

TEST REPORT



CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970
Fax: +82-31-624-9501

Report No.:
CTK-2021-00840
Page (1) / (250) Pages

1. Client

- Name : KAONMEDIA Co., Ltd.
- Address : KAONMEDIA Building, 884-3 Seongnam-daero, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea
- Date of Receipt : 2021-01-07

2. Manufacturer

- Name : KAONMEDIA Co., Ltd.
- Address : KAONMEDIA Building, 884-3, Seongnam-daero, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea

3. Use of Report : For FCC Conformance

4. Test Sample / Model: IP Set-top-box(OTT STB) / KSTB2100

5. Date of Test : 2021-02-09 to 2021-03-25

6. Test Standard(method) used : FCC 47 CFR part 15 subpart C 15.407

7. Testing Environment: Temp.: (23 ± 1) °C, Humidity: (49 ± 3) % R.H

8. Test Results : Compliance

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

| | | |
|-------------|--------------------------|-----------------------------|
| Affirmation | Tested by | Technical Manager |
| | Ji-Hye, Kim: (Signature) | Won-Jae, Hwang: (Signature) |

2021-03-26

Republic of KOREA **CTK Co., Ltd.**



CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970
Fax: +82-31-624-9501

Report No.:
CTK-2021-00840
Page (2) / (250) Pages

REPORT REVISION HISTORY

| Date | Revision | Page No |
|------------|-------------------------|---------|
| 2021-03-26 | Issued (CTK-2021-00840) | all |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

This report shall not be reproduced except in full, without the written approval of CTK Co., Ltd. This document may be altered or revised by CTK Co., Ltd. personnel only, and shall be noted in the revision section of the document. Any alteration of this document not carried out by CTK Co., Ltd. will constitute fraud and shall nullify the document.



CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970
Fax: +82-31-624-9501

Report No.:
CTK-2021-00840
Page (3) / (250) Pages

CONTENTS

| | |
|---|-----|
| 1. General Product Description | 4 |
| 1.1 Client Information | 4 |
| 1.2 Product Information | 4 |
| 1.3 Peripheral Devices | 5 |
| 1.4 Model Differences | 5 |
| 2. Facility and Accreditations | 6 |
| 2.1 Test Facility | 6 |
| 2.2 Laboratory Accreditations and Listings | 6 |
| 2.3 Calibration Details of Equipment Used for Measurement | 6 |
| 3. Test Specifications | 7 |
| 3.1 Standards | 7 |
| 3.2 Mode of operation during the test | 8 |
| 3.3 Device Modifications | 9 |
| 3.4 Maximum Measurement Uncertainty | 9 |
| 3.5 Test Software | 9 |
| 4. Technical Characteristic Test | 10 |
| 4.1 6dB Bandwidth | 10 |
| 4.2 26 dB Bandwidth and 99% Bandwidth | 24 |
| 4.3 OUTPUT POWER | 75 |
| 4.4 Power Spectral Density | 131 |
| 4.5 Frequency Stability | 187 |
| 4.6 Unwanted Emissions | 188 |
| 4.7 AC Conducted Emissions | 247 |
| APPENDIX A – Test Equipment Used For Tests | 250 |



CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (4) / (250) Pages

1. General Product Description

1.1 Client Information

| | |
|-----------------------|--|
| Company | KAONMEDIA Co., Ltd. |
| Contact Point | KAONMEDIA Building, 884-3 Seongnam-daero, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea |
| Contact Person | Name : Minseok Choi E-mail : minseok.choi@kaonmedia.com Tel : +82-31-724-8683 Fax : - |

1.2 Product Information

| | |
|------------------------------|---|
| FCC ID | WQTKSTB2100 |
| Product Description | IP Set-top-box(OTT STB) |
| Model name | KSTB2100 |
| Variant Model name | - |
| Operating Frequency | UNII 1 : 5 180 MHz – 5 240 MHz (20 MHz_BW) 5 190 MHz – 5 230 MHz (40 MHz_BW) 5 210 MHz (80 MHz_BW) UNII 2A : 5 260 MHz – 5 320 MHz (20 MHz_BW) 5 270 MHz – 5 310 MHz (40 MHz_BW) 5 290 MHz (80 MHz_BW) UNII 2C : 5 500 MHz – 5 720 MHz (20 MHz_BW) 5 510 MHz – 5 710 MHz (40 MHz_BW) 5 530 MHz – 5 690 MHz (80 MHz_BW) UNII 3 : 5 745 MHz – 5 825 MHz (20 MHz_BW) 5 755 MHz – 5 795 MHz (40 MHz_BW) 5 775 MHz (80 MHz) |
| RF Output Power | 802.11a : 25.86 dBm (385.36 mW) 802.11n_HT20 : 25.55 dBm (359.30 mW) 802.11n_HT40 : 25.66 dBm (368.51 mW) 802.11ac_VHT20 : 25.51 dBm (355.75 mW) 802.11ac_VHT40 : 25.19 dBm (330.57 mW) 802.11ac_VHT80 : 23.31 dBm (214.05 mW) |
| Antenna Specification | Antenna type : PCB Antenna Peak Gain : 1.9 dBi (ANT1), 2.0 dBi (ANT2), 1.9 dBi (ANT3), 1.9 dBi (ANT4) |
| Type of Modulation | OFDM |
| Data Rate | 802.11a : 54 / 48 / 36 / 24 / 18 / 12 / 9 / 6 Mbps 802.11n : up to 600 Mbps 802.11ac : up to 1.7 Gbps |
| Power Source | DC 12 V (Adapter) |
| Hardware Rev | Rev0.3 |
| Software Rev | 0.1.5 |



CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970
Fax: +82-31-624-9501

Report No.:
CTK-2021-00840
Page (5) / (250) Pages

1.3 Peripheral Devices

| Device | Manufacturer | Model No. | Serial No. |
|------------------------------|---------------------------------------|-------------------|------------|
| Note Computer | HP | 15-bs563TU | CND7253R6N |
| AC/DC Adapter | HP | HSTNN-CA40 | - |
| Switching Mode Power Adaptor | CHENAHOU FRECOM ELECTRONICS CO., LTD. | F18L16-120150SPAU | - |

1.4 Model Differences

Not applicable



CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970
Fax: +82-31-624-9501

Report No.:
CTK-2021-00840
Page (6) / (250) Pages

2. Facility and Accreditations

2.1 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea.

2.2 Laboratory Accreditations and Listings

| Country | Agency | Registration Number |
|---------|--------|---------------------|
| USA | FCC | 805871 |
| CANADA | ISED | 8737A-2 |
| KOREA | NRRA | KR0025 |

2.3 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.



CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (7) / (250) Pages

3. Test Specifications

3.1 Standards

| FCC Part Section(s) | Requirement(s) | Limit | Status (Note 1) | Test Condition |
|--|-----------------------------------|--|-----------------|----------------|
| 15.407(e) | 6 dB Bandwidth | > 500 kHz | C | Conducted |
| 15.407(a) | 26 dB Bandwidth and 99% Bandwidth | NA | C | |
| 15.407(a)(1) | Conducted Output Power | < 250 mW (5 150 – 5 250 MHz) < 250 mW (5 250 – 5 350 MHz, 5 470 – 5 725 MHz) < 1 W (5 725 – 5 850 MHz) | C | |
| 15.407(a)(1) | Power Spectral Density | < 11 dBm/MHz (5 150 – 5 250 MHz) < 11 dBm/MHz (5 250 – 5 350 MHz, 5 470 – 5 725 MHz) < 30 dBm/500 KHz (5 725 – 5 850 MHz) | C | |
| 15.407(g) | Frequency Stability | NA | C | |
| 15.407 (b) | Undesirable emission | < -27 dBm/MHz EIRP (5 150 – 5 250 MHz, 5250 – 5350 MHz, 5470 – 5725 MHz) < -17 dBm/MHz EIRP (5715 – 5725 MHz, 5 850 – 5 860 MHz) < -27 dBm/MHz EIRP outside (5 715 – 5 850 MHz) | C | Radiated |
| 15.205, 15.407 (b) (5),(6) | Radiated Spurious Emission | 15.209(a) | C | |
| 15.207 | AC Conducted Emissions | 15.207(a) | C | Line Conducted |
| <i>Note 1:</i> C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable | | | | |
| <i>Note 2:</i> The data in this test report are traceable to the national or international standards. | | | | |
| <i>Note 3:</i> The sample was tested according to the following specification: FCC Part 15.247, ANSI C63.10-2013 | | | | |
| <i>Note 4:</i> The tests were performed according to the method of measurements prescribed in KDB No.789033. | | | | |

3.2 Mode of operation during the test

The EUT is operated in a manner representative of the typical of the equipments. During at testing, system components were manipulated within the confines of typical usage to maximize each emission.

For WLAN function, the engineering test program was provided and enabled to make EUT continuous transmit.

All modulation modes were tests. The results are only attached worst cases.

Test Frequency

- 802.11a, 802.11n_HT20, 802.11ac_VHT20

| | Lowest channel | Middle channel | Highest channel |
|----------------|----------------|----------------|-----------------|
| UNII 1 | 5 180 MHz | 5 200 MHz | 5 240 MHz |
| UNII 2A | 5 260 MHz | 5 300 MHz | 5 320 MHz |
| UNII 2C | 5 500 MHz | 5 600 MHz | 5 720 MHz |
| UNII 3 | 5 745 MHz | 5 785 MHz | 5 825 MHz |

- 802.11n_HT40, 802.11ac_VHT40

| | Lowest channel | Middle channel | Highest channel |
|----------------|----------------|----------------|-----------------|
| UNII 1 | 5 190 MHz | - | 5 230 MHz |
| UNII 2A | 5 270 MHz | - | 5 310 MHz |
| UNII 2C | 5 510 MHz | 5 590 MHz | 5 710 MHz |
| UNII 3 | 5 755 MHz | - | 5 795 MHz |

- 802.11ac_VHT80

| | Lowest channel | Middle channel | Highest channel |
|----------------|----------------|----------------|-----------------|
| UNII 1 | 5 210 MHz | - | - |
| UNII 2A | 5 290 MHz | - | - |
| UNII 2C | 5 530 MHz | - | 5 690 MHz |
| UNII 3 | 5 775 MHz | - | - |

Test mode

| Test mode | Modulation | Data rate | Duty Cycle | Duty Cycle Factor |
|----------------|------------|-----------|------------|-------------------|
| 802.11a | OFDM | 6 Mbps | 95.2 % | 0.21 dB |
| 802.11n_HT20 | OFDM | MCS 0 | 95.3 % | 0.21 dB |
| 802.11n_HT40 | OFDM | MCS 0 | 90.9 % | 0.42 dB |
| 802.11ac_VHT20 | OFDM | MNSS 0 | 98.7 % | 0.00 dB |
| 802.11ac_VHT40 | OFDM | MNSS 0 | 97.4 % | 0.11 dB |
| 802.11ac_VHT80 | OFDM | MNSS 0 | 94.5 % | 0.25 dB |



CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970
Fax: +82-31-624-9501

Report No.:
CTK-2021-00840
Page (9) / (250) Pages

3.3 Device Modifications

The following modifications were necessary for compliance:

Not applicable

3.4 Maximum Measurement Uncertainty

The value of the measurement uncertainty for the measurement of each parameter.

