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**Systeme zur Kommunikation über Hochspannungsleitungen für
Anwendungen der elektrischen Energieversorgung –
Teil 2: Anschlussgeräte für analoge Trägerfrequenzübertragung über
Hochspannungsleitungen (TFH)
(IEC 62488-2:2017);
Englische Fassung EN 62488-2:2017**

Power line communication systems for power utility applications –
Part 2: Analogue power line carrier terminals or APLC
(IEC 62488-2:2017);
English version EN 62488-2:2017

Systèmes de communication sur lignes d'énergie pour les applications des compagnies
d'électricité –
Partie 2: Bornes analogiques à courant porteur en ligne (CPL)
(IEC 62488-2:2017);
Version anglaise EN 62488-2:2017

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Anwendungsbeginn

Anwendungsbeginn für die von CENELEC am 2017-08-30 angenommene Europäische Norm als DIN-Norm ist 2019-06-01.

Nationales Vorwort

Vorausgegangener Norm-Entwurf: E DIN EN 62488-2:2018-04.

Für dieses Dokument ist das nationale Arbeitsgremium K 952 „Netzleittechnik“ der DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE (www.dke.de) zuständig.

Die enthaltene IEC-Publikation wurde vom TC 57 „Power systems management and associated information exchange“ erarbeitet.

Das IEC-Komitee hat entschieden, dass der Inhalt dieses Dokuments bis zu dem Datum (stability date) unverändert bleiben soll, das auf der IEC-Website unter „<http://webstore.iec.ch>“ zu diesem Dokument angegeben ist. Zu diesem Zeitpunkt wird entsprechend der Entscheidung des Komitees das Dokument

- bestätigt,
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- geändert.

Für den Fall einer undatierten Verweisung im normativen Text (Verweisung auf ein Dokument ohne Angabe des Ausgabedatums und ohne Hinweis auf eine Abschnittsnummer, eine Tabelle, ein Bild usw.) bezieht sich die Verweisung auf die jeweils aktuellste Ausgabe des in Bezug genommenen Dokuments.

Für den Fall einer datierten Verweisung im normativen Text bezieht sich die Verweisung immer auf die in Bezug genommene Ausgabe des Dokuments.

Der Zusammenhang der zitierten Dokumente mit den entsprechenden deutschen Dokumenten ergibt sich, soweit ein Zusammenhang besteht, grundsätzlich über die Nummer der entsprechenden IEC-Publikation. Beispiel: IEC 60068 ist als EN 60068 als Europäische Norm durch CENELEC übernommen und als DIN EN 60068 ins Deutsche Normenwerk aufgenommen.

Das Präsidium des DIN hat mit Präsidialbeschluss 1/2004 festgelegt, dass DIN-Normen, deren Inhalt sich auf internationale Arbeitsergebnisse der Informationsverarbeitung gründet, unter bestimmten Bedingungen allein in englischer Sprache veröffentlicht werden dürfen. Diese Bedingungen sind für die vorliegende Norm erfüllt.

Da sich die Benutzer der vorliegenden Norm der englischen Sprache als Fachsprache bedienen, wird die Englische Fassung der EN 62448-2 veröffentlicht. Zu deren Abschnitt 1, der den Anwendungsbereich festlegt, und Abschnitt 3, der die Begriffe und Abkürzungen festlegt, wurde eine Übersetzung angefertigt und als informativer Nationaler Anhang NA der vorliegenden Norm hinzugefügt. Für die meisten der verwendeten Begriffe existieren keine gebräuchlichen deutschen Benennungen, da sich die deutschen Anwender in der Regel ebenfalls der englischen Benennungen bedienen. Diese Norm steht nicht in unmittelbarem Zusammenhang mit Rechtsvorschriften und ist nicht als Sicherheitsnorm anzusehen.

Das Original-Dokument enthält Bilder in Farbe, die in der Papierversion in einer Graustufen-Darstellung wiedergegeben werden. Elektronische Versionen dieses Dokuments enthalten die Bilder in der originalen Farbdarstellung.

Nationaler Anhang NA (informativ)

Auszugsweise Übersetzung

Reihenfolge und Inhalt der folgenden Abschnitte sind identisch mit denen in den jeweiligen Abschnitten der Englischen Fassung.

1 Anwendungsbereich

Dieser Teil von IEC 62488 gilt für Endgeräte und Systeme für die analoge Trägerfrequenzübertragung über Hochspannungsleitungen (TFH) per Einseitenband-Amplitudenmodulation (AM-SSB), die zur Übertragung von Informationen über Stromversorgungsleitungen (Höchstspannung, Hochspannung und Mittelspannung) eingesetzt werden.

Das vorliegende Dokument behandelt insbesondere Basisband-Signale mit Bandbreiten von 4 kHz und 2,5 kHz oder Vielfache hiervon, die den gleichen Hochfrequenzbandbreiten für Einkanal- oder Mehrkanal-ATFH-Endgeräte entsprechen.

Bild 1 zeigt eine schematische Darstellung des Anwendungsbereichs der Norm IEC 62488-2 in einem vollständigen System zur Kommunikation über Hochspannungsleitungen.

