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Technical Specification

GEO-Mobile Radio Interface Specifications;
Part 5: Radio interface physical layer specifications;
Sub-part 6: Radio Subsystem Link Control;
GMR-2 05.008

Reference

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IPRs:

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TS 101 377 V1.1.1	Digital Voice Systems Inc		US	US 5,715,365	US
TS 101 377 V1.1.1	Digital Voice Systems Inc		US	US 5,754,974	US
TS 101 377 V1.1.1	Digital Voice Systems Inc		US	US 5,226,084	US
TS 101 377 V1.1.1	Digital Voice Systems Inc		US	US 5,701,390	US
TS 101 377 V1.1.1	Digital Voice Systems Inc		US	US 5,826,222	US

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Project	Company	Title	Country of Origin	Patent n°	Countries Applicable
TS 101 377 V1.1.1	Ericsson Mobile Communication	Improvements in, or in relation to, equalisers	GB	GB 2 215 567	GB
TS 101 377 V1.1.1	Ericsson Mobile Communication	Power Booster	GB	GB 2 251 768	GB
TS 101 377 V1.1.1	Ericsson Mobile Communication	Receiver Gain	GB	GB 2 233 846	GB
TS 101 377 V1.1.1	Ericsson Mobile Communication	Transmitter Power Control for Radio Telephone System	GB	GB 2 233 517	GB

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Project	Company	Title	Country of Origin	Patent n°	Countries Applicable
TS 101 377 V1.1.1	Hughes Network Systems		US	Pending	US

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Project	Company	Title	Country of Origin	Patent n°	Countries Applicable
TS 101 377 V1.1.1	Lockheed Martin Global Telecommunic. Inc	2.4-to-3 KBPS Rate Adaptation Apparatus for Use in Narrowband Data and Facsimile Communication Systems	US	US 6,108,348	US
TS 101 377 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Cellular Spacecraft TDMA Communications System with Call Interrupt Coding System for Maximizing Traffic ThroughputCellular Spacecraft TDMA Communications System with Call Interrupt Coding System for Maximizing Traffic Throughput	US	US 5,717,686	US
TS 101 377 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Enhanced Access Burst for Random Access Channels in TDMA Mobile Satellite System	US	US 5,875,182	
TS 101 377 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Spacecraft Cellular Communication System	US	US 5,974,314	US
TS 101 377 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Spacecraft Cellular Communication System	US	US 5,974,315	US
TS 101 377 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Spacecraft Cellular Communication System with Mutual Offset High-argin Forward Control Signals	US	US 6,072,985	US
TS 101 377 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Spacecraft Cellular Communication System with Spot Beam Pairing for Reduced Updates	US	US 6,118,998	US

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

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- the third digit (n) is incremented when editorial only changes have been incorporated in the specification;
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The present document is part 5, sub-part 6 of a multi-part deliverable covering the GEO-Mobile Radio Interface Specifications, as identified below:

Part 1: "General specifications";

Part 2: "Service specifications";

Part 3: "Network specifications";

Part 4: "Radio interface protocol specifications";

Part 5: "Radio interface physical layer specifications";

Sub-part 1: "Physical Layer on the Radio Path; GMR-2 05.001";

Sub-part 2: "Multiplexing and Multiple Access on the Radio Path; GMR-2 05.002";

Sub-part 3: "Channel Coding; GMR-2 05.003";

Sub-part 4: "Modulation; GMR-2 05.004";

Sub-part 5: "Radio Transmission and Reception; GMR-2 05.005";

Sub-part 6: "Radio Subsystem Link Control; GMR-2 05.008";

Sub-part 7: "Radio Subsystem Synchronization; GMR-2 05.010";

Part 6: "Speech coding specifications".

Introduction

GMR stands for GEO (Geostationary Earth Orbit) Mobile Radio interface, which is used for mobile satellite services (MSS) utilizing geostationary satellite(s). GMR is derived from the terrestrial digital cellular standard GSM and supports access to GSM core networks.

Due to the differences between terrestrial and satellite channels, some modifications to the GSM standard are necessary. Some GSM specifications are directly applicable, whereas others are applicable with modifications. Similarly, some GSM specifications do not apply, while some GMR specifications have no corresponding GSM specification.

Since GMR is derived from GSM, the organization of the GMR specifications closely follows that of GSM. The GMR numbers have been designed to correspond to the GSM numbering system. All GMR specifications are allocated a unique GMR number as follows:

GMR-n xx.zyy

where:

- xx.0yy (z = 0) is used for GMR specifications that have a corresponding GSM specification. In this case, the numbers xx and yy correspond to the GSM numbering scheme.
- xx.2yy (z = 2) is used for GMR specifications that do not correspond to a GSM specification. In this case, only the number xx corresponds to the GSM numbering scheme and the number yy is allocated by GMR.
- n denotes the first (n = 1) or second (n = 2) family of GMR specifications.

A GMR system is defined by the combination of a family of GMR specifications and GSM specifications as follows:

- If a GMR specification exists it takes precedence over the corresponding GSM specification (if any). This precedence rule applies to any references in the corresponding GSM specifications.

NOTE: Any references to GSM specifications within the GMR specifications are not subject to this precedence rule. For example, a GMR specification may contain specific references to the corresponding GSM specification.

- If a GMR specification does not exist, the corresponding GSM specification may or may not apply. The applicability of the GSM specifications is defined in GMR-n 01.201.

1 Scope

The present document specifies the Radio sub-system link control implemented in the MES, Satellite, and Gateway of the GMR-2 system.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] GMR-2 01.004 (ETSI TS 101 377-1-1): "GEO-Mobile Radio Interface Specifications; Part 1: General specifications; Sub-part 1: Abbreviations and Acronyms; GMR-2 01.004".

[2] GMR-2 03.009 (ETSI TS 101 377-3-6): "GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 6: Handover Procedures; GMR-2 03.009".

[3] GMR-2 03.022 (ETSI TS 101 377-3-11): "GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 11: Functions Related to Mobile Earth Station (MES) in Idle Mode; GMR-2 03.022".

[4] GMR-2 04.004 (ETSI TS 101 377-4-3): "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 3: Layer 1 General requirements; GMR-2 04.004".

[5] GMR-2 04.006 (ETSI TS 101 377-4-5): "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 5: GMR-2 Mobile Earth Station - Network Interface; Data Link (DL) layer Specifications; GMR-2 04.006".

[6] GMR-2 04.008 (ETSI TS 101 377-4-7): "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 7: Mobile radio interface Layer 3 Specifications; GMR-2 04.008".

[7] GMR-2 05.002 (ETSI TS 101 377-5-2): "GEO-Mobile Radio Interface Specifications; Part 5: Radio interface physical layer specifications; Sub-part 2: Multiplexing and Multiple Access on the Radio Path; GMR-2 05.002".

[8] GMR-2 05.005 (ETSI TS 101 377-5-5): "GEO-Mobile Radio Interface Specifications; Part 5: Radio interface physical layer specifications; Sub-part 5: Radio Transmission and Reception; GMR-2 05.005".

[9] GMR-2 06.012 (ETSI TS 101 377-5-4): "GEO-Mobile Radio Interface Specifications; Part 5: Radio interface physical layer specifications; Sub-part 4: Modulation; GMR-2 05.004".

[10] GMR-2 06.001 (ETSI TS 101 377-6-1): "GEO-Mobile Radio Interface Specifications; Part 6: Speech coding specifications; Sub-part 1: Basic Rate Speech; Basic Rate Speech Processing Functions; GMR-2 06.001".

[11] GSM 05.08 (ETSI ETS 300 758): "Digital cellular telecommunications system (Phase 2); Radio subsystem link control (GSM 05.08 version 4.22.0)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

Immediate Assignment: procedure used to establish a Radio Resource connection between the MES and the network. It concludes with an IMMEDIATE ASSIGNMENT message sent by the network to the MES via the SDCCH granting a traffic channel for communications.

CELL_RESELECT_HYSTERESIS: parameter used to prevent frequent spot beam switches and the associated location updates. The concern applies to cases where the satellite antenna sidelobe levels allow an MES to receive the S-BCCH from spot beams having LAIs different from the LAI of the beam(s) upon which it is currently registered. A different LAI and spot beam is selected only if it is "better" in terms of the path loss criterion than any of the spot beams in the current LAI by at least the value of CELL_RESELECT_HYSTERESIS.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in GMR-2 01.004 [1].

4 General

The radio sub-system link control aspects that are addressed are as follows:

a) RF power control;

b) Radio link failure;

c) Beam selection and re-selection in Idle mode.

Handover may also be employed to meet network management requirements, e.g., relief of congestion.

Handover may occur during a call from S-DCCH to S-TCH, e.g., during the initial signalling period at call set-up.

The handover may be between channels on the same spotbeam. Examples are given of handover strategies, however, theses will be determined in detail by the network operator.

Adaptive control of the RF transmit power from a MES and from the Gateway is implemented in order to optimize the forward and return link performance and minimize the effects of co-channel interference in the system.

The criteria for determining radio link failure are specified in order to ensure that calls which fail either from loss of radio coverage or unacceptable interference are satisfactorily handled by the network.

Radio link failure may result in release of a call in progress.

Procedures for spotbeam selection and re-selection while in Idle mode (i.e., not actively processing a call), are specified in order to ensure that an MES can select a satellite spotbeam with which it can reliably communicate on both the radio forward and return links.

Information signalled between the MES and Gateway is summarized in tables 11.0-1 and 11.0-2. A full specification of the Layer 1 header is given in GMR-2 04.004 [4], and of the Layer 3 fields in GMR-2 04.008 [6].

5 Handover

Network directed handovers can occur for reasons other than radio link control, e.g. S-SDCCH to S-TCH transfers. The following describes the process for intra-cell handovers that result from interference and fading mitigation.

5.1 Overall process

The overall handover process is implemented in the MES and gateway. Measurement of radio subsystem forward performance is made in the MES. These measurements are signalled to the gateway for assessment. The gateway measures the return performance for the MES being served. Initial assessment of the measurements in conjunction with defined thresholds and intra-spotbeam handover strategy are performed in the gateway.

NOTE: Optionally, the gateway may measure the interference levels in unassigned channels on active carriers and manages a database of "clear", "unacceptable" and "unknown" channels for use in initial assignments and handover assignments.

5.2 MES measurement procedure

The MES shall monitor the forward signal and its quality in its serving spotbeam. The requirements for measurement are given in clause 10.

5.3 Gateway measurement procedure

A procedure shall be implemented in the gateway by which it monitors the return RX signal level and quality from each MES being served by the spotbeam. The requirements for measurement are given in clause 10.