Coverage factor $k = 2$, Confidence levels of 95 %

| Description | Uncertainty |
|--------------------------------------|---------------|
| Conducted RF Output Power | ± 1.5 dB |
| Power Spectral Density | ± 1.5 dB |
| Occupied Bandwidth | ± 0.1 MHz |
| Unwanted Emission(conducted) | ± 3.0 dB |
| Radiated Emissions ($f \leq 1$ GHz) | ± 4.0 dB |
| Radiated Emissions ($f > 1$ GHz) | ± 5.0 dB |

3.5 Test Software

| | |
|---------------------|--|
| Conducted Test | Ics Pro Ver. 6.0.3 |
| Radiated Test | TOYO EMI software EP5RE Ver. 6.0.1.0 |
| Line Conducted Test | ESCI7, ESCI3 : EMC32 Ver. 8.50.0 ESR7 : EMC32 Ver. 8.53.0 |



CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970
Fax: +82-31-624-9501

Report No.:
CTK-2021-00840
Page (10) / (250) Pages

4. Technical Characteristic Test

4.1 6dB Bandwidth

Test Procedures

KDB 789033 – Section C.2
ANSI C63.10-2013 - Section 6.9.2

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Test Settings :

Center frequency = the highest, middle and the lowest channels

- a) RBW = 100 kHz
- b) VBW $\geq 3 \times$ RBW
- c) Detector = peak
- d) Trace mode = Max hold
- e) Sweep = auto couple
- f) Allow trace to fully stabilize
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Minimum Standard:

6 dB Bandwidth > 500 kHz



CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (11) / (250) Pages

Test Data:

ANT1

| 6 dB Bandwidth (MHz) | | | |
|-------------------------|-----------|--------------|----------------|
| Mode | 802.11a | 802.11n_HT20 | 802.11ac_VHT20 |
| Frequency | | | |
| 5 745 MHz | 16.42 | 17.57 | 17.61 |
| 5 785 MHz | 16.35 | 17.63 | 17.62 |
| 5 825 MHz | 16.36 | 17.57 | 17.60 |
| Measurement uncertainty | ± 0.1 MHz | | |

| 6 dB Bandwidth (MHz) | | |
|-------------------------|--------------|----------------|
| Mode | 802.11n_HT40 | 802.11ac_VHT40 |
| Frequency | | |
| 5 755 MHz | 36.37 | 36.41 |
| 5 795 MHz | 36.41 | 36.40 |
| Measurement uncertainty | ± 0.1 MHz | |

| 6 dB Bandwidth (MHz) | |
|-------------------------|----------------|
| Mode | 802.11ac_VHT80 |
| Frequency | |
| 5 775 MHz | 76.39 |
| Measurement uncertainty | ± 0.1 MHz |



CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (12) / (250) Pages

ANT2

| | 6 dB Bandwidth (MHz) | | |
|-------------------------|----------------------|--------------|----------------|
| Mode | 802.11a | 802.11n_HT20 | 802.11ac_VHT20 |
| Frequency | | | |
| 5 745 MHz | 16.41 | 17.66 | 17.65 |
| 5 785 MHz | 16.44 | 17.66 | 17.64 |
| 5 825 MHz | 16.41 | 17.66 | 17.63 |
| Measurement uncertainty | ± 0.1 MHz | | |

| | 6 dB Bandwidth (MHz) | |
|-------------------------|----------------------|----------------|
| Mode | 802.11n_HT40 | 802.11ac_VHT40 |
| Frequency | | |
| 5 755 MHz | 36.43 | 36.41 |
| 5 795 MHz | 36.40 | 36.42 |
| Measurement uncertainty | ± 0.1 MHz | |

| | 6 dB Bandwidth (MHz) |
|-------------------------|----------------------|
| Mode | 802.11ac_VHT80 |
| Frequency | |
| 5 775 MHz | 76.45 |
| Measurement uncertainty | ± 0.1 MHz |



CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (13) / (250) Pages

ANT3

| | 6 dB Bandwidth (MHz) | | |
|-------------------------|----------------------|--------------|----------------|
| Mode | 802.11a | 802.11n_HT20 | 802.11ac_VHT20 |
| Frequency | | | |
| 5 745 MHz | 16.35 | 17.61 | 17.64 |
| 5 785 MHz | 16.34 | 17.60 | 17.62 |
| 5 825 MHz | 16.37 | 17.63 | 17.60 |
| Measurement uncertainty | ± 0.1 MHz | | |

| | 6 dB Bandwidth (MHz) | |
|-------------------------|----------------------|----------------|
| Mode | 802.11n_HT40 | 802.11ac_VHT40 |
| Frequency | | |
| 5 755 MHz | 36.39 | 36.43 |
| 5 795 MHz | 36.39 | 36.39 |
| Measurement uncertainty | ± 0.1 MHz | |

| | 6 dB Bandwidth (MHz) |
|-------------------------|----------------------|
| Mode | 802.11ac_VHT80 |
| Frequency | |
| 5 775 MHz | 76.38 |
| Measurement uncertainty | ± 0.1 MHz |



CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (14) / (250) Pages

ANT4

| | | 6 dB Bandwidth (MHz) | | |
|-------------------------|--|----------------------|--------------|----------------|
| Mode | | 802.11a | 802.11n_HT20 | 802.11ac_VHT20 |
| Frequency | | | | |
| 5 745 MHz | | 16.39 | 17.59 | 17.61 |
| 5 785 MHz | | 16.37 | 17.60 | 17.63 |
| 5 825 MHz | | 16.40 | 17.65 | 17.60 |
| Measurement uncertainty | | ± 0.1 MHz | | |

| | | 6 dB Bandwidth (MHz) | |
|-------------------------|--|----------------------|----------------|
| Mode | | 802.11n_HT40 | 802.11ac_VHT40 |
| Frequency | | | |
| 5 755 MHz | | 36.43 | 36.40 |
| 5 795 MHz | | 36.41 | 36.38 |
| Measurement uncertainty | | ± 0.1 MHz | |

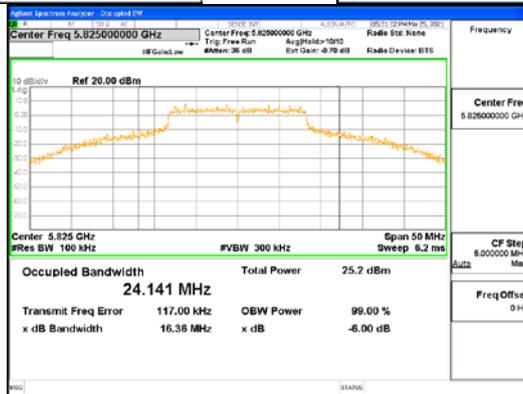
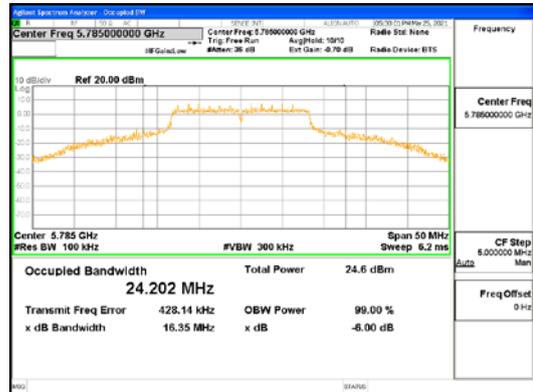
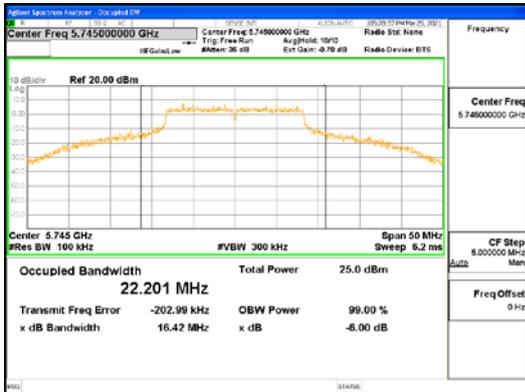
| | | 6 dB Bandwidth (MHz) |
|-------------------------|--|----------------------|
| Mode | | 802.11ac_VHT80 |
| Frequency | | |
| 5 775 MHz | | 76.02 |
| Measurement uncertainty | | ± 0.1 MHz |

See next pages for actual measured spectrum plots.

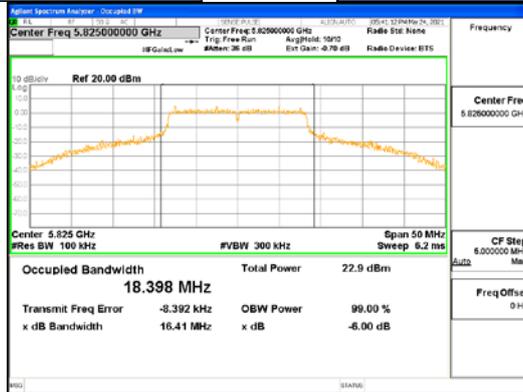
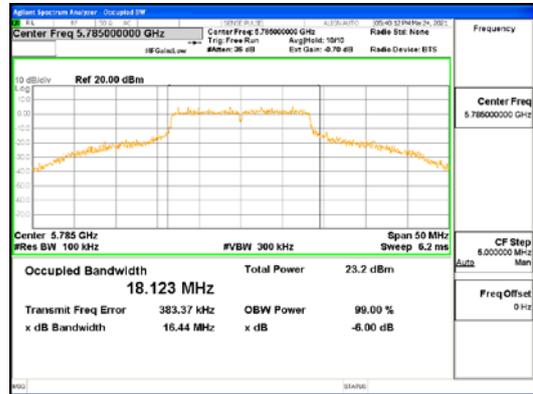
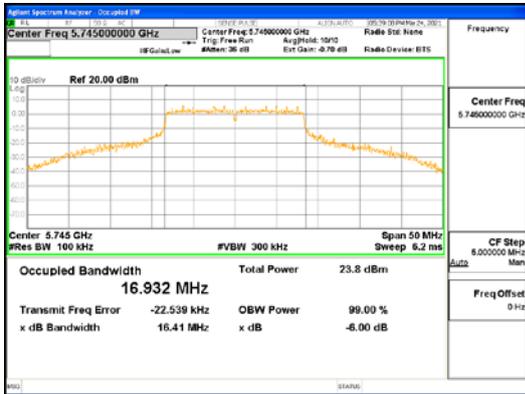


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (15) / (250) Pages



ANT1_802.11a

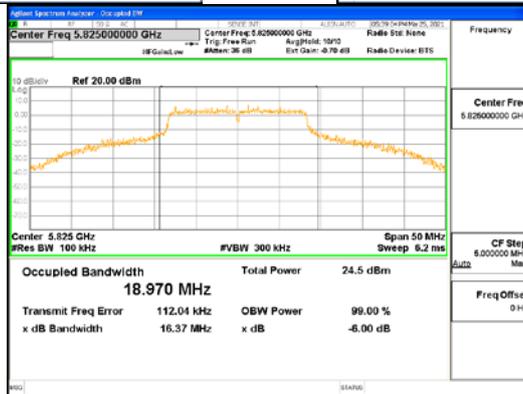
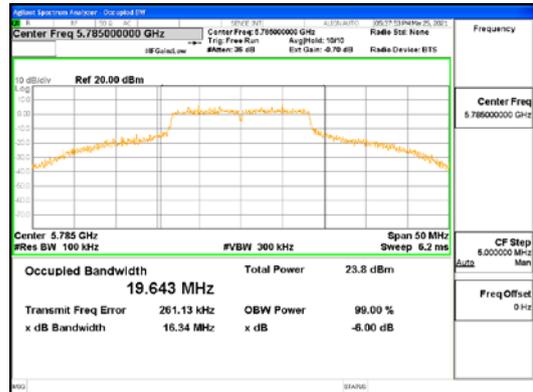


ANT2_802.11a

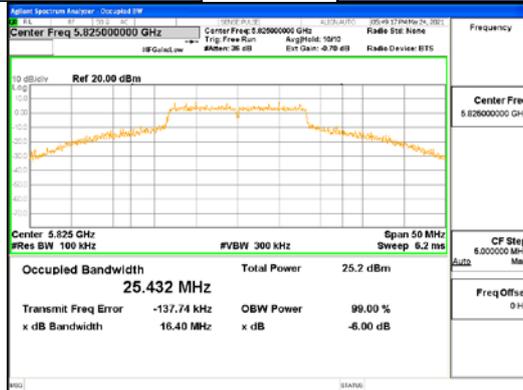
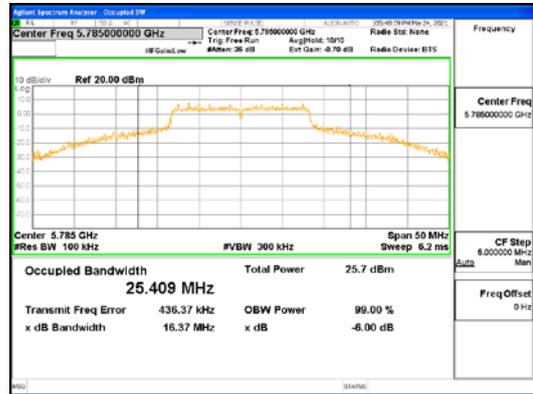
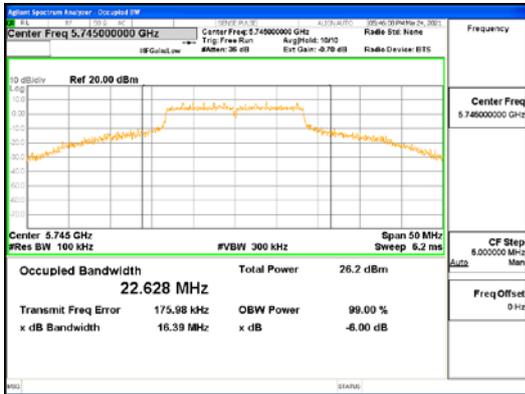


