FCC 47 CFR PART 15 SUBPART E

UNII

CERTIFICATION TEST REPORT

FOR

GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n, ANT+ and NFC

MODEL NUMBER : SM-A600GN/DS, SM-A600GN

FCC ID: A3LSMA600GN

REPORT NUMBER: 4788371667-E4V2

ISSUE DATE: APR 07, 2018

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

Prepared by
UL Korea, Ltd.
26th floor, 152, Teheran-ro, Gangnam-gu Seoul, 06236, Korea

Suwon Test Site: UL Korea, Ltd. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16675, Korea
TEL: (031) 337-9902
FAX: (031) 213-5433

ACCREDITED
Testing Laboratory

TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	03/30/18	Initial issue	Junwhan Lee
V2	04/07/18	Updated to address TCB's question	Junwhan Lee

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS 6
1.1. INTRODUCTION OF TEST DATA REUSE 7
1.2. DIFFERENCE 7
1.3. SPOT CHECK VERIFICATION DATA 7
1.4. REFERENCE DETAIL 8
2. TEST METHODOLOGY 9
3. FACILITIES AND ACCREDITATION 9
4. CALIBRATION AND UNCERTAINTY 9
4.1. MEASURING INSTRUMENT CALIBRATION 9
4.2. SAMPLE CALCULATION 9
4.3. MEASUREMENT UNCERTAINTY 10
5. EQUIPMENT UNDER TEST 11
5.1. DESCRIPTION OF EUT 11
5.2. MAXIMUM OUTPUT POWER 11
5.3. DESCRIPTION OF AVAILABLE ANTENNAS 12
5.4. WORST-CASE CONFIGURATION AND MODE 12
5.5. DESCRIPTION OF TEST SETUP 13
6. TEST AND MEASUREMENT EQUIPMENT 15
7. SUMMARY TABLE 16
8. MEASUREMENT METHODS 17
9. REFERENCE MEASUREMENTS RESULTS 18
9.1. ON TIME AND DUTY CYCLE RESULTS 18
9.2. DUTY CYCLE PLOTS 18
9.3. 26 dB BANDWIDTH 20
9.3.1. 802.11a MODE IN THE 5.2 GHz BAND 21
9.3.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND 21
9.3.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND 21
9.3.4. 802.11a MODE IN THE 5.3 GHz BAND 21
9.3.5. 802.11n HT20 MODE IN THE 5.3 GHz BAND 22
9.3.6. 802.11n HT40 MODE IN THE 5.3 GHz BAND 22
9.3.7. 802.11a MODE IN THE 5.5 GHz BAND 22
9.3.8. 802.11n HT20 MODE IN THE 5.5 GHz BAND 22

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

9.3.9. 802.11n HT40 MODE IN THE 5.5 GHz BAND 23
9.3.10. 802.11a MODE IN THE 5.8 GHz BAND 23
9.3.11. 802.11n HT20 MODE IN THE 5.8 GHz BAND 23
9.3.12. 802.11n HT40 MODE IN THE 5.8 GHz BAND 23
9.3.13. 26 dB BANDWIDTH PLOTS 24

9.4. 99% BANDWIDTH 36
9.4.1. 802.11a MODE IN THE 5.2 GHz BAND 37
9.4.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND 37
9.4.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND 37
9.4.4. 802.11a MODE IN THE 5.3 GHz BAND 37
9.4.5. 802.11n HT20 MODE IN THE 5.3 GHz BAND 38
9.4.6. 802.11n HT40 MODE IN THE 5.3 GHz BAND 38
9.4.7. 802.11a MODE IN THE 5.5 GHz BAND 38
9.4.8. 802.11n HT20 MODE IN THE 5.5 GHz BAND 38
9.4.9. 802.11n HT40 MODE IN THE 5.5 GHz BAND 39
9.4.10. 802.11a MODE IN THE 5.8 GHz BAND 39
9.4.11. 802.11n HT20 MODE IN THE 5.8 GHz BAND 39
9.4.12. 802.11n HT40 MODE IN THE 5.8 GHz BAND 39
9.4.13. 99% BANDWIDTH PLOTS 40

10. ANTENNA PORT TEST RESULTS 52

10.1. 6 dB BANDWIDTH 52
10.1.1. 802.11a MODE IN THE 5.8 GHz BAND 53
10.1.2. 802.11n HT20 MODE IN THE 5.8 GHz BAND 53
10.1.3. 802.11n HT40 MODE IN THE 5.8 GHz BAND 53
10.1.4. 6 dB BANDWIDTH PLOTS 54

10.2. OUTPUT POWER AND PPSD 57
10.2.1. 802.11a MODE IN THE 5.2 GHz BAND 58
10.2.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND 59
10.2.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND 60
10.2.4. 802.11a MODE IN THE 5.3 GHz BAND 61
10.2.5. 802.11n HT20 MODE IN THE 5.3 GHz BAND 62
10.2.6. 802.11n HT40 MODE IN THE 5.3 GHz BAND 63
10.2.7. 802.11a MODE IN THE 5.5 GHz BAND 64
10.2.8. 802.11n HT20 MODE IN THE 5.5 GHz BAND 65
10.2.9. 802.11n HT40 MODE IN THE 5.5 GHz BAND 66
10.2.10. 802.11a MODE IN THE 5.8 GHz BAND 67
10.2.11. 802.11n HT20 MODE IN THE 5.8 GHz BAND 68
10.2.12. 802.11n HT40 MODE IN THE 5.8 GHz BAND 69
10.2.13. 802.11a MODE AT STRADDLE CHANNEL 70
10.2.14. 802.11n HT20 MODE AT STRADDLE CHANNEL 71
10.2.15. 802.11n HT40 MODE AT STRADDLE CHANNEL 72
10.2.16. OUTPUT POWER AND PPSD PLOTS 73

11. TRANSMITTER ABOVE 1 GHz 88

11.1. 5.2 GHz 90
11.1.1. TX Above 1GHz 802.11a MODE IN THE 5.2GHz BAND 90
11.1.2. TX Above 1GHz 802.11n HT20 MODE IN THE 5.2GHz BAND 98
11.1.3. TX Above 1GHz 802.11n HT40 MODE IN THE 5.2GHz BAND 106

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

11.2. 5.3 GHz 112
11.2.1. TX ABOVE 1 GHz 802.11a MODE IN THE 5.3 GHz BAND 112
11.2.2. TX ABOVE 1GHz 802.11n HT20 MODE IN THE 5.3GHz BAND 120
11.2.3. TX ABOVE 1GHz 802.11n HT40 MODE IN THE 5.3GHz BAND 128

11.3. 5.5-5.6 GHz 134
11.3.1. TX ABOVE 1 GHz 802.11a MODE IN THE 5.5 GHz BAND 134
11.3.2. TX ABOVE 1GHz 802.11n HT20 MODE IN THE 5.5GHz BAND 146
11.3.3. TX ABOVE 1GHz 802.11n HT40 MODE IN THE 5.5GHz BAND 158

11.4. 5.8 GHz 170
11.4.1. TX ABOVE 1GHz 802.11a MODE IN THE 5.8GHz BAND 170
11.4.2. TX ABOVE 1GHz 802.11n HT20 MODE IN THE 5.8GHz BAND 180
11.4.3. TX ABOVE 1GHz 802.11n HT40 MODE IN THE 5.8GHz BAND 190

12. WORST-CASE BELOW 1 GHz 198

13. AC POWER LINE CONDUCTED EMISSIONS 200

14. DYNAMIC FREQUENCY SELECTION 205

14.1. OVERVIEW 205
14.1.1. LIMITS 205
14.1.1. TEST AND MEASUREMENT SYSTEM 209
14.1.2. SETUP OF EUT 212
14.1.3. DESCRIPTION OF EUT 213

14.2. RESULTS FOR 20 MHz BANDWIDTH 214
14.2.1. TEST CHANNEL 214
14.2.2. RADAR WAVEFORM AND TRAFFIC 214
14.2.3. OVERLAPPING CHANNEL TESTS 216
14.2.4. MOVE AND CLOSING TIME 216

14.3. RESULTS FOR 40 MHz BANDWIDTH 219
14.3.1. TEST CHANNEL 219
14.3.2. RADAR WAVEFORM AND TRAFFIC 219
14.3.3. OVERLAPPING CHANNEL TESTS 221
14.3.4. MOVE AND CLOSING TIME 221

15. SETUP PHOTOS 224

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

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,ANT+ and NFC
MODEL NUMBER:	SM-A600GN/DS, SM-A600GN
SERIAL NUMBER:	R38K108GLMR, R38K108GVGN (RADIATED, Original); R38K10BCS5W (CONDUCTED, Original); R38K108NTAW, R38K108M8ZJ (RADIATED, Spot check & Additional test);
DATE TESTED:	FEB 22, 2018 - MAR 09, 2018 (Original) MAR 12, 2018 - MAR 29, 2018 (Spot check & Additional test)

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart E	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.

Approved & Released For
UL Korea, Ltd. By:

SungGil Park
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: A3LSMA600FN UNII WLAN(FCC CFR 47 Part 15E). 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: A3LSMA600GN shares the same enclosure and circuit board as FCC ID: A3LSMA600FN. 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: A3LSMA600FN remains representative of FCC ID: A3LSMA600GN. The test data of FCC ID: A3LSMA600FN being submitted for this application to cover WLAN features.

Due to difference of charger, radiated emission under 1GHz and AC line conducted test were performed newly.

1.3. SPOT CHECK VERIFICATION DATA

Band	Test Item	Mode	Frequency	Test Limit	Original model SM-A600FN/DS Results FCC ID : A3LSMA600FN	Spot check model SM-A600GN/DS Results FCC ID : A3LSMA600GN	Deviation	Remark
UNII WLAN (5GHz)	Band Edge	802.11n HT40	5190 MHz	54 dBuV/m	51.12 dBuV/m	50.48 dBuV/m	-0.64 dB	
	RSE	802.11 a	5200 MHz	68.2 dBuV/m	58.25 dBuV/m	56.88 dBuV/m	-1.37 dB	
	Band Edge	802.11 n HT40	5310 MHz	54 dBuV/m	48.90 dBuV/m	49.31 dBuV/m	0.41 dB	
	RSE	802.11 a	5260 MHz	68.2 dBuV/m	58.32 dBuV/m	57.86 dBuV/m	-0.46 dB	
	Band Edge	802.11n HT20	5500 MHz	68.2 dBuV/m	65.83 dBuV/m	65.87 dBuV/m	0.04 dB	
	RSE	802.11 a	5500 MHz	54 dBuV/m	44.16 dBuV/m	44.04 dBuV/m	-0.12 dB	
	Band Edge	802.11 a	5745 MHz	-27 dBm	-32.56 dBm	-31.46 dBm	1.10 dB	
	RSE	802.11 a	5785 MHz	54 dBuV/m	47.05 dBuV/m	45.76 dBuV/m	-1.29 dB	

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

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

1.4. REFERENCE DETAIL

Reference application that contains the reused reference data.

Equipment Class	Reference FCC ID	Type Grant/Permissive Change	Reference Application	Folder Test/RF Exposure	Report Tittle / Section
DTS	A3LSMA600FN	Grant	4788371662-E1V2	Test	FCC Report DTS WLAN / All sections (Except section 11.3 and 12)
			4788371662-E2V2	Test	FCC Report BLE All sections (Except section 11.3 and 12)
DSS	A3LSMA600FN	Grant	4788371662-E3V2	Test	FCC Report BT / All sections (Except section 11.3 and 12)
NII	A3LSMA600FN	Grant	4788371662-E4V2	Test	FCC Report UNII WALN / All sections (Except section 12 and 13)
DXX	A3LSMA600FN	Grant	4788371662-E5V2	Test	FCC Report ANT+ / All sections (Except section 7.2.5 and 8)
			4788371662-E6V2	Test	FCC Report NFC / All sections (Except section 8.1.3 and 9)
PCE	A3LSMA600FN	Grant	4788371662-E7V3	Test	FCC Report WWAN / All sections (Except Conducted Output Power)

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

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 789033 D02 General UNII Test Procedures New Rules v02r01
4. KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02
5. KDB 905462 D03 UNII Clients Without Radar Detection New Rules v01r02
6. KDB 484596 D01 Referencing Test Data DR01-42712
7. ANSI C63.10-2013.

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
☒ Chamber 1
☒ Chamber 2
☒ 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/PDF/TL/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:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

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	2.32 dB
Radiated Disturbance, Below 1GHz	3.86 dB
Radiated Disturbance, Above 1 GHz	5.97 dB

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

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

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, ANT+ and NFC.
This test report addresses the NII (UNII) operational mode.

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]
5180 - 5240	802.11a	16.01	39.90
	802.11n HT20	15.57	36.09
5190 - 5230	802.11n HT40	14.21	26.36
5260 - 5320	802.11a	15.85	38.45
	802.11n HT20	16.40	43.60
5270 - 5310	802.11n HT40	14.31	26.97
5500 - 5720	802.11a	16.29	42.60
	802.11n HT20	16.00	39.84
5510 - 5710	802.11n HT40	13.76	23.78
5745 - 5825	802.11a	16.19	41.57
	802.11n HT20	15.76	37.69
5755 - 5795	802.11n HT40	13.73	23.58

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antenna, with a maximum gain of:

Frequency Range [MHz]	Antenna Gain [dBi]
UNII 1 5150 – 5250	-1.17
UNII 2A 5250 – 5350	-1.74
UNII 2C 5470 – 5725	-1.74
UNII 3 5725 – 5850	-2.12

5.4. 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.

