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**Before the**
**Federal Communications Commission**
**Washington, D.C. 20554**

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| In the Matter of | ) | |
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| 1998 Biennial Regulatory Review -- | ) | |
| Modifications to Signal Power | ) | |
| Limitations Contained in Part 68 | ) | CC Docket No. 98-163 |
| of the Commission's Rules | ) | |
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# COMMENTS OF THE ALLIANCE FOR TELECOMMUNICATIONS INDUSTRY SOLUTIONS, INC. ON BEHALF OF COMMITTEE T1

**THE ALLIANCE FOR TELECOMMUNCIATIONS INDUSTRY SOLUTIONS, INC.**
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Suite 500
Washington, D.C. 20005
(202) 434-8828

October 29, 1998

**Before the**
**Federal Communications Commission**
**Washington, D.C. 20554**

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**COMMENTS OF THE**
**ALLIANCE FOR TELECOMMUNICATIONS INDUSTRY SOLUTIONS, INC.**
**ON BEHALF OF COMMITTEE T1**

The Alliance for Telecommunications Industry Solutions ("ATIS") submits these comments on behalf of its Accredited Standards Committee T1 with the Federal Communications Commission (the "FCC" or the "Commission" in response to the FCC's Notice of Proposed Rulemaking ("NPRM"), In the Matter of 1998 Biennial Regulatory Review -- Modifications to Signal Power Limitations Contained in Part 68 of the Commission's Rules, CC Docket No. 98-163, adopted September 8, 1998 and released September 16, 1998. ATIS's comments on behalf of Committee T1[1] provide information regarding work currently ongoing in

[1] In addition to Committee T1, ATIS sponsors eleven (11) other open industry committees and forums. They are the Carrier Liaison Committee, which oversees the consensus resolution of "equal access" and network interconnection issues arising on an industry-wide basis; the Ordering and Billing Forum, which deals with issues of access ordering, provisioning, billing, carrier selection and subscription, directory services, and toll free Service Management System Number Administration; the Network Interconnection Interoperability Forum, which addresses issues including interconnection architecture, testing, installation and maintenance, network management, rating and routing; the Industry Numbering Committee, which develops the North American Numbering Plan Administrator guidelines pertaining to such areas as central office codes and carrier identification codes, and addresses issues of local number portability and number pooling; the Toll Fraud Prevention Committee, which has amongst its efforts the

Committee T1 relevant to the FCC's NPRM, specifically, those changes proposed to Sections 68.308(h)(1)(iv) and 68.308 (h)(2)(v) to raise the permissible power level at which digital terminal equipment may transmit encoded analog signals into the public telecommunications network.

## STATEMENT

Committee T1, a sponsored committee of ATIS, and accredited by the American National Standards Institute ("ANSI") develops interconnection and interoperability standards, technical reports and technical requirements for the United States telecommunications networks.[2]

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development of implementation guidelines on electronic bonding for the telecommunications industry; the Telecommunications Industry Forum, which gives practical application to standards on electronic data interchange, bar coding, and standard coding language as well as the development of implementation guidelines on electronic bonding for the telecommunications industry; the Protection Engineers Group, which develops contributions for submission to accredited standards committees on electrical protection; Standards Committee O5, an accredited standards committee for wood poles and other wood products used in the construction of electrical supply and communication lines; the Network Reliability Steering Committee, which analyzes network outage data, initiates corrective actions as well as preparing Federal Communications Commission reports on these outages and serves as the industry's liaison to the Network Reliability and Interoperability Council; the SONET Interoperability Forum, which addresses technical/operational issues regarding the implementation of SONET technology; and the Internetwork Interoperabilty Test Coordination Committee, which manages the cross industry testing program for network reliability, including local number portability testing and Year 2000 testing.

[2] In order to be an accredited committee of the American National Standards Institute ("ANSI"), the committee shall have a secretariat. As a legal entity, ATIS serves as the Committee T1 Secretariat and has the responsibility for a number of important duties for Committee T1, including organizing the Committee, overseeing the Committee's compliance with its bylaws, maintaining a list of standards for which the Committee is responsible, providing a Committee Secretary to perform administrative work including meeting arrangements, preparation and distribution of meeting documentation and maintenance of all Committee T1 records. ATIS also attends all of the meetings of the Committee and submits standards to ANSI for review and approval as American National Standards. ATIS also publishes the T1 technical reports and requirements and manages publication of Committee T1 standards.

