CERTIFICATION TEST REPORT

Report Number. : 4789354096-E3V2

Applicant	:	SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	:	SM-P615
FCC ID	:	A3LSMP615
EUT Description	:	GSM/WCDMA/LTE Tablet + BT/BLE, DTS/UNII a/b/g/n/ac and ANT+
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C

Date Of Issue:
March 10, 2020

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

IAS ACCREDITED
Testing Laboratory
TL-637

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	03/05/20	Initial issue	Jihyeon Park
V2	03/10/20	Updated to address TCB's question	Jihyeon Park

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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.

TABLE OF CONTENTS

REPORT REVISION HISTORY **2**

TABLE OF CONTENTS **3**

1. ATTESTATION OF TEST RESULTS **5**

2. SUMMARY TABLE **6**

3. TEST METHODOLOGY **6**

4. FACILITIES AND ACCREDITATION **6**

5. CALIBRATION AND UNCERTAINTY **7**

5.1. MEASURING INSTRUMENT CALIBRATION *7*

5.2. SAMPLE CALCULATION *7*

5.3. MEASUREMENT UNCERTAINTY *7*

5.4. DECISION RULE *7*

6. EQUIPMENT UNDER TEST **8**

6.1. EUT DESCRIPTION *8*

6.2. MAXIMUM OUTPUT POWER *8*

6.3. DESCRIPTION OF AVAILABLE ANTENNAS *9*

6.4. TESTED CHANNELS LIST *9*

6.5. WORST-CASE CONFIGURATION AND MODE *10*

6.6. DESCRIPTION OF TEST SETUP *11*

7. MEASUREMENT METHOD **13**

8. TEST AND MEASUREMENT EQUIPMENT **14**

9. ANTENNA PORT TEST RESULTS **15**

9.1. ON TIME AND DUTY CYCLE *15*

9.2. 6 dB BANDWIDTH *16*

9.2.1. 802.11b MODE 17

9.2.2. 802.11g MODE 21

9.2.3. 802.11n HT20 MODE 25

9.3. OUTPUT POWER *29*

9.3.1. 1TX_TEST RESULTS 30

9.3.2. 2TX_TEST RESULTS 31

9.4. POWER SPECTRAL DENSITY *32*

9.4.1. 802.11b MODE 33

9.4.2. 802.11g MODE 37

9.4.3. 802.11n HT20 MODE 41

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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.

9.5. CONDUCTED SPURIOUS EMISSIONS 45
9.5.1. 802.11b MODE 46
9.5.2. 802.11g MODE 50
9.5.3. 802.11n HT20 MODE 54

10. RADIATED TEST RESULTS 58

10.1. TRANSMITTER ABOVE 1 GHz 60
10.1.1. TX ABOVE 1 GHz 802.11b MODE IN THE 2.4 GHz BAND 60
10.1.2. TX ABOVE 1 GHz 802.11g MODE IN THE 2.4 GHz BAND 88
10.1.3. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 2.4 GHz BAND 118

10.2. WORST CASE BELOW 1 GHZ 148

11. AC POWER LINE CONDUCTED EMISSIONS 150

11.1.1. AC Power Line 151

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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.

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.

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

MODEL NUMBER: SM-P615

SERIAL NUMBER: R32N1004Z2N (CONDUCTED)
R32N1004YJN (RADIATED);

DATE TESTED: FEB 10, 2020 – FEB 26, 2020;

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Complies

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:

Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Jihyeon Park
Suwon Lab Technician
UL Korea, Ltd.

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

2. SUMMARY TABLE

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

3. TEST METHODOLOGY

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

4. 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/wp-content/uploads/2017/05/TL-637.pdf.

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

5. CALIBRATION AND UNCERTAINTY

5.1. 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.

5.2. 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)

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

5.3. MEASUREMENT UNCERTAINTY

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

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

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

5.4. DECISION RULE

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

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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.

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

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

WiFi operating mode

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

6.2. MAXIMUM OUTPUT POWER

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

Frequency Range [MHz]	Mode	Output Power [dBm]		Output Power [mW]	
		ANT1	ANT2	ANT1	ANT2
2412 - 2472	802.11b SISO	18.40	17.13	69.18	51.64
	802.11g SISO	15.61	14.41	36.39	27.61
	802.11g MIMO	16.17		41.40	
	802.11n(HT20) SISO	15.49	14.53	35.40	28.38
	802.11n(HT20) MIMO	16.54		45.08	

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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.

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

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

The radio utilizes an internal antennas, with Antenna 1's maximum gain of –6.0 dBi and Antenna 2's maximum gain of –5.9 dBi

"WIFI1" and "WIFI2" as indicated in antenna specification are written as Antenna 1 and Antenna 2 in this report.

6.4. TESTED CHANNELS LIST

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

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

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

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

6.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission below 1GHz and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.
Radiated emission above 1GHz was performed with the EUT set to transmit low/mid/High Channels.
For SISO (Antenna 1), the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.
For SISO (Antenna 2), the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.
For MIMO, the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.
Based on the baseline scan, the worst-case data rates were:
802.11b mode: 1 Mbps
802.11g mode: 6 Mbps 2TX
802.11n HT20 mode: MCS0 2TX

Depending on spot-check results for 802.11g / n HT20, SISO(Antenna 1) mode is worst case than SISO(Antenna 2) and MIMO. So radiation test for 802.11g / n HT20 were evaluated at SISO(Antenna 1) mode.

Note : As a result of the radiated test, SISO(antenna 1)mode is the worst case. Thus all RSE tested to SISO(Antenna 1) mode.
All radiated and power line conducted tests were performed attached with travel adapter for the worst case condition mode.

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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.

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA50EWE	EP-DT725BWE	N/A
Data Cable	SAMSUNG	EP-DR140AWE	N/A	N/A
Earphone	SAMSUNG	EHS64AVFWE	N/A	N/A

I/O CABLE

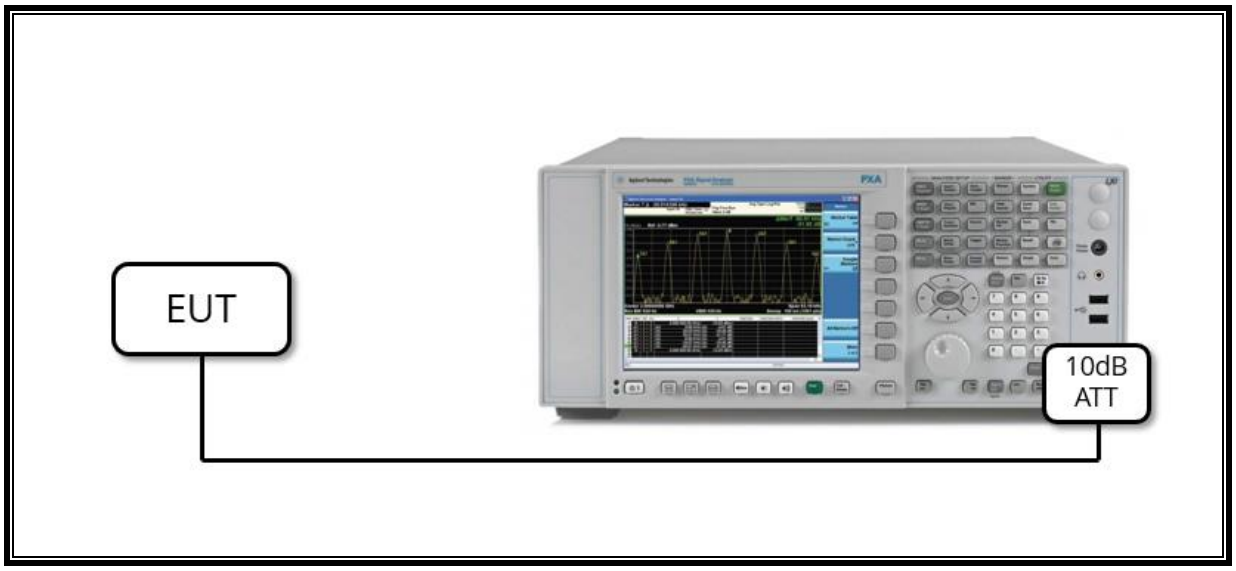
I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	C Type	Shielded	1.0m	N/A
2	Audio	2	Mini-Jack	Unshielded	1.2m	N/A

TEST SETUP

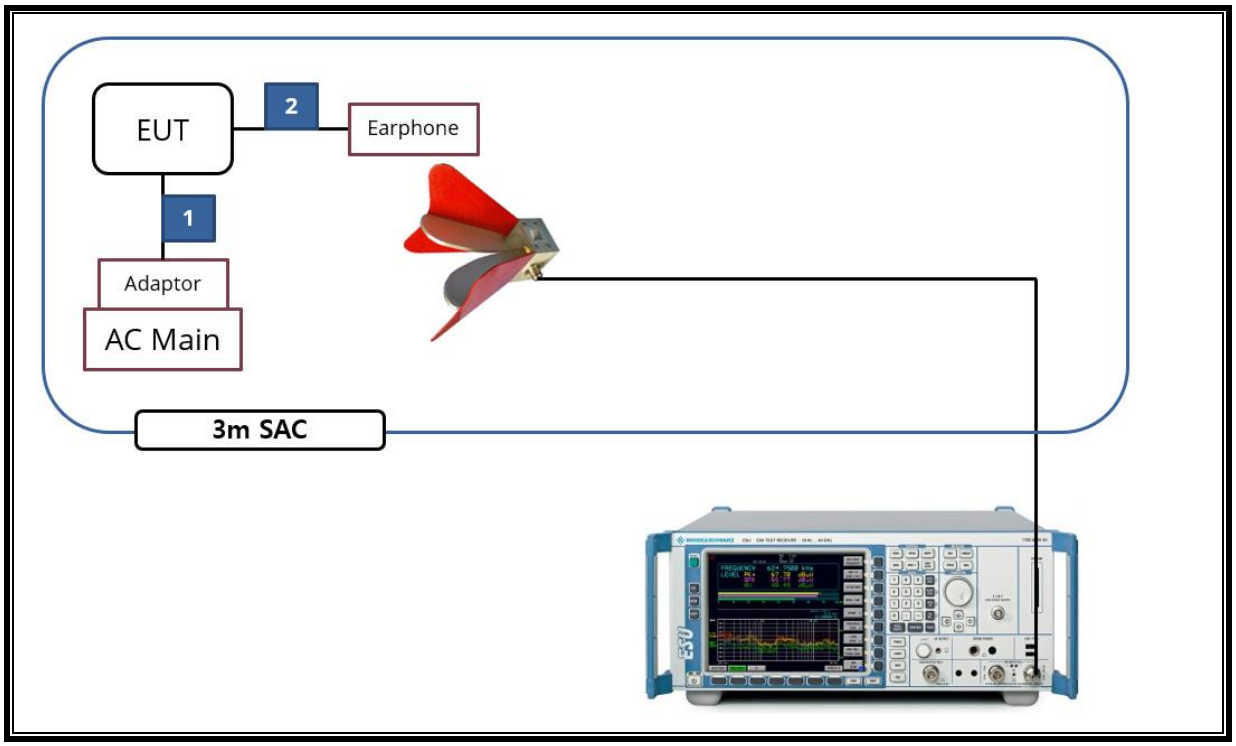
The EUT is a stand-alone unit during the tests.
Test software in hidden menu exercised the EUT to enable DTS mode.

