Technical Criteria for the Accreditation Of
Electromagnetic Compatibility (EMC)
And
Radio Testing Laboratories
Preface

The need for accreditation has become an ever-increasing burden on EMC and telecommunication testing laboratories with the proliferation of product specific test standards within the European Community and the creation of Telecommunications Certification Bodies (TCBs) within the United States. The intent of this document is to provide an accreditation scheme based on EMC and radio test phenomena rather than standard specific requirements. This method will also allow for swifter, cost effective extensions of laboratories’ scopes, without sacrificing the technical integrity of the accreditation. This document was developed by the ACIL in response to requests from member laboratories to reduce the time and cost of the accreditation process by improving the efficiency of the assessments necessary for technically similar, or in some cases identical, electromagnetic compatibility (EMC) or radio test methods.

The purpose of this document is to define an accreditation scheme that allows for the inclusion of specific test standards in a laboratory’s scope of accreditation based upon demonstration of technical competence in a basic set of test elements. This document presents these basic elements in a set of core electromagnetic compatibility (EMC) and radio test methods upon which most standards, for which accreditation is desired, are based. It further serves to provide a method by which both current and future standard specific requirements may be incorporated into a laboratory’s scope of accreditation.

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# Technical Criteria for the Accreditation of Electromagnetic Compatibility (EMC) and Radio Testing Laboratories

Revision 8, January 1, 2002  
ACIL EMC Committee, EMC Laboratory Accreditation Task Force

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1.0 Introduction

This document is intended for use by a laboratory accreditation body to supplement the general laboratory accreditation requirements contained in ISO Standard 17025 and other program specific requirements when accrediting a laboratory for electromagnetic compatibility (EMC) and radio testing. Specifically, it is intended to assist an assessor during the assessment phase of the accreditation process as a guide to evaluate the capability of the prospective laboratory and to determine the competency of the laboratory personnel for performing the required measurements. It is not intended to replace the good engineering judgment of the technical assessor or a thorough evaluation of the facility. Other points may and should be added to the checklists, selected below, as the on-site assessment progresses.

EMC is a broad and complex subject covering various phenomena, such as those identified as basic EMC tests in Section 3.1.1 below. Since a laboratory may wish to be assessed to two or more basic EMC tests, the assessor shall identify the baseline test methods defined in Sections 4 and 5, covering the scope of accreditation requested by the applicant. The checklists contained within these sections were developed to be used with one or more baseline standards for each phenomenon. As stated in 2.0 below, the differences between the baseline standards and specific test standards for which accreditation is sought should also be evaluated.

In addition, a laboratory may also be assessed to the basic radio tests as identified in 3.1.2 below. The baseline radio test methods are defined in Section 6 and should be utilized in conjunction with the checklists for each scope of accreditation dealing with radio communication equipment.

Baseline standards are intended to evaluate a laboratory’s competence in the selected basic EMC or radio test. During the on-site audit, the assessor, in conjunction with the laboratory, shall identify an appropriate test procedure within the baseline standard for an in depth review in order to determine competence in the basic EMC or radio test.

2.0 Application

For each basic EMC or radio test phenomenon to be assessed, the baseline test method checklist(s) is to be used as a guide to evaluate the technical competence of the laboratory. The checklists are selected based on the requested scope of accreditation. It may be necessary to use one or more of the checklists in order to perform an assessment of the core tests required by the test standard(s) for which accreditation is sought.

The checklists are to be used in conjunction with the specific requirements from each standard included in the scope of accreditation. Consideration needs to be given to the test standards covered by the scope of accreditation. Each checklist provides guidance on its use. When the scope of the accreditation includes standards other than the baseline standard, the assessor should evaluate the laboratory’s ability to identify and evaluate the differences between the baseline standards and the additional standards.

2.1 Extension of Scope of Accreditation

An accredited laboratory that desires to expand its scope of accreditation may use the following procedure. A laboratory's scope of accreditation may be expanded to include test standards encompassing core tests for which the laboratory has been previously accredited. The laboratory must request in writing...
to the accrediting body that its scope of accreditation be expanded to include additional specified standards. The request must be accompanied by a documented demonstration of technical compliance to the incremental changes.

This procedure provides a means for a laboratory to increase its scope of accreditation, without the need for an on-site assessment, to include standards that are generally covered by the basic EMC or radio test for which the laboratory has previously been accredited.

When requesting an expansion of scope, the accredited laboratory shall provide detailed information regarding the standard for which accreditation is sought. The laboratory shall provide the following information:

- Identify the relationship between the current accreditation and the standard for which an increase in scope is requested.
- Identify and evaluate the differences between the previously assessed baseline standard and the standard(s) to be added.
- Summarize the critical parameters of the standard.
- Document special considerations contained in the standard.
- Identify any unique test equipment.
- Describe how staff competence with respect to the added standard(s) has been achieved.

Compliance with the requirements of the standard may be verified by the accrediting body at the next regularly scheduled on-site assessment of the accredited laboratory.

This procedure is NOT intended to allow a laboratory to increase its scope of accreditation to include standards or phenomenon for which basic EMC or radio test accreditation has not been granted through an on-site assessment.

The form in Appendix A may be used when requesting an extension of scope of accreditation.

### 3.0 Organization

#### 3.1 Basic EMC and Radio Tests

Each EMC or radio phenomenon has been divided into various core tests; in addition, baseline test methods are identified based on their general applicability for performing both basic EMC and radio tests. In some instances, more than one baseline standard may be required to cover some EMC phenomena or applications, in which case, checklists for both baseline test methods should be used during the assessment process.

The purpose of the basic EMC and radio tests is to define the applicable EMC and radio test methods by their basic parameters. These core tests are designed to encompass the basic test elements that other electromagnetic compatibility and radio test methods are based upon.
3.1.1 Electromagnetic Compatibility Test Methods

The basic EMC tests are divided into two major sub categories, emissions tests and immunity tests.

The following core emissions tests are defined in this document:
- Conducted Emissions, Current
- Conducted Emissions, Voltage
- Conducted Emissions, Transient
- Radiated Emissions, Magnetic Field
- Radiated Emissions, Electric Field

The following core immunity (susceptibility) tests are defined in this document:
- Electrostatic Discharge (ESD)
- Radiated Immunity, Magnetic Field
- Radiated Immunity, Electric Field, Screen Room or Absorber Lined Shielded Enclosure (ALSE)
- Radiated Immunity, Electric Field, Parallel Plate, Stripline or TEM Device
- Transient Immunity
- Conducted Immunity, Audio Frequency
- Conducted Immunity, Radio Frequency
- Power Input Disturbances

3.1.2 Radio Test Methods

The following basic radio tests are defined in this document:
- RF Output Power
- Modulation Characteristics
- Occupied Bandwidth
- Spurious Emissions (at the antenna terminals)
- Radiated Emissions
  - Cabinet Radiation
  - Intentional Radiators
- Frequency Stability
- Spread Spectrum Devices
  - Direct Sequence Devices
  - Frequency Hopping Devices
- Unlicensed National Information Infrastructure Devices (UNII)
- Unlicensed Personal Communications Systems (UPCS)

3.2 Comparison of Test Standards to Basic Tests

A matrix is provided in Appendix B, which compares the specific requirements for a number of standards to the basic EMC tests defined in this document. This matrix is intended to be used as a guide to assist accrediting bodies and laboratories to determine a laboratory’s eligibility to increase scope to include standard specific requirements. The guide is a living document and is intended to be reviewed and updated as necessary.
4.0 Basic EMC Tests – Emissions

4.1 Conducted Current Emissions

4.1.1 Test Summary
This basic EMC test includes those tests that require the current level of the conducted current emissions produced by the equipment under test to be measured. The conducted current emissions produced by the equipment under test are measured by means of a test receiver connected to a current probe placed around the lead(s) under test or a shunt connected in series with the lead under test. The measuring device is connected to the test receiver or spectrum analyzer by means of coaxial or other suitable cabling. The frequency range of interest is then scanned for emissions from the equipment under test and the receiver meter reading is recorded and adjusted for current probe/shunt factor, pre-amplifier gain and cable loss as appropriate. The corrected reading is then compared to the specified limit in order to determine compliance with the applicable standard or regulatory limit.

4.1.2 Test Parameters
The parameters of a conducted current emissions test for which accreditation may be obtained under this basic EMC test are defined below:

- **Test Type:** Conducted Current Emissions
- **Frequency Range:** DC to 400 MHz
- **Pick up Device:** Current Probe or Shunt
- **Receiving Device:** EMI Receiver or Spectrum Analyzer
- **Test Environment:** Shielded Enclosure or Ground Reference Plane

4.1.3 Test Equipment
The minimum basic test equipment along with the critical parameters of that equipment necessary in order to demonstrate the ability to perform conducted current emission measurements in accordance with this basic EMC test are indicated below:

- **Receiver:** Frequency Range, Bandwidth, and Detector
- **LISN or Capacitor:** Frequency Range, Impedance
- **Transducer:** Frequency Range, Correction Factors, and Saturation
- **Transient Limiter:** Frequency Range, Insertion Loss
- **Cabling:** Insertion Loss, Impedance

4.1.4 Baseline Test Methods
The following standards are identified as baseline test methods for evaluating equipment to this basic EMC test. Other standards may be used, as appropriate.

- IEC/EN 61000-3-2, Conducted Emissions, AC Power Line, Harmonics
- CE101 (MIL-STD-461D/E), Conducted Emissions, AC/DC Power Line
- CE03 (MIL-STD-461C), Conducted Emissions, AC/DC Power & Signal Lines
Specific Checklist, Conducted Current Emissions

Introduction:

This checklist is intended to provide guidance to the Technical Assessor in assessing an EMC laboratory with a scope covering conducted current emission measurements. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory.

The assessment of signal line and power line conducted current emission measurements shall be based on the assessor selecting one or more baseline test methods for an in-depth review to assess the competence of the laboratory for this basic EMC test. When selecting the standard(s) to be utilized for on-site assessment, several factors should be considered:

- The scope of accreditation.
- The needs of the regulatory agency(s) or user of such accreditation.
- The standard or method that requires the most comprehensive audit to determine competence of the laboratory being assessed.

1) List the selected baseline standard(s), the specific test procedure from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Standard Selected</th>
<th>Test Procedure Selected</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure described in the selected baseline test method(s).

3) Does the laboratory have the test equipment necessary to perform the selected baseline test method?

4) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

5) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.
The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic EMC test for which accreditation is sought.

6) Facility
   a. Does the facility for measuring conducted current emissions meet the minimum facility requirements specified in the baseline standard(s) for this test?
   b. Is there sufficient power available for performing the measurements?
   c. Are the ambient conditions at least 6 dB below the limit?
   d. Are isolation transformers and/or RF filters, if needed, properly installed?
   e. Are the conducting surfaces in accordance with the standard?
   f. Does the test equipment provide the necessary sensitivity to make the required measurement?

7) High Powered EUT
   a. Do the laboratory personnel know how the laboratory would handle a large high-powered EUT?
   b. Do the laboratory personnel know how the laboratory would handle a large EUT located on a factory floor?

8) Performance of Test
   a. Are the tests performed per the selected standard?
   b. Is the EUT and test equipment properly located, configured and operated? Be sure to check for proper distances between conducting surfaces.
   c. Is the EUT (both floor-standing and table-top) set up properly?
   d. Is the excess power cord (signal lines) configured (bundled) properly?
   e. Are all the power cords and I/O cables the specified length and properly terminated?
   f. Are all EUT and test equipment ports properly terminated?
   g. Is the EUT properly exercised in accordance with the selected standard to determine worst-case emissions?
   h. Are the correct frequency ranges measured and the correct detector and bandwidth settings used in accordance with the selected standard?
   i. Can test personal determine broadband and narrowband conducted emissions?
   j. Are broadband and narrowband conducted current emissions properly measured according to the relevant standard? Ask for a detailed explanation as to how this would be handled.
   k. If regulatory requirements apply to the EUT, in addition to the baseline test method, are these requirements followed?
   l. Are all the settings and adjustments on the test equipment properly set for the measurement?
   m. Are the proper measurements made in accordance with the selected standard?

9) Software/Firmware
   a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
b. Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.

c. Is the software/firmware documented and under configuration control?

d. Does the operator understand the limitations of the software/firmware?

10) Personnel

Do the test personnel demonstrate proper understanding and ability to operate the test equipment? For example, can the person performing the test explain or demonstrate:

a. Proper instrument settings for the emission being measured.

b. How to detect and handle overload conditions.

c. The detection of emissions in the presence of noise.

d. How to make measurements in other unusual measurement conditions.

e. How to convert and report the measured value for comparison with the specified limits.

11) Test Reports

a. Is the test report complete and does it follow the guidance given in the standard and by the applicable regulatory requirement, if any? Ask the laboratory for a few previously prepared reports to determine completeness and accuracy.

(Note: All test reports should contain a report of measurements relative to the standard to which compliance is being demonstrated. In certain instances, the test report should also adequately detail the labeling and other regulatory requirements.)

b. Is the measured data reported in accordance with the standard?

c. Are the test results presented in a clear and concise manner for an easy comparison with the limits?

d. Are all conversion factors and sample calculations included in the report?

e. Does the test report document all equipment set-up conditions and test equipment settings so the tests can be repeated with the same results, if necessary?

f. Are adequate photographs and descriptive material included in the report?

g. Does the test report clearly document compliance with the applicable standard or regulatory requirements, including user information or labeling requirements, if any?

h. Is the test report properly signed by an authorized signatory of the test laboratory?

12) Regulatory Requirements

a. Does the laboratory have a thorough understanding of any regulatory requirements in addition to the requirements given in the baseline test method?

b. Are there any special limitations or additional requirements for testing equipment needed to meet specific regulatory testing requirements?

c. Are there any regulatory limits and conditions on testing equipment covered by this scope of accreditation?

13) Other Standards
Is the laboratory capable of performing conducted current emission measurements for all the measurement methods listed in the scope of accreditation? Has the laboratory demonstrated the ability to adapt the basic EMC test method for conducted current emission measurements to the other standard specific requirements?

(Note: This is determined through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought. This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)

ASSESSOR'S COMMENTS / OBSERVATIONS:
4.2 Conducted Voltage Emissions

4.2.1 Test Summary
This basic EMC test includes those tests that require the level of the conducted voltage emissions produced by the equipment under test to be measured, either on input power leads, signal leads, or I/O leads. The conducted voltage emissions produced by the equipment under test are measured by means of a test receiver connected to the RF port of a line impedance stabilization network (LISN), artificial mains network, impedance stabilization network (ISN), or similar device, connected in series with the lead under test. The LISN is connected to the test receiver or spectrum analyzer by means of coaxial or other suitable cabling. The frequency range of interest is then scanned for emissions from the equipment under test and the receiver meter reading is recorded and adjusted for LISN insertion loss, pre-amplifier gain and cable loss as appropriate. The corrected reading is then compared to the specified limit in order to determine compliance with the applicable standard or regulatory limit.

4.2.2 Test Parameters
The parameters of a conducted voltage emissions test for which accreditation may be obtained under this basic EMC test are defined below:

<table>
<thead>
<tr>
<th>Test Type:</th>
<th>Conducted Voltage Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range:</td>
<td>9 kHz to 400 MHz</td>
</tr>
<tr>
<td>Powerline pick-up device:</td>
<td>Line Impedance Stabilization Network</td>
</tr>
<tr>
<td>Signal line pick-up device:</td>
<td>Impedance Stabilization Network</td>
</tr>
<tr>
<td>Receiving Device:</td>
<td>EMI Receiver or Spectrum Analyzer</td>
</tr>
<tr>
<td>Test Environment:</td>
<td>Shielded Enclosure or Ground Reference Plane</td>
</tr>
</tbody>
</table>

4.2.3 Test Equipment
The minimum basic test equipment along with the critical parameters of that equipment necessary in order to demonstrate the ability to perform conducted emissions voltage measurements in accordance with this basic EMC test are indicated below:

<table>
<thead>
<tr>
<th>Receiver:</th>
<th>Frequency Range, Bandwidth, Detector and Impedance</th>
</tr>
</thead>
<tbody>
<tr>
<td>LISN (powerline):</td>
<td>Frequency Range, Impedance, and Insertion Loss</td>
</tr>
<tr>
<td>ISN (signal line):</td>
<td>Frequency Range, Impedance, and Insertion Loss</td>
</tr>
<tr>
<td>Transient Limiter:</td>
<td>Frequency Range, Insertion Loss</td>
</tr>
<tr>
<td>Cabling:</td>
<td>Insertion Loss, Impedance</td>
</tr>
</tbody>
</table>

4.2.4 Baseline Test Methods
The following standards are identified as baseline test methods for evaluating equipment to this basic EMC test. Other standards may be used, as appropriate.

- FCC Part 15 (ANSI C63.4-2000), Conducted Emissions, AC Power Line
- CE102 (MIL-STD-461D/E), Conducted Emissions, AC/DC Power Line
Specific Checklist
Conducted Voltage Emissions

Introduction:

This checklist is intended to provide guidance to the Technical Assessor in assessing an EMC laboratory with a scope covering conducted voltage emission measurements. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory. Conducted voltage emission measurements may cover both signal line and power line conducted voltage measurements, in which cases different test procedures and impedance networks will be required.

The assessment of signal line and power line conducted voltage emission measurements shall be based on the assessor selecting one or more baseline test methods for an in-depth review to assess the competence of the laboratory for this basic EMC test. When selecting the baseline test method(s) to be utilized for on-site assessment, several factors should be considered:

- The scope of accreditation.
- The needs of the regulatory agency(s) or user of such accreditation.
- The standard or method that requires the most comprehensive audit to determine competence of the laboratory being assessed for the scope of accreditation.

(Note: Evaluation of two baseline test methods will be required when the scope of accreditation includes test methods that require two substantially different test methods; e.g., signal line and power line measurements.)

1) List the selected baseline standard(s), the specific test procedure from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Standard Selected</th>
<th>Test Procedure Selected</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Method, Section or Paragraph from the Selected Baseline Standard)</td>
<td></td>
</tr>
</tbody>
</table>

2) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure described in the selected baseline test method(s).

3) Does the laboratory have the test equipment necessary to perform the selected baseline test method?

4) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

5) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.
The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic EMC test for which accreditation is sought.

6) Facility
   a. Does the facility for measuring conducted voltage emissions meet the minimum requirements specified in the baseline standard(s) for this test?
   b. Is there appropriate power available for performing the measurements?
   c. Are the ambient conditions at least 6 dB below the limit?
   d. Are isolation transformers and/or RF filters, if needed, appropriate and properly installed?
   e. Are the conducting surfaces in accordance with the appropriate guidance document or standards?
   f. Does the test equipment provide the necessary sensitivity to make the required measurement?

7) High Powered EUT
   a. Do the laboratory personnel know how the laboratory would handle a large high-powered EUT?
   b. Do the laboratory personnel know how the laboratory would handle a large EUT located on a factory floor?
   c. Do the laboratory personnel know the conditions and use of a voltage probe?
   d. Do the laboratory personnel know what special measurements and conditions are required when the power requirement of the EUT is greater than the rated capacity of the LISN?

8) LISNs/ISNs
   a. Does the laboratory use the correct impedance stabilization network(s) for the performance of these measurements?
   b. Have the network(s) been constructed and calibrated in accordance with the standard?
   c. Are the network(s) used properly? (Attachment of the EUT to wires attached to the terminals of the network is improper use of the network.)

9) Performance of Test
   a. Are the tests performed per the selected standard?
   b. Is the EUT and test equipment properly located, configured and operated? (Be sure to check for proper distances between conducting surfaces.)
   c. Is the EUT (both floor-standing and table-top) set up properly?
   d. Is the excess power cord (signal lines) configured (bundled) properly?
   e. Are all the power cords and I/O cables the specified length and properly terminated?
   f. Are all EUT and test equipment ports properly terminated?
   g. Is the EUT properly exercised in accordance with the selected standard to determine worst-case emissions?
   h. Are broadband and narrowband conducted emissions properly measured according to the relevant standard? Ask for a detailed explanation as to how this would be handled.
   i. Are all the settings and adjustments on the test equipment properly set for the measurement?
   j. Are the proper measurements made in accordance with the selected standard?
10) Software/Firmware
   a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type
      of test procedure being performed?
   b. Do the laboratory personnel know how to properly use the software/firmware? Ask for a
demonstration to show proper use.
   c. Is the software/firmware documented and under configuration control?
   d. Does the operator understand the limitations of the software/firmware?

11) Personnel
    Do the test personnel demonstrate proper understanding and ability to operate the test equipment? For
    example, can the person performing the test explain or demonstrate:
    a. Proper instrument settings for the emission being measured?
    b. How to detect and handle overload conditions?
    c. The detection of emissions in the presence of noise?
    d. How to make measurements in other unusual measurement conditions?

