

TEST REPORT

Product Name: Smart Phone
Trade Mark: ecom
Model No. / HVIN: Smart-Ex 02
Add. Model No. / HVIN: N/A
Report Number: 190518039RFC-3
Test Standards: FCC 47 CFR Part 15 Subpart C
RSS-247 Issue 2
RSS-Gen Issue 5
FCC ID: XAM500079GR01
IC: 8311A-500079GR01
Test Result: PASS
Date of Issue: July 20, 2019

Prepared for:

ecom instruments GmbH
Industriestrasse 2, Assamstadt, 97959, Germany

Prepared by:

Shenzhen UnionTrust Quality and Technology Co., Ltd.
16/F, Block A, Building 6, Baoneng Science and Technology Park,
Qingxiang Road No.1, Longhua New District, Shenzhen, China
TEL: +86-755-2823 0888
FAX: +86-755-2823 0886

Prepared by: 
Henry Lu
Team Leader

Reviewed by: 
Kevin Liang
Assistant Manager

Approved by: 
Billy Li
Technical Director

Date: July 20, 2019

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China
Tel: +86-755-28230888 Fax: +86-755-28230886 E-mail: info@uttlab.com

[Http://www.uttlab.com](http://www.uttlab.com)

Version

Version No.	Date	Description
V1.0	July 20, 2019	Original



Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China

Tel: +86-755-28230888

Fax: +86-755-28230886

E-mail: info@uttlab.com

[Http://www.uttlab.com](http://www.uttlab.com)

CONTENTS

1. GENERAL INFORMATION	4
1.1 CLIENT INFORMATION	4
1.2 EUT INFORMATION	4
1.2.1 GENERAL DESCRIPTION OF EUT	4
1.2.2 DESCRIPTION OF ACCESSORIES	5
1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD	5
1.4 OTHER INFORMATION	6
1.5 DESCRIPTION OF SUPPORT UNITS	6
1.6 TEST LOCATION	6
1.7 TEST FACILITY	6
1.8 DEVIATION FROM STANDARDS	7
1.9 ABNORMALITIES FROM STANDARD CONDITIONS	7
1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER	7
1.11 MEASUREMENT UNCERTAINTY	7
2. TEST SUMMARY	8
3. EQUIPMENT LIST	9
4. TEST CONFIGURATION	10
4.1 ENVIRONMENTAL CONDITIONS FOR TESTING	10
4.1.1 NORMAL OR EXTREME TEST CONDITIONS	10
4.1.2 RECORD OF NORMAL ENVIRONMENT	10
4.2 TEST CHANNELS	10
4.3 EUT TEST STATUS	11
4.4 PRE-SCAN	11
4.5 TEST SETUP	12
4.5.1 FOR RADIATED EMISSIONS TEST SETUP	12
4.5.2 FOR CONDUCTED EMISSIONS TEST SETUP	13
4.5.3 FOR CONDUCTED RF TEST SETUP	14
4.6 SYSTEM TEST CONFIGURATION	14
4.7 DUTY CYCLE	15
5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION	18
5.1 REFERENCE DOCUMENTS FOR TESTING	18
5.2 ANTENNA REQUIREMENT	18
5.3 CONDUCTED PEAK OUTPUT POWER	19
5.4 6 dB BANDWIDTH & OCCUPIED BANDWIDTH	20
5.5 POWER SPECTRAL DENSITY	25
5.6 CONDUCTED OUT OF BAND EMISSION	28
5.7 RADIATED SPURIOUS EMISSIONS	37
5.8 BAND EDGE MEASUREMENTS (RADIATED)	44
5.9 CONDUCTED EMISSION	53
APPENDIX 1 PHOTOS OF TEST SETUP	56
APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS	56

1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	ecom instruments GmbH
Address of Applicant:	Industriestrasse 2, Assamstadt, 97959, Germany
Manufacturer:	Pepperl+Fuchs GmbH
Address of Manufacturer:	Lilienthalstrasse 200, 68307 Mannheim, Germany

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	Smart Phone		
Model No. / HVIN:	Smart-Ex 02		
Add. Model No. / HVIN:	N/A		
Trade Mark:	ecom		
DUT Stage:	Identical Prototype		
EUT Supports Function:	GSM Bands:	GSM 850/ PCS 1900	
	UTRA Bands:	Band II/ Band IV/ Band V	
	E-UTRA Bands:	FDD Band 2/ Band 4/ Band 5/ Band 7/ Band 12/ Band 13/ Band 25/ Band 26/ Band 66/ Band 71	
		TDD Band 38/ Band 41	
	2.4 GHz ISM Band:	IEEE 802.11b/g/n	
		Bluetooth V4.2	
	5 GHz U-NII Bands:	5 150 MHz to 5 250 MHz	IEEE 802.11a/n/ac
		5 250 MHz to 5 350 MHz	IEEE 802.11a/n/ac
		5 470 MHz to 5 725 MHz	IEEE 802.11a/n/ac
		5 725 MHz to 5 850 MHz	IEEE 802.11a/n/ac
	RNSS Bands:	1559 MHz to 1610 MHz	GPS/ GLONASS/ BDS/ Galileo
NFC:	13.553 MHz to 13.567 MHz		
Sample Received Date:	May 20, 2019		
Sample Tested Date:	May 28, 2019 to June 20, 2019		

1.2.2 Description of Accessories

Adapter	
Model No.:	S008ACM0500200
Input:	100-240 V~50/60 Hz 0.3 A Max
Output:	5.0 V $\pm$ 2 A
AC Cable:	N/A
DC Cable:	N/A

Battery (1)	
Model No.:	EX-BP S02
Battery Type:	Lithium-ion Rechargeable Battery
Rated Voltage:	3.7 Vdc
Rated Capacity:	4400 mAh

Battery (2)	
Model No.:	EX-BP S02C
Battery Type:	Lithium-ion Rechargeable Battery
Rated Voltage:	3.7 Vdc
Rated Capacity:	3920 mAh

Cable	
Description:	USB Changing Cable
Cable Type:	Shielded without ferrite
Length:	1.2 Meter

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Frequency Band:	2400 MHz to 2483.5 MHz
Frequency Range:	2412 MHz to 2462 MHz
Support Standards:	IEEE 802.11b, IEEE 802.11g, IEEE 802.11n-HT20, IEEE 802.11n-HT40
Type of Modulation:	IEEE 802.11b: DSSS(CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM(64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11n-HT20: OFDM(64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11n-HT40: OFDM(64-QAM, 16-QAM, QPSK, BPSK)
Data Rate:	IEEE 802.11b: Up to 11 Mbps IEEE 802.11g: Up to 54 Mbps IEEE 802.11n-HT20: Up to MCS7(64 Mbps) IEEE 802.11n-HT40: Up to MCS7(135 Mbps)
Number of Channels:	IEEE 802.11b: 11 IEEE 802.11g: 11 IEEE 802.11n-HT20: 11 IEEE 802.11n-HT40: 7
Channel Separation:	5 MHz
Antenna Type:	Integral Antenna
Antenna Gain:	-4.17 dBi
Maximum Peak Power:	IEEE 802.11b: 20.48 dBm IEEE 802.11g: 24.29 dBm IEEE 802.11n-HT20: 23.39 dBm IEEE 802.11n-HT40: 23.44 dBm
Normal Test Voltage:	3.7 V Battery

1.4 OTHER INFORMATION

Operation Frequency Each of Channel	
IEEE 802.11b, IEEE 802.11g, IEEE 802.11n-HT20	$f = 2407 + 5k \text{ MHz}, k = 1, \dots, 11$
IEEE 802.11n-HT40	$f = 2407 + 5k \text{ MHz}, k = 3, \dots, 9$
Note: f is the operating frequency (MHz); k is the operating channel.	

1.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	Supplied by
Notebook	Lenovo	E450	SL10G10780	UnionTrust

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Antenna Cable	SMA	0.3 Meter	Applicant

1.6 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China 518109
Telephone: +86 (0) 755 2823 0888
Fax: +86 (0) 755 2823 0886

1.7 TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L9069

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC/EN 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories

CAB identifier: CN0032

FCC Accredited Lab.

Designation Number: CN1194

Test Firm Registration Number: 259480

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China

Tel: +86-755-28230888

Fax: +86-755-28230886

E-mail: info@uttlab.com

[Http://www.uttlab.com](http://www.uttlab.com)

1.8 DEVIATION FROM STANDARDS

None.

