CERTIFICATION TEST REPORT

Report Number. : 11988952-E2V3

Applicant	:	RACHIO, INC. 1321 15 STREET DENVER, CO 80202, U.S.A.
FCC ID	:	2AOTB-ZULWC
IC ID	:	23555-ZULWC
EUT Description	:	RACHIO 3 SPRINKLER CONTROLLER
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART E (EXCEPT DFS) INDUSTRY CANADA RSS - 247 ISSUE 2 INDUSTRY CANADA RSS - GEN ISSUE 4

Date Of Issue:
April 12, 2018

Prepared by:
UL Verification Services Inc.
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	03/14/18	Initial Issue	Frank Ibrahim
V2	04/04/18	Update Sections 5.3, 5.5, 8.2.3, 8.3.3, 8.4.3, 8.5.3, 8.6.3, 8.7.3, 8.8.3, 8.9.3, 8.10.3, 8.11.3, 8.12.3, 8.13.3, 8.13.4	David Garcia
V3	04/12/18	Revised Maximum Output Power Section.	Frank Ibrahim

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: RACHIO, INC.
1321 15 ST
DENVER, CO 80202, U.S.A.

EUT DESCRIPTION: RACHIO 3 SPRINKLER CONTROLLER

MODEL: 16ZULW-C

SERIAL NUMBER: 1109141171

DATE TESTED: AUG 20, 2017 – JAN 24, 2018

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart E	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 4	Complies

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
OPERATIONS LEADER
UL Verification Services Inc.

Prepared By:

JOHN LY
EMC TECHNICIAN
UL Verification Services Inc.

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2. TEST METHODOLOGY

FCC: 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 v01r04, FCC KDB 644545 D03 v01, ANSI C63.10-2013.

3. FACILITIES AND ACCREDITATION

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

47173 Benicia Street	47266 Benicia Street
☐ Chamber A	☐ Chamber D
☒ Chamber B	☐ Chamber E
☐ Chamber C	☐ Chamber F
	☐ Chamber G
	☐ Chamber H

The above test sites and facilities are covered under FCC Test Firm Registration # 208313.
UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.
Chambers A through C are covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-3, respectively. Chambers D through H are covered under Industry Canada company address code 22541 with site numbers 22541 -1 through 22541-5, respectively.

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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:

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

Parameter	Uncertainty
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

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

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Rachio 3 Sprinkler Controller.

5.2. DESCRIPTION OF DIFFERENCES BETWEEN 16 ZONE AND 8 ZONE DEVICES

The 8 zone device uses the same circuit board as the 16 zone with some small population differences. The 8 zone has 8 fewer triacs (analog switches) populated as well as supporting resistors/capacitors around the triacs. There are also jumpers populated differently to route connections to different poles on the connector. None of these parts are related to the RF circuitry, power supply or any high frequency operation

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5.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power for FCC as follows:

FCC:

5.2GHz Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5180 - 5240	802.11a	11.02	12.65
	802.11n HT20	10.12	10.28
5190 - 5230	802.11n HT40	10.20	10.47

5.3GHz Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5260 - 5320	802.11a	11.56	14.32
	802.11n HT20	11.59	14.42
5270 - 5310	802.11n HT40	11.61	14.49

5.6GHz Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5500 - 5720	802.11a	10.25	10.59
	802.11n HT20	10.57	11.40
5510 - 5710	802.11n HT40	11.29	13.46

5.8GHz Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5745 - 5825	802.11a	10.71	11.78
	802.11n HT20	10.63	11.56
5755 - 5795	802.11n HT40	10.53	11.30

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The transmitter has a maximum conducted power and EIRP for ISED as follows:

ISED:

5.2GHz Band

Frequency Range (MHz)	Mode	Output EIRP (dBm)	Output EIRP (mW)
5180 - 5240	802.11a	12.62	18.28
	802.11n HT20	11.72	14.86
5190 - 5230	802.11n HT40	11.80	15.14

5.3GHz Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5260 - 5320	802.11a	11.56	14.32
	802.11n HT20	11.59	14.42
5270 - 5310	802.11n HT40	11.61	14.49

5.6GHz Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5500 - 5720	802.11a	10.25	10.59
	802.11n HT20	10.57	11.40
5510 - 5710	802.11n HT40	11.29	13.46

5.8GHz Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5745 - 5825	802.11a	10.71	11.78
	802.11n HT20	10.63	11.56
5755 - 5795	802.11n HT40	10.53	11.30

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5.4. DESCIPTION OF CHANGE

Based on the manufacturer's declaration, the reason for the additional testing as covered by this report is the co-location of an additional radio (LoRa 915 MHz radio) on their device that is not covered under the Murata WiFi module's certification.

5.5. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes two integrated antennas, with the following maximum gains:

	Peak Antenna Gain (dBi)
Frequency (GHz)	Main (Chain 0)
5180-5320	2.0
5500-5700	2.0
5745-5825	2.0

5.6. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was SONY, s_atp_1_00139_B_10_5.
The test utility software used during testing was Tera Term Ver 4.79.

5.7. WORST-CASE CONFIGURATION AND MODE

Radiated emission below 1 GHz, radiated emissions from 18 to 40 GHz and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

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

Worst-case data rates as provided by the client were:

802.11a mode: 6 Mbps
802.11n HT20mode: MCS0
802.11n HT40mode: MCS0

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5.8. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List			
Description	**Manufacturer**	**Model**	**Serial Number**
AC Adapter	Rachio	ILA48-24 1000	N/A

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	2-Prong	Unshielded	1.5	

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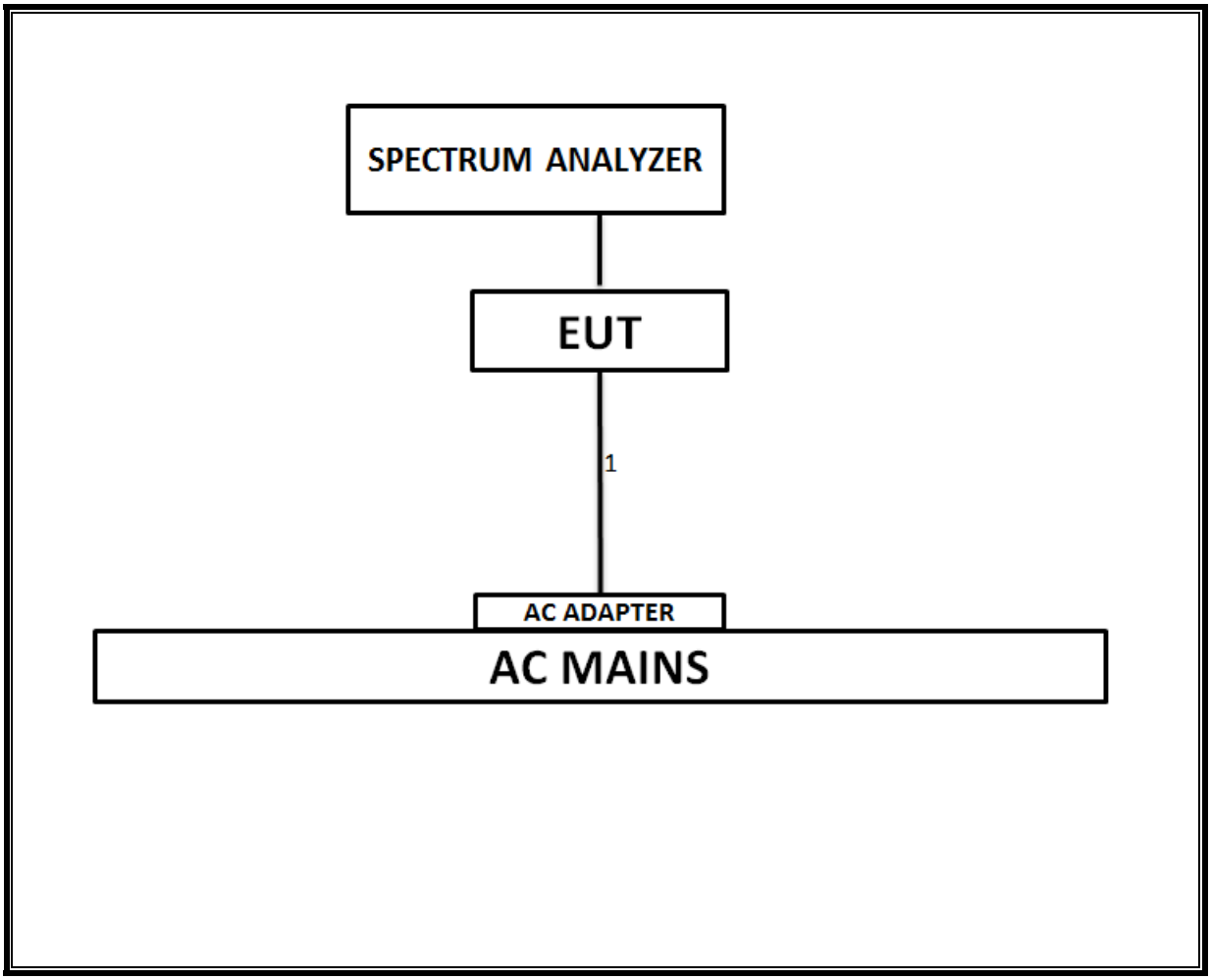
TEST SETUP

CONDUCTED TEST SETUP DIAGRAM



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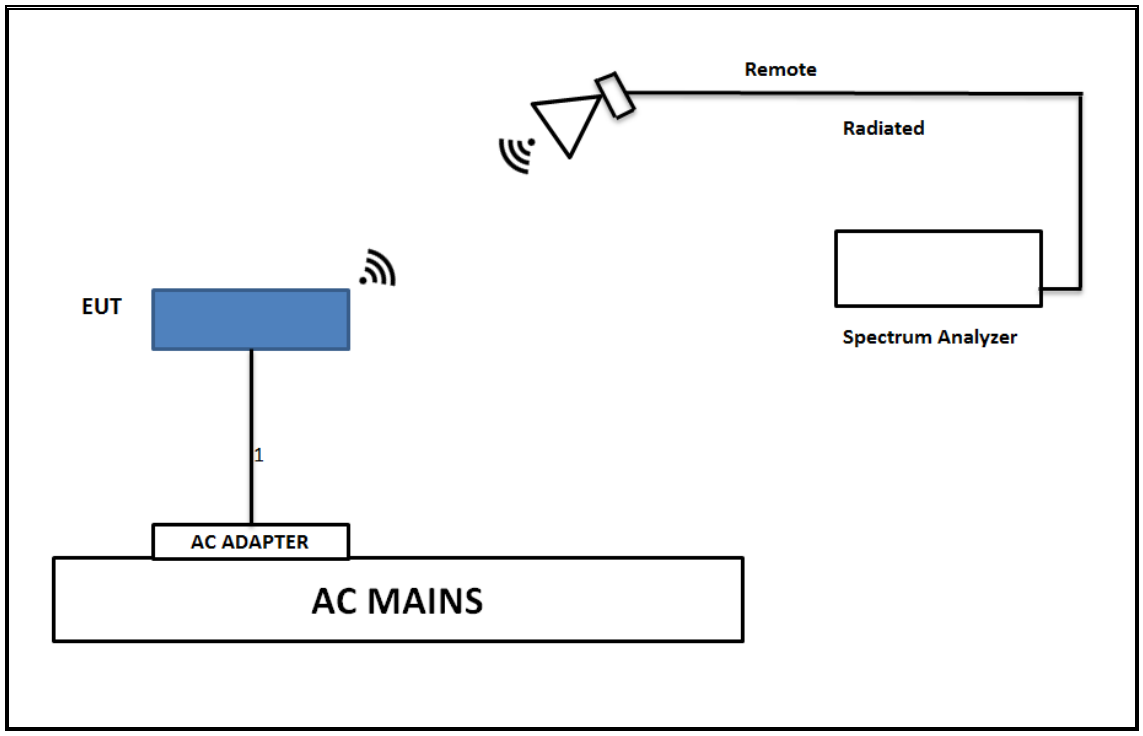
TEST SETUP

RADIATED AND AC LINE CONDUCTED EMISSIONS SETUP DIAGRAM



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6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List				
Description	**Manufacturer**	**Model**	**T Number**	**Cal Due**
Amplifier, 1-18GHz	Miteq	AFS42-00101800-25-S-42	493	06/23/18
Filter, HPF 6 HPF	Micro-Tronics	HPS17542	483	06/24/18
Filter, HPF 3GHz	Micro-Tronics	HPM17543	485	06/24/18
Switch Driver	Keysight	11713A	457	N/A
Filter, LPF 5GHz	Micro-Tronics	LPS17541	482	06/24/18
Antenna, Horn 1-18GHz	ETS Lindgren	3117	345	06/14/18
Antenna, Horn 18-26.5GHz	ARA	MWH-1826/B	449	06/12/18
Antenna, Horn 26.5- 40GHz	ARA	MWH-2640/B	446	06/12/18
Antenna, Active Loop 9KHz to 30MHz	Emco	6502	35	03/09/18
Controller	Sunol Sciences	SC110V	1290	N/A
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB1	899	06/15/18
Amplifier, 10KHz to 1GHz, 32dB	Keysight	8447D	10	02/15/18
Amplifier, 1 to 8 GHz, 35dB	Miteq	AMF-4D-01000800-30-29P	1156	06/24/18
Amplifier, 1 to 26.5GHz, 23.5dB	Agilent	8449B	404	07/23/18
Amplifier, 26 to 40GHz, 34dB	Miteq	TTA2640-35-HG	1864	08/21/18
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	907	01/23/18
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	1454	01/08/19
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	1466	04/11/18

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Test Software List					
Description	**Manufacturer**	**Model**	**T No.**	**Cal Date**	**Cal Due**
Radiated Software	UL	UL EMC	Ver 9.5, Dec 01, 2016		
Conducted Software	UL	UL EMC	Ver 9.5, May 26 2015		

Test Software List			
Description	**Manufacturer**	**Model**	**Version**
Radiated Software	UL	UL EMC	Ver 9.5, Apr 26, 2016
Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015
Antenna Port Software	UL	UL RF	Ver 5.1.1, July 15, 2016

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7. MEASUREMENT METHODS

On Time and Duty Cycle: KDB 789033 D02 v01r04, Section B.

6 dB Emission BW: KDB 789033 D02 v01r04, Section C.2.

26 dB Emission BW: KDB 789033 D02 v01r04, Section C.2.1.

99% Occupied BW: KDB 789033 D02 v01r04, Section D.

Conducted Output Power: KDB 789033 D02 v01r04, Section E.3.b (Method PM-G) and KDB 662911 D01 v02r01.

Power Spectral Density: KDB 789033 D02 v01r04, Section F and KDB 662911 D01 v02r01.

Unwanted emissions in restricted bands: KDB 789033 D02 v01r04, Sections G.3, G.4, G.5, and G.6, and KDB 662911 D01 v02r01.

Unwanted emissions in non-restricted bands: KDB 789033 D02 v01r04, Sections G.3, G.4, and G.5, and KDB 662911 D01 v02r01.

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

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8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 789033 Zero-Span Spectrum Analyzer Method.

RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)
802.11a	0.176	0.219	0.806	80.6%	0.94	5.675
802.11n HT20	0.164	0.207	0.794	79.4%	1.00	6.098
802.11n HT40	0.100	0.203	0.492	49.2%	3.08	10.040

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DUTY CYCLE PLOTS

DUTY CYCLE 802.11a MODE

DUTY CYCLE 802.11n HT20 MODE

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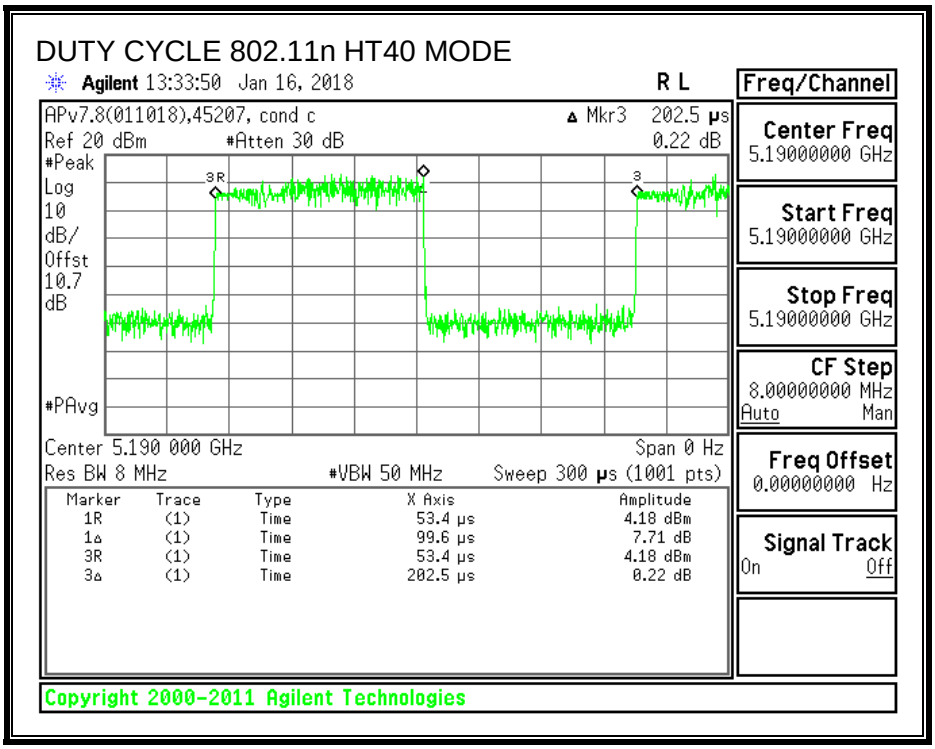
DUTY CYCLE 802.11n HT40 MODE



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8.2. 11a MODE IN THE 5.2GHz BAND

