SECTION 8

CIRCUIT-MODE SERVICES

8.1 AMS(R)S circuit-mode general requirements

Note.– The AMS(R)S circuit-mode service is a communications service between aircraft and ground facilities using satellite links as one of the connecting media. The AMS(R)S circuit-mode service provides a means to establish and maintain a non-shared switched circuit between aircraft and ground users on demand. The primary purpose of the circuit-mode service is to provide for safety voice communications. A switched circuit is held for the duration of the call unless automatically pre-empted in order to reassign resources for a higher priority call attempt. AMS(R)S switched circuits may be interconnected with one or more terrestrial communications facilities in tandem with the AMS(R)S subnetwork. These facilities may include safety circuit-switched networks or dedicated circuits.

8.1.1 **AMS(R)S circuit-mode services**. Circuit-mode AMS(R)S communications services shall be provided to Level 3 and 4 AESs and shall consist of distress, urgency, flight safety, and other messages related to meteorology and flight regularity.

Note.– Non-AMS(R)S circuit switched voice and data service for non-safety communications may be supported by AMS(R)S on a not-to-interfere basis provided that the provisions of Section 8.3.2 are complied with.

8.1.2 **Order of importance**. AMS(R)S services for ATS communications shall have precedence over non-AMS(R)S communications.

8.1.3 **Non-AMS(R)S communications**. Non-AMS(R)S communications shall not interfere with AMS(R)S communications.

8.2 Circuit-mode system architecture

AES circuit-mode services shall be able to specify a particular GES to be used in air-origination calls and shall not be restricted to its log-on GES. Conversely, a ground originated call arriving from the terrestrial network of any GES which has current log-on information of the AES shall be completed by that GES rather than the GES to which the AES is logged on.

8.2.1 **Circuit-mode link layer signalling interface**. The AES and GES circuit-mode service procedures shall use the AMS(R)S link layer to exchange signalling information. This information shall be conveyed in circuit-mode – link interface data units (CM-LIDU). As a link service user, the AMS(R)S circuit-mode procedures shall use the services of the link layer interface defined in Sections 5 and 6. Each CM-LIDU shall be comprised of specific link interface control information (LICI) parameters required by the link layer service. The CM-LIDUs and their relevant LICI parameters are defined in Table 8.2-1.

8.2.2 **Circuit-mode telephony interworking interface**

Note.– Guidance material on the circuit-mode telephony interworking interface is contained in the guidance attachments to these Standards.

8.2.2.1 The AES and GES circuit-mode service procedures shall interwork with external telephony networks through an interworking interface comprising a standardized set of interworking telephony events which conform to ITU CCITT Recommendations Q.601 to Q.608. The set of interworking telephony events used by the circuit-mode procedures, and the requirements for mapping parameters between the events and corresponding CM-LIDUs, shall be as defined in Tables 8.2-2 to 8.2-5.

Note.‑ Details of ITU CCITT Recommendations Q.601 to Q.608 are contained in CCITT Blue Book, Volume VI ‑ Fascicle VI.6.

Table 8.2-1. Circuit-mode – link interface data units

LIDU
1. Abbreviated access request - telephone
2. Call announcement
3. C channel assignment
4. Call information - service address
5. Call progress - call attempt result
6. Call progress - channel release
7. Call progress - data mode
8. Call progress - test
9. Call progress - connect
10. Telephony acknowledge

LICI parameters
Message type (all)
AES ID (all)
GES ID (all)
Q number (all)
Application reference number (all)
Source (1,2)
Service direction (1,2)
Service ID (1,2)
Network ID (1)
Circuit data rate (1,2)
Voice channel characteristics (1,2)
Called terminal (2)
Calling terminal (1,4)
Initial EIRP (3)
Receive channel frequency (3)
Transmit channel frequency (3)
Report type (5,6,7,8,9)
S (5,6)
Location (5,6)
Cause class (5,6)
Cause value (5,6)
Digit 0,1 (1)
Digit 2-9 (1,4)
Ack/nack (10)
Routing (5,6,10)
Message type of missing CM-LIDU (10)

Table 8.2-2. AES outgoing procedure – interworking telephony events

Event type	Event name	Parameter mapping requirements (Figure)	To/from interworking interface with aircraft network
FITE 18	Calling party category indicator – AMS(R)S call origination	E.1-1a,b	From
FITE 22	Clear forward	E.1-2	From
BITE 5	Address complete	E.1-3	To
BITE 12	Call unsuccessful – network congestion	E.1-4	To
BITE 14	Call unsuccessful – address incomplete	A.1-5	To
BITE 15	Call unsuccessful – unallocated number	E.1-6	To
BITE 16	Call unsuccessful – called party busy	E.1-7	To
BITE 17	Call unsuccessful – line out of service	E.1-8	To
BITE 20	Call unsuccessful – send error indication	E.1-9	To
BITE 22	Answer	E.1-10	To
BITE 25	Clear back	E.1-11	To

Table 8.2-3. AES incoming procedure – interworking telephony events

Event type	Event name	Parameter mapping requirements (Figure)	To/from interworking interface with aircraft network
FITE 18	Calling party category indicator – AMS(R)S call origination	E.2-1	To
FITE 22	Clear forward	E.2-2	To
BITE 12	Call unsuccessful – network congestion	E.2-3	From

BITE 16	Call unsuccessful – called party busy	E.2-4	From
BITE 17	Call unsuccessful – line out of service	E.2-5	From
BITE 22	Answer	E.2-6	From
BITE 25	Clear back	E.2-7	From

Table 8.2-4. GES outgoing procedure – interworking telephony events

Event type	Event name	Parameter mapping requirements (Figure)	To/from interworking interface with terrestrial network
FITE 18	Calling party category indicator – AMS(R)S call origination	E.3-1	From
FITE 22	Clear forward	E.3-2	From
BITE 5	Address complete	E.3-3	To
BITE 12	Call unsuccessful – network congestion	E.3-4	To
BITE 16	Call unsuccessful – called party busy	E.3-5	To
BITE 17	Call unsuccessful – line out of service	E.3-6	To
BITE 20	Call unsuccessful – send error indication	E.3-7	To
BITE 22	Answer	E.3-8	To
BITE 25	Clear back	E.3-9	To

Table 8.2-5. GES incoming procedure – interworking telephony events

Event type	Event name	Parameter mapping requirements (Figure)	To/from interworking interface with terrestrial network
FITE 18	Calling party category indicator – AMS(R)S call origination	E.4-1a	To
FITE 22	Clear forward	E.4-2	To
BITE 5	Address complete	E.4-3	From
BITE 12	Call unsuccessful - network congestion	E.4-4	From
BITE 14	Call unsuccessful - address incomplete	E.4-5	From
BITE 15	Call unsuccessful - unallocated number	E.4-6	From
BITE 16	Call unsuccessful - subscriber busy	E.4-7	From
BITE 17	Call unsuccessful - line out of service	E.4-8	From
BITE 20	Call unsuccessful - send error indication	E.4-9	From
BITE 22	Answer	E.4-10	From
BITE 25	Clear back	E.4-11	From
BITE 27	Sending finished - Set up speech condition	E.4-12	From
BITE 29	Release incoming side	E.4-13	From

8.2.3 **Other AES circuit-mode system interfaces**

8.2.3.1 **AES management interface**. The specific information exchanged between AES circuit-mode services and AES management shall be as defined in Section 9.

8.2.3.2 **AES voice codec external interface**. The AES external voice interface shall convey bi-directional voice information in a form compatible with aircraft-specific audio systems.

8.2.4 **Other GES circuit-mode system interfaces**

8.2.4.1 **GES management interface**. The specific information exchanged between GES circuit-mode services and GES management shall be as defined in Section 10.

8.2.4.2 **Voice codec external interface**. The GES external voice interface shall convey bi-directional voice information in a form compatible with terrestrial network audio channels.

8.3 AMS(R)S service requirements

8.3.1 **Connectivity**. The AMS(R)S service shall support the on-demand establishment of switched circuits between any aircraft within the service area of a GES and the terrestrial networks serving the GES. The AMS(R)S service shall allow a circuit switched transaction to be established between an aircraft and a terrestrial network via a GES other than the GES to which the aircraft is logged on.

