

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

CERTIFICATION TEST REPORT

FOR

GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/LTE radio, IEEE 802.11a/b/g/n and Bluetooth radio

MODEL NUMBER: A1428 and A1429

FCC ID: BCG-E2599A IC: 579C-E2599A IC: 579C-E2610A

REPORT NUMBER: 11U14136-4, Revision A

ISSUE DATE: AUGUST 7, 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

NVLAP LAB CODE 200065-0

Revision History

Rev.	Date	Revisions	Revised By
-	07/27/2012	Original	T. LEE
А	08/07/2012	Added Model A1429	T. LEE

UL CCS FORM NO: CCSUP4701D 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 45

TABLE OF CONTENTS

1.	ATTESTATION OF TEST RESULTS4			
2.	TEST	METHODOLOGY	.5	
3.	FACILI	TIES AND ACCREDITATION	.5	
4.	CALIB	RATION AND UNCERTAINTY	.5	
4	4.1.	MEASURING INSTRUMENT CALIBRATION	.5	
4	4.2.	SAMPLE CALCULATION	.5	
4	4.3.	MEASUREMENT UNCERTAINTY	.5	
5.	EQUIP	MENT UNDER TEST	.6	
5	5.1.	DESCRIPTION OF EUT	.6	
5	5.2.	MAXIMUM OUTPUT POWER	.6	
5	5.3.	DESCRIPTION OF AVAILABLE ANTENNAS	.6	
5	5.4.	SOFTWARE AND FIRMWARE	.6	
5	5.5.	MODEL DIFFERNECE	.6	
5	5.6.	WORST-CASE CONFIGURATION AND MODE	. 7	
5	5.7.	DESCRIPTION OF TEST SETUP	.8	
6.	TEST	AND MEASUREMENT EQUIPMENT1	1	
6. 7.		AND MEASUREMENT EQUIPMENT1	1 2	
6. 7.	TEST A ANTEN 7.1.	AND MEASUREMENT EQUIPMENT1 INA PORT TEST RESULTS1 6 dB BANDWIDTH	1 2 12	
6. 7. 7	TEST / ANTEN 7.1. 7.2.	AND MEASUREMENT EQUIPMENT	11 12 12	
6. 7. 7	TEST / ANTEN 7.1. 7.2. 7.3.	AND MEASUREMENT EQUIPMENT	12 12 15	
6. 7. 7 7 7	TEST / ANTEN 7.1. 7.2. 7.3. 7.4.	AND MEASUREMENT EQUIPMENT	11 12 112 115 118 21	
6. 7. 7 7 7	TEST / ANTEN 7.1. 7.2. 7.3. 7.4. 7.5.	AND MEASUREMENT EQUIPMENT	11 12 15 18 21 22	
6. 7. 7 7 7 7 7 7 7	TEST / ANTEN 7.1. 7.2. 7.3. 7.4. 7.5. 7.6.	AND MEASUREMENT EQUIPMENT	12 12 15 18 21 22 25	
6. 7. 7 7 7 7 7 7 7 7 7 7 7 7 7 8.	TEST / ANTEN 7.1. 7.2. 7.3. 7.4. 7.5. 7.6. RADIA	AND MEASUREMENT EQUIPMENT	11 12 12 15 18 21 22 25 29	
6. 7. 7 7 7 7 7 7 7 7 8.	TEST / ANTEN 7.1. 7.2. 7.3. 7.4. 7.5. 7.6. RADIA 8.1.	AND MEASUREMENT EQUIPMENT	11 12 12 15 18 21 22 25 29 29	
6. 7. 7 7 7 7 7 7 8. 8.	TEST / ANTEN 7.1. 7.2. 7.3. 7.4. 7.5. 7.6. RADIA 8.1. 3.2.	AND MEASUREMENT EQUIPMENT	11 12 15 18 21 22 25 29 29 30	
6. 7. 7 7 7 7 7 8. 8. 8.	TEST A ANTEN 7.1. 7.2. 7.3. 7.4. 7.5. 7.6. RADIA 8.1. 8.2. 8.3.	AND MEASUREMENT EQUIPMENT	11 12 15 18 21 22 29 29 30 35	
6. 7. 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	TEST / ANTEN 7.1. 7.2. 7.3. 7.4. 7.5. 7.6. RADIA 3.1. 3.2. 3.3. 3.4.	AND MEASUREMENT EQUIPMENT	11 12 15 18 21 22 29 29 30 35 36	
6. 7. 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	TEST / ANTEN 7.1. 7.2. 7.3. 7.4. 7.5. 7.6. RADIA 3.1. 3.2. 3.3. 3.4. AC PO	AND MEASUREMENT EQUIPMENT	11 12 15 18 21 22 29 30 35 36 39	

