Page: 1 of 114

FCC TEST REPORT

Application No: ZR/2019/A0026

Applicant: Lenovo(Shanghai) Electronics Technology Co., Ltd.

Address of Applicant: Section 304-305, Building No. 4, # 222, Meiyue Road, China (Shanghai)

Pilot Free Trade Zone

Manufacturer: Lenovo PC HK Limited

Address of Manufacturer 23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay, Hong

Kong P.R.China

Factory: MOTOROLA (WUHAN) MOBILITY TECHNOLOGIES COMMNICATION

CO. LTD.

Address of Factory: 19 GAOXIN 4TH RD, EAST LAKE HIGH TECH ZONE, WUHAN HUBEI

CHINA

EUT Description: Portable Tablet Computer

Model No.: Lenovo TB-X606F

Trade Mark: Lenovo

FCC ID: O57TBX606F

Standards: 47 CFR FCC Part 2, Subpart J

47 CFR Part 15, Subpart C

Test Method: KDB558074 D01 15.247 Meas Guidance v05r02

ANSI C63.10 (2013)

Date of Receipt: 2019/11/9

Date of Test: 2019/11/10 to 2019/11/21

Date of Issue: 2019/12/12

Test Result: PASS *

Derek Yang

Derele yang

Wireless Laboratory Manager



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^{. *} In the configuration tested, the EUT complied with the standards specified above.

Page: 2 of 114

1 Version

	Revision Record					
Version Chapter Date Modifier Remark						
00		2019/12/12		Original		

Authorized for issue by:		
Tested By	Nike Mu	2019/12/12
	(Mike Hu) /Project Engineer	Date
Checked By	David Chen	2019/12/12
	(David Chen) /Reviewer	Date



Page: 3 of 114

2 Test Summary

Test Item	Test Requirement	Test method	Test Result	Result
AC Power Line Conducted Emission	15.207	ANSI C63.10 2013	Clause 4.2	PASS
Duty Cycle	-		Clause 4.3	PASS
Conducted Output Power	15.247 (b)(3)	ANSI C63.10 2013	Clause 4.4	PASS
DTS (6 dB) Bandwidth & 99% Occupied Bandwidth	15.247 (a)(2)	ANSI C63.10 2013	Clause 4.5	PASS
Power Spectral Density	15.247 (e)	ANSI C63.10 2013	Clause 4.6	PASS
Band-edge for RF Conducted Emissions	15.247(d)	ANSI C63.10 2013	Clause 4.7	PASS
RF Conducted Spurious Emissions	15.247(d)	ANSI C63.10 2013	Clause 4.8	PASS
Radiated Spurious Emissions	15.247(d);15.205/15.209	ANSI C63.10 2013	Clause 4.9	PASS
Restricted bands around fundamental frequency (Radiated Emission)	15.247(d);15.205/15.209	ANSI C63.10 2013	Clause 4.10	PASS



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Page: 4 of 114

Contents

1	VERSION	2
2	TEST SUMMARY	
3	GENERAL INFORMATION	5
	3.1 CLIENT INFORMATION	5
	3.2 TEST LOCATION	
	3.3 TEST FACILITY	5
	3.4 GENERAL DESCRIPTION OF EUT	6
	3.5 TEST ENVIRONMENT AND MODE	7
	3.6 DESCRIPTION OF SUPPORT UNITS	7
4	TEST RESULTS AND MEASUREMENT DATA	7
	4.1 ANTENNA REQUIREMENT	7
	4.2 AC POWER LINE CONDUCTED EMISSIONS	
	4.3 DUTY CYCLE	
	4.3.1 Test Results	
	4.3.1 Test Plots	
	4.4 CONDUCTED OUTPUT POWER	14
	4.4.1 Test Results	
	4.5 DTS (6 dB) BANDWIDTH & 99% OCCUPIED BANDWIDTH	
	4.5.1 Test Results	
	4.5.2 Test plots	
	4.6 POWER SPECTRAL DENSITY	
	4.6.1 Test Results	
	4.6.2 Test plots	
	4.7 BAND-EDGE FOR RF CONDUCTED EMISSIONS	
	4.7.1 Test plots	
	4.8 RF CONDUCTED SPURIOUS EMISSIONS	
	4.8.1 Test plots	
	4.9 RADIATED SPURIOUS EMISSIONS	
	4.9.1 Radiated emission below 1GHz	
	4.9.2 Transmitter emission above 1GHz	
	4.10 RESTRICTED BANDS AROUND FUNDAMENTAL FREQUENCY	
	4.10.1 ANT1	
5	MEASUREMENT UNCERTAINTY (95% CONFIDENCE LEVELS, K=2)	112
6	EQUIPMENT LIST	113
7	PHOTOGRAPHS - ELIT CONSTRUCTIONAL DETAILS	11/



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Page: 5 of 114

3 General Information

3.1 Client Information

Applicant:	Lenovo(Shanghai) Electronics Technology Co., Ltd.		
Address of Applicant:	Section 304-305, Building No. 4, # 222, Meiyue Road, China (Shanghai) Pilot Free Trade Zone		
Manufacturer: Lenovo PC HK Limited			
Address of Manufacturer: 23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay, H P.R.China			
Factory:	MOTOROLA (WUHAN) MOBILITY TECHNOLOGIES COMMNICATION CO. LTD.		
Address of Factory:	19 GAOXIN 4TH RD, EAST LAKE HIGH TECH ZONE, WUHAN HUBEI CHINA		

3.2 Test Location

Company:	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
Address:	No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China
Post code:	518057
Telephone:	+86 (0) 755 2601 2053
Fax:	+86 (0) 755 2671 0594
E-mail:	ee.shenzhen@sgs.com

3.3 Test Facility

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

CNAS (No. CNAS L2929)

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• VCCI

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• FCC -Designation Number: CN1178

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

• Industry Canada (IC)



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Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.

