



Compliance Testing, LLC

Previously Flom Test Lab

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FCC CFR47 Part 15.225 Test Report

Prepared for: Blackboard, Inc

Model: VR4101

Description: Vending Card Reader

To

Federal Communications Commission

Rule Part(s) 15.225

Date of Issue: June 23, 2011

On the behalf of the applicant:

Blackboard, Inc.
22601 N 19th Ave
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Attention of:

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Project No: p1160003

John Erhard
Project Test Engineer



Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	6/23/11	John Erhard	Original Document



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ILAC / A2LA

Compliance Testing, LLC, has been 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 joint ISO-ILAC-IAF Communiqué dated January 2009)

The tests results contained within this test report all fall within our scope of accreditation, unless noted in the table below

Please refer to <http://www.compliancetesting.com/labscope.html> for current scope of accreditation.

Testing Certificate Number: **2152.01**



FCC OATS Reg, #933597

IC Reg. #2044A-1

Non-accredited tests contained in this report:
N/A



The applicant has been cautioned as to the following:

15.21 Information to User

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a) Special Accessories

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator the responsible part may employ other methods of ensuring that the special accessories are provided to the consumer, without additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.



Standard Test Conditions Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing.

In accordance with ANSI C63.10-2009 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature	Humidity	Pressure
26.10	31.20	962.80

EUT Description

Vending machine card reader with integrated Wi-Fi and RFID

EUT Operation during Tests

The EUT utilized test software to run in continuous modulated and CW mode for testing purposes.

Accessories					
Qty	Type	Make, Model			S/N
None					
Cables:					
Qty	Type	Length (m)	Shield	Shielded Hood	Ferrite
1	CAT-5	3	No	No	No



Test Results Summary

Specification	Test Name	Pass, Fail, N/A	Comments
15.225(a)	Fundamental Field Strength	Pass	
15.225(b)(c)(d)	Out of Band Spurious Emissions	Pass	
15.225(e)	Frequency Stability	Pass	
12.209	Radiated Emissions	Pass	
12.207	Conducted Powerline Emissions	Pass	
RSS-210	99% Occupied Bandwidth	Pass	

15.203: Antenna Requirement:

- ☒ The antenna is permanently attached to the EUT
- ☐ The antenna uses a unique coupling
- ☐ The EUT must be professionally installed
- ☐ The antenna requirement does not apply



Field Strength

Name of Test: Field Strength

Specification: 15.225(a)(b)(c)

Test Equipment Utilized: i00379, i00326

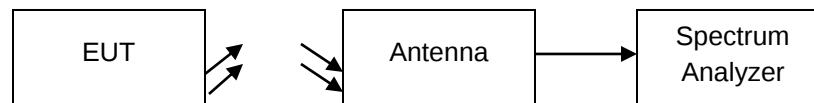
Engineer: John Erhard

Test Date: 6/22/2011

Test Procedure

The EUT was tested on an anechoic chamber at a distance of 1 meter from the receiving loop antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Fundamental Field Strength. The antenna correction and distance correction factors were summed with the quasi-peak measurement to ensure accurate readings were obtained. The following table indicates the highest emission in each of the indicated bands.

Test Setup



Field Strength

Frequency Band (MHz)	Measured Frequency (MHz)	Monitored Level (dBuV/m)	Distance CF (dB)	Antenna CF (dB)	Corrected Measurement (dBuV/m)	Limit (dBuV/m)	Result
13.110_13.410	13.3485	56.65	59.1	17.8	-20.25	40.51	Pass
13.410_13.553	13.553	68.55	59.1	17.8	-8.35	50.47	Pass
13.553_13.567	13.55691	80.14	59.1	17.8	3.24	84.00	Pass
13.567_13.710	13.57	65.85	59.1	17.8	-11.05	50.47	Pass
13.710_14.010	13.7715	47.55	59.1	17.8	-29.35	40.51	Pass

Note: Cable correction factors are not included in this measurement as the low loss of the high quality TWINAX cable at low frequencies is practically non-existent.



