

# Unlicensed National Information Infrastructure

## Devices (UNII)-Part 15 Subpart E

- Test procedures for UNII devices are, as of yet, undetermined. When a "recommended" test procedure is released by the OET Lab, guidance will be provided as to what is considered "acceptable test procedures".
- Acceptable procedures

Peak conducted transmit output power.

\* Method #2 is more accurate than #1 as compared to what is specified for the peak transmit power. Compliance with either method is acceptable.

1) Use a peak power meter.

2) Use an analyzer with RBW greater than emission bandwidth. Use a reduced video filter e.g. VBW = emission bandwidth/30.(Video filter). No video averaging. Use a Peak detector on max hold.

\* For Broadband emissions where the available analyzer bandwidth is less than emission bandwidth. Set the RBW=1MHz,VBW= 30kHz. You can use a bandwidth correction factor of  $10 \log(\text{emission BW}) / 1\text{MHz}$  with the 1 MHz capturing the peak of the emission. Use a Peak detector on max hold.

Emission Bandwidth "B"MHz.

\* Use a RBW = 1% of the emission bandwidth.

\* Set the VBW > RBW

\* Use a peak detector.

\* Do not use the Max Hold function. Rather, use the view button to capture the emission.

\* Measure the widest width of the emission that is 26 dB down from the peak of the emission.

Peak power spectral density(PPSD).

\* Method #3 is more accurate than #1 as compared to what is specified for the PPSD limit.

Compliance with either method is acceptable.

\*Antenna conducted measurement

1) \* Use a peak detector on max hold.

\*Set RBW= 1MHz, VBW > 1 MHz. The PPSD is the highest level found across the emission in any 1 MHz band.

2)\*Use Video averaging.

\*Use of a Reduced VBW, "video filter" is not allowed.

\*Set RBW= 1MHz, VBW > 1 MHz. The PPSD is the highest level found across the emission in any 1 MHz band. After 100 sweeps of video averaging.

\* When the emission bandwidth is less than 1 MHz, See Section 15.407(a)5.

\* It is permissible to use a bandwidth less than the measurement bandwidth provided the measured power is integrated to show total power over the measurement bandwidth. Each of the segments are added together and the sum is divided by the number of segments.

3) \*Alternatively... You can use the CAT method described in the IEEE UPCS Bulletin. Available by IEEE only.

Peak excursion measurement.

1) Using an analyzer set the span to view the entire emission. The largest difference between the following two traces in any 1 MHz band on any frequency across the emission cannot be greater than 13 dB. Submit a plot

1<sup>st</sup> Trace. Use a RBW=VBW=1MHz with the detector to Peak Max Hold.

2<sup>nd</sup> Trace. Use a RBW=1MHz and VBW= 30kHz with the detector to Peak Max Hold.

15.401:

Does the EUT meet the definition of a UNII device, based on the technical description of the EUT? (See Section 15.403(i))

- Modulation must be digital. While "high data rate" is not specifically defined, policy requires a minimum data rate of 1 Mbps.

15.407(a):

Were acceptable test procedures and instrument settings used to measure the peak transmit power, emission bandwidth, peak power spectral density, and peak excursion of the modulation envelope? (See Sections 15.403(e), (c), and (d))

15.407(a)(1):

Does the measured peak transmit power comply with the appropriate limit, based on the measured emission bandwidth?

- **Look for consistency throughout the test report, user's manual, and technical descriptions, wrt the various measured and/or stated transmit power levels.**

Does the measured peak power spectral density (psd) comply with the +4 dBm/MHz limit?

Does the measured peak transmit power, in conjunction with the stated antenna gain, comply with the *de facto* EIRP limit (calculated peak transmit power limit + 6 dBi) for all proposed antennas?

- **Note that the transmit power limit is reduced in order to comply with the *de facto* EIRP limit. If the measured transmit power is already below the limit a reduction may not be necessary.**
- **If compliance with the EIRP limit is achieved for various antennas by adjusting the transmit power at the time of installation, then professional installation of this transmitter is required. The installation manual must contain adequate instructions such that the correct transmit power can be chosen for any antenna being used.**

Does the measured peak power spectral density, in conjunction with the stated antenna gain, comply with the *de facto* +10 dBm EIRPower spectral density (EIRPsd) limit for all proposed antennas?

