

### FCC CFR47 PART 15 SUBPART C INDUSTRY CANADA RSS-210 ISSUE 8

**CERTIFICATION TEST REPORT** 

FOR

IEEE 802.11a/b/g/n AND BLUETOOTH RADIO

**MODEL NUMBER: A1421** 

FCC ID: BCG-A1421 IC: 579C-A1421

REPORT NUMBER: 12U14485-3

ISSUE DATE: JULY 31, 2012

Prepared for APPLE, INC. 1 INFINITE LOOP CUPERTINO, CA 95014, U.S.A

Prepared by UL CCS 47173 BENICIA STREET FREMONT, CA 94538, U.S.A. TEL: (510) 771-1000 FAX: (510) 661-0888

R

NVLAP LAB CODE 200065-0

### **Revision History**

Rev.	Issue Date	Revisions	Revised By
	07/31/2012	Initial Issue	T. LEE

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 2 of 111

# TABLE OF CONTENTS

1.	ATTESTATION OF TEST RESULTS	5
2.	TEST METHODOLOGY	6
3.	FACILITIES AND ACCREDITATION	6
4.	CALIBRATION AND UNCERTAINTY	6
4	4.1. MEASURING INSTRUMENT CALIBRATION	6
4	4.2. SAMPLE CALCULATION	6
4	4.3. MEASUREMENT UNCERTAINTY	6
5.	EQUIPMENT UNDER TEST	7
5	5.1. DESCRIPTION OF EUT	7
5	5.2. MAXIMUM OUTPUT POWER	7
5	5.3. DESCRIPTION OF AVAILABLE ANTENNAS	7
5	5.4. SOFTWARE AND FIRMWARE	7
5	5.5. WORST-CASE CONFIGURATION AND MODE	7
5	5.1. DESCRIPTION OF TEST SETUP	8
6.	TEST AND MEASUREMENT EQUIPMENT	10
7.	ANTENNA PORT TEST RESULTS	11
7	7.1. BASIC DATA RATE GFSK MODULATION	
	7.1.1. 20 dB AND 99% BANDWIDTH	
	7.1.4. AVERAGE TIME OF OCCUPANCY	
	7.1.5. OUTPUT POWER	
	7.1.6. AVERAGE POWER	34
	7.1.7. CONDUCTED SPURIOUS EMISSIONS	35
7	7.1. ENHANCED DATA RATE QPSK MODULATION	44
	7.1.1. OUTPUT POWER	
	7.1.2. AVERAGE POWER	
7	7.2. ENHANCED DATA RATE 8PSK MODULATION	
	7.2.1. HOPPING FREQUENCI SEPARATION	
	7.2.3. AVERAGE TIME OF OCCUPANCY	61
	7.2.4. OUTPUT POWER	68
	7.2.5. AVERAGE POWER	72
	7.2.6. CONDUCTED SPURIOUS EMISSIONS	73
8.	RADIATED TEST RESULTS	82
8	8.1. LIMITS AND PROCEDURE	82
	Page 3 of 111	

ä	3.2.	TRAN	SMITTER ABOVE 1 GHz	
	8.2.	1. B/	ASIC DATA RATE GFSK MODULATI	ON83
	8.2.	2. El	NHANCED DATA RATE 8PSK MODU	JLATION
ě	3.3.	WORS	T-CASE BELOW 1 GHz	
9.	AC	POWE	R LINE CONDUCTED EMISSIONS	
10	S	ETUP F	°HOTOS	

Page 4 of 111

# 1. ATTESTATION OF TEST RESULTS

DATE TESTED:	JULY 03 - JULY 31, 2012
SERIAL NUMBER:	CCQHT01CF4K3
MODEL:	A1421
EUT DESCRIPTION:	IEEE 802.11a/b/g/n and Bluetooth radio
COMPANY NAME:	APPLE, INC. 1 INFINITE LOOP CUPERTINO, CA, 95014, U.S.A.

APPLICABLE STANDARDS						
STANDARD	TEST RESULTS					
CFR 47 Part 15 Subpart C	Pass					
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass					
INDUSTRY CANADA RSS-GEN Issue 3	Pass					

UL CCS 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 CCS 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS 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 CCS By:

Ti (1)

TIM LEE STAFF ENGINEER UL CCS

Tested By:

TOM CHEN EMC ENGINEER UL CCS

UL CCS

Page 5 of 111

# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, 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 Benicia Street, Fremont, California, USA.

UL CCS 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

# 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%.

# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

Model A1421, is a iPod Touch with multimedia functions (music, application support, and video), IEEE 802.11a/b/g/n and Bluetooth radio. The rechargeable battery is not user accessible.

## 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range	Mode	Output Power	Output Power
(MHz)		(dBm)	(mW)
2402 - 2480	Basic GFSK	14.34	27.16
2402 - 2480	Enhanced 8PSK	13.50	22.39

## 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain of -1.11 dBi in the 2.4 GHz band.

## 5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 10A351.

The EUT driver software installed in the host support equipment during testing was Broadcom\_Rel\_6\_10\_56\_158.

The test utility software used during testing was WL\_tool.

# 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 X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

# 5.1. DESCRIPTION OF TEST SETUP

#### SUPPORT EQUIPMENT

Support Equipment List					
Description	Manufacturer	Model	Serial Number		
AC Adapter	Apple	A1344	NA		
Laptop PC	Apple	MacBook Pro	NA		
Directional Coupler	RF-Lambda	RFDC5M06G15	NA		
Headset	Apple	NA	NA		

#### I/O CABLES (Conducted Setup)

Cable No.	Port	# of Identic Ports	Connector Type	Cable Type	Cable Length	Remarks
1	In/Out	1	SMA	Shielded	0.2m	NA
2	In/Out	1	SMA	Shielded	0.6m	NA
3	Antenna Port	1	SMA	Shielded	0.1m	NA
4	Laptop	1	USB	Un-shielded	1m	NA

#### I/O CABLES (Radiated Setup)

	I/O CABLE LIST							
Cable No.	Port	# of Identic Ports	Connector Type	Cable Type	Cable Length	Remarks		
1	AC	1	US115VAC	Un-Shielded	2m	NA		
2	DC	1	DC	Un-Shielded	1m	NA		
3	Jack	1	Earphone	Shielded	0.5m	NA		
4	Antenna Port	1	Horn	Un-shielded	2m	NA		