5.4 Strategy

The intra-spotbeam handover strategy employed by the network for radio link control determines the handover decisions that are made based on the measurement results reported by the MES/gateway and various threshold parameters set for each spotbeam. The exact handover strategies will be determined by the gateway operators in that the algorithm threshold parameters are configurable. These configurable items allow the gateway operator to tailor the handover control algorithm to suit a desired strategy and to fine-tune the algorithm as traffic and interference data are accumulated.

For a MES in an interference scenario, intra-spotbeam handover from one channel/timeslot in the serving spotbeam to another channel/timeslot in the same spotbeam can be performed if the link measurements show a low RXQUAL, but a high RXLEV on the serving spotbeam. Handover can occur either to a timeslot on a new carrier or to a different timeslot on the same carrier and may include a change of bearer rate and channel coding. For a given set of forward and return link measurements, the decision to handover, and whether or not that handover will include a change of bearer rate and channel coding, will depend upon operator configurable threshold settings.

NOTE: Optionally, based on interference measurements, the gateway may attempt handovers to currently unassigned channels in the following order:

a) channels categorized as "Clear";

b) channels categorized as "Unknown" (insufficient or invalid measurement data);

c) channels categorized as "unacceptable" in order of lowest to highest interference band only if handover includes a change from S-TCH/QBS to S-TCH/HRS.

For a MES in a fading/blockage scenario, intra-spotbeam handover from one channel/timeslot in the serving spotbeam to another channel/timeslot in the same spotbeam, can be performed if the link measurements show a low RXQUAL, and a low RXLEV coupled with high commanded/implemented transmit power levels on the serving spotbeam. In this case a handover from S-TCH/QBS to S-TCH/HRS is required since the MES is not suffering from an interference condition which could be aided by a clearer channel of the same bearer/coding.

The algorithm for handover shall be as specified in GMR-2 03.009 [2].

5.5 Restrictions

Intra-spotbeam handover shall not be required for single hop user-to-user connections or for S-SDCCH connections.

Handovers with no change of bearer rate and coding shall only occur between two S-TCH/QBS traffic channels.

Handovers with change of bearer rate and channel coding shall only occur from S-TCH/QBS to S-TCH/HRS traffic channels. Handovers with change of bearer rate and channel coding shall maintain the same vocoder on the S-TCH/HRS as on the S-TCH/QBS traffic channel.

6 RF power control

6.1 Overall process

RF power control is employed to minimize the transmit power required by a MES or Gateway while maintaining the quality of the radio links. By minimizing the transmit power levels, interference to co-channel users is reduced and satellite utilization is increased.

6.2 MES implementation

RF power control shall be implemented in the MES.

The power control level to be employed by the MES is indicated by means of the power control information sent either in the layer 1 header of each forward S-SACCH message block (see GMR-2 04.004 [4]), or in a dedicated signalling block (see GMR-2 04.008 [6]).

The MES shall employ the most recently commanded power control level appropriate to the channel for all transmitted bursts on either a S-TCH, S-FACCH, S-SACCH or S-SDCCH. If the commanded power control level is not supported by the MES as defined by its power class in GMR-2 05.005 [8], the MES shall act as though the closest supported power control level had been broadcast.

The MES shall confirm the power control level that it is currently employing in the return S-SACCH layer 1 header. The indicated value shall be the power control level actually used by the MES for the last burst of the previous S-SACCH period.

The MES shall collect measurement reports on the forward link and report them on the return link as specified in clauses 10 and 11. For single hop user terminal-to-user terminal connections, the MES shall have special measurement reporting requirements as defined in clause 10.4.

When accessing a spotbeam on the S-RACH (random access) and before receiving the first power command during a communication on a S-SDCCH or S-TCH (after an Immediate Assignment), the MES shall use the power level defined by the MS_TXPWR_MAX_CCH parameter (see table 11.1) broadcast on the S-BCCH of the spotbeam, or if MS_TXPWR_MAX_CCH corresponds to a power control level not supported by the MES as defined by its power class in GMR-2 05.005 [8], the MES shall act as though the closest supported power control level had been broadcast.

6.3 MES power control range

The range over which a MES shall be capable of varying its RF output power shall be from its maximum output down to its minimum, in steps specified in GMR-2 05.005 [8].

6.4 Gateway implementation

RF power control commands shall be generated in the Gateway for both directions in a MES-to-gateway traffic channel connection. For S-SDCCH connections, the gateway shall use a fixed forward transmitter power value, configurable on a gateway basis and the MES shall use a transmitter power value derived from the System Information Messages. For single hop MES-to-MES connections, the gateway shall provide RF power control in the return direction by changing the user terminal transmitter power. The gateway shall transmit the S-SAACH at a fixed maximum power level on the gateway-to-MES forward link.

6.5 Gateway power control range

The range over which the Gateway shall be capable of reducing its RF output power from its maximum level as specified in GMR-2 05.005 [8].

6.6 Strategy

The RF power control strategy employed by the gateway shall be as specified in annex A.

The power level to be employed in each case shall be based on the measurement results reported by the MES and the Gateway and the parameter set as specified in annex A. The gateway shall provide RF power control based on connection type (gateway-to-user or single hop user-to-user), the MES type (handheld, vehicular, fixed) based on the reported RF Power Capability in the terminal classmark (see GMR-2 04.008 [6], clauses 11.5.1.5 and 11.5.1.6), and the traffic channel type (GMR-2 05.002 [7], clause 5.2.2 and clause 5.2.3).

The gateway shall have the capability to modify the parameter set during the course of a connection as determined by the System Power Control function implemented by the Network.

6.7 Timing

Upon receipt of a command from the S-SACCH to change its power level, the MES shall change to the new level. The change shall commence no later than four TDMA frames from the frame containing the last S-SACCH burst. The MES shall change the power to the new power level irrespective of whether actual transmission takes place or not.

Upon receipt of a command to change its power level, the gateway shall change to the new level. The change shall commence immediately. The gateway shall change the power to the new power level irrespective of whether actual transmission takes place or not.

In case of channel change, the commanded power level shall be applied on the new channel immediately.

7 Radio link failure

7.1 Criterion

The criterion for determining radio link failure in the MES and gateway shall be based on the success rate of decoding messages on the forward and return S-SACCH, respectively. Radio Resource call clearing procedures are as specified in GMR-2 04.008 [6], clause 4.5.2.1 MES Procedure.

The aim of determining radio link failure in the MES is to ensure that calls with unacceptable voice/data quality, which cannot be improved by RF power control or handover, are released in a defined manner. In general, the parameters that control the forced release should be set such that the forced release will not normally occur until the call has degraded to a quality below that at which the majority of subscribers would have manually released the call. This ensures that, for example, a call on the edge of a radio coverage area, although of bad quality, can usually be completed if the subscriber wishes.

The radio link failure criterion is based on the radio link counter S. If the MES is unable to decode a S-SACCH message, S is decreased by 1. In the case of a successful reception of a S-SACCH message, S is increased by 2. In any case, S shall not exceed the value of RADIO_LINK_TIMEOUT (see table 11.1). If S reaches 0, a radio link failure shall be declared. The action to be taken is specified in GMR-2 04.008 [6]. The RADIO_LINK_TIMEOUT parameter is transmitted in the S-BCCH data.

The MES shall continue transmitting as normal on the return link until S reaches 0.

The algorithm shall start after the assignment of a dedicated channel and S shall be initialized to RADIO_LINK_TIMEOUT.

The detailed operation shall be as follows:

a) the radio link time-out algorithm shall be stopped at the reception of a channel change command;

b) (Re-)Initialization and start of the algorithm shall be done whenever the MES switches to a new channel when the main signalling link (see GMR-2 04.008 [6]) has been established;

c) the RADIO_LINK_TIMEOUT value used at (re-)initialization shall be that used on the previous channel (in the Immediate Assignment case the value received on the BCCH), or the value received on S-SACCH if the MES has received a RADIO_LINK_TIMEOUT value on the new channel before the initialization;

d) if the first RADIO_LINK_TIMEOUT value on the S-SACCH is received on the new channel after the initialization, the counter shall be re-initialized with the new value.

7.2 Gateway procedure

The radio link failure criterion is based on the radio link counter S. The gateway shall implement a return link counter limit, RETURN_RADIO_LINK_TIMEOUT (see table 11.1). The range of RETURN_RADIO_LINK_TIMEOUT shall be from 2 to 64. This value shall be managed on a gateway basis.

If the gateway is unable to decode a S-SACCH message, S is decreased by 1. In the case of a successful reception of a S-SACCH message, S is increased by 2. In any case, S shall not exceed the value of RETURN_RADIO_LINK_TIMEOUT. If S reaches 0, a radio link failure shall be declared.

The GATEWAY shall continue transmitting as normal on the forward link until S reaches 0.

The algorithm shall start after the assignment of a dedicated channel and S shall be initialized to RETURN_RADIO_LINK_TIMEOUT.

The detailed operation shall be as follows:

a) the radio link time-out algorithm shall be stopped at the reception of a channel change command;

b) (Re-)Initialization and start of the algorithm shall be done whenever the GATEWAY switches to a new channel when the main signalling link (see GMR-2 04.008 [6]) has been established.

8 Idle Mode Tasks

While in idle mode, a MES shall implement the spotbeam selection and re-selection procedures described in GMR-2 03.022 [3]. These procedures make use of measurements and sub-procedures described in this clause.

The procedures ensure that the MES can select a satellite spotbeam from which it can reliably decode forward link data and with which it has a high probability of communications on the return link. Once the MES has selected a spotbeam, access to the network may be initiated.

The MES shall not use the Discontinuous Reception (DRX) mode of operation (i.e., powering itself down when it is not expecting paging messages from the network) while performing the spotbeam selection algorithm defined in GMR-2 03.022 [3]. However, use of powering down is permitted at all other times in Idle mode.

The MES times given refer to internal processes in the MES required to ensure that the MES camps as quickly as possible to the most appropriate spotbeam.

8.1 Introduction to the spotbeam selection/re-selection process

For spotbeam selection, the MES searches for a primary spotbeam carrier. The primary spotbeam carrier is the Common Control Signal Carrier. If the MES finds a primary spotbeam carrier, it uses the S-HMSCH and S-HBCCH signal to obtain frequency and bit level timing corrections so that received signals can be decoded. The MES then searches for the primary carriers of the spotbeams adjacent to the located spotbeam and selects the strongest carrier giving the highest priority (i.e., 1 is the highest priority) service state based on information gathered during the search. The allowable service states and their priority are defined in table 8.1.1.

