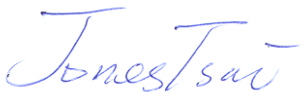
FCC/IC RF Test Report

APPLICANT	:	**Wistron Corporation**
EQUIPMENT	:	**Tablet PC**
BRAND NAME	:	**Lenovo**
MODEL NAME	:	**TP00065A**
FCC ID	:	**PU5-TP00065A**
IC	:	**4182A-TP00065A**
STANDARD	:	**FCC Part 15 Subpart C §15.247** **IC RSS-210 issue 8**
CLASSIFICATION	:	**(DTS) Digital Transmission System**

This is a partial report which is included the radiated band edges and spurious emission measurement test items. The product was received on Jul. 22, 2014 and testing was completed on Sep. 13, 2014. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor



Approved by: Jones Tsai / Manager

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APPENDIX A. TEST RESULT OF RADIATED TEST RESULTS

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR471416-04C	Rev. 01	Initial issue of report	Sep. 26, 2014

SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.4	15.247(d)	RSS-210 A8.5	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 1.21 dB at 2483.920 MHz

1 General Description

1.1 Applicant

Wistron Corporation

21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih Dist, New Taipei City 221,Taiwan R.O.C.

1.2 Manufacturer

Wistron Corporation

21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih Dist, New Taipei City 221,Taiwan R.O.C.

1.3 Feature of Equipment Under Test

Product Feature	
Equipment	Tablet PC
Brand Name	Lenovo
Model Name	TP00065A
FCC ID	PU5-TP00065A
IC	4182A-TP00065A
DUT Description	A tablet (PAD) computer, contains 802.11a/b/g/n/ac and Bluetooth transceiver (radio module)
EUT supports Radios application	WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth v4.0 EDR/LE
EUT Stage	Production Unit

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

Antenna Information					
Antenna 1	Manufacturer	High-tek			
	P/N	Main Antenna :	025.9004Q.0011	Aux. Antenna :	025.9004R.0011
	Antenna Type		PIFA Antenna		PIFA Antenna
	Peak gain		WLAN(2.4GHz): 0.06dBi		WLAN(2.4GHz): -0.33dBi
			WLAN(5GHz): 1.66dBi		Bluetooth : -0.33dBi
					WLAN(5GHz): 1.70dBi
Antenna 2	Manufacturer	WNC			
	P/N	Main Antenna :	025.9004O.0001	Aux. Antenna :	025.9004O.0001
	Antenna Type		PIFA Antenna		PIFA Antenna
	Peak gain		WLAN(2.4GHz): 0.06dBi		WLAN (2.4GHz): -0.35dBi
			WLAN(5GHz): 1.42Bi		Bluetooth:-0.35dBi
					WLAN(5GHz): 1.49dBi

1.4 Product Specification of Equipment Under Test

Product Specification subjective to this standard	
Tx/Rx Channel Frequency Range	802.11b/g/n/ac : 2412 MHz ~ 2462 MHz
Maximum (Peak) Output Power to antenna	**<Ant. 1>** 802.11b : 19.83 dBm (0.0962 W) 802.11g : 21.43 dBm (0.1390 W) **<Ant. 2>** 802.11b : 20.28 dBm (0.1067 W) 802.11g : 21.68 dBm (0.1472 W) **<SISO Ant. 1>** 802.11n HT20 : 21.59 dBm (0.1442 W) 802.11n HT40 : 21.11 dBm (0.1291 W) **<SISO Ant. 2>** 802.11n HT20 : 21.98 dBm (0.1578 W) 802.11n HT40 : 21.37 dBm (0.1371 W) **<MIMO Ant. 1+2>** 802.11n HT20 : 24.37 dBm (0.2735 W) 802.11n HT40 : 18.04 dBm (0.0637 W)
Type of Modulation	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)
Antenna Function for Transmitter	

	Ant. 1	Ant. 2
802.11 b	V	V
802.11 g	V	V
802.11 n SISO	V	V
802.11 n MIMO	V	V

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1022 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.		
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-3273456 / FAX: +886-3-3284978		
Test Site No.	**Sporton Site No.**		**IC Registration No.**
	TH02-HY	03CH06-HY	4086B-1

1.7 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r01
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ANSI C63.4-2003
- IC RSS-210 Issue 8
- IC RSS-Gen Issue 3
- NOTICE 2012-DRS0126

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. Per the section 2.2.3 of Notice of 2012-DRS0126, " Receivers Excluded from Industry Canada Requirements", only radiocommunication receivers operating in stand-alone mode within the band 30-960 MHz and scanner receivers are subject to Industry Canada requirements.

2 Test Configuration of Equipment Under Test

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conducted emission (150 kHz to 30 MHz) and radiated emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plane for Ant. 1 and Z plane for Ant. 1 and Ant. 1+2) were recorded in this report.

