

Test Report

Report Number: 3113464MPK-001 Project Numbers: 3113464

Report Date: February12, 2007

Testing performed on the Tablet PC LE1700 With Novatel Wireless ES720 Dualband CDMA module Model Number: T006 FCC ID: Q3QHWNVWEX720 IC ID: 4587A-NVWEX720

> to FCC Parts: 22H & 24E and Part 15B Industry Canada RSS-129 & RSS-133

for

Motion Computing Inc



A2LA Certificate Number: 1755-01

<u>Test Performed by:</u> Intertek Testing Services NA, Inc 1365 Adams Court Menlo Park, CA 94025 Test Authorized by: Motion Computing Inc 8601 Ranch Road 2222 Austin, TX 78730, USA

Prepared by:

Suresh Kondapalli, Test Engineer

Reviewed by:

Date: 02/12/2007

Date: 02/12/2007

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1.0 Introduction

1.1 Product Description

This report is intended to show compliance of the LE1700 Tablet PC, model: T006 to the rules of FCC Part 22 and Part 24.

As declared by the Applicant, the transmitter module ES720, used in the model T006, is identical to the module which has been certified for Novatel Communications, Inc., FCC ID: PKRNVWES720, IC ID: **3229B-ES720**, Model: ES720A, except for the antenna. The antenna used in T006 model has less gain than the antenna in the certified model.

The test results related to antenna conducted measurements for Modulation characteristics, Occupied Bandwidth and Frequency Stability are not expected change due installation in the tablet PC; therefore, the test results from the original Application are applicable to the model: T006.

Description of Test	FCC Rule	Result
ERP, EIRP	22.913(a), 24.232(b)	Complies
Modulation characteristics	2.1047	Test Not Performed ¹
Occupied Bandwidth, Emission Designator	2.1049	Test Not Performed ¹
Out of Band Emissions at Antenna Terminals	2.1051, 22.917(a), 24.238(a)	Test Not Performed ¹
Frequency Stability vs. Temperature and Voltage	2.1055	Test Not Performed ¹

¹ Refer to original application for FCC ID: PKRNVWES720

The following tests were performed to ensure compliance of the Model T006 with installation of approved module:

- Conducted Output Power
- Transmitter Radiated Spurious Emissions
- Receiver Spurious Radiated Emissions
- AC Line Conducted Emissions



For more information about the radio, refer to the attached product description.

Applicant	Motion Computing Inc.		
Model No.	T006		
Wireless Interface under	CDMA		
test			
FCC Identifier/	FCC ID: Q3QHWNVWEX720		
IC Identifier	IC ID: 4587ANVWEX720		
Use of Product	LE1700 Tablet PC		
Manufacturer & FCC ID	Novatel Wireless FCC ID: PKRNVWES720		
of Transmitter Module			
Type of Transmission	CDMA 1xRTT, CDMA Ev-Do rev A		
Frequency Range	824.7 - 848.31 MHz, CDMA channels: 1013 - 777		
	1851.25 - 1908.75 MHz, CDMA channels: 25 - 1175		
Rated RF Output Power	24.6dBm – Celluar Band CDMA 1xRTT and CDMA Ev-Do rev A		
	24.8dBm – PCS Band CDMA 1xRTT and CDMA Ev-Do rev A		
Antenna	Main Antenna: Flexable PCB, Gain:1 dBi, -3dBi Average; Make		
	Compal/Motion Computing Inc		
	Aux Antenna: Diversity Antenna, Internal, make Motion Computing		
	Inc		
Manufacturer Name &	Motion Computing Inc.		
Address	8601 Ranch Road 2222		
	Austin, TX 78730 USA		

EUT receive date: EUT receive condition:	January 10, 2007 The prototype version of the EUT was received in good condition with no apparent damage. As declared by the Applicant it is identical to the production units.
Test start date:	January 13, 2007
Test completion date:	February 10, 2007



