Battery Life Measurement and Current Consumption Technique

Version 12.0

19 April 2022

This is Industry Specification is a Non-binding Permanent Reference Document of the GSMA

Security Classification: Non-confidential

Copyright Notice

Disclaimer

Antitrust Notice

This GSMA Permanent Reference Document (PRD) is classified by GSMA as an Industry Specification, as such it has been developed and is maintained by GSMA in accordance with the provisions set out GSMA AA.35 - Procedures for Industry Specifications.

Table of Contents

1 Introduction

1.1 Overview

This document is applicable to 3GPP system capable devices. It defines mobile user equipment (UE) power consumption test methods for specific technologies, applications and services.

1.2 Scope

This document describes a selection of basic measurements that are representative of the main uses of mobile user equipment (UE) with a view that the resulting figures can provide a measure of battery performance or current consumption or current consumption whilst being exercised by a specific technology within a specified parameter set.

Whilst the figures are not intended to provide a definitive power consumption figure for UE, they may be used to extrapolate indicative power consumption data for complicated usage scenarios.

In this document, main categories of features have been defined to rationalise the amount of testing required, whilst maintaining an overview of the battery performance. The categories are illustrated in the diagram below.

The performance figures produced by the tests are intended to give benchmarks for the operators to use when comparing terminals. It is not anticipated that the figures will be made available to end-users.

1.3 References

Reference	Document	Name
1	3GPP TS 25.101	(UTRA) UE Radio transmission and reception, Release 7 or higher
2	3GPP TS 05.05	Radio transmission and reception, Release 8 or higher
3	3GPP TS 05.080	Radio subsystem link control, Release 8 or higher
4	3GPP TS 25.133	(UTRA) Requirements for support of radio resource management, Release 7 or higher
5	3GPP TR 21.910	Multimode UE categories principles and procedures, Release 7 or higher
6	3GPP TS 34.108	Common test environments for user equipment, Release 7 or higher
7	3GPP TS 25.304	(UTRA) User Equipment (UE) procedures in idle mode and procedures for cell reselection in connected mode, Release 7 or higher
8	3GPP TS 34.171	Assisted Global Positioning System (A-GPS) , Release 7 or higher
9	3GPP TS 34.121-1	User Equipment (UE) conformance specification; Radio transmission and reception (FDD); Part 1: Conformance specification

Reference	Document	Name
10	OMTP	OMTP local connectivity: wired analogue audio
11	3GPP TS 36.101	(E-UTRA) UE Radio transmission and reception, Release 8 or higher
12	3GPP TS 36.133	(E-UTRA) Requirements for support of radio resource management, Release 8 or higher
13	3GPP TS 36.521-1	(E-UTRA) User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Conformance Testing, Release 8 or higher
14	3GPP TS 36.211	(E-UTRA) Physical channels and modulation, Release 8 or higher
15	3GPP TS 36.213	(E-UTRA); Physical layer procedures, Release 8 or higher
16	3GPP TS 38.101-1	(NR) UE radio transmission and reception; Part 1: Range 1 Standalone, Release 15 or higher
17	3GPP TS 38.101-2	(NR) UE radio transmission and reception; Part 2: Range 2 Standalone, Release 15 or higher
18	3GPP TS 38.101-3	(NR) UE radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios, Release 15 or higher
19	3GPP TS 38.133	(NR) Requirements for support of radio resource management, Release 15 or higher

1.4 Abbreviations

The table below gives a list of abbreviations used in this document, and not already defined in 3GPP specification [12] (see section 1.3).

Term	Description
AAC	Advanced Audio Coding
CA	Carrier Aggregation
cDRX	Connected DRX
DASH	Dynamic Adaptive Streaming over HTTP
dB	Decibel
dBm	electrical power unit in decibels (dB), referenced to 1 milliwatt (mW)
DC	Direct Current
DC	Dual Connectivity (5G-NR)
DTIM	Delivery Traffic Indication Map
DUT	Device Under Test
EDGE	Enhanced Data Rates for GSM Evolution
EDR	Enhanced Data Rate

Term	Description
eDRX	Extended Discontinuous Receive
eMTC	Enhanced Machine Type Communications
EN-DC	E-UTRA-NR Dual Connectivity
ESP	Encapsulating Security Payload
EVS	Enhanced Voice Services
fps	frames per second
FTP	File Transfer Protocol
GAN	Generic Access Network
GERAN	GSM EDGE Radio Access Network
GPRS	General Packet Radio Service
HD	High Definition
Hz	Hertz
I-DRX	Idle mode DRX
IKE	Internet Key Exchange
IoT	Internet of Things
kHz	kilo Hertz
ksps	kilo symbols per second
MB	Mega Bytes
Mb	Mega bits
MHz	Mega Hertz
ms	Millisecond
MS	Mobile System
mW	Milliwatt
NB-IoT	Narrow Band Internet of Things
NR	New Radio (5G)
NSA	Non Standalone (5G)
PCL	Power Control Level
RTS	Request to send
Rx	Receive
SA	Standalone (5G)
SML	Short Metric Location, or storage of soft metric representation for a single uncoded bit
SPS	Semi Persistent Scheduling
Tx	Transmit
UAPSD	Unscheduled Automatic Power Save Delivery
UE	User Equipment
VGA	Video Graphics Array

Term	Description
VoLTE	Voice over LTE
VoWiFi	Voice over Wi-Fi
WLAN	Wireless Local Area Network
WMM	WLAN Multimedia

2 Parameters and Settings

2.1 General Settings

2.1.1 System Simulator

The system simulator should have access to the internet. This configuration is required for smartphone testing, as in normal situation these type of devices sending periodical updates and requests to the home servers.

2.1.2 Connection Diagram – Cellular with WLAN Access Point

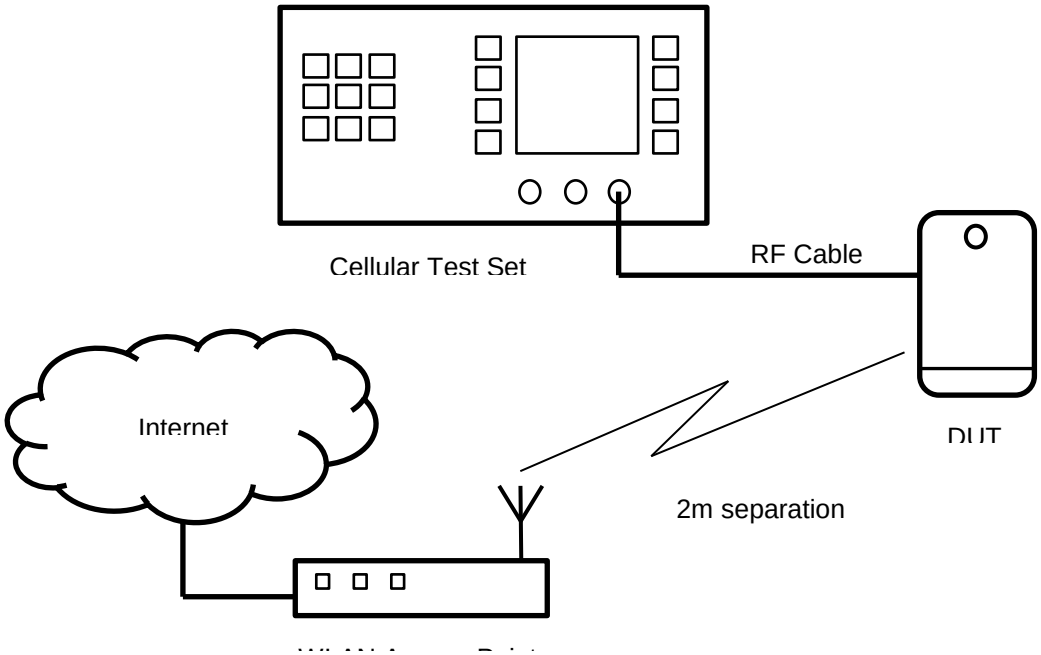

Figure 1: Test set-up for GSM, WCDMA or E-UTRA Standby / WLAN enabled

The WLAN AP is directly connected to Public Internet (not GAN, nor VPN).

2.2 Common Parameters

There are certain parameters that are common to all modes of operation as shown in the table below.

Item	Parameter
Ambient Temperature	18-25 Celsius
PLMN	Home
Backlight	Default setting Measurements in (any) Idle Mode should be taken after the backlight went off. Measurements for video, browsing, streaming etc., the backlight should be on.

Item	Parameter
	Measurements for music etc., the backlight should be off.
SIM	Supporting clock stop
Keypad	No activity except for browsing
Cell Broadcast	Not used
Cell Reselection	No
System Information 13	Is an optional message which allows for more efficient decoding of BCCH. This is an important message for GPRS; although optional, it is almost universally used, therefore it has been added to the scenario.
Display Contrast/Brightness	Default (as delivered by factory)
Test Environment Lightning	Office conditions with no direct sun shine on the DUT
Audio Volume	Middle of available range

Table 1: Common parameters to all modes of operations

The following external resources provide input files for the tests described in this specification. The files have to be downloaded onto a dedicated media or streaming server before using them for the tests.

The files can be found on GitHub public repository at the following link: https://github.com/GSMATerminals/Battery-Life-Measurement-Test-Files-Public/tree/master

All relative paths listed in what follows refer to the repository top path.

VoLTE Call:

- ./reference_files/audio/call/volte/volte.wav

Audio stream:

- ./reference_files/audio/streaming/audio_only_stream_aac.3gp

Browsing:

- ./reference_files/browsing/textimage.htm

Music:

- ./reference_files/audio/playback/music.mp3

Progressive Video Streaming:

- ./reference_files/video/streaming/progressive/video_stream_480p_30fps_a.mp4
- ./reference_files/video/streaming/progressive/video_stream_720p_30fps_a.mp4
- ./reference_files/video/streaming/progressive/video_stream_720p_30fps_b.mp4
- ./reference_files/video/streaming/progressive/video_stream_720p_30fps_c.webm
- ./reference_files/video/streaming/progressive/video_stream_1080p_30fps_a.mp4
- ./reference_files/video/streaming/progressive/video_stream_1080p_30fps_b.mp4
- ./reference_files/video/streaming/progressive/video_stream_1080p_30fps_c.webm
- ./reference_files/video/streaming/progressive/video_stream_1080p_60fps_b.mp4
- ./reference_files/video/streaming/progressive/video_stream_2160p_30fps_c.webm

DASH (Dynamic Adaptive Streaming over HTTP) Video Streaming:

- ./reference_files/video/streaming/dash/dash_720p.html

Video Playback application:

- ./reference_files/video/playback/video_player_01.3gp
- ./reference_files/video/playback/video_player_02.3gp
- ./reference_files/video/playback/video_player_03.3gp
- ./reference_files/video/playback/video_player_04.3gp
- ./reference_files/video/playback/video_player_05.3gp
- ./reference_files/video/playback/video_player_06.mpg
- ./reference_files/video/playback/video_player_07.mpg
- ./reference_files/video/playback/video_player_08.mpg

Camera:

- ./reference_files/camera/photo.gif

2.3 GSM/GPRS

2.3.1 GSM Standby Parameters

The GSM configuration of the tests are described below. Some bearer parameters shall be selected among some recommended values. These parameters and the selected value shall be reported with the tests results.

Parameter	Value	Comment
BCCH	ARFCN : 189 for 850 MHz 62 for 900 MHz 698 for 1800 MHz 660 for 1900 MHz	All values are chosen to be mid band. All bands supported by the DUT must be measured. Results must indicate which band(s) have been measured, and individual result for each band.
Rx Level	-82 dBm	
Paging Interval	5 Multi Frames	
No of Neighbour Cells declared in the BA_List	16 frequencies as defined in Annex A	
Periodic Location Updates	No	T3212 = 0

Table 2: GSM parameters for Standby Time

NOTE: Although the DUT is required to monitor these neighbour cells, the test equipment does not provide signals on these frequencies. No signals should be present on the neighbour frequencies. If signals are present then the DUT will attempt to synchronise to the best 6 neighbour frequencies, and this is not part of the test.

2.3.2 GSM/GPRS Standby Parameters

For GPRS most of the key parameters can be kept from GSM configuration (see section 2.3.1) but the paging type and interval needs to be addressed.

Two possibilities for paging types are available:

1. Network mode of operation I. All paging messages (GSM or GPRS) are sent on the PPCH - or CCCH-PCH if no PPCH is present. In PS connected mode CS paging arrives on the PDTCH.
2. Network mode of operation II. All paging messages are sent on the CCCH-PCH whether PS connected or not. This means the mobile equipment must monitor paging channel even when in a packet call.

Most deployed GPRS networks operate in network mode I or network mode II, therefore mode II has been adopted as the standard. For simplicity the paging has been selected to arrive on the CCCH-PCH

Finally, the paging interval needs to be considered. As the decisions on paging mode and channel lead to use the same paging system as in GSM, the same paging interval was selected: 5 multi frames.

Parameter	Value	Comment
Network Mode of Operation	II	
Paging Channel	CCCH-PCH	
Paging Interval	5 Multi Frames	
All other Parameters	As for GSM Standby	

Table 3: GSM/GPRS parameters for Standby Time

NOTE: The selected parameters for GSM/GPRS standby are effectively the same as those used in GSM. Therefore, the same results should be obtained when measuring/modelling GSM and GSM/GPRS as per the details above.

2.3.3 GSM Talk Time and GPRS PS Data Transfer Parameters

All common parameters (section 2.2) apply, plus the additional GSM configuration parameters. Some bearer parameters shall be selected among some recommended values. These parameters and the selected value shall be reported with the tests results.

Parameter	Value	Comment
Hopping	On	
Hopping Sequence (850)	128, 159, 189, 219, 251	
Hopping Sequence (900)	1, 30, 62, 93, 124	
Hopping Sequence (1800)	512, 600, 690, 780, 855	
Hopping Sequence (1900)	512, 590, 670, 750, 810	
Hopping Sequence (450)	259, 268, 276, 284, 293	
Hopping Sequence (480)	306, 315, 323, 331, 340	

Parameter	Value	Comment
Handover	No	
Rx Level	-82 dBm	
Terminal Tx Level (900, 850, 480 & 450)	(max, PCL=7 (29 dBm), min)	Used pcl values for max and min shall be reported with the test results
Terminal Tx Level (1800, 1900)	(max, PCL=1 (28 dBm), min)	Used pcl values for max and min shall be reported with the test results
Uplink Dtx	Off	
Call	Continuous	
Codec	EFR	
No of neighbour cells declared in the BA_LIST	16 Frequencies As Defined In Annex A	

Table 4: GSM parameters for Talk Time and Packet Switched Data Transfer

NOTE: Where transfer is band specific, the band measured must be specified

The following parameters are suggested based on observations of real operation. Justifications follow the table. However these are only suggestions and it is recommended that vendors define the test for their most efficient transfer mode. The test results and the channel parameters used to perform the test should all be reported in the last column of the table.