12) Test Reports
    a. Is the test report complete and does it follow the guidance given in the standard and by the
       applicable regulatory requirement, if any? Ask the laboratory for a few previously prepared
       reports to determine completeness and accuracy. (Note: All test reports should contain a report
       of measurements relative to the standard to which compliance is being demonstrated. In certain
       instances, such as FCC DoC reports, the test report should also adequately detail the labeling
       and other regulatory requirements.)
    b. Is the measured data reported in accordance with the standard?
    c. Are the test results presented in a clear and concise manner for an easy comparison with the
       limits?
    d. Are all conversion factors and sample calculations included in the report?
    e. Does the test report document all equipment set-up conditions and test equipment settings so the
       tests can be repeated with the same results, if necessary?
    f. Are adequate photographs and descriptive material included in the report?
    g. Does the test report clearly document compliance with the applicable standard or regulatory
       requirements, including user information or labeling requirements, if any?
    h. Is the test report properly signed by an authorized signatory of the test laboratory?

13) Regulatory Requirements
    a. Does the laboratory have a thorough understanding of any regulatory requirements in addition to
       the requirements given in the baseline test method?
    b. Are there any special limitations or additional requirements for testing equipment needed to meet
       specific regulatory testing requirements? (For equipment subject to Part 15 of the FCC Rules, see
       47 CFR 15.31-15.35.)
    c. Is there any labeling or user information requirements? (For equipment subject to FCC
       requirements, see 47 CFR Parts 2, 15 and 18.)
    d. Are there any regulatory limits and conditions on testing equipment covered by this scope of
       accreditation? (For equipment subject to FCC requirements, see 47 CFR 15.107 and 18.307.)
14) Other Standards

Is the laboratory capable of performing conducted voltage emission measurements for all the measurement methods listed in the scope of accreditation? Has the laboratory demonstrated the ability to adapt the basic EMC test method for conducted voltage emission measurements to the other standard specific requirements?

(Note: This is determined through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought. This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)

ASSESSOR'S COMMENTS / OBSERVATIONS:
4.3 Conducted Transient Emissions

4.3.1 Test Summary

This basic EMC test includes those tests that require the level of the conducted transient emissions produced by the equipment under test to be measured. The conducted transient emissions produced by the equipment under test are measured in the time domain by means of an oscilloscope or other suitable measuring instrument connected to the lead under test by means of either a voltage or current probe. The equipment under test is then exercised in modes likely to produce voltage and/or current transients on the power bus. Transients are captured with the oscilloscope and the obtained amplitude and duration are then compared to the specified limit in order to determine compliance with the applicable standard.

4.3.2 Test Parameters

The parameters of a conducted transient emissions test for which accreditation may be obtained under this basic EMC test are defined below:

- **Test Type:** Conducted Transient Emissions
- **Frequency Range:** Time Domain
- **Pick up Device:** Voltage or Current Probe
- **Receiving Device:** Oscilloscope
- **Test Environment:** Shielded Enclosure or Ground Reference Plane

4.3.3 Test Equipment

The minimum basic test equipment along with the critical parameters of that equipment necessary in order to demonstrate the ability to perform conducted emissions transient measurements in accordance with this basic EMC test are indicated below:

- **Oscilloscope:** Bandwidth, Trigger Function, Accuracy, and Voltage Range
- **Probe:** Bandwidth, Correction Factors, and Impedance

4.3.4 Baseline Test Methods

The following standards are identified as baseline test methods for evaluating equipment to this basic EMC test. Other standards may be used, as appropriate.

- CE07 (MIL-STD-461C), Conducted Emissions, AC/DC Power Line
- EN 61000-3-3, Conducted Emissions, AC Power Line, Voltage Flicker
Specific Checklist
Conducted Transient Emissions

Introduction:

This checklist is intended to provide guidance to the Technical Assessor in assessing an EMC laboratory with a scope covering conducted transient emission measurements. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory.

The assessment of power line conducted transient emission measurements shall be based on the assessor selecting one or more baseline test methods for an in-depth review to assess the competence of the laboratory for this basic EMC test. When selecting the standard(s) to be utilized for on-site assessment, several factors should be considered:

- The scope of accreditation.
- The needs of the regulatory agency(s) or user of such accreditation.
- The standard or method that requires the most comprehensive audit to determine competence of the laboratory being assessed.

1) List the selected baseline standard(s), the specific test procedure from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Standard Selected</th>
<th>Test Procedure Selected</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Method, Section or Paragraph from the Selected Baseline Standard)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure described in the selected baseline test method(s).

3) Does the laboratory have the test equipment necessary to perform the selected baseline test method?

4) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

5) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.
The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic EMC test method for which accreditation is sought.

6) Facility
   a. Does the facility for measuring conducted transient emissions meet the minimum requirements specified in the baseline standard(s) for this test?
   b. Is there appropriate power available for performing the measurements?
   c. Are isolation transformers, if needed, appropriate and properly installed?
   d. Are the conducting surfaces in accordance with the standard?
   e. Does the test equipment provide the necessary sensitivity to make the required measurement?

7) Performance of Test
   a. Is the equipment under test (EUT) configured in accordance with the standard?
   b. Is the EUT exercised in accordance with the standard?
   c. Is the length of power leads as specified within the standard?
   d. Is the EUT, power, and I/O leads configured as specified in the standard with respect to any required ground reference planes?
   e. Is the measuring device (oscilloscope) appropriate to the standard or test method being performed?
      i. Bandwidth?
      ii. Input Range?
      iii. Trigger Function?
      iv. Sensitivity?
      v. Accuracy?
      vi. Resolution?

8) Test Data
   Are X-Y plots of the transient emissions provided? Do the plots show the:
   a. Transient Duration?
   b. Transient Amplitude?
   c. Transient Rise Time?

9) Software/Firmware
   a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
   b. Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.
   c. Is the software/firmware documented and under configuration control?
   d. Does the operator understand the limitations of the software/firmware?

10) Personnel
    Do the test personnel demonstrate proper understanding and ability to operate the test equipment? For example, can the person performing the test explain or demonstrate:
a. Proper instrument settings for the emission being measured?
b. How to detect and handle overload conditions?
c. The detection of emissions in the presence of noise?
d. How to make measurements in other unusual measurement conditions?

11) Test Reports

a. Is the test report complete and does it follow the guidance given in the standard and by the applicable regulatory requirement, if any? Ask the laboratory for a few previously prepared reports to determine completeness and accuracy. (Note: All test reports should contain a report of measurements relative to the standard to which compliance is being demonstrated. In certain instances, the test report should also adequately detail the labeling and other regulatory requirements.)
b. Is the measured data reported in accordance with the standard?
c. Are the test results presented in a clear and concise manner for an easy comparison with the limits?
d. Are all conversion factors and sample calculations included in the report?
e. Does the test report document all equipment set-up conditions and test equipment settings so the tests can be repeated with the same results, if necessary?
f. Are adequate photographs and descriptive material included in the report?
g. Does the test report clearly document compliance with the applicable standard or regulatory requirements, including user information or labeling requirements, if any?
h. Is the test report properly signed by an authorized signatory of the test laboratory?

12) Regulatory Requirements

a. Does the laboratory have a thorough understanding of any regulatory requirements in addition to the requirements given in the baseline test method?
b. Are there any special limitations or additional requirements for testing equipment needed to meet specific regulatory testing requirements?
c. Are there any regulatory limits and conditions on testing equipment covered by this scope of accreditation?

13) Other Standards

Is the laboratory capable of performing conducted transient emission measurements for all the measurement methods listed in the scope of accreditation? Has the laboratory demonstrated the ability to adapt the basic EMC test method for conducted transient emission measurements to the other standard specific requirements?

(Note: This is determined through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought. This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)
<table>
<thead>
<tr>
<th>ASSESSOR'S COMMENTS / OBSERVATIONS:</th>
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<tbody>
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</table>
4.4 Radiated Emissions, Magnetic Field

4.4.1 Test Summary
This basic EMC test includes those tests that require the magnetic component of the radiated field produced by the equipment under test to be measured. The magnetic component of the radiated emissions produced by the equipment under test is measured by means of a loop antenna placed at a specified distance from the equipment under test. The antenna is connected to a spectrum analyzer or receiver by means of coaxial cabling. The frequency range of interest is then scanned for emissions from the equipment under test and the receiver meter reading is recorded and adjusted for any antenna factors, preamplifier gain or cable loss. The corrected reading is then compared to the specified limit in order to determine compliance with the applicable standard.

4.4.2 Test Parameters
The primary parameters of a magnetic field radiated emissions test for which accreditation may be obtained under this basic EMC test are defined below:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Type:</td>
<td>Radiated Emissions, Magnetic Field</td>
</tr>
<tr>
<td>Frequency Range:</td>
<td>10 Hz to 30 MHz</td>
</tr>
<tr>
<td>Pick up Device:</td>
<td>Loop Antenna</td>
</tr>
<tr>
<td>Receiving Device:</td>
<td>Receiver or Spectrum Analyzer</td>
</tr>
<tr>
<td>Test Environment:</td>
<td>Shielded Enclosure or OATS (based on baseline test method selected)</td>
</tr>
</tbody>
</table>

4.4.3 Test Equipment
The minimum basic test equipment, along with the critical parameters of that equipment, necessary in order to demonstrate the ability to perform radiated emissions magnetic field measurements in accordance with this basic EMC test, is indicated below:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Critical Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver</td>
<td>Frequency Range, Bandwidth, and Detector</td>
</tr>
<tr>
<td>Loop Antenna</td>
<td>Frequency Range, Sensitivity, and Correction Factors</td>
</tr>
<tr>
<td>Cabling</td>
<td>Insertion Loss</td>
</tr>
</tbody>
</table>

4.4.4 Baseline Test Methods
The following standards are identified as baseline test methods for evaluating equipment to this basic EMC test. Other standards may be used, as appropriate.

- RE101 (MIL-STD-4621D/E), Radiated Emissions, Shielded Enclosure

(Note: Two baseline test methods will be required when the scope of accreditation includes test methods that require two substantially different test methods, e.g., OATS and shield rooms.)
Specific Checklist
Radiated Emissions – Magnetic Field

Introduction:
This checklist is intended to provide guidance to the Technical Assessor in assessing an EMC laboratory with a scope covering radiated magnetic field emission measurements. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory. Radiated magnetic field emission measurements may cover both open field measurements and those performed within a shielded enclosure, in which cases different test procedures, equipment and facilities will be required.

The assessment of radiated magnetic field emission measurements shall be based on the assessor selecting one or more baseline test methods for an in-depth review to assess the competence of the laboratory for this basic EMC test. When selecting the standard(s) to be utilized for on-site assessment, several factors should be considered:

- The scope of accreditation.
- The needs of the regulatory agency(s) or user of such accreditation.
- The standard or method that requires the most comprehensive audit to determine competence of the laboratory being assessed for the scope of accreditation.

1) List the selected baseline test method(s), the specific test procedure from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Standard Selected</th>
<th>Test Procedure Selected (Method, Section or Paragraph from the Selected Baseline Standard)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>

2) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure described in the selected baseline test method(s).

3) Does the laboratory have the test equipment necessary to perform the selected baseline test method?

4) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

5) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.
The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic EMC test for which accreditation is sought.

6) Facility
   a. Does the facility for measuring radiated magnetic field emissions meet the minimum facility requirements specified in the baseline standard for this test?
   b. Is there sufficient power available for performing the measurements?
   c. Does the test equipment provide the necessary sensitivity to make the required measurement?
   d. Are isolation transformers and/or RF filters, if needed, properly installed?
   e. For an OATS facility, is the test facility sufficiently large and without obstructions so that repeatable measurements can be made? (Any large or nearby conducting surfaces, as well as buried cables, may affect the suitability of the site to perform these measurements.)
   f. Are ambient emissions at least 6 dB below the limits to be measured? (Higher ambient levels may be permitted in some circumstances.)
   g. Does the facility meet the layout and other specifications in the standard?
   h. For a shielded enclosure, does the facility retain its integrity and does it meet the manufacturer's specifications?

7) Performance of Test
   a. Does the laboratory use the correct antenna for these measurements?
   b. Is the test equipment and EUT configured in accordance with the selected test procedure?
   c. Are the tests performed per the selected standard?
   d. Is the EUT and test equipment properly located, configured and operated? (Be sure to check for proper distances between EUT and measuring antenna.)
   e. Are the power cords, cables, and other wires bundled properly?
   f. Are all the power cords and I/O cables the specified length and properly terminated?
   g. Are all EUT and test equipment ports properly terminated?
   h. Is the EUT properly exercised in accordance with the selected standard to determine worst-case emissions?
   i. Are the correct frequency ranges, detector functions and bandwidth settings proper for the measurement being made?
   j. If additional regulatory requirements apply to the EUT, are these requirements followed? (See, for example, 47 CFR Part 15 re large equipment, measurement distance, test in-situ, etc., MIL-STD-462 for measurement locations, etc.)
   k. Is EUT rotated, if applicable, during the test to determine the worst-case emission?
   l. Is the test antenna oriented properly for measuring horizontal and vertical emissions?
   m. Are the measurements made in accordance with the selected standard?
   n. Are all the settings and adjustments on the test equipment properly set for the measurement?
8) Software/Firmware
   a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
   b. Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.
   c. Is the software/firmware documented and under configuration control?
   d. Does the operator understand the limitations of the software/firmware?

9) Personnel
   Do the test personnel demonstrate proper understanding and ability to operate the test equipment? For example, can the person performing the test explain or demonstrate:
      a. Proper instrument settings for the emission being measured?
      b. How to detect and handle overload conditions?
      c. The detection of emissions in the presence of noise?
      d. How to make measurements in other unusual measurement conditions?
      e. The proper times, limitation and uses of preamplifiers, band pass filters, etc.?

10) Test Report
    a. Is the test report complete and does it follow the guidance given in the standard and by the applicable regulatory requirement, if any? Ask the laboratory for a few previously prepared reports to determine completeness and accuracy.
    b. Is the measured data reported in accordance with the standard?
    c. Are the test results presented in a clear and concise manner for an easy comparison with the limits?
    d. Are all conversion factors and sample calculations included in the report and are they accurate?
    e. Does the test report document all equipment set-up conditions and test equipment settings so the tests can be repeated with the same results, if necessary?
    f. Are adequate photographs and descriptive material included in the report?
    g. Does the test report clearly document compliance with the applicable standard or regulatory requirements, including user information or labeling requirements, if any?
    h. Is the test report properly signed by an authorized signatory of the test laboratory?

11) Regulatory Requirements
    a. Does the laboratory have a thorough understanding of the additional regulatory requirements under the basic EMC test?
    b. Are there any limitations or additional requirements for testing equipment? (For equipment subject to Part 15 or the FCC Rules, see 47 CFR 15.31-35.)
    c. Are there any labeling or user information requirements? (For equipment subject to FCC requirements, see 47 CFR Parts 2, 15 and 18.)
    d. Are there any regulatory limits and conditions on testing? (For equipment subject to FCC requirements, see 47 CFR 15.107 and 18.307.)
12) Other Standards

Is the laboratory capable of performing radiated emission magnetic field measurements for all the measurement methods listed in the scope of accreditation? Has the laboratory demonstrated the ability to adapt the basic EMC test method for radiated emission magnetic field measurements to the other standard specific requirements?

(Note: This is determined through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought. This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)

ASSESSOR'S COMMENTS OBSERVATIONS:
4.5 Radiated Emissions, Electric Field

4.5.1 Test Summary
This basic EMC test includes those tests that require the electric component of the radiated field produced by the equipment under test to be measured. The electric field component of the radiated emissions produced by the equipment under test are measured by means of a test antenna placed at a specified distance from the equipment under test or envelope containing the same. The antenna is connected to a spectrum analyzer or receiver by means of coaxial cabling. The frequency range of interest is then scanned for emissions from the equipment under test and the receiver meter reading is recorded and adjusted for any antenna factors, preamplifier gain or cable loss. The corrected reading is then compared to the specified limit in order to determine compliance with the applicable standard.

4.5.2 Test Parameters
The primary parameters of a magnetic field radiated emissions test for which accreditation may be obtained under this basic EMC test are defined below:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Type</td>
<td>Radiated Emissions, Electric Field</td>
</tr>
<tr>
<td>Frequency Range</td>
<td>10 kHz to 100 GHz</td>
</tr>
<tr>
<td>Pick up Device</td>
<td>A variety of antennas that depend on the frequency range and test method</td>
</tr>
<tr>
<td>Receiving Device</td>
<td>Receiver or Spectrum Analyzer</td>
</tr>
<tr>
<td>Test Environment</td>
<td>Shielded Enclosure or OATS (depending on baseline test method selected)</td>
</tr>
</tbody>
</table>

4.5.3 Test Equipment
The minimum basic test equipment along with the critical parameters of that equipment necessary in order to demonstrate the ability to perform electric field radiated emissions testing in accordance with this basic EMC test are indicated below:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver</td>
<td>Frequency Range, Bandwidth, Detector, Impedance and Sensitivity</td>
</tr>
<tr>
<td>Antenna</td>
<td>Frequency Range, Antenna Factors and Radiation Pattern</td>
</tr>
<tr>
<td>Cabling</td>
<td>Insertion Loss, Voltage Standing Wave Ratio (VSWR)</td>
</tr>
<tr>
<td>Preamplifier</td>
<td>Gain, VSWR</td>
</tr>
<tr>
<td>Test Site</td>
<td>Normalized Site Attenuation (NSA) or Shielding Effectiveness</td>
</tr>
</tbody>
</table>

4.5.4 Baseline Test Methods
The following standards are identified as baseline test methods for evaluating equipment to this core EMC test. Other standards may be used, as appropriate.

- ANSI C63.4 (FCC Part 15), Radiated Emissions, OATS
- CISPR 22:1997, Radiated Emissions, OATS
- RE02 (MIL-STD-461C), Radiated Emissions, Shielded Enclosure
- RE102 (MIL-STD-461D/E), Radiated Emissions, Absorber Lined Enclosure
(Note: Two baseline test methods will be required when the scope of accreditation includes test methods that require two substantially different test methods, e.g., OATS and shield rooms.)
Specific Checklist
Radiated Emissions – Electric Field

Introduction:

This checklist is intended to provide guidance to the Technical Assessor in assessing an EMC laboratory with a scope covering radiated electric field measurements. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory. Radiated electric field emission measurements may be made on an Open Area Test Site (OATS) or in a shielded enclosure depending on the standard. Each method requires a different facility and set-up procedure. As a result, two different baseline test methods will be required for laboratories that want both types of test methods in their scopes of accreditation.

The assessment of radiated magnetic field emission measurements shall be based on the assessor selecting one or more baseline test methods for an in-depth review to assess the competence of the laboratory for this basic EMC test. When selecting the standard(s) to be utilized for on-site assessment, several factors should be considered:

- The scope of accreditation.
- The needs of the regulatory agency(s) or user of such accreditation.
- The standard or method that requires the most comprehensive audit to determine competence of the laboratory being assessed for the scope of accreditation.

1) List the selected baseline test method(s), the specific test procedure from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Standard Selected</th>
<th>Test Procedure Selected</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

2) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure described in the selected baseline test method(s).

3) Does the laboratory have the test equipment necessary to perform the selected baseline test method?

4) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

5) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.
6) Is the facility for this test method appropriate and has it been properly characterized? Create an assessment for each type of facility used to make the measurement:
   a. Shielded enclosure
   b. Partially treated shielded enclosure (462D specifies minimum absorption values at normal incidence)
   c. Anechoic chamber (Has it been validated to meet alternative normalized site attenuation at the specified measurement distances?)
   d. OATS (Has the site been validated to meet the normalized site attenuation at the specified measurement distances?)
   e. Other (List) (Is it acceptable to the user of the standard?)

The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic EMC test for which accreditation is sought.

7) Facility
   a. Does the facility for measuring radiated electric field emissions meet the minimum facility requirements specified in the baseline test method for this test?
   b. Is there sufficient power available for performing the measurements?
   c. Are isolation transformers and/or RF filters, if needed, properly installed?
   d. For an OATS facility, does it meet the site requirements in C63.4 (2000)?
   e. Does the facility meet the normalized site attenuation requirements for each of the specified measurement distances? (Request a partial demonstration of site attenuation measurements. Review the laboratory’s records on site attenuation.)
   f. Are ambient emissions at least 6 dB below the limits to be measured? (Higher ambient levels may be permitted in some circumstances.)
   g. Does the facility meet the layout and other specifications in the standard?
   h. If an alternative test site to OATS is used, is the basis for using such a facility acceptable to the appropriate regulatory authority or specifier?
   i. For a shielded enclosure, does the facility retain its integrity and does it continue to meet the standard manufacturer’s specifications?
   j. Is the ground plane adequate for the test site?
   k. Does the turntable meet the specifications and guidelines in the standards, including referenced standards?
   l. Is the table for the EUT non-reflecting and the appropriate height, size, and construction?
   m. Is the antenna mast installed and used in accordance with the standard?
   n. Can the antenna be oriented for measuring both vertical and horizontal polarization?

8) Performance of Test
   a. Are the tests performed in accordance with the selected standard?
   b. Is the EUT and test equipment properly located, configured and operated? (Be sure to check for
proper distances between the EUT and measuring antenna(s).)