- **Note that the psd limit is reduced in order to comply with the *de facto* EIRPsd limit. If the measured psd is already below the limit a reduction may not be necessary.**

15.407(a)(2):

Does the measured peak transmit power comply with the appropriate limit, based on the measured emission bandwidth?

- **Look for consistency throughout the test report, user's manual, and technical descriptions, wrt the various measured and/or stated transmit power levels.**

Does the measured peak power spectral density comply with the +11 dBm/MHz limit?

Does the measured peak transmit power, in conjunction with the stated antenna gain, comply with the *de facto* EIRP limit (calculated peak transmit power limit + 6 dBi) for all proposed antennas?

- **Note that the transmit power limit is reduced in order to comply with the *de facto* EIRP limit. If the measured transmit power is already below the limit a reduction may not be necessary.**
- **If compliance with the EIRP limit is achieved for various antennas by adjusting the transmit power at the time of installation, then professional installation of this transmitter is required. The installation manual must contain adequate instructions such that the correct transmit power can be chosen for any antenna being used.**

Does the measured peak power spectral density, in conjunction with the stated antenna gain, comply with the *de facto* +17 dBm EIRPsd limit for all proposed antennas?

- **Note that the psd limit is reduced in order to comply with the *de facto* EIRPsd limit. If the measured psd is already below the limit a reduction may not be necessary.**

15.407(a)(3):

Does the measured peak transmit power comply with the appropriate limit, based on the measured emission bandwidth?

- Look for consistency throughout the test report, user's manual, and technical descriptions, wrt the various measured and/or stated transmit power levels.

Does the measured peak power spectral density comply with the +17 dBm/MHz limit?

Does the measured peak transmit power, in conjunction with the stated antenna gain, comply with the *de facto* EIRP limit (calculated peak transmit power limit + 6 dBi) for all proposed antennas?

- Note that the transmit power limit is reduced in order to comply with the *de facto* EIRP limit. If the measured transmit power is already below the limit a reduction may not be necessary.
- If compliance with the EIRP limit is achieved for various antennas by adjusting the transmit power at the time of installation, then professional installation of this transmitter is required. The installation manual must contain adequate instructions such that the correct transmit power can be chosen for any antenna being used.

Does the measured peak power spectral density, in conjunction with the stated antenna gain, comply with the *de facto* +23 dBm EIRPsd limit for all proposed antennas?

- Note that the psd limit is reduced in order to comply with the *de facto* EIRPsd limit. If the measured psd is already below the limit a reduction may not be necessary.

Does the measured peak transmit power, in conjunction with the stated antenna gain, comply with the *de facto* EIRP limit (calculated peak transmit power limit + 23 dBi) for all proposed antennas to be used solely in point-to-point applications?

- Note that the transmit power limit is reduced in order to comply with the *de facto* EIRP limit. If the measured transmit power is already below the limit a reduction may not be necessary.
- If compliance with the EIRP limit is achieved for various antennas by adjusting the transmit power at the

**time of installation, then professional installation of this transmitter is required. The installation manual must contain adequate instructions such that the correct transmit power can be chosen for any antenna being used.**

Does the measured peak power spectral density, in conjunction with the stated antenna gain, comply with the *de facto* +40 dBm EIRPsd limit for all proposed antennas to be used solely in point-to-point applications?

- **Note that the psd limit is reduced in order to comply with the *de facto* EIRPsd limit. If the measured psd is already below the limit a reduction may not be necessary.**

Does the proposed point-to-point system meet the appropriate requirements, and do the installation instructions contain the correct language?

- **Understand the intent behind allowing the EIRP relaxation for point-to-point applications only.**
- **When multiple antennas are listed in the installation manual, those that may only be used in point-to-point applications should be clearly indicated.**

15.407(a)(6):

Does the ratio of peak modulation envelope excursion to peak transmit power meet the 13 dB/MHz limit?

- **The comparison between the two measured levels is made within the same 1 MHz segment.**

15.407(b)(1)-(3):

Were acceptable test procedures and instrument settings used to measure the EIRP of emissions outside of the frequency bands of operation, both within and outside of the passband of all proposed antennas?

Do the measured unwanted emission EIRP levels comply with the appropriate limits, as determined by the frequency band of operation and the frequency of the spurious emission, up to 40 GHz, for all proposed antennas?

- These limits are on the Effective Isotropic Radiated Transmit Power. The same measurement settings used to measure the transmit power of the fundamental emission may be used here.
- Within the passband of the antenna an RF conducted measurement may be made. This level, added to the stated antenna gain for each proposed antenna, must comply with the limit.
- Outside of the passband of the antenna a radiated measurement must be made, as the gain of the antenna outside of its passband is uncertain, or, the emission may radiate from the case of the EUT. This measured field strength must then be converted to an equivalent EIRP for comparison to the limit.
- It is likely that compliance with the unwanted emission EIRP limit, particularly at the bandedges, will determine the maximum transmit power allowable at bandedge channels for each antenna. The installation manual must make this clear.

15.407(b)(5):

Were acceptable test procedures and instrument settings used to measure unwanted radiated emission levels below 1 GHz, and AC line conducted emissions?

- Use ANSI C63.4 as a guide.

Do the measured unwanted radiated emission levels comply with the Section 15.209 field strength limit?

- In order to demonstrate compliance with this particular requirement, measurements may be performed on the highest gain antenna of each "type". In other words, if multiple yagi, patch, and dish antennas are proposed, only the highest gain yagi, patch, and dish must be tested.
- Measurements should also be made on the lowest gain antenna, so that the EUT is operating at its highest available output power, in order to test for case radiation.

Do the measured AC line conducted emission levels comply with the Section 15.207 limit?

15.407(b)(6):

Were acceptable test procedures and instrument settings used to measure the field strength of all unwanted radiated emissions in restricted bands, as defined in Section 15.205?

Do the measured unwanted radiated emission average levels comply with the Section 15.209 field strength limit, up to 40 GHz?

- In order to demonstrate compliance with this particular requirement, measurements may be performed on the highest gain antenna of each "type". In other words, if multiple yagi, patch, and dish antennas are proposed, only the highest gain yagi, patch, and dish must be tested.
- A duty cycle correction factor, as defined in Section 15.35(c), may be applied to a measurement made with an average detector, or its equivalent, to further reduce the value.
- Measurements should also be made on the lowest gain antenna, so that the EUT is operating at its highest available output power, in order to test for case radiation.

Do the measured unwanted radiated emission peak levels comply with the Section 15.35(b) field strength limit, up to 40 GHz?

- In order to demonstrate compliance with this particular requirement, a true peak measurement must be made- instrument settings used to measure the peak transmit power may not be used. (i.e.  $VBW \geq RBW$  )
- In order to demonstrate compliance with this particular requirement, measurements may be performed on the highest gain antenna of each "type". In other words, if multiple yagi, patch, and dish antennas are proposed,



only the highest gain yagi, patch, and dish must be tested.

- Measurements should also be made on the lowest gain antenna, so that the EUT is operating at its highest available output power, in order to test for case radiation.
- Unless the measured peak field strength levels comply with the average limit, then both peak and average data must be submitted.
- Look for consistency in reported peak and average measurements.

15.407(c):

Does the EUT discontinue transmission under the proper conditions, based on the technical description?

15.407(d):

Does the EUT use an integral transmitting antenna if it operates in the 5.15-5.25 GHz band, based on the technical description and photographs?

- An antenna that attaches with a connector inside of the case is acceptable, provided that there is no need for the user to ever open the case. Check the user's manual.

15.407(e):

Will the EUT will be restricted to indoor operation if it operates in the 5.15-5.25 GHz band, based on the technical description, user's manual, and any advertising literature provided?

15.407(f):

UNII devices are subject to the radio frequency exposure requirements specified in 1.1307(b), 2.1091, and 2.1093. How does the device comply?

- For TCB applications, follow the TCB RF exposure procedure.

15.407(g):

Was an acceptable test procedure used to measure frequency stability?

Does the measured frequency stability data indicate that the fundamental emission will be maintained within the band of operation under all conditions of normal operation, as specified in the user's manual?

- **A plot of the emission at the bandedge, with the EUT tuned to a bandedge channel, may be required for devices that do not utilize a standard carrier that may be measured.**

15.33, 15.35, 15.203, and 15.204:

Does the UNII system comply with these Sections?

15.101(a):

If the EUT also meets the definition of a personal computer peripheral, then that portion of the EUT must also be authorized, through Verification (if Class A), Certification, or DoC. If Class A use is proposed, then a justification for this rating must be provided. Was this done?