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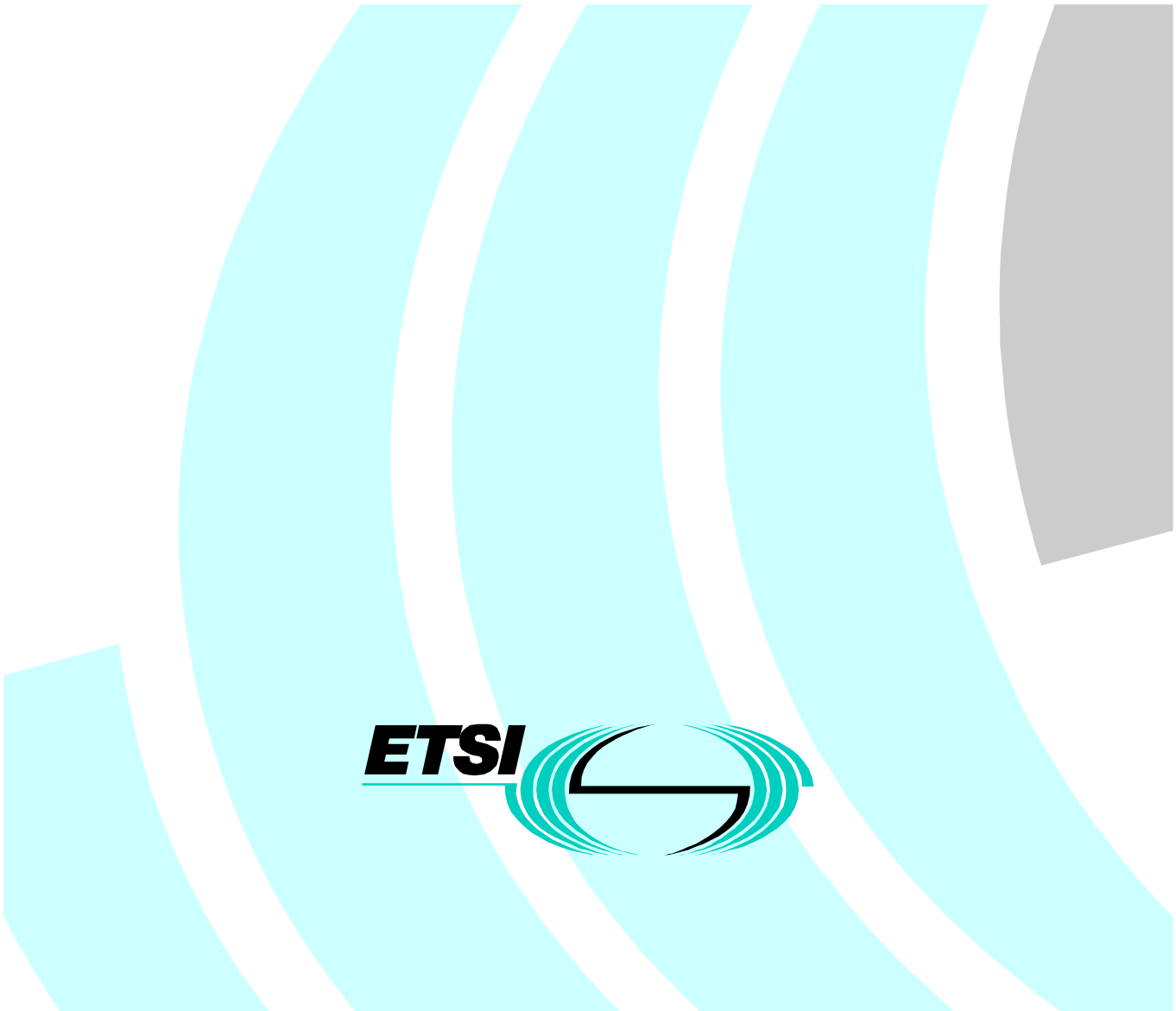
Technical Specification

GEO-Mobile Radio Interface Specifications;
Part 4: Radio interface protocol specifications;
Sub-part 13: Technical Realization of the Early Flag Technique;
GMR-2 04.201



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Contents

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IPRs:

Project	Company	Title	Country of Origin	Patent n°	Countries Applicable
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

IPR Owner: Ericsson Mobile Communications (UK) Limited
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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).

