



CERTIFICATION TEST REPORT

Report Number. : 4789247752-E3V1

Applicant : SAMSUNG ELECTRONICS CO., LTD.
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,
GYEONGGI-DO, 16677, KOREA

Model : SM-G980F/DS, SM-G980F

FCC ID : A3LSMG980F

EUT Description : GSM/WCDMA/LTE Phone with BT/BLE, DTS/UNII a/b/g/n/ac/ax,
ANT+, NFC and WPT

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C

Date Of Issue:

January 07, 2020

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ACCREDITED

Testing Laboratory

TL-637

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	01/07/20	Initial issue	Sungeun Lee

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	5
1.1. INTRODUCTION OF TEST DATA REUSE	6
1.2. DIFFERENCE	6
1.3. SPOT CHECK VERIFICATION DATA.....	6
1.4. REFERENCE DETAIL.....	7
2. TEST METHODOLOGY	8
3. FACILITIES AND ACCREDITATION	8
4. CALIBRATION AND UNCERTAINTY	8
4.1. MEASURING INSTRUMENT CALIBRATION.....	8
4.2. SAMPLE CALCULATION.....	8
4.3. MEASUREMENT UNCERTAINTY	9
4.4. DECISION RULE	9
5. EQUIPMENT UNDER TEST	10
5.1. DESCRIPTION OF EUT.....	10
5.2. MAXIMUM OUTPUT POWER.....	11
5.3. DESCRIPTION OF AVAILABLE ANTENNAS	11
5.4. TESTED CHANNELS LIST	12
5.5. WORST-CASE CONFIGURATION AND MODE	13
5.6. DESCRIPTION OF TEST SETUP.....	13
6. TEST AND MEASUREMENT EQUIPMENT	15
7. REFERENCE MEASUREMENT RESULTS.....	16
7.1. ON TIME AND DUTY CYCLE RESULTS.....	16
8. MEASUREMENT METHODS	17
9. SUMMARY TABLE	17
10. ANTENNA PORT TEST RESULTS	18
10.1. 6 dB BANDWIDTH.....	18
10.1.1. 802.11b MODE IN THE 2.4 GHz BAND.....	19
10.1.2. 802.11g MODE IN THE 2.4 GHz BAND.....	19
10.1.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND	19
10.1.4. 6 dB BANDWIDTH PLOTS.....	20
10.2. OUTPUT POWER.....	30
10.2.1. 1TX_TEST RESULTS	31

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.

EUT DESCRIPTION: GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, ANT+, NFC and WPT

MODEL NUMBER: SM-G980F/DS, SM-G980F

SERIAL NUMBER: 38b95f7950197ece, 39989048ab1f7ece (CONDUCTED, Original)
R3CMA0BVGAAH, R3CMA0D84RA (RADIATED, Original);
R38MBOAHJRL (RADIATED, Spot check)

DATE TESTED: OCT 31, 2019 – NOV 29, 2019 (Original);
NOV 05, 2019 – NOV 29, 2019 (Spot check);

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. 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 IAS, any agency of the Federal Government, or any agency of any government.

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Tested By:



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UL Korea, Ltd.

1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: A3LSMG981B DTS WLAN(FCC CFR 47 Part 15C). And the applicant takes full responsibility that the test data as referenced in this report represent compliance for this FCC ID.

1.2. DIFFERENCE

The FCC ID: A3LSMG980F shares the same enclosure and circuit board as FCC ID: A3LSMG981B. The WLAN antennas and surrounding circuitry and layout are identical between these two units.

After confirming through preliminary radiated emissions that the performance of the FCC ID: A3LSMG981B remains representative of FCC ID: A3LSMG980F. The test data of FCC ID: A3LSMG981B being submitted for this application to cover WLAN features.

1.3. SPOT CHECK VERIFICATION DATA (Worst case of the radiated spurious and band edge emissions)

Band	Test Item	Mode	Frequency	Test Limit	Original model	Spot check model	Deviation	Remark
					SM-G981B/DS	SM-G980F/DS		
					FCC ID : A3LSMG981B	FCC ID : A3LSMG980F		
DTS WLAN (2.4 GHz)	Band Edge	BE_H_11b_2462_Ant1	2462 MHz	54 dBuV/m	43.32 dBuV/m	43.46 dBuV/m	0.14 dB	
	RSE	HARM_11b_2412_Ant1	2412_2nd	54 dBuV/m	39.38 dBuV/m	39.89 dBuV/m	0.51 dB	2nd Harmonic
	Band Edge	BE_V_11b_2472_Ant2	2472 MHz	54 dBuV/m	43.13 dBuV/m	42.80 dBuV/m	-0.33 dB	
	RSE	HARM_11b_2462_Ant2	2462_2nd	54 dBuV/m	38.18 dBuV/m	34.48 dBuV/m	-3.70 dB	2nd Harmonic
	Band Edge	BE_H_11g_2412_All	2412 MHz	54 dBuV/m	51.71 dBuV/m	50.97 dBuV/m	-0.74 dB	
	RSE	HARM_11g_2437_All	2437_4th_NF	54 dBuV/m	48.82 dBuV/m	47.14 dBuV/m	-1.68 dB	4th Harmonic
	Band Edge	BE_H_11n_HT20_2417_All	2417 MHz	54 dBuV/m	49.83 dBuV/m	51.61 dBuV/m	1.78 dB	
	RSE	HARM_11n_HT20_2417_All	2417_4th_NF	54 dBuV/m	48.27 dBuV/m	47.50 dBuV/m	-0.77 dB	4th Harmonic

Comparison of two models, upper deviation is within 3dB range and all test results are under FCC Technical Limits.

1.4. REFERENCE DETAIL

Reference application that contains the reused reference data in the individual test reports:

Equipment Class	Reference FCC ID (Parent)	Application Type	Reference Test report number	Exhibit Type	Variant Test Report Number	Data Re-used
PCE	A3LSMG981B	Original Grant	4789230288-E2	Test Report	4789247752-E2	All
DTS	A3LSMG981B	Original Grant	4789230288-E3 (802.11b/g/n)	Test Report	4789247752-E3 (802.11b/g/n)	All
			4789230288-E4 (802.11ax)	Test Report	4789247752-E4 (802.11ax)	All
			4789230288-E5 Bluetooth LE	Test Report	4789247752-E5 Bluetooth LE	All
DSS	A3LSMG981B	Original Grant	4789230288-E6 (Bluetooth)	Test Report	4789247752-E6 (Bluetooth)	All
NII	A3LSMG981B	Original Grant	4789230288-E7 (802.11a/n/ac)	Test Report	4789247752-E7 (802.11a/n/ac)	All
			4789230288-E8 (802.11ax)	Test Report	4789247752-E8 (802.11ax)	All
DXX	A3LSMG981B	Original Grant	4789230288-E9 (ANT+)	Test Report	4789247752-E9 (ANT+)	All
			4789230288-E10 (NFC)	Test Report	4789247752-E10 (NFC)	All
DCD	A3LSMG981B	Original Grant	4789230288-E11 (WPT)	Test Report	4789247752-E11 (WPT)	All

For this application the data reuse is summarized below for each equipment class:

Equipment Class	Reference FCC ID (Parent)	Application Type	Test Item	Data Re-used
PCE	A3LSMG981B	Original Grant	WWAN	All except SAR (full test), HAC (full test)
DTS	A3LSMG981B	Original Grant	BLE	All
			WLAN	All except SAR (full test), HAC (full test)
			WLAN 802.11ax	All except HAC (full test)
DSS	A3LSMG981B	Original Grant	BT	All except SAR (full test)
NII	A3LSMG981B	Original Grant	WLAN	All except SAR (full test), HAC (full test)
			WLAN 802.11ax	All except HAC (full test)
DXX	A3LSMG981B	Original Grant	ANT+	All
			NFC	All
DCD	A3LSMG981B	Original Grant	WPT	All except RF exposure

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 15.
3. KDB 558074 D01 DTS Meas Guidance v05r02.
4. ANSI C63.10-2013.
5. KDB 662911 D01 v02r01

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 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.

218 Maeyeong-ro	
<input checked="" type="checkbox"/>	Chamber 1
<input checked="" type="checkbox"/>	Chamber 2
<input type="checkbox"/>	Chamber 3

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at <http://www.iasonline.org/wp-content/uploads/2017/05/TL-637.pdf>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	2.35 dB
Radiated Disturbance, 30 MHz to 1 GHz	3.49 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.82 dB
Radiated Disturbance, 18 GHz to 40 GHz	5.49 dB

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

4.4. DECISION RULE

Decision rule for statement(s) of conformity is based on Procedure 1, Clause 4.4.2 in IEC Guide 115:2007.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, ANT+, NFC and WPT. This test report addresses the DTS (WLAN) operational mode.

This report covers the Samsung models SM-G980F/DS and SM-G980F. These models are identical in hardware except SM-G980F has single SIM tray. With some pre-scan, model SM-G980F/DS was set for spot check test.

WiFi operating mode

Frequency range	Mode	ANT 1	ANT 2
2.4GHz (2412 MHz ~ 2472 MHz)	802.11b SISO	TX/RX	TX/RX
	802.11g SISO	TX/RX	TX/RX
	802.11g MIMO	TX/RX	TX/RX
	802.11n(HT20) SISO	TX/RX	TX/RX
	802.11n(HT20) MIMO	TX/RX	TX/RX
	802.11ax(HE20) SISO	TX/RX	TX/RX
	802.11ax(HE20) MIMO	TX/RX	TX/RX

Note. 802.11ax(HE20) mode data is reported on the 4789247752-E4.

Simultaneous TX Condition

Simultaneous Tx Condition - RSDB

Mode	# of TX	5GHz		2.4GHz		Test Case
		ANT1	ANT2	ANT1	ANT2	
2.4GHz + 5GHz RSDB Only	2	A	-	-	B	V
	2	-	A	B	-	V
	2	A	-	B	-	-
	2	-	A	-	B	-
2.4GHz + 5GHz RSDB & MIMO	3	A	A	B	-	-
	3	A	A	-	B	-
	3	A	-	B	B	-
	3	-	A	B	B	-
2.4GHz + 5GHz RSDB MIMO	4	A	A	B	B	V

Note. A = 13 dBm / B =15 dBm

Simultaneous Tx Condition - Bluetooth with 5GHz WLAN (Not RSDB)

Mode	# of TX	5GHz		2.4GHz Bluetooth	Test Case
		ANT1	ANT2	ANT1	
2.4GHz Bluetooth + 5GHz WLAN (Not RSDB)	2	A	-	C	-
	2	-	A	C	-
	3	A	A	C	V

Note1. A = 13 dBm, C = 16.5 dBm

Note2. Spurious Emissions for Simultaneous Transmission were reported on the UNII 802.11ax test report(4789247752-E8).

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum total conducted average output power as follows:

Frequency Range [MHz]	Mode	Output Power [dBm]		Output Power [mW]	
		ANT1	ANT2	ANT1	ANT2
2412 - 2472	802.11b SISO	18.41	18.61	69.34	72.61
	802.11g SISO	15.19	15.68	33.04	36.98
	802.11g MIMO	18.19		65.92	
	802.11n(HT20) SISO	15.20	15.93	33.11	39.17
	802.11n(HT20) MIMO	18.38		68.87	

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

**The internal antenna was Permanently attached.
 Therefore this E.U.T Complies with the requirement of §15.203.**

The radio utilizes an internal antennas, with ANT 1's maximum gain of -3.80 dBi and ANT 2's maximum gain of -7.50 dBi

“Sub #2 WiFi #1” and “Sub #4 WiFi #2” as indicated in antenna specification are written as ANT1 and ANT2 in this report.

5.4. TESTED CHANNELS LIST

802.11b Mode	Channel	Frequency (MHz)
Low	1	2412
Mid	6	2437
High	11	2462
Reduction High 1	12	2467
Reduction High 2	13	2472

802.11g Mode	Channel	Frequency (MHz)
Low	1	2412
Mid	6	2437
High	10	2457
Reduction High 1	11	2462
Reduction High 2	12	2467
Reduction High 3	13	2472

802.11n HT20 Mode	Channel	Frequency (MHz)
Reduction Low	1	2412
Low	2	2417
Mid	6	2437
High	10	2457
Reduction High 1	11	2462
Reduction High 2	12	2467
Reduction High 3	13	2472

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission below 1GHz and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. Radiated emission above 1GHz was performed with the EUT set to transmit low/mid/High Channels.

For SISO (ANT1), the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

For SISO (ANT2), the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

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

Based on the baseline scan, the worst-case data rates were:

802.11b mode: 1 Mbps

802.11g mode: 6 Mbps 2TX

802.11n HT20 mode: MCS0 2TX

Depending on spot-check results for 802.11g / n HT20, MIMO mode is worst case than SISO (ANT1) and SISO (ANT2). So radiation test for 802.11g / n HT20 were evaluated at MIMO mode.

Note : All radiated and power line conducted tests were performed attached with travel adapter for the worst case condition mode.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Charger	SAMSUNG	EP-TA800	R37M5WSB411SE3	N/A
Data Cable	SAMSUNG	EP-DG977	N/A	N/A

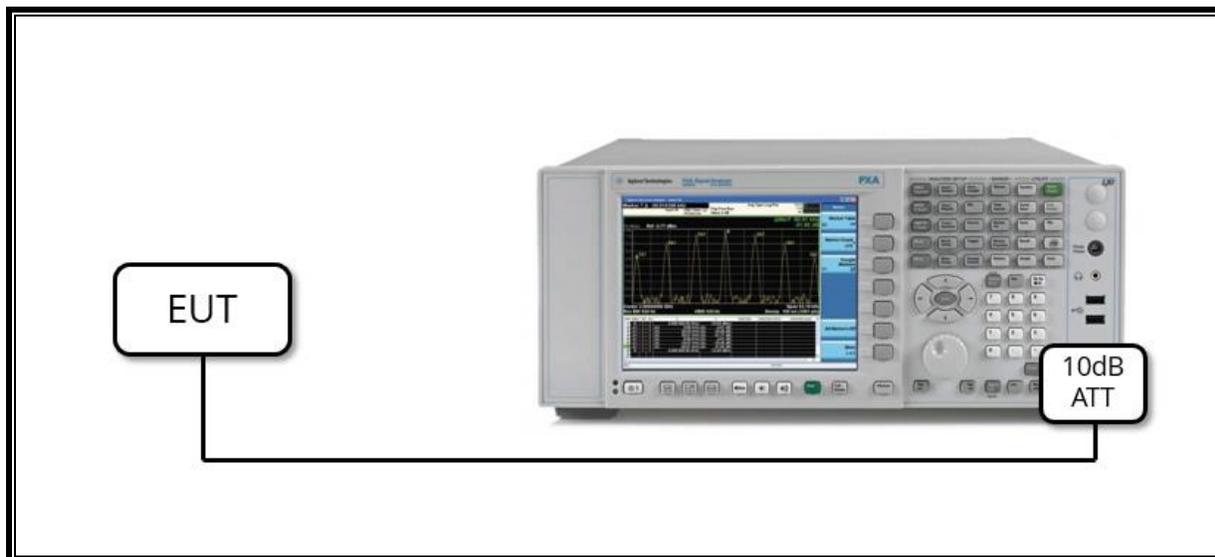
I/O CABLE

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	C Type	Shielded	1.0m	N/A

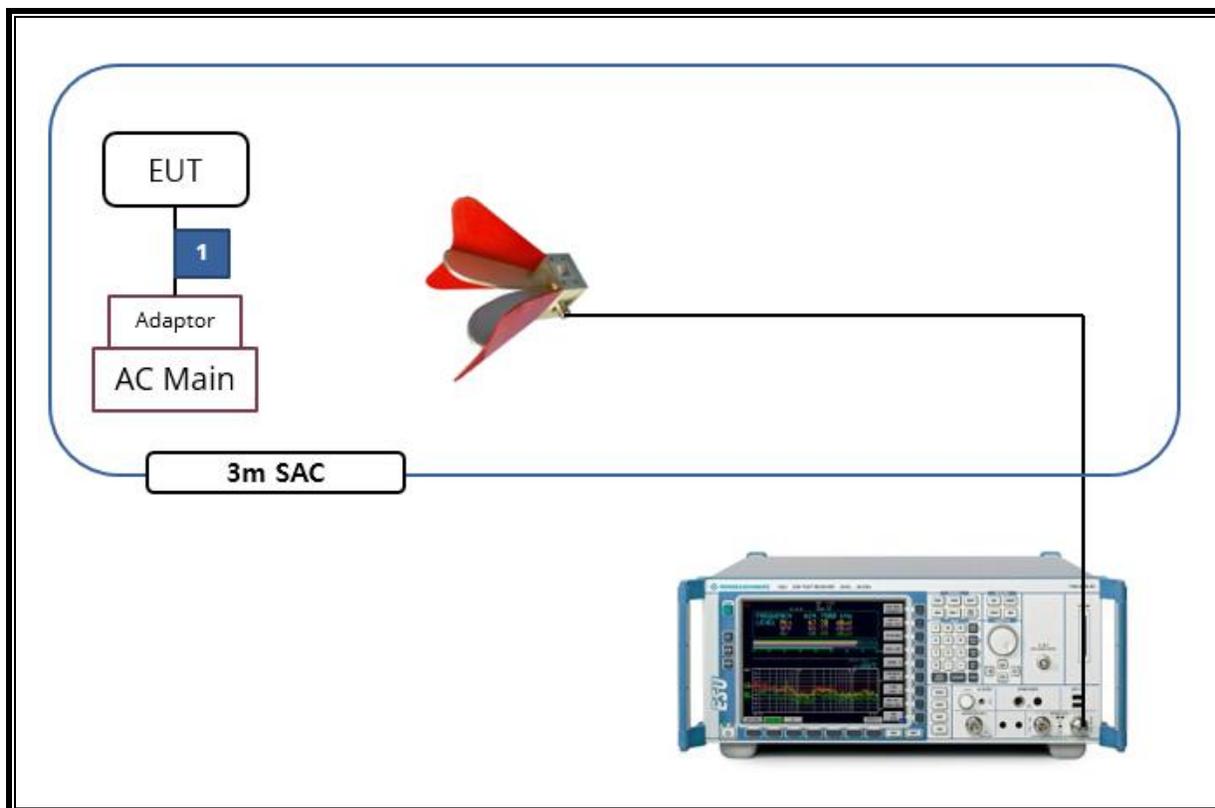
TEST SETUP

The EUT is a stand-alone unit during the tests.
Test software in hidden menu exercised the EUT to enable DTS mode.

SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List				
Description	Manufacturer	Model	S/N	New Cal Due
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00167211	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00161451	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168724	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168717	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00205959	08-04-20
Antenna, Horn, 40 GHz	ETS	3116C	00166155	08-14-20
Antenna, Horn, 40 GHz	ETS	3116C	00168645	10-02-21
Preamplifier	ETS	3116C-PA	00168841	08-08-20
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-05-20
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-05-20
Preamplifier, 1000 MHz	Sonoma	310N	370599	08-05-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-06-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-06-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	08-06-20
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-06-20
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-06-20
Spectrum Analyzer, 43.5 GHz	R&S	FSW43	104089	08-06-20
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-09-20
Attenuator	PASTERNAK	PE7087-10	A001	08-08-20
Attenuator	PASTERNAK	PE7087-10	A008	08-08-20
Attenuator	PASTERNAK	PE7004-10	2	08-06-20
Attenuator	PASTERNAK	PE7087-10	A009	08-08-20
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-06-20
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-06-20
EMI Test Receive, 44 GHz	R&S	ESW44	101590	08-05-20
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-05-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-06-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-06-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	020	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	020	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	009	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	016	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	021	08-06-20
LISN	R&S	ENV-216	101837	08-09-20
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	10-02-21
Antenna, Loop, 9kHz-30MHz				
Description	Manufacturer	Model	Version	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	UL	UL EMC	Ver 9.5	

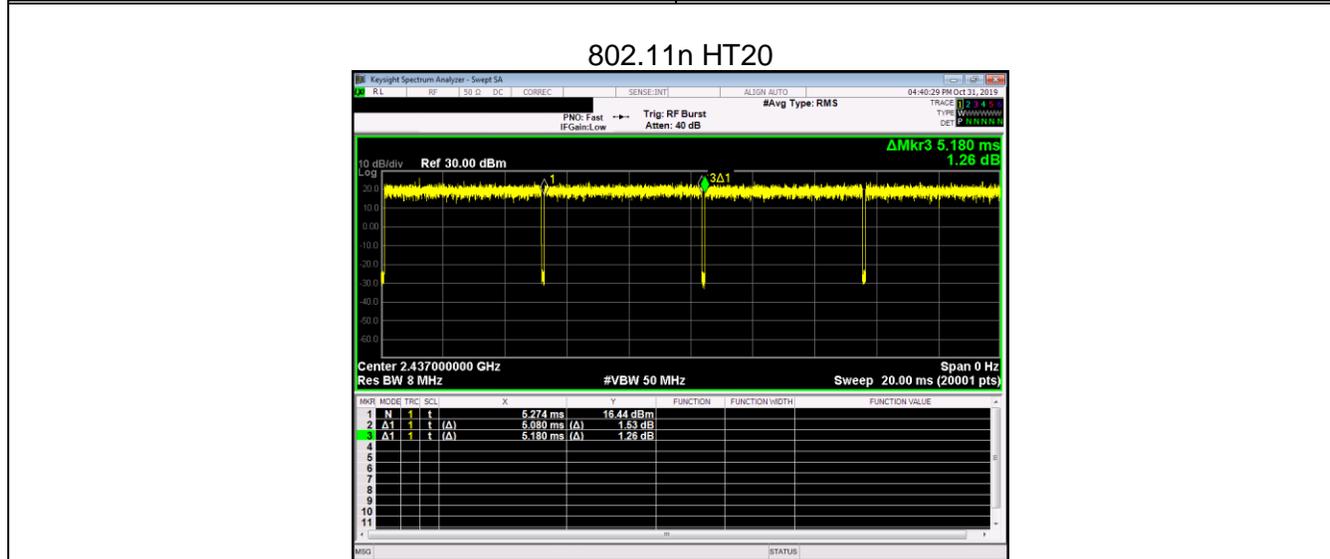
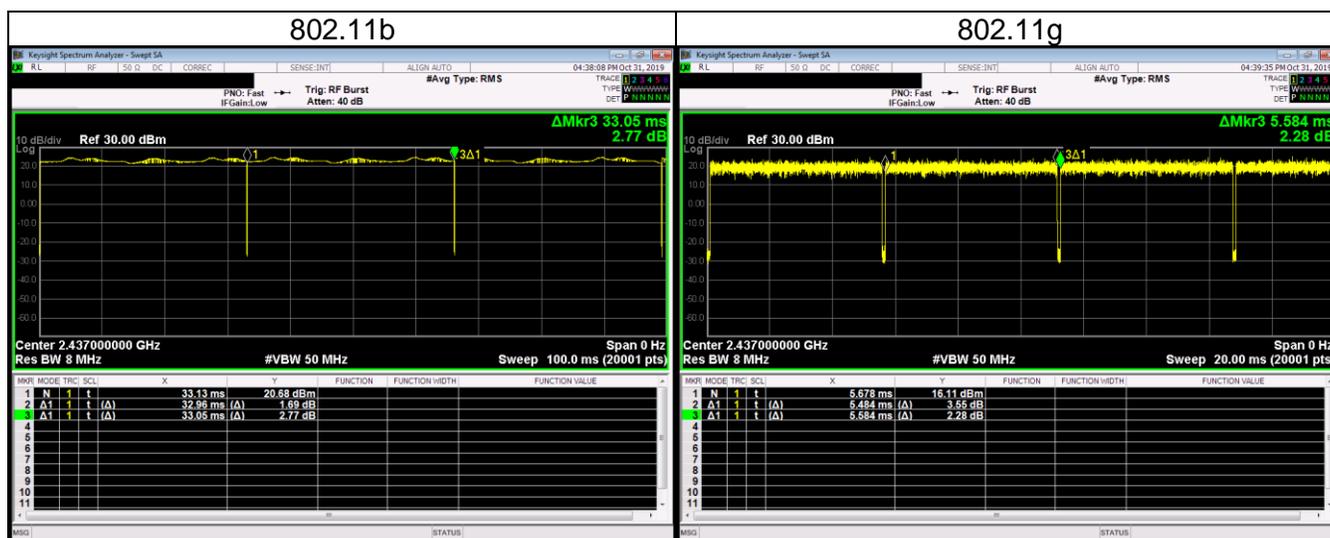
7. REFERENCE MEASUREMENT RESULTS

7.1. ON TIME AND DUTY CYCLE RESULTS

LIMITS

None; for reporting purposes only.

Band	Mode	On Time [ms]	Period [ms]	Duty Cycle X [Linear]	Duty Cycle X [%]	Duty Cycle Correction Factor [dB]	1/T Minimum VBW [kHz]
2.4 GHz	802.11b	32.96	33.05	0.997	99.73	0.00	0.030
	802.11g	5.48	5.58	0.982	98.21	0.00	0.182
	802.11n(HT20)	5.08	5.18	0.981	98.07	0.00	0.197



8. MEASUREMENT METHODS

6 dB BW : KDB 558074 D01 v05r02, Section 8.2

OUTPUT POWER : KDB 558074 D01 v05r02, Section 8.3.2.3.

POWER SPECTRAL DENSITY : KDB 558074 D01 v05r02, Section 8.4.

Out-of-band EMISSIONS (Conducted) : KDB 558074 D01 v05r02, Section 8.5.

Out-of-band EMISSIONS IN NON-RESTRICTED BANDS: KDB 558074 D01 v05r02, Section 8.5.

Out-of-band EMISSIONS IN RESTRICTED BANDS KDB 558074 D01 v05r02, Section 8.6.

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

9. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
15.247 (a)(2)	Occupied Band width (6dB)	> 500kHz	Conducted	Pass
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-30dBc		Pass
15.247 (b)(3)	TX conducted output power	< 30dBm		Pass
15.247 (e)	PSD	< 8dBm		Pass
15.207 (a)	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass
15.205, 15.209	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass

10. ANTENNA PORT TEST RESULTS

10.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

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

TEST PROCEDURE

Reference to KDB 558074 D01 15.247 Meas Guidance: The transmitter output is connected to a spectrum analyzer with the RBW set to 100 kHz, the VBW $\geq 3 \times$ RBW, peak detector and max hold.

RESULTS

10.1.1. 802.11b MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]		Minimum Limit [MHz]
		ANT1	ANT2	
1	2412	7.555	7.528	0.5
6	2437	7.057	7.550	
11	2462	7.073	7.538	
12	2467	7.541	7.540	
13	2472	7.014	7.551	
Worst		7.014	7.528	

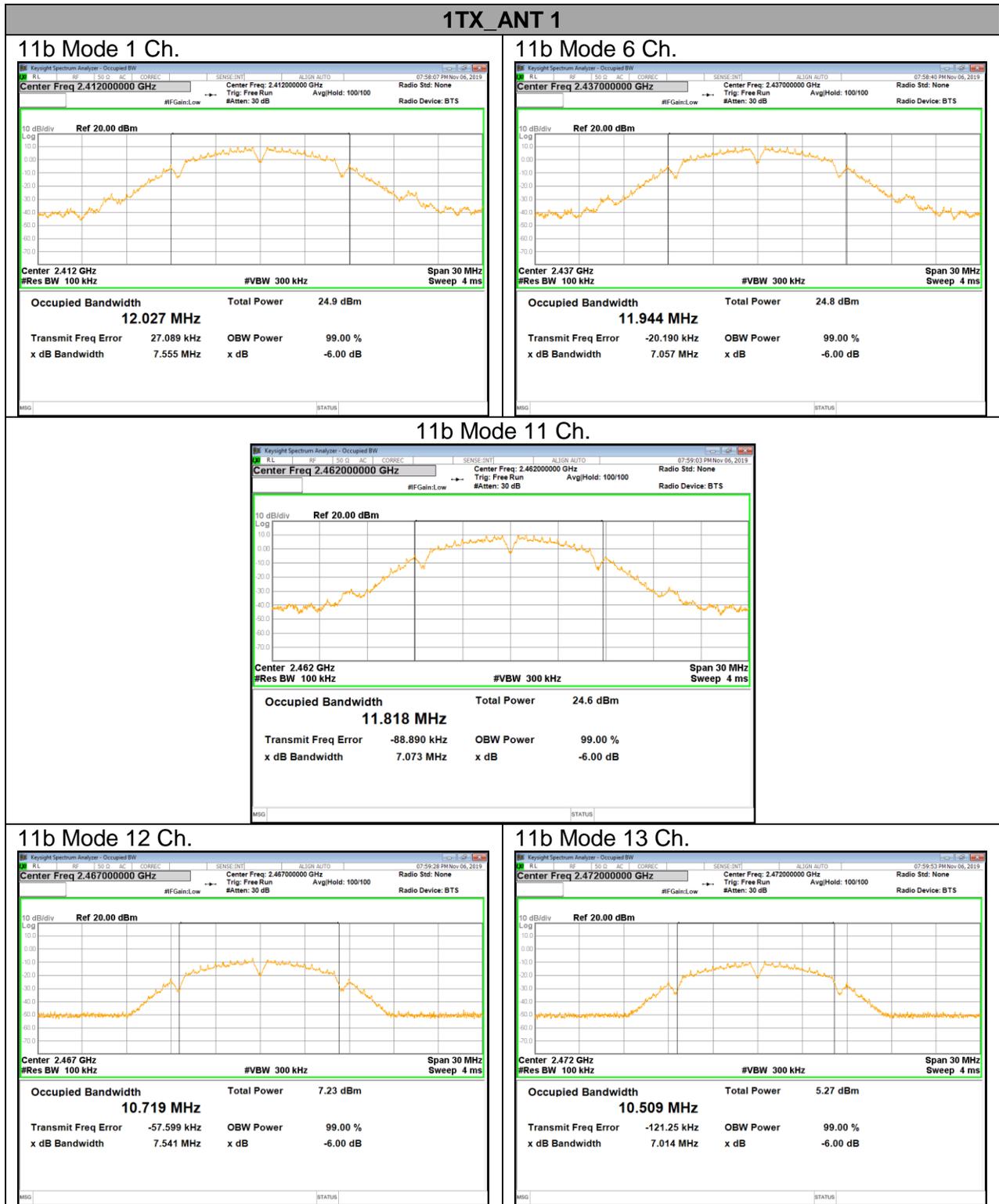
10.1.2. 802.11g MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]		Minimum Limit [MHz]
		ANT1	ANT2	
1	2412	16.340	16.330	0.5
6	2437	16.320	16.320	
10	2457	16.320	16.350	
11	2462	16.350	16.370	
12	2467	16.370	16.360	
13	2472	16.320	16.370	
Worst		16.320	16.320	

10.1.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

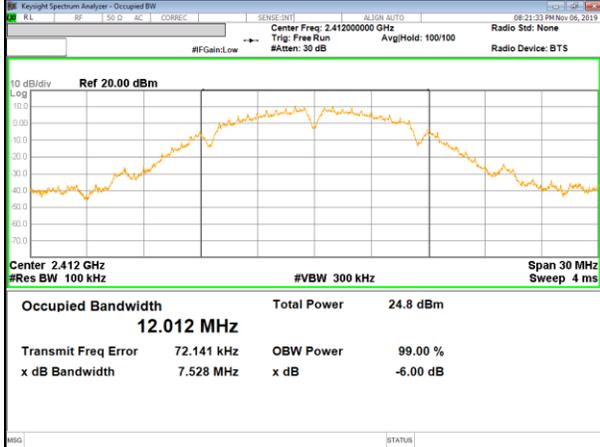
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]		Minimum Limit [MHz]
		ANT1	ANT2	
1	2412	17.560	17.550	0.5
2	2417	17.570	17.580	
6	2437	17.580	17.540	
10	2457	17.590	17.560	
11	2462	17.570	17.590	
12	2467	17.620	17.580	
13	2472	17.290	17.570	
Worst		17.290	17.540	

10.1.4. 6 dB BANDWIDTH PLOTS

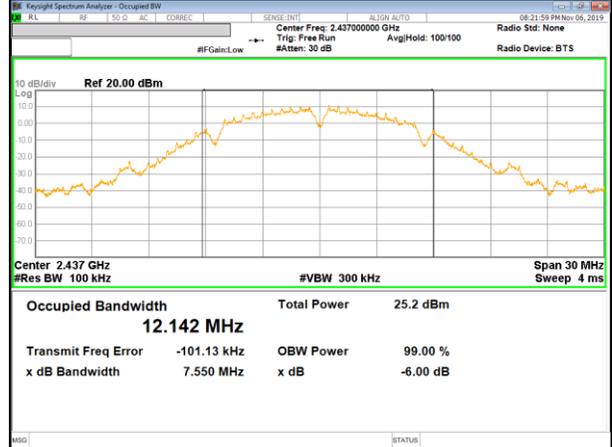


1TX_ANT 2

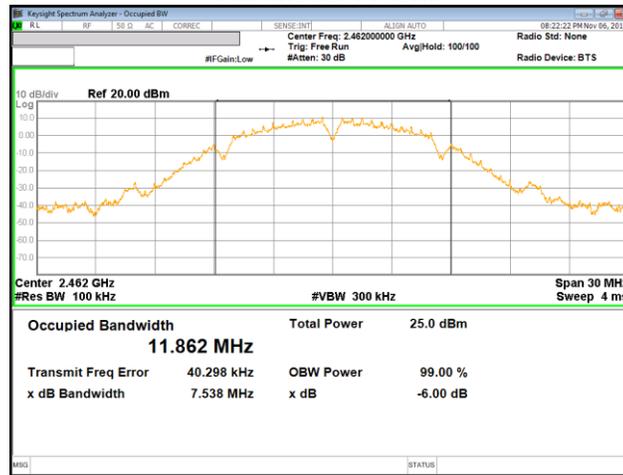
11b Mode 1 Ch.