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

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

802.11a mode: 6 Mbps
802.11n HT20 mode: MCS0
802.11n HT40 mode: MCS0

Note : All radiated and power line conducted tests were performed connected with earphone and charger for evaluation of worst case mode.

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA50JWS	DK6K104VS/A- E	N/A
Data Cable	SAMSUNG	ECB-DU68WE	N/A	N/A
Earphone	SAMSUNG	EHS61ASFWE	N/A	N/A

I/O CABLES

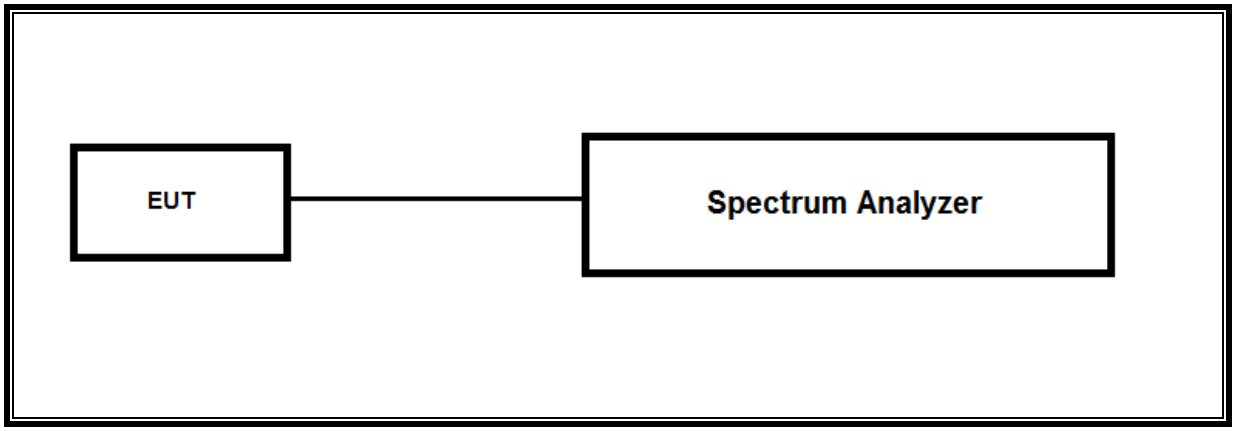
I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	Mini-USB	Shielded	1.2m	N/A
2	Audio	2	Mini-Jack	Unshielded	1.2m	N/A

TEST SETUP

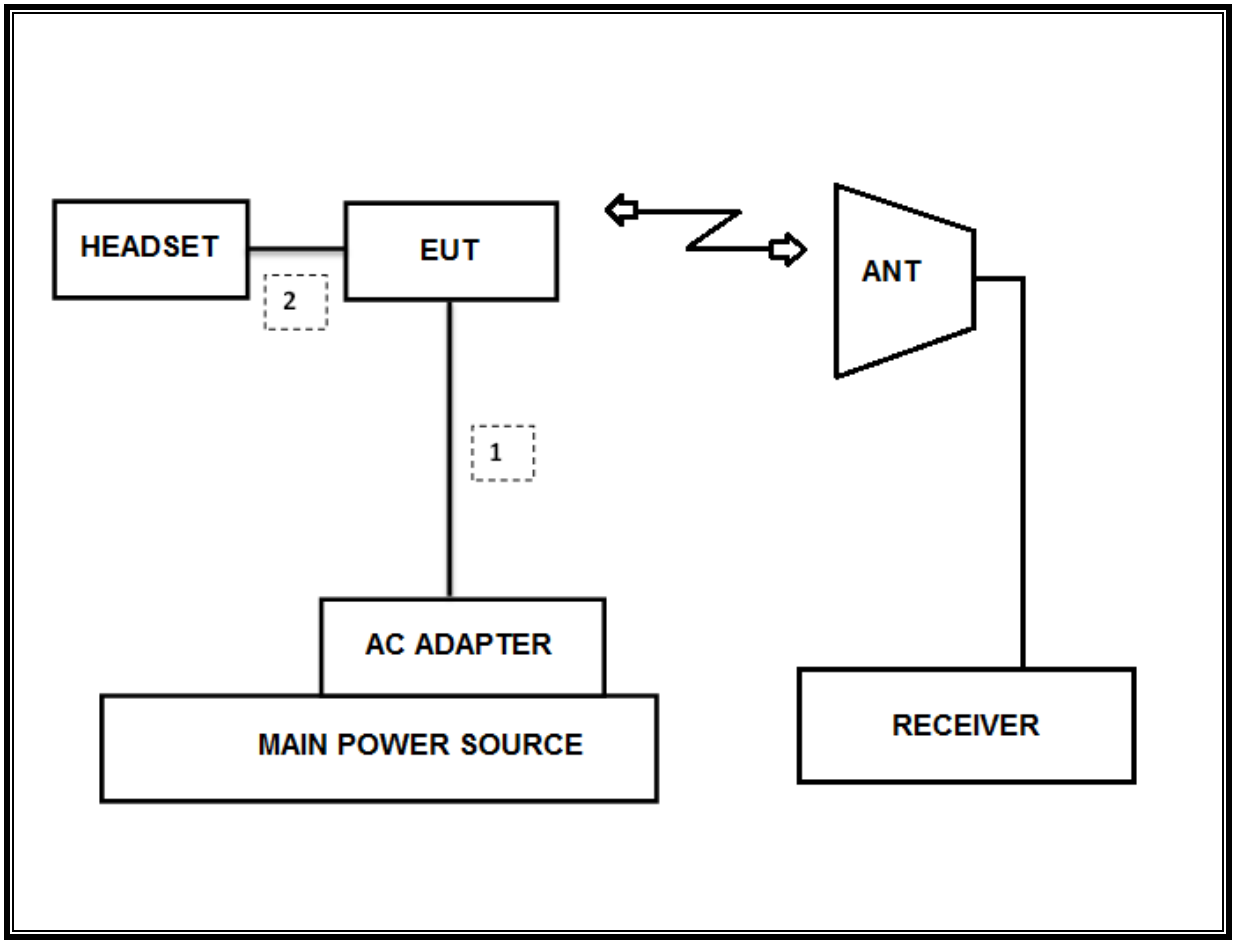
The EUT is a stand-alone unit during the tests.
Test software in hidden menu exercised the EUT to enable NII mode.

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

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**	**Cal Due**
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	08-31-19
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	09-14-19
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	08-31-19
Antenna, Horn, 18 GHz	ETS	3115	00167211	10-14-18
Antenna, Horn, 18 GHz	ETS	3115	00161451	03-10-19
Antenna, Horn, 18 GHz	ETS	3117	00168724	05-31-19
Antenna, Horn, 18 GHz	ETS	3117	00168717	05-31-19
Antenna, Horn, 18 GHz	ETS	3117	00205959	11-29-18
Antenna, Horn, 40 GHz	ETS	3116C	00166155	12-04-19
Antenna, Horn, 40 GHz	ETS	3116C	00168645	12-04-19
Antenna, Horn, 40 GHz	ETS	3116C-PA	00168841	11-13-19
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-09-18
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-07-18
Preamplifier, 1000 MHz	Sonoma	310N	370599	08-10-18
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-08-18
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-08-18
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	08-11-18
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-08-18
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-08-18
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-08-18
Attenuator	PASTERNACK	PE7087-10	A001	08-08-18
Attenuator	PASTERNACK	PE7087-10	A008	08-08-18
Attenuator	PASTERNACK	PE7087-10	2	08-10-18
Attenuator	PASTERNACK	PE7087-10	A009	08-08-18
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-08-18
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-08-18
EMI Test Receive, 44 GHz	R&S	ESW44	101590	08-09-18
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-07-18
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-08-18
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-08-18
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	020	08-11-18
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-08-18
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-08-18
High Pass Filter 3GHz	Micro-Tronics	HPM17543	020	08-11-18
High Pass Filter 6GHz	Micro-Tronics	HPS17542	009	08-08-18
High Pass Filter 6GHz	Micro-Tronics	HPS17542	016	08-08-18
High Pass Filter 6GHz	Micro-Tronics	HPS17542	021	08-11-18
LISN	R&S	ENV-216	101837	08-09-18
UL Software				
Description	**Manufacturer**	**Model**	**Version**	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	UL	UL EMC	Ver 9.5	

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
15.407(e)	6dB Band width (5.8Ghz)	500KHz	Condcuted	PASS
15.407 (a)(2)	TX Cond. Power 5.15-2.25, 5.25-5.35 & 5.47-5.725	<24dBm or 11+10Log(OBW)		PASS
15.407 (a)(3)	TX Cond. Power 5.725-5.825	< 30dBm or 17+10Log(OBW)		PASS
15.407 (a)(5)	PSD (5.2,5.3,5.5GHz)	<11dBm		PASS
15.407 (a)(5)	PSD (5.8GHz)	30dBm per 500kHz		PASS
15.207 (a)	AC Power Line conducted emissions	Section 10	Radiated	PASS
15.407 (b) & 15.209	Radiated Spurious Emission	< 54dBuV/m		PASS
15.407 (h)(2)	Dynamic Frequency Selection	N/A	Condcuted	PASS

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

8. MEASUREMENT METHODS

On-Time and Duty Cycle : KDB 789033 D02 v02r01, Section B.

6dB Emission BW : KDB 789033 D02 v02r01, Section C.2.

26dB Emission BW : KDB 789033 D02 v02r01, Section C.1.

99% Occupied BW : KDB 789033 D02 v02r01, Section D.

Conducted Output Power : KDB 789033 D02 v02r01, Section E.2.d(Method SA-2)

Power Spectral Density : KDB 789033 D02 v02r01, Section F.

Unwanted emissions in restricted bands : KDB 789033 D02 v02r01, Section G.

Unwanted emissions in non-restricted bands : KDB 789033 D02 v02r01, Section G.

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

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

9. REFERENCE MEASUREMENTS RESULTS

LIMITS

None; for reporting purposes only.

PROCEDURE

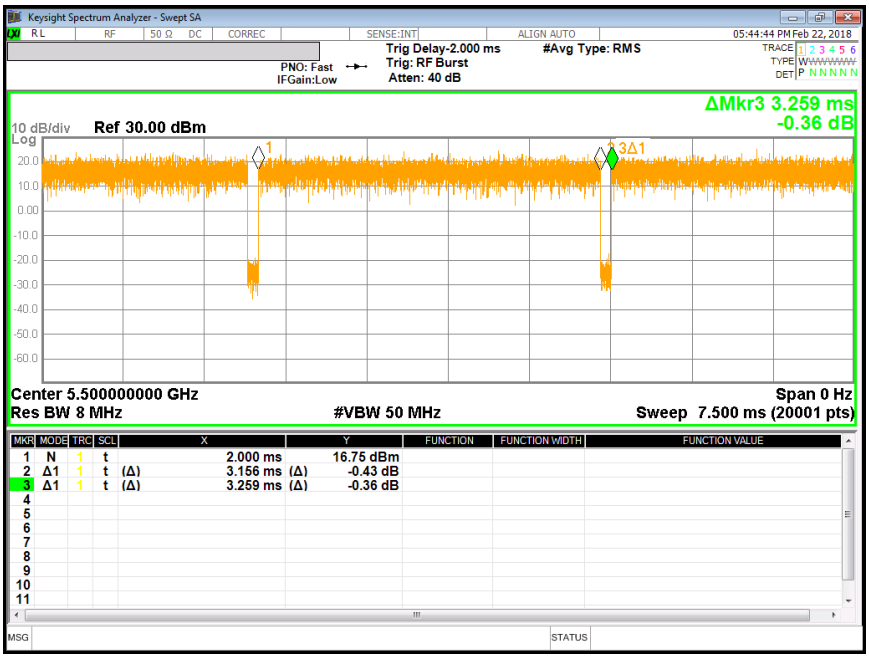
KDB 789033 D02 v02r01 Zero-Span Spectrum Analyzer Method.

9.1. ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B [msec)	Period [msec]	Duty Cycle x [linear]	Duty Cycle [%]	Duty Cycle Correction Factor [dB]	1/T Minimum VBW [kHz]
802.11a	3.156	3.259	0.968	96.8%	0.14	0.317
802.11n HT20	2.928	3.031	0.966	96.6%	0.15	0.342
802.11n HT40	1.432	1.533	0.934	93.4%	0.30	0.698

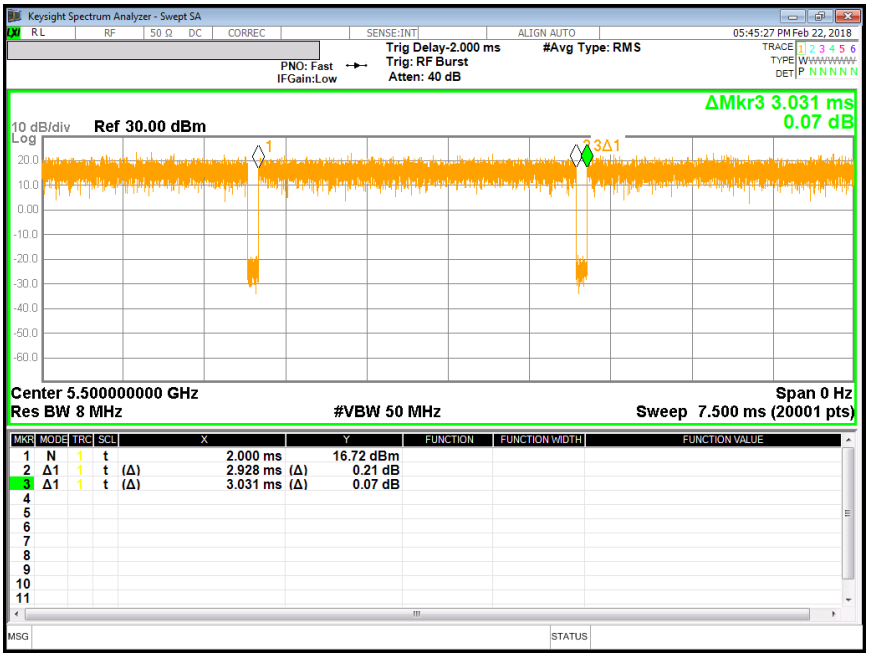
9.2. DUTY CYCLE PLOTS

DUTY CYCLE 802.11a MODE



UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

DUTY CYCLE 802.11n HT20 MODE



DUTY CYCLE 802.11n HT40 MODE

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

9.3. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Reference to 789033 D02 General UNII Test Procedures New Rules v02r01: The transmitter output is connected to a spectrum analyzer with the RBW set to approximately 1% of EBW, the VBW > RBW, peak detector and max hold.