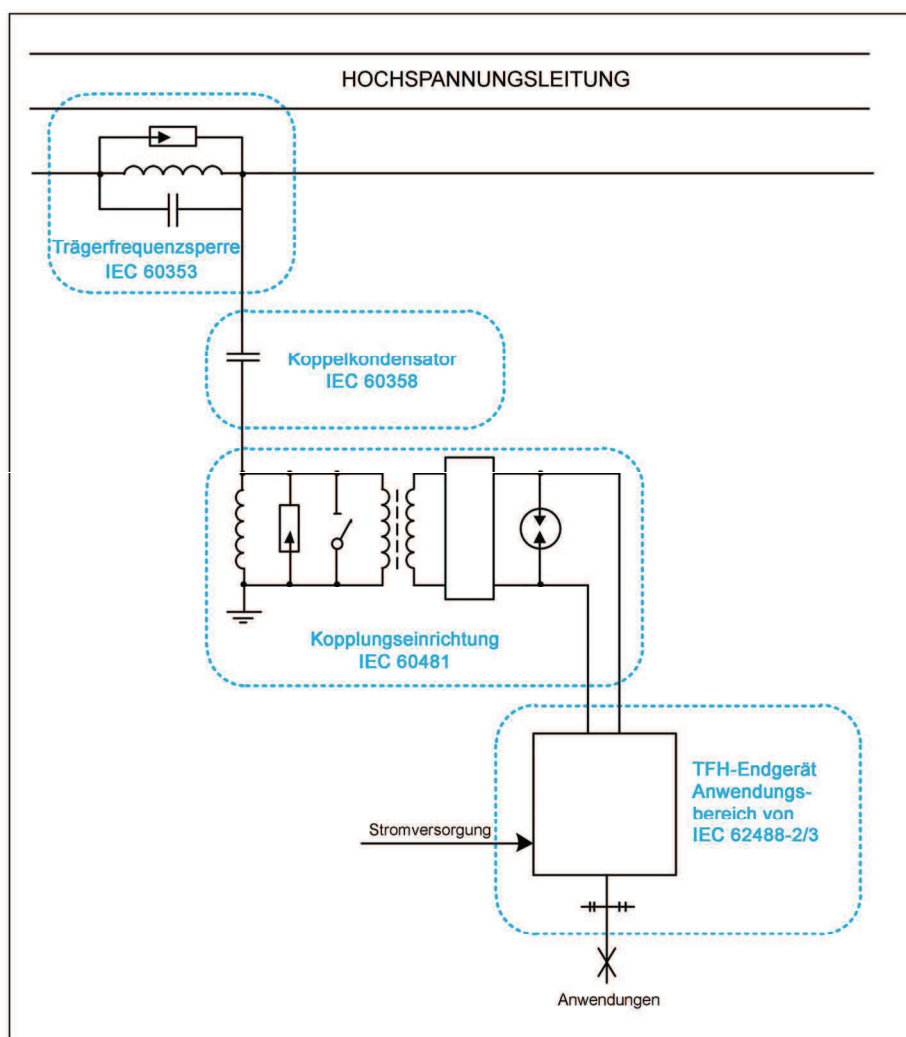


Bild 1 – Schematische Darstellung des Anwendungsbereichs von IEC 62488-2

3 Begriffe und Abkürzungen

3.1 Begriffe

Für die Anwendung dieses Dokuments gelten die Begriffe nach IEC 62488-1 und die folgenden Begriffe.

ISO und IEC unterhalten Terminologie-Datenbanken zur Verwendung in der Normung unter den folgenden Adressen:

- IEC Electropedia: verfügbar unter <http://www.electropedia.org/>
- ISO Online Browsing-Plattform: verfügbar unter <http://www.iso.org/obp>

3.1.1

absoluter Leistungspegel

Leistung eines Signals, ausgedrückt in Dezibel bezogen auf Referenzleistung von 1 mW wie in Gleichung (1) festgelegt

$$X [\text{dBm}] = 10 \times \log_{10} (P/1\text{mW}), \quad (1)$$

Dabei ist

P = Signalleistung

3.1.2

ATFH-Einrichtung

(en: (APLC equipment))

TFH-Einrichtung mit einer Niederfrequenz-Schnittstelle für jeden Niederfrequenz-Kanal, die AM-SSB-Modulation auf die Signale am Eingang jeder Niederfrequenz-Schnittstelle anwendet und über die Stromversorgungsleitung die modulierten Signale überträgt, die benachbarte Frequenzbänder belegen, die das HF-Übertragungsband des TFH vollständig abdecken

Anmerkung 1 zum Begriff: Niederfrequenz-Kanäle haben typischerweise eine Bandbreite von 4,0 kHz oder 2,5 kHz, können jedoch auch eine andere Bandbreite haben.

Anmerkung 2 zum Begriff: Zusätzlich zu den angegebenen Schnittstellen dürfen auch andere Schnittstellen vorhanden sein, z. B. Datenschnittstellen, LF-Schutzsignalübertragungs- und Steuerschnittstellen oder Befehlsschnittstellen für die Schutzsignalübertragung.

3.1.3

Basishochfrequenzband

elementare Unterteilung des Hochfrequenzbereichs oder eines Teils dieses Bereichs, die einem einzigen HF-ATFH-Sende- oder Empfangskanal zugeordnet ist

3.1.4

effektiv übertragenes Sprachband

Teil des Sprachfrequenz-Basisbands, der für die Telefonkommunikation genutzt wird, ohne Telefonsignalisierungskanal

3.1.5

Pegel-Referenzpunkt

Punkt in einem System mit dem relativen Pegel 0 dBr

Anmerkung 1 zum Begriff: Genauer gesagt wird davon ausgegangen, dass ein Sinusreferenzsignal mit 1 020 Hz im Sprachfrequenzband den betreffenden Signalweg mit einer Amplitude durchläuft, bei der sein absoluter Pegel 0 dBm im 0-dBr-Punkt beträgt. [ITU-T G.100.1]

Anmerkung 2 zum Begriff: Der Pegel-Referenzpunkt darf physisch oder auch nur hypothetisch existieren.