Table 8.1.1: Allowable user terminal service states and priorities

Priority	State	Service
4	No primary spotbeam carriers found	No Service
3	Primary spotbeam carrier found - Decodable S-HMSCH and S-HBCCH in a unregistered LAI	No Service unless user performs manual action
2	Primary spotbeam carrier found - Decodable S-HMSCH and S-HBCCH in the registered LAI	Alerting Only Mode (Disadvantaged Environment)
1	Primary spotbeam carrier found - Decodable S-HMSCH, S-SCH and S-BCCH	Full Service (Advantaged Environments)

Subsequent actions depend upon whether the MES is in a disadvantaged or advantaged environment. A disadvantaged environment is defined as a location where a MES can successfully decode received high margin bursts from the satellite but not normal power bursts. An advantaged environment is defined as a location where the MES can successfully decode both received high margin and normal power bursts from the satellite.

In a disadvantaged environment, the MES configures itself to monitor potential pages from the paging channel (if registered), periodically reads the S-HBCCH information, and monitors the primary spotbeam carriers in the cluster. By monitoring the primary spotbeam carriers in the cluster, the MES determines if the environment has changed from disadvantaged to advantaged or if spotbeam re-selection should occur.

In an advantaged environment, the MES configures itself to read potential pages, periodically reads the S-SCH and the S-BCCH information, and monitors the primary spotbeam carriers in the cluster to determine if spotbeam re-selection should occur (i.e., another spotbeam has become better).

Note that "normal Service", as defined in GMR-2 03.022 [3], may include both Alerting Only Mode (Disadvantaged operations) and full Service (Advantaged operations). Degradation of service state below Full Service due to radio environment conditions is considered "Normal Service" in the Disadvantaged mode of operations.

8.2 Disadvantaged mode operations

8.2.1 Measurements for spotbeam selection

If the MES has determined that it is in a disadvantaged environment, it shall read the full S-HBCCH data for the serving spotbeam within 155 seconds. This includes time for one message repeat.

A MES in idle mode shall always fulfil the performance requirement specified in GMR-2 05.005 [8] at levels down to reference sensitivity level or reference interference level.

8.2.2 Criteria for spotbeam selection

Initially, the MES shall try to select the spotbeam it last camped on and attempt to read the S-HBCCH. After being able to read and decode the S-HBCCH data, subsequent operations and possible spotbeam re-selection shall be performed according to the procedures in GMR-2 03.022 [3].

When camped on a spotbeam in disadvantaged mode, if the LAI information (read from the S-HBCCH) indicates that the MES is not registered in this spotbeam (or spotbeam pair [see clause 8.7]), then the MES shall provide a "No Service until User Action Taken" indication to the user. Otherwise, the MES shall indicate "Alerting Only Mode ".

8.2.3 Forward signalling failure

The forward signalling failure criterion for disadvantaged operations is based on the forward link (i.e., downlink) signalling failure counter (DSC). When the MES enters disadvantaged mode operations, DSC shall be initialized to a value equal to 45. Thereafter, whenever the MES attempts to decode the S-HBCCH, if a S-HBCCH message is successfully decoded, DSC is increased by 1, (however never beyond the maximum value of DSC as specified above). If the S-HBCCH message is not successfully decoded, DSC is decreased by 4. When DSC reaches 0, the MES shall initialize a spotbeam reselection process according to GMR-2 03.022 [3], clause 7.5. Hence, if a forward signalling failure occurs on an already disadvantaged channel, a spotbeam reselection shall be initiated

8.2.4 Criteria for spotbeam re-selection

While camping on a spotbeam in a disadvantaged environment, the MES shall continue to monitor the primary spotbeam carrier for potential pages if the MES is registered in the LAI. Spotbeam re-selection for more suitable communication shall only occur when:

- the MES is able to successfully transition to the Advantage Mode of Operations (i.e., read the S-BCCH data) or if a forward signalling failure occurs.

However, the MES is allowed to re-select a spotbeam providing Disadvantaged Mode only, if:

- the current spotbeam has a higher average quality of the received S-HBCCH signal, and the MES is registered in it, e.g. it is a part of a valid beam pair with which the MES is registered.

The MES shall continue to monitor the primary carriers of spotbeams in the current cluster to assist with re-selection when the MES enters an advantaged environment.

The MES may maintain a list of candidate spotbeams for re-selection. A spotbeam in the current neighbour spotbeam frequency list is considered to be a candidate for re-selection if the MES can successfully read at least the S-HBCCH data. If such list is maintained by the MES, it shall be updated at least every 30 minutes.

The MES shall attempt to decode the Version ID for each S-HBCCH message for the serving spotbeam at least every 10 minutes. The MES may wait until a new Version ID number for a message is detected before attempting to decode the S-HBCCH message.

Monitoring of primary carriers in the cluster for re-selection shall be done so as to minimize interruptions to monitoring of the paging channel. Note that in rare cases of channel allocation within a spotbeam cluster, the MES may occasionally omit a single S-HPACH message, if monitoring of the S-HPACH channel conflicts with monitoring of a non-serving primary carrier.

The maximum time allowed for synchronization to a primary spotbeam carrier and to read the S-HBCCH data is as specified in clause 8.2.1.

The MES shall attempt to read the S-BCCH data at least every 10 minutes on the serving and non-serving spotbeams those on the candidate list, if such exists, or all non-serving spotbeams in the cluster otherwise - to determine whether the MES can transition to Advantaged Mode of Operations. The MES shall attempt to read the S-BCCH immediately if user-initiated actions invokes Full Service.

When the MES enters the advantaged mode of operations from the disadvantaged mode, the MES may initiate the procedures specified in clause 8.3.

8.3 Transition from disadvantaged to advantaged mode operations

After entering the advantaged mode from the disadvantaged the MES shall read the full S-BCCH data as specified in clause 8.4.1. If a candidate list for spotbeam re-selection exists, the MES shall continue to maintain it as described in clause 8.2.4.

8.4 Advantaged Mode Operations

8.4.1 Measurements for spotbeam selection

If the MSE has determined that it is in an advantaged environment, it shall read the full S-BCCH data for the serving spotbeam within 5 seconds. Thereafter the MES shall measure the received level and attempt to decode S-BCCH data for the primary carriers in the cluster as described in clause 8.4.4.1.

If no candidate list for spotbeam re-selection exists, the MES may create one and maintain it as described in clause 8.2.4.

8.4.2 Use of the C1 and C2 criteria for spotbeam selection and re-selection

The path loss criterion parameter C1 is used by the MES in order to distinguish between advantaged and disadvantaged mode of operations, see clause 8.1. It is also an indicator to the MES of whether two-way communication is possible to the network. It is defined by:

C1 = (A - max(B,0))

where:

A = Received Level Average - RXLEV_ACCESS_MIN

B = MS_TXPWR_MAX_CCH - P

RXLEV_ACCESS_MIN = Minimum received level at the MES required for access to the system.

MS_TXPWR_MAX_CCH = Maximum TX power level an MES may use when accessing the system until otherwise commanded

P = Maximum RF output power of the MES.

All values are expressed in dBm.

The path loss criterion (GMR-2 03.022 [3]) is satisfied if C1 > 0.

The re-selection criterion C2 is used for spotbeam re-selection in advantaged mode only and is defined by:

C2 = C1 + CELL_RESELECT_OFFSET - TEMPORARY_OFFSET * H(PENALTY_TIME - T),
for PENALTY_TIME < > 11111

C2 = C1 - CELL_RESELECT_OFFSET,
for PENALTY_TIME = 11111

where:

H(x) = 0 for x < 0
= 1 for x >= 0

T: is the timer, started from zero, at the point at which the spotbeam was placed by the MES on the list of strongest carriers, to an accuracy of a TDMA frame. T is reset to zero whenever the spotbeam is no longer on the list of strongest carriers.

CELL_RESELECT_OFFSET applies an offset to the C2 re-selection criterion for that spotbeam (see table 11.1).

TEMPORARY_OFFSET applies a negative offset (see table 11.1) to C2 for the duration of PENALTY_TIME after the timer T has started for that spotbeam.

PENALTY_TIME is the duration for which TEMPORARY_OFFSET applies (see table 11.1). The all ones bit pattern on the PENALTY_TIME parameter is reserved to change the sign of CELL_RESELECT_OFFSET and the value of TEMPORARY_OFFSET is ignored as indicated by the equation defining C2.

CELL_RESELECT_OFFSET, TEMPORARY_OFFSET and PENALTY_TIME are spotbeam re-selection parameters which are broadcast on the S-BCCH of the spotbeam when CELL_RESELECT_PARAM_IND (see table 11.1) is set to 1. When CELL_RESELECT_PARAM_IND is set to 0 and ADDITIONAL_RESELECT_PARAM is 0, then the MES should take CELL_BAR_QUALIFY(see table 11.1) as 0, also in this case the spotbeam re-selection parameters take a value of 0 and therefore C2 = C1. The use of C2 is described in GMR-2 03.022 [3].

These parameters are used to ensure that the MES can select a spotbeam with which it has the highest probability of successful communication on forward and return links.

8.4.3 Forward signalling failure

The forward signalling failure criterion for advantaged operations is based on the forward link (i.e., downlink) signalling failure counter (DSC). When the MES enters advantaged mode operations, DSC shall be initialized to a maximum value of 900.

Thereafter, whenever the MES attempts to decode the S-BCCH, if a S-BCCH message is successfully decoded, DSC is increased by 1, (however never beyond the maximum value of DSC as specified above). If the S-BCCH message is not successfully decoded, DSC is decreased by 4. When DSC reaches 0, the MES reverts to disadvantage mode of operations.

8.4.4 Measurements for spotbeam re-selection

8.4.4.1 Monitoring of received level and S-BCCH data

While in idle mode in an advantaged environment, a MES shall continue to monitor the primary carriers in the spotbeam cluster. If a candidate list for spotbeam re-selection exists, the MES shall monitor only the primary carriers on that list. A running average of received level in the proceeding 5 seconds shall be maintained for each monitored carrier.

For the serving spotbeam, receive level measurement samples shall be taken at least for the S-BCCH and the receive level average shall be determined using samples collected over a period of 5 seconds.

At least 5 received level measurement samples are required per receive level average value. New sets of receive level average values shall be calculated as often as possible. The samples allocated to each carrier shall as far as possible be uniformly distributed over each evaluation period.

The same number of measurement samples shall be taken for all monitored non-serving primary spotbeam carriers and the samples allocated to each carrier shall as far as possible be uniformly distributed over each evaluation period.