The final configuration from all the combinations and the worst-case data rates were investigated by measuring the maximum power across all the data rates and modulation modes under section 2.2.

Based on the worst configuration found above, the RF power setting is set individually to meet FCC compliance limit for the final conducted and radiated tests shown in section 2.3.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437		

2.2 Pre-Scanned RF Power

Preliminary tests were performed in different data rate and data rate associated with the highest power were chosen for full test shown in the following tables.

<Ant. 1>

802.11b				
Data Rate (MHz)	1M bps	2M bps	5.5M bps	11M bps
Peak Power (dBm)	**19.83**	19.40	19.33	19.29

802.11g								
Data Rate (MHz)	6M bps	9M bps	12M bps	18M bps	24M bps	36M bps	48M bps	54M bps
Peak Power (dBm)	**21.43**	21.22	21.11	21.10	20.91	20.85	20.76	20.75

<Ant. 2>

802.11b				
Data Rate (MHz)	1M bps	2M bps	5.5M bps	11M bps
Peak Power (dBm)	**20.28**	20.20	20.00	19.86

802.11g								
Data Rate (MHz)	6M bps	9M bps	12M bps	18M bps	24M bps	36M bps	48M bps	54M bps
Peak Power (dBm)	**21.68**	21.55	21.55	21.53	21.49	21.45	21.41	21.33

<SISO Ant. 1>

2.4GHz 802.11n HT20								
Data Rate (MHz)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
Peak Power (dBm)	**21.59**	21.46	21.34	21.23	21.22	21.22	21.19	21.12

2.4GHz 802.11n HT40								
Data Rate (MHz)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
Peak Power (dBm)	**21.11**	21.10	21.08	21.04	21.04	20.99	20.92	20.85

<SISO Ant. 2>

2.4GHz 802.11n HT20								
Data Rate (MHz)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
Peak Power (dBm)	**21.98**	21.62	21.60	21.38	21.15	20.99	20.88	20.75

2.4GHz 802.11n HT40								
Data Rate (MHz)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
Peak Power (dBm)	**21.37**	21.28	21.25	21.01	20.98	20.97	20.92	20.62

<MIMO Ant. 1+2>

2.4GHz 802.11n HT20								
Data Rate (MHz)	**MCS8**	**MCS9**	**MCS10**	**MCS11**	**MCS12**	**MCS13**	**MCS14**	**MCS15**
Peak Power (dBm)	**24.37**	24.02	24.18	24.29	24.28	24.28	24.35	24.36

2.4GHz 802.11n HT40								
Data Rate (MHz)	**MCS8**	**MCS9**	**MCS10**	**MCS11**	**MCS12**	**MCS13**	**MCS14**	**MCS15**
Peak Power (dBm)	**18.04**	17.89	17.82	17.79	17.78	17.82	17.62	17.31

Note: MIMO Ant. 1+2 is a calculated result from sum of the power MIMO Ant. 1 and MIMO Ant. 2.

2.3 Test Mode

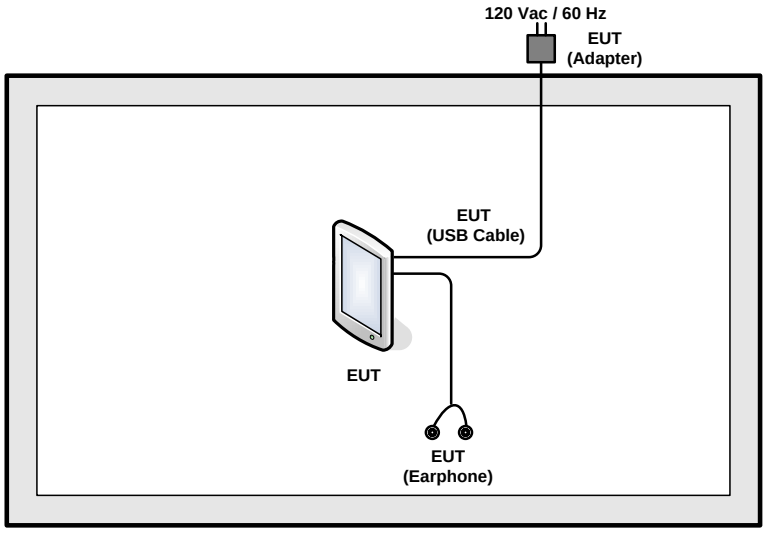
Final results of test modes, data rates and test channels are shown as following table.

