

INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 1
AMENDEMENT 1

Semiconductor devices –
Part 16-1: Microwave integrated circuits – Amplifiers
(standards.iteh.ai)

Dispositifs à semiconducteurs –
Partie 16-1: Circuits intégrés hyperfréquences - Amplificateurs

IEC 60747-16-1:2001/AMD1:2007
<https://standards.iteh.ai/catalog/standards/sist/dalz/101-0536-47/iec-60747-16-1-2001-amd1-2007>
de806d39fd37/iec-60747-16-1-2001-amd1-2007





THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2007 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

Useful links:

IEC publications search - www.iec.ch/searchpub

The advanced search enables you to find IEC publications by a variety of criteria (reference number, text, technical committee,...).

It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available on-line and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Liens utiles:

Recherche de publications CEI - www.iec.ch/searchpub

La recherche avancée vous permet de trouver des publications CEI en utilisant différents critères (numéro de référence, texte, comité d'études,...).

Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

Just Published CEI - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications de la CEI. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (VEI) en ligne.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.



INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 1
AMENDEMENT 1

Semiconductor devices –
Part 16-1: Microwave integrated circuits – Amplifiers

Dispositifs à semiconducteurs –
Partie 16-1: Circuits intégrés hyperfréquences – Amplificateurs

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX



ICS 31.080.99

ISBN 978-2-83220-234-0

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

FOREWORD

This amendment has been prepared by subcommittee 47E: Discrete semiconductor devices, of IEC technical committee 47: Semiconductor devices.

This bilingual version (2012-09) corresponds to the monolingual English version, published in 2007-01. The text of this amendment is based on the following documents:

FDIS	Report on voting
47E/305/FDIS	47E/317/RVD

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[IEC 60747-16-1:2001/AMD1:2007](https://standards.iteh.ai/catalog/standards/sist/da27f61-ab38-47e8-8da8-de806d39fd37/iec-60747-16-1-2001-amd1-2007)

Page 2

<https://standards.iteh.ai/catalog/standards/sist/da27f61-ab38-47e8-8da8-de806d39fd37/iec-60747-16-1-2001-amd1-2007>

CONTENTS

Replace the titles of Subclauses 5.11, 5.13, 5.14, 5.15, 5.19, and 5.21 by the following new titles:

- 5.11 Intermodulation distortion (two-tone) (P_1/P_n)
- 5.13 Magnitude of the input reflection coefficient (input return loss) ($|S_{11}|$)
- 5.14 Magnitude of the output reflection coefficient (output return loss) ($|S_{22}|$)
- 5.15 Magnitude of the reverse transmission coefficient (isolation) ($|S_{12}|$)
- 5.19 n th order harmonic distortion ratio (P_1/P_{nth})
- 5.21 Spurious intensity under specified load VSWR (P_o/P_{sp})

Add the titles of following new clause and subclauses:

- 5.22 Adjacent channel power ratio ($P_{o(mod)}/P_{adj}$)
- 6 Verifying methods
 - 6.1 Load mismatch tolerance (Ψ_L)
 - 6.2 Source mismatch tolerance (Ψ_S)
 - 6.3 Load mismatch ruggedness (Ψ_R)

Add the titles of following new figures:

- Figure 12 – Circuit for the measurement of the adjacent channel power ratio
- Figure 13 – Circuit for the verification of load mismatch tolerance in method 1
- Figure 14 – Circuit for the verification of load mismatch tolerance in method 2
- Figure 15 – Circuit for the verification of source mismatch tolerance in method 1

Figure 16 – Circuit for the verification of source mismatch tolerance in the method 2

Figure 17 – Circuit for the verification of load mismatch ruggedness

Page 5

2 Normative references

Replace existing references IEC 60617-12, IEC 60617-13 and IEC 60747-1 as follows:

IEC 60617:2001, *Graphical symbols for diagrams*

IEC 60747-1:2006, *Semiconductor devices – Part 1: General*

IEC 60747-4:-, *Semiconductor devices – Discrete devices – Part 4: Microwave diodes and transistors*¹

IEC 60747-16-2:2001, *Semiconductor devices – Part 16-2: Microwave integrated circuits – Frequency prescalers*