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (16) / (250) Pages



ANT3_802.11a

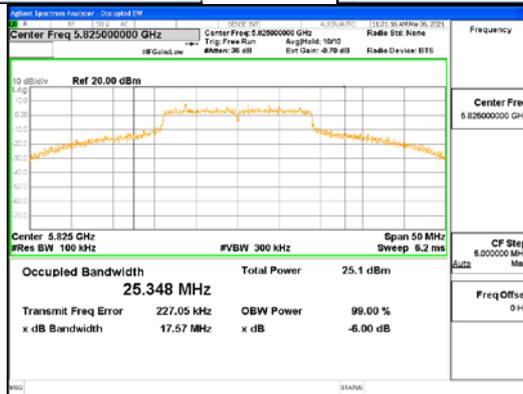
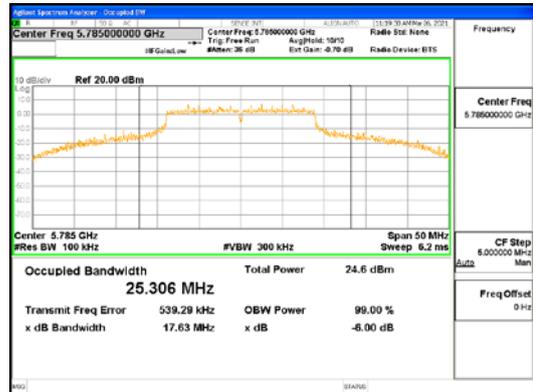
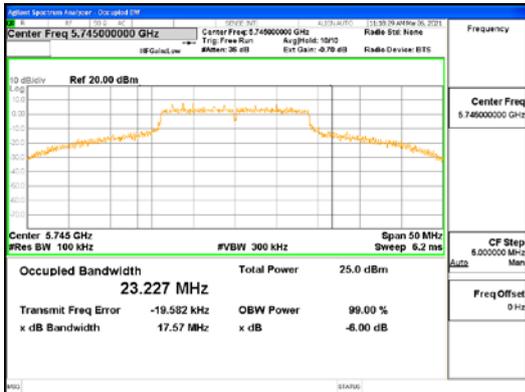


ANT4_802.11a

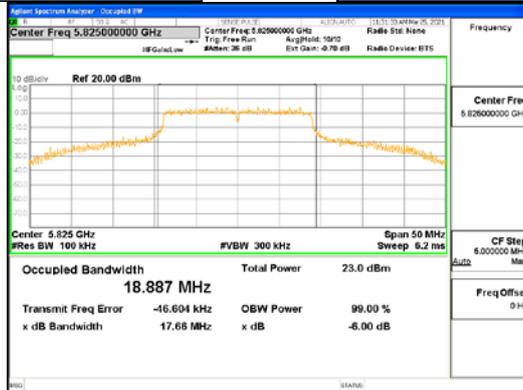
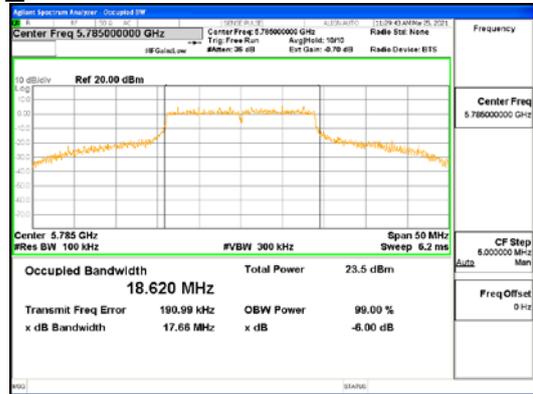
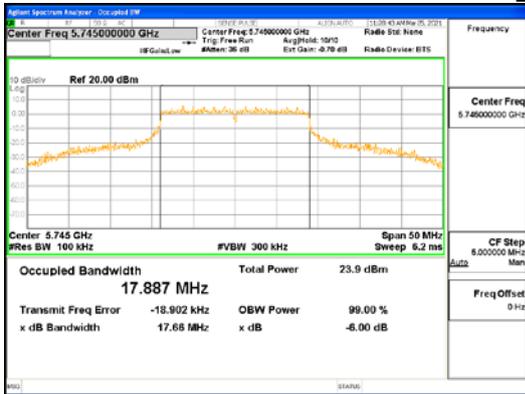


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (17) / (250) Pages



ANT1_802.11n_HT20

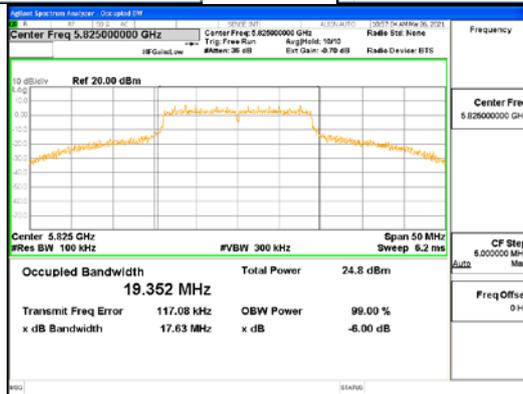


ANT2_802.11n_HT20

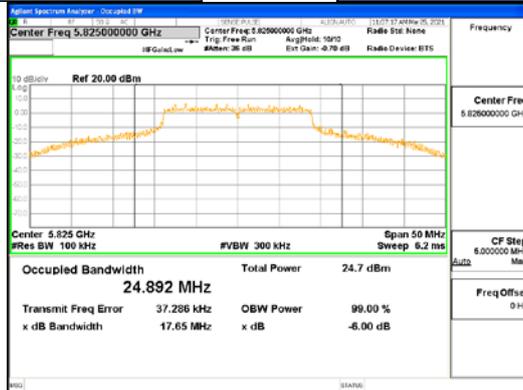
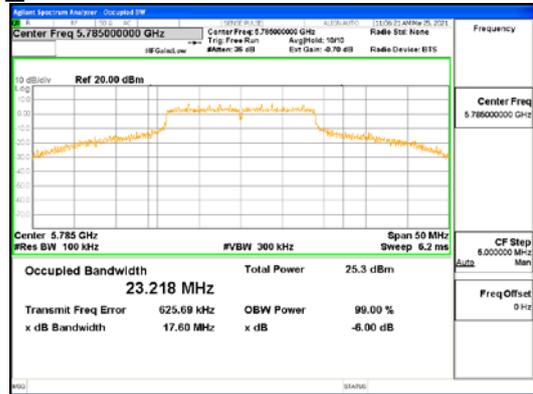
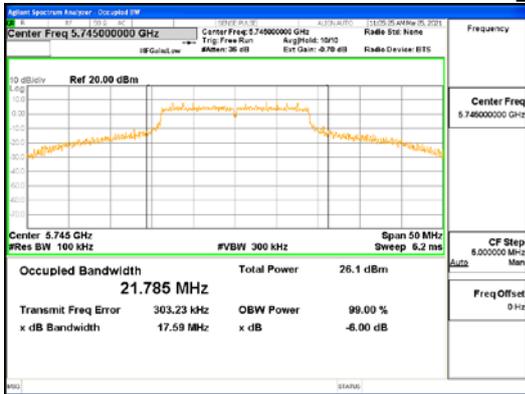


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (18) / (250) Pages



ANT3_802.11n_HT20

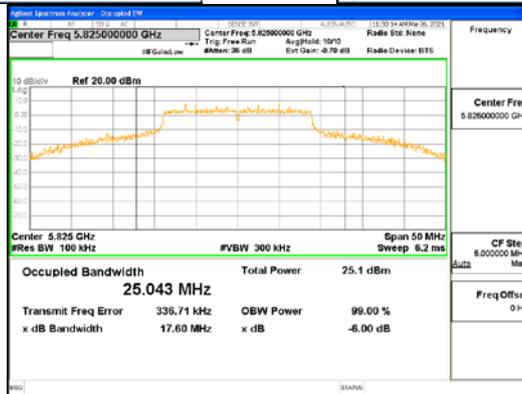
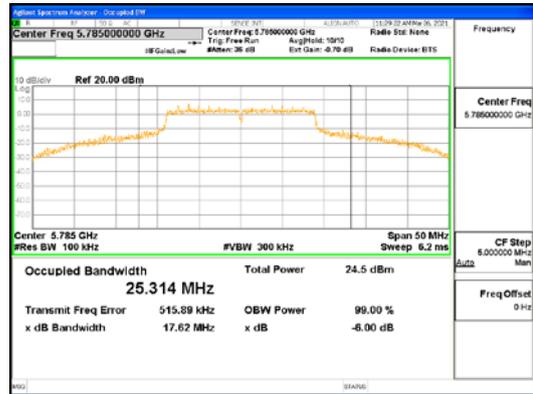
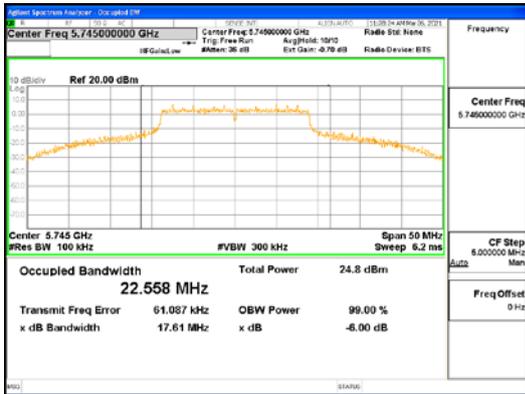


ANT4_802.11n_HT20

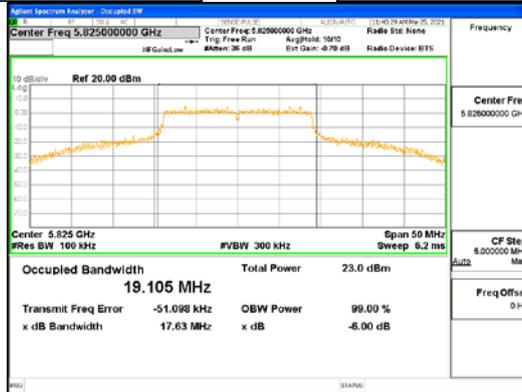
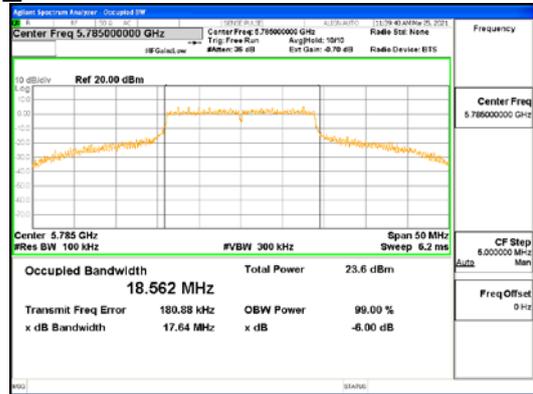
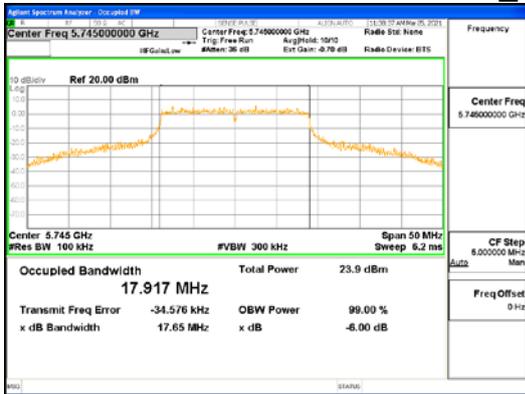


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (19) / (250) Pages



ANT1_802.11ac_VHT20

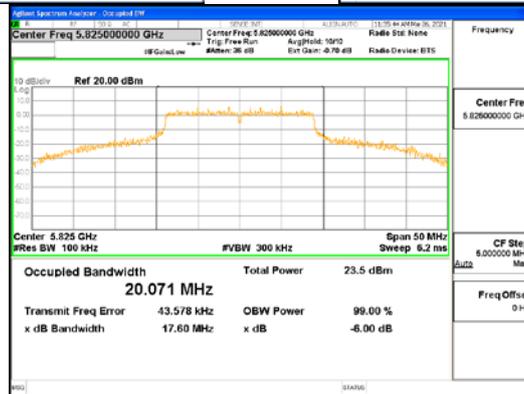
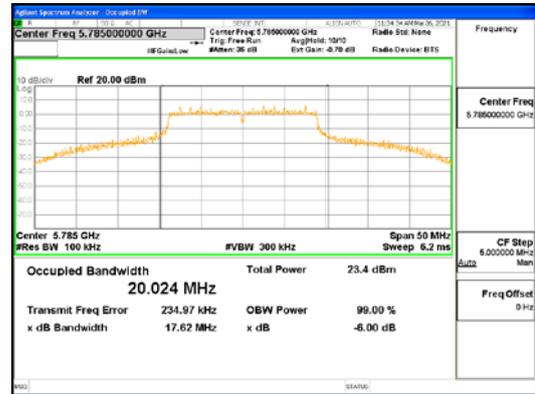
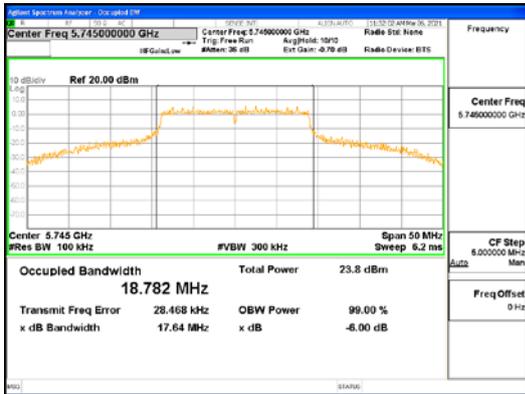


