CERTIFICATION TEST REPORT

Report Number. : 12148309-E4V3

Applicant	:	SONOS, INC. 614 CHAPALA STREET SANTA BARBARA, CA 93101, U.S.A
Model	:	S17
FCC ID	:	SBVRM017
IC	:	5373A-RM017
EUT Description	:	802.11 a/b/g/n 4x4 (HT20) Client Device
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART E ISED RSS-247 ISSUE 2 ISED RSS-GEN ISSUE 5

Date Of Issue:
July 30, 2019

Prepared by:
UL Verification Services Inc.
47173 Benicia Street
Fremont, CA 94538 U.S.A.
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NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	5/8/2019	Initial Issue	
V2	6/20/2019	Updated Section 5.5 & 7	K.Kedida
V3	7/30/2019	Updated Section 5.5	K.Kedida

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SONOS, INC.
614 CHAPALA STREET
SANTA BARBARA, CA 93101, U.S.A

EUT DESCRIPTION: 802.11 a/b/g/n 4x4 (HT20) Client Device

MODEL: S17

SERIAL NUMBER: 5C-AA-FD-D0-08-14 (Radiated Sample)
5C-AA-FD-D0-08-8E (Radiated Sample)
5C:FF:DD:00:03:69 (Conducted Sample)

DATE TESTED: February 25 to March 11, 2019

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart E	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. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

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:

Dan Coronia
Operations Leader
Consumer Technology Division
UL Verification Services Inc.

Reviewed By:

Kiya Kedida
Senior Project Engineer
Consumer Technology Division
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, FCC 14-30, FCC KDB 905462 D02 v02/D03 v01r02/D06 v02, FCC KDB 789033 D02 v02r01, ANSI C63.10-2013, FCC 06-96, 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, and 47658 Kato Road, 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	47658 Kato Rd.
☐ Chamber A	☐ Chamber D	☐ Chamber I
☐ Chamber B	☐ Chamber E	☒ Chamber J
☐ Chamber C	☐ Chamber F	☒ Chamber K
	☐ Chamber G	☐ Chamber L
	☐ Chamber H	

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code: 2324A.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

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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

RADIATED EMISSIONS

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

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

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	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

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

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5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The EUT is an 802.11 a/b/g/n 4x4 (HT20) Client Device. Product model S17 is a high-performance wireless speaker and part of the Sonos sound system. The device's primary function will be for streaming via WiFi, but also features Bluetooth audio streaming and Bluetooth Low Energy, used for simplified set-up.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.2 GHz band, 4TX			
5180-5240	802.11a	18.38	68.87
5180-5240	802.11n HT20	19.66	92.47
5.3 GHz band, 4TX			
5260-5320	802.11a	18.48	70.47
5260-5320	802.11n HT20	21.55	142.89
5.6 GHz band, 4TX			
5500-5700	802.11a	17.62	57.81
5500-5700	802.11n HT20	20.12	102.80
5.8 GHz band, TX			
5725-5850	802.11a	22.87	193.64
5725-5850	802.11n HT20	25.32	340.41

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5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes FPC and PCB antenna, with maximums gain per chain as follows:

Frequency (MHz)	5GHz Max Antenna Gain dBi			
	Chain 0 (Horizontal Polarization)	Chain 1 (Horizontal Polarization)	Chain 2 (Vertical Polarization)	Chain 3 (Vertical Polarization)
5180 - 5850	3.4	3.4	4	3.8

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was Sonos Compliance GUI 4.0.

5.5. WORST-CASE CONFIGURATION AND MODE

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

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

The EUT can only be setup in desktop orientation; therefore, all radiated testing was performed with the EUT in desktop orientation. The test set-up includes the power supply and USB-C Cord. Note that the USB-C Cord is not supplied with the product, it is used as support equipment for testing purposes only.

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

802.11a mode: 6 Mbps
802.11n HT20mode: MCS0

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	X230	SON-00002240	N/A
AC Adapter	Lenovo	42T4418	11S42T4418Z1ZGWG0B5776	N/A

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC Power	1	AC	Unshielded	2	AC Mains to EUT
2	Ethernet	1	RJ45	Unshielded	10	Ethernet to Ethernet converter
3	Ethernet to USB	1	RJ45 to USB	Unshielded	0.2	USB to USB adapter
4	USB adapter to USB C	1	USB to USB C	Unshielded	0.12	USB C to EUT
5	DC Power	1	DC	Shielded	1.2	AC/DC Adapter to Laptop
6	AC Power	1	AC	Unshielded	1	AC Mains to AC/DC Adapter

TEST SETUP

The EUT connected to support laptop via the ethernet cable during testing.
The test utility software on support laptop exercised the radio card.
For radiated testing, the support laptop was set up outside the chamber.

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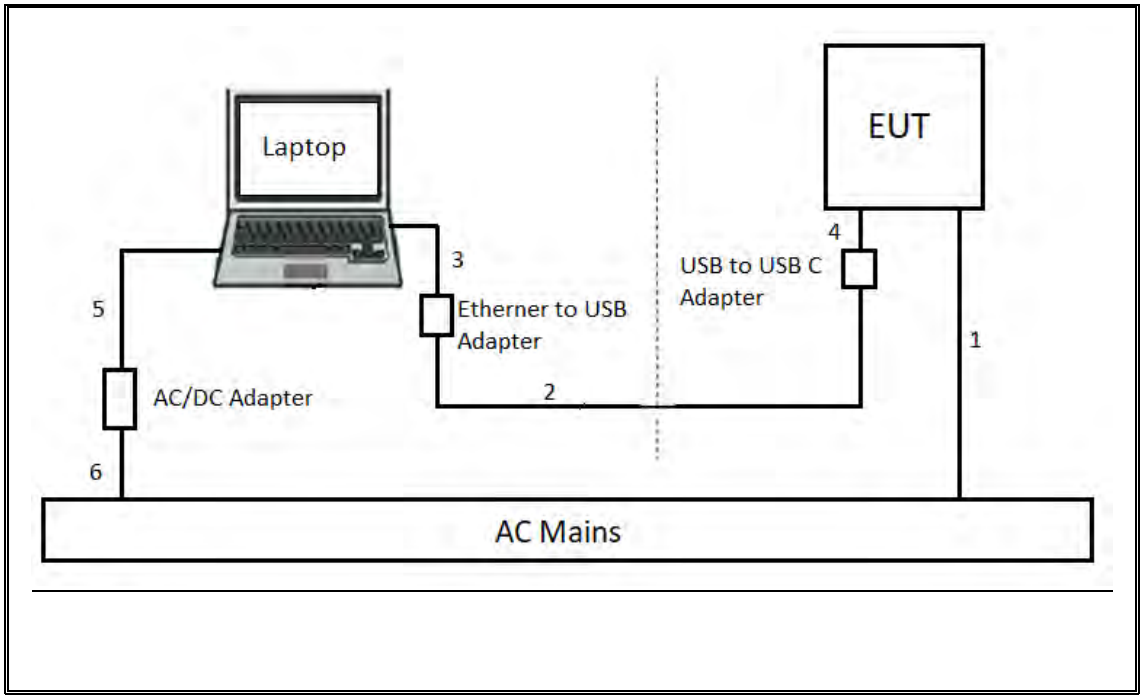
SETUP DIAGRAM



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6. MEASUREMENT METHOD

On Time and Duty Cycle: KDB 789033 D02 v02r01, Section B.

6 dB Emission BW: KDB 789033 D02 v02r01, Section C.2

26 dB Emission BW: KDB 789033 D02 v02r01, Section C.1

99% Occupied BW: KDB 789033 D02 v02r01, Section D.

Conducted Output Power: KDB 789033 D02 v02r01, Sections II.E.3.b (Method PM-G) & II.E.2.b (Method SA-1).

Power Spectral Density: KDB 789033 D02 v02r01, Section F

Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4

Unwanted emissions: KDB 789033 D02 v02r01, Sections II.G.3 – II.G.6.

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

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7. 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**	**ID Num**	**Cal Due**	**Last Cal**
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	PRE0180174	05/31/2019	05/31/2018
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	175953	12/13/2019	12/13/2018
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	AT0067	03/26/2019	03/26/2018
Amplifier, 1-7GHz, 24dB	AMPLICAL	AMP1G7-24-27	T1608	07/30/2019	07/30/2018
Amplifier, 1-7GHz, 24dB	AMPLICAL	AMP1G7-24-27	T1609	11/03/2019	11/03/2018
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179372	05/04/2019	05/04/2018
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179375	05/08/2019	05/08/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1450	01/23/2020	01/23/2019
Power Sensor	ETS-Lindgren	7002-006	T1022	01/22/2020	01/22/2019
Hybrid Antenna, 30MHz to 3GHz	SunAR rf motion	JB3	PRE0181575	08/01/2019	08/01/2018
18 - 26.5 GHz Horn Antenna	ARA	MWH-1826/B	T448	03/13/2019	03/13/2018
Pre-Amp 1-26.5 GHz	Agilent	8449B	T404	03/09/2020	03/09/2019
26.5 – 40 GHz Horn Antenna	ARA	MWH-2640	T90	09/11/2019	09/11/2018
Pre-Amp 26-40GHz	MITEQ	NSTTA2640-35-HG	T1864	03/09/2020	03/09/2019
Antenna, Passive Loop 30Hz to 1MHz	ELETRO METRICS	EM-6871	PRE0179465	05/22/2019	05/22/2018
Antenna, Passive Loop 100kHz to 30MHz	ELETRO METRICS	EM-6872	PRE0179467	05/22/2019	05/22/2018
AC Line Conducted					
EMI Receiver	Rohde & Schwarz	ESR	T1436	02/14/2020	02/14/2019
LISN for Conducted Emissions CISPR-16	FCC INC.	FCC LISN 50/250	T1310	06/15/2019	06/15/2018

Test Software List			
Description	**Manufacturer**	**Model**	**Version**
Radiated Software	UL	UL EMC	Ver 9.5, June 22, 2018
Antenna Port Software	UL	UL RF	Ver 9.3.2, Jan. 07, 2019
AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

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)
802.11a	0.112	0.220	0.512	51.18%	2.91	8.897
802.11n HT20	0.118	0.210	0.563	56.27%	2.50	8.454

DUTY CYCLE 802.11a 1TX MODE

DUTY CYCLE 802.11n CDD MODE

8.2. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

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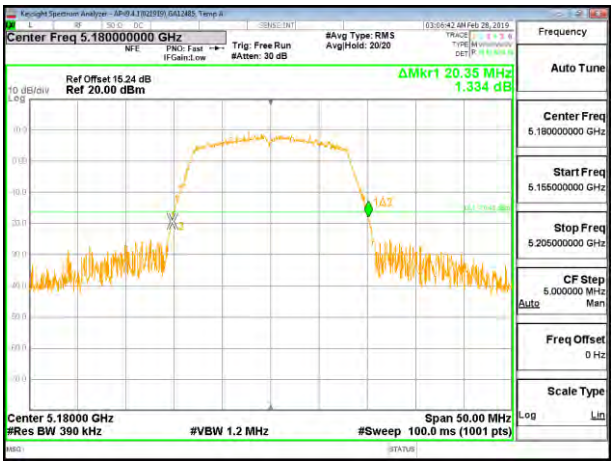
8.2.1. 802.11a MODE IN THE 5.2 GHz BAND

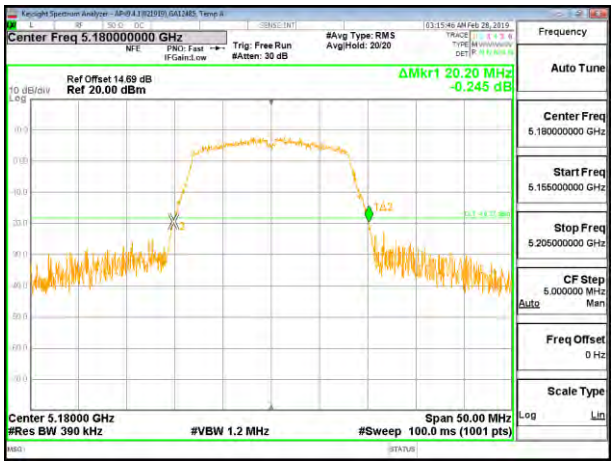
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Chain 0 (MHz)	26 dB Bandwidth Chain 1 (MHz)	26 dB Bandwidth Chain 2 (MHz)	26 dB Bandwidth Chain 3 (MHz)
Low	5180	20.35	20.20	20.25	20.05
Mid	5200	20.45	20.15	20.15	20.25
High	5240	20.35	20.25	20.20	19.90

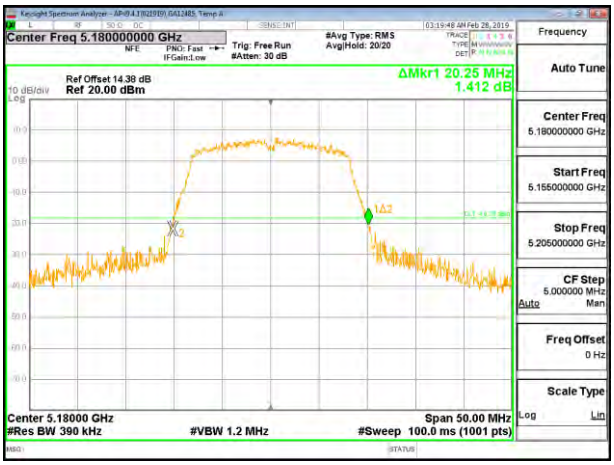
LOW CHANNEL



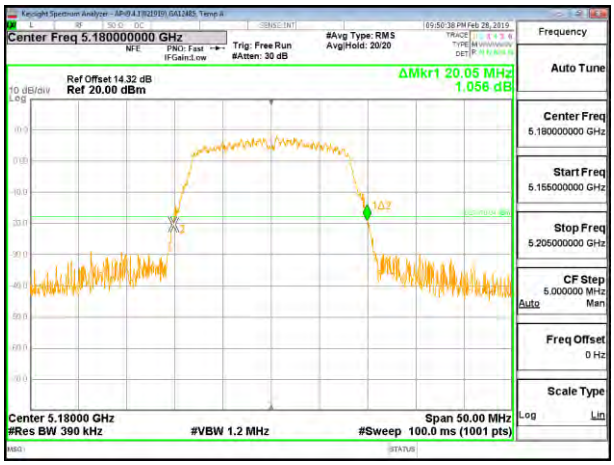
LOW CHANNEL CHAIN 0



LOW CHANNEL CHAIN 1

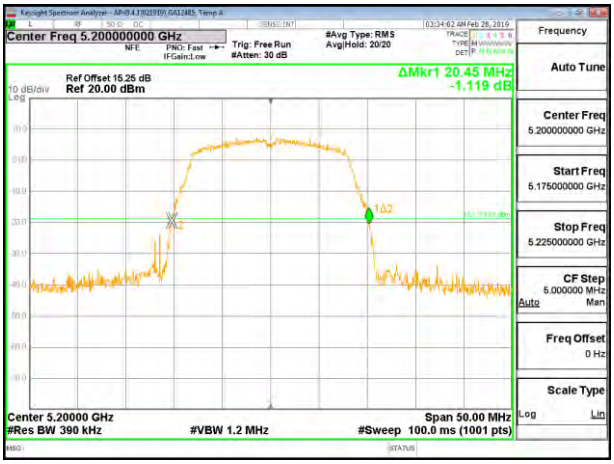


LOW CHANNEL CHAIN 2

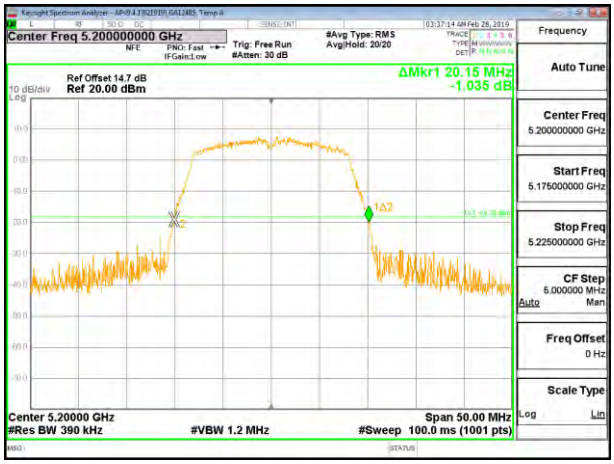


LOW CHANNEL CHAIN 3

MID CHANNEL



MID CHANNEL CHAIN 0



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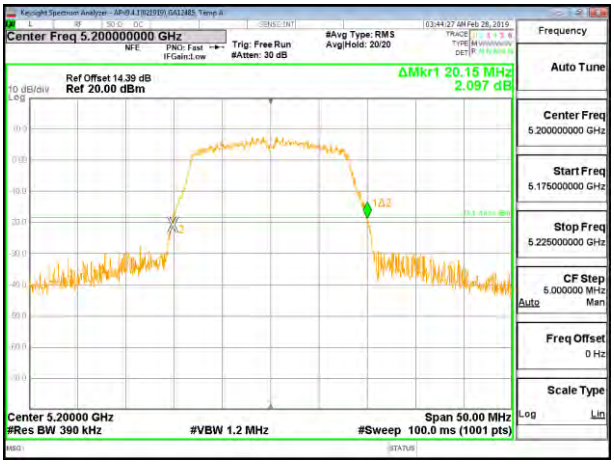
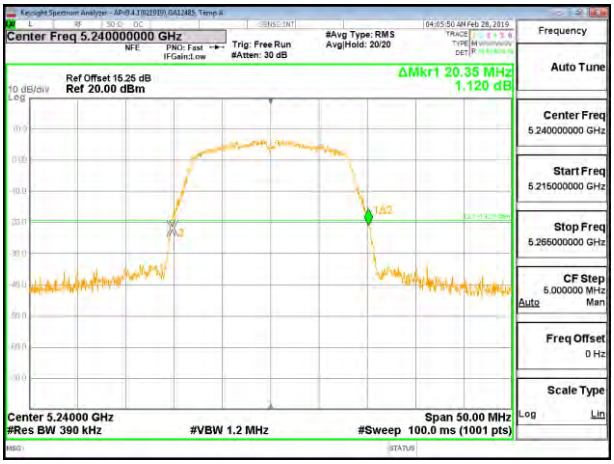


