# 8 FCC §15.247(a)(2) – 6 dB Emission Bandwidth

## 8.1 Applicable Standard

According to FCC §15.247(a) (2),

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

## 8.2 Test Procedure

According to ANSI C63.10-2013, the steps for the first option are as follows:

(1) Set RBW = 100 kHz. (2) Set the VBW ≥ [3 × RBW]. (3) Detector = peak. (4) Trace mode = max hold.

(5) Sweep = auto couple. (6) Allow the trace to stabilize. (7) 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.

## 8.3 Test Equipment List and Details

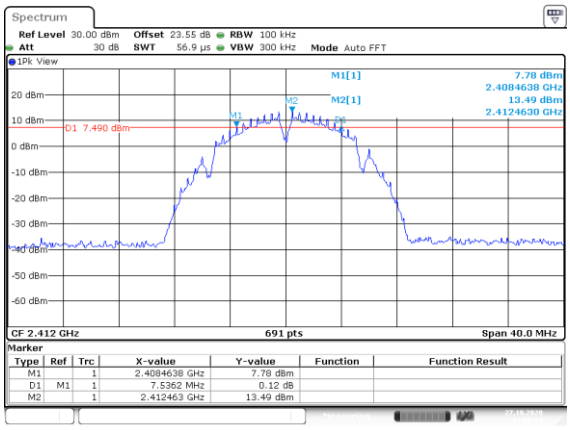
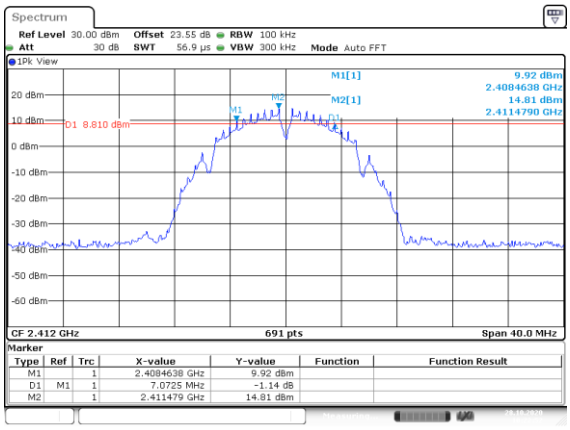
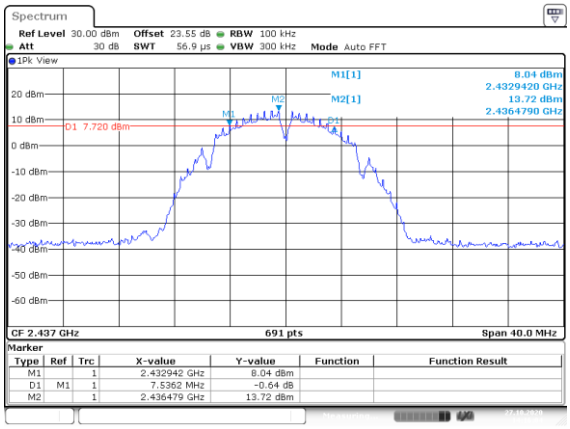
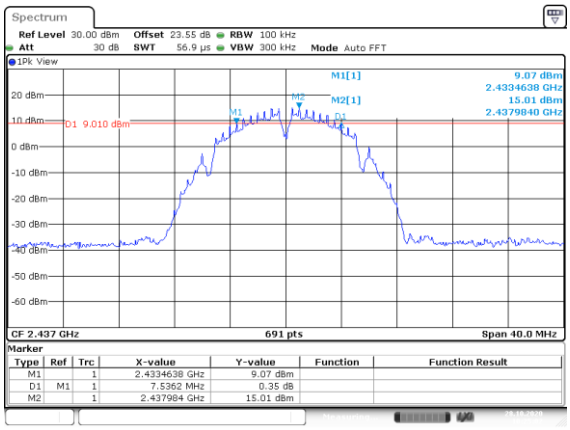
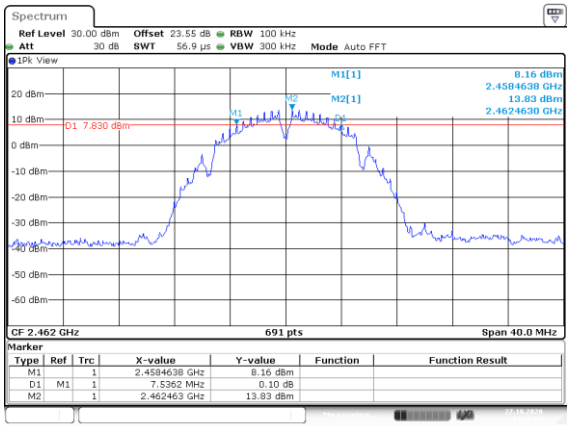
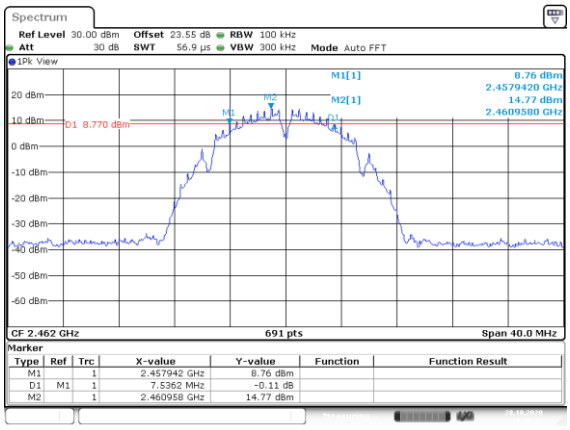
| Description | Manufacture | Model | Serial No. | Cal. Date. | Cal. Due. |
|---|---|---|---|---|---|
| **Conducted Room(TH-02)** | | | | | |
| Spectrum Analyzer | Rohde & Schwarz | FSU26 | 100406 | 2020/03/11 | 2021/03/10 |
| Cable | MTJ | MT40S | 620620-MT40S-100 | Each use | - |

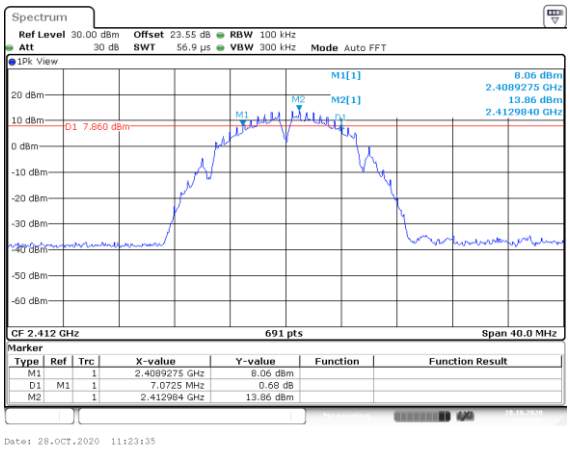
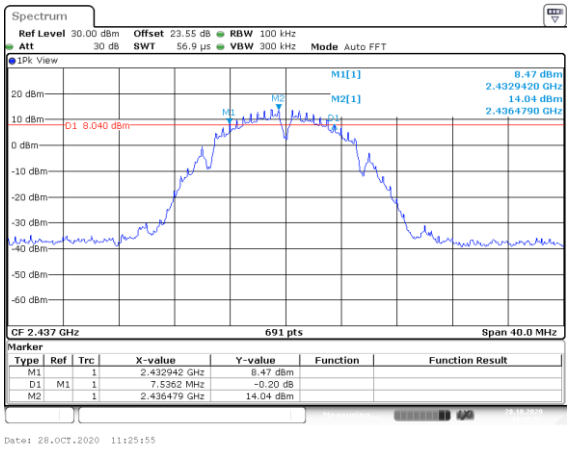
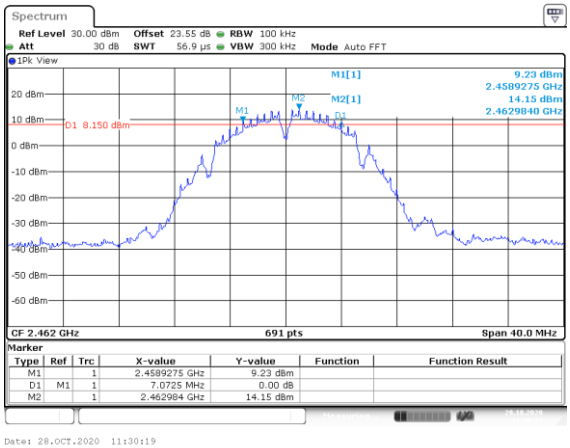
***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).*

## 8.4 Test Results

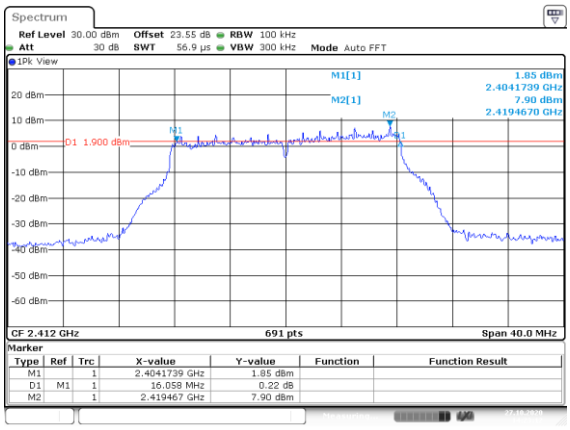
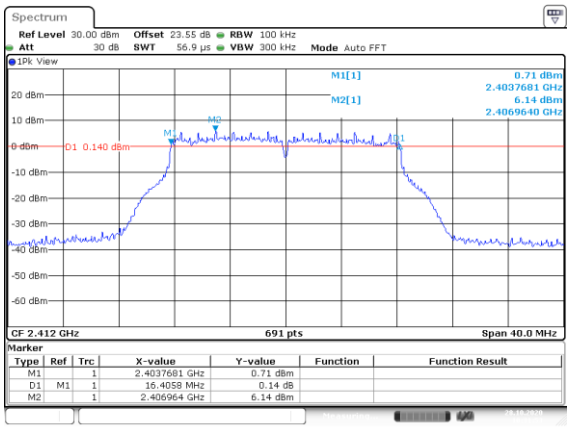
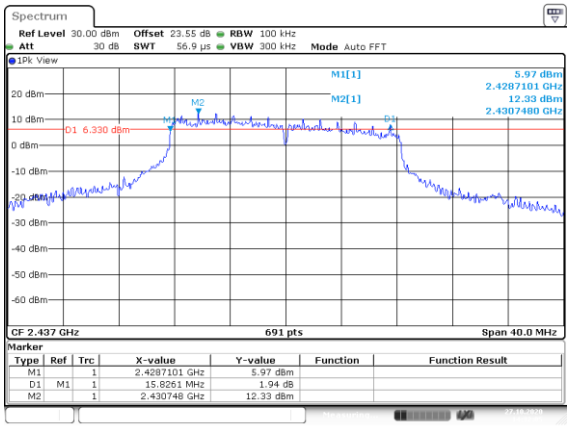
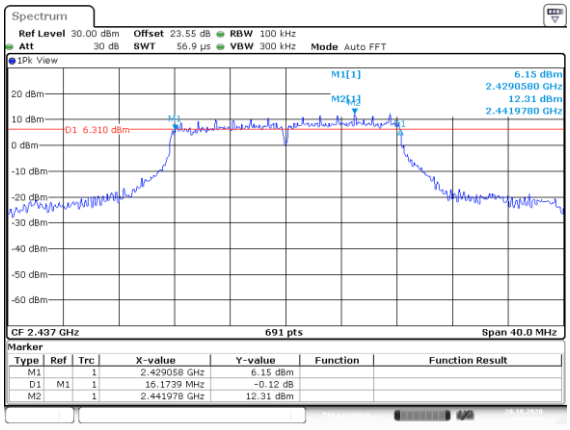
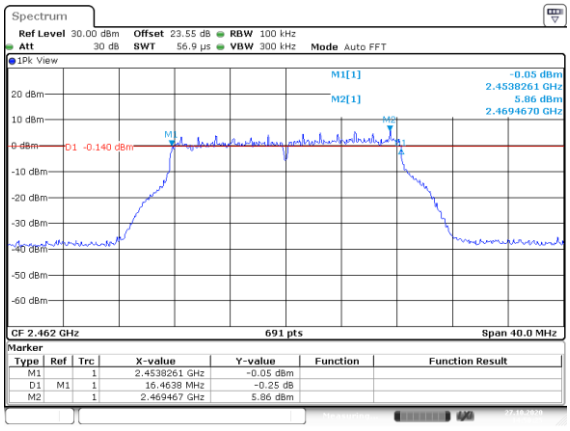
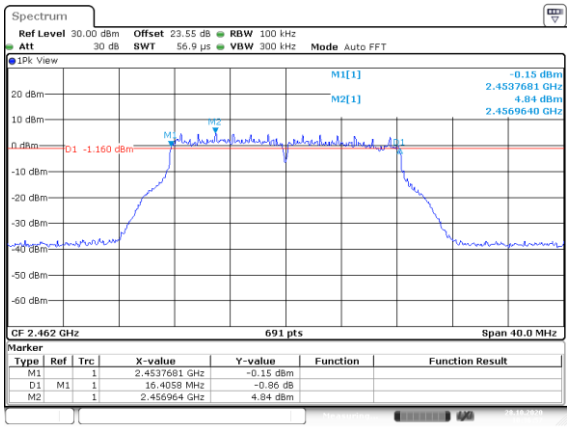
| Channel | Frequency (MHz) | 6 dB BW (MHz) | | | 6dB Limit (MHz) | Result |
|---|---|---|---|---|---|---|
| | | Ant. 1 | Ant. 2 | Ant. 3 | | |
| **802.11b mode** | | | | | | |
| Low | 2412 | 7.54 | 7.07 | 7.07 | > 0.5 | Compliance |
| Middle | 2437 | 7.54 | 7.54 | 7.54 | > 0.5 | Compliance |
| High | 2462 | 7.54 | 7.54 | 7.07 | > 0.5 | Compliance |
| **802.11g mode** | | | | | | |
| Low | 2412 | 16.06 | 16.41 | 15.71 | > 0.5 | Compliance |
| Middle | 2437 | 15.83 | 16.17 | 16.35 | > 0.5 | Compliance |
| High | 2462 | 16.46 | 16.41 | 15.83 | > 0.5 | Compliance |
| **802.11ax HE20 mode** | | | | | | |
| Low | 2412 | 18.90 | 18.96 | 17.10 | > 0.5 | Compliance |
| Middle | 2437 | 17.10 | 17.45 | 18.78 | > 0.5 | Compliance |
| High | 2462 | 18.72 | 18.96 | 17.16 | > 0.5 | Compliance |
| **802.11ax HE40 mode** | | | | | | |
| Low | 2422 | 28.75 | 37.80 | 32.58 | > 0.5 | Compliance |
| Middle | 2437 | 35.71 | 36.52 | 37.33 | > 0.5 | Compliance |
| High | 2452 | 38.03 | 36.06 | 37.57 | > 0.5 | Compliance |