1.9 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.11 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9KHz-150KHz	±3.8 dB
2	Conducted emission 150KHz-30MHz	±3.4 dB
3	Radiated emission 9KHz-30MHz	±4.9 dB
4	Radiated emission 30MHz-1GHz	±4.7 dB
5	Radiated emission 1GHz-18GHz	±5.1 dB
6	Radiated emission 18GHz-26GHz	±5.2 dB
7	Radiated emission 26GHz-40GHz	±5.2 dB

2. TEST SUMMARY

FCC 47 CFR Part 15 Subpart C Test Cases			
Test Item	Test Requirement	Test Method	Result
Antenna Requirement	FCC 47 CFR Part 15 Subpart C Section 15.203/15.247 (c) RSS-Gen Issue 5, Section 6.8	N/A	PASS
AC Power Line Conducted Emission	FCC 47 CFR Part 15 Subpart C Section 15.207 RSS-Gen Issue 5, Section 8.8	ANSI C63.10-2013 Clause 6.2	PASS
Conducted Peak Output Power	FCC 47 CFR Part 15 Subpart C Section 15.247 (b)(3) RSS-247 Issue 2, Section 5.4(d)	ANSI C63.10-2013 Clause 11.9.1.3	PASS
6dB Bandwidth	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2) RSS-247 Issue 2, Section 5.2(a)	ANSI C63.10-2013 Clause 11.8.1	PASS
Occupied Bandwidth	RSS-Gen Issue 5, Section 6.7	RSS-Gen Issue 5, Section 6.7	PASS
Power Spectral Density	FCC 47 CFR Part 15 Subpart C Section 15.247 (e) RSS-247 Issue 2, Section 5.2(b)	ANSI C63.10-2013 Clause 11.10.2	PASS
Conducted Out of Band Emission	FCC 47 CFR Part 15 Subpart C Section 15.247(d) RSS-247 Issue 2, Section 5.5	ANSI C63.10-2013 Clause 11.11	PASS
Radiated Spurious Emissions	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209 RSS-Gen Issue 5, Section 6.13/8.9/8.10	ANSI C63.10-2013 Clause 11.11 & Clause 11.12	PASS
Band Edge Measurements (Radiated)	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209 RSS-247 Issue 2, Section 5.5	ANSI C63.10-2013 Clause 11.13	PASS

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
☒	3M Chamber & Accessory Equipment	ETS-LINDGREN	3M	N/A	Dec. 03, 2018	Dec. 03, 2021
☒	Receiver	R&S	ESIB26	100114	Nov. 24, 2018	Nov. 24, 2019
☒	Loop Antenna	ETS-LINDGREN	6502	00202525	Dec. 03, 2018	Dec. 03, 2019
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Dec. 08, 2018	Dec. 08, 2019
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	Dec. 08, 2018	Dec. 08, 2019
☒	Preamplifier	HP	8447F	2805A02960	Nov. 24, 2018	Nov. 24, 2019
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201874	May 18, 2019	May 18, 2020
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	Jan. 05, 2019	Jan. 05, 2020
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☒	Test Software	Audix	e3	Software Version: 9.160333		

Conducted Emission Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
☒	Receiver	R&S	ESR7	1316.3003K07-101181-K3	Nov. 24, 2018	Nov. 24, 2019
☒	Pulse Limiter	R&S	ESH3-Z2	0357.8810.54	Nov. 24, 2018	Nov. 24, 2019
☒	LISN	R&S	ESH2-Z5	860014/024	Nov. 24, 2018	Nov. 24, 2019
☒	Test Software	Audix	e3	Software Version: 9.160323		

Conducted RF test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Nov. 24, 2018	Nov. 24, 2019
☒	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430035	Nov. 24, 2018	Nov. 24, 2019

4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

Environment Parameter	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage (V)	Relative Humidity (%)
NT/NV	+15 to +35	3.7 V Battery	20 to 75
Remark: 1) NV: Normal Voltage; NT: Normal Temperature			

4.1.2 Record of Normal Environment

Test Item	Temperature (°C)	Relative Humidity (%)	Pressure (kPa)	Tested by
AC Power Line Conducted Emission	25.0	41	99.8	Gemini Huang
Conducted Peak Output Power	24.9	51	100.1	Hank Wu
6dB Bandwidth & Occupied Bandwidth				
Power Spectral Density				
Conducted Out of Band Emission	22.4	52	100.52	Fire Huo
Radiated Spurious Emissions Band Edge Measurements (Radiated)				

4.2 TEST CHANNELS

Mode	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
IEEE 802.11b	2412 MHz to 2462 MHz	Channel 1	Channel 7	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11g	2412 MHz to 2462 MHz	Channel 1	Channel 7	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11n-HT20	2412 MHz to 2462 MHz	Channel 1	Channel 7	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11n-HT40	2422 MHz to 2452 MHz	Channel 3	Channel 7	Channel 9
		2422 MHz	2437 MHz	2452 MHz

4.3 EUT TEST STATUS

Mode	Tx Function	Description
IEEE 802.11b IEEE 802.11g IEEE 802.11n-HT20 IEEE 802.11n-HT40	1Tx	1. Keep the EUT in continuously transmitting with modulation test single.

Power Setting			
Mode	Channel 1	Channel 6	Channel 11
IEEE 802.11b	19	19	19
IEEE 802.11g	20	20	20
IEEE 802.11n-HT20	17	17	17
IEEE 802.11n-HT40	17	17	17

Test Software
Test software name: QRCT ;

4.4 PRE-SCAN

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. Following data rate was (were) selected for the final test as listed below

Mode	Worst-case data rates
IEEE 802.11b	1 Mbps
IEEE 802.11g	6 Mbps
IEEE 802.11n-HT20	MCS0
IEEE 802.11n-HT40	MCS0

