

FCC CFR47 PART 15 SUBPART E

CERTIFICATION TEST REPORT CLASS II PERMISSIVE CHANGE

FOR THE APPLE IPAD IS A TABLET DEVICE WITH MULTIMEDIA FUNCTIONS (MUSIC, APPLICATION SUPPORT, AND VIDEO), 802.11A/B/G/N RADIO, AND BLUETOOTH RADIO FUNCTIONS

MODEL NUMBER: A1432, A1454, & A1455*

FCC ID: BCGA1432 (A1432) FCC ID: BCGA1454 (A1454) FCC ID: BCGA1455 (A1455)

REPORT NUMBER: 15U21850-E34V3

ISSUE DATE: DECEMBER 07, 2015

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

Prepared by UL VERIFICATION SERVICES INC. FREMONT, CA 94538, U.S.A. TEL: (510) 771-1000 FAX: (510) 661-0888

*Models differences are detailed within the body of this report

NVLAP LAB CODE 200065-0

Revision History

Rev.	lssue Date	Revisions	Revised By
V1	11/16/2015	Initial issue. Upgrade 12U14526-2 Revision A report to 5.2/5.3/5.6GHz band to new rule per KDB 789033 D02 v01.	T. Chu
V2	12/02/2015	Inserting Additional FCC IDs to cover page & header	M. Mekuria
V3	12/07/2015	Revised report to address TCB's questions	T. Chu

Page 2 of 199

TABLE OF CONTENTS

1.	AT	TESTATION OF TEST RESULTS	6
2.	TES	ST METHODOLOGY	7
3.	FAG	CILITIES AND ACCREDITATION	7
4.	CAI	LIBRATION AND UNCERTAINTY	7
	4.1.	MEASURING INSTRUMENT CALIBRATION	7
	4.2.	SAMPLE CALCULATION	7
	4.3.	MEASUREMENT UNCERTAINTY	7
5.	EQ	UIPMENT UNDER TEST	8
	5.1.	DESCRIPTION OF EUT	8
,	5.2.	DESCRIPTION OF CLASS II PERMISSIVE CHANGE	8
,	5.3.	DESCRIPTION OF MODELS DIFFERENCES	8
,	5.4.	MAXIMUM OUTPUT POWER	9
	5.5.	DESCRIPTION OF AVAILABLE ANTENNAS	9
,	5.6.	SOFTWARE AND FIRMWARE	10
,	5.7.	WORST-CASE CONFIGURATION AND MODE	10
	5.8.	DESCRIPTION OF TEST SETUP	11
6.	TES	ST AND MEASUREMENT EQUIPMENT	14
	-		
7.	ON	TIME, DUTY CYCLE AND MEASUREMENT METHODS	
7.	ON 7.1.		15
7.		TIME, DUTY CYCLE AND MEASUREMENT METHODS	15 15
7.	7.1.	TIME, DUTY CYCLE AND MEASUREMENT METHODS ON TIME AND DUTY CYCLE RESULTS	15 15 15
7.	7.1. 7.2.	TIME, DUTY CYCLE AND MEASUREMENT METHODS ON TIME AND DUTY CYCLE RESULTS MEASUREMENT METHOD FOR POWER AND PPSD	15 15 15 15
7.	7.1. 7.2. 7.3. 7.4.	TIME, DUTY CYCLE AND MEASUREMENT METHODS ON TIME AND DUTY CYCLE RESULTS MEASUREMENT METHOD FOR POWER AND PPSD MEASUREMENT METHOD FOR AVG SPURIOUS EMISSIONS ABOVE 1 GHz	15 15 15 15 16
7. 8.	7.1. 7.2. 7.3. 7.4. AN⁻ 8.1.	TIME, DUTY CYCLE AND MEASUREMENT METHODS ON TIME AND DUTY CYCLE RESULTS MEASUREMENT METHOD FOR POWER AND PPSD MEASUREMENT METHOD FOR AVG SPURIOUS EMISSIONS ABOVE 1 GHz DUTY CYCLE PLOTS TENNA PORT TEST RESULTS	15 15 15 16 18 18
7. 8.	7.1. 7.2. 7.3. 7.4. AN⁻ 8.1. 8.1.	TIME, DUTY CYCLE AND MEASUREMENT METHODS ON TIME AND DUTY CYCLE RESULTS MEASUREMENT METHOD FOR POWER AND PPSD MEASUREMENT METHOD FOR AVG SPURIOUS EMISSIONS ABOVE 1 GHz DUTY CYCLE PLOTS TENNA PORT TEST RESULTS	15 15 15 16 18 18 18
7. 8.	7.1. 7.2. 7.3. 7.4. AN⁻ 8.1.	TIME, DUTY CYCLE AND MEASUREMENT METHODS ON TIME AND DUTY CYCLE RESULTS. MEASUREMENT METHOD FOR POWER AND PPSD. MEASUREMENT METHOD FOR AVG SPURIOUS EMISSIONS ABOVE 1 GHz DUTY CYCLE PLOTS S02.11a MODE IN THE 5.2 GHz BAND. 1. 26 dB BANDWIDTH. 2. 99% BANDWIDTH.	15 15 15 16 18 18 21
7. 8.	7.1. 7.2. 7.3. 7.4. 8.1. 8.1. 8.1.	TIME, DUTY CYCLE AND MEASUREMENT METHODS ON TIME AND DUTY CYCLE RESULTS. MEASUREMENT METHOD FOR POWER AND PPSD. MEASUREMENT METHOD FOR AVG SPURIOUS EMISSIONS ABOVE 1 GHz DUTY CYCLE PLOTS S02.11a MODE IN THE 5.2 GHz BAND. 1. 26 dB BANDWIDTH. 2. 99% BANDWIDTH. 3. AVERAGE POWER	15 15 15 16 18 18 21 24
8.	7.1. 7.2. 7.3. 7.4. 8.1. 8.1. 8.1. 8.1. 8.1. 8.1. 8.2.	TIME, DUTY CYCLE AND MEASUREMENT METHODS ON TIME AND DUTY CYCLE RESULTS. MEASUREMENT METHOD FOR POWER AND PPSD. MEASUREMENT METHOD FOR AVG SPURIOUS EMISSIONS ABOVE 1 GHz. DUTY CYCLE PLOTS B02.11a MODE IN THE 5.2 GHz BAND. 1. 26 dB BANDWIDTH. 2. 99% BANDWIDTH. 3. AVERAGE POWER 4. OUTPUT POWER AND PPSD 802.11n HT20 MODE IN THE 5.2 GHz BAND	15 15 15 16 18 18 21 24 25 29
8.	7.1. 7.2. 7.3. 7.4. 8.1. 8.1. 8.1. 8.1. 8.2. 8.2.	TIME, DUTY CYCLE AND MEASUREMENT METHODS ON TIME AND DUTY CYCLE RESULTS MEASUREMENT METHOD FOR POWER AND PPSD MEASUREMENT METHOD FOR AVG SPURIOUS EMISSIONS ABOVE 1 GHz DUTY CYCLE PLOTS TENNA PORT TEST RESULTS 802.11a MODE IN THE 5.2 GHz BAND 1. 26 dB BANDWIDTH 3. AVERAGE POWER 4. OUTPUT POWER AND PPSD 802.11n HT20 MODE IN THE 5.2 GHz BAND 1. 26 dB BANDWIDTH	15 15 15 16 18 21 24 25 29 29
8.	7.1. 7.2. 7.3. 7.4. 8.1. 8.1. 8.1. 8.1. 8.1. 8.1. 8.2.	TIME, DUTY CYCLE AND MEASUREMENT METHODS ON TIME AND DUTY CYCLE RESULTS. MEASUREMENT METHOD FOR POWER AND PPSD. MEASUREMENT METHOD FOR AVG SPURIOUS EMISSIONS ABOVE 1 GHz DUTY CYCLE PLOTS TENNA PORT TEST RESULTS 802.11a MODE IN THE 5.2 GHz BAND. 1. 26 dB BANDWIDTH. 2. 99% BANDWIDTH. 3. AVERAGE POWER 4. OUTPUT POWER AND PPSD 802.11n HT20 MODE IN THE 5.2 GHz BAND. 1. 26 dB BANDWIDTH. 2. 99% BANDWIDTH. 3. AVERAGE POWER 4. OUTPUT POWER AND PPSD 802.11n HT20 MODE IN THE 5.2 GHz BAND. 1. 26 dB BANDWIDTH. 2. 99% BANDWIDTH.	15 15 15 16 18 18 21 21 25 29 29 32
8.	7.1. 7.2. 7.3. 7.4. 8.1. 8.1. 8.1. 8.1. 8.2. 8.2. 8.2.	TIME, DUTY CYCLE AND MEASUREMENT METHODS ON TIME AND DUTY CYCLE RESULTS. MEASUREMENT METHOD FOR POWER AND PPSD. MEASUREMENT METHOD FOR AVG SPURIOUS EMISSIONS ABOVE 1 GHz DUTY CYCLE PLOTS TENNA PORT TEST RESULTS 802.11a MODE IN THE 5.2 GHz BAND. 1. 26 dB BANDWIDTH. 2. 99% BANDWIDTH. 3. AVERAGE POWER 4. OUTPUT POWER AND PPSD 802.11n HT20 MODE IN THE 5.2 GHz BAND. 1. 26 dB BANDWIDTH. 3. AVERAGE POWER 4. OUTPUT POWER AND PPSD 802.11n HT20 MODE IN THE 5.2 GHz BAND. 1. 26 dB BANDWIDTH. 3. AVERAGE POWER 4. OUTPUT POWER AND PPSD 802.11n HT20 MODE IN THE 5.2 GHz BAND. 1. 26 dB BANDWIDTH. 2. 99% BANDWIDTH. 3. AVERAGE POWER.	15 15 15 16 18 21 24 25 29 29 32 35
8.	7.1. 7.2. 7.3. 7.4. 8.1. 8.1. 8.1. 8.1. 8.2. 8.2. 8.2. 8.2	TIME, DUTY CYCLE AND MEASUREMENT METHODS ON TIME AND DUTY CYCLE RESULTS. MEASUREMENT METHOD FOR POWER AND PPSD MEASUREMENT METHOD FOR AVG SPURIOUS EMISSIONS ABOVE 1 GHz DUTY CYCLE PLOTS TENNA PORT TEST RESULTS 802.11a MODE IN THE 5.2 GHz BAND. 1. 26 dB BANDWIDTH. 2. 99% BANDWIDTH. 3. AVERAGE POWER 4. OUTPUT POWER AND PPSD 802.11n HT20 MODE IN THE 5.2 GHz BAND 1. 26 dB BANDWIDTH. 2. 99% BANDWIDTH. 3. AVERAGE POWER 4. OUTPUT POWER AND PPSD 802.11n HT20 MODE IN THE 5.2 GHz BAND 1. 26 dB BANDWIDTH. 2. 99% BANDWIDTH. 3. AVERAGE POWER 4. OUTPUT POWER AND PPSD 802.11n HT40 MODE IN THE 5.2 GHz BAND 802.11n HT40 MODE IN THE 5.2 GHz BAND	15 15 15 16 18 18 21 24 25 29 29 32 35 36 40
8.	7.1. 7.2. 7.3. 7.4. 8.1. 8.1. 8.1. 8.1. 8.2. 8.2. 8.2. 8.2	TIME, DUTY CYCLE AND MEASUREMENT METHODS ON TIME AND DUTY CYCLE RESULTS. MEASUREMENT METHOD FOR POWER AND PPSD MEASUREMENT METHOD FOR AVG SPURIOUS EMISSIONS ABOVE 1 GHz DUTY CYCLE PLOTS TENNA PORT TEST RESULTS 802.11a MODE IN THE 5.2 GHz BAND. 1. 26 dB BANDWIDTH. 2. 99% BANDWIDTH. 3. AVERAGE POWER 4. OUTPUT POWER AND PPSD 802.11n HT20 MODE IN THE 5.2 GHz BAND 1. 26 dB BANDWIDTH. 2. 99% BANDWIDTH. 3. AVERAGE POWER 4. OUTPUT POWER AND PPSD 802.11n HT20 MODE IN THE 5.2 GHz BAND 1. 26 dB BANDWIDTH. 2. 99% BANDWIDTH. 3. AVERAGE POWER 4. OUTPUT POWER AND PPSD 802.11n HT40 MODE IN THE 5.2 GHz BAND 1. 26 dB BANDWIDTH. 2. 017 UT POWER AND PPSD 802.11n HT40 MODE IN THE 5.2 GHz BAND 1. 26 dB BANDWIDTH.	15 15 15 16 18 18 21 24 25 29 29 32 35 36 40 40
8.	7.1. 7.2. 7.3. 7.4. 8.1. 8.1. 8.1. 8.1. 8.2. 8.2. 8.2. 8.2	TIME, DUTY CYCLE AND MEASUREMENT METHODS ON TIME AND DUTY CYCLE RESULTS. MEASUREMENT METHOD FOR POWER AND PPSD. MEASUREMENT METHOD FOR AVG SPURIOUS EMISSIONS ABOVE 1 GHz DUTY CYCLE PLOTS TENNA PORT TEST RESULTS . 802.11a MODE IN THE 5.2 GHz BAND. 1. 26 dB BANDWIDTH. 2. 99% BANDWIDTH. 3. AVERAGE POWER. 4. OUTPUT POWER AND PPSD. 802.11n HT20 MODE IN THE 5.2 GHz BAND. 1. 26 dB BANDWIDTH. 2. 99% BANDWIDTH. 3. AVERAGE POWER. 4. OUTPUT POWER AND PPSD. 802.11n HT20 MODE IN THE 5.2 GHz BAND. 1. 26 dB BANDWIDTH. 2. 99% BANDWIDTH. 3. AVERAGE POWER. 4. OUTPUT POWER AND PPSD. 802.11n HT40 MODE IN THE 5.2 GHz BAND. 1. 26 dB BANDWIDTH. 2. 0UTPUT POWER AND PPSD. 802.11n HT40 MODE IN THE 5.2 GHz BAND. 1. 26 dB BANDWIDTH.	15 15 15 16 18 18 21 24 25 29 29 32 35 36 40 40

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	A1432, BCGA1454, BCGA1455	ATE. DECEMBER 07, 2015
8.3.3.	AVERAGE POWER	
8.3.4.	OUTPUT POWER AND PPSD	45
8.4. 802	.11a MODE IN THE 5.3 GHz BAND	
8.4.1.	26 dB BANDWIDTH	48
8.4.2.	99% BANDWIDTH	
8.4.3.	AVERAGE POWER	
8.4.4.	OUTPUT POWER AND PPSD	
	2.11n HT20 MODE IN THE 5.3 GHz BAND	
8.5.1.	26 dB BANDWIDTH	
8.5.2. 8.5.3.	99% BANDWIDTH AVERAGE POWER	
8.5.4.	OUTPUT POWER AND PPSD	
8.6. 802	.11n HT40 MODE IN THE 5.3 GHz BAND	
8.6.1.	26 dB BANDWIDTH	
8.6.2.	99% BANDWIDTH	-
8.6.3.	AVERAGE POWER	
8.6.4.	OUTPUT POWER AND PPSD	75
8.7. 802	2.11a MODE IN THE 5.6 GHz BAND	
8.7.1.	26 dB BANDWIDTH	
8.7.2.	99% BANDWIDTH	
8.7.3. 8.7.4.	AVERAGE POWER OUTPUT POWER AND PPSD	
-		
<i>8.8. 80</i> 2 8.8.1.	2.11n HT20 MODE IN THE 5.6 GHz BAND 26 dB BANDWIDTH	
0.0.1. 8.8.2.	28 dB BANDWIDTH	
8.8.3.	AVERAGE POWER	
8.8.4.	OUTPUT POWER AND PPSD	
8.9. 802	2.11n HT40 MODE IN THE 5.6 GHz BAND	
8.9.1.	26 dB BANDWIDTH	
8.9.2.	99% BANDWIDTH	
8.9.3.	AVERAGE POWER	
8.9.4.	OUTPUT POWER AND PPSD	
9. RADIAT	ED TEST RESULTS	
9.1. LIM	IITS AND PROCEDURE	117
9.2. TRA 9.2.1.	ANSMITTER ABOVE 1 GHz TX ABOVE 1 GHz 802.11a MODE IN THE 5.2 GHz BAND	
9.2.1.	TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.2 GHz BAND	
9.2.3.	TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.2 GHz	
9.2.4.	TX ABOVE 1 GHz 802.11a MODE IN THE 5.3 GHz BAND	
9.2.5.	TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.3 GHz	
9.2.6. 9.2.7.	TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.3 GHz TX ABOVE 1 GHz 802.11a MODE IN THE 5.6 GHz BAND	
9.2.7. 9.2.8.	TX ABOVE 1 GHz 802.11a MODE IN THE 5.0 GHz BAND	
9.2.9.	TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.6 GHz	
9.2.10.	2.4 GHz and 5GHz band Colocation	148
9.3. WC	RST-CASE BELOW 1 GHz	
10. AC PC	OWER LINE CONDUCTED EMISSIONS	154
	Page 4 of 199	
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11. DYNA	MIC FREQUENCY SELECTION	158
11.1. O	VERVIEW	
11.1.1.	LIMITS	
11.1.2.	TEST AND MEASUREMENT SYSTEM	161
11.1.3.	SETUP OF EUT	
11.1.4.	DESCRIPTION OF EUT	166
11.2. C	LIENT MODE RESULTS FOR 20 MHz BANDWIDTH	
11.2.1.	TEST CHANNEL	
11.2.2.	RADAR WAVEFORM AND TRAFFIC	168
11.2.3.	OVERLAPPING CHANNEL TESTS	170
11.2.4.	MOVE AND CLOSING TIME	170
11.3. C	LIENT MODE RESULTS FOR 40 MHz BANDWIDTH	
11.3.1.	TEST CHANNEL	
11.3.2.	RADAR WAVEFORM AND TRAFFIC	
11.3.3.	OVERLAPPING CHANNEL TESTS	
11.3.4.	MOVE AND CLOSING TIME	
11.3.5.	NON-OCCUPANCY PERIOD	182
11.4. C	LIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 20 MHz	
BANDWID	TH	
11.4.1.	TEST CHANNEL	
11.4.2.	RADAR WAVEFORM AND TRAFFIC	
11.4.3.	OVERLAPPING CHANNEL TESTS	
11.4.4.	MOVE AND CLOSING TIME	185
12. SETU	P PHOTOS	190

Page 5 of 199

1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	APPLE, INC. 1 INFINITE LOOP CUPERTINO, CA 95014, U.S.A.					
EUT DESCRIPTION:	The Apple iPad is a tablet device with multimedia functions (music, application support, and video), 802.11a/b/g/n radio, and Bluetooth radio functions					
MODEL:	A1432, A1454, & A1455					
SERIAL NUMBER:	PT758824					
DATE TESTED:	JULY 15 - AUGUST 22, 2012					
APPLICABLE STANDARDS						
STANDARD TEST RESULTS						
CFR 47 P	art 15 Subpart E	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:

FRANK IBRAHIM WISE PROJECT LEADER UL Verification Services Inc.

Tested By:

TOM CHEN EMC ENGINEER UL Verification Services Inc.

Page 6 of 199

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 14-30, FCC KDB 662911 D01 v02r01, FCC KDB 905462 D02 v01r02/D03 v01r01/D06 v01, FCC KDB 789033 D02 v01, ANSI C63.10-2009.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <u>http://ts.nist.gov/standards/scopes/2000650.htm</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%.

Page 7 of 199

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a iPad tablet device with iPod functions (music, application support, and video), 802.11a/b/g/n radio, and Bluetooth radio functions.

5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

Upgrade 5.2/5.3/5.6GHz band to new rule per KDB 789033 D02 v01.

We have reviewed the original test report for UNII-1, UNII-2A and UNII-2C bands and are hereby attesting that all current technical requirements are still met and all applicable test procedures remain the same. Therefore, the original report is still applicable and no additional testing is done.

We updated the following on this report:

- Updated report to latest KDB 789033 D02 v01.
- 5.2G output power table limit/PPSD limit.
- Removed IC related information.
- Removed Peak Excursion.

5.3. DESCRIPTION OF MODELS DIFFERENCES

FCC ID: BCGA1432 Model #: A1432

Model A1432, is a tablet with multimedia functions (music, application support, and video)IEEE 802.11a/b/g/n radio and Bluetooth radio. The rechargeable battery is not user accessible.

FCC ID: BCGA1454 Model #: A1454

Model A1454 is a tablet with multimedia functions (music, application support, and video), cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/LTE radio, IEEE 802.11a/b/g/n and Bluetooth radio. The rechargeable battery is not user accessible.

FCC ID: BCGA1455 Model #: A1455

Model A1455, is a tablet with multimedia functions (music, application support, and video), cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/CDMA1xRTT/ EV-DO Rev 0, A, B / LTE radio, IEEE 802.11a/b/g/n radio and Bluetooth radio. The rechargeable battery is not user accessible.

Page 8 of 199

REPORT NO: 15U21850-E34V3 FCC ID: BCGA1432, BCGA1454, BCGA1455

5.4. MAXIMUM OUTPUT POWER

Frequency Range	Mode	Output Power	Output Power
(MHz)		(dBm)	(mW)
5180 - 5240	802.11a	14.257	26.650
5180 - 5240	802.11n HT20	14.354	27.252
5190 - 5230	802.11n HT40	15.780	37.844
5260 - 5320	802.11a	17.176	52.192
5260 - 5320	802.11n HT20	17.278	53.432
5270 - 5310	802.11n HT40	17.260	53.211
5500 - 5700	802.11a	16.585	45.551
5500 - 5700	802.11n HT20	16.421	43.863
5510 - 5670	802.11n HT40	16.491	44.576

The transmitter has a maximum conducted output power as follows:

5.5. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain as shown below:

Frequency Band (GHz)	Antenna Gain (dBi)
2.4-2.4835	1.41
5.15-5.25	4.70
5.25-5.35	5.08
5.5-5.7	5.42
5.725-5.85	5.27

Page 9 of 199

5.6. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 10A378

The EUT driver software installed during testing was Broadcom_Rel_6_10_56_166

The EUT is connected to the power meter.

5.7. WORST-CASE CONFIGURATION AND MODE

For the fundamental investigation, since the EUT is a portable device that has three orientations; X, Y and Z orientations have been investigated, also with AC/DC adapter, and earphone, and the worst case was found to be at Y orientation without AC adapter and earphone for both 2.4GHz and 5GHz band.

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

Worst-case data rates as provided by the manufacturer are:

For 802.11a mode: 6Mbps For 802.11n HT20: MCS0 For 802.11n HT40: MCS0

For 2.4 GHz band, an investigation of the fundamental frequency on both Ant0 and Ant1 ports showed that Ant0 is worst-case; therefore, all final radiated testing was performed using Ant0.

For 5 GHz bands, an investigation of the fundamental frequency on both Ant0 and Ant1 ports showed that Ant1 is worst-case; therefore, all final radiated testing was performed using Ant1.

Low channel for both 11a and 11n HT20 in the 5.6 GHz band, was tested for harmonics and BE at the power level of Low1 channel (5520 MHz) as worst-case scenario.

High channel for both 11a and 11n HT20 in the 5.6 GHz band, was tested for harmonics and BE at the power level of High1 channel (5680 MHz) as worst-case scenario.

Page 10 of 199

5.8. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST						
Description	Manufacturer	Model	Serial Number	FCC ID		
AC Adapter	Apple	A1401	D060812	DoC		
Power Splitter	Krytar	158010	99250	N/A		
Dc Power Supply	Agilent	E3610A	KR24104150	N/A		
Laptop PC	Apple	MacBook Pro	AOU269116	N/A		

I/O CABLES (CONDUCTED SETUP)

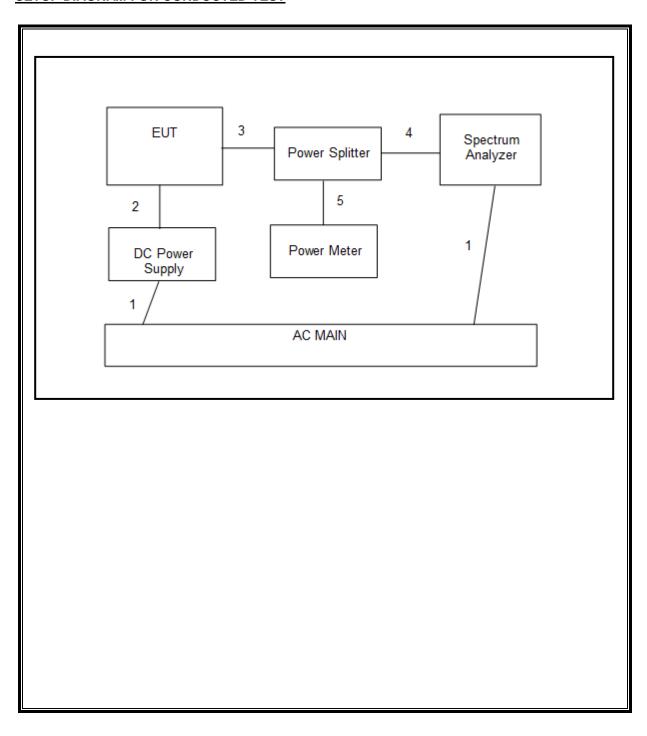
I/O CABLE LIST						
Cable No.	Port	#of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	2	AC	Un-shielded	2.0m	N/A
2	DC	1	DC	Un-shielded	1.0m	N/A
3	Antenna Port	1	Splitter	Un-shielded	0.1m	N/A
4	RF out	1	Spectrum Analyzer	Un-Shielded	None	N/A
5	RF out	1	Power Meter	Shielded	None	NA

I/O CABLES (RADIATED SETUP)

	I/O Cable List						
Cable No		# of identical ports	Connector Type		Cable Length (m)	Remarks	
1	DC	1	MINI USB	UN-SHELDED	1.0m	N/A	
2	AUDIO	1	MINI JACK	UN-SHELDED	1.0m	N/A	

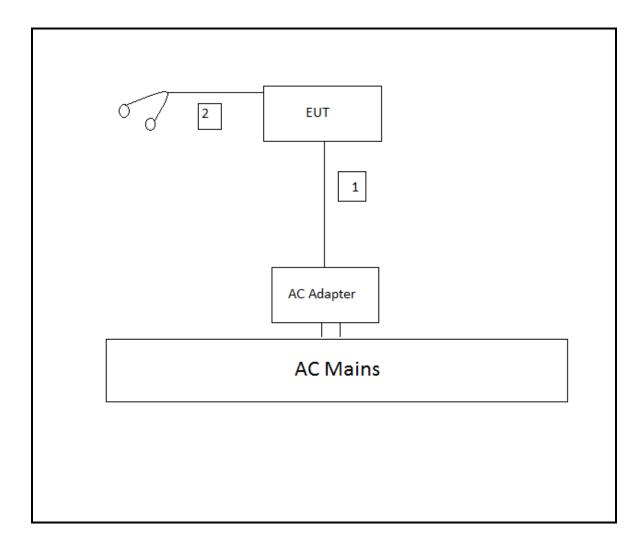
Page 11 of 199

DATE: DECEMBER 07, 2015



Page 12 of 199

SETUP DIAGRAM FOR RADIATED TEST



Page 13 of 199

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	11/11/12		
Antenna, Horn, 18 GHz	EMCO	3115	C00945	10/06/12		
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	11/11/12		
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1		02/07/13		
Horn Antenna, 26.5 GHz	ARA	MWH-1826/B	C00589	04/23/13		
Horn Antenna, 40 GHz	ARA	MWH-2640/B	C00981	06/14/13		
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	C01069	12/15/12		
E-Series Power Sensor 9 kHg~18 GHz	Agilent	E9304A	1260847C	05/23/13		
P-Series single channel Power Meter	Agilent / HP	N1911A		07/27/13		
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 14 of 199

7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 789033 Zero-Span Spectrum Analyzer Method.

