NSTISS
NATIONAL SECURITY TELECOMMUNICATIONS AND INFORMATION SYSTEMS SECURITY

SECRETARIAT MANAGER

NSTISSC-014/93
11 May 1993

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Appendix E, NSTISSAM TEMPEST/1-92

Due to an error during printing and distribution, NSTISSAM TEMPEST/1-92, "Compromising Emanations Laboratory Test Requirements, Electromagnetics," was published with an incorrect Appendix E. Please destroy Appendix E contained in the 15 December 1992 document, and replace with the attached.

(b)(3)-P.L. 86-36
(b)(6)

.....

[redacted]
Manager

Encl:
Appendix E to NSTISSAM TEMPEST/1-92, dated 1 April 1993

Appendix E
Automated TEMPEST Testing Systems
Certification Requirements

E.1 (U) Purpose.

This appendix describes the requirements for the certification of automated detection systems for TEMPEST testing. The automated detection systems considered for this appendix are tunable over a range of test frequencies at selected bandwidths and obtain calibrated measurements of the peak amplitude of detected emanations at each point of a frequency scan. All systems using computer controlled frequency scanning and/or emanation level measurement must comply with this appendix before performing TEMPEST tests. Although a system may also identify those emanations which are correlated to RED signals, this appendix does not address this capability. Vendors are encouraged to submit details of automated systems which identify emanations which are correlated to RED signals for separate approval.

E.1.2 (U) Supplementary Manual Test.

A certified automated detection system measures peak EUT emanations. If the measured peak emanations are above the applicable limit, either corrective measures must be made to reduce such emanations below the limit or a manual search for correlated emanations must be conducted using the procedure of Paragraph 10.2.5. Manual testing is mandatory for the test conditions under which the automated system is not certified to perform searches.

E.1.3 (U) General Approach.

As defined, TEMPEST emanations are assumed to be either direct baseband emanations, transition emanations, double sideband amplitude modulation emanations, or frequency/phase modulation emanations with small modulation indices. In order to perform a tunable TEMPEST test, an automated detection system must be capable of detecting these types of emanations, perform accurate measurements, and must meet the certification procedures outlined in this appendix.

(U) The signals present during an automated TEMPEST test fall into two groups; baseband (Rd-type) and transition (Rt-type). Automated detection systems typically respond differently to signals from these two groups, therefore tests must be performed separately to certify the automated detection systems for use during tests for Rd and for Rt type signals. An automated detection system may be certified to perform searches for only Rd-type emanations or for both Rd and Rt-type emanations.

E.1.4 (U) System Certification Philosophy.

Confidence in the accuracy of automated detection systems is maintained through a multi-level certification approach. The system certification will be performed and overseen by a TEMPEST Professional Level II (TPII) or the sponsoring organization's designated Responsible Engineer (RE) and consists of the following four components:

1. Advance Certification Testing
2. Periodic Calibration Verification
3. Scan Accuracy Verification
4. Critical Feature List Monitoring

E.1.4.1 (U) Advance Certification Testing.

A number of tests must be performed before the automated detection system may be considered certified for use during TEMPEST testing of an EUT. These tests are designed to ensure that the automated detection system (hardware and software) is capable of making accurate measurements for the type of signal expected. A given automated detection system may be certified for only Rd-type signal tests, or it may be certified for both Rd and Rt-type signal testing. Tests required for these signal type certifications are listed in Paragraph E.3 for tunable receivers and Paragraph E.6 for spectrum analyzer systems.

E.1.4.2 (U) Periodic Calibration Verification.

Once the advance certification has been approved by the sponsoring organization, the calibration of the system must be maintained. All requirements for six month periodic calibration of calibration sources (e.g. signal generators, etc) remain in effect. In addition, any attenuators within the automated receiver (which are not otherwise calibrated on the six month periodic basis), and any internal signal sources used during TEMPEST scans must have their calibration verified at the end of every six month interval. Specific test requirements are described in paragraph E.4.

E.1.4.3 (U) Scan Accuracy Verification.

At the end of each scan made by the certified automated detection system, the system accuracy for that scan's parameters must be verified. The accuracy must be verified using the same scan parameters as used for the actual scan. The specific test required is described in paragraph E.5.

E.1.4.4 (U) Critical Feature List Monitoring.

As part of the advance certification, the TPII/RE submitting the documentation must also submit a Critical Features List (CFL) for the automated detection system. This CFL must list all the hardware and software modules used in the automated detection system which have a direct effect on the accuracy of the system measurements. Once the automated detection systems certification is approved, any changes, upgrades, repairs, or modifications to those modules listed in the CFL must be approved by the TPII responsible for the automated detection system. The applicable portions of the initial advance certification tests must be performed to ensure that the system accuracy has not been adversely affected by the modifications, etc. These test results are maintained on file by the TPII. Paragraph E.7 provides more detail on the specific requirements for the CFL.

E.1.5 (U) Alternative Approaches.

The procedures discussed differ from manual receiver test procedures presented in the basic document. Investigation into alternative and innovative approaches, other than those provided herein, is encouraged; however, any proposed procedures and methods must be submitted in advance to the sponsoring organization for approval.

E.2 (U) Automated Test Procedures.

E.2.1 (U) General.

Automated TEMPEST testing uses an automated detection system to perform searches for peak EUT emanations. The automated detection system steps through and obtains a peak measurement at each point of a frequency scan. The detection system must ensure that the time duration of the measurement gate time at each point of a scan is long enough to contain the RED data transfer. Externally triggered gates may be used to synchronize the measurement of RED gate to the RED data transfer, but the triggering method must be justified by the tester and approved by the sponsoring organization. If any EUT peak emanations are detected above the applicable limit, either corrective measures must be made to reduce such emanations below the limit or a manual search for correlated emanations must be conducted using the procedure of Paragraph 10.2.5.

E.2.2 (U) Tuning Scheme.

To ensure all required frequencies are scanned, the tuning scheme used in tunable detection systems must provide continuous coverage of the test frequency range. Many manual detection systems use an analog tuning scheme which provides the required continuous coverage. Typically, automated detection systems change the tuned frequency between adjacent measurement points in discrete increments or steps. To meet the requirements for continuous coverage while using frequency step tuning, the frequency step of the automated system shall be less than or equal to 65 percent of the overall system bandwidth.

E.2.3 (U) Measurement Accuracy.

At all tuned frequencies at or below 1 GHz, signal amplitudes within 20 dB of Peak Measurement Sensitivity (PMS) shall be measured to +/- 3 dB accuracy with 75 percent confidence. That is, when a large number of measurements are made of a signal, 75 percent of the measurements will be within 3 dB of the input signal level. Only the noise internal to the detection systems must be accounted for in this confidence. At signal amplitudes 20 dB above PMS, the required accuracy shall be +/- 3 dB with 100 percent confidence. That is, when a large number of measurements are made of a signal at this amplitude, all measurements will be with +/- 3 dB. At all tuned frequencies above 1 GHz, the required accuracy shall be +/- 4 dB with the confidence level as described above.

E.2.4 (U) Digital Voltmeter (DVM).

For automated testing, the DVM shall measure the peak amplitude of the received signal and/or noise. The peak detection circuitry of the DVM must be capable of accurate response to both high and low duty cycle pulse trains. To ensure accuracy, the measurement must not begin until all components of the automated system have settled.

E.2.5 (U) Measurement Gate Time.

The measurement gate time shall be at least equal to the character time of the signal under investigation. The same measurement gate time shall be used for calibration verification as was used during the test of the EUT.

E.2.6 (U) Substitution Sources.

The appropriate substitution source must be used for all certification and verification tests. Rd-type certification tests performed on an AC coupled receiver must be performed with a 30 percent Amplitude Modulated (AM) sinewave source. Rd-type certification tests performed on a DC coupled receiver must be performed with an unmodulated sinewave source. All Rt-type certification and verification tests must be performed with an impulse generator.

E.3 (U) Advance Certification Testing Requirements.

The Advance Certification Testing Requirements include the requirement to certify the performance of the detection system to both Rd-type signals and Rt-type signals separately. Typically the majority of test time is spent searching for
Rd-type signals. It is expected that most automated detection systems will become certified for Rd-type signals, and many systems will not be certified for Rt-type signals. Once the testing for Rd-type signals is completed, the TPII/RE may elect to continue for certification of Rt-type signals or not continue. If an automated detection system is certified for only Rd-type signals, then it may be used only for Rd-type signal searches, and all Rt-type tests must be performed manually.

E.3.1 (U) Rd-Type Signal Certification Tests

E.3.1.1 (U) Peak Measurement Sensitivity PMS (Rd-type).

Using an appropriate sinewave substitution source with a level equal to the PMS, record 200 measurements of the output level. At least 150 measurements must be within 3 dB of the source level (within 4 dB above 1 GHz). PMS must be determined at the low, middle, and high frequency points of each receiver band. This set of measurements shall be performed for each predetection bandwidth with the shortest measurement gate time to be certified. Each bandwidth's PMS must be lower than the specification limit for the appropriate category. If this requirement is not met, special techniques to validate measurement below PMS will be considered on a case-by-case basis.

E.3.1.1.1 (U) Measurement Accuracy Verification
Near PMS (Rd-type).

Once the PMS level is established, accuracy near PMS must be verified. This is done by the following procedure: the input level must be increased in 1 dB steps from PMS to a level of PMS plus 6 dB. The required accuracy must be met at each step through this range. The certifying TPII/RE has the option to use the following alternative

measurement method for verifying accuracy near PMS: If the first ten readings are within 3 dB, then the remaining 190 measurements are not required for that level.

E.3.1.2 (U) Measurement Gate Time.

Use an impulse generator as a substitution source with a level at least PMS plus 20 dB. Select the widest overall system bandwidth. Adjusting the repetition rate, find the minimum numbers of impulses occurring during a receiver's gate, such that 200 consecutive measurements of the output level are within 3 dB of the source level. The measurement gate time is then one divided by the impulse generator repetition rate multiplied by the number of impulses needed. Perform this set of measurements at each fixed gate time or three fixed gate times per decade, whichever is less.

E.3.1.3 (U) Amplitude Gain Linearity.

Using an appropriate substitution source with a level equal to PMS, record 200 measurements of the output level. Increase the input level in 3 dB increments to the Maximum Measurable Signal (MMS) while recording the output level of each increment. Once over PMS plus 20 dB any set of ten consecutive measurements must be within 3 dB of the source level. Otherwise, at least 75 percent of the measurements for each amplitude increment must be within 3 dB of the source level. Repeat this verification, decreasing the source level from MMS to PMS in 3 dB decrements. Perform these measurements for each overall system bandwidth to be certified using a different frequency for each bandwidth. The TPII must ensure that all receiver bands and bandwidths are tested at least once. At frequencies above 1 GHz, 4 dB accuracy is required.

E.3.1.4 (U) Receiver Band Gain Compensation.

Using an appropriate substitution source with a level of at least PMS plus 20 dB, measure the output level. The source frequency shall be varied across the entire tuning range of the detection system. The bandwidth must be less than 1 percent of the receiver's tuned frequency or the narrowest available. A minimum of 100 uniformly distributed frequencies per receiver band must be tested. Plot the difference between the source level and the measured output level, versus frequency. This difference shall not exceed 3 dB at or below 1 GHz or 4 dB above 1 GHz.

E.3.1.5 (U) Sinewave Dynamic Response.

Use a modulate sinewave substitution source with a level of 0 dBm or MMS minus 3 dB. Measuring the detection system output level, scan a frequency range of ten bandwidths or the tuning range of the detection system on each side of the source center frequency. Step the detection system in 65 percent bandwidth steps. One source frequency shall be tested for each receiver band. Plot the source level and measured output level versus frequency. The measured output level shall be within 3 dB of the source level. The scan must be performed for increasing and decreasing frequency, and the detected levels must be symmetrical +/- 3 dB within 40 dB of the peak amplitude.

E.3.1.6 (U) Maximum Overall System Bandwidth Validation.

The maximum overall system bandwidth must be measured consistent with the procedures in Appendix F, paragraphs F.2, F.3, except that the measuring device or indicating device must be the automated detection system's DVM.

E.3.2 (U) Rt-Type Signal Certification Tests.

E.3.2.1 (U) PMS (Rt-type).

Using an Impulse Generator with a level equal to the PMS, record 200 measurements of the output level. At least 150 measurements must be within 3 dB of the source level (within 4 dB above 1 GHz). PMS must be determined at the low, middle, and high frequency points of each receiver band. This set of measurements shall be performed for each predetection bandwidth using the shortest measurement gate time to be certified. Each bandwidth's PMS must be lower than the specification limit for the appropriate category. If this requirement is not met, special techniques to validate measurement below PMS will be considered on a case-by-case basis.

E.3.2.1.1 (U) Measurement Accuracy Verification Near PMS (Rt-type).

Once the PMS level is established, accuracy near PMS must be verified. This is done by the following procedure: the input level must be increased in 1 dB steps to a level of PMS plus 6 dB. The required accuracy must be met at each step through this range. The certifying TPII/RE has the option to use the following alternatives measurement method for verifying accuracy near PMS: If the first ten readings are with 3 dB, then the remaining 190 measurements are not required for that level (within 4 dB above 1 GHz).

E.3.2.2 (U) Impulsive Amplitude Gain Linearity.

Using an Impulse Generator with a level equal to PMS, record 200 measurements of the output level. Increase the input level in
3 dB increments to the Maximum Measurable Signal (MMS) while recording the output level of each increment. If the first ten measurements are within 3 dB of the source level, the remaining 190 measurements for that increment are not required. Otherwise, at least 75 percent of the measurements for each amplitude increment must be within 3 dB of the source level. Repeat this verification, decreasing the source level from MMS to PMS in 3 dB decrements. Perform these measurements for each overall system bandwidth to be certified using a different frequency for each bandwidth. The TPII must ensure that all receiver bands and bandwidths are tested at least once.

E.4 (U) Periodic Calibration Verification Requirements.

All manual detection systems calibration must be verified on a
six month cycle (as per requirements listed in the basic document, Paragraph 7.6). Automated detection systems may have extra components, such as internal attenuators, internal reference sources, etc., which are not normally calibrated as part of the manual system calibration process. This section describes the tests required for automated detection systems. If a system component is covered under the manual system's calibration, then it need not be re-tested under this requirement.

E.4.1 (U) Internal Attenuator Calibration Verification.

The calibration of the internal attenuator must be verified at the lowest and highest valid frequencies for the automated detection system. The substitution source's level should be set initially to PMS plus one-half of the instantaneous dynamic range. The appropriate substitution source's level is then increased throughout its range along with the internal attenuator, using the smallest available steps size in the internal attenuator. (Other step sizes may be allowed, but must be justified by the certifying TPII.) All measurements must agree within 2 dB for frequencies at or below 1 GHz. At frequencies above 1 GHz, all measurements must be within 4 dB.

E.4.2 (U) Internal Source Verification.

The procedure to calibrate/verify an internal source will depend on the type of source in the individual detection system. Therefore, if an automated detection system includes an internal source, the certifying TPII must propose the procedure for calibration at the time of the advance systems certification. This procedure must be performed at least every six months.

E.5 (U) Scan Accuracy Verification Requirements.

At the completion of each scan, the calibration of the automated detection systems must be verified. The appropriate substitution source must be set to a level equal to the appropriate specification limit. Without changing the settings used during the scan, record 200 measurements of the output level. At least 150 measurements must be within 3 dB of the source level. If the first ten measurements are within 3 dB, the remaining 190 measurements are not needed. The system calibration must be verified at the low, middle and high end of each receiver band. The system calibration fails verification if the error at any frequency exceeds the requirement. Failure of calibration verification requires that the detection system be recalibrated and the test scan repeated. Measurement accuracy must be within 4 dB at frequencies above 1 GHz.

E.6 (U) Automated Detection Systems Using a Spectrum Analyzer.

E.6.1 (U) Implementation.

Requirements for automated detection systems which use a spectrum analyzer as the measurement receiver and perform swept frequency measurements are described in this section. The analyzer used in a detection system shall have a 50 ohm input impedance and be capable of performing measurements using a 0 Hz frequency span. The bands of the detection system are determined using the characteristics of the preamps, preselectors, and the analyzer itself. The analyzer shall have the characteristics included in the following paragraphs.

E.6.1.1 (U) Tuning Scheme.

To ensure all required frequencies are scanned, the spectrum analyzer must provide continuous coverage of the test frequency range. Analog sweep analyzers provide the continuous coverage needed. Analyzers that utilize frequency synthesizers and tune in discrete steps must ensure that the frequency step shall be less than or equal to 65 percent of the pre-detection bandwidth.

E.6.1.2 (U) Digital Trace Storage.

The spectrum analyzer shall be capable of storing the amplitude of signals detected during a scan. A trace is defined as this collection of measurements. The storage points in the trace shall be uniformly distributed over an arithmetic frequency span of the scan. The distribution of the points over the frequency span determines the displayed frequency resolution of the analyzer. For this appendix, a spectrum analyzer shall have a trace storage of at least 500 uniformly distributed storage points.

E.6.1.3 (U) Positive Peak Detection.

The analyzer must be capable of measuring and storing the peak amplitude of the received signal or noise. When the analyzer is tuning between the frequencies of two adjacent digital storage points, the maximum peak amplitude of any detected signal and/or noise shall be stored in at least one of the two adjacent digital storage points.

E.6.1.4 (U) Gate Time.

For a swept spectrum analyzer, the effective gate time is approximately the period of time required to tune continuously over a frequency range less than or equal to 65 percent of the overall system bandwidth. For a 0 Hz frequency span, the gate time may be interpreted as the sweep time divided by the number of trace storage points.

E.6.2 (U) Automated Test Procedures Using a Spectrum Analyzer.

All requirements for automated detection systems described elsewhere in this document apply to automated systems using spectrum analyzers except as noted below.

E.6.2.1 (U) Sweep Time and Frequency Span Determination.

The minimum sweep time and maximum frequency span for a frequency scan is determined using the overall system bandwidth and the gate time. The rate at which the system can accurately scan frequencies is proportional to the rate the total frequency span is covered. Calculation of the minimum sweep time and maximum frequency span for a frequency sweep using a spectrum analyzer is given below.

$$\frac{\nabla F}{\nabla t} = \frac{\text{span}}{\text{sweeptime}}$$

$$\text{MinSweepTime} = \frac{\text{Span} \times \text{CharTime}}{0.65 \times \text{OverallSystemBW}}$$

The equation is independent of the number of stored points in an analyzer trace. To ensure frequency accuracy

required by the document (+/-5%), the maximum frequency span is limited by the number of stored points in a trace. The calculation of the maximum frequency span is given below.

$$MaxFreqSpan = 0.05(\#points-1) \times MinScanFreq$$

When performing scans for automated tests using a spectrum analyzer, the analyzer settings for each scan shall be limited by the equations in this paragraph. If the frequency span allowed by the equations creates an uncalibrated measurement condition in the analyzer, the span shall be reduced until the uncalibrated condition is eliminated.

E.6.2.2 (U) Scan Accuracy Verification.

At the completion of each scan, the accuracy of the system must be verified with an unmodulated sinewave source. The substitution source shall be set at a level equal to the scan specification limit. Using a sweep time and system bandwidth used during the scan, record a trace using 0 Hz frequency span with the center frequency set equal to the source frequency. At least 150 of the first 200 trace measurements shall be within 3 dB of the source frequency. If the first ten trace measurements are within 3 dB, then proceed. The system calibration shall be verified at the low, middle, and high frequency ends of each frequency band. The system fails calibration verification if 3 dB accuracy is not achieved at any of the test frequencies. Failure of the calibration verification requires that the detection system be re-calibrated and the test scan repeated or that the scan be performed manually for that frequency range.

E.6.3 (U) Advance Certification Testing Requirements.

An automated detection system which uses a spectrum analyzer as the measurement receiver shall be certified in accordance with the documentation requirements in Paragraph E.3 of this appendix except as noted below.

E.6.3.1 (U) Rd-Type Signal Certification Tests.

E.6.3.1.1 (U) PMS Rd-Type.

For spectrum analyzers, PMS is certified using a frequency span of 0 Hz and a center frequency equal to the frequency of the substitution source. PMS measurements are made for the shortest swept time appropriate for the bandwidth being certified. Using an unmodulated sinewave substitution source with a level equal to PMS, record one trace of the output level. At least 150 measurements of the first 200 measurements must be within 3 dB of the source level. The system shall be tested at the low, middle, and high frequencies of each receiver band. Each bandwidth's PMS must be lower than the specification limit for the appropriate category.

E.6.3.1.2 (U) Spectrum Analyzer Measurement Accuracy Verification Near PMS (Rd-type).

Once the PMS level is established, accuracy near PMS must be verified. This is done by the following procedure: the input level must be increased in 1 dB steps from PMS to a level of PMS plus 6 dB. The required accuracy must be met at each step through this range. The certifying TPII/RE has the option to use the following alternative measurement method for verifying accuracy near PMS: If the first ten readings are within 3 dB, then the remaining 190 measurements are not required for that level. If accurate measurements cannot be made at the specification limit for each category, special techniques to achieve such measurements will be considered on a case-by-case basis.

E.6.3.2 (U) Measurement Gate Time.

One of two methods may be used to certify the gate time for a spectrum analyzer. The first uses an impulse generator as the calibration source while the second uses a pulse unmodulated sinewave generator.

E.6.3.2.1 (U) Measurement Gate Time Certification Using an Impulse Generator.

Use an impulse generator as a substitution source with a level at least PMS plus 20 dB. Select the widest overall system bandwidth for the detection system. Adjust the repetition rate such that the rate is the inverse of the gate time to be certified. Set the sweep time such that 200 impulses will occur during the entire frequency sweep (i.e., for a 1 ms gate time the sweep time would be 200 ms). Adjust the frequency span to the maximum span allowed

by the equation in Paragraph E.6.2.1 Record one trace of the output level. At least 200 measurements of the trace must be within 3 dB of the source level. Perform this set of measurements at three evenly distributed gate times per decade of times to be certified.

E.6.3.2.2 (U) Measurement Gate Time Certification Using a Pulsed Sinewave Generator.

Use a pulsed (ON/OFF keyed) unmodulated sinewave generator with a level at least PMS plus 20 dB and a pulse duty cycle less than or equal to 50 percent. Select the widest overall system bandwidth for the detection system. Adjust the pulse rate such that the rate is the inverse of the gate time to be certified. Set the sweep time to the minimum sweep time of the analyzer and set the frequency span to the maximum span allowed by the equation in Paragraph E.6.2.1 for the selected bandwidth, gate time, and sweep time. Set the output frequency of the sinewave generator to a frequency contained with the span of the trace. Record one trace of the output level. Report the frequency contained with the span of the trace. The frequency of the maximum measured level must be within the frequency rang of +/- 32.5 percent of the overall system bandwidth centered about the source frequency (this is based on the 65 percent maximum frequency step of a step tuned receiver). Repeat the measurement for a total of 200 traces. All 200 measurements must meet the frequency requirements (+/- 32.5 percent of the pre-detection bandwidth about the source frequency) and be within 3 dB of the source level.

E.6.3.3 (U) Amplitude Gain Linearity.

For spectrum analyzers, amplitude gain linearity is certified using a frequency span of 0 Hz and a center frequency equal to the frequency of the unmodulated sinewave substitution source. Select a sweep time appropriate for the bandwidth being certified. Using a substitution source with a level equal to PMS, record one trace of the output level. Increase the input level in 3 dB increments to the Maximum Measurable Signal, while recording one trace at each increment. If the first 10 measurements of the trace are within 3 dB of the source level, proceed to the next level. Otherwise, at least 75 percent of the measurements in the trace must be within 3 dB of the source level. After MMS is reached, repeat the measurement procedures decreasing the source level from MMS to PMS in 3 dB increments. Report the results of the measurements of each level in the increment and decrement phases of the linearity certification. Perform the linearity certification for each overall system bandwidth to be certified using a different frequency for each bandwidth. Select certification frequencies such that all bands of the detection system are exercised. At frequencies above
1 GHz, 4 dB accuracy is required.

E.6.3.4 (U) Receiver Band Gain Compensation.

For spectrum analyzers, gain compensation is certified using a frequency span of 0 Hz and a center frequency equal to the frequency of the substitution source. Select a sweep time appropriate for the bandwidths which will be used during the certification tests. Using an unmodulated sinewave generator as the substitution source, set the output level to at least PMS plus 20 dB. The source frequency shall be varied across the entire tuning range of the spectrum analyzer. Starting with the narrowest overall system bandwidth and lowest tuned frequency, vary the source frequency across the entire tuning range of the spectrum analyzer. Adjust the center frequency of the analyzer equal to the source frequency and acquire one trace. Report either the first trace measurement or the trace peak measurement. Increase the source frequency and repeat the measurement procedure. The bandwidth must be less than 1 percent of the center frequency or the narrowest available when performing the measurements. A minimum of 100 uniformly distributed measurements shall be performed for each detection system band. Submit a plot of the difference between the source level and the measured output level versus frequency for the data recorded. This difference shall not exceed 3 dB at or below 1 GHz, or 4 dB above 1 GHz.

E.6.3.5 (U) Sinewave Dynamic Response.
Use an unmodulated sinewave substitution source with a level of 0 dBm or MMS minus 3 dB. The measurements will be performed for one frequency in each detection system band. Select a bandwidth and a gate time appropriate for the frequency to be tested. Perform a sweep with the center frequency set equal to the source frequency and the frequency span set to 20 times the overall system bandwidth or the range of the detection system band, whichever is smaller. The sweep time, frequency span, bandwidth and gate time shall confirm to the equation in Paragraph E.6.2.1. The recorded trace shall be symmetrically centered about the source frequency to within 3 dB for all traced measurements recorded within 40 dB of the source input level. The measurement technique described in Paragraph E.3.1.5 may be used as an alternative method with the spectrum analyzer set to 0 Hz span mode.

E.6.3.6 (U) Maximum Overall System Bandwidth Validation.

Perform the overall system bandwidth procedures outlined in Appendix F, Paragraphs F.2 and F.3 of this document. Use the video output of the spectrum analyzer when performing the Appendix F procedures if access to the output is possible. If the video output is not accessible, perform the bandwidth validation procedures using a frequency span of 0 Hz and a sweep time appropriate for the bandwidth.

E.6.4 (U) Rt-type Signal Certification Tests.

E.6.4.1 (U) PMS (Rt-Type)

For spectrum analyzers, PMS (Rt-type) is certified using a frequency span of 0 Hz. Using an Impulse Generator with a level equal to the PMS, record 200 measurements of the output level. At least 150 measurements must be within 3 dB of the source level (within 4 dB above 1 GHz). PMS must be determined at the low, middle, and high frequency points of each receiver band. This set of measurements shall be performed for each predetection bandwidth using the shortest measurement gate time to be certified. Each bandwidth's PMS must be lower than the specification limit for the appropriate category. If this requirement is not met, special techniques to validate measurement below PMS will be considered on a case-by-case basis.

E.6.4.2 (U) Spectrum Analyzer Measurement Accuracy Verification Near PMS (Rt-type).

Once the PMS level is established, accuracy near PMS must be verified. This is done by the following procedure: the input level must be increased in 1 dB steps to a level of PMS + 6 dB. The required accuracy must be met at each step through this range. The certifying TPII/RE has the option to use the following alternative measurement method for veriying accuracy near PMS: If the first ten readings are within 3 dB, then the remaining 190 measurements are not required for that level (within 4 dB above 1 GHz).

E.6.4.3 (U) Impulsive Amplitude Gain Linearity.

For spectrum analyzers, amplitude gain linearity is certified using a frequency span of 0 Hz. Select a sweep time appropriate for the bandwidth being certified. Using a substitution source with a level equal to PMS, record one trace of the ouput level. Increase the input level in 3 dB increments to the Maximum Measurable Signal, while recording one trace at each increment. If the first ten measurements of the trace are within 3 dB of the source level, proceed to the next level. Otherwise, at least 75 percent of the measurements in the trace must be within 3 dB of the source level. After MMS is reached, repeat the measurement procedures decreasing the source level from MMS to PMS in 3 dB increments. Report the results of the measurements for each level in the increment and decrement phases of the linearity certification. Perform the linearity certification for each overall system bandwidth to be certified using a different frequency for each bandwidth. Select certification frequencies such that all bands of the detection system are exercised. At frequencies above 1 GHz, 4 dB accuracy is required.

E.7 (U) Critical Feature List Requirements.

E.7.1 (U) Critical Features List.

The CFL shall list hardware and software and/or firmware items which are critical to the operation of the automated detection system. An item is considered critical if its modification, repair, update, or replacement may affect the automated detection system measurement capabilities. Examples of critical hardware items are the automated detection system receiver preselectors, IF amplifiers, peak detectors, and DVM. An example of critical firmware or software item is a program which combines a DVM reading, the precalibrated gain and linearity factors to determine the signal level appearing at the detection system input. The CFL shall list the latest revision dates of the critical items and a list/matrix of which certification tests must be repeated if such a a modification, etc is made to that component. Any modification or replacement of an item(s) on the CFL requires the appropriate recertification tests of the automated detection system and a revision update of the CFL. The results of the recertification tests will be maintained on file by the TPII (and not submitted to the sponsoring agency). The updated systems will be completely certified during the next scheduled (three year) certification cycle.

E.8 (U) Documentation Requirements.

Documentation requirements for automated testing are indicated below and in Paragraphs 6.3 and 6.4.

E.8.1 (U) Test Instrument Certification.

The certification approval for an automated detection system is valid for a period of three years upon approval. The certification shall be submitted to the sponsoring organization by the TPII. PMS verification test results will determine the signaling rates a system will be certified to test. If an automated detection system PMS verification only meets the limits for Rd-type emanations, then the detection system will qualify to perform searches for only Rd-type emanations. A system which meets both Rd and Rt PMS verification will qualify to perform searches for both Rd and Rt-type emanations.

E.8.2 (U) Test Plan Additions.

The character time and measurement gate time used for each scan must be included in the test plan.

E.8.3 (U) Data Collection and Reporting.

Since the automated detection system signal output is not normally continuously monitored by the TEMPEST tester, the automated system must measure and record the emanation or noise level at each tuned frequency increment. For reporting purposes, data reduction may be applied when the number of measurements for a given automated test exceeds 500. If data reduction is performed, a minimum of 500 measurement points between the start and stop frequency of the test shall be displayed. The points will be chosen to ensure uniform display density. Any data reduction scheme that compresses more than one data point to one display point shall choose the maximum measured point over the range of points to be compressed. For reporting, a graphical plot for each scan shall be displayed or plotted. Calibration verification data shall be presented separately.

E.9 (U) Security.

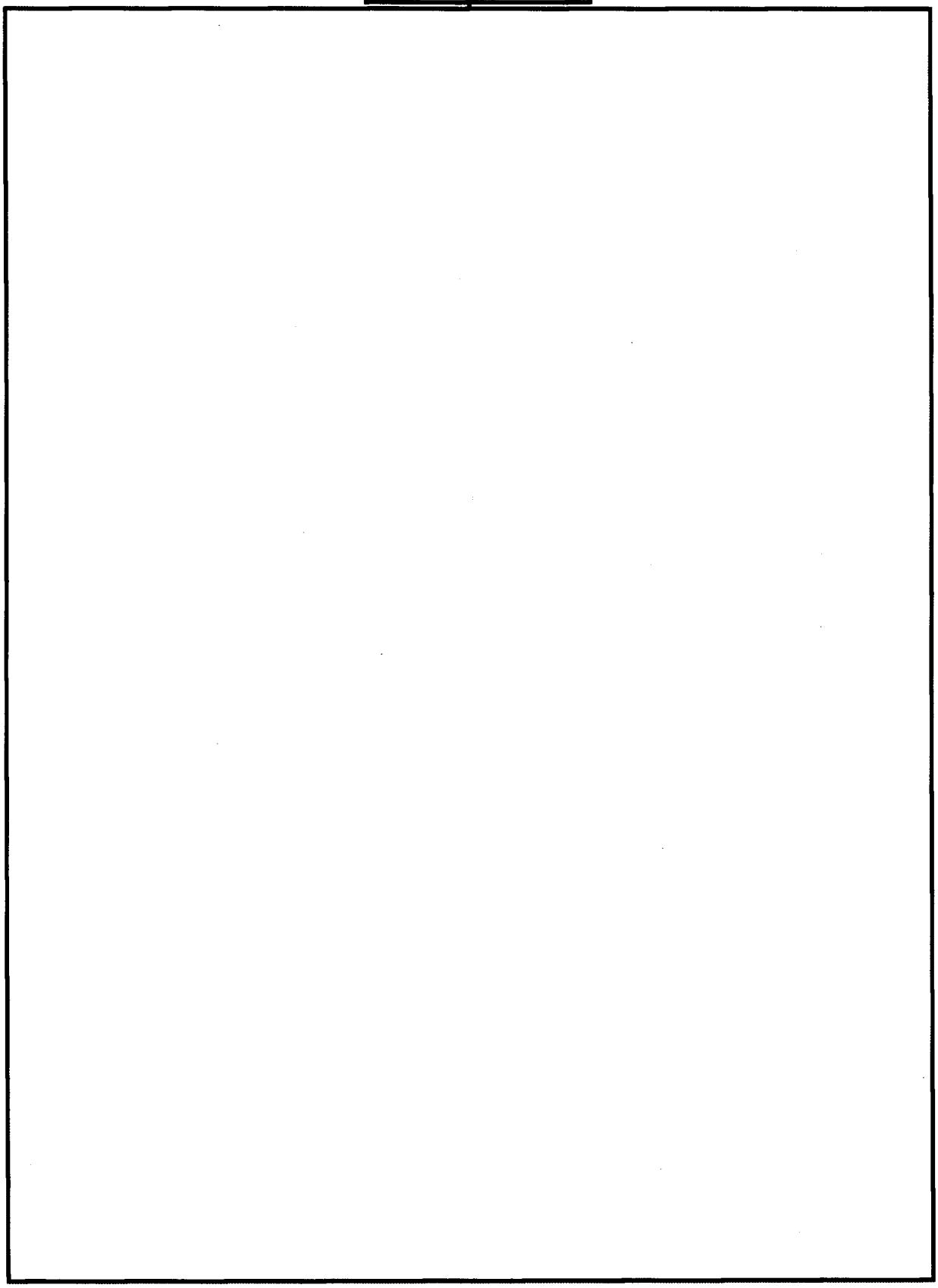
Since automated detection systems generally use both external and embedded computers and process classified information, DoD 5220.22M, Section XIII, "Security Requirements for ADP Systems," or appropriate department or agency guidance should be used as guidance for ADP security requirements.

DISTRIBUTION:

(b)(3)-P.L. 86-36

~~FOR OFFICIAL USE ONLY~~

(b)(3)-P.L. 86-36



~~FOR OFFICIAL USE ONLY~~