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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.

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.

7. MEASUREMENT METHOD

6 dB BW : KDB 558074 D01 v05r02, Section 8.2

OUTPUT POWER : KDB 558074 D01 v05r02, Section 8.3.2.3.

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

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

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

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

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

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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.

8. TEST AND MEASUREMENT EQUIPMENT

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

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

Antenna, Loop, 9kHz-30MHz			
Description	**Manufacturer**	**Model**	**Version**
Radiated software	UL	UL EMC	Ver 9.5
AC Line Conducted software	UL	UL EMC	Ver 9.5

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

9. ANTENNA PORT TEST RESULTS

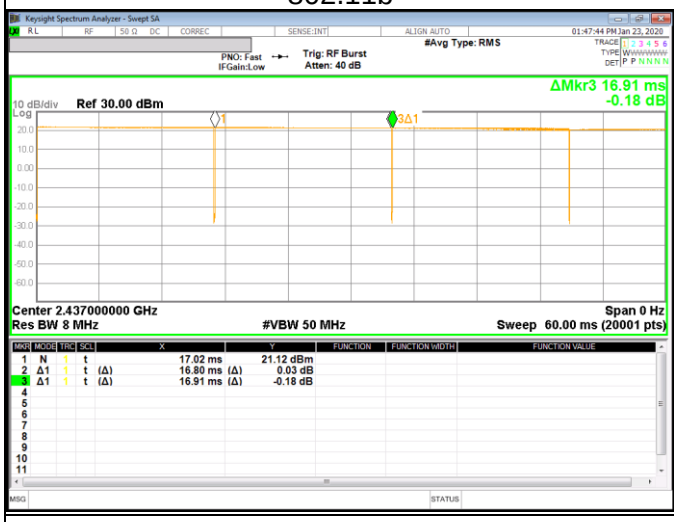
9.1. ON TIME AND DUTY CYCLE

LIMITS

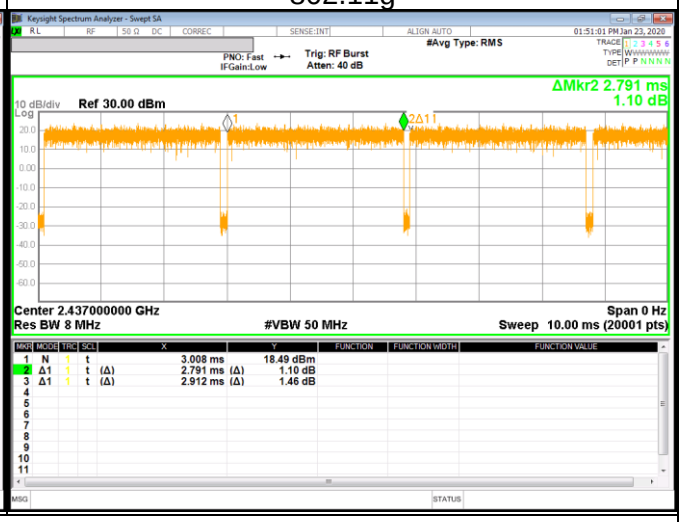
None; for reporting purposes only.

Band	Mode	On Time [ms]	Period [ms]	Duty Cycle X [Linear]	Duty Cycle X [%]	Duty Cycle Correction Factor [dB]	1/T Minimum VBW [kHz]
2.4 GHz	802.11b	16.80	16.91	0.99	99.3	0.00	0.060
	802.11g	2.791	2.912	0.96	95.8	0.18	0.358
	802.11n(HT20)	2.595	2.696	0.96	96.3	0.17	0.385

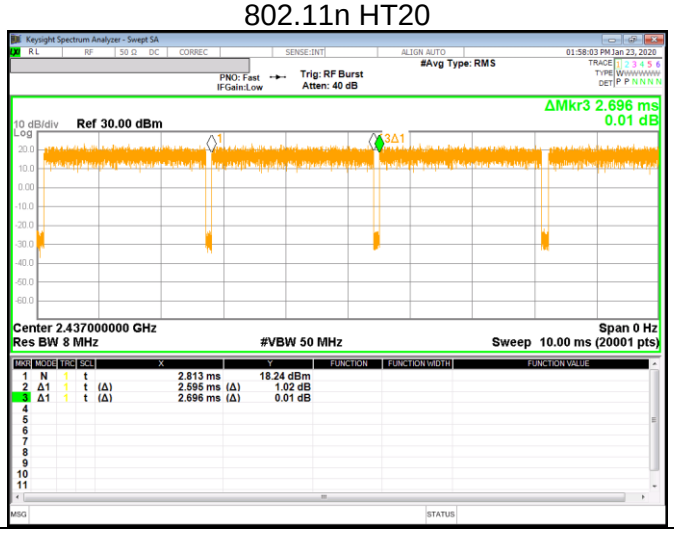
802.11b



802.11g



802.11n HT20



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

9.2. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

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

TEST PROCEDURE

Reference to KDB 558074 D01 15.247 Meas Guidance: The transmitter output is connected to a spectrum analyzer with the RBW set to100 kHz, the VBW >= 3 x RBW, peak detector and max hold.

RESULTS

- Please refer to the next page

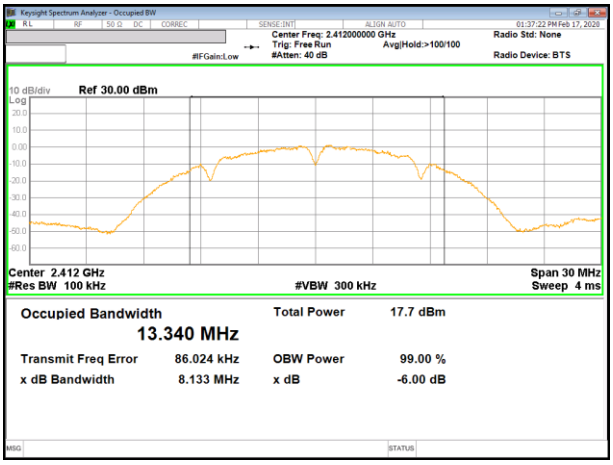
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

9.2.1. 802.11b MODE

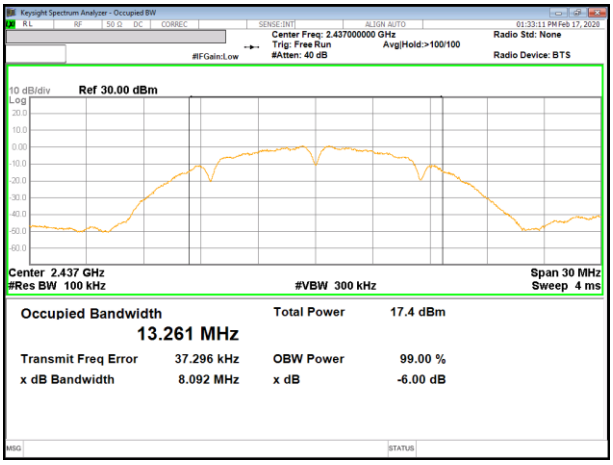
1TX Antenna 1 MODE

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	8.1330	0.5
Mid 6	2437	8.0920	0.5
High 11	2462	7.8770	0.5
High 12	2467	8.0300	0.5
High 13	2472	8.2750	0.5

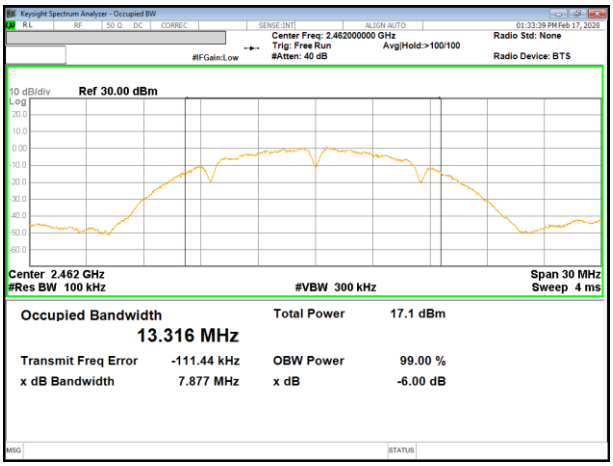
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.



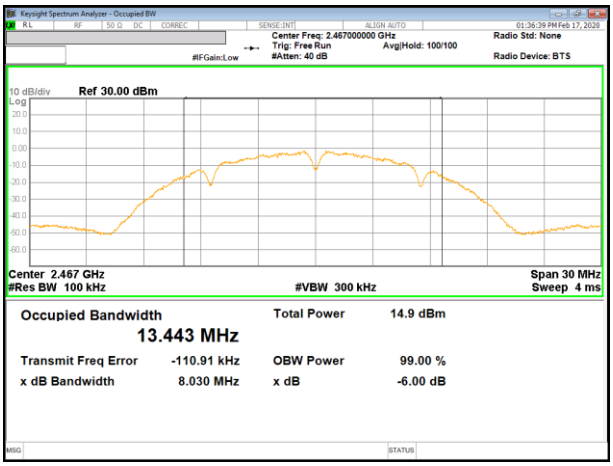
LOW CHANNEL 1



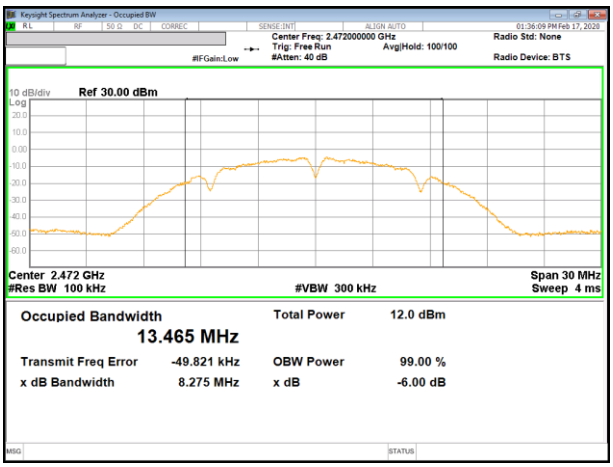
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



