ISO/IEC JTC 1/SC 25/WG 3(Kyoto2/Keller)026a
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Development of CLC TR 50174-99-1

Information technology - Cabling installation - Remote powering

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History

- ISO/IEC TR 29125
  - based on cable bundles in ventilated rooms
  - main focus on differences in Category and construction
- EN 50173-1 and ISO/IEC 11801(-1)
  - channel requirements for DC loop resistance
  - requirements at 20 degrees Celsius
- new high power remote power solutions claiming to be compliant with existing cabling standards brought to market

Initial Assumptions

- Different cable constructions will dissipate heat differently
- The main cause for the difference is copper wire diameter
- Installation conditions will influence heating much more than any other parameter
  - installations are often done in unventilated spaces, trunking, ducts, wall etc.
  - even if small bundles are used, they are often laid on top of each other and thereby effectively constructing bigger bundles
- Assessment of the installed bases should facilitate the use of new remote power applications

CLC TR 50174-99-1 Intent

Introduction

The EN 50174 series standards specify the specification, planning and practices applicable to installation of telecommunications cabling.

This Technical Report describes requirements and recommendations for the following aspects of cabling comprising balanced cabling components of Category 5 and above (as defined in EN 50173-1) intended to support remote powering:

- specification;
- planning;
- installation;
- administration;
- operation.

This Technical Report also defines a set of specific implementations which are the basis of a mathematical model and a matching testing protocol used to qualify that mathematical model.

The delivery of POTS, ISDN, PoE and PoEplus using fully energised bundles of up to 100 cables in accordance with EN 50288-x-1 in ventilated pathways is not considered to represent a problem and is not considered in this Technical Report. In addition, there is no reported evidence of such installations of those remote powering applications producing problems in unventilated conditions. As a result, this Technical Report will only consider such situations if the modelling and subsequent testing of cabling implementations indicates any cause for concern.

CLC TR 50174-99-1 Structure

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CONTENTS

- Step 1: obtain data from cabling in a range of installation environments

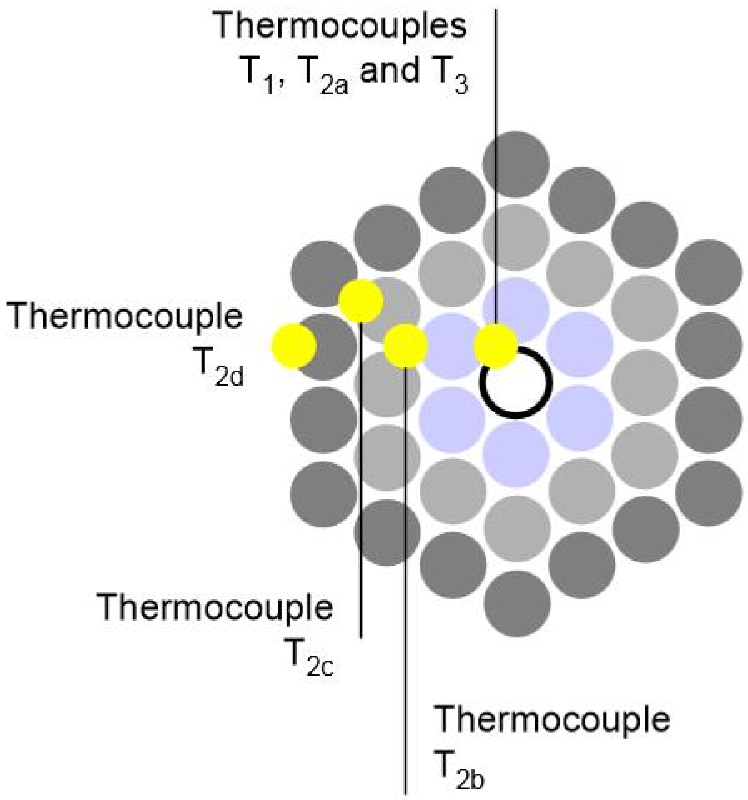
Prior Work

- Previous test methods
  - different test methods have been used to determine cable heating
- Modelling
  - reuse of the work on cable heating already done on power cables appears problematic
  - TC215 WG2 has reviewed a number of attempts at making formulas for heating
  - early standard work on this also existed in Germany
- Correlation
  - results from previous test results and available models do not show good agreement

- Step 2: define a test methodology
- Step 3: find a model that correlates to observations

