



CERTIFICATION TEST REPORT

Report Number. : 12124121-E3V5

Applicant : APPLE, INC.
1 APPLE PARK WAY
CUPERTINO, CA 95014, U.S.A.

Model : A1920, A2099 AND A2100

FCC ID : BCG-E3218A

ISED ID : 579C-E3218A

EUT Description : SMARTPHONE

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C
ISED RSS-247 ISSUE 2

Date Of Issue:
August 10, 2018

Prepared by:
UL Verification Services Inc.
47173 Benicia Street
Fremont, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888



NVLAP LAB CODE 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	7/2/2018	Initial Issue	Chin Pang
V2	7/5/2018	Address TCB's Questions	Chin Pang
V3	7/9/2018	Address TCB's Questions	Chin Pang
V4	7/13/2018	Address TCB's Questions	Chin Pang
V5	8/10/2018	Address TCB's Questions	Jingang Li

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE, INC.
1 APPLE PARK WAY
CUPERTINO, CA 95014, U.S.A.

EUT DESCRIPTION: SMARTPHONE

MODEL: A1920, A2099 AND A2100

SERIAL NUMBER: C39WF004JVX8

DATE TESTED: JANUARY 26, 2018 – JULY 14, 2018

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5	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.

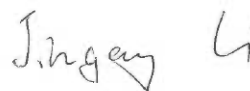
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. 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 the U.S. government.

Approved & Released For
UL Verification Services Inc. By:



Chin Pang
CONSUMER TECHNOLOGY DIVISION
Senior Engineer
UL Verification Services Inc.

Prepared By:



Jingang Li
CONSUMER TECHNOLOGY DIVISION
TEST ENGINEER
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, KDB 558074 D01 v04, ANSI C63.10-2013, RSS-GEN Issue 5, and RSS-247 Issue 2.

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 (ISED:2324B-1)	☒ Chamber D (ISED:22541-1)
☐ Chamber B (ISED:2324B-2)	☒ Chamber E (ISED:22541-2)
☐ Chamber C (ISED:2324B-3)	☒ Chamber F (ISED:22541-3)
	☐ Chamber G (ISED:22541-4)
	☐ Chamber H (ISED:22541-5)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through C is covered under ISED company address code 2324B with site numbers 2324B -1 through 2324B-3, respectively. Chambers D through H are covered under ISED Canada company address code 22541 with site numbers 22541 -1 through 22541-5, respectively.

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. The full scope of accreditation can be viewed at [NVLAP Lab Search](#).

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:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamplifier Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

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%.

5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The equipment under test is a mobile phone with GSM, GPRS, EGFRS, UMTS, LTE, TD-SCDMA and CDMA technologies. It also supports IEEE 802.11a/b/g/n/ac, Bluetooth, GPS and NFC. The device has a built-in inductive charging receiver which is not user accessible. The rechargeable battery is not accessible.

5.2. DIFFERENCE IN MODEL NUMBER

Model A2099, A2100 is electrically identical to Model A1920. Three model numbers are allocated for marketing and logistic purposes only. A1920 was used to perform all final tests

5.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

2.4GHz BAND

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
1Tx			
2412 - 2472	802.11b	21.92	155.60
2412 - 2472	802.11g	Covered by 11n HT20	
2412 - 2472	802.11n HT20	21.89	154.53

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2Tx			
2412 - 2472	802.11n HT20 CDD	23.86	243.22

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Range (GHz)	Antenna 4 (dBi)	Antenna 3 (dBi)
2.4	-2.8	-4.1

5.5. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was v16.30.67.7

5.6. WORST-CASE CONFIGURATION AND MODE

EUT was investigated in three orthogonal orientations X, Y and Z on Ant 4 (Antenna 4) and Ant 3 (Antenna 3), it was determined that X (Flatbed) orientation was worst-case orientation for Ant 4 and Ant 3.

Radiated band edge, harmonic, and spurious emissions from 1GHz to 18GHz were performed with the EUT was set to transmit at highest power on Low/Middle/High channels.

Radiated emissions below 30MHz, below 1GHz, 18-26GHz and power line conducted emissions were performed with the EUT transmits at the channel with the highest output power as worst-case scenario.

For HT20 modes, radiated harmonics spurious were performed with the EUT set at the 2TX CDD mode with power setting equal or higher than SISO modes as the worst-case scenario. G mode covered by HT20 mode since it has the same power as HT20.

Below 1GHz tests were performed with EUT connected to AC power adapter as the worst case; and for above 1GHz, the worst-case configuration reported was tested with EUT only. For AC line conducted emission, test was investigated with AC power adapter and with laptop. There were no emissions found below 30MHz within 20dB of the limit.

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

802.11b mode: 1 Mbps
802.11n HT20mode: MCS0

There are two vendors of the WiFi/Bluetooth radio modules: variant 1 and variant 2. The Wi-Fi/Bluetooth radio modules have the same mechanical outline (e.g., the same package dimension and pin-out layout), use the same on-board antenna matching circuit, have an identical antenna structure, and are built and tested to conform to the same specifications and to operate within the same tolerances.

Baseline testing was performed on the two variants to determine the worst case on all conducted power and radiated emissions.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Apple	MacBook Pro	HRP007154	FCC DoC
AC/DC adapter	Delta Electronic	A1343	ADP-85EBT V85	NA
EUT AC/DC Adapter	Apple	A1385	D292365CDYADHLHC3	NA

I/O CABLES (CONDUCTED TEST)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Antenna	1	SMA	Un-Shielded	0.2	To spectrum Analyzer
2	USB	1	USB	Shielded	1	N/A
3	AC	1	AC	Un-shielded	2	N/A

I/O CABLES (RADIATED ABOVE 1 GHZ)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
NA						

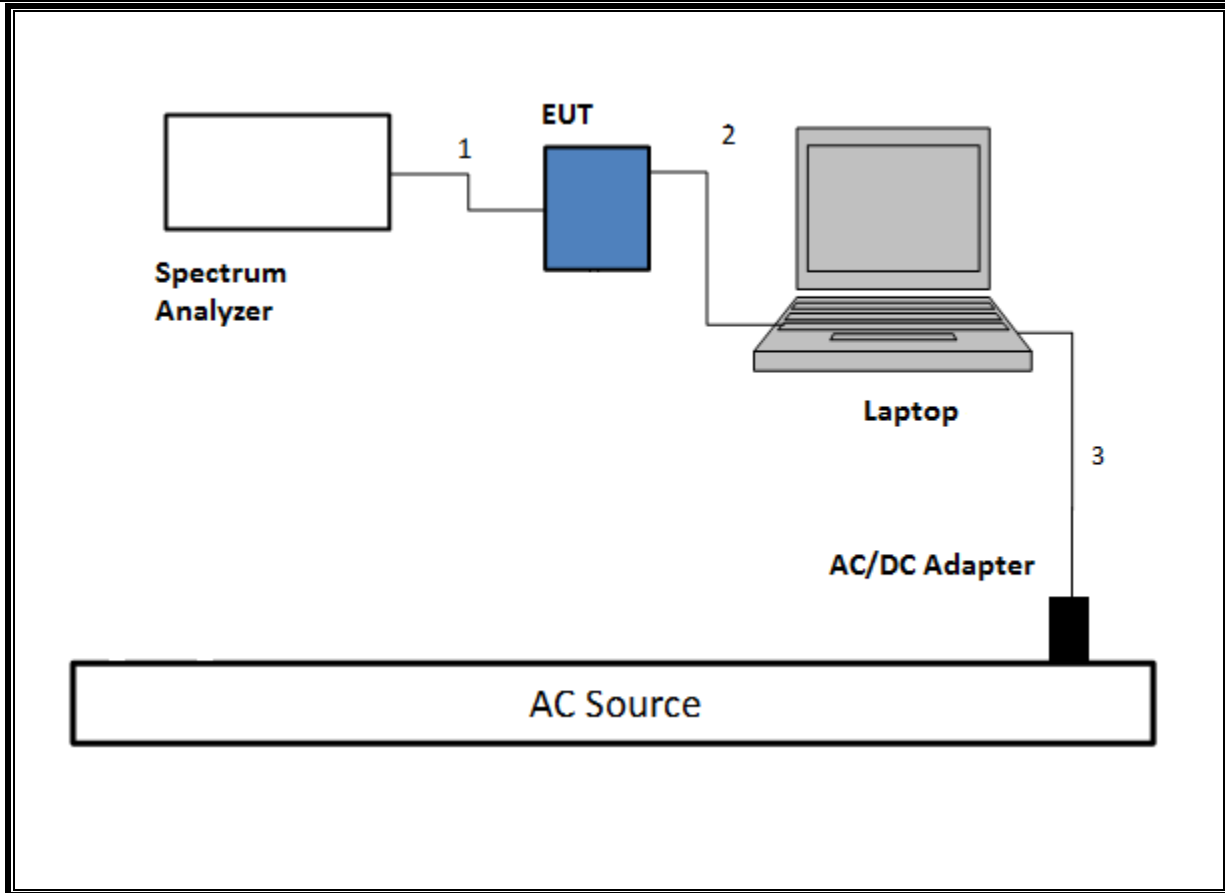
I/O CABLES (BELOW 1GHz AND AC POWER LINE TEST WITH ADAPTER AND LAPTOP)

I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-shielded	2	N/A
2	USB	1	USB	Shielded	1	N/A

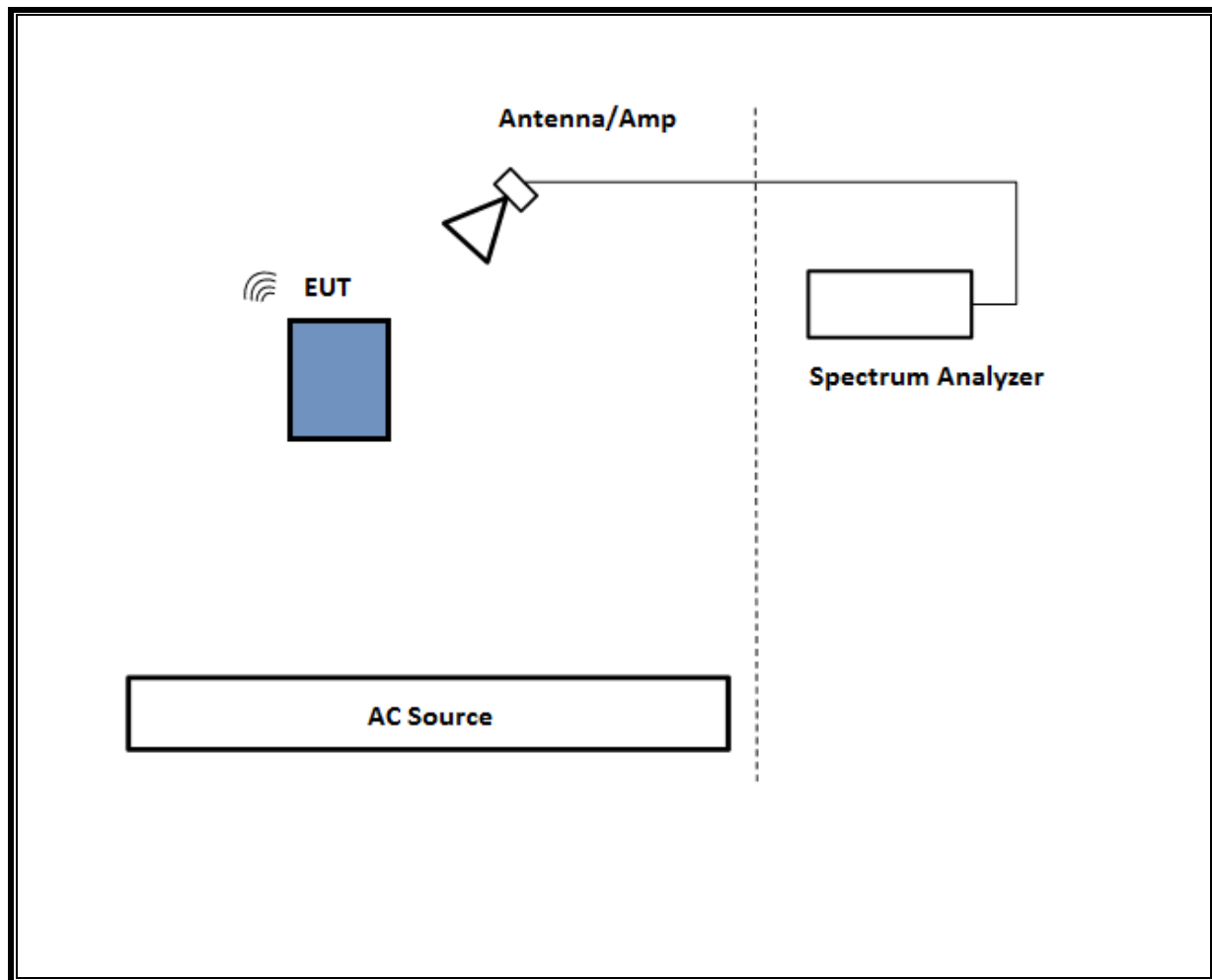
TEST SETUP

The EUT is installed in a host laptop computer during the tests. Test software exercised the EUT.

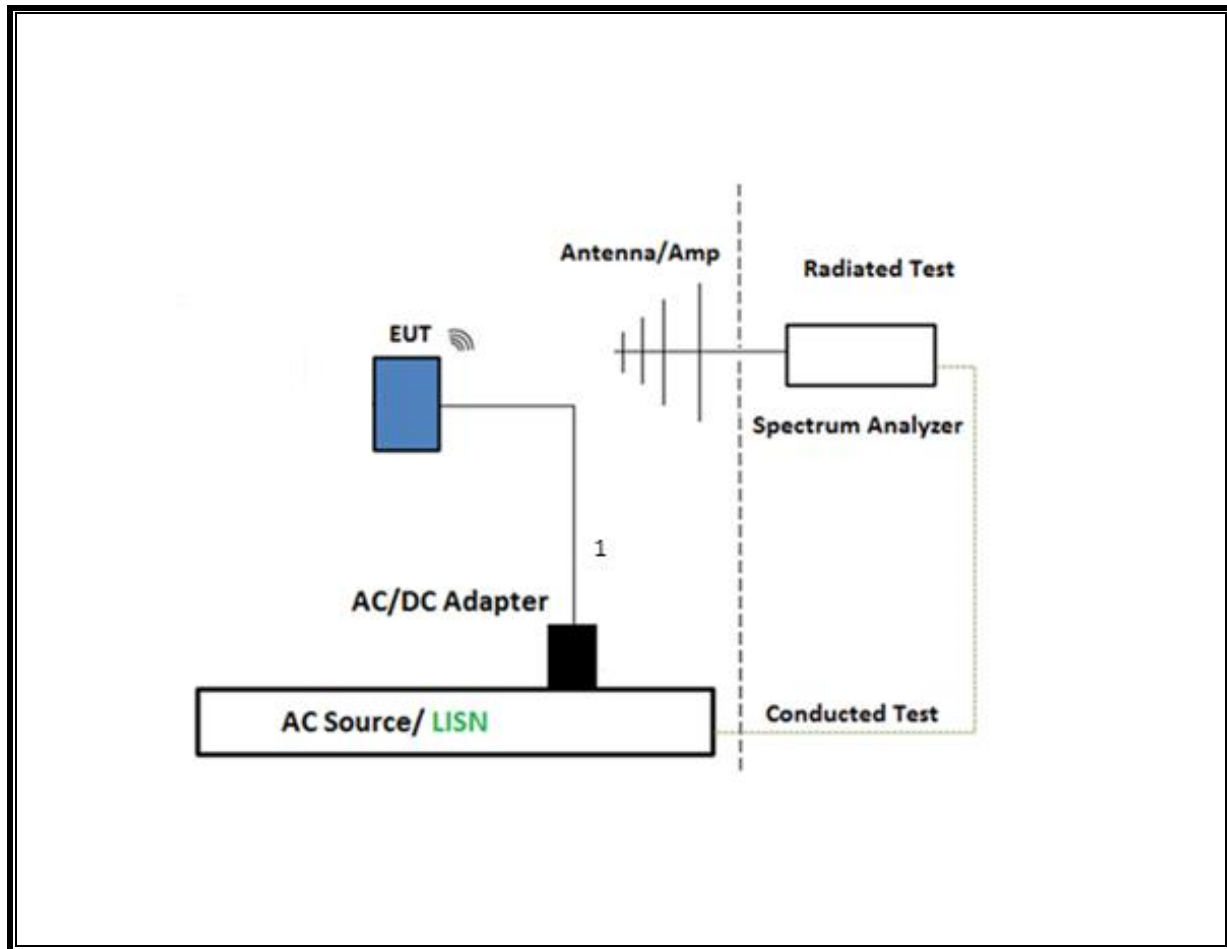
SETUP DIAGRAM FOR CONDUCTED TESTS



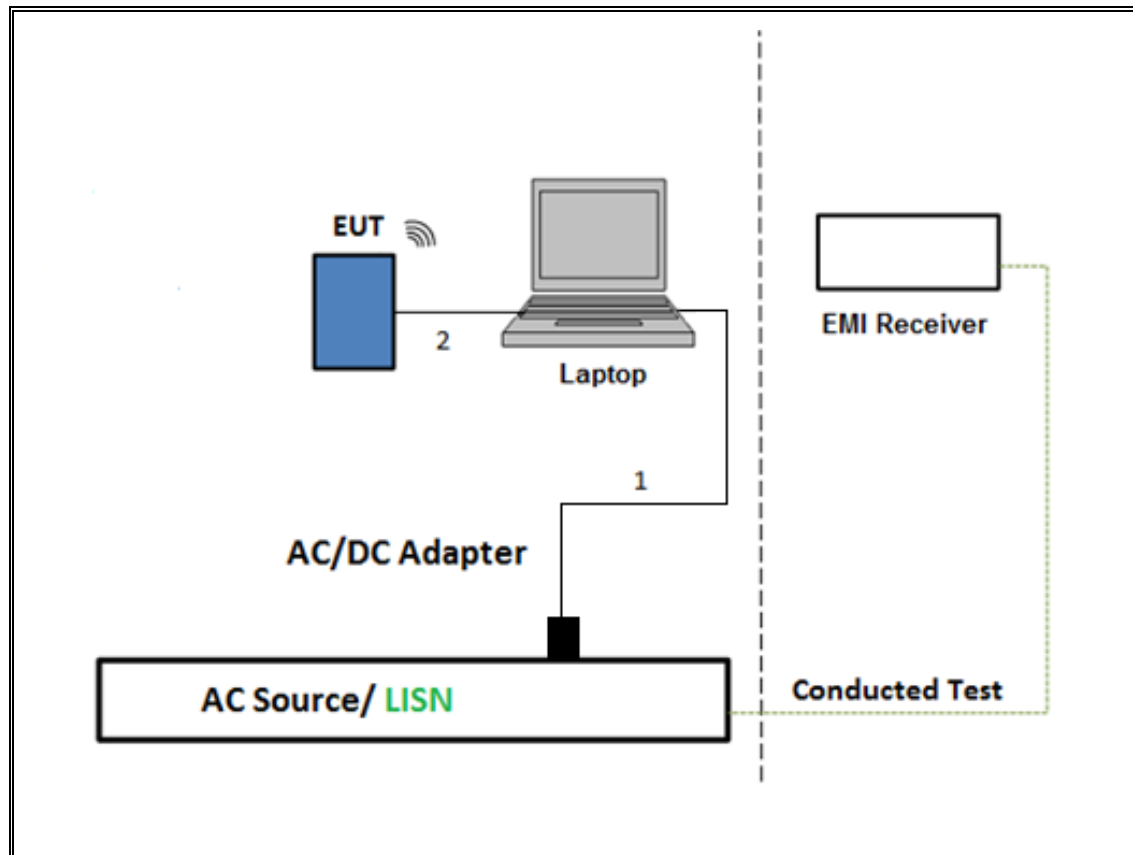
SETUP DIAGRAM FOR RADIATED TESTS Above 1GHz



SETUP DIAGRAM FOR Below 1GHz and AC LINE CONDUCTED TEST



TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION



6. MEASUREMENT METHOD

On Time and Duty Cycle: KDB 558074 D01 v04, Section 6.