Page 3 of 45

1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	APPLE, INC.
	1 INFINITE LOOP
	CUPERTINO, CA, 95014, U.S.A.

EUT DESCRIPTION: cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/LTE radio, IEEE 802.11a/b/g/n and Bluetooth radio.

MODEL: A1428 and A1429

SERIAL NUMBER: C39HV0HPF5P5

DATE TESTED: May 23 and July 9, 2012

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:

- tii Au

TIM LEE STAFF ENGINEER UL CCS Tested By:

Chin Pany

CHING PANG EMC ENGINEER UL CCS

Page 4 of 45

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 A1428, is a mobile phone with multimedia functions (music, application support, and video), cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/CDMA1xRTT/ EV-DO Rev 0, A, B /1xAdvanced/ LTE radio, IEEE 802.11a/b/g/n radio 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	BLE	11.71	14.825

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PiFA antenna, with a maximum gain as below table.

Frequency (GHz)	Gain (dBi) Type: Pifa
2.400-2.480	-1.4
5.150-5.250	0.14
5.250-5.350	-1.66
5.47-5.725	-0.83
5725-5850	-2.85

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was WL Tool FW 6.10.56.166.

The EUT is also linked in Bluetooth Enable Test mode with Rohde & Schwarz CBT Test box.

5.5. MODEL DIFFERNECE

Model A1428 is identical to Model A1429 except in the license bands. Model A1429 encompasses CDMA technology. Testing conducted on Model A1428 is considered representative for Model A1429

Page 6 of 45

5.6. WORST-CASE CONFIGURATION AND MODE

For Radiated Emissions below 1 GHz and Power line Conducted Emissions, the channel with the highest conducted output power was selected as worst-case scenario.

The worst-position was the EUT with highest emissions. To determine the worst-case, the EUT is a portable device that has three orientations; therefore X, Y and Z orientations have been investigated with and without AC adapter, and the worst case was found to be at Z position without AC Adapter.

Page 7 of 45

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Channel	Frequency	Average Power		
	(MHz)	(dBm)		
Low	2402	9.90		
Middle	2440	9.95		
High	2480	10.00		

I/O CABLES (Conducted Setup)

Channel	Frequency	Average Power	
	(MHz)	(dBm)	
Low	2402	9.90	
Middle	2441	9.95	
High	2480	10.00	

I/O CABLES (Radiated Setup)

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

TEST SETUP

The EUT is a stand-alone device.

Page 8 of 45

SETUP DIAGRAM FOR TESTS (CONDUCTED)



UL CCS FORM NO: CCSUP4701D 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 9 of 45

SETUP DIAGRAM FOR TESTS (RADIATED)



Page 10 of 45

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		
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01159	04/09/13		
Antenna, Horn, 18 GHz	EMCO	3115	C00872	05/29/13		
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00589	04/28/13		
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	04/16/13		
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	01/27/13		
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	04/12/13		
EMI Test Receiver, 9 kHz-7 GHz	R & S	ESCI 7	1000741	07/06/13		
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	11/10/12		
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRM50702	N02685	CNR		
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	12/04/12		
Peak Power Meter	Agilent / HP	E4416A	C00963	12/04/12		
Bluetooth Tester	R&S	CBT	NA	05/15/13		

