# Chapter-6A(E1-E2:CM)
# Roaming

# ROAMING

## Roaming

This report gives information about how international and national roaming is performed in the radio network once a roaming agreement between two operators has been settled. Strategies on how to influence (improve) roaming performance are presented. Important geographical areas are pointed out together with recommendations for parameter settings and coverage. A recommended checklist for the operator is presented. Some open issues are mentioned that could be investigated further.

## Introduction

The information here has been taken from GSM Specification 02.11, 03:22 and 05.08. The information has been slightly modified in order to be easier to understand. There are two operating modes for PLMN (Public Land Mobile Network) selection available in the MS, automatic and manual.

## Registration on a PLMN

In both automatic and manual modes, the concept of *registration* on a PLMN is used. An MS (Mobile Station) successfully *registers* on a PLMN if:
a) The MS has found a suitable cell of the PLMN to camp on; and
b) a LU (Location Update) request from the MS has been accepted in the LA (Location Area) of the cell on which the MS is camped.
When the PLMN has been successfully *registered* in the MS, the PLMN identity is stored on the SIM card.

**Registration process at switch-on/recovery from lack of coverage**

At switch on, the MS selects and attempts to perform a LU on the *registered* PLMN (if it exists). On recovery from lack of coverage , the MS selects the *registered* PLMN (if it exists) and, if necessary, attempts to perform a LU. If successful *registration* is achieved, the MS indicates the selected PLMN. If there is no *registered* PLMN in the SIM card or if *registration* is not possible (due to the PLMN being unavailable or *registration* failure) the MS follows the procedure below:
The MS first scans the whole GSM frequency band that the MS is capable of scanning and makes *registration* attempts. This means that:

♦ A single band 900 MS must investigate at least the 30 strongest RF channels in GSM 900 that were discovered during the scan.

♦ A dual band 900/1800 MS must investigate at least the 30 strongest RF channels in GSM 900 plus the 40 strongest RF channels for GSM 1800 that were discovered during the scan.

If the investigated frequency is a BCCH, the MS will try to decode the PLMN identity. It is only when all the investigated frequencies have been analysed that a list of available

PLMN is created. What is done with this list depends on the MS operating mode, automatic or manual:

**Automatic Network Selection Mode Procedure**

The MS selects and attempts *registration* on other PLMNs, if available and allowable, in all of its bands of operation in the following order:

I. HPLMN (if not previously selected);
II. Each PLMN in the "PLMN Selector" data field in the SIM (in priority order);
III. Other PLMNs with received signal level above -85 dBm in random order;
IV. All other PLMNs in order of decreasing signal strength.

If successful *registration* is achieved, the MS indicates the selected PLMN.

If *registration* cannot be achieved because no PLMNs are available and allowable, the MS indicates "no service" to the user. It will then wait until a new PLMN is available and allowable and then repeat the procedure. In case one or more PLMNs were available and allowable, but an LU failure made *registration* on those PLMNs unsuccessful or an entry in a forbidden LAI list prevented a *registration* attempt, the MS selects the first such PLMN again and enters a limited service state. An MS goes into lack of coverage when the C1 criterion of the cell the MS is camping on falls below zero for a period of time equal to or greater than 5 seconds. If during this time no better cell can be found, the MS experiences of coverage. Manual Network Selection Mode Procedure ,the MS indicates whether there are any PLMNs, in all of its bands of operation, which are available. Also “Forbidden PLMNs" are indicated. Any PLMN shall only be presented once.

If displayed, the PLMNs meeting the criteria above are presented in the following order:

I. HPLMN;
II. PLMNs contained in the "PLMN Selector" data field in the SIM (in priority order);
III. Other PLMNs with received signal level above -85 dBm in random order;
IV. All other PLMNs in order of decreasing signal strength.

The user may select his desired PLMN and the MS then initiates *registration* on this PLMN. (This may take place at any time during the presentation of PLMNs).

For such a *registratio*n, the MS shall ignore the contents of the forbidden LAI and PLMN lists. Hence, the user may initiate *registration* on all indicated PLMNs.

If the user does not select a PLMN, the selected PLMN shall be the one that was selected before the PLMN selection procedure started. If no such PLMN was selected or that PLMN is no longer available, then the MS shall attempt to camp on any acceptable cell and enter the limited service state.

## User reselection

At any time the user may request the MS to initiate reselection and *registration* onto an available PLMN, according to the following procedures, dependent upon the operating mode.

