

FCC 47 CFR PART 15 SUBPART C INDUSTRY CANADA RSS-210 ISSUE 8

CERTIFICATION TEST REPORT

FOR

HANDHELD COMPUTING DEVICE

MODEL NUMBER: 1573

FCC ID: C3K1573 IC: 3048A-1573

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Prepared for MICROSOFT CORPORATION ONE MICROSOFT WAY REDMOND, WA 98052, U.S.A.

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NVLAP LAB CODE 200065-0

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Rev.	Date	Revisions	Revised By
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Pass

1. ATTESTATION OF TEST RESULTS

INDUSTRY CANADA RSS-GEN Issue 3

COMPANY NAME: MICROSOFT CORPORATION ONE MICROSOFT WAY REDMOND, WA 98052, U.S.A.						
EUT DESCRIPTION:	HANDHELD COMPUTING DEVICE WITH WWAN, 802.1 A/B/G/N WLAN AND BLUETOOTH RADIOS					
MODEL:	1573					
SERIAL NUMBER:	SERIAL NUMBER: 001925433252					
DATE TESTED:	DATE TESTED: OCTOBER 23, 2013 – OCTOBER 28, 2013					
	APPLICABLE STANDARDS					
	TEST RESULTS					
CFR 47	7 Part 15 Subpart C	Pass				
INDUSTRY CANADA RSS-210 Issue 8 Annex 8 Pass						

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL Verification Services Inc. By:

- Tim Son

TIM LEE WISE PROGRAM MANAGER UL Verification Services Inc.

Tested By:

JOE VANG EMC ENGINEER UL Verification Services Inc.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2009, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
Chamber A	Chamber D
Chamber B	🖂 Chamber E
Chamber C	Chamber F

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <u>http://www.ccsemc.com</u>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB) 36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

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4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a handheld computing device with WWAN, 802.11 a/b/g/n WLAN and Bluetooth radios.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range	Mode	Output Power	Output Power
(141112)		(ubili)	(1100)
2412 - 2462	802.11b	16.26	42.27
2412 - 2462	802.11g	20.84	121.34
2412 - 2462	802.11n HT20	20.55	113.50
2422 - 2452	802.11n HT40	22.23	167.11
5745 - 5825	802.11a	20.67	116.68
5745 - 5825	802.11n HT20	18.46	70.15
5755 - 5795	802.11n HT40	18.26	66.99

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5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an PIFA antenna, with a maximum gain of 3.1 dBi and 2.6 dBi in the 2.4 GHz band and 2.2 dBi and 3.9 dBi in the 5 GHz band.

5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Window RT 8.1 Preview Build 943

The test utility software used during testing was Laptool 189.1.0.9.0\ WIFI Tool.exe

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

Based on the baseline scan, the worst-case data rates were:

802.11b mode: 1 Mbps 802.11g mode: 6 Mbps 802.11a mode: 6 Mbps 802.11n HT20mode: MCS0

Radiated emissions for EUT with antenna was performed and passed; therefore, antenna port spurious was not performed.

Conducted measurement was conducted on Model 1572 under FCC ID C3K1572. Model 1572 are identical to Model 1573 except Model 1573 includes the WWAN radio.

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List								
Description Manufacturer Model Serial Number FCC ID								
USB Ethernet Adaptor	CISCO	USB 300M	CU90MC02233	DoC				
Laptop	Lenovo	L420	7854CT0	DoC				
AC Adaptor (laptop)	Lenovo	92P1156	111S92P1156ZDXN272091	N/A				

I/O CABLES

I/O Cable List								
Cable Port # of identical			Connector	Cable Type	Cable	Remarks		
No		ports	Туре		Length (m)			
1	AC	1	AC	Unshielded	1.8	AC adapter		
2	USB	1	USB	Unshielded	0.1	USB to Ethernet adapter		
3	DC	1	DC	Unshielded	1.8			
4	Ethernet	1	RJ 45	Unshielded	7.62	Connects to USB adapter		

TEST SETUP

The EUT is a standalone wireless handheld computing device. Test software exercised the wireless module installed within the device under test.

