

3 Functions and specifications

The SUPx4 unit provides the following functions and conforms to the corresponding standards and recommendations (conformance to applicable parts of the standards).

3.1 Feature licences

Part of the MileGate functionality is subject to feature licences. For more information on feature licences please refer to [012] Release Note “MileGate R5B” and to [915] Technical Bulletin “Feature Licences for MileGate”.

3.2 Main functions and specifications

Table 4: Main functions and specifications

Feature	Rating or standard	Release
48 PSTN user ports according to ITU-T Q.552	ITU-T Q.552 (11/2001) Transmission characteristics at 2-wire analogue interfaces of digital exchanges ITU-T G.711 (1988)	r1a
	Pulse Code Modulation (PCM) of voice frequencies	r1a
BORSCHT functionality:	Battery feed Overvoltage protection Ringing injection Supervision Codec Hybrid Testing	r1a
Voice impedances configurable for different countries and applications	ITU-T Q.552 (11/2001) Transmission characteristics at 2-wire analogue interfaces of digital exchanges	r1a
Input and output level configuration	ITU-T G.712 (11/2001) Transmission performance characteristics of pulse code modulation channels	r1a
Input and output overvoltage protection According to ITU-T K.20, enhanced test level with acceptance criteria A. Note: External primary protection (230V Gas Discharge Tubes) is mandatory	ITU-T K.20 (07/2003) Resistibility of telecommunication equipment installed in a telecommunications centre to overvoltages and overcurrents	r1a
Connector	DIN 41612	r1a
V5CAS mode of operation (internal communication)		r1a

Table 4: Main functions and specifications (continued)

Feature	Rating or standard	Release
MCAS mode of operation	Technical specification for customer signalling in public networks: T 0197, Mercury Communications Ltd., 1990 Analogue 2-wire signalling state diagrams: C6 0193 Issue 2, Mercury Communications Ltd, 1996	r1b
Phone-Exchange mode of operation		r2a
Phone-Phone modes of operation		r2a
Pulsed no battery type "a-wire disconnected"	NZ PTC 107, 6.5	r1a
Wetting current	BT, SIN 242 Issue 2.2, November 2002 "Calling Line Identification Service"	r1a
Onboard ringing generator		r1a
Onboard line-test function		r1a
Front side shutdown button		r1a
Thermal management		r1a
Protection against equipment damage caused by faulty installation of cables		r1a
Partial operation of the user ports allowed		r1a
Front panel access. One shielded cable is connected to the front panel. It carries all 48 subscriber lines		r1a
Integrated filter for direct connection with a SUAD3/4 unit (ADSL/ADSL2/ADSL2plus) without external splitters (SUPC4 only)		r1a
No hardware settable options on the unit. All unit parameters are software settable with the Element Manager		r1a
Hot swapping: You can replace a SUPx4 unit without interfering with any other units. No actions on powering, configuration or commissioning need to be taken if you remove/replace a SUPx4 unit		r1a
Alarm reporting	ITU-T X.733 (1992) Information technology – open systems interconnection – systems management: Alarm reporting function	r1a
Power supply		r1a
- Power supply range V_{BAT}	refer to [201] System Description "MileGate R5B"	
- Maximum current consumption, I_{VBAT} $V_{BAT} = -48 V$	1.5 A	
- Maximum total power requirement from battery, P_{TOT} $V_{BAT} = \text{nominal voltage}$	70 W	
- Maximum basic power consumption from battery (all ports disabled), $V_{BAT} = \text{nominal voltage}$	20 W	

Table 4: Main functions and specifications (continued)

Feature	Rating or standard	Release
Mechanical parameters		r1a
- Construction practice	19 inch	
- Height of unit (1 HU = 44.45 mm)	6 HU	
- Width of unit (1 TE = 5.08 mm)	4 TE (1 slot)	
- Size of the PCB (H x D)	233 mm x 220 mm	
- Weight	470 g (SUPM4) 570 g (SUPC4)	
- RoHS	Directive 2002/95/EC of the European Parliament and of the Council of 27.1.2003 on the Restriction of the use of certain hazardous substances in electrical and electronic equipment	
- WEEE	Directive 2002/96/EC of the European Parliament and of the Council of 27.1.2003 on waste electrical and electronic equipment	
Reliability		r1a
- Calculated MTTF at 35 °C (MIL-HDBK-217F)	59 years (SUPM4) 53 years (SUPC4)	
Emission	refer to [201] System Description "MileGate R5B"	r1a
Immunity	refer to [201] System Description "MileGate R5B"	r1a
Safety	refer to [201] System Description "MileGate R5B"	r1a
Ambient conditions	refer to [201] System Description "MileGate R5B"	r1a