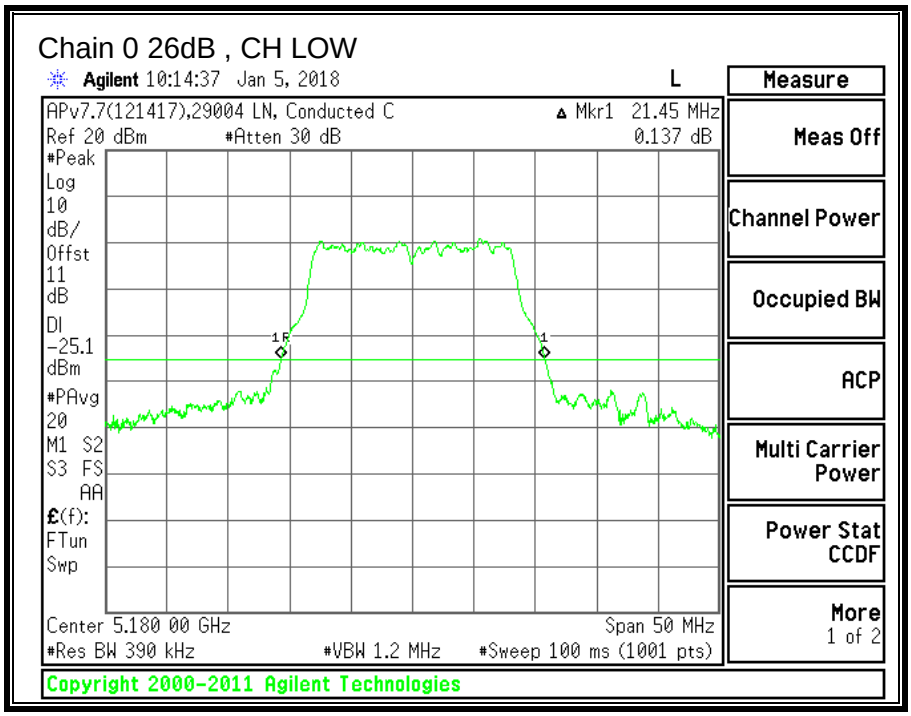
8.2.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	26 dB BW (MHz)
Low	5180	21.45
Mid	5200	21.45
High	5240	21.45



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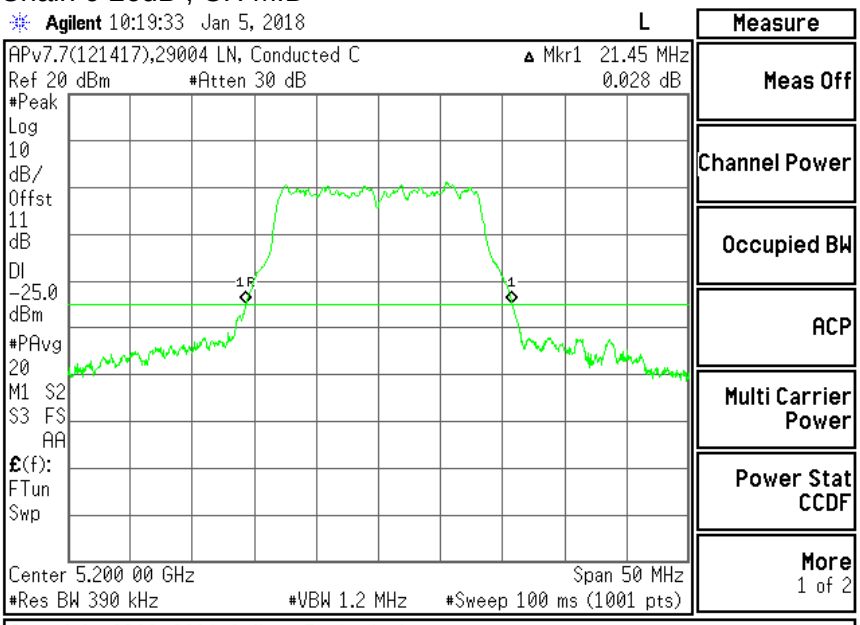
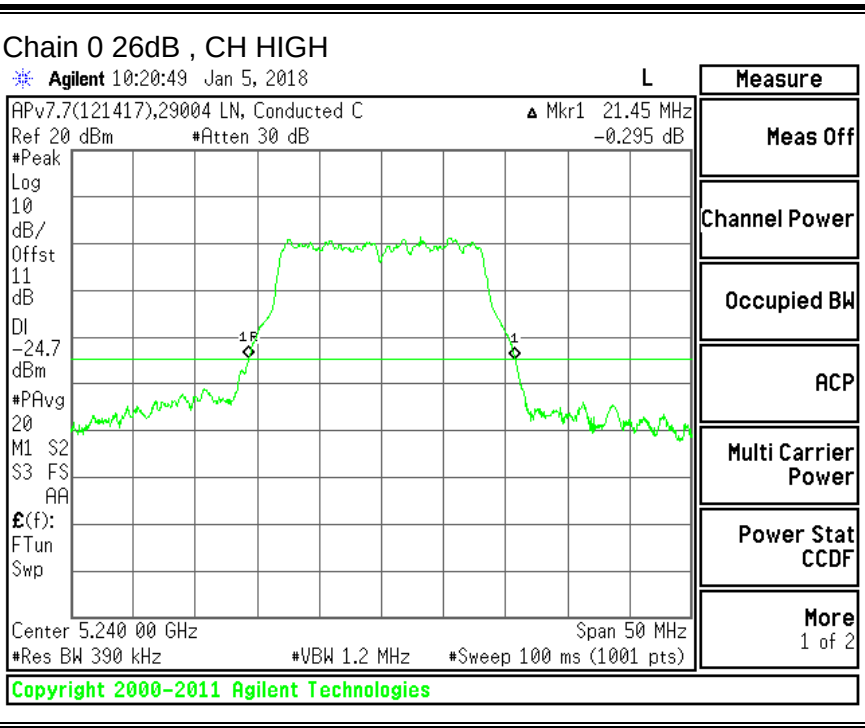
Chain 0 26dB , CH MID



Chain 0 26dB , CH HIGH



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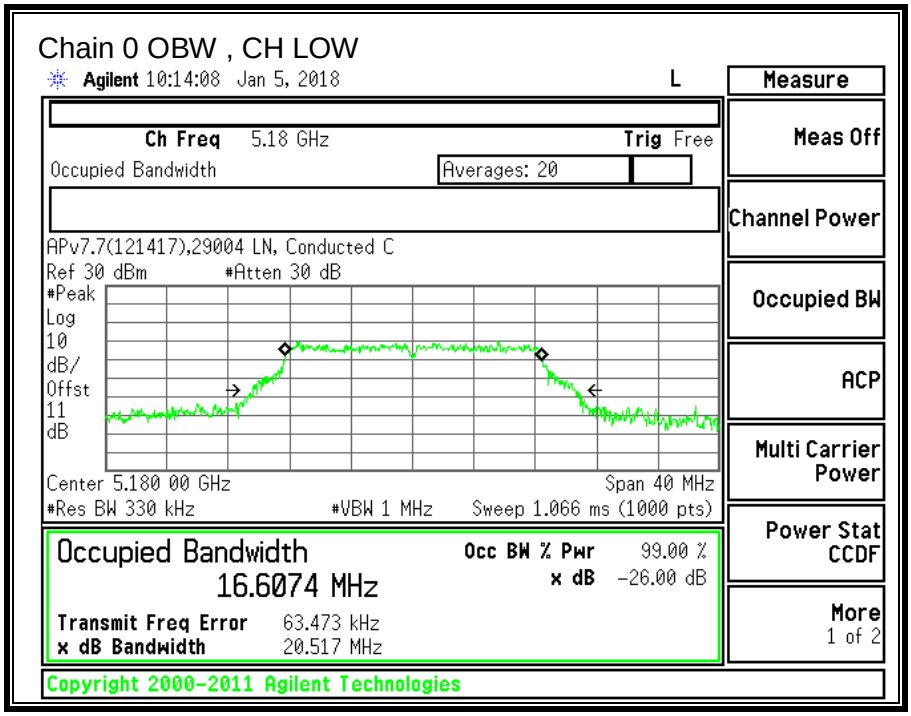
8.2.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	99% (MHz)
Low	5180	16.6074
Mid	5200	16.6252
High	5240	16.5606



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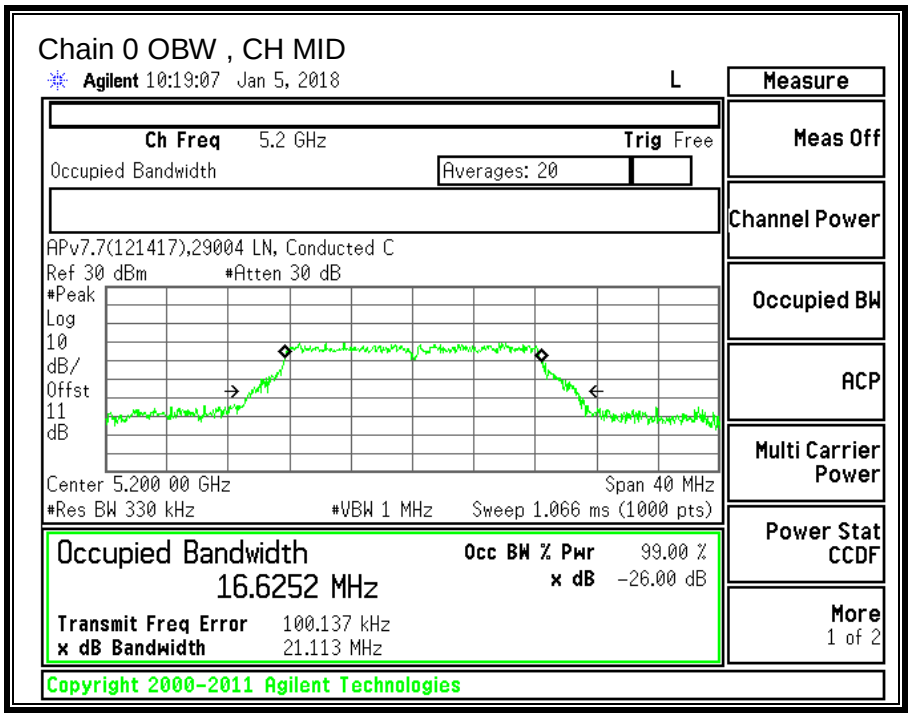

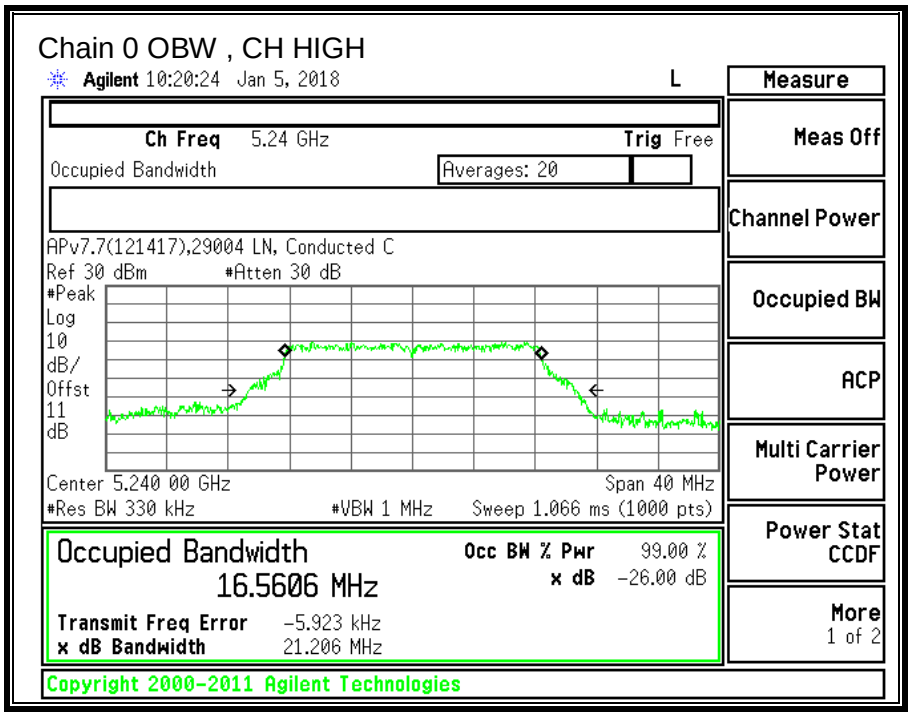

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8.2.3. OUTPUT POWER

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. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. 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 operations.

(iv) For 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.

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ISED RSS 247 Issue 2, Clause 6.2.1.1

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less stringent. Devices shall implement transmitter power control (TPC) in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

For other devices, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

DIRECTIONAL ANTENNA GAIN

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

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RESULTS (FCC)

Antenna Gain and Limits

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Power Limit (dBm)
Low	5180	2.00	24.00
Mid	5200	2.00	24.00
High	5240	2.00	24.00

Duty Cycle CF (dB)	0.94	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	10.08	11.02	24.00	-12.98
Mid	5200	9.98	10.92	24.00	-13.08
High	5240	9.78	10.72	24.00	-13.28

Test Information

Tester: LN 39004
Date: 01/10/18

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RESULTS (ISED)

Antenna Gain and Limits

Channel	Frequency (MHz)	Directional Ant Gain (dBi)	Occupied 99% BW (MHz)	EIRP Limit (dBm)
Low	5180	2.00	16.61	22.20
Mid	5200	2.00	16.63	22.21
High	5240	2.00	16.56	22.19

Duty Cycle CF (dB)	0.94	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Cond Power (dBm)	Total Corr'd EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
Low	5180	10.08	13.02	22.20	-9.18
Mid	5200	9.98	12.92	22.21	-9.29
High	5240	9.78	12.72	22.19	-9.47

Test Information

Tester: LN 39004
Date: 01/10/18

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8.3. 11n HT20 MODE IN THE 5.2GHz BAND

8.3.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	26 dB BW (MHz)
Low	5180	21.75
Mid	5200	21.90
High	5240	21.85

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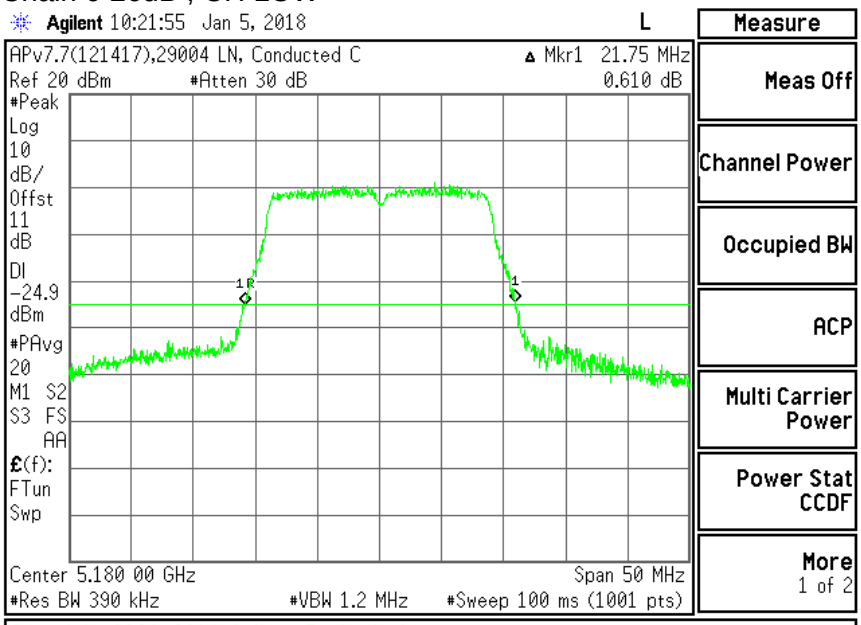
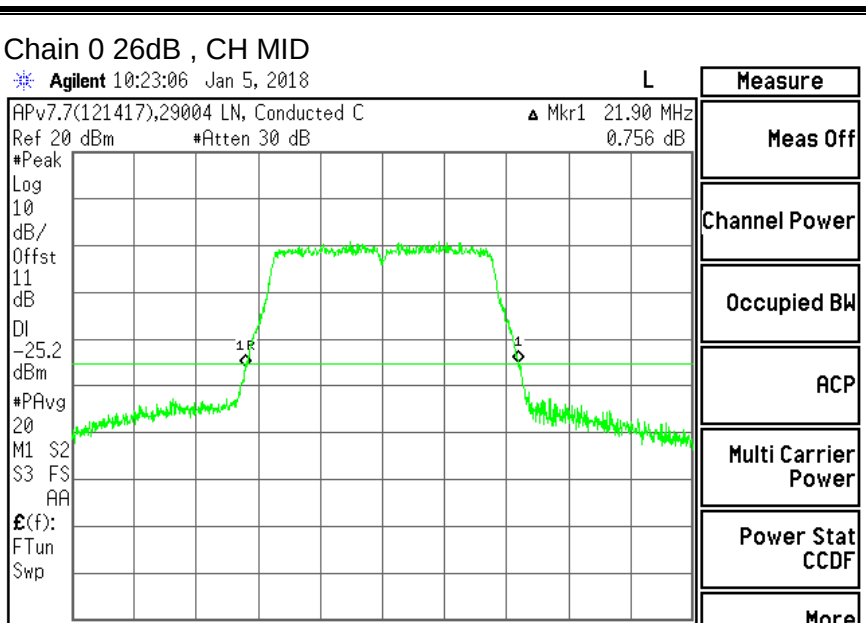
Chain 0 26dB , CH LOW



Chain 0 26dB , CH MID



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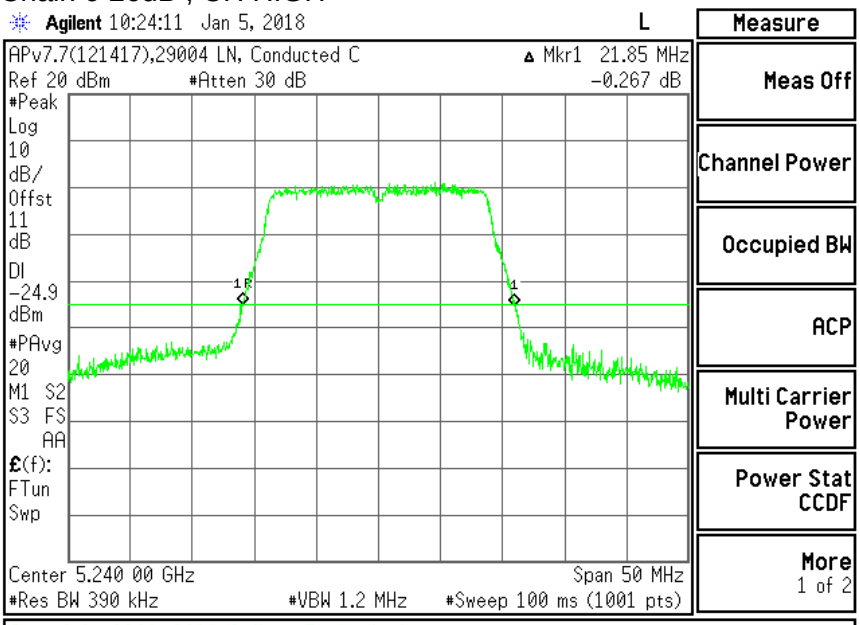
Chain 0 26dB , CH HIGH