Parameter	Suggested Value	Used Value (To Be Reported)
Multi-Slot Class	12	
Terminal Type	1	
Slots (Uplink)	1	
Slots (Downlink)	4	
Duty Cycle	100%	
Coding Scheme	CS4	
CS Can Change	No	
Transfer Mode	Acknowledged	
Non Transparent	Yes	
Retransmissions	Yes	

Table 5: Additional parameters for Packet Switched Transfer

All GPRS UEs currently available are generally “class 12” or higher. Therefore, “class 12” operation (4DL, 1UL slots) has been chosen as the baseline for this test. Type 1 operation has also been chosen as being the lowest common denominator.

Other parameters have been selected to represent the terminal being used as a modem for download of a large block of data. This choice was made for two reasons:

1. It is an operation that the user will actually perform, and that will occur in much the same way regardless of the user (unlike browsing for example, which is highly user specific)
2. It is relatively easy to set up on test equipment.

Acknowledged mode is specified as this is generally used for data downloads. For the same reason non-transparent mode is chosen. Finally, the coding scheme with the highest throughput (lowest protection) was chosen and it was decided that this coding scheme would not change (no link adaptation).

NOTE: No retransmissions are supposed to happen. The sensitivity or decoding performance of the terminal is not measured – no fading channel is specified – the purpose of the tests in this document is to establish the power consumption of the mobile equipment on an ideal (and easily reproducible) channel. In view of this and the relatively high receive signal strength, retransmissions are not expected.

2.4 WCDMA

2.4.1 WCDMA Standby Parameters

The WCDMA bearer configuration of the tests is described below. Some bearer parameters shall be selected among some recommended values. These parameters and the selected value shall be reported with the tests results. Parameters apply to all scenarios run in standby mode unless otherwise specified.

Parameter	Recommended Value	Comment
Serving Cell UARFCN (Downlink)	Band I: Mid Range Band II: Mid Range Band IV: Mid Range Band V: Mid Range Band VI: Mid Range Band VIII: Mid Range Band IX: Mid Range	All bands supported by the DUT must be measured. Results must indicate which band(s) have been measured, and individual result for each band
Number of neighbours declared in the BA_List	16	See NOTE below
Neighbour Cells on different frequency	No	
Serving Cell Scrambling Code	Any	Used value shall be reported with the test results
Neighbour Cell Scrambling Codes	Any	See note. Used values shall be reported with the test results
Paging Interval	1.28 s (DRX 7)	This value must be used unless operator requests 2.56 S (DRX 8).
Periodic Location Updates	No	T3212 = 0

Parameter	Recommended Value	Comment
Number of Paging Indicators per frame	18	
Ioc	-60 dBm	Refer to [9] Section 7.1.1
$\hat{I}_{or}/I_{oc}$	-1 dB	Refer to [9] Section 7.1.1
CPICH_Ec/Ior	-3.3 dB	Refer to [9] Annex E.2.
PICH_Ec/Ior	-8.3 dB	Refer to [9] Annex E.2.
SIntrasearch	Sintrasearch = 12 dB	
Sintersearch	= 10 dB	
Qqualmin	= -20 dB	
Qrxlevlmin	= -113 dBm	
SsearchRAT	SsearchRAT = 4 dB	

Table 6: WCDMA parameters for Standby Time

NOTE: Although the DUT is required to monitor these neighbour cells, the test equipment does not provide signals. Signals should not be present on the neighbour frequencies. If signals are present then the DUT will attempt to synchronise and this is not part of the test. The number of neighbours are the number of intra-frequency neighbours. No GSM neighbour cell is declared in the Inter-RAT neighbour list for WCDMA Standby test.

2.4.2 WCDMA Talk Time Parameters

All common parameters (section 2.2) apply, plus the WCDMA bearer configuration is described below. Some bearer parameters are left to the vendor to decide. In these cases the values used must be reported with the test results.

Parameters	Value	Comment
Serving Cell UARFCN (downlink)	Band I: Mid Range Band II: Mid Range Band IV: Mid Range Band V: Mid Range Band VI: Mid Range Band VIII: Mid Range Band IX: Mid Range	All bands supported by the terminal must be measured. Results must indicate which band(s) have been measured, and individual result for each band
Serving Cell UARFCN (uplink)	Band I: Mid Range Band II: Mid Range Band IV: Mid Range Band V: Mid Range Band VI: Mid Range	

Parameters	Value	Comment
	Band VIII: Mid Range Band IX: Mid Range	
Serving Cell Scrambling Code	255	
Use Secondary Scrambling Code	No	
Fixed Channelisation Code	Yes	
Hard Handover	No	
Soft / Softer Handover	No	
Channel type – UL & DL / Bearer	Voice 12.2k (AMR) "Conversational / speech / UL:12.2 DL:12.2 kbps / CS RAB + UL:3.4 DL:3.4 kbps SRBs for DCCH" (as defined in 3GPP TS25.993-6.7.0 Ref #4)	
Loc	-60 dBm	Refer to [9], Section 7.2.
$\hat{I}_{or}/I_{oc}$	-1 dB	Refer to [9], Section 7.2.
CPICH_Ec/Ior	-10 dB	Refer to [9], Annex E.3.3
P-CCPCH_Ec/Ior	-12 dB	Refer to [9], Annex E.3.3
DPCH_Ec/Ior	-15 dB	1.6 dB better than performance test cases in [9], Section 7.2
Uplink DTX	No	
Terminal Tx level	1) Fixed value of 10 dBm AND 2) Power distribution as defined below	
Number of neighbours declared in the BA_LIST	16	See NOTE below
Neighbour cells on different frequency	No	

Table 7: WCDMA parameters for Talk Time

NOTE: Although the mobile equipment is required to monitor these neighbour cells, the test equipment does not provide signals. No signals should be present on the neighbour frequencies. If signals are present then the terminal will attempt to synchronise and this is not part of the test. The number of neighbours are the number of intra-frequency neighbours. No GSM neighbour cell is declared in the Inter-RAT neighbour list for WCDMA Standby test.

Power distribution should be programmed as follows:

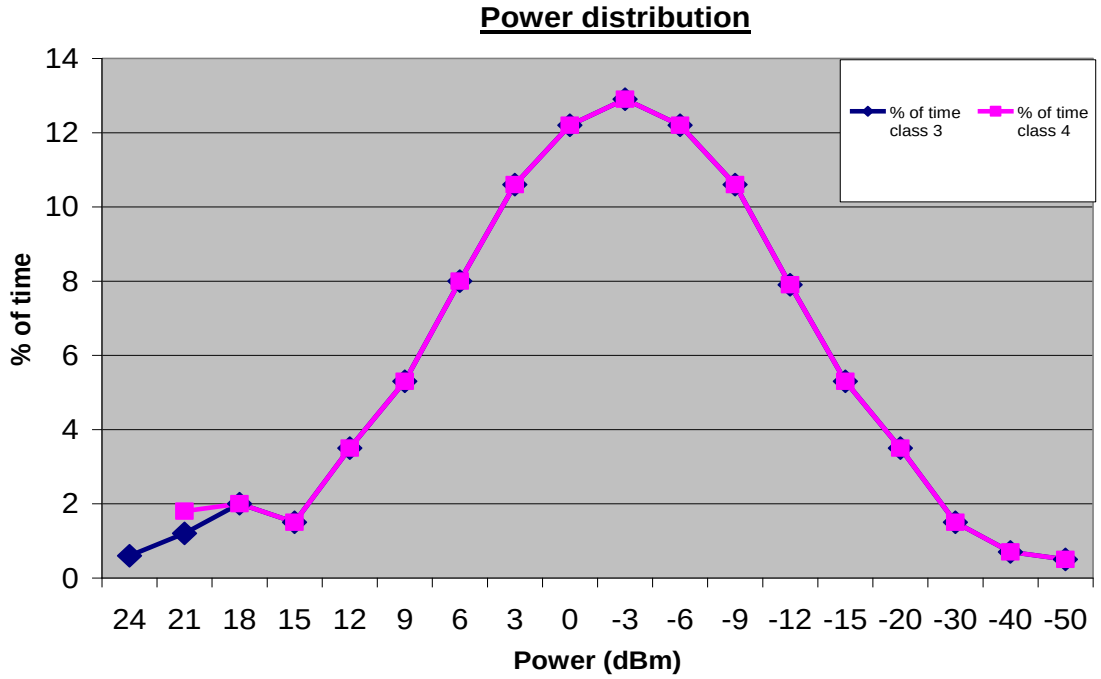

Figure 2: Terminal Tx Power distribution for WCDMA

Power dBm	% of time class 3	% of time class 4
24	0,6	n/a
21	1,2	1,8
18	2	
15	1,5	
12	3,5	
9	5,3	
6	8	
3	10,6	
0	12,2	
-3	12,9	
-6	12,2	
-9	10,6	
-12	7,9	
-15	5,3	
-20	3,5	

Power dBm	% of time class 3	% of time class 4
-30	1,5	
-40	0,7	
-50	0,5	
Total	100	100

Table 8: UE Tx Power distribution for WCDMA

- This is designed to exercise the (non-linear) WCDMA power amplifier across its full range. The data is taken from operation on a live network.
- The method of testing involves averaging over a defined period. A test set must be configured to produce the relevant power for the relevant percentage of that period
- Alternatively, depending on the test set, it may be easier to individually measure the current at each power level and average according to the % weighting given.
- To ensure that results are always repeatable, the measurements should always be made with the DUT moving from minimum power to maximum power. This will minimise any effects due to residual heat in the DUT after transmitting at higher power levels.

2.4.3 WCDMA PS Data Transfer Parameters

The WCDMA bearer configuration of the tests is described below. Some bearer parameters shall be selected among some recommended values. These parameters and the selected value shall be reported with the tests results. The configuration is based on a Category 8 UE or higher.

Parameters	Value	Comment
Serving Cell UARFCN (Downlink)	Band I: Mid Range Band II: Mid Range Band IV: Mid Range Band V: Mid Range Band VI: Mid Range Band VIII: Mid Range Band IX: Mid Range	In test results
Serving Cell UARFCN (Uplink)	Band I: Mid Range Band II: Mid Range Band IV: Mid Range Band V: Mid Range Band VI: Mid Range Band VIII: Mid Range Band IX: Mid Range	In test results
Serving Cell Scrambling Code	255	In test results
Number Of neighbours Declared In The BA_LIST	16	See NOTE below

Parameters	Value	Comment
Use Secondary Scrambling Code	No	In test results
Fixed Channelization Code	Yes	In test results
Hard Handover	No	In test results
Soft / Softer Handover	No	In test results
Channel Type – UL & DL / Bearer	Interactive Or Background / Hspa In Both Uplink And Downlink	
Uplink tti	2 ms	
Nominal Avg. UL Inf. Bit Rate	0 KBPS	
Ack-Nack Repetition Factor	3	Required for continuous HS-DPCCH signal
CQI Feedback Cycle, k	4 ms	
CQI Repetition Factor	2	Required for continuous HS-DPCCH signal)
Beta_C	15/15	
ΔACK, ΔNACK and ΔCQI	5/15	beta_hs/Beta_C=5/15
Beta_EC	5/15	
AG Index	12	This sets the Beta_ED=47/15
Nominal Avg. Inf. Bit Rate	7200 kbps	
Inter-TTI Distance	1 tti's	
Number Of harq Processes	6 processes	
Information Bit Payload (N_{INF})	14411 bits	
Binary Channel Bits per TTi	15360 bits	
Total Available smls In ue	134400 smls	
Number Of smls Per harq Proc.	22400 smls	
Coding Rate	0.94	
Number Of Physical Channel Codes	10 Codes	
Modulation	16qam	
Ioc	-60 dB	
$\hat{I}_{or}/I_{oc}$	10 dB	
CPICH_Ec/Ior	-10 dB	

Parameters	Value	Comment
P-CCPCH_Ec/Ior	-12 dB	
SCH ec/ior	-12 dB	
DPCH_Ec/Ior	-10 dB	
E-agch ec/ior	-30 dB	
e-hich	-20 dB	
hs-scch-1	-13 dB	
hs-scch-2	-20 dB	
hs-pdsch	-1.80 dB	
Duty Cycle	100%	In test results
Terminal Tx Level	1) Fixed Value Of 10 dBm, And 2) Power Distribution As Defined In Circuit Switched Section Above.	
T1: DCH to FACH When No Data Is Transferred	10 s	In test results
T2: FACH to IDLE When No Data Is Transferred	5 s	In test results

Table 9: WCDMA parameters for Packet Switched Transfer

Note: Although the UE is required to monitor these neighbour cells, the test equipment does not in fact provide signals. No signals should be present on the neighbour frequencies. If signals are present then the terminal will attempt to synchronise and this is not part of the test. The number of neighbours is the number of intra-frequency neighbours. No GSM neighbour cell is declared in the Inter-RAT neighbour list for WCDMA Standby test.

Where transfer is band specific, the band measured must be specified.

2.5 WCDMA GSM Dual Mode

2.5.1 GSM/WCDMA Dual Mode Standby Parameter

In this scenario the DUT is camped on GSM according to section 2.3.1 with the addition of 16 WCDMA neighbour cells on the same UARFCN in the BA_LIST according to section 2.4.1.

NOTE: If the test equipment does not support 16+16 neighbour cell configuration, then choose the best fit possible and note this in the Annex B “Pro-forma tables”.

2.5.2 (GSM/GPRS)/WCDMA Dual Mode Standby Parameter

In this scenario the DUT is camped on GSM/GPRS according to section 2.3.2 with the addition of 16 WCDMA neighbour cells on the same UARFCN in the BA_LIST according to section 2.4.1.