The receive level averages for the monitored primary spotbeam carriers in a cluster shall be updated at least every 5 minutes and may be updated more frequently.

The MES shall synchronize to and attempt to decode the full S-BCCH data for the serving spotbeam at least every 5 minutes.

The MES shall attempt to decode the S-BCCH data block that contains the parameters affecting spotbeam re-selection for each of the monitored primary spotbeam carriers at least every 5 minutes.

Note that in rare cases of channel allocation within a spotbeam cluster, the MES may occasionally omit a single S-HPACH message, if monitoring of the S-HPACH channel conflicts with monitoring of a non-serving primary carrier.

In order to minimize power consumption, MESs that employ DRX (i.e., power down when paging blocks are not due) should monitor the signal strengths of non-serving primary spotbeam carriers during the frames of the paging block that they are required to listen to. Received level measurement samples can thus be taken on several non-serving primary spotbeam carriers and on the serving carrier during each paging block.

The MES shall attempt to check the Spotbeam ID Code for each monitored non-serving primary spotbeam carriers at least every 5 minutes, to confirm that it is monitoring the same spotbeam. If a change of Spotbeam ID is detected then the carrier shall be treated as a new carrier and the S-BCCH data re-determined.

In both cases, this monitoring shall be done so as to minimize interruptions to the monitoring of the S-HPACH.

The maximum time allowed for synchronization to a primary spotbeam carrier and to read the S-BCCH data is as specified in clause 8.2.1.

8.4.4.2 Path loss criteria and timings for disadvantaged mode reversion and for spotbeam selection and re-selection

The MES is required to perform the following measurements (see GMR-2 03.022 [3], clause 6.6) to ensure that the path loss criterion to the serving spotbeam is acceptable.

At least every 5 minutes, the MES shall calculate the value of C1 and C2 for the serving spotbeam and re-calculate C1 and C2 values for the monitored non-serving spotbeams (if possible and necessary). The MES shall then check whether:

a) The path loss criterion (C1) for current serving spotbeam falls below zero for a period of 5 minutes. This indicates that the path loss to the spotbeam has become too high and the MES must revert to disadvantage mode operations.

b) The calculated value of C2 for a non-serving suitable spotbeam exceeds the value of C2 for the serving spotbeam for a period of 5 minutes if the two spotbeams form a valid beam pair. If the spotbeams do not form a valid beam pair, then the C2 value for the new spotbeam shall be required exceed the C2 value of the serving spotbeam by at least CELL_RESELECT_HYSTERESIS dB as defined by the S-BCCH data from the current serving spotbeam, for a period of 5 minutes in order to be selected. This indicates that it is a better spotbeam.

Since information concerning a number of channels is already known to the MES, it may assign high priority to measurements on the strongest carriers from which it has not previously made attempts to obtain S-BCCH information, and omit repeated measurements on the known ones.

NOTE: The tolerance on all the above timings is ±10 %, except for PENALTY_TIME where it is ±2 sec.

8.5 Release of S-TCH and S-SDCCH

8.5.1 Normal case

When the MES releases a S-TCH or S-SDCCH and returns to idle mode, it shall, as quickly as possible, try to select and camp on the most recently registered spotbeam carrier and initiate the spotbeam procedures specified in clause 8.4.2.

NOTE: The MES design should allow for the finite time that the spotbeam re-selection task takes. For example, the user may want to originate a new call very soon after the end of a previous call, and the MES design should make this possible, e.g., by storing the origination until a spotbeam has been selected.

8.5.2 Call re-establishment

This clause does not apply to the GMR-2 system.

8.6 Limited service state (abnormal cases and emergency calls)

When in the limited service state (see GMR-2 03.022 [3]), the aim is to gain normal service rapidly and the following tasks shall be performed, depending on the conditions:

a) The MES shall monitor the signal strength of potential S-BCCH carriers, and search for a S-BCCH carrier which has C1 > 0 and which is not barred. When such a carrier is found, the MES shall camp on that spotbeam.

b) The MES shall perform spotbeam re-selection at least among the spotbeams of the cluster surrounding the spotbeam on which the MES has camped, according to GMR-2 03.022 [3], clause 7.5, except that a zero value of CELL_RESELECT_HYSTERESIS shall be used.

8.7 Inclined orbit operations

During inclined orbit operation of the spacecraft, spotbeam footprints move and change shape. This effect is most pronounced for beams located farthest from the equator. Because of the beam motion, some locations on the Earth's surface will be illuminated by one beam for part of the day, and by a different beam for the remainder of the day. A user terminal at one of these locations will sense the beam change and signal for a Location Update. To prevent this cyclic variation from causing a location update by MESs in the system, points that change beams during the day due to inclined orbits will be identified to the NCC.

The NCC shall assign a single unique Location Area Code to the spotbeam pair (i.e., two adjacent spotbeams) illuminating a common set of points during the beam oscillations occurring over a 24-hour satellite inclined orbit period. Since there are up to six nearest neighbours to a spotbeam, the NCC shall have the capability to assign six or less LACs to a single spotbeam. By defining a single LAC for a spot beam pair, beam switching is allowed without requiring location re-registration. Further, the switching occurs without hysteresis.

Additionally, the NCC shall assign a Location Area Code to the spotbeam for points in the beam that are only illuminated by that spotbeam during the course of the satellite's orbit. This establishes the single spotbeam Location Area Code or LAC-0 for the spotbeam.

The NCC shall transmit the single spotbeam LAC and the six Inclined Orbit Beam Pair LACs in the System Information Type 10 message on the S-BCCH and S-HBCCH in every spotbeam. The NCC shall use the same Beam Pair LAC in the System Broadcast for a spotbeam and its neighbour that illuminate those points on the earth that oscillate between spotbeams during the course of the satellite's orbit.

The MES shall use the System Information Type 10 messages during the Location Updating to register in the Beam Pair LAC as specified in GMR-2 03.022 [3], clause 6.4.1. The MES shall report its satellite LAC as well as its LAI to the gateway in the Layer 3 message contained in the SABM frame as specified in GMR-2 04.008 [6]. This allows the gateway to locate the MES for mobility management purposes.

If the MES is registered in a Beam Pair LAC, the NCC shall perform paging for the MES in both Beams 1 and 2 concurrently. If either page is successful, the MES shall respond in the spotbeam that it is camped on provided that the process described in clause 8.4 is successful. The NCC shall perform call set-up in the spotbeam in which it received a response.

9 Network pre-requisites

The S-BCCH carrier shall be transmitted on timeslots per GMR-2 05.002 [7]. The RF power level may be ramped down between timeslots to facilitate switching between RF transmitters. Unused signalling blocks on the S-AGCH, S-PCH, S-HPACH and S-BCCH shall contain no transmitted energy, nor will other unused timeslots.

Radio link measurements are used in RF power control processes.

10 Radio link measurements

10.1 Signal strength

10.1.1 General

The received signal level shall be employed as a criterion in the RF power control and intra-spotbeam handover process.

10.1.2 Physical parameter

The RMS received signal level at the receiver input shall be measured by the MES over the full range of -117,5 to -86,5 dBm and the Gateway over the full range of -129,5 to -98,5 dBm with an absolute accuracy of ±0,5 dB under normal conditions and ±1 dB over the full range under extreme conditions.

The MES and Gateway need not necessarily measure signal levels below the reference sensitivity. If the received signal level falls below the reference sensitivity level for the type of MES or Gateway, then the MES or Gateway shall report a level within a range allowing for the absolute accuracy specified above.

The relative accuracy shall be as follows:

If signals of level x1 and x2 dBm are received (where x1 < = x2) and levels y1 and y2 dBm respectively are measured, if x2 - x1 < 10 dB and x1 is not below the reference sensitivity level, then y1 and y2 shall be such that:

(x2 - x1) - a < = y2 - y1 < = (x2 - x1 + b) if the measurements are on the same or on different RF channel

where:

a and b are in dB and depend on the value of x1 as follows:

	a	b
X1 ≥ S +1 4	2	2
S + 14 > X1 ≥ S + 1	3	2
S + 1 > X1	4	2

where: S = reference sensitivity level as specified in GMR-2 05.005 [8].

The selectivity of the received signal level measurement shall be as follows:

a) for adjacent (200 kHz) channel > = 16 dB

b) for adjacent (400 kHz) channel > = 40 dB

c) for adjacent (600 kHz) channel > = 40 dB

The selectivity shall be met using a random, continuous, modulated signal for the wanted signal at the level 10 dB above the reference sensitivity level. The unwanted signal shall use the same modulation as the wanted signal with the power level increased above the wanted level by the selectivity for each adjacent frequency offset. There shall be less than ±0,5 dB change in the desired signal level.

10.1.2.1 Measurement scaling for fixed terminals

The measurement requirements specified in clause 10.1.2 are for mobile terminals with G/T and axial ratio performance capabilities as specified in GMR-2 05.005 [8], clause 7.5.2. Fixed terminals shall perform the same received signal strength measurement but shall scale the actual measurement by the difference between the Fixed Terminal performance and the referenced mobile terminal performance. This will present a normalized set of received signal strength reports to the power control algorithm.

10.1.3 Statistical parameters for power control

The reported parameters (RXLEV) shall be the average of the received signal level measurement samples in dBm taken within the measurement period defined in clause 10.4. In averaging, measurements made during previous reporting periods shall always be discarded.

The Gateway shall make a received signal level measurement on all time slots of the associated physical channel including those of the S-SACCH, but excluding the idle time slots.

10.1.3.1 Statistical parameters for intra-spotbeam handover control

The Gateway shall calculate a 5 second average of all MES and Gateway RXLEV values (which are generated over the measurement periods which occurred during the 5 second averaging period) and report these averaged values internal to the gateway for use in the Intra-Spotbeam Handover Control algorithm.

NOTE: Optionally, for interference and fading mitigation, the 5 second averaging may be replaced with a report every 480 ms. In this case all MES/Gateway RXLEV values shall be reported for use in the Intra-Spotbeam Handover Control algorithm every 480 ms.

10.1.4 Range of parameter

The measured signal level shall be mapped to an RXLEV value as defined in table 10.1.1.

Table 10.1.1: RXLEV to signal level mapping

RXLEV	Mobile Earth Station receive signal strength at antenna output (dBm)
0	less than -117,5
1	-117,5 to -117,0
2	-117,0 to -116,6
: :	: :
62	-87,0 to -86,5
63	greater than -86,5

RXLEV	Ground Terminal receive signal strength at antenna output (dBm)
0	less than -124,5
1	-124,5 to -124,0
2	-124,0 to -123,5
: :	: :
46	-102,0 to -101,5
47	greater than -101,5

Six bits are used to define RXLEV for each carrier measured. Assumed values for RXLEV shall be the midpoint of the range shown above

10.2 Signal quality

10.2.1 General

The received signal quality shall be employed as a criterion in the RF power control and intra-spotbeam handover processes.