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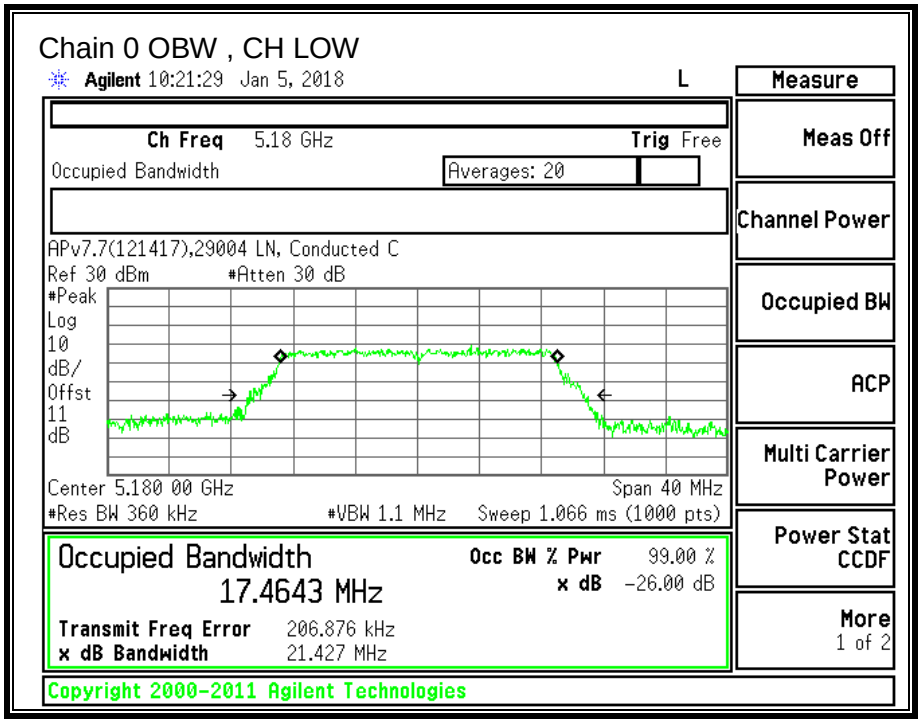
8.3.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	99% (MHz)
Low	5180	17.4643
Mid	5200	17.6360
High	5240	17.9626



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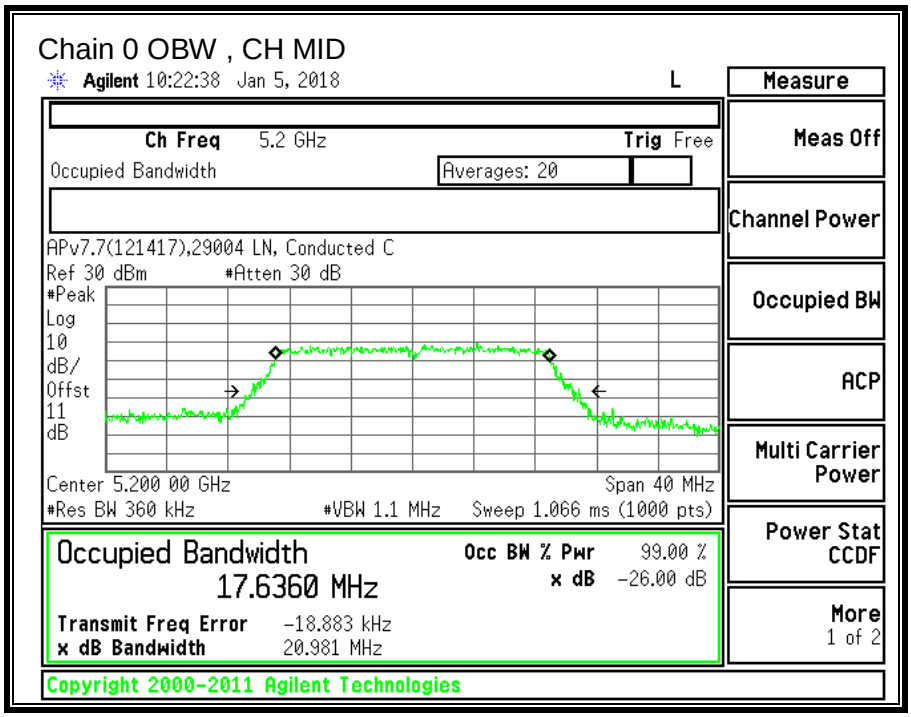

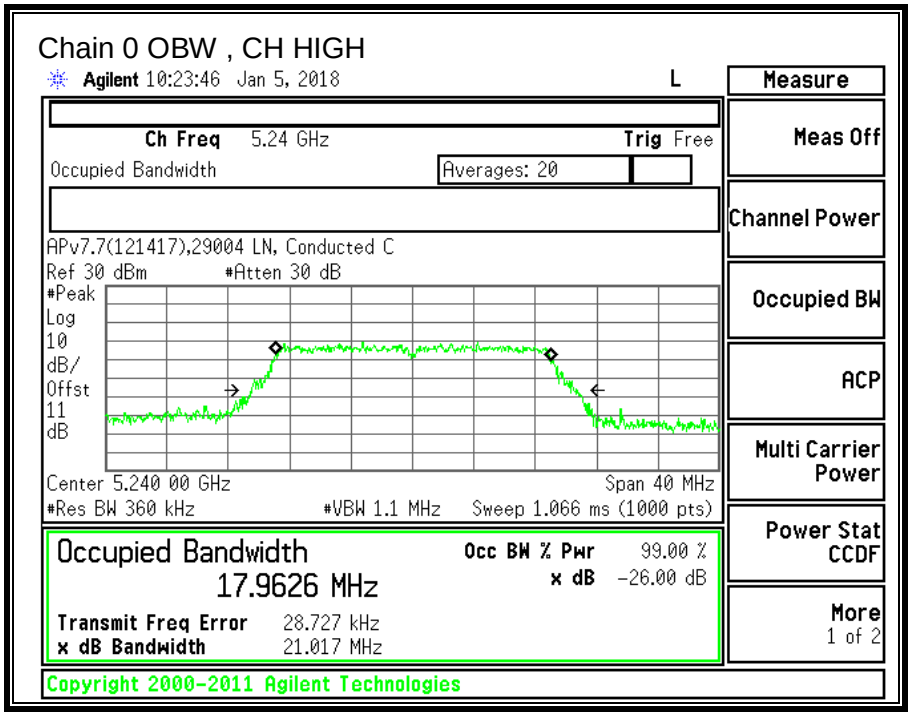

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8.3.3. OUTPUT POWER

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. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. 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 operations.

(iv) For 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.

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ISED RSS 247 Issue 2, Clause 6.2.1.1

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less stringent. Devices shall implement transmitter power control (TPC) in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

For other devices, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

DIRECTIONAL ANTENNA GAIN

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

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RESULTS (FCC)

Antenna Gain and Limits

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Power Limit (dBm)
Low	5180	2.00	24.00
Mid	5200	2.00	24.00
High	5240	2.00	24.00

Duty Cycle CF (dB)	1.00	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	9.05	10.05	24.00	-13.95
Mid	5200	9.12	10.12	24.00	-13.88
High	5240	9.08	10.08	24.00	-13.92

Test Information

Tester: LN 39004
Date: 01/10/18

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RESULTS (ISED)

Antenna Gain and Limits

Channel	Frequency (MHz)	Directional Ant Gain (dBi)	Occupied 99% BW (MHz)	EIRP Limit (dBm)
Low	5180	2.00	17.46	22.42
Mid	5200	2.00	17.64	22.46
High	5240	2.00	17.96	22.54

Duty Cycle CF (dB)	1.00	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Cond Power (dBm)	Total Corr'd EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
Low	5180	9.05	12.05	22.42	-10.37
Mid	5200	9.12	12.12	22.46	-10.34
High	5240	9.08	12.08	22.54	-10.46

Test Information

Tester: LN 39004
Date: 01/10/18

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8.4. 802.11n HT40 MODE IN THE 5.2 GHz BAND

8.4.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5190	40.40
High	5230	40.60

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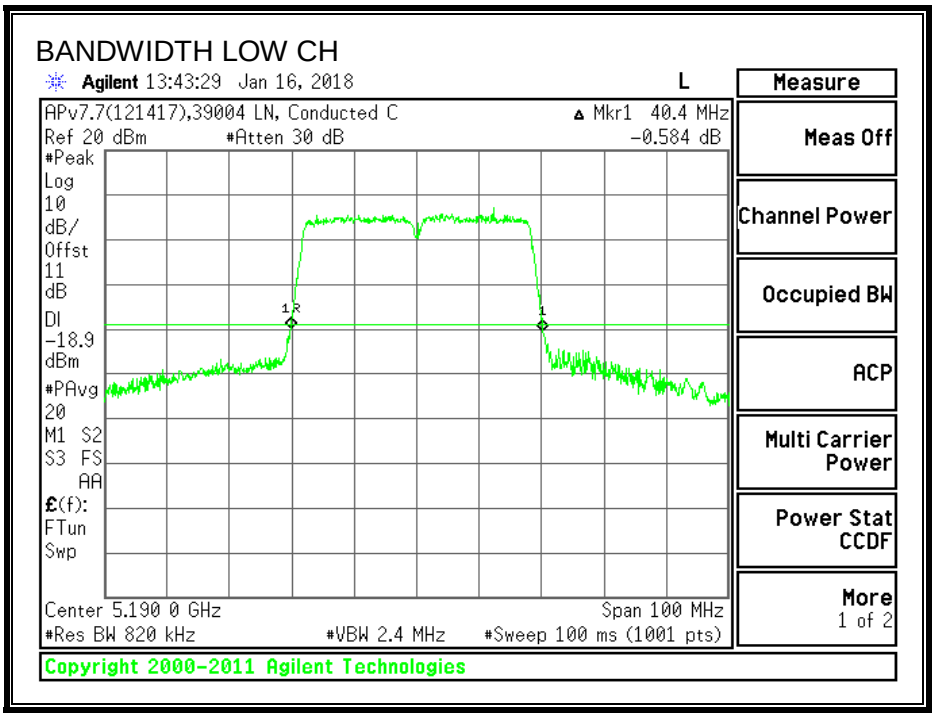
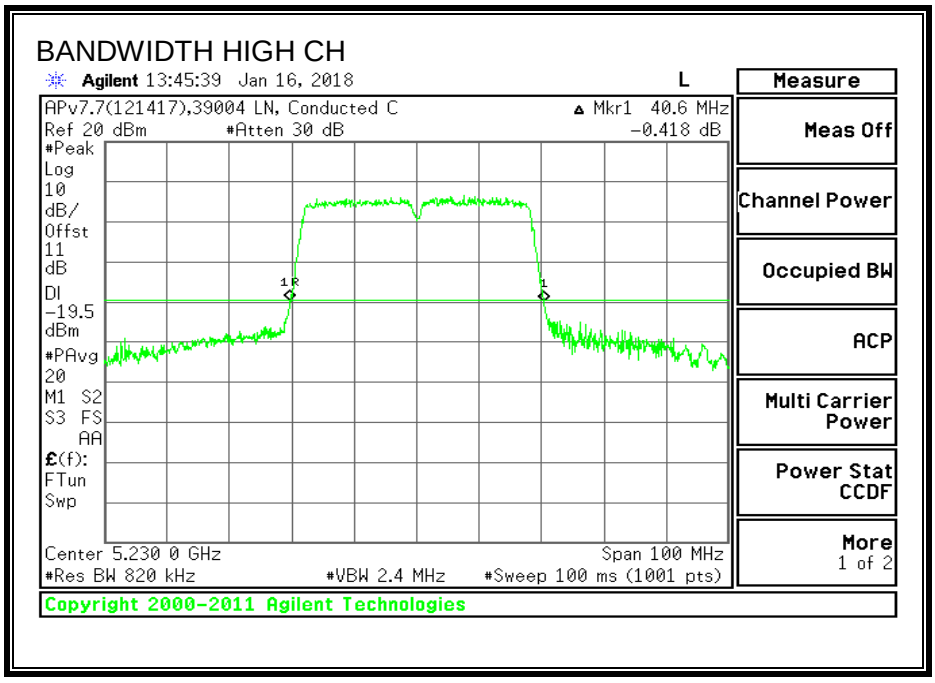
26 dB BANDWIDTH





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8.4.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5190	34.8461
High	5230	35.7947

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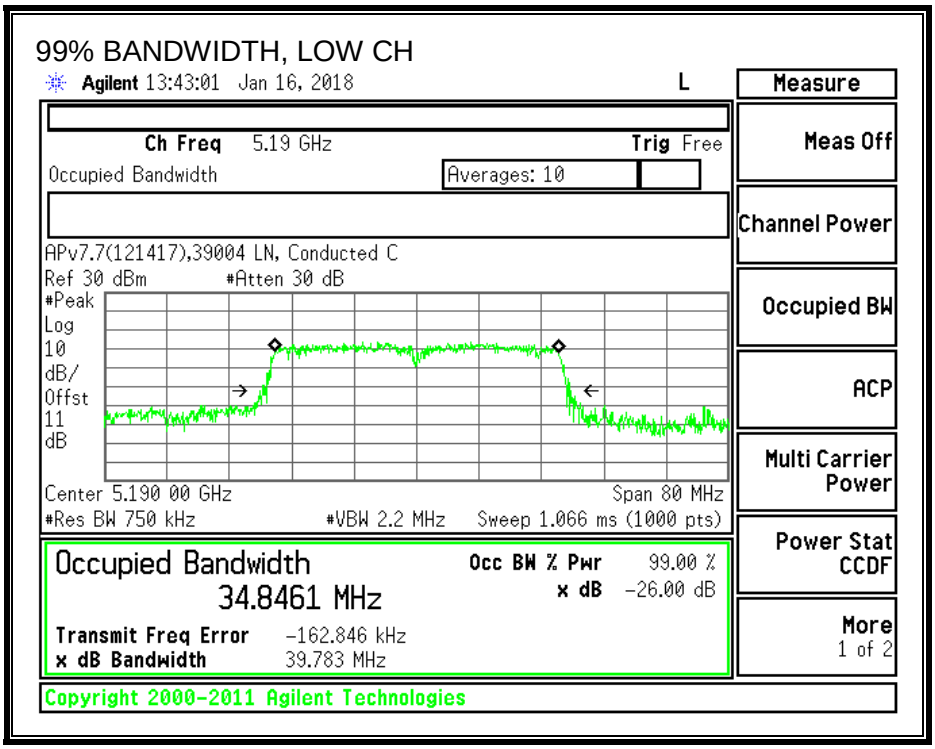
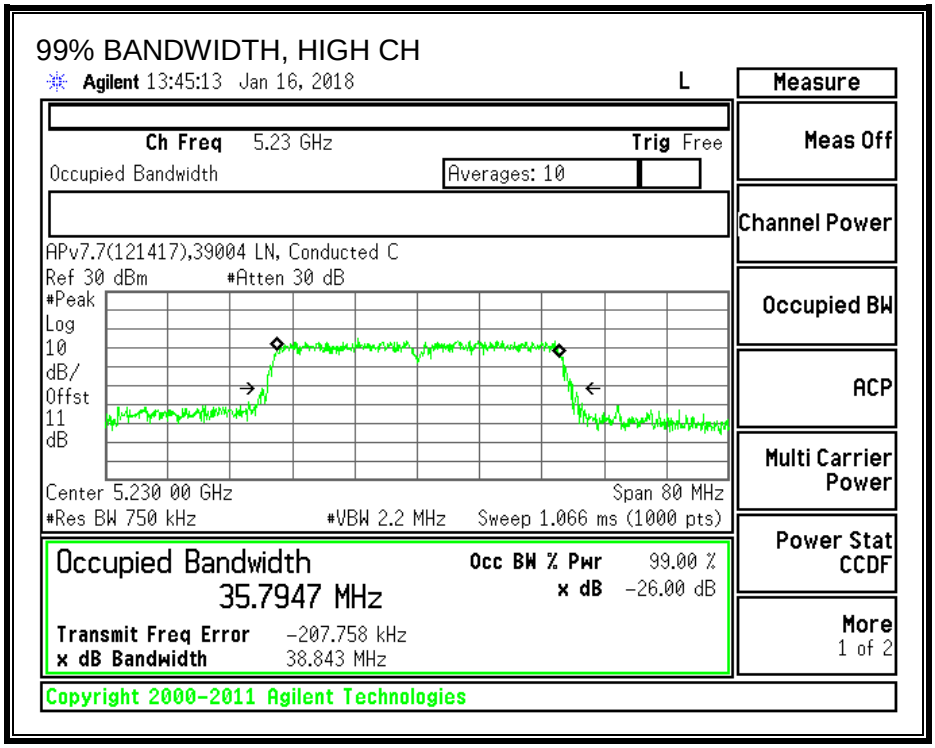
99% BANDWIDTH





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8.4.3. OUTPUT POWER

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 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.