<2.4GHz>

Test Cases				
Radiated TCs	Radiated Band Edge	802.11b	1 Mbps	1/11
		802.11g	6 Mbps	1/11
		802.11n HT20	MCS0	1/6/11
		802.11n HT40	MCS0	3/6/9
	Radiated Spurious Emission	802.11b	1 Mbps	1/6/11
		802.11g	6 Mbps	1/6/11
		802.11n HT20	MCS0	1/6/11
		802.11n HT40	MCS0	3/6/9

2.4 Connection Diagram of Test System

<WLAN Tx Mode>



2.5 EUT Operation Test Setup

For WLAN function, programmed RF utility, “Continuous Tx” make the EUT provide functions like channel selection and power level for continuous transmitting and receiving signals.

3 Radiated Test Items

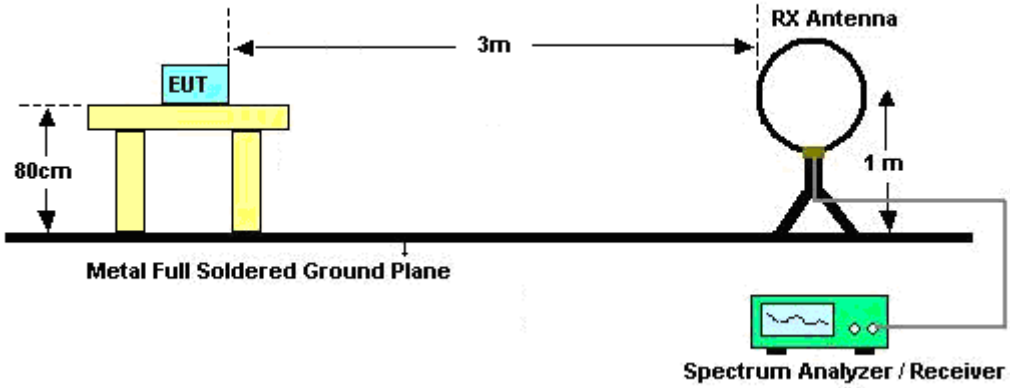
3.1 Measuring Instruments of Radiated Test Items

See list of measuring instruments of this test report.

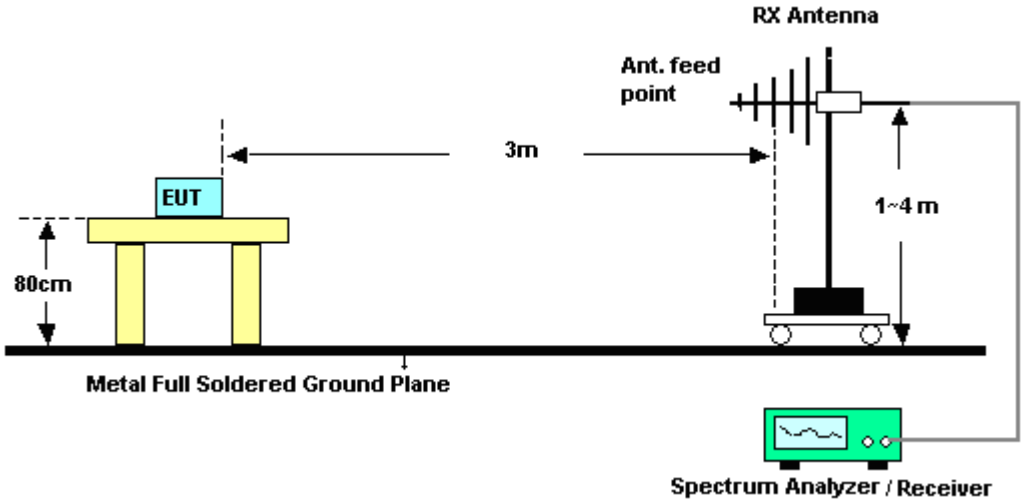
3.2 Test Setup of Radiated Test Items

3.2.1 Radiated band edge and Spurious Emission Measurement

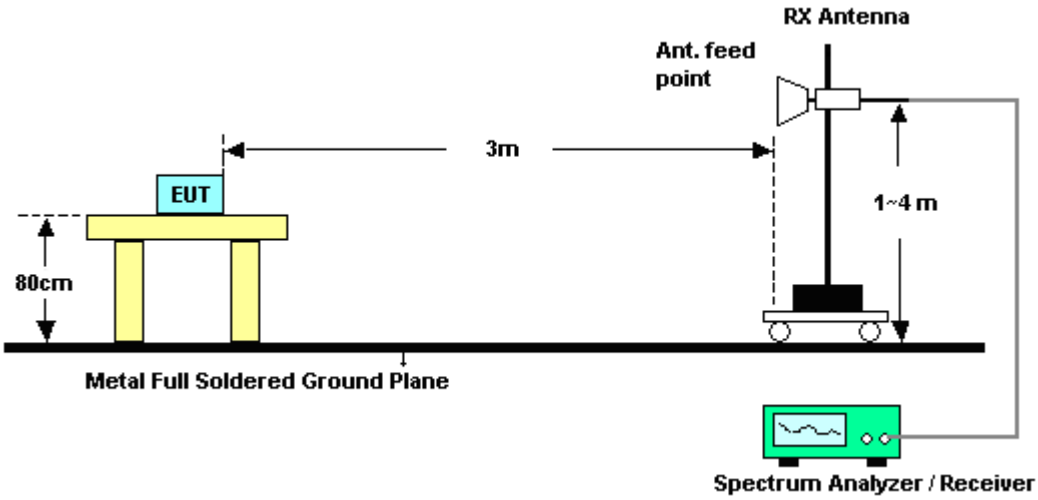
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.2.2 Test Results of Radiated Emissions (9kHz ~ 30MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