3.4 General Description of EUT

	T		
EUT Description:	Portable Tablet Computer		
Model No.:	Lenovo TB-X606F		
Trade Mark:	Lenovo		
Hardware Version:	Lenovo Tablet TB-X606F		
Software Version:	TB-X606F_RF01_191026		
IEEE 802.11 WLAN Mode Supported	 ⊠ 802.11B (20 MHz channel bandwidth), ⊠ 802.11G (20 MHz channel bandwidth) ⊠ 802.11N (20 MHz channel bandwidth), □ 802.11N (40 MHz channel bandwidth) 		
Operation Frequency:	2400 MHz -2483.5MHz fc = 2407 MHz + N * 5 MHz, where: -fc = "Operating Frequency" in MHz, -N = "Channel Number" with the range from 1 to 11 for the 20 MHz channel bandwidth, or 3 to 9 for the 40 MHz channel bandwidth.		
Type of Modulation:	IEEE for 802.11B: DSSS IEEE for 802.11G: OFDM IEEE for 802.11N(HT20): OFDM		
Sample Type:	☑ Portable Device, ☐Module		
Antenna Type:	☐ External, ☑ Integrated		
Antenna Ports			
Smart System	 ⊠ SISO (for 802.11B/G/N), □ MIMO (for 802.11N): 2 Tx & 2 Rx, □ Diversity (for 802.11B/G): Tx & Rx 		
Antenna Gain:	0.43dBi		
Power Supply	☐ AC/DC Adapter; ☐ Battery ☐ PoE:; ☐ Other:		

Operation Frequency of each channel (802.11B/G/N HT20)							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2412MHz	4	2427MHz	7	2442MHz	10	2457MHz
2	2417MHz	5	2432MHz	8	2447MHz	11	2462MHz
3	2422MHz	6	2437MHz	9	2452MHz		

Remark

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:



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Page: 7 of 114

Channel	Frequency for 802.11B/G/N (HT20)	Frequency for 802.11N (HT40)	
The Lowest channel	2412MHz	2422MHz	
The Middle channel	2437MHz	2437MHz	
The Highest channel	2462MHz	2452MHz	

3.5 Test Environment and Mode

Operating Environment:			
Temperature:	25.0 °C		
Humidity:	50 % RH		
Atmospheric Pressure:	101.30 KPa		
Test mode:			
Transmitting mode:	Keep the EUT in transmitting mode with all kind of modulation and all kind of data rate.		

3.6 Description of Support Units

The EUT has been tested independent unit.

4 Test results and Measurement Data

4.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(c)

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.

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 0.43dBi.



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Page: 8 of 114

4.2 AC Power Line Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207			
Test Method:	ANSI C63.10: 2013			
Test Frequency Range:	150kHz to 30MHz			
	Frequency range (MHz)	Limit (d	BuV)	
	Frequency range (MHZ)	Quasi-peak	Average	
129	0.15-0.5	66 to 56*	56 to 46*	
Limit:	0.5-5	56	46	
	5-30	60	50	
	* Decreases with the logarith	nm of the frequency.		
Test Procedure:	room. 2) The EUT was connected Impedance Stabilization impedance. The power of to a second LISN 2, which plane in the same way as multiple socket outlet strict single LISN provided the 3) The tabletop EUT was placed on the horizontal 4) The test was performed of the EUT shall be 0.4 in vertical ground reference reference plane. The LIS unit under test and bond mounted on top of the ground the EUT and associated	 * Decreases with the logarithm of the frequency. 1) The mains terminal disturbance voltage test was conducted in a shielded room. 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded. 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2. 5) In order to find the maximum emission, the relative positions of 		



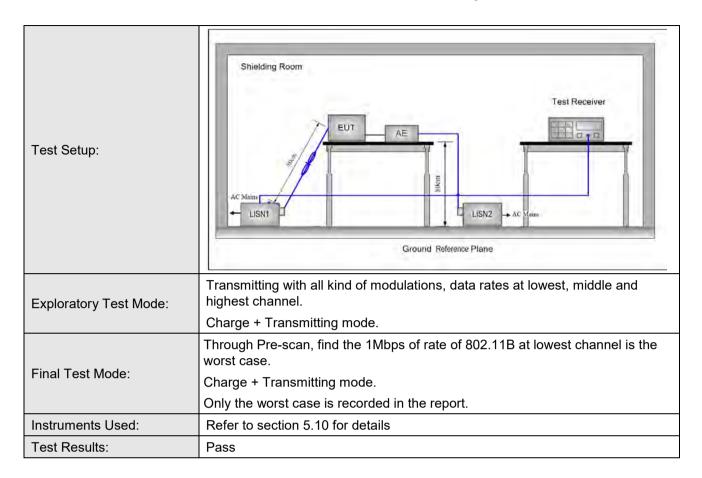
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Page: 9 of 114





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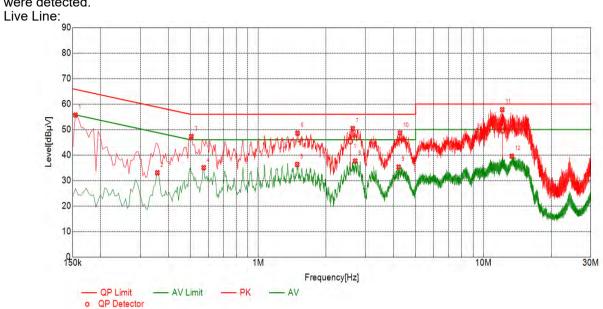
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10 of 114 Page:

Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.



Test Graph

	Suspected List						
NO.	Freq.[MHz]	Level[dBµV]	Factor[dB]	Limit[dBµV]	Margin[dB]	Detector	Туре
1	0.1545	55.68	10.10	65.75	10.07	PK	L
2	0.3570	33.06	10.10	48.80	15.74	AV	L
3	0.5055	47.32	10.10	56.00	8.68	PK	L
4	0.5730	35.05	10.10	46.00	10.95	AV	L
5	1.4910	36.32	10.10	46.00	9.68	AV	L
6	1.4955	48.60	10.10	56.00	7.40	PK	L
7	2.6295	50.41	10.10	56.00	5.59	PK	L
8	2.6970	37.68	10.10	46.00	8.32	AV	L
9	4.2045	35.29	10.10	46.00	10.71	AV	L
10	4.2630	48.69	10.10	56.00	7.31	PK	L
11	12.1245	57.81	10.10	60.00	2.19	PK	L
12	13.3710	39.54	10.11	50.00	10.46	AV	L



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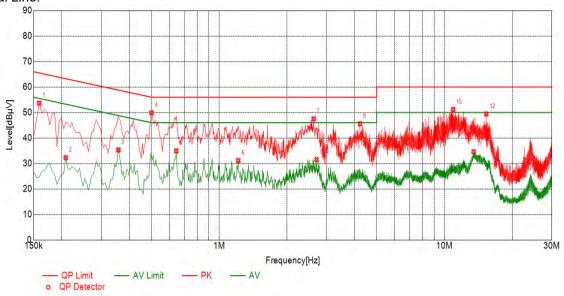
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Report No.: ZR/2019/A002602

11 of 114 Page:





Test Graph

rest Graph							
Suspected List							
NO.	Freq.[MHz]	Level[dBµ V]	Factor[dB]	Limit[dBµV	Margin[dB]	Detector	Туре
1	0.1590	53.66	10.10	65.52	11.86	PK	N
2	0.2085	32.28	10.10	53.26	20.98	AV	N
3	0.3570	35.30	10.10	48.80	13.50	AV	N
4	0.5010	49.91	10.10	56.00	6.09	PK	N
5	0.6450	34.96	10.10	46.00	11.04	AV	N
6	1.2165	31.13	10.10	46.00	14.87	AV	N
7	2.6295	47.50	10.10	56.00	8.50	PK	N
8	2.7060	31.54	10.10	46.00	14.46	AV	N
9	4.2225	45.57	10.10	56.00	10.43	PK	N
10	10.9410	51.21	10.10	60.00	8.79	PK	N
11	13.4790	34.61	10.11	50.00	15.39	AV	N
12	15.3510	49.42	10.11	60.00	10.58	PK	N

Remarks:

- 1. The following Quasi-Peak and Average measurements were performed on the EUT:
- 2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.