NOTE

- Calculation for 26dB Bandwidth of UNII-2C and UNII-3 Straddle Channel

ex) Fundamental frequency : 5720MHz
  - 26dB BW : 21.00MHz
  - Turning Frequency : 5725MHz
  - 26dB Bandwidth of UNII-2C band Portion
    = (5725 – (5720 - (21.00 / 2)) = 15.50 MHz
  - 26dB Bandwidth of UNII-3 band Portion
    = (5720 + (21.00 / 2) -5725) = 5.50 MHz

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

RESULTS

9.3.1. 802.11a MODE IN THE 5.2 GHz BAND

Channel	Frequency [MHz]	26 dB Bandwidth [MHz]
Low	5180	21.07
Mid	5200	20.98
High	5240	21.35
Worst		21.35

9.3.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

Channel	Frequency [MHz]	26 dB Bandwidth [MHz]
Low	5180	21.43
Mid	5200	21.31
High	5240	21.19
Worst		21.43

9.3.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND

Channel	Frequency [MHz]	26 dB Bandwidth [MHz]
Low	5190	39.41
High	5230	39.45
Worst		39.45

9.3.4. 802.11a MODE IN THE 5.3 GHz BAND

Channel	Frequency [MHz]	26 dB Bandwidth [MHz]
Low	5260	21.06
Mid	5300	21.04
High	5320	20.87
Worst		21.06

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

9.3.5. 802.11n HT20 MODE IN THE 5.3 GHz BAND

Channel	Frequency [MHz]	26 dB Bandwidth [MHz]
Low	5260	22.56
Mid	5300	21.86
High	5320	21.86
Worst		22.56

9.3.6. 802.11n HT40 MODE IN THE 5.3 GHz BAND

Channel	Frequency [MHz]	26 dB Bandwidth [MHz]
Low	5270	39.66
High	5310	39.81
Worst		39.81

9.3.7. 802.11a MODE IN THE 5.5 GHz BAND

Channel	Frequency [MHz]	26 dB Bandwidth [MHz]
Low	5500	21.22
Mid	5580	20.99
High	5700	21.05
Straddle	5720	15.58
Worst		21.22

9.3.8. 802.11n HT20 MODE IN THE 5.5 GHz BAND

Channel	Frequency [MHz]	26 dB Bandwidth [MHz]
Low	5500	21.08
Mid	5580	21.36
High	5700	21.23
Straddle	5720	15.70
Worst		21.36

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

9.3.9. 802.11n HT40 MODE IN THE 5.5 GHz BAND

Channel	Frequency [MHz]	26 dB Bandwidth [MHz]
Low	5510	39.56
Mid	5590	39.65
High	5670	39.82
Straddle	5710	34.68
Worst		39.82

9.3.10. 802.11a MODE IN THE 5.8 GHz BAND

Channel	Frequency [MHz]	26 dB Bandwidth [MHz]
Straddle	5720	5.58
Low	5745	21.28
Mid	5785	21.03
High	5825	21.16
Worst		21.28

9.3.11. 802.11n HT20 MODE IN THE 5.8 GHz BAND

Channel	Frequency [MHz]	26 dB Bandwidth [MHz]
Straddle	5720	5.70
Low	5745	21.07
Mid	5785	21.30
High	5825	21.24
Worst		21.30

9.3.12. 802.11n HT40 MODE IN THE 5.8 GHz BAND

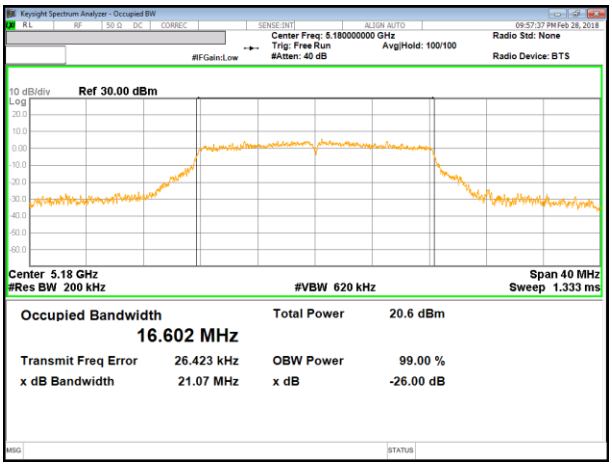
Channel	Frequency [MHz]	26 dB Bandwidth [MHz]
Straddle	5710	4.68
Low	5755	39.58
High	5795	39.80
Worst		39.80

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

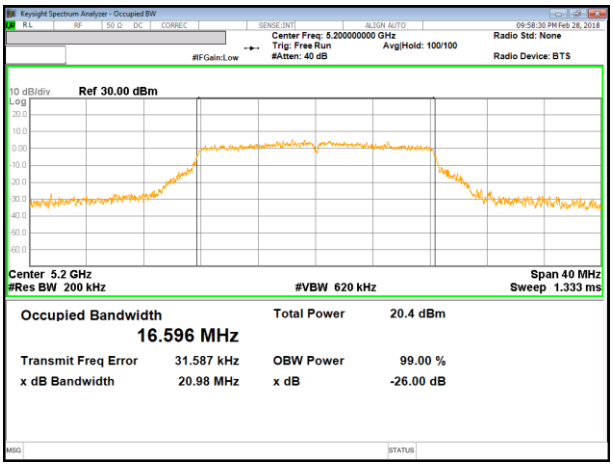
9.3.13. 26 dB BANDWIDTH PLOTS

UNII 5.2 GHz IEEE 802.11a mode

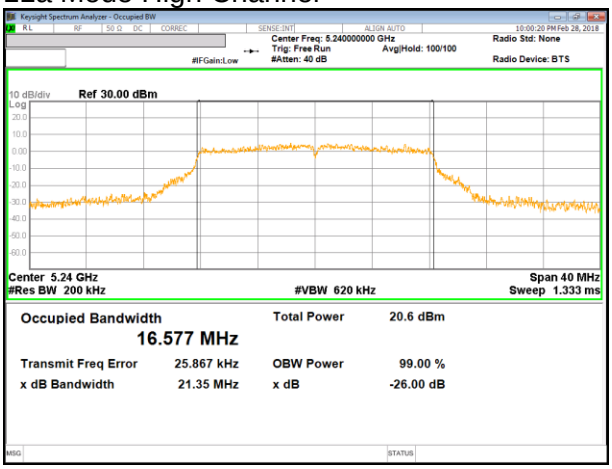
11a Mode Low Channel



11a Mode Middle Channel



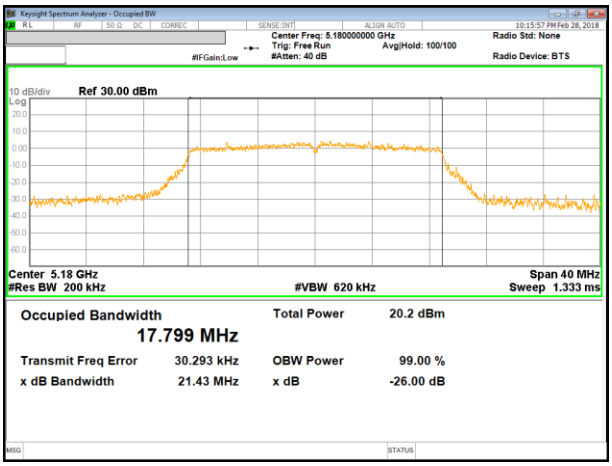
11a Mode High Channel



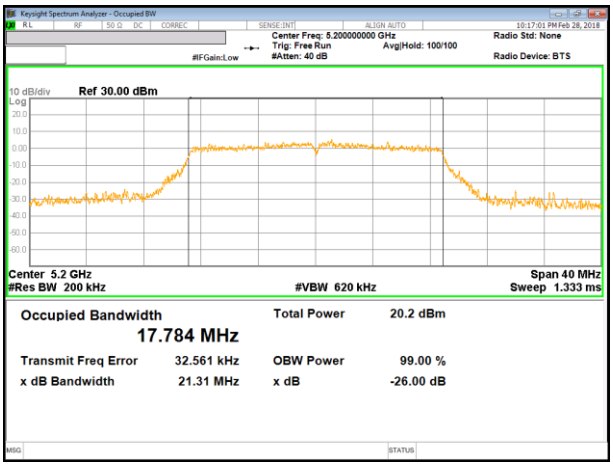
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.2 GHz IEEE 802.11n HT20 mode

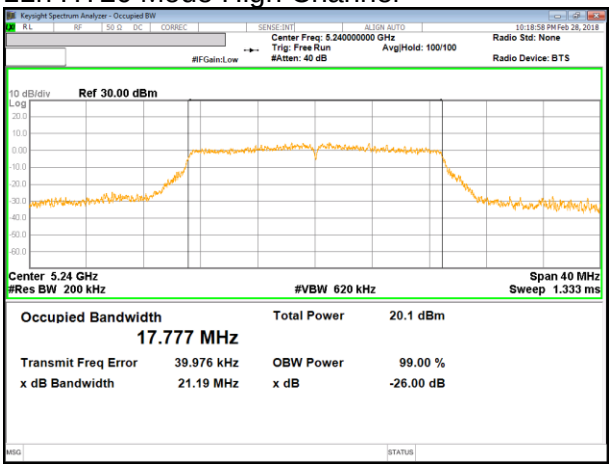
11n HT20 Mode Low Channel



11n HT20 Mode Middle Channel



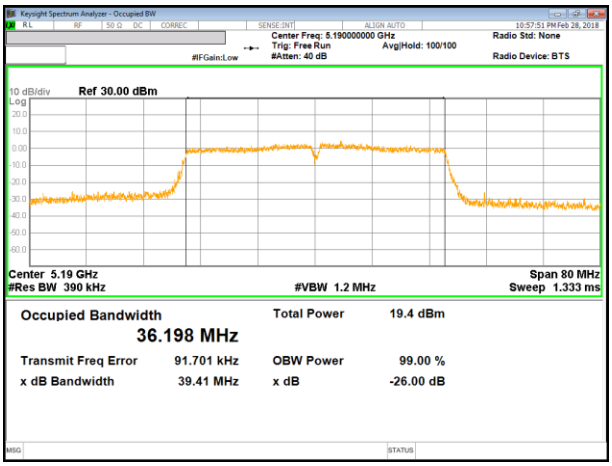
11n HT20 Mode High Channel



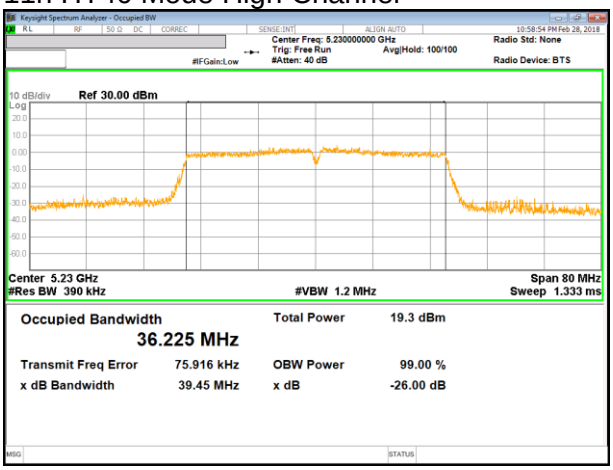
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.2 GHz IEEE 802.11n HT40 mode

11n HT40 Mode Low Channel



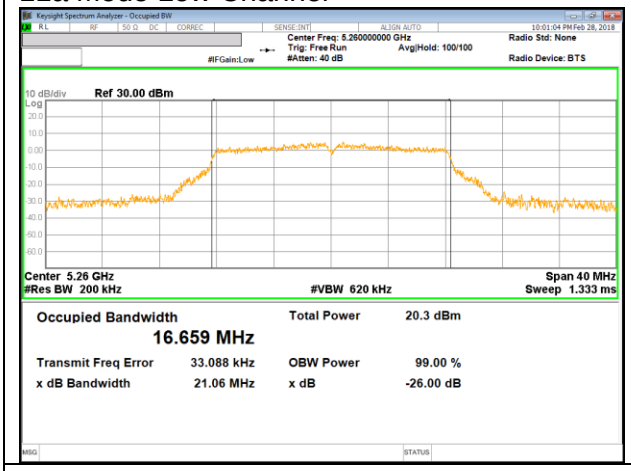
11n HT40 Mode High Channel



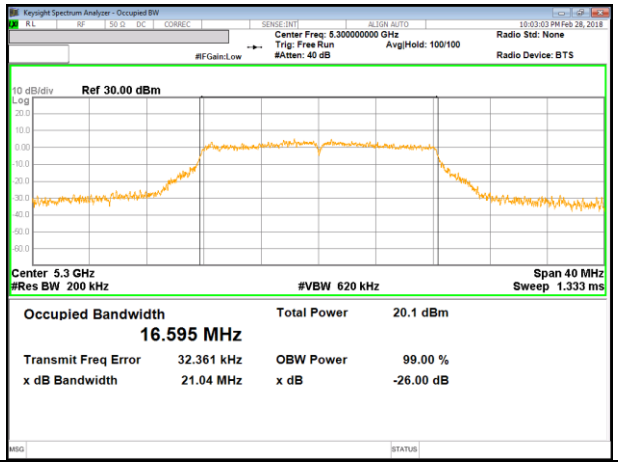
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.3 GHz IEEE 802.11a mode