3.1.6

LF-Kanal

Frequenzband, das für die Signalübertragung einer Niederfrequenz-Schnittstelle genutzt wird

3.1.7**Lastkapazität**

<für Mehrkanal-Endgerät> maximale Einfrequenz-Sinuswellenleistung, ausgedrückt in dBm0, die von einem Mehrkanalverstärker ohne nennenswerte Überlastung übertragen werden muss

3.1.8**mittlere Hochfrequenzband-Ausgangsleistung**

Ausgangsleistung eines ATFH-Endgeräts im Nennbereich des Hochfrequenzbands, gemittelt über eine im Verhältnis zur Zykluszeit der niedrigsten Modulationsfrequenz genügend lange Dauer, während der diese mittlere Leistung den Höchstwert annimmt, für den das Endgerät ausgelegt ist

3.1.9**Nennbereich des Hochfrequenzbands**

Frequenzband innerhalb des Trägerfrequenzbereichs, in dem ein bestimmter ATFH-Sender oder ATFH-Empfänger betrieben wird

Anmerkung 1 zum Begriff: Der Nennbereich des Hochfrequenzbands wird auch als Nennbereich des Trägerfrequenzbands bezeichnet.

3.1.10**Ausgangsleistung im Nennbereich des Hochfrequenzbands**

Ausgangsleistung eines ATFH-Endgeräts im Nennbereich des Hochfrequenzbands, angegeben als die Hüllkurvenspitzenleistung (PEP), für die das Endgerät entsprechend den Anforderungen an die Nebenaussendungen und Kanalüberlagerungsstörungen (bei Mehrkanal-TFH-Endgeräten) ausgelegt ist und die am Hochfrequenz-Schnittstellenausgang über einer Widerstandslast gleich der Nennimpedanz verfügbar ist

3.1.11**Leistungsverhältnis**

Verhältnis zwischen den Leistungen P_1 und P_2 zweier Signale

Anmerkung 1 zum Begriff: Das Leistungsverhältnis X_{12} wird normalerweise in Dezibel (dB) angegeben und mittels Gleichung (2) berechnet.

$$X_{12} [\text{dB}] = 10 \times \log_{10} (P_1 / P_2) . \quad (2)$$

3.1.12**relativer Leistungspegel**

Leistungspegel an einem Punkt in einem Stromkreis, der durch den Ausdruck $10 \times \log_{10} (P/P_0)$ dBr gegeben ist, wobei P die Leistung eines Sinussignals mit Referenzfrequenz 1 020 Hz am betreffenden Punkt ist und P_0 die Leistung dieses Signals am 0-dBr-Referenzpunkt [ITU-T P.10/G.100 R-8, ITU-T G.100.1]

Anmerkung 1 zum Begriff: Der Zusammenhang zwischen dem relativen Leistungspegel P_{rel} , dem absoluten Leistungspegel P und dem Leistungspegel des Systems P_0 ergibt sich aus Gleichung (3):

$$P_{\text{rel}} [\text{dBr}] = P [\text{dBm}] - P_0 [\text{dBm0}] \quad (3)$$

Anmerkung 2 zum Begriff: Der relative Leistungspegel ist abhängig vom Messpunkt und nicht vom Signaltyp.

3.1.13**Nebenaussendungen**

Aussendungen auf einer oder mehreren Frequenzen außerhalb der erforderlichen Bandbreite, wobei der Pegel dieser Aussendungen herabgesetzt werden kann, ohne dass die Übertragung der entsprechenden Information beeinträchtigt wird

Anmerkung 1 zum Begriff: Nebenaussendungen umfassen harmonische Aussendungen, parasitäre Aussendungen, Intermodulationsprodukte und Frequenzumsetzungsprodukte, jedoch nicht Außerband-Aussendungen [ITU-R SM.329-12].

3.1.14

Leistungspegel des Systems

in dBm0 angegebener Leistungspegel, so dass x dBm0 bedeutet, dass x dB am Pegel-Referenzpunkt des Systems größer oder kleiner als 1 mW ist, je nachdem, ob x positiv oder negativ ist, d. h. dass x dB an einem beliebigen Punkt des Systems größer oder kleiner als das Pegel-Referenzsignal von 1 020 Hz ist

Anmerkung 1 zum Begriff: Netze sind häufig für die Übertragung verschiedener Signaltypen (Sprache, Modem, Fax usw.) mit verschiedenen Pegeln ausgelegt, die in dBm0 angegeben werden [ITU-T G.100.1].

3.1.15

psophometrischer Leistungspegel des Systems

psophometrisch gewichteter Pegel, angegeben in dBm0p, entsprechend den Festlegungen in ITU-T O.41

Anmerkung 1 zum Begriff: Der Ausdruck dBm0p wird auf dieselbe Weise wie dBm0 verwendet, wenn der Pegel mit einem Psophometer statt mit einer linearen Pegelmesseinrichtung gemessen wird. Die psophometrische Gewichtung wird nur in Verbindung mit der Bestimmung von Rauschpegeln in Sprachkanälen eingesetzt. Die äquivalente Rauschbandbreite des psophometrisch gewichteten Filters beträgt etwa 1,8 kHz.