**Automatic Network Selection Mode**

The MS selects and attempts *registration* on PLMNs, if available and allowable, in all of its bands of operation in accordance with the following order:

I. HPLMN;

II. PLMNs contained in the "PLMN Selector" data field in the SIM (in priority order) excluding the previously selected PLMN;
III. Other PLMNs with the received signal level above -85 dBm in random order excluding the previously selected PLMN;
IV. Any other PLMNs, excluding the previously selected PLMN in order of decreasing signal strength or, alternatively, the previously selected PLMN may be chosen ignoring its signal strength;
V. The previously selected PLMN.
The previously selected PLMN is the PLMN that the MS has selected prior to the start of the user reselection procedure Manual Network Selection Mode

## Roaming in VPLMN of home country (National Roaming)

With the liberalisation in the Telecom industry, there was a need to specify a new type of roaming to be used between operators in the same country. “National Roaming” was then specified for phase 2 mobiles. A requirement to look for home PLMN when visiting another PLMN in the same country was added to the GSM standard. In case of national roaming, the MS shall periodically attempt to obtain service on its HPLMN. For this purpose, value “EF HPLMN ” minutes may be stored in the SIM by the service provider. EF HPLMN is either in the range 6 minutes to 8 hours in 6-minute steps or it indicates that no periodic attempts shall be made. If no value is stored in the SIM, a default value of 30 minutes is used. Only the service provider is allowed to set the EF HPLMN -value. The attempts to access the HPLMN shall be as specified below:
a) The periodic attempts shall only be performed in automatic mode when the MS is roaming in its home country;
b) After switch on, a period of at least 2 minutes and at most EF HPLMN minutes shall elapse before the first attempt is made;
c) The MS shall make an attempt if the MS is on the VPLMN at time EF HPLMN after the last attempt;
d) The MS shall only perform periodic attempts while in idle mode;
e) If the HPLMN is not found, the MS shall remain on the VPLMN.
Note that it is not possible to define National Roaming with a foreign operator (with another MCC). This leads unfortunately to undesired behavior at borders between countries. Once an MS has registered in a PLMN of a foreign operator it must first loose coverage from that PLMN before attempting to register in its HPLMN.

## Abnormal cases

If there is no SIM in the MS, if there is an authentication failure, or if the MS receives an "IMSI unknown in HLR" or "illegal MS" response to an LU request, then effectively there is no selected PLMN ("No SIM" state). In these cases, the states of the cell selection process are such that no PLMN selection information is used. No further attempts at *registration* on any PLMN are made until the MS is switched off and on again, or a SIM is inserted. When in Automatic Network Selection mode and the MS is in the 'not

updated' state with one or more suitable cells to camp on; then after 4 unsuccessful LU requests the MS may continue (or start if it is not running)

## Roaming not allowed in this LA

If in either PLMN selection mode the LU response "Roaming not allowed in this LA" is received: the PLMN Automatic or Manual Mode Selection, depending on whether the MS is in automatic or manual mode. (This requirement applies to all MSs.) Strategies (to obtain and keep the roaming traffic)
The GSM specifications have been written to distribute roaming traffic as even as possible among the available operators. Thus, in theory, if three operators are sharing the roaming traffic, they get one third of the traffic each. This is however only true if they have exactly the same network with the same parameter settings. This section will discuss what can be done in the network in order to capture and keep as much roaming traffic as possible.

**Assumption**

Most MSs are set to run in Automatic Mode. Only advanced users bother to select the network manually. This indicates that the strategy of capturing roaming traffic should be adapted to the Automatic Mode selection process rather than to the Manual one.

**Random selection**

.Thus, the random function is mobile specific, which means that it is up to the MS manufacturer to have a good randomizer. Ericsson is using a standardised randomiser in their MSs, supplied by IAR systems (www.iar.com ). It is possible that other MS manufacturers use less good randomisers giving priority to networks with high signal strength or certain frequency range.

## How to capture the international roaming traffic

Given that a roaming agreement with the roaming MS is existing, the main rule is to capture the traffic as early as possible when the roaming MS enters the country of the own network. Statistically it also helps to have as high signal strength as possible Thus, in general the cell should be placed where the roaming user switches on his/her MS and the output power of the cell should be maximised. At the border (entrance area) Cells should be set up on all major entrances to the country such as highways, trains and boat connections. Not only sufficient coverage is needed, high signal strength levels are also important at the actual border and in a zone stretching from the border into the own country along the path the MS is travelling. This could for example be along a road or a railway track. The intention is to capture both the users that make a temporary stop at the border (and maybe switch on their phones as they entry the country) plus the users that just travel across the border. The later are thus captured when they leave the coverage from the foreign PLMN network. This usually happens inside the own country a certain distance away from the border.