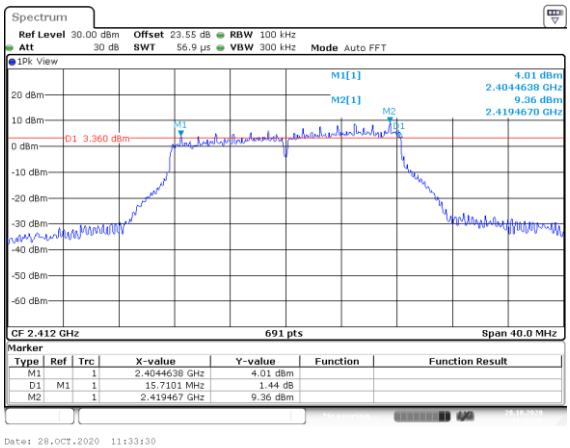
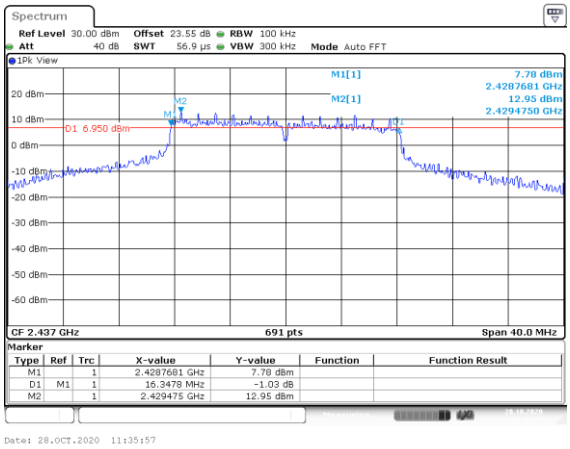
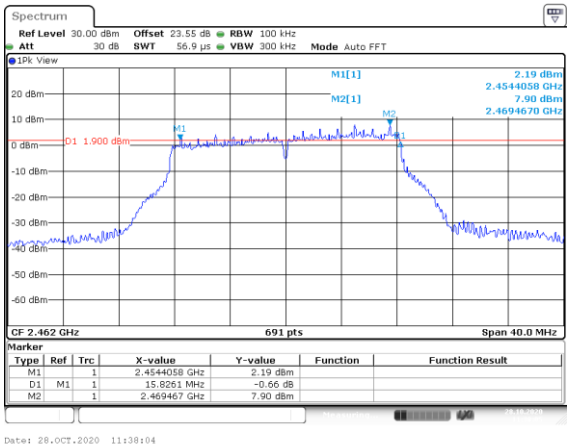
**802.11b mode:**

| Ant. 1 | Ant. 2 |
|---|---|
| **Low CH** | **Low CH** |
|  |  |
| **Middle CH** | **Middle CH** |
|  |  |
| **High CH** | **High CH** |
|  |  |

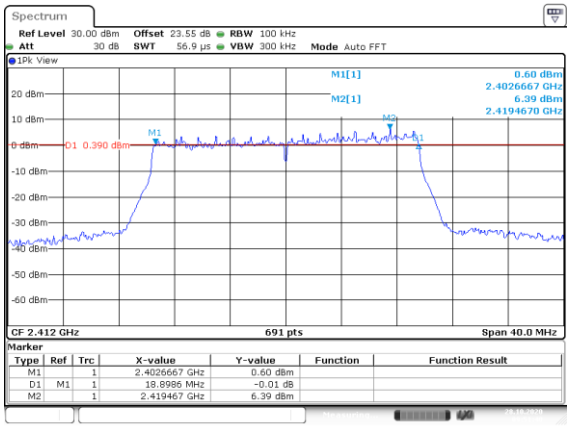
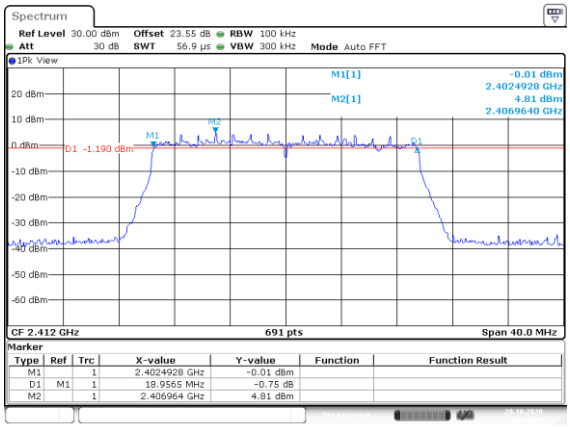
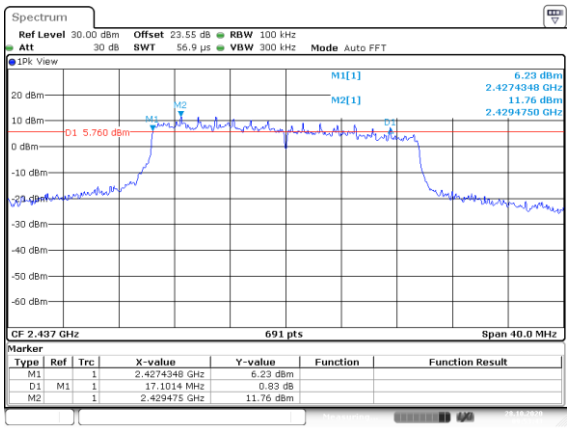
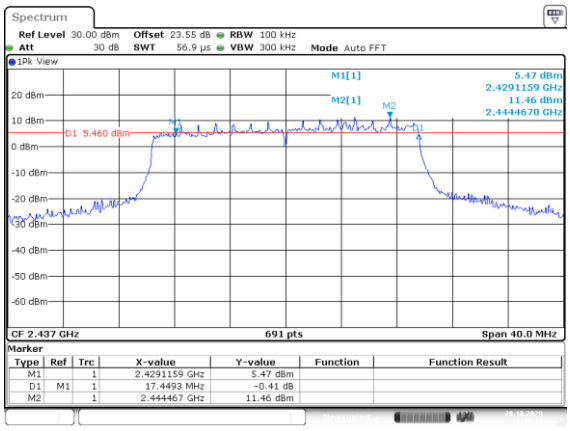
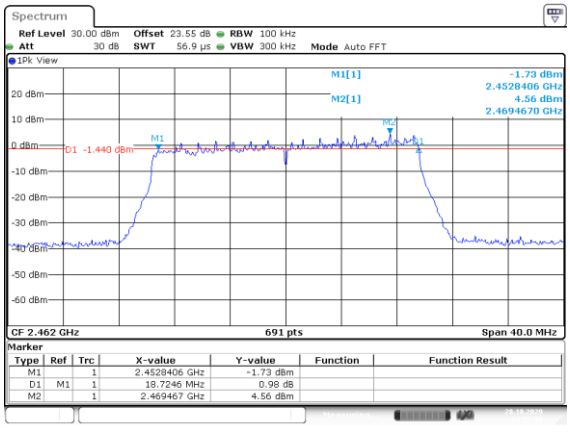
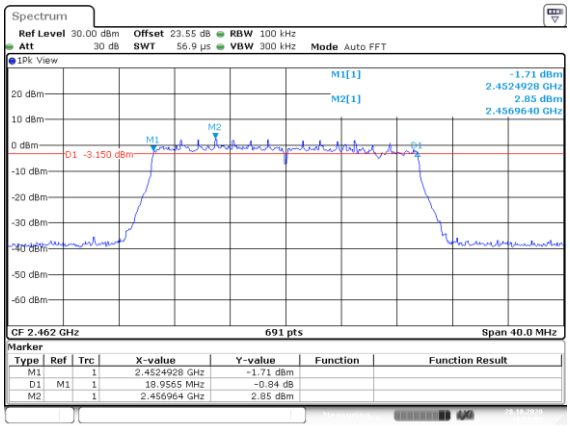
| Ant. 3 | - |
|---|---|
| **Low CH** | - |
|  | - |
| **Middle CH** | - |
|  | - |
| **High CH** | - |
|  | - |

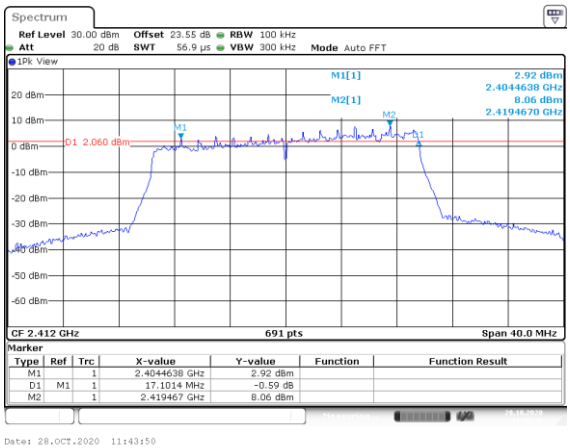
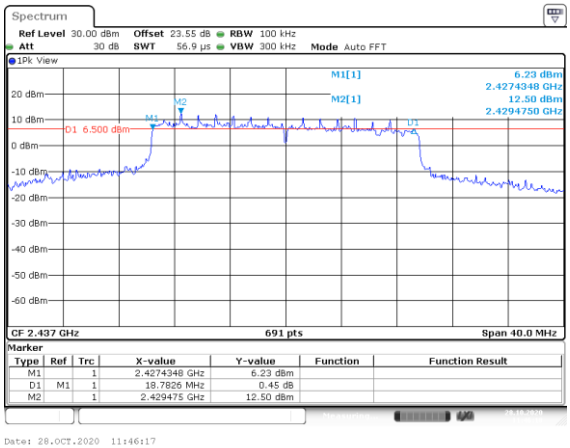
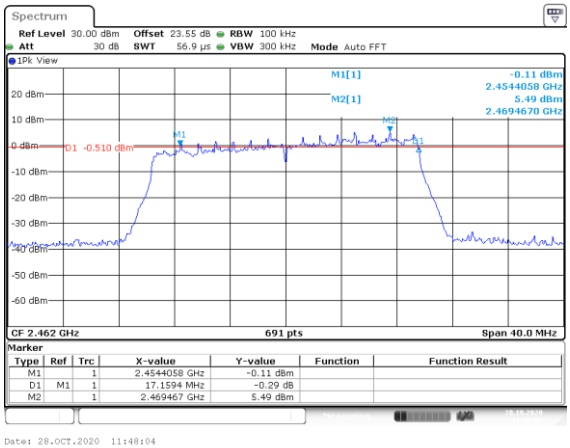
**802.11g mode:**

| Ant. 1 | Ant. 2 |
|---|---|
| **Low CH** | **Low CH** |
|  |  |
| **Middle CH** | **Middle CH** |
|  |  |
| **High CH** | **High CH** |
|  |  |