MID CHANNEL CHAIN 2

MID CHANNEL CHAIN 3

HIGH CHANNEL



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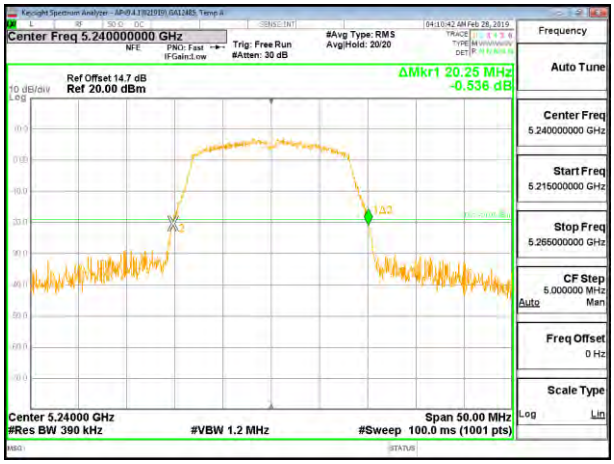

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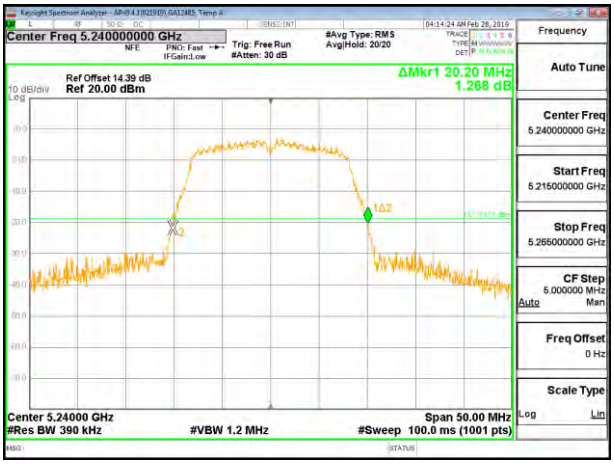
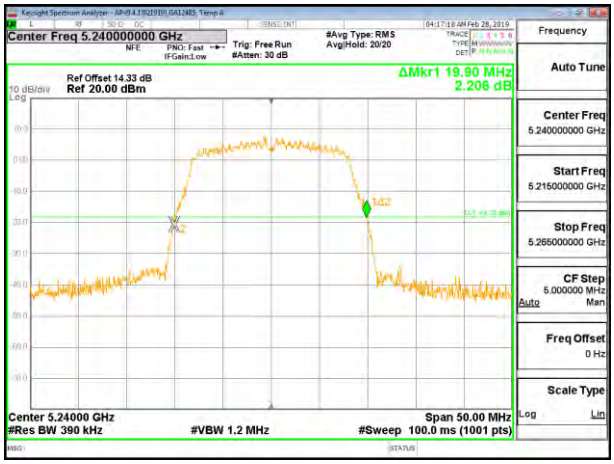


HIGH CHANNEL CHAIN 2



HIGH CHANNEL CHAIN 3

8.2.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Chain 0 (MHz)	26 dB Bandwidth Chain 1 (MHz)	26 dB Bandwidth Chain 2 (MHz)	26 dB Bandwidth Chain 3 (MHz)
Low	5180	20.80	20.40	20.50	20.40
Mid	5200	20.60	20.30	20.25	20.25
High	5240	20.50	20.25	20.45	20.25

LOW CHANNEL

LOW CHANNEL CHAIN 0

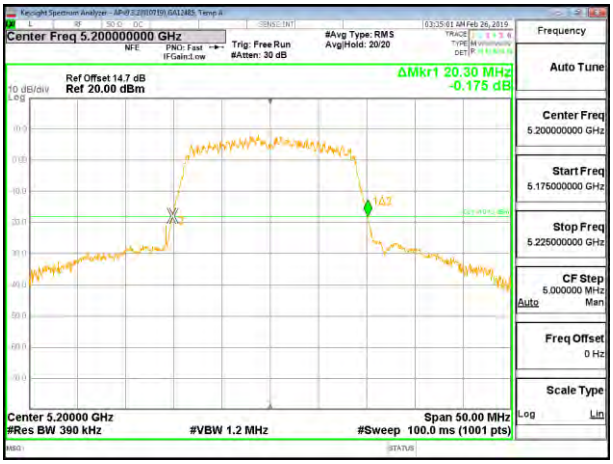
LOW CHANNEL CHAIN 1

LOW CHANNEL CHAIN 2

LOW CHANNEL CHAIN 3

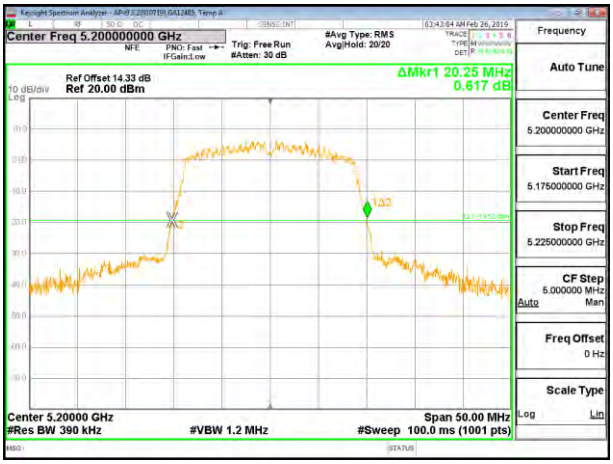
MID CHANNEL

MID CHANNEL CHAIN 0



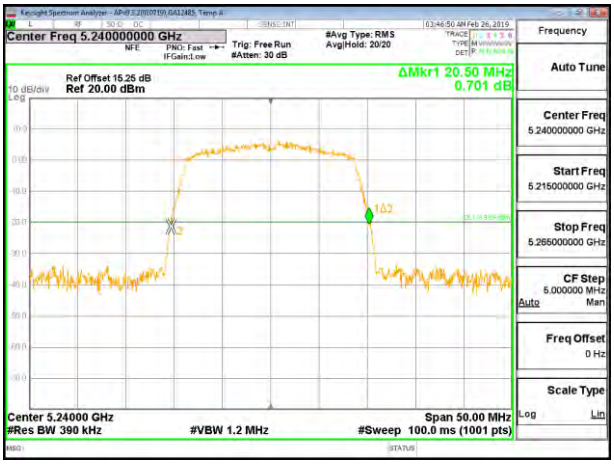
MID CHANNEL CHAIN 1

MID CHANNEL CHAIN 2



MID CHANNEL CHAIN 3

HIGH CHANNEL



HIGH CHANNEL CHAIN 0

HIGH CHANNEL CHAIN 1

HIGH CHANNEL CHAIN 2

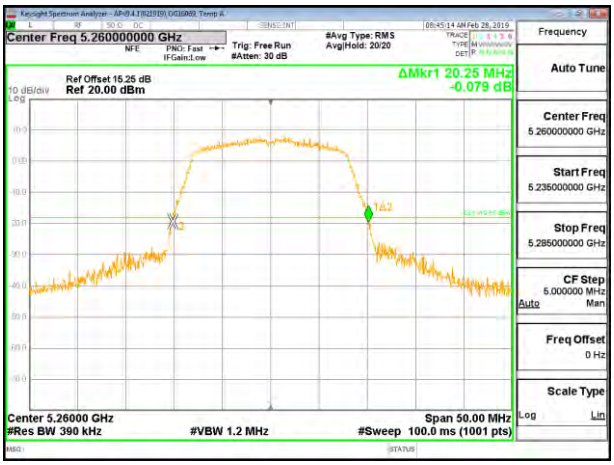
HIGH CHANNEL CHAIN 3

8.2.3. 802.11a MODE IN THE 5.3 GHz BAND

4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)	26 dB Bandwidth Antenna 3 (MHz)	26 dB Bandwidth Antenna 4 (MHz)
Low	5260	20.25	20.10	20.15	20.20
Mid	5300	20.40	20.15	20.05	20.05
High	5320	20.35	20.25	20.35	19.95

LOW CHANNEL



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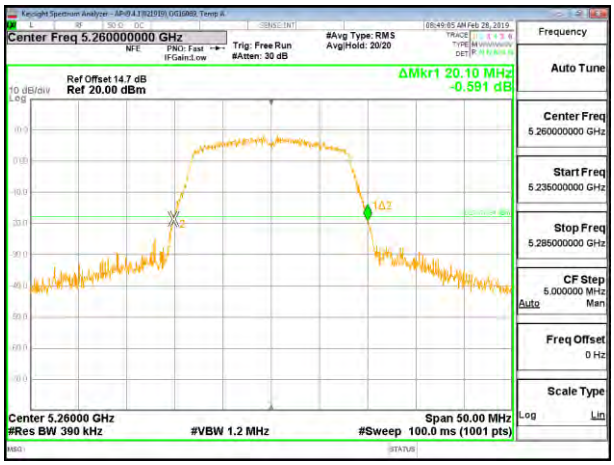
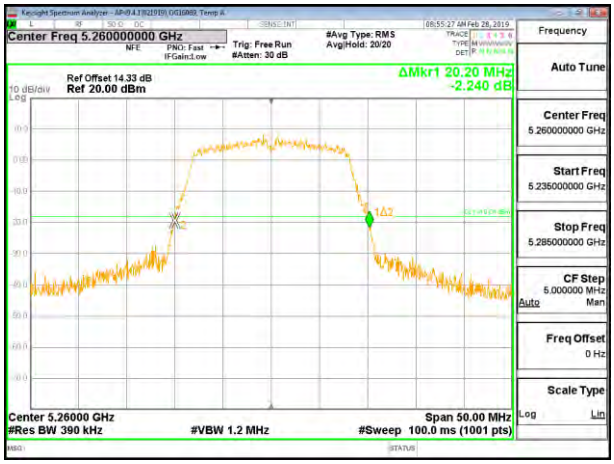


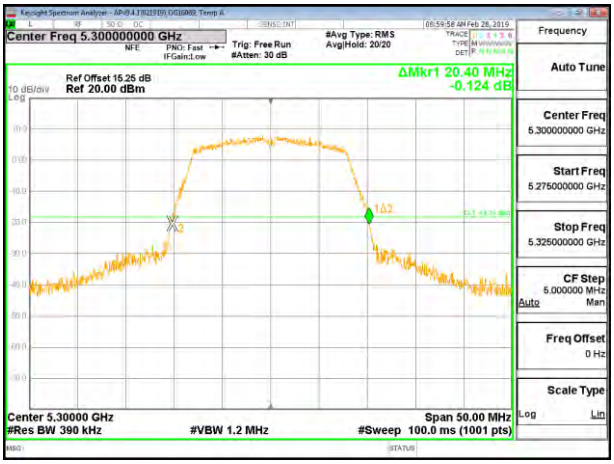
LOW CHANNEL CHAIN 1

LOW CHANNEL CHAIN 2

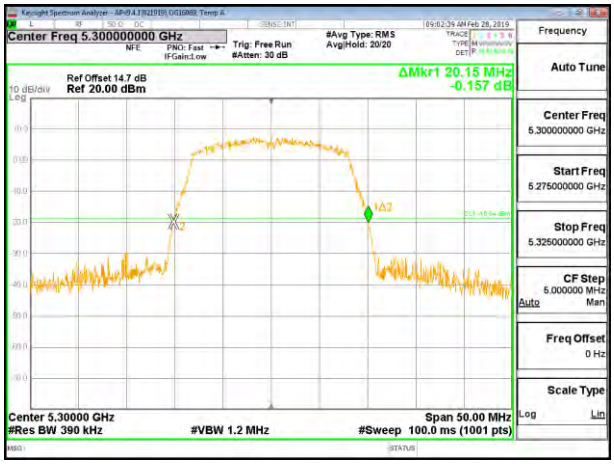


LOW CHANNEL CHAIN 3

MID CHANNEL



MID CHANNEL CHAIN 0



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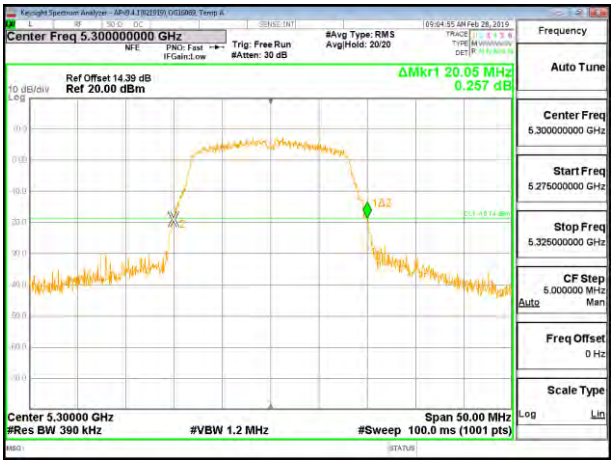
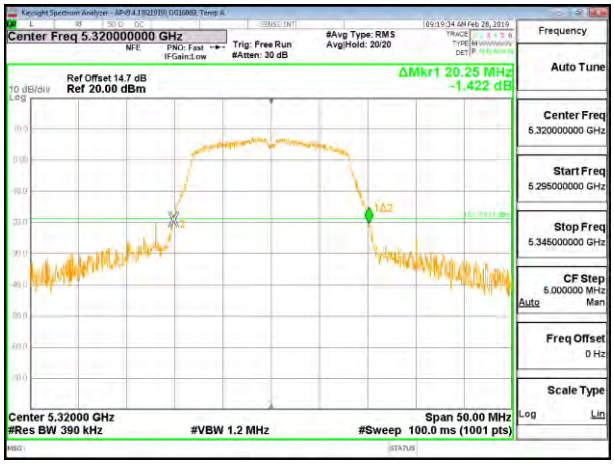


MID CHANNEL CHAIN 2

MID CHANNEL CHAIN 3

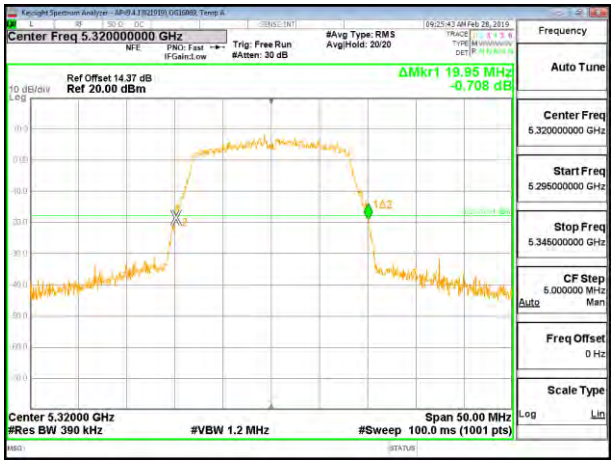
HIGH CHANNEL

HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1

HIGH CHANNEL CHAIN 2



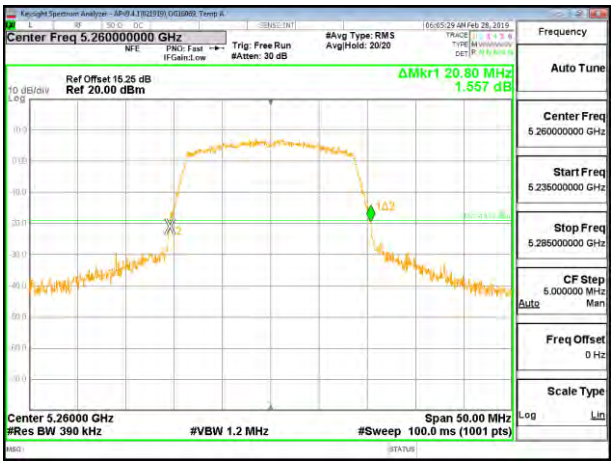
HIGH CHANNEL CHAIN 3

8.2.4. 802.11n HT20 MODE IN THE 5.3 GHz BAND

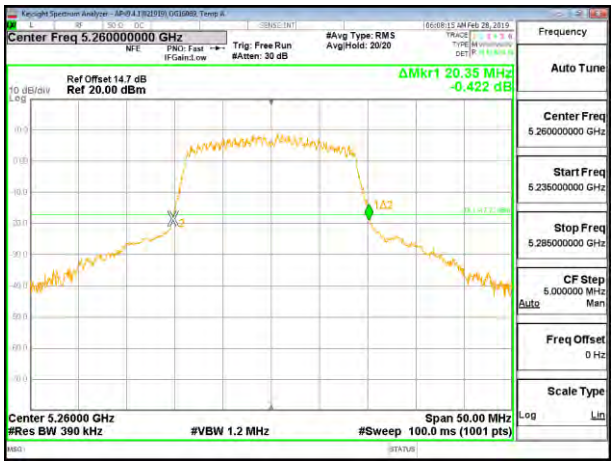
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)	26 dB Bandwidth Antenna 3 (MHz)	26 dB Bandwidth Antenna 4 (MHz)
Low	5260	20.80	20.35	20.60	20.35
Mid	5300	20.70	20.30	20.40	20.45
High	5320	20.65	20.45	20.45	20.50