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SETUP DIAGRAM FOR TESTS



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6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List							
Description	Manufacturer	Model	Asset	Cal Date	Cal Due		
Spectrum Analyzer, 26.5 GHz	Agilent	E4440A	C01179	02/26/13	02/26/14		
Spectrum Analyzer, 26.5 GHz	Agilent	E4440A	C01176	12/13/12	12/13/13		
Spectrum Analyzer, 40 GHz	Agilent	8564E	C00951	07/29/13	07/29/14		
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00980	11/14/12	11/14/13		
Single Channel PK Power Meter	Agilent	N1911A	F00026	04/02/13	04/02/14		
Peak and Average Power Sensor	Agilent	E9323A	F00160	04/03/13	04/03/14		
Spectrum Analyzer	Agilent	N9030A	F00128	2/22/2013	2/22/2014		
Horn Antenna, 1-18GHz	ETS Lindgren	3117	F00133	2/19/2013	2/19/2014		
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB3	F00168	3/7/2013	3/7/2014		
High Pass Filter, fc: 3.0GHz, 50 Ohr	Micro-Tronics	HPM17543	F00180	8/24/2013	8/24/2014		
Low Pass Filter, fc: 5GHz, 50 Ohms	Micro-Tronics	LPS17541	F00174	8/24/2013	8/24/2014		
RF PreAmplifier, 1-18GHz	Miteq	To Be Determir	F00353	8/24/2013	8/24/2014		
Amplifier	Sonoma	310	F00008	11/6/2012	11/6/2013		

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7. MEASUREMENT METHODS

KDB 558074 Measurement Procedure PK2 is used for power and PKPSD is used for power spectral density.

Unwanted emissions within Restricted Bands are measured using traditional radiated procedures.

2.4GHz	ON Time Period Duty Cycle Duty Duty Cycle		1/T			
Mode	В		х	Cycle	Correction Factor	Minimum VBW
	(msec)	(msec)	(linear)	(%)	(dB)	(kHz)
802.11b	1.00	1.00	1.000	100.0%	0.00	0.010
802.11g	1.00	1.00	1.000	100.0%	0.00	0.010
802.11n HT20	0.283	0.289	0.980	98.0%	0.09	3.534
802.11n HT40	0.299	0.304	0.984	98.4%	0.00	0.010

7.1.1. ON TIME AND DUTY CYCLE RESULTS

5.8GHz	ON Time	Period	Duty Cycle	Duty	Duty Cycle	1/T
Mode	В		x	Cycle	Correction Factor	Minimum VBW
	(msec)	(msec)	(linear)	(%)	(dB)	(kHz)
802.11a	1.62	1.63	0.994	99.4%	0.00	0.010
802.11n HT20	0.283	0.288	0.982	98.2%	0.00	0.010
802.11n HT40	0.299	0.304	0.986	98.6%	0.00	0.010

7.1.2. MEASUREMENT METHOD FOR POWER AND PPSD

The Duty Cycle is greater than or equal to 98% therefore KDB 789033 Method SA-1 is used.

7.1.3. MEASUREMENT METHOD FOR AVERAGE SPURIOUS EMISSIONS ABOVE 1 GHz

The Duty Cycle is greater than or equal to 98%, KDB 789033 Method AD with Power RMS Averaging is used.

7.1.4. DUTY CYCLE PLOTS





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							A MI	12 288	9.00	
Rof 30 /	dBm	#Atto	n 30 dB					0.	73 dB	Center Freq
#Peak		25				2		<u>v</u> .		2.43700000 GHz
.og				LAL HULLEHE		113-1	dittent to	and the second	did dint	
10	defe can de d	atadama Maku	A Distant	udu huburu in	du de lais o	1 .1.1.1	Land that	. dimension	a de notado de	Start Fred
IB/			_							2.43700000 GHz
Offst										
0.7										
dB										Stop Freq
			_							2.43700000 GHz
										CF Step
										8.00000000 MHz
" Avg										Auto Ma
Center	2.437 000) GHz						Spa	an 0 Hz	E
Res BW	/ 8 MHz		#	#VBW 50 I	MHz	Sweep	733.3 µs	s (1001	pts)	Freq Offset
Marker	Tra	ce Typ	e	>	Axis			Amplitu	ude	0.00000000 Hz
1R	(1)) Tir	ne	1	86.3 µs			17.49 dE	3m l	
1∆	(1)) Tir	ne	2	83.1 µs			-1.75 dB		Signal Track
2R	(1)) Tir	ne	1	86.3 µs			17.49 dE	m	On Ct
2∆	(1)) Tir	ne	2	88.9 µs			0.73 c	18	<u>.</u>



