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## **Compatibility Test First Part MARSIS Active / SC X-Band On**

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### **1 INTRODUCTION**

The aim of this document is a brief description of the impact on the MARSIS science performances during the X-Transmitter On of the SC. This study was carried out both on the Ionosphere and Sub Surface Science analysis.

Due to a large number of missing packets on the Flash Memory timeline, executed in the same orbit of the X-Tx test, it hasn't been possible to investigate also on the FM science performance; at this point we would not be able to conclusively assess that the missing packets have been caused by the X Band ON, since anomalies similar to this are occasionally present.

In order to study and understand the possible anomalies of the X-Band On of the SC during the MARSIS operations we have analyzed two adjacent observations in the same area, 11 orbits before and 11 orbits after the compatibility test.

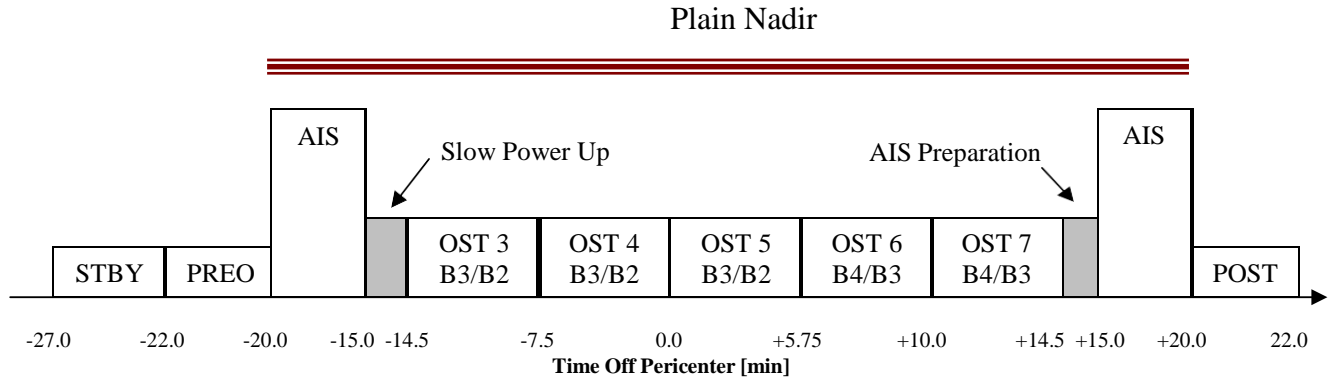


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## 2 ORBIT ENVIRONMENTAL CONFIGURATION

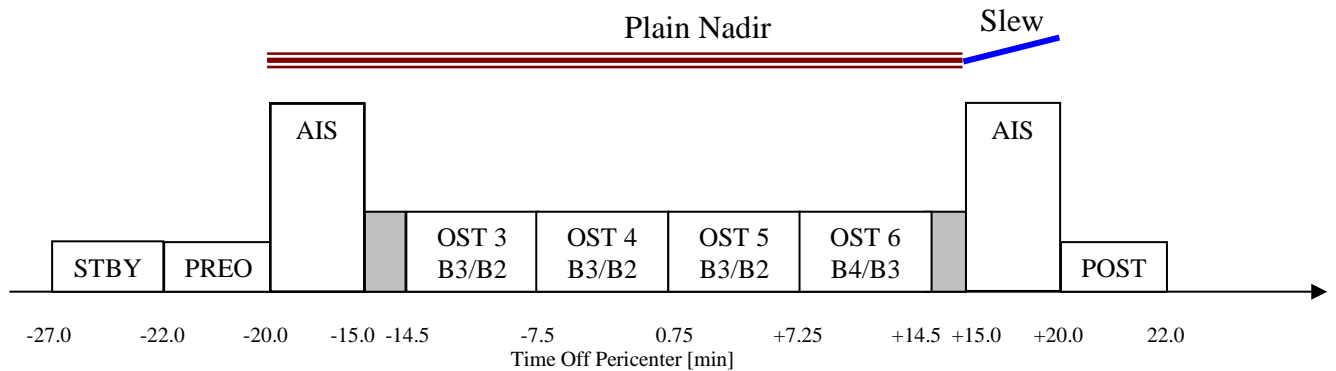
### 2.1 Orbit 3773 (Adjacent Observation, 11 orbit before the Test)