4.5 TEST SETUP

4.5.1 For Radiated Emissions test setup

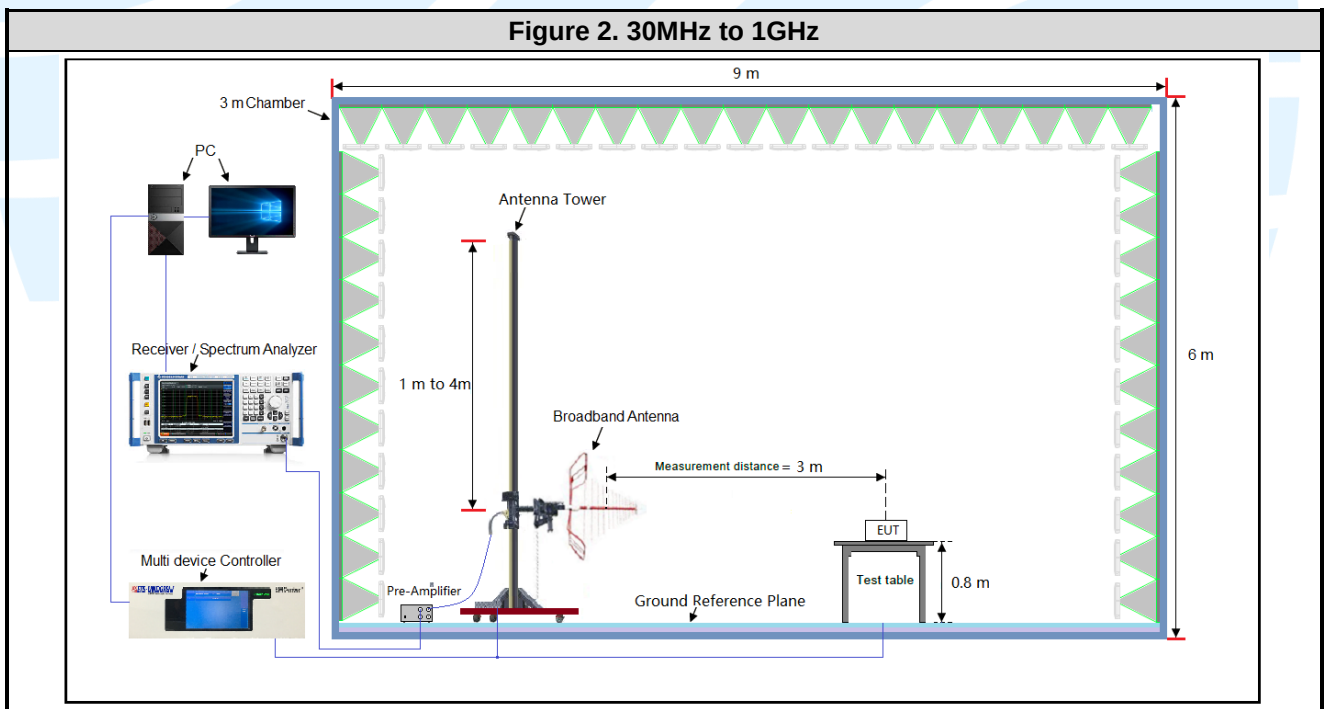
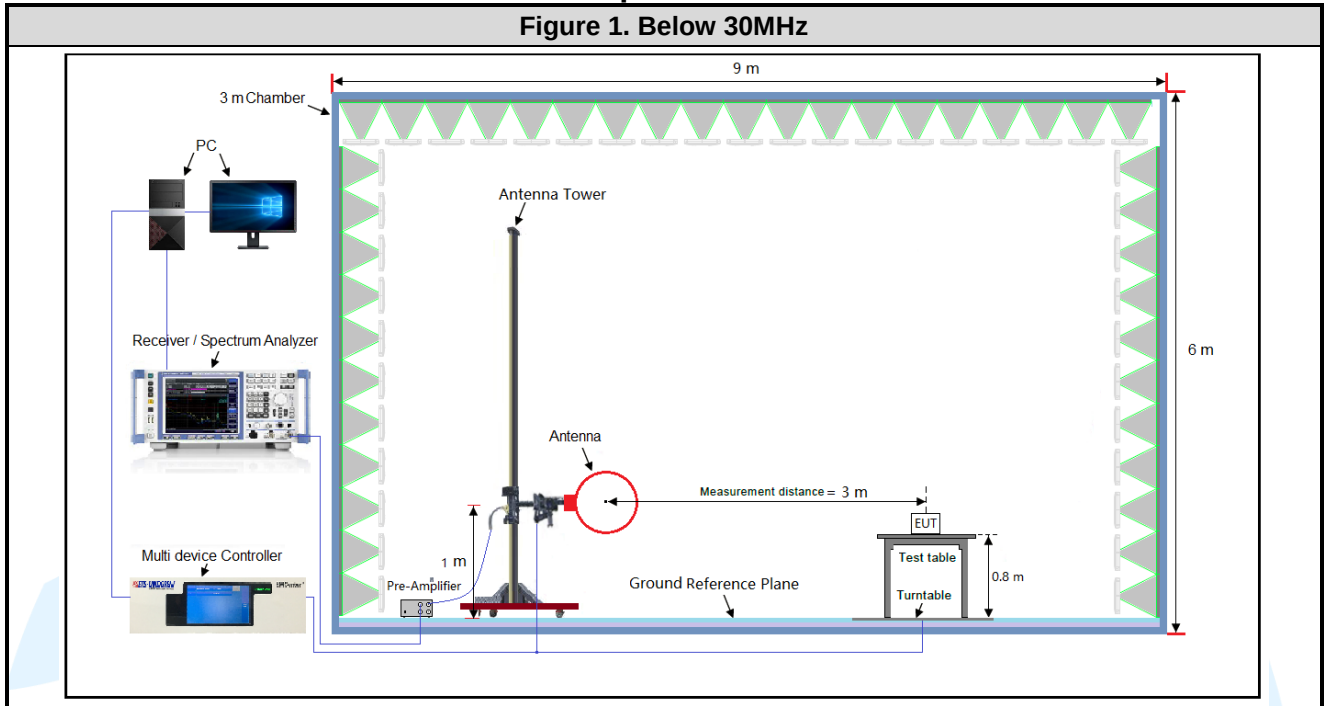
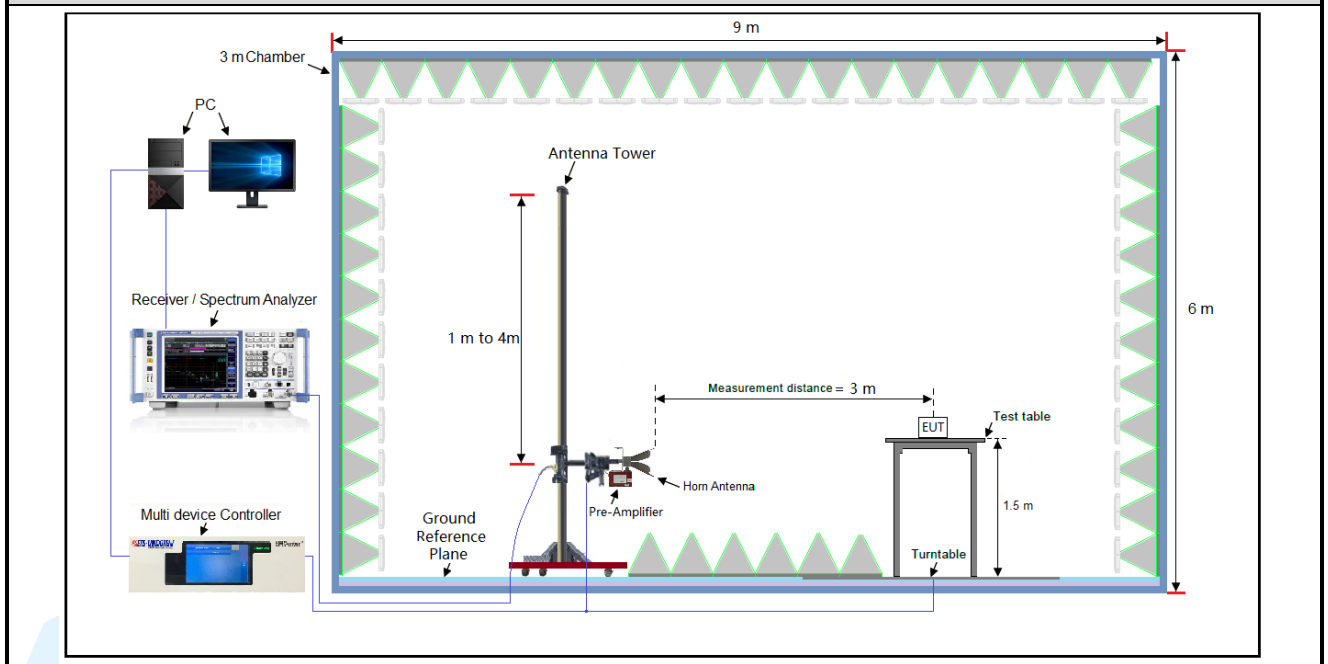
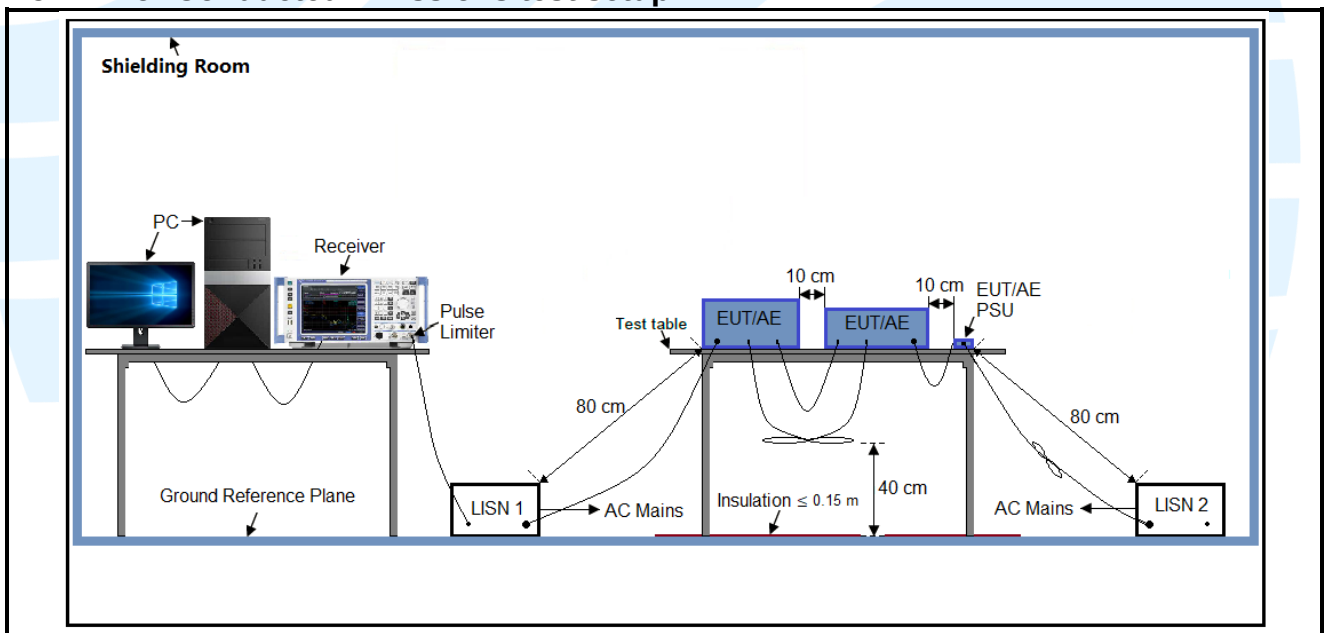


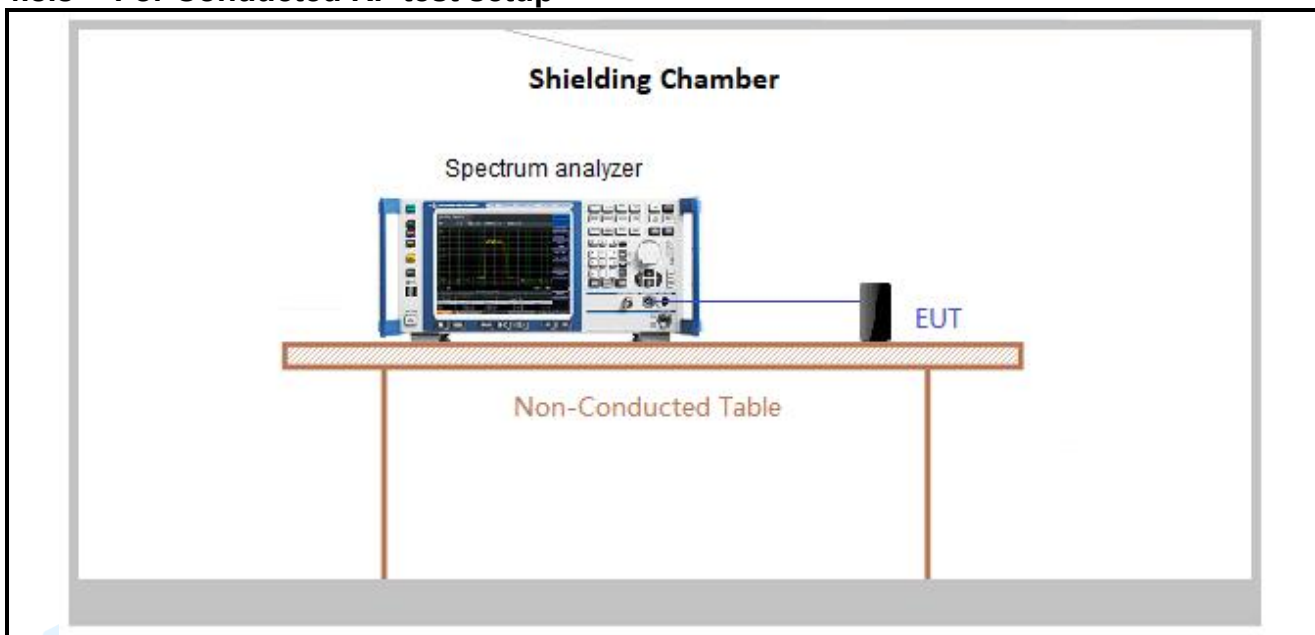
Figure 3. Above 1GHz



4.5.2 For Conducted Emissions test setup



4.5.3 For Conducted RF test setup



4.6 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. It was powered by 3.7 V Battery. Only the worst case data were recorded in this test report.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4.7 DUTY CYCLE

Test Procedure: ANSI C63.10-2013 Clause 11.6.