3.2 Abkürzungen

AC	Wechselstrom (en: alternating current)
AM-SSB	Einseitenband-Amplitudenmodulation (en: amplitude modulation SSB)
ATFH	analoge Trägerfrequenzübertragung über Hochspannungsleitungen (en: APLC, analogue power line carrier)
DC	Gleichstrom (en: direct current)
DTFH	digitale Trägerfrequenzübertragung über Hochspannungsleitungen (en: DPLC, digital power line carrier)
DSP	digitale Signalverarbeitung (en: digital signal processing; digital signal processor)
E&M	E&M-Signalisierung (en: ear & mouth)
FAR	voll reflexionsfreier Raum (en: fully anechoic room)
FDM	Frequenzmultiplexverfahren; Frequenzmultiplexer (en: frequency division multiplexing; frequency division multiplexer)
FSK	Frequenzumtastung (en: frequency shift keying)
FXO	Schnittstelle Telefon (en: foreign exchange office)
FXS	Schnittstelle Telefonnetz (en: foreign exchange subscriber)
HF	Hochfrequenz (en: high frequency)
LAN	lokales Netz (en: local area network)
LCL	Unsymmetriedämpfung (en: longitudinal conversion loss)
LF	Niederfrequenz (en: low frequency)

MIB	Managementinformationsbasis (en: management information base)
OATS	Freifeld (en: open area test site)
OSB	Symmetrie des Ausgangssignals (en: output signal balance)
PBX	Nebenstellenvermittlungseinrichtung (en: private branch exchange)
PEP	Hüllkurvenspitzenleistung (en: peak envelope power)
TFH	Trägerfrequenzübertragung über Hochspannungsleitungen (en: PLC, power line carrier)
RMS	Effektivwert (en: root mean square)
Rx	Empfänger, empfangen (en: receiver; receive)
SAC	Halbabsorberkammer (en: semi anechoic chamber)
SNMP	einfaches Netzwerkverwaltungsprotokoll (en: simple network management protocol)
SSB	Einseitenband (en: single side band)
Tx	Sender; senden (en: transmitter; transmit)
VF	Sprachfrequenz (en: voice frequency)
WAN	Weitverkehrsnetz (en: wide area network)
2W	Zweidraht- (en: two wire)
4W	Vierdraht- (en: four wire)

– Leerseite –

English Version

Power line communication systems for power utility applications
- Part 2: Analogue power line carrier terminals or APLC
(IEC 62488-2:2017)

Systèmes de communication sur lignes d'énergie pour les applications des compagnies d'électricité - Partie 2 : Bornes analogiques à courant porteur en ligne (CPL)
(IEC 62488-2:2017)

Systeme zur Kommunikation über Hochspannungsleitungen für Anwendungen der elektrischen Energieversorgung - Teil 2: Anschlussgeräte für analoge Trägerfrequenzübertragung über Hochspannungsleitungen (TFH)
(IEC 62488-2:2017)

This European Standard was approved by CENELEC on 2017-08-30. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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European foreword

The text of document 57/1867/FDIS, future edition 1 of IEC 62488-2, prepared by IEC/TC 57 "Power systems management and associated information exchange" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62488-2:2017.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2018-05-30
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2020-08-30

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 62488-2:2017 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60255-26:2013	NOTE	Harmonized as EN 60255-26:2013.
IEC 60255-151:2009	NOTE	Harmonized as EN 60255-151:2009.
IEC 60495:1993	NOTE	Harmonized as EN 60495:1994.
IEC 60721-3-4:1995	NOTE	Harmonized as EN 60721-3-4:1995.
IEC 60870-5-101	NOTE	Harmonized as EN 60870-5-101.
IEC 60870-5-104	NOTE	Harmonized as EN 60870-5-104.
IEC 61869-2:2012	NOTE	Harmonized as EN 61869-2:2012.
IEC 62351 (series)	NOTE	Harmonized as EN 62351 (series).

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60038	-	IEC standard voltages	EN 60038	-
IEC 60068-2-1	-	Environmental testing -- Part 2-1: Tests - Test A: Cold	EN 60068-2-1	-
IEC 60068-2-2	-	Environmental testing -- Part 2-2: Tests - Test B: Dry heat	EN 60068-2-2	-
IEC 60068-2-6	-	Environmental testing -- Part 2-6: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	-
IEC 60068-2-27	-	Environmental testing -- Part 2-27: Tests - Test Ea and guidance: Shock	EN 60068-2-27	-
IEC 60068-2-30	-	Environmental testing -- Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)	EN 60068-2-30	-
IEC 60068-2-31	-	Environmental testing -- Part 2-31: Tests - Test Ec: Rough handling shocks, primarily for equipment-type specimens	EN 60068-2-31	-
IEC 60255-27	2013	Measuring relays and protection equipment -- Part 27: Product safety requirements	EN 60255-27	2014
IEC 60529	-	Degrees of protection provided by enclosures- (IP Code)	-	-
IEC 60721-3-1	1997	Classification of environmental conditions -- Part 3: Classification of groups of environmental parameters and their severities -- Section 1: Storage	EN 60721-3-1	1997
IEC 60721-3-2	1997	Classification of environmental conditions -- Part 3: Classification of groups of environmental parameters and their severities -- Section 2: Transportation	EN 60721-3-2	1997
+ A1	1995	-	-	-
IEC 60721-3-3	1994	Classification of environmental conditions -- Part 3: Classification of groups of environmental parameters and their severities -- Section 3: Stationary use at weatherprotected locations	EN 60721-3-3	1995
+ A2	1996	-	+ A2	1997
IEC 60834-1	-	Performance and testing of teleprotection-equipment of power systems -- Part 1: Narrow-band command systems	-	-
IEC 60950-1	-	Information technology equipment - Safety - Part 1: General requirements	EN 60950-1	-