#### SETUP DIAGRAM FOR CONDUCTED TESTS



#### SETUP DIAGRAM FOR CONDUCTED TESTS



Page 9 of 111

# 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 Due			
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	07/14/13			
Antenna, Horn, 18 GHz	EMCO	3115	C00945	06/29/13			
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	11/11/12			
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	07/12/13			
Horn Antenna, 26.5 GHz	ARA	MWH-1826/B	C00589	07/28/13			
Horn Antenna, 40 GHz	ARA	MWH-2640/B	C00981	05/10/13			
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	03/14/13			
Reject Filter, 2.0-2.9 GHz	Micro-Tronics	BRM50702	N02684	CNR			
High Pass Filter, 7.6 GHz	Micro-Tronics	HPM13195	N02682	CNR			
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01159	04/09/13			
Peak Power Meter	Agilent	N1911A	1260847C	08/04/12			
Peak Power Sensor	Agilent	E9323A	1244073F	08/04/12			
Reject Filter, 5.725-5.825 GHz	Micro-Tronics	BRC13192	N02676	CNR			
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRM50702	N02685	CNR			
Highpass Filter, 7.6 GHz	Micro-Tronics	HPM13195	N02682	CNR			
EMI Test Receiver, 30MHz	R&S	ESHS 20	N02396	08/19/13			
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	12/13/12			

Page 10 of 111

# 7. ANTENNA PORT TEST RESULTS

## 7.1. BASIC DATA RATE GFSK MODULATION

### 7.1.1. 20 dB AND 99% BANDWIDTH

#### <u>LIMIT</u>

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq$  1% of the 20 dB bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.

#### **RESULTS**

Channel	Frequency	20 dB Bandwidth	99% Bandwidth	
	(MHz)	(kHz)	(kHz)	
Low	2402	987.82	1019.2	
Middle	2441	990.17	1018.0	
High	2480	990.24	1018.0	

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 11 of 111

#### 20 dB BANDWIDTH





Page 12 of 111



Page 13 of 111

#### 99% BANDWIDTH





Page 14 of 111



Page 15 of 111

### 7.1.2. HOPPING FREQUENCY SEPARATION

#### LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

#### **RESULTS**

Page 16 of 111

#### **HOPPING FREQUENCY SEPARATION**



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 17 of 111

### 7.1.3. NUMBER OF HOPPING CHANNELS

#### LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 nonoverlapping channels.

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

#### **RESULTS**

Normal Mode: 79 Channels observed.

Page 18 of 111

#### NUMBER OF HOPPING CHANNELS



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 19 of 111



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 20 of 111



Page 21 of 111



Page 22 of 111

### 7.1.4. AVERAGE TIME OF OCCUPANCY

#### <u>LIMIT</u>

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels \* 0.4 s) is equal to 10 \* (# of pulses in 3.16 s) \* pulse width.

For AFH mode, the average time of occupancy in the specified 8 second period (20 channels \* 0.4 seconds) is equal to 10 \* (# of pulses in 0.8 s) \* pulse width.

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.375	32	0.120	0.4	-0.280
DH3	1.635	14	0.229	0.4	-0.171
DH5	2.87	11	0.316	0.4	-0.084

#### **RESULTS**

Page 23 of 111

### PULSE WIDTH - DH1

- Agrietit 14.3	ال 30.4	u u, zu	12				A ML	۲ 1 77	<u> </u>	
ef 30 dBm Peak	#	Atten 3	0 dB					1.3	31 dB	Center Freq 2.44100000 GHz
og ) 1R B/	1 <b>(</b>									Start Freq 2.44100000 GHz
B										Stop Freq 2.44100000 GHz
gAv										CF Ste 1.0000000 MHz <u>Auto M</u>
/1 S2 3 VS	-	hphhh	KVN/MRV	uter and the state of the state	AN THE AND	ww.ihuut	hin the state of the	r <sup>a</sup> ndhaddoo	htter http://html	Freq Offset 0.00000000 Hz
f): Tun										Signal Track On <u>O</u>
enter 2.441 000	) GHz		v	BW 1 M	H7			Spa me (601	in 0 Hz	

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 24 of 111

#### NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH1



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 25 of 111

#### PULSE WIDTH - DH3



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 26 of 111

#### NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH3



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

### PULSE WIDTH – DH5

U14485			61		7 ms	
ef 30 dBm Peak	#Atten 30 dB			0.5	7 dB	Center Freq 2.44100000 GHz
og 1R 3/ ∲						Start Freq 2.44100000 GHz
itst						Stop Fred 2.44100000 GH;
JAν						CF Ste 1.00000000 MH: <u>Auto M</u>
1 S2 3 VS AA		where the second	antherited and a second	Hole and the state	terry and	Freq Offset 0.00000000 Hz
f): Γun						Signal Tracl On <u>C</u>
enter 2.441 000	GHz			Spai	n O Hz	

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 28 of 111

#### NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH5



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 29 of 111

## 7.1.5. OUTPUT POWER

#### <u>LIMIT</u>

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

#### **RESULTS**

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	14.07	30	-15.93
Middle	2441	14.22	30	-15.78
High	2480	14.34	30	-15.66

Page 30 of 111

### OUTPUT POWER

Agrient 15.6	0.00 0010,2012			1. 1	
∪14485 ∋f30 dBm ?eak	#Atten 30	dB	Mkr1 2	2.401 800 GHz 14.07 dBm	Center Freq 2.40200000 GHz
9g					Start Freq 2.39700000 GHz
tst					Stop Fred 2.40700000 GHz
JAV				- Winner	CF Ste 1.00000000 MHz <u>Auto M</u>
1 S2 FS ΔΔ					Freq Offset 0.00000000 Hz
): Tun Vp					Signal Track On <u>C</u>
enter 2.402 000	GHz			Span 10 MHz	