3.3 User ports

Table 5: User ports

Feature	Rating or standard
Number of user ports per SUPx4 unit	48
Maximum number of subscribers in off-hook per SUPx4 unit, duration infinite	15
Maximum number of subscribers in off-hook per SUPx4 unit, reduced loop current, duration infinite	48

3.4 Voice transmission specification

Table 6: Voice transmission specification

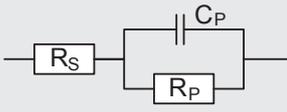
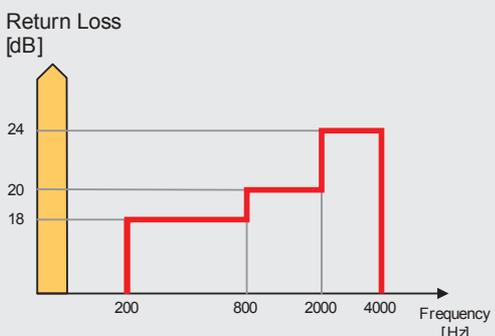
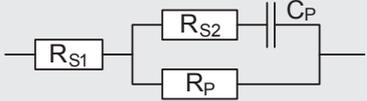
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Return loss					Q.552; 2.2.1.2; Fig. 1																																																														
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Impedance unbalance about earth					Q.552; 2.2.2; Fig. 2																																																														
Relative voice levels					Q.552; 2.2.3.1																																																														
- Input (Subscriber → SUPx4):					-4 ... +4 dBr																																																														
- Output (SUPx4 → Subscriber):					-10 ... 0 dBr																																																														
- Selectable in steps of 0.5 dB																																																																			
Tolerances of relative levels					Q.552; 2.2.3.2																																																														
Variation of gain with input level					Q.552; 3.1.1.4; Fig. 4																																																														
Loss distortion with frequency					Q.552; 3.1.1.5; Fig. 5a, b																																																														
Absolute group delay					Q.552; 3.1.2.1																																																														
Group delay distortion with frequency					Q.552; 3.1.2.2																																																														
Crosstalk					Q.552; 3.1.4																																																														
Input signals above 4.6 kHz					Q.552; 3.1.6.1																																																														

Table 6: Voice transmission specification (continued)

Feature	Rating or standard																																					
	SUPM4	SUPC4																																				
Level of individual components	Q.552; 3.1.7.1																																					
Terminal Balance Return Loss	<p>The following test networks are supported. The test network ID must correspond to the voice impedance ID. Refer to Q.552; 3.1.8.1; Fig. 10:</p>  <table border="1"> <thead> <tr> <th>ID</th> <th>R_S [Ω]</th> <th>R_P [Ω]</th> <th>C_P [nF]</th> </tr> </thead> <tbody> <tr> <td>a</td> <td>900</td> <td>0</td> <td>-</td> </tr> <tr> <td>b</td> <td>600</td> <td>0</td> <td>-</td> </tr> <tr> <td>c</td> <td>600</td> <td>0</td> <td>-</td> </tr> <tr> <td>d</td> <td>200</td> <td>680</td> <td>100</td> </tr> <tr> <td>e</td> <td>370</td> <td>620</td> <td>310</td> </tr> <tr> <td>f</td> <td>220</td> <td>820</td> <td>115</td> </tr> <tr> <td>g</td> <td>370</td> <td>620</td> <td>310</td> </tr> <tr> <td>h</td> <td>270</td> <td>750</td> <td>150</td> </tr> </tbody> </table>		ID	R _S [Ω]	R _P [Ω]	C _P [nF]	a	900	0	-	b	600	0	-	c	600	0	-	d	200	680	100	e	370	620	310	f	220	820	115	g	370	620	310	h	270	750	150
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Weighted noise	Q.552; 3.3.2.1																																					
Total distortion	Q.552; 3.3.3; Fig. 14 a, b																																					