Pericenter data: 15 – December -06, T 04:40:48 UTC



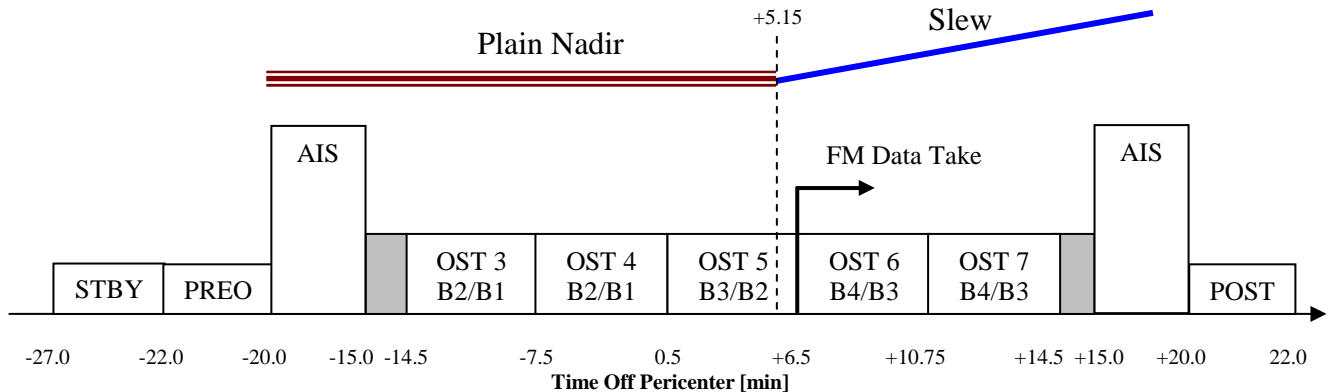
### 2.2 Orbit 3795 (Adjacent Observation, 11 Orbits after the test)

Pericenter data: 21 – December -06, T 08:31:36 UTC



### 2.3 Orbit 3784 (Compatibility Test)

Pericenter data: 18 – December -06, T 06:36:10 UTC





### 3 SUB SURFACE SCIENCE RESULTS

#### 3.1 Orbit 3773 (Adjacent Observation, 11 Orbits before the test)

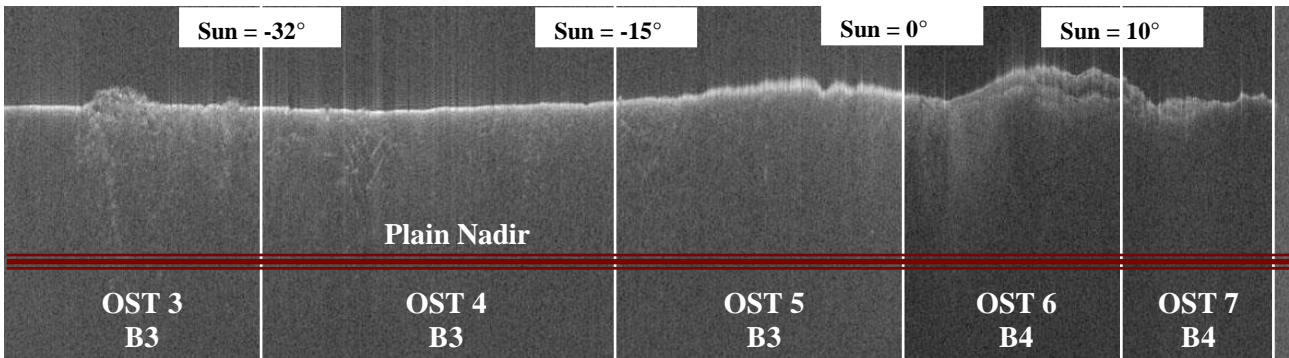


Fig. 3.1.1 (MARSIS Radargram, first Tx Bands)