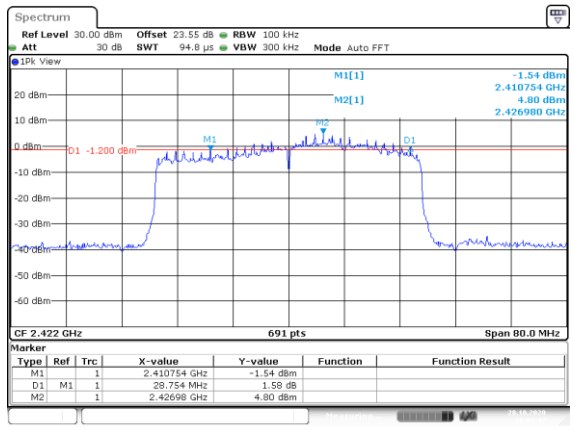
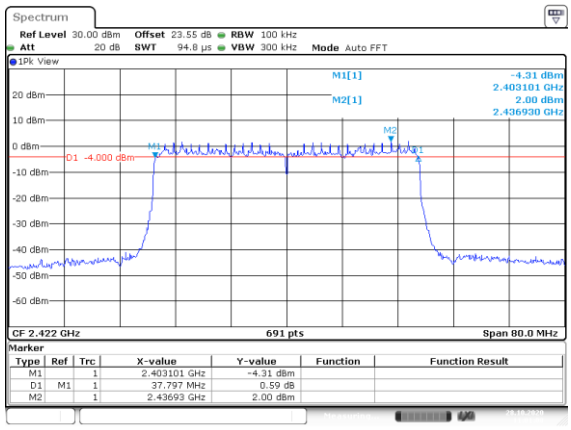
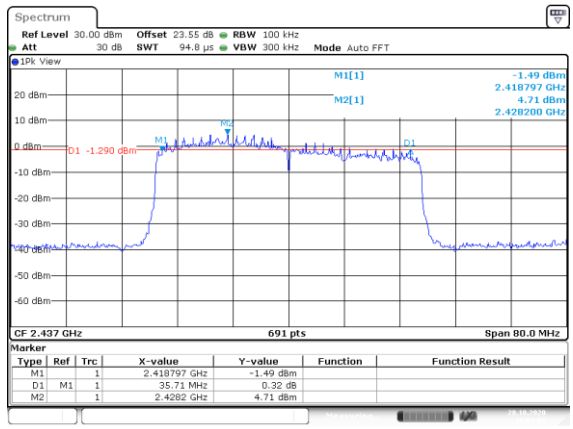
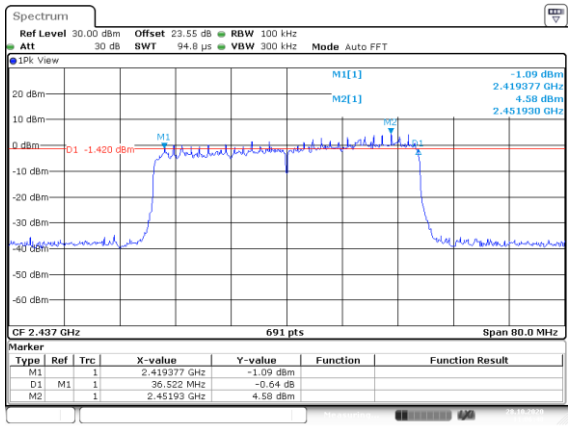
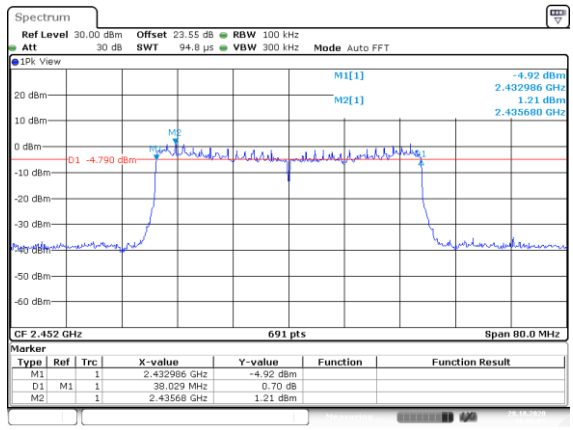
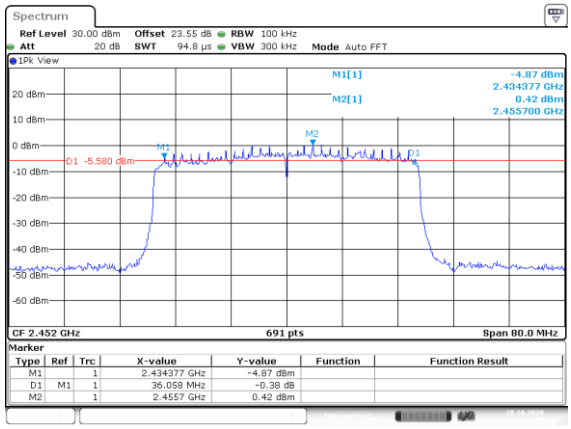
| Ant. 3 | - |
|---|---|
| **Low CH** | - |
|  | - |
| **Middle CH** | - |
|  | - |
| **High CH** | - |
|  | - |

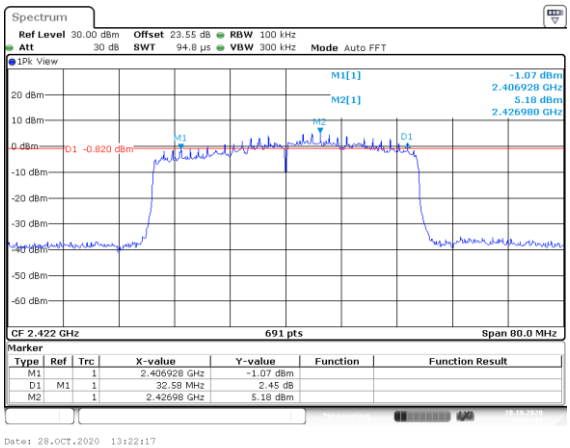
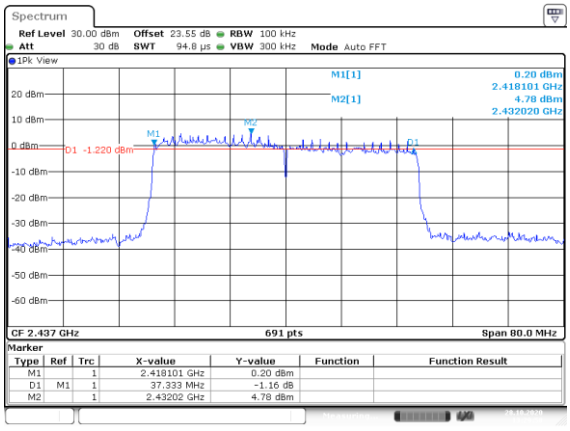
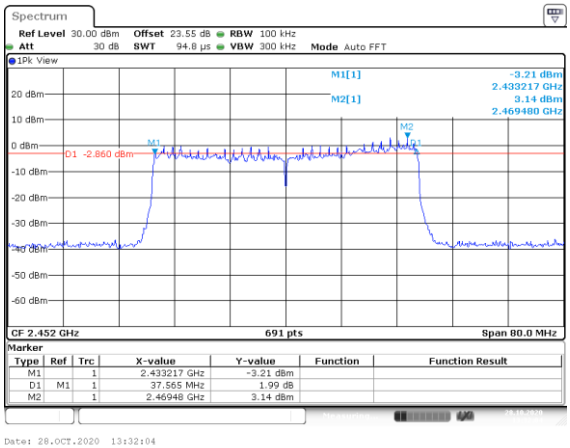
**802.11ax HE20 mode:**

| Ant. 1 | Ant. 2 |
|---|---|
| **Low CH** | **Low CH** |
|  |  |
| **Middle CH** | **Middle CH** |
|  |  |
| **High CH** | **High CH** |
|  |  |

| Ant. 3 | - |
|---|---|
| **Low CH** | - |
|  | - |
| **Middle CH** | - |
|  | - |
| **High CH** | - |
|  | - |

**802.11ax HE40 mode:**

| Ant. 1 | Ant. 2 |
|---|---|
| **Low CH** | **Low CH** |
|  |  |
| **Middle CH** | **Middle CH** |
|  |  |
| **High CH** | **High CH** |
|  |  |

| Ant. 3 | - |
|---|---|
| **Low CH** | - |
|  | - |
| **Middle CH** | - |
|  | - |
| **High CH** | - |
|  | - |

# 9 FCC §15.247(b) (3) – Maximum Output Power

## 9.1 Applicable Standard

According to FCC §15.247(b) (3),

Systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

## 9.2 Test Procedure

(1) Place the EUT on a bench and set it in transmitting mode.

(2) Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to measuring equipment.

(3). Add a correction factor to the display.

## 9.3 Test Equipment List and Details

| Description | Manufacture | Model | Serial No. | Cal. Date. | Cal. Due. |
|---|---|---|---|---|---|
| **Conducted Room(TH-02)** | | | | | |
| USB Wideband Power Sensor | Agilent | U2021XA | MY52500008 | 2020/01/06 | 2021/01/05 |
| Cable | MTJ | MT40S | 620620-MT40S-100 | Each use | - |

***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).*

## 9.4 Test Results

| Channel | Frequency (MHz) | Maximum Peak Output Power (dBm) | | | | Maximum Peak Output Power (W) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|---|
| | | Ant. 1 | Ant. 2 | Ant. 3 | Sum | | | |
| **802.11b mode** | | | | | | | | |
| Low | 2412 | 21.73 | 21.62 | 21.84 | 26.50 | 0.4467 | 30 | Compliance |
| Middle | 2437 | 22.01 | 22.83 | 22.26 | 27.15 | 0.5188 | 30 | Compliance |
| High | 2462 | 21.78 | 22.54 | 22.39 | 27.02 | 0.5035 | 30 | Compliance |
| **802.11g mode** | | | | | | | | |
| Low | 2412 | 18.42 | 18.15 | 19.58 | 23.53 | 0.2254 | 30 | Compliance |
| Middle | 2437 | 23.08 | 22.54 | 23.91 | 27.98 | 0.6281 | 30 | Compliance |
| High | 2462 | 17.21 | 16.84 | 18.59 | 22.39 | 0.1734 | 30 | Compliance |
| **802.11n HT20 mode** | | | | | | | | |
| Low | 2412 | 17.22 | 16.68 | 18.16 | 22.17 | 0.1648 | 30 | Compliance |
| Middle | 2437 | 22.15 | 22.36 | 22.98 | 27.28 | 0.5346 | 30 | Compliance |
| High | 2462 | 15.26 | 14.58 | 16.21 | 20.17 | 0.1040 | 30 | Compliance |
| **802.11n HT40 mode** | | | | | | | | |
| Low | 2422 | 17.02 | 16.23 | 18.16 | 21.98 | 0.1578 | 30 | Compliance |
| Middle | 2437 | 17.65 | 17.51 | 18.94 | 22.85 | 0.1928 | 30 | Compliance |
| High | 2452 | 14.88 | 14.37 | 15.89 | 19.86 | 0.0968 | 30 | Compliance |
| **802.11ax HE20 mode** | | | | | | | | |
| Low | 2412 | 17.41 | 16.88 | 18.45 | 22.40 | 0.1738 | 30 | Compliance |
| Middle | 2437 | 22.33 | 22.54 | 23.22 | 27.48 | 0.5598 | 30 | Compliance |
| High | 2462 | 15.48 | 14.76 | 16.43 | 20.38 | 0.1091 | 30 | Compliance |
| **802.11ax HE40 mode** | | | | | | | | |
| Low | 2422 | 17.15 | 16.58 | 18.38 | 22.21 | 0.1663 | 30 | Compliance |
| Middle | 2437 | 17.85 | 17.71 | 19.11 | 23.04 | 0.2014 | 30 | Compliance |
| High | 2452 | 15.05 | 14.51 | 16.04 | 20.02 | 0.1005 | 30 | Compliance |

# 10 FCC §15.247(d) – 100 kHz Bandwidth of Frequency Band Edge

## 10.1 Applicable Standard

According to FCC §15.247(d),

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

## 10.2 Test Procedure

(1) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
(2) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
(3) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
(4) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.

