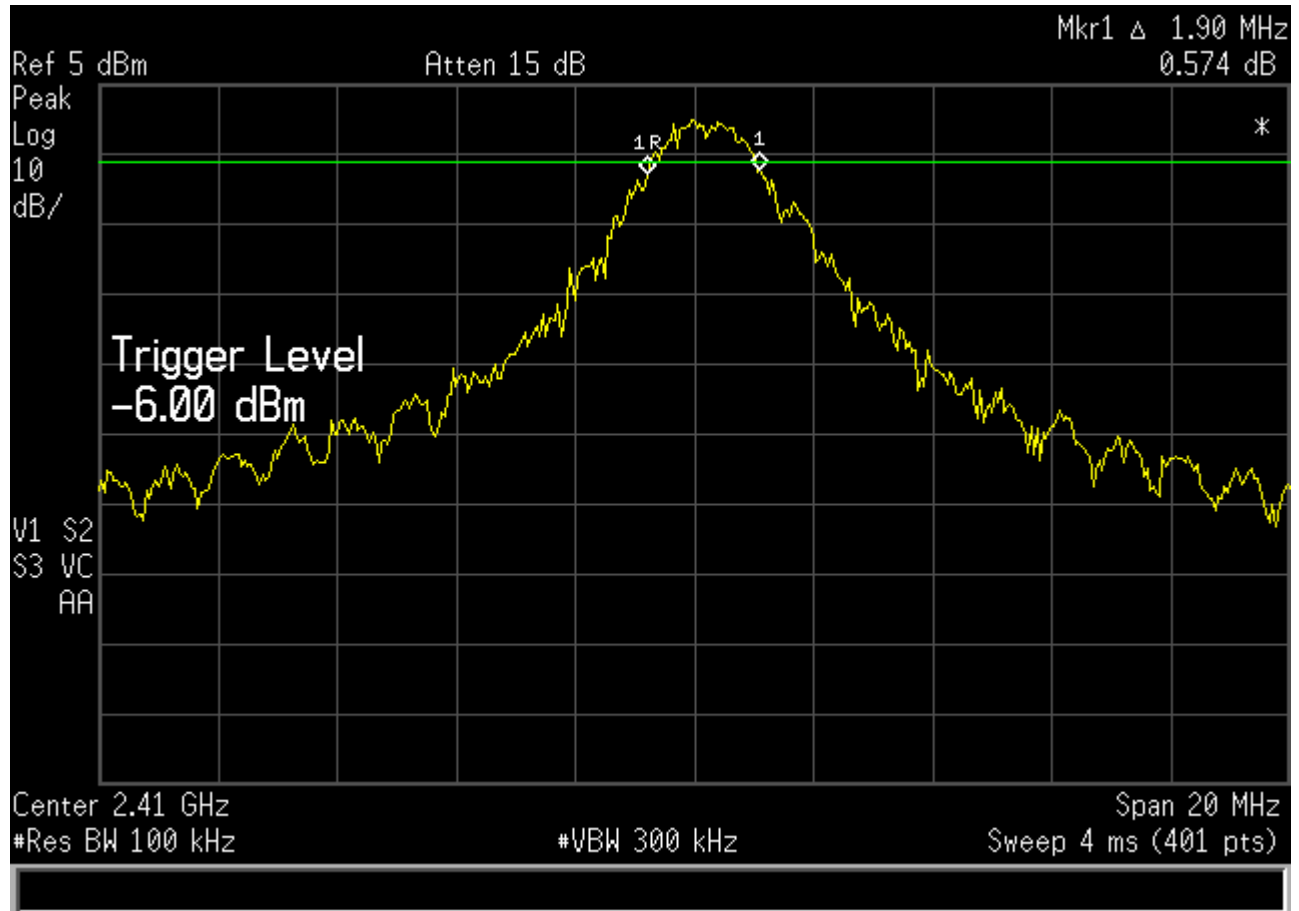
The measurement was made with the spectrum analyzer's resolution bandwidth (RBW) equal to 100 kHz. In order to make an accurate measurement, the span was set greater than RBW.

The 6-dB Bandwidth was measured by using the DELTA MARKER function of the analyzer.

Test Results

Frequency (MHz)	6-dB channel bandwidth (MHz)	Plot
2.41 GHz	1.9	1.1

Plot 1.1





4.2 Occupied Bandwidth FCC 15.215(c) and RSS-GEN Section 4.6

Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer.

The transmitter was operated at its maximum carrier power measured under normal test conditions.

The span of the analyzer was set to capture all products of the modulation process, including the emission skirts.

