

**PROCEDURES FOR INTERWORKING BETWEEN INMARSAT AERONAUTICAL
MOBILE SATELLITE SYSTEM AND THE INTERNATIONAL
PUBLIC SWITCHED TELEPHONE NETWORK/ISDN**

1 Introduction

This Recommendation provides the detailed procedures for interworking between the INMARSAT aeronautical system and signalling systems of the public fixed network. For a brief description of the INMARSAT aeronautical system, see Appendix I to Recommendation Q.1151.

2 Conversion of information elements

Tables 1/Q.1152 and 2/Q.1152 list the signals of the INMARSAT aeronautical system that are relevant for the purpose of interworking with the PSTN/ISDN. The forward interworking telephone events (FITEs) and backward interworking telephone events (BITEs), as defined in Annex A to Recommendations Q.601 to Q.608, that correspond to each of these signals is also provided in the tables.

Tables 3/Q.1152 to 18/Q.1152 give the relationship between signals of the fixed network signalling systems and the INMARSAT aeronautical system.

2.1_w Signalling System R2_w

2.1.1 Table 3/Q.1152 gives the relationship between messages in the INMARSAT Aeronautical signalling system and forward signals in Signalling System R2 for air-to-ground calls i.e. interworking of INMARSAT aeronautical to Signalling System R2.

Table 4/Q.1152 shows the relationship between forward signals in Signalling System R2 and messages in the INMARSAT aeronautical signalling system for ground-to-air calls. In the comment column actions taken by the MSSC are indicated, in particular for signals of R2 which have no equivalent message in the INMARSAT aeronautical system.

The signal numbers for forward signals of Signalling System R2 are those given in Table A-7 of Annex A to Recommendations Q.601 - Q.608.

2.1.2 Table 5/Q.1152 gives the relationship between messages in the INMARSAT aeronautical signalling system and backward signals in Signalling System R2 for ground-to-air calls, i.e. interworking of Signalling System R2 to INMARSAT aeronautical.

Backward signals in Signalling System R2 generated by the MSSC for unsuccessful ground-to-air calls are given in Table 5 bis/Q.1152. These signals are not related to any specific message received from the aircraft earth station.

Table 6/Q.1152 gives the relationship between backward signals in Signalling System R2 and messages in the INMARSAT aeronautical signalling system for air-to-ground calls, i.e. interworking of INMARSAT aeronautical to Signalling System R2. The comments column indicates specific actions taken by the MSSC.

The signal number of backward signals of Signalling System R2 are those given in Table A-11 of Annex A to Recommendations Q.601-Q.608.

2.2_w Signalling System No. 7 (TUP)w

2.2.1 Tables 7/Q.1152 and 8/Q.1152 are similar to Tables 3/Q.1152 and 4/Q.1152, respectively, and apply to forward signals in Signalling System No. 7 (TUP).

The signal numbers for forward signals of Signalling System No. 7 (TUP) are those given in Table A-5bis of Annex A to Recommendations Q.601-Q.608.

2.2.2 Tables 9/Q.1152, 9 bis/Q.1152 and 10/Q.1152 are similar to Tables 5/Q.1152, 5bis/Q.1152 and 6/Q.1152, respectively, and apply to backward signals in Signalling System No. 7 (TUP).

The signal numbers for backward signals in Signalling System No. 7 (TUP) are those given in Table A-9bis of Annex A to Recommendations Q.601-Q.608.

2.3_w Signalling System No. 5w

2.3.1 Tables 11/Q.1152 and 12/Q.1152 are similar to Tables 3/Q.1152 and 4/Q.1152, respectively, and apply to forward signals in Signalling System No. 5.

The signal numbers for forward signals of Signalling System No. 5 are those given in Table A-4 of Annex A to Recommendations Q.601-Q.608.

2.3.2 Tables 13/Q.1152, 13bis/Q.1152 and 14/Q.1152 are similar to Tables 5/Q.1152, 5bis/Q.1152 and 6/Q.1152, respectively, and apply to backward signals in Signalling System No. 5.