7.1. ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time	Period	Duty Cycle	Duty	Duty Cycle	1/B
	В		x	Cycle	Correction Factor	Minimum VBW
	(msec)	(msec)	(linear)	(%)	(dB)	(kHz)
802.11a 20 MHz	2.055	2.094	0.981	98.1%	0.08	0.487
802.11n HT20	1.917	1.947	0.985	98.5%	0.07	0.522
802.11n HT40	0.9445	0.9599	0.984	98.4%	0.07	1.059

7.2. MEASUREMENT METHOD FOR POWER AND PPSD

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

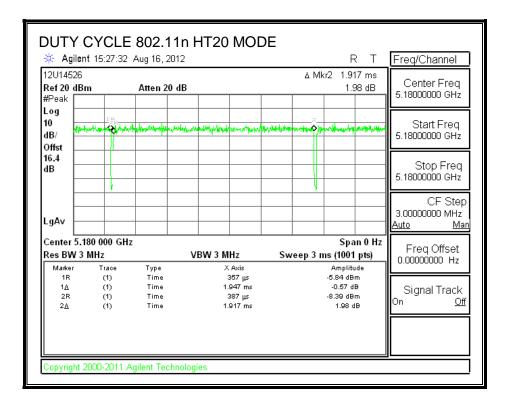
7.3. MEASUREMENT METHOD FOR AVG SPURIOUS EMISSIONS ABOVE 1 GHz

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

Page 15 of 199

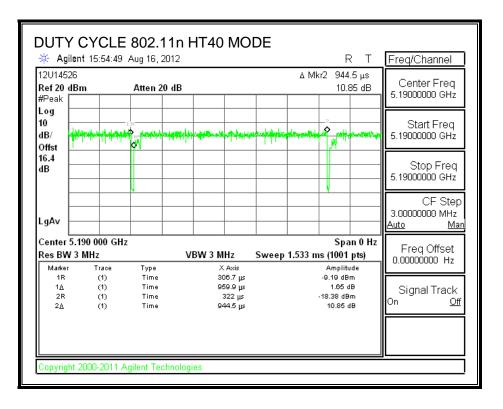
7.4. DUTY CYCLE PLOTS

🄅 Agi	ilent 16:43:1	16 Aug 15, 20	12		RT	Marker
Project:	12U14526			∆ Mk	r2 - 2.055 ms	Select Marker
Ref 20 (#Peak	dBm	#Atten 20	dB		3.50 dB	
Log					2	
10 ID/	-	(12-2, 1-4, 14-18-1-1-17)	114 A TEN B 1944 WAL HOLD AND BURNER		Roventerinteril	Marker Trace
dB/ Offst						<u>Auto 1 2</u>
16.4						
dB						Readout
						Time
						Marker Table
#PAvg						OnOf
Center	5.180 000 G	iHz			Span 0 H	z
Res BW	/ 3 MHz		VBW 3 MHz	Sweep 3 n	ns (1001 pts)	Marker All Off
Marker	Trace	Type	X Axis		Amplitude	
1R	(1)	Time	372 μs		-7.95 dBm	
1∆ 2R	(1)	Time Time	2.094 ms		0.00 dB -7.95 dBm	
2K 2A	(1) (1)	Time	372 μs 2.055 ms		-7.90 dBm 3.50 dB	
	(0	, inte	2.000 ms		0.00 40	
						More
						2 of 2
						2012



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Page 16 of 199



Page 17 of 199

8. ANTENNA PORT TEST RESULTS 8.1. 802.11a MODE IN THE 5.2 GHz BAND

8.1.1. 26 dB BANDWIDTH

<u>LIMITS</u>

None; for reporting purposes only.

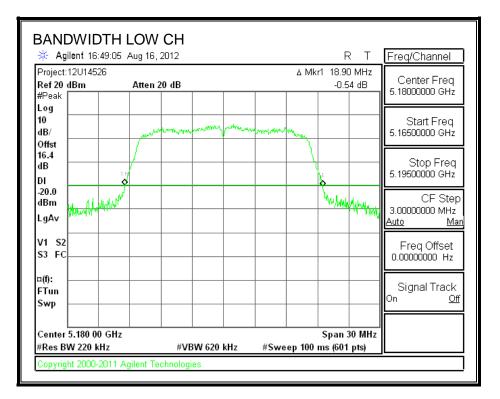
RESULTS

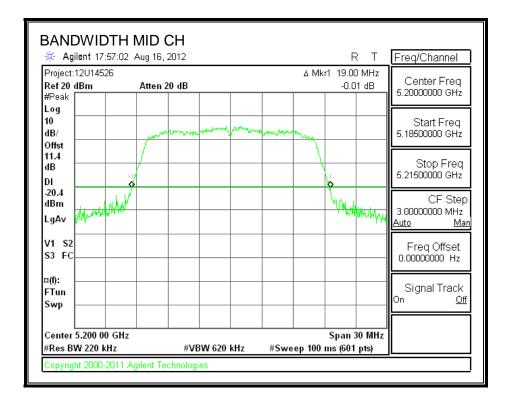
Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5180	18.90
Mid	5200	19.00
High	5240	18.95

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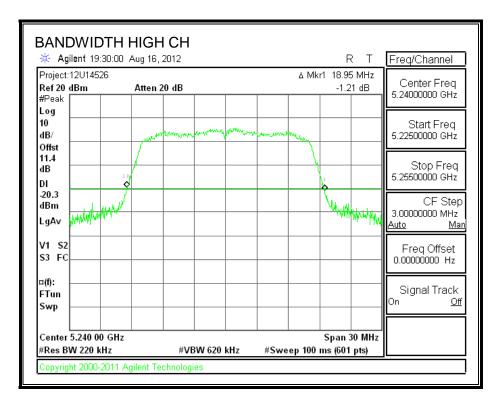
Page 18 of 199

26 dB BANDWIDTH





Page 19 of 199



Page 20 of 199

8.1.2. 99% BANDWIDTH

<u>LIMITS</u>

None; for reporting purposes only.

RESULTS

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5180	16.3359
Mid	5200	16.3390
High	5240	16.3392

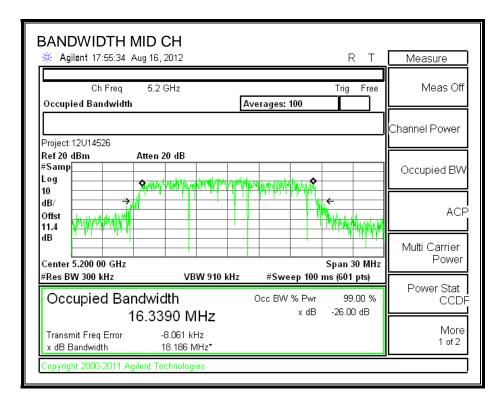
 Page 21 of 199

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 FORM NO: CCSUP4701H

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 Services Inc.

BANDWIDTH LO			RТ	Measure
Ch Freq 5. Occupied Bandwidth	18 GHz	Averages: 100	Trig Free	Meas Off
Project:12U14526				Channel Power
Ref 20 dBm Atte #Samp	n 20 dB			Occupied BW
dB/ Offst 16.4			+ Muhrulput al (1,1,1,1,1,1)	ACP
dB	VBW 910 k	44- #Success 20.72	Span 30 MHz	Multi Carrier Power
Occupied Bandw	/idth	(Hz #Sweep 89.72) Occ BW % Pwr x dB	99.00 %	Power Stat CCDF
16.3 Transmit Freq Error x dB Bandwidth	3 59 MHz 475.189 Hz 18.164 MHz*		20.00 00	More 1 of 2
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Page 22 of 199

BANDWIDTH HIGH CH	Measure
Ch Freq 5.24 GHz Trig Free Occupied Bandwidth Averages: 100	Meas Off
Project:12U14526	Channel Power
Ref 20 dBm Atten 20 dB #Samp Log	Occupied BW
dB/ Offst 11.4 Add Add Add Add Add Add Add Add Add Ad	ACP
dB Center 5.240 00 GHz #Res BW 300 kHz VBW 910 kHz #Sweep 100 ms (601 pts)	Multi Carrier Power
Occupied Bandwidth Occ BW % Pwr 99.00 % 16.3392 MHz x dB -26.00 dB	Power Stat CCDF
Transmit Freq Error 3.270 kHz x dB Bandwidth 18.195 MHz*	More 1 of 2
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Page 23 of 199

8.1.3. AVERAGE POWER

<u>LIMITS</u>

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.4 dB (including 10 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency	Power
	(MHz)	(dBm)
Low	5180	13.98
Mid	5200	13.93
High	5240	13.85

Page 24 of 199

8.1.4. OUTPUT POWER AND PPSD

<u>LIMITS</u>

FCC §15.407 (a) (1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

Page 25 of 199

Limits FCC 15.407

Channel	Frequency	Directi onal Gain	Power Limit	PPSD Limit
	(MHz)	(dBi)	(dBm)	(dBm)
Low	5180	4.70	24.00	11.00
Mid	5200	4.70	24.00	11.00
High	5240	4.70	24.00	11.00

Output Power Results

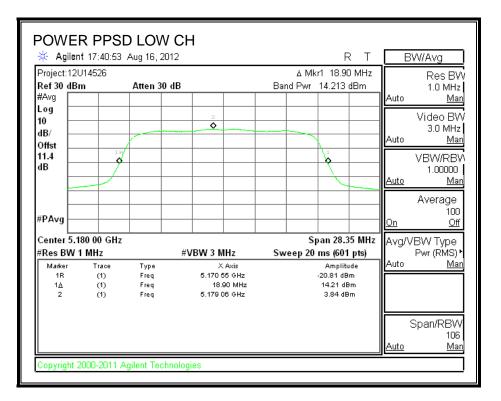
Channel	Frequency	Meas	Corr'd	Power	Power
		Power	Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5180	14.213	14.213	24.00	-9.787
Mid	5200	14.257	14.257	24.00	-9.743
High	5240	14.124	14.124	24.00	-9.876

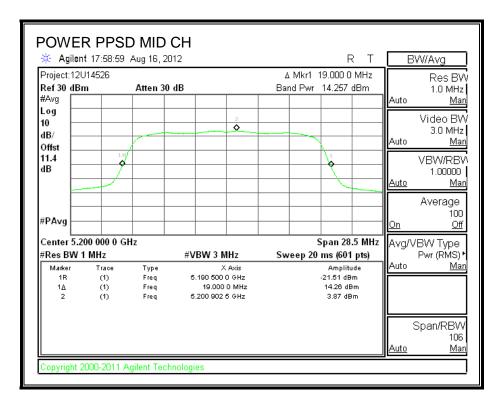
PPSD Results

Channel	Frequency	Meas	Corr'd	PPSD	PPSD
		PPSD	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5180	3.84	3.84	11.00	-7.16
Mid	5200	3.87	3.87	11.00	-7.13
High	5240	3.70	3.70	11.00	-7.30

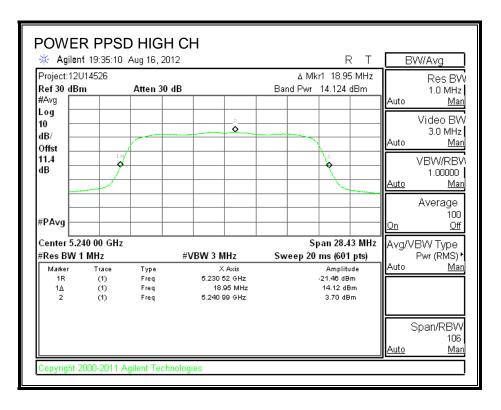
Page 26 of 199

OUTPUT POWER AND PPSD





Page 27 of 199



Page 28 of 199

8.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

8.2.1. 26 dB BANDWIDTH

LIMITS

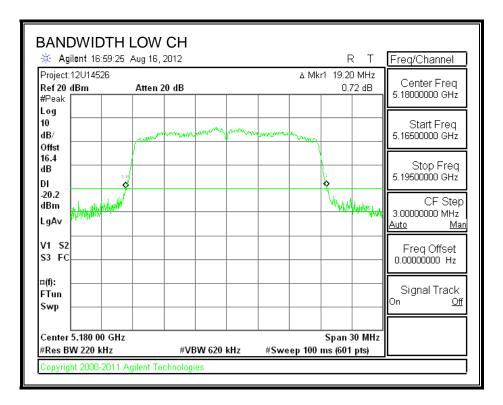
None; for reporting purposes only.

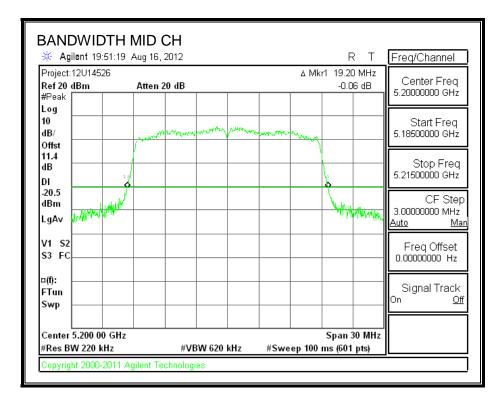
RESULTS

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5180	19.20
Mid	5200	19.20
High	5240	19.25

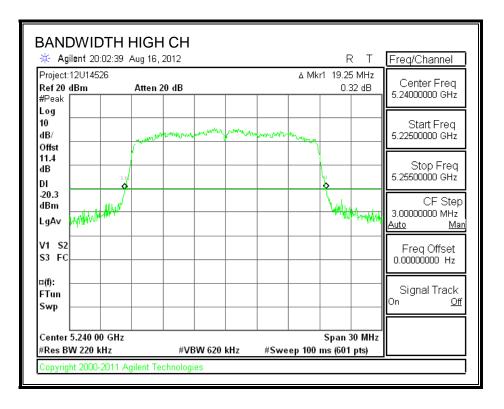
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Page 29 of 199





Page 30 of 199



Page 31 of 199

8.2.2. 99% BANDWIDTH

<u>LIMITS</u>

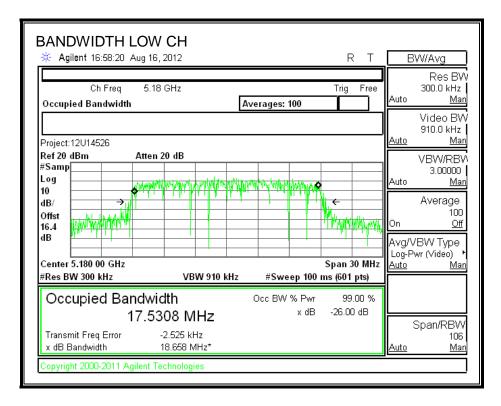
None; for reporting purposes only.

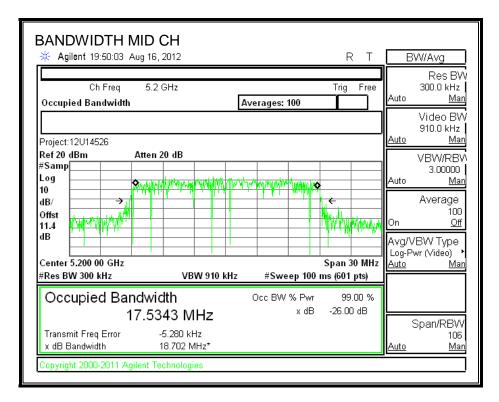
RESULTS

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5180	17.5308
Mid	5200	17.5343
High	5240	17.5313

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Page 32 of 199





Page 33 of 199

BANDWIDTH HIGH CH Agilent 20:01:37 Aug 16, 2012		RТ	Measure
Ch Freq 5.24 GHz Occupied Bandwidth	Averages: 100	Trig Free	Meas Off
Project: 12U14526			Channel Power
Ref 20 dBm Atten 20 dB #Samp Log 10	e Maria M		Occupied BW
dB/ Offst 11.4 dB		C MARANA	ACP
Center 5.240 00 GHz #Res BW 300 kHz VBW 910	kHz #Sweep 100 i	Span 30 MHz ms (601 pts)	Multi Carrier Power
Occupied Bandwidth 17.5313 MHz	Occ BW % Pwr x dB	99.00 % -26.00 dB	Power Stat CCDF
Transmit Freq Error -5.525 kHz x dB Bandwidth 18.666 MHz*			More 1 of 2
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Page 34 of 199

8.2.3. AVERAGE POWER

<u>LIMITS</u>

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.4 dB (including 10 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency	Power	
	(MHz)	(dBm)	
Low	5180	13.94	
Mid	5200	13.94	
High	5240	13.87	

Page 35 of 199

8.2.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

Page 36 of 199

Limits FCC 15.407

Channel	Frequency	Directi onal Gain	Power Limit	PPSD Limit
	(MHz)	(dBi)	(dBm)	(dBm)
Low	5180	4.70	24.00	11.00
Mid	5200	4.70	24.00	11.00
High	5240	4.70	24.00	11.00

Output Power Results

Channel	Frequency	Meas	Corr'd	Power	Power
		Power	Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5180	14.354	14.354	24.00	-9.646
Mid	5200	14.155	14.155	24.00	-9.845
High	5240	14.298	14.298	24.00	-9.702

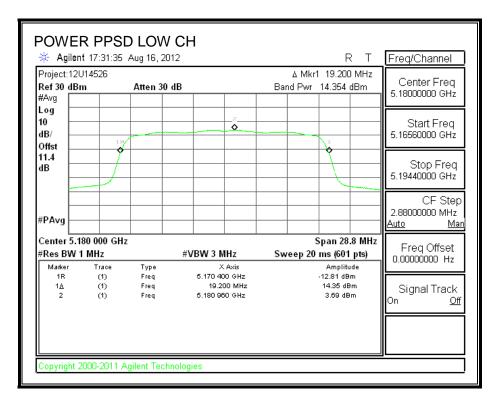
PPSD Results

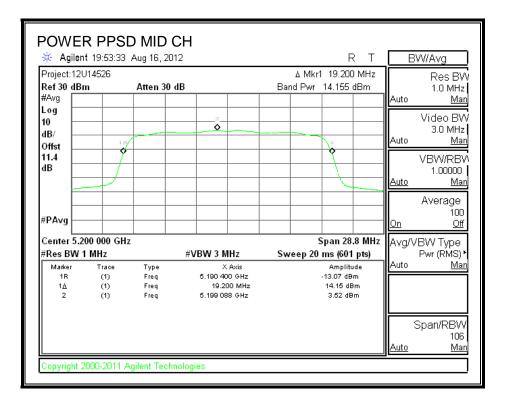
Channel	Frequency	Meas	Corr'd	PPSD	PPSD
		PPSD	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5180	3.69	3.69	11.00	-7.31
Mid	5200	3.52	3.52	11.00	-7.48
High	5240	3.67	3.67	11.00	-7.33

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Page 37 of 199

OUTPUT POWER AND PPSD





Page 38 of 199

-	f 20:07:23	Aug 16, 201	2				F		B\	N/Avg
Project:12U Ref 30 dBi #Avg		Atten 30 d	B		Bar		r1 19.25 14.298		Auto	Res BV 1.0 MHz <u>Mar</u>
Log 10 dB/ Offst	18		2 Q				1		Auto	Video BV 3.0 MHz <u>Mar</u>
dB									<u>Auto</u>	VBW/RBV 1.00000 <u>Mar</u>
#PAvg									<u>On</u>	Average 100 <u>Off</u>
Center 5.2	40 00 GHz	· · · · · ·				S	an 28.8	8 MHz		BW Type
#Res BW ⁷ Marker 1R 1∆ 2	1 MHz Trace (1) (1) (1)	Type Freq Freq Freq	5.230 3	Axis 8 GHz 25 MHz	Sw		ms (601 Amplitu -13.36 dB 14.30 dE 3.67 dB	nde m Im	Auto	Pwr (RMS) ⁽ <u>Mar</u>
									S <u>Auto</u>)pan/RBW 106 <u>Mar</u>

Page 39 of 199

8.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND

8.3.1. 26 dB BANDWIDTH

LIMITS

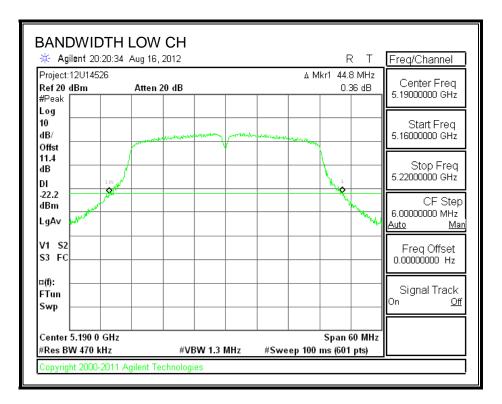
None; for reporting purposes only.

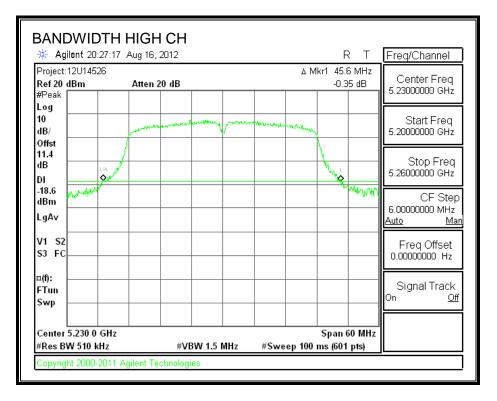
RESULTS

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5190	44.8
High	5230	45.6

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Page 40 of 199





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Page 41 of 199

8.3.2. 99% BANDWIDTH

<u>LIMITS</u>

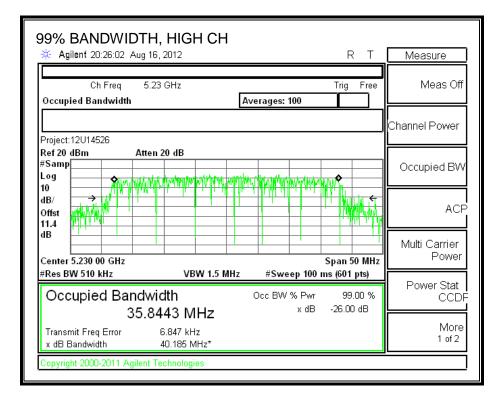
None; for reporting purposes only.

RESULTS

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5190	35.7917
High	5230	35.8443

Page 42 of 199

99% BANDWIDTH, LOV	V CH		RТ	Measure
Ch Freq 5.19 GHz Occupied Bandwidth	А	verages: 100	Trig Free	Meas Off
Project:12U14526				Channel Power
Ref 20 dBm Atten 20 dB #Samp Log 10		Rind//Madurence.	14.00	Occupied BW
dB/ → 1 → 1 → 1 → 1 → 1 → 1 → 1 → 1 → 1 →			<	ACP
Center 5.190 00 GHz	BW 1.5 MHz	#Sweep 100 r	Span 50 MHz ns (601 pts)	Multi Carrier Power
Occupied Bandwidth 35.7917 N	1Hz	Occ BW % Pwr x dB	99.00 %	Power Stat CCDF
Transmit Freq Error -7.045 k x dB Bandwidth 39.871 l				More 1 of 2
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Page 43 of 199

8.3.3. AVERAGE POWER

<u>LIMITS</u>

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.4 dB (including 10 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency	Power
	(MHz)	(dBm)
Low	5190	11.95
High	5230	15.45

Page 44 of 199

8.3.4. OUTPUT POWER AND PPSD

<u>LIMITS</u>

FCC §15.407 (a) (1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

Page 45 of 199

Limits

Channel	Frequency	Directi	Power	PPSD
		onal		
		Gain	Limit	Limit
	(MHz)	(dBi)	(dBm)	(dBm)
Low	5190	4.70	24.00	11.00
High	5230	4.70	24.00	11.00

Output Power Results

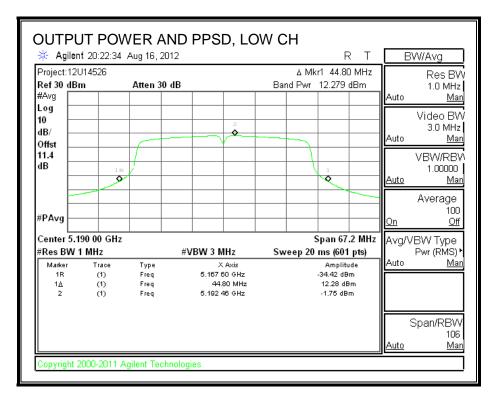
Channel	Frequency	Meas	Corr'd	Power	Power
		Power	Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5190	12.279	12.279	24.00	-11.721
High	5230	15.780	15.780	24.00	-8.220

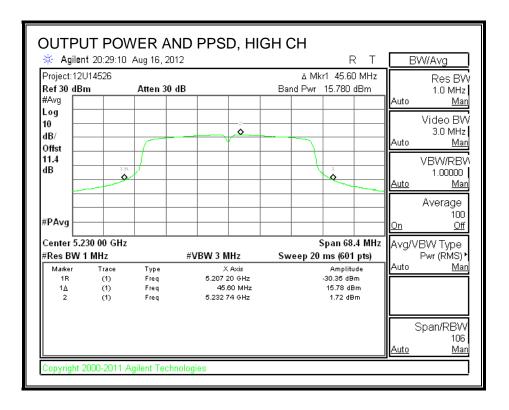
PPSD Results

Channel	Frequency	Meas	Corr'd	PPSD	PPSD
		PPSD	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5190	-1.75	-1.75	11.00	-12.75
High	5230	1.72	1.72	11.00	-9.28

Page 46 of 199

OUTPUT POWER AND PPSD





Page 47 of 199

8.4. 802.11a MODE IN THE 5.3 GHz BAND

8.4.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

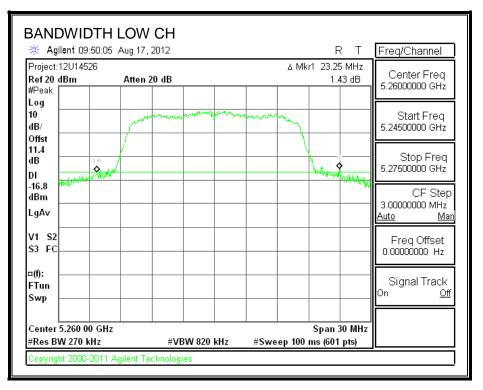
RESULTS

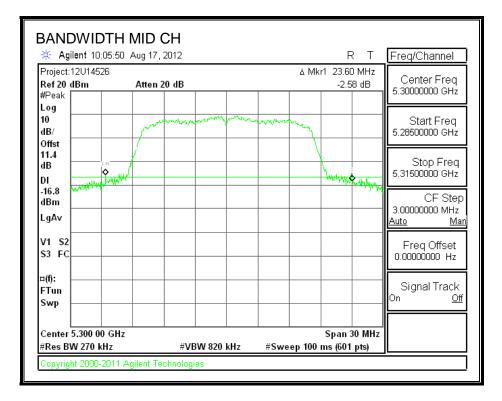
Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5260	23.25
Mid	5300	23.60
High	5320	19.00

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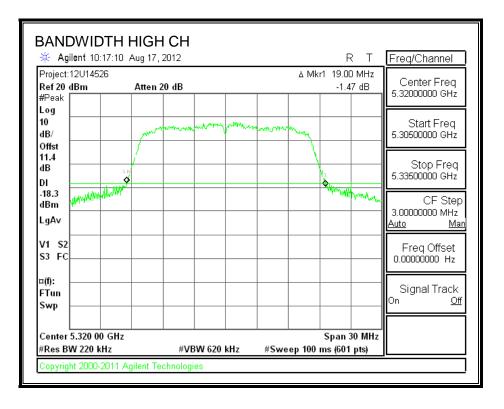
Page 48 of 199

26 dB BANDWIDTH





Page 49 of 199



Page 50 of 199

8.4.2. 99% BANDWIDTH

<u>LIMITS</u>

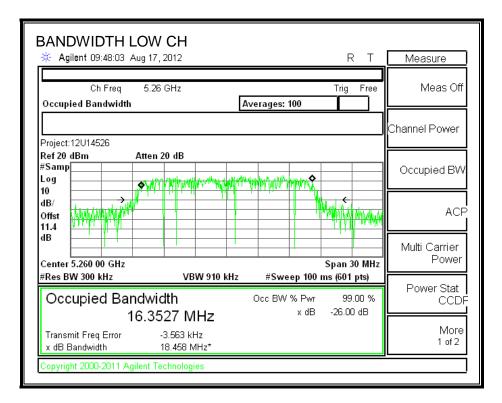
None; for reporting purposes only.