## 10.3 Test Equipment List and Details

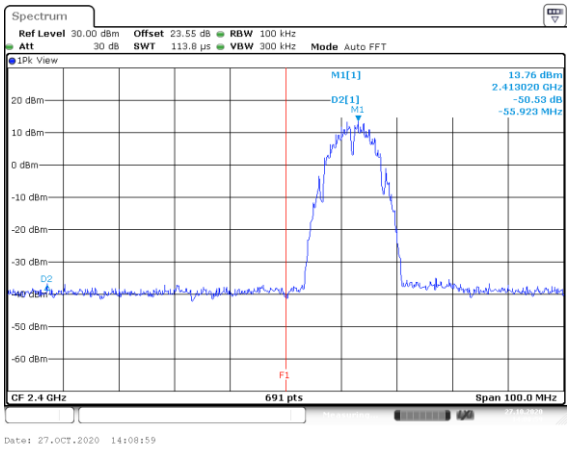
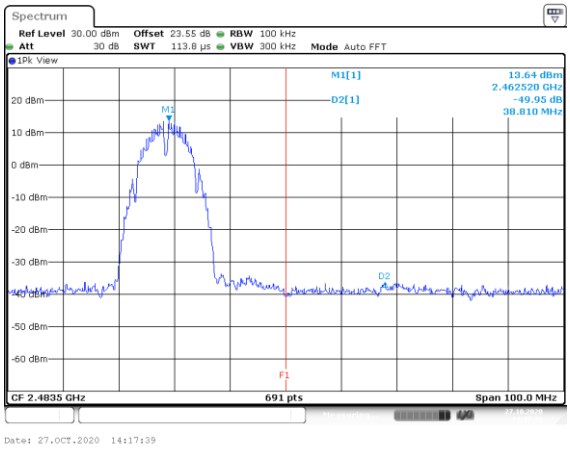
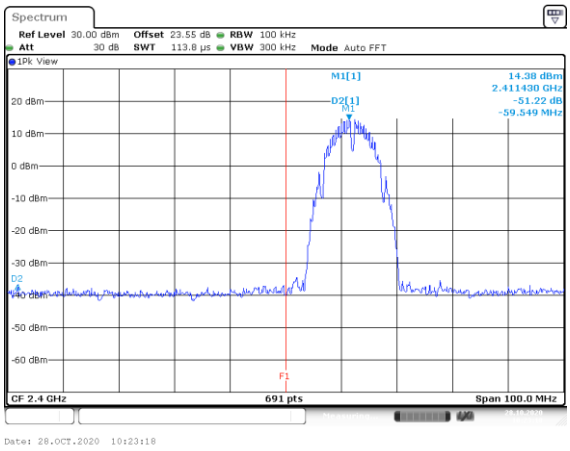
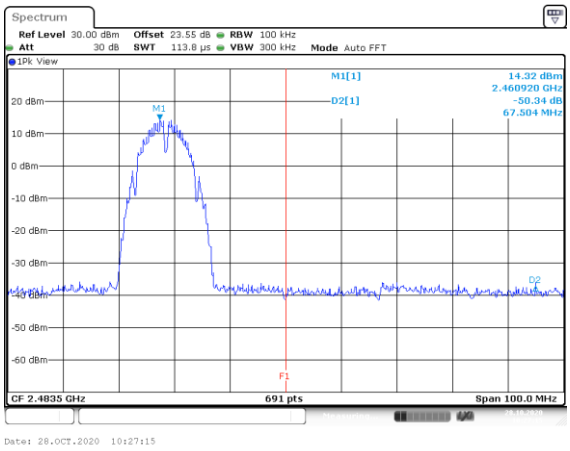
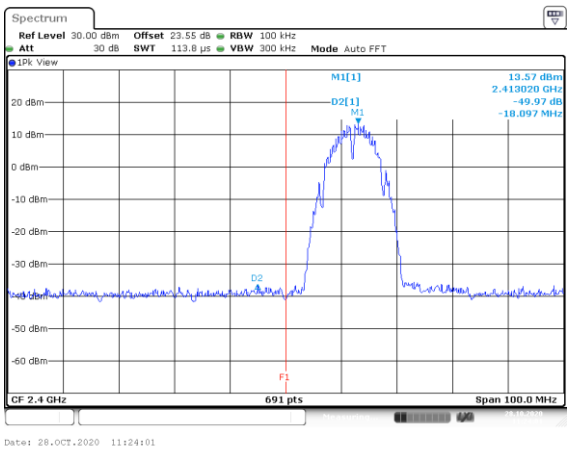
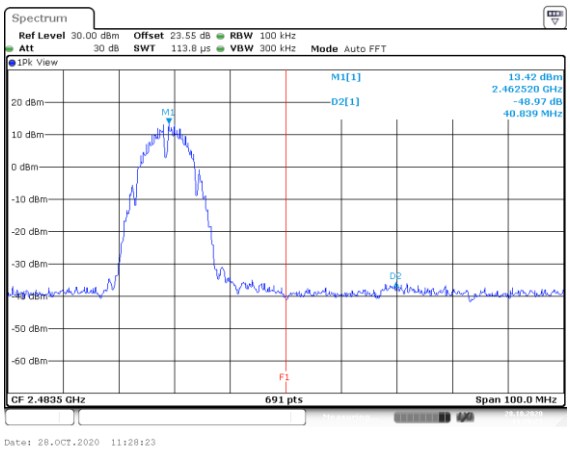
| Description | Manufacture | Model | Serial No. | Cal. Date. | Cal. Due. |
|---|---|---|---|---|---|
| **Conducted Room(TH-02)** | | | | | |
| Spectrum Analyzer | Rohde & Schwarz | FSU26 | 100406 | 2020/03/11 | 2021/03/10 |
| Cable | MTJ | MT40S | 620620-MT40S-100 | Each use | - |

***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).*

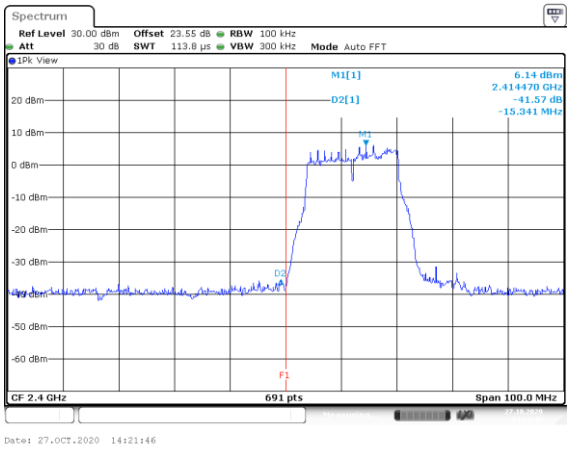
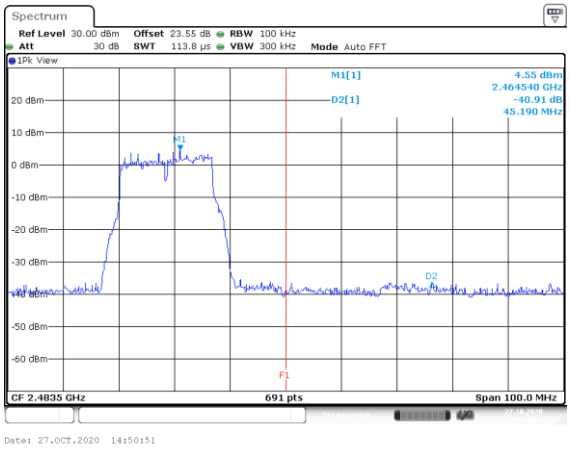
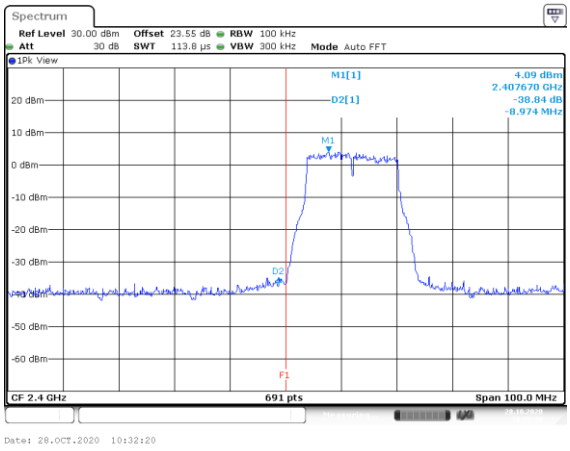
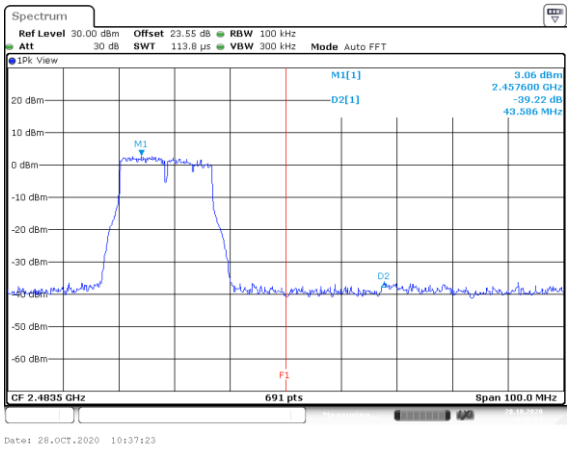
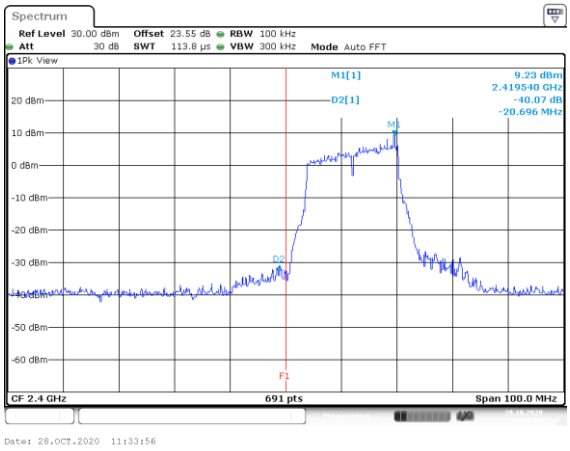
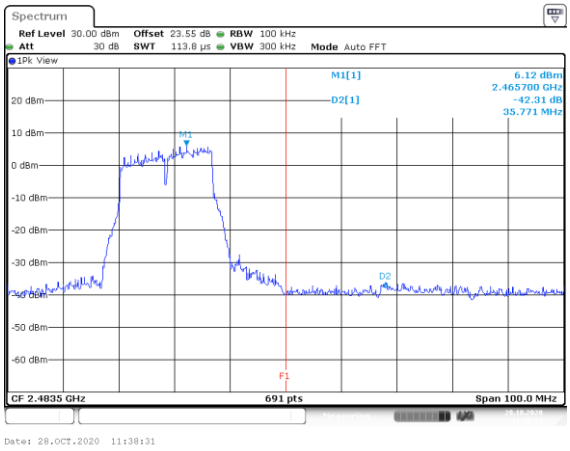
## 10.4 Test Results

| Channel | Frequency (MHz) | Delta Peak to Band Emission (dBc) | | | Limit (dBc) | Result |
|---|---|---|---|---|---|---|
| | | Ant. 1 | Ant. 2 | Ant. 3 | | |
| **802.11b mode** | | | | | | |
| Low | 2412 | 50.53 | 51.22 | 49.97 | ≥ 20 | Compliance |
| High | 2462 | 49.95 | 50.34 | 48.97 | ≥ 20 | Compliance |
| **802.11g mode** | | | | | | |
| Low | 2412 | 41.57 | 38.84 | 40.07 | ≥ 20 | Compliance |
| High | 2462 | 40.91 | 39.22 | 42.31 | ≥ 20 | Compliance |
| **802.11ax HE20 mode** | | | | | | |
| Low | 2412 | 39.76 | 38.43 | 40.81 | ≥ 20 | Compliance |
| High | 2462 | 39.55 | 38.5 | 41.1 | ≥ 20 | Compliance |
| **802.11ax HE40 mode** | | | | | | |
| Low | 2422 | 41.29 | 38.03 | 40.56 | ≥ 20 | Compliance |
| High | 2452 | 46.15 | 45.6 | 38.42 | ≥ 20 | Compliance |

