
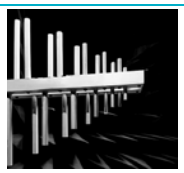
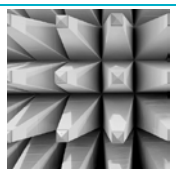

CTC advanced
member of RWTÜV group

Bundesnetzagentur

BNetzA-CAB-02/21-102

# TEST REPORT

**Test report no.: 1-9148/19-01-04**

## Testing laboratory


**CTC advanced GmbH**
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: http://www.ctcadvanced.com
e-mail: mail@ctcadvanced.com


**Accredited Testing Laboratory:**
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate starting with the registration number: D-PL-12076-01.

## Applicant


**Ingenico Group**
9 Avenue de la Gare Rovaltain
26958 Valence Cedex 9 / FRANCE
Phone: -/-
Contact: Georges Allemand
e-mail: georges.allemand@ingenico.com
Phone: +33 4 75 84 20 14


## Manufacturer


**Ingenico Group**
9 Avenue de la Gare Rovaltain
26958 Valence Cedex 9 / FRANCE


## Test standard/s

| | |
|---|---|
| FCC - Title 47 CFR Part 15 | FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices |
| RSS - 247 Issue 2 | Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices |

For further applied test standards please refer to section 3 of this test report.

## Test Item

| | |
|---|---|
| **Kind of test item:** | **Payment Terminal** |
| **Model name:** | **Lane/3000 CL/Eth/WiFi/BT** |
| **FCC ID:** | **XKB-L3000CLWIBT** |
| **IC:** | **2586D-L3000CLWIBT** |
| Frequency: | UNII bands 5150 MHz to 5850 MHz |
| Technology tested: | WLAN |
| Antenna: | Integrated antenna |
| Power supply: | 8 V DC / 115 V AC by mains adapter PSC16A-080L6 |
| Temperature range: | 0°C to +40°C |

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

## Test report authorized:

cn=Marco Bertolino, o=CTC advanced GmbH, ou=BTL-161128, email=Marco.Bertolino@ctcadvanced.com, c=DE
2020.02.19 15:13:09 +01'00'

Marco Bertolino
Lab Manager
Radio Communications & EMC

## Test performed:

cn=Mihail Dorongovskij, o=CTC advanced GmbH, ou=DOR-281116, email=Mihail.Dorongovskij@ctcadvanced.com, c=DE
2020.02.20 08:13:25 +01'00'

Mihail Dorongovskij
Lab Manager
Radio Communications & EMC

# 1 Table of contents

# 2 General information

## 2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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In no case this test report can be considered as a Letter of Approval.

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

## 2.2 Application details

| | |
|---|---|
| Date of receipt of order: | 2019-12-09 |
| Date of receipt of test item: | 2020-01-14 |
| Start of test: | 2020-01-14 |
| End of test: | 2020-02-05 |
| Person(s) present during the test: | -/- |

## 2.3 Test laboratories sub-contracted

None

## 3 Test standard/s, references and accreditations

| Test standard | Date | Description |
|---|---|---|
| FCC - Title 47 CFR Part 15 | -/- | FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices |
| RSS - 247 Issue 2 | February 2017 | Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices |
| RSS - Gen Issue 5 incl. Amendment 1 | March 2019 | Spectrum Management and Telecommunications Radio Standards Specification<br>- General Requirements for Compliance of Radio Apparatus |

| Guidance | Version | Description |
|---|---|---|
| KDB 789033 D02 | v02r01 | Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E |
| ANSI C63.4-2014 | -/- | American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz |
| ANSI C63.10-2013 | -/- | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices |

| Accreditation | Description |
|---|---|
| D-PL-12076-01-04 | Telecommunication and EMC Canada<br>https://www.dakks.de/as/ast/d/D-PL-12076-01-04.pdf |
| D-PL-12076-01-05 | Telecommunication FCC requirements<br>https://www.dakks.de/as/ast/d/D-PL-12076-01-05.pdf |

# 4 Test environment

| | | | |
|---|---|---|---|
| Temperature | : | $T_{nom}$<br>$T_{max}$<br>$T_{min}$ | +24 °C during room temperature tests<br>No tests under extreme temperature conditions required.<br>No tests under extreme temperature conditions required. |
| Relative humidity content | : | | 46 % |
| Barometric pressure | : | | 1014 hpa |
| Power supply | : | $V_{nom}$<br>$V_{max}$<br>$V_{min}$ | 8 V DC / 115 V AC by mains adapter PSC16A-080L6<br>No tests under extreme voltage conditions required.<br>No tests under extreme voltage conditions required. |

# 5 Test item

## 5.1 General description

| | | |
|---|---|---|
| Kind of test item | : | Payment Terminal |
| Model name | : | Lane/3000 CL/Eth/WiFi/BT |
| HMN | : | n/a |
| PMN | : | Lane/3000 |
| HVIN | : | Lane/3000 CL/Eth/WiFi/BT |
| FVIN | : | n/a |
| S/N serial number | : | Radiated unit: 181397313011070602695494<br>Conducted unit: 181397313011070602695500 |
| Hardware status | : | 01 |
| Software status | : | OS Version 038605/ Appli Version 010299 |
| Firmware status | : | -/- |
| Frequency band | : | UNII bands 5150 MHz to 5850 MHz |
| Type of radio transmission<br>Use of frequency spectrum | :<br>: | OFDM |
| Type of modulation | : | (D)BPSK, (D)QPSK, 16 – QAM, 64 – QAM |
| Number of channels | : | 20 MHz: 21<br>40 MHz: 11 |
| Antenna | : | Integrated antenna |
| Power supply | : | 8 V DC / 115 V AC by mains adapter PSC16A-080L6 |
| Temperature range | : | 0°C to +40°C |

## 5.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup and EUT photos are included in test report: 1-9148/19-01-01_AnnexA
1-9148/19-01-01_AnnexB
1-9148/19-01-01_AnnexD

# 6 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

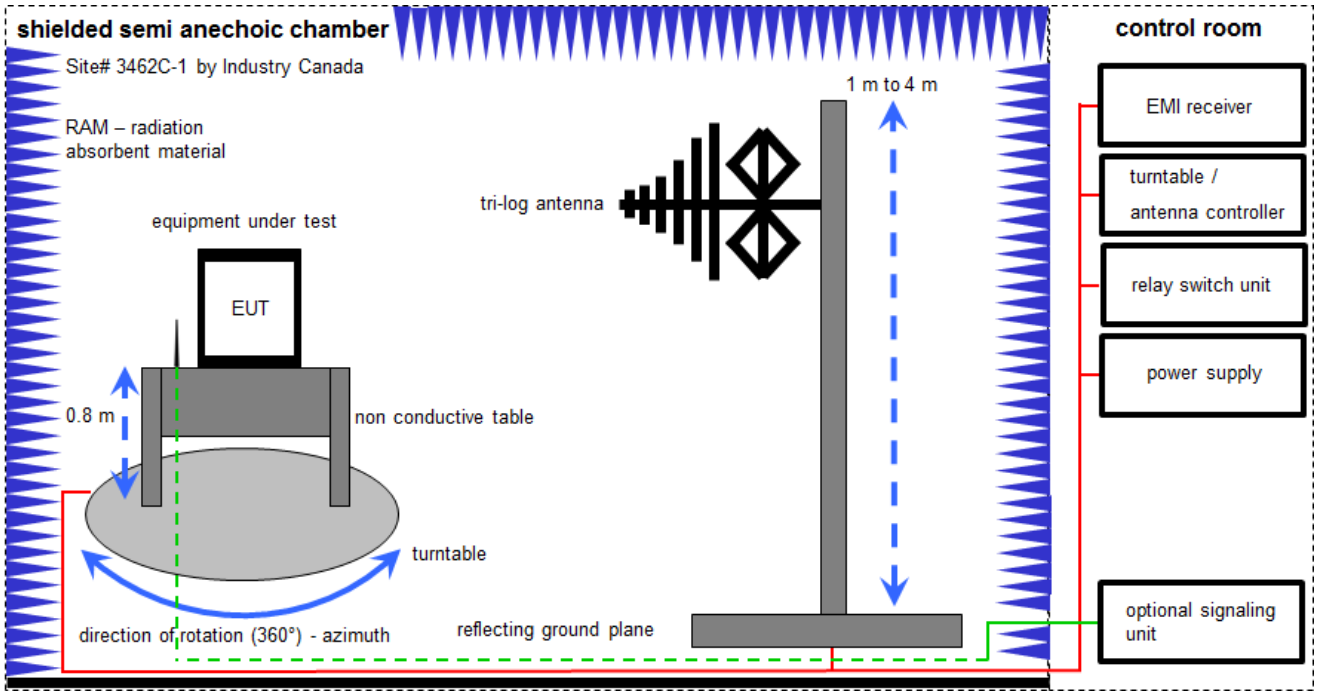
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

**Agenda:** Kind of Calibration

| | | | |
|---|---|---|---|
| k | calibration / calibrated | EK | limited calibration |
| ne | not required (k, ev, izw, zw not required) | zw | cyclical maintenance (external cyclical maintenance) |
| ev | periodic self verification | izw | internal cyclical maintenance |
| Ve | long-term stability recognized | g | blocked for accredited testing |
| vlkl! | Attention: extended calibration interval | | |
| NK! | Attention: not calibrated | *) | next calibration ordered / currently in progress |

## 6.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 30 MHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are conform to specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



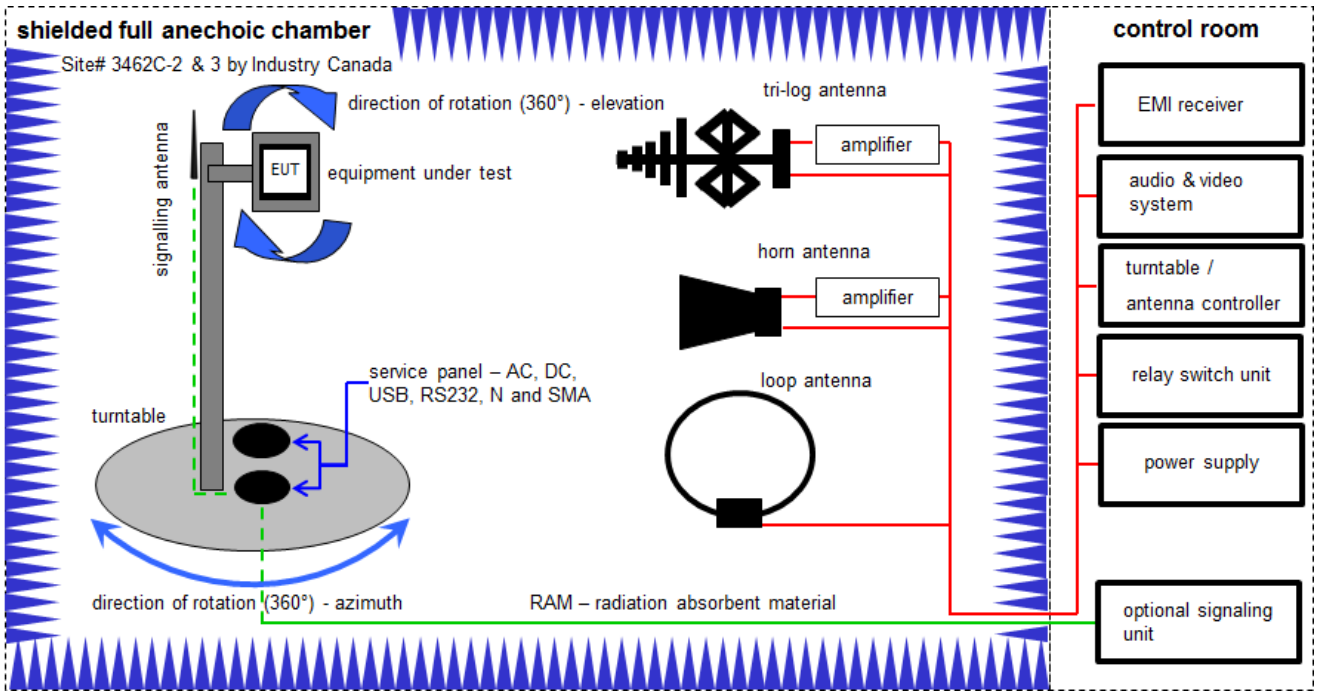

Measurement distance: tri-log antenna 10 meter; EMC32 software version: 10.30.0
FS = UR + CL + AF (FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

*Example calculation:*
FS [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBµV/m] (35.69 µV/m)

**Equipment table:**

| No. | Lab / Item | Equipment | Type | Manufacturer | Serial No. | INV. No. | Kind of Calibration | Last Calibration | Next Calibration |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A | Switch-Unit | 3488A | HP | 2719A14505 | 300000368 | ev | -/- | -/- |
| 2 | A | Meßkabine 1 | HF-Absorberhalle | MWB AG 300023 | -/- | 300000551 | ne | -/- | -/- |
| 3 | A | Analyzer-Reference-System (Harmonics and Flicker) | ARS 16/1 | SPS | A3509 07/0 0205 | 300003314 | vlKl! | 15.01.2018 | 14.01.2020 |
| 4 | A | Analyzer-Reference-System (Harmonics and Flicker) | ARS 16/1 | SPS | A3509 07/0 0205 | 300003314 | vlKl! | 17.01.2020 | 16.01.2022 |
| 5 | A | Antenna Tower | Model 2175 | ETS-Lindgren | 64762 | 300003745 | izw | -/- | -/- |
| 6 | A | Positioning Controller | Model 2090 | ETS-Lindgren | 64672 | 300003746 | izw | -/- | -/- |
| 7 | A | Turntable Interface-Box | Model 105637 | ETS-Lindgren | 44583 | 300003747 | izw | -/- | -/- |
| 8 | A | TRILOG Broadband Test-Antenna 30 MHz - 3 GHz | VULB9163 | Schwarzbeck Mess - Elektronik | 295 | 300003787 | vlKl! | 19.02.2019 | 18.02.2021 |
| 9 | A | EMI Test Receiver | ESR3 | Rohde & Schwarz | 102587 | 300005771 | k | 21.05.2019 | 20.05.2020 |

## 6.2 Shielded fully anechoic chamber




Measurement distance: tri-log antenna and horn antenna 3 meter; loop antenna 3 meter

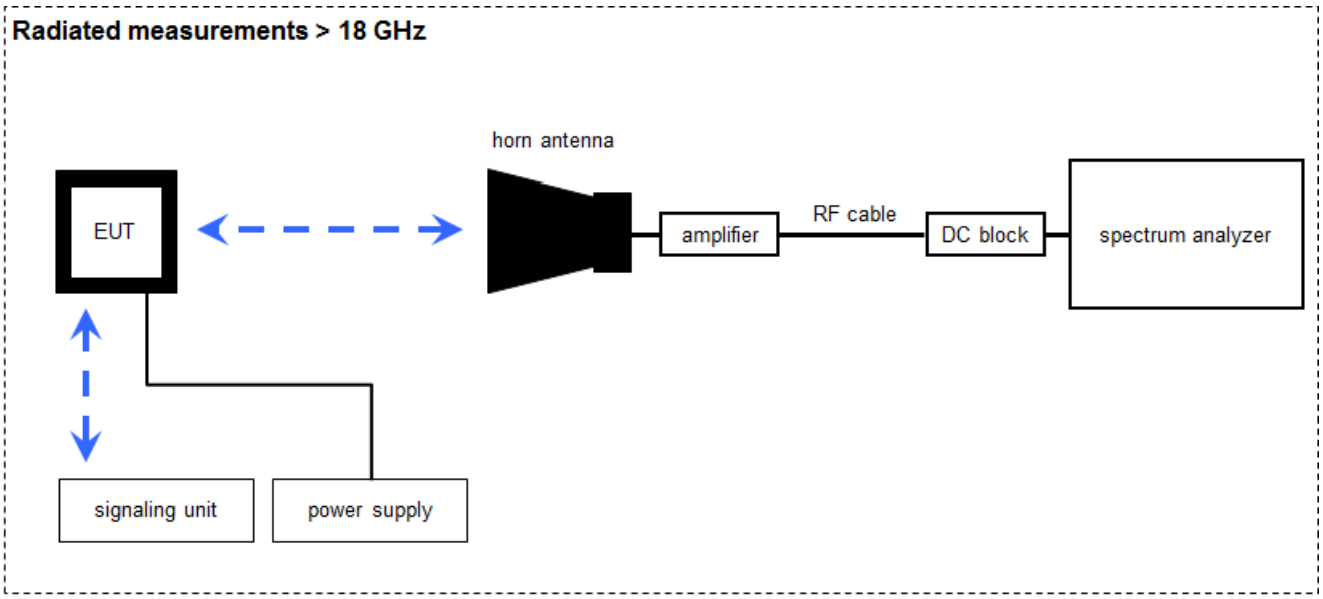
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

*Example calculation:*
FS [dBµV/m] = 40.0 [dBµV/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dBµV/m] (71.61 µV/m)

**Equipment table:**

| No. | Lab / Item | Equipment | Type | Manufacturer | Serial No. | INV. No. | Kind of Calibration | Last Calibration | Next Calibration |
|---|---|---|---|---|---|---|---|---|---|
| 1 | C | Active Loop Antenna 9 kHz to 30 MHz | 6502 | EMCO | 2210 | 300001015 | vIKI! | 13.06.2019 | 12.06.2021 |
| 2 | A, B, C | Anechoic chamber | FAC 3/5m | MWB / TDK | 87400/02 | 300000996 | ev | -/- | -/- |
| 3 | A, B | Double-Ridged Waveguide Horn Antenna 1-18.0GHz | 3115 | EMCO | 9107-3697 | 300001605 | vIKI! | 27.02.2019 | 26.02.2021 |
| 4 | A, B, C | Switch / Control Unit | 3488A | HP | * | 300000199 | ne | -/- | -/- |
| 5 | A, B, C | Variable isolating transformer | MPL IEC625 Bus Variable isolating transformer | Erfi | 91350 | 300001155 | ne | -/- | -/- |
| 6 | A, B, C | EMI Test Receiver 20Hz- 26,5GHz | ESU26 | R&S | 100037 | 300003555 | k | 11.12.2019 | 10.12.2020 |
| 7 | A | Highpass Filter | WHK1.1/15G-10SS | Wainwright | 3 | 300003255 | ev | -/- | -/- |
| 8 | A | Highpass Filter | WHKX7.0/18G-8SS | Wainwright | 19 | 300003790 | ne | -/- | -/- |
| 9 | A | Broadband Amplifier 0.5-18 GHz | CBLU5184540 | CERNEX | 22049 | 300004481 | ev | -/- | -/- |
| 10 | A, B, C | 4U RF Switch Platform | L4491A | Agilent Technologies | MY50000037 | 300004509 | ne | -/- | -/- |
| 11 | A, B, C | NEXIO EMV-Software | BAT EMC V3.19.1.9 | EMCO | -/- | 300004682 | ne | -/- | -/- |
| 12 | A, B, C | PC | ExOne | F+W | -/- | 300004703 | ne | -/- | -/- |
| 13 | A | RF-Amplifier | AMF-6F06001800-30-10P-R | NARDA-MITEQ Inc | 2011572 | 300005241 | ev | -/- | -/- |
| 14 | A | High Pass Filter | VHF-3500+ | Mini Circuits | -/- | 400000193 | ne | -/- | -/- |

## 6.3 Radiated measurements > 18 GHz




Measurement distance: horn antenna 50 cm

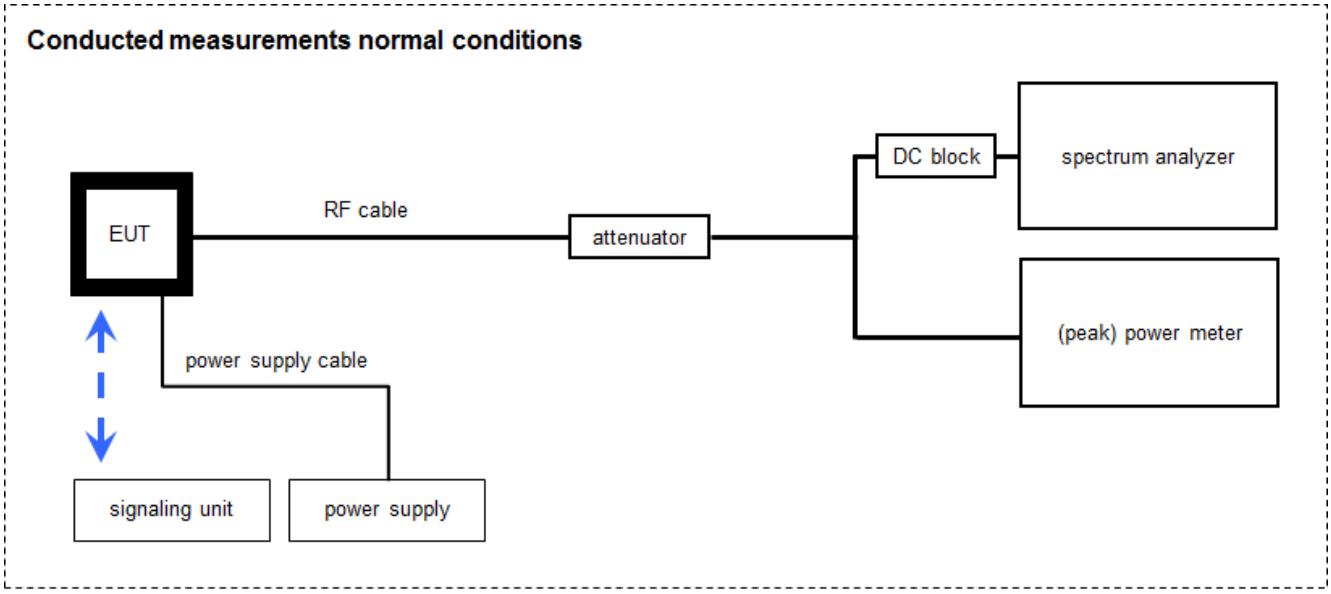
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss signal path & distance correction; AF-antenna factor)

*Example calculation:*
FS [dBµV/m] = 40.0 [dBµV/m] + (-60.1) [dB] + 36.74 [dB/m] = 16.64 [dBµV/m] (6.79 µV/m)

**Equipment table:**

| No. | Lab / Item | Equipment | Type | Manufacturer | Serial No. | INV. No. | Kind of Calibration | Last Calibration | Next Calibration |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A | Broadband Low Noise Amplifier 18-50 GHz | CBL18503070-XX | CERNEX | 19338 | 300004273 | ev | -/- | -/- |
| 2 | A | Horn Antenna 18.0-40.0 GHz | LHAF180 | Microw.Devel | 39180-103-021 | 300001747 | vlKI! | 18.02.2019 | 17.02.2022 |
| 3 | A | DC-Blocker | WA7046 | Weinschel Associates | -/- | 400001310 | ev | -/- | -/- |
| 4 | A | RF-Cable | ST18/SMAm/SMAm/48 | Huber & Suhner | Batch no. 600918 | 400001182 | ev | -/- | -/- |
| 5 | A | RF-Cable | ST18/SMAm/SMAm/48 | Huber & Suhner | Batch no. 127377 | 400001183 | ev | -/- | -/- |
| 6 | A | Signal Analyzer 40 GHz | FSV40 | R&S | 101042 | 300004517 | k | 17.12.2019 | 16.12.2020 |

## 6.4 Conducted measurements with peak power meter & spectrum analyzer



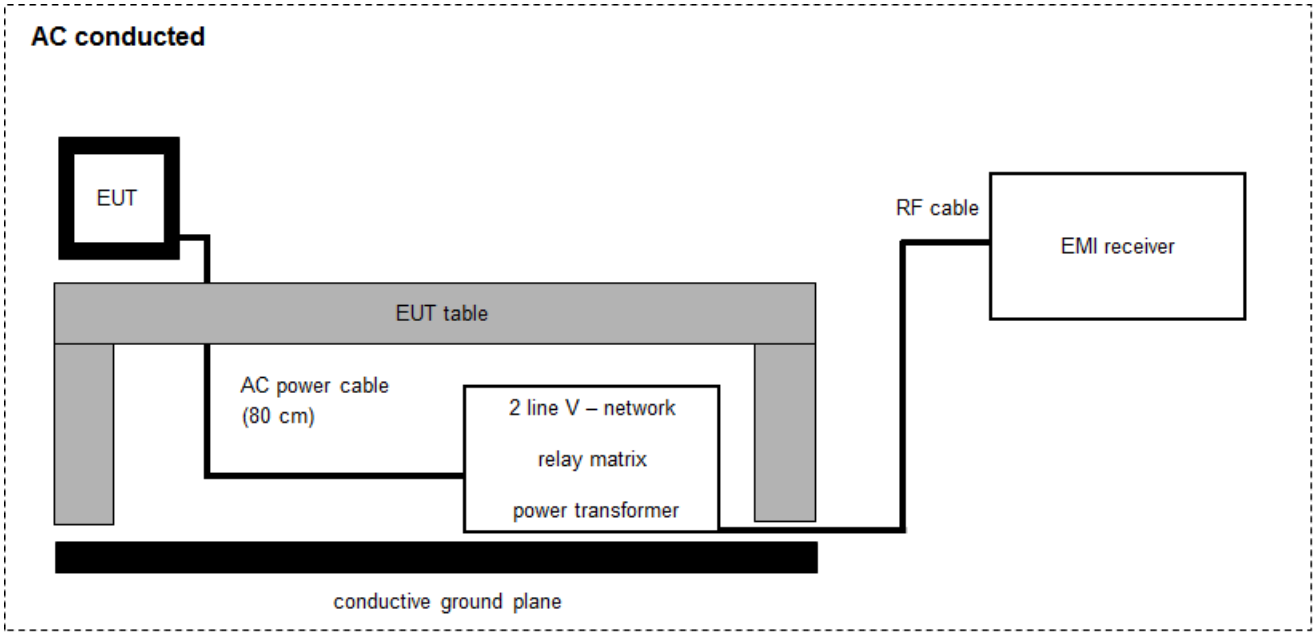

OP = AV + CA
(OP-output power; AV-analyzer value; CA-loss signal path)

*Example calculation:*
OP [dBm] = 6.0 [dBm] + 11.7 [dB] = 17.7 [dBm] (58.88 mW)

**Equipment table:**

| No. | Lab / Item | Equipment | Type | Manufacturer | Serial No. | INV. No. | Kind of Calibration | Last Calibration | Next Calibration |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A | Signal Analyzer 40 GHz | FSV40 | R&S | 101042 | 300004517 | k | 17.12.2019 | 16.12.2020 |
| 2 | A | DC-Blocker 0.1-40 GHz | 8141A | Inmet | -/- | 400001185 | ev | -/- | -/- |
| 3 | A | Isolating Transformer | RT5A | Grundig | 12780 | 300001166 | ev | -/- | -/- |
| 4 | A | Hygro-Thermometer | -/-, 5-45°C, 20-100%rF | Thies Clima | -/- | 400000108 | ev | 11.05.2018 | 10.05.2020 |
| 5 | A | PC Tester R005 | Intel Core i3 3220/3,3 GHz, Prozessor | -/- | 2V2403033A4523 | 300004589 | ne | -/- | -/- |
| 6 | A | RF-Cable | ST18/SMAm/SMAm/60 | Huber & Suhner | Batch no. 606844 | 400001181 | ev | -/- | -/- |
| 7 | A | Coax Attenuator 10 dB 2W 0-40 GHz | MCL BW-K10-2W44+ | Mini Circuits | -/- | 400001186 | ev | -/- | -/- |
| 8 | A | DC-Blocker | WA7046 | Weinschel Associates | -/- | 400001310 | ev | -/- | -/- |
| 9 | A | Tester Software RadioStar | Version 1.0.0.X | CTC advanced GmbH | 0001 | 400001380 | ne | -/- | -/- |

## 6.5 AC conducted




FS = UR + CF + VC
(FS-field strength; UR-voltage at the receiver; CR-loss of the cable and filter; VC-correction factor of the ISN)

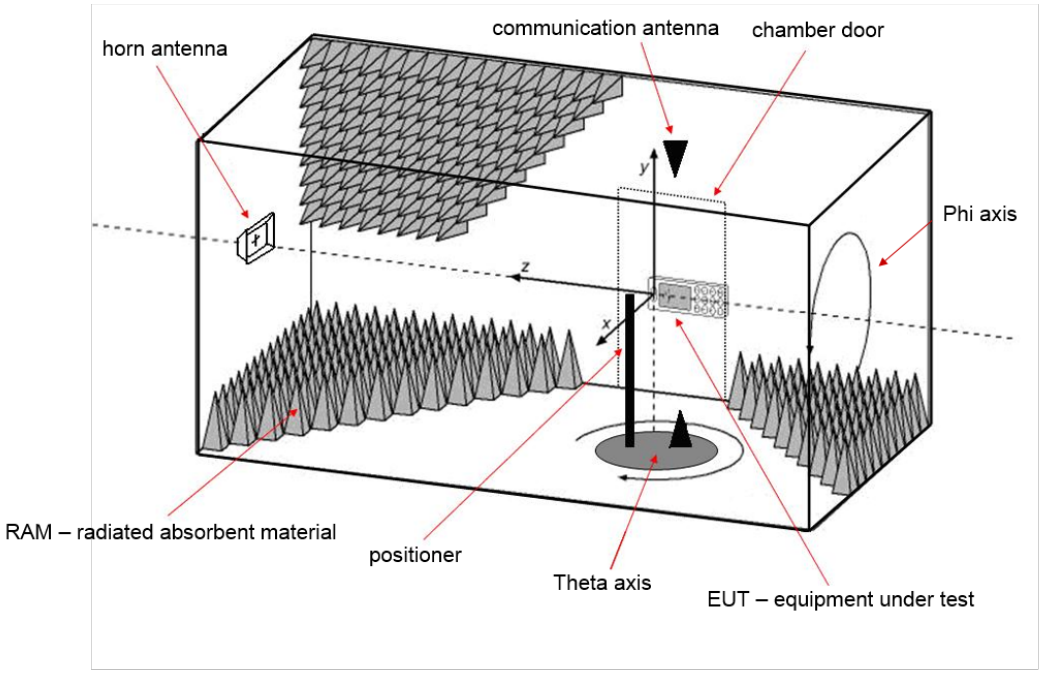
*Example calculation:*
FS [dBµV/m] = 37.62 [dBµV/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dBµV/m] (244.06 µV/m)

**Equipment table:**

| No. | Lab / Item | Equipment | Type | Manufacturer | Serial No. | INV. No. | Kind of Calibration | Last Calibration | Next Calibration |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A | Two-line V-Network (LISN) 9 kHz to 30 MHz | ESH3-Z5 | R&S | 892475/017 | 300002209 | vIKI! | 11.12.2019 | 10.12.2021 |
| 2 | A | RF-Filter-section | 85420E | HP | 3427A00162 | 300002214 | NK! | -/- | -/- |
| 3 | A | EMI Test Receiver | ESCI 3 | R&S | 100083 | 300003312 | k | 10.12.2019 | 09.12.2020 |
| 4 | A | Hochpass 150 kHz | EZ-25 | R&S | 100010 | 300003798 | ev | -/- | -/- |

## 6.6 Shielded fully anechoic chamber

**OTA – over the air performance**




EM Quest software version: 1.0.7.0

OP = AV + D - G + CA
(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

*Example calculation:*
OP [dBm] = -40.0 [dBm] + 49.9 [dB] – 12.4 [dBi] + 9 [dB] = 6.5 [dBm] (4.47 mW)

**Equipment table:**

| No. | Lab / Item | Equipment | Type | Manufacturer | Serial No. | INV. No. | Kind of Calibration | Last Calibration | Next Calibration |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A | Splitter | 42000 | Anaren | 4730 | 400000085 | ev | -/- | -/- |
| 2 | A | Switch Unit | TS-RSP | R&S | 100155 | 300003281 | ev | -/- | -/- |
| 3 | A | CTIA-Chamber | CTIA-Chamber AMS 8500 | ETS-Lindgren Finnland | 100083 | 300003327 | ne | -/- | -/- |
| 4 | A | CTIA-Chamber - Positioning Equipment | CTIA-Chamber - Positioning Equipment | EMCO/2 | | 300003328 | ne | -/- | -/- |
| 5 | A | CTIA-Chamber - Software | CTIA-Chamber - Software | EMCO/2 | A3509 07/0 0205 | 300003328 | ne | -/- | -/- |
| 6 | A | CTIA-Chamber - Antenna | 3164-04 | EMCO/2 | 00041915 | 300003328 | ne | -/- | -/- |
| 7 | A | Spectrum Analyzer 9kHz - 30 GHz | FSP30 | R&S | 100623 | 300003464 | vlKI! | 13.12.2018 | 12.12.2020 |

# 7 Sequence of testing

## 7.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

**Setup**

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, it is placed on a table with 0.8 m height.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

**Premeasurement***

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

**Final measurement**

- Identified emissions during the pre-measurement are maximized by the software by rotating the turntable from 0° to 360°.
- Loop antenna is rotated about its vertical axis for maximum response at each azimuth about the EUT. (For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT)
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

*)Note: The sequence will be repeated three times with different EUT orientations.

## 7.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

**Setup**

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

**Premeasurement**

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

**Final measurement**

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position ± 45° and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

## 7.3 Sequence of testing radiated spurious 1 GHz to 18 GHz

**Setup**

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

**Premeasurement**

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height is 1.5 m.
- At each turntable position and antenna polarization the analyzer sweeps with positive peak detector to find the maximum of all emissions.

**Final measurement**

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

## 7.4 Sequence of testing radiated spurious above 18 GHz

**Setup**

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet.
- The measurement distance is as appropriate (e.g. 0.5 m).
- The EUT is set into operation.

**Premeasurement**

- The test antenna is handheld and moved carefully over the EUT to cover the EUT's whole sphere and different polarizations of the antenna.

**Final measurement**

- The final measurement is performed at the position and antenna orientation causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement and the limit is stored.

# 8 Measurement uncertainty

| Measurement uncertainty | | |
|---|---|---|
| Test case | Uncertainty | |
| Antenna gain | ± 3 dB | |
| Power spectral density | ± 1.15 dB | |
| Spectrum bandwidth | ± 100 kHz (depends on the used RBW) | |
| Occupied bandwidth | ± 100 kHz (depends on the used RBW) | |
| Maximum output power | ± 1.15 dB conducted<br>± 3 dB radiated | |
| Minimum emissions bandwidth | ± 100 kHz (depends on the used RBW) | |
| Band edge compliance radiated | ± 3 dB | |
| Spurious emissions conducted | > 3.6 GHz | ± 1.15 dB |
| | > 7 GHz | ± 1.15 dB |
| | > 18 GHz | ± 1.89 dB |
| | ≥ 40 GHz | ± 3.12 dB |
| Spurious emissions radiated below 30 MHz | ± 3 dB | |
| Spurious emissions radiated 30 MHz to 1 GHz | ± 3 dB | |
| Spurious emissions radiated 1 GHz to 12.75 GHz | ± 3.7 dB | |
| Spurious emissions radiated above 12.75 GHz | ± 4.5 dB | |
| Spurious emissions conducted below 30 MHz (AC conducted) | ± 2.6 dB | |

## 9 Summary of measurement results

| | |
|---|---|
| ☒ | No deviations from the technical specifications were ascertained |
| ☐ | There were deviations from the technical specifications ascertained |
| ☒ | This test report is only a partial test report.<br>The content and verdict of the performed test cases are listed below. |

| TC Identifier | Description | Verdict | Date | Remark |
|---|---|---|---|---|
| RF-Testing | CFR Title 47 Part 15<br>RSS 247, Issue 2 | See table | 2020-02-19 | -/- |

| Test specification clause | Test case | C | NC | NA | NP | Remark |
|---|---|---|---|---|---|---|
| -/- | Output power verification (cond.) | -/- | | | | Declared |
| -/- | Antenna gain | -/- | | | | -/- |
| U-NII Part 15 | Duty cycle | -/- | | | | -/- |
| §15.407(a)<br>RSS - 247 (6.2.x.1) | Maximum output power<br>(conducted & radiated) | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.407(a)<br>RSS - 247 (6.2.x.1) | Power spectral density | ☒ | ☐ | ☐ | ☐ | -/- |
| RSS - 247 (6.2.4.1) | Spectrum bandwidth<br>6dB bandwidth | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.407(a)<br>RSS - 247 (6.2.x.2) | Spectrum bandwidth<br>26dB bandwidth | ☒ | ☐ | ☐ | ☐ | -/- |
| RSS Gen clause<br>6.6 | Spectrum bandwidth<br>99% bandwidth | -/- | | | | -/- |
| §15.205<br>RSS - 247 (6.2.x.2) | Band edge compliance radiated | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.407(b)<br>RSS - 247 (6.2.x.2) | TX spurious emissions radiated | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.109<br>RSS-Gen | RX spurious emissions radiated | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.209(a)<br>RSS-Gen | Spurious emissions radiated<br>< 30 MHz | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.107(a)<br>§15.207 | Spurious emissions conducted<br>emissions< 30 MHz | ☒ | ☐ | ☐ | ☐ | -/- |
| §15.407<br>RSS - 247 (6.3) | DFS | -/- | | | | See report<br>1-9148/19-01-05 |

Notes:

| C: | Compliant | NC: | Not compliant | NA: | Not applicable | NP: | Not performed |
|---|---|---|---|---|---|---|---|

## 10 Additional comments

| | | | |
|---|---|---|---|
| Reference documents: | | DFS report: 1-9148/19-01-05<br>ICO-OPE-03994 Wifi_labtool_Radio_agreement_procedure.pdf<br>1-9148_19-01-04_Annex_MR_A_1.pdf | |
| Special test descriptions: | | None | |
| Configuration descriptions: | | Used power settings for all tests: | a-mode: 14<br>n HT20-mode: 13<br>n HT40-mode: 11 |
| EUT selection: | ☒ | Only one device available | |
| | ☐ | Devices selected by the customer | |
| | ☐ | Devices selected by the laboratory (Randomly) | |

Provided channels:

Channels with 20 MHz channel bandwidth:

| U-NII-1 & U-NII-2A (5150 MHz to 5250 MHz & 5250 MHz to 5350 MHz) channel number & center frequency | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| channel | **36** | **40** | 44 | **48** | **52** | **56** | 60 | **64** |
| $f_c$ / MHz | **5180** | **5200** | 5220 | **5240** | **5260** | **5280** | 5300 | **5320** |

| U-NII-2C (5470 MHz to 5725 MHz) channel number & center frequency | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| channel | **100** | 104 | 108 | 112 | 116 | **120** | 124 | 128 | 132 | 136 | **140** |
| $f_c$ / MHz | **5500** | 5520 | 5540 | 5560 | 5580 | **5600** | 5620 | 5640 | 5660 | 5680 | **5700** |

| U-NII-3 (5725 MHz to 5850 MHz) channel number & center frequency | | | | | |
|---|---|---|---|---|---|
| channel | **149** | 153 | **157** | 161 | **165** |
| $f_c$ / MHz | **5745** | 5765 | **5785** | 5805 | **5825** |

Channels with 40 MHz channel bandwidth:

| U-NII-1 & U-NII-2A (5150 MHz to 5250 MHz & 5250 MHz to 5350 MHz) channel number & center frequency | | | | |
|---|---|---|---|---|
| channel | **38** | **46** | **54** | **62** |
| $f_c$ / MHz | **5190** | **5230** | **5270** | **5310** |

| U-NII-2C (5470 MHz to 5725 MHz) channel number & center frequency | | | | | |
|---|---|---|---|---|---|
| channel | **102** | 110 | **118** | 126 | **134** |
| $f_c$ / MHz | **5510** | 5550 | **5590** | 5630 | **5670** |

| U-NII-3 (5725 MHz to 5850 MHz) channel number & center frequency | | |
|---|---|---|
| channel | **151** | **159** |
| $f_c$ / MHz | **5755** | **5795** |

Note: The channels used for the tests were marked in bold in the list.

Test mode:

☐ No test mode available.
Iperf is used to transmit data to a companion device

☒ Special software is used.
EUT is transmitting pseudo random data by itself

Antennas and transmit operating modes:

☒ Operating mode 1 (single antenna)
- Equipment with 1 antenna,
- Equipment with 2 diversity antennas operating in switched diversity mode by which at any moment in time only 1 antenna is used,
- Smart antenna system with 2 or more transmit/receive chains, but operating in a mode where only 1 transmit/receive chain is used)

☐ Operating mode 2 (multiple antennas, no beamforming)
- Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously but without beamforming.

☐ Operating mode 3 (multiple antennas, with beamforming)
- Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously with beamforming.
  In addition to the antenna assembly gain (G), the beamforming gain (Y) may have to be taken into account when performing the measurements.

# 11 Measurement results

## 11.1 Identify worst case data rate

Measurement:

All modes of the module will be measured with an average power meter to identify the maximum transmission power on mid channel. In the case that only one or two channels are available, only these will be measured.

In further tests only the identified worst case modulation scheme or bandwidth will be measured.

Measurement parameters:

| Measurement parameter | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Resolution bandwidth: | 3 MHz |
| Video bandwidth: | 3 MHz |
| Trace mode: | Max hold |
| Used test setup: | See chapter 6.4 – A |
| Measurement uncertainty: | See chapter 8 |

Results:

| OFDM – mode | Modulation scheme / bandwidth | | | | | |
|---|---|---|---|---|---|---|
| | U-NII-1 & U-NII-2A | | U-NII-2C | | U-NII-3 | |
| | lowest channel | highest channel | lowest channel | highest channel | lowest channel | highest channel |
| a – mode | 6 Mbit/s | 6 Mbit/s | 6 Mbit/s | 6 Mbit/s | 6 Mbit/s | 6 Mbit/s |
| n HT20 – mode | MCS0 | MCS0 | MCS0 | MCS0 | MCS0 | MCS0 |
| n HT40 – mode | MCS0 | MCS0 | MCS0 | MCS0 | MCS0 | MCS0 |

## 11.2 Antenna gain

Description:

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

Measurement parameters:

| Measurement parameter | |
|---|---|
| External result file(s) | 1-9148_19-01-04_Annex_MR_A_1.pdf<br>Peak OP 3MHz/3MHz |
| Test setup: | See chapter 6.6 – A (radiated)<br>See chapter 6.4 – A (conducted) |
| Measurement uncertainty: | See chapter 8 |

Limits:

| Antenna Gain |
|---|
| 6 dBi / > 6 dBi output power and power density reduction required |

Results:

| U-NII-1<br>(5150 MHz to 5250 MHz) | Antenna gain | | |
|---|---|---|---|
| | Lowest channel | Middle channel | Highest channel |
| Conducted power / dBm @ 3 MHz RBW | 5.7 | -/- | 6.5 |
| Radiated power / dBm @ 3 MHz RBW | 2.9 | -/- | 1.5 |
| Gain / dBi (calculated or declared) | -2.8 | -/- | -5.0 |

| U-NII-2A<br>(5250 MHz to 5350 MHz) | Antenna gain | | |
|---|---|---|---|
| | Lowest channel | Middle channel | Highest channel |
| Conducted power / dBm @ 3 MHz RBW | 4.5 | -/- | 3.6 |
| Radiated power / dBm @ 3 MHz RBW | 1.7 | -/- | 0.2 |
| Gain / dBi (calculated or declared) | -2.8 | -/- | -3.4 |

| U-NII-2C<br>(5470 MHz to 5725 MHz) | Antenna gain | | |
|---|---|---|---|
| | Lowest channel | Middle channel | Highest channel |
| Conducted power / dBm @ 3 MHz RBW | 4.6 | 4.0 | 6.5 |
| Radiated power / dBm @ 3 MHz RBW | 1.1 | 1.4 | 1.0 |
| Gain / dBi (calculated or declared) | -3.5 | -2.6 | -5.5 |

| U-NII-3<br>(5725 MHz to 5850 MHz) | Antenna gain | | |
|---|---|---|---|
| | Lowest channel | Middle channel | Highest channel |
| Conducted power / dBm @ 3 MHz RBW | 9.3 | 9.6 | 9.6 |
| Radiated power / dBm @ 3 MHz RBW | 1.0 | 1.7 | 2.9 |
| Gain / dBi (calculated or declared) | -8.3 | -7.9 | -6.7 |

## 11.3 Duty cycle

Description:

The duty cycle is necessary to compute the maximum power during an actual transmission. The shown plots and values are to show an example of the measurement procedure. The real value is measured direct during the power measurement or power density measurement. The correction value is shown in each plot of these measurements.