Committee T1 also develops positions on related subjects under consideration in various international standards bodies. It focuses on those functions and characteristics associated with the interconnection and interoperability of telecommunications networks at interfaces with end-user systems, carriers, information and enhanced service providers, including switching, signaling, transmission, performance, operation, administration and maintenance aspects. It is also concerned with procedural matters at points of interconnection, such as maintenance and provisioning methods and documentation, for which standardization would benefit the telecommunications industry.

To accomplish its work, Committee T1 has six technical subcommittees ("TSCs") managed by a T1 Advisory Group. Each TSC recommends standards and develops technical reports in its area of focus such as performance and signal processing (T1A1); interfaces, power and protection for networks (T1E1); internetwork operations, administration, maintenance, and provisioning standards (T1M1); wireless/mobile services and systems (T1P1); services architectures, and signaling (T1S1); and digital hierarchy and synchronization (T1X1).

Committee T1's due process procedures provide for fairness and reasoned decision-making in the standards development process. All meetings of the Committee T1, including its subcommittees, working groups, and subworking groups are pre-announced and open to members and others having a direct and material interest in the subject matter at hand. Today, all meeting notifications and committee documentation are provided in a totally electronic environment by the T1 bulletin board system ("T1BBS") as well as in hard copy for those parties requesting such documentation.[3] Written agendas are also distributed electronically and in hard

[3] The T1BBS can be located on the world wide web at www.t1.org.

copy, in advance of the meetings. This openness in the process permits the introduction of standards proposals by both T1 members and non-T1 members alike. Standards proposals are then publicized for comment, and subcommittee, working group, or subworking group participation are invited from any interested party. To become a T1 proposed standard, a two-thirds majority consensus of all T1 voting members must approve the proposal. The proposal gets circulated in the form of a "letter ballot" whereby T1 and TSC members are given the opportunity to cast their vote as well as offer comment on the proposal. A system of records documentation is maintained for all draft standards, letter ballots, objections, and appeals.

Once a proposed standard is approved by the Committee T1, the standard is submitted to ANSI for a sixty-day review on public notice.[4] This review includes a verification that the requirements for due process, consensus, and other criteria for approval have been met; as well as consideration of any submitted evidence or comments that a proposed standard is contrary to the public interest, contains unfair provisions, is unsuitable for national use, or is technically inadequate. At each level of review, there is full opportunity to dissent to any standards proposal, and any dissenting comments must be properly addressed to reconcile differences wherever possible. Industry implementation of T1-developed standards is voluntary.

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[4] Technical Reports and Technical Requirements do not get submitted to ANSI for further public comment and review as such reports are not intended to be American National Standards. Committee T1 Technical Reports and Technical Requirements provide a formalized means of making technical information available to the telecommunications industry. They may be typically used to: a) describe/report the status of a standard or study project or otherwise establish a "terms of reference" document for the current and future use of a TSC; b) publish technical data, such as network criteria, network characterizations or service functionality for new or existing services; c) publicize findings of a study, review or survey; or d) document procedures, interworkings or interconnection issues which would benefit the industry but which are not adaptable or practical as a standard. See Section 9.1, Standards Committee T1-Telecommunications Procedures Manual, 11th Issue--October, 1998.

## T1A1'S WORK ON A TEST PLAN FOR MEASURING CROSSTALK POTENTIAL OF MODEMS CONFORMING TO ITU-T RECOMMENDATION V.90

In its NPRM, the FCC proposes to change the Part 68 Rules, specifically sections 68.308(h)(1)(iv) and 68.308(h)(2)(v), to increase the permissible power limit at which digital terminal equipment may transmit encoded analog signals into the public telecommunications network.[5] Specifically, the proposed change would raise the permissible level from -12dBm to -6dBm, a significant increase. As the NPRM acknowledges, such a change will allow Internet Service Providers (ISPs) and other online service providers who employ Pulse Code Modulation (PCM) or 56 kilobit per second modems (i.e., the digital modem conforming to ITU-T Recommendation V.90) to transmit data at higher speeds to end-users.[6] The transmit power level currently specified in Part 68 (-12dBm) for this type of equipment was established to preclude the potential generation of harmful interference in the network by such equipment.

Committee T1 suggests that empirical data be collected to confirm that no harmful interference is generated by equipment operating at the higher power level. To this end, Committee T1 is currently circulating a letter ballot to its membership of a draft T1 Technical Report specifying a test plan to investigate the crosstalk generating potential in the environment to which the NPRM applies.[7] The comment period for this draft technical report (via the letter

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[5] NPRM, at para. 5.

[6] NPRM, at para. 1.