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ISED RSS 247 Issue 2, Clause 6.2.1.1

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less stringent. Devices shall implement transmitter power control (TPC) in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

For other devices, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

DIRECTIONAL ANTENNA GAIN

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

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RESULTS (FCC)

Antenna Gain and Limits

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Power Limit (dBm)
Low	5190	2.00	24.00
High	5230	2.00	24.00

Duty Cycle CF (dB)	3.08	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5190	7.12	10.20	24.00	-13.80
High	5230	7.05	10.13	24.00	-13.87

TEST INFORMATION

Date: 1/16/2018
Tester: 39004

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RESULTS (ISED)

Antenna Gain and Limits

Channel	Frequency (MHz)	Directional Ant Gain (dBi)	Occupied 99% BW (MHz)	EIRP Limit (dBm)
Low	5190	2.00	34.85	23.00
High	5230	2.00	35.79	23.00

Duty Cycle CF (dB)	3.08	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Cond Power (dBm)	Total Corr'd EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
Low	5190	7.12	12.20	23.00	-10.80
High	5230	7.05	12.13	23.00	-10.87

TEST INFORMATION

Date: 1/16/2018
Tester: 39004

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8.5. 802.11a MODE IN THE 5.3 GHz BAND

8.5.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5260	21.50
Mid	5300	21.50
High	5320	21.45

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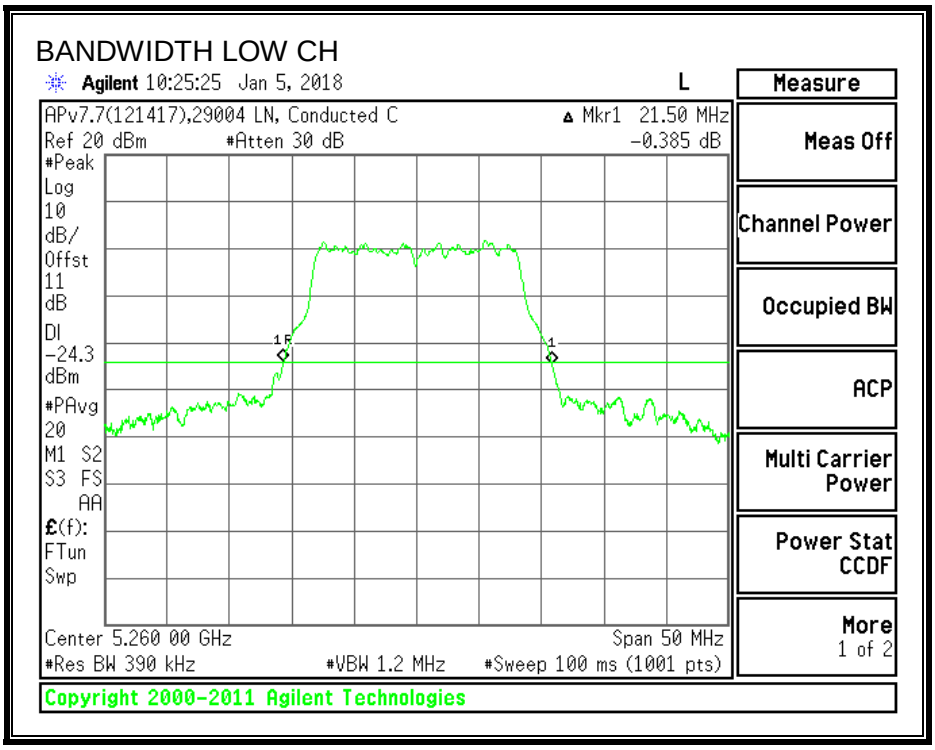
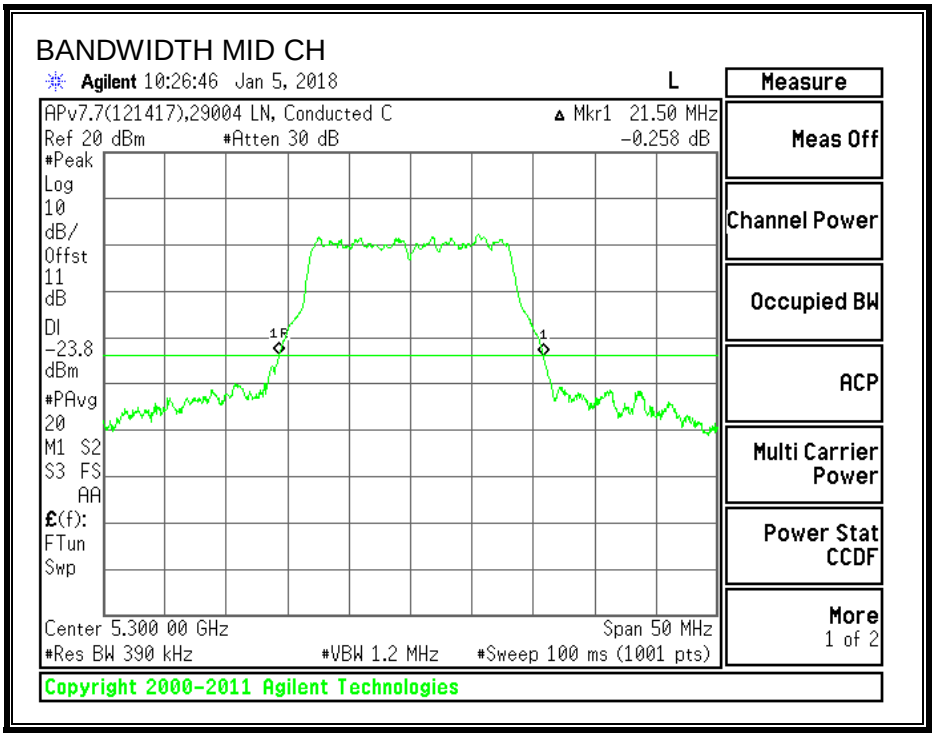
26 dB BANDWIDTH





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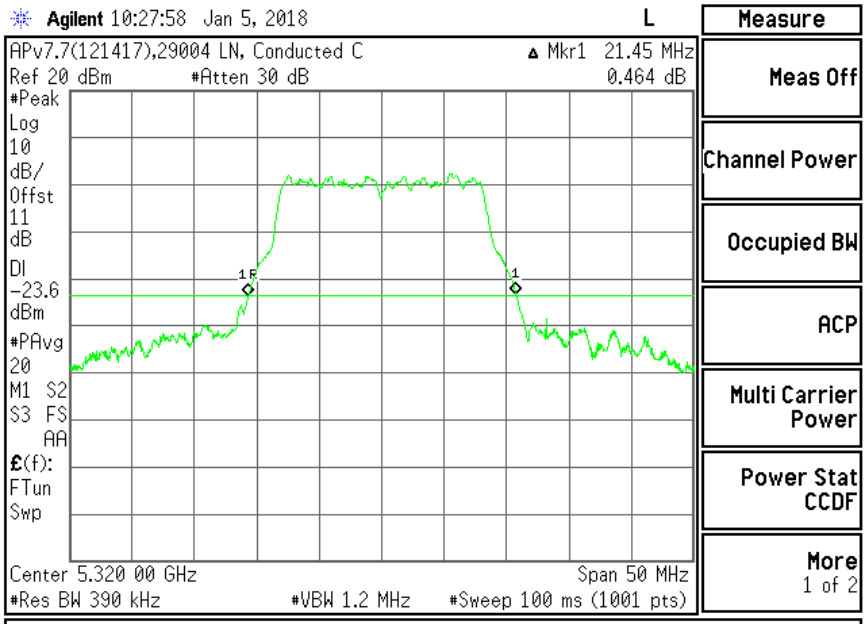
BANDWIDTH HIGH CH



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8.5.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5260	16.6389
Mid	5300	16.6329
High	5320	16.4269

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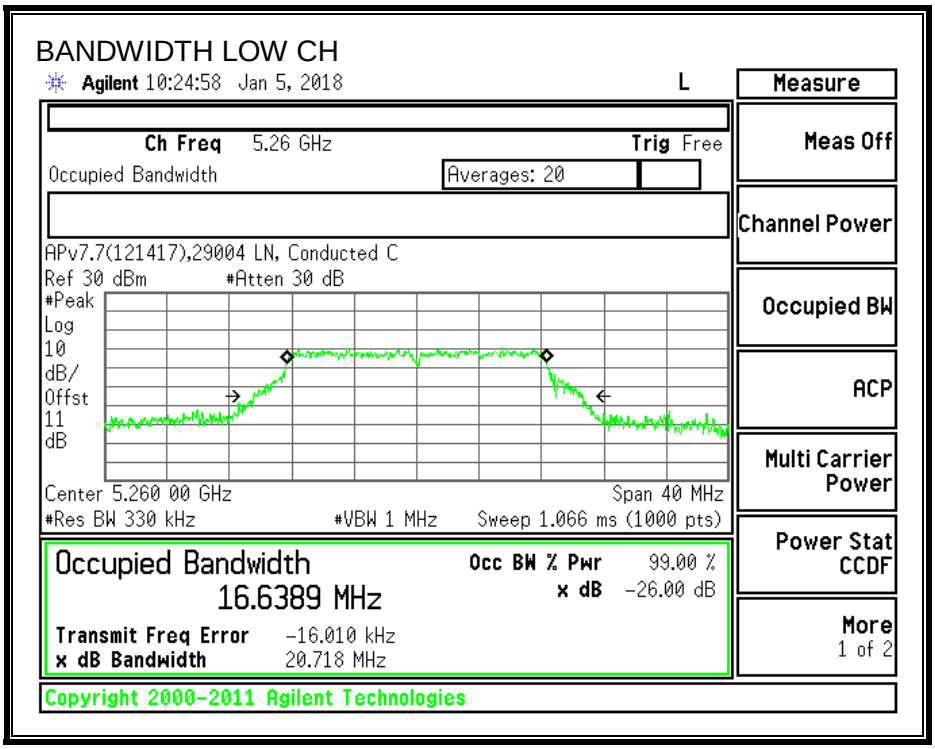
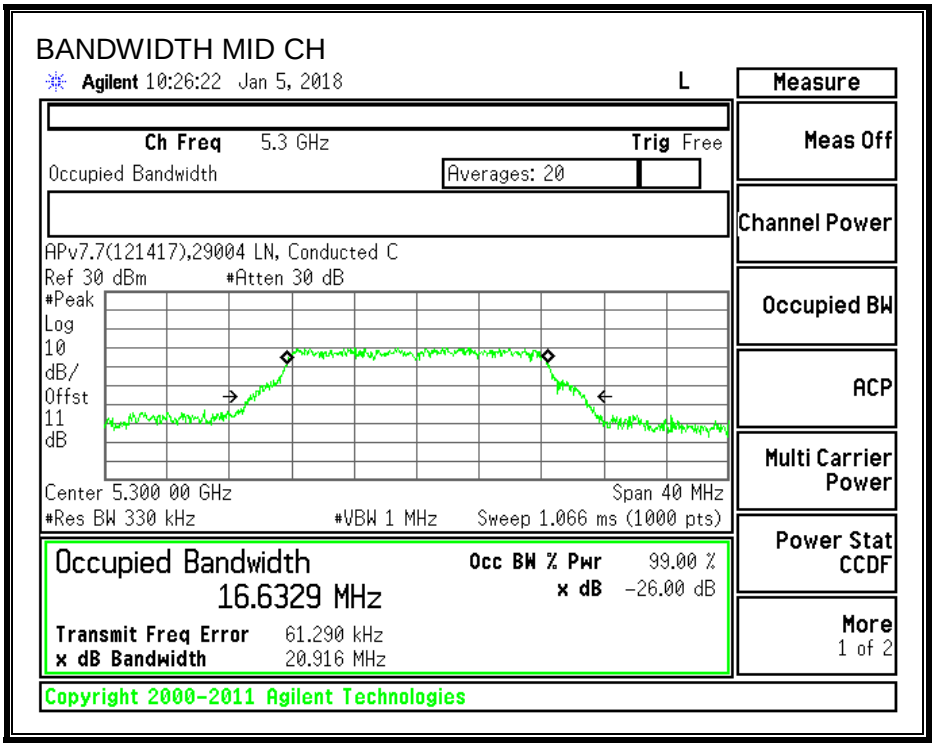
99% BANDWIDTH





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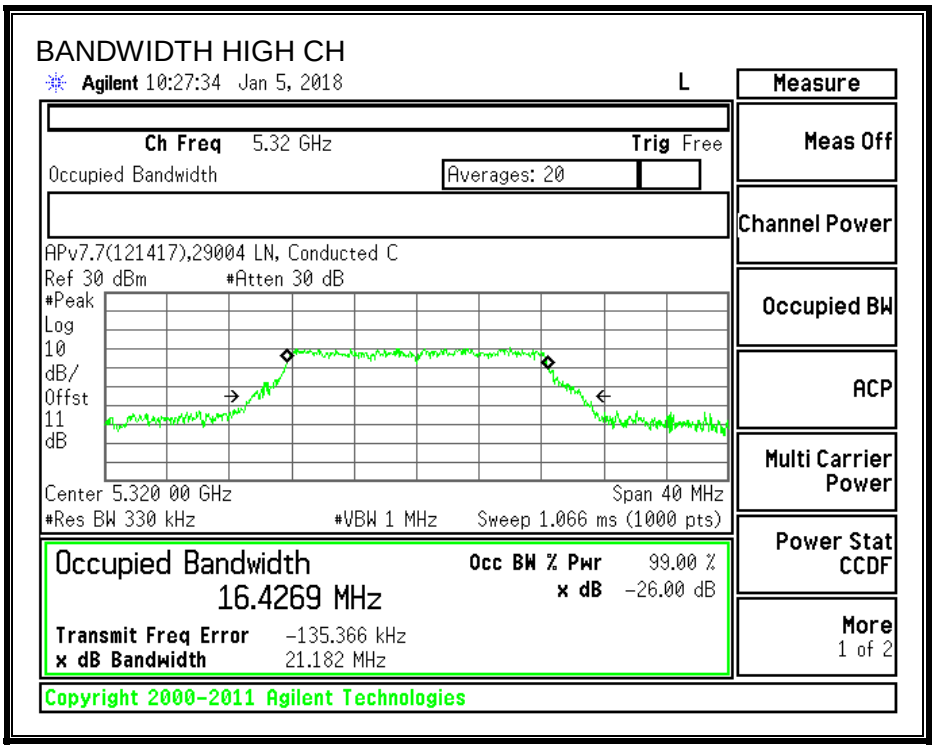

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8.5.3. OUTPUT POWER

LIMITS

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.

ISED RSS-247 Issue 2 Section 6.2.2.1

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less. Devices shall implement TPC in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

Devices, other than devices installed in vehicles, shall comply with the following:

a) The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band;

b) The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

DIRECTIONAL ANTENNA GAIN

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

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RESULTS (FCC)

Bandwidth, Antenna Gain and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Power Limit (dBm)
Low	5260	21.50	2.00	24.00
Mid	5300	21.50	2.00	24.00
High	5320	21.45	2.00	24.00

Duty Cycle CF (dB)	0.94	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5260	10.32	11.26	24.00	-12.74
Mid	5300	10.45	11.39	24.00	-12.61
High	5320	10.62	11.56	24.00	-12.44

TEST INFORMATION

Date: 1/5/2018
Tester: 39004

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RESULTS (ISED_CONDUCTED POWER)

Bandwidth and Limits

Channel	Frequency (MHz)	Min 99% BW (MHz)	Power Limit (dBm)
Low	5260	16.64	23.21
Mid	5300	16.63	23.21
High	5320	16.43	23.16

Duty Cycle CF (dB)	0.94	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
Low	5260	10.32	11.26	23.21	-11.95
Mid	5300	10.45	11.39	23.21	-11.82
High	5320	10.62	11.56	23.16	-11.60

TEST INFORMATION

Date: 1/5/2018
Tester: 39004

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RESULTS (ISED_EIRP)

Bandwidth, Antenna Gain and Limits

Channel	Frequency (MHz)	Min 99% BW (MHz)	Directional Ant Gain (dBi)	EIRP Limit (dBm)
Low	5260	16.64	2.00	29.21
Mid	5300	16.63	2.00	29.21
High	5320	16.43	2.00	29.16

Duty Cycle CF (dB)	0.94	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
Low	5260	10.32	13.26	29.21	-15.95
Mid	5300	10.45	13.39	29.21	-15.82
High	5320	10.62	13.56	29.16	-15.60

TEST INFORMATION

Date: 1/5/2018
Tester: 39004

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8.6. 802.11n HT20 MODE IN THE 5.3 GHz BAND

8.6.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5260	21.85
Mid	5300	21.75
High	5320	21.90

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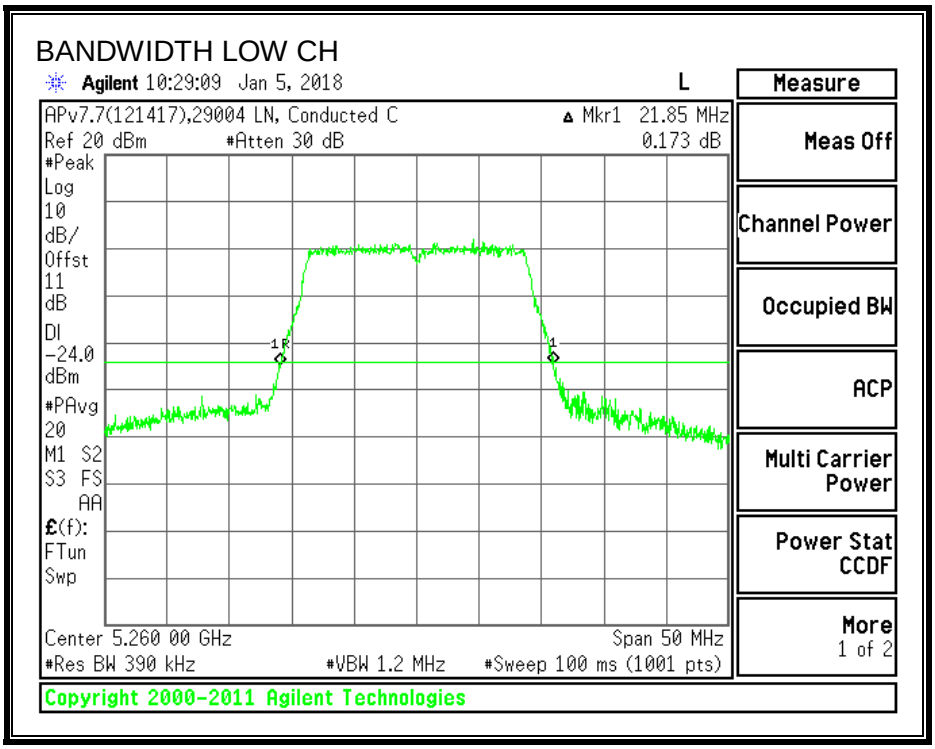
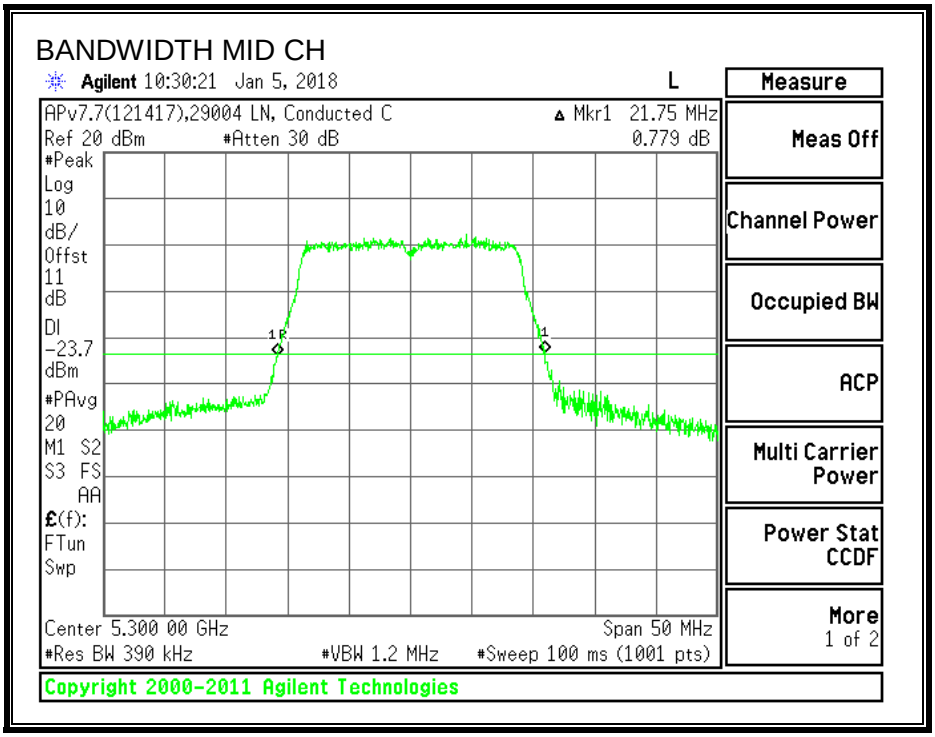
26 dB BANDWIDTH