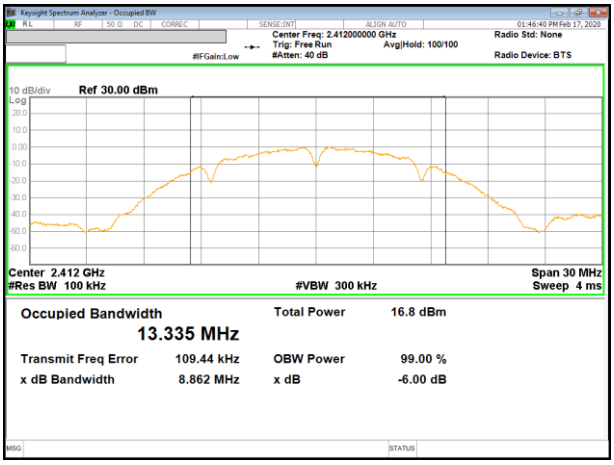
HIGH CHANNEL 13

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

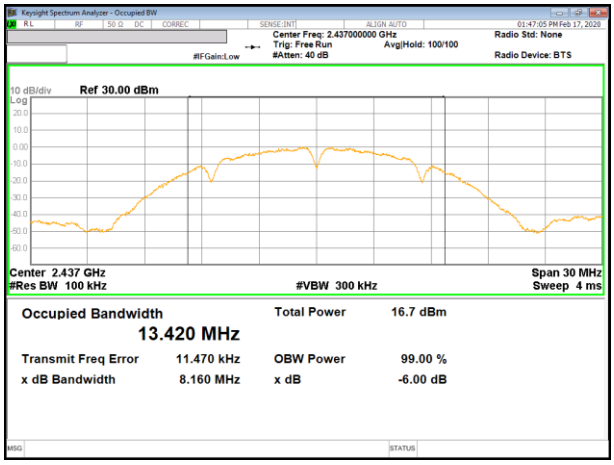
1TX Antenna 2 MODE

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	8.8620	0.5
Mid 6	2437	8.1600	0.5
High 11	2462	8.0920	0.5
High 12	2467	8.6040	0.5
High 13	2472	8.4410	0.5

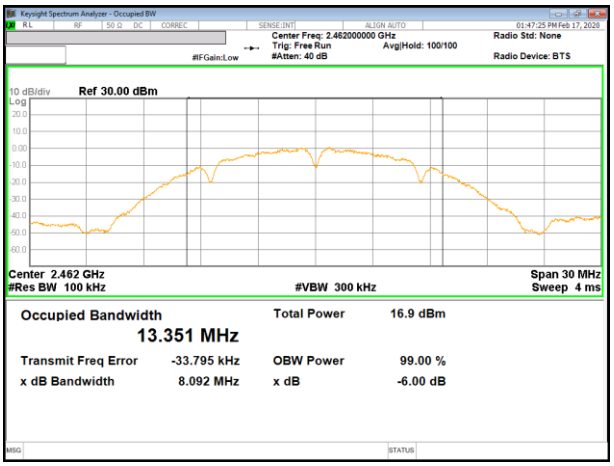
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.



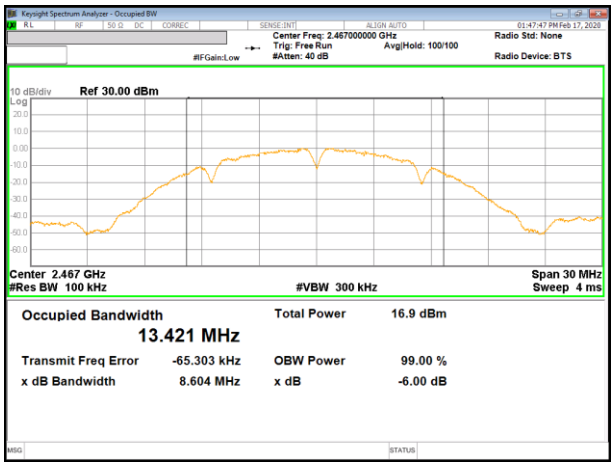
LOW CHANNEL 1



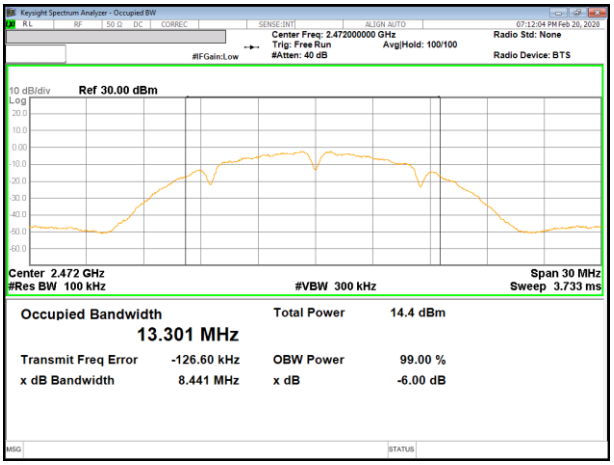
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

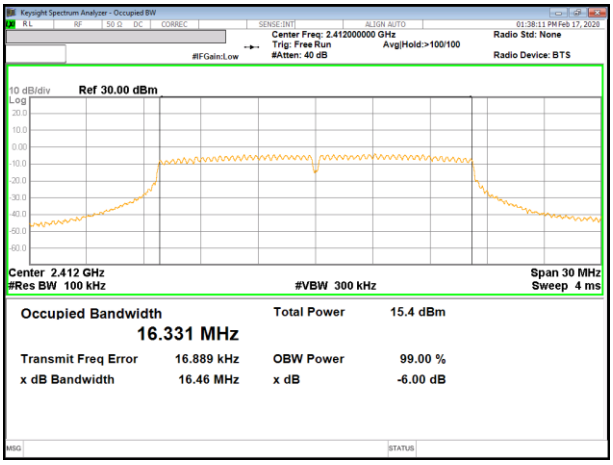
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

9.2.2. 802.11g MODE

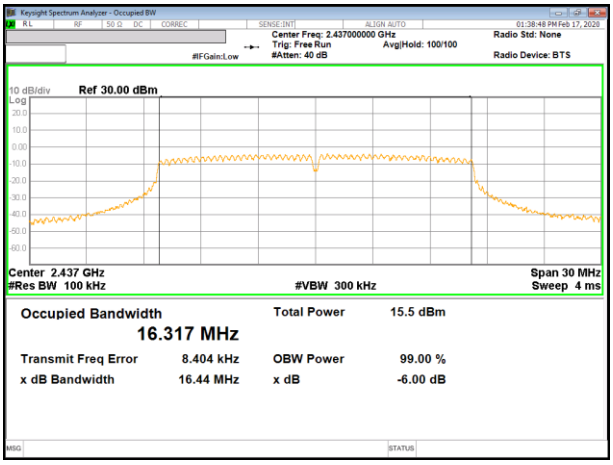
1TX Antenna 1 MODE

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	16.4600	0.5
Mid 6	2437	16.4400	0.5
High 11	2462	16.4500	0.5
High 12	2467	16.4400	0.5
High 13	2472	16.4500	0.5

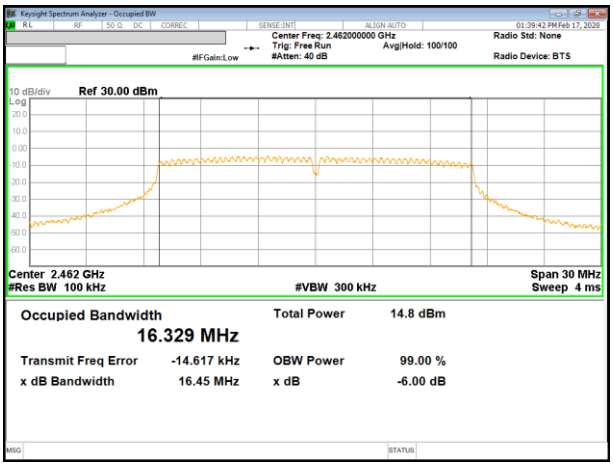
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.



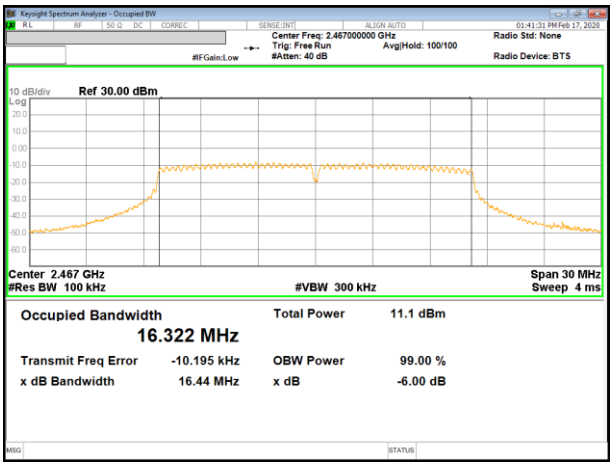
LOW CHANNEL 1



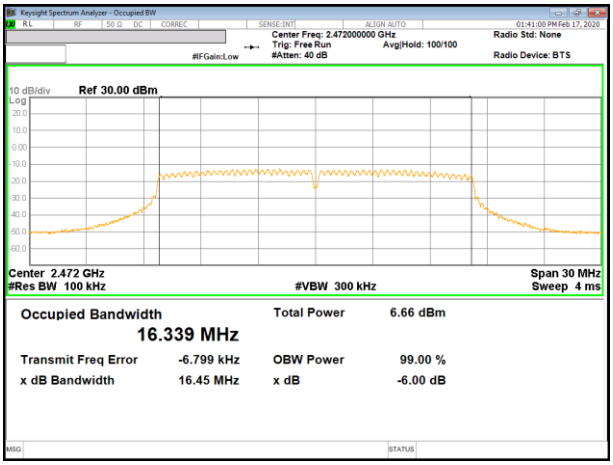
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



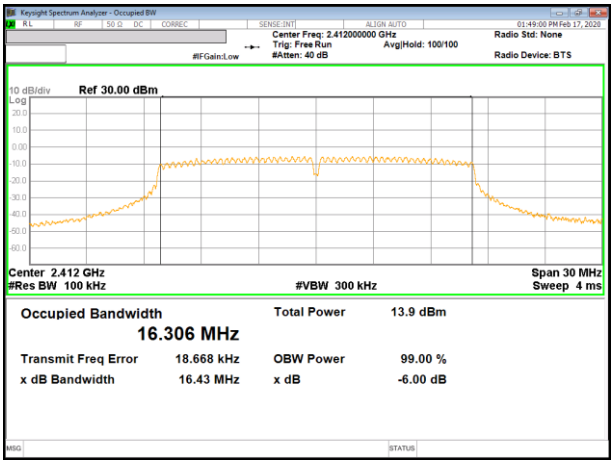
HIGH CHANNEL 13

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

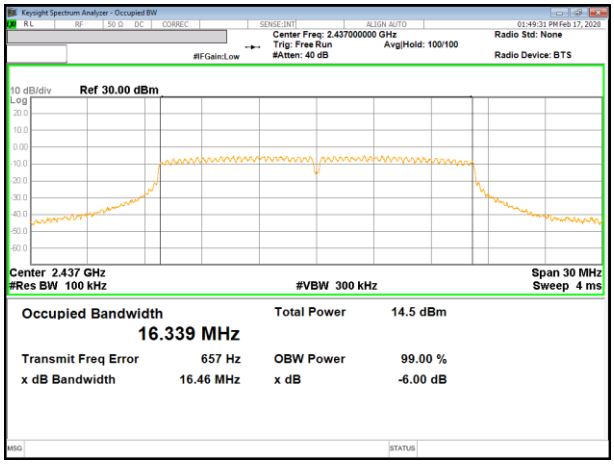
1TX Antenna 2 MODE

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	16.4300	0.5
Mid 6	2437	16.4600	0.5
High 11	2462	16.4400	0.5
High 12	2467	16.4300	0.5
High 13	2472	16.4400	0.5

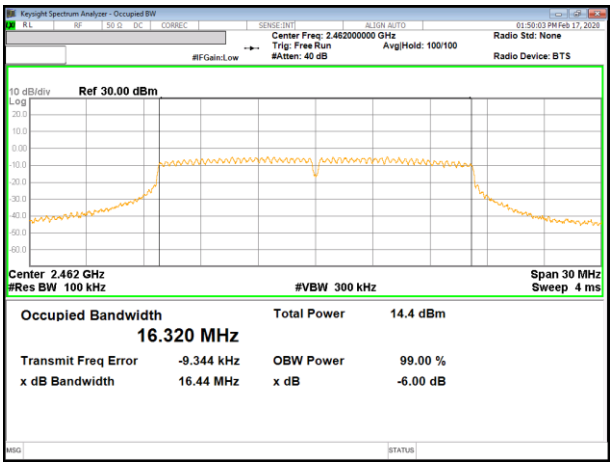
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.