ANT2_802.11ac_VHT20

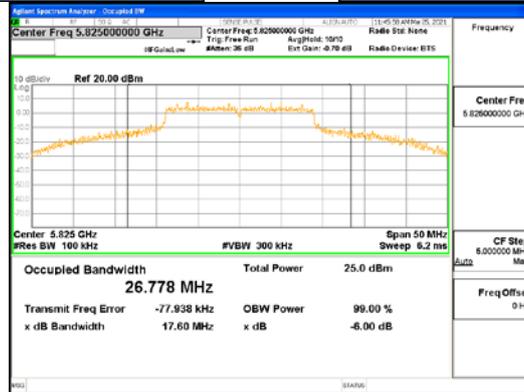
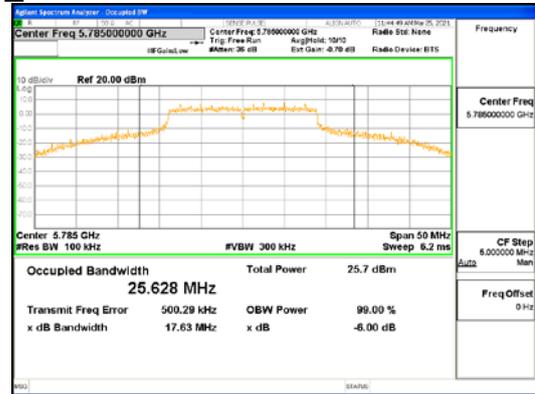
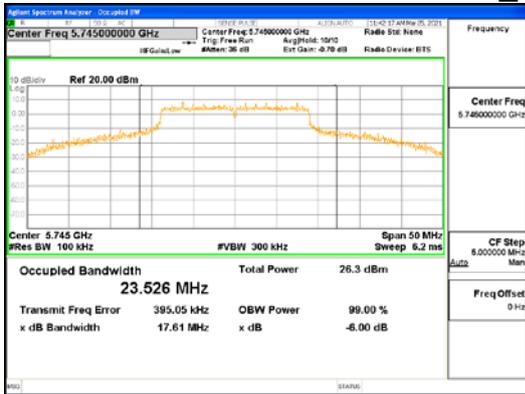


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (20) / (250) Pages



ANT3_802.11ac_VHT20



ANT4_802.11ac_VHT20

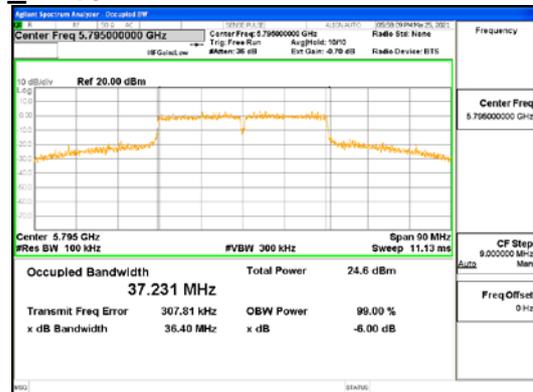
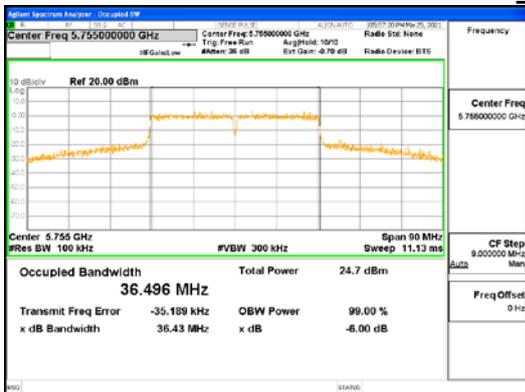


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

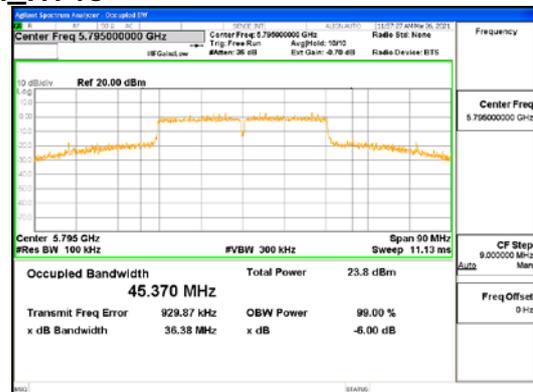
Report No.:
 CTK-2021-00840
 Page (21) / (250) Pages



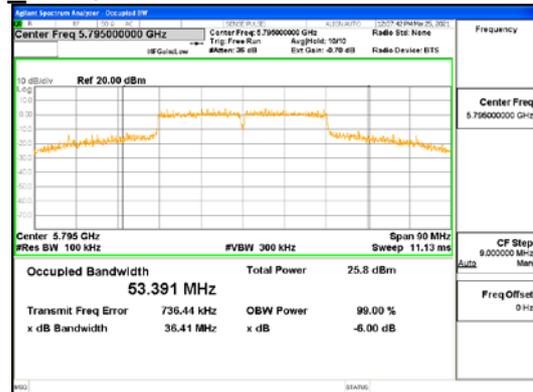
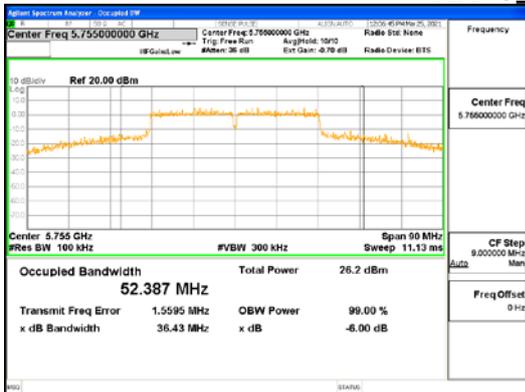
ANT1_802.11n_HT40



ANT2_802.11n_HT40



ANT3_802.11n_HT40



ANT4_802.11n_HT40

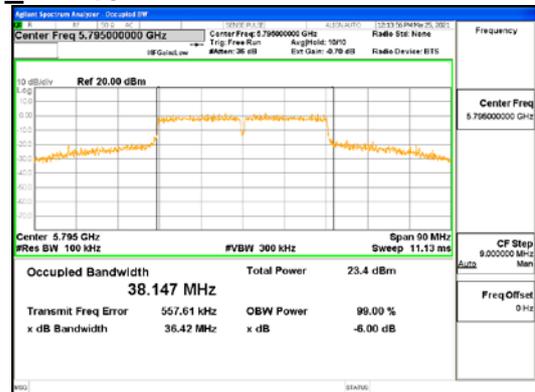


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

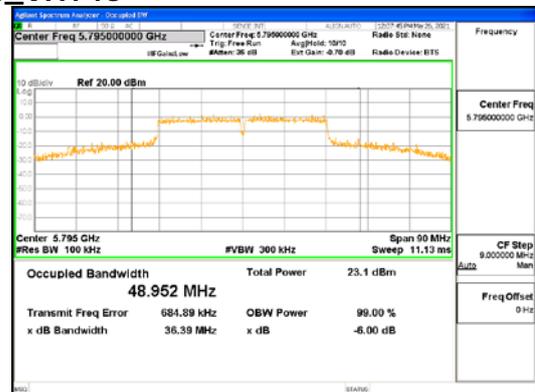
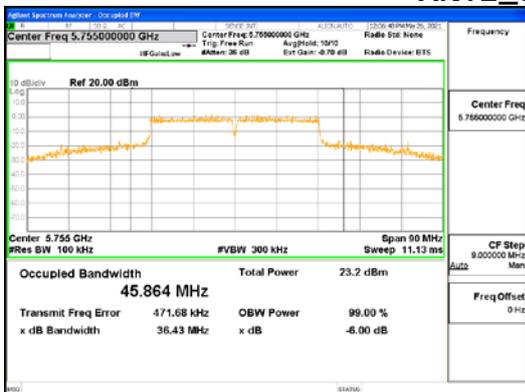
Report No.:
 CTK-2021-00840
 Page (22) / (250) Pages



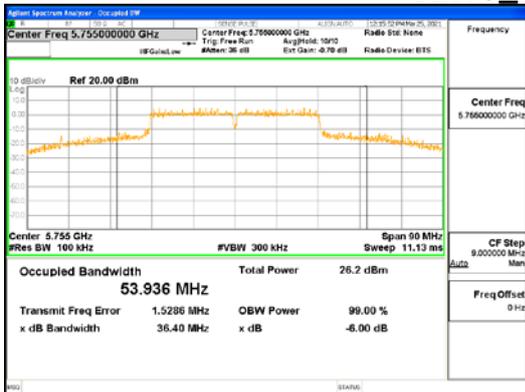
ANT1_802.11ac_VHT40



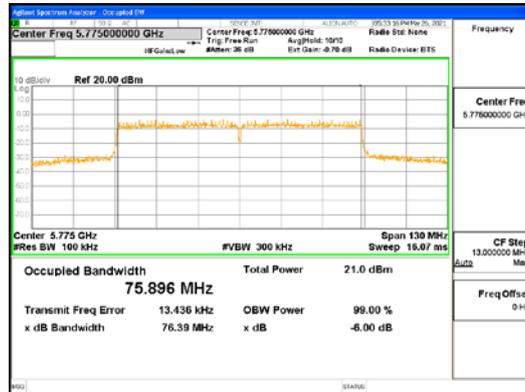
ANT2_802.11ac_VHT40



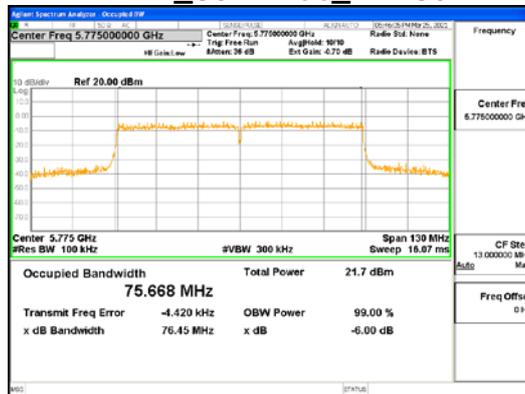
ANT3_802.11ac_VHT40



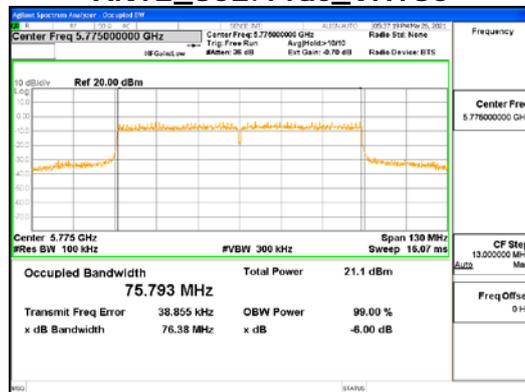
ANT4_802.11ac_VHT40



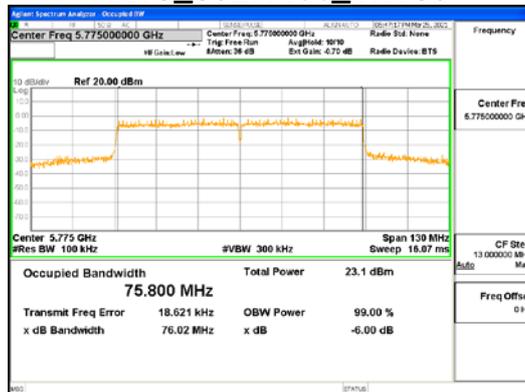
ANT1_802.11ac_VHT80



ANT2_802.11ac_VHT80



ANT3_802.11ac_VHT80



ANT4_802.11ac_VHT80



CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970
Fax: +82-31-624-9501

Report No.:
CTK-2021-00840
Page (24) / (250) Pages

4.2 26 dB Bandwidth and 99% Bandwidth

Test Procedures

KDB 789033 – Section C.1
ANSI C63.10-2013 - Section 6.9.2

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 26 dB relative to the maximum level measured in the fundamental emission.

Test Procedures

KDB 789033 – Section C.1
ANSI C63.10-2013 - Section 6.9.3

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

Use the 99% power bandwidth function of the instrument and report the measured bandwidth.