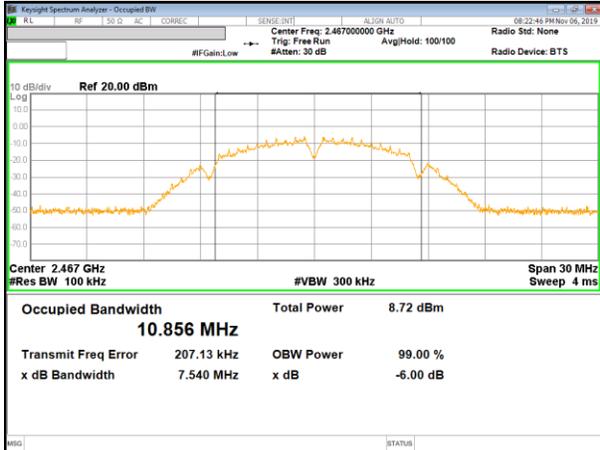
11b Mode 6 Ch.



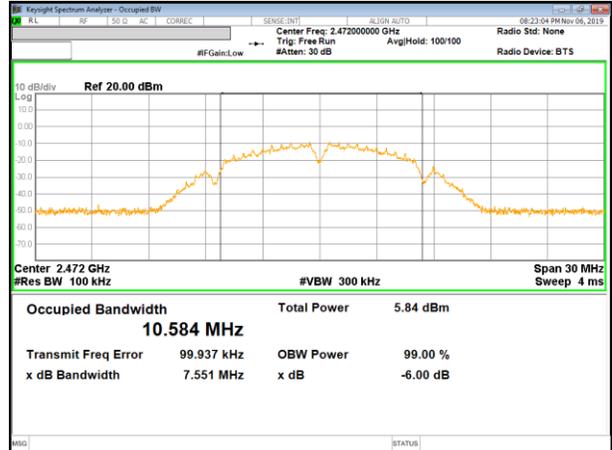
11b Mode 11 Ch.



11b Mode 12 Ch.

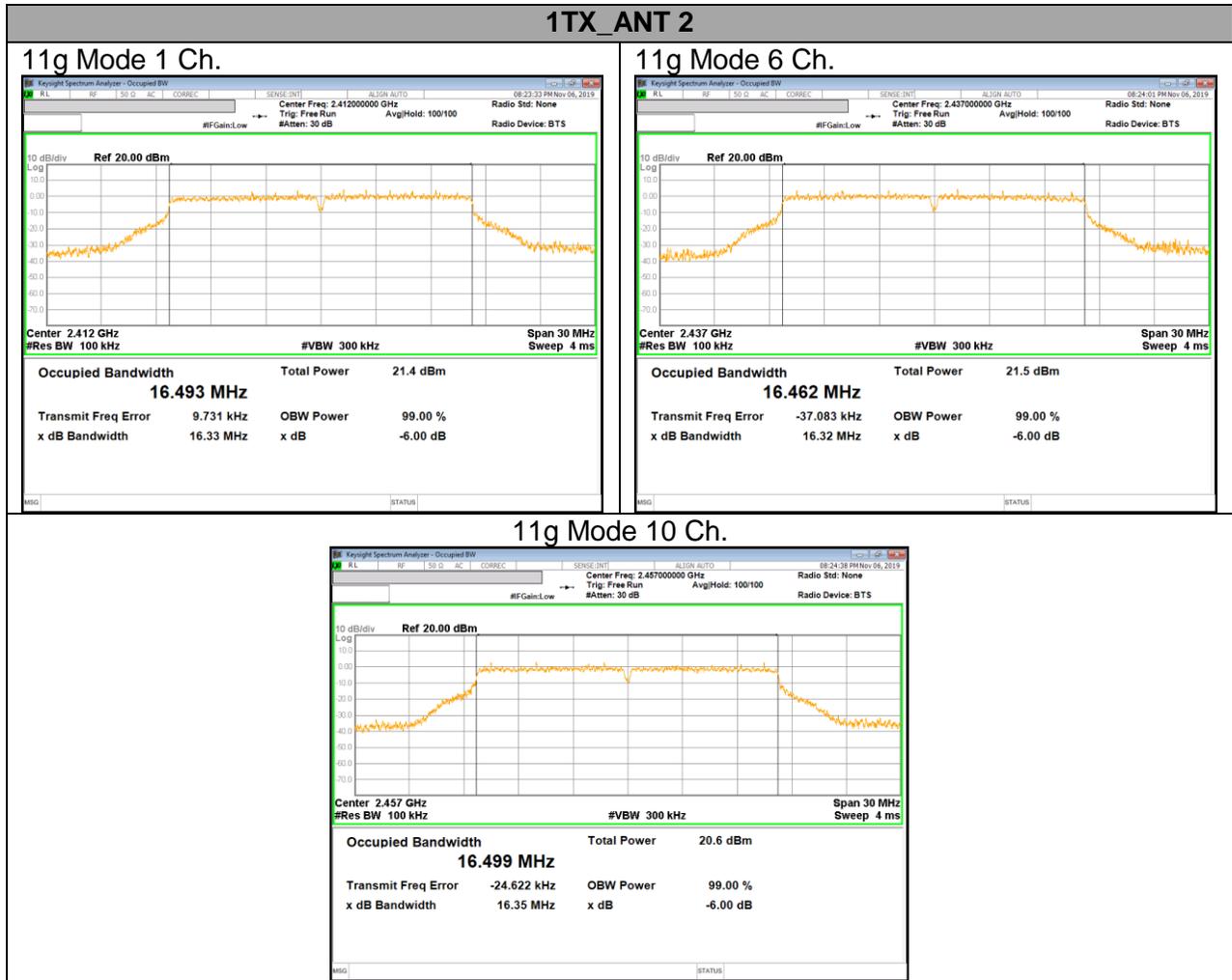


11b Mode 13 Ch.



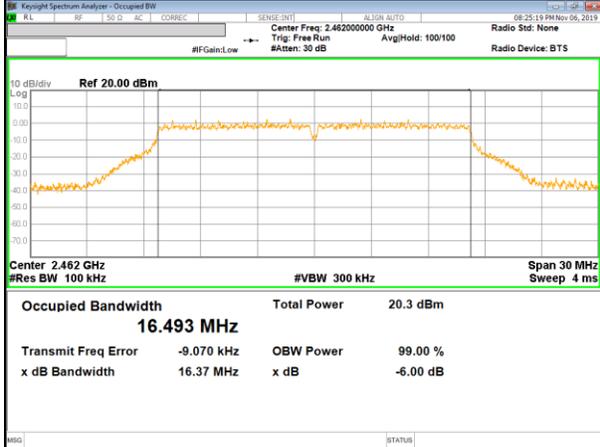




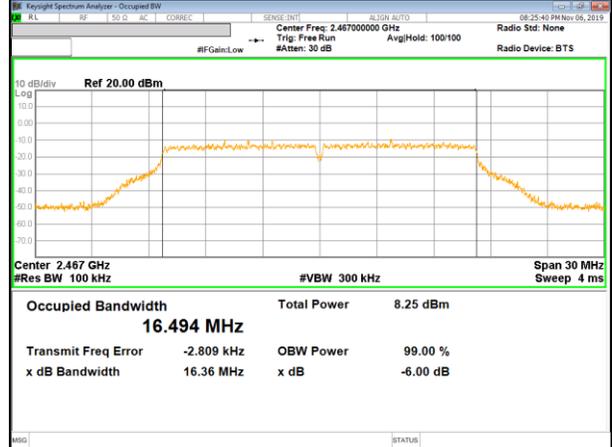


1TX_ANT 2

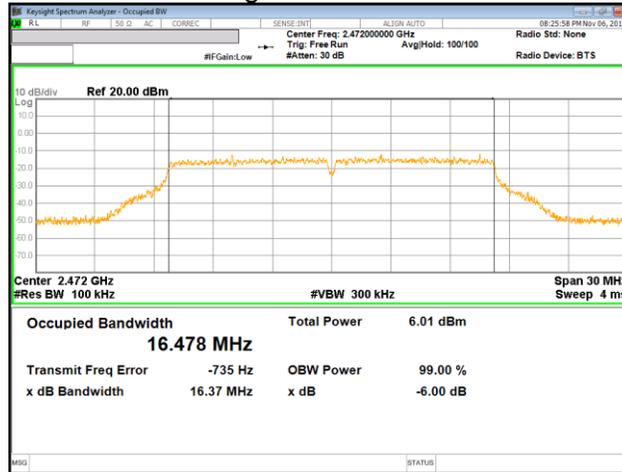
11g Mode 11 Ch.



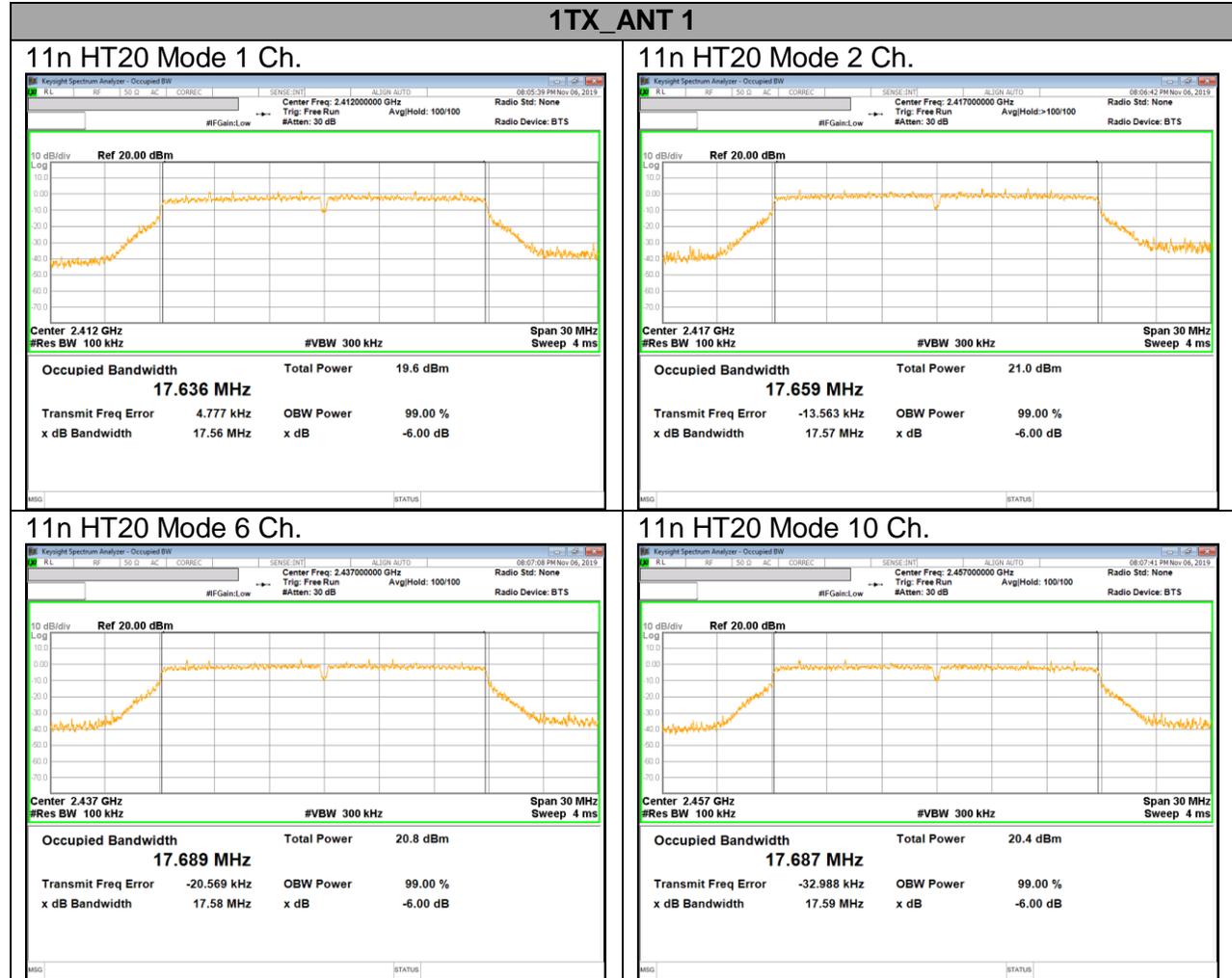
11g Mode 12 Ch.



11g Mode 13 Ch.

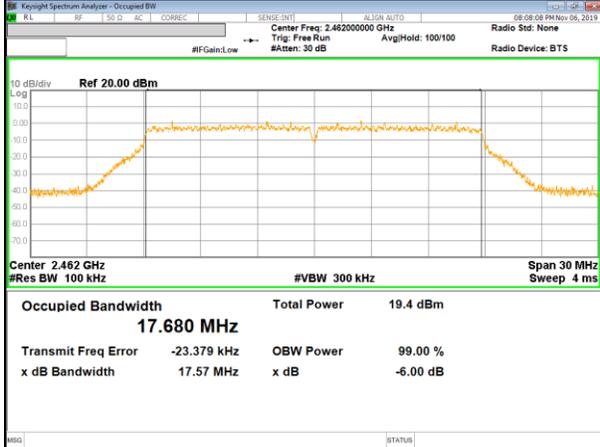


1TX_ANT 1

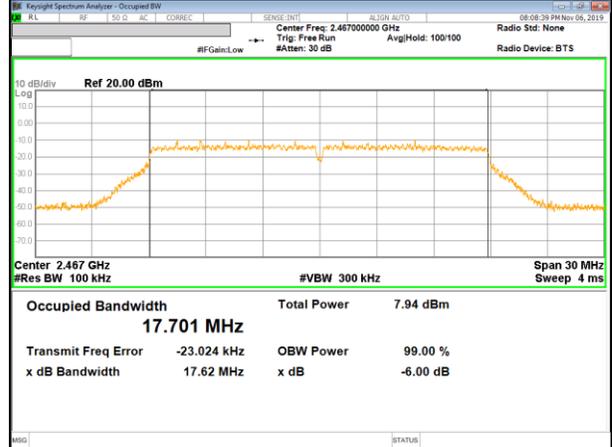


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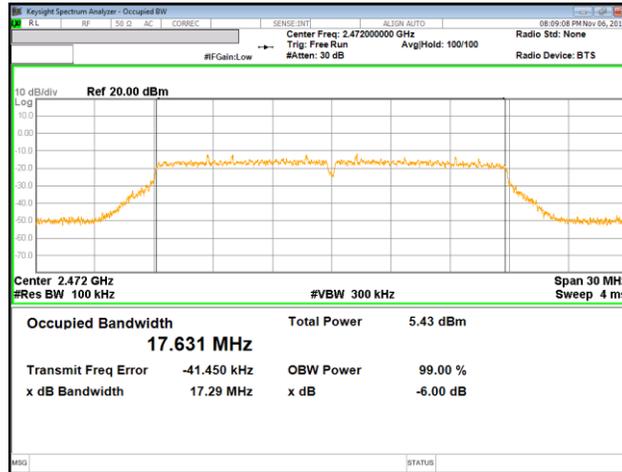
11n HT20 Mode 11 Ch.