The contents of the present document are subject to continuing work within TC-SES and may change following formal TC-SES approval. Should TC-SES modify the contents of the present document it will then be republished by ETSI with an identifying change of release date and an increase in version number as follows:

Version 1.m.n

where:

- 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 4, sub-part 13 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";

Sub-part 1: "GMR-2 Mobile Earth Station-Network Interface; General Aspects and Principles; GMR-2 04.001";

Sub-part 2: "GMR-2 Mobile Earth Station-Network Interface; Channel Structures and Access capabilities; GMR-2 04.003";

Sub-part 3: "Layer 1 General requirements; GMR-2 04.004";

Sub-part 4: "Data Link Layer General Aspects; GMR-2 04.005";

Sub-part 5: "GMR-2 Mobile Earth Station - Network Interface; Data Link (DL) layer Specifications; GMR-2 04.006";

Sub-part 6: "Mobile Radio Interface Signalling Layer 3; General Aspects; GMR-2 04.007";

Sub-part 7: "Mobile radio interface Layer 3 Specifications; GMR-2 04.008";

Sub-part 8: "Point-to-Point Short Message Services; GMR-2 04.011";

Sub-part 9: "Performance requirements on the mobile radio interface; GMR-2 04.013";

Sub-part 10: "Rate Adaptation on the Mobile Earth Station (MES) - Gateway System Interface; GMR-2 04.021";

Sub-part 11: "Call Waiting (CW) and Call Holding (HOLD) Supplementary Services; GMR-2 04.083";

Sub-part 12: "Multiparty Supplementary Services (MPTY); GMR-2 04.084";

Sub-part 13: "Technical Realisation of the Early Flag Technique; GMR-2 04.201";

Sub-part 14: "Call Barring Supplementary Services; GMR-2 02.088";

Part 5: "Radio interface physical layer specifications";

Part 6: "Speech coding specifications".

Introduction

GMR stands for GEO (Geostationary Earth Orbit) Mobile Radio interface, which is used for mobile satellite services (MSS) utilising 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 describes the so-called "Early Flag Technique (EFT)", which could be implemented in the Fax Adaptor, and built as a unit separate to a Group 3 Fax machine or as an integral part of a GMR-2 specific Fax machine. The use of the Early Flags technique is meant to improve the performance of GMR-2 Fax communication service. This document is to be used in conjunction with GMR-2 03.045 [2], which describes the overall system level aspects of ITU Group 3 Fax communication over the GMR-2 channel.

The EFT is a "delay mitigating" technique for the provision of Real-Time Facsimile Service over a low bit rate digital satellite channel. The present document addresses the usage and implementation of the EFT. The EFT applies to the Mobile Earth Station (MES) and is implemented either as an add-on to the existing group 3 Facsimile machine or as an integral part of a GMR-2 specific Facsimile machine.

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, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, subsequent revisions do apply.

[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 03.045 (ETSI TS 101 377-3-12): "GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 12: Technical realization of Facsimile Group 3 Transparent (GMR-2 03.045)".

[3] ITU-T Recommendation T.4: "Standardization of Group 3 facsimile terminals for document transmission", Fascicle VII.3, 1988.

[4] ITU-T Recommendation T.30: "Procedures for document facsimile transmission in the general switched telephone network", Fascicle VII.3, 1988.

[5] ITU-T Recommendation V.21: "300 bits per second duplex modem standardized for use in the general switched telephone network", Fascicle VIII.1, 1988.

[6] ITU-T Recommendation V.27ter: "2400 bits per second duplex modem using the echo cancellation technique standardized for use on the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits", Fascicle VIII.1, 1988.

3 Abbreviations

Abbreviations used in the present document are listed in GMR-2 01.004 [1].

4 Group 3 facsimile service recommendations

This clause provides an overview of the ITU group 3 facsimile service recommendations.

4.1 Overview of ITU-T Group 3 Facsimile

There are five separate and consecutive phases of a Facsimile Call:

Phase A: Call Establishment:

This phase consists of the dialing, connection to the telephone line by both FTEs. This phase ends when both the calling and called FTEs have been switched to the telephone line;

Phase B: Pre-message Procedure:

This phase consists of two parts: the Identification clause and the Command clause:

1) The Identification clause is the initial sequence of this phase. During this clause, the called FTE sends information about itself and its capabilities to the calling FTE. This information consists of signaling messages known as group identification, subscriber identification (optional), and non-standard facilities (optional). During this clause, the called FTE also sends a confirmation of reception message indicating that it is ready to proceed to the next phase;

2) The Command clause is in response to the Identification clause, and where the calling FTE sends its group identification, phasing/training, synchronization, as well as the optional commands of non-standard facilities, subscriber identification, polling (send) command (for reverse faxes), line conditioning, and echo suppressor disabling;

Phase C: Message Transmission:

This phase consists of two parts, referred to as In-message procedure, and Message Transmission:

1) The in-message procedure takes place at the same time as the message transmission, and controls the complete in-message synchronization, error detection and correction, and line supervision;

2) The message transmission part is the transmission of the actual facsimile information, i.e., the page data;

Phase D: Post Message Procedure:

The post-message procedure includes the exchange of End-of-Message signalling, Confirmation signalling, Multipage signalling, and End-of-Facsimile signalling;

Phase E: Call Release:

This phase consists of the release of the telephone connection between the called and calling FTEs. As can be seen from the description of the phases, the actual facsimile call consists of Phases B, C, and D. Phases A and E deal with the physical connection of the FTEs.