NOTE: If the test equipment does not support 16+16 neighbour cell configuration, then choose the best fit possible and note in Annex B “Pro-forma tables”.

2.5.3 WCDMA (GSM/GPRS) Dual Mode Standby Parameter

In this scenario the DUT is camped on the WCDMA according to section 2.4.1 with the addition of 16 GSM/GPRS neighbour cells in the BA_LIST according to section 2.3.2, with frequencies as defined in Annex A.21.2.

NOTE: If the test equipment does not support 16+16 neighbour cell configuration, then choose the best fit possible and note in Annex B “Pro-forma tables”.

2.6 E-UTRA

2.6.1 E-UTRA Standby Parameters

The E-UTRA bearer configuration of the tests are described below. Some bearer parameters shall be selected among some recommended values. These parameters and the selected value shall be reported with the tests results. Parameters apply to all scenarios run in standby mode unless otherwise specified.

Parameter	Recommended Value		Comment
	FDD	TDD	
Serving Cell Downlink EARFCN	Mid range for all supported E-UTRA bands		All bands supported by the DUT must be measured. Results must indicate which band(s) have been measured, and individual result for each band
Number of neighbours declared in the neighbour cell list	16 intra-frequency, 0 inter-frequency, 0 inter-RAT, no MBSFN cells		Although the DUT is required to monitor these neighbour cells, the test equipment does not in fact provide signals.
DRX Cycle	1.28 s	1.28 s	Results must indicate the used DRX cycle.
Periodic TAU	No		T3412 = 111xxxxx
Reference Signal Energy per Resource Element (RS EPRE)	-85 dBm/15kHz	-85 dBm/15kHz	Refer to [13], Annex C.0 Default value used for 3GPP performance test setup and signalling tests.
N_{oc}	-98 dBm/15kHz		
Uplink downlink configuration	NA	1	Refer to [13], Annex C.2

Parameter	Recommended Value		Comment
	FDD	TDD	
Special sub-frame configuration	NA	4	
PBCH EPRE Ratio	PBCH_RA = 0 dB PBCH_RB = 0 dB		
PSS EPRE Ratio	PSS_RA = 0 dB		
SSS EPRE Ratio	SSS_RA = 0 dB		
PCFICH EPRE Ratio	PCFICH_RB = 0 dB		
PDCCH EPRE Ratio	PDCCH_RA = 0 dB PDCCH_RB = 0 dB		
PDSCH EPRE Ratio	PDSCH_RA = 0 dB PDSCH_RB = 0 dB		
PHICH EPRE Ratio	PHICH_RA = 0 dB PHICH_RB = 0 dB		
Serving cell bandwidth	10 MHz		
Number of antenna ports at eNodeB	2		
Cyclic Prefix Length	Normal		No extended cyclic prefix
PHICH Duration	Normal		1 symbol only, no extended PHICH
PDCCH length	2 symbols		Refer to [13], Annex C.1
DCI Aggregation Level	8 CCEs		Refer to [13], Annex C.3.1 Note that there is no UL in this test so DCI 0 is not relevant
Qrxlevmin	-120 dBm		Lower than the expected RSRP to ensure that the DUT camps on the target cell
Qqualmin	-20 dB		Lower than the expected RSRQ to ensure that the DUT camps on the target cell.
SintraSearchP	0 dB		I.e. DUT may choose not to perform intra-frequency measurements. NOTE: In Rel-8 only SIntraSearch is sent. In case Rel-8 is used this shall have the same value as SIntraSearchP in the table.
SintraSearchQ	0 dB		
Paging and System Information change notification on PDCCH	No		No P-RNTI on PDCCH

Parameter	Recommended Value		Comment
	FDD	TDD	
System Information Reception	No		System information will be transmitted, but not received by the DUT during the test.
IMS VoPS	supported		EPS Network Feature Support
OCNG	According to Table E-UTRA_FDD Idle_1	According to Table E-UTRA TDD_Idle_1	[13], Annex A.5.1.2

Table 10: E-UTRA_Idle_1 Parameters for E-UTRA Standby use case

This OCNG Pattern for FDD fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in two parts by the allocated area – two sided), starts with PRB 0 and ends with PRB $N_{RB}-1$.

Relative power level γ_{PRB} [dB]			PDSCH Data
Subframe			
0	5	1 – 4, 6 – 9	
Allocation			
0 – (First allocated PRB-1) and (Last allocated PRB+1) – ($N_{RB}-1$)	0 – (First allocated PRB-1) and (Last allocated PRB+1) – ($N_{RB}-1$)	0 – (First allocated PRB-1) and (Last allocated PRB+1) – ($N_{RB}-1$)	
0	0	0	Note 1
NOTE 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH. NOTE 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in [15].			

Table 11: E-UTRA_FDD_idle_1 / OP.2 FDD: Two sided dynamic OCNG FDD Pattern

This OCNG Pattern for TDD fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the sub-frames available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is discontinuous in frequency domain

(divided in two parts by the allocated area – two sided), starts with PRB 0 and ends with PRB $N_{RB}-1$.

Relative power level γ_{PRB} [dB]				PDSCH Data
Subframe (only if available for DL)				
0	5	3, 4, 6, 7, 8, 9 (6 as normal subframe) Note 2	1,6 (6 as special subframe) Note 2	
Allocation				
0 – (First allocated PRB-1) and (Last allocated PRB+1) – ($N_{RB}-1$)	0 – (First allocated PRB-1) and (Last allocated PRB+1) – ($N_{RB}-1$)	0 – (First allocated PRB-1) and (Last allocated PRB+1) – ($N_{RB}-1$)	0 – (First allocated PRB-1) and (Last allocated PRB+1) – ($N_{RB}-1$)	
[0]	[0]	[0]	[0]	Note 1

NOTE 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.

NOTE 2: Sub-frames available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in [14]

NOTE 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in [15].

Table 12: E-UTRA_TDD_idle_1 / OP.2 TDD: Two sided dynamic OCNG TDD Pattern

2.6.2 E-UTRA (VoLTE) Talk Time Parameters

The E-UTRA bearer configuration for Voice over LTE tests is described below. Some bearer parameters shall be selected among some recommended values. These parameters and the selected value shall be reported with the tests results.

Parameter	Recommended Value		Comment
	FDD	TDD	
Serving Cell Downlink EARFCN	MID RANGE for all supported E-UTRA bands		All bands supported by the handset must be measured. Results must indicate which band(s) have been measured, and individual result for each band.
Serving Cell Uplink EARFCN	MID RANGE for all supported E-UTRA bands		
Number of neighbours declared in the neighbour cell list	16 intra-frequency, 0 inter-frequency, 0 inter-RAT, no MBSFN cells		Although the mobile equipment is required to monitor these neighbour cells, the test equipment does not in fact provide signals.
Reference Signal Energy Per Resource Element (RS EPRE)	-85 dBm/15kHz		Refer to [13], Annex C.0 Default value used for 3GPP performance test setup and signalling tests.
PBCH EPRE Ratio	PBCH_RA = 0 dB PBCH_RB = 0 dB		Refer to [13], Annex C.2
PSS EPRE Ratio	PSS_RA = 0 dB		
SSS EPRE Ratio	SSS_RA = 0 dB		
PCFICH EPRE Ratio	PCFICH_RB = 0 dB		
PDCCH EPRE Ratio	PDCCH_RA = 0 dB PDCCH_RB = 0 dB		
PDSCH EPRE Ratio	PDSCH_RA = 0 dB PDSCH_RB = 0 dB		
PHICH EPRE Ratio	PHICH_RA = 0 dB PHICH_RB = 0 dB		
RoHC	On		3GPP Profile1
UL TX Power level	10 dBm		The Output Power of the DUT as defined in [11] See NOTE below
DL Transmission scheme	2x2 closed loop spatial multiplexing		i.e. uses TX Mode 4
Cyclic Prefix Length	Normal		No extended cyclic prefix
PHICH Duration	Normal		1 symbol only, no extended PHICH
DCI Aggregation Level	4 CCEs for DCI0 8 CCEs for all other DCI formats		Refer to [13], Annex C.3.1
DRX Configuration	DRX : On		

Parameter	Recommended Value		Comment
	FDD	TDD	
LongDRX-Cycle	40 sub-frames		Result must indicate used value
onDuration Timer	4 sub-frames		Result must indicate used value
DRX-Inactivity Time	4 sub-frames		Result must indicate used value
Short DRX	Off		
DL and UL Channel Bandwidth	10 MHz		This configuration corresponds to 0.6 Mbit/s DL / 0.5 Mbit/s UL for FDD, while 0.35 Mbit/s DL / 0.214 Mbit/s UL for TDD.
Uplink downlink configuration	NA	1	
Special subframe configuration	NA	4	
NRB (DL)	12		
MCS (DL)	0		
NRB (UL)	20		
MCS (UL)	0		
PDCCH length	2 symbols		
OCNG	According to Table E-UTRA_FDD_Idle_1	According to Table_E-UTRA_TDD_Idle_1	3GPP [13], Annex A.5.1.2

Table 13: E-UTRA parameters for talk time

NOTE: **Output power:** The mean power of one carrier of the UE, delivered to a load with resistance equal to the nominal load impedance of the transmitter.

Mean power: When applied to E-UTRA transmission this is the power measured in the operating system bandwidth of the carrier. The period of measurement shall be at least one sub-frame (1 ms) for frame structure type 1 and one sub-frame (0.675 ms) for frame structure type 2 excluding the guard interval, unless otherwise stated.

Further assumptions:

- CQI is set to 1
- EPS Network Feature Support is enabled and IMS Voice over PS supported.
- SPS Disabled (UL dynamic scheduling enabled)
- No SRS is transmitted
- No HARQ and ARQ retransmissions are expected – low bit error rate is assumed
- No System Information (on PDSCH or PBCH) or paging is received
- Default Codec is AMR-WB. If the EVS codec is supported, then the EVS AMR-WB IO mode may be used as an alternative implementation of AMR-WB.

2.6.3 E-UTRA PS Data Transfer Parameters

Download:

Some bearer parameters shall be selected among some recommended values. These parameters and the selected value shall be reported with the tests results.

Parameter	Recommended Value		Comment
	FDD	TDD	
Serving Cell Downlink EARFCN	MID RANGE for all supported E-UTRA bands		All bands supported by the handset must be measured. Results must indicate which band(s) have been measured, and individual result for each band.
Serving Cell Uplink EARFCN	MID RANGE for all supported E-UTRA bands		
Number of neighbours declared in the neighbour cell list	16 intra-frequency, 0 inter-frequency, 0 inter-RAT, no MBSFN cells		Although the mobile equipment is required to monitor these neighbour cells, the test equipment does not in fact provide signals.
Reference Signal Energy Per Resource Element (RS EPRE)	-85 dBm/15kHz		Refer to [13], Annex C.0 Default value used for 3GPP performance test setup and signalling tests.
PBCH EPRE Ratio	PBCH_RA = 0 dB PBCH_RB = 0 dB		Refer to [13], Annex C.2
PSS EPRE Ratio	PSS_RA = 0 dB		
SSS EPRE Ratio	SSS_RA = 0 dB		
PCFICH EPRE Ratio	PCFICH_RB = 0 dB		
PDCCH EPRE Ratio	PDCCH_RA = 0 dB PDCCH_RB = 0 dB		
PDSCH EPRE Ratio	PDSCH_RA = 0 dB PDSCH_RB = 0 dB		
PHICH EPRE Ratio	PHICH_RA = 0 dB PHICH_RB = 0 dB		
RoHC	No		
UL TX Power level	10 dBm		The output power of the DUT as defined in [11] See NOTE below
DL Transmission scheme	2x2 closed loop spatial multiplexing		i.e. uses TX Mode 4
Cyclic Prefix Length	Normal		No extended cyclic prefix
PHICH Duration	Normal		1 symbol only, no extended PHICH

Parameter	Recommended Value		Comment
	FDD	TDD	
DCI Aggregation Level	4 CCEs for DCI0 8 CCEs for all other DCI formats		Refer to [13],C.3.1
DL and UL Channel Bandwidth	10 MHz		This configuration corresponds to 10 Mbit/s downlink for FDD, while 7.5 Mbit/s downlink for TDD.
Uplink downlink configuration	NA	1	
Special subframe configuration	NA	4	
Allocated resource blocks in DL	12		
TBS Index in DL	19		
Allocated resource blocks in UL	3% of the DL data rate shall be assumed for transferring TCP ACKs in UL		
TBS Index in UL	20		
PDCCH length	2 symbols		
OCNG	According to Table E-UTRA_FDD_Idle_1	According to Table_E-UTRA_TDD_Idle_1	[13], Annex A.5.1.2
DRX Configuration	DRX : On		
LongDRX-Cycle	320 sub-frames		Result must indicate used value
onDuration Timer	2 sub-frames		Result must indicate used value
DRX-Inactivity Time	100 sub-frames		Result must indicate used value
Short DRX	Off		

Table 14: E-UTRA 2 / General parameters for E-UTRA FDD and TDD File Download use case

NOTE: **Output power:** The mean power of one carrier of the UE, delivered to a load with resistance equal to the nominal load impedance of the transmitter.

Mean power: When applied to E-UTRA transmission this is the power measured in the operating system bandwidth of the carrier. The period of measurement shall be at least one sub-frame (1 ms) for frame structure type 1 and one sub-frame (0.675 ms) for frame structure type 2 excluding the guard interval, unless otherwise stated.

Further assumptions:

- When the DUT is in active state, CQI is assumed to be periodic and scheduled such that it is sent every 40 ms to the network. If cDRX feature and CQI reporting cannot be enabled in the same test case due to some test equipment limitations, cDRX enabling shall be preferred to CQI reporting, and the final choice mentioned in the measurement report.
- No SRS is transmitted.
- No HARQ and ARQ retransmissions are expected – low bit error rate is assumed
- No System Information (on PDSCH or PBCH) or paging is received.
- A test duration of ten minutes is assumed.

Upload:

The same general parameters as for the E-UTRA FDD and TDD file download use case as defined in table E-UTRA_2 shall be used. The bandwidth and resource allocation shall however be modified as shown in table E-UTRA 3.