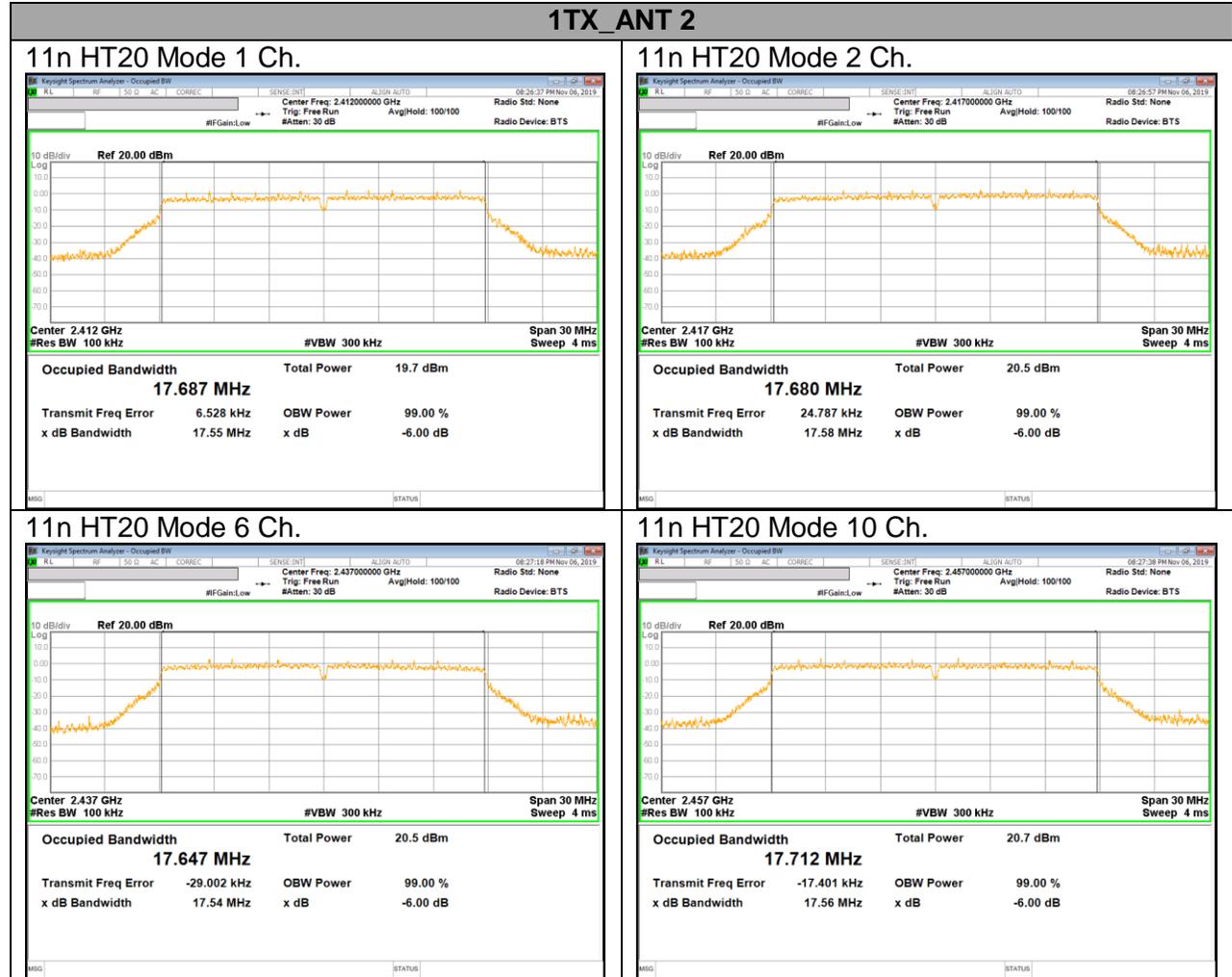
11n HT20 Mode 12 Ch.



11n HT20 Mode 13 Ch.

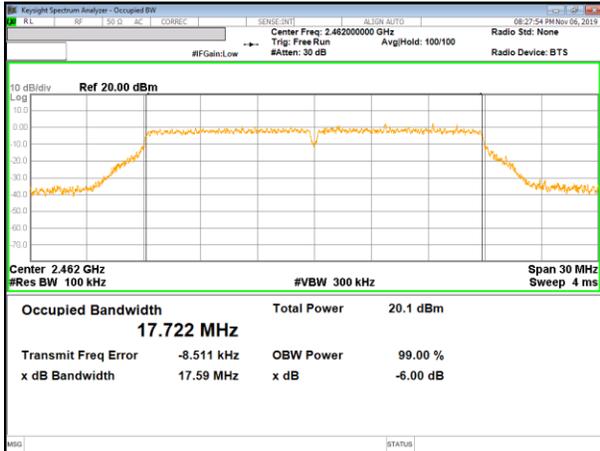


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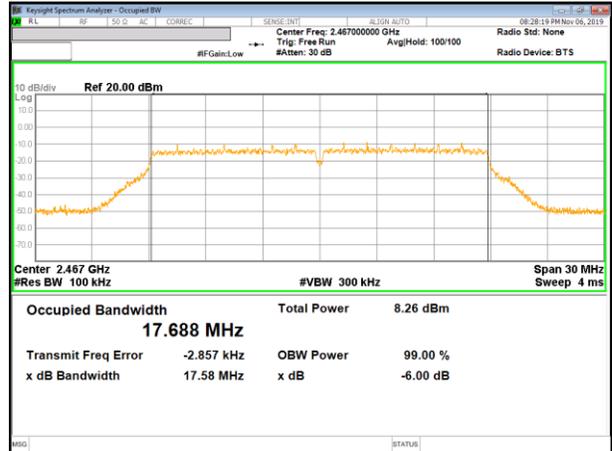


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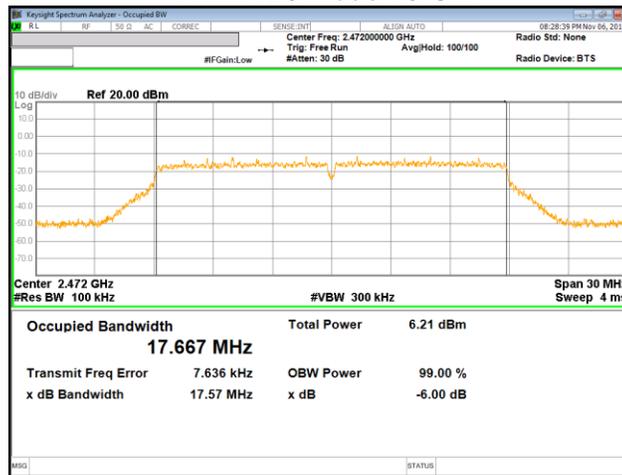
11n HT20 Mode 11 Ch.



11n HT20 Mode 12 Ch.



11n HT20 Mode 13 Ch.



10.2. OUTPUT POWER

LIMITS

FCC §15.247

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

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss was entered as an offset in the power meter to allow for direct reading of power.

Output power measurement was performed utilizing the 8.3.2.3 under KDB558074 D01 15.247 Meas Guidance.

Duty cycle correction factor is not added to the average output power results for duty cycle factor > 98%.

DIRECTIONAL ANTENNA GAIN

The TX chains are correlated and the antenna gain is unequal among the chains.
The directional gain is:

Bands [MHz]	ANT 1 [dBi]	ANT 2 [dBi]	Correlated Directional Gain [dBi]
2412-2472	-3.80	-7.50	-2.44

- IEEE 802.11b Mode is not supported MIMO operation. So can't transmit on two antennas as the same time.

RESULTS

10.2.1. 1TX_TEST RESULTS

Frequency Range [MHz]	ANT Gain		FCC Power Limit [dBm]	Max Power [dBm]
	ANT1	ANT2		
2412 - 2472	-3.80	-7.50	30.00	30.00
Included in Calculations of Corr'd Power				
Duty Cycle CF	802.11b		0.00	dB
	802.11g		0.00	dB
	802.11n HT20		0.00	dB

Calculation of Output Power result

→ Corr'd Power = Meas Power + Duty Cycle CF

Mode	Channel	Frequency [MHz]	Meas Power [dBm]		Corr'd Power [dBm]		Power Limit [dBm]
			ANT1	ANT2	ANT1	ANT2	
802.11b	1	2412	18.32	18.10	18.32	18.10	30.00
	6	2437	18.41	18.61	18.41	18.61	
	11	2462	18.15	18.25	18.15	18.25	
	12	2467	2.26	2.24	2.26	2.24	
	13	2472	0.07	0.30	0.07	0.30	
Worst Case					18.41	18.61	
802.11g	1	2412	15.01	15.44	15.01	15.44	30.00
	6	2437	15.19	15.68	15.19	15.68	
	10	2457	14.75	15.07	14.75	15.07	
	11	2462	13.85	14.63	13.85	14.63	
	12	2467	2.60	2.90	2.60	2.90	
13	2472	0.26	0.70	0.26	0.70		
Worst Case					15.19	15.68	
802.11n HT20	1	2412	13.92	14.04	13.92	14.04	30.00
	2	2417	15.15	15.02	15.15	15.02	
	6	2437	15.20	15.01	15.20	15.01	
	10	2457	14.65	15.93	14.65	15.93	
	11	2462	13.80	14.58	13.80	14.58	
12	2467	2.72	2.90	2.72	2.90		
13	2472	0.29	0.66	0.29	0.66		
Worst Case					15.20	15.93	

10.2.2. 2TX_TEST RESULTS

Frequency Range [MHz]	ANT Gain	FCC Power Limit [dBm]	Max Power [dBm]
	Correlated Chain Directional Gain [dBi]		
2412 - 2472	-2.44	30.00	30.00
Included in Calculations of Corr'd Power			
Duty Cycle CF	802.11g	0.00	dB
	802.11n HT20	0.00	dB

Calculation of Output Power result

→ Total Corr'd Power = ANT1 Power + ANT2 Power + Duty Cycle CF

Mode	Channel	Frequency [MHz]	Meas Power [dBm]		Total Corr'd Power [dBm]	Power Limit [dBm]
			ANT1	ANT2		
802.11g	1	2412	15.17	14.97	18.08	30.00
	6	2437	15.33	15.03	18.19	
	10	2457	14.90	15.25	18.09	
	11	2462	13.90	14.81	17.39	
	12	2467	2.07	2.28	5.19	
	13	2472	0.07	0.39	3.24	
Worst Case					18.19	
802.11n HT20	1	2412	14.12	14.40	17.27	30.00
	2	2417	15.30	15.43	18.38	
	6	2437	15.35	15.01	18.19	
	10	2457	14.91	15.24	18.09	
	11	2462	13.90	14.85	17.41	
	12	2467	2.60	3.12	5.88	
13	2472	0.19	0.72	3.47		
Worst Case					18.38	

10.3. PSD

LIMITS

FCC §15.247

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

TEST PROCEDURE

Power Spectral Density was performed utilizing the section 8.4 under KDB558074 D01 15.247 Meas Guidance.

RESULTS

10.3.1. TEST RESULTS

Included in Calculations of Corr'd Power			
Duty Cycle CF	802.11b	0.00	dB
	802.11g	0.00	dB
	802.11n HT20	0.00	dB

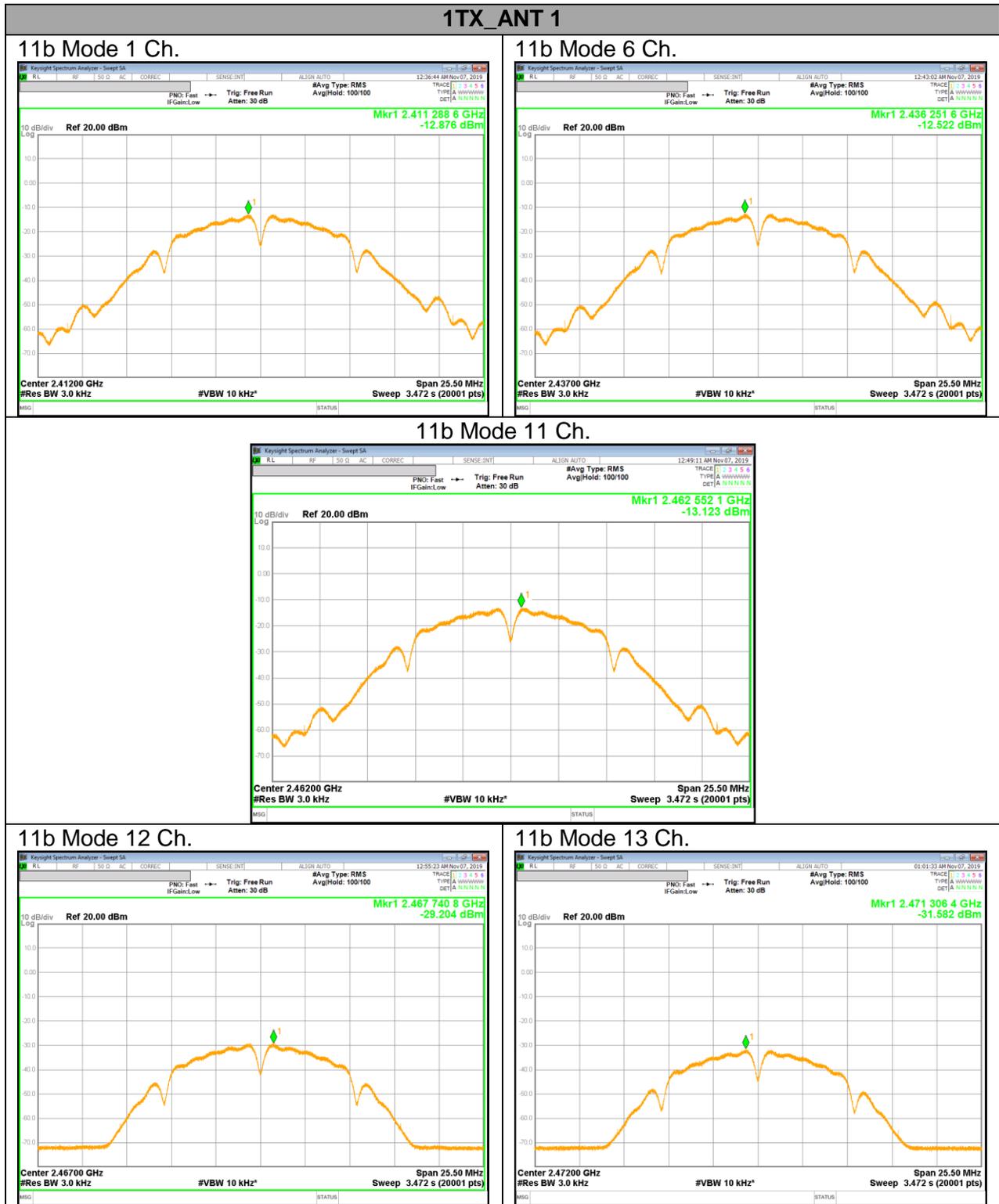
Calculation of Output PSD result

- 1TX : Corr'd PSD = Meas PSD + Duty Cycle CF
- 2TX : Total PSD = ANT1 Meas PSD + ANT2 Meas PSD + Duty Cycle CF

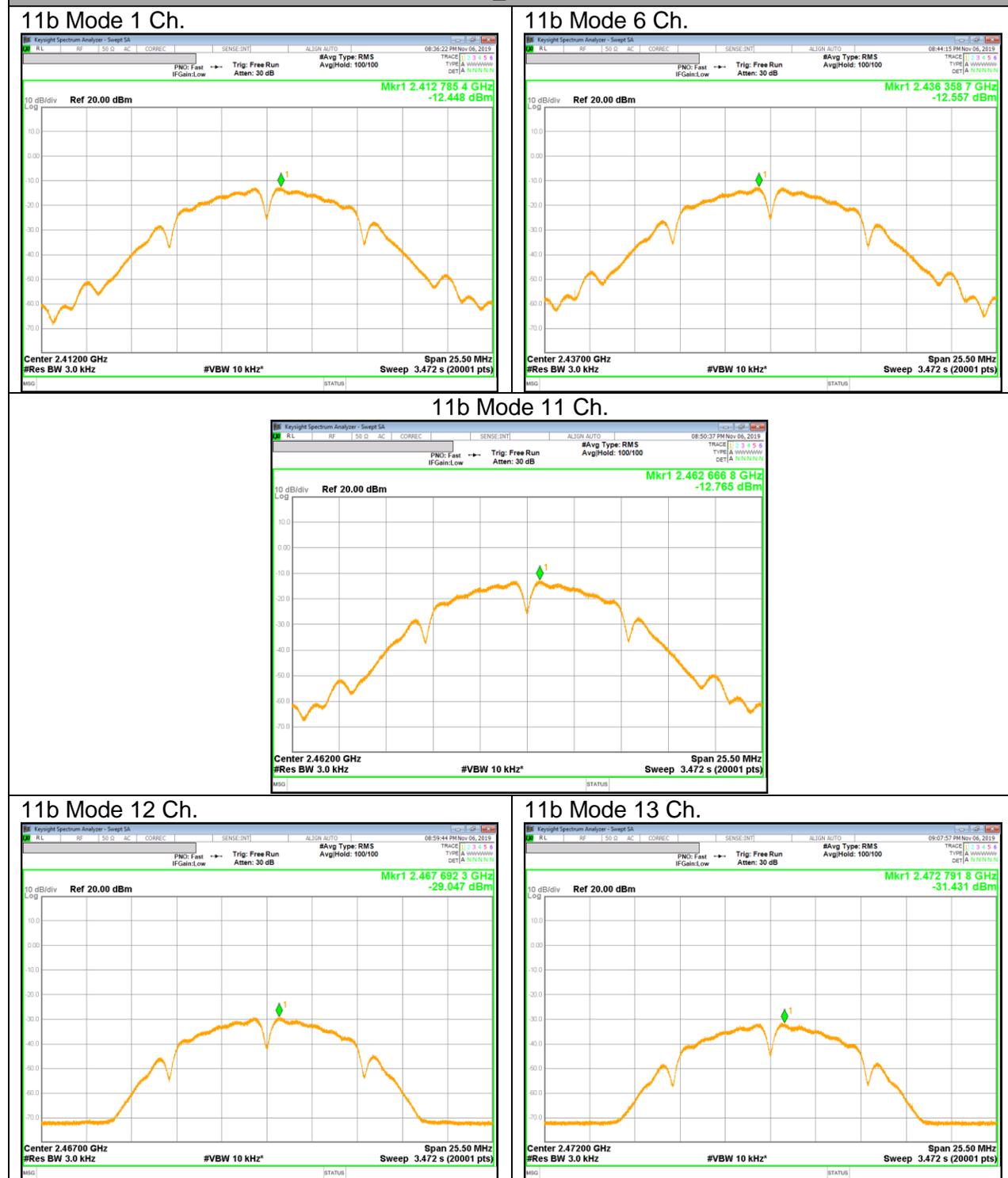
Mode	Channel	Frequency [MHz]	Meas PSD [dBm/3kHz]		Corr'd PSD [dBm/3kHz]		PSD Limit [dBm/3kHz]	Margin [dB]
			ANT1	ANT2	ANT1	ANT2		
802.11b	1	2412	-12.88	-12.45	-12.88	-12.45	8.00	-20.88
	6	2437	-12.52	-12.56	-12.52	-12.56		-20.52
	11	2462	-13.12	-12.77	-13.12	-12.77		-21.12
	12	2467	-29.20	-29.05	-29.20	-29.05		-37.20
	13	2472	-31.58	-31.43	-31.58	-31.43		-39.58
Worst Case					-12.52	-12.45		-20.52