3.5 Signalling specification

Table 7: Signalling specification - DC loop feeding

Feature	Rating or standard	
	SUPM4, SUPC4 no ADSL	SUPC4 with ADSL
On-hook voltage unloaded @ $V_{BAT} = -39.5 \dots -60.0 V_{DC}$	$U_{ONHOOK} = -53 \dots -59 V$	$U_{ONHOOK} = -44 \dots -50 V$
@ $V_{BAT} = -60.0 \dots -72 V_{DC}$	$ U_{ONHOOK} = V_{BAT} - 2 V \pm 3 V$	$U_{ONHOOK} = -44 \dots -50 V$
On-hook voltage @ $I_{LOOP} = 2.0 mA$	$ U_{ONHOOK} \geq 44 V$	
On-hook voltage @ $I_{LOOP} = 5.0 mA$	$ U_{ONHOOK} \geq 44 V$	
Maximum on-hook loop current	$I_{LOOP} \leq 5 mA$	
Loop current	Constant current feeding	
Selectable loop currents	15.0 mA, $\pm 10\%$ 19.5 mA, $\pm 10\%$ 23.5 mA, $\pm 10\%$ 30.0 mA, $\pm 10\%$ 39.0 mA, $\pm 10\%$ 45.0 mA, $\pm 10\%$	
Normal polarity	a-wire is more positive than b-wire. a-wire is close to GND but still negative.	
Maximum loop resistance	2 kOhm including the terminal. This fulfils the requirements of a long haul interface.	
Off-hook detection @ default loop current (23.5 mA)	$I_{LOOP} \geq 15 mA$	
On-hook detection	$I_{LOOP} \leq 7 mA$	

Table 8: Signalling specification - off-hook detection timing

Feature	Rating or standard	
	SUPM4	SUPC4
Safe detection	$t_{line} \geq 20 ms$	
No detection	$t_{line} < 15 ms$	

If a wake up signal, e.g. a polarity reversal, is sent out to initiate CLIP, the terminal will draw a short current pulse which can be interpreted by the SUPx4 as an off-hook event. So the detection time for off-hook has to be increased to prevent this false off-hook detection to $\geq 200 ms$.

In the V5CAS mode of operation, the off-hook timing parameter is configured in the CPS of the IPSxx or PCOMx unit as the Connect Timeout parameter (HS1.3).

In the MCAS mode of operation the off-hook detection time is predefined to 200 ms in the SUPx4.

Table 9: Signalling specification - reduced battery

Feature	Rating or standard	
	SUPM4	SUPC4
During the "reduced battery" state, the loop current is reduced to a predefined level. This level is set to a value that still ensures a correct on-hook/off-hook detection.		
Minimum loop current	15 mA	

Table 10: Signalling specification - pulse dialling

Feature	Rating or standard	
	SUPM4	SUPC4
<p>In the V5CAS mode of operation, the pulse dialling as well as the on-hook/off-hook times are defined by the custom parameter set (CPS) of the signalling interworking unit (IPSxx or PCOMx unit). In the MCAS mode of operation, the following predefined values are used:</p>		
		<p>Note that pulse dialling on SUPC4 can disturb the ADSL transmission. It is recommended not to use pulse dialling with the SUPC4 unit.</p>
Detection	≥ 22 ms	Do not use pulse dialling
No detection	< 15 ms	
Pulse length	22 ms ... 100 ms	
Pause length	22 ms ... 80 ms	
Interdigit time	≥ 140 ms	
Pulse cadence	7 pps ... 22 pps	
Pause/pulse ratio	50% ... 70%	
Distortion (line-CAS):	≤ 4 ms	

Table 11: Signalling specification - flash impulse

Feature	Rating or standard
<p>A flash impulse is transferred as an on-hook/off-hook signal. In the V5CAS mode of operation, the flash detection times are defined by the custom parameter set (CPS) of the signalling interworking unit (IPSxx or PCOMx unit). In the MCAS mode of operation, the flash detection times are defined by the CAS. Note: If SUPx4 is in thermal overheat state 1 and a flash impulse is > 200 ms, then this flash impulse will interrupt the call since it is detected as a short but valid on-hook state.</p>	

Table 12: Signalling specification - ground key

Feature	Rating or standard	
	SUPM4	SUPC4
Detection during on-hook	on the negative wire (with normal polarity: b-wire)	
Detection during off-hook	on the a-wire or b-wire	
Detection time	≥ 6 ms	
No detection time	< 6 ms	
Delay (line-CAS):	≤ 100 ms	

Table 13: Signalling specification - DTMF dialling

Feature
DTMF signals are transmitted transparently in the voice band. The SUPx4 does not influence the DTMF signalling.