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X Aylie	11 16.09.32	Aug 5, 201	3				K I	Freq/Channel
					Δ	Mkr2 1.6	32 ms	Contor From
Ref 30 dB	m	#Atten 30	dB			0.	61 dB	5 78500000 GHz
#Peak	23	2			2			0.10000000000
Log 🙀	etysland and an area	New House	The shake with the shakes of the	all you have been a second	skrear and hit	un Viterbig	- manual	
10								Start Freq
dB/ ├─								5.78500000 GHz
Offst 📙								
11.3								Stop From
dB								Stop Fred
								5.76500000 GH2
								CF Ste
								8.00000000 MHz
" " "								Auto M
Center 5.	785 000 GHz					Sp	an 0 Hz	
Res BW 8	MHz		#VBW 50 I	MHz	Sweep 3	3 ms (100	1 pts)	Freq Offset
Marker	Trace	Type	×	Axis	· · ·	Amplit	ude	0.0000000 HZ
1R	(1)	Time		552 µs		15.06 d	Bm	
1∆	(1)	Time	1	.623 ms		0.85	dB	Signal Track
2R	(1)	Time		552 µs		15.06 d	Bm	On O
2∆	(1)	Time	1	.632 ms		0.61	dB	<u> </u>



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Ref 30 (#Peak	dBm	Atten 30 dB		14	Иkr2 303.6 µ -1.21 dt	s B 5.79500000 GHz
₋og l0 lB/ Dffet	life-eftender-ninegel		and a state of the		un stepherinakeriake	Start Freq 5.79500000 GHz
1.3 IB						Stop Freq 5.79500000 GHz
¢PA∨g						CF Step 8.00000000 MHz <u>Auto Ma</u>
Center Res BW	5.795 000 GH / 8 MHz	z	#VBW 50 MHz	Sweep 613.3	Span 0 μs (1001 pts)	Hz Freq Offset
Marker	Trace	Туре	X Axis		Amplitude	
1R 1∆ 2R	(1) (1) (1)	Time Time Time	160.1 µs 299.3 µs 160.1 µs		6.11 dBm 2.86 dB 6.11 dBm	Signal Track
2 <u>A</u>	(1)	Time	303.6 µs		-1.21 dB	

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8. ANTENNA PORT TEST RESULTS

8.1. 802.11b MODE IN THE 2.4 GHz BAND

8.1.1. 6 dB BANDWIDTH

<u>LIMITS</u>

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer with the RBW set between 1% and 5% of the EBW, the VBW $>= 3 \times RBW$, peak detector and max hold.

RESULTS

Channel	Frequency	6 dB BW	6 dB BW	Minimum	
		Chain 0	Chain 1	Limit	
	(MHz)	(MHz)	(MHz)	(MHz)	
Low	2412	10.170	10.170	0.5	
Mid	2437	10.177	10.170	0.5	
High	2462	10.145	9.860	0.5	

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6 dB BANDWIDTH, Chain 0





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6 dB BANDWIDTH, Chain 1



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8.1.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Channel Frequency		99% BW
		Chain 0	Chain 1
	(MHz)	(MHz)	(MHz)
Low	2412	13.4389	13.4178
Mid	2437	13.4466	13.4090
High	2462	13.4216	13.4103

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99% BANDWIDTH, Chain 0





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99% BANDWIDTH, Chain 1



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8.1.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.75 dB (including 10 dB pad and .75 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency	Chain 0	Chain 1	Total
		Power Power		Power
	(MHz)	(dBm)	(dBm)	(dBm)
Low	2412	12.98	12.27	15.65
Mid	2437	12.85	12.81	15.84
High	2462	12.91	12.84	15.89

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8.1.4. OUTPUT POWER

LIMITS

FCC §15.247

IC RSS-210 A8.4

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is the same for each chain. The directional gain is equal to the antenna gain.