6 dB BW: KDB 558074 D01 v04, Section 8.1.

99% BW: ANSI C63.10-2013, Section 6.9.3.

Output Power: KDB 558074 D01 v04, Section 9.2.3.2.

Power Spectral Density: KDB 558074 D01 v04, Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v04, Section 11.1 (b).

Out-of-band emissions in restricted bands: KDB 558074 D01 v04, Section 12.1.

Band-edge: KDB 558074 D01 v04, Section 12.1.

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

7. TEST AND MEASUREMENT EQUIPMENT

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

Description	Manufacturer	Model	ID Num	Cal Due
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T346	04/03/2019
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T741	12/30/2018
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T119	04/03/2019
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T136	6/26/2018
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T740	12/30/2018
Spectrum Analyzer, PSA, 3Hz to 44GHz	Agilent (Keysight) Technologies	E4446A	T177	04/12/2019
Power Meter, P-series single channel	Keysight	N1912A	T1273	07/17/2018
Power Sensor	Keysight	N1921A	T1228	06/28/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T342	02/22/2019
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	T408	12/15/2018
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T173	06/24/2018
Antenna Horn 18 to 26.5GHz	ARA	MWH-1826/B	T449	06/12/2018
Pre-Amp 18-26GHz	Agilent Technology	8449B	T404	07/23/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1454	01/08/2019
AC Line Conducted				
EMI Test Receiver 9KHz-7GHz	Rohde & Schwarz	ESCI7	T1436	01/25/2019
LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	06/15/2018
Power Cable, Line Conducted Emissions	UL	PG1	T861	08/31/2018
LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	06/15/2018
UL AUTOMATION SOFTWARE				
*Radiated Software	UL	UL EMC	Ver 9.5, April 26, 2016	
*Conducted Software	UL	UL EMC	Ver 5.4, October 13, 2016	
*AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015	

Note: * indicates automation software version used in the compliance certification testing

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

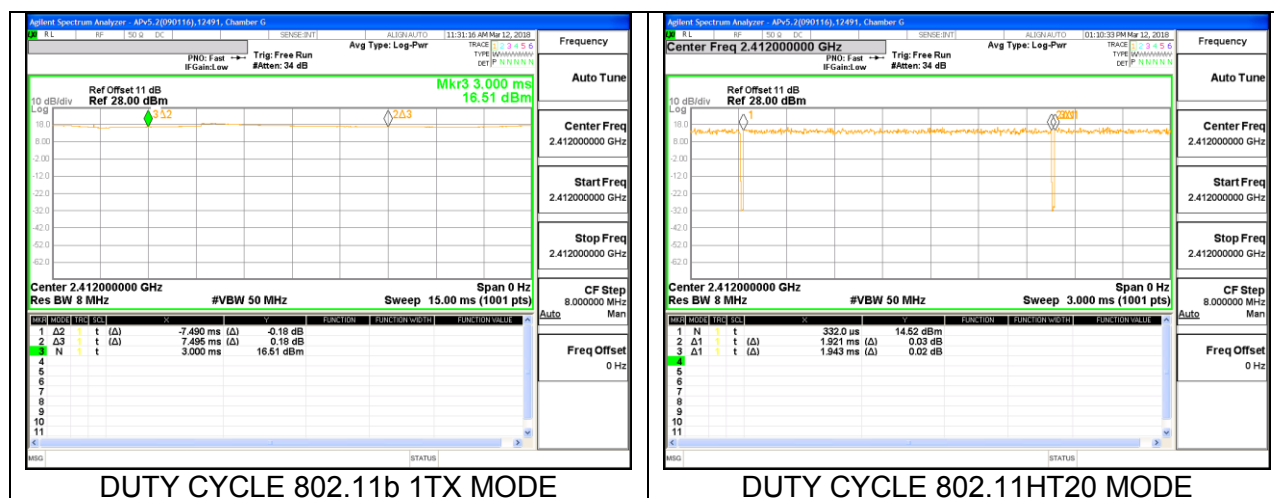
PROCEDURE

KDB 558074 D01 v04, Section 6

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
802.11b 1TX	100.000	100.000	1.000	100.00%	0.00	0.010
802.11n HT20 1TX/ 2TX	1.921	1.943	0.989	98.87%	0.00	0.010

DUTY CYCLE PLOTS



8.2. 99% BANDWIDTH

LIMITS

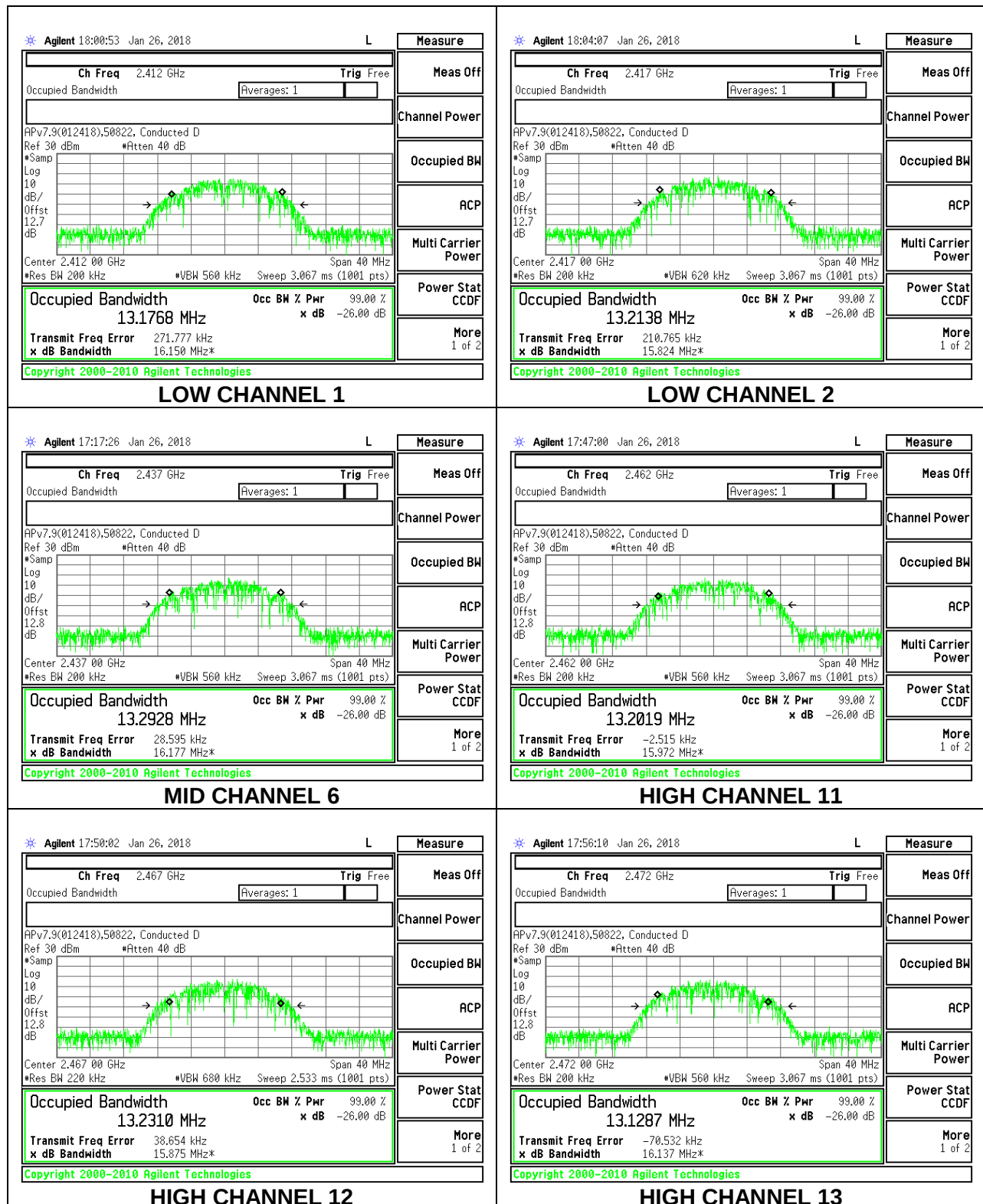
None; for reporting purposes only.

RESULTS

8.2.1. 802.11b MODE

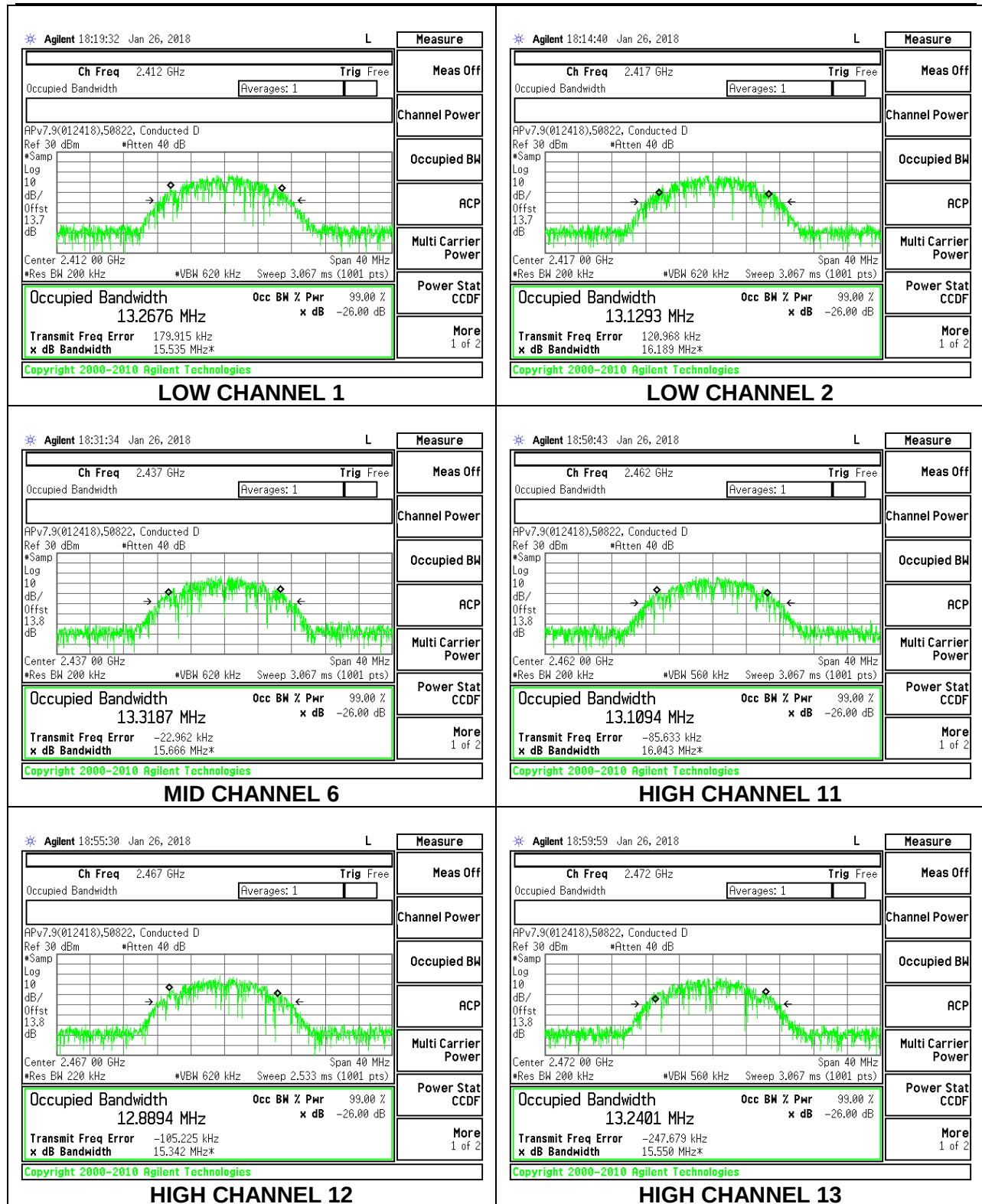
1TX Antenna 4

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	13.177
Low 2	2417	13.214
Mid 6	2437	13.293
High 11	2462	13.202
High 12	2467	13.231
High 13	2472	13.129



1TX Antenna 3

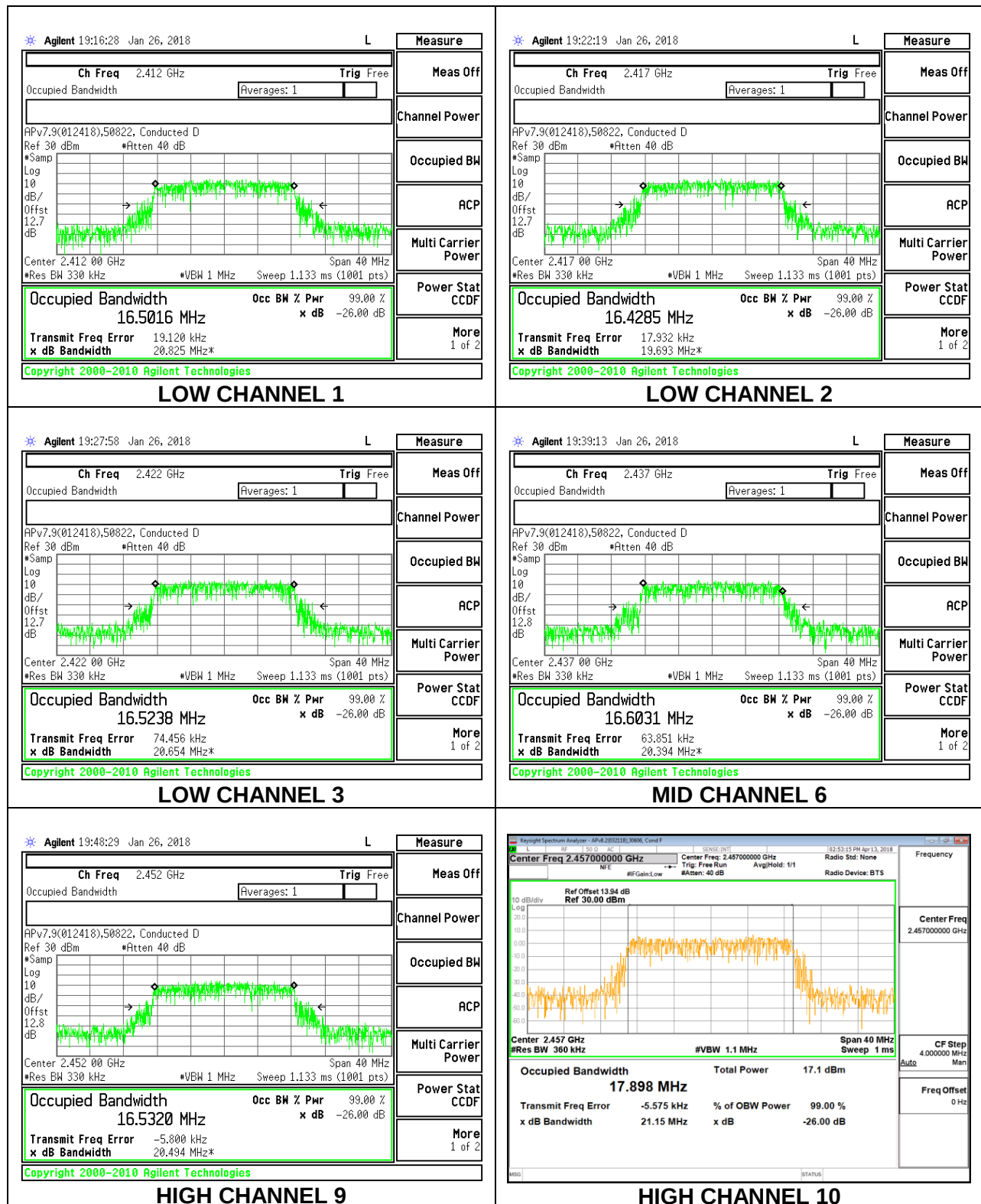
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	13.268
Low 2	2417	13.129
Mid 6	2437	13.319
High 11	2462	13.109
High 12	2467	12.889
High 13	2472	13.240