10.2.2 Physical parameter (RXQUAL)

The received signal quality shall be measured by the MES and Gateway in a manner that can be related to an equivalent average BER before channel decoding (i.e., chip error ratio), assessed over the measurement period defined in clause 10.4.

10.2.3 Statistical parameters (RXQUAL) for power control

The reported parameters (RXQUAL) shall be the received signal quality, averaged over the reporting period of one S-SACCH multiframe as defined in clause 10.4. In averaging, measurements made during previous reporting periods shall always be discarded.

10.2.3.1 Statistical parameters for intra-spotbeam handover control (RXQUAL)

The Gateway shall calculate a 5 second average of all MES and Gateway RXQUAL values (which are generated over the measurement periods which occurred during the 5 second averaging period) and report these averaged values internal to the gateway for use in the Intra-Spotbeam Handover Control algorithm.

NOTE: (Option) for interference and fading mitigation removes this 5 second averaging and all MES/Gateway RXQUAL values are reported for use in the Intra-Spotbeam Handover Control algorithm every 480 ms.

10.2.4 Range of parameter (RXQUAL)

When the quality is assessed over the full set and sub-set of frames defined in clause 10.4, the levels of RXQUAL are defined and shall be mapped to the equivalent BER before channel decoding as shown in table 10.2.1.

Table 10.2.1: RXQUAL to equivalent BER mapping

RXQUAL_15	11,9 % < BER	Assumed value = 12,5 %
RXQUAL_14	10,5 % < BER < 11,9 %	Assumed value = 11,2 %
RXQUAL_13	9,1 % < BER < 10,5 %	Assumed value = 9,8 %
RXQUAL_12	7,9 % < BER < 9,1 %	Assumed value = 8,5 %
RXQUAL_11	6,6 % < BER < 7,9 %	Assumed value = 7,3 %
RXQUAL_10	5,6 % < BER < 6,6 %	Assumed value = 6,1 %
RXQUAL_9	4,6 % < BER < 5,6 %	Assumed value = 5,1 %
RXQUAL_8	3,7 % < BER < 4,6 %	Assumed value = 4,2 %
RXQUAL_7	2,9 % < BER < 3,7 %	Assumed value = 3,3 %
RXQUAL_6	2,1 % < BER < 2,9 %	Assumed value = 2,5 %
RXQUAL_5	1,4 % < BER < 2,1 %	Assumed value = 1,8 %
RXQUAL_4	0,9 % < BER < 1,4 %	Assumed value = 1,2 %
RXQUAL_3	0,5 % < BER < 0,9 %	Assumed value = 0,7 %
RXQUAL_2	0,2 % < BER < 0,5 %	Assumed value = 0,3 %
RXQUAL_1	0,05 % < BER < 0,2 %	Assumed value = 0,1 %
RXQUAL_0	BER < 0,05 %	Assumed value = 0,0 %

The assumed values may be employed in any averaging process applied to RXQUAL.

The BER values used to define a quality band are the estimated error probabilities before channel decoding, averaged over the full set or sub set of TDMA frames as defined in clause 10.4. The accuracy to which a MES and gateway shall be capable of estimating the error probabilities when on a S-TCH is given in table 10.2.2

Table 10.2.2: Error probability estimation accuracy

Quality band	Range of actual BER (in percent)	Probability that the correct RXQUAL band is reported by the MES shall exceed:					
		Full rate channel	half rate channel	quarter rate channel	Eight rate channel	DTX mode	
						S-TCH/HRS	S-TCH/QBS
RXQUAL_15	Greater than 12,48	80 %	70 %	70 %	70 %	60 %	55 %
RXQUAL_14	11,05 to 11,32	80 %	70 %	70 %	70 %	60 %	55 %
RXQUAL_13	9,62 to 9,95	80 %	70 %	70 %	70 %	60 %	55 %
RXQUAL_12	8,38 to 8,58	80 %	70 %	70 %	70 %	60 %	55 %
RXQUAL_11	7,05 to 7,42	80 %	70 %	70 %	70 %	60 %	55 %
RXQUAL_10	6,01 to 6,15	80 %	70 %	70 %	70 %	60 %	55 %
RXQUAL_9	4,98 to 5,19	80 %	70 %	70 %	70 %	60 %	55 %
RXQUAL_8	4,04 to 4,22	80 %	70 %	70 %	70 %	60 %	55 %
RXQUAL_7	3,20 to 3,36	80 %	70 %	70 %	70 %	60 %	55 %
RXQUAL_6	2,36 to 2,60	80 %	70 %	70 %	70 %	60 %	55 %
RXQUAL_5	1,61 to 1,84	80 %	70 %	70 %	70 %	60 %	55 %
RXQUAL_4	1,07 to 1,19	80 %	70 %	70 %	70 %	60 %	55 %
RXQUAL_3	0,63 to 0,73	80 %	70 %	70 %	70 %	60 %	55 %
RXQUAL_2	0,28 to 0,37	80 %	70 %	70 %	70 %	60 %	55 %
RXQUAL_1	0,103 to 0,148	80 %	70 %	70 %	70 %	60 %	55 %
RXQUAL_0	Less than 0,03	80 %	70 %	70 %	70 %	60 %	55 %

10.3 Aspects of discontinuous transmission (DTX)

The use of DTX on S-TCHs is configurable (i.e., DTX may be used or not used).

When DTX is employed on an S-TCH, not all TDMA frames may be transmitted. However, the following subset of table 10.3.1. The TDMA frames shown in table 10.3.1 shall be occupied by the SID (silence descriptor) speech frame and shall always be transmitted. , and hence these frames shall be employed to assess quality and signal level during DTX. See GMR-2 06.001 [10] for detailed specification of the SID frame transmission requirements.

Table 10.3.1

Type of channel	SID message block frames TDMA frame number (FN) modulo N	N
S-TCH/HES	Reserved	104
S-TCH/QBS	104 + SMI, 108 + SMI, 112 + SMI	208
S-TCH/HRS	104 + SMI, 106 + SMI, 108 + SMI, 110 + SMI, 112 + SMI, 114 + SMI	208
S-TCH/ELS	Reserved	416
NOTE: S-TCH/HRS uses S-TCH/QBS mode and reports using either the 0,2 or 1,3 QR SMIs in combination, hence a reporting cycle of 208 frames. SMI is defined in GMR-2 05.002 [7]		

DTX is not allowed on data traffic channels.

DTX is required on the S-SDCCH i.e. DTX is always used on S-SDCCH.

10.4 Measurement reporting

For the mobile earth station, the measurement period on the forward link shall be based on the return link S-SACCH multiframe message block. For the gateway, the measurement period on the return link shall be based on the forward link S-SACCH multiframe message block. The last TDMA frame of the measurement period shall precede the S-SACCH reporting block by 5 TDMA frames. The length of the measurement period shall be as defined in table 10.4.1.

Table 10.4.1: S-SACCH measurement period based on S-TCH type

S_TCH	Measurement period in TDMA frames
FR	104
HR	104
QR	208
HRR	208
ER	416

For a S-SDCCH, the measurement period is as defined for S-TCH type.

The MES and gateway shall include the full set of S-TCH and S-SACCH TDMA frame measurements in the RXLEV_FULL (see tables 11.2 and 11.3) and RXQUAL_FULL (see tables 11.2 and 11.3) reports as shown in table 10.4.2.

Table 10.4.2

Satellite Channel Type	Channel TDMA frames per S-TCH multiframe	Channel S-TCH multiframes per S-SACCH multiframe	Channel TDMA frames per S-SACCH multiframe	S-SACCH TDMA frames per S-SACCH multiframe	Total number of TDMA frames in RXLEV and RXQUAL
TCH/F	24	4	96	4	100
TCH/H	12	4	48	4	52
TCH/HR	12	8	96	8	104
TCH/Q	6	8	48	4	52
TCH/E	3	16	48	4	52
SDCCH/E	3	16	48	4	52

The MES and gateway shall include the subset of S-TCH and S-SACCH TDMA frame measurements in the RXLEV_SUB (see tables 11.2 and 11.3) and RXQUAL_SUB (see tables 11.2 and 11.3) reports as shown in table 10.4.3.

Table 10.4.3

Satellite Channel Type	Channel TDMA frames per S-SACCH multiframe	S-SACCH TDMA frames per S-SACCH multiframe	Total TDMA frames in RXLEV and RXQUAL
TCH/F			Reserved
TCH/H			Reserved
TCH/HR	6	8	14
TCH/Q	3	4	7
TCH/E			Reserved
SDCCH/E	0	4	4

The MES shall modify its reporting during single-hop traffic connections and shall include the subset of S-SACCH TDMA frame measurements in the RXLEV_SUB and RXQUAL_SUB reports as shown in table 10.4.4.

Table 10.4.4

Channel Type	Channel TDMA frames per S-SACCH multiframe	S-SACCH TDMA frames per S-SACCH multiframe	Total TDMA frames in RXLEV and RXQUAL
Any S-TCH	0	4	4

Whether the MES is on a S-TCH or a S-SDCCH, if the next S-SACCH message block is used for a different Layer 3 message, the averaged data which would otherwise be sent in that block is discarded and a new average started for the current block, i.e., any S-SACCH message will report the average data for the previous measurement period only.

The MES shall transmit the Measurement Report (See GMR-2 04.008 [6], clause 10.1.21) at least once every other measurement period when the S-SACCH is used for other Layer 3 messages.

11 Control parameters

The parameters employed to control the radio links are shown in tables 11.1 through 11.4.