8.3.2 **Priority and pre-emption**. AMS(R)S calls shall have priority over all non-AMS(R)S calls and shall be capable of pre-empting non-AMS(R)S calls if required to gain immediate access to the circuit-mode service. AMS(R)S calls shall be established and maintained in accordance with the priority levels defined in Table 8.3-1. An AMS(R)S call with a higher service priority than an AMS(R)S call in progress shall be able to pre-empt the lower service priority call if necessary to gain immediate access to circuit-mode service. All AMS(R)S call attempts crossing the interface between a GES and a terrestrial network shall be identified as to the associated priority category.

8.3.3 **Grade-of-service**. The GES shall have available sufficient C channel resources such that an air or ground-originated call attempt received at the GES shall experience a probability of blockage within the GES of no more than 0.01. Available GES C channel resources shall include all pre-emptable resources, (e.g. those in use by non-safety users).

Table 8.3-1. Circuit-mode priority

Priority	Service	Link layer Q No.	C channel Q No.	Description
1	AMS(R)S	15	15	Distress and urgency
2	AMS(R)S	12	12	Flight safety
3	AMS(R)S	10	10	Regularity and meteorological
4	AMSS	9	4	Public correspondence

8.4 AMS(R)S performance requirements

8.4.1　　　　Call processing delays

Note.– Guidance material on access delay performance requirements for the AMS(R)S subnetwork and how they impact planning of ATS terrestrial networks is contained in the guidance attachments to these Standards.

8.4.1.1 **Air-originations**

8.4.1.1.1　　　**GES signalling transit delay**. The maximum time delay for a GES to present a call origination event (FITE 18, see Table 8.2-5) to the terrestrial network interworking interface after the first arrival of all AES call information at the GES link layer shall be 1.0 second (95th percentile).

Note.– All AES call information is contained within the "abbreviated access request" CM-LIDU received via the R channel.

8.4.1.1.2　　　**GES C channel assignment delay**. The maximum time delay for a GES to enqueue a "C channel assignment" CM-LIDU for service by the P channel link layer after an "abbreviated access request" CM-LIDU has arrived at the GES link layer shall be 1.5 seconds (95th percentile).

8.4.1.1.3　　　**AES C channel assignment response delay**. The maximum time delay for an AES to begin transmitting a C channel carrier after a "C channel assignment" CM-LIDU has arrived at the AES link layer shall be 1.0 second (95th percentile).

8.4.1.2 **Ground-originations**

8.4.1.2.1　　　**GES C channel assignment delay**. The maximum time delay for a GES to enqueue a "C channel assignment" CM-LIDU for service by the P channel link layer after a call origination event (FITE 18, see Table 8.2-4) has arrived at the terrestrial network interworking interface shall be 1.5 seconds (95th percentile).

8.4.1.2.2　　　**AES C channel assignment response delay**. The maximum time delay for an AES to begin transmitting a C channel carrier after both a "call announcement" CM-LIDU and a "C channel assignment" CM-LIDU have arrived at the AES link layer shall be 1.0 second (95th percentile).

Note.- The AES procedures for ground-originated calls require an AES to await the successful receipt of both CM-LIDUs before C channel transmission can begin. These procedures include error-recovery logic to handle their potential receipt out of normal order.

8.4.2 **Transfer delay**. The total allowable transfer delay within the AMS(R)S subnetwork on a C channel operating at 21.0 kbits/s shall be no more than 0.485 second.

8.4.2.1 The maximum transfer delay component that can be attributed to the AES or GES shall be 0.080 second for each.

Note 1.- Fixed transfer delay components of 0.285 second and 0.040 second are allotted to RF propagation delay (worst case path geometry) and vocoder frame emission delay respectively. Allocating 0.040 second for vocoder frame emission delay provides for worst case synchronization where the first 0.020 second vocoder speech frame is delayed by an additional C channel interleaver block.

Note 2.- Total transfer delay for the AMS(R)S subnetwork is defined as the elapsed time commencing at the instant that speech is presented to the AES or GES and concluding at the instant that the speech enters the interconnecting network of the counterpart GES or AES. This delay includes vocoder processing time, physical layer delay, RF propagation delay, and any other delays within the AMS(R)S subnetwork.

8.4.3 **Misrouting**. The probability of misrouting caused by internal processing or signalling errors within the GES shall not exceed 1 in 10^6.

Note.- Misrouting can occur if the GES misinterprets (1) the network-ID or ground address digits contained in an "abbreviated access request - telephone" CM-LIDU (for air-originations) or (2) the AES-ID or terminal-ID contained in a FITE 18 received from the interworking interface with the terrestrial network (for ground-originations).

8.5 Circuit-mode voice encoding algorithm

8.5.1 All AES and GES implementations shall provide circuit-mode voice communications using the voice encoding/decoding algorithm defined in Appendix H. All such voice communications shall be conducted over a 21 kbits/s C channel as defined in Section 4.5.

8.6 AMS(R)S circuit-mode procedures

The AMS(R)S circuit-mode procedures comprise the following four functional areas:

a) For the AES circuit-mode services:

    i) AES outgoing logic procedure (for air-originations); and
    ii) AES incoming logic procedure (for ground-originations).

b) For the GES circuit-mode services:

    i) GES outgoing logic procedure (for ground-originations); and

ii)   GES incoming logic procedure (for air-originations).

8.6.1   AMS(R)S circuit-mode procedures

Note 1.‑ It is assumed that an AMS(R)S circuit-mode service procedure will encode or interpret the relevant parameters of any CM-LIDU being transmitted or received without specifically stating the exact code values in the procedures contained herein. Specific requirements for parameter encoding can be found in the interworking telephony events mapping requirements defined in Appendix E.

Note 2.‑ The term "C channel resources" includes all required C channel hardware and sufficient transmitter power to maintain a C channel.

8.6.1.1 AES circuit-mode logic

Note.‑ The requirements for mapping between interworking telephony events and CM-LIDUs by the AES outgoing and incoming procedures are defined in Appendix E Sections E.1 and E.2 respectively. Circuit-mode configuration parameters (e.g. those used in Section 8.6.1.1.1) are defined in Appendix F, Section F.1.)

8.6.1.1.1   **AES outgoing circuit-mode procedure**. Receipt of an "AMS(R)S call origination" event (FITE 18) at the interworking interface shall cause AES circuit-mode services to assign a unique application reference number to the call. AES circuit-mode services shall then do the following:

a)   If sufficient AES C channel resources are not available and the blockage is attributable to calls operating at a C channel priority equal to or greater than the current call attempt, AES circuit-mode services shall return a "call unsuccessful ‑ network congestion" event (BITE 12) to the interworking interface and terminate all activities for the call; or

b)   If sufficient C channel resources are available or if at least one of the calls causing the blockage is operating at a C channel priority less than the current call attempt, AES circuit-mode services shall do the following and then await a C channel assignment from GES circuit-mode services:

i)   If the call priority is distress/urgency, AES circuit-mode services shall forward to the link layer nA21 "abbreviated access request ‑ telephone" CM-LIDUs; or

ii)   If the call priority is flight safety, AES circuit-mode services shall forward to the link layer nA22 "abbreviated access request ‑ telephone" CM-LIDUs; or

iii)   If the call priority is regularity/meteorological, the AES circuit-mode services shall forward to the link layer nA23 "abbreviated access request ‑ telephone" CM-LIDUs.