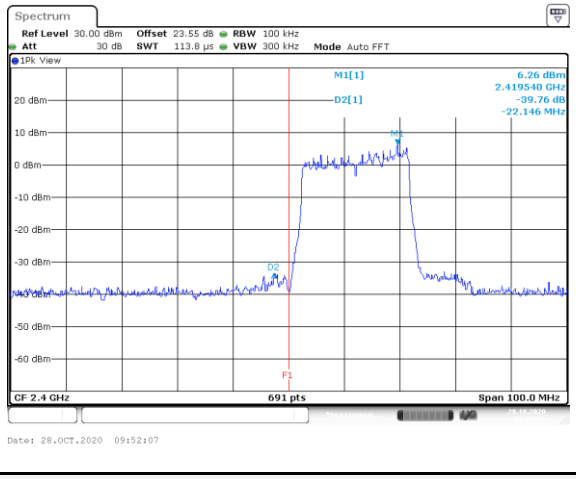
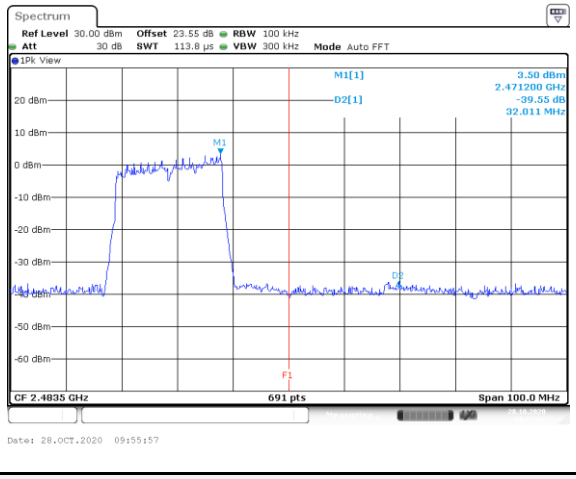
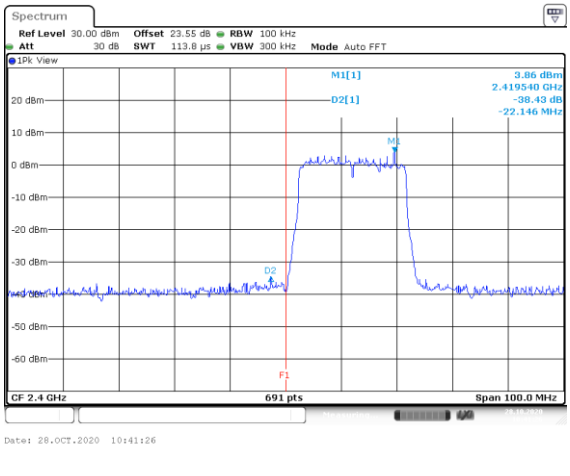
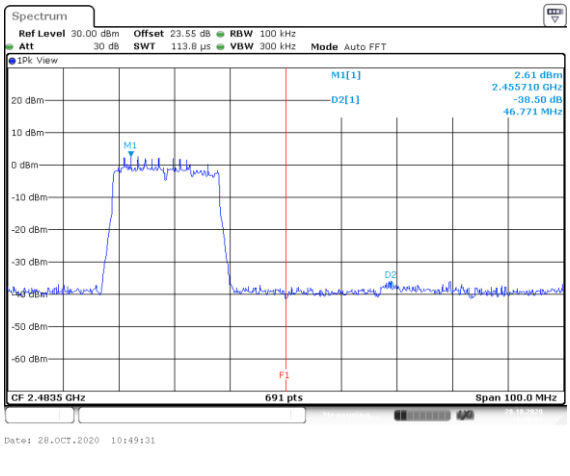
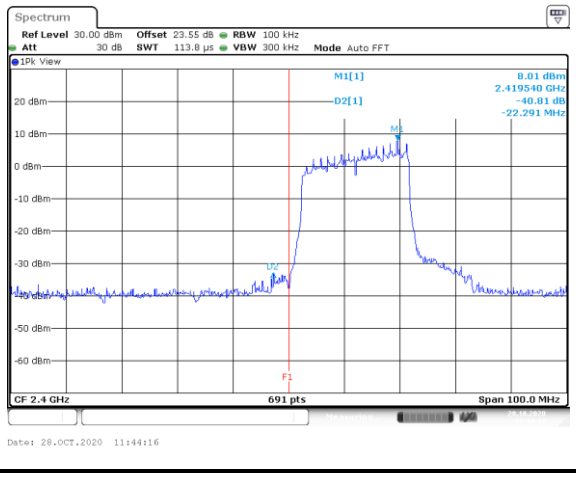
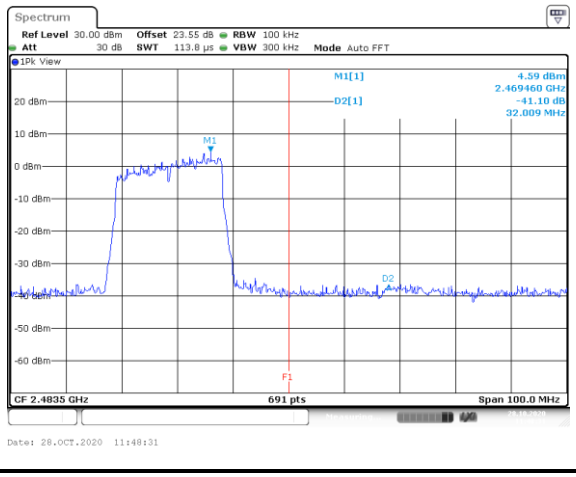
## 802.11b mode:

| Ant. 1 Low CH | Ant. 1 High CH |
|---|---|
|  |  |
| **Ant. 2 Low CH** | **Ant. 2 High CH** |
|  |  |
| **Ant. 3 Low CH** | **Ant. 3 High CH** |
|  |  |

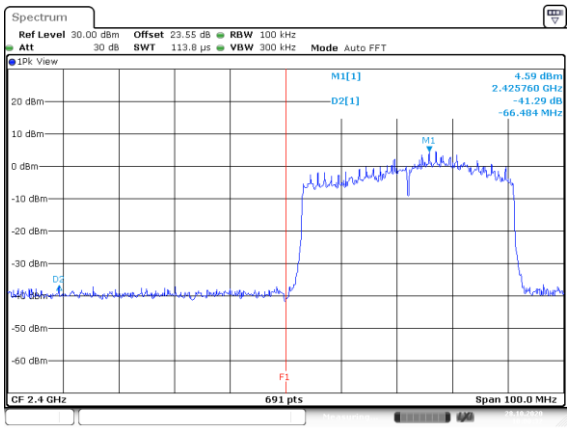
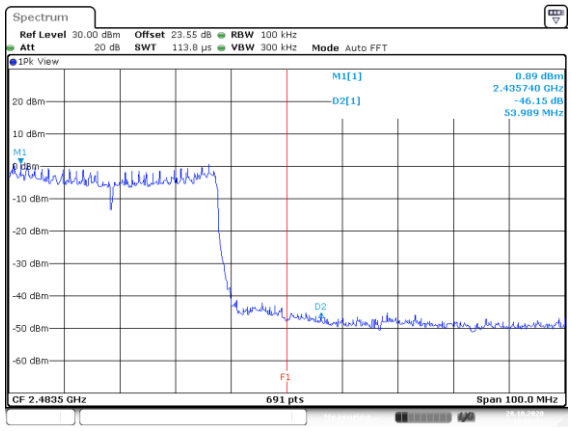
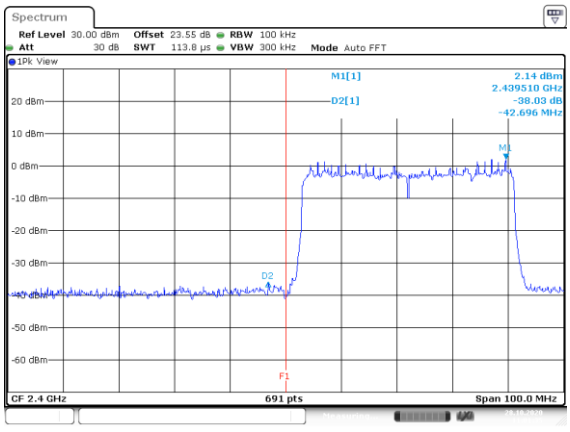
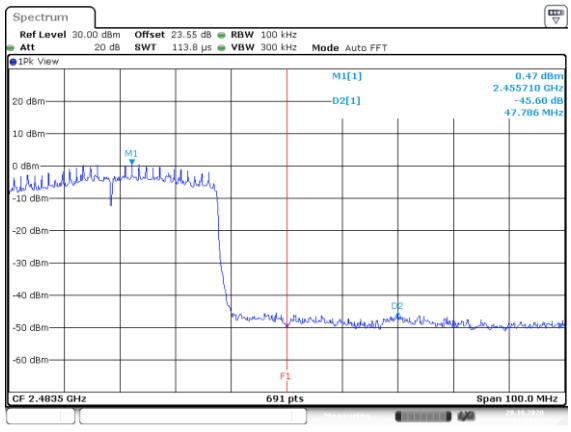
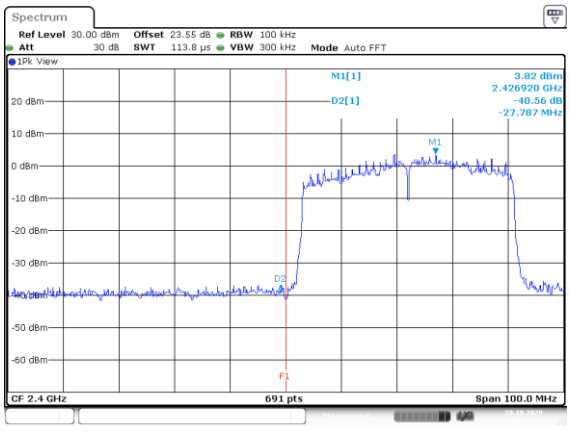
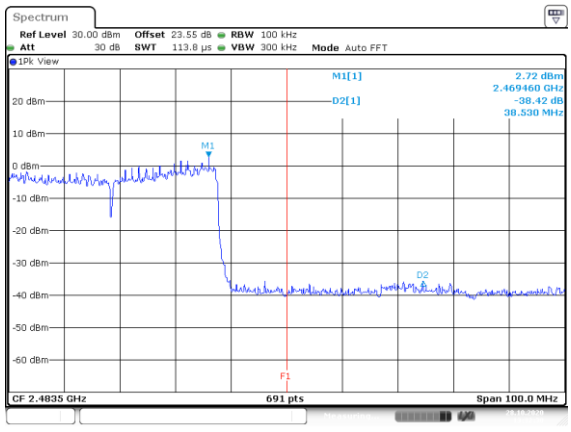
## 802.11g mode:

| Ant. 1 Low CH | Ant. 1 High CH |
|---|---|
|  |  |
| **Ant. 2 Low CH** | **Ant. 2 High CH** |
|  |  |
| **Ant. 3 Low CH** | **Ant. 3 High CH** |
|  |  |

## 802.11ax HE20 mode:

| Ant. 1 Low CH | Ant. 1 High CH |
|---|---|
|  |  |
| **Ant. 2 Low CH** | **Ant. 2 High CH** |
|  |  |
| **Ant. 3 Low CH** | **Ant. 3 High CH** |
|  |  |

## 802.11ax HE40 mode:

| Ant. 1 Low CH | Ant. 1 High CH |
|---|---|
|  |  |
| **Ant. 2 Low CH** | **Ant. 2 High CH** |
|  |  |
| **Ant. 3 Low CH** | **Ant. 3 High CH** |
|  |  |

# 11 FCC §15.247(e) – Power Spectral Density

## 11.1 Applicable Standard

According to FCC §15.247(e),

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

## 11.2 Test Procedure

According to ANSI C63.10-2013,

(1) Set analyzer center frequency to DTS channel center frequency.