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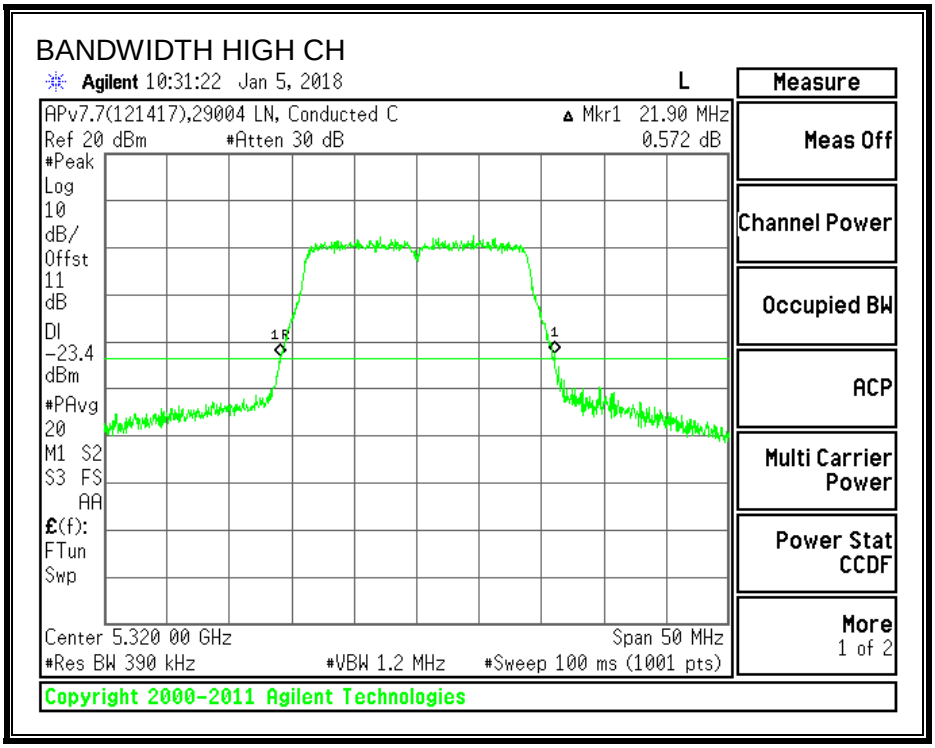

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8.6.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5260	17.6812
Mid	5300	17.8692
High	5320	17.3479

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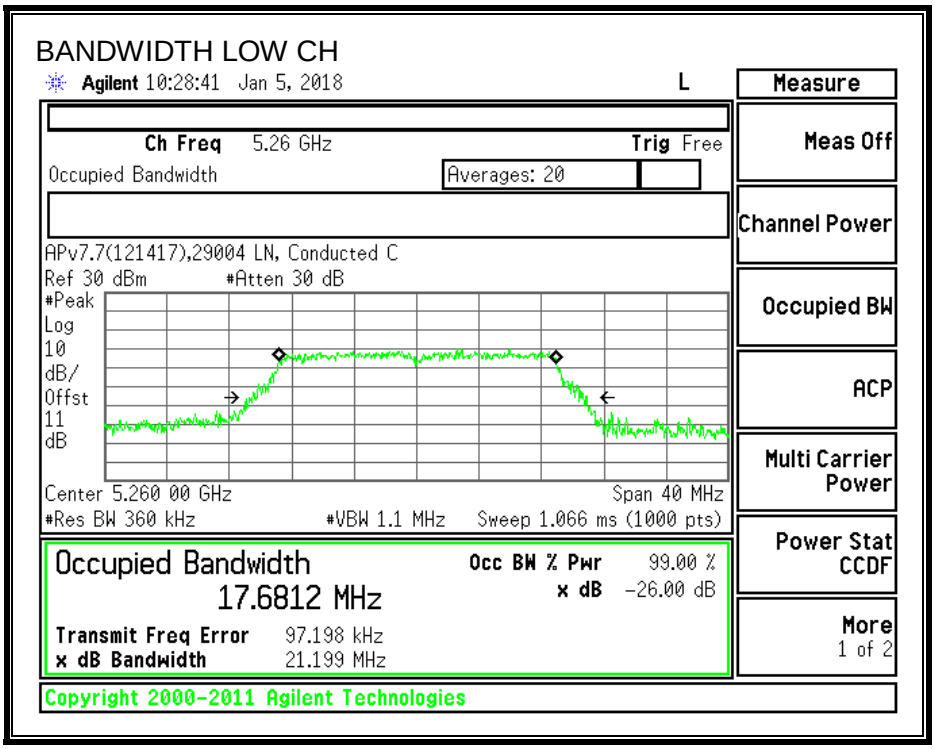
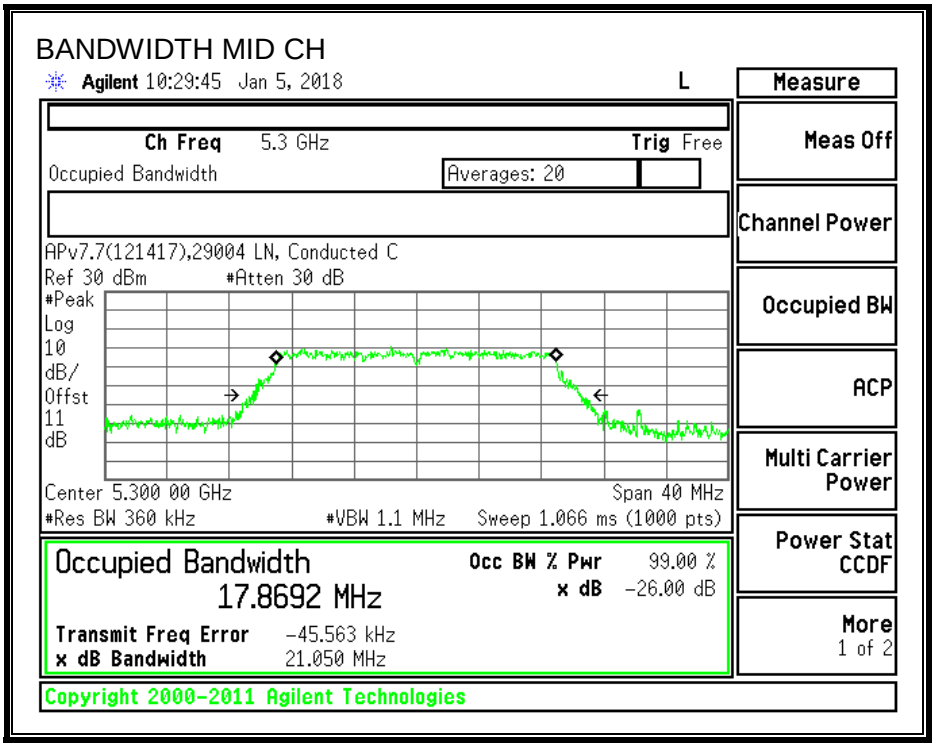
99% BANDWIDTH





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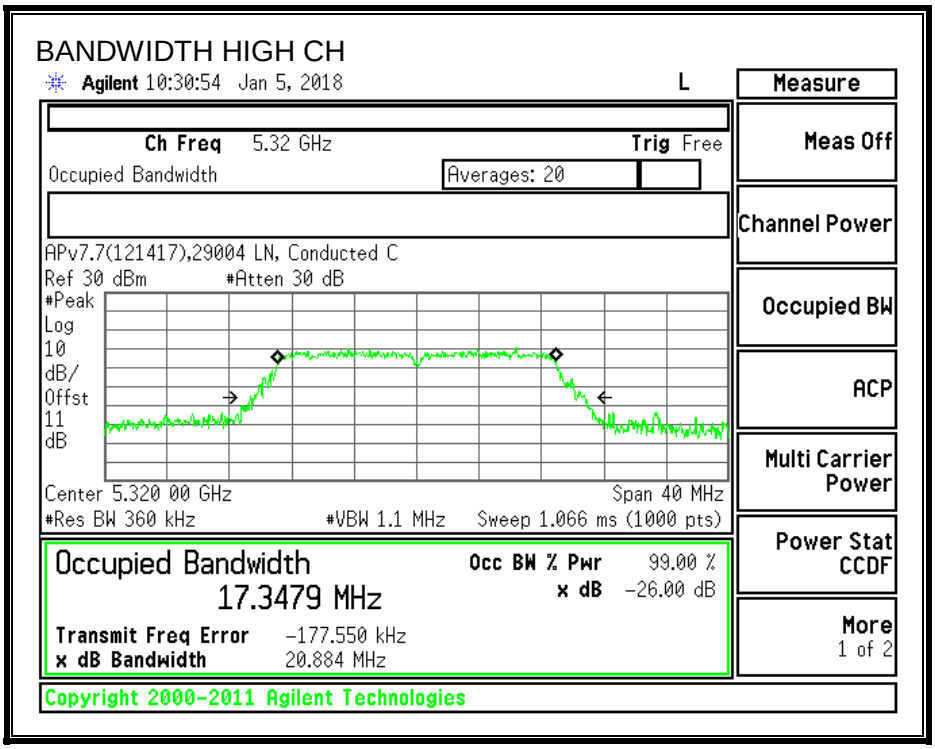

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8.6.3. OUTPUT POWER

LIMITS

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.

ISED RSS-247 Issue 2 Section 6.2.2.1

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less. Devices shall implement TPC in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

Devices, other than devices installed in vehicles, shall comply with the following:

a) The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band;

b) The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

DIRECTIONAL ANTENNA GAIN

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

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RESULTS (FCC)

Bandwidth, Antenna Gain and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Power Limit (dBm)
Low	5260	21.85	2.00	24.00
Mid	5300	21.75	2.00	24.00
High	5320	21.90	2.00	24.00

Duty Cycle CF (dB)	1.00	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5260	10.41	11.41	24.00	-12.59
Mid	5300	10.57	11.57	24.00	-12.43
High	5320	10.59	11.59	24.00	-12.41

Test Information

Tester: LN 39004
Date: 01/10/18

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701J
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
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RESULTS (ISED_CONDUCTED POWER)

Bandwidth and Limits

Channel	Frequency (MHz)	Min 99% BW (MHz)	Power Limit (dBm)
Low	5260	17.68	23.48
Mid	5300	17.87	23.52
High	5320	17.35	23.39

Duty Cycle CF (dB)	1.00	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5260	10.41	11.41	23.48	-12.07
Mid	5300	10.57	11.57	23.52	-11.95
High	5320	10.59	11.59	23.39	-11.80

Test Information

Tester: LN 39004
Date: 01/10/18

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701J
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
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RESULTS (ISED_EIRP)

Bandwidth, Antenna Gain and Limits

Channel	Frequency (MHz)	Min 99% BW (MHz)	Directional Ant Gain (dBi)	EIRP Limit (dBm)
Low	5260	17.6812	2.00	29.48
Mid	5300	17.8692	2.00	29.52
High	5320	17.3479	2.00	29.39

Duty Cycle CF (dB)	1.00	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
Low	5260	10.41	13.41	29.48	-16.07
Mid	5300	10.57	13.57	29.52	-15.95
High	5320	10.59	13.59	29.39	-15.80

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8.7. 802.11n HT40 MODE IN THE 5.3 GHz BAND

8.7.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5270	40.30
High	5310	40.50

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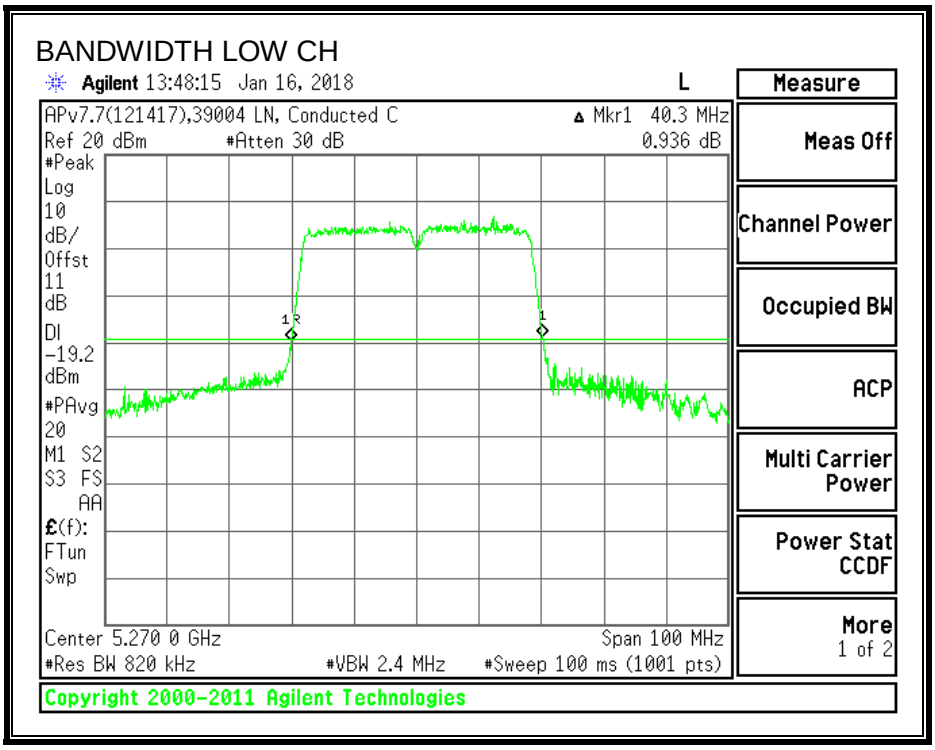
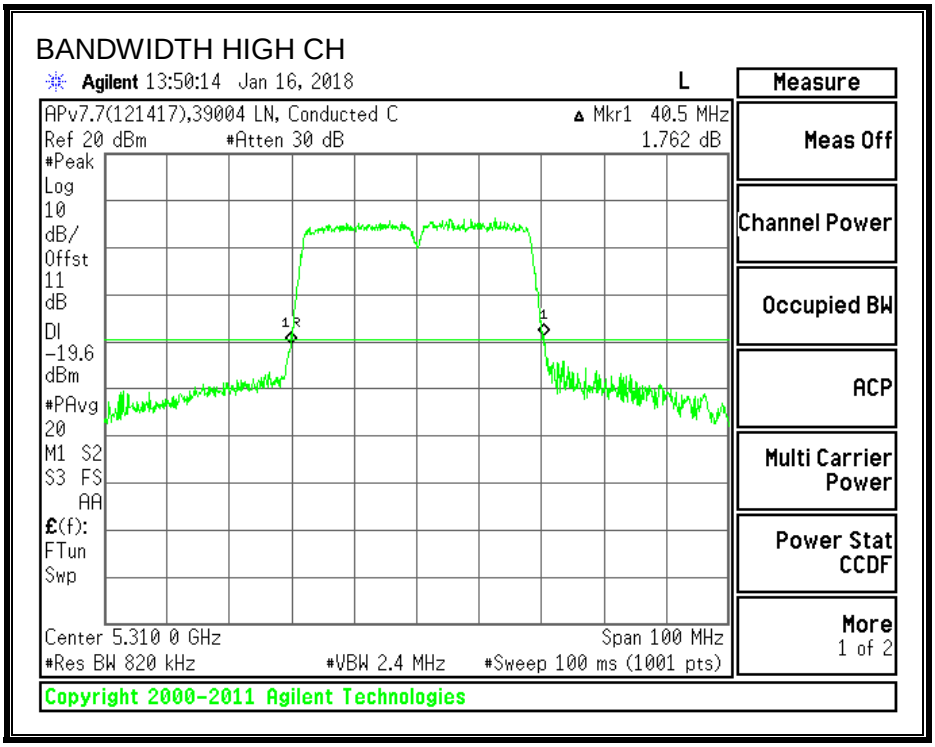
26 dB BANDWIDTH





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8.7.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5270	36.2724
High	5310	35.7989