- Does the laboratory use the correct antenna for these measurements? (An electric field monopole antenna is not permitted for products subject to regulatory requirements.)
- Is the test equipment and EUT configured in accordance with the selected baseline test method?
- Can the laboratory personnel explain how the laboratory would handle a large high-powered EUT or a large EUT located on a factory floor, if applicable?
- Are both vertical and horizontal emissions measured for the maximum value of each emission being measured?
- Is the EUT rotated and the antenna raised and lowered for the maximum value of each emission?
- Is the EUT (both floor-standing and table-top) set-up properly?
- Are the power cords, cables and other wires bundled properly?
- Are all the power cords and I/O cables the specified length and properly terminated?
- Are the EUT and test equipment ports properly terminated?
- Is the EUT properly exercised in accordance with the selected standard to determine worst-case emissions?
- Are the correct frequency ranges, detector functions, and bandwidth settings used in accordance with the selected standard?
- Can test personnel detect and take account of broadband and narrowband emissions? Ask for a detailed explanation as to how this would be handled.
- If additional regulatory requirements apply to the EUT, are these requirements followed? (See for example 47 CFR Part 15 re detector functions, frequency range of measurements, measurement distance, etc.)
- Are the measurements made in accordance with the selected baseline test method and regulatory requirements if applicable?
- Are all the settings and adjustments on the test equipment properly set for the measurement? (Be sure to check regulations, if applicable.)

**9) Software/Firmware**

- If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
- Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.
- Is the software/firmware documented and under configuration control?
- Does the operator understand the limitations of the software/firmware?

**10) Personnel**

Do the test personnel demonstrate proper understanding of the test method and operation of the test equipment? For example, can the person explain or demonstrate:

- The proper instrument settings for the emission being measured?
- How to detect and handle overload conditions?
- The detection of emissions in the presence of noise?
- How to make measurements in other unusual measurement conditions?
- The proper times, limitation and uses of preamplifiers, bandpass filters, etc.?
11) Test Reports

   a. Ask the laboratory for a few previously prepared reports to determine completeness and accuracy.
   b. Are the test reports complete and follow the guidance given in the standard and by the applicable regulatory requirement, if any?
   c. Is the measured data reported in accordance with the selected standard?
   d. Are the test results presented in a clear and concise manner for an easy comparison with the limits?
   e. Are all conversion factors and sample calculations included in the report and are they accurate?
   f. Does the test report document all equipment set-up conditions and test equipment settings so the tests can be repeated with the same results, if necessary?
   g. Are adequate photographs and descriptive material included in the report?
   h. Does the test report clearly document compliance with the applicable standard or regulatory requirements, including user information or labeling requirements, if any?
   i. Is the test report properly signed by the authorized signatory?

12) Regulatory Requirements

   a. Does the laboratory have a thorough understanding of the additional regulatory requirements under the Basic EMC Test?
   b. Limitations and additional requirements for testing equipment? (For equipment subject to Part 15 of the FCC Rules, see 47 CFR 15.31-15.35.)
   c. Labeling and user information requirements? (For equipment subject to FCC requirements, see 47 CFR Parts 2, 15 and 18.)
   d. Regulatory limits and conditions on testing? (For equipment subject to FCC requirements, see 47 CFR 15.107 and 18.307.)

13) Other Standards

   Is the laboratory capable of performing radiated emission electric field measurements for all the measurement methods listed in the scope of accreditation? Has the laboratory demonstrated the ability to adapt the basic EMC test method for radiated emission electric field measurements to the other standard specific requirements?

   (Note: This is determined through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought. This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)
ASSESSOR'S COMMENTS / OBSERVATIONS:

<table>
<thead>
<tr>
<th>Line 1</th>
<th>Line 2</th>
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5.0 Basic EMC Tests - Immunity

5.1 Electrostatic Discharge

5.1.1 Test Summary
This basic EMC test includes those tests that require the equipment under test to be subjected to static electricity discharges brought on by environmental conditions as well as the installation environment of the equipment under test. The test voltage is achieved by charging a capacitor to a set voltage level. Once the charge voltage is attained, the voltage is discharged to the equipment under test through a defined discharge network. The equipment under test and surrounding surfaces are subjected to repeated discharges at a predetermined rate as the equipment under test is monitored for degradation of performance.

5.1.2 Test Parameters
The primary parameters of an electrostatic discharge test for which accreditation may be obtained under this basic EMC test are defined below:

<table>
<thead>
<tr>
<th>Test Type:</th>
<th>Electrostatic Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Level:</td>
<td>1 to 25 kV</td>
</tr>
<tr>
<td>Polarity:</td>
<td>Positive or Negative</td>
</tr>
<tr>
<td>Test Environment:</td>
<td>Temperature and Humidity Controlled</td>
</tr>
<tr>
<td>Discharge method:</td>
<td>Contact or Air</td>
</tr>
<tr>
<td>Application:</td>
<td>Direct or Indirect</td>
</tr>
</tbody>
</table>

5.1.3 Test Equipment
The minimum basic equipment, along with critical parameters of that equipment, necessary in order to demonstrate ability to perform electrostatic discharge testing in accordance with this basic EMC test is indicated below:

- **ESD Simulator:** Energy Storage Capacitor, Charging Resistor, Discharge Resistor, Output Voltage, Polarity, Discharge Electrodes
- **Oscilloscope:** Bandwidth & Transient Response
- **Coaxial Target:** Bandwidth & Resistance/Impedance
- **Coupling Planes:** Dimensions & Material

5.1.4 Baseline Test Methods
Industry standard test methods that are utilized to perform testing to this basic EMC test, and which may be utilized for baseline evaluation, include but are not limited to:

- EN 61000-4-2, Basic EMC Publication, Electrostatic Discharge
- SAE J1113-13, EMC Measurement Procedure, Electrostatic Discharge
Specific Checklist
Electrostatic Discharge

Introduction

This checklist is intended to provide guidance to the Technical Assessor in assessing an EMC laboratory wishing to be assessed with a scope covering electrostatic discharge testing. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory.

The assessment of electrostatic discharge test methods shall be based on the assessor selecting one or more baseline test methods for an in-depth review to assess the competence of the laboratory for this core test method. When selecting the standard(s) to be utilized for on-site assessment, several factors should be considered:

- The scope of Accreditation.
- The needs of the regulatory agency(s) or user of such accreditation.
- The standard or method that requires the most comprehensive audit to determine competence of the laboratory being assessed.

1) List the selected baseline standard(s), the specific test procedure from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Standard Selected</th>
<th>Test Procedure Selected (Method, Section or Paragraph from the Selected Baseline Standard)</th>
<th>Remarks</th>
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</tbody>
</table>

2) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure within the selected baseline standard(s).

3) Does the laboratory have the test equipment necessary to perform the selected baseline test method? The laboratory should submit a list of all test equipment utilized to perform these measurements.

4) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

5) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.

The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic EMC test for which accreditation is sought.
6) Facility
   a. Does the facility for performing ESD testing meet the minimum requirements, including temperature
      and humidity controls as specified in the baseline standard(s) for this test?
   b. Are the conducting surfaces in accordance with the standard?

7) Performance of Test
   a. Is the equipment under test configured in accordance with the standard?
   b. Is the equipment under test exercised in accordance with the standard?
   c. Is the length of power leads as specified within the standard?
   d. Are the I/O lead lengths as specified within the standard?
   e. Are the I/O leads terminated as specified within the standard?
   f. Is the equipment under test, power, and I/O leads configured as specified with the standard with respect
      to any required ground reference or vertical coupling planes?
   g. Are the ground reference and vertical coupling planes connected to earth as specified in the standard?
   h. Is an appropriate discharge network and electrode utilized for the tests?
   i. Are discharges applied to the equipment under test as specified in the reference standard?
      a. Applied levels, including lower levels where required by the reference standard
      b. Minimum number of discharges at each polarity
      c. Test point locations
   j. Is the ESD simulator appropriate to the standard or test method being performed?
      a. Voltage Range
      b. Discharge Resistor
      c. Discharge Capacitor
      d. Charging Resistor
      e. Discharge Rate
   k. Have the characteristics of the ESD simulator been verified to meet the characteristics tabulated in the
      reference standard?
   l. Does the equipment utilized to verify the characteristics of the ESD simulator have sufficient bandwidth
      and dynamic range to measure the characteristics tabulated in the reference standard?
   m. Does verification test set-up agree with the figures and description detailed in the reference standard and
      is the return cable the same as used in testing?

8) Personnel
   a. Do the test personnel demonstrate proper understanding and operation of the test equipment?
   b. Do the test personnel understand the different types of discharges and their applicability?
      i. Air Discharges
      ii. Contact Discharges
      iii. Direct Discharges
      iv. Indirect Discharges
   c. Do the test personnel apply all applicable test levels?
9) **Test Data**
   a. Are the points on and around the equipment under test that were selected for formal ESD testing reported on the data sheet?
   b. Are all levels tested and reported?

9) **Software/Firmware**
   a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
   b. Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.
   c. Is the software/firmware documented and under configuration control?
   d. Does the operator understand the limitations of the software/firmware?

10) Is the laboratory capable of performing ESD testing for all the measurement methods listed in the scope of accreditation? State the range for performing these measurements, if different from the selected baseline standard.

11) Has the laboratory demonstrated, through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought, the ability to adapt the basic EMC test for electrostatic discharge testing to the other standard specific requirements? (Note: This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)
ASSESSOR'S COMMENTS / OBSERVATIONS:
5.2 Radiated Immunity, Magnetic Field

5.2.1 Test Summary
This basic EMC test includes those tests that require the equipment under test to be subjected to a magnetic field. The disturbing magnetic field is produced by a sinusoidal signal source, the output of which is applied to an induction coil. The equipment under test is either immersed in the resulting magnetic field by situating the equipment under test inside of the induction coil or the surface of the equipment under test is probed with the induction coil located in close proximity to the sample. The magnetic field strength that the equipment under test is exposed to is determined by measuring the current that is applied to the test coil of specific design. The desired frequency range, if applicable, is swept and the equipment under test monitored for degradation of performance.

5.2.2 Test Parameters
The primary parameters of a magnetic field radiated immunity test for which accreditation may be obtained under this basic EMC test are defined below:

<table>
<thead>
<tr>
<th>Test Type:</th>
<th>Radiated Immunity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range:</td>
<td>DC to 100 kHz</td>
</tr>
<tr>
<td>Field Strength:</td>
<td>1 to 100 A/M</td>
</tr>
<tr>
<td>Field Generating Device:</td>
<td>Coil, Helmholtz coil</td>
</tr>
</tbody>
</table>

5.2.3 Test Equipment
The minimum basic equipment, along with critical parameters of that equipment necessary in order to demonstrate ability to perform radiated immunity testing in accordance with this basic EMC test, is indicated below:

<table>
<thead>
<tr>
<th>Signal Source:</th>
<th>Frequency Range, Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coil:</td>
<td>Test Volume, conversion factor</td>
</tr>
<tr>
<td>Field/Current Monitoring Device:</td>
<td>Input Range</td>
</tr>
<tr>
<td>Measuring Instrument:</td>
<td>Frequency Range, Input Range</td>
</tr>
</tbody>
</table>

5.2.4 Baseline Standards
Industry standard test methods that are utilized to perform testing to this basic EMC test, and which may be utilized for baseline evaluation, include but are not limited to:

- EN 61000-4-8, Basic EMC Publication, Power Frequency Magnetic Field
- RS101 (MIL-STD-461D/E), Radiated Susceptibility, Magnetic Field
- MIL-STD-1399, DC Magnetic Field

*(Note: It may be necessary to evaluate more than one baseline test method when the scope of accreditation is such that DC, Discrete Power Frequency and Swept Frequency-type tests are requested.)*

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Specific Checklist
Radiated Immunity – Magnetic Field

Introduction:
This checklist is intended to provide guidance to the Technical Assessor in assessing an EMC laboratory wishing to be assessed with a scope covering radiated magnetic field immunity testing. This checklist should not be considered as limiting and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory.

The assessment of radiated magnetic field immunity testing shall be based on the assessor selecting one or more baseline test methods for an in-depth review to assess the competence of the laboratory for this core test method. When selecting the standard(s) to be utilized for on-site assessment, several factors should be considered:

- The scope of Accreditation.
- The needs of the regulatory agency(s) or user of such accreditation.
- The standard or method that requires the most comprehensive audit to determine competence of the laboratory being assessed.

1) List the selected baseline standard(s), the specific test procedure from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Standard Selected</th>
<th>Test Procedure Selected</th>
<th>Remarks</th>
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<td>(Method, Section or Paragraph from the Selected Baseline Standard)</td>
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</table>

2) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure within the selected baseline standard(s).

3) Does the laboratory have the test equipment necessary to perform the selected baseline test method? The laboratory should submit a list of all test equipment utilized to perform these measurements.

4) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

5) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.

The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory’s competence in the basic EMC test for which accreditation is sought.
6) Facility
a. Does the facility for performing magnetic field radiated immunity testing meet the minimum requirements, including temperature and humidity controls as specified in the baseline standard(s) for this test?

7) Performance of Test
a. Is the equipment under test configured in accordance with the standard?
b. Is the equipment under test exercised in accordance with the standard?
c. Is the length of power leads as specified within the standard?
d. Are the I/O lead lengths as specified within the standard?
e. Are the I/O leads terminated as specified within the standard?
f. Is the equipment under test, power and I/O leads configured as specified with the standard with respect to any required ground reference or vertical coupling planes?
g. Are the ground reference and vertical coupling planes connected to earth and meet the minimum size requirements as specified in the referenced standard?
h. If required, are appropriate line-stabilization devices (LISN’s or Caps) installed in the leads under test as specified in the standard?
i. Is the test sample power source appropriate for the intended use of the equipment under test?
j. Is an appropriate transducer / pickup device utilized for the measuring the magnetic field?
k. Is the transducer / pickup device installed in accordance with the standard?
l. Is the field generating system appropriate to the standard or test method being performed?
   Field Generating Device:
   Frequency Range?
   Test Volume?
   Field Uniformity within the Device?
   Signal Source
   Frequency Range?
   Output Level?
m. Was the output current and total distortion factor verified where required by the referenced standard?
n. Are the coil dimensions adequate relative to the devices tested in accordance with the referenced standard?

9) Software/Firmware
a. If there is software/firmware to automate testing, is it accurate and appropriate for the type of test procedure being performed?
b. Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.
c. Is the software/firmware documented and under configuration control?
d. Does the operator understand the limitations of the software/firmware?
8) Personnel
   a. Do the test personnel demonstrate proper understanding and operation of the test equipment?
   b. Do the test personnel apply all applicable test levels?

9) Test Data
   a. Is the test data presented as required by the standard?
   b. Is the appropriate number of data points reported?
   c. Are the sides of the equipment tested reported?
   d. Is the equipment used reported?

10) Is the test data presented as required by the standard?

11) Is the laboratory capable of performing magnetic field radiated immunity testing for all the measurement methods listed in the scope of accreditation? State the frequency range and test levels for performing these measurements, if different from the selected baseline standard.

12) Has the laboratory demonstrated, through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought, the ability to adapt the basic EMC test for radiated magnetic field immunity testing to the other standard specific requirements. (Note: This is intended to be a sampling process, the depth in which additional standards are reviewed is at the discretion of the assessor.)
ASSESSOR'S COMMENTS / OBSERVATIONS:
5.3 Radiated Immunity, Electric Field, Screen Room or ALSE

5.3.1 Test Summary
This basic EMC test includes those tests that require the equipment under test to be subjected to a radiated electric field. The disturbing RF signal is produced by a signal source that is modulated, either internally or externally, by an audio frequency source to produce the necessary modulated RF waveform. This RF signal is then passed to an RF power amplifier, increasing the RF power to the level necessary to generate the desired field strength. This RF signal is then passed through a penetration into the test enclosure where it is applied to the test antenna. The radiated electric field is generated as a result of the RF power applied to the test antenna. The resultant field strength is determined by one of two methods depending on the standard used. The applied field strength may be monitored with an isotropic probe during the test and the output level of the RF signal source adjusted to maintain the test level. The RF level may also be controlled by measuring the forward power applied to the test antenna, reproducing the levels attained during a previously performed calibration procedure. The desired frequency range is then swept at a rate determined by the test standard and the equipment under test monitored for any indications of degradation. This procedure is repeated for each orientation of the test antenna and for each test antenna in the frequency range of the test.

5.3.2 Test Parameters
The primary parameters of a radiated immunity test performed within a shielded enclosure or semi-anechoic chamber for which accreditation may be obtained under this basic EMC test are defined below:

- Test Type: Radiated Immunity
- Frequency Range: 10 kHz to 40 GHz
- Field Strength: 1 Volt/meter to 200 Volts/meter
- Field Generating Device: Test Antenna
- Test Environment: Shielded Enclosure or Semi-Anechoic Enclosure

5.3.3 Test Equipment
The minimum basic equipment, along with critical parameters of that equipment necessary in order to demonstrate ability to perform radiated immunity testing in accordance with this basic EMC test, is indicated below:

- Shielded Enclosure: Dimensions
- Semi-Anechoic Chamber: Dimensions, Treatment
- RF Signal Source: Frequency Range, Step/Sweep Rate and Modulation
- AF Signal Source: Frequency, Waveform
- RF Power Amplifier: Frequency, Power Output, VSWR capability
- Directional Coupler: Frequency Range, power handling
- Transmission lines/devices: Power Handling Ability, attenuation
- Test Antenna: Type, Power Handling Ability
- RF Probe: Type, Frequency Range, and Field Strength Range
- Spectrum Analyzer: Frequency Range
5.3.4 Baseline Standards

Industry standard test methods that are utilized to perform testing to this basic EMC test, and which may be utilized for baseline evaluation, include but are not limited to:

- EN 61000-4-3, Basic EMC Publication, Radiated RF Immunity
- RS103 (MIL-STD-461D/E), Radiated Susceptibility, Absorber Lined Shielded Enclosure (ALSE)
- RS03 (MIL-STD-461C), Radiated Susceptibility, Shielded Enclosure

(Note: Two baseline test methods will be required when the scope of accreditation includes test methods that require two substantially different test methods; e.g., shielded room or semi-anechoic enclosure.)
Specific Checklist
Radiated Immunity – Electric Field, Screen Room or ALSE

Introduction:
This checklist is intended to provide guidance to the Technical Assessor in assessing an EMC laboratory wishing to be assessed with a scope covering radiated electric field immunity testing. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory.

The assessment of radiated electric field immunity testing shall be based on the assessor selecting one or more baseline test methods for an in-depth review to assess the competence of the laboratory for this basic EMC test method. When selecting the standard(s) to be utilized for on-site assessment, several factors should be considered:

- The scope of Accreditation.
- The needs of the regulatory agency(s) or user of such accreditation.
- The standard or method that requires the most comprehensive audit to determine competence of the laboratory being assessed.

1) List the selected baseline standard(s), the specific test procedure from within that standard and any remarks.

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<tr>
<th>Standard Selected</th>
<th>Test Procedure Selected</th>
<th>Remarks</th>
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</thead>
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</tbody>
</table>

2) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure within the selected baseline standard(s).

3) Does the laboratory have the test equipment necessary to perform the selected baseline test method? The laboratory should submit a list of all test equipment utilized to perform these measurements.

4) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

5) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.

The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic EMC test for which accreditation is sought.
6) Facility

In what environment does the laboratory perform these measurements and has the facility been properly characterized?

   a. Shielded enclosure?
   b. Partially treated shielded enclosure? (462D specifies minimum absorption values at normal incidence)
   c. Anechoic chamber? (Has it validated to meet alternative normalized site attenuation?)
   d. Other? (List) (Is it acceptable to the user of the standard?)

   e. Does the facility for performing electric field radiated immunity testing meet the minimum requirements specified in the baseline standard(s) for this test?

7) Performance of Test

   a. Is the equipment under test configured in accordance with the standard?
   b. Are all four faces of the EUT tested coincident with the calibration plane?
   c. Is the equipment under test exercised in accordance with the standard and exposed to both antenna polarizations during the test?
   d. Is the length of power leads as specified within the standard?
   e. Are the I/O lead lengths as specified within the standard?
   f. Are the I/O leads terminated as specified within the standard?
   g. Is the equipment under test, power and I/O leads configured as specified with the standard with respect to any required ground reference planes?
   h. If required, are appropriate line-stabilization devices (LISN’s or Caps) installed in the leads under test as specified in the standard?
   i. Is the test sample power source appropriate for the intended use of the equipment under test?
   j. Is an appropriate transducer / pickup device utilized for the electric field calibration?
   k. Is the transducer / pickup device installed or positioned in accordance with the standard?
   l. Is the field generating system appropriate to the standard or test method being performed?

Signal Source
   Frequency Range
   Modulation Capability

Amplifier
   Frequency Range
   RF Power Output (adequate for the field strengths and modulation required)

Antennas
   Power Handling
   Polarization
   Beam Width

Power meter, directional coupler and sensors
Dynamic range
Measure both forward and reverse power

m. Does the test environment meet the requirements of the standard?
   - Field Uniformity (both average and deviation requirements)?
   - RF Absorber Ratings?
   - Modulation distortion?

n. Is the field strength calibrated as specified in the standard?
o. Is the field strength applied during the performance of the test controlled as specified in the standard?
   - Dual Antenna
   - Real Time Field Sensor
   - Pre-calibrated Forward Power

8) Software/Firmware
a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
b. Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.
c. Is the software/firmware documented and under configuration control?
d. Does the operator understand the limitations of the software/firmware?

9) Personnel
a. Do the test personnel demonstrate proper understanding and operation of the test equipment?
b. Do the test personnel apply all applicable test levels?

10) Test Data
a. Is the test data presented as required by the standard?
b. Is the appropriate number of data points reported?
c. Are the sides of the equipment tested reported?
d. Is the equipment used reported?

11) Is the laboratory capable of performing electric field radiated immunity testing for all the measurement methods listed in the scope of accreditation? State the frequency range and test levels for performing these measurements, if different from the selected baseline standard.

12) Has the laboratory demonstrated, through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought, the ability to adapt the basic EMC test for radiated electric field immunity testing to the other standard specific requirements. (Note: This is intended to be a sampling process, the depth in which additional standards are reviewed is at the discretion of the assessor.)
5.4 Radiated Immunity, Electric Field, Parallel Plate, Stripline or TEM Device

5.4.1 Test Summary
This basic EMC test includes those tests that require the equipment under test to be subjected to a radiated electric field. The disturbing RF signal is produced by a signal source that is modulated, either internally or externally, by an audio frequency source to produce the necessary modulated RF waveform. This RF signal is then passed to an RF power amplifier, increasing the RF power to the level necessary to generate the desired field strength. This RF signal is then passed through a penetration into the test enclosure where it is applied to the test device. The radiated electric field is generated as a result of the RF power applied to the septum of the TEM Cell or top plate of the stripline or parallel plate. The resultant field strength is determined by one of two methods depending on the standard used. The applied field strength may be monitored with an isotropic probe during the test and the output level of the RF signal source adjusted to maintain the test level. The RF level may also be controlled by measuring the forward power applied to the test device, reproducing the levels attained during a previously performed calibration procedure. The desired frequency range is then swept at a rate determined by the test standard and the equipment under test monitored for any indications of degradation.

5.4.2 Test Parameters
The primary parameters of a radiated immunity test performed within a parallel plate, stripline or TEM device for which accreditation may be obtained under this basic EMC test are defined below:

- **Test Type:** Radiated Immunity
- **Frequency Range:** 10 kHz to 40 GHz
- **Field Strength:** 1 Volt / meter to 200 Volts / meter
- **Test Environment:** TEM Device

5.4.3 Test Equipment
The minimum basic equipment, along with critical parameters of that equipment, necessary in order to demonstrate ability to perform radiated immunity testing in accordance with this basic EMC test is indicated below:

- **Test Device:** Working Height/Volume, Bandwidth, Shielded, Power Handling
- **RF Signal Source:** Frequency Range, Step/Sweep Rate and Modulation
- **AF Signal Source:** Frequency, Waveform
- **RF Power Amplifier:** Frequency, Power Output, VSWR ‘capability’
- **Directional Coupler:** Frequency Range, power handling
- **Transmission lines / devices:** Power Handling Ability, attenuation
- **RF Probe:** Type, Frequency Range, and Field Strength Range
- **Spectrum Analyzer:** Frequency Range
5.4.4 Baseline Test Methods

Industry standard test methods that are utilized to perform testing to this basic EMC test, and which may be utilized for baseline evaluation, include but are not limited to:

- RS03/RS103 (MIL-STD-462C/D/E), Radiated Susceptibility, Parallel Plate
- SAE J1113-23, Immunity to Radiated EM Fields, Stripline
- SAE J1113-25, Immunity to Radiated EM Fields, Tri-Plate Line

Specific Checklist
Radiated Immunity – Electric Field, TEM Device

Introduction:
This checklist is intended to provide guidance to the Technical Assessor in assessing an EMC laboratory wishing to be assessed with a scope covering radiated electric field immunity testing in TEM devices. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory.

The assessment of radiated electric field immunity testing in TEM devices shall be based on the assessor selecting one or more baseline test methods for an in-depth review to assess the competence of the laboratory for this core test method. When selecting the standard(s) to be utilized for on-site assessment, several factors should be considered:

- The scope of accreditation.
- The needs of the regulatory agency(s) or user of such accreditation.
- The standard or method that requires the most comprehensive audit to determine competence of the laboratory being assessed.

1) List the selected baseline standard(s), the specific test procedure from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Standard Selected</th>
<th>Test Procedure Selected</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Method, Section or Paragraph from the Selected Baseline Standard)</td>
<td></td>
</tr>
</tbody>
</table>

2) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure within the selected baseline standard(s).

3) Does the laboratory have the test equipment necessary to perform the selected baseline test method? The laboratory should submit a list of all test equipment utilized to perform these measurements.

4) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.
5) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.

The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic EMC test for which accreditation is sought.

6) Facility

In what environment does the laboratory perform these measurements and has the facility been properly characterized?

a. TEM Cell?
   b. Parallel Plate?
   c. Stripline?
   d. TriPlate?
   e. Other? (List) (Is it acceptable to the user of the standard?)

f. Does the facility for performing electric field radiated immunity testing meet the minimum requirements specified in the baseline standard(s) for this test?

7) Performance of Test

a. Is the equipment under test configured within the TEM device in accordance with the standard?
b. Is the equipment under test exercised in accordance with the standard?
c. Is the length of power leads as specified within the standard?
d. Are the I/O lead lengths as specified within the standard?
e. Are the I/O leads terminated as specified within the standard?
f. Is the test sample power source appropriate for the intended use of the equipment under test?
g. Is an appropriate transducer / pickup device utilized for the electric field calibration?
h. Is the transducer / pickup device installed in accordance with the standard?
i. Is the field generating system appropriate to the standard or test method being performed?
   Signal Source
      Frequency Range
      Modulation Capability
   Amplifier
      Frequency Range
      RF Power Output (adequate for the field strengths and modulation required)
Power meter, directional coupler and sensors
  Dynamic range
  Measure both forward and reverse power

j. Is the field strength calibrated as specified in the standard?
k. Is the field strength applied during the performance of the test controlled as specified in the standard?

Real Time Field Sensor
  Pre-calibrated Forward Power

8) Software/Firmware
a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
b. Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.
c. Is the software/firmware documented and under configuration control?
d. Does the operator understand the limitations of the software/firmware?

9) Personnel
a. Do the test personnel demonstrate proper understanding and operation of the test equipment?
b. Do the test personnel apply all applicable test levels?

10) Test Data
a. Is the test data presented as required by the standard?
b. Is the appropriate number of data points reported?

11) Is the laboratory capable of performing electric field radiated immunity TEM device testing for all the measurement methods listed in the scope of accreditation? State the frequency range and test levels for performing these measurements, if different from the selected baseline standard.

12) Has the laboratory demonstrated, through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought, the ability to adapt the basic EMC test for TEM device radiated immunity testing to the other standard specific requirements. (Note: This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)
5.5 Transient Immunity

5.5.1 Test Summary
This basic EMC test includes those tests that require the equipment under test to be subjected to transient disturbances including high-energy surges. These disturbances may be applied to the equipment under tests input power leads, interconnecting leads or ground structure. Transient waveforms are defined by voltage and current waveforms measured into a defined impedance. The disturbing transient is produced by charging a capacitive element. Once the capacitor reaches a preset voltage level, the capacitor is discharged through an RLC shaping network. The resultant waveform is then applied to the leads under test of the sample by means of a capacitive, inductive or avalanche-coupling network. A defined number of pulses are applied at a rate defined in the specific standard and the equipment under test is monitored for degradation of performance.

5.5.2 Test Parameters
The primary parameters of transient immunity tests for which accreditation may be obtained under this basic EMC test are defined below:

Test Type: Transient Immunity
Voltage Level: 0 to 6 kV
Polarity: Positive and Negative
Application Method: Capacitive, Inductive or Avalanche Coupling Network

5.5.3 Test Equipment
The minimum basic equipment, along with the critical parameters of that equipment necessary to demonstrate ability to perform transient immunity testing in accordance with this basic EMC test, is indicated below:

Transient Generator: Output level, output waveform, polarity, source impedance, repetition rate
Coupling Device: Coupling capacitance, transfer impedance, avalanche voltage
Decoupling Network: Inductance
Oscilloscope: Bandwidth, Sampling Rate
Verification Loads: Impedance

5.5.4 Baseline Test Methods
Industry standard test methods that are utilized to perform testing to this basic EMC test, and which may be utilized for baseline evaluation, include but are not limited to:

- EN 61000-4-4, Basic EMC Publication, Electrical Fast Transient
- EN 61000-4-5, Basic EMC Publication, Surge
- CS06 (MIL-STD-461C), Voltage Spike
- CS115 (MIL-STD-461D/E), Impulse Excitation
• CS116 (MIL-STD-461D/E), Damped Sinusoidal Transients

(Note: Two or more baseline test methods may be required when the scope of accreditation includes test methods that require substantially different test methods; e.g., voltage spikes and electrical surges.)

Specific Checklist
Transient Immunity

Introduction:
This checklist is intended to provide guidance to the Technical Assessor in assessing an EMC laboratory wishing to be assessed with a scope covering transient immunity testing. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory.

The assessment of transient immunity test methods shall be based on the assessor selecting one or more baseline test methods for an in-depth review to assess the competence of the laboratory for this core test method. When selecting the standard(s) to be utilized for on-site assessment, several factors should be considered:

• The scope of accreditation.
• The needs of the regulatory agency(s) or user of such accreditation.
• The standard or method that requires the most comprehensive audit to determine competence of the laboratory being assessed.

1) List the selected baseline standard(s), the specific test procedure from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Standard Selected</th>
<th>Test Procedure Selected</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Method, Section or Paragraph from the Selected Baseline Standard)</td>
<td></td>
</tr>
</tbody>
</table>

2) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure within the selected baseline standard(s).

3) Does the laboratory have the test equipment necessary to perform the selected baseline test method? The laboratory should submit a list of all test equipment utilized to perform these measurements.

4) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

5) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.

6) The laboratory should submit a listing of transient waveforms within their capability.
The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic EMC test for which accreditation is sought.

7) Facility
   a. Does the facility for performing transient immunity testing meet the minimum requirements specified in the baseline standard(s) for this test?

8) Performance of Test
   a. Is the equipment under test configured in accordance with the standard?
   b. Is the equipment under test exercised in accordance with the standard?
   c. Is the length of power leads as specified within the standard?
   d. Are I/O lead lengths as specified within the standard?
   e. Are the I/O leads terminated as specified within the standard?
   f. Is the equipment under test, power and I/O leads configured as specified with the standard with respect to any required ground reference planes?
   g. If required, are coupling/decoupling devices installed in the leads under test as specified in the standard?
   h. Are the coupling/decoupling devices appropriate for the leads on which tests are performed?
   i. Is the test sample power source appropriate for the intended use of the equipment under test?
   j. Is an appropriate transducer / pickup device utilized for the measurements?
   k. Is the transducer / pickup device installed in accordance with the standard?
   l. Is the transient generator appropriate to the standard or test method being performed?
      Waveform?
      Voltage?
      Current?
      Source Impedance?
      Repetition Rate?
      Coupling Method?

9) Software/Firmware
   a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
   b. Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.
   c. Is the software/firmware documented and under configuration control?
   d. Does the operator understand the limitations of the software/firmware?

10) Personnel
   a. Do the test personnel demonstrate proper understanding and operation of the test equipment?
   b. Do the test personnel apply all applicable test levels?

11) Test Data
   a. Is the test data presented as required by the standard?
   b. Is the appropriate number of data points reported?
12) Is the laboratory capable of performing transient immunity testing for all the measurement methods listed in the scope of accreditation? State the voltage range and waveshape for performing these measurements, if different from the selected baseline standard.

13) Has the laboratory demonstrated, through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought, the ability to adapt the basic EMC test for transient immunity testing to the other standard specific requirements. (Note: This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)

ASSESSOR'S COMMENTS / OBSERVATIONS:
5.6 Conducted Immunity, Audio Frequency

5.6.1 Test Summary
This basic EMC test includes those tests that require the equipment under test to be subjected to audio frequency disturbances applied to power input and interconnecting leads. Power inputs include those from both AC and DC sources. The disturbance is produced by an audio frequency CW signal source. This audio frequency signal is then passed to a power amplifier, increasing the AF power level necessary to generate the desired disturbance level. The AF signal is then passed to a coupling transformer, the secondary of which is connected in series with the EUT lead under test. The induced AF level is determined by monitoring the voltage induced into the lead under test. The desired frequency range is then swept at the prescribed rate and the equipment under test is monitored for any indications of malfunction or degradation of performance.

5.6.2 Test Parameters
The parameters of an audio frequency conducted immunity test for which accreditation may be obtained under this basic EMC test are defined below:

- Test Type: Audio Frequency Conducted Immunity
- Frequency Range: 10 Hz to 100 kHz
- Test Level: 0 to 10 volts RMS
- Injection Device: Coupling Transformer

5.6.3 Test Equipment
The minimum basic test equipment, along with the critical parameters of that equipment necessary in order to demonstrate the ability to perform AF conducted immunity testing in accordance with this basic EMC test, is indicated below:

- AF Signal Source: Frequency Range, Step/Sweep Rate, and Modulation Capability
- AF Power Amplifier: Frequency Range, Power Output
- Injection Device: Transformer, Turns Ratio, and Current Capability
- Monitoring Device: Type, Frequency Range, and Power Handling Capability

5.6.4 Baseline Test Methods
Industry standard test methods that are utilized to perform testing to this basic EMC test, and which may be utilized for baseline evaluation, include but are not limited to:

- CS101 (MIL-STD-461D/E), Audio Frequency Conducted Susceptibility
Specific Checklist
Conducted Immunity – Audio Frequency

Introduction:
This checklist is intended to provide guidance to the Technical Assessor in assessing an EMC laboratory wishing to be assessed with a scope covering conducted audio frequency immunity testing. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory.

The assessment of conducted audio frequency immunity test methods shall be based on the assessor selecting one or more baseline test methods for an in-depth review to assess the competence of the laboratory for this core test method. When selecting the standard(s) to be utilized for on-site assessment, several factors should be considered:

- The scope of accreditation.
- The needs of the regulatory agency(s) or user of such accreditation.
- The standard or method that requires the most comprehensive audit to determine competence of the laboratory being assessed.

1) List the selected baseline standard(s), the specific test procedure from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Standard Selected</th>
<th>Test Procedure Selected (Method, Section or Paragraph from the Selected Baseline Standard)</th>
<th>Remarks</th>
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<tbody>
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</tbody>
</table>

2) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel perform the appropriate test procedure within the selected baseline standard(s).

3) Does the laboratory have the test equipment necessary to perform the selected baseline test method? The laboratory should submit a list of all test equipment utilized to perform these measurements.

4) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

5) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.

The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic EMC test for which accreditation is sought.
6) **Facility**
   
a. Does the facility for performing audio frequency conducted immunity testing meet the minimum requirements specified in the baseline standard(s) for this test?

7) **Performance of Test**
   
a. Is the equipment under test configured in accordance with the standard?
   
b. Is the equipment under test exercised in accordance with the standard?
   
c. Is the length of power leads as specified within the standard?
   
d. Are I/O lead lengths as specified within the standard?
   
e. Are the I/O leads terminated as specified within the standard?
   
f. Is the equipment under test, power and I/O leads configured as specified with the standard with respect to any required ground reference planes?
   
g. If required, are appropriate line-stabilization devices (LISN’s or Caps) installed in the leads under test as specified in the standard?
   
h. Is the test sample power source appropriate for the intended use of the equipment under test?
   
i. Is an appropriate transducer / pickup device utilized for the measuring the applied disturbance?
   
j. Is the transducer / pickup device installed in accordance with the standard?
   
k. Is the disturbance generating system appropriate to the standard or test method being performed?

<table>
<thead>
<tr>
<th>Signal Source</th>
<th>Frequency Range</th>
<th>Output Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amplifier</td>
<td>Frequency Range</td>
<td>Power Output</td>
</tr>
<tr>
<td>Coupling Devices</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8) **Software/Firmware**
   
a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
   
b. Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.
   
c. Is the software/firmware documented and under configuration control?
   
d. Does the operator understand the limitations of the software/firmware?

9) **Personnel**
   
a. Do the test personnel demonstrate proper understanding and operation of the test equipment?
   
b. Do the test personnel apply all applicable test levels?

10) **Test Data**
    
a. Is the test data presented as required by the standard?
    
b. Is the appropriate number of data points reported?

11) Is the laboratory capable of performing audio frequency conducted immunity testing for all the measurement methods listed in the scope of accreditation? State the frequency range and level for
performing these measurements, if different from the selected baseline standard.

12) Has the laboratory demonstrated, through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought, the ability to adapt the basic EMC test for conducted audio frequency immunity testing to the other standard specific requirements. (Note: This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)

ASSESSOR'S COMMENTS / OBSERVATIONS:
5.7 Conducted Immunity, Radio Frequency

5.7.1 Test Summary
This basic EMC test includes those tests that require that the equipment under test be subjected to radio frequency electromagnetic energy, injected onto its power and interconnecting cables. The disturbance is produced by a signal source that is modulated, either internally or externally, by an audio frequency source to produce the necessary modulated RF waveform. This RF signal is then passed to an RF power amplifier, increasing the RF power to the level necessary to generate the desired disturbance level. The RF signal is then passed to a coupling device, either a coupling/decoupling network or inductive current clamp. The induced RF level is determined by either monitoring the forward power applied to the injection device determined in a pre-calibration routine or by monitoring the RF current induced into the lead or cable bundle under test. The desired frequency range is then swept at a rate determined by the test standard and the equipment under test is monitored for any indications of degradation.

5.7.2 Test Parameters
Parameters of a radio frequency conducted immunity for which accreditation may be obtained under this basic EMC test are defined below:

- Test Type: Conducted Immunity
- Frequency Range: 10 kHz to 500 MHz
- Test Level: 0 to 10 volts RMS, 0 to 500 ma
- Injection Device: Coupling/Decoupling Network or Injection Probe
- Test Environment: Shielded Enclosure

5.7.3 Test Equipment
The minimum basic test equipment, along with the critical parameters of that equipment necessary in order to demonstrate the ability to perform conducted RF immunity testing in accordance with this basic EMC test, is indicated below:

- RF Signal Source: Frequency Range, Step/Sweep Rate, and Modulation Capability
- AF Signal Source: Frequency, Waveform
- RF Power Amplifier: Frequency, Power Output, VSWR Capability
- Injection Device: Type, Frequency Range, and Power Handling Ability
- Monitoring Device: Type, Frequency Range, and Power Handling Ability
- Spectrum Analyzer: Frequency Range

5.7.4 Baseline Test Methods
Test methods that are utilized to perform injected conducted immunity testing basic EMC test, and which may be utilized for baseline evaluation, include but are not limited to:
- EN 61000-4-6, Basic EMC Publication, Immunity to Conducted Disturbances
- CS114 (MIL-STD-461D/E), Bulk Cable Injection
- CS02 (MIL-STD-461C), RFR Conducted Susceptibility

**Specific Checklist**

**Conducted Immunity – Radio Frequency**

**Introduction:**
This checklist is intended to provide guidance to the Technical Assessor in assessing an EMC laboratory wishing to be assessed with a scope covering conducted radio frequency immunity testing. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory.

The assessment of conducted radio frequency immunity test methods shall be based on the assessor selecting one or more baseline test methods for an in-depth review to assess the competence of the laboratory for this core test method. When selecting the standard(s) to be utilized for on-site assessment, several factors should be considered:

- The scope of accreditation.
- The needs of the regulatory agency(s) or user of such accreditation.
- The standard or method that requires the most comprehensive audit to determine competence of the laboratory being assessed.

1) List the selected baseline standard(s), the specific test procedure from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Standard Selected</th>
<th>Test Procedure Selected (Method, Section or Paragraph from the Selected Baseline Standard)</th>
<th>Remarks</th>
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</thead>
<tbody>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure within the selected baseline standard(s).

3) Does the laboratory have the test equipment necessary to perform the selected baseline test method? The laboratory should submit a list of all test equipment utilized to perform these measurements.

4) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

5) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.
The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic EMC test for which accreditation is sought.

6) Facility
   a. Does the facility for performing radio frequency conducted immunity testing meet the minimum requirements specified in the baseline standard(s) for this test?

7) Performance of Test
   a. Is the equipment under test configured in accordance with the standard?
   b. Is the equipment under test exercised in accordance with the standard?
   c. Is the length of power leads as specified within the standard?
   d. Are the I/O lead lengths as specified within the standard?
   e. Are the I/O leads terminated as specified within the standard?
   f. Is the equipment under test, power and I/O leads configured as specified with the standard with respect to any required ground reference planes?
   g. If required, are appropriate line-stabilization devices (LISN’s or Caps) installed in the leads under test as specified in the standard?
   h. Is the test sample power source appropriate for the intended use of the equipment under test?
   i. Is an appropriate transducer/pickup device utilized for the measuring the applied disturbance?
   j. Is the transducer/pickup device installed in accordance with the standard?
   k. Is the disturbance generating system appropriate to the standard or test method being performed?

<table>
<thead>
<tr>
<th>Signal Source</th>
<th>Frequency Range</th>
<th>Power Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amplifier</td>
<td>Frequency Range</td>
<td>Impedance</td>
</tr>
<tr>
<td>Coupling Devices</td>
<td>Frequency Range</td>
<td>Power Handling Ability</td>
</tr>
</tbody>
</table>

   l. Is the injected signal level calibrated and monitored as specified in the standard?

8) Software/Firmware
   a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
   b. Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.
   c. Is the software/firmware documented and under configuration control?
   d. Does the operator understand the limitations of the software/firmware?
9) **Personnel**
   a. Do the test personnel demonstrate proper understanding and operation of the test equipment?
   b. Do the test personnel apply all applicable test levels?

10) **Test Data**
   a. Is the test data presented as required by the standard?
   b. Is the appropriate number of data points reported?

11) Is the laboratory capable of performing radio frequency conducted immunity testing for all the measurement methods listed in the scope of accreditation? State the frequency range and level for performing these measurements, if different from the selected baseline standard.

12) Has the laboratory demonstrated, through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought, the ability to adapt the basic EMC test for RF conducted immunity testing to the other standard specific requirements. (Note: This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)

**ASSESSOR'S COMMENTS / OBSERVATIONS:**

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5.8 Power Input Disturbances

5.8.1 Test Summary
This basic EMC test includes those tests that require the equipment under test to be subjected to variations in the input power source supplying primary power to the equipment under test. Power inputs include those from both AC and DC sources. A programmable power source or combination of programmable waveform generator and amplifier generates the disturbances. The disturbances include sudden deviations in equipment under test rated voltage or frequency, slow deviations of rated voltage and frequency and steady state conditions. The equipment under test is connected to a defined power source and various deviations in the input power to the equipment under test are applied as the equipment under test is monitored for degradation of performance.

5.8.2 Test Parameters
The parameters of an input power test for which accreditation may be obtained under this basic EMC test are defined below:

<table>
<thead>
<tr>
<th>Test Type:</th>
<th>Power Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Power Frequency:</td>
<td>DC to 400 Hz</td>
</tr>
<tr>
<td>Rated Voltage:</td>
<td>0 to 230 Volts, one – three phase</td>
</tr>
<tr>
<td>Rated Current:</td>
<td>0 to 30 Amperes</td>
</tr>
<tr>
<td>Disturbances:</td>
<td>Variation in Frequency and / or Voltage</td>
</tr>
</tbody>
</table>

5.8.3 Test Equipment
The minimum basic equipment, along with critical parameters of that equipment necessary in order to demonstrate ability to perform power input testing in accordance with this basic EMC test, is indicated below:

| Programmable Power Source: | Frequency Range, Voltage Range, Current Range, Response Time, phases |
| Oscilloscope: | Transient Response, voltage |

5.8.4 Baseline Test Methods
Test methods that are utilized to perform testing to this basic EMC test, and which may be utilized for baseline evaluation, include but are not limited to:

- EN 61000-4-11, Basic EMC Publication, Voltage Dips and Interrupts
- RTCA DO-160, Power Input
Specific Checklist
Power Input Disturbances

Introduction:
This checklist is intended to provide guidance to the Technical Assessor in assessing an EMC laboratory wishing to be assessed with a scope covering power input disturbance testing. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory.

The assessment of power input disturbance test methods shall be based on the assessor selecting one or more baseline test methods for an in-depth review to assess the competence of the laboratory for this core test method. When selecting the standard(s) to be utilized for on-site assessment, several factors should be considered:

- The scope of accreditation.
- The needs of the regulatory agency(s) or user of such accreditation.
- The standard or method that requires the most comprehensive audit to determine competence of the laboratory being assessed.

1) List the selected baseline standard(s), the specific test procedure from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Standard Selected</th>
<th>Test Procedure Selected</th>
<th>Remarks</th>
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2) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure within the selected baseline standard(s).

3) Does the laboratory have the test equipment necessary to perform the selected baseline test method? The laboratory should submit a list of all test equipment utilized to perform these measurements.

4) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

5) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.

The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic EMC test for which accreditation is sought.
6) **Facility**
   a. Does the facility for performing radio frequency conducted immunity testing meet the minimum requirements specified in the baseline standard(s) for this test?

7) **Performance of Test**
   a. Is the equipment under test configured in accordance with the standard?
   b. Is the equipment under test exercised in accordance with the standard?
   c. Is the length of power leads as specified within the standard?
   d. Is the test sample power source appropriate for the intended use of the equipment under test?
   e. Is an appropriate transducer / pickup device utilized for the measurements?
   f. Is the transducer / pickup device installed in accordance with the standard?
   g. Is the power source appropriate to the standard or test method being performed?
      - Output Voltage?
      - Output Frequency?
      - Output Current?
      - Response Time?
      - Output Impedance?
      - Overshoot?
      - Inrush?

8) **Software/Firmware**
   a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
   b. Do the laboratory personnel how to properly use the software/firmware? Ask for a demonstration to show proper use.
   c. Is the software/firmware documented and under configuration control?
   d. Does the operator understand the limitations of the software/firmware?

9) **Personnel**
   a. Do the test personnel demonstrate proper understanding and operation of the test equipment?
   b. Do the test personnel apply all applicable test levels?

10) **Test Data**
    a. Is the test data presented as required by the standard?
    b. Is the appropriate number of data points reported?
    c. Are plots of the event recorded?

11) Is the laboratory capable of performing power input disturbance testing for all the measurement methods listed in the scope of accreditation? State the voltage range for performing these measurements, if different from the selected baseline standard.
12) Has the laboratory demonstrated, through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought, the ability to adapt the basic EMC test for power input disturbance testing to the other standard specific requirements. (Note: This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)

ASSESSOR'S COMMENTS / OBSERVATIONS:
6.0 Radio Test Methods

6.1 Conducted RF Power Output

6.1.1 Test Summary
Antenna port measurements, whether intended or unintended, are typically performed by direct connection to the RF connector of the radio. For situations where direct conducted measurements cannot be performed (i.e. integral antenna) there are provisions for making these measurements in the radiated field. The RF power output is a measurement of the intended RF signal(s) with instrumentation containing sufficient bandwidth to encompass the entire intended signals.

6.1.2 Test Parameters
The parameters of an antenna port conducted measurement test for which accreditation may be obtained under this basic radio test are defined below:

- **Test Type:** RF Measurements at Antenna Terminals
- **Frequency Range:** 9 kHz to 100 GHz
- **Test Environment:** Bench-top

6.1.3 Test Equipment
The following test equipment, at a minimum, is normally used for performing antenna-conducted measurements.

- **RF Power Meter (or equivalent):** Frequency range, max. input power
- **Spectrum Analyzer:** Frequency range, max. input power
- **Bandpass (high or low) Filters:** Attenuation v Frequency
- **Attenuators:** Attenuation v Frequency
- **Directional Couplers:** Attenuation v Frequency

6.1.4 Baseline Test Method
The following standards are identified as baseline test methods for evaluating equipment to this basic radio test. Other standards may be used, as appropriate.

- ANSI approved standard EIA/TIA-603-1992 – Land Mobile, FM or PM Communication Equipment Measurement and Performance Standards. See also 47 CFR 2.1046 and the applicable technical rules for each radio service covered by the scope of accreditation.
Specific Checklist
Conducted RF Power Output

Introduction:

This checklist is intended to provide guidance to the Technical Assessor in assessing a test laboratory with a scope covering conducted RF power output measurements. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory. The measurement of conducted RF power output shall be based on the assessor selecting the above mentioned standard (referenced in 6.1.4), which includes the basic radio test method. Test methods from other baseline standards may be used, when appropriate.

1) List the selected baseline test method(s), the specific test procedure from within that standard and any remarks.

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<tr>
<th>Baseline Standard Selected</th>
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<td></td>
<td>(Method, Section or Paragraph from the Selected Baseline Standard)</td>
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</table>

2) Over what frequency and power range does the laboratory perform conducted RF power output measurements and what sensor is used for each frequency range?

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Power Range</th>
<th>Power Sensor (include calibration date)</th>
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</table>

3) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure described in the selected baseline test method(s).

4) Does the laboratory have the test equipment necessary to perform the selected baseline test method?

5) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the
selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

6) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.

The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic radio test for which accreditation is sought.

7) Facility
   a. Does the facility for measuring conducted RF output power meet the minimum facility requirements specified in the baseline test method for this test?

8) Performance of Test
   a. Does the laboratory use the correct test equipment to make the conducted RF output power measurement for the frequency and power of the emission? (The preferred instrument is a power meter. If a spectrum analyzer is used are precautions taken to assure an accurate measurement?)
   b. Is an appropriate transducer or pickup device utilized for the measurements?
   c. Is the test equipment and EUT configured in accordance with the selected test method?
   d. Is the test performed per the selected test method and for the radio service under which the equipment will be operated?
   e. Is the proper frequency range covered by the test? (See 47 CFR 2.1057)
   f. Are the correct resolution bandwidth and video bandwidth used?
   g. Is the proper detector function used to make the measurement?
   h. Does the test equipment have sufficient power handling capability to make an accurate measurement?
   i. Does the test take into account overloading and what precautions are taken to prevent it?
   j. Does the test equipment have the required sensitivity to make the measurement?

9) Software/Firmware
   a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
   b. Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.
   c. Is the software/firmware documented and under configuration control?
   d. Does the operator understand the limitations of the software/firmware?

(Note: RF output power measurements are typically made using a power meter. Modulation must be applied to the transmitter depending on the type of transmitter, modulation type and the radio service.)
10) Personnel

Do the test personnel demonstrate proper understanding and operation of the EUT and test equipment? For example, can the person explain or demonstrate:

a. Proper instrument settings for the signal being measured?
b. How to handle overload conditions?
c. Limitations and uses of preamplifiers, bandpass filters, and attenuators, etc.?
d. How to handle other unusual measurement conditions?
e. Proper application of this measurement for a variety of transmitter types and modulations. (e.g. SSB, etc.)
f. The proper expression of RF power output; peak envelope power, carrier power, etc.

11) Test Reports

Ask the laboratory for a few previously prepared reports to determine completeness and accuracy. Is the test report complete and does it follow the guidance given in the standard and by the applicable regulatory requirement, if any?

a. Is the measured data reported in accordance with the standard and the applicable regulatory requirements?
b. Are the test results presented in a clear and concise manner for an easy comparison with the limits? Are all conversion factors and sample calculations included in the report?
c. Does the test report document all equipment set-up conditions and test equipment settings so the tests can be repeated with the same results, if necessary? Are adequate photographs and descriptive material included in the report?
d. Does the test report clearly document compliance with the applicable standard or regulatory requirements, including user information or labeling requirements, if any?
e. Is the test report properly signed?
f. The proper procedure and requirements for other types of transmitters covered under the scope of accreditation.
g. The proper RF output power expression to be reported? (e.g. ERP or EIRP)

12) Regulatory Requirements

When performing this basic radio test, the application regulatory technical rules must be consulted for the appropriate limits and test conditions.

a. Does the laboratory have a thorough understanding of the applicable regulatory rules for this basic radio test?
b. Does the laboratory understand and apply the limitations and additional requirements for testing both licensed and unlicensed transmitters? (See 47 CFR 2.1051, 15.35, Part 15 and the applicable radio service technical requirements.)
c. Does the laboratory understand and apply the labeling and user information requirement for both licensed and unlicensed transmitters? (See 47 CFR Parts 2 and 15)
d. Is the laboratory aware of, and can it access, the latest interpretations of the rules for each type of transmitter within its scope of accreditation?

13) Other Standards

Is the laboratory capable of performing RF conducted power output measurements for all the measurement methods listed in the scope of accreditation? Has the laboratory demonstrated the ability to adapt the basic radio test method for conducted RF output power measurements to the other standard specific requirements?

(Note: This is determined through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought. This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)

ASSESSOR'S COMMENTS / OBSERVATIONS:

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6.2 Occupied Bandwidth and Masks

6.2.1 Test Summary
The Occupied Bandwidth and Emission Masks tests are measurements to determine the spectral content of the modulated RF signal for licensed transmitters.

6.2.2 Test Parameters
The typical parameters for measurement of antenna conducted emissions for which accreditation may be obtained under this basic radio test are:

- **Test Type:** RF Measurements at Antenna Terminals
- **Frequency Range:** 9kHz to 100GHz
- **Test Environment:** Bench-top

6.2.3 Test Equipment
The minimum basic test equipment, along with critical parameters of that equipment, necessary in order to demonstrate ability to perform occupied bandwidth testing in accordance with this basic radio test is indicated below.

- **Spectrum Analyzer:** Frequency range, max. input power
- **Attenuators:** Attenuation v Frequency
- **Directional Couplers:** Attenuation v Frequency

6.2.4 Baseline Test Method
The following standards are identified as baseline test methods for evaluating equipment to this basic radio test. Other standards may be used, as appropriate.

- ANSI approved standard EIA/TIA-603-1992 – Land Mobile, FM or PM Communication Equipment Measurement and Performance Standards. See also 47 CFR 2.1047 and the applicable technical requirements for each radio service covered by the scope of accreditation.
Introduction:

This checklist is intended to provide guidance to the Technical Assessor in assessing a test with a scope covering occupied bandwidth measurements. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory. The measurement of occupied bandwidth shall be based on the assessor selecting the above mentioned standard (referenced in 6.2.4), which includes the basic radio test method. Test methods from other baseline standards may be used, when appropriate.

1) List the selected baseline test method(s), the specific test procedure from within that standard and any remarks.

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<thead>
<tr>
<th>Baseline Standard Selected</th>
<th>Test Procedure Selected (Method, Section or Paragraph from the Selected Baseline Standard)</th>
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2) Over what frequency range does the laboratory perform occupied bandwidth measurements?

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<tr>
<th>Frequency Range</th>
<th>Test Equipment (include calibration date)</th>
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3) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure described in the selected baseline test method(s).

4) Does the laboratory have the test equipment necessary to perform the selected baseline test method?

5) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.
6) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.

The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic radio test for which accreditation is sought.

7) Facility
   a. Does the facility for measuring occupied bandwidth meet the minimum facility requirements specified in the baseline test method for this test?

8) Performance of the Test
   a) Does the laboratory use the correct test equipment and procedure to measure the occupied bandwidth for the EUT? Is an appropriate transducer or pickup device utilized for the measurements?
   b) Is the test equipment and EUT configured in accordance with the selected test method?
   c) Is the test performed per the selected test method and regulatory requirement for the EUT?
   d) Is the proper frequency range covered by the test? (See 47 CFR 2.1057)
   e) Are the correct resolution bandwidth and video bandwidth used?
   f) Is the proper detector function used to make the measurement?
   g) Does the test instrumentation have sufficient power handling capability to make an accurate measurement?
   h) Does the test take into account overloading and what precautions are taken to prevent it?
   i) Does the test instrumentation have the sensitivity to make the measurement?
   j) Are measurements performed for each type of emission generated by the radio?
   k) Has the proper modulation been applied to the EUT?
   l) Has the proper emission mask been applied to the transmitter?

9) Software/Firmware
   a) If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
   b) Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.
   c) Is the software/firmware documented and under configuration control?
   d) Does the operator understand the limitations of the software/firmware?

10) Personnel
    Do the test personnel demonstrate proper understanding and operation of the EUT and the test equipment? For example, can the person explain or demonstrate:
    a. Proper instrument settings for the signal being measured?
b. How to handle overload conditions?
c. Proper times, limitations and uses of preamplifiers, bandpass filters, attenuators, etc.?
d. How to handle other unusual measurement conditions?
e. Proper understanding of the regulatory requirements for the transmitter under test?
f. Proper procedures and requirements for other types of transmitters covered under the scope of accreditation?

11) Test Reports

Ask the laboratory for a few previously prepared reports to determine completeness and accuracy. Are the test reports complete and do they follow the guidance given in the standard and by the applicable regulatory requirement, if any?

a. Is the measured data reported in accordance with the standard?
b. Are the test results presented in a clear and concise manner for an easy comparison with the limits? Are all conversion factors and sample calculations included in the report?
c. Does the test report document all equipment set-up conditions and test equipment settings so the tests can be repeated with the same results, if necessary? Are adequate photographs and descriptive material included in the report?
d. Does the test report clearly document compliance with the applicable standard or regulatory requirements, including user information or labeling requirements, if any?
e. Is the test report properly signed?

12) Regulatory Requirements

When performing this basic radio test, the application regulatory technical rules must be consulted for the appropriate limits and test conditions.

a. Does the laboratory have a thorough understanding of the applicable regulatory rules for this basic radio test?
b. Does the laboratory understand and apply the limitations and additional requirements for testing both licensed and unlicensed transmitters? (See 47 CFR 2.1051, 15.35, Part 15 and the applicable radio service technical requirements.)
c. Does the laboratory understand and apply the labeling and user information requirement for both licensed and unlicensed transmitters? (See 47 CFR Parts 2 and 15)
d. Is the laboratory aware of, and can it access, the latest interpretations of the rules for each type of transmitter within its scope of accreditation?

13) Other Standards

Is the laboratory capable of performing occupied bandwidth measurements for all the measurement methods listed in the scope of accreditation? Has the laboratory demonstrated the ability to adapt the basic radio test method for occupied bandwidth measurements to the other standard specific requirements?
Note: This is determined through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought. This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.

ASSESSOR'S COMMENTS / OBSERVATIONS:
6.3 Modulation Characteristics

6.3.1 Test Summary
The modulation characteristics, i.e. the modulation waveform specifications, are tested by measuring the waveform quality to determine the normalized correlated power between the actual waveform and the ideal waveform, and the synchronization and timing. A curve or equivalent data which shows modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed and peak envelope power output versus the modulation input voltage shall be supplied.

6.3.2 Test Parameters
The primary parameters of a modulation characteristics test for which accreditation may be obtained under this basic radio test are defined below:

Test Type: Modulation Characteristics  
Frequency Range: 9kHz to 100GHz

6.3.3 Test Equipment
The minimum basic equipment, along with critical parameters of that equipment necessary in order to demonstrate ability to perform modulation characteristics testing in accordance with this basic radio test, is indicated below.

Spectrum Analyzer: Resolution bandwidth (RBW), Video bandwidth (VBW), Span, Sweep time. 
Attenuators: Attenuation, Frequency range, VSWR. (Use only if the RF power level is greater than the maximum allowable input to the Spectrum Analyzer)

6.3.4 Baseline Test Method
The following standards are identified as baseline test methods for evaluating equipment to this basic radio test. Other standards may be used, as appropriate.

- ANSI approved standard EIA/TIA-603-1992 – Land Mobile, FM or PM Communication Equipment Measurement and Performance Standards. See also 47 CFR 2.1047 and the applicable technical requirements for each radio service covered by the scope of accreditation.
Specific Checklist
Modulation Characteristics

Introduction:

This checklist is intended to provide guidance to the Technical Assessor in assessing a test laboratory with a scope covering modulation characteristics measurements. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory. The measurement of modulation characteristics shall be based on the assessor selecting the above mentioned standard (referenced in 6.3.4), which includes the basic radio test method. Test methods from other baseline standards may be used, when appropriate.

1) List the selected baseline test method(s), the specific test procedure from within that standard and any remarks.

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<th>Baseline Standard Selected</th>
<th>Test Procedure Selected</th>
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2) Over what frequency range and types of modulation does the laboratory perform modulation characteristics measurements?

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<tr>
<th>Frequency Range</th>
<th>Modulation Type</th>
<th>Test Equipment (include calibration date)</th>
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3) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure described in the selected baseline test method(s).

4) Does the laboratory have the test equipment necessary to perform the selected baseline test method?

5) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

6) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.
The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic radio test for which accreditation is sought.

7) Facility
   a. Does the facility for measuring modulation characteristics meet the minimum facility requirements specified in the baseline test method for this test?

8) Performance of Test
   a. Does the laboratory use the correct test equipment and procedures to measure the modulation characteristics for the transmitter under test?
   b. Is the test equipment and EUT configured in accordance with the selected test method and regulatory requirement?
   c. Is the test performed per the selected standard considering the regulatory specification for the transmitter under test?
   d. Are measurements performed for each modulation type generated by the radio?
   e. Is the audio input level increased to at least the level used for the occupied bandwidth test?

9) Software/Firmware
   a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
   b. Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.
   c. Is the software/firmware documented and under configuration control?
   d. Does the operator understand the limitations of the software/firmware?

10) Personnel
    Do the test personnel demonstrate proper understanding and operation of the transmitter under test and the test equipment? For example, can the person explain or demonstrate:
    a. Proper instrument settings for the signal being measured?
    b. How to handle overload conditions?
    c. Proper times, limitations and uses of preamplifiers, bandpass filters, attenuators, etc.?
    d. How to handle other unusual measurement conditions?
    e. Proper understanding of the regulatory requirements for the EUT?
    f. Proper procedures and requirements for other types of transmitters covered under the scope of accreditation?
    g. The proper method for displaying the test results?
11) Test Reports

   a. Ask the laboratory for a few previously prepared reports to determine completeness and accuracy. Are the test reports complete and do they follow the guidance given in the standard and by the applicable regulatory requirement, if any?
   b. Is the measured data reported in accordance with the standard? (For equipment subject to FCC requirements a family of curves is required.)
   c. Are the test results presented in a clear and concise manner for an easy comparison with the limits? Are all conversion factors and sample calculations included in the report?
   d. Does the test report document all equipment set-up conditions and test equipment settings so the tests can be repeated with the same results, if necessary? Are adequate photographs and descriptive material included in the report?
   e. Does the test report clearly document compliance with the applicable standard or regulatory requirements, including user information or labeling requirements, if any?
   f. Is the test report properly signed?

14) Regulatory Requirements

   When performing this basic radio test, the application regulatory technical rules must be consulted for the appropriate limits and test conditions.

   a. Does the laboratory have a thorough understanding of the applicable regulatory rules for this basic radio test?
   b. Does the laboratory understand and apply the limitations and additional requirements for testing both licensed and unlicensed transmitters? (See 47 CFR 2.1051, 15.35, Part 15 and the applicable radio service technical requirements.)
   c. Does the laboratory understand and apply the labeling and user information requirement for both licensed and unlicensed transmitters? (See 47 CFR Parts 2 and 15)
   d. Is the laboratory aware of, and can it access, the latest interpretations of the rules for each type of transmitter within its scope of accreditation?

13) Other Standards

   Is the laboratory capable of performing modulation characteristics measurement for all the measurement methods listed in the scope of accreditation? Has the laboratory demonstrated the ability to adapt the basic radio test method for the modulation characteristics measurement to the other standard specific requirements?

   (Note: This is determined through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought. This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)
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6.4 Spurious Emissions at Antenna Terminals

6.4.1 Test Summary
Spurious emissions tests measure the unwanted emissions from transmitters and receivers, and typically consist of LO leakage, harmonics of the fundamental emissions, and mixing products of local oscillators with other signals generated by the device.

6.4.2 Test Parameters
The parameters of an input power test for which accreditation may be obtained under this basic radio test are defined below:

<table>
<thead>
<tr>
<th>Test Type:</th>
<th>RF Measurements at Antenna Terminals</th>
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<tbody>
<tr>
<td>Frequency Range:</td>
<td>9kHz to 100GHz</td>
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<tr>
<td>Test Environment:</td>
<td>Bench-top</td>
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</tbody>
</table>

6.4.3 Primary Test Equipment
The minimum basic equipment, along with critical parameters of that equipment necessary in order to demonstrate ability to perform spurious emissions testing in accordance with this basic radio test, is indicated below.

<table>
<thead>
<tr>
<th>Spectrum Analyzer:</th>
<th>Frequency range, max. input power, Longest Available Sweep Time</th>
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<tbody>
<tr>
<td>Attenuators:</td>
<td>Attenuation v Frequency</td>
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<tr>
<td>Directional Couplers:</td>
<td>Attenuation v Frequency</td>
</tr>
</tbody>
</table>

6.4.4 Baseline Test Methods
The following standards are identified as baseline test methods for evaluating equipment to this basic radio test. Other standards may be used, as appropriate.

- ANSI approved standard EIA/TIA-603-1992 – Land Mobile, FM or PM Communication Equipment Measurement and Performance Standards. See also 47 CFR 2.1051 and the applicable technical requirements for each radio service covered by the scope of accreditation.
Specific Checklist

Spurious Emissions at the Antenna Terminals

Introduction:

This checklist is intended to provide guidance to the Technical Assessor in assessing a test laboratory wishing to be assessed with a scope covering conducted spurious emission measurements. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory. The measurement of conducted spurious emissions shall be based on the assessor selecting the above mentioned standard (referenced in 6.4.4), which includes the basic radio test method. Test methods from other baseline standards may be used when appropriate.

1) List the selected baseline standard(s), the specific test method from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Baseline Standard Selected</th>
<th>Test Procedure Selected</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

2) Over what frequency range does the laboratory perform conducted spurious emission measurements?

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Test Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(include calibration date)</td>
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</tbody>
</table>

3) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure described in the selected baseline test method(s).

4) Does the laboratory have the test equipment necessary to perform the selected baseline test method?

5) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.
6) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.

The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic radio test for which accreditation is sought.

7) Facility

   a. In what environment does the laboratory perform these measurements and has the facility been properly characterized?
   b. Does the facility for measuring conducted spurious emissions meet the minimum facility requirements specified in the baseline test method for this test?

8) Performance of Test

   a. Does the laboratory use the correct test equipment for measuring conducted spurious emissions over the required frequency range? See 47 CFR 2.1057.
   b. Is the test equipment and EUT configured in accordance with the selected test method and the applicable technical rules for the EUT?
   c. Is the test performed per the selected standard and the applicable technical rules for the EUT?
   d. Is the EUT terminated properly for this measurement?
   e. Is the correct resolution bandwidth and video bandwidth used?
   f. Is the proper detector function used to make the measurement?
   g. Does the test take into account overloading and what precautions are taken to prevent it?
   h. Does the test instrumentation have the sensitivity to make the measurement?

9) Software/Firmware

   a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
   b. Do the laboratory personnel know how to properly operate the software/firmware? Ask for a demonstration to show proper use.
   c. Is the software/firmware documented and under configuration control?
   d. Does the operator understand the limitations of the software/firmware?

10) Personnel

Do the test personnel demonstrate proper understanding and operation of the EUT and test equipment? For example, can the person explain or demonstrate:

   a. Proper instrument settings for the signal being measured?
   b. How to handle overload conditions?
   c. Detection of conducted emissions in the presence of noise?
   d. Proper times, limitations and uses of preamplifiers, bandpass filters, attenuators, etc.?
11) Test Reports

   a. Ask the laboratory for a few previously prepared reports to determine completeness and accuracy. Is the test report complete and does it follow the guidance given in the standard and by the applicable regulatory requirement, if any?
   b. Is the measured data reported in accordance with the selected test method and applicable regulatory technical rules?
   c. Are the test results presented in a clear and concise manner for an easy comparison with the limits? Are all conversion factors and sample calculations included in the report?
   d. Does the test report document all equipment set-up conditions and test equipment settings so the tests can be repeated with the same results, if necessary? Are adequate photographs and descriptive material included in the report?
   e. Does the test report clearly document compliance with the applicable standard or regulatory requirements, including user information or labeling requirements, if any?
   f. Is the test report properly signed?

12) Regulatory Requirements

When performing this basic radio test, the application regulatory technical rules must be consulted for the appropriate limits and test conditions.

   a. Does the laboratory have a thorough understanding of the applicable regulatory rules for this basic radio test?
   b. Does the laboratory understand and apply the limitations and additional requirements for testing both licensed and unlicensed transmitters? (See 47 CFR 2.1051, 15.35, Part 15 and the applicable radio service technical requirements.)
   c. Does the laboratory understand and apply the labeling and user information requirement for both licensed and unlicensed transmitters? (See 47 CFR Parts 2 and 15)
   d. Is the laboratory aware of, and can it access, the latest interpretations of the rules for each type of transmitter within its scope of accreditation?

13) Other Standards

Is the laboratory capable of performing conducted spurious emission measurements for all the measurement methods listed in the scope of accreditation? Has the laboratory demonstrated the ability to adapt the basic radio test method for spurious emission measurements to the other standard specific requirements?

(Note: This is determined through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought. This is intended to be a sampling
process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.

ASSESSOR'S COMMENTS / OBSERVATIONS:
6.5 Frequency Stability

6.5.1 Test Summary
Transmit output frequency variation can be significantly affected by variations in the power supply voltage and operating temperature. The purpose of this test is to simulate the temperature and power supply voltage variations that a product may experience in service. In addition, measurements to determine the frequency stability of transmitters at the time interval of transmitter-on and transmitter-off are performed for Transient Frequency Behavior requirements.

6.5.2 Test Parameters
The parameters of a frequency stability test for which accreditation may be obtained under this basic radio test are defined below:

- **Test Type:** RF Conducted at antenna terminal or close coupled radiated
- **Frequency Range:** 9 kHz to 100 GHz
- **Voltage Range:** All
- **Temperature Range:** All

6.5.3 Test Equipment
The minimum basic equipment, along with the critical parameters of that equipment necessary in order to demonstrate the ability to perform frequency stability testing in accordance with this basic radio test, is indicated below:

- **Temperature Chamber:** Temperature range, calibration
- **Frequency Counter:** Frequency range, drift, and accuracy
- **Spectrum Analyzer (Receiver):** Frequency range, drift, accuracy (frequency)
- **Variable Power Supply:** Voltage range, stability

6.5.4 Baseline Test Methods
The following standards are identified as baseline test methods for evaluating equipment to this basic radio test. Other standards may be used, as appropriate.

- ANSI approved standard EIA/TIA-603-1992 – Land Mobile, FM or PM Communication Equipment Measurement and Performance Standards. See also 47 CFR 2.1051 and the applicable technical requirements for each radio service covered by the scope of accreditation.

(Note: When both licensed and unlicensed transmitters are to be included in the scope of accreditation, the EIA/TIA-603-1992 shall be selected as the baseline test method for this basic radio test.)
Specific Checklist

Frequency Stability

Introduction:

This checklist is intended to provide guidance to the Technical Assessor in assessing a test laboratory with a scope covering frequency stability measurements. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory.

The assessment of frequency stability measurements shall be based on the assessor selecting one or more baseline test methods for an in-depth review to assess the competence of the laboratory for this basic radio test. Inasmuch as the TIA/EIA RS-603 includes the more encompassing test method for measuring frequency stability, that procedure shall be selected as the baseline test method when licensed transmitters are included in the scope of accreditation. ANSI C-63.4 (2000) may be used when only intentional radiators are to be tested.

1) List the selected baseline standard(s), the specific test method from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Baseline Standard Selected</th>
<th>Test Method Selected</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Method, Section or Paragraph from the Selected Baseline Standard)</td>
<td></td>
</tr>
</tbody>
</table>

2) Over what frequency range and temperature range does the laboratory perform frequency stability measurements?

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Test Instrument (include calibration date)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

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3) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure described in the selected baseline test method(s).

4) Does the laboratory have the test equipment necessary to perform the selected baseline test method?

5) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

6) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.

The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic radio test for which accreditation is sought.

7) Facility

   a. Is the laboratory environment adequate for performing this test?
   b. Is the temperature chamber cover the required temperature and large enough to facilitate the testing of the EUT?
   c. Are the variable voltage power supplies adequate for varying the voltage of the EUT for this test?
   d. Does the facility for measuring frequency stability meet the minimum facility requirements specified in the selected standard for this test?

8) Performance of Test

   a. Does the laboratory use the correct test equipment to make frequency stability measurements for variations in both temperature and supply voltage?
   b. Is the test equipment and EUT configured in accordance with the selected test method?
   c. Is the test performed per the selected standard?
   d. Is the proper frequency range covered during the test?
   e. Is the temperature varied over the applicable temperature for the EUT?
   f. Is the proper voltage applied and varied, as appropriate, to the EUT during the test?
g. Is the radio allowed to stabilize at each frequency and voltage when making the measurement?

h. For battery-operated devices, is the measurement performed at the endpoint specified by the manufacturer?

i. For devices with automatic shutoff, is the measurement performed at the shutoff point?

j. Does the test equipment have sufficient power handling capability to make an accurate measurement?

k. Does the test instrumentation have the sensitivity to make the measurement?

9) Software/Firmware

a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?

b. Do the laboratory personnel know how to properly operate the software/firmware? Ask for a demonstration to show proper use.

c. Is the software/firmware documented and under configuration control?

d. Does the operator understand the limitations of the software/firmware?

10) Personnel

Do the test personnel demonstrate proper understanding and operation of the test equipment? For example, can the person explain or demonstrate:

a. The proper instrument settings for the signal being measured?

b. How to handle overload conditions?

c. How frequency stability will be handled for a variety of transmitters; e.g., EIRPS, cell phones, battery-operated transmitters, etc.?

d. Proper times, limitations and uses of preamplifiers, bandpass filters, attenuators, etc.?

e. How to handle other unusual measurement conditions?

f. The proper method for displaying the test results for a variation in temperature and voltages?

11) Test Reports

a. Ask the laboratory for a few previously prepared reports to determine completeness and accuracy. Is the test report complete and does it follow the guidance given in the standard and by the applicable regulatory requirement, if any?

b. Is the measured data reported in accordance with the selected standard and applicable regulatory technical rules? (See, for example, 47 CFR 2.1055)

c. Are the test results presented in a clear and concise manner for an easy comparison with the limits? Are all conversion factors and sample calculations included in the report?

d. Does the test report document all equipment set-up conditions and test equipment settings so the tests can be repeated with the same results, if necessary? Are adequate photographs and descriptive material included in the report?

e. Does the test report clearly document compliance with the applicable standard or regulatory requirements, including user information or labeling requirements, if any?

f. Is the test report properly signed?
12) Regulatory Requirements

When performing this basic radio test, the application regulatory technical rules must be consulted for the appropriate limits and test conditions.

a. Does the laboratory have a thorough understanding of the applicable regulatory rules for this basic radio test?

b. Does the laboratory understand and apply the limitations and additional requirements for testing both licensed and unlicensed transmitters? (See 47 CFR 2.1055, 15.35, Part 15 and the applicable radio service technical requirements.)

c. Does the laboratory understand and apply the labeling and user information requirement for both licensed and unlicensed transmitters? (See 47 CFR Parts 2 and 15)

d. Is the laboratory aware of, and can it access, the latest interpretations of the rules for each type of transmitter within its scope of accreditation?

13) Other Standards

Is the laboratory capable of performing frequency stability measurements for all the measurement methods listed in the scope of accreditation? Has the laboratory demonstrated the ability to adapt the basic radio test method for frequency stability measurements to the other standard specific requirements?

(Note: This is determined through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought. This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)

ASSESSOR'S COMMENTS / OBSERVATIONS:
6.6 Radiated emissions

6.6.1 Test Summary
The measurement of radiated emissions is required for both licensed radio equipment and unlicensed intentional radiators (low power unlicensed transmitters operating under Part 15 of the FCC Rules). The radiated emission test methods for these two types of transmitters are different. Radiated emissions from licensed radio transmitters are generally specified in terms of power and are typically measured using the substitution method. Radiated emissions from many intentional radiators are generally specified in terms of field strength (V/m) at a specified distance from the EUT and are typically measured using the test methods in Sections 4.4 and 4.5 for magnetic and electric field strength measurements, respectively. In either case, the magnetic and electric field components of the radiated emissions produced by the equipment under test (EUT) are measured by means of a test antenna placed at a specified distance from the EUT. The antenna is connected to a spectrum analyzer or receiver by means of coaxial cabling. The frequency range of interest is then scanned for emissions from the equipment under test and the receiver meter reading and detector function is recorded and adjusted for any antenna factors, preamplifier gain or cable loss. The corrected reading is then compared to the specified limit in order to determine compliance with the applicable standard.

As mentioned above, the procedure is slightly different for many types of licensed radio equipment. The licensed transmitter is tested for emissions as described above. After the receiver readings of emissions from the EUT are recorded for the frequency range of interest, the EUT is removed from the test stand and is replaced with an antenna connected to a signal generator. The signal generator is set to the frequency of each recorded emission, and the output level is adjusted to match the recorded received level. The output level is then compared against the limits in the specification, after applying suitable correction factors, and is expressed as ERP, EIRP or dB referenced to the power level of the fundamental.

6.6.2 Test Parameters
The primary parameters of a magnetic (below 30 MHz) and electric (above 30 MHz) field radiated emissions test for which accreditation may be obtained under this test method are defined below:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Type</td>
<td>Radiated Emissions, Electric and Magnetic Fields</td>
</tr>
<tr>
<td>Frequency Range</td>
<td>10 kHz to 100 GHz</td>
</tr>
<tr>
<td>Pick up Device</td>
<td>A variety of antennas that depend on the frequency range (Note: Rod antennas are not permitted for FCC tests.)</td>
</tr>
<tr>
<td>Receiving Device</td>
<td>Receiver or Spectrum Analyzer</td>
</tr>
<tr>
<td>Test Environment</td>
<td>OATS</td>
</tr>
</tbody>
</table>

6.6.3 Test Equipment
The minimum basic test equipment, along with the critical parameters of that equipment necessary in order to demonstrate the ability to perform electric field radiated emissions testing in accordance with this basic radio test, is indicated below:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver</td>
<td>Frequency Range, Bandwidth, and Detector</td>
</tr>
<tr>
<td>Signal generator</td>
<td>Frequency range, calibrated output power</td>
</tr>
</tbody>
</table>
6.6.4 Baseline Test Methods

The following standards are identified as baseline test methods for evaluating equipment to this basic radio test. Other standards may be used, as appropriate.

- ANSI approved standard EIA/TIA-603-1992 – Land Mobile, FM or PM Communication Equipment Measurement and Performance Standards
- EN 300 220, Radiated Emissions, Substitution Method

(Note: When both transmitters in the licensed radio services and unlicensed intentional radiators are to be included in the scope of accreditation. The ANSI C63.4 (2000) standard shall be selected as the baseline test method for this basic radio test.)
Specific Checklist

Radiated Emissions

Introduction:

This checklist is intended to provide guidance to the Technical Assessor in assessing a laboratory with a scope covering radiated emission measurements for transmitters. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory. Radiated emission measurements for transmitters must be made on an open area test site (OATS), or acceptable alternative test site, depending on the standard. Some methods require a different facility and set-up procedure. Inasmuch as the more encompassing test method is C63.4 (2000), that procedure shall be selected when intentional radiators are included in the scope of accreditation. Other standards may be used, when appropriate, or when only licensed radio equipment is to be tested.

1) List the selected baseline standard(s), the specific test procedure from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Standard Selected</th>
<th>Test Procedure Selected</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
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</table>

2) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure described in the selected baseline test method(s).

*The selected transmitter should be one in which the regulatory requirements are sufficiently complex so as to demonstrate the capability of the laboratory for the selected scope of accreditation and a working knowledge of the baseline test method and regulatory requirements.*

3) Does the laboratory have the facility and test equipment necessary to perform the selected baseline test method?

4) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

5) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.

6) In what environment does the laboratory perform these measurements and has the facility been properly characterized?
a. In the frequency range of 30 MHz to 1 GHz, does the radiated facility meet the requirements and conditions for open area test site (OATS) specified in C63.4 (2000)? (Request a partial demonstration of site attenuation measurements. Review the laboratory’s records on site attenuation.)

b. If an alternative test site to OATS is used, is the basis for using such a facility acceptable to the appropriate regulatory authority or specifier?

c. For measurements below 30 MHz and above 1 GHz, is the test site the conditions and requirements in C63.4 (2000), including the referenced documents.

d. Is the ground plane adequate for the test site?

e. Does the turntable meet the specifications and guidelines in the standards, including all normative referenced standards?

f. Is the table for the EUT non-reflecting and the appropriate height, size, and construction?

g. Is the antenna mast installed in accordance with the standard?

h. Can the antenna be rotated to provide for measuring both vertical and horizontal polarization?

i. Describe the test site(s) used for this measurement.

The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess a laboratory’s competence in the basic radio test for which accreditation is sought.

7) Facility

a. Does the facility for measuring radiated electric field emissions meet the minimum facility requirements specified in the baseline standard for this test?

b. Is there sufficient and suitable electrical power available for performing the measurements?

c. Are isolation transformers, if needed, properly installed?

d. Do the antenna(s) meet the minimum requirements in the selected standard and is it calibrated?

e. Does the facility meet the normalized site attenuation requirements for each of the specified measurement distances? (Alternatively, request documentation of how measurements at non-limit distances are handled.)

f. Are ambient emissions at least 6 dB below the limits to be measured? (Higher ambient levels may be permitted in some circumstances.)

g. Does the facility meet the layout and other specifications in the standard?
h. Is the facility for making initial pre-scan adequately characterized for these types of measurements?
i. For measurement of intentional radiators, does the facility meet the requirements in 47 CFR 15?

8) Performance of Test

a. Does the laboratory use the correct antenna for these measurements? (An electric field monopole antenna is not permitted for products subject to FCC requirements.)
b. Is the test equipment and EUT configured in accordance with the selected test method and applicable technical regulations under which the transmitter is permitted to operate?
c. Ask the laboratory personnel for an explanation of how the laboratory would handle a large high-powered EUT or a large EUT located on a factory floor, if applicable?
d. Are the tests performed in accordance with the selected standard?
e. Is the EUT and test equipment properly located, configured and operated for the selected test method and applicable FCC rules? (Be sure check for proper distances between EUT and measuring antenna(s).)
f. Are both vertical and horizontal emissions measured for the maximum value of each emission being measured?
g. Is the EUT rotated and the antenna raised and lowered for the maximum value of each emission?
h. Is the EUT (both floor-standing and table-top) set-up properly?
i. Are the power cords, cables and other wires bundled properly?
j. Are all the power cords and I/O cables the specified length and terminated properly?
k. Are the EUT and test equipment ports terminated properly?
l. Is the EUT properly exercised in accordance with the selected standard to determine worst-case emissions?
m. Are the correct frequency ranges, detector functions, and bandwidth settings used in accordance with the selected standard and the applicable regulatory requirements? (See 47 CFR 15.31-15.35)

n. Can test personal detect and take account of broadband and narrowband emissions? Ask for a detailed explanation as to how this would be handled.
o. Are the measurements made over the appropriate frequency range, with the proper detector function and measurement distances? (See 47 CFR Part 15)
p. Are the measurements made in accordance with the selected standard and applicable regulatory requirements?
q. Are all the settings and adjustments on the test equipment properly set for the measurement? (Be sure to check applicable regulations.)

9) Software/Firmware

a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
b. Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.
c. Is the software/firmware documented and under configuration control?
d. Does the operator understand the limitations of the software/firmware?
10) Personnel

Do the test personnel demonstrate proper understanding and operation of each type of EUT and the equipment needed to perform the test? For example, can the person explain or demonstrate:

a. The proper instrument settings for the emission being measured?
b. How to handle overload conditions?
c. How weak emissions are detected in the presence of noise?
d. How to make measurements in other unusual measurement conditions?
e. Proper times, limitation and uses of preamplifiers, band-pass filters, etc.?
f. Ask for a written procedure or description of how cabinet radiation and should be performed.
g. Ask for a written procedure or description of how radiated spurious emissions for licensed transmitters should be measured.
h. Ask for a written explanation of how measurements below 30 MHz and above 1 GHz should be measured. (The additional requirements in 47 CFR 15.31-35 must be included in the explanation).
i. Ask for an explanation of how to measure a variety of licensed transmitters and intentional radiators. (The explanation should include the special requirements for cell phones, anti-pilferage devices, garage door openers, field disturbance sensors, etc.)
j. Ask for a written explanation or demonstration of how the laboratory would determine the linear average value of a measured peak emission. (Include in the explanation the equipment to be used, etc.)

11) Test Reports

a. Ask the laboratory for a few previously prepared reports to determine completeness and accuracy.
b. Are the test reports complete and follow the guidance given in the standard and by the applicable regulatory requirement, if any?
c. Is the measured data reported in accordance with the selected standard?
d. Are the test results presented in a clear and concise manner for an easy comparison with the limits?
e. Are all conversion factors and sample calculations included in the report and is it accurate?
f. Does the test report document all equipment set-up conditions and test equipment settings so the tests can be repeated with the same results, if necessary?
g. Are adequate photographs and descriptive material included in the report?
h. Does the test report clearly document compliance with the applicable standard or regulatory requirements, including user information or labeling requirements, if any?
i. Is the test report properly signed by the authorized signatory?

12) Regulatory Requirements

When performing this basic radio test, the application regulatory technical rules must be consulted for the appropriate limits and test conditions.
a. Does the laboratory have a thorough understanding of the applicable regulatory rules for this basic radio test?

b. Does the laboratory understand and apply the limitations and additional requirements for testing both licensed and unlicensed transmitters? (See 47 CFR 2.1053, 2.1057, 15.31-15.37, Part 15 and the applicable radio service technical requirements.)

c. Does the laboratory understand and apply the labeling and user information requirement for both licensed and unlicensed transmitters? (See 47 CFR Parts 2 and 15)

d. Is the laboratory aware of, and can it access, the latest interpretations of the rules for each type of transmitter within its scope of accreditation?

13) Other Standards

Is the laboratory capable of performing radiated emission measurements for all the measurement methods and types of transmitters listed in the scope of accreditation? Has the laboratory demonstrated the ability to adapt the basic radio test method for radiated emission measurements to the other standard specific requirements?

(Note: This is determined through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought. This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)

ASSESSOR'S COMMENTS / OBSERVATIONS:
6.7 Spread Spectrum Requirements

Spread spectrum radios are subject to measurements covered by other basic radio tests described above (6.1, 6.2, and 6.3). The specialized modulations used by direct sequence spread spectrum (DSSS) and frequency hopping spread spectrum (FHSS) systems require testing unique to spread spectrum systems.

6.7.1 Processing Gain, Jamming Method (DSSS)

6.7.1.1 Test Summary

The test consists of stepping a signal generator in 50 kHz increments across the passband of the system. At each point, the generator level required to produce the recommended Bit Error Rate (BER) is recorded. This level is the jammer level. The output power of the transmitter is measured at the same point. The jammer to signal (J/S) ratio is then calculated from which the processing gain can be calculated.

6.7.1.2 Test Parameters

The parameters of a processing gain test for which accreditation may be obtained under this Basic Radio Test are defined below:

- Test Type: RF conducted emission
- Frequency Range: 902-928/ 2400-2483.5/ 5725-5850 MHz

6.7.1.3 Test Equipment

The minimum basic equipment, along with the critical parameters of that equipment necessary in order to demonstrate the ability to perform processing gain measurements in accordance with this basic radio test, are defined below:

- RF Power Meter: Frequency range, maximum input power
- Spectrum Analyzer: Frequency range, maximum input power
- BER Meter: Sensitivity, resolution
- Signal Generator: Output level, stability, and resolution
- Attenuator: Attenuation vs. frequency
- Directional Coupler: Attenuation vs. frequency
- Power Combiner: Attenuation vs. frequency

6.7.1.4 Baseline Test Method

The following standards are identified as baseline test methods for evaluating equipment to this basic radio test. Other standards may be used, as appropriate.

- FCC Procedures for testing Direct Sequence Spread Spectrum Systems, see also 47 CFR 15.31-15.35 & 15.247
Specific Checklist
Spread Spectrum Communication Systems --
Processing Gain/Jamming Margin (DSSS)

Introduction:
This checklist is intended to provide guidance to the Technical Assessor in assessing a test laboratory with a scope covering processing gain measurements. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory.

The assessment of processing gain measurements shall be based on the assessor selecting one or more baseline test methods for an in-depth review to assess the competence of the laboratory for this basic radio test. When selecting the baseline test method(s) to be utilized for on-site assessment, several factors should be considered:

- The scope of accreditation.
- The needs of the regulatory agency(s) or user of such accreditation.
- The standard or method that requires the most comprehensive audit to determine competence of the laboratory being assessed for the scope of accreditation.

1) List the selected baseline standard(s), the specific test procedure from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Baseline Standard Selected</th>
<th>Test Procedure Selected</th>
<th>Remarks</th>
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<tbody>
<tr>
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</tbody>
</table>

2) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure described in the selected baseline test method(s).

3) Does the laboratory have the test equipment necessary to perform the selected baseline test method?

4) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

5) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.
The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic radio test for which accreditation is sought.

6) Facility
   a. In what environment does the laboratory perform these measurements and has the facility been properly characterized?
   b. Does the facility for measuring processing gain meet the minimum facility requirements specified in the baseline standard for this test?

7) Performance of Test
   a. Does the laboratory use the correct test equipment to make the processing gain measurement?
   b. Is the test equipment and EUT configured in accordance with the selected test method?
   c. Is the test performed per the selected standard?
   d. Were acceptable test procedures and instrument settings used to measure the processing gain ($G_P$) and jamming margin ($M_J$)?
   e. Was the $M_J$ calculated properly (choosing the lowest remaining ($J/S$) ratio, after discarding the worst-case 20%)?
   f. Was an appropriate bit error rate (BER) chosen (approximately $10^{-2}$ for voice or $10^{-5}$ for data)?
   g. Was the correct value for $(S/N)_o$ chosen, based on the combination of chosen BER and modulation format?
   h. Was $G_P$ calculated properly ($G_P = (S/N)_o + M_J + L_{sys}$, with $L_{sys}$ less than or equal to 2 dB)?
   i. Was the measured $G_P$ compared to the theoretical $G_P$?

8) Software/Firmware
   a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
   b. Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.
   c. Is the software/firmware documented and under configuration control?
   d. Does the operator understand the limitations of the software/firmware?

9) Personnel
   Do the test personnel demonstrate proper understanding and operation of the test equipment? For example, can the person explain or demonstrate:
   a. Proper instrument settings for the signal being measured?
   b. How to handle overload conditions?
   c. Detection of emissions in the presence of noise?
   d. Proper times, limitations and uses of preamplifiers, bandpass filters, attenuators, etc.?
10) Test Reports

a. Ask the laboratory for a few previously prepared reports to determine completeness and accuracy. Is the test report complete and does it follow the guidance given in the standard and by the applicable regulatory requirement, if any?
b. Is the measured data reported in accordance with the standard?
c. Are the test results presented in a clear and concise manner for an easy comparison with the limits? Are all conversion factors and sample calculations included in the report?
d. Does the test report document all equipment set-up conditions and test equipment settings so the tests can be repeated with the same results, if necessary? Are adequate photographs and descriptive material included in the report?
e. Does the test report clearly document compliance with the applicable standard or regulatory requirements, including user information or labeling requirements, if any?
f. Is the test report properly signed?

11) Regulatory Requirements

a. In many cases, equipment is being tested to meet regulatory requirements. Does the laboratory have a thorough understanding of the additional regulatory requirements under the basic radio test?
b. Limitations and additional requirements for testing equipment? (For equipment subject to Part 15 of the FCC Rules, see 47 CFR 15.247)
c. Labeling and user information requirements? (For equipment subject to FCC requirements, see 47 CFR Parts 2 and 15.)
d. Regulatory limits and conditions on testing? (For equipment subject to Part 15 of the FCC Rules, see 47 CFR 15.247)

12) Other Standards

Is the laboratory capable of performing processing gain measurements for all the measurement methods listed in the scope of accreditation? Has the laboratory demonstrated the ability to adapt the basic radio test method for processing gain measurements to the other standard specific requirements?

(Note: This is determined through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought. This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)
ASSESSOR’S COMMENTS / OBSERVATIONS:
6.7.2 Channel Occupancy

6.7.2.1 Test Summary
Frequency hopping systems use a pseudo random hop algorithm to change the transmit operating frequency as a function of time. Tests are performed to determine the maximum channel occupancy during a specified time period.

6.7.2.2 Test Parameters
The primary parameters of a processing gain test for which accreditation may be obtained under this basic radio test are defined below:

<table>
<thead>
<tr>
<th>Test Type:</th>
<th>RF conducted emission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range:</td>
<td>902-928/2400-2483.5/5725-5850 MHz</td>
</tr>
</tbody>
</table>

6.7.2.3 Test Equipment
The minimum test equipment, along with the critical parameters of that equipment necessary in order to demonstrate the ability to perform channel occupancy measurements in accordance with this basic radio test, is defined below:

<table>
<thead>
<tr>
<th>Spectrum Analyzer:</th>
<th>Frequency range, maximum input power, and accuracy in 0 span</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attenuator:</td>
<td>Attenuation vs. frequency</td>
</tr>
</tbody>
</table>

6.7.2.4 Baseline Test Method
The following standards are identified as baseline test methods for evaluating equipment to this basic radio test. Other standards may be used, as appropriate.

- FCC Procedures for testing Frequency Hopping Spread Spectrum Systems, see also 47 CFR 15.31-15.35 & 15.247
Specific Checklist
Spread Spectrum Communication Systems
Hopping Channel Occupancy (FHSS)

Introduction:

This checklist is intended to provide guidance to the Technical Assessor in assessing a test laboratory with a scope covering hopping channel occupancy measurements. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory.

The assessment of hopping channel occupancy measurements shall be based on the assessor selecting one or more baseline test methods for an in-depth review to assess the competence of the laboratory for this basic radio test. When selecting the baseline test method(s) to be utilized for on-site assessment, several factors should be considered:

- The scope of accreditation.
- The needs of the regulatory agency(s) or user of such accreditation.
- The standard or method that requires the most comprehensive audit to determine competence of the laboratory being assessed for the scope of accreditation.

1) List the selected baseline standard(s), the specific test procedure from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Baseline Standard Selected</th>
<th>Test Procedure Selected</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2) Over what frequency range does the laboratory perform hopping channel occupancy measurements?

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Test Instrument (include calibration date)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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3) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure described in the selected baseline test method(s).

4) Does the laboratory have the test equipment necessary to perform the selected baseline test method?

5) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

6) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.

The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic radio test for which accreditation is sought.

7) Facility
   a. In what environment does the laboratory perform these measurements and has the facility been properly characterized?
   b. Does the facility for measuring hopping channel occupancy meet the minimum facility requirements specified in the baseline standard for this test?

8) Performance of Test
   a. Does the laboratory use the correct test equipment to make the hopping channel occupancy measurement for the frequency and power of the emission?
   b. Is the test equipment and EUT configured in accordance with the selected test method?
   c. Is the test performed per the selected standard?
   d. Were acceptable test procedures and instrument setting used to measure the hopping channel occupancy?
   e. Was the correct resolution bandwidth, video bandwidth and span used to make the measurement?
   f. Was the correct detector used?
   g. Was the channel separation measured?
   h. Was there a determination as to whether the hopping sequence is pseudo random based on the technical description?

9) Software/Firmware
   a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
   b. Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.
   c. Is the software/firmware documented and under configuration control?
d. Does the operator understand the limitations of the software/firmware?

10) Personnel

Do the test personnel demonstrate proper understanding and operation of the test equipment? For example, can the person explain or demonstrate:

a. Proper instrument settings for the signal being measured?
b. How to handle overload conditions?
c. Detection of emissions in the presence of noise?
d. The proper times, limitations and uses of preamplifiers, bandpass filters, attenuators, etc.?
e. How to handle other unusual measurement conditions?

11) Test Reports

a. Ask the laboratory for a few previously prepared reports to determine completeness and accuracy. Is the test report complete and does it follow the guidance given in the standard and by the applicable regulatory requirement, if any?
b. Is the measured data reported in accordance with the standard?
c. Are the test results presented in a clear and concise manner for an easy comparison with the limits? Are all conversion factors and sample calculations included in the report?
d. Does the test report document all equipment set-up conditions and test equipment settings so the tests can be repeated with the same results, if necessary? Are adequate photographs and descriptive material included in the report?
e. Does the test report clearly document compliance with the applicable standard or regulatory requirements, including user information or labeling requirements, if any?
f. Is the test report properly signed?

12) Regulatory Requirements

a. In many cases, equipment is being tested to meet regulatory requirements. Does the laboratory have a thorough understanding of the additional regulatory requirements under the basic radio test?
b. Limitations and additional requirements for testing equipment? (For equipment subject to Part 2 of the FCC Rules, see 47 CFR 15.247)
c. Labeling and user information requirements? (For equipment subject to FCC requirements, see 47 CFR Parts 2 and 15)
d. Regulatory limits and conditions on testing? (For equipment subject to FCC requirements, see 47 CFR 15.247.)

13) Other Standards

Is the laboratory capable of performing channel occupancy measurements for all the measurement methods listed in the scope of accreditation? Has the laboratory demonstrated the ability to adapt the basic radio test method for channel occupancy measurements to the other standard specific requirements?
(Note: This is determined through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought. This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)

ASSESSOR'S COMMENTS / OBSERVATIONS:
6.7.3 Spread Spectrum Communication Systems -- Spectral Density

6.7.3.1 Test Summary
Spectral Density measurements are RF power measurements performed in a specified resolution bandwidth with results expressed in watt/Hz, dBm/Hz, dBW/MHz, etc.

6.7.3.2 Test Parameters
The typical parameters of spectral density measurements for which accreditation may be obtained under this basic radio test are defined below:

<table>
<thead>
<tr>
<th>Test Type</th>
<th>RF Measurements at Antenna Terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range:</td>
<td>10Hz to 30 kHz (AF) 9kHz to 100GHz (RF)</td>
</tr>
<tr>
<td>Test Environment:</td>
<td>Bench-top</td>
</tr>
</tbody>
</table>

6.7.3.3 Test Equipment
The minimum test equipment, along with critical parameters of that equipment necessary in order to demonstrate ability to perform spectral density testing in accordance with this basic radio test, is indicated below.

<table>
<thead>
<tr>
<th>Spectrum Analyzer</th>
<th>Frequency range, Maximum Input Power and Bandwidth Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attenuators:</td>
<td>Attenuation v Frequency</td>
</tr>
<tr>
<td>Directional Couplers:</td>
<td>Attenuation v Frequency</td>
</tr>
</tbody>
</table>

6.7.3.4 Baseline Test Method
The following standards are identified as baseline test methods for evaluating equipment to this basic radio test. Other standards may be used, as appropriate.

- FCC Procedures for testing Direct Sequence and Frequency Hopping Spread Spectrum Systems, see also 47 CFR 15.31-15.35 & 15.247

(Note: Two or more baseline test methods will be required when the scope of accreditation includes standards that require substantially different test methods.)
Specific Checklist
Spread Spectrum Communication Systems -- Spectral Density

Introduction:
This checklist is intended to provide guidance to the Technical Assessor in assessing a test laboratory with a scope covering spectral density measurements. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory.

The assessment of spectral density measurements shall be based on the assessor selecting one or more baseline test methods for an in-depth review to assess the competence of the laboratory for this basic radio test. When selecting the baseline test method(s) to be utilized for on-site assessment, several factors should be considered:

- The scope of accreditation.
- The needs of the regulatory agency(s) or user of such accreditation.
- The standard or method that requires the most comprehensive audit to determine competence of the laboratory being assessed for the scope of accreditation.

1) List the selected baseline standard(s), the specific test procedure from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Baseline Standard Selected</th>
<th>Test Procedure Selected</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Method, Section or Paragraph from the Selected Baseline Standard)</td>
<td></td>
</tr>
</tbody>
</table>

2) Over what frequency range does the laboratory perform spectral density measurements?

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Test Instrument (include calibration date)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure described in the selected baseline test method(s).

4) Does the laboratory have the test equipment necessary to perform the selected baseline test method?

5) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

6) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.

The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic radio test for which accreditation is sought.

7) Facility
   a. In what environment does the laboratory perform these measurements and has the facility been properly characterized?
   b. Does the facility for measuring spectral density meet the minimum facility requirements specified in the baseline standard for this test?

8) Performance of Test
   a. Does the laboratory use the correct test equipment to make the spectral density measurement for the frequency of the emission?
   b. Is the test equipment and EUT configured in accordance with the selected test method?
   c. Is the test performed per the selected standard?
   d. Does the test equipment have sufficient power handling capability to make an accurate measurement?
   e. Are the correct resolution and video bandwidth settings used to make the measurement?
   f. Are the correct sweep and dwell times used to make the measurement?
   g. Does the test take into account overloading and what precautions are taken to prevent it?
   h. Does the test equipment have the sensitivity to make the measurement?

9) Software/Firmware
   a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
   b. Do the laboratory personnel know how to properly operate the software/firmware? Ask for a demonstration to show proper use.
   c. Is the software/firmware documented and under configuration control?
   d. Does the operator understand the limitations of the software/firmware?
10) Personnel

Do the test personnel demonstrate proper understanding and operation of the test equipment? For example, can the person explain or demonstrate:

   a. Proper instrument settings for the signal being measured?
   b. How to handle overload conditions?
   c. The proper times, limitations and uses of preamplifiers, bandpass filters, attenuators, etc.?
   d. How to handle other unusual measurement conditions?

11) Test Reports

   a. Ask the laboratory for a few previously prepared reports to determine completeness and accuracy. Are the test reports complete and do they follow the guidance given in the standard and by the applicable regulatory requirement, if any?
   b. Is the measured data reported in accordance with the standard?
   c. Are the test results presented in a clear and concise manner for an easy comparison with the limits? Are all conversion factors and sample calculations included in the report?
   d. Does the test report document all equipment set-up conditions and test equipment settings so the tests can be repeated with the same results, if necessary? Are adequate photographs and descriptive material included in the report?
   e. Does the test report clearly document compliance with the applicable standard or regulatory requirements, including user information or labeling requirements, if any?
   f. Is the test report properly signed?

12) Regulatory Requirements

   a. In many cases, equipment is being tested to meet regulatory requirements. Does the laboratory have a thorough understanding of the additional regulatory requirements under the basic radio test?
   b. Limitations and additional requirements for testing equipment? (For equipment subject to FCC requirements see Parts 2 and 15 of the FCC Rules)
   c. Labeling and user information requirements? (For equipment subject to FCC requirements, see 47 CFR Part 2 and other and other application rule parts)
   d. Regulatory limits and conditions on testing? (For equipment subject to FCC requirements, see the specific rule parts for the type of equipment being tested.)

13) Other Standards

Is the laboratory capable of performing spectral density measurements for all the measurement methods listed in the scope of accreditation? Has the laboratory demonstrated the ability to adapt the basic radio test method for spectral density measurements to the other standard specific requirements?
(Note: This is determined through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought. This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)

ASSESSOR'S COMMENTS / OBSERVATIONS:
6.8 Unlicensed Personal Communications Services Devices

6.8.1 Test Summary

The Unlicensed Personal Communications Services (UPCS) basic radio test method covers the emissions and operational characteristics of UPCS devices. This baseline test method does not cover licensed personal communications services (PCS) devices. The measurement method includes tests for radio transmitters and monitoring of the time/spectrum widow for UPCS devices. Both radiated and conducted measurements are included in this baseline test method.

6.8.2 Test Parameters

The parameters of UPCS measurements for which accreditation may be obtained under this basic radio test are defined below:

- **Test Type**: RF Measurements at Antenna Terminals
- **Frequency Range**: 9 kHz to 40 GHz
- **Test Environment**: Bench-top and Open Area Test Site

6.8.3 Test Equipment

The following test equipment, at a minimum, is normally used for performing antenna-conducted measurements.

- **Antennas**: Frequency Range, Antenna Factor and Radiation Pattern
- **Digital Storage Oscilloscope**: Bandwidth, Time Accuracy, Time Interval Resolution, Digitizing Rate, Sweep Speed, Vertical Accuracy, Vertical Resolution, Vertical Sensitivity, Input Impedance and Input Coupling
- **Frequency Counter**: Frequency – Range, Resolution, and Accuracy. Power – Range and Sensitivity
- **Low-Noise Amplifier**: Frequency Range, Gain, Noise Figure, and Power Gain Compression
- **Modulation Analyzer**: Frequency Range and Resolution. Time Interval Resolution, RF Burst Width, Dynamic Range, Input Impedance and Sample Rate
- **Square-Notch Interference Generator**: Bandwidth, Frequency Resolution, Output Accuracy, Power Spectral Density Range, and Amplitude Resolution
### Amplitude Resolution

**Multicarrier Interference Generator:**
- Power Output per Carrier, Frequency Tolerance, and Adjacent Channel Interference

**RF Power Meter:**
- Frequency Range, Power Range, Absolute and Relative Power Accuracy, Power Measurement Resolution and Sensor VSWR

**Pulse/Arbitrary Waveform Generator:**
- Arbitrary Waveform Length, Arbitrary Amplitude Resolution, Arbitrary Sample Rate, Arbitrary Memory, Timing Accuracy, Rise/Fall Time, Output Amplitude, Output Impedance and Trigger

**Signal Generator:**
- Output Frequency Range, Frequency Accuracy, Frequency Resolution, Output Range, Output Accuracy, and Output Resolution

**Spectrum Analyzer:**
- Frequency Range, Bandwidth, Detector, Impedance and Sensitivity

**Complex Waveform Analyzer:**
- Frequency – Range, Resolution, Accuracy, Span and Dynamic Range, Triggering

### 6.8.4 Baseline Test Method

The following standards are identified as baseline test methods for evaluating equipment to this basic radio test. Other standards may be used, as appropriate.

Specific Checklist
Unlicensed Personal Communications Service Device

Introduction:

This checklist is intended to provide guidance to the Technical Assessor in assessing a test laboratory with a scope covering Unlicensed Personal Communications Service (UPCS) Device measurements. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory. The measurement of UPCS devices shall be based on the assessor selecting the above mentioned standard (referenced in 6.8.4), which includes the basic radio test method. Test methods from other baseline standards may be used, when appropriate.

1) List the selected baseline test method(s), the specific test procedure from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Baseline Standard Selected</th>
<th>Test Procedure Selected</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure described in the selected baseline test method(s).

3) Does the laboratory have the test equipment necessary to perform the selected baseline test method?

4) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

5) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.

The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic radio test for which accreditation is sought.

6) Facility
   a. Does the facility for conducted UPCS measurements meet the minimum facility requirements specified in the baseline test method for this test?
   b. Does the facility for radiated UPCS measurements meet the minimum facility requirements specified in the baseline test method for this test?
7) Performance of Test

a. Are measurements performed for each of the following tests?
   • RF measurements
   • Monitoring tests
   • Time and Spectrum Window Access
b. Is the EUT and test equipment configured in accordance with the standard?
c. Is the EUT exercised to in accordance with the selected test method to determine worst case measurements?
d. Are the proper bandwidth, frequency ranges and detector function settings used during the peak power transmit test?
e. Is the peak power transmit measurement repeated at the required number of frequencies?
f. Are the proper resolution bandwidth and video bandwidth used for making the emission bandwidth measurement?
g. Are the proper spectrum analyzer settings used when making the power spectral density measurement? Is the laboratory capable of making the power spectral density measurement using the compute average transient method?
h. Is a representative digital sequence used to measure the peak power?
i. Are emission measurements made at the channel edges? Are measurements made for out-of-sub-channel emissions and out-of-sub-band emissions?
j. Are the out-of-channel emissions measured both above and below the channel over the required frequency range?
k. Is the carrier frequency stability measurement made over the required time period? Is the measurement repeated for each of the temperature and voltage ranges required by the baseline test method?
l. For isochronous devices, is the frame repetition stability measurement performed?
m. Is the required number of readings taken for the frame repetition stability measurement?

8) Software/Firmware

a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
b. Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.
c. Is the software/firmware documented and under configuration control?
d. Does the operator understand the limitations of the software/firmware?

9) Personnel

Do the test personnel demonstrate proper understanding and operation of the EUT and test equipment? For example, can the person explain or demonstrate:

a. Proper instrument settings for the signal being measured?
b. The difference between isochronous and asynchronous frequency bands?
c. How to measure power spectral density using the computed average transient method?
d. What procedure should be followed when the EUT has a non-detachable antenna?
e. How to generate interference in selected sub-bands in order to confine operation of the EUT in one region?
f. How to calculate the threshold limits based on power level and emission bandwidth? How the threshold limits relate to the test method?
g. How to account for the antenna gain of the EUT?
h. Is the term “least interfered channel” understood?

10) Test Reports

Ask the laboratory for a few previously prepared reports to determine completeness and accuracy. Is the test report complete and does it follow the guidance given in the standard and by the applicable regulatory requirement, if any?

a. Is the measured data reported in accordance with the standard and the applicable regulatory requirements?
b. Are the test results presented in a clear and concise manner for an easy comparison with the limits? Are all conversion factors and sample calculations included in the report?
c. Does the test report document all equipment set-up conditions and test equipment settings so the tests can be repeated with the same results, if necessary? Are adequate photographs and descriptive material included in the report?
d. Does the test report clearly document compliance with the applicable standard or regulatory requirements, including user information or labeling requirements, if any?
e. Is the test report properly signed?
f. Is the proper RF output power expression reported?

11) Regulatory Requirements

When performing this basic radio test, the applicable regulatory technical rules must be consulted for the appropriate limits and test conditions.

a. Does the laboratory have a thorough understanding of the applicable regulatory rules for this basic radio test?
b. Does the laboratory understand and apply the limitations and additional requirements for testing unlicensed transmitters? (See 47 CFR Part 15 Subpart D.)
c. Does the laboratory understand and apply the labeling and user information requirement for both licensed and unlicensed transmitters? (See 47 CFR Parts 2 and 15.311)

d. Is the laboratory aware of, and can it access, the latest interpretations of the rules for each type of transmitter within its scope of accreditation?

e. Does the laboratory understand the requirements associated with the frequency coordination of this band? (Frequency coordination is required in both the United States and Canada. For example, the FCC requires an attestation from UTAM.)

12) Other Standards

Is the laboratory capable of performing UPCS measurements for all the measurement methods listed in the scope of accreditation? Has the laboratory demonstrated the ability to adapt the basic radio test method for UPCS measurements to the other standard specific requirements?

(Note: This is determined through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought. This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)
ASSESSOR'S COMMENTS / OBSERVATIONS:
6.9 Unlicensed National Information Infrastructure

6.9.1 Test Summary
The Unlicensed National Information Infrastructure (UNII) basic radio test method covers the tests for UNII devices that use wideband digital modulation techniques and provide high data rate mobile and fixed communications.

6.9.2 Test Parameters
The parameters of the UNII measurement for which accreditation may be obtained under this basic radio test are defined below:

- **Test Type:** RF Measurements at Antenna Terminals
- **Frequency Range:** 9 kHz to 40 GHz
- **Test Environment:** Bench-top

6.9.3 Test Equipment
The following test equipment, at a minimum, is normally used for performing antenna-conducted measurements.

- **RF Power Meter (or equivalent):** Frequency range, max. input power
- **Spectrum Analyzer:** Frequency range, max. input power

6.9.4 Baseline Test Method
The following standards are identified as baseline test methods for evaluating equipment to this basic radio test. Other standards may be used, as appropriate.

- Unlicensed National Information Infrastructure Devices (UNII) – Part 15 Subpart E Checklist for Telecommunication Certification Bodies. (See 47 CFR Part 15, Subpart E.)
Specific Checklist
Unlicensed National Information Infrastructure

Introduction:

This checklist is intended to provide guidance to the Technical Assessor in assessing a test laboratory with a scope covering Unlicensed National Information Infrastructure (UNII) measurements. This checklist should not be considered as limiting, and the assessor is encouraged to ask additional questions and raise related issues to determine the technical competence of the laboratory. The measurement of UNII devices shall be based on the assessor selecting the above mentioned standard (referenced in 6.9.4), which includes the baseline test method. Test methods from other baseline standards may be used, when appropriate.

1) List the selected baseline test method(s), the specific test procedure from within that standard and any remarks.

<table>
<thead>
<tr>
<th>Baseline Standard Selected</th>
<th>Test Procedure Selected</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2) Observe the laboratory personnel set up the test equipment and EUT. The laboratory personnel shall then perform the appropriate test procedure described in the selected baseline test method(s).

3) Does the laboratory have the test equipment necessary to perform the selected baseline test method?

4) Does the test equipment meet the requirements of the selected baseline test method, including the normative standards referenced therein? The laboratory should be aware of the specifications of the selected test equipment and should be capable of demonstrating that the test equipment complies, either through product literature or actual measurements.

5) Does the laboratory have a procedure for determining the proper operating condition of the test equipment and EUT? Ask for a spot check demonstration.

The remaining questions contained within this checklist, in conjunction with the selected baseline test method, shall be utilized as guidance to assess the laboratory's competence in the basic radio test for which accreditation is sought.

6) Facility

Does the facility for measuring UNII devices meet the minimum facility requirements specified in the baseline test method for this test?
7) **Performance of Test**

a. Are measurements performed each of the following tests?
   - Peak Conducted Transmit Output Power
   - Emission Bandwidth
   - Peak Power Spectral Density
   - Peak Excursion
b. Does the laboratory use the correct test equipment to make the UNII measurements?
c. For power measurements is an appropriate transducer or pickup device utilized for the measurements?
d. Is the peak power output measured by direct connection of the test instrument to the EUT?
e. Is the test equipment and EUT configured in accordance with the selected test method?
f. Are the correct resolution bandwidth and video bandwidth used?
g. Is the proper detector function used to make the measurement?
h. Does the test equipment have sufficient power handling capability to make an accurate measurement?
i. Does the test take into account overloading and what precautions are taken to prevent it?
j. Does the test equipment have the required sensitivity to make the measurement?

8) **Software/Firmware**

a. If there is software/firmware used to automate testing, is it accurate and appropriate for the type of test procedure being performed?
b. Do the laboratory personnel know how to properly use the software/firmware? Ask for a demonstration to show proper use.
c. Is the software/firmware documented and under configuration control?
d. Does the operator understand the limitations of the software/firmware?

9) **Personnel**

Do the test personnel demonstrate proper understanding and operation of the EUT and test equipment? For example, can the person explain or demonstrate:

a. Proper instrument settings for the signal being measured?
b. How to handle overload conditions?
c. Limitations and uses of preamplifiers, bandpass filters, and attenuators, etc.?
d. How to handle other unusual measurement conditions?
e. The proper expression of RF power output; peak envelope power, carrier power, etc.?
f. What measurements should be made when the EUT uses different types of antennas?
10) Test Reports

Ask the laboratory for a few previously prepared reports to determine completeness and accuracy. Is the test report complete and does it follow the guidance given in the standard and by the applicable regulatory requirement, if any?

   a. Is the measured data reported in accordance with the standard and the applicable regulatory requirements?
   b. Are the test results presented in a clear and concise manner for an easy comparison with the limits? Are all conversion factors and sample calculations included in the report?
   c. Does the test report document all equipment set-up conditions and test equipment settings so the tests can be repeated with the same results, if necessary? Are adequate photographs and descriptive material included in the report?
   d. Does the test report clearly document compliance with the applicable standard or regulatory requirements, including user information or labeling requirements, if any?
   e. Is the test report properly signed?
   f. The proper procedure and requirements for other types of transmitters covered under the scope of accreditation.
   g. The proper RF output power expression to be reported? (e.g. ERP or EIRP)

11) Regulatory Requirements

When performing this basic radio test, the application regulatory technical rules must be consulted for the appropriate limits and test conditions.

   a. Does the laboratory have a thorough understanding of the applicable regulatory rules for this basic radio test?
   b. Does the laboratory understand and apply the limitations and additional requirements for testing both licensed and unlicensed transmitters? (See 47 CFR Part 15 Subpart E.)
   c. Does the laboratory understand and apply the labeling and user information requirement for both licensed and unlicensed transmitters? (See 47 CFR Parts 2 and 15)
   d. Is the laboratory aware of, and can it access, the latest interpretations of the rules for each type of transmitter within its scope of accreditation?

12) Other Standards

Is the laboratory capable of performing UNII measurements for all the measurement methods listed in the scope of accreditation? Has the laboratory demonstrated the ability to adapt the basic radio test method for UNII measurements to the other standard specific requirements?

(Note: This is determined through interview and identification of the variations between the selected baseline standards and those for which accreditation is sought. This is intended to be a sampling process. The depth to which additional standards are reviewed shall be at the discretion of the assessor.)
ASSESSOR'S COMMENTS / OBSERVATIONS:
Appendix A - Justification of Incremental Increase in Accredited Scope
The following will be used to describe how to fill out the “Documented demonstration of technical compliance to incremental changes, by extension of scope to a laboratory’s accreditation”. The object is to supply enough information to the accrediting organization, to enable them to increase the scope of the applying Laboratory’s accreditation.

Note: Red indicates instructions
Blue indicates examples
Green indicates where to find the information described throughout this document. See letters (A, B, C…). See example below (first 3 pages and last 2 pages) of this document.

To print these pages, they must be printed on 8.5 by 11-inch paper, fit the page to the paper by selecting fit to page. The readability of the printout will be greatly enhanced by printing on a color printer.

Company Name: (A) Fill in
Address: (B) Fill in
Contact: (C) Fill in
Voice: (D) Fill in
Email: (E) Fill in
Lab ID: (F) Fill in

Standard(s) to be Added: (G) List the generic standards or procedures for which an incremental change is being requested. (See also R and S below)
Jurisdiction: (H) List the country, region, or other jurisdiction (such as company or agency) where the regulation applies.
  International: (I) Under jurisdiction, this would list the most basic version of the standard such as CISPR 22.
  European Union: (J) This would refer to the standard used in the European Union.
Standard reference number: (K) List the particular standard for the jurisdiction.
Date of Issue: (L) Date of the standard referenced above. This would include amendments along with their dates.
Comment: (M) A descriptive comment of the standard.
General overview: (N) Describe the standard by its name and type of testing done. Include how the added standard is similar to other standards for which the lab has already been accredited.
Relationship to the extension of scope and present accreditations: (O). Place an asterisk above those core test methods for which the lab has previously been accredited. The lab will specify what it has been previously accredited to, through the Core test methods accreditation, and the incremental increase in accreditation being requested through this incremental method. See below for additional explanation on describing the relationship of the standard and the primary method.
### Laboratory is now NVLAP Accredited for

**Phenomena/ Core test method**

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<thead>
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<th>Procedure (G) and/or Standard # to be added</th>
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</table>

*This row lists those Core test methods for which the laboratory has been previously accredited. (P)*

- **The Core test methods Available for Accreditation. (Q)**
- **List the Standard repeated for each Core test method associated with the procedure or standard. (R)**
- **USE EITHER R OR S, NOT BOTH**

---

Another way would be to list the Standard here, then the basic standard in the Standard, and how they relate to the Primary methods.

- **Or list each basic Standard as it might relate to Core test method. (S)**

---

**ACIL EMC Committee, EMC Laboratory Accreditation Task Force**
### Technical Criteria for the Accreditation of Electromagnetic Compatibility (EMC) and Radio Testing Laboratories

**Revision 8: January 1, 2002**

ACIL EMC Committee, EMC Laboratory Accreditation Task Force

See previous page for description of the first two columns below.

<table>
<thead>
<tr>
<th>Phenomena/ Core test method</th>
<th>Procedure (G) and/or Standard #</th>
<th>Description: (T)</th>
<th>Limit (U)</th>
<th>Criteria (V)</th>
<th>Comments (W)</th>
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<td>See Std. Level A &amp; B Group I &amp; II</td>
<td>Pass/Fail</td>
<td>Std. conducted test</td>
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<td></td>
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<td>See Std. Level A &amp; B Group I &amp; II</td>
<td>Pass/Fail</td>
<td>0.030 to 18 GHz</td>
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<td>Magnetic emissions</td>
<td>See Std. Level A &amp; B Group I &amp; II</td>
<td>Pass/Fail</td>
<td>9 kHz-30 MHz</td>
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</tbody>
</table>

**Second example**

| EN50082-1 (S) | EN61000-4-2 (S) | ESD | ±8 kV air, ±4 kV contact | Criteria B |
| EN61000-4-3 (S) | Radiated Immunity | 3V/m | Criteria A |
| EN61000-4-4 (S) | EFT | ±1 kV AC, ±5 kV dci/O | Criteria B |

(cont’d.)

Below refers to the way the Test Procedures used by the Lab are identified. (X) This might be as simple as a cover sheet referring to other internal test procedures for a Standard consisting of a series of basic standards.

<table>
<thead>
<tr>
<th>Internal Test Procedure (X)</th>
<th>Additional Test Equipment if necessary: (Y)</th>
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</thead>
<tbody>
<tr>
<td>1 XXTP EN55011</td>
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<tr>
<td>2</td>
<td>6</td>
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<tr>
<td>3</td>
<td>7</td>
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</table>
Special Considerations: (Z) Describe any deviations from the “Core test methods” for the Standard being considered. Be sure to point out that the Laboratory understands the deviations and how they will be addressed.

List any significant differences from previously accredited tests.
List any significant differences in site/equipment from previously accredited tests.

How has staff competence been achieved: (AA) Describe how the staff would become competent to perform these tests. Reference the fact that the test has been documented, and the staff is able to perform the tests, by following the procedure or any special training, which might be necessary.

Comments: (BB) This would be a summary as to why the laboratory feels it should receive the extension to its present scope of accreditation. Examples might include how long the lab has been performing the test, other organizations that have previously reviewed the testing procedure, the fact that the procedures are in place and all test equipment is or will be available, and whether there are any sections of the desired extension of scope the laboratory is not capable of doing now and how that will be handled.

We the undersigned attest to this application:

Laboratory Manager Signature: (CC)________________________________________

Responsible Accreditation Authorized Signature: (DD)________________________
Documented demonstration of technical compliance to incremental changes, by extension of scope to laboratory's accreditation

Company: (A) XXX Corporation
Address: (B) 1234 Elm
Anywhere, IL 60025
Contact: (C) Tom Tester, Voice: (D) 123-555-1234, email: (E) ttester@xxx.com
Lab ID: (F) 12345

Standard: (G) CISPR 11

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Standard</th>
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<tbody>
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<td>1998</td>
<td>Refers to CISPR 11 1997</td>
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<td>Chinese Taipei</td>
<td>CNS 13803</td>
<td>1997</td>
<td>Annexes 1-5 from (CISPR 11 and CISPR 23: 1997)</td>
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</table>

General overview: (N) CISPR 11 is for emissions testing of Industrial, Scientific and Medical (ISM) Equipment. CISPR 11 is similar to CISPR 22 and FCC Part 15 with a few exceptions. CISPR 11 has two equipment groupings. Group I is ISM Equipment that uses internally generated energy necessary for its internal operation. Group I is identical to CISPR 22 except for the test distances. Group II intentionally generates and/or uses electromagnetic radiation for the treatment of material. This energy has frequency restrictions, but when met, the emissions at those special frequencies can be unlimited. The size of the equipment is often quite large and needs to be considered when testing CISPR 11. Group II is tested to 18 GHz in some cases. This is measured as Radiated Power.
### Relationship to the Extension of scope and present accreditations:

<table>
<thead>
<tr>
<th>Procedure and/or Standard # (G)</th>
<th>Description (T)</th>
<th>Limit (U)</th>
<th>Criteria (V)</th>
<th>Comments (W)</th>
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<td>See Std. Level A &amp; B Group I &amp; II</td>
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<td>Std. conducted test</td>
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### Internal Test Procedure (X)

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Special Considerations: (Z) Radiated testing is done at up to 30 Meter.
How has Staff Competence been achieved: (AA) These tests are documented and each staff member performing the test is able to run the test from the documentation. These tests have been performed at XXX Corporation for more than 15 years and, as stated earlier, these tests are performed in a manner similar to CISPR 22.

Comments: (BB) As stated above, XXX Corporation has been doing CISPR 11 testing for more than 15 years. We have been audited under ISO Guide 25 by NVLAP. We have all the equipment and procedures in place.

We the undersigned attest to this application:

Laboratory Manager Signature: CC) ________________________________

Responsible Accreditation Authorized Signature: (DD) ________________________________
Appendix B - Comparison of Test Standards to Basic EMC Tests
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