1.2 Summary of Test Results

FCC ID: Q3QHWNVWEX720 IC ID: 4587A-NVWEX720

Description of Test	FCC Rule	IC Rule	Result	Page
RF Power Output (ERP/EIRP)	2.1046	SRSP-503	Complies	7
Tranmitter Spurious Radiation	2.1053, 22.917(a), 24.238(a)	RSS 129 RSS 132 RSS 133	Complies	8
RF Exposure evaluation	2.1091	RSS 102	Complies *	
Receiver Radiated Spurious Emissions	15.109	RSS-Gen	Complies	11
AC Line Conducted Emission	15.207	RSS-Gen	Complies	19

* Separate SAR test report is attached.



1.3 Test Configuration

1.3.1 Support Equipment

Item #	Description	Model No.	S/N
1	Wireless communications test set	Agilent 8960 Series 10	GB43133135
	(Base Station Simulator)		

1.3.2 Block diagram of Test Setup



Note: For radiated emission test, Spectrum Analyzer and Directional coupler were not connected to the EUT

1.4 Related Submittal(s) Grants

None



2.0 **RF Power Output** FCC 2.1046

2.1 Test Procedure

The EUT RF output was connected as shown on the diagram in sec.1.3.2. The BSS was setup to "originate call" and control the EUT (as a mobile station) to transmit the maximum power.

Output power directly measured on the Base Station Simulator.

Measurements were performed at three frequencies (low, middle, and high channels) in both Cellular in PCS bands.

2.2 Test Results

Channel	Frequency	Measured Output Power		Measured O	utput Power
#	(MHz)	Cellular Ba	and 1xRTT	Cellular Band	EV-DO Rev A
		(dBm)	Watts	(dBm)	Watts
1013	824.7	24.79	0.301	24.80	0.305
384	836.52	24.86	0.306	24.76	0.299
777	848.31	24.82	0.303	24.57	0.286
		PCS Ban	d 1xRTT	PCS Band E	V-DO Rev A
25	1851.25	24.75	0.298	24.60	0.286
600	1880.0	25.17	0.328	24.99	0.315
1175	1908.75	24.85	0.305	25.24	0.334



3.0 Part 22/24 Spurious Radiation FCC 2.1053, 22.917(a), 24.238(a)

3.1 Requirement

The mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency outside the frequency band by at least $(43 + 10 \log P) dB$.

Note: That corresponds to the level of -13 dBm for any out-of-band and spurious emissions.

3.2 Test Procedure

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to 10th harmonic of each of the three fundamental frequency (low, middle, and high channels) for each band (cellular and PCS) was investigated. The tests were performed with the EUT placed on three orthogonal axes. The worst case of emissions was reported.

For spurious emissions attenuation, the substitution method was used. The EUT was substituted by a reference antenna (half-wave dipole - below 1 GHz, or Horn antenna - above 1GHz), connected to a signal generator. The signal generator output level (V_g in dBm) was adjusted to obtain the same reading as from EUT. The ERP/EIRP at the spurious emissions frequency was calculated as follows.

$\text{ERP}_{(dBm)} = \mathbf{V}_{g} + \mathbf{G}_{(dBd)}$; $\text{EIRP}_{(dBm)} = \mathbf{V}_{g} + \mathbf{G}_{(dBi)}$

The spurious emissions attenuation is the difference between ERP/EIRP at the fundamental frequency (see section 3) and at the spurious emissions frequency.