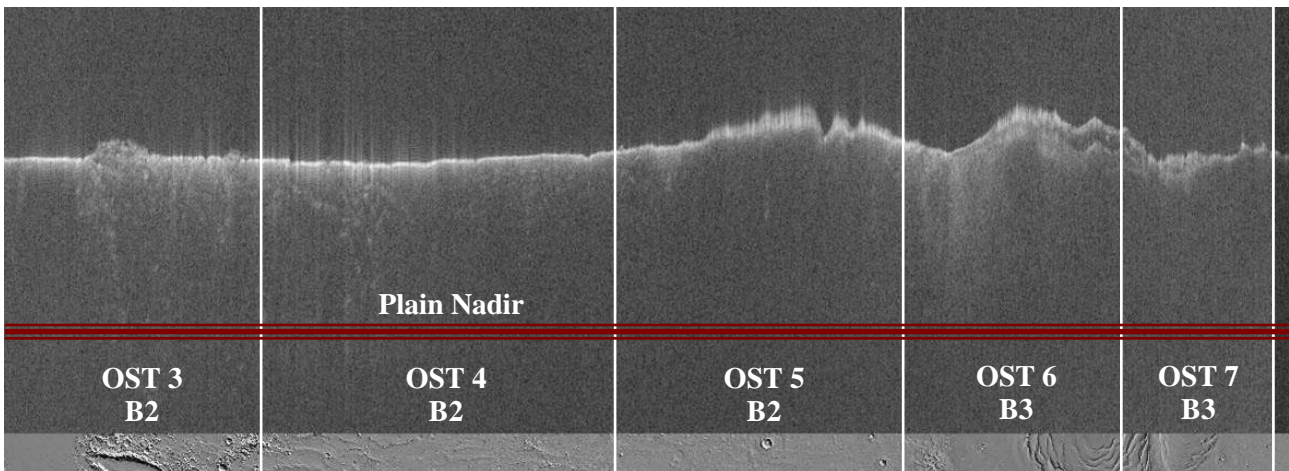


Fig. 3.1.2 (MARSIS Radargram, second Tx Bands)

The performances of MARSIS are standard until the OST line 4, for both the transmitted bands. It is well evident a small degradation of the SNR and the spatial resolution starting from the OST line 5, second transmitted band (Fig. 3.1.2), caused by the sun ionization of the upper ionosphere layer. In the OST lines: 6 and 7, for both the Radar Bands, it is shown the behavior of the Northern Polar Cap, it is also evident the bottom of the Cap.

### 3.2 Orbit 3795 (Adjacent Orbit, 11 Orbits after the test)

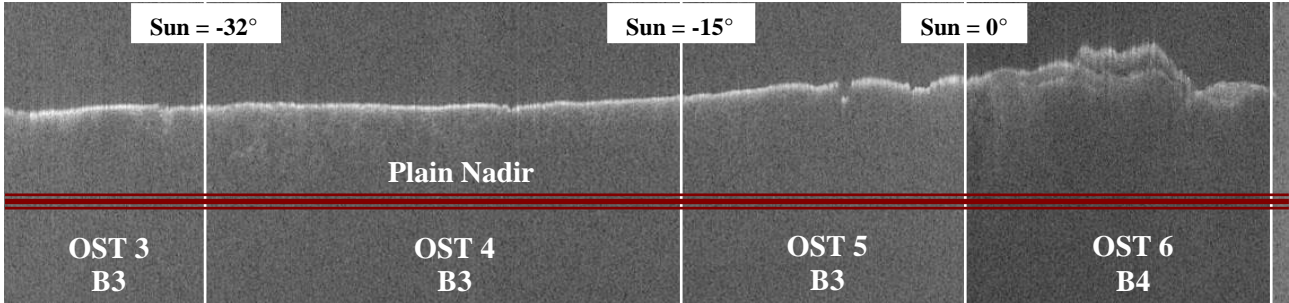


Fig. 3.3.1 (MARSIS Radargram, first Tx Bands)