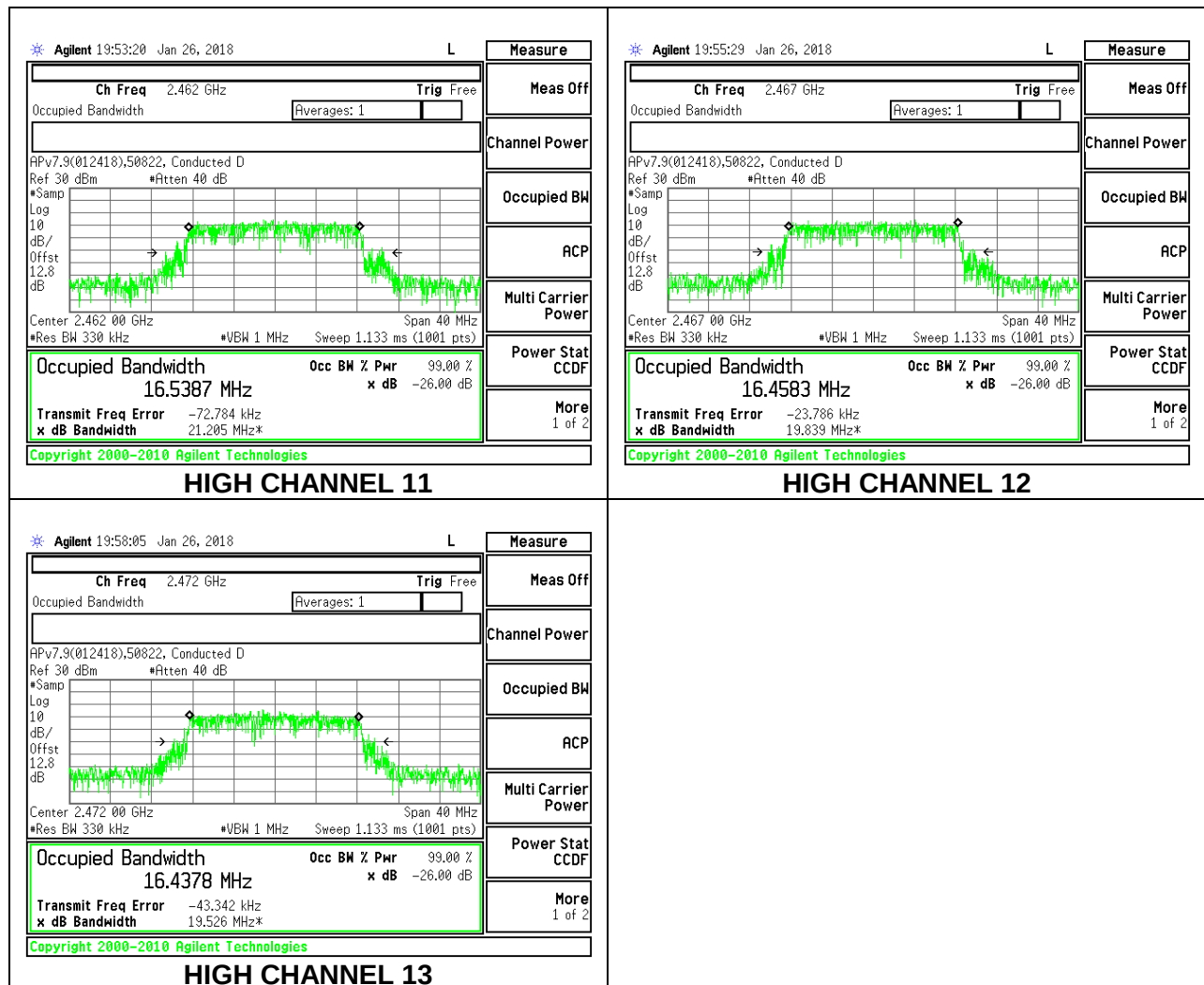


8.2.2. 802.11n HT20 MODE

1TX Antenna 4

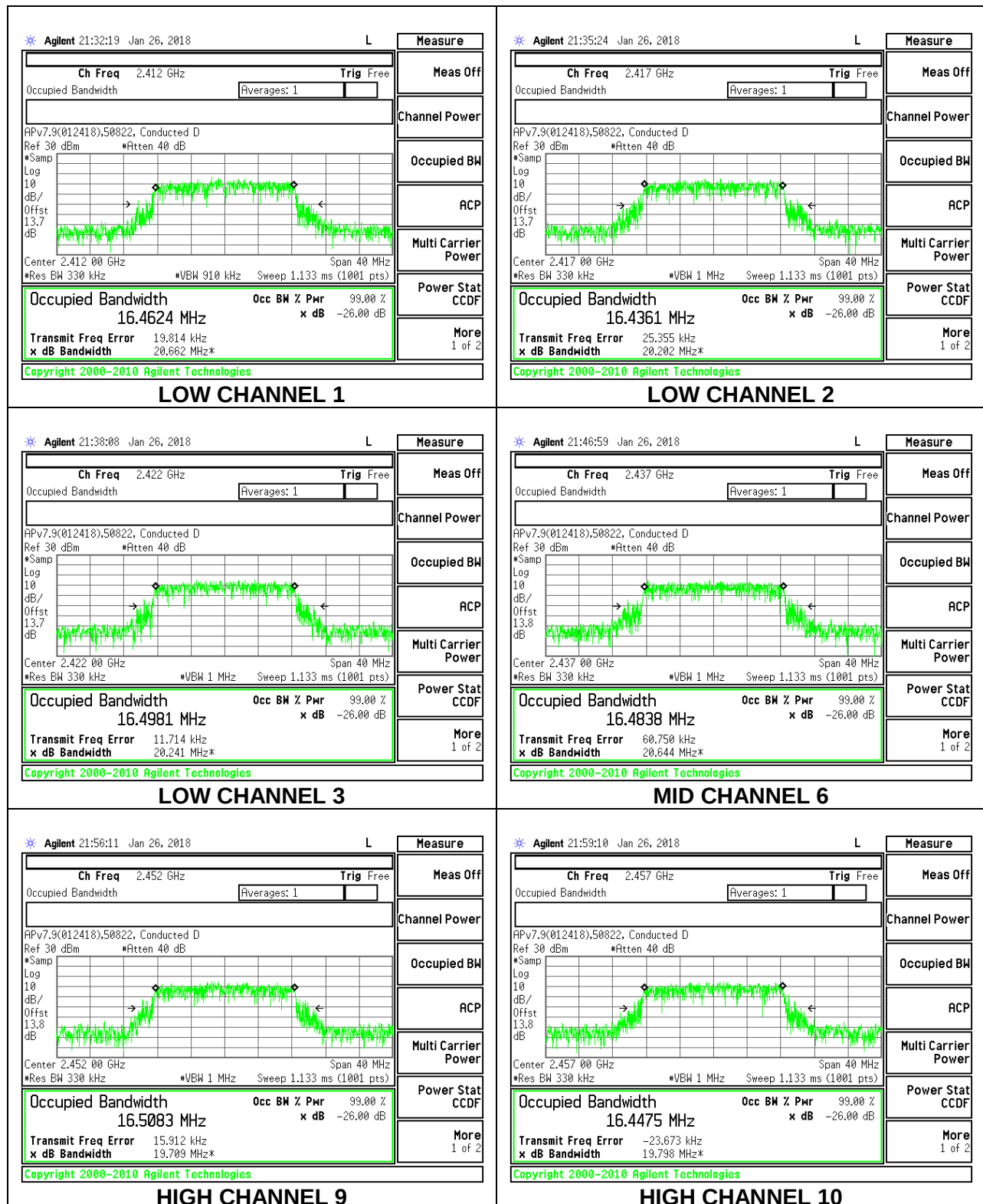
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	16.502
Low 2	2417	16.428
Low 3	2422	16.524
Mid 6	2437	16.603
High 9	2452	16.532
High 10	2457	17.898
High 11	2462	16.539
High 12	2467	16.458
High 13	2472	16.438

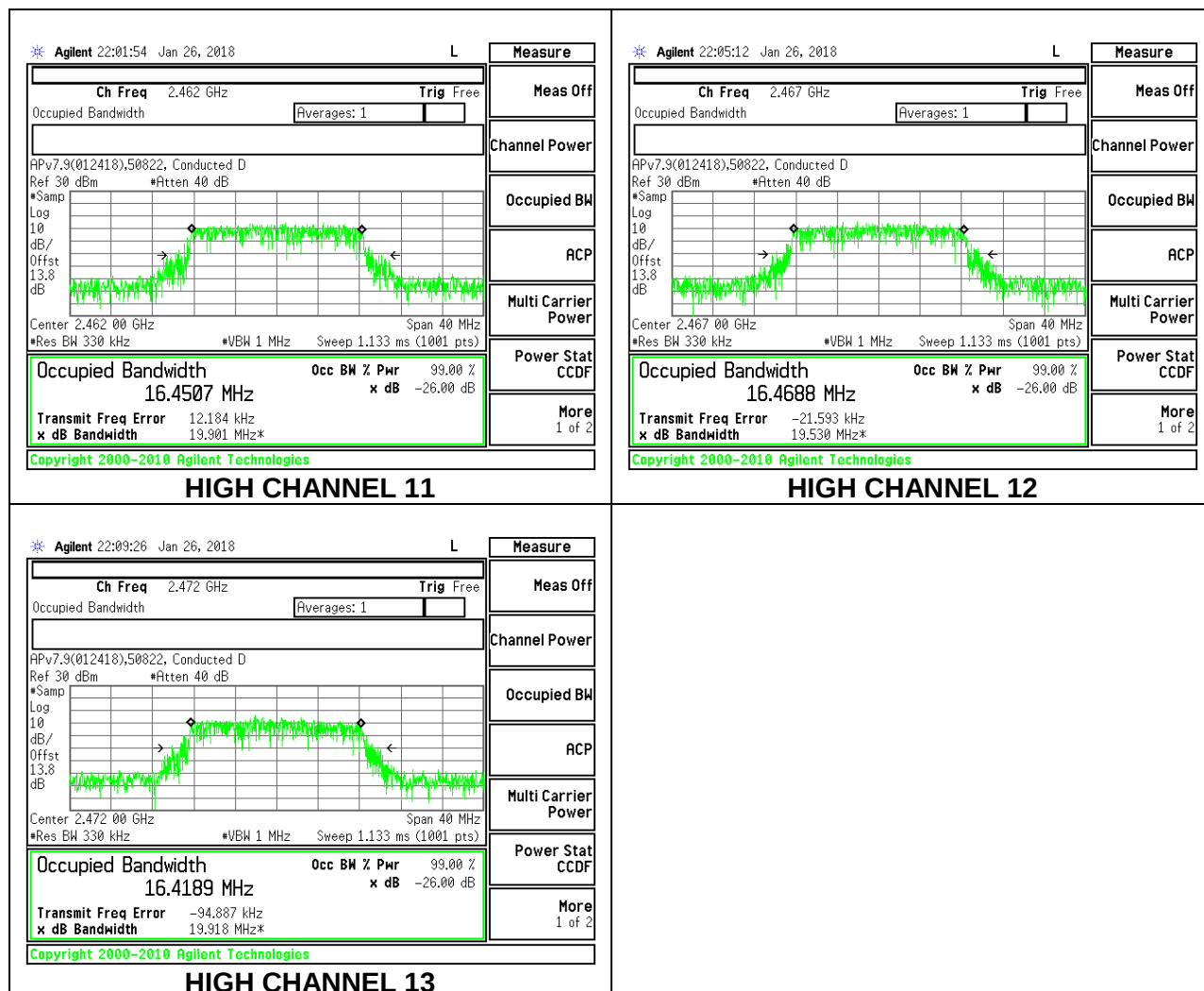




1TX Antenna 3

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	16.462
Low 2	2417	16.436
Low 3	2422	16.498
Mid 6	2437	16.484
High 9	2452	16.508
High 10	2457	16.448
High 11	2462	16.451
High 12	2467	16.469
High 13	2472	16.419

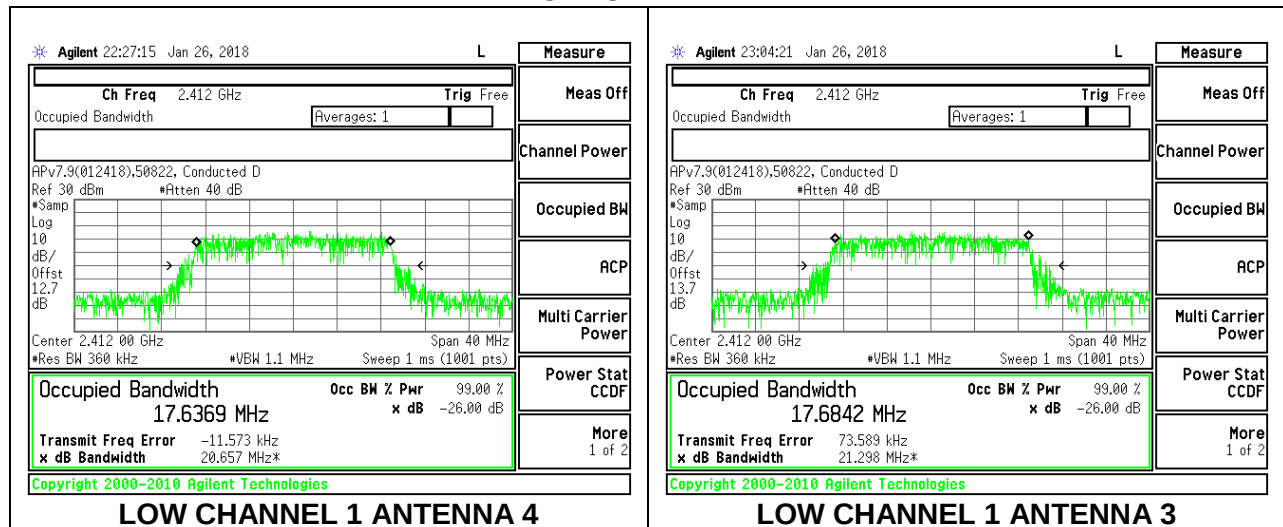




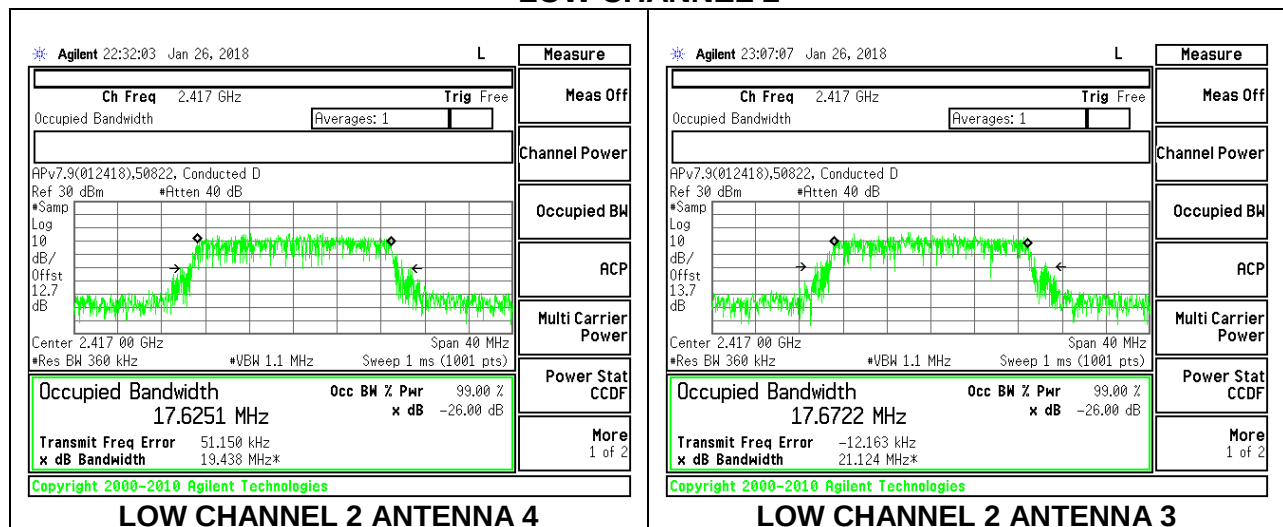
2TX Antenna 4 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth ANT 4 (MHz)	99% Bandwidth ANT 3 (MHz)
Low 1	2412	17.637	17.684
Low 2	2417	17.625	17.672
Low 3	2422	17.732	17.669
Low 4	2427	17.741	17.653
Mid 6	2437	17.745	17.674
High 8	2447	17.687	17.812
High 9	2452	17.793	17.690
High 10	2457	17.743	17.749
High 11	2462	17.671	17.714
High 12	2467	17.716	17.614
High 13	2472	17.711	17.800