**At international airports**

Here it is important to have indoor cells. If it is possible to set up antennas in the gates/corridors leading out to the aircraft, this could be a good solution since this is where most users switch their MSs on and off. Also outdoor coverage on the tarmac is important since some users switch on/off their phones in the aircraft.

**At train stations**

People may also enter the country by train. Train lines should be covered at the border in the same way., but all MSs are not active (in Idle or Dedicated Mode) while onboard the train. Instead, the users switch on their MSs when they reach the final destination (the train station) in order to call a friend or a taxi. The coverage on the station platform and in the station building should therefore be as good as possible. Also the outdoor coverage close to the train station is important.

**Other coverage aspects**

Good coverage within the country also captures roaming MSs. It is particularly important that the own network has coverage where the competitor networks does not, for example tunnels (car and train), underground passages and car parks, restaurants and hotels. Roaming MSs that leave a competitor network in the mentioned areas will thus change networks if there is another network available.

## How to keep the international roaming traffic

**Registration**

It is important that the roaming traffic that gets connected to the network also gets *registered.* This is important since when a roaming MS looses coverage, it first tries to re-connect to the *registered* network. If this fails, other networks are selected accordingly. An investigation of the registration success rate is recommended. There is unfortunately no counter for registration. Coverage aspects In order to keep the roaming traffic in the network , it is essential to have coverage everywhere where the competitor networks have coverage. If this is not the case, roaming traffic will, in case of lack of coverage, chose another network to camp on. Example:In an underground car park, a roaming MS loses coverage. A competitor network has built an indoor cell in the garage. The MS will then try to re-connect to the *registered* network, but since there is no coverage, it will instead connect to the competitor PLMN. Hence, indoor coverage in cities is very important in this sense.

## National roaming

National roaming is allowed and activated on a LA basis. Only the service provider can influence the periodic timer HPLMN . This means that the operator allowing the roaming in its network can not influence (prevent or delay) how often the MSs should try to go back to its HPLMN.

# Parameter settings

**Parameter *not* influencing roaming performance**

It must be stressed that roaming is done while the mobile is in idle mode. Hence, all radio network features that only affect active mode behaviour can not give influence on the roaming performance. This includes:

- Locating
- HCS – Hierarchical Cell Structure
- MS and BTS power control
- CLS - Cell Load Sharing
- OL / UL subcell structure

The next section describes the parameters of the feature Idle mode behaviour. Idle mode behaviour parameters For MSs:

- ACCMIN *(minimum received signal level for network access)*

The setting of ACCMIN is important. In order to make the MSs camp as long as possible on the network, ACCMIN should be set as low as possible. This corresponds to –110 dBm.

- CCHPWR *(maximum MS output power for network access)*

The setting of CCHPWR also has an effect on this issue since the cell selection quantity (the *C1* criterion) is calculated according to the following:

*C1 = (received signal level* – ACCMIN) – max(CCHPWR – P, 0),

*C1* is satisfied if *C1* > 0

The condition states that the MS must measure the DL higher than ACCMIN, and that the MS must be able to transmit enough power in the UL (P ≥ CCHPWR, P in the formula corresponds to the maximum output power of the MS according to its class). If the UL is weaker than the DL, playing with the CCHPWR setting could make some MS classes stay longer on the network in low signal strength areas. However, these mobiles would not be able to keep a connection since the UL is too weak.

- Idle mode BA list *(BCCH allocation list for cell re-selection)*

After a cell has been successfully selected, the MS will start the cell reselection task. The MS continuously monitors all neighbouring BCCH carriers, as indicated by the idle mode BA list. It is important that this BA list is as complete as possible. If some ARFCNs are missing, the MS may end up in a state where it has to scan the whole operating band, even if the signal strength from that PLMN is still sufficient. After scanning the whole band it *could* happen that the MS ends up in another PLMN. One of the reasons could be that the PLMN to which the MS was registered is not among the strongest RF channels (even if it exists and is above ACCMIN). The recommendation is to have an idle mode BA list as complete as possible. Examples on how to allocate the BA frequencies is presented below:

⇒ Take all BCCH frequencies in both GSM900 and GSM1800. This solution is very easy but will certainly generate a BA list that will be too long.

⇒ Take every frequency in the active mode BA list. This corresponds to the neighbours of the cell. Now add the BCCH frequencies of the co-sited neighbours to these cells.

⇒ Take the BCCHs of the neighbouring cells and add the neighbours of the neighbouring cells. Restrict the length of this list with, for example, a criteria based on distance. For phase 2 MSs only:

♦ CBQ *(control of cell priority)*

The parameter CBQ should be set to HIGH to reduce cell reselection times. If the MS encounters cells with CBQ set to LOW it will have to check the whole BA list for another cell with CBQ set to high that could have priority. This is time consuming.

