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Summary Report of Mission Acceleration Measurements for STS-87

Launched November 19, 1997

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January 1999

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Abstract

Two accelerometer systems, the Orbital Acceleration Research Experiment and the Space Acceleration Measurement System, were used to measure and record the microgravity environment of the Orbiter Columbia during the STS-87 mission in November-December 1997. Data from two separate Space Acceleration Measurement System units were telemetered to the ground during the mission and data plots were displayed for investigators of the Fourth United States Microgravity Payload experiments in near real-time using the World Wide Web. Plots generated using Orbital Acceleration Research Experiment data (telemetered to the ground using a tape delay) were provided to the investigators using the World Wide Web approximately twelve hours after data recording.

Disturbances in the microgravity environment as recorded by these instruments are grouped by source type: Orbiter systems, on-board activities, payload operations, and unknown sources. The environment related to the Ku-band antenna dither, Orbiter structural modes, attitude deadband collapses, water dump operations, crew sleep, and crew exercise was comparable to the effects of these sources on previous Orbiter missions. Disturbances related to operations of the Isothermal Dendritic Growth Experiment and Space Acceleration Measurement Systems that were not observed on previous missions are detailed. The effects of Orbiter cabin and airlock depressurization and extravehicular activities are also reported for the first time. A set of data plots representing the entire mission is included in the CD-ROM version of this report.

Acronyms and Abbreviations

AADSF	Advanced Automated Directional Solidification Furnace
AZ	azimuth
CHeX	Confined Helium Experiment
CUE	Collaborative Ukranian Experiments
DAP	Digital Auto Pilot
EDFT	Extravehicular Activity Demonstration Flight Test
EL	elevation
ELF	Enclosed Laminar Flames
EVA	extravehicular activity
g_{RMS}	root-mean-square acceleration
IDGE	Isothermal Dendritic Growth Experiment
LHP/NaSBE	Looped Heat Pipe and Sodium Sulphur Battery Experiment
MAWS	Microgravity Analysis Workstation
MEPHISTO	Materials for the Study of Interesting Phenomena of Solidification on Earth and in Orbit
MET	Mission Elapsed Time
MEWS	Mission Evaluation Workstation System
MPESS	Mission Peculiar Experiment Support Structure
MSID	Measurement Stimulus Identifier
OARE	Orbital Acceleration Research Experiment
PAO	Public Affairs Office
PCIS	Passive Cycle Isolation System
PEP	Particle Engulfment and Pushing by a Solid/Liquid Interface
PIMS	Principal Investigator Microgravity Services
PRCS	Primary Reaction Control System
PSD	power spectral density
QTH	Quasi-Steady Three-Dimensional Histogram
RMS	root-mean-square
RSS	root-sum-of-squares
SAMS	Space Acceleration Measurement System
SIMPLEX	Shuttle Ionospheric Modification with Pulsed Local Exhaust
SOLSE	Shuttle Ozone Limb Sounding Experiment
TGDF	Turbulent Gas-Jet Diffusion Flames
TSH	Triaxial Sensor Head
USMP-4	Fourth United States Microgravity Payload
VM	vector magnitude
VRCS	Vernier Reaction Control System
WCI	Wetting Characteristics of Immiscibles
WWW	World Wide Web
X_b, Y_b, Z_b	Orbiter body coordinate system axes
X_O, Y_O, Z_O	Orbiter structural coordinate system axes