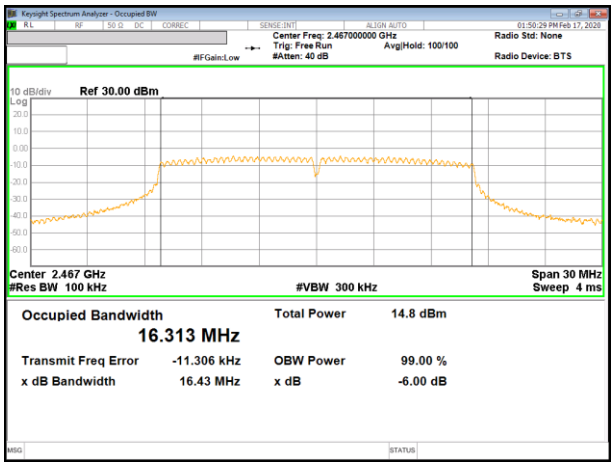
LOW CHANNEL 1



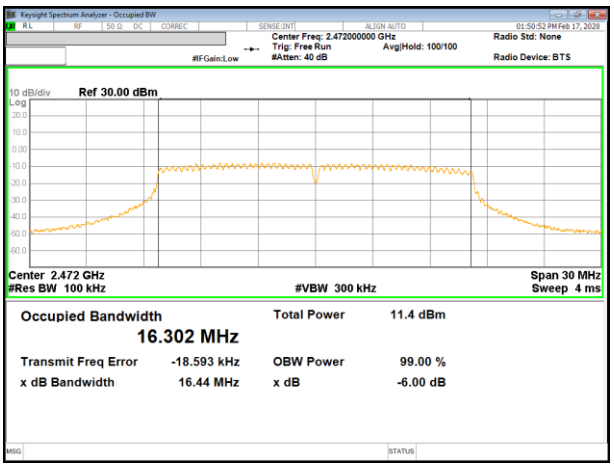
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

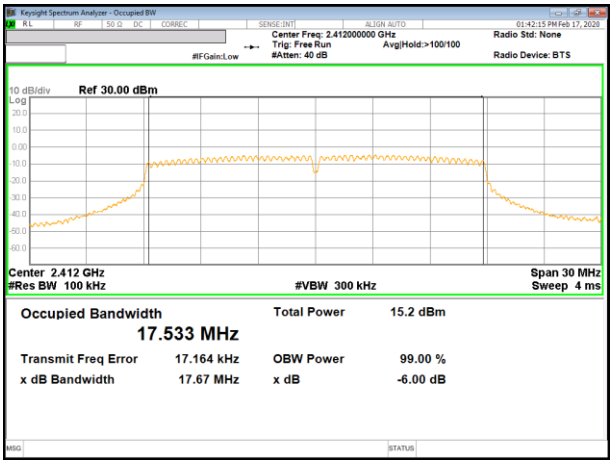
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

9.2.3. 802.11n HT20 MODE

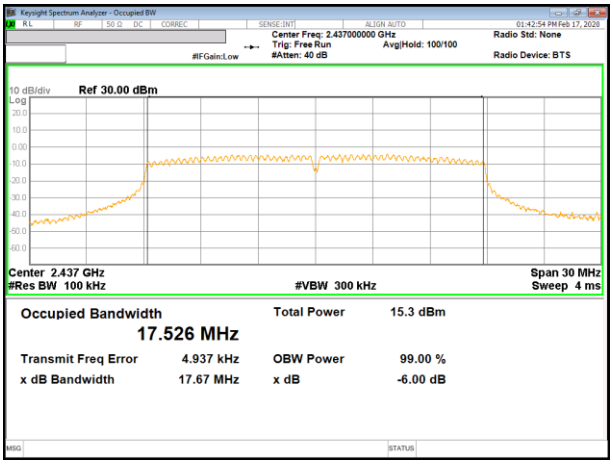
1TX Antenna 1 MODE

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	17.6700	0.5
Mid 6	2437	17.6700	0.5
High 11	2462	17.6400	0.5
High 12	2467	17.6700	0.5
High 13	2472	17.6900	0.5

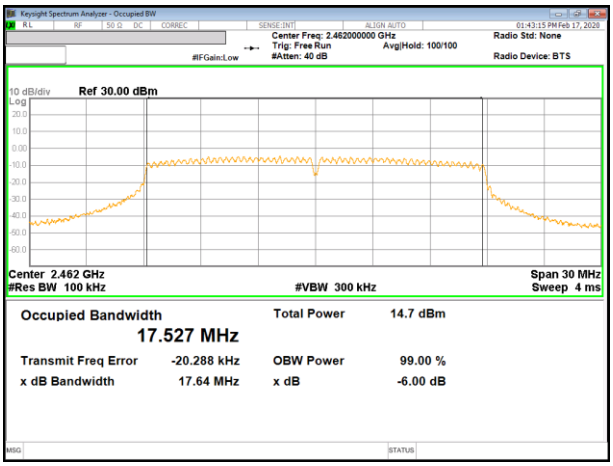
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.



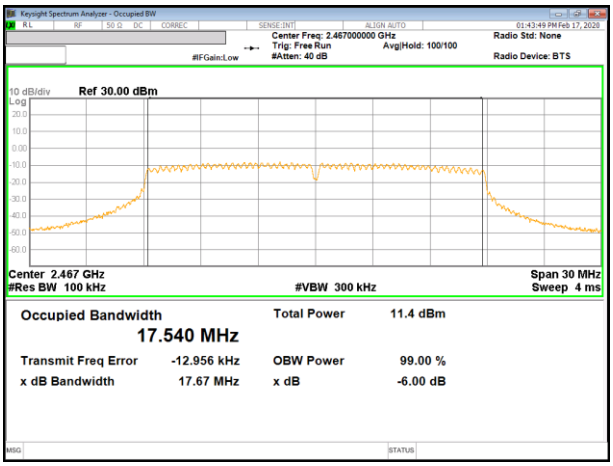
LOW CHANNEL 1



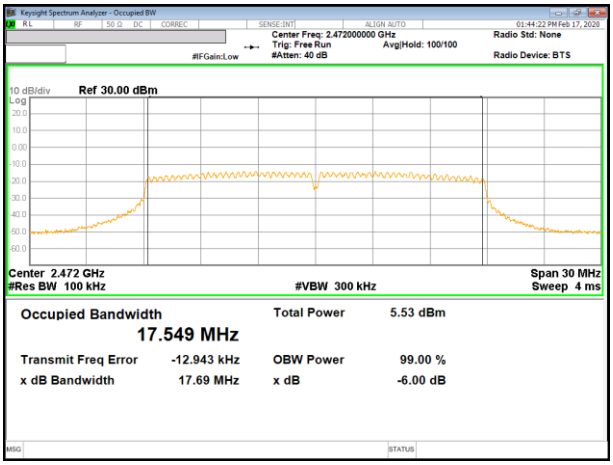
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



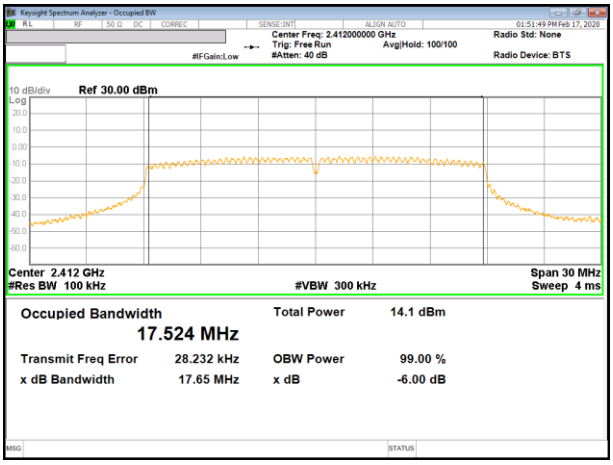
HIGH CHANNEL 13

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

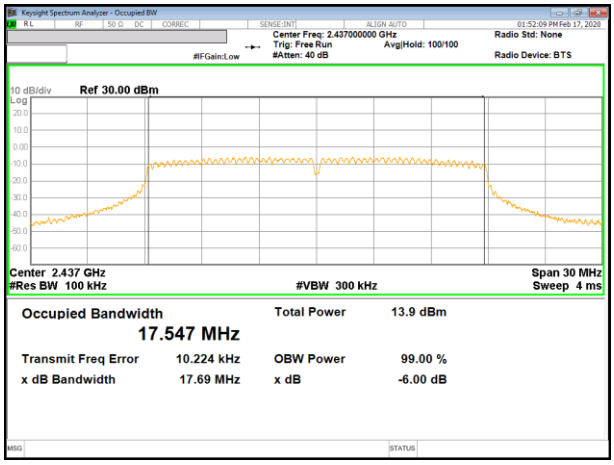
1TX Antenna 2 MODE

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	17.6500	0.5
Mid 6	2437	17.6900	0.5
High 11	2462	17.6700	0.5
High 12	2467	17.6500	0.5
High 13	2472	17.6400	0.5

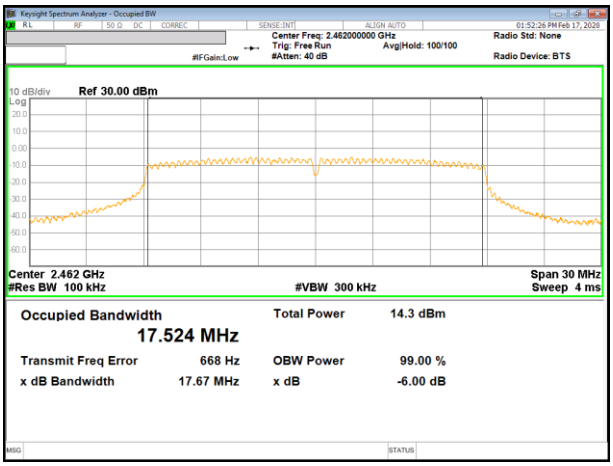
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.



