

# TECHNICAL ASSESSOR CHECKLIST TO BE USED FOR ON-SITE AUDITS OF TEST LABORATORIES PERFORMING BSMI EMC MEASUREMENTS

Checklist created by Bureau of Standards, Metrology, and Inspection, Taiwan. May 1999  
for laboratories testing to CNS 13438 - 1996

**Instructions to the Assessor:** This checklist addresses specific criteria relating to accreditation of a laboratory to determine the capability and competence of that laboratory to perform tests to show compliance of ITE equipment subject to the BSMI EMC Regulations. It is intended to be used during the assessment phase of the accreditation process as a guide to evaluate the capability of the prospective laboratory facility and to determine the competency of the laboratory personnel for performing the required measurements. It is not intended to replace the good engineering judgement of the technical assessor or a thorough evaluation of facility. Other points may and should be added to this checklist as the on-site assessment progresses.

Circle all items you observed and verified at the laboratory. Circle the letter "Y", representing "yes" to show agreement. **Circle the letter "N", representing "No", to show a deficiency.** Record the item number and deficiency explanations and/or comments in this list on the comment sheets.

Place a "C" beside each item on which you are commenting for other reasons. If Not Applicable, mark with the letters "NA".

**I. Qualification:** (The following is the minimum requirements for a laboratory to be a BSMI designated laboratory. The assessor does not necessary to proceed a practical laboratory accrediting process, if the laboratory could not meet these minimum requirements)

Y N 1. A test facility (i.e. one laboratory) is not allowed to be used by two or more entities to apply for more than one laboratory designation certificates. Is this requirement complied with?

Y N 2. Is there at least one 10-m site (distance between EUT and antenna) used for the radiated emission compliance test? (Lab has no 10 m site is not acceptable. 10-m site can be a OATS or Semi Anechoic Chamber.)

**II. Documentation:** (The following is the minimum number of required documents and should be expanded as necessary for the scope of the accreditation.)

- Y N 3. CNS 13438 - 1996
- Y N 4. CNS 13306-1 (CISPR Publication 16-1:1993)
- Y N 5. CNS 13306-2 (CISPR Publication 16-2:1996)
- Y N 6. ANSI C63.4 (1992)
- Y N 7. CISPR Publication 22 (1993) – 2nd Ed with amendments 1&2
- Y N 8. CISPR Publication 22 (1997) - 3rd Edition
- Y N 9. ISO/IEC Guide 25 - 1990 (3rd Edition)

**III. MEASUREMENT INSTRUMENTATION**

A. Line Impedance Stabilization Network (LISN).

- Y N 10. Are 50 Ohm/ 50 microhenry LISN's used ?
- Y N 11. Do the LISN's have an indication of calibration status per ISO Guide 25?
- Y N 12. Has the impedance and insertion loss of the LISN's been calibrated within the last year? Is the tolerance of the calibration results within  $\pm 20\%$  of nominal impedance show in Fig 7b of CISPR 16-1 1993?
- Y N 13. Are the LISN impedance measurements made at the point where the EUT is connected to the LISN with 50-ohm termination on the instrumentation monitoring port? (Note: Connection of the EUT to the LISN socket or at the end of an extension cord may make a difference in line conducted measurements.)
- Y N 14. Ask for a spot check of the LISN's impedance and insertion loss measurements. Are the tests made in accordance with Fig 7b of CISPR 16-1 1993, Section 11.3 and are the test results within tolerance?

Y N 15. Is a correction factor used when measuring conducted emissions? If so, then why?

Y N 16. If there is firmware/software to assist in the automation of measurements, is it accurate and appropriate for the type of measurements, being performed? Ask for a demonstration to show appropriate use. Is it documented and under configuration control?

#### B. Antennas

Y N 17. Do all the antennas used for compliance measurements comply with the criteria in CISPR 16-1, Section 15.4 & 15.5, as appropriate? (Note: Rod and log-spiral antennas are not permitted for measurements.)

Y N 18. Are all antennas used for final compliance testing calibrated and have calibration stickers on them?

Y N 19. Are all antennas calibrated at least once a year?

Y N 20. During a demonstration of radiated emission measurements, are the antennas used in accordance with good engineering practice?

#### C. Measurement Receiver or Spectrum Analyzer.

Y N 21. Does the measuring receiver(s) or spectrum analyzer(s) used for final EMC measurements meet the requirements in CISPR 16-1, Clause 2?

Y N 22. Is the measuring receiver(s) or spectrum analyzer(s) calibrated? Is there documentation showing all calibration per ISO Guide 25?

Y N 23. Has unit been calibrated within the last year?

Y N 24. Are quasi-peak detector and average detector function available?

- Y N 25. If there is firmware/software to assist in the automation of measurements, is it accurate and appropriate for the type of measurements being performed? Ask for a demonstration to show appropriate use. is it documented and under configuration control?
- Y N 26. Have the RF Cables, RF Switches, attenuators and pre-amps been calibrated?
- Y N 27. Ask for a demonstration of the use this equipment for different types of signals and product. Are the correct application notes and precautions for overload, ambient, etc used by the testing personnel during the demo? (Demonstration can be combined with other requested tests.)

**IV. TEST FACILITIES**

**A. Facilities for Measuring Powerline Conducted Emissions.**

- Y N 28. Is there 110 V / 60 Hz AC ( and/or 220 V / 60 Hz, if needs) power available to perform the required measurement?
- Y N 29. Is there sufficient power available to perform the required measurements and is the powerline conducted ambient at least 6 dB below the limit?
- Y N 30. Is the LISN safely grounded?
- Y N 31. Is the measurement frequency range used for measuring conducted emissions 150 kHz to 30 MHz?
- Y N 32. Based on preliminary tests. Does this conducted emission compliance test represent the maximized cable configuration and worse case mode of EUT operation yielding the highest levels?

- Y N 33. For each type and size of EUT's to be measured, does each line-conduction measurement facility comply with the conditions and requirements of CISPR 22, Section 10 and Fig 4, 5, 6, 7, 8, 9? Be sure to ask about the need and use of a LISN(s) and isolation transformers, if needed.
- Y N 34. For each type of EUT to be measured at this facility, can accurate and repeatable line conducted measurements be preformed?
- Y N 35. Is the vertical conducting plane, if used, installed and used properly?
- Y N 36. Ask for a demonstration or description of how large EUT's are handled. (Ask the test person to explain what special measurements and conditions are required when the power requirement is greater than the rate capacity of the LISN.)

B. Facilities for Measuring Radiated Emissions in the frequency range of 30 MHz to 1 GHz.

- Y N 37. For each type and size of EUT's to be measured, does each radiated emission test facility comply with the conditions and requirements of CISPR 22, Section 11 and/or Fig 10, 11, 12, 13, and 14?
- Y N 38. Are LISN(s) and isolation transformers, if used, installed properly?
- Y N 39. Is a turntable used for rotating the EUT through the 360-degree azimuth?
- Y N 40. Is a LISN used in the radiated emission test setup for measuring conducted emissions?
- Y N 41. If yes. Then is the receptacle for the EUT power connection to the open area test site ground plane and located flush with the ground plane?
- Y N 42. Has it been verified that the LISN does not cause inaccuracy in radiated emission measurements?
- Y N 43. Are measurements made at 10-m distance between EUT and antenna?

- Y N 44. Is the conducting ground plane in accordance with CISPR 22, Clause 11.3.4?
- Y N 45. Is the turntable installed and grounded properly?
- Y N 46. Is the antenna positioner installed and used properly?
- Y N 47. Are the guidelines in annex L of CISPR 16-1 followed?
- Y N 48. Does the radiated emission test site(s) meet the validation requirements of CISPR 16-1 annex L? The site validation data must meet the  $\pm 4$  dB criteria. For alternative test sites, see CISPR 22 annex A.
- Y N 49. Ask for demonstration of the tests to perform site validation and check a few key spot points of greatest excursion of the NSA. Are the measurements performed correctly and are the test results within tolerance?
- Y N 50. For each type of EUT to be measured at this facility, can accurate and repeatable radiated measurements be performed at each radiated emission test site?
- Y N 51. Ask for a demonstration or description of how large EUT's are handled, including in-situ, if appropriate? (Note: In this case, a large EUT is one that is larger than can be handled on a test site.)

## **V. EMISSION TESTS**

A. General operating conditions and configurations of the EUT: (Require a demonstration and/or description of the testing and set-up for all types of equipment to be tested at the facility.)

- Y N 52. Does the test engineer have a written set of instructions for operation the EUT? The instructions should include turn-on procedure, turn-off procedure, procedure for setting the proper modes and the method of determining that the EUT is operating properly.
- Y N 53. Do the operating conditions and set-up for each type follow the general guidelines and procedures in CISPR 22 Section 9.2?

- Y N 54. Is the EUT set-up, configured and arranged with appropriate accessories per CISPR 22 Sections 9.1?
- Y N 55. Are all EUT ports connected to and terminated into a device of typical usage per CISPR 22 Sections 9.1?
- Y N 56. If there are multiple ports of the same type on the EUT, is each port connected to an additional cable to investigate the additive effect these cables have on the EUT emissions, per CISPR22 Sections 9.1?
- Y N 57. Is the EUT configured in accordance with the appropriate diagram and associated text in CISPR 22 Section 9, if appropriate?
- B. Powerline conducted emission tests: (Assessor should request a demonstration and/or description of the testing and set-up for all types of equipment to be tested at the facility.)
- Y N 58. Are the powerline conducted emission tests performed in accordance with the applicable parts of CISPR 22, Section 10?
- Y N 59. Does the procedure for using a voltage probe, if required, follow CISPR 16-2 Section 2.4.3.2?
- Y N 60. If a voltage probe is not required, can the test person provide an adequate explanation of when and how it is used?
- Y N 61. Are all surfaces of the EUT (both floor standing and table) at least 80 cm from any other grounded surfaces, including all LISN's per CISPR 22 Sections 10?
- Y N 62. Is the conducted emission test setup in accordance with Figure 4, Fig 5 or Fig 7 for a table top EUT and Figure 8 or Fig 9 for a floor standing EUT?
- Y N 63. Is the excess power cord length between the EUT and the LISN folded back and forth in a bundle, located in the center of the power cord, not to exceed 40 cm?

- Y N 64. Is the EUT connected to one LISN and all the peripherals connected to at least one other LISN?
- Y N 65. Bases on preliminary tests, does this conducted emission compliance test represent the maximized cable configuration and worse case mode of EUT operation yielding the highest levels?
- Y N 66. For each type of EUT, are the correct frequency ranges measured and the correct detectors and bandwidth used per CISPR 22 and CISPR 16-1?
- C. Radiated emission tests: (Assessor should request a demonstration and/or description of the testing and set-up for all types of equipment to be tested of the facility.)
- Y N 67. Are the radiated emission tests performed in accordance with CISPR 22 Sections 11?
- Y N 68. Are the procedures for handling ambient emissions, if appropriate, follow the guidelines in CISPR 22 Section 11.6 and good engineering practices, when appropriate?
- Y N 69. Are pre-scan (when appropriate) and final radiated measurements made in accordance with the CISPR 22 Section 11?
- Y N 70. Is the radiated emission test setup in accordance with Figure 10 for a tabletop EUT and Figure 11 and/or Figure 12 and/or Fig 13 and/or Fig 14 for a floor standing EUT?
- Y N 71. Based on preliminary tests, does this radiated emission compliance test represent the maximized cable configuration and worse case mode of EUT operation yielding the highest levels?

Y N 72. For each type of EUT, are the correct frequency ranges investigated and the correct detectors and bandwidth used per CISPR 22 and CISPR 16-1?

**VI. TEST REPORTS:** (Assessor should request to review several samples test reports for various types of products. This can be accomplished during the pre-audit)

Y N 73. Do each of the test reports contain all the information requested in CISPR 22 Section 10.5 and 11.5 and other applicable Parts of the BSMI EMC regulations?

Y N 74. Is the standard (i.e. CNS 13438) to which the EUT was tested clearly referenced in the test report? If an alternative procedure was used, are the deviations clearly defined and referenced in the test report?

Y N 75. Is the rationale for selecting and arranging the EUT clearly stated and are the components of the EUT system clearly identified?

Y N 76. Is the equipment labeled in accordance with the BSMI Regulations?

Y N 77. Can a regulatory agency or reasonably competent test engineer duplicate the test results from the description of the EUT and test set-up? Are there adequate photographs and descriptive material included in the report ?

Y N 78. Are the test results presented in a clear and concise manner for comparison with the limits and specification?

Y N 79. Are all conversion and correction factors included in the report?

Y N 80. Is the test report signed in accordance with ISO Guide 25?

Y N 81. Is the test report signed in accordance with the requirements of the Accrediting Body?

**VII. PERSONNEL COMPETENCY:** (The following is a list of general or lead in questions, which intended to be used as a guide to assess competency of Laboratory personnel. Additional specific questions should be used to determine the technical competency of the personnel performing the measurements, when appropriate. More probing questions should be asked of the person responsible for and signing the report of measurements.)

Questions to ask: (The assessor should check Y (yes) or N (no) based on his/her belief that the laboratory personnel have provided the proper responses to the specific question(s).)

- Y N 82. Is there sufficient training and supervision in place to ensure technical competency of the personnel performing the measurements.
- Y N 83. Has the appropriate technical competency been determined for all test personnel and persons supervising the testing?
- Y N 84. Has at least one Laboratory person demonstrates appropriate working knowledge of each of the documents under Section I, above, with others demonstrate working knowledge of documents used for specific tests; as appropriate?
- Y N 85: Has laboratory personnel demonstrates ability to obtain recent and appropriate interpretations of the BSMI Rules?
- Y N 86. Does the test person understand how to perform radiated emission prescan measurements and how they are applied during the final measurements?
- Y N 87. Does the test person know how to determine if the emission is from the EUT or an ambient?
- Y N 88. Does the test person know how to handle an emission that is close to or coincident with an ambient?
- Y N 89. Does the test person know how to identify and avoid potential overload conditions of the test instrumentation?
- Y N 90. Do the test personnel know the requirements for measurement of broadband conducted emissions and how are they handled?

- Y N 91. Are coax cables, antennas, receiver or spectrum analyzer checked at the start of each test for proper operation?
- Y N 92. Is calibration performed each time the test operator changes the frequency bands of the receiver or spectrum analyzer?
- Y N 93. Is a graph or other equivalent data generated each time a compliance test is performed to show the ambient? Can the test personnel explain the data.
- Y N 94. Can the test person explain the testing requirements for the various types of products to be tested by the prospective lab?
- Y N 95. Can the test person describe at least three different types of examples of IT equipment to be tested? Can he/she demonstrate or explain how the equipment would be set-up and tested? Can he/she adequately discuss the assumptions that went into the test set-up?
- Y N 96. Can the test person discuss how measurements would be performed at the user's location, if he planned to or currently provides in-situ testing.
- Y N 97. Does the test person correctly perform pre-scan and final conducted and radiated emission tests? Be sure to observe the set-up and arrangement for the complete test.
- Y N 98. Have someone at the perspective lab replicate three frequency points on the horizontal site attenuation and three frequency points on the vertical site attenuation. Verify accuracy of these frequencies to previous recorded data. Suggestion: Pick frequencies from previous data that have both low and high deviations from the NSA.