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1. Introduction

The STS-87 mission launched on the Space Shuttle Orbiter Columbia at 1997/323/19:46:00 Greenwich Mean Time, which corresponds to Eastern Standard Time 14:46 on 19 November 1997. Wheel stop upon landing was at 1997/339/12:21:02 Greenwich Mean Time. In addition to Greenwich Mean Time, the timing convention typically used on Orbiter missions is Mission Elapsed Time (MET). This timing system provides a measure of time elapsed since launch in days/hours:minutes:seconds. For STS-87, wheel stop occurred at MET 015/16:35:02. The payloads manifested on this mission include the microgravity experiments of the Fourth United States Microgravity Payload (USMP-4): three materials science experiments growing semiconductor crystals in the Advanced Automated Directional Solidification Furnace (AADSF); a fundamental physics investigation called the Confined Helium Experiment (CHeX); a study geared towards an improved understanding of the growth of metals, the Isothermal Dendritic Growth Experiment (IDGE); a semiconductor crystal growth experiment in the French furnace MEPHISTO; combustion science studies of Enclosed Laminar Flames (ELF); materials science investigations into Particle Engulfment and Pushing by a Solid/Liquid Interface (PEP) and the Wetting Characteristics of Immiscibles (WCI); and two accelerometer systems, the Orbital Acceleration Research Experiment (OARE) and the Space Acceleration Measurement System (SAMS).

One common characteristic of these experiments is that various effects of gravity make it difficult, if not impossible, to achieve usable results when performing the experiments on Earth's surface. Therefore, the investigators have taken advantage of the microgravity environment afforded by being in low-Earth orbit to perform their research. Interpretation of the experiment results both during the mission and upon post-mission analyses of data and samples requires an understanding of the microgravity environment in which the experiments were conducted.

This report provides the experiment teams with a post-mission interpretation of the accelerometer data collected during the mission. The data files, processed into engineering units, are available on the Internet; see Appendix A for data access instructions. It is such accelerometer data, combined with an assessment of mission and experiment activities, that permits a characterization of the microgravity environment that existed on Columbia during the mission. The text herein gives details about some characteristics of the environment that were noted during the mission and during post-mission data analysis. For example, the disturbances studied include the Ku-band antenna 17 Hz dither; the effect of changing the Orbiter attitude deadband limits; the effects of different bicycle ergometer configurations; the environment related to different Orbiter attitudes; and the effect of IDGE experiment fans and SAMS computer hard drives. The enclosed CD-ROM contains the text of this report, plots of accelerometer data collected during STS-87, and previous reports discussing the environment experienced by the second and third USMP payloads [1,2]. The data plots give an overview of the environment during the majority of the mission. The plots, which are included on the CD-ROM as Appendices B, C, D, E, and supplementary spectrograms plotted out to the Nyquist frequencies for all SAMS sensor heads collecting data during the mission, are also useful for identifying times when specific disturbances were apparent.

2. Mission Configuration

In addition to USMP-4, several other payloads were included on the STS-87 flight, see Table 1. The Extravehicular Activity Demonstration Flight Test (EDFT) and the Spartan satellite deploy and retrieval were of particular interest to the USMP-4 investigators because there was a possibility that these activities would impact the timeline assigned to USMP-4, thus also impacting the microgravity environment. The AADSF, CHeX, IDGE, MEPHISTO, and SAMS USMP-4 experiments were located in the payload bay of Columbia on two Mission Peculiar Experiment Support Structures (MPESS). The Spartan satellite and the equipment for the EDFT were also located in the payload bay, as were several experiments on a Hitchhiker platform. Figure 1 is a schematic of the payload bay which gives an indication of the approximate locations of the USMP-4 experiments. The OARE was attached to the keel bridge of Columbia, underneath the other USMP-4 experiments, see Figure 2. Within the middeck, the crew performed the USMP-4 investigations ELF, PEP, and WCI in the Middeck Glovebox Facility. The plant growth investigations of the Collaborative Ukrainian Experiment were also conducted within the middeck. The crew exercised on a bicycle ergometer located in the flight deck, attached to the floor so that the long axis of the bicycle was aligned with the Orbiter X_O-axis. The STS-87 crew members are listed in Table 2.