IEC 61000-4-2	-	Electromagnetic compatibility (EMC) -- Part 4-EN 61000-4-2 2: Testing and measurement techniques - Electrostatic discharge immunity test	-
IEC 61000-4-3	-	Electromagnetic compatibility (EMC) - Part 4-- 3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	-
IEC 61000-4-4	-	Electromagnetic compatibility (EMC) -- Part 4-EN 61000-4-4 4: Testing and measurement techniques - Electrical fast transient/burst immunity test	-
IEC 61000-4-5	-	Electromagnetic compatibility (EMC) - Part 4-EN 61000-4-5 5: Testing and measurement techniques - Surge immunity test	-
IEC 61000-4-6	-	Electromagnetic compatibility (EMC) -- Part 4-EN 61000-4-6 6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields	-
IEC 61000-4-8	-	Electromagnetic compatibility (EMC) -- Part 4-EN 61000-4-8 8: Testing and measurement techniques - Power frequency magnetic field immunity test	-
IEC 61000-4-11	-	Electromagnetic compatibility (EMC) -- Part 4-EN 61000-4-11 11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests	-
IEC 61000-4-16	-	Electromagnetic compatibility (EMC) - Part 4-EN 61000-4-16 16: Testing and measurement techniques - Test for immunity to conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz	-
IEC 61000-4-17	-	Electromagnetic compatibility (EMC) - Part 4-- 17: Testing and measurement techniques - Ripple on d.c. input power port immunity test	-
IEC 61000-4-18	-	Electromagnetic compatibility (EMC) -- Part 4-EN 61000-4-18 18: Testing and measurement techniques - Damped oscillatory wave immunity test	-
IEC 61000-4-20	2010	Electromagnetic compatibility (EMC) -- Part 4-EN 61000-4-20 20: Testing and measurement techniques - Emission and immunity testing in transverse electromagnetic (TEM) waveguides	2010
IEC 61000-4-29	-	Electromagnetic compatibility (EMC) -- Part 4-EN 61000-4-29 29: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests	-
IEC 61000-6-2	-	Electromagnetic compatibility (EMC) - Part 6-EN 61000-6-2 2: Generic standards - Immunity standard for industrial environments	-
IEC 61000-6-4	2006	Electromagnetic compatibility (EMC) -- Part 6-EN 61000-6-4 4: Generic standards - Emission standard for industrial environments	2007
IEC 61000-6-5	2015	Electromagnetic compatibility (EMC) - Part 6-EN 61000-6-5 5: Generic standards - Immunity for equipment used in power station and substation environment	2015
IEC 62488-1	2012	Power line communication systems for powerEN 62488-1 utility applications -- Part 1: Planning of analogue and digital power line carrier systems operating over EHV/HV/MV electricity grids	2013

CISPR 14-1	2016	Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission	EN 55014-1	2017
CISPR 16-1-1	2015	Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus		-
CISPR 16-1-2	2014	Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-2: Radio disturbance and immunity measuring apparatus - Coupling devices for conducted disturbance measurements	EN 55016-1-2	2014
CISPR 16-1-4	2010	Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-4: Radio disturbance and immunity measuring apparatus - Antennas and test sites for radiated disturbance measurements	EN 55016-1-4	2010
CISPR 16-2-1	2014	Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-1: Methods of measurement of disturbances and immunity - Conducted disturbance measurements	EN 55016-2-1	2014
CISPR 16-2-3	2016	Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-3: Methods of measurement of disturbances and immunity - Radiated disturbance measurements	EN 55016-2-3	2017
CISPR 22	2008	Information technology equipment - Radio-disturbance characteristics - Limits and methods of measurement		-

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INTRODUCTION

IEC 62488 series is a family of standards dealing with all aspects of power line communication systems operating over electricity power lines.

These international standards apply to power line carrier terminals and systems (PLC) used to transmit information over power networks including extra high, high and medium voltage (EHV/HV/MV) power lines. Both analogue and digital modulation as well as narrow and broadband systems will be included.

The complexity and extensive size of present-day electricity generation, transmission and distribution systems are such that it is possible to control them only by means of an associated and often equally large and complex telecommunication system having a high order of reliability.

The control of electrical networks and transmission and reception of data are through a combination of analogue and digital communication systems controlling devices and systems distributed throughout the electrical network.

The emergence of digital communication systems for controlling the devices of the electrical distribution network enables faster data transmission. The traditional analogue communication systems mainly due to legacy applications are still extensively used.

The ability to represent the various electrical parameters as an analogue signal and/or a digital signal ensures the quality and quantitative aspects of seamless communication to be maintained throughout the electrical power network.

Therefore, by using either analogue power line communication, digital power line communication or a combination of both types of systems, seamless efficient communication may be maintained throughout the power network.

In many countries, Power Line Carrier (PLC) channels represent a main part of the utility-owned telecommunication system. A circuit which would normally be routed via a PLC channel can also be routed via a channel using a different transmission medium, such as a point to point radio or open-wire circuit. Since, in many cases, automatic switching is used, the actual rerouting, although predetermined, is unpredictable.

It is important, therefore, that the input and output signals and criteria exchanged among all terminal used in the communications system are compatible. This compatibility is also beneficial in creating the ability to interchange and interconnect terminals from different sources.

This document has been prepared to enable compatibility between APLC links from different sources or between APLC links and other transmission medium to be achieved and to define the terminal performance required in APLC networks.

1 Scope

This part of IEC 62488 applies to Amplitude Modulation Single Sideband (AM-SSB) Analogue Power Line Carrier (APLC) Terminals and Systems used to transmit information over power lines (EHV/HV/MV).

In particular this document covers basically baseband signals with bandwidths of 4 kHz and 2,5 kHz, or multiples thereof, corresponding to the same high frequency bandwidth/s for single or multi-channel APLC terminals.

Figure 1 shows a schematic representation of the scope of the IEC 62488-2 standard within a complete power line communication system installation.