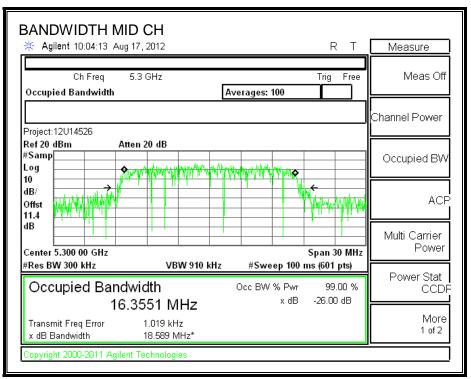
RESULTS

Frequency	99% Bandwidth
(MHz)	(MHz)
5260	16.3527
5300	16.3551
5320	16.3541

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Page 51 of 199





Page 52 of 199

BANDWIDTH HIGH CH Agilent 10:16:19 Aug 17, 2012			RТ	Measure
Ch Freq 5.32 GHz Occupied Bandwidth	Average	es: 100	Trig Free	Meas Off
Project:12U14526				Channel Power
Ref 20 dBm Atten 20 dB #Samp	[nd ^a]][[]][]][] [[]]	aller 11 ⁴⁴ Marta re ,		Occupied BW
dB/ Offst			< Martine Martine Martine	ACP
dB			pan 30 MHz	Multi Carrier Power
#Res BW 300 kHz VB Occupied Bandwidth		weep 100 ms W % Pwr	; (601 pts) 99.00 %	Power Stat CCDF
16.3541 M		x dB	-26.00 dB	More
Transmit Freq Error -4.401 kH x dB Bandwidth 18.253 M				1 of 2
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Page 53 of 199

8.4.3. AVERAGE POWER

<u>LIMITS</u>

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.4 dB (including 10 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency	Power
	(MHz)	(dBm)
Low	5260	16.90
Mid	5300	16.87
High	5320	15.97

Page 54 of 199

8.4.4. OUTPUT POWER AND PPSD

<u>LIMITS</u>

FCC §15.407 (a) (2)

For the band 5.25–5.35 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

Page 55 of 199

Limits

Channel	Frequency	Fixed	В	11 + 10 Log B	Directional	Power	PPSD
		Limit		Limit	Gain	Limit	Limit
	(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dBm)	(dBm)
Low	5260	24	16.3527	23.14	5.08	23.14	11.00
Mid	5300	24	16.3551	23.14	5.08	23.14	11.00
High	5320	24	16.3541	23.14	5.08	23.14	11.00

Output Power Results

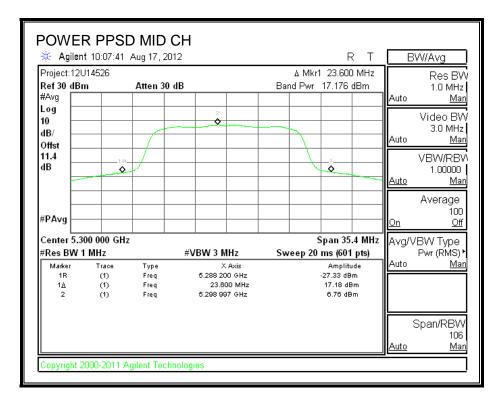
Channel	Frequency	Meas	Corr'd	Power	Power
		Power	Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5260	17.164	17.164	23.14	-5.972
Mid	5300	17.176	17.176	23.14	-5.961
High	5320	16.451	16.451	23.14	-6.685

PPSD Results

Channel	Frequency	Meas	Corr'd	PPSD	PPSD
		PPSD	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5260	6.74	6.74	11.00	-4.26
Mid	5300	6.76	6.76	11.00	-4.24
High	5320	6.03	6.03	11.00	-4.97

Page 56 of 199

POWER P			RT	BW/Avg
Project:12U1452 Ref 30 dBm #Avg	6 Atten 3	0 dB	∆ Mkr1 23.25 MH; Band Pwr 17.164 dBm	
Log 10 dB/ Offst		2		Video BV 3.0 MHz Auto <u>Man</u>
11.4 dB				VBW/RBV 1.00000 <u>Auto Man</u>
#PAvg				Average 100 <u>On Off</u>
Center 5.260 00			Span 34.88 MH	1
#Res BW 1 MHz Marker Tra 1R (1 1Δ (1 2 (1	ice Type) Freq) Freq	#VBW 3 MHz X Axis 5.248 38 GHz 23.25 MHz 5.259 13 GHz	Sweep 20 ms (601 pts) Amplitude -27.64 dBm 17.16 dBm 6.74 dBm	Auto Mar
				Span/RBW 106 <u>Auto Mar</u>



Page 57 of 199

-		Aug 17, 20	12		RT		3W/Avg
Project:12U Ref 30 dBi #Avg		Atten 30	dB		19.000 0 MHz 16.451 dBm	Auto	Res BV 1.0 MHz <u>Mar</u>
Log 10 dB/ Offst			2			Auto	Video BW 3.0 MHz <u>Mar</u>
11.4 dB						- <u>Auto</u>	VBW/RBV 1.00000 <u>Mar</u>
#PAvg						<u>On</u>	Average 100 <u>Off</u>
Center 5.3 #Res BW 1	20 000 0 G	Hz	#VBW 3 MHz	Sween 2	Span 28.5 MH 0 ms (601 pts)	z Avg/	VBW Type Pwr (RMS)
Marker 1R 1 <u>∆</u> 2	Trace (1) (1) (1) (1)	Type Freq Freq Freq	X Axis 5.310 500 0 GHz 19.000 0 MHz 5.319 145 0 GHz	546642	Amplitude -19.02 dBm 16.45 dBm 6.03 dBm	Auto	Mar
						Auto	Span/RBW 106 <u>Mar</u>

Page 58 of 199

8.5. 802.11n HT20 MODE IN THE 5.3 GHz BAND

8.5.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

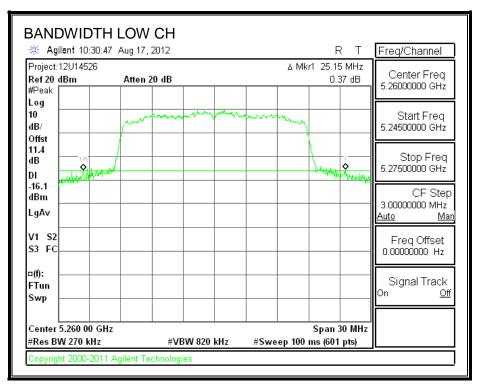
RESULTS

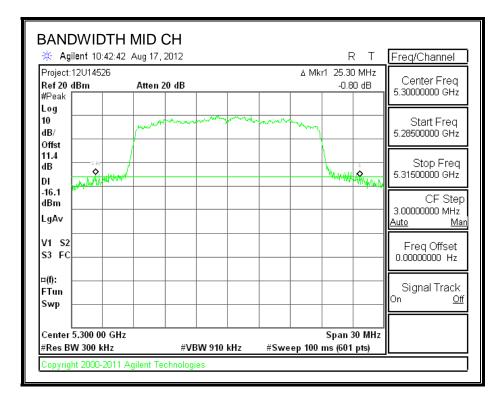
Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5260	25.15
Mid	5300	25.30
High	5320	19.60

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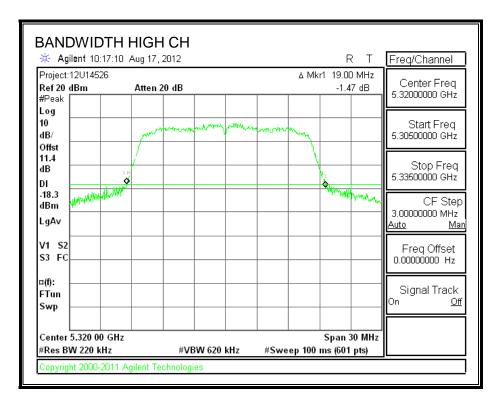
Page 59 of 199

26 dB BANDWIDTH





Page 60 of 199



Page 61 of 199

8.5.2. 99% BANDWIDTH

<u>LIMITS</u>

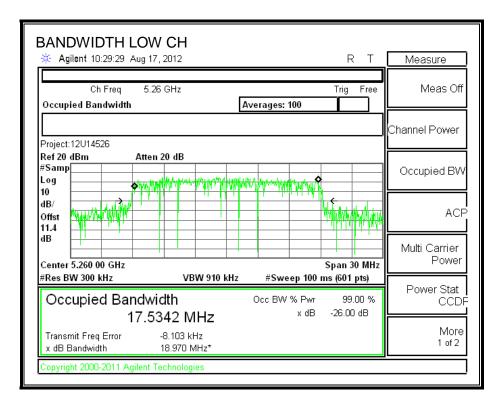
None; for reporting purposes only.

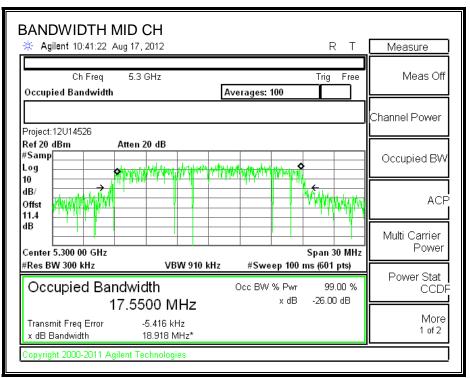
RESULTS

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5260	17.5342
Mid	5300	17.5500
High	5320	17.5299

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Page 62 of 199





Page 63 of 199

BANDWIDTH HIGH CH Agilent 10:48:20 Aug 17, 2012 R T	Measure			
Ch Freq 5.32 GHz Trig Free Occupied Bandwidth Averages: 100	Meas Off			
Project: 12U14526	Channel Power			
Ref 20 dBm Atten 20 dB #Samp Log	Occupied BW			
10 dB/ Offst 11.4	ACP			
dB Center 5.320 00 GHz Span 30 MHz	Multi Carrier Power			
#Res BW 300 kHz VBW 910 kHz #Sweep 100 ms (601 pts)	Power Stat			
Occupied Bandwidth Occ BW % Pwr 99.00 % 17.5299 MHz × dB -26.00 dB				
Transmit Freq Error -8.368 kHz x dB Bandwidth 18.699 MHz*	More 1 of 2			
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Page 64 of 199

8.5.3. 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 11.4 dB (including 10 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency	Power
	(MHz)	(dBm)
Low	5260	16.91
Mid	5300	16.90
High	5320	15.91

Page 65 of 199

8.5.4. OUTPUT POWER AND PPSD

<u>LIMITS</u>

FCC §15.407 (a) (2)

For the band 5.25–5.35 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

Page 66 of 199

Limits

Channel	Frequency	Fixed	В	11 + 10 Log B	Directional	Power	PPSD
		Limit		Limit	Gain	Limit	Limit
	(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dBm)	(dBm)
Low	5260	24	17.5342	23.44	5.08	23.44	11.00
Mid	5300	24	17.5500	23.44	5.08	23.44	11.00
High	5320	24	17.5299	23.44	5.08	23.44	11.00

Output Power Results

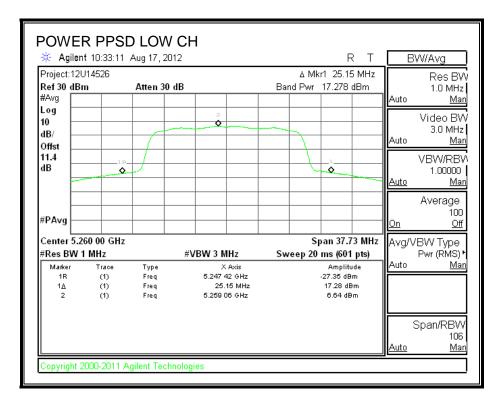
Channel	Frequency	Meas	Corr'd	Power	Power
		Power	Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5260	17.278	17.278	23.44	-6.161
Mid	5300	17.251	17.251	23.44	-6.192
High	5320	16.357	16.357	23.44	-7.081

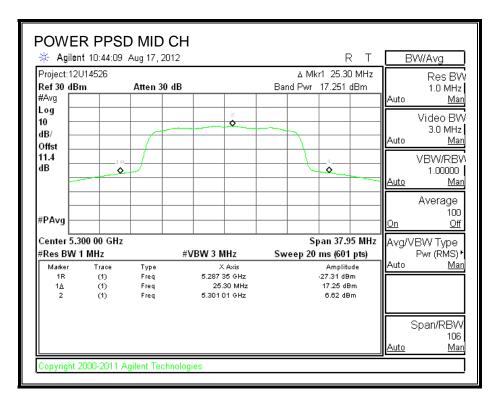
PPSD Results

Channel	Frequency	Meas	Corr'd	PPSD	PPSD
		PPSD	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5260	6.64	6.64	11.00	-4.36
Mid	5300	6.62	6.62	11.00	-4.38
High	5320	5.74	5.74	11.00	-5.26

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Page 67 of 199





Page 68 of 199

🔆 Agilen	f 10:51:19	Aug 17, 201	2			F	ς Т	B	N/Avg
Project:12U Ref 30 dBr #Avg		Atten 30 d	IB	E	∆ Mk 3and Pwr	r1 19.60 16.357		Auto	Res BW 1.0 MHz <u>Man</u>
Log 10 dB/ Offst	18		2			1		Auto	Video BW 3.0 MHz <u>Man</u>
11.4 dB	•					8		<u>Auto</u>	VBW/RBV 1.00000 <u>Man</u>
#PAvg								<u>On</u>	Average 100 <u>Off</u>
Center 5.3 #Res BW 1			#VBW 3 MH	z	weep 20	Span 29 ms <i>(</i> 601			BW Type Pwr (RMS) •
Marker 1R 1∆ 2	Trace (1) (1) (1)	Type Freq Freq Freq	X A 5.310 20 19.60 5.319 17	kis GHz MHz		Amplitu -15.39 dB 16.36 dE 5.74 dB	ide Im Im	Auto	Man
								S <u>Auto</u>)pan/RBW 106 <u>Mar</u>

Page 69 of 199

8.6. 802.11n HT40 MODE IN THE 5.3 GHz BAND

8.6.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

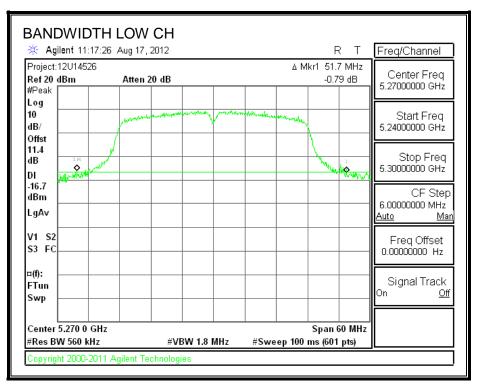
RESULTS

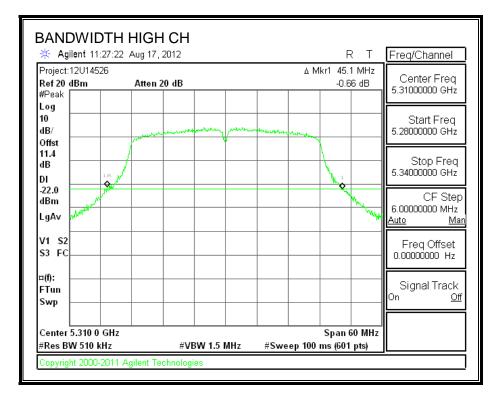
Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5270	51.70
High	5310	45.10

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Page 70 of 199

26 dB BANDWIDTH





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Page 71 of 199

8.6.2. 99% BANDWIDTH

<u>LIMITS</u>

None; for reporting purposes only.

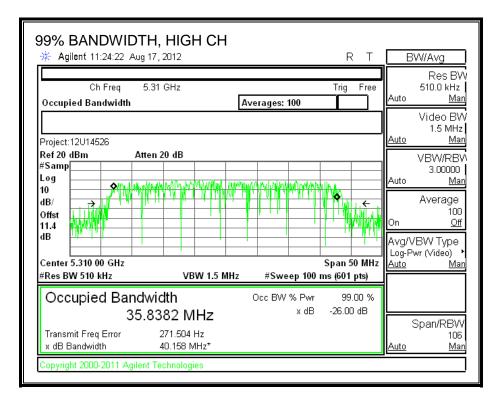
RESULTS

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5270	35.8357
High	5310	35.8382

DATE: DECEMBER 07, 2015

Page 72 of 199

Agilent 11:15:42 Aug 17	7, 2012		R T	Measure
Ch Freq 5.2 Occupied Bandwidth	7 GHz	Averages: 100	Trig Free	Meas Off
•				Channel Power
≠Samp Log ∳ tutioti√n'n		11 ¹¹ 11 ¹¹¹ 111 ¹¹¹ 111 ¹¹¹ 111111		Occupied BV
10 IB/ → 10 IT.4 IB				ACI
Center 5.270 00 GHz #Res BW 510 kHz	VBW 1.5 M		Span 50 MHz ns (601 pts)	Multi Carrier Power
Occupied Bandw 35.8	idth 357 MHz	Occ BW % Pwr x dB		Power Stat CCD
Transmit Freq Error x dB Bandwidth	-1.102 kHz 41.001 MHz*			More 1 of 2



Page 73 of 199

8.6.3. AVERAGE POWER

<u>LIMITS</u>

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.4 dB (including 10 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency	Power
	(MHz)	(dBm)
Low	5270	17.0
High	5310	11.9

Page 74 of 199

8.6.4. OUTPUT POWER AND PPSD

<u>LIMITS</u>

FCC §15.407 (a) (2)

For the band 5.25–5.35 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

Page 75 of 199

Limits

Channel	Frequency	Fixed	В	11 + 10 Log B	Directional	Power	PPSD
		Limit		Limit	Gain	Limit	Limit
	(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dBm)	(dBm)
Low	5270	24	35.8357	26.54	5.08	24.00	11.00
High	5310	24	35.8380	26.54	5.08	24.00	11.00

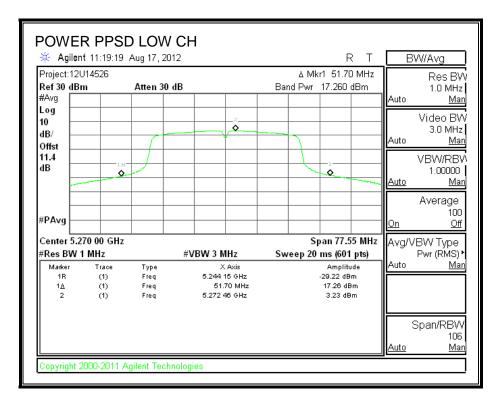
Output Power Results

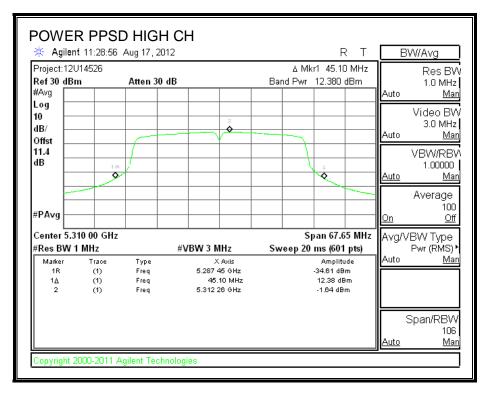
Channel	Frequency	Meas	Corr'd	Power	Power
		Power	Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5270	17.260	17.260	24.00	-6.740
High	5310	12.380	12.380	24.00	-11.620

PPSD Results

Channel	Frequency	Meas	Corr'd	PPSD	PPSD
		PPSD	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5270	3.29	3.29	11.00	-7.71
High	5310	-1.64	-1.64	11.00	-12.64

Page 76 of 199





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Page 77 of 199

8.7. 802.11a MODE IN THE 5.6 GHz BAND

8.7.1. 26 dB BANDWIDTH

LIMITS

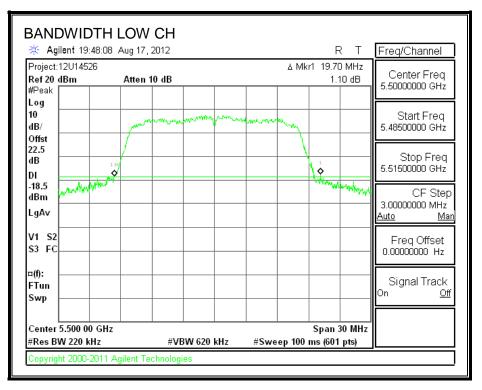
None; for reporting purposes only.

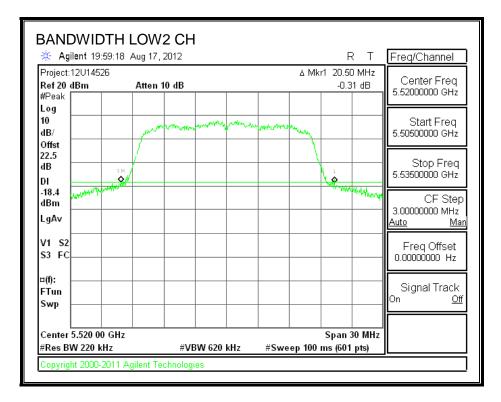
RESULTS

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5500	19.70
Low2	5520	20.50
Mid	5580	20.00
High2	5680	19.60
High	5700	19.10

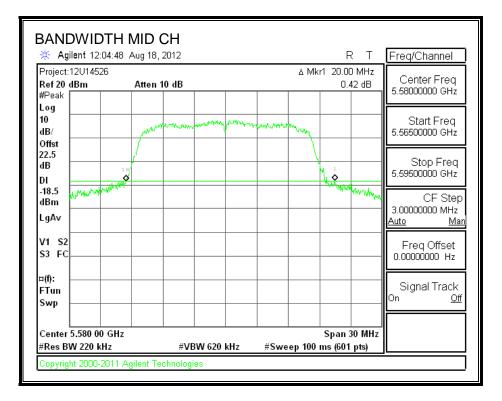
Page 78 of 199

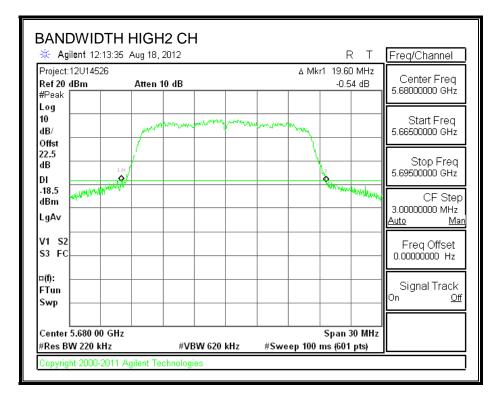
26 dB BANDWIDTH



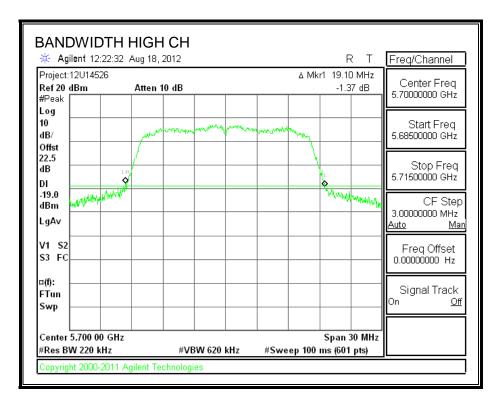


Page 79 of 199





Page 80 of 199



Page 81 of 199

8.7.2. 99% BANDWIDTH

<u>LIMITS</u>

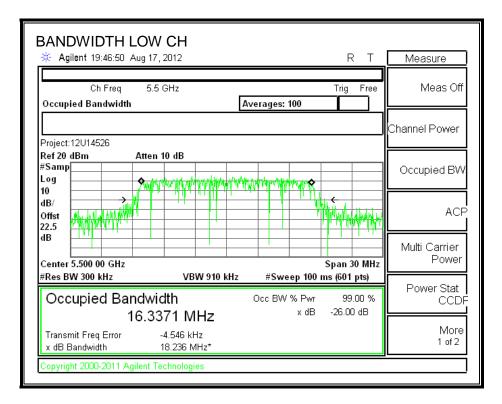
None; for reporting purposes only.