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Page: 12 of 114

4.3 Duty Cycle

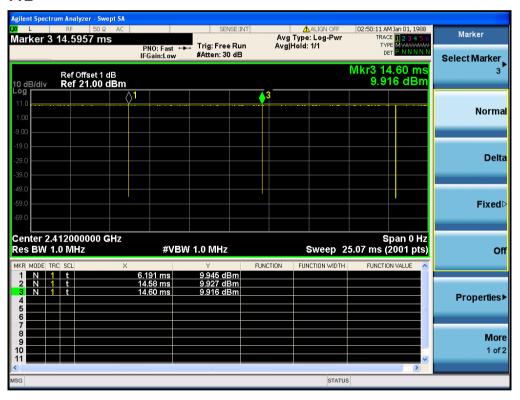
4.3.1 Test Results

Test Mode	TX Freq. [MHz]	Duty cycle [%]
11B	Ant 1: CH1	99.76
11G	Ant 1: CH1	97.05
11N20	Ant 1: CH1	98.27

4.3.1 Test Plots

4.3.1.1 ANT1

4.3.1.1.1 11B





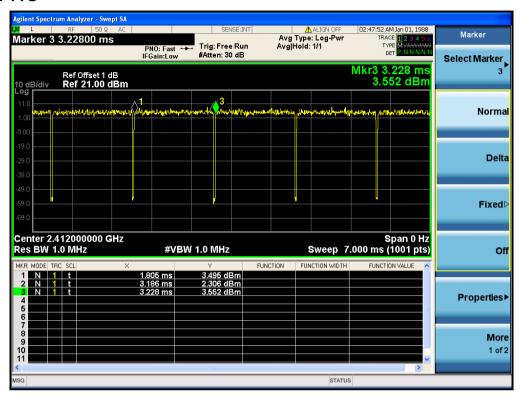
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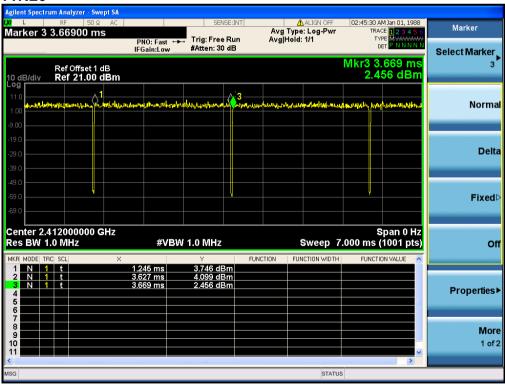
Report No.: ZR/2019/A002602

Page: 13 of 114

4.3.1.1.2 11G



4.3.1.1.3 11N20





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Page: 14 of 114

4.4 Conducted Output Power

Test Requirement:	47 CFR Part 15C Section 15.247 (b)(3)		
Test Method:	ANSI C63.10 :2013 Section 11.9.1.3		
Test Setup:	POWER METER E.U.T Non-Conducted Table Ground Reference Plane		
Test Instruments:	Refer to section 5.10 for details		
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates		
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G; 6.5Mbps of rate is the worst case of 802.11N(HT20);		
Limit:	30dBm		
Test Results: Pass			



Page: 15 of 114

4.4.1 Test Results

Measurement Data of Average Power:

Mode	Test Channel	Average Output Power (dBm) [Duty Cycle Considered]	Result
	Lowest	17.19	Report purpose only
802.11B	Middle	17.41	Report purpose only
002.112	Highest	17.08	Report purpose only
	Lowest	15.95	Report purpose only
802.11G	Middle	16.04	Report purpose only
302.110	Highest	15.77	Report purpose only
	Lowest	12.99	Report purpose only
802.11N20	Middle	16.12	Report purpose only
	Highest	12.79	Report purpose only

Measurement Data of Peak Power:

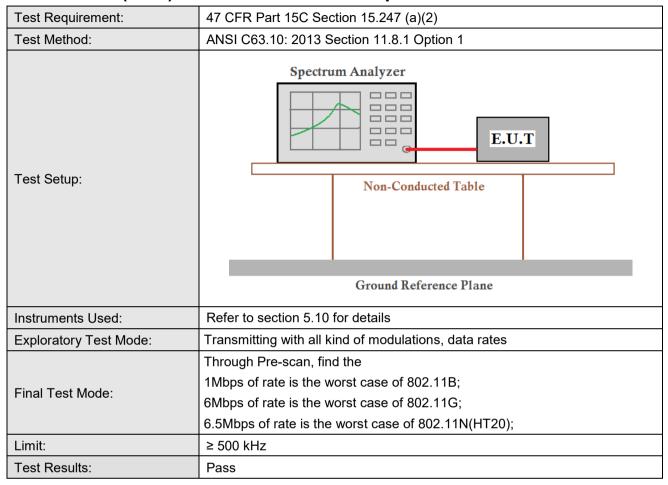
Mode	Test Channel	Peak Output Power (dBm)	Limit (dBm)	Result
	Lowest	17.56	30.00	Pass
802.11B	Middle	21.50	30.00	Pass
002.112	Highest	21.04	30.00	Pass
	Lowest	21.39	30.00	Pass
802.11G	Middle	21.58	30.00	Pass
302	Highest	21.17	30.00	Pass
	Lowest	20.85	30.00	Pass
802.11N20	Middle	21.07	30.00	Pass
332	Highest	20.67	30.00	Pass



Report No.: ZR/2019/A002602

Page: 16 of 114

4.5 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth



4.5.1 Test Results

Mode	Test Channel	Occupied Bandwidth (MHz)	6dB Emission Bandwidth (MHz)	Limit (kHz)	Result
	Lowest	12.67	12.70	≥500	Pass
802.11B	Middle	13.06	13.02	≥500	Pass
002.1115	Highest	12.90	12.87	≥500	Pass
	Lowest	16.41	16.30	≥500	Pass
802.11G	Middle	16.55	16.43	≥500	Pass
	Highest	16.43	16.32	≥500	Pass
	Lowest	17.50	17.50	≥500	Pass
802.11N20	Middle	17.68	17.60	≥500	Pass
002.111120	Highest	17.51	17.51	≥500	Pass