Measurement:

| Measurement parameter | |
|---|---|
| According to: KDB789033 D02, B. | |
| External result file(s) | 1-9148_19-01-04_Annex_MR_A_1.pdf<br>FCC Part 15.407 Max Output Power and PSD |
| Used test setup: | See chapter 6.4 – A |
| Measurement uncertainty: | See chapter 8 |

Results:

Duty cycle and correction factor:

| | | |
|---|---|---|
| a – mode | 100% | 0.0 dB |
| n HT20 – mode | 100% | 0.0 dB |
| n HT40 – mode | 100% | 0.0 dB |

## 11.4 Maximum output power

### 11.4.1 Maximum output power according to FCC requirements

Description:

Measurement of the maximum output power conducted

Measurement:

| Measurement parameter | |
|---|---|
| According to: KDB789033 D02, E.2.e. | |
| External result file(s) | 1-9148_19-01-04_Annex_MR_A_1.pdf<br>FCC Part 15.407 Max Output Power and PSD |
| Used test setup: | See chapter 6.4 – A |
| Measurement uncertainty: | See chapter 8 |

Limits:

| Radiated output power | Conducted output power for mobile equipment |
|---|---|
| Conducted power + 6 dBi antenna gain | 250mW 5.150-5.250 GHz<br>The lesser one of<br>250mW or 11 dBm + 10 log Bandwidth 5.250-5.350 GHz<br>250mW or 11 dBm + 10 log Bandwidth 5.470-5.725 GHz<br>(where Bandwidth is the 26dB Bandwidth [MHz])<br>1W 5.725-5.85 GHz |

Results:

| | | | |
|---|---|---|---|
| a | Maximum output power conducted [dBm] | | |
| | U-NII-1 (5150 MHz to 5250 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 4.8 | 4.7 | 4.5 |
| | U-NII-2A (5250 MHz to 5350 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 2.8 | 4.4 | 1.8 |
| | U-NII-2C (5470 MHz to 5725 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 3.1 | 2.4 | 4.7 |
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 7.6 | 8.8 | 8.8 |

Results:

| | | | |
|---|---|---|---|
| n HT20 | Maximum output power conducted [dBm] | | |
| | U-NII-1 (5150 MHz to 5250 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 4.8 | 4.3 | 4.1 |
| | U-NII-2A (5250 MHz to 5350 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 1.9 | 3.3 | 1.0 |
| | U-NII-2C (5470 MHz to 5725 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 2.2 | 1.4 | 3.9 |
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 6.7 | 8.2 | 8.3 |

Results:

| | | | |
|---|---|---|---|
| n HT40 | Maximum output power conducted [dBm] | | |
| | U-NII-1 (5150 MHz to 5250 MHz) | | |
| | Lowest channel | | Highest channel |
| | 1.6 | | 1.2 |
| | U-NII-2A (5250 MHz to 5350 MHz) | | |
| | Lowest channel | | Highest channel |
| | 0.5 | | -0.4 |
| | U-NII-2C (5470 MHz to 5725 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | -0.2 | -0.7 | 0.9 |
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | | Highest channel |
| | 3.3 | | 5.6 |

### 11.4.2 Maximum output power according to IC requirements

Description:

Measurement of the maximum output power conduced + radiated

Measurement:

| Measurement parameter | |
|---|---|
| External result file(s) | 1-9148_19-01-04_Annex_MR_A_1.pdf<br>ISED Max Output Power and PSD |
| Used test setup: | See chapter 6.4 – A |
| Measurement uncertainty: | See chapter 8 |

Limits:

| Radiated output power | Conducted output power for mobile equipment |
|---|---|
| The lesser one of<br>200 mW or 10 dBm + 10 log Bandwidth 5.150-5.250 GHz<br>1 W or 17 dBm + 10 log Bandwidth 5.250-5.350 GHz<br>1 W or 17 dBm + 10 log Bandwidth 5.470-5.725 GHz<br>(where Bandwidth is the 99% Bandwidth [MHz])<br>Conducted power + 6dBi antenna gain 5.725-5.825 GHz | The lesser one of<br><br>250mW or 11 dBm + 10 log Bandwidth 5.250-5.350 GHz<br>250mW or 11 dBm + 10 log Bandwidth 5.470-5.725 GHz<br>(where Bandwidth is the 99% Bandwidth [MHz])<br>1W 5.725-5.825 GHz |

Results:

| | | | |
|---|---|---|---|
| a | Maximum output power [dBm] | | |
| | U-NII-1 (5150 MHz to 5250 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | Conducted | | |
| | 4.8 | 4.6 | 4.4 |
| | Radiated (calculated – see chapter antenna gain) | | |
| | 2.0 | 1.8 | -0.6 |
| | U-NII-2A (5250 MHz to 5350 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | Conducted | | |
| | 2.8 | 4.3 | 1.9 |
| | Radiated (calculated – see chapter antenna gain) | | |
| | 0.0 | 1.5 | -1.5 |
| | U-NII-2C (5470 MHz to 5725 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | Conducted | | |
| | 3.1 | 2.3 | 4.6 |
| | Radiated (calculated – see chapter antenna gain) | | |
| | -0.4 | -0.3 | -0.9 |
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | Conducted | | |
| | 7.6 | 8.8 | 8.7 |
| | Radiated (calculated – see chapter antenna gain) | | |
| | 0.7 | 0.9 | 2.0 |

Results:

| | | | |
|---|---|---|---|
| n HT20 | Maximum output power [dBm] | | |
| | U-NII-1 (5150 MHz to 5250 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | Conducted | | |
| | 4.6 | 4.1 | 3.9 |
| | Radiated (calculated – see chapter antenna gain) | | |
| | 1.8 | 1.3 | -1.1 |
| | U-NII-2A (5250 MHz to 5350 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | Conducted | | |
| | 1.8 | 3.2 | 0.9 |
| | Radiated (calculated – see chapter antenna gain) | | |
| | -1.0 | 0.4 | -2.5 |
| | U-NII-2C (5470 MHz to 5725 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | Conducted | | |
| | 2.1 | 1.3 | 3.7 |
| | Radiated (calculated – see chapter antenna gain) | | |
| | -1.4 | -1.3 | -1.8 |
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | Conducted | | |
| | 6.7 | 8.1 | 8.2 |
| | Radiated (calculated – see chapter antenna gain) | | |
| | -2.6 | 0.2 | 1.5 |

Results:

| | | | |
|---|---|---|---|
| n HT40 | Maximum output power [dBm] | | |
| | U-NII-1 (5150 MHz to 5250 MHz) | | |
| | Lowest channel | Highest channel | |
| | Conducted | | |
| | 1.6 | 1.4 | |
| | Radiated (calculated – see chapter antenna gain) | | |
| | -1.2 | -3.6 | |
| | U-NII-2A (5250 MHz to 5350 MHz) | | |
| | Lowest channel | Highest channel | |
| | Conducted | | |
| | 0.5 | -0.4 | |
| | Radiated (calculated – see chapter antenna gain) | | |
| | -2.3 | -3.8 | |
| | U-NII-2C (5470 MHz to 5725 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | Conducted | | |
| | -0.2 | -0.7 | 0.9 |
| | Radiated (calculated – see chapter antenna gain) | | |
| | -3.7 | -3.3 | -4.6 |
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | Highest channel | |
| | Conducted | | |
| | 3.3 | 5.6 | |
| | Radiated (calculated – see chapter antenna gain) | | |
| | -5.0 | -1.1 | |

## 11.5 Power spectral density

### 11.5.1 Power spectral density according to FCC requirements

Description:

Measurement of the power spectral density of a digital modulated system. The measurement is repeated at the lowest, middle and highest channel.

Measurement:

| Measurement parameter | |
|---|---|
| According to: KDB789033 D02, F. | |
| External result file(s) | 1-9148_19-01-04_Annex_MR_A_1.pdf<br>FCC Part 15.407 Max Output Power and PSD |
| Used test setup: | See chapter 6.4 – A |
| Measurement uncertainty: | See chapter 8 |

Limits:

| Power Spectral Density |
|---|
| power spectral density conducted ≤ 11 dBm in any 1 MHz band (band 5150 – 5250 MHz)<br><br>power spectral density conducted ≤ 11 dBm in any 1 MHz band (band 5250 – 5350 MHz)<br>power spectral density conducted ≤ 11 dBm in any 1 MHz band (band 5470 – 5725 MHz)<br><br>power spectral density conducted ≤ 30 dBm in any 500 kHz band (band 5725 – 5850 MHz) |

Results:

| | | | |
|---|---|---|---|
| a | Power spectral density (dBm/1MHz or dBm/500kHz) | | |
| | U-NII-1 (5150 MHz to 5250 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | -6.8 | -6.9 | -6.9 |
| | U-NII-2A (5250 MHz to 5350 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | -8.5 | -6.5 | -9.7 |
| | U-NII-2C (5470 MHz to 5725 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | -8.6 | -9.3 | -6.8 |
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | -6.4 | -5.3 | -5.8 |

Results:

| | | | |
|---|---|---|---|
| n HT20 | Power spectral density (dBm/1MHz or dBm/500kHz) | | |
| | U-NII-1 (5150 MHz to 5250 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | -7.0 | -7.6 | -7.6 |
| | U-NII-2A (5250 MHz to 5350 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | -9.9 | -8.1 | -10.7 |
| | U-NII-2C (5470 MHz to 5725 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | -9.8 | -10.6 | -7.6 |
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | -7.1 | -6.1 | -6.6 |

Results:

| | | | |
|---|---|---|---|
| n HT40 | Power spectral density (dBm/1MHz or dBm/500kHz) | | |
| | U-NII-1 (5150 MHz to 5250 MHz) | | |
| | Lowest channel | | Highest channel |
| | -13.1 | | -13.0 |
| | U-NII-2A (5250 MHz to 5350 MHz) | | |
| | Lowest channel | | Highest channel |
| | -13.4 | | -14.2 |
| | U-NII-2C (5470 MHz to 5725 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | -15.3 | -15.3 | -14.2 |
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | | Highest channel |
| | -13.3 | | -11.8 |

### 11.5.2 Power spectral density according to IC requirements

Description:

Measurement of the power spectral density of a digital modulated system. The measurement is repeated at the lowest, middle and highest channel.

Measurement:

| Measurement parameter | |
|---|---|
| External result file(s) | 1-9148_19-01-04_Annex_MR_A_1.pdf<br>ISED Max Output Power and PSD |
| Used test setup: | See chapter 6.4 – A |
| Measurement uncertainty: | See chapter 8 |

Limits:

| Power Spectral Density |
|---|
| power spectral density e.i.r.p. ≤ 10 dBm in any 1 MHz band (band 5150 – 5250 MHz)<br><br>power spectral density conducted ≤ 11 dBm in any 1 MHz band (band 5250 – 5350 MHz)<br>power spectral density conducted ≤ 11 dBm in any 1 MHz band (band 5470 – 5725 MHz)<br><br>power spectral density conducted ≤ 30 dBm in any 500 kHz band (band 5725 – 5850 MHz) |

Results:

| | | | |
|---|---|---|---|
| a | Power spectral density (dBm/1MHz or dBm/500kHz) | | |
| | U-NII-1 (5150 MHz to 5250 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | Conducted | | |
| | -6.4 | -6.9 | -6.9 |
| | Radiated (calculated – see chapter antenna gain) | | |
| | -9.2 | -9.7 | -11.9 |
| | U-NII-2A (5250 MHz to 5350 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | -8.4 | -6.7 | -9.3 |
| | U-NII-2C (5470 MHz to 5725 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | -8.6 | -9.4 | -6.9 |
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | -6.3 | -5.4 | -5.9 |

Results:

| | | | |
|---|---|---|---|
| n HT20 | Power spectral density (dBm/1MHz or dBm/500kHz) | | |
| | U-NII-1 (5150 MHz to 5250 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | Conducted | | |
| | -7.2 | -7.7 | -7.7 |
| | Radiated (calculated – see chapter antenna gain) | | |
| | -10.0 | -10.5 | -12.7 |
| | U-NII-2A (5250 MHz to 5350 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | -10.0 | -8.1 | -10.7 |
| | U-NII-2C (5470 MHz to 5725 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | -9.8 | -10.6 | -7.8 |
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | -7.5 | -6.1 | -6.5 |

Results:

| | | | |
|---|---|---|---|
| n HT40 | Power spectral density (dBm/1MHz or dBm/500kHz) | | |
| | U-NII-1 (5150 MHz to 5250 MHz) | | |
| | Lowest channel | | Highest channel |
| | Conducted | | |
| | -13.1 | | -13.0 |
| | Radiated (calculated – see chapter antenna gain) | | |
| | -15.9 | | -18.0 |
| | U-NII-2A (5250 MHz to 5350 MHz) | | |
| | Lowest channel | | Highest channel |
| | -13.5 | | -14.2 |
| | U-NII-2C (5470 MHz to 5725 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | -15.3 | -15.4 | -14.2 |
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | | Highest channel |
| | -13.3 | | -11.8 |

## 11.6 Minimum emission bandwidth for the band 5.725-5.85 GHz

Description:

Measurement of the 6 dB bandwidth of the modulated signal.

Measurement:

| Measurement parameter | |
|---|---|
| According to: KDB789033 D02, C.2. | |
| External result file(s) | 1-9148_19-01-04_Annex_MR_A_1.pdf<br>FCC Part 15.407 & ISED Minimum Emission BW |
| Used test setup: | See chapter 6.4 – A |
| Measurement uncertainty: | See chapter 8 |

Limits:

| FCC | IC |
|---|---|
| The minimum 6 dB bandwidth shall be at least 500 kHz. | |

Results:

| a | 6 dB emission bandwidth (MHz) | | |
|---|---|---|---|
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 16.5 | 16.5 | 16.5 |

Results:

| n HT20 | 6 dB emission bandwidth (MHz) | | |
|---|---|---|---|
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 17.7 | 17.7 | 17.9 |

Results:

| n HT40 | 6 dB emission bandwidth (MHz) | |
|---|---|---|
| | U-NII-3 (5725 MHz to 5850 MHz) | |
| | Lowest channel | Highest channel |
| | 36.4 | 36.4 |

## 11.7 Spectrum bandwidth / 26 dB bandwidth

Description:

Measurement of the 26 dB bandwidth of the modulated signal.

Measurement:

| Measurement parameter | |
|---|---|
| According to: KDB789033 D02, C.1. | |
| External result file(s) | 1-9148_19-01-04_Annex_MR_A_1.pdf<br>FCC Part 15.407 & ISED Bandwidths |
| Used test setup: | see chapter 6.4 – A |
| Measurement uncertainty: | See chapter 8 |

Limits:

| Spectrum Bandwidth – 26 dB Bandwidth |
|---|
| **IC:** Any unwanted emissions that fall into the band 5250-5350 MHz shall be attenuated below the channel power by at least 26 dB, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth (i.e. 99% bandwidth), above 5250 MHz. The 26 dB bandwidth may fall into the 5250-5350 MHz band; however, if the occupied bandwidth also falls within the 5250-5350 MHz band, the transmission is considered as intentional and the devices shall comply with all requirements in the band 5250-5350 MHz including implementing dynamic frequency selection (DFS) and TPC, on the portion of the emission that resides in the 5250-5350 MHz band.<br><br>**FCC:** Radar Detection Function of Dynamic Frequency Selection (DFS). U-NII devices operating with any part of its 26 dB emission bandwidth in the 5.25-5.35 GHz and 5.47-5.725 GHz bands shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems.<br>According to 789033 D02 General U-NII Test Procedures New Rules v02r01 the 99% bandwidth may be used in lieu of the 26 dB bandwidth. The DFS radar detection mechanism on Channel 48 (5240 MHz) is only required when the 99% bandwidth also falls in the 5.25-5.35 GHz band. |

Results:

| | | | |
|---|---|---|---|
| a | 26 dB bandwidth (MHz) | | |
| | U-NII-1 (5150 MHz to 5250 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 20.2 | 20.2 | 20.1 |
| | Lowest frequency | | Highest frequency |
| | 5170.0 | | 5249.95 |
| | U-NII-2A (5250 MHz to 5350 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 20.3 | 20.0 | 20.2 |
| | U-NII-2C (5470 MHz to 5725 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 20.0 | 20.2 | 34.9 |
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 37.0 | 41.2 | 48.1 |
| | Lowest frequency | | Highest frequency |
| | 5726.3 | | 5849.75 |

Results:

| | | | |
|---|---|---|---|
| n HT20 | 26 dB bandwidth (MHz) | | |
| | U-NII-1 (5150 MHz to 5250 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 20.4 | 20.5 | 20.4 |
| | Lowest frequency | | Highest frequency |
| | 5170.0 | | 5250.1 |
| | U-NII-2A (5250 MHz to 5350 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 20.6 | 20.4 | 20.7 |
| | U-NII-2C (5470 MHz to 5725 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 20.5 | 20.6 | 31.2 |
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 36.6 | 42.3 | 49.8 |
| | Lowest frequency | | Highest frequency |
| | 5726.6 | | 5849.8 |

Results:

| | | | |
|---|---|---|---|
| n HT40 | 26 dB bandwidth (MHz) | | |
| | U-NII-1 (5150 MHz to 5250 MHz) | | |
| | Lowest channel | | Highest channel |
| | 42.3 | | 41.2 |
| | Lowest frequency | | Highest frequency |
| | 5168.4 | | 5250.5 |
| | U-NII-2A (5250 MHz to 5350 MHz) | | |
| | Lowest channel | | Highest channel |
| | 41.3 | | 41.4 |
| | U-NII-2C (5470 MHz to 5725 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 41.5 | 41.6 | 41.7 |
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | | Highest channel |
| | 64.9 | | 74.0 |
| | Lowest frequency | | Highest frequency |
| | 5726.4 | | 5835.6 |

## 11.8 Occupied bandwidth / 99% emission bandwidth

Description:

Measurement of the 99% bandwidth of the modulated signal acc. RSS-GEN.

Measurement:

| Measurement parameter | |
|---|---|
| External result file(s) | 1-9148_19-01-04_Annex_MR_A_1.pdf<br>FCC Part 15.407 & ISED Bandwidths |
| Test setup: | See sub clause 6.5 – B |
| Measurement uncertainty: | See chapter 8 |

Usage:

| -/- | IC |
|---|---|
| OBW is necessary for Emission Designator | |

Results:

| | | | |
|---|---|---|---|
| a | 99% bandwidth (kHz) | | |
| | U-NII-1 (5150 MHz to 5250 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 17083 | 16833 | 16783 |
| | U-NII-2A (5250 MHz to 5350 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 16933 | 16733 | 16833 |
| | U-NII-2C (5470 MHz to 5725 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 16733 | 16833 | 17682 |
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 19530 | 27023 | 33217 |

Results:

| | | | |
|---|---|---|---|
| n HT20 | 99% bandwidth (kHz) | | |
| | U-NII-1 (5150 MHz to 5250 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 17932 | 17932 | 17832 |
| | U-NII-2A (5250 MHz to 5350 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 17932 | 17882 | 17982 |
| | U-NII-2C (5470 MHz to 5725 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 17932 | 18232 | 18232 |
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 19331 | 25874 | 33916 |

Results:

| | | | |
|---|---|---|---|
| n HT40 | 99% bandwidth (kHz) | | |
| | U-NII-1 (5150 MHz to 5250 MHz) | | |
| | Lowest channel | | Highest channel |
| | 36563 | | 36464 |
| | U-NII-2A (5250 MHz to 5350 MHz) | | |
| | Lowest channel | | Highest channel |
| | 36763 | | 36863 |
| | U-NII-2C (5470 MHz to 5725 MHz) | | |
| | Lowest channel | Middle channel | Highest channel |
| | 36663 | 36663 | 36663 |
| | U-NII-3 (5725 MHz to 5850 MHz) | | |
| | Lowest channel | | Highest channel |
| | 37363 | | 37862 |

## 11.9 Band edge compliance radiated

Description:

Measurement of the radiated band edge compliance. The EUT is turned in the position that results in the maximum level at the band edge. Then a sweep over the corresponding restricted band is performed. The EUT is set to the lowest channel for the lower restricted band and to the highest channel for the upper restricted band. Measurement distance is 3m.

Measurement:

| Measurement parameter | |
|---|---|
| Detector: | Peak / RMS |
| Sweep time: | Auto |
| Resolution bandwidth: | 1 MHz |
| Video bandwidth: | ≥ 3 x RBW |
| Span: | See plots! |
| Trace mode: | Max Hold |
| Test setup: | See sub clause 6.2 – A |
| Measurement uncertainty: | See chapter 8 |

Limits:

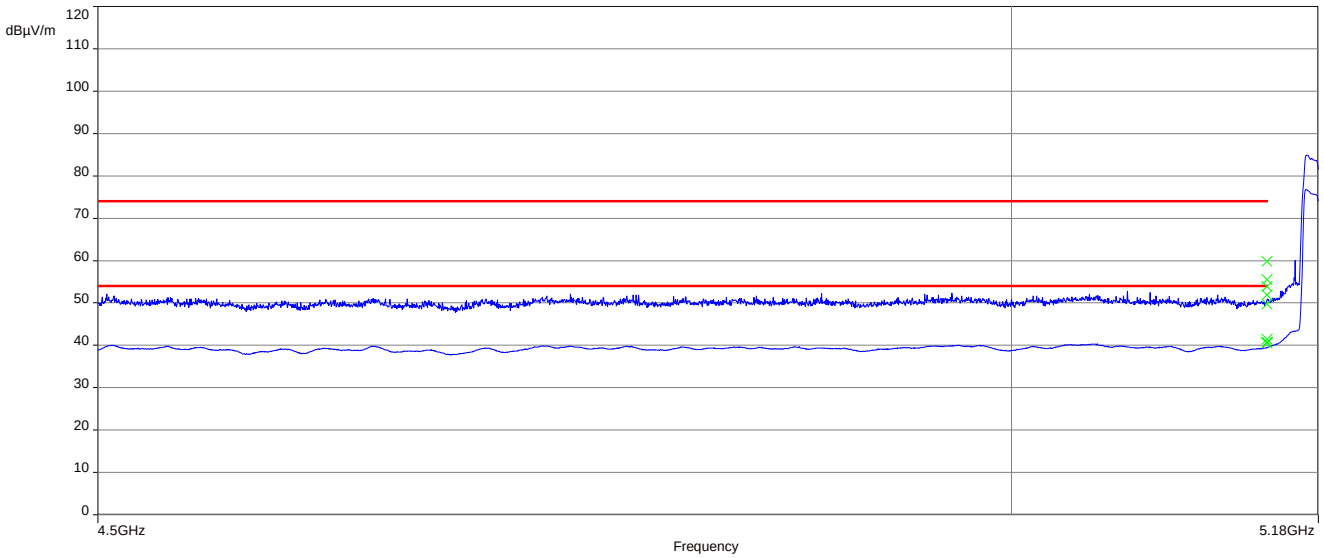
| Band Edge Compliance Radiated |
|---|
| In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 5.205(c)). |
| 74 dBµV/m (peak)<br>54 dBµV/m (average) |

Result:

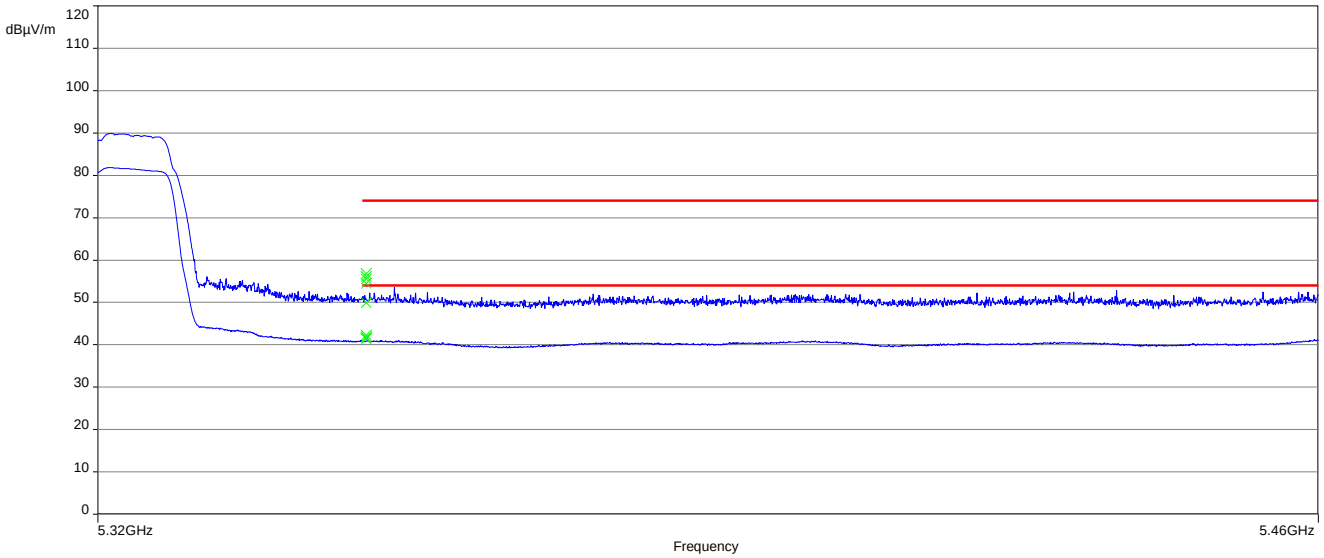
| Scenario | Band Edge Compliance Radiated [dBµV/m] |
|---|---|
| band edge | < 74 dBµV/m (peak)<br>< 54 dBµV/m (average) |

**Plots:**

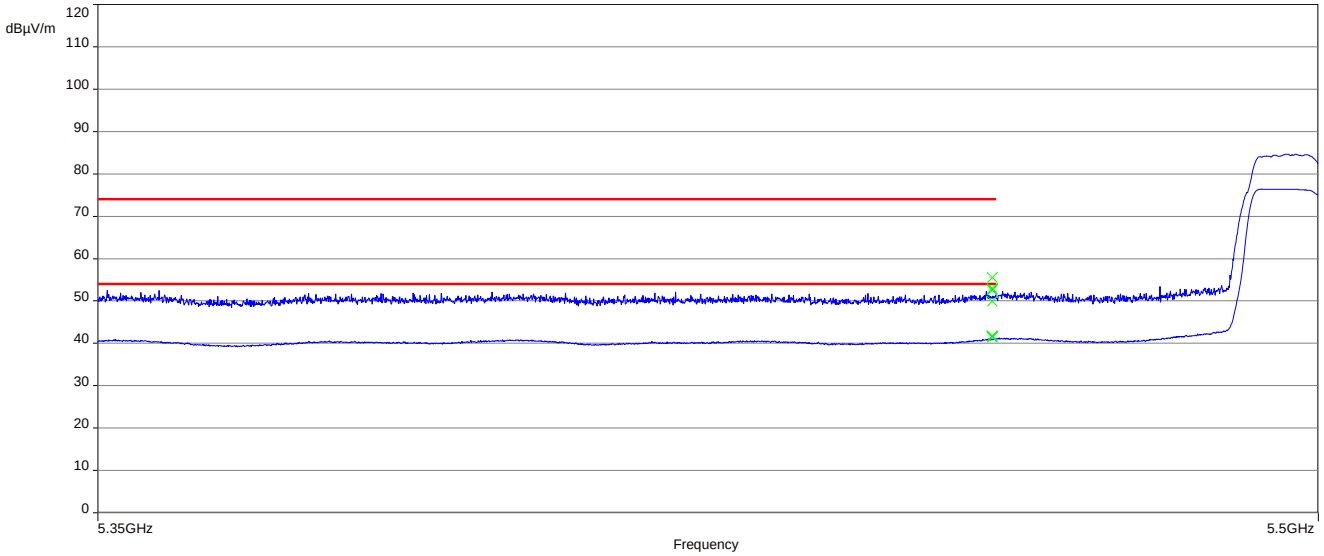
**Plot 1:** lower band edge; U-NII-1; lowest channel; 20 MHz channel bandwidth



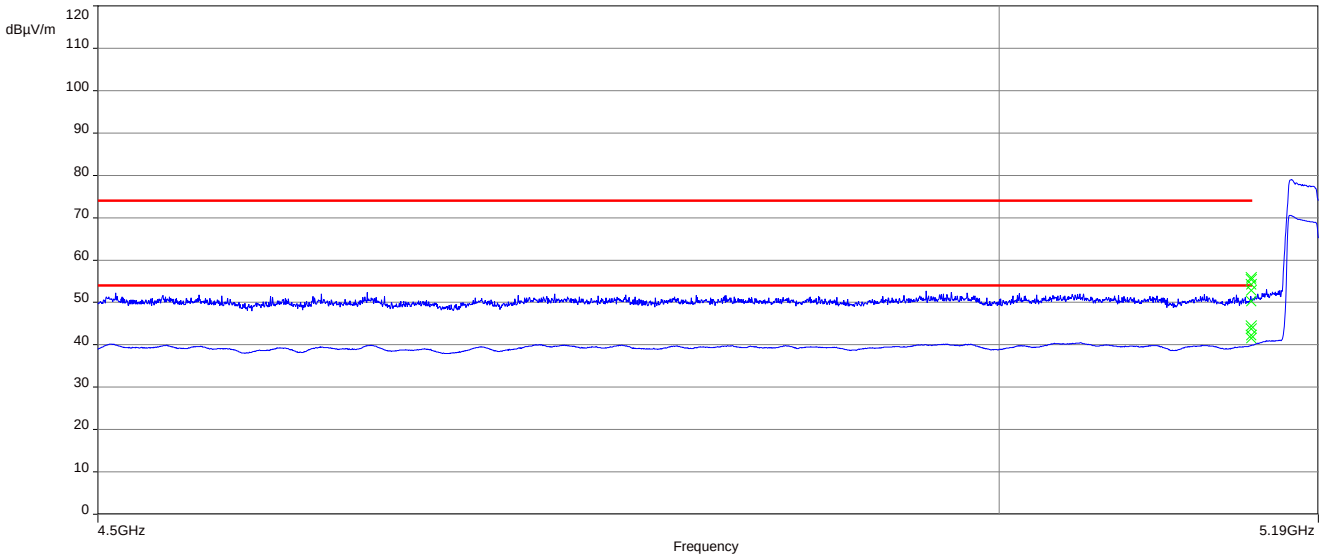

**Plot 2:** upper band edge; U-NII-2A; highest channel; 20 MHz channel bandwidth



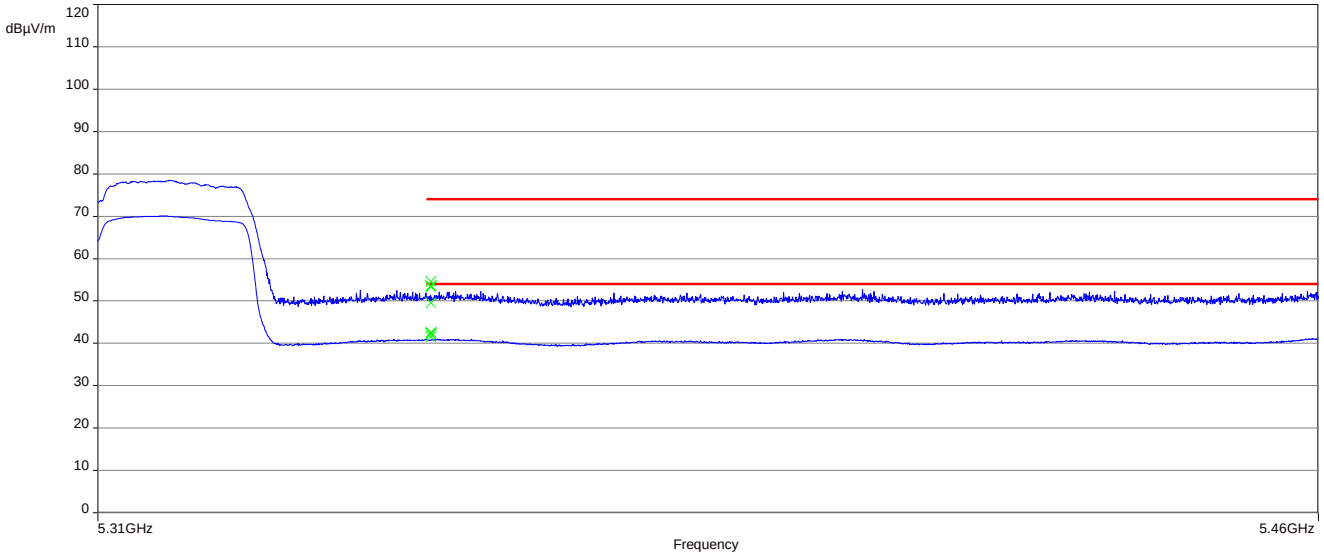
**Plot 3:** lower band edge; U-NII-2C; lowest channel; 20 MHz channel bandwidth



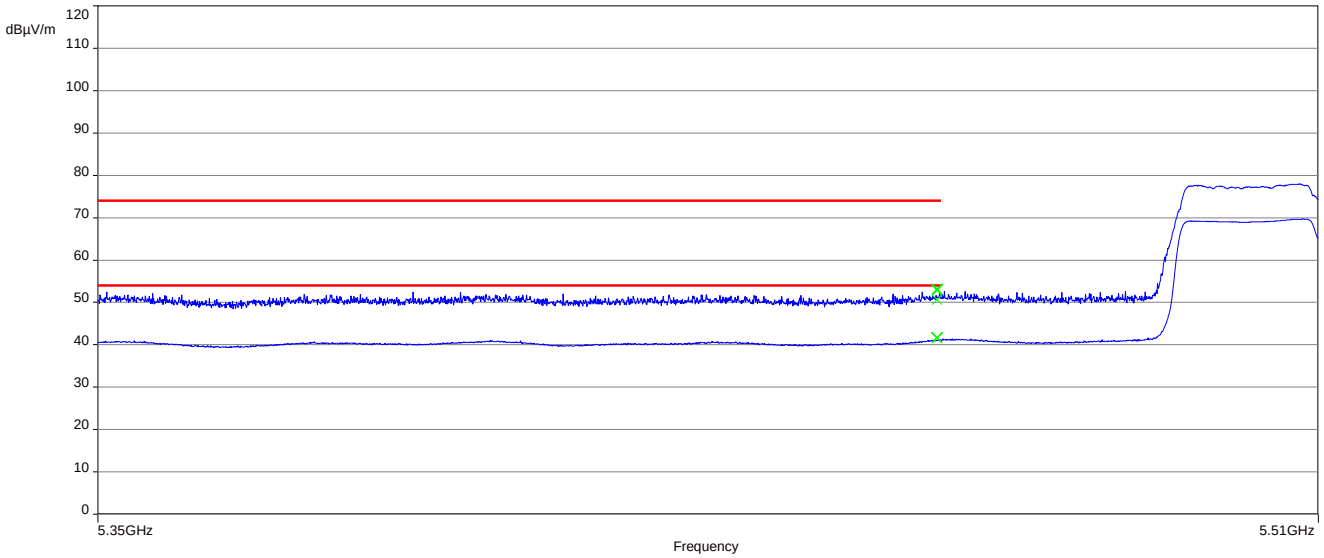

**Plot 4:** lower band edge; U-NII-1; lowest channel; 40 MHz channel bandwidth



**Plot 5:** upper band edge; U-NII-2A; highest channel; 40 MHz channel bandwidth




**Plot 6:** lower band edge; U-NII-2C; lowest channel; 40 MHz channel bandwidth



## 11.10 Spurious emissions radiated below 30 MHz

Description:

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The limits are re-calculated to a measurement distance of 3 m with 40 dB/decade according CFR Part 2.

Measurement:

| Measurement parameter | |
|---|---|
| Detector: | Peak / Quasi Peak |
| Sweep time: | Auto |
| Video bandwidth: | F < 150 kHz: 200 Hz<br>F > 150 kHz: 9 kHz |
| Resolution bandwidth: | F < 150 kHz: 1 kHz<br>F > 150 kHz: 100 kHz |
| Span: | 9 kHz to 30 MHz |
| Trace mode: | Max Hold |
| Test setup: | See sub clause 6.2 – C |
| Measurement uncertainty: | See chapter 8 |

Limits:

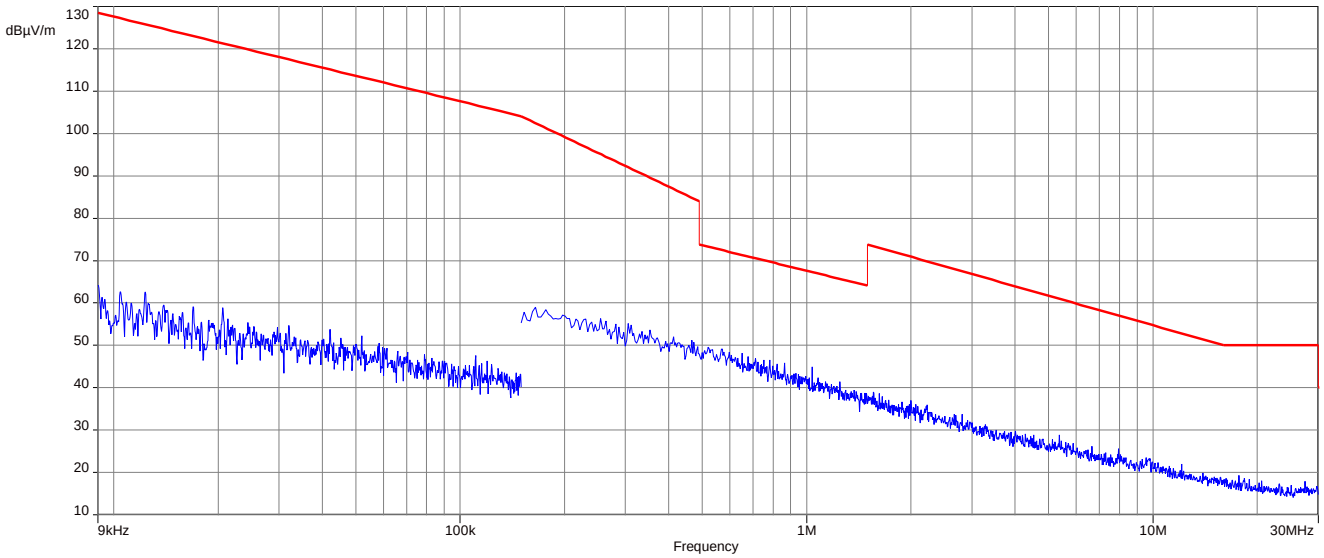
| Spurious Emissions Radiated < 30 MHz | | |
|---|---|---|
| Frequency (MHz) | Field Strength (dBµV/m) | Measurement distance |
| 0.009 – 0.490 | 2400/F(kHz) | 300 |
| 0.490 – 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |

Results:

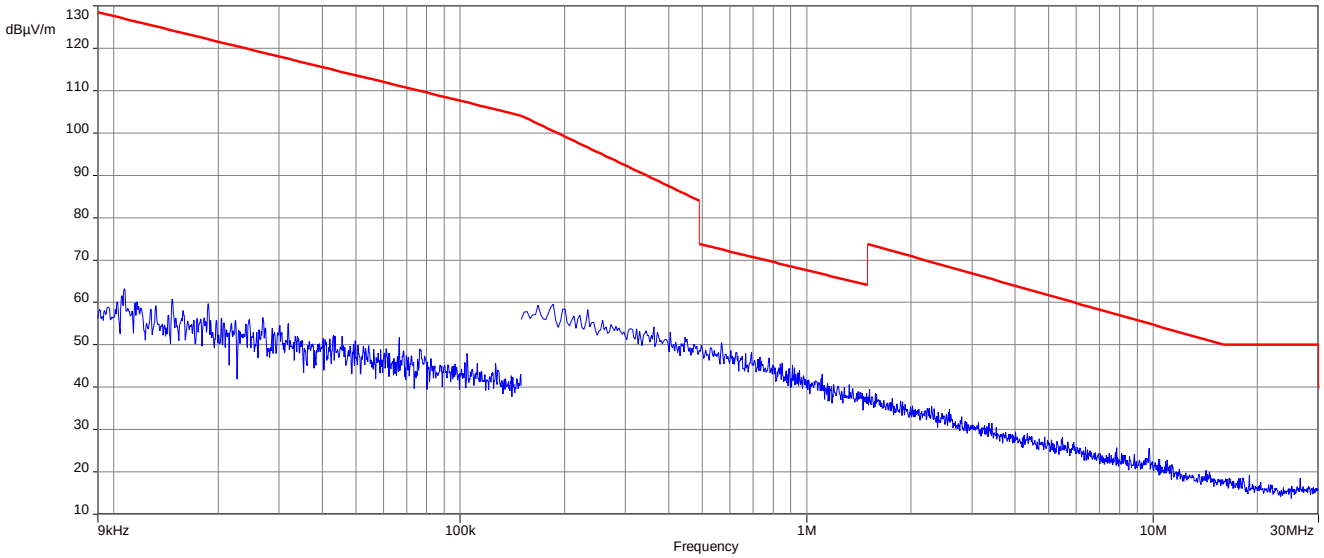
| Spurious Emissions Radiated < 30 MHz [dBµV/m] | | |
|---|---|---|
| F [MHz] | Detector | Level [dBµV/m] |
| All detected emissions are more than 20 dB below the limit. | | |
| | | |
| | | |

**Plots:** 20 MHz channel bandwidth

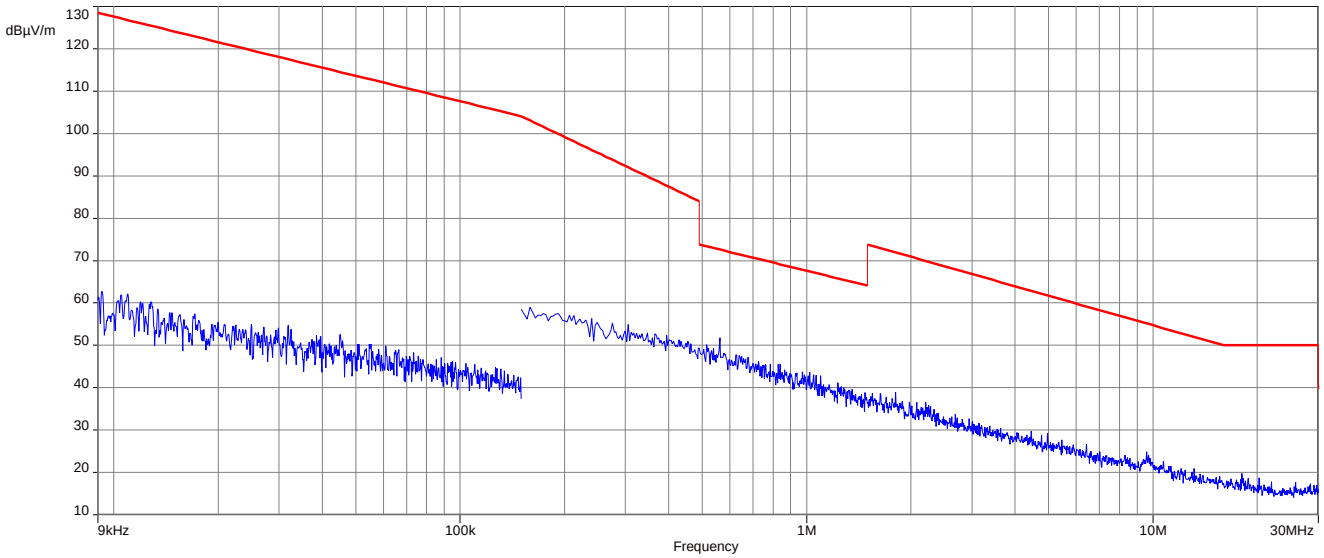
**Plot 1:** 9 kHz to 30 MHz, U-NII-1; lowest channel



