

International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.108.2
Amendment 1
(10/2007)

SERIES G: TRANSMISSION SYSTEMS AND MEDIA,
DIGITAL SYSTEMS AND NETWORKS

International telephone connections and circuits – General
definitions

Transmission planning aspects of echo cancellers
**Amendment 1: New Appendix III –
Guidance for using echo cancellers to prevent
low-level echo**

ITU-T Recommendation G.108.2 (2007) – Amendment 1



ITU-T G-SERIES RECOMMENDATIONS
TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

INTERNATIONAL TELEPHONE CONNECTIONS AND CIRCUITS	G.100–G.199
General definitions	G.100–G.109
General Recommendations on the transmission quality for an entire international telephone connection	G.110–G.119
General characteristics of national systems forming part of international connections	G.120–G.129
General characteristics of the 4-wire chain formed by the international circuits and national extension circuits	G.130–G.139
General characteristics of the 4-wire chain of international circuits; international transit	G.140–G.149
General characteristics of international telephone circuits and national extension circuits	G.150–G.159
Apparatus associated with long-distance telephone circuits	G.160–G.169
Transmission plan aspects of special circuits and connections using the international telephone connection network	G.170–G.179
Protection and restoration of transmission systems	G.180–G.189
Software tools for transmission systems	G.190–G.199
GENERAL CHARACTERISTICS COMMON TO ALL ANALOGUE CARRIER-TRANSMISSION SYSTEMS	G.200–G.299
INDIVIDUAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON METALLIC LINES	G.300–G.399
GENERAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON RADIO-RELAY OR SATELLITE LINKS AND INTERCONNECTION WITH METALLIC LINES	G.400–G.449
COORDINATION OF RADIOTELEPHONY AND LINE TELEPHONY	G.450–G.499
TRANSMISSION MEDIA AND OPTICAL SYSTEMS CHARACTERISTICS	G.600–G.699
DIGITAL TERMINAL EQUIPMENTS	G.700–G.799
DIGITAL NETWORKS	G.800–G.899
DIGITAL SECTIONS AND DIGITAL LINE SYSTEM	G.900–G.999
QUALITY OF SERVICE AND PERFORMANCE – GENERIC AND USER-RELATED ASPECTS	G.1000–G.1999
TRANSMISSION MEDIA CHARACTERISTICS	G.6000–G.6999
DATA OVER TRANSPORT – GENERIC ASPECTS	G.7000–G.7999
PACKET OVER TRANSPORT ASPECTS	G.8000–G.8999
ACCESS NETWORKS	G.9000–G.9999

For further details, please refer to the list of ITU-T Recommendations.

ITU-T Recommendation G.108.2

Transmission planning aspects of echo cancellers

Amendment 1

New Appendix III – Guidance for using echo cancellers to prevent low-level echo

Summary

Amendment 1 to ITU-T Recommendation G.108.2 provides guidance for using echo cancellers to prevent low-level echo.

Source

Amendment 1 to ITU-T Recommendation G.108.2 (2007) was agreed on 11 October 2007 by ITU-T Study Group 12 (2005-2008).

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g. interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

© ITU 2008

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

ITU-T Recommendation G.108.2

Transmission planning aspects of echo cancellers

Amendment 1

New Appendix III – Guidance for using echo cancellers to prevent low-level echo

(This appendix does not form an integral part of this Recommendation)

Echo control has proven to be a major challenge in efforts to deliver PSTN-equivalent voice quality in the VoIP environment. The primary echo problem encountered early in the VoIP evolution is referred to as "initial echo" where the customer hears echo on the first few syllables they speak at the beginning of a call. Fortunately, this problem has been significantly reduced by the introduction of network echo cancellers that have improved (i.e., faster) convergence speeds.

While customer complaints of initial echo have been significantly reduced, another echo problem has surfaced that involves very low, but detectable, voice reflections that can be audible for the entire duration of a call. This low-level echo problem occurs on calls terminated in IP phones that have some form of echo control designed into them, and on hybrid IP/PSTN connections where network-based echo cancellers (e.g., in a media gateway) are used to cancel echo reflected from the PSTN. Given the presence of active echo control, why the echo?

The problem with IP phones has pretty much been traced to echo canceller designs that, while reducing the level of echo coming from the set itself, did not insert enough loss and, thus, let leak through a level of echo that was still audible by the customer at the other end of the connection. Low-level echo involving IP phones has been addressed to a large extent by the IP phones being manufactured with improved echo canceller designs.

Efforts to address complaints of echo on hybrid IP/PSTN connections with a media gateway echo canceller have been complicated by a different underlying issue. Some network echo cancellers disable on connections assumed to not need an active echo canceller, with the severity of the echo problem depending on the algorithm the canceller uses to decide it is unneeded. Some cancellers have been observed to disable when the echo return loss (ERL) seen by the canceller was at least 35 dB; others at 45 dB; and yet another that disabled based on an absolute level of –65 dBm for the echo signal reaching its near-in port.

What constitutes an acceptable level of echo signal reduction has become increasingly problematic with the now-common use of amplified receivers in IP phones and headset adjuncts that allow customers to add gain to the receive signal. This gain can be substantial; for example, with one popular IP phone design, 21 dB of gain can be applied if the customer uses the maximum setting of the receive amplifier. Thus in the case where an echo canceller disables for an ERL of 45 dB, a loud-speaking terminal whose speech level reaches the canceller at –10 dBm will be reflected back to that customer at –55 dBm (reduced by the 45 dB of ERL). But if the customer adds 10 dB of gain to the connection with their amplified receive feature, the echo level would then be –45 dBm, a low *but readily audible* echo on calls with the long delays of VoIP.

With a design that uses the absolute -65 dBm level as the disabling threshold, the likelihood of audible low-level echo is significantly reduced. Additionally, by controlling echoes down to, that design meets the ITU-T G.168 Test 2A requirement that the return echo level of the canceller be -65 dBm or greater for inputs in the -10 to -30 dBm range. Even so, we have found that some echo problems may occur with such a canceller design, because actual speech signals are often more dynamic than the G.168-defined test signal (the composite source signal), with spikes of speech leaking through that are approximately -60 dBm in level.

It is recognized that processing and memory resources can be saved by disabling echo cancellers where it is assumed they are not needed. However, problems experienced with low-level echo in actual VoIP deployments lead to the conclusion that this practice introduces an impairment (with associated customer complaints) that more than offsets any benefit. Accordingly, network cancellers should not be disabled because it is assumed there is sufficient ERL without them, as the factors described here show that such an assumption may be flawed.

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Cable networks and transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
Series M	Telecommunication management, including TMN and network maintenance
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Telephone transmission quality, telephone installations, local line networks
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks, open system communications and security
Series Y	Global information infrastructure, Internet protocol aspects and next-generation networks
Series Z	Languages and general software aspects for telecommunication systems