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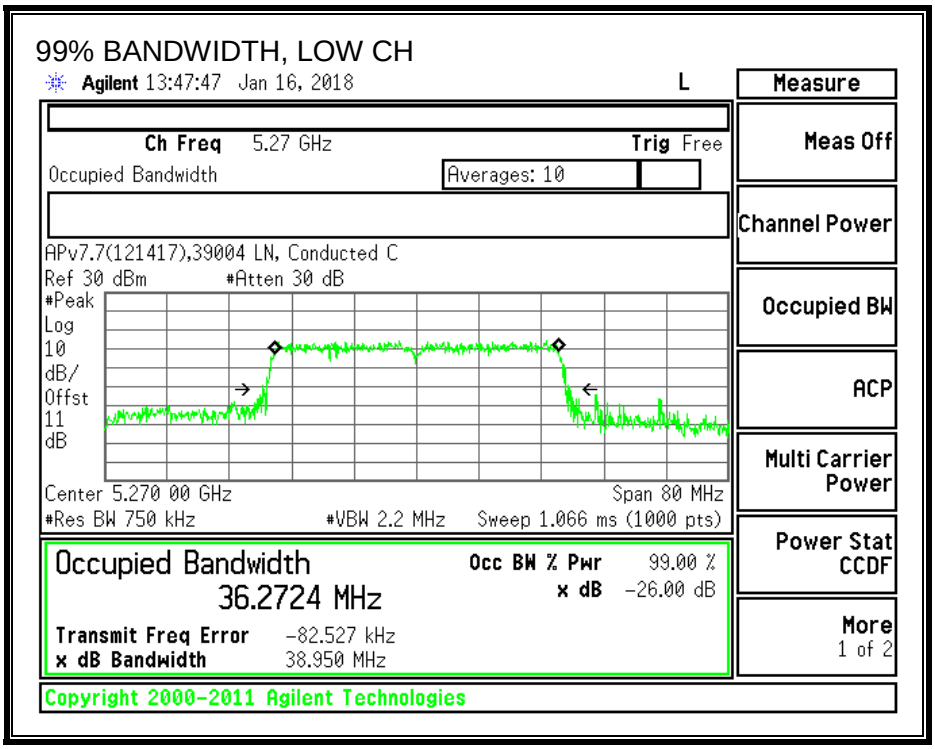
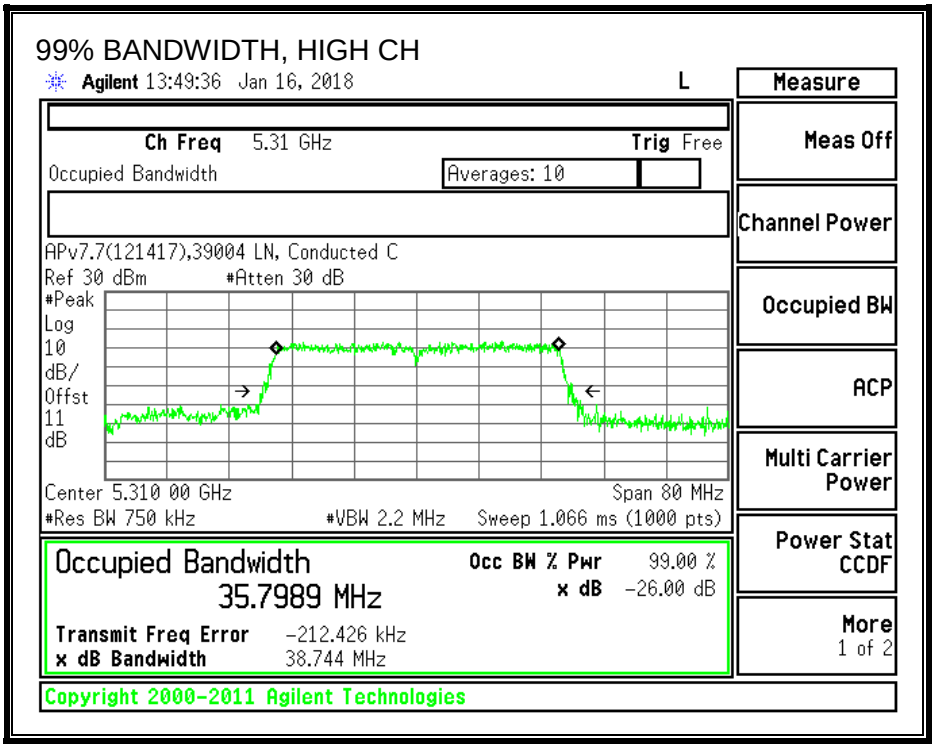
99% BANDWIDTH





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8.7.3. OUTPUT POWER

LIMITS

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.

ISED RSS-247 Issue 2 Section 6.2.2.1

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less. Devices shall implement TPC in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

Devices, other than devices installed in vehicles, shall comply with the following:

a) The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band;

b) The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W

DIRECTIONAL ANTENNA GAIN

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

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RESULTS (FCC)

Bandwidth, Antenna Gain, and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain (dBi)	Power Limit (dBm)
Low	5270	40.30	2.00	24.00
High	5310	40.50	2.00	24.00

Duty Cycle CF (dB)	3.08	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5270	8.53	11.61	24.00	-12.39
High	5310	8.42	11.50	24.00	-12.50

TEST INFORMATION

Date: 1/16/2018
Tester: 39004

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RESULTS (ISED_CONDUCTED POWER

Bandwidth and Limits

Channel	Frequency (MHz)	Min 99% BW (MHz)	Power Limit (dBm)
Low	5270	36.27	24.00
High	5310	35.80	24.00

Duty Cycle CF (dB)	3.08	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5270	8.53	11.61	24.00	-12.39
High	5310	8.42	11.50	24.00	-12.50

TEST INFORMATION

Date: 1/16/2018
Tester: 39004

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RESULTS (ISED_EIRP)

Bandwidth, Antenna Gain and Limits

Channel	Frequency (MHz)	Min 99% BW (MHz)	Directional Ant Gain (dBi)	EIRP Limit (dBm)
Low	5270	36.27	2.00	30.00
High	5310	35.80	2.00	30.00

Duty Cycle CF (dB)	3.08	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
Low	5270	8.53	13.61	30.00	-16.39
High	5310	8.42	13.50	30.00	-16.50

TEST INFORMATION

Date: 1/16/2018
Tester: 39004

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8.8. 11a MODE IN THE 5.6GHz BAND

8.8.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	26 dB BW (MHz)
Low	5500	21.50
Mid	5580	21.50
High	5700	21.60

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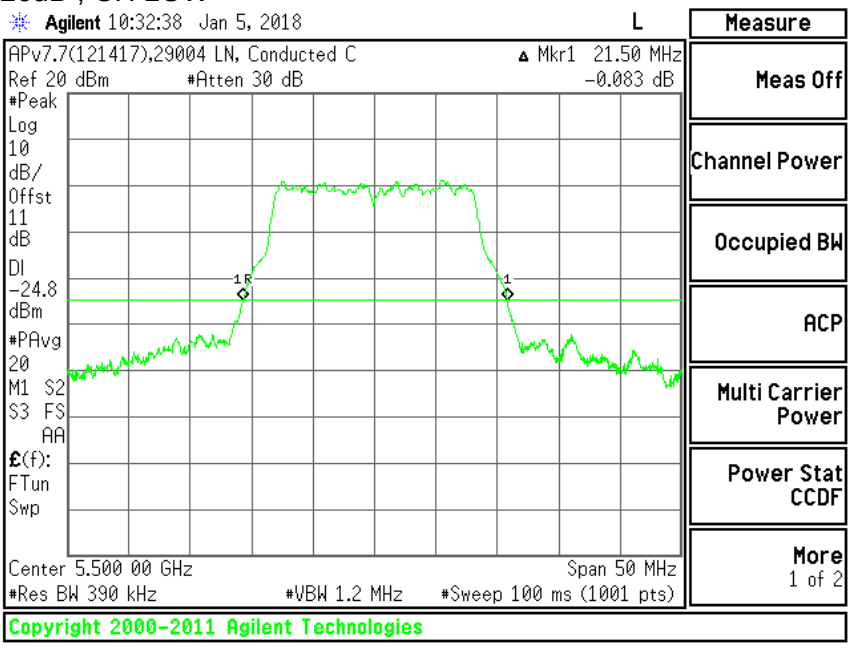
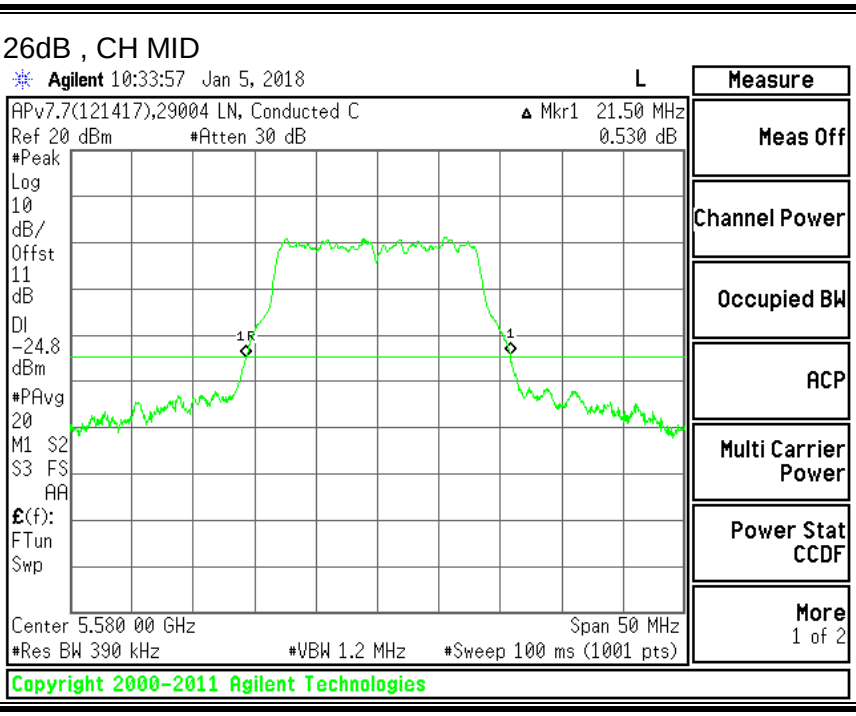
26dB , CH LOW



26dB , CH MID



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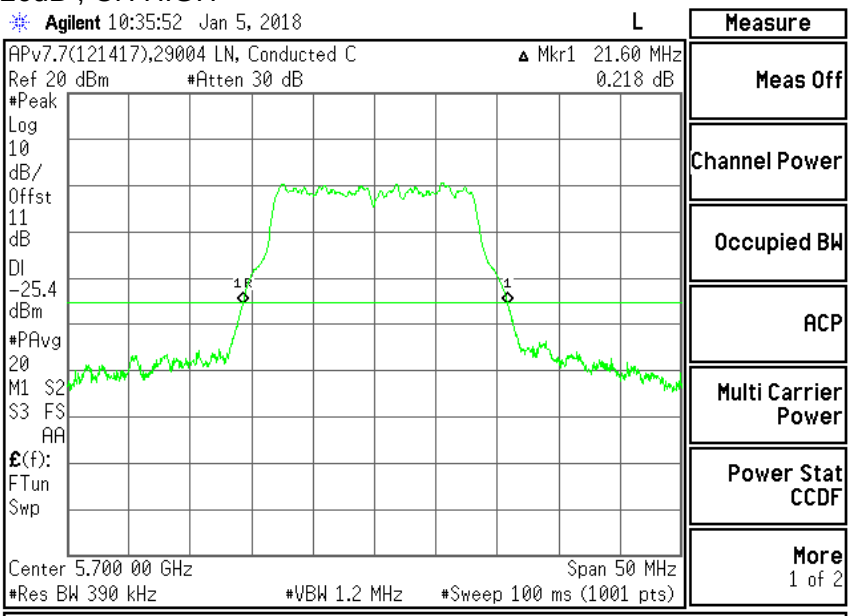
26dB , CH HIGH



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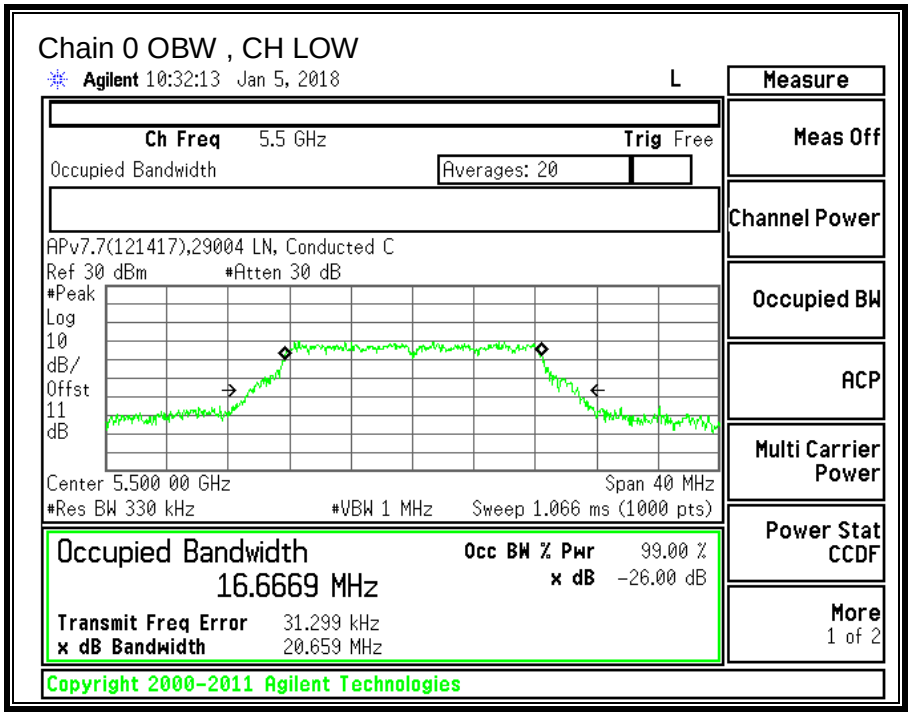
8.8.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	99% (MHz)
Low	5500	16.6669
Mid	5580	16.4869
High	5700	16.6388



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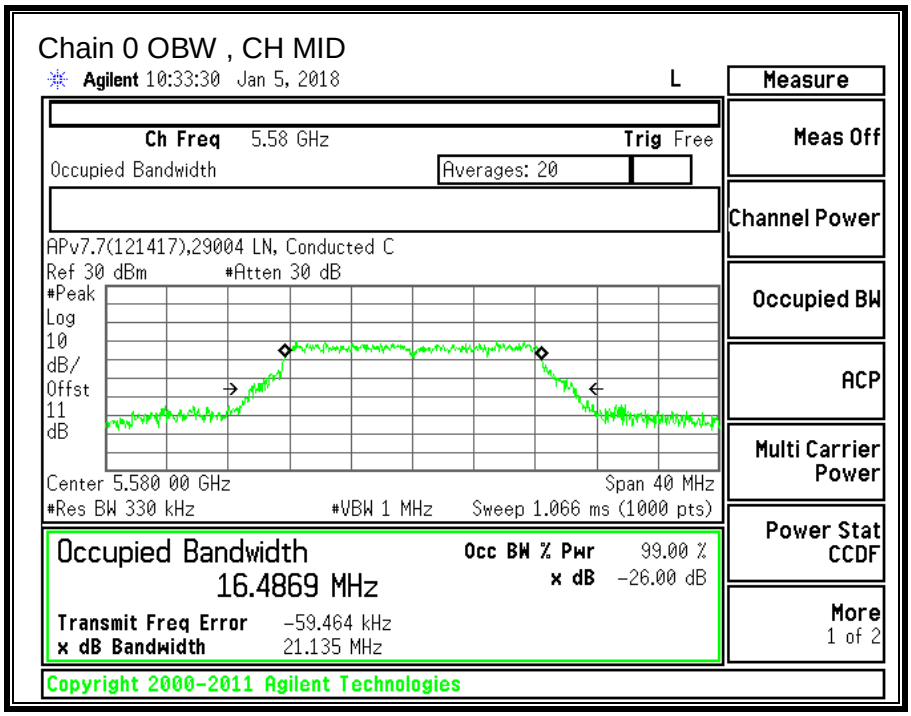

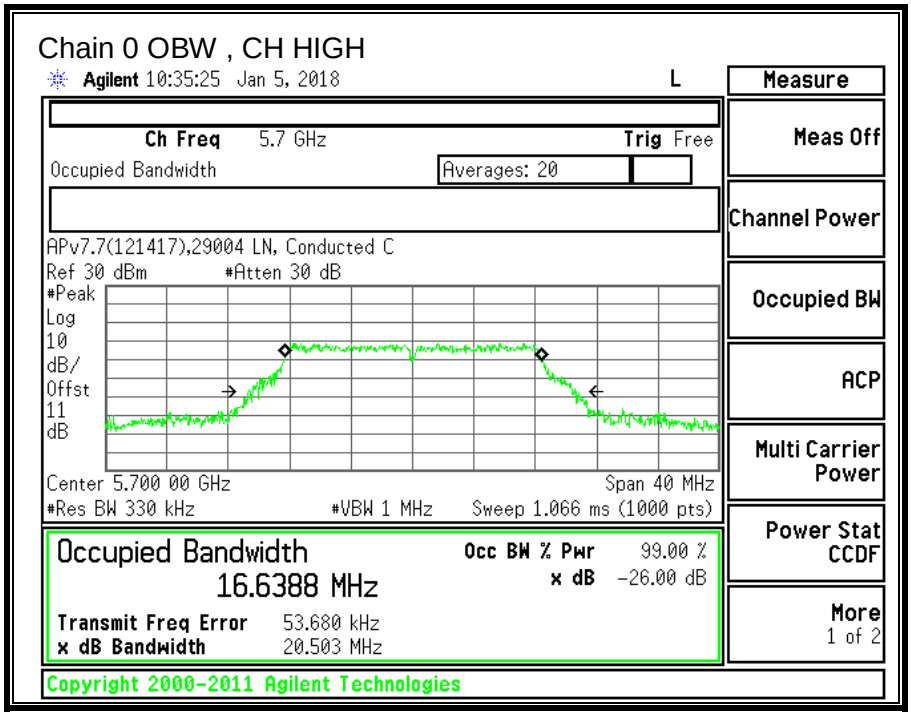

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8.8.3. OUTPUT POWER

LIMITS

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.

RSS-247 ISSUE 2 SECTION 6.2.3.1

The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.
The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz.