3.3 Test Equipment

EMCO 3115 Horn Antennas Rohde & Schwarz FSP40 Spectrum Analyzer Low Pass Filter Preamplifiers



3.4 Test Results

CDMA 1xRTT Trnsmitter Radiated Spurious Emissions

Frequency	Antenna Polariz.	SA Reading	Signal Generator Output required to have the same SA	ERP*	ERP Limit	ERP Margin
		(EUT)	Reading as from EUT			
MHz		dB(µV)	VgdBm	dBm	dBm	dB
Channel 101	3, 824.7 MI	Hz				
1649.4	V	40.4	-37.4	-31.0	-13.0	-18.2
2472.6	V	33.9	-39.8	-32.3	-13.0	-19.3
3296.8	V	33.2	-42.4	-35.3	-13.0	-22.3
Channel 384	, 836.5 MH	Z				
1673.0	V	40.1	-37.7	-31.3	-13.0	-18.3
2509.2	V	43.3	-35.3	-27.8	-13.0	-14.8
3345.6	V	36.6	-39.0	-31.9	-13.0	-18.9
Channel 777	, 848.3 MH	Z				
1696.6	V	39.5	-38.3	-31.9	-13.0	-18.9
2546.4	V	36.8	-39.2	-31.7	-13.0	-18.7
3395.2	V	33.2	-42.4	-35.3	-13.0	-22.3

* ERP is calculated as: $ERP_{(dBm)} = V_{g(dBm)} + G_{(dBd)}$

Frequency	Antenna Polariz.	SA Reading	Signal Generator Output required to have the same SA	EIRP*	EIRP Limit	EIRP Margin
		(EUT)	Reading as from EUT			
MHz		dB(µV)	V _g dBm	dBm	dBm	dB
Channel 185	1.25 MHz					
3702.5	V	40.8	-32.0	-22.2	-13.0	-9.2
5553.7	V	30.3	-40.9	-29.9	-13.0	-16.9
7405.0	V	29.3	-39.9	-28.5	-13.0	-15.5
9256.2	V	29.0	-39.0	-27.2	-13.0	-14.2
Channel 188	0 MHz					
3760.0	V	37.4	-35.4	-25.6	-13.0	-12.6
5640.0	V	29.3	-41.9	-30.9	-13.0	-17.9
7520.0	V	29.0	-40.2	-28.8	-13.0	-15.8
9400.0	V	31.0	-37.0	-25.2	-13.0	-12.2
Channel 190	9.8 MHz					
3819.6	V	33.7	-39.1	-29.3	-13.0	-16.3
5729.4	V	31.0	-40.2	-29.2	-13.0	-16.2
7639.2	V	29.6	-39.6	-28.2	-13.0	-15.2
9549.0	V	31.0	-37.0	-25.2	-13.0	-12.2

* EIRP is calculated as: $EIRP_{(dBm)} = V_{g (dBm)} + G_{(dBi)}$

* All other emissions not reported are more than 20 dB below the limit.



CDMA EV-DO Rev. A Trnsmitter Radiated Spurious Emissions

Frequency	Antenna Polariz.	SA Reading (EUT)	Signal Generator Output required to have the same SA Reading as from EUT	ERP*	ERP Limit	ERP Margin
MHz		dB(µV)	V _g dBm	dBm	dBm	dB
Channel 101	3, 824.7 MI	Hz				
1649.4	V	29.1	-48.7	-42.3	-13.0	-29.3
2472.6	V	24.0	-54.0	-46.5	-13.0	-33.5
3296.8	V	13.0	-62.6	-55.5	-13.0	-42.5
Channel 384	, 836.5 MH	Z				
1673.0	V	32.9	-44.9	-38.5	-13.0	-25.5
2509.2	V	24.8	-53.2	-45.7	-13.0	-32.7
3345.6	V	4.72	-70.8	-63.7	-13.0	-50.7
Channel 777	, 848.3 MH	Z				
1696.6	V	33.1	-44.7	-38.3	-13.0	-25.3
2546.4	V	24.1	-53.9	-46.4	-13.0	-33.4
3395.2	V	9.31	-66.3	-59.2	-13.0	-46.2