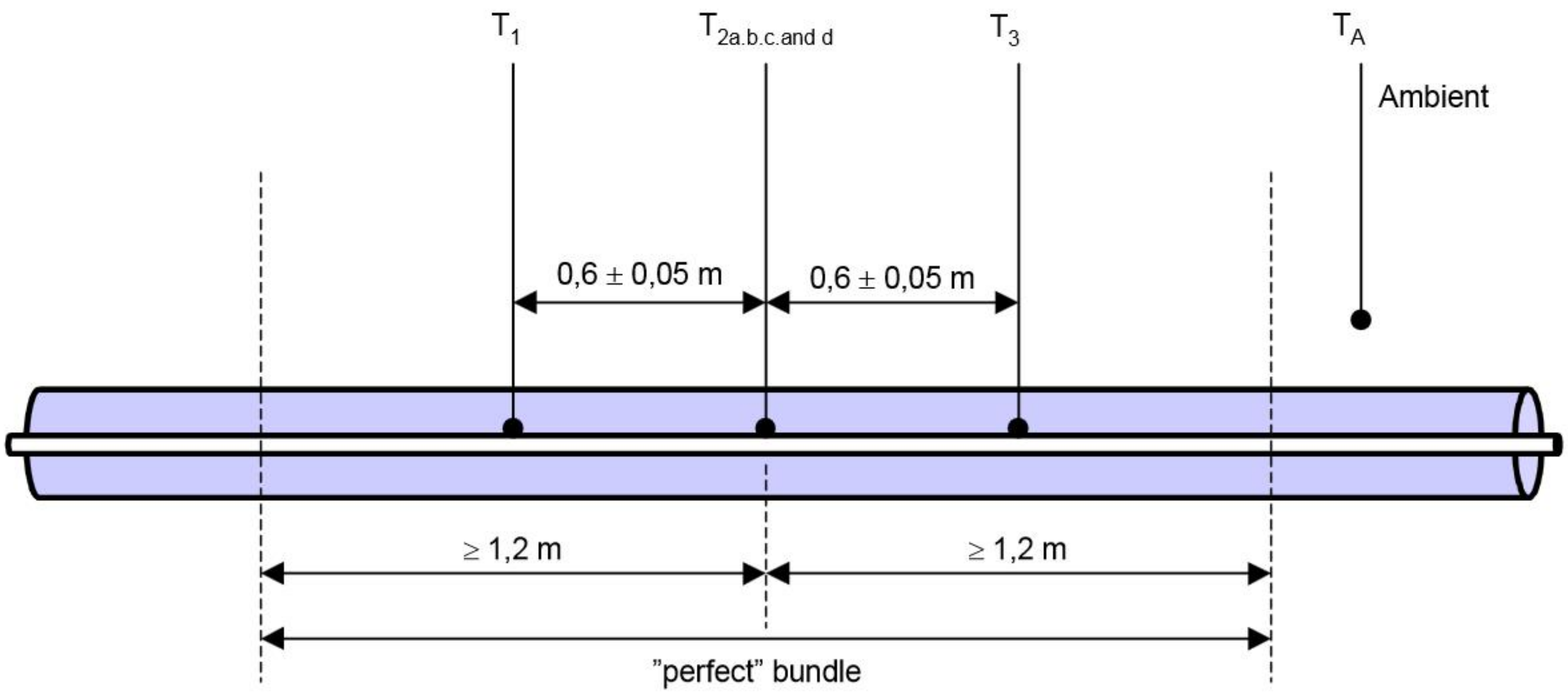
Test Methodology for CLC TR 50174-99-1

- To compare results a uniform test method had to be developed
- 37 cable to make “perfect” bundle