Table 1. STS-87 Payloads

Payloads	Location
Fourth United States Microgravity Payload (USMP-4)	Payload Bay
Extravehicular Activity Demonstration Flight Test (EDFT-05)	Payload Bay
Spartan 201-04	Payload Bay
Middeck Glovebox	Middeck
Looped Heat Pipe and Sodium Sulphur Battery Experiment (LHP/NaSBE)	Hitchhiker-Payload Bay
Turbulent Gas-Jet Diffusion Flames (TGDF)	Gas Canister-Payload Bay
Shuttle Ozone Limb Sounding Experiment (SOLSE)	Payload Bay
GAS G-036	Payload Bay
Collaborative Ukranian Experiments (CUE)	Middeck
AERCam/Sprint	Freeflyer
Shuttle Ionospheric Modification with Pulsed Local Exhaust (SIMPLEX)	Middeck

Table 2. STS-87 Crew

Crewmember	Position
Kevin R. Kregel	Commander
Steven W. Lindsey	Pilot
Kalpana Chawla	Mission Specialist 1
Winston E. Scott	Mission Specialist 2
Takao Doi	Mission Specialist 3
Leonid K. Kadenyuk	Payload Specialist 1

Several of the payload bay USMP-4 experiments were started at the beginning of the mission. The remaining experiments were initiated when the primary microgravity time started at approximately MET 005/12:00. During the designated microgravity period, the crew and Orbiter control teams attempted to maintain a quiet microgravity environment. Prior to that time, the Spartan satellite deploy and retrieval and EDFT activities occurred. The Spartan satellite was deployed using the Orbiter Remote Manipulator System, with initial grapple of the satellite at MET 001/23:46. A deploy situation resulting in an uncontrolled tumbling of the satellite resulted in replanning of the mission timeline. The satellite was captured and returned to the payload bay by two crew members during an extravehicular activity (EVA) at about MET 005/07:40. A portion of the EDFT was run following the satellite stow until about MET 005/11. IDGE, Middeck Glovebox microgravity investigations, CUE operations, and Hitchhiker experiments were performed throughout the mission. A redeployment of the Spartan and additional EDFT activities occurred late in the mission. Times for several activities that were of interest to the microgravity scientists are listed in Table 3. Appendix F, available on the report CD-ROM, is a copy of the logbook kept by the Principal Investigator Microgravity Services (PIMS) team during the mission. Numerous events of interest are indicated there. Figure 3 gives an overview of the timing of major mission events.

3. Acceleration Measurement Program Support of USMP-4

The Microgravity Research Program's Acceleration Measurement Program is based at the NASA Lewis Research Center. This program provides microgravity investigators with accelerometer systems, acceleration data analysis, and carrier microgravity environment characterization.

3.1 Accelerometer Systems on USMP-4

Two types of accelerometer systems were included in the USMP-4 contingent to provide the experiments with a characterization of the microgravity environment of Columbia during the STS-87 mission. Two SAMS units were located on the MPESS. These units recorded and downlinked in near real-time acceleration data in the 0.01 Hz to 100 Hz range in support of the AADSF, MEPHISTO, CHeX, and IDGE experiments. This frequency range is mostly affected by vibrations

due to the operation of Orbiter and experiment apparatus and by crew activity. More information about the SAMS is available in the literature [1-7] and details about the specific configuration of the two SAMS units on STS-87 are provided in Table 4. SAMS Unit G, Triaxial Sensor Head (TSH) C was activated during the mission, but set to a scientifically insignificant data sampling rate because of data downlink restrictions. The SAMS data are reported here in terms of the Orbiter structural coordinate system and the reference frame used is such that a forward thrust of the Orbiter is recorded as a negative X_0 acceleration.