Test Settings :

Center frequency = the highest, middle and the lowest channels

- a) RBW = approximately 1 % of the emission bandwidth
- b) VBW \geq RBW
- c) Detector = peak
- d) Trace mode = Max hold
- e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

Minimum Standard:

NA



CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (25) / (250) Pages

Test Data:

ANT1

| Mode | 26 dB Bandwidth and 99% Bandwidth (MHz) | | | | | |
|-------------------------|---|-------|--------------|-------|----------------|-------|
| | 802.11a | | 802.11n_HT20 | | 802.11ac_VHT20 | |
| | 26 dB | 99% | 26 dB | 99% | 26 dB | 99% |
| 5 180 MHz | 21.04 | 16.68 | 21.43 | 17.82 | 21.39 | 17.83 |
| 5 200 MHz | 20.90 | 16.64 | 21.54 | 17.83 | 21.34 | 17.85 |
| 5 240 MHz | 21.10 | 16.66 | 21.43 | 17.83 | 21.58 | 17.84 |
| 5 260 MHz | 20.98 | 16.65 | 21.30 | 17.81 | 21.61 | 17.83 |
| 5 300 MHz | 21.16 | 16.67 | 21.39 | 17.83 | 21.41 | 17.84 |
| 5 320 MHz | 21.11 | 16.66 | 21.43 | 17.84 | 21.40 | 17.84 |
| 5 500 MHz | 21.01 | 16.65 | 21.29 | 17.81 | 21.30 | 17.83 |
| 5 600 MHz | 21.01 | 16.64 | 21.51 | 17.87 | 21.38 | 17.83 |
| 5 720 MHz | 21.14 | 16.67 | 21.55 | 17.84 | 21.61 | 17.85 |
| 5 745 MHz | 42.02 | 25.20 | 45.81 | 25.76 | 47.51 | 25.63 |
| 5 785 MHz | 43.15 | 27.20 | 47.41 | 28.38 | 46.43 | 28.35 |
| 5 825 MHz | 43.09 | 26.68 | 44.68 | 27.82 | 46.73 | 27.79 |
| Measurement uncertainty | ± 0.1 MHz | | | | | |

| Mode | 26 dB Bandwidth and 99% Bandwidth (MHz) | | | |
|-------------------------|---|-------|----------------|-------|
| | 802.11n_HT40 | | 802.11ac_VHT40 | |
| | 26 dB | 99 % | 26 dB | 99 % |
| 5 190 MHz | 39.98 | 36.29 | 39.99 | 36.32 |
| 5 230 MHz | 40.06 | 36.32 | 39.92 | 36.29 |
| 5 270 MHz | 39.90 | 36.28 | 39.87 | 36.28 |
| 5 310 MHz | 39.97 | 36.33 | 39.90 | 36.29 |
| 5 510 MHz | 39.95 | 36.31 | 39.93 | 36.33 |
| 5 590 MHz | 39.80 | 36.31 | 40.18 | 36.28 |
| 5 710 MHz | 40.02 | 36.29 | 39.77 | 36.29 |
| 5 755 MHz | 90.00 | 58.09 | 89.89 | 59.33 |
| 5 795 MHz | 90.00 | 61.25 | 90.00 | 61.54 |
| Measurement uncertainty | ± 0.1 MHz | | | |



CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (26) / (250) Pages

| | 26 dB Bandwidth and 99% Bandwidth (MHz) | |
|-------------------------|---|-------|
| Mode | 802.11ac_VHT80 | |
| Frequency | 26 dB | 99 % |
| 5 210 MHz | 81.14 | 75.87 |
| 5 290 MHz | 81.60 | 75.70 |
| 5 530 MHz | 81.56 | 75.81 |
| 5 690 MHz | 81.01 | 75.76 |
| 5 775 MHz | 129.00 | 76.13 |
| Measurement uncertainty | ± 0.1 MHz | |

ANT2

| | 26 dB Bandwidth and 99% Bandwidth (MHz) | | | | | |
|-------------------------|---|-------|--------------|-------|----------------|-------|
| Mode | 802.11a | | 802.11n_HT20 | | 802.11ac_VHT20 | |
| Frequency | 26 dB | 99% | 26 dB | 99% | 26 dB | 99% |
| 5 180 MHz | 21.09 | 16.68 | 21.36 | 17.79 | 21.33 | 17.81 |
| 5 200 MHz | 20.95 | 16.67 | 21.43 | 17.79 | 21.18 | 17.80 |
| 5 240 MHz | 20.94 | 16.64 | 21.24 | 17.78 | 21.26 | 17.80 |
| 5 260 MHz | 21.19 | 16.66 | 21.49 | 17.79 | 21.30 | 17.79 |
| 5 300 MHz | 21.10 | 16.66 | 21.25 | 17.78 | 21.31 | 17.78 |
| 5 320 MHz | 21.04 | 16.66 | 21.23 | 17.79 | 21.28 | 17.77 |
| 5 500 MHz | 21.18 | 16.66 | 21.35 | 17.78 | 21.25 | 17.76 |
| 5 600 MHz | 21.18 | 16.65 | 21.20 | 17.77 | 21.34 | 17.78 |
| 5 720 MHz | 21.13 | 16.67 | 21.33 | 17.78 | 21.15 | 17.78 |
| 5 745 MHz | 35.91 | 19.01 | 36.99 | 19.12 | 35.39 | 18.95 |
| 5 785 MHz | 37.79 | 20.58 | 38.01 | 19.98 | 42.37 | 20.28 |
| 5 825 MHz | 38.64 | 20.99 | 41.03 | 21.49 | 40.31 | 21.01 |
| Measurement uncertainty | ± 0.1 MHz | | | | | |



CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (27) / (250) Pages

| 26 dB Bandwidth and 99% Bandwidth (MHz) | | | | |
|---|--------------|-------|----------------|-------|
| Mode | 802.11n_HT40 | | 802.11ac_VHT40 | |
| Frequency | 26 dB | 99 % | 26 dB | 99 % |
| 5 190 MHz | 39.52 | 36.27 | 39.46 | 36.26 |
| 5 230 MHz | 39.60 | 36.29 | 39.42 | 36.27 |
| 5 270 MHz | 39.37 | 36.23 | 39.51 | 36.26 |
| 5 310 MHz | 39.50 | 36.28 | 39.47 | 36.27 |
| 5 510 MHz | 39.46 | 36.26 | 39.45 | 36.24 |
| 5 590 MHz | 39.41 | 36.24 | 39.27 | 36.24 |
| 5 710 MHz | 39.49 | 36.27 | 39.55 | 36.28 |
| 5 755 MHz | 77.48 | 37.15 | 75.34 | 37.91 |
| 5 795 MHz | 80.27 | 39.29 | 79.50 | 40.65 |
| Measurement uncertainty | ± 0.1 MHz | | | |

| 26 dB Bandwidth and 99% Bandwidth (MHz) | | |
|---|----------------|-------|
| Mode | 802.11ac_VHT80 | |
| Frequency | 26 dB | 99 % |
| 5 210 MHz | 80.75 | 75.82 |
| 5 290 MHz | 80.43 | 75.82 |
| 5 530 MHz | 80.54 | 75.77 |
| 5 690 MHz | 80.78 | 75.80 |
| 5 775 MHz | 81.97 | 75.80 |
| Measurement uncertainty | ± 0.1 MHz | |



CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (28) / (250) Pages

ANT3

| Mode | 26 dB Bandwidth and 99% Bandwidth (MHz) | | | | | |
|-------------------------|---|-------|--------------|-------|----------------|-------|
| | 802.11a | | 802.11n_HT20 | | 802.11ac_VHT20 | |
| | 26 dB | 99% | 26 dB | 99% | 26 dB | 99% |
| 5 180 MHz | 20.84 | 16.63 | 21.16 | 17.79 | 21.30 | 17.79 |
| 5 200 MHz | 21.03 | 16.62 | 21.23 | 17.81 | 21.25 | 17.80 |
| 5 240 MHz | 21.00 | 16.64 | 21.17 | 17.79 | 21.27 | 17.79 |
| 5 260 MHz | 21.07 | 16.64 | 21.18 | 17.77 | 21.36 | 17.78 |
| 5 300 MHz | 20.93 | 16.61 | 21.14 | 17.78 | 21.26 | 17.79 |
| 5 320 MHz | 21.00 | 16.63 | 21.26 | 17.77 | 21.29 | 17.80 |
| 5 500 MHz | 21.00 | 16.61 | 21.33 | 17.75 | 21.39 | 17.78 |
| 5 600 MHz | 21.06 | 16.62 | 21.31 | 17.82 | 21.46 | 17.78 |
| 5 720 MHz | 20.91 | 16.62 | 21.30 | 17.79 | 21.29 | 17.78 |
| 5 745 MHz | 37.90 | 20.23 | 43.47 | 20.31 | 41.06 | 20.40 |
| 5 785 MHz | 41.11 | 21.95 | 44.26 | 22.55 | 44.93 | 22.52 |
| 5 825 MHz | 38.06 | 21.06 | 42.48 | 22.16 | 43.17 | 22.43 |
| Measurement uncertainty | ± 0.1 MHz | | | | | |

| Mode | 26 dB Bandwidth and 99% Bandwidth (MHz) | | | |
|-------------------------|---|-------|----------------|-------|
| | 802.11n_HT40 | | 802.11ac_VHT40 | |
| | 26 dB | 99 % | 26 dB | 99 % |
| 5 190 MHz | 39.55 | 36.26 | 39.51 | 36.26 |
| 5 230 MHz | 39.64 | 36.34 | 39.53 | 36.27 |
| 5 270 MHz | 39.37 | 36.26 | 39.52 | 36.23 |
| 5 310 MHz | 39.41 | 36.26 | 39.64 | 36.26 |
| 5 510 MHz | 39.66 | 36.24 | 39.47 | 36.26 |
| 5 590 MHz | 39.54 | 36.25 | 39.57 | 36.27 |
| 5 710 MHz | 39.69 | 36.23 | 39.45 | 36.27 |
| 5 755 MHz | 84.85 | 44.96 | 89.69 | 48.53 |
| 5 795 MHz | 89.26 | 46.99 | 87.98 | 50.90 |
| Measurement uncertainty | ± 0.1 MHz | | | |



CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (29) / (250) Pages

| 26 dB Bandwidth and 99% Bandwidth (MHz) | | |
|---|----------------|-------|
| Mode | 802.11ac_VHT80 | |
| Frequency | 26 dB | 99 % |
| 5 210 MHz | 80.79 | 75.81 |
| 5 290 MHz | 80.85 | 75.71 |
| 5 530 MHz | 80.93 | 75.74 |
| 5 690 MHz | 80.45 | 75.67 |
| 5 775 MHz | 110.7 | 75.88 |
| Measurement uncertainty | ± 0.1 MHz | |

ANT4

| 26 dB Bandwidth and 99% Bandwidth (MHz) | | | | | | |
|---|-----------|-------|--------------|-------|----------------|-------|
| Mode | 802.11a | | 802.11n_HT20 | | 802.11ac_VHT20 | |
| | 26 dB | 99% | 26 dB | 99% | 26 dB | 99% |
| 5 180 MHz | 20.90 | 16.60 | 21.38 | 17.77 | 21.16 | 17.77 |
| 5 200 MHz | 20.94 | 16.61 | 21.26 | 17.78 | 21.17 | 17.77 |
| 5 240 MHz | 20.95 | 16.64 | 21.30 | 17.78 | 21.37 | 17.80 |
| 5 260 MHz | 20.78 | 16.61 | 21.22 | 17.78 | 21.23 | 17.77 |
| 5 300 MHz | 21.07 | 16.64 | 21.21 | 17.78 | 21.27 | 17.80 |
| 5 320 MHz | 20.95 | 16.62 | 21.32 | 17.77 | 21.20 | 17.82 |
| 5 500 MHz | 21.03 | 16.63 | 21.38 | 17.78 | 21.27 | 17.79 |
| 5 600 MHz | 20.99 | 16.65 | 21.33 | 17.79 | 21.46 | 17.79 |
| 5 720 MHz | 20.85 | 16.63 | 21.41 | 17.80 | 21.28 | 17.78 |
| 5 745 MHz | 42.06 | 25.59 | 44.09 | 24.05 | 44.33 | 25.60 |
| 5 785 MHz | 43.07 | 26.94 | 44.60 | 26.62 | 45.53 | 27.74 |
| 5 825 MHz | 42.56 | 27.21 | 46.50 | 26.93 | 45.72 | 28.52 |
| Measurement uncertainty | ± 0.1 MHz | | | | | |



CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (30) / (250) Pages

| 26 dB Bandwidth and 99% Bandwidth (MHz) | | | | |
|---|--------------|-------|----------------|-------|
| Mode | 802.11n_HT40 | | 802.11ac_VHT40 | |
| Frequency | 26 dB | 99 % | 26 dB | 99 % |
| 5 190 MHz | 39.55 | 36.26 | 39.40 | 36.25 |
| 5 230 MHz | 39.50 | 36.28 | 39.65 | 36.28 |
| 5 270 MHz | 39.58 | 36.27 | 39.53 | 36.27 |
| 5 310 MHz | 39.51 | 36.26 | 39.53 | 36.29 |
| 5 510 MHz | 39.49 | 36.26 | 39.44 | 36.26 |
| 5 590 MHz | 39.65 | 36.27 | 39.54 | 36.23 |
| 5 710 MHz | 39.68 | 36.28 | 39.51 | 36.25 |
| 5 755 MHz | 89.17 | 53.92 | 89.59 | 56.69 |
| 5 795 MHz | 88.73 | 55.76 | 89.55 | 57.25 |
| Measurement uncertainty | ± 0.1 MHz | | | |