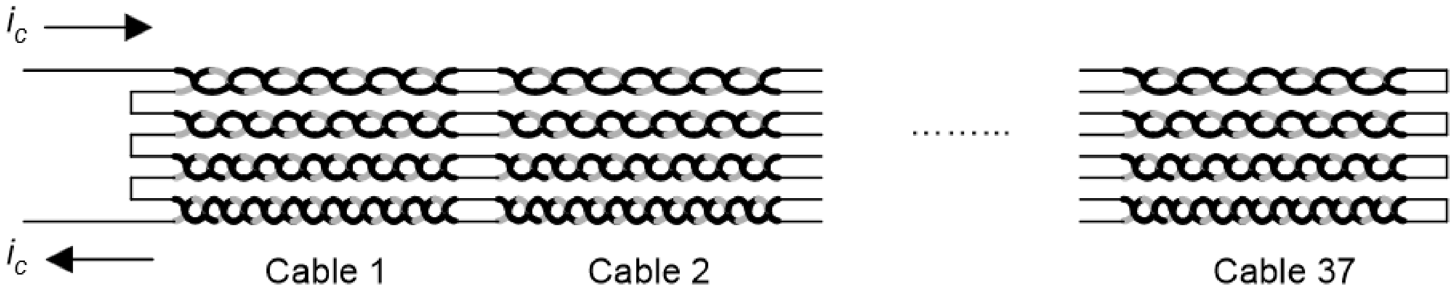
Test Methodology for CLC TR 50174-99-1

- To compare results a uniform test method had to be developed
- T_1 and T_3 monitors the heat dissipation through the bundle ends



Test Methodology for CLC TR 50174-99-1

- To compare results a uniform test method had to be developed
- All wires carry the same current



- Step 4: obtain results from multiple "test rigs"
  - 3 test "laboratories" undertaking work and submitting results