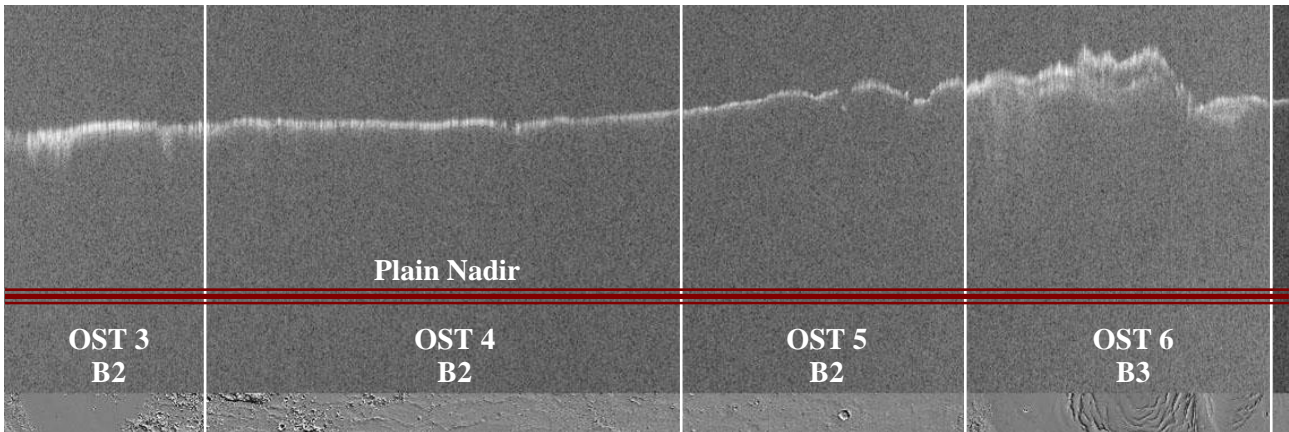


Fig. 3.3.2 (MARSIS Radargram, first Tx Bands)

MARIS performance is standard until the OST line 5, first transmitted bands (Fig. 3.3.1) and for the OST lines: 4, 5 second transmitted bands (Fig. 3.3.2).

A degradation of the SNR and the spatial resolution have been detected in the OST line 6, first transmitted band (Fig. 3.3.1) and in the OST lines: 3 and 6, second transmitted bands (Fig. 3.3.2).

The loss of performance has been caused by the ionization of the upper ionosphere layer.

The OST line 3, Band 2 (Fig. 3.3.2) presents a strong degradation of the performances due to the combination of the surface topography and the ionization of the upper ionosphere layer.