Frequency Stability

Name of Test: Frequency Stability

Specification: 15.225(e)

Engineer: John Erhard

Test Equipment Utilized: i00019, i00027, i00343, i00319, i00108 Test Date: 6/22/2011

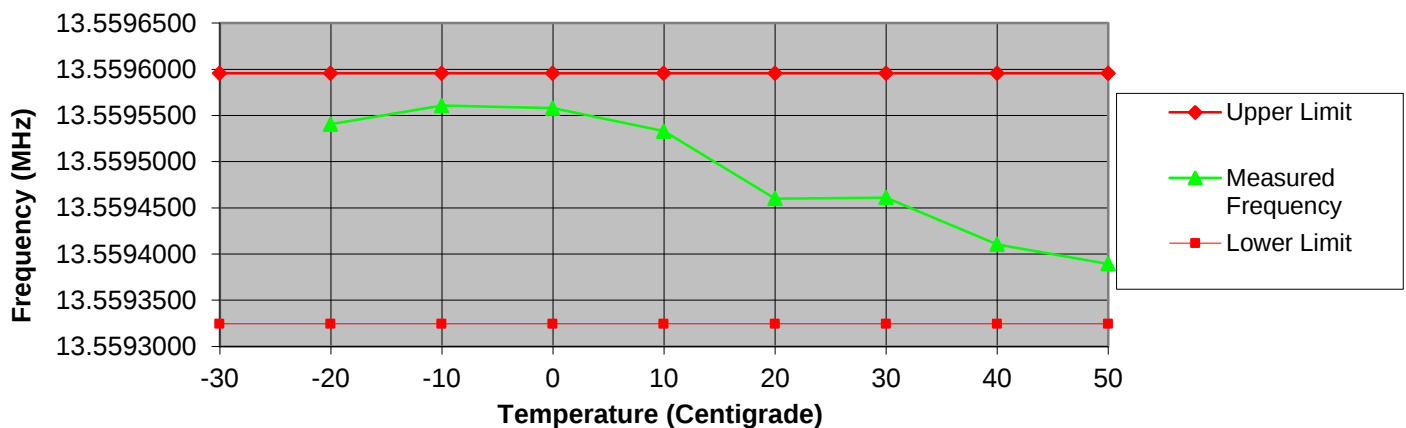
Test Procedure

The EUT was placed in an environmental test chamber and a frequency counter was utilized to verify that the frequency stability met the requirement for frequency stability across the temperature range from -20°C to +50°C. A variable DC power supply was used to vary the voltage from 85% to 115% of the rated voltage.