Parameter	Value		Comment
	FDD	TDD	
DL & UL Channel bandwidth	10 MHz		This configuration corresponds to 5Mbit/s uplink for FDD, while 2 Mbit/s for TDD.
Uplink downlink configuration	NA	1	
Special sub-frame configuration	NA	4	
Allocated resource blocks in UL	11		
TBS Index in UL	20		
Allocated resource blocks in DL	3% of the UL data rate shall be assumed for transferring TCP ACKs in DL		
TBS Index in DL	20		
PDCCH length	2 Symbols		
OCNG in DL	According to Table E-UTRA_FDD_Idle_1	According to Table E-UTRA_TDD_Idle_1	[13], Annex A.5.1.2

Table 15: E-UTRA 3 / General parameters for E-UTRA FDD File Upload use case

Further assumptions:

- CQI is assumed to be periodic and scheduled such that it is sent every 40 ms to the network
- No SRS is transmitted
- No HARQ and ARQ retransmissions are expected – low bit error rate is assumed
- No System Information (on PDSCH or PBCH) or paging is received.

Parallel Download/Upload:

The same general parameters as for the E-UTRA FDD and TDD file download use case as defined in Table E-UTRA_2 shall be used. The bandwidth and resource allocation shall however be modified as shown in Table E-UTRA 4.

Parameter	Value		Comment
	FDD	TDD	
DL & UL Channel bandwidth	10 MHz		This configuration corresponds to 50 Mbit/s downlink and 25 Mbit/s uplink for FDD or 28 Mbit/s downlink and 10 Mbit/s uplink for TDD..
Uplink downlink configuration	NA	1	
Special sub-frame configuration	NA	4	
Allocated resource blocks in UL	50		
TBS Index in UL	21		
Allocated resource blocks in DL	50		
TBS Index in DL	21		
PDCCH length	2 Symbols		
OCNG in DL	According to Table E-UTRA_FDD Idle_1	According to Table E-UTRA_TDD Idle_1	[13], Annex A.5.1.2

Table 16: E-UTRA 4 / General parameters for E-UTRA FDD File DL/UL use case

Further assumptions:

- When the DUT is in active state, CQI is assumed to be periodic and scheduled such that it is sent every 40 ms to the network. If cDRX feature and CQI reporting cannot be enabled in the same test case due to some test equipment limitations, cDRX enabling shall be preferred to CQI reporting and the final choice mentioned in the measurement report.
- No SRS is transmitted.
- No HARQ and ARQ retransmissions are expected – low bit error rate is assumed
- No System Information (on PDSCH or PBCH) or paging is received.

2.7 WLAN in conjunction with Cellular

2.7.1 WLAN Standby Parameters

This section is applicable for a DUT with WLAN capabilities. WLAN parameters of the test Access Point (AP) are described below:

Parameter	Mandatory Value	Comment
WLAN Standards	IEEE 802.11b/g/a/n	
WLAN Frequency (2.4 GHz)	7	
WLAN Frequency (5 GHz)	36	DUTs that support the 2.4 GHz and the 5 GHz band be tested in each band
Authentication / Ciphering	WPA2	
DTIM Period	3	
WMM/UAPSD Power Save	1) Both Turned On, and 2) Both Turned Off	All WLAN tests in which a WLAN access Point is used shall be run twice with WMM/UAPSD turned On And turned Off.
WLAN RSSI	-70 dBm	
Beacon Interval	100 ms	

Table 17: Access Point WLAN parameters

WLAN parameters of the DUT are described below: The DUT shall be put in the mode that the user will encounter in the production model. Those values need to be recorded into the Annex B Pro-forma table.

Parameter	Recommended Values	Comment
WLAN Standards	IEEE 802.11b/g/A/N	Used value shall be reported with the test results
Long Retry Limit	4	Used value shall be reported with the test results
Short Retry Limit	7	Used value shall be reported with the test results
RTS Threshold	2346	Used value shall be reported with the test results
Tx Power Level	100 mW	Used value shall be reported with the test results
WLAN Network Scan Period	Every 5 Minutes	Used value shall be reported with the test results

Table 18: DUT WLAN parameters

2.7.2 GAN Standby Parameters

The GSM cell should be configured as described in section 2.3.1. Additionally the GSM cell covers the following GAN network parameters:

Parameter	Mandatory Value	Comment
Preferred Mode	GAN	
Keep Alive Timer	100 s	
ESP Re-keying (IPSec)	1 hour	
LKE Re-keying (IPSec)	8 hours	

Table 19: GAN network parameters

2.7.3 WLAN in conjunction with GSM or WCDMA Talk Time Parameters

The WLAN, GAN and GSM configuration parameters are the same as defined in the WLAN Standby Time test section 3.8. In addition the following network GAN parameters apply:

Parameter	Recommended Value	Comment
RTP/UDP Packet Sample Size	20 ms	
Channel Mode	Full Rate AMR	
Speech Codec Rate	12.2 Kbit/s	
WLAN UE TX Level	10 dBm	
Call	40/40/20 voice activity pattern	Refer to initial configuration in section 6.1

Table 20: Additional GAN network parameters for VoIP

2.7.4 VoWiFi additional Parameters

Parameter	Target Value	Comment
WLAN UE Tx Level	10 dBm	
Audio Duty Cycle	50%	

Table 21: Additional Access Point parameters for VoWiFi

The parameters and the selected values used for the test shall be reported with the tests results. The type and configuration of the VoWiFi client used for the test shall be stated in the test report. Any SIP settings should also be stated.

2.8 NB-IoT

The recommended NB-IoT configurations of the tests are described below. These parameters and the selected values shall be reported with the tests results.

2.8.1 NB-IoT Standby Parameters

Parameter	Recommended Value	Comment
DRX Cycle	2.56 s	
PSM timers	For Metering T3324: 8 s For Trackers T3324: no use	Result must indicate used value
eDRX timers	For Metering T_{eDRX}: no use T_{ptw}: no use For Trackers T_{eDRX}: 81.92s $T_{ptw:}$ 2.56s	Result must indicate used value
CE mode of operation parameters: – number of repetitions for: NPDCCH, NPRACH	Number of repetitions for NPRACH in CE0: 1 Number of repetitions for NPRACH in CE1: 8 Number of repetitions for NPRACH in CE2: 32	

Table 22: NB-IoT Standby Parameters

2.8.2 NB-IoT Data Transfer Parameters

Parameter	Recommended Value	Comment
TBS for DL and UL	Maximum DL TBS(R13): 680 Maximun UL TBS(R13): 1000	
CE mode of operation parameters: – number of repetitions for: NPDCCH, NPRACH, NPDSCH, NPUSCH	Number of repetitions for NPRACH in CE0: 1 Number of repetitions for NPRACH in CE1: 8 Number of repetitions for NPRACH in CE2: 32	
NPUSCH power control	0-NominalNPUSCH-r13: -110~-114dBm alpha-r13:1 deltaPreambleMsg3-r13: 0dB	

Table 23: NB-IoT Data Transfer Parameters

2.9 CAT-M (tbd)

2.9.1 CAT-M Standby Parameters

2.9.2 CAT-M Data Transfer 1 Parameters

2.9.3 CAT-M Data Transfer 2 Parameters

2.10 5G-NR (tbd)

2.10.1 5G-NR Standby Parameters

2.10.2 5G-NR Data Talk Time Parameters

2.10.3 5G-NR Data Transfer Parameters

3 Test Method

3.1 General Description

The bearer configurations of the tests are described in the previous section for handheld devices. Some bearer parameters shall be selected among some recommended values. These parameters and the selected value shall be reported with the tests results, along with the nominal voltage of the (dummy) battery used for testing.

There are 3 measurement methods described in this section for handheld devices:

3. The first method uses a dummy battery and a power supply.
4. The second uses a live battery and measurement circuitry. The former is provided where repeatability is a requirement while the latter is included for backward compatibility reasons.
5. For USB data modems, the test method uses a measurement circuit placed between the USB data modem and the USB port.

3.2 Measurement Preparation

- For the method employing a dummy battery and power supply, please reference 3.2.1 and 3.2.2.
- For the method employing a live battery, please reference 3.2.3.
- For the method related to USB data modems, please reference 3.2.4.

When using the Dummy Battery Fixture test method, it is mandatory to use a conductive RF connection.

3.2.1 Dummy Battery Fixture

The dummy battery fixture is a device designed to replace the usual battery pack to facilitate powering the DUT from an external DC source and simulating “normal” indications to any active battery management functions within the DUT.

The dummy battery may consist of a battery pack where the connections to the internal cells have been broken and connections instead made to the DC source. Alternatively, it may consist of a fabricated part with similar dimensions and connections to a battery pack and containing or simulating any required active battery management components.

The dummy battery should provide a connection between the battery terminals of the DUT and the DC power source whilst minimising, as far as possible, the resistance, inductance and length of cables required.

Separate “source and sense” conductors may be used to accurately maintain the nominal battery voltage as close to the DUT terminals as possible.

It may be necessary to include some capacitance across the DUT terminals to counteract the effects of cable inductance on the DUT terminal voltage when the DUT draws transient bursts of current. Such capacitance should be kept to a minimum, bearing in mind that it will affect the temporal resolution of the current sampling.

3.2.2 Power Source and Current Measurement Device

This device performs the combined functions of providing, regulated DC power to the DUT and measuring the current consumption of the DUT.

The power source should support the following minimum set of features:

- Configurable output voltage with a resolution of 0.01V or better.
- Output voltage range covering the nominal voltage of the DUT battery with some headroom (=nominal voltage + 5%) to compensate for voltage drop in the supply cables.
- Remote sensing to allow the effects of resistance of the supply cables to be compensated for, and to allow maintenance of the nominal voltage at the DUT battery terminals.
- The DC source should have sufficient output current capability, both continuous and peak, to adequately supply the DUT during all measurements. Current limiting of the power supply shall not function during a measurement.

The following current measurement capability when configured for standby and dedicated mode tests should be met or exceeded:

Parameter	Idle Mode Requirement	Dedicated Mode Requirement
Internal Resistance	<= 0.1 ohms*	<= 0.1 ohms*
Sampling Frequency	>= 50 ksps	>= 50 ksps
Resolution	<= 0.1mA	<= 0.5mA

Table 24: Measurement requirements for Power Supply

3.2.3 Battery Preparation

The measure of the battery performance shall be done in optimal configuration. The best battery performances can be obtained, e.g. by doing a battery cycling, by having the battery fully charged and discharged at least 3 consecutive times.

[The cycling method should be described as FFS]

3.2.4 Current Measurement Device

This device performs the combined functions of providing, and measuring the current consumption of the USB data modem. It should be placed between the USB port and the USB data modem.

The following current measurement capability when configured for standby and dedicated mode tests should be met or exceeded:

Parameter	Dedicated Mode Requirement
Internal Resistance	<= 0.1 ohms*
Sampling Frequency	>= 50 ksps
Resolution	<= 0.5mA

Table 25: Measurement requirements for current consumption

3.3 Standby Test Method using a Power Supply

3.3.1 Configuration

The standby configuration of the test equipment and DUT depends on the radio technology to be used for standby testing. These are described in Chapter 5.

3.3.2 Battery Current Drain

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

6. The DUT battery is replaced with the “dummy battery” circuit described in section 3.2.1.
7. The dummy battery is connected to a combined DC power source and current measurement device capable of meeting the minimum measurement requirements specified in section 3.2.2.
8. The DC power source is configured to maintain a voltage equal to the Nominal Battery Voltage across the dummy battery terminals. Determination of the Nominal Battery Voltage is described in section 4.2.
9. Activate the DUT
10. Wait 3 minutes after activation for DUT boot processes to be completed.
11. In idle mode, record the current samples over a continuous 30 minute period.
12. Calculate the average current drain (I_{idle}) from the measured samples.
13. Calculate the battery life as indicated in the following section.

NOTE: It is important that a controlled RF environment is presented to the DUT and it is recommended this is done using a RF shielded enclosure. This is necessary because the idle mode BA (BCCH) contains a number of ARFCNs. If the DUT detects RF power at these frequencies, it may attempt synchronisation to the carrier, which will increase power consumption. Shielding the DUT will minimise the probability of this occurring, but potential leakage paths through the BSS simulator should not be ignored.

3.4 Active Mode Test Procedure using a Power Supply

The following configuration applies to the subsequent tests:

- Circuit switched voice
- Packet switched data (e.g. FTP)
- Browsing
- Interface usage
- Application software

3.4.1 Configuration

The standby configuration of the test equipment and DUT depends on the radio technology to be used for standby testing. These are described in Chapter 5.

3.4.2 Battery Current Drain

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

- The DUT battery is replaced with the “dummy battery” circuit described in section 3.2.1.
- The dummy battery is connected to a combined DC power source and current measurement device capable of meeting the minimum measurement requirements specified in section 3.2.2.
- The DC power source is configured to maintain a voltage equal to the Nominal Battery Voltage across the dummy battery terminals. Determination of the Nominal Battery Voltage is described in section 4.2.
- Activate the DUT
- Wait three minutes after activation for DUT boot processes to be completed. Place the terminal into the appropriate test configuration and wait for 30 s.
- While the terminal is still in the test configuration record the current samples
- Over a continuous 10 minutes period for connected mode operations.
- (For testing an application use the times specified in the preceding section)
- Calculate the average current drain (In dedicated) from the measured samples.
- If appropriate to the test, record the volume of data transferred in the thirty minute period.
- Calculate the battery life as indicated in the following section.

3.5 Standby Test procedure using a Battery Pack

3.5.1 Configuration

The standby configuration of the test equipment and device depends on the radio technology to be used for standby testing. These are described in Chapter 5

3.5.2 Battery Current Drain

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

- Fully charge the battery on the DUT, with the DUT deactivated, following the manufacturer charging instructions stated in the user manual, using the manufacturer charger.
- Remove the battery from the DUT.
- Re-connect the battery with the measurement circuitry described in section 4 in series with the battery (positive terminal).
- Activate the DUT.
- After activation wait for DUT boot processes to be completed. Place the terminal into the appropriate test configuration and wait for 3 more minutes to be sure that all initialization processes has been completed. (Boot processes refer to events which occur only once per power cycle)
- In idle mode, record the current samples over a continuous 30 minute period.
- Calculate the average current drain (Idle) from the measured samples.

- Calculate the battery life as indicated in the following section.

3.5.3 Measurement Circuitry

Sampled measurements of the voltage across the sense resistor shall be performed. The following measurement equipment is recommended. Equipment of equivalent performance can be used but this must be indicated in the test results.