Table 11.1: Radio sub-system link control parameters

Parameter Name	Description	Range	Bits	Channel
BIDC	Spotbeam identification code	0 to 255	8	S-HMSCH
MS_TXPWR_MAX_CCH	The maximum TX power level a MES may use when accessing the system until otherwise commanded	0 to 31 (Note)	5 (Note)	S-BCCH
RXLEV_ACCESS_MIN	Minimum received level at the MES required for access to the system.	0 to 63	6	S-BCCH
RADIO_LINK_TIMEOUT	The value of the radio link failure counter, in S-SACCH message blocks (maximum value of 16).	-	4	S-BCCH
CELL_RESELECT_ HYSTERESIS	RXLEV hysteresis for required spotbeam re-selection. 0 dB to 14 dB, 2 dB steps, i.e. 0 = 0 dB, 1 = 2 dB. etc.	0 to 7	3	S-BCCH
CELL_BAR_ACCESS	See table 11.1a.	0/1	1	S-BCCH
CELL_BAR_QUALIFY	See table 11.1a.	0/1	1	S-BCCH
CELL_RESELECT_ PARAM_IND	Indicates the presence of C2 beam reselection parameters (1 = parameters present).	0/1	1	S-BCCH
CELL_RESELECT_ OFFSET	Applies an offset to the C2 reselection criterion. 0 dB to 31.5 dB, 0,5 dB steps, i.e. 0 = 0 dB, 1 = 0,5 dB, etc.	0 to 63	6	S-BCCH
TEMPORARY_OFFSET	Applies a counteractive negative offset to the CELL_RESELECT_OFFSET in the calculation of C2 for the duration of PENALTY_TIME 0 dB to 60 dB, 10 dB steps i.e. 0 = 0 dB, 1 = 10 dB, etc. and 7 = infinity	0 to 7	3	S-BCCH
PENALTY_TIME	For values < 31, PENALTY_TIME G gives the duration for which the TEMPORARY_OFFSET temporary offset is applied. 20 to 620 s, 20 s steps, i.e. 0 = 20 s, 1 = 40 s, etc. PENALTY_TIME = 31 is reserved to indicate that CELL_RESELECT_OFFSET is subtracted from C1 in the calculation of C2 and the TEMPORARY_OFFSET is ignored.	0 to 31	5	S-BCCH
NOTE: The range of values allowed, 0 to 31, does not cover all possible MES power settings as defined in GMR-2 05.005 [8], tables 6.1-2 and 6.1-3. Values 0 to 31 above, directly equate to power control levels 0 to 31 defined in GMR-2 05.005 [8], tables 6.1-2 and 6.1-3. All MESs shall limit transmissions to the lesser of the maximum achievable power of the MES (according to its classmark) or the configured MS_TXPWR_MAX_CCH, until otherwise commanded by the system.				

Table 11.1a: Parameters affecting spotbeam priority for spotbeam selection

CELL_BAR_QUALIFY	CELL_BAR_ACCESS	Spotbeam selection priority	Status for spotbeam reselection
0	0	Normal	Normal
0	1	Barred	Barred
1	0	Low	Normal
1	1	Low	Normal

If all the following conditions are met then the "Spotbeam Selection Priority" and the "Status for Spotbeam Reselection" shall be set to normal:

a) this beam belongs to the MES HPSMN mode;

b) the MES is in spotbeam test operation mode;

c) the CELL_BAR_ACCESS is set to "1";

d) the CELL_BAR_QUALIFY is set to "0";

e) the Access Control class 15 is barred.

NOTE: A low priority spotbeam is only selected if there are no suitable spotbeams of normal priority (see GMR-2 03.022 [3]).

Table 11.2: Power control parameters - Return S-SACCH

Parameter name	Description	Range	Bits	Message
MS_TXPWR_REQUEST (ordered MES power level)	The power level to be used by a MES	4 to 40	6	L1 header forward
MS_TXPWR_CONF (actual MES power level)	Indication of the power level in use by the MES	4 to 40	6	L1 header return
MS RXLEV_FULL_SERVING_BEAM (Received Signal Strength Measurement Report Parameter)	The mean of RXLEV in the current serving spotbeam accessed over all TDMA frames in a SACCH cycle	0 to 63	6	Measurement results
MS RXLEV_SUB_SERVING_BEAM (Received Signal Strength Measurement Report Parameter)	The RXLEV in the current serving spotbeam accessed over a subset of TDMA frames in a SACCH cycle	0 to 63	6	Measurement Results
MS RXQUAL_FULL_SERVING_BEAM (Received Signal Quality (CER) Measurement Report Parameter)	The mean RXQUAL in the current serving a spotbeam, assessed over all TDMA frames in a SACCH cycle	0 to 15	4	Measurement Results
MS RXQUAL_SUB_SERVING_BEAM (Received Signal Quality (CER) Measurement Report Parameter)	The RXQUAL in the current serving a spotbeam, assessed over subset of TDMA frames in a SACCH cycle	0 to 15	4	Measurement Results
MS DTX_used Flag	Indicates whether or not the MES used DTX during the previous measurement	0 to 1	1	Measurement results
MS DTX_Detect Flag	Indicates whether or not the MES detected DTX in the measurement period	0 to 1	1	Measurement results

Table 11.3: Power control parameters - Gateway report

Parameter name	Description	Range	Bits
BS_TXPWR_REQUEST (Gateway implemented Power Level)	Implemented Indication of the power level in use by the gateway	0 to 34	6
BS RXLEV_FULL_SERVING_BEAM (Received Signal Strength Measurement Report Parameter)Gateway Received Signal Strength Full-up Mean Measurement Report Parameter	The mean of RXLEV for the assigned circuit accessed over all TDMA frames	0 to 47	6
BS RXLEV_SUB_SERVING_BEAM (Received Signal Strength Measurement Report Parameter)Gateway Sub-mean Received Signal Strength Measurement Report Parameter	The RXLEV in the current assigned circuit over a subset of TDMA frames	0 to 63	6
BS RXQUAL_FULL_SERVING_BEAM (Received Signal Quality (CER) Measurement Report Parameter)Gateway Full mean Received Signal Quality (CER) Measurement Report Parameter	The mean RXQUAL (CER) in the current assigned circuit, assessed over all TDMA frames	0 to 15	4
BS RXQUAL_SUB_SERVING_BEAM (Received Signal Quality (CER) Measurement Report Parameter)Gateway Sub mean Received Signal Quality (CER) Measurement Report Parameter	The RXQUAL (CER) in the current assigned circuit, assessed over a subset of TDMA frames	0 to 15	4

Table 11.4: Intra-spotbeam handover control parameters - Gateway

Parameter name	Description	Range	Bits	Message
MS_TXPWR_REQUEST (ordered MES power level)	5 second average of same parameter referenced in table 11.2	4 to 40	6	L1 header forward
MS_TXPWR_CONF (actual MES power level)	5 second average of same parameter referenced in table 11.2	4 to 40	6	L1 header return
MS RXLEV (Received Signal Strength Measurement Report Parameter) The TCE averages together the valid Full-up and/or Sub mean values of this parameter during the defined measurement period	5-second average of same parameter referenced in table 11.2. The MS_RXLEV values that were used for power control over the 5-second averaging period.	0 to 63	6	Measurement results
MS RXQUAL (Received Signal Quality (CER) Measurement Report Parameter) The TCE averages together the valid Full-up and/or Sub mean values of this parameter during the defined measurement period	5-second average of same parameter referenced in table 11.2. The MS_RXQUAL values that were used for power control over the 5-second averaging period.	0 to 15	4	Measurement Results
BS_TXPWR_REQUEST (Gateway implemented Power Level)	5 second average of same parameter referenced in table 11.3	0 to 34	6	
BS_RXLEV (Gateway Received Signal Strength Measurement Report Parameter) The TCE averages together the valid Full-up and/or Sub mean values of this parameter during the defined measurement period	5-second average of the BS_RXLEV values that were used for power control over the 5 seconds averaging period. Same parameter referenced in table 11.3	0 to 47	6	
BS RXQUAL (Gateway Received Signal Quality (CER) Measurement Report Parameter) The TCE averages together the valid Full-up and/or Sub mean values of this parameter during the defined measurement period	5-second average of the BS_RXQUAL (CER) values that were used for power control over the 5-second averaging period. Same parameter referenced in table 11.3	0 to 15	4	

Annex A (informative): Definition of a Basic RF Power Control Process and Parameters

A.1 Scope

This annex documents a basic RF power control process. The basic solution is not mandatory for network operators.

A.1.1 Introduction

In-Call power control shall be implemented with the goal of minimizing the RF power output from the MES, the gateway, and satellite while maintaining sufficient signal level received at the gateway and MES to keep adequate speech/data quality. In the absence of in-call power control, a fixed power level shall be applied. As depicted in Figure A.1, Power Control shall be implemented by the issuance of power commands to the gateway and MES by the gateway Traffic Channel Equipment (TCE), based upon processing of signal strength and quality measurements and comparisons with their associated signal thresholds.

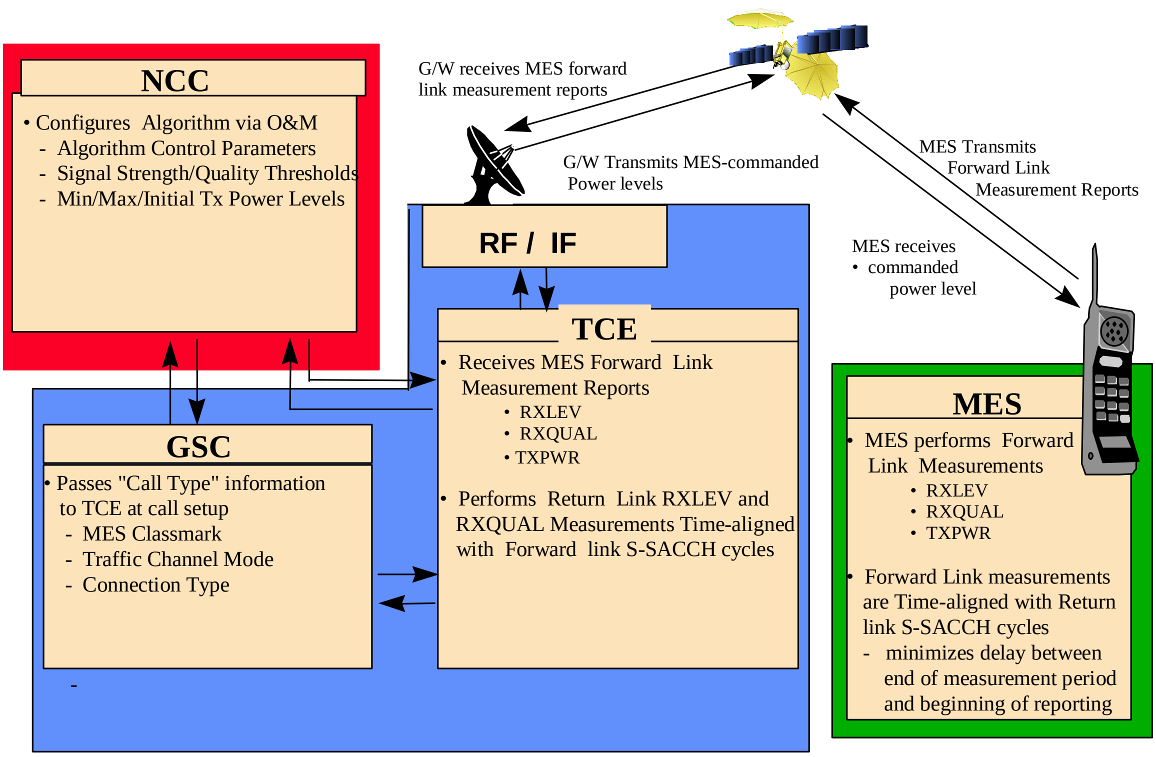

Figure A.1: "In-Call" Power Control System View

A.1.2 Power Control Parameter Prefix/Suffix Definitions

BS_and **MS_**: Prefixes representing Base Station and Mobile Station; BS and MS are acronyms which are used in GSM for the Base Station and Mobile Station respectively. The GMR parallel to the GSM Base Station and Mobile stations are the Gateway (GW) and the Mobile Earth Station (MES), respectively. This power control process is based upon the GSM 05.08 [11], appendix A specification and, therefore, this process description maintains usage of the prefixes BS and MS with the understood application to the GW and MES.