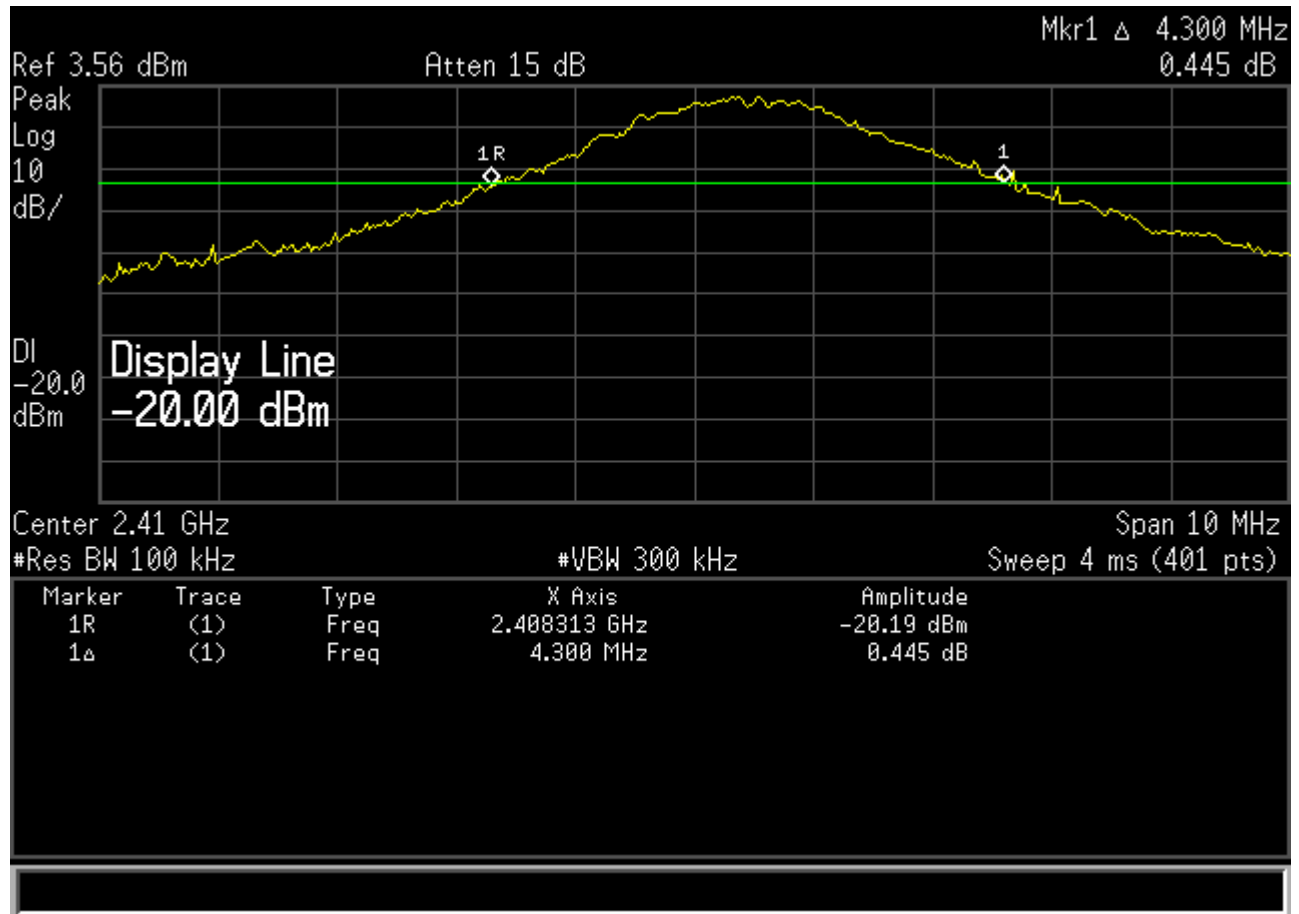
The resolution bandwidth was set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth was set to 3 times the resolution bandwidth. Video averaging was not used. If practical, a sampling detector was used since a peak or, peak hold, may produce a wider bandwidth than actual.

The 20 dB bandwidth was considered to equal the 99% bandwidth and was used to determine the occupied bandwidth.

Test Results

Frequency (MHz)	Occupied bandwidth (MHz)	Plot
2.41 GHz	4.30	2.1

Plot 2.1





4.3 Conducted Output Power FCC Ref: 15.247(b)(3)

Requirement

For systems operating in the 2400 to 2483.5 MHz band using digital modulation, the maximum peak output power is 1 watt (30 dBm).