The signal numbers for backward signals in Signalling System No. 5 are those given in Table A-8 of Annex A to Recommendations Q.601-Q.608.

2.4 The relationship between forward and backward signals of Signalling System No. 7 (ISUP) and messages of the INMARSAT aeronautical signalling system is for further study.

TABLE 1/Q.1152

INMARSAT aeronautical - forward signals

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FITE No.	Message: info element: value
<u>w</u> Ground-to-air callsw	
1	Call announcement: AES id: called terminal
17	Call announcement: service: telephone
22	Channel release
<u>w</u> Air-to-ground callsw	
17	Access request: message type: public/crew voice
18	Access request: message type: crew distress voice
1	Access request: address digits 0,1
1	Service address: address digits 2 ... 17
22	Channel release

wNotew- Signals required for interworking with Signalling System No. 7 (ISUP) are for further study.

TABLE 2/Q.1152

INMARSAT aeronautical - backward signals

BITE No.	Message: info element: value
<u>Ground-to-air callsw</u>	
5	Test
22	Connect
29	Channel release
16	Call attempt result: Cause: User busy
12	Call attempt result: Cause: No channel available
17	Call attempt result: Cause: Destination out of service
<u>Air-to-ground callsw</u>	
22	Connect
2	Call attempt result: Address complete
29	Channel release
20	Call attempt result: Cause: Unspecified
16	Call attempt result: Cause: User busy
15	Call attempt result: Cause: Unassigned number
17	Call attempt result: Cause: Destination out of service
12	Call attempt result: Cause: No channel available
14	Call attempt result: Cause: Invalid number format

Note - Signals required for interworking with Signalling System No. 7 (ISUP) are for further study.

TABLE 3/Q.1152

**Conversion of forward signals in the INMARSAT aeronautical signalling system to Signalling System R2
Air-to-ground calls**

INMARSAT aeronautical signalling system	Signalling System R2	Signal No.
Message: info element: value	Signal name: info element	No.

Access request: message type	Calling party's category		
- public voice	- subscriber/operator without forward transfer facility		12
- crew voice	- subscriber/operator without forward transfer facility		12
- crew distress voice	- subscriber/with priority		14
Access requests: address digits 0, 1 digits 0, 1	Country code indicator (echo suppressor controls)		10
Service Address: digits 2 to 17	Address signals/first digit		1
Test: response	Not applicable		
Channel release	Clear forward		16

wNotew - Signal No. 21, nature of circuit indicator; one satellite circuit in the connection - is generated by the GES, if required.

TABLE 4/Q.1152

**Conversion of forward signals in Signalling System R2 to INMARSAT aeronautical signalling system
Ground-to-air calls**

Signalling system R2		INMARSAT aeronautical signalling system		Comments
Signal No.	Signal name	Message: info element: value		
1	Address signals	Call announcement: AES identity, called terminal		
2-6	Language digit: I-1 ...5			Interpreted by MSSC
7	Discriminating digit			Interpreted by MSSC
8	Country code indicator outgoing half suppressor required			MSSC will insert echo control device if needed
9	Country code indicator no echo suppressor reqd.			Interpreted by MSSC
10, 11	Country code indicator incoming half echo suppressor required			Interpreted by MSSC
12	Calling party's category, subscriber or operator without forward transfer facility	Call announcement - service: telephone		
13	Calling party's category, data transmission control			Not applicable
14	Calling party's category, subscriber with priority	Call announcement - service: telephone, priority for futher study		

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TABLE 4/Q.1152 (Contd.)

