G3-PLC in Eskom

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30 March 2023

Eskom

GENERATION CAPACITY		TRANSMISSION		DISTRIBUTION	
30 power stations		Transmission lines	33 158km	Distribution lines	47 809km
Total nominal capacity of	46 466MW	Transformer capacity	154 500MVA	Reticulation lines	310 290km
Base-load stations		Grids	9	Cables	8 288km
Coal-fired stations	38 773MW			Customers	6.7 million
Nuclear power	1 860MW			Operating clusters	5
Mid-merit and peaking stations				Zones	27
Pumped storage	2 724MW			CNCs	308
Hydro stations	600MW			Service hubs	101
OCGTs	2 409MW			Contact centres	8
Self-dispatching energy					
Sere Wind Farm	100MW				

- **Eskom** is a South African electricity public utility.

- The company is divided into Generation, Transmission and Distribution divisions, and together Eskom generates approximately 95% of electricity used in South Africa, amounting to ~45% used in Africa.

- Approximately **700 000 G3-PLC devices installed** (~ 500 000 basic prepayment meters and ~200 000 smart prepayment meters)
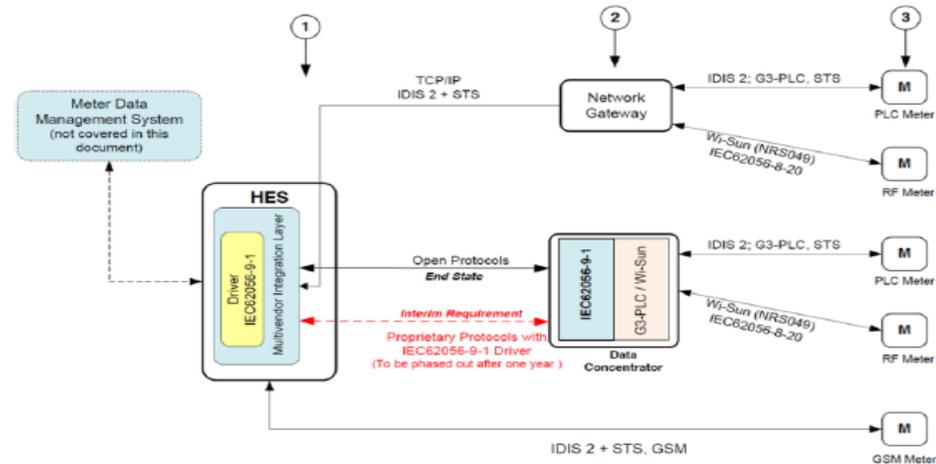
SOURCE: https://en.wikipedia.org/wiki/Eskom, https://www.eskom.co.za/about-eskom/company-information/

2016 — G3-PLC part of technical specifications for Eskom Smart Prepayment Project in 2016 for rolling out ~36 000 meters