Parameter	Idle Mode Setting
Measurement Resistance	0.5 ohms
Tolerance/Type	1%, 0.5W, High Precision Metal Film Resistor
Sampling Frequency	50 ksps
Resolution	0.1mA over the full dynamic range of DUT currents.
Noise Floor	Less than lowest ADC step

Table 26: Measurement circuitry for Standby Time

NOTE: It is important that a controlled RF environment is presented to the DUT and it is recommended this is done using a RF shielded enclosure. This is necessary because the idle mode BA (BCCH) contains a number of ARFCNs. If the DUT detects RF power at these frequencies, it may attempt synchronisation to the carrier, which will increase power consumption. Shielding the DUT will minimise the probability of this occurring, but potential leakage paths through the BSS simulator should not be ignored.

- Good engineering practice should be applied to the measurement of current drawn.
- A low value of series resistance is used for sensing the current drawn from the battery.
- Its value needs to be accurately measured between the points at which the voltage across it is to be measured, with due consideration for the resistance of any connecting cables.
- Any constraints on the measurement of the voltage (e.g. due to test equipment grounding arrangements) should be reflected in the physical positioning of the resistance in the supply circuit.
- Voltages drop between battery and DUT in the measurement circuit shall also be considered as this may affect DUT performances".
- It is also important that leakage into the measurement circuitry does not affect the results.

3.6 Active Mode Test Procedure using a Battery Pack

The following configuration applies to the following tests:

- Circuit switched voice
- Packet switched data (e.g. FTP)
- Browsing
- Interface usage
- Application software

3.6.1 Configuration

Configure the channel and applications as defined in the appropriate earlier section of this document.

3.6.2 Battery Current Drain

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

- Fully charge the battery on the DUT, with the DUT deactivated, following the manufacturer charging instructions stated in the user manual, using the manufacturer charger.
- Remove the battery from the DUT.
- Re-connect the battery with the measurement circuitry described in section 3 in series with the battery (positive terminal).
- Activate the DUT.
- Wait 3 minutes after activation for the DUT boot processes to be completed.
- Place the terminal into the appropriate test configuration and wait for 30 s.
- While the terminal is still in the test configuration record the current samples
- Over a continuous 10 minutes period for connected mode operations.
- Over the period specified in the relevant preceding section if testing an application.
- Calculate the average current drain ($I_{dedicated}$) from the measured samples.
- If appropriate to the test, record the volume of data transferred in the 30 minute period.
- Calculate the battery life as indicated in the following section.

3.6.3 Measurement Circuitry

Sampled measurements of the voltage across the sense resistor shall be performed. The following measurement equipment is recommended. Equipment of equivalent performance can be used but this must be indicated in the test results:

Parameter	Dedicated Mode Setting
Measurement Resistance	0.1 ohms
Tolerance/Type	1%, 0.5W, High Precision Metal Film Resistor
Sampling Frequency	50 ksps
Resolution	0.5mA Over the full dynamic range of DUT currents
Noise Floor	Less Than Lowest ADC Step

Table 27: Measurement circuitry for Active Mode

NOTE: It is important that a controlled RF environment is presented to the DUT and it is recommended this is done using a RF shielded enclosure. This is necessary because the idle mode BA (BCCH) contains a number of ARFCNs. If the DUT detects RF power at these frequencies, it may attempt synchronisation to the carrier, which will increase power consumption. Shielding the DUT will minimise the probability of this occurring, but potential leakage paths through the BSS simulator should not be ignored.

- Good engineering practice should be applied to the measurement of current drawn.
- A low value of series resistance is used for sensing the current drawn from the battery.
- Its value needs to be accurately measured between the points at which the voltage across it is to be measured, with due consideration for the resistance of any connecting cables.
- Any constraints on the measurement of the voltage (e.g. due to test equipment grounding arrangements) should be reflected in the physical positioning of the resistance in the supply circuit.
- Voltages drop between battery and DUT in the measurement circuit shall also be considered as this may affect DUT performances.
- It is also important that leakage into the measurement circuitry does not affect the results.

3.7 Active Mode Test Procedure for USB data modems.

The following configuration applies to the following tests:

- FTP Download

3.7.1 Configuration

Configure the channel and applications as defined in the appropriate earlier section of this document.

3.7.2 Current Consumption

The following procedure shall be used to measure the average current drain of the USB data modem:

14. Connect the USB data modem with the USB port as described in section 3
15. Activate the USB data modem
16. Wait 3 minutes after activation for the USB data modem boot processes to be completed.
17. Place the USB data modem into the appropriate test configuration and wait for 30 s.
18. While the USB data modem is still in the test configuration record the current samples:

    a. Over a continuous 10 minute period for connected mode operations
    b. Calculate the average current drain ($I_{dedicated}$) from the measured samples.
    c. Record the volume of data transferred in the 10 minute period.

4 Effective Battery Capacity

4.1 General

This methodology is given so that the actual capacity of a battery sold with the DUT can be determined.

- The DUT and battery shall be at room temperature prior to making this measurement and charging and discharging shall be performed in a room temperature environment. (UE switched-on)

- The battery pack used in this test shall be new, not previously used. The battery shall be prepared per section 4.
- The battery pack shall be fully charged using the DUT or charger provided with the DUT, following the manufacturer's charging instructions stated in the user manual.
- If charging is being done in the DUT itself, the DUT shall be camped to the network, see section 7 and otherwise not used.
- It is not strictly required that the charging be stopped exactly when the DUT's battery meter says that charging is complete but is strongly recommended.
- The battery shall be removed from the terminal and discharged to its End-of-Life at a discharge rate of "C/5".
- The "End-of-Life voltage" is the voltage below, which the phone will not operate. This voltage will vary with the characteristics of the UE so the UE manufacturer must report this value.

C/5 discharge rate refers a discharge current which is one-fifth that of C where C is the approximate capacity of the battery. For example, a battery of approximately 1000 mAh (milliamp – hour) capacity, C, will be discharged at 200 mA or C/5. If then, the duration of the discharge period is measured to be 4.5 hours, the actual capacity of the battery is 4.5 hours x 200 mA = 900 mAh. The most accurate way to achieve a C/5 discharge rate is to use a programmable current sink. Other means are possible. However, note that if a fixed resistor is used then the current will have to be monitored and integrated (as the battery voltage falls so will the current).

4.2 Battery Life Time

The recommended battery lifetime measure is the following:

Battery lifetime is quoted from current measurements in section 3 and battery capacity measurements in section 4

To obtain a battery lifetime in terms of hours:

- Divide the battery capacity by the average current consumption

To obtain a battery lifetime in terms of data transfer:

- Divide the battery capacity by the average current consumption
- Divide the number of hours by 0.1666 (=10 minutes) and multiply by the data transferred in 10 minutes

To obtain the current consumption per MB for USB data modem (in mAh per MB):

- Multiply the average current consumption by 0.1666 (=10 minutes) and divide by the data transferred in 10 minutes

4.3 Battery Life Calculation - MIoT

The battery life of DUT can be calculated as follows:

19. Record the battery capacity of DUT as C, the unit is mAh
20. Record the frequency of a data event as f_{DTE}, which means f_{DTE} times per Day. The DUT may perform several data events per day. Each data event can be numbered with i (i=1, 2, 3, ….)

NOTE: If a data event is not happened every day, the value of f_{DTE} can be Decimals less than 1.

21. Calculate the Battery life according to following formula:

Battery life= C / CDay

If PSM is enabled:

$C_{Day} = f_{DTE1}I_{DTE1}T_{DTE1} + f_{DTE2}I_{DTE2}T_{DTE2} + \ldots + I_{Idle}T3342*(f_{DTE1}+f_{DTE2}+\ldots+f_{DTEi})+I_{PSM}T_{PSM}$

$T_{PSM} = 24*3600 – [f_{DTE1}T_{DTE1} + f_{DTE2}T_{DTE2} + \ldots + f_{DTEi}T_{DTEi} + T3324*(f_{TDE1} + f_{TDE2} + \ldots + f_{TDEi})]$ (in seconds)

If PSM is disabled:

$C_{Day} = f_{DTE1}I_{DTE1}T_{DTE1} + f_{DTE2}I_{DTE2}T_{DTE2} + \ldots + I_{Idle}T_{idle}$

$T_{idle} = 24*3600 – [f_{DTE1}T_{DTE1} + f_{DTE2}T_{DTE2} + \ldots + f_{DTEi}T_{DTEi}]$ (in seconds)

5 Standby Time Test

5.1 Standby with Cellular carriers

Test Case Title	Configuration	Testprocedures	
		Power Supply	Battery Pack
5.1.1 GSM	Section 2.3.1	Section 3.3	Section 3.5
5.1.2 GSM/GPRS	Section 2.3.2	Section 3.3	Section 3.5
5.1.3 WCDMA	Section 2.4.2	Section 3.3	Section 3.5
5.1.4.1 GSM/WCDMA Dual Mode	Section 2.5.1	Section 3.3	Section 3.5
5.1.4.2 (GSM/GPRS)/WCDMA Dual Mode	Section 2.5.2	Section 3.3	Section 3.5
5.1.4.3 WCDMA (GSM/GPRS) Dual Mode	Section 2.5.3	Section 3.3	Section 3.5
5.1.5.1 E-UTRA	Section 2.6.1	Section 3.3	Section 3.5
5.1.5.2 E-UTRA Carrier Aggregation (tbd)	tbd	tbd	tbd
5.1.6.1 5G SA (tbd)	tbd	tbd	tbd
5.1.6.2 5G NSA (tbd)	tbd	tbd	tbd

Description

This test case is measuring the standby time of a DUT in different RAT environment as indicated in the table above.

Initial configuration

Common parameters according to section 2.2

Test Method and general description according to 3.1

Measurement preparation according to section 3.2

Standby specific configuration as mentioned in table above

Test procedure

Test procedure according to section as listed in table above

5.2 Standby with WLAN in combination with GSM or WCDMA or E-UTRA

Test Case Title		Configuration	Testprocedures	
			Power Supply	Battery Pack
5.2.1	GSM Standby Time, WLAN enabled, no AP	Section 2.3.1	Section 3.3	Section 3.5
5.2.2	GSM Standby Time, WLAN enabled, DUT connected to AP	Section 2.7.1 Section 2.1	Section 3.3	Section 3.5
5.2.3	GAN Standby Time over WLAN, GSM coverage available	Section 2.7.2	Section 3.3	Section 3.5
5.2.4	WCDMA Standby, WLAN enabled, no AP	Section 2.7.1	Section 3.3	Section 3.5
5.2.5	WCDMA Standby, WLAN enabled, DUT connected to AP	Section 2.7.1 Section 2.1	Section 3.3	Section 3.5
5.2.6	E-UTRA Standby, WLAN enabled, no AP	Section 2.7.1	Section 3.3	Section 3.5
5.2.7	E-UTRA Standby, WLAN enabled, DUT connected to AP	Section 2.7.1 Section 2.1	Section 3.3	Section 3.5

Description

This test case is measuring the standby time of a DUT in different GSM configurations in combination with WLAN as indicated in the table above. This forces the DUT to search periodically for WLAN access points.

Initial Configuration

Common parameters according to section 2.2

Test Method and general description according to 3.1

Measurement preparation according to section 3.2

Standby specific configuration as mentioned in table above

Test procedure

Test procedure according to section listed in table above.

5.3 MIoT

5.3.1 Power Consumption of switching on

Description

To measure the average current and time taken to switch on the DUT.

Initial configuration

DUT is powered off

DUT is in a test location with good network coverage

DUT is equipped with dummy battery and connected to the power consumption tester via power line

Test procedure

22. Set the output voltage of power consumption tester the same as DUT nominal voltage.
23. Switch on power consumption tester and start power consumption measurement.

24. Power on the DUT. Measure and record the average current and time taken during the registration procedure. The registration procedure starts from switching on DUT and ends at the time when DUT enters into idle mode.
25. Stop power consumption measurement.
26. Switch off the DUT
27. Repeat step 3-5 twice more. Get the average current and test duration of three times.
28. Record the voltage (V), average current ($I_{SwitchOn}$) and duration ($T_{SwitchOn}$) (in seconds) of registration.

5.3.2 Power Consumption during Idle Mode

Description

To measure the average current when DUT is in standby mode.

Initial configuration

DUT is powered off

DUT is in a test location with good network coverage

DUT is equipped with dummy battery and connected to the power consumption tester via power line

Test procedure

29. Set the output voltage of power consumption tester the same as DUT nominal voltage
30. Switch on power consumption tester and power on the DUT.
31. Start power consumption measurement when DUT completes registration on the IoT service platform and enters into standby mode. Measure the average current for 5 minutes while DUT is in standby mode. Record the test results
32. Stop power consumption measurement.
33. Record the voltage (V) and average current (I_{Idle}) in step 3.

5.3.3 Power Consumption during Power Saving Mode

To measure the average current when DUT is in power saving mode.

Initial configuration

DUT is in idle mode.

DUT is in a test location with good network coverage

DUT is equipped with dummy battery and connected to the power consumption tester via power line

Test procedure

1. Set the output voltage of power consumption tester the same as DUT nominal voltage
2. Switch on power consumption tester.
3. DUT enters into power saving mode. Start power consumption measurement. Measure the average current over a continuous min{5 minute, T3412} period while DUT is in power saving mode.
4. Stop power consumption measurement.
5. Record the voltage (V) and average current (I_{PSM}) in step 3.

6 Talk Time Test

6.1 General

The set-up is described for UEs having a standard headset audio jack as described in [10]. If such interface is not available, another headset interface may be used.

To simulate a call with a 40/40/20 voice activity pattern (40% talk / 40% listen / 20% silence), 4 s audio followed by silence is sent on the uplink via the UE audio jack to the test equipment. The test equipment loops back the packets introducing a 5 s end to end delay. It is tolerated that the jitter of audio packet loopback delays can reach up to 2 ms maximum (measured at the LTE simulator).

A 10 second long reference audio file is provided (see the “Common Parameters” section); it contains a 4 s audio activity followed by silence. This reference audio file is repeatedly injected into the DUT audio input while the current drain is being measured.

This methodology yields to a global “40% talk / 40% listen / 20% silence” voice activity pattern (Figure below).

The DUT current drain is measured during 10 minutes (The UE display shall be OFF).