Procedure

The antenna port of the EUT was connected directly to a Peak Power Meter.

Test Results

Frequency (GHz)	Output in dBm	Output in mW	Plot number
2.41	3.56	2.270	N/A - Peak Power Meter used

4.4 Power Spectral Density FCC Ref: 15.247(a)(1)(iii)

Requirement

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than +8dBm in any 3kHz band.

Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer. A refererecle level offset was applied to the analyzer amplitude to account for the associated cable loss.

The span was set to cover the entire emission bandwidth. The detector was set to PEAK. With a resolution bandwidth of 100 kHz or greater, the marker frequency was set to the peak emission and then moved to the center of the display. The span was set to encompass the peak emission envelope. The analyzer resolution and video bandwidths was then set to 3 kHz. The total sweep time was calculated as follows:

Sweep time (Sec.) = Span/Resolution Bandwidth

Example:

Sweep time (Sec) = 300 kHz / 3kHz

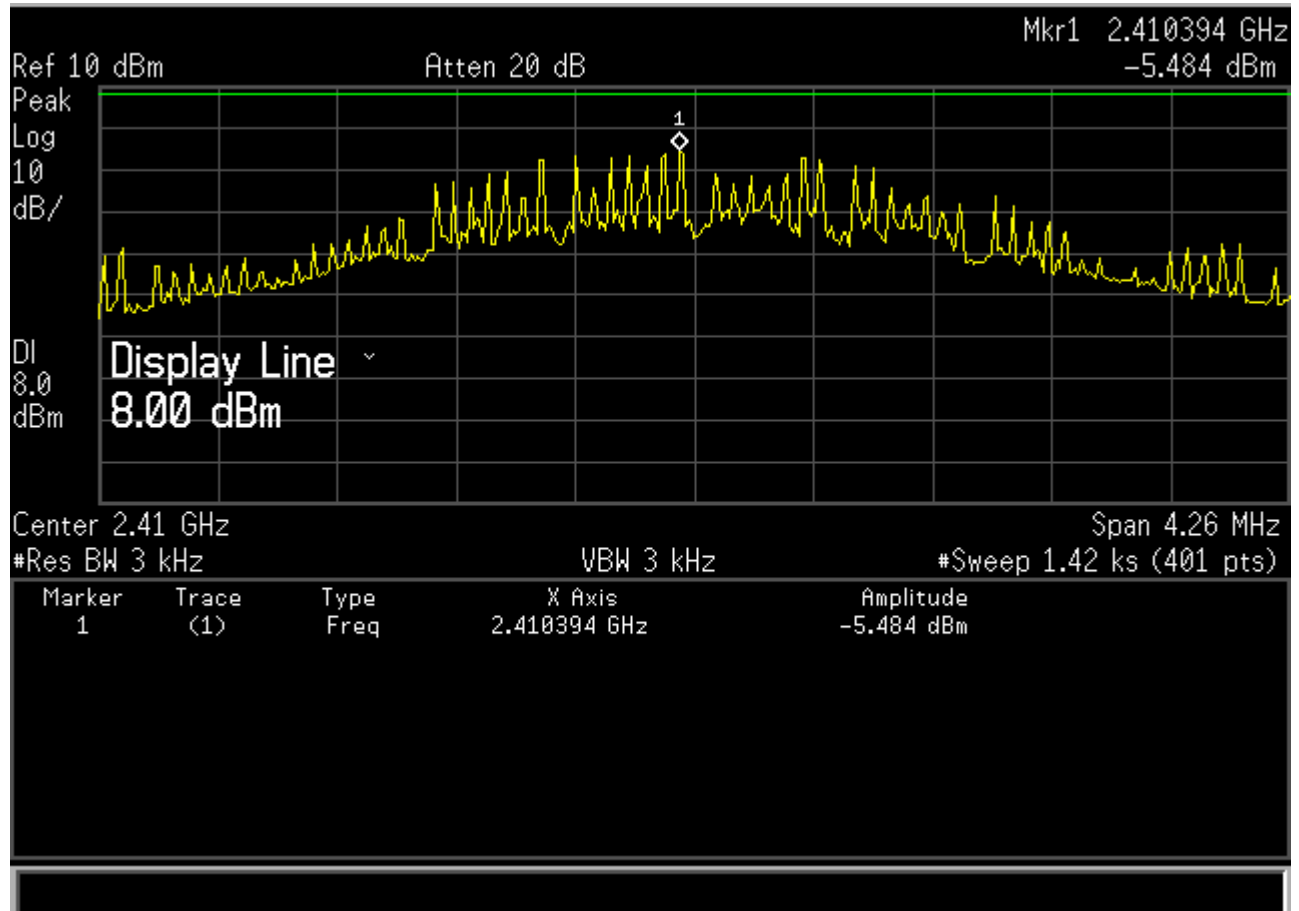
Sweep time (Sec) = 100 Seconds

A peak search was performed on the resultant trace. The amplitude of that peak was recorded as the maximum power density in dBm. If applicable, the power spectral density was measured for all data rates and modulation modes on the middle channel.