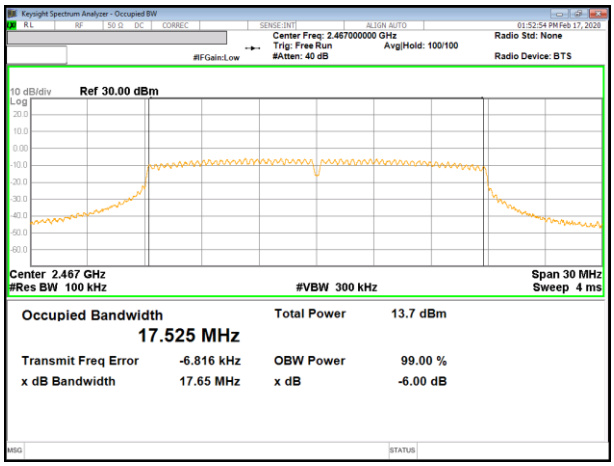
LOW CHANNEL 1



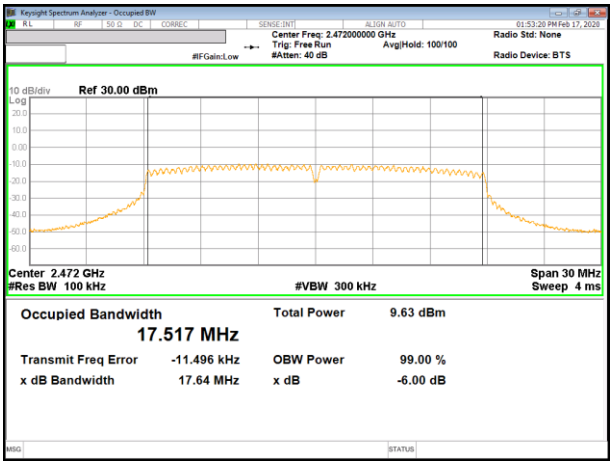
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

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

9.3. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

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

TEST PROCEDURE

The transmitter output is connected to a power meter.
The cable assembly insertion loss was entered as an offset in the power meter to allow for direct reading of power.
Output power measurement was performed utilizing the 8.3.2.3 under KDB558074 D01 15.247 Meas Guidance.

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

DIRECTIONAL ANTENNA GAIN

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

Bands [MHz]	ANT 1 [dBi]	ANT 2 [dBi]	Correlated Directional Gain [dBi]
2 412- 2472	-6.00	-5.90	-2.94

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

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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

9.3.1. 1TX_TEST RESULTS

Frequency Range [MHz]	ANT Gain		FCC Power Limit [dBm]	Max Power [dBm]
	ANT1	ANT2		
2 412 – 2 472	-6.00	-5.90	30.00	30.00

Included in Calculations of Corr'd Power			
Duty Cycle CF	802.11b	0.00	dB
	802.11g	0.18	dB
	802.11n HT20	0.17	dB

Calculation of Output Power result
→ Corr'd Power = Meas Power + Duty Cycle CF

Mode	Channel	Frequency [MHz]	Meas Power [dBm]		Corr'd Power [dBm]		Power Limit [dBm]
			ANT1	ANT2	ANT1	ANT2	
802.11b	1	2412	18.16	**17.13**	18.16	**17.13**	30.00
	6	2437	**18.40**	16.96	**18.40**	16.96	
	11	2462	18.08	16.60	18.08	16.60	
	12	2467	15.23	16.37	15.23	16.37	
	13	2472	12.52	14.68	12.52	14.68	
Worst Case					**18.40**	**17.13**	
802.11g	1	2412	15.17	**14.23**	15.35	**14.41**	30.00
	6	2437	**15.43**	14.02	**15.61**	14.20	
	11	2462	15.03	13.94	15.21	14.12	
	12	2467	10.75	13.66	10.93	13.84	
	13	2472	7.00	10.78	7.18	10.96	
Worst Case					**15.61**	**14.41**	
802.11n HT20	1	2412	15.06	**14.36**	15.23	**14.53**	30.00
	6	2437	**15.32**	13.92	**15.49**	14.09	
	11	2462	14.94	13.68	15.11	13.85	
	12	2467	11.41	14.09	11.58	14.26	
	13	2472	5.24	9.53	5.41	9.70	
Worst Case					**15.49**	**14.59**	

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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.

9.3.2. 2TX_TEST RESULTS

Frequency Range [MHz]	ANT Gain Correlated Chain Directional Gain [dBi]	FCC Power Limit [dBm]	Max Power [dBm]
2 412 – 2 472	-2.94	30.00	30.00

Included in Calculations of Corr'd Power			
Duty Cycle CF	802.11g	0.18	dB
	802.11n HT20	0.17	dB

Calculation of Output Power result
→ Total Corr'd Power = ANT1 Power + ANT2 Power + Duty Cycle CF

Mode	Channel	Frequency [MHz]	Meas Power [dBm]		Total Corr'd Power [dBm]	Power Limit [dBm]
			ANT1	ANT2		
802.11g	1	2412	12.98	12.11	15.76	30.00
	6	2437	13.73	12.08	**16.17**	
	11	2462	13.34	13.35	15.93	
	12	2467	13.24	12.17	14.05	
	13	2472	11.2	10.5	8.35	
Worst Case					**16.17**	
802.11n HT20	1	2412	13.75	12.92	**16.54**	30.00
	6	2437	13.68	12.47	16.30	
	11	2462	13.51	13.5	16.11	
	12	2467	13.5	12.28	13.59	
	13	2472	10.69	10.1	6.51	
Worst Case					**16.54**	

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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.

9.4. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

RSS-247 (5.2) (b)

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

TEST PROCEDURE

Power Spectral Density was performed utilizing the section8.4 under KDB558074 D01 15.247 Meas Guidance.

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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. 802.11b MODE

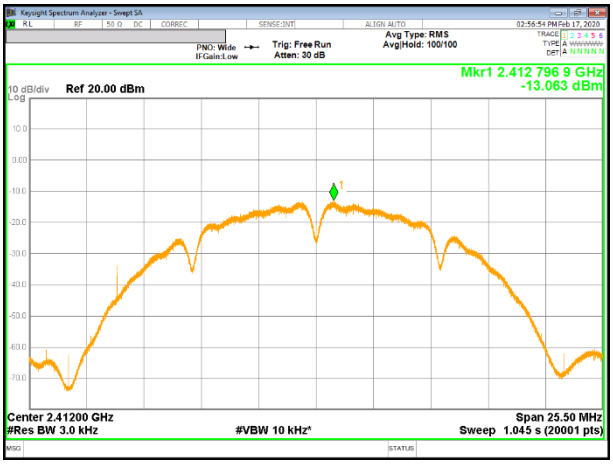
1TX Antenna 1 MODE

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD

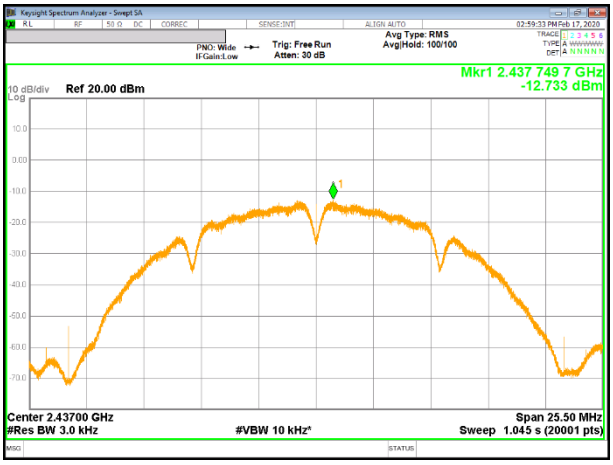
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-13.06	-13.06	8.0	-21.1
Mid 6	2437	-12.73	-12.73	8.0	-20.7
High 11	2462	-13.52	-13.52	8.0	-21.5
High 12	2467	-15.64	-15.64	8.0	-23.6
High 13	2472	-19.33	-19.33	8.0	-27.3

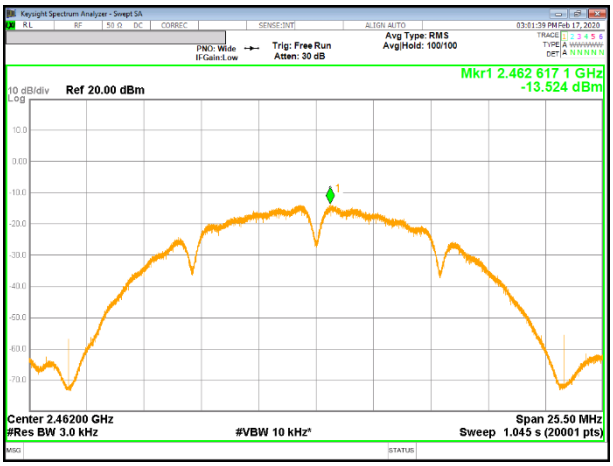
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.



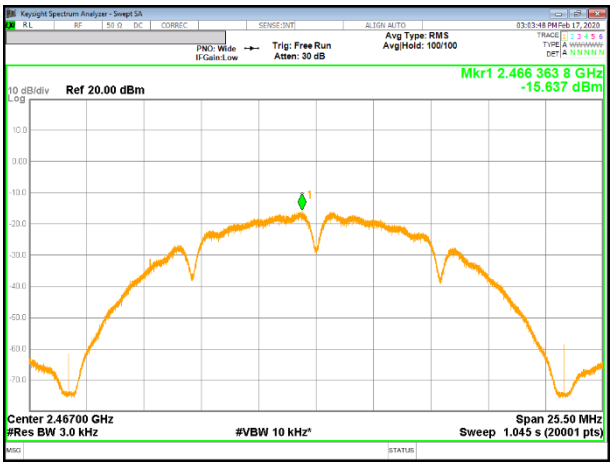
LOW CHANNEL 1



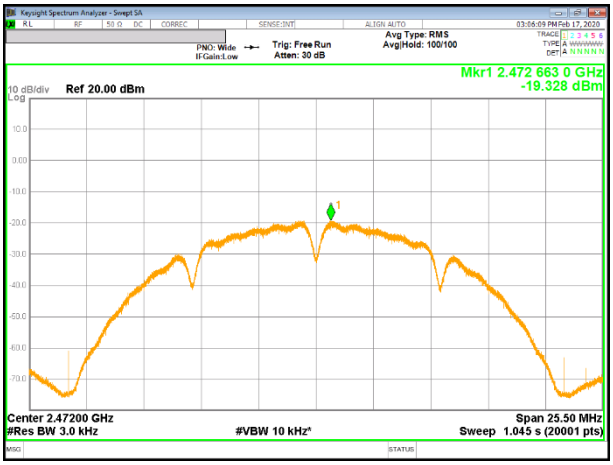
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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.

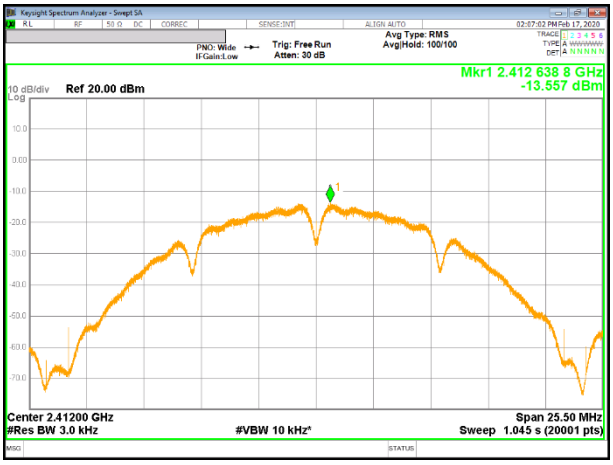
1TX Antenna 2 MODE

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD

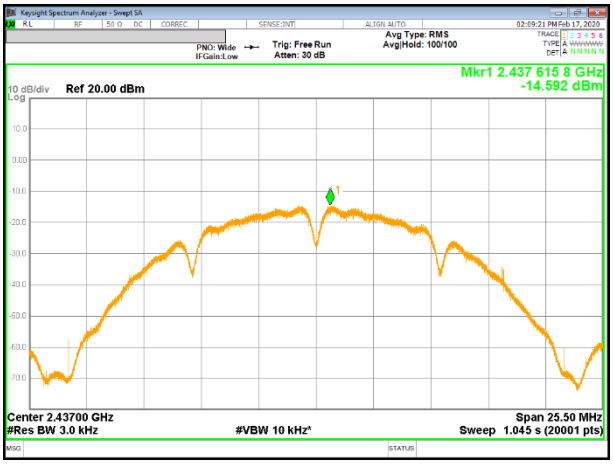
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-13.56	-13.56	8.0	-21.6
Mid 6	2437	-14.59	-14.59	8.0	-22.6
High 11	2462	-14.10	-14.10	8.0	-22.1
High 12	2467	-14.34	-14.34	8.0	-22.3
High 13	2472	-16.93	-16.93	8.0	-24.9

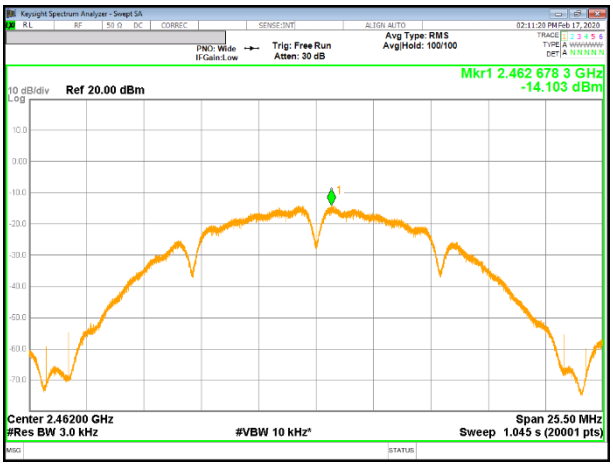
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.



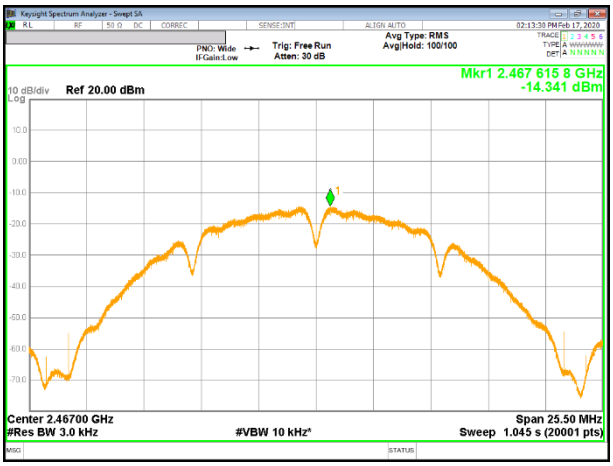
LOW CHANNEL 1



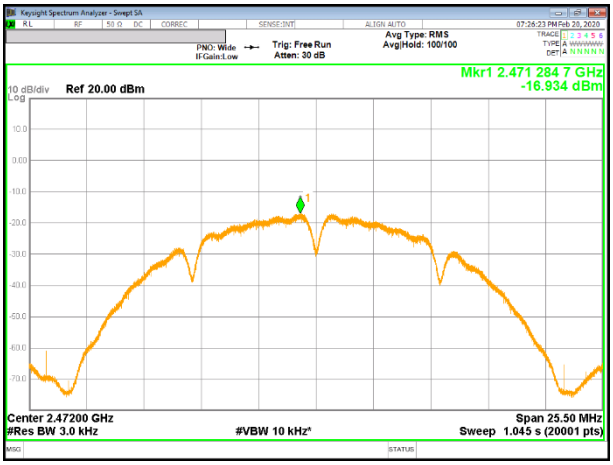
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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.

9.4.2. 802.11g MODE

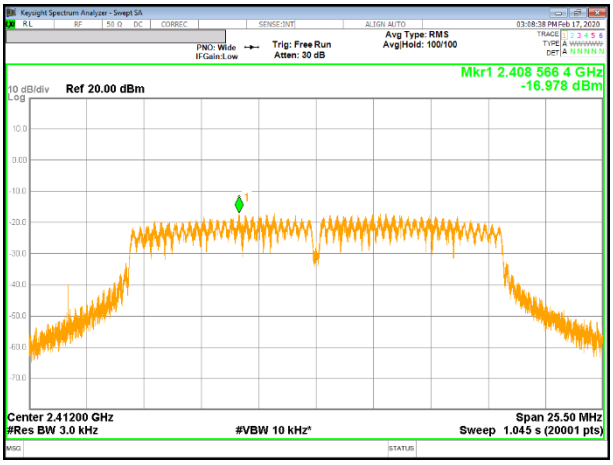
1TX Antenna 1 MODE

Duty Cycle CF (dB)	0.18	Included in Calculations of Corr'd PSD

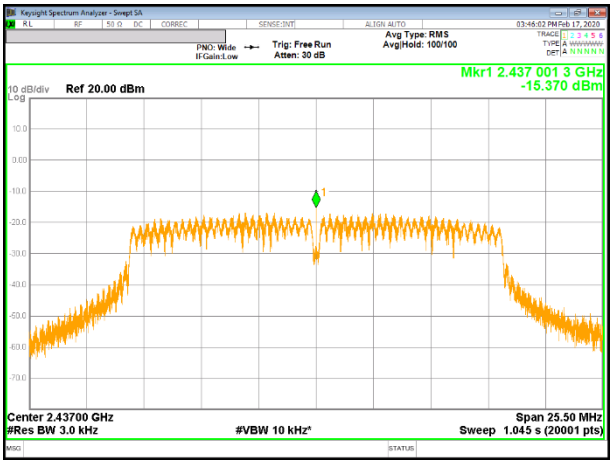
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-16.98	-16.80	8.0	-24.8
Mid 6	2437	-15.37	-15.19	8.0	-23.2
High 11	2462	-16.85	-16.67	8.0	-24.7
High 12	2467	-21.44	-21.26	8.0	-29.3
High 13	2472	-24.92	-24.74	8.0	-32.7

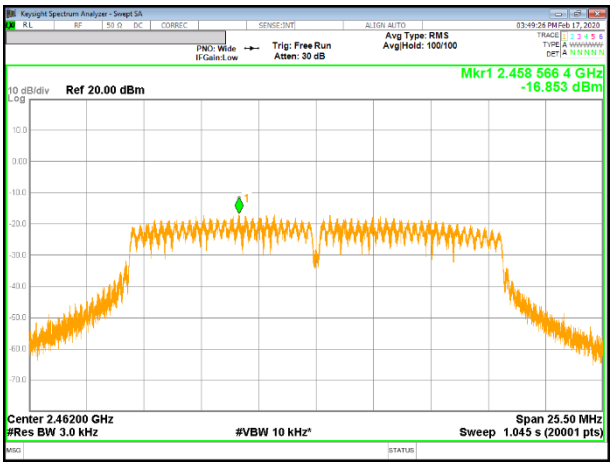
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.



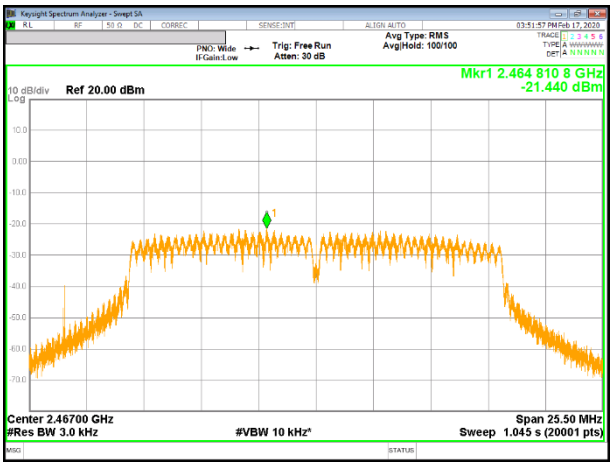
LOW CHANNEL 1



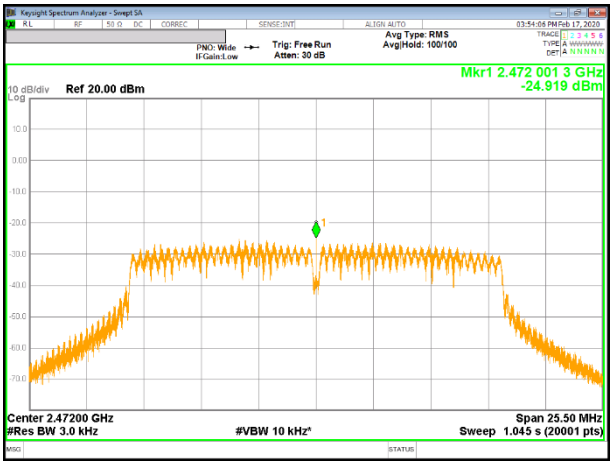
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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.