Page 11 of 45

7. ANTENNA PORT TEST RESULTS

7.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

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

TEST PROCEDURE

KDB 558074 D01 v01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

RESULTS

Channel	Frequency	6 dB Bandwidth	Minimum Limit	
	(MHz)	(KHz)	(KHz)	
Low	2402	638.100	500.0	
Middle	2440	643.000	500.0	
High	2480	635.420	500.0	

Page 12 of 45

6 dB BANDWIDTH





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: CCSUP4701D FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 13 of 45



Page 14 of 45

7.2. 99% **BANDWIDTH**

<u>LIMIT</u>

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth and to 1% of the span. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	2402	1.0722
Middle	2440	1.0727
High	2480	1.0962

Page 15 of 45

99% BANDWIDTH





Page 16 of 45



Page 17 of 45

7.3. OUTPUT POWER

<u>LIMIT</u>

§15.247 (b) (1)

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

TEST PROCEDURE

KDB 558074 D01 v01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

RESULTS

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	11.14	30	-18.86
Middle	2440	11.71	30	-18.29
High	2480	11.62	30	-18.38

UL CCS FORM NO: CCSUP4701D 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 18 of 45

PEAK POW	ER LOW C	Н	R T	Peak Search
Ref 20 dBm	Atten 20 dB		Mkr1 546.7 μs 11.14 dBm	Next Peak
#Peak Log				
10 dB/				Next Pk Right
dB				Next Pk Left
#PAvg				Min Search
S1 M2 S3 FC AA				Pk-Pk Search
¤(f): FTun				Mkr © CF
Center 2.402 000 Res BW 1 MHz	GHz#	/VBW 3 MHz	Span 0 Hz Sweep 1 ms (601 pts)	More 1 of 2



Page 19 of 45

A Agricia 12.20	.04 Adg 2, 20	12				Feak Search
Dof 20 dBm	Atton 20	dB		M	kr1 738.3 μs 11.62 dBm	Not Deel
#Peak	Allen 20			1		Next Peak
og						
0						Next Pk Right
IB/						i toxet i trigite
6						
IB						Next Pk Left
PAve			+			Min Search
1 Avg						
S1 M2						
53 FC						Pk-Pk Search
AA 						
Tun						Mkr@C
· · · · ·						
Center 2.480 000	GHz				Span 0 Hz	More
Res BW 1 MHz		#VBW 3 I	dHz	Sween 1	ms (601 nts)	1 of 2

Page 20 of 45

7.4. 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 16 dB (including 15 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	9.90
Middle	2440	9.95
High	2480	10.00

Page 21 of 45

7.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

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.

TEST PROCEDURE

Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

RESULTS

Offset=Attenuation + Cable Loss + 10 log(3K/100K)=0.8dB

Channel	Frequency	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	-6.36	8	-14.36
Middle	2440	-6.10	8	-14.10
High	2480	-6.13	8	-14.13

POWER SPECTRAL DENSITY





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: CCSUP4701D TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

PSD HIGH	CH i8:34 May 23, 2012			RТ	Peak Search				
Ref 10 dBm	Mkr1 2.480 230 8 GHz f 10 dBm Atten 20 dB -6.13 dBm								
HPeak Log 10 dB/					Next Pk Right				
Offst 0.8 dB DI					Next Pk Left				
8.0 dBm LgA∨					Min Search				
M1 S2 S3 FC AA					Pk-Pk Search				
¤(f): f>50k Swp					Mkr © CF				
Center 2.480 000 #Res BW 100 kH	0 0 GHz Iz #V	/BW 300 kHz	Sweep 1	Span 820 kHz ms (601 pts)	More 1 of 2				
Copyright 2000-2	011 Agilent Technolog	gies							

Page 24 of 45

7.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

TEST PROCEDURE

KDB 558074 D01 v01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

Page 25 of 45

RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL





Page 26 of 45

SPURIOUS EMISSIONS, MID CHANNEL





UL CCS FORM NO: CCSUP4701D 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.

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: CCSUP4701D 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 45

8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

<u>LIMITS</u>

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.