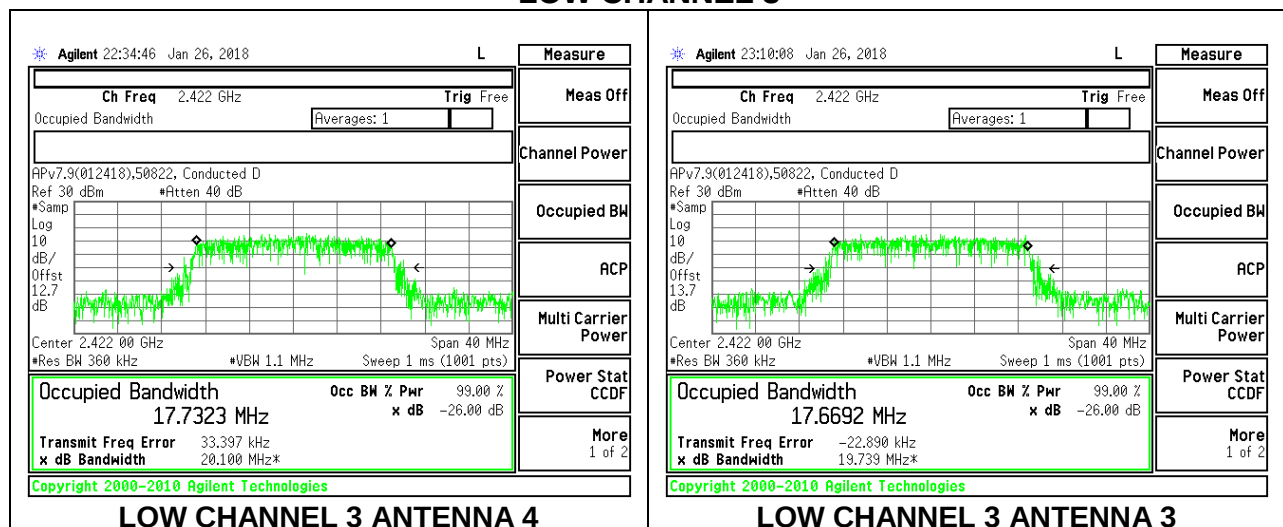
LOW CHANNEL 1



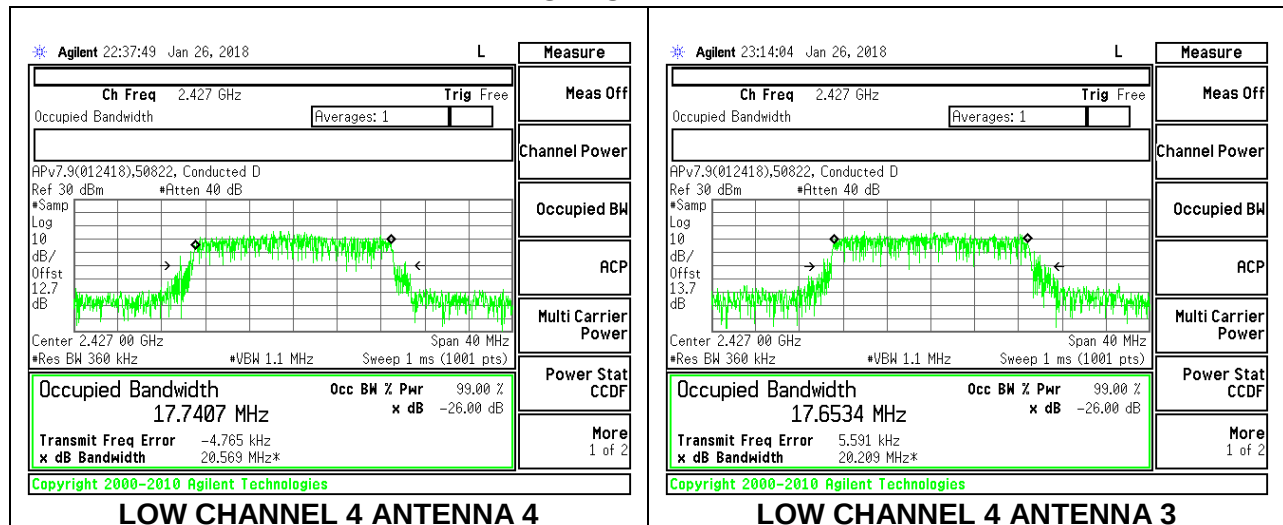
LOW CHANNEL 2



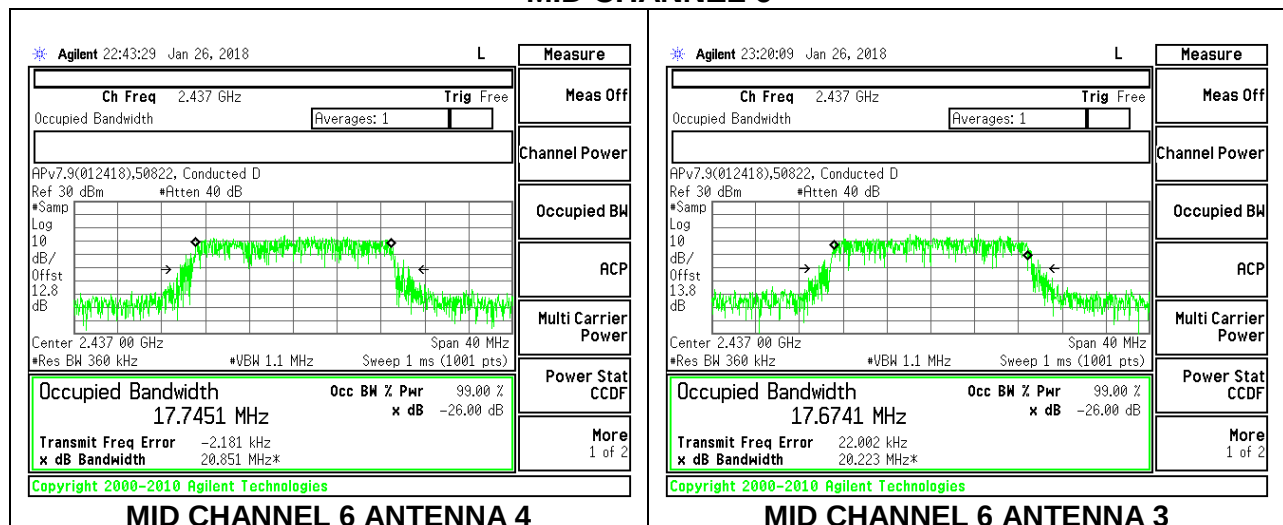
LOW CHANNEL 3



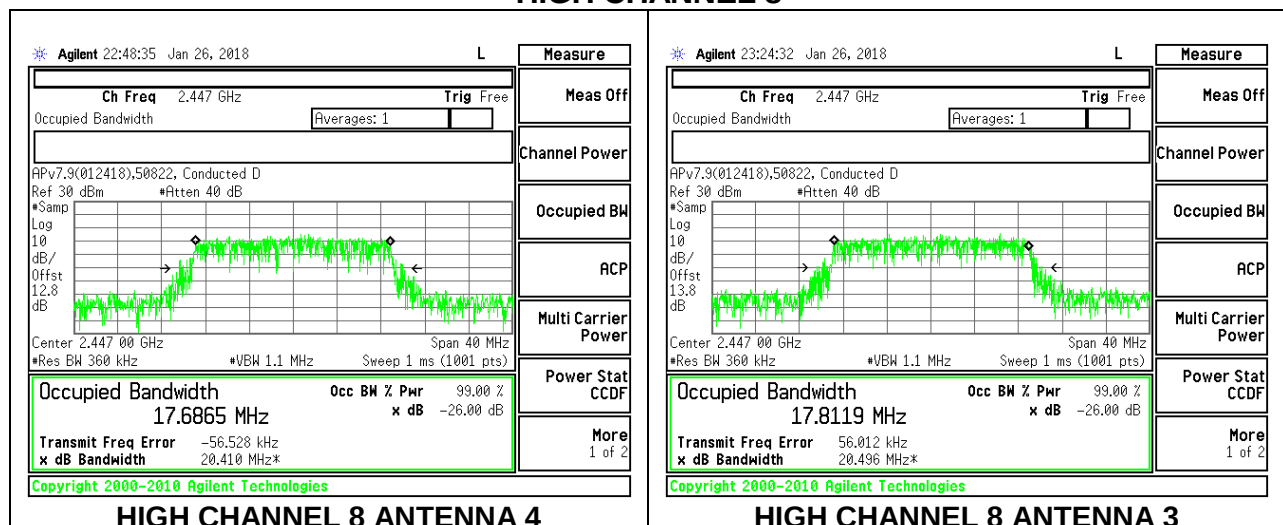
LOW CHANNEL 4



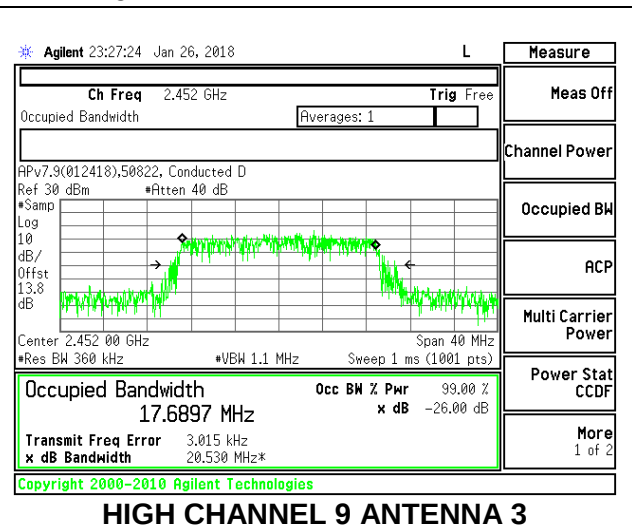
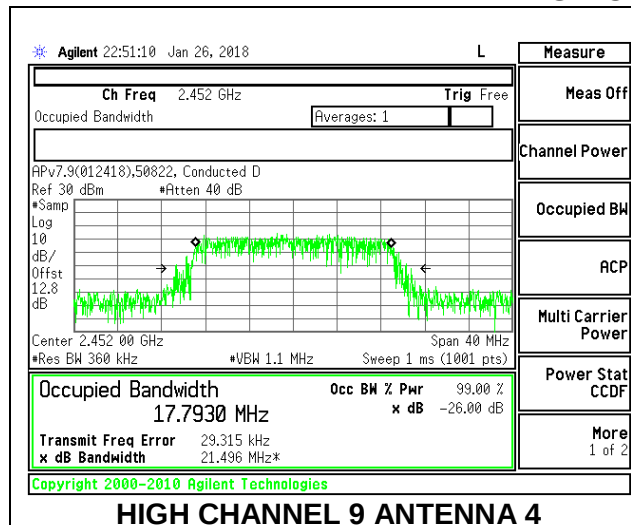
MID CHANNEL 6



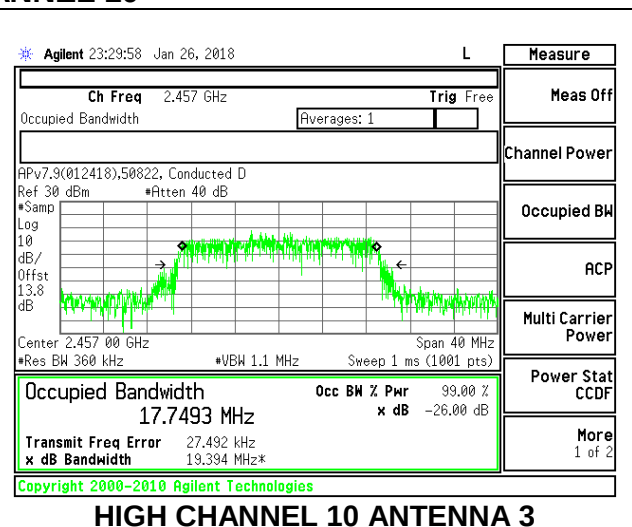
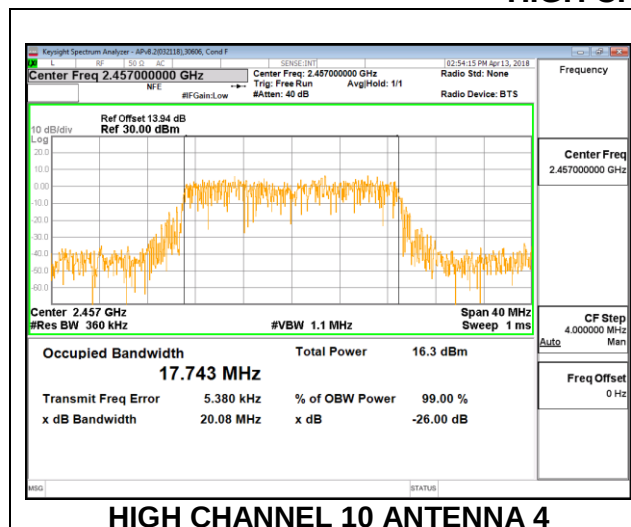
HIGH CHANNEL 8



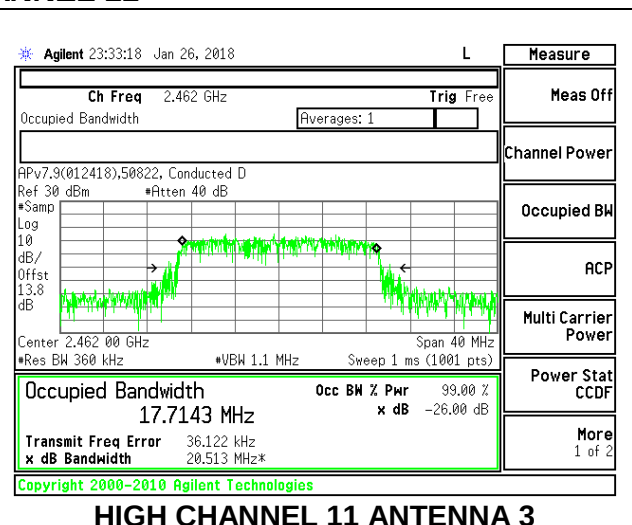
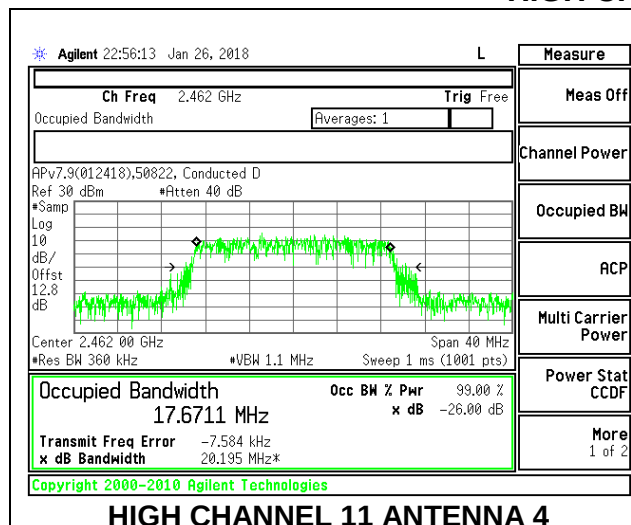
HIGH CHANNEL 9



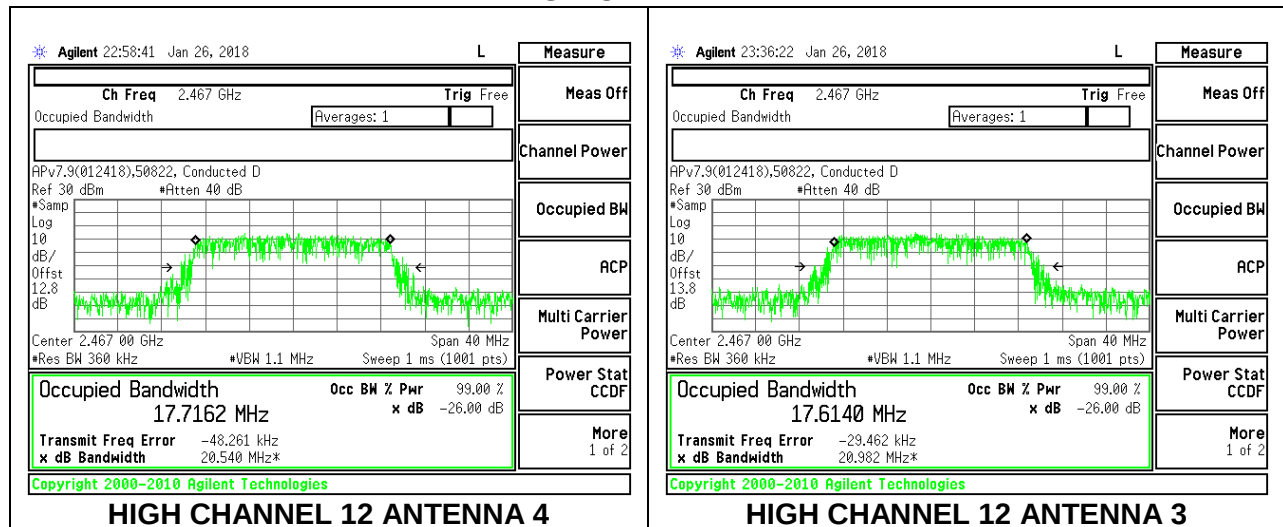
HIGH CHANNEL 10



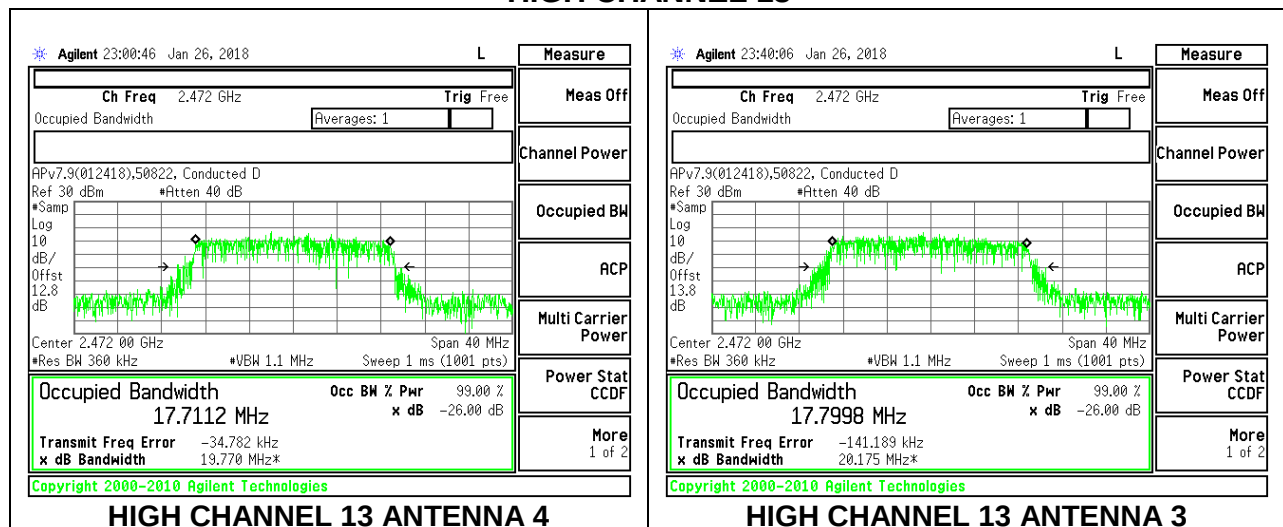
HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13



8.3. 6 dB BANDWIDTH

LIMITS

FCC §15.407 (e)

