



TEST REPORT

Report Number. : 13603562-E3V1

Applicant : IKEA OF SWEDEN AB
BOX 702
SE-343 81, ÄLMHULT, SWEDEN

Model : 920-00632

Brand : IKEA

FCC ID : FHO-920-00632

ISED : 10912A-92000632

EUT Description : WIRELESS RADIO MODULE 802.11 a/b/g/n

Test Standard(s) : FCC 47 CFR PART 15 SUBPART E (Exclude DFS)
ISED RSS-247 ISSUE 2
ISED RSS-GEN ISSUE 5 + A1

Date of Issue:

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Prepared by:

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	3/10/2021	Initial Issue	-

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: IKEA OF SWEDEN AB
BOX 702
SE-343 81, ALMHULT, SWEDEN

EUT DESCRIPTION: WIRELESS RADIO MODULE 802.11 a/b/g/n

MODEL: 920-00632

BRAND: IKEA

SERIAL NUMBER: 54-2A-1B-50-0A-FC-C (RADIATED),
54-2A1B-50-0E-D8-E (CONDUCTED)

SAMPLE RECEIPT DATE: NOVEMBER 30, 2020

DATE TESTED: DECEMBER 03, 2020 TO JANUARY 16, 2021

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart E	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5 + A1	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.

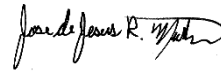
This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This 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.

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UL Verification Services Inc. By:



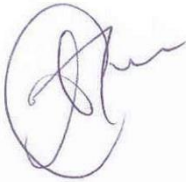
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2. TEST RESULT SUMMARY

This report contains data provided by the customer which can impact the validity of results. UL Verification Services Inc. is only responsible for the validity of results after the integration of the data provided by the customer.

FCC Clause	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle	Reporting purposes only	Per ANSI C63.10, Section 12.2.
See Comment	RSS-GEN 6.7	26dB BW/99% OBW	Reporting purposes only	Per ANSI C63.10 Sections 6.9.2 and 6.9.3
15.407 (e)	RSS-247 6.2.4.1	6 dB BW		None.
15.407 (a) (1-4), (h) (1)	RSS-247 6.2	Output Power		None.
15.407 (a) (1-3, 5)	RSS-247 6.2	PSD		None.
15.209, 15.205, 15.407 (b)	RSS-GEN 8.9, 8.10, RSS-247 6.2	Radiated Emissions		None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions		None.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with;

- FCC CFR 47 Part 2
- FCC CFR 47 Part 15,
- FCC KDB 662911 D01 v02r01,
- FCC KDB 905462 D06 v02
- FCC KDB 789033 D02 v02r01,
- KDB 414788 D01 Radiated Test Site v01r01
- ANSI C63.10-2013,
- RSS-GEN Issue 5 + A1
- RSS-247 Issue 2

4. FACILITIES AND ACCREDITATION

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
☐	Building 1: 47173 Benicia Street, Fremont, California, USA	US0104	2324A	208313
☐	Building 2: 47266 Benicia Street, Fremont, California, USA	US0104	22541	208313
☒	Building 4: 47658 Kato Rd, Fremont, California, USA	US0104	2324B	208313

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	U _{Lab}
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.78 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.40 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.84 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	6.01 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.73 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.51 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.29 dB

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

5.4. 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)
 $36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$

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.
 $36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a wireless radio module 802.11 a/b/g/n

6.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
FCC			
5.2 GHz band, 2TX			
5180-5240	802.11a	19.66	92.47
	802.11n HT20	20.78	119.67
ISED	Mode	EIRP (dBm)	EIRP (mW)
5.2 GHz band, 2TX			
5180-5240	802.11a	18.44	69.82
	802.11n HT20	19.81	95.72
FCC & ISED	Mode	Output Power (dBm)	Output Power (mW)
5.3 GHz band, 2TX			
5260-5320	802.11a	19.88	97.27
	802.11n HT20	20.34	108.14
5.6 GHz band, 2TX			
5500-5700	802.11a	19.20	83.18
	802.11n HT20	19.32	85.51
5.8 GHz band, 2TX			
5725-5850	802.11a	22.54	179.47
	802.11n HT20	24.48	280.54

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna(s) gain and type, as provided by the manufacturer's are as follows:

The radio utilizes 3 antenna models, each model is two PCB dipole antennas, with a maximum gain as below. E1915 and E1922 are chosen as the worst case and radiated test is performed on both of these two antenna models only.

The directional gain of non cross polarization antenna model: E1915 is the worst compare to cross polarization antenna models: E19122 and E1913. Therefore antenna model: E1915 is used for the output power and PSD directional gain calculation.

Frequency Range	Antenna model	Antenna 1	Antenna 2
5.15 to 5.25 GHz	E1915 (non cross polarization)	4.88	3.64
	E1922 (cross polarization)	4.1	3.7
	E1913 (cross polarization)	2.27	2.67
5.25 to 5.35 GHz	E1915 (non cross polarization)	4.63	3.52
	E1922 (cross polarization)	3.7	3.6
	E1913 (cross polarization)	2.35	2.81
5.47 to 5.725 GHz	E1915 (non cross polarization)	4.49	3.77
	E1922 (cross polarization)	3.3	3.7
	E1913 (cross polarization)	2.2	3.77
5.725 to 5.85 GHz	E1915 (non cross polarization)	4.12	2.76
	E1922 (cross polarization)	2.5	2.8
	E1913 (cross polarization)	0.79	2.82

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was v13.1

The software used during testing was 20.0f1

6.5. 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 fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that antenna models: E1915 and E1922 Y orientation was worst-case orientation; therefore, all final radiated testing and ISED 5.2G band power and PSD were performed with the EUT in Y orientation on these two antenna models.

For all the conducted test (except ISED 5.2G band power and PSD, FCC/ISED 5.3G and 5.6G restricted by conducted PSD), it was based on the higher passing power of bandedge, radiated spurious emissions between antenna models: E1915 and E1922.

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

802.11a mode: 6 Mbps

802.11n HT20 mode: MCS0

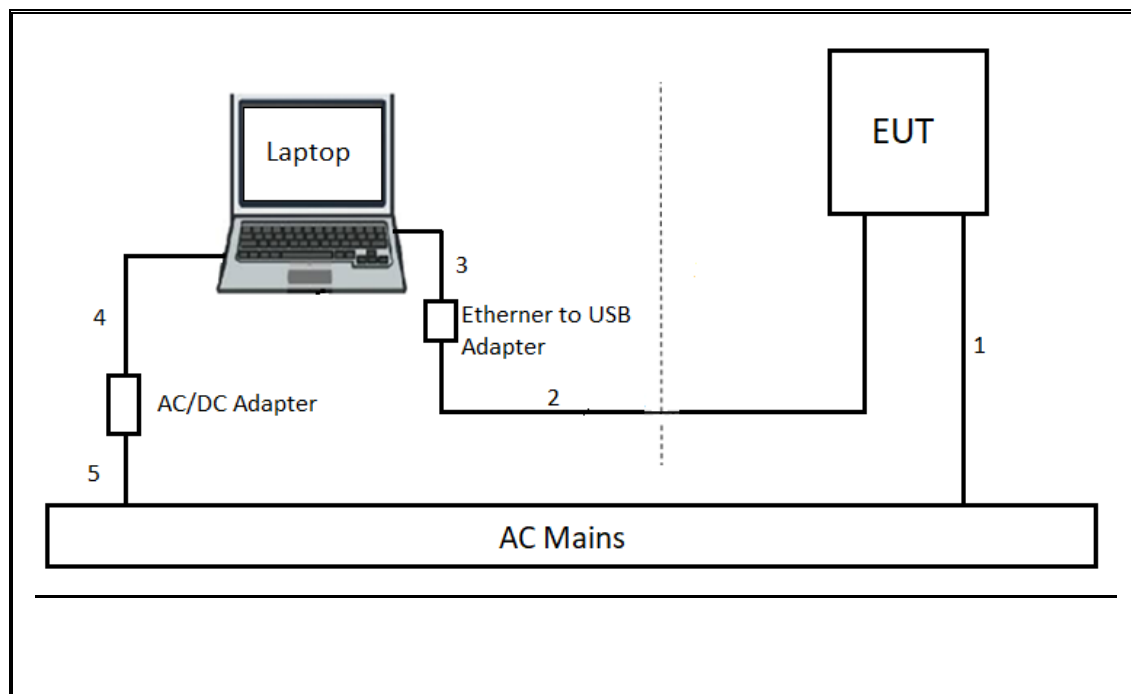
6.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT						
Description		Manufacturer	Model	Serial Number		FCC ID/ DoC
Laptop		Lenovo	X1 Carbon	R90HKAZ3		PD97265NGU
AC Adapter		Lenovo	ADLX90NLC2A	11S45N0247Z1ZS9B599814		DoC
I/O CABLES						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC Power	1	2 Prong AC	Unshielded	3	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 Ethernet Adapter
4	DC Power	1	DC	Unshielded	1.2	AC/DC Adapter to Laptop
5	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.

SETUP DIAGRAMS



7. 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, Section E.3.b (Method PM-G) and KDB 789033 D02 v02r01, Section E.2.b (Method SA-1)

Power Spectral Density: KDB 789033 D02 v02r01, Section F

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

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

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

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

8. 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
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179376	04/03/2021	04/03/2020
Amplifier, 100MHz-18GHz	AMPLICAL	AMP0.1G18-47-20	PRE0197319	05/04/2021	05/04/2020
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T863	08/31/2021	08/31/2020
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179372	02/25/2021	02/25/2020
Amplifier, 1 to 18GHz, 35dB	AMPLICAL	AMP1G18-35	T1571	08/20/2021	08/20/2020
Antenna, Horn Double Ridge Guide 700MHz to 18GHz	A.H. Systems, Inc.	SAS-571	T963	01/25/2021	01/25/2020
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	PRE0180174	12/29/2021	12/29/2020
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB3	T900	02/05/2021	02/05/2020
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179522	02/20/2021	02/20/2020
RF Amplifier, 1-18GHz	MITEQ	AFS42-00101800-25-S-42	171460	09/29/2021	09/29/2020
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T346	07/20/2021	07/20/2020
Antenna Horn, 18 to 26GHz	ARA	SWH-28	T447	05/20/2021	05/20/2020
Rf Amplifier, 18-26.5GHz, 60dB gain	AMPLICAL	AMP18G26.5-60	171590	06/07/2021	06/07/2020
Antenna, Horn 26.5 to 40GHz	ARA	MWH-2640/B	T446	09/24/2021	09/24/2020
Rf Amplifier, 26-40GHz, 60dB gain	AMPLICAL	AMP26G40-60	PRE0181239	06/07/2021	06/07/2020
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	T1268	01/22/2021	01/22/2020
Power Sensor, P-series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	T413	02/26/2021	02/26/2020
Antenna, Passive Loop 30Hz - 1MHz	ELECTRO METRICS	EM-6871	PRE0179465	07/27/2021	07/27/2020
Antenna, Passive Loop 100KHz - 30MHz	ELECTRO METRICS	EM-6872	PRE0179467	07/27/2021	07/27/2020
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight Technologies Inc	N9030A	T906	07/20/2021	07/20/2020
AC Line Conducted					
LISN	Fischer Custom Communications, Inc	FCC-LISN-50/250-25-2-01-480V	PRE0186446	01/21/2021	01/21/2020
L.I.S.N	FCC INC.	FCC LISN 50/250	24	01/21/2021	01/21/2020
EMI TEST RECEIVER	Rohde & Schwarz	ESR	T1436	02/20/2021	02/20/2020
Transient Limiter	COM-POWER	LIT-930A	PRE0129246	01/23/2021	01/23/2020
TEST SOFTWARE LIST					
Description	Manufacturer	Model	Version		
Radiated Software	UL	UL EMC	Ver 9.5, April 30, 2020, Oct 21, 2019		
Antenna Port Software	UL	UL RF	2020.12.3		
AC Line Conducted Software	UL	UL EMC	Ver 9.5, July 7, 2020		

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

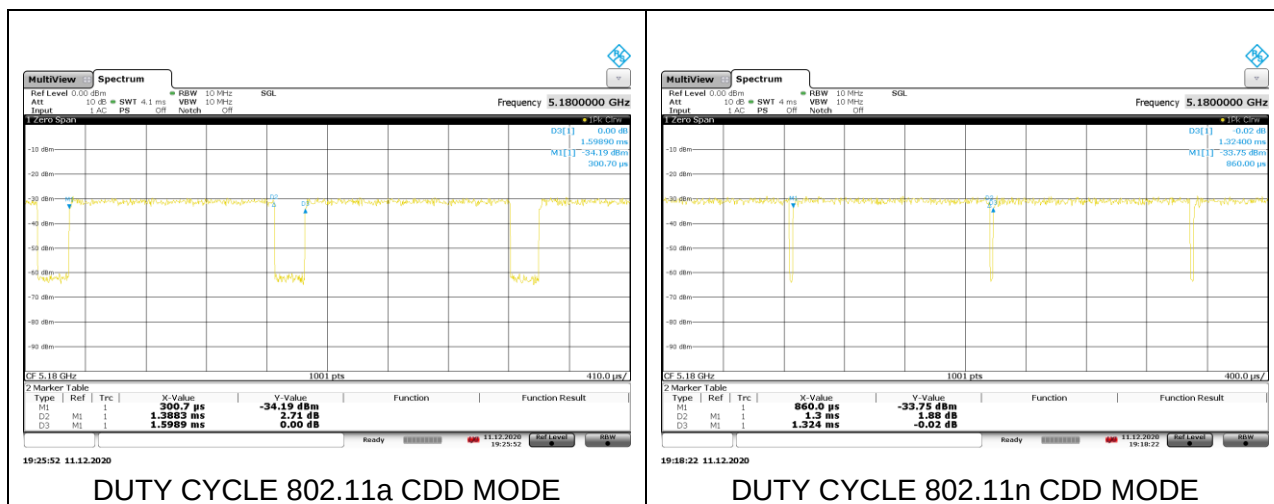
None; for reporting purposes only.

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	1.388	1.599	0.868	86.83	0.61	0.720
802.11n HT20	1.300	1.324	0.982	98.19	0.00	0.010



9.2. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

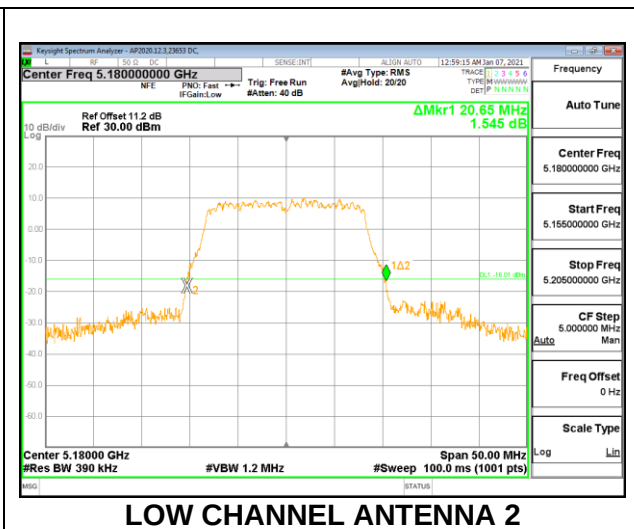
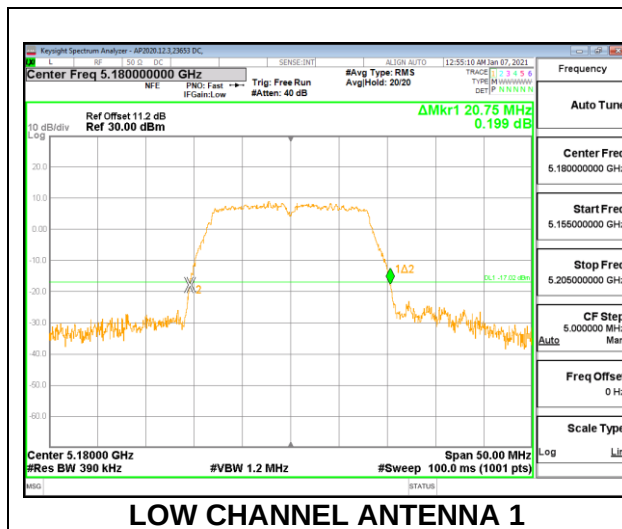
RESULTS

9.2.1. 802.11a MODE IN THE 5.2 GHz BAND

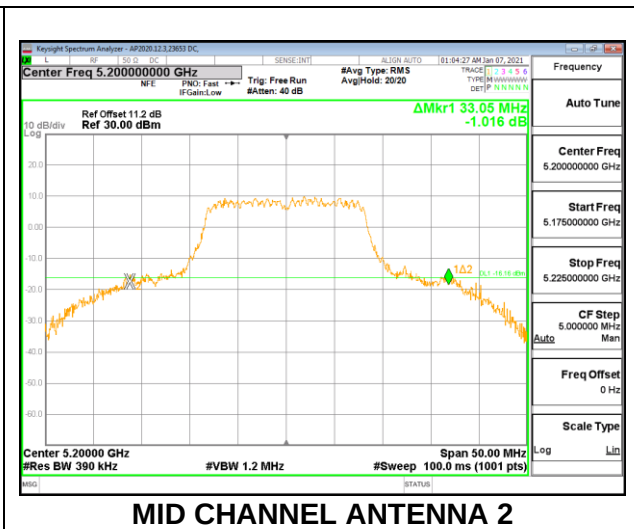
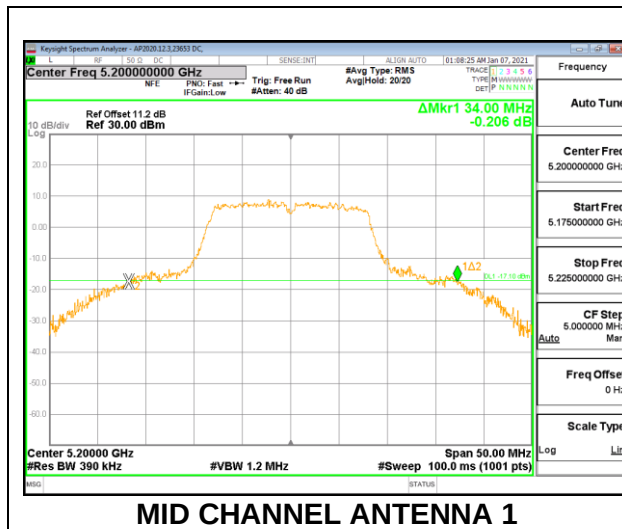
2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)
Low	5180	20.75	20.65
Mid	5200	34.00	33.05
High	5240	34.50	34.15

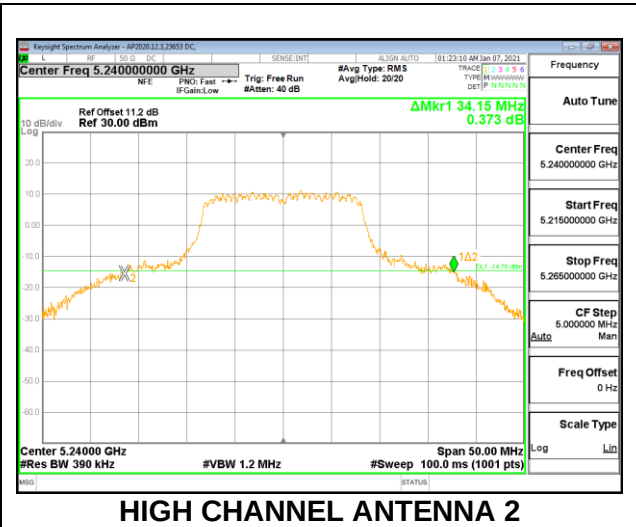
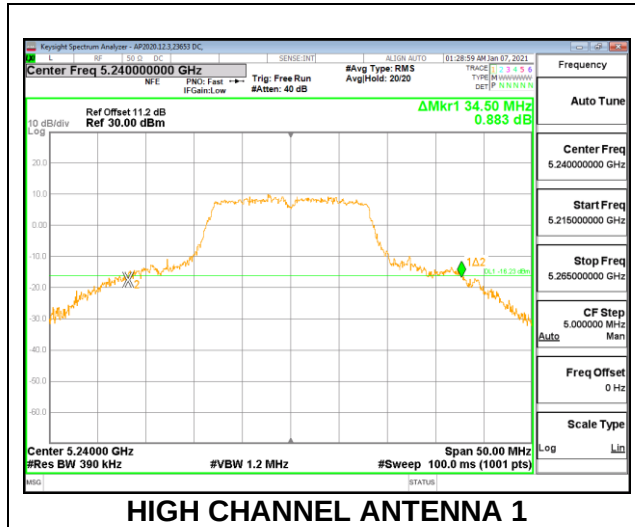
LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

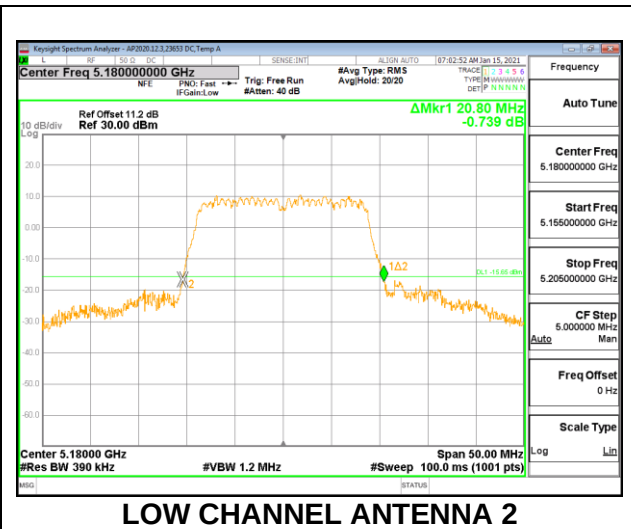
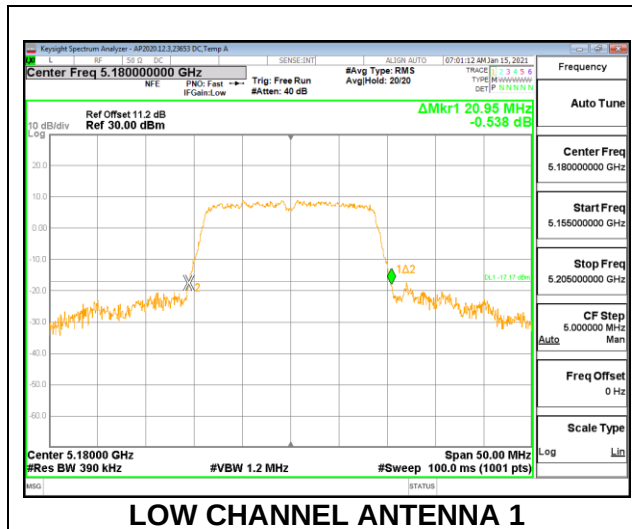


9.2.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

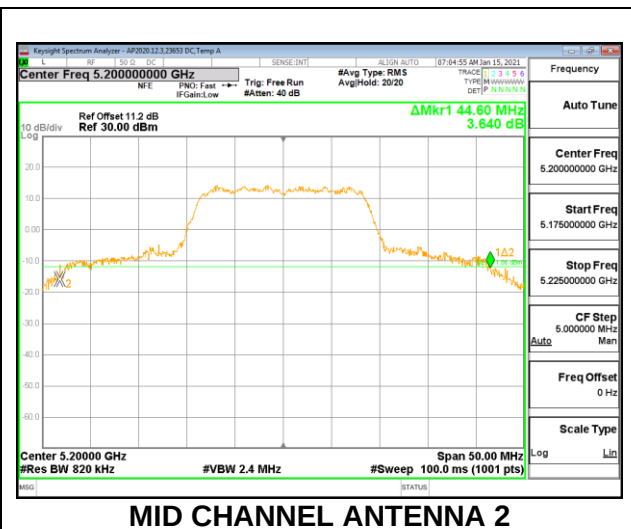
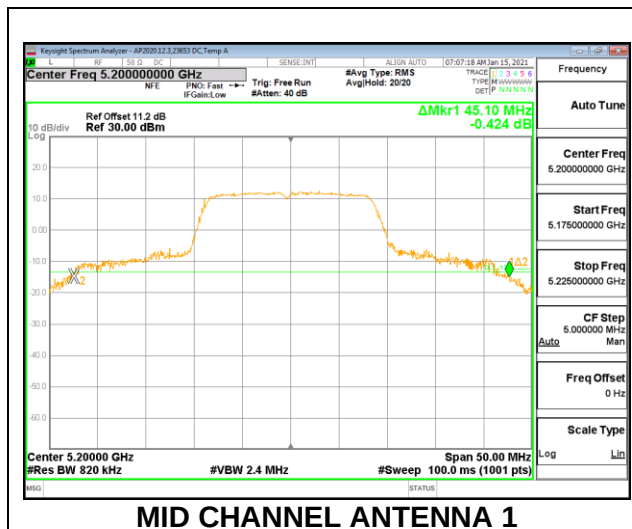
2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)
Low	5180	20.95	20.80
Mid	5200	45.10	44.60
High	5240	45.30	43.95

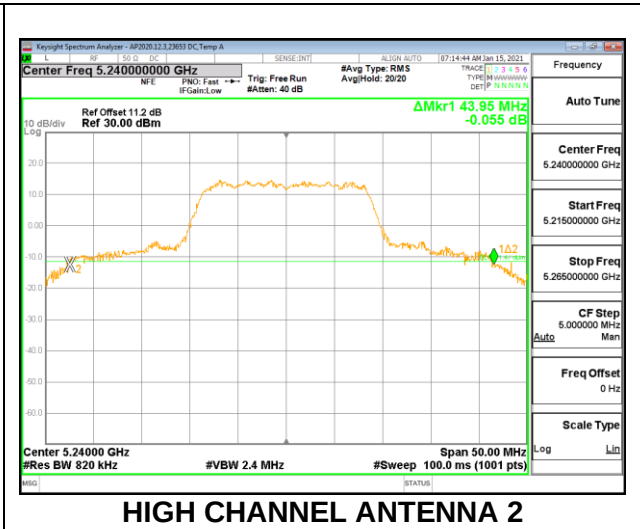
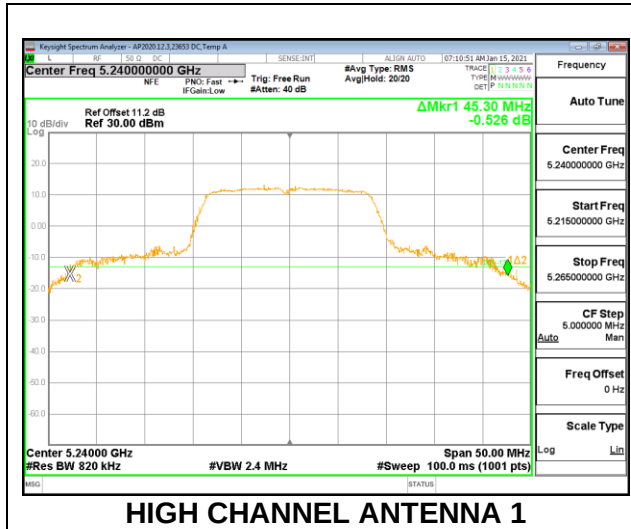
LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

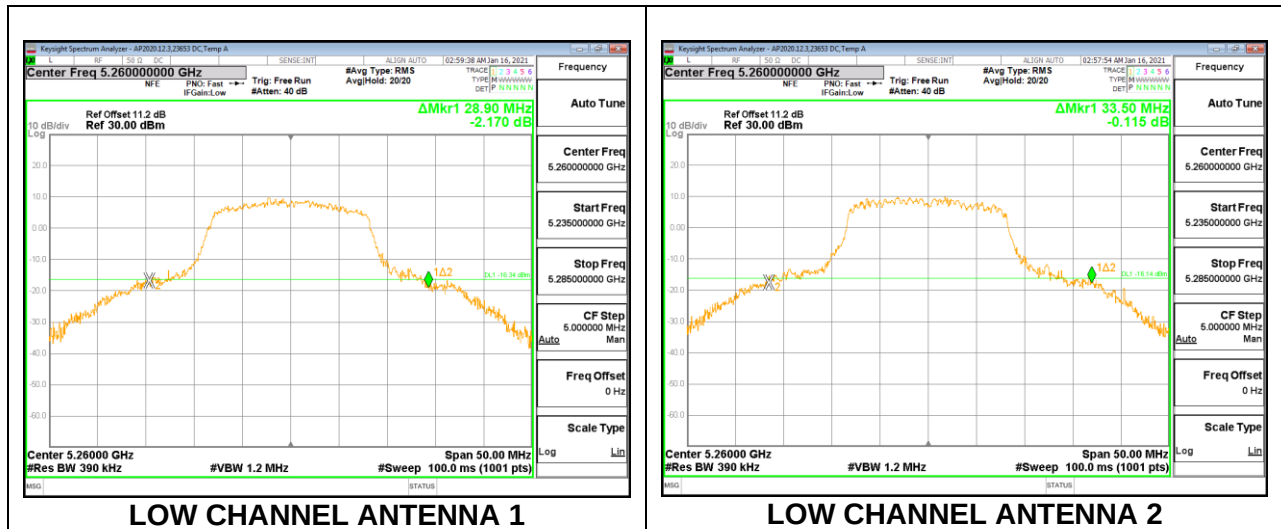


9.2.3. 802.11a MODE IN THE 5.3 GHz BAND

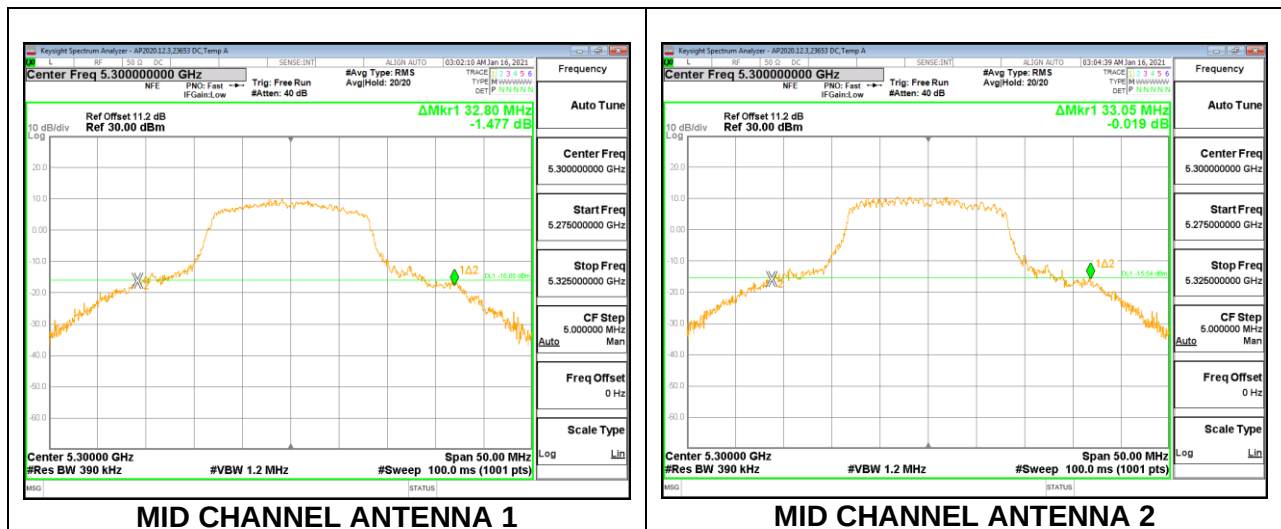
2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)
Low	5260	28.90	33.50
Mid	5300	32.80	33.05
High	5320	29.50	30.00

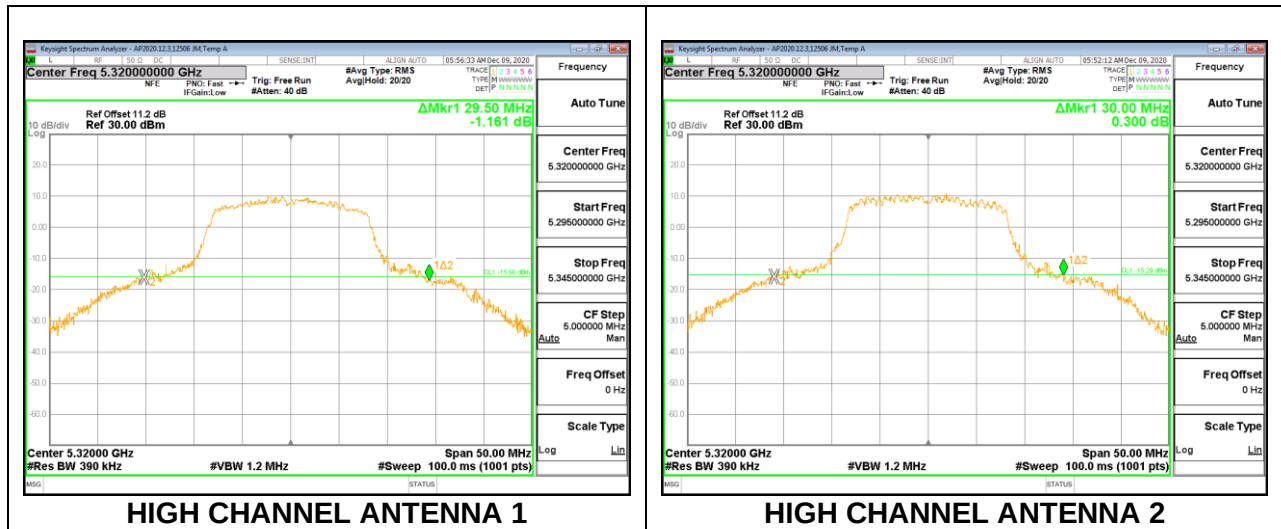
LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

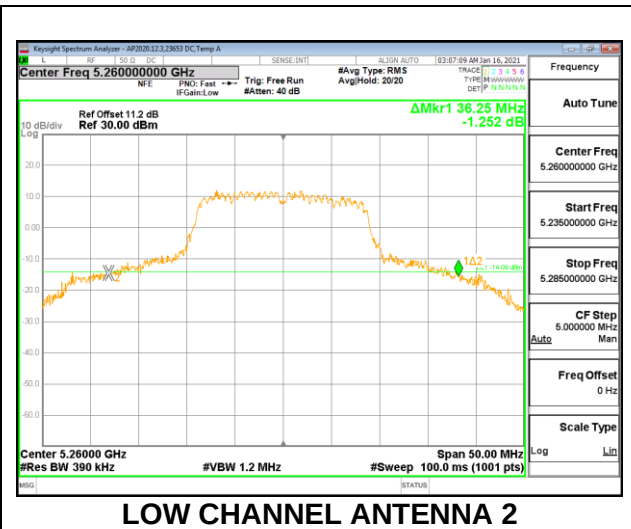
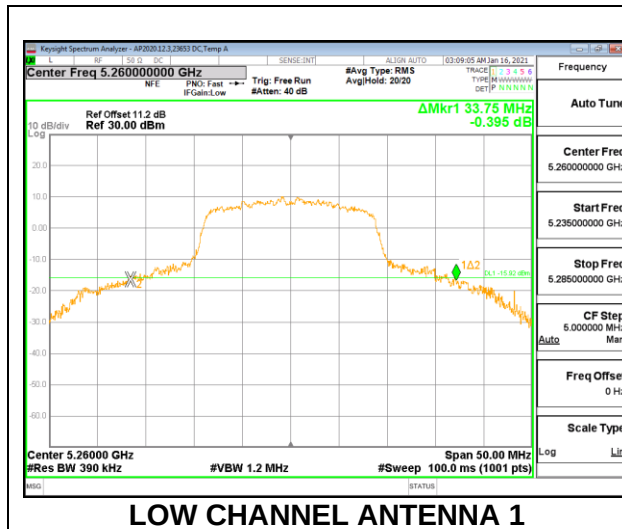


9.2.4. 802.11n HT20 MODE IN THE 5.3 GHz BAND

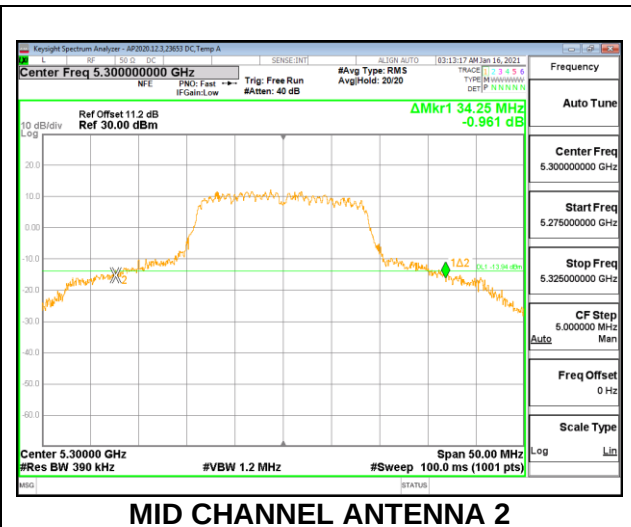
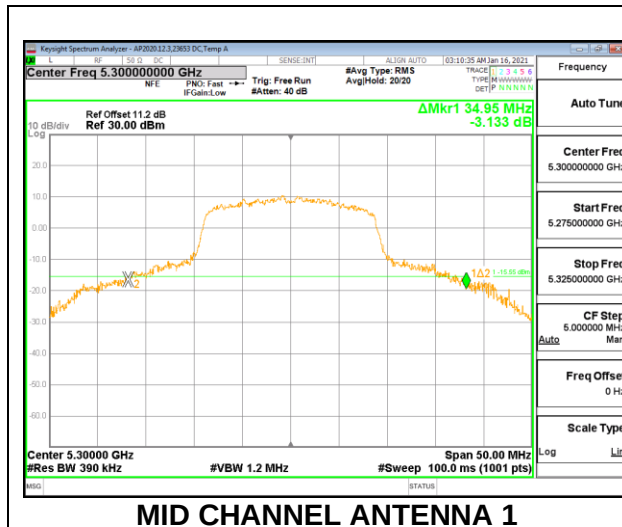
2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)
Low	5260	33.75	36.25
Mid	5300	34.95	34.25
High	5320	35.05	32.10

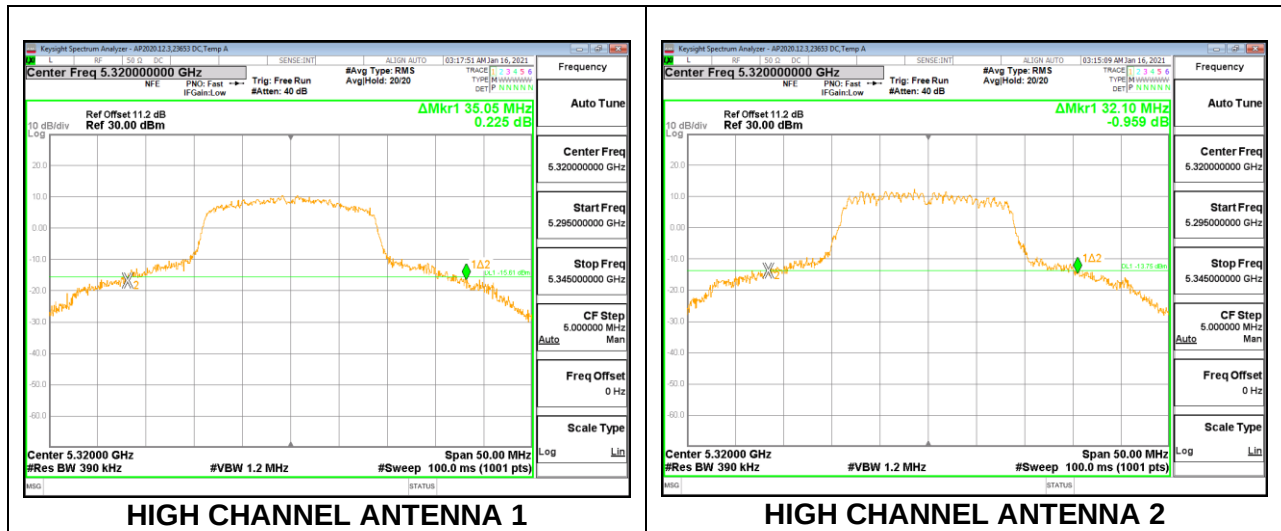
LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

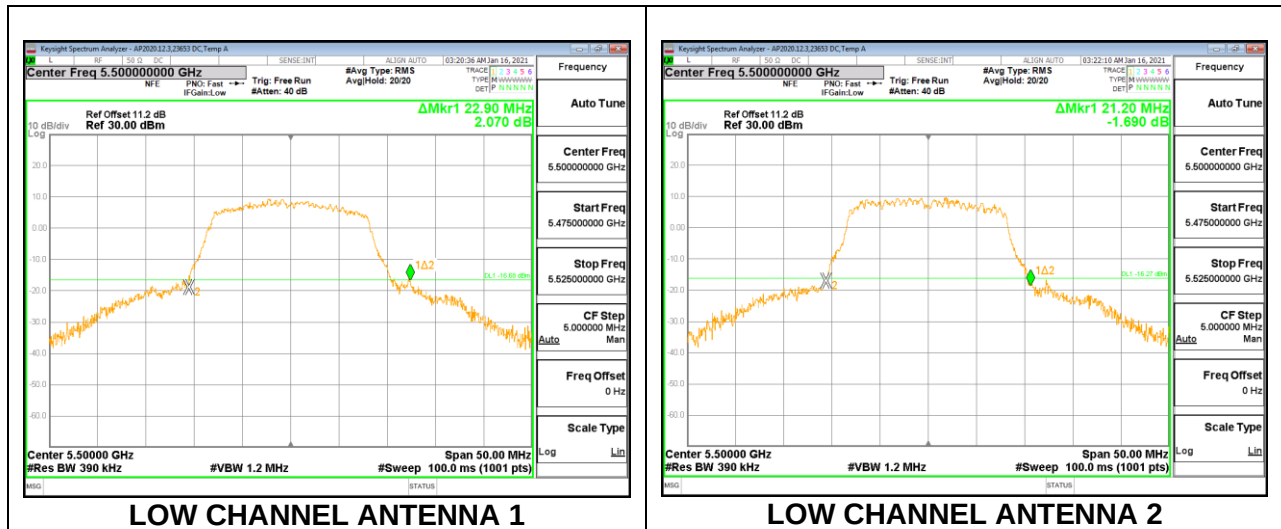


9.2.5. 802.11a MODE IN THE 5.6 GHz BAND

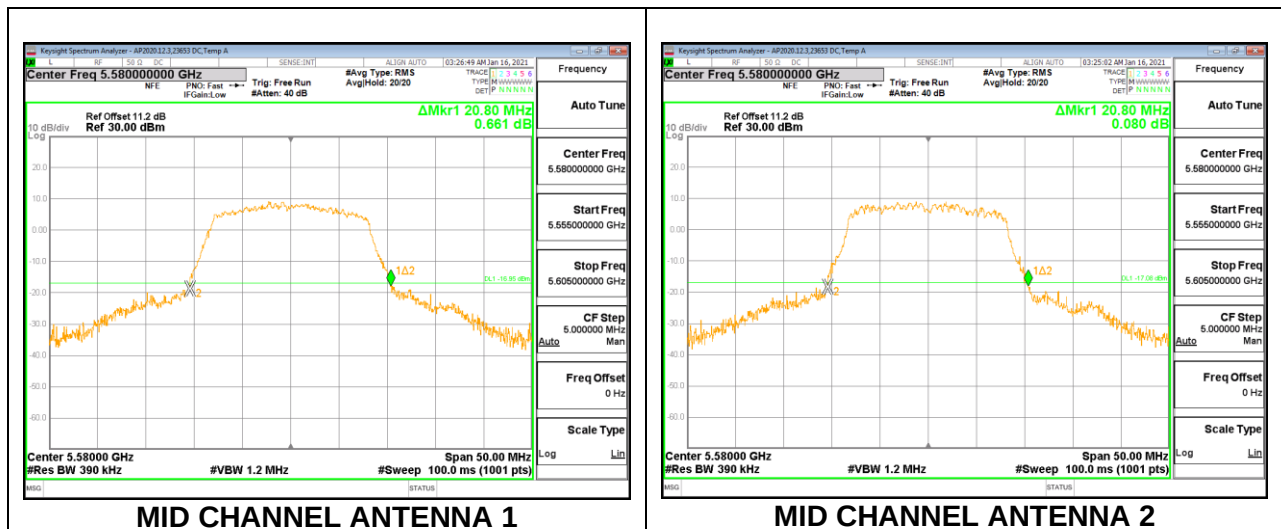
2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)
Low	5500	22.90	21.20
Mid	5580	20.80	20.80
High	5700	22.95	23.20

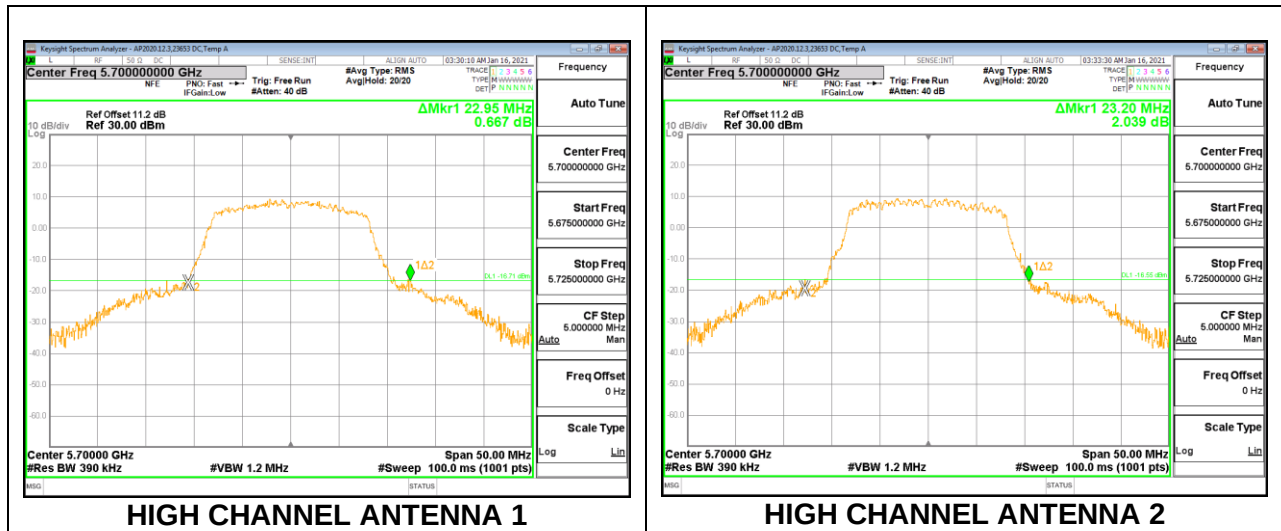
LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

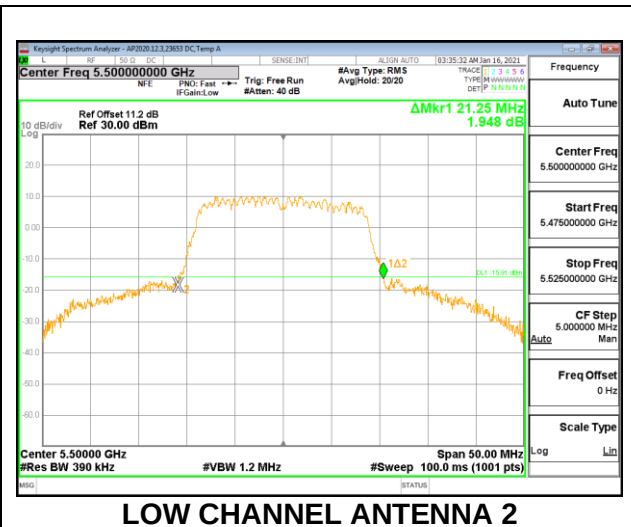
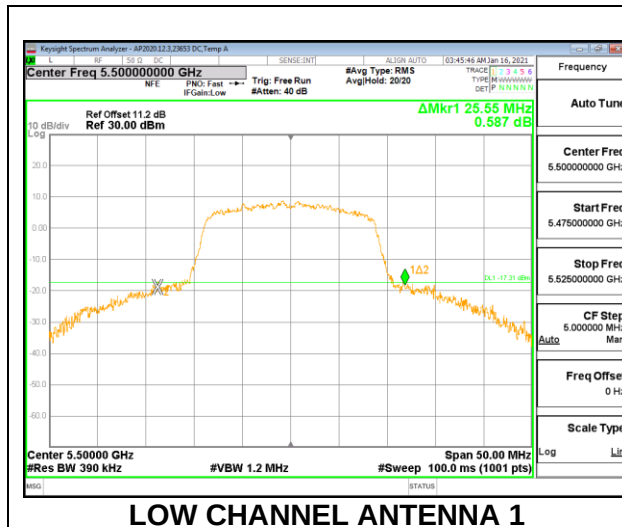


9.2.6. 802.11n HT20 MODE IN THE 5.6 GHz BAND

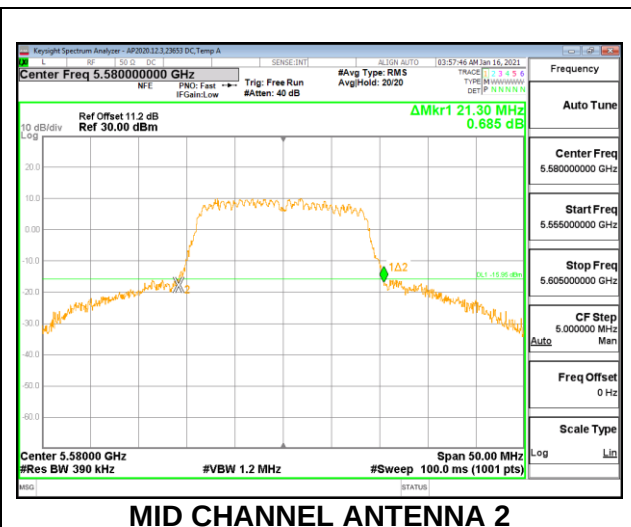
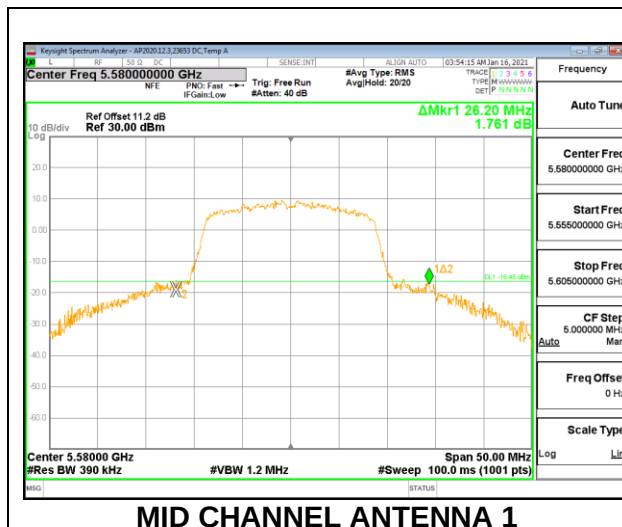
2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)
Low	5500	25.55	21.25
Mid	5580	26.20	21.30
High	5700	21.70	22.15

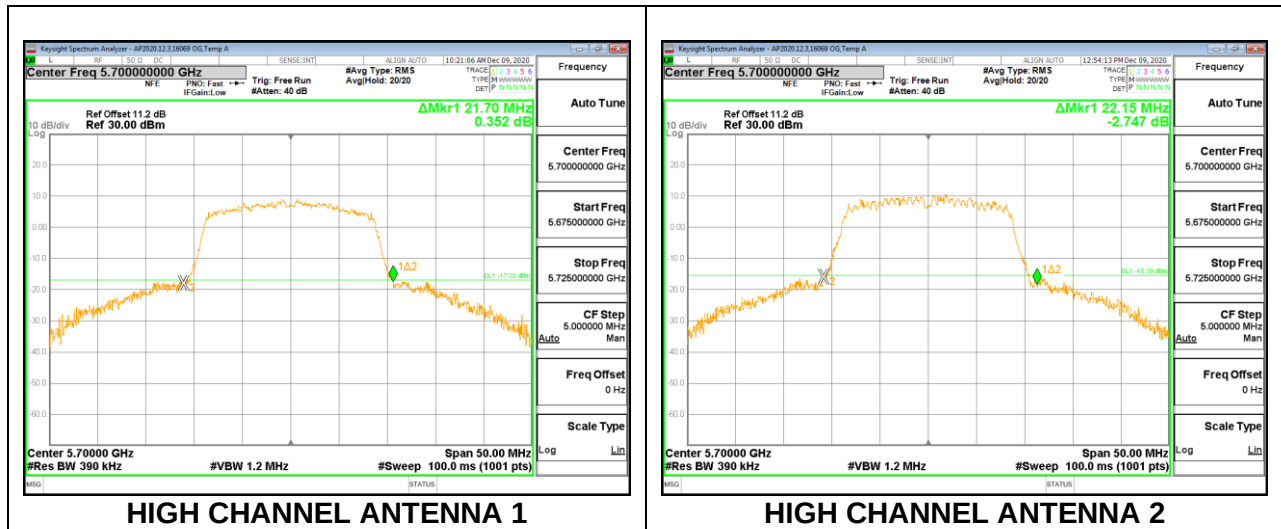
LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

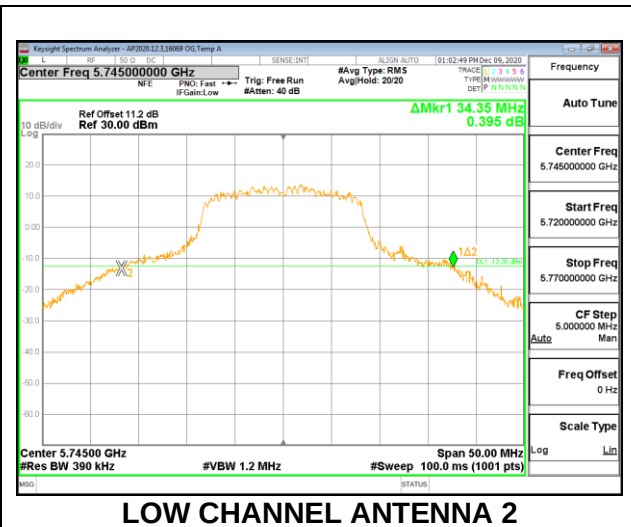
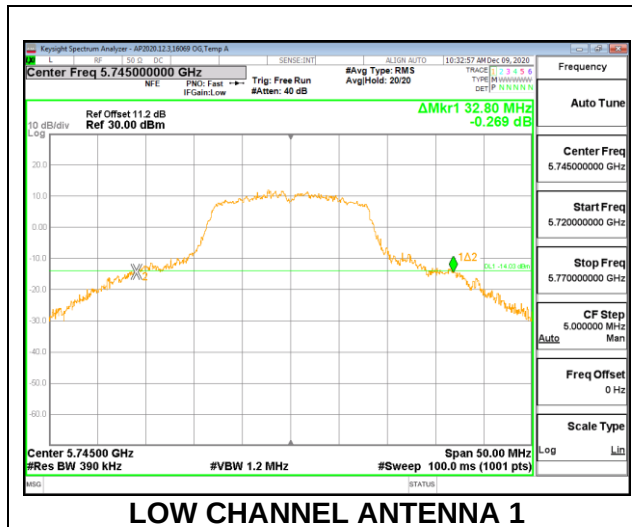


9.2.7. 802.11a MODE IN THE 5.8 GHz BAND

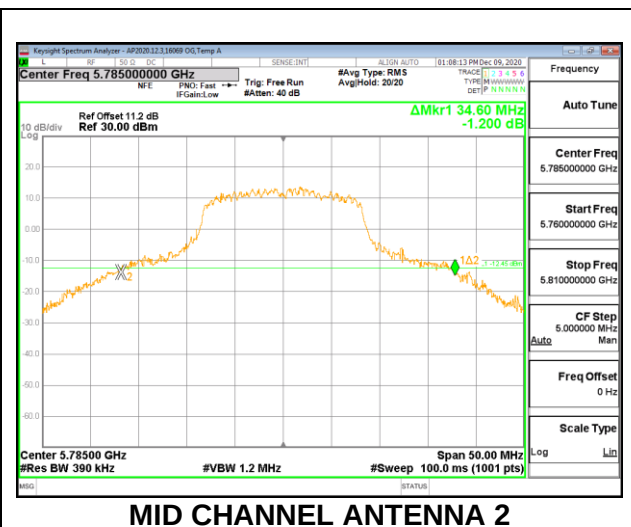
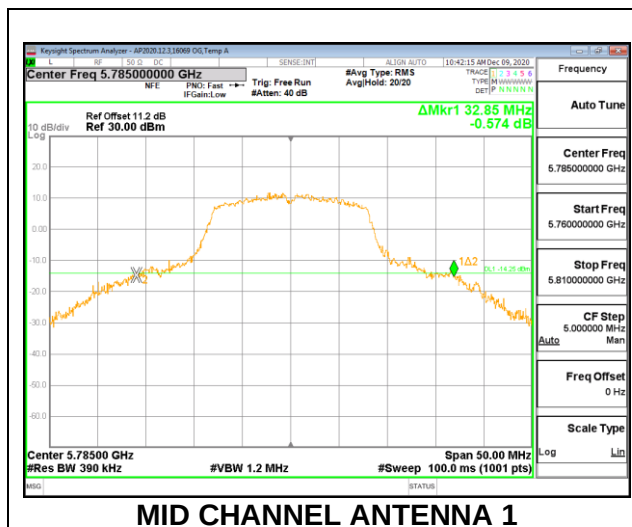
2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)
Low	5745	32.80	34.35
Mid	5785	32.85	34.60
High	5825	34.70	34.35

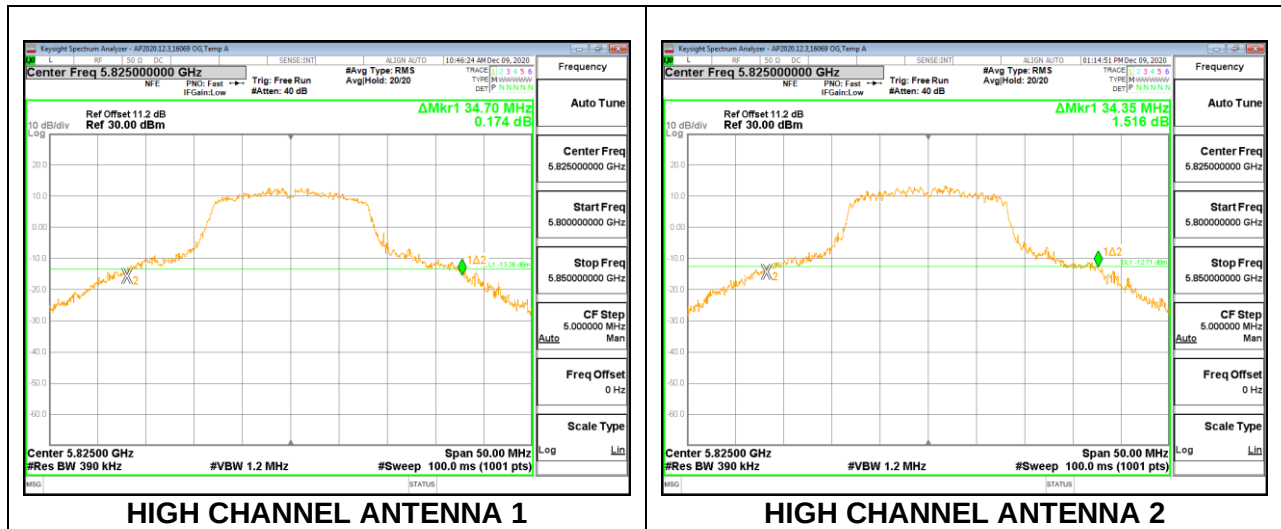
LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

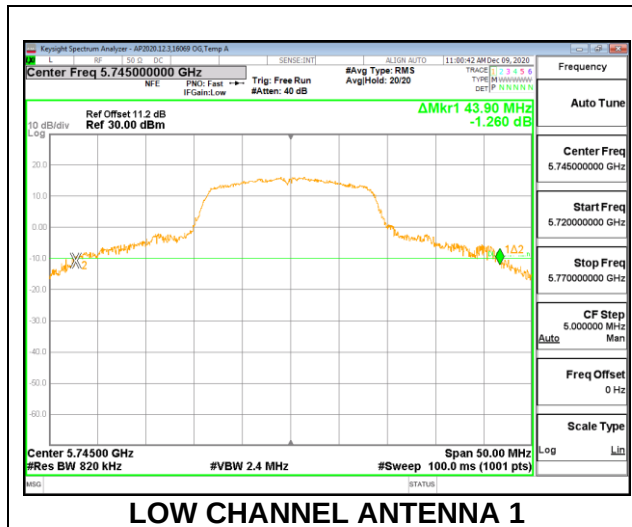


9.2.8. 802.11n HT20 MODE IN THE 5.8 GHz BAND

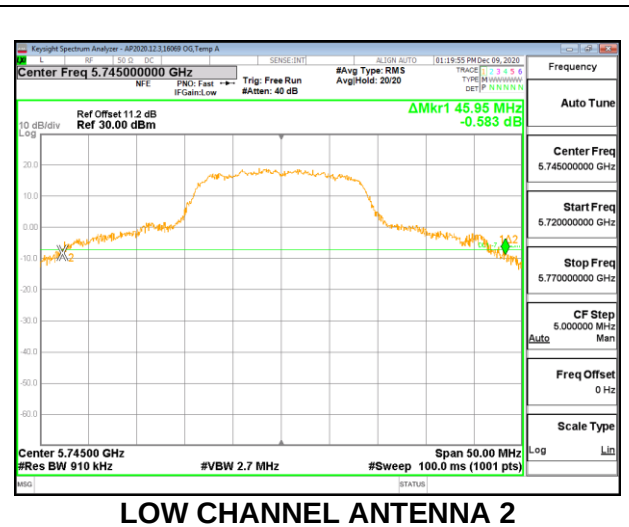
2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	26 dB Bandwidth Antenna 1 (MHz)	26 dB Bandwidth Antenna 2 (MHz)
Low	5745	43.90	45.95
Mid	5785	44.35	45.45
High	5825	45.80	46.60

LOW CHANNEL

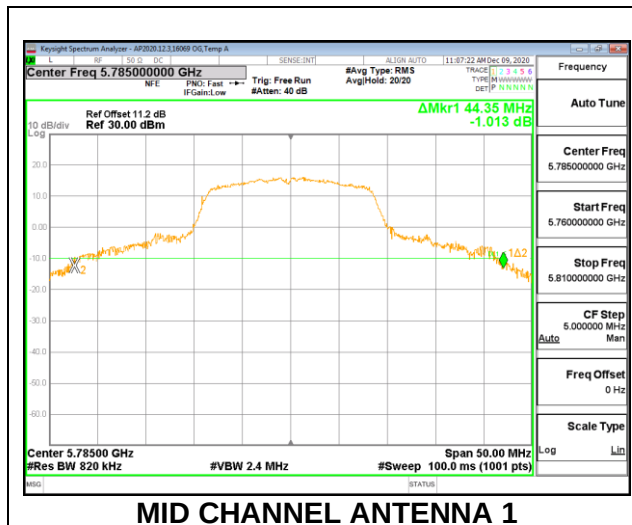


LOW CHANNEL ANTENNA 1

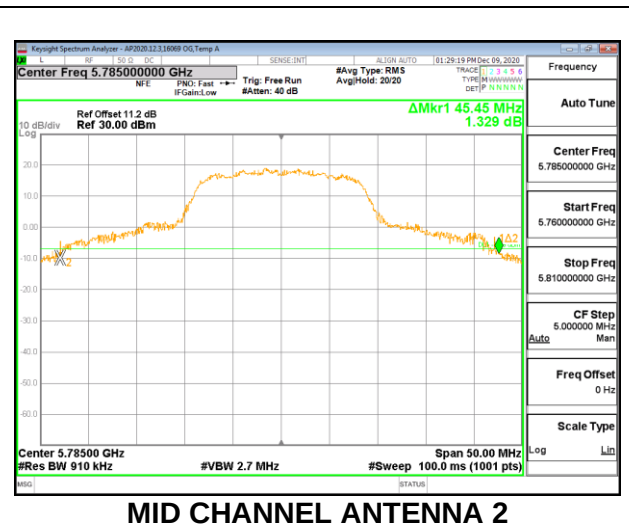


LOW CHANNEL ANTENNA 2

MID CHANNEL

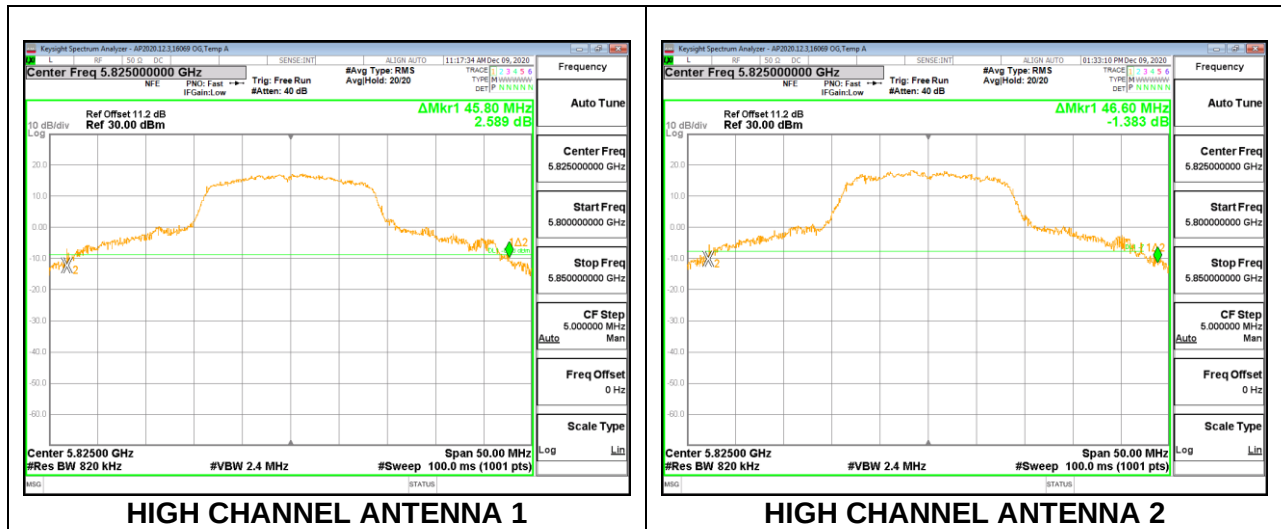


MID CHANNEL ANTENNA 1



MID CHANNEL ANTENNA 2

HIGH CHANNEL



9.3. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

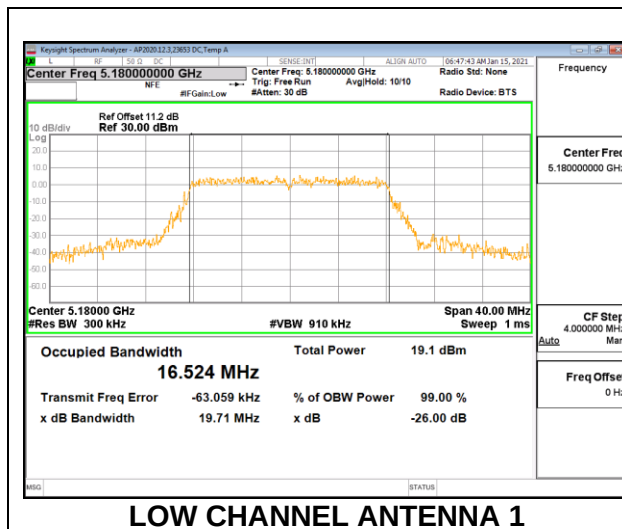
RESULTS

9.3.1. 802.11a MODE IN THE 5.2 GHz BAND

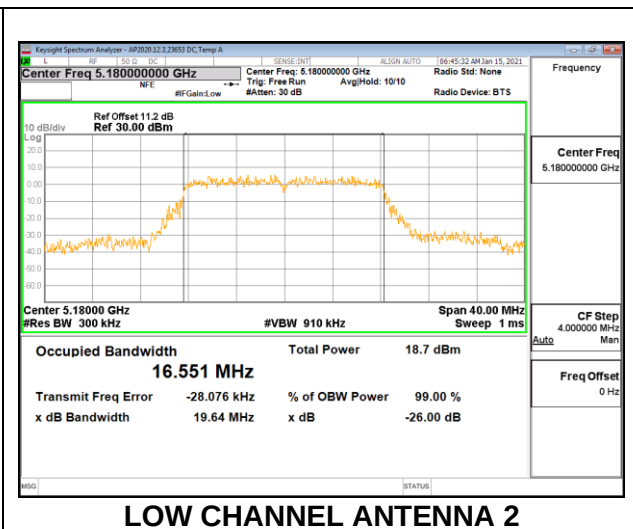
2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth Antenna 1 (MHz)	99% Bandwidth Antenna 2 (MHz)
Low	5180	16.524	16.551
Mid	5200	16.903	16.867
High	5240	16.940	17.358

LOW CHANNEL

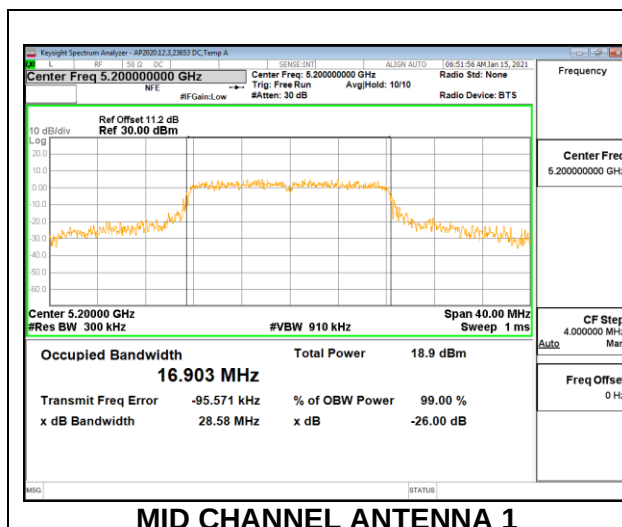


LOW CHANNEL ANTENNA 1

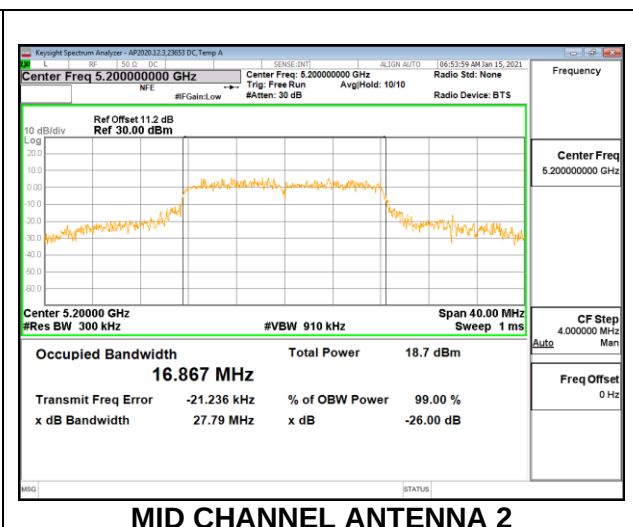


LOW CHANNEL ANTENNA 2

MID CHANNEL

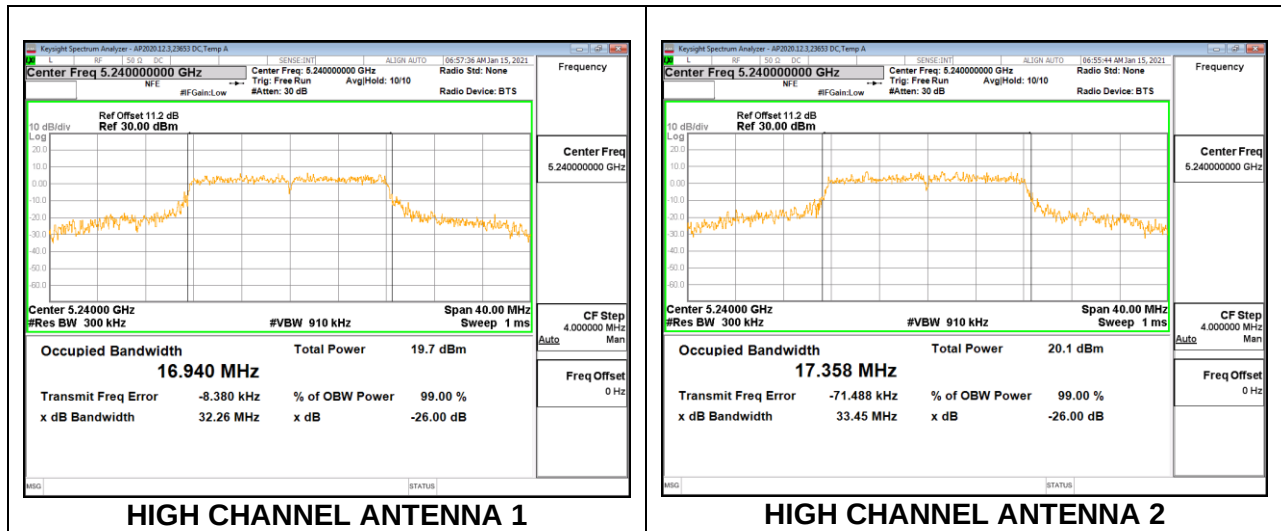


MID CHANNEL ANTENNA 1



MID CHANNEL ANTENNA 2

HIGH CHANNEL

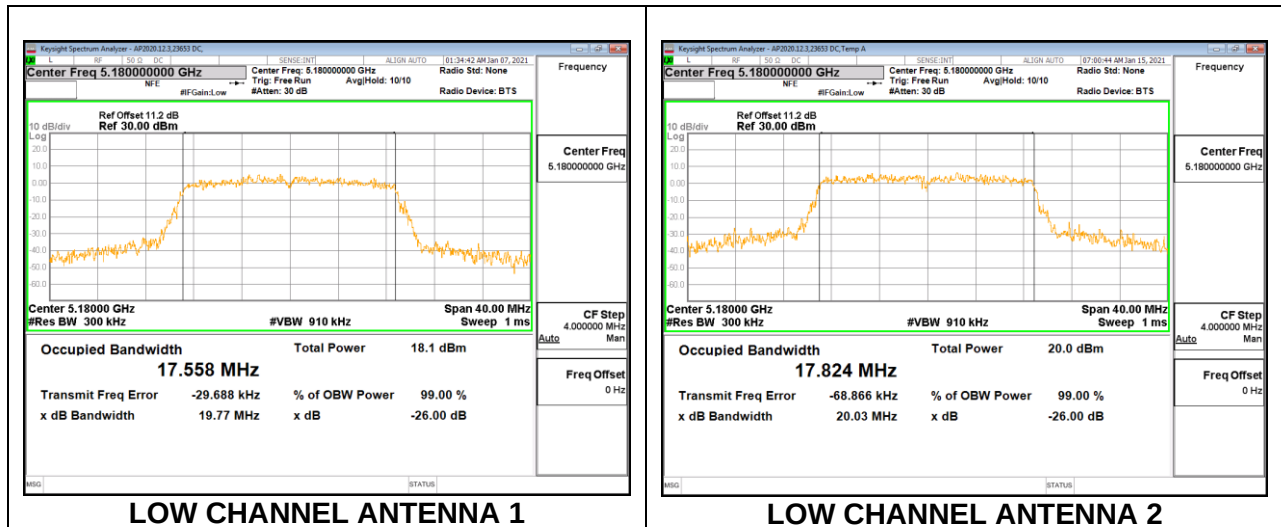


9.3.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

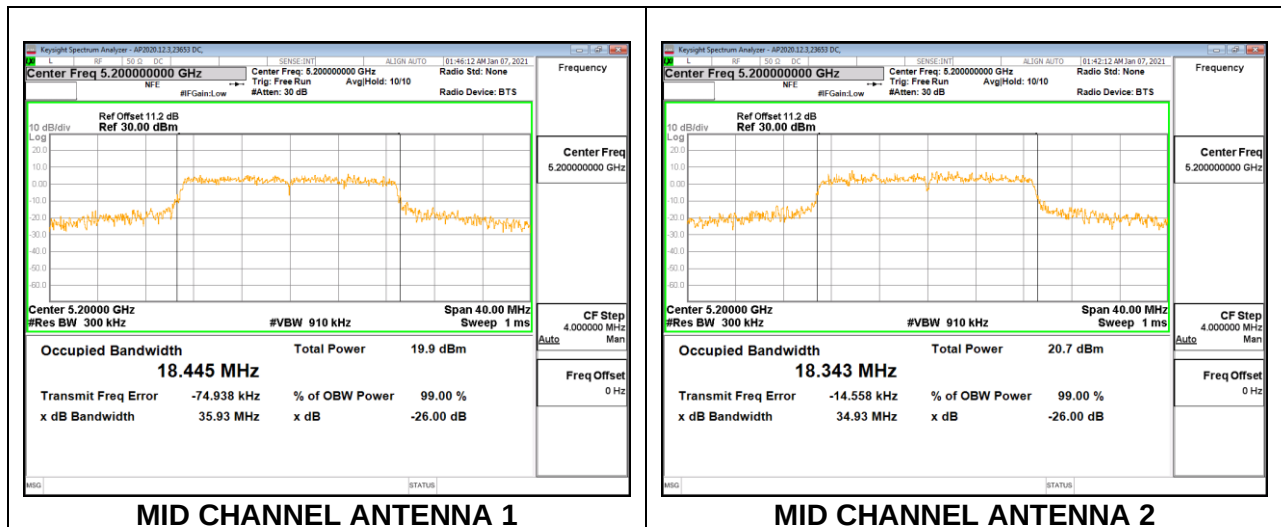
2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth Antenna 1 (MHz)	99% Bandwidth Antenna 2 (MHz)
Low	5180	17.558	17.824
Mid	5200	18.445	18.343
High	5240	18.364	18.493

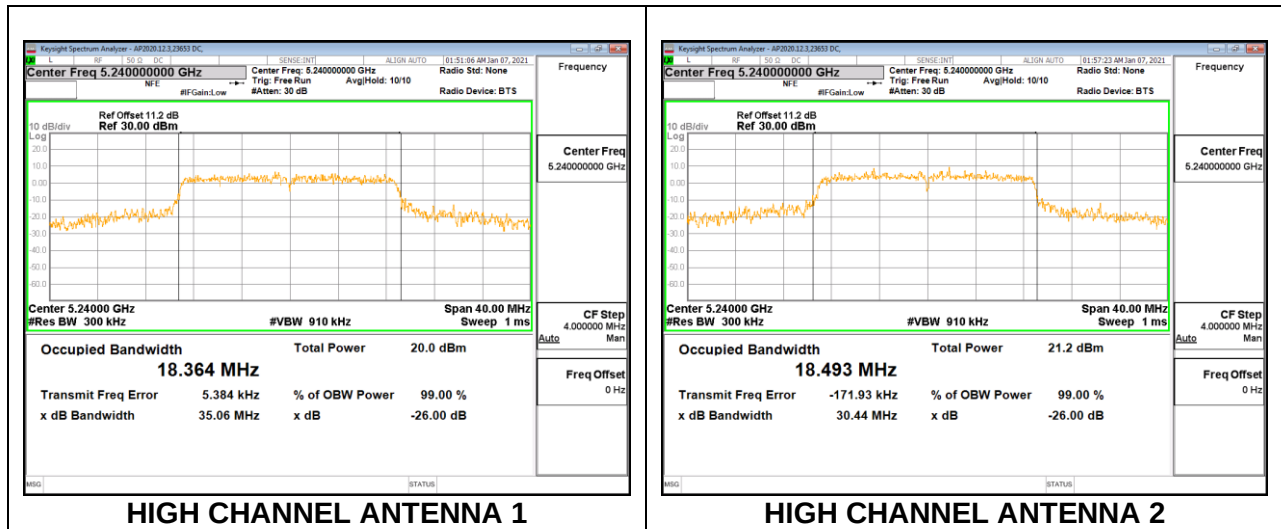
LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

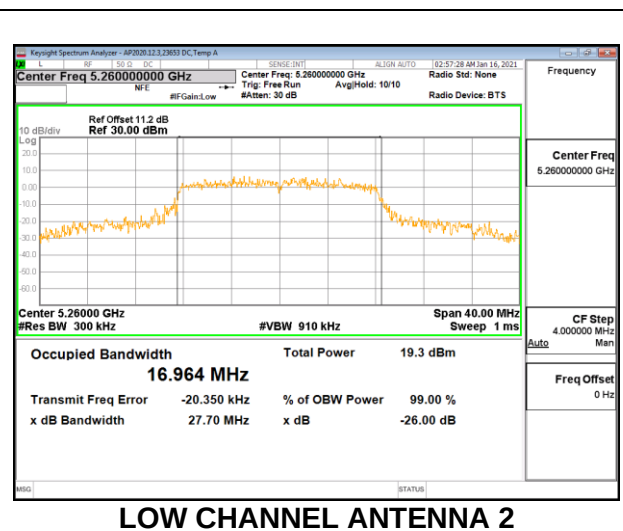
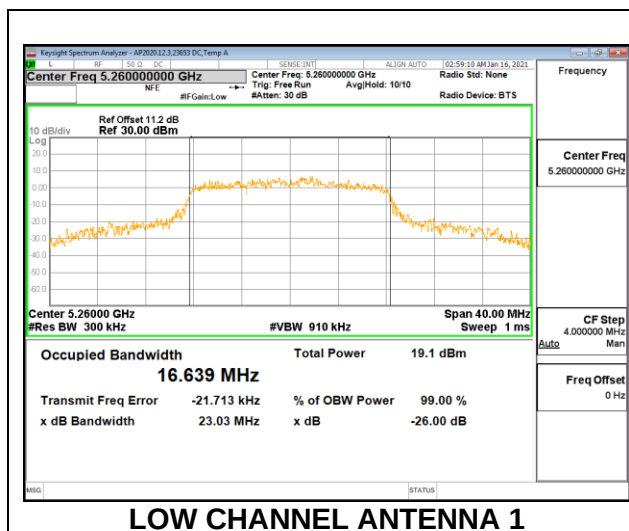


9.3.3. 802.11a MODE IN THE 5.3 GHz BAND

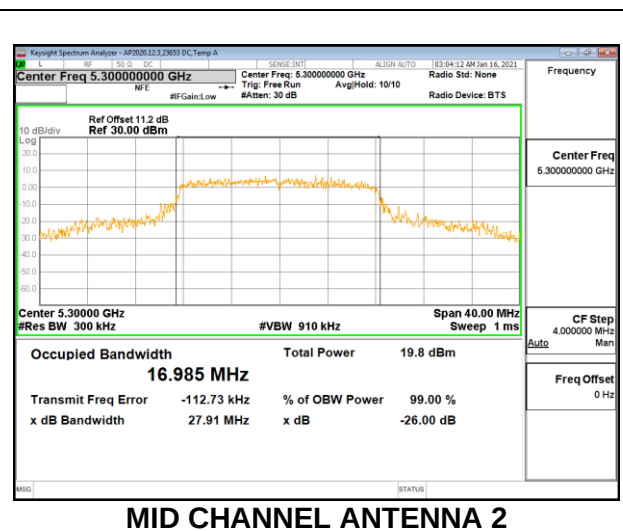
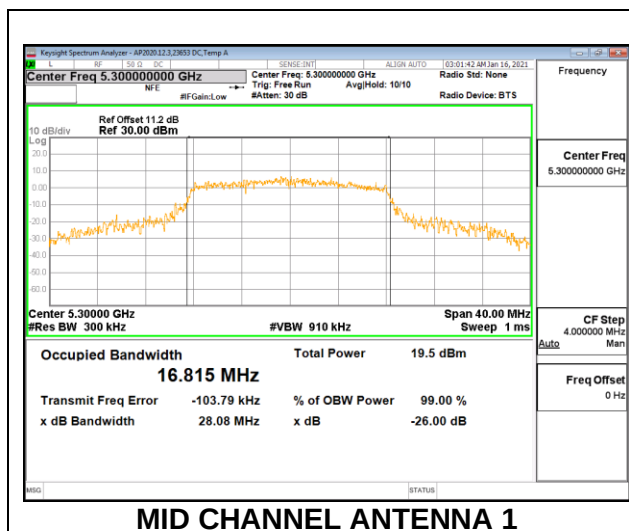
2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth Antenna 1 (MHz)	99% Bandwidth Antenna 2 (MHz)
Low	5260	16.639	16.964
Mid	5300	16.815	16.985
High	5320	16.918	16.896

LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