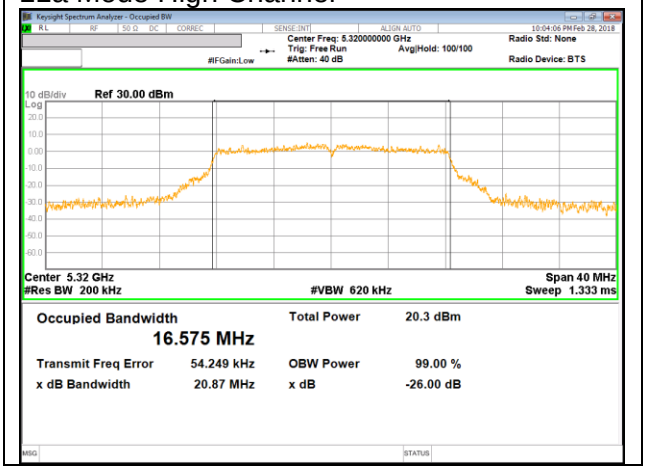
11a Mode Low Channel



11a Mode Middle Channel



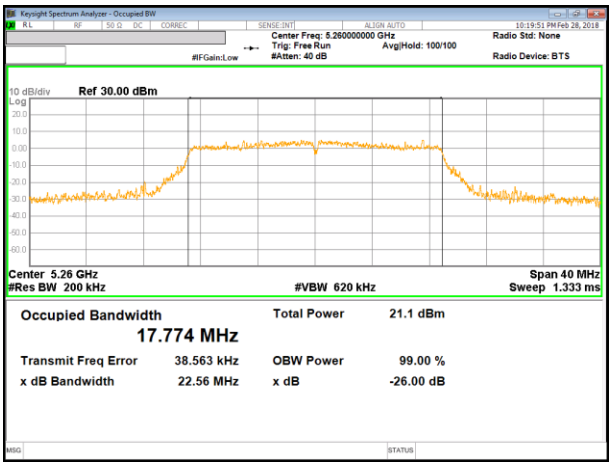
11a Mode High Channel



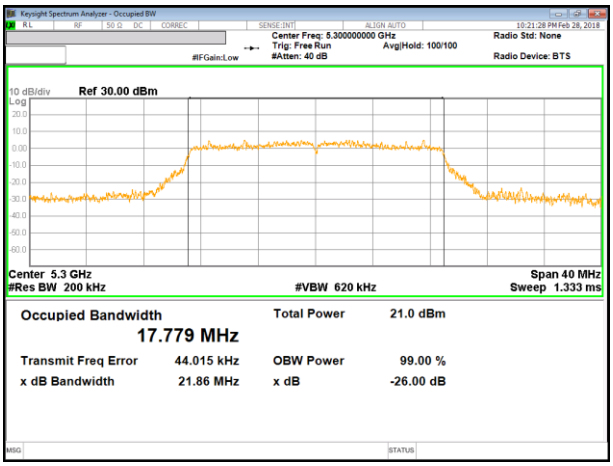
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.3 GHz IEEE 802.11n HT20 mode

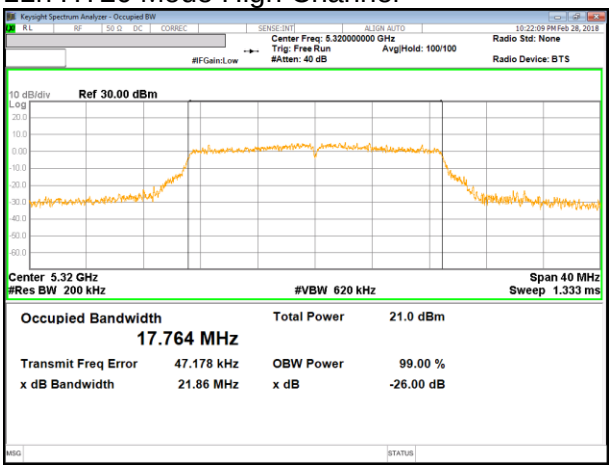
11n HT20 Mode Low Channel



11n HT20 Mode Middle Channel



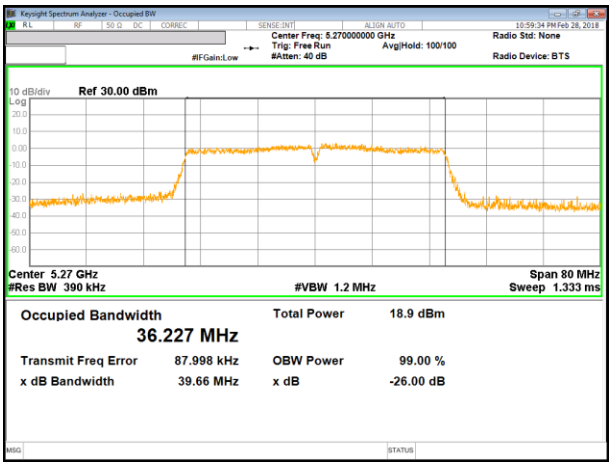
11n HT20 Mode High Channel



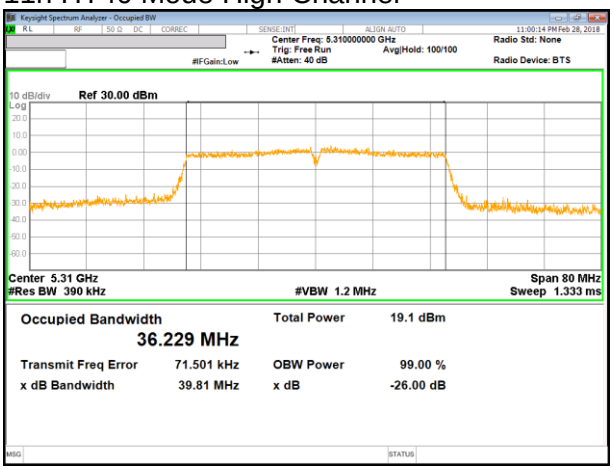
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.3 GHz IEEE 802.11n HT40 mode

11n HT40 Mode Low Channel



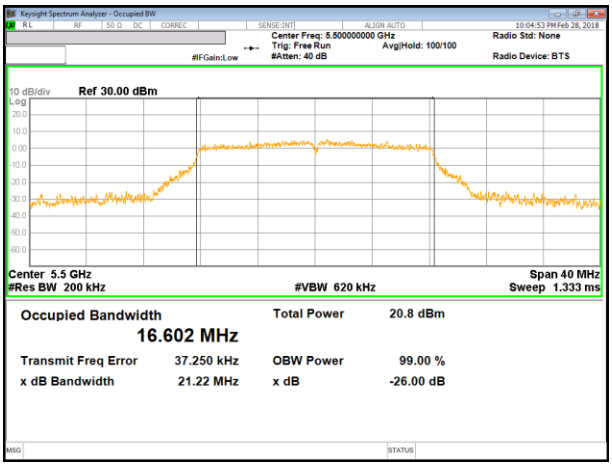
11n HT40 Mode High Channel



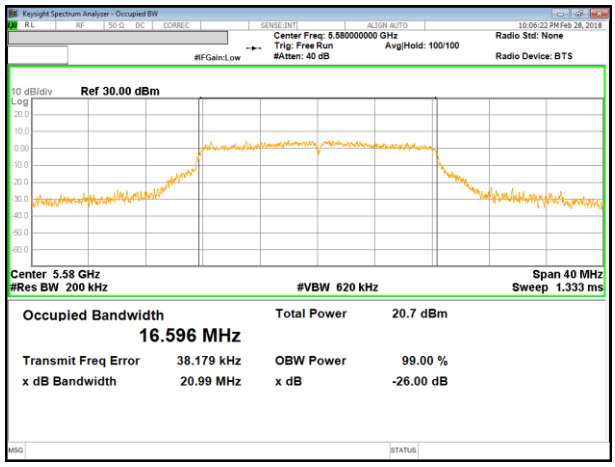
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.5 GHz IEEE 802.11a mode

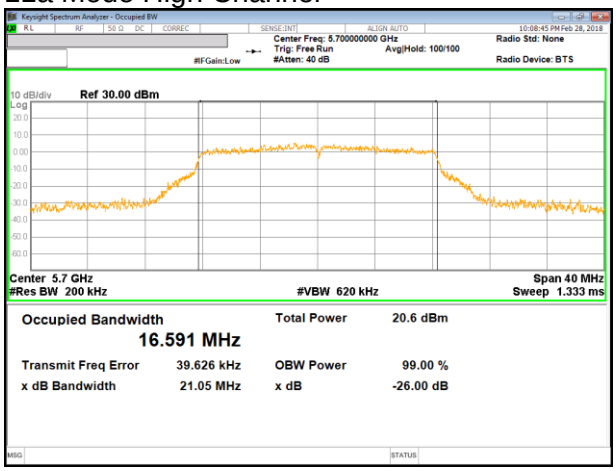
11a Mode Low Channel



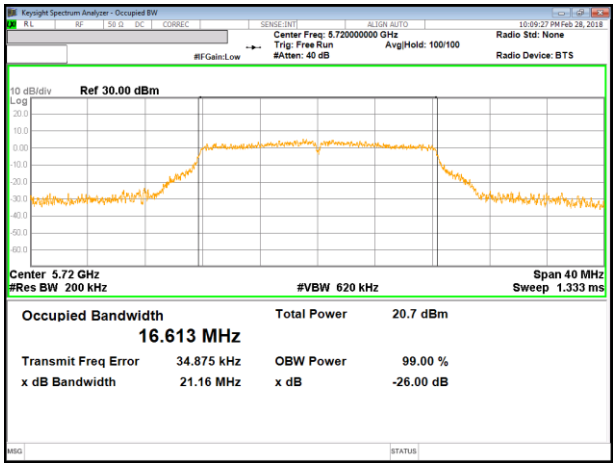
11a Mode Middle Channel



11a Mode High Channel



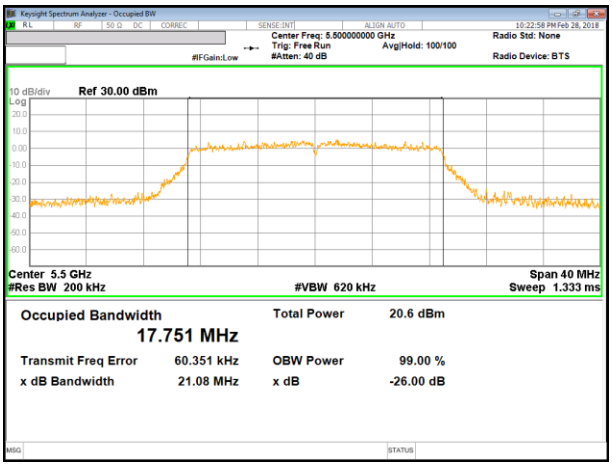
11a Mode Straddle Channel



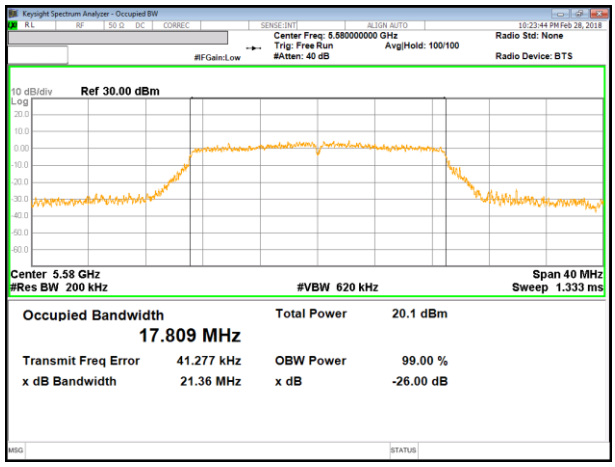
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.5 GHz IEEE 802.11n HT20 mode