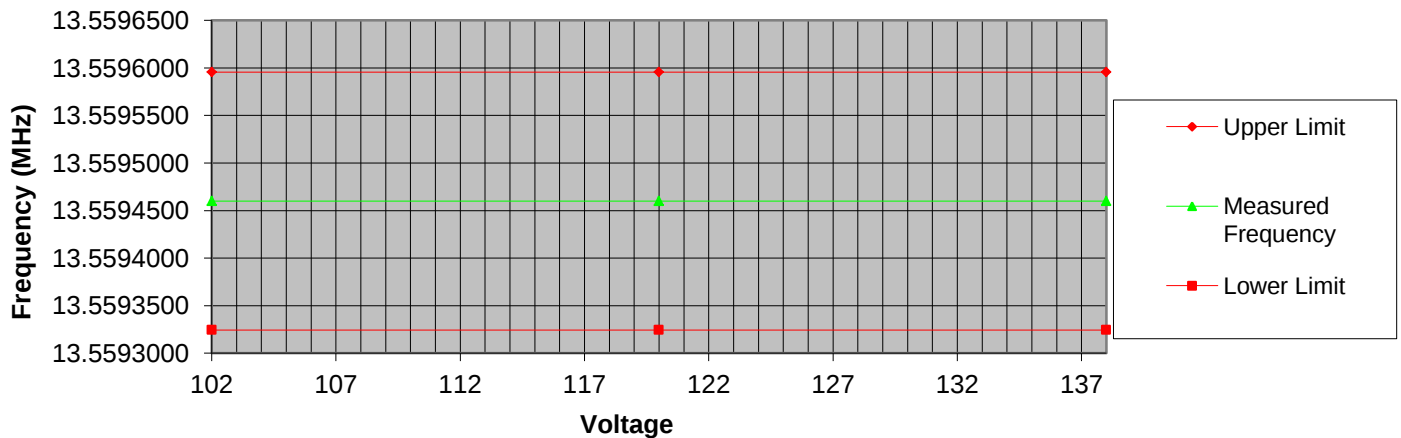
Test Setup



Frequency Stability vs. Temperature



Frequency Stability vs. Voltage





Radiated Emissions

Name of Test: Radiated Emissions

Specification: 15.209

Engineer: John Erhard

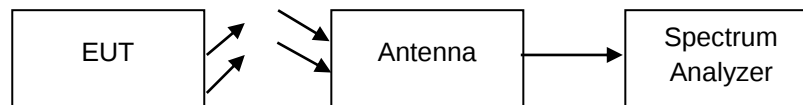
Test Equipment Utilized: i00033, i00267

Test Date: 6/22/2011

Test Procedure

The EUT was tested on an Open Area Test Site (OATS) at a distance of 3 meters from the receiving antenna. A spectrum analyzer was used to verify that the UUT met the requirements for Radiated Emissions. The spectrum for each tuned frequency was examined beyond the 10th harmonic.

Test Setup



Radiated Emissions

Emission Freq (MHz)	Measured Value (dBuV/m)	Correction Factor (dB)	Corrected Value (dBuV/m)	Limit (dBuV/m)	Margin dB
160.795	18.020	12.086	30.106	43.500	-13.394
158.725	25.530	12.277	37.807	43.500	-5.693
144.975	17.630	13.039	30.669	43.500	-12.831
37.300	1.830	16.313	18.143	40.000	-21.857
314.860	27.740	15.681	43.421	46.000	-2.579
645.000	5.060	22.437	27.497	46.000	-18.503