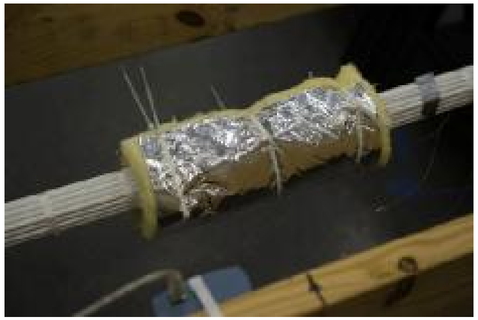
Installation condition testing

Cable bundle

Plastic duct

Insulation layer 1

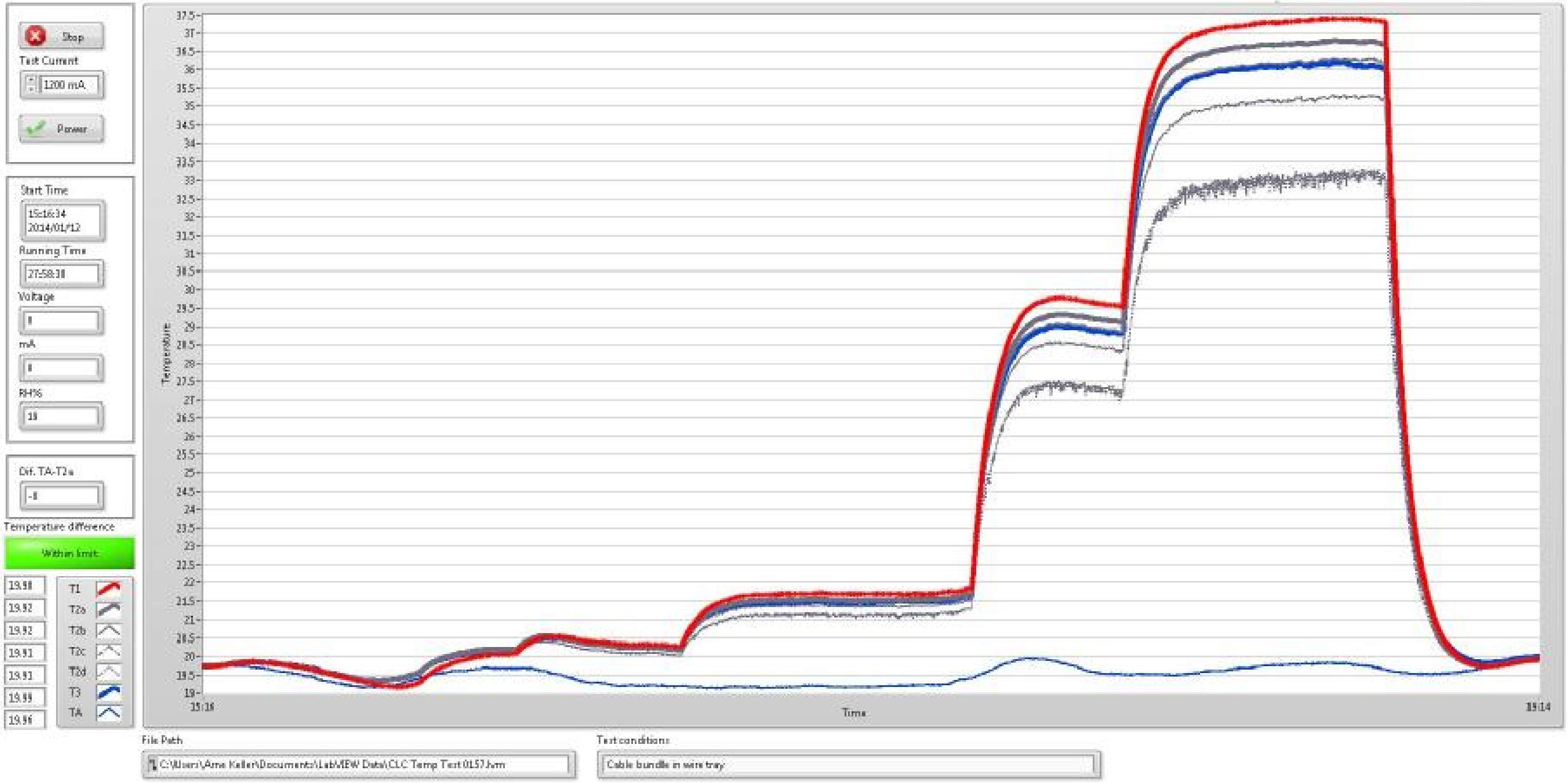
Insulation layer 2



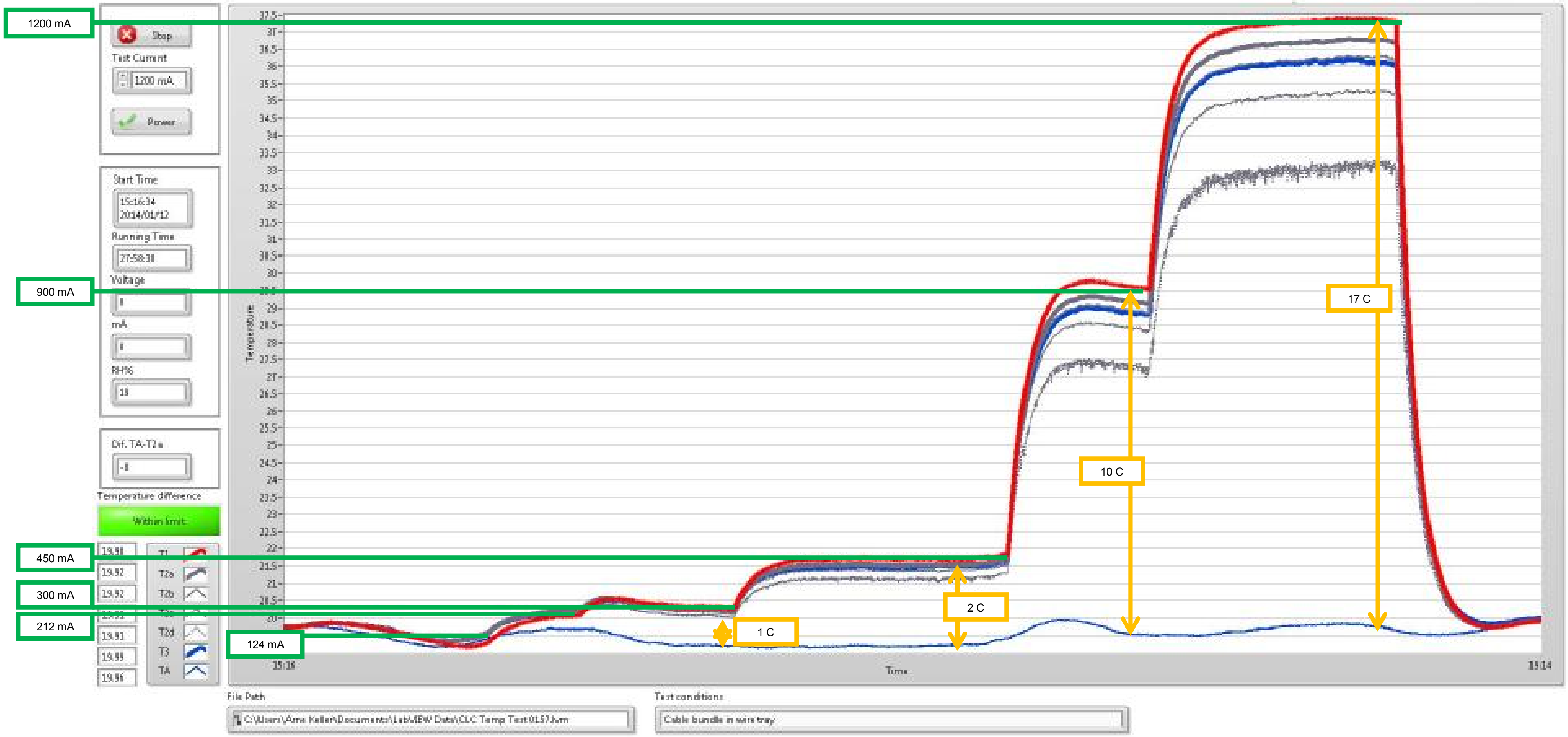
Simulated fire barrier

PSU and Current measurement

Example: measurement interface



Not verified result of Cat 6_A F/UTP in wire tray



Example: numeric output from test

Date	2014-01-12	2014-01-12	2014-01-12	2014-01-12	2014-01-12	2014-01-12	2014-01-12	2014-01
Time	16:36.3	16:36.3	16:36.3	16:36.3	16:36.3	16:36.3	16:36.3	16:3
Y_Unit_Label	Sec	Celcius	Celcius	Celcius	Celcius	Celcius	Celcius	Celcius
X_Dimension	Time	Time	Time	Time	Time	Time	Time	Time
X0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E
Delta_X	1	1	1	1	1	1	1	
End_of_Header								
X_Value	Seconds	T1	T2a	T2b	T2c	T2d	T3	TA
	0	19.966545	19.751987	19.749658	19.683615	19.593465	19.147033	19.434
	10	19.960254	19.738511	19.736022	19.664879	19.590024	19.134478	19.435
	20	19.960371	19.741409	19.748584	19.664465	19.58961	19.139232	19.438
	30	19.954441	19.744747	19.746141	19.66712	19.601072	19.132371	19.44
	40	19.968054	19.744228	19.736177	19.671986	19.600608	19.140893	19.460
	50	19.954306	19.729781	19.743621	19.662977	19.59183	19.13154	19.446
	60	19.959431	19.724943	19.735698	19.665945	19.594799	19.126004	19.435
	70	19.96212	19.756367	19.743546	19.684918	19.608674	19.141446	19.459
	80	19.962739	19.744009	19.747072	19.668978	19.59366	19.139746	19.442
	90	19.962407	19.743908	19.746496	19.674196	19.600964	19.131763	19.459
	100	19.966233	19.747736	19.748458	19.675694	19.606634	19.14533	19.454
	110	19.959915	19.746283	19.74785	19.678331	19.607185	19.142485	19.453

Early Test Results

- 2- or 4-pair powering
  - both methods gives the same heating when the same energy is released in the cable
- Ambient temperature influence
  - the heating from the applications adds on top of the ambient temperature
  - different ambient temperature does not change the temperature rise