♦ CRO *(Cell reselection offset)*

This gives a kind of "bonus" to the signal strength of the cell and therefore the MSs will camp longer on it. This has no particular influence on roaming if the idle mode BA list is adapted to the size of the cell in idle mode. It is not possible to use CRO to try to go below ACCMIN.

♦ PT and TO *(Penalty Time and Temporary Offset for fast moving MSs)*

Parameter TO should only be used in areas where fast moving mobiles move through small sized cells, i.e. micro cells. Otherwise the recommendation is to set TO = 0. In combination with TO = 0, PT could be set to any value between 0 – 30. Note, the value PT = 31 is reserved to change the sign of CRO. The value PT = 31 is only recommended to be used in special conditions where a negative CRO value is wanted, hence when the cell is supposed to be down prioritised. This is definitely not the case in for example border areas.

## PLMN selector on SIM card

When looking at the PLMN selection process it seems that the data contained in the SIM is an important factor. A better understanding of the "PLMN selector field" of the SIM card is needed in order to investigate its impact on roaming performance. What happens in the SIM is not considered as being a part of the GSM radio network. Therefore this has not been investigated further here. An idea in order to increase the amount of international roaming users could be to get foreign operators to put the identity of "your own network" in the PLMN selector field of their SIM cards. Note that the ranking of "your network" in this list must be higher than the ranking of the competitor networks in your own country (only if also present).

## Multiband aspects

The PLMN selection and registration process is the same on GSM900 and GSM1800 cells. The type of cell is of no importance, only the coverage difference (path-loss) could have an influence. It is also important that the Idle mode BA list is as complete as possible, especially in the border regions. Conclusions and recommendations The registration process has been explained. The radio related parameters that can have an influence on roaming have been listed. Coverage aspects and SIM related issues have been discussed. In order to improve the roaming performance the following checklist should be studied:

♦ Check if possible radio related agreements (ACCMIN settings, antenna directions, frequency allocation, output power etc.) with neighbouring PLMN networks (from neighbouring countries) are being respected. In some cases this also involves PLMNs from the own country.

♦ Check the coverage in the border areas and the important places pointed. Close to the border it is important to have a good signal strength where the signal strength of foreign networks falls below their ACCMIN.

♦ Look for coverage holes within the own country where roamers could be lost (tunnels, in underground car parks, indoor locations, etc.).

♦ Check the setting of the Idle mode behaviour parameters

♦ Make Idle mode BA lists complete in border areas and areas with bad coverage.

♦ Make agreements with foreign operators to put the identity of "your network" in the PLMN selector fields of their SIM cards.

This study focuses on the radio part of the GSM network. Other parts of the GSM system have an influence on the roaming performance and should be studied further:

♦ It is important that the MSs get *registere*d. What are the elements that can influence the registration process? Is it possible to measure the registration success rate? What could be the reasons for having a registration failure?

♦ The behaviour of the different type of mobiles can vary a lot and this could have an influence on the roaming behaviour. Whether this should be investigated or not is a trade off between the possible gain and the cost of the time consuming work.

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# Chapter-6B (E1-E2:CM)
# International Roaming

# International Roaming

GSM operates in the 900MHz and 1.8GHz bands in Europe and the 1.9GHz and 850MHz bands in the US. The 850MHz band is also used for GSM and 3G in Australia, Canada and many South American countries. By having harmonised spectrum across most of the globe, GSM's international roaming capability allows users to access the same services when travelling abroad as at home. This gives consumers seamless and same number connectivity many countries.

An Operator wishing to launch International Roaming facility should have agreements with large number foreign mobile operators world wide. Agreement should be Bilateral so as to have both In & Out Roaming. Money is to be collected by an Operator from the other Operator for roaming usage by the other operator's subscriber in his network. As such Agreement is required with each Operator individually.Ideally agreement and testing should be for each network individually. There are about 850 GSM networks owned by 650 operators worldwide. BSNL has CMTS ( Cellular Mobile Telephone Service ) Licences for 21 Service Areas out of total 23 Service Area. i.e. whole of India except Delhi and Mumbai. As such BSNL should have 850 X 21 agreements and 850 X 21 set of testing etc. Which is practically Impossible. Therefore, BSNL has installed a solution provided by M/s Roamware, USA. This basically enables to have one nodal network in BSNL and all the remaining networks can piggy back on the nodal network. W.B.Circle is the nodal circle in BSNL and all other BSNL networks piggy back on W.B.Circle for International Roaming. This facilitates in having 1 agreement and 1 set of testing with the foreign Operator for whole of BSNL instead of 21 agreements and 21 sets of testing.Pvt. Operators in India started CMTS Operations w.e.f from last Qtr of 1995 onwards. BSNL started its countrywide CMTS Operations w.e.f. 19.10.2002 onwards progressively. As such by the time BSNL launched its Mobile Service, its competitors in India had already negotiated and established Roaming agreements with majority of the foreign Operators whereas BSNL had none.