8.6.1.1.1.1   AES circuit-mode services shall do the following while awaiting a response from GES circuit-mode services:

a)   If a response is not received from GES circuit-mode services within tA50 seconds after the transmission of the latest "abbreviated access request – telephony" CM-LIDU, the AES shall command the selection of an R channel frequency and then shall transmit the original quantity of CM-LIDUs; provided that the total number of retransmissions of the CM-LIDU series does not exceed four. If, tA50 seconds after the fourth retransmission of the CM-LIDU series, no response has been received, AES circuit-mode services shall return a "call unsuccessful – line out of service" event (BITE 17) to the interworking interface and terminate all activities for the call; or

b)   If a "clear forward" event (FITE 22) is received at the interworking interface, AES circuit-mode services shall forward to the link layer a "call progress – channel release" CM-LIDU via the R channel and terminate all activities for the call; or

c)   If the call attempt is to be pre-empted by a higher priority call, AES circuit-mode services shall forward a "clear back" event (BITE 25) to the interworking interface, forward to the link layer a "call progress – channel release" CM-LIDU via the R channel, and then terminate all activities for the call; or

d)   If any of the following responses are received, AES circuit-mode services shall do the following:

i)   If either a "call progress – call attempt result" CM-LIDU or a "call progress – channel release" CM-LIDU are received, AES circuit-mode services shall forward a "clear back" event (BITE 25) or an appropriate "call unsuccessful" event (BITEs 14, 15, 16, 17, or 20) to the interworking interface as determined by the cause location, cause class, and cause value parameters received in the CM-LIDU. AES circuit-mode services shall then terminate all activities for the call; or

ii)   If a "C channel assignment" CM-LIDU is received, AES circuit-mode services shall request AES management to allocate C channel resources and activate a C channel unit on the assigned frequency at the C channel Q number value as per Table 8.3-1.

Note.–   This is to say that the Q number of the C channel is inferred from the Q number used in the initial circuit-mode call signalling at the link layer.

AES circuit-mode services shall then forward to the link layer a "call information – service address" CM-LIDU every tA29 seconds indefinitely and interconnect the C channel audio interface with that of the calling terminal.

Note.–   The call information conveyed by the "call information – service address" CM-LIDU is redundant with that conveyed by the "abbreviated access request" CM-LIDU. This information is used

to maintain compatibility with the circuit continuity test procedure in use by those GESs which are providing AMSS services to non-AMS(R)S users; and it will not be submitted to digit analysis by a GES.

8.6.1.1.1.2   If no response is received from GES circuit-mode services within tA28 seconds after C channel unit activation, AES circuit-mode services shall forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band, return a "call unsuccessful – line out of service" event (BITE 17) to the interworking interface, and terminate all activities for the call. Otherwise, AES circuit-mode services shall do the following:

a)   If one or more "call progress – test" CM-LIDUs are received, AES circuit-mode services shall ignore them; or

b)   If one or more "call progress – channel release" CM-LIDUs are received, or if a "clear forward" event (FITE 22) is received at the interworking interface, then AES circuit-mode services shall forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band, return an appropriate telephony event (BITE 14, 15, 16, 17, 20, or 25) to the interworking interface, and terminate all activities for the call; or

c)   If a "call progress – connect" CM-LIDU is received, or if the CM-LIDU arrives preceded by either a "call progress – test" CM-LIDU or a "call progress – call attempt result" CM-LIDU which was previously received within tA28 seconds after C channel unit activation, AES circuit-mode services shall do the following:

i)   Ensure that the repetitive transmission of the "call information – service address" CM-LIDU has ceased; and

ii)   Forward an "answer" event (BITE 22) to the interworking interface and forward to the link layer a positive "telephony acknowledge" CM-LIDU via the C channel sub-band. If any additional "call progress – connect" CM-LIDUs are received subsequent to the initial "call progress – connect" CM-LIDU, AES circuit-mode services shall respond to each by forwarding to the link layer a positive "telephony acknowledge" CM-LIDU to GES circuit-mode services; or

Note.– At this point the end-to-end call is established.

d)   If a "call progress – call attempt result" CM-LIDU (encoded to indicate an "address complete" event) is received, or if it arrives preceded by a "call progress – test"

CM-LIDU which was previously received within tA28 seconds after C channel unit activation, AES circuit-mode services shall do the following:

   i)   Ensure that the repetitive transmission of the "call information – service address" CM-LIDU has ceased; and

   ii) Forward an "address complete" event (BITE 5) to the interworking interface and forward to the link layer a positive "telephony acknowledge" CM-LIDU via the C channel sub-band. If any additional "call progress – call attempt result" CM-LIDUs are received subsequent to the initial "call progress – call attempt result" CM-LIDU, AES circuit-mode services shall respond to each by forwarding to the link layer a positive "telephony acknowledge" CM-LIDU to GES circuit-mode services; or

   e)   If C channel resources are pre-empted for a higher priority call, AES circuit-mode services shall forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band, return a "clear back" event (BITE 25) to the interworking interface, and terminate all activities for the call; or

   f)   If the C channel sub-band link layer commands the call be terminated, AES circuit-mode services shall forward a "clear back" event (BITE 25) to the interworking interface and terminate all activities for the call.

8.6.1.1.2   **AES incoming circuit-mode procedure**. This procedure shall be defined by the following interrelated procedures:

   a)   AES incoming circuit-mode call initiation – Section 8.6.1.1.2.1;

   b)   AES incoming C channel continuity check – Section 8.6.1.1.2.2;

   c)   AES incoming aircraft completion – Section 8.6.1.1.2.3; and

   d)   AES incoming C channel maintenance – Section 8.6.1.1.2.4.

8.6.1.1.2.1   **AES incoming circuit-mode call initiation**. Upon receipt of either a "call announcement" or "C channel assignment" CM-LIDU with a unique application reference number, AES circuit-mode services shall do the following:

   a)   If a "C channel assignment" was received, AES circuit-mode services shall forward to the link layer a negative "telephony acknowledge" CM-LIDU (encoded to indicate that the "call announcement" CM-LIDU is missing) via the R channel and do the following:

        i)   If neither a related "call announcement" CM-LIDU or a "call progress – channel release" CM-LIDU are received within tA27 seconds of the transmission of the latest negative "telephony acknowledge" CM-LIDU, AES circuit-mode services shall forward to the link layer the negative "telephony acknowledge" CM-LIDU

via the R channel and await their arrival for an additional tA27 seconds; provided that the total number of repetitions of the "telephony acknowledge" CM-LIDU does not exceed four. If neither of the aforementioned CM-LIDUs are received within tA27 seconds after the fourth repetition of the "telephony acknowledge" CM-LIDU, AES circuit-mode services shall forward to the link layer a "call progress – call attempt result" CM-LIDU via the R channel and terminate all activities for the call; or

ii)   If a "call progress – channel release" CM-LIDU is received within tA27 seconds after the latest transmission of the "telephony acknowledge" CM-LIDU, AES circuit-mode services shall terminate all activities for the call; or

iii) If the call attempt is to be preempted for a higher priority call, AES circuit-mode services shall forward to the link layer a "call progress – call attempt result" CM-LIDU via the R channel and terminate all activities for the call; or

iv)   If the related "call announcement" CM-LIDU is received within tA27 seconds after the latest transmission of the "telephony acknowledge" CM-LIDU, AES circuit-mode services shall do the following:

  1)   If the called terminal is occupied with a call at a priority higher than or equal to the current call attempt, or if C channel resources are not available, AES circuit-mode services shall forward to the link layer a "call progress – call attempt result" CM-LIDU via the R channel and terminate all activities for the call; or

    2)   If the called terminal and C channel resources are both available, AES circuit-mode services shall request AES management to allocate C channel resources and activate a C channel unit on the assigned frequency at the C channel Q number value as per Table 8.3-1.

      Note.– This is to say that the Q number of the C channel shall be inferred from the Q number used in the initial circuit-mode call signalling at the link layer.