_inc and **_red**: Suffix representing **inc**rease and **red**uction; Used as suffix for parameters used for power **inc**rease assessment and power **red**uction assessment.

U_ and **L_**: Prefix representing **U**pper and **L**ower; Used as prefix to threshold parameters to indicate upper or lower level threshold.

_UL_ and **_DL_**: **U**p**L**ink and **D**own**L**ink; Used to indicate link directions. UL and DL are used in the same context as GSM in that they represent the direction from the handset perspective. DL is used for the Forward Direction which is received by the handset in the DownLink from the spacecraft. UL is used for the Return Direction which is transmitted by the handset on the Uplink to the spacecraft. It is noted that RXLEV_UL and RXQUAL_UL are measurement values in the return direction which are actually measured on a "spacecraft downlink" from the gateway perspective but are referred to as "UL" based upon the GSM convention referencing from the handset perspective where these are measured on the **U**p**L**ink to the BTS tower. This power control process is based upon the GSM 05.08 Appendix A specification and therefore, this description maintains usage of the _UL_ and _DL_ nomenclature.

A.2 Power Control Process Overview

The overall power control process is a series of sub-processes. Each of these sub-processes is governed by its associated configurable parameters, which are discussed herein.

For the purpose of RF power control processing, the gateway shall store the parameters and thresholds shown in tables A.1 through A.4. These parameters shall be stored in the Gateway (GSC and TCE) and shall be managed at a network level (NCC) via O&M. Table A.1 represents Radio Criteria thresholds. The gateway (TCE) shall store different default

settings for the parameters listed in table A.1 for all combinations of the Classmarks, Traffic Channel Modes and Connection Types listed below.

i) MES Classmark
   a) MES Classmark = 1 (fixed terminal)
   b) MES Classmark > 1 (mobile terminal classmarks 2, 3 and 4)

ii) Traffic Channel Mode
   a) TCH/QBS e) TCH/F9.6
   b) TCH/HRS f) TCH/H4.8
   c) TCH/HES g) TCH/HR2.4
   d) TCH/ELS h) TCH/Q2.4

iii) Connection Type
   a) MES-to-MES (Note: This is not applicable for FAX/Data service thresholds)
   b) Non-MES-to-MES (Mobile to either PSTN or PSMN)

The gateway (TCE) must store different versions of table A.2 also, as a function of MES Classmark, Traffic Channel Mode, and Connection Type.

iv) MES Classmark
   a) MES Classmark = 1 (fixed terminal)
   b) MES Classmark = 2 (mobile terminal)
   c) MES Classmark = 3 (mobile terminal)
   d) MES Classmark = 4 (mobile terminal)

Tables A.3 and A.4 are operator configurable parameters which shall be set at a Network level and therefore only one version of these parameters shall be stored by the TCE and the same values shall be applied to each call irrespective of MES classmark, Traffic Channel Mode, or Connection Type.

The following measurements shall be continuously processed in the gateway (TCE):

i) Measurements reported by MES in the S-SACCH message:

- Forward RXLEV (RXLEV_DL);
- Forward RXQUAL (RXQUAL_DL).

ii) Measurements performed in the gateway:

- Return RXLEV (RXLEV_UL);
- Return RXQUAL (RXQUAL_UL).

A.2.1 Power Control Algorithm Sample and Decision Window Generation

Figure A.2 presents the functional depiction of the generation of a set of power control algorithm samples from a set of measurement reports to form a power control decision window.

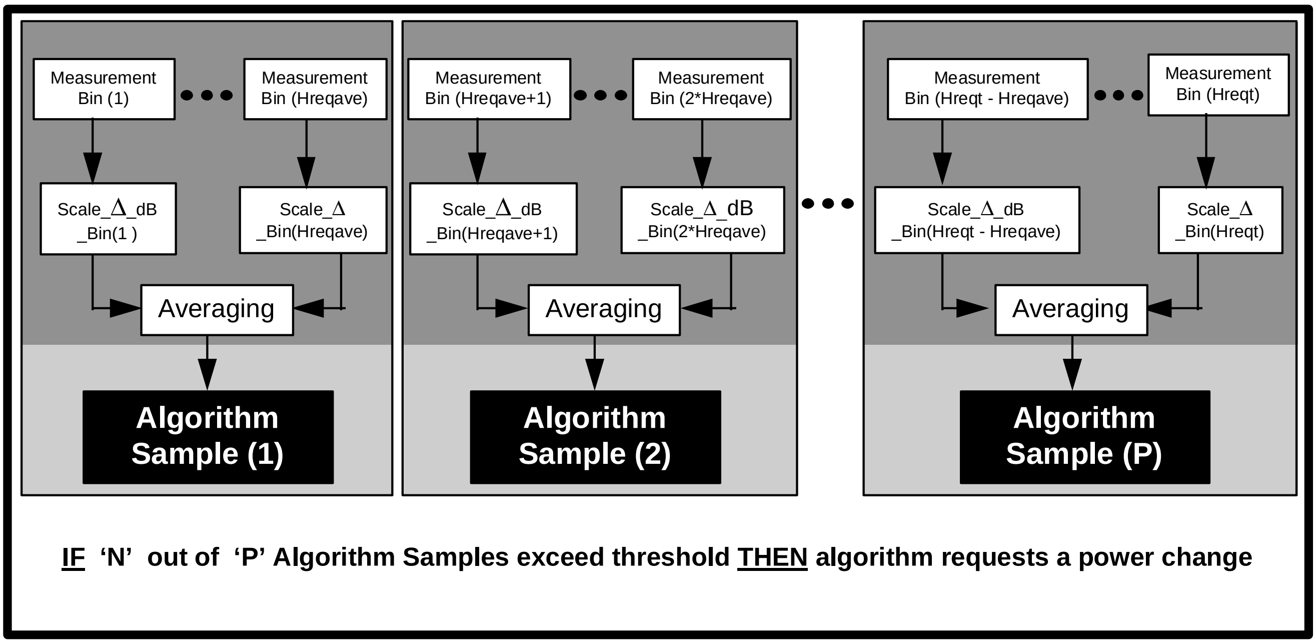

Figure A.2: Power Control Algorithm Decision Window

A.2.1.1 Power Control Sliding Window Process

Every S-SACCH cycle epoch a new measurement value shall be introduced to the process. The way in which algorithm samples will be recalculated depends on the configured value of Hreqave.

The parameters which govern the sliding window and sample generation process are defined as follows where the "_xxx" suffix is "_inc" for the power increase assessment process and "_red" for the power reduction process:

P_xxx The total number of RXLEV and RXQUAL algorithm samples to be compared against the threshold values.

Hreqave_xxx The required number of RXLEV and RXQUAL S-SACCH cycle measurements which shall be averaged together to form a single RXLEV or RXQUAL algorithm sample.

Hreqt_xxx The total number of RXLEV and RXQUAL measurements needed to form "P" algorithm samples. (Hreqt = Hreqave x P).

The power control decision window shall be sized to evaluate "P" algorithm samples, numbered (1) through (P), which shall be derived from "Hreqt" S-SACCH cycle measurements in measurement bins numbered (1) through (Hreqt). The value in Sample(1) shall be comprised of the most recent "Hreqave" S-SACCH cycle measurements which are in measurement bins (1) through (Hreqave) and all Samples shall be derived from a number of measurement bins equal to "Hreqave".

Decision epochs shall occur each S-SACCH cycle epoch unless the P_Con_interval_xxx timer interval has not passed since the last change in power. Forward link power control shall be timed against return link S-SACCH epochs and Return link power control shall be timed against Forward Link S-SACCH epochs. Every S-SACCH cycle epoch the value that was in measurement bin(Hreqt) shall be shifted out of the decision window; the values that were in bin(1) through bin(Hreqt -1) shall be shifted one position to fill bin(2) through bin(Hreqt); and the newly received S-SACCH cycle measurement value shall fill measurement bin(1). At the next decision epoch, after this sliding window procedure is completed, the current values in the "Hreqt" measurement bins shall be scaled and averaged, "Hreqave" at a time, to form the "P" samples for the next decision.

A.2.1.2 Power Control Scaling (Normalization) Process

"Hreqave" measurement values shall be averaged together to form a single algorithm sample. The "Hreqave" S-SACCH cycle measurement values shall be scaled prior to averaging. Through scaling, all measurements shall be normalized relative to the most recent commanded power level. The scaling shall be accomplished by means of a factor called 'Scale_Δ_dB'.

Prior to a decision at the current S-SACCH cycle epoch (defined as the end of the S-SACCH cycle), the scaling factor, "Scale_Δ_dB", must be established as prescribed by the network operator. Once the Scale_Δ_dB is derived for measurement Bin(J), it shall be applied in the following manner for the RXLEV, and RXQUAL S-SACCH cycle measurements associated with Bin(J):

Scaled_RXLEV_Bin(J):

Scaled_RXLEV_Bin(J) = RXLEV_Measurement_Bin(J) + Scale_Δ_dB_Bin(J)

Scaled_RXQUAL_Bin(J):

Take the RXQUAL_measurement_Bin(J) value and obtain an "Estimated_RXLEV" via interpolation using stored tabular data* of RXLEV vs. RXQUAL associated with the MES classmark.

Scaled_Estimated_RXLEV = Estimated_RXLEV + Scale_Δ_dB_Bin(J).

Scaled_RXQUAL_Bin(J) = interpolated RXQUAL using the Scaled_Estimated_RXLEV and the stored tabular data* of RXLEV vs. RXQUAL associated with the MES classmark.