**Conversion of forward signals in Signalling System R2 to INMARSAT aeronautical signalling system
Ground-to-air calls**

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Signalling system R2		INMARSAT aeronautical signalling system		Comments
Signal No.	Signal name	Message:	info element: value	
15	Calling party's category, operator with forward transfer capability	Call announcement	- service: telephone	
16	Clear forward	Channel release		
17	Forward transfer			Not applicable
18	First digit; I-1, I-2 ... I-10			Interpreted by MSSC
19	Reply to A-14; I-1 ... I-10			Not applicable
20	Reply to first A-13; I-13			Not applicable
21	Reply to first A-13; I-14			Not applicable

W

TABLE 5/Q.1152

**Conversion of backward signals in the INMARSAT aeronautical signalling system
to Signalling System R2
Ground-to-air calls**

INMARSAT aeronautical signalling system Message: info element: value	Signalling system R2 Signal name: info element	Signal No.
Test: response	International, subscriber line free, charge	13
Connect	Answer signal	11
Channel release	Clear back	12
Call attempt result: Cause value:	Subscriber line busy	5
- user busy	Congestion on the national network	1
- no channel available	Subscriber line out of order	10
- destination out of service	International; send special info tone	14
- others		

w

TABLE 5bis/Q.1152

Unsuccessful call events and backward signals in Signalling System R2
Ground-to-air calls

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INMARSAT aeronautical signalling system event in INMARSAT system	Signalling System R2 signal name: info element	Signal No.
Congestion in MSSC	B4 - Congestion	6
Incomplete AES number	B5 - Unallocated number	7
Unallocated AES number	B5 - Unallocated number	7
Continuity test failure	B8 - Subscriber line out of order	10
AES barred for incoming access	B2 - Send special info tone	4
AES absent	B2 - Send special info tone	4
No satellite channel available	B4 - Congestion	6

TABLE 6/Q.1152

Conversion of backward signals in Signalling System R2 to INMARSAT Aeronautical Signalling System
Air-to-ground calls

SIGNALLING SYSTEM R2		INMARSAT AERONAUTICAL SIGNALLING SYSTEM	
SIGNAL No.	SIGNAL NAME	MESSAGE: INFO ELEMENT: VALUE	COMMENTS
1	A4 - Congestion on the national network switching equipment congestion	Call attempt result: Remote public network,	
2	A6 - Address complete, charge, set up speech condition	" : address complete	
3	A15 - Congestion in an international exchange or at its output	" : international network, switching equipment	
4	B2 - Send special information tone	" : remote public network, unspecified	
5	B3 - Subscriber line busy	" : remote public network, user busy	
6	B4 - Congestion	" : remote public network, switching equipment congestion	
7	B5 - Unallocated number	" : remote public network, unassigned number	
8	B6 - Subscriber line free, charge	" : address complete	
9	B7 - Subscriber line free, no charge	" : address complete information, used by MSSC only	No charge
10	B8 - Subscriber line out of order service	" : remote public network, destination out of	
11	Answer	Connect	

TABLE 6/Q.1152 (Contd.)

Conversion of backward signals in Signalling System R2 to
INMARSAT aeronautical signalling system
Air-to-ground calls

SIGNAL No.	SIGNALLING SYSTEM R2 SIGNAL NAME	INMARSAT AERONAUTICAL MESSAGE: INFO ELEMENT: VALUE	COMMENTS
12	Clear back	Channel release	Clearback supervision done by MSSC
13	B1-B6 - International, subscriber line free, charge	Call attempt result: address complete	
14	B9, B10 - International, send special information tone	" : international network, unspecified	
15	B11-B15 - Congestion	" : remote public network, switching equipment congestion	

TABLE 7/Q.1152

Conversion of forward signals in INMARSAT aeronautical signalling system
to Signalling System No. 7
Air-to-ground calls

INMARSAT AERONAUTICAL MESSAGE: INFORMATION ELEMENT: VALUES SIGNAL No.	SIGNALLING SYSTEM No. 7 SIGNAL NAME: INFORMATION ELEMENT
Access request: Message type: Public voice/ Crew voice/ Crew distress voice	Calling party's category indicator: Ordinary subscriber/ Ordinary subscriber/ Subscriber with priority
	13 13 14
Access request: Address digits 0, 1 Service address: Digit 2 to 17	Address signals: Digit 1, 2 ... 0 nature of address indicator, international number
	1 3
Test: Response	Continuity check performed on previous circuit
	22
Channel release	Clear forward signal
	16

Note - Signal No. 5, nature of circuit indicator, one satellite in connection, is generated by the MSSC.