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 31 of 111



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 32 of 111

Agilent 15:08:42 Jul 3, 2012       12U14485       Ref 30 dBm       #Peak       Log       0dB/       Offst       17       dB       LgAv       M1 S2       S3 FS       Add	R T kr1 2.479 917 GHz 14.34 dBm	Ereq/Channel Center Freq 2.48000000 GHz Start Freq 2.47500000 GHz Stop Freq 2.48500000 GHz
12U14485 M Ref 30 dBm #Atten 30 dB #Peak Log 10 dB/ Offst 17 dB LgAv M1 S2 S3 FS AA	kr1 2.479 917 GHz 14.34 dBm	Center Freq 2.48000000 GHz Start Freq 2.47500000 GHz Stop Freq 2.48500000 GHz CF Step
Log 10 dB/ Offst 17 dB LgAv M1 S2 S3 FS AA		Start Freq 2.47500000 GHz Stop Freq 2.48500000 GHz CF Step
Offst 17 dB		Stop Freq 2.48500000 GHz CF Step
LgAv M1 S2 S3 FS AA		CF Step
M1 S2 S3 FS AA	- I I N	1.0000000 MHz <u>Auto Man</u>
		Freq Offset 0.00000000 Hz
¤(f): [ FTun [ Swp [ Tun]		Signal Track On <u>Off</u>
Center 2.480 000 GHz #Res BW 3 MHz Swe		

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 33 of 111

### 7.1.6. AVERAGE POWER

#### <u>LIMIT</u>

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### **RESULTS**

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	13.60
Middle	2441	13.72
High	2480	13.80

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 34 of 111

### 7.1.7. CONDUCTED SPURIOUS EMISSIONS

#### **LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

#### **RESULTS**

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 35 of 111

#### SPURIOUS EMISSIONS, LOW CHANNEL



UL CCS 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL CCS. FORM NO: CCSUP4701G TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 36 of 111
LOW CHAI	NNEL SPI 25:35 Jul 3, 2012					R	? Т	Freq/Channel
12U14485 Ref 30 dBm	#Atten 30	dB			Mkr	1 14.3 -35.60	6 GHz dBm	Center Freq
#Peak Log 10 dB/								Start Freq 30.0000000 MHz
Offst 17 dB DI								Stop Freq 26.000000 GHz
-6.1 dBm LgAv								CF Step 2.59700000 GHz <u>Auto Man</u>
M1 S2 S3 FS AA	man	and the second second	A Marca	and the second		n.l	W	Freq Offset 0.00000000 Hz
¤(f): FTun Swp								Signal Track On <u>Off</u>
Start 30 MHz #Res BW 100 kH	 Iz	VBW 300 I	Hz	Sweep	Sto 8.775	op 26.00 s (601	0 GHz Î pts)	
Copyright 2000-2	011 Agilent Tech	nologies						

Page 37 of 111

# SPURIOUS EMISSIONS, MID CHANNEL



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 38 of 111

MID CHANNEL	SPURIOUS	R T	Freq/Channel
12U14485 Ref 30 dBm #/	Atten 30 dB	Mkr1 13.97 GHz -36.01 dBm	Center Freq 13.0150000 GHz
#Feak Log 10 dB/			Start Freq 30.0000000 MHz
Offst 17 dB DI			Stop Freq 26.000000 GHz
-6.0 dBm LgAv			CF Step 2.59700000 GHz <u>Auto Man</u>
M1 S2 S3 FS AA	w Marine Marine Marine	man and the second seco	Freq Offset 0.00000000 Hz
¤(f): FTun Swp			Signal Track On <u>Off</u>
Start 30 MHz #Res BW 100 kHz	VBW 300 kHz	Stop 26.00 GHz Sweep 8.775 s (601 pts)	

# SPURIOUS EMISSIONS, HIGH CHANNEL



UL CCS 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL CCS. FORM NO: CCSUP4701G TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 40 of 111

HIGH CH	ANNEL SI		S					
Agilent 15	:41:16 Jul 3, 20	12				+		Freq/Channel
Ref 30 dBm #Peak	#Atten 3	30 dB			MK	-36.74	dBm	Center Freq 13.0150000 GHz
Log 10 dB/								Start Freq 30.000000 MHz
offist 17 dB								Stop Freq 26.000000 GHz
-5.8 dBm LgAv								CF Step 2.59700000 GHz Auto Man
M1 S2 S3 FS	han a work	Con Marine	Jun Aun	معليا سياتشيه	an M	mon	~~~	Freq Offset 0.00000000 Hz
AA ,∧,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,								Signal Track On <u>Off</u>
Start 30 MHz #Res BW 100 I	(H7	VBW 30	0 kH7	Swe	St ep 8.775	op 26.0 s <i>(</i> 601	0 GHz	
Copyright 2000-	2011 Agilent Te	chnologies	_				. /	

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 41 of 111

#### SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



UL CCS 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL CCS. FORM NO: CCSUP4701G TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 42 of 111



Page 43 of 111

# 7.1. ENHANCED DATA RATE QPSK MODULATION

# 7.1.1. OUTPUT POWER

## <u>LIMIT</u>

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

## TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

#### **RESULTS**

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	12.65	30	-17.35
Middle	2441	12.51	30	-17.49
High	2480	12.52	30	-17.48

Page 44 of 111

# OUTPUT POWER

: Aynem 13:48:34	JUI 30, 2012			K I	IFreq/Channel
1014485 af 20.5 dBm	#Atten 20 d	B	Mkr1 2.40	1 733 GHz 12.65 dBm	Center Freq 2.40200000 GHz
)g		↓ ♦			
3/					Start Freq 2.39700000 GHz
fst			- I I I	$\langle    $	
'					Stop Freq 2.40700000 GHz
				X	CF Ste
gAv					1.00000000 MHz
FC					Freq Offset
АА					0.00000000 112
): Tun					Signal Track
vp					On <u>O</u>
enter 2.402 000 GH	z		S	pan 10 MHz	

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 45 of 111



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 46 of 111

PEAK		WER	≀ HIG		4					) т	
12U1448 Ref 20.5	ient 13: 35 5 dBm	54:51	#Atten 2	0 dB				Mkr1 2.	+ 479 817 12.52	≺ 7GHz 2dBm	Center Freq
#A∨g Log 10					1 •						Start Freq
dB/ Offst 14									$\overline{\}$		2.47500000 GHz Stop Fred
ab .	A									$\overline{\}$	2.48500000 GHz
#LgAv	,										1.00000000 MHz <u>Auto Man</u>
V1 S2 S3 FC AA											Freq Offset 0.00000000 Hz
⊐(f): FTun Swp											Signal Track On <u>Off</u>
 Center2 ≇Res BV	2.480 00 N 3 MH	DO GHz z		v	BW 3 M	Hz	#Swee	o 19.32 i	Span ns (601	10 MHz pts)	
Copyrigh	nt 2000-:	2011 A(	gilent Teo	chnologi	es						

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 47 of 111

# 7.1.2. AVERAGE POWER

#### <u>LIMIT</u>

None; for reporting purposes only.