For 2.4 GHz band, 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 29 of 45

8.2. TRANSMITTER ABOVE 1 GHz

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)





Page 30 of 45

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)





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: CCSUP4701D FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 31 of 45

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





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: CCSUP4701D FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 32 of 45

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





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: CCSUP4701D FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

Page 33 of 45

HARMONICS AND SPURIOUS EMISSIONS

lest Engr: William Zhuang													
Test Engr	:	William	Zhuang	g									
Date:	ate: 07/09/12												
Project #	:	1201413	6										
Company	/:	Apple											
Test Targ	et:		a										
Mode Op	er:	BILE, PO	wer Set	ting:	10 dBm,	X positio	n						
	f	Measuren	nent Fred	Juency	Amp	Preamp (Gain			Average	Field Stren	gth Limit	
	Dist	Distance	to Anter	ina	D Corr	Distance	Correc	ct 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	ss		HPF	High Pas	s Filter	r					
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	
Low Ch.	2402 MI	Iz											
4.804	3.0	43.1	33.1	6.2	-34.8	0.0	0.0	47.6	74.0	-26.4	V	Р	
4.804	3.0	33.1	33.1	6.2	-34.8	0.0	0.0	37.5	54.0	-16.5	V	<u>A</u>	
4.804	3.0	44.6	33.1	6.2	-34.8	0.0	0.0	49.1	74.0	-24.9	H	Р	
4.804	3.0	33.9	33.1	6.2	-34.8	0.0	0.0	38.4	54.0	-15.6	H	A	
Mid Ch.	2440 MH							40.4					
4.880	3.0	43.9	33.1	6.2	-34.8	0.0	0.0	48.4	74.0	-25.6	V	P	
4.000	3.0	41.2	33.1	6.2	-34.8	0.0	0.0	37.9	54.0	-10.1	V TT	A	*****
4.000	3.0	41.2	33.1	6.2	-34.0	0.0	0.0	45.0	54.0	-20.2	п Н	<u> </u>	
7 320	3.0	36.4	35.8	8.4	-34.0	0.0	0.0	45.6	74.0	-10.2	H	P	
7.320	3.0	24.1	35.8	8.4	-34.9	0.0	0.0	33.3	54.0	-20.7	H	A	
7.320	3.0	37.7	35.8	8.4	-34.9	0.0	0.0	47.0	74.0	-27.0	V	P	***************************************
7.320	3.0	26.3	35.8	8.4	-34.9	0.0	0.0	35.6	54.0	-18.4	V	Α	
High Ch.	2480 M	Hz											
4.960	3.0	45.3	33.2	6.3	-34.8	0.0	0.0	50.0	74.0	-24.0	V	P	
4.960	3.0	35.0	33.2	6.3	-34.8	0.0	0.0	39.7	54.0	-14.3	V	Α	
4.960	3.0	43.0	33.2	6.3	-34.8	0.0	0.0	47.7	74.0	-26.3	H	Р	
4.960	3.0	33.0	33.2	6.3	-34.8	0.0	0.0	37.7	54.0	-16.3	H	<u>A</u>	
7.440	3.0	37.0	36.0	8.4	-34.9	0.0	0.0	46.5	74.0	-27.5	H	Р	
7.440	3.0	24.7	36.0	8.4	-34.9	0.0	0.0	34.2	54.0	-19.8	H	<u>A</u>	
7.440	3.0	37.3	36.0	8.4	-34.9	0.0	0.0	46.8	74.0	-27.2	V	P	
7.440	3.0	24.7	36.0	8.4	-34.9	0.0	0.0	34.2	54.0	-19.8	V	A	