Since BSNL did not have roaming agreement with any foreign Operator and the same is a time consuming Process, BSNL launched its International Roaming facility by Piggy backing on M/s Spice Punjab ( A CMTS Licensee in Punjab – A Modi Group Co.) w.e.f. 29.1.04. for post paid subscribers.

Initially BSNL deployed DUAL IMSI (International Mobile Subscriber Identity) SIM card for the same , but now use triple IMSI.

IMSI format - Digits- MCC-MNC-Subs./MSC identity etc.

No. of Digits - 3 – 2 - 10 digits ( Total 15)

Dual IMSI has 2 IMSIs. – IMSI of subscriber pertaining to his home network and dummy IMSI Sponsor Network.

While within India, Subscriber Selects Home IMSI and while abroad he selects Dummy IMSI of Sponsor Network i.e. W.B.circle/BSNL. The same is done in the following manner :-

- Insert the BSNL International Roaming SIM card in the mobile handset and Switch on the handset.
- Go to Cellone menu and select it.
- Then go to Network menu under Cell one menu and select it.
- Finally select International Option out of the two options available, namely National and International.

By doing so the subscriber selects W.B.circle/BSNL like IMSI and makes the foreign Operator feel that he is a W.B.circle/BSNL Subscriber. All circles of BSNL piggy back on W.B.circle/BSNL.

Note- Mobile facility would be available through this option only while abroad. While within India, this setting should be kept as National. Majority of the total International Roaming Revenue is from In-Roaming vis a vis out roaming. Also substantial amount of revenue is from International SMS.

Note :- Identity and credentials of applicant for this facility should be meticulously verified otherwise it may result in fraud due to delay in receiving Usage value/ Billing Information of Out-Roamer

By Piggy backing on W.B.circle /BSNL via the solution provided by M/s Roamware, BSNL could start Bilateral International Roaming. Therefore, BSNL is also establishing Roaming Agreements with foreign operators directly and launching Roaming with Foreign Operators via these direct Agreements. Although the Agreement and Testing for direct agreements is Bilateral, BSNL is presently only using these agreements for In Roaming as well as out Roaming.

In Case of direct agreements West Bengal Circle/BSNL is the nodal circle and all other circles of BSNL piggy back on W.B.Circle/BSNL.

With W.B.Circle as nodal circle, the SIM card for Roaming abroad would require W.B.Circle like IMSI. This would require TRIPLE IMSI SIM Cards. i.e. a SIM card with Home IMSI, sponser Spice like IMSI( Not used now ) and W.B.Circle like IMSI.BSNL started and is presently having Triple IMSI SIM cards. BSNL now introduce Triple IMSI SIM cards for International Out Roaming. As such, SIM cards of subscribers with International Roaming facility would have to be replaced by Triple IMSI SIM Cards. Agreement is negotiated and signed by BSNL C.O. and testing and O&M is done by W.B. Circle.

Presently Subscribers of foreign Operators not Permitted to Roam in Assam, J&K and N.E. However, Post paid Subscribers of these Service areas can Out Roam in foreign operators network. Financial Settlements with Foreign Operators is done by West Bengal Circle for whole of BSNL. West Bengal Circle is responsible for Reconciliation and Financial settlements. CA Cell in BSNL C.O. has issued detailed instructions regarding accounting Procedure and head of accounts etc. for International Roaming.

Salient Aspects :-

Criteria of selection of network adopted by Handset:-

Almost 100% of In-Roamers use automatic selection mode and not manual selection mode as they are not bothered about the network they log on to.

On switching on, Handset scans all networks available.

Checks which of them have signal level Greater than equal to -85dBm.

Checks if any one of them is the network in which he was previously logged on to ? If yes then logs on to that network. Or else logs on to any one signal better than -85dBm.

In view of above, it is vital to have optimum Signal level of BSNL mobile network at all entry points like Roads and Airports and at those places specially which are frequently visited by foreigners. Check this with Test SIM cards of foreign Operators / MTNL in automatic mode.

It is understood that all circles have Test SIM cards of foreign Operators with which direct agreement has been launched. It needs to be checked periodically checked if Roaming with these networks is ok. Test SIM cards of these operators should be available in each circle. Usage of SIM Cards of foreign Operators has to be within Limits. As such the same has to be done only in accordance with the instructions of W.B.Circle.Weekly Circle wise Report on International Roaming is to be uploaded by W.B.Circle. All circles to review the same and take action for improvement accordingly.