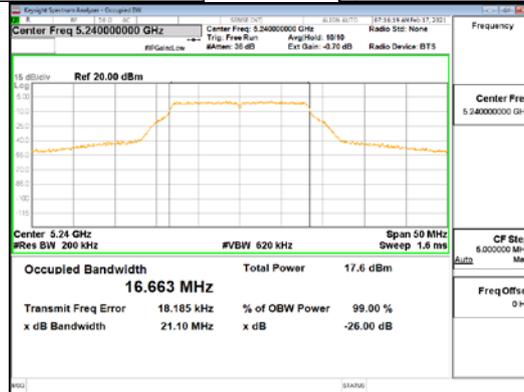
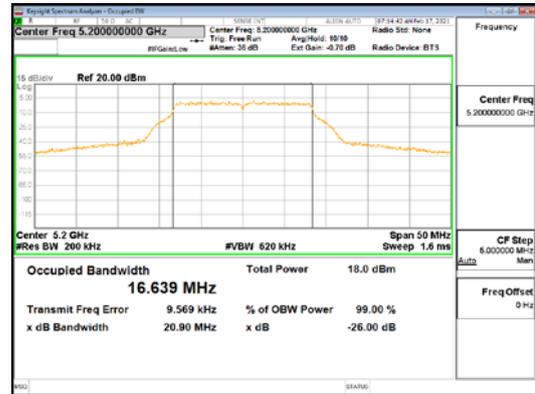
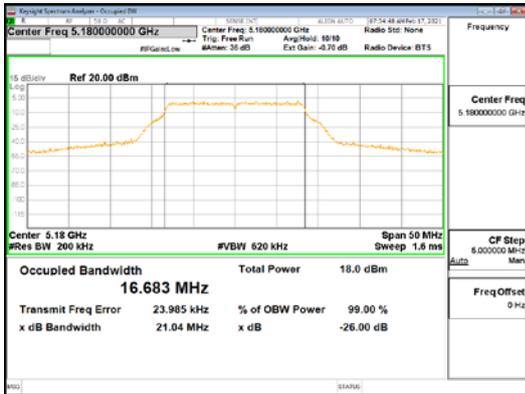
| 26 dB Bandwidth and 99% Bandwidth (MHz) | | |
|---|----------------|-------|
| Mode | 802.11ac_VHT80 | |
| Frequency | 26 dB | 99 % |
| 5 210 MHz | 81.05 | 75.82 |
| 5 290 MHz | 80.54 | 75.75 |
| 5 530 MHz | 80.92 | 75.74 |
| 5 690 MHz | 80.21 | 75.76 |
| 5 775 MHz | 118.80 | 75.97 |
| Measurement uncertainty | ± 0.1 MHz | |

See next pages for actual measured spectrum plots.

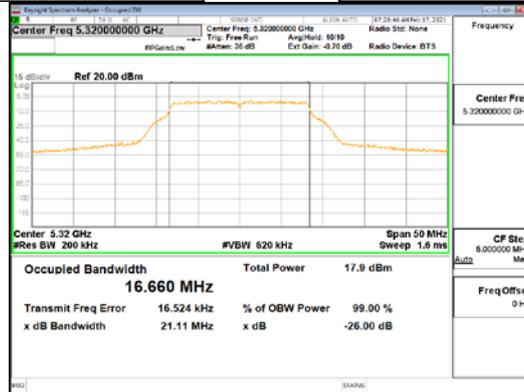
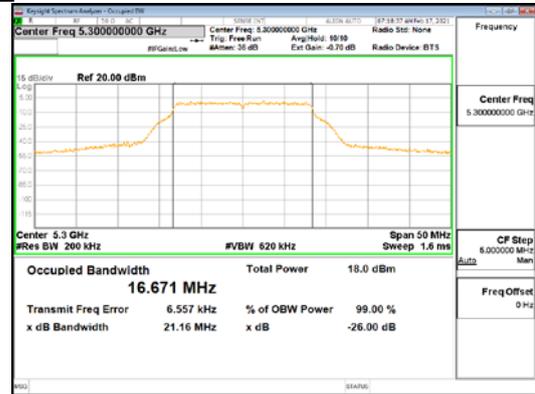
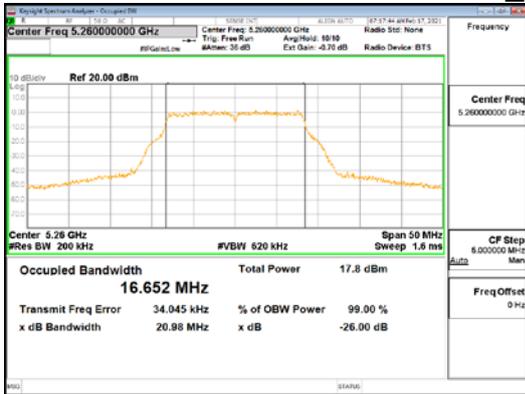


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (31) / (250) Pages



ANT1_802.11a_UNII 1

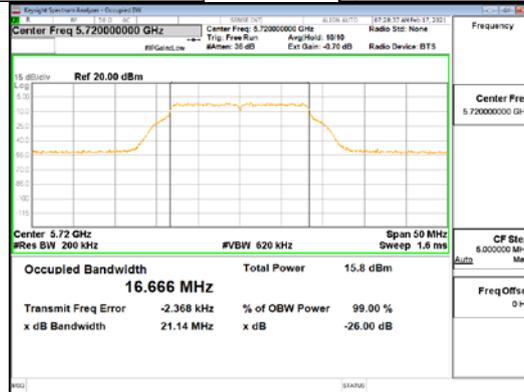
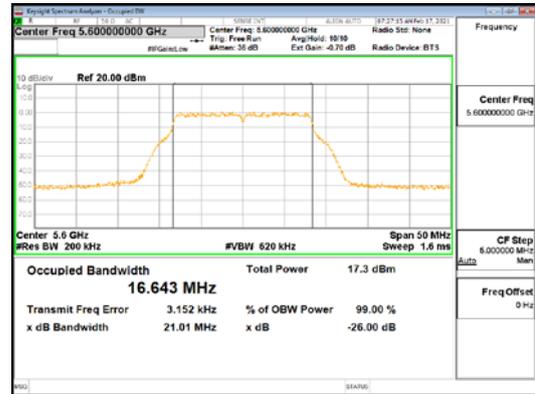
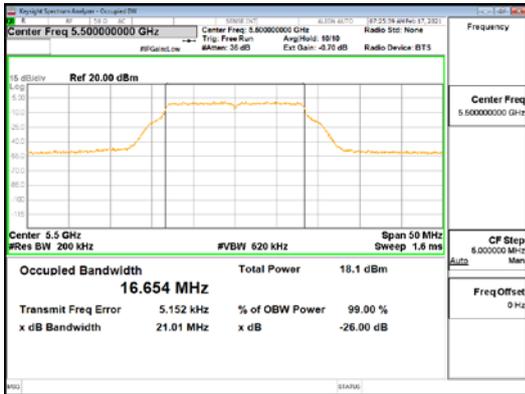


ANT1_802.11a_UNII 2A

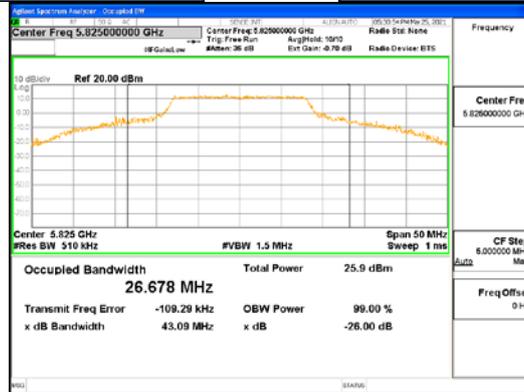
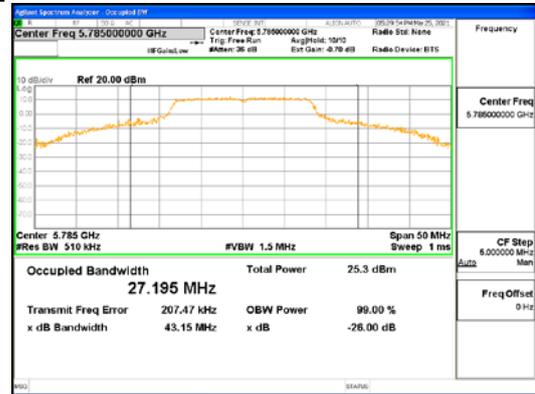
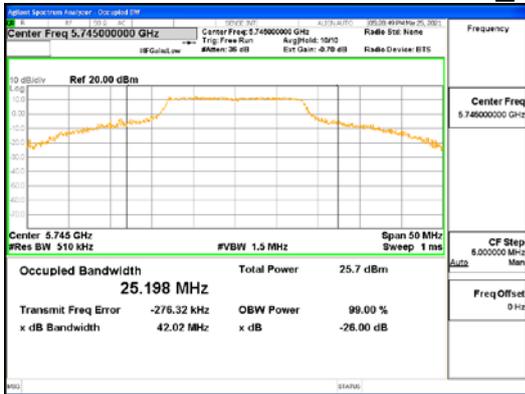


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (32) / (250) Pages



ANT1_802.11a_UNII 2C

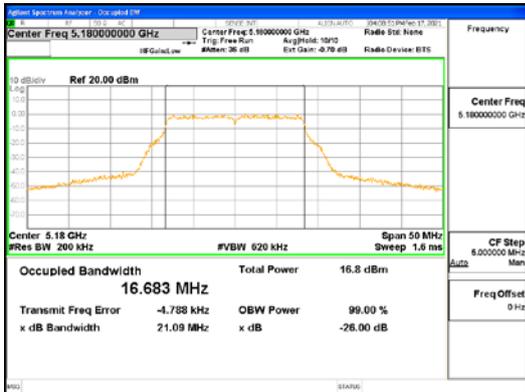


ANT1_802.11a_UNII 3

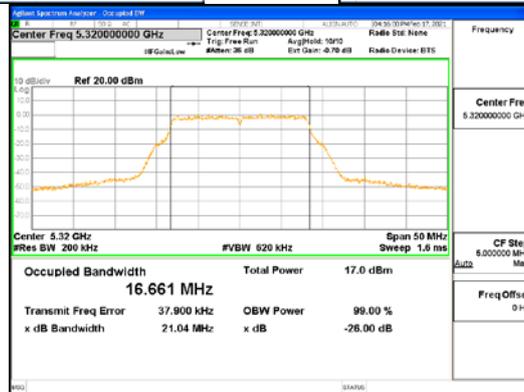
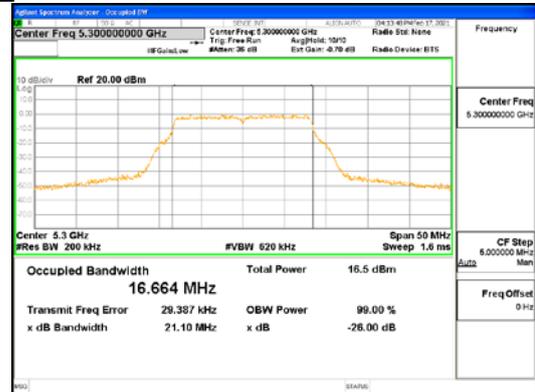
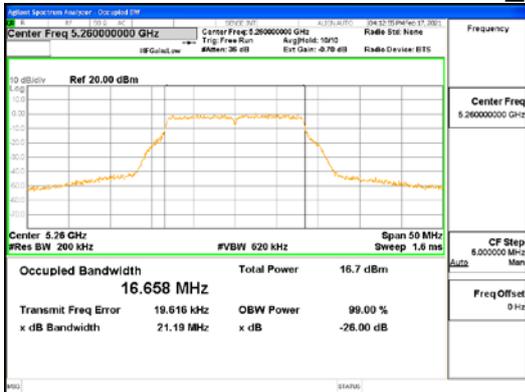


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (33) / (250) Pages



ANT2_802.11a_UNII 1

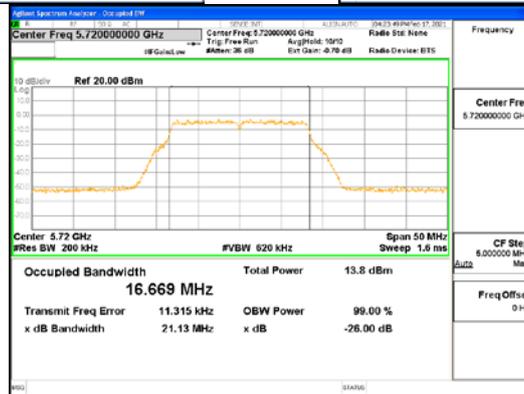
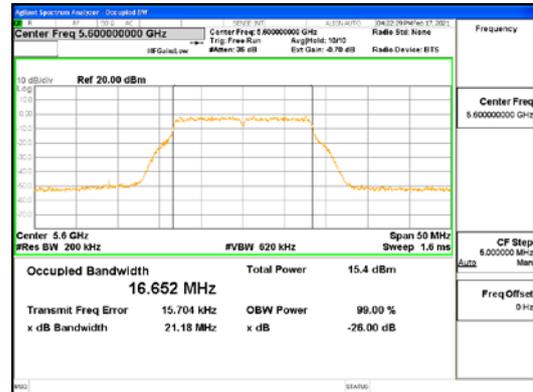
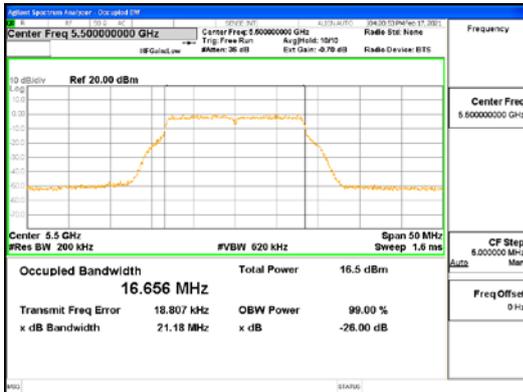