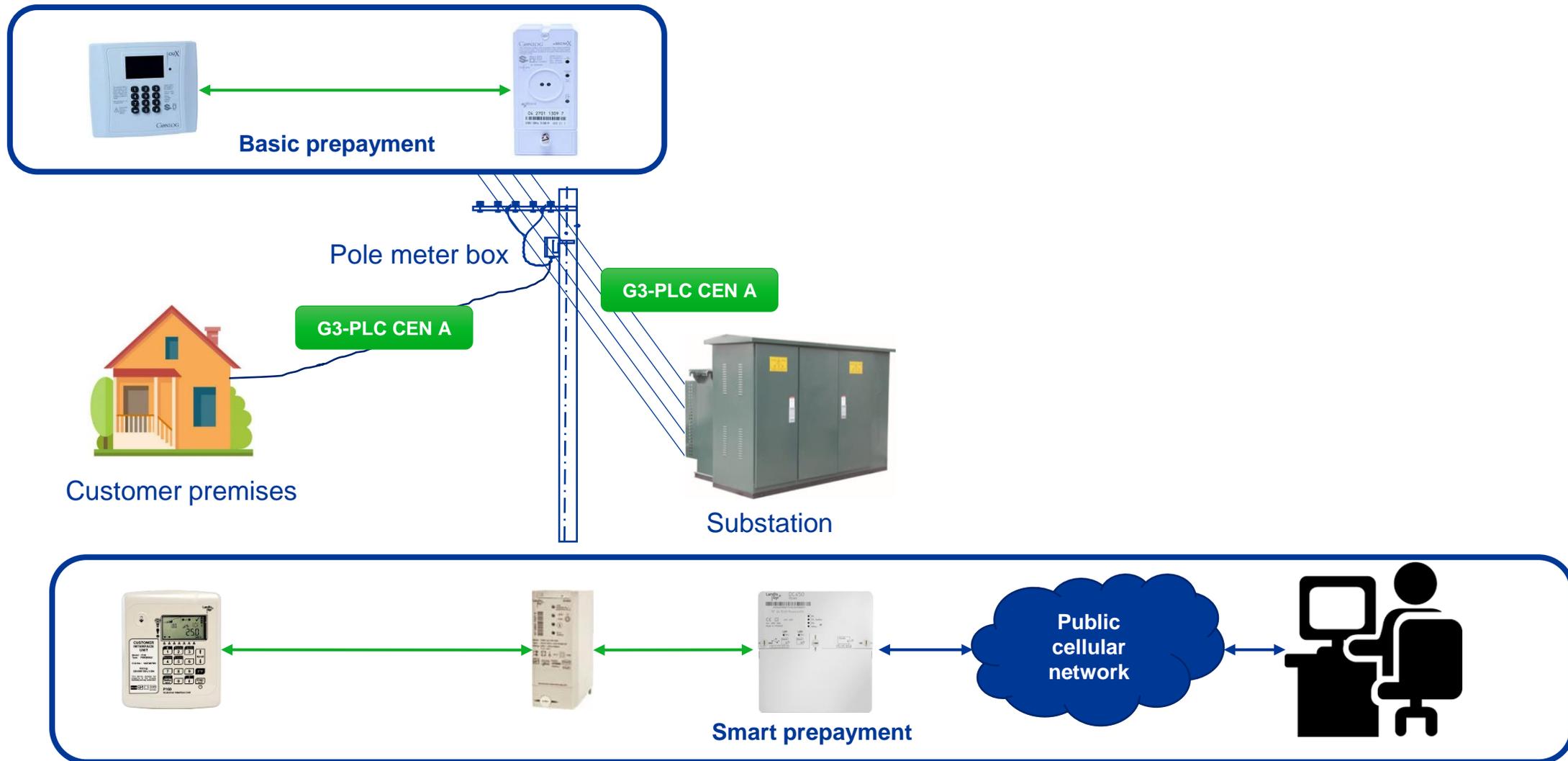**2017** — G3-PLC included in Eskom "Basic Prepayment Meter Standard"

2018 — G3-PLC part of Eskom "Smart Metering Standard"


Standardization/Adoption mainly driven by:

- Robustness of G3-PLC in comparison to G1-PLC (PLAN) deployed in earlier years!

- Healthy eco-system of both smart and basic prepayment metering products from manufacturers in Africa, Asia and Europe.