## TEST PROCEDURE

The transmitter output is connected to a power meter.

## **RESULTS**

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	11.50
Middle	2441	11.50
High	2480	11.60

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 48 of 111

# 7.2. ENHANCED DATA RATE 8PSK MODULATION

# 7.2.1. 20 dB AND 99% BANDWIDTH

#### <u>LIMIT</u>

None; for reporting purposes only.

## TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq$  1% of the 20 dB bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.

## **RESULTS**

Channel	Frequency	20 dB Bandwidth	99% Bandwidth
	(MHz)	(kHz)	(kHz)
Low	2402	1.123	1049.6
Middle	2441	1.126	1050.1
High	2480	1.123	1051.8

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 49 of 111

#### 20 dB BANDWIDTH





Page 50 of 111



Page 51 of 111

#### 99% BANDWIDTH





Page 52 of 111

BANDWIDTH HIGH CH           ※ Agilent 17:48:54 Jul 31, 2012         R T	Measure
Ch Freq 2.48 GHz Trig Free Occupied Bandwidth	Meas Off
12U14485	Channel Power
Ref 20 dBm #Atten 20 dB #Samp Log	Occupied BW
10 dB/ Offst 13.5 √/ Aµ/(1) √/ 4µ/(1) √/ 4	ACP
dB	Multi Carrier Power
#Res BW 30 kHz #VBW 100 kHz #Sweep 250 ms (601 pts)	
Occupied Bandwidth Occ BW % Pwr 99.00 % 1.0518 MHz × dB -26.00 dB	Power Stat CCDF
Transmit Freq Error 44.172 kHz x dB Bandwidth 1.134 MHz*	More 1 of 2
Copyright 2000-2011 Agilent Technologies	

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 53 of 111

# 7.2.1. HOPPING FREQUENCY SEPARATION

# LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

## **RESULTS**

Page 54 of 111

#### **HOPPING FREQUENCY SEPARATION**



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 55 of 111

# 7.2.2. NUMBER OF HOPPING CHANNELS

## LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 nonoverlapping channels.

## TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

#### **RESULTS**

Normal Mode: 79 Channels observed.

Page 56 of 111

#### NUMBER OF HOPPING CHANNELS



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 57 of 111



Page 58 of 111



UL CCS 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL CCS. FORM NO: CCSUP4701G TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 59 of 111



Page 60 of 111

# 7.2.3. AVERAGE TIME OF OCCUPANCY

# <u>LIMIT</u>

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

## TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels \* 0.4 s) is equal to 10 \* (# of pulses in 3.16 s) \* pulse width.

## **RESULTS**

# 8PSK (EDR) Mode

DH Packet	Pulse	Number of	Average	Limit	Margin
	Width	Pulses in	Time of		
	(msec)	3.16	(sec)	(sec)	(sec)
		seconds			
DH1	0.38	29	0.110	0.4	-0.290
DH3	1.635	11	0.180	0.4	-0.220
DH5	2.9	6	0.174	0.4	-0.226

Page 61 of 111

# PULSE WIDTH - DH1

2114485	71.22 0	ur 5, 20	14				A Mk	r1 38	ົ້	
ef 30 dBm Peak	ŧ	≠Atten 3	0 dB					1.1	14 dB	Center Freq 2.44100000 GHz
og ) ⊥R B/ <b>♦ • •</b>	1									Start Freq 2.44100000 GHz
B										Stop Frec 2.44100000 GHz
gAv										CF Ste 1.0000000 MHz <u>Auto M</u>
/1 S2 3 VS AA	- Mar	* <b> </b>	1. soffwardt f	-	htyl telle	Marapalfo	ertilden ber	<del>Mh#//</del> /	₩₩₩₩	Freq Offset 0.00000000 Hz
f): Fun										Signal Track On <u>O</u>
enter 2.441 00	0 GHz			DW 1 M				Spa ma (601	in 0 Hz	

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 62 of 111

#### NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH1



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 63 of 111

# PULSE WIDTH – DH3

	2.20 JULJ, 2012		A Milet 1 627	
2014465 Ref 30 dBm Peak	#Atten 30 dB		-0.75 dB	Center Freq 2.44100000 GHz
.og 0 1ℝ  B/ ♦		1 •		Start Freq 2.44100000 GHz
)ffst 7 IB				Stop Freq 2.44100000 GHz
.gAv				CF Step 1.00000000 MHz <u>Auto Ma</u>
V1 S2 53 VS AA		hydrifthy	www.www.www.www.www.	Freq Offset 0.00000000 Hz
(f): Tun				Signal Track
Center 2.441 000	) GHz	BW 1 MHz	Span 0 Hz Sweep 3 ms (601 pts)	

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 64 of 111

#### NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH3



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 65 of 111

# PULSE WIDTH – DH5

	17 Jul J, 2012		
Ref 30 dBm #Peak	#Atten 30 dB	1.54 dE	Center Freq 2.44100000 GHz
-og			Start Freq 2.44100000 GHz
7 IB			Stop Freq 2.44100000 GHz
.gAv			CF Step 1.00000000 MHz <u>Auto Ma</u>
V1 S2 53 VS <mark>44-идириници</mark> АА	where we want the second se	deeplothelikelikelikelikelikelikelikelikelikelik	Freq Offset 0.00000000 Hz
(f): Tun			Signal Track OnO1
Center 2.441 000 @	GHz VBW 1 MI	Span 0	Hz

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 66 of 111

#### NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH5



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 67 of 111

# 7.2.4. OUTPUT POWER

# <u>LIMIT</u>

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

#### **RESULTS**

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	13.24	30	-16.76
Middle	2441	13.39	30	-16.61
High	2480	13.50	30	-16.50

Page 68 of 111

#### **OUTPUT POWER**



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 69 of 111



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 70 of 111

			4					) т	Frag(Chappal
12U14485 Ref 30 dBm #Peak	# <b>A</b>	tten 30 dB				Mkr1 2	.479 900 13.50	) GHz ) dBm	Center Freq 2.48000000 GHz
Log 10 dB/			1						Start Freq 2.47500000 GHz
Offst 17 dB								×	Stop Freq 2.48500000 GHz
LgAv									CF Step 1.00000000 MHz Auto Man
M1 S2 S3 FS									Freq Offset 0.00000000 Hz
AA ⊐(f): FTun Swp									Signal Track On <u>Off</u>
Center 2.480 #Res BW 3 M	000 GHz	v	BW 3 M	Hz	Sw	eep 20	Span 1 ms (601	10 MHz pts)	
Copyright 2000-2011 Agilent Technologies									

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 71 of 111

# 7.2.5. AVERAGE POWER

## <u>LIMIT</u>

None; for reporting purposes only.

## TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Average Power		
	(MHz)	(dBm)		
Low	2402	11.24		
Middle	2441	11.35		
High	2480	11.45		

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 72 of 111
# 7.2.6. CONDUCTED SPURIOUS EMISSIONS

#### **LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

#### **RESULTS**

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 73 of 111

# SPURIOUS EMISSIONS, LOW CHANNEL



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 74 of 111

LOW CHA	NNEL SPU 80:15 Jul 3, 2012	JRIOUS			RL	Freq/Channel
12U14485 Ref 30 dBm	#Atten 30	dB		Mk	a1 14.10 GHz -36.29 dBm	Center Freq
#Peak Log 10 dB/						- Start Freq 30.000000 MHz
Offst 17 dB DI						Stop Freq 26.0000000 GHz
-7.3 dBm LgAv						CF Step 2.59700000 GHz <u>Auto Man</u>
M1 S2 S3 FS AA	manut	ward and		May and May and	more	Freq Offset 0.00000000 Hz
¤(f): FTun Swp						Signal Track On <u>Off</u>
Start 30 MHz #Res BW 100 kł	lz	VBW 300	kHz S	S1 weep 8.775	top 26.00 GHz 5 s (601 pts)	

UL CCS 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL CCS. FORM NO: CCSUP4701G TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 75 of 111

# SPURIOUS EMISSIONS, MID CHANNEL



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 76 of 111

Agilent 15:3	11NEL SPUP 34:47 Jul 3, 2012	1005		RТ	Freq/Channel
12U14485 Ref 30 dBm	#Atten 30 d	В	M	cr1 14.10 GHz -36.58 dBm	Center Freq
#Peak Log 10					Stort From
dB/ Offst					30.0000000 MHz
17 dB					Stop Freq 26.000000 GHz
DI -7.2 dBm					CF Step
LgA∨					2.59700000 GHz <u>Auto Mar</u>
M1 S2 S3 FS			-	mm	Freq Offset 0.00000000 Hz
AA	many .				Signal Track
Swp					On <u>Off</u>
Center 13.02 GH #Res BW 100 kH	1z	VBW 300 kHz	Sween 8 77	) 2 an 25.97 GHz 5 s /601 pts)	

UL CCS 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL CCS. FORM NO: CCSUP4701G TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 77 of 111

# SPURIOUS EMISSIONS, HIGH CHANNEL



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 78 of 111

HIGH CH	ANNEL SI	PURIOUS	6					
🔆 Agilent 18	5:45:56 Jul 3, 20	12				F	₹ T	Freq/Channel
12U14485 Ref 30 dBm #Reak	#Atten 3	0 dB			Mk	ar1 14.1 -35.50	4 GHz dBm	Center Freq 13.0150000 GHz
H Cak Log 10 dB/								Start Freq 30.0000000 MHz
dB								Stop Freq 26.000000 GHz
-7.2 dBm LgAv								CF Step 2.59700000 GHz <u>Auto Man</u>
M1 S2 S3 FS AA	when when when	W. W. W. W. W.	- And Andrew	and the second s	A	Ym N	w	Freq Offset 0.00000000 Hz
¤(f): FTun Swp								Signal Track On <u>Off</u>
Start 30 MHz #Res BW 100	kHz	VBW 300	kHz	Swe	St ep 8.775	op 26.0 is(601	0 GHz pts)	
Copyright 2000	)-2011 Agilent Te	chnologies						

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 79 of 111

#### SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 80 of 111



Page 81 of 111

# 8. RADIATED TEST RESULTS

# 8.1. LIMITS AND PROCEDURE

# LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

# TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

Page 82 of 111

# 8.2. TRANSMITTER ABOVE 1 GHz

# 8.2.1. BASIC DATA RATE GFSK MODULATION

# RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

Agilent 11:31:1	1 Jul 5, 2012				RΤ	Freq/Channel
e <b>f 120 dB</b> µ∨ Peak	#Atten 0	dB		Mkr1 2	2.321 07 GHz 58.95 dBµ∨	Center Freq 2.35000000 GHz
og 0 B/						Start Freq 2.31000000 GHz
ntist 2.3 B						- Stop Freq 2.3900000 GHz
4.0 Βμ∨						CF Ste 8.0000000 MHz
y~v 1 ∨2 ~~/~/~/~/~/~/~/~/~/~/~/~/~/~/~/~/~/~/~	an a	Ververin-shadnes	untradianteriori	up han makadan	the the states of the second	Freq Offset 0.00000000 Hz
(f): Tun wp						Signal Track OnO
tart 2.310 00 GHz Res BW 1 MHz		#VBW 1 M	I III	Stop 2 Sweep 1	2.390 00 GHz ms (601 pts)	

Page 83 of 111

			P.41.	-1 2 247 07 CU-	
Ref 120 dBµ∨ #Peak	#Atten 0 dB			45.87 dBµ∀	Center Freq 2.3500000 GHz
.og  0  B/					Start Freq 2.31000000 GHz
IB					- Stop Freq 2.39000000 GHz
ј4.0 ІВµ∨ _gAv					CF Step 8.0000000 MHz Auto Ma
S1 V2		>			Freq Offset 0.00000000 Hz
(f): :Tun Swp					Signal Track
Start 2.310 00 GH	z #\/PW	10 Hz	Swoon 6	op 2.390 00 GHz 238 c (601 ptc)	