Powerline Conducted Emissions

Name of Test: Powerline Conducted Emissions

Specification: 15.207

Engineer: John Erhard

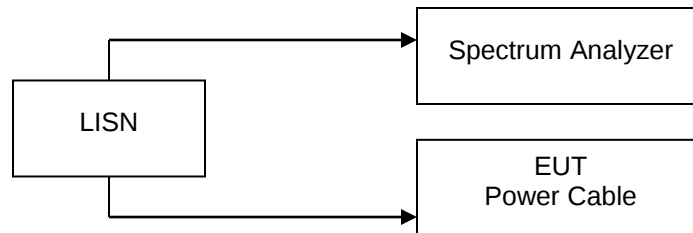
Test Equipment Utilized: i00379, i00270

Test Date: 6/22/2011

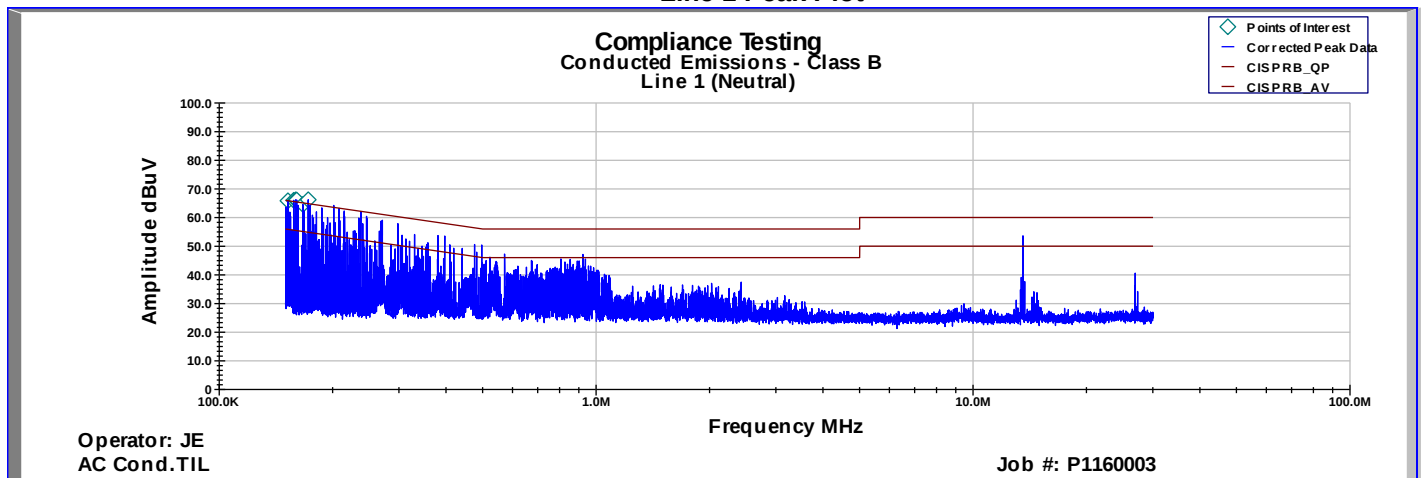
Test Procedure

The EUT power cable connected to a LISN and the monitored output of the LISN was connected directly to a spectrum analyzer. The conducted emissions from 150 kHz to 30 MHz were monitored and compared to the specification limits. The average measurements were the worst case and are recorded in the tables below.

