

## Check List for Test Plan Preparation EMC Testing of Wireless Devices

# Northwest EMC, Inc.

## Overview

The most economical use of test time can be achieved through the use of a test plan. The information contained in a test plan will allow us to provide more competitive rates, better preparation in advance of testing, and, consequently, more-effective use of test time. The test plan should include a thorough functional description of the product. The following parameters should be specified: output power (fixed or variable), data rates, modulation scheme(s), channel assignments, wired input/output (I/O) ports, power supply requirements, accessories, and installation options. Too often during the authorization process, an untested feature is revealed in the user manual that was not obvious in the sample presented for testing. A test plan is a key strategy in preventing delays during the equipment authorization process.

Please provide the following items. Your efforts will allow us to prepare an effective test plan.

## Information to Supply NWEMC

1. Compliance Objective - Please provide a narrative of what you have and what you want to accomplish during the testing and approval process. Address items such as: Do you need Certification of a new product, or the Class II Permissive change of an existing product? Do you want a Composite, modular, or limited modular approval? Are you buying a certified radio and you just want to integrate it into your existing product? Does your product already contain other radios? Are the other radios within 20cm and can they transmit simultaneously?
2. Target markets – U.S., Canada, EU, etc.
3. Brief product description – What does it do and what's its intended use? For example, "RFID radio used in a handheld computer for inventory management in warehouses."
4. Complete List of operating modes including modulation types and data rates. If the radio meets an industry standard such as 802.11g or Bluetooth, just indicate that instead. Otherwise, list every possible data rate and modulation type.
5. Expected maximum output power level (either peak conducted, EIRP, or ERP) - Can it be varied, or is it fixed for all modulation types, data rates, and antennas?
6. The channel number and center frequency of the lowest, the middle, and the highest transmit frequencies
7. Will the equipment be professionally installed?
8. All the antennas with their max (peak) gain (dBi), antenna type description (e.g. Yagi, dipole, patch), manufacturer, and part number. If there is an associated antenna cable whose loss is not combined in the gain figure, please provide the minimum length, type (e.g. RG214), and loss (dB) for the antenna cable.

9. For testing to European requirements, specify the operating temperature range of your radio and its intended environment (e.g. indoor use only, or both indoor and outdoor use).
10. For battery operated equipment, specify the type of battery (e.g. lithium ion), full charge voltage, and discharge voltage where the radio stops functioning.
11. A list of all body-worn accessories such as belt-clips, holsters, and lanyards.
12. All wired ports including data and signal ports, as well as power ports.
13. Supply voltage requirements – volts and amps.
14. All installation options. For example, handheld use or a desktop docking station.
15. In the case where a previously approved radio module is used, the FCC ID numbers and any applicable test reports.
16. Detailed equipment configuration for each test – see “Preparation for the EMC Testing of Wireless Devices” below.
17. Complete operating instructions to perform the testing described below.

## Preparation for the EMC Testing of Wireless Devices

### Radiated Emissions

18. The radio’s software and / or firmware should be capable of the following operational modes. It is important to note that for each mode, continuous uninterrupted operation is required:
  - Transmit or receive continuously while operating at a single channel (FCC exempts receivers that operate above 960 MHz and below 30 MHz – Canada and Europe do not). For frequency hoppers, this means without the carrier hopping. The operating channel should be selectable from the lowest, middle, and the highest channels available. The transmitted carrier must be modulated. If a variety of modulation rates are available, they should be selectable from the lowest, middle and the highest modulation rates available. The data should be pseudo-random. All “1”s, all “0”s, or alternating “1010101...” could be worse case, but is not required by the regulatory agencies. If a variety of transmitted output power levels are available, they should be selectable from the lowest, the middle, and highest output power levels available.
19. The highest gain antenna of each type, as well as the lowest gain antenna of all the antennas specified with the unit must be tested.
20. Any ancillary equipment required to operate the radio such as personal computers should be dedicated for that use until testing is completed. If the radio has a wired interface (e.g. USB) with a personal computer, the radio will also be tested for compliance as a PC peripheral to the applicable ITE specifications. This testing requires the radio to be tested as part of complete PC system, so it is important to supply a PC (or notebook) that is known to have low emissions.

21. In the case of a radio that uses OOK modulation seeking certification under FCC 15.231, the radio should be configured for un-modulated, continuous-wave (CW) operation. Peak measurements are made with the average data numerically derived based upon a duty cycle correction factor. The duty cycle correction factor is measured on a second unit that is configured for normal operation.

## Antenna Port Emissions

22. The radio's software and / or firmware should be capable of the following operational modes. It is important to note that for each mode, continuous uninterrupted operation is required:

- Same mode required for radiated emissions (see above).

Also

- For frequency hoppers, the hopping mode typical of normal operation. All hopping channels specified for normal operation must be used. If a variety of modes are available, they should be selectable.

23. A provision should be made to allow the direct connection of the radio's antenna port (RF output port) to a spectrum analyzer. This usually entails modifying a second unit (different than the radio used for radiated emissions testing). A standard female RF connector (e.g. SMA female) is soldered to the RF output port in place of the antenna.

## Immunity Testing

24. European requirements include immunity testing with the radio both transmitting and receiving. The radio and associated equipment should be configured for typical operation and a means provided for monitoring the radio link. For example, in the case of a wireless network where the client radio is the equipment under test, it should be configured to continuously "ping" a remote access point. The pinging can be monitored to see if the link is degraded or broken as a result of the immunity test.