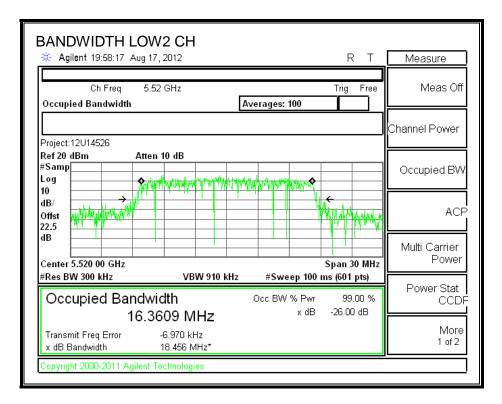
RESULTS

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5500	16.3371
Low2	5520	16.3609
Mid	5580	16.3586
High2	5680	16.3476
High	5700	16.3529

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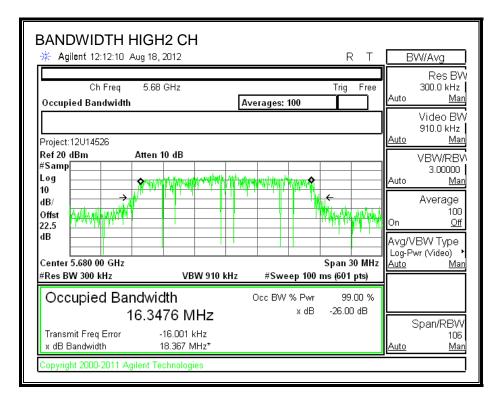
Page 82 of 199





Page 83 of 199

BANDWIDTH MID CH	R T	Measure
Ch Freq 5.58 GHz Occupied Bandwidth	Trig Free	Meas Off
		Channel Power
Project:12U14526 Ref 20 dBm Atten 10 dB #Samp Log Arc.////amw.co/action/		Occupied BW
10 dB/ Offst 22.5		ACF
dB	Span 30 MHz	Multi Carrier Power
	910 kHz #Sweep 100 ms (601 pts)	Power Stat
Occupied Bandwidth 16.3586 MH	Occ BW % Pwr 99.00 % x dB -26.00 dB	CCDI
Transmit Freq Error -435.575 H: x dB Bandwidth 18.303 MH;	z	More 1 of 2
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Page 84 of 199

BANDWIDTH HIGH CH Agilent 12:21:03 Aug 18, 2012		RТ	Measure
Ch Freq 5.7 GHz Occupied Bandwidth	Averages: 100	Trig Free	Meas Off
Project:12U14526			Channel Power
Ref 20 dBm Atten 10 dB #Samp Log			Occupied BW
dB/ Offst 22.5 dB			ACP
Center 5.700 00 GHz #Res BW 300 kHz VBW 91	0 kHz #Sweep 100	Span 30 MHz ms (601 pts)	Multi Carrier Power
Occupied Bandwidth 16.3529 MHz	Occ BW % Pwr x dB	99.00 % -26.00 dB	Power Stat CCDF
Transmit Freq Error x dB Bandwidth-2.585 kHz 18.254 MHz*			More 1 of 2
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Page 85 of 199

8.7.3. AVERAGE POWER

<u>LIMITS</u>

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.5 dB (including 10 dB pad and 1.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency	Power
	(MHz)	(dBm)
Low	5500	15.49
Low2	5520	15.97
Mid	5580	15.94
High2	5680	15.97
High	5700	15.50

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Page 86 of 199

8.7.4. OUTPUT POWER AND PPSD

<u>LIMITS</u>

FCC §15.407 (a) (2)

For the band 5.47–5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

Page 87 of 199

Limits

Channel	Frequency	Fixed	В	11 + 10 Log B	Directional	Power	PPSD
		Limit		Limit	Gain	Limit	Limit
	(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dBm)	(dBm)
Low	5500	24	16.3371	23.13	5.42	23.13	11.00
Low2	5520	24	16.3609	23.14	5.42	23.14	11.00
Mid	5580	24	16.3586	23.14	5.42	23.14	11.00
High2	5680	24	16.3476	23.13	5.42	23.13	11.00
High	5700	24	16.3529	23.14	5.42	23.14	11.00

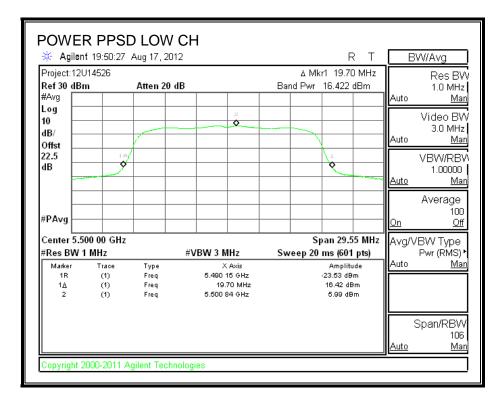
Output Power Results

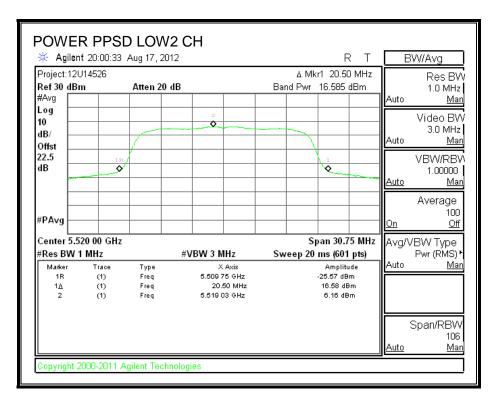
Channel	Frequency	Meas	Corr'd	Power	Power
		Power	Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5500	16.422	16.422	23.13	-6.710
Low2	5520	16.585	16.585	23.14	-6.552
Mid	5580	16.397	16.397	23.14	-6.740
High2	5680	16.574	16.574	23.13	-6.561
High	5700	16.089	16.089	23.14	-7.047

PPSD Results

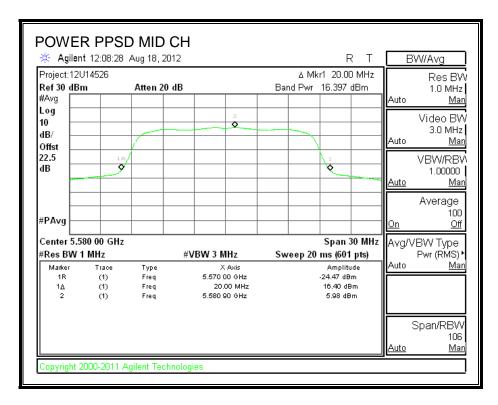
Channel	Frequency	Meas	Corr'd	PPSD	PPSD
		PPSD	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5500	5.99	5.99	11.00	-5.01
Low2	5520	6.16	6.16	11.00	-4.84
Mid	5580	5.98	5.98	11.00	-5.02
High2	5680	6.16	6.16	11.00	-4.84
High	5700	5.68	5.68	11.00	-5.32

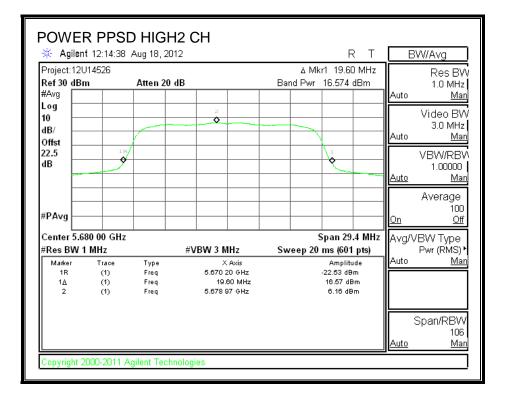
Page 88 of 199





Page 89 of 199





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Page 90 of 199

🔆 Agilen	it 12:25:37	Aug 18, 201	2			R	Т	B	W/Avg
Project:12U Ref 30 dBi #Avg		Atten 20 d	B	Bar	∆Mkr ndPwr 1	1 19.10 16.089 d		Auto	Res BV 1.0 MHz <u>Mar</u>
Log 10 dB/ Offst			2		_			Auto	Video BV 3.0 MHz <u>Mar</u>
22.5 dB						2		<u>Auto</u>	VBVV/RB\ 1.00000 <u>Mar</u>
#PAvg								<u>On</u>	Average 100 <u>Off</u>
Center 5.7 #Res BW 1	00 00 GHz 1 MHz		#VBW 3 MHz	Sw	Sp: eep 20 r	an 28.6 ns (601			BW Type Pwr (RMS) '
Marker 1R 1 <u>∆</u> 2	R (1) Freq 5.690.45 GHz ∆ (1) Freq 19.10 MHz			-	Amplitu 20.13 dBr 16.09 dB 5.68 dBr	n m	Auto	Mar	
								Auto	Span/RBW 106 Mai

Page 91 of 199

8.8. 802.11n HT20 MODE IN THE 5.6 GHz BAND

8.8.1. 26 dB BANDWIDTH

LIMITS

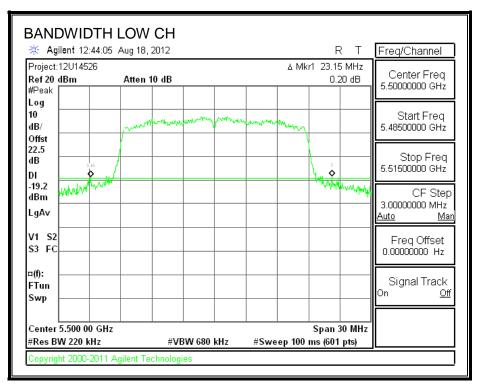
None; for reporting purposes only.

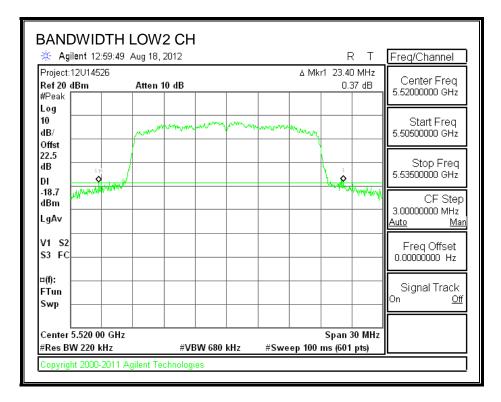
RESULTS

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5500	23.15
Low2	5520	23.40
Mid	5580	20.45
High2	5680	19.35
High	5700	19.25

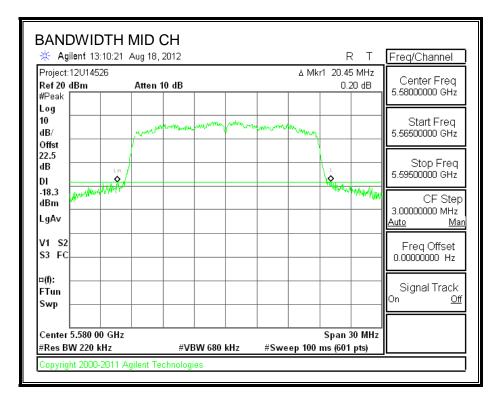
Page 92 of 199

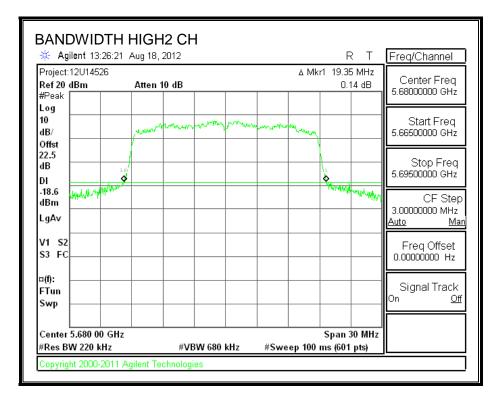
26 dB BANDWIDTH





Page 93 of 199





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Page 94 of 199

🔆 Agilent 13:43:3	30 Aug 18, 2012			RТ	Freq/Channel
Project:12U14526 Ref 20 dBm #Peak	Atten 10 dB		∆ Mkr1 19.2 0	25 MHz .51 dB	Center Freq 5.70000000 GHz
Log 10 dB/ Offst	man and a second	www.www.www.	www.		Start Freq 5.68500000 GHz
22.5 dB DI	1R Š		• • • • • • • • • • • • • • • • • • •		Stop Freq 5.71500000 GHz
-20.0 dBm LgAv	w/		Web	Munhusaya	CF Step 3.0000000 MHz <u>Auto Man</u>
V1 S2 S3 FC					Freq Offset 0.00000000 Hz
¤(f): FTun Swp					Signal Track On <u>Off</u>
Center 5.700 00 GH #Res BW 220 kHz		W 680 kHz #	Span Sweep 100 ms (60	30 MHz 1 pts)	

Page 95 of 199

8.8.2. 99% BANDWIDTH

<u>LIMITS</u>

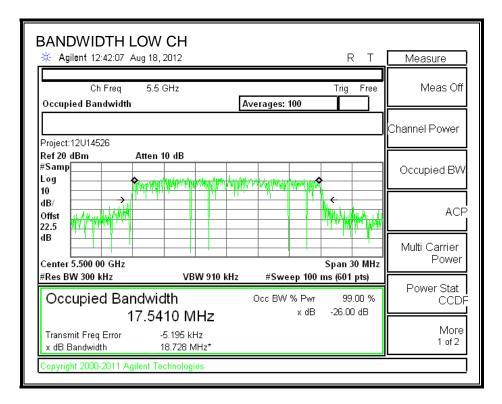
None; for reporting purposes only.

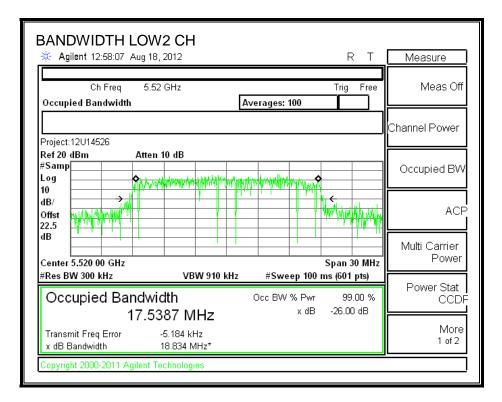
RESULTS

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5500	17.5410
Low2	5520	17.5387
Mid	5580	17.5274
High2	5680	17.5362
High	5700	17.5205

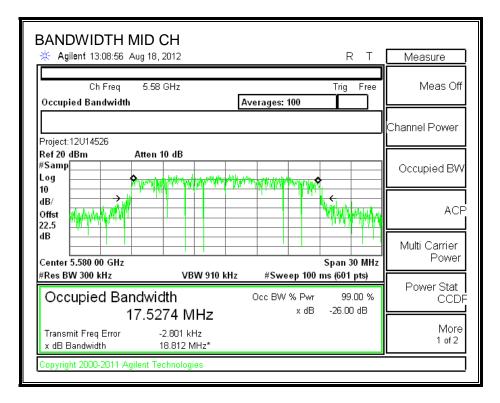
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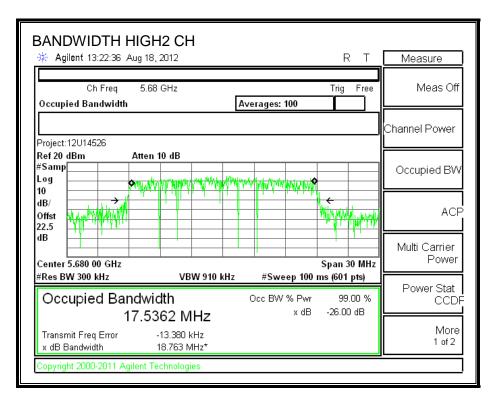
Page 96 of 199





Page 97 of 199





Page 98 of 199

BANDWIDTH HIGH CH	Т	Measure
Ch Freq 5.7 GHz Trig Occupied Bandwidth Averages: 100	Free	Meas Off
Project: 12U14526		Channel Power
Ref 20 dBm Atten 10 dB #Samp Log		Occupied BW
dB/ Offst 22.5	Marina	ACP
dB Center 5.700 00 GHz Span 3 #Res BW 300 kHz VBW 910 kHz #Sweep 100 ms (601		Multi Carrier Power
	00 %	Power Stat CCDF
Transmit Freq Error -8.131 kHz x dB Bandwidth 18.687 MHz*		More 1 of 2
Copyright 2000-2011 Agilent Technologies		

Page 99 of 199

8.8.3. AVERAGE POWER

<u>LIMITS</u>

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.5 dB (including 10 dB pad and 1.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency	Power
	(MHz)	(dBm)
Low	5500	15.48
Low2	5520	15.95
Mid	5580	15.93
High2	5680	15.97
High	5700	14.46

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Page 100 of 199

8.8.4. OUTPUT POWER AND PPSD

<u>LIMITS</u>

FCC §15.407 (a) (2)

For the band 5.47–5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

Page 101 of 199

Limits

Channel	Frequency	Fixed	В	11 + 10 Log B	Directional	Power	PPSD
		Limit		Limit	Gain	Limit	Limit
	(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dBm)	(dBm)
Low	5500	24	17.5410	23.44	5.42	23.44	11.00
Low2	5520	24	17.5387	23.44	5.42	23.44	11.00
Mid	5580	24	17.5274	23.44	5.42	23.44	11.00
High2	5680	24	17.5362	23.44	5.42	23.44	11.00
High	5700	24	17.5205	23.44	5.42	23.44	11.00

Output Power Results

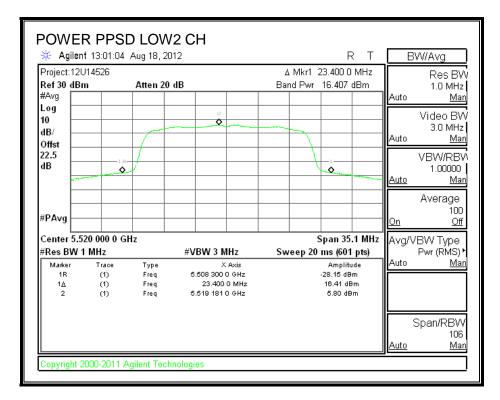
Channel	Frequency	Meas	Corr'd	Power	Power
		Power	Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5500	15.971	15.971	23.44	-7.470
Low2	5520	16.407	16.407	23.44	-7.030
Mid	5580	16.392	16.392	23.44	-7.045
High2	5680	16.421	16.421	23.44	-7.018
High	5700	15.009	15.009	23.44	-8.426

PPSD Results

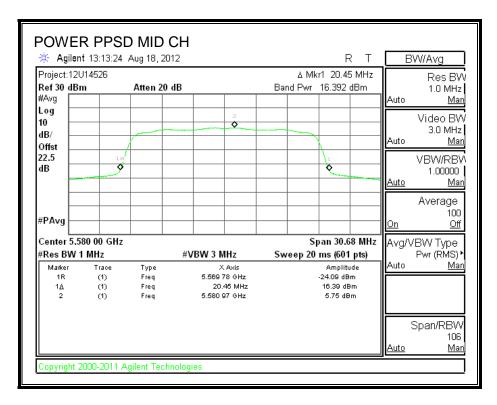
Channel	Frequency	Meas	Corr'd	PPSD	PPSD
		PPSD	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5500	5.32	5.32	11.00	-5.68
Low2	5520	5.80	5.80	11.00	-5.20
Mid	5580	5.75	5.75	11.00	-5.25
High2	5680	5.80	5.80	11.00	-5.20
High	5700	4.34	4.34	11.00	-6.66

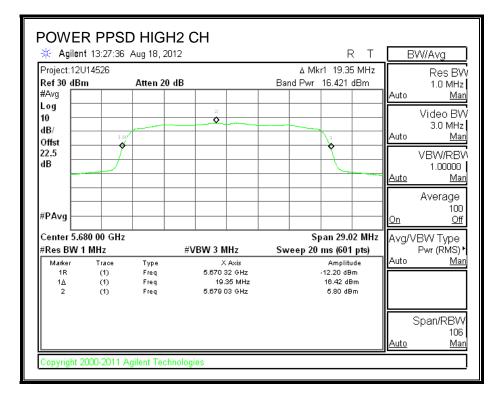
Page 102 of 199

🔆 Agilen	t 12:47:29	Aug 18, 20)12			F	RΤ	В	W/Avg
Project:12U Ref 30 dBr #Avg		Atten 20	dB	Bai	∆Mk ndPwr	r1 23.19 15.971		Auto	Res BV 1.0 MHz <u>Mar</u>
Log 10 dB/ Offst			2					Auto	Video BV 3.0 MHz <u>Mar</u>
22.5 dB						1		<u>Auto</u>	VBW/RB\ 1.00000 <u>Mar</u>
#PAvg								<u>On</u>	Average 100 <u>Off</u>
Center 5.5 #Res BW 1			#V/DW/ 2_MU_	6		oan 34.7		Avg/∖	/BW Type
#Res Bwv 1 Marker 1R 1∆ 2	Trace (1) (1) (1) (1)	Type Freq Freq Freq	#VBW 3 MHz X. Axis 5.488 42 GHz 23.15 MHz 5.499 19 GHz	<u>.</u>	/eep 20	Amplite -30.26 dB 15.97 dB 5.32 dB	ude Im 9m	Auto	Pwr (RMS) ⁱ <u>Mar</u>
								: <u>Auto</u>	Span/RBW 106 <u>Mar</u>



Page 103 of 199





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Page 104 of 199

	t 13:47:55	D HIGH Aug 18, 201			RT	E	W/Avg
Project:12U Ref 30 dBr #Avg		Atten 20	IB	_	Mkr1 19.25 MHz wr 15.009 dBm	: Auto	Res BV 1.0 MHz <u>Mar</u>
Log 10 dB/ Offst	18		2		1	Auto	Video BV 3.0 MHz <u>Mar</u>
22.5 dB						Auto	VBW/RBV 1.00000 <u>Mar</u>
#PAvg						<u>On</u>	Average 100 <u>Off</u>
Center 5.7 #Res BW 1		· ·	#VBW 3 MHz	Sweep	Span 28.88 MH 20 ms (601 pts)	l ···	/BW Type Pwr (RMS) •
Marker 1R 1 <u>∆</u> 2	Trace (1) (1) (1)	Type Freq Freq Freq	X Axis 5.690 38 GHz 19.25 MHz 5.700 98 GHz		Amplitude -12.63 dBm 15.01 dBm 4.34 dBm	Auto	<u>Mar</u>
						Auto	Span/RBW 106 <u>Mar</u>

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Page 105 of 199

8.9. 802.11n HT40 MODE IN THE 5.6 GHz BAND

8.9.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

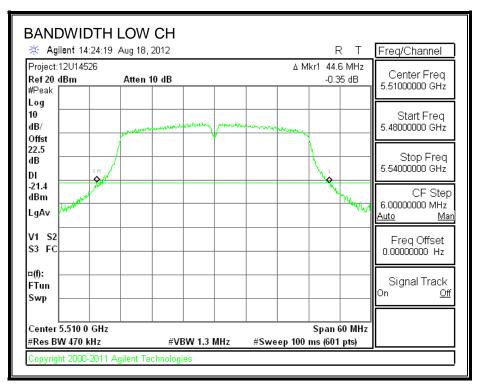
RESULTS

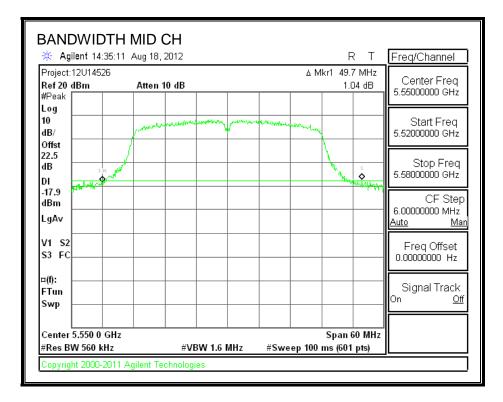
Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5510	44.60
Mid	5550	49.70
High	5670	45.40

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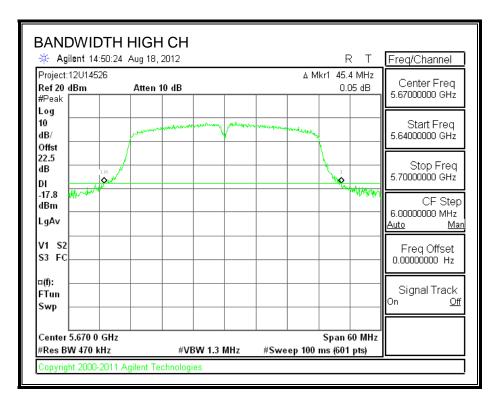
Page 106 of 199

26 dB BANDWIDTH





Page 107 of 199



Page 108 of 199

8.9.2. 99% BANDWIDTH

<u>LIMITS</u>

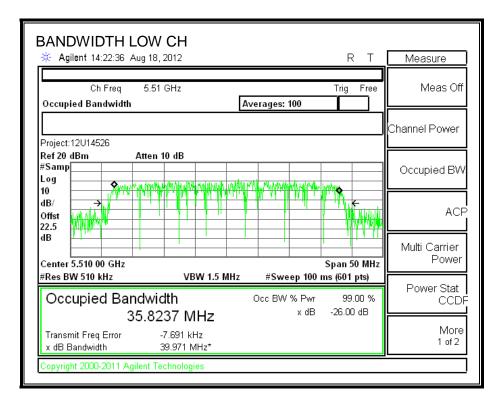
None; for reporting purposes only.

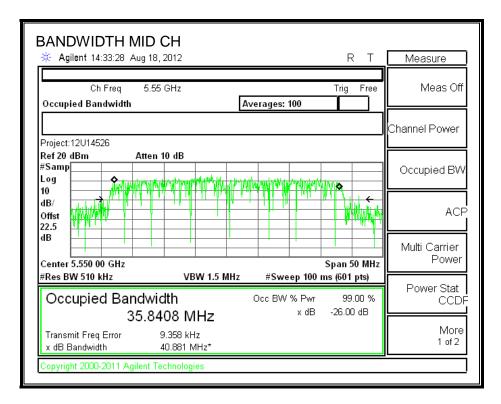
RESULTS

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5510	35.8237
Mid	5550	35.8408
High	5670	35.8519

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Page 109 of 199





Page 110 of 199

BANDWIDTH HIGH CH	Measure
Ch Freq 5.67 GHz Trig Free Occupied Bandwidth Averages: 100	Meas Off
Project: 12U14526	Channel Power
Ref 20 dBm Atten 10 dB #Samp	Occupied BW
dB/ Offst 22.5	ACP
dB Center 5.670 00 GHz #Res BW 510 kHz VBW 1.5 MHz #Sweep 100 ms (601 pts)	Multi Carrier Power
Occupied Bandwidth Occ BW % Pwr 99.00 % 35.8519 MHz × dB -26.00 dB	Power Stat CCDF
Transmit Freq Error -9.135 kHz × dB Bandwidth 40.614 MHz*	More 1 of 2
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Page 111 of 199

8.9.3. AVERAGE POWER

<u>LIMITS</u>

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.5 dB (including 10 dB pad and 1.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency	Power
	(MHz)	(dBm)
Low	5510	12.47
Mid	5550	15.99
High	5670	15.96

Page 112 of 199

8.9.4. OUTPUT POWER AND PPSD

<u>LIMITS</u>

FCC §15.407 (a) (2)

For the band 5.47–5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

Page 113 of 199

Limits

Channel	Frequency	Fixed	В	11 + 10 Log B	Directional	Power	PPSD
		Limit		Limit	Gain	Limit	Limit
	(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dBm)	(dBm)
Low	5510	24	35.8237	26.54	5.42	24.00	11.00
Mid	5550	24	35.8408	26.54	5.42	24.00	11.00
High	5670	24	35.8519	26.55	5.42	24.00	11.00

Output Power Results

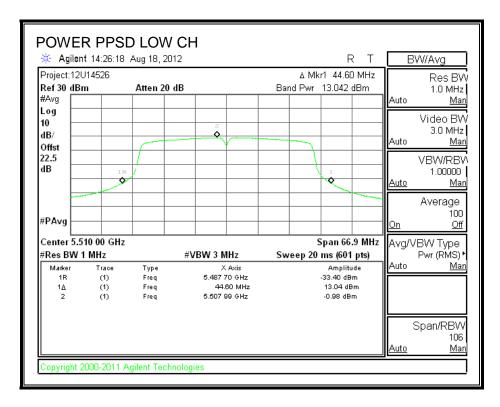
Channel	Frequency	Meas	Corr'd	Power	Power
		Power	Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5510	13.042	13.042	24.00	-10.958
Mid	5550	16.325	16.325	24.00	-7.675
High	5670	16.491	16.491	24.00	-7.509

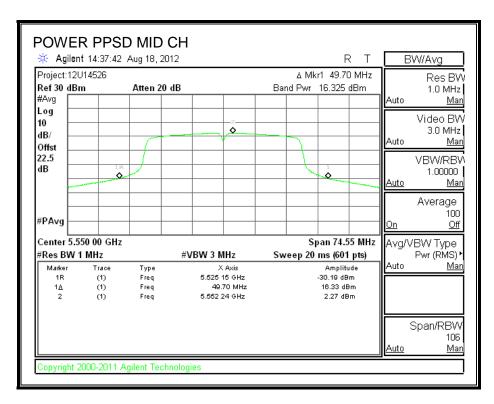
PPSD Results

Channel	Frequency	Meas	Corr'd	PPSD	PPSD
		PPSD	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5510	-0.98	-0.98	11.00	-11.98
Mid	5550	2.27	2.27	11.00	-8.73
High	5670	2.48	2.48	11.00	-8.52

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Page 114 of 199





Page 115 of 199

🔆 Agilen	f 14:53:08	Aug 18, 201	2				F	₹ T	B	W/Avg
Project:12U Ref 30 dBr #Avg		Atten 20 d	IB		Bar	∆ Mki nd Pwr	r1 45.40 16.491		Auto	Res BV 1.0 MHz <u>Mar</u>
Log 10 dB/ Offst			2						Auto	Video BW 3.0 MHz <u>Mar</u>
22.5 dB							-1 • • •		<u>Auto</u>	VBW/RBV 1.00000 <u>Mar</u>
#PAvg									<u>On</u>	Average 100 <u>Off</u>
Center 5.6 #Res BW 1			#VBW 3 MI	Hz	Sw	S eep 20	ipan 68 ms (601		Avg/V	BW Type Pwr (RMS) •
Marker 1R 1 <u>∆</u> 2	Trace (1) (1) (1)	Type Freq Freq Freq	5.647 30	0 MHz			Amplitu 28.16 dB 16.49 dE 2.48 dB	ide m Im	Auto	Mar
									S Auto	Span/RBW 106 <u>Mar</u>

Page 116 of 199

9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

<u>LIMITS</u>

FCC §15.205 and §15.209

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.