Table 14: Signalling specification - CLIP (Calling Line Identification Presentation)

Feature
CLIP is supported. This means that on-hook VF-transmission is possible during ringing pauses, after an initial ring or after an (initial) polarity reversal.

Table 15: Signalling specification - ringing voltage (part 1)

Feature
Each SUPx4 subscriber port has its own ringing signal source. The ringing signal is balanced, also called symmetrical. Note: The ringing signal characteristics “ring over b-wire”, “ring over a-wire” and “ring over b-wire ringing earth-backed” are not applicable.
The ringing voltage is superimposed on both, the a-wire and the b-wire. It is a contra directional voltage. The difference of these two voltages gives the ringing voltage.
The ringing signal has a DC offset of about 20 V _{DC} .
During ringing pause the normal on-hook voltage is applied to the line.

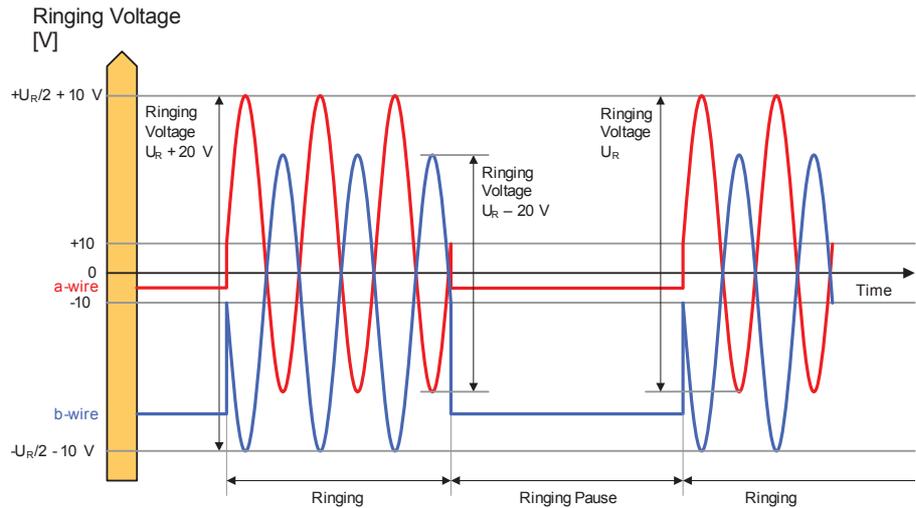


Table 16: Signalling specification - ringing voltage (part 2)

Feature	Rating or standard	
	SUPM4, SUPC4 no ADSL	SUPC4 with ADSL
Ring signal form	sinusoidal	
Ring frequencies f_{RING}	16 2/3, 20; 25; 50 Hz \pm 3 Hz	
Maximum ring signal voltage	$\leq 75 V_{RMS}$, unloaded	$\leq 50 V_{RMS}$, unloaded
Minimum ring signal voltage	$\geq 65 V_{RMS}$, max. load	$\geq 40 V_{RMS}$, max. load
Maximum load per subscriber @ $f_{RING} \leq 25Hz$ or @ $f_{RING} = 50 Hz$ or Definition of 1 REN:	3 REN 1.6 REN 2.5 kOhm 1.8 kOhm + 850 nF = 7.7 kOhm -76.5° @ 25Hz	
Maximum load per SUPx4 unit for simultaneous ringing	24 REN	
Maximum ringing current (short circuit):	$\leq 120 mA$	
Ringing signal crest factor	≥ 1.2	
Ringing delay CAS \rightarrow a/b-wire	$\leq 40 ms$	
Ringing distortion CAS \rightarrow a/b-wire	$\leq 40 ms$	
Ringing cadence	according to CAS	