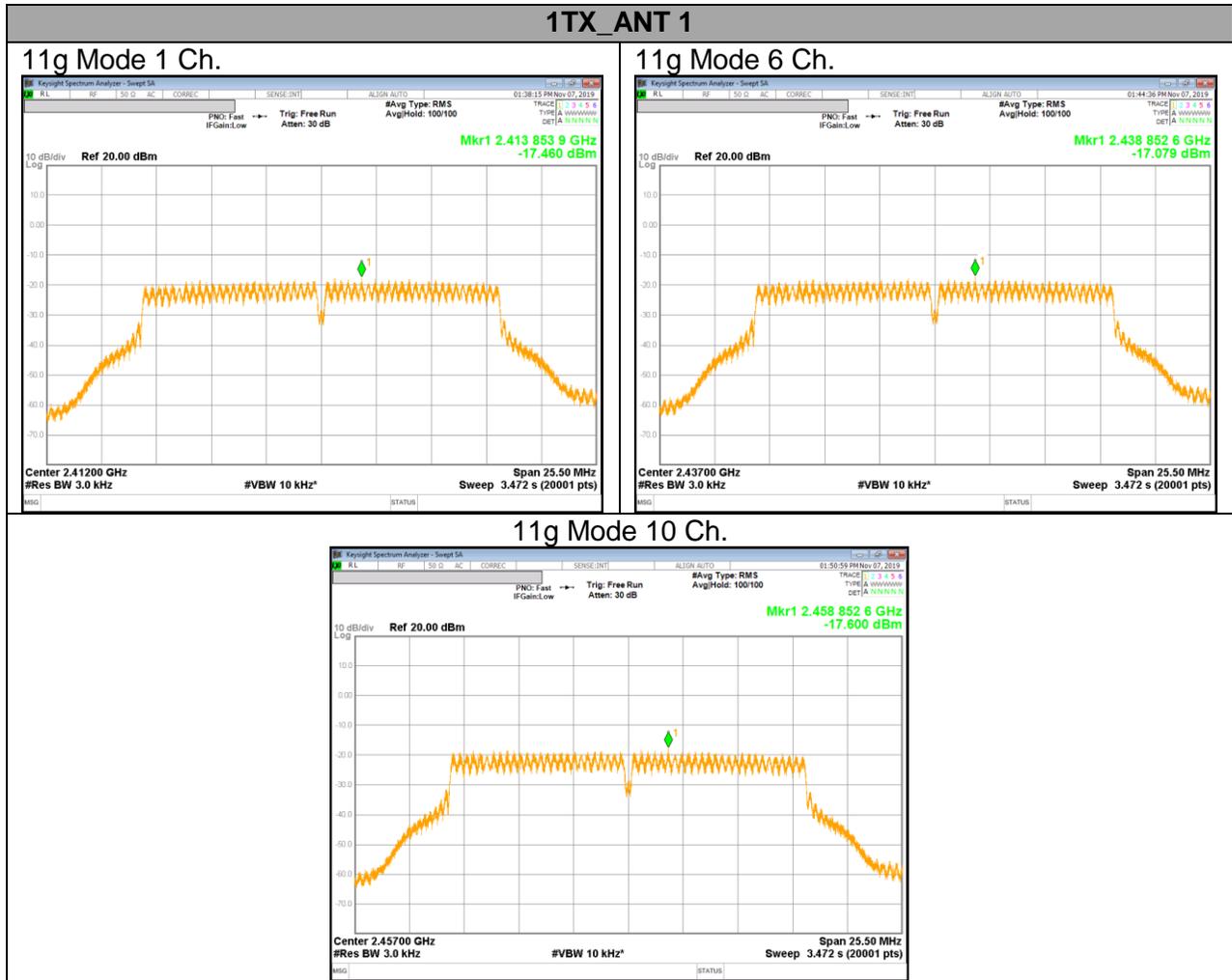
Mode	Channel	Frequency [MHz]	Meas PSD [dBm/3kHz]		Total Corr'd PSD [dBm/3kHz]	PSD Limit [dBm/3kHz]	Margin [dB]
			ANT1	ANT2			
802.11g	1	2412	-17.46	-17.01	-14.22	8.00	-22.22
	6	2437	-17.08	-16.53	-13.78		-21.78
	10	2457	-17.60	-17.88	-14.73		-22.73
	11	2462	-18.87	-18.04	-15.43		-23.43
	12	2467	-30.34	-30.35	-27.34		-35.34
	13	2472	-32.86	-31.55	-29.15		-37.15
Worst Case					-13.78		-21.78
802.11n HT20	1	2412	-20.48	-19.94	-17.19	8.00	-25.19
	2	2417	-19.48	-19.18	-16.32		-24.32
	6	2437	-19.32	-19.42	-16.36		-24.36
	10	2457	-20.16	-19.68	-16.90		-24.90
	11	2462	-20.73	-19.93	-17.30		-25.30
	12	2467	-32.09	-31.39	-28.71		-36.71
	13	2472	-34.81	-34.02	-31.39		-39.39
Worst Case					-16.32		-24.32