      AES circuit-mode services shall then forward to the link layer a "call progress – test" CM-LIDU and perform the AES incoming C channel continuity check procedure in 8.6.1.1.2.2; or

b)   If a "call announcement" CM-LIDU was received, AES circuit-mode services shall do the following:

i)   If a "call progress – channel release" CM-LIDU is received within tA25 seconds after receipt of the "call announcement" CM-LIDU, AES circuit-mode services shall terminate all activities for the call; or

ii)   If neither a "C channel assignment" CM-LIDU or a "call progress – channel release" CM-LIDU are received within tA25 seconds after receipt of the "call announcement" CM-LIDU, AES circuit-mode services shall forward to the link

layer a negative "telephony acknowledge" CM-LIDU (encoded to indicate that the "C channel assignment" CM-LIDU is missing) via the R channel and await their arrival for an additional tA27 seconds. If neither of the CM-LIDUs arrive after tA27 seconds, AES circuit-mode services shall again forward to the link layer the negative "telephony acknowledge" CM-LIDU and await an additional tA27 seconds; provided that the total number of repetitions of the negative "telephony acknowledge" CM-LIDU does not exceed four. If neither of the CM-LIDUs are received within tA27 seconds after the fourth repetition of the negative "telephony acknowledge" CM-LIDU, AES circuit-mode services shall forward to the link layer a "call progress – call attempt result" CM-LIDU via the R channel and terminate all activities for the call; or

iii)   If the call attempt is to be pre-empted for a higher priority call, AES circuit-mode services shall forward to the link layer a "call progress – call attempt result" CM-LIDU via the R channel and terminate all activities for the call; or

iv)   If a "C channel assignment" CM-LIDU is received within either tA25 seconds after receipt of the "call announcement" CM-LIDU or tA27 seconds after receipt of the transmission of the latest negative "telephony acknowledge" CM-LIDU, AES circuit-mode services shall do the following:

a) If the called terminal is occupied with a call at a priority higher than or equal to the current call attempt, or if C channel resources are not available, AES circuit-mode services shall forward to the link layer a "call progress – call attempt result" CM-LIDU via the R channel and terminate all activities for the call; or

b) If the called terminal and C channel resources are both available, AES circuit-mode services shall request AES management to allocate the resources at a C channel Q number value as per Table 8.3-1 and activate a C channel unit on the assigned frequency. AES circuit-mode services shall then forward to the link layer a "call progress – test" CM-LIDU and perform the AES incoming C channel continuity check procedure in 8.6.1.1.2.2.

8.6.1.1.2.2   **AES incoming channel continuity check**. Where required elsewhere in Section 8, AES circuit-mode services shall perform a C channel continuity check by doing the following:

a)   If neither a "call progress – test" CM-LIDU or a "call progress – channel release" CM-LIDU are received within tA26 seconds after the most recent "call progress – test" CM-LIDU has been forwarded, AES circuit-mode services shall forward to the link layer another "call progress – test" CM-LIDU until any of the following occur:

i)   If neither a "call progress – test" CM-LIDU or a "call progress – channel release" CM-LIDU are received within tA41 seconds after activation of the C channel unit, AES circuit-mode services shall stop forwarding "call progress – test" CM-LIDUs, shall then forward to the link layer a "call progress – call attempt result" CM-LIDU via the R channel and terminate all activities for the call; or

ii)   If a "call progress – channel release" CM-LIDU is received within tA41 seconds after activation of the C channel unit, AES circuit-mode services shall terminate all activities for the call; or

iii)   If the C channel is to be pre-empted for a higher priority call, AES circuit-mode services shall forward to the link layer a "call progress – call attempt result" CM-LIDU via the R channel and terminate all activities for the call; or

iv)   If a "call progress – test" CM-LIDU is received within tA41 seconds after C channel unit activation, AES circuit-mode services shall enable the circuit path between the C channel unit and the forward circuit of the aircraft network. AES circuit-mode services shall then forward to the link layer a positive "telephony acknowledge" CM-LIDU via the C channel sub-band, forward an "AMS(R)S call origination" event (FITE 18) to the interworking interface and await completion of the call to the called terminal as per the AES incoming aircraft completion procedure defined in 8.6.1.1.2.3.

8.6.1.1.2.3   **AES incoming aircraft completion**.   Where required elsewhere in Section 8, AES circuit-mode services shall do the following in order to complete a call across the aircraft network to the called terminal:

a)   If one or more "call progress – test" CM-LIDUs are received, AES circuit-mode services shall forward to the link layer a positive "telephony acknowledge" CM-LIDU via the C channel sub-band, or

b)   If an "answer" event (BITE 22) is not received from the interworking interface within tA42 seconds after forwarding the "AMS(R)S call origination" event (FITE 18), AES circuit-mode services shall forward a "clear forward" event (FITE 22) to the interworking interface, forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band and terminate all activities for the call; or

c)   If a "call progress – channel release" CM-LIDU is received within tA42 seconds after forwarding the "AMS(R)S call origination" event (FITE 18), or if the C channel is to be pre-empted for a higher priority call, then AES circuit-mode services shall forward a "clear forward" event (FITE 22) to the interworking interface, forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band and terminate all activities for the call; or

d)   If an "answer" event (BITE 22) is received from the interworking interface within tA42 seconds after forwarding the "AMS(R)S call origination" event (FITE 18), AES circuit-mode services shall forward to the link layer a "call progress – connect" CM-LIDU, and perform the AES incoming C channel maintenance procedure defined in 8.6.1.1.2.4.

8.6.1.1.2.4   **AES incoming C channel maintenance**. Where required elsewhere in Section 8, AES circuit-mode services shall allow the end-to-end connection to continue while doing the following to maintain a C channel:

a)   If, within tA26 seconds after transmission of the latest "call progress – connect" CM-LIDU, neither a positive "telephony acknowledge" CM-LIDU is received or a "clear back" event (BITE 25) is received from the interworking interface, AES circuit-mode services shall again forward to the link layer the "call progress – connect" CM-LIDU via the C channel sub-band; or

b)   If, within tA30 seconds after transmission of the first "call progress – connect" CM-LIDU, neither a positive "telephony acknowledge" CM-LIDU is received or a "clear back" event (BITE 25) is received from the interworking interface, AES circuit-mode services shall stop forwarding the "call progress – connect" CM-LIDU, forward a "clear forward" event (FITE 22) to the interworking interface, forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band and terminate all activities for the call; or

c)   If, within tA30 seconds after transmission of the first "call progress – connect" CM-LIDU, a "call progress – channel release" CM-LIDU is received, AES circuit-mode services shall stop forwarding the "call progress – connect" CM-LIDU, forward a "clear forward" event (FITE 22) to the interworking interface, forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band and terminate all activities for the call; or

d)   If the C channel is to be pre-empted for a higher priority call, AES circuit-mode services shall forward a "clear forward" event (FITE 22) to the interworking interface, forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band, and terminate all activities for the call; or

e)   If one or more positive "telephony acknowledge" CM-LIDUs are received, AES circuit-mode services shall stop forwarding the "call progress – connect" CM-LIDU and do the following while allowing the C channel to function: or

Note.– This is the location in the logic procedure at which the end-to-end voice channel is ready for use and the air and ground users can begin conversation.

i)   If a "clear back" event (BITE 25) is received from the interworking interface, AES circuit-mode services shall forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band and terminate all activities for the call; or

ii)   If a "call progress – channel release" CM-LIDU is received, AES circuit-mode services shall forward a "clear forward" event (FITE 22) to the interworking interface, forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band and terminate all activities for the call; or

iii) If the C channel is to be pre-empted for a higher priority call, AES circuit-mode services shall forward a "clear forward" event (FITE 22) to the interworking interface, forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band, and terminate all activities for the call.

Note.– The above logic transitions monitor for call clearing via either a normal call clearing action or an AES-initiated C channel pre-emption.

f) If the C channel sub-band link layer commands the call be terminated, AES circuit-mode services shall forward a "clear forward" event (FITE 22) to the interworking interface and terminate all activities for the call.

8.6.1.2 **GES circuit-mode logic**

Note.– The requirements for mapping between interworking telephony events and CM-LIDUs by the GES outgoing and incoming procedures are defined in Appendix E, Sections E.3 and E.4 respectively.

8.6.1.2.1   **GES outgoing circuit-mode procedure**. This procedure shall be defined by the following interrelated procedures:

a)   GES outgoing circuit-mode call initiation – Section 8.6.1.2.1.1;

b)   GES outgoing C channel establishment – Section 8.6.1.2.1.2;

c)   GES outgoing C channel continuity check – Section 8.6.1.2.1.3;

d)   GES outgoing C channel maintenance – Section 8.6.1.2.1.4; and

e)   GES outgoing C channel release guard – Section 8.6.1.2.1.5.