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 84 of 111

### **RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 85 of 111

🔆 Agilent 11:27:	29 Jul 5, 2012	, , , , , , , , , , , , , , , , , , ,	Freq/Channel
Ref 120 dBµ∨ #Peak	#Atten 0 dB	Mkr1 2.342 13 GHz 45.84 dBµ∀	Center Freq 2.3500000 GHz
Log 10 dB/			- Start Freq 2.31000000 GHz
Diffst 32.3 dB DI			- Stop Freq 2.3900000 GHz
54.0 dBµ∀ LgAv			- CF Step - 8.0000000 MHz Auto Mai
31 V2			- Freq Offset 0.00000000 Hz
*(f): =Tun Swp			Signal Track On <u>Off</u>
Start 2.310 00 GHz #Res BW 1 MHz	 : #VBW 10 H	Stop 2.390 00 GHz z Sweep 6.238 s (601 pts)	

Page 86 of 111

### **RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 87 of 111

🔆 Agilent 12:18:4	17 Jul 5, 2012	R T	Freq/Channel
Ref 120 dBµ∨ #Peak	#Atten 0 dB	Mkr1 2.498 982 5 GHz 46.25 dBµ∀	Center Freq 2.49175000 GHz
Log 10 dB/			Start Freq 2.48350000 GHz
dB			- Stop Freq 2.5000000 GHz
54.0 dBµ∨ ∟gAv			CF Step 1.6500000 MHz <u>Auto Ma</u>
51 V2			Freq Offset 0.00000000 Hz
*(f): =Tun Swp			Signal Track On <u>Off</u>
Start 2.483 500 0 G #Res BW 1 MHz	Hz #VBW 10	Stop 2.500 000 0 GHz Hz Sweep 1.287 s (601 pts)	

Page 88 of 111

### **RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 89 of 111

🔆 Agilent 12:06:3	39 Jul 5, 2012		RT	Freq/Channel
Ref 120 dBµ∨ #Peak	#Atten 0 dB	Mkr1 2.5	00 000 0 GHz 46.27 dBµ∨	Center Freq 2.49175000 GHz
Log 10 dB/				Start Freq 2.48350000 GHz
3150 32.6 dB				Stop Freq 2.50000000 GHz
54.0 dBµ∀ LgAv				CF Step 1.65000000 MHz Auto Mar
51 V2				Freq Offset 0.00000000 Hz
«(f): FTun Swp				Signal Track On <u>Off</u>
Start 2.483 500 0 G #Res BW 1 MHz	Hz #VBW 1	Stop 2.5 0 Hz Sweep 1.28	00 000 0 GHz 7 s (601 pts)	

Page 90 of 111

## HARMONICS AND SPURIOUS EMISSIONS

Date:	:	William 07/05/12	Zhuan	g									
Project #		12U1448	5										
Company	:	Apple											
Test Targ	et:	FCC IC											
Mode Op	er:	Bluetoot	th. GFSI	K									
			,										
	f	Measuren	nent Free	quency	Amp	Preamp (	Gain			Average	Field Stren	gth Limit	
	Dist	Distance	to Anter	nna	D Corr	Distance	Correc	et to 3 me	ters	Peak Fie	ld Strength	Limit	
	Read	Analyzer	Reading		Avg	Average	Field S	trength @	3 m	Margin v	s. Average	Limit	
	AF	Antenna	Factor		Peak	Calculate	d Peak	Field Stre	ength	Margin v	s. Peak Lii	nit	
	CL	Cable Los	<b>SS</b>		HPF	High Pas	s Filter						
f	Dist	Read	AF	CL	Amp	D Corr	Fltr	Corr.	Limit	Margin	Ant. Pol.	Det.	Notes
GHz	(m)	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dB	V/H	P/A/QP	
GFSK, Lo	w Ch. 2	402 MHz											
4.804	3.0	46.2	33.1	6.2	-34.8	0.0	0.0	50.7	74.0	-23.4	V	P	
4.804	3.0	34.5	33.1	6.2	-34.8	0.0	0.0	39.0	54.0	-15.0	V	<u>A</u>	
4.804	3.0	46.8	33.1	6.2	-34.8	0.0	0.0	51.3	74.0	-22.7	H	Р	
4.804	3.0	35.1	33.1	6.2	-34.8	0.0	0.0	39.5	54.0	-14.5	H	<u>A</u>	
GFSK, Mi	de Ch.	2441 MHz											
4.882	3.0	47.3	33.1	6.2	-34.8	0.0	0.0	51.9	74.0	-22.1	V	<u>P</u>	
4.882	3.0	35.2	33.1	6.2	-34.8	0.0		39.8 52.6	54.0	-14.2	V TT	A	
4.002	2.0	49.1	22.1	6.2	-34.0	0.0	0.0	55.0 41.0	74.0	-20.4	п u	<u>г</u>	
+.002 7 323	3.0	44.6	35.8	84	-34.0	0.0	0.0	53.8	74.0	-13.1	H H	P	
7 323	3.0	32.8	35.8	84	-34.9	0.0	0.0	42.1	54.0	-11 9	н	A	
7.323	3.0	47.4	35.8	8.4	-34.9	0.0	0.0	56.7	74.0	-17.3	v V	P	
7.323	3.0	34.6	35.8	8.4	-34.9	0.0	0.0	43.9	54.0	-10.1	v	A	
GFSK, Hi	gh Ch.	2480 MHz	) !	1	1	1				1			
1 060	3.0	45.8	33.2	6.3	-34.8	0.0	0.0	50.5	74.0	-23.5	V	Р	
+.700	3.0	34.1	33.2	6.3	-34.8	0.0	0.0	38.8	54.0	-15.2	V	Α	
+.900 4.960	3.0	45.8	33.2	6.3	-34.8	0.0	0.0	50.5	74.0	-23.5	H	Р	
+.900 4.960 4.960		34.0	33.2	6.3	-34.8	0.0	0.0	38.7	54.0	-15.3	Н	<u>A</u>	
4.960 4.960 4.960 4.960	3.0		36.0	8.4	-34.9	0.0	0.0	53.6	74.0	-20.4	H	Р	
4.960 4.960 4.960 4.960 7.440	3.0 3.0	44.1	,	5 0 4	-34.9	0.0	0.0	42.4	54.0	-11.6	H	A	
4.960 4.960 4.960 7.440 7.440	3.0 3.0 3.0	44.1 32.9	36.0	8.4	ł	( ·			740	1 1 1 1	\$ \$7	D I	
4.960 4.960 4.960 7.440 7.440 7.440	3.0 3.0 3.0 3.0	44.1 32.9 51.1	36.0 36.0	8.4 8.4	-34.9	0.0	0.0	60.7	/4.0	-13.3	<u>v</u>	P	