Table 17: Signalling specification - metering

Feature	Rating or standard	
	SUPM4	SUPC4
Each subscriber circuit on the SUPx4 unit has its own metering generator. Metering pulses can be sent to the line during off-hook and up to 25.5 seconds after going on-hook.		
	Note that metering pulses on SUPC4 can disturb the ADSL transmission. It is recommended not to use metering with the SUPC4 unit.	
Metering frequencies	12 kHz ± 30 Hz 16 kHz ± 40 Hz	
Metering level at 200 Ohm load	0.5 ± 0.1 V _{RMS} 0.9 ± 0.2 V _{RMS} 1.8 ± 0.2 V _{RMS} 2.4 ± 0.3 V _{RMS} 3.0 ± 0.3 V _{RMS}	
Metering level unloaded	@ 0.5 V setting ≤ 0.9 V _{RMS} @ 0.9 V setting ≤ 1.7 V _{RMS} @ 1.8 V setting ≤ 3.0 V _{RMS} @ 2.4 V setting ≤ 4.0 V _{RMS} @ 3.0 V setting ≤ 5.0 V _{RMS}	
Pulse and pause length	V5CAS: According to the custom parameter set (CPS) of the signalling interworking unit (IPSxx or PCOMx unit). MCAS: According to the CAS	
Shaping	smooth ramping avoids any noise	

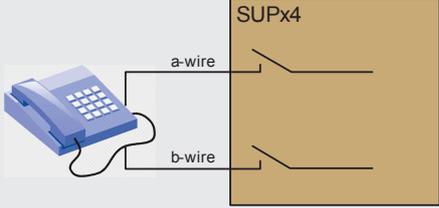
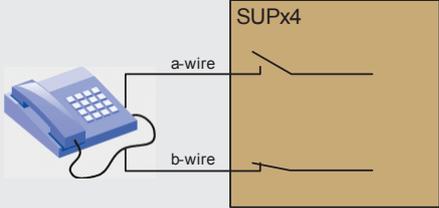
Table 18: Signalling specification - polarity reversal

Feature	Rating or standard	
	SUPM4	SUPC4
Polarity reversal with normal polarity (a-wire more positive than b-wire), off-hook	supported	
Polarity reversal with reversed polarity (b-wire more positive than a-wire), off-hook	supported	
Polarity reversal with normal polarity (a-wire more positive than b-wire), on-hook	supported if I _{LOOP} ≥ 1 mA	
Polarity reversal with reversed polarity (b-wire more positive than a-wire), on-hook	supported if I _{LOOP} ≥ 1 mA	
Delay CAS → a/b-wire	≤ 100 ms	
Smooth polarity reversal	supported	

Table 19: Signalling specification - pulsed no battery

Feature	Rating or standard
	Pulsed no battery is supported in the V5CAS mode of operation only.
The SUPx4 unit supports two types of pulsed no battery:	