TABLE 8/Q.1152

Conversion of forward signals in Signalling System No. 7 TUP
to INMARSAT aeronautical signalling system
Ground-to-air calls

SIGNALLING SYSTEM No. 7 SIGNAL No.	SIGNAL NAME	INMARSAT AERONAUTICAL MESSAGE: INFO ELEMENT: VALUE	COMMENTS
1	Address signals	Call announcement: AES ID, called terminal	
2	Nature of address indicator, national significant number	-	Interpreted by MSSC
3	Nature of address indicator, international number	-	Interpreted by MSSC
4	Nature of circuit indicator, no satellite in connection	-	Ignored by MSSC
5	Nature of circuit indicator, one satellite in connection	-	Ignored by MSSC
6	Echo suppressor indicator, outgoing half-echo suppressor not included	- if needed	MSSC will insert echo control device
7	Echo suppressor indicator, outgoing half-echo suppressor included	-	Interpreted by MSSC
8-12	Calling party's category indicator, language digit	Call announcement: - service: telephone	-
13	Calling party's category indicator, ordinary calling subscriber	Call announcement: - service: telephone	-

TABLE 8/Q.1152 (Contd.)

Conversion of forward signals in Signalling System No. 7 TUP to
INMARSAT aeronautical signalling system
Ground-to-air calls

SIGNAL No.	SIGNALLING SYSTEM No. 7 SIGNAL NAME	INMARSAT AERONAUTICAL MESSAGE: INFO ELEMENT: VALUE	COMMENTS
14	Calling party's category indicator, calling subscriber with priority	Call announcement - service: telephone, priority for further study	-
15	Calling party's category indicator, data call	-	Not applicable
16	Clear forward	Channel release	-
17	Forward transfer	-	Not applicable
18	Continuity proved	-	Interpreted by MSSC
19	Continuity check failure	Channel release	-
20	Continuity check required on this circuit	-	Interpreted by MSSC
21	Continuity check not required on this circuit	-	Interpreted by MSSC
22	Continuity check performed on previous circuit	-	Interpreted by MSSC
23	Service information	-	Interpreted by MSSC
24	General set-up message	-	Interpreted by MSSC

TABLE 9/Q.1152

Conversion of backward signals in INMARSAT aeronautical signalling system to
Signalling System No. 7 TUP
Ground-to-air calls

INMARSAT AERONAUTAL MESSAGE: INFORMATION ELEMENT: VALUE	SIGNALLING SYSTEM No. 7 SIGNAL NAME	SIGNAL No.
Test: Response	AFC: Address complete, subscriber free, charge	4
Connect	ANC: Answer, charge	16
Channel release	CLB: Clear back	19
Call attempt result: Cause value:		
- User busy	SGB: Subscriber busy	12
- No channel available	CGC: Circuit group congestion	8
- Destination out of service	LOS: Line out of service	13
- others	SST: Send special information tone	14

TABLE 9bis/Q.1152

Unsuccessful events and backward signals in Signalling System No. 7
Ground-to-air calls

INMARSAT AERONAUTICAL EVENT IN INMARSAT SYSTEM	SIGNALLING SYSTEM No. 7 SIGNAL NAME	SIGNAL No.
Congestion in MSSC	SEC: Switching equipment congestion	7
No satellite channel available	NNC: National network congestion	9
Incomplete AES number	ADI: Address incomplete	10
Unallocated AES number	UNN: Unallocated number	11
Continuity test failure	LOS: Line out of service	13
AES barred for incoming access	SST: Send special information tone	14
AES absent	SST: Send special information tone	14

TABLE 10/Q.1152

Conversion of backward signals in Signalling System No. 7 TUP
to INMARSAT aeronautical signalling system
Air-to-ground calls