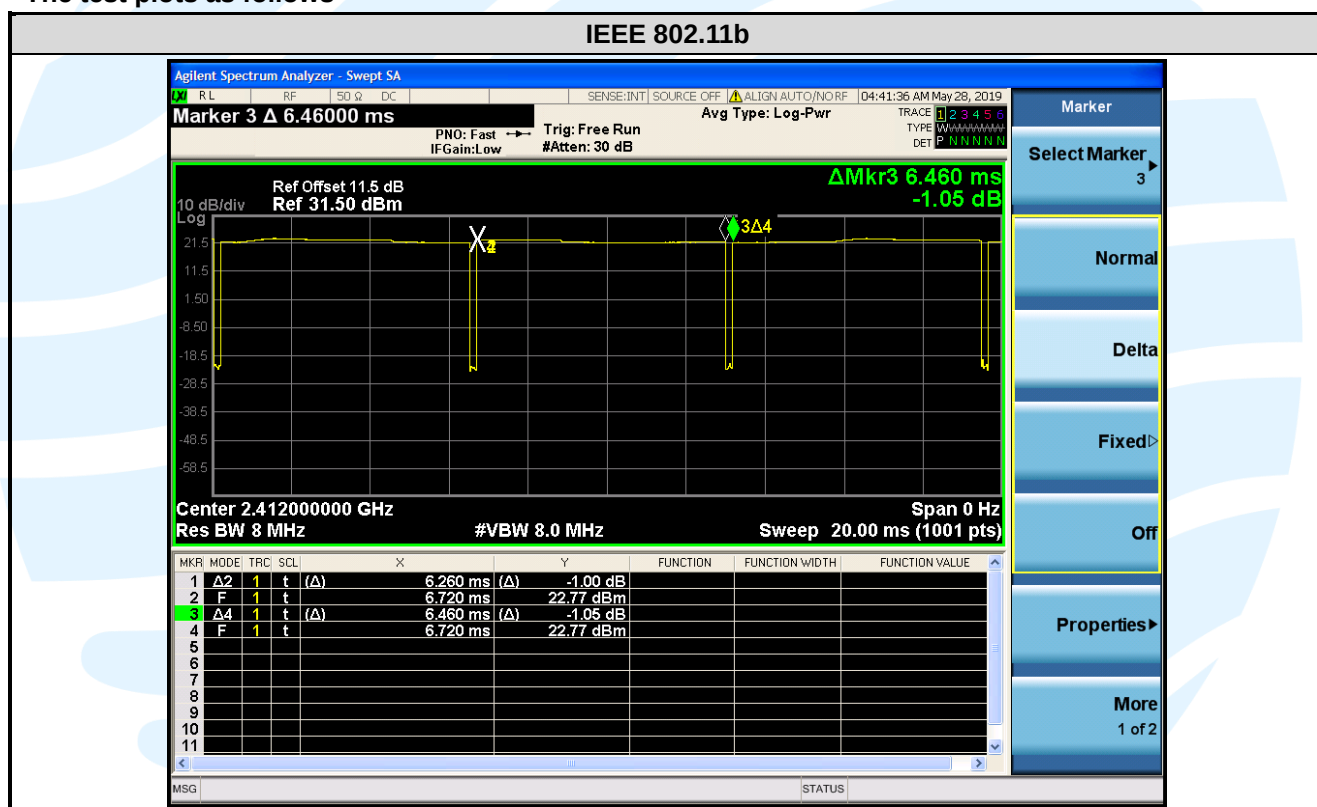
Test Results

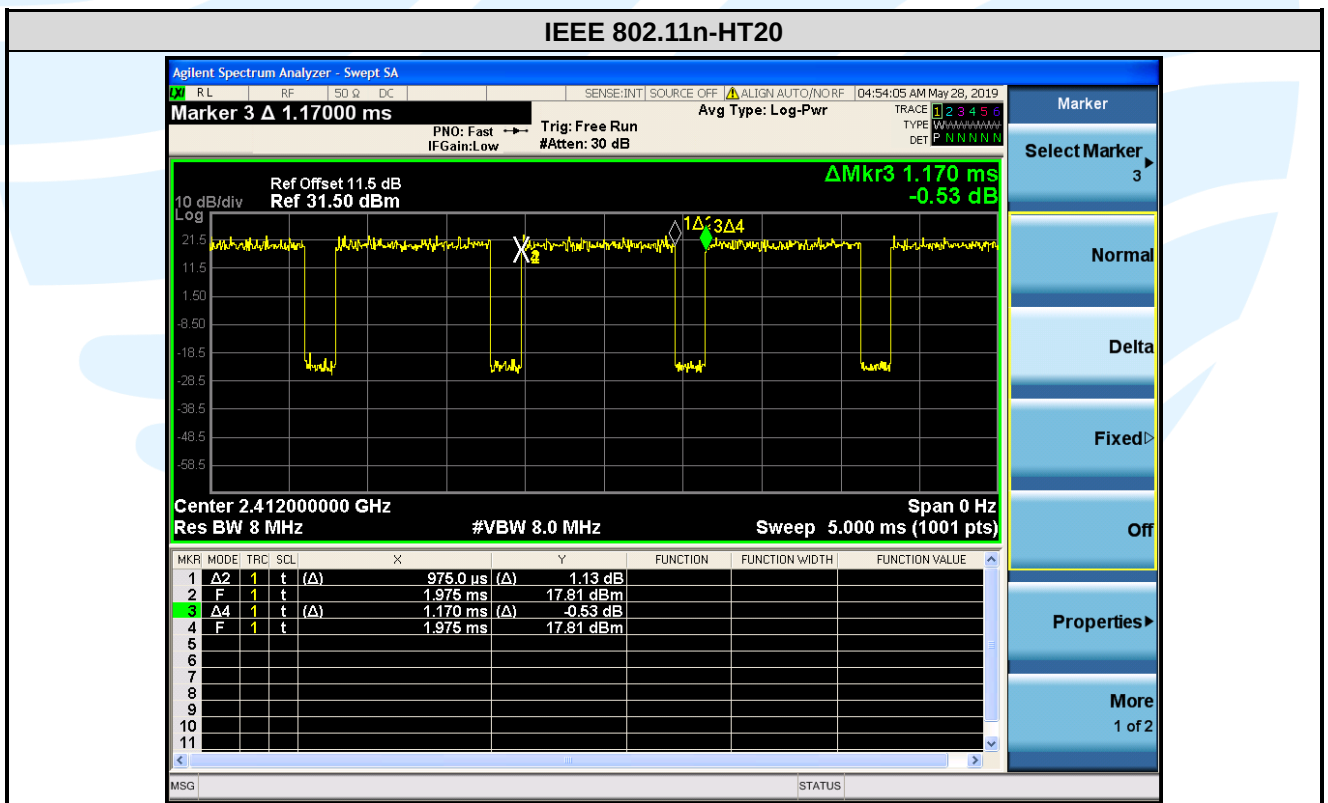
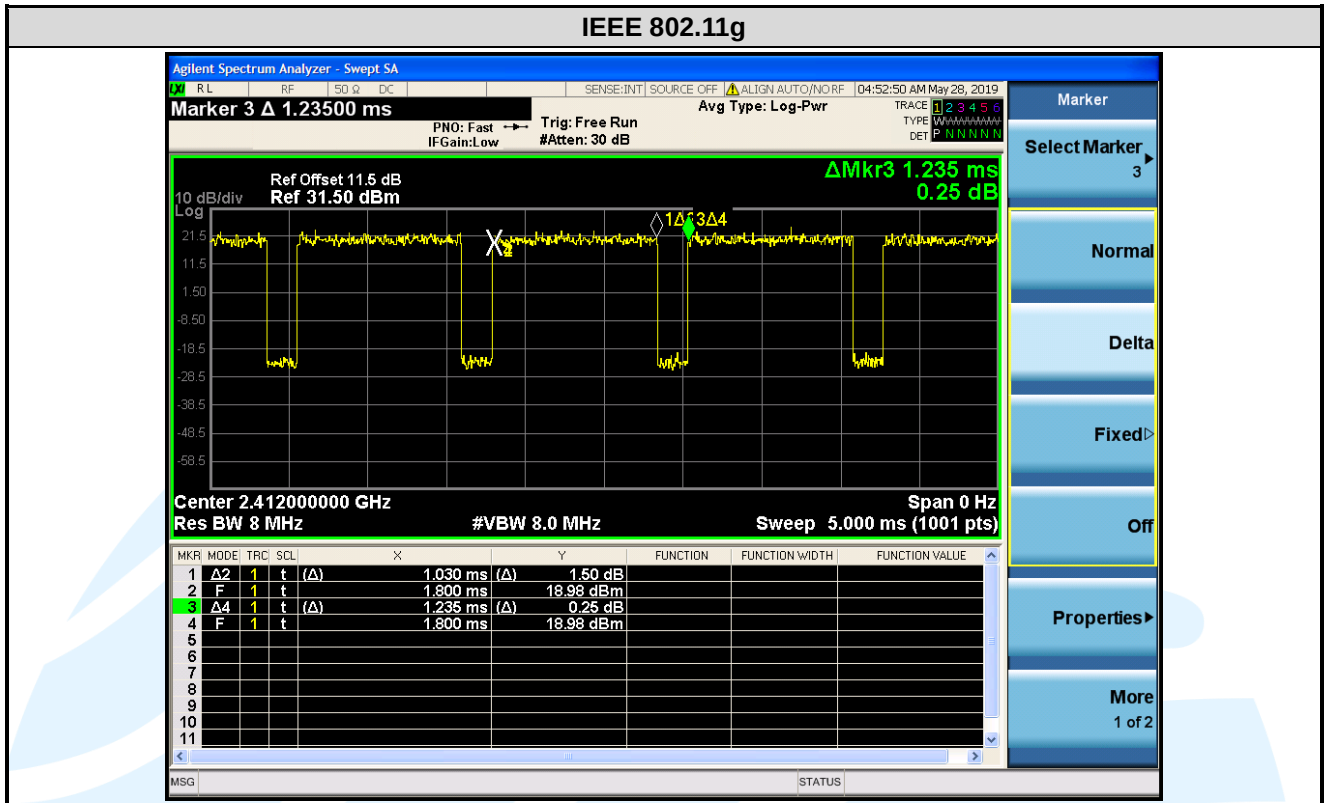
Mode	Data rates (Mbps)	On Time (msec)	Period (msec)	Duty Cycle (linear)	Duty Cycle (%)	Duty Cycle Factor (dB)	1/ T Minimum VBW (kHz)	Average Factor (dB)
IEEE 802.11b	1	6.260	6.460	0.97	96.90	0.14	0.16	-0.27
IEEE 802.11g	6	1.030	1.235	0.83	83.40	0.79	0.97	-1.58
IEEE 802.11n-HT20	MCS0	0.975	1.170	0.83	83.33	0.79	1.03	-1.58
IEEE 802.11n-HT40	MCS0	0.483	0.684	0.71	70.61	1.51	2.07	-3.02