LOW CHANNEL



LOW CHANNEL CHAIN 0

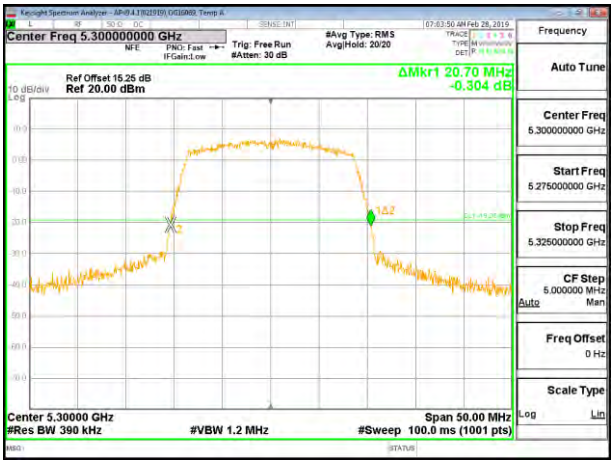


LOW CHANNEL CHAIN 1

LOW CHANNEL CHAIN 2

LOW CHANNEL CHAIN 3

MID CHANNEL



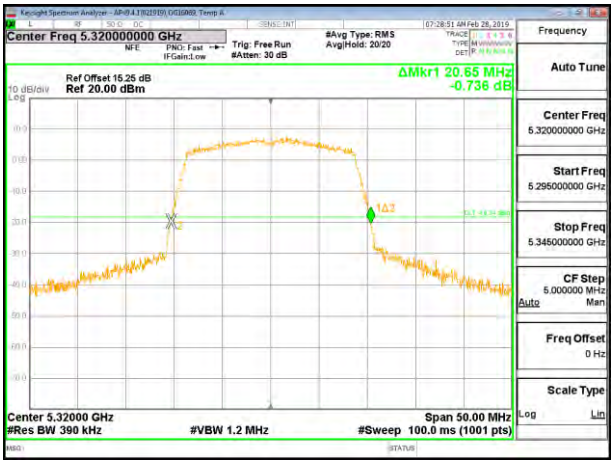
MID CHANNEL CHAIN 0

MID CHANNEL CHAIN 1

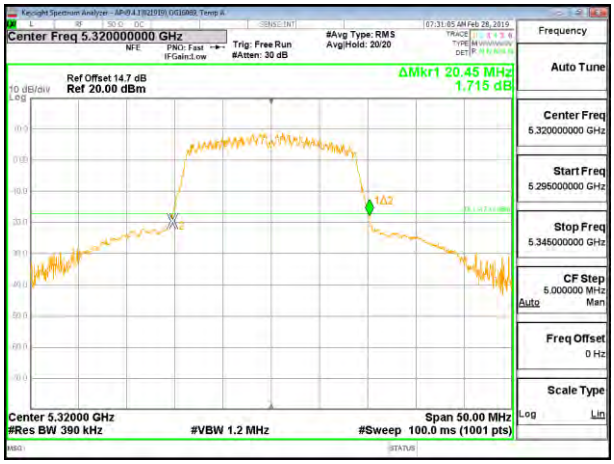
MID CHANNEL CHAIN 2

MID CHANNEL CHAIN 3

HIGH CHANNEL

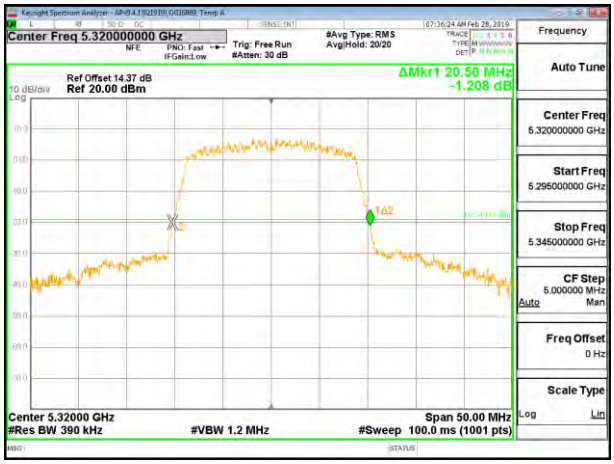


HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1

HIGH CHANNEL CHAIN 2



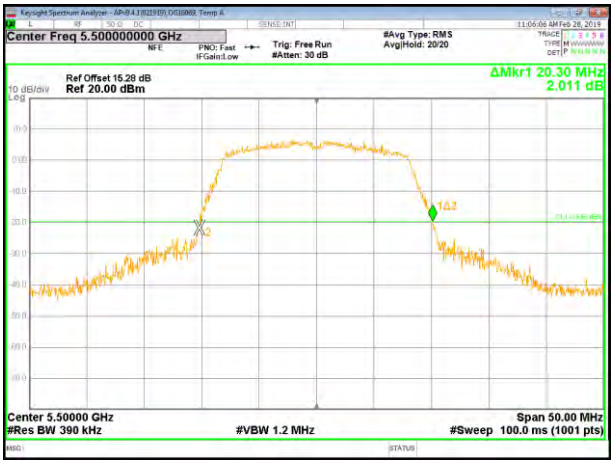
HIGH CHANNEL CHAIN 3

8.2.5. 802.11a MODE IN THE 5.6 GHz BAND

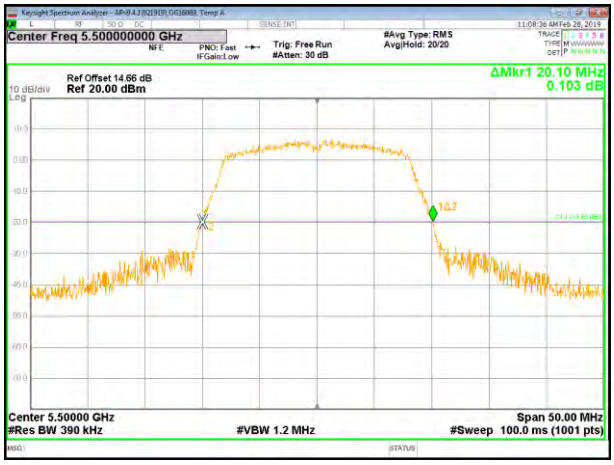
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Chain 0 (MHz)	26 dB Bandwidth Chain 1 (MHz)	26 dB Bandwidth Chain 2 (MHz)	26 dB Bandwidth Chain 3 (MHz)
Low	5500	20.30	20.10	20.15	20.15
Mid	5580	20.25	20.25	20.15	20.15
High	5700	20.25	20.15	20.25	19.85

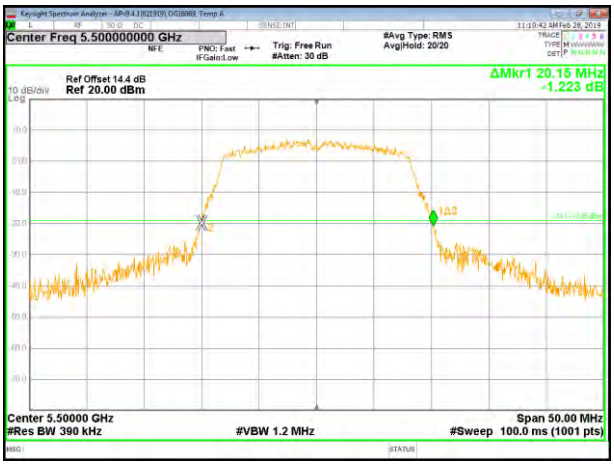
LOW CHANNEL



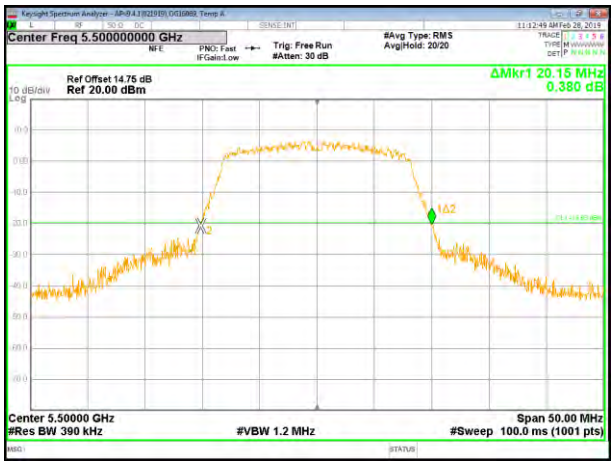
LOW CHANNEL CHAIN 0



LOW CHANNEL CHAIN 1

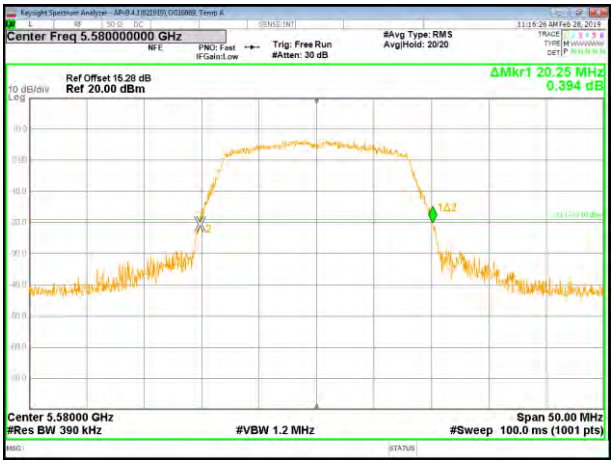


LOW CHANNEL CHAIN 2

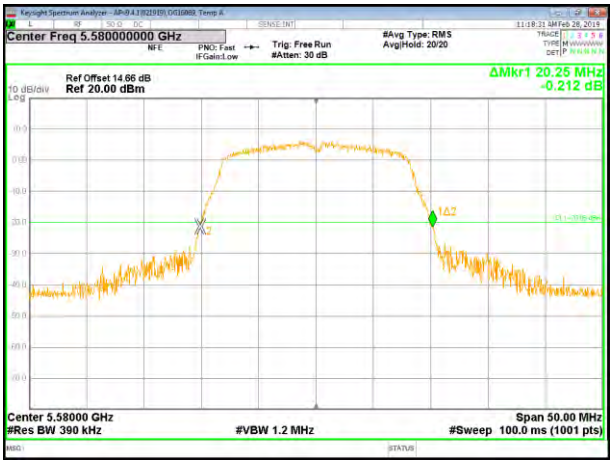


LOW CHANNEL CHAIN 3

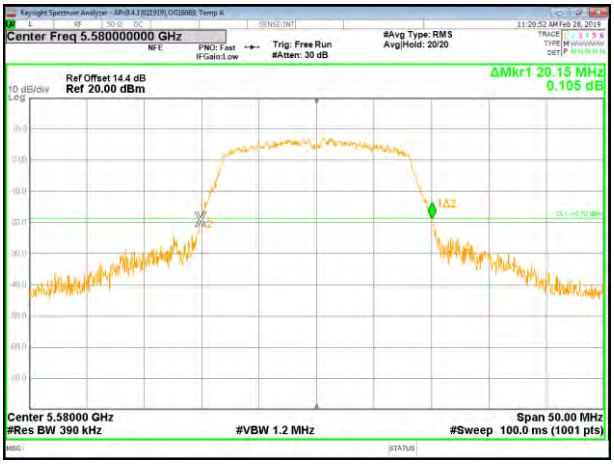
MID CHANNEL



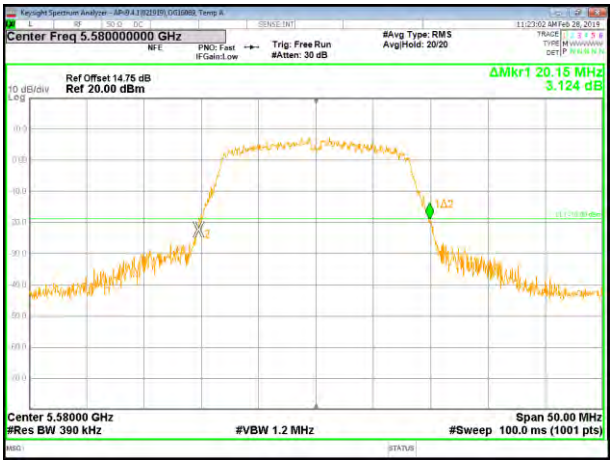
MID CHANNEL CHAIN 0



MID CHANNEL CHAIN 1

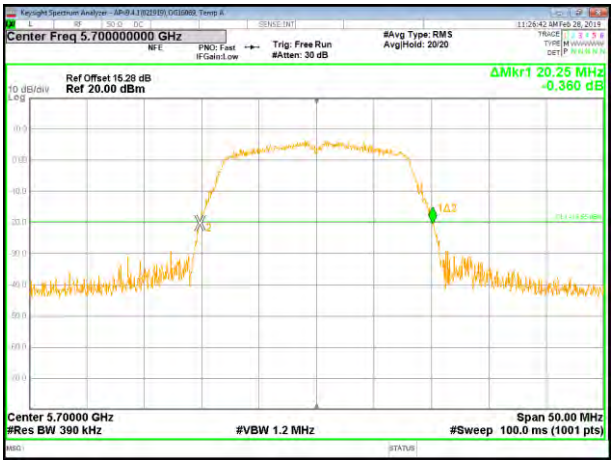


MID CHANNEL CHAIN 2

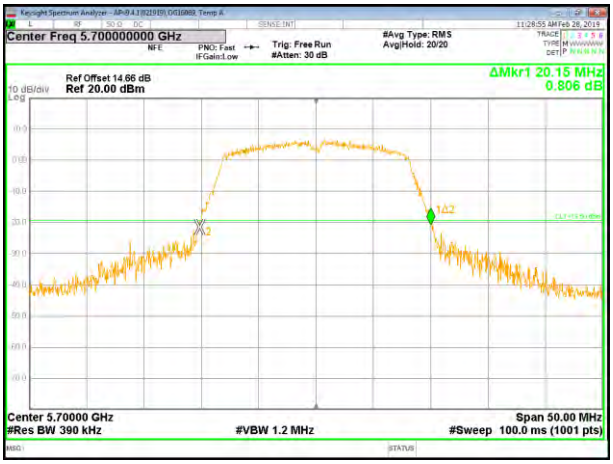


MID CHANNEL CHAIN 3

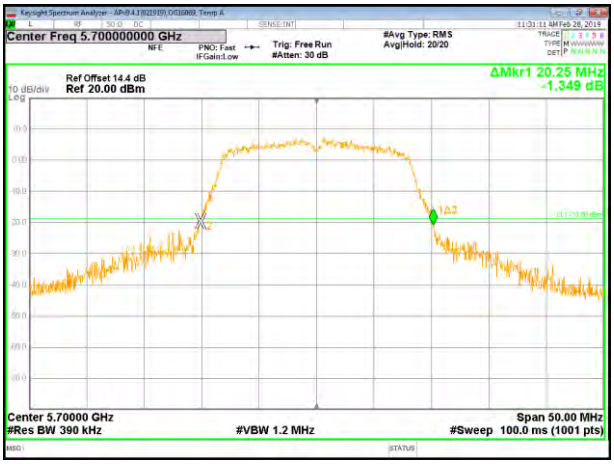
HIGH CHANNEL



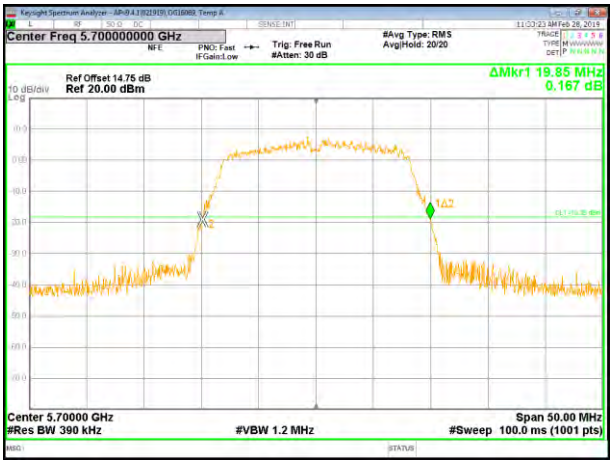
HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



HIGH CHANNEL CHAIN 2



HIGH CHANNEL CHAIN 3

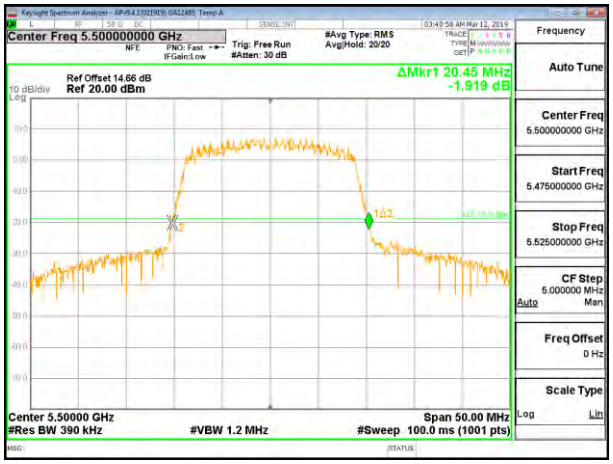
8.2.6. 802.11n HT20 MODE IN THE 5.6 GHz BAND

4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Chain 0 (MHz)	26 dB Bandwidth Chain 1 (MHz)	26 dB Bandwidth Chain 2 (MHz)	26 dB Bandwidth Chain 3 (MHz)
Low	5500	20.75	20.45	20.80	20.70
Mid	5580	20.60	20.60	20.70	20.65
High	5700	20.60	20.70	20.65	20.65