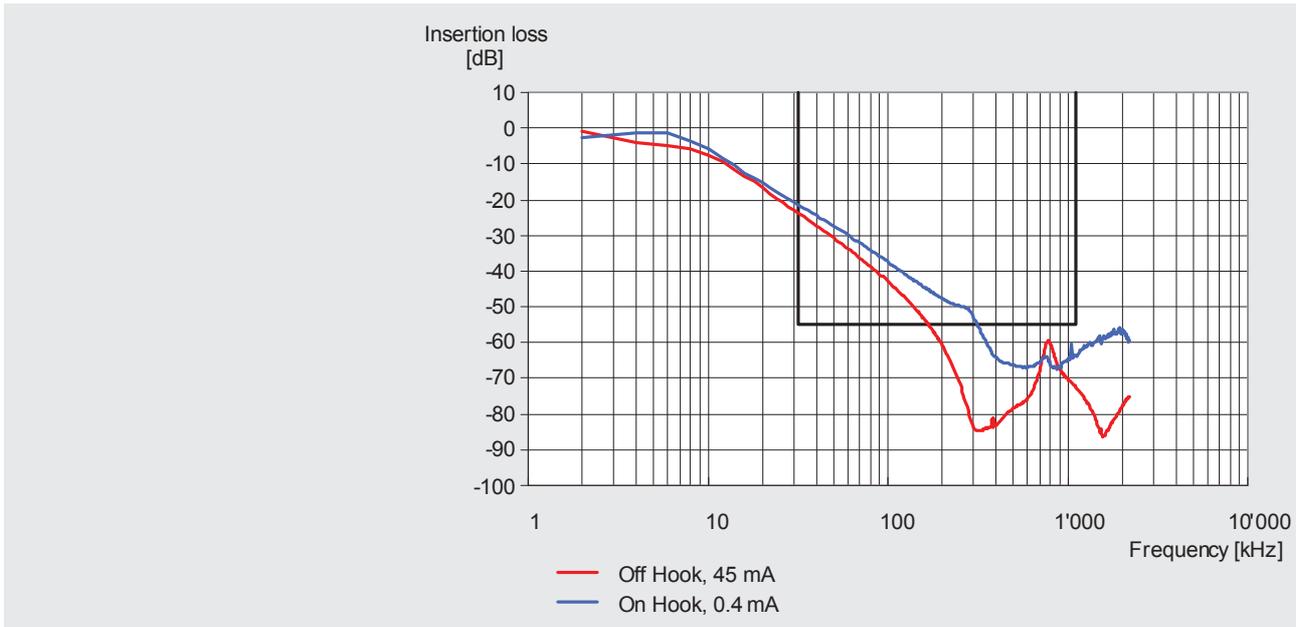
Table 19: Signalling specification - pulsed no battery (continued)

Feature	Rating or standard
	<p>a-wire and b-wire disconnected (default): An information element (IE) "pulsed no battery" causes a disconnect of both wires.</p> 
	<p>a-wire disconnected: An information element (IE) "pulsed no battery" disconnects the a-wire only. The b-wire remains on the $-V_{BAT}$.</p> 
<p>Delay CAS → a/b-wire</p>	<p>≤ 100 ms</p>

3.6 Filter insertion loss

Table 20: Filter insertion loss

Feature	Rating or standard
	A low pass filter is implemented on the SUPC4 unit only.
	The implemented filter does not fulfil the mask specifications for a splitter according to ETSI TS 101 952-1-1: 32 kHz to 1104 kHz: Insertion loss ≥ 55 dB



3.7 Thermal management

Table 21: Thermal management

Feature	Rating or standard
Normal state No restrictions.	$T \leq 70 \text{ }^{\circ}\text{C}$
Overheat state 1 In the V5CAS and MCAS direct line operation modes, new calls are possible only for high priority subscribers. Ongoing calls are not affected. In all other operation modes new calls are possible without restriction.	$T_{\text{ON}} > 70 \text{ }^{\circ}\text{C}$ $T_{\text{OFF}} < 68 \text{ }^{\circ}\text{C}$
Overheat state 2 All ongoing calls are immediately stopped.	$T_{\text{ON}} > 85 \text{ }^{\circ}\text{C}$ $T_{\text{OFF}} < 83 \text{ }^{\circ}\text{C}$

3.8 Line test

Table 22: Line test - cyclic line test

Feature	Rating or standard
Cyclic line-test interval	1 day 1 week
Cyclic line-test starting time	Any time is configurable

Table 23: Line test - line test measurement ranges and tolerances

Feature	Rating or standard
Isolation	
a - b	0 ... 800 k Ω
b - a	0 ... 800 k Ω
a - ground	0 ... 800 k Ω
b - ground	0 ... 800 k Ω
Foreign Voltage AC	
a - b	0 ... 250 V
a - ground	0 ... 250 V
b - ground	0 ... 250 V
Foreign Voltage DC	
a - b	0 ... 250 V
a - ground	0 ... 250 V
b - ground	0 ... 250 V
Noise	
a - b	-40 ... 0 dBm
Capacitance	
a - b	0 ... 40 μ F
a - ground	0 ... 40 μ F
b - ground	0 ... 40 μ F

Table 24: Line test - line test alarm thresholds

Feature	Rating or standard
Resistance/Isolation:	
a - b	10; 20; 30; 40; 50; 100 k Ω , or
b - a	"Not used"
a - ground	
b - ground	
Foreign voltage:	
DC	10, 20, 40, 50, 60 V _{DC} , or "Not used"
Foreign voltage:	
AC	5, 10, 20, 30, 40 V _{eff} , or "Not used"
Noise:	
a - b, in the range of 300 Hz ... 3400 Hz	-10, -20, -30, -40 dBm, or "Not used"
Capacitance	No threshold selectable since no alarm will be generated. The measured value will be displayed.