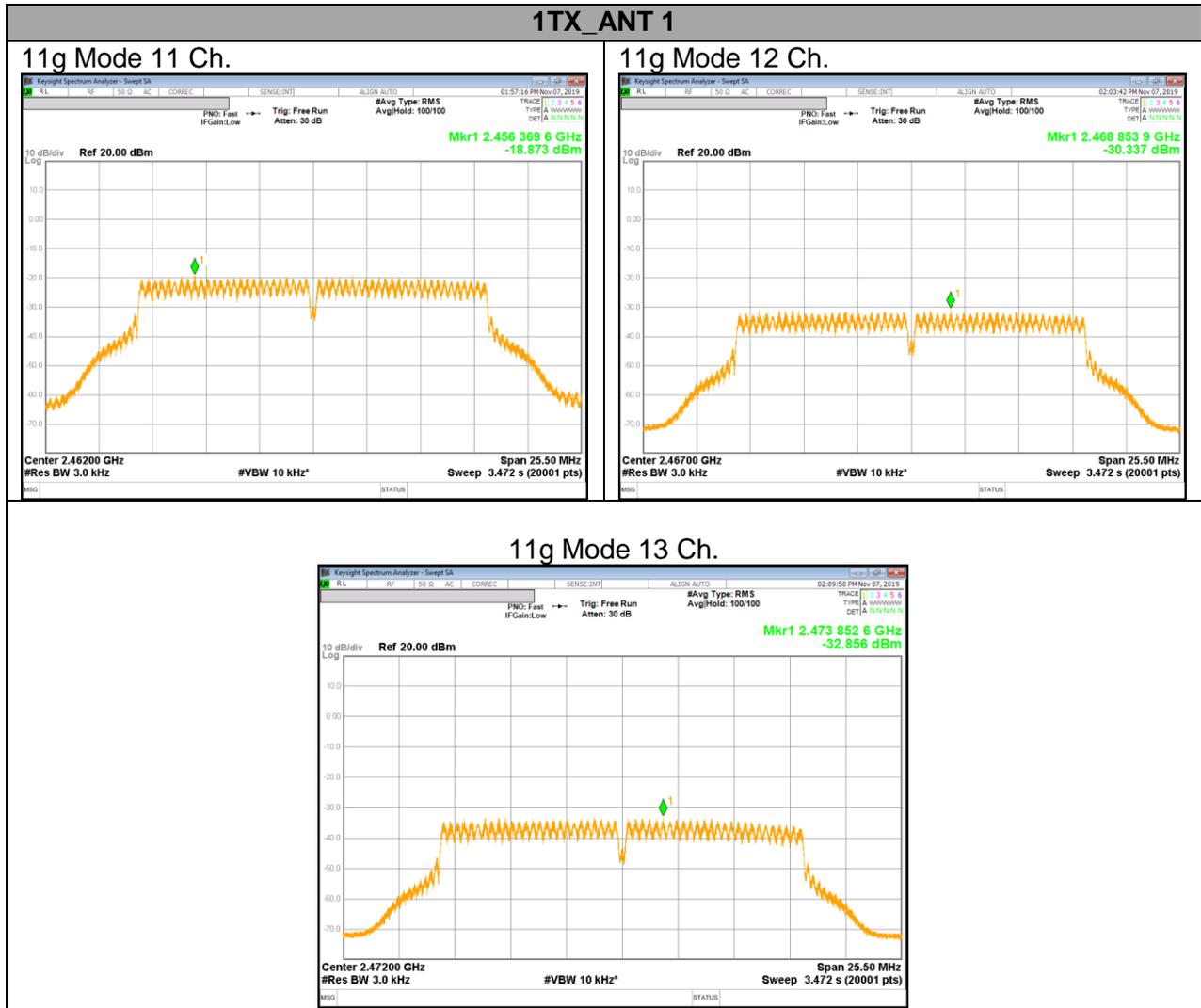
10.3.2. PSD PLOTS

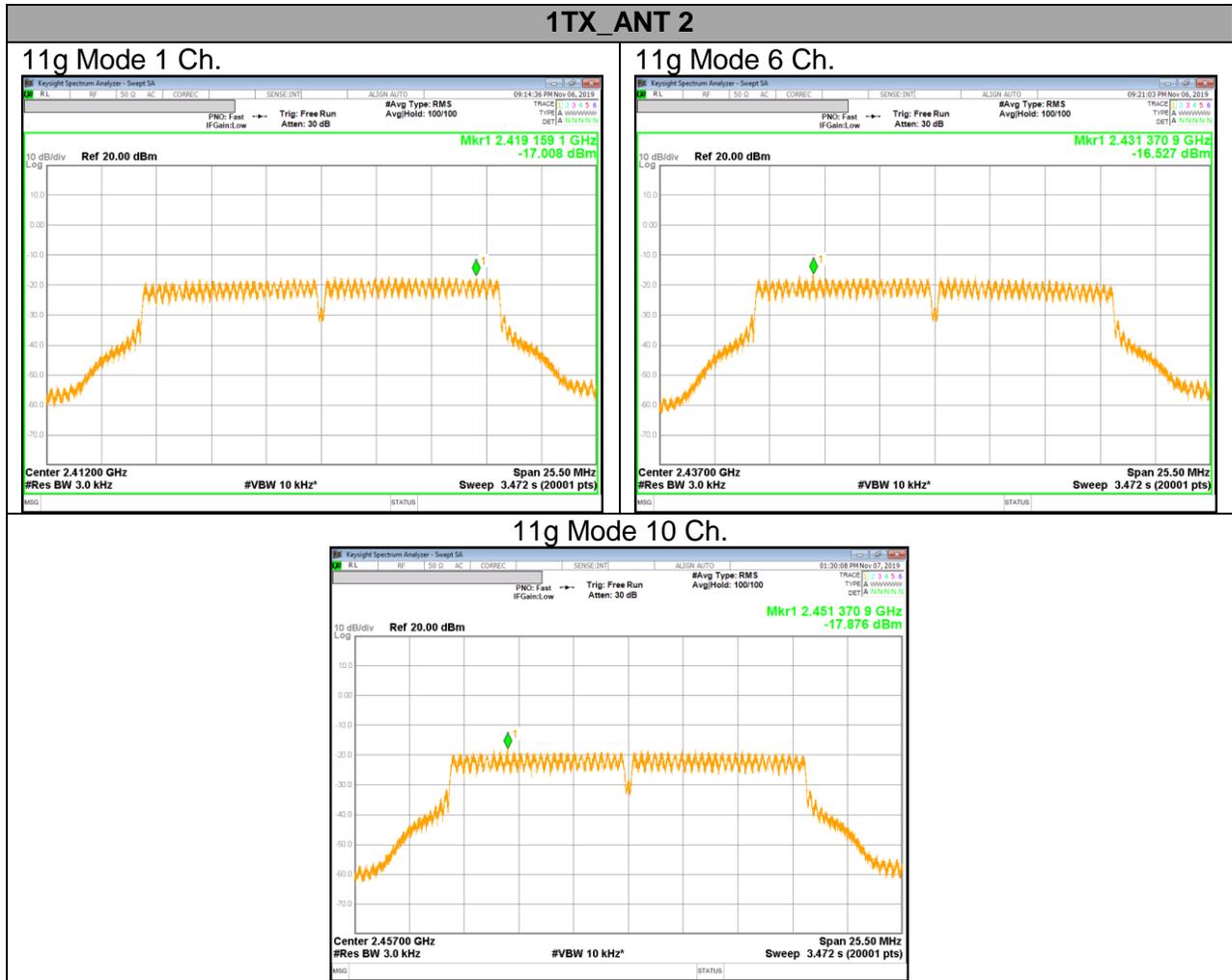


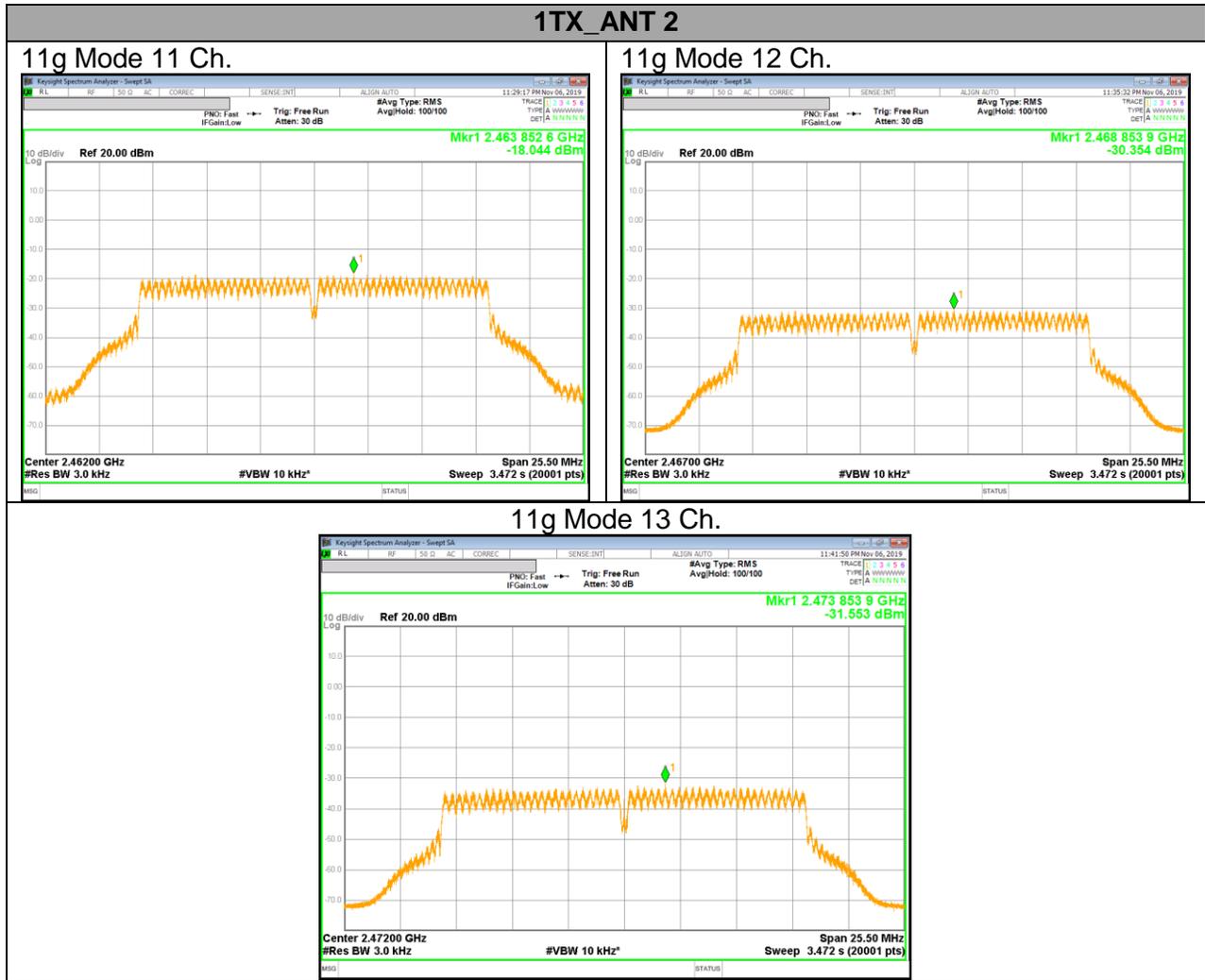
1TX_ANT 2

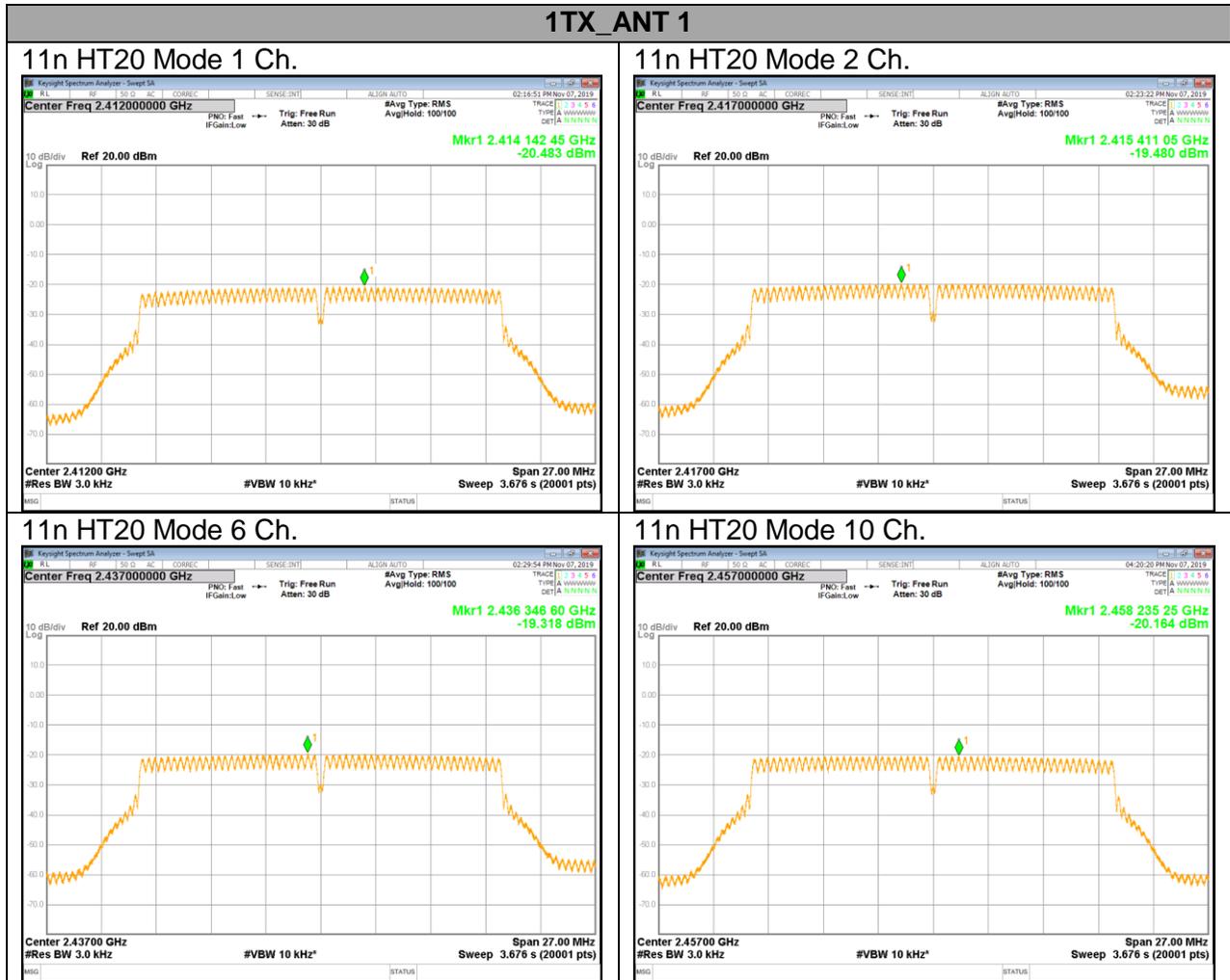




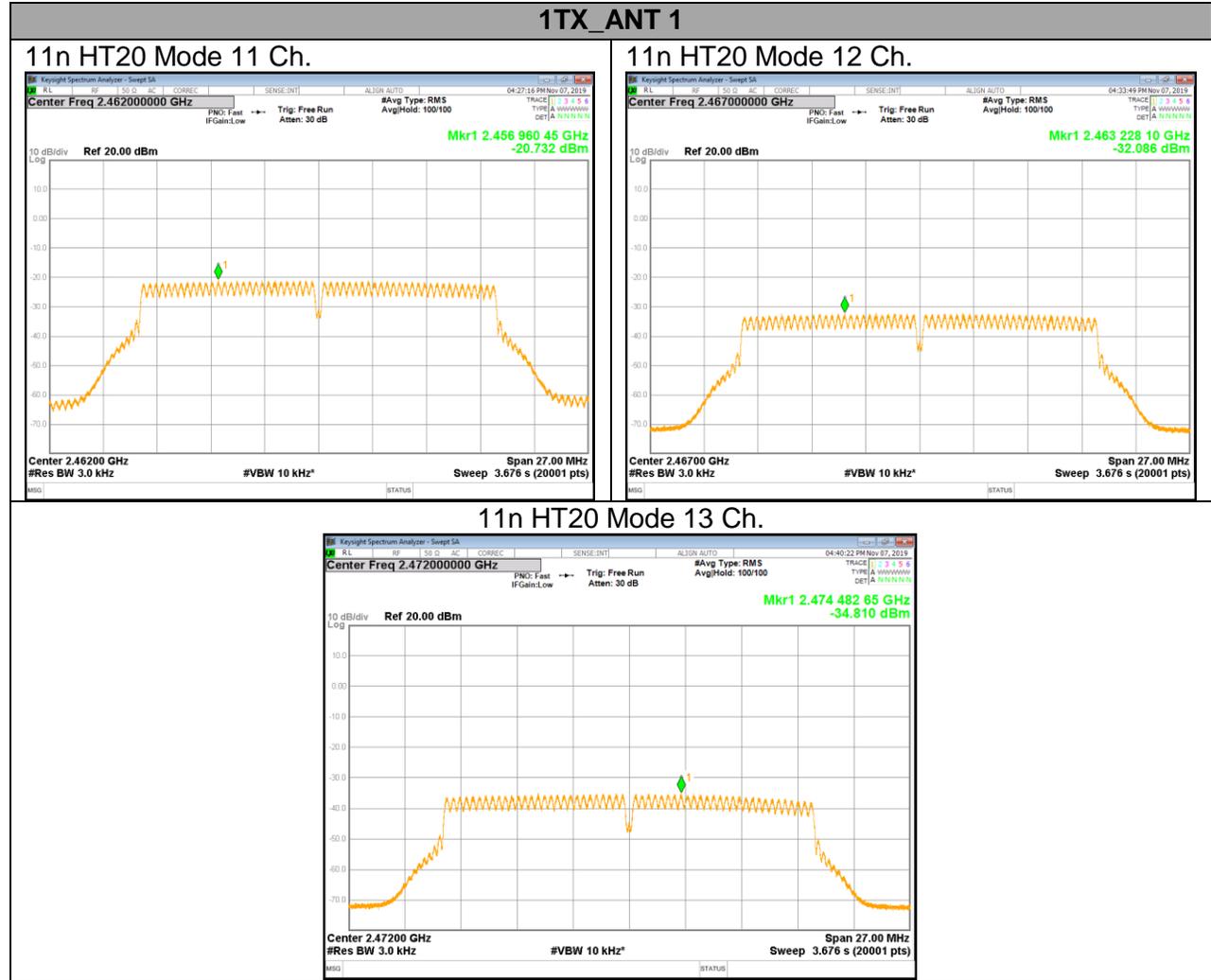




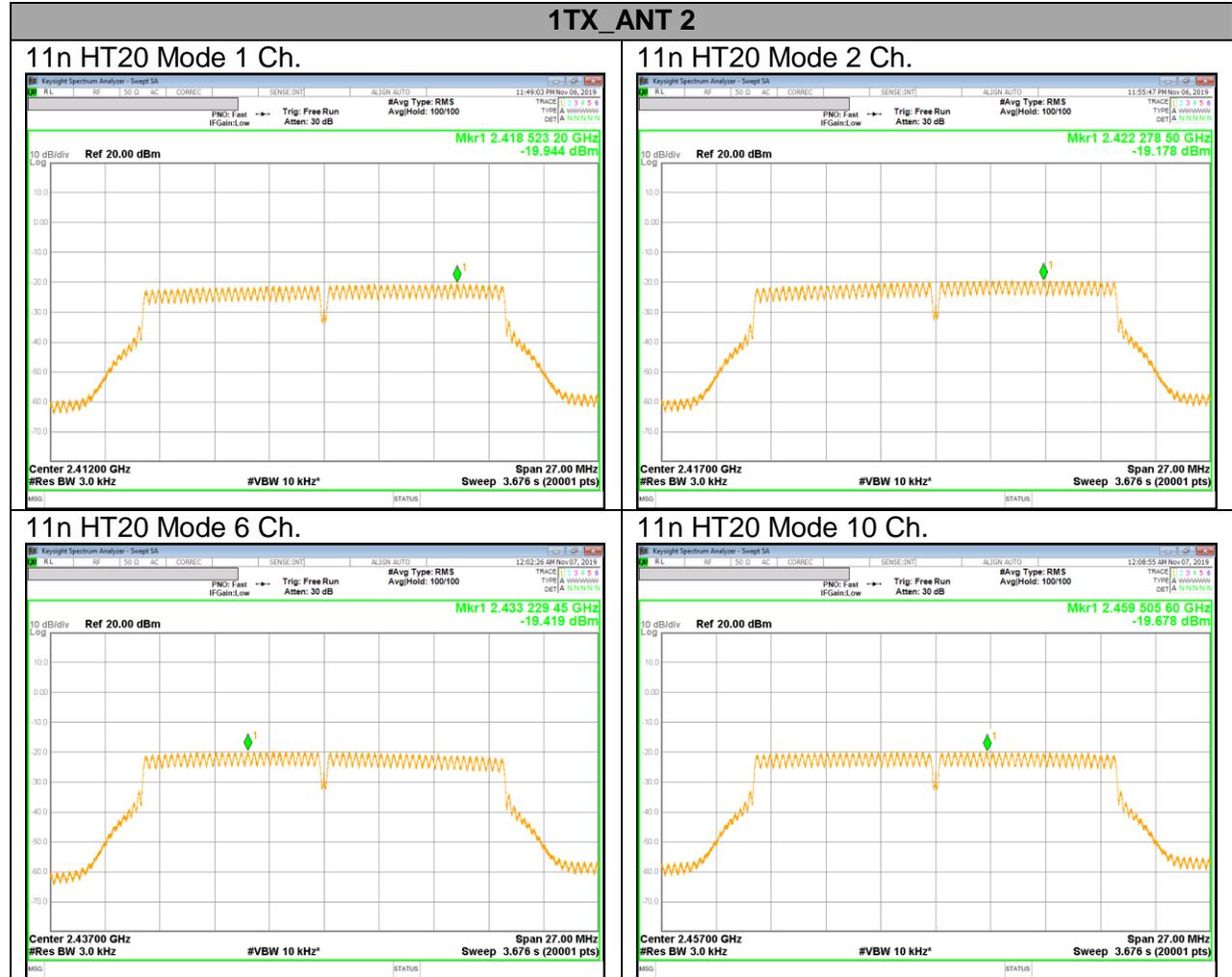




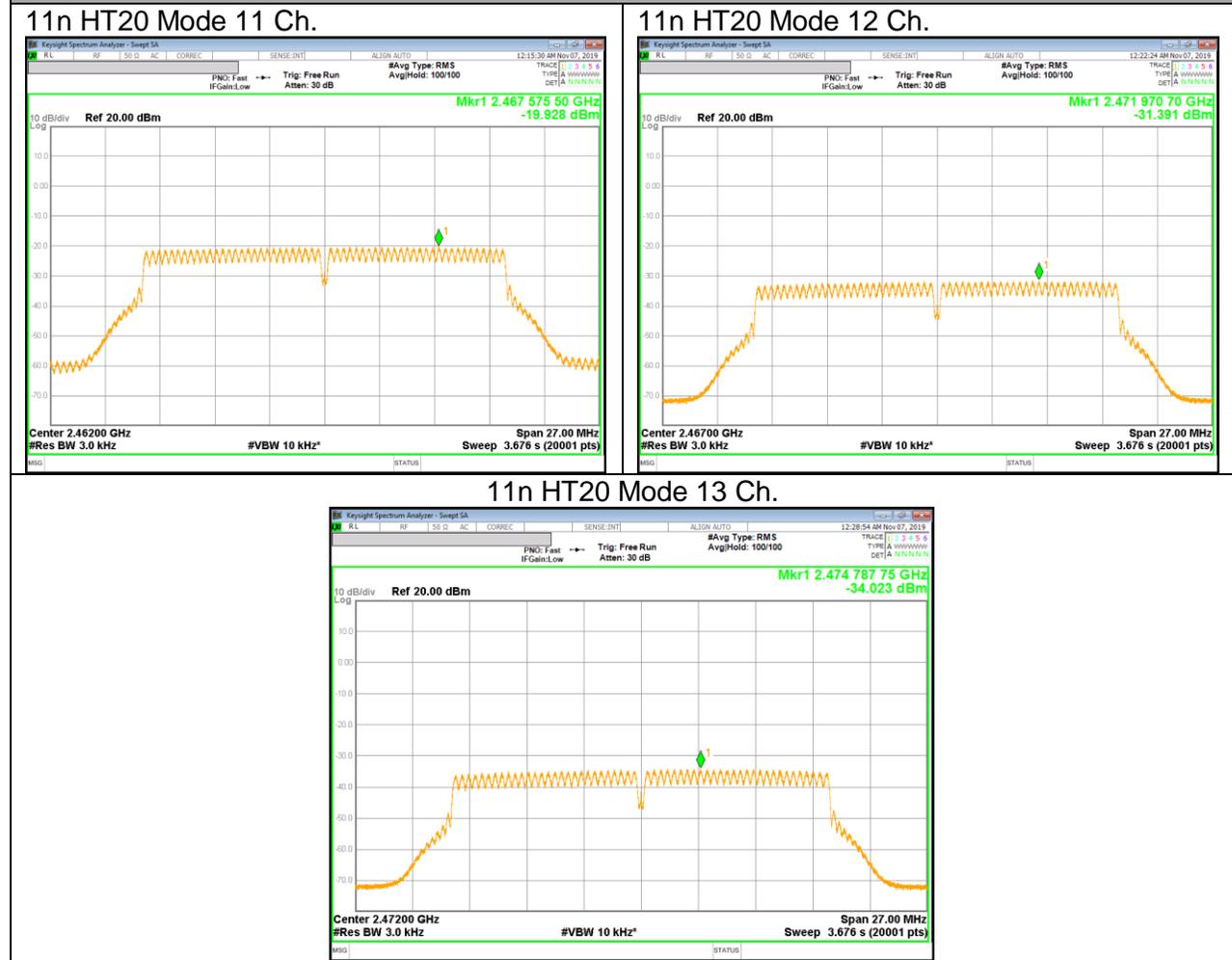
1TX_ANT 1



1TX_ANT 2



1TX_ANT 2



10.4. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