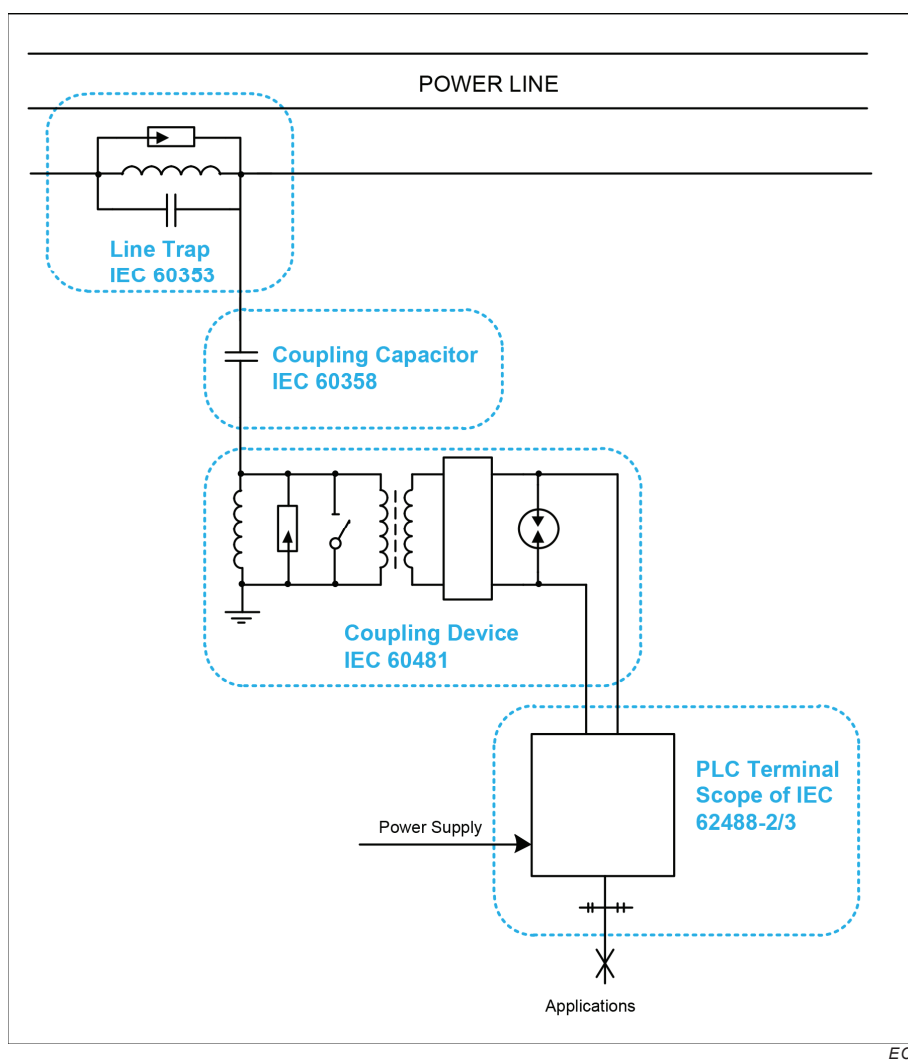


Figure 1 – Schematic representation of the scope of IEC 62488-2

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60038, *IEC standard voltages*

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-30, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-31, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*

IEC 60255-27:2013, *Measuring relays and protection equipment – Part 27: Product safety requirements*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60721-3-1:1997, *Classification of environmental conditions – Part 3 Classification of groups of environmental parameters and their severities – Section 1: Storage*

IEC 60721-3-2:1997, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation*

IEC 60721-3-3:1994, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 3: Stationary use at weatherprotected locations*

IEC 60721-3-3:1994/AMD1:1995

IEC 60721-3-3:1994/AMD2:1996

IEC 60834-1, *Teleprotection equipment of power systems – Performance and testing – Part 1: Command systems*

IEC 60950-1, *Information technology equipment – Safety – Part 1: General requirements*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3 : Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-16, *Electromagnetic compatibility (EMC) – Part 4-16: Testing and measurement techniques – Test for immunity to conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz*

IEC 61000-4-17, *Electromagnetic compatibility (EMC) – Part 4-17: Testing and measurement techniques – Ripple on d.c. input power port immunity test*

IEC 61000-4-18, *Electromagnetic compatibility (EMC) – Part 4-18: Testing and measurement techniques – Damped oscillatory wave immunity test*

IEC 61000-4-20:2010, *Electromagnetic compatibility (EMC) – Part 4-20: Testing and measurement techniques – Emission and immunity testing in transverse electromagnetic (TEM) waveguides*

IEC 61000-4-29, *Electromagnetic compatibility (EMC) – Part 4-29: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments*

IEC 61000-6-4:2006, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*
IEC 61000-6-4:2006/AMD1:2010

IEC 61000-6-5:2015, *Electromagnetic compatibility (EMC) – Part 6-5: Generic standards – Immunity for equipment used in power station and substation environment*

IEC 62488-1:2012, *Power line communication systems for power utility applications – Part 1: Planning of analogue and digital power line carrier systems operating over EHV/HV/MV electricity grids*

CISPR 16-1-1:2015, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*

CISPR 16-1-2:2014, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-2: Radio disturbance and immunity measuring apparatus – Coupling devices for conducted disturbance measurements*

CISPR 16-1-4:2010, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-4: Radio disturbance and immunity measuring apparatus – Antennas and test sites for radiated disturbance measurements*

CISPR 16-2-1:2014, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-1: Methods of measurement of disturbances and immunity – Conducted disturbance measurements*

CISPR 16-2-3:2016, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-3: Methods of measurement of disturbances and immunity – Radiated disturbance measurements*

CISPR 14-1:2016, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission*

CISPR 22:2008, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62488-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1.1

absolute power level

power of a signal expressed in decibels referred to 1mW as defined by Equation (1)

$$X[\text{dBm}] = 10 \times \log_{10}(P/1\text{mW}), \quad (1)$$

where

P = signal power

3.1.2

APLC equipment

PLC equipment with an LF interface for each LF channel, applying AM-SSB modulation to the signals at the input of each LF interface and transmitting over the power line the modulated signals, which occupy adjacent frequency bands fully covering the HF transmission band of the PLC

Note 1 to entry: The LF channel bandwidths are typically either 4,0 or 2,5 kHz, but can be different.