Table 25: Line test - permanent line check

Feature	Rating or standard
a-wire and b-wire short	not configurable
AC power cross	
Transversal current	
Longitudinal current	

3.9 Length of subscriber lines

Table 26: Length of subscriber lines

Feature	Rating or standard	
	SUPM4	SUPC4
<p>The maximum subscriber (loop) cable length depends on several factors. One important factor is the resistance of the loop and the connected telephone set. The DC-resistance of the two wires should not exceed 2x1000 Ohm including the telephone set. The telephone set is typically 200 ... 600 Ohm.</p> <p>Taking into account that the ADSL/ADSL2/ADSL2plus range of reach of the SUAD3 unit, used together with the SUPC4 unit, is much lower than the range of reach of a SUPM4 unit, the ringing voltage and the battery feed voltage of the SUPC4 unit have been reduced. With that the maximum loop length is also reduced compared to the SUPM4 unit.</p>		
Maximum cable length		
@ 0.4 mm wire diameter	5.0 km	limited by the ADSL loop length
@ 0.6 mm wire diameter	11.3 km	
@ 0.8 mm wire diameter	19.9 km	
@ 1.0 mm wire diameter	31.0 km	
<p>The above values are calculated under the assumption that the telephone set has a DC-resistance of 600 Ω.</p>		
	<p>Before you operate with a maximum line length investigate also the following criteria:</p> <ul style="list-style-type: none"> - Influence of the cable length on the function of the subscriber set (national standards for telephone sets). - Cable attenuation for voice transmission and/or - Metering pulses. 	
	<p>It is highly recommended to use twisted wire pairs in order to minimize the susceptibility to cross talk and induced voltages.</p>	

3.10 Power consumption

Table 27: Power consumption, $V_{BAT} = -48 V$

I_{Loop} [mA]	Loop length	Off-hook [n]	I_{VBAT} [A]	P_{TOT} [W]
-	-	0	0.17	8.2
15	short	16	0.42	20.1
19.5	short	16	0.47	22.5
23.5	short	16	0.52	24.8
30	short	16	0.59	28.3
39	short	16	0.70	33.4
45	short	16	0.78	37.3
15	long	16	0.60	28.8
19.5	long	16	0.72	34.4
23.5	long	16	0.82	39.2
30	long	16	0.96	46.2
39	long	16	1.18	56.4
45	long	16	1.30	62.4

The differentiation between short loop and long loop is the loop voltage, i.e. loop resistance x loop current. The indicative loop resistance for the **short** loop with the different loop currents is defined as follows:

- $R_{LOOP} < 1220 \Omega @ I_{LOOP} = 15 \text{ mA}$
- $R_{LOOP} < 940 \Omega @ I_{LOOP} = 19.5 \text{ mA}$
- $R_{LOOP} < 750 \Omega @ I_{LOOP} = 23.5 \text{ mA}$
- $R_{LOOP} < 530 \Omega @ I_{LOOP} = 30 \text{ mA}$
- $R_{LOOP} < 380 \Omega @ I_{LOOP} = 39 \text{ mA}$
- $R_{LOOP} < 320 \Omega @ I_{LOOP} = 45 \text{ mA}$

The table below shows the power consumption of the SUPx4 unit with a load of 0.1 Erlang, i.e. with 5 active subscribers.

Table 28: Power consumption @ 0.1 Erlang, $V_{BAT} = -48 V$

I_{Loop} [mA]	Loop length	Off-hook [n]	I_{VBAT} [A]	P_{TOT} [W]
15	short	5	0.25	11.9
19.5	short	5	0.26	12.6
23.5	short	5	0.28	13.4
30	short	5	0.30	14.5
39	short	5	0.34	16.1
45	short	5	0.36	17.3
15	long	5	0.30	14.2
19.5	long	5	0.33	15.6
23.5	long	5	0.35	17.0
30	long	5	0.40	19.0
39	long	5	0.46	22.2
45	long	5	0.51	24.3