3.3 Test Results of Radiated Test Items

3.4 Radiated Band Edges and Spurious Emission Measurement

3.4.1 Limit of Radiated band edge and Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.4.2 Test Procedure

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r01.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
1	802.11b	98.70	2280.00	0.44	10Hz
2	802.11b	98.70	2270.00	0.444	10Hz
1	802.11g	98.57	2070.00	0.484	10Hz
2	802.11g	98.57	2070.00	0.484	10Hz
1	2.4GHz 802.11n HT20	98.46	1920.00	0.524	10Hz
2	2.4GHz 802.11n HT20	98.46	1930.00	0.52	10Hz
1+2	2.4GHz 802.11n HT20 for Ant. 1+2 (1)	97.06	990.00	1.01	3kHz
1+2	2.4GHz 802.11n HT20 for Ant. 1+2 (2)	97.06	990.00	1.01	3kHz
1	2.4GHz 802.11n HT40	96.93	948.00	1.05	3kHz
2	2.4GHz 802.11n HT40	96.93	948.00	1.05	3kHz
1+2	2.4GHz 802.11n HT40	94.70	500.00	2.00	3kHz
1+2	2.4GHz 802.11n HT40	94.70	500.00	2.00	3kHz

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Power Meter	Anritsu	ML2495A	1036004	300MHz~40GHz	Aug. 17, 2013	Aug. 02, 2014	Aug. 16, 2014	Conducted (TH02-HY)
Power Sensor	Anritsu	MA2411B	1027253	300MHz~40GHz	Aug. 17, 2013	Aug. 02, 2014	Aug. 16, 2014	Conducted (TH02-HY)
Spectrum Analyzer	R&S	FSP30	101067	9kHz ~ 30GHz	Nov. 20, 2013	Sep. 04, 2014 ~ Sep. 11, 2014	Nov. 19, 2014	Radiation (03CH06-HY)
Spectrum Analyzer	Agilent	E4408B	MY44211030	9kHz ~ 26.5GHz	Dec. 02, 2013	Sep. 04, 2014 ~ Sep. 11, 2014	Dec. 01, 2014	Radiation (03CH06-HY)
EMI Test Receiver	R&S	ESVS10	834468/0003	20MHz ~ 1000MHz	May 06, 2014	Sep. 04, 2014 ~ Sep. 11, 2014	May 05, 2015	Radiation (03CH06-HY)
Bilog Antenna	Schaffner	CBL6112B	2885	30MHz ~ 2GHz	Oct. 10, 2013	Sep. 04, 2014 ~ Sep. 11, 2014	Oct. 09, 2014	Radiation (03CH06-HY)
Double Ridge Horn Antenna	EMCO	3117	00066583	1GHz ~ 18GHz	Jul. 24, 2014	Sep. 04, 2014 ~ Sep. 11, 2014	Jul. 23, 2015	Radiation (03CH06-HY)
Amplifier	SONOMA	310N	186713	9kHz ~ 1GHz	Apr. 16, 2014	Sep. 04, 2014 ~ Sep. 11, 2014	Apr. 15, 2015	Radiation (03CH06-HY)
Preamplifier	EMCI	EMC051845	SN980048	1GHz ~ 18GHz	Jul. 17, 2014	Sep. 04, 2014 ~ Sep. 11, 2014	Jul. 16, 2015	Radiation (03CH06-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	15GHz ~ 40GHz	Oct. 03, 2013	Sep. 04, 2014 ~ Sep. 11, 2014	Oct. 02, 2014	Radiation (03CH06-HY)
Preamplifier	Agilent	8449B	3008A01917	1GHz ~ 26.5GHz	Apr. 10, 2014	Sep. 04, 2014 ~ Sep. 11, 2014	Apr. 09, 2015	Radiation (03CH06-HY)
Turn Table	INN-CO	DS2000	420/650/00	0 ~ 360 degree	N/A	Sep. 04, 2014 ~ Sep. 11, 2014	N/A	Radiation (03CH06-HY)
Antenna Mast	MF	MF-7802	MF780208212	1 m ~ 4 m	N/A	Sep. 04, 2014 ~ Sep. 11, 2014	N/A	Radiation (03CH06-HY)

5 Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.50**