### 3.3 Orbit 3784 (Compatibility Test)

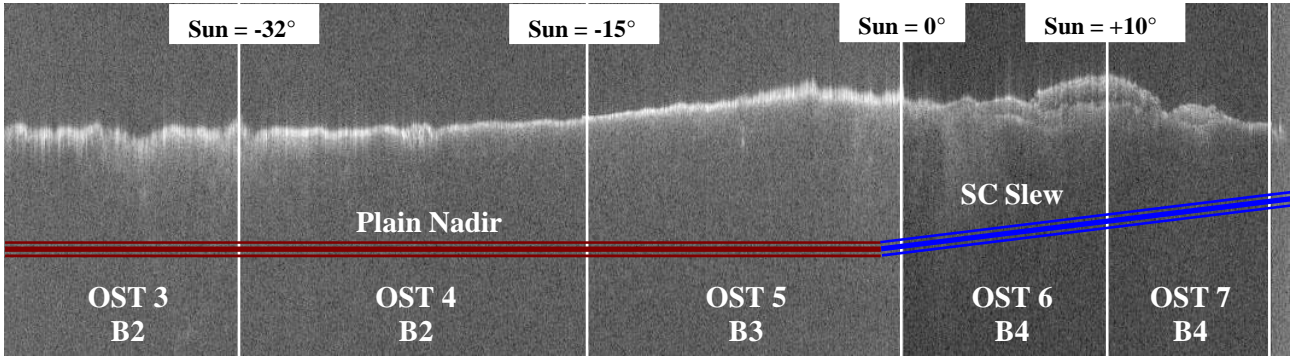


Fig. 3.2.1 (MARSIS Radargram, first Tx Bands)

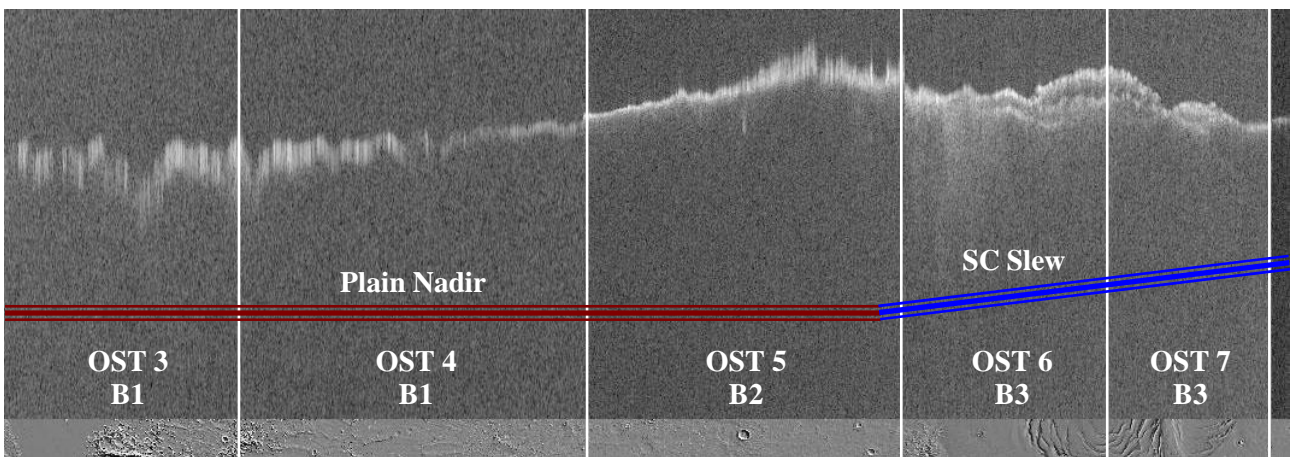


Fig. 3.2.2 (MARSIS Radargram, first Tx Bands)

In all the OST lines, for both the Radar channels; there is present a strong component of the noise figure that has affected the whole observation.

The phenomena is much evident in the OST lines: 3 and 4 of the second transmitted Bands (Fig. 3.3.2). In fact, the Radar Band 1 is more sensitive to the environmental condition and in particular to the upper ionosphere layer also in the deepest night side.

In the OST line 6 for both the Radar bands, the loss of performances have been probably caused by a combination of the upper ionosphere layer, the SC slew and the X-Band On of the SC's transmitter.