Chain 0	Chain 1	Uncorrelated Chains
Antenna	Antenna	Directional
Gain	Gain	Gain
(dBi)	(dBi)	(dBi)
3.10	2.60	2.86

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<u>RESULTS</u>

Limits

Channel	Frequency	Directional	FCC	IC	IC	Max
		Gain	Power	Power	EIRP	Power
			Limit	Limit	Limit	
	(MHz)	(dBi)	(dBm)	(dBm)	(dBm)	(dBm)
Low	2412	2.86	30.00	30	36	30.00
Mid	2437	2.86	30.00	30	36	30.00
High	2462	2.86	30.00	30	36	30.00

Results

Channel	Frequency	Chain 0	Chain 1	Total	Power	Margi
		Meas	Meas	Corr'd	Limit	
		Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	2412	15.89	15.67	18.79	30.00	-11.21
Mid	2437	16.26	16.19	19.24	30.00	-10.76
High	2462	15.93	15.91	18.93	30.00	-11.07

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OUTPUT POWER, Chain 0





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OUTPUT POWER, Chain 1



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8.1.5. PSD

LIMITS

FCC §15.247

IC RSS-210 A8.2

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

PSD Results

Channel	Frequency	Chain 0	Chain 1	Total	Limit	Margin
		Meas	Meas	PSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	2412	-11.62	-13.04	-9.26	8.0	-17.3
Mid	2437	-10.13	-11.43	-7.72	8.0	-15.7
High	2462	-12.49	-11.71	-9.07	8.0	-17.1

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PSD, Chain 0





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PSD, Chain 1



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8.1.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the inband reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

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RESULTS

IN-BAND REFERENCE LEVEL, Chain 0



LOW CHANNEL BANDEDGE, Chain 0



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HIGH CHANNEL BANDEDGE, Chain 0



OUT-OF-BAND EMISSIONS, Chain 0



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DUT OF	BANE 9:29:04) Chai Aug 21, 2	in 0 013	MID	СН			F	₹Т	Freq/Channel
Ref 20 dBm_ #Peak	1	Atten 20)dB				Mk	ar3 4.87 -51.51	73 GHz dBm	Center Freq 13.0150000 GHz
Log 10 dB/	Ò									Start Freq 30.000000 MHz
0ffst 10.7 dB	3									Stop Freq 26.000000 GHz
-14.9 dBm #PA∨g					gul Mark Langa					CF Step 2.59700000 GHz <u>Auto Man</u>
Start 30 MHz #Res BW 100	kHz		#VB	W 300	kHz	Swee	Sto p 2.482 :	р 26.00 s (2001	0 GHz pts)	Freq Offset
Marker 1 2 3	Trace (1) (1) (1) (1)	Type Freq Freq Freq		× 4 2.4 4.8	Axis 71 MHz 32 GHz 73 GHz			Amplit -58.34 dE 4.74 dE -51.51 dE	ude 9m 9m 9m	Signal Track On <u>Off</u>



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IN-BAND REFERENCE LEVEL, Chain 1



LOW CHANNEL BANDEDGE, Chain 1



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HIGH CHANNEL BANDEDGE, Chain 1



OUT-OF-BAND EMISSIONS, Chain 1



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					M	kr2 2.43	32 GHz	1 <u></u>	
f20dBr eak	n	Atten 20 d	IB			4.48	B dBm	Center F 13.0150000	Freq GHz
g	2 0								
								Start F 30.0000000	req MHz
7								Stop F 26.0000000	Frec GHz
.9				addition to a second state	in and a subset of		-	CF	Ste
Avg —	New York Contraction							2.59700000 <u>Auto</u>	GHz <u>M</u>
nrt 30 Mi es BW 1	Hz 100 kHz		#VBW 300	kHz S	St weep 2.482	op 26.00 s (2001	0 GHz pts)	Freq Of	fset
darker	Trace	Туре	X	Axis		Amplit	ude	0.00000000	
1 2	(1) (1)	Freq Freq	4 2.4	71 MHz 32 GHz		-58.78 dE 4.48 dE	im Im	Signal T On	rack <u>C</u>



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8.2. 802.11g MODE IN THE 2.4 GHz BAND

8.2.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer with the RBW set between 1% and 5% of the EBW, the VBW $>= 3 \times RBW$, peak detector and max hold.