* ERP is calculated as: $ERP_{(dBm)} = V_{g(dBm)} + G_{(dBd)}$

Frequency	Antenna Polariz.	SA Reading (FUT)	Signal Generator Output required to have the same SA Beading as from FUT	EIRP*	EIRP Limit	EIRP Margin
MHz		dB(μV)	V _g dBm	dBm	dBm	dB
Channel 185	1.25 MHz					
3702.5	V	14.1	-58.7	-48.9	-13.0	-35.9
5553.7	V	14.6	-56.6	-45.6	-13.0	-32.6
7405.0	V	9.2	-60.0	-48.6	-13.0	-36.6
9256.2	V	10.1	-57.9	-46.1	-13.0	-33.1
Channel 188	0 MHz					
3760.0	V	18.9	-53.9	-44.1	-13.0	-31.1
5640.0	V	14.6	-56.6	-45.6	-13.0	-32.6
7520.0	V	8.8	-60.4	-59.0	-13.0	-46.0
9400.0	V	11.2	-56.8	-45.0	-13.0	-32.0
Channel 190	9.8 MHz					
3819.6	V	16.2	-56.6	-46.8	-13.0	-33.8
5729.4	V	12.5	-58.7	-47.7	-13.0	-34.7
7639.2	V	13.5	-55.7	-44.3	-13.0	-31.3
9549.0	V	10.6	-57.4	-45.6	-13.0	-32.6

* EIRP is calculated as: $EIRP_{(dBm)} = V_{g (dBm)} + G_{(dBi)}$

*All other emissions not reported are more than 20 dB below the limit.

Test Result: Complies by 9.2 dB

EMC Report for Motion Computing Inc on the LE1700 Tablet PC Model: T006 File: 3113464MPK-001



4.0 Radiated Emissions from receiver and digital part FCC 15.109

4.1 Radiated Emission Limits

The following radiated emission limits apply to Class B unintentional radiators:

Frequency MHz	Class A at 10m µV/m	Class A at 3m dB(µV/m)
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
Above 960	500	54.0

Radiated Emissions Limits, FCC Section 15.209(a)

- Note: Three sets of units are commonly used for EMI measurement, decibels below one milliwatt (-dBm), decibels above a microvolt, dB (μ V), and microvolts (μ V). To convert between them, use the following formulas: 20 LOG₁₀(μ V) = dB (μ V), dB (m) = dB (μ V)-107.
- 4.2 Block Diagram of Setup

For Radiated Measurements & AC Line Conducted Emissions:



AC/DC Adaptor: Delta Electronics, ADP-50HH Rev. B, S/N. KOW0641001371

S = Shielded	$\mathbf{F} = $ With Ferrite
$\mathbf{U} = \mathbf{U}$ nshielded	\mathbf{m} = Length in Meters



4.3 Support Equipment

Item #	Description	Model No.	Serial No.
1	Speakers	SP-12	Not Labeled
2	RCA Headphones	Not Labeled	Not Labeled
3	Netgear 5 port 10/100/1000 Mbs Gigabit switch	GS605	GS19147DB002667
4	Motion Computing DVD+/- RW Drive	EDW085	CN-042020006-00381-69E-00A8
5	Philips Monitor	107S11/74	32131535
6	USB Flash Drive	Not Labeled	Not Labeled



4.4 Configuration Photographs

FCC Part 15 Radiated Emission Test Setup Photographs













4.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where FS = Field Strength in $dB(\mu V/m)$

RA = Receiver Amplitude (including preamplifier) in dB(μ V); AF = Antenna Factor in dB(1/m) CF = Cable Attenuation Factor in dB; AG = Amplifier Gain in dB

Assume a receiver reading of 52.0 dB(μ V) is obtained. The antennas factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB(μ V/m). This value in dB(μ V/m) was converted to its corresponding level in μ V/m.

 $RA = 52.0 \text{ dB}(\mu\text{V})$ AF = 7.4 dB(1/m) CF = 1.6 dB AG = 29.0 dB $FS = 52.0+7.4+1.6-29.0 = 32 \text{ dB}(\mu\text{V/m})$ Level in $\mu\text{V/m}$ = Common Antilogarithm [(32 \text{ dB}\mu\mV/m)/20] = 39.8 \mu\mV/m

4.6 Test Results

Tested By:	Suresh Kondapalli
Test Date:	January 29, 2007

The results on the following page(s) were obtained when the device was tested in the condition described in Section 4.