IEC 60747-16-4:2004, *Semiconductor devices – Part 16-4: Microwave integrated circuits – Switches*

IEC/TS 61340-5-1:1998, *Electrostatics - Part 5-1: Protection of electronic devices from electrostatic phenomena - General requirements*

IEC/TS 61340-5-2:1999, *Electrostatics - Part 5-2: Protection of electronic devices from electrostatic phenomena - User guide*

3 Terminology

[IEC 60747-16-1:2001/AMD1:2007](https://standards.iteh.ai/catalog/standards/sist/da27f61-ab38-47e8-8da8-d9e6753c-31710-301-a311-400)

Replace, on pages 6 and 7, the terms 3.7, 3.9, 3.10, 3.11, 3.14 and 3.16 by the following new terms:

3.7

intermodulation distortion P_1/P_n

ratio of the fundamental component of the output power to the n th order component of the output power, at a specified input power

3.9

magnitude of the input reflection coefficient

(input return loss)

$|S_{11}|$

see 3.5.2.1 of IEC 60747-7

3.10

magnitude of the output reflection coefficient

(output return loss)

$|S_{22}|$

see 3.5.2.2 of IEC 60747-7

3.11

magnitude of the reverse transmission coefficient

(isolation)

$|S_{12}|$

see 3.5.2.4 of IEC 60747-7

¹ The second edition of IEC 60747-4, which is cited in this standard, and to which terms introduced in this amendment refer, is currently in preparation (ADIS).

3.14 **n th order harmonic distortion ratio P_1/P_{nth}**

ratio of the power of the fundamental frequency measured at the output port of the device to the power of the n th order harmonic component measured at the output port for a specified output power

3.16**spurious intensity under specified load VSWR P_o/P_{sp}**

ratio of the power of the fundamental frequency measured at the output port of the device to the maximum spurious power measured at the output port under specified load VSWR

Add the following new terms:

3.17**output power**

P_o

see 3.3 of IEC 60747-16-2

3.18**output power at 1 dB gain compression**

$P_{o(1dB)}$

see 8.2.13 of IEC 60747-4

3.19**noise figure**

F

see 702-08-57 of IEC 60050-702

3.20**power added efficiency**

η_{add}

see 8.2.15 of IEC 60747-4

3.21**adjacent channel power ratio**

$P_{o(mod)}/P_{adj}$

see 3.10 of IEC 60747-16-4

3.22**load mismatch tolerance**

Ψ_L

see 7.2.20 of IEC 60747-4

3.23**source mismatch tolerance**

Ψ_S

see 7.2.21 of IEC 60747-4

3.24**load mismatch ruggedness**

Ψ_R

see 7.2.22 of IEC 60747-4

Page 9

4.3.1 Detailed block diagram – Functional blocks

Replace, in the last paragraph, “IEC 60617-12 or IEC 60617-13” by “IEC 60617”.

Page 12

4.6.2 Dynamic or a.c. characteristics

Replace the title and parameters 4.6.2.10, 4.6.2.20 and 4.6.2.22 by the following new title and new parameters:

4.6.2 Dynamic or r.f. characteristics

Parameters	Min.	Max.	Types			
			A	B	C	D
4.6.2.10 Intermodulation distortion	+				+	+
4.6.2.20 <i>n</i> th order harmonic distortion ratio (where appropriate) (note 2)	+					+
4.6.2.22 Spurious intensity under specified load VSWR (where appropriate) (note 2)	+					+

Add the following new parameters:

Parameters	Min.	Max.	Types			
			A	B	C	D
4.6.2.23 Adjacent channel power ratio (where appropriate)	+					+
4.6.2.24 Load mismatch tolerance (where appropriate)		+				+
4.6.2.25 Source mismatch tolerance (where appropriate)		+				+
4.6.2.26 Load mismatch ruggedness (where appropriate)		+				+

Page 14

4.7 Mechanical and environmental ratings, characteristics and data

Replace "IEC 60747-1, Chapter VI, clause 7" by "Subclause 5.10 and 5.11 of IEC 60747-1:2006".

4.8.8 Handling precautions

Replace "IEC 60747-1, Chapter IX" by "IEC 61340-5-1 and IEC 61340-5-2".