RESULTS

Channel	Frequency	6 dB BW	6 dB BW	Minimum
		Chain 0	Chain 1	Limit
	(MHz)	(MHz)	(MHz)	(MHz)
Low	2412	16.50	16.46	0.5
Mid	2437	16.42	16.54	0.5
High	2462	16.42	16.50	0.5

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6 dB BANDWIDTH, Chain 0





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6 dB BANDWIDTH, Chain 1



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8.2.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	99% BW	99% BW
		Chain 0	Chain 1
	(MHz)	(MHz)	(MHz)
Low	2412	16.4048	16.4079
Mid	2437	16.3978	16.4002
High	2462	16.3938	16.3987

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99% BANDWIDTH, Chain 0





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Ch Freq 2.4	62 GHz		100	Trig Free	Center Freq 2.46200000 GHz
Occupied Bandwidth		Averages:	100		Start Freq 2.44700000 GHz
Ref 20 dBm Atter #Samp Log 10 dB/ Offst 10.7 dB Center 2.462 00 GHz #Res BW 150 kHz	20 dB	Hz #Swe	S ep 100 ms	← → → → → → → → → → → → → →	Stop Freq 2.47700000 GHz 3.00000000 MHz <u>Auto Ma</u> Freq Offset 0.00000000 Hz
Occupied Bandw 16.3 Transmit Free Error	idth 938 MHz -744 383 Hz	Occ BW	% Pwr x dB	99.00 % -26.00 dB	Signal Track On <u>Of</u>

99% BANDWIDTH, Chain 1



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8.2.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.75 dB (including 10 dB pad and .75 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency	Chain 0	Chain 1	Total
		Power	Power	Power
	(MHz)	(dBm)	(dBm)	(dBm)
Low	2412	11.09	10.72	13.92
Low	2417	12.18	11.75	14.98
Mid	2437	12.03	11.70	14.88
High	2462	11.21	11.42	14.33

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8.2.4. OUTPUT POWER

LIMITS

FCC §15.247

IC RSS-210 A8.4

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is the same for each chain. The directional gain is equal to the antenna gain.

Chain 0	Chain 1	Uncorrelated Chains				
Antenna	Antenna	Directional				
Gain	Gain	Gain				
(dBi)	(dBi)	(dBi)				
3.10	2.60	2.86				

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<u>RESULTS</u>

Limits

Channel	Frequency	Directiona	FCC	IC	IC	Max
		Gain	Power	Power	EIRP	Power
			Limit	Limit	Limit	
	(MHz)	(dBi)	(dBm)	(dBm)	(dBm)	(dBm)
Low	2412	2.86	30.00	30	36	30.00
Low	2417	2.86	30.00	30	36	30.00
Mid	2437	2.86	30.00	30	36	30.00
High	2462	2.86	30.00	30	36	30.00

Results

Channel	Frequency	Chain 0	Chain 1	Total	Power	Margi
		Meas	Meas	Corr'd	Limit	
		Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	2412	19.52	19.19	22.37	30.00	-7.63
Low	2417	20.84	20.53	23.70	30.00	-6.30
Mid	2437	20.23	19.98	23.12	30.00	-6.88
High	2462	19.51	19.91	22.72	30.00	-7.28