Basic and smart prepayment meter installations

Basic prepayment

Pole meter box

G3-PLC CEN A

G3-PLC CEN A

Customer premises

Substation

Smart prepayment

Public cellular network

Split meter architecture standardization

- CIU needs to be paired to unique meter, and vice versa
- After outage, customer needs immediate access to prepayment data via CIU
  - (What is the most efficient architecture to rebuild G3-PLC connectivity between CIU and meter?)
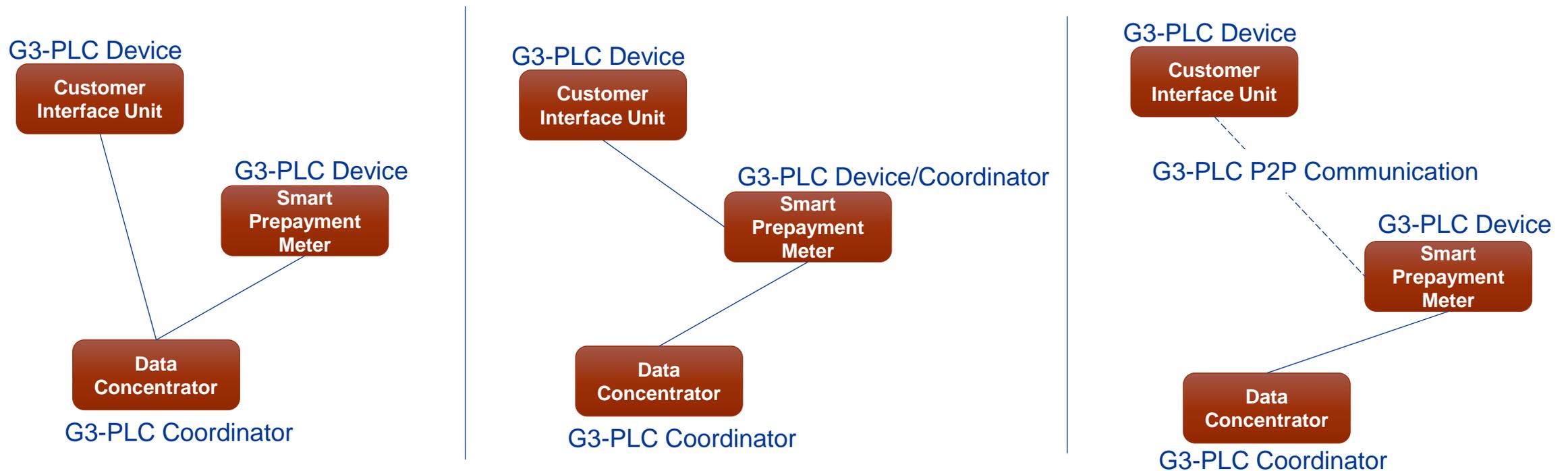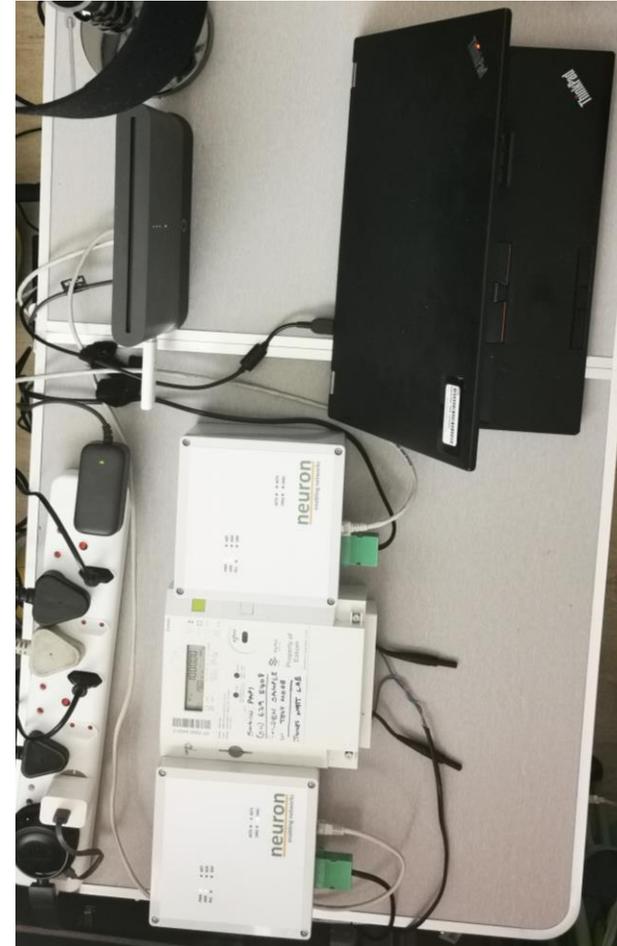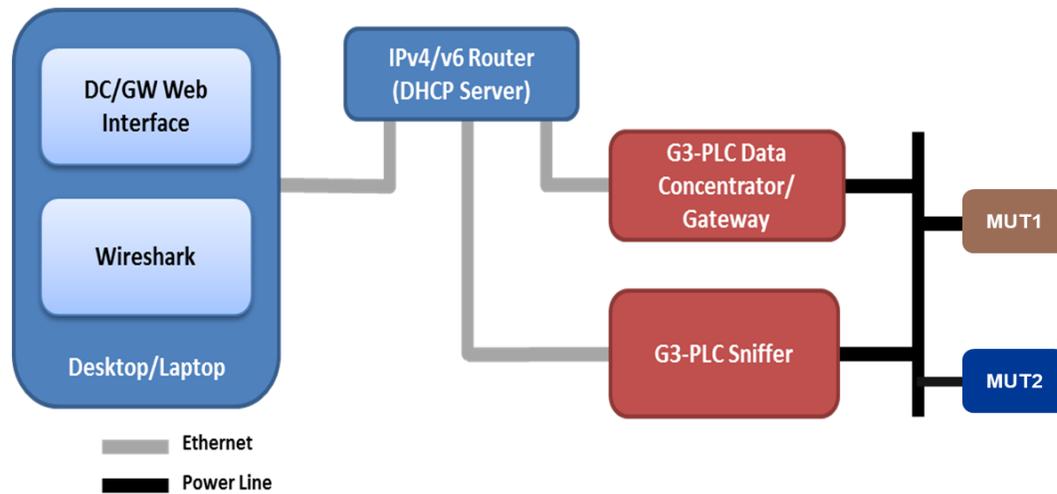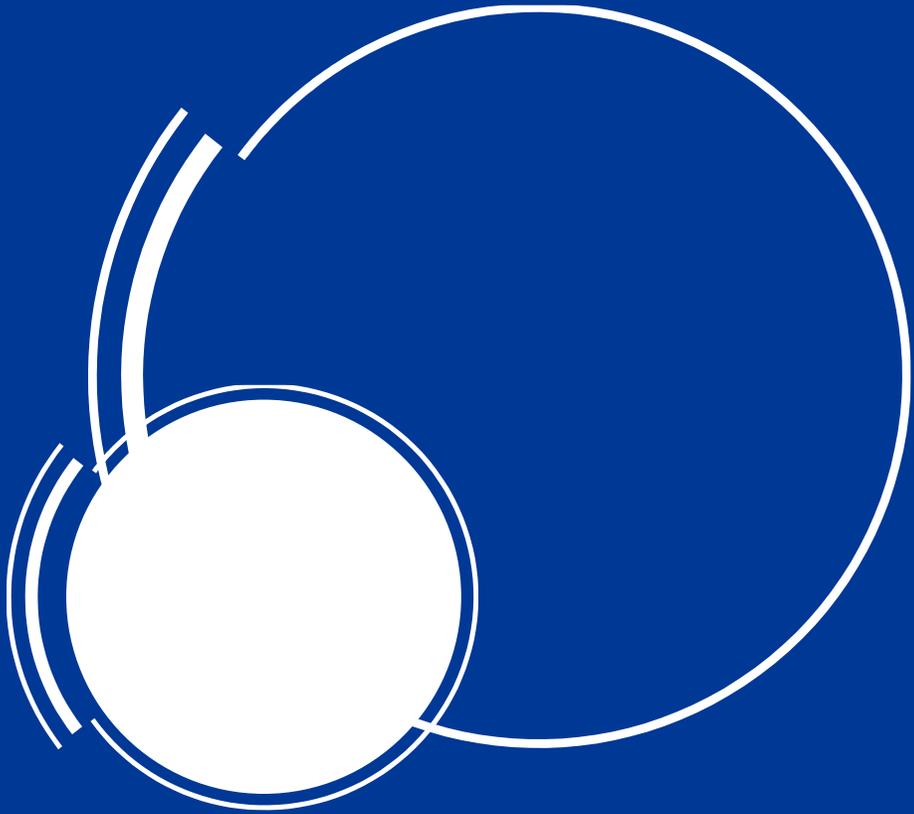
```
… 661.4                           BROADCAST          nBox  G3_FCC        0x926a   1 Bytes BCN REQ
… 672.5      COORDINATOR                             nBox  G3_FCC        0xef52   6 Bytes BCN PAN_C
… 677.8                                              nBox  G3_FCC+ DATA 0x50b1  42 Bytes LBP                    CHALLENGE EAPReq(mes1)
… 677.9                                              nBox  G3_FCC+ DATA 0x3437  82 Bytes LBP                    JOINING EAPRes(mes2)
… 697.8                                              nBox  G3_FCC+ DATA 0xfe92  42 Bytes LBP                    CHALLENGE EAPReq(mes1)
… 698.0                                              nBox  G3_FCC+ DATA 0xfe92  42 Bytes LBP                    CHALLENGE EAPReq(mes1)
… 718.0                                              nBox  G3_FCC+ DATA 0xcbb7  42 Bytes LBP                    CHALLENGE EAPReq(mes1)
