



SATELLITE ACCESS PROCEDURES

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CONFIDENTIAL PROPRIETARY

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1 INTRODUCTION

This document outlines the technical requirements and procedures to access the satellites operated by SES. It provides an overview of general criteria that need to be met by accessing earth stations, in addition to information on antenna alignment and transponder sharing. It also includes information on troubleshooting with relevant contact information.

In order to ensure optimum performance to satellite users it is vital that the SES technical standards are adhered to.

1.1 DEFINITIONS AND ACRONYMS

The following definitions and acronyms are use throughout this document:

CID	Carrier ID, the encoding of an identifier on a DVB transmission, in accordance with an industry standard (e.g., ETSI-TS-103129 (DVB-CID, May 2013).
DTH	Direct to Home
DVB	Digital Video Broadcast
Good Night	Customer verification of the end of an occasional service event with the Operations Centre
SES Operations Centre	shall mean in context, any of the following operations centres as used by SES:
	PMOC Payload Management and Operations Centre
	DINO Digital Network Operations Centre
	AAC Access Centre
	NOC Networks Operations Centre
VAS	Value Added Services

1.2 EARTH STATION PERFORMANCE REQUIREMENTS

All earth stations (both fixed and transportable) that will access a satellite operated by SES shall meet the requirements contained in the relevant SES Access Document. SES reserves the right to remotely test and/or physically inspect each earth station site to ensure compliance with these requirements.

1.2.1 Carrier ID

Customers with DVB transmissions are strongly encouraged to utilize modems that have the capability of encoding an identifier (Carrier ID (DVB-CID)), and to enable CID on their DVB video and data transmissions. CID is a technique that identifies the uplink station emitting a transmission, aimed at helping satellite operators to quickly identify and resolve interference and improve the quality of service for all customers.

The FCC will require Satellite News Gathering (SNG)/OU uplinkers in the United States to use CID on their transmissions from 1 June 2016. However, the objective of the global satellite industry is to go further than SNG and implement this technique on all DVB video and data transmissions. The implementation of CID at an uplinker's facility will be the responsibility of the uplinker, however, newer DVB modems will

likely include the DVB-CID capability, making it easy and low or no cost for an uplinker to enable CID on their transmissions.

1.3 ANTENNA ALIGNMENT

Normal orbit perturbation of geosynchronous satellites will cause a satellite's position to vary in latitude, longitude and altitude within its defined station-keeping box. SES maintains its satellites within plus or minus 0.1° in latitude and longitude and provides Centre of the Box data or Antenna Pointing data to support the correct pointing of customer antennas¹.

The times the satellite is at the centre of the box should be utilized to align non-tracking earth station antennas in azimuth, elevation and polarization. A spectrum analyser or other device responding to signal levels can be used to peak up the antenna. Earth station antennas that do not utilize auto tracking will have to be checked periodically, the time of adjustment depending on the antenna size and frequency of operation.

1.4 CUSTOMERS OPERATING IN MULTI-CARRIER TRANSPONDERS

Special considerations must be observed for multi-carrier (fractional) transponder traffic. Since a large number of carriers share the available bandwidth and power of the transponder, any change to assigned allocations can affect all traffic in the transponder. For every service in a multi-carrier transponder, the allowable power and bandwidth that may be used by the customer is precisely specified by SES.

The customer must not deviate from the authorized transponder power levels and/or centre frequencies without authorization from SES. Uncoordinated adjustment of carrier parameters can cause interference and degradation to other services utilizing the transponder.

SES routinely monitors all satellite transponders to verify the power and bandwidth utilization as compared to the customer's resources.

¹ Visit <https://www.ses.com/our-network/technical-data>

2 CONTACT NUMBERS AND ESCALATION

2.1 CONTACT NUMBERS

For accessing the satellite, the customer will contact any of the following Operations Centres, depending on the type of service to access.

- PMOC** **+ 1 410 970 7570, + 1 800 772 2363, +31 70 306 4111**
The primary technical operations interface for users of space segment only services on the Global and North American fleet satellites is the SES PMOC. For Global OU Services contact +31 70 306 4242; for North American OU Services contact +1 800 772 2363.
- PMOC L2** **+1 703 367 7304**
The PMOC Level 2 is responsible for 24/7 escalated payload operations on the SES fleet and provides appropriate technical response to resolve escalated customer problems.
- NOC** **+1 866 244-5012, Option #1, +1 703 330-3305, Option #1**
The primary technical operations interface for all VAS services is the SES NOC. For these services, the NOC is the customer's only point of contact for all service matters, including space segment, fibre and uplink earth station. The NOC will coordinate internally with the appropriate engineering and operations group to resolve any service issues.
- DINO** **+ 352 710 725 333**
The primary technical operations interface for DTH and ASTRA fleet services is the SES DINO.
- AAC** **+ 352 710 725 731**
The primary technical operations interface for Occasional Use services accessing the ASTRA fleet is the ASTRA Access Centre.