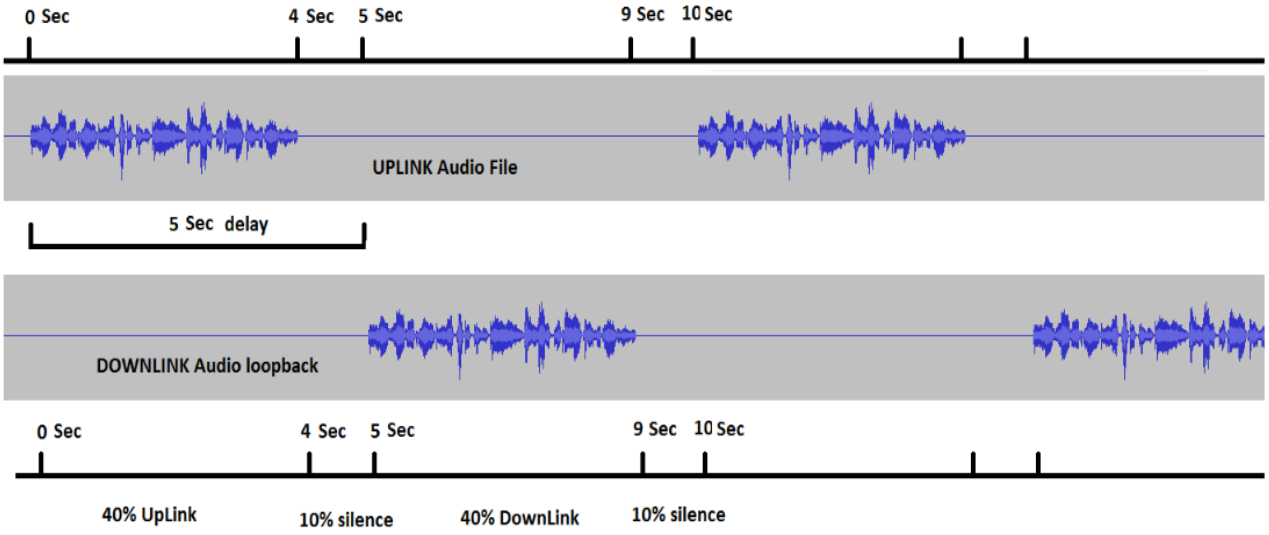

Figure 3: Voice Activity Pattern

6.2 Talk Time Scenarios

Test Case Title		Configuration	Testprocedures	
			Power Supply	Battery Pack
6.1.1	GSM	Section 2.3.3	Section 3.3	Section 3.5
6.1.2	WCDMA	Section 2.4.2	Section 3.3	Section 3.5
6.1.3	VoWiFi (no Cellular Coverage)	Section 2.7.2, 2.7.3 and 2.7.4	Section 3.3	Section 3.5
6.1.4	VoLTE	Section 2.6.2	Section 3.3	Section 3.5
6.1.5	VoNR (tbd)	tbd	tbd	tbd

Description

The purpose of this test is to measure the talk time of the DUT when attached to the access technologies listed in the table above.

Default Codec for VoWiFi and VoLTE is AMR-WB. If the EVS codec is supported, then the EVS AMR-WB IO mode may be used as an alternative implementation of AMR-WB

The UE current consumption and thus the talk time during a VoLTE call is expected to depend on the speech activity pattern due to the use of discontinuous transmission (DTX). Therefore a typical voice activity shall be injected during the talk time measurement, including talk, listen and silent periods.

Initial configuration

Common parameters according to section 2.2

Test Method and general description according to 3.1

Measurement preparation according to section 3.2

Standby specific configuration as mentioned in table above

Test procedure

Test procedure according to section as listed in table above

7 Packet Switched Transfer Test

7.1 General

Data transfer tests of various types are defined in later sections; however, the principles indicated in this section are also applicable to some of the later described tests.

It is recommended that the results of all the packet switched data tests be expressed as total amount of data transferred (in Mb) rather than time spent in the mode – the data transfer total is a more useful indication to the user of what the terminal is capable of and will be very roughly the same regardless of the actual duty cycle seen.

The FTP Download shall be started from a dedicated server of the test file. The size of the file must guarantee a continuous transfer so that the file transfer does not run out during the testing (at least 10 minutes).

The bearer used shall be the most efficient one, and bearer parameters used shall be stated in the test results.

In this test we consider a file download to an external device (e.g. laptop) connected with the DUT via

- Cable
- Bluetooth.
- USB port - data modem

During the test using a cable connection, the DUT should not be powered by the external device via the cable connection. If this kind of charging cannot be disabled by an appropriate SW tool, the cable FTP test is not relevant.

Record the USB standard version number used on the results sheet.

For WLAN the following applies:

The test file shall be located on a dedicated server or PC with network sharing enabled to allow the terminal to access the file via the WLAN.

During the test the terminal shall be in GSM standby.

7.2 PS Data Transfer with Cellular Carriers

Test Case Title	DL	UL	Parallel DL/UL	Configuration	Testprocedures	
	A	B	C		Power Supply	Battery Pack
7.2.1 GPRS	X			Section 2.3.3	Section 3.3	Section 3.5
7.2.2 WCDMA	X			Section 2.4.3	Section 3.3	Section 3.5
7.2.3 WLAN	X			Section 2.7.1	Section 3.3	Section 3.5
7.2.4 USB Data Modem	X	X	X	tbd	Section 3.3	Section 3.5
7.2.5 E-UTRA	X	X	X	Section 2.6.3	Section 3.3	Section 3.5
7.2.6 5G SA (tbd)	X	X	X	tbd	tbd	tbd
7.2.7 5G NSA (tbd)	X	X	X	tbd	tbd	tbd

Description

The purpose of this test is to measure the battery drain during PS Data transfer of the DUT when attached according to the scenarios listed in the table above.

Initial configuration

Common parameters according to section 2.2

Test Method and general description according to 3.1

Measurement preparation according to section 3.2

Standby specific configuration according to section as listed in table above

Test procedure

Test procedure according to section as listed in table above

7.3 MIoT

7.3.1 Power Consumption of Data Transfer Event during Active Mode

Description

To measure the average current of a data transfer event for DUT in active mode, e.g. status reporting.

Initial configuration

DUT is powered off

DUT is in a test location with good network coverage

DUT is equipped with dummy battery and connected to the power consumption tester via power line

Test procedure

34. Set the output voltage of power consumption tester the same as DUT nominal voltage
35. Switch on power consumption tester and power on the DUT.
36. Trigger a data transfer event on DUT when DUT enters into idle mode.
37. Start power consumption measurement. Measure and record the average current and time during this data transfer event.
38. Stop power consumption measurement after the DUT completes the data transfer and enters into idle mode again.
39. Repeat step 3-5 twice more. Get the average current and test duration of three times.
40. Record the voltage (V), average current (I_{DTE}) and time (T_{DTE}) (in seconds).

8 Browsing Test

The following test simulates Internet browsing operations. It exercises the communications link, the display, and the processor. As per the principles in section 7, the bearer used shall be the most efficient one, and bearer parameters used shall be stated in the test results.

8.1 HTML Browsing

Description

The GSMA have created a web page containing text and an image that automatically refreshes every 20 s. By ‘refreshes’ it is meant that the page contains appropriate HTML instructions so as to force the browser to completely reload the page and image every 20 s.

Initial configuration

To execute the test download the HTML test page and its associated files from the GSMA website as described in section 2 and load it onto your own local web server that is accessible to the terminal. The test should not be run from the GSMA web server because it is not configured to act as a test server.

Test procedure

To run the test, enter the URL of the web page into the browser. The complete test page and image should now be automatically refreshed by the browser every 20 s until the browser is closed.

For the duration of this test, the backlight shall be lit. If this does not happen automatically because of the page update then it must be forced by other means. For example it may be possible to set this in the options, or it can be achieved by manually pressing a key. The method used must be indicated in the test results.

Measure the current for five minutes as defined in section 3

NOTE:

- Using HTML <meta> tags to control the browser caching is not a reliable way. Some browsers may ignore the <meta> tags for cache control.
- When using HTML <meta> tags to control the refresh timer the timer will start counting from the time when the page is loaded. Since the page loading time is a variable for different solutions, the number of page loading iterations in the 5 min measurement time is not fixed.
- If the test is performed in a WCDMA network, the refresh duration of 20 s might not be long enough to allow the HSPA modem to ramp down from DCH to FACH to IDLE (for certain network configurations)

8.2 HTML Browsing For DUTs with Full Web Browsers

Description

For smartphones with full desktop web page rendering capabilities, the small web page used in section 8.1 is not suitable. This test case therefore uses ETSI's "Kepler reference page", which is an approximation of a full web page with pictures and content resembling a representative full web page.

Initial configuration

- Download the ZIP file of the "Kepler reference web page" from http://docbox.etsi.org/STQ/Open/Kepler.
- For the execution of this test case, place the content of the ZIP file in five different folders of a web server so the page and its contents are reloaded instead of taken from the cache of the DUT during the test.
- Ensure that the web browser's cache is empty to prevent from locally loading the pages.
- Ensure that the DUT can load the web page in less than 60 s. If the DUT can't load the page in this timeframe this test cannot be performed.

Test procedure

41. Open the “index.html” file in the first of the five folders on the web server in the web browser of the DUT. Ensure that the full page is downloaded, including the pictures and the content of the frames.
42. Ensure that the page is fully loaded before proceeding. Afterwards, scroll down the web page, e.g. by using the touch screen, scroll keys, etc.
43. After 60 s after the start of the download, open the “index.html” file at the next location on the web server and ensure that the full page is downloaded, including the pictures and the content of the frames.

NOTE: By starting the timer at the beginning of the request and NOT after the page has been fully downloaded, it is ensured that the overall test duration is constant, independent from the DUT’s and the network’s capabilities to deliver the page at a certain speed.

44. Repeat steps 2 and 3 until the page has been loaded five times. The total test time is therefore five minutes.
45. Measure the current for five minutes as defined in section 3.4 or 3.5.

9 Streaming Content Test

Since the used bearer and transmit power of the terminal is affecting the streaming power consumption, it is recommended that a system simulator is used. In case the system simulator is not connected to the internet, the streaming server provides the required streaming files that can be downloaded and installed on the system simulator.

The default setting for the appropriate bearer (see section 7) shall be used. When supported, WCDMA or E-UTRA shall be used.

9.1 Video Progressive Streaming

Description

UEs do support a variety of different streaming formats, which makes it difficult to determine one “default” video stream suitable for every UE. Therefore, a set of core video formats is defined and is available on the streaming server as reference content.

Filename	Bit Rate (kbps)	fps	Resolution / Size	Video Part	Audio Part
video_stream_480p_30fps_a.mp4	1500	30	854x480 (FWVGA)	H.264	AAC
video_stream_720p_30fps_a.mp4	3000	30	1280x720 (HD)	H.264	AAC
video_stream_720p_30fps_b.mp4	10000	30	1280x720 (HD)	H.265	AAC
video_stream_720p_30fps_c.webm	1300	30	1280x720 (HD)	VP9	VORBIS
video_stream_1080p_30fps_a.mp4	5800	30	1920x1080 (HD)	H.264	AAC
video_stream_1080p_30fps_b.mp4	12000	30	1920x1080 (HD)	H.265	AAC
video_stream_1080p_30fps_c.webm	2300	30	1920x1080 (HD)	VP9	VORBIS
video_stream_1080p_60fps_b.mp4	20000	60	1920x1080 (HD)	H.265	AAC
video_stream_2160p_30fps_c.webm	17000	30	3840x2160 (HD)	VP9	VORBIS

Table 28: Set of reference streaming formats

Initial configuration

The power consumption measurement shall be carried out by selecting and re-playing the stream with the highest possible bit rate and codec that are supported by the DUT. If the terminal capabilities are unknown, the test shall be started with highest numbered Video Stream in the table. If this stream does not work, the next lower Video Stream shall be used. As per the principles in section 7, the bearer used shall be the most efficient one, and bearer parameters used shall be stated in the test results.

The pre-installed Media Player of the DUT shall be used for Video Streaming. Full Screen shall be enabled, if supported by the DUT.

The Video Stream shall be played using the inbuilt (hands free) speaker of the DUT. If this is not available, the original stereo cable headset or original Bluetooth headset (or one recommended by the terminal manufacturer) shall be used.

Test Procedure

46. Connect to the Reference Portal to obtain the video content.
47. Start the download by selecting the appropriate video. After the connection is successfully established with the streaming server and the download has started, start watching the clip.
48. After 30 s of the start of the video download above, start the power consumption measurement.
49. The video content shall be downloaded to the DUT as fast as possible with the selected radio profile to reflect how videos are streamed to UEs from public video portals in practice.
50. Stop the power consumption measurement after 10 minutes (total duration between the time stamps of the first and last power samples).