8.6.1.2.1.1   **GES outgoing circuit-mode call initiation**. Receipt of an "AMS(R)S call origination" event (FITE 18) at the interworking interface shall cause GES circuit-mode services to assign a unique application reference number to the call. If the AES is not logged on, GES circuit-mode services shall forward a "call unsuccessful – send error indication" event (BITE 20) to the interworking interface and terminate all activities for the call. Otherwise, GES circuit-mode services shall request GES management to assign C channel resources to the call at the C channel Q number value as per Table 8.3-1.

Note.– This is to say that the Q number of the C channel shall be inferred from the Q number used in the initial circuit-mode call signalling at the link layer.

GES circuit-mode services shall then do the following:

a)   If a "clear forward" event (FITE 22) is received at the interworking interface, GES circuit-mode services shall terminate all activities for the call; or

b)   If C channel resources are not available, GES circuit-mode services shall forward a "call unsuccessful – network congestion" event (BITE 12) to the interworking interface and terminate all activities for the call; or

c) If C channel resources are available, GES circuit-mode services shall forward to the link layer a "call announcement" CM-LIDU followed immediately by a "C channel assignment" CM-LIDU. GES circuit-mode services shall then request GES management to activate the previously assigned C channel unit on the assigned frequency and then establish the C channel as per 8.6.1.2.1.2.

8.6.1.2.1.2 **GES outgoing C channel establishment**. Where required elsewhere in Section 8, GES circuit-mode services shall do the following to establish a C channel for use in a ground-origination:

a) If, within tG16 seconds after the latest transmission of either the "call announcement" or "C channel assignment" CM-LIDUs, a negative "telephony acknowledge" CM-LIDU is received, GES circuit-mode services shall again forward to the link layer the missing CM-LIDU indicated in the received CM-LIDU and await an additional tG16 seconds; or

b) If nothing is received from AES circuit-mode services within tG16 seconds after the latest transmission of either the "call announcement" or "C channel assignment" CM-LIDU, GES circuit-mode services shall again forward to the link layer both of the CM-LIDUs and await an additional tG16 seconds. If, after the additional tG16 second period, nothing is received, GES circuit-mode services shall forward a "call unsuccessful – line out of service" event (BITE 17) to the interworking interface and forward to the link layer a "call progress – channel release" CM-LIDU via the P channel. If the from-aircraft carrier is not present, terminate all activities for the call. Otherwise, if the C channel from-aircraft carrier does not terminate within tG23 seconds after the first "call progress – channel release" CM-LIDU was forwarded, GES circuit-mode services shall again forward the CM-LIDU. If the from-aircraft carrier terminates during either tG23 second period, GES circuit-mode services shall terminate all activities for the call. If the from-aircraft carrier does not terminate by the expiry of the second tG23 second period, GES circuit-mode services shall terminate all activities for the call; or

i) **Recommendation**.– The status of an unterminated from-aircraft carrier should be posted to a monitoring function.

c)   If a "call progress – call attempt result" CM-LIDU is received, GES circuit-mode services shall forward an appropriate "call unsuccessful" event (BITES 12, 16, or 17) to the interworking interface.   Also, GES circuit-mode services shall await tG23 seconds for the C channel from-aircraft carrier to terminate.   If the from-aircraft carrier is not present, terminate all activities for the call.   Otherwise, if the from-aircraft carrier terminates by the end of the period, GES circuit-mode services shall terminate all activities for the call. If the from-aircraft carrier does not terminate within the same period GES circuit-mode services shall terminate all activities for the call at the end of the period; or

   i) **Recommendation**.– The status of an unterminated from-aircraft carrier should be posted to a monitoring function.

d)   If a "clear forward" event (FITE 22) is received at the interworking interface, GES circuit-mode services shall forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band followed by a "call progress – channel release" CM-LIDU via the P channel. GES circuit-mode services shall then perform the GES outgoing C channel release guard procedure defined in 8.6.1.2.1.5; or

e)   If a "call progress – test" CM-LIDU is received, GES circuit-mode services shall forward to the link layer a "call progress – test" CM-LIDU and then perform the GES outgoing C channel continuity check procedure defined in 8.6.1.2.1.3.

8.6.1.2.1.3   **GES outgoing C channel continuity check**. When checking the circuit continuity of a C channel which is to be used for a ground-origination, GES circuit-mode services shall do the following:

a)   If tG34 seconds have elapsed from the time that the first "call progress – test" CM-LIDU was sent to AES circuit-mode services, GES circuit-mode services shall forward a "call unsuccessful – line out of service" event (BITE 17) to the interworking interface and forward to the link layer a "call progress – channel release" CM-LIDU via the P channel. If the from-aircraft carrier is not present, terminate all activities for the call. Otherwise, if the C channel from-aircraft carrier does not terminate within tG23 seconds after the first transmission of the "call progress – channel release" CM-LIDU, GES circuit-mode services shall again forward the CM-LIDU via the P channel and await an additional tG23 seconds. If the from-aircraft carrier terminates during either period, GES circuit-mode services shall terminate all activities for the call. If the from-aircraft carrier does not terminate by expiry of the second period, GES circuit-mode services shall terminate all activities for the call at the end of the period; or

   i) **Recommendation**.– The status of an unterminated from-aircraft carrier should be posted to a monitoring function.

b)   If tG34 seconds have not elapsed since the time that the first "call progress – test" CM-LIDU was sent to AES circuit-mode services, GES circuit-mode services shall do

the following while simultaneously forwarding to the link layer a "call progress – test" CM-LIDU to AES circuit-mode services every tG35 seconds:

i)   If a "call progress – call attempt result" CM-LIDU is received, GES circuit-mode services shall stop forwarding "call progress – test" CM-LIDUs to AES circuit-mode services. GES circuit-mode services shall then forward an appropriate "call unsuccessful" event (BITEs 12, 16, or 17) to the interworking interface and await tG23 seconds for the C channel from-aircraft carrier to terminate. If the from-aircraft carrier is not present, terminate all activities for the call. Otherwise, if the from-aircraft carrier terminates by the end of the period, GES circuit-mode services shall terminate all activities for the call. If the from-aircraft carrier does not terminate by the expiry of this period, GES circuit-mode services shall terminate all activities for the call at the end of the period; or

   1) **Recommendation**.– The status of an unterminated from-aircraft carrier should be posted to a monitoring function.

ii) If a "clear forward" event (FITE 22) is received at the interworking interface, GES circuit-mode services shall forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band, stop forwarding "call progress – test" CM-LIDUs and then perform the GES outgoing C channel release guard procedure defined in 8.6.1.2.1.5; or

iii) If a "call progress – channel release" CM-LIDU is received from AES circuit-mode services, GES circuit-mode services shall forward a "clear back" event (BITE 25) to the interworking interface and stop forwarding "call progress – test" CM-LIDUs. GES circuit-mode services shall then await tG23 seconds for the C channel from-aircraft carrier to terminate. If the from-aircraft carrier is not present, terminate all activities for the call. Otherwise, if the from-aircraft carrier terminates during the period, GES circuit-mode services shall terminate all activities for the call. If the from-aircraft carrier does not terminate within this period GES circuit-mode services shall terminate all activities for the call at the end of the period; or

   1) **Recommendation**.– The status of an unterminated from-aircraft carrier should be posted to a monitoring function.

iv) If a positive "telephony acknowledge" CM-LIDU is received, GES circuit-mode services shall stop forwarding "call progress – test" CM-LIDUs. GES circuit-mode services shall then forward an "address complete" event (BITE 5) to the interworking interface and perform the GES outgoing C channel maintenance procedure defined in 8.6.1.2.1.4; or

v) If a "call progress – connect" CM-CIDU is received, GES circuit-mode services shall stop forwarding "call progress – test" CM-LIDUs. GES circuit-mode services shall then forward an "address complete" event (BITE 5) and an "answer" event

(BITE 22) to the interworking interface, forward to the link layer a positive "telephony acknowledge" CM-LIDU via the C channel sub-band, and perform the GES outgoing C channel maintenance procedure defined in 8.6.1.2.1.4.

