Title: Battery Life Measurement Technique

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1 INTRODUCTION

1.1 DOCUMENT SUMMARY

This document is the result of a joint effort between ECTEL/TMS who represent European Manufacturers of GSM ME and the Terminal Working Group of the GSM MoU Association to develop a common method for battery life measurements. The procedure is provided for information and unrestricted use.

This document aims to provide an agreed and common means for quoting battery life and current consumption figures for GSM Mobile Stations comparable to the fuel consumption measurement method in liters/100km or miles/liter. The document introduces the consumption of current drain of the particular mobile phone given in mA.

It is important to note that the capacity of a particular battery may vary by 30% and more, therefore the calculated values may not always be reflected in real life. Subsequently if the measured battery capacity is to be used rather than the nominal capacity measurements then measurements should be made on a significant number of batteries and the average taken to determine likely capacity.

When quoting measurements made under this technique it is required that the following statement is made.

> **"Measurements to GSM Association/ECTEL Battery Life Measurement Technique Document"**

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2 TEST METHOD

2.1 PARAMETERS

When testing MS battery life, it is initially assumed that the MS is a single band MS operating with the GSM FR speech codec. The following parameters shall be used.

Table-1 Common settings

Parameters	Settings
Speech Codec	GSM FR
BCCH	GSM900: ARFCN 62 GSM1800: ARFCN 710 GSM1900: ARFCN 660
PLMN	HPLMN
RX Level	- 82 dBm
Speech	None
Volume	Max
Backlight	Default
Temperature	18-25° C
Keypad	No extra pressing

Table-2 Idle Mode Settings

Parameters	Settings
SIM	Phase 2 with clock stop, supporting the appropriate voltage of the MS under test.
Cell reselection	No
BA list	16 frequencies as follows GSM900:1,9,17,26,34,42,50,58, 67,75,83,91,99,108,116,124. GSM1800:512,530,560,580,610, 640,670,700,720,740,760,790 810,840,860,885 GSM1900: 512, 530, 550, 570, 590, 610, 630, 650, 670, 690, 710, 730, 750, 770 ,790, 810

SMS CB	OFF
DRX BS_PA_MFRMS	5 multiframes

Table-3 Dedicated Mode Settings

Parameters	Setting
Hopping	ON, 5 frequencies GSM900: 1, 30, 62, 93, 124 GSM1800: 512, 600, 690, 780, 885. GSM1900: 512, 590, 670, 750, 810.
Handover	No
MS-Tx-Lev	29 dBm GSM900 28 dBm GSM1800
BA List	16 frequencies as follows GSM900:1,9,17,26,34,42,50,58,67,75,83,91,99,108,116,124 GSM1800:512,530,560,580,610,640,670,700,720,740,760,790,810,840,860,885 GSM1900: 512, 530, 550, 570, 590, 610, 630, 650, 670, 690, 710, 730, 750, 770 ,790, 810
Uplink-DTX	OFF
Call	Continuous

2.2 TEST PROCEDURE

2.2.1 Battery Current Drain

The following procedure shall be used to measure the average current drain of the MS:

Idle Mode:

1. Fully charge the battery on the MS, with the MS deactivated, following the manufacturers charging instructions stated in the user manual, using the manufacturers charger.
2. Remove the battery from the MS and wait one hour.

3. Re-connect the battery with the measurement circuitry described in section 2.2.3 in series with the battery (positive terminal).
4. Activate the MS.
5. Wait 30 seconds after activation for MS boot processes to be completed.
6. In idle mode, record the current samples over a continuous 30 minute period.
7. Calculate the average current drain (I_{idle}) from the measured samples.

Dedicated Mode:

1. Fully charge the battery on the MS, with the MS deactivated, following the manufacturers charging instructions stated in the user manual, using the manufacturers charger.
2. Remove the battery from the MS and wait one hour.
3. Re-connect the battery with the measurement circuitry described in section 0 in series with the battery (positive terminal).
4. Activate the MS.
5. Wait 30 seconds after activation for MS boot processes to be completed.
6. Initiate a call and wait for 30 seconds.
7. In dedicated mode, record the current samples over a continuous 10 minute period.
8. Calculate the average current drain ($I_{dedicated}$) from the measured samples.

2.2.2 Measurement Circuitry

Sampled measurements of the voltage across the sense resistor shall be performed. The following measurement parameters shall be used:

Parameter	Idle Mode Setting	Dedicated Mode Setting
Measurement Resistance	0.5 ohms	0.1 ohms
Tolerance/Type	1%, 0.5W, high precision metal film resistor	1%, 0.5W, high precision metal film resistor
Sampling frequency	50 ksps	50 ksps
Resolution	0.1mA over the full dynamic range of MS currents.	0.5mA over the full dynamic range of MS currents.
Noise floor	Less than lowest ADC step	Less than lowest ADC step

Additional notes:

1. It is important that a controlled RF environment is presented to the MS under test. This is necessary because the idle mode BA(BCCH) contains a number of ARFCNs. If the MS detects RF power at these frequencies, it may attempt synchronisation to the carrier, which will increase power consumption. Shielding the MS under test will minimise the

probability of this occurring, but potential leakage paths through the BSS simulator should not be ignored.

2. A low value of series resistance is used for sensing the current drawn from the battery. Its value needs to be accurately measured with due consideration for the resistance of any connecting cables. It is also important that leakage into the measurement circuitry does not affect the results.

2.3 BATTERY CAPACITY

The battery capacity should be measured independent of the MS current drain, since the series measurement resistance affects the ability of the MS to fully utilise the battery capacity. Battery capacity measurements techniques are FFS.

The capacity of different batteries will vary according to age, usage, charging conditions and unit to unit production spreads.

2.4 BATTERY LIFETIME

A number of different options exist for quoting MS battery lifetimes:

1. Manufacturers quote current consumption, or battery life and battery capacity for the product in the box (nominal capacity).
2. Manufacturers quote battery life/100mAh capacity and the battery capacity for the product in the box (nominal capacity).
3. Manufacturers only quote battery life for the product in the box (based on nominal capacity and the currents measured according the proposed test method.)
4. A separate battery capacity measurement technique is developed and battery lifetime is quoted from current measurements and battery capacity measurements.

No single option is specified at this stage as the decision involves both marketing and technical issues

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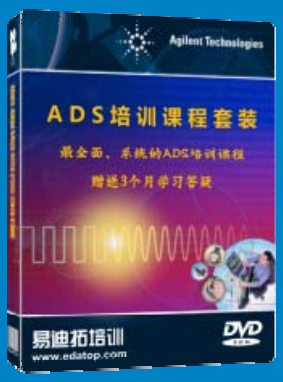

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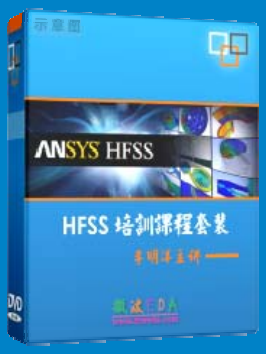

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