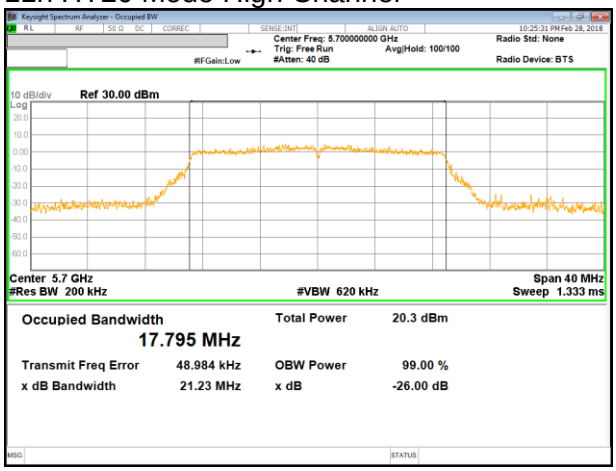
11n HT20 Mode Low Channel



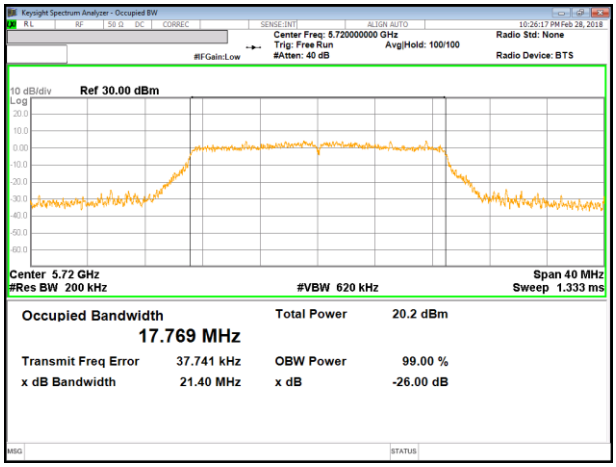
11n HT20 Mode Middle Channel



11n HT20 Mode High Channel



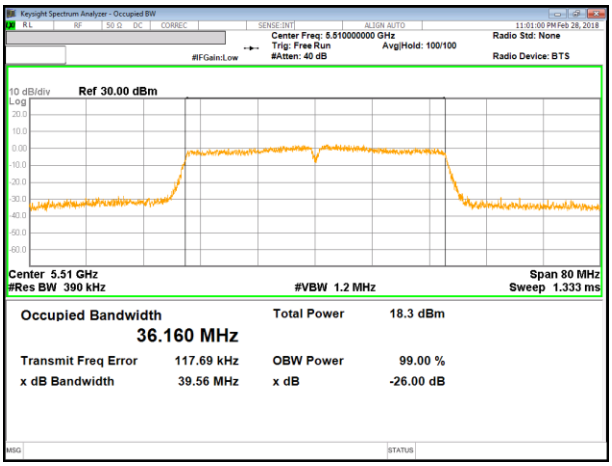
11n HT20 Mode Straddle Channel



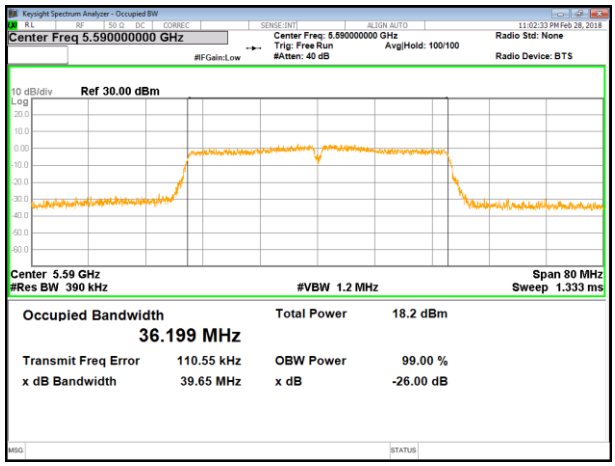
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.5 GHz IEEE 802.11n HT40 mode

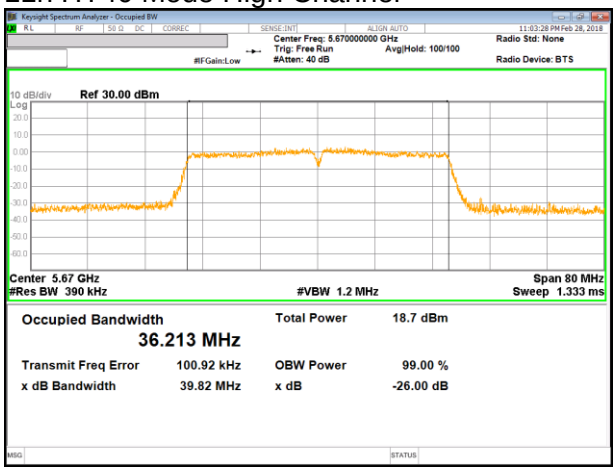
11n HT40 Mode Low Channel



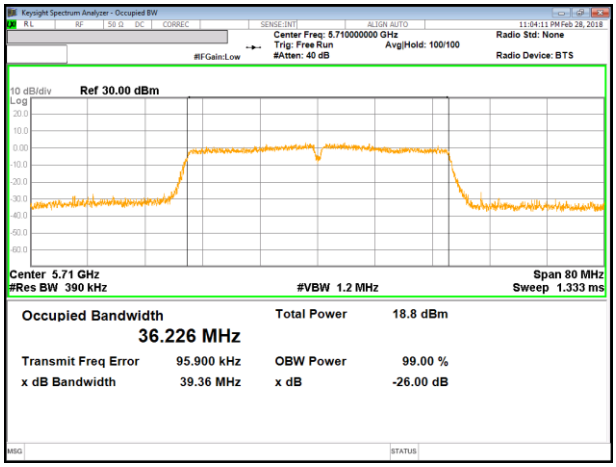
11n HT40 Mode Middle Channel



11n HT40 Mode High Channel



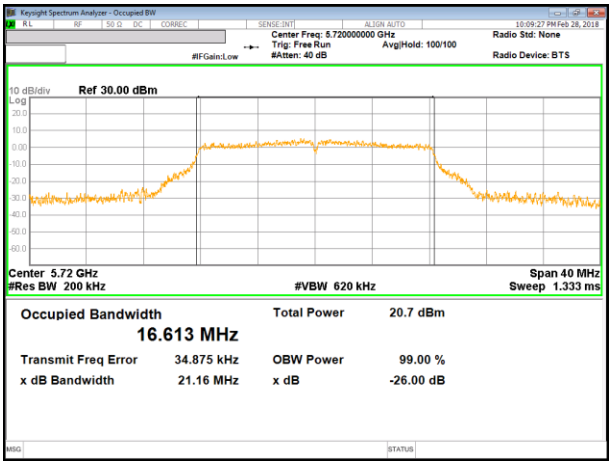
11n HT40 Mode Straddle Channel



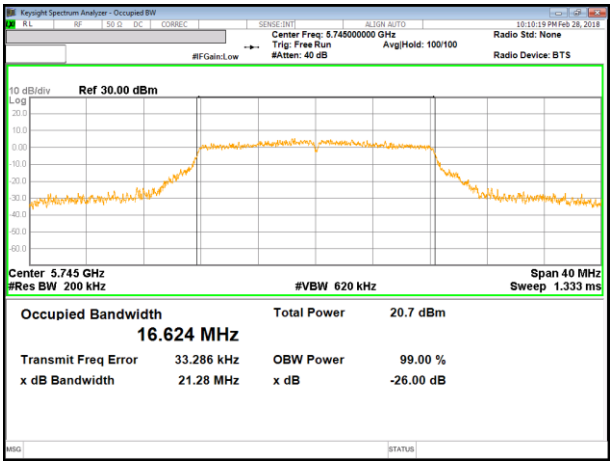
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.8 GHz IEEE 802.11a mode

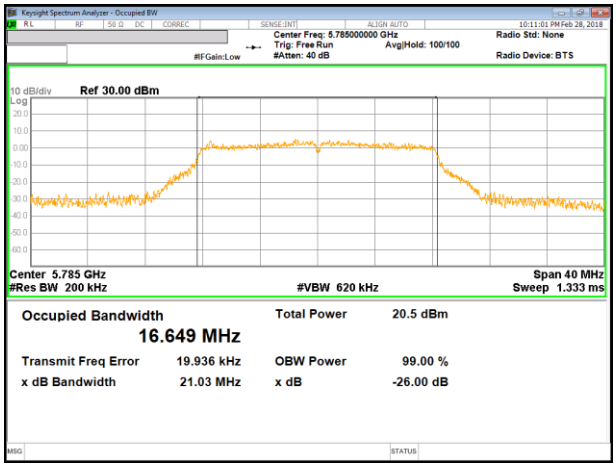
11a Mode Straddle Channel



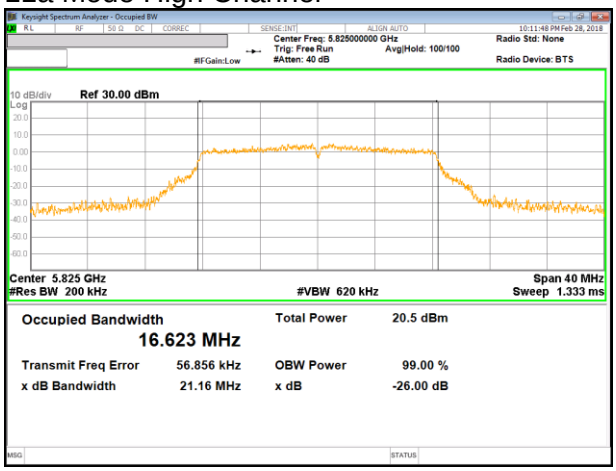
11a Mode Low Channel



11a Mode Middle Channel



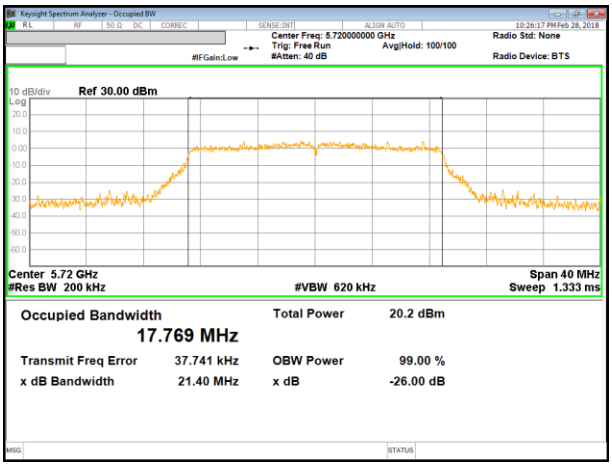
11a Mode High Channel



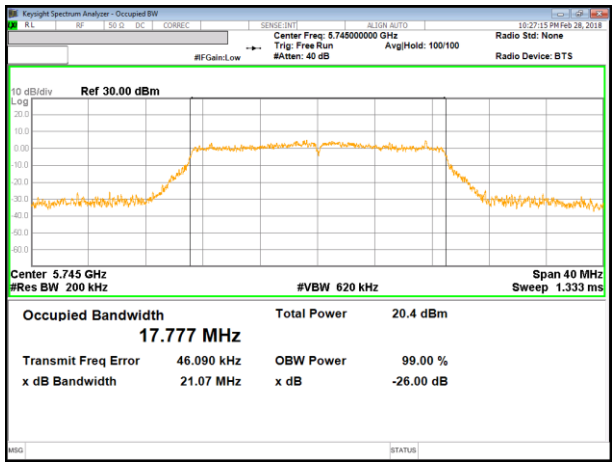
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.8 GHz IEEE 802.11n HT20 mode

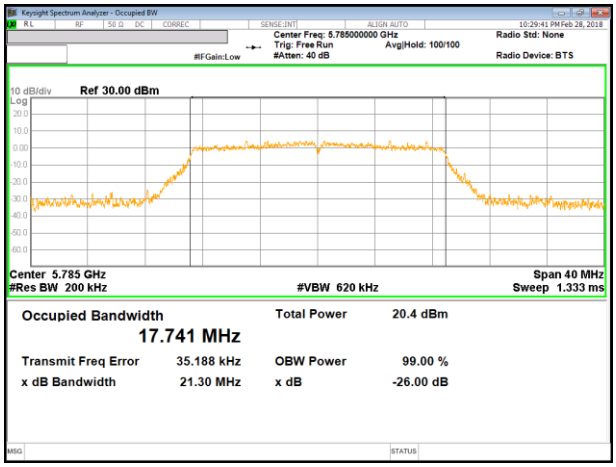
11n HT20 Mode Straddle Channel



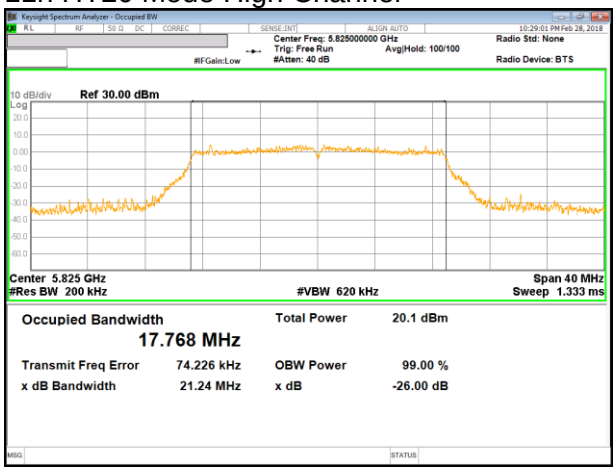
11n HT20 Mode Low Channel



11n HT20 Mode Middle Channel



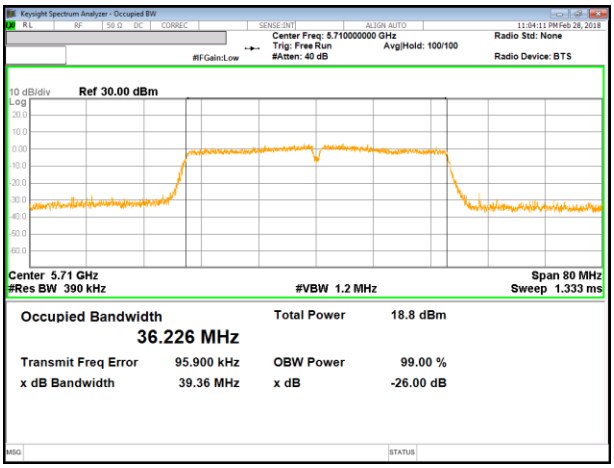
11n HT20 Mode High Channel



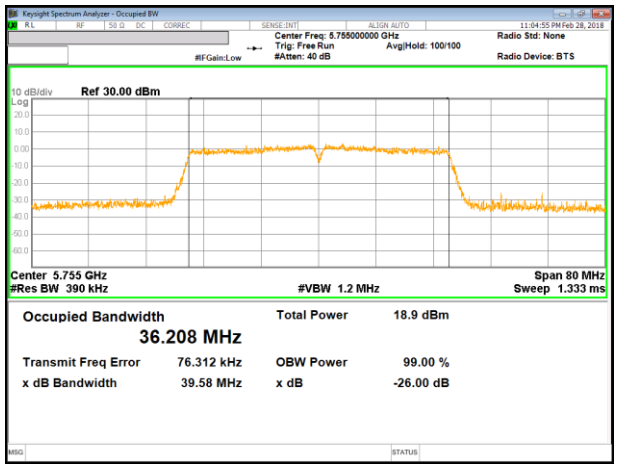
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.8 GHz IEEE 802.11n HT40 mode