Test Results

Frequency (MHz)	Power Spectral Density (dBm)	Plot
2.41 GHz	-5.484	4.1

Plot 4.1



4.5 Out of Band Emissions FCC Ref: 15.247(c)

Requirement

In any 100 kHz bandwidth outside the frequency band in which the transmitter is operating, the RF power shall be at least 20dB below that of the carrier.

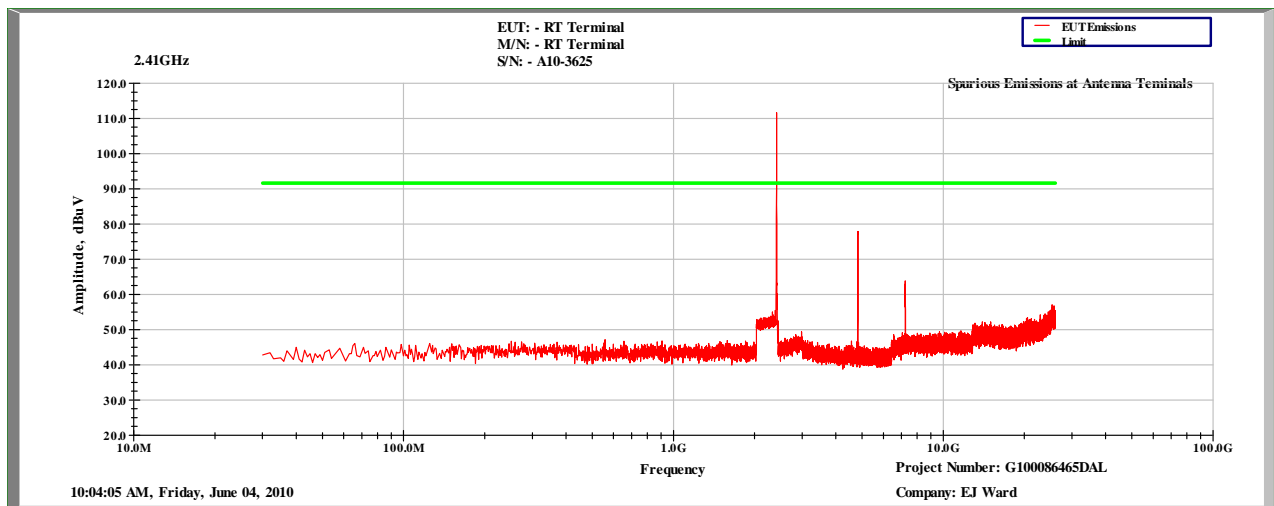
Procedure

The antenna port of the RT terminal was connected to the input of a spectrum analyzer. The analyzer resolution and video bandwidths were set to 100 kHz. The output was set to transmit at its highest output power level and produced the highest conducted output power level. The spectrum analyzer was scanned from 30MHz to 26GHz using the max hold function to detect any out of band spurious emissions. The resulting trace was corrected for the cable loss between the test sample and the spectrum analyzer.