4.2 Binary Coded Signalling

The interchange of information and control signals between the two fax machines verifies compatibility and assures proper operation. For group 3 facsimile service, the signals are realized using Binary Coded signalling utilising an HDLC frame for the binary coded signals. All binary coded signals are transmitted at 300 bps in accordance with ITU-T Recommendation V.21 [5]. A preamble consisting of HDLC flags must precede all of the binary coded signals. The preamble sequence lasts for a period of 1 second ±15%. Once the transmitting and receiving FTEs have been identified, the signal exchange consists of commands issued by the transmitting FTE and responses issued from the receiving FTE. A time out, referred to in this specification as the TCR timer, is utilized to detect the loss of command/response synchronization. The TCR timer is nominally 3 seconds. When it expires, the transmitting FTE retransmits the last command sent to the other FTE. The facsimile call transitions from Phase B into Phase C when the receiving FTE issues a Confirmation to Receive (CFR) signal to the transmitting FTE. Upon entering Phase C, the receiving FTE expects the message data consisting of ITU-T Recommendation V.27ter [6]/V.29/V.33/V.17 modulation after a 75 ms ±20 ms period of silence. The message data is encoded in accordance with ITU-T Recommendation T.4 [3]. In the current GMR-2 System, the message data is transmitted at 2,4 kbps. The transition from Phase C to Phase D occurs when a special T.4 frame (RTC/RCP) is sent by the receiving FTE. At this point, the receiving FTE expects binary coded signalling messages on the 300 bps signalling channel.

Phase D consists of the exchange of the post-message binary coded signalling commands and responses. The call may transition from phase D back to phase B, C (additional page data or retransmissions), or to Phase E (Call termination). The transition jump depends on which binary coded signalling message are exchanged between the two FTEs. When the post-message signal is a Disconnect, then the call transitions to Phase E. Otherwise, upon receipt of the Message Confirmation signal, the transition is back to Phase C (normally) or to Phase B, when retraining has been requested.

5 Early Flag Technique

This clause provides a functional description of the use of the EFT.

5.1 Command/Response time-outs

The most common difficulty in facsimile transmission over satellite channels is meeting the command/response TCR timer (as defined in clause 5.4.2 of IUT-3/93) requirement. Due to the long transmission delays to/from the satellite, baseband processing at the MES and Gateway Earth Station, and the wide range of delays across the terrestrial connection, the total system delay often exceeds the command/response timer. While the binary coded signalling preamble is specified as lasting 1 second ±15%, most FTEs accept the binary coded response signal having a preamble as long as 2,5 to 3,0 seconds.

This flexibility in the preamble duration is what gives rise to the EFT. Instead of allowing TCR to expire at the FTE, the Terminal Adaptation Function (TAF) begins "early" transmission of the HDLC preamble (i.e., HDLC flag sequence) prior to the reception of an actual command or response indication from the remote IWF. The time period to wait prior to sending the early preamble sequence depends on the overall maximum system delay and the realization that the total preamble duration will consist of the "spoofed" preamble duration plus the actual preamble duration sent by the FTE. It is important to ensure that the total preamble period seen by the FTE does not exceed the maximum preamble duration that it can tolerate. The most common cut-off observed in practice is around 2,6 seconds, which will be used in this specification.

5.2 System Delay

5.2.1 Mobile-to-PSTN Connections

According to the GMR-2 system delay budget, a conservative estimate of the mobile-to-PSTN round trip delay is 2 240 ms, which includes a generous 500 ms command-response turn-around time for the Facsimile machine, and a typical PSTN local loop delay of 60 ms. The T.30 timers, which are sensitive to this propagation delay, are 3 seconds ±15%, i.e., from 2 550 ms to 3 450 ms. At the worst situation of 2 550 ms, the GMR-2 system allows for a 310 ms extra propagation time. This extra time will be necessary and useful for PSTN Facsimile machines that are not in the PSTN local loop.