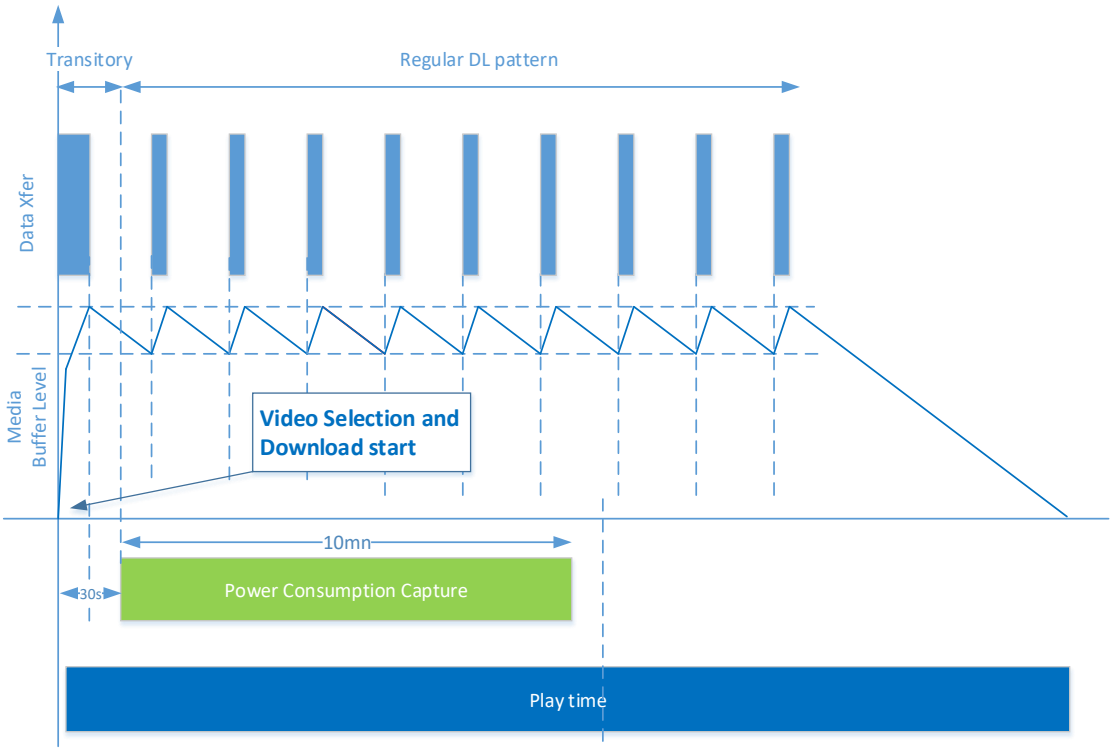

Figure 4: Video Streaming and Power Consumption Measurement

The reference content for Video Streams can be retrieved from the GSMA website. It can be noticed that the filename itself gives some information about the video/audio encoder that applies:

Filename	Video Codec	Audio Codec
xxxx_a.*	H264	AAC
xxxx_b.*	H265	AAC
xxxx_c.*	VP9	VORBIS

Table 29: Progressive Streaming filenames and Video/Audio Codecs

9.2 Dynamic Adaptive Streaming over HTTP (DASH)

Description

Dynamic Adaptive Streaming over HTTP or DASH video content can be played by loading the provided web page through a web browser. The reference content for DASH Video Streams can be retrieved from the GSMA website.

Initial configuration

The bearer used shall be the most efficient one, and bearer parameters used shall be stated in the test results.

Filename	Bit Rate (kbps)	fps	Resolution / Size	Video Part	Audio Part
dash_720p.html	3000	30	1280x720 (HD)	H.264	AAC

Table 30: Set of reference DASH streaming formats

The pre-installed Web Browser of the DUT shall be used for DASH Video Streaming. Full Screen shall be enabled, if supported by the DUT.

The Video Stream shall be played using the inbuilt (hands free) speaker of the DUT. If this is not available, the original stereo cable headset or original Bluetooth headset (or one recommended by the terminal manufacturer) shall be used.

Test procedure

51. Connect to the Reference Content Portal to obtain the web page content
52. Start the download by selecting the appropriate video stream. After the connection is successfully established with the streaming server and the download has started, start watching the movie.
53. After 30 s of the start of the video download above, start the power consumption measurement.
54. The video content shall be downloaded to the DUT as fast as possible with the selected radio profile to reflect how videos are streamed to UEs from public video portals in practice.
55. Stop the power consumption measurement after 10 minutes (total duration between the time stamps of the first and last power samples).

9.3 Audio Streaming

Description

Audio Streams are usually only supplied on WCDMA – E-UTRA Bearers, i.e. this test only applies to WCDMA – E-UTRA capable UEs only. The reference content for Audio Streams can be retrieved from the GSMA website.

The following core audio streaming formats are defined and available on the streaming server as reference content as follows:

	Codec	Bit Rate	Sampling Rate	SBR Signalling
Audio Stream 1	AAC+	32 kbps	44.1 kHz	0 (= implicit)
Audio Stream 2	AAC-LC Stereo	96 kbps	44,1 kHz	Not applicable

Table 31: Set of Audio stream formats

Initial configuration

The pre-installed Media Player of the DUT shall be used for Audio Streaming.

The Audio Stream shall be played using the inbuilt (hands free) speaker of the DUT. If this is not available, the original stereo cable headset or original Bluetooth headset (or one recommended by the terminal manufacturer) shall be used.

Test procedure

56. Connect to the Reference Content Portal to obtain the audio content
57. The actual playing time should be 10 minutes
58. After successfully established connection to the streaming server, start listening to the audio clip
59. Start Power Consumption Measurement

10 Application software test

Suggested standard applications are as follows. These have been chosen as the applications most commonly provided on terminals at present. Clearly if a terminal does not support the application, the corresponding test is not required.

These are activities that do not require active data transfer channel. For these tests the terminal shall be in idle mode as far as air interface activities are concerned (either WCDMA or GSM/GPRS according to the type of terminal)

10.1 Music Playback

Description

UEs support a variety of different music playback formats. The most common one in use is the mp3 media format. A reference file in this format is supplied on the GSMA web page (see references section). If this format is not supported, a reference file shall be transcoded from this file. The following information shall be noted in the test results.

- Codec used
- Data rate
- Use of internal or external memory
- Radio technology used

The volume used during the test shall also be described in the test results and shall be set to a middle volume level (e.g. 5 out of 10 possible levels). The DUT shall be connected to a WCDMA or E-UTRA network.

Initial configuration

The following parameters are used for the media file:

- Bit Rate: 128 kbps
- Sampling Rate: 44.1 kHz (Stereo)
- Download the reference music file from the GSMA website and store it onto the terminal. The media file shall be stored on the external memory card and played back from there. If the DUT does not support an external memory card, the media file shall be stored in the internal phone memory and played from there.
- The pre-installed Music Player of the DUT shall be used for music playback. Enabling of screensavers shall be set to the default values as delivered from the factory.
- The original stereo cable headset or original Bluetooth headset (or one recommended by the terminal manufacturer) shall be used.

Test procedure

60. Save the media file on the phone (memory selection see above)
61. The actual playing time should be 5 minutes
62. Set the volume to mid-level and start listening to the audio media clip
63. Start Power Consumption Measurement

10.2 Video Playback

Description

UEs do support a variety of different Video Playback formats. Most common use is the H.264 media format. If this is not supported, MPEG4 Visual Simple Profile Level 0 media

format or H.263 Profile 0 Level 10 shall be used to perform this test. The codecs and resolution used for the test shall be specified in the test results.

Filename	Bit Rate (kbps)	fps	Resolution / Size	Video Part	Audio Part
video_player_06.mpg	4000	30	640x480 (VGA)	H.264	AAC
video_player_07.mpg	8000	30	1280x720 (HD 720p)	H.264	AAC
video_player_08.mpg	10000	30	1920x1080 (HD 1080p)	H.264	AAC

Table 32: Set of reference local video formats

Initial configuration

The media file shall be stored onto the handset on the external memory and played back from there. If the DUT does not support an external memory card, the media file shall be stored in the internal phone memory and played from there.

The pre-installed Media Player of the DUT shall be used for Video playback. Background illumination shall be enabled. Screensaver shall be disabled.

The original stereo cable headset or original Bluetooth headset (or one recommended by the terminal manufacturer) shall be used. Full Screen shall be enabled, if supported by the DUT.

Test procedure

64. Save the media file on the phone
65. The actual playing time should be 5 minutes
66. Set the volume to mid-level and start watching the video media clip
67. Start Power Consumption Measurement

10.3 Camera Operation

Description

The taken pictures shall be stored on the external memory card. If the DUT does not support an external memory card, the pictures shall be stored in the internal phone memory.

Use the DUT under normal light conditions (bright daylight) in a normal illuminated room. Use no external lamps or flashlight and switch off the internal lamp or flash. Picture size/resolution and quality shall be set to maximum. Use the UE in airplane mode to have a defined default status.

Test procedure

68. The reference image to be photographed shall be downloaded from the GSMA website and displayed on a suitable computer screen
69. Start taking photos.
70. Take 20 pictures at an interval of 30 s
71. Measure the current consumption during the period that photographs are being taken and stored

10.4 Video Recording

Initial configuration

- If certain parameter data is not defined by the default factory settings at the factory the measurements shall be made using the setting parameters that the manufacturer assumes will most likely be employed by the users.
- Mass storage memory is used for streaming video material. If the DUT does not have an external mass memory extension slot, internal memory shall be used instead.
- In case that the terminal has two cameras, the highest resolution (main) camera is to be used for recording.
- Audio recording shall be on.
- Video stabilization, if supported, shall be on.
- If the display is equipped with an illumination function (e.g. backlight), this shall be lit for the duration of the test.
- If the brightness or contrast of the display is adjustable, the adjustable parameter shall be set at the factory setting when measurement is done.
- If the DUT has an ambient light sensor controlled display, the input of the sensor shall be set to maximum.
- Keypad lights: default settings.
- Measurements have to be carried out in a light environment (in the region of 500 lux).
- Viewfinder on.
- The highest video recording quality available on the terminal shall be used.

Test procedure

72. A default video file available at the GSMA website shall be played on a PC with medium volume.
73. Enable Video recording on the terminal.
74. Capture the video clip as full screen on the viewfinder.
75. Start Power Consumption Measurement
76. The actual recording time should be 10 minutes.
77. Record the Video Recording time and the settings used in Appendices LINK respectively.

NOTE: The PC display refresh rate shall be at least twice the recording frames per second in order to minimise interference.

11 Bluetooth Interface Usage Test

This section is designed to test the effect of Bluetooth accessories on the standard operation of a terminal. Clearly the tests are only applicable to a terminal that supports Bluetooth and specifically supports the accessories indicated in the following subsections.

Record the Bluetooth standard version number used on the results sheet.

11.1 Common Parameters

Parameter	Value
Radio environment	The interface tested shall be the only Bluetooth connection in the test area. No other radio should transmit in the 2.4 GHz band (e.g. WLAN)
Distance (Phone to BT device)	10 centimetres
Power Class of the BT device	To be stated in the test report
Enhanced Data Rate (EDR)	ON
Sniff interval	0x800 (about 1.28 s)
Sniff Attempt parameter	8
Sniff Timeout parameter	8

Table 33: Bluetooth interface parameters

It is recommended to set-up the following scenarios with Bluetooth devices associated with the DUT. However the accessory device used must be Bluetooth certified and commercially available.

11.2 Headset – Talk Time

- This scenario shall be run on top of a Talk Time scenario (ref. sections 4 or 5).
- The test shall be run with a commercially available Bluetooth certified headset.

When measuring talk time, a voice signal shall be sent in both directions of the Bluetooth connection. Reasoning: This approach prevents a Bluetooth device to enter sniff mode during silence periods.

The test setup simulates a regular call situation with the headset connected to the terminal under test and a regular voice call open to a second terminal. The baseband role (Master\Slave) of the Phone when connected with a Bluetooth headset is another factor that can affect the power consumption. It is recommended that this parameter is reported (typically Phone is Master of the connection).

11.3 Headset – Music Player

- This scenario shall be run on top of the Music Playback scenario (refer section 10.1).
- The test shall be run with a commercially available Bluetooth certified headset. The test report should specify if the connection between Phone and Headset is an EDR

level or non-EDR level connection. Using a BT A2DP headset with optimum bit rate can lower the power consumed.

11.4 DUT in BT discovery mode – Standby Time

- This scenario shall be run on top of a Standby Time scenario (refer section 5).

Bluetooth is enabled on the DUT side but remains unconnected with other devices throughout the test cycle. There shall be no other Bluetooth device in range. The DUT shall be kept in invisible mode while the test is executed.

11.5 BT data transfer in idle

The objective of this test is to measure specifically Bluetooth power efficiency.

The test parameters are:

- Cellular mode: idle, as per the already specified idle mode scenario
- BT node to terminal distance: 1 meter, or use artificial attenuation to achieve the same result
- File to transfer: GSMA MP3 reference file (as per Music Playback scenario)

The results are to be specified as MB Transfer within battery life (as per other data transfer tests).

12 GPS Tracking

The objective of this test is to measure the average current consumption of the entire terminal during GPS Tracking. During this test the terminal shall be in GSM Standby according to section 5.1 with no other applications active.

12.1 Option 1: Satellite simulator available (preferred)

Initial configuration

The test setup shall follow Figure A.2 of [9].

Satellite Simulator configuration:

Refer to table 5.6.1 of [9]

Test procedure

78. The default GPS Tracking periodicity shall be used. The value used, if known, shall be noted in the test data for GPS tracking. If adaptive tracking is used then it shall be noted in the test data for GPS tracking.
79. Navigate to and enable the bundled mapping application. Should no bundled mapping application be available, or should the bundled mapping application not be suitable then t, any application that can run in the background, without display view and on 1Hz, could be used
80. Wait until it is clear that terminal has a valid positioning fix and wait for the backlight to extinguish.
81. Start the measurement, run the measurement for ten minutes and note the average current consumption over this period.
82. Complete the test data for GPS tracking.

12.2 Option 2: Satellite simulator not available

Initial configuration

Place the terminal in a stationary position. If the test is performed outside ensure the internal GPS antenna has unobstructed line of sight to clear sky conditions. If the test is performed inside then it must be ensured that the GPS signal is provided to the terminal (for example using a cable connection or use of a GPS antenna repeater).

Test procedure

83. The default GPS Tracking periodicity shall be used. The value used, if known, shall be noted in the test data for GPS tracking. If adaptive tracking is used then it shall be noted in the test data for GPS tracking.
84. Navigate to and enable the bundled mapping application. Should no bundled mapping application be available, or should the bundled mapping application not be suitable, any application that can run in the background, without display view and on 1Hz, could be used
85. Wait until it is clear that terminal has a valid positioning fix and wait for the backlight to extinguish.
86. Start the measurement, run the measurement for ten minutes and note the average current consumption over this period.
87. Complete the test data for GPS tracking

Annex A GSM/GPRS NEIGHBOR CELLS LISTS

A.1 Single Mode

Neighbor cells to be monitored in single mode GSM/GPRS scenarios.

Parameter	Band	Value
Neighbor Cell ARFCNs	900 Band	1, 9, 17, 26, 34, 42, 50, 58, 67, 75, 83, 91, 99, 108, 116, 124
	1800 Band	512, 536, 560, 585, 610, 635, 660, 685, 710, 735, 760, 785, 810, 835, 860, 885
	1900 Band	512, 530, 550, 570, 590, 610, 630, 650, 670, 690, 710, 730, 750, 770, 790, 810
	850 Band	128, 137, 145, 153, 161, 169, 177, 185, 193, 201, 209, 217, 225, 233, 241, 251
	450 Band	259, 262, 265, 267, 269, 271, 273, 275, 277, 279, 281, 283, 285, 287, 290, 293
	480 Band	306, 309, 312, 314, 316, 318, 320, 322, 324, 326, 328, 330, 332, 334, 337, 340

Table 34: GSM/GPRS Single Mode Neighbor cells

A.2 Dual Mode

GSM/GPRS 64 neighbour cells to be monitored in dual mode WCDMA/(GSM/GPRS) scenario.