## 4 ACTIVE IONOSPHERIC SCIENCE ANALYSIS

### 4.1 Orbit 3773 (Adjacent Observation, 11 orbit before the Test)

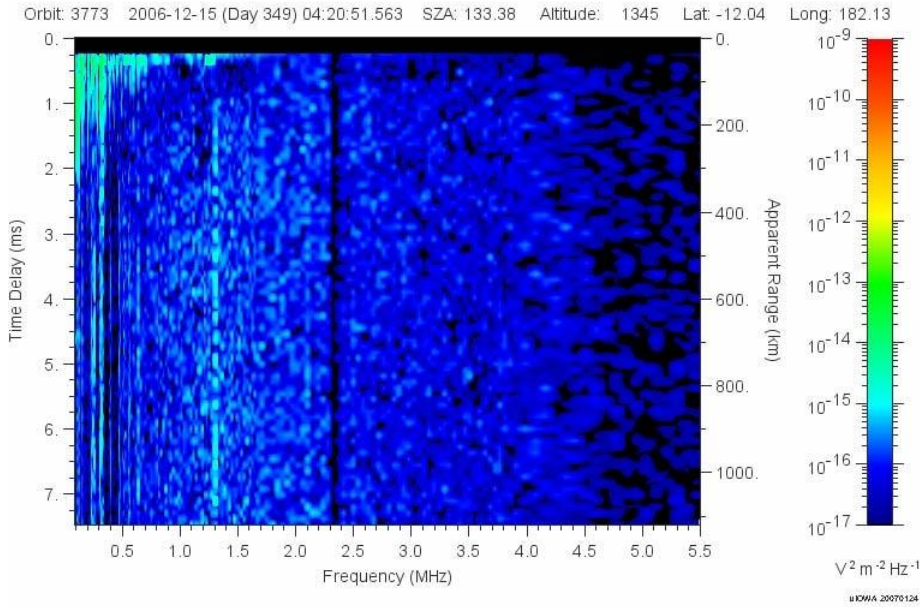


Fig. 4.1.1 (MARSIS AIS Ionogram, Orbit 3773)

### 4.2 Orbit 3795 (Adjacent Observation, 11 orbit after the Test)

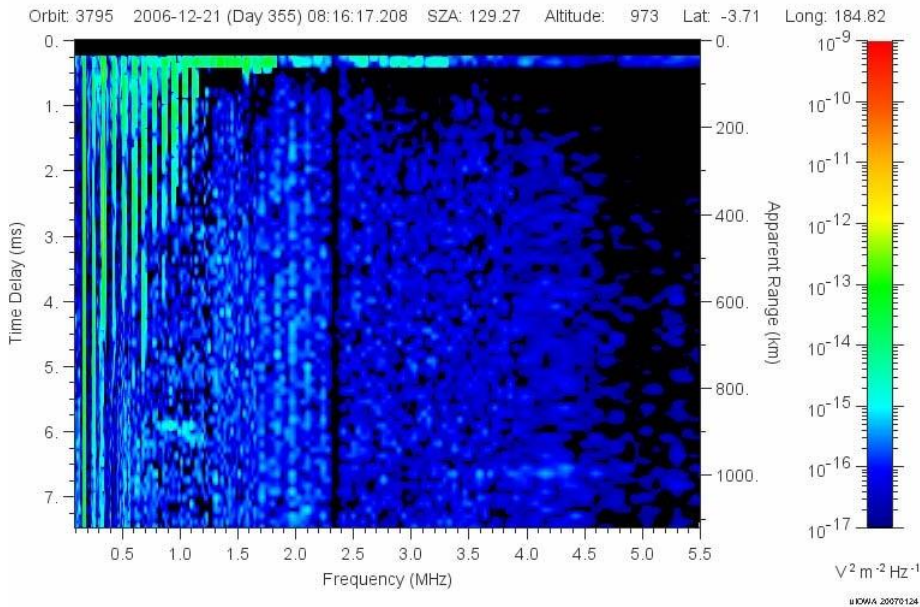


Fig. 4.2.1 (MARSIS AIS Ionogram, Orbit 3795)