8.6.1.2.1.4   **GES outgoing C channel maintenance**. Where required elsewhere in Section 8, GES circuit-mode services shall enable the circuit path between the forward circuit of the terrestrial network and the C channel unit, and then do the following to maintain the C channel:

a)   If a "call progress – connect" CM-LIDU is received, GES circuit-mode services shall forward to the link layer a positive "telephony acknowledge" CM-LIDU via the C channel sub-band. If an identical CM-LIDU was not received previously during the GES outgoing C channel establishment procedure defined in 8.6.1.2.1.3, GES circuit-mode services shall also forward an "answer" event (BITE 22) to the interworking interface; or

b)   If a "clear forward" event is received at the interworking interface, GES circuit-mode services shall forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band. GES circuit-mode services shall then perform the GES outgoing C channel release guard procedure defined in 8.6.1.2.1.5; or

c)   If the C channel from-aircraft carrier drops for more than tG19 seconds, GES circuit-mode services shall forward a "clear back" event (BITE 25) to the interworking interface. GES circuit-mode services shall then forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band and perform the GES outgoing C channel release guard procedure defined in 8.6.1.2.1.5; or

d)   If the C channel is to be pre-empted for a higher priority call, GES circuit-mode services shall forward a "clear back" event (BITE 25) to the interworking interface. GES circuit-mode services shall then forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band and perform the GES outgoing C channel release guard procedure defined in 8.6.1.2.1.5; or

e)   If a "call progress – channel release" CM-LIDU is received, GES circuit-mode services shall forward a "clear back" event (BITE 25) to the interworking interface and terminate all activities for the call.

8.6.1.2.1.5   **GES outgoing C channel release guard**. When releasing a C channel which is in use for a ground-origination, GES circuit-mode services shall do the following when required elsewhere in Section 8:

a)   If the C channel from-aircraft carrier terminates within tG17 seconds after the last of the six "call progress – channel release" CM-LIDUs has been forwarded, GES circuit-mode services shall terminate all activities for the call; or

b)   If the C channel from-aircraft carrier does not terminate within tG17 seconds after the last of the six "call progress – channel release" CM-LIDUs has been forwarded, GES circuit-mode services shall forward to the link layer twelve "call progress – channel release" CM-LIDUs via the C channel sub-band and one "call progress – channel release" CM-LIDU via the P channel. If the from-aircraft carrier is not present,

terminate all activities for the call. Otherwise, if the C channel from-aircraft carrier terminates within tG18 seconds after the transmission of the "call progress – channel release" CM-LIDU via the P channel, GES circuit-mode services shall terminate all activities for the call. If the C channel from-aircraft carrier does not terminate within the same tG18 second period, GES circuit-mode services shall terminate all activities for the call at the end of the period; or

    i) **Recommendation**.-   The status of an unterminated from-aircraft carrier should be posted to a monitoring function.

c)   If a "call progress – channel release" CM-LIDU is received, GES circuit-mode services shall await the termination of the C channel from-aircraft carrier. If the from-aircraft carrier is not present, terminate all activities for the call. Otherwise, if the C channel from-aircraft carrier terminates within tG18 seconds after receipt of the "call progress – channel release" CM-LIDU, GES circuit-mode services shall terminate all activities for the call. If the C channel from-aircraft carrier does not terminate within this same period, GES circuit-mode services shall terminate all activities for the call at the end of the period.

    i) **Recommendation**.-   The status of an unterminated from-aircraft carrier should be posted to a monitoring function.

8.6.1.2.2   **GES incoming circuit-mode procedure**. This procedure shall be defined by the following interrelated procedures:

a)   GES incoming circuit-mode call initiation – Section 8.6.1.2.2.1;
b)   GES incoming bi-directional setup – Section 8.6.1.2.2.2;
c)   GES incoming C channel establishment – Section 8.6.1.2.2.3;
d)   GES incoming terrestrial completion – Section 8.6.1.2.2.4;
e)   GES incoming C channel maintenance – Section 8.6.1.2.2.5; and
f)   GES incoming C channel release guard – Section 8.6.1.2.2.6.

8.6.1.2.2.1   **GES incoming circuit-mode call initiation**. Upon receipt from an AES of an "abbreviated access request – telephone" CM-LIDU with a unique application reference number, GES circuit-mode services shall request GES management to assign C channel resources at the C channel Q number value as per Table 8.3-1.

Note.– This is to say that the Q number of the C channel shall be inferred from the Q number used in the initial circuit-mode call signalling at the link layer.

GES circuit-mode services shall then do the following:

a)   If a "call progress – channel release" CM-LIDU is received prior to GES management assigning C channel resources, GES circuit-mode services shall terminate all activities for the call; or

b)   If C channel resources are not available, then GES circuit-mode services shall forward to the link layer a "call progress – call attempt result" CM-LIDU via the P channel.

GES circuit-mode services shall then await tG9 seconds for the potential receipt of a repetition of the original "abbreviated access request – telephone" CM-LIDU at the current application reference number. If such an additional CM-LIDU is received from AES circuit-mode services, GES circuit-mode services shall again forward the "call progress – call attempt result" CM-LIDU. Otherwise, GES circuit-mode services shall terminate all activities for the call after expiry of the initial tG9 second period.

Otherwise, GES circuit-mode services shall forward to the link layer a "C channel assignment" CM-LIDU. Simultaneously, GES circuit-mode services shall request GES management to activate the previously assigned C channel unit. Any redundant "Abbreviated Access Request-Telephone" CM-LIDUs (with an identical application reference number) received prior to C channel unit activation shall be ignored. GES circuit-mode services shall then perform the GES incoming bi-directional setup procedure defined in 8.6.1.2.2.2.

Note.– Redundant "abbreviated access request – telephone" CM-LIDUs might be received, prior to C channel unit activation, as a result of the series transmission of several such CM-LIDUs by the AES. The redundant CM-LIDUs can be ignored without effect.

8.6.1.2.2.2 **GES incoming bi-directional setup**. Where required elsewhere in Section 8, GES circuit-mode services shall perform routing analysis of the network-ID specified in the "abbreviated access request — telephone" CM-LIDU while simultaneously performing the following:

Note 1.– Routing analysis is considered to be a GES-specific procedure wherein the network-ID parameter is used to identify the specific group of voice circuits which interconnect the GES with the desired terrestrial circuit-switched voice network.

Note 2.– The logic in this subsection initiates terrestrial call completion while initiating simultaneously the establishment of the C channel.

a) If an additional "abbreviated access request – telephone" CM-LIDU at the current application reference number is received from AES circuit-mode services within tG11 seconds after the latest "C channel assignment" CM-LIDU has been forwarded to the link layer, GES circuit-mode services shall again forward the "C channel assignment" CM-LIDU to AES circuit-mode services; or

b) If a "call information – service address" CM-LIDU is not received within tG11 seconds after the latest "C channel assignment" CM-LIDU has been forwarded to the link layer, GES circuit-mode services shall perform the GES incoming release guard procedure defined in 8.6.1.2.2.6; or

c) If a "call progress – channel release" CM-LIDU is received, GES circuit-mode services shall await the termination of the C channel from-aircraft carrier. If the from-aircraft carrier is not present, terminate all activities for the call. Otherwise, if the C channel from-aircraft carrier terminates within tG24 seconds after receipt of the "call progress – channel release" CM-LIDU, GES circuit-mode services shall terminate all activities for the call. If the carrier does not terminate within the same

tG24 second period, GES circuit-mode services shall terminate all activities for the call at the end of the period; or

    i) **Recommendation**.– The status of an unterminated from-aircraft carrier should be posted to a monitoring function.

d) If a "call information – service address" CM-LIDU is received within tG11 seconds after C channel unit activation, GES circuit-mode services shall send "call progress – test" CM-LIDUs every tG10 seconds indefinitely; or

e) If routing analysis indicates that completion of the call is blocked due to congestion in either the GES switching equipment or the forward circuit group leading to the terrestrial network, GES circuit-mode services shall stop forwarding "call progress – test" CM-LIDUs and then forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band. GES circuit-mode services shall then perform the GES incoming release guard procedure defined in Section 8.6.1.2.2.6; or

f) If routing analysis is successful in obtaining a forward circuit to the terrestrial network, GES circuit-mode services shall forward an "AMS(R)S call origination" event (FITE 18) to the interworking interface with the terrestrial network. If a "call information – service address" CM-LIDU has already been received, GES circuit-mode services shall then perform the GES incoming terrestrial completion procedure defined in 8.6.1.2.2.4; otherwise GES circuit-mode services shall await establishment of the C channel by performing the GES incoming C channel establishment procedure defined in 8.6.1.2.2.3.