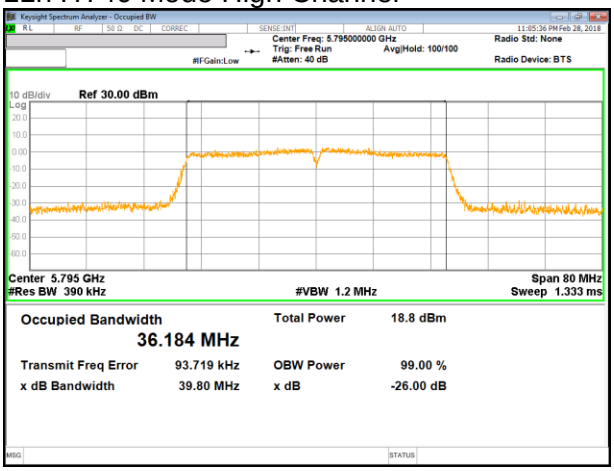
11n HT40 Mode Straddle Channel



11n HT40 Mode Low Channel



11n HT40 Mode High Channel



UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

9.4. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Reference to 789033 D02 General UNII Test Procedures New Rules v02r01: The transmitter output is connected to a spectrum analyzer with the RBW set to approximately 1% of EBW, the VBW > RBW, peak detector and max hold.

NOTE

- Calculation for 99% Bandwidth of UNII-2C and UNII-3 Straddle Channel

ex) Fundamental frequency : 5720MHz
  - 99% BW : 21.00MHz
  - Turning Frequency : 5725MHz
  - 99% Bandwidth of UNII-2C band Portion
    = (5725 – (5720 - (21.00 / 2)) = 15.50 MHz
  - 99% Bandwidth of UNII-3 band Portion
    = (5720 + (21.00 / 2) -5725) = 5.50 MHz

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15E
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675 Korea TEL: (031) 337-9902,FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

RESULTS

9.4.1. 802.11a MODE IN THE 5.2 GHz BAND

Channel	Frequency [MHz]	99% Bandwidth [MHz]
Low	5180	16.49
Mid	5200	16.48
High	5240	16.51
Worst		16.51

9.4.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

Channel	Frequency [MHz]	99% Bandwidth [MHz]
Low	5180	17.67
Mid	5200	17.67
High	5240	17.68
Worst		17.68

9.4.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND

Channel	Frequency [MHz]	99% Bandwidth [MHz]
Low	5190	36.14
High	5230	36.14
Worst		36.14

9.4.4. 802.11a MODE IN THE 5.3 GHz BAND

Channel	Frequency [MHz]	99% Bandwidth [MHz]
Low	5260	16.47
Mid	5300	16.50
High	5320	16.50
Worst		16.50

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

9.4.5. 802.11n HT20 MODE IN THE 5.3 GHz BAND

Channel	Frequency [MHz]	99% Bandwidth [MHz]
Low	5260	17.70
Mid	5300	17.72
High	5320	17.72
Worst		17.72

9.4.6. 802.11n HT40 MODE IN THE 5.3 GHz BAND

Channel	Frequency [MHz]	99% Bandwidth [MHz]
Low	5270	36.13
High	5310	36.15
Worst		36.15

9.4.7. 802.11a MODE IN THE 5.5 GHz BAND

Channel	Frequency [MHz]	99% Bandwidth [MHz]
Low	5500	16.48
Mid	5580	16.49
High	5700	16.48
Straddle	5720	13.25
Worst		16.49

9.4.8. 802.11n HT20 MODE IN THE 5.5 GHz BAND

Channel	Frequency [MHz]	99% Bandwidth [MHz]
Low	5500	17.68
Mid	5580	17.70
High	5700	17.70
Straddle	5720	13.86
Worst		17.70

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

9.4.9. 802.11n HT40 MODE IN THE 5.5 GHz BAND

Channel	Frequency [MHz]	99% Bandwidth [MHz]
Low	5510	36.16
Mid	5590	36.12
High	5670	36.17
Straddle	5710	33.11
Worst		36.17

9.4.10. 802.11a MODE IN THE 5.8 GHz BAND

Channel	Frequency [MHz]	99% Bandwidth [MHz]
Straddle	5720	3.25
Low	5745	16.49
Mid	5785	16.46
High	5825	16.48
Worst		16.49

9.4.11. 802.11n HT20 MODE IN THE 5.8 GHz BAND

Channel	Frequency [MHz]	99% Bandwidth [MHz]
Straddle	5720	3.86
Low	5745	17.72
Mid	5785	17.69
High	5825	17.66
Worst		17.72

9.4.12. 802.11n HT40 MODE IN THE 5.8 GHz BAND

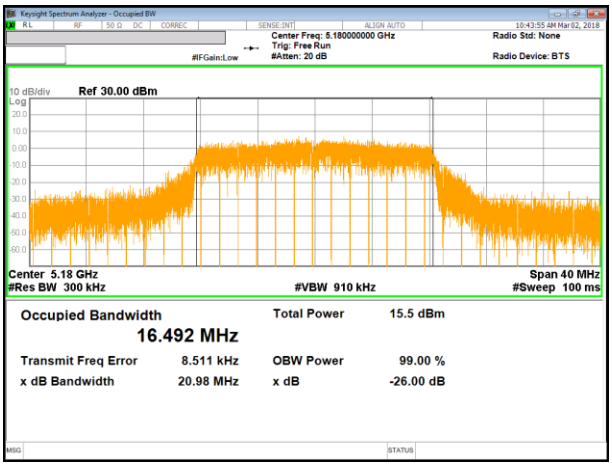
Channel	Frequency [MHz]	99% Bandwidth [MHz]
Straddle	5710	3.11
Low	5755	36.15
High	5795	36.21
Worst		36.21

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

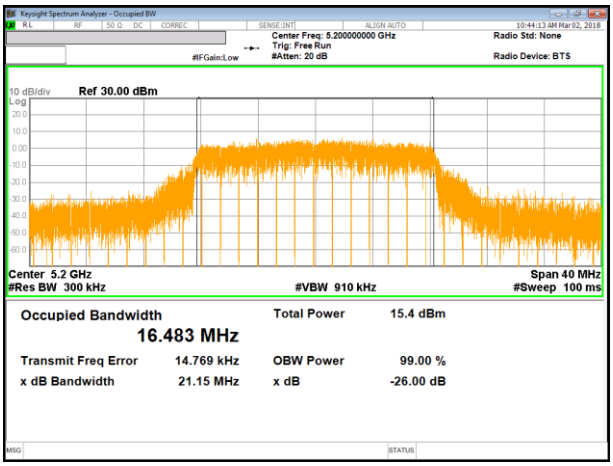
9.4.13. 99% BANDWIDTH PLOTS

UNII 5.2 GHz IEEE 802.11a mode

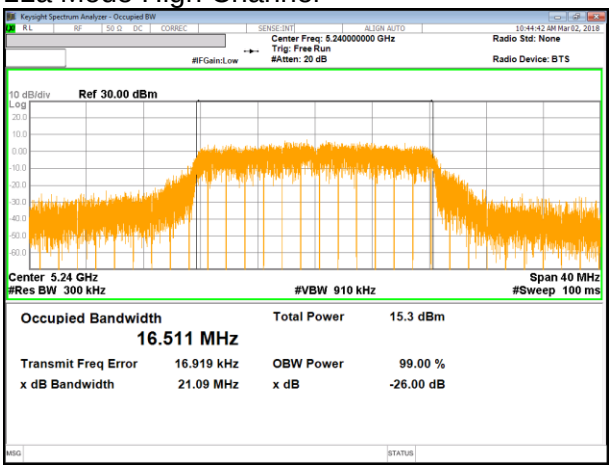
11a Mode Low Channel



11a Mode Middle Channel



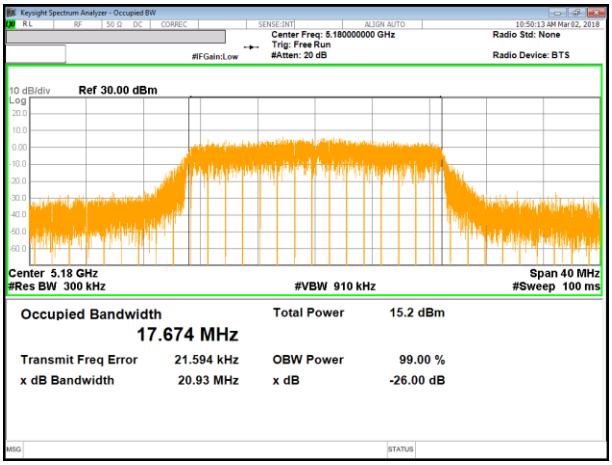
11a Mode High Channel



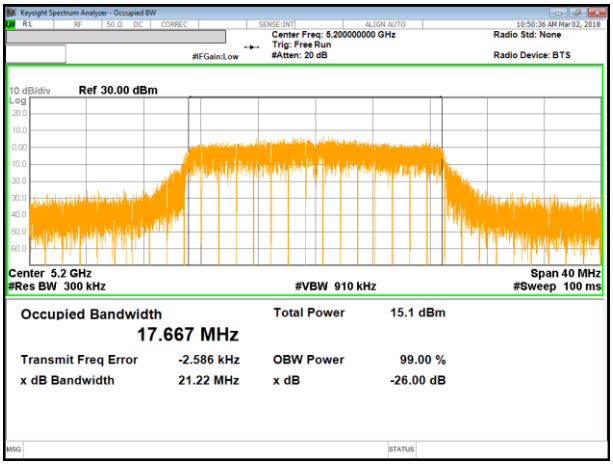
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.2 GHz IEEE 802.11n HT20 mode

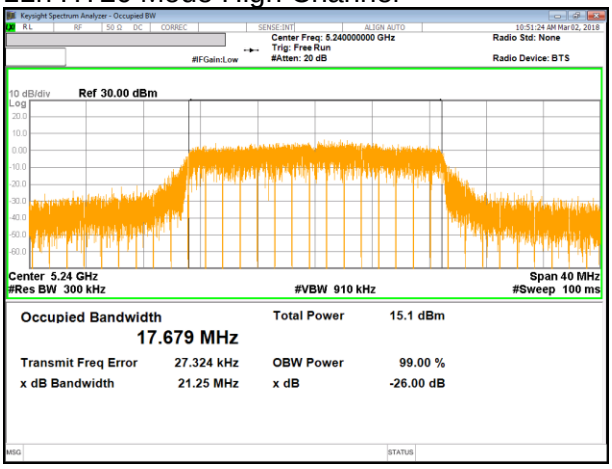
11n HT20 Mode Low Channel



11n HT20 Mode Middle Channel



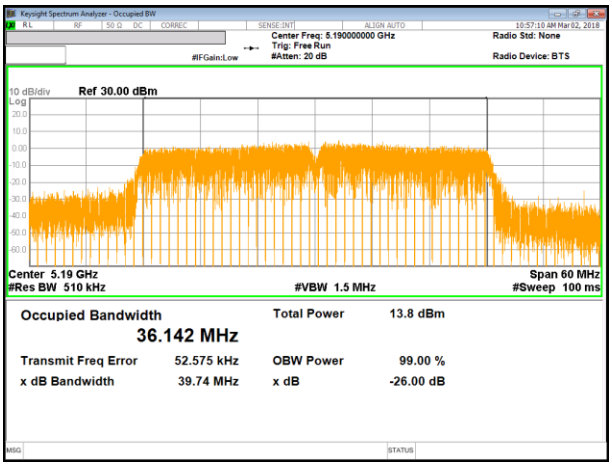
11n HT20 Mode High Channel



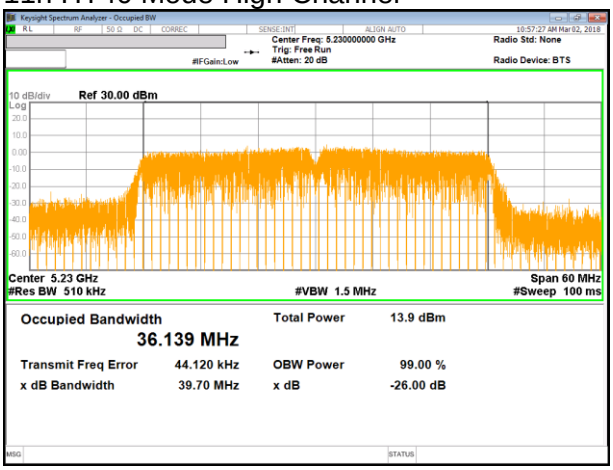
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.2 GHz IEEE 802.11n HT40 mode