LOW CHANNEL

LOW CHANNEL CHAIN 0



LOW CHANNEL CHAIN 1

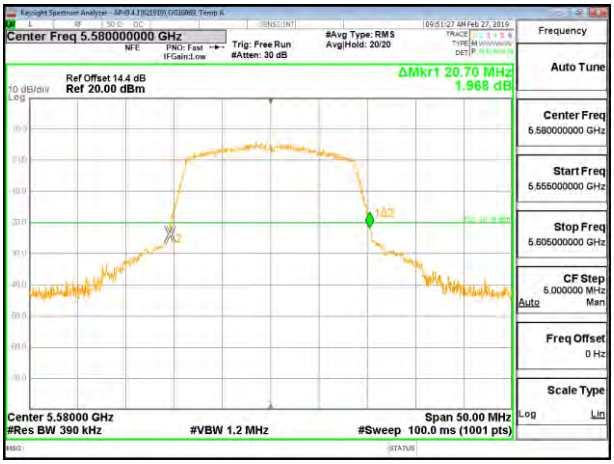
LOW CHANNEL CHAIN 2

LOW CHANNEL CHAIN 3

MID CHANNEL

MID CHANNEL CHAIN 0

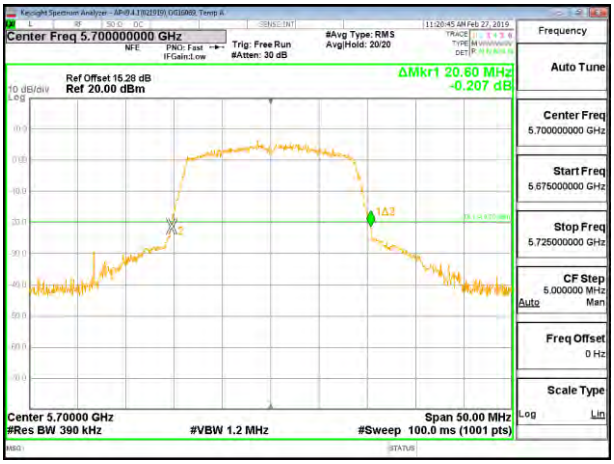
MID CHANNEL CHAIN 1



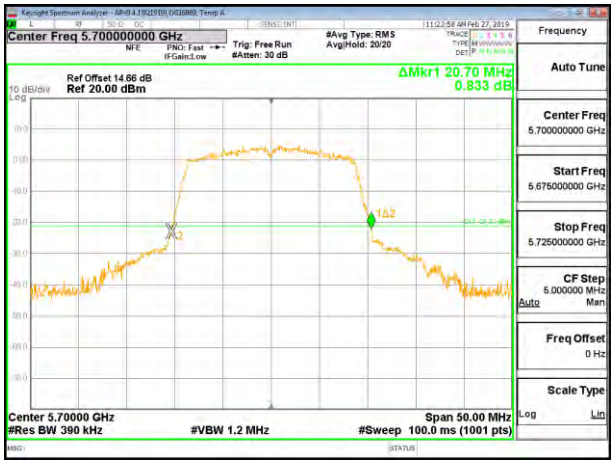
MID CHANNEL CHAIN 2

MID CHANNEL CHAIN 3

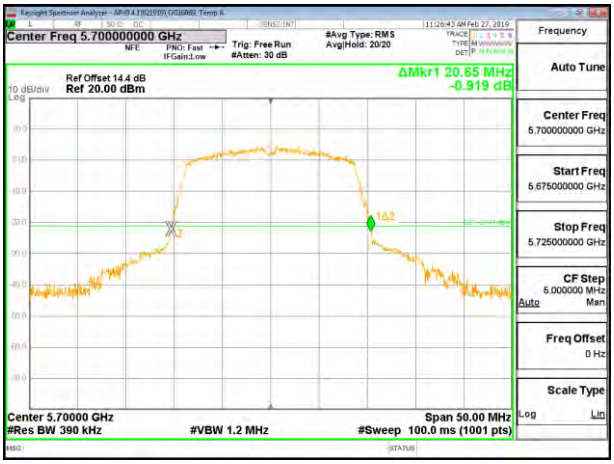
HIGH CHANNEL



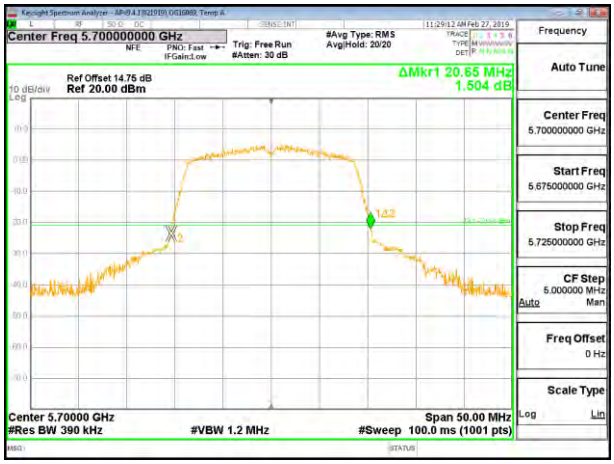
HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



HIGH CHANNEL CHAIN 2



HIGH CHANNEL CHAIN 3

8.2.7. 802.11a MODE IN THE 5.8 GHz BAND

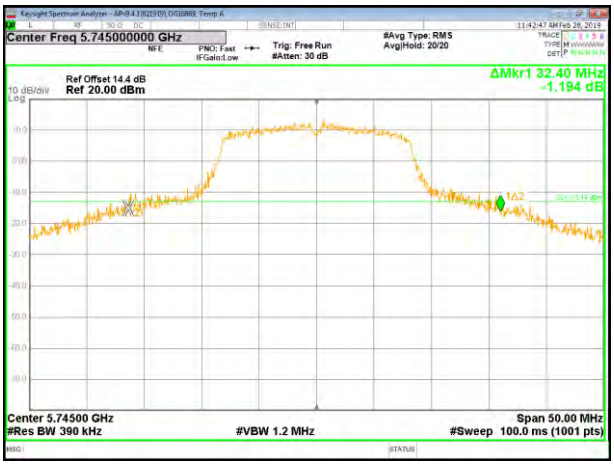
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)	26 dB Bandwidth Antenna 3 (MHz)	26 dB Bandwidth Antenna 4 (MHz)
Low	5745	29.95	33.60	32.40	31.60
Mid	5785	32.00	34.55	32.70	32.00
High	5825	30.65	31.65	32.15	31.75

LOW CHANNEL

LOW CHANNEL CHAIN 0

LOW CHANNEL CHAIN 1

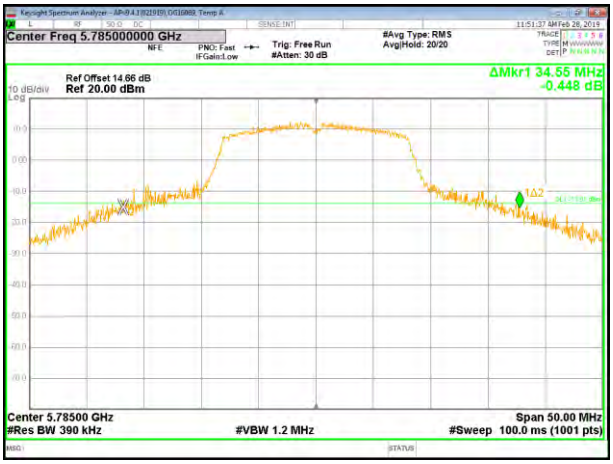


LOW CHANNEL CHAIN 2

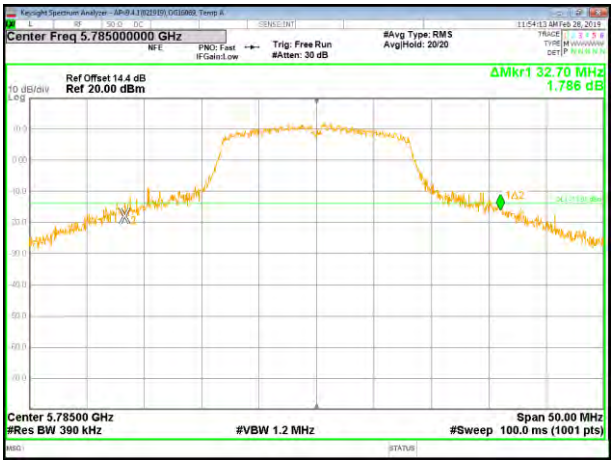
LOW CHANNEL CHAIN 3

MID CHANNEL

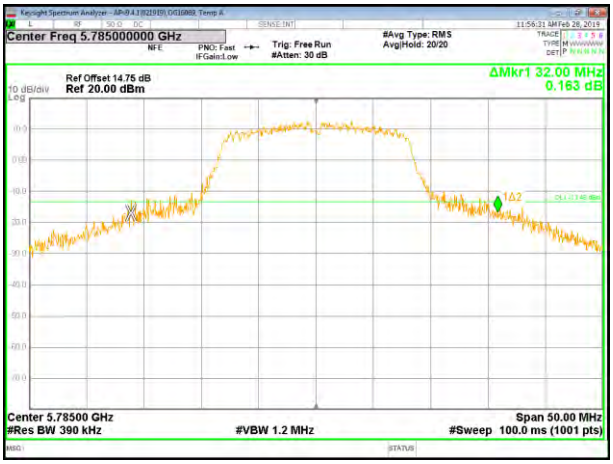
MID CHANNEL CHAIN 0



MID CHANNEL CHAIN 1



MID CHANNEL CHAIN 2



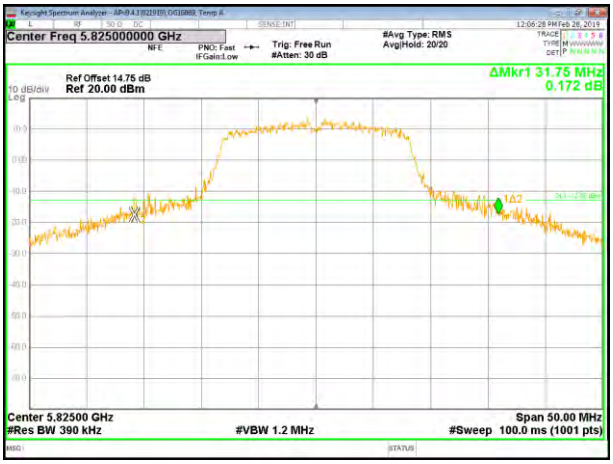
MID CHANNEL CHAIN 3

HIGH CHANNEL

HIGH CHANNEL CHAIN 0

HIGH CHANNEL CHAIN 1

HIGH CHANNEL CHAIN 2



HIGH CHANNEL CHAIN 3

8.2.8. 802.11n HT20 MODE IN THE 5.8 GHz BAND

4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)	26 dB Bandwidth Antenna 3 (MHz)	26 dB Bandwidth Antenna 4 (MHz)
Low	5745	29.75	29.15	29.10	31.30
Mid	5785	30.40	29.10	29.30	30.20
High	5825	32.65	29.00	29.90	30.20

LOW CHANNEL

LOW CHANNEL CHAIN 0

LOW CHANNEL CHAIN 1

LOW CHANNEL CHAIN 2

LOW CHANNEL CHAIN 3

MID CHANNEL

MID CHANNEL CHAIN 0

MID CHANNEL CHAIN 1

MID CHANNEL CHAIN 2

MID CHANNEL CHAIN 3

HIGH CHANNEL

HIGH CHANNEL CHAIN 0

HIGH CHANNEL CHAIN 1

HIGH CHANNEL CHAIN 2

HIGH CHANNEL CHAIN 3

8.3. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

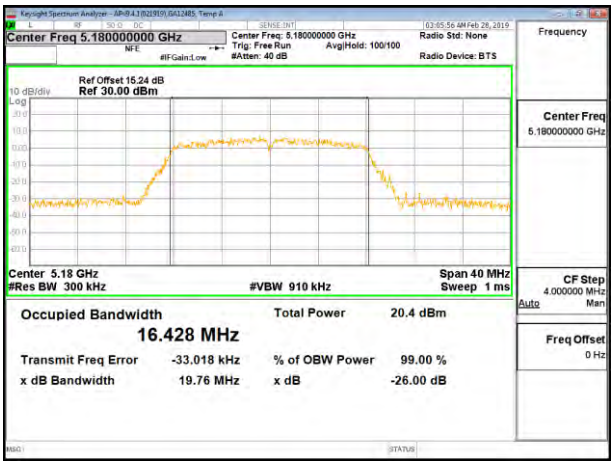
UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

8.3.1. 802.11a MODE IN THE 5.2 GHz BAND

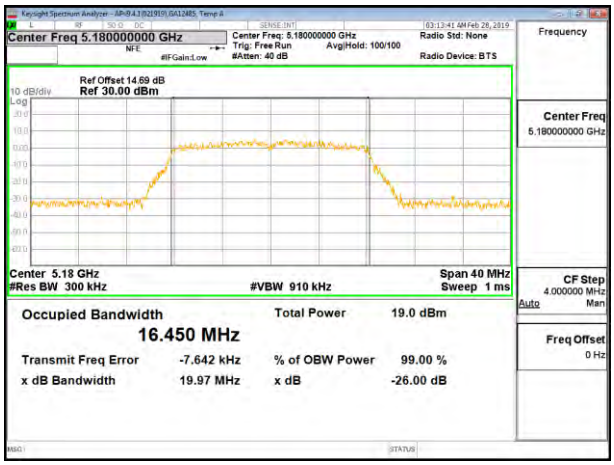
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)	99% Bandwidth Chain 2 (MHz)	99% Bandwidth Chain 3 (MHz)
Low	5180	16.428	16.450	16.422	16.443
Mid	5200	16.475	16.426	16.481	16.475
High	5240	16.460	16.427	16.436	16.415