8.3. RECEIVER ABOVE 1 GHz

The Engineer: William Zhung: Configuration: EUT alone: Tode: Kx On Test Equipment: Horn 1-18GHz Pre-amplifer Pre-amplifer 26-40GHz Horn > 18GHz Lin T95: SN: 3245 @3m T145 Agilent 3008A005€ 20' cable 22807500 20' cable 22807500 Image: Cable 22807700 T12' cable 22807600 20' cable 22807500 Image: Cable 22807700 Image: Cable 22807700 T12' cable 22807600 20' cable 22807500 Image: Cable 22807700 Image: Cable 22807600 Image: Cable 22807700 Ima																	e 14136 2	y: Appl #: 11U 09/2012	ompan roject ate: 7/
est Equipment: Horn 1-18GHz Pre-amplifer 1-26GHz Horn > 18GHz Lin T 145 Agitent 3008A0056 v V Pre-amplifer 26-40GHz Horn > 18GHz Lin 3' cable 22807700 12' cable 22807600 20' cable 22807500 3' cable 22807700 12' cable 22807600 20' cable 22807500 20' cable 22807500 V Pre-amplifer 26-40GHz HPF Reject Filter Pack Massum 3' cable 22807700 12' cable 22807600 20' cable 22807500 12' cable 22807600 20' cable 22807500 PC Pack Massum Pack Massum Pack Massum Pack Massum Pack Massum Pack Massum Pack Massum															ıg	huan ?	William Z EUT alone	gineer: ration: 1 Rx On	est En onfigu lode: l
Horn 1-18GHz Pre-amplifer 1-26GHz Pre-amplifer 26-40GHz Horn > 18GHz Lin T59; S/N: 3245 @3m T145 Agilent 3008A005€ 20' cable 22807500 20' cable 22807500	14	Limit									_				-		<u>t:</u>	uipmen	est Eq
Inc, and care care Inc. requent counset Inc. req. requent counset <thindext counset<="" th=""> Inc</thindext>	3 210 _	_ RX RSS 21		θHZ	rn > 180	Hor			26-40GH	pliter	Pre-am	HZ	1-260	npliter	Pre-an		18GHz	orn 1-	H
3' cable 22807700 12' cable 22807600 20' cable 22807500 Peak Measuren RBW=11 3' cable 22807700 12' cable 22807600 20' cable 22807500 3' cable 22807700 Peak Measuren RBW=11 1' cable 22807600 20' cable 22807500 2' cable 22807600 Peak Measuren RBW=11 1' cable 22807500 Peak Measuren RBW=11 Image: Peak Measuren RBW=1000 Avg and Xug Mar Mag Mage Mage Measuren RBW=104 Peak Measuren RBW=104 State Cable 22807500 O Corr Filtr Peak Avg Pk Lim Avg Lim Avg Mar Mag Measuren RBW=104 Measuren Aug														gilent		_	oles	uency Cal	Hi Fred
3 cable 22807700 v 12' cable 22807600 v 20' cable 22807500 v Average Measure RBW=1MHz; VBN f Dist Read Pk Read Avg, BB/n AF CL Amp D Corr Fitr Peak Avg Pk Lim Avg Lim Pk Mar Avg Mar No GHz (m) dBuV dB/n dB dB dB dB dB/w/m dBuV/m dBuV/m dBuV/m dBuV/m dBuV/m dBuV/m dB dB (V) 98 3.0 43.3 30.8 24.3 2.7 35.9 0.0 0.0 34.4 21.9 74 54 -39.4 -32.0 N 98 3.0 43.3 30.8 24.3 2.7 -35.9 0.0 0.0 37.3 25.4 74 54 -36.5 -28.7 N 187 3.0 41.7 29.4 27.7 3.6 -35.5 0.0 0.0 37.5 25.3 74 54	3' cable 22807700 12' cable 22807600 20' cable 22807500 HPF Reject Filter Peak Measurements RBW=VBW=1MHz																		