11n HT40 Mode Low Channel



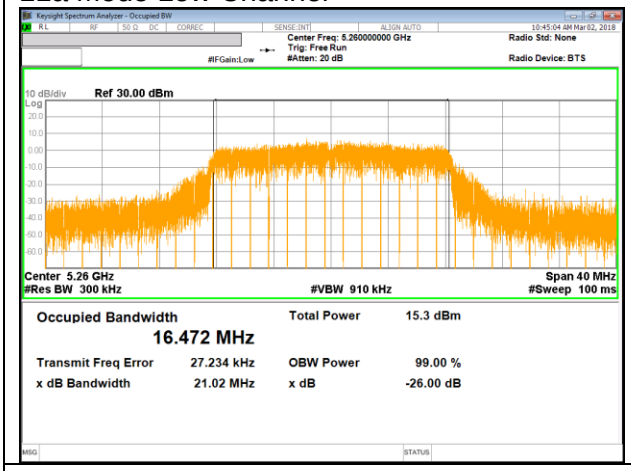
11n HT40 Mode High Channel



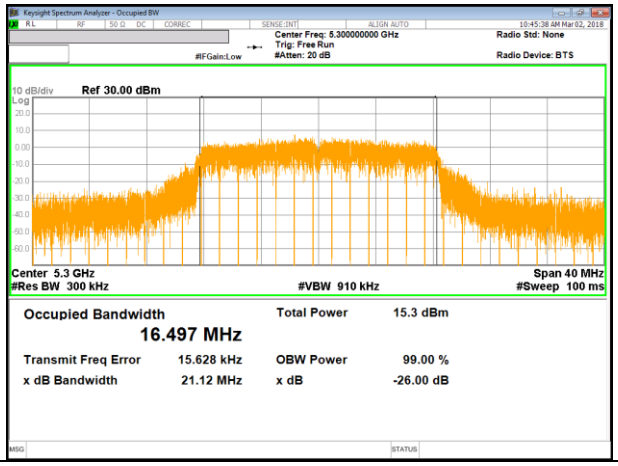
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.3 GHz IEEE 802.11a mode

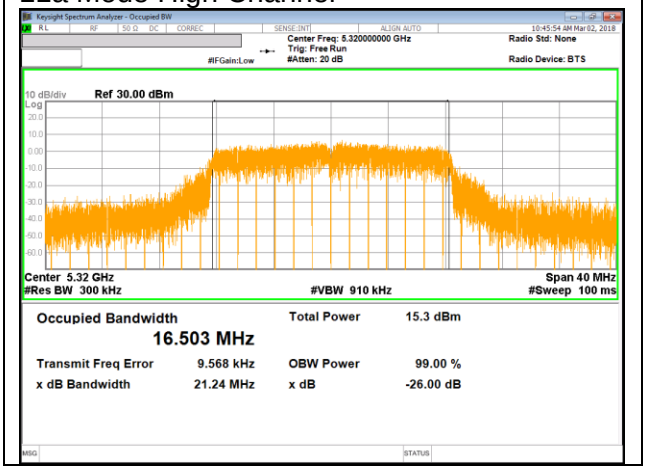
11a Mode Low Channel



11a Mode Middle Channel



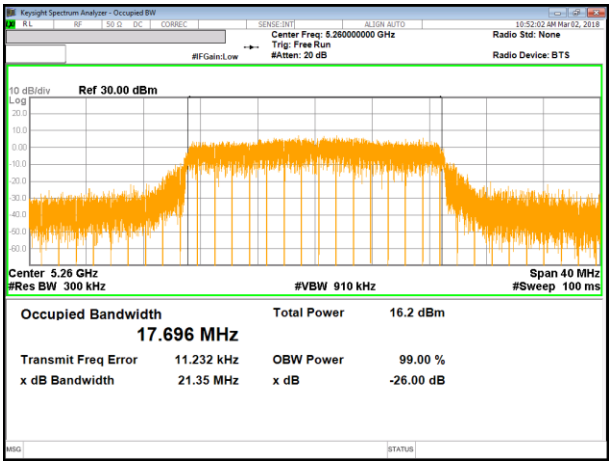
11a Mode High Channel



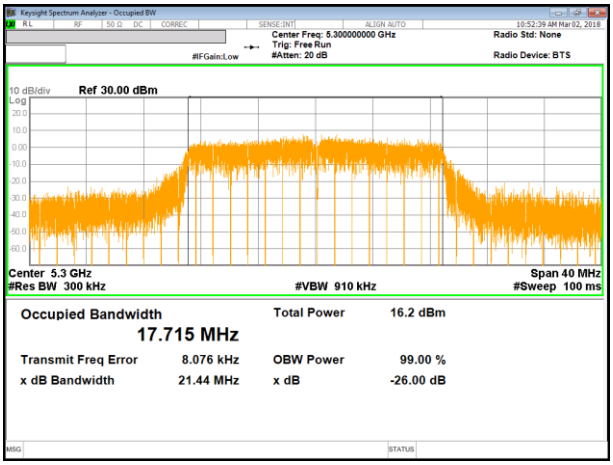
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.3 GHz IEEE 802.11n HT20 mode

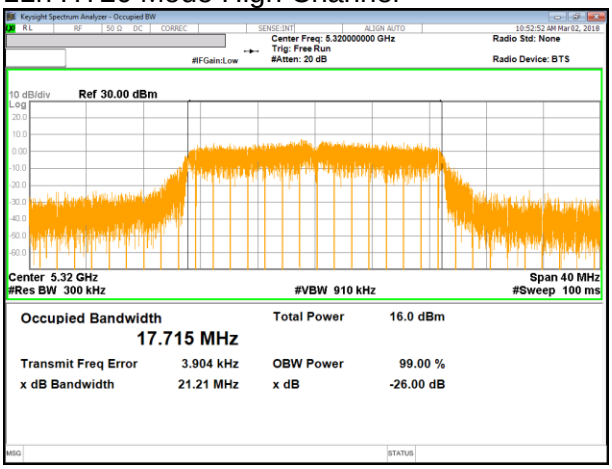
11n HT20 Mode Low Channel



11n HT20 Mode Middle Channel



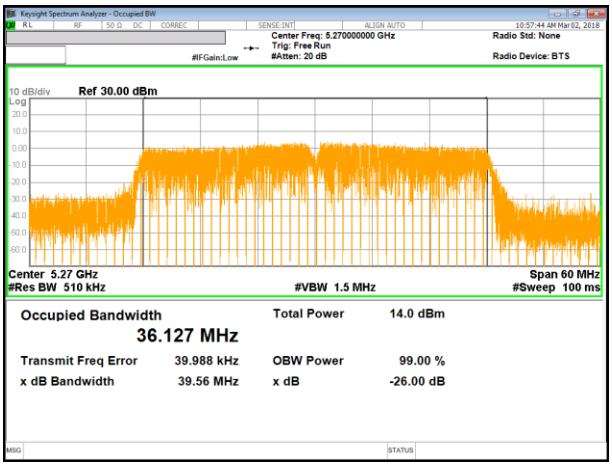
11n HT20 Mode High Channel



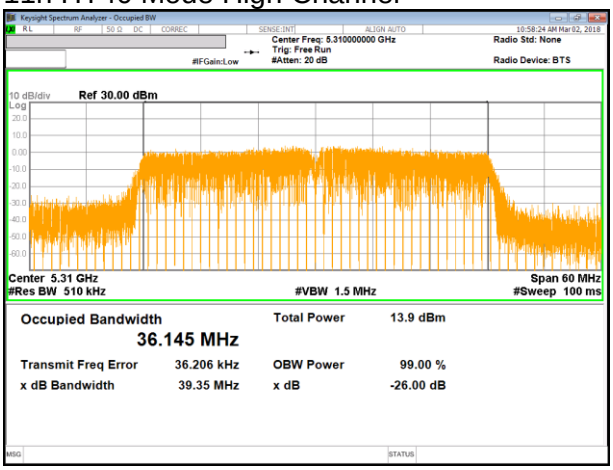
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.3 GHz IEEE 802.11n HT40 mode

11n HT40 Mode Low Channel



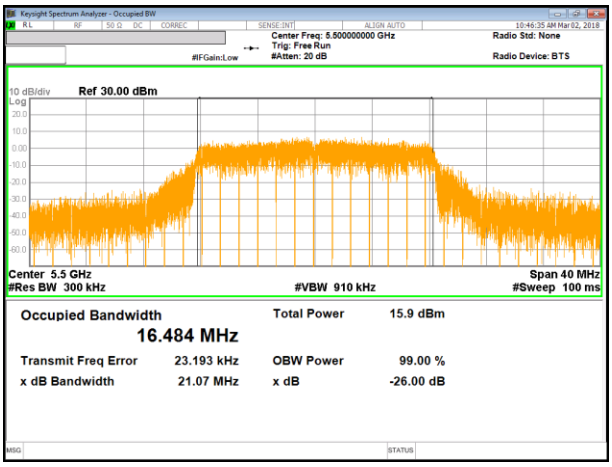
11n HT40 Mode High Channel



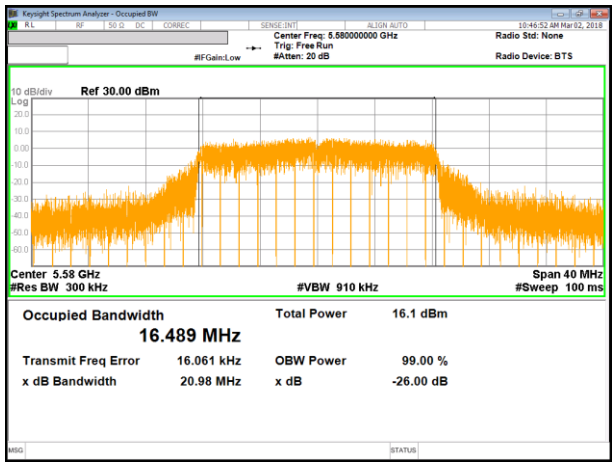
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.5 GHz IEEE 802.11a mode

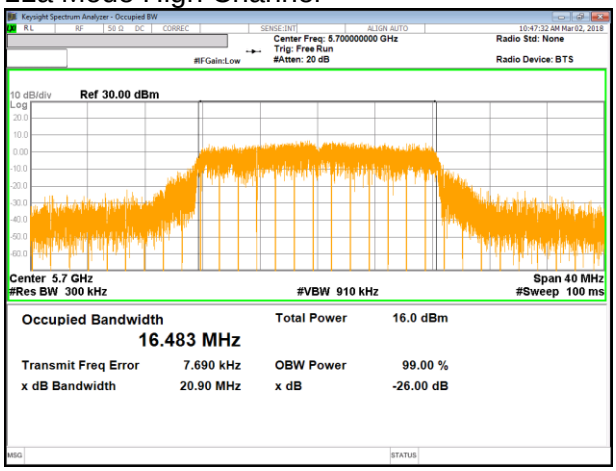
11a Mode Low Channel



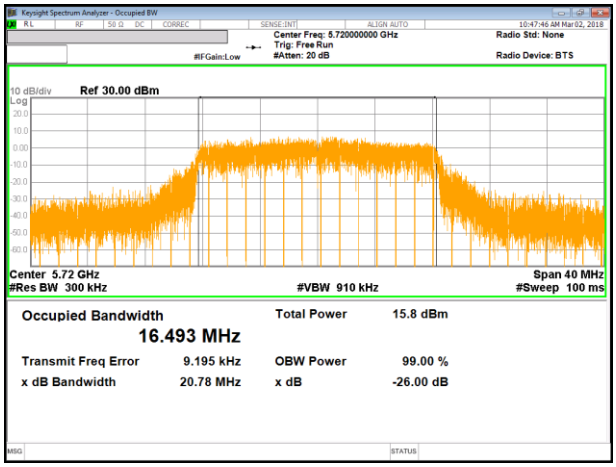
11a Mode Middle Channel



11a Mode High Channel



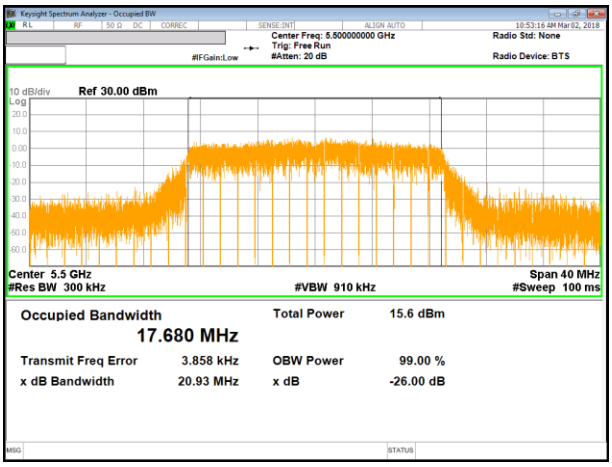
11a Mode Straddle Channel



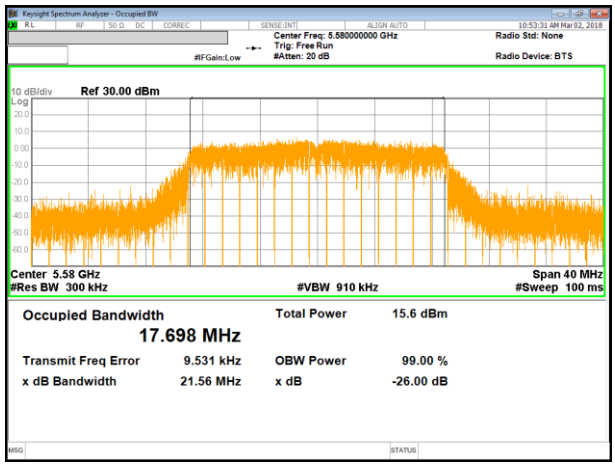
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.5 GHz IEEE 802.11n HT20 mode