(2) Set the span to 1.5 times the DTS bandwidth. (3) Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.

(4) Set the VBW ≥ [3 × RBW]. (5) Detector = peak. (6) Sweep time = auto couple.

(7) Trace mode = max hold. (8) Allow trace to fully stabilize.

(9) Use the peak marker function to determine the maximum amplitude level within the RBW.

(10) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

## 11.3 Test Equipment List and Details

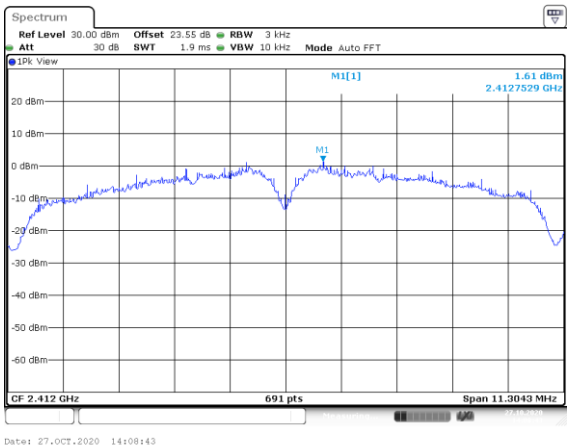
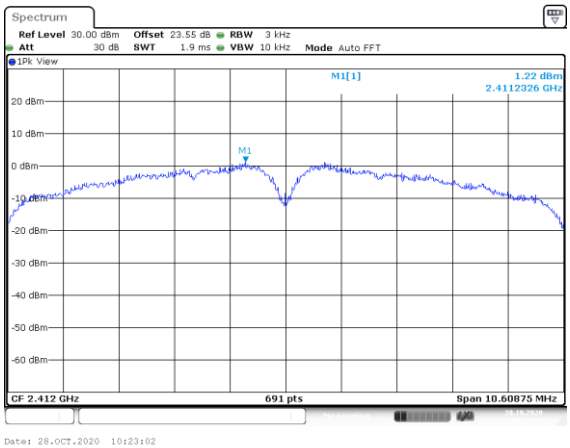
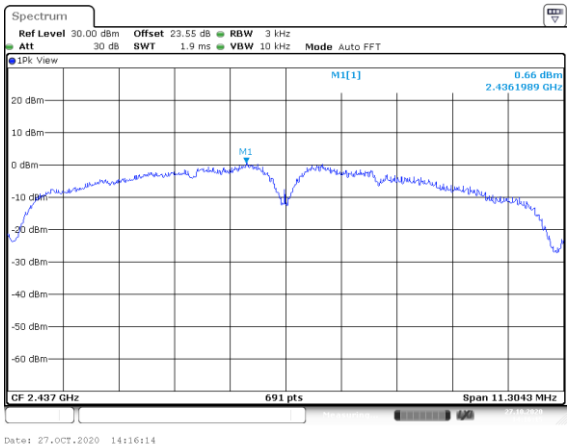
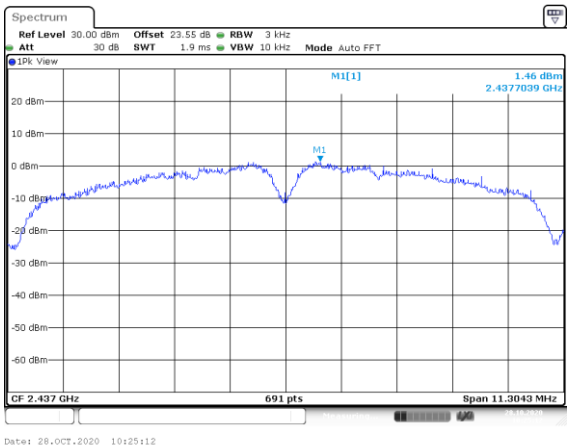
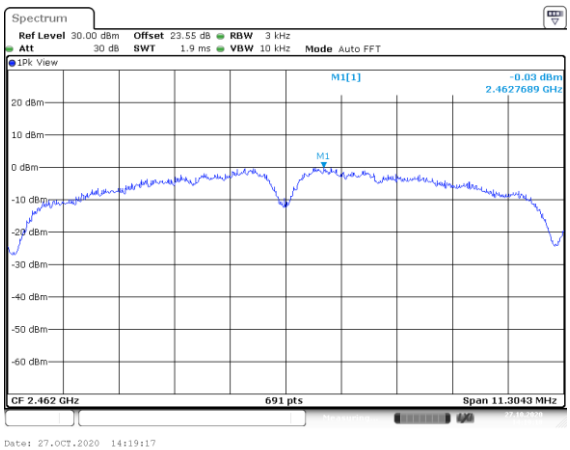
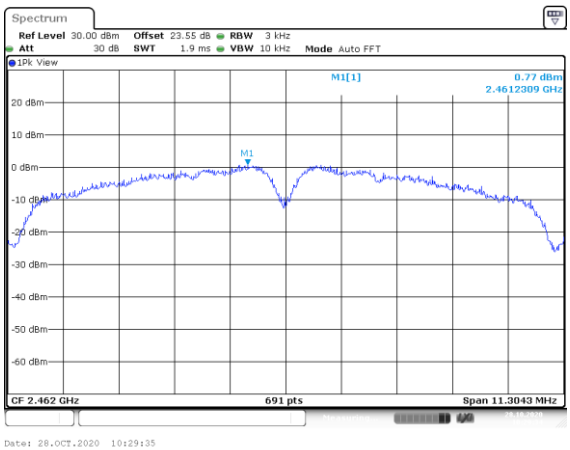
| Description | Manufacture | Model | Serial No. | Cal. Date. | Cal. Due. |
|---|---|---|---|---|---|
| **Conducted Room(TH-02)** | | | | | |
| Spectrum Analyzer | Rohde & Schwarz | FSU26 | 100406 | 2020/03/11 | 2021/03/10 |
| Cable | MTJ | MT40S | 620620-MT40S-100 | Each use | - |

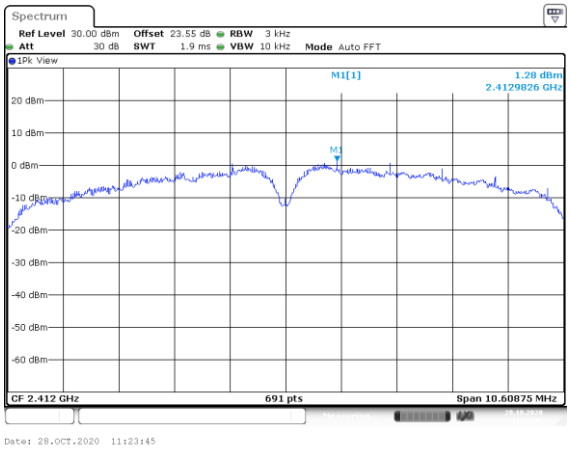
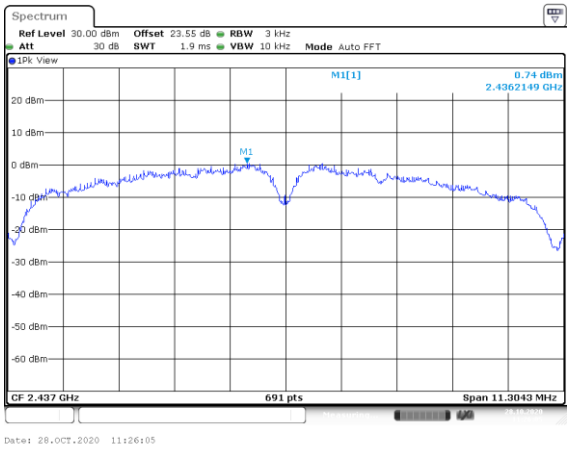
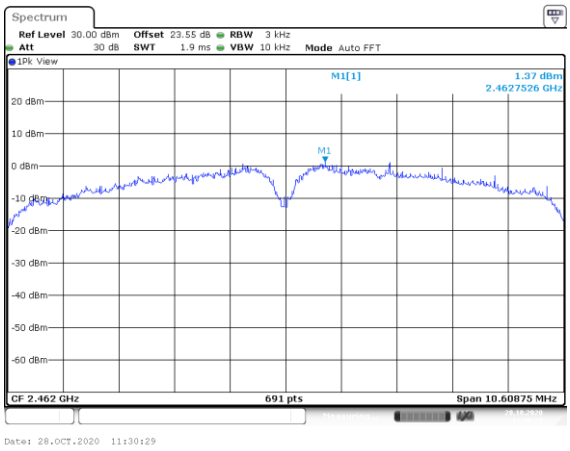
***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).*