… 718.2                                              nBox  G3_FCC+ DATA 0xcbb7  42 Bytes LBP                    CHALLENGE EAPReq(mes1)
… 738.2                                              nBox  G3_FCC+ DATA 0x94d8  42 Bytes LBP                    CHALLENGE EAPReq(mes1)
… 793.4                                              nBox  G3_FCC+ DATA 0x853a  12 Bytes LBP                    JOINING
… 793.5                                              nBox  G3_FCC+ DATA 0x856b  42 Bytes LBP                    CHALLENGE EAPReq(mes1)
… 793.5                                              nBox  G3_FCC+ DATA 0xefc8  82 Bytes LBP                    JOINING EAPRes(mes2)
… 813.5                                              nBox  G3_FCC+ DATA 0x0e90  42 Bytes LBP                    CHALLENGE EAPReq(mes1)
… 833.5                                              nBox  G3_FCC+ DATA 0x3bb5  42 Bytes LBP                    CHALLENGE EAPReq(mes1)
… 853.5                                              nBox  G3_FCC+ DATA 0x64da  42 Bytes LBP                    CHALLENGE EAPReq(mes1)
… 896.2                                              nBox  G3_FCC+ DATA 0xb296  12 Bytes LBP                    JOINING
… 896.3                                              nBox  G3_FCC+ DATA 0x013a  42 Bytes LBP                    CHALLENGE EAPReq(mes1)
… 896.4                                              nBox  G3_FCC+ DATA 0x086a  82 Bytes LBP                    JOINING EAPRes(mes2)