2.2 ESCALATION LISTS

In the event that the customer determines it is necessary to escalate a service issue, the customer can request escalation of the service issue from the 1st level contact, or alternatively contact the next level contact in the escalation list directly. The escalation contact lists for the SES Operation Centres are provided in the following tables.

Escalation level	Contact person	Contact details
1 st level	SES PMOC Technician on Duty	Tel: + 1 410 970 7570 + 1 800 772 2363 +31 70 306 4111 Email: pmoc@ses.com
2 nd level	Supervisor, PMOC Bob Fuson	Tel: + 1 410 970 7549 (Office) Email: bobby.fuson@ses.com
3 rd level	Senior Manager, Payload Operations Jeff Watts	Tel: + 1 410 970 7525 (Office) Email: jeffrey.watts@ses.com
4 th level	SVP, Customer Service Delivery Chris Grogan	Tel: + 352 710 725 701 (Office) Email: chris.grogan@ses.com

Table 2-1 Escalation contacts for the PMOC

Escalation level	Contact person	Contact details
1 st level	SES NOC Technician on Duty	Tel: + 1 703 330-3305 Option #1 Email: noc@ses.com
2 nd level	Manager, NOC Tyrone Bryson	Tel: +1 703 367-7327 (Office) Email: tyrone.bryson@ses.com
3 rd level	SVP, Customer Service Delivery Chris Grogan	Tel: + 352 710 725 701 (Office) Email: chris.grogan@ses.com

Table 2-2 Escalation contacts for the NOC

Escalation level	Contact person	Contact details
1 st level	SES DINO and AAC Technician on Duty	Tel: + 352 710 725 333 Email: dino@ses.com
2 nd level	Engineer, Customer Service Delivery Pedro De Lima	Tel: +352 710 725 8631 (Office) Email: pedro.de.lima@ses.com
3 rd level	General Manager, Customer Service Operations Roland Smith	Tel: + 352 710 725 225 (Office) Email: roland.smith@ses.com
4 th level	SVP, Customer Service Delivery Chris Grogan	Tel: + 352 710 725 701 (Office) Email: chris.grogan@ses.com

Table 2-3 Escalation contacts for the DINO and AAC

3 SATELLITE ACCESS PROCEDURES

3.1 SUMMARY

For all services, access to a satellite transponder is arranged by calling the appropriate SES Operations Centre. The 24/7 staff will determine if the satellite access request is

valid and authorized to transmit. This will also ensure that the initial uplink can be verified, monitored, and documented by SES.

During the satellite access, the SES Operations Centre will verify the following.

- Earth station registration code;
Please note that earth station registration is required for all earth stations accessing the SES fleet. Upon application for registration an earth station code will be assigned and, with antenna verification test requirements (if applicable), communicated to the customer. The assigned earth station codes are expected to be part of submitted transmission plans.
- Satellite, transponder, and frequency slot allocations
- Uplink polarisation
- Cross-polarisation isolation
- Carrier power level, signal quality, etc.
- During the access procedure, the Earth Station operator will be required to:
 - Peak the transmit antenna to the assigned SES satellite.
 - Rotate/adjust the transmit antenna polarisers, if required.
 - Transmit signals of differing power levels (both modulated and unmodulated).
 - For DVB transmissions, enable the DVB-CID transmission, if applicable.

The earth station operator shall contact the SES Operations Centre allowing for enough time in advance for the controller to complete the entire access procedure, including cross-pol verification. Failure to do this may result in access delays.

It is very important that the earth station operator informs SES before making any equipment modifications while transmitting to the satellite

3.2 BEFORE ACTIVATION

BEFORE calling SES, the earth station operator shall ensure the following:

1. The transmitter is in standby mode at maximum attenuation. For earth stations performing multiple uplinks through a single uplink chain, earth station operators must ensure that the modulator is at maximum attenuation.
2. All uplink equipment is warmed, stable, and tuned to the correct frequency;
3. The antenna is properly pointed, optimized, and set for the correct polarisation. For optimum performance, antenna pointing should be performed while the satellite is at centre of box. (Centre of the box predictions are found in the SES website).
4. The waveguide switches are configured properly.

3.3 DURING ACTIVATION

DURING activation the SES staff will direct the earth station operator to perform the following steps:

1. Transmit an unmodulated carrier at the lowest possible power.
2. Wait for further instruction while the controller checks the cross-pol and frequency of the carrier, as well as any other carrier specifications as necessary.
3. When directed, modulate the signal and SES will then verify the EIRP.
4. Slowly increase power to a level as stated by SES and stop.
5. Wait for further instructions while your bandwidth is checked.
6. The SES staff member will verify the phone number that should be available throughout the transmission in case a problem in relation with your uplink has to be solved. The controller will remind you to call again just before the end of the uplink (occasional use space segments).
7. SES will receive and decode the DVB-CID identifier from the transmission, whenever possible.