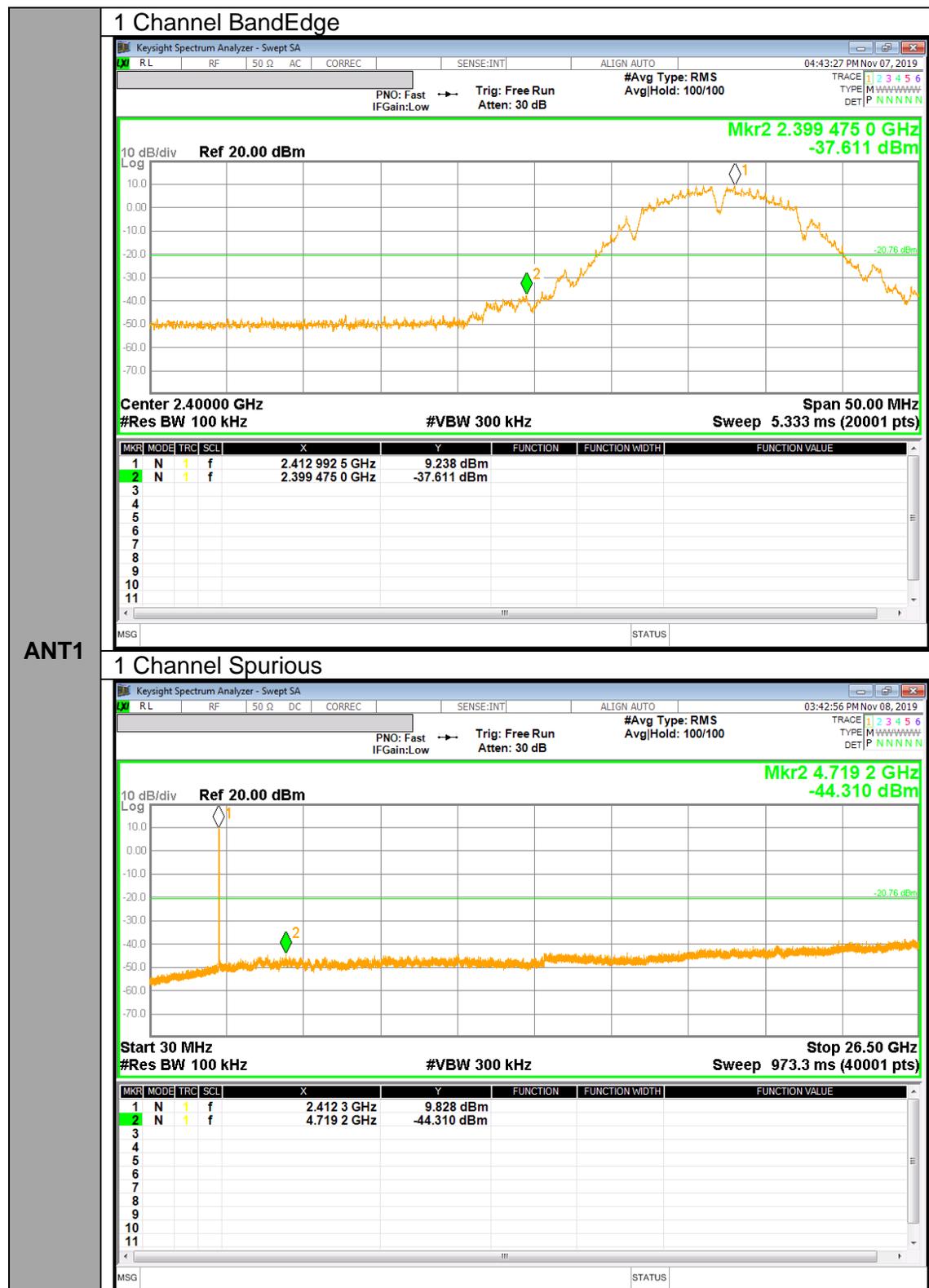
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

TEST PROCEDURE

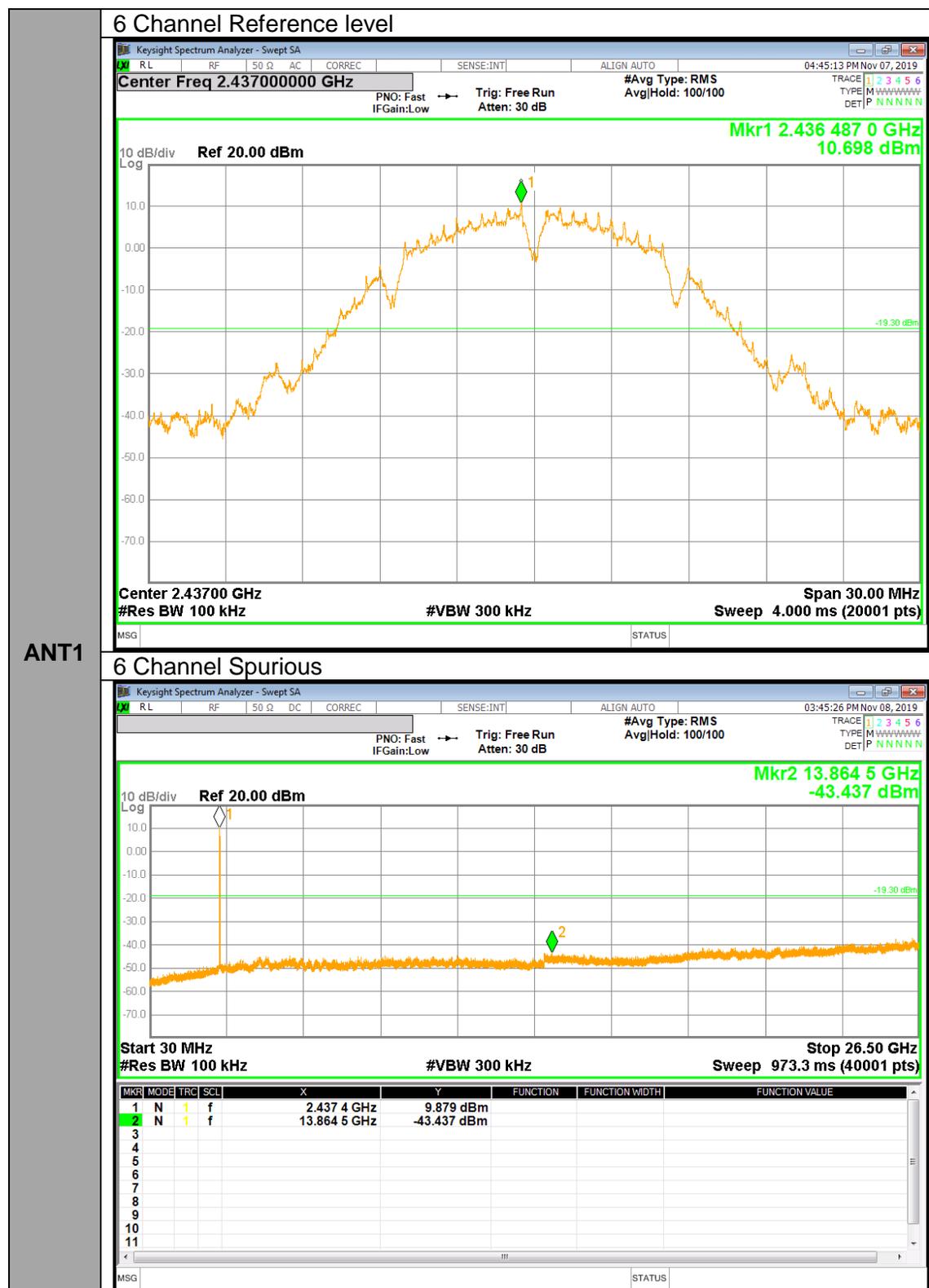
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge, out-of-band emissions (where measurements to the general radiated limits will not be made)

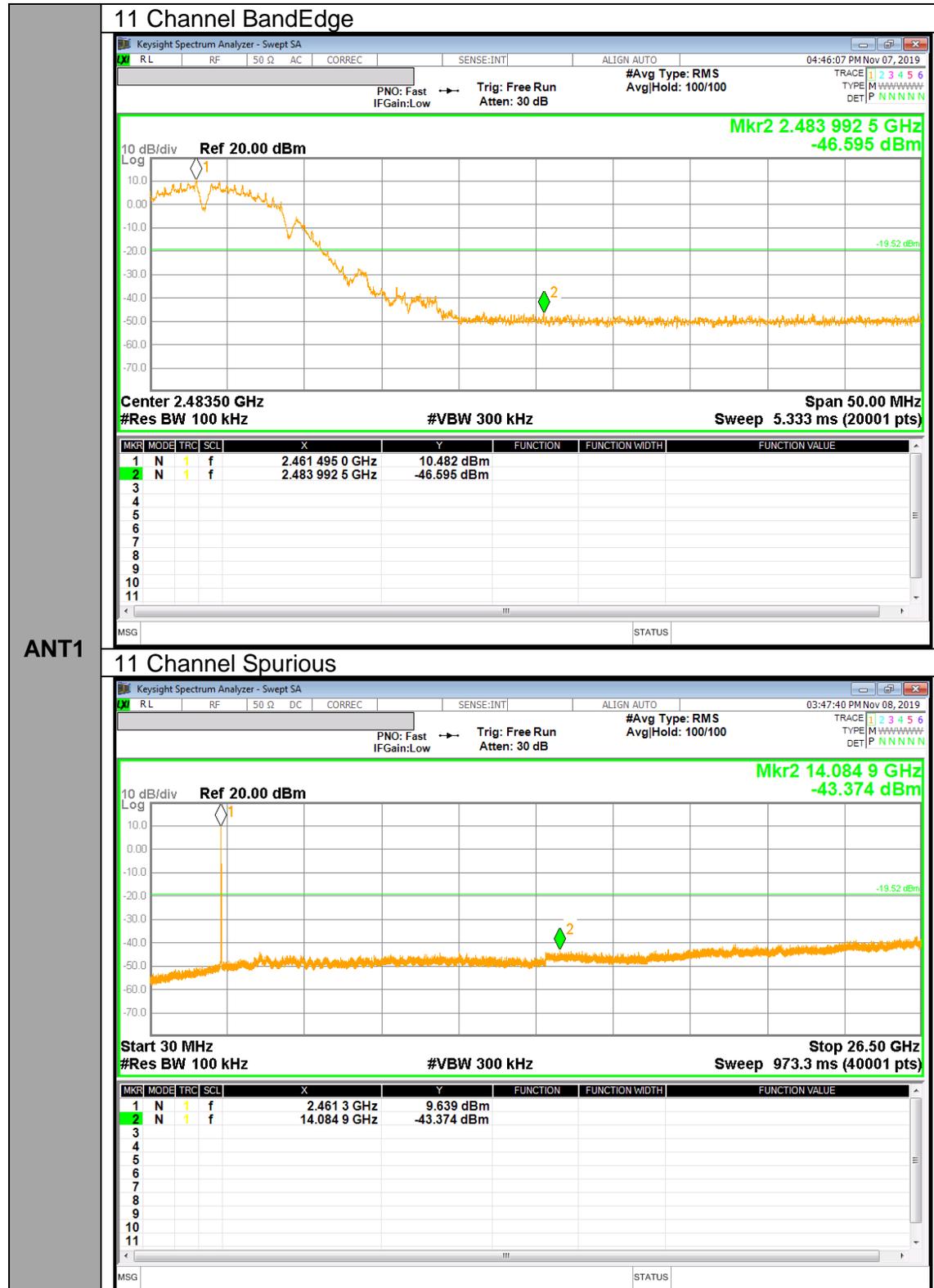
RESULTS

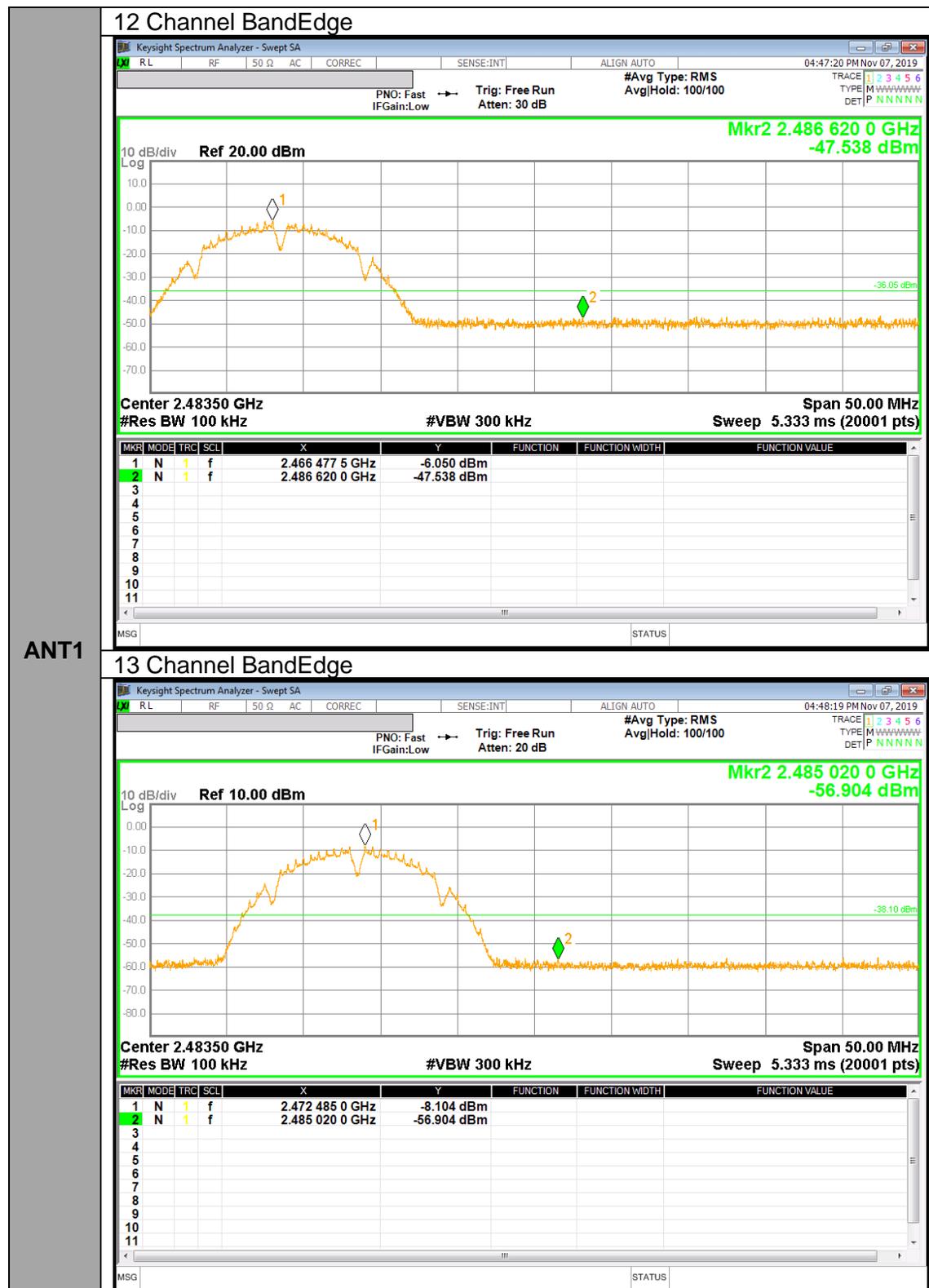
10.4.1. 802.11b MODE IN THE 2.4 GHz BAND