RSS-247 5.2 (a)

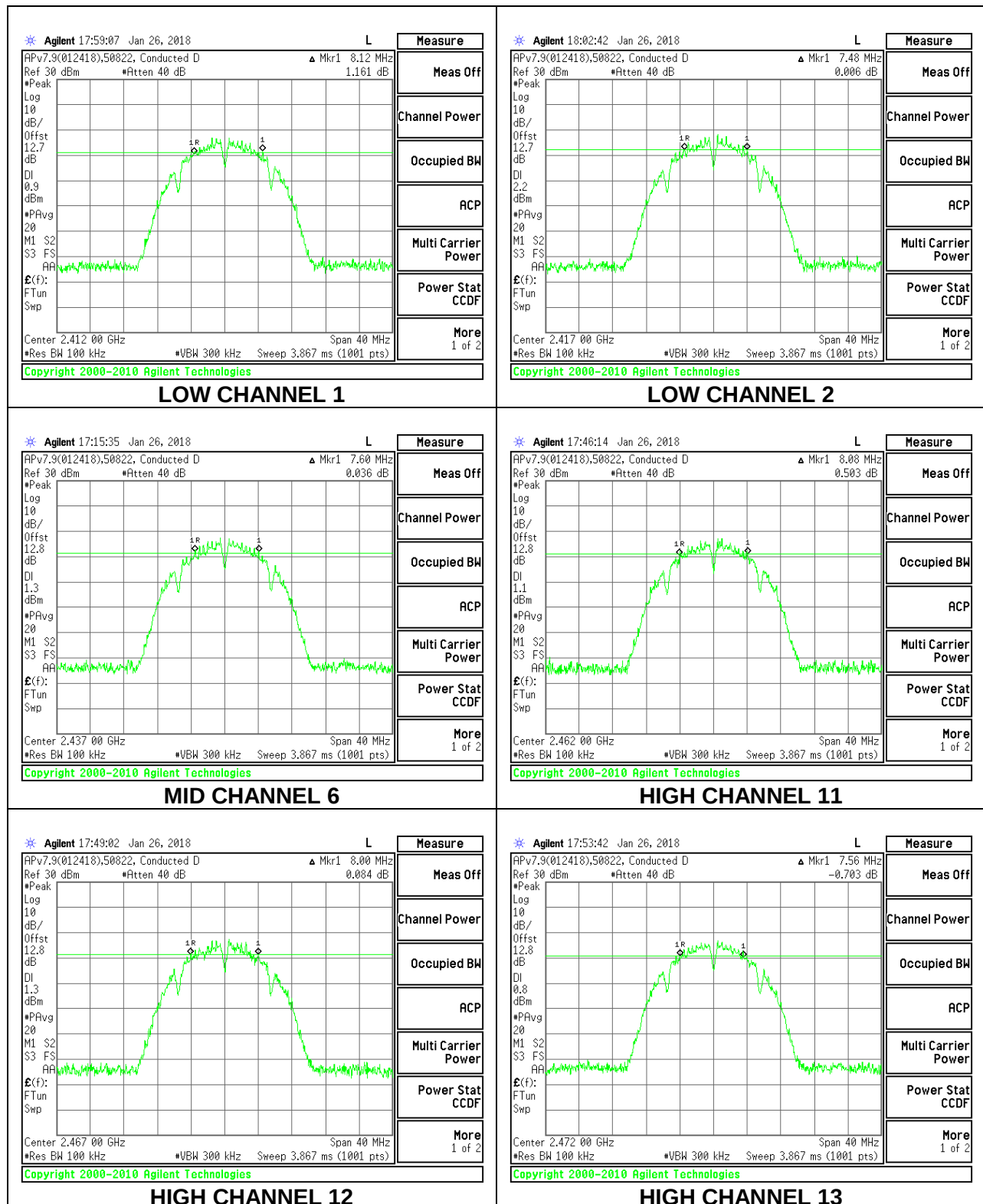
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

8.3.1. 802.11b MODE

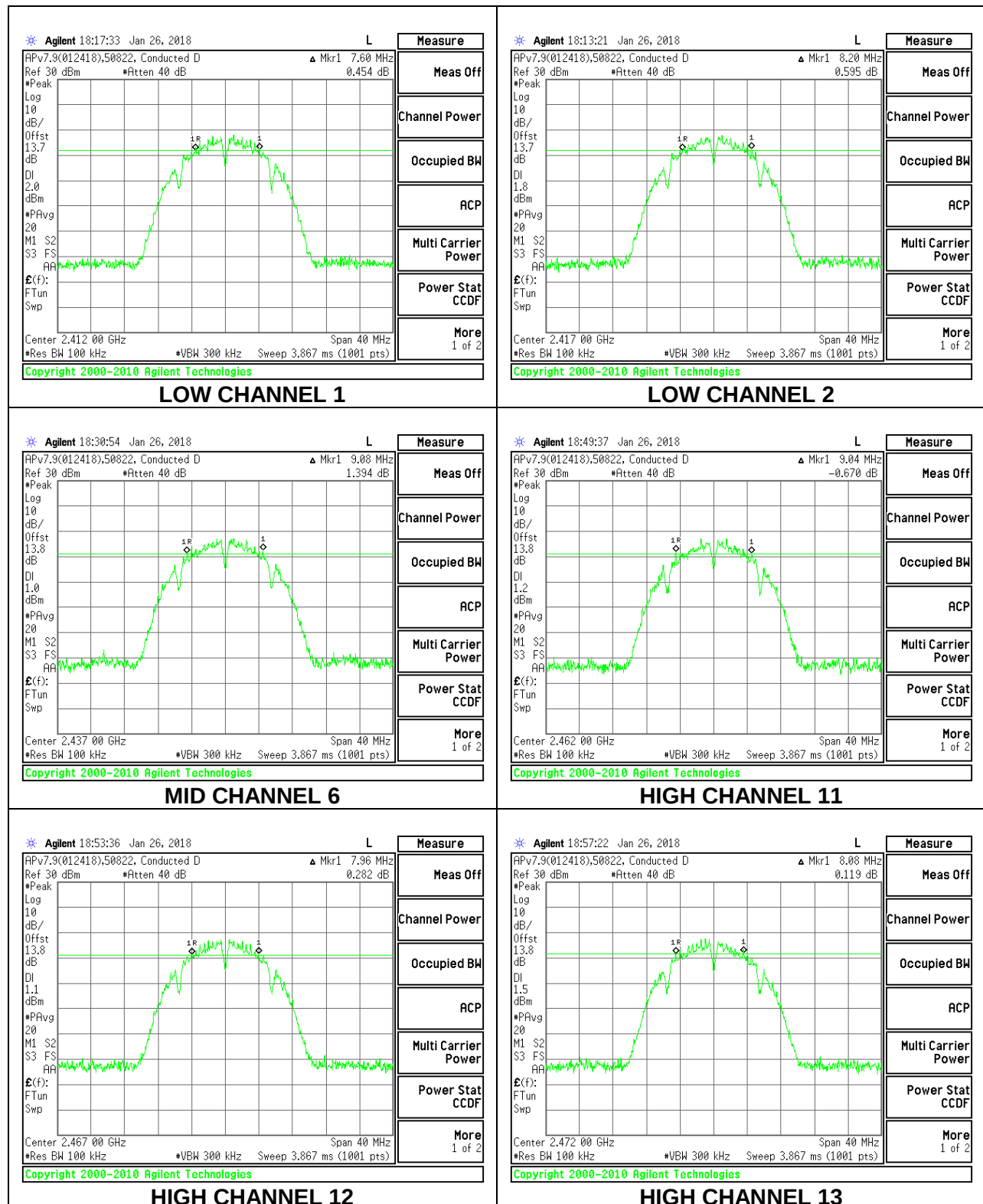
1TX Antenna 4

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	8.12	0.5
Low 2	2417	7.48	0.5
Mid 6	2437	7.60	0.5
High 11	2462	8.08	0.5
High 12	2467	8.00	0.5
High 13	2472	7.56	0.5



1TX Antenna 3

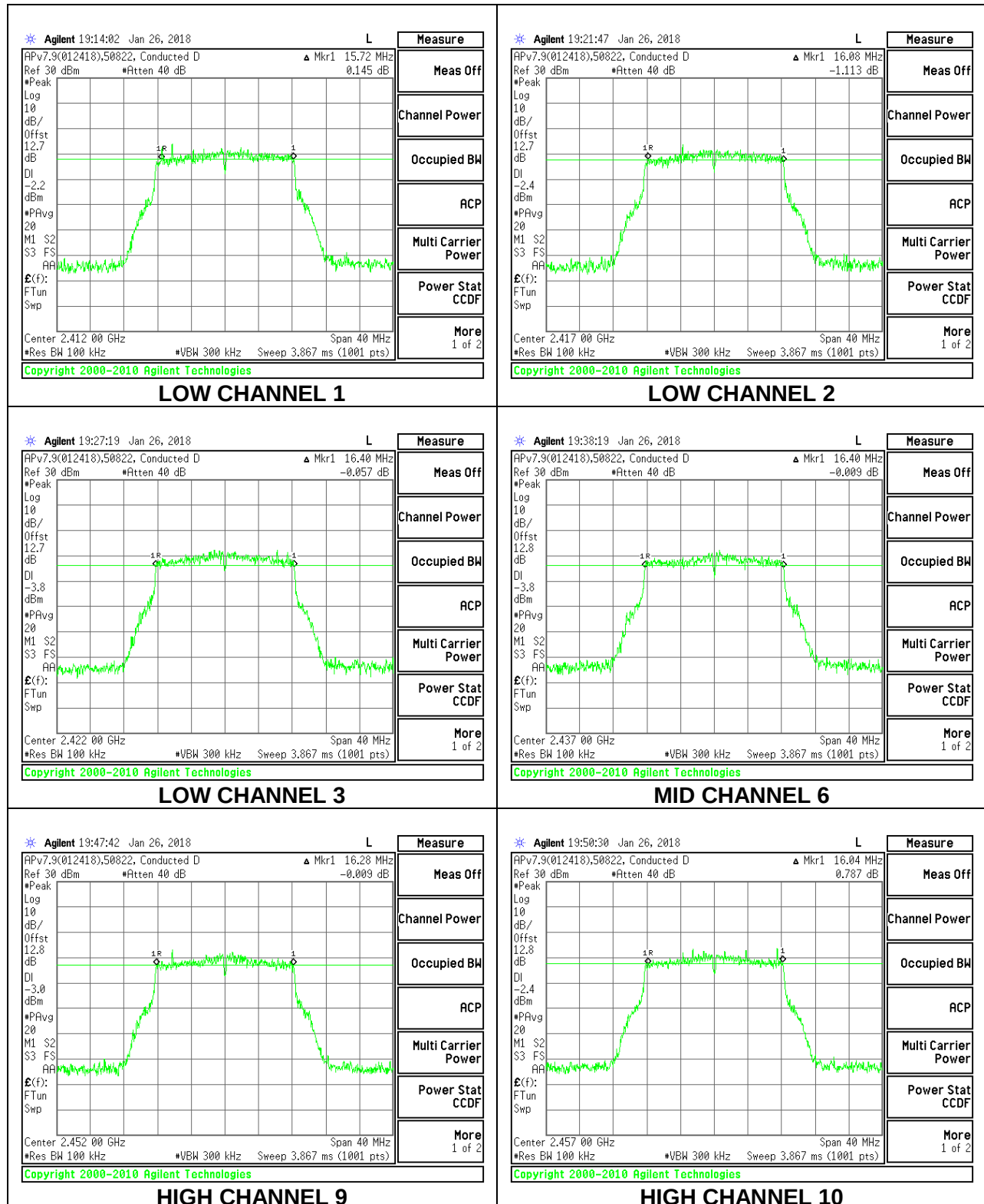
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	7.60	0.5
Low 2	2417	8.20	0.5
Mid 6	2437	9.08	0.5
High 11	2462	9.04	0.5
High 12	2467	7.96	0.5
High 13	2472	8.08	0.5

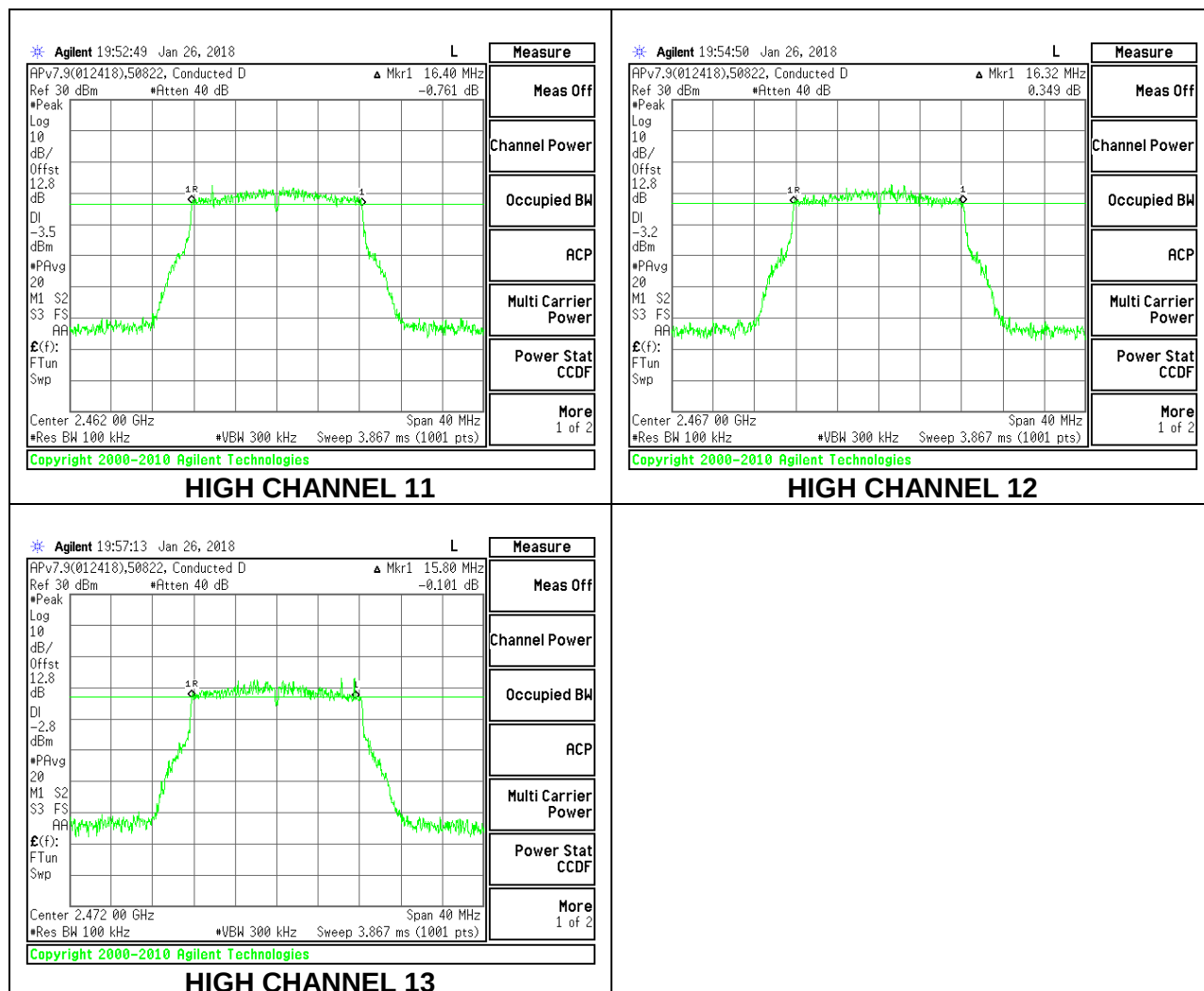


8.3.2. 802.11n HT20 MODE

1TX Antenna 4

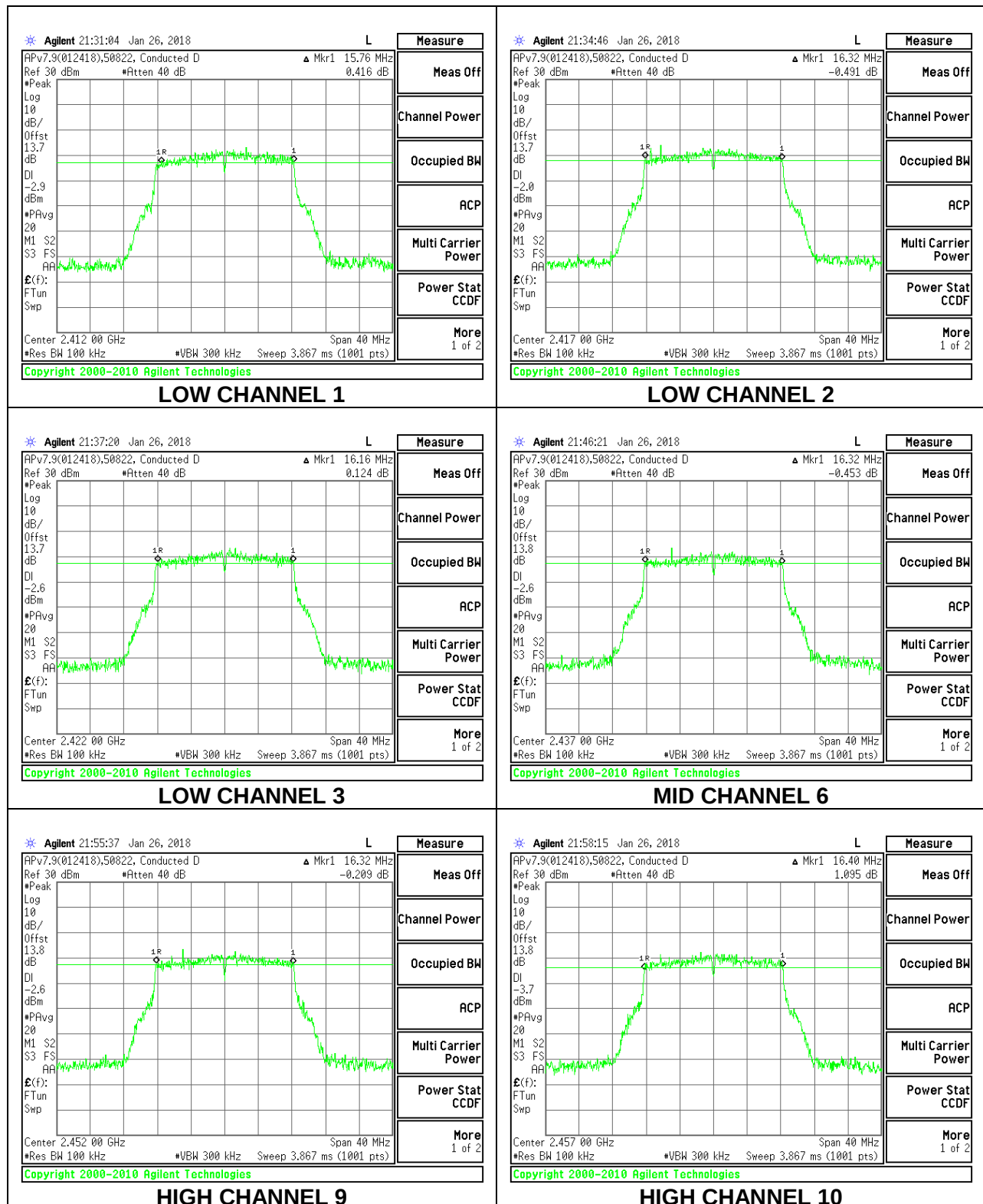
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	15.72	0.5
Low 2	2417	16.08	0.5
Low 3	2422	16.40	0.5
Mid 6	2437	16.40	0.5
High 9	2452	16.28	0.5
High 10	2457	16.04	0.5
High 11	2462	16.40	0.5
High 12	2467	16.32	0.5
High 13	2472	15.80	0.5

