

	<h1>Operation Change Request</h1>				OCR No: 049																																																							
					Issue: 3																																																							
Title: Tangent height Fine Tuning																																																												
Description of Request: OCR_048 modified several measurement parameters for SCIAMACHY measurement operations in the ENVISAT mission extension orbit. Some of them concerned ESM settings in the Basic Scan Profile table reflecting fixed altitudes. The uploaded new values had been derived based on simulations with the ENVISAT CFIs. Geolocation analysis revealed that the specified tangent heights for limb-type measurements are not fully achieved with the modified Basic Scan Profile angles and a fine-tuning is required.																																																												
<table border="1"> <thead> <tr> <th rowspan="3">State</th> <th colspan="2">Nominal Orbit</th> <th colspan="2">Nominal Orbit</th> <th colspan="2">Mission Extension Orbit</th> <th colspan="2">Mission Extension Orbit</th> </tr> <tr> <th>Start</th> <th>Stop</th> <th>Start</th> <th>Stop</th> <th>Start</th> <th>Stop</th> <th>Start</th> <th>Stop</th> </tr> <tr> <th colspan="2">Specified (km)</th> <th colspan="2">Executed (km)</th> <th colspan="2">Specified (km)</th> <th colspan="2">Executed (km)</th> </tr> </thead> <tbody> <tr> <td>limb (28-37,40,41)</td> <td>-6</td> <td>250</td> <td>-6,3</td> <td>264</td> <td>-3</td> <td>250</td> <td>-6,2</td> <td>270</td> </tr> <tr> <td>limb_mesosphere (27)</td> <td>153</td> <td>n.a.</td> <td>153,5</td> <td>n.a.</td> <td>153</td> <td>n.a.</td> <td>158,2</td> <td>n.a.</td> </tr> <tr> <td>mesosphere_thermosphere (55)</td> <td>153</td> <td>350</td> <td>153,3</td> <td>370</td> <td>153</td> <td>350</td> <td>158</td> <td>350</td> </tr> </tbody> </table>									State	Nominal Orbit		Nominal Orbit		Mission Extension Orbit		Mission Extension Orbit		Start	Stop	Start	Stop	Start	Stop	Start	Stop	Specified (km)		Executed (km)		Specified (km)		Executed (km)		limb (28-37,40,41)	-6	250	-6,3	264	-3	250	-6,2	270	limb_mesosphere (27)	153	n.a.	153,5	n.a.	153	n.a.	158,2	n.a.	mesosphere_thermosphere (55)	153	350	153,3	370	153	350	158	350
State	Nominal Orbit		Nominal Orbit		Mission Extension Orbit		Mission Extension Orbit																																																					
	Start	Stop	Start	Stop	Start	Stop	Start	Stop																																																				
	Specified (km)		Executed (km)		Specified (km)		Executed (km)																																																					
limb (28-37,40,41)	-6	250	-6,3	264	-3	250	-6,2	270																																																				
limb_mesosphere (27)	153	n.a.	153,5	n.a.	153	n.a.	158,2	n.a.																																																				
mesosphere_thermosphere (55)	153	350	153,3	370	153	350	158	350																																																				
Table 1: Specified and executed limb tangent heights in nominal and mission extension orbit. The start position refers to the first ESM pointing, i.e. the first horizontal scan is executed 1 step (3km) above (limb – first scan at 0 km) or below (limb_mesosphere, mesosphere_thermosphere – first scan at 153 km). Discussions with SSAG and SQWG concluded that the goal for the stop altitude should be to achieve the executed values (264km and 370 km) and not the specified ones.																																																												
Originator: M. Gottwald, E. Krieg, DLR-IMF			Date of Issue: 30/11/2010			Signature: M. Gottwald via email 30/11/2010																																																						
Assessment of SSAG/SQWG (necessary for requests by scientists): The topic was discussed at SSAG #41 and recommended for investigation. Option 1 (see SOST statement about implementation below) is recommended for implementation followed by L0 NRT verification and – if verification successful – permanent implementation asap.																																																												
SSAG: H. Bovensmann, IUP			Date: 1.12.2010			Signature: e-mail, 1.12.2010																																																						
Classification of OCR:																																																												

OCR Analysis (incl. Implementation Option):

Fine-tuning the limb tangent heights requires raising/lowering the start/stop altitudes, i.e. ESM Basic Scan settings for profiles

- 2 (limb – first scan at 0 km)
- 3 (pointing at 370 km)
- 5 (limb_mesosphere and limb_mesosphere_thermosphere – first scan at 150 km)
- 9 (pointing at 264 km)

Note profile 14 remains unchanged because the ESM setting is always overwritten by the parameters provided with the START TIMELINE MCMD.

	Angle_1km (°)	Δ Tangent Height (km)	LoS (°)	Scanner (10e-6 rad)
Profile 2 (ESM pointing at -3km)	0,017597629	3,2	-26,96588511	-235322
Profile 5 (ESM pointing at 153 km)	0,019557482	-5	-24,34108758	-212417
Profile 9 (ESM pointing at 264 km)	0,021490255	-6	-22,34050896	-194958
Profile 3 (ESM pointing at 370 km)	0,023658735	20	-19,51209867	-170276

Table 2: Required limb altitude corrections in mission extension orbit and resulting Basic Scan Profile angles.