8.6.1.2.2.3 **GES incoming C channel establishment**. Where required elsewhere in Section 8, GES circuit-mode services shall do the following while awaiting the establishment of the C channel:

Note.– Within this subsection, it is possible that signalling events might be received from the terrestrial network. Therefore, if any telephony interworking events are received at the interworking interface with the terrestrial network, they should be held in queue for interpretation by logic specified in subsequent subsections.

a) If an additional "abbreviated access request – telephone" CM-LIDU at the current application reference number is received from AES circuit-mode services within tG11 seconds after the latest "C channel assignment" CM-LIDU has been

forwarded to the link layer, GES circuit-mode services shall again forward the "C channel assignment" CM-LIDU to AES circuit-mode services; or

b) If a "call progress – channel release" CMLIDU is received within tG11 seconds of C channel unit activation, GES circuit-mode services shall stop forwarding "call progress – test" CM-LIDUs and forward a "clear forward" event (FITE 22) to the interworking interface. (If additional "call progress – channel release" CM-LIDUs are received, GES circuit-mode services shall ignore them.) GES circuit-mode services shall then await tG24 seconds after receipt of the "call progress – channel release" CM-LIDU for the C channel from-aircraft carrier to terminate. If the from-aircraft carrier is not present, terminate all activities for the call. Otherwise, if the C channel from-aircraft carrier terminates within the tG24 second period, GES circuit-mode services shall terminate all activities for the call. If the C channel from-aircraft carrier does not terminate within the same period, GES circuit-mode services shall terminate all activities for the call at the end of the period; or

i) **Recommendation**.– The status of the unterminated from-aircraft carrier should be posted to a monitoring function.

c) If a "call information – service address" CM-LIDU is not received within tG11 seconds after the latest "C channel assignment" CM-LIDU has been forwarded to the link layer, GES circuit-mode services shall forward a "clear forward" event (FITE 22) to the interworking interface and perform the GES incoming release guard procedure defined in 8.6.1.2.2.6; or

d) If a "call information – service address" CM-LIDU is received within tG11 seconds after C channel unit activation, GES circuit-mode services shall send "call progress – test" CM-LIDUs every tG10 seconds indefinitely and perform the GES incoming terrestrial completion procedure defined in 8.6.1.2.2.4.

8.6.1.2.2.4 **GES incoming terrestrial completion**. While GES circuit-mode services is awaiting completion of the call across the terrestrial network it shall enable the circuit path between the C channel unit and the forward circuit of the terrestrial network while simultaneously forwarding to the link layer a "call progress – test" CM-LIDU every tG10 seconds indefinitely. It shall also do the following:

Note.– At this point circuit continuity is established through the GES between the C channel and the terrestrial network circuit. Call completion across the terrestrial network is still under way and call progress tones from that network may be audible to the on-aircraft party. If the called party answers the call attempt, this will be indicated by receipt from the terrestrial network of an "answer" event (BITE 22) at the interworking interface.

a) If the C channel from-aircraft carrier terminates for more than tG13 seconds, GES circuit-mode services shall forward a "clear forward" event (FITE 22) to the interworking interface. After the FITE 22 event has been forwarded, GES circuit-mode services shall stop forwarding "call progress – test" CM-LIDUs. GES

circuit-mode services shall then forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band. GES circuit-mode services shall then perform the GES incoming release guard procedure defined in 8.6.1.2.2.6; or

b)   If either a "release incoming side" event (BITE 29) or a "call unsuccessful" event (BITEs 12, 14, 15, 16, 17, or 20) were received from the interworking interface, GES circuit-mode services shall stop forwarding "call progress – test" CM-LIDUs. GES circuit-mode services shall then forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band. GES circuit-mode services shall then perform the GES incoming release guard procedure defined in 8.6.1.2.2.6; or

c)   If a "call progress – channel release" CM-LIDU is received, GES circuit-mode services shall stop forwarding "call progress – test" CM-LIDUs and shall forward a "clear forward" event (FITE 22) to the interworking interface. (If additional "call progress - channel release" CM-LIDUs are received, GES circuit-mode services shall ignore them.) If the from-aircraft carrier is not present, terminate all activities for the call. Otherwise, if the C channel from-aircraft carrier does not terminate within the same period, GES circuit-mode services shall terminate all activities for the call at the end of the period; or

   i)   **Recommendation**.–   The status of an unterminated from-aircraft carrier should be posted to a monitoring function.

d)   If an "address complete" event (BITE 5) or "sending finished" event (BITE 27) are received at the interworking interface, GES circuit-mode services shall stop forwarding "call progress – test" CM-LIDUs. It shall then forward to the link layer a "call progress – call attempt result" CM-LIDU every tG10 seconds until a positive "telephony acknowledge" CM-LIDU is received. If a positive "telephony acknowledge" CM-LIDU is not received within tG11 seconds of the transmission of the first "call progress – call attempt result" CM-LIDU, GES circuit-mode services shall forward a "clear forward" event (FITE 22) to the interworking interface, forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band, and perform the GES incoming release guard procedure defined in 8.6.1.2.2.6. Otherwise, GES circuit-mode services shall perform the GES incoming C channel maintenance procedure defined in 8.6.1.2.2.5; or

e)   If an "answer" event (BITE 22) is received at the interworking interface, GES circuit-mode services shall stop forwarding "call progress – test" CM-LIDUs. It shall then forward to the link layer a "call progress – connect" CM-LIDU every tG10 seconds until a positive "telephony acknowledge" CM-LIDU is received. If a positive "telephony acknowledge" CM-LIDU is not received within tG11 seconds after the first "call progress – connect" CM-LIDU was forwarded, GES circuit-mode services shall forward a "clear forward" event (FITE 22) to the interworking interface, forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band, and perform the GES incoming release guard procedure defined in 8.6.1.2.2.6. Otherwise, GES circuit-mode services shall perform the GES incoming C channel maintenance procedure defined in 8.6.1.2.2.5.

8.6.1.2.2.5   **GES incoming C channel maintenance**. GES circuit-mode services shall then allow the end-to-end circuit-mode connection to continue until any of the following occur:

a)   If an "answer" event (BITE 22) is received at the interworking interface, GES circuit-mode services shall forward to the link layer a "call progress – connect" CM-LIDU every tG10 seconds until a positive "telephony acknowledge" CM-LIDU is received. If a positive "telephony acknowledge" CM-LIDU is not received within tG11 seconds after the first "call progress – connect" CM-LIDU was forwarded, GES circuit-mode services shall forward a "clear forward" event (FITE 22) to the interworking interface, forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band, and perform the GES incoming release guard procedure defined in 8.6.1.2.2.6. Otherwise, GES circuit-mode services shall allow the end-to-end circuit-mode connection to continue; or

b)   If a "clear back" event (BITE 25) is received at the interworking interface, GES circuit-mode services shall forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band. GES circuit-mode services shall then perform the GES incoming release guard procedure defined in 8.6.1.2.2.6; or

c)   If the C channel from-aircraft carrier terminates for more than tG13 seconds, GES circuit-mode services shall forward a "clear forward" event (FITE 22) to the interworking interface. GES circuit-mode services shall then forward to the link layer six "call progress – channel release" CM-LIDUs via the C channel sub-band and then perform the GES incoming release guard procedure defined in 8.2.1.2.2.6; or

d)   If a "call progress – channel release" CM-LIDU is received, GES circuit-mode services shall forward a "clear forward" event (FITE 22) to the interworking interface. (If additional "call progress – channel release" CM-LIDUs are received, GES circuit-mode services shall ignore them.) If the from-aircraft carrier is not present, terminate all activities for the call. Otherwise, if the C channel from-aircraft carrier does not terminate within tG14 seconds after the receipt of the "call progress – channel release" CM-LIDU, GES circuit-mode services shall terminate all activities for the call. If the C channel from-aircraft carrier terminates within the same tG14 second period, GES circuit-mode services shall terminate all activities for the call at the end of the period.

i) **Recommendation**.– The status of an unterminated from-aircraft carrier should be posted to a monitoring function.