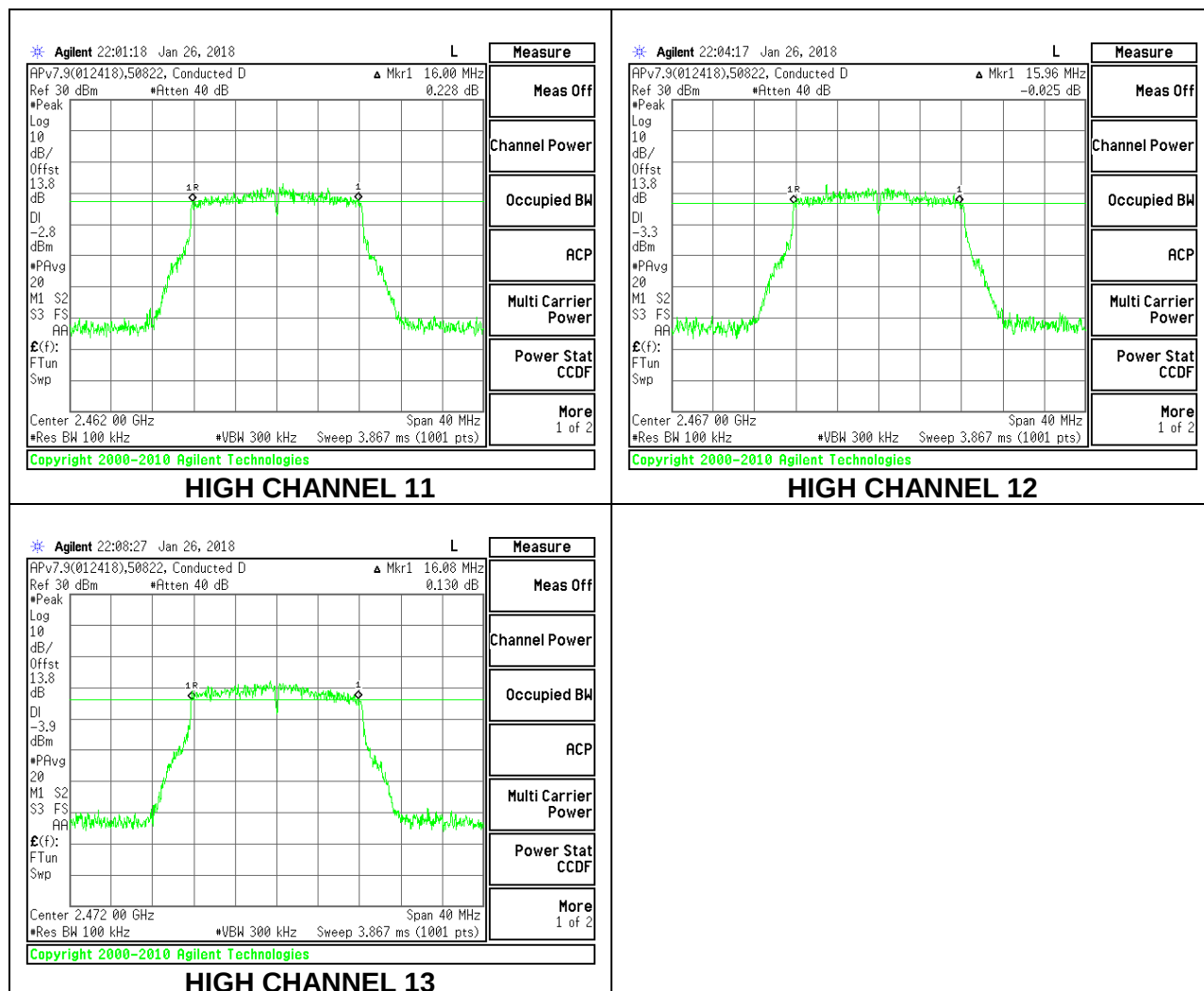




1TX Antenna 3

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	15.76	0.5
Low 2	2417	16.32	0.5
Low 3	2422	16.16	0.5
Mid 6	2437	16.32	0.5
High 9	2452	16.32	0.5
High 10	2457	16.40	0.5
High 11	2462	16.00	0.5
High 12	2467	15.96	0.5
High 13	2472	16.08	0.5

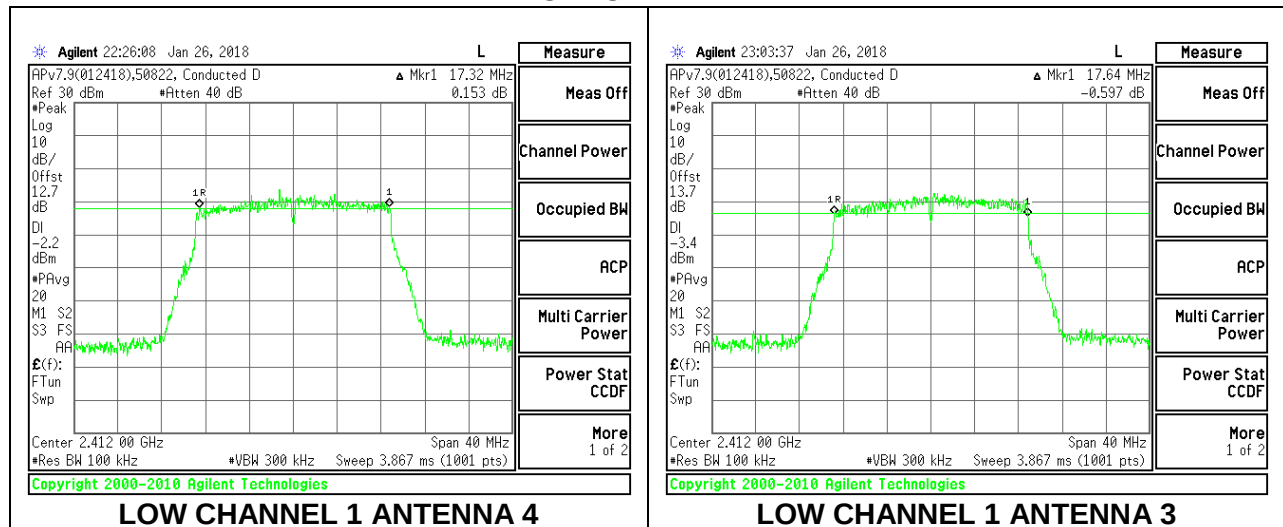




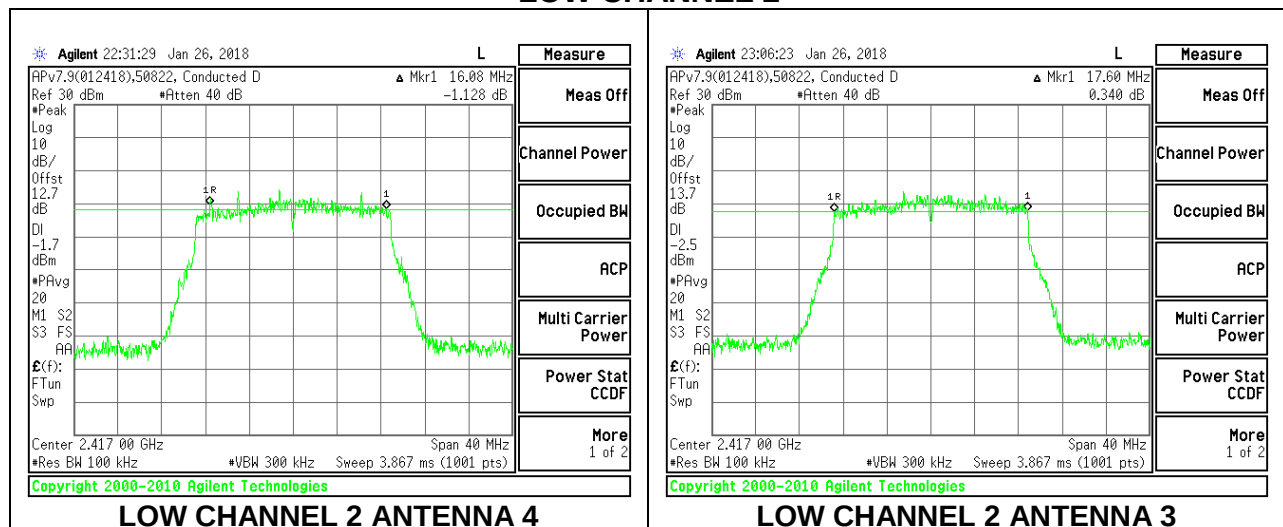
2TX Antenna 4 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	6 dB BW ANT 4 (MHz)	6 dB BW ANT 3 (MHz)	Minimum Limit (MHz)
Low 1	2412	17.32	17.64	0.5
Low 2	2417	16.08	17.60	0.5
Low 3	2422	17.36	17.28	0.5
Low 4	2427	17.56	17.60	0.5
Mid 6	2437	17.60	17.56	0.5
High 8	2447	17.56	17.60	0.5
High 9	2452	17.60	17.60	0.5
High 10	2457	17.68	17.16	0.5
High 11	2462	17.16	17.52	0.5
High 12	2467	16.76	17.16	0.5
High 13	2472	16.92	17.16	0.5