ANT2_802.11a_UNII 2A

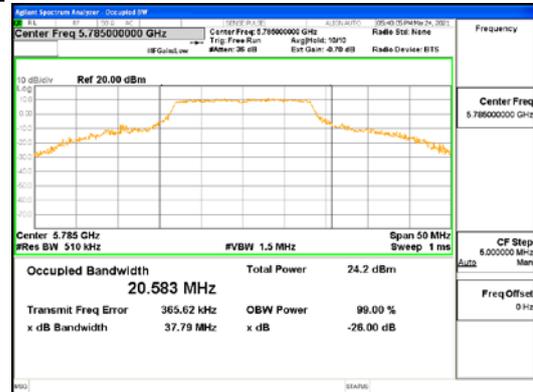
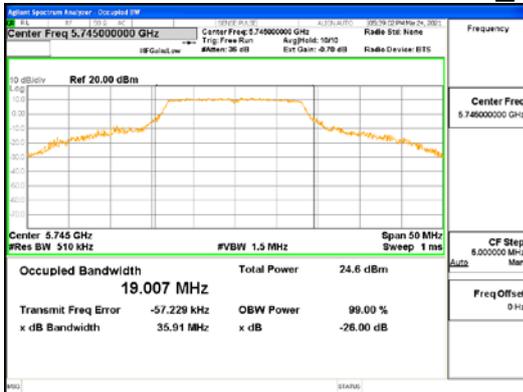


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (34) / (250) Pages



ANT2_802.11a_UNII 2C

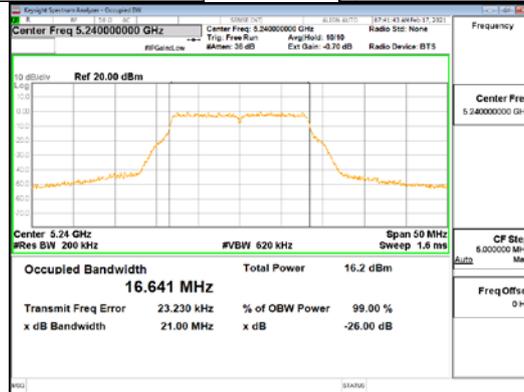
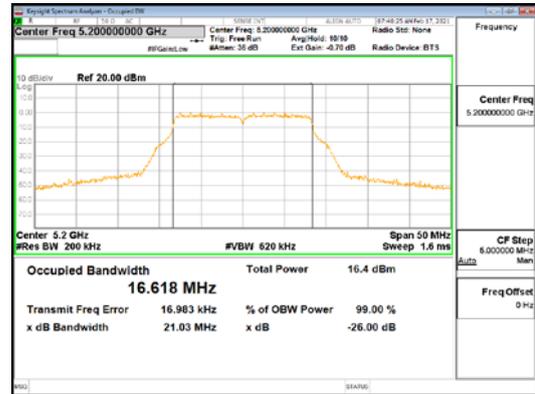
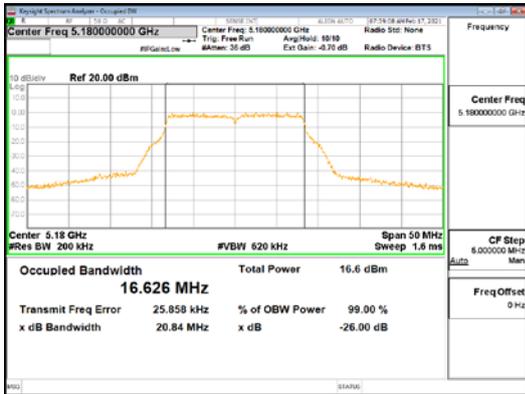


ANT2_802.11a_UNII 3

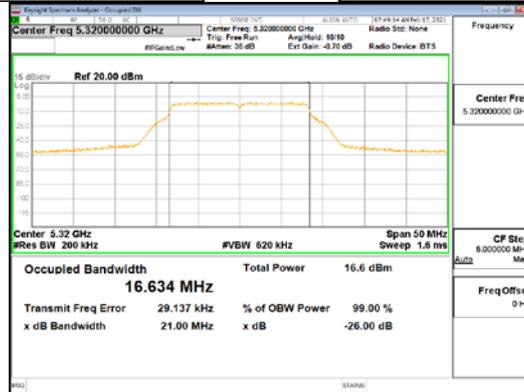
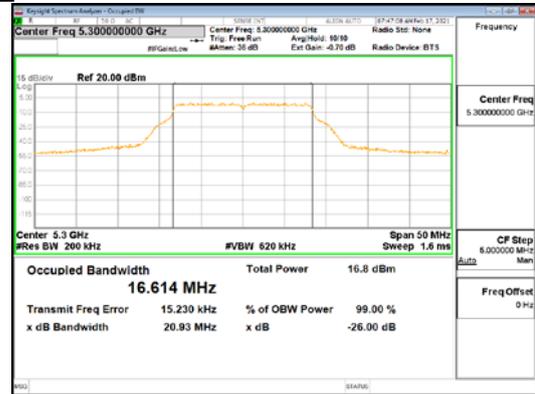
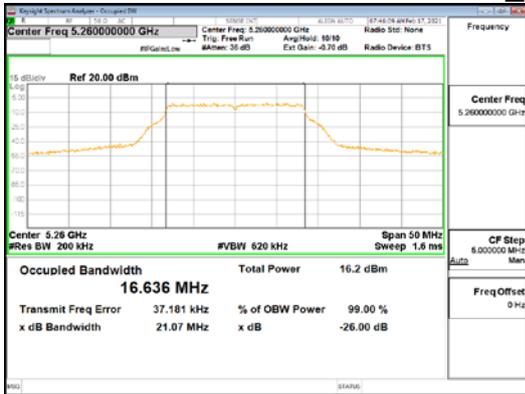


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (35) / (250) Pages



ANT3_802.11a_UNII 1

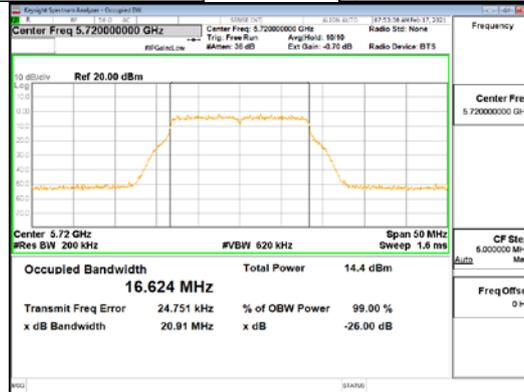
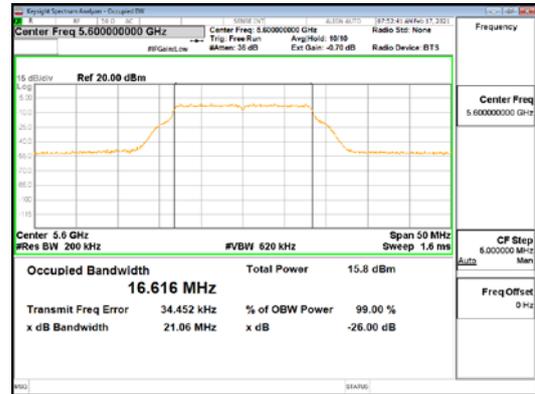
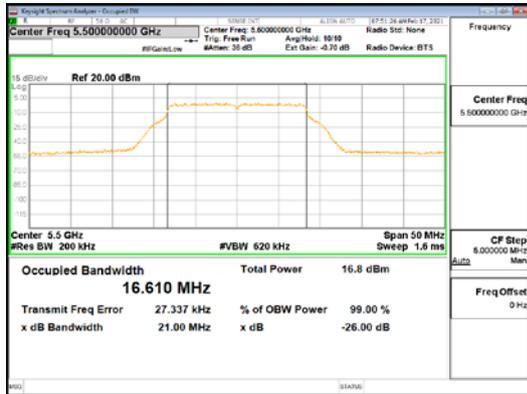


ANT3_802.11a_UNII 2A

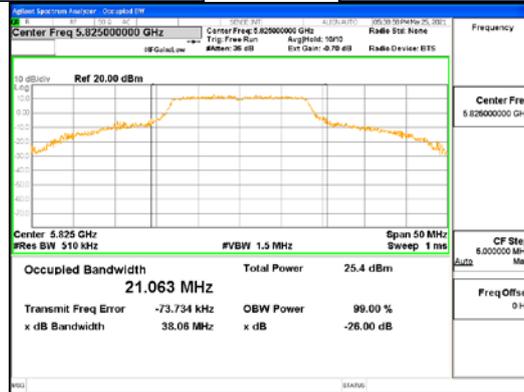
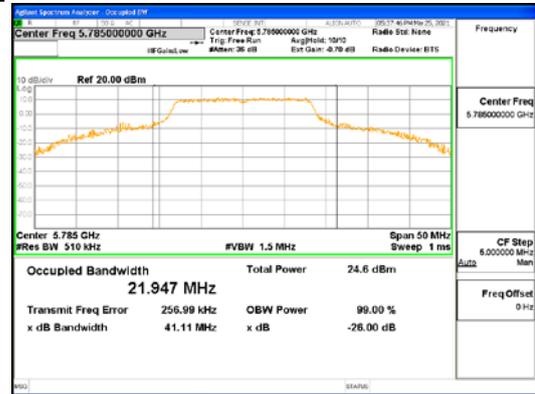
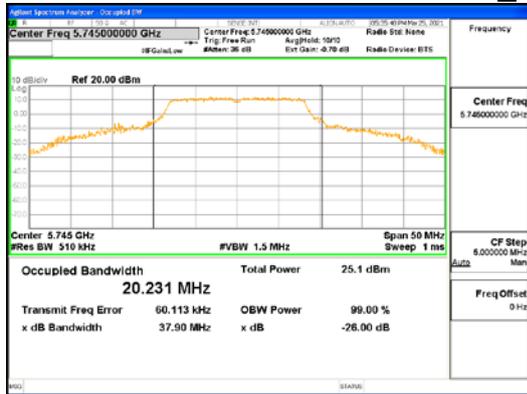


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (36) / (250) Pages



ANT3_802.11a_UNII 2C

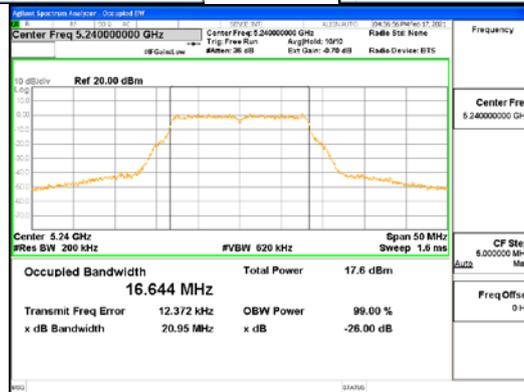
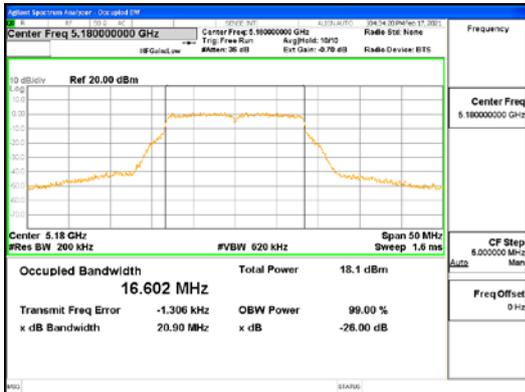