[7] A copy of the letter ballot and the draft proposed Technical Report entitled " A Test Plan For Measuring the Crosstalk Potential of Modems Conforming To ITU-T Recommendation V.90" is attached.

ballot) closed on October 27, 1998.[8] It is anticipated that any comments that may be received on the ballot will be resolved at the T1A1 meeting to be held during the week of November 2, 1998, at which time the test plan will be available for execution by interested parties.

This Technical Report setting forth the test plan was prepared by TSC T1A1 (specifically T1A1.7-- the Working Group on Signal Processing and Network Performance for Voiceband Services), which develops and recommends standards, technical reports, and technical requirements related to the description of performance and the processing of voice, audio, data, image and video signals and their multimedia integration within the U.S. telecommunications networks. T1A1 also develops and recommends positions on, and fosters consistence with, standards and related subjects under consideration in other North American and international standards bodies.

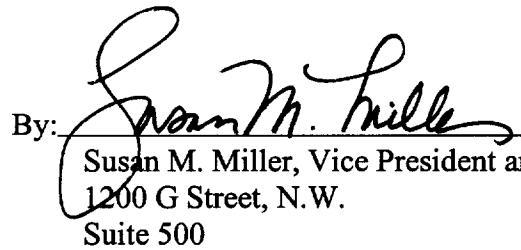
## CONCLUSION

On behalf of Committee T1, ATIS respectfully submits that there may be value in collecting empirical data to confirm that no harmful interference is generated by equipment operating at the increased power level. Accordingly, Committee T1 offers these comments regarding the development of a test plan by which such data could be generated.

[8] At the date of filing these comments, the letter ballot results, including comments, were being tabulated and reviewed. Final results of this letter ballot (LB 711) will be posted on the T1BBS at www.t1.org/html/ballots.htm.

Respectfully submitted,

ALLIANCE FOR TELECOMMUNICATIONS
INDUSTRY SOLUTIONS, INC.

By: 

Susan M. Miller, Vice President and General Counsel
1200 G Street, N.W.
Suite 500
Washington, D.C. 20005
(202) 434-8828

Date: October 29, 1998

September 15, 1998

TO: Members of Accredited Standards Committee
T1 - Telecommunications
Members of Technical Subcommittee T1A1

SUBJECT: T1 Letter Ballot T1 LB 711

Dear Members:

Enclosed for your action, please find the following T1 Letter Ballot voting form:

- T1 LB 711, Draft Proposed Technical Report - A Test Plan for Measuring the Crosstalk Potential of Modems Conforming to ITU-T Recommendation V.90

Please note that the closing date of this T1 Letter Ballot is October 27, 1998.

*** You should send your reponse and any corresponding comments to t1ballot@atis.org. If you have any questions, please contact Steve Barclay at sbarclay@atis.org. ***

Your earliest response to this letter ballot is appreciated.

ADDITIONAL INFORMATION:

THE DOCUMENT ASSOCIATED WITH THIS LETTER BALLOT IS NOW AVAILABLE FROM THE T1 HOMEPAGE in the "Current" Letter Ballots directory.

To obtain a copy of lb711.pdf go to:

WWW: http://www.t1.org/index/10001.htm
FTP: ftp://ftp.t1.org/pub/ballots/current/lb711.pdf
Telnet/Dial-in: Conference 100 (Letter Ballots) under File Directory #1, Current T1 Letter Ballots

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ACCREDITED STANDARDS COMMITTEE
T1-TELECOMMUNICATIONS
LETTER BALLOT

**-- ACTION REQUESTED --**

REPLY TO: ATIS
T1 Secretariat
1200 G St., NW, Suite 500
Washington, DC 20005
FAX: 202.347.7125
EM: t1ballot@atis.org

Letter Ballot Number: LB 711
Document Number: T1A1.7/98-027R1
Date: 09/15/98
Ballot Period: 6 Weeks
Ballot Closes: 10/27/98

Authorized By: T1A1 Chair
Distributed By: T1 Secretariat

Subject: Draft Proposed Technical Report - A Test Plan for Measuring the Crosstalk Potential of Modems Conforming to ITU-T Recommendation V.90

Statement: The T1A1 Chair has authorized this dp Technical Report for letter ballot. Please note: Due to an interest category imbalance at the time of this letter ballot, weighted voting of a 0.68 value applies to the manufacturing interest group.

Question: Should this draft proposed Technical Report be

approved for publication?

Ballot: YES ____ NO ____ (Comments Required)

Ballot: YES ____ (w/ comments) ABSTAIN ____ (w/ reasons)

ABSTAIN ____

(IF VOTING "NO, WILL VOTE CHANGE TO "YES" IF THE ATTACHED CHANGES ARE MADE?)

YES ____ NO ____

Signature _____ Principal___ Alternate___

Organization _____ DATE_____

Telephone #: _____

See ANSI's PATENT POLICY
(under the Committee T1 Letter Ballots section)

**COMMITTEE T1 – TELECOMMUNICATIONS**
**Working Group T1A1.7**
**Kissimmee, FL; November 3-5, 1998**

**T1A1.7/98-027r1**

**Draft Technical Report**

**TITLE:** **A Test Plan for Measuring the Crosstalk Potential of Modems Conforming to ITU-T Recommendation V.90**

**SOURCE*:** **Technical Editor**

**PROJECT:** **T1Q1-11, Network Performance for Voice and Voiceband Data**

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## ABSTRACT

This Technical Report contains a test plan which can be used to investigate the potential for crosstalk induced into adjacent voiceband service subscriber loops by modems conforming to ITU-T Recommendation V.90 operating with the power level of the encoded analog signal in excess of that permitted by FCC Part 68. Thresholds of harm to the public network as well as rationale for the thresholds are provided.

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* CONTACT: Barry Lerich; email: blerich@notes.cc.bellcore.com; Tel: 973-829-2959; Fax: 973-829-5866

Report No. xx

November 1998

**A Technical Report**

**on**

# A Test Plan for Investigating the Crosstalk Potential of Modems Conforming to ITU-T Recommendation V.90

Prepared by
T1A1.7
Working Group on
Signal Processing and
Network Performance
for Voiceband Services

Committee T1 is sponsored by the Alliance for Telecommunications Industry Solutions
Accredited by the American National Standards Institute

# A Technical Report on

## A Test Plan for Investigating the Crosstalk Potential of Modems Conforming to ITU-T Recommendation V.90


### Abstract

This Technical Report contains a test plan which can be used to investigate the potential for crosstalk induced into adjacent voiceband service subscriber loops by modems conforming to ITU-T Recommendation V.90 operating with the power level of the encoded analog signal in excess of that permitted by FCC Part 68. Thresholds of harm to the public network as well as rationale for the thresholds are provided.



**Document T1A1.7/98-027r1**
**Prepared by**
**T1A1.7**
**Working Group on Signal Processing and**
**Network Performance for Voiceband Services**

## Foreword

This T1 Technical Report was initiated in the T1A1.7 Working Group on Signal Processing and Network Performance for Voiceband Services.

When modems conforming to ITU-T Recommendation V.90 were developed, discussion was initiated throughout the industry regarding the continued need for the FCC maximum power constraint on encoded analog signals, other than voice, input into the public network. If the V.90 digital modem was permitted to transmit at some level in excess of the FCC maximum, it was purported that the modem could achieve downstream data rates closer to the theoretical maximum of 56 kbit/s. In October 1996, Working Group T1A1.7 determined that V.90 modems were bound by the FCC power constraint. An unknown factor attendant to the increased power levels is the potential for harm to the network in the form of impaired performance to other voiceband services in subscriber cable pairs adjacent to those carrying V.90 signals. Preliminary testing conducted in December 1997 was not considered of sufficient depth upon which to base a decision regarding the need for the constraint in this application or the advisability of support for waiver consideration.

This Technical Report contains a test plan that can be used to evaluate the potential for network harm in the form of crosstalk.

Suggestions for improvement of the Technical Report are welcome and should be sent to the Alliance for Telecommunications Industry Solutions - Committee T1 Secretariat, 1200 G Street N.W., Suite 500, Washington, D.C. 20005.

## Contents

## 1 Introduction

Parts 68.308 (h) (1) [iv] and 68.308 (h) (2) [v], FCC Rules and Regulations [1], constrain the maximum power from registered terminal equipment connecting to subrate services and 1.544 Mbit/s digital services. If such equipment generates signals in digital form that are intended for eventual conversion into voiceband analog signals other than voice, the maximum equivalent power of the encoded analog signal is limited to -12 dBm averaged over any 3 second time interval. Modems conforming to ITU-T Recommendation V.90 [2] are considered to be such equipment. The V.90 digital modems are usually used in modem servers that connect individual subscribers using companion analog modems to Internet service providers (ISP) or to corporate data networks. Adherence to this power constraint limits the downstream[1] connect rate of the modems to a rate less than the theoretical maximum of 56 kbit/s. For the application addressed in this test plan, the upstream connect rate is equivalent to that described in ITU-T Recommendation V.34 [3]. Note that other conditions on the channel between a subscriber's modem and a V.90 modem server may also affect the connect rate, but that subject is beyond the scope of this technical report.

There has been discussion throughout the industry regarding the continued need for the FCC maximum signal power constraint. Information submitted to ITU-T Study Group 15 [4] provided a theoretical calculation based on the crosstalk model of ANSI T1.413 [5] to support the premise that the FCC power constraint is not necessary for the V.90 application.[2] If the maximum power constraint is to be retained in FCC Part 68, then, to permit the V.90 modem to attain connect rates closer to the theoretical maximum, the possibility of a waiver of the maximum power constraint for this modem application, may be worthy of consideration. Preliminary testing reported to T1A1.7 [6] was not considered of sufficient depth upon which to base a decision regarding the need for the constraint in this application, or the advisability of support for waiver consideration.

## 2 Scope

This Technical Report contains a test plan which can be used to investigate the potential for crosstalk induced into adjacent voiceband service subscriber loops by modems conforming to ITU-T Recommendation V.90 operating with the power level of the encoded analog signal in excess of that permitted by FCC Part 68. The focus of the test plan is (1) to determine the level of crosstalk generated by V.90 modems and determine if the detected level of crosstalk would impair voice services carried on subscriber loops in the same cable binder group as loops carrying V.90 modem traffic, and (2) to investigate the mutual effect on the modem throughput by other like modem traffic in the same cable binder group. Additionally, this technical report provides thresholds of harm which can be used

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[1] For the purposes of this test plan, "downstream" refers to the direction from the V.90 modem server to the analog modem test site, and "upstream" refers to the direction from the analog modem test site to the V.90 modem server.

[2] The calculation assumed 49 V.90 disturbers transmitting at –6 dBm in a single cable binder group and concluded that the crosstalk loss to the 50th pair would be –76.7 dBm or 13.3 dBm.

to evaluate test results obtained through the execution of the test plan. The rationale associated with the selection of the thresholds of harm has also been provided for completeness.

## 3 Purpose

This Technical Report presents a methodology for determining the potential impact on other services of V.90 modems transmitting in excess of the FCC mandated power constraint of −12 dBm signal power of the encoded analog signal. The thresholds of harm presented in this document are intended as pass/fail criteria for tests conducted in the execution of the plan. Should a particular set of equipment undergoing tests in accordance with this plan pass all specified tests, the documented results would provide support for consideration of a recommendation for waiver of the FCC power constraint for the server modem of that particular modem pair.

It is further noted that the thresholds of harm presented in this document are not a recommendation for change of the applicable provisions of FCC Part 68. Nor does this Technical Report suggest that passing of the tests by one modem manufacturer provides sufficient justification to recommend modification of FCC Part 68 or to recommend a blanket waiver for all V.90 equipment.

## 4 References


1. Code of Federal Regulations (CFR), Title 47, Part 308, *Connection of Terminal Equipment to the Telephone Network*, National Archives and Records Administration, October 1, 1997.
2. ITU-T Recommendation V.90, *A digital modem and analogue modem pair for use on the public telephone network (PSTN) at data signalling rates of up to 56,000 bit/s downstream and up to 33,600 bit/s upstream.*
3. ITU-T Recommendation V.34, *A modem operating at data signalling rates of up to 33,600 bit/s for use on the general switched telephone network and on leased point-to-point 2-wire telephone-type circuits.*
4. PCM'97-029, submitted at the ITU-T Q23/15 V.pcm Rapporteur meeting, Dublin, Ireland, July 7-11, 1997.
5. ANSI T1.413-1995, *Asymmetric Digital Subscriber Line (ADSL) Metallic Interface.*
6. Contribution T1A1.7/98-004, *PCM Modem Output Signal Testing*, March 17, 1998.
7. T1E1.4/98-007R4, *Asymmetric Digital Subscriber Line (ADSL) Metallic Interface* (draft ANSI T1.413 revision)
8. COM 12-R 10-E, Annex 15 Response to liaison from SG 15 on evaluation of ADSL interference into POTS


## 5 Definitions

**PCM modem** the term "PCM modem" was used to denote the digital modem of the pair of modems that was described in draft versions of ITU-T

Recommendation V.90. Implementations of the PCM modem were proprietary. In this technical report, the term "PCM modem" is not intended to be synonymous with the term "V.90 modem".

**Analog modem** the analog modem of the pair of modems that is described in ITU-T Recommendation V.90.

## 6 PCM Modem Power Output Test Plan

Contribution T1A1.7/98-004 reported the results of preliminary testing of proprietary design 56 kbit/s modems, accomplished to try to determine if the output signal power in excess of –12 dBm from those modems results in detectable crosstalk impairment on adjacent subscriber lines. Tests were conducted with up to six modems with output analog signal power of -6 dBm. T1A1.7 members, at the March 1998 meeting, did not believe that the testing was sufficient to warrant support of a waiver of the -12 dBm FCC Part 68 constraint on the power level of encoded analog signals input into the public network by this application.

This section contains a more rigorous test scenario.

### 6.1 Operating Configuration

The connection between the V.90 modem server and the subscriber's companion analog modem may take any one of the three possible generic operating configurations shown in Figure 1, Figure 2, or Figure 3.

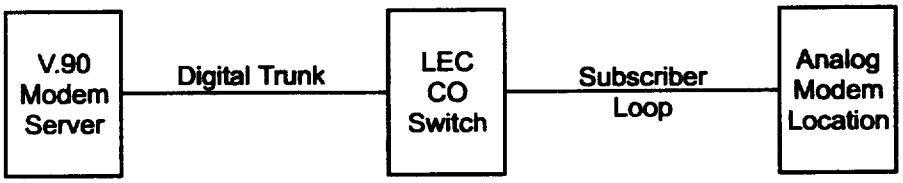


**Figure 1 Intra-office Connection**

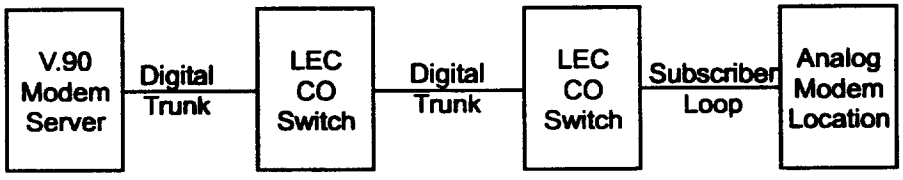


**Figure 2 Inter-office Connection (all digital trunking)**

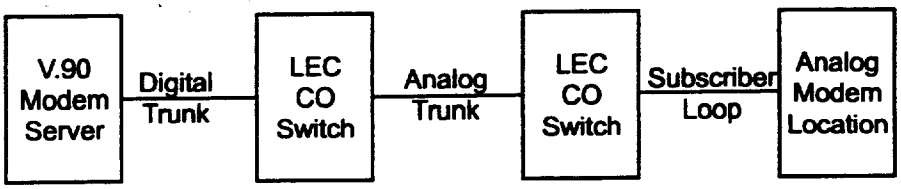


**Figure 3 Inter-office Connection (analog trunk segment)**

Figure 1 and Figure 2 assume that the network portion of the connection is always digital, whereas Figure 3 assumes that some part of the network portion of the connection is analog.

The designers of the V.90 modem indicate that the pair of modems operating in a configuration equivalent to Figure 3 will not use the V.90 transmission scheme after the handshaking process has completed. Rather, the V.90 modem pair will use the V.34 scheme for both the transmitted and received signals over a channel that contains an analog carrier system component. As a result, this Technical Report presumes that a V.90 modem will comply with all the requirements of FCC part 68 when operating in a connection equivalent to that shown in Figure 3. Consequently, this technical report does not address a connection configuration containing analog segments other than the subscriber loop to the analog modem.

### 6.2 Subscriber Loop Cable Information.

1. Identify the cable to be used for testing.[3] Loops should be between 3 and 7 kft.

   a. Determine and record the pair-to-pair crosstalk coupling loss between the various combinations of pairs in a 25-pair binder group in the cable. If this is accomplished empirically, a resistive termination should be used on the cable pairs, the tests should be conducted over the voiceband (0 – 4 kHz), and the test arrangement used should be identified.

      If the information is obtained from earlier research, the source should be identified and the results should be included in the report of test plan execution.

   b. This test scenario should be conducted with 24 disturbers and one disturbed pair in the binder group. For the disturbed pair, select the pair that exhibits the worst-case crosstalk effect (i. e., the least coupling loss). Note that there are 300 pair-to-pair combinations in a 25-pair cable.

   c. Connect the 24 disturber cable pairs to directory number appearances on the serving switch.

   d. Measure the echo return loss of each connected cable pair. The connection arrangement used to do this should be identified.

[3] Artificial cable cannot be used for this test.

### 6.3 Test Equipment

Record the identification and limit specifications for all test measuring equipment used in the execution of this test plan to demonstrate that no measured signals are masked by test equipment limitations.

### 6.4 Connection

1. Connect analog test modems to the 24 disturbing pairs in the configuration of either Figure 1 or Figure 2.
2. Verify translations for the connections between the V.90 server trunks and disturbing pair directory numbers to ensure no network loss pads are inserted in the connections. Arrange for translation modifications to remove pad insertion if necessary. If available, use test capabilities of the server modem to verify that no pads are inserted.

### 6.5 Test Steps

1. On the disturbed pair, dial the milliwatt supply in the serving switch; measure and record power at the analog modem test site to determine loop loss. Confirm that the measured loss is consistent with the loop length and that no pads have been inserted.
2. On a disturbing pair, establish an analog modem to server communication channel with one modem to a V.90 server that meets the FCC power constraint.
    a. With a noise measuring set, measure and record the 3-kHz flat power in dBrn on the downstream side of the four-wire channel between the server and the serving switch. For this test, the particular channel on which the server modem is communicating must be extracted and decoded.
    b. For reference, observe the communication on the two-wire loop and record the spectrum of the modem signal.
    c. Terminate the modem to server communication.
3. On a disturbing pair, establish an analog modem to server communication channel with one modem to a V.90 server that exceeds the FCC power constraint.
    a. With a noise measuring set, measure and record the 3-kHz flat power in dBrn on the downstream side of the four-wire channel between the server and the serving switch. For this test, the particular channel on which the server modem is communicating must be extracted and decoded.
    b. For reference, observe the communication on the two-wire loop and record the spectrum of the modem signal.
    c. Terminate the modem to server communication.
4. Connect the disturbed pair to a directory number on the central office switch. At the subscriber end of the pair, measure and record the C-message and 3-kHz flat noise, and observe the spectrum with no disturbers (baseline measurement).

5. Connect the noise-measuring test equipment to the subscriber end of the disturbed pair and a standard 900 Ω resistive termination to the central office end of the disturbed pair. Measure and record the C-message and 3-kHz flat noise, and observe the spectrum with no disturbers (baseline measurement). If necessary, attempt to minimize baseline noise by improving balance, changing grounding, or eliminating external sources of interference.
6. On the disturbing pairs, establish modem communications between all 24 modems and the server used for step 2.
    a. Monitor the communications on each established connection as each subsequent modem connection is established and record any variation in throughput. Completely define method of throughput determination, using server network management reporting features (e. g., data rate, retrains, block errors, etc.) if available.
    b. Measure and record C-message and 3-kHz flat noise, and observe the spectrum at the subscriber and central office ends of the disturbed pair as each modem connection is established. Record any pertinent spectrum data observed on the disturbed pair.
7. On the disturbing pairs, establish modem communications between all 24 modems and the server used for step 3.
    a. Monitor the communications on each established connection as each subsequent modem connection is established and record any variation in throughput. Completely define method of throughput determination, using server network management reporting features (e. g., data rate, retrains, block errors, etc.) if available.
    b. Measure and record C-message and 3-kHz flat noise, and observe the spectrum at the subscriber and central office ends of the disturbed pair as each modem connection is established. Record any pertinent spectrum data observed on the disturbed pair.
8. Compare test results with the thresholds of harm presented in Section 7.3.
9. Report all observations and conclusions in a T1A1.7 contribution.

# 7 Criteria for harm

## 7.1 General

The V.90 modem is terminal equipment and, like all terminal equipment intended to attach to the PSTN, is required to meet the requirements of FCC Part 68[4]. The major objective of FCC Part 68 is to protect against harm, where harm is defined as: "Electrical hazards to telephone company personnel, damage to telephone company equipment, malfunction of telephone company billing equipment, and degradation of service to persons other than the user of the subject terminal equipment, his calling or called party." As indicated in Section 0, a theoretical study indicates that several V.90 modems operating in the same cable binder

[4] FCC Part 68 and its Canadian counterpart, viz. CS–03, have been harmonized.

group have the potential to raise background noise in an adjacent pair by 13.3 dBrn. This additional noise could degrade the service to persons other than the users of the V.90 modem equipment. While it is recognized that the potential for interference exists, it is also recognized that the potential impairment may be considered significantly small in the pragmatic sense.

Section 6 provided a test plan to be used to evaluate potential voiceband crosstalk generated by V.90 modems operating in excess of the FCC power constraint. This section presents a set of thresholds of harm for the parameters measured during the testing process. Rationale associated with the selection of these thresholds is also presented.

## 7.2 Rationale for Thresholds of Harm

### 7.2.1 Rationale for Voiceband Data Service Threshold

The threshold of harm for crosstalk into voiceband data services is based on work being done in T1E1.4 and published in T1E1.4/98-007r4 [7]. Figure 4 is the asymmetrical digital subscriber line (ADSL) equipment transmit power spectral density mask in that contribution. The mask defines the maximum power of the ADSL transmit signal across the specified frequency band and was determined to prevent the ADSL signal from interfering with other services carried in adjacent cable pairs. For the V.90 modem application, to protect voiceband data services, T1A1.7 has adopted the portion of the power spectral density mask between 0 Hz and 4 kHz in Figure 4 as the limit on interference that can be generated by 24 V.90 disturbers into a cable pair in the same binder group.

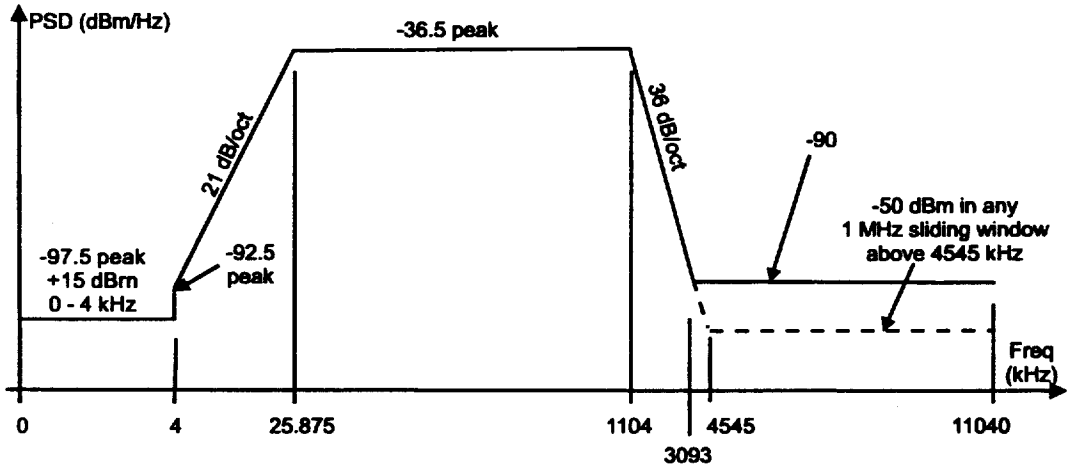


**Figure 4 ADSL Power Spectral Density Mask**

### 7.2.2 Rationale for Voice Service Threshold

The threshold of harm for crosstalk into voice services is based on the work that was performed in ITU-T Study Group 12 and published in a liaison to Study Group 15 [8]. In that document it suggests that the total noise should not exceed 18.5 dBrnC. For the V.90 modem application, to protect voice services, T1A1.7

has adopted this interference requirement as the maximum interference that can be generated by 24 V.90 disturbers into a cable pair in the same binder group.

### 7.2.3 Rationale for Interference in the 3995 to 4005 Hz Band Threshold

Voice and voiceband services should not have significant power present in the 3995 to 4005 Hz band. Thus, the signal from the V.90 modems and the crosstalk resulting from V.90 modems should not cause significant power in the 3995 to 4005 Hz band. T1A1.7 believes that the current requirement in FCC Part 68 is a sufficient threshold of harm for crosstalk in the 3995 to 4005 Hz frequency band. Thus 24 V.90 disturbers should not generate more than -29 dBV of power in the 3995 to 4005 Hz frequency band on the disturbed pair.

### 7.2.4 Rationale for Voiceband Data Rate Threshold

T1A1.7 believes that relaxation of the FCC power constraint should not affect the data rates of other modems operating in the same cable binder group. Therefore, the V.90 modem operating with a signal power higher than that permitted by FCC Part 68 should not cause a reduction in the upstream or downstream data rates of a similar modem operating in the same binder group when compared to the performance attained when the modems are operating at a power level consistent with the FCC power constraint.

## 7.3 Thresholds of Harm

### 7.3.1 Threshold for voiceband data service interference

The threshold of harm for 24 V.90 disturbers into a disturbed pair, within the same binder group, is defined as the limit shown in Figure 4 in the 0 to 4000 Hz frequency band. This power measurement shall be performed at the CO end of the facility.

### 7.3.2 Threshold for Voice Service Interference

The threshold of harm for 24 V.90 disturbers into a disturbed pair, within the same binder group, is defined as 18.5 dBrnC.

### 7.3.3 Threshold for Interference in the Band 3995 to 4005 Hz

The threshold of harm for 24 V.90 disturbers into a disturbed pair, within the same binder group, is defined as -29 dBV of power in the band 3995 to 4005 Hz on the disturbed pair.

### 7.3.4 Threshold for Interference with the Voiceband Data Rate Signal

The threshold of harm for a V.90 disturber is said to have been exceeded when a V.90 modem operating at a power level in excess of that permitted by FCC Part 68 causes a reduction in the upstream or downstream data rates of a similar modem pair operating in the same cable binder group or in the upstream data rate of its own connection.