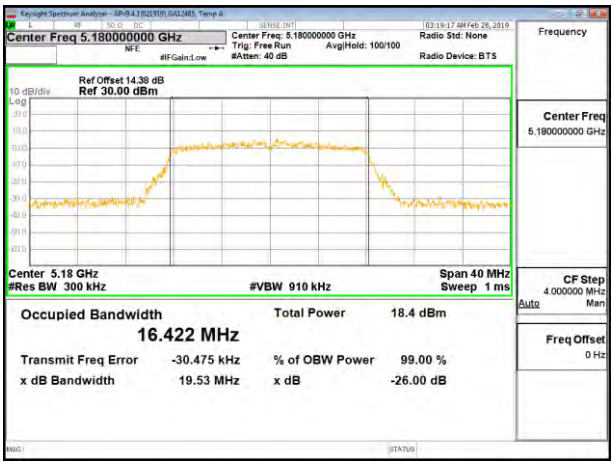
LOW CHANNEL



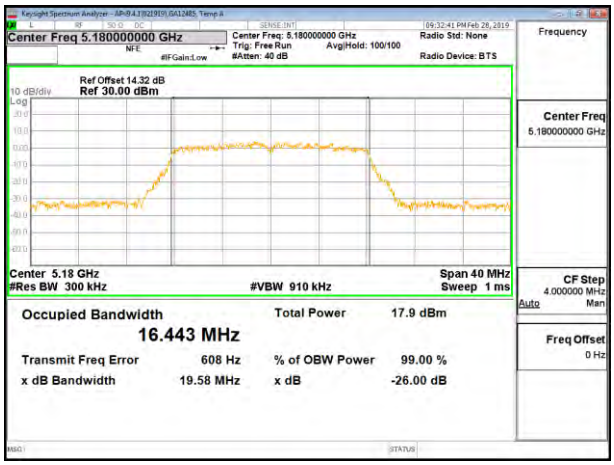
LOW CHANNEL CHAIN 0



LOW CHANNEL CHAIN 1

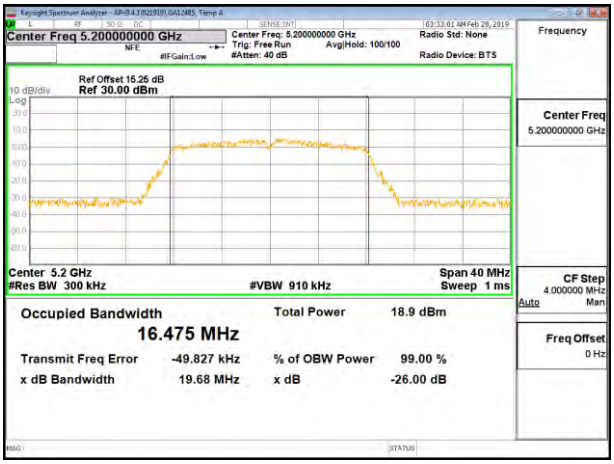


LOW CHANNEL CHAIN 2

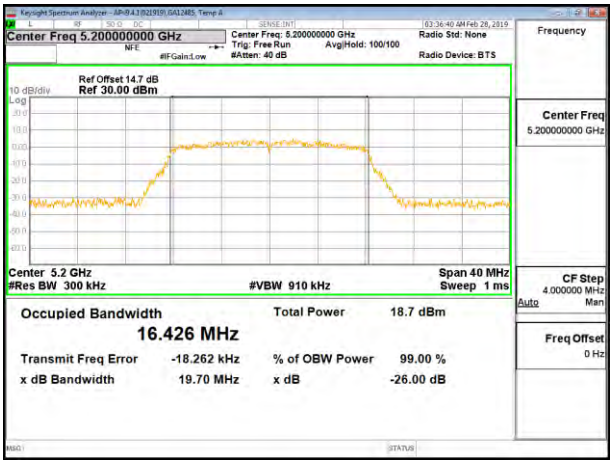


LOW CHANNEL CHAIN 3

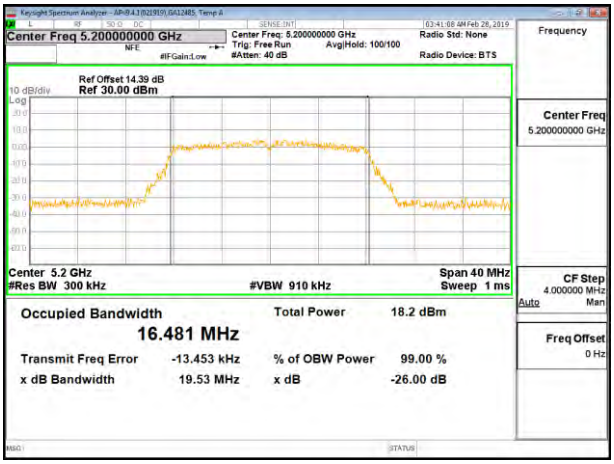
MID CHANNEL



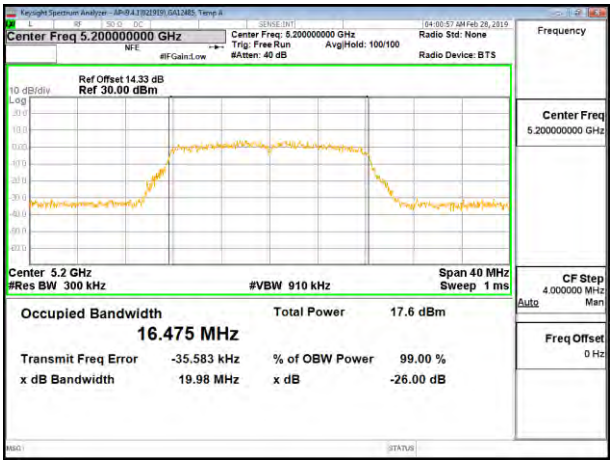
MID CHANNEL CHAIN 0



MID CHANNEL CHAIN 1

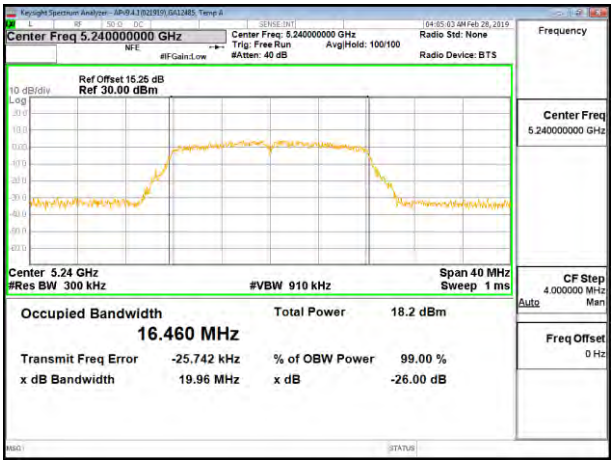


MID CHANNEL CHAIN 2

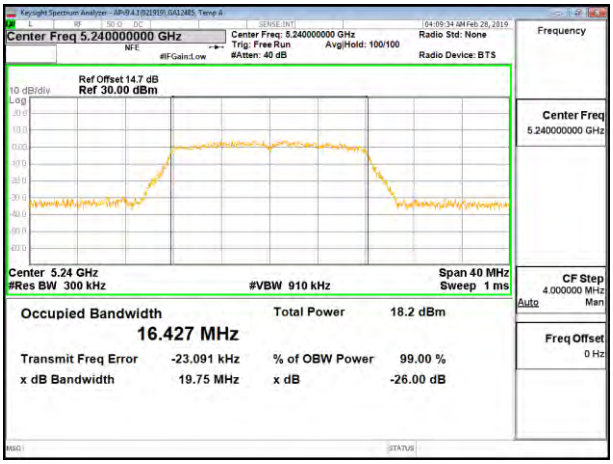


MID CHANNEL CHAIN 3

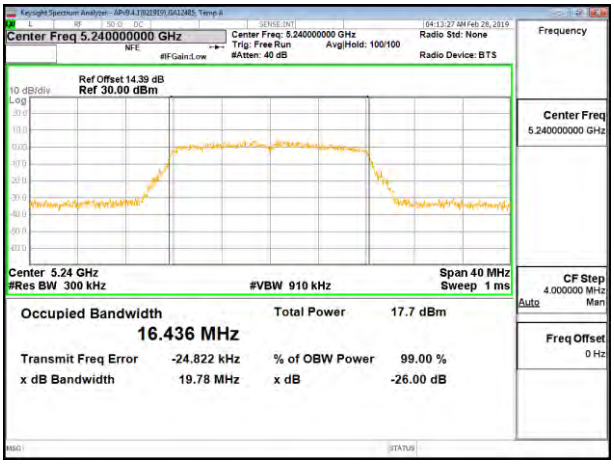
HIGH CHANNEL



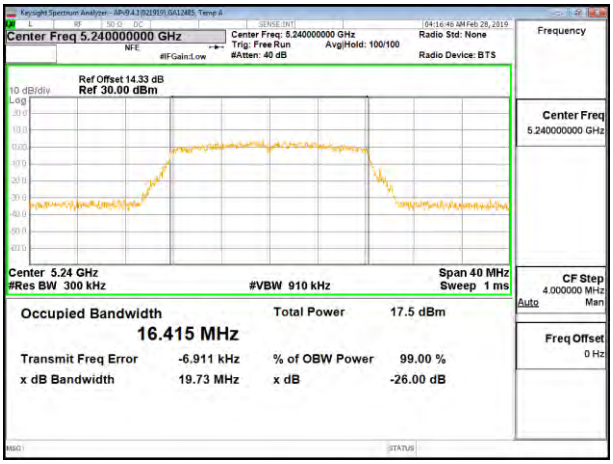
HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



HIGH CHANNEL CHAIN 2



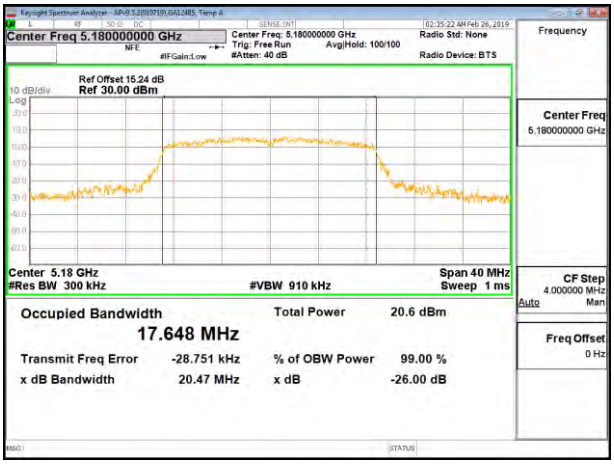
HIGH CHANNEL CHAIN 3

8.3.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

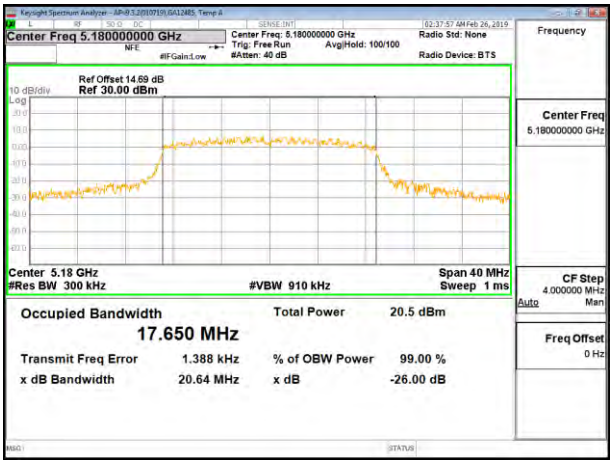
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)	99% Bandwidth Chain 2 (MHz)	99% Bandwidth Chain 3 (MHz)
Low	5180	17.648	17.650	17.605	17.608
Mid	5200	17.581	17.565	17.540	17.586
High	5240	17.612	17.592	17.580	17.577

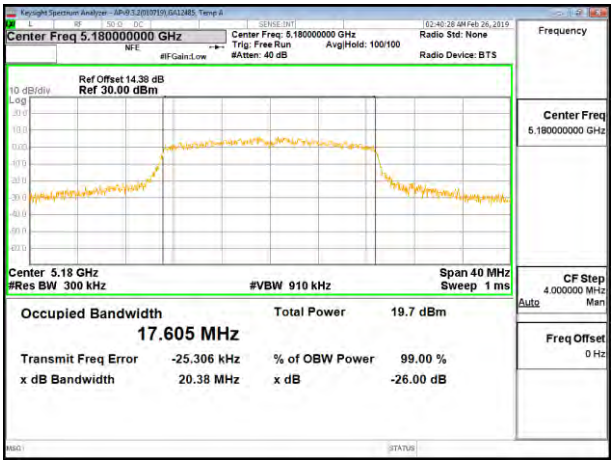
LOW CHANNEL



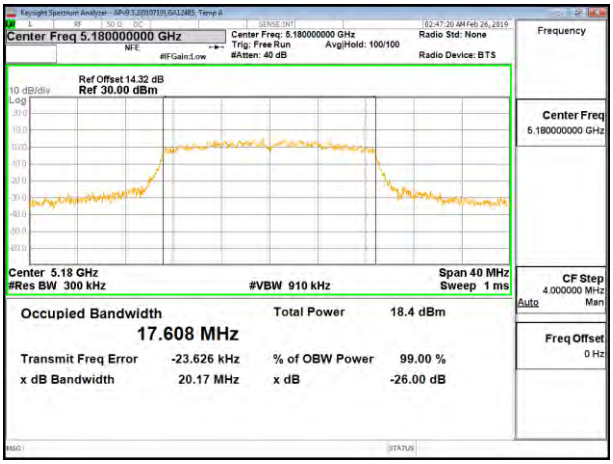
LOW CHANNEL CHAIN 0



LOW CHANNEL CHAIN 1

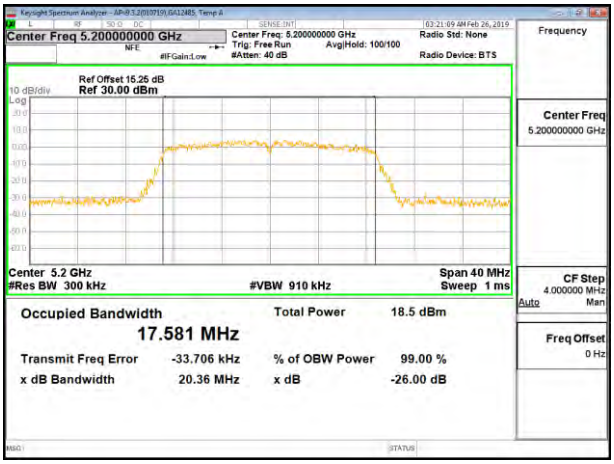


LOW CHANNEL CHAIN 2

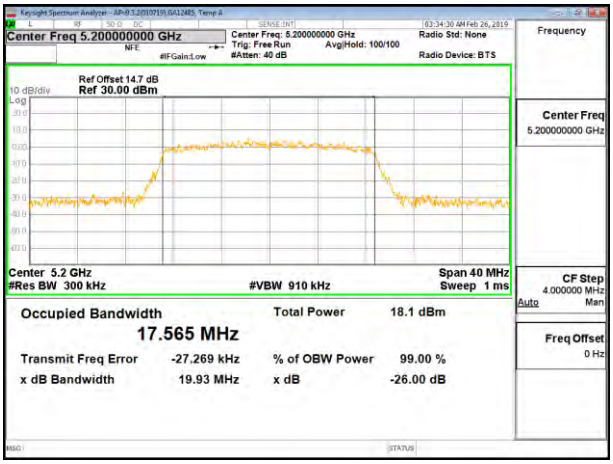


LOW CHANNEL CHAIN 3

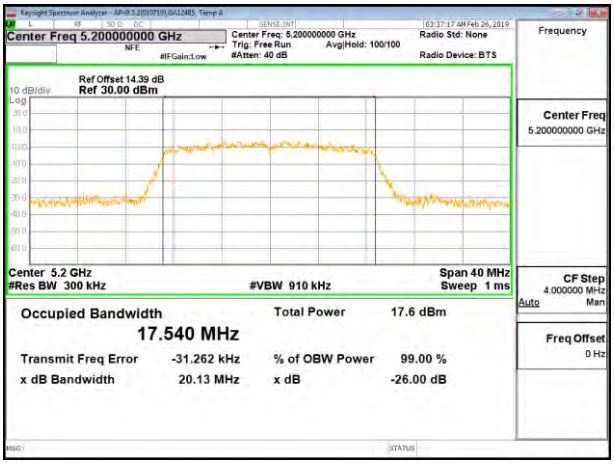
MID CHANNEL



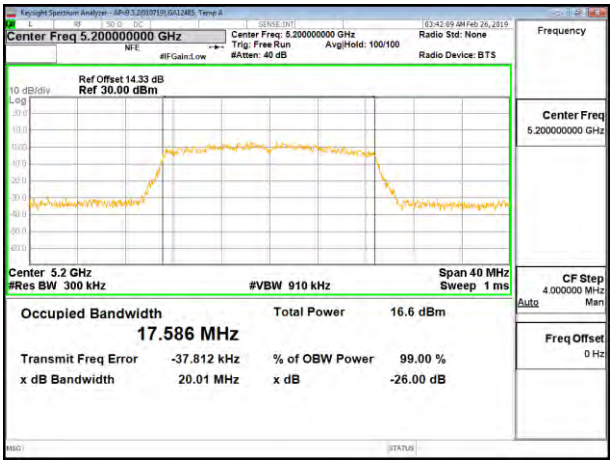
MID CHANNEL CHAIN 0



MID CHANNEL CHAIN 1

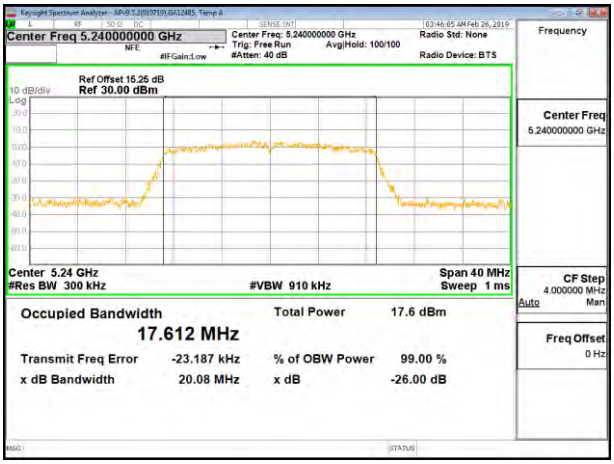


MID CHANNEL CHAIN 2

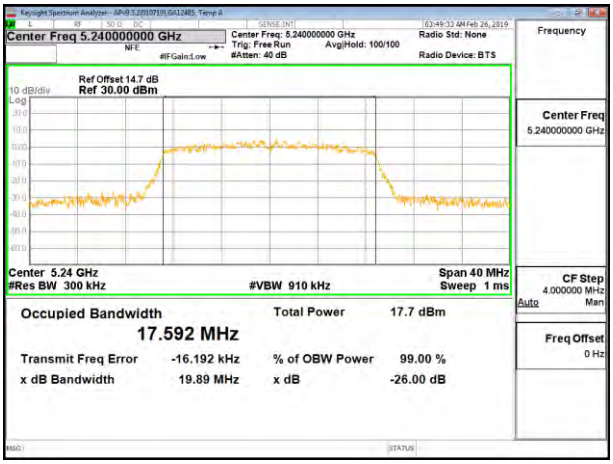


MID CHANNEL CHAIN 3

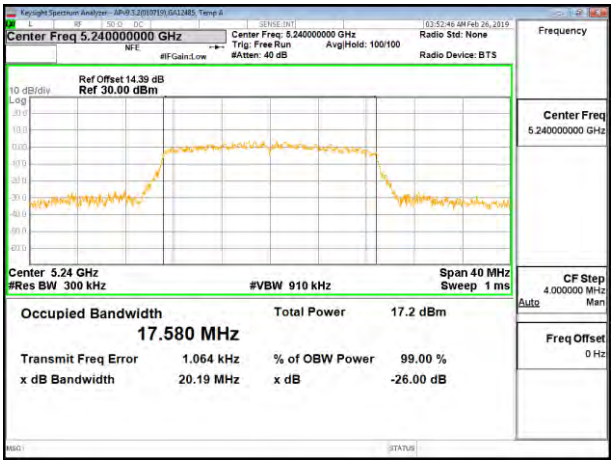
HIGH CHANNEL



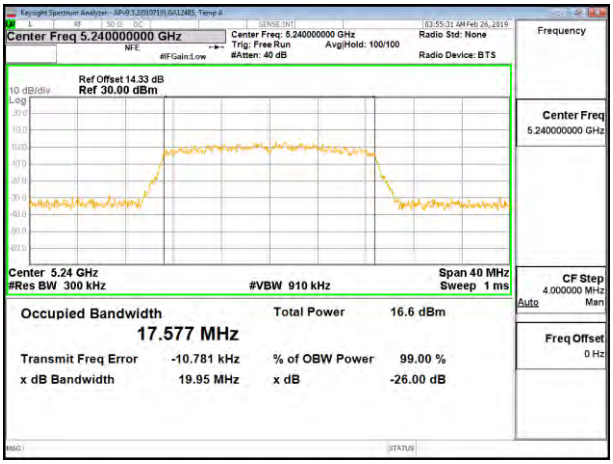
HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



HIGH CHANNEL CHAIN 2



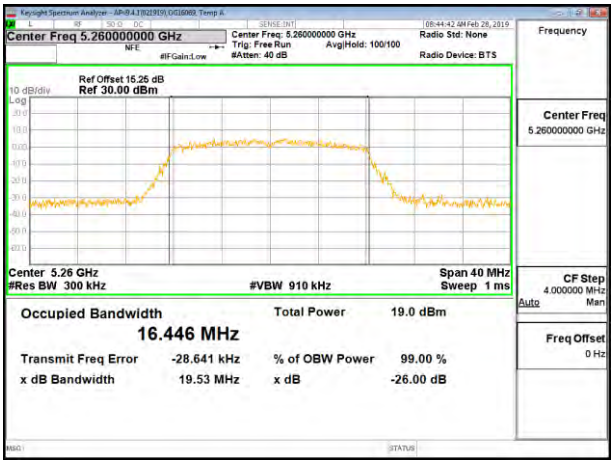
HIGH CHANNEL CHAIN 3

8.3.3. 802.11a MODE IN THE 5.3 GHz BAND

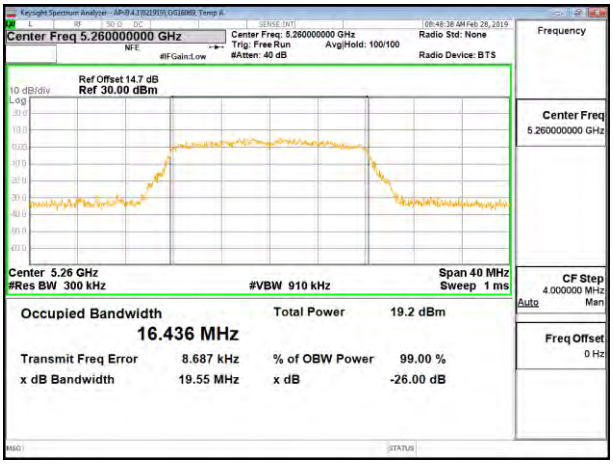
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)	99% Bandwidth Chain 2 (MHz)	99% Bandwidth Chain 3 (MHz)
Low	5260	16.446	16.436	16.404	16.513
Mid	5300	16.490	16.391	16.396	16.417
High	5320	16.455	16.447	16.429	16.430

