



July 2010.

Cellular Mobile Network Billing Verification Methodology

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LIST OF ABBREVIATIONS

BCCH	Broadcast Control Channel <i>(Contains information about the cell & neighbor freq along with power level)</i>
CAA	Call Attempt
CAC	Call connected
CAD	Call disconnected
CCH	Common Control Channel <i>(MS to BTS communication, contains info about synch/paging)</i>
C/I	Carrier to Interference ratio
CMTO	Cellular Mobile Telecom Operator
DCCH	Dedicated Control Channel <i>(Two-way communication, Contains information about call connection/disconnection time)</i>
L3U	Layer 3 Uplink
L3D	Layer 3 Downlink
RACH	Random Access Channel <i>(Communication request from MS to BTS)</i>
SACCH	Slow Associated Control Channel <i>(Used to transmit signaling information)</i>
SIM	Subscriber Identification Module
USSD	Unstructured supplementary service data

1. INTRODUCTION

Pakistan's mobile communication has seen an unprecedented growth in the past few years. Seeing the growth of telecommunication, Pakistani Cellular Mobile operators has launched various voice packages having billing pulse of '1' , '30' , '60' seconds etc.

Despite the efforts carried out by CMTO's to provide high quality telecom services to subscribers, PTA continue to receive improper billing complaints. With the aim of protecting telecom subscriber rights, PTA plans to verify the CMTO's billing as per their advertised rates. After thorough study and utilization of the tool (NEMO) for billing related tests PTA conducted tests in July and October 2009.

Based on the observations and experimental test results, a comprehensive CMN Billing verification methodology has been formulated for PTA to verify the subscriber bills through a stepwise approach.

2. QOS TOOL CAPABILITIES

Based on the QoS tool (NEMO) a setup is needed to establish calls between two SIMs using a predefined call duration and call repetition time. NEMO analyzer generates an output file consisting of call logs from which we can extract the desirable events/stats.

The analyzer report (sample attached as Annex-A) carries plenty of information, however the following shall be used:

- Date of the Test
- Call Start time
- Call End time
- Setup time
- Called Number

The main information needed to verify the CMN billing is:

1. The call duration and
2. The billing plan of that particular SIM being tested.

The billable duration of the call can be extracted from the Analyzer report events i.e. Call start/end time and setup time. Layer 3 messages contain information about DCCH (*Dedicated Control Channel used for call connection/disconnection time*), CCCH (*Common Control Channel used for MS to BTS communication for synch/paging*), RACH (*Random Access Channel used for request from MS to BTS*) and BCCH (*Broadcast Control Channel containing the information about the cell & neighbor freq along with power level*).

We are only interested in the call connection /disconnection parameter which can be extracted by Dedicated Control Channel (DCCH) connect acknowledge message i.e. the call connection time. However the call disconnection time is also verified by Layer 3 uplink message which also uses DCCH to generate the RELEASE COMPLETE Message.

3. VERIFICATION METHODOLOGY

PTA's existing NEMO tool deals with Technical QoS parameters and doesn't automatically calculate billing part. In order to perform the desired CMN billing verification a semi automatic mechanism is devised to calculate the call charges as follows.

'Call duration' is extracted from the Analyzer report mentioned at section 2 above. A product (multiplication) of 'call duration' and 'advertised billing rate' determines the total cost of the call. An MS Excel Sheet has been recommended (attached as **Annex-B**) with formulae to automatically calculate values once the above mentioned input data is entered into the corresponding cells.

3.1 FOR PREPAID SIMS

- a) A total of 10 calls each are recommended to be made through prepaid SIMs of each operator to its own and other operators network thus covering both on-net and off-net calls, for each calling plan.
- b) Call durations should be set depending upon the billing pulse of the package used for testing. Slight variations exist in the methodology for selecting billable call duration time for 1, 30, 60 second billing packages.

$$\text{Call time (sec)} = \text{Setup time (sec)} + \text{Call duration (sec)}$$

- i. For "1 second" Package it is proposed to establish each call for a duration of 10 seconds and then calculate billing as described in Annex-B.
- ii. For "30" second Package it is proposed to establish each call for a duration of 28 seconds and then calculate billing as described in Annex-B.
- iii. For "60" second Package it is proposed to establish each call for a duration of 58 seconds and then calculate billing as described in Annex-B.