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OUTPUT POWER, Chain 0





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OUTPUT POWER, Chain 1





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8.2.5. PSD

LIMITS

FCC §15.247

IC RSS-210 A8.2

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

PSD Results

Channel	Frequency	Chain 0	Chain 1	Total	Limit	Margin
		Meas	Meas	PSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	2412	0.42	-1.87	2.43	8.0	-5.6
Mid	2437	-0.83	-0.63	2.28	8.0	-5.7
High	2462	-2.38	-2.17	0.74	8.0	-7.3

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PSD, Chain 0





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PSD, Chain 1



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8.2.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the inband reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

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RESULTS

IN-BAND REFERENCE LEVEL, Chain 0



LOW CHANNEL BANDEDGE, Chain 0



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HIGH CHANNEL BANDEDGE, Chain 0



OUT-OF-BAND EMISSIONS, Chain 0



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5						ML	-2 4 97	- LD -		annor
ef 20 dBi Peak ⊡	m	Atten 20	dB		1		-57.86	dBm	Center 13.015000	r Fred 30 GH:
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fst									Ctor	
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om PAvg —	wind apression	and the second difference of the second differ	Landina a langun a Ma						2.5970000 <u>Auto</u>	0 GH2 ⊻
art 30 M	Hz					Sto	p 26.00	0 GHz		
les BW	100 kHz		#VBW 300	kHz	Swee	p 2.482	s (2001	pts)	Freq (Offset
Marker	Trace	Type	,	X Axis			Amplitu	Jde	0.000000	00 112
1	(1)	Freq Freq	2.4	445 GHz 873 GHz			0.60 dE 57.86 dB)m Im	Ci ana al	Treat
_									On	11aci <u>C</u>



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IN-BAND REFERENCE LEVEL, Chain 1



LOW CHANNEL BANDEDGE, Chain 1



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HIGH CHANNEL BANDEDGE, Chain 1



OUT-OF-BAND EMISSIONS, Chain 1



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			<u> </u>					Mkr	2 14 32	6 GHz	
ef 20 Peak	dBm		Atten 2	20 dB					-53.48	dBm	Center Fre 13.0150000 GH
og) B/ ffat	•	>									Start Free 30.0000000 MH
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5.5 Bm PAvg	artau Madella M	Pennen		-		,			ullakette		CF St 2.59700000 GH <u>Auto</u> !
tart 30 Res Bl) MHz W 100	kHz		#VE	W 300	kHz	Swee	Sto p 2.482	p 26.00 s (2001	0 GHz pts)	Freq Offse 0.00000000 H
Marker 1 2	. 1	race (1) (1)	Type Freq Freq		X 2.4 14.3	. Axis 132 GHz 26 GHz			Amplitu 0.73 dE •53.48 dB	ude 9m Im	Signal Trac On



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8.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

8.3.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer with the RBW set between 1% and 5% of the EBW, the VBW $>= 3 \times RBW$, peak detector and max hold.

RESULTS

Channel	Frequency	6 dB BW	6 dB BW	Minimum
		Chain 0	Chain 1	Limit
	(MHz)	(MHz)	(MHz)	(MHz)
Low	2412	17.00	17.04	0.5
Mid	2437	17.00	17.04	0.5
High	2462	17.00	17.04	0.5

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6 dB BANDWIDTH, Chain 0





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6 dB BANDWIDTH, Chain 1



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8.3.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	annel Frequency		99% BW	
		Chain 0	Chain 1	
	(MHz)	(MHz)	(MHz)	
Low	2412	17.5374	17.5607	
Mid	2437	17.5305	17.5614	
High	2462	17.5337	17.5565	

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99% BANDWIDTH, Chain 0





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Ch Freq 2.462 (Trig Free	Center Freq
Occupied Bandwidth		Averages: 100		2.4020000 0112
				Start Freq 2.44700000 GHz
Ref 20 dBm Atten 20 #Samp Log	dB	11 d.M.a.r.a.W.a.relana		Stop Freq 2.47700000 GHz
10 dB/ → 4 0 ffst 10.7				CF Step 3.00000000 MHz <u>Auto Ma</u>
dB			Span 30 MHz	Freq Offset 0.00000000 Hz
#Res BW 150 kHz	#VBW 470 kHz	#Sweep 100 i	ns (601 pts)	
Occupied Bandwidt 17.533	h 7 MHz	Occ BW % Pwr x dB	99.00 % -26.00 dB	Signal Irack On <u>Of</u>
Transmit Freq Error -20 x dB Bandwidth 19.	1.720 kHz 147 MHz*			