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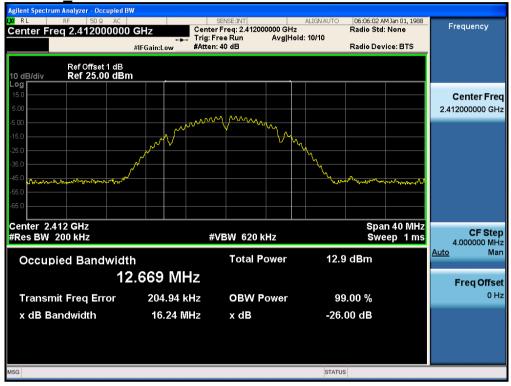
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Page: 17 of 114

4.5.2 Test plots

4.5.2.1 ANT1

4.5.2.1.1 802.11B Lowest Channel





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Report No.: ZR/2019/A002602

Page: 19 of 114

4.5.2.1.2 802.11B Middle Channel





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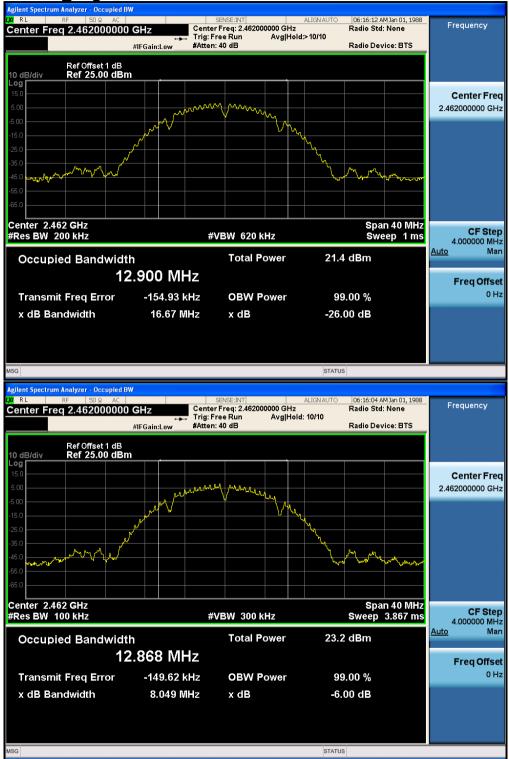
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Report No.: ZR/2019/A002602

Page: 20 of 114

4.5.2.1.3 802.11B_ Highest Channel





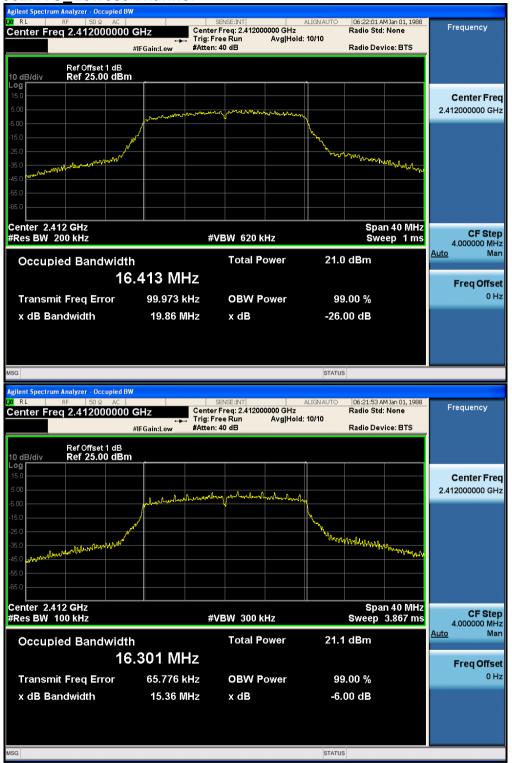
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Page: 21 of 114

4.5.2.1.4 802.11G Lowest Channel





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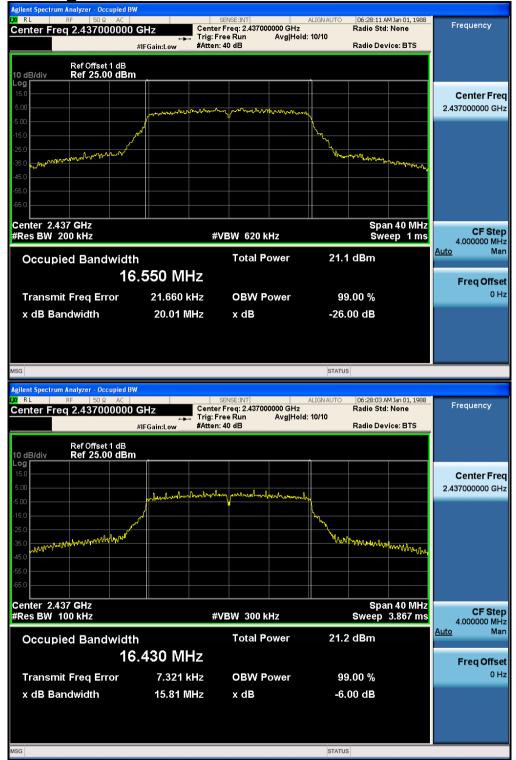
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Page: 22 of 114

4.5.2.1.5 802.11G Middle Channel





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4.5.2.1.6 802.11G_ Highest Channel





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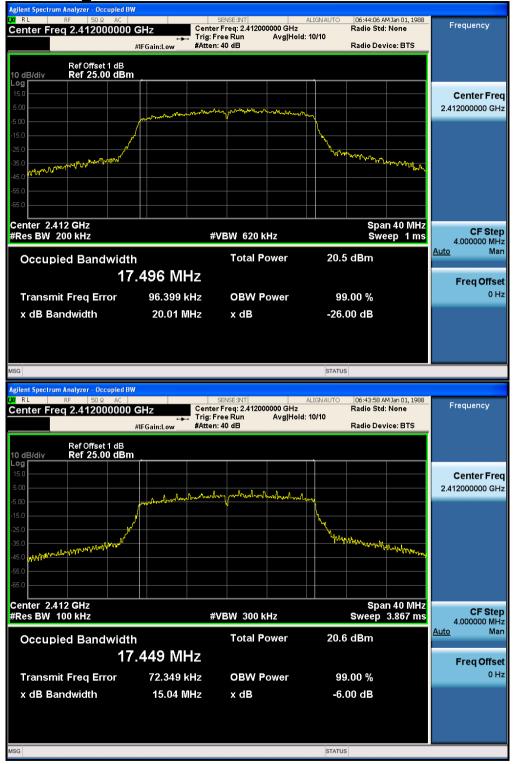
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Report No.: ZR/2019/A002602