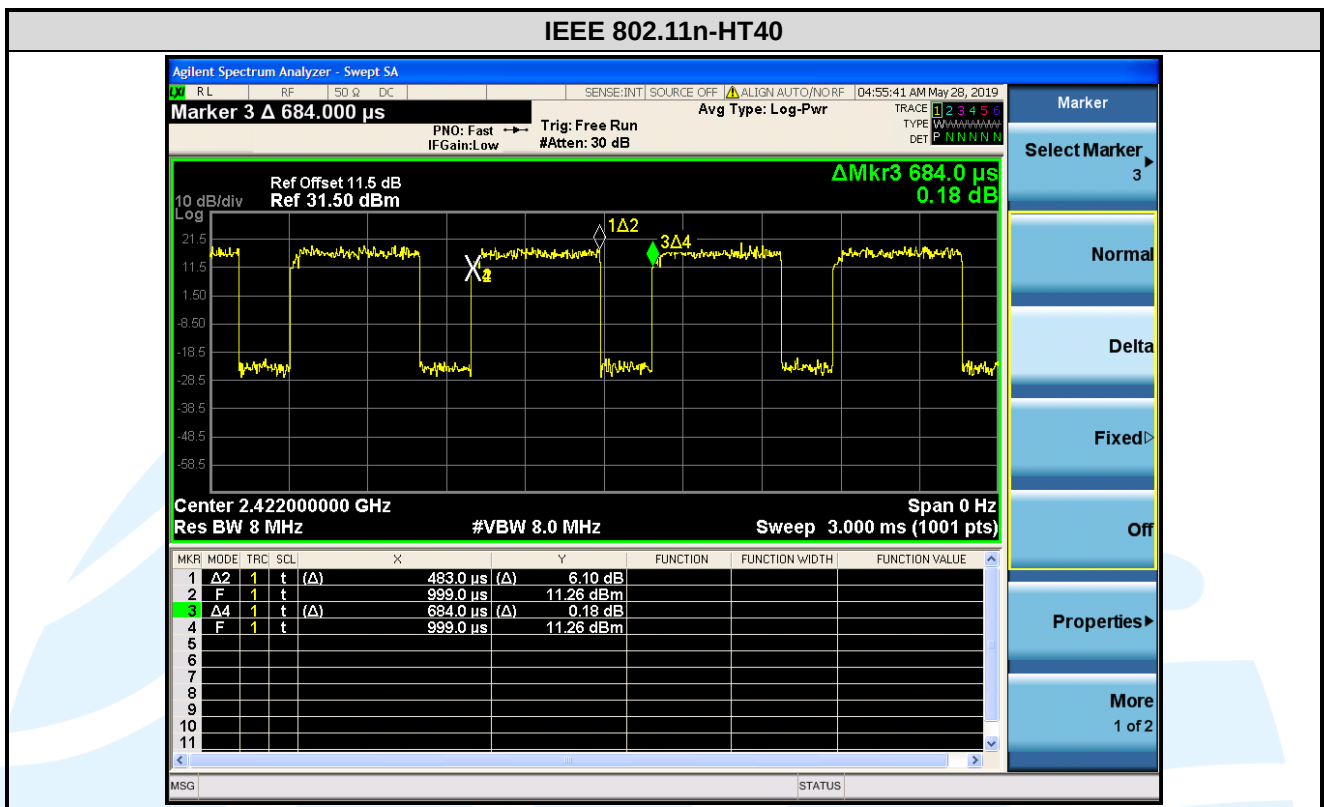
Remark:

- 1) Duty cycle= On Time/ Period;
- 2) Duty Cycle factor = $10 * \log(1/ \text{Duty cycle})$;
- 3) Average factor = $20 \log_{10} \text{Duty Cycle}$.

The test plots as follows







Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China

Tel: +86-755-28230888

Fax: +86-755-28230886

E-mail: info@uttlab.com
[Http://www.uttlab.com](http://www.uttlab.com)

5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part 2	Frequency allocations and radio treaty matters; general rules and regulations
2	FCC 47 CFR Part 15	Radio Frequency Devices
3	RSS-247 Issue 2	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
4	RSS-Gen Issue 5	General Requirements for Compliance of Radio Apparatus
5	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices
6	KDB 558074 D01 15.247 Meas Guidance v05r02	Guidance for compliance measurements on Digital Transmission Systems, Frequency Hopping Spread Spectrum system, and Hybrid system devices operating under Section 15.247 of the FCC rules

5.2 ANTENNA REQUIREMENT

Standard Requirement
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. 15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi. RSS-Gen Issue 5, Section 6.8 requirement: According to RSS-Gen Issue 5, Section 6.8, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns.
EUT Antenna: Antenna in the interior of the equipment and no consideration of replacement. The gain of the antenna is -4.17 dBi.

5.3 CONDUCTED PEAK OUTPUT POWER

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.247 (b)(3)
RSS-247 Issue 2, Section 5.4(d)

Test Method: ANSI C63.10-2013 Clause 11.9.1.3

Limit: For systems using digital modulation in the 2400-2483.5 MHz bands: 1 Watt.

Test Procedure:

1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.
2. Measure out each test modes' peak or average output power, record the power level.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.5.3 for details.

Instruments Used: Refer to section 3 for details

Test Results:

Mode	Channel/ Frequency (MHz)	Maximum Conducted Average Power (dBm)	Maximum Conducted Peak Power (dBm)	Maximum e.i.r.p (dBm)	Limit (dBm)	Pass / Fail
IEEE 802.11b	1(2412)	17.16	20.03	15.86	30	Pass
	6(2437)	17.34	20.48	16.31	30	Pass
	11(2462)	17.05	19.86	15.69	30	Pass
IEEE 802.11g	1(2412)	16.30	24.08	19.91	30	Pass
	6(2437)	16.51	24.29	20.12	30	Pass
	11(2462)	16.25	23.94	19.77	30	Pass
IEEE 802.11n-HT20	1(2412)	14.05	23.11	18.94	30	Pass
	6(2437)	14.27	23.39	19.22	30	Pass
	11(2462)	14.00	23.07	18.90	30	Pass
IEEE 802.11n-HT40	3(2422)	14.15	23.31	19.14	30	Pass
	6(2437)	14.24	23.44	19.27	30	Pass
	9(2452)	14.18	23.37	19.20	30	Pass

Note: The antenna gain of -4.17 dBi less than 6dBi maximum permission antenna gain value based on 1 watt (30dBm) peak output power limit.