Problems of Out Roamers :-

List of Countries and Networks where In Roaming is Available – Refer BSNL INTERNET Website – Cellone section

Coverage Map of Operators to know if coverage of an Operator with which Out Roaming Possible via BSNL SIM Card is there in a given town / city. – Refer gsmworld.com website – GSM Roaming section – Coverage MAP

Frequency of handset should be Compatible in Foreign Operator’s network. Check website for freq. & model No.

Subscribers should be Clear as to how to select the International Roaming facility in the Triple IMSI SIM Card.

Configuration in MSC as per the instructions of W.B.Circle and only after checking if Billing Center has configured the same. If configuration is not there in Billing Center then CDR will not be rated and would go into MIU.

Detailed diagram of signal flow including details/ contents of all MAP packets in case of all call scenarios in International roaming for troubleshooting are most essential AND SHOULD BE AVAILABLE WITH STAFF ON DUTY IN MSC AND SMSC 24 X 7 X 365

Analyze problem and Raise trouble tickets on the problem to west Bengal Circle for the Problem.

Guidelines to be given along with triple IMSI SIM Card.

Check email and coordinate with Call Center.

OUT-Roamers would be in a different time Zone and as such 24X7X365 support essential.

Formulate a procedure for the same. In case of non resolution of problem within a given time, it should be escalated to the higher level.
Whenever, a new network element is Introduced in BSNL network it is essential to have configuration for the same in SRS supplied by Roamware for International Roaming. The same would be done by W.B.Circle. Each network element has GT ( Global Title – same as MSISDN Number) For piggy backing/ direct agreements on the network of W.B.circle a dully GT needs to be defined for the network element so that the network element of the foreign Operator feels that it is communicating with the network element of W.B. Similar is the situation in case of direct agreements when all circles of BSNL piggy back on W.B.Circle. Time frames for sending TAP files to foreign Operators every 6 hours including for CDRS in MIU ( Message Investigation Unit ). New MSCs should be put in commercial operation only when they are able to automatically send CDRs to billing center. Billing centers would send all International Roaming rated CDRS to W.B. Circle. For the case for direct agreements, Clearing House in this case is M/s MACH.
In case TAP files do not reach the foreign Operator 24-36 hrs they are liable to be rejected and no payment made to the VPLMN.

This is so specially in case of HURs ( High Usage Reports ). Each Operator has its own threshold for HUR ( suspected fraud ). Clearing house will send HUR to HPLMN based on the criteria of the HPLMN for usage beyond the threshold in the VPLMN by an In – Roamer.

HUR report should reach the foreign Operator within 36 of last call of HUR being made.

BSNL billing center does not have the capability to have 650 thresholds one for each operator. It is the work of clearing house with specialized software. Clearing house can do this only on receipt of TAP file timely. As a matter of abundant Precaution, apart from sending TAP files timely, Billing centers have also been asked to send email to foreign Operator ( for direct agreements ) for usage >= 20 SDRs by an In-Roaming IMSI, in a calendar day. Billing Centers are also required to pursue with all concerned and ensure that the TAP files generated by them have been accepted by the respective foreign Operator. SDR ( Special Drawing Rights) is a non real currency. Rate published by IMF. Errors in TAP files to be avoided. In case of Error, the same is returned to W.B.Circle / billing center and is to resent after correction, within the stipulated time. Problem has been reported in International SMS traffic. In view of above SMS can be sent / received via M/s Iris wireless via Internet. This is already operational in all the zones.

Action is also being taken in BSNL C.O. for signing up with an International GRX for GPRS International Roaming. There are special instructions of GOI for Roaming with networks of Pakistan.

The main instruction is for providing CRI ( Call Related information of In-Roamers from Pakistan and for I/c calls of Out Roamers in Pakistan including content of SMS (excluding I/c SMS for BSNL Out Roamer. )

The relevant International Roaming agreement documents are as follows :-

AA 12 – This is the basic legal framework document for bilateral international roaming relationships, inter-alia, defining law with which the agreement would be governed, period of validity, liabilities of parties, definitions etc. This Document is negotiated and signed by both Operators.

AA-13 - This is operational document containing practical principles and procedures, the parties agree to implement on international roaming. It inter-alia, contains billing & accounting procedures, settlement procedures, testing and fraud prevention procedures etc. This Document is negotiated and signed by both Operators.

These documents are Individual to each Operator and are exchanged between operators. They are not negotiated. However, some Operators do negotiate tariff.