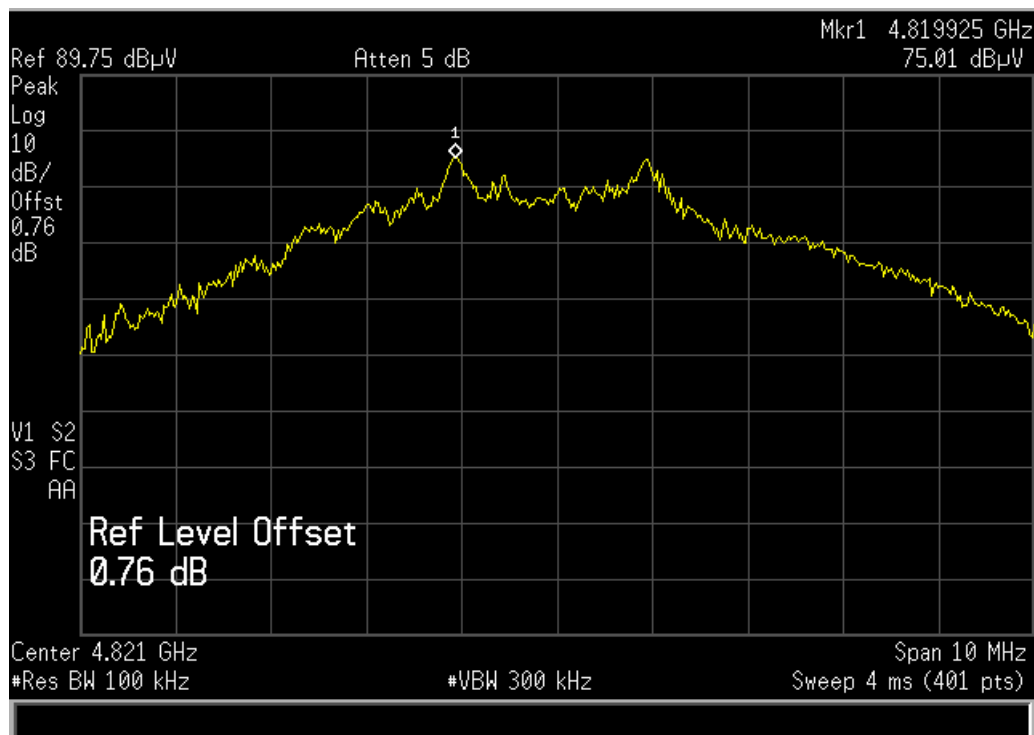
Test Results

The EUT met the out of band emission at antenna terminal requirements. The graphs in Plot 5.1 through Plot 5.2 illustrate the output power and also show that there are no spurious emissions within 20dB of the peak carrier power.

Plot 5.1



Plot 5.2



2nd Harmonic 4.821 GHz measurements



4.6 Restricted Bands FCC Ref: 15.247(c) and 15.205

Requirement

Radiated emissions in the restricted bands listed in Section 15.205 shall meet the general emissions limits of 15.209..

Procedure

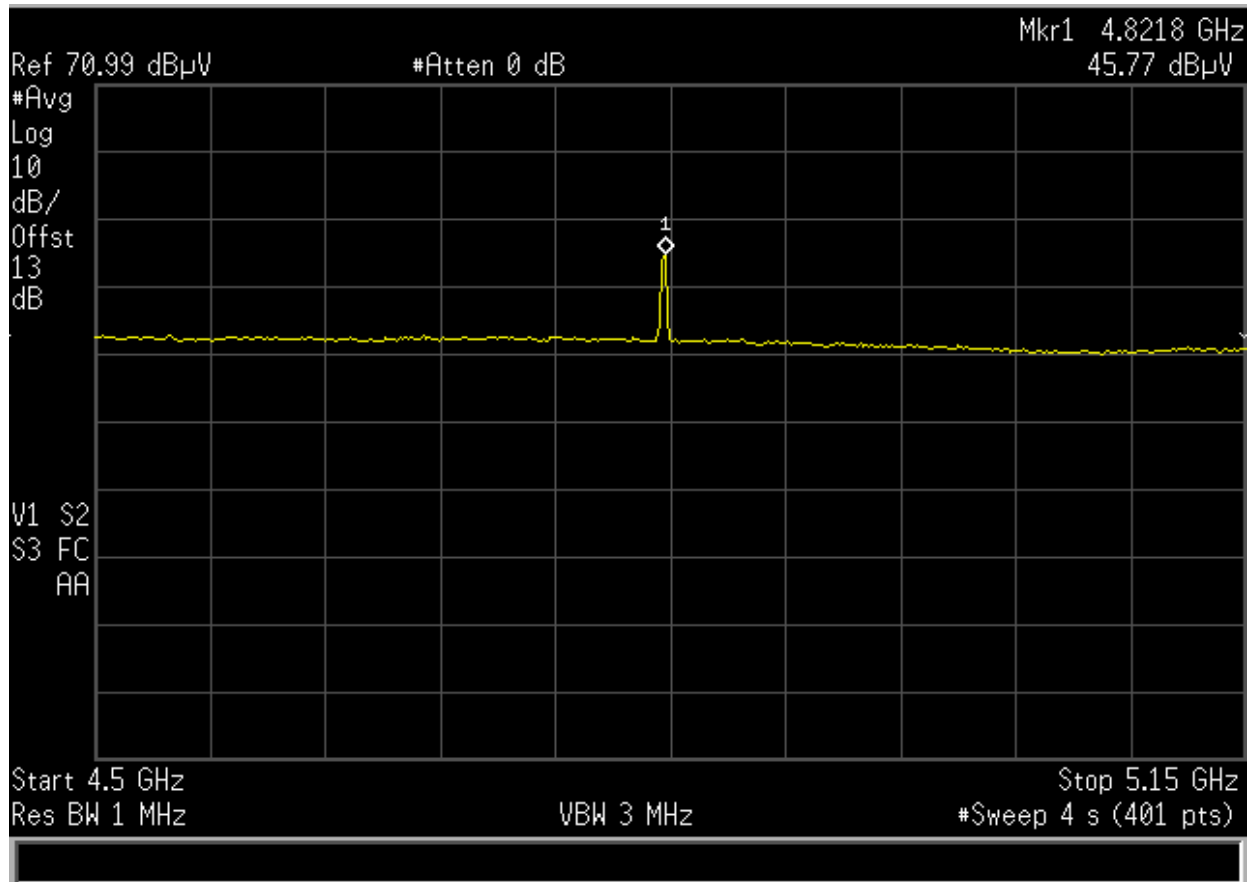
The EUT was set to maximum transmit power. The radiated emissions were measured from 30 MHz to 26 GHz. Any emissions within the restricted bands were compared the to the general emissions limits of 15.209.