Table 3. Activities of Interest to Microgravity Scientists

EVENT	MSID	MET	GMT
PAYLOAD BAY DOOR OPEN	V37X3300Y V37X3305Y	000/01:29:42 000/01:31:02	323:21:15:42 323:21:17:02
SPARTAN GRAPPLE	V54X2027J	001/23:46:13	325:19:32:13
SPARTAN UNBERTH	V54X8131E	002/00:19:45	325:20:05:45
SPARTAN RELEASE	V54X2027J	002/01:18:37	325:21:04:37
SPARTAN RE-GRAPPLE	V54X2034J	002/01:24:37	325:21:10:37
STARBOARD RADIATOR DEPLOY	V37X3510E	003/09:51:42	327:05:37:42
CABIN DEPRESSURIZATION (END)	V64P2405A	004/09:34:42	328:05:20:42
STARBOARD RADIATOR STOW	V37X3548E	005/00:54:28	328:20:40:28
ORBITAL MANEUVERING SYSTEM 3 IGNITION	V43H4655C V43H5655C	N/A 005/01:33:33	N/A 328:21:19:33
ORBITAL MANEUVERING SYSTEM 3 CUTOFF	V43H4655C V43H5655C	N/A 005/01:33:48	N/A 328:21:19:48
ORBITAL MANEUVERING SYSTEM IGNITION	V43H4655C V43H5655C	005/03:04:38 N/A	328:22:50:38 N/A
ORBITAL MANEUVERING SYSTEM CUTOFF	V43H4655C V43H5655C	005/03:04:50 N/A	328:22:50:50 N/A
AIRLOCK DEPRESSURIZATION (END)	V64P0101A	005/03:56:25	328:23:42:25
CABIN REPRESSURIZATION (START)	V64P2405A	005/04:15:54	329:00:01:54
SPARTAN GRAPPLE	V54X2027J	005/06:52:50	329:02:38:50
SPARTAN BERTH	V54X8135E	005/07:37:09	329:03:23:09
SPARTAN LATCH	V54X8144E	005/07:37:09	329:03:23:09
SPARTAN UNGRAPPLE	V54X2027J	005/07:40:24	329:03:26:24
AIRLOCK REPRESSURIZATION (START)	V64PO101A	005/11:59:40	329:07:45:40
PORTSIDE RADIATOR DEPLOY	V37X3501E	007/03:43:57	330:23:29:57
PORTSIDE RADIATOR STOW	V37X3505E	010/07:48:56	334:03:34:56
STARBOARD RADIATOR DEPLOY	V37X3511E	010/20:38:42	334:16:24:42
PORTSIDE RADIATOR DEPLOY	V37X3500E	012/14:35:06	336:10:21:06
CABIN DEPRESSURIZATION (END)	V61P2405A	012/19:31:30	336:15:17:30
STARBOARD RADIATOR STOW	V37X3563E	012/19:44:18	336:15:30:18
PORTSIDE RADIATOR STOW	V37X3543E	012/19:44:55	336:15:30:55
SPARTAN GRAPPLE	V54X2027J	013/08:56:53	337:04:42:53
SPARTAN UNBERTH	V54X8131E	013/09:10:19	337:04:56:19
SPARTAN BERTH	V54X8136E	013/13:25:27	337:09:11:27
SPARTAN LATCH	V54X8144E	013/13:26:02	337:09:12:02
SPARTAN UNGRAPPLE	V54X2027J	013/13:28:54	337:09:14:54
CABIN REPRESSURIZATION (START)	V64P2405A	013/13:24:49	337:09:10:49
AIRLOCK DEPRESSURIZATION (END)	V64P0101A	013/13:25:05	337:09:11:05
AIRLOCK REPRESSURIZATION (START)	V64P0101A	013/18:22:24	337:14:08:24
FLIGHT CONTROL SYSTEM CHECKOUT -AUXILIARY POWER UNIT START	V46P0320A	014/14:05:24	338:09:51:24
AUXILIARY POWER UNIT STOP	V46P0320A	014/14:17:21	338:10:03:21
PAYLOAD BAY DOOR CLOSE	V37X3307Y V37X3302Y	015/12:53:10 015/12:56:16	339:08:39:10 339:08:42:16
AUXILIARY POWER UNIT ACTIVATION	V46P0220A V46P0120A V46P0320A	015/15:30:35 015/15:49:26 015/15:49:33	339:11:16:35 339:11:35:26 339:11:35:33
DEORBIT BURN	V43H4655C V43H5655C	015/15:35:28 015/15:35:28	339:11:21:28 339:11:21:28
DEORBIT BURN CUTOFF	V43H4655C