Note 2 to entry: In addition to the mentioned interfaces other interfaces may be present such as data interfaces, LF teleprotection and control interfaces or teleprotection command interfaces.

3.1.3

basic high frequency band

elementary subdivision of the high frequency range or part thereof allocated to a single APLC transmit or receive high frequency channel

3.1.4

effective transmitted voice band

that part of the voice-frequency baseband used for telephone communication, not including the telephone signalling channel

3.1.5

level reference point

point in a system with the relative level 0 dBr

Note 1 to entry: More specifically, a sinusoidal reference signal of 1020 Hz in the voice frequency band is thought to pass the signal path under consideration with such amplitude that its absolute level is 0 dBm at the 0 dBr point. [ITU-T G.100.1]

Note 2 to entry: The level reference point may exist physically or only hypothetically.

3.1.6

LF channel

frequency band used for the signal transmission of a low frequency interface

3.1.7

load capacity, <for the multi-channel terminal>

maximum single frequency sine wave power expressed in dBm0 which a multi-channel amplifier must transmit without appreciable overloading

3.1.8

mean high frequency band output power

output power of an APLC terminal at nominal high frequency band terminal averaged over a time sufficiently long compared with the cycle time of the lowest modulation frequency and during which this average power assumes the highest value for which the terminal has been designed

3.1.9

nominal high frequency band

frequency band in which a particular APLC transmitter or receiver is operating within the carrier-frequency range

Note 1 to entry: The nominal high frequency band is also referred to as nominal carrier frequency band.

3.1.10

nominal high frequency band output power

output power of an APLC terminal at nominal high frequency band expressed as the peak envelope power (PEP) for which the terminal has been designed, compatible with the requirements for spurious emissions and inter-channel interference (for multi-channel PLC terminals), available at the high frequency interface output across a resistive load equal to the nominal impedance

3.1.11

power ratio

ratio between the powers P_1 and P_2 of two signals

Note 1 to entry: The power ratio X_{12} is usually expressed in decibels (dB) and is calculated according to equation (2)

$$X_{12}[\text{dB}] = 10 \times \log_{10}(P_1/P_2). \quad (2)$$

3.1.12

relative power level

power level at a point on a circuit given by the expression $10 \times \log_{10}(P/P_0)$ dBr, where P represents the power of a sinusoidal signal at the reference frequency 1020 Hz at the point concerned and P_0 the power of that signal at the 0 dBr reference point [ITU-T P.10/G.100 R-8, ITU-T G.100.1]

Note 1 to entry: The relation between the relative power level P_{rel} , the absolute power level P and the system power level P_0 is given by Equation (3):

$$P_{\text{rel}}[\text{dBr}] = P[\text{dBm}] - P_0[\text{dBm0}] \quad (3)$$

Note 2 to entry: The relative power level depends on the measuring point and not on the type of signal.

3.1.13

spurious emissions

emissions on a frequency, or on frequencies, which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information

Note 1 to entry: Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude out-of-band emissions [ITU-R SM.329-12].

3.1.14

system power level

power level expressed in dBm₀, such that x dBm₀ means x dB above or below 1 mW at the level reference point of the system, according to whether x is positive or negative, i.e. x dB above or below the level reference signal of 1020 Hz at any point of the system

Note 1 to entry: Networks are often designed to carry different types of signals (speech, modem, fax, etc.) at different levels, expressed in dBm₀ [ITU-T G.100.1].

3.1.15

system psophometric power level

psophometrically weighted level expressed in dBm_{0p} as defined according to ITU-T O.41

Note 1 to entry: The term dBm_{0p} is used in the same way as dBm₀ when the level is measured with a psophometer instead of a flat-response level measuring set. The psophometric weighting is used only in connection with the specification of noise levels on voice channels. The equivalent noise bandwidth of the psophometrically-weighted filter is about 1,8 kHz.

3.2 Abbreviations

AC	Alternating Current
AM-SSB	Amplitude Modulation SSB
APLC	Analogue PLC
DC	Direct Current
DPLC	Digital PLC
DSP	Digital Signal Processing, Digital Signal Processor
E&M	Ear & Mouth
FAR	Fully Anechoic Room
FDM	Frequency Division Multiplexing, Frequency Division Multiplexer
FSK	Frequency Shift Keying
FXO	Foreign Exchange Office
FXS	Foreign Exchange Subscriber
HF	High Frequency
LAN	Local Area Network
LCL	Longitudinal Conversion Loss
LF	Low Frequency
MIB	Management Information Base
OATS	Open Area Test Site
OSB	Output Signal Balance
PBX	Private Branch Exchange
PEP	Peak Envelope Power
PLC	Power Line Carrier
RMS	Root Mean Square
Rx	Receiver, receive
SAC	Semi Anechoic Chamber
SNMP	Simple Network Management Protocol
SSB	Single Side Band
Tx	Transmitter, transmit
VF	Voice Frequency

WAN Wide Area Network
2W Two Wire
4W Four Wire

4 Low frequency side interfaces

4.1 General

All interfaces described in Clause 4 are optional. However, as stated in the definition of 3.1.2, it shall be possible to configure APLC equipment such that it has one low frequency interface for each LF channel.