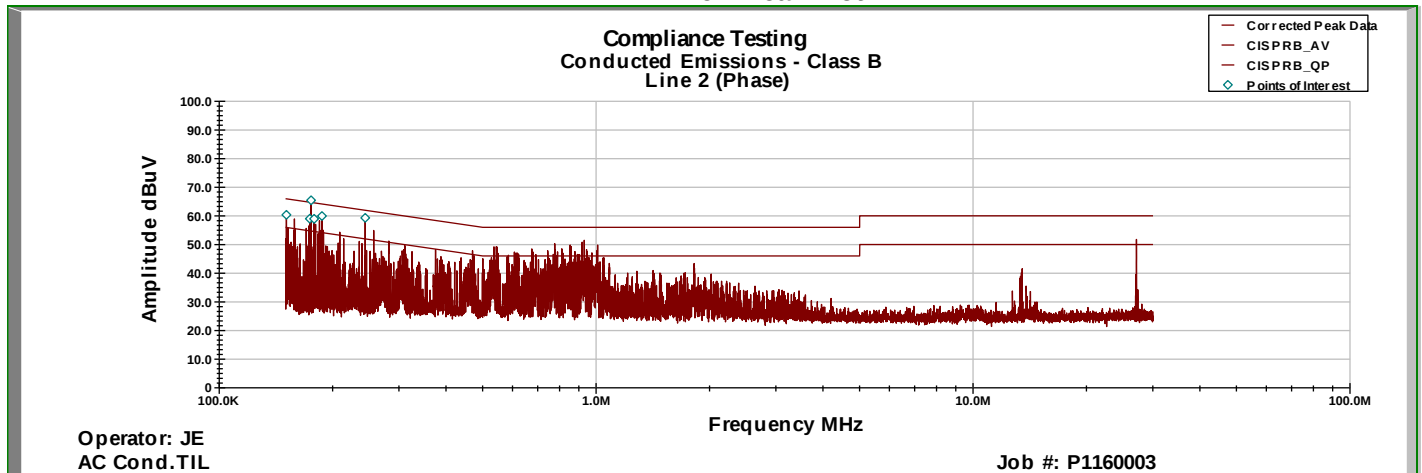
Test Setup



Line 1 Peak Plot



Line 2 Peak Plot





Line 1 Neutral AVG Detector

Frequency	Measured Data (dBuV)	LISN Corr Fact (dB)	Cable Loss (dB)	Attenuator (dB)	L1 Final Data (dBuV)	Limit (dBuV)	AVG Margin (dB)
164.19 KHz	24.38	0.20	0.031	10.000	34.612	55.595	-20.982
161.65 KHz	26.06	0.20	0.035	10.000	36.299	55.667	-19.368
156.76 KHz	28.02	0.23	0.041	10.000	38.298	55.807	-17.509
155.13 KHz	28.56	0.25	0.041	10.000	38.849	55.853	-17.005
152.26 KHz	29.14	0.28	0.039	10.000	39.457	55.936	-16.478
150.9 KHz	29.57	0.29	0.042	10.000	39.901	55.974	-16.073

Line 2 Phase AVG Detector

Frequency	Measured Data (dBuV)	LISN Corr Fact (dB)	Cable Loss (dB)	Attenuator (dB)	L2 Final Data (dBuV)	Limit (dBuV)	AVG Margin (dB)
248.99 KHz	21.30	0.18	0.085	10.000	31.565	53.172	-21.607
184.94 KHz	24.46	0.20	0.000	10.000	34.662	55.002	-20.339
182.14 KHz	22.70	0.20	0.005	10.000	32.902	55.082	-22.180
175.99 KHz	23.14	0.20	0.014	10.000	33.350	55.257	-21.907
161.91 KHz	24.75	0.20	0.035	10.000	34.982	55.660	-20.678
157.82 KHz	25.64	0.22	0.034	10.000	35.899	55.777	-19.878

Line 1 Neutral QP Detector

Frequency	Measured Data (dBuV)	LISN Corr Fact (dB)	Cable Loss (dB)	Attenuator (dB)	L1 Final Data (dBuV)	Limit (dBuV)	QP Margin (dB)
164.19 KHz	33.725	0.200	0.031	10.000	43.955	65.595	-21.639
161.65 KHz	36.817	0.200	0.035	10.000	47.051	65.667	-18.616
156.76 KHz	38.655	0.232	0.041	10.000	48.928	65.807	-16.879
155.13 KHz	40.242	0.249	0.041	10.000	50.532	65.853	-15.322
152.26 KHz	39.356	0.277	0.039	10.000	49.672	65.936	-16.263
150.9 KHz	40.084	0.291	0.042	10.000	50.417	65.974	-15.557

Line 2 Phase QP Detector

Frequency	Measured Data (dBuV)	LISN Corr Fact (dB)	Cable Loss (dB)	Attenuator (dB)	L2 Final Data (dBuV)	Limit (dBuV)	QP Margin (dB)
248.99 KHz	25.63	0.18	0.085	10.000	35.895	63.172	-27.277
184.94 KHz	28.99	0.20	0.000	10.000	39.188	65.002	-25.814
182.14 KHz	30.33	0.20	0.005	10.000	40.539	65.082	-24.543
175.99 KHz	31.03	0.20	0.014	10.000	41.244	65.257	-24.014
161.91 KHz	34.52	0.20	0.035	10.000	44.759	65.660	-20.901
157.82 KHz	34.87	0.22	0.034	10.000	45.124	65.777	-20.653