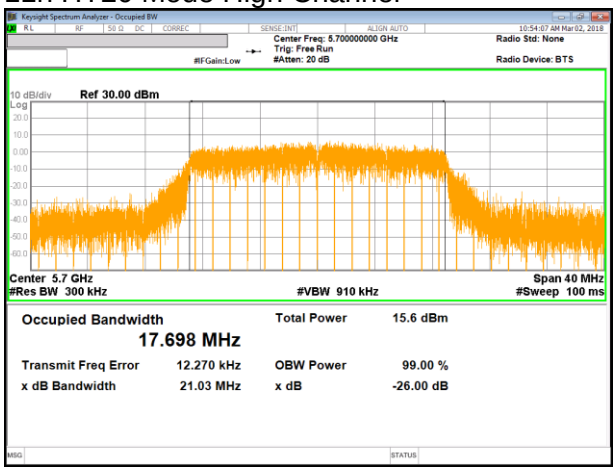
11n HT20 Mode Low Channel



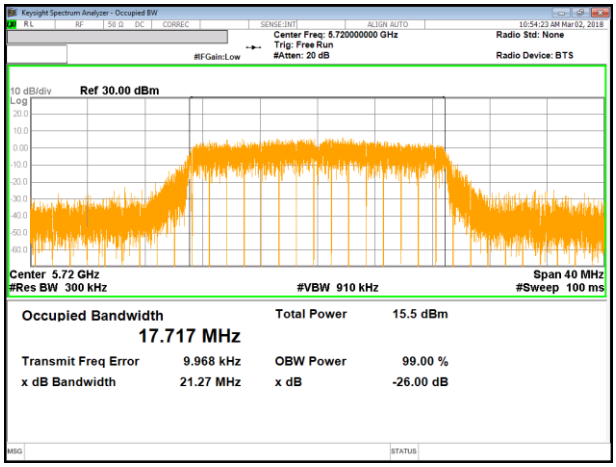
11n HT20 Mode Middle Channel



11n HT20 Mode High Channel



11n HT20 Mode Straddle Channel

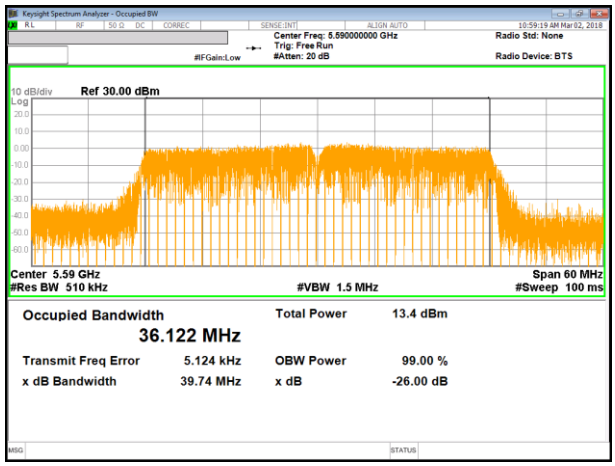


UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

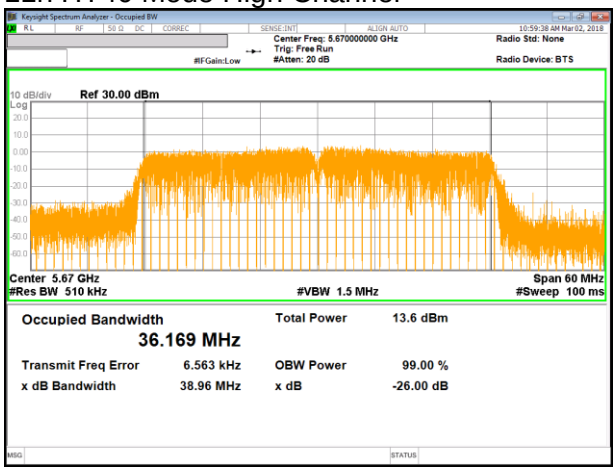
UNII 5.5 GHz IEEE 802.11n HT40 mode

11n HT40 Mode Low Channel

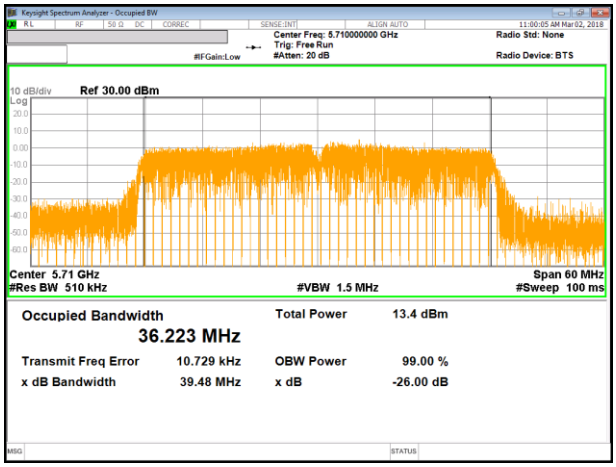
11n HT40 Mode Middle Channel



11n HT40 Mode High Channel



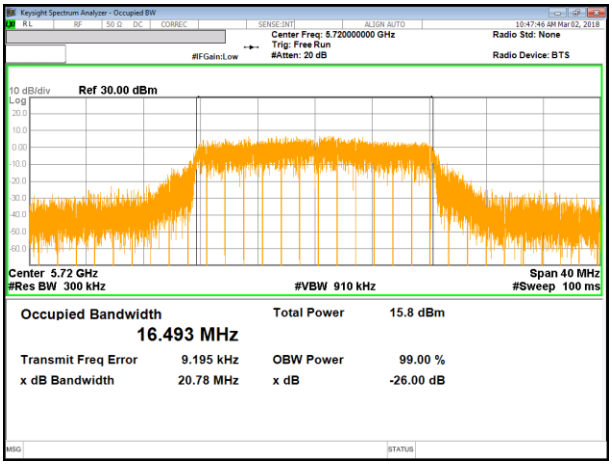
11n HT40 Mode Straddle Channel



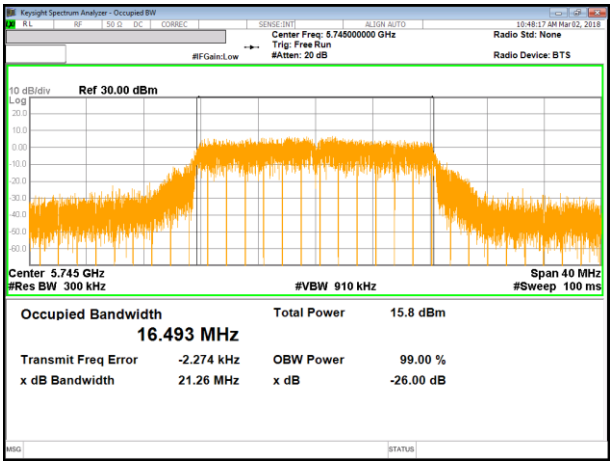
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.8 GHz IEEE 802.11a mode

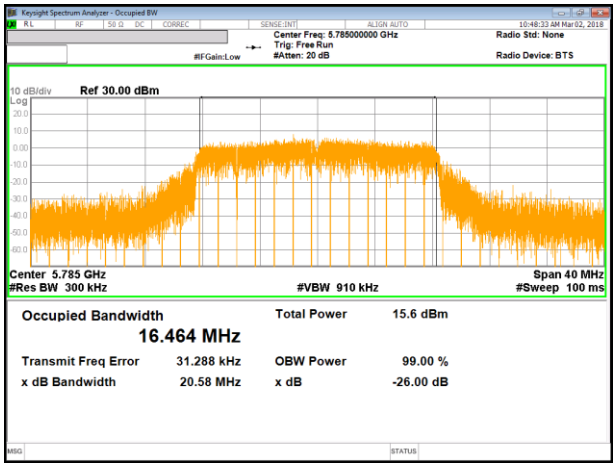
11a Mode Straddle Channel



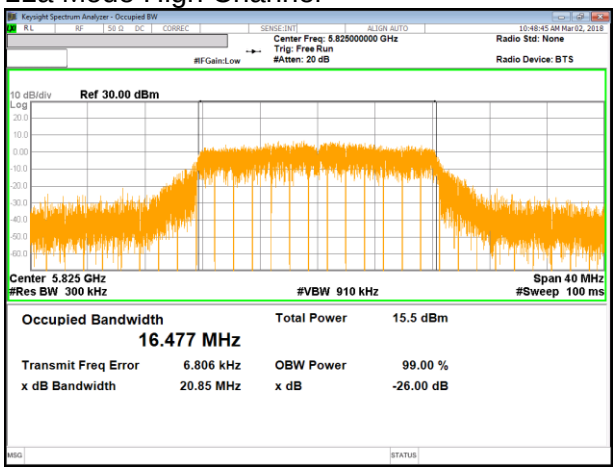
11a Mode Low Channel



11a Mode Middle Channel



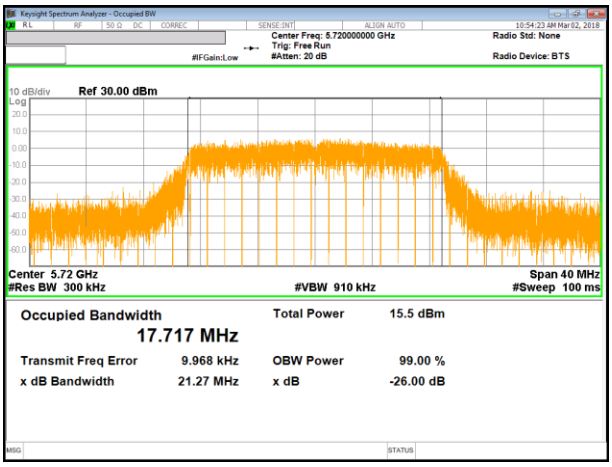
11a Mode High Channel



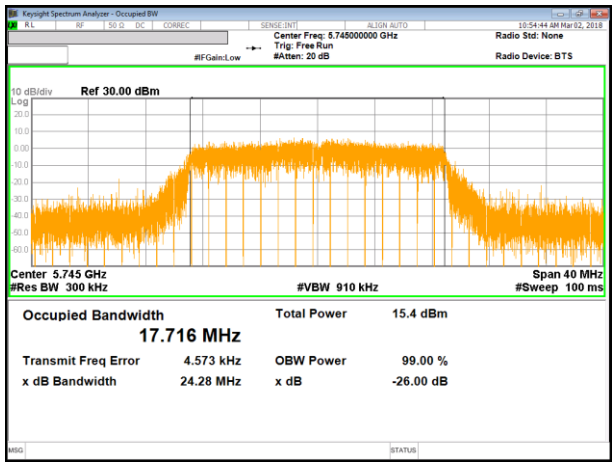
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

UNII 5.8 GHz IEEE 802.11n HT20 mode

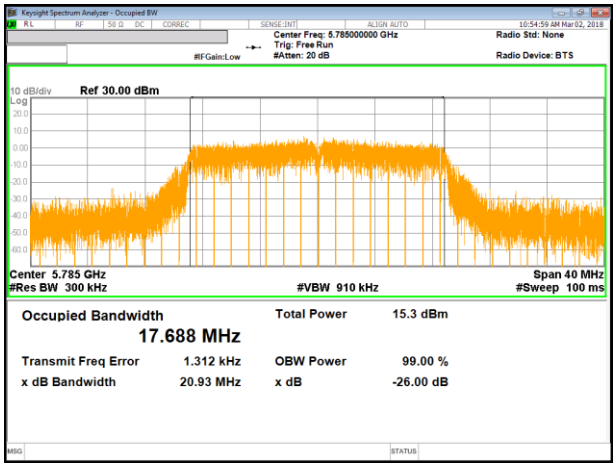
11n HT20 Mode Straddle Channel



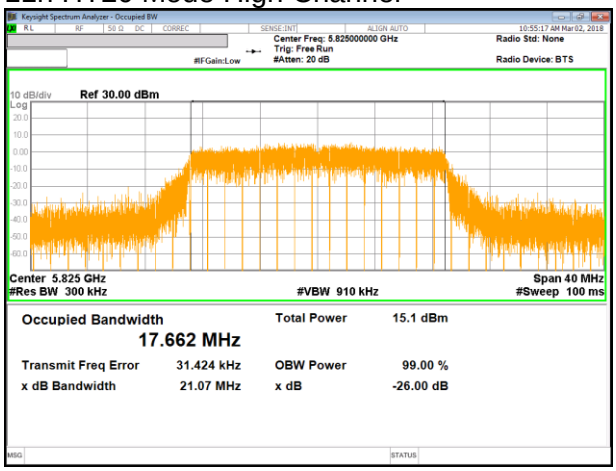
11n HT20 Mode Low Channel



11n HT20 Mode Middle Channel



11n HT20 Mode High Channel



UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.