SIGNAL No.	SIGNALLING SYSTEM No. 7 SIGNAL NAME	INMARSAT AERONAUTICAL MESSAGE: INFO ELEMENT: VALUE	COMMENTS
1	ADC: Address complete, charge	Call attempt result: address complete	-
2	ADN: Address complete, no charge	Call result: address complete information used by MSSC only	No- charge
3	ADX: Address complete, coinbox	Call result: address complete	-
4	AFC: Address complete, subscriber free charge	Call result: address complete	-
5	AFN: Address complete, subscriber free no charge	Call result: address complete information used by MSSC only	No- charge
6	AFX: Address complete, subscriber free, coinbox	Call result: address complete	-
7	SEC: Switching equipment congestion	Call result: international network, switching equipment congestion	-
8	CGC: Circuit-group congestion	Call result: international network, no channel available	-
9	NNC: National network congestion	Call result: remote public network, switching equipment congestion	-

TABLE 10/Q.1152 (contd.)

Conversion of backward signals in Signalling System No. 7 TUP
to INMARSAT aeronautical signalling system
Air-to-ground calls

SIGNAL No.	SIGNALLING SYSTEM No. 7 SIGNAL NAME	INMARSAT AERONAUTICAL MESSAGE: INFO ELEMENT: VALUE	COMMENTS
10	ADI: Address complete	Call result: remote public network, invalid number format	-
11	UNN: Unallocated number	Call result: remote public network, unassigned number	-
12	SGB: Subscriber busy	Call result: remote public network, user busy	-
13	LOS: Line out of service	Call result: remote public network, destination out of service	-
14	SST: Send special information tone	Call result: international network, unspecified	-
15	CFL: Call failure	Call result: international network, unspecified	-
16	ANC: Answer, charge	Connect	-
17	ANN: Answer, no charge	Connect	No charge informa- tion used by MSSC
18	RAN: Reanswer	Connect	-
19	CLB: Clearback	Channel release	Clearback
		supervision done by MSSC	

TABLE 10/Q.1152 (contd.)

Conversion of backward signals in Signalling System No. 7 TUP
to INMARSAT aeronautical signalling system
Air-to-ground calls

SIGNALLING SYSTEM No. 7 SIGNAL No.	SIGNAL NAME	INMARSAT AERONAUTICAL MESSAGE: INFO ELEMENT: VALUE	COMMENTS
20	GRQ: General request message	-	Interpreted by MSSC
21	Call unsuccessful, access barred unspecified	Call attempt result: remote public network,	-
22	DPN: Call unsuccessful, digital path not provided	- Not applicable	

TABLE 11/Q.1152

Conversion of forward signals in INMARSAT aeronautical signalling system
to Signalling System No. 5
Air-to-ground calls

INMARSAT AERONAUTICAL MESSAGE: INFO ELEMENT: VALUE	SIGNALLING SYSTEM No. 5 SIGNAL NAME	SIGNAL No.
Access request: message type: - public voice - crew voice - crew distress voice	Discriminating digit 0 " 7 " 7	7
Access request: address digits 0, 1 Service address: digit 2 to 17	Address digits	1
Test: response	Not applicable	
Channel release	Clear forward	10

TABLE 12/Q.1152

Conversion of forward signals in INMARSAT aeronautical signalling system
to Signalling System No. 5
Air-to-ground calls

SIGNAL No.	SIGNALLING SYSTEM No. 5 SIGNAL NAME	INMARSAT AERONAUTICAL MESSAGE: INFO ELEMENT: VALUE	COMMENTS
1	Address signals	Call announcement: AES identity, called terminal	
2-6	Language digit: 1 ...5		Interpreted by MSSC
7	Discriminating digit 0	Call announcement: - service: telephone	
8	Start of pulsing signal KP1	-	Interpreted by MSSC
9	Start of pulsing signal KP2	-	Interpreted by MSSC
10	Clear forward	Channel release	
11	Forward transfer	-	Not applicable