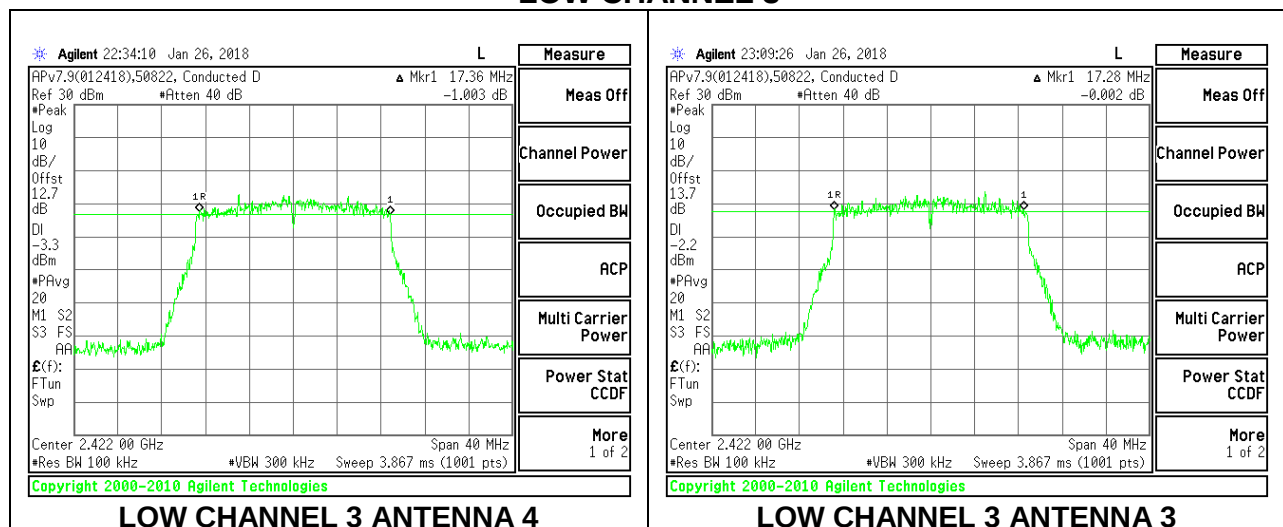
LOW CHANNEL 1



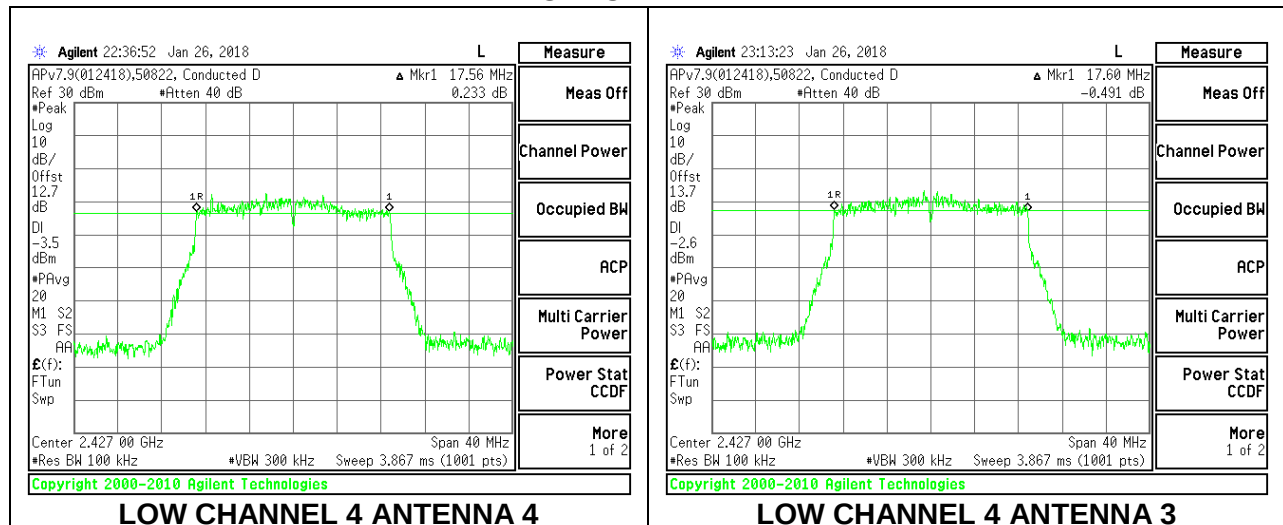
LOW CHANNEL 2



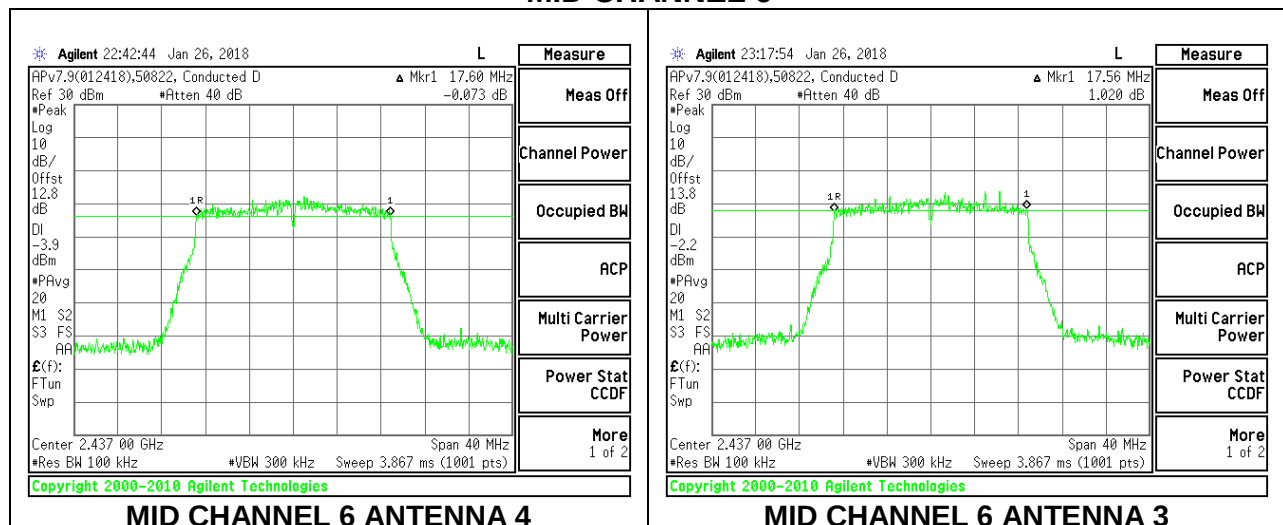
LOW CHANNEL 3



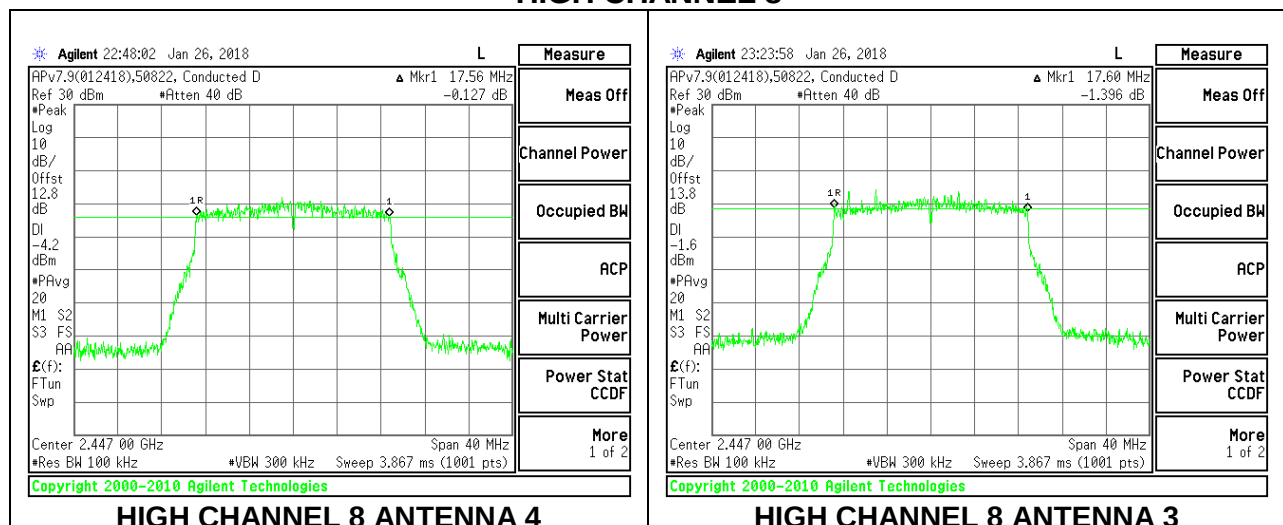
LOW CHANNEL 4



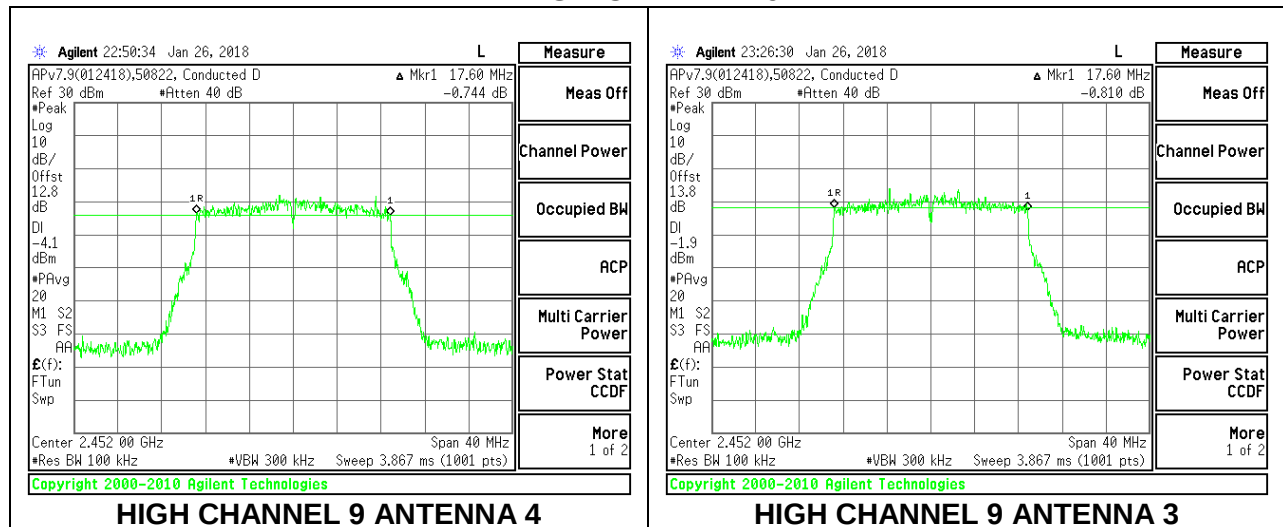
MID CHANNEL 6



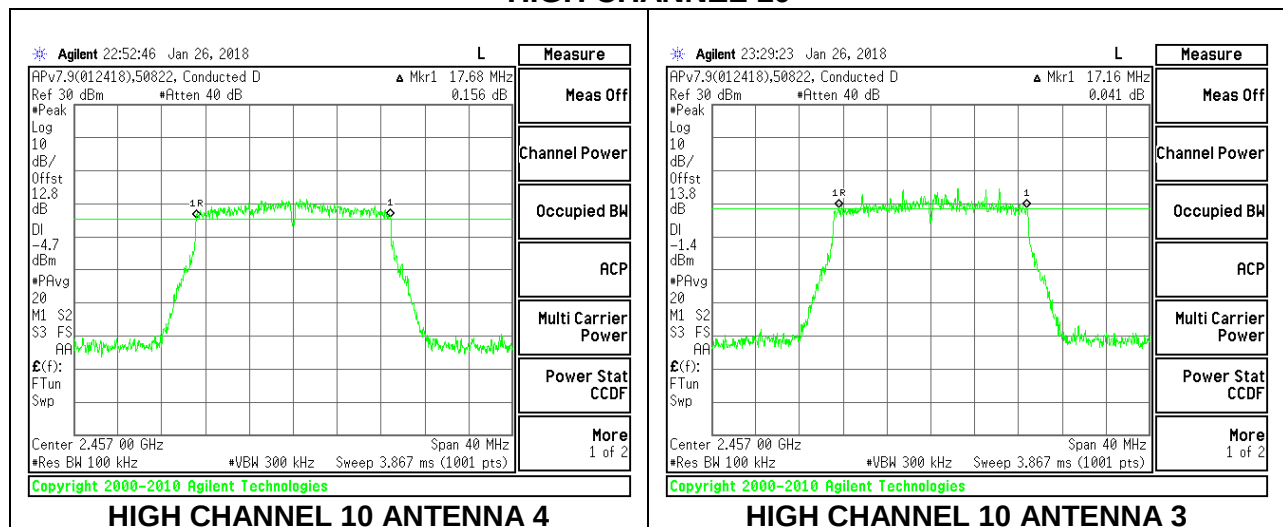
HIGH CHANNEL 8



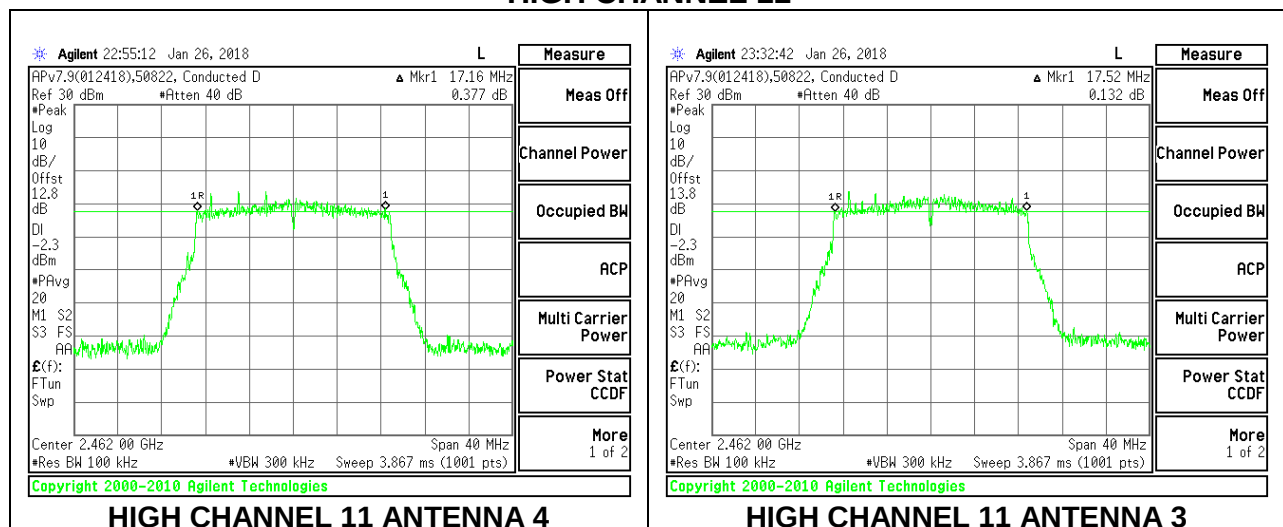
HIGH CHANNEL 9



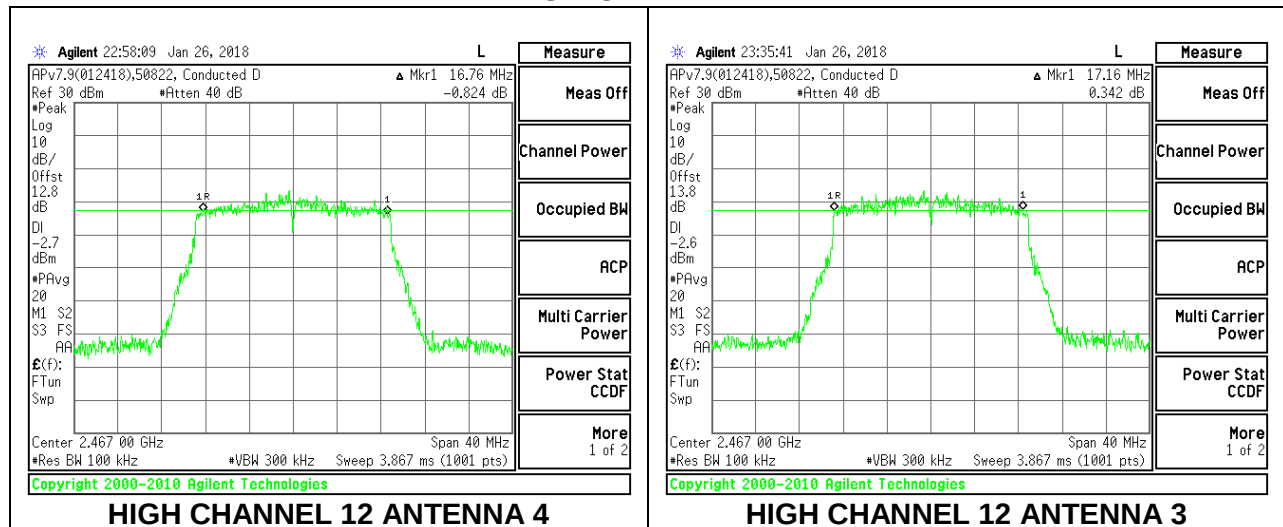
HIGH CHANNEL 10



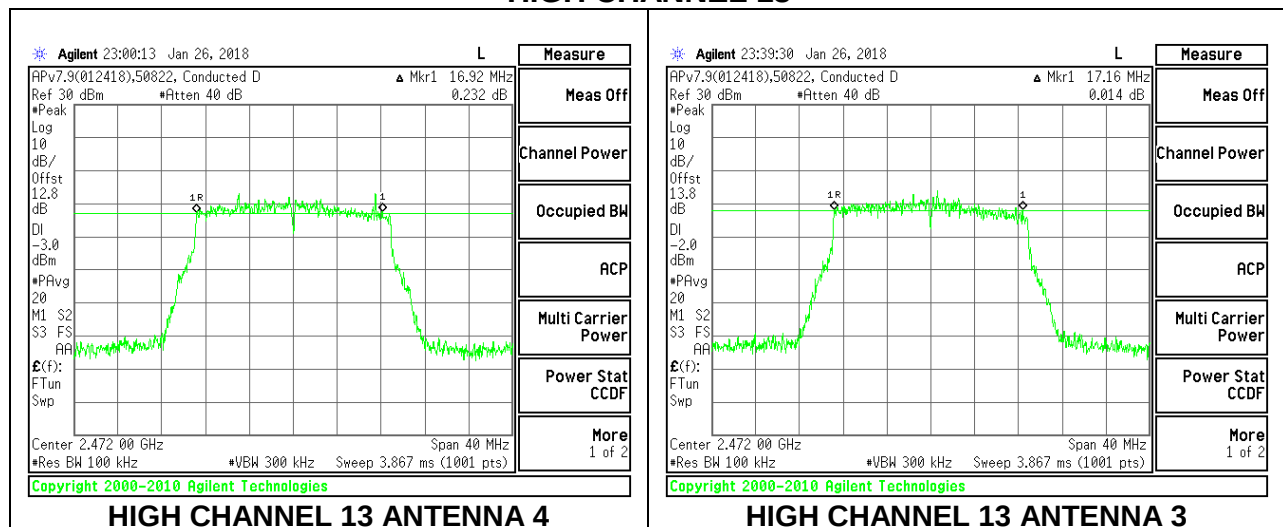
HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13



8.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

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

TEST PROCEDURE

The transmitter output is connected to a gated average reading power meter

The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

DIRECTIONAL ANTENNA GAIN

For 1 TX:

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

For 2 TX:

Tx chains are uncorrelated for power and correlated for PSD due to the device supporting CDD in all MIMO modes. The directional gains are as follows:

Band (GHz)	Antenna 4 Gain (dBi)	Antenna 3 Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)	Correlated Chains Directional Gain (dBi)
2.4	-2.80	-4.10	-3.40	-0.42

RESULTS

8.4.1. 802.11b MODE

ID:	44366	Date:	5/3/18
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1TX ANT. 4

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low_1	2412	-2.80	30.00	30	36	30.00
Low_2	2417	-2.80	30.00	30	36	30.00
Mid	2437	-2.80	30.00	30	36	30.00
High_11	2462	-2.80	30.00	30	36	30.00
High_12	2467	-2.80	30.00	30	36	30.00
High_13	2472	-2.80	30.00	30	36	30.00

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power
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Results

Channel	Frequency (MHz)	Measured Peak Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low_1	2412	19.30	19.30	30.00	-10.70
Low_2	2417	19.47	19.47	30.00	-10.53
Mid	2437	19.44	19.44	30.00	-10.56
High_11	2462	19.41	19.41	30.00	-10.59
High_12	2467	19.48	19.48	30.00	-10.52
High_13	2472	18.96	18.96	30.00	-11.04

ID:	44366	Date:	5/3/18
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1TX ANT. 3

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low_1	2412	-4.10	30.00	30	36	30.00
Low_2	2417	-4.10	30.00	30	36	30.00
Mid	2437	-4.10	30.00	30	36	30.00
High_11	2462	-4.10	30.00	30	36	30.00
High_12	2467	-4.10	30.00	30	36	30.00
High_13	2472	-4.10	30.00	30	36	30.00

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power
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Results

Channel	Frequency (MHz)	Measured Peak Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low_1	2412	20.21	20.21	30.00	-9.79
Low_2	2417	21.83	21.83	30.00	-8.17
Mid	2437	21.92	21.92	30.00	-8.08
High_11	2462	21.90	21.90	30.00	-8.10
High_12	2467	20.46	20.46	30.00	-9.54
High_13	2472	18.84	18.84	30.00	-11.16

8.4.2. 802.11n HT20 MODE

ID:	44366	Date:	5/3/18
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1TX ANT. 4

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low_1	2412	-2.80	30.00	30	36	30.00
Low_2	2417	-2.80	30.00	30	36	30.00
Low_3	2422	-2.80	30.00	30	36	30.00
Mid_6	2437	-2.80	30.00	30	36	30.00
High_9	2452	-2.80	30.00	30	36	30.00
High_10	2457	-2.80	30.00	30	36	30.00
High_11	2462	-2.80	30.00	30	36	30.00
High_12	2467	-2.80	30.00	30	36	30.00
High_13	2472	-2.80	30.00	30	36	30.00

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power
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Results

Channel	Frequency (MHz)	Measured Peak Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low_1	2412	17.26	17.26	30.00	-12.74
Low_2	2417	19.25	19.25	30.00	-10.75
Low_3	2422	19.47	19.47	30.00	-10.53
Mid_6	2437	19.50	19.50	30.00	-10.50
High_9	2452	19.48	19.48	30.00	-10.52
High_10	2457	19.40	19.40	30.00	-10.60
High_11	2462	17.40	17.40	30.00	-12.60
High_12	2467	15.45	15.45	30.00	-14.55
High_13	2472	7.94	7.94	30.00	-22.06

ID:	44366	Date:	5/3/18
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1TX ANT. 3

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low_1	2412	-4.10	30.00	30	36	30.00
Low_2	2417	-4.10	30.00	30	36	30.00
Low_3	2422	-4.10	30.00	30	36	30.00
Mid_6	2437	-4.10	30.00	30	36	30.00
High_9	2452	-4.10	30.00	30	36	30.00
High_10	2457	-4.10	30.00	30	36	30.00
High_11	2462	-4.10	30.00	30	36	30.00
High_12	2467	-4.10	30.00	30	36	30.00
High_13	2472	-4.10	30.00	30	36	30.00

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power
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Results

Channel	Frequency (MHz)	Measured Peak Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low_1	2412	17.27	17.27	30.00	-12.73
Low_2	2417	19.47	19.47	30.00	-10.53
Low_3	2422	21.87	21.87	30.00	-8.13
Mid_6	2437	21.89	21.89	30.00	-8.11
High-9	2452	21.84	21.84	30.00	-8.16
High-10	2457	19.36	19.36	30.00	-10.64
High_11	2462	17.37	17.37	30.00	-12.63
High_12	2467	15.34	15.34	30.00	-14.66
High_13	2472	7.81	7.81	30.00	-22.19

8.4.3. 2TX ANT. 4 + ANT. 3 CDD MODE

ID:	44366	Date:	5/3/18
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Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low_1	2412	-3.40	30.00	30	36	30.00
Low_2	2417	-3.40	30.00	30	36	30.00
Low_3	2422	-3.40	30.00	30	36	30.00
Low_4	2427	-3.40	30.00	30	36	30.00
Mid	2437	-3.40	30.00	30	36	30.00
High_8	2447	-3.40	30.00	30	36	30.00
High_9	2452	-3.40	30.00	30	36	30.00
High_10	2457	-3.40	30.00	30	36	30.00
High_11	2462	-3.40	30.00	30	36	30.00
High_12	2467	-3.40	30.00	30	36	30.00
High_13	2472	-3.40	30.00	30	36	30.00

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power
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Results