8.6.1.2.2.6   **GES incoming release guard**. When releasing a C channel which is in use for an air-origination, GES circuit-mode services shall do the following when required elsewhere in Section 8:

a)   If the C channel from-aircraft carrier terminates within tG12 seconds after the last of the six "call progress – channel release" CM-LIDUs was forwarded, GES circuit-mode services shall terminate all activities for the call; or

b)   If the C channel from-aircraft carrier does not terminate within tG12 seconds after the last of the six "call progress – channel release" CM-LIDUs was forwarded, GES circuit-mode services shall forward to the link layer twelve "call progress – channel

release" CM-LIDUs via the C channel sub-band followed by one "call progress – channel release" CM-LIDU via the P channel. If the from-aircraft carrier is not present, terminate all activities for the call. Otherwise, if the C channel from-aircraft carrier terminates within tG14 seconds after the transmission of the "call progress – channel release" CM-LIDU sent via the P channel, GES circuit-mode services shall terminate all activities for the call. If the C channel from-aircraft carrier does not terminate within the same tG14 second period, GES circuit-mode services shall terminate all activities for the call at the end of the period; or

    i) **Recommendation**.– The status of an unterminated from-aircraft carrier should be posted to a monitoring function.

c) If a "call progress – channel release" CM-LIDU is received, GES circuit-mode services shall await the termination of the C channel from-aircraft carrier. If the from-aircraft carrier is not present, terminate all activities for the call. Otherwise, if the C channel from-aircraft carrier terminates within tG14 seconds after receipt of the "call progress – channel release" CM-LIDU, GES circuit-mode services shall terminate all activities for the call. If the C channel from-aircraft carrier does not terminate within the same tG14 second period, GES circuit-mode services shall terminate all activities for the call at the end of the period.

    i) **Recommendation**.– The status of an unterminated from-aircraft carrier should be posted to a monitoring function.

8.7 ATS-specific terrestrial network standards

Note.– Guidance material on aeronautical speech circuit switching and signalling is contained in ICAO Circular 183 and in the guidance attachments to this Standard.

8.7.1 **Closed user group**. The AMS(R)S voice service inclusive of interconnecting aircraft and terrestrial networks shall be considered a closed user group to the extent that it is a non-public safety service to be accessible only by ATS and AOC users and used strictly for the conveyance of safety information.

Note.– The definition of a closed user group implies that a private numbering plan is also in effect. A telephony numbering plan for the safety service need not conform to that of the international public switched telephone network (PSTN) as defined in CCITT Recommendation E.163.

8.7.2 **Safety terrestrial private networks**. The GES shall interwork in tandem with private ground networks that may be implemented by ATS administrations and aircraft operators. These networks shall provide connectivity between the GES facilities and the relevant ATS or aircraft operator facilities and shall interwork with the GES circuit-mode procedures defined herein.

8.7.2.1 The application of aeronautical speech circuit switching and signalling interfaces between the GES and an administration or aircraft operator shall be made on the basis of individual agreements.

8.7.2.1.1   **Recommendation**.- Terrestrial networks should provide:

a)   priority access to the ground party without adversely impacting any existing communications by the ground party;

b)   automatic call-back in those instances where a call is blocked by an engaged condition at a ground party;

c)   the capability of alternate routing when necessary and feasible;

d)   identification of originator of incoming air-originated calls, when feasible; and

e)   call forwarding, when necessary and feasible.

Note.- Call forwarding ensures that calls to operating positions which are temporarily not manned will be rerouted automatically to an appropriate operating position.

8.7.2.2 The characteristics of the ringing tone, the busy tone, and the congestion tone used by the terrestrial network shall conform to ITU CCITT Recommendation E.180.

Note.- Details of ITU CCITT Recommendation E.180 are contained in CCITT Blue Book, Volume II - Fascicle II-2.

8.7.3   **Registration of air-originated attempts to a busy ground party**. All call attempts offered to a terrestrial network or a ground destination shall be afforded the priority and pre-emption services defined in Section 8.3.2.

8.7.3.1 **Recommendation**.- If an air-originated call attempt is blocked due to an engaged condition at the ground party, a record of the call attempt should be maintained by the ground user or terrestrial network for a subsequent ground-originated return call to the original aircraft. A GES should not be required to provide specific functions that allow a blocked call attempt to be held in a GES-managed internal queue for later service.

8.8 Telephony numbering plan

8.8.1   **General**. A universal telephony numbering plan for AMS(R)S circuit-mode services shall be established so as to facilitate universal interoperability with terrestrial networks.

8.8.2   **Aircraft numbering**

8.8.2.1 **Specific requirements**. A fixed address length of 10 address digits shall be allotted to the aircraft numbering plan. All assigned addresses shall be of the same length.

8.8.2.2 **Address analysis**. Numbering of individual aircraft destinations shall consist of the AES ID of the aircraft expressed as eight octal digits to which is appended the two-digit decimal ID of the calling or called

terminal on the aircraft numbered from 00 to 99 decimal. The first 10 terminal addresses (00-09) shall be reserved for ATS application.

8.8.2.2.1   AES circuit-mode services shall maintain a private, 100 entry terminal ID address space specific to all AMS(R)S safety terminals on an aircraft. Use of this address space, as opposed to the parallel address space for non-safety services, shall be inferred by AES circuit-mode services by the associated priority of the call attempt.

8.8.2.2.2   ***Recommendation***.– *Subsequent mutual agreement by aircraft manufacturers and ATS administrations should provide for the assignment of aircraft terminal ID "00" as the default destination for all ground-originated safety voice calls to an aircraft. Flight deck audio management systems should associate any incoming call directed to this terminal ID with an appropriate available audio channel on the flight deck (e.g. "SATCOM 1" or "SATCOM 2" on a flight deck audio panel). Terminal IDs "05" to "09" should be reserved for the future application of facsimile devices or other types of digital terminals.*

8.8.3   Terrestrial numbering

8.8.3.1 **Ground destination address**. All terrestrial addresses shall be 10 digits in length so as to simplify address analysis in the GES and intervening terrestrial networks.

8.8.3.1.1   **Address analysis**. Numbering of individual ground destinations shall consist of the following digit sequence:

> a) a digit "8";
>
> b) a three digit country code signifying the destination State;
>
> c) a three digit facility code signifying the destination facility within the destination State. The code values to be assigned to individual facilities within a State shall be determined and published by the administration of the destination State; and
>
> d) a three digit agent code signifying the destination agent within the destination facility. The code values to be assigned to individual agents within a facility shall be determined and published by the organizational entity controlling the facility.

Note 1.– A GES is not required to convert any ground address received during an air-originated AMS(R)S call. The terrestrial network may convert any such address, if necessary, to that which is required for that particular network.

Note 2.– GES operators may convert a ground address to that which is required by a particular terrestrial network upon mutual agreement with that network operator.

Note 3.– Country codes are based on the International Telecommunication Union (ITU) country code shown in Table 1 of Appendix 43 of the ITU Radio Regulations. However, only one code per country should be used in the AMS(R)S service for safety and regulatory communications.

8.8.3.2 **Network ID**. Network ID "10" shall be used in all air-originated safety calls.

Note.– Additional network IDs may be used for safety communications upon prior arrangement between GES operators and the affected ATS administrations and aircraft operators.

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