DIRECTIONAL ANTENNA GAIN

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

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RESULTS (FCC)

Bandwidth, Antenna Gain, and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain (dBi)	Power Limit (dBm)
Low	5500	21.50	2.00	24.00
Mid	5580	21.50	2.00	24.00
High	5700	21.60	2.00	24.00

Duty Cycle CF (dB)	0.94	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5500	9.22	10.16	24.00	-13.84
Mid	5580	9.31	10.25	24.00	-13.75
High	5700	9.11	10.05	24.00	-13.95

Test Information

Tester: LN 39004
Date: 01/10/18

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701J
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
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RESULTS (ISED_Conducted Power)

Bandwidth and Limits

Channel	Frequency (MHz)	Min 99% BW (MHz)	Power Limit (dBm)
Low	5700	16.67	23.22
Mid	5700	16.49	23.17
High	5700	16.64	23.21

Duty Cycle CF (dB)	0.94	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5500	9.22	10.16	23.22	-13.06
Mid	5580	9.31	10.25	23.17	-12.92
High	5700	9.11	10.05	23.21	-13.16

TEST INFORMATION

Date: 1/16/2018
Tester: 39004

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RESULTS (ISED_EIRP)

Bandwidth, Antenna Gain, and Limits

Channel	Frequency (MHz)	Min 99% BW (MHz)	Directional Ant. Gain (dBi)	EIRP Limit (dBm)
Low	5500	16.67	2.00	29.22
Mid	5580	16.49	2.00	29.17
High	5700	16.64	2.00	29.21

Duty Cycle CF (dB)	0.94	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
Low	5500	9.22	12.16	29.22	-17.06
Mid	5580	9.31	12.25	29.17	-16.92
High	5700	9.11	12.05	29.21	-17.16

TEST INFORMATION

Date: 1/16/2018
Tester: 39004

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8.9. 11n HT20 MODE IN THE 5.6GHz BAND

8.9.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5500	22.05
Mid	5580	21.85
High	5700	21.70
144	5720	21.50

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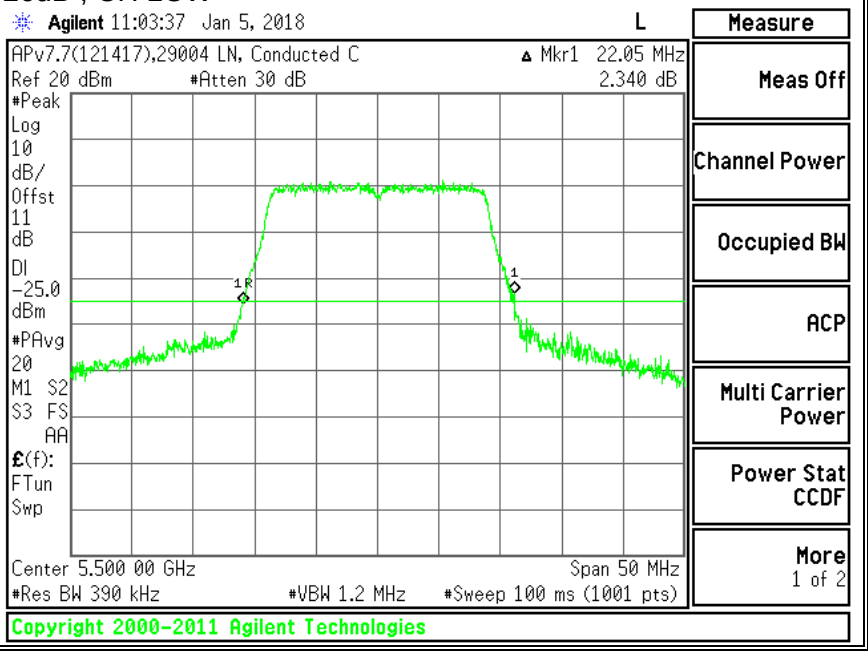
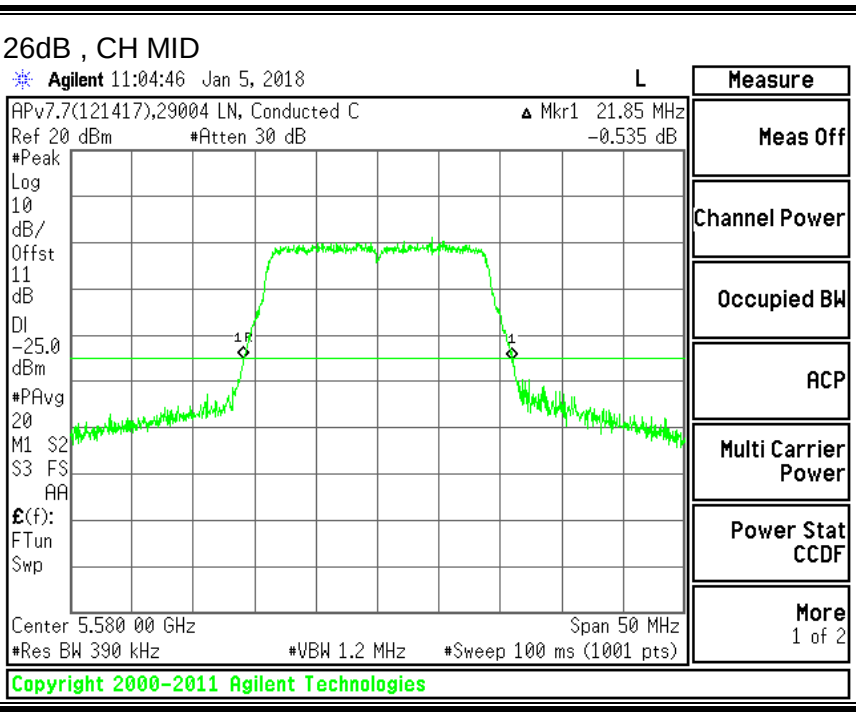
26dB , CH LOW



26dB , CH MID



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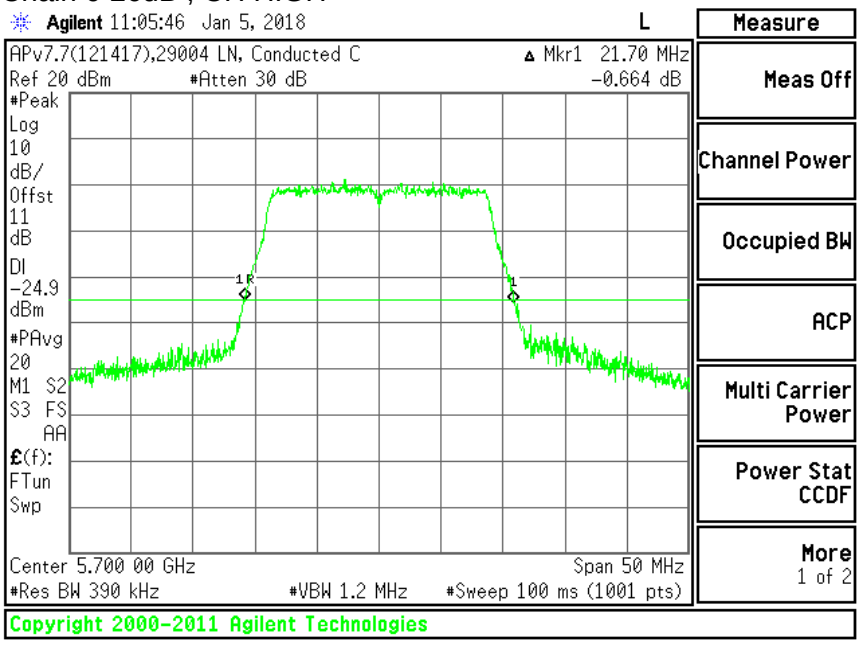
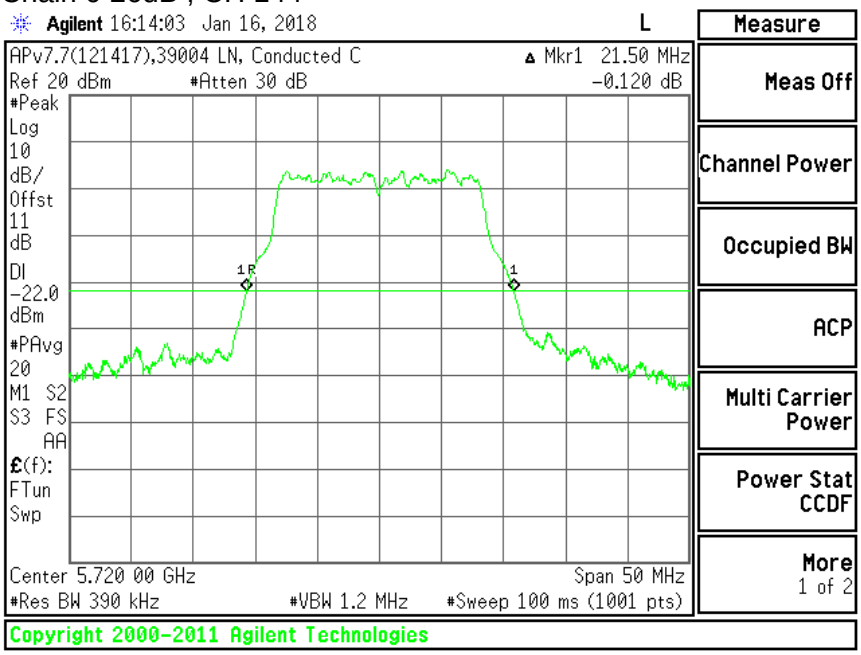
Chain 0 26dB , CH HIGH



Chain 0 26dB , CH 144



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8.9.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5500	17.8267
Mid	5580	17.6325
High	5700	17.7846
144	5720	17.9514

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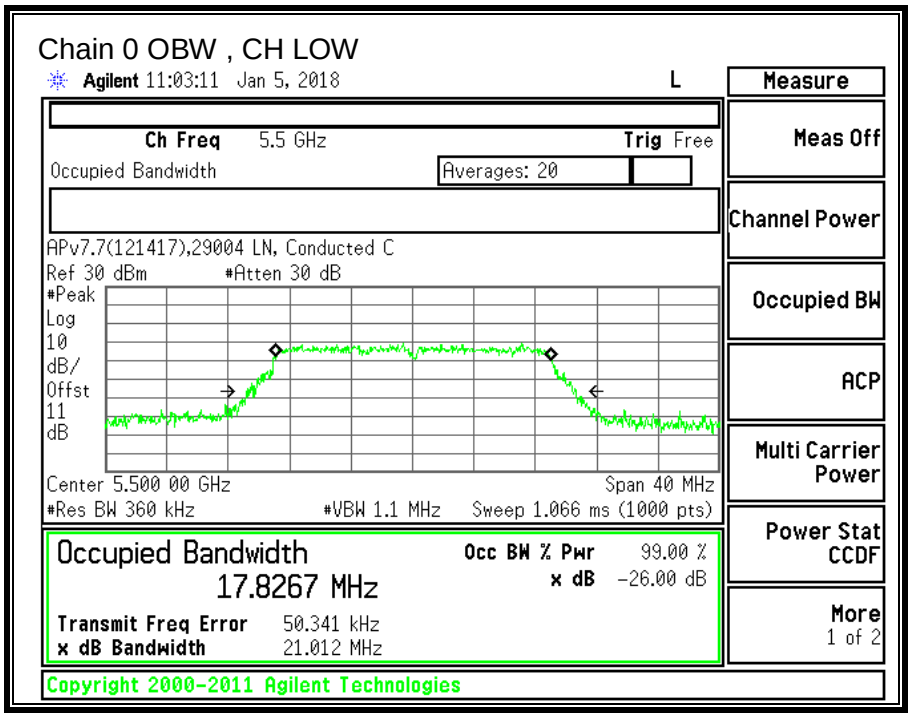

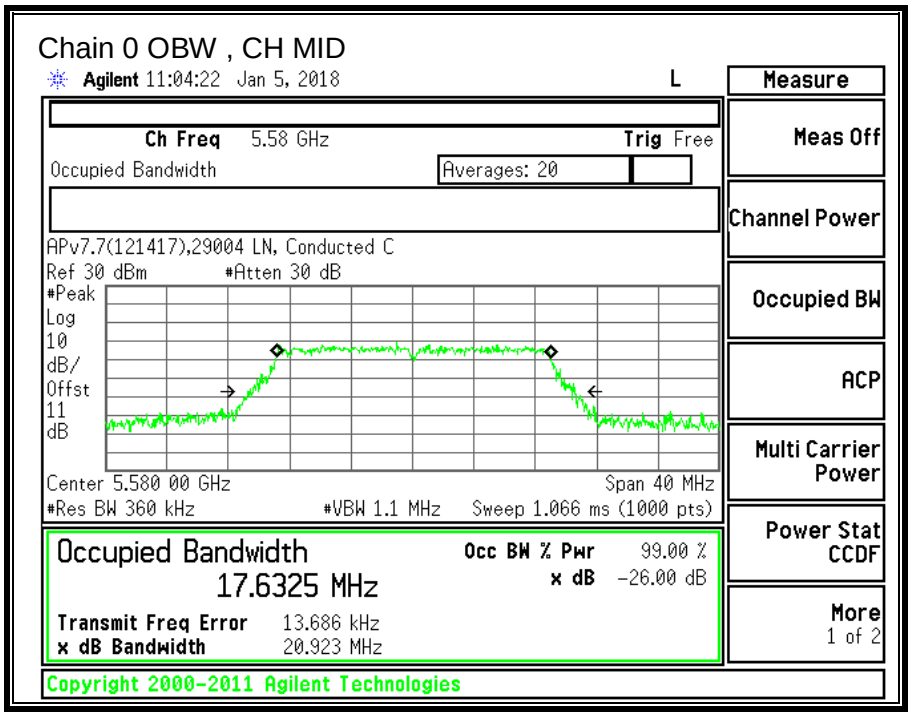

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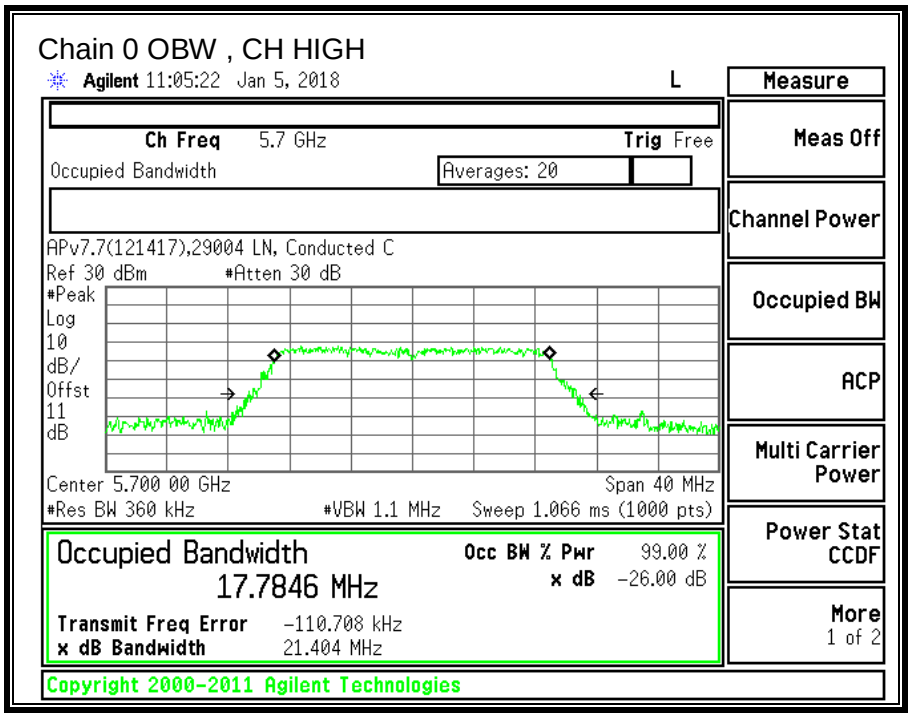

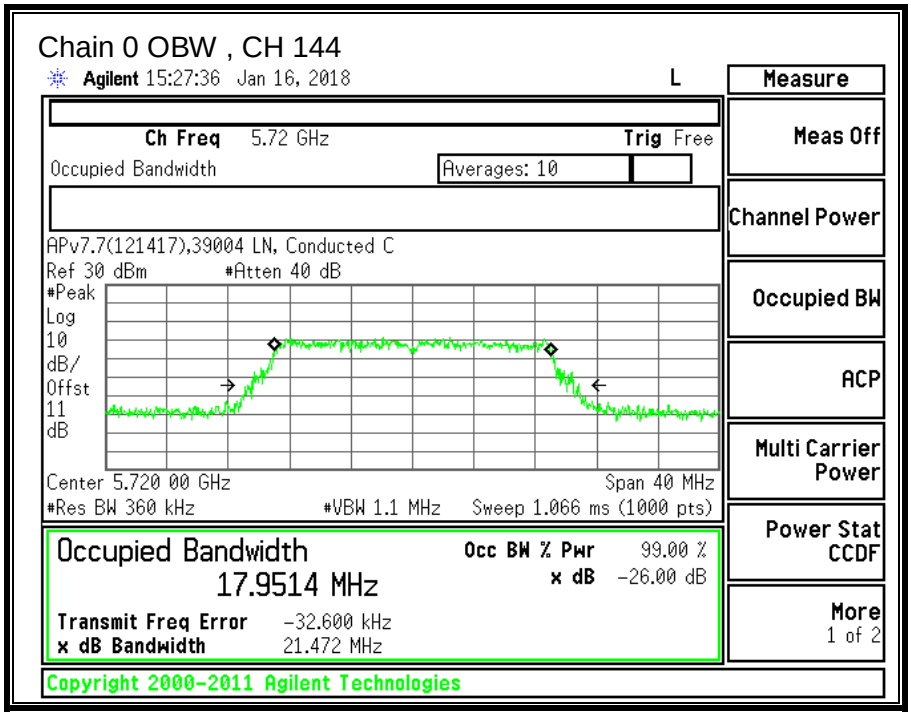

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8.9.3. OUTPUT POWER AND PSD

LIMITS

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.

RSS-247 ISSUE 2 SECTION 6.2.3.1

The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.
The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz.