## 11.4 Test Results

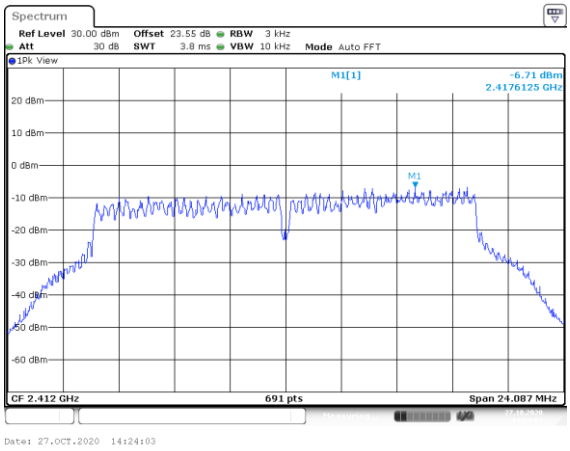
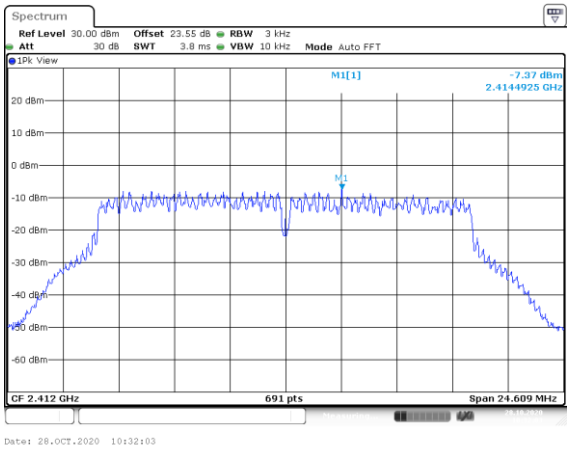
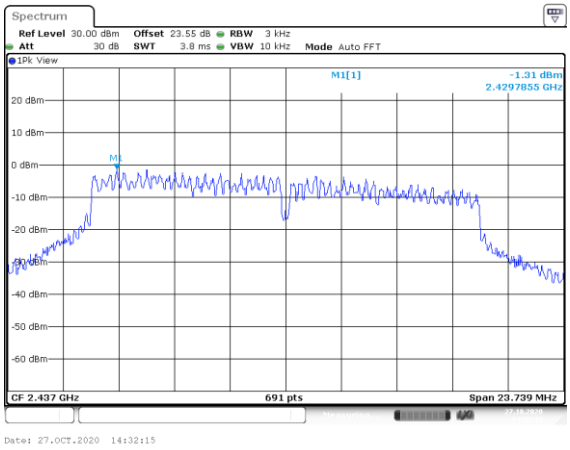
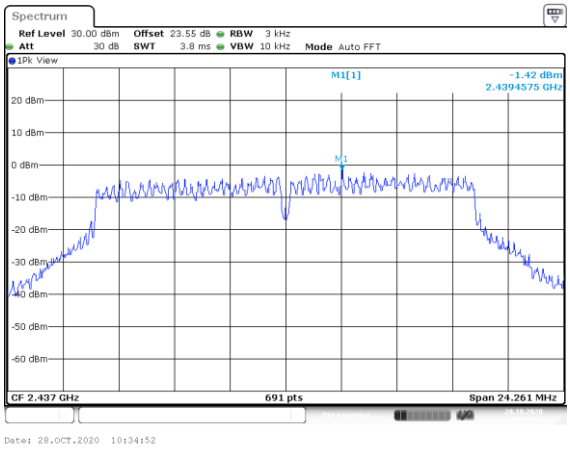
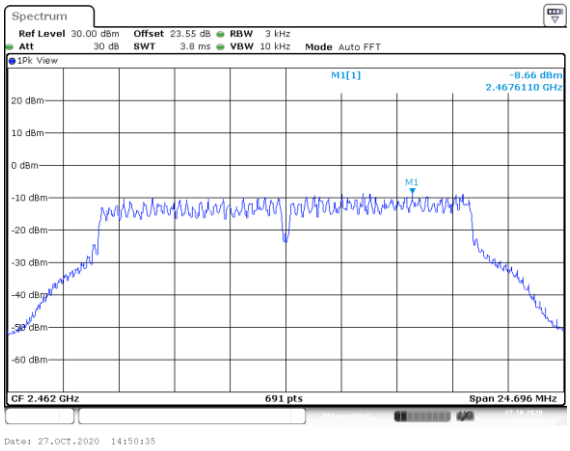
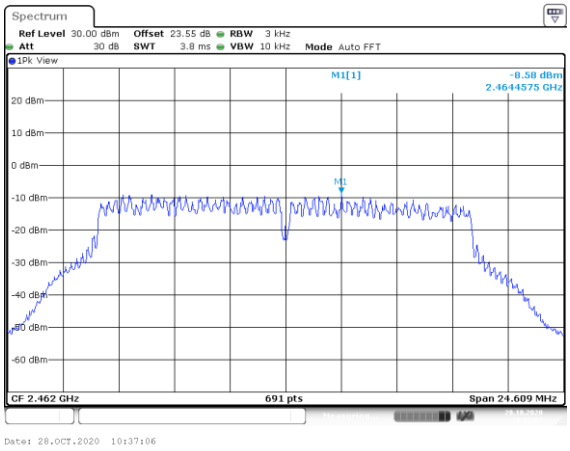
| Channel | Frequency (MHz) | PSD (dBm/3 kHz) | | | | Limit (dBm/3 kHz) | Result |
|---|---|---|---|---|---|---|---|
| | | Ant. 1 | Ant. 2 | Ant. 3 | Sum. | | |
| **802.11b mode** | | | | | | | |
| Low | 2412 | 1.76 | 1.37 | 1.43 | 6.29 | 8 | Compliance |
| Middle | 2437 | 0.81 | 1.61 | 0.89 | 5.89 | 8 | Compliance |
| High | 2462 | 0.12 | 0.92 | 1.52 | 5.66 | 8 | Compliance |
| **802.11g mode** | | | | | | | |
| Low | 2412 | -6.55 | -7.21 | -4.62 | -1.21 | 8 | Compliance |
| Middle | 2437 | -1.15 | -1.26 | -1.66 | 3.42 | 8 | Compliance |
| High | 2462 | -8.50 | -8.42 | -5.93 | -2.67 | 8 | Compliance |
| **802.11ax HE20 mode** | | | | | | | |
| Low | 2412 | -7.68 | -7.49 | -7.05 | -2.62 | 8 | Compliance |
| Middle | 2437 | -0.97 | -3.17 | -0.58 | 3.34 | 8 | Compliance |
| High | 2462 | -10.23 | -9.15 | -9.64 | -4.88 | 8 | Compliance |
| **802.11ax HE40 mode** | | | | | | | |
| Low | 2422 | -11.06 | -12.42 | -9.68 | -6.14 | 8 | Compliance |
| Middle | 2437 | -9.93 | -10.63 | -9.41 | -5.19 | 8 | Compliance |
| High | 2452 | -12.82 | -13.55 | -12.82 | -8.28 | 8 | Compliance |

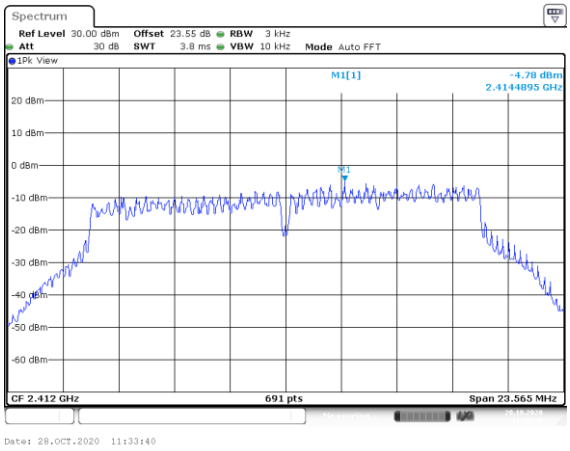
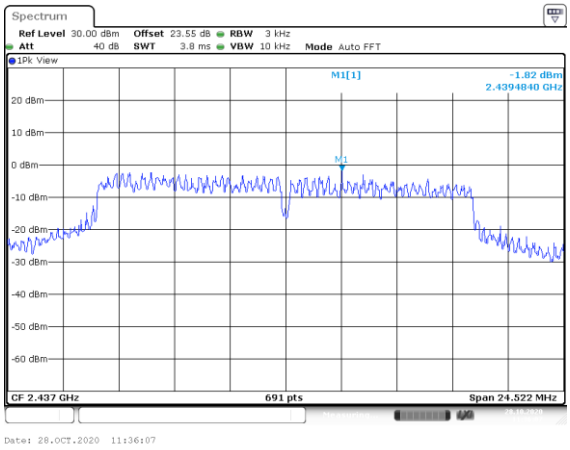
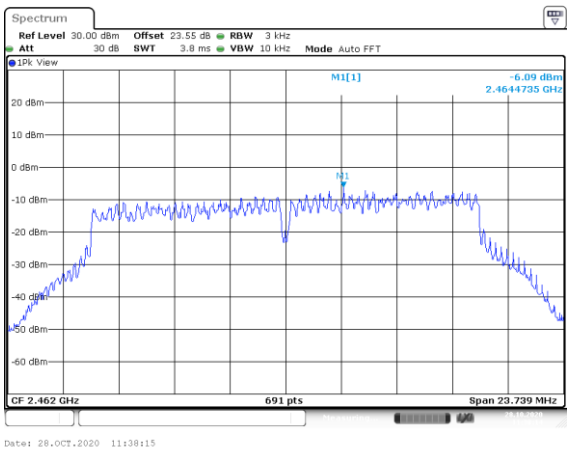
**802.11b mode**:

| Ant. 1 | Ant. 2 |
|---|---|
| **Low CH** | **Low CH** |
|  |  |
| **Middle CH** | **Middle CH** |
|  |  |
| **High CH** | **High CH** |
|  |  |

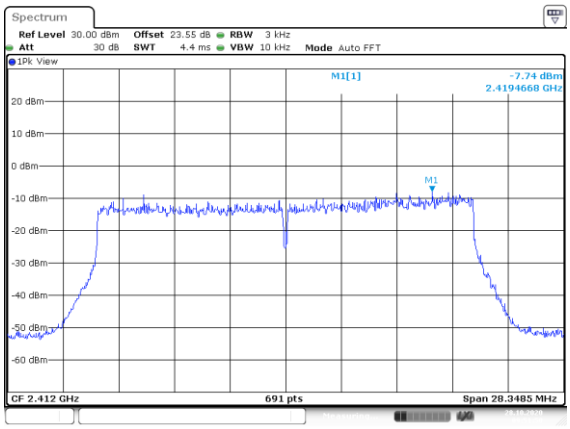
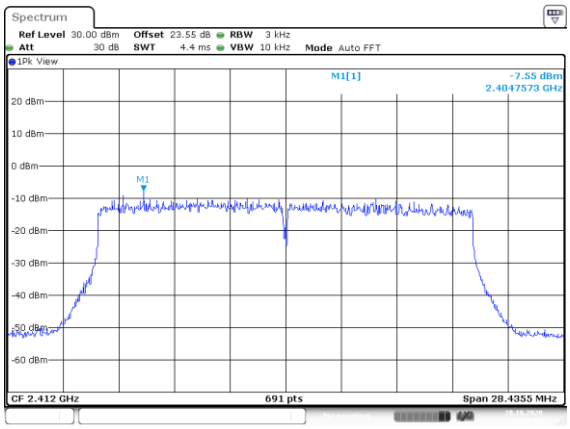
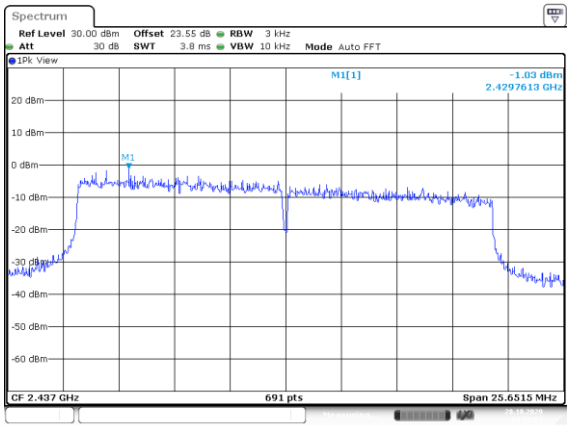
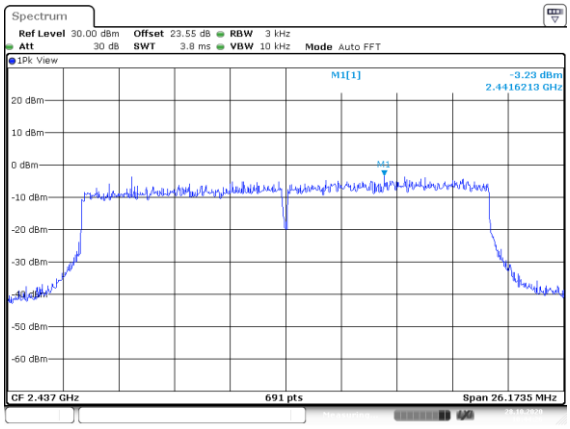
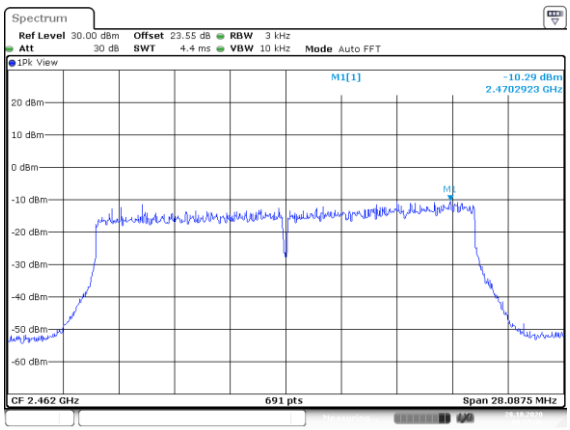
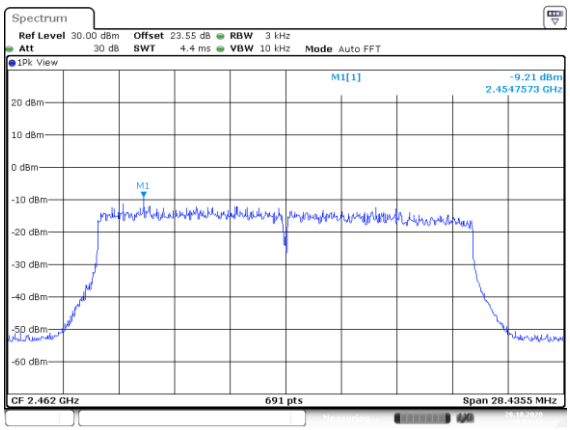
| Ant. 3 | - |
|---|---|
| **Low CH** | - |
|  | - |
| **Middle CH** | - |
|  | - |
| **High CH** | - |
|  | - |