Channel	Frequency (MHz)	Ant 4	Ant 3	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
		Measured Peak Power (dBm)	Measured Peak Power (dBm)			
Low_1	2412	16.23	16.40	19.33	30.00	-10.67
Low_2	2417	18.35	18.46	21.42	30.00	-8.58
Low_3	2422	19.39	19.88	22.65	30.00	-7.35
Low_4	2427	19.44	21.92	23.86	30.00	-6.14
Mid	2437	19.38	21.94	23.86	30.00	-6.14
High_8	2447	19.43	21.83	23.80	30.00	-6.20
High_9	2452	19.34	19.77	22.57	30.00	-7.43
High_10	2457	18.24	18.30	21.28	30.00	-8.72
High_11	2462	16.27	16.20	19.25	30.00	-10.75
High_12	2467	14.42	14.27	17.36	30.00	-12.64
High_13	2472	6.87	6.97	9.93	30.00	-20.07

8.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

RSS-247 (5.2) (b)

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

RESULTS

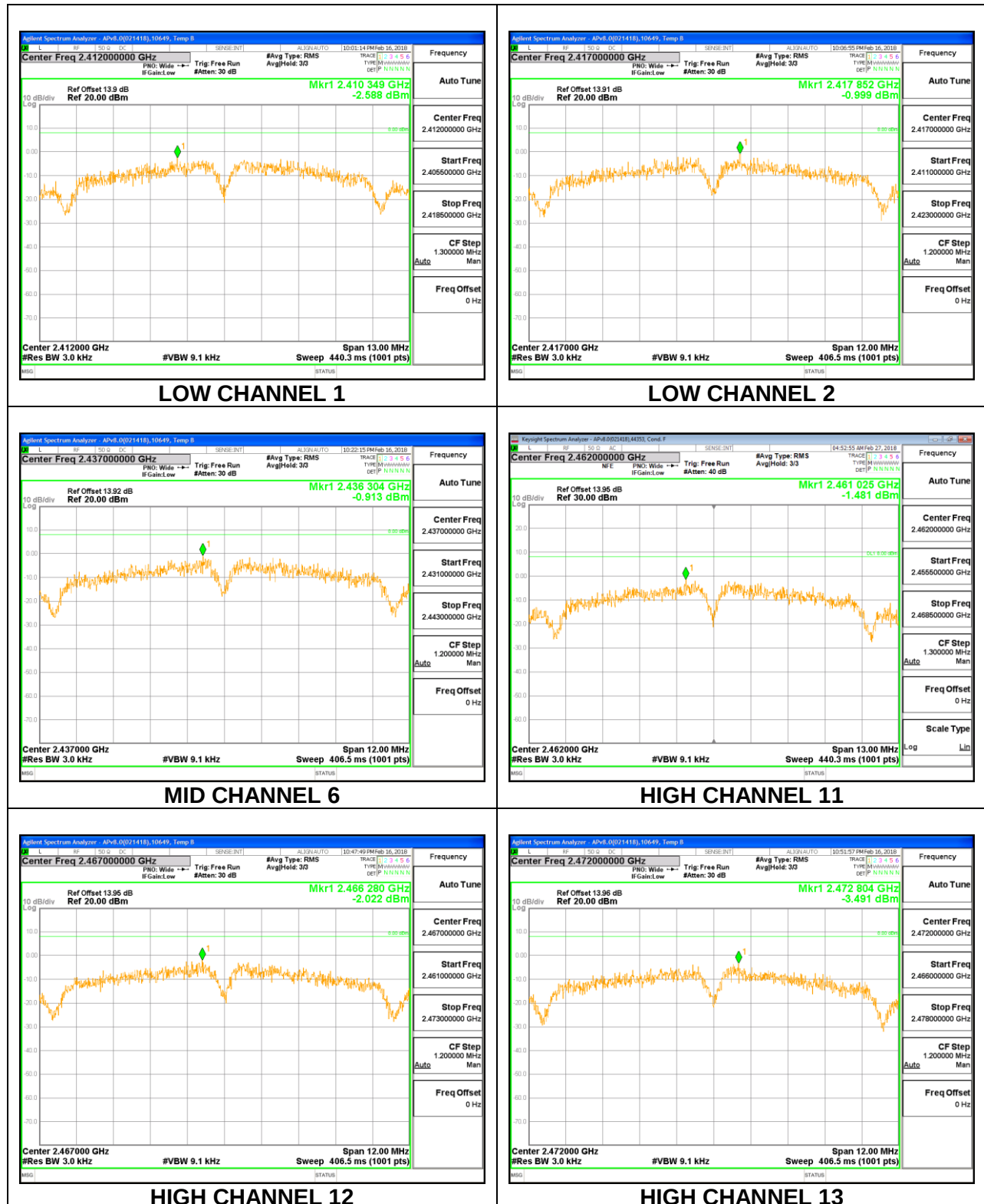
8.5.1. 802.11b MODE

1TX Antenna 4

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD
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PSD Results

Channel	Frequency (MHz)	Ant 4 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-2.59	-2.59	8.0	-10.6
Low 2	2417	-1.00	-1.00	8.0	-9.0
Mid 6	2437	-0.91	-0.91	8.0	-8.9
High 11	2462	-1.48	-1.48	8.0	-9.5
High 12	2467	-2.02	-2.02	8.0	-10.0
High 13	2472	-3.49	-3.49	8.0	-11.5

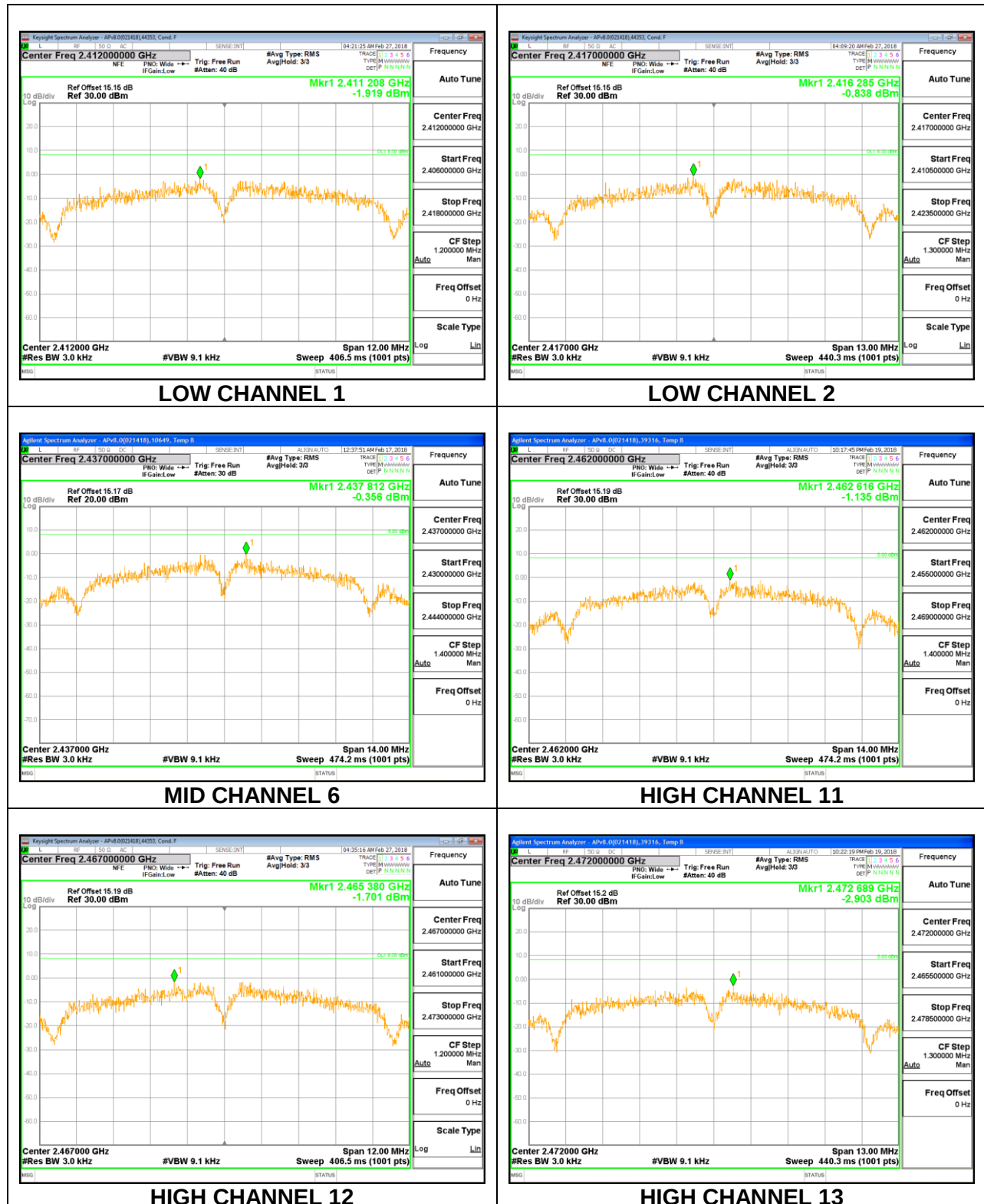


1TX Antenna 3

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD
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PSD Results

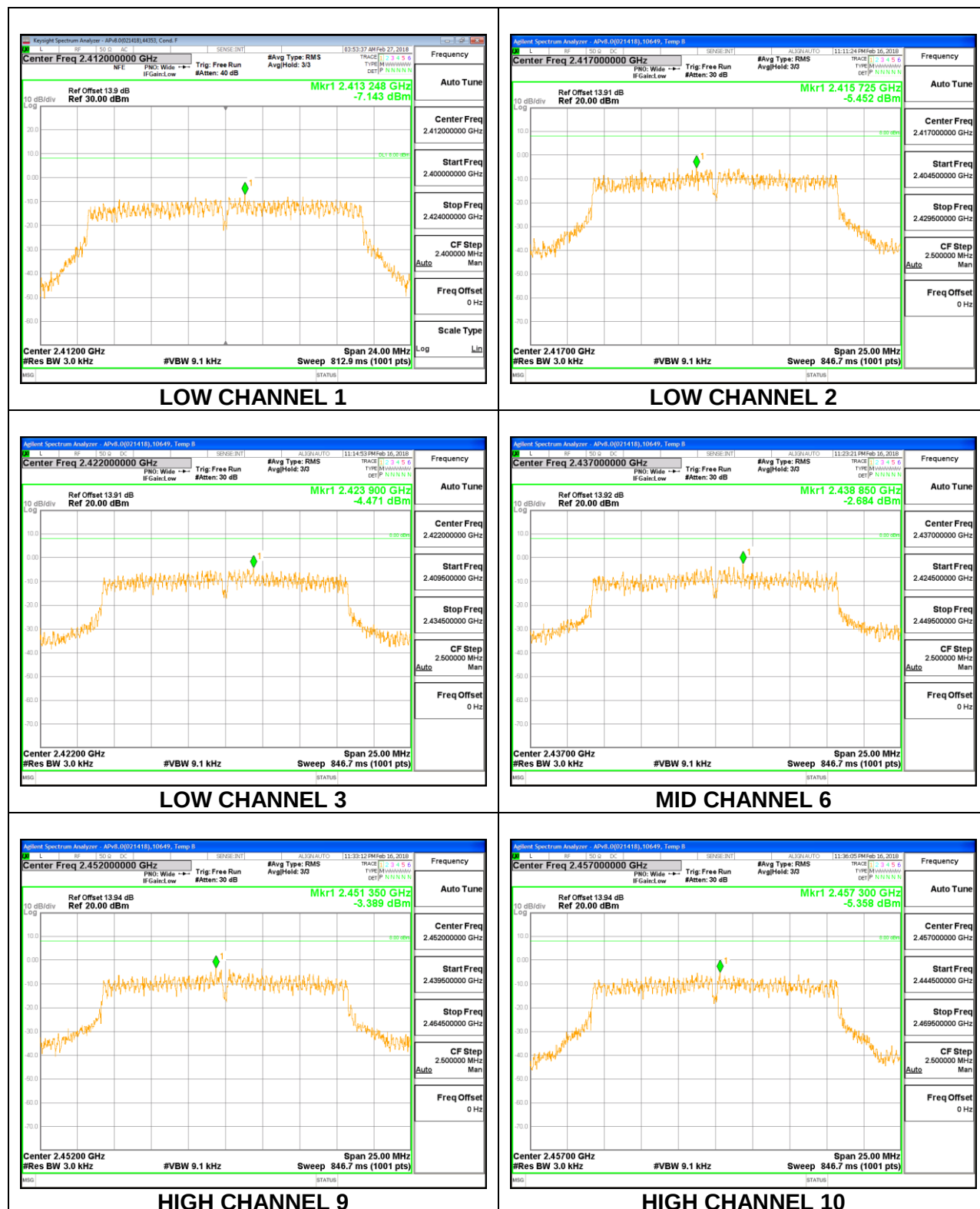
Channel	Frequency (MHz)	Ant 3 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-1.92	-1.92	8.0	-9.9
Low 2	2417	-0.84	-0.84	8.0	-8.8
Mid 6	2437	-0.36	-0.36	8.0	-8.4
High 11	2462	-1.14	-1.14	8.0	-9.1
High 12	2467	-1.70	-1.70	8.0	-9.7
High 13	2472	-2.90	-2.90	8.0	-10.9

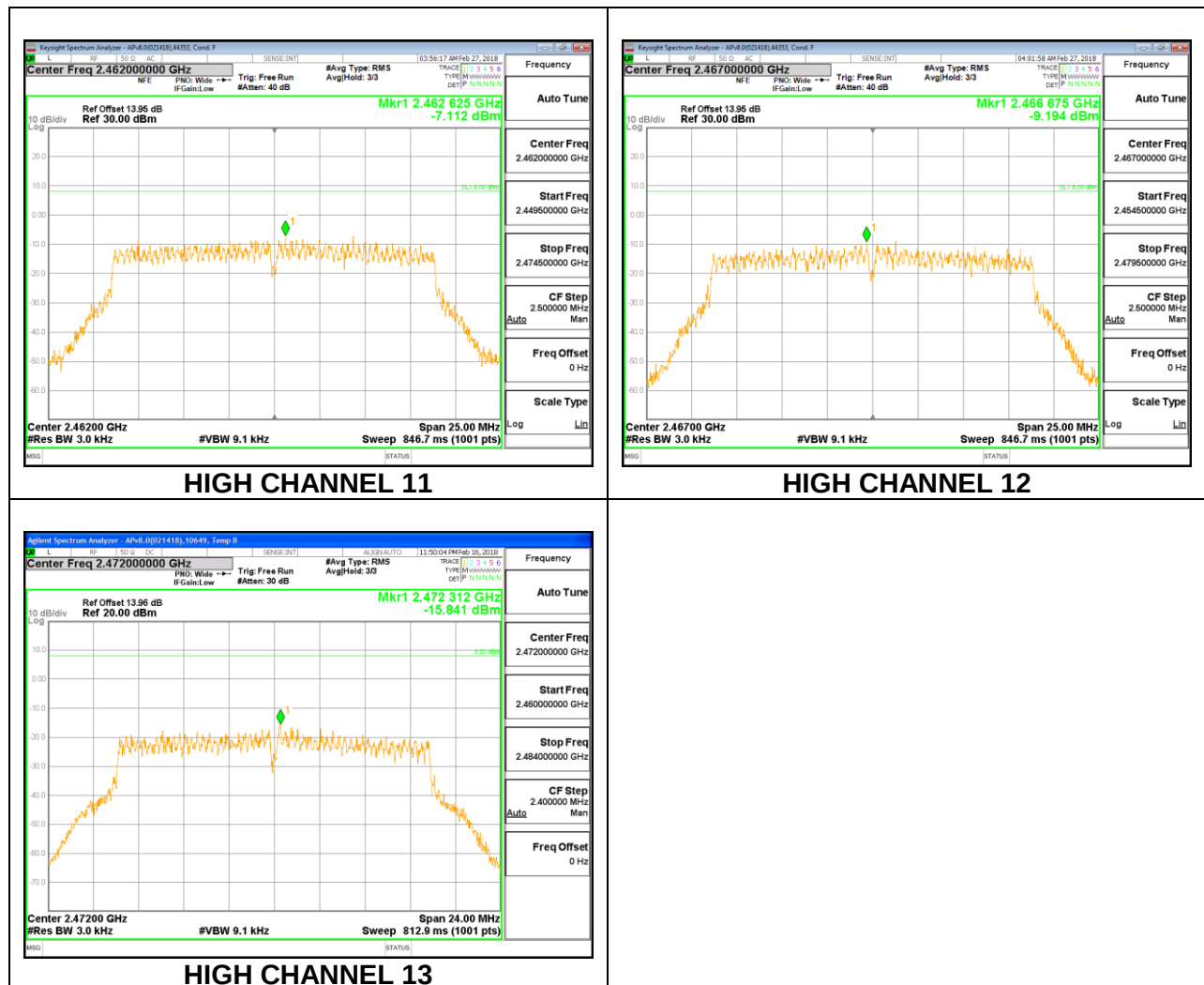


8.5.2. 802.11n HT20 MODE

1TX Antenna 4

Duty Cycle CF (dB)		0.00	Included in Calculations of Corr'd PSD		
PSD Results					
Channel	Frequency (MHz)	Ant 4 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-7.14	-7.14	8.0	-15.1
Low 2	2417	-5.45	-5.45	8.0	-13.5
Low 3	2422	-4.47	-4.47	8.0	-12.5
Mid 6	2437	-2.68	-2.68	8.0	-10.7
High 9	2452	-3.39	-3.39	8.0	-11.4
High 10	2457	-5.36	-5.36	8.0	-13.4
High 11	2462	-7.11	-7.11	8.0	-15.1
High 12	2467	-9.19	-9.19	8.0	-17.2
High 13	2472	-15.84	-15.84	8.0	-23.8





1TX Antenna 3

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD
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PSD Results

Channel	Frequency (MHz)	Ant 3 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-7.26	-7.26	8.0	-15.3
Low 2	2417	-5.13	-5.13	8.0	-13.1
Low 3	2422	-4.20	-4.20	8.0	-12.2
Mid 6	2437	-4.50	-4.50	8.0	-12.5
High 9	2452	-4.28	-4.28	8.0	-12.3
High 10	2457	-5.30	-5.30	8.0	-13.3
High 11	2462	-6.76	-6.76	8.0	-14.8
High 12	2467	-8.35	-8.35	8.0	-16.4
High 13	2472	-16.56	-16.56	8.0	-24.6