Page 91 of 111

# 8.2.2. ENHANCED DATA RATE 8PSK MODULATION

## **RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)**



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

		MI-1 2 242 00 CII-	
Ref 120 dBµ∨ #Peak	#Atten 0 dB	MKF1 2.342 00 GHz 45.85 dBµ∀	Center Freq 2.35000000 GHz
.og  0  B/			Start Freq 2.31000000 GHz
IB			Stop Freq 2.39000000 GHz
i4.0 IBμ∨ _gAv			CF Step 8.0000000 MHz Auto Ma
51 V2			Freq Offset 0.00000000 Hz
:(f): :Tun Swp			Signal Track On <u>Off</u>
Start 2.310 00 GH	Z #\/BW 10 H-	Stop 2.390 00 GHz	

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 93 of 111

### **RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 94 of 111

♣ Agilent 12:30:	:08 Jul 5, 2012			R T	Freq/Channel
Ref 120 dBµ∨ #Peak	#Atten 0 dB		Mkr1 2	2.347 73 GHz 45.82 dBµ∀	Center Freq 2.35000000 GHz
Log 10 dB/					Start Freq 2.31000000 GHz
Diffst 32.3 dB DI					Stop Freq 2.39000000 GHz
54.0 dBµ∨ LgAv					CF Step 8.0000000 MHz <u>Auto Ma</u> i
51 V2					Freq Offset 0.00000000 Hz
«(f): FTun Swp					Signal Track On <u>Off</u>
Start 2.310 00 GH: #Res BW 1 MHz	 z #V	/BW 10 Hz	Stop 2 Sweep 6.238	2.390 00 GHz	

Page 95 of 111

### **RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 96 of 111

Agrient 15:57:5	6 JUI5,2012	RI	Freq/Channel
Ref 120 dBµ∨ #Peak	#Atten 0 dB	Mkr1 2.483 500 0 GHz 50.68 dBµ∀	Center Freq 2.49175000 GHz
.og  0  B/			Start Freq 2.48350000 GHz
IB			Stop Freq 2.5000000 GHz
i4.0 IBµ∨ .gAv			CF Step 1.6500000 MHz <u>Auto Ma</u>
31 V2 33 FC <b>P</b>			Freq Offset 0.00000000 Hz
(f): 'Tun Swp			Signal Track On <u>Off</u>
Start 2.483 500 0 G	Hz #VBW 10 H	Stop 2.500 000 0 GHz z Sweep 1.287 s (601 pts)	

UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 97 of 111

### **RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**



UL CCS FORM NO: CCSUP4701G 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 98 of 111

🔆 Agilent 13:33:3	37 Jul 5, 2012			RI	Freq/Channel
Ref 120 dBµ∨ #Peak	#Atten 0 dB		Mkr1 2.4	483 527 5 GHz 46.75 dBµ∨	Center Freq 2.49175000 GHz
Log 10 dB/					Start Freq 2.48350000 GHz
dB					Stop Freq 2.50000000 GHz
54.0 dBµ∀					CF Step 1.6500000 MHz Auto Ma
51 V2					Freq Offset 0.00000000 Hz
×(f): =Tun Swp					Signal Track On <u>Off</u>
Start 2.483 500 0 G	Hz #VB	N 10 Hz	Stop 2.5	500 000 0 GHz 87 s (601 pts)	~

Page 99 of 111

## HARMONICS AND SPURIOUS EMISSIONS

Project #: Company: Fest Target: Mode Oper:		1211448	Test Engr:William ZhuangDate:07/05/12Duris of H13U14485										
Company: Fest Target: Mode Oper:		oject #: 12U14485											
fest Target: Mode Oper:	Company: Apple												
Mode Oper:	:	FCC IC											
Mode Oper: Bluetooth, 8PSK		Bluetoot	h, 8PSF	ζ									
f	F	Measurem	nent Fred	mency	Amp	Preamp (	Gain			Average	Field Stren	eth Limit	
I	Dist	Distance	to Anter	1	D Corr	Distance	Correc	et to 3 me	ters	Peak Fie	ld Strength	Limit	
ī	Read	Analyzer Reading		Δνα	Δ verage	Field S	trength @	3 m	Margin x	is Δverage	Limit		
1	ΔF	Antenna ]	Factor		Peak	Calculate	d Peak	Field Stre	noth	Margin v	is. Peak Lit	nit	
1	CI.	Cable Los	s		HPF	High Pas	s Filter		Ingen	wiaigin v	S. I Cak Lli	int	
,	CL	Cable L03	3			ingn i as	s i nici						
f	Dist	Read	AF	CL	Amp	D Corr	Fltr	Corr.	Limit	Margin	Ant. Pol.	Det.	Notes
GHz	( <b>m</b> )	dBuV	dB/m	dB	dB	dB	dB	dBu V/m	dBuV/m	dB	V/H	P/A/QP	
BPSK, Low	Ch. 24	02 MHz			-								
1.804	3.0	44.1	33.1	6.2	-34.8	0.0	0.0	48.5	74.0	-25.5	V	Р	
1.804	3.0	32.3	33.1	6.2	-34.8	0.0	0.0	36.8	54.0	-17.2	V	Α	
1.804	3.0	42.8	33.1	6.2	-34.8	0.0	0.0	47.3	74.0	-26.7	Н	Р	
1.804	3.0	31.3	33.1	6.2	-34.8	0.0	0.0	35.7	54.0	-18.3	H	A	
BPSK, Mid (	<u>Ch. 24</u>	41 MHz	ļ	ļ	ļ	ļ							
.882	3.0	46.1	33.1	6.2	-34.8	0.0	0.0	50.6	74.0	-23.4	H	Р	
1.882	3.0	33.6	33.1	6.2	-34.8	0.0	0.0	38.2	54.0	-15.8	H	A	
1.882	3.0	42.0	33.1	6.2	-34.8		0.0	46.6	74.0	-27.4	V.	P	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
1.882	3.0	31.0	33.1	6.2	-34.8	0.0	0.0	35.5	54.0	-18.5	<u>V</u>	<u>A</u>	
1 2 2 2	2.0	42.5	25.0	0.4 9.4	-34.9	0.0	0.0	20.1	74.0	-22.4	V V	F	
1 2 2 2	2.0	29.0	25.0	0.4 9.4	-34.9	0.0	0.0	39.1	54.0 74.0	-14.9	 	A D	
323	3.0	24.4	35.8	84	-34.9	0.0	0.0	43.5	54.0	-20.3	н		
SPSK. High	Ch. 2	480 MHz					0.0		2-1.0				~~~~~~
.960	3.0	48.8	33.2	6.3	-34.8	0.0	0.0	53.5	74.0	-20.5	Н	Р	
1.960	3.0	35.5	33.2	6.3	-34.8	0.0	0.0	40.2	54.0	-13.8	Н	A	
1.960	3.0	48.6	33.2	6.3	-34.8	0.0	0.0	53.3	74.0	-20.7	V	Р	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
1.960	3.0	35.5	33.2	6.3	-34.8	0.0	0.0	40.2	54.0	-13.8	V	A	
/.440	3.0	45.5	36.0	8.4	-34.9	0.0	0.0	55.0	74.0	-19.0	V	Р	
/.440	3.0	31.7	36.0	8.4	-34.9	0.0	0.0	41.2	54.0	-12.8	<u>V</u>	Α	
/.440	3.0	38.8	36.0	8.4	-34.9	0.0	0.0	48.3	74.0	-25.7	H	Р	
/.440	3.0	27.5	36.0	8.4	-34.9	0.0	0.0	37.1	54.0	-16.9	Н	A	
Rev. 4.1.2.7													
Note: No ot	ther ei	missions	were de	tected	l above t	he syster	n nois	e floor.					