For the restricted band close to the fundamental emission the spectrum analyzer was manually set to show the band edge of the 2.41GHz as well as the entire adjacent restricted band. The amplitude was offset to account for cable loss.

Test Results

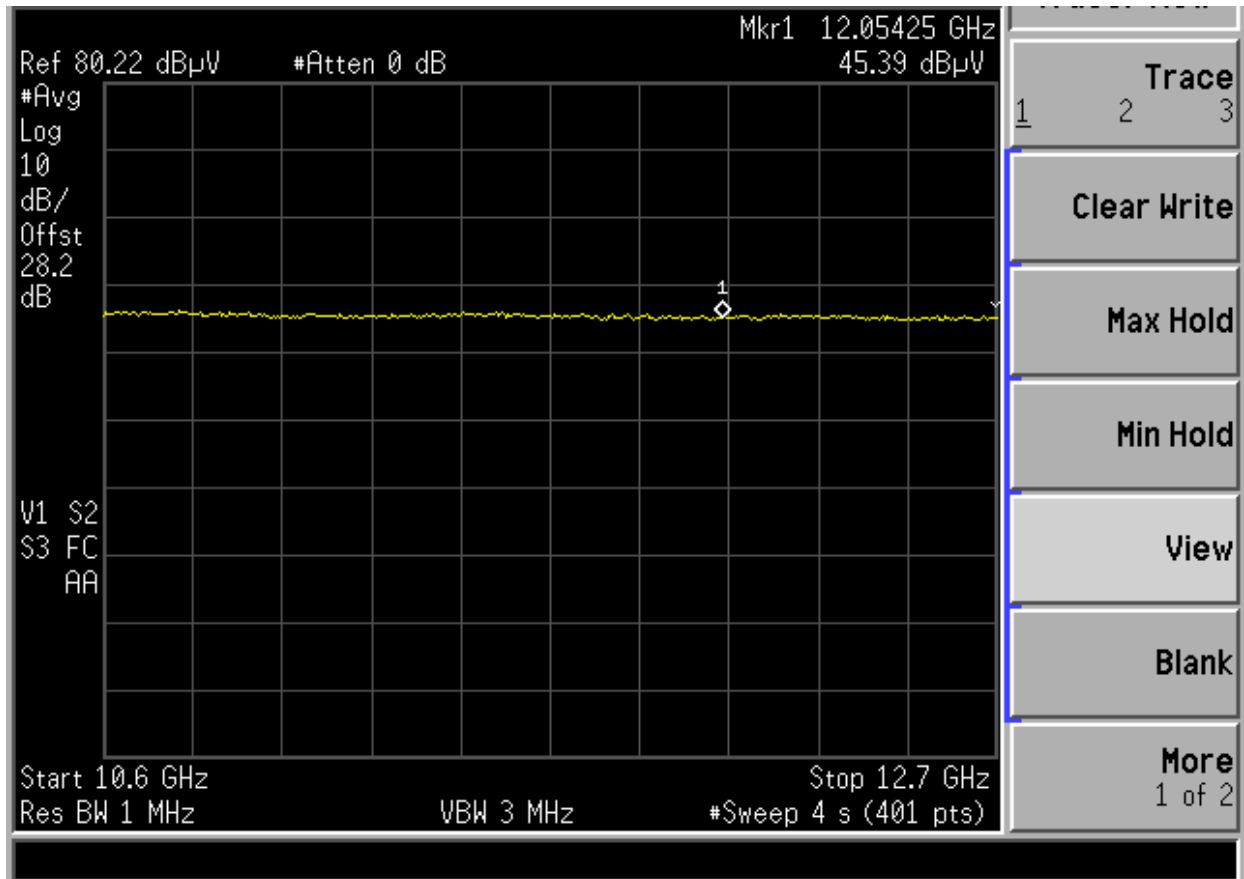
The EUT met the restricted band measurements. There were no emissions which exceeded the limits of 15.209 contained in the restricted bands. See plots 6.1 and 6.3.