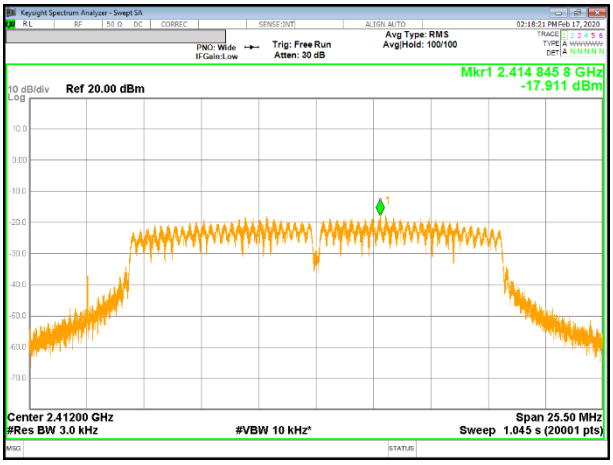
1TX Antenna 2 MODE

Duty Cycle CF (dB)	0.18	Included in Calculations of Corr'd PSD

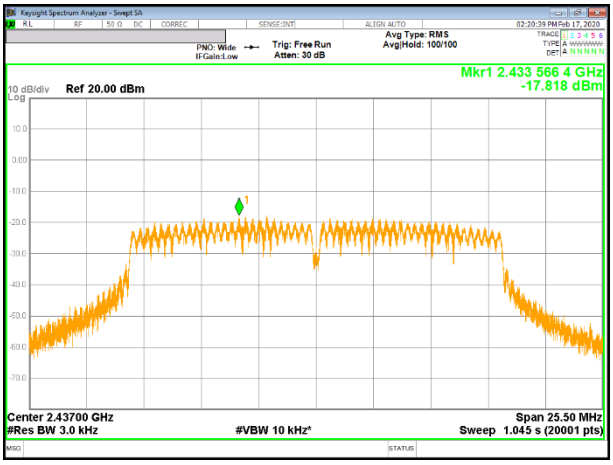
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-17.91	-17.73	8.0	-25.7
Mid 6	2437	-17.82	-17.64	8.0	-25.6
High 11	2462	-17.62	-17.44	8.0	-25.4
High 12	2467	-17.67	-17.49	8.0	-25.5
High 13	2472	-21.06	-20.88	8.0	-28.9

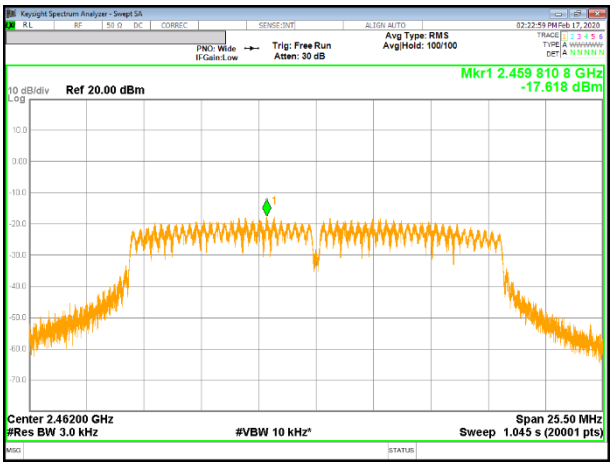
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.



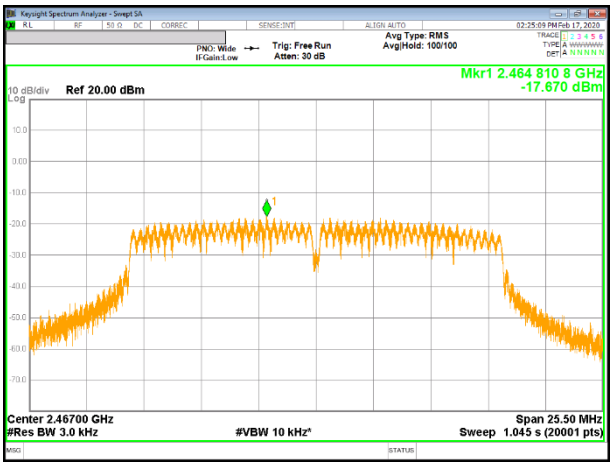
LOW CHANNEL 1



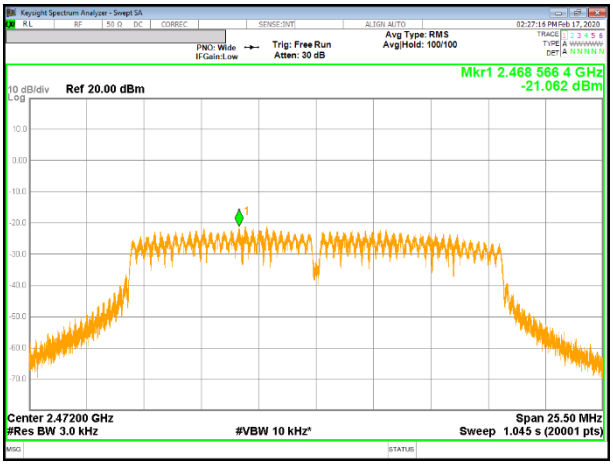
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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.

9.4.3. 802.11n HT20 MODE

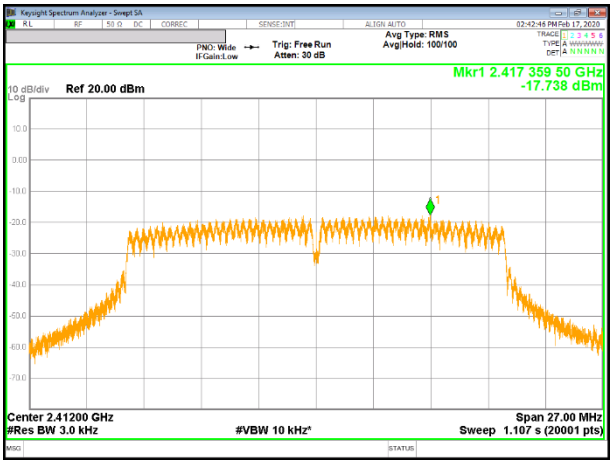
1TX Antenna 1 MODE

Duty Cycle CF (dB)	0.17	Included in Calculations of Corr'd PSD

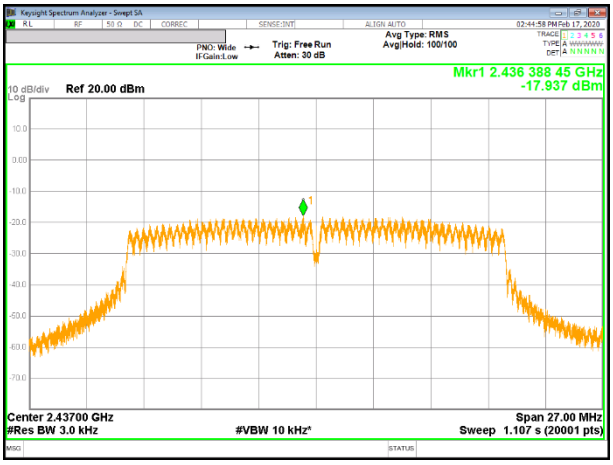
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-17.74	-17.57	8.0	-25.6
Mid 6	2437	-17.94	-17.77	8.0	-25.8
High 11	2462	-17.49	-17.32	8.0	-25.3
High 12	2467	-20.73	-20.56	8.0	-28.6
High 13	2472	-25.82	-25.65	8.0	-33.7

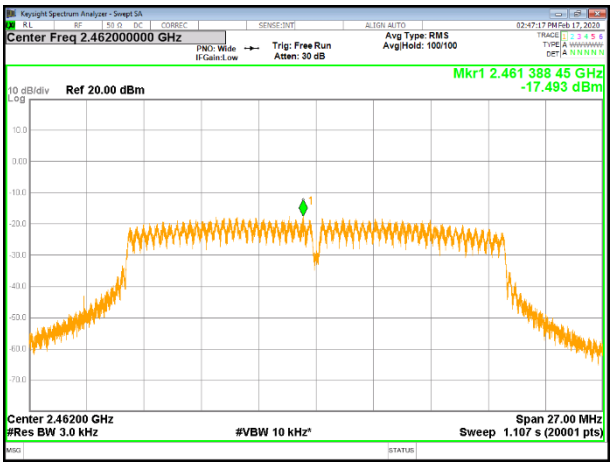
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.



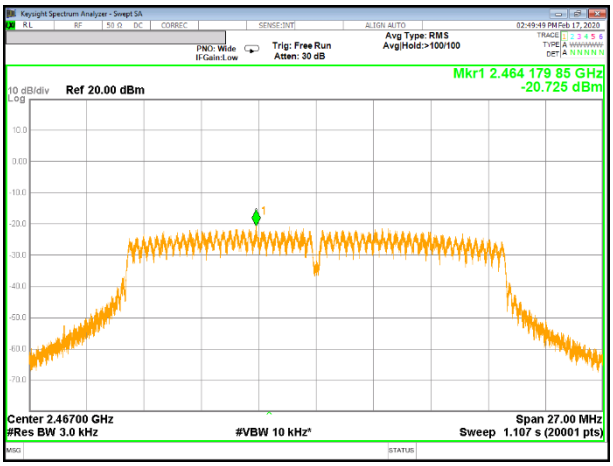
LOW CHANNEL 1



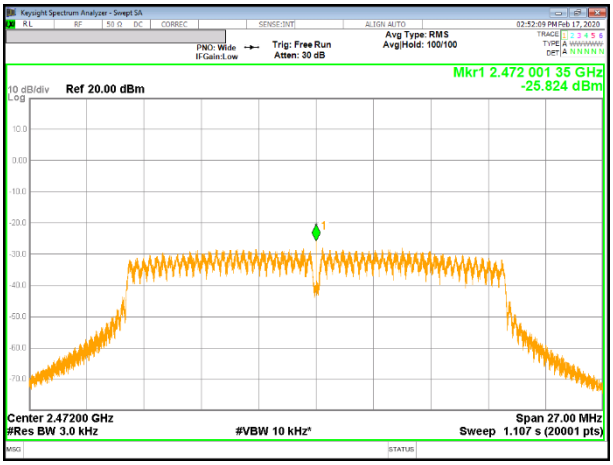
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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.

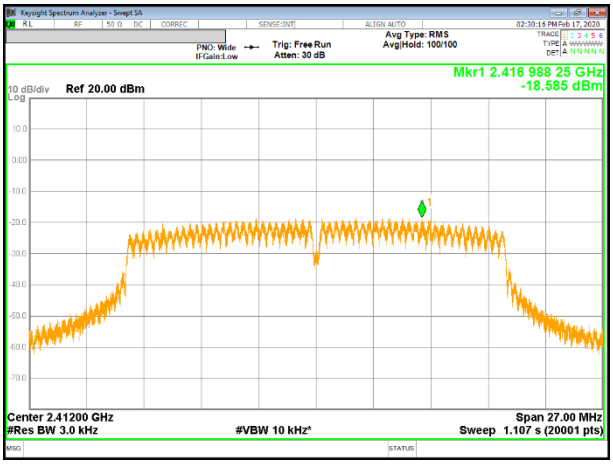
1TX Antenna 2 MODE

Duty Cycle CF (dB)	0.17	Included in Calculations of Corr'd PSD

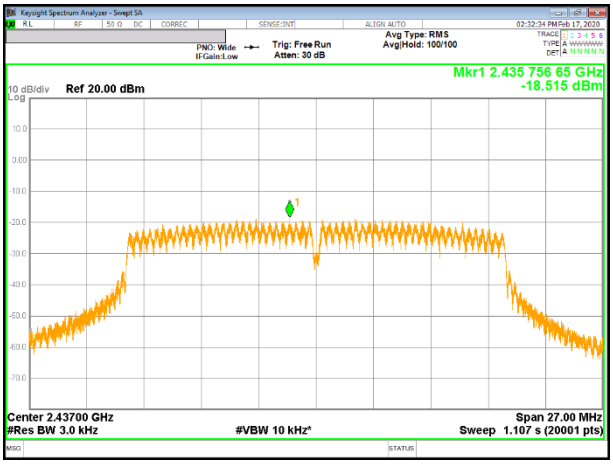
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-18.59	-18.42	8.0	-26.4
Mid 6	2437	-18.52	-18.35	8.0	-26.3
High 11	2462	-18.19	-18.02	8.0	-26.0
High 12	2467	-19.18	-19.01	8.0	-27.0
High 13	2472	-22.63	-22.46	8.0	-30.5

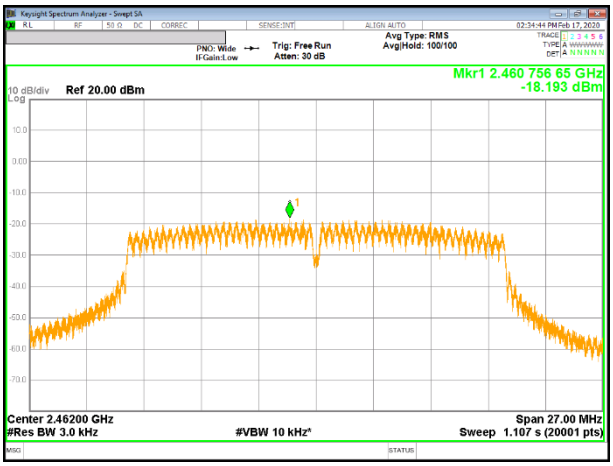
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.