IMPORTANT: DO NOT activate carriers, deactivate carriers or change power, frequency, polarization, antenna pointing or any transmitting equipment without first contacting the SES Operations Centre and receiving authorisation to do so.

If you are instructed by SES to cease transmission, you must **IMMEDIATELY** comply without discussion.

4 OCCASIONAL USE SERVICES

For Occasional Use Services, follow the access procedures described in Section 3.

The confirmation process for Occasional Use Services can be expedited by using the booking identification number designated in the OU Confirmation. For confirmation of the booking identification number and other parameters the Occasional Use Bookings Offices may be called at:

+31 70 306 4200	The Netherlands
+1 800 732 3273	United States

All customers are required to notify the applicable SES Operations Centre when they have completed transmission to a satellite.

The transmission should be completed by the booked end time shown in the OU Confirmation. This is especially important since billing is based on the booked start time and booked end time (and also the Good Night time when an approx. out has been established for the booking). In the event of a booking with an approx. out, if the customer does not Good Night by the booked end time, the approx. out is activated. The customer must then call the applicable Satellite Operations Centre with a Good Night time within the approx. out window and the customer will be billed in 5 minute increments. If the transmission is not Good Nighted, the booked time (from the booked start time to the booked end time), as well as the approx. out, will be billed to the customer.

If an Occasional Use Service is not completed by the booked end time, then SES will contact the uplink earth station and require that the transmission immediately cease. If an extension is desired, then the Occasional Use Bookings Office must be contacted immediately. Only the Occasional Use Bookings Office or the Satellite Operations Centre can grant an extension, subject to availability. If an extension is not granted, then the customer must immediately cease transmission.

5 TELEVISION CARRIER INITIAL FULL LINE-UP TESTS (IFLU)

This section describes the IFLU (Initial Full Line Up) procedures for Digital Video Broadcast carriers accessing the European fleet of the SES satellite system.

All mandatory tests highlighted in the Antenna Verification Procedures must have been carried out and approved by SES prior to the commencement of IFLU tests.

5.1 CARRIER RF PARAMETERS

Purpose of the test:

- Verify the RF transmit carrier frequency
- Optimise the earth station polarization setting
- Set the nominal EIRP of the uplink carrier
- Verify the system Carrier to Noise Ratio.

Test Equipment:

- a) Spectrum Analyser
- b) Down Converter

Note: Actual test equipment arrangement may vary at each earth station.

Before commencing the tests, the DINO shall arrange for the transponder to be set to linear operation. The uplink station and the DINO shall ascertain, by means of a spectrum analyser, that the satellite is free of any activated carrier in the bandwidth and polarization which the station plans to illuminate.

5.1.1 CENTRE FREQUENCY

Performance Objective:

RF Frequency Tolerance as $\pm 5\%$ of the bandwidth of the modulated carrier.

Test Procedure:

- Under the direction of the DINO, the customer's earth station shall transmit a clean carrier at transponder centre frequency as given by DINO and with an EIRP of at least 15 dB below nominal.

Note: The assigned frequency may deviate from the transponder centre frequency by several MHz. This is in order to have the cross-polar part of the transmitted carrier visible within the cross-polar transponder's frequency gap.

- Measure the frequency of the carrier on the spectrum analyser.

5.1.2 CROSS-POL

Performance Objective:

Cross-pol isolation of 30 dB for FSS transponders and 35 dB for BSS transponders.

Test Procedure:

- Under the direction of the DINO, increase the EIRP to around 6 dB below transponder saturation level.
- The DINO will observe the opposite polarization using the reference earth station. Adjust the spectrum analyser for maximum resolution and sensitivity in order to identify the cross-polar component of the earth station under test.
- Under the direction of the DINO, slowly rotate the antenna feed assembly in order to optimise the polarization.
- The uplink shall seal the polarization angle as nominal setting for operational use on the given satellite.

5.1.3 C/No MEASUREMENT

Performance Objective:

- C/No >96 dBHz measured on DINO reference earth station.

Test Procedure:

- The DINO will measure the C/No with the raised clean carrier.

5.1.4 NOMINAL UPLINK EIRP

Performance Objective:

EIRP achieving transponder saturation as instructed by DINO

Test Procedure:

- Bring down the clean carrier used for the tests under Sections 5.1.1 to 5.1.3.
- Confirm the correct nominal transmit frequency with the DINO and set it in the modulator. The nominal centre frequency could be different than the frequency used for the tests under Sections 5.1.1 to 5.1.3.
- At the earth station switch modulation on at a very low power. Make sure the modulator symbol rate is set according to the transponder to be used. (Typically 27.5 Msym/s for BSS33MHz, 22 Msym/s for FSS26MHz and 30Msym/s for FSS36MHz)

Note: Great care should be taken to set the transmission parameters correctly. In particular the selection of a wrong symbol rate may cause interference into neighbouring channels.

- At the earth station use a spectrum analyser to verify that the carrier is modulated correctly and that the modulated spectrum bandwidth is not exceeding the transponder bandwidth.
- Under the direction of the DINO, increase uplink EIRP in small increments until reaching the transponder saturation point. This will be the nominal uplink EIRP for the future use of the transponder and should be kept at that value unless otherwise required by the DINO.

5.2 RECEIVE EB/NO VERSUS BER

Purpose of the test:

To verify overall, clear sky, link performance and link margin using the DINO reference downlink.

Performance objectives:

With the DINO reference downlink, for a given FEC the required E_b/N_0 shall be higher or equal to²:

DVB-S	
ModCod	E_b/N_0
QPSK 1/2	5.5
QPSK 2/3	6.0
QPSK 3/4	6.5
QPSK 5/6	7.0
QPSK 7/8	7.4
8PSK 2/3	7.9
8PSK 5/6	9.9
8PSK 8/9	10.4
16QAM 3/4	10.0
16QAM 7/8	11.7

DVB-S2		
ModCod	E_b/N_0	Pilots
QPSK 1/4	0.9	OFF
QPSK 1/3	0.8	OFF
QPSK 2/5	0.9	OFF
QPSK 1/2	1.2	OFF
QPSK 3/5	1.8	OFF
QPSK 2/3	2.0	OFF
QPSK 3/4	2.5	OFF
QPSK 4/5	2.8	OFF
QPSK 5/6	3.2	OFF
QPSK 8/9	3.8	OFF
QPSK 9/10	4.1	OFF
8PSK 3/5	3.5	ON
8PSK 2/3	3.9	ON
8PSK 3/4	4.7	ON
8PSK 5/6	5.8	ON
8PSK 8/9	6.8	OFF
8PSK 9/10	7.0	OFF
16APSK 2/3	5.9	ON
16APSK 3/4	6.5	ON
16APSK 4/5	6.9	ON
16APSK 5/6	7.4	ON
16APSK 8/9	8.4	ON
16APSK 9/10	8.5	OFF
32APSK 3/4	8.4	ON
32APSK 4/5	9.2	ON
32APSK 5/6	9.8	ON
32APSK 8/9	11.6	ON
32APSK 9/10	12.1	ON

Test Equipment:

At the customer's earth station:

- a) Transport stream originating from multiplex and compression centre (normal operating conditions). Alternatively a DVB/MPEG Transport stream Generator may be used to simulate the signal from the multiplex and compression centre.

² The E_b/N_0 values shown for DVB-S and DVB-S2 represent IF-Loop measurements and as such are lower bounds on E_b/N_0 required. The operational values of E_b/N_0 that result in the desired link performance over the satellite link (e.g. a QEF condition) may be higher.

At the DINO:

- b) BER performance testing equipment.

Test Procedure:

- At the earth station, connect the transport stream signal to the modulator input to measure the link performance.
- Make sure the modulator symbol rate and FEC is set according to the service to be used.

Note: In some cases, as a means to run the test, the DINO might request the use of different parameters than the ones intended for the service.

CAUTION: Because this test is using a transport stream originating from the multiplex and compression centre, great care should be taken not to transmit any DVB SI data that could adversely affect (interfere) with other transmissions on the satellite(s).

- Under the direction of the DINO transmit carrier at nominal uplink EIRP as established in section 5.1.4. Verify that uplink EIRP is nominal.
- The DINO will perform the required measurements

5.3 TRANSPORT STREAM ANALYSIS

Purpose of the test:

This test will ensure that only valid Service Information is present in the SI/PSI tables in order to avoid interference with other DVB transmissions. Furthermore, the test will verify that all transport stream information is available in order to allow DVB compliant Integrated Receiver Decoders to correctly find and display services.

Performance objective:

Refer to the [DVB standard](#) specifications.

Test Equipment:

DVB/MPEG Transport Stream Analyser supporting DVB defined Priority Level Measurements (see ETSI ETR 290).

Test Procedure:

- At the customer earth station site, configure equipment for normal broadcasting ensuring DVB compliance and adherence to the SES NIT requirements.
- On the downlink side the DINO will perform the required measurements and record as appropriate.

5.4 CARRIER ID DECODING AND INFORMATION

The DINO will check for a Carrier ID on the customer's transmission, and update the SES records accordingly. If a CID is not detected on the transmission, SES may

enquire if the customer has modems with the DVB-CID capability, and request the customer to enable the CID signal.