Page 15

5.1.2 General precautions

Replace "clause 2 of IEC 60747-1, Chapter VII, Section One" by "clause 6.3, 6.4 and 6.6 of IEC 60747-1:2006".

5.1.3 Handling precautions

Replace "clause 1 of IEC 60747-1, Chapter IX" by "IEC 61340-5-1 and IEC 61340-5-2".

Page 25

Replace the existing title of Subclause 5.11 by the following new title:

5.11 Intermodulation distortion (two-tone) (P_1/P_n)

5.11.3 Principle of measurement

Replace, in the first line “ P_n and P_1 ” by “ P_1 and P_n ”.

Replace Equation (14) by the following:

$$P_1 = P_b + L_2 \tag{14}$$

Replace the text after Equations (13), (14), (15) and (16) as follows:

where

P_1 and P_n are the powers of the fundamental signal and the intermodulation distortion, respectively;

P_a , P_b and P_c are the values indicated by the spectrum analyser corresponding to P_i , P_1 and P_n , respectively;

L_1 is the difference between the loss L_A and L_B where L_A is the loss from point E to point A and L_B is the loss from point E to point B shown in Figure 3, respectively. L_2 is the circuit loss from point C to point D shown in Figure 3. P_i , P_1 , P_n , P_a , P_b and P_c are expressed in dBm. L_1 and L_2 are expressed in decibels.

The intermodulation distortion, P_1/P_n , which is expressed in dBC, is derived from Equations (14) and (15) as follows:

$$P_1/P_n = P_1 - P_n = P_b - P_c \tag{16}$$

Page 28

Replace the existing title of subclause 5.13 by the following new title:

5.13 Magnitude of the input reflection coefficient (input return loss) ($|S_{11}|$)

Replace, in Equation (17), the symbol “ $|s_{11}|$ ” by “ $|S_{11}|$ ”.

Page 29

Replace, the symbol “($|s_{22}|$)” by “($|S_{22}|$)” in the following places:

in both the title and text of subclause 5.14, on page 30 in Equation (18); on page 31, in Subclause 5.14.2.1 and in Equation (19),

Page 32

5.14.2.4 Circuit description and requirements

Delete, in the second paragraph of this subclause, the symbol “ $|s_{22}|$ ”.

5.14.2.6 Measurement procedure

Delete, in the last line of this subclause, the symbol “ $|s_{22}|$ ”.

Replace the existing last line of this subclause by the following:

Page 33

Replace, in the title of Subclause 5.15 and in Equation (20), “ $(|s_{12}|)$ ” by “ $|S_{12}|$ ”

Page 39

Replace, in the title of Subclause 5.19, “ (P_{nth}/P_1) ” by “ (P_1/P_{nth}) ”.

Delete, in Subclause 5.19.1, the term “ P_{nth}/P_1 ”.

5.19.3 Principle of measurement

Replace, in Subclause 5.19.3, “ P_{nth}/P_1 ” by “ P_1/P_{nth} ”.

Replace the existing Equation (29) by the following:

$$\frac{P_1}{P_{nth}} = P_1 - P_{nth}$$

iTeH STANDARD PREVIEW
(standards.iteh.ai)

(29)

Page 40

[IEC 60747-16-1:2001/AMD1:2007](https://standards.iteh.ai/catalog/standards/sist/daf27f61-ab38-47e8-8da8-39fd37/iec-60747-16-1-2001-amd1-2007)

<https://standards.iteh.ai/catalog/standards/sist/daf27f61-ab38-47e8-8da8-39fd37/iec-60747-16-1-2001-amd1-2007>

5.19.6 Measurement procedure

Delete, in the last line of subclause 5.19.6, the term “ P_{nth}/P_1 ”.

Page 42

Replace, in the title of subclause 5.21, “ (P_{sp}/P_o) ” by “ (P_o/P_{sp}) ”.

Page 43

5.21.3 Principle of measurement

Replace the existing Equation (35) and the line preceding as follows:

The spurious intensity P_o/P_{sp} in dBc is defined as follows:

$$P_o/P_{sp} = P_o - P_{sp} \quad (35)$$

Page 44

5.21.6 Measurement procedure

Delete in the last line of this subclause, the term “ P_{sp}/P_o ”.