Result	s:	Complies FCC Class H	3 by 2.8 dB
Note:	a)	A complete scan from 2	30 MHz to 7.5 GHz was made with antenna oriented horizontally and
		vertically.	
	b)	Testing was conducted	
	b)	The highest emissions	are reported
	c)	Analyzer setting:	RBW = 100 kHz, VBW = 100 kHz - below 1 GHz
			RBW =1 MHz, VBW = 30 kHz - above 1 GHz
		Detector mode:	Peak unless otherwise specified in the data page
	d)	All other emissions no	t reported are at least 10 dB below the limit





Intertek Testing Services Radiated Emissions 30 MHz - 1000 MHz FCC Part 15 Class B (QP-Horizontal) Model Number: LE1700 with CDMA Module ITS Job Number: 3113464

Operator: SK

04:08:18 PM, Monday, January 29, 2007

Company: Motion Computing, Inc

Frequency	Quasi Pk FS	Limit@3m	AF	RA	AG	CF	Margin
MHz	dB(uV/m)	dB(uV/m)	dB(1/m)	dB(uV)	dB	dB	dB
200.00	16.8	43.5	10.6	34.1	32.8	2.0	-26.7
366.18	34.2	46.0	15.4	45.7	32.8	2.8	-11.8
427.20	34.0	46.0	16.4	44.2	32.8	3.1	-12.0
854.40	34.9	46.0	21.8	37.9	32.6	4.8	-11.1

Test Mode: Receiving Temperature: 21 C Humidity : 52 %





Intertek Testing Services Radiated Emissions 30 MHz - 1000 MHz FCC Part 15 Class A (QP-Vertical)

Operator: SK

04:08:18 PM, Monday, January 29, 2007

Model Number: LE1700 ITS Job Number: 3113464 Company: Motion Computing, Inc

Frequency	Quasi Pk FS	Limit@3m	AF	RA	AG	CF	Margin
MHz	dB(uV/m)	dB(uV/m)	dB(1/m)	dB(uV)	dB	dB	dB
96.1	33.7	43.5	10.9	51.3	32.9	1.3	-9.7
366.0	43.2	46.0	15.4	54.8	32.8	2.8	-2.8
427.0	39.7	46.0	16.0	50.4	32.8	3.1	-6.2
854.0	37.1	46.0	21.0	40.9	32.6	4.8	-8.9

Test Mode: Receiving Temperature: 21 C Humidity : 52 %



5.0 AC Line Conducted Emission FCC Rule 15.207:

5.1 Procedure

AC line conducted emission test was performed according the ANSI C63.4 (2003) standard. The EUT was connected to the AC Line through the LISN.

5.2 Test Results

For the test result, see the following pages. The EUT passed by 7.5 dB.



AC Line Conducted Emission data



Intertek Ttesting Services								
Line Conducted Emissions 150 kHz - 30 MHz								
	EN 55022 Class B (Line 1)							
Operator: SK		Model Numb	er: LE1700 with	n CDMA Modu	le			
01:28:23 PM, Monday	y, January 15,							
2007		Company: M	otiomn Compu	ting Inc				
Frequency	Av Level	Av Limit	QP Limit	Av Margin				
MHz	(dBuV)	(dBuV)	(dBuV)	(dBuV)				
0.34	35.2	48	60.3	-12.8				
0.27	33.5	48	62.3	-14.5				
0.15	31.4	48	66	-16.6				
0.21	34.7	48	64.3	-13.3				
4.03	38.9	48	56	-9.1				
4.23	40.5	48	56	-7.5				
4.18	39.3	48	56	-8.7				
Test Mode: 115V 60H	Iz CDMA 1x RTT							
Temperature: 20 C,								
Humidity: 55 %								