99% BANDWIDTH, Chain 1



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8.3.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.75 dB (including 10 dB pad and .75 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency	Chain 0	Chain 1	Total
		Power	Power	Power
	(MHz)	(dBm)	(dBm)	(dBm)
Low	2412	11.12	10.74	13.94
Low	2417	12.14	11.77	14.97
Mid	2437	11.97	11.66	14.83
High	2457	11.62	11.48	14.56
High	2462	10.01	10.55	13.30

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8.3.4. OUTPUT POWER

LIMITS

FCC §15.247

IC RSS-210 A8.4

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is the same for each chain. The directional gain is equal to the antenna gain.

Chain 0	Chain 1	Uncorrelated Chains
Antenna	Antenna	Directional
Gain	Gain	Gain
(dBi)	(dBi)	(dBi)
3.10	2.60	2.86

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<u>RESULTS</u>

Limits

Channel	Frequency	Directional	FCC	IC	IC	Max
		Gain	Power	Power	EIRP	Power
			Limit	Limit	Limit	
	(MHz)	(dBi)	(dBm)	(dBm)	(dBm)	(dBm)
Low	2412	2.86	30.00	30	36	30.00
Low	2417	2.86	30.00	30	36	30.00
Mid	2437	2.86	30.00	30	36	30.00
High	2457	2.86	30.00	30	36	30.00
High	2462	2.86	30.00	30	36	30.00

Results

Channel	Frequency	Chain 0	Chain 1	Total	Power	Margi
		Meas	Meas	Corr'd	Limit	
		Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	2412	19.46	19.13	22.31	30.00	-7.69
Low	2417	20.44	20.10	23.28	30.00	-6.72
Mid	2437	20.28	20.55	23.43	30.00	-6.57
High	2457	20.05	19.88	22.98	30.00	-7.02
High	2462	18.48	18.85	21.68	30.00	-8.32

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OUTPUT POWER, Chain 0





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OUTPUT POWER, Chain 1



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8.3.5. PSD

LIMITS

FCC §15.247

IC RSS-210 A8.2

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

PSD Results

Channel	Frequency	Chain 0	Chain 1	Total	Limit	Margin
		Meas	Meas	PSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	2412	-1.57	-0.44	2.04	8.0	-6.0
Mid	2437	-1.36	-0.44	2.13	8.0	-5.9
High	2462	-2.45	-0.86	1.43	8.0	-6.6

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PSD, Chain 0





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PSD, Chain 1



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8.3.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the inband reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

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RESULTS

IN-BAND REFERENCE LEVEL, Chain 0



LOW CHANNEL BANDEDGE, Chain 0



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HIGH CHANNEL BANDEDGE, Chain 0



OUT-OF-BAND EMISSIONS, Chain 0



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							Mkr	2 18 78	0.687	
ef 20 dBi 'eak ⊡	n	Atten 20	dB			1		-56.03	dBm	Center Fred 13.0150000 GH
g –	4									<u> </u>
8/										Start Fred 30.0000000 MH
.7										Stop Fre 26.000000 GH
5.4 -		+					2			
βm PA∨g —	war hereward	******	urturretur#				a a di sua ana a di sua a di sua a di sua di su Internetta di sua di			2.59700000 GH Auto <u>N</u>
art 30 M tes BW 1	Hz 100 kHz		#VB	W 300	kHz	Swee	Sto p 2.482	р 26.00 s (2001	0 GHz pts)	Freq Offset
Marker	Trace	Туре		×	Axis		•	Amplitu	Jde	0.0000000 Hz
1 2	(1) (1)	Freq Freq		2.4 18.7	82 GHz 80 GHz			3.85 dE -56.03 dB	im Im	Signal Trac On <u>(</u>



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IN-BAND REFERENCE LEVEL, Chain 1



LOW CHANNEL BANDEDGE, Chain 1



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