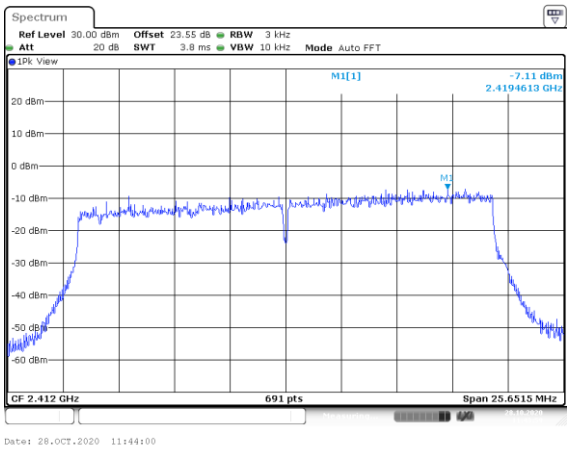
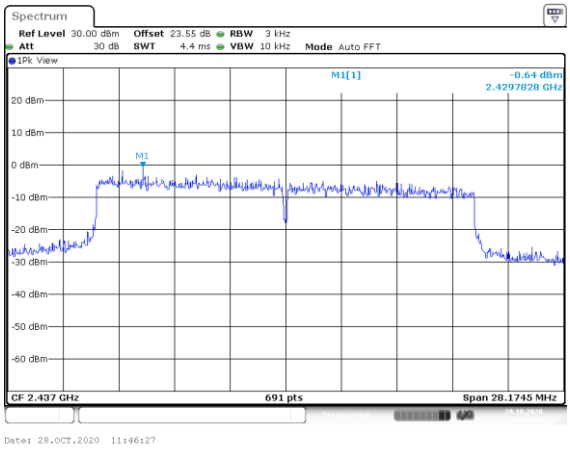
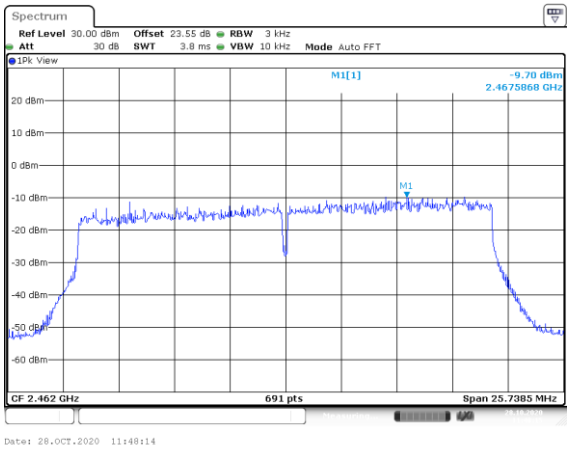
**802.11g mode**:

| Ant. 1 | Ant. 2 |
|---|---|
| **Low CH** | **Low CH** |
|  |  |
| **Middle CH** | **Middle CH** |
|  |  |
| **High CH** | **High CH** |
|  |  |

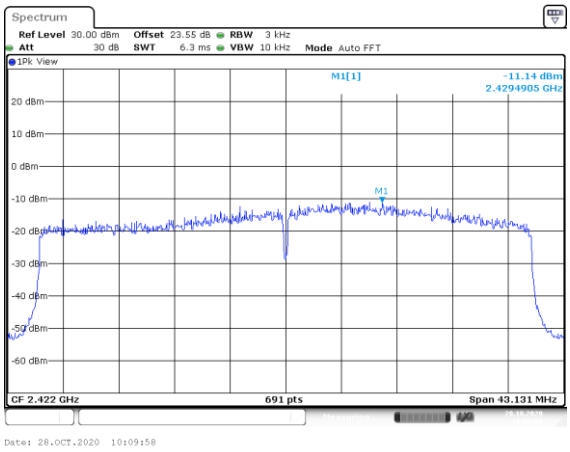
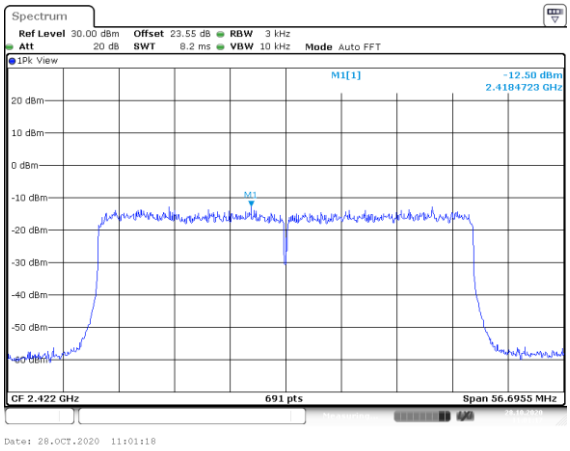
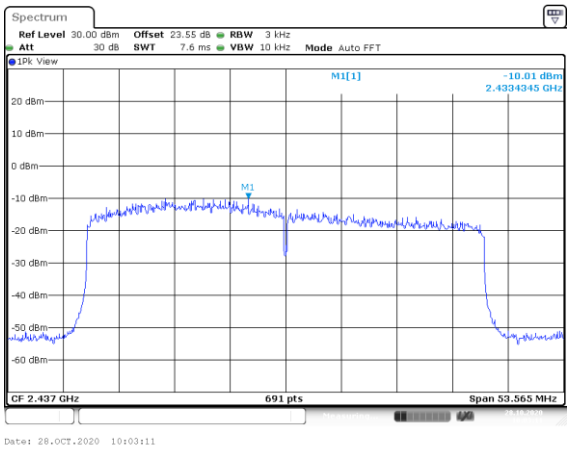
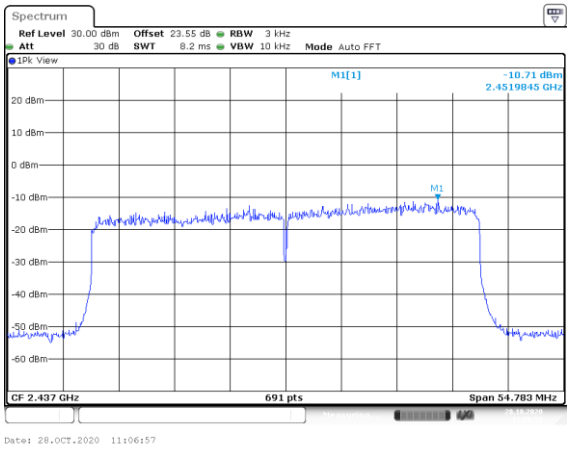
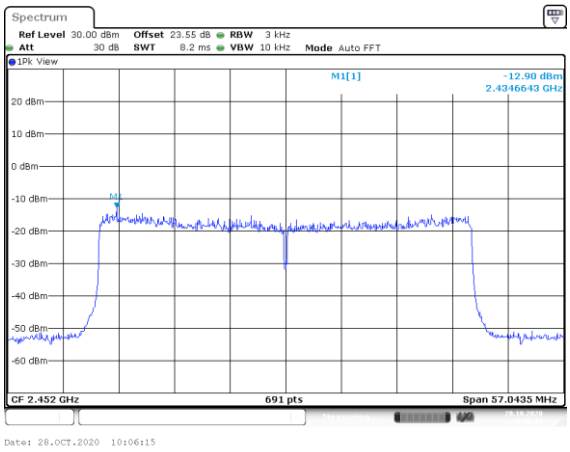
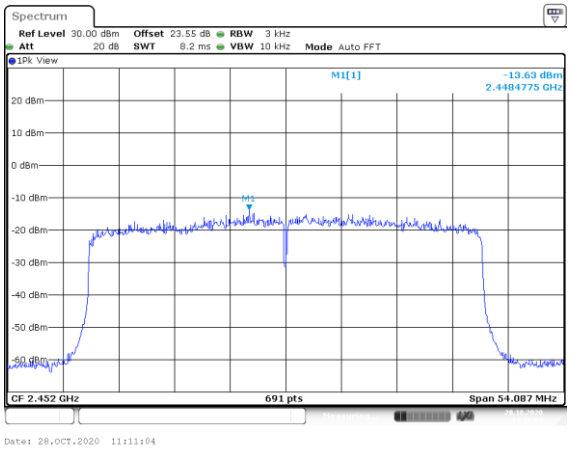
| Ant. 3 | - |
|---|---|
| **Low CH** | - |
|  | - |
| **Middle CH** | - |
|  | - |
| **High CH** | - |
|  | - |

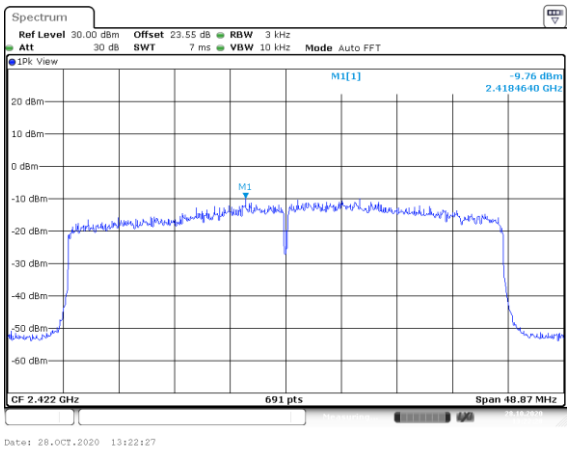
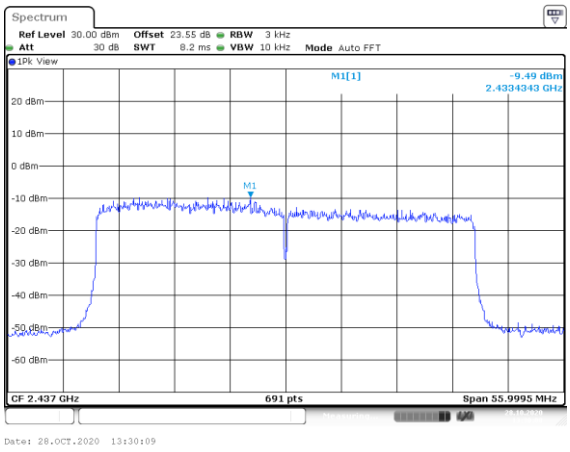
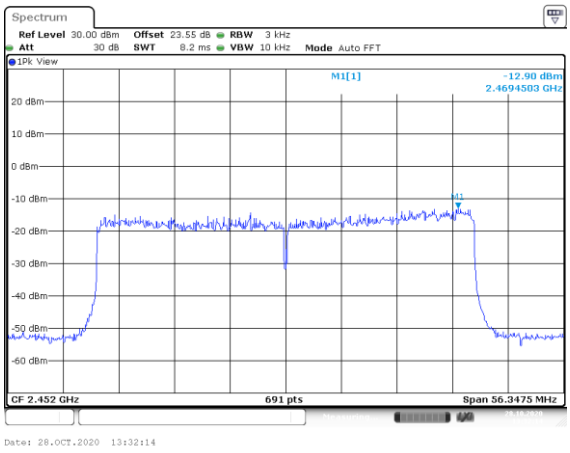
**802.11ax HE20 mode**:

| Ant. 1 | Ant. 2 |
|---|---|
| **Low CH** | **Low CH** |
|  |  |
| **Middle CH** | **Middle CH** |
|  |  |
| **High CH** | **High CH** |
|  |  |

| Ant. 3 | - |
|---|---|
| **Low CH** | - |
|  | - |
| **Middle CH** | - |
|  | - |
| **High CH** | - |
|  | - |

**802.11ax HE40 mode**:

| Ant. 1 | Ant. 2 |
|---|---|
| **Low CH** | **Low CH** |
|  |  |
| **Middle CH** | **Middle CH** |
|  |  |
| **High CH** | **High CH** |
|  |  |

| | |
|---|---|
| **Ant. 3** | - |
| **Low CH** | - |
|  | - |
| **Middle CH** | - |
|  | - |
| **High CH** | - |
|  | - |

**----- END OF REPORT -----**