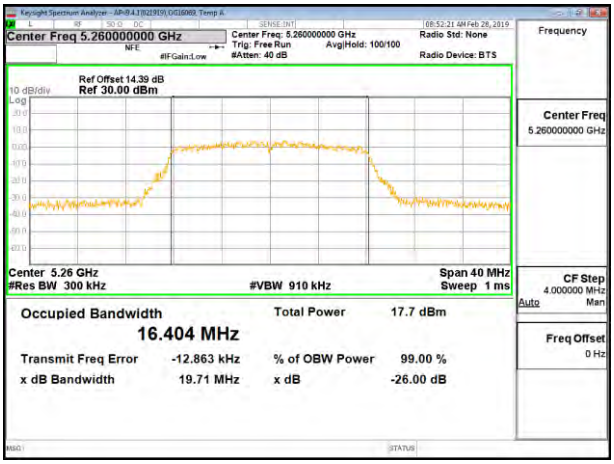
LOW CHANNEL



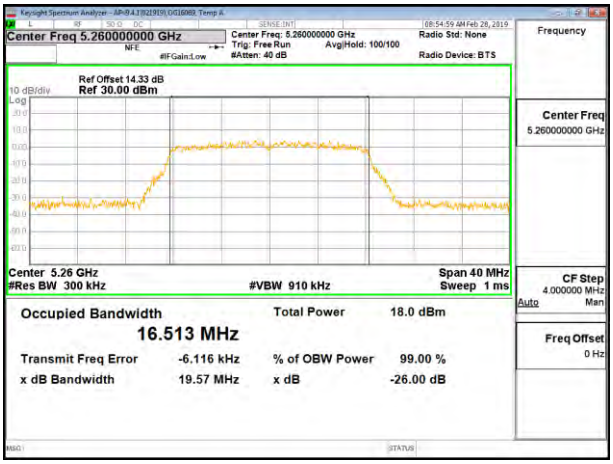
LOW CHANNEL CHAIN 0



LOW CHANNEL CHAIN 1

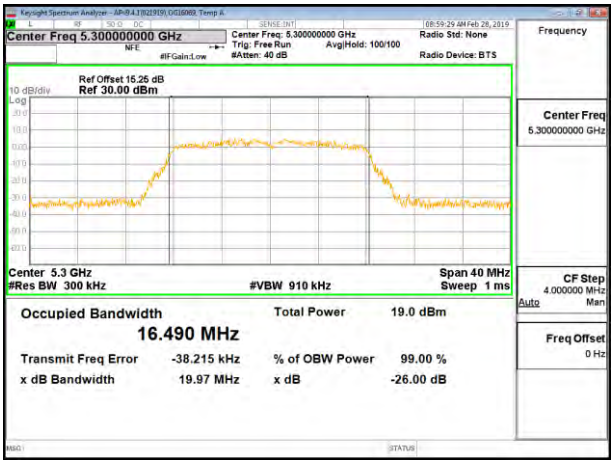


LOW CHANNEL CHAIN 2

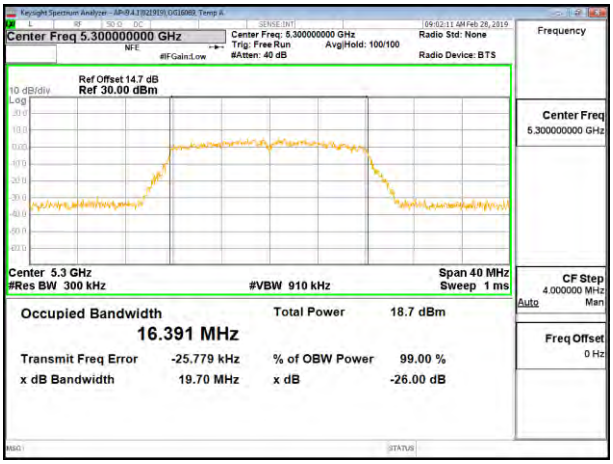


LOW CHANNEL CHAIN 3

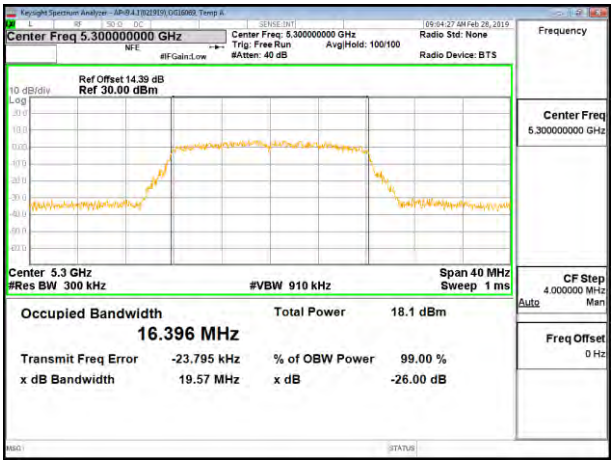
MID CHANNEL



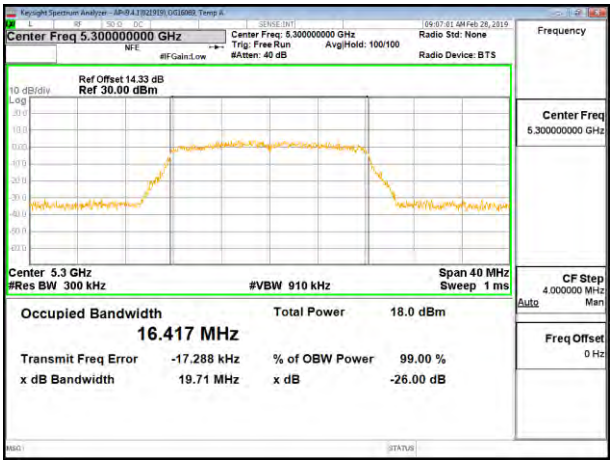
MID CHANNEL CHAIN 0



MID CHANNEL CHAIN 1

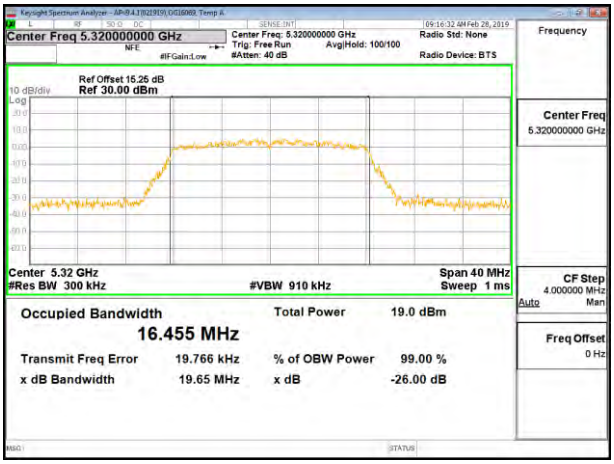


MID CHANNEL CHAIN 2

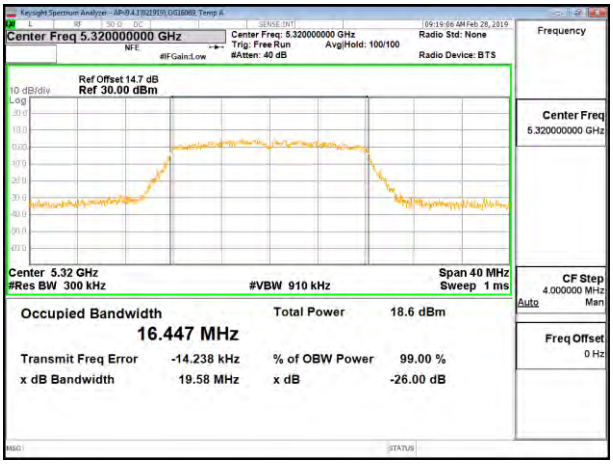


MID CHANNEL CHAIN 3

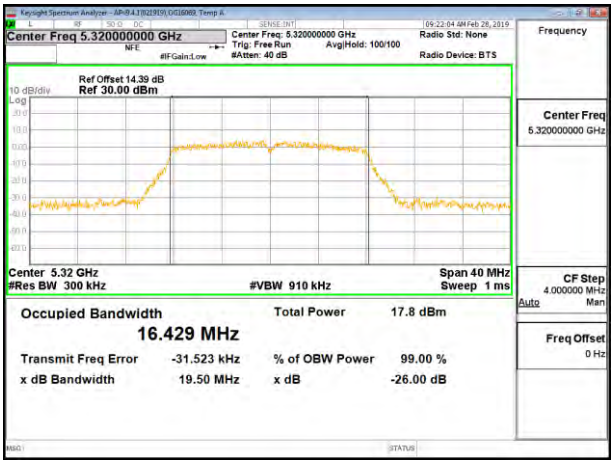
HIGH CHANNEL



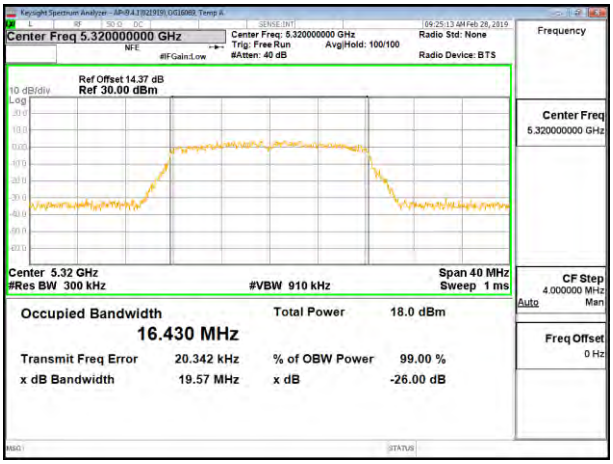
HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



HIGH CHANNEL CHAIN 2



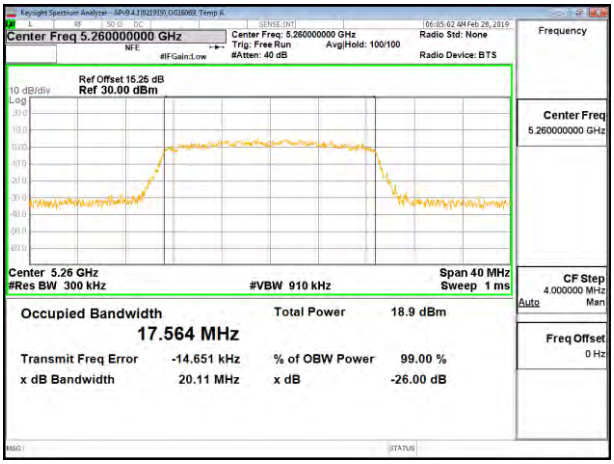
HIGH CHANNEL CHAIN 3

8.3.4. 802.11n HT20 MODE IN THE 5.3 GHz BAND

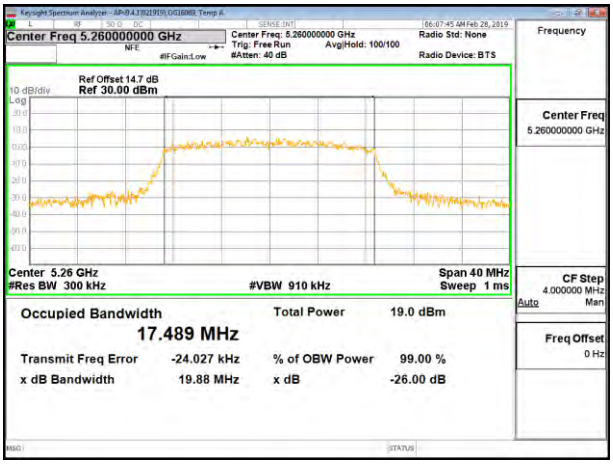
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)	99% Bandwidth Chain 2 (MHz)	99% Bandwidth Chain 3 (MHz)
Low	5260	17.564	17.489	17.598	17.595
Mid	5300	17.578	17.587	17.569	17.599
High	5320	17.560	17.648	17.648	17.588