5.46 DB BANDWIDTH & OCCUPIED BANDWIDTH

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2)
 RSS-247 Issue 2, Section 5.2(a)
 RSS-Gen Issue 5, Section 6.7

Test Method: ANSI C63.10-2013 Clause 11.8.1
 RSS-Gen Issue 5, Section 6.7

Limit: For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

Test Procedure: Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
 Use the following spectrum analyzer settings:

6dB Bandwidth

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Occupied Bandwidth

- Set RBW = 1% to 5% of the occupied bandwidth
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.5.3 for details.

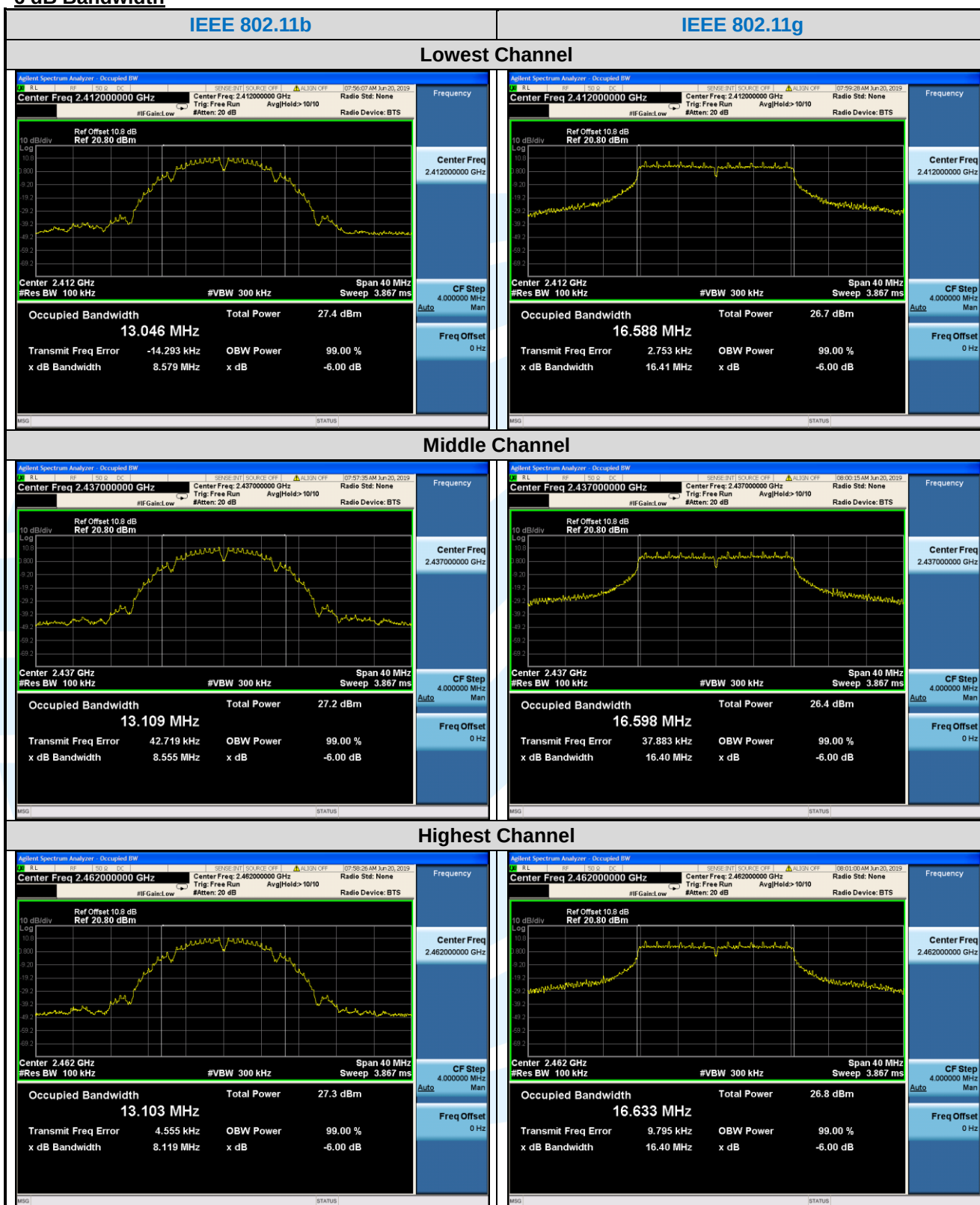
Instruments Used: Refer to section 3 for details

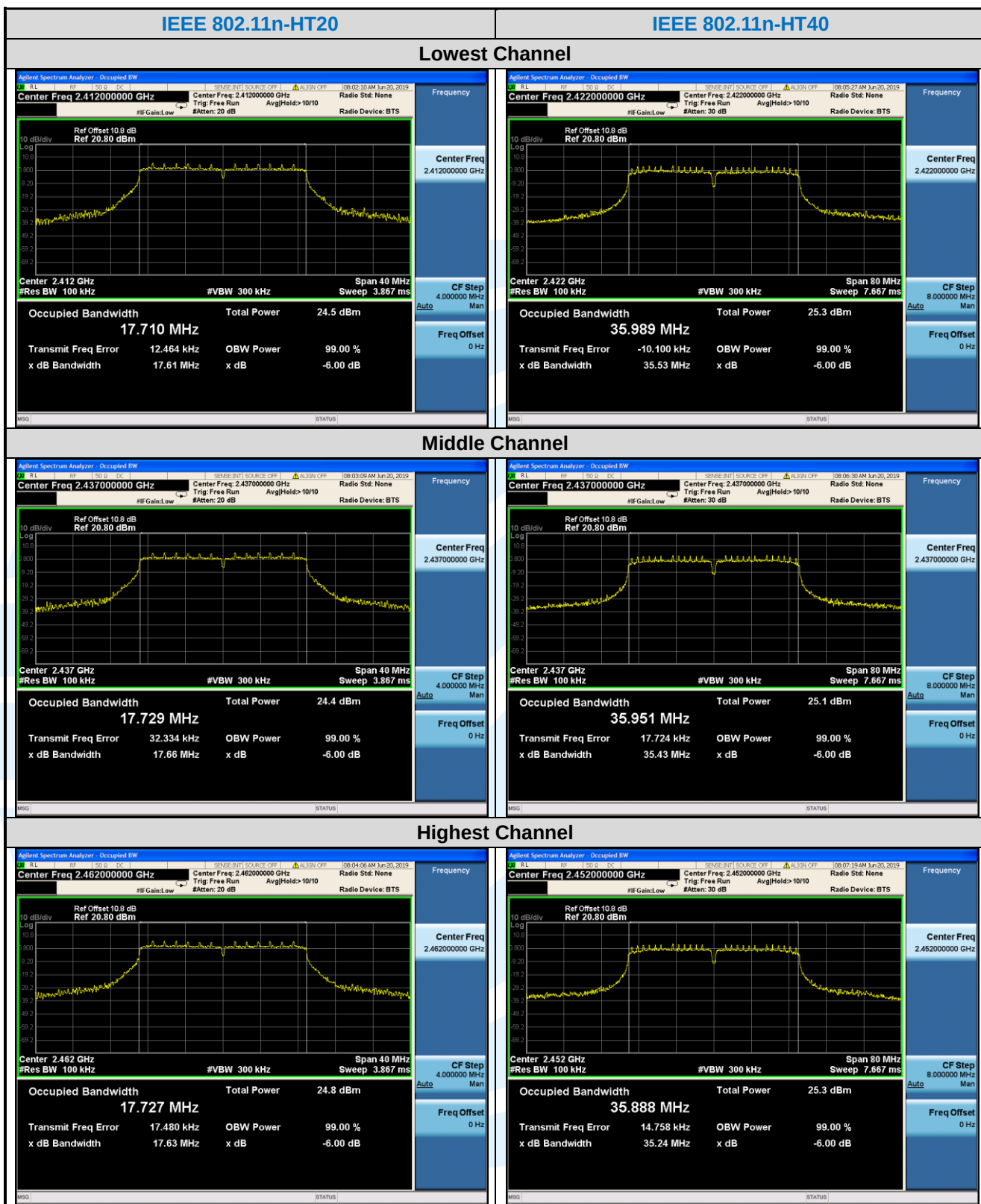
Test Results:

Mode	Channel/ Frequency (MHz)	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)	6 dB Bandwidth Limit	Pass / Fail
IEEE 802.11b	1(2412)	8.579	13.087	> 500 kHz	Pass
	6(2437)	8.555	13.139	> 500 kHz	Pass
	11(2462)	8.119	13.148	> 500 kHz	Pass
IEEE 802.11g	1(2412)	16.41	17.232	> 500 kHz	Pass
	6(2437)	16.40	17.247	> 500 kHz	Pass
	11(2462)	16.40	17.535	> 500 kHz	Pass
IEEE 802.11n-HT20	1(2412)	17.61	18.116	> 500 kHz	Pass
	6(2437)	17.66	18.150	> 500 kHz	Pass
	11(2462)	17.63	18.198	> 500 kHz	Pass
IEEE 802.11n-HT40	3(2422)	35.53	36.423	> 500 kHz	Pass
	6(2437)	35.43	36.362	> 500 kHz	Pass
	9(2452)	35.24	36.294	> 500 kHz	Pass