Page: 24 of 114

4.5.2.1.7 802.11N20 Lowest Channel





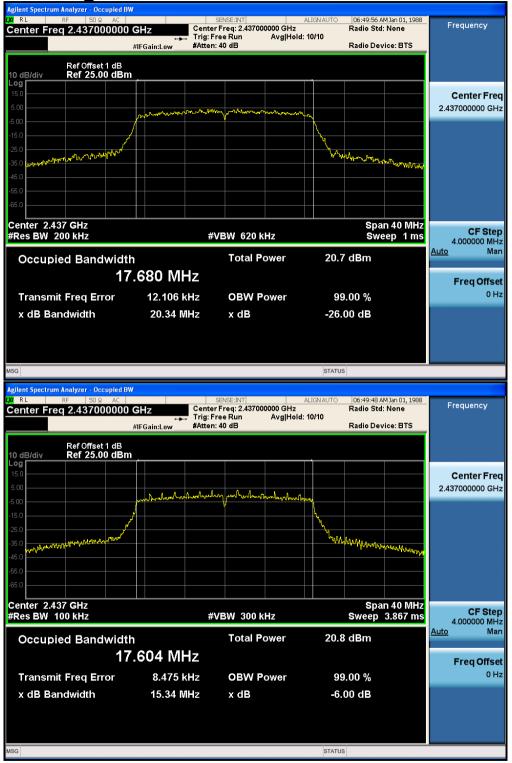
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Report No.: ZR/2019/A002602

Page: 25 of 114

4.5.2.1.8 802.11 N20_ Middle Channel





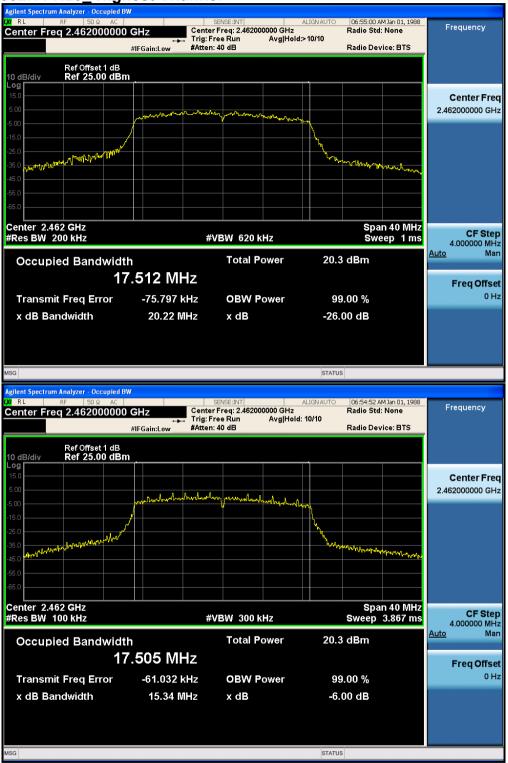
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Report No.: ZR/2019/A002602

Page: 26 of 114

4.5.2.1.9 802.11 N20_ Highest Channel



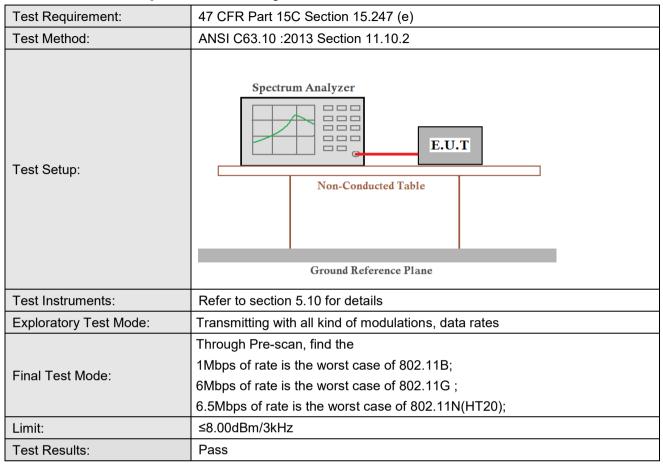


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Page: 27 of 114

4.6 Power Spectral Density



4.6.1 Test Results

Mode	Test Channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
	Lowest	-6.57	≤8.00	Pass
802.11B	Middle	-4.49	≤8.00	Pass
3322	Highest	-6.10	≤8.00	Pass
	Lowest	-9.99	≤8.00	Pass
802.11G	Middle	-9.71	≤8.00	Pass
002.110	Highest	-9.44	≤8.00	Pass
	Lowest	-11.12	≤8.00	Pass
802.11N20	Middle	-10.41	≤8.00	Pass
	Highest	-10.70	≤8.00	Pass



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Report No.: ZR/2019/A002602

28 of 114 Page:

4.6.2 **Test plots**

4.6.2.1 ANT1

4.6.2.1.1 802.11B Lowest Channel





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Report No.: ZR/2019/A002602

Page: 29 of 114

4.6.2.1.2 802.11B Middle Channel



4.6.2.1.3 802.11B_ Highest Channel





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4.6.2.1.4 802.11G Lowest Channel



4.6.2.1.5 802.11G_ Middle Channel





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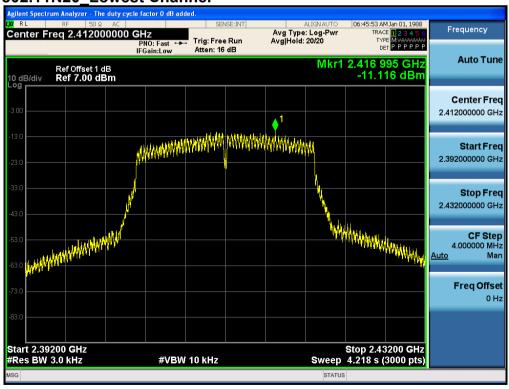
Report No.: ZR/2019/A002602