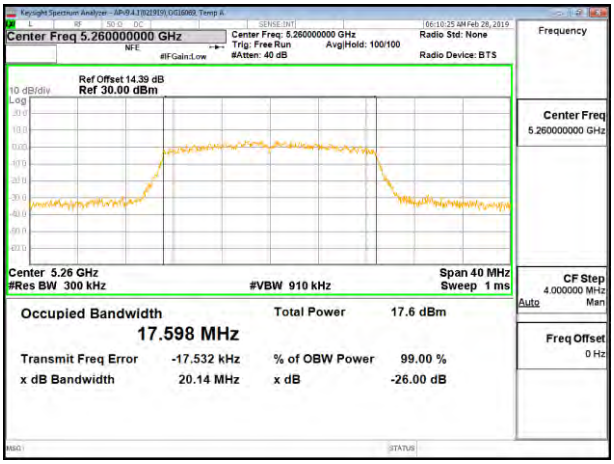
LOW CHANNEL



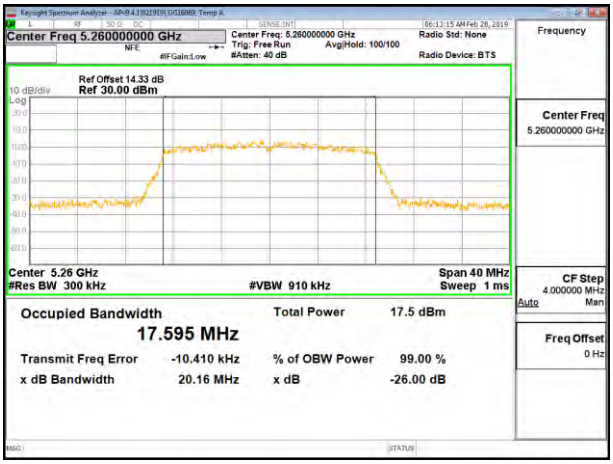
LOW CHANNEL CHAIN 0



LOW CHANNEL CHAIN 1

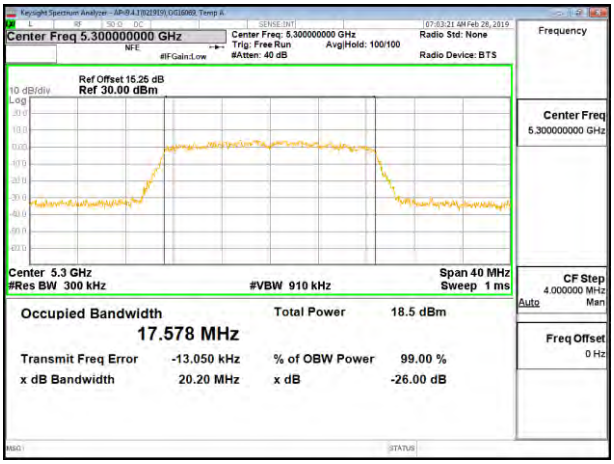


LOW CHANNEL CHAIN 2

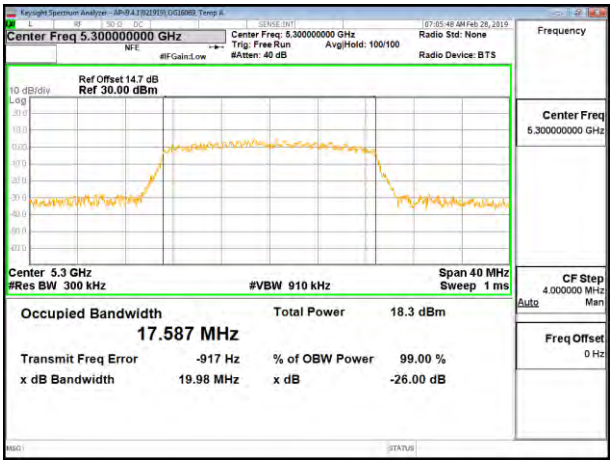


LOW CHANNEL CHAIN 3

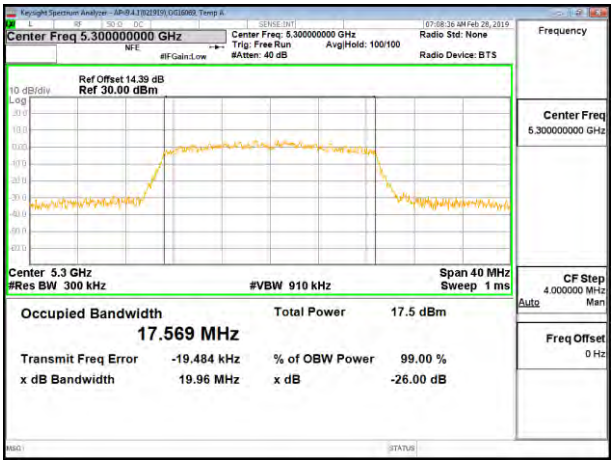
MID CHANNEL



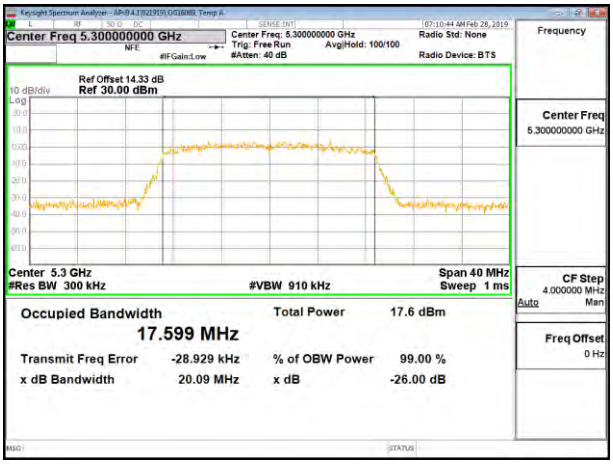
MID CHANNEL CHAIN 0



MID CHANNEL CHAIN 1

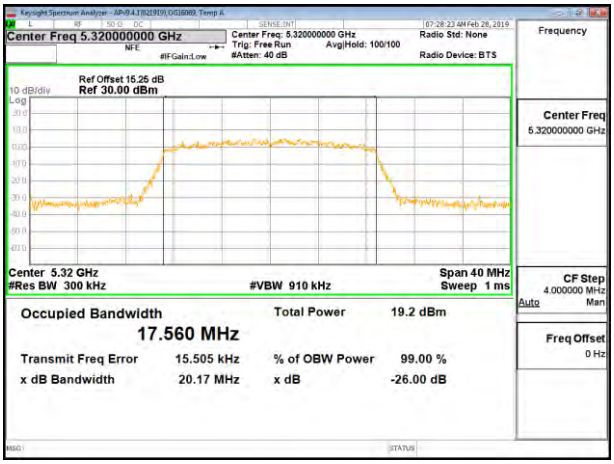


MID CHANNEL CHAIN 2

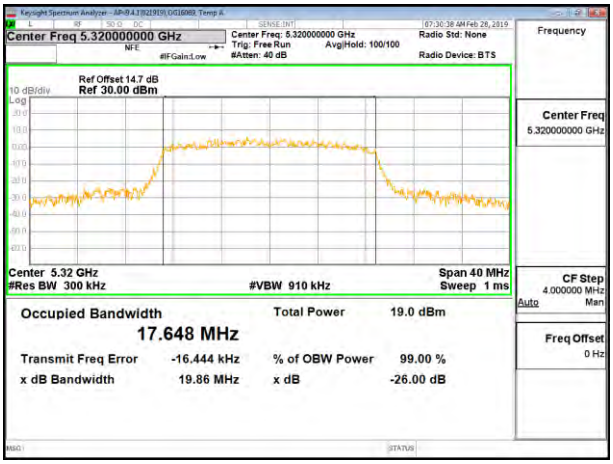


MID CHANNEL CHAIN 3

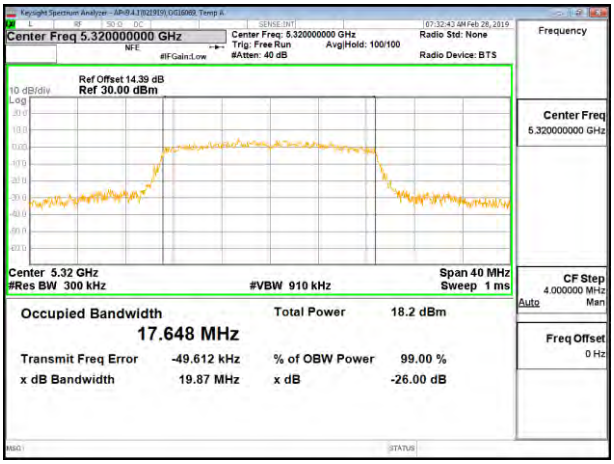
HIGH CHANNEL



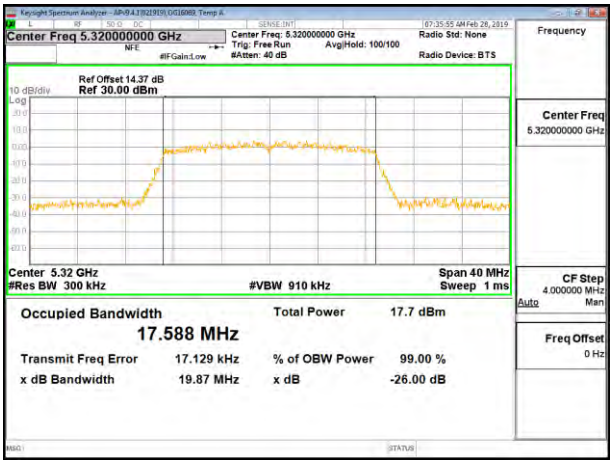
HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



HIGH CHANNEL CHAIN 2



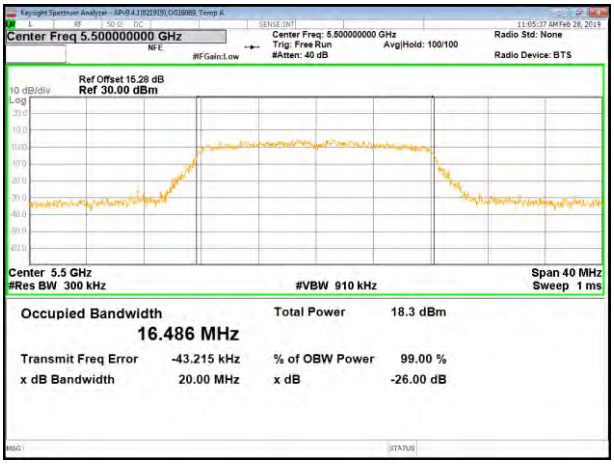
HIGH CHANNEL CHAIN 3

8.3.5. 802.11a MODE IN THE 5.6 GHz BAND

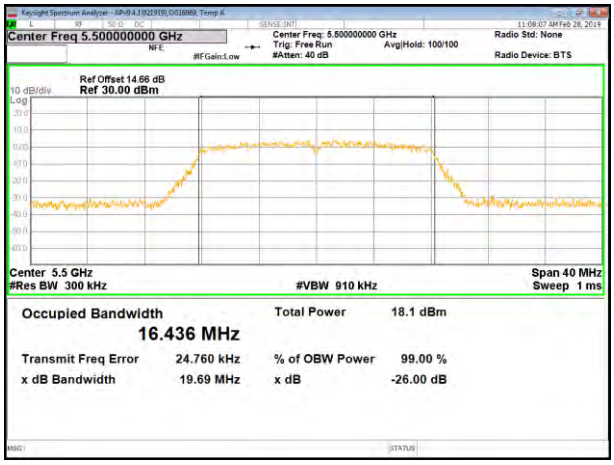
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)	99% Bandwidth Chain 2 (MHz)	99% Bandwidth Chain 3 (MHz)
Low	5500	16.486	16.436	16.408	16.414
Mid	5580	16.473	16.442	16.465	16.434
High	5700	16.522	16.467	16.477	16.417

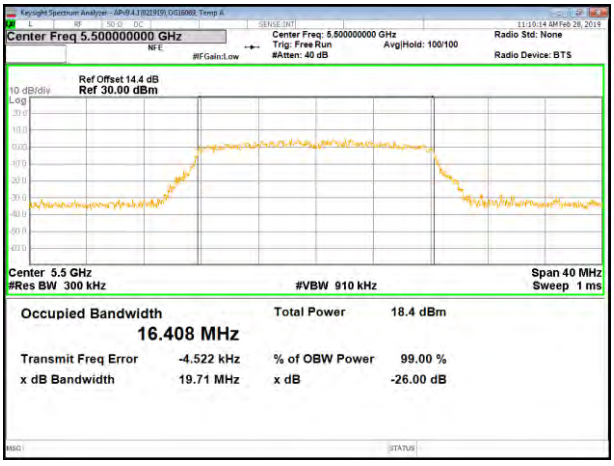
LOW CHANNEL



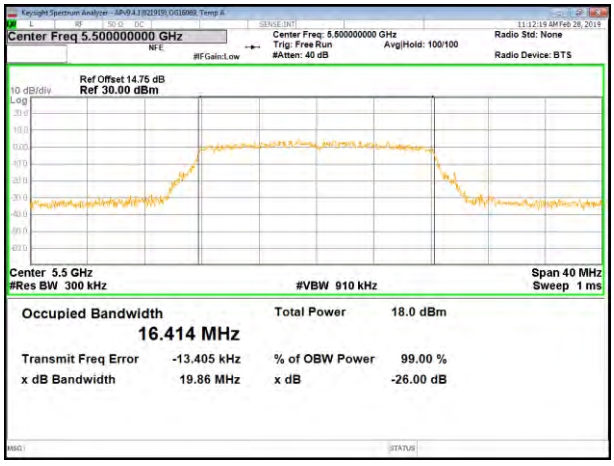
LOW CHANNEL CHAIN 0



LOW CHANNEL CHAIN 1

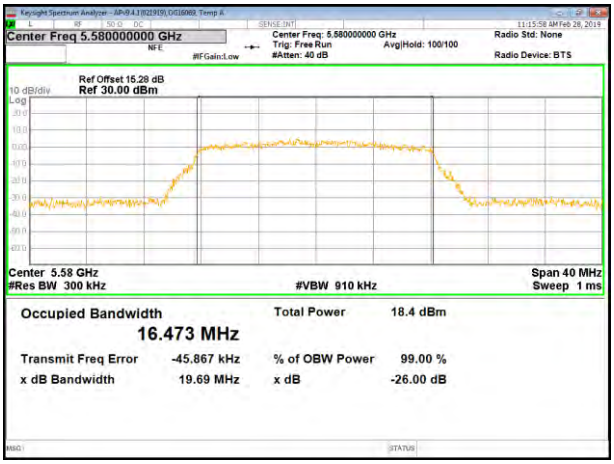


LOW CHANNEL CHAIN 2

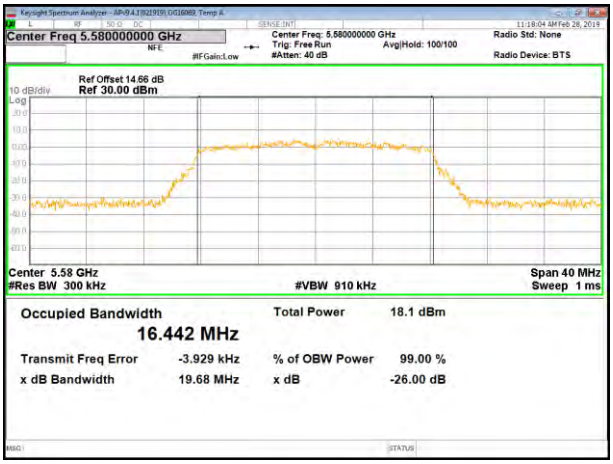


LOW CHANNEL CHAIN 3

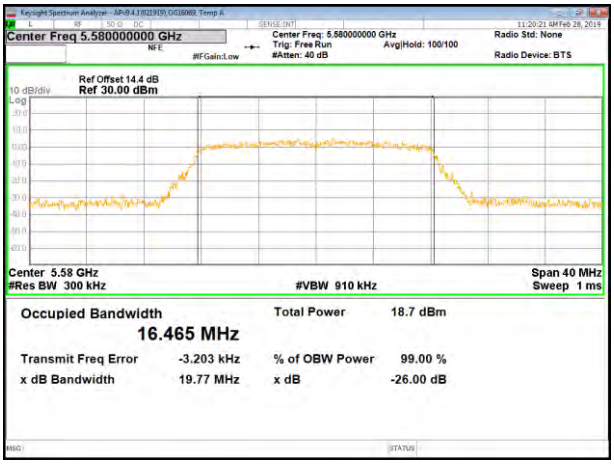
MID CHANNEL



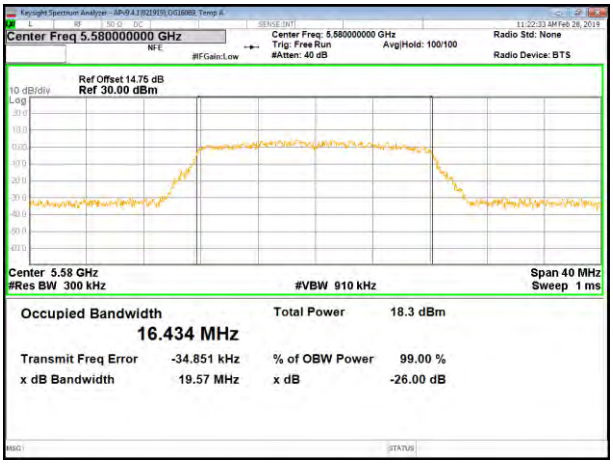
MID CHANNEL CHAIN 0



MID CHANNEL CHAIN 1

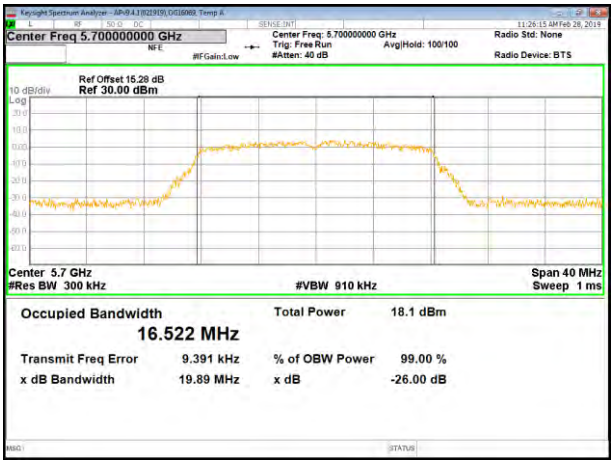


MID CHANNEL CHAIN 2

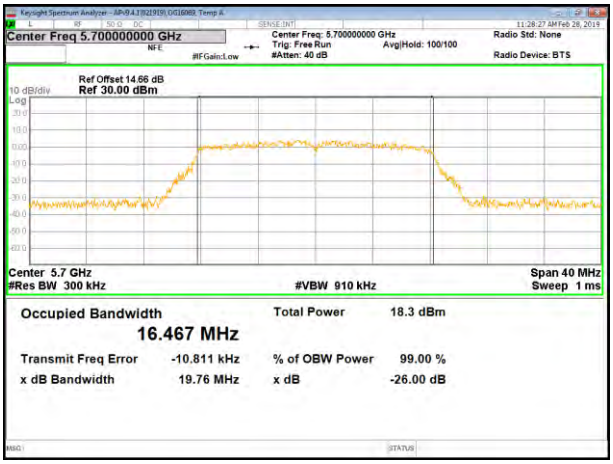


MID CHANNEL CHAIN 3

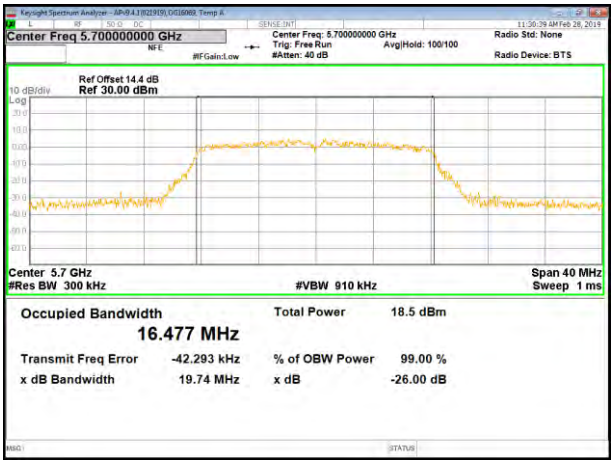
HIGH CHANNEL



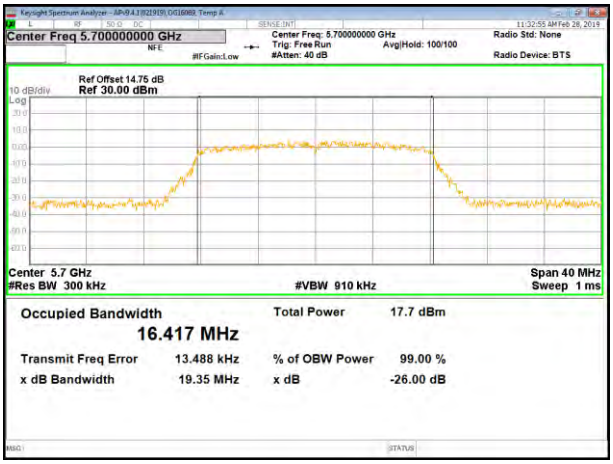
HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



HIGH CHANNEL CHAIN 2



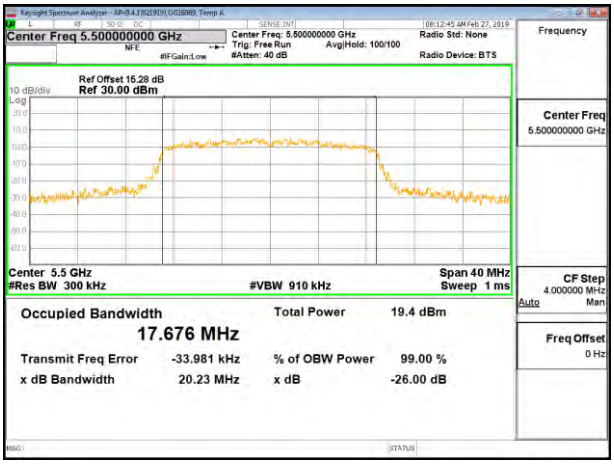
HIGH CHANNEL CHAIN 3

8.3.6. 802.11n HT20 MODE IN THE 5.6 GHz BAND

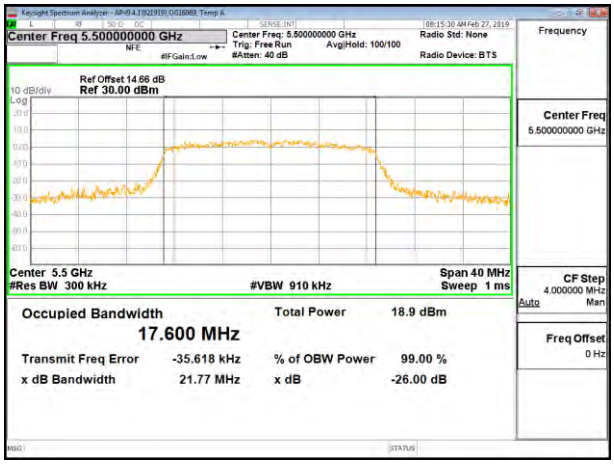
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)	99% Bandwidth Chain 2 (MHz)	99% Bandwidth Chain 3 (MHz)
Low	5500	17.676	17.600	17.625	17.592
Mid	5580	17.581	17.572	17.577	17.557
High	5700	17.564	17.656	17.668	17.592