# 8.3. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



Page 101 of 111

#### SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)



Page 102 of 111

Project No.	12014485							
Client Name:Apple								
Model /Device:A18								
Config /Other:Worst Case								
Test By:William Zhuang								
		•						
Horizontal	30 - 1000MI	lz						
			T122 Sunol	5mB Amp		CFR 47 Part		
Test	Meter		Bilog.TXT	Path 30-		15 Class B		
Frequency	Reading	Detector	(dB)	1000MHz (dB)	dBuV/m	3m	Margin	Polarity
48.4153	36.24	РК	8.6	-29.1	15.74	40	-24.26	Horz
602.2302	36.74	РК	18.5	-26.5	28.74	46	-17.26	Horz
645.4576	31.07	РК	19.9	-26.5	24.47	46	-21.53	Horz
691.3989	32.15	РК	20	-26.2	25.95	46	-20.05	Horz
Vertical 30 -	• 1000MHz							
			T122 Sunol	5mB Amp		CFR 47 Part		
Test	Meter		Bilog.TXT	Path 30-		15 Class B		
Frequency	Reading	Detector	(dB)	1000MHz (dB)	dBuV/m	3m	Margin	Polarity
	38 01	РК	12.4	-29.2	21.21	40	-18.79	Vert
41.8245	50.01				22 01	40	-17.09	Vert
41.8245 55.5875	44.71	РК	7.2	-29	22.91	10		
41.8245 55.5875 154.6423	44.71 35.9	РК РК	7.2 12.5	-29 -28	22.91	43.5	-23.1	Vert
41.8245 55.5875 154.6423 195.1559	44.71 35.9 36.53	PK PK PK	7.2 12.5 11.9	-29 -28 -27.6	20.4 20.83	43.5 43.5	-23.1 -22.67	Vert Vert
41.8245 55.5875 154.6423 195.1559 463.8249	44.71 35.9 36.53 43.21	РК РК РК РК	7.2 12.5 11.9 17.2	-29 -28 -27.6 -26.9	20.4 20.83 33.51	43.5 43.5 43.5 46	-23.1 -22.67 -12.49	Vert Vert Vert

Page 103 of 111

# 9. AC POWER LINE CONDUCTED EMISSIONS

# LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

Frequency of Emission (MHz)	Conducted I	.imit (dBuV)
	Quasi-peak	Average
0.15-0.5	66 to 56 "	56 to 46 *
0.5-5	56	46
5-30	60	50

\* Decreases with the logarithm of the frequency.

# TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

**RESULTS** 

Page 104 of 111

#### **<u>6 WORST EMISSIONS</u>**

Project No:12U14485 Client Name:Apple Inc. Model/Device:Bluetooth worst case Test Volt/Freq:120 VAC / 60Hz Test By:Tom Chen

Line-L1 .15 - 30MHz

			T24 IL	LC Cables		CFR 47 Part		CFR 47 Part	
Test	Meter		L1.TXT	1&3.TXT		15 Class B		15 Class B	
Frequency	Reading	Detector	(dB)	(dB)	dB(uVolts)	QP	Margin	Avg	Margin
0.2805	47.44	РК	0.1	0	47.54	60.8	-13.26	-	-
0.2805	34.99	Av	0.1	0	35.09	-	-	50.8	-15.71
0.5685	48.34	РК	0.1	0	48.44	56	-7.56	-	-
0.5685	35.41	Av	0.1	0	35.51	-	-	46	-10.49
0.861	44.75	РК	0.1	0	44.85	56	-11.15	-	-
0.861	24.87	Av	0.1	0	24.97	-	-	46	-21.03
Line-L2.15	- 30MHz								
			T24 IL	LC Cables		CFR 47 Part		CFR 47 Part	
Test	Meter		L2.TXT	2&3.TXT		15 Class B		15 Class B	
Frequency	Reading	Detector	(dB)	(dB)	dB(uVolts)	QP	Margin	Avg	Margin
0.2625	45.07	РК	0.1	0	45.17	61.4	-16.23	-	-
0.2625	27.21	Av	0.1	0	27.31	-	-	51.4	-24.09
0.5055	39.64	РК	0.1	0	39.74	56	-16.26	-	-
0 5055	20.24	Δ	0.1	0	20.44	-	-	46	-25.56
0.5055	20.54	AV	0.1	0	-				
0.7485	38.64	PK	0.1	0	38.74	56	-17.26	-	-

Page 105 of 111

#### LINE 1 RESULTS



Page 106 of 111

### LINE 2 RESULTS



Page 107 of 111