Parameter	Band	Value
Neighbor Cell ARFCNs	900 Band	1, 9, 17, 26, 34, 42, 50, 58, 67, 75, 83, 91, 99, 108, 116, 124
	1800 Band	512, 536, 560, 585, 610, 635, 660, 685, 710, 735, 760, 785, 810, 835, 860, 885
	1900 Band	512, 530, 550, 570, 590, 610, 630, 650, 670, 690, 710, 730, 750, 770, 790, 810
	850 Band	128, 137, 145, 153, 161, 169, 177, 185, 193, 201, 209, 217, 225, 233, 241, 251
	450 Band	259, 262, 265, 267, 269, 271, 273, 275, 277, 279, 281, 283, 285, 287, 290, 293
	480 Band	306, 309, 312, 314, 316, 318, 320, 322, 324, 326, 328, 330, 332, 334, 337, 340

Table 35: GSM/GPRS Dual Mode Neighbor cells

Annex B Pro Forma Tables

B.1 Test Results

This Annex contains the Pro-forma result tables in excel format and can be used to record the test results.

GSMA-PRD-TS09-Proforma-v12.xlsx

B.2 Detailed Test Parameters

B.2.1 Parameters Used for GPRS PS

Parameter	Used Value
Multi-Slot Class	
Terminal Type	
Slots (Uplink)	
Slots (Downlink)	
Duty Cycle	
Coding Scheme	
CS Can Change	
Transfer Mode	
Transparent / Non Transparent	
Retransmissions	

Table 36: Parameters Used for GPRS PS

B.2.2 Parameters used for WCDMA Idle Mode and CS Mode

Parameter	Used Value
Serving Cell Scrambling Code	
Neighbor Cell Scrambling Codes	
Paging Interval	
Ec/No	

Table 37: Parameters used for WCDMA Idle Mode and CS Mode

B.2.3 Parameters used for WCDMA PS Mode

Parameter	Used Value
Serving Cell Scrambling Code	
Use Secondary Scrambling Code	
Fixed Channelization Code	
Hard Handover	
Soft/Softer Handover	
CHANNEL TYPE ul & dl BEARER	
CPICH RSCP (ec)	
eC/NO	
DUTY CYCLE	

Table 38: Parameters used for WCDMA PS Mode

B.2.4 Parameters used for Streaming Mode

Parameter	Used Value
Video Stream filename	

Table 39: Parameters used for Streaming Mode

B.2.5 Parameters used for Audio/Video Playback Tests

Parameter	Used Value
MP3 File Format Used (Y/N)	
If MP3 Format Was Not Used, Specify The Used Format	
Video Format (MP4 or H.263)	

Table 40: Parameters used for Audio/Video Playback Tests

B.2.6 Parameters used for Video Recording

Parameter	Used Value
Frames Per Second (FPS)	
Bit Rate (Kbps)	
Resolution	
Video Codec	
Audio Codec	

Parameter	Used Value
Audio Codec Bit Rate (Kbps)	
Keypad Backlight (ON or OFF)	
Target Memory (Local Memory SSD/Memory Stick/Other)	

Table 41: Parameters used for Video Recording

B.3 Bluetooth & USB Revision Numbers

Parameter	Used Value
Bluetooth Standard Version Number Used	
USB Standard Version Number Used	

Table 42: Bluetooth & USB Revision Numbers

B.4 GPS Tracking

Parameter	Used Value
Test Procedure Used	(Option 1 or Option 2)
Test Performed Inside Or Outside	(Option 2 only)
Actual Sky Conditions	(Option 2 outside only)
GPS Repeater Available	(Y/N Option 2 inside only)
GPS Tracking Periodically	
Adaptive Tracking	(Y/N)
Test Duration	(If different from 10 minutes)
Behaviour Of The Display During Test	(If not totally OFF)

Table 43: GPS Tracking

Annex C Document Management

C.1 Document History

Version	Date	Brief Description of Change	Approval Authority	Editor / Company
1.0.0	4 April 1998	Draft version tabled information		
2.0.0	27 April 1998	Version 2.0.0 tabled for MoU Plenary		
3.0.0	April 1998	Approved at MoU 39		
3.0.1	August 1998	Document Classification Scheme		
3.1.1	October 1998	Approved MoU 40		
3.1.1	6 January 2006	Reformatted document to GSMA style guide, marked with new designator “DG.09” to match owning group name.		
4.0.0	30 June 2006	Revised version approved in DG#10. Update including new customer usages and new enablers: WCDMA, Browsing, Streaming, Application Software, VT, Bluetooth interface.		
4.1.0	08 November 2006	Comments from Nokia / NEC. Addition of FTP scenario. Editorial modifications.		
4.4.0	09 March 2007	Editorial corrections. Java applets clarifications. FTP downloads with Bluetooth. Standard version number for BT and FTP test scenarios. BT data transfer in idle scenario. Addendum to measurement circuitry definitions. Update of Performa table.		
4.5.0	15 June 2007	Editorial corrections. New/updated scenarios: Wi-Fi, GAN, Video & Audio Streaming, VT, Music & Video Playback.		
4.5.1	14 September 2007	Clarification on 68 neighbour cells		
4.6	01 May 2008	Clarification on Volume and Display settings. The bit rate for BLM video stream #1 and #3, listed in the table in chapter 8.1, is changed. Correction have been done to the Browser test scenario 7.1 & 7.2	DG / EMC	
4.7	06 June 2008	T3212 parameter value added Section 3 &9 Ec/No > 12dB.added to section 5.2 link to reference file in section 2.2 added	DG / EMC	
4.8	01 December 2008	Video Recording & WLAN FTP download scenario added	DG / EMC	

Version	Date	Brief Description of Change	Approval Authority	Editor / Company
5.0	10th January 2009	Section 10 – To allow the use of a video loopback in place of a second terminal. Section 19.3.2 – The procedure requires a delay of 3 minutes The 3 minute window may not provide enough time for boot processes to be completed on all handsets Small changes to sections 4.5 and 9.0 Specify volume level for 9.1, 92 , 9.4 & 9.5	DG / EMC	
5.1	15th September 2009	Document has been updated to latest GSMA PRD template due to that section and references had to be re-numbered. Imported CR DG22__015r1 CR_to_BLM_Document_to_add_power_supply_measurement_procedure.doc. Sections (old version12, 20, 21, 22, 23, 24) 11, 19, 20, 21, 22, 23, 24 has been updated. Imported CR DG22_017r1 CR to DG.09 GPS Tracking Version 2.0.doc Added new section 13 GPS Tracking and added under Annex B section B5	DG / EMC	
6.0	30 September 2010	Document DG24_023r2 added USB data modem.(TIM) Document DG25_017r1 Document Clean up(SE) Document DG26_013 updating the references in Table 2.10 (DTAG) Document number changed to TS.09	DAG 76 & EMC 88	Armin Schoeller
6.1	15.12.2011 & 16.03.2011	Doc BLM_15_004 CR to DGv6.0 clean-up was approved. Unnecessary text removed. Doc BLM_15_005 Added in section 19.2 definition of Headroom. Doc BLM_16_002 2nd phase clean up TS09 v6.0 Doc BLM_16_003 Section 13 GPS additional info added Doc BLM_16_004 Added parameters to 'Cross Reference table' section 1.3 & removed and added parameters to section 4.2 BLM_16_005 Section 8.1 Video Streaming table updated/replaced & some text updated Section 8.2 Audio Streaming added 1 row to the table. Section 9.2 Video Playback Updated text video format to be used.		Marc Ouwehand Nokia
6.2	25.5.2011	BLM_17_003: Editorial clean up in different sections. (Most was already implemented via BLM_15_004 & BLM_16_002. BLM_17_004r1: Removed reference in the header the older document name. BLM_17_005r1 Section 3.7 Updated 2		Marc Ouwehand Nokia

Version	Date	Brief Description of Change	Approval Authority	Editor / Company
		parameters: in tables: “Auth./Ciph”& “WLAN Standards”. BLM_17_007r1 Section 5.2 Removed, modified and added parameters in the table.		
6.3	25.05.2011	BLM_16_006 Section 5.2 WCDMA table have been updated. BLM16_007 Section 2 Common Parameter table update text Backlight and Keypad. Section 3.3 Updated WCDMA Parameters Standby Time: Removed CPICH_RSCP (EC), Serving Cell Code Power, EC/NO, Changed Sintrasearch, SsearchRAT, Added: Number of paging indicators per frame (Np), IOC, $\hat{I}_{or}/I_{oc}$, CPICH_Ec/Ior, PICH_Ec/Ior, Sintersearch, Qqualmin, Qrxlevlmin Section 7.1 & 7.2 Text added at the end of paragraph Section 9.1 Text added at the end of paragraph Section 9.3 Idle mode changed in Airplane mode. Section 11.1 table entry Enhanced Data Rate (EDR) value changed. Section 11.2, 11.3 & 11.5 Added text at the end of every paragraph.		Marc Ouwehand Nokia
6.4	28.08.2011	BLM #18_001 Details: This CR is combining section 7.1 and 7.2 on web browsing for GPRS and UMTS as the text in both section is almost identical. Section 7.2 completely deleted. Pro-forma excel sheet has been accordingly changed as well. (7.1 became 6.1 See 003r1 doc) BLM #18_002r2: Details: Added a new Web Browsing test for devices supporting a ‘full’ web browser. New section 7.3 added, which is re-numbered due to the removal of the former Section 7.2(see BLM #18_001) (7.2 became 6.2 See 003r1 doc) Pro-forma excel sheet has been accordingly changed as well. BLM #18_003r1: Details: This CR included the last part of clean-up operation. Following sections removed: Section 4.4/v6.3 section 4.3 WCDMA/GSM Dual Mode Section 5.3 GPRS/WCDMA Dual Mode Section 5.4 WCDMA/GPRS Dual Mode Complete Section 6 including sub		Marc Ouwehand Nokia

Version	Date	Brief Description of Change	Approval Authority	Editor / Company
		sections. This means that all sections and section after chapter 6 were renumbered. It was agreed not to use Void, but clean it up, consequence is that all references are renumbered after former section 6 and that Pro-forma result sheet also changed accordingly. BLM #18_004r1: Details: Removed the Result Tables from the TS09 word document and replaced it with Embedded Excel sheet version. BLM #18_005 Details: Added 2 Timer parameters to the end of Section 5.2 WCDMA parameter table		
7.0	25.10.2011	BLM #18_006r1: Details: Including LTE test requirements. Sections 3.8 and 5.3, 5.4 and 5.5 has been added.	DAG / EMC	Marc Ouwehand Nokia
7.1	14.12.2011	BLM #19_002r1: Details; Video Stream section 7 updated and included HD stream in the table.		Marc Ouwehand Nokia
		BLM #19_004: Details: Section 5.2 WCDMA HSDPA bearer updated		Marc Ouwehand Nokia
7.2	14.03.2012	BLM #20_002: Local video files – Section 2 and 8.2 have been updated with Video Playback references BLM #20_003: Correction section 5.2 WCDMA table parameter DPCH-EC/IOR BLM #20_005: Added missing Video links under section 2 and updated table under section 7.1 BLM #20_008: Section 8.2 text be revised/corrected BLM #20_010: Section 3.7 updated comment for parameter WMM/UAPSD Power Save		Marc Ouwehand Nokia
7.3	19.06.2012	BLM #21_003: EUL Settings – Section 5.2 table added and changed parameters.		Marc Ouwehand / Nokia, Martin Sauter / Deutsche Telekom
7.4	26.09.2012	BLM #22_003r2 TS09 Clean-up BLM #22_004r1 LTE/Wi-Fi Test Cases. BLM #22_005 Removal of Java Tests BLM #22_006r2 Addition of LTE TDD Parameters BLM #22_007 Addition of LTE TDD Download Parameters BLM #22_008 Addition of LTE TDD		Marc Ouwehand / Nokia

Version	Date	Brief Description of Change	Approval Authority	Editor / Company
		Parameters BLM #22_009 TX level for WCDMA in section 5.2 changed to 10.		
7.5	11.12.2012	BLM #23_003 Adding Wi-Fi 5 GHZ band in section 3.8. BLM #23_004r1 Music Playback Test Case update (section 8,1) BLM #23_005 Java Clean up (section 2) BLM #23_006r1 Video Streaming Time and Method. (Section 7) BLM #23_007r1 LTE TDD Parameters (Section 5)		Marc Ouwehand / Nokia
7.6	13.06.2013	BLM25_004r1 Several minor corrections in different sections. BLM25_006: Links section 2 updated		Marc Ouwehand / Nokia
8.0	21.03.2016	BLM36_004 Introduction of the IMS service Voice over LTE BLM36_005 VoLTE audio BLM36_007 VoLTE voice activity pattern BLMDG38_003 Clarification of Test procedure 6.2 for HTML Browsing For Devices With Full Web Browsers		Francois Goeusse / Intel Corporation
9.0	29.11.2016	BLMDG42_005 Video Streaming Test Protocol Clarification BLMDG44_003 VoLTE NW update BLMDG45_003 Migration Onto GitHub BLMDG45_004 Video Files Added BLMDG45_005 Dash Streaming Feature		Francois Goeusse / Intel Corporation
10.0	12.06.2017	Updated with changes in TS.09 CR1005	TSG#28	Paul Gosden
10.1	26.09.2017	Formating corrected	TSG	Paul Gosden
10.2	March 2018	Formating corrected	TSG	Paul Gosden
11.0	Feb 2021	Implementing changes in CR1008	TSG#42 ISAG#6	Petra Rauer Vodafone
12.0	April 2022	Implementing changes in CR1009	TSG#47 ISAG#19	Paul Gosden GSMA

C.2 Other Information

Type	Description
Document Owner	TSG
Editor / Company	Petra Rauer Vodafone

It is our intention to provide a quality product for your use. If you find any errors or omissions, please contact us with your comments. You may notify us at prd@gsma.com

Your comments or suggestions & questions are always welcome.