Plot 6.1



4.5 to 5.15 GHz restricted bandwidth; 2nd Harmonic

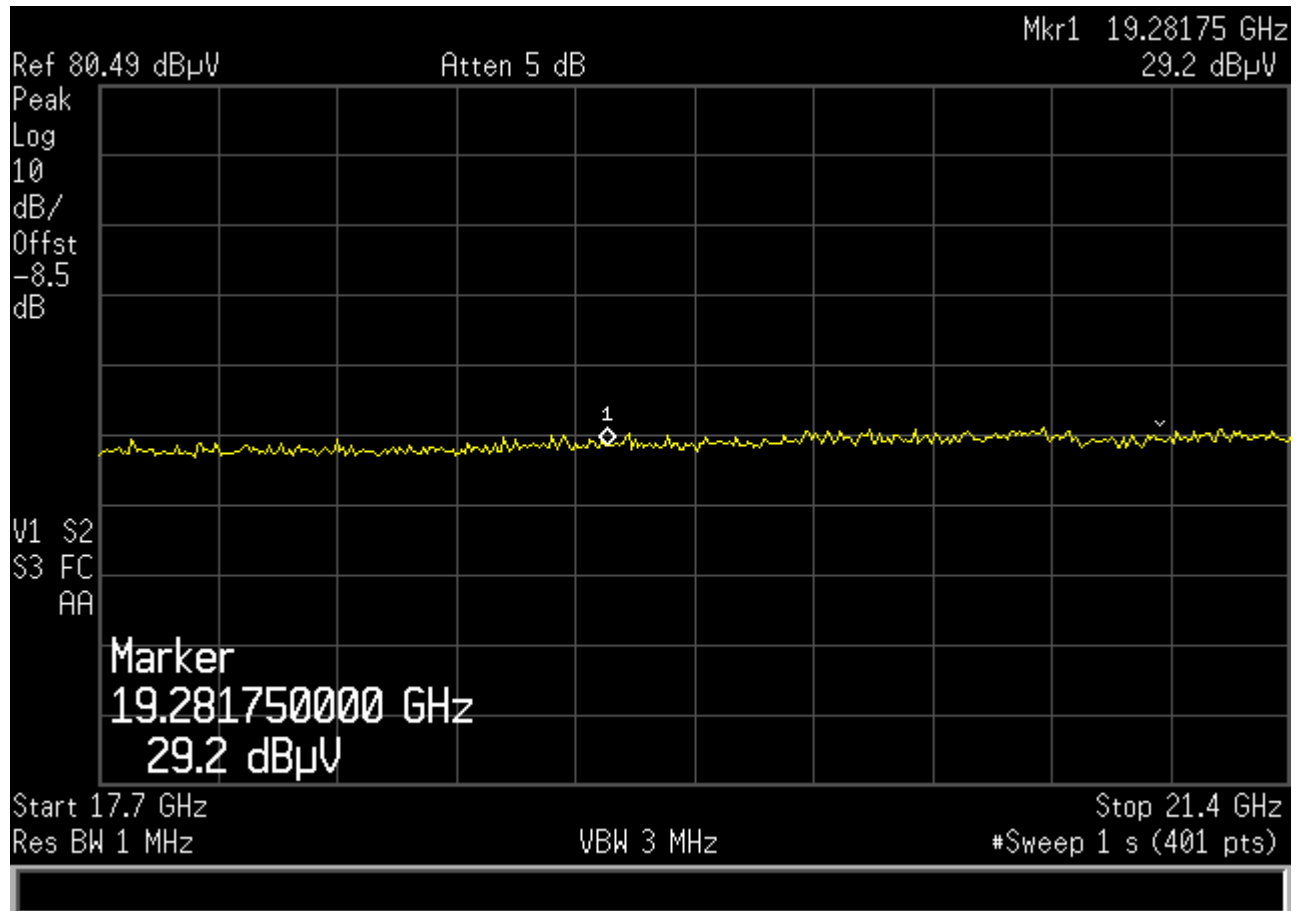
Plot 6.2



10.6 to 12.7 GHz restricted bandwidth; 5th Harmonic



Plot 6.3



17.7 to 21.4 GHz restricted bandwidth; 8th Harmonic

4.8 AC Line Conducted Emission

FCC 15.207: In accordance with ANSI C63.4 (2009), conducted emissions were performed from 150 kHz to 30 MHz.