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; the video bandwidth is set to 1 MHz for peak measurements and as applicable for average measurements.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable 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.

TEST RESULT

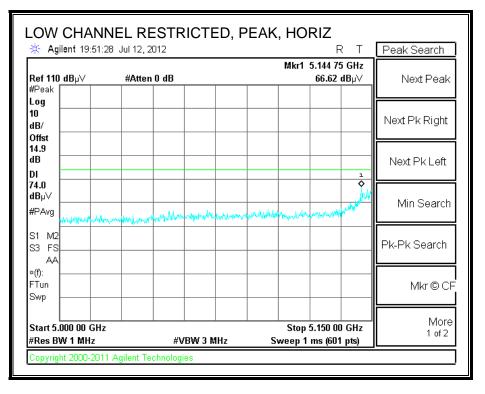
No other spurious emissions were found above 18G.

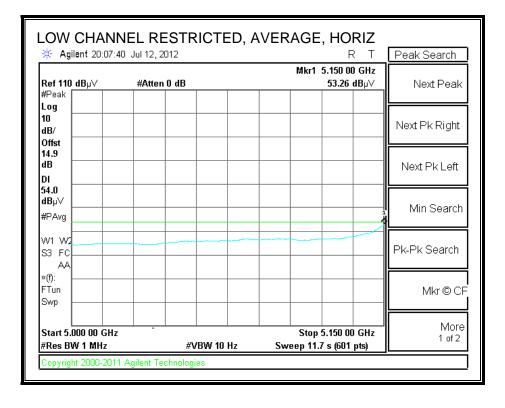
Page 117 of 199

9.2. TRANSMITTER ABOVE 1 GHz

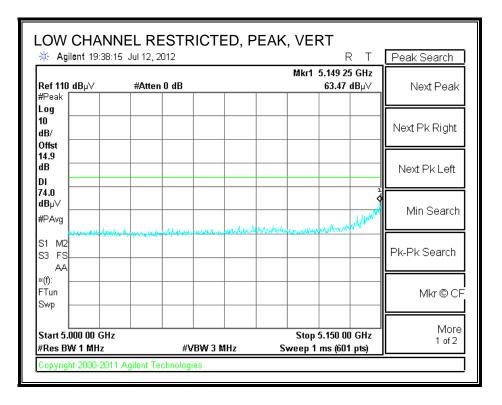
9.2.1. TX ABOVE 1 GHz 802.11a MODE IN THE 5.2 GHz BAND

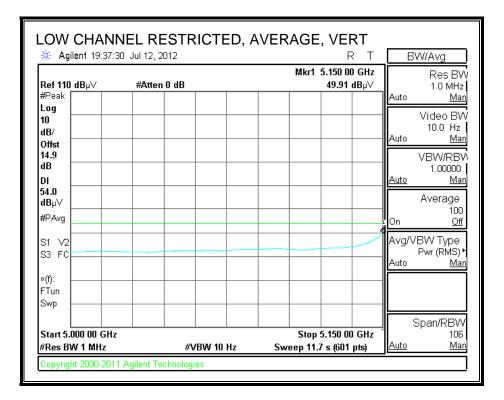
RESTRICTED BANDEDGE (LOW CHANNEL)





Page 118 of 199





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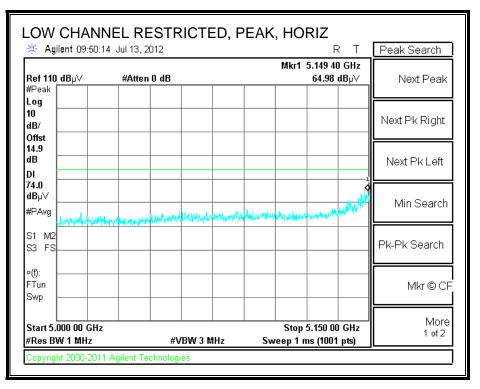
Page 119 of 199

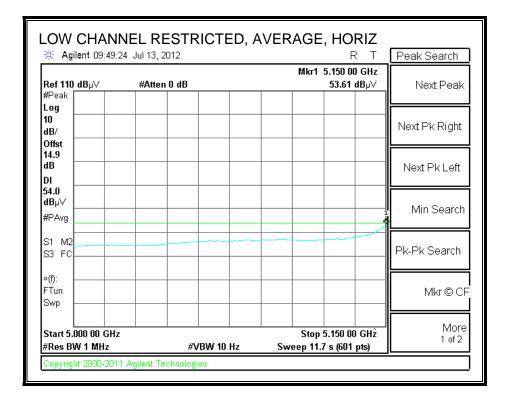
High Freq Complian				s, Frei	nont 5n	ı Chamb	er						
•				, 									
Fest Engr:		Chin Pa	-										
Date:		08/13/12											
Project #:		12U1452	6										
Company:	:	Apple											
Fest Targe	et:	FCC 15.	407										
Mode Ope	r:	a mode,	5.2GHz	(Wo	rst Case)							
	f	Measuren	ant Fra	manew	Amp	Preamp (Gain			Average	Field Stren	ath Limit	
	Dist	Distance			-	Distance		rt to 3 me	ters	0	ld Strength	0	
	Read	Analyzer			Avg			trength @			vs. Average		
	AF	Antenna			Peak	0		Field Stre		0	vs. Average vs. Peak Lii		
	AF CL	Cable Los			HPF	High Pas			.ngtn	wargin	və. r cak Lli	init	
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, 5	180MH	z											
15.540	3.0	34.3	39.0	12.5	-34.0	0.0	0.0	51.8	74.0	-22.2	V	Р	
15.540	3.0	22.4	39.0	12.5		0.0	0.0	39.8	54.0	-14.2	V	Α	
15.540	3.0	34.7	39.0	12.5	-34.0	0.0	0.0	52.2	74.0	-21.8	Н	Р	
15.540	3.0	22.8	39.0	12.5	-34.0	0.0	0.0	40.3	54.0	-13.7	H	A	
	l	L		ļ	ļ	ļ	ļ						
Mid Ch, 5	~~~~			<u> </u>									
15.600	3.0	34.5	38.8	12.5	5	0.0	0.0	51.8	74.0	-22.2	V	Р	
15.600	3.0	22.3	38.8	12.5	*	0.0	0.0	39.7	54.0	-14.3	V	A	
15.600	3.0	35.0	38.8	12.5	ç	0.0	0.0	52.3	74.0	-21.7	H	P	
15.600	3.0	22.3	38.8	12.5	-34.0	0.0	0.0	39.7	54.0	-14.3	H	A	
High Ch,	1 5240ml	<u>ן</u> זעק			1								
11 <u>91 C1</u> , . 15.720	3240111	33.5	38.4	12.6	-34.0	0.0	0.0	50.6	74.0	-23.4	v	Р	
15.720	3.0	22.0	38.4	12.6	\$0000000000000000000000000000000000000	0.0	0.0	<u> </u>	54.0	-15.0	v	A	
15.720	3.0	34.0	38.4	12.6		0.0	0.0	51.0	74.0	-23.0	H	P	
15.720	3.0	22.0	38.4	12.6	~~~~~	0.0	0.0	39.0	54.0	-15.0	H	A	
Rev. 4.1.2. Note: No		missions	were de	tected	above t	ho eveto	n noid	. floor					

Page 120 of 199

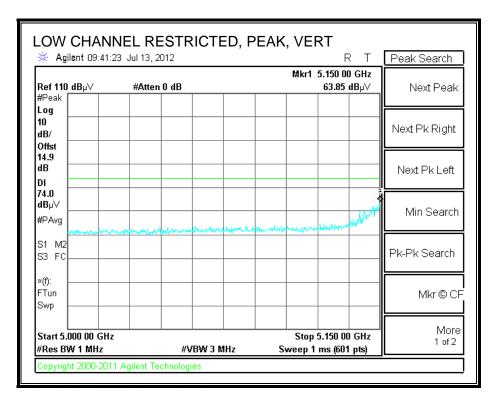
9.2.2. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.2 GHz BAND

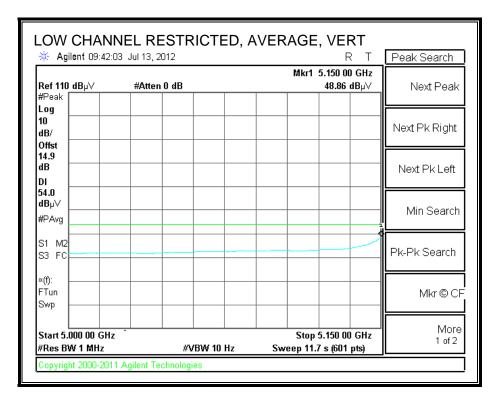
RESTRICTED BANDEDGE (LOW CHANNEL)





Page 121 of 199





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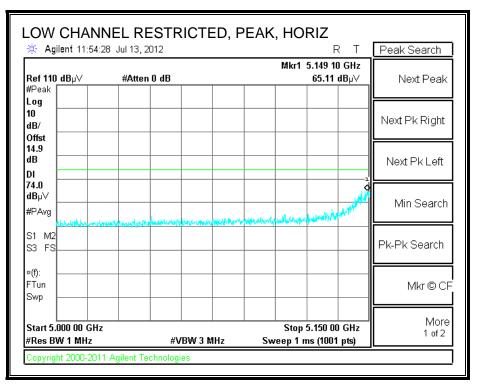
Page 122 of 199

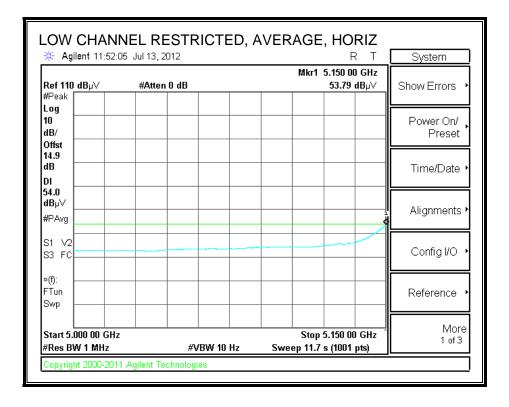
Compliano Test Engr: Date:	ce Cerí	Measuren				<u>a</u> .							
-		tification	Service	s, Frer	nont 5n	1 Chamb	er						
-		Chin Pa	no										
Juic.		08/13/12	0										
Project #:		12U1452											
Company:		Apple	0										
Fest Targe		FCC 15.	407										
Mode Ope:		HT20, 5.		X (W	orst Cas	e)							
loue o pe						•)							
	f	Measuren	uent Fred	mency	Amp	Preamp (Gain			Average	Field Stren	oth Limit	
	Dist	Distance			-	Distance		t to 3 me	ters	-	ld Strength	-	
	Read	Analyzer			Avg			trength @			vs. Average		
	AF	Antenna			Peak	0		Field Stre		-	vs. Peak Lii		
	CL	Cable Los			HPF	High Pas				Bill 1			
f	Dist	Read	AF	CL	Amp	D Corr	Fltr	Corr.	Limit	Margin	Ant. Pol.	Det.	Notes
GHz	(m)	dBuV	dB/m	{	dB	dB	}	8	dBuV/m	dB	V/H	P/A/QP	
Low Ch, 5	,	×				ĺ				1			
5.540	3.0	35.0	39.0	12.5	-34.0	0.0	0.0	52.4	74.0	-21.6	v	Р	
5.540	3.0	22.4	39.0	12.5	\$	0.0	0.0	39.9	54.0	-14.1	V	Ā	
5.540	3.0	34.6	39.0	12.5	-34.0	0.0	0.0	52.1	74.0	-21.9	Н	Р	
5.540	3.0	22.4	39.0	12.5	-34.0	0.0	0.0	39.9	54.0	-14.1	H	Α	
	1	L				ļ	ļ						
Mid Ch, 52	~~~~~		20.0	10 -	24.0	0.0	0.0	52.2			*7		
5.600	3.0	34.9	38.8	12.5	-34.0	0.0	0.0	52.2	74.0	-21.8	V V	P	
15.600 15.600	3.0 3.0	22.4 34.7	38.8 38.8	12.5 12.5	-34.0 -34.0	0.0 0.0	0.0 0.0	39.7 52.0	54.0 74.0	-14.3 -22.0	V H	A P	
15.600	3.0	22.4	38.8	12.5	ç	0.0	0.0	<u> </u>	74.0 54.0	-14.3	н Н	A	
	<u> </u>				<u> </u>				÷			<u></u>	
High Ch, S	5240MI	Hz											
5.720	3.0	34.7	38.4	12.6	-34.0	0.0	0.0	51.8	74.0	-22.2	V	Р	
15.720	3.0	22.0	*****	12.6		0.0	0.0	39.0	54.0	-15.0	V	A	
15.720	3.0	34.2	38.4	12.6	-34.0	0.0	0.0	51.2	74.0	-22.8	H	Р	
15.720	3.0	22.0	38.4	12.6	-34.0	0.0	0.0	39.0	54.0	-15.0	H	A	

Page 123 of 199

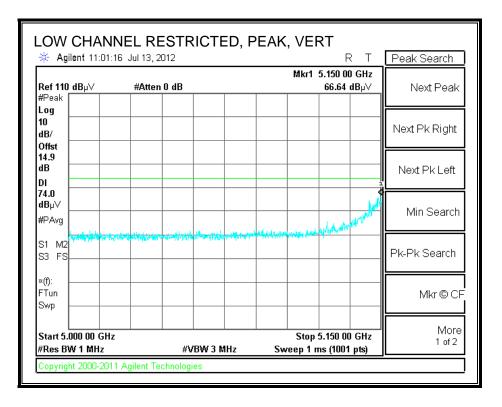
9.2.3. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.2 GHz BAND

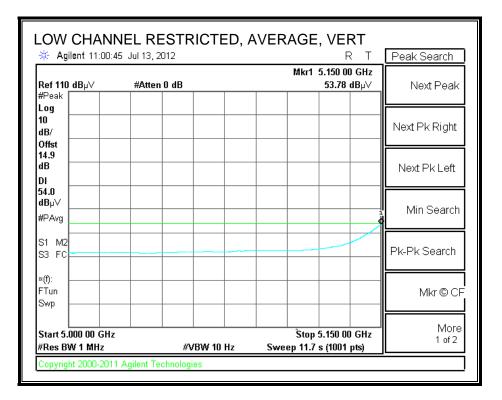
RESTRICTED BANDEDGE (LOW CHANNEL)





Page 124 of 199





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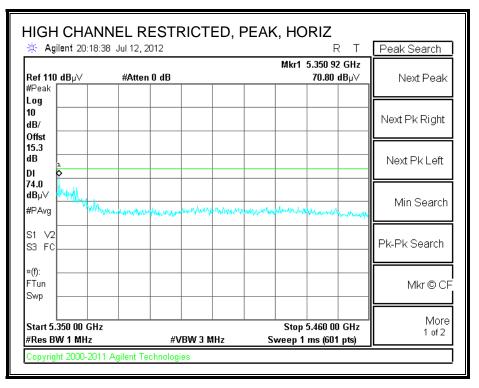
Page 125 of 199

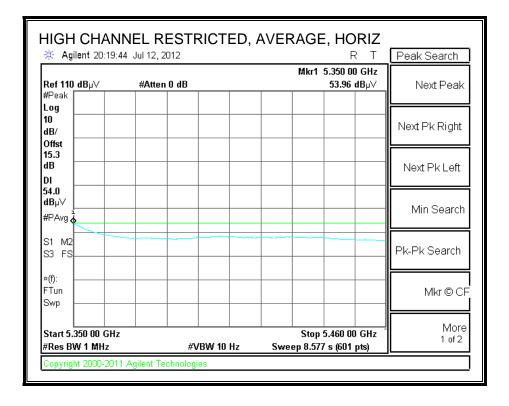
		Measuren											
Complia	nce Cer	tification	Service	s, Frei	nont 5n	h Chamb	er						
Fest Engr	•	Chin Pa	na										
Date:	•	08/13/12	-										
Project #		12U1452											
Company		Apple											
Test Targ		FCC 15.	407										
Mode Op	er:	HT40, 5.	2GHz, 1	X (W	orst Ca	se)							
	f	Measuren	uent Fred	mency	Δmn	Preamp (Tain			Average	Field Strens	oth Limit	
	Dist	Distance				Distance		t to 3 me	ters	-	ld Strength	-	
	Read	Analyzer			Avg			trength @			s. Average		
	AF	Antenna	-		Peak	-		Field Stre		-	s. Peak Lin		
	CL	Cable Los			HPF	High Pas			0				
				,	,	,				,			
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB		Corr.	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Jow Ch,	~ · ·	8	ub/III	UD	шь	uв	иь		иви у/ш	шь	<u>v/n</u>	r/A/Qr	
5.570	3.0	35.3	38.9	12.5	-34.0	0.0	0.0	52.7	74.0	-21.3	Н	Р	
5.570	3.0	22.5	38.9	12.5	-34.0	0.0	0.0	39.9	54.0	-14.1	Н	Α	
5.570	3.0	35.2	38.9	12.5	-34.0	0.0	0.0	52.6	74.0	-21.4	V	Р	
5.570	3.0	22.4	38.9	12.5	-34.0	0.0	0.0	39.9	54.0	-14.1	V	<u>A</u>	
ligh Ch,	5230M	1 ₇		ļ									
<u>11gn C11</u> , 5.690	3.0	34.3	38.5	12.6	-34.0	0.0	0.0	51.4	74.0	-22.6	Н	Р	
5.690	3.0	22.3	38.5	÷	ç	0.0	0.0	39.4	54.0	-14.6	H	A	
5.690	3.0	34.6	38.5	ż		0.0	0.0	51.7	74.0	-22.3	V	P	
5.690	3.0	22.2	38.5	12.6	-34.0	0.0	0.0	39.3	54.0	-14.7	V	A	
	-			<u> </u>	1								
Rev. 4.1.2		1		ŝ	1								
		missions	were de	tected	l ahove t	he syster	n nois	e floor					
1010.110	oulei e	1115510115	were ue	iecieu		ne syster	II IIOIS	e 11001.					

Page 126 of 199

9.2.4. TX ABOVE 1 GHz 802.11a MODE IN THE 5.3 GHz BAND

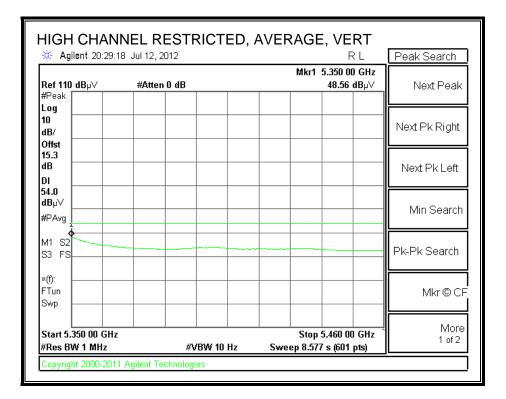
RESTRICTED BANDEDGE (HIGH CHANNEL)





Page 127 of 199

Ref 110 dBµ∨ #Atten 0 dB #Peak Log		Mkr1 5.350 55 GHz 67.52 dBµ∀	Peak Search
3		<u>от.52 йо</u> µ∨	Next Peak
10 dB/ Offst			Next Pk Right
15.3 dB DI			Next Pk Left
74.0 8 dBµ√ M/Mail 4 #PAvg M Market	e-2-111Malanamarkalylunce	(Mer warman and her ward	Min Search
S1 M2 S3 FC			Pk-Pk Search
»(f): FTun Swp			Mkr © CF
Start 5.350 00 GHz #Res BW 1 MHz #N	/BW 3 MHz	Stop 5.460 00 GHz Sweep 1 ms (601 pts)	More 1 of 2



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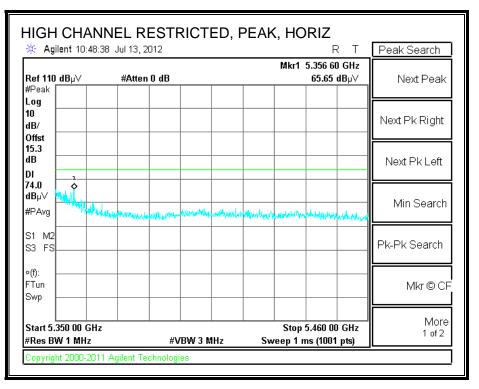
Page 128 of 199