Intertek Ttesting Services							
	Line Conducted Emissions 150 kHz - 30 MHz						
EN 55022 Class B (Line 2)							
Operator: SK Model Number: LE1700 with CDMA Module							
01:28:23 PM, Monday, January 15, 2007 Company: Motiomn Computing Inc							
Frequency	Av Level	Av Limit	QP Limit	Av Margin			
MHz	(dBuV)	(dBuV)	(dBuV)	(dBuV)			
0.27	35.5	48	62.3	-12.5			
0.34	39.4	48	60.3	-8.6			
4.03	40.4	48	56	-7.6			
4.18	38.3	48	56	-9.7			
4.23	40.5	48	56	-7.5			
Test Mode: 115V 60⊦	Iz CDMA 1x RTT						
Temperature: 20 C,							
Humidity: 55 %							



AC Line Conducted Emission data CDMA EVDO revA



Intertek Ttesting Services								
	Line Conducted Emissions 150 kHz - 30 MHz							
	EN 55022 Class B (Line 1)							
Operator: SK Model Number: LE1700 with CDMA Module					le			
01:28:23 PM, Monday, January 15,								
2007		Company: M	<u>otiomn Compu</u>	ting Inc				
Frequency	Av Level	Av Limit	QP Limit	Av Margin				
MHz	(dBuV)	(dBuV)	(dBuV)	(dBuV)				
0.34	35.2	48.0	60.3	-12.8				
0.27	33.5	48.0	62.3	-14.5				
0.15	31.4	48.0	66.0	-16.6				
0.21	34.7	48.0	64.3	-13.3				
4.03	38.9	48.0	56.0	-9.1				
4.23	40.5	48.0	56.0	-7.5				
4.18	39.3	48.0	56.0	-8.7				
Test Mode: 115V 60H	Test Mode: 115V 60Hz CDMA EV-DO							
Temperature: 20 C,								
Humidity: 55 %								

Intertek ETL SEMKO



Intertek Testing Services								
	Line Conducted Emissions 150 kHz - 30 MHz							
	EN 55022 Class B (Line 2)							
Operator: SK		Model Numb	er: LE1700 witl	n CDMA Module	e			
01:28:23 PM, Monday, January 15, 2007 Company: Motiomn Computing Inc								
Frequency	Av Level	Av Limit	QP Limit	Av Margin				
MHz	(dBuV)	(dBuV)	(dBuV)	(dBuV)				
0.27	35.5	48.0	62.3	-12.5				
0.34	39.4	48.0	60.3	-8.6				
4.03	40.4	48.0	56.0	-7.6				
4.18	38.3	48.0	56.0	-9.7				
4.23	40.5	48.0	56.0	-7.5				
Test Mode: 115V 60H	Test Mode: 115V 60Hz CDMA 1x RTT							
Temperature: 20 C,	Temperature: 20 C,							
Humidity: 55 %	Humidity: 55 %							



5.3 Cofiguration Photos









6.0 List of Test Equipment

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

EQUIPMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. INTERVAL	CAL. DUE
RF Filter Section	Hewlett Packard	85460A	3448A00267	12	9/11/07
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	9/11/07
Spectrum Analyzer	R & S	FSP40	036612004	12	7/12/07
Signal Generator	Hewlett Packard	83732A	3222A00119	12	3/30/07
BI-Log Antenna	ARA Inc.	1154	LPB-2513/A	12	8/29/07
Horn Antenna	EMCO	3115	9170-3712	12	7/26/07
Pre-Amplifier	Sonoma Inst.	310	185634	12	2/20/07
Pre-Amplifier	Miteq	AMF-4D-001180-24-10P	799159	12	4/03/07
High Pass Filter	Reactel	7HS-4/18 S11	(94)3	#	#
LISN	FCC	FCC-LISN-50-50-M-H	2012	12	7/19/07
Spectrum Analyzer	Hewlett Packard	8591EM	3801A01250	12	9/13/07

Calibration performed by ITS prior to the test



7.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / 3113464	SK	February 12, 2007	Original document