- c) Balance check will be performed after making all calls mentioned at 3.1 above separately for on-net and off-net calls, for each billing plan, between any two SIMs, through SMS USSD string.
- d) The final cost of the billable calls will be calculated using Excel sheet after multiplying the call billable duration with the advertised package rates. The taxes are also to be included accordingly. *(Please see Annex-B)*
- e) The balance information received through SMS as well as data obtained from Operators CDRs will be cross checked by the results of Excel Sheet. Cost of checking through SMS USSD string shall be adjusted accordingly.
- f) An allowable tolerance of "1" second which could occur between the Operators CDR and QoS tool will be considered while making calculations.

3.2 FOR POSTPAID SIMS

Follow the process as mentioned at section 3.1 above except that the billing information has to be obtained from the operator through CDRs for desired calculations or checked online as any other user would do to get to his/ her instantaneous balance.

4. RECOMMENDED TEST CONDITIONS

In present scenario with semi automated approach, following conditions must be met during the execution of CMN billing project.

- a) The test be made for off-net & on-net for voice calls only.
- b) The SIMs be purchased without disclosing the identity of PTA.
- c) Ensure that the "calling number" advertised packages rates be confirmed by the operators' websites accordingly both post and prior to execution of test.
- d) Both prepaid and postpaid packages offered by Operators are tested.
- e) The most widely and simple advertised package plans be tested against 1, 30, 60 second billing pulses, or as directed by the Authority.
- f) That the test can be performed either in PTA office or elsewhere and mobility is not required.

5. STEP WISE PROCEDURAL TASKS.

The CMN billing verification process is defined in tasks as below.

- a) Find out the maximum time required by Operator to update the billing database after making each prepaid/ postpaid call.
- b) Confirm the package details/ package type of the SIMs being used for the test.
- c) Advertised packages by CMTOs should be noted from their websites both post and prior to execution of test.
- d) Plan as many Operator's testing as possible depending on tool's capability for benchmarking purposes.
- e) Establish a set of '10' calls from each of the transmitting mobile terminals having call duration w.r.t Package billing pulse identified in Section 3.
- f) For prepaid, after successful completion of set of '10' calls, manually check (**if automated not possible**) and note down the SIM balance using appropriate USSD string.
- g) After each on-net testing, the SIMs at the Called End (receiving side) shall be replaced by the SIMs of other operators for off-net testing. Ensure that a total of '10' calls per operator should be established both for on-net and off-net scenario.
- h) After successful completion of calls, Analyzer reports will be generated from the call logs.
- i) The Desired parameters (Call Start time, End time and Setup time) will be exported to MS Excel Chart as shown in Annex-B.
- j) By inserting the call charges as mentioned in 5(b), taxes and the cost of SMS for balance check the total cost of the calls will be calculated (see Annex-B).
- k) Detailed CDRs will be collected from operators of the tested SIMs for cross verification of the results.
- l) An acceptable tolerance of '1' second may be allowed while verification of call timings.
- m) A final summary will be generated after the compilation of combined results as shown in Annex-C.