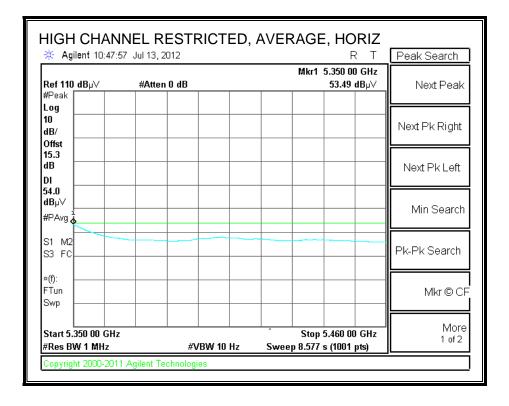
Test Engr: Chin Pang Date: 08/13/12 Project #: 12U14526			0												
Project #	:	12U1452	6												
Company	y:	Apple													
Test Targ		FCC 15.													
Mode Op	er:	a mode 5	5.3GHz	TX(W	orst Cas	se)									
	f	Measuren	nent Fred	uency	Amp	Preamp (Gain			Average	Field Stren	gth Limit			
	Dist	Distance	to Anter	ina	D Corr	Distance	Correc	et to 3 me	ters	Peak Fie	Peak Field Strength Limit				
	Read	Analyzer			Avg			trength @			/s. Average				
	AF	Antenna	Factor		Peak	Calculate	d Peak	Field Str	ength	-	/s. Peak Lii				
	CL	Cable Los	ss		HPF	High Pas	s Filter		-	-					
f	Dist	Read	AF	CL	Amp	D Corr	Fltr	Corr.	Limit	-	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,	,														
15.780	3.0	34.3	38.2	12.6	-33.9	0.0	0.0	51.2	74.0	-22.8	<u>v</u>	Р			
15.780	3.0	22.2 34.1	38.2 38.2	12.6 12.6	-33.9 -33.9	0.0	0.0 0.0	39.1	54.0	-14.9	V H	A P			
15.780 15.780	3.0	22.1	38.2	12.0	-33.9	0.0	0.0	51.0 39.0	74.0 54.0	-23.0 -15.0	н Н	A P			
13.700	3.0	22.1	30.2	12.0	-33.9	0.0	0.0	39.0	34.0	-13.0	11	<u>A</u>			
Mid Ch,	300MH	1 7.		<u>}</u>											
10.600	3.0	36.6	38.3	9.7	-35.7	0.0	0.0	48.8	74.0	-25.2	v	Р			
10.600	3.0	24.5	38.3	9.7	-35.7	0.0	0.0	36.7	54.0	-17.3	V	A			
15.900	3.0	34.3	37.8	12.7	-33.9	0.0	0.0	50.8	74.0	-23.2	V	P			
15.900	3.0	22.3	37.8	12.7	-33.9	0.0	0.0	38.9	54.0	-15.1	V	Α			
10.600	3.0	34.2	38.3	9.7	-35.7	0.0	0.0	46.4	74.0	-27.6	H	Р			
10.600	3.0	21.9	38.3	9.7	-35.7	0.0	0.0	34.0	54.0	-20.0	H	A			
15.900	3.0	34.0	37.8	12.7	-33.9	0.0	0.0	50.6	74.0	-23.4	H	Р			
15.900	3.0	22.3	37.8	12.7	-33.9	0.0	0.0	38.8	54.0	-15.2	H	<u>A</u>			
	52203.0			<u> </u>											
High Ch. 10.640		1z 35.1	38.3	9.7	25 7	0.0	0.0	47.3	74.0	-26.7	v	Р			
10.640 10.640	3.0	22.8	38.3	9.7	-35.7 -35.7	0.0	0.0	<u>47.3</u> 35.0	74.0 54.0	-26.7 -19.0	v v	A			
10.640 15.960	3.0	34.9	37.6	9.7	-33.9	0.0	0.0	<u>55.0</u> 51.3	54.0 74.0	-19.0	v	A P			
	3.0	22.4	37.6	12.7	-33.9	0.0	0.0	38.8	54.0	-15.2	V	A			
15.960	3.0	34.0	38.3	9.7	-35.7	0.0	0.0	46.3	74.0	-27.7	Ĥ	P			
~~~~~	3.0	21.9	38.3	9.7	-35.7	0.0	0.0	34.2	54.0	-19.8	H	Ā			
10.640		34.4	37.6	12.7	-33.9	0.0	0.0	50.9	74.0	-23.1	Н	P			
10.640 10.640	3.0		1 25 (	12.7	-33.9	0.0	0.0	38.7	54.0	-15.3	Н	A	***************************************		
15.960 10.640 10.640 15.960 15.960	3.0	22.3	37.6												

Page 129 of 199

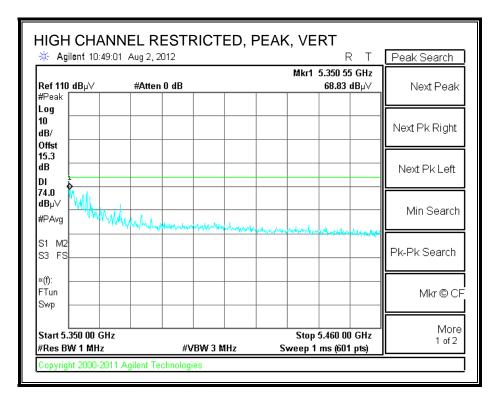
# 9.2.5. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.3 GHz BAND

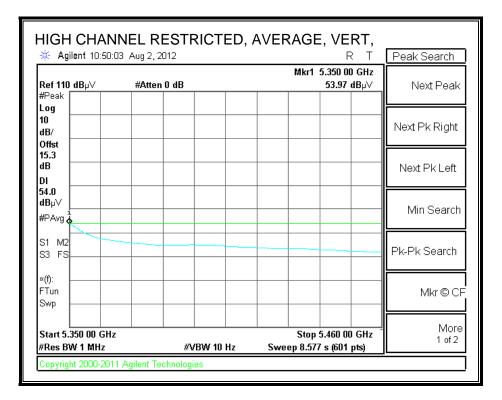
## **RESTRICTED BANDEDGE (HIGH CHANNEL)**





Page 130 of 199





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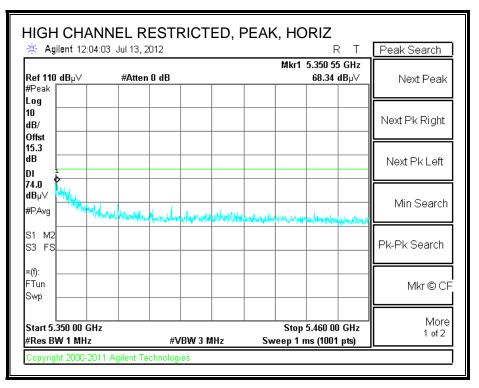
Page 131 of 199

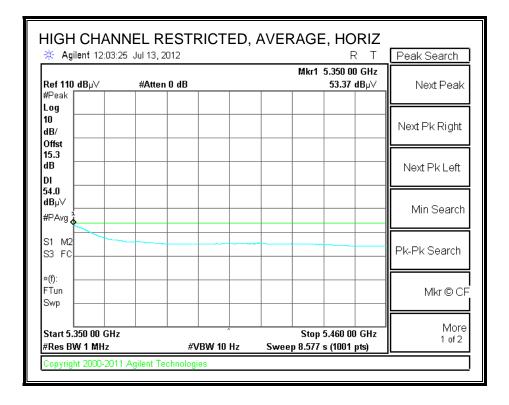
Test Engi		Chin Pa	na												
Date:	•	08/13/12	0												
Date: Project #		12U1452													
Company		Apple	U												
Company Test Targ		FCC15.4	07												
Mode Op		HT20, 5.		x ( w	orst Ca	(92									
intoue o p		11120,00			orst eu	30)									
	f	Measuren	nent Fred	quency	Amp	Preamp (	Gain			Average	Field Stren	gth Limit			
	Dist	Distance	to Anter	ina	D Corr	Distance	Correc	t to 3 me	ters	Peak Fie	Field Strength Limit				
	Read	Analyzer	Reading		Avg	Average	Field S	rength @	3 m	Margin v	s. Average	Limit			
	AF	Antenna	Factor		Peak	Calculate	d Peak	Field Stre	ength	Margin v	s. Peak Li	nit			
	CL	Cable Los	ss		HPF	High Pas	s Filter								
f	Dist	Read	AF	CL	Amp	D Corr	Fltr	Corr.	Limit		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,		······		Į											
15.780	3.0	34.6	38.2	12.6	-33.9	0.0	0.0	51.5	74.0	-22.5	<u>v</u>	Р			
15.780	3.0	22.1	38.2	12.6		0.0	0.0	39.0	54.0	-15.0	<u>V</u>	<u>A</u>			
15.780	3.0	35.2	38.2	12.6	-33.9	0.0	0.0	52.0	74.0	-22.0	H	P			
15.780	3.0	22.1	38.2	12.6	-33.9	0.0	0.0	38.9	54.0	-15.1	H	A			
Mid Ch,	1 5200MU	l													
10.600	3.0	37.1	38.3	9.7	-35.7	0.0	0.0	49.3	74.0	-24.7	v	Р			
10.600	3.0	24.1	38.3	9.7	-35.7	0.0	0.0	36.3	54.0	-17.7	V	A			
15.900	3.0	35.0	37.8	12.7	-33.9	0.0	0.0	51.6	74.0	-22.4	V	P			
15.900	3.0	22.2	37.8	12.7	-33.9	0.0	0.0	38.8	54.0	-15.2	V	Α			
10.600	3.0	33.4	38.3	9.7	-35.7	0.0	0.0	45.5	74.0	-28.5	Н	P			
10.600	3.0	21.5	38.3	9.7	-35.7	0.0	0.0	33.7	54.0	-20.3	Н	Α			
10.000	3.0	34.2	37.8	12.7	-33.9	0.0	0.0	50.8	74.0	-23.2	H	Р			
15.900	3.0	22.2	37.8	12.7	-33.9	0.0	0.0	38.8	54.0	-15.2	H	A			
15.900			ļ	Į											
15.900 15.900					1	L		ļ		-28.0					
15.900 15.900 High Ch			26.2	0-	2= -	0.0					v	Р			
15.900 15.900 High Ch 10.640	3.0	33.8	38.3	9.7	-35.7	0.0	0.0	46.0	74.0	÷					
15.900 15.900 High Ch 10.640 10.640	3.0 3.0	33.8 21.3	38.3	9.7	-35.7	0.0	0.0	33.5	54.0	-20.5	V	A			
15.900 15.900 High Ch. 10.640 10.640 15.960	3.0 3.0 3.0	33.8 21.3 34.5	38.3 37.6	9.7 12.7	-35.7 -33.9	0.0	0.0 0.0	33.5 50.9	54.0 74.0	-20.5 -23.1	V V	Р			
15.900 15.900 High Ch 10.640 10.640 15.960 15.960	3.0 3.0 3.0 3.0 3.0	33.8 21.3 34.5 22.3	38.3 37.6 37.6	9.7 12.7 12.7	-35.7 -33.9 -33.9	0.0 0.0 0.0	0.0 0.0 0.0	33.5 50.9 38.7	54.0 74.0 54.0	-20.5 -23.1 -15.3	V V V	P A			
15.900 15.900 High Ch 10.640 10.640 15.960 15.960 10.640	3.0 3.0 3.0 3.0 3.0 3.0	33.8 21.3 34.5 22.3 33.8	38.3 37.6 37.6 38.3	9.7 12.7 12.7 9.7	-35.7 -33.9 -33.9 -35.7	0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0	33.5 50.9 38.7 46.0	54.0 74.0 54.0 74.0	-20.5 -23.1 -15.3 -28.0	V V V H	P A P			
15.900 15.900 High Ch. 10.640 10.640 15.960 15.960 10.640 10.640	3.0 3.0 3.0 3.0 3.0	33.8 21.3 34.5 22.3	38.3 37.6 37.6	9.7 12.7 12.7	-35.7 -33.9 -33.9	0.0 0.0 0.0	0.0 0.0 0.0	33.5 50.9 38.7	54.0 74.0 54.0	-20.5 -23.1 -15.3	V V V	P A			
15.900 15.900 High Ch. 10.640 10.640 15.960	3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0	33.8 21.3 34.5 22.3 33.8 21.3	38.3 37.6 37.6 38.3 38.3	9.7 12.7 12.7 9.7 9.7	-35.7 -33.9 -33.9 -35.7 -35.7	0.0 0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0 0.0	33.5 50.9 38.7 46.0 33.5	54.0 74.0 54.0 74.0 54.0	-20.5 -23.1 -15.3 -28.0 -20.5	V V V H H	P A P A			

Page 132 of 199

# 9.2.6. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.3 GHz BAND

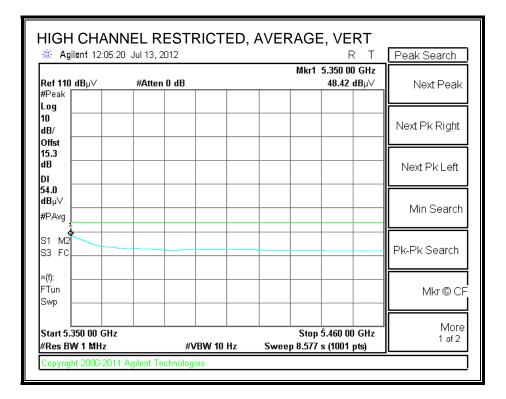
## **RESTRICTED BANDEDGE (HIGH CHANNEL)**





Page 133 of 199

	CHANN		RICTED, I	PEAK, VER	RT RT	Peak Search
Ref 110 #Peak	dBµ∨	#Atten 0 dB			350 11 GHz 67.86 dBµ∨	Next Peak
Log 10 dB/ Offst						Next Pk Right
15.3 dB DI 1						Next Pk Left
74.0 ¥ dBµ∨ #PAvg	Male Hunderson	a made unait and	-		and a barrier	Min Search
S1 M2 S3 FC						Pk-Pk Search
×(f): FTun Swp -						Mkr © CF
	350 00 GHz N 1 MHz	#\	/BW 3 MHz	Stop 5. Sweep 1 ms	460 00 GHz : (1001 pts)	More 1 of 2
Copyrigh	ht 2000-2011 A	Agilent Technolog	ies			



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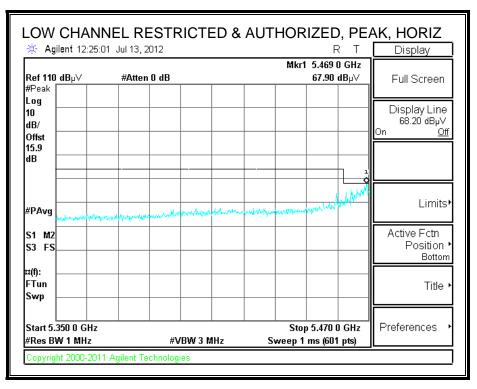
Page 134 of 199

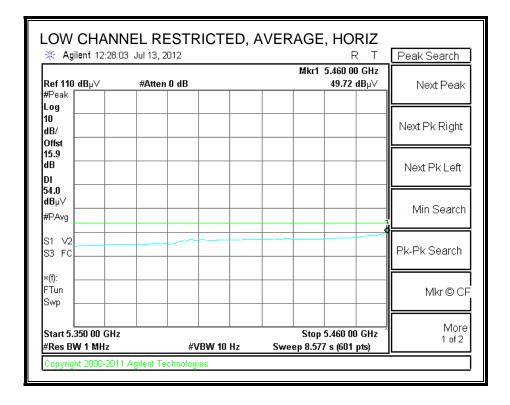
		Measuren tification		s, Frei	nont 5n	n Chamb	er							
Test Engr Date:		Chin Pa 08/13/12	-											
Project #		12U1452	6											
Company		Apple												
Test Targ Mode Op		FCC 15. HT40, 5.		w / w		>								
Mode Op	er:	11140, 5.	JGIIZ, I	A ( W	orst Ca	se)								
	f	Measuren	nent Fred	quency	Amp	Preamp (	Gain			Average	Field Stren	gth Limit		
	Dist	Distance			D Corr	Distance	Correc	et to 3 me	eters	Peak Field Strength Limit				
	Read	Analyzer			Avg	Average		_	-	Margin vs. Average Limit				
	AF	Antenna			Peak				ength	Margin v	rs. Peak Lir	nit		
	CL	Cable Los	35		HPF	High Pas	s Filter							
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB		Corr.	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes	
Low Ch,			aD/m	aD	dD	dD	dD	abuv/m	abuv/m	db	V/II	riniQr		
15.810	3.0	34.6	38.1	12.6	-33.9	0.0	0.0	51.4	74.0	-22.6	v	P		
15.810	3.0	22.3			-33.9	0.0	0.0	39.1	54.0	-14.9	v	Ā		
15.810	3.0	34.9		12.6	-33.9	0.0	0.0	51.6	74.0	-22.4	H	P		
15.810	3.0	22.3	38.1	12.6	-33.9	0.0	0.0	39.1	54.0	-14.9	H	A		
		ļ								ļ				
High Ch,														
10.620	3.0	33.8		9.7	-35.7	0.0	0.0	46.0	74.0	-28.0	V	P		
10.620 15.930	3.0	21.3 34.3		9.7	-35.7 -33.9	0.0 0.0	0.0 0.0	33.5 50.8	54.0 74.0	-20.5 -23.2	V V	A P		
15.930	3.0	22.3		12.7		0.0		38.8	74.0 54.0	-15.2	v	A		
10.620	3.0	33.7		9.7	-35.7	0.0	0.0	45.9	74.0	-28.1	н	P		
10.620	3.0	21.4		9.7	-35.7	0.0	0.0	33.7	54.0	-20.3	H	A		
15.930	3.0	35.0	37.7	¢	-33.9	0.0	0.0	51.5	74.0	-22.5	H	P		
15.930	3.0	22.5	37.7	12.7	-33.9	0.0	0.0	39.0	54.0	-15.0	H	A		
										ļ				
Rev. 4.1.2 Note: No		missions	were de	tected	above t	the system	m nois	e floor.						

Page 135 of 199

## 9.2.7. TX ABOVE 1 GHz 802.11a MODE IN THE 5.6 GHz BAND

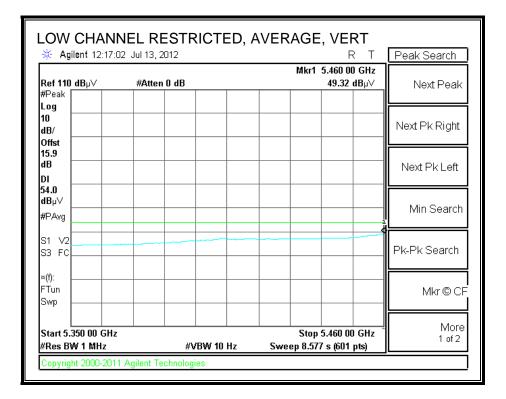
#### **RESTRICTED & AUTHORIZED BANDEDGE (LOW CHANNEL)**





Page 136 of 199

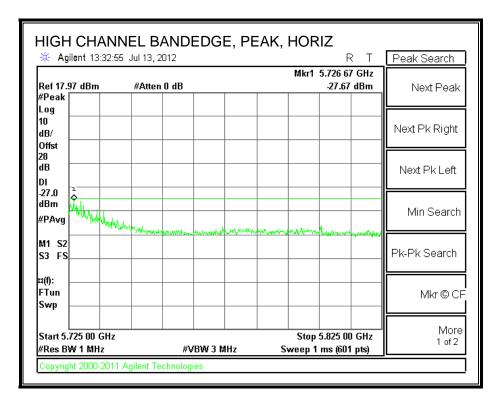
🔆 Agilent 12:15:	36 Jul 13, 2012		R	T Peak Search
<b>Ref 110 dB</b> µ∨ #Peak	#Atten 0 dB		Mkr1 5.469 8 G 66.16 dBµ	
_og  0  B/ Dffst				Next Pk Right
15.9 18				Next Pk Left
PAvg	anne additional and	www.Wybhrelbyth.wy	mundered and the second metric with the	Min Search
51 V2 53 FC				Pk-Pk Search
t(f): Tun Swp				Mkr © C
Start 5.350 0 GHz Res BW 1 MHz	#VB	W 3 MHz	Stop 5.470 0 G Sweep 1 ms (601 pt	

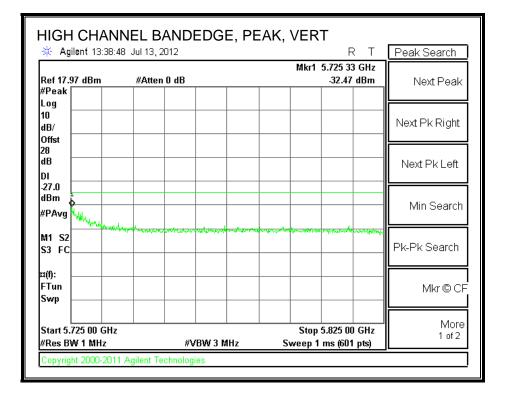


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Page 137 of 199

#### REPORT NO: 15U21850-E34V3 FCC ID: BCGA1432, BCGA1454, BCGA1455 AUTHORIZED BANDEDGE (HIGH CHANNEL)





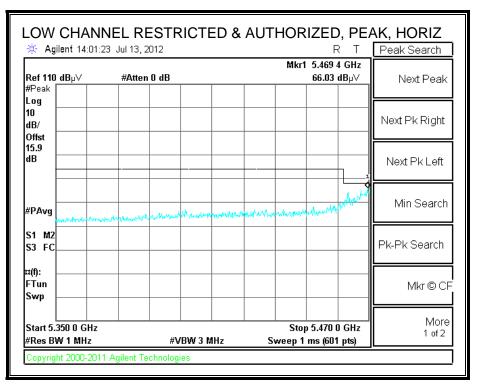
Page 138 of 199

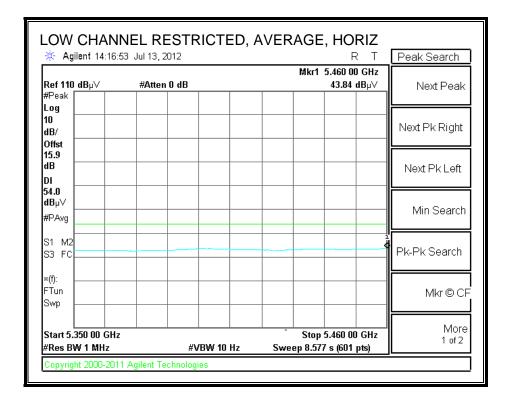
Chin P: 08/13/12 12U145: Apple FCC 15 a mode, Distance Analyzer Antenna Cable Lo Read dBuV Iz	26 407 5.6GHz nent Free to Anter Reading Factor	quency	Amp D Corr Avg Peak HPF	Preamp Distance Average	Correc Field S ed Peak	trength @		Peak Fie	Field Stren, Id Strength	Limit					
12U145: Apple FCC 15 a mode, Measurer Distance Analyzer Antenna Cable Lo Read dBuV	407 5.6GHz ment Free to Anter Reading Factor ss AF	quency nna	Amp D Corr Avg Peak HPF	Preamp Distance Average Calculate	Correc Field S ed Peak	trength @		Peak Fie	ld Strength	Limit					
Apple FCC 15 a mode, Measurer Distance Analyzer Antenna Cable Lo Read dBuV	407 5.6GHz nent Free to Anter Reading Factor ss AF	quency nna	Amp D Corr Avg Peak HPF	Preamp Distance Average Calculate	Correc Field S ed Peak	trength @		Peak Fie	ld Strength	Limit					
FCC 15 a mode, Measurer Distance Analyzer Antenna Cable Lo Read dBuV	5.6GHz ment Free to Anter Reading Factor ss AF	quency nna	Amp D Corr Avg Peak HPF	Preamp Distance Average Calculate	Correc Field S ed Peak	trength @		Peak Fie	ld Strength	Limit					
a mode, Measure Distance Analyze Antenna Cable Lo Read dBuV	5.6GHz ment Free to Anter Reading Factor ss AF	quency nna	Amp D Corr Avg Peak HPF	Preamp Distance Average Calculate	Correc Field S ed Peak	trength @		Peak Fie	ld Strength	Limit					
Measures Distance Analyzes Antenna Cable Lo Read dBuV	nent Free to Anter Reading Factor ss AF	quency nna	Amp D Corr Avg Peak HPF	Preamp Distance Average Calculate	Correc Field S ed Peak	trength @		Peak Fie	ld Strength	Limit					
Distance Analyzes Antenna Cable Lo Read dBuV	to Anter Reading Factor ss AF	nna	D Corr Avg Peak HPF	Distance Average Calculate	Correc Field S ed Peak	trength @		Peak Fie	ld Strength	Limit					
Analyzer Antenna Cable Lo Read dBuV	Reading Factor ss AF		Avg Peak HPF	Average Calculate	Field S ed Peak	trength @			-						
Antenna Cable Lo Read dBuV	Factor ss AF		Peak HPF	Calculate	ed Peak		3 m	Average Field Strength @ 3 m Margin vs. Average Limit							
Cable Lo Read dBuV	AF	CL	HPF							Limit					
Read dBuV	AF	CL		High Pas	a Eilter		ength	Margin v	rs. Peak Lir	nit					
dBuV		CL			s rinter										
	dD/m	dB	Amp dB	D Corr dB		Corr.	Limit dBuV/m		Ant. Pol.	Det.	Notes				
1 <b>Z</b>	:	dD	db	dD	dD	abuv/m	dDuv/m	dB	V/H	P/A/QP					
33.0	38.4	10.1	-35.6	0.0	0.0	45.7	74.0	-28.3	v	P					
21.0		10.1	-35.6	0.0	0.0	33.7	74.0 54.0	-20.3	v	A					
		. <b>.</b>	¢	¢	¢			· ••••••••••••••••••••••••••							
21.0			¢	0.0	0.0	33.8	54.0	-20.2	H	Ā					
1		1		1	<u>.</u>			Ì		ĺ					
[z		ļ	Į	ļ	ļ			ļ							
35.0		• • • • • • • • • • • • • • • • • • • •	¢	0.0	0.0	48.2	74.0	-25.8	V	P					
		• • • • • • • • • • • • • • • • • • • •	¢	÷	\$	•••••••••••••••••••••••••		• • • • • • • • • • • • • • • • • • • •							
		•	¢	÷	\$	••••••••••••••••••••••		· • · · · · · · · · · · · · · · · · · ·		·····					
44.0	30.5	10.2	-35.0	0.0	0.0	00.0	54.0	-10.5	п						
								•							
	38.7	10.4	-35.6	0.0	0.0	47.6	74.0	-26.4	V	P					
21.8		•	¢	0.0	0.0	35.4	54.0	-18.6	V						
33.9	38.7	10.4	-35.6	0.0	0.0	47.5	74.0	-26.5	H	P					
21.8	38.7	10.4	-35.6	0.0	0.0	35.4	54.0	-18.6	H	A					
		ļ	ļ	Į	ļ			ļ							
	z 35.0 22.4 35.5 22.3 Hz 33.9 21.8 33.9 21.8	21.0 38.4 z 35.0 38.5 22.4 38.5 35.5 38.5 22.3 38.5 22.3 38.5 Hz 33.9 38.7 21.8 38.7 33.9 38.7 21.8 38.7	21.0         38.4         10.1           z	21.0         38.4         10.1         -35.6           z         35.0         38.5         10.2         -35.6           22.4         38.5         10.2         -35.6           35.5         38.5         10.2         -35.6           22.3         38.5         10.2         -35.6           22.3         38.5         10.2         -35.6           33.9         38.7         10.4         -35.6           21.8         38.7         10.4         -35.6           21.8         38.7         10.4         -35.6	21.0         38.4         10.1         -35.6         0.0           z	21.0         38.4         10.1         -35.6         0.0         0.0           z	21.0         38.4         10.1         -35.6         0.0         0.0         33.8           z	21.0         38.4         10.1         -35.6         0.0         0.0         33.8         54.0           z	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	21.0         38.4         10.1         -35.6         0.0         0.0         33.8         54.0         -20.2         H           z	21.0       38.4       10.1       -35.6       0.0       0.0       33.8       54.0       -20.2       H       A         z				