ANT3_802.11a_UNII 3

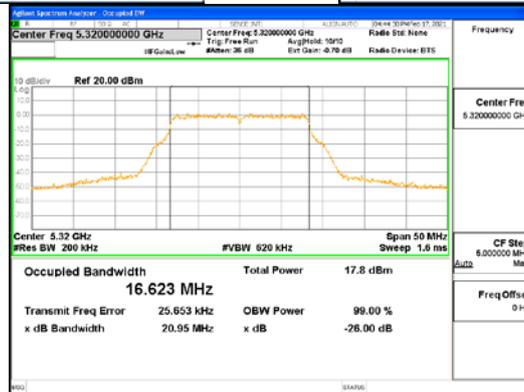
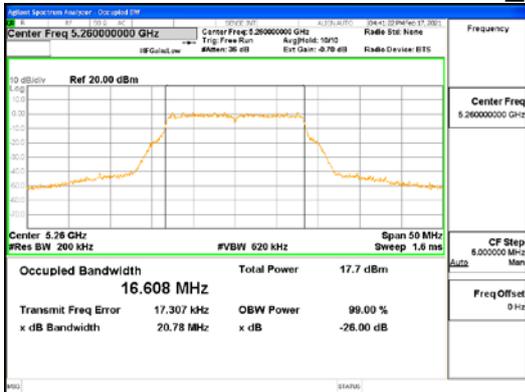


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (37) / (250) Pages



ANT4_802.11a_UNII 1

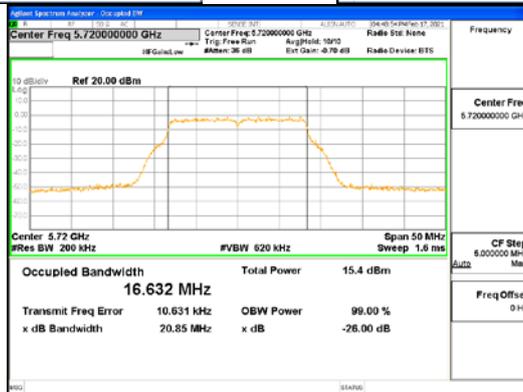
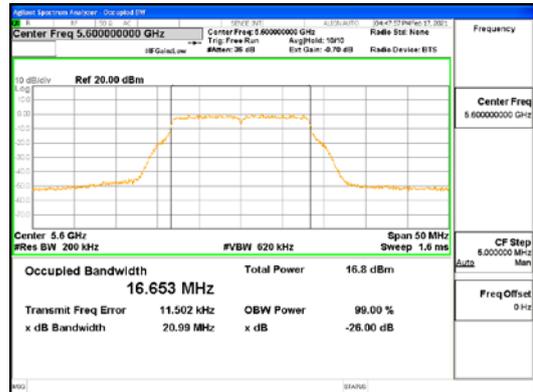
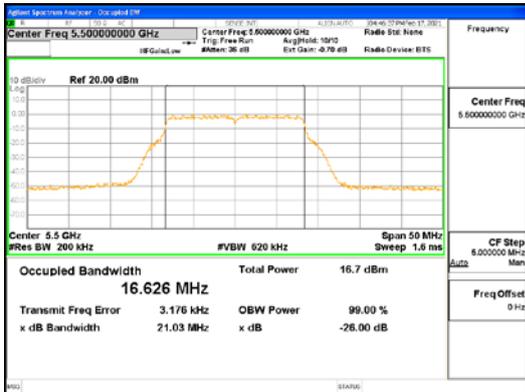


ANT4_802.11a_UNII 2A

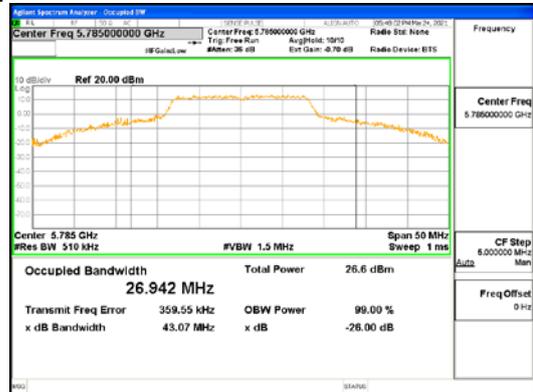
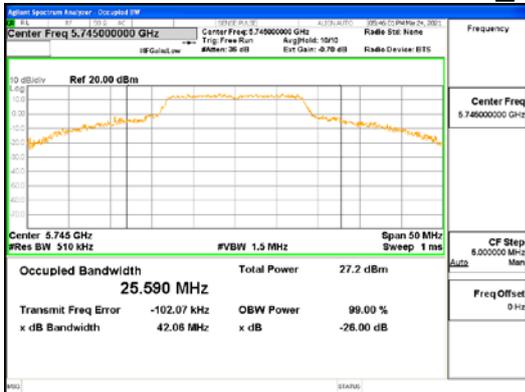


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (38) / (250) Pages



ANT4_802.11a_UNII 2C

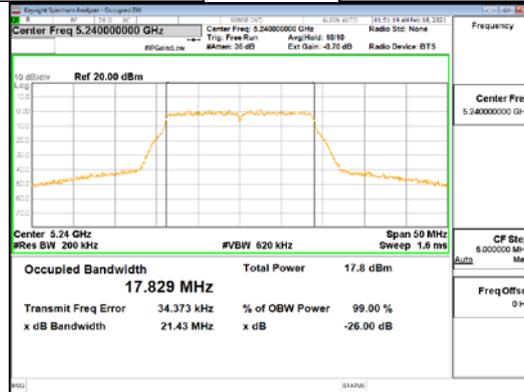
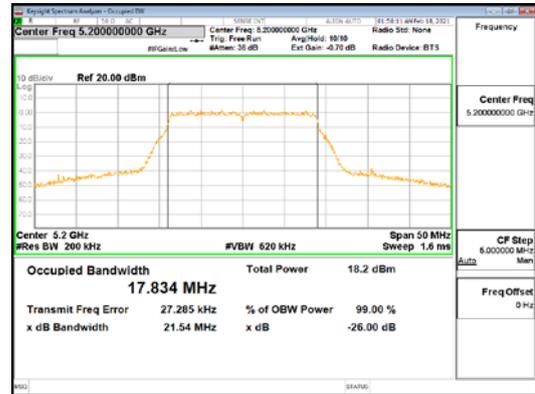
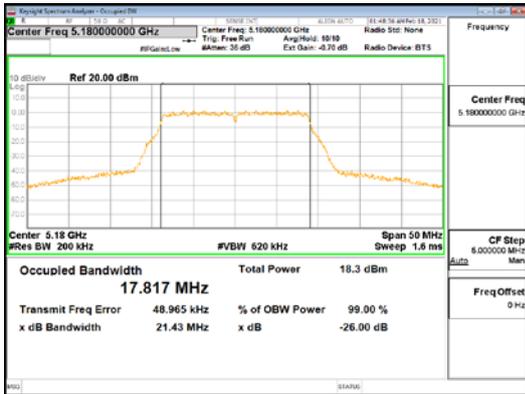


ANT4_802.11a_UNII 3

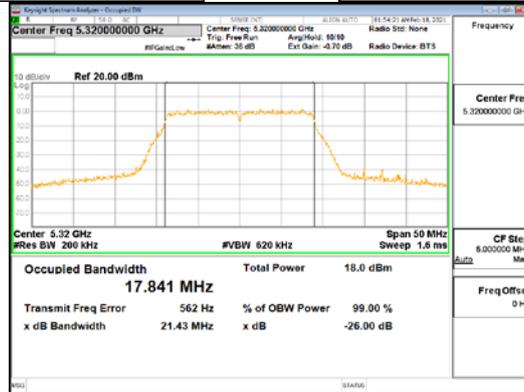
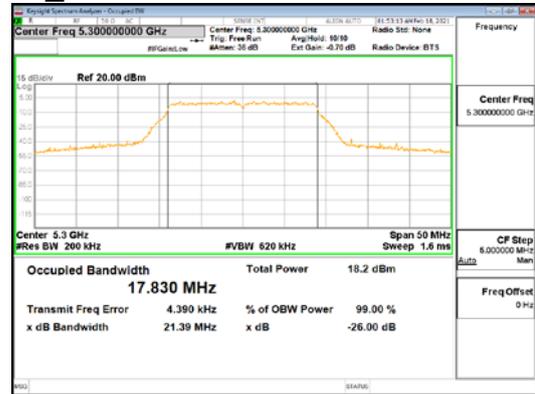
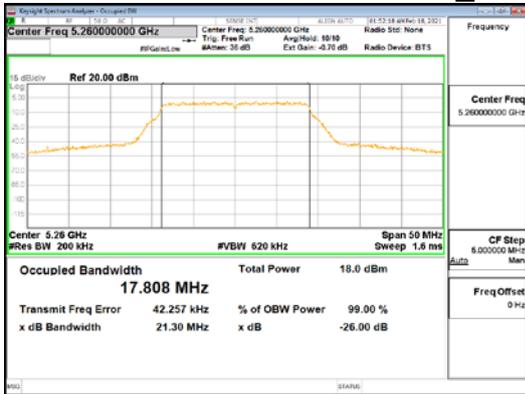


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (39) / (250) Pages



ANT1_802.11n_HT20_UNII 1

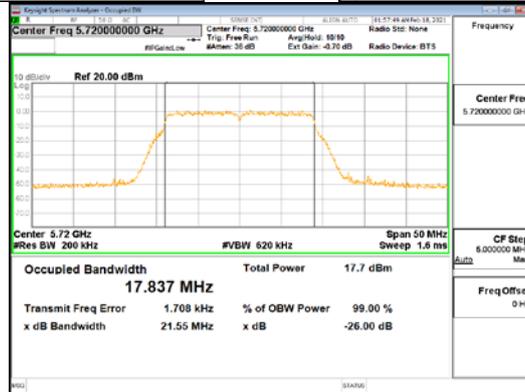
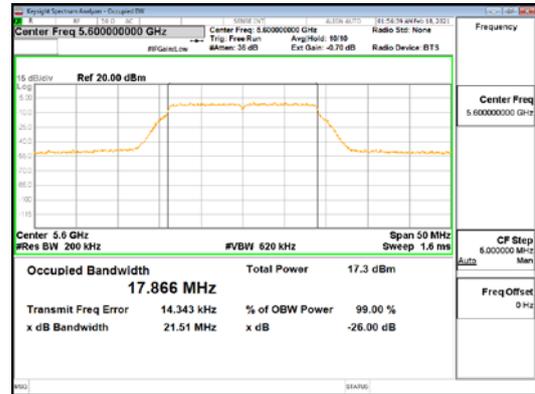
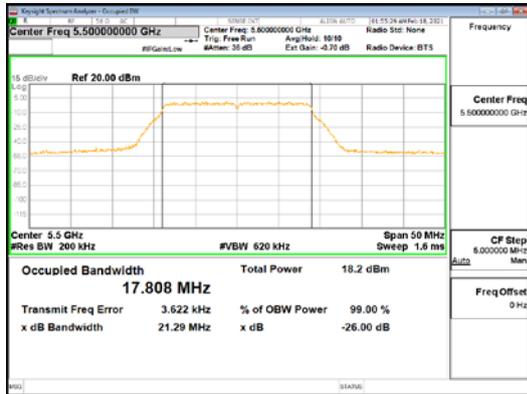


ANT1_802.11n_HT20_UNII 2A

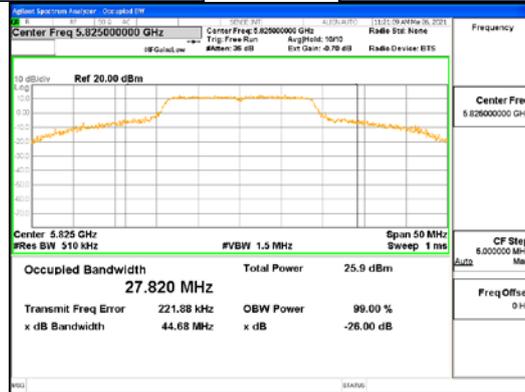
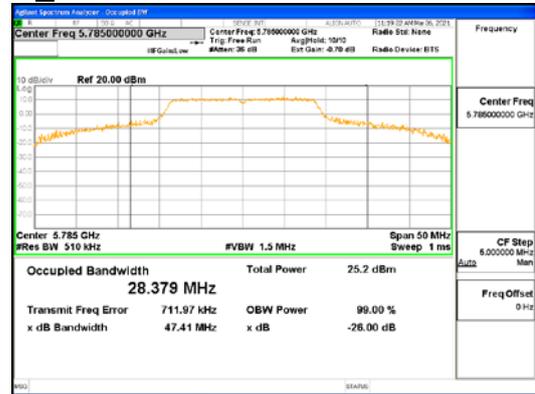
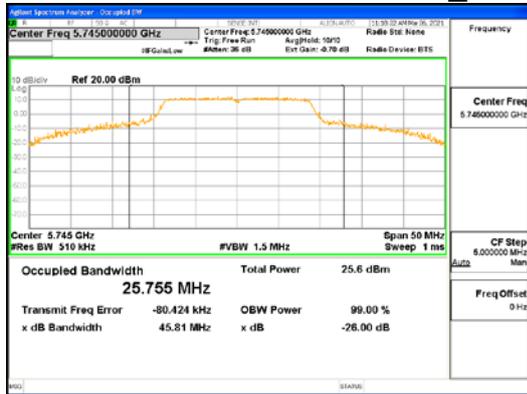


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2021-00840
 Page (40) / (250) Pages



ANT1_802.11n_HT20_UNII 2C



ANT1_802.11n_HT20_UNII 3