Page: 31 of 114

4.6.2.1.6 802.11G_ Highest Channel



4.6.2.1.7 802.11N20 Lowest Channel





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Report No.: ZR/2019/A002602

Page: 32 of 114

4.6.2.1.8 802.11 N20 Middle Channel



4.6.2.1.9 802.11 N20_ Highest Channel





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Page: 33 of 114

4.7 Band-edge for RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)		
Test Method:	ANSI C63.10: 2013 Section 11.13		
Test Setup:	Spectrum Analyzer E.U.T Non-Conducted Table Ground Reference Plane		
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates		
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G; 6.5Mbps of rate is the worst case of 802.11N(HT20);		
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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		
Instruments Used:	Refer to section 5.10 for details		
Test Results:	Pass		



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Report No.: ZR/2019/A002602

34 of 114 Page:

4.7.1 **Test plots**

4.7.1.1 ANT1

4.7.1.1.1 802.11B Lowest Channel





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Report No.: ZR/2019/A002602

Page: 35 of 114

4.7.1.1.2 802.11B_ Highest Channel



4.7.1.1.3 802.11G Lowest Channel





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Report No.: ZR/2019/A002602

Page: 36 of 114

4.7.1.1.4 802.11G_ Highest Channel



4.7.1.1.5 802.11N20 Lowest Channel





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Report No.: ZR/2019/A002602

Page: 37 of 114

4.7.1.1.6 802.11 N20_ Highest Channel





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Report No.: ZR/2019/A002602

Page: 38 of 114

4.8 RF Conducted Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.11
Test Setup:	Spectrum Analyzer E.U.T Non-Conducted Table Ground Reference Plane
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G; 6.5Mbps of rate is the worst case of 802.11N(HT20);
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass





Report No.: ZR/2019/A002602

39 of 114 Page:

4.8.1 **Test plots**

4.8.1.1 ANT1

4.8.1.1.1 802.11B Lowest Channel





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Report No.: ZR/2019/A002602

Page: 40 of 114





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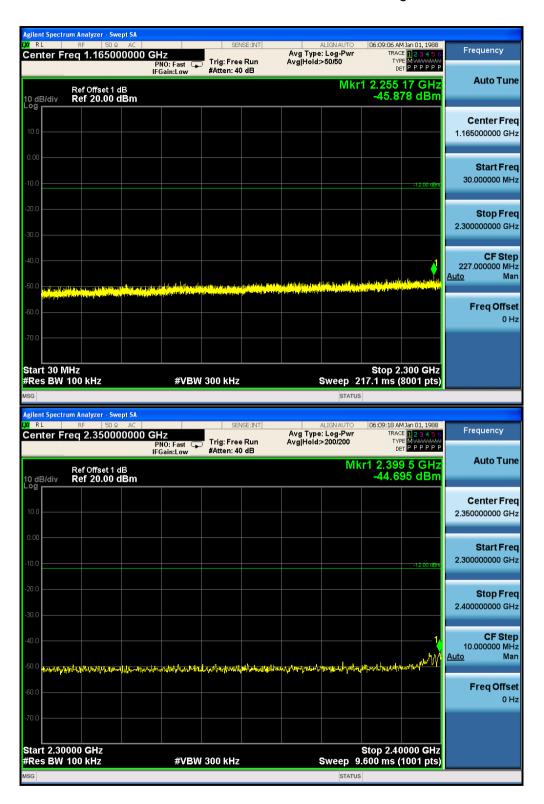
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Report No.: ZR/2019/A002602

Page: 41 of 114



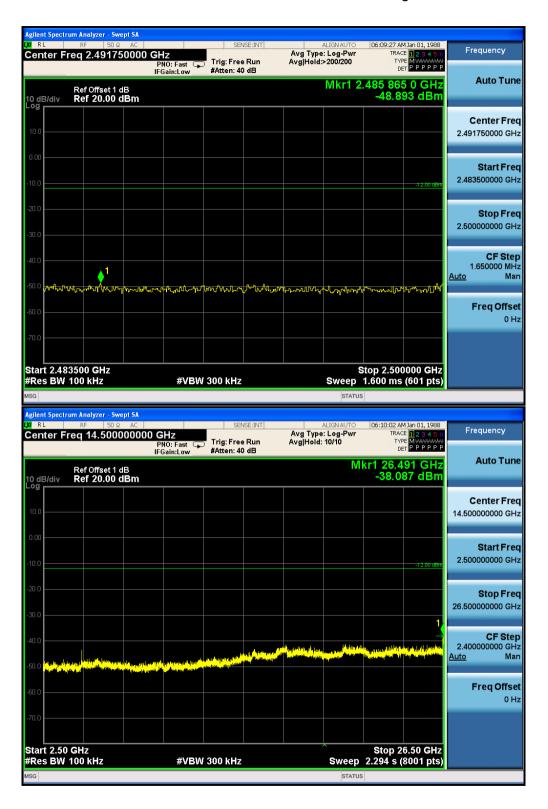


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Report No.: ZR/2019/A002602

Page: 42 of 114





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Report No.: ZR/2019/A002602

43 of 114 Page:

4.8.1.1.2 802.11B Middle Channel





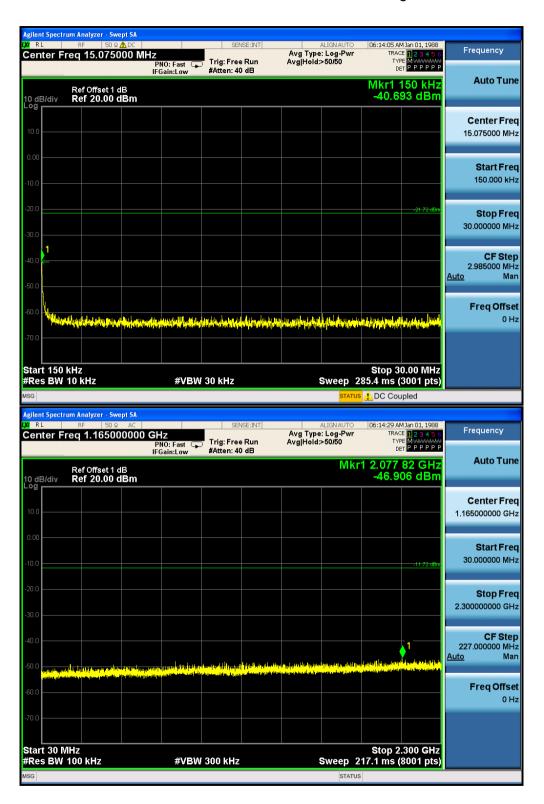
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Report No.: ZR/2019/A002602