A.2.1.3 Power Control: Averaging of Measurement Bin Values to form Algorithm Samples

In order to generate an "algorithm sample", Hreqave "S-SACCH cycle measurement bin values" shall be scaled and averaged together. The timing of the processing shall be controlled by parameters, set by O&M, as follows:

a) RXLEV_XX (XX = DL or UL): for every connection, and for both forward and return links, up to 32 S-SACCH cycle measurements shall be stored. A S-SACCH cycle measurement is the value evaluated by the MES and gateway during a S-SACCH multiframe cycle. Every cycle, with these measurement values, the gateway shall evaluate the scaled and averaged values of the received power as defined by the parameters Hreqave and Hreqt, applicable to RXLEV. This creates new RXLEV_XX "algorithm samples" for comparison against the upper and lower level RXLEV threshold values (U_RXLEV_XX_P and L_RXLEV_XX_P respectively). The RXLEV threshold values are network operator configurable parameters, which shall be selected for each "call type" (as a function of MES classmark, traffic channel mode, and connection type).

b) RXQUAL_XX (XX = DL or UL):

For every connection and for both links, up to 32 S-SACCH cycle measurements shall be stored. Every cycle, with these measurement values, the gateway shall evaluate the scaled, averaged received signal qualities as defined by the parameters Hreqave and Hreqt, applicable to RXQUAL. This creates new RXQUAL_XX "algorithm samples" for comparison against the upper and lower level RXQUAL threshold values (U_RXQUAL_XX_P and L_RXQUAL_XX_P respectively). The RXQUAL threshold values are network operator configurable parameters which shall be selected for each "call type" (as a function of MES classmark, traffic channel mode, and connection type).

c) Hreqave_xxx and Hreqt_xxx:

The value of Hreqave_xxx (xxx = inc for power increases and xxx = red for power reductions) shall be defined by O&M, for each gateway, for the averaging of reported S-SACCH cycle measurements into algorithm samples. Hreqt_xxx shall be determined by the configured values of Hreqave_xxx and P_xxx where Hreqt_xxx = (Hreqave_xxx) × (P_xxx).

Hreqave defines the period over which an algorithm sample shall be produced for an upper or lower threshold comparison, in terms of the number of S-SACCH cycle measurement results, i.e. the number of S-SACCH cycle measurements contributing to each algorithm sample. Hreqt is the total number of S-SACCH cycle measurements that must be maintained to comprise an "algorithm decision window" for an upper or lower threshold comparison.

Hreqave measurement values shall be scaled and averaged together to form a single algorithm sample. An algorithm decision window is comprised of "P" algorithm samples.

A.3 Minimum and Maximum Tx Power Determination Processes.

The use of a minimum Transmit Power on the forward or return links shall be implemented by a configurable minimum TXPWR level set by the XX_TXPWR_min parameters. The BS_TXPWR_min shall establish an absolute minimum power for transmissions by the gateway in the forward direction and the MS_TXPWR_min shall establish an absolute minimum power for the MES in the return direction. When the power control algorithm arrives at a "Next_XX_TXPWR level" this new power level shall be checked against the minimum (maximum) and if it is less (greater) than the minimum (maximum), then the "Next_XX_TXPWR" shall be reset to be equal to the minimum (maximum).

Table A.1: Network Operator Configurable Radio Criteria Thresholds for Power Control (Configurable by MES Classmark, Traffic Channel Mode, and Connection Type)

Parameter Name	Direction	Description	Threshold Parameters		Averaging Parameters
L_RXLEV_UL_P	RETURN	RXLEV threshold on the uplink for power increase. Interface value is integer between 0 (Note) and 31 with step size = 1 Corresponds to a real number (dBm).	P_inc	N_inc	Hreqave_inc
U_RXLEV_UL_P		RXLEV threshold on the uplink for power reduction. Interface value is integer between 0 (Note) and 31 with step size = 1 Corresponds to a real number (dBm).	P_red	N_red	Hreqave_red
L_RXQUAL_UL_P	RETURN	RXQUAL threshold on the uplink for power reduction. Interface value is integer between 0 (Note) and 31 with step size = 1 Corresponds to a real number.	P_red	N_red	Hreqave_red
U_RXQUAL_UL_P		RXQUAL threshold on the uplink for power increase Interface value is integer between 0 (Note) and 31 with step size = 1 Corresponds to a real number.	P_inc	N_inc	Hreqave_inc
L_RXLEV_DL_P	FORWARD	RXLEV threshold on the downlink for power increase. Interface value is integer between 0 (Note) and 31 with step size = 1 Corresponds to a real number (dBm).	P_inc	N_inc	Hreqave_inc
U_RXLEV_DL_P		RXLEV threshold on the downlink for power reduction. Interface value is integer between 0 (Note) and 31 with step size = 1 Corresponds to a real number (dBm).	P_red	N_red	Hreqave_red
L_RXQUAL_DL_P	FORWARD	RXQUAL threshold on the downlink for power increase. Interface value is integer between 0 (Note) and 31 with step size = 1 Corresponds to a real number.	P_red	N_red	Hreqave_red
U_RXQUAL_DL_P		RXQUAL threshold on the downlink for power reduction. Interface value is integer between 0 (Note) and 31 with step size = 1 Corresponds to a real number.	P_inc	N_inc	Hreqave_inc
NOTE: Setting a threshold parameter to 0.0 is a mechanism that disables power control assessment by use of that parameter.					

Table A.2: Network Operator Configurable Power Control Parameters (configurable by MES Classmark, Traffic Channel Mode, and Connection Type) "Min/Max/Initial Power Parameters"

Parameter Name	Description
MS_TXPWR_MAX	Maximum TX power that a MS may use in the serving spotbeam Interface value an integer in range specified in GMR-2 05.005 [8], clause 6. Real number (dBm): range specified in GMR-2 05.005 [8], clause 6.
MS_TXPWR_INIT	Initial commanded power level that MS will use at beginning of transmission on a S-TCH Interface value an integer in range specified in GMR-2 05.005 [8], clause 6. Real number (dBm): range specified in GMR-2 05.005 [8], clause 6.
MS_TXPWR_MIN	Establishes Minimum MS Tx Power on return link when MS_TXPWR_MIN_FLAG = 1 Interface value an integer in range specified in GMR-2 05.005 [8], clause 6. Real number (dBm): range specified in GMR-2 05.005 [8], clause 6.
BS_TXPWR_MAX	Maximum TX power used in the forward direction in the serving spotbeam Interface value an integer in range specified in GMR-2 05.005 [8], clause 6. Real number (dBm): range specified in GMR-2 05.005 [8], clause 6.
BS_TXPWR_INIT	Initial power level that Gateway will use at beginning of transmission on a S-TCH Interface value an integer in range specified in GMR-2 05.005 [8], clause 6. Real number (dBm): range specified in GMR-2 05.005 [8], clause 6.
BS_TXPWR_MIN	Establishes Minimum Gateway Tx Power on forward link when BS_TXPWR_MIN_FLAG=1 Interface value an integer in range specified in GMR-2 05.005 [8], clause 6. Real number (dBm): range specified in GMR-2 05.005 [8], clause 6.

Table A.3: Network Operator Configurable Power Control Parameters (Configured at a Network Level) "Algorithm Decision Window Parameters"

Parameter Name	Description
Hreqave_inc and Hreqave_red	RXLEV, RXQUAL and RXCNI averaging periods defined in terms of number of S-SACCH cycles. Hreqave_inc is used for power increase assessments and Hreqave_red is used for power reduction assessment. (Hreqave is the number of S-SACCH cycle measurements which are averaged together to form a single upper or lower threshold comparison algorithm sample). Range (1, 32); step size 1 (Note: Hreqt_xxx is the total number of S-SACCH cycle measurements used to form samples in the power control decision window and Hreqt_xxx = P_xxx / Hreqave_xxx)
P_inc and P_red	The number of algorithm samples used in the algorithm decision window for the threshold comparison process. Range (1, 32); step size 1. (Note: for either power increase or reduction assessment, Hreqt_xxx is the total number of S-SACCH cycle measurements used to form samples in the power control decision window and Hreqt_xxx = P_xxx / Hreqave_xxx)
N_inc, N_red	The number of algorithm samples, in an algorithm decision window, required to break threshold in order for a power change to be requested. Range (0, 32); step size 1.

Table A.4: Operator Configurable Power Control Parameters (Configured at Network Level) "Power Change Parameters"

Parameter Name	Description
P_Con_INTERVAL_inc	Minimum interval between increases in the RF power level. Range (1,30 s); units of S-SACCH cycles Step Size = 1
P_Con_INTERVAL_red	Minimum interval between reductions in the RF power level. Range (1,30 s); units of S-SACCH cycles Step Size = 1
Power_inc_FLAG	Flag indicating how power increases will be determined (0 = Fixed Step size, 1= Dynamic determination based upon algorithm predicted need)
Power_red_FLAG	Flag indicating how power reductions will be determined (0 = Fixed Step size, 1= Dynamic determination based upon algorithm predicted need)
Power_Inc_Step_Size	Fixed Power increase (dBm) step size used when Power_inc_FLAG = 0 Interface value is an integer in range of 0 to 12 representing a number of +0.5 dB steps Real number Range: 0,5 to 6,0, step size = 0,5) (also used as default step size when Power_inc_FLAG = 1 and Dynamic Increase assessment fails)
Power_Red_Step_Size	Fixed Power reduction (dBm) step size used when Power_red_FLAG = 0 Interface value is an integer in range of 0 to 12 representing a number of -0,5 dB steps Real number Range: -0,5 to -6,0, step size = 0,5 dB) (also used as default step size when Power_red_FLAG = 1 and Dynamic Reduction assessment fails)
Power_inc_frac	The fraction of the estimated power increase delta that will be used as the requested power increase (used when determining Power_inc_Step_Size when Power_inc_FLAG = 1) Interface value is an integer in range of 0 to 10, step size = 1, representing an integer number of 10 % increments Real number Range = 0,0 to 1,0 step size = 0,1
Power_red_frac	The fraction of the estimated power increase delta that will be used as the requested power reduction (used when determining Power_red_Step_Size when Power_red_FLAG = 1) Interface value is an integer in range of 0 to 10, step size = 1, representing an integer number of 10 % increments Real number Range = 0,0 to 1,0 step size = 0,1
MAX_LOST_UL_S-SACCH	Maximum number of consecutive lost Return link S-SACCH messages before resetting BS_TXPWR to BS_TXPWR_MAX (Range = 1 to 10 step size = 1)

History

Document history		
V1.1.1	March 2001	Publication