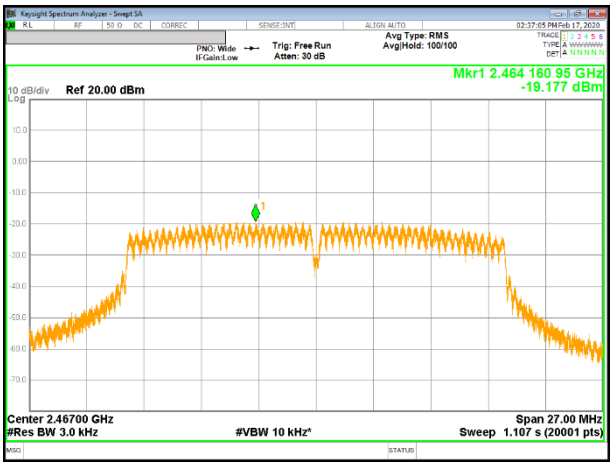
LOW CHANNEL 1



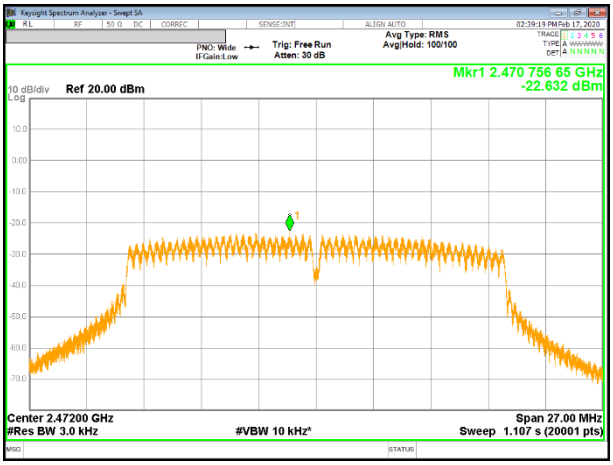
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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.

9.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

RSS-247 5.5

Output power was measured based on the use of peak measurement, therefore the required attenuation is 20 dB.

RESULTS

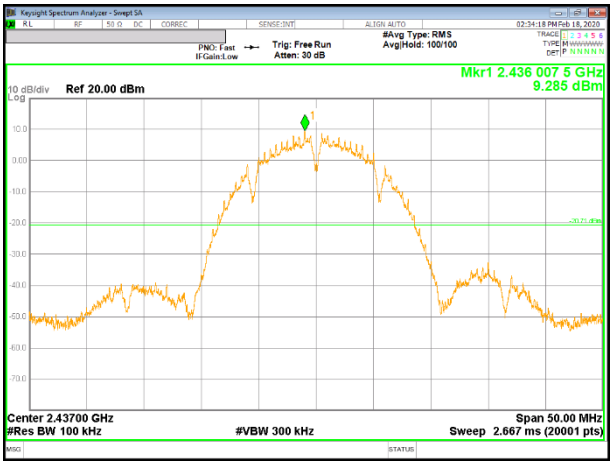
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

9.5.1. 802.11b MODE

1TX Antenna 1 MODE

LOW CHANNEL 1 BANDEDGE

OUT-OF-BAND LOW CHANNEL 1



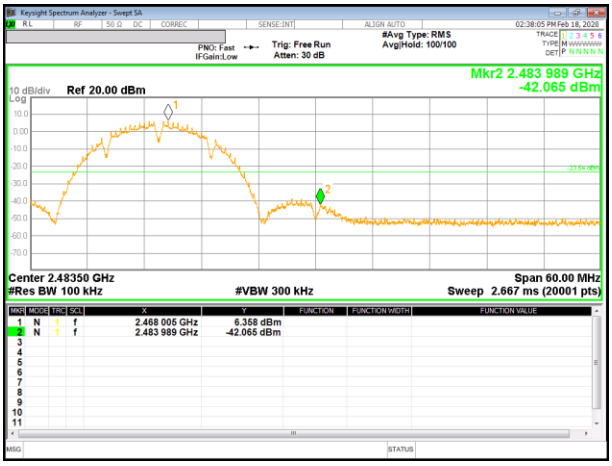
IN-BAND REFERNCE LEVEL

OUT-OF-BAND MID CHANNEL

HIGH CHANNEL 11 BANDEDGE

OUT-OF-BAND HIGH CHANNEL 11

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

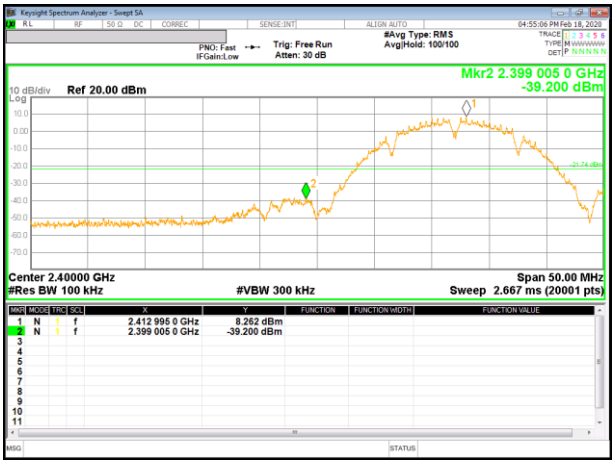


HIGH CHANNEL 12 BANDEDGE

HIGH CHANNEL 13 BANDEDGE

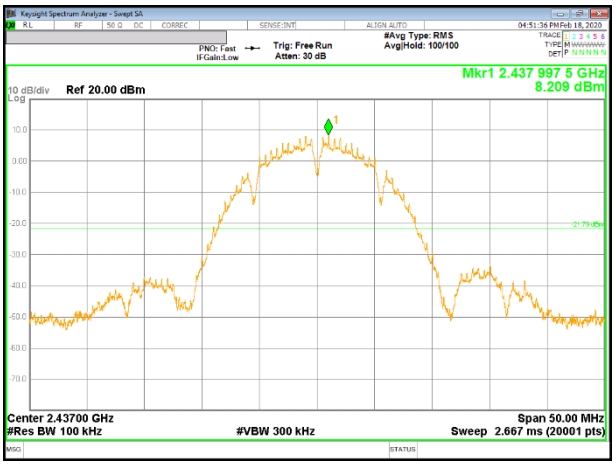
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

1TX Antenna 2 MODE



LOW CHANNEL 1 BANDEDGE

OUT-OF-BAND LOW CHANNEL 1



IN-BAND REFERNCE LEVEL

OUT-OF-BAND MID CHANNEL

HIGH CHANNEL 11 BANDEDGE

OUT-OF-BAND HIGH CHANNEL 11

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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.

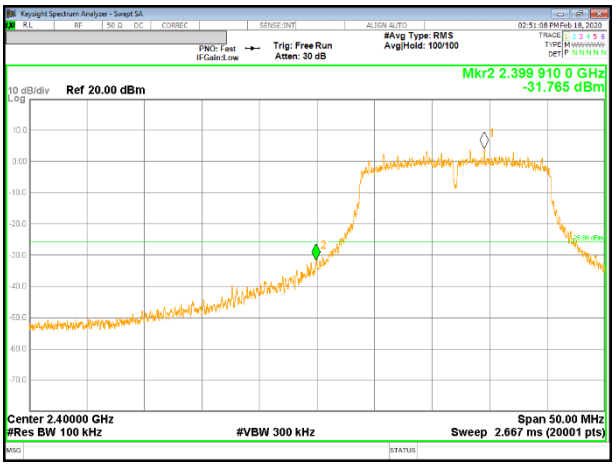
HIGH CHANNEL 12 BANDEDGE

HIGH CHANNEL 13 BANDEDGE

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

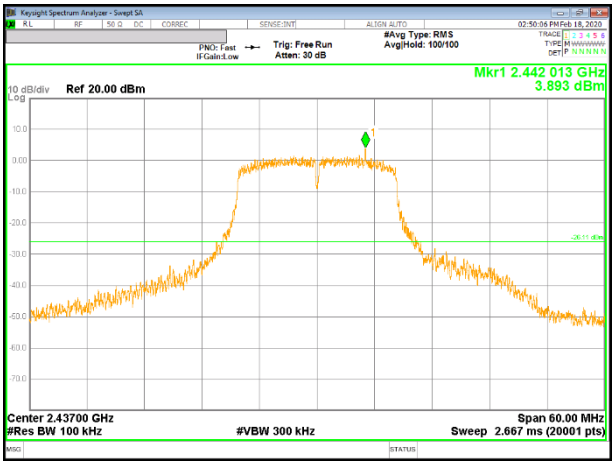
9.5.2. 802.11g MODE

1TX Antenna 1 MODE



LOW CHANNEL 1 BANDEDGE

OUT-OF-BAND LOW CHANNEL 1



IN-BAND REFERNCE LEVEL

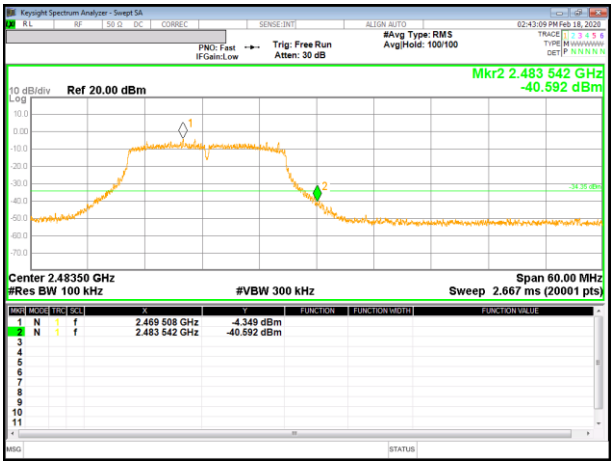
OUT-OF-BAND MID CHANNEL

HIGH CHANNEL 11 BANDEDGE

OUT-OF-BAND HIGH CHANNEL 11

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(03)
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.

HIGH CHANNEL 12 BANDEDGE



HIGH CHANNEL 13 BANDEDGE

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