### 4.3 Orbit 3784 (Compatibility Test)

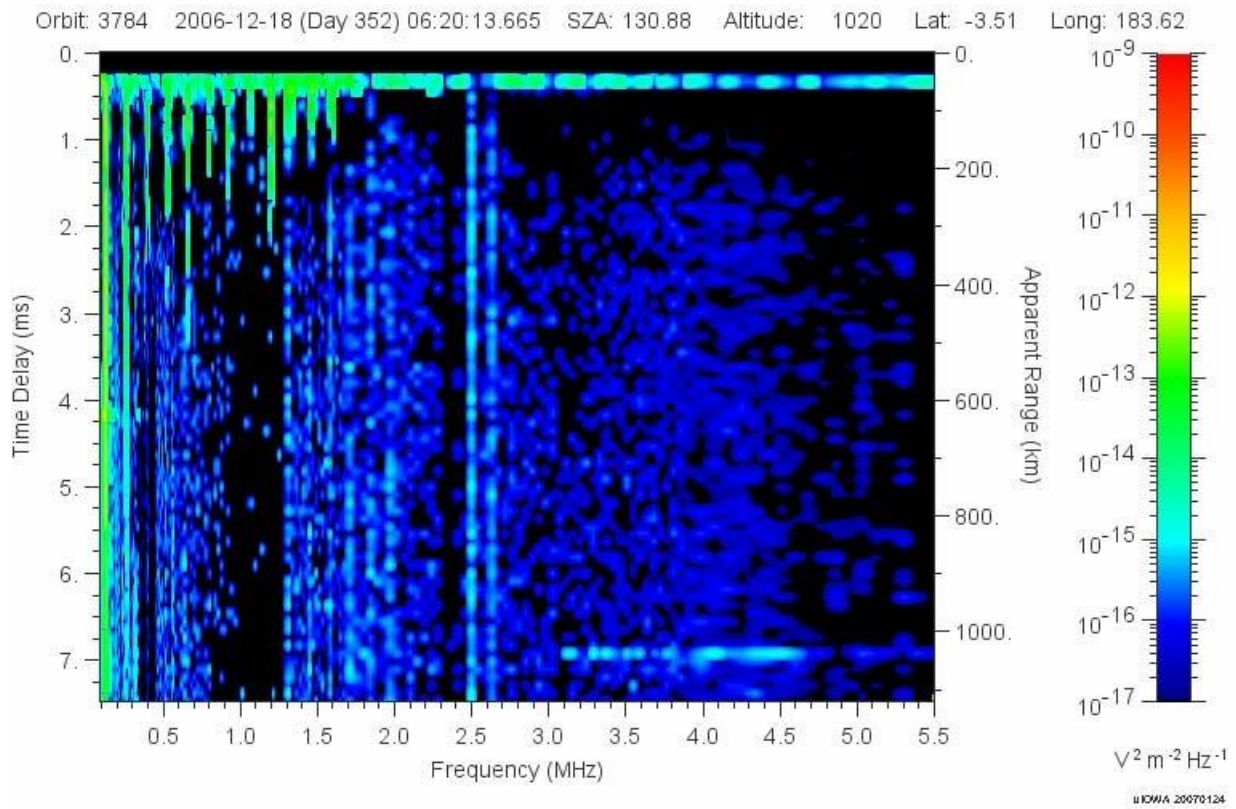


Fig. 4.3.1 (MARSIS AIS Ionogram, Orbit 3784)

There are a couple of lines that show up around 2.5MHz (Fig. 4.3.1) that are not present during other time periods (Fig. 4.1.1) and (Fig. 4.2.1). Interference similar to this is occasionally present.



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## **5 CONCLUSIONS**

The X-Band On of the SC may have slightly affected the MARSIS science performance in SSX mode (Sub Surface Sounding mode) in the loss of SNR (Signal To Noise Rate).

There has also been detected a frequency line of about 2.5 MHz during the AIS mode (Active Ionosphere Sounding mode) typically not present during the past observations.

Concluding, the interferences detected in SSX and AIS modes are not damaging, in general, the MARSIS Science Performances and we don't have concerns about the simultaneous operation of MARSIS and the X-band of the SC.