Figure 2 shows the generic architecture of an APLC terminal with the LF interfaces on the left and the RF interface on the right. The type of interface – digital (⏏) or analogue (⏚) – is indicated. In addition, two internal conceptual signals appear in this figure: (1) The “Baseband signal”, representing the FDM multiplexed signal of all LF signals and (2) the “Passband signal”, representing the baseband signal converted to the RF band by SSB modulation. These two signals are generally not accessible by the user. In case only one LF interface is present, the function of the block “Frequency Division Multiplexer / Demultiplexer” degenerates to a simple through connection.

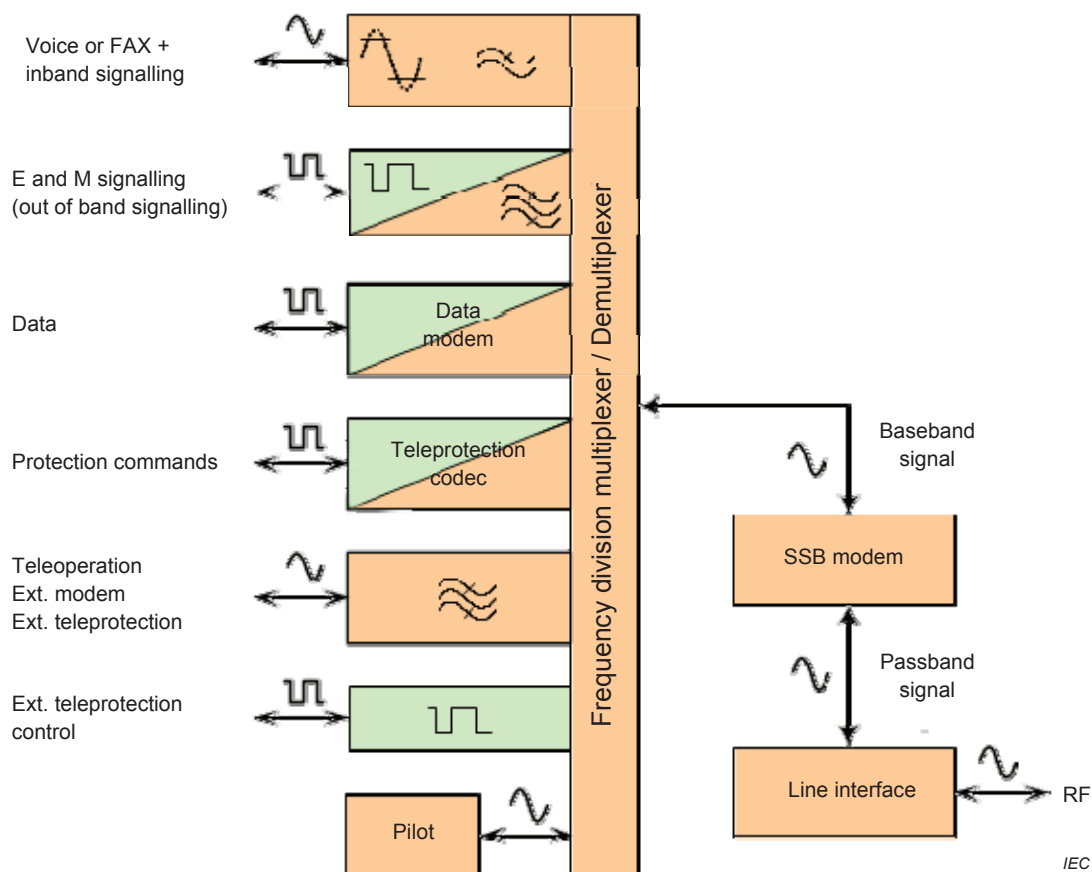


Figure 2 – Generic architecture of an APLC terminal

4.2 Analogue interfaces

4.2.1 General

In 4.2, a description of the analogue interfaces is given. For each of them the key parameters and the recommended characteristic values are indicated. All levels are specified as absolute power levels (dBm) unless otherwise noted.

4.2.2 Voice frequency band

The effective transmitted voice-frequency band is 300 to 3 400 Hz according to ITU-T G.232. Other recommended values for the effective transmitted voice band are:

- 300 to 2 400 Hz,
- 300 to 2 000 Hz.

4.2.3 Nominal impedance

The nominal impedance of all analogue low-frequency inputs and outputs shall be 600 Ω balanced.

4.2.4 Return loss

The return loss for all voice-frequency interfaces shall not be less than 14 dB within the effective transmitted frequency band.

4.2.5 Degree of unbalance to Earth

For all voice-frequency inputs longitudinal conversion loss and outputs signal balance shall not be less than 40 dB within the effective transmitted frequency band.

4.2.6 ITU-T voice channel interface

4.2.6.1 Description

One of the most used interfaces is related to the voice applications. Typically, it is used for interconnection to/from the multiplexor transit of subscriber service. One or more voice channel interfaces could be present in each terminal if needed.

4.2.6.2 Voice signal levels

- The minimum range of the transmit input level shall be –17 to 0 dBm
- The minimum range of the received output level shall be –7 to +4 dBm

4.2.7 Subscriber interface

4.2.7.1 Description

In some cases it is requested to make a subscriber connection to a PBX from a remote location. To make this possible APLC links provide for the telephone connection between PBX and two-wire telephone set by configuring a PBX interface at the local APLC terminal and a subscriber interface at the remote APLC terminal.

In Figure 3 a possible application scheme is given.