5.2.2 Mobile-to-Mobile Connections

According to the GMR-2 system delay budget, a conservative estimate of the mobile to mobile delay is 3 860 ms. This is the total system delay as the FTEs are directly connected to the MESs. Given this delay, the TCR timer on the FTEs will expire, causing them to retransmit their previous command. Since the ITU T Recommendation T.30 [4] protocol is half duplex, the FTEs will ignore the response coming from the remote FTEs. The purpose of the EFT is to avoid this type of command/response race conditions.

6 EFT specific details

This clause gives specific details of the EFT.

6.1 EFT for Mobile-to-Mobile Connections

The Facsimile TAFs of the respective MESs shall each keep two early flag timers, referred to as TEF-1, TEF-2. Essentially, the first timer TEF-1 defines the start of the Early Flag transmission and TEF-2 defines the end of the Early Flag transmission. The EFT procedure is now described.

a) The TEF-1 and TEF-2 timers shall have the values of 2 500 ±50 and 4 950 ±50 ms respectively at each MES TAF/FA

b) The TEF-1 and TEF-2 timers shall be started after the TAF/FA has completely received the ITU-T Recommendation T.30 [4] binary coded signalling message from the local FTE that requires a valid response from the remote FTE. These messages are defined in table 6.3.1;

c) The TEF-1 and TEF-2 timers shall be reset and early flags shall not be sent upon reception of the expected response (i.e., message preamble) from the remote TAF/FA over the satellite. In this case, the EFT shall have no effect of the existing facsimile call processing normally supported by the respective TAF/FAs; In other words, the TAF/FA shall 'transparently' transmit the received response to the local FTE for standard T.30 processing;

d) When the TEF-1 timer expires and the expected response (i.e., message preamble) from the remote MES/FTE has not been received, the MES TAF/FA shall begin transmission of ITU-T Recommendation T.30 [4] flag sequences to the local MES/FTE. Additionally, the MES shall continue to wait for the expected response from the Remote MES's TAF/FA.

e) If the response (i.e., message preamble) from the remote MES/FTE is received after the TEF-1 timer expired (and early flags are being transmitted to the local MES/FTE) and before the TEF-2 timer expires, the received response shall be appended to the early flags and transmitted to the local MES/FTE. This condition represents the case where the early flag method has avoided a possible timeout condition.

f) When the TEF-2 timer expires and a response (i.e., message preamble) from the remote MES/FTE is still not received, the MES TAF/FA shall terminate the transmission of the early flag sequences and reset both TEF-1 and TEF-2 timers and a 'transparent' connection to the local MES/FTE is resumed. At this point, the connection is under the ITU-T Recommendation T.30 [4] protocol control.

At this point (end of item e above), according to ITU-T Recommendation T.30 [4] protocol, the local FTE is expected to attempt additional command transmissions, up to a maximum of 3 attempts. It is of course likely that the response to the first command is received after or even during the transmission of the next attempt. If the response arrives during the time when the second attempt is in progress, the received response must be buffered suitably and transmitted to the local MES/FTE after the (half-duplex) MES/FTE is in the receive mode again. On the other hand, if the response to the first attempt is received after the transmission of the second attempt, then the response can be 'transparently' conveyed to the local MES/FTE. However, it is suggested that care be taken in the TAF/FA to make intelligent association between several repeated commands and a received response. This will certainly be helpful, if not necessary, in the proper processing of T.30 protocol. The details are expected to be implementation dependent and hence are beyond the scope of this document.

6.2 Mobile-PSTN connections

In this case, the TAF/FA shall behave as described in clause 6.1.

6.3 Early Flag Technique ITU-T T.30 Messages

The table 6.3.1 lists all the ITU-T Recommendation T.30 [4] binary coded signalling messages and other ITU-T Recommendation T.30 [4] call states that require valid responses and are thus candidates for the EFT at the TAFs.

Table 6.3.1: Candidate Messages for EFT Handling

Message	Comment
Digital Identification Signal (DIS)	
Digital Transmit Command (DTC)	
Training Check (TCF)	This is not a binary coded signal but it is nonetheless retransmitted using the same EFT processing as for binary coded signals.
Failure to Train (FTT)	This is a response message which requires the transmission of the previous DCS/TCF messages.
Command Repeat (CRP)	
Disconnect (DCN)	
Multipage Signal (MPS)	
Retrain Positive (RTP)	
Retrain Negative (RTN)	
End of Message (EOM)	
End of Procedure (EOP)	
Continue to Correct (CTC)	Valid only for error correcting modes.
Partial Page Signal (PPS)	Valid only for error correcting modes.
End of Retransmission (EOR)	Valid only for error correcting modes.
Receive Ready (RR)	Valid only for error correcting modes.
Receive Not Ready (RNR)	Valid only for error correcting modes.

History

Document history		
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