DIRECTIONAL ANTENNA GAIN

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

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESULTS (FCC)

Bandwidth, Antenna Gain, and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain (dBi)	Power Limit (dBm)
Low	5500	22.05	2.00	24.00
Mid	5580	21.85	2.00	24.00
High	5700	21.70	2.00	24.00

Duty Cycle CF (dB)	1.00	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5500	9.44	10.44	24.00	-13.56
Mid	5580	9.57	10.57	24.00	-13.43
High	5700	9.49	10.49	24.00	-13.51

TEST INFORMATION

Date: 1/16/2018
Tester: 39004

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RESULTS (ISED_Conducted Power)

Bandwidth and Limits

Channel	Frequency (MHz)	Min 99% BW (MHz)	Power Limit (dBm)
Low	5500	17.83	23.51
Mid	5580	17.63	23.46
High	5700	17.78	23.50

Duty Cycle CF (dB)	1.00	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5500	9.44	10.44	23.51	-13.07
Mid	5580	9.57	10.57	23.46	-12.89
High	5700	9.49	10.49	23.50	-13.01

TEST INFORMATION

Date: 1/16/2018
Tester: 39004

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RESULTS (ISED_EIRP)

Bandwidth, Antenna Gain, and Limits

Channel	Frequency (MHz)	Min 99% BW (MHz)	Directional Ant. Gain (dBi)	EIRP Limit (dBm)
Low	5500	17.83	2.00	29.51
Mid	5580	17.63	2.00	29.46
High	5700	17.78	2.00	29.50

Duty Cycle CF (dB)	1.00	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
Low	5500	8.44	11.44	29.51	-18.07
Mid	5580	8.57	11.57	29.46	-17.89
High	5700	8.49	11.49	29.50	-18.01

TEST INFORMATION

Date: 1/16/2018
Tester: 39004

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STRADDLE CHANNEL 144 RESULTS (ISED_EIRP)

UNII-2C BAND

Bandwidth, Antenna Gain, and Limits

Channel	Frequency (MHz)	Min 99% BW (MHz)	Directional Ant. Gain (dBi)	EIRP Limit (dBm)
144	5720	17.95	2.00	29.54

Duty Cycle CF (dB)	1.00	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
144	5720	7.05	10.05	29.54	-19.49

TEST INFORMATION

Date: 1/16/2018
Tester: 39004

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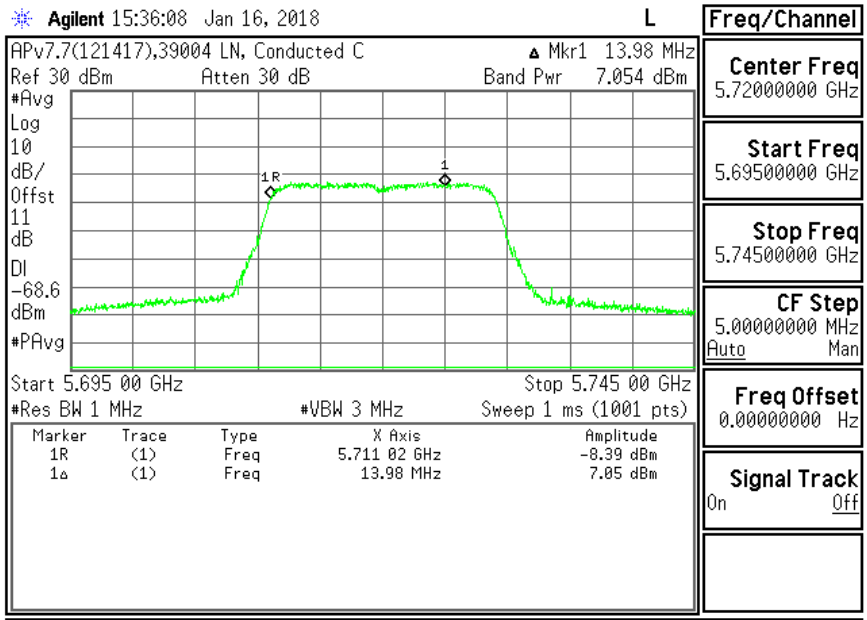
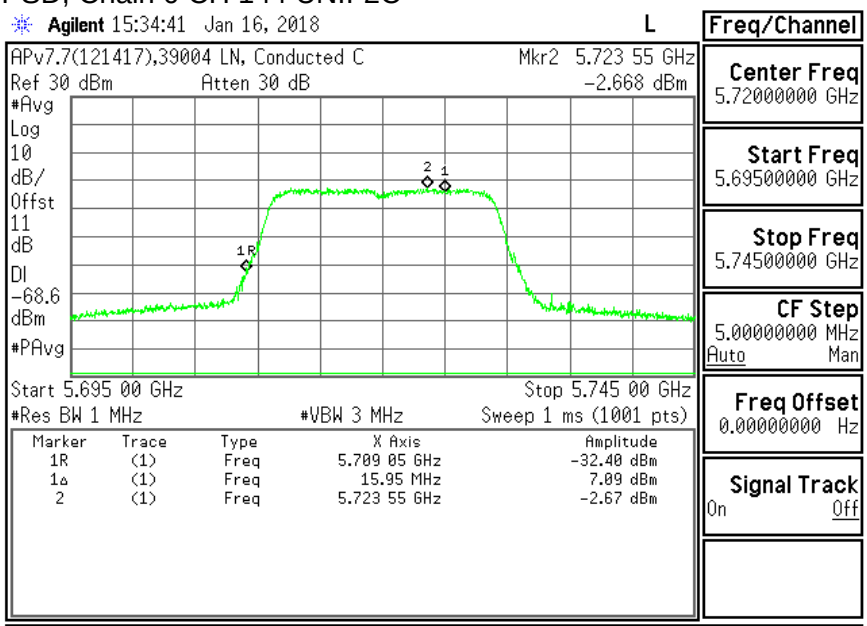
OUTPUT POWER Chain 0 CH 144 UNII-2C



PSD, Chain 0 CH 144 UNII-2C



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UNII-3 BAND (FCC and ISED)

Antenna Gain and Limit

Channel	Frequency (MHz)	Directional Gain (dBi)	Power Limit (dBm)	PSD Limit (dBm)
144	5720	2.00	30.00	30.00

Duty Cycle CF (dB)	1.00	Included in Calculations of Corr'd Power & PSD

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
144	5720	2.05	3.05	30.00	-26.95

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
144	5720	-3.96	-2.96	30.00	-32.96

TEST INFORMATION

Date: 1/16/2018
Tester: 39004

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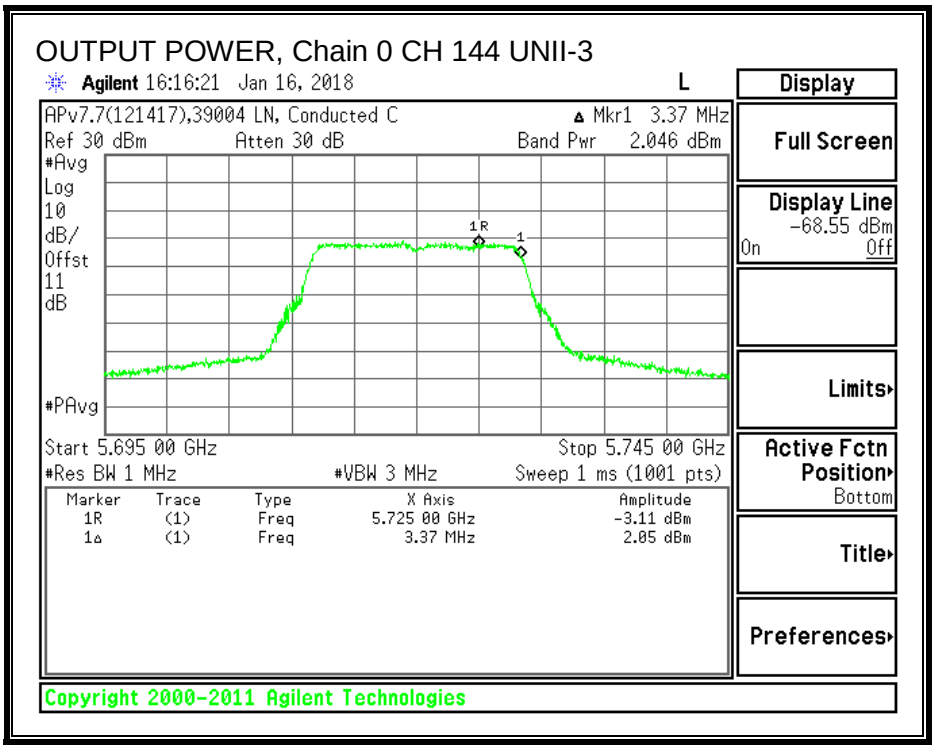
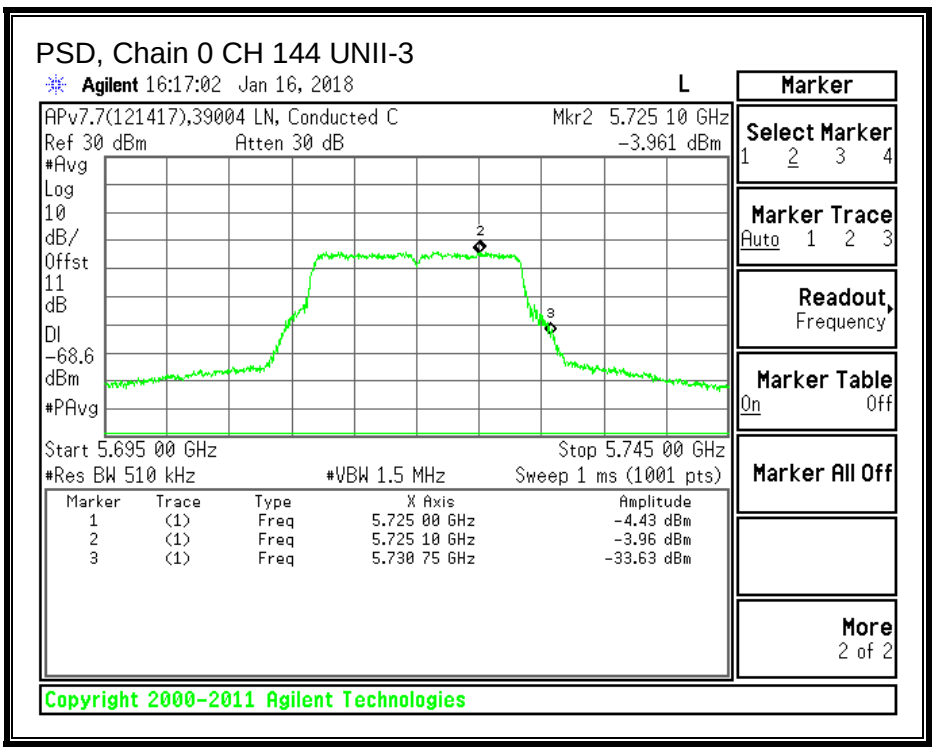
OUTPUT POWER, Chain 0 CH 144 UNII-3



PSD, Chain 0 CH 144 UNII-3



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8.10. 802.11n HT40 MODE IN THE 5.6 GHz BAND

8.10.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5510	40.30
Mid	5550	42.90
High	5670	40.40
142	5710	40.50

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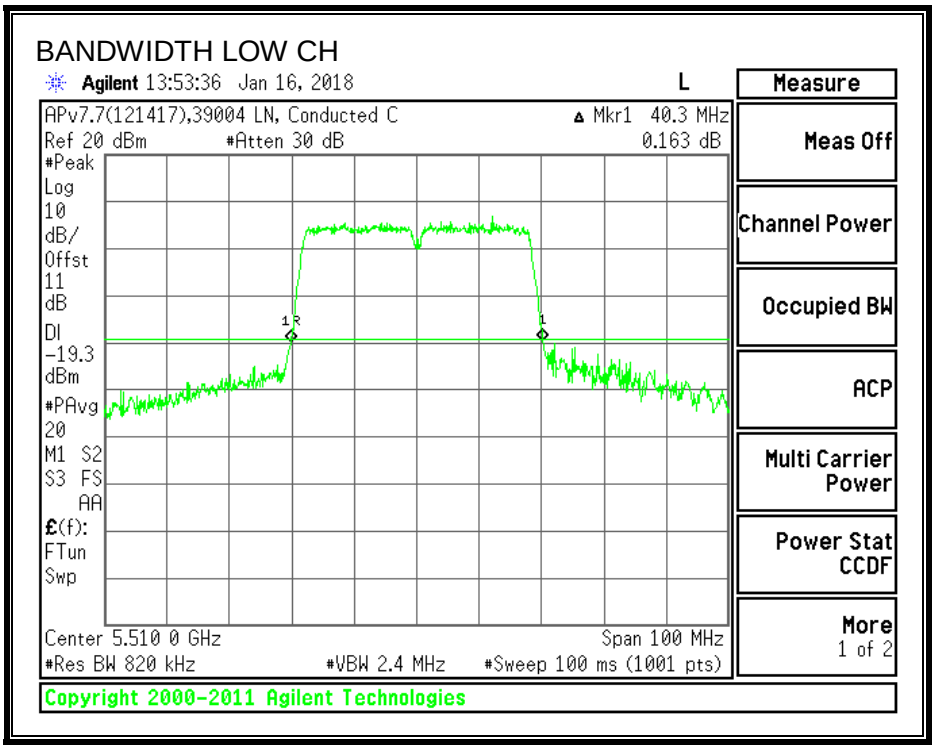
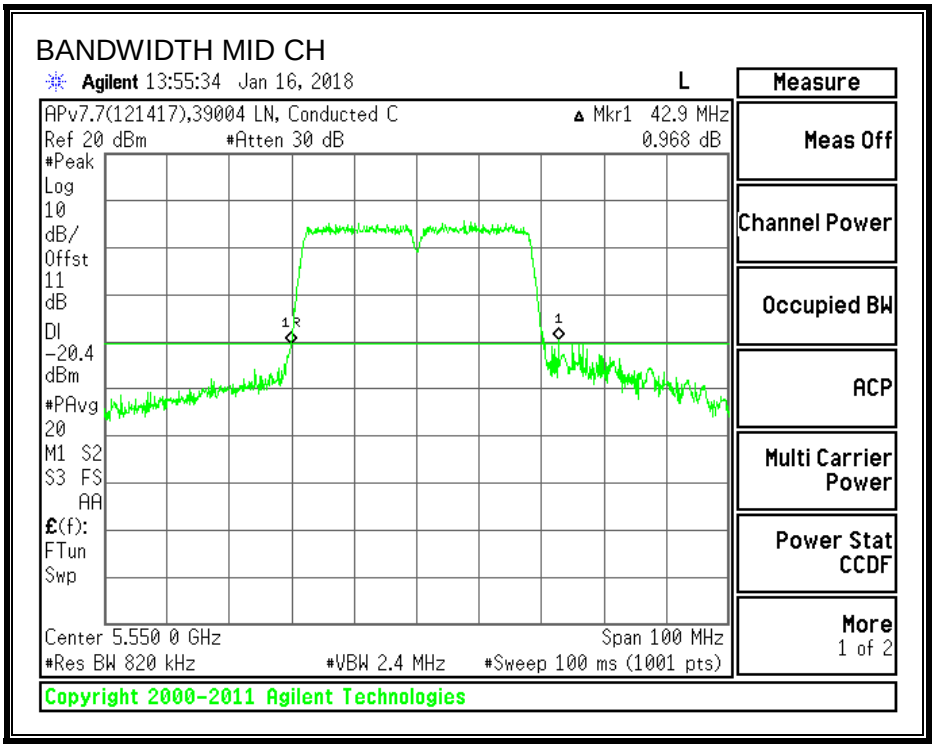
26 dB BANDWIDTH





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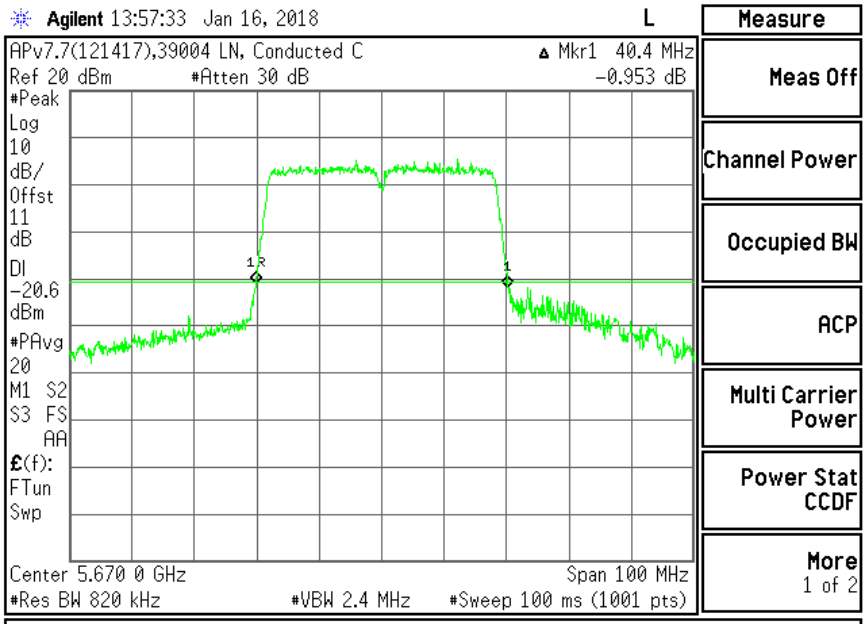
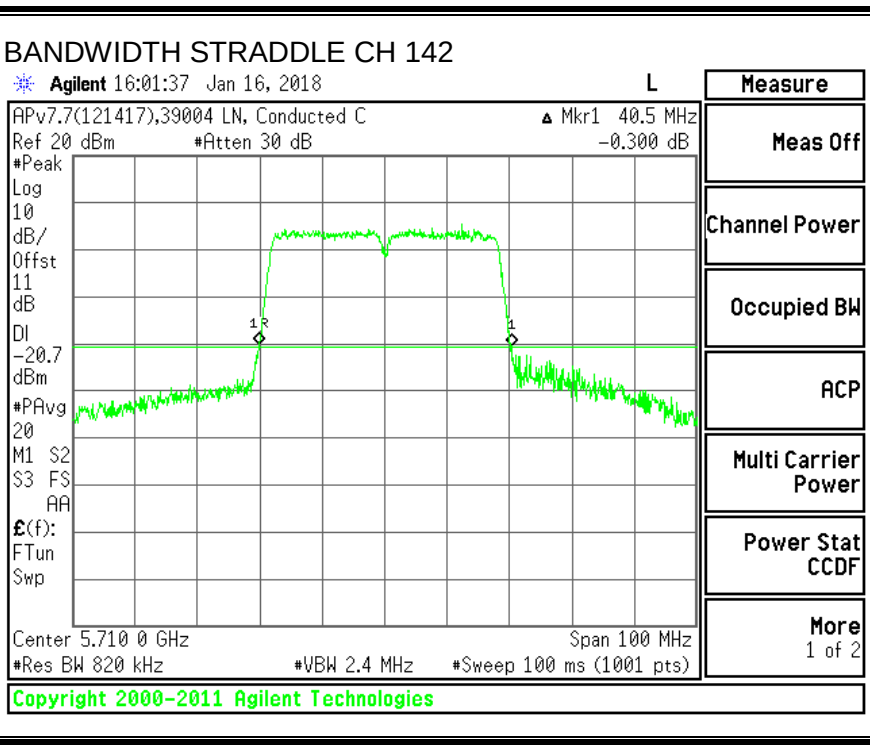
BANDWIDTH HIGH CH



BANDWIDTH STRADDLE CH 142



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