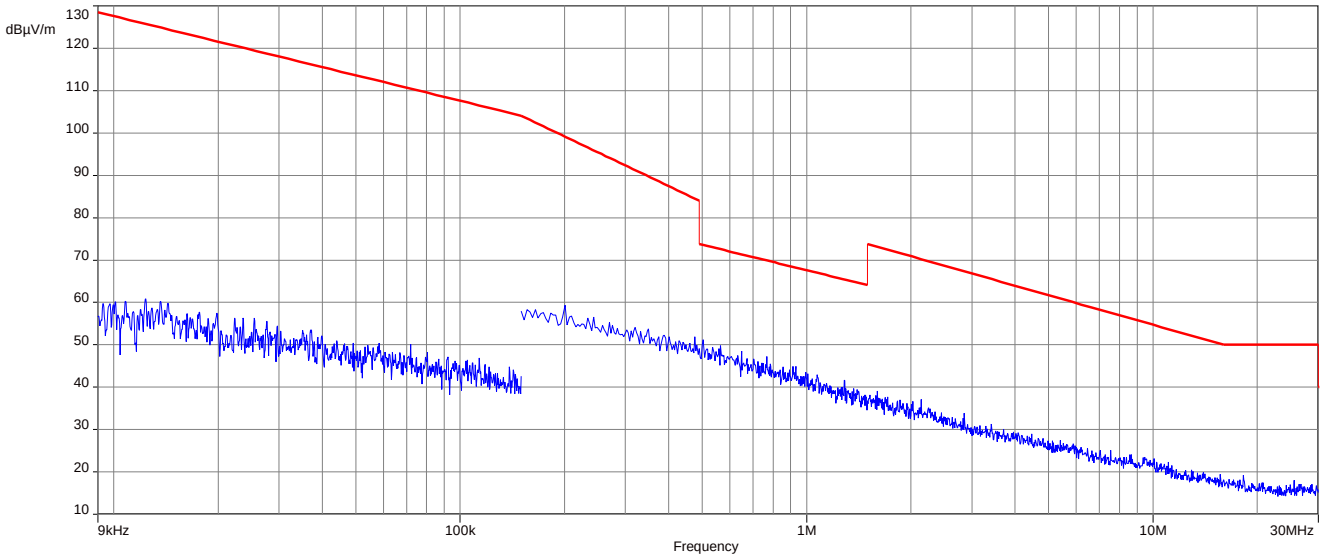

**Plot 2:** 9 kHz to 30 MHz, U-NII-1; highest channel



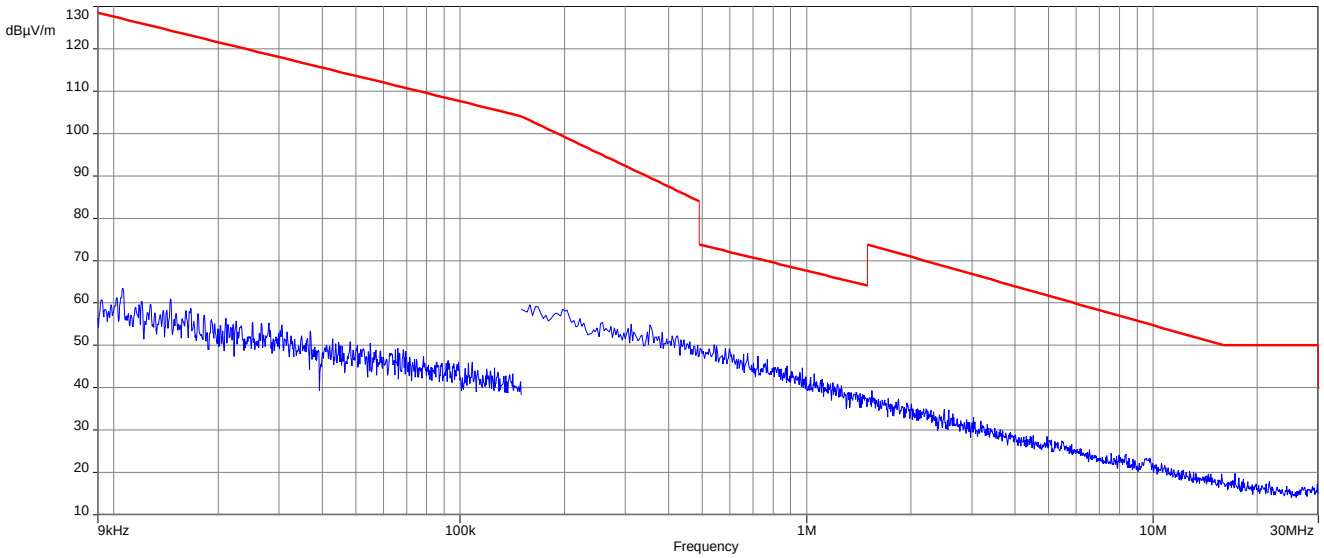
**Plot 3:** 9 kHz to 30 MHz, U-NII-2A; lowest channel



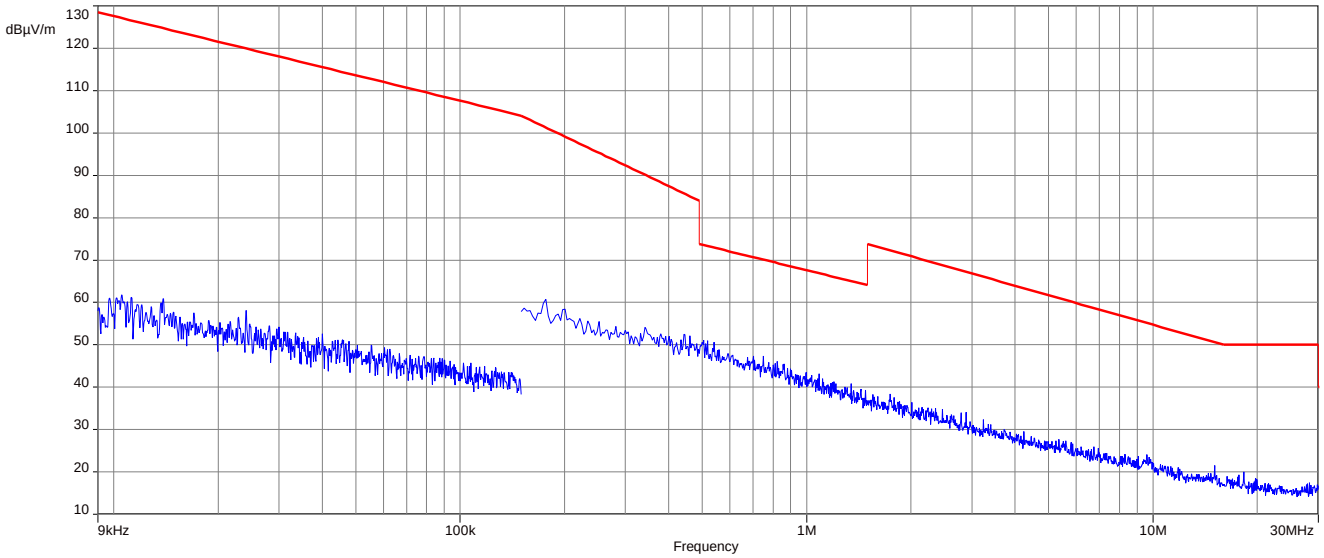

**Plot 4:** 9 kHz to 30 MHz, U-NII-2A; highest channel



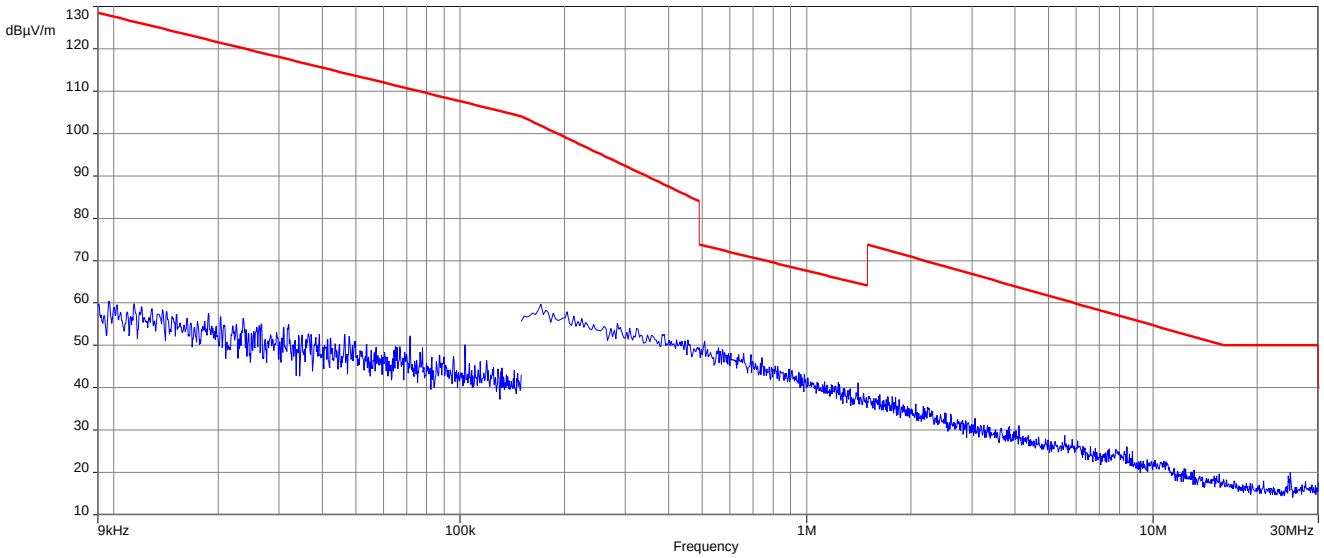
**Plot 5:** 9 kHz to 30 MHz, U-NII-2C; lowest channel



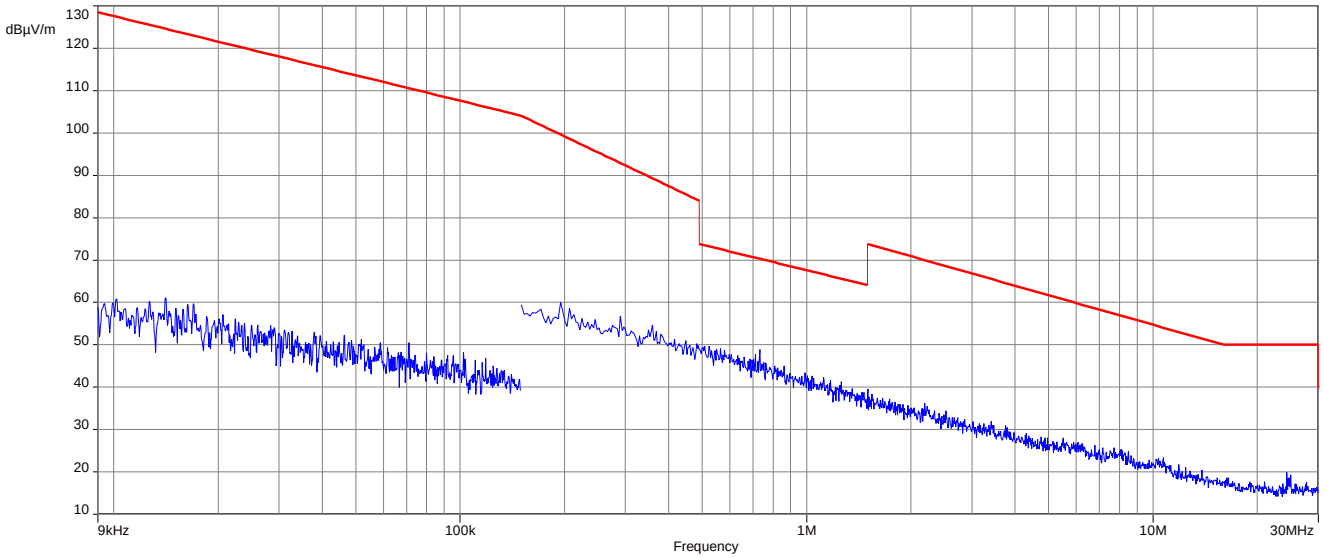

**Plot 6:** 9 kHz to 30 MHz, U-NII-2C; middle channel



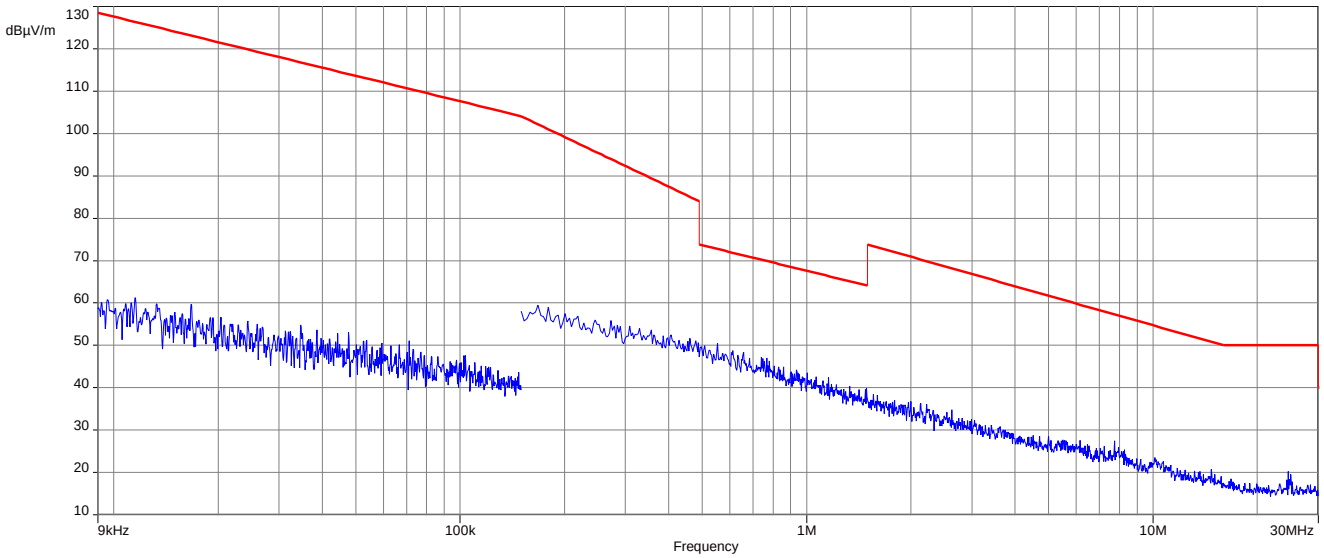
**Plot 7:** 9 kHz to 30 MHz, U-NII-2C; highest channel



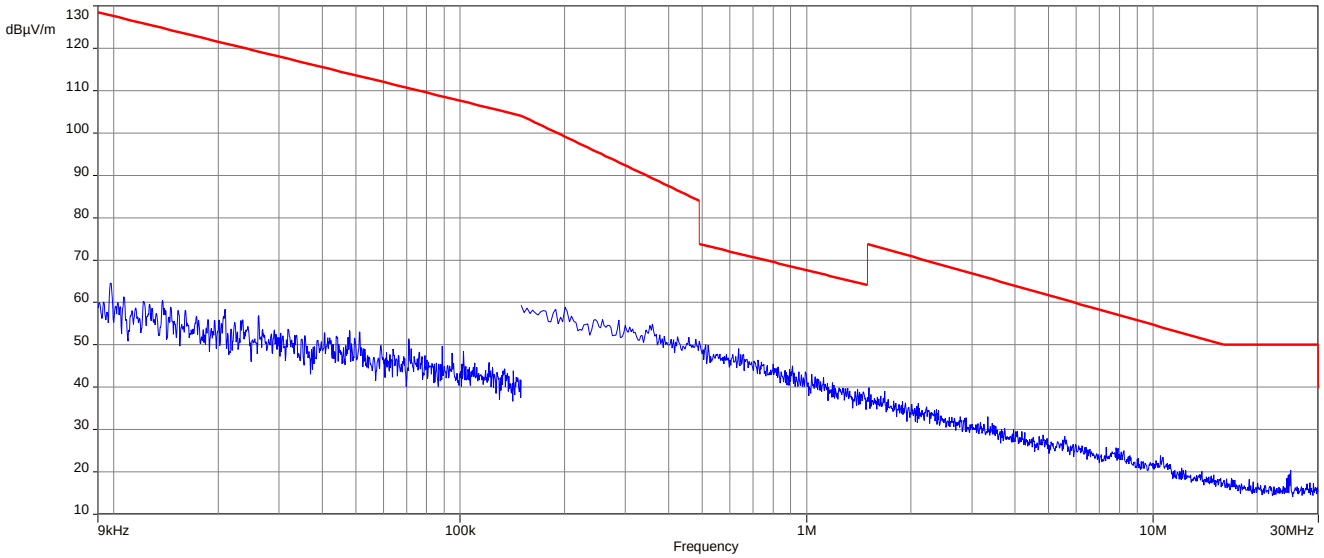

**Plot 8:** 9 kHz to 30 MHz, U-NII-3; lowest channel



**Plot 9:** 9 kHz to 30 MHz, U-NII-3; middle channel

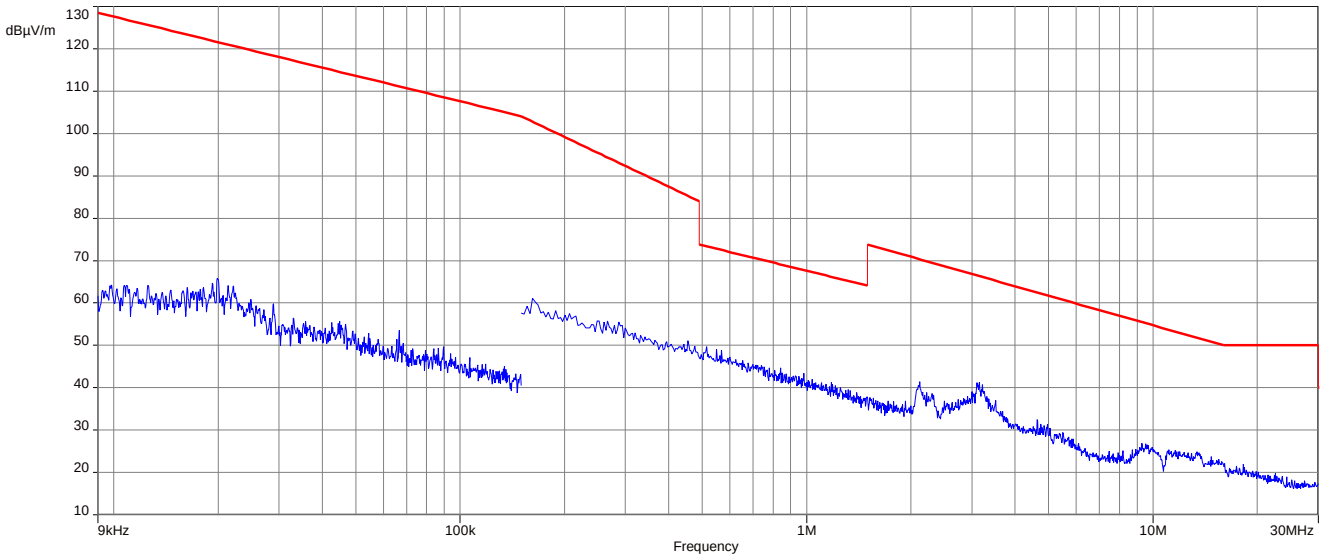



**Plot 10:** 9 kHz to 30 MHz, U-NII-3; highest channel

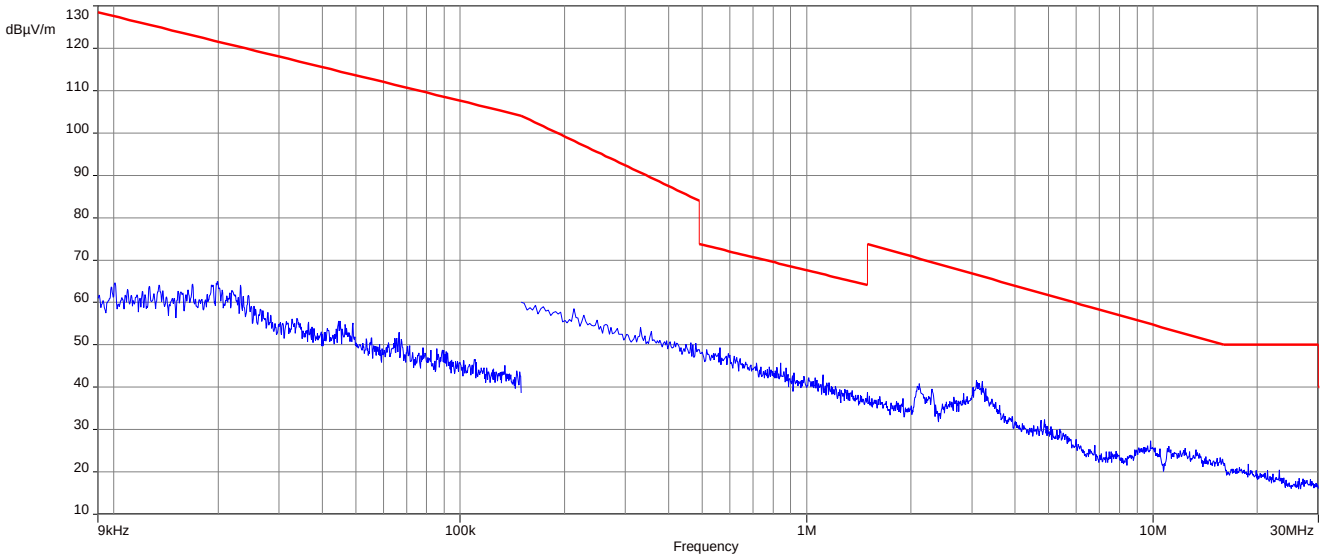


**Plots:** 40 MHz channel bandwidth

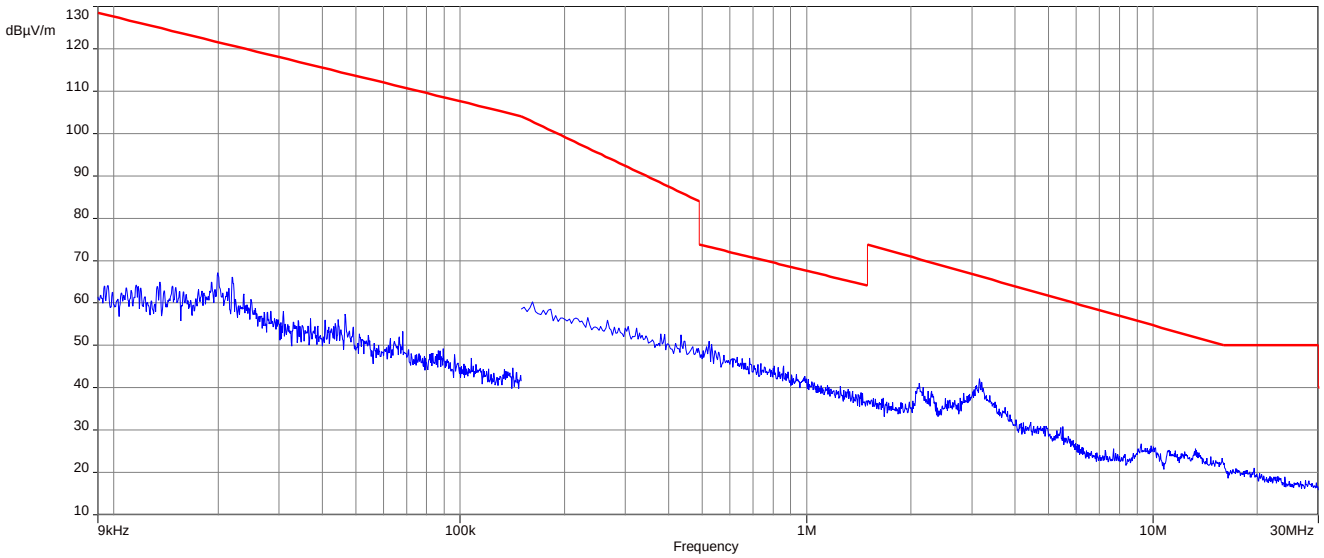
**Plot 1:** 9 kHz to 30 MHz, U-NII-1; lowest channel



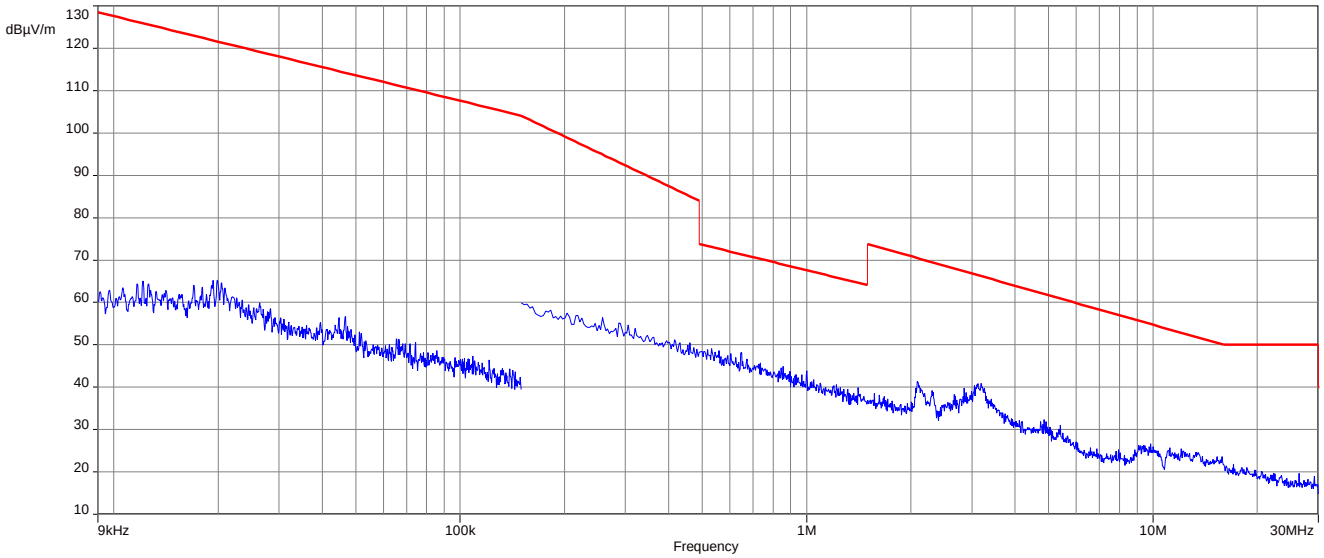

**Plot 2:** 9 kHz to 30 MHz, U-NII-1; highest channel



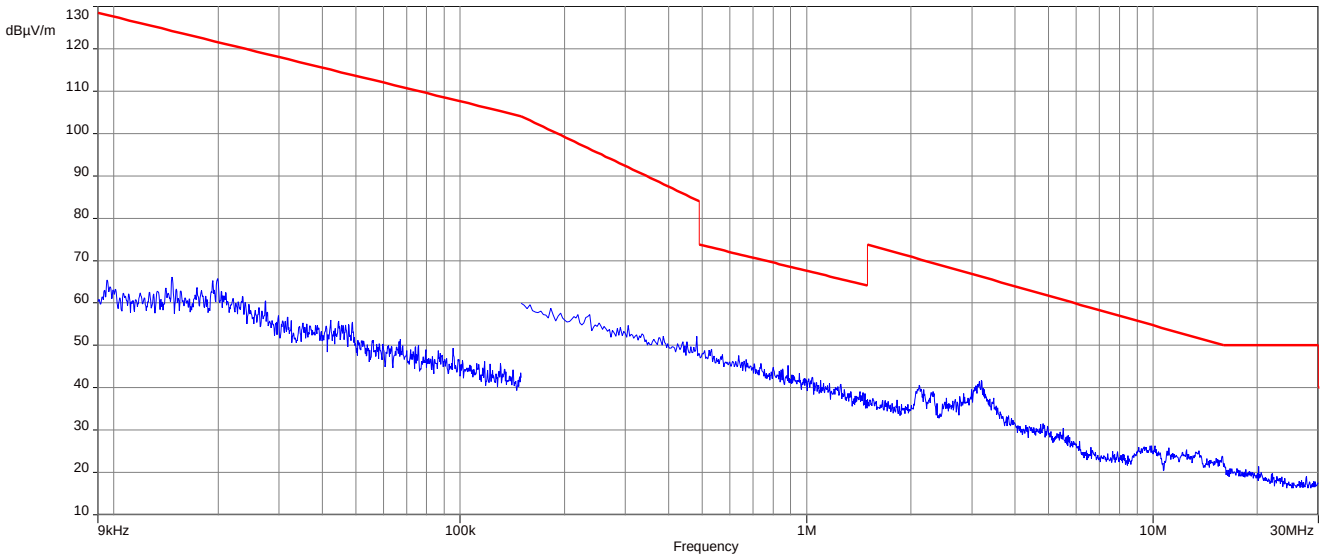
**Plot 3:** 9 kHz to 30 MHz, U-NII-2A; lowest channel



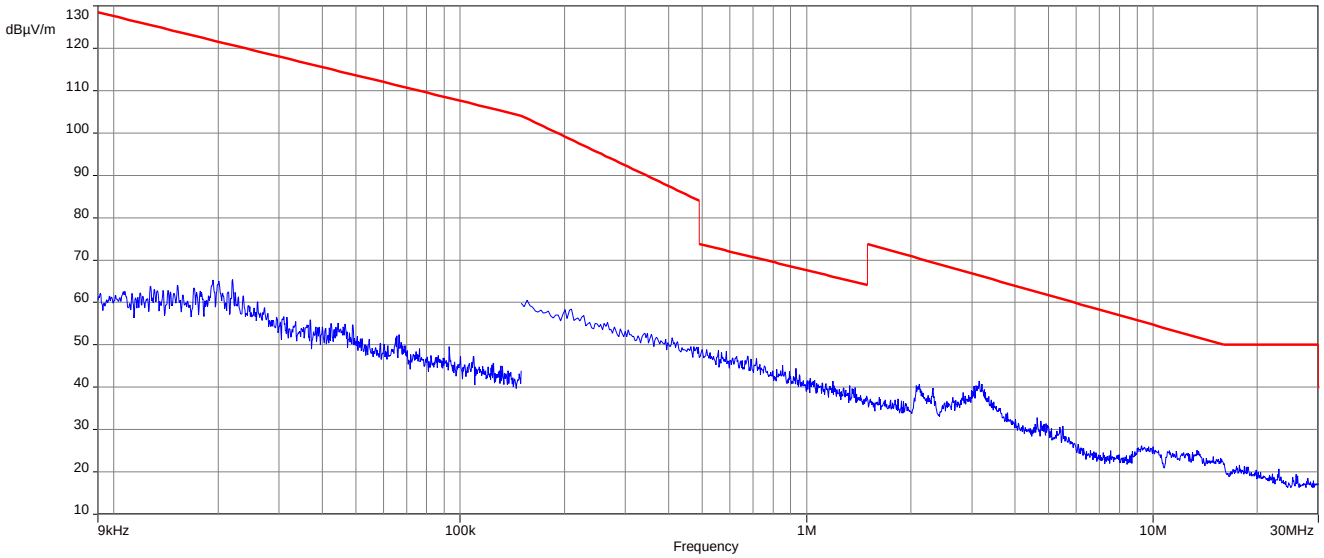

**Plot 4:** 9 kHz to 30 MHz, U-NII-2A; highest channel



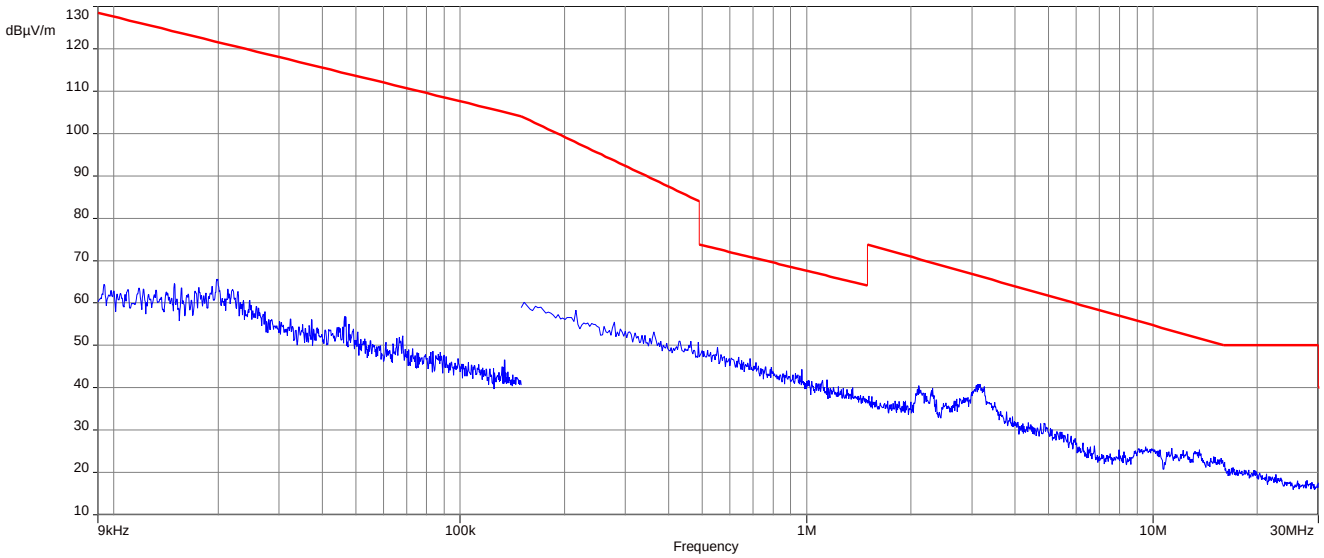
**Plot 5:** 9 kHz to 30 MHz, U-NII-2C; lowest channel



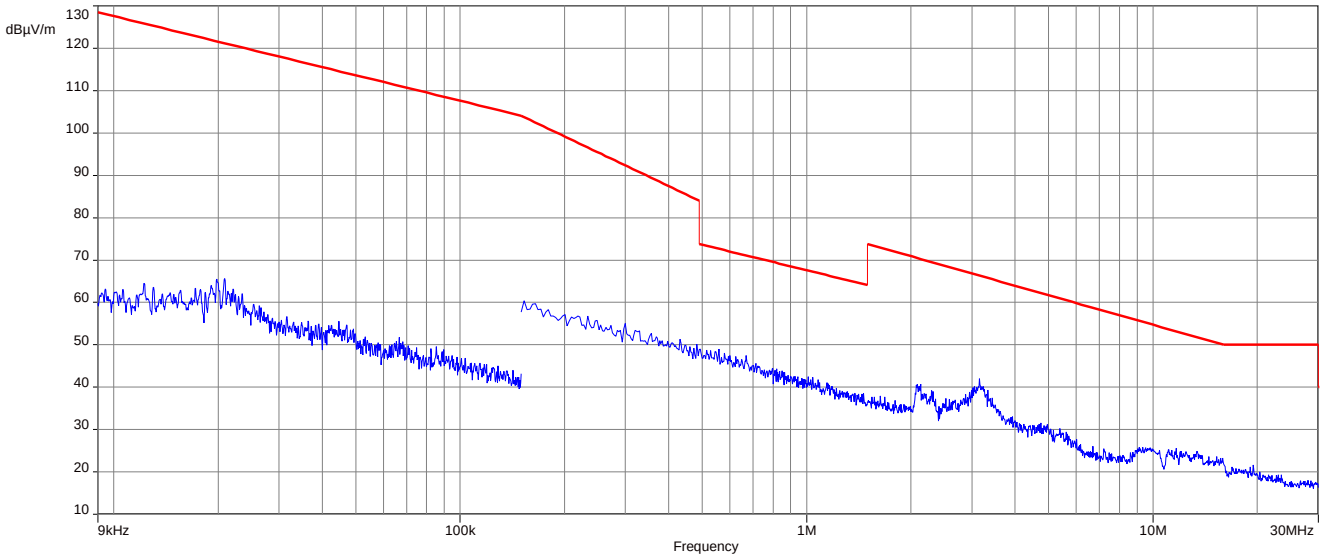

**Plot 6:** 9 kHz to 30 MHz, U-NII-2C; middle channel



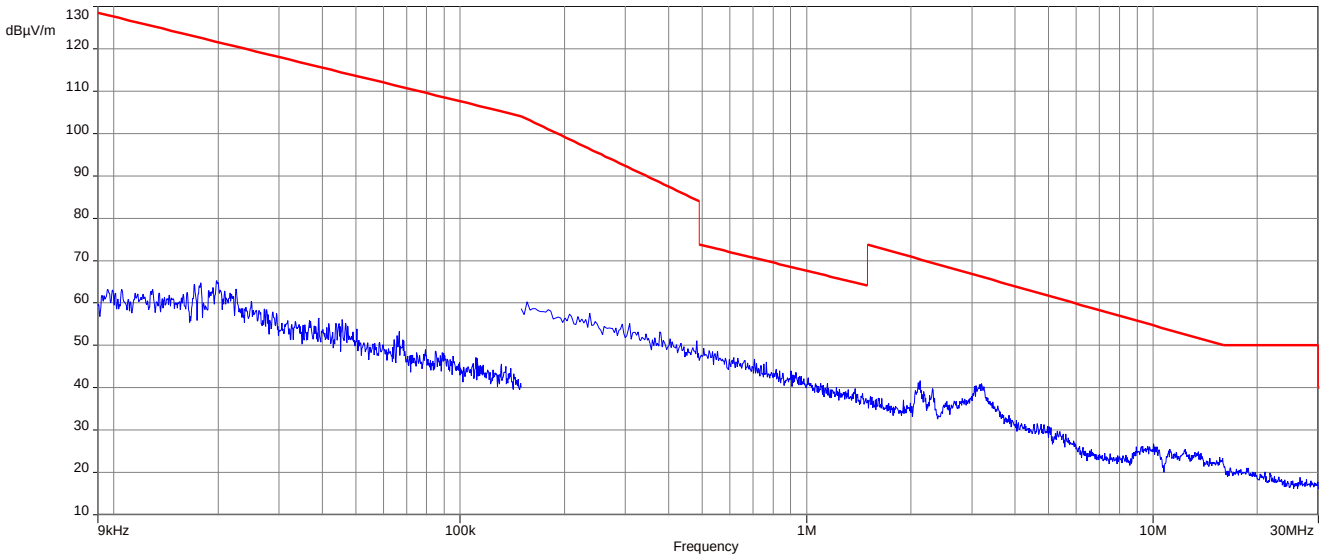
**Plot 7:** 9 kHz to 30 MHz, U-NII-2C; highest channel




**Plot 8:** 9 kHz to 30 MHz, U-NII-3; lowest channel



**Plot 9:** 9 kHz to 30 MHz, U-NII-3; highest channel



## 11.11 Spurious emissions radiated 30 MHz to 1 GHz

Description:

Measurement of the radiated spurious emissions and cabinet radiations below 1 GHz.

Measurement:

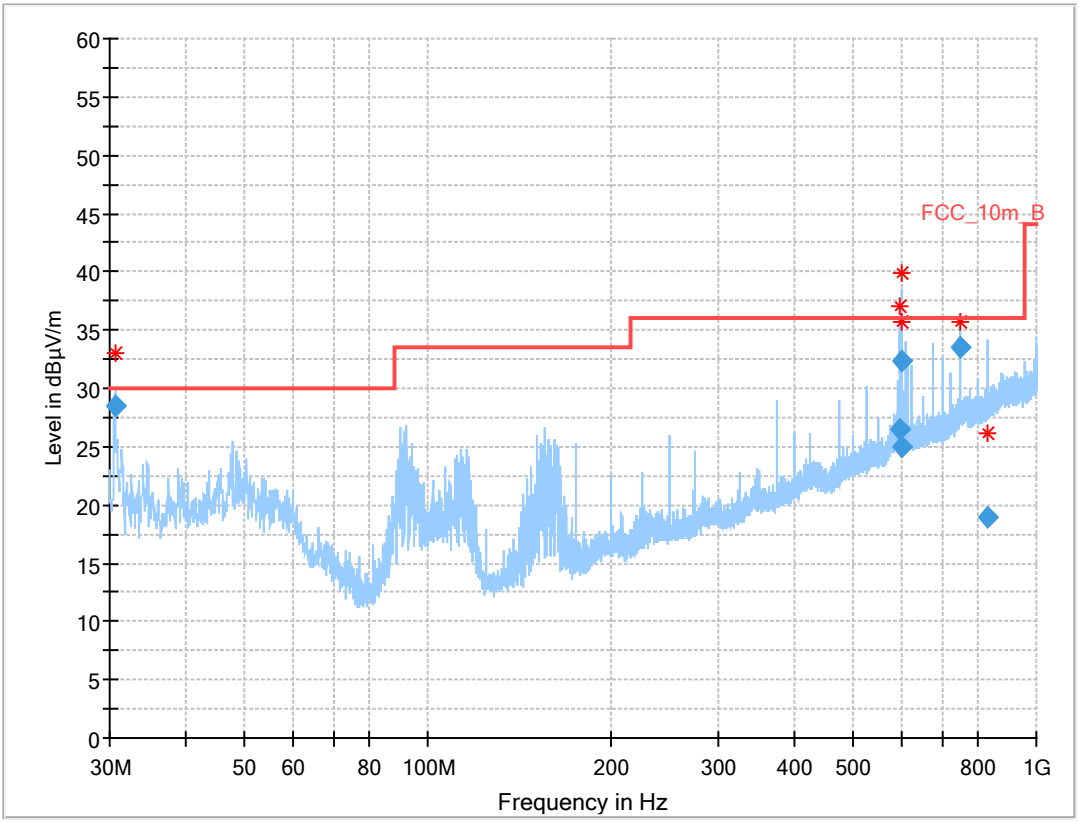
| Measurement parameter | |
|---|---|
| Detector: | Quasi Peak |
| Sweep time: | Auto |
| Resolution bandwidth: | 120 kHz |
| Video bandwidth: | 500 kHz |
| Span: | 30 MHz to 1 GHz |
| Test setup: | See sub clause 6.1 – A<br>See sub clause 6.2 – B<br>See sub clause 6.3 – A |
| Measurement uncertainty: | See chapter 8 |

Limits:

| TX Spurious Emissions Radiated | | |
|---|---|---|
| §15.209 | | |
| Frequency (MHz) | Field Strength (dBµV/m) | Measurement distance |
| 30 - 88 | 30.0 | 10 |
| 88 – 216 | 33.5 | 10 |
| 216 – 960 | 36.0 | 10 |
| Above 960 | 54.0 | 3 |
| §15.407 | | |
| Outside the restricted bands! | -27 dBm / MHz | |

**Plots:** 20 MHz channel bandwidth

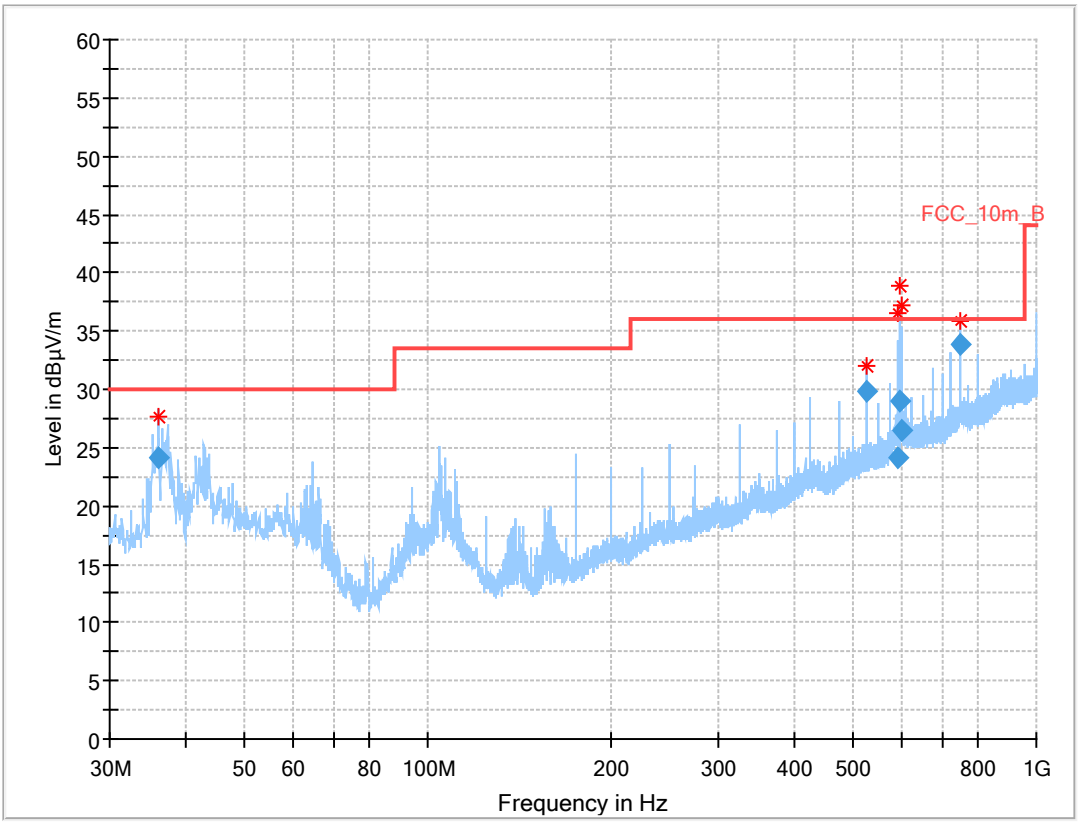
**Plot 1:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-1; lowest channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 30.611 | 28.45 | 30.0 | 1.6 | 1000 | 120 | 101.0 | V | 254 | 12 |
| 598.324 | 26.41 | 36.0 | 9.6 | 1000 | 120 | 160.0 | H | 268 | 20 |
| 600.000 | 32.40 | 36.0 | 3.6 | 1000 | 120 | 160.0 | H | 80 | 20 |
| 601.630 | 25.04 | 36.0 | 11.0 | 1000 | 120 | 160.0 | H | 268 | 20 |
| 749.995 | 33.57 | 36.0 | 2.4 | 1000 | 120 | 132.0 | H | 304 | 22 |
| 832.504 | 18.86 | 36.0 | 17.1 | 1000 | 120 | 160.0 | H | 119 | 23 |