Page 139 of 199

## 9.2.8. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.6 GHz BAND

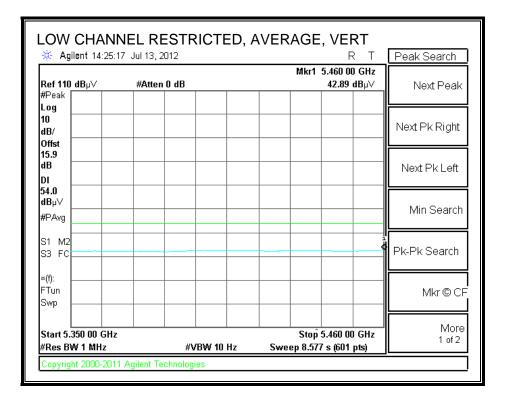
#### **RESTRICTED & AUTHORIZED BANDEDGE (LOW CHANNEL)**





Page 140 of 199

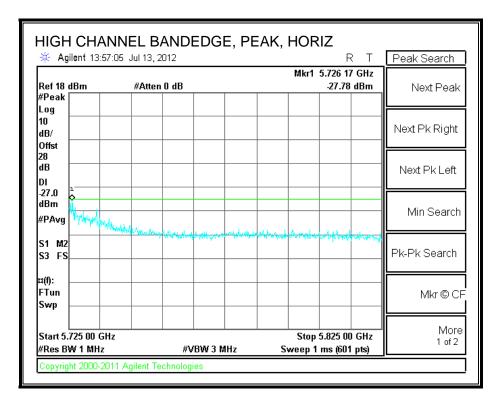
🔆 Agilent 14:22	24 Jul 13, 2012			RT	Peak Search
Ref 110 dBµ∨ #Peak	#Atten 0 dB		Mkr1 5.464 56.15	l8GHz 5dBµ∨	Next Peak
Log 10 1B/ Offst					Next Pk Right
15.9 18					Next Pk Left
*PAvg			an and a second	1_1_	Min Search
51 M2 53 FC					Pk-Pk Search
t(f): -Tun Swp					Mkr © C
Start 5.350 0 GHz Res BW 1 MHz		¥VBW 3 MHz	Stop 5.470 Sweep 1 ms (60		More 1 of 2

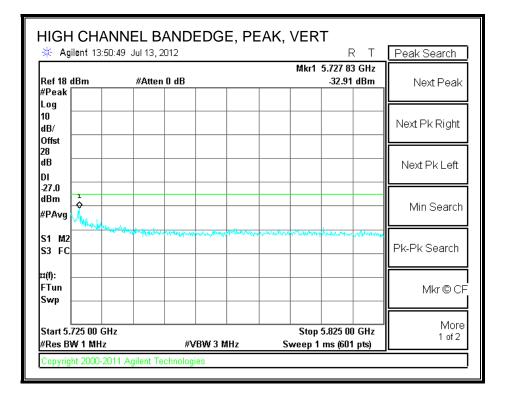


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Page 141 of 199

#### REPORT NO: 15U21850-E34V3 FCC ID: BCGA1432, BCGA1454, BCGA1455 AUTHORIZED BANDEDGE (HIGH CHANNEL)





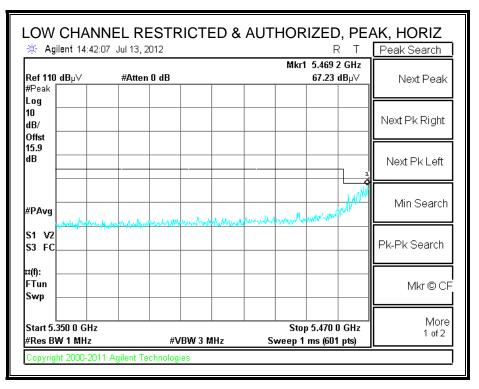
Page 142 of 199

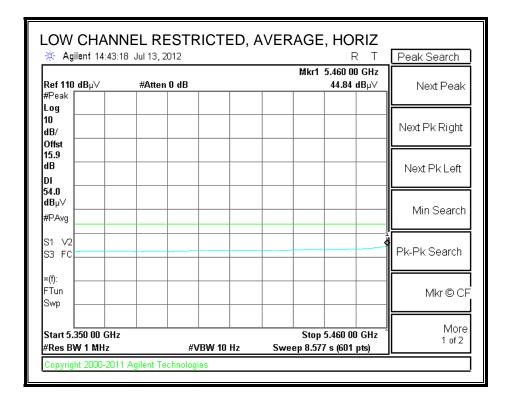
		Measuren tification		s, Frei	nont 5n	n Chamb	er						
Fest Engr		Chin Pa	ng										
Date:		08/13/12											
Project #		12U1452	6										
Company		Apple											
Test Targ		FCC 15.		~~~ ~									
Mode Op	er:	H120 mc	ode, 5.60	GHz, 1	X ( Wo	rst Case)							
	f	Measuren	nent Fre	quency	Amp	Preamp (	Gain			Average	Field Stren	gth Limit	
	Dist	Distance	to Anter	ına	D Corr	Distance	Correc	et to 3 me	eters	Peak Fie	ld Strength	Limit	
	Read	Analyzer	-		Avg	-		trength @		_	vs. Average		
	AF	Antenna			Peak	Calculate			ength	Margin v	vs. Peak Lir	nit	
	CL	Cable Los	35		HPF	High Pas	s Filter	r -					
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB		Corr.	Limit dBuV/m	-	Ant. Pol. V/H	Det. P/A/QP	Notes
Low Ch,			uD/m	dD	dD	dD	dD	ubuv/n	ubuv/m	aD	¥/11	riniQr	
11.000	3.0	32.9	38.4	10.1	-35.6	0.0	0.0	45.6	74.0	-28.4	V	P	
11.000	3.0	21.0		<b>*</b>	-35.6	0.0	0.0	33.8	54.0	-20.2	v	Ā	
11.000	3.0	33.4	38.4	10.1	-35.6	0.0	0.0	46.2	74.0	-27.8	H	P	
11.000	3.0	21.0	38.4	10.1	-35.6	0.0	0.0	33.8	54.0	-20.2	H	A	
	-												
Mid Ch, 11.160	5600MH 3.0	z 34.3	38.5	10.2	-35.6	0.0	0.0	47.5	74.0	-26.5	v	P	
11.160	3.0	22.5		<b>*************</b>	-35.6	·	0.0	35.7	54.0	-18.3	v	A	
11.160	3.0	34.3	• • • • • • • • • • • • • • • • • • • •	10.2	·····	0.0	0.0	47.5	74.0	-26.5	Ĥ	P	
11.160	3.0	21.8	38.5	10.2	-35.6	0.0	0.0	35.0	54.0	- <b>19.0</b>	H	A	
		<u>.</u>		ļ		ļ							
	·····	•••••••••••••••••••••••••••••••••••	20.7	10.4	25.6			47.4	74.0				
		•	• • • • • • • • • • • • • • • • • • • •	\$	þ	· • • • • • • • • • • • • • • • • • • •	\$	• • • • • • • • • • • • • • • • • • • •		• • • • • • • • • • • • • • • • • • • •	¢		
		• • • • • • • • • • • • • • • • • • • •	• • • • • • • • • • • • • • • • • • • •	\$	b	• <b>•</b> • • • • • • • • • • • • • • • • •	\$	• • • • • • • • • • • • • • • • • • • •		• • • • • • • • • • • • • • • • • • • •			
	3.0	21.6	38.7	¢	-35.6	0.0	0.0	35.3	54.0	-18.7	H	Ā	
High Ch 11.400 11.400 11.400 11.400 Rev. 4.1.2	, 5700MI 3.0 3.0 3.0 3.0 2.7	Hz 33.7 21.6 34.5	38.7 38.7 38.7 38.7	10.4 10.4 10.4 10.4	-35.6 -35.6 -35.6 -35.6	0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0	47.4 35.3 48.1 35.3	74.0 54.0 74.0	-26.6 -18.7 -25.9	V V H	P A P	

Page 143 of 199

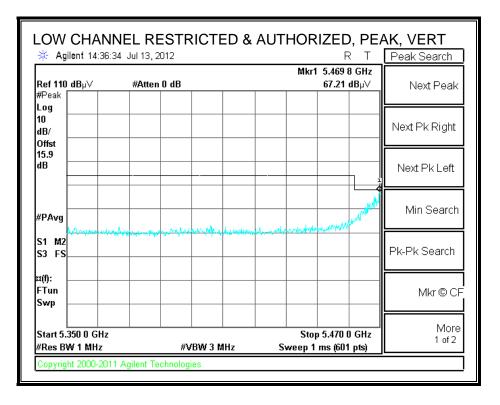
## 9.2.9. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.6 GHz BAND

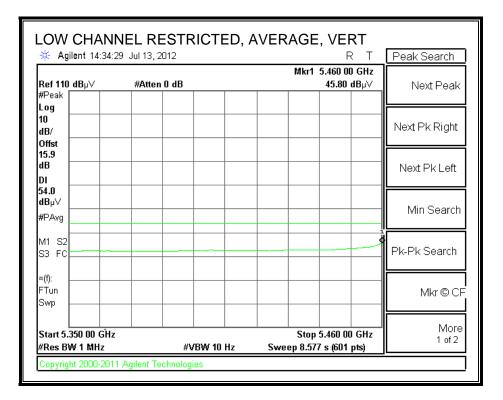
#### **RESTRICTED & AUTHORIZED BANDEDGE (LOW CHANNEL)**





Page 144 of 199

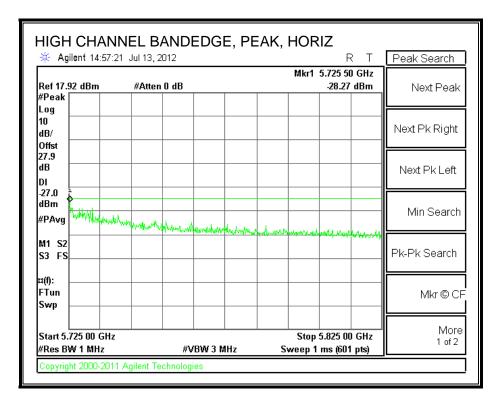


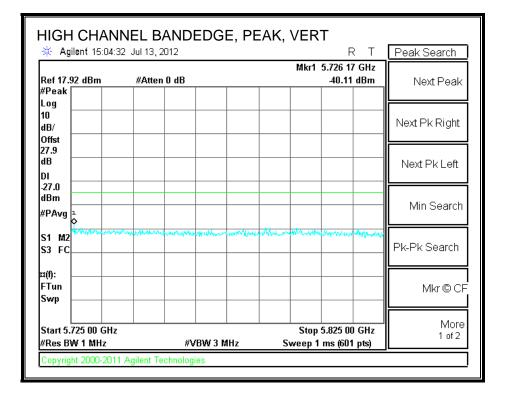


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Page 145 of 199

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Page 146 of 199

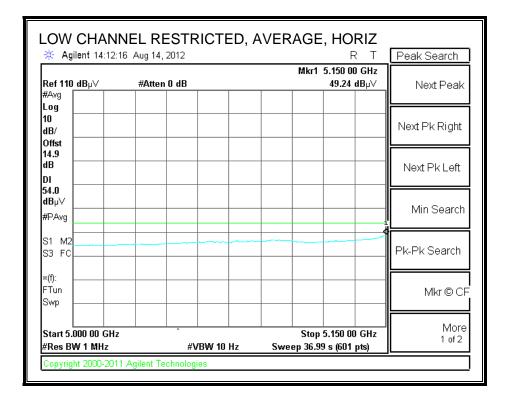
-		tification		s, rrei	nont 31	а спашо	er							
Fest Engi			Chin Pang Deu 240											
Date:		08/13/12												
Project #		12U1452	6											
Company	-	Apple												
Fest Targ Mode Op		FCC 15. HT40, 5.												
viode Op	er:	H140, 5.	oGnz, i	A(W	orst Ca	se)								
	f	Measuren	nent Fred	quency	-	Preamp				Average	Field Stren	gth Limit		
	Dist	Distance			D Corr	Distance	Correc	et to 3 me	eters	Peak Fie	ld Strength	Limit		
	Read	Analyzer	_		Avg	-		trength @		-	vs. Average			
	AF	Antenna			Peak				ength	Margin v	vs. Peak Lis	mit		
	CL	Cable Los	35		HPF	High Pas	s Filter							
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB		Corr.	Limit dBuV/m		Ant. Pol. V/H	Det. P/A/QP	Notes	
			aD/m	aD	۵D	dD	۵D	abuv/n	dDuV/m	dD	v/n	PINQP		
Low Ch, 11.020	3.0	32.4	38.4	10.1	-35.6	0.0	0.0	45.2	74.0	-28.8	v	P		
11.020	3.0	20.8		10.1	-35.6	0.0	0.0	33.6	74.0 54.0	-20.0	v	A		
11.020	3.0	32.9		10.1	-35.6	0.0	0.0	45.7	74.0	-28.3	H	P		
11.020	3.0	20.8		¢	-35.6	0.0	0.0	33.6	54.0	-20.4	H	Ā		
		1				1				1				
Mid Ch,	5550MH	z				ļ				ļ				
11.100	3.0	34.6		¢	-35.6	0.0	0.0	47.7	74.0	-26.3	V	Р		
11.100	3.0	22.4	38.5	¢	-35.6	0.0	0.0	35.5	54.0	-18.5	V	A		
11.100	3.0	34.6		10.2	o	0.0	0.0	47.7	74.0	-26.3	H	P		
11.100	3.0	22.5	38.5	10.2	-35.6	0.0	0.0	35.6	54.0	-18.4	H	A		
High Ch	5670M	i. Hz				÷	·			+				
11.340	3.0	33.5	38.7	10.4	-35.6	0.0	0.0	47.0	74.0	-27.0	V	P		
11.340	3.0	21.5		10.4	o	0.0	0.0	35.0	54.0	-19.0	V	A		
11.340	3.0	33.8	38.7	10.4	-35.6	0.0	0.0	47.3	74.0	-26.7	H	P		
11.340	3.0	21.6	38.7	10.4	-35.6	0.0	0.0	35.1	54.0	-18.9	H	A		
						Ļ	ļ							
Rev. 4.1.2 Note: No		missions	were de	tected	i above (	: the syste:	<u>m nois</u>	e floor.						

Page 147 of 199

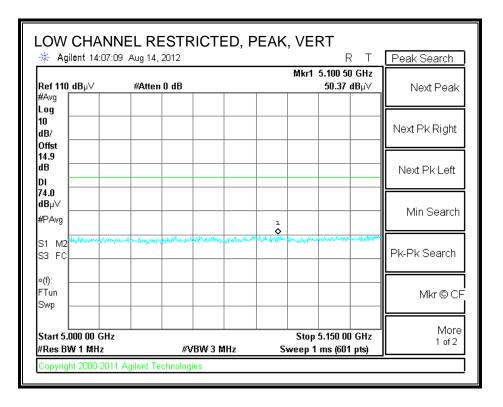
## 9.2.10. 2.4 GHz and 5GHz band Colocation

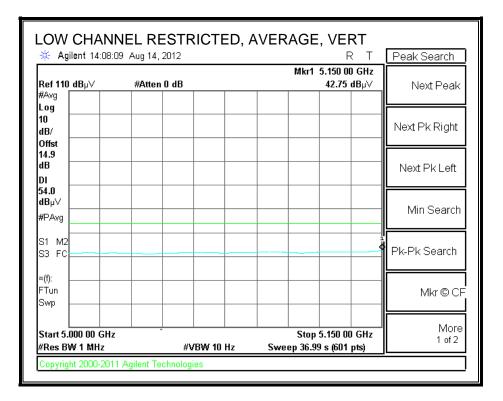
## BANDEDGE (CHANNEL 36 and Bluetooth High CHANNEL)

LOW CHAN		ICTED, PE	EAK, HOI	RIZ R T	Peak Search
Ref 110 dBµ∨ #Avg	#Atten 0 dB		Mkr1 :	5.149 25 GHz 59.30 dBµ∨	Next Peak
Log 10 dB/ Offst					Next Pk Right
14.9 dB DI					Next Pk Left
74.0 dBµ∨ #PAvg	here have been a state of the s		June June da La La La		Min Search
S1 M2 S3 FC	Unite Standard Marine Pollane	Phone record for the second seco	11. ALM THE PROPERTY OF		Pk-Pk Search
«(f): FTun Swp					Mkr © CF
Start 5.000 00 GHz #Res BW 1 MHz	#VE	BW 3 MHz	•	5.150 00 GHz ms (601 pts)	More 1 of 2
Copyright 2000-2011	Agilent Technologie	s			



Page 148 of 199





Page 149 of 199

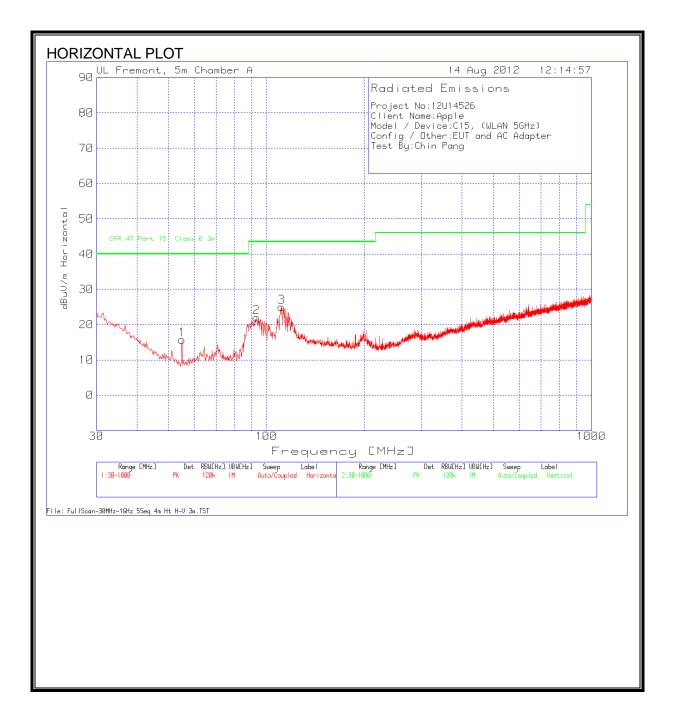
Test Engr Date: Project # Company Test Targ Mode Op	: y: et:	Chin pa 08/14/12 12U1452 Apple FCC 15. Co-locat	26 407	Hz an	d BT TX								
	f Dist Read AF CL	Measuren Distance Analyzer Antenna Cable Los	to Anter Reading Factor	ina	-	0	Correc Field S d Peak	trength @ Field Stre	3 m	Peak Fie Margin v	Field Stren ld Strength ys. Average ys. Peak Lin	Limit Limit	
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,	~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~											
10.360 10.360	3.0	34.9 22.4	38.2 38.2	9.4 9.4	-35.8 -35.8	0.0 0.0	0.0	46.8 34.3	74.0 54.0	-27.2 -19.7	V V	P	
10.360 15.540	3.0	35.5	<u>38.2</u> 39.0	9.4 12.5	-35.8	0.0	0.0	<u> </u>	54.0 74.0	-19.7	V V	A P	
15.540	3.0	22.3	39.0	12.5	-34.0	0.0	0.0	39.7	54.0	-14.3	v	A	
10.360	3.0	35.3	38.2	9.4	-35.8	0.0	0.0	47.1	74.0	-26.9	Ĥ	P	
10.360	3.0	22.4	38.2	9.4	-35.8	0.0	0.0	34.3	54.0	<b>-19.7</b>	Н	Α	
15.540	3.0	35.2	39.0	12.5	-34.0	0.0	0.0	52.7	74.0	-21.3	Н	Р	
15.540	3.0	22.3	39.0	12.5	-34.0	0.0	0.0	39.8	54.0	-14.2	H	<u>A</u>	
BTHigh	ab 2480	j MII~											
4.960	<u>cn, 2480</u> 3.0	55.6	33.6	6.4	-35.5	0.0	0.0	60.0	74.0	-14.0	Н	Р	
4.960	3.0	40.2	33.6	6.4	-35.5	0.0	0.0	44.6	54.0	-9.4	H H	A	
7.440	3.0	50.4	35.9	8.5	-35.5	0.0	0.0	59.4	74.0	-14.6	H	P	
7.440	3.0	36.1	35.9	8.5	-35.5	0.0	0.0	45.2	54.0	-8.9	H	A	
9.920	3.0	35.9	38.1	9.1	-35.9	0.0	0.0	47.2	74.0	-26.8	Н	Р	
9.920	3.0	23.1	38.1	9.1	-35.9	0.0	0.0	34.4	54.0	<b>-19.6</b>	H	A	
4.960	3.0	48.5	33.6	6.4	-35.5	0.0	0.0	53.0	74.0	-21.0	<u>V</u>	Р	
4.960	3.0	36.4	33.6	6.4	-35.5	0.0	0.0	40.8	54.0	-13.2	V	A	
/.++U	3.0	50.1	33.9	0.3	-33.3	0.0	0.0	37.1	34.0	-14.7	*		
7.440 7.440 Rev. 4.1.2 Note: No		41.3 30.1 missions	35.9 35.9 were de	8.5 8.5 tected	-35.5 -35.5 above t	0.0 0.0 the system	0.0 0.0 m nois	50.3 39.1 se floor.	74.0 54.0	-23.7 -14.9	V V	P A	

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Page 150 of 199

## 9.3. WORST-CASE BELOW 1 GHz

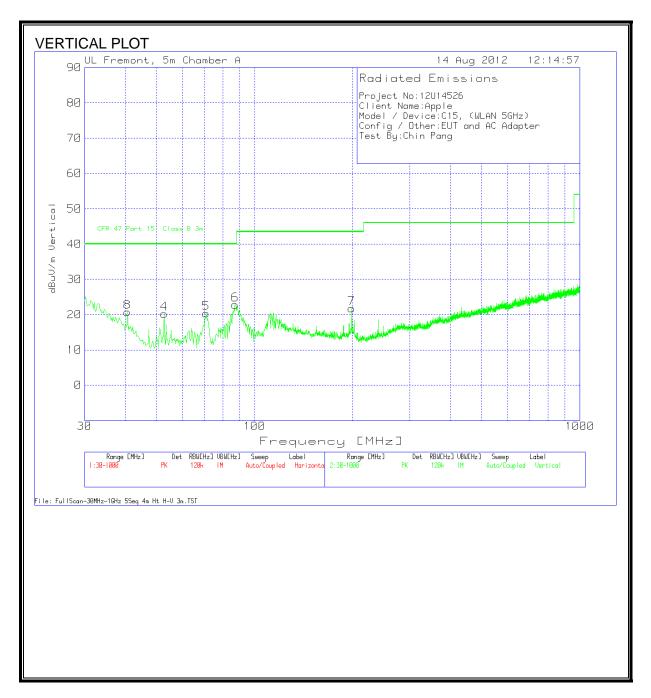
## SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



Page 151 of 199

## REPORT NO: 15U21850-E34V3 FCC ID: BCGA1432, BCGA1454, BCGA1455

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



Page 152 of 199

Polarity
Horz
Horz
Horz
Polarity
Vert

Page 153 of 199

## **10. AC POWER LINE CONDUCTED EMISSIONS**

## LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted	Limit (dBµV)
	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.

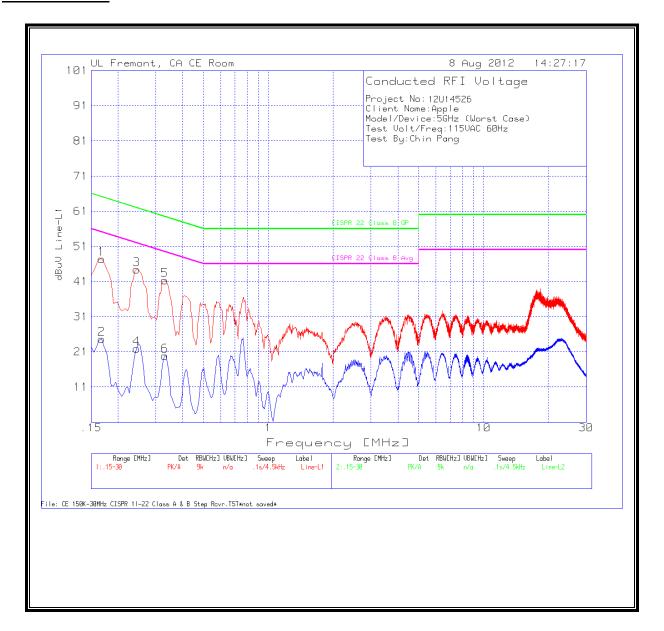
Line conducted data is recorded for both NEUTRAL and HOT lines.

Page 154 of 199

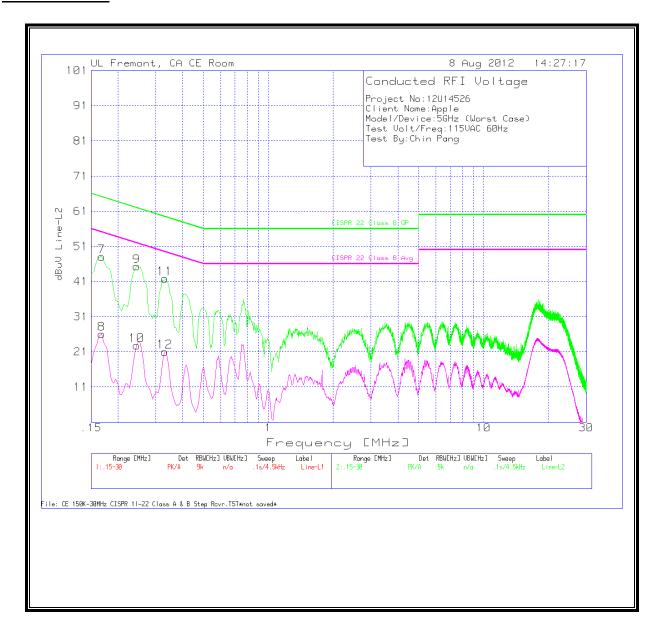
## **<u>6 WORST EMISSIONS</u>**

Project No:	12U14526								
Client Nam	e:Apple								
Model/Dev	ice:5GHz ('	Worst Case	)						
Test Volt/F	req:115VA	C 60Hz							
Test By:Chi	n Pang								
Line-L1.15	- 30MHz								
Frequency	Reading	Detector	T24 IL L1.	LC Cables	dBuV	CISPR 22B	Margin	CISPR 22B	Margin
0.168	47.28	РК	0.1	0	47.38	65.1	-17.72	-	-
0.168	24.53	Av	0.1	0	24.63	-	-	55.1	-30.47
0.2445	44.34	PK	0.1	0	44.44	61.9	-17.46	-	-
0.2445	21.81	Av	0.1	0	21.91	-	-	51.9	-29.99
0.33	41.21	РК	0.1	0	41.31	59.5	-18.19	-	-
0.33	19.79	Av	0.1	0	19.89	-	-	49.5	-29.61
Line-L2.15	- 30MHz								
Frequency	Reading	Detector	T24 IL L1.	LC Cables	dBuV	CISPR 22B	Margin	CISPR 22B	Margin
0.168	47.94	РК	0.1	0	48.04	65.1	-17.06	-	-
0.168	25.97	Av	0.1	0	26.07	-	-	55.1	-29.03
0.2445	45.18	PK	0.1	0	45.28	61.9	-16.62	-	-
0.2445	22.76	Av	0.1	0	22.86	-	-	51.9	-29.04
0.33	41.78	PK	0.1	0	41.88	59.5	-17.62	-	-
0.33	20.89	Av	0.1	0	20.99	-	-	49.5	-28.51

Page 155 of 199



Page 156 of 199



Page 157 of 199

## 11. DYNAMIC FREQUENCY SELECTION

## 11.1. OVERVIEW

## 11.1.1. LIMITS

FCC

§15.407 (h) and FCC 06-96 APPENDIX "COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVCIES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION".

Page 158 of 199

## Table 1: Applicability of DFS requirements prior to use of a channel

Requirement	Operatio	nal Mode	
	Master	Client (without radar detection)	Client (with radar detection)
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
Uniform Spreading	Yes	Not required	Not required

## Table 2: Applicability of DFS requirements during normal operation

Requirement	Operationa	Operational Mode						
	Master	Client	Client					
		(without DFS)	(with DFS)					
DFS Detection Threshold	Yes	Not required	Yes					
Channel Closing Transmission Time	Yes	Yes	Yes					
Channel Move Time	Yes	Yes	Yes					

## Table 3: Interference Threshold values, Master or Client incorporating In-Service Monitoring

Maximum Transmit Power	Value
	(see note)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 dBm
Note 1: This is the level at the input of the receiver a Note 2: Throughout these test procedures an addition of the test transmission waveforms to account for var- will ensure that the test signal is at or above the deter response.	onal 1 dB has been added to the amplitude ariations in measurement equipment. This

Page 159 of 199

## Table 4: DFS Response requirement values

Parameter	Value
Non-occupancy period	30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds
Channel Closing Transmission Time	200 milliseconds + approx. 60 milliseconds over remaining 10 second period

The instant that the *Channel Move Time* and the *Channel Closing Transmission Time* begins is as follows:

For the Short pulse radar Test Signals this instant is the end of the Burst.

For the Frequency Hopping radar Test Signal, this instant is the end of the last radar burst generated.

For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission.

The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate channel changes (an aggregate of approximately 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.

#### Pulse Width Radar PRI Minimum Minimum Pulses Type (Microseconds) (Microseconds) Percentage of Trials Successful Detection 1428 60% 30 1 18 1 2 30 1-5 150-230 23-29 60% 3 6-10 200-500 60% 30 16-18 4 11-20 200-500 12-16 60% 30 80% 120 Aggregate (Radar Types 1-4)

## Table 5 – Short Pulse Radar Test Waveforms

## Table 6 – Long Pulse Radar Test Signal

	<u> </u>		<u>v</u>				
Radar	Bursts	Pulses	Pulse	Chirp	PRI	Minimum	Minimum
Waveform		per	Width	Width	(µsec)	Percentage	Trials
		Burst	(µsec)	(MHz)		of Successful	
			. ,			Detection	
5	8-20	1-3	50-100	5-20	1000-	80%	30
					2000		

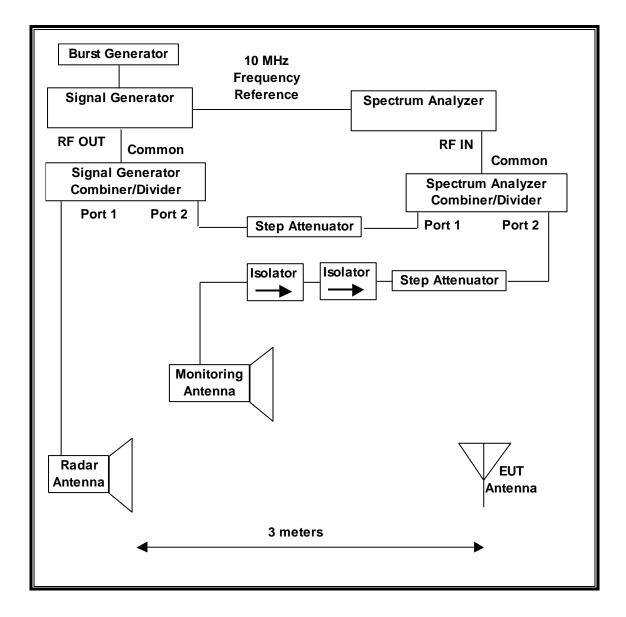
## Table 7 – Frequency Hopping Radar Test Signal

Radar Waveform	Pulse Width (µsec)	PRI (µsec)	Burst Length (ms)	Pulses per Hop	Hopping Rate (kHz)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	300	9	.333	70%	30

Page 160 of 199