AA - 14 - This document basically contains the list of services being offered by BSNL to In-roamers, tariffs and taxes imposed by BSNL on In-roamers, Bank A/c details of BSNL, contact details of various officers in BSNL with regard to international roaming.

IR-21 - The IR-21 document gives technical details of the BSNL Network i. e. the Network Codes, MSRN Series, IMSI Series, GT Addresses, etc.

Billing and Transfer Information:

This is summary of AA 14, and IR 21 documents of Individual Operator. This is one page document giving brief on the BSNL network codes, taxes, currency of settlement, method of TAP File Transfer, version of TAP Files, fall back procedure, details of clearing house, contact details for TADIG testing, address of invoice etc. This Document is Individual to each Operator and is exchanged between operators. It is not negotiated. There are various other documents pertaining to GSM International Roaming. They are all available on GSMA website gsminfocenter.org. It is a Password protected website. Access for the same has been provided to W.B.Circle.

## Guidelines for BSNL Mobile Subscribers with International Roaming Facility:-

Welcome to the world of International Roaming: Now you can Roam world-wide* and stay in touch with the same BSNL Mobile Telephone Number. Please spend a minute and go through this online guide. This will guide you step by step on how to optimally utilize International Roaming Facility.

1. List of Operators and Countries : The List of Operators and Countries in whose network you can roam using the International Roaming SIM card of BSNL is available on BSNL website. Find the name of the Country in the list where you propose to visit. View the names of the Operators in the table against the name of that country. Mobile network of these operators are available for you for roaming in that country. You can view the coverage map ** of the operator's network for precisely knowing if the mobile service of that Operator is available in the city you propose to visit in that country by browsing the link http://www.gsmworld.com/roaming/gsminfo/index.shtml in the following manner:

Click on the name of the country. Then find the name of the desired operator in that country on the website site. Click on the coverage map option under the operator's name. The coverage map can be zoomed many fold by repeatedly clicking on it for ascertaining coverage in a given place in the country.

2. Handset required for roaming in the network of a foreign operator : *Roaming in the foreign Operator's mobile network requires you to use a compatible handset.* Networks of most of the Operators world-wide operate in the same frequency band as that used by Indian GSM networks i.e. 900 / 1800 Mhz. However, many GSM mobile networks in North and South American Continents operate in 1900 Mhz. frequency band. Some networks in these continents even use 850 Mhz. frequency band. It is mandatory to ensure that your Mobile handset is capable of working in the frequency band(s) as used by the networks in the country you are visiting. For knowing the frequency band in which a network of a country operates and for examples of some compatible handsets for operation in various frequency bands, please refer to the tables. BSNL subscribers going to Japan and South Korea may note that compatible handsets

are available at the Airports in these countries on rent, however, the subscriber should arrange to confirm the same on his own.

3. Procedure for selecting International Roaming option in the SIM card:-

(i) Insert the BSNL International Roaming SIM card in the mobile handset.

(ii) Switch on the handset.

(iii) Go to Cellone menu and select it.

(iv) Then go to Network menu under Cell one menu and select it.

(v) Finally select International Option out of the two options available, namely National and International.

(Note- Mobile facility would be available through this option only while you are abroad.)

(Note- While within India, keep this setting to National)

4. Problem reporting: In the unfortunate eventuality of having any difficulty in availing the International Roaming facility inspite of following the instructions as mentioned above, you may please report your problem to BSNL call center on: - +91-9400024365.

Notes:

1. The credit limit of a subscriber is based on the amount of his Security deposit. Usage beyond Credit limit during the billing period would result in disconnection. As such, in case a subscriber anticipates, his usage to be higher than his credit limit during the billing period specially for his roaming abroad, he may get his credit limit enhanced by depositing additional security deposit, before hand. Subscribers may contact the person as stated in Para 4 above, for availing this facility.

2. It is the responsibility of the subscriber to ensure that his usage abroad is within the limits as prescribed by FEMA (Foreign Exchange management Act) from time to time.

* List of Operators and Countries is available on BSNL website, however, the same is subject to change without notice.

*Coverage maps of some operators may not be available on website. Moreover they are subject to change without notice.

* Quality of Service provided by a network of a country, may vary from time to time without notice.

*Tariff is subject to change from time to time.

Note :

1. Bilateral : Foreign as well as BSNL subscribers can roam in each others network.

2. In Roamers : Only foriegn subscribers can roam in BSNL network in India and not

vice versa.