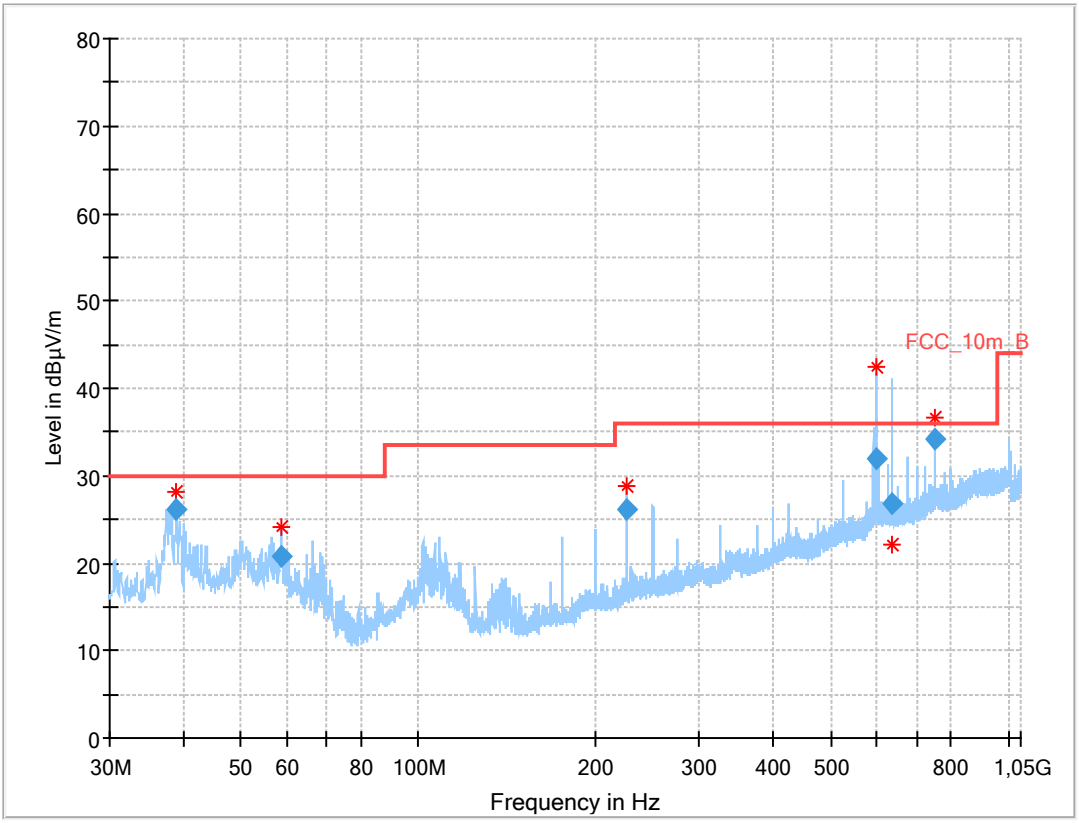
**Plot 2:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-1; middle channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 36.132 | 24.07 | 30.0 | 5.9 | 1000 | 120 | 116.0 | V | 280 | 13 |
| 525.007 | 29.84 | 36.0 | 6.2 | 1000 | 120 | 160.0 | H | 273 | 19 |
| 591.038 | 24.06 | 36.0 | 11.9 | 1000 | 120 | 160.0 | H | 294 | 20 |
| 598.343 | 29.07 | 36.0 | 6.9 | 1000 | 120 | 160.0 | H | 267 | 20 |
| 601.674 | 26.51 | 36.0 | 9.5 | 1000 | 120 | 160.0 | H | 355 | 20 |
| 750.005 | 33.91 | 36.0 | 2.1 | 1000 | 120 | 130.0 | H | 185 | 22 |

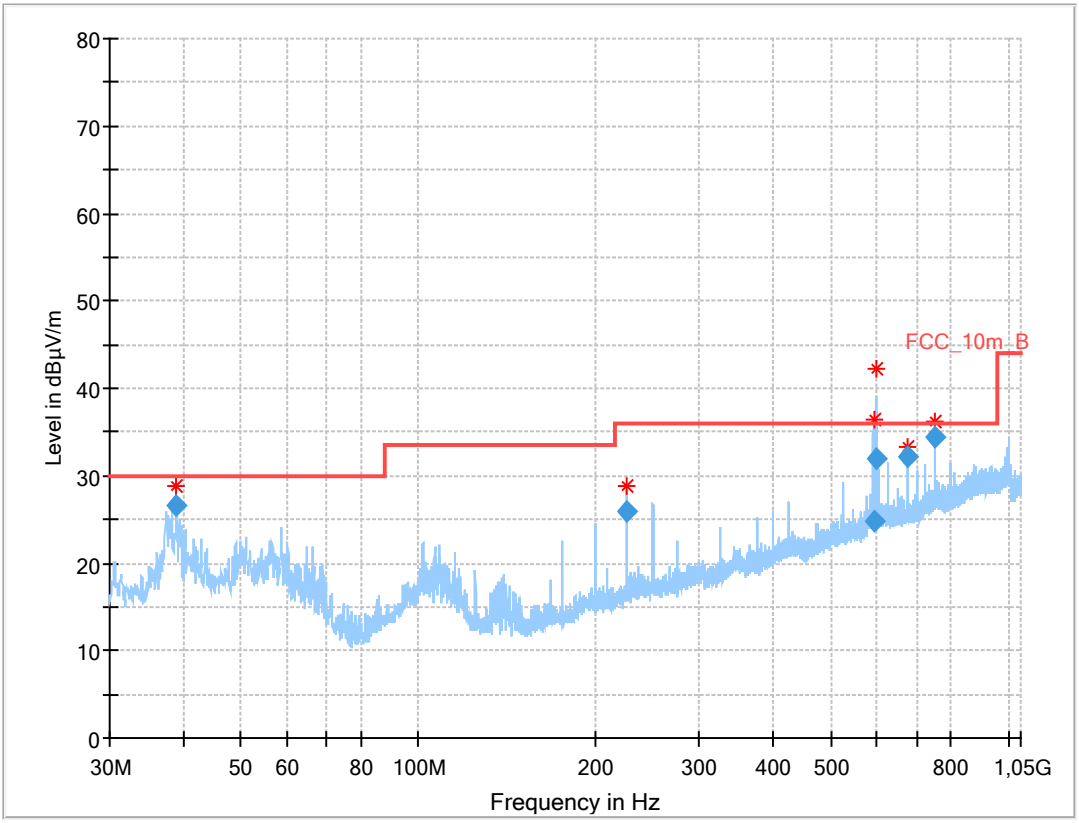
**Plot 3:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-1; highest channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 38.941 | 26.25 | 30.0 | 3.8 | 1000 | 120 | 98.0 | V | 202 | 13 |
| 58.721 | 20.80 | 30.0 | 9.2 | 1000 | 120 | 170.0 | V | 178 | 14 |
| 224.998 | 26.22 | 36.0 | 9.8 | 1000 | 120 | 127.0 | V | -22 | 12 |
| 598.330 | 31.90 | 36.0 | 4.1 | 1000 | 120 | 127.0 | H | 277 | 20 |
| 635.742 | 26.92 | 36.0 | 9.1 | 1000 | 120 | 170.0 | V | -22 | 20 |
| 749.996 | 34.23 | 36.0 | 1.8 | 1000 | 120 | 137.0 | H | 202 | 22 |

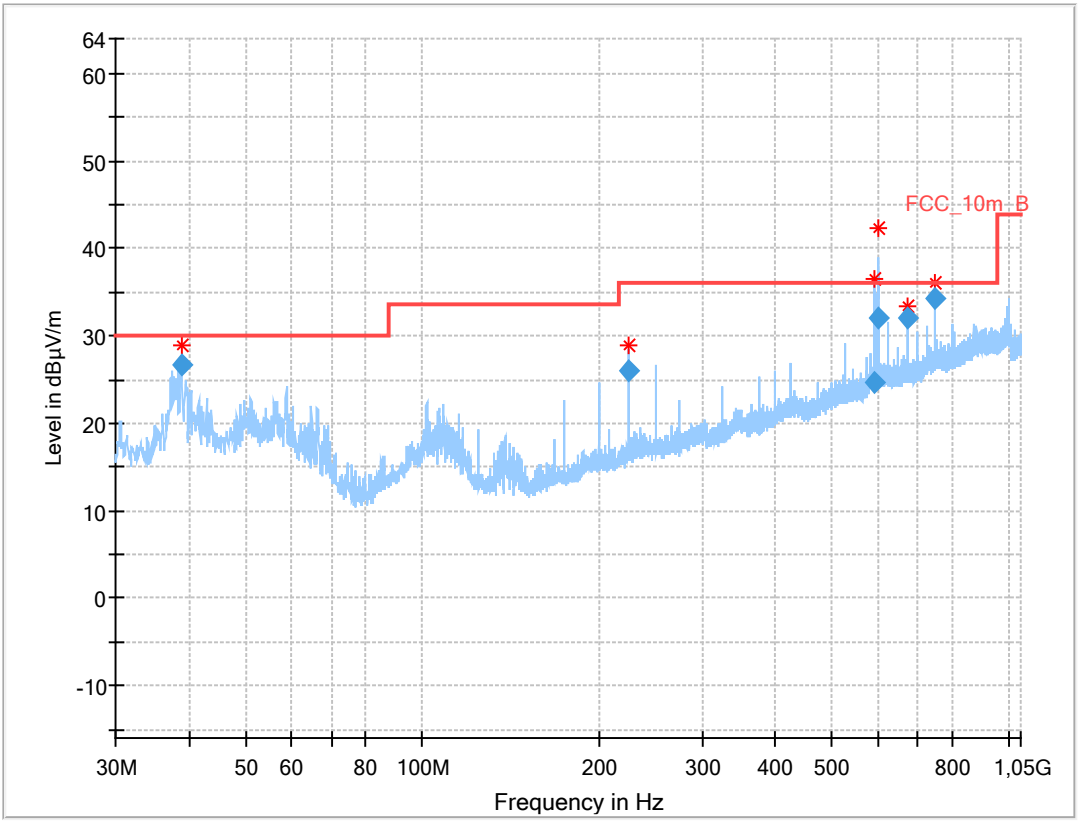
**Plot 4:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-2A; lowest channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 38.948 | 26.63 | 30.0 | 3.4 | 1000 | 120 | 114.0 | V | 157 | 13 |
| 224.996 | 25.99 | 36.0 | 10.0 | 1000 | 120 | 170.0 | V | -21 | 12 |
| 590.979 | 24.73 | 36.0 | 11.3 | 1000 | 120 | 170.0 | H | 274 | 20 |
| 598.340 | 31.96 | 36.0 | 4.0 | 1000 | 120 | 143.0 | H | 276 | 20 |
| 674.995 | 32.11 | 36.0 | 3.9 | 1000 | 120 | 170.0 | H | 247 | 21 |
| 749.998 | 34.32 | 36.0 | 1.7 | 1000 | 120 | 155.0 | H | 202 | 22 |

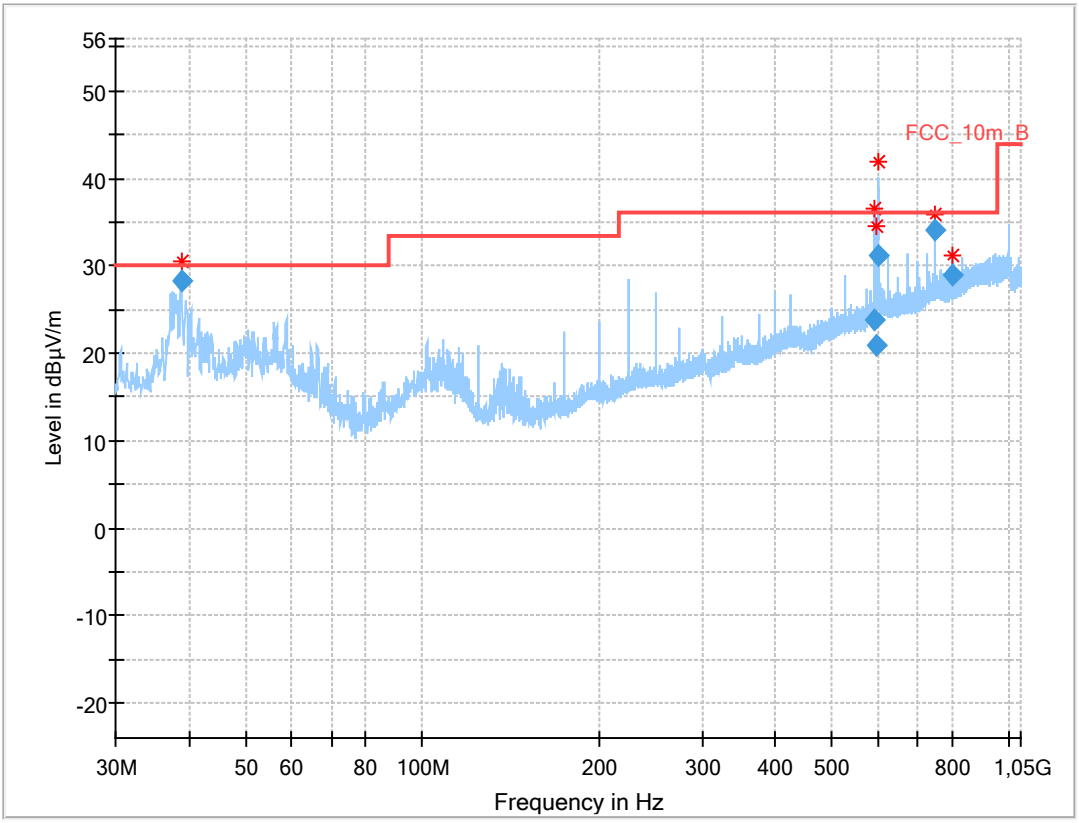
**Plot 5:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-2A; middle channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 38.948 | 26.63 | 30.0 | 3.4 | 1000 | 120 | 114.0 | V | 157 | 13 |
| 224.996 | 25.99 | 36.0 | 10.0 | 1000 | 120 | 170.0 | V | -21 | 12 |
| 590.979 | 24.73 | 36.0 | 11.3 | 1000 | 120 | 170.0 | H | 274 | 20 |
| 598.340 | 31.96 | 36.0 | 4.0 | 1000 | 120 | 143.0 | H | 276 | 20 |
| 674.995 | 32.11 | 36.0 | 3.9 | 1000 | 120 | 170.0 | H | 247 | 21 |
| 749.998 | 34.32 | 36.0 | 1.7 | 1000 | 120 | 155.0 | H | 202 | 22 |

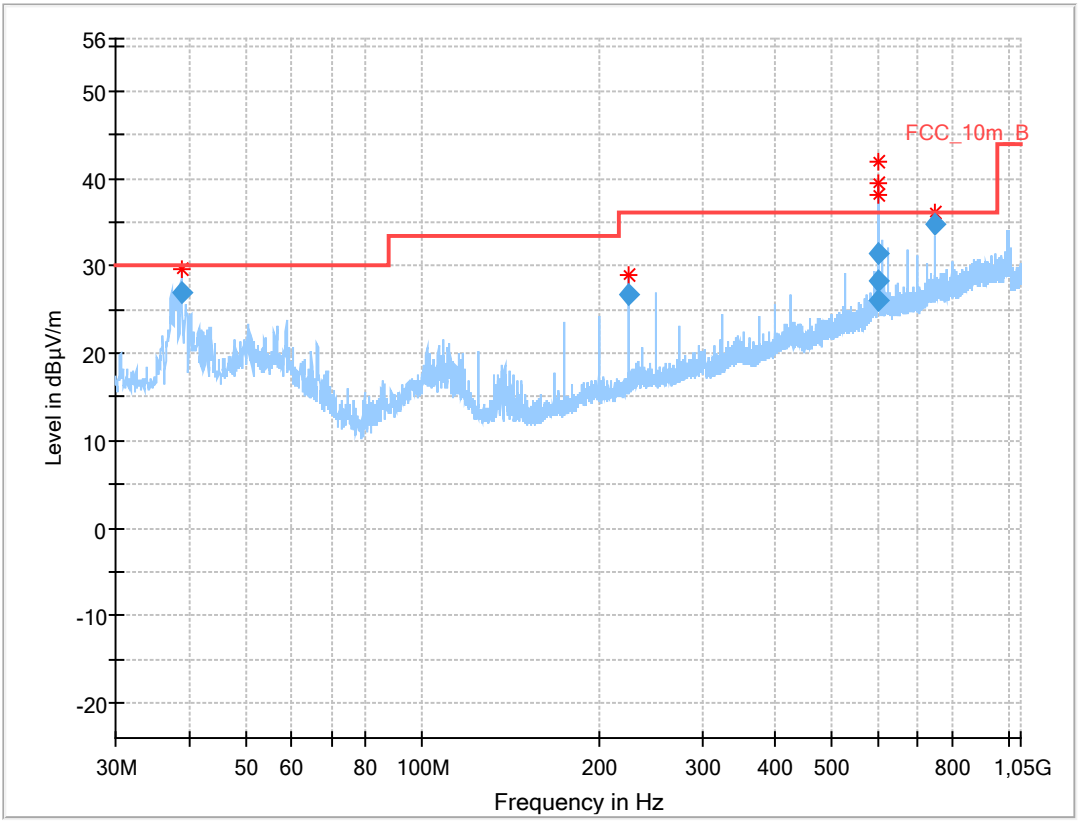
**Plot 6:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-2A; highest channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 38.949 | 28.35 | 30.0 | 1.7 | 1000 | 120 | 101.0 | V | 202 | 13 |
| 591.030 | 23.91 | 36.0 | 12.1 | 1000 | 120 | 162.0 | H | 278 | 20 |
| 594.648 | 21.02 | 36.0 | 15.0 | 1000 | 120 | 170.0 | H | 279 | 20 |
| 598.313 | 31.12 | 36.0 | 4.9 | 1000 | 120 | 151.0 | H | 279 | 20 |
| 749.991 | 34.07 | 36.0 | 1.9 | 1000 | 120 | 129.0 | H | 202 | 22 |
| 799.996 | 29.00 | 36.0 | 7.0 | 1000 | 120 | 148.0 | H | 202 | 22 |

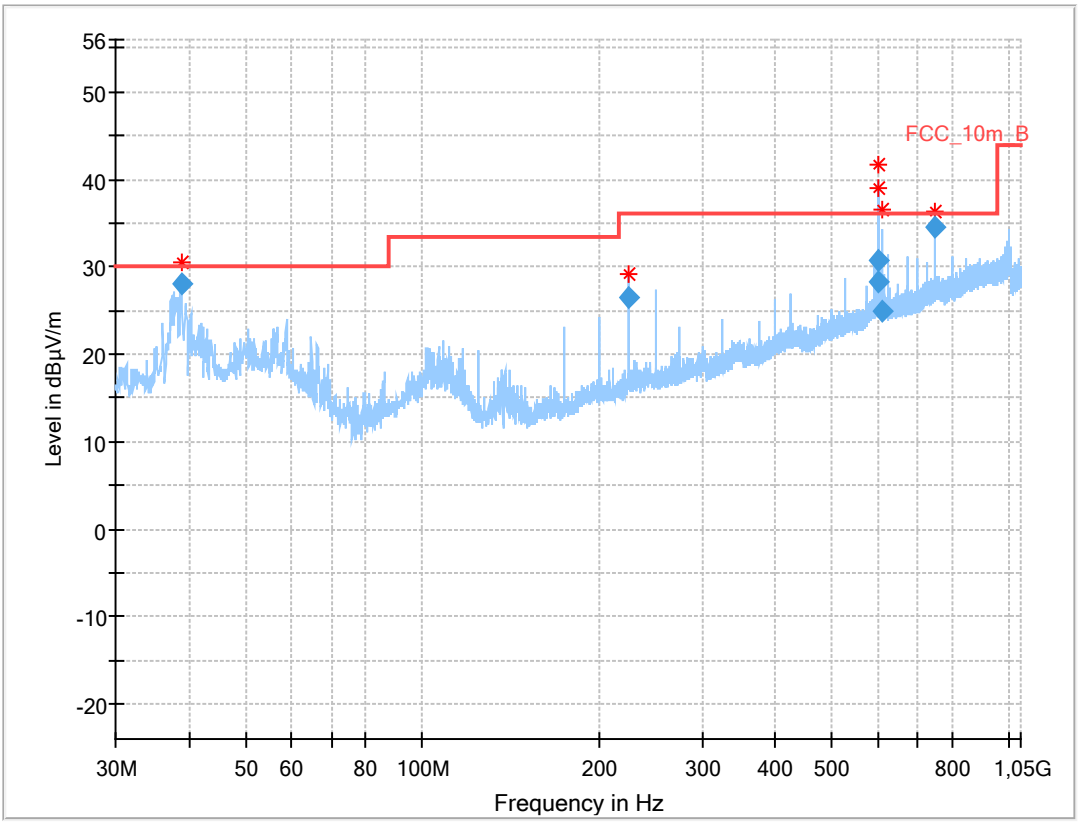
**Plot 7:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-2C; lowest channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 38.943 | 26.97 | 30.0 | 3.0 | 1000 | 120 | 139.0 | V | 286 | 13 |
| 224.996 | 26.71 | 36.0 | 9.3 | 1000 | 120 | 133.0 | V | 13 | 12 |
| 598.072 | 26.05 | 36.0 | 10.0 | 1000 | 120 | 170.0 | H | 112 | 20 |
| 598.323 | 28.32 | 36.0 | 7.7 | 1000 | 120 | 170.0 | H | 112 | 20 |
| 601.682 | 31.39 | 36.0 | 4.6 | 1000 | 120 | 144.0 | H | 265 | 20 |
| 749.987 | 34.74 | 36.0 | 1.3 | 1000 | 120 | 132.0 | H | 202 | 22 |

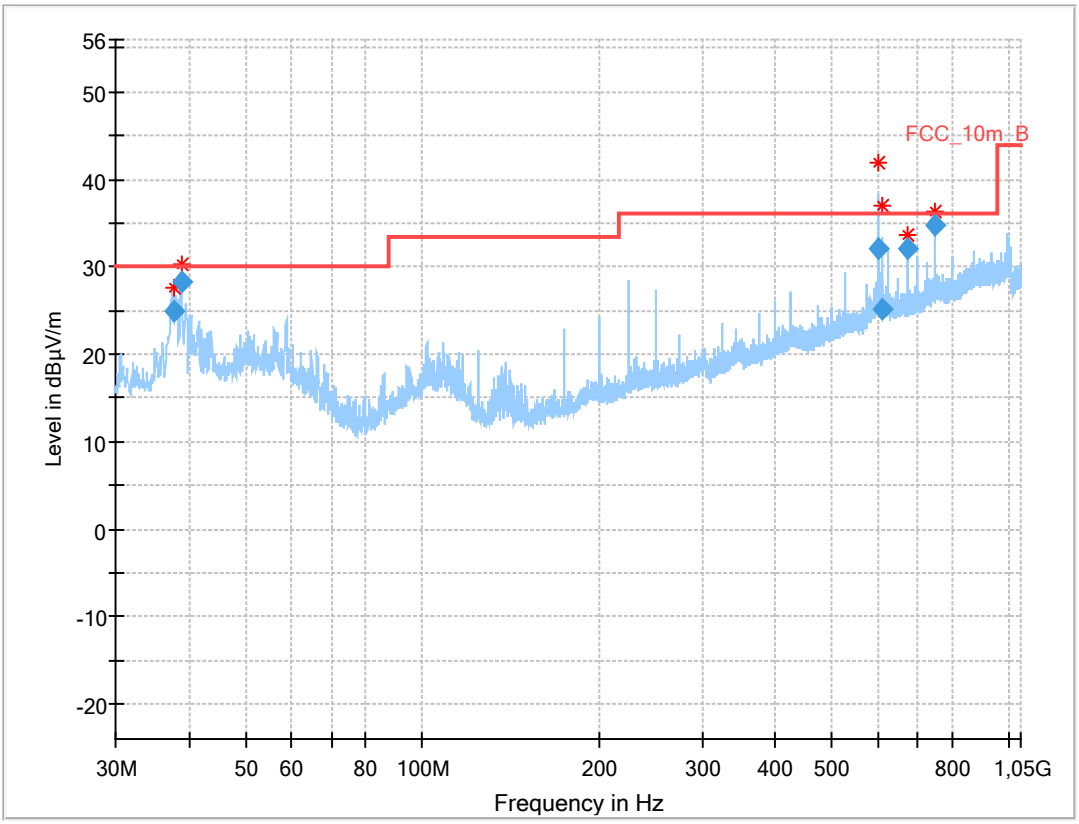
**Plot 8:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-2C; middle channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 38.949 | 28.13 | 30.0 | 1.9 | 1000 | 120 | 118.0 | V | 202 | 13 |
| 224.999 | 26.52 | 36.0 | 9.5 | 1000 | 120 | 170.0 | V | 22 | 12 |
| 598.334 | 28.39 | 36.0 | 7.6 | 1000 | 120 | 170.0 | H | 112 | 20 |
| 601.694 | 30.73 | 36.0 | 5.3 | 1000 | 120 | 153.0 | H | 276 | 20 |
| 608.904 | 25.05 | 36.0 | 11.0 | 1000 | 120 | 170.0 | H | 273 | 21 |
| 749.995 | 34.46 | 36.0 | 1.5 | 1000 | 120 | 132.0 | H | 202 | 22 |

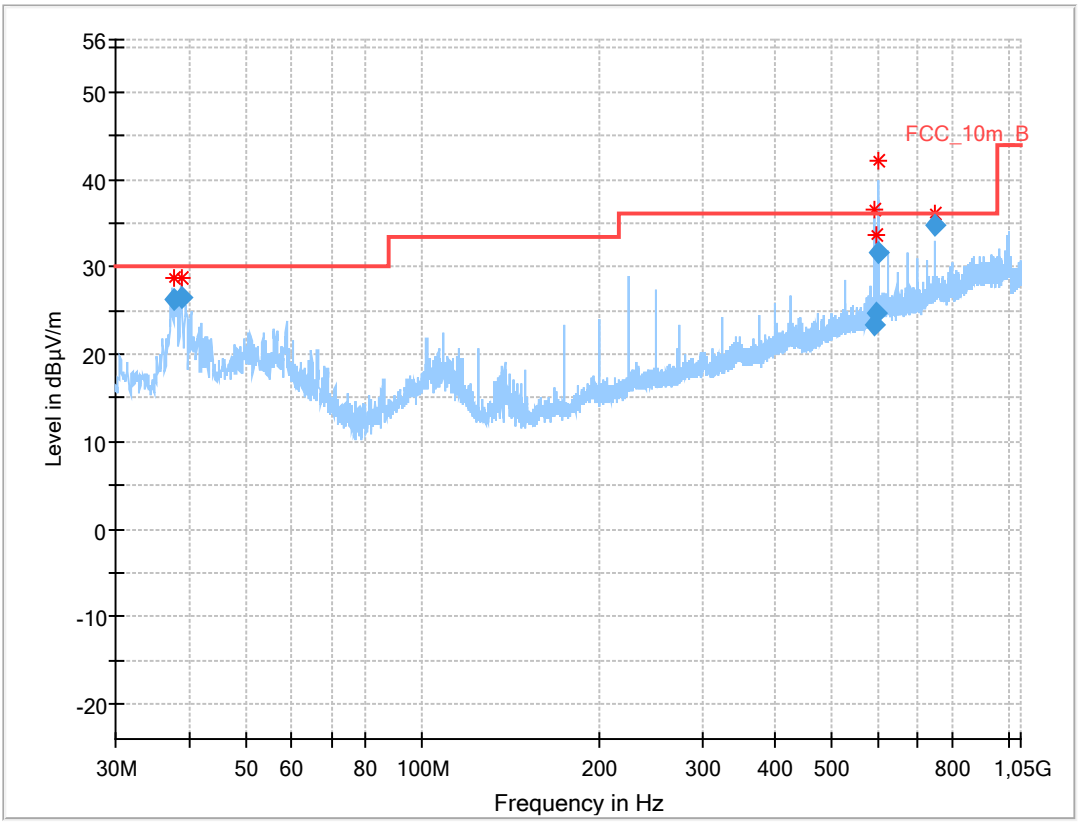
**Plot 9:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-2C; highest channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 37.801 | 24.89 | 30.0 | 5.1 | 1000 | 120 | 102.0 | V | 292 | 13 |
| 38.957 | 28.28 | 30.0 | 1.7 | 1000 | 120 | 107.0 | V | 202 | 13 |
| 601.668 | 31.99 | 36.0 | 4.0 | 1000 | 120 | 151.0 | H | 279 | 20 |
| 608.984 | 25.19 | 36.0 | 10.8 | 1000 | 120 | 170.0 | H | 280 | 21 |
| 675.006 | 32.17 | 36.0 | 3.8 | 1000 | 120 | 166.0 | H | 247 | 21 |
| 750.002 | 34.72 | 36.0 | 1.3 | 1000 | 120 | 130.0 | H | 202 | 22 |

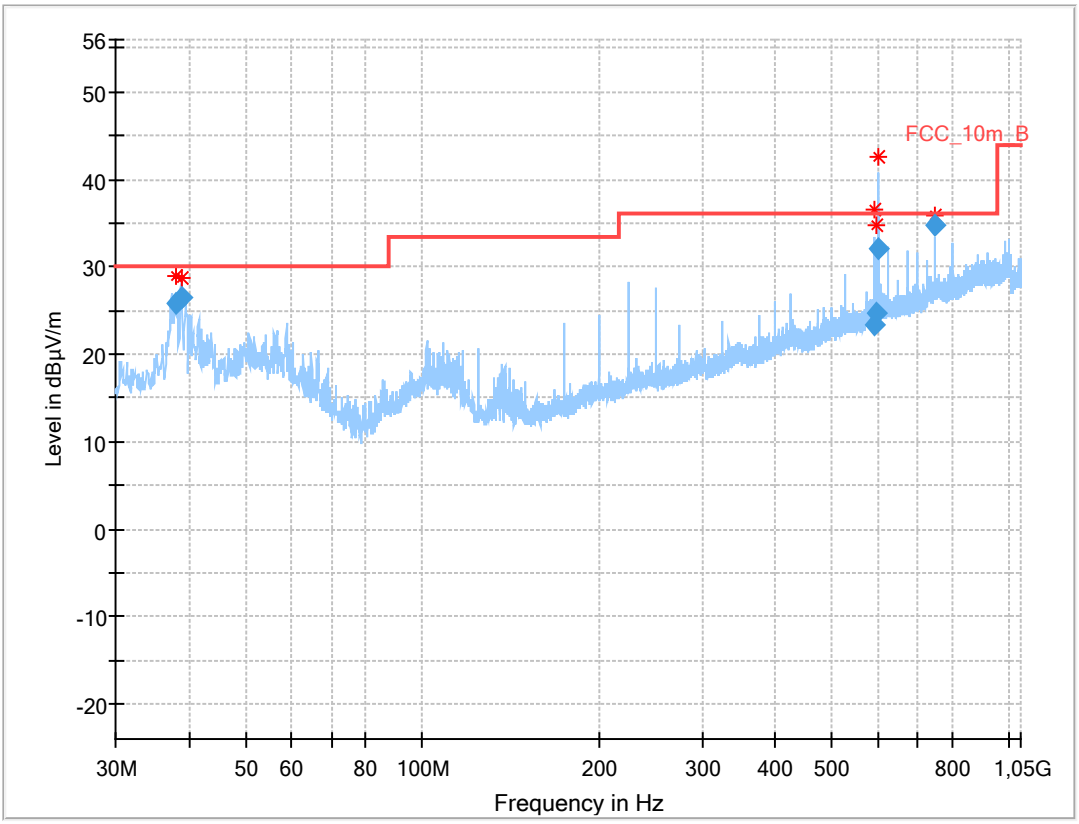
**Plot 10:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-3; lowest channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 37.778 | 26.33 | 30.0 | 3.7 | 1000 | 120 | 131.0 | V | 202 | 13 |
| 38.949 | 26.58 | 30.0 | 3.4 | 1000 | 120 | 107.0 | V | 264 | 13 |
| 591.057 | 23.41 | 36.0 | 12.6 | 1000 | 120 | 170.0 | H | 279 | 20 |
| 594.718 | 24.63 | 36.0 | 11.4 | 1000 | 120 | 134.0 | H | 292 | 20 |
| 598.314 | 31.55 | 36.0 | 4.5 | 1000 | 120 | 139.0 | H | 275 | 20 |
| 749.995 | 34.86 | 36.0 | 1.1 | 1000 | 120 | 132.0 | H | 202 | 22 |

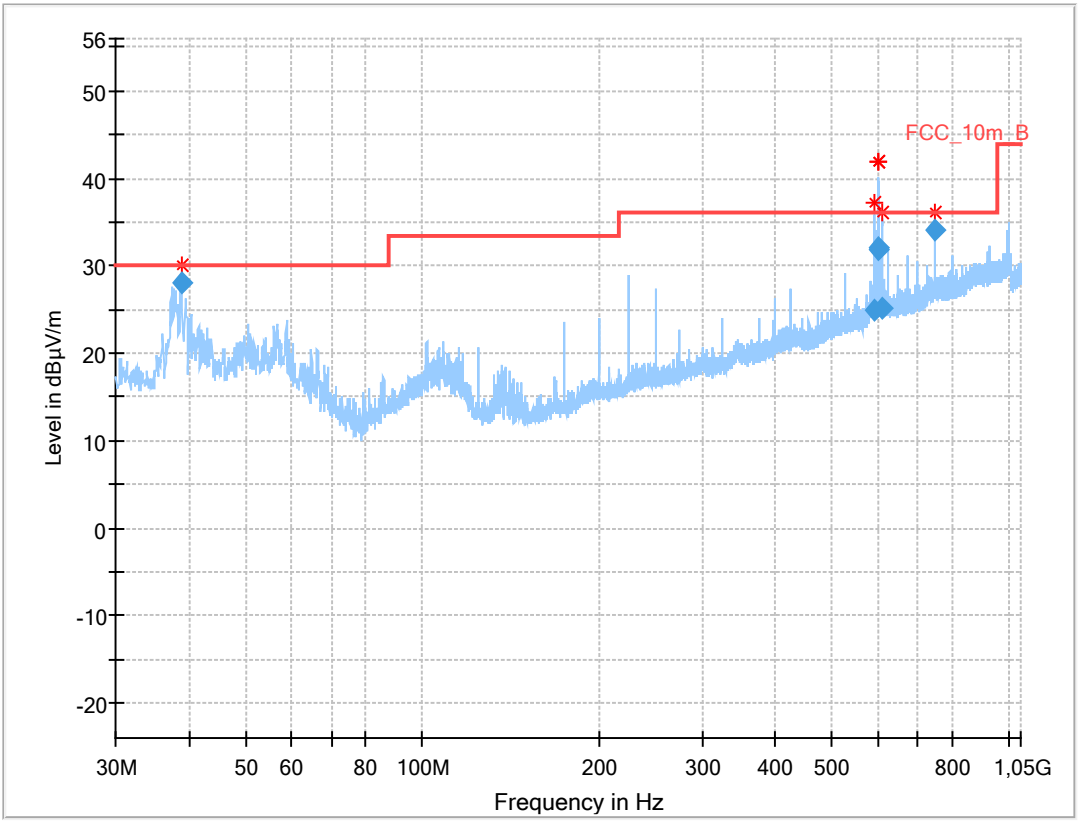
**Plot 11:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-3; middle channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 38.088 | 25.91 | 30.0 | 4.1 | 1000 | 120 | 122.0 | V | 202 | 13 |
| 38.957 | 26.55 | 30.0 | 3.5 | 1000 | 120 | 98.0 | V | 262 | 13 |
| 591.065 | 23.46 | 36.0 | 12.5 | 1000 | 120 | 170.0 | H | 249 | 20 |
| 594.678 | 24.68 | 36.0 | 11.3 | 1000 | 120 | 159.0 | H | 268 | 20 |
| 598.325 | 32.06 | 36.0 | 3.9 | 1000 | 120 | 138.0 | H | 276 | 20 |
| 749.991 | 34.67 | 36.0 | 1.3 | 1000 | 120 | 137.0 | H | 202 | 22 |

**Plot 12:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-3; highest channel

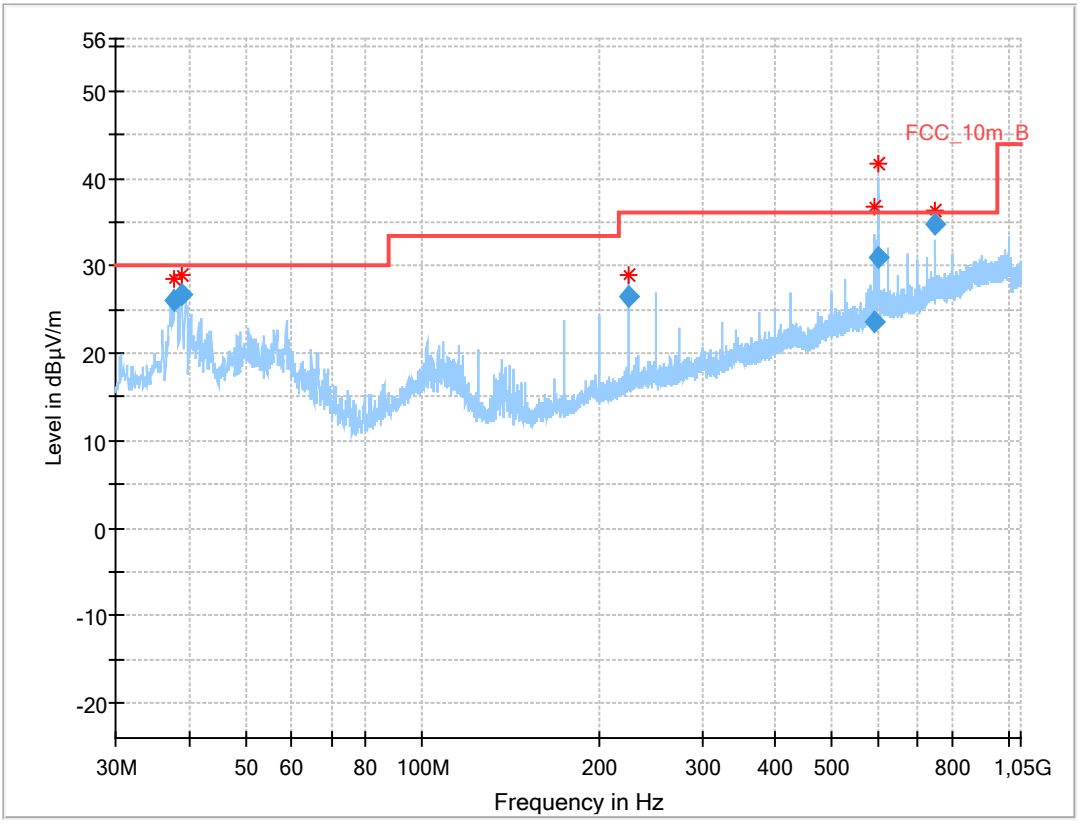



**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 38.936 | 28.05 | 30.0 | 2.0 | 1000 | 120 | 101.0 | V | 202 | 13 |
| 591.008 | 24.98 | 36.0 | 11.0 | 1000 | 120 | 138.0 | H | 272 | 20 |
| 598.343 | 32.03 | 36.0 | 4.0 | 1000 | 120 | 134.0 | H | 275 | 20 |
| 601.657 | 31.88 | 36.0 | 4.1 | 1000 | 120 | 155.0 | H | 279 | 20 |
| 608.963 | 25.08 | 36.0 | 10.9 | 1000 | 120 | 170.0 | H | 266 | 21 |
| 749.992 | 34.09 | 36.0 | 1.9 | 1000 | 120 | 132.0 | H | 202 | 22 |

**Plots:** 40 MHz channel bandwidth

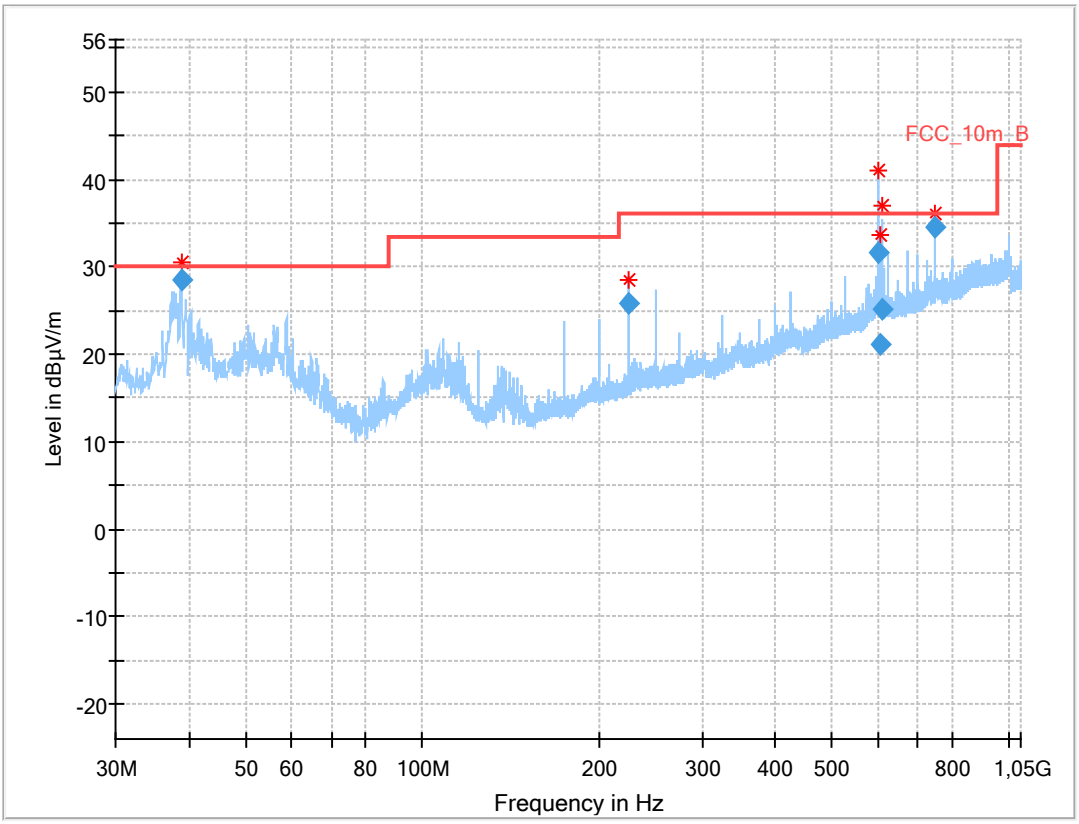
**Plot 1:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-1; lowest channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 37.799 | 26.01 | 30.0 | 4.0 | 1000 | 120 | 151.0 | V | 188 | 13 |
| 38.956 | 26.78 | 30.0 | 3.2 | 1000 | 120 | 98.0 | V | 263 | 13 |
| 224.989 | 26.47 | 36.0 | 9.5 | 1000 | 120 | 151.0 | V | 22 | 12 |
| 591.029 | 23.69 | 36.0 | 12.3 | 1000 | 120 | 170.0 | H | 273 | 20 |
| 598.308 | 31.04 | 36.0 | 5.0 | 1000 | 120 | 139.0 | H | 266 | 20 |
| 749.985 | 34.75 | 36.0 | 1.3 | 1000 | 120 | 131.0 | H | 202 | 22 |

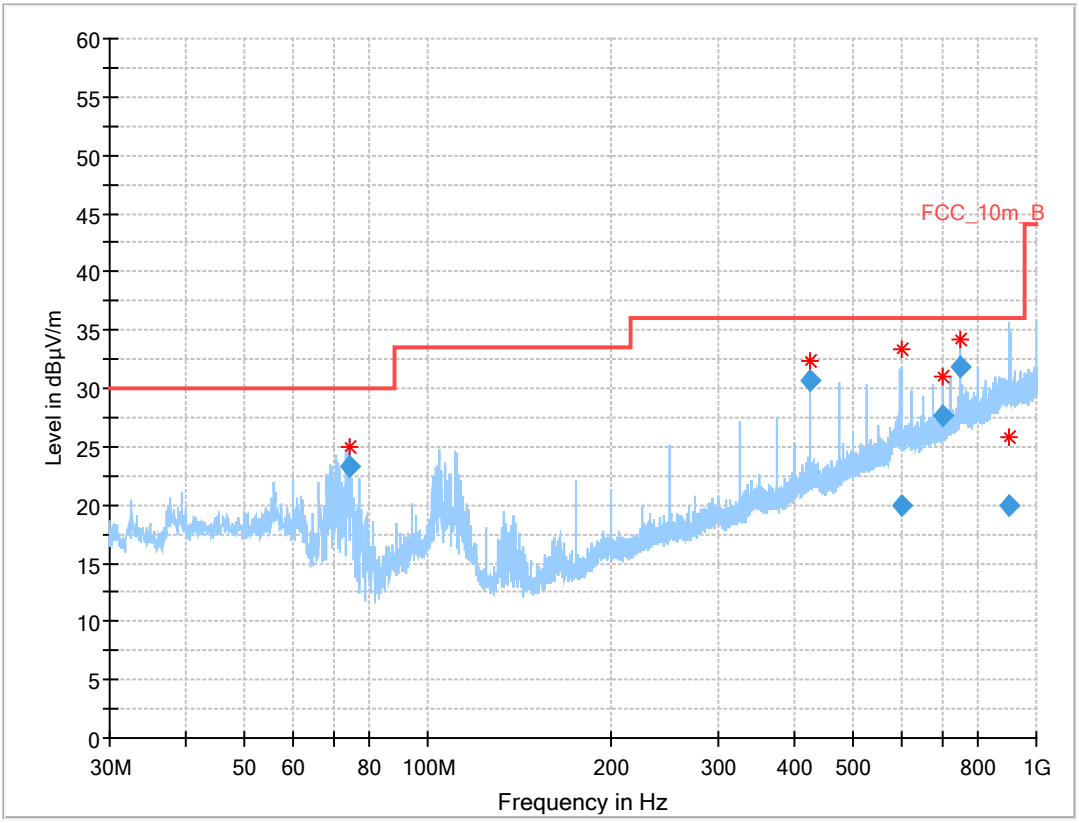
**Plot 2:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-1; highest channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 38.948 | 28.50 | 30.0 | 1.5 | 1000 | 120 | 101.0 | V | 202 | 13 |
| 224.982 | 25.85 | 36.0 | 10.2 | 1000 | 120 | 110.0 | V | -22 | 12 |
| 601.651 | 31.55 | 36.0 | 4.5 | 1000 | 120 | 136.0 | H | 248 | 20 |
| 605.308 | 21.20 | 36.0 | 14.8 | 1000 | 120 | 134.0 | H | 259 | 20 |
| 608.947 | 25.11 | 36.0 | 10.9 | 1000 | 120 | 170.0 | H | 260 | 21 |
| 749.991 | 34.65 | 36.0 | 1.4 | 1000 | 120 | 124.0 | H | 202 | 22 |

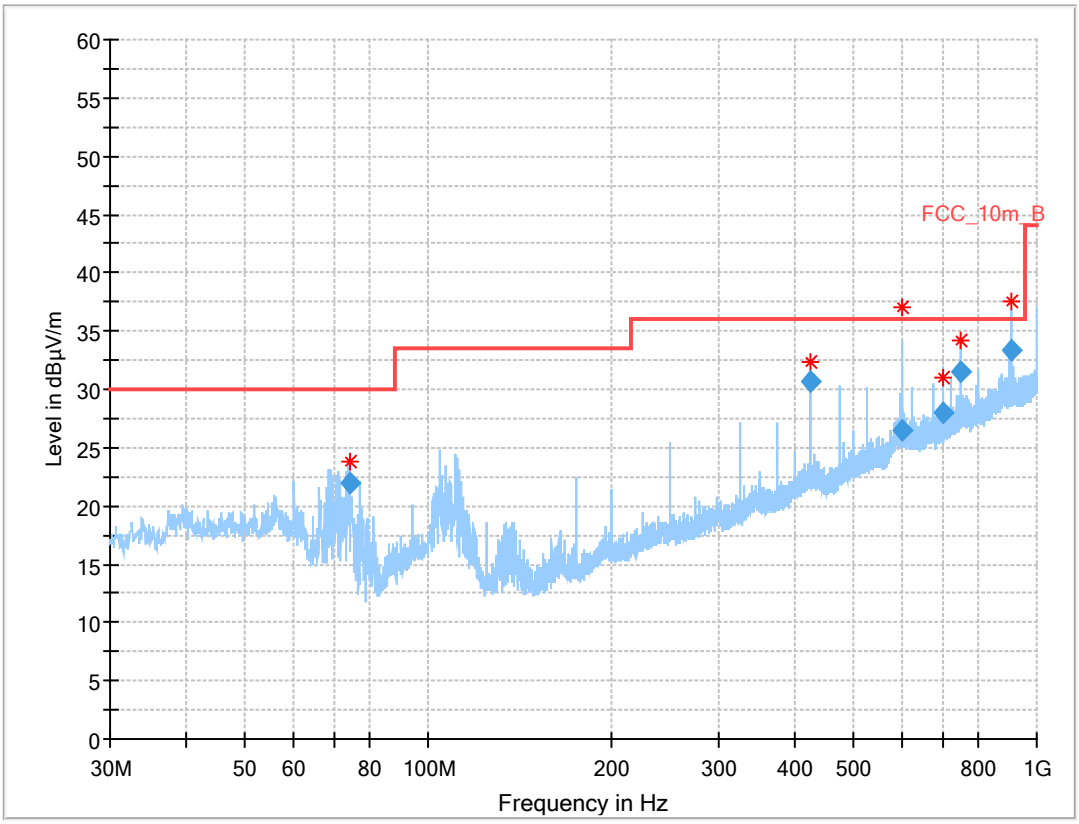
**Plot 3:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-2A; lowest channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 74.550 | 23.27 | 30.0 | 6.7 | 1000 | 120 | 160.0 | V | 355 | 8 |
| 424.992 | 30.71 | 36.0 | 5.3 | 1000 | 120 | 160.0 | H | 85 | 17 |
| 601.763 | 19.93 | 36.0 | 16.1 | 1000 | 120 | 160.0 | H | 66 | 20 |
| 699.997 | 27.62 | 36.0 | 8.4 | 1000 | 120 | 160.0 | H | 224 | 21 |
| 749.991 | 31.76 | 36.0 | 4.2 | 1000 | 120 | 129.0 | H | 241 | 22 |
| 904.510 | 20.02 | 36.0 | 16.0 | 1000 | 120 | 160.0 | H | 294 | 24 |

**Plot 4:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-2A; highest channel

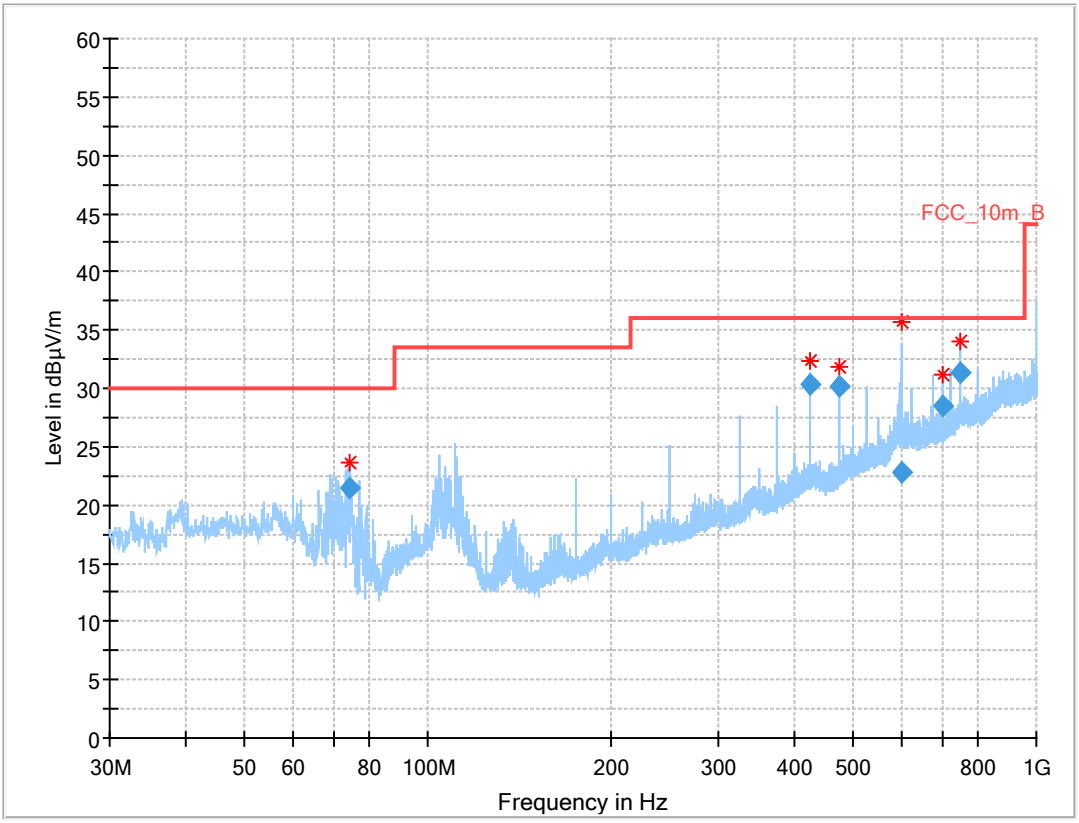



t

**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 74.557 | 21.89 | 30.0 | 8.1 | 1000 | 120 | 160.0 | V | 355 | 8 |
| 425.006 | 30.62 | 36.0 | 5.4 | 1000 | 120 | 160.0 | H | 98 | 17 |
| 599.965 | 26.48 | 36.0 | 9.5 | 1000 | 120 | 160.0 | H | 43 | 20 |
| 700.001 | 28.07 | 36.0 | 7.9 | 1000 | 120 | 149.0 | H | 213 | 21 |
| 750.000 | 31.46 | 36.0 | 4.5 | 1000 | 120 | 153.0 | H | 235 | 22 |
| 905.472 | 33.29 | 36.0 | 2.7 | 1000 | 120 | 131.0 | H | 312 | 24 |

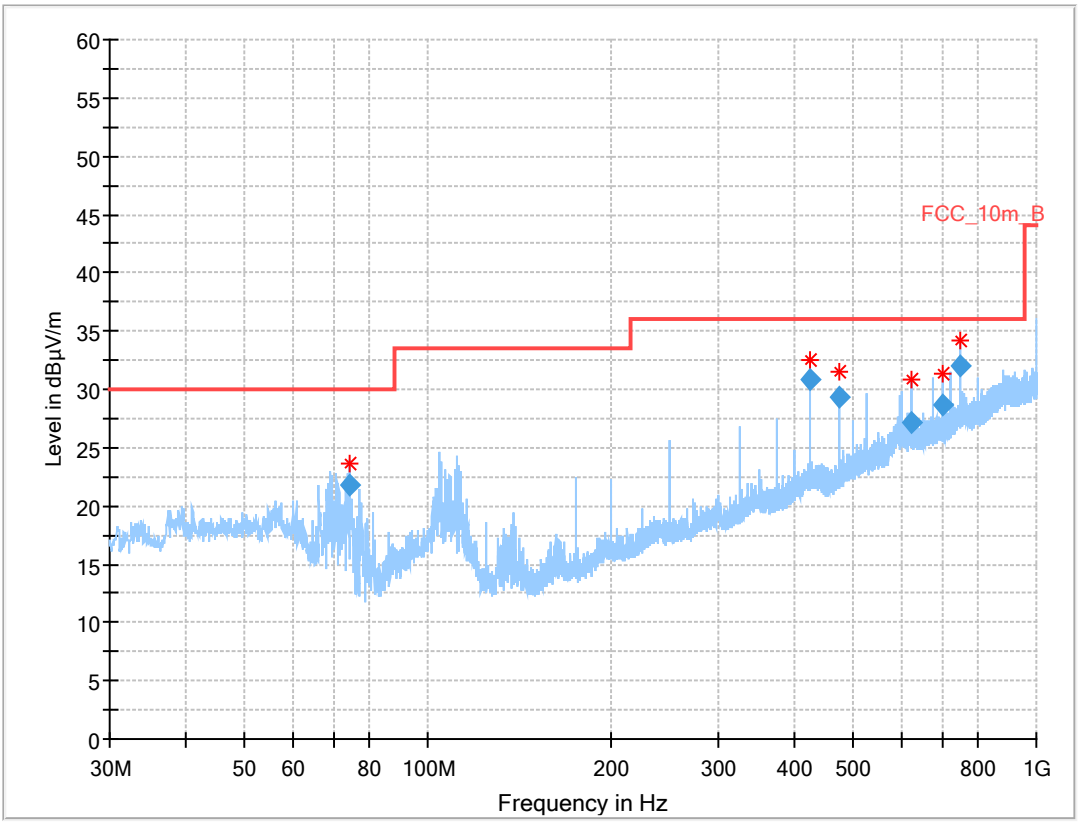
**Plot 5:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-2C; lowest channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 74.574 | 21.46 | 30.0 | 8.5 | 1000 | 120 | 155.0 | V | 347 | 8 |
| 425.003 | 30.33 | 36.0 | 5.7 | 1000 | 120 | 160.0 | H | 105 | 17 |
| 475.001 | 30.12 | 36.0 | 5.9 | 1000 | 120 | 160.0 | H | 105 | 18 |
| 601.684 | 22.85 | 36.0 | 13.2 | 1000 | 120 | 160.0 | H | 41 | 20 |
| 699.979 | 28.50 | 36.0 | 7.5 | 1000 | 120 | 148.0 | H | 41 | 21 |
| 750.006 | 31.42 | 36.0 | 4.6 | 1000 | 120 | 160.0 | H | 241 | 22 |

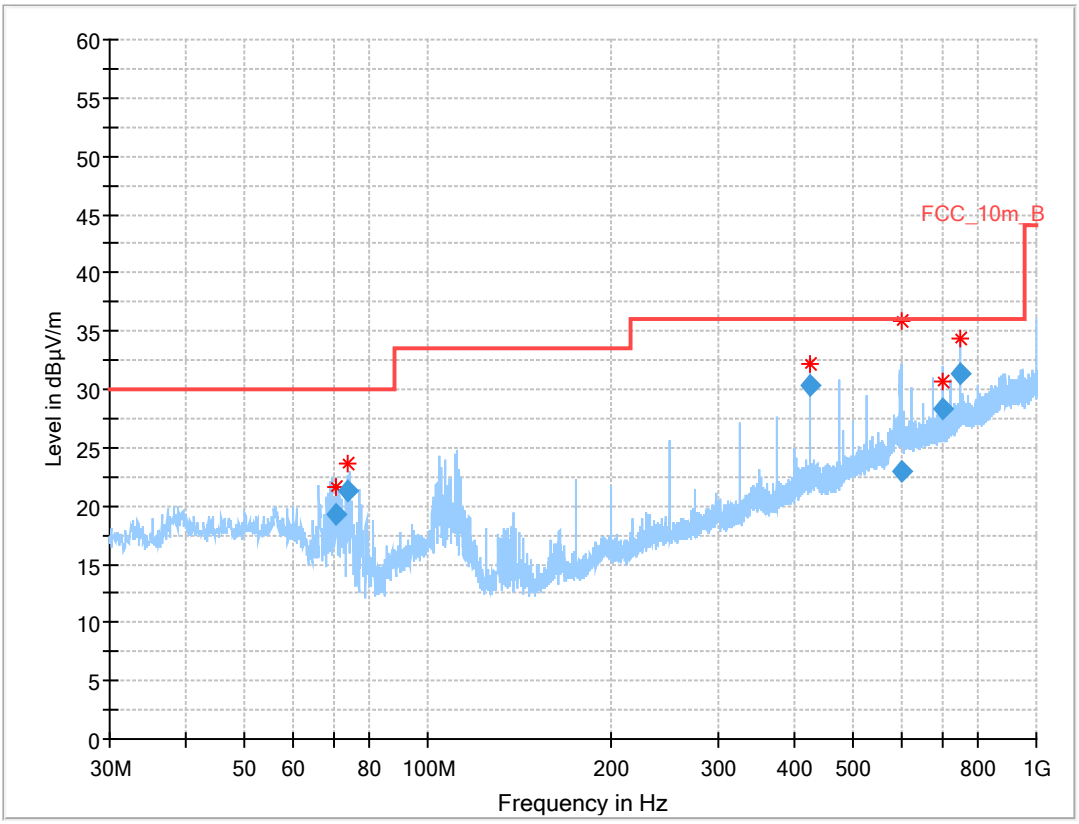
**Plot 6:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-2C; middle channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 74.565 | 21.83 | 30.0 | 8.2 | 1000 | 120 | 160.0 | V | 355 | 8 |
| 424.999 | 30.79 | 36.0 | 5.2 | 1000 | 120 | 153.0 | H | 87 | 17 |
| 475.002 | 29.39 | 36.0 | 6.6 | 1000 | 120 | 160.0 | H | 115 | 18 |
| 624.982 | 27.18 | 36.0 | 8.8 | 1000 | 120 | 160.0 | H | 55 | 21 |
| 700.014 | 28.72 | 36.0 | 7.3 | 1000 | 120 | 148.0 | H | 38 | 21 |
| 749.996 | 32.01 | 36.0 | 4.0 | 1000 | 120 | 133.0 | H | 231 | 22 |

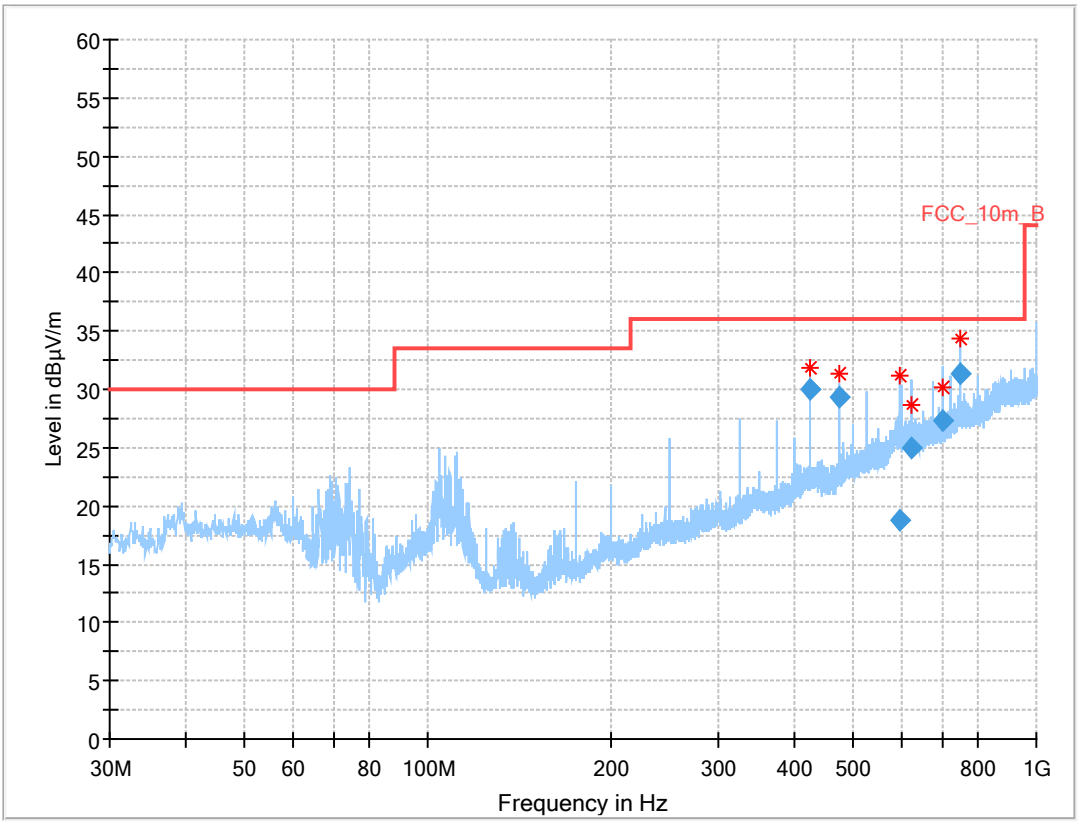
**Plot 7:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-2C; highest channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 70.837 | 19.19 | 30.0 | 10.8 | 1000 | 120 | 102.0 | V | 355 | 9 |
| 73.938 | 21.28 | 30.0 | 8.7 | 1000 | 120 | 160.0 | V | 342 | 8 |
| 425.016 | 30.40 | 36.0 | 5.6 | 1000 | 120 | 160.0 | H | 90 | 17 |
| 601.690 | 22.97 | 36.0 | 13.0 | 1000 | 120 | 160.0 | H | 55 | 20 |
| 700.006 | 28.34 | 36.0 | 7.7 | 1000 | 120 | 151.0 | H | 45 | 21 |
| 750.007 | 31.27 | 36.0 | 4.7 | 1000 | 120 | 114.0 | H | 227 | 22 |

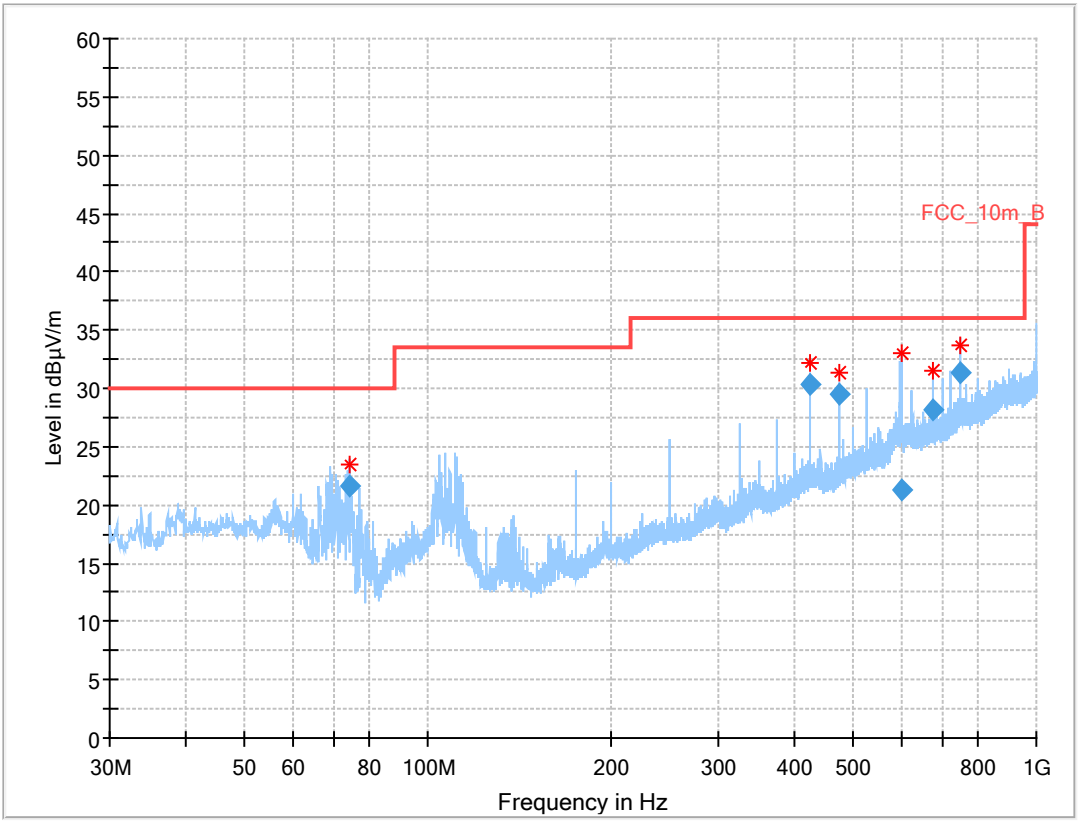
**Plot 8:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-3; lowest channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 425.005 | 29.99 | 36.0 | 6.0 | 1000 | 120 | 160.0 | H | 74 | 17 |
| 474.997 | 29.40 | 36.0 | 6.6 | 1000 | 120 | 160.0 | H | 111 | 18 |
| 598.334 | 18.75 | 36.0 | 17.3 | 1000 | 120 | 160.0 | H | 84 | 20 |
| 625.004 | 24.94 | 36.0 | 11.1 | 1000 | 120 | 160.0 | H | 95 | 21 |
| 700.006 | 27.39 | 36.0 | 8.6 | 1000 | 120 | 150.0 | H | 52 | 21 |
| 749.994 | 31.26 | 36.0 | 4.7 | 1000 | 120 | 160.0 | H | 231 | 22 |

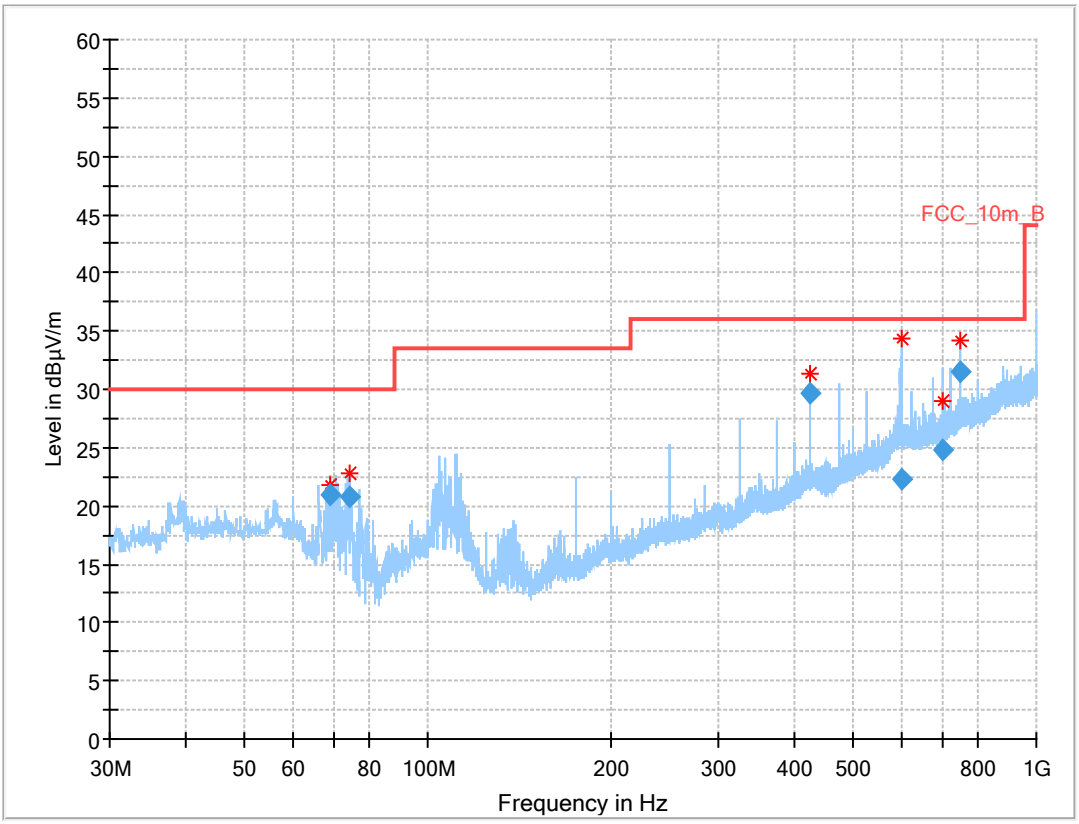
**Plot 9:** 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-3; highest channel




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 74.551 | 21.62 | 30.0 | 8.4 | 1000 | 120 | 160.0 | V | 355 | 8 |
| 425.017 | 30.31 | 36.0 | 5.7 | 1000 | 120 | 160.0 | H | 91 | 17 |
| 474.985 | 29.52 | 36.0 | 6.5 | 1000 | 120 | 160.0 | H | 97 | 18 |
| 601.646 | 21.30 | 36.0 | 14.7 | 1000 | 120 | 149.0 | H | 69 | 20 |
| 674.996 | 28.11 | 36.0 | 7.9 | 1000 | 120 | 160.0 | H | 47 | 21 |
| 749.990 | 31.29 | 36.0 | 4.7 | 1000 | 120 | 127.0 | H | 146 | 22 |

**Plot 13:** 30 MHz to 1 GHz, cabinet radiation, vertical & horizontal polarization




**Results:**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 68.990 | 20.89 | 30.0 | 9.1 | 1000 | 120 | 114.0 | V | 136 | 10 |
| 74.564 | 20.83 | 30.0 | 9.2 | 1000 | 120 | 160.0 | V | 196 | 8 |
| 424.997 | 29.62 | 36.0 | 6.4 | 1000 | 120 | 160.0 | H | 64 | 17 |
| 601.660 | 22.29 | 36.0 | 13.7 | 1000 | 120 | 160.0 | H | 64 | 20 |
| 699.973 | 24.76 | 36.0 | 11.2 | 1000 | 120 | 160.0 | H | 58 | 21 |
| 749.989 | 31.55 | 36.0 | 4.5 | 1000 | 120 | 160.0 | H | 228 | 22 |

## 11.12 Spurious emissions radiated 1 GHz to 40 GHz

Description:

Measurement of the radiated spurious emissions and cabinet radiations from 1 GHz to 40 GHz.

Measurement:

| Measurement parameter | |
|---|---|
| Detector: | Quasi Peak below 1 GHz<br>(alternative Peak)<br>Peak above 1 GHz / RMS |
| Sweep time: | Auto |
| Resolution bandwidth: | 1 MHz |
| Video bandwidth: | 3 MHz |
| Span: | 1 GHz to 40 GHz |
| Trace mode: | Max Hold / Average with 100 counts + 20 log (1 / X)<br>for duty cycle lower than 100 % |
| Test setup: | See sub clause 6.1 – A<br>See sub clause 6.2 – B<br>See sub clause 6.3 – A |
| Measurement uncertainty: | See chapter 8 |

Limits:

| TX Spurious Emissions Radiated | | |
|---|---|---|
| §15.209 | | |
| Frequency (MHz) | Field Strength (dBµV/m) | Measurement distance |
| Above 960 | 54.0 | 3 |
| §15.407 | | |
| Outside the restricted bands! | -27 dBm / MHz | |

**Results:** 20 MHz channel bandwidth

| TX Spurious Emissions Radiated [dBµV/m] / dBm | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| U-NII-1 (5150 MHz to 5250 MHz) | | | | | | | | |
| Lowest channel | | | Middle channel | | | Highest channel | | |
| F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] |
| | Peak | | | Peak | | | Peak | |
| | AVG | | | AVG | | | AVG | |
| | Peak | | | Peak | | | Peak | |
| | AVG | | | AVG | | | AVG | |
| For emissions above 18 GHz please take look at the plots. | | | For emissions above 18 GHz please take look at the plots. | | | For emissions above 18 GHz please take look at the plots. | | |

| TX Spurious Emissions Radiated [dBµV/m] / dBm | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| U-NII-2A (5250 MHz to 5350 MHz) | | | | | | | | |
| Lowest channel | | | Middle channel | | | Highest channel | | |
| F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] |
| | Peak | | | Peak | | 10642 | Peak | 53.1 |
| | AVG | | | AVG | | | AVG | 40.8 |
| | Peak | | | Peak | | | Peak | |
| | AVG | | | AVG | | | AVG | |
| For emissions above 18 GHz please take look at the plots. | | | For emissions above 18 GHz please take look at the plots. | | | For emissions above 18 GHz please take look at the plots. | | |

| TX Spurious Emissions Radiated [dBµV/m] / dBm | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| U-NII-2C (5470 MHz to 5725 MHz) | | | | | | | | |
| Lowest channel | | | Middle channel | | | Highest channel | | |
| F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] |
| 11000 | Peak | 52.7 | 11200 | Peak | 58.7 | 11400 | Peak | 63.2 |
| | AVG | 40.9 | | AVG | 46.9 | | AVG | 51.4 |
| | Peak | | | Peak | | | Peak | |
| | AVG | | | AVG | | | AVG | |
| For emissions above 18 GHz please take look at the plots. | | | For emissions above 18 GHz please take look at the plots. | | | For emissions above 18 GHz please take look at the plots. | | |

| TX Spurious Emissions Radiated [dBµV/m] / dBm | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| U-NII-3 (5725 MHz to 5850 MHz) | | | | | | | | |
| Lowest channel | | | Middle channel | | | Highest channel | | |
| F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] |
| 11491 | Peak | 61.0 | 11572 | Peak | 63.4 | 11652 | Peak | 61.4 |
| | AVG | 50.1 | | AVG | 52.8 | | AVG | 51.4 |
| | Peak | | | Peak | | | Peak | |
| | AVG | | | AVG | | | AVG | |
| For emissions above 18 GHz please take look at the plots. | | | For emissions above 18 GHz please take look at the plots. | | | For emissions above 18 GHz please take look at the plots. | | |

**Results:** 40 MHz channel bandwidth

| TX Spurious Emissions Radiated [dBµV/m] / dBm | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| U-NII-1 (5150 MHz to 5250 MHz) | | | | | | | | |
| Lowest channel | | | Middle channel | | | Highest channel | | |
| F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] |
| | Peak | | | Peak | | | Peak | |
| | AVG | | | AVG | | | AVG | |
| | Peak | | | Peak | | | Peak | |
| | AVG | | | AVG | | | AVG | |
| For emissions above 18 GHz please take look at the plots. | | | For emissions above 18 GHz please take look at the plots. | | | For emissions above 18 GHz please take look at the plots. | | |

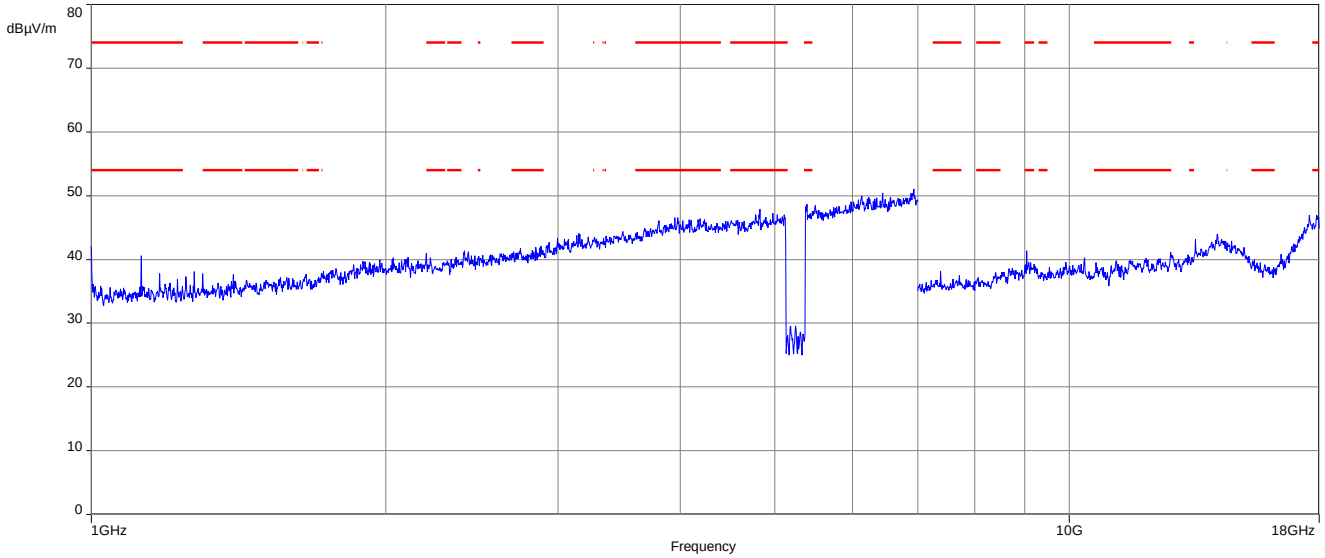
| TX Spurious Emissions Radiated [dBµV/m] / dBm | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| U-NII-2A (5250 MHz to 5350 MHz) | | | | | | | | |
| Lowest channel | | | Middle channel | | | Highest channel | | |
| F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] |
| | Peak | | | Peak | | | Peak | |
| | AVG | | | AVG | | | AVG | |
| | Peak | | | Peak | | | Peak | |
| | AVG | | | AVG | | | AVG | |
| For emissions above 18 GHz please take look at the plots. | | | For emissions above 18 GHz please take look at the plots. | | | For emissions above 18 GHz please take look at the plots. | | |

| TX Spurious Emissions Radiated [dBµV/m] / dBm | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| U-NII-2C (5470 MHz to 5725 MHz) | | | | | | | | |
| Lowest channel | | | Middle channel | | | Highest channel | | |
| F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] |
| | Peak | | | Peak | | | Peak | |
| | AVG | | | AVG | | | AVG | |
| | Peak | | | Peak | | | Peak | |
| | AVG | | | AVG | | | AVG | |
| For emissions above 18 GHz please take look at the plots. | | | For emissions above 18 GHz please take look at the plots. | | | For emissions above 18 GHz please take look at the plots. | | |

| TX Spurious Emissions Radiated [dBµV/m] / dBm | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| U-NII-3 (5725 MHz to 5850 MHz) | | | | | | | | |
| Lowest channel | | | Middle channel | | | Highest channel | | |
| F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] | F [MHz] | Detector | Level [dBµV/m] |
| | Peak | | | Peak | | | Peak | |
| | AVG | | | AVG | | | AVG | |
| | Peak | | | Peak | | | Peak | |
| | AVG | | | AVG | | | AVG | |
| For emissions above 18 GHz please take look at the plots. | | | For emissions above 18 GHz please take look at the plots. | | | For emissions above 18 GHz please take look at the plots. | | |

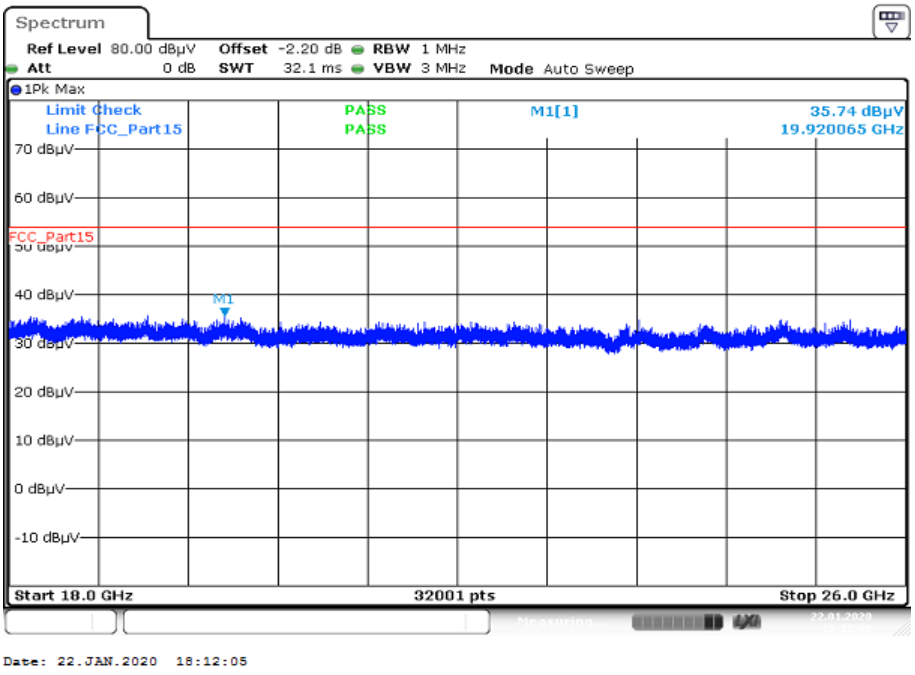
**Plots:** 20 MHz channel bandwidth

**Plot 1:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-1; lowest channel

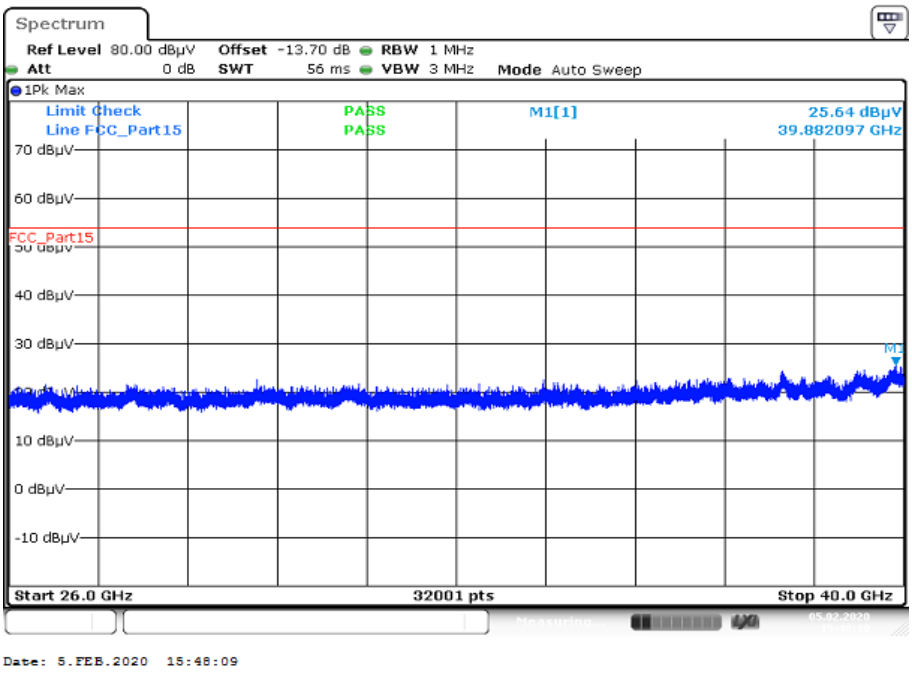



**NOTE: The carrier signal is notched.**

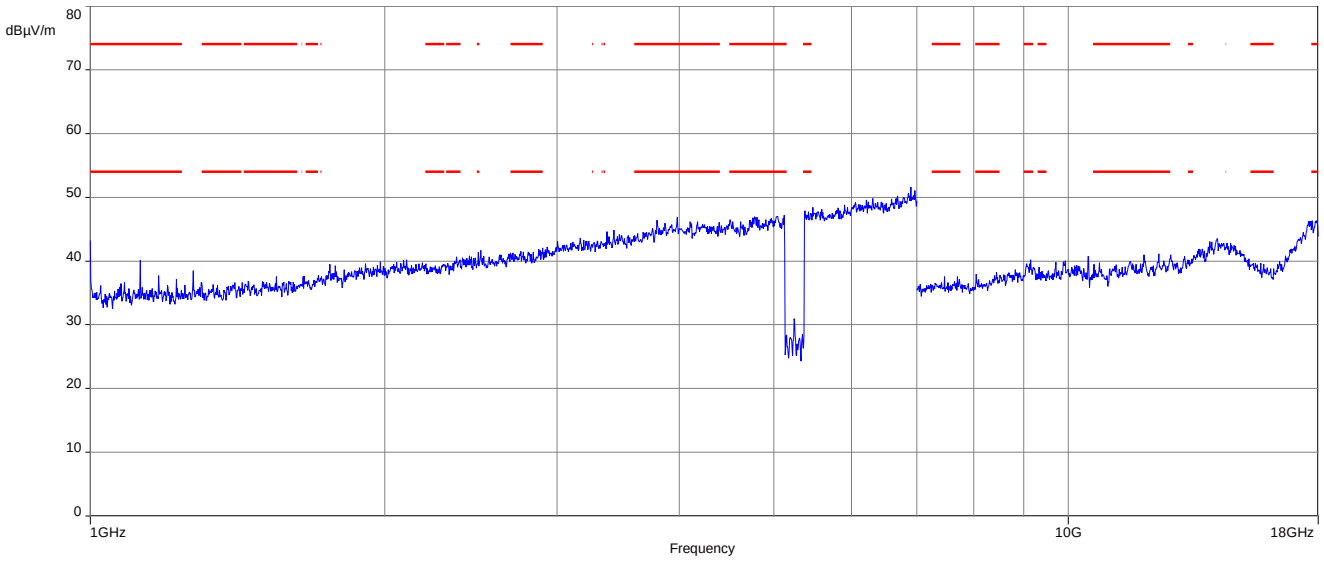
**Plot 2:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-1; lowest channel



**Plot 3:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-1; lowest channel

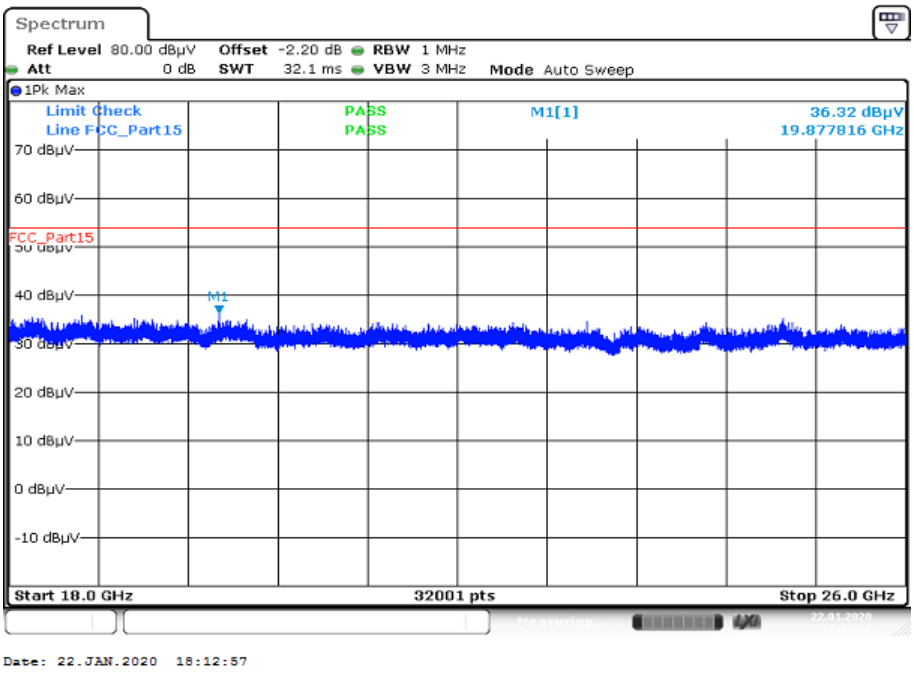



**Plot 4:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-1; highest channel

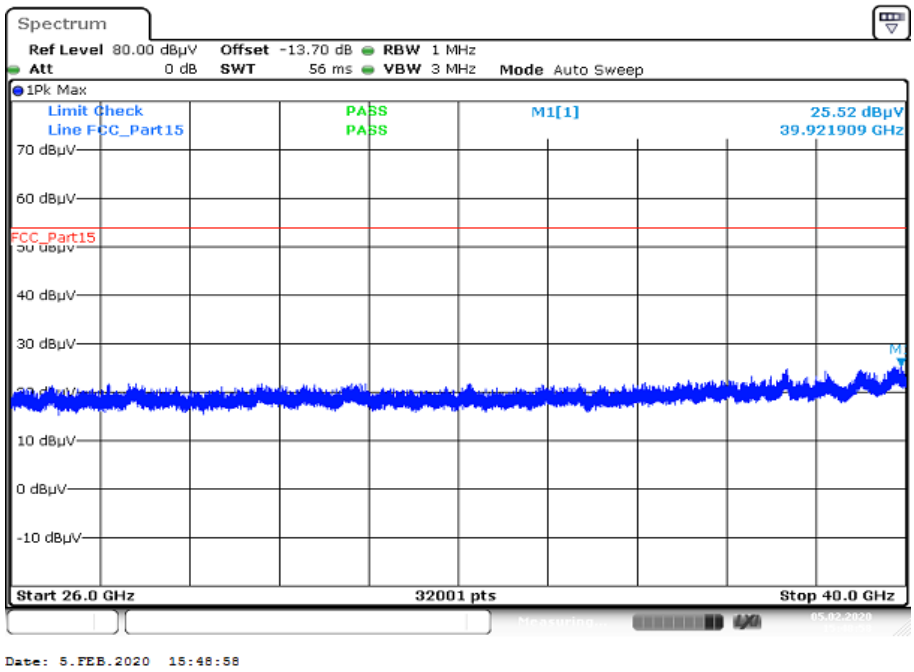



**NOTE: The carrier signal is notched.**

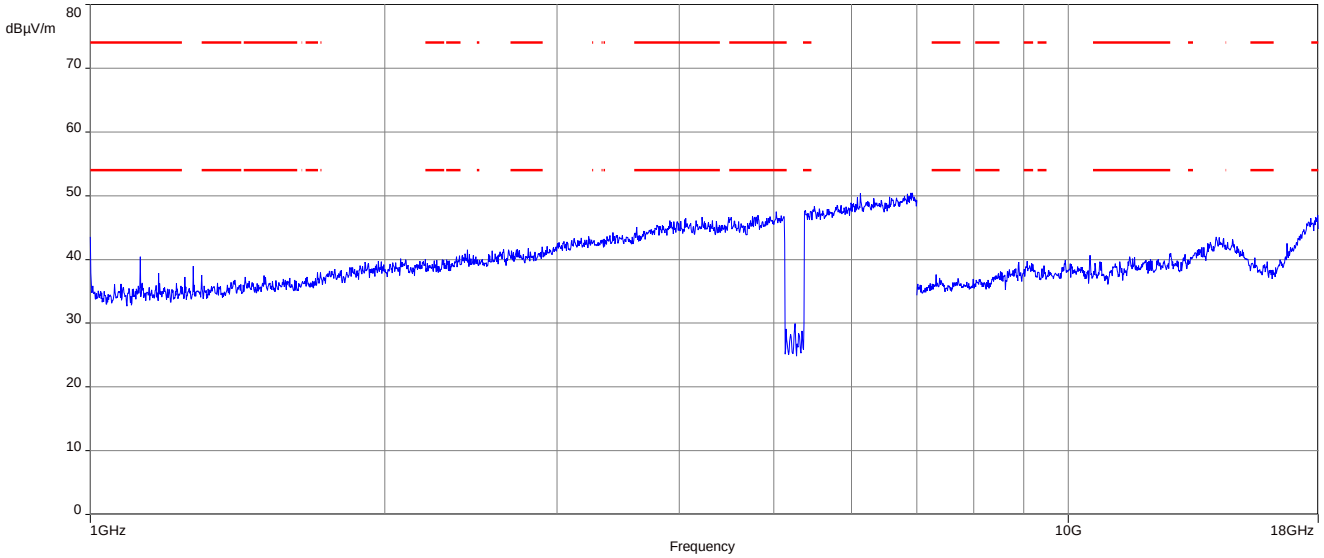
**Plot 5:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-1; highest channel




**Plot 6:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-1; highest channel

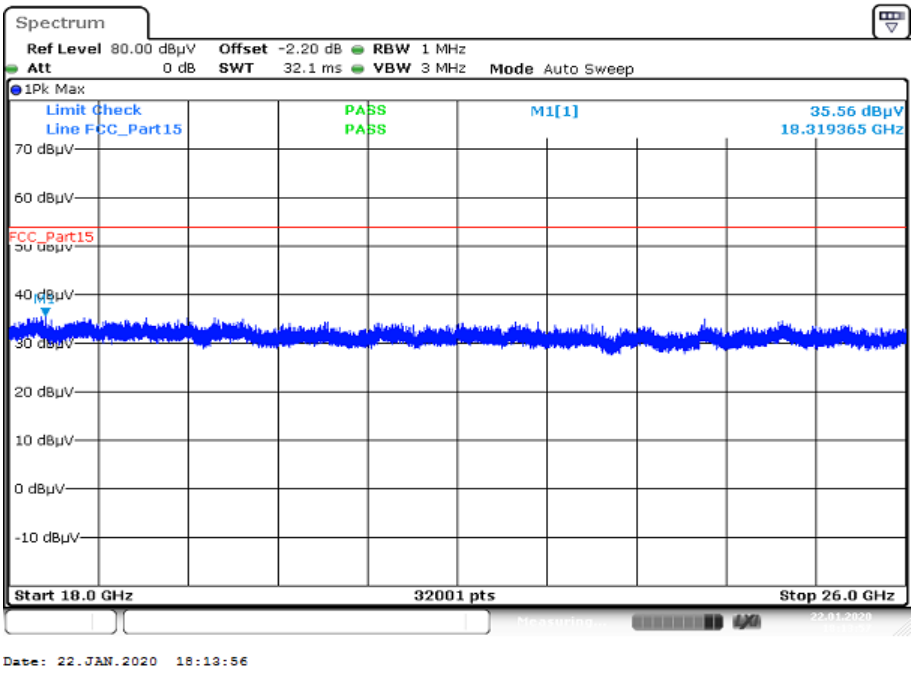


**Plot 7:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2A; lowest channel

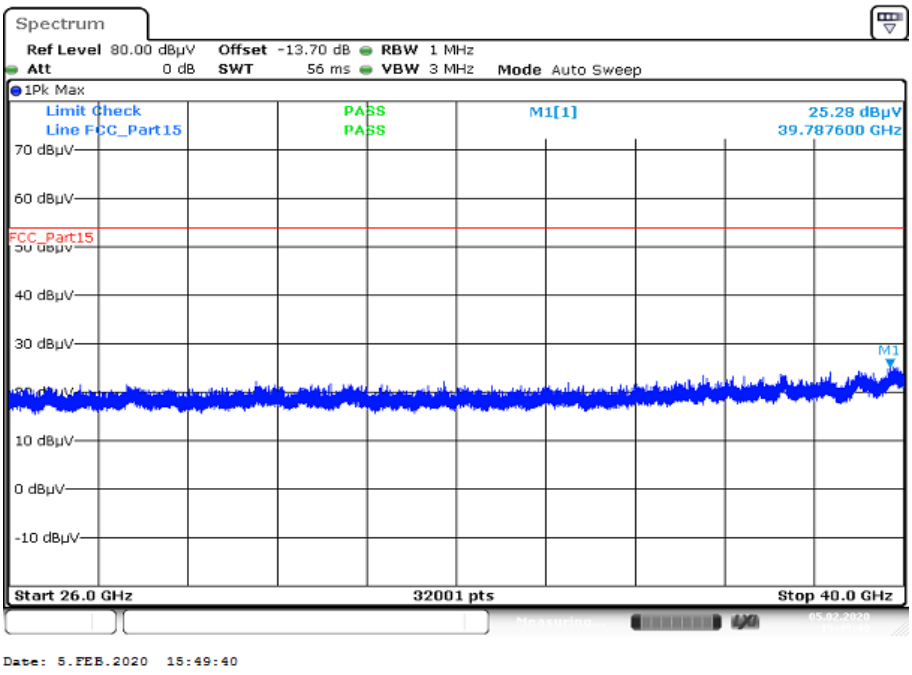



**NOTE: The carrier signal is notched.**

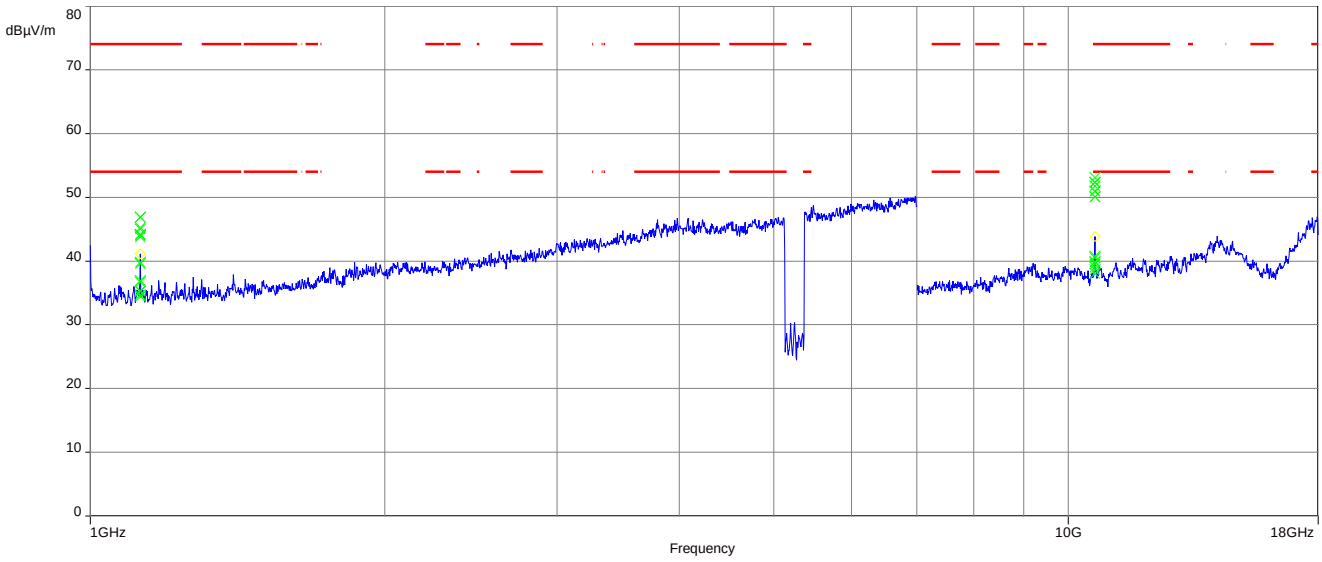
**Plot 8:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-2A; lowest channel



**Plot 9:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-2A; lowest channel

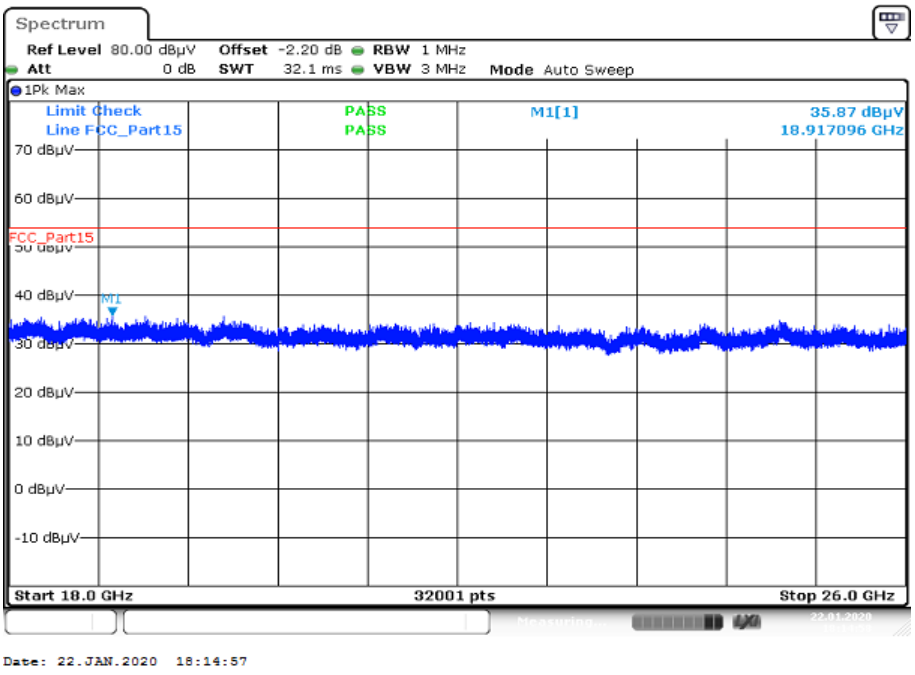



**Plot 10:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2A; highest channel

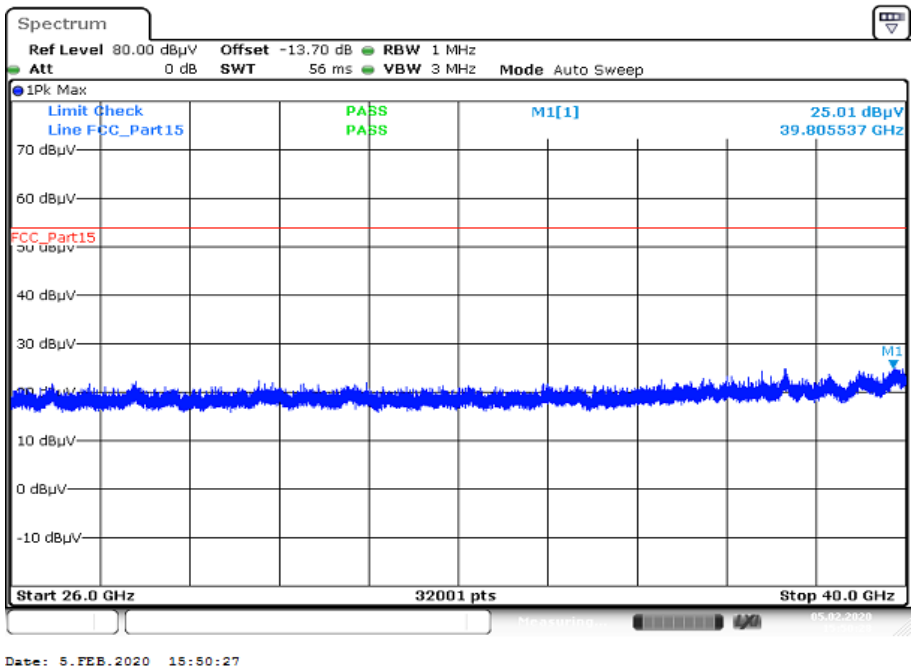



**NOTE: The carrier signal is notched.**

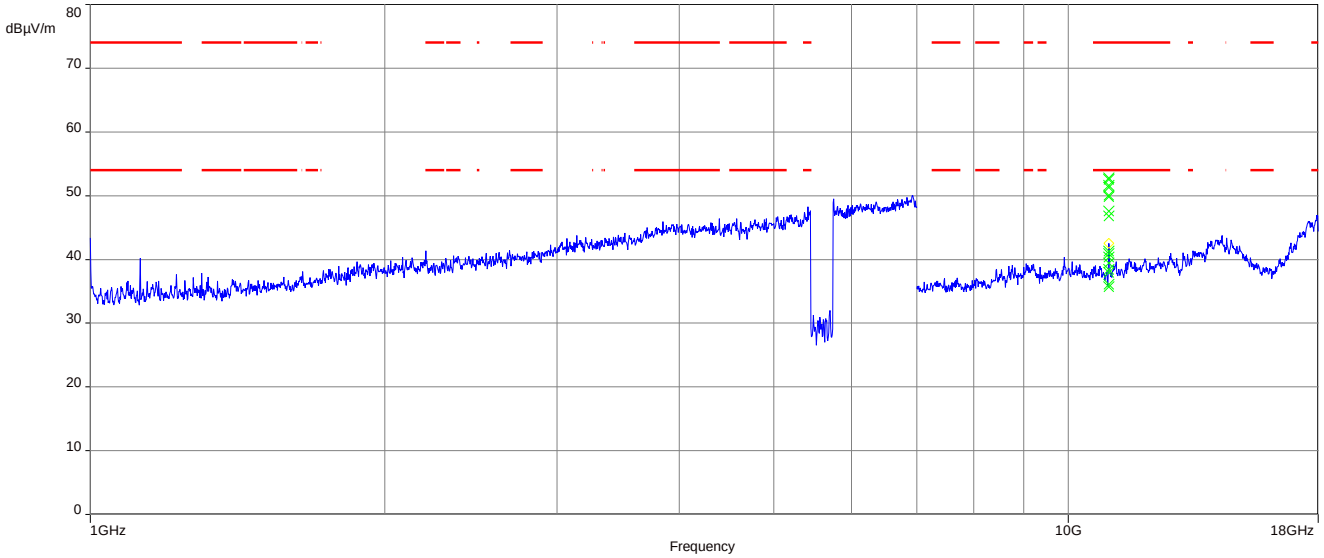
**Plot 11:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-2A; highest channel




**Plot 12:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-2A; highest channel

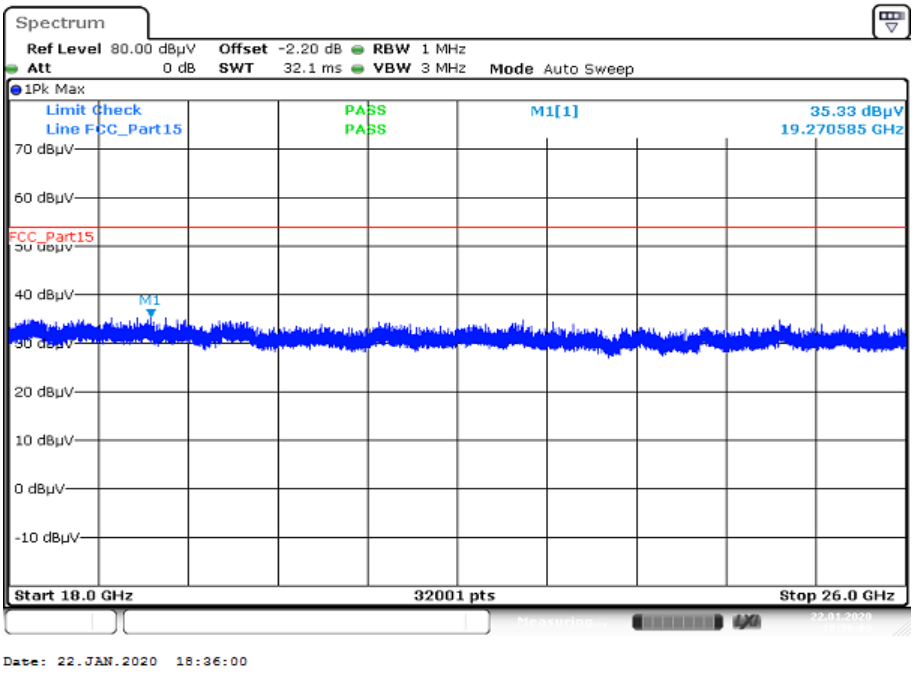


**Plot 13:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2C; lowest channel

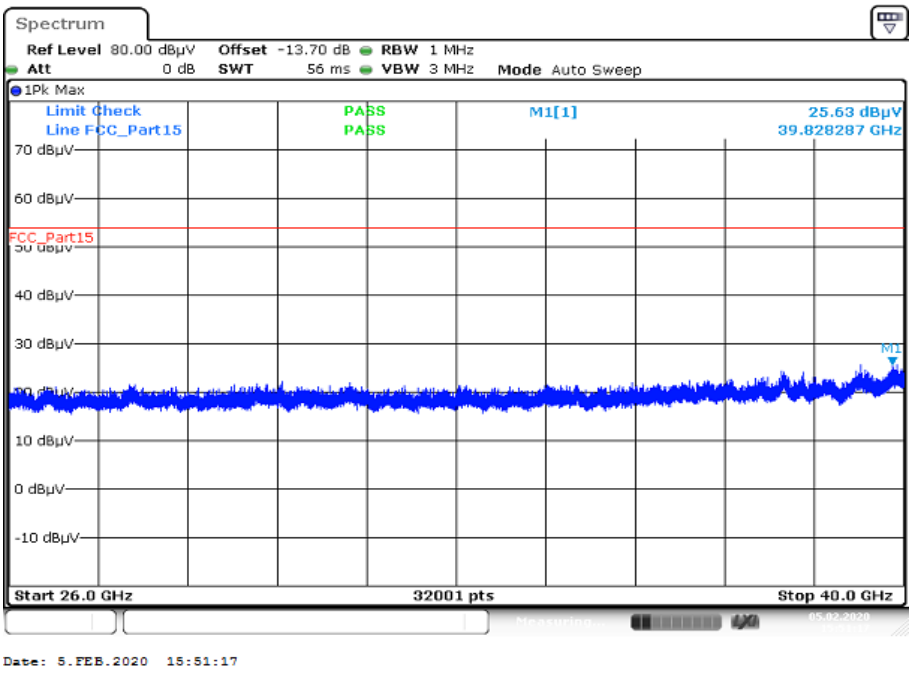



**NOTE: The carrier signal is notched.**

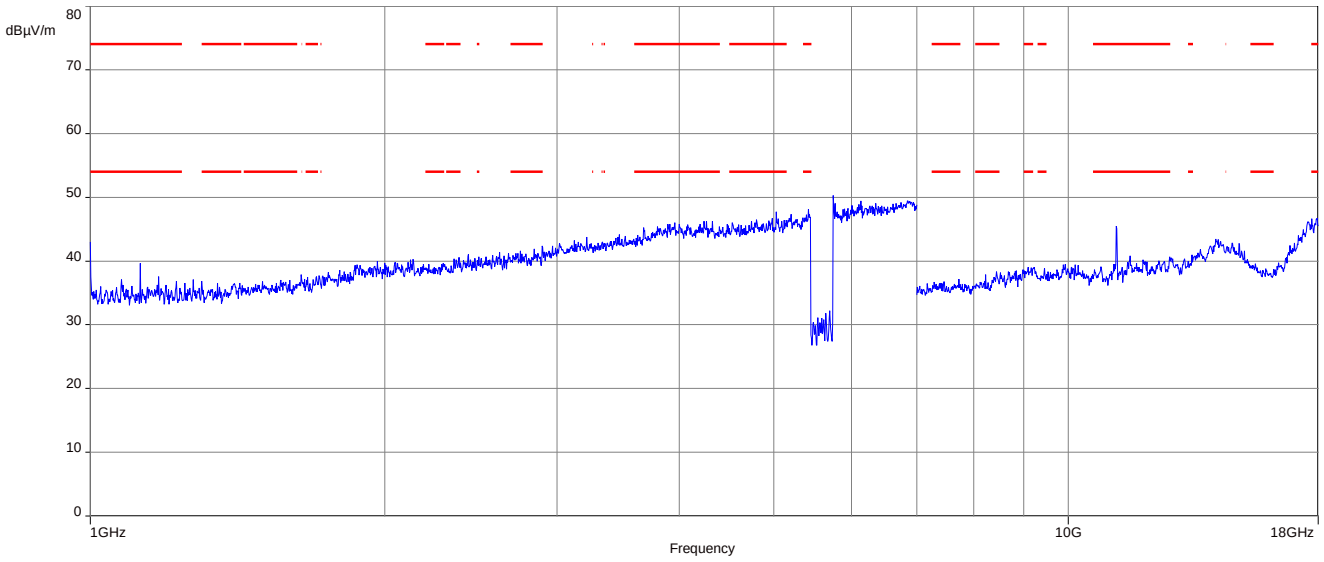
**Plot 14:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-2C; lowest channel



**Plot 15:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-2C; lowest channel

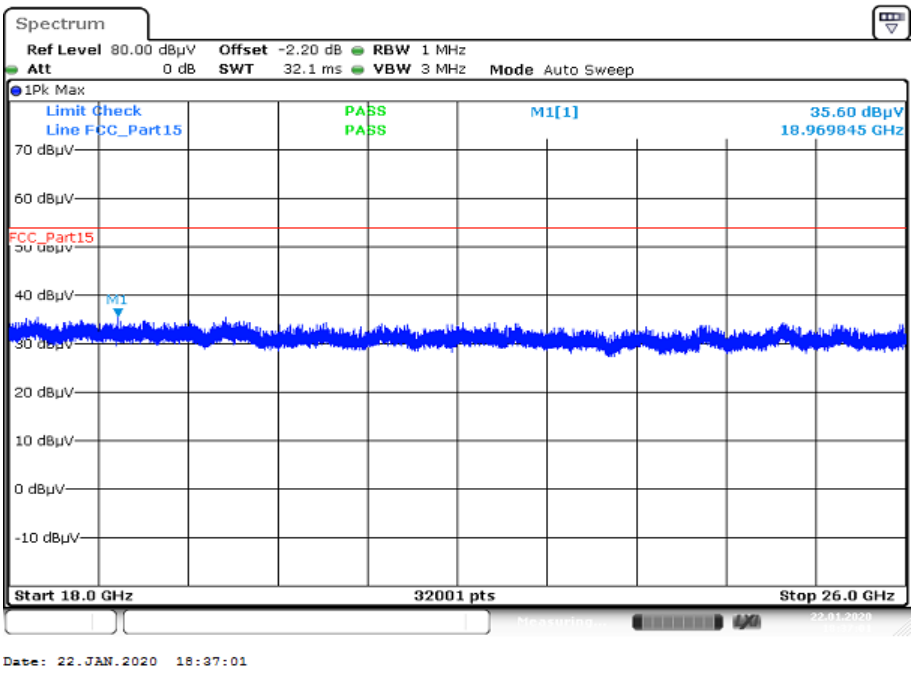



**Plot 16:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2C; middle channel

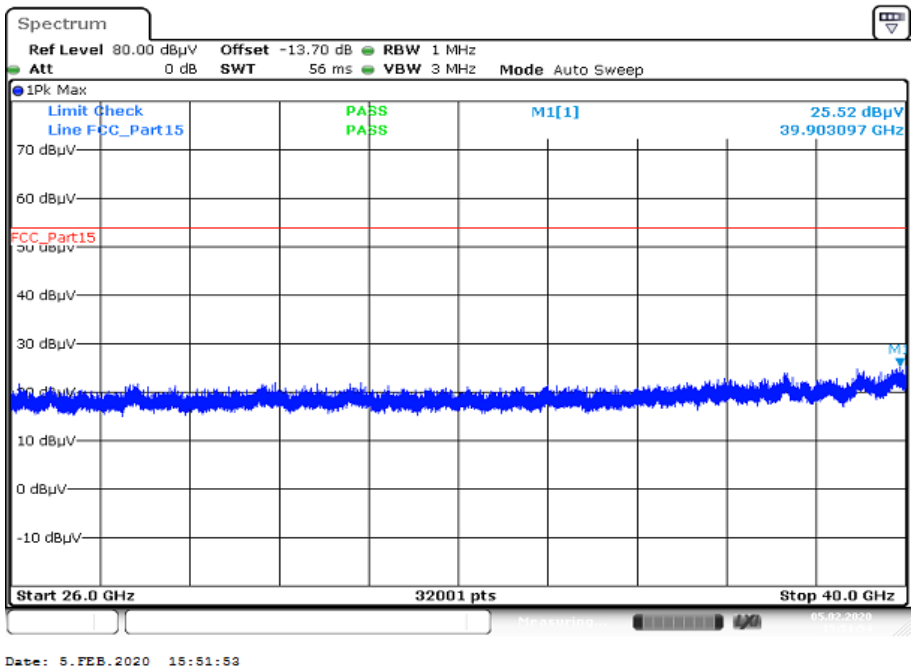



**NOTE: The carrier signal is notched.**

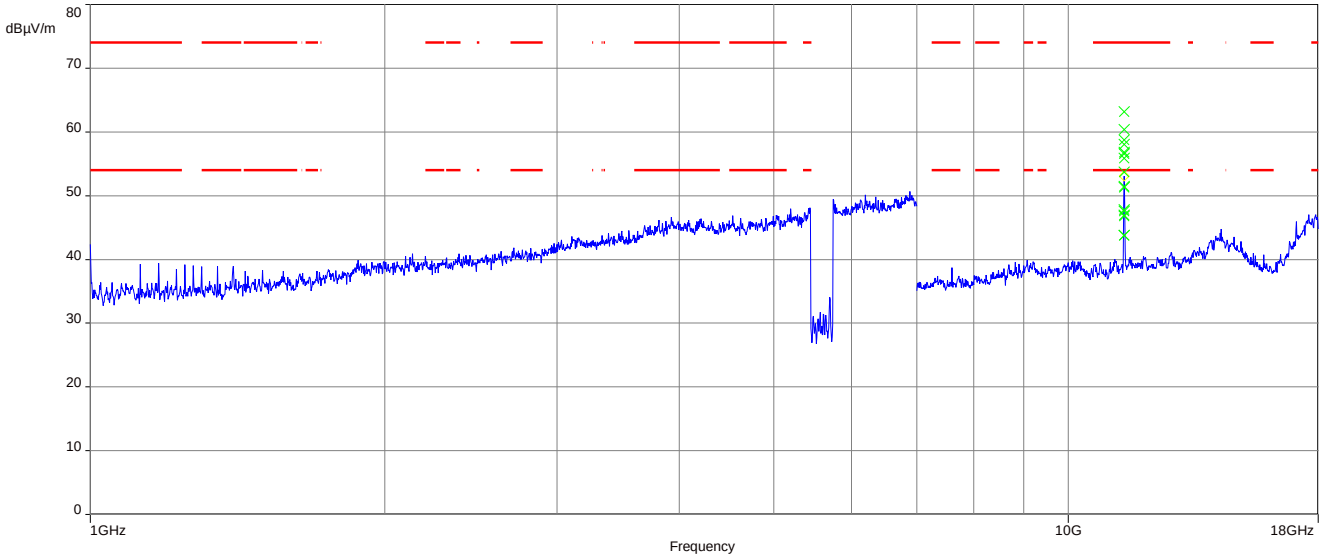
**Plot 17:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-2C; middle channel




**Plot 18:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-2C; middle channel

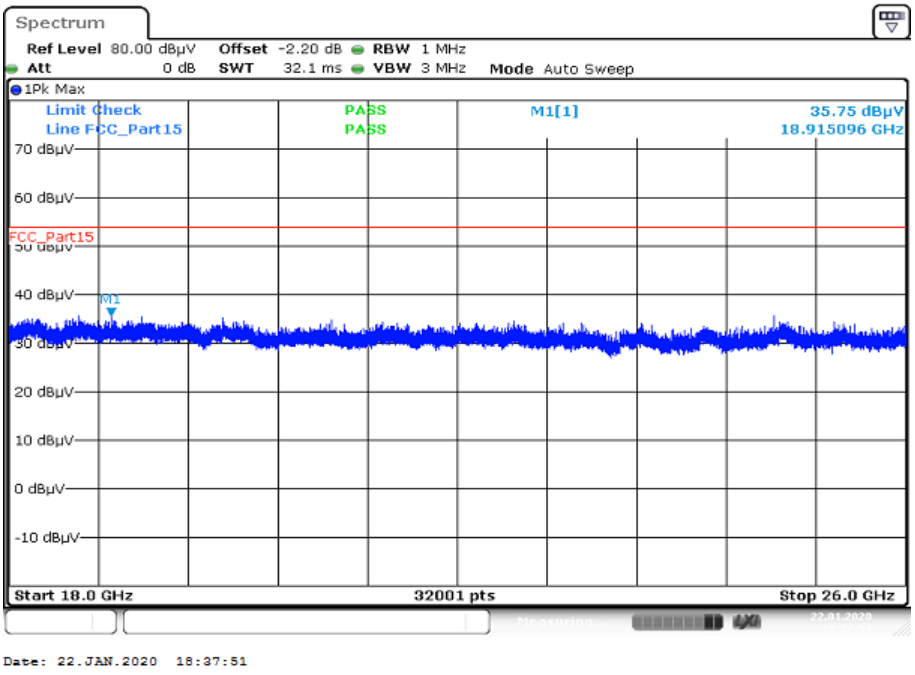


**Plot 19:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2C; highest channel

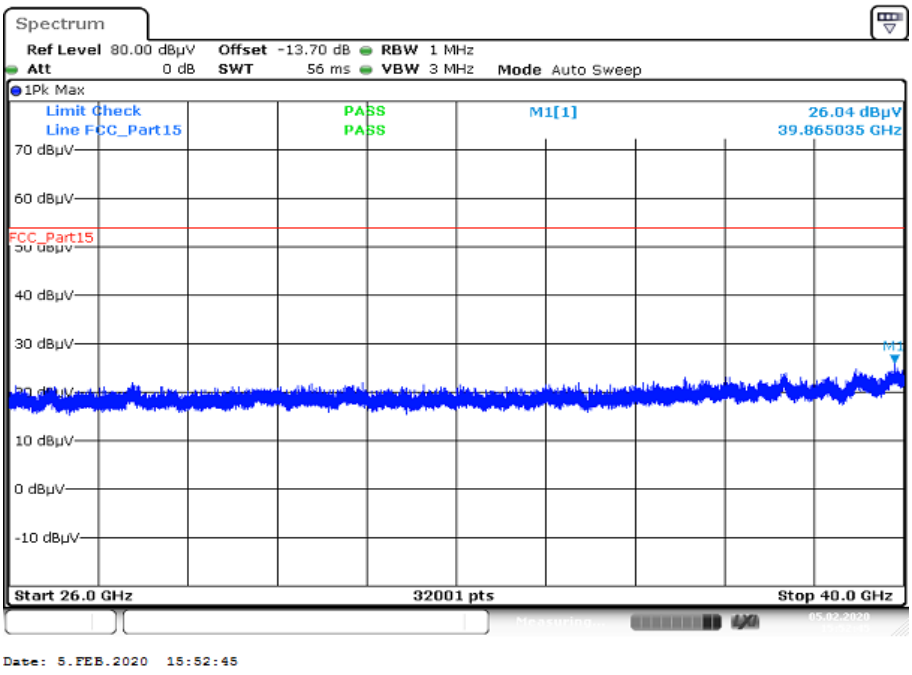



**NOTE: The carrier signal is notched.**

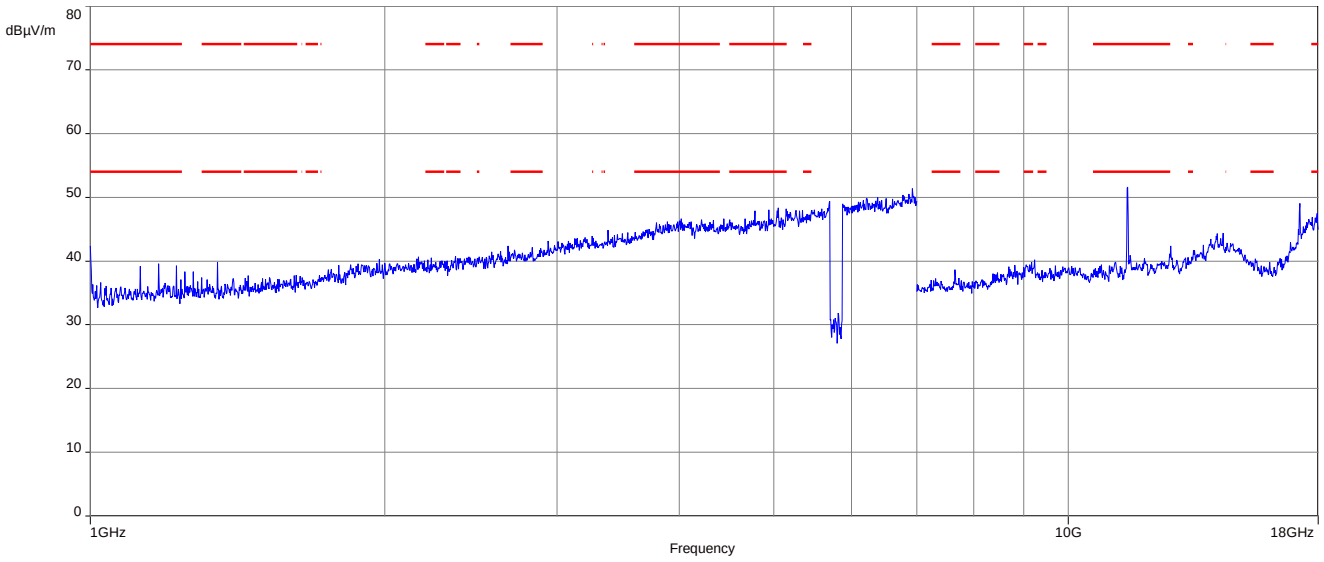
**Plot 20:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-2C; highest channel



**Plot 21:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-2C; highest channel

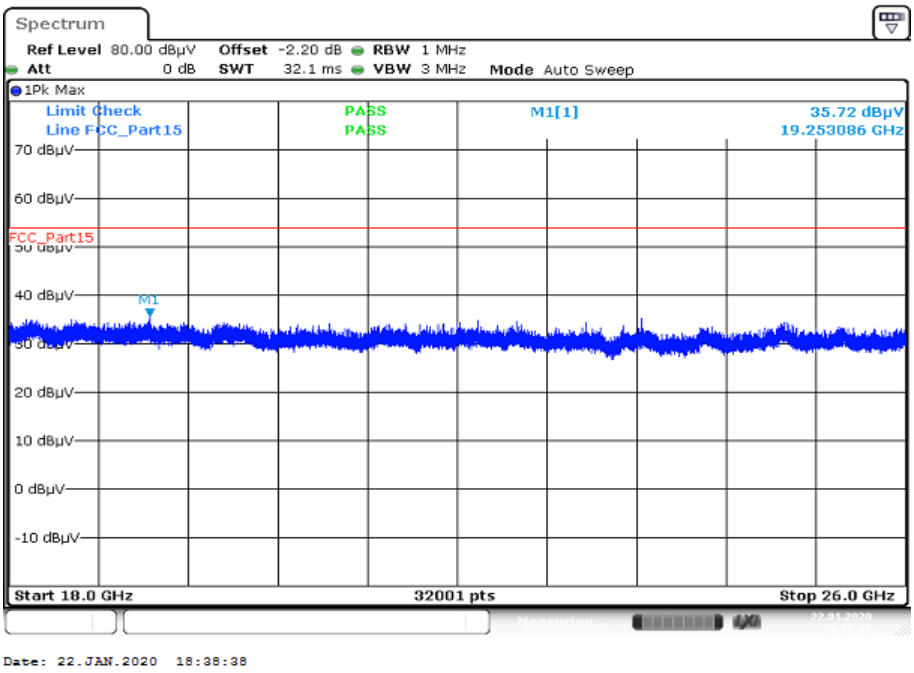



**Plot 22:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-3; lowest channel

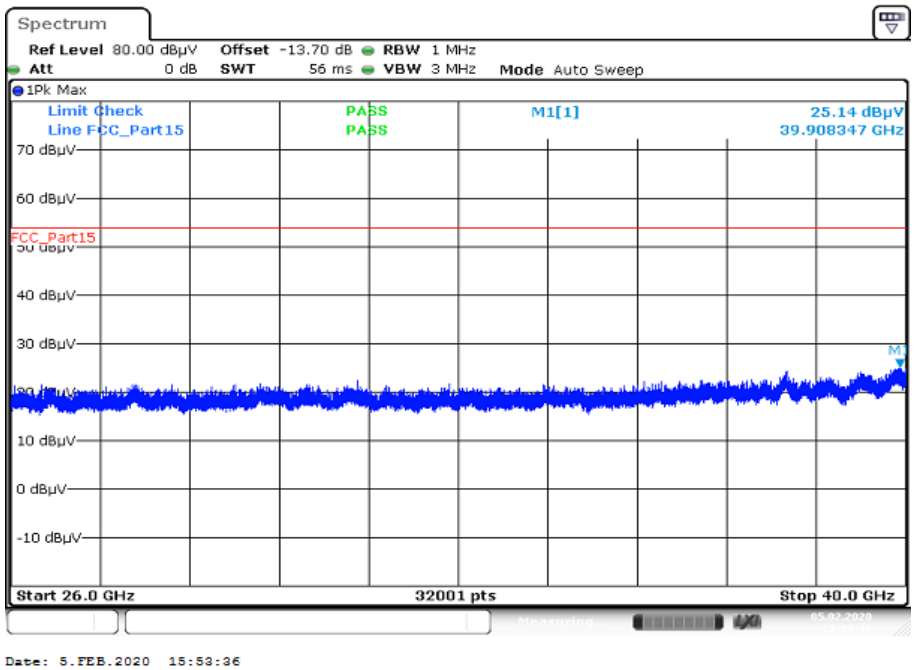



**NOTE: The carrier signal is notched.**

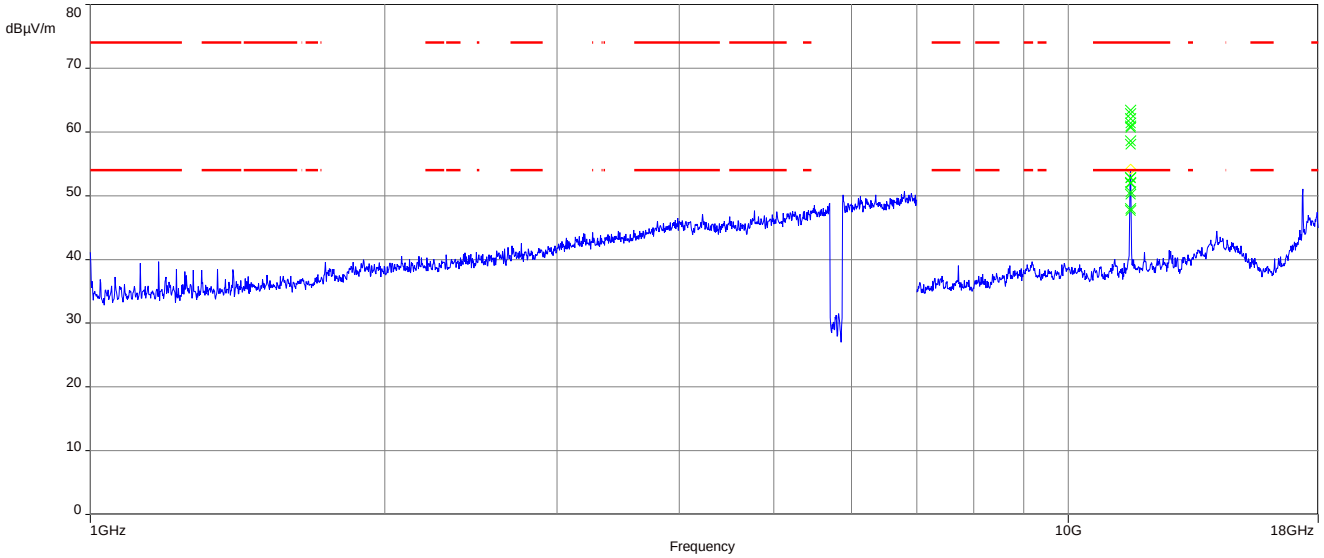
**Plot 23:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-3; lowest channel




**Plot 24:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-3; lowest channel

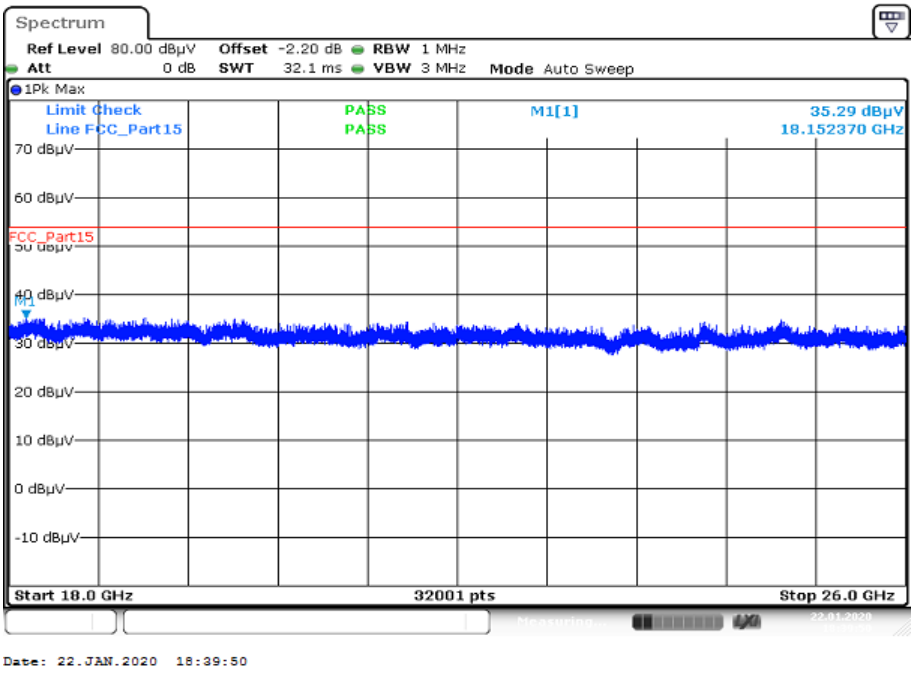


**Plot 25:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-3; middle channel

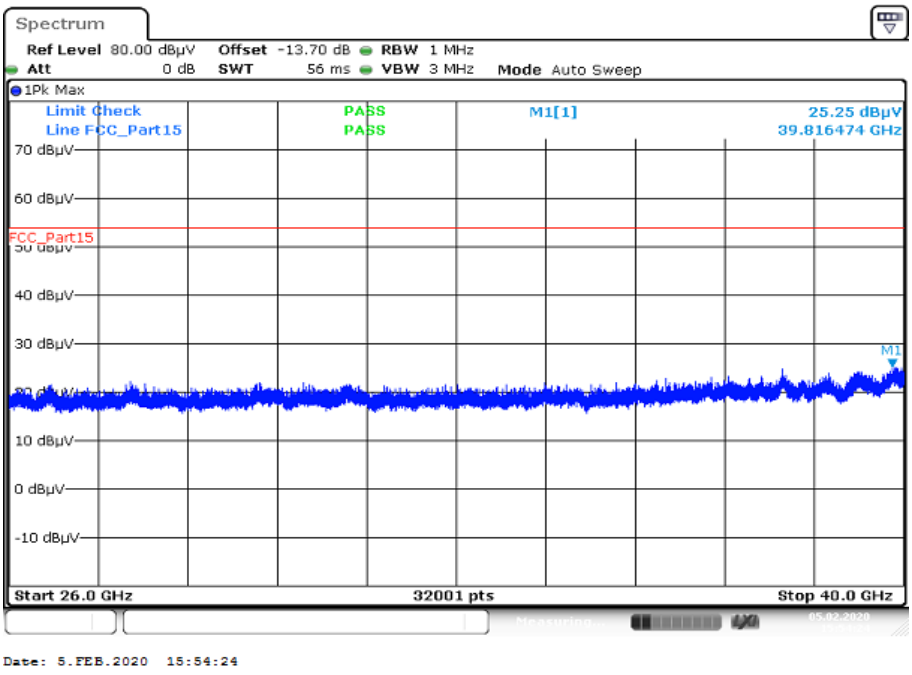



**NOTE: The carrier signal is notched.**

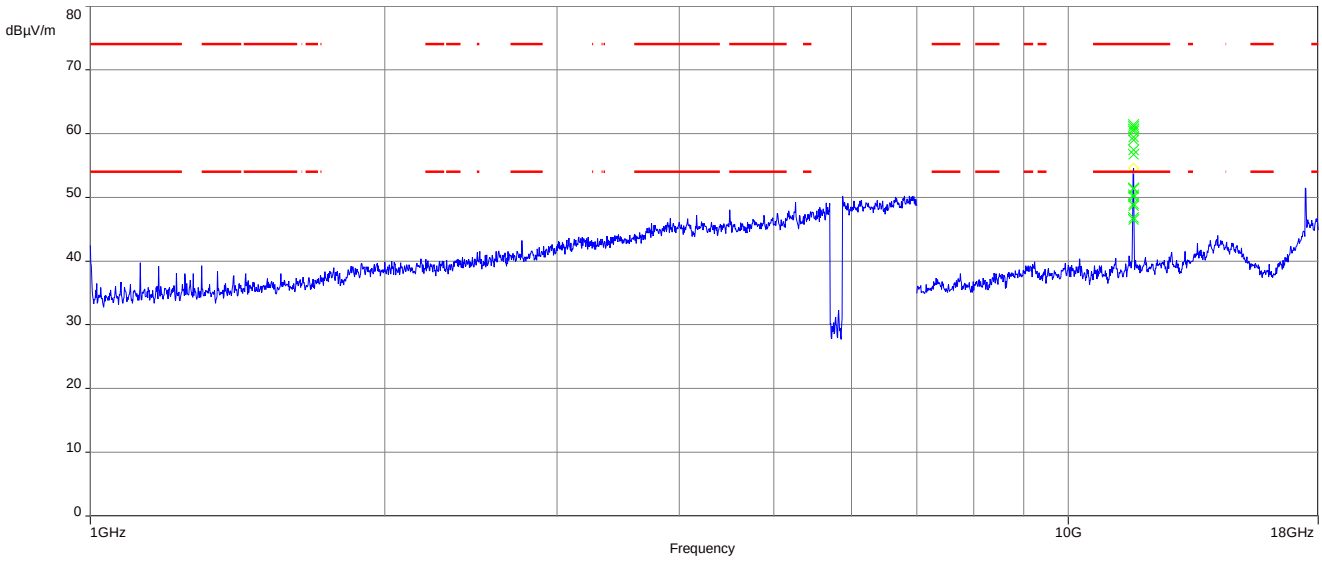
**Plot 26:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-3; middle channel



**Plot 27:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-3; middle channel

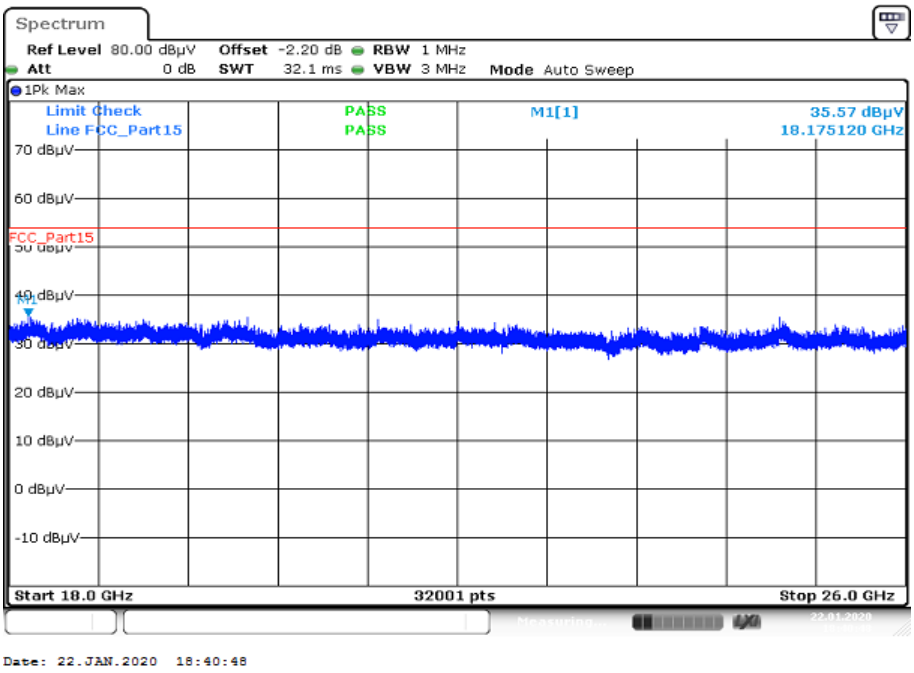



**Plot 28:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-3; highest channel

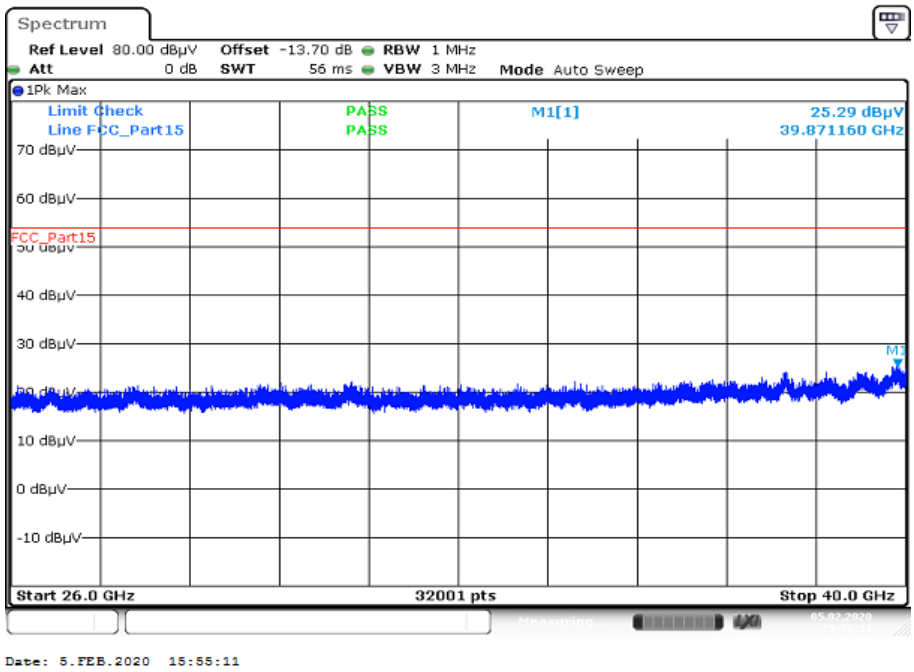



**NOTE: The carrier signal is notched.**

**Plot 29:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-3; highest channel

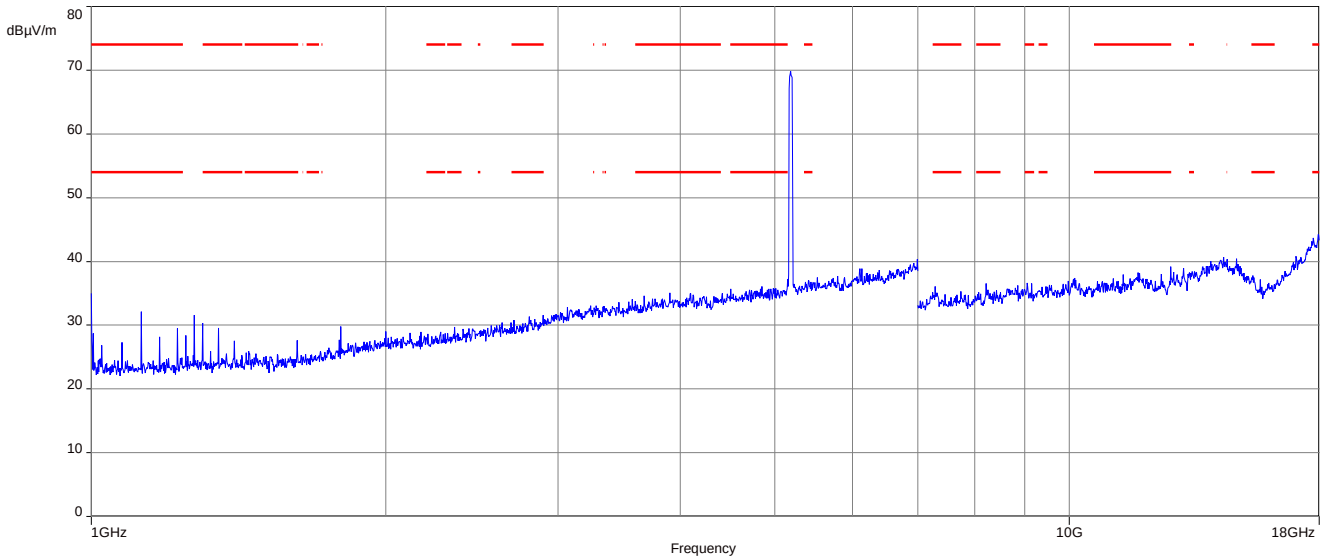



**Plot 30:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-3; highest channel

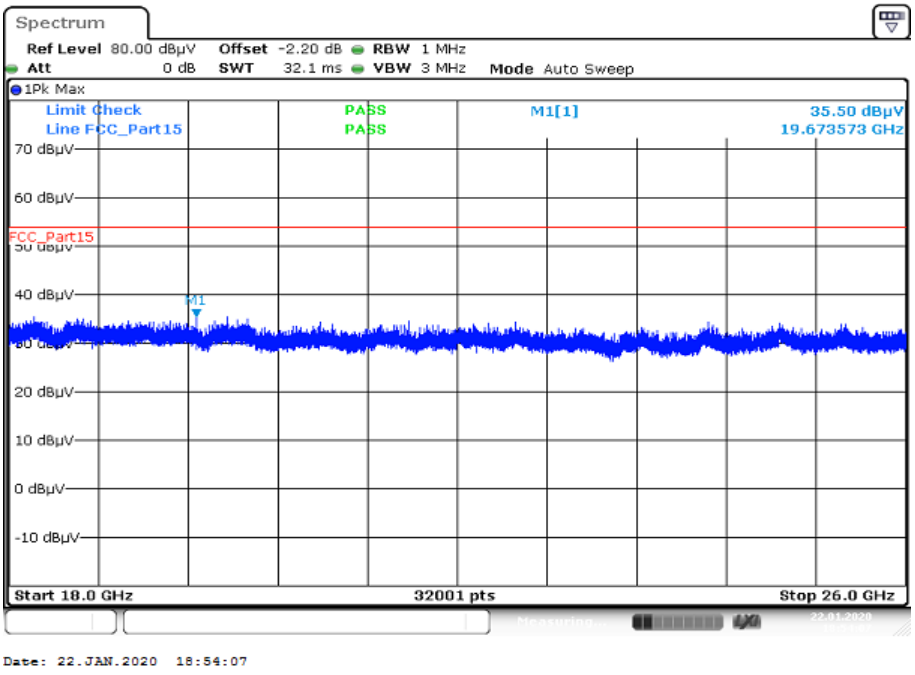


**Plots:** 40 MHz channel bandwidth

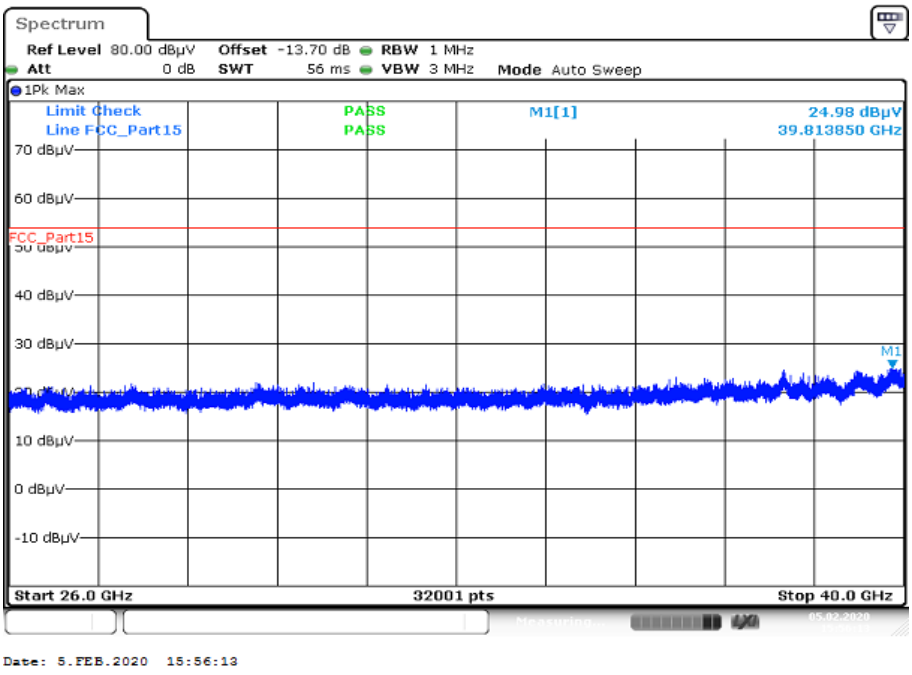
**Plot 1:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-1; lowest channel



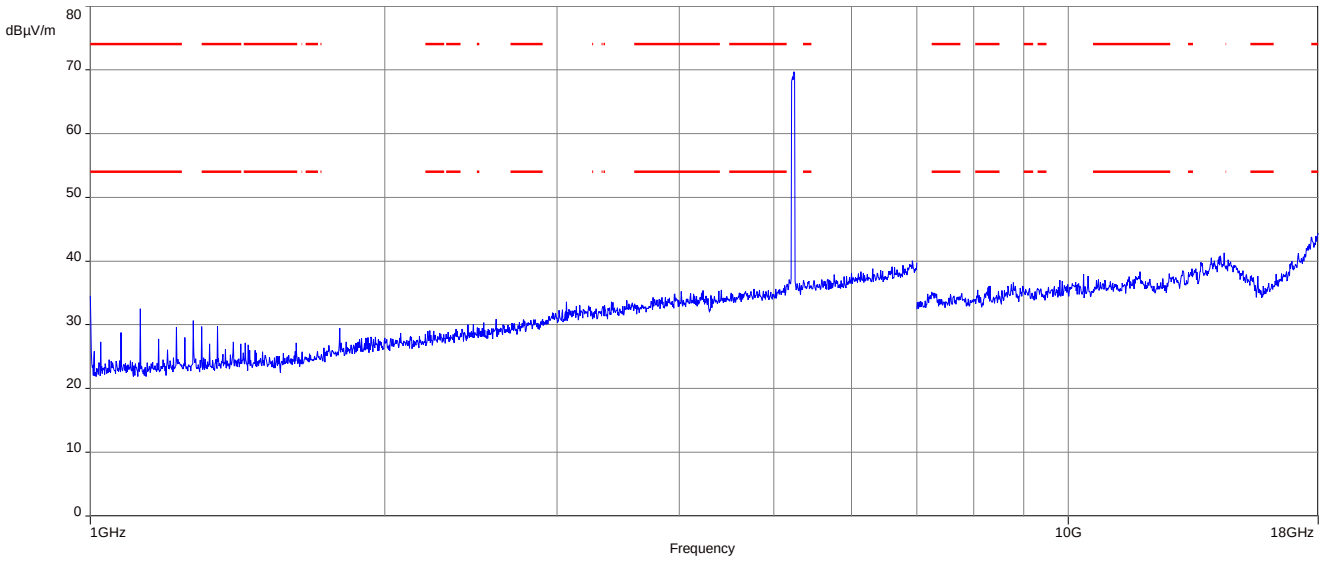

**Plot 2:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-1; lowest channel



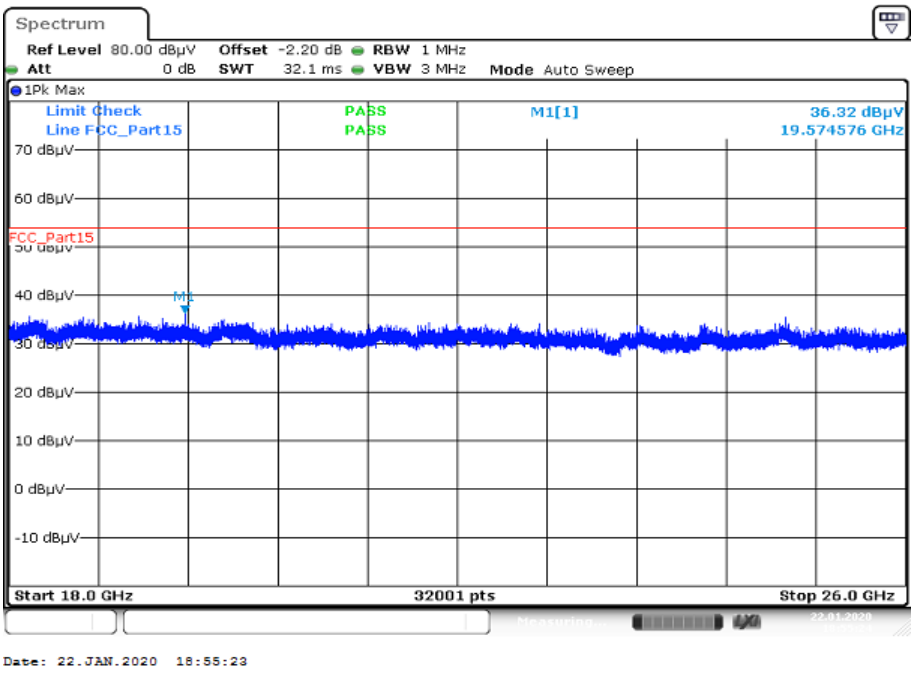
**Plot 3:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-1; lowest channel



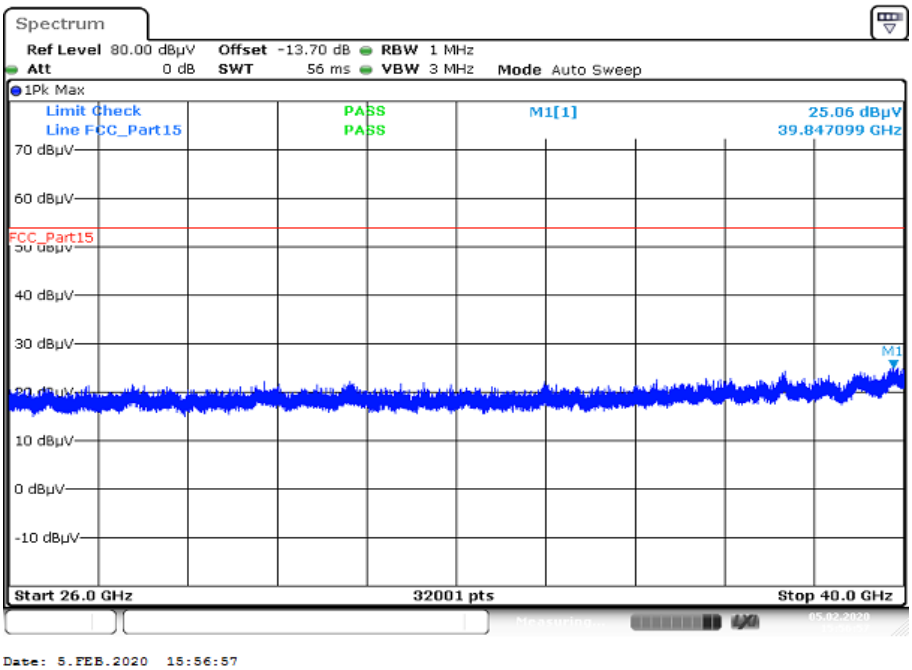

**Plot 4:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-1; highest channel



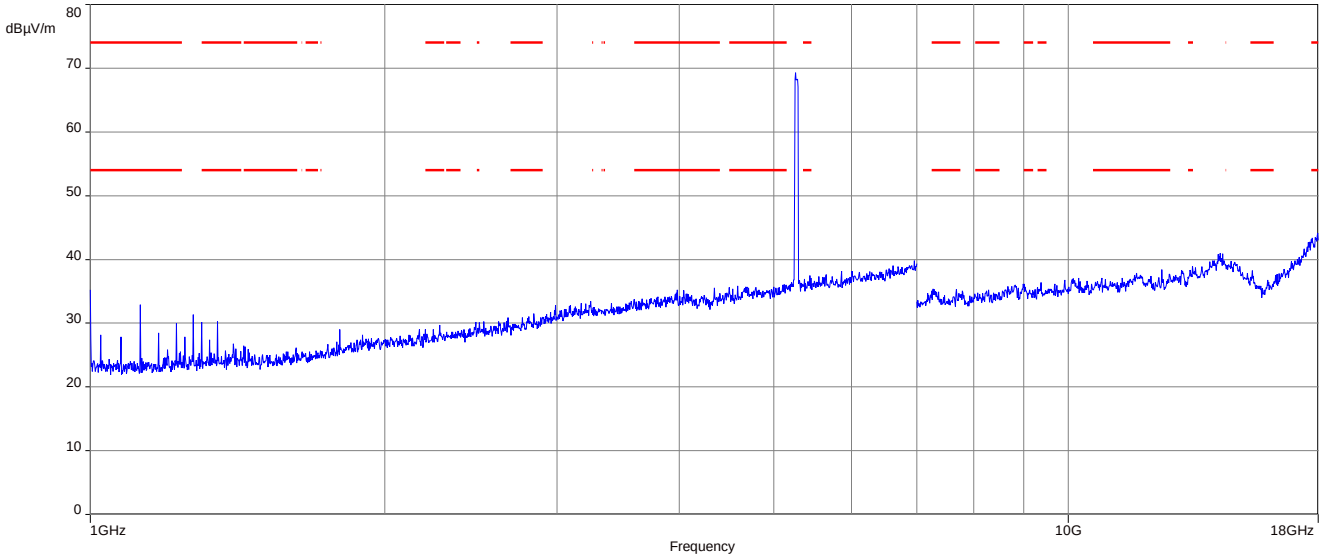
**Plot 5:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-1; highest channel



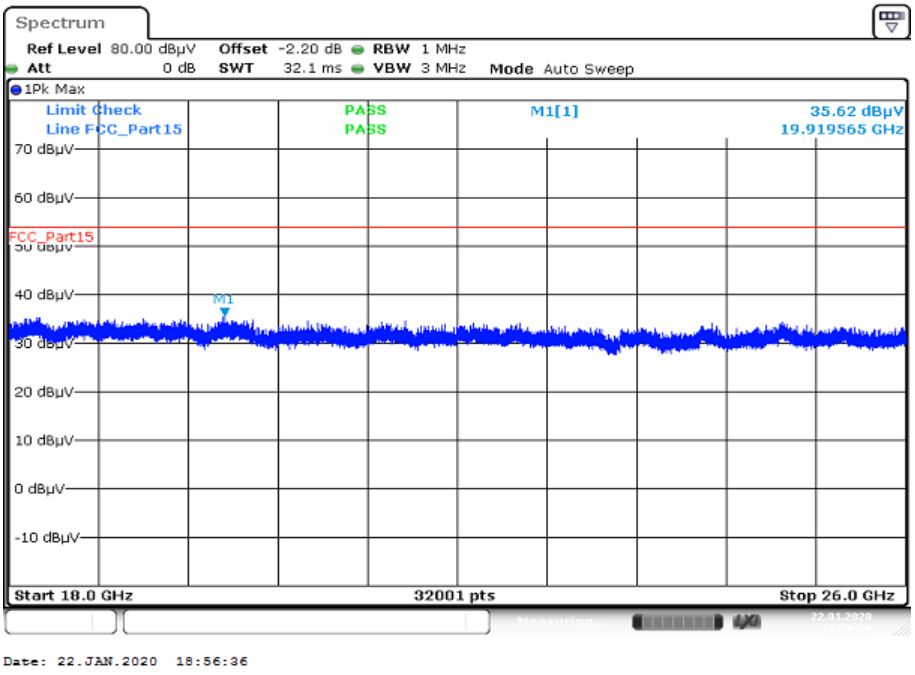

**Plot 6:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-1; highest channel



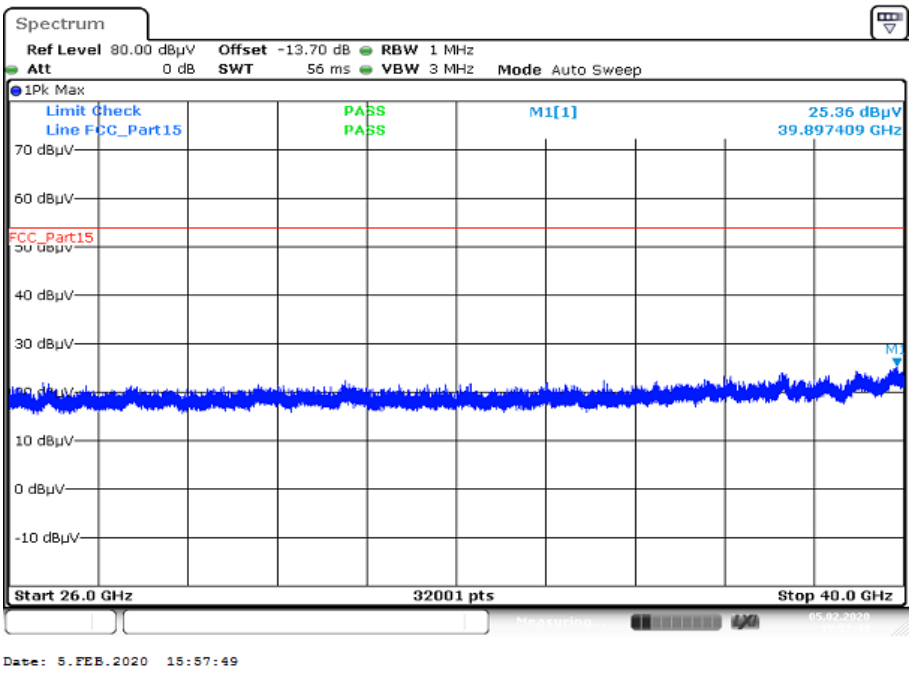
**Plot 7:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2A; lowest channel



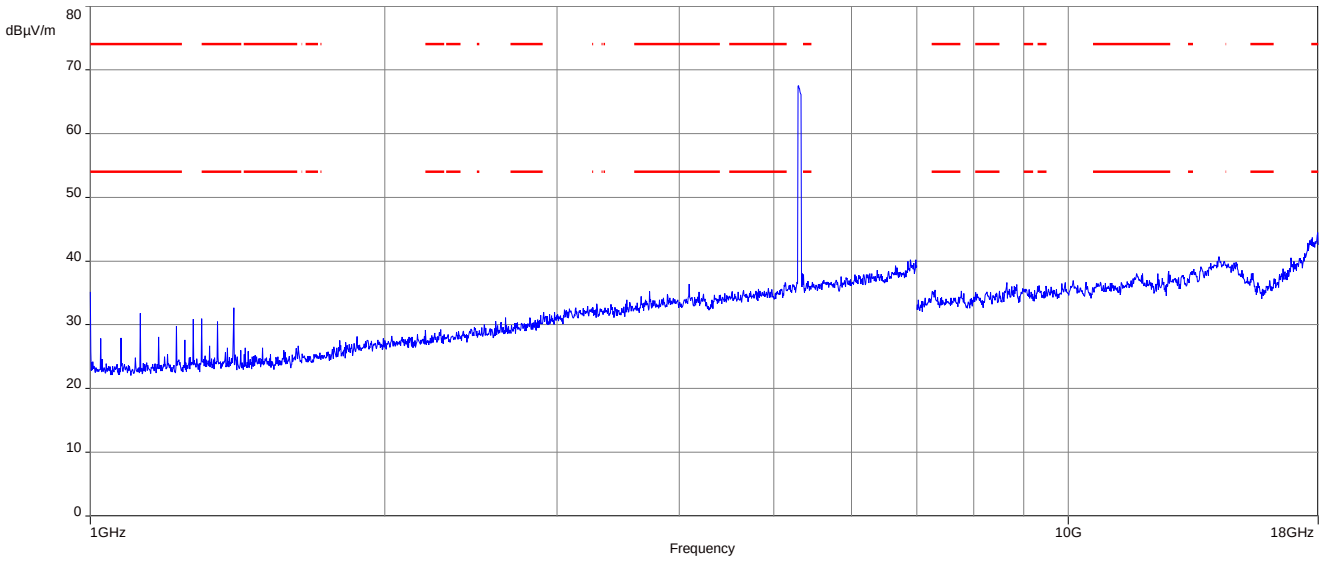

**Plot 8:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-2A; lowest channel



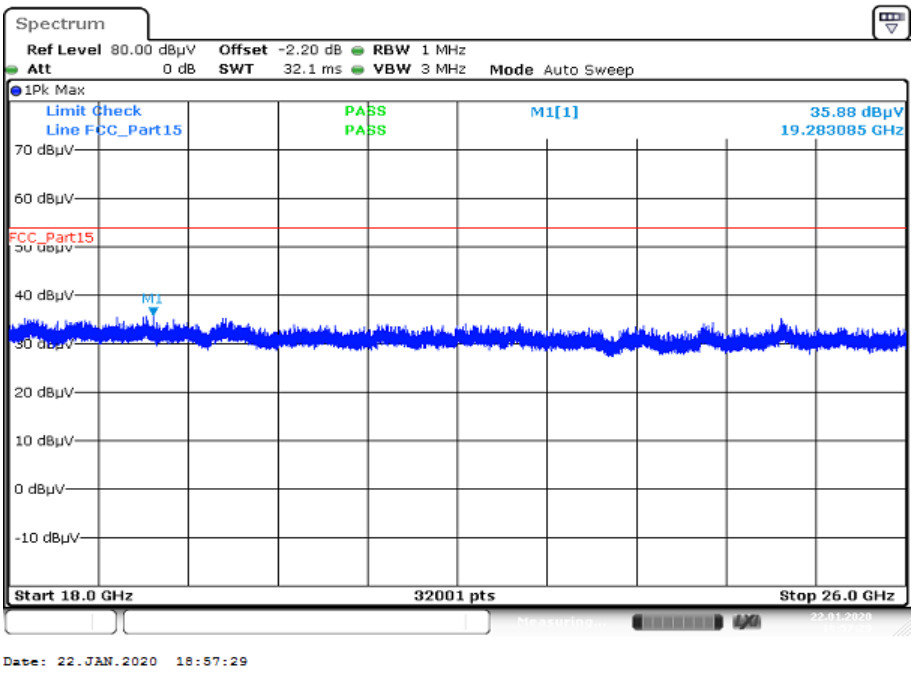
**Plot 9:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-2A; lowest channel



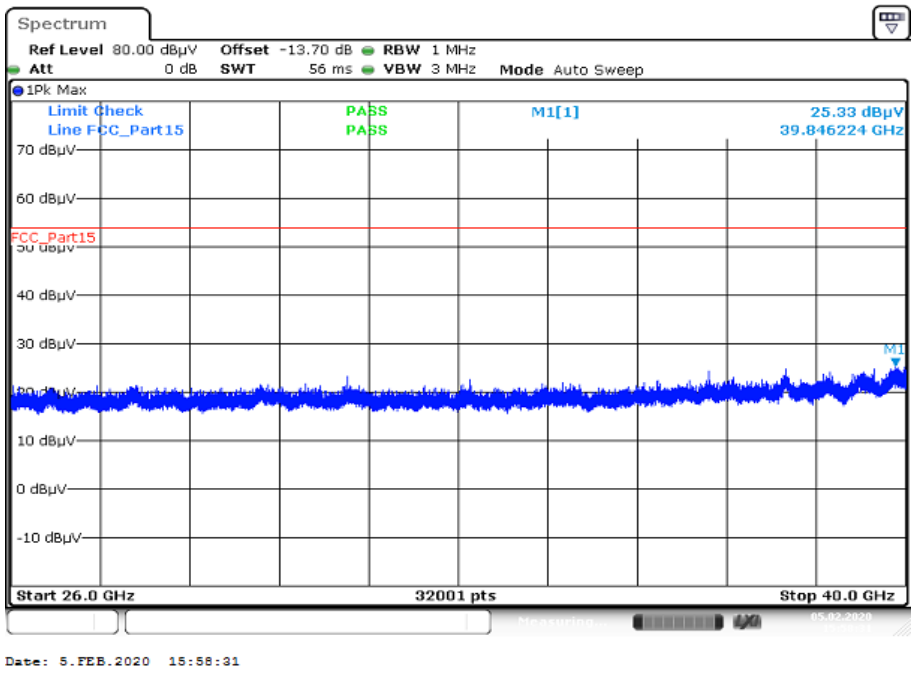

**Plot 10:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2A; highest channel



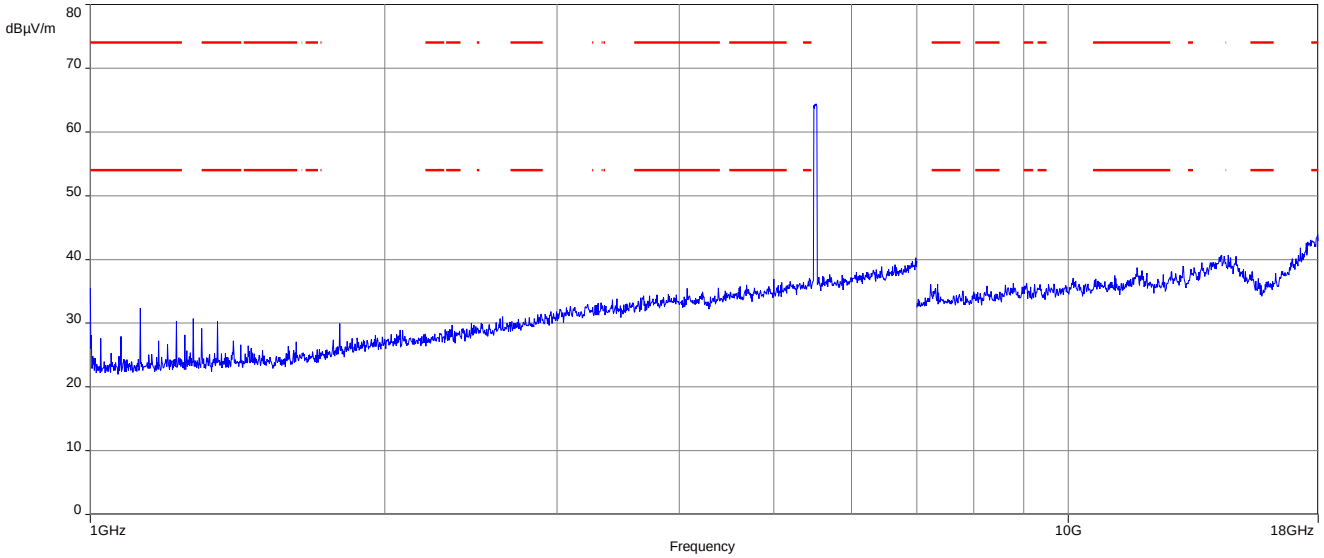
**Plot 11:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-2A; highest channel



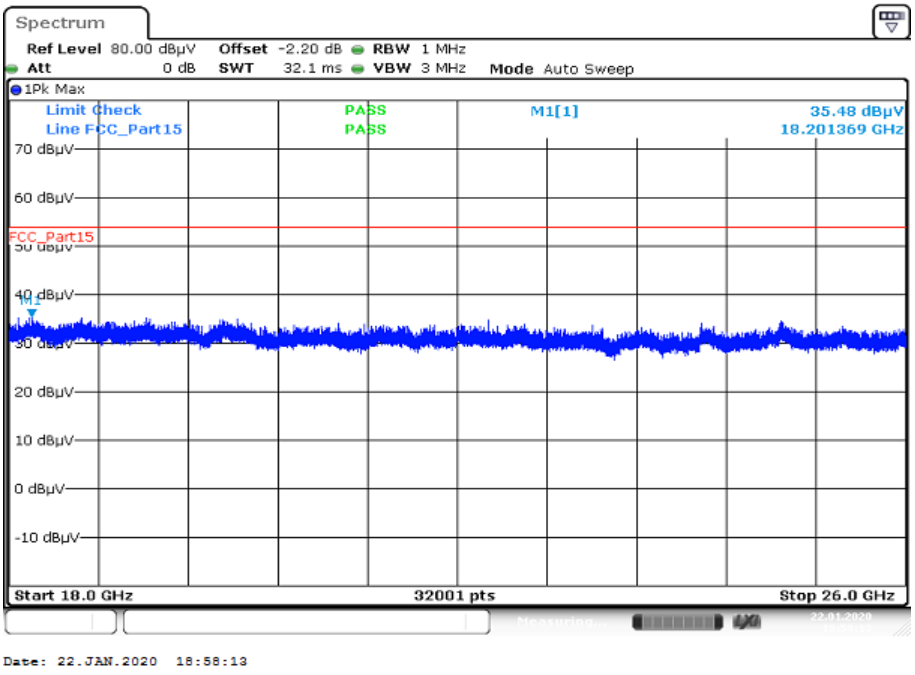

**Plot 12:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-2A; highest channel



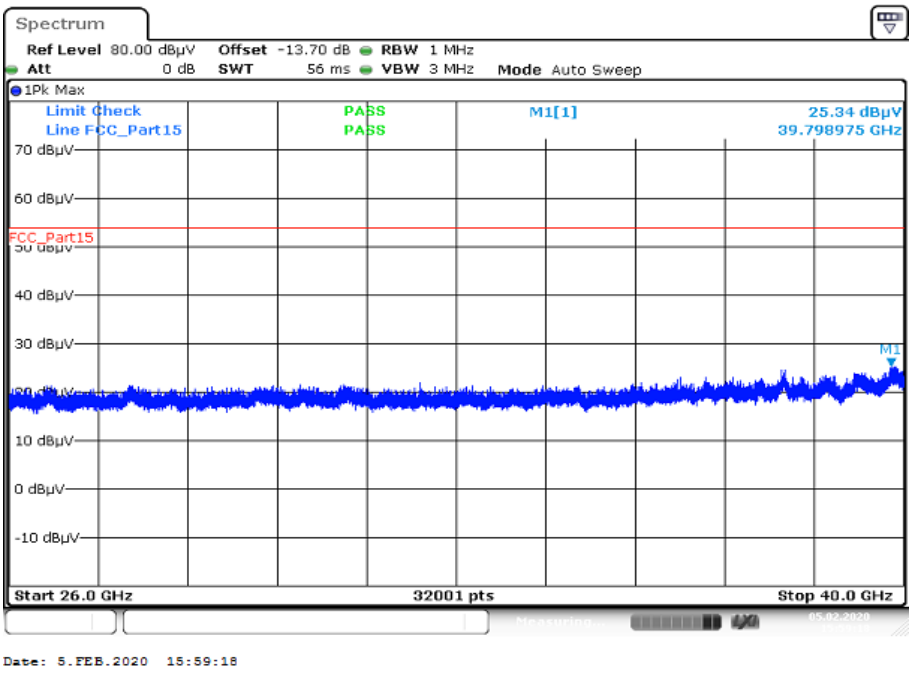
**Plot 13:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2C; lowest channel



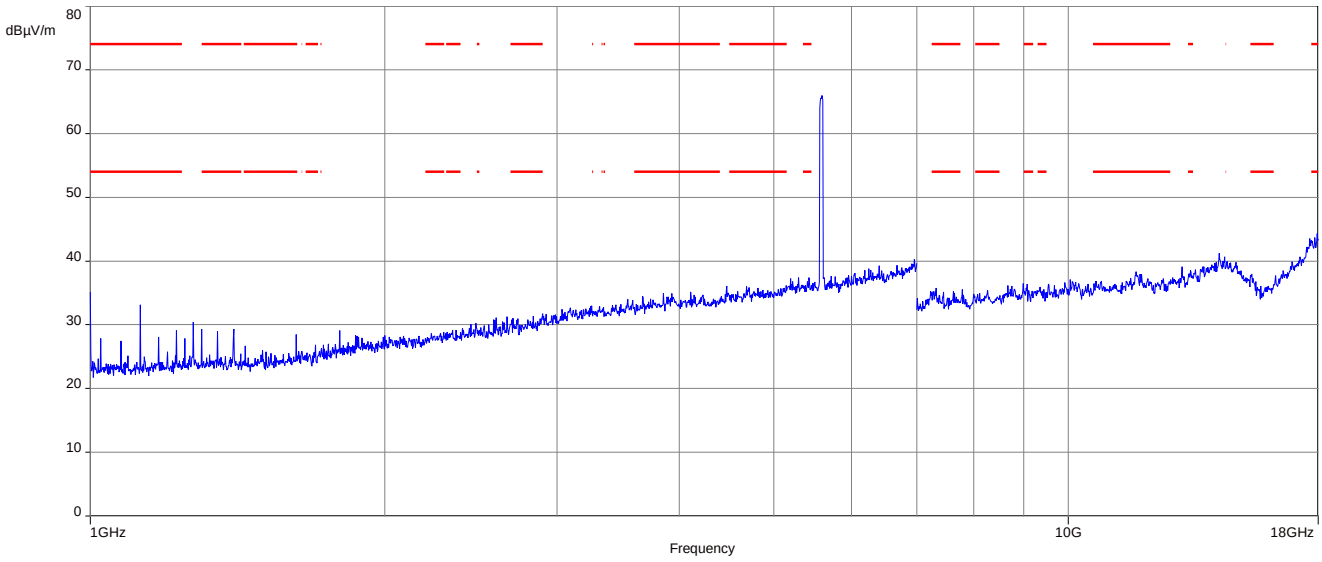

**Plot 14:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-2C; lowest channel



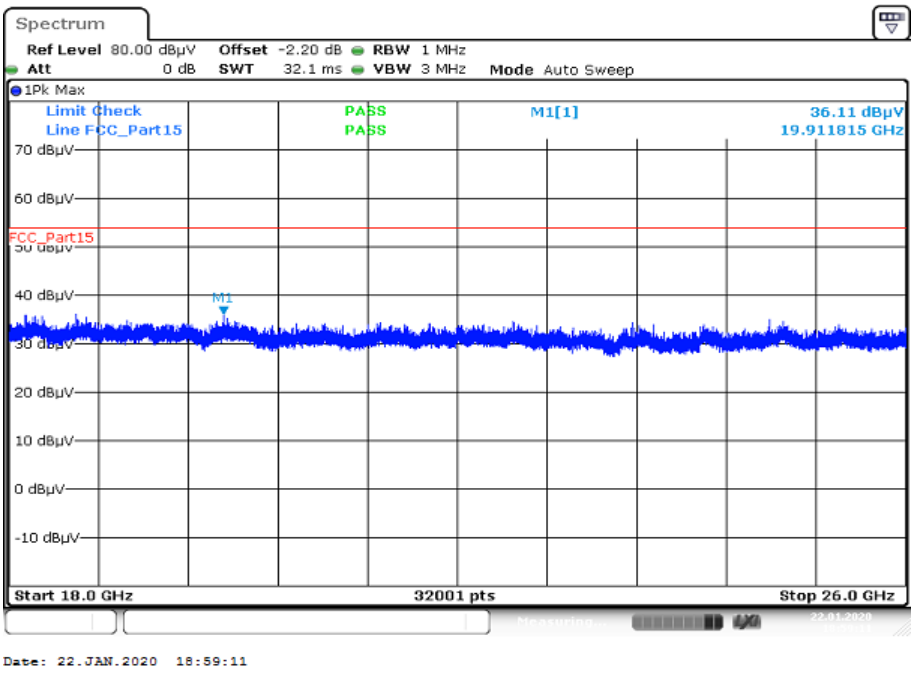
**Plot 15:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-2C; lowest channel



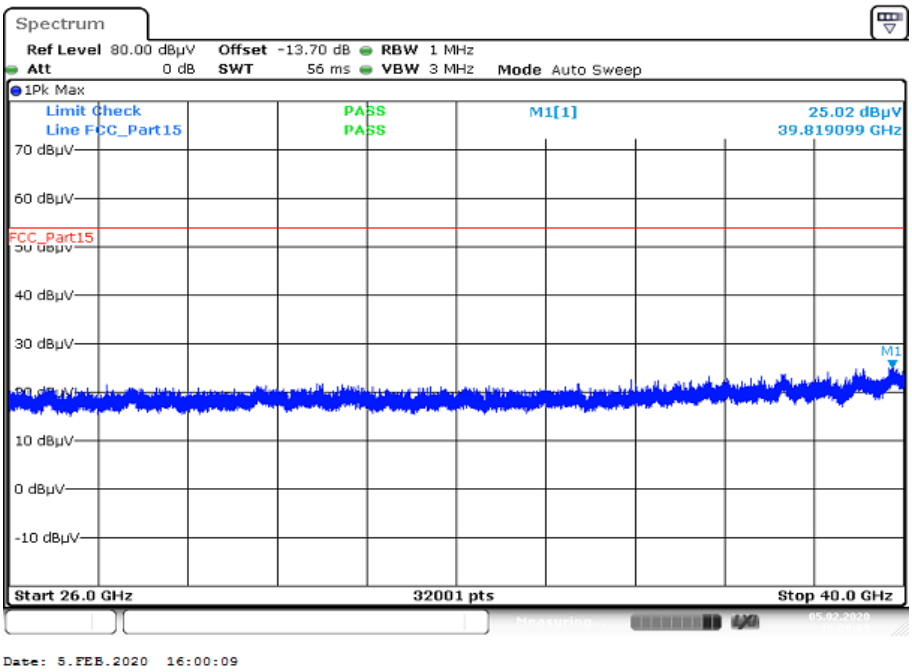

**Plot 16:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2C; middle channel



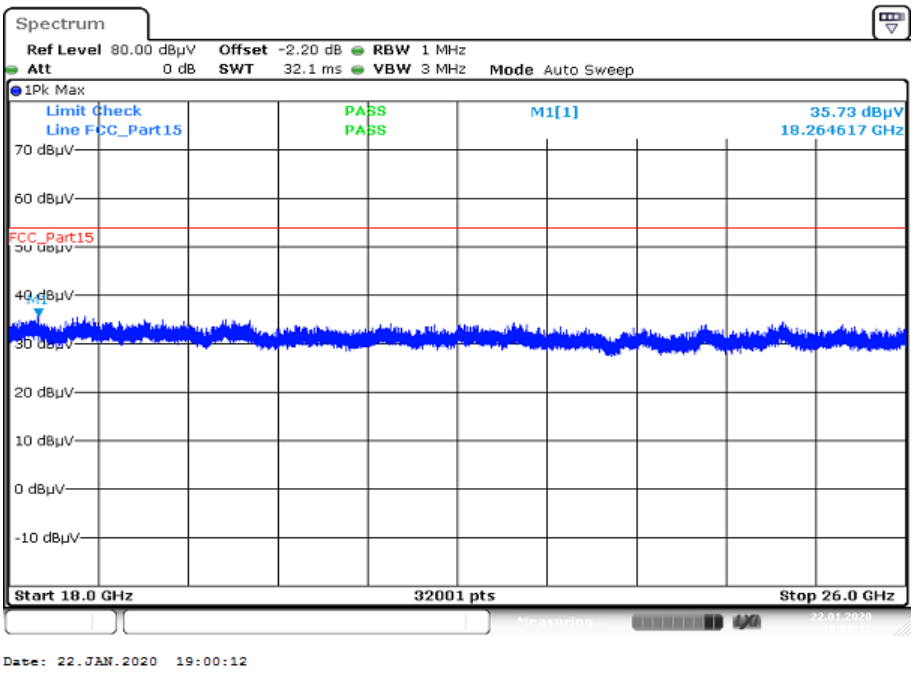
**Plot 17:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-2C; middle channel



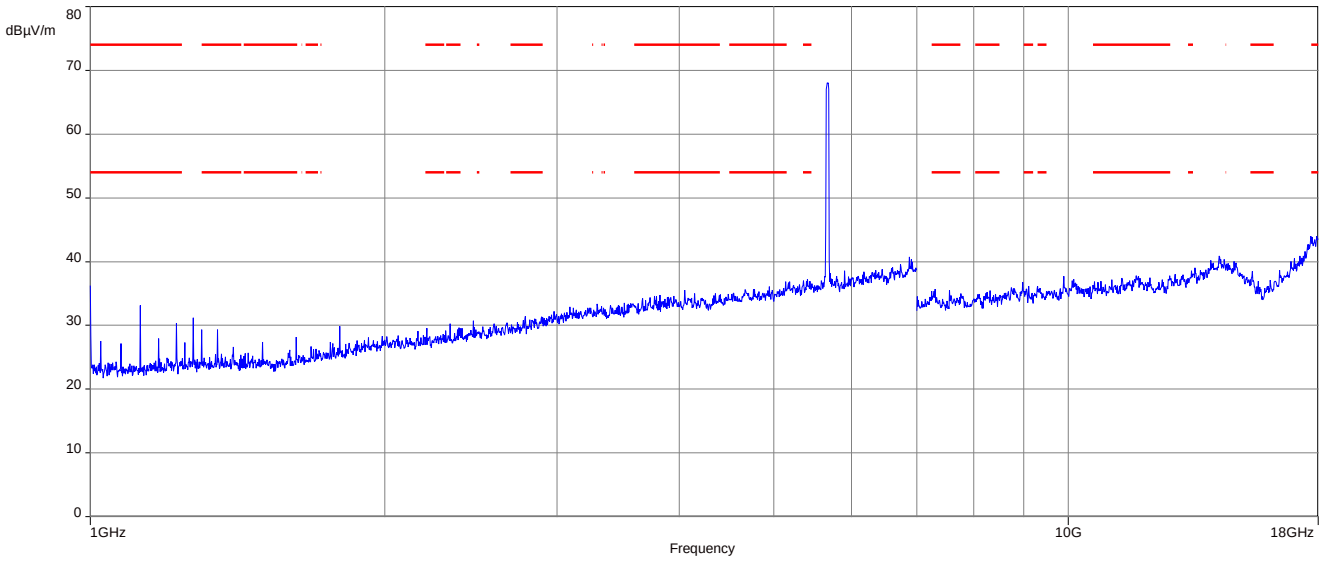

**Plot 18:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-2C; middle channel



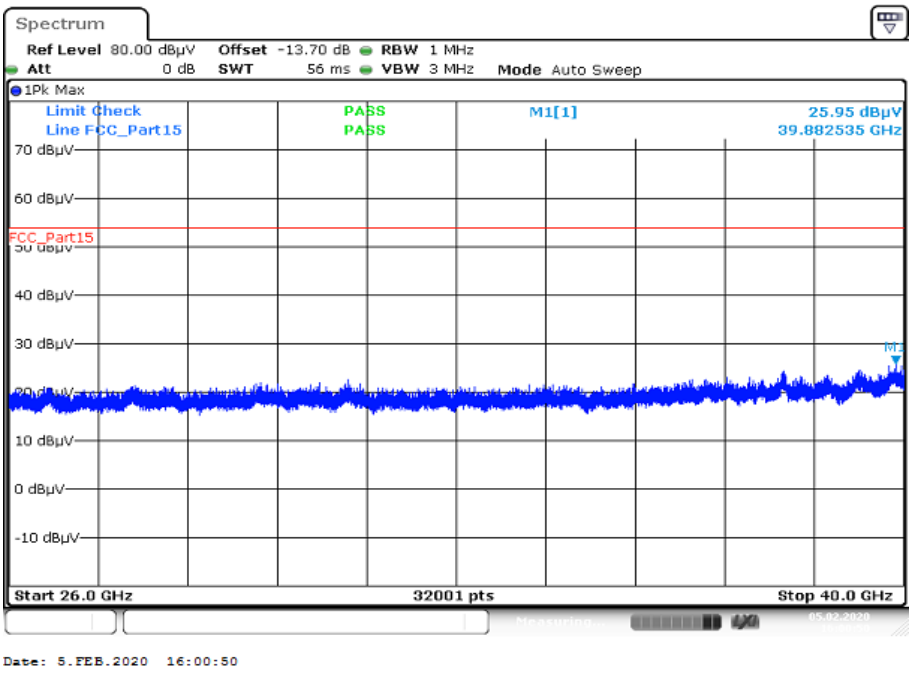
**Plot 19:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2C; highest channel



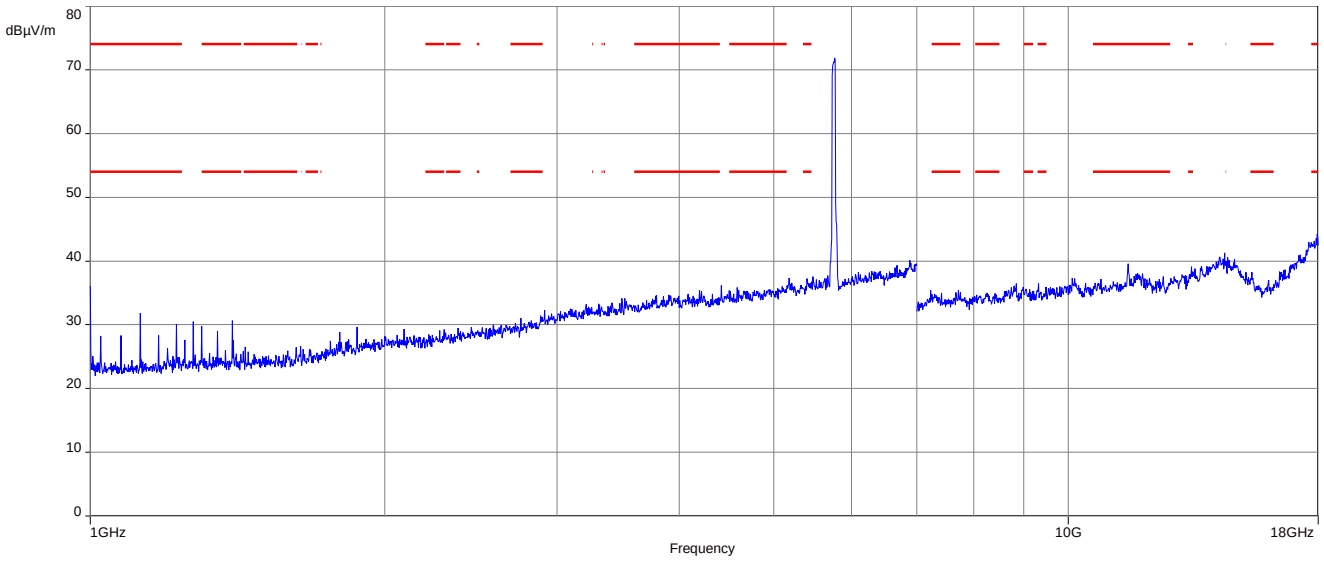

**Plot 20:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-2C; highest channel



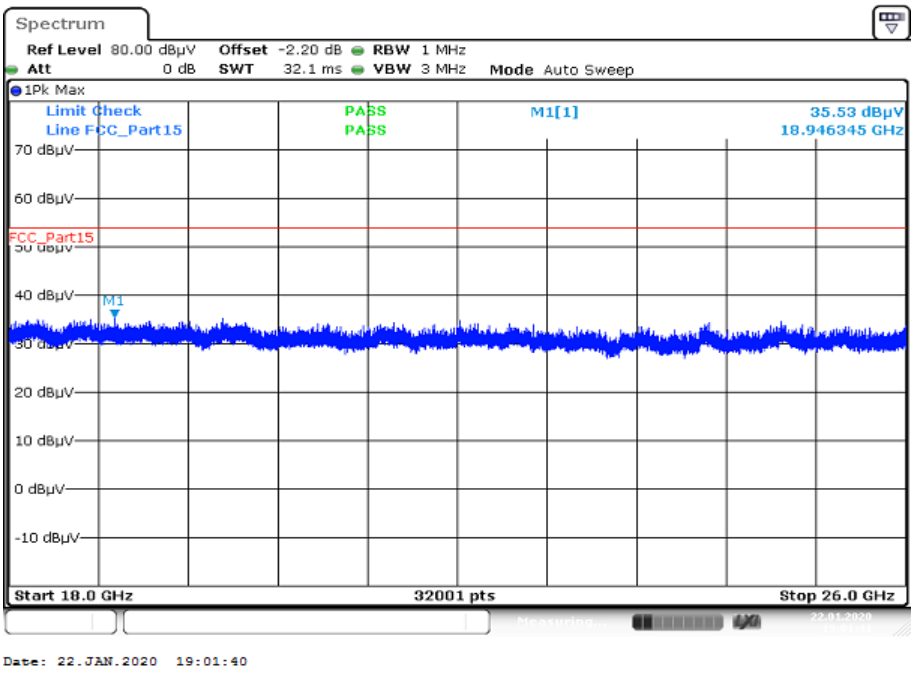
**Plot 21:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-2C; highest channel



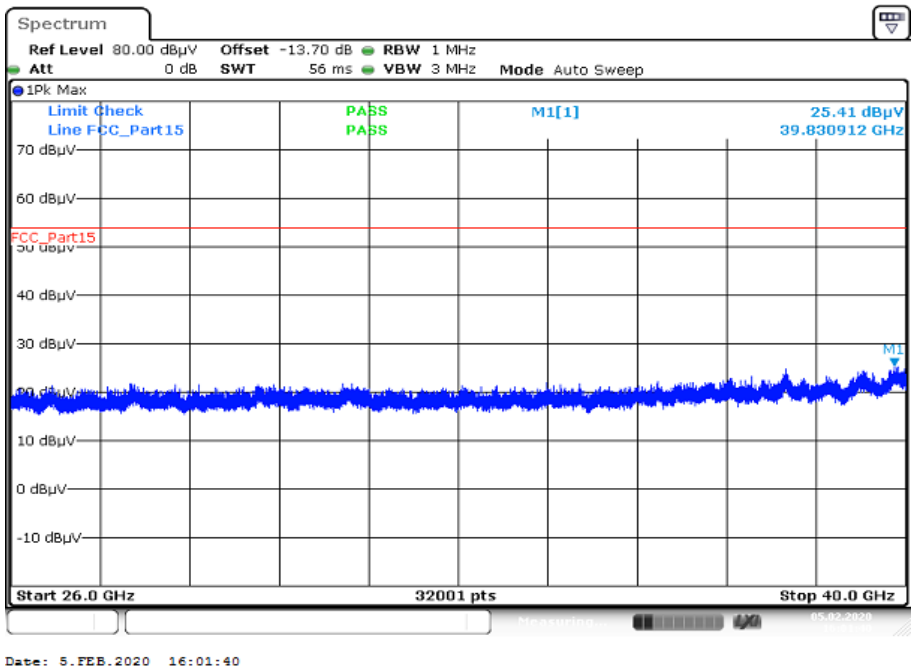

**Plot 22:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-3; lowest channel



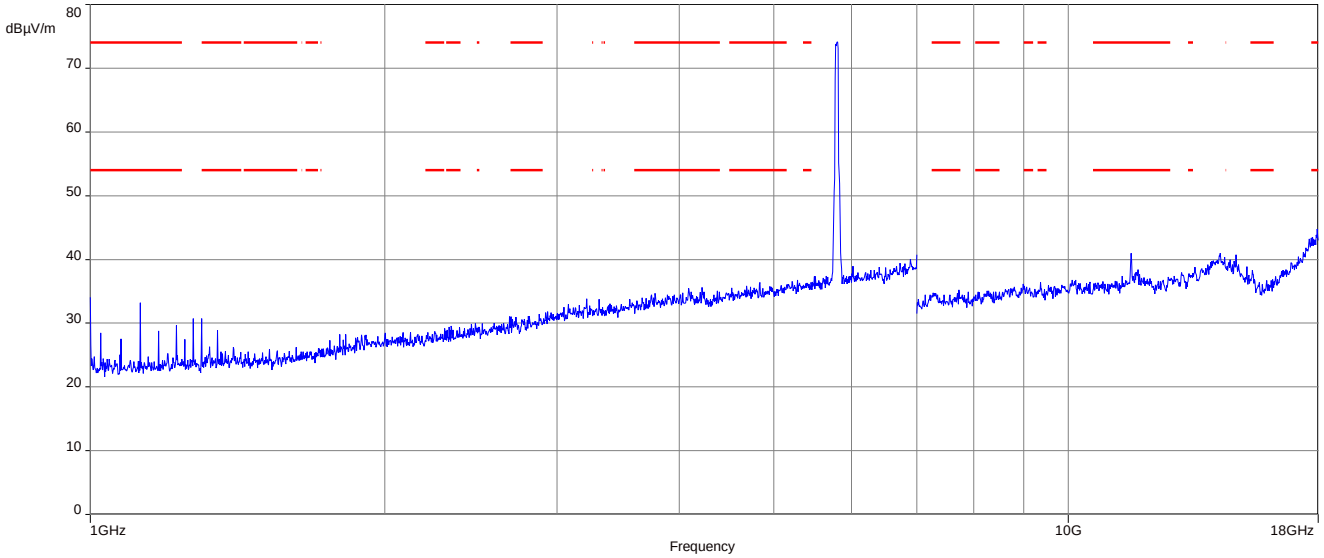
**Plot 23:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-3; lowest channel



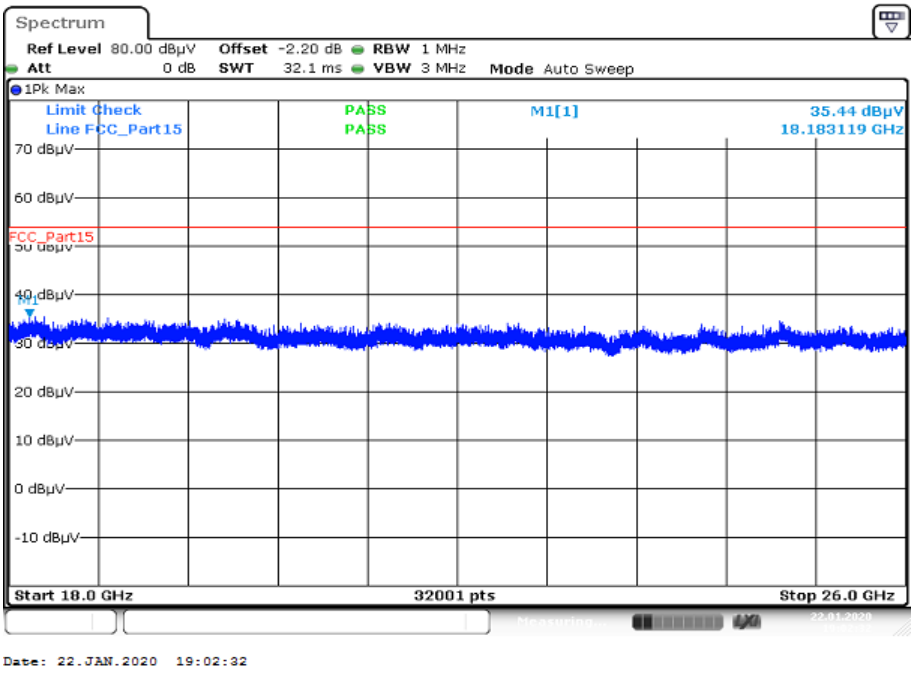

**Plot 24:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-3; lowest channel



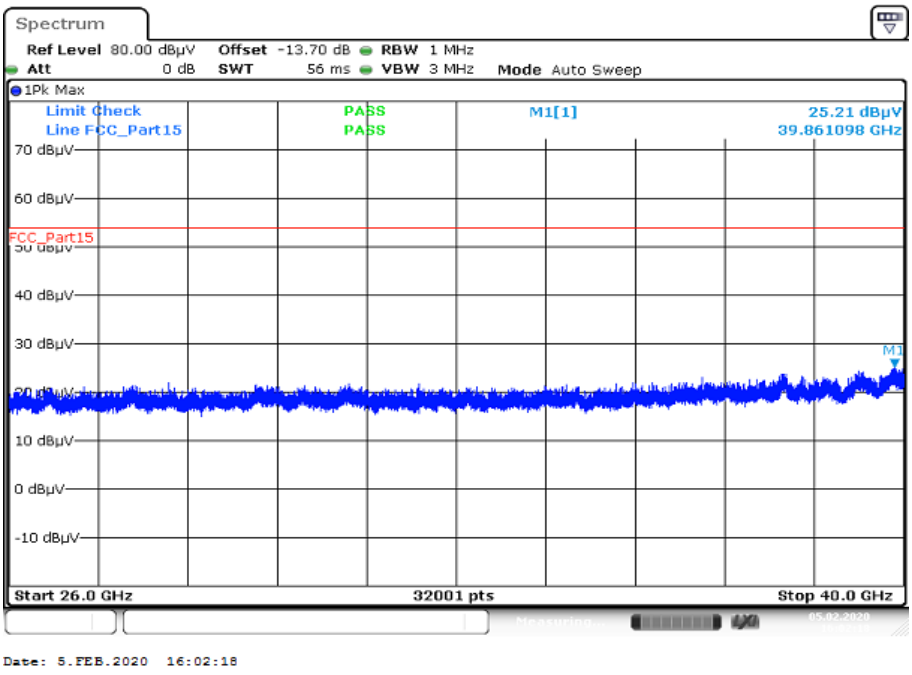
**Plot 25:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-3; highest channel



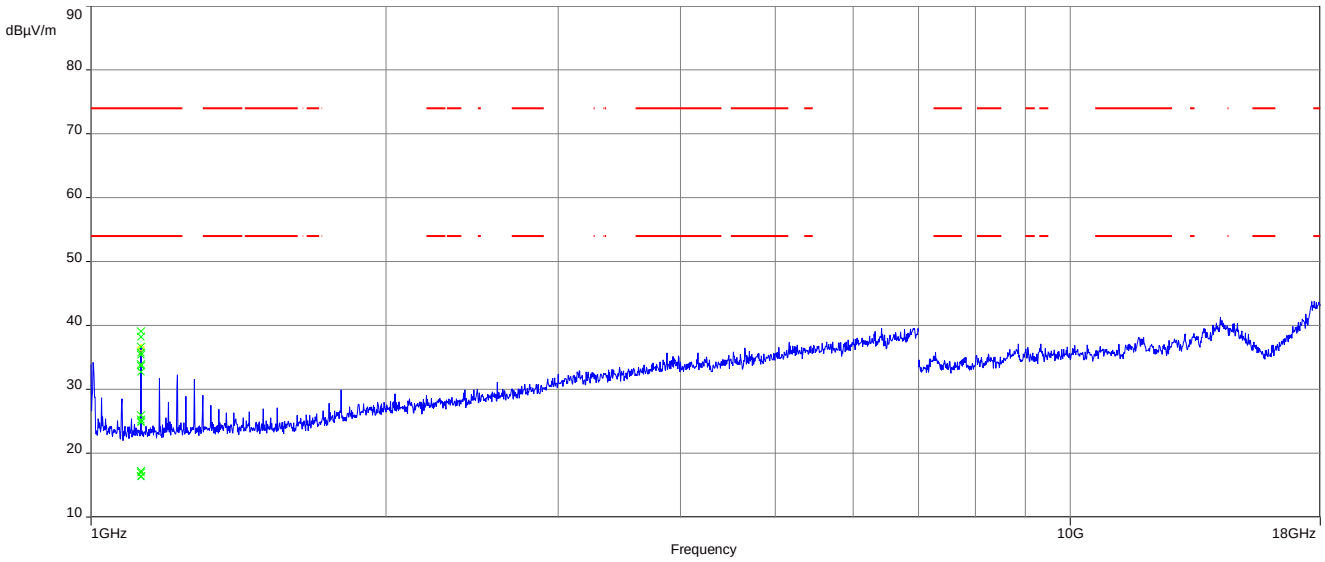

**Plot 26:** 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-3; highest channel



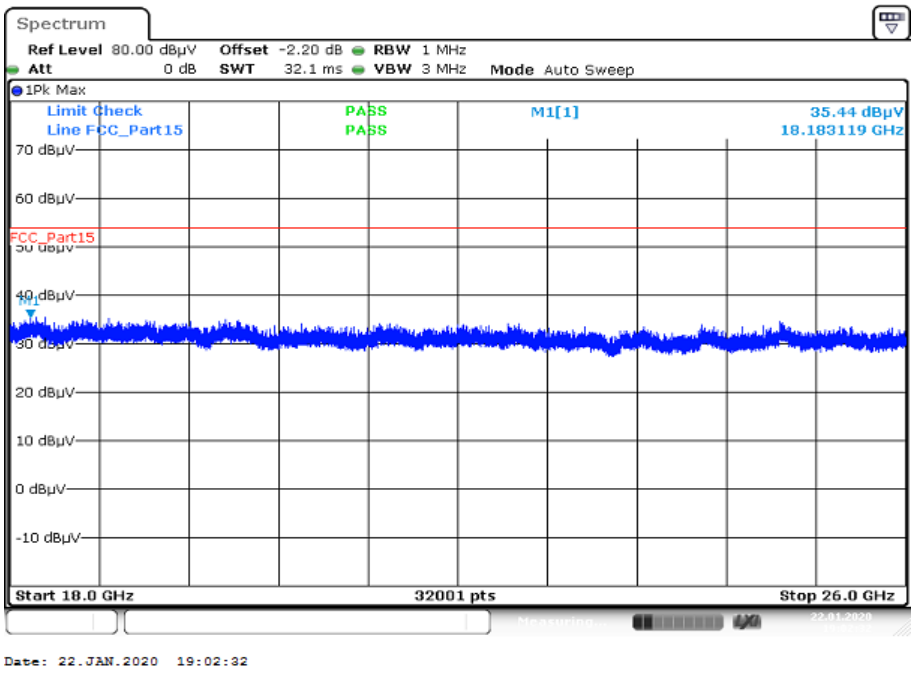
**Plot 27:** 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-3; highest channel



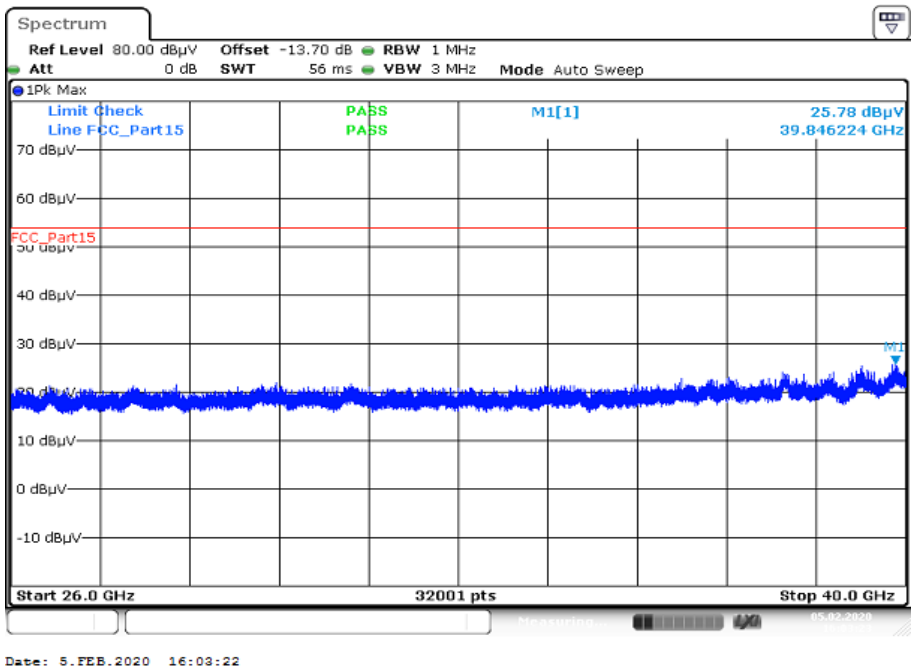

**Plot 31:** 1 GHz to 18 GHz, 5825 MHz, vertical & horizontal polarization, cabinet radiation



**Plot 32:** 18 GHz to 26 GHz, 5825 MHz, vertical & horizontal polarization, cabinet radiation




**Plot 33:** 26 GHz to 40 GHz, 5825 MHz, vertical & horizontal polarization, cabinet radiation



## 11.13 Spurious emissions conducted below 30 MHz (AC conducted)

**Description:**

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. Both power lines, phase and neutral line, are measured. Found peaks are re-measured with average and quasi peak detection to show compliance to the limits.

**Measurement:**

| Measurement parameter | |
|---|---|
| Detector | Peak - Quasi Peak / Average |
| Sweep time | Auto |
| Resolution bandwidth | F < 150 kHz: 200 Hz<br>F > 150 kHz: 9 kHz |
| Video bandwidth | F < 150 kHz: 1 kHz<br>F > 150 kHz: 100 kHz |
| Span | 9 kHz to 30 MHz |
| Trace mode | Max. hold |
| Test setup | See chapter 6.4 - A |
| Measurement uncertainty | See chapter 8 |

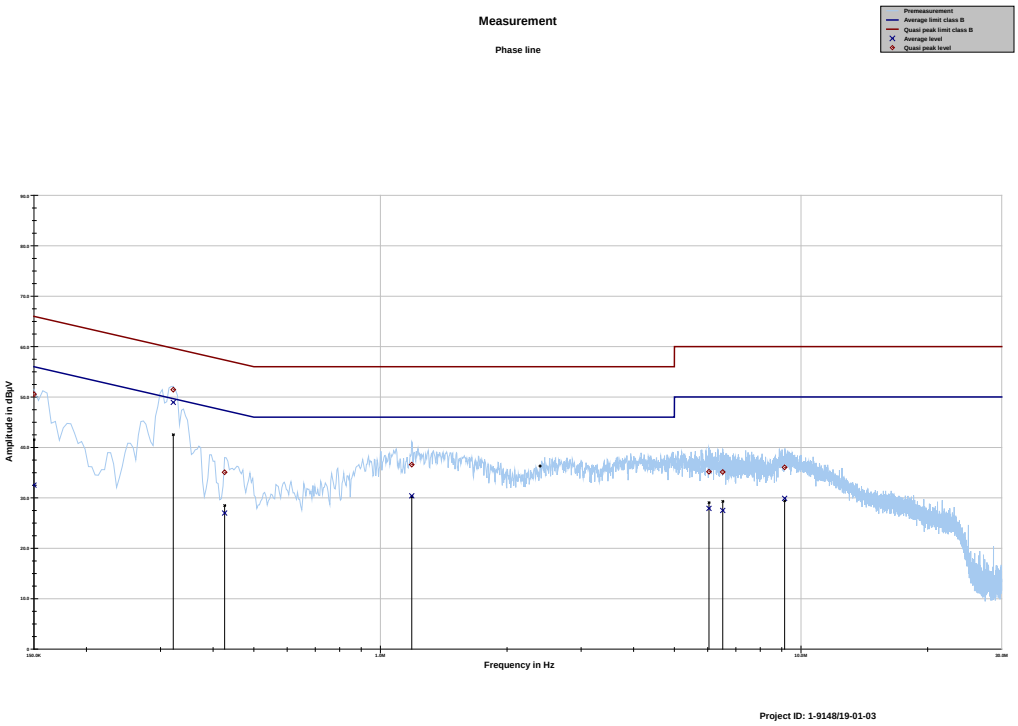
**Limits:**

| FCC | | IC |
|---|---|---|
| Frequency / MHz) | Quasi-Peak / (dBµV / m) | Average / (dBµV / m) |
| 0.15 – 0.5 | 66 to 56* | 56 to 46* |
| 0.5 – 5 | 56 | 46 |
| 5 – 30.0 | 60 | 50 |

*Decreases with the logarithm of the frequency

**Plots:**

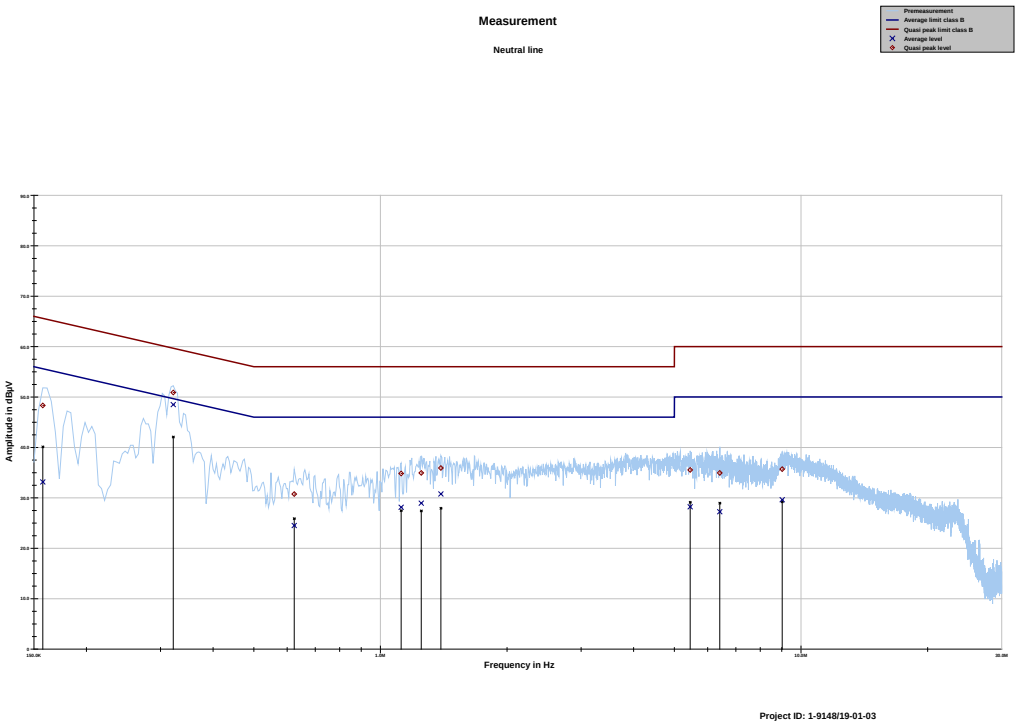
**Plot 1:** 150 kHz to 30 MHz, phase line




**Final results:**

| Frequency | Quasi peak level | Margin quasi peak | Limit QP | Average level | Margin average | Limit AV |
|---|---|---|---|---|---|---|
| MHz | dBµV | dB | dBµV | dBµV | dB | dBµV |
| **0.150000** | 50.56 | 15.44 | 66.000 | 32.52 | 23.48 | 56.000 |
| **0.321638** | 51.44 | 8.22 | 59.664 | 48.93 | 2.17 | 51.096 |
| **0.426113** | 35.07 | 22.26 | 57.328 | 26.99 | 21.12 | 48.111 |
| **1.187288** | 36.59 | 19.41 | 56.000 | 30.39 | 15.61 | 46.000 |
| **6.041644** | 35.19 | 24.81 | 60.000 | 27.91 | 22.09 | 50.000 |
| **6.515512** | 35.13 | 24.87 | 60.000 | 27.50 | 22.50 | 50.000 |
| **9.142312** | 36.04 | 23.96 | 60.000 | 29.89 | 20.11 | 50.000 |

**Plot 2:** 150 kHz to 30 MHz, neutral line




**Final results:**

| Frequency | Quasi peak level | Margin quasi peak | Limit QP | Average level | Margin Average | Limit AV |
|---|---|---|---|---|---|---|
| MHz | dBµV | dB | dBµV | dBµV | dB | dBµV |
| 0.157463 | 48.32 | 17.27 | 65.597 | 33.15 | 22.64 | 55.787 |
| 0.321638 | 50.89 | 8.77 | 59.664 | 48.49 | 2.61 | 51.096 |
| 0.623869 | 30.75 | 25.25 | 56.000 | 24.52 | 21.48 | 46.000 |
| 1.120125 | 34.82 | 21.18 | 56.000 | 28.13 | 17.87 | 46.000 |
| 1.250719 | 34.94 | 21.06 | 56.000 | 28.94 | 17.06 | 46.000 |
| 1.392506 | 35.91 | 20.09 | 56.000 | 30.77 | 15.23 | 46.000 |
| 5.452106 | 35.53 | 24.47 | 60.000 | 28.21 | 21.79 | 50.000 |
| 6.411037 | 34.94 | 25.06 | 60.000 | 27.25 | 22.75 | 50.000 |
| 9.022913 | 35.69 | 24.31 | 60.000 | 29.63 | 20.37 | 50.000 |

## 12 Observations

No observations except those reported with the single test cases have been made.

## Annex A Glossary

| | |
|---|---|
| **EUT** | Equipment under test |
| **DUT** | Device under test |
| **UUT** | Unit under test |
| **GUE** | GNSS User Equipment |
| **ETSI** | European Telecommunications Standards Institute |
| **EN** | European Standard |
| **FCC** | Federal Communications Commission |
| **FCC ID** | Company Identifier at FCC |
| **IC** | Industry Canada |
| **PMN** | Product marketing name |
| **HMN** | Host marketing name |
| **HVIN** | Hardware version identification number |
| **FVIN** | Firmware version identification number |
| **EMC** | Electromagnetic Compatibility |
| **HW** | Hardware |
| **SW** | Software |
| **Inv. No.** | Inventory number |
| **S/N or SN** | Serial number |
| **C** | Compliant |
| **NC** | Not compliant |
| **NA** | Not applicable |
| **NP** | Not performed |
| **PP** | Positive peak |
| **QP** | Quasi peak |
| **AVG** | Average |
| **OC** | Operating channel |
| **OCW** | Operating channel bandwidth |
| **OBW** | Occupied bandwidth |
| **OOB** | Out of band |
| **DFS** | Dynamic frequency selection |
| **CAC** | Channel availability check |
| **OP** | Occupancy period |
| **NOP** | Non occupancy period |
| **DC** | Duty cycle |
| **PER** | Packet error rate |
| **CW** | Clean wave |
| **MC** | Modulated carrier |
| **WLAN** | Wireless local area network |
| **RLAN** | Radio local area network |
| **DSSS** | Dynamic sequence spread spectrum |
| **OFDM** | Orthogonal frequency division multiplexing |
| **FHSS** | Frequency hopping spread spectrum |
| **GNSS** | Global Navigation Satellite System |
| **$C/N_0$** | Carrier to noise-density ratio, expressed in dB-Hz |

## Annex B Document history

| Version | Applied changes | Date of release |
|---|---|---|
| -/- | Initial release | 2020-02-19 |

## Annex C Accreditation Certificate – D-PL-12076-01-04

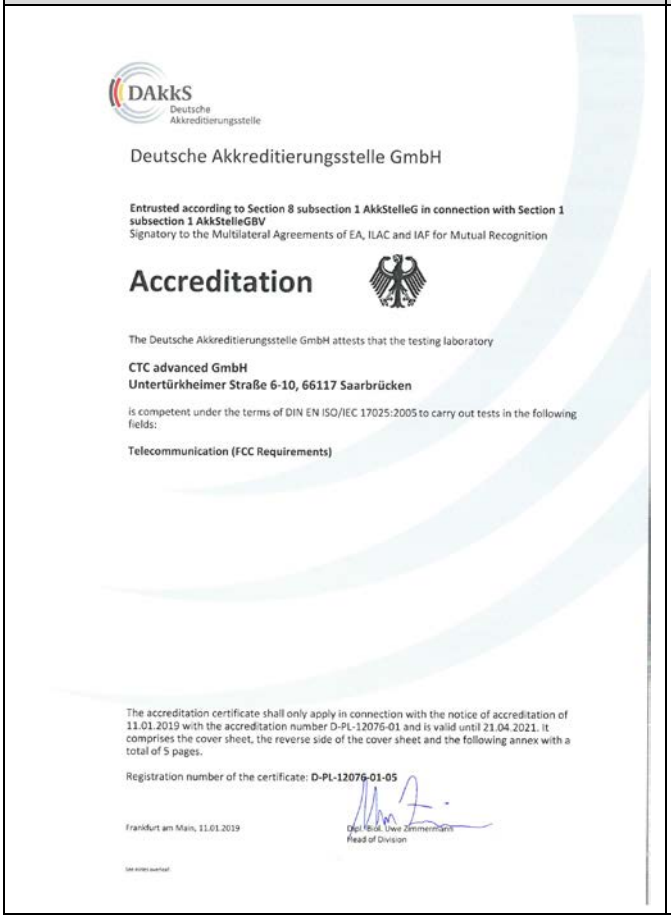
| first page | last page |
|---|---|
|  |  |



**Note: The current certificate annex is published on the website (link see below) of the Accreditation Body DAkkS or may be received by CTC advanced GmbH on request**

https://www.dakks.de/as/ast/d/D-PL-12076-01-04.pdf

## Annex D Accreditation Certificate – D-PL-12076-01-05

| first page | last page |
|---|---|
|  |  |



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################################## END OF TEST REPORT ##################################