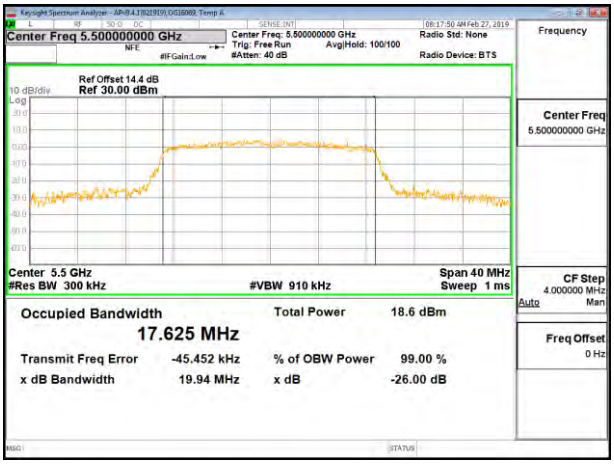
LOW CHANNEL



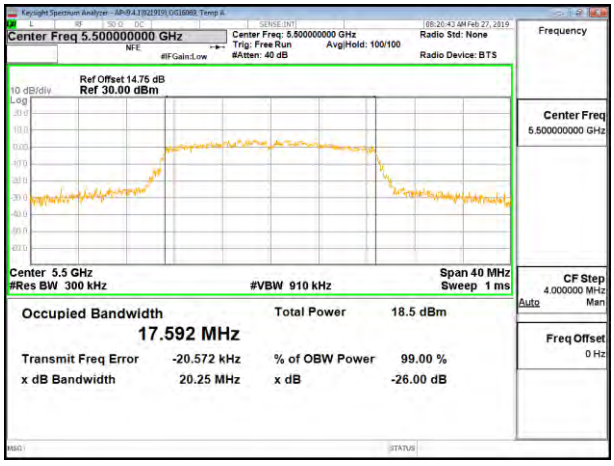
LOW CHANNEL CHAIN 0



LOW CHANNEL CHAIN 1

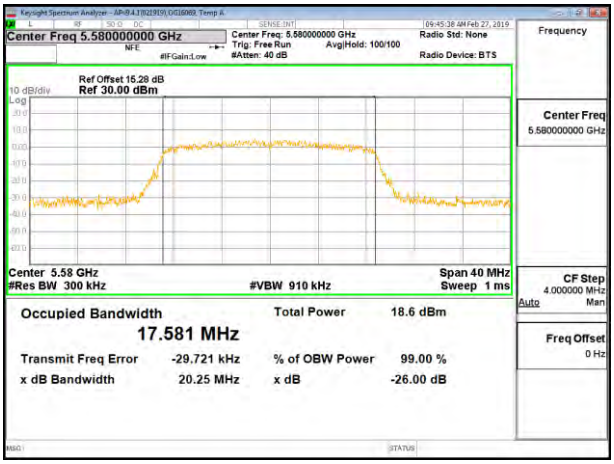


LOW CHANNEL CHAIN 2

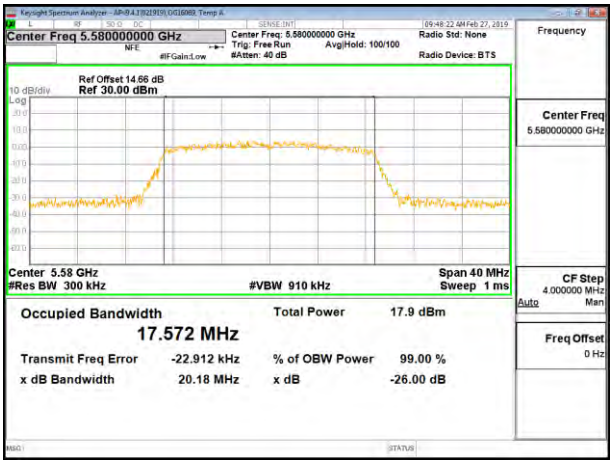


LOW CHANNEL CHAIN 3

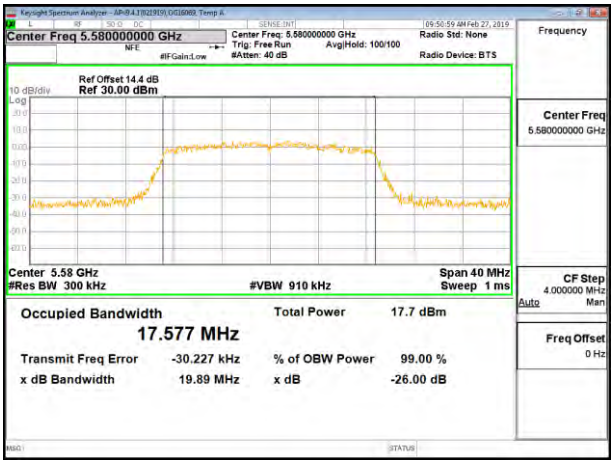
MID CHANNEL



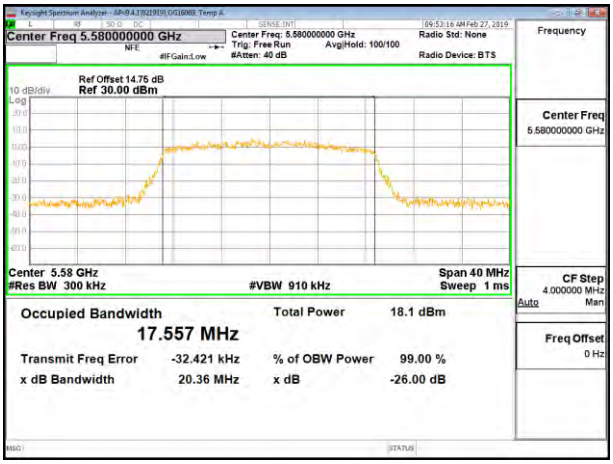
MID CHANNEL CHAIN 0



MID CHANNEL CHAIN 1

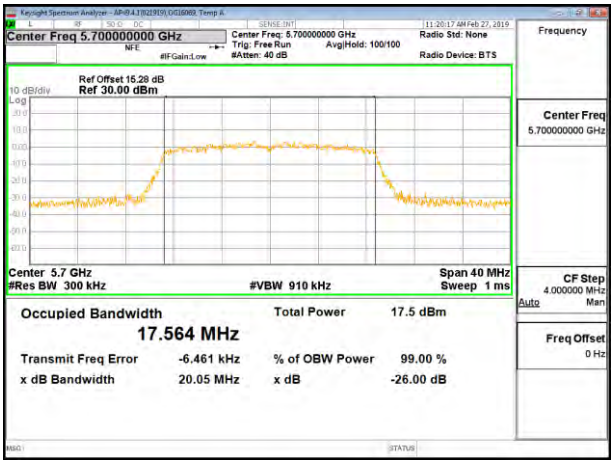


MID CHANNEL CHAIN 2

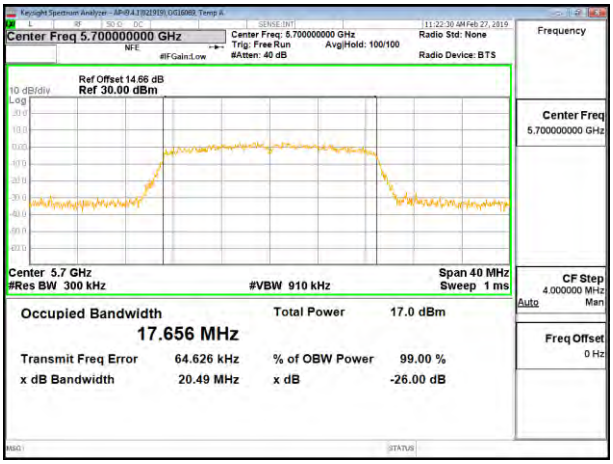


MID CHANNEL CHAIN 3

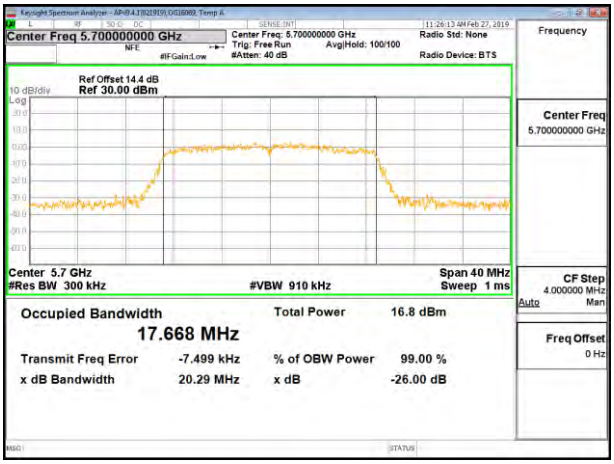
HIGH CHANNEL



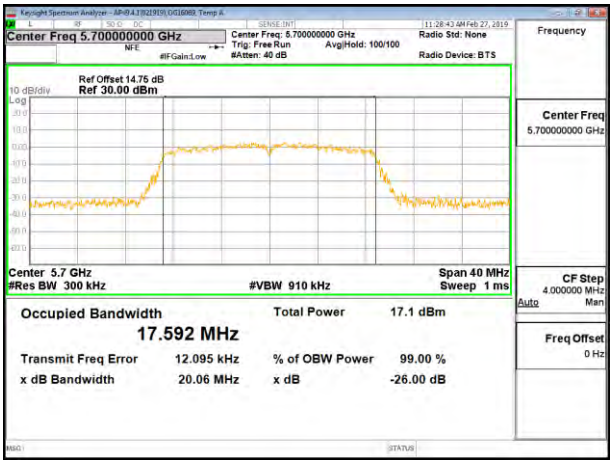
HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



HIGH CHANNEL CHAIN 2



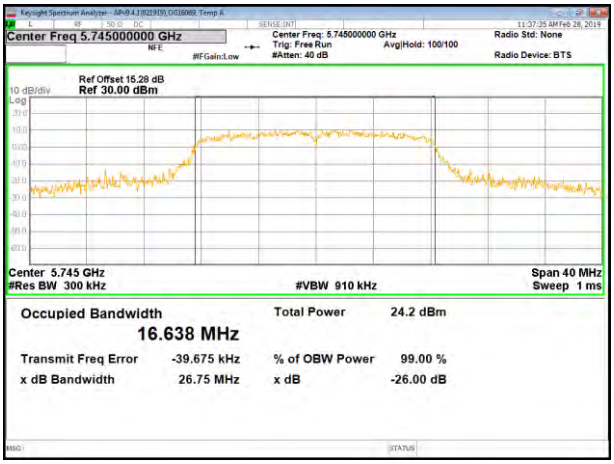
HIGH CHANNEL CHAIN 3

8.3.7. 802.11a MODE IN THE 5.8 GHz BAND

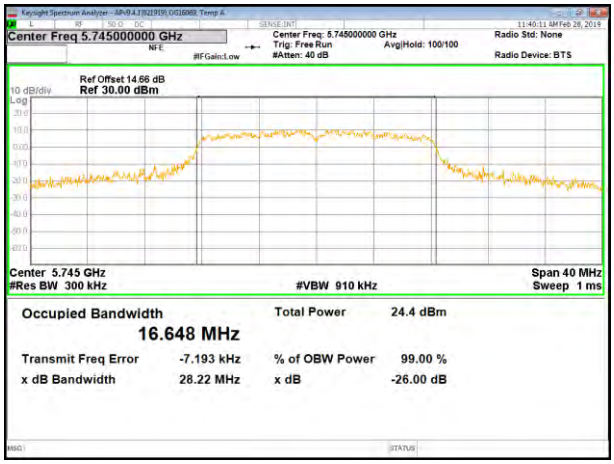
4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth Chain 0 (MHz)	99% Bandwidth Chain 1 (MHz)	99% Bandwidth Chain 2 (MHz)	99% Bandwidth Chain 3 (MHz)
Low	5745	16.638	16.648	16.758	16.523
Mid	5785	16.580	16.735	16.734	16.500
High	5825	16.614	16.612	16.624	16.590

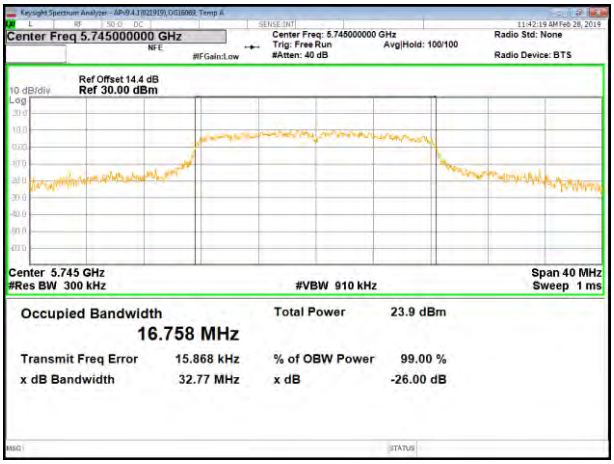
LOW CHANNEL



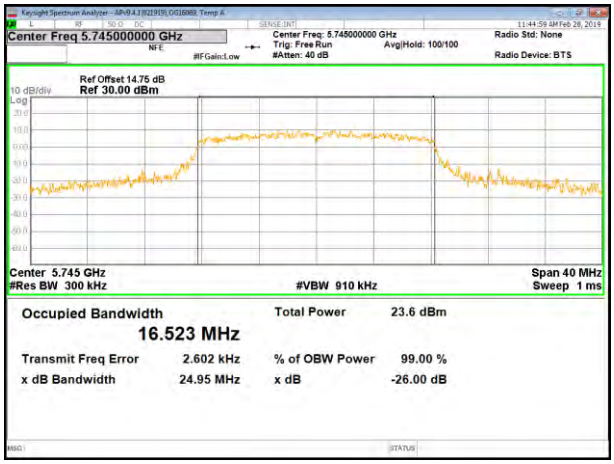
LOW CHANNEL CHAIN 0



LOW CHANNEL CHAIN 1

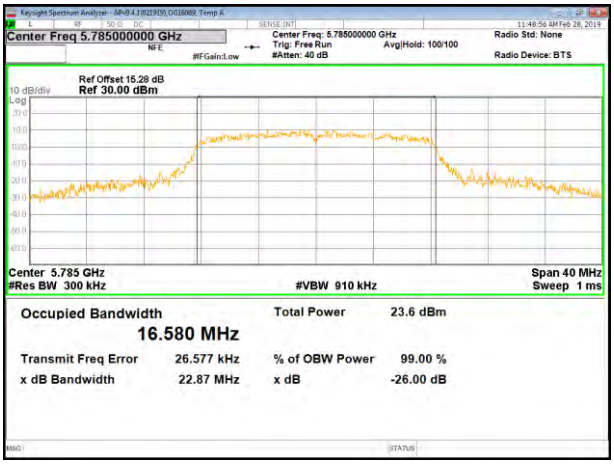


LOW CHANNEL CHAIN 2

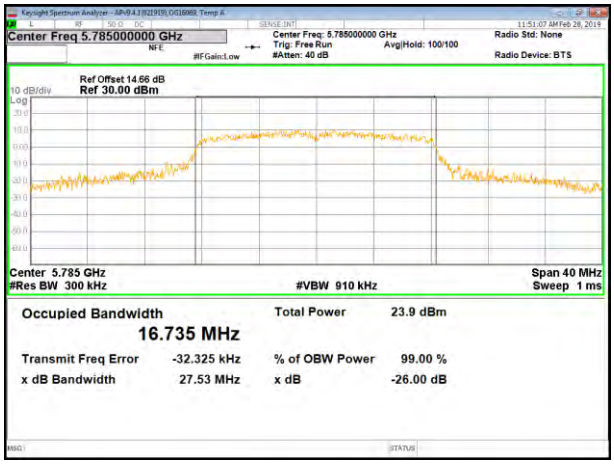


LOW CHANNEL CHAIN 3

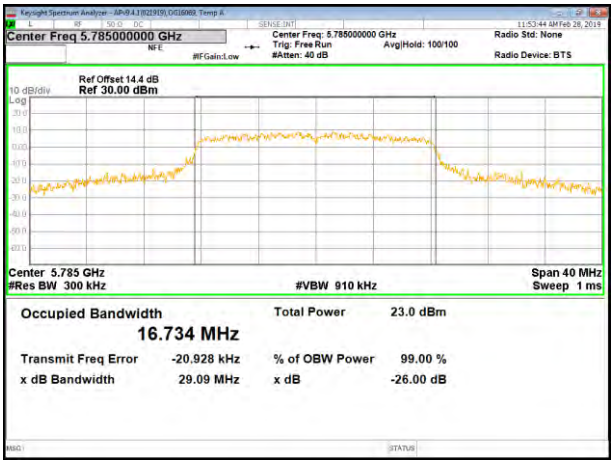
MID CHANNEL



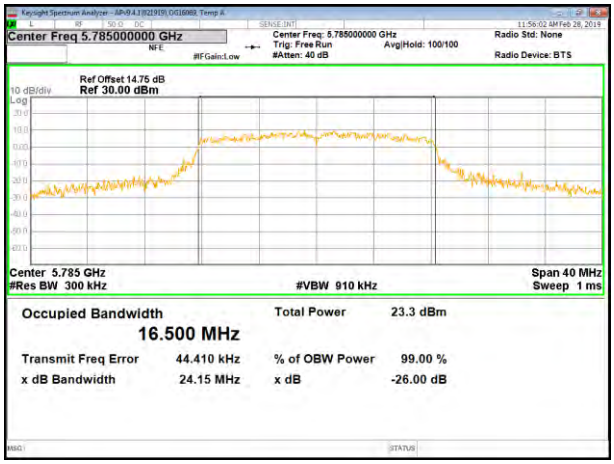
MID CHANNEL CHAIN 0



MID CHANNEL CHAIN 1



MID CHANNEL CHAIN 2



MID CHANNEL CHAIN 3