99% Occupied Bandwidth

Name of Test: 99% Occupied Bandwidth

Specification: RSS 210 Industry Canada Only

Engineer: John Erhard

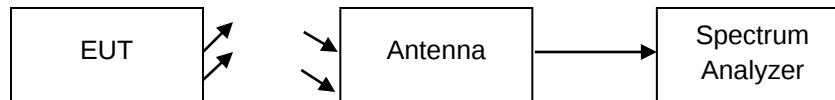
Test Equipment Utilized: i00033, i00326

Test Date: 6/22/2011

Test Procedure

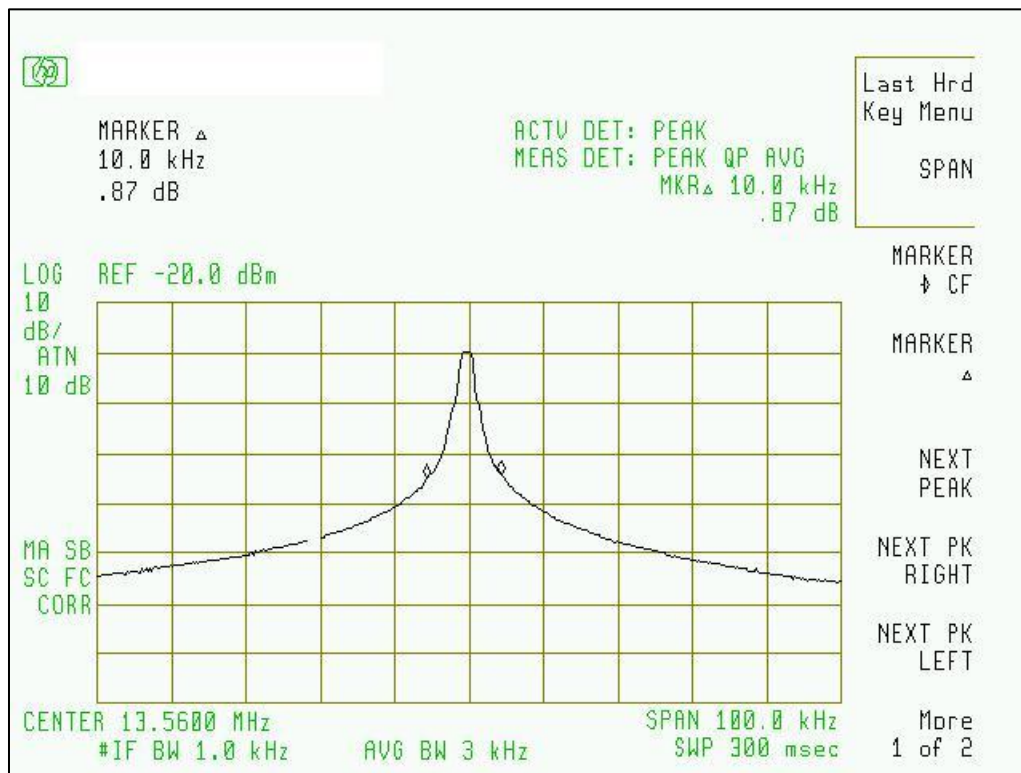
The EUT was tested on an anechoic chamber at a distance of 1 meter from the receiving loop antenna. A spectrum analyzer was used to measure the 99% occupied bandwidth.

Test Setup



99% Bandwidth Summary

Frequency MHz	Recorded Measurement	Result
13.56	10.0 kHz	Pass





Test Equipment Utilized

Description	MFG	Model Number	CT Asset Number	Last Cal Date	Cal Due Date
Frequency Counter	HP	5334B	i00019	1/26/2011	1/26/2012
Temperature Chamber	Tenney	Tenney Jr	i00027	NCR	NCR
Spectrum Analyzer	HP	85462A	i00033	10/3/2010	10/3/2011
Data Bucket	Fluke	Hydra	i00343	11/10/2010	11/10/2011
Bi-Log Antenna	Schaffner	CBL6111C	i00267	11/21/2009	11/21/2011
DMM	Fluke	87 III	i00319	1/26/2011	1/26/2012
Active Loop Antenna	EMCO	6507	i00326	4/29/2011	4/29/2013
Spectrum Analyzer	Agilent	7405A	i00379	11/22/2010	11/22/2011
VARIAC	Powerstat	3PN126	i00108	NCR	NCR
LISN	FCC	FCC-LISN-50-32-2-01	i00270	9/30/2010	9/30/2012

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT