



CERTIFICATION TEST REPORT

Report Number. : 12943451-E3V2

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

Model : A2218

FCC ID : BCG-E3308A

IC : 579C-E3308A

EUT Description : SMARTPHONE

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C
ISED RSS-247 ISSUE 2
ISED RSS-GEN ISSUE 5

Date Of Issue:
August 21, 2019

Prepared by:
UL Verification Services Inc.
47173 Benicia Street
Fremont, CA 94538 U.S.A.
TEL: (510) 319-4000
FAX: (510) 661-0888



NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	8/16/2019	Initial Issue	Chin Pang
V2	8/21/2019	Addressed TCB Feedback on Sections 7, 8.1, 8.4, 8.6 and 9	Tony Li

REPORT REVISION HISTORY	2
1. ATTESTATION OF TEST RESULTS	5
2. TEST METHODOLOGY	6
3. FACILITIES AND ACCREDITATION	6
4. CALIBRATION AND UNCERTAINTY	7
4.1. MEASURING INSTRUMENT CALIBRATION	7
4.2. SAMPLE CALCULATION	7
4.3. MEASUREMENT UNCERTAINTY	7
5. EQUIPMENT UNDER TEST	8
5.1. EUT DESCRIPTION	8
5.2. MAXIMUM OUTPUT POWER	8
5.3. DESCRIPTION OF AVAILABLE ANTENNAS	9
5.4. SOFTWARE AND FIRMWARE	9
5.5. WORST-CASE CONFIGURATION AND MODE	9
5.6. DESCRIPTION OF TEST SETUP	11
6. MEASUREMENT METHOD	15
7. TEST AND MEASUREMENT EQUIPMENT	16
8. ANTENNA PORT TEST RESULTS	18
8.1. ON TIME AND DUTY CYCLE	18
8.2. 99% BANDWIDTH	21
8.2.1. 802.11b MODE	22
8.2.2. 802.11n HT20 MODE	26
8.2.3. 802.11ax HE20 MODE	36
8.2.4. 802.11ax HE20 OFDMA MODE 2TX	60
8.3. 6 dB BANDWIDTH	80
8.3.1. 802.11b MODE	81
8.3.2. 802.11n HT20 MODE	85
8.3.3. 802.11ax HE20 MODE	96
8.3.4. 802.11ax HE20 OFDMA MODE 2TX	120
8.4. OUTPUT POWER	140
8.4.1. 802.11b MODE	141
8.4.2. 802.11n HT20 MODE	143
8.4.3. 802.11ax HE20 MODE	146
8.4.4. 802.11ax HE20 OFDMA MODE 2TX	154
8.5. POWER SPECTRAL DENSITY	158
8.5.1. 802.11b MODE	159
8.5.2. 802.11n HT20 MODE	163
8.5.3. 802.11ax HE20 MODE	173
8.5.4. 802.11ax HE20 OFDMA MODE 2TX	197

8.6.	CONDUCTED SPURIOUS EMISSIONS	217
8.6.1.	802.11b MODE	218
8.6.2.	802.11n HT20 MODE	222
8.6.3.	802.11ax HE20 MODE	234
8.6.4.	802.11ax HE20 OFDMA MODE 2TX	258
9.	RADIATED TEST RESULTS	290
9.1.	TRANSMITTER ABOVE 1 GHz	292
9.1.1.	TX ABOVE 1 GHz 802.11b MODE IN THE 2.4 GHz BAND	292
9.1.2.	TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 2.4 GHz BAND	320
9.1.3.	TX ABOVE 1 GHz 802.11ax HE20 MODE IN THE 2.4 GHz BAND	374
9.1.4.	TX ABOVE 1 GHz 802.11ax HE20 OFDMA MODE IN THE 2.4 GHz BAND	438
9.2.	WORST CASE BELOW 1 GHz	486
9.3.	WORST CASE 18-26 GHz	488
10.	AC POWER LINE CONDUCTED EMISSIONS	490
10.1.1.	AC Power Line Host	491
10.1.2.	AC Power Line Norm	493
11.	SETUP PHOTOS	495

1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: SMARTPHONE

MODEL: A2218

SERIAL NUMBER: Radiated & Conducted
G6TYW036N39T, G6TYW03BN39T, G6TYW02HN39M,
G6TYW009N39M

DATE TESTED: MAY 21, 2019 – AUGUST 21, 2019

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. 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:



Chin Pang
Senior Engineer
Consumer Technology Division
UL Verification Services Inc.

Prepared By:



Tony Li
Test 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, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, 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 (ISED:2324B-1)	☒ Chamber D (ISED:22541-1)	☐ Chamber I (ISED:2324A-5)
☒ Chamber B (ISED:2324B-2)	☒ Chamber E (ISED:22541-2)	☐ Chamber J (ISED:2324A-6)
☐ Chamber C (ISED:2324B-3)	☒ Chamber F (ISED:22541-3)	☒ Chamber K (ISED:2324A-1)
	☒ Chamber G (ISED:22541-4)	☐ Chamber L (ISED:2324A-3)
	☒ Chamber H (ISED:22541-5)	

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

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

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%.

5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The Apple iPhone is a smartphone with multimedia functions (music, application support, and video), cellular GSM, GPRS, EGPRS, UMTS, LTE, TD-SCDMA, CDMA, IEEE 802.11a/b/g/n/ac/ax, Bluetooth, Ultra-Wide band, GPS and NFC. All models support at least one UICC based SIM. The second SIM, if present, is either UICC based pSIM (physical SIM) or e-SIM (electronic SIM). The device has a built-in inductive charging receiver. The rechargeable battery is also not user accessible.

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)
1Tx			
2412 - 2472	802.11b	21.21	132.13
2412 - 2472	802.11g	Covered by 802.11n HT20 1TX	
2412 - 2472	802.11n HT20	21.17	130.92
2412 - 2472	802.11ax HE20, 242-Tones	21.15	130.32
2412 - 2472	802.11ax HE20, 26-Tones	21.19	131.52
2Tx			
2412 - 2472	802.11n HT20 CDD	23.23	210.38
2412 - 2472	802.11g SDM/STBC	Covered by 802.11n HT20 2TX CDD	
2412 - 2472	802.11ax HE20, 242-Tones	23.18	207.97
2412 - 2472	802.11ax HE20, 26-Tones	22.35	171.79

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Range	Antenna 4	Antenna 3
2400-2480	-0.90	-2.30

5.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was v1.29.99992

5.5. 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 3. For ANT 4 and 2Tx, Z (Portrait) orientation was the worst case.

Radiated band edge, harmonic, and spurious emissions from 1GHz to 18GHz were performed with the EUT 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 radiated harmonics spurious below 1GHz, 1-18GHz L/M/H channels, 18-26GHz, and power line conducted emissions were performed with the EUT set at the 2TX CDD mode among the CDD/SDM modes and 2TX HE mode with power setting equal or higher than SISO modes as 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 tests, the worst-case configuration reported was 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.

The output power and psd for the 802.11 ax mode were investigated between all different tones, and we found that the highest tone had the highest output power and PSD readings, the lowest tone had the highest PSD readings. Therefore, full testing was performed on both the highest and lowest tones.

The PSD were performed as worst case mode.

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

802.11b mode: 1 Mbps
802.11n HT20mode: MCS0
802.11ax HE20mode: MCS0

There are two vendors of the WiFi/Bluetooth radio modules: variANT 4 and variANT 3. The WiFi/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.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
laptop	Apple	A1502	HRP003436	QDS-BRCM1080
Laptop AC/DC adapter	Liteon Technology	PA-1450-BA1	B123	NA
EUT AC Adapter	Apple	A1385	D29325SM03XDHLHC9	NA

I/O CABLES

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

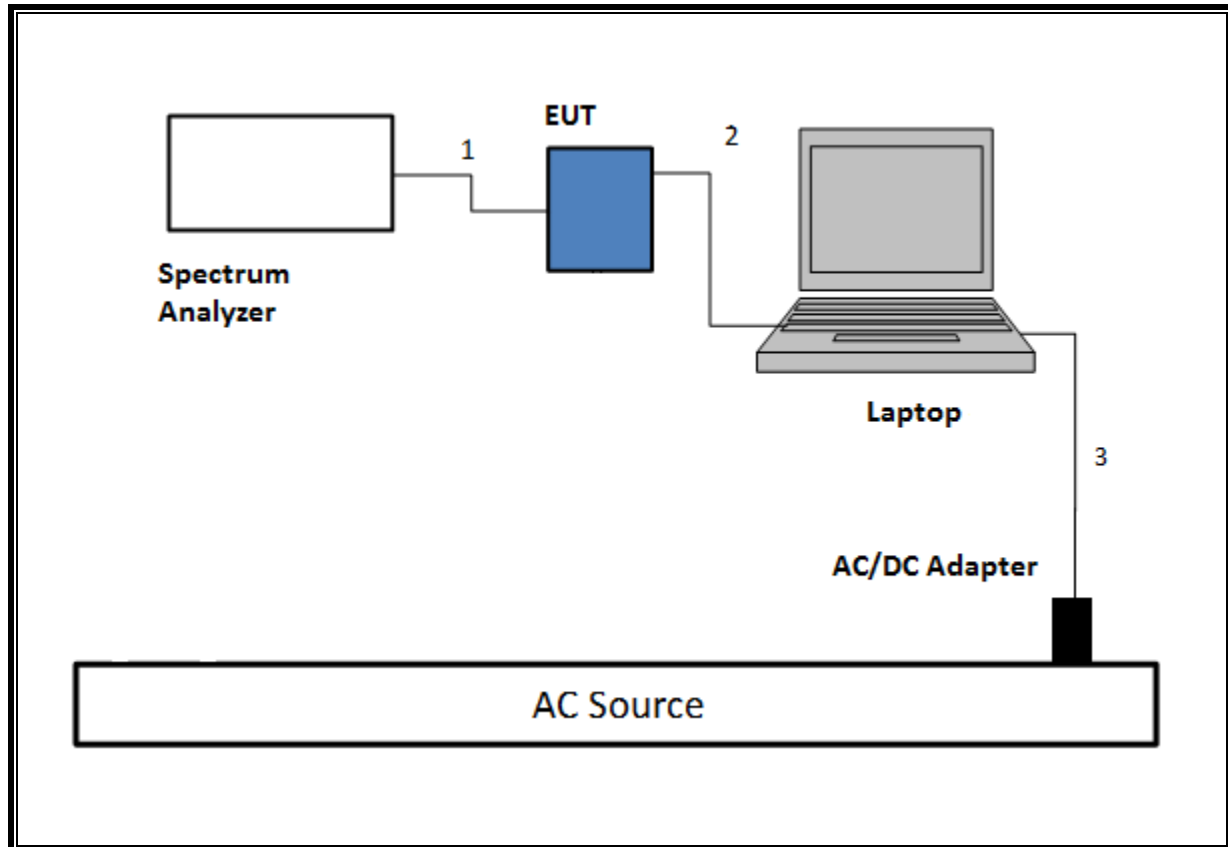
I/O CABLES (BELOW 1GHz AND AC POWER LINE TEST WITH ADAPTER AND LAPTOP)

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	Un-shielded	1	N/A

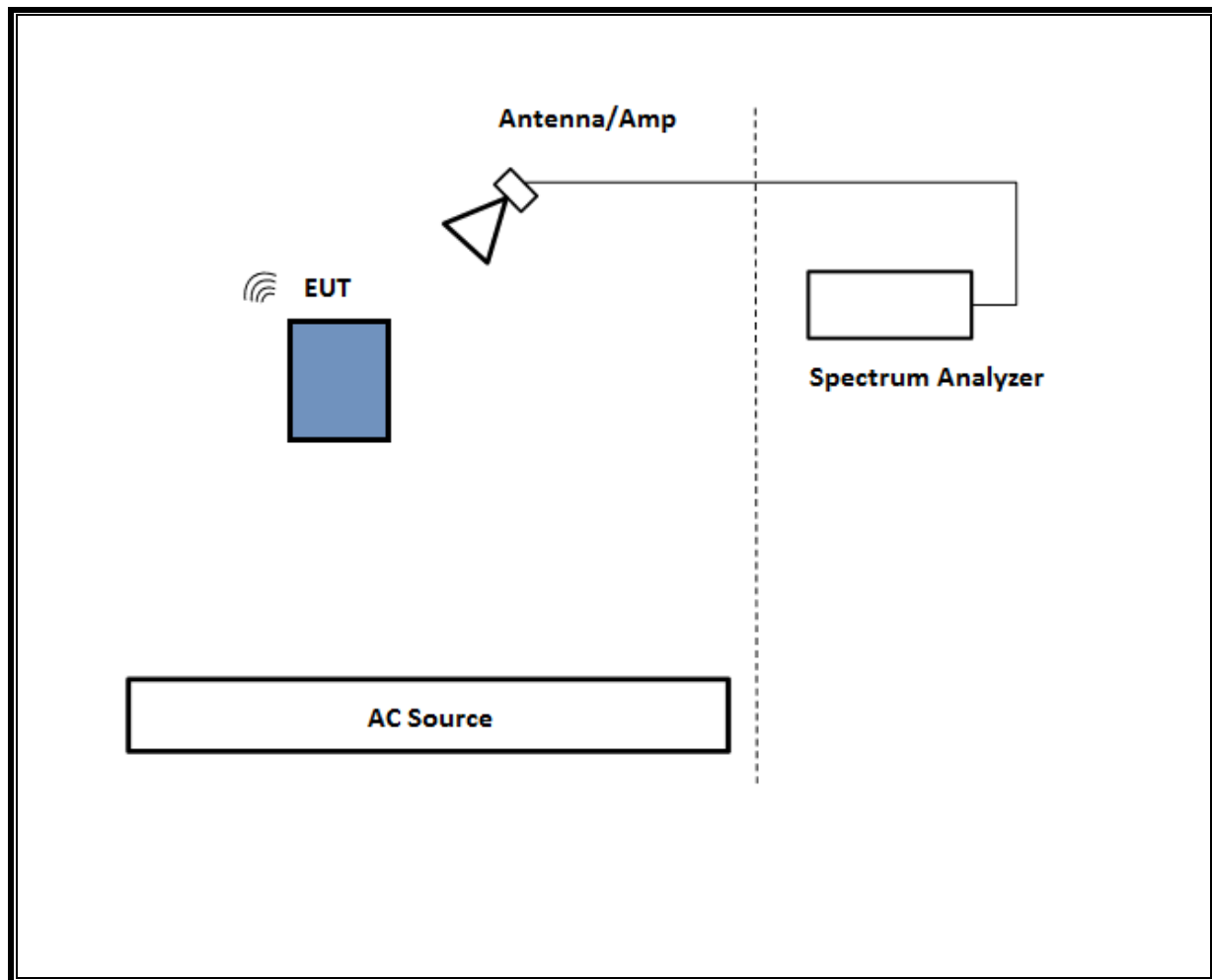
TEST SETUP

The EUT is connected to a test laptop during the tests. Test software exercised the radio card.

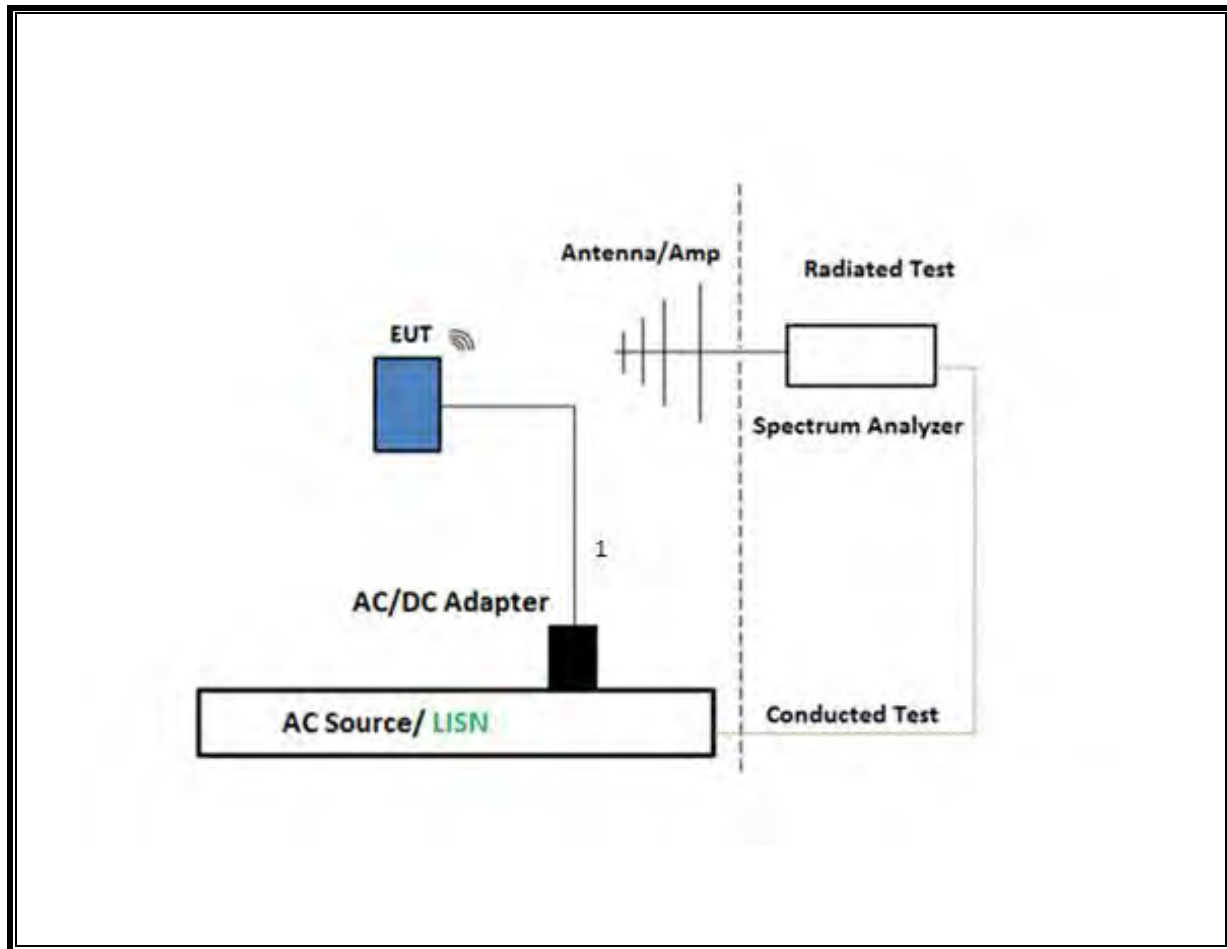
SETUP DIAGRAM FOR CONDUCTED TESTS



SETUP DIAGRAM FOR RADIATED TESTS Above 1GHz



SETUP DIAGRAM FOR Below 1GHz and AC LINE CONDUCTED TEST



6. MEASUREMENT METHOD

6 dB BW: ANSI C63.10 Subclause -11.8.1 RBW $\geq$ DTS BW

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

Output Power: ANSI C63.10 Subclause -11.9.2.3.1 Method AVGPM (Measurement using an RF average-reading power meter)

PSD: ANSI C63.10 Subclause -11.10.3 Method AVGPS-1

Radiated emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11

Radiated emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1

Conducted emissions in restricted frequency bands: ANSI C63.10 Subclause -11.12.2

Band-edge: ANSI C63.10 Subclause -11.13.3.2 Integration method -Peak detection

Band-edge: ANSI C63.10 Subclause -11.13.3.3 Integration method -Trace averaging with continuous transmission at full power

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

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

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
*Antenna Horn 18 to 26.5GHz	ARA	MWH-1826/B	T449	06/29/2019	06/29/2018
Amplifier, 1 to 18GHz, 35dB	AMPLICAL	AMP1G18-35	138301	09/15/2019	09/15/2018
Amplifier, 1 to 18GHz, 35dB	AMPLICAL	AMP1G18-35	T1569	05/04/2020	05/04/2019
Amplifier, 10kHz to 1GHz, 32dB	Sonoma Instrument Co.	310N	T286	06/06/2020	06/06/2019
Amplifier, 1-18GHz	MITEQ	AFS42-00101800-25-S-42	T931	05/11/2020	05/11/2019
Amplifier, 1-18GHz	MITEQ	AFS42-00101800-25-S-42	T740	05/31/2020	05/31/2019
Amplifier, 1-18GHz	MITEQ	AFS42-00101800-25-S-42	T491	05/30/2020	05/30/2019
Amplifier, 1-18GHz	MITEQ	AFS42-00101800-25-S-42	T1567	01/26/2020	01/26/2019
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB1	T185	06/06/2020	06/06/2019
*Antenna, Double Ridge Guide Horn Antenna 700MHz to 18GHz	A.H. SYSTEMS	SAS-571	PRE0190811	07/12/2019	07/12/2018
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T344	05/07/2020	05/07/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T712	02/26/2020	02/26/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T119	03/22/2020	03/22/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T120	05/10/2020	05/10/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T136	06/14/2020	06/14/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T863	05/30/2020	05/30/2019
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179367	05/16/2020	05/16/2019
Power Meter, P-series single channel	Keysight	N1912A	T1244	01/30/2020	01/30/2019
Power Sensor	Keysight	N1921A	T1224	02/22/2020	02/22/2019
Pre-Amp 18-26GHz	Agilent Technology	8449B	T404	03/23/2020	03/23/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1454	01/23/2020	01/23/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T905	01/24/2020	01/24/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1816	01/11/2019	01/11/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A-544	T1113	01/22/2020	01/22/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T340	01/22/2020	01/22/2019

AC Line Conducted					
Description	Manufacturer	Model	ID Num	Cal Due	Last Cal
EMI Test Receiver 9Khz-7GHz	Rohde & Schwarz	ESCI7	T1436	02/14/2020	02/14/2019
Power Cable, Line Conducted Emissions	UL	PG1	T861	08/31/2019	08/31/2018
*LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	06/19/2019	06/19/2018
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		

*Testing is completed before equipment expiration date.

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)
2.4GHz Band						
802.11b 1TX	2.990	2.990	1.000	100.00%	0.00	0.010
802.11n HT20 1TX	1.921	1.943	0.989	98.87%	0.00	0.010
802.11n HT20 CDD	1.927	1.943	0.992	99.18%	0.00	0.010
802.11ax HE20 1TX, 242-Tones	1.577	1.592	0.991	99.06%	0.00	0.010
802.11ax HE20 1TX, 26-Tones	4.125	4.167	0.990	98.99%	0.00	0.010
802.11ax HE20 OFDMA, 242-Tones	1.577	1.592	0.991	99.06%	0.00	0.010
802.11ax HE20 OFDMA, 26-Tones	4.125	4.167	0.990	98.99%	0.00	0.010





802.11ax HE20 1TX, 242-TONES



802.11ax HE20 1TX, 26-TONES



802.11ax HE20 OFDMA, 242-TONES



802.11ax HE20 OFDMA, 26-TONES

8.2. 99% BANDWIDTH

LIMITS

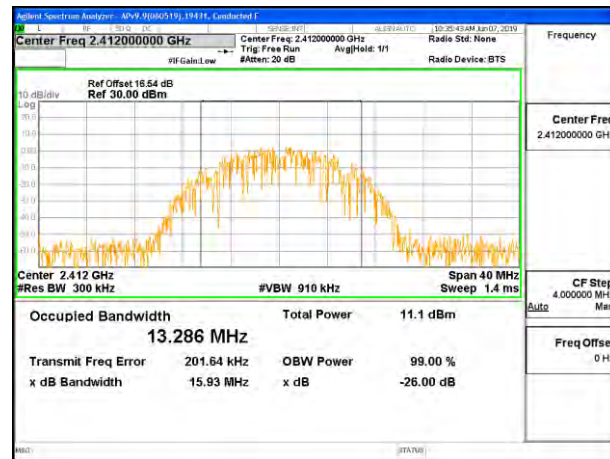
None; for reporting purposes only.

RESULTS

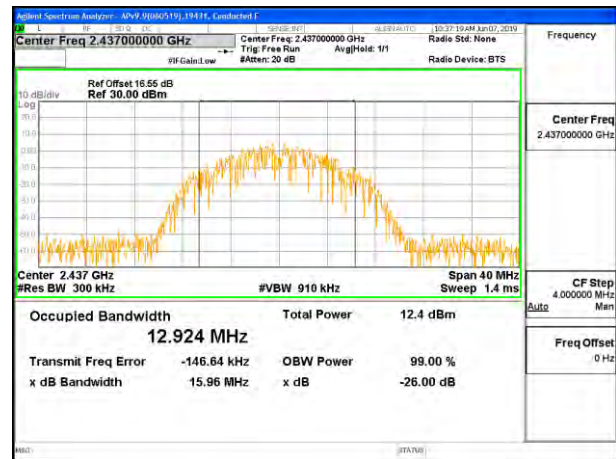
8.2.1. 802.11b MODE

1TX Antenna 4 MODE

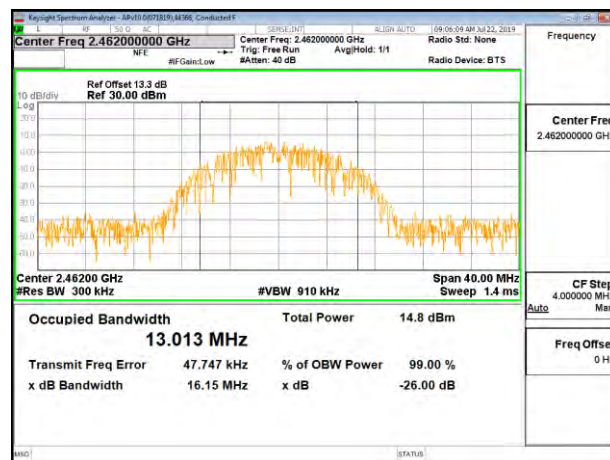
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	13.2860
Mid 6	2437	12.9240
High 11	2462	13.0130
High 12	2467	13.1760
High 13	2472	13.3470



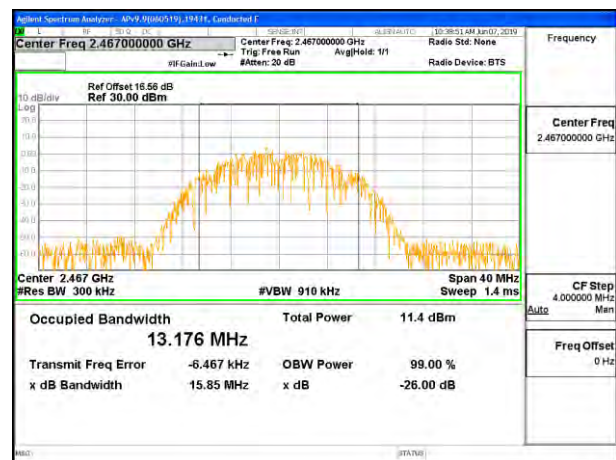
LOW CHANNEL 1



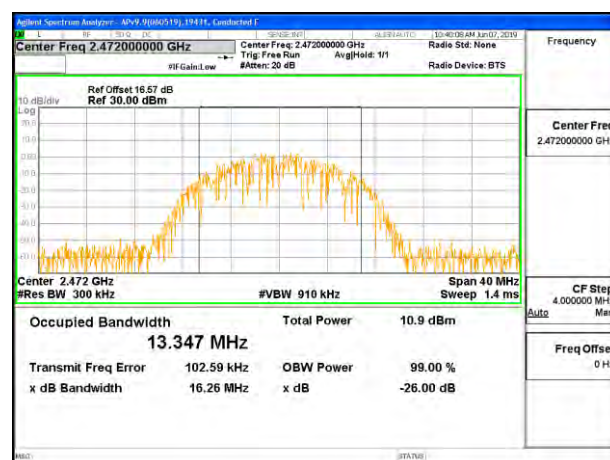
MID CHANNEL 6



HIGH CHANNEL 11



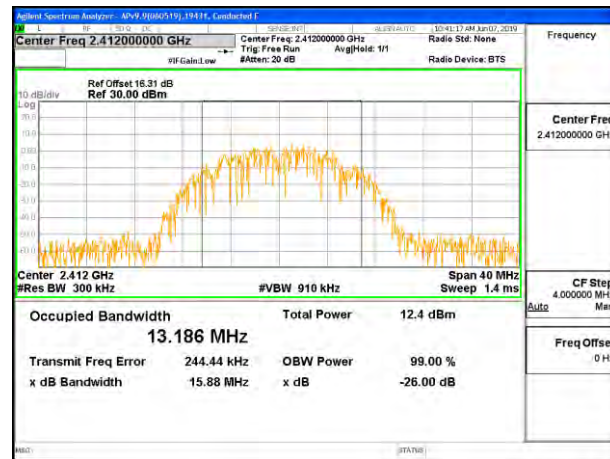
HIGH CHANNEL 12



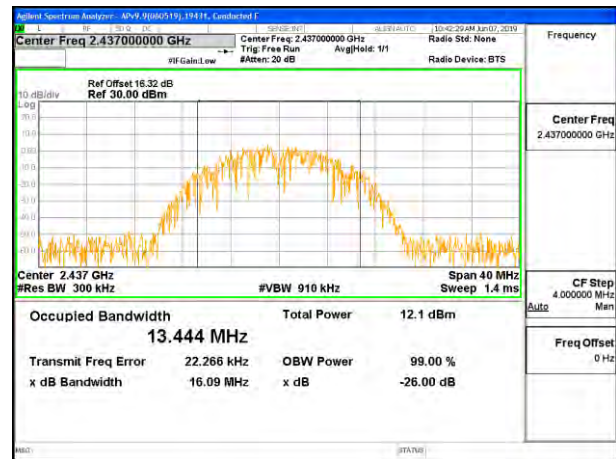
HIGH CHANNEL 13

1TX Antenna 3 MODE

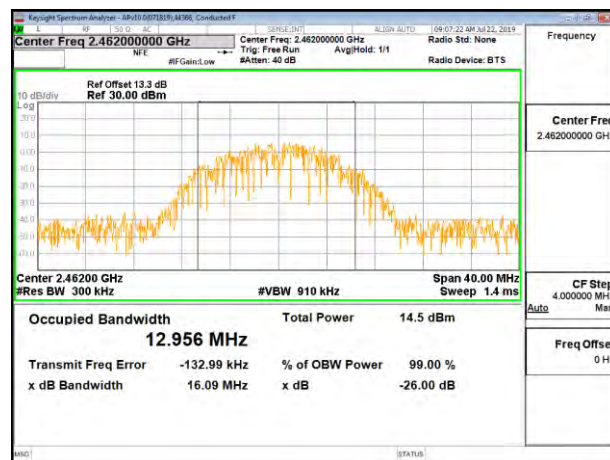
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	13.1860
Mid 6	2437	13.4440
High 11	2462	12.9560
High 12	2467	13.2120
High 13	2472	13.2960



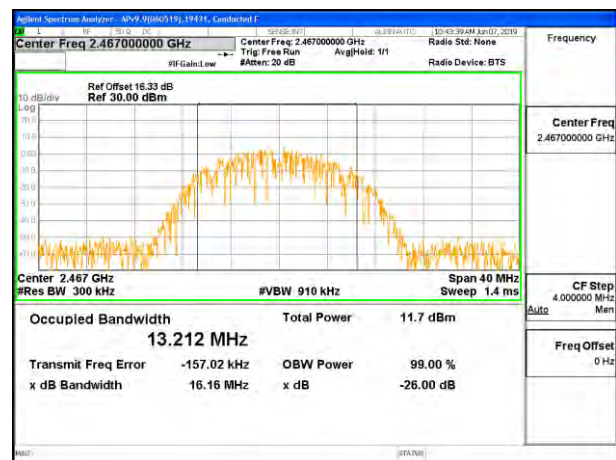
LOW CHANNEL 1



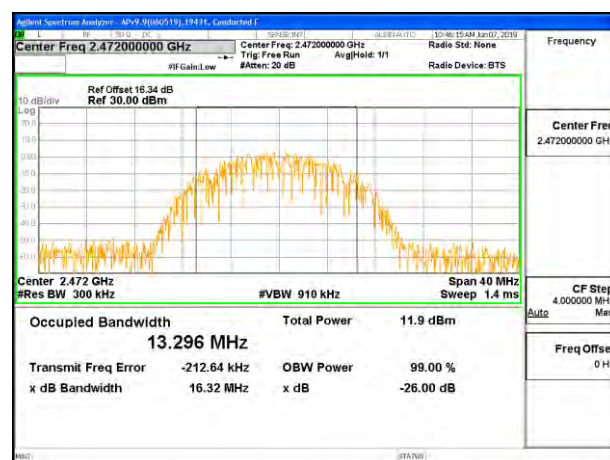
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

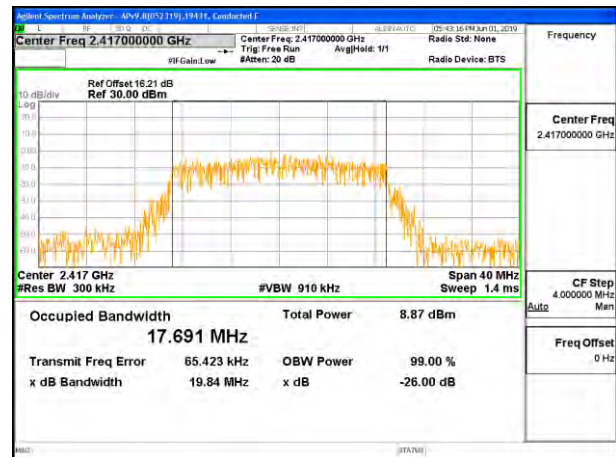
8.2.2. 802.11n HT20 MODE

1TX Antenna 4 MODE

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	17.6400
Low 2	2417	17.6910
Low 3	2422	17.5530
Mid 6	2437	17.6870
High 9	2452	17.7270
High 10	2457	17.6740
High 11	2462	17.5860
High 12	2467	17.5260
High 13	2472	17.7020



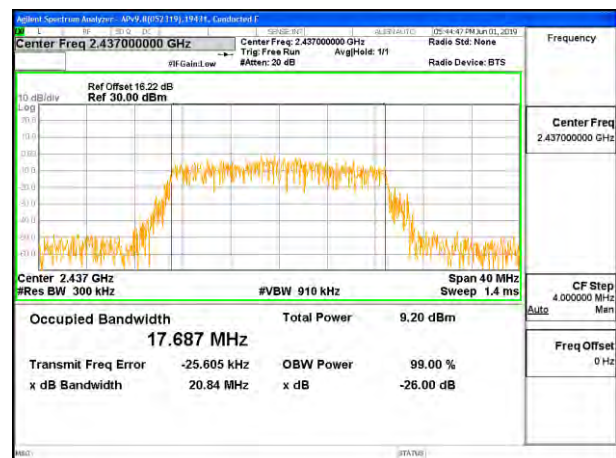
LOW CHANNEL 1



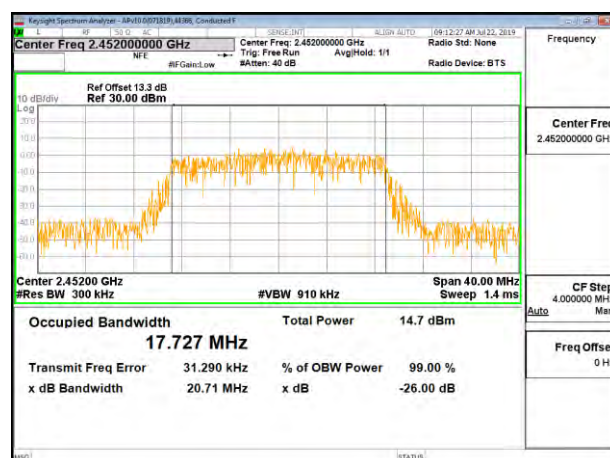
LOW CHANNEL 2



LOW CHANNEL 3



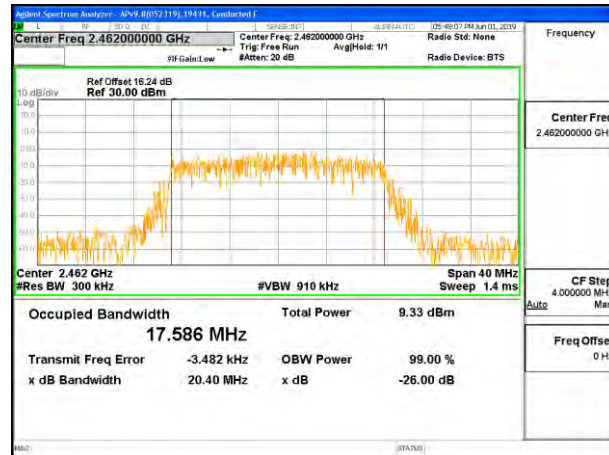
MID CHANNEL 6



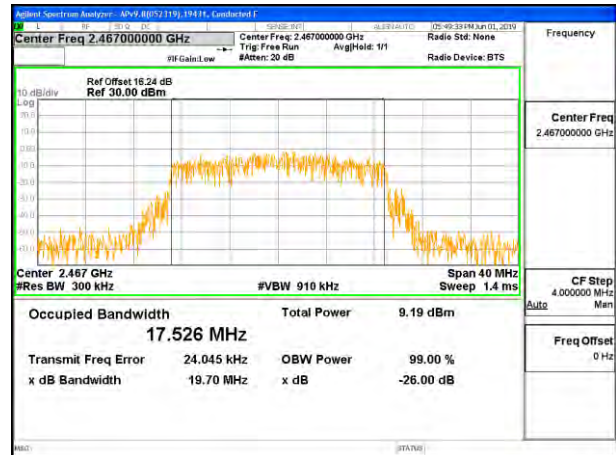
HIGH CHANNEL 9



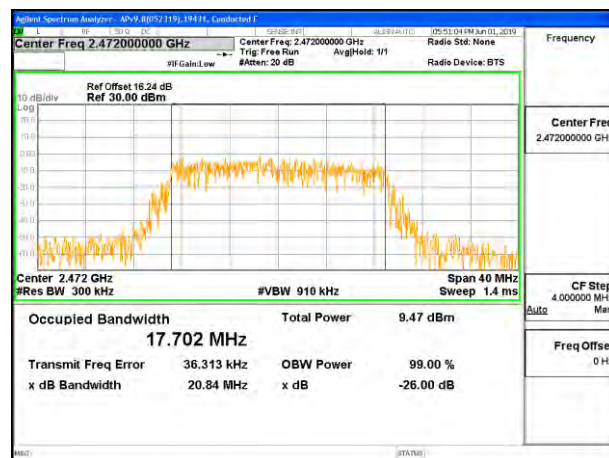
HIGH CHANNEL 10



HIGH CHANNEL 11



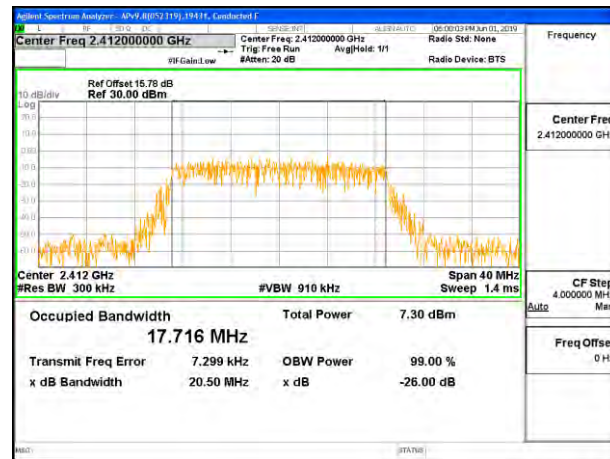
HIGH CHANNEL 12



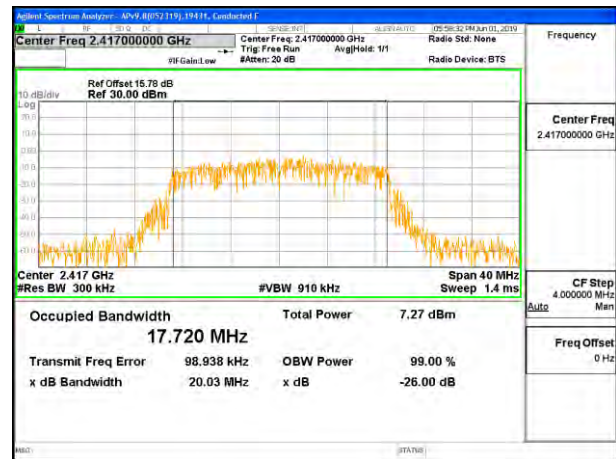
HIGH CHANNEL 13

1TX Antenna 3 MODE

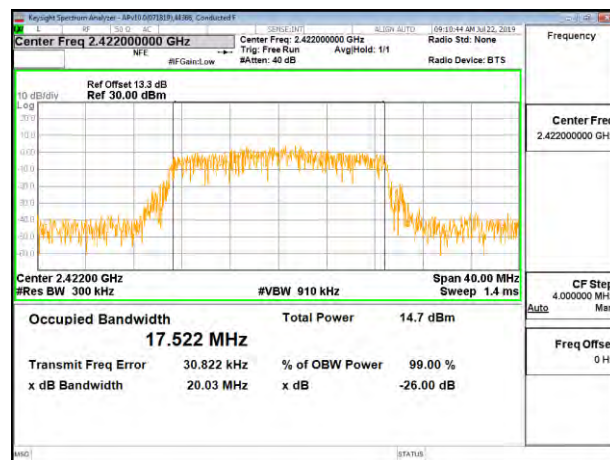
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	17.7160
Low 2	2417	17.7200
Low 3	2422	17.5220
Mid 6	2437	17.6500
High 9	2452	17.7290
High 10	2457	17.5810
High 11	2462	17.5320
High 12	2467	17.5950
High 13	2472	17.7110



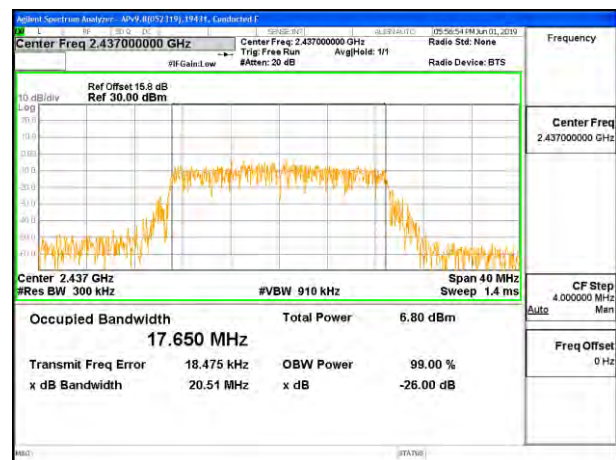
LOW CHANNEL 1



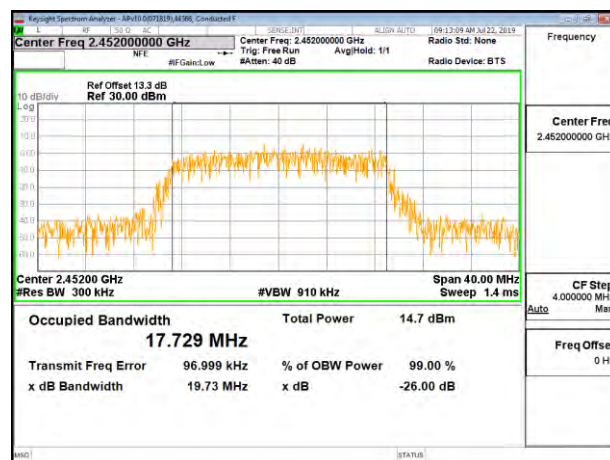
LOW CHANNEL 2



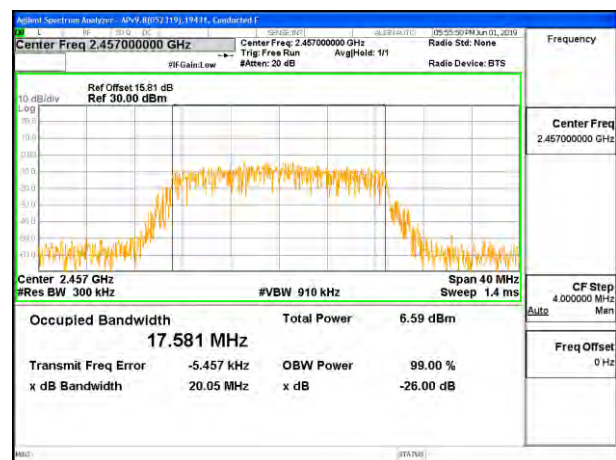
LOW CHANNEL 3



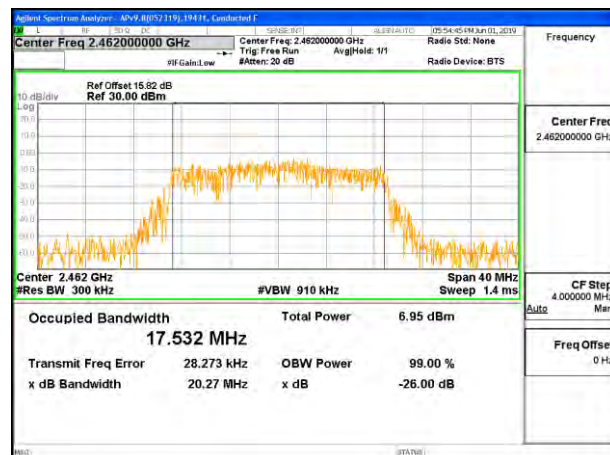
MID CHANNEL 6



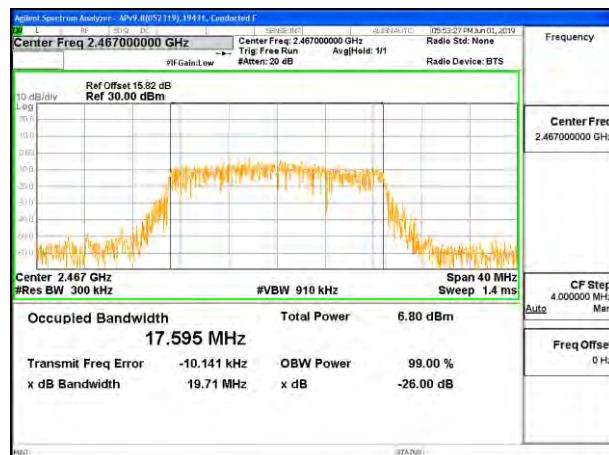
HIGH CHANNEL 9



HIGH CHANNEL 10



HIGH CHANNEL 11



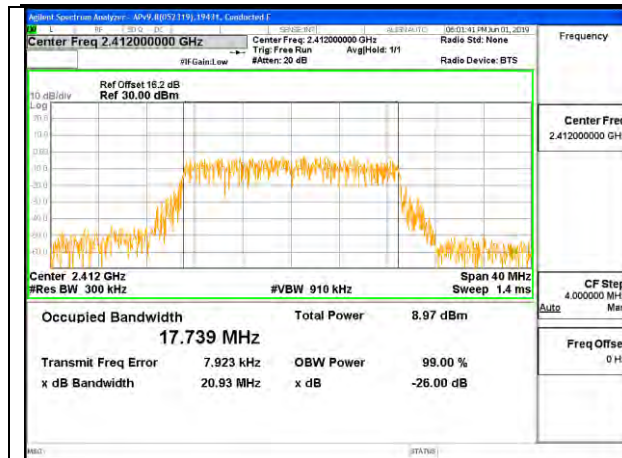
HIGH CHANNEL 12



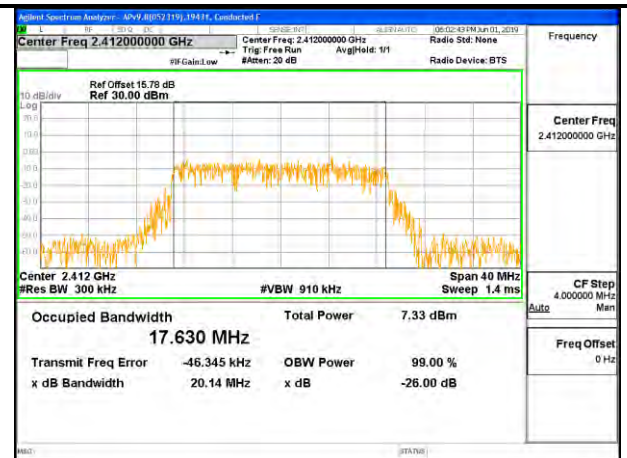
HIGH CHANNEL 13

2TX Antenna 4 + Antenna 3 CDD MODE

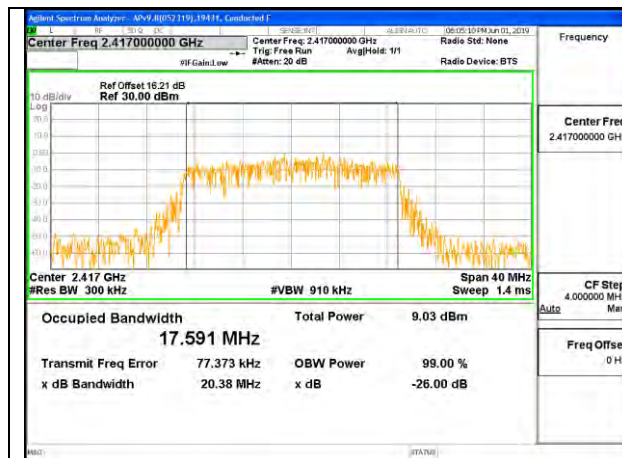
Channel	Frequency (MHz)	99% Bandwidth Ant 4 (MHz)	99% Bandwidth Ant 3 (MHz)
Low 1	2412	17.7390	17.6300
Low 2	2417	17.5910	17.5950
Low 3	2422	17.6570	17.7770
Mid 6	2437	17.6400	17.7310
High 9	2452	17.5880	17.5960
High 10	2457	17.5470	17.6750
High 11	2462	17.6020	17.6580
High 12	2467	17.5300	17.6360
High 13	2472	17.6440	17.7370



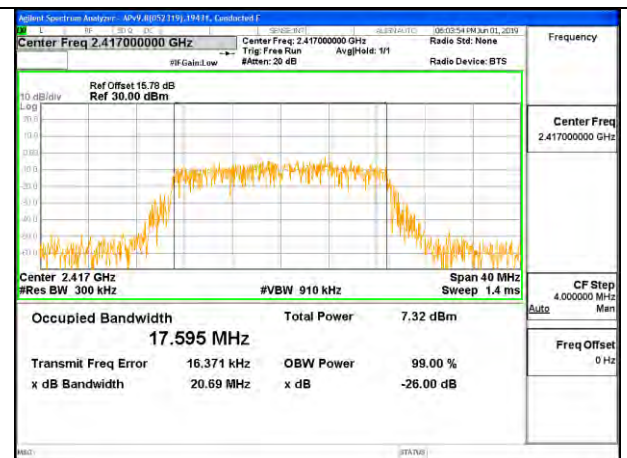
LOW CHANNEL 1 CHAIN 0



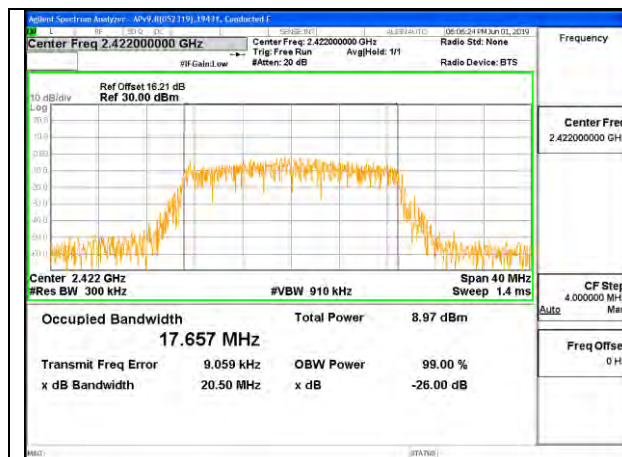
LOW CHANNEL 1 CHAIN 1



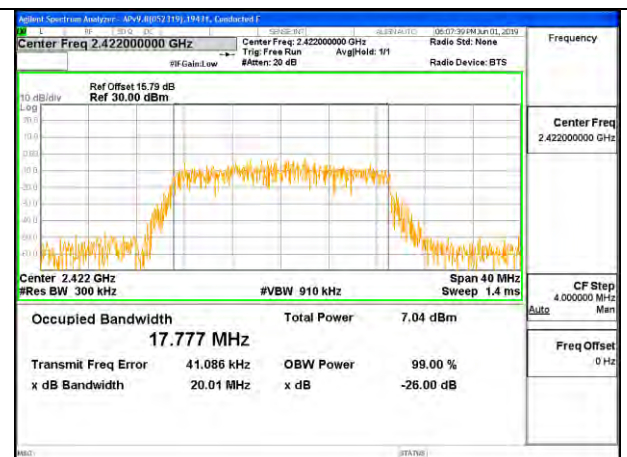
LOW CHANNEL 2 CHAIN 0



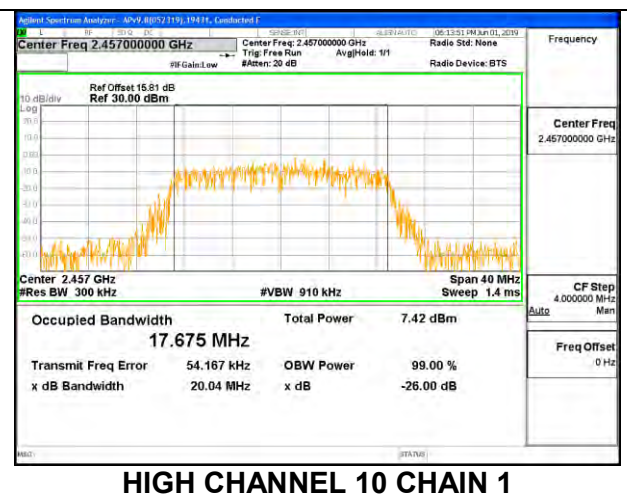
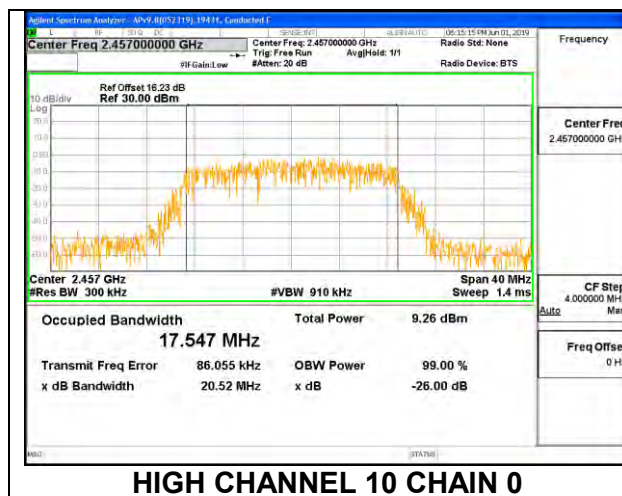
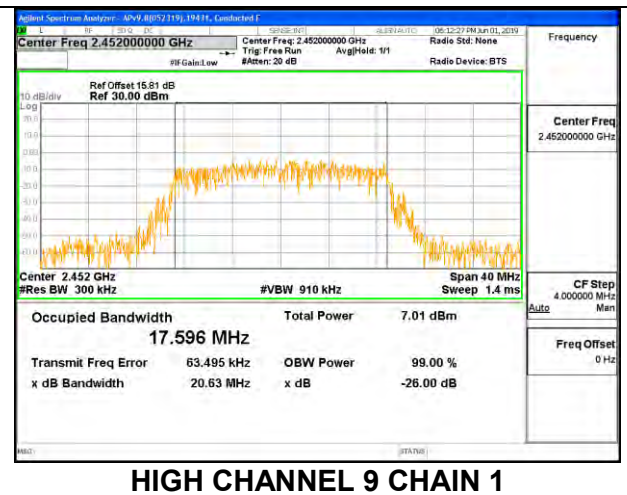
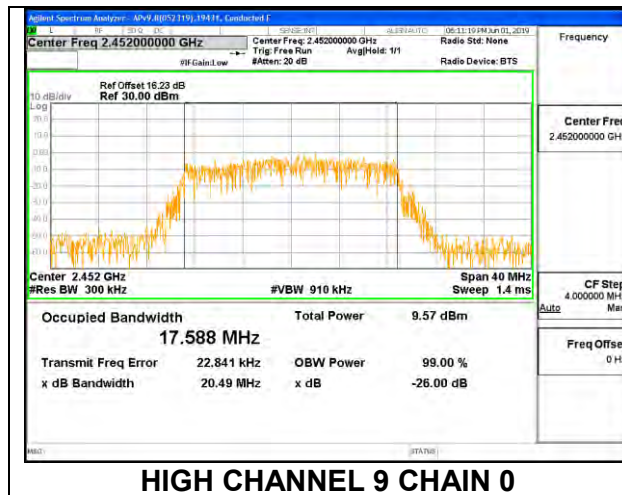
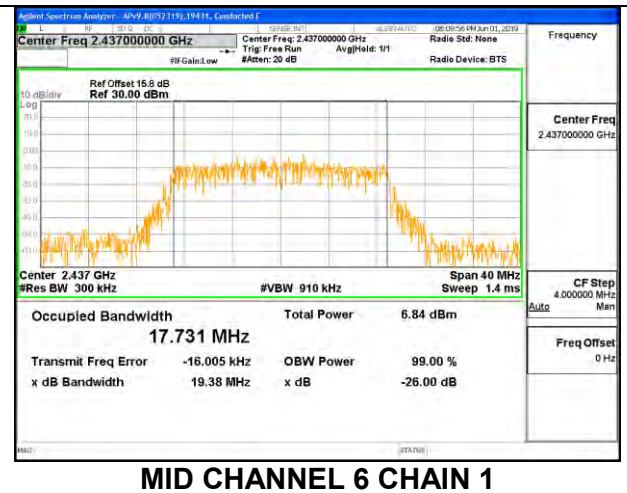
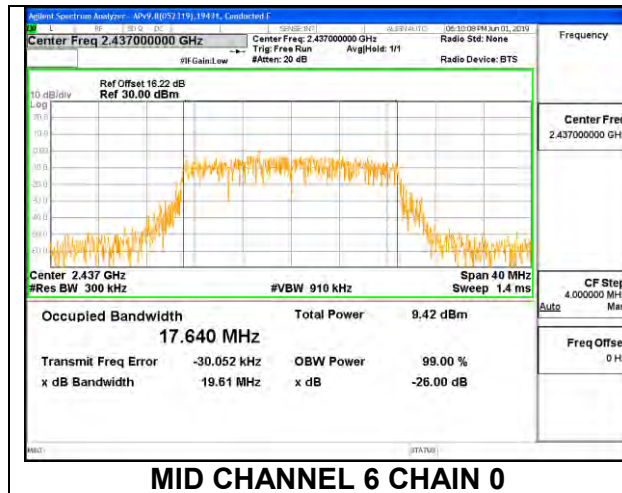
LOW CHANNEL 2 CHAIN 1

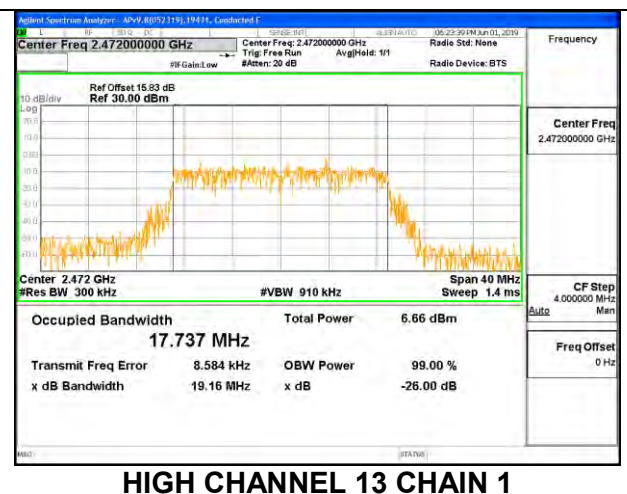
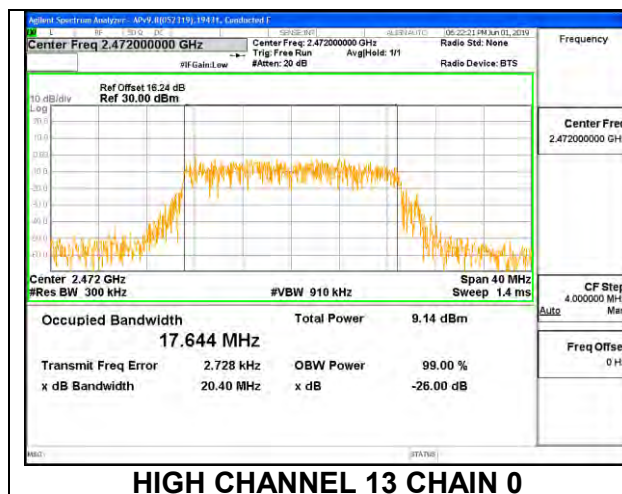
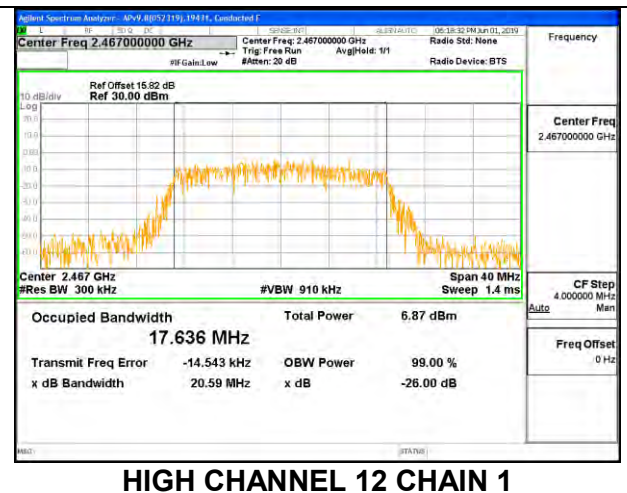
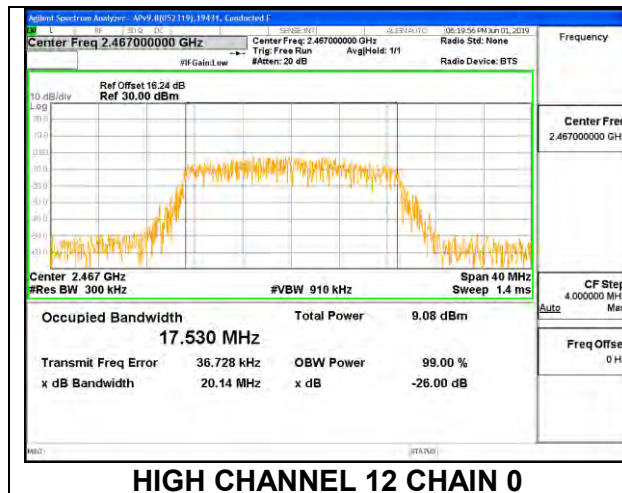
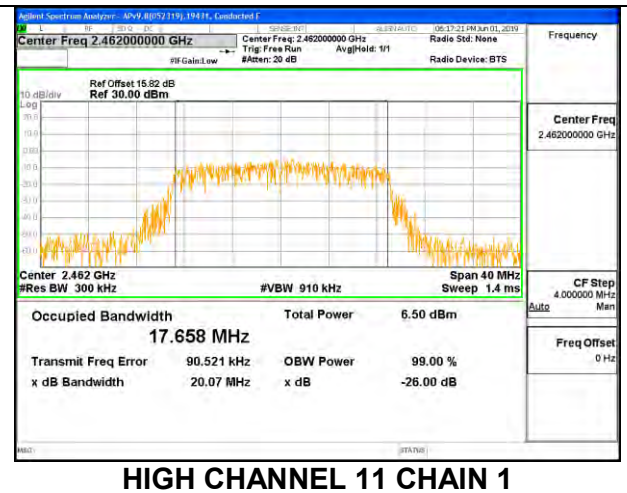
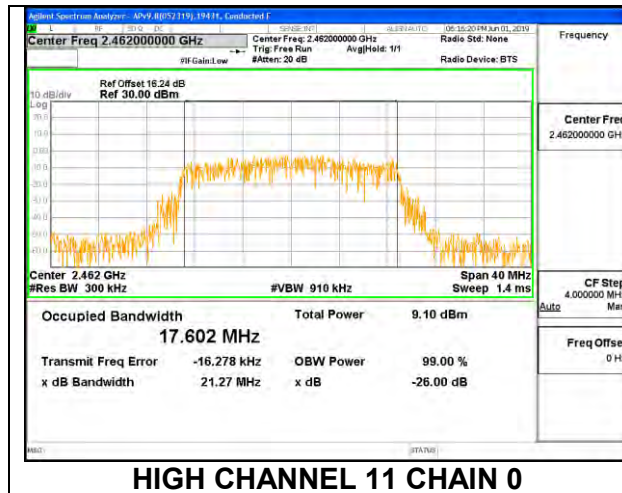


LOW CHANNEL 3 CHAIN 0



LOW CHANNEL 3 CHAIN 1

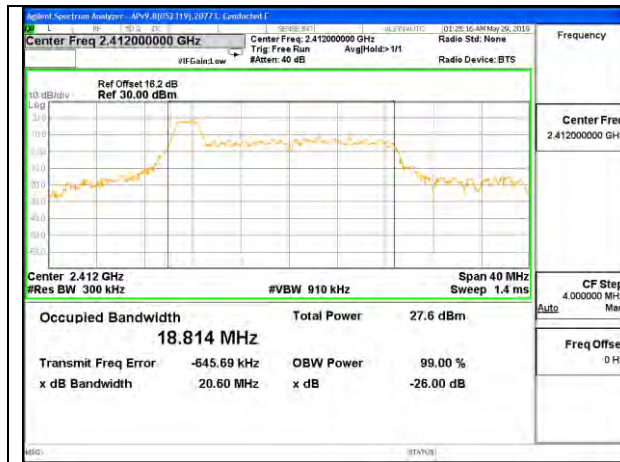




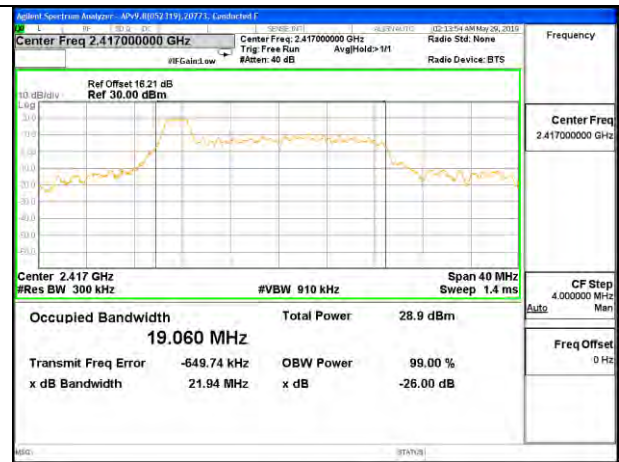
8.2.3. 802.11ax HE20 MODE

Antenna 4, LEGACY SISO MODE: 26-Tones, RU index 0

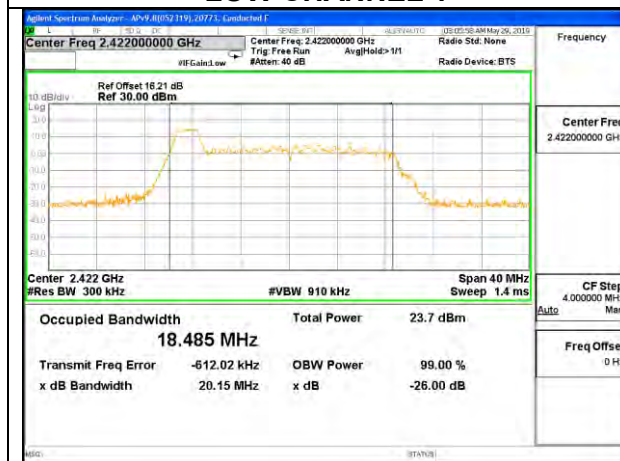
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	18.8140
Low 2	2417	19.0600
Low 3	2422	18.4850
Mid 6	2437	18.4070
High 9	2452	18.6710
High 10	2457	18.4760
High 11	2462	18.3370
High 12	2467	18.3110
High 13	2472	18.1950



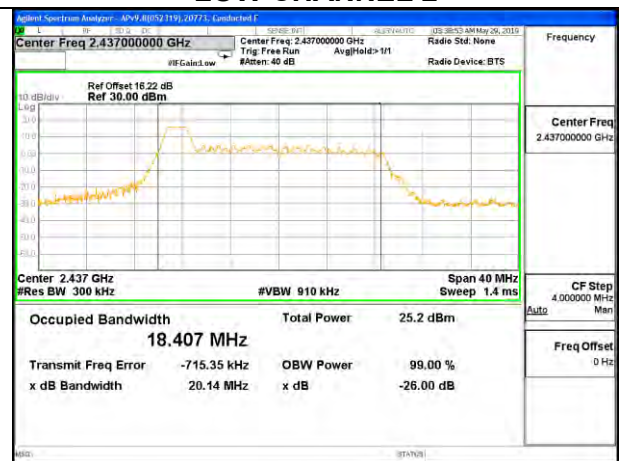
LOW CHANNEL 1



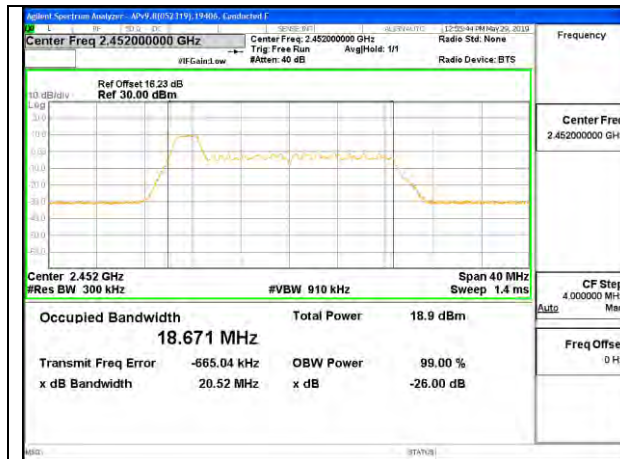
LOW CHANNEL 2



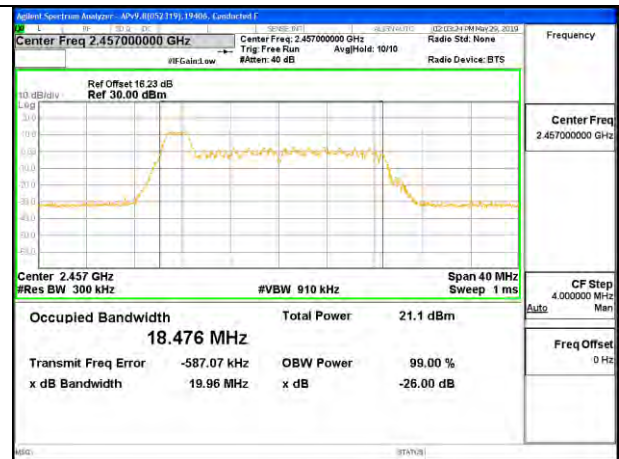
LOW CHANNEL 3



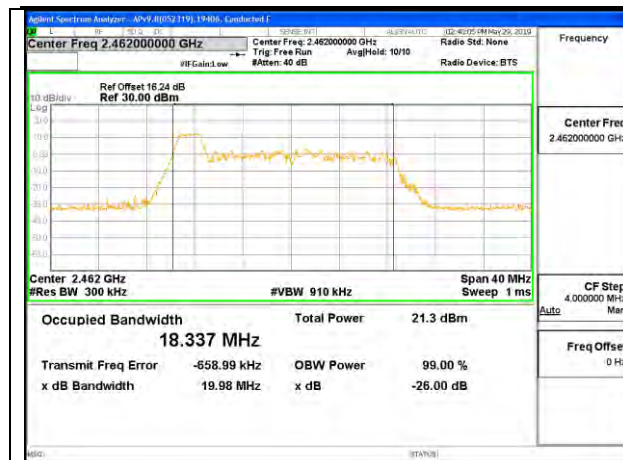
MID CHANNEL 6



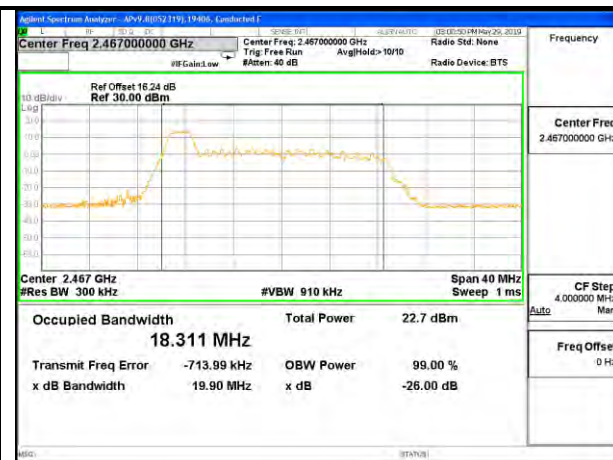
HIGH CHANNEL 9



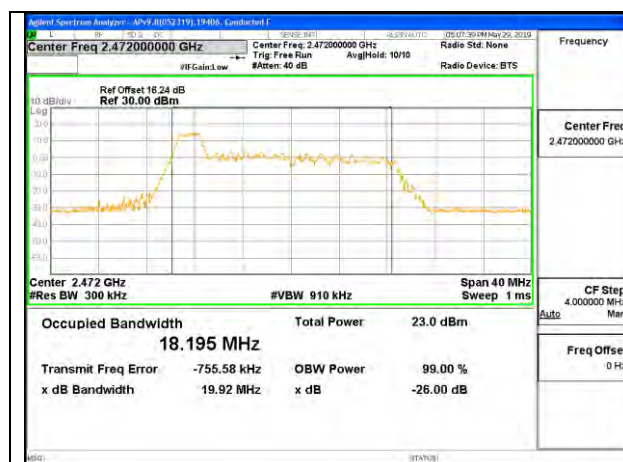
HIGH CHANNEL 10



HIGH CHANNEL 11



HIGH CHANNEL 12

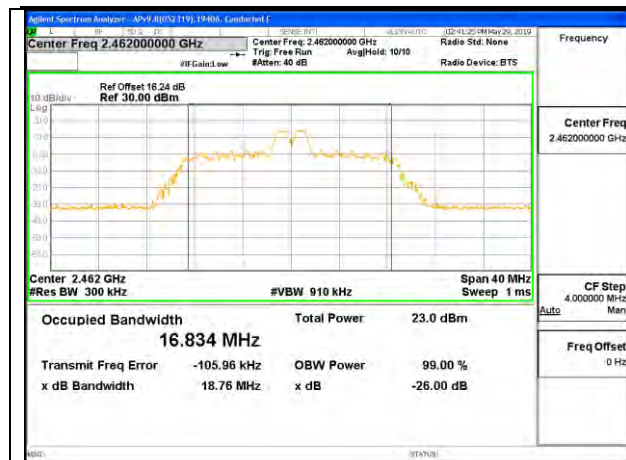


HIGH CHANNEL 13

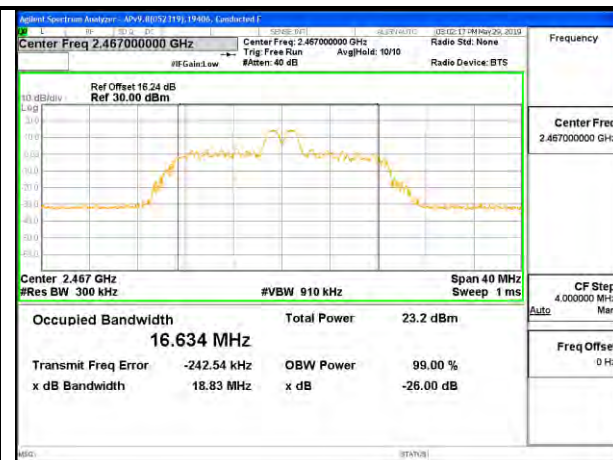
Antenna 4, LEGACY SISO MODE: 26-Tones, RU index 4

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	17.3440
Low 2	2417	17.2540
Low 3	2422	17.0810
Mid 6	2437	17.3050
High 9	2452	17.3130
High 10	2457	17.0260
High 11	2462	16.8340
High 12	2467	16.6340
High 13	2472	17.2130

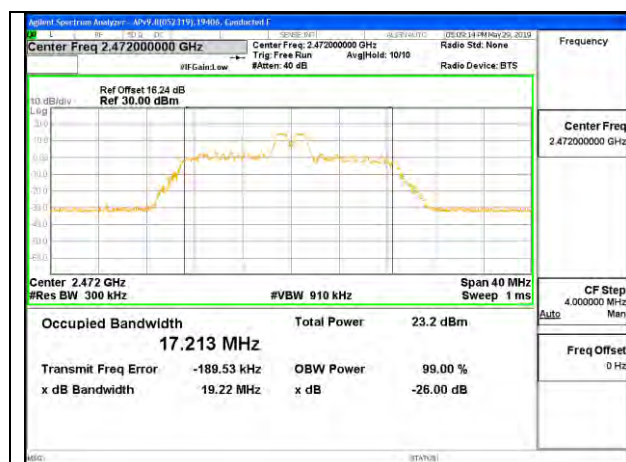




HIGH CHANNEL 11



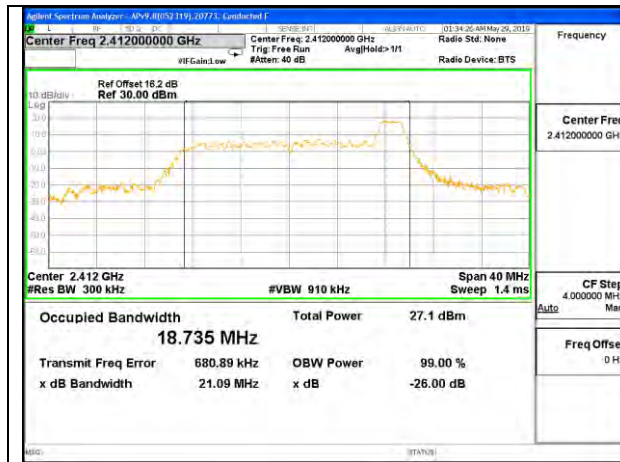
HIGH CHANNEL 12



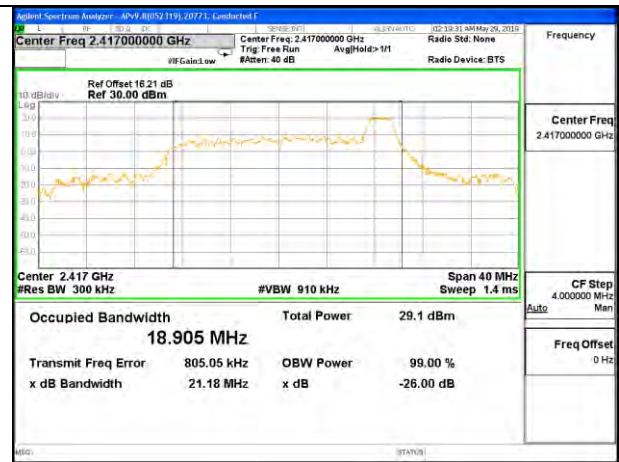
HIGH CHANNEL 13

Antenna 4, LEGACY SISO MODE: 26-Tones, RU index 8

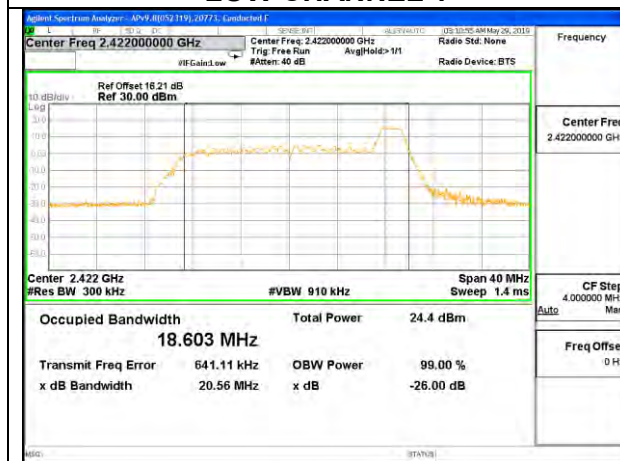
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	18.7350
Low 2	2417	18.9050
Low 3	2422	18.6030
Mid 6	2437	18.8730
High 9	2452	18.7500
High 10	2457	18.5250
High 11	2462	18.2550
High 12	2467	18.6780
High 13	2472	18.7750



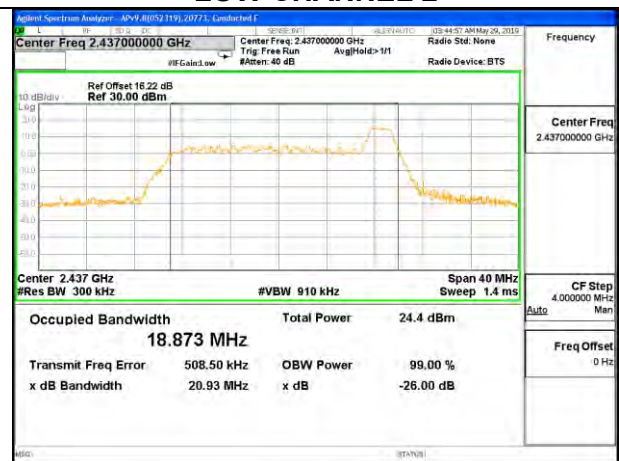
LOW CHANNEL 1



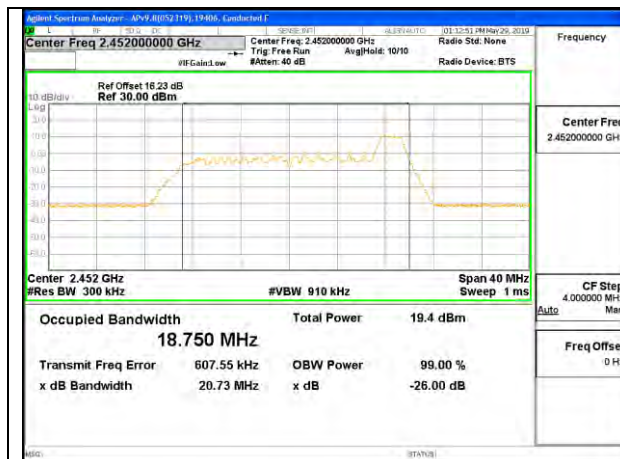
LOW CHANNEL 2



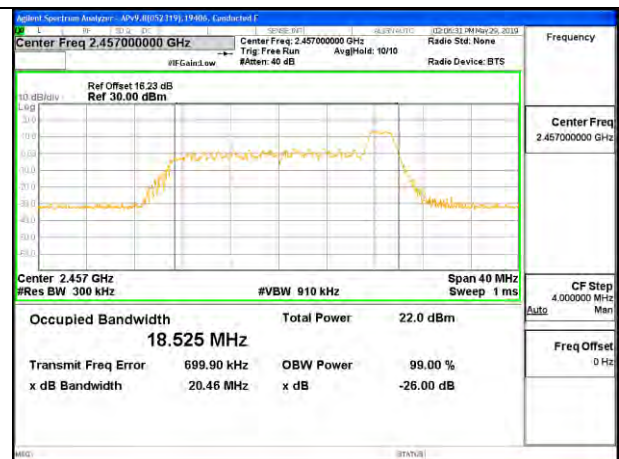
LOW CHANNEL 3



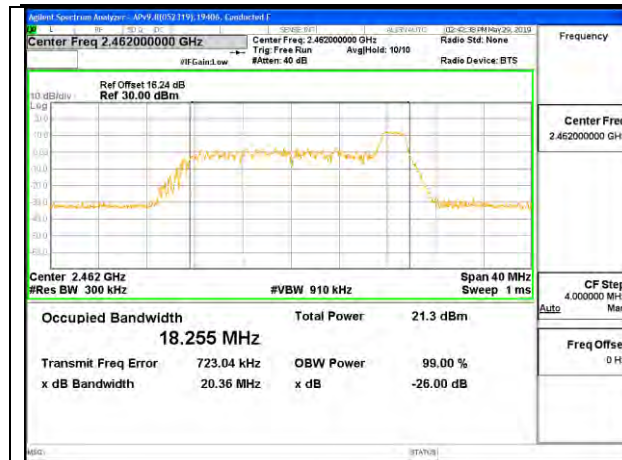
MID CHANNEL 6



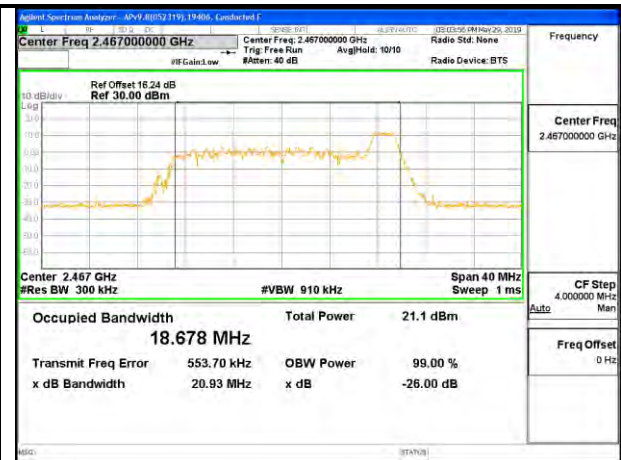
HIGH CHANNEL 9



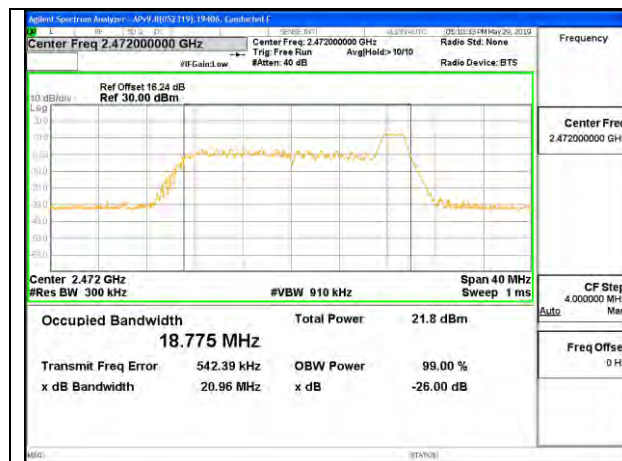
HIGH CHANNEL 10



HIGH CHANNEL 11



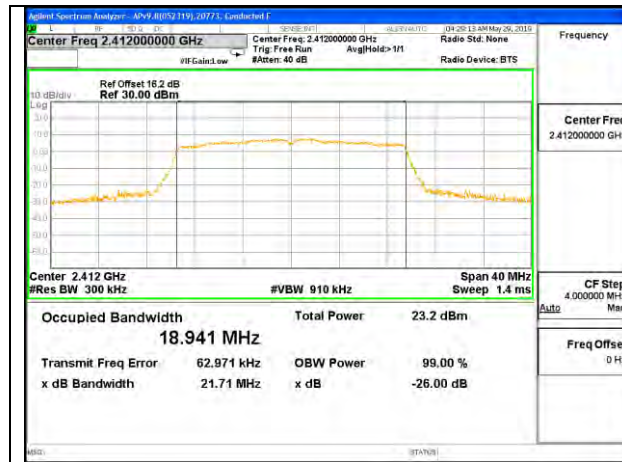
HIGH CHANNEL 12



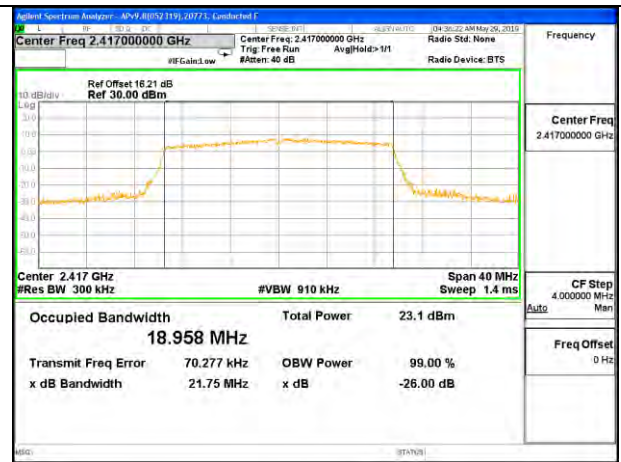
HIGH CHANNEL 13

Antenna 4, LEGACY SISO MODE: 242-Tones, RU index 61

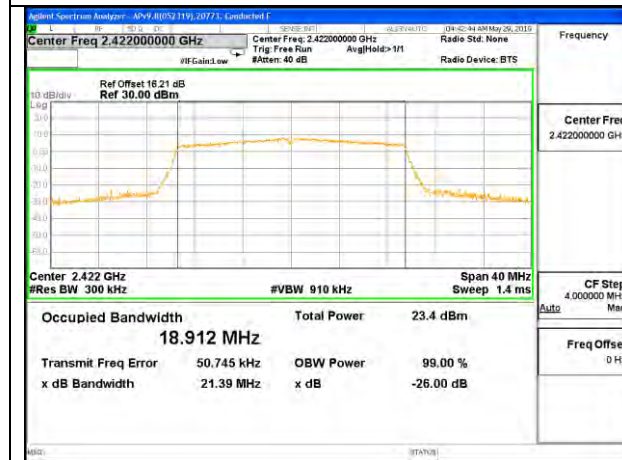
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	18.9410
Low 2	2417	18.9580
Low 3	2422	18.9120
Mid 6	2437	19.0150
High 9	2452	19.0240
High 10	2457	18.9170
High 11	2462	18.8640
High 12	2467	18.8820
High 13	2472	18.8810



LOW CHANNEL 1



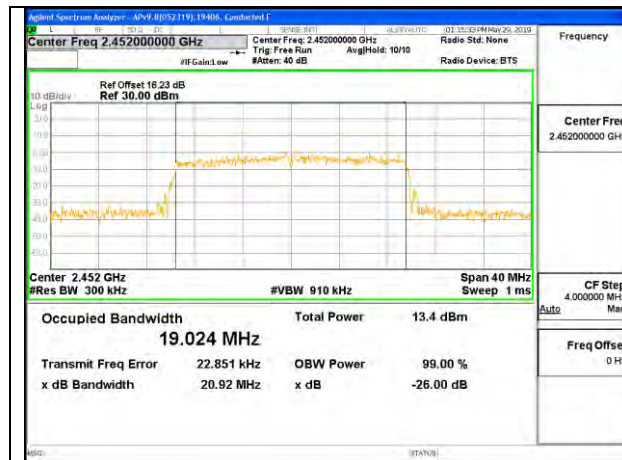
LOW CHANNEL 2



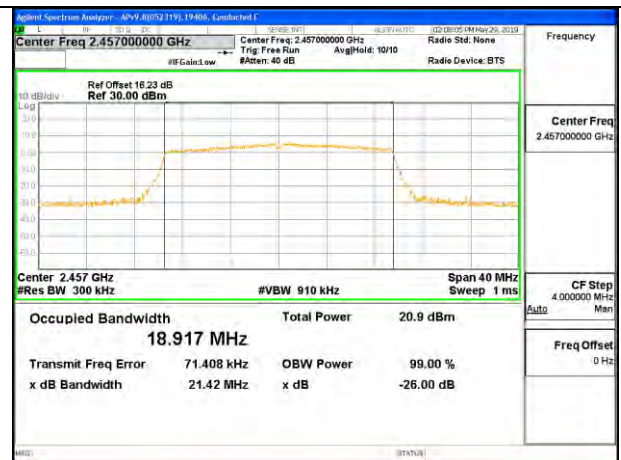
LOW CHANNEL 3



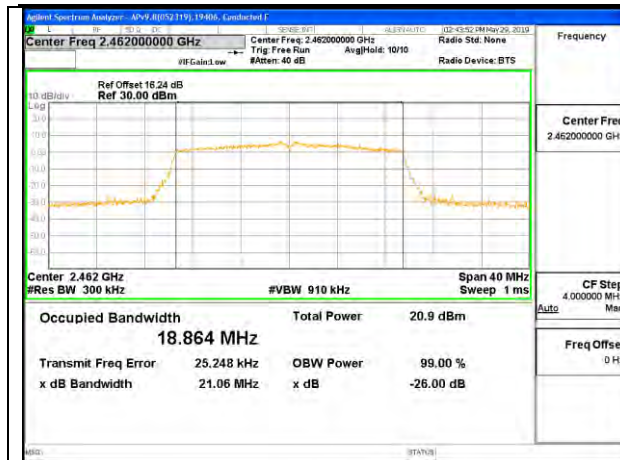
MID CHANNEL 6



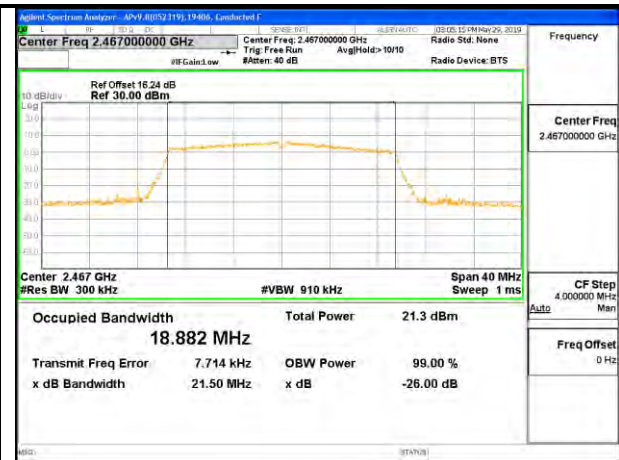
HIGH CHANNEL 9



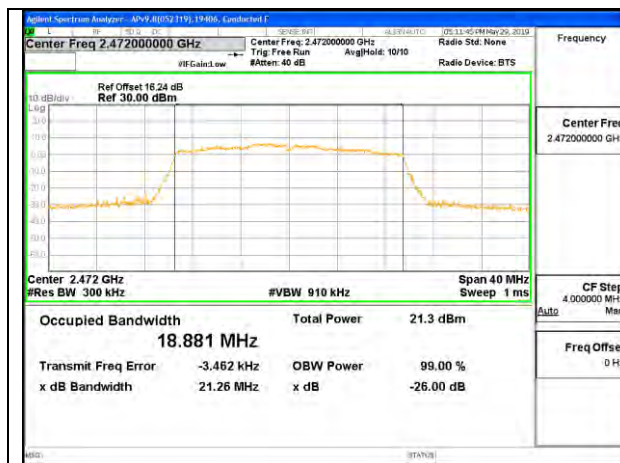
HIGH CHANNEL 10



HIGH CHANNEL 11



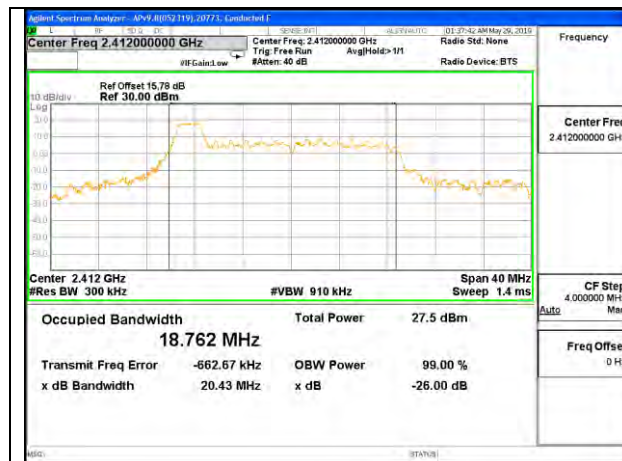
HIGH CHANNEL 12



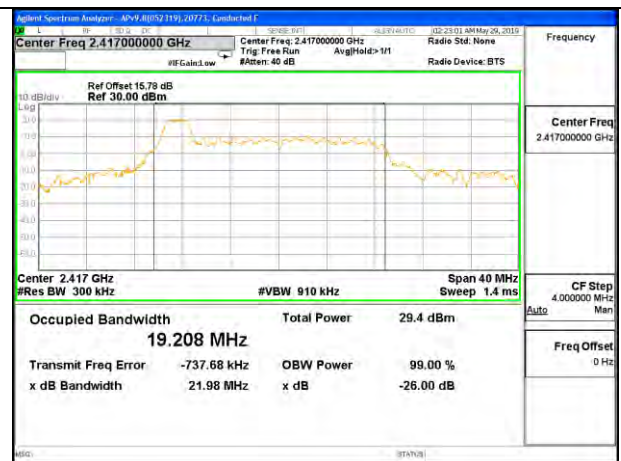
HIGH CHANNEL 13

Antenna 3, LEGACY SISO MODE: 26-Tones, RU index 0

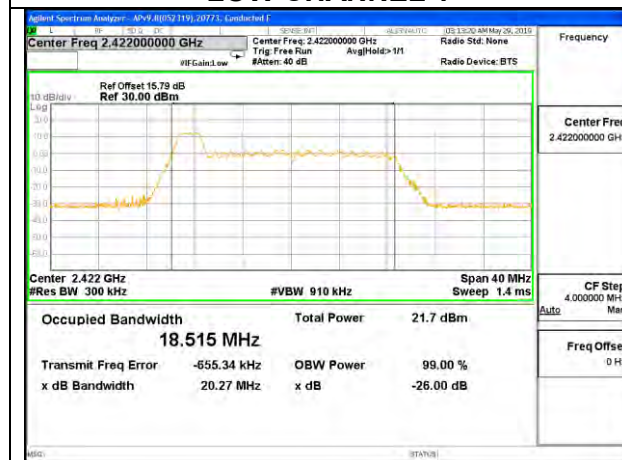
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	18.7620
Low 2	2417	19.2080
Low 3	2422	18.5150
Mid 6	2437	18.4690
High 9	2452	18.6020
High 10	2457	18.4490
High 11	2462	18.2740
High 12	2467	18.3160
High 13	2472	18.3580



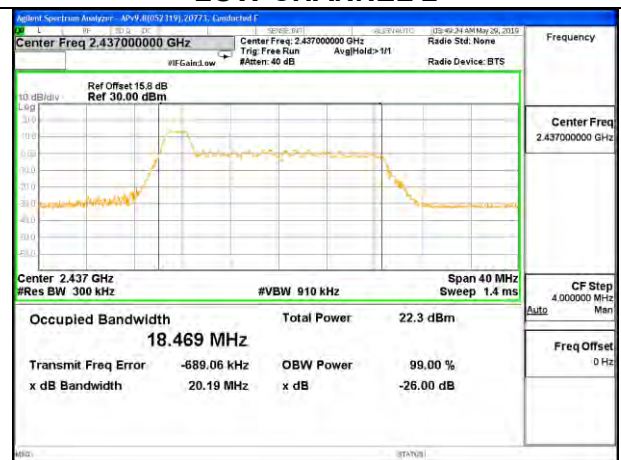
LOW CHANNEL 1



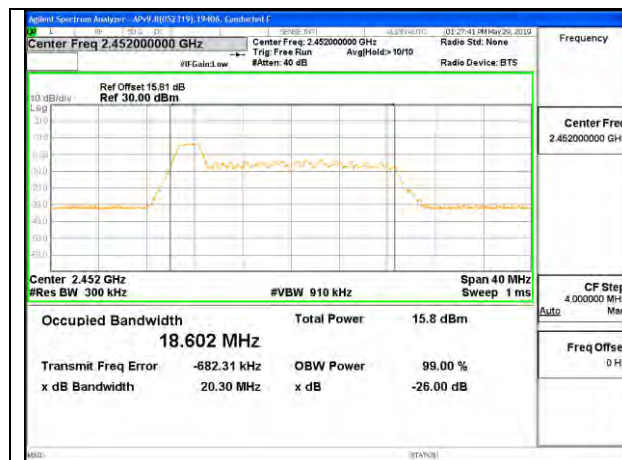
LOW CHANNEL 2



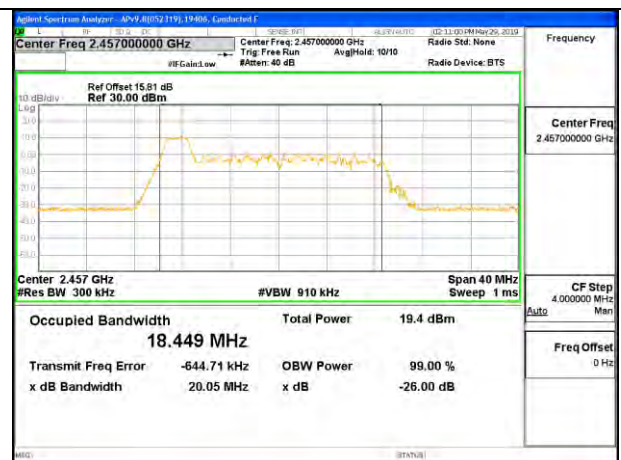
LOW CHANNEL 3



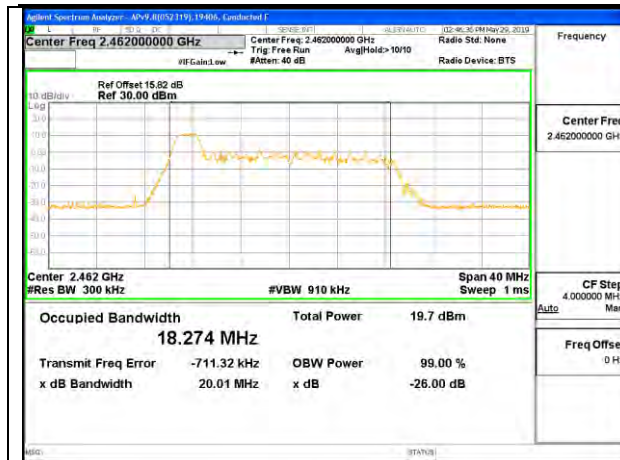
MID CHANNEL 6



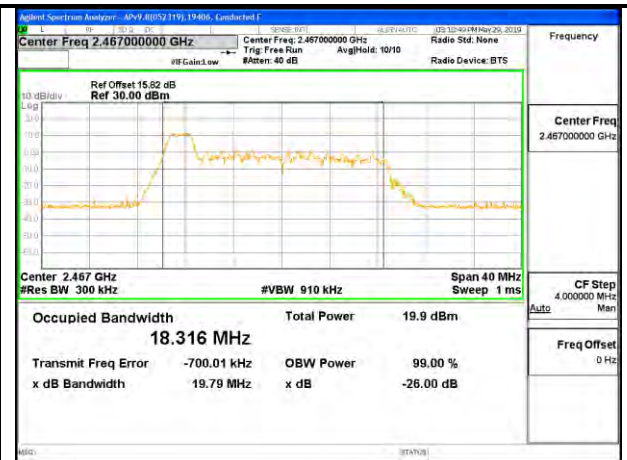
HIGH CHANNEL 9



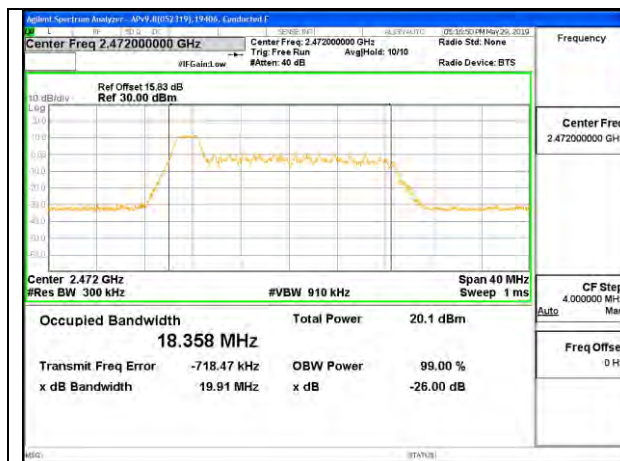
HIGH CHANNEL 10



HIGH CHANNEL 11



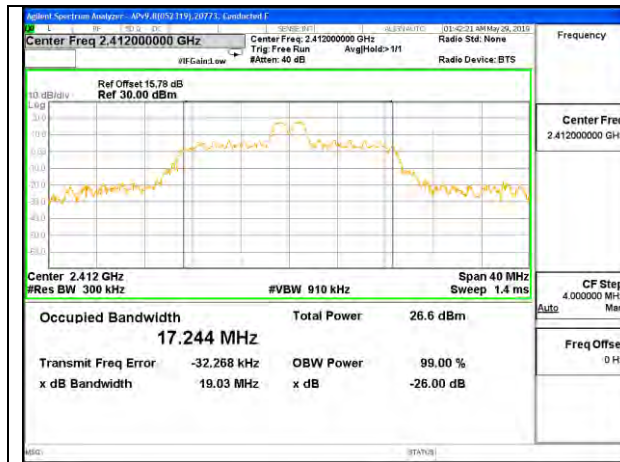
HIGH CHANNEL 12



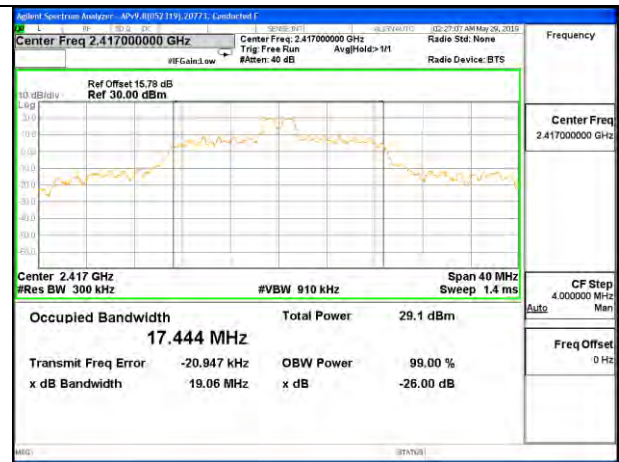
HIGH CHANNEL 13

Antenna 3, LEGACY SISO MODE: 26-Tones, RU index 4

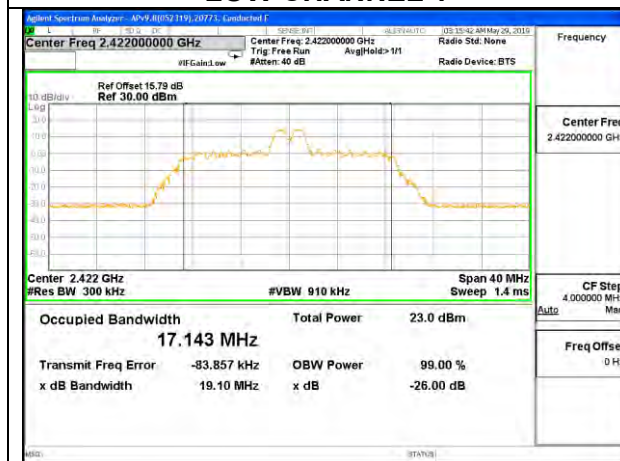
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	17.2440
Low 2	2417	17.4440
Low 3	2422	17.1430
Mid 6	2437	17.3630
High 9	2452	17.1060
High 10	2457	17.0870
High 11	2462	16.8120
High 12	2467	16.9880
High 13	2472	17.1730



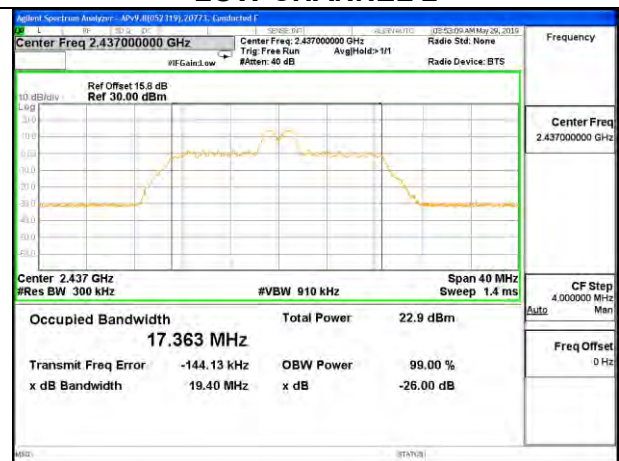
LOW CHANNEL 1



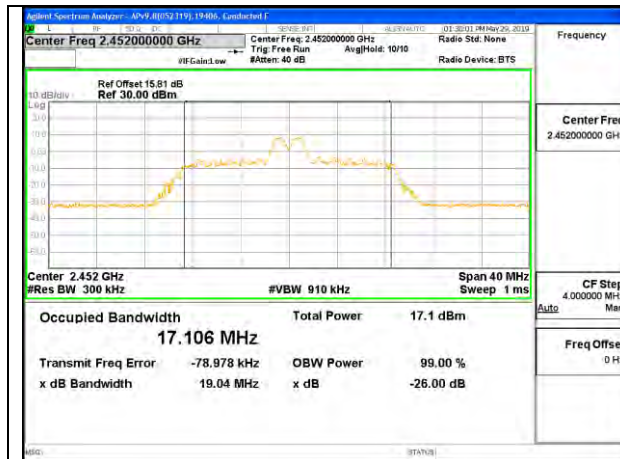
LOW CHANNEL 2



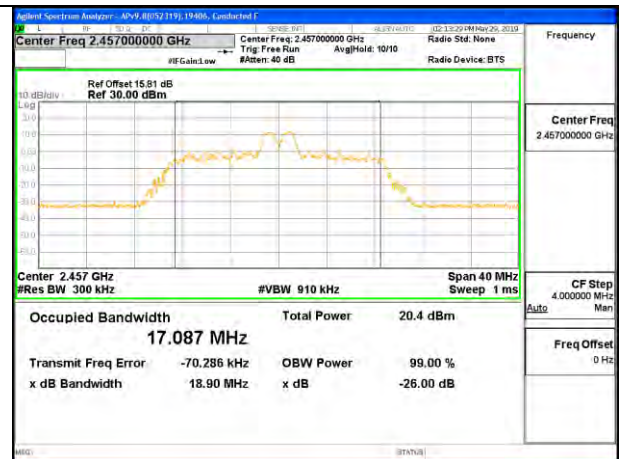
LOW CHANNEL 3



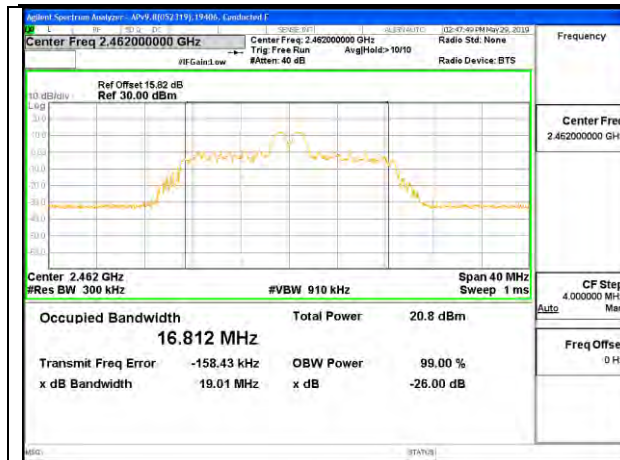
MID CHANNEL 6



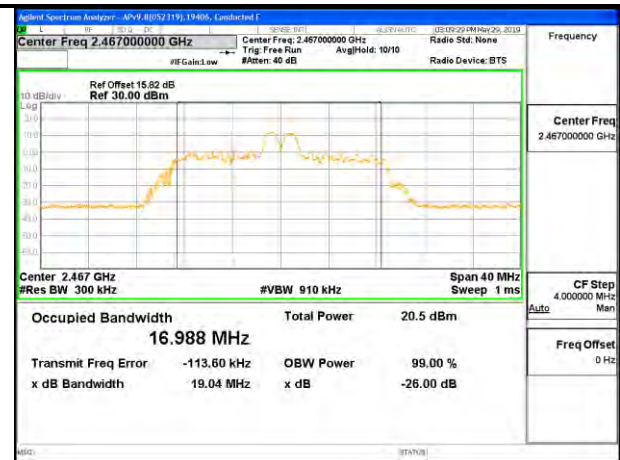
HIGH CHANNEL 9



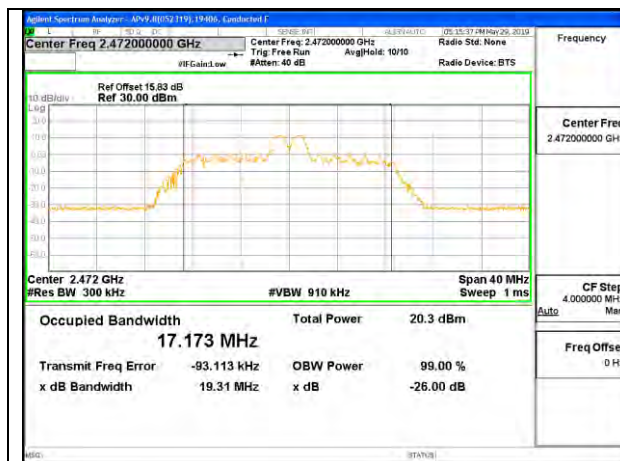
HIGH CHANNEL 10



HIGH CHANNEL 11



HIGH CHANNEL 12

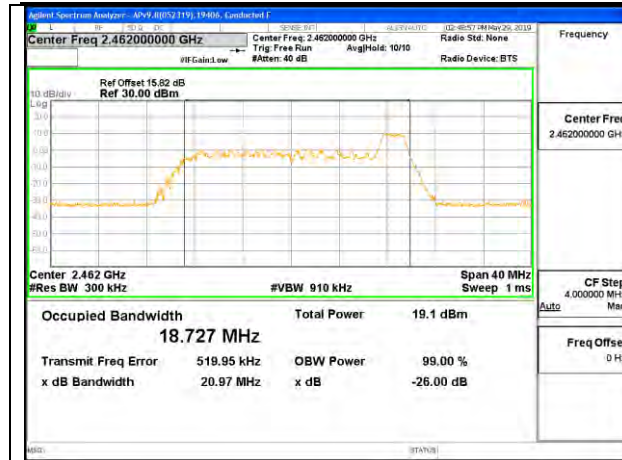


HIGH CHANNEL 13

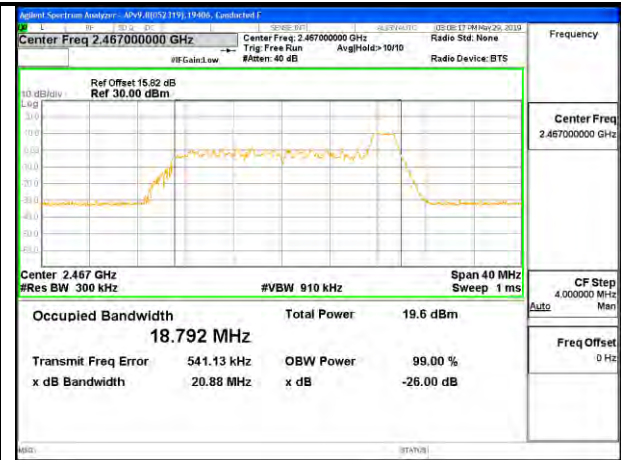
Antenna 3, LEGACY SISO MODE: 26-Tones, RU index 8

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	18.7880
Low 2	2417	18.7360
Low 3	2422	18.7540
Mid 6	2437	18.8320
High 9	2452	18.7140
High 10	2457	18.5020
High 11	2462	18.7270
High 12	2467	18.7920
High 13	2472	18.6840

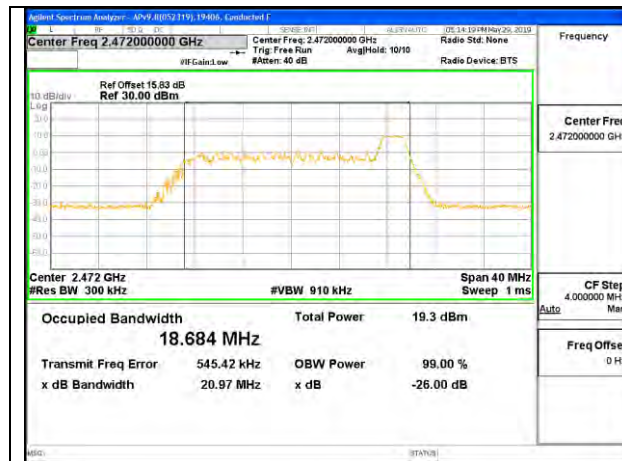




HIGH CHANNEL 11



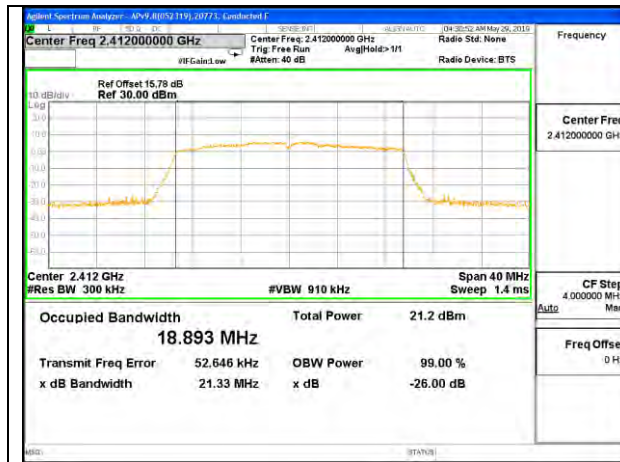
HIGH CHANNEL 12



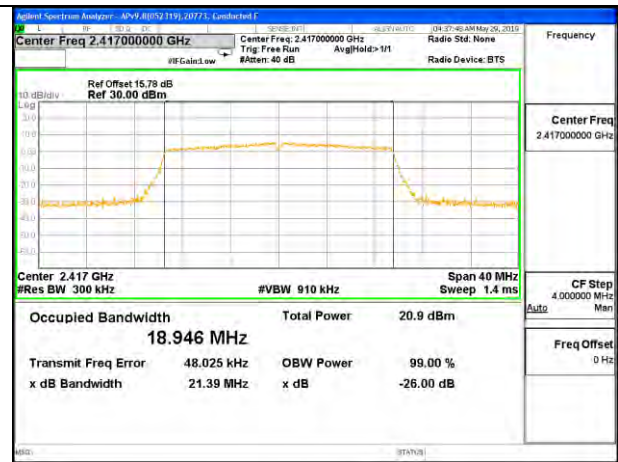
HIGH CHANNEL 13

Antenna 3, LEGACY SISO MODE: 242-Tones, RU index 61

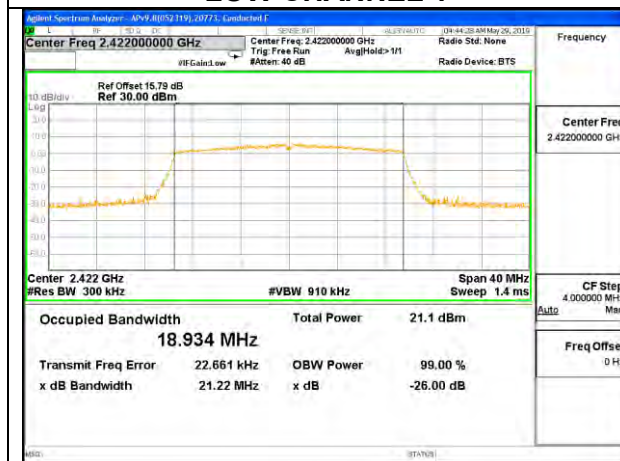
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	18.8930
Low 2	2417	18.9460
Low 3	2422	18.9340
Mid 6	2437	19.0130
High 9	2452	18.9440
High 10	2457	18.8970
High 11	2462	18.9420
High 12	2467	18.9560
High 13	2472	18.8900



LOW CHANNEL 1



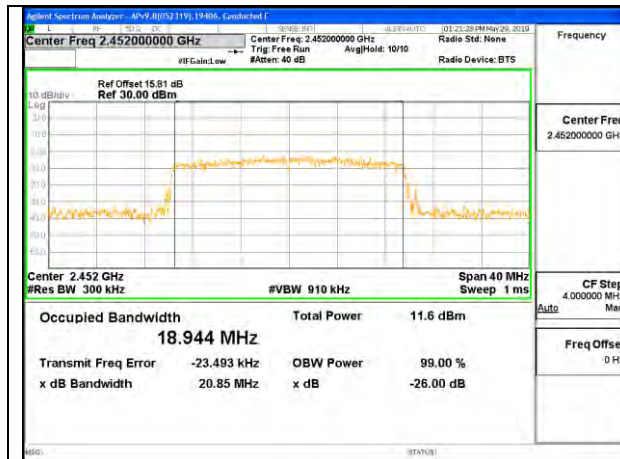
LOW CHANNEL 2



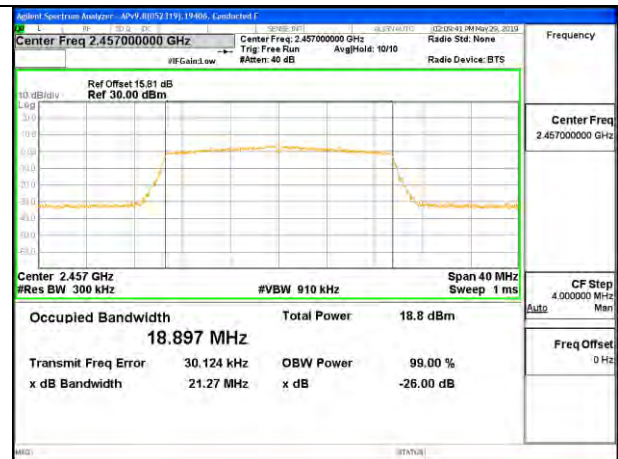
LOW CHANNEL 3



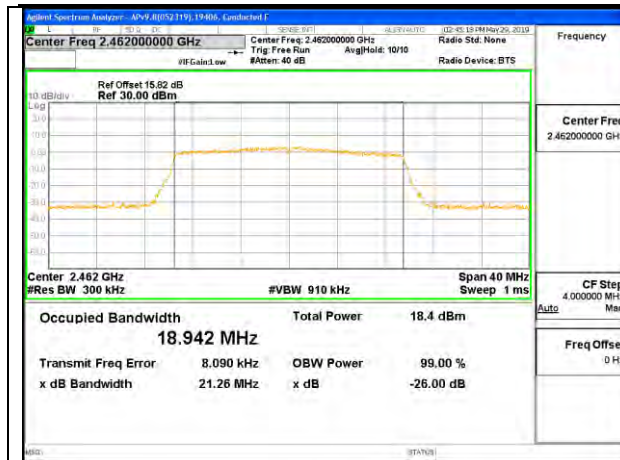
MID CHANNEL 6



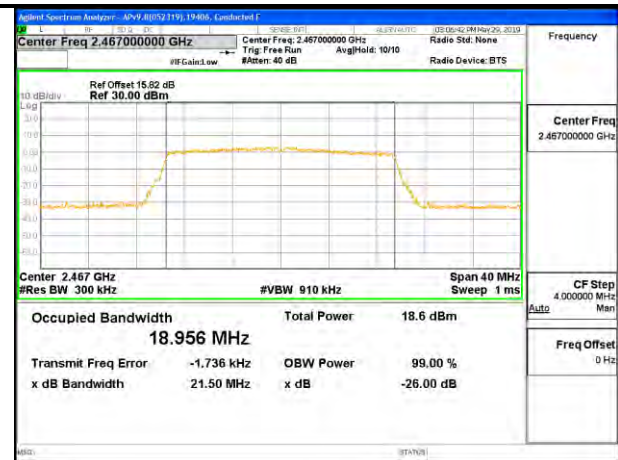
HIGH CHANNEL 9



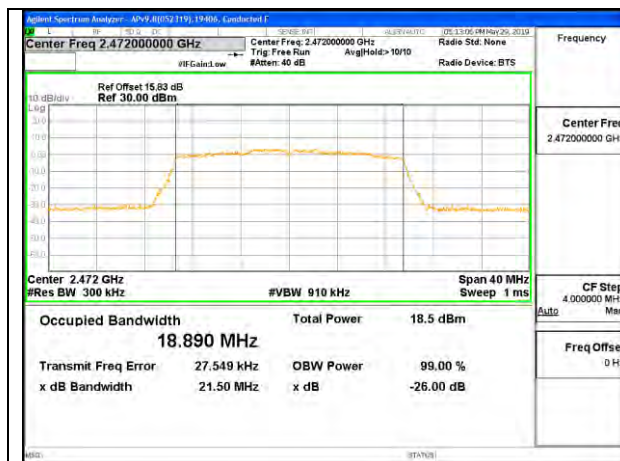
HIGH CHANNEL 10



HIGH CHANNEL 11



HIGH CHANNEL 12

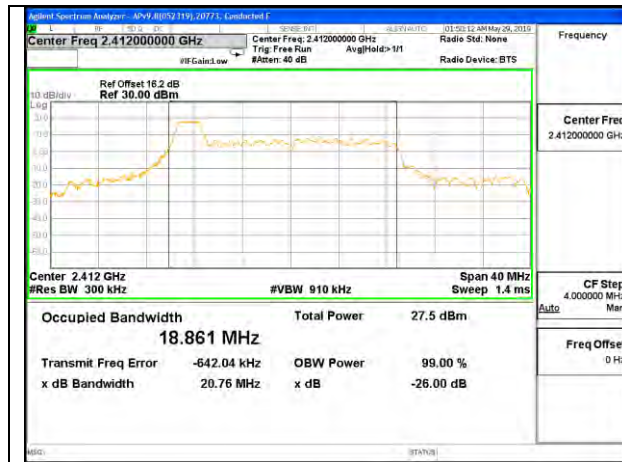


HIGH CHANNEL 13

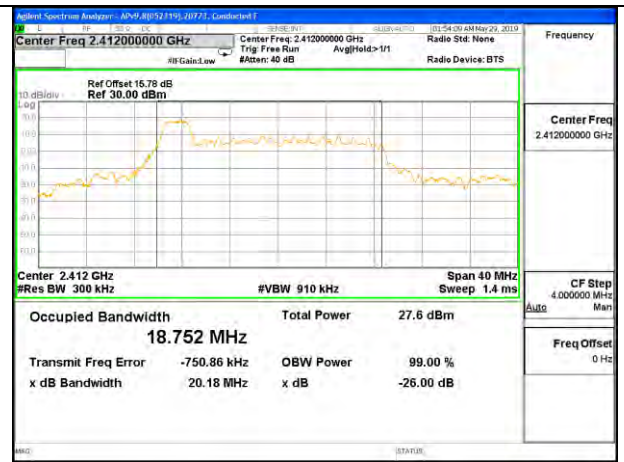
8.2.4. 802.11ax HE20 OFDMA MODE 2TX

Antenna 4 + Antenna 3 2TX MODE: 26-Tones, RU Index 0

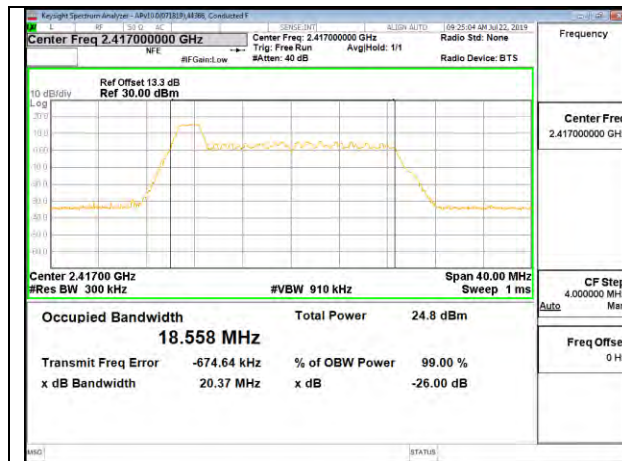
Channel	Frequency (MHz)	99% Bandwidth Ant 4 (MHz)	99% Bandwidth Ant 3 (MHz)
Low 1	2412	18.8610	18.7520
Low 2	2417	18.5580	18.9790
Low 3	2422	18.4610	18.3570
Low 4	2427	18.4650	18.4580
Mid 6	2437	18.3810	18.3710
High 9	2452	18.3630	18.3440
High 10	2457	18.4980	18.3040
High 11	2462	18.2850	18.2270
High 12	2467	18.1450	18.1930
High 13	2472	18.2480	18.2550



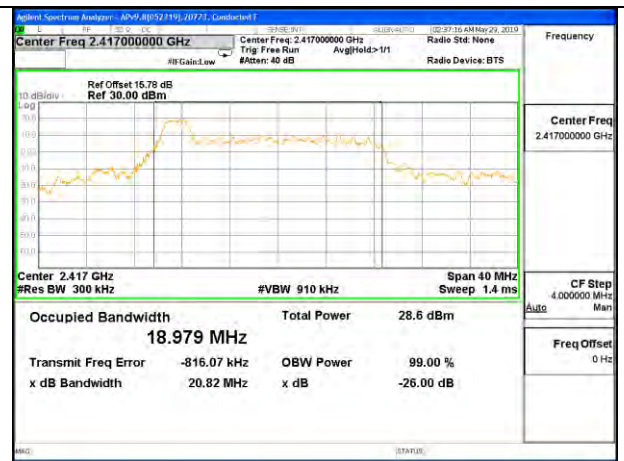
LOW CHANNEL 1 ANT 4



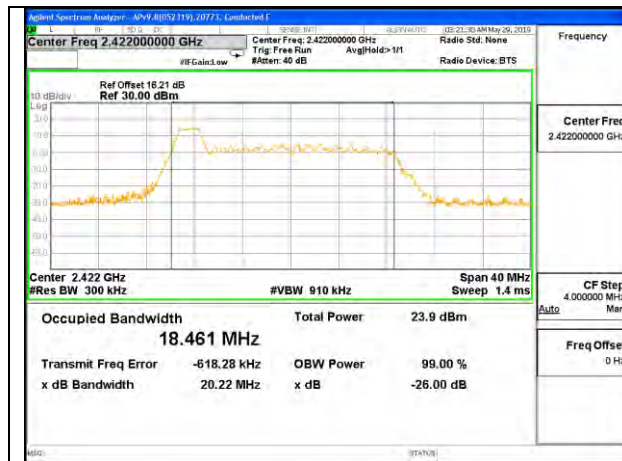
LOW CHANNEL 1 ANT 3



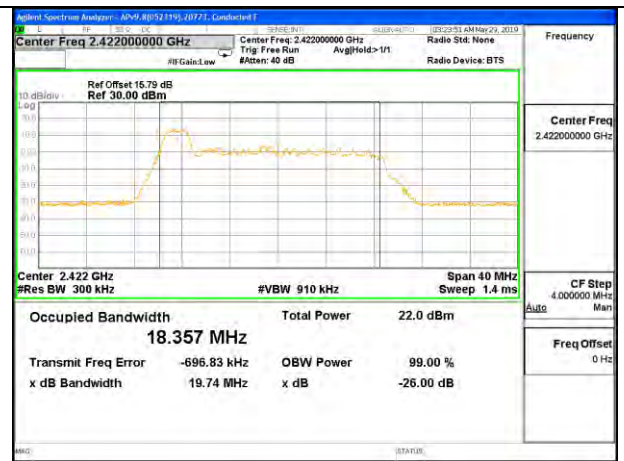
LOW CHANNEL 2 ANT 4



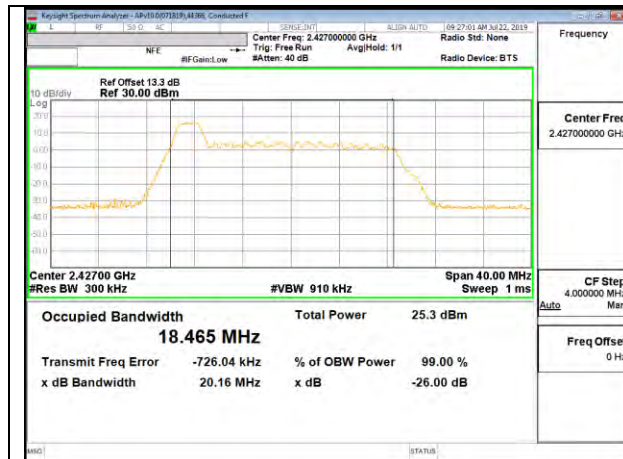
LOW CHANNEL 2 ANT 3



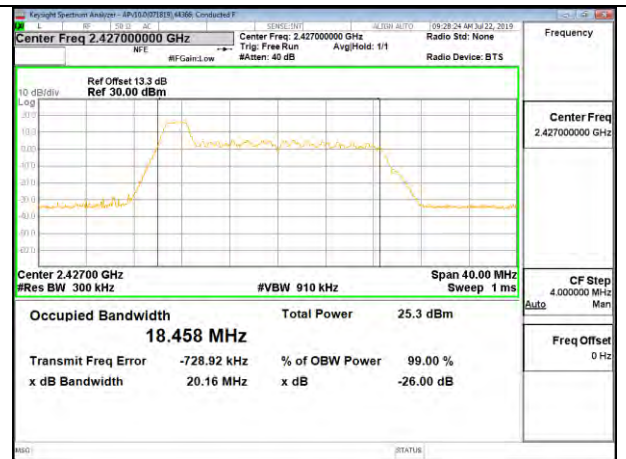
LOW CHANNEL 3 ANT 4



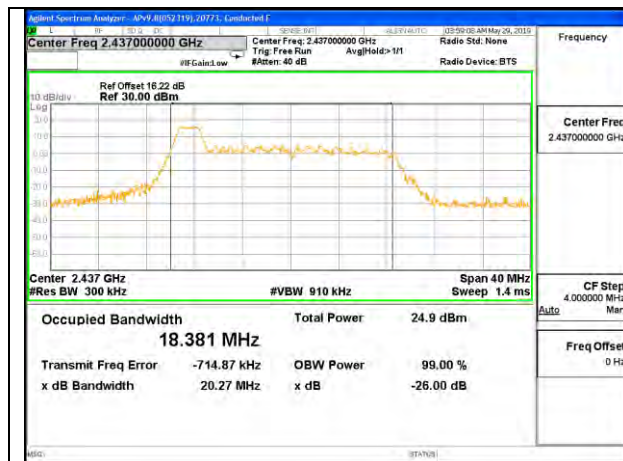
LOW CHANNEL 3 ANT 3



LOW CHANNEL 4 ANT 4



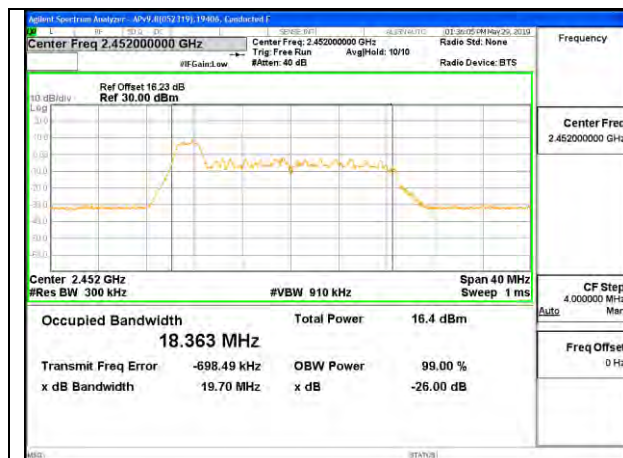
LOW CHANNEL 4 ANT 3



MID CHANNEL 6 ANT 4



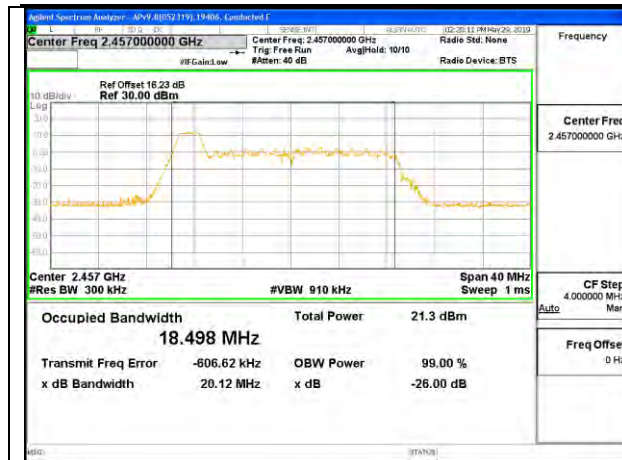
MID CHANNEL 6 ANT 3



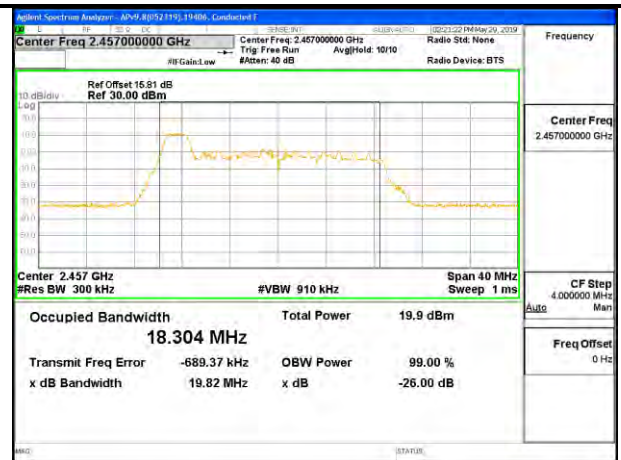
HIGH CHANNEL 9 ANT 4



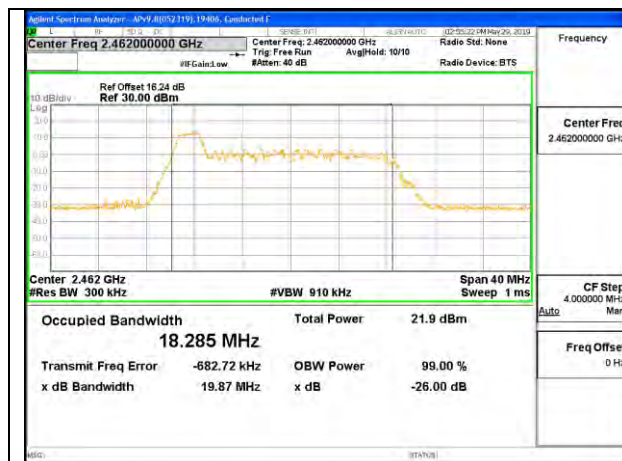
HIGH CHANNEL 9 ANT 3



HIGH CHANNEL 10 ANT 4



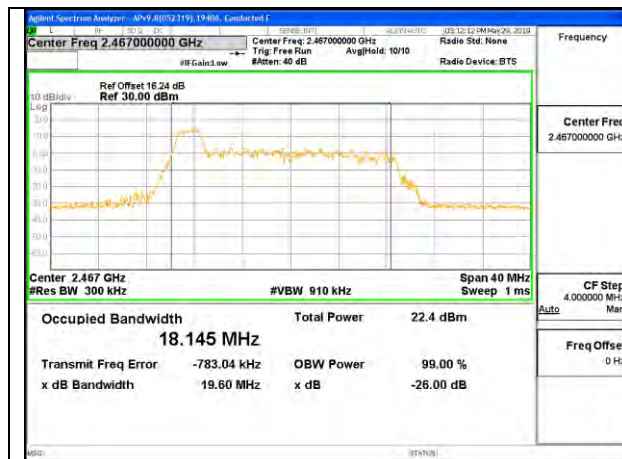
HIGH CHANNEL 10 ANT 3



HIGH CHANNEL 11 ANT 4



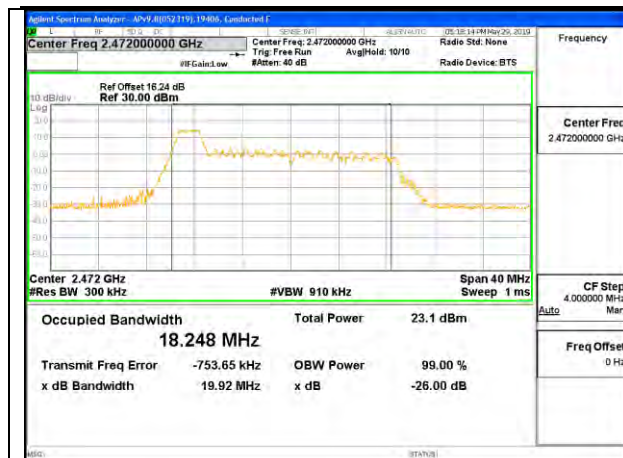
HIGH CHANNEL 11 ANT 3



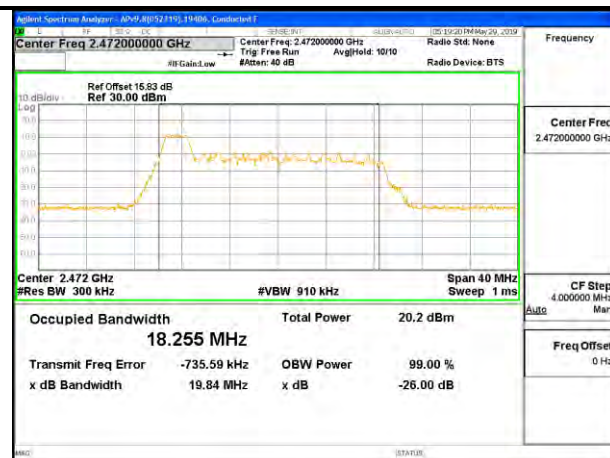
HIGH CHANNEL 12 ANT 4



HIGH CHANNEL 12 ANT 3



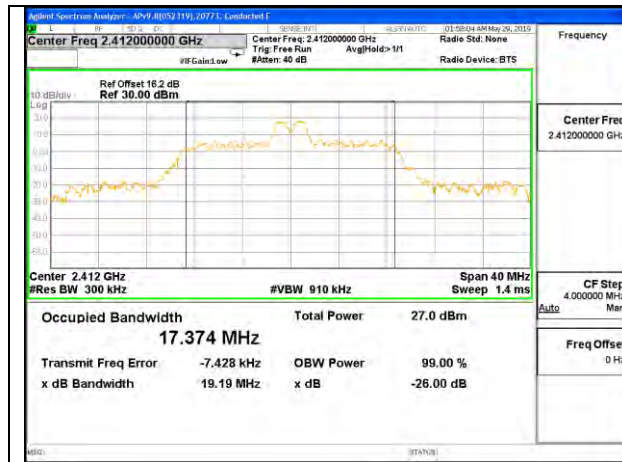
HIGH CHANNEL 13 ANT 4



HIGH CHANNEL 13 ANT 3

Antenna 4 + Antenna 3 2TX MODE: 26-Tones, RU Index 4

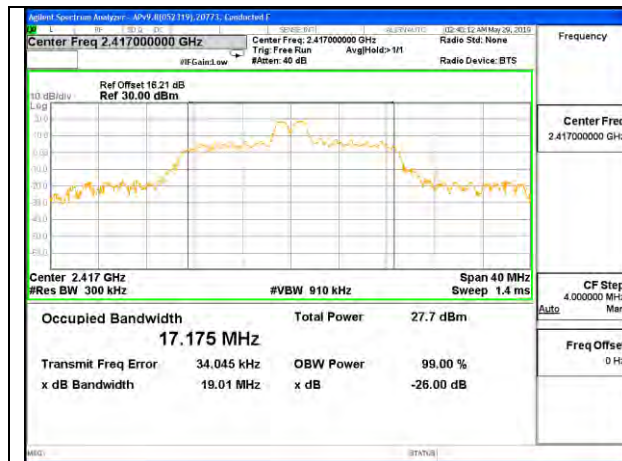
Channel	Frequency (MHz)	99% Bandwidth Ant 4 (MHz)	99% Bandwidth Ant 3 (MHz)
Low 1	2412	17.3740	16.9050
Low 2	2417	17.1750	16.9740
Low 3	2422	17.1040	16.6660
Low 4	2427	17.1840	17.1800
Mid 6	2437	17.2660	16.9000
High 9	2452	16.6660	16.6310
High 10	2457	16.9710	16.6490
High 11	2462	16.7620	16.6250
High 12	2467	16.7240	16.8510
High 13	2472	17.0270	16.8300



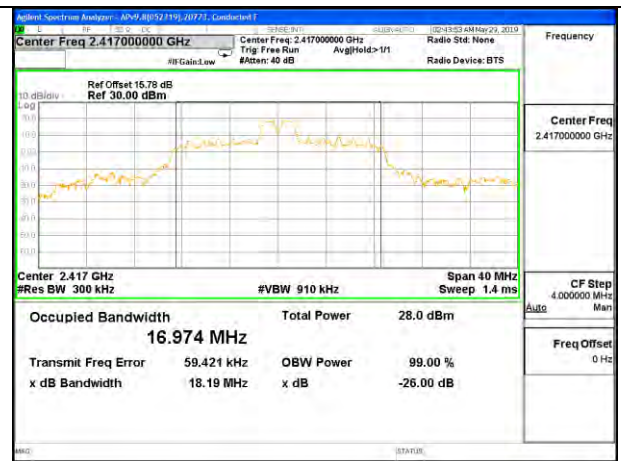
LOW CHANNEL 1 ANT 4



LOW CHANNEL 1 ANT 3



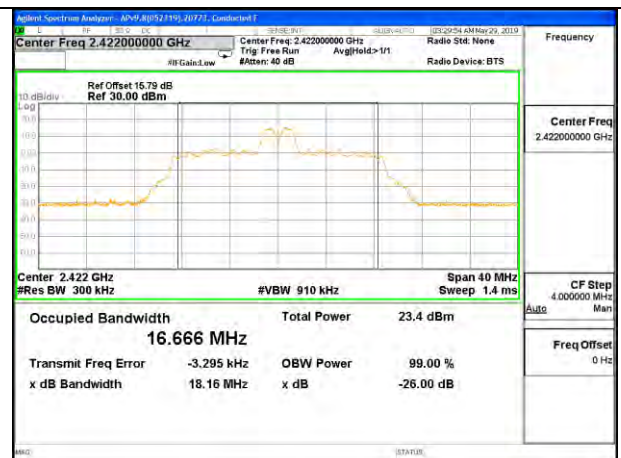
LOW CHANNEL 2 ANT 4



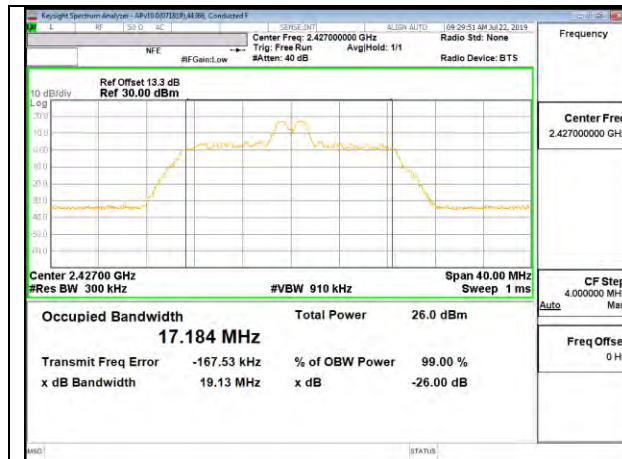
LOW CHANNEL 2 ANT 3



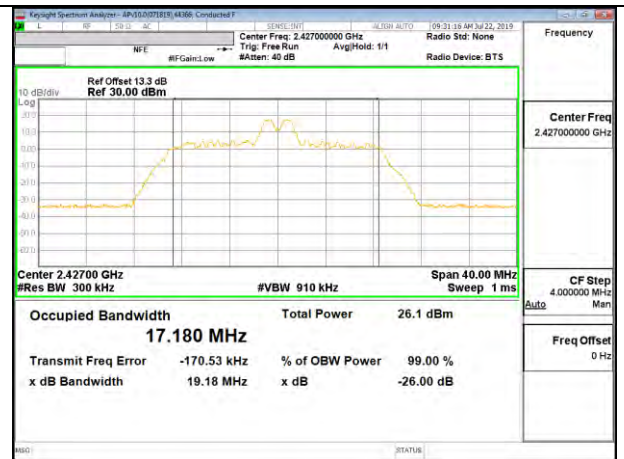
LOW CHANNEL 3 ANT 4



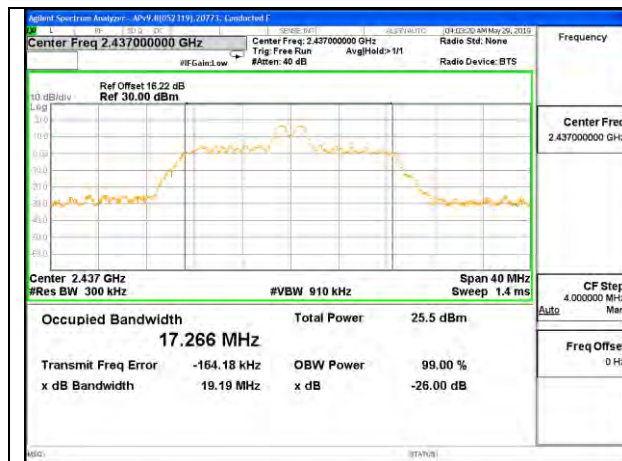
LOW CHANNEL 3 ANT 3



LOW CHANNEL 4 ANT 4



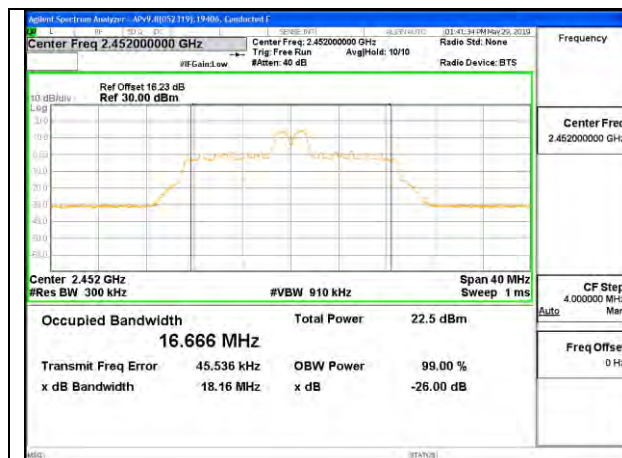
LOW CHANNEL 4 ANT 3



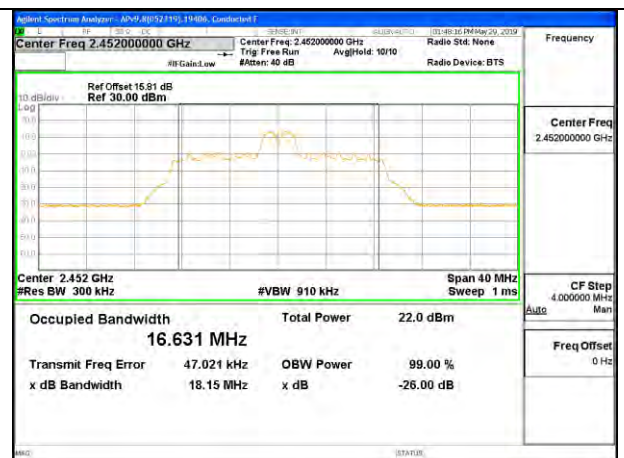
MID CHANNEL 6 ANT 4



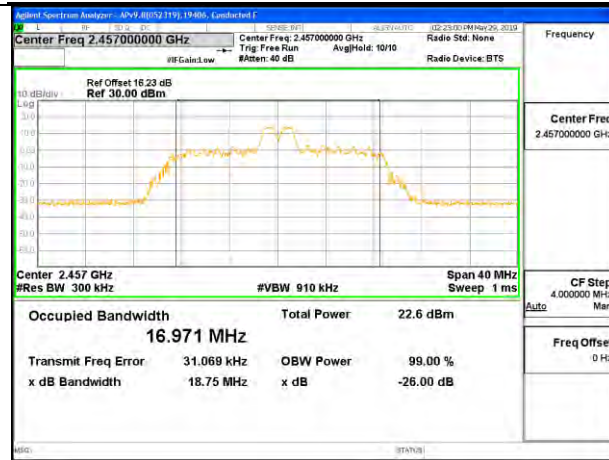
MID CHANNEL 6 ANT 3



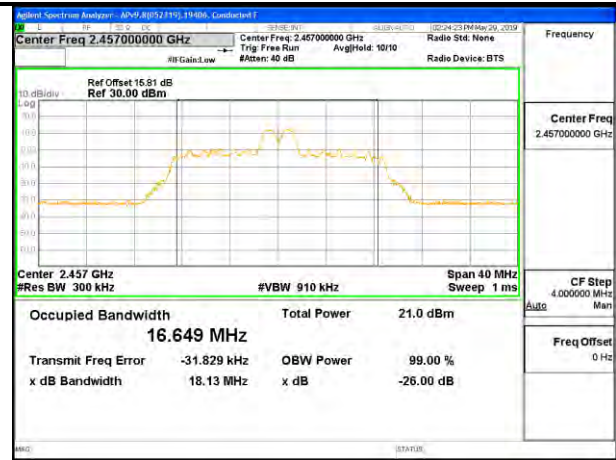
HIGH CHANNEL 9 ANT 4



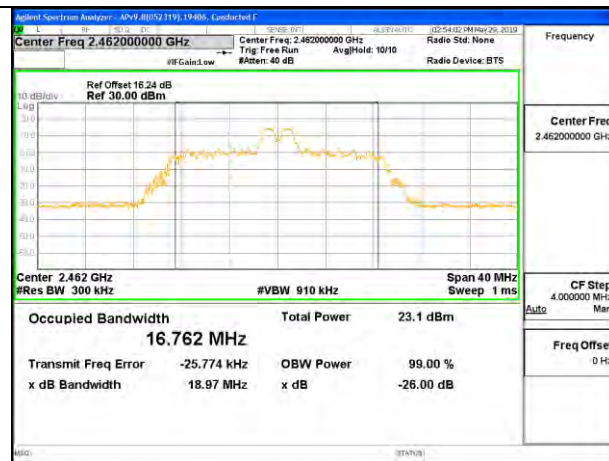
HIGH CHANNEL 9 ANT 3



HIGH CHANNEL 10 ANT 4



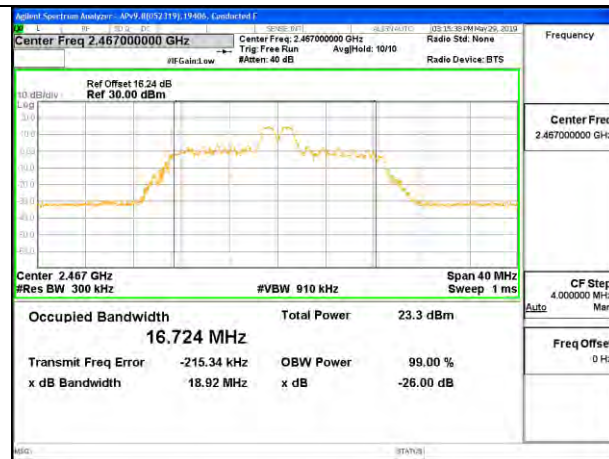
HIGH CHANNEL 10 ANT 3



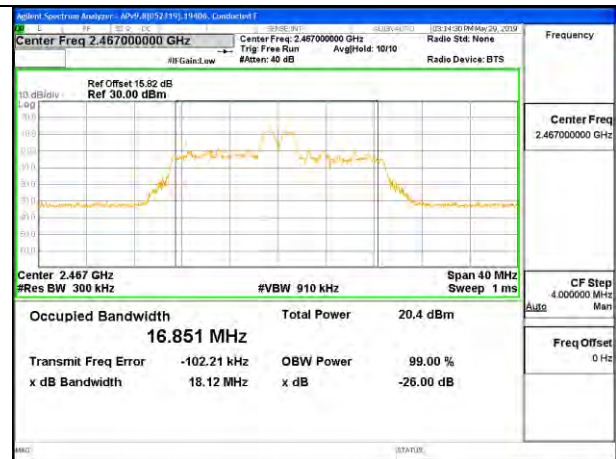
HIGH CHANNEL 11 ANT 4



HIGH CHANNEL 11 ANT 3



HIGH CHANNEL 12 ANT 4

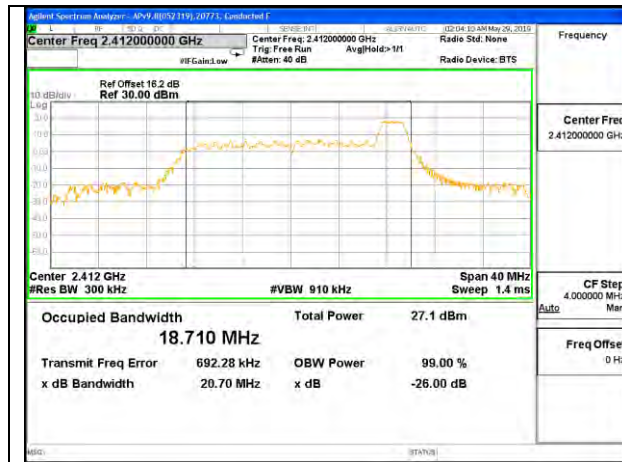


HIGH CHANNEL 12 ANT 3

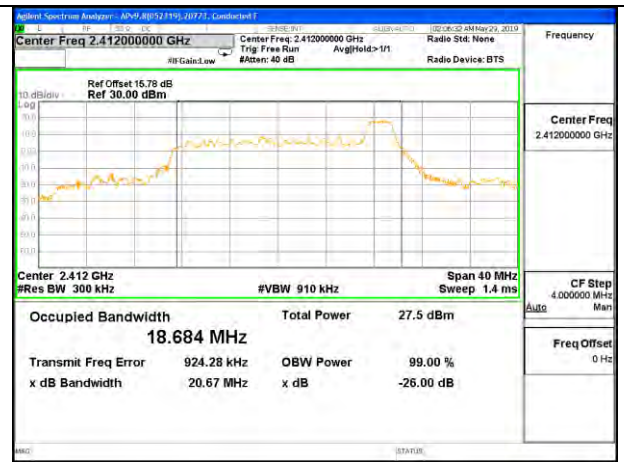


Antenna 4 + Antenna 3 2TX MODE: 26-Tones, RU Index 8

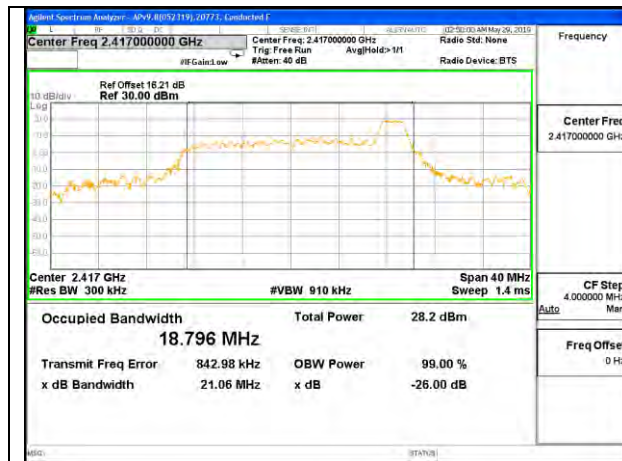
Channel	Frequency (MHz)	99% Bandwidth Ant 4 (MHz)	99% Bandwidth Ant 3 (MHz)
Low 1	2412	18.7100	18.6840
Low 2	2417	18.7960	19.0280
Low 3	2422	18.6060	18.5600
Low 4	2427	18.8360	18.8450
Mid 6	2437	18.8980	18.4820
High 9	2452	18.3690	18.3870
High 10	2457	18.4040	18.4660
High 11	2462	18.4350	18.4760
High 12	2467	18.7130	18.4190
High 13	2472	18.7760	18.4500



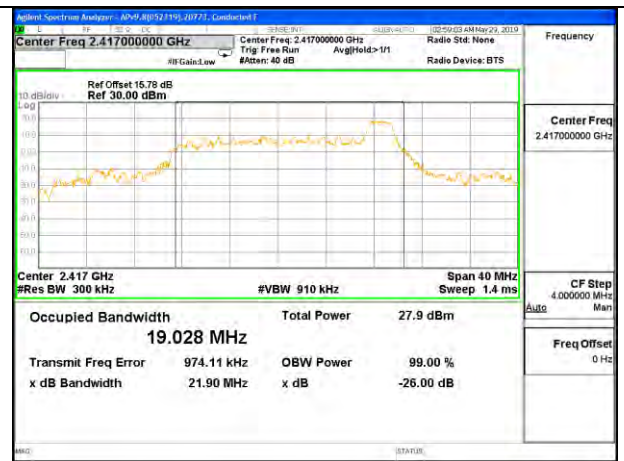
LOW CHANNEL 1 ANT 4



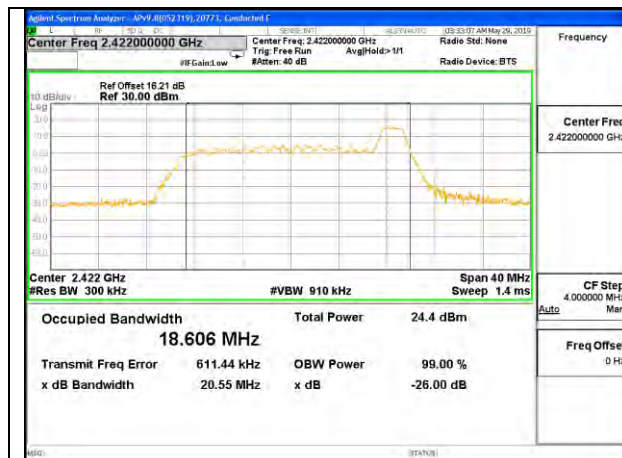
LOW CHANNEL 1 ANT 3



LOW CHANNEL 2 ANT 4



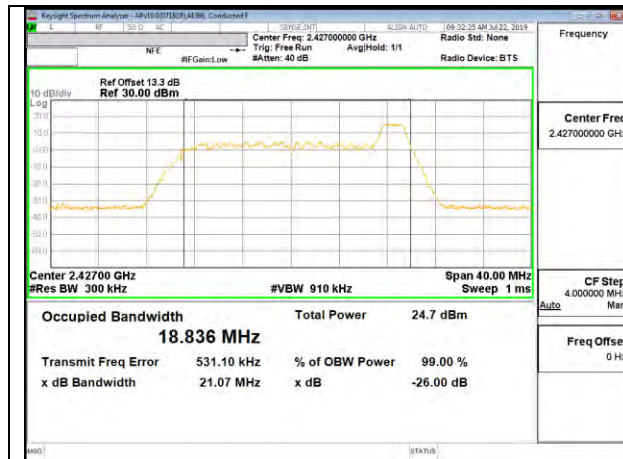
LOW CHANNEL 2 ANT 3



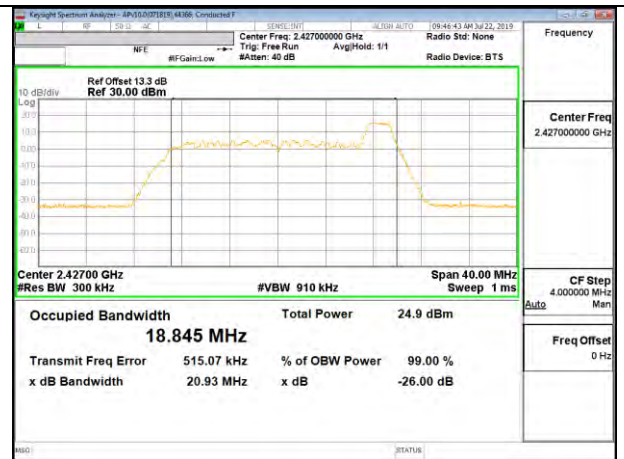
LOW CHANNEL 3 ANT 4



LOW CHANNEL 3 ANT 3



LOW CHANNEL 4 ANT 4



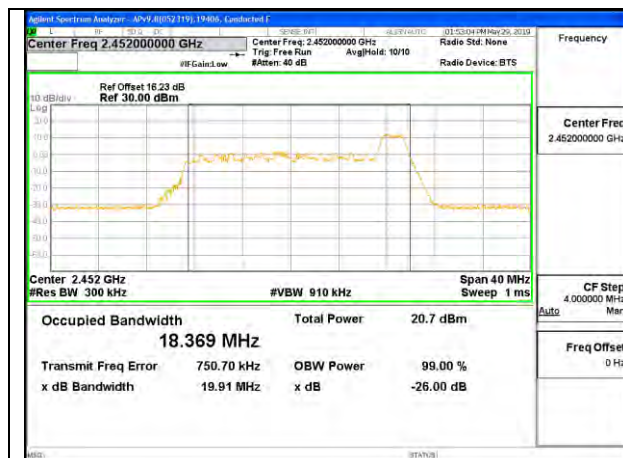
LOW CHANNEL 4 ANT 3



MID CHANNEL 6 ANT 4



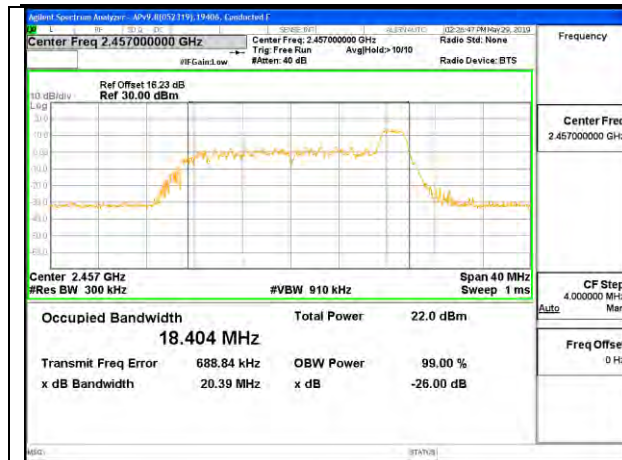
MID CHANNEL 6 ANT 3



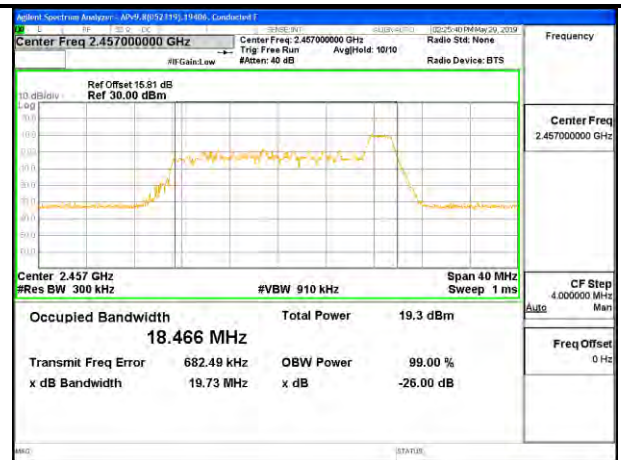
HIGH CHANNEL 9 ANT 4



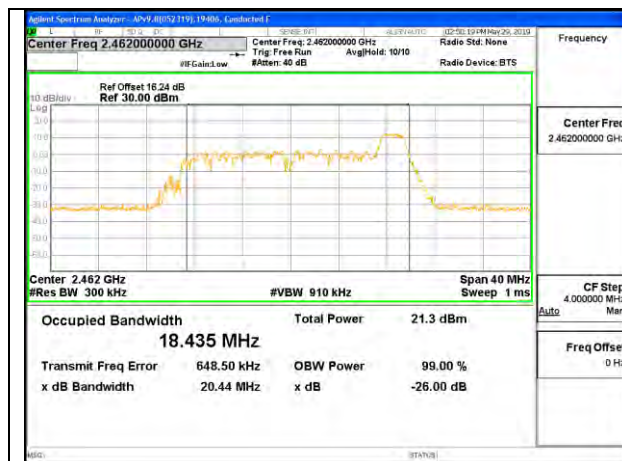
HIGH CHANNEL 9 ANT 3



HIGH CHANNEL 10 ANT 4



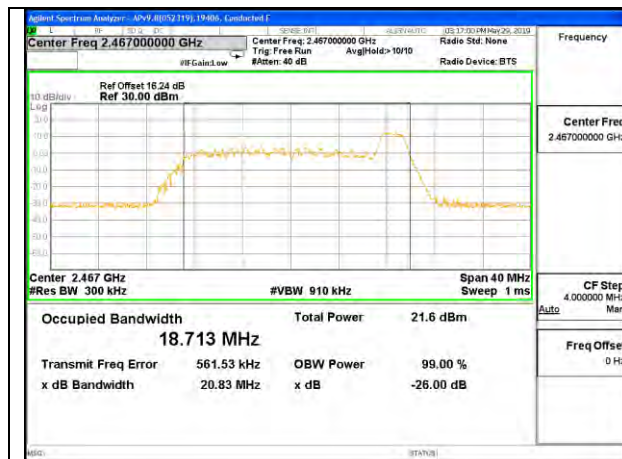
HIGH CHANNEL 10 ANT 3



HIGH CHANNEL 11 ANT 4



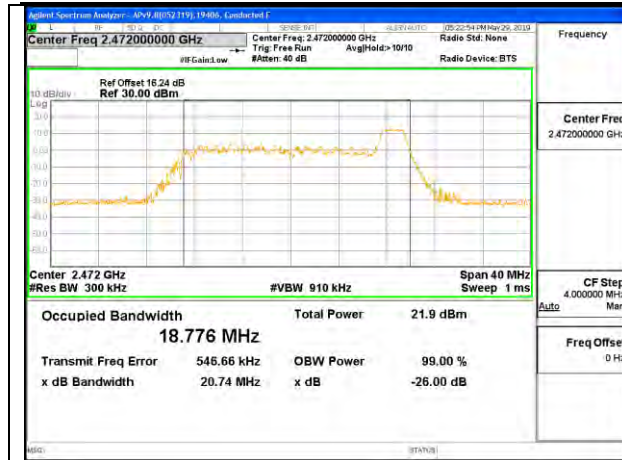
HIGH CHANNEL 11 ANT 3



HIGH CHANNEL 12 ANT 4



HIGH CHANNEL 12 ANT 3



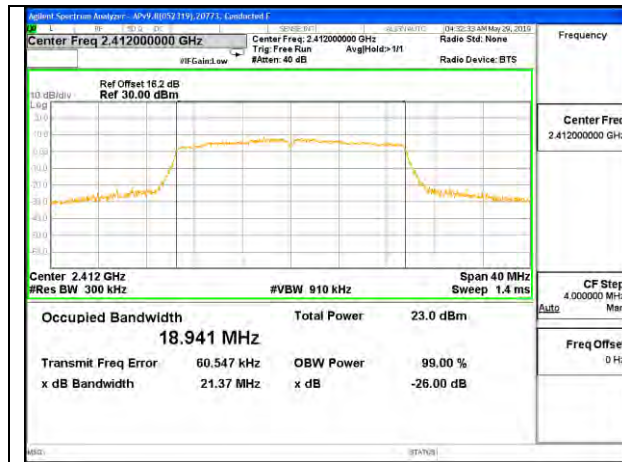
HIGH CHANNEL 13 ANT 4



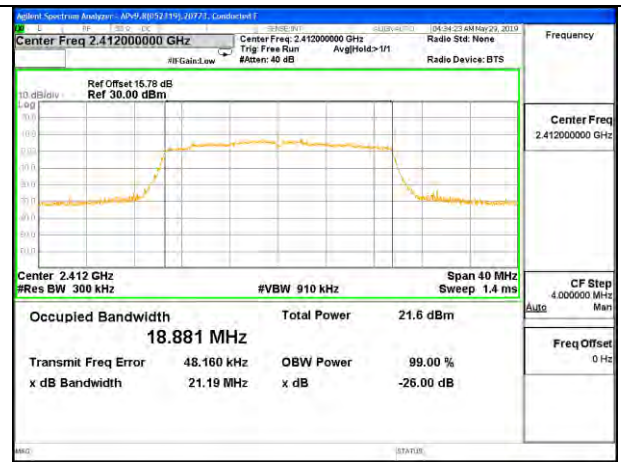
HIGH CHANNEL 13 ANT 3

Antenna 4 + Antenna 3 2TX MODE: 242-Tones, RU Index 61

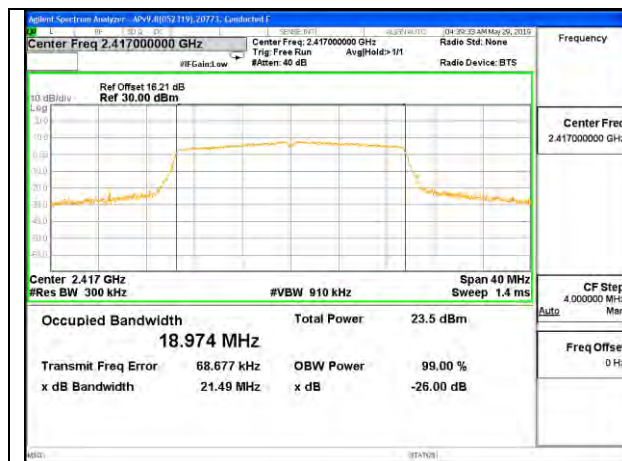
Channel	Frequency (MHz)	99% Bandwidth Ant 4 (MHz)	99% Bandwidth Ant 3 (MHz)
Low 1	2412	18.9410	18.8810
Low 2	2417	18.9740	18.9460
Low 3	2422	18.9190	18.9560
Low 4	2427	18.8220	18.9670
Mid 6	2437	19.0270	19.0110
High 9	2452	18.9510	18.9320
High 10	2457	18.9150	18.8960
High 11	2462	18.8610	18.9320
High 12	2467	18.9010	18.9880
High 13	2472	18.9100	18.8840



LOW CHANNEL 1 ANT 4



LOW CHANNEL 1 ANT 3



LOW CHANNEL 2 ANT 4



LOW CHANNEL 2 ANT 3



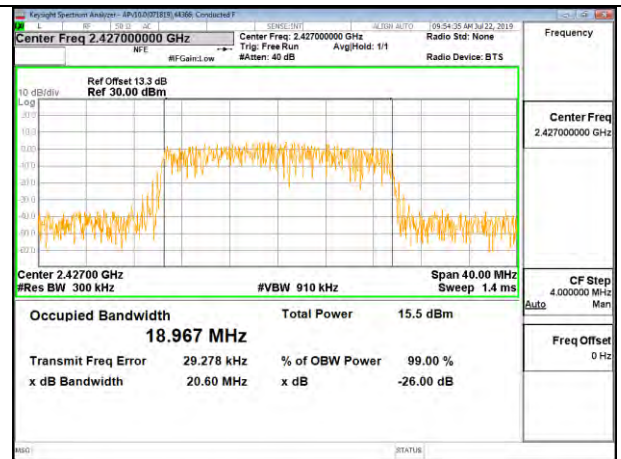
LOW CHANNEL 3 ANT 4



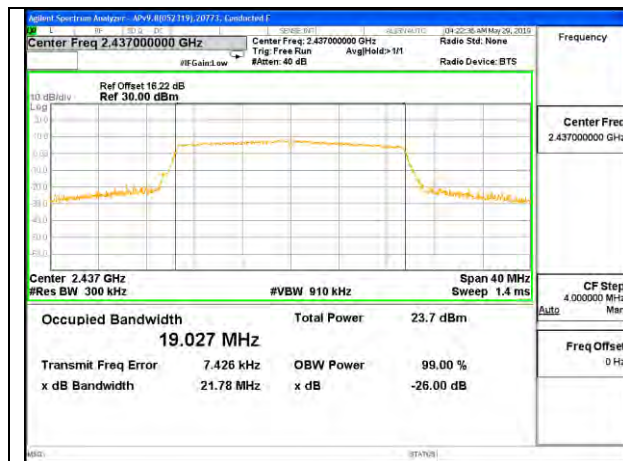
LOW CHANNEL 3 ANT 3



LOW CHANNEL 4 ANT 4



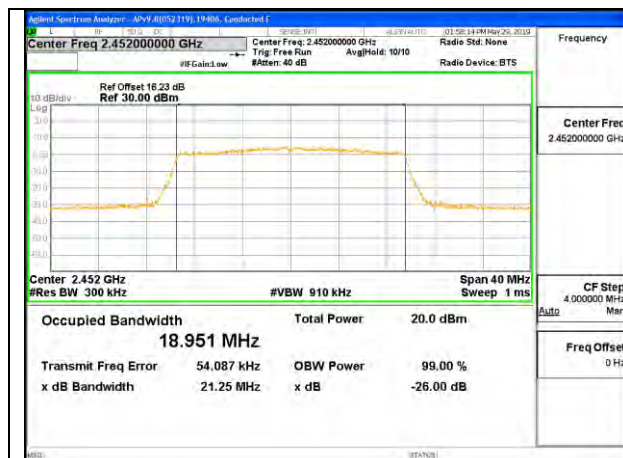
LOW CHANNEL 4 ANT 3



MID CHANNEL 6 ANT 4



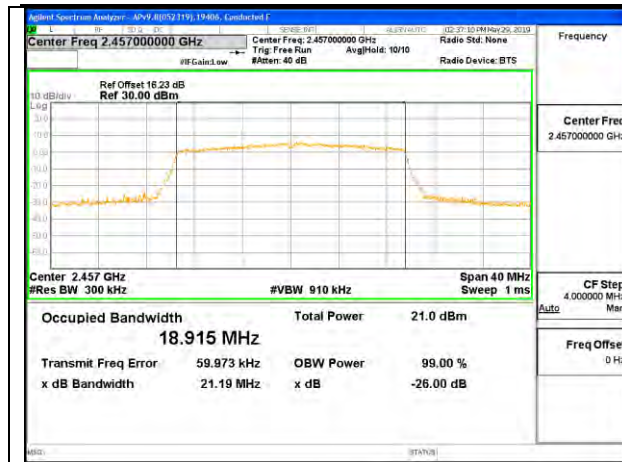
MID CHANNEL 6 ANT 3



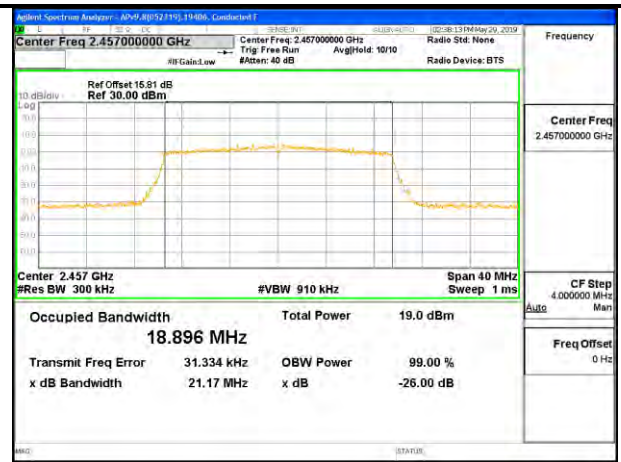
HIGH CHANNEL 9 ANT 4



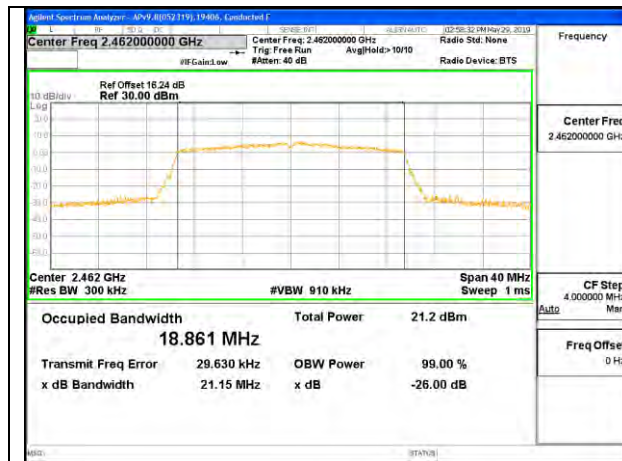
HIGH CHANNEL 9 ANT 3



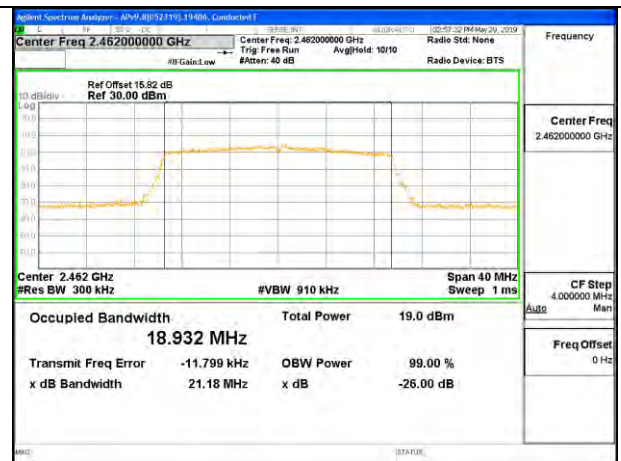
HIGH CHANNEL 10 ANT 4



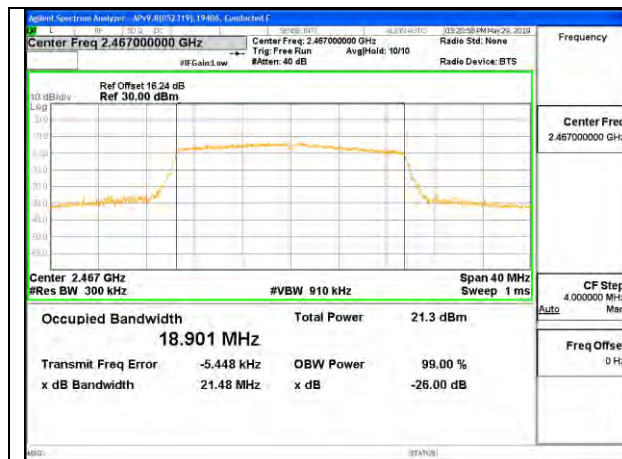
HIGH CHANNEL 10 ANT 3



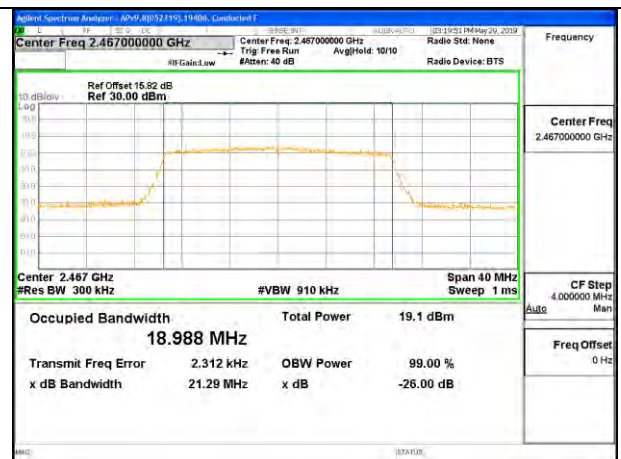
HIGH CHANNEL 11 ANT 4



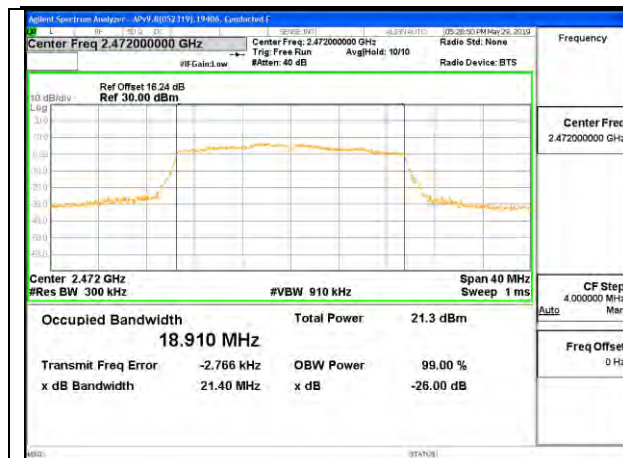
HIGH CHANNEL 11 ANT 3



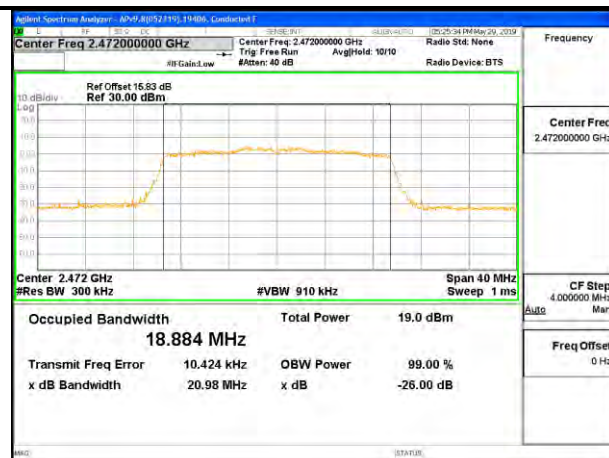
HIGH CHANNEL 12 ANT 4



HIGH CHANNEL 12 ANT 3



HIGH CHANNEL 13 ANT 4



HIGH CHANNEL 13 ANT 3

8.3. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

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 MODE

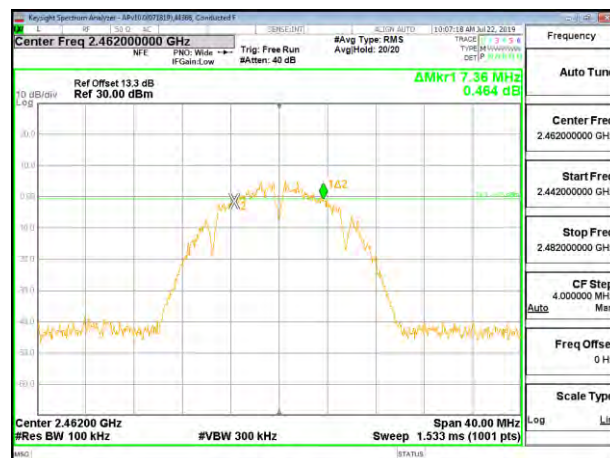
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	7.6400	0.5
Mid 6	2437	7.6800	0.5
High 11	2462	7.3600	0.5
High 12	2467	7.4000	0.5
High 13	2472	7.2400	0.5



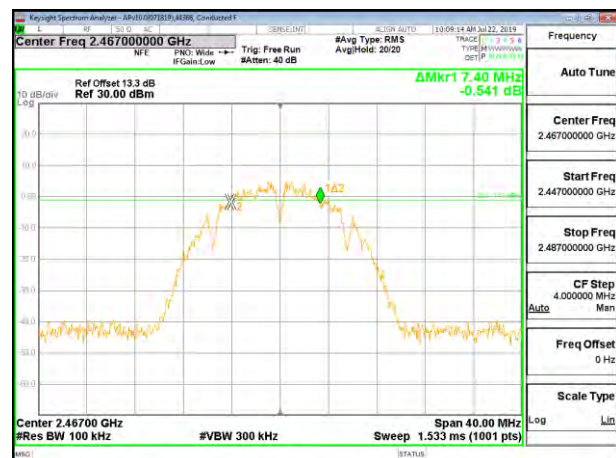
LOW CHANNEL 1



MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

1TX Antenna 3 MODE

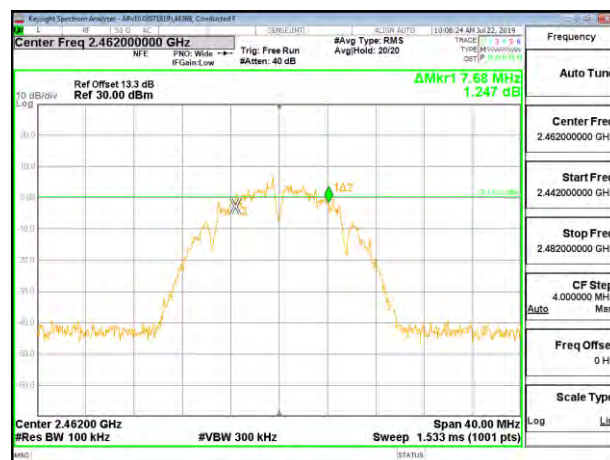
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	7.7600	0.5
Mid 6	2437	7.6800	0.5
High 11	2462	7.6800	0.5
High 12	2467	7.4400	0.5
High 13	2472	7.6800	0.5



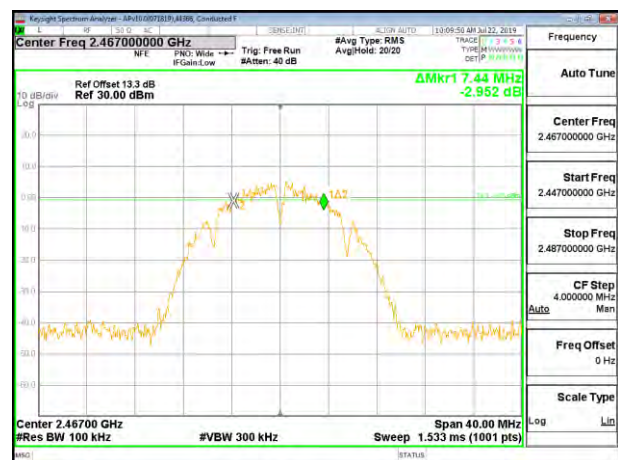
LOW CHANNEL 1



MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

8.3.2. 802.11n HT20 MODE

1TX Antenna 4 MODE

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	17.6800	0.5
Low 2	2417	17.6400	0.5
Low 3	2422	17.2400	0.5
Mid 6	2437	17.2000	0.5
High 9	2452	17.2800	0.5
High 10	2457	17.6400	0.5
High 11	2462	17.6400	0.5
High 12	2467	17.6000	0.5
High 13	2472	17.8000	0.5





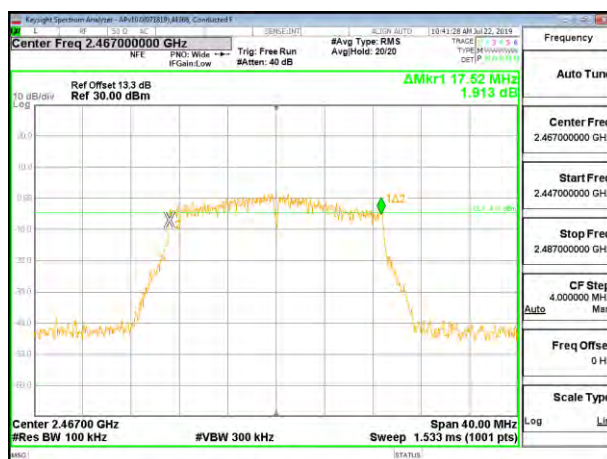
1TX Antenna 3 MODE

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	17.6400	0.5
Low 2	2417	17.7200	0.5
Low 3	2422	17.6400	0.5
Mid 6	2437	17.6400	0.5
High 9	2452	17.6800	0.5
High 10	2457	17.6000	0.5
High 11	2462	17.4400	0.5
High 12	2467	17.5200	0.5
High 13	2472	17.7200	0.5





HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

2TX Antenna 4 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	6 dB Bandwidth Ant 4 (MHz)	6 dB Bandwidth Ant 3 (MHz)	Minimum Limit (MHz)
Low 1	2412	17.6400	17.0400	0.5
Low 2	2417	17.2400	17.0000	0.5
Low 3	2422	17.6400	17.6400	0.5
Mid 6	2437	17.7200	17.0400	0.5
High 9	2452	17.0000	17.0000	0.5
High 10	2457	17.6400	17.6800	0.5
High 11	2462	17.2400	17.0000	0.5
High 12	2467	17.2000	17.3600	0.5
High 13	2472	17.6800	17.7600	0.5