- Cable bundles in free air and embedded in insulation were tested to show extremes
  - for d.c. resistance = 7,1 Ω/100 m
  - Free air
    - i_c @ 300mA: Temperature rise = 1.2 degrees Celsius
    - i_c @ 900mA : Temperature rise = 20 degrees Celsius
  - Insulation air
    - i_c @ 300mA: Temperature rise = 7 degrees Celsius
    - i_c @ 900mA : Temperature rise = 75 degrees Celsius

Mathematical Model Development

- Early German model is being evaluated
- IEC TC64 model to be re-evaluated (simple spreadsheet)

- 2 universities has shown interest in helping develop a model

- Sufficient test results have to be available to do this work

Issues for Cabling and Components

- Cables with resistance higher than specified in the cable standards will cause more heating
  - channel loop resistance should be changed to a Ohm/m requirement as included in ISO/IEC DTR 11801-99-1
- CLC cable committees have been requested to re-consider the existing common d.c. resistance for all cable Categories

This concludes the part of the presentation endorsed by CLC TC215/WG2

Personal observations

- Universal deployment of remote powering demands:
  - Worst case cabling taken into account (Class D/Cat 5(E))
  - Full channel length have to be assumed for temperature reduction (if correct design have been done with minimum performing component no additional heating can be allowed, reality shows that there are no problem today)
  - Average installation conditions assumed (to be determined/ffs)
  - Average number of cables energized (to be determined/ffs)
  - Average amount of power on used cables (to be determined/ffs)

- Engineered use of remote power to the specific installation site allows:
  - Actual cabling performance (Wire size)
  - Actual installation conditions
  - Actual cable length
  - Actual number of cables to be energized
  - Actual power used on used cables
  - ***This will in the majority of cases allow a much higher power delivery maintaining channel performance and lifetime of cables***