## 11.1.2. TEST AND MEASUREMENT SYSTEM

## RADIATED METHOD SYSTEM BLOCK DIAGRAM



Page 161 of 199

## SYSTEM OVERVIEW

The short pulse and long pulse signal generating system utilizes the NTIA software. The Vector Signal Generator has been validated by the NTIA. The hopping signal generating system utilizes the CCS simulated hopping method and system, which has been validated by the DoD, FCC and NTIA. The software selects waveform parameters from within the bounds of the signal type on a random basis using uniform distribution.

The short pulse types 2, 3 and 4, and the long pulse type 5 parameters are randomized at runtime.

The hopping type 6 pulse parameters are fixed while the hopping sequence is based on the August 2005 NTIA Hopping Frequency List. The initial starting point randomized at run-time and each subsequent starting point is incremented by 475. Each frequency in the 100-length segment is compared to the boundaries of the EUT Detection Bandwidth and the software creates a hopping burst pattern in accordance with Section 7.4.1.3 Method #2 Simulated Frequency Hopping Radar Waveform Generating Subsystem of FCC 06-96 APPENDIX. The frequency of the signal generator is incremented in 1 MHz steps from  $F_L$  to  $F_H$  for each successive trial. This incremental sequence is repeated as required to generate a minimum of 30 total trials and to maintain a uniform frequency distribution over the entire Detection Bandwidth.

The signal monitoring equipment consists of a spectrum analyzer. The aggregate ON time is calculated by multiplying the number of bins above a threshold during a particular observation period by the dwell time per bin, with the analyzer set to peak detection and max hold.

#### SYSTEM CALIBRATION

A 50-ohm load is connected in place of the spectrum analyzer, and the spectrum analyzer is connected to a horn antenna via a coaxial cable, with the reference level offset set to (horn antenna gain – coaxial cable loss). The signal generator is set to CW mode. The amplitude of the signal generator is adjusted to yield a level of –64 dBm as measured on the spectrum analyzer.

Without changing any of the instrument settings, the spectrum analyzer is reconnected to the Common port of the Spectrum Analyzer Combiner/Divider. The Reference Level Offset of the spectrum analyzer is adjusted so that the displayed amplitude of the signal is –64 dBm.

The spectrum analyzer displays the level of the signal generator as received at the antenna ports of the Master Device. The interference detection threshold may be varied from the calibrated value of –64 dBm and the spectrum analyzer will still indicate the level as received by the Master Device.

Page 162 of 199

## ADJUSTMENT OF DISPLAYED TRAFFIC LEVEL

A link is established between the Master and Slave and the distance between the units is adjusted as needed to provide a suitable received level at the Master and Slave devices. The video test file is streamed to generate WLAN traffic. The monitoring antenna is adjusted so that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold.

#### TEST AND MEASUREMENT EQUIPMENT

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

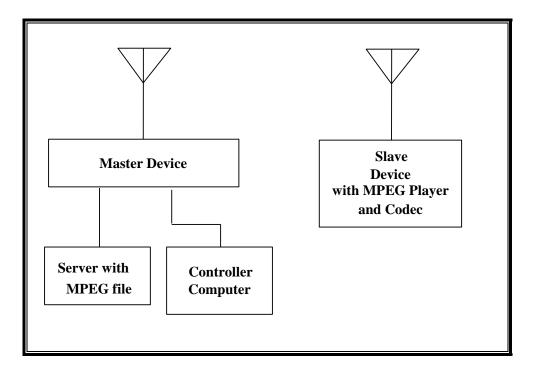
TEST EQUIPMENT LIST							
Description Manufacturer Model Asset Number Cal Due							
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01178	08/15/12			
Vector Signal Generator, 20GHz	Agilent / HP	E8267C	C01066	11/17/12			

Page 163 of 199

## 11.1.3. SETUP OF EUT

## **CLIENT MODE:**

## RADIATED METHOD EUT TEST SETUP



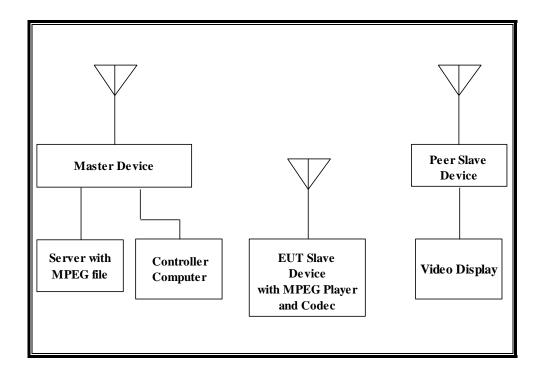
#### SUPPORT EQUIPMENT

The following support equipment was utilized for the DFS tests documented in this report:

	PERIPHERAL SUPPORT EQUIPMENT LIST						
Description	Manufacturer	Model	Serial Number	FCC ID			
Wireless Access Point	Cisco	AIR-AP1252AG-A-	FTX130390D9	LDK102061			
(Master Device)		K9					
AC Adapter (AP)	Delta Electronics	EADP-45BB B	DTH1049902N	DoC			
Notebook PC (Server)	Apple	MacBook Pro A1150	AOU257941	DoC			
AC Adapter (Server)	Delta Electronics	A1344	MV05104CNAL1A	DoC			
Notebook PC (Controller)	Dell	PP18L	10657517725	DoC			
AC Adapter (Controller PC)	Dell	LA65SN0-00	CN-ODF263-71615- 6AU-1019	DoC			

Page 164 of 199

## RADIATED METHOD EUT TEST SETUP



## SUPPORT EQUIPMENT

The following support equipment was utilized for the DFS tests documented in this report:

	PERIPHERAL SUPPORT EQUIPMENT LIST						
Description	Manufacturer	Model	Serial Number	FCC ID			
Wireless Access Point	Cisco	AIR-AP1252AG-A-	FTX130390D9	LDK102061			
(Master Device)		K9					
AC Adapter (AP)	Delta Electronics	EADP-45BB B	DTH1049902N	DoC			
Notebook PC (Server)	Apple	MacBook Pro A1150	AOU257941	DoC			
AC Adapter (Server)	Delta Electronics	A1344	MV05104CNAL1A	DoC			
Notebook PC (Controller)	Dell	PP18L	10657517725	DoC			
AC Adapter (Controller PC)	Dell	LA65SN0-00	CN-ODF263-71615- 6AU-1019	DoC			
Apple TV (Peer Slave Device)	Apple	A1427	C07GY040F14P	BCGA1427			
LCD Monitor	Dell	Prototype	6279	N/A			

## 11.1.4. DESCRIPTION OF EUT

The EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges.

The EUT is a Slave Device without Radar Detection.

The highest power level within these bands is 21.6 dBm EIRP in the 5250-5350 MHz band and 21.18 dBm EIRP in the 5470-5725 MHz band.

The only antenna assembly utilized with the EUT has a gain of 4.25 dBi in the 5250-5350 MHz band and 4.51 dBi in the 5470-5725 MHz band.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is -64 dBm. After correction for procedural adjustments, the required radiated threshold at the antenna port is -64 + 1 = -63 dBm.

The calibrated radiated DFS Detection Threshold level is set to –64 dBm. The tested level is lower than the required level hence it provides margin to the limit.

The EUT uses one transmitter/receiver chain connected to an antenna to perform radiated tests.

In the client mode, WLAN traffic is generated by streaming the video file TestFile.mp2 "6 ½ Magic Hours" from the Master to the Slave in full motion video mode using Safari web browser. In the Client-to-Client Communications mode, WLAN traffic is generated by streaming the video file TestFile.mp2 "6 ½ Magic Hours" from the Master, to the Slave, and mirror to the peer slave device in full motion video mode using Safari web browser.

TPC is not required since the maximum EIRP is less than 500 mW (27 dBm).

The EUT utilizes the 802.11a/n architecture. Two nominal channel bandwidths of 20 MHz and 40 MHz are implemented in standard client mode. One nominal channel bandwidth of 20 MHz is implemented in Client-to-Client Communications mode.

The software installed in the EUT is IOS (Build 10A371).

## UNIFORM CHANNEL SPREADING

This requirement is not applicable to Slave radio devices.

Page 166 of 199

## **OVERVIEW OF MASTER DEVICE WITH RESPECT TO §15.407 (h) REQUIREMENTS**

The Master Device is a Cisco Access Point, FCC ID: LDK102061. The minimum antenna gain for the Master Device is 3.5 dBi.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is -64 dBm. After correction for procedural adjustments, the required radiated threshold at the antenna port is -64 + 1 = -63 dBm.

The calibrated radiated DFS Detection Threshold level is set to –64 dBm. The tested level is lower than the required level hence it provides margin to the limit.

The software installed in the access point is 12.4(25d)JA1.

Page 167 of 199

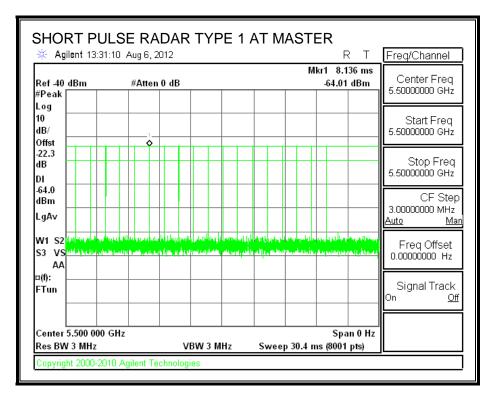
## 11.2. CLIENT MODE RESULTS FOR 20 MHz BANDWIDTH

## 11.2.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5500 MHz.

## 11.2.2. RADAR WAVEFORM AND TRAFFIC

## RADAR WAVEFORM



Page 168 of 199

## **TRAFFIC**

🔆 Agilent 13:19:0	30 Aug 6, 2012		RT	Freq/Channel
Ref -40 dBm #Peak	#Atten 0 dB		Mkr1 1.36 s -80.49 dBm	Center Freq 5.50000000 GHz
Log 10 dB/ Offst				Start Freq 5.5000000 GHz
-22.3 dB DI				Stop Freq 5.5000000 GHz
-64.0 to an ideat dBm LgAv	n de Trekonsen formeljenen fektigen der Hennen in der State d			CF Step 3.00000000 MHz <u>Auto M</u> a
W1 S2 S3 FS AA				Freq Offset 0.00000000 Hz
¤(f): FTun				Signal Track ^{On <u>Of</u>}
Center 5.500 000 G Res BW 3 MHz	5Hz VBW 3	MHz Sween	Span 0 Hz 9 16 s (8001 pts)	

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Page 169 of 199

## 11.2.3. OVERLAPPING CHANNEL TESTS

## RESULTS

These tests are not applicable.

## 11.2.4. MOVE AND CLOSING TIME

#### **REPORTING NOTES**

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time = (Number of analyzer bins showing transmission) * (dwell time per bin)

The observation period over which the FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

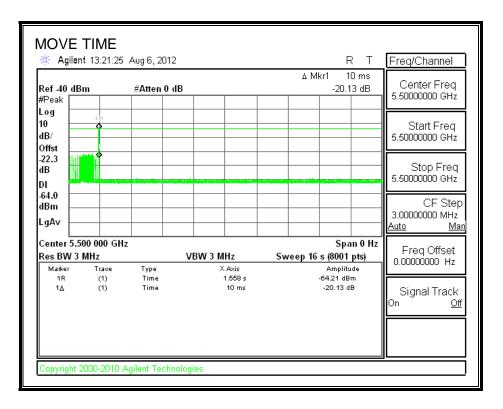
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

#### **RESULTS**

Agency	Channel Move Time	Limit
	(sec)	(sec)
FCC / IC	0.010	10

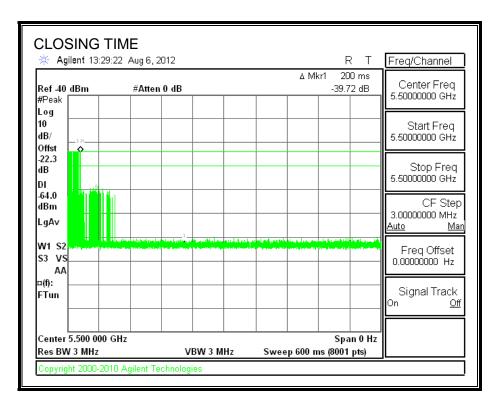
Agency	Aggregate Channel Closing Transmission Time	Limit
	(msec)	(msec)
FCC	0.0	60
IC	4.0	260

## MOVE TIME



Page 171 of 199

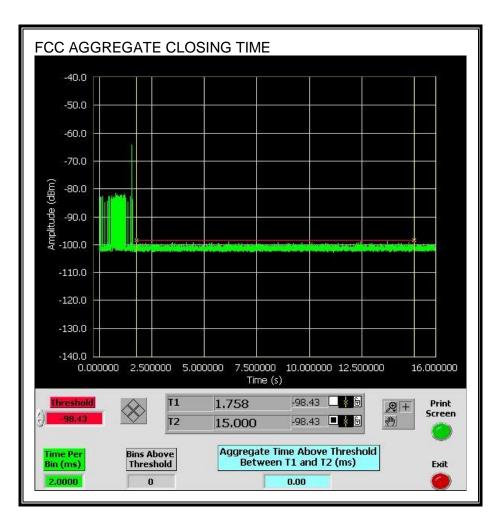
## **CHANNEL CLOSING TIME**



Page 172 of 199

## AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.



Page 173 of 199

Only intermittent transmissions are observed during the IC aggregate monitoring period.

IC AGGRE	GATE CLOSII	NG TIME			
-40.0					
-50.0	-			14 - Bi	
-60.0					
-70.0					
Ê -80.0				4 g	
-80.0 -90.0 -90.0					
북 -100.0 -					
-110.0					
-120.0			4) j	ia	
-130.0				-	
-140.0					
0.00000	00 2.500000 5.0	00000 7.500000 Time (		500000 10	5.000000
Threshold	T1	1.558	-98.43 🔲 🕺		Print
- <b>98.43</b>	<u>T2</u>	15.000	-98.43 🔳 🗱		Screen
Time Per Bin (ms)	Bins Above Threshold	Aggregate Betwee	fime Above Thre n T1 and T2 (ms	shold	Exit
2.0000	2	Detwee	4.00	<u> </u>	

Page 174 of 199

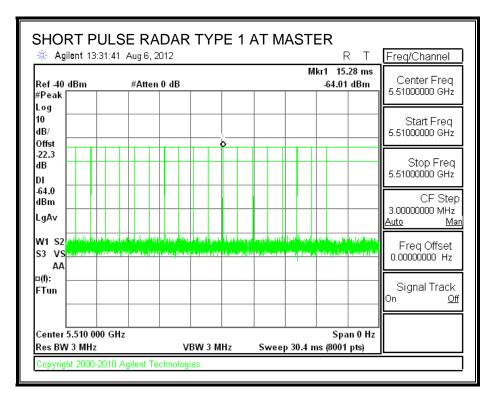
## 11.3. CLIENT MODE RESULTS FOR 40 MHz BANDWIDTH

## 11.3.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5510 MHz.

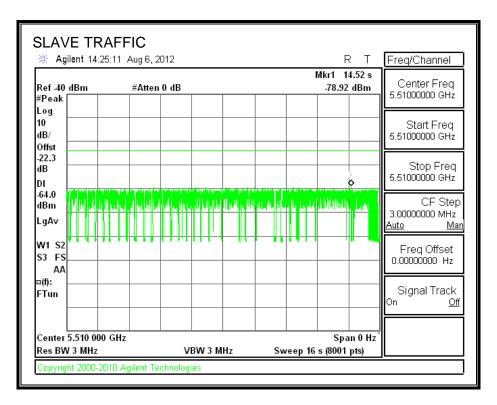
## 11.3.2. RADAR WAVEFORM AND TRAFFIC

## RADAR WAVEFORM



Page 175 of 199

## **TRAFFIC**



Page 176 of 199

## 11.3.3. OVERLAPPING CHANNEL TESTS

## RESULTS

These tests are not applicable.

## 11.3.4. MOVE AND CLOSING TIME

#### **REPORTING NOTES**

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time = (Number of analyzer bins showing transmission) * (dwell time per bin)

The observation period over which the FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

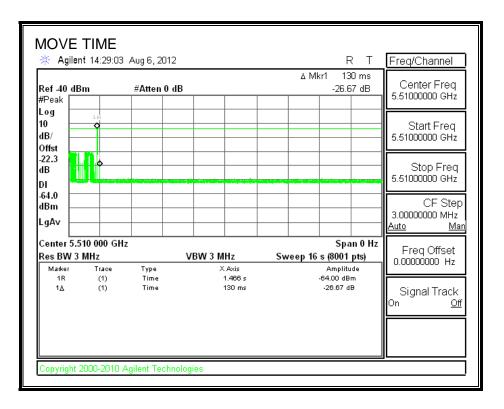
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

#### RESULTS

Agency	Channel Move Time	Limit
	(sec)	(sec)
FCC / IC	0.130	10

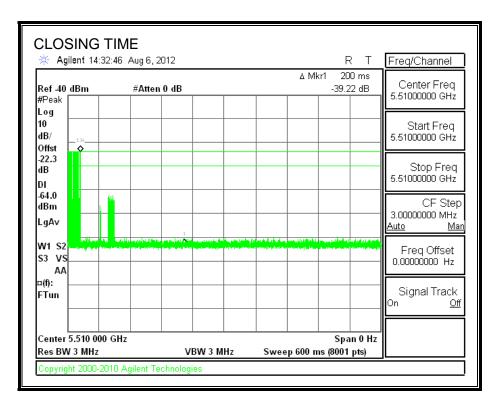
Agency	Aggregate Channel Closing Transmission Time	Limit
	(msec)	(msec)
FCC	0.0	60
IC	2.0	260

## MOVE TIME



Page 178 of 199

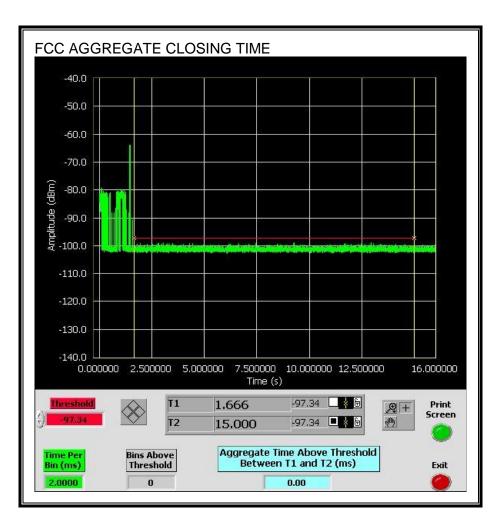
## **CHANNEL CLOSING TIME**



Page 179 of 199

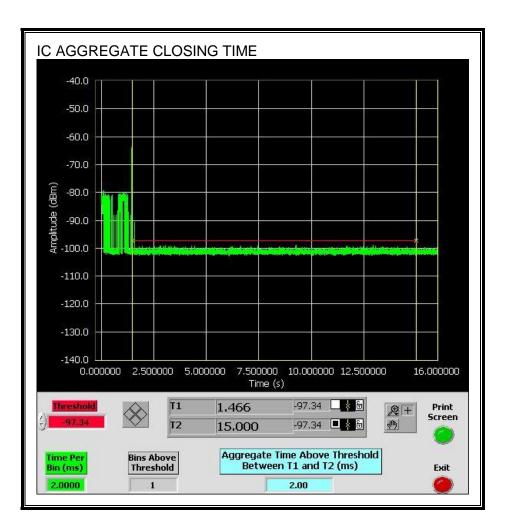
## AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.



Page 180 of 199

Only intermittent transmissions are observed during the IC aggregate monitoring period.

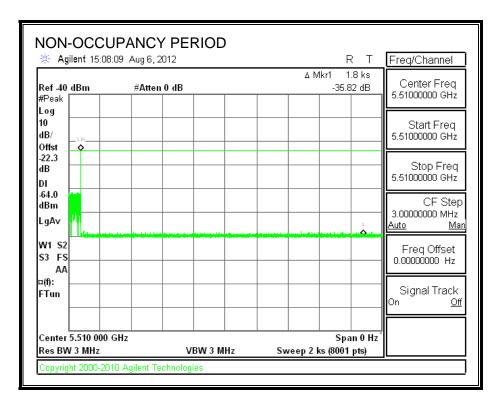


Page 181 of 199

## 11.3.5. NON-OCCUPANCY PERIOD

#### RESULTS

No EUT transmissions were observed on the test channel during the 30-minute observation time.



Page 182 of 199

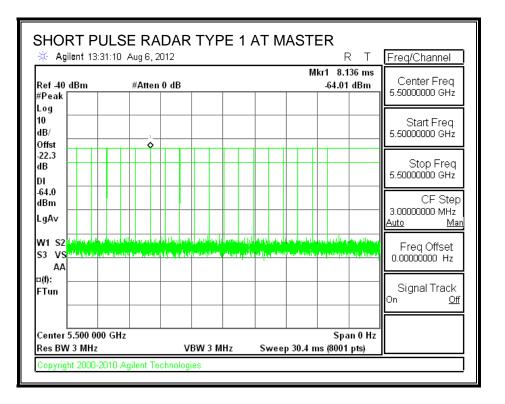
# 11.4. CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 20 MHz BANDWIDTH

## 11.4.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5500 MHz.

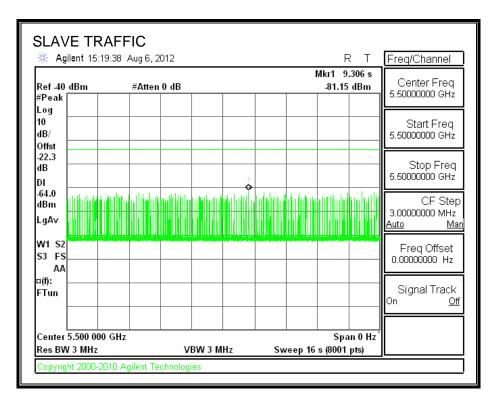
## 11.4.2. RADAR WAVEFORM AND TRAFFIC

## RADAR WAVEFORM



Page 183 of 199

## **TRAFFIC**



Page 184 of 199

## 11.4.3. OVERLAPPING CHANNEL TESTS

## RESULTS

These tests are not applicable.

## 11.4.4. MOVE AND CLOSING TIME

#### **REPORTING NOTES**

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time = (Number of analyzer bins showing transmission) * (dwell time per bin)

The observation period over which the FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

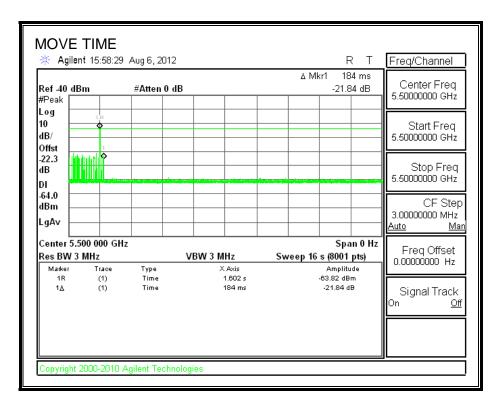
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

#### RESULTS

Agency	Channel Move Time	Limit
	(sec)	(sec)
FCC / IC	0.184	10

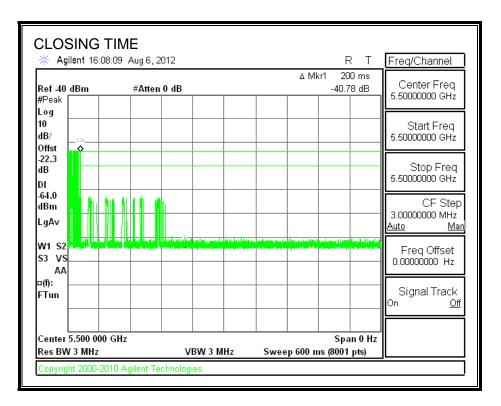
Agency	Aggregate Channel Closing Transmission Time	Limit
	(msec)	(msec)
FCC	0.0	60
IC	10.0	260

## MOVE TIME



Page 186 of 199

## **CHANNEL CLOSING TIME**

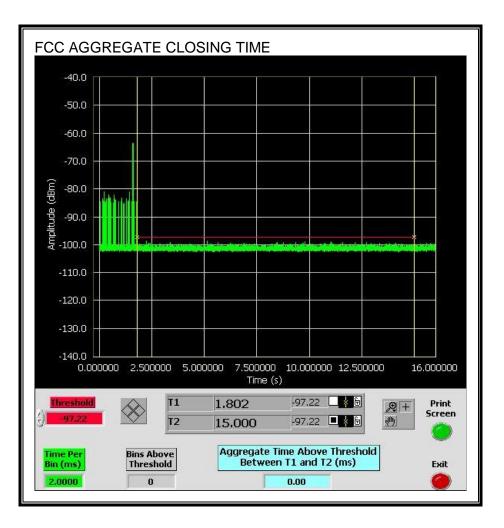


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Page 187 of 199

## AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.



Page 188 of 199

Only intermittent transmissions are observed during the IC aggregate monitoring period.

IC AGGF	REGAT	E CLO	SINC	G TIME				
-40.0								
-50.0	8		35					
-60.0					0		ç	
-70.0					1			
Ê -80.0	Jui - I				0		·	
-80.0 -90.0 -100.0							i c	
비료 문국 -100.0								
-110.0	71				i.			
-120.0		5 12. 1			sii		:	
-130.0		<del>.</del>			8			
-140.0								
0.0	0000 2	.500000	5.0000		0000 10.00 me(s)	0000 12.50	0000	16.000000
Threshold		<b>T1</b>		1.602	-97.	22 🗌 🗱 🔓		Print Screen
- <b>97.22</b>		T2		15.000	-97.	22 🗖 🕴 🖯	<u>_</u>	
Time Per Bin (ms)		ns Above nreshold		Aggrega Bet	ate Time Ab ween T1 ar	iove Thresh nd T2 (ms)	old	Exit
2.0000	ſ	5			10.00			0

Page 189 of 199