f Dist Read Pk Read Avg. AF CL Amp D Corr Fltr Peak Avg Pk Lim Avg Lim Pk Mar Avg Mar No GHz (m) dBuV dBuV dB dB dB dB dB dB dB dB dBuV/m dBuV/m dBuV/m dBuV/m dB dB (V) 098 3.0 43.3 30.8 24.3 2.7 -35.9 0.0 0.0 34.4 21.9 74 54 -39.4 -32.0 M 098 3.0 41.5 29.5 27.7 3.6 -35.5 0.0 0.0 37.3 25.4 74 54 -36.5 -28.6 1 857 3.0 41.7 29.4 27.7 3.6 -35.5 0.0 0.0 37.5 25.3 74 54 -36.5 -28.7 N 267 3.0 41.1 28.0 31.0 5.1 -35.1<	<u>rements</u> 3W=10Hz	Average Measuren RBW=1MHz ; VBW=	▼ A RE	•	•				7500	le 2280	20' cab	•	07600	ble 228	12' ca	•	307700	able 228	3' c
GHz (m) dBuV dBuV dBuV dB dB dB dBuV/m dBuV/m dB dB (V) 998 3.0 43.5 30.9 24.3 2.7 -35.9 0.0 0.0 34.6 22.0 74 54 -39.6 -32.0 N 998 3.0 43.5 30.8 24.3 2.7 -35.9 0.0 0.0 34.4 21.9 74 54 -39.6 -32.1 I I 157 3.0 41.5 29.5 27.7 3.6 -35.5 0.0 0.0 37.3 25.4 74 54 -36.7 -28.6 I 157 3.0 41.7 29.4 27.7 3.6 -35.5 0.0 0.0 37.5 25.3 74 54 -36.5 -28.7 N 267 3.0 41.1 28.0 31.0 5.1 -35.1 0.0 0.0 42.1 28.9 74 54	otes	vg Mar Note	Avg N	Pk Mar	Avg Lim	im	P	Av	Peak	Fltr	D Corr	Amp	CL	AF	ad Avg.	Re	Read Pk	Dist	f
98 3.0 43.3 30.8 24.3 2.7 -35.9 0.0 0.0 34.4 21.9 74 54 -39.6 -32.1 1 57 3.0 41.5 29.5 27.7 3.6 35.5 0.0 0.0 37.3 25.4 74 54 -36.7 -28.6 1 57 3.0 41.7 29.4 27.7 3.6 -35.5 0.0 0.0 37.5 25.3 74 54 -36.5 -28.6 1 67 3.0 41.1 28.0 31.0 5.1 -35.1 0.0 0.0 40.0 28.9 74 54 -33.1 -25.1 V 67 3.0 41.1 28.0 31.0 5.1 -35.1 0.0 0.0 42.1 28.9 74 54 -31.9 -25.1 V 67 3.0 41.1 28.0 31.0 5.1 -35.1 0.0 0.0 42.1 28.9 74 54 -31.9 -25.1 V 9 0.70.08.11 <td< td=""><td>//H) V</td><td>dB (V/H -32.0 V</td><td>dB -32.0</td><td>dB -39.4</td><td>dBuV/m 54</td><td>/m</td><td>ı di</td><td>dBuV 22.0</td><td>dBuV/m 34.6</td><td>dB 0.0</td><td>0.0</td><td>dB -35.9</td><td>dB 2.7</td><td>dB/m 24.3</td><td>dBuV 30.9</td><td>-</td><td>dBuV 43.5</td><td>(m) 3.0</td><td>. Hz 98</td></td<>	//H) V	dB (V/H -32.0 V	dB -32.0	dB -39.4	dBuV/m 54	/m	ı di	dBuV 22.0	dBuV/m 34.6	dB 0.0	0.0	dB -35.9	dB 2.7	dB/m 24.3	dBuV 30.9	-	dBuV 43.5	(m) 3.0	. Hz 98
57 3.0 41.5 29.5 27.7 3.6 -35.5 0.0 0.0 37.3 25.4 74 54 -36.7 -28.6 1 57 3.0 41.7 29.4 27.7 3.6 -35.5 0.0 0.0 37.3 25.3 74 54 -36.7 -28.6 1 67 3.0 41.7 29.4 27.7 3.6 -35.5 0.0 0.0 40.9 28.9 74 54 -33.1 -25.1 N 67 3.0 41.1 28.0 31.0 5.1 -35.1 0.0 0.0 42.1 28.9 74 54 -33.1 -25.1 N 67 3.0 41.1 28.0 31.0 5.1 -35.1 0.0 0.0 42.1 28.9 74 54 -31.9 -25.1 1 7 .07.08.11 .0 0.0 0.0 42.1 28.9 74 54 -31.9 -25.1 1 7 .07.08.11 .0 0.0 0.0 42.1	Н	-32.1 Н	-32.1	-39.6	54			21.9	34.4	0.0	0.0	-35.9	2.7	24.3	30.8		43.3	3.0	98