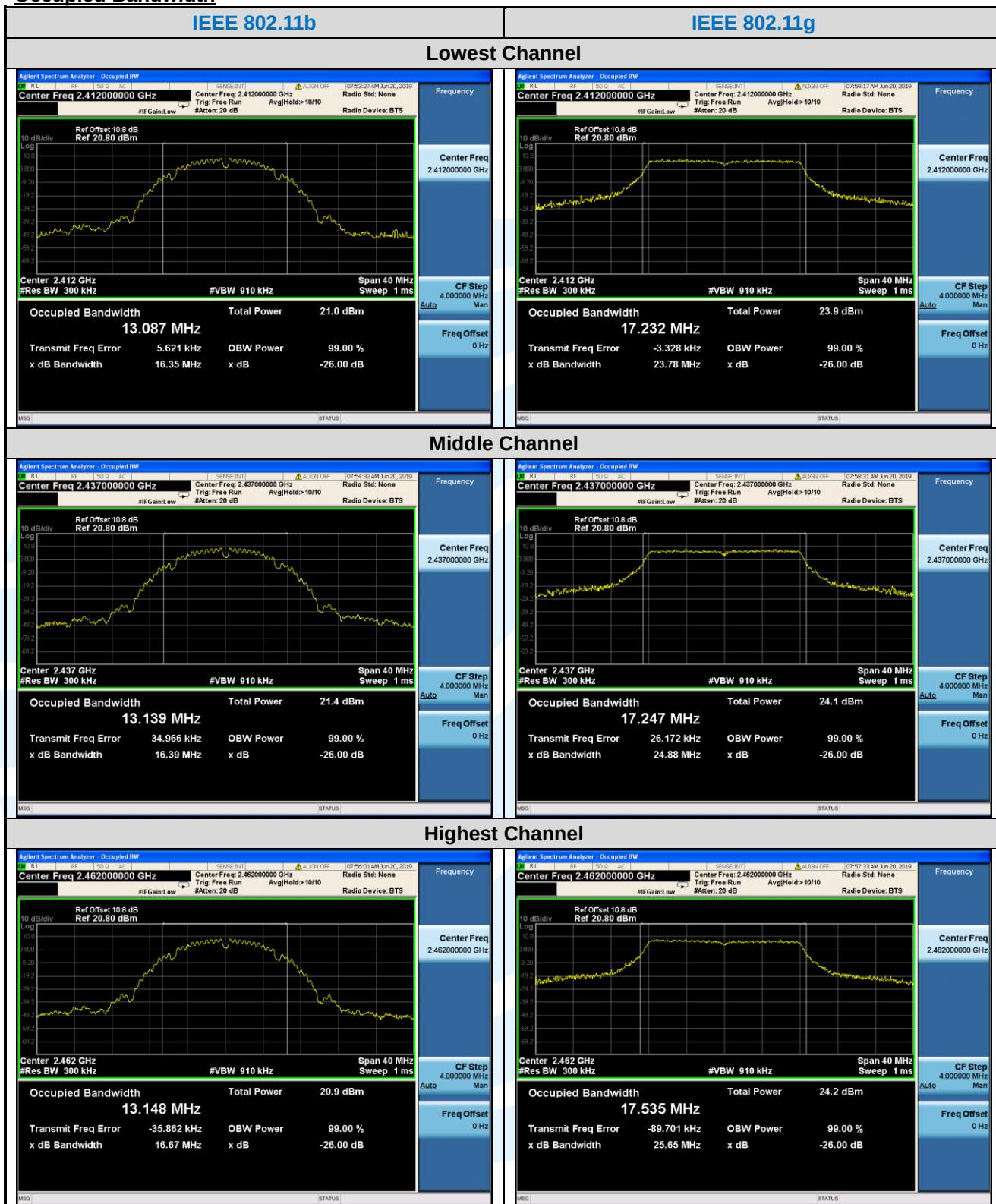
The test plots as follows:

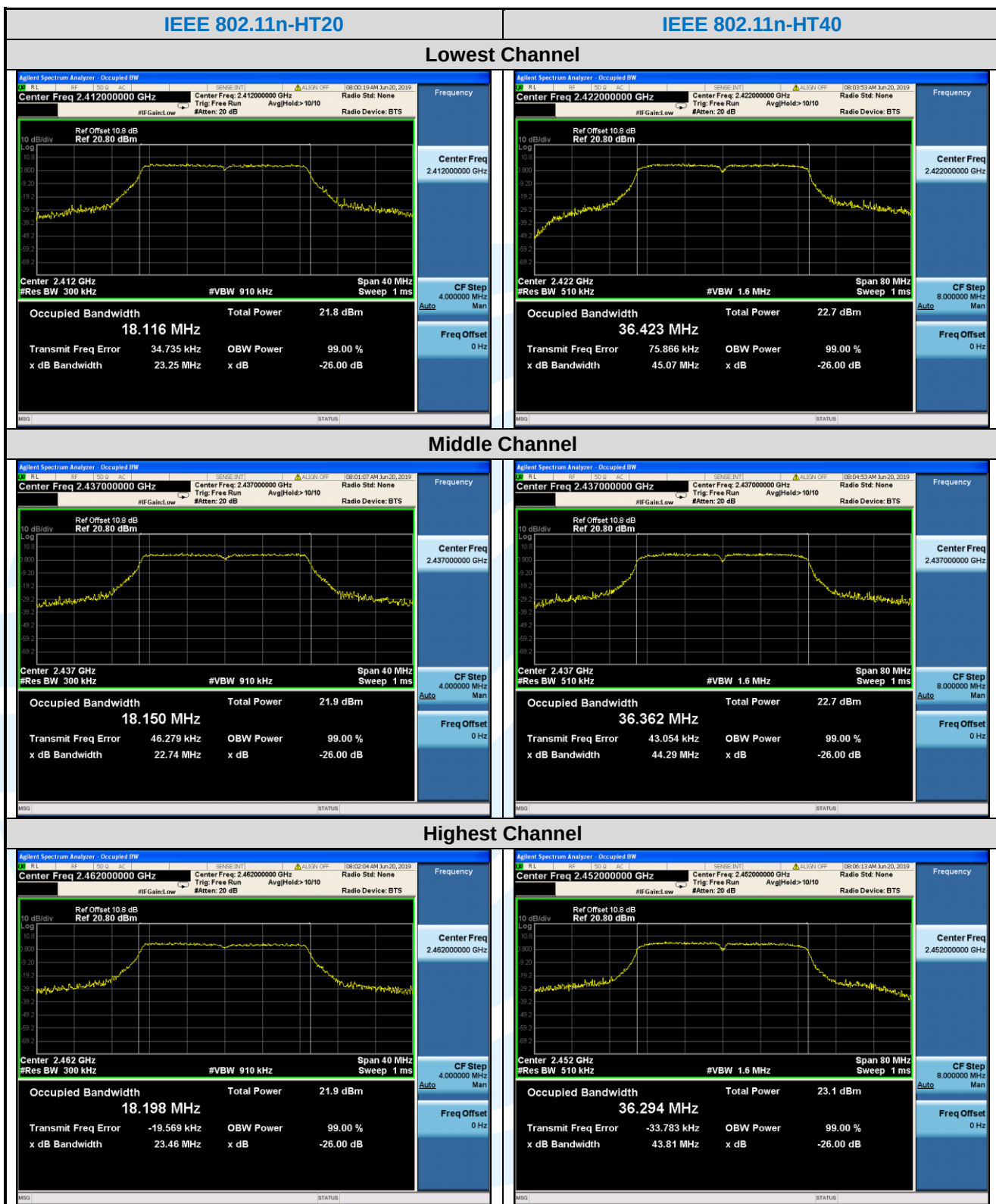
6 dB Bandwidth





Occupied Bandwidth



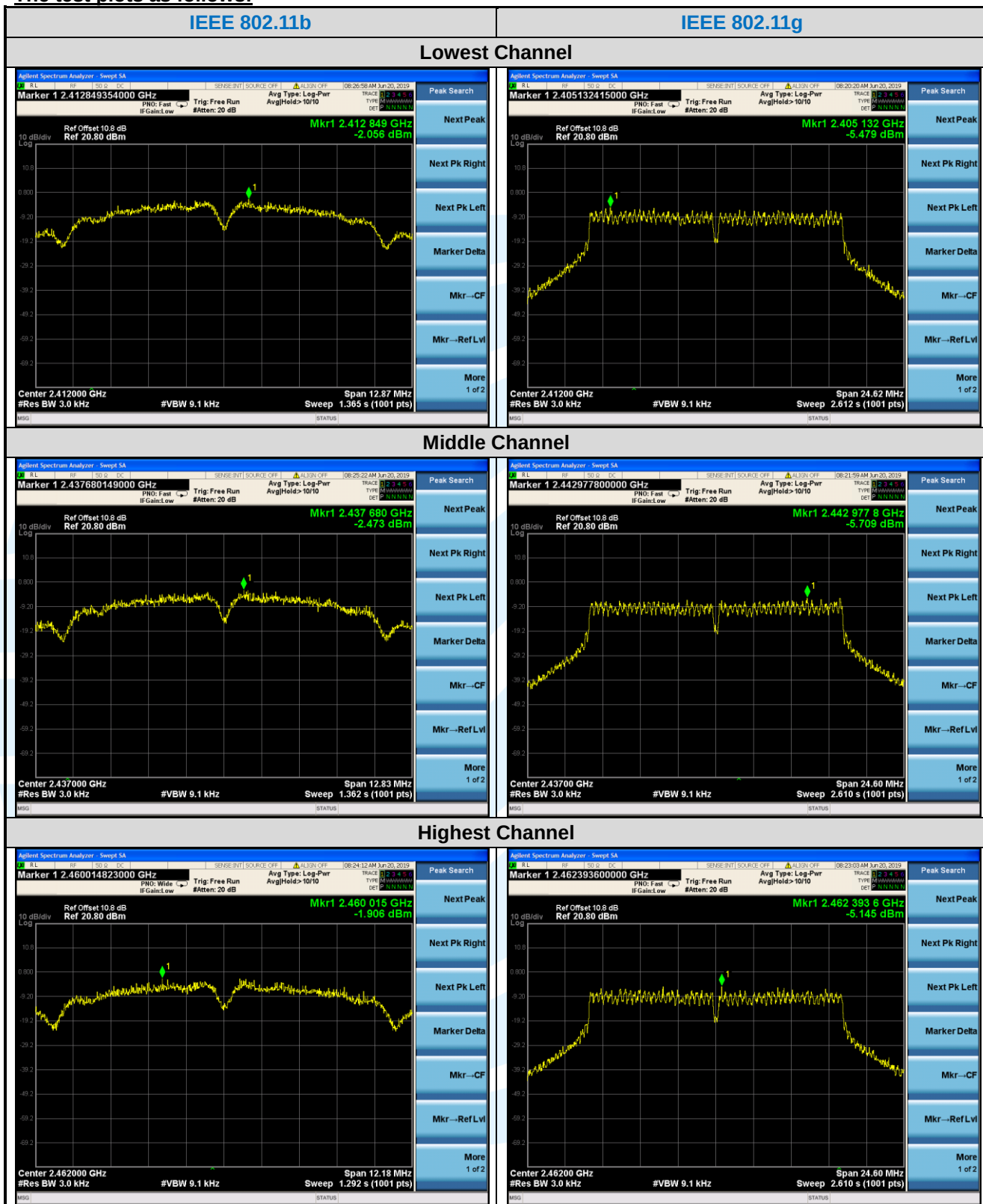


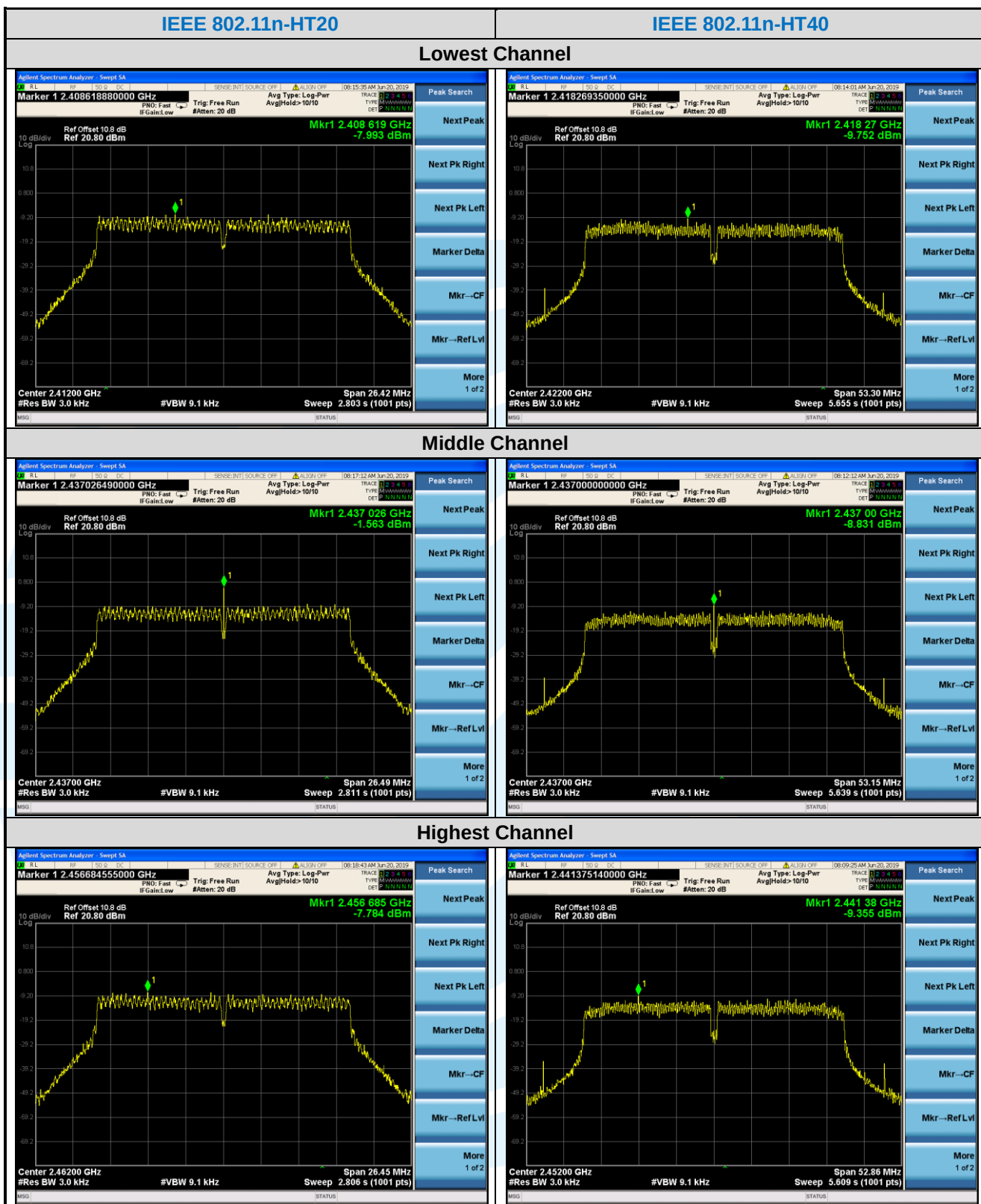
5.5 POWER SPECTRAL DENSITY

Test Requirement:	FCC 47 CFR Part 15 Subpart C Section 15.247 (e) RSS-247 Issue 2, Section 5.2(b)
Test Method:	ANSI C63.10-2013 Clause 11.10.2
Limit:	For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.
Test Procedure:	Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer. Use the following spectrum analyzer settings: - Set analyzer center frequency to DTS channel center frequency. - Set the span to 1.5 times the DTS bandwidth. - Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$. - Set the VBW $\geq 3 \times \text{RBW}$. - Detector = peak. - Sweep time = auto couple. - Trace mode = max hold. - Allow trace to fully stabilize. - Use the peak marker function to determine the maximum amplitude level within the RBW. - If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat. Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.
Test Setup:	Refer to section 4.5.3 for details.
Instruments Used:	Refer to section 3 for details
Test Results:	

Mode	Channel/ Frequency (MHz)	PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)	Pass / Fail
IEEE 802.11b	1(2412)	-2.056	8	Pass
	6(2437)	-2.473	8	Pass
	11(2462)	-1.906	8	Pass
IEEE 802.11g	1(2412)	-5.479	8	Pass
	6(2437)	-5.709	8	Pass
	11(2462)	-5.145	8	Pass
IEEE 802.11n-HT20	1(2412)	-7.993	8	Pass
	6(2437)	-1.563	8	Pass
	11(2462)	-7.784	8	Pass
IEEE 802.11n-HT40	3(2422)	-9.752	8	Pass
	6(2437)	-8.831	8	Pass
	9(2452)	-9.355	8	Pass

The test plots as follows:





5.6 CONDUCTED OUT OF BAND EMISSION

Test Requirement:	FCC 47 CFR Part 15 Subpart C Section 15.247(d) RSS-247 Issue 2, Section 5.5
Test Method:	ANSI C63.10-2013 Clause 11.11
Limit:	In any 100kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.
Test Procedure:	Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer. Use the following spectrum analyzer settings: Step 1: Measurement Procedure REF a) Set instrument center frequency to DTS channel center frequency. b) Set the span to ≥ 1.5 times the DTS bandwidth. c) Set the RBW = 100 kHz. d) Set the VBW $\geq 3 \times$ RBW. e) Detector = peak. f) Sweep time = auto couple. g) Trace mode = max hold. h) Allow trace to fully stabilize. i) Use the peak marker function to determine the maximum PSD level. j) Note that the channel found to contain the maximum PSD level can be used to establish the reference level. Step 2: Measurement Procedure OOB a) Set RBW = 100 kHz. b) Set VBW ≥ 300 kHz. c) Detector = peak. d) Sweep = auto couple. e) Trace Mode = max hold. f) Allow trace to fully stabilize. g) Use the peak marker function to determine the maximum amplitude level. Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.
Test Setup:	Refer to section 4.5.3 for details.
Instruments Used:	Refer to section 3 for details
Test Results:	Pass

The test plots as follows:

