

03/03/2022

Federal Communications Commission
Office of Engineering and Technology
Laboratory Division

**GUIDELINES FOR COMPLIANCE TESTING OF
UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE (U-NII)
5.9 GHz DEVICES UNDER PART 15, SUBPART E**

1. INTRODUCTION

This document provides guidance for determining 5.9 GHz U-NII devices emissions compliance under Part 15, Subpart E of the FCC rules.

This document includes acceptable procedures for measuring emission bandwidth, maximum output power, power spectral density, and unwanted emissions both in and out of the restricted bands. For equipment under test (EUT) that can transmit on multiple outputs simultaneously (e.g., MIMO or beamforming devices), *see* KDB Publication 662911 for additional guidance. When technical requirements are expressed in terms of radiated power (EIRP) or radiated power spectral density (EIRP/given bandwidth), general requirements applicable to radiated test setup and measurement, stated in Clause 5 of ANSI C63.10-2013, must be followed.

All EUT operating modes and configurations must satisfy all requirements. The operating mode and configuration that is the worst case for one test may not be the worst case for another test.

Note that average emission measurements in the restricted bands are based on continuous transmission by the U-NII device during the measurement interval. Downward adjustment of test data based on actual operational duty cycle of the device is not permitted.

2. MEASUREMENT PROCEDURES

2.1 General Guidance

Refer to KDB Publication 789033.

2.2 Frequency Stability

Refer to KDB 789033.

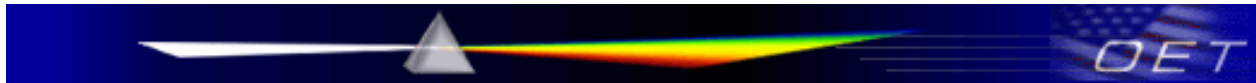
2.3 Duty Cycle (x), Transmission Duration (T), and Maximum Power Control Level

Refer to KDB Publication 789033 or

2.4 Emission Bandwidth (EBW)

Refer to Section II C of KDB Publication 789033.

2.5 99% Occupied Bandwidth



03/03/2022

Refer to Section II D of KDB Publication 789033.

2.6 Maximum Output Power

Refer to KDB Publication 789033. Any of the methods in Section II E of KDB Publication 789033 for maximum output power or power spectral density can be used. Refer to KDB Publication 662911 D01 and D02 if conducted power measurements are combined with directional gain of the antenna system to demonstrate compliance with the radiated limit.

Note that total transmit power of a device operating on a channel that spans the 5.725-5.850 GHz and 5.850-5.895 GHz bands is subject to the limit specified in § 15.407(a). However, if the device is capable of multiple simultaneous transmissions, maximum power of each individual transmission within a band is subject to the limit specified in § 15.407(a). Refer to Section III of KDB Publication 789033 for further guidance on channel aggregation.

2.8 Maximum Power Spectral Density (PSD)

Refer to Section F of KDB Publication 789033.

2.9 Unwanted Emission Measurement

Use guidance in KDB Publication 789033 for all measurements. Unwanted emissions outside of restricted bands are measured with an RMS detector. In addition, 15.35(b) applies where the peak emissions must be limited to no more than 20 dB above the average limit. Refer to KDB 662911 D01 and D02 if conducted power measurements are combined with directional gain of the antenna system to demonstrate compliance with the radiated limit.

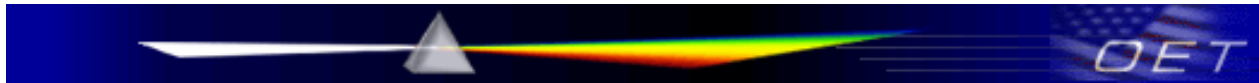
Unwanted band-edge emissions may be measured using the integration method as described in KDB Publication 789033 3. d) (ii). Emissions below 5.725 GHz should be measured using peak-detection while emission above 5.895 GHz should be measured using average detection.

2.10 Out of Band Emissions

2.10.1 General

Indoor access points, subordinate devices and client devices operating in the 5.850-5.895 GHz band are required to meet the following OOB Emissions.

- a) For an indoor access point or subordinate, all emissions at or above 5.895 GHz shall not exceed an EIRP of 15 dBm/MHz and shall decrease linearly to an EIRP of -7 dBm/MHz at or above 5.925 GHz.
- b) For a client device or an outdoor access point, all emissions at or above 5.895 GHz shall not exceed an EIRP of -5 dBm/MHz and shall decrease linearly to an EIRP of -27 dBm/MHz at or above 5.925 GHz.
- c) For a client device or indoor access point or subordinate device, all emissions below 5.725 GHz shall not exceed an EIRP of -27 dBm/MHz at 5.65 GHz increasing linearly to 10



03/03/2022

dBm/MHz at 5.7 GHz, and from 5.7 GHz increasing linearly to a level of 15.6 dBm/MHz at 5.72 GHz, and from 5.72 GHz increasing linearly to a level of 27 dBm/MHz at 5.725 GHz.

2.10.2 Test Procedure

a) Measurement Procedures

The measurements shall be performed using Section G of KDB Publication 789033 as guidance.

b) Out of Band Emissions Mask

Indoor access points, subordinate devices, client devices, and outdoor access points shall meet the Out of Band Emissions as illustrated in Figure 1 below.

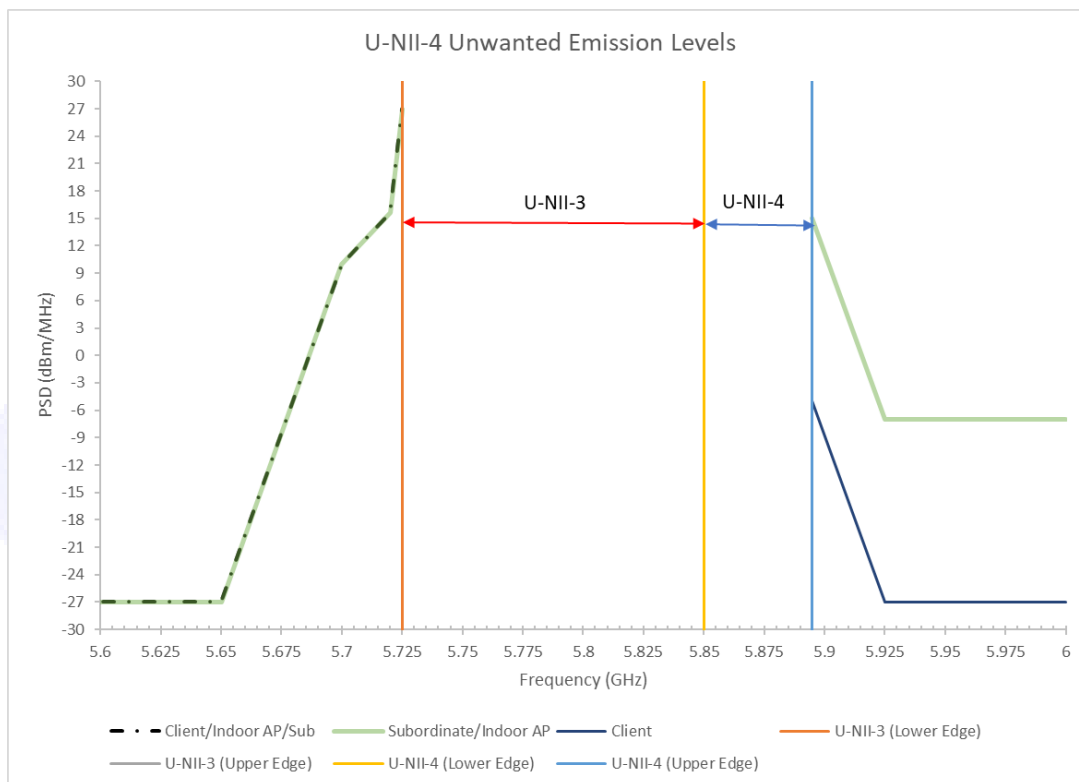
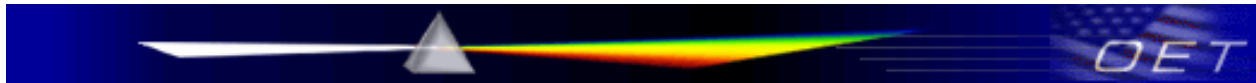


Figure 1. Out of Band Emission Mask of U-NII Devices Operating in the 5.850-5.895 GHz Band

2.11 Minimum Emission Bandwidth for the band 5.850-5.895 GHz

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 kHz for the 5.850–5.895 GHz band. The following procedure shall be used for measuring this bandwidth:

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW.



03/03/2022

- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

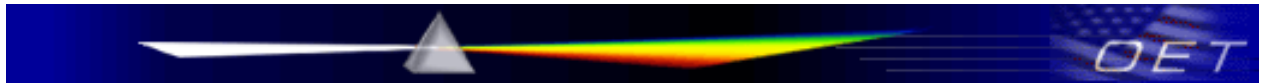
Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described in this section. For devices that use channel aggregation refer to III.A and III.C of KDB Publication 789033 for determining emission bandwidth.

3. Declarations Required in applications for certification

A filing for certification shall include a declaration statement that is signed and dated by the grantee. The below requirements shall be declared (wordings are suggestions only). Keep in mind that these declarations by themselves do not override additional requirements that maybe required in the rules.

Indoor devices:

- a) Clients
 - 1) Client device (EUT) will not directly connect to another client device.
 - 2) Client device (EUT) will only associate and connect with an indoor Access Point (AP) or indoor Subordinate.
 - 3) Client device (EUT) will always be under the control of an indoor AP. However, there may exist situations where the client may transmit brief messages, prior to being under the control of an AP, to join an AP network. But these brief messages will only occur if the client has detected a signal confirming that an AP is operating on a particular channel. These brief messages will have a time-out mechanism if the client does not receive a response from an AP.
- b) Subordinates
 - 1) No direct connection to internet
 - 2) Prohibited for control of or communications with unmanned aircraft systems including drones.
 - 3) Supplied power from a wired connection and has no batteries.
 - 4) Indoor installation only.



03/03/2022

c) Access Points

- 1) Supplied power from a wired connection and has no batteries.
- 2) Indoor installation only.