Intertek Testing Services
Conducted Emissions 150 kHz - 30 MHz
FCC Part 15 meets Class B Line 1

Operator: WBC
Thursday, May 6, 2010

Model Number: RT Automated Fuel Control Terminal
Company: EJ Ward

A	B	C	D	E	F	G	H	J
Frequency (MHz)	QP dB(uV)	L1 Avg dBuV	Class B QP LIMIT dBuV	Class B QP Margin dB	Class B Avg LIMIT dBuV	Class B Avg Margin dB	Cable dB	LISN
26.404	20.83	15.80	60.00	-39.17	50.00	-34.20	0.13	10.24
25.923	28.48	23.02	60.00	-31.52	50.00	-26.98	0.13	10.24
25.548	21.21	16.32	60.00	-38.79	50.00	-33.68	0.13	10.23
25.315	40.80	36.27	60.00	-19.20	50.00	-13.73	0.13	10.23
25.191	40.16	36.37	60.00	-19.84	50.00	-13.63	0.13	10.23
24.831	48.28	47.71	60.00	-11.72	50.00	-2.29	0.13	10.23
24.707	48.70	47.80	60.00	-11.30	50.00	-2.20	0.13	10.23
24.349	34.10	8.91	60.00	-25.90	50.00	-41.09	0.13	10.22
23.852	47.37	44.81	60.00	-12.63	50.00	-5.19	0.13	10.22
0.155	45.68	30.92	65.86	-20.18	55.86	-24.94	0.03	11.60

Intertek Testing Services
Conducted Emissions 150 kHz - 30 MHz
FCC Part 15 meets Class B Line 2

Operator: WBC
Thursday, May 6, 2010

Model Number: RT Automated Fuel Control Terminal
Company: EJ Ward

A	B	C	D	E	F	G	H	J
Frequency (MHz)	QP dB(uV)	L2 Avg dBuV	Class B QP LIMIT dBuV	Class B QP Margin dB	Class B Avg LIMIT dBuV	Class B Avg Margin dB	Cable dB	LISN
25.829	18.98	13.67	60.00	-41.02	50.00	-36.33	0.13	10.30
25.704	19.02	13.62	60.00	-40.98	50.00	-36.38	0.13	10.30
25.470	20.37	15.58	60.00	-39.63	50.00	-34.42	0.13	10.30
25.347	21.26	15.62	60.00	-38.74	50.00	-34.38	0.13	10.30
24.986	21.21	16.09	60.00	-38.79	50.00	-33.91	0.13	10.31
24.862	21.18	16.03	60.00	-38.82	50.00	-33.97	0.13	10.31
24.489	21.44	16.23	60.00	-38.56	50.00	-33.77	0.13	10.31
24.131	20.74	15.73	60.00	-39.26	50.00	-34.27	0.13	10.31
23.400	19.41	14.74	60.00	-40.59	50.00	-35.26	0.13	10.32
0.153	51.50	35.58	65.91	-14.41	55.91	-20.33	0.02	11.19

Test Mode: Transmitting
Temperature: 22.3 C
Humidity : 41.2 %



Sample calculations:

B = raw spectrum analyzer reading + H + J

C = raw spectrum analyzer reading + H + J

E = B - D

G = C - F

5.0 List of test equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
EMI Receiver	R&S	ES17	100044	12	03/17/11
Spectrum Analyzer	Agilent	E7405A	US40240235	12	03/17/11
BI-Log Antenna	Schaffner	CBL6112B	2726	12	07/15/10
Horn Antenna	AH Systems	SAS-571	787	12	04/06/11
Pre-Amplifier	Miteq	AMF-5D-00501800-28-13P	1469795	12	07/13/10
LISN	FCC	FCC-LISN-50-25-2-01	01020	12	06/17/10

No Calibration required



6.0 Document History

Revision/ Job Number	Writer Initial s	Date	Change
0/ G100086465	WBC	June 10, 2010	Original document