Add the following new Subclause 5.22, new Clause 6 and (to appear on a separate end page), new Bibliography:

5.22 Adjacent channel power ratio ($P_{o(mod)}/P_{adj}$)

5.22.1 Purpose

To measure the adjacent channel power ratio under the specified conditions.

5.22.2 Circuit diagram

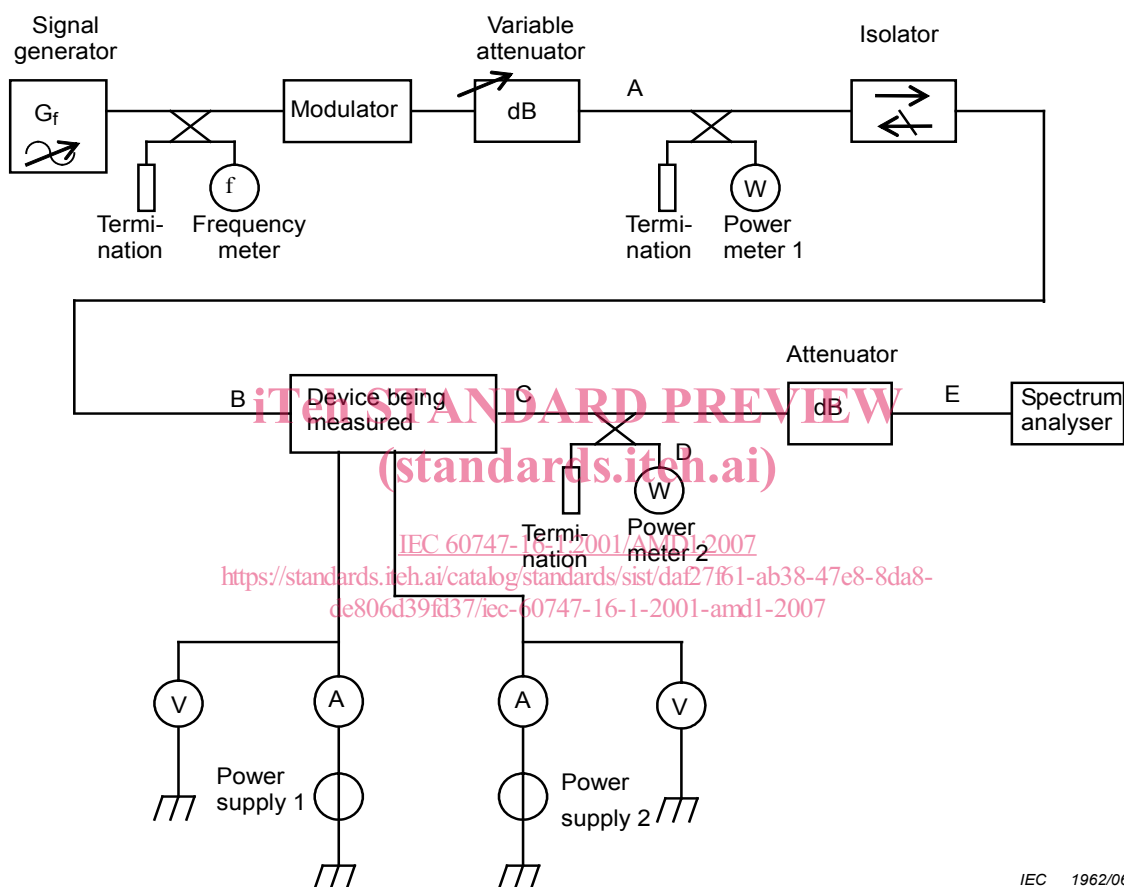


Figure 12 – Circuit for the measurement of the adjacent channel power ratio

5.22.3 Principle of measurement

Under the condition that the modulated signal is supplied for the device being measured in order to get the specified output power (P_o), P_{adj} is the total output power in the specified bandwidth at the specified frequency away from the carrier signal, and $P_{o(mod)}$ is the total output power in the specified bandwidth at the carrier signal. Adjacent channel power ratio $P_{o(mod)}/P_{adj}$ is the ratio of $P_{o(mod)}$ to the P_{adj} . The adjacent channels are in both the upper side band and lower side band of the carrier. The modulation signal is the carrier signal modulated with the standard test signal having the same rate as the specified code transmission rate.