Call and SMS statistics

Nemo Analyze

Date
Project
Customer
Name of cluster
Prepared by
Approved by

Print Time: 4/5/2009 9:54:20PM

[Measurement files](#)
[Parameter and KPI descriptions](#)

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Outgoing Calls

Send #	Date From - To	Start - End time	Phone num. From - To	Coverage	Blocked	Setup time (s)	Dropped	Call complete	Speech quality	Hopping
Mobile originated										
1	10/13/2009	2:29:20 PM		-71.10 ✓			6	✓	3.08	✓
	10/13/2009	2:29:51 PM	0321 XXXXXXX							
2	10/13/2009	2:30:01 PM		-69.10 ✓			6	✓		✓
	10/13/2009	2:30:32 PM	0321 XXXXXXX							
3	10/13/2009	2:30:42 PM		-69.20 ✓			6	✓		✓
	10/13/2009	2:31:13 PM	0321 XXXXXXX							
4	10/13/2009	2:31:23 PM		-74.42 ✓			6	✓		✓
	10/13/2009	2:31:54 PM	0321 XXXXXXX							
5	10/13/2009	2:32:04 PM		-72.42 ✓			6	✓		✓
	10/13/2009	2:32:34 PM	0321 XXXXXXX							
6	10/13/2009	2:29:21 PM		-70.99 ✓				✓ Status:		✓
			0321 XXXXXXX							
7	10/13/2009	2:30:40 PM		-71.18 ✓			9	✓ Status:		✓
			0300 XXXXXXX							
8	10/13/2009	2:31:58 PM		-72.25 ✓				✓ Status:		✓
			0333 XXXXXXX							
9	10/13/2009	2:33:17 PM		-65.44 ✓				✓ Status:		✓
			0300 XXXXXXX							
10	10/13/2009	2:34:35 PM		-66.20 ✓				✓ Status:		✓
			0300 XXXXXXX							
11	10/13/2009	2:29:20 PM		-72.01 ✓				✓ Status:		✓
			0300 XXXXXXX							
12	10/13/2009	2:30:10 PM		-65.30 ✓			13	✓	1.14	
	10/13/2009	2:30:49 PM	0300 XXXXXXX							
13	10/13/2009	2:30:59 PM		-72.30 ✓				✓ Status:		✓

ANNEX-B

Example: Calculation for '5' on net Calls from Operator 'A' to Operator 'A' with 30 sec billing package.

Initial Balance (PKR) 560.48
Manually checked

Sr. No	Subscribers		Time		Setup time (Y)	Difference Time End(Time) - Start(Time)	Diff Time (sec) (X)= B-A	Billable Call Time (Z)= X - Y	Scaling Factor	Advertised Tariff tested (Rs/30 sec) (P)	Call charges without Tax (Q)=P*Z	* Total charges (incl Tax) (R)= (Q+0.195Q)
	Caller(A) (Operator-A) Public demand 30 sec	Called(B) (Operator-A)	Start time (A)	End time (B)								
	0336 xxxxxxxx	0331 xxxxxxxx	4:01:21	4:01:51	8	0:00:30	30	22	1	0.99	0.99	1.18305
2	0336 xxxxxxxx	0331 xxxxxxxx	4:02:42	4:03:12	14	0:00:30	30	16	1	0.99	0.99	1.18305
3	0336 xxxxxxxx	0331 xxxxxxxx	4:04:01	4:04:31	8	0:00:30	30	22	1	0.99	0.99	1.18305
4	0336 xxxxxxxx	0331 xxxxxxxx	4:05:20	4:05:50	8	0:00:30	30	22	1	0.99	0.99	1.18305
5	0336 xxxxxxxx	0331 xxxxxxxx	4:06:39	4:07:09	8	0:00:30	30	22	1	0.99	0.99	1.18305
Balance after 5 calls (PKR)				555.72								
Manually checked												
Bill charged (PKR)				4.76								
											4.95	5.91525

Calculated Call charges

* 19.5%GST and 10% Advance Tax

ANNEX-C

Operator		Billing Error		
		For Call duration Upto 30 seconds (PKR)	For Call duration Upto 1 minutes (PKR)	Call duration Upto 1000 minutes (PKR) (ESTIMATED)
Warid	On-net	-	-	-
	Off-net	-	-	-
Ufone	On-net	-	-	-
	Off-net	-	-	-
Telenor	On-net	-	-	-
	Off-net	-	-	-
Mobilink	On-net	-	-	-
	Off-net	-	-	-
Zong	On-net	-	-	-
	Off-net	-	-	-