3. Out Roamers : Only BSNL subscribers can roam in Foreign network and not vice versa.

4. BSNL subscribers with International Roaming Facility are required to ensure that their Mobile handsets are compatible for working with the frequency as given in the table below. For Knowing model Numbers of some sample handsets and the frequency in which they operate see our website.

5. Presently, most GSM networks world wide including Indian GSM networks operate on 900 Mhz / 1800 Mhz frequency bands. 1900 / 850 Mhz frequency bands are mainly used by Operators in North and South American Continents.

6. BSNL subscribers going to Japan and South Korea may note that compatible handsets are available at the Airports in these countries on rent, however, the subscriber should arrange to confirm the same on his own.

**Details of International Roaming (IR) Services of BSNL**

BSNL is providing International Roaming services in 476 Networks in 195 countries covering nook and corner of the world.

This is being dispatched to help you understand various billing components pertaining to International Roaming so as to enable you to use our International roaming services in an informed uninterrupted and seamless way. All details pertaining to our international roaming service are also available at website www.ir.bsnl.co.in.

**Subscription-** IR Service of BSNL is available on request to postpaid customers by filling up a simple service request form. Two self attested photographs, an attested copy of the passport and a one time security deposit of INR 5000/- [refundable] needs to be deposited along with request form. Subsequently, INR 99/- per month will be charged as a subscription fees over and above the actual international roaming usage.

**Using the IR services**

While roaming abroad, you can choose a network of your choice by simply following the steps mentioned below:

 Before leaving, check that your roaming function has been activated by calling our Customer Service Centre (Call Toll Free Number 1503)

 After landing into foreign country, switch ON the phone and go to the „Menu‟. Click on Cellone (BSNL Mobile in new SIMs) and select Network.

 In the network you will get options of National and International. Select International, you will get „CellOne‟ and „Partner Network‟

 Select the option Cellone, you will get a message - "CellOne International Selected". Wait for two minutes you will get the Network automatically

 If it fails, please select the network manually.(By selecting Setting and then Network in your phone)

**International Roaming Tariffs** –The applicable charges are variable and dependent on theforeign operators. For an updated detailed tariff of operators in various countries, we request you to visit our website www.ir.bsnl.co.in.
**Voice/SMS-**All voice calls viz. incoming and outgoing (including calls to BSNL Customer Care) are chargeable while you are overseas. The call charges are completely operator dependent and are in general charged for a 60 second pulse. The SMS is charged for 160 characters per outgoing SMS (For example, in case of an SMS of 170 characters, it will be treated as 2 SMSs). **GPRS/Data –** The charges for GPRS/Data usages are calculated in terms of the Volume of data sent or received. As with the Voice / SMS, charges here are variable and completely dependent on foreign operators. Also note that your local plans for GPRS/Blackberry are not valid overseas and all data usages are charges at the visited operator rates.
**Blackberry Usages –** When roaming abroad, receiving and sending mails adds to the data usage and is charged accordingly.
**Billing & Payments -**
☐ While you are roaming overseas, as a service gesture, BSNL does not normally restrict your usage to the extent of your credit limit. This is done to allow you continued access, considering the significantly higher usage charges in international roaming.
☐ To get periodic updates on usage, subscribe to our free usage alerts service by sending an SMS "USG" to 53333. The charges incurred by you, while on international roaming, are sent to us by international operator and can take 3 days or even more and accordingly the alerts received by you may not reflect the latest status and will be as per the last update received by us.

**Some Useful Tips –**
☐ If you encounter any difficulties while roaming abroad, you can book your complaint at **www.ir.bsnl.co.in** OR Call +919434024365
☐ Check the Handset compatibility with Network frequency (GSM MHz 850/900/1800/1900) before travelling outside India and make sure that your handset will work in the country you are traveling to. Japan & Korea support 3G Hand Set, USA & Canada supports 1900 MHz Hand Set.
☐ To call back home dial the number with "+91".
☐ You can alert your callers that you are overseas by activating a Caller Tune announcing that you are overseas. Dial 56700 and select the English category.
☐ Certain GPRS based applications viz. GPS, Facebook, Blackberry messenger or any other instant messaging application etc. continuously consume data bandwidth leading to high Data-Roaming charges even when you are not using the same. This is applicable to smart phones and high-end GPRS capable handsets which poll (communicate with) the home network continuously. We advice you take an informed decision to keep these applications switched-on, while you are overseas. For any assistance in the matter, please call our customer helpline.
☐ Loss/Theft of SIM card or mobile phone while overseas should be reported to BSNL immediately at +919434024365. In case the theft is not reported immediately, all usage till the time of reporting will be payable by you.

**We have tried to give some helpful information relating to International Roaming.**

**We advice you to visit our website www.ir.bsnl.co.in for any further information.**