… 916.3                                              nBox  G3_FCC+ DATA 0x03f8  42 Bytes LBP                    CHALLENGE EAPReq(mes1)
… 936.4                                              nBox  G3_FCC+ DATA 0x36dd  42 Bytes LBP                    CHALLENGE EAPReq(mes1)
… 956.4                                              nBox  G3_FCC+ DATA 0x69b2  42 Bytes LBP                    CHALLENGE EAPReq(mes1)
… 959.5                           BROADCAST          nBox  G3_FCC        0x1d80   1 Bytes BCN REQ
… 964.1      COORDINATOR                             nBox  G3_FCC        0xa68a   6 Bytes BCN PAN_C
```

```
0... .... .... .... = Type       : From LBD (0)
.001 .... .... .... = Code        : 1  JOINING
.... 0000 0000 0000 = Trans. ID   : ok (0)
A_LBD        : 095146fffe003199    (095146):FFFE003199
Embedded EAP Message
    0000 10.. = Code              : Response (2)
    0000 0000 = Identifier        : 0
    .... .... 0100 0110 = Length  : 70
    0010 1111 = Type              : EAP-PSK (47)
    0100 0000 = Flags             : EAP-PSK second message (64)
    EAP-PSK RAND_S   : 888d6feb07b79f5ab6c007ca035b1bb5
    EAP-PSK RAND_P   : 7e3dcd082d0c0d4ad98c1b4170be8f79
    EAP-PSK MAC_P    : 9ef0bb489592bb695fd6d4769f904f62
    EAP-PSK ID_P     :                                  139
G3 MFR : MAC Footer
```

Not EUI-64 format!

- Compliant with G3-PLC specification
- However, number only applicable to Japanese market (not South Africa)

Thank you