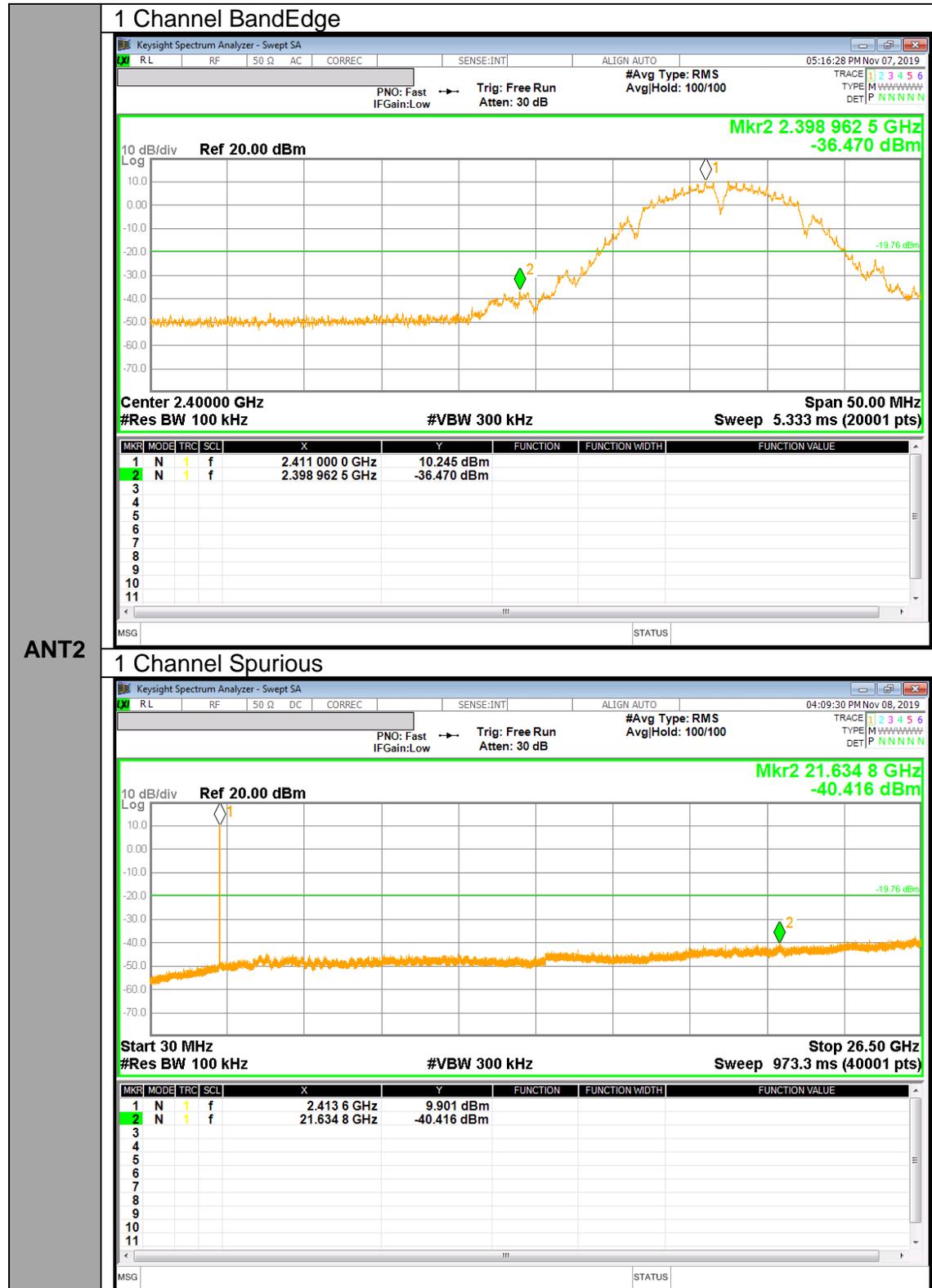
ANT1



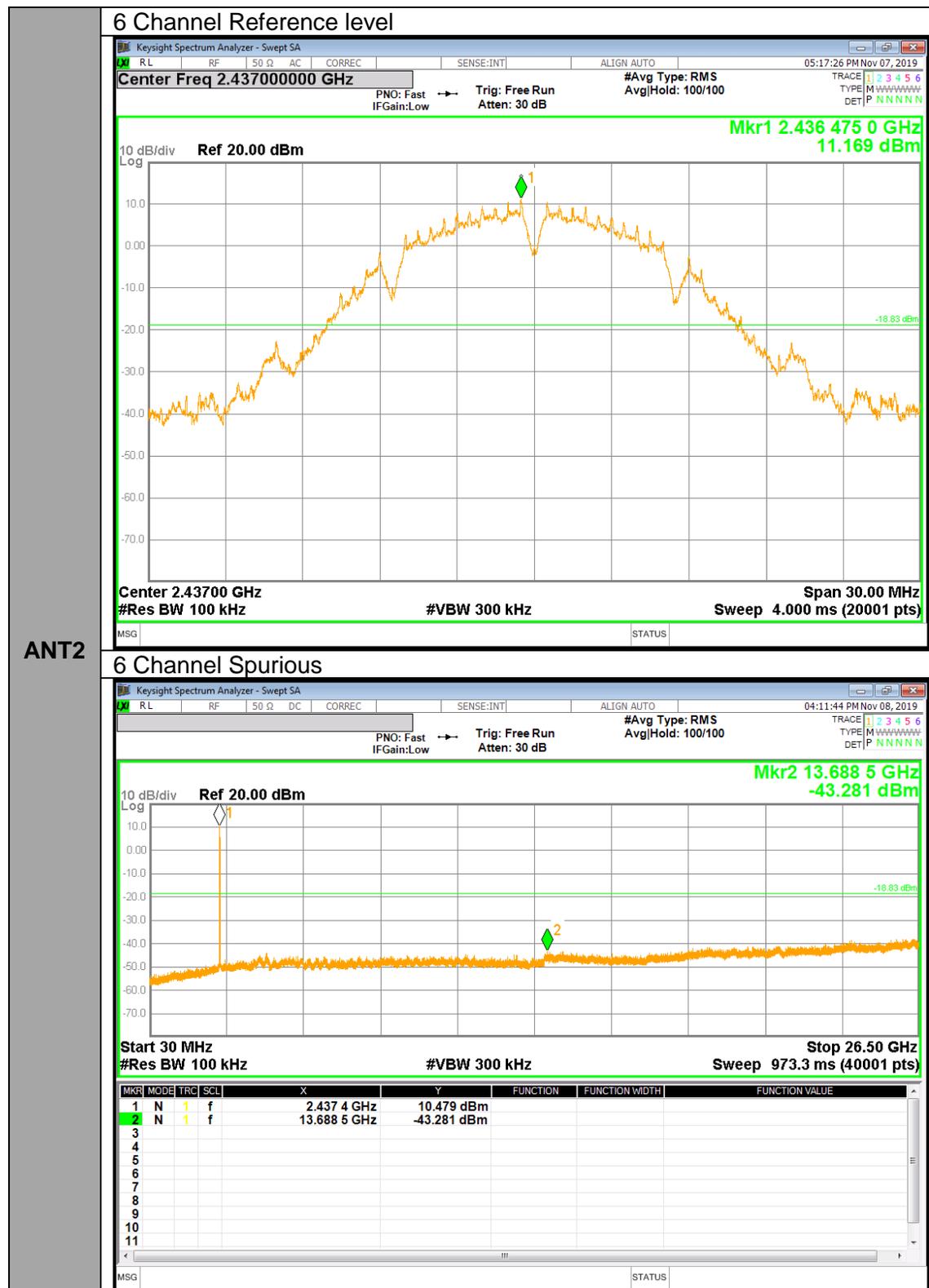


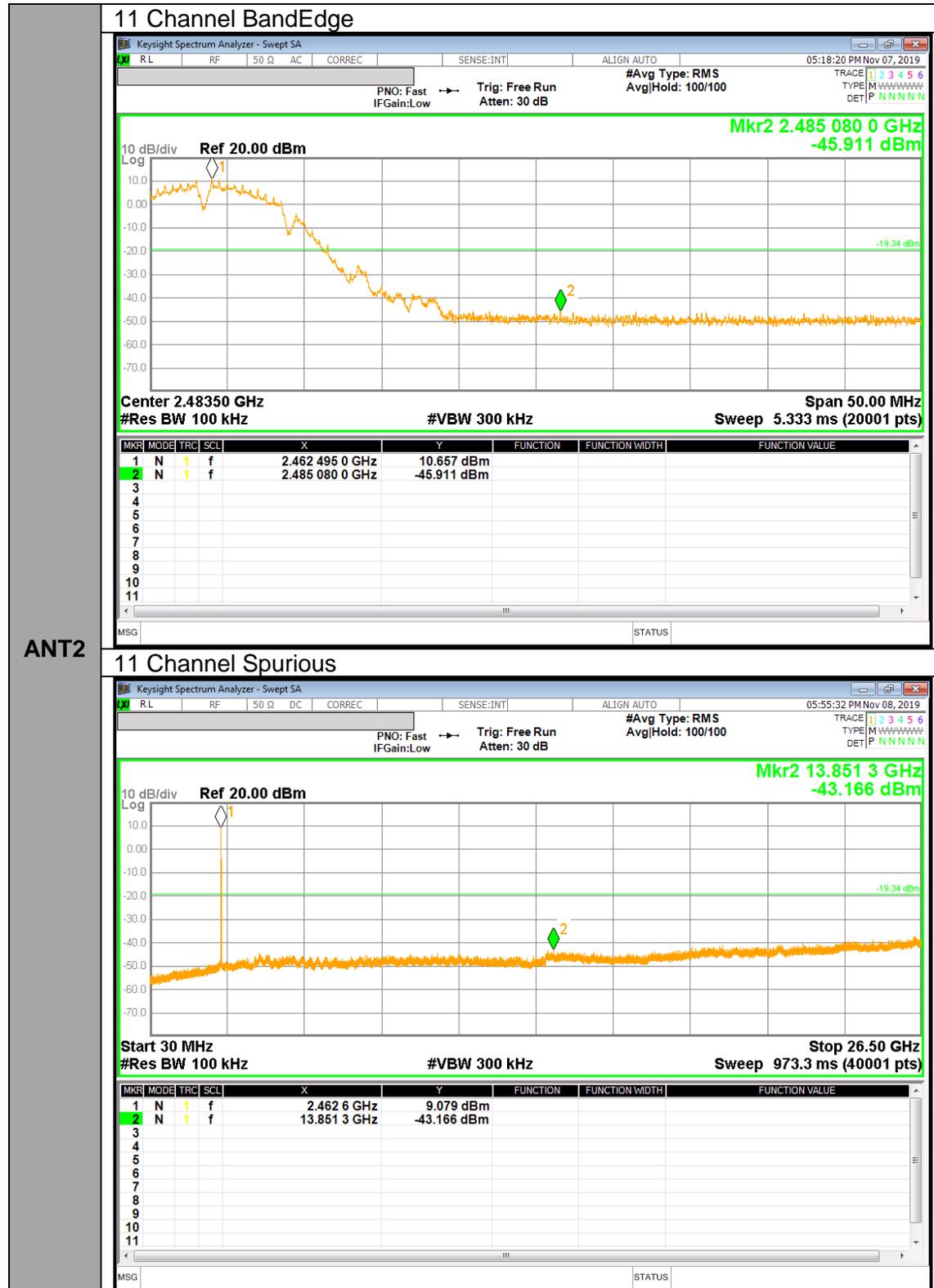


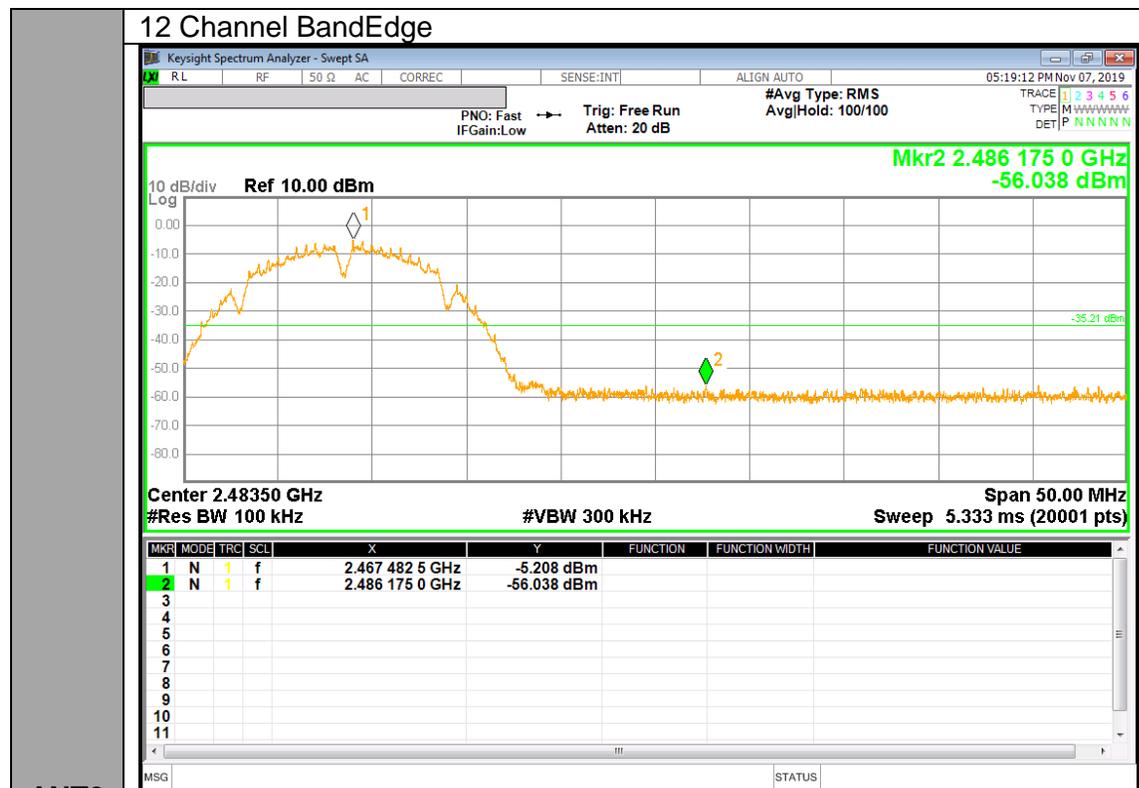
ANT1



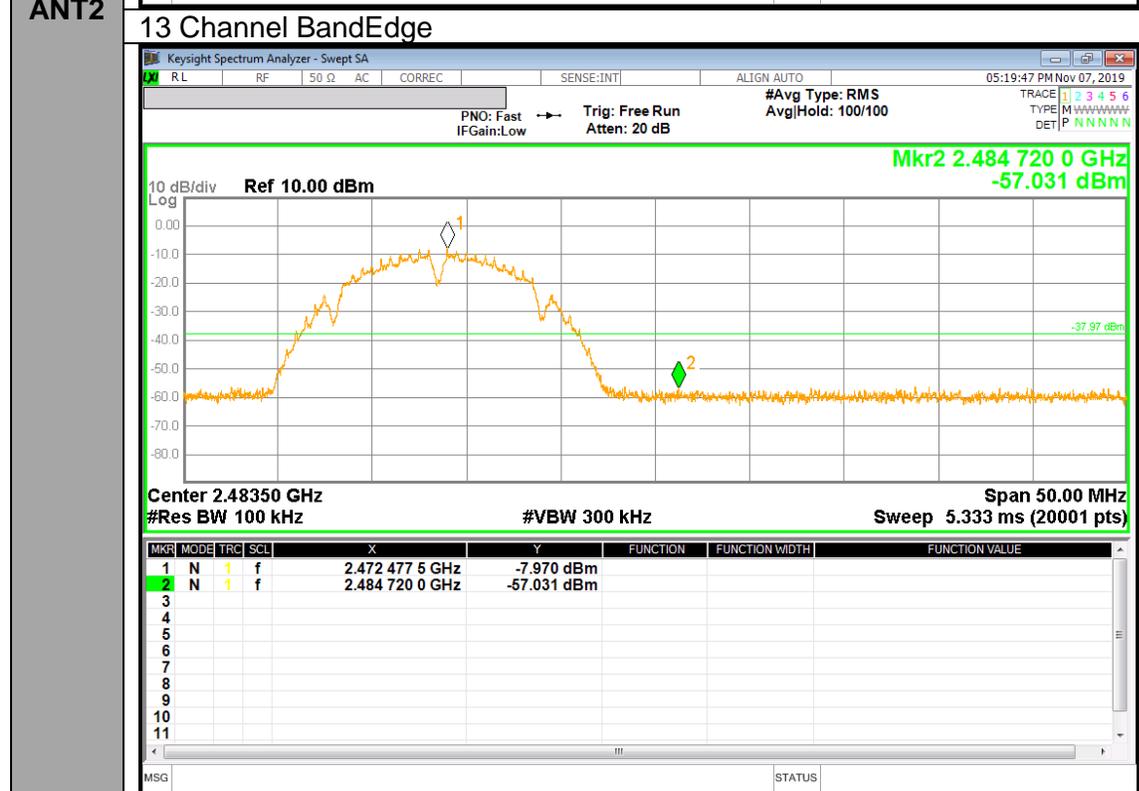
ANT2







ANT2



10.4.2. 802.11g MODE IN THE 2.4 GHz BAND