$P_{o(mod)}/P_{adj}$ is given as the following equation in the circuit of Figure 12.

$$P_o = P_1 + L_1 \tag{36}$$

$$P_{o(mod)} = P_2 + L_2 \tag{37}$$

$$P_{adj} = P_3 + L_2 \tag{38}$$

$$P_{o(mod)}/P_{adj} = P_{o(mod)} - P_{adj} = P_2 - P_3 \quad (39)$$

where

P_1 is the value indicated by the power meter 2;

P_2 is the value of total power in the specified bandwidth at the carrier signal indicated by the spectrum analyser;

P_3 is the value of total output power in the specified channel bandwidth at the specified frequency that is equal to the channel spacing away from the carrier signal indicated by the spectrum analyser;

L_1 is the power at point C in dBm, less the power at point D in dBm;

L_2 is the power at point C in dBm, less the power at point E in dBm.

P_o , $P_{o(mod)}$, P_{adj} , P_1 , P_2 and P_3 are expressed in dBm;

L_1 and L_2 are expressed in dB;

$P_{o(mod)}/P_{adj}$ is expressed in dB.

5.22.4 Circuit description and requirement

The circuit losses L_1 and L_2 should be measured beforehand.

5.22.5 Precautions to be observed

The output signal and oscillation should be checked by the spectrum analyser. Oscillation should be eliminated during these measurements. Harmonics or spurious responses of the signal generator should be reduced so as to be negligible. An adequate attenuator should be inserted at the input of the spectrum analyser when the output power is high.

5.22.6 Measurement procedure IEC 60747-16-1:2001/AMD1:2007

<https://standards.iteh.ai/catalog/standards/sist/da27f61-ab38-47e8-8da8-355691111111>

The frequency of the signal generator shall be set to the specified value.

The bias conditions shall be applied to the device being measured.

An adequate input power shall be applied to the device being measured.

The following items of the modulator are set to the specified values according to the standard code of the test signal: modulation method, signal transmission rate and modulation bandwidth.

The following items of the spectrum analyser are set to the specified values: carrier frequency, sweep range, resolution bandwidth, video bandwidth, number of sampling and sweep time.

The value of P_1 is measured at the power meter 1.

Output power of the device being measured P_o is calculated from Equation (36).

By adjusting the variable attenuator, P_o is set to the specified value.

The channel spacing and the channel bandwidth are set to the specified values.

The values of P_2 and P_3 are measured at the spectrum analyser.

$P_{o(mod)}$, P_{adj} are calculated from Equations (37) and (38).

Adjacent channel power ratio $P_{o(mod)}/P_{adj}$ is calculated from Equation (39).

NOTE The display of the spectrum analyser is set to maximum hold mode. The detection mode of the spectrum analyser is set to positive peak mode.

5.22.7 Specified conditions

- Ambient or reference-point temperature
- Bias conditions
- Frequency (carrier frequency)
- Output power
- Standard code of the test signal:
 - channel spacing
 - channel bandwidth
 - modulation method
 - signal transmission rate
 - modulation bandwidth
- Spectrum analyser:
 - sweep range
 - resolution bandwidth
 - * video bandwidth of a spectrum analyser
 - * sampling numbers of a spectrum analyser
 - * sweep time of a spectrum analyser

iTeh STANDARD PREVIEW

6 Verifying methods (standards.iteh.ai)

6.1 Load mismatch tolerance (Ψ_L)

[IEC 60747-16-1:2001/AMD1:2007](https://standards.iteh.ai/catalog/standards/sist/daf27f61-ab38-47e8-8da8-de806d39fd37/iec-60747-16-1-2001-amd1-2007)

6.1.1 Purpose <https://standards.iteh.ai/catalog/standards/sist/daf27f61-ab38-47e8-8da8-de806d39fd37/iec-60747-16-1-2001-amd1-2007>

To verify the load mismatch tolerance under specified conditions.

6.1.2 Verification of method 1 (spurious intensity)