67 3.0 40.0 28.0 31.0 5.1 -35.1 0.0 0.0 40.9 28.9 74 54 -33.1 -25.1 V 67 3.0 41.1 28.0 31.0 5.1 -35.1 0.0 0.0 40.9 28.9 74 54 -33.1 -25.1 V 67 3.0 41.1 28.0 31.0 5.1 -35.1 0.0 0.0 42.1 28.9 74 54 -33.1 -25.1 V 67 3.0 41.1 28.0 31.0 5.1 -35.1 0.0 0.0 42.1 28.9 74 54 -33.1 -25.1 V 70.07.08.11 0.0 0.0 42.1 28.9 74 54 -31.9 -25.1 I 70.07.08.11 0.0 0.0 0.0 42.1 28.9 74 54 -31.9 -25.1 I 70.07.08.11 0.0 0.0 0.0 0.0 0.0 0.0 42.1 28.9 74 54 -31.9 -25.	H V	5 0.0 0.0 37.3 25.4 74 54 -36.7 -28.6 H						-35.5	3.6	27.7 27.7	29.5 29.4		41.5	3.0 3.0	57 57				
67 3.0 41.1 28.0 31.0 5.1 -35.1 0.0 0.0 42.1 28.9 74 54 -31.9 -25.1 1 v. 07.08.11 f Measurement Frequency Amp Preamp Gain Avg Lim Average Field Strength Limit Pk Lim Peak Field Strength Limit Dist Distance to Antenna D Corr Distance Correct to 3 meters Pk Lim Peak Field Strength Limit Read Analyzer Reading Avg Average Field Strength @ 3 m Avg Mar Margin vs. Average Limit AF Antenna Factor Peak Calculated Peak Field Strength Pk Mar Margin vs. Peak Limit CL Cable Loss HPF High Pass Filter Pk Mar Margin vs. Peak Limit	V	-25.1 V	-25.1	-33.1	54			28.9	40.9	0.0	0.0	-35.1	5.1	31.0	28.0		40.0	3.0	67
fMeasurement FrequencyAmpPreamp GainAvg LimAverage Field Strength LimitDistDistance to AntennaD CorrDistance Correct to 3 metersPk LimPeak Field Strength LimitReadAnalyzer ReadingAvgAverage Field Strength @ 3 mAvg MarMargin vs. Average LimitAFAntenna FactorPeakCalculated Peak Field StrengthPk MarMargin vs. Peak LimitCLCable LossHPFHigh Pass FilterHigh Pass Filter																		.11	v. 07.08
DistDistance to AntennaD CorrDistance Correct to 3 metersPk LimPeak Field Strength LimitReadAnalyzer ReadingAvgAverage Field Strength @ 3 mAvg MarMargin vs. Average LimitAFAntenna FactorPeakCakulated Peak Field StrengthPk MarMargin vs. Peak LimitCLCable LossHPFHigh Pass FilterPilterPilter		l Strength Limit	ield Str	Average Fig	Avg Lim	1				Gain	Preamp	Amp		/	Frequency	nent F	Measuren	f	
Read Analyzer Reading Avg Average Field Strength @ 3 m Avg Mar Margin vs. Average Limit AF Antenna Factor Peak Cakulated Peak Field Strength Pk Mar Margin vs. Peak Limit CL Cable Loss HPF High Pass Filter		rength Limit	Streng	Peak Field	Pk Lim	I		rs	t to 3 mete	Correc	Distance	D Corr			itenna	o An	Distance t	Dist	
CL Cable Loss HPF High Pass Filter		verage Limit	Avera	Margin vs	Avg Mar	1		3 m	trength @	Field S	Average	Avg			ing	Readi	Analyzer I	Read	
		eak Limit	Реак І	Margin vs.	PK Mar	1		ngtn	Field Stre	s Filter	High Pas	Peak HPF			r	acto:	Cable Los	AF CL	

Page 35 of 45

8.4. WORST-CASE BELOW 1 GHz

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



Page 36 of 45

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



Page 37 of 45

HORIZON	ITAL AND	VERTIC	AL DATA					
Project No	o:11U14136							
Client Nar	ne:Apple							
Model /De	evice: A142	.8						
Config /Ot	ther:Worst	case						
Test By:W	illiam Zhua	ing						
Horizontal	30 - 1000N	/IHz						
Test Frequ	Meter Rea	Detector	T122 Suno	5mB Amp	dBuV/m	CFR 47 Par	Margin	Polarity
41.0492	39.36	РК	13	-29.2	23.16	40	-16.84	Horz
114.5164	32.49	РК	13.5	-28.4	17.59	43.5	-25.91	Horz
143.2054	32.78	РК	12.9	-28.1	17.58	43.5	-25.92	Horz
181.5867	32.98	РК	11.1	-27.7	16.38	43.5	-27.12	Horz
783.2814	29.99	РК	21.2	-25.5	25.69	46	-20.31	Horz
Vertical 30) - 1000MH	z						
Test Frequ	Meter Rea	Detector	T122 Suno	5mB Amp	dBuV/m	CFR 47 Par	Margin	Polarity
56.3629	38.93	РК	7.2	-29	17.13	40	-22.87	Vert
69.1567	38.74	РК	8.1	-28.9	17.94	40	-22.06	Vert
154.2546	34.3	РК	12.5	-28	18.8	43.5	-24.7	Vert
161.4269	35	РК	12.4	-27.9	19.5	43.5	-24	Vert
195.1559	36.44	РК	11.9	-27.6	20.74	43.5	-22.76	Vert
199.0328	35.32	РК	12.7	-27.6	20.42	43.5	-23.08	Vert

Page 38 of 45

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

Frequency of Emission (MHz)	Conducted Limit (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

ANSI C63.4

UL CCS FORM NO: CCSUP4701D 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 39 of 45

RESULTS

<u>6 WORST EMISSIONS</u>

Project No:11U14136									
Client Name:Apple									
Model/De	vice:A1428	3 and A142	9						
Test Volt/Freq:115Vac 60Hz									
Test By:Ch	nin Pang								
Line-L1.1	5 - 30MHz								
Test Frequ	Meter Rea	Detector	T24 IL L1.T	LC Cables	dB(uVolts	CISPR 11/2	Margin	CISPR 11/2	Margin
0.168	63.2	PK	0.1	0	63.3	65.1	-1.8	-	-
0.168	45.89	Av	0.1	0	45.99	-	-	55.1	-9.11
0.2445	57.43	PK	0.1	0	57.53	61.9	-4.37	-	-
0.2445	33.52	Av	0.1	0	33.62	-	-	51.9	-18.28
0.3255	54.03	PK	0.1	0	54.13	59.6	-5.47	-	-
0.3255	25.37	Av	0.1	0	25.47	-	-	49.6	-24.13
Line-L2 .15 - 30MHz									
Test Frequ	Meter Rea	Detector	T24 IL L2.T	LC Cables	dB(uVolts	CISPR 11/2	Margin	CISPR 11/2	Margin
0.1635	53.72	PK	0.1	0	53.82	65.3	-11.48	-	-
0.1635	32.37	Av	0.1	0	32.47	-	-	55.3	-22.83
0.2445	50.33	PK	0.1	0	50.43	61.9	-11.47	-	-
0.2445	29.13	Av	0.1	0	29.23	-	-	51.9	-22.67
0.321	46.08	PK	0.1	0	46.18	59.7	-13.52	-	-
0.321	21.42	Av	0.1	0	21.52	-	-	49.7	-28.18

LINE 1 RESULTS



Page 41 of 45

LINE 2 RESULTS



Page 42 of 45