Page: 44 of 114



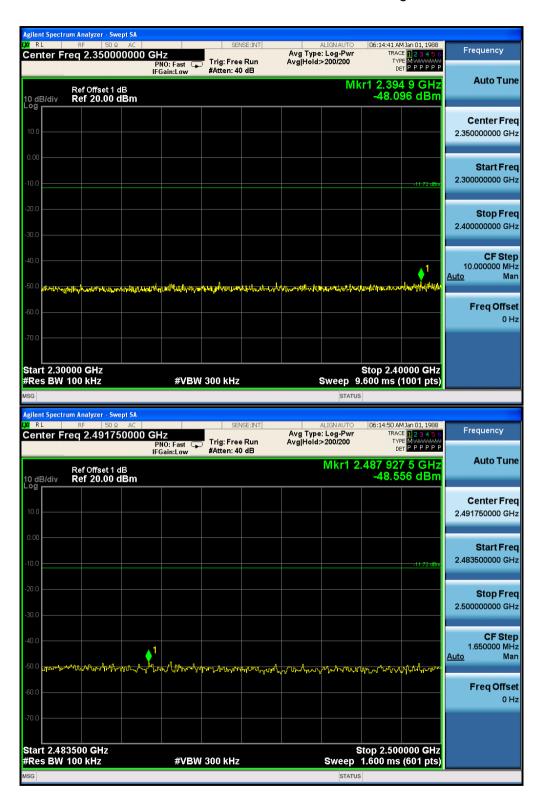


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Report No.: ZR/2019/A002602

Page: 45 of 114



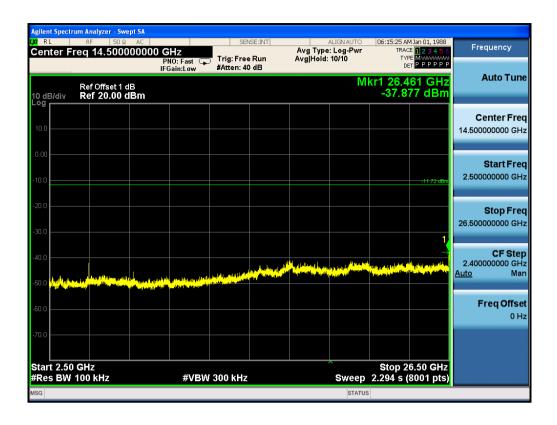


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Report No.: ZR/2019/A002602

46 of 114 Page:





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Report No.: ZR/2019/A002602

47 of 114 Page:

4.8.1.1.3 802.11B_ Highest Channel





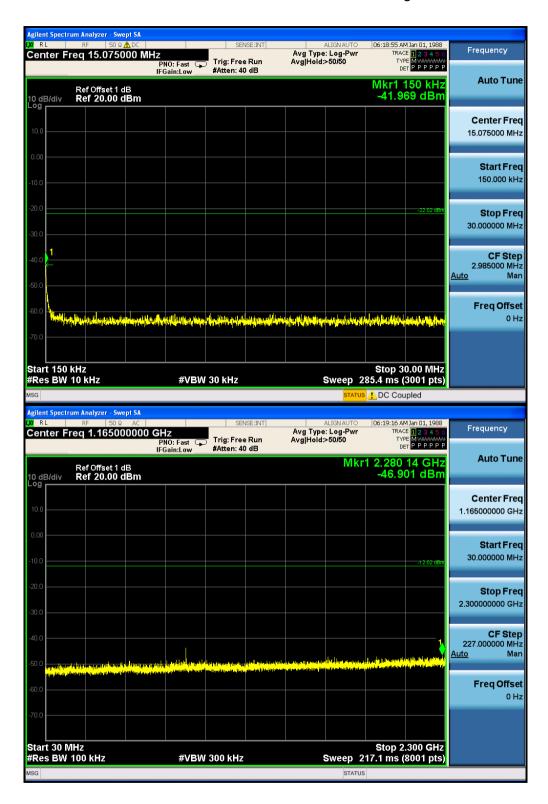
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Report No.: ZR/2019/A002602

Page: 48 of 114



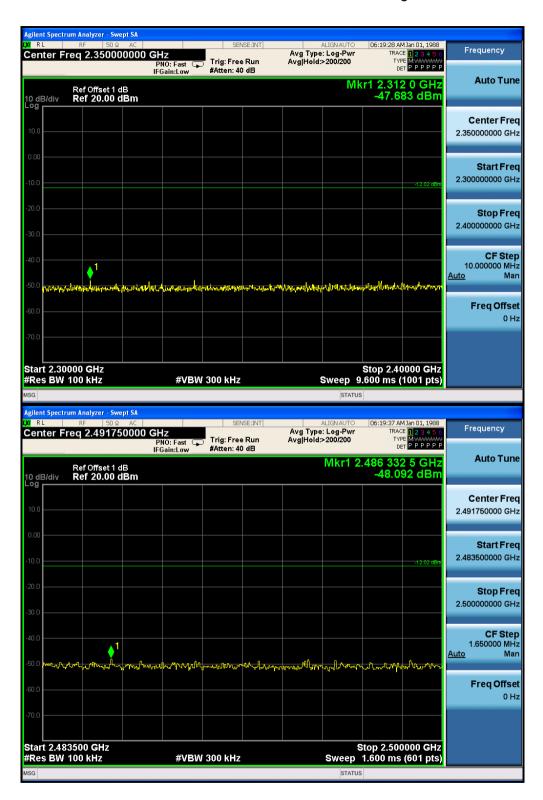


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Page: 49 of 114





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Report No.: ZR/2019/A002602

50 of 114 Page:





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Report No.: ZR/2019/A002602

Page: 51 of 114

4.8.1.1.4 802.11G Lowest Channel



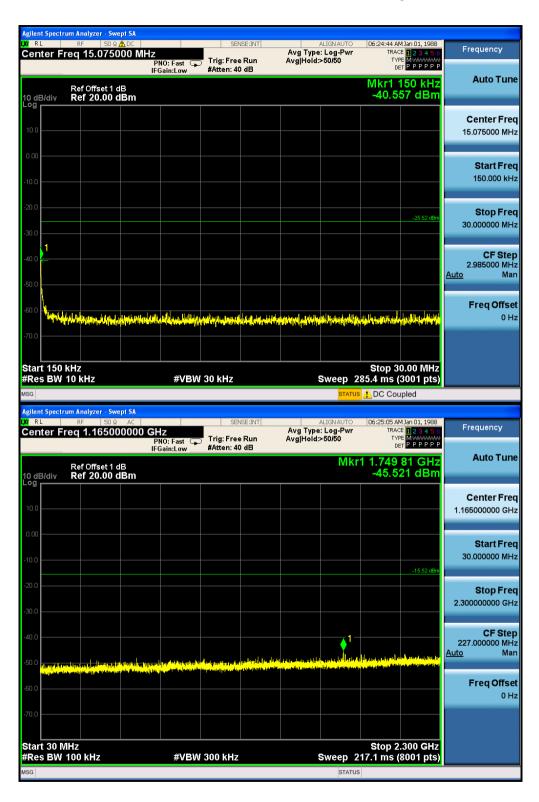


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Report No.: ZR/2019/A002602

Page: 52 of 114



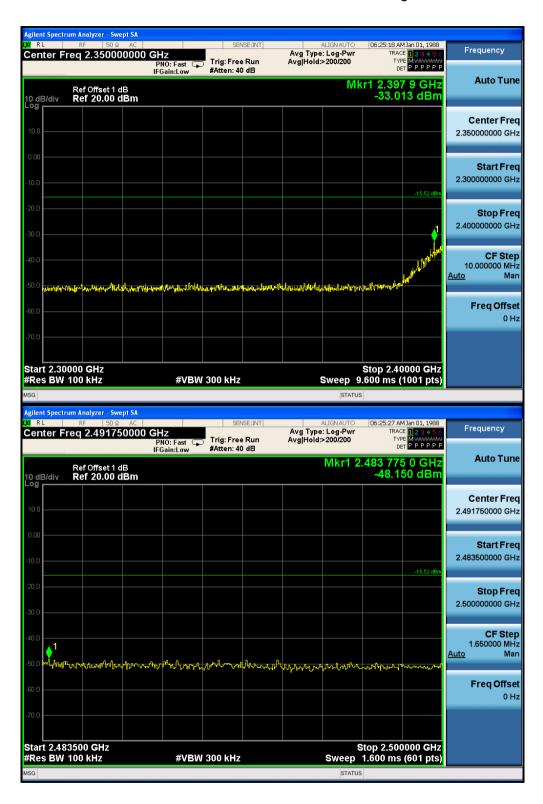


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Page: 53 of 114



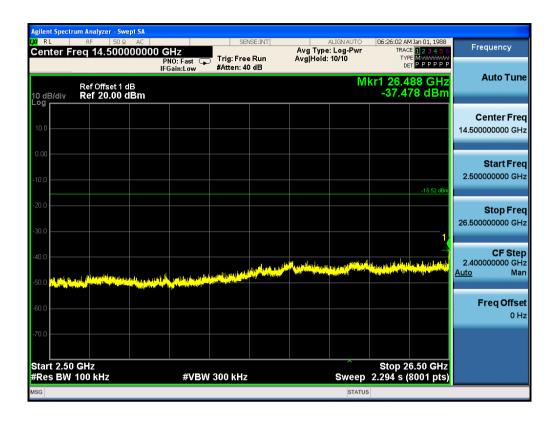


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Report No.: ZR/2019/A002602

54 of 114 Page:





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Report No.: ZR/2019/A002602

Page: 55 of 114

4.8.1.1.5 802.11G_ Middle Channel



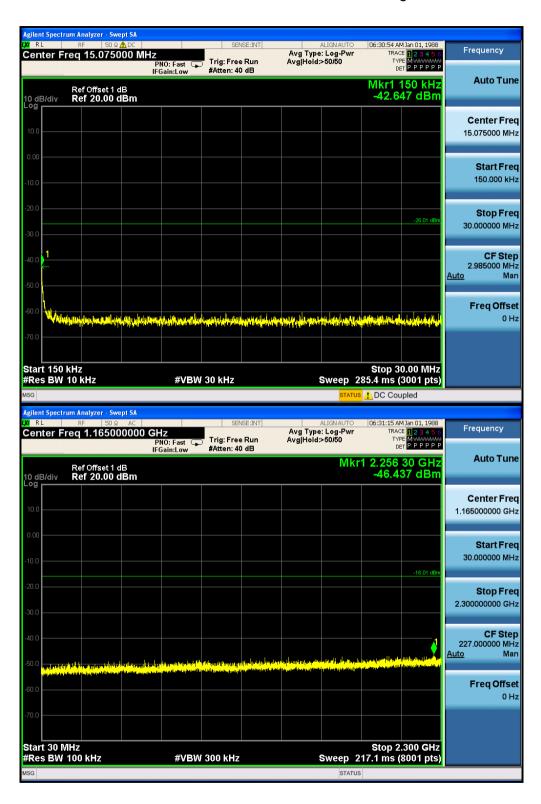


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Report No.: ZR/2019/A002602

Page: 56 of 114



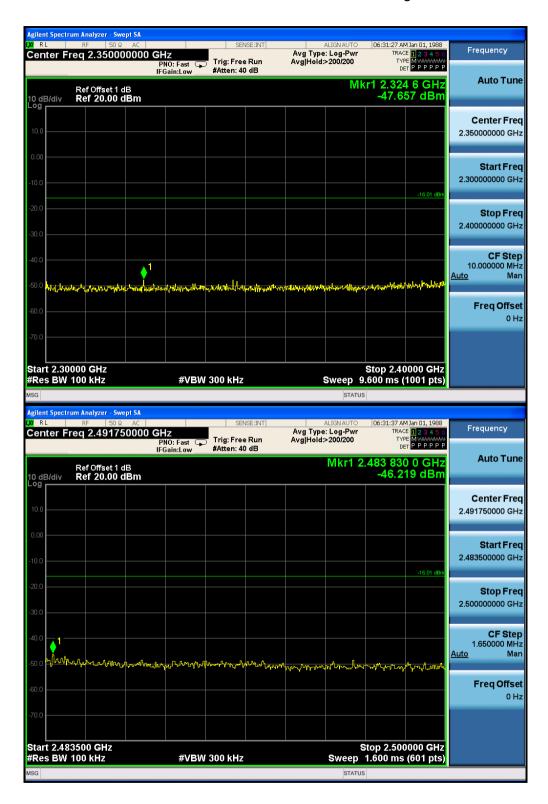


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Report No.: ZR/2019/A002602

Page: 57 of 114



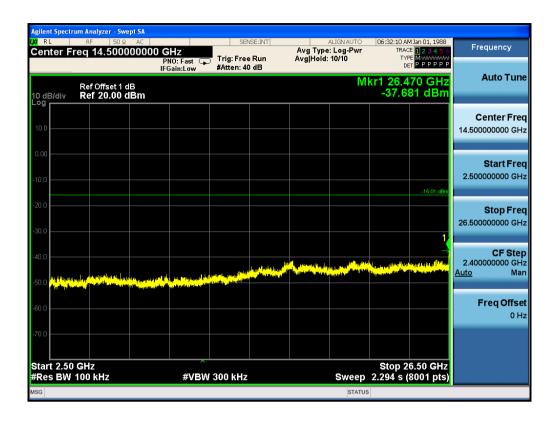


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Report No.: ZR/2019/A002602

58 of 114 Page:





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