TABLE 13/Q.1152

Conversion of backward signals in INMARSAT aeronautical signalling system to
Signalling System No. 5 TUP
Ground-to-air calls

INMARSAT AERONAUTICAL MESSAGE: INFO ELEMENT: VALUE	SIGNALLING SYSTEM No. 5 SIGNAL NAME	SIGNAL No.
Test: response	Inform that ST has been sent	5
Connect	Answer signal	2
Channel release	Clear back	3
Call attempt result: cause value	Busy flash signal	1
- user busy	Busy flash signal	1
- no channel available	information tone (Note 1)	-
- destination out of service	information tone (Note 1)	-
- others		

Note 1 - May include appropriate recorded announcement.

TABLE 13bis/Q.1152

Unsuccessful call events and backward signals in Signalling System No. 5
Ground-to-air calls

INMARSAT AERONAUTICAL EVENT IN INMARSAT SYSTEM	SIGNAL NAME	SIGNALLING SYSTEM No. 5 SIGNAL No.
Congestion in MSSC	Busy flash	1
No satellite channel available	Busy flash	1
Incomplete AES number	Information tone (Note 1)	
Unallocated AES number	Information tone (Note 1)	
Continuity test failure	Information tone (Note 1)	
AES absent	Information tone (Note 1)	
AES barred for incoming access	Information tone (Note 1)	

Note 1 - May include appropriate recorded announcement.

TABLE 14/Q.1152

Conversion of backward signals in Signalling System No. 5
to INMARSAT aeronautical signalling system
Air-to-ground calls

SIGNALLING SYSTEM No. 5		INMARSAT AERONAUTICAL		COMMENTS
SIGNAL No.	SIGNAL NAME	MESSAGE: INFO ELEMENT: VALUE		
1	Busy - flash	Call attempt result: international network, unspecified		
2	Answer	Connect		
3	Clear back	Channel release		
4	Proceed to send	-	Interpreted by MSSC	
5	Inform that ST has been sent	Call attempt result: address complete		

3. Incoming INMARSAT aeronautical logic procedures (Air-to-ground calls)

Figure 1/Q.1112 contains the procedures for the incoming INMARSAT aeronautical signalling system.

This description only includes those aspects of the INMARSAT aeronautical system which have to be implemented for interworking purposes. Internal procedures, such as those required for setting up and clearing satellite channels are not shown. This also applies to pre-emption procedures for assigning channels to distress calls.

The following details should be noted:

- 3.1 The access request contains information elements for the required service, and the required network, plus two address digits. For some private networks, and/or subscription services on public networks, this information will be sufficient to determine the complete call routing. In all but the most exceptional cases, it will be enough information to select a circuit for onward routing from the MSSC.
- 3.2 The initial analysis of the request checks that the AES is authorized for the service requested and finds a suitable channel and channel unit, on which to service the call. The call is aborted if the AES is not an authorized user of the INMARSAT system.
- 3.3 In the cases where all of the required address information is contained in the access request signal unit, an address message is received by the incoming procedure, once continuity of the assigned satellite channel has been successfully tested.
- 3.4 The called address is analysed to verify its integrity. The satellite channel may be cleared at this point, either if the dialled address is incomplete or if the AES goes on-hook. The call may also be aborted if proper credit card data is not received from the AES.
- 3.5 The dialled digits are transferred to the interworking procedure, and the answer signal is awaited. The last digit may be withheld until receipt of credit card information. All successful address complete signals are converted to a call attempt result message, with the cause field set to address complete.
- 3.6 Unsuccessful call event signals (BITEs 9-20) are transferred to the AES by the call attempt result message, with the cause field set appropriately.
- 3.7 On receipt of the answer signals, the connect message is sent to the AES.
- 3.8 The call is cleared in the normal way, either on receipt of a release message from the interworking procedure, or an indication of AES on-hook conveyed by means of a channel release message.