The 4 updated scanner ESM settings shall be tested in several consecutive orbits. Two options are possible.

Option 1: Execute test for 4 orbits and afterwards return to current final flight settings. Permanent implementation would follow once the modified settings have been verified by NRT level 0 analysis. It has to be noted that the new value for profile 3 (370 km) cannot be part of this test provided it occurs prior to December 15th (the corresponding state 55 – *limb_mesosphere_thermosphere* – is only scheduled on December 15th). Since this limb altitude is the least critical, it would however be justified that the change from 350 km to 370 km would be made together with the potential permanent upload of the other three profile values.

Option 2: Execute test but leave the modified values on-board. Only when the NRT level 0 analysis has indicated that the updated values do not deliver the specified tangent heights, we return to the current final flight settings. In this case a more detailed analysis is required why the executed limb altitudes failed again.

SOST: M. Gottwald, E. Krieg, DLR-IMF (ESA, Industry if necessary)	Date: 30/11/2010	Signature: M. Gottwald via email 30/11/2010
---	------------------	--

Approval of Proposed Implementation:

Originator Approval: M. Gottwald, E. Krieg, DLR-IMF	Date: 30/11/2010	Signature: M. Gottwald via email 30/11/2010
--	------------------	--

SSAG Approval: H. Bovensmann, IUP	Date: 1.12.2010	Signature: H. Bovensmann via e-mail 1.12.2010
--------------------------------------	-----------------	--

Decision / Approval:

Option 1 (see SOST statement on implementation below) is approved for implementation followed by the appropriate verification. Permanent implementation will be decided in a new OCR if the change turns out to be successful. The discrepancy between specified altitude and executed altitude is to be monitored by SOST and further discussed with ESA and probably with industry.

DLR Approval: A. Friker (if necessary NIVR, SPEC)	Date: 01.12.2010	Signature: A. Friker via e-mail 01.12.2010
--	------------------	---

Implementation by SOST:

The proposed Basic Scan Profile test (option 1) requires changing measurement parameters only. Therefore it can be executed without modifying the schedule. Validity start time of the test settings is selected for December 8th starting in orbit 45865. In orbit 45869 the current final flight Basic Scan Profile is uploaded again.

SOST M. Gottwald/E. Krieg, DLR-IMF	Date: 2/12/2010	Signature: M. Gottwald via email 2/12/2010
---------------------------------------	-----------------	---

Annex: Modified Basic Scan Profile table

Basic Scan Profile ID	Azimuth		Elevation		Note: All positions are effective scanner positions. Conversion algorithms of H/W- constellation are not considered. All angular positions/rates are given in ASM/ESM scanner notation. Intended use
	Basic Scan Position 10-6 rad	Basic Scan Rate 10-6 rad/sec	Basic Scan Position 10-6 rad	Basic Scan Rate 10-6 rad/sec	
0	0000000000	000000	-0000261799	000000	ASM position IDLE ESM position IDLE
1	0000000000	000000	-0000794125	000000	ASM new unused position pointing into telescope, mirror not used ESM pointing in nadir direction (-z) - start position for nadir_pointing_left
2	-0000785398	000000	-0000235322	000000	ASM pointing in direction of velocity vector (-y) ESM pointing at an altitude of -3 km
3	-0000471239	000131	-0000170276	000000	ASM following trajectory of sun from position of sunrise ESM pointing at an altitude of 370 km
4	0003298672	-008145	0000986111	000000	ASM_Diffuser_1 - starting position +9 deg diffuser normal ESM pointing to mean sun elevation within sub-solar window
5	-0001003564	-000174	-0000212417	000000	ASM following moon trajectory from mean position of the full moon (245 deg) - currently unused ESM pointing at an altitude of 153 km
6	-0000468621	000131	0002879793	000000	ASM following sun trajectory ESM difusor in fixed ESM pos. of 180-15 deg - timing required for normal incidence of sun on ESM
7	-0006283185	000000	-0006283185	000000	ASM position for 360 deg revolution of scanner bearings ESM position for 360 deg revolution of scanner bearings
8	-0000468621	000131	0000570714	000222	ASM following sun trajectory ESM following sun via extra_mirror with half angular velocity from start at 150 km above horizon
9	-0000785398	000000	-0000194958	000000	ASM pointing in direction of velocity vector (-y) ESM pointing at an altitude of 264 km
10	0003263766	-008145	0000170480	000000	ASM_Diffuser_2 - starting position +7 deg diffuser normal; ASM_diffuser_atmosphere ESM pointing to SLS (9.768 deg)
11	0003228859	-008145	0003319617	000000	ASM_Diffuser_3 - starting position +5 deg diffuser normal ESM pointing difusor to internal calibration sources (10.2 + 180 deg)
12	0003193953	-008145	0000183658	000000	ASM_Diffuser_4 - starting position +3 deg diffuser normal ESM pointing to WLS (10.523 deg)
13	0003159046	-008145	0000186279	000000	ASM_Diffuser_5 - starting position +1 deg diffuser normal* ESM pointing to WLS under non-optimal angle (10.673 deg)
14	-0000471239	000227	-0000233153	000000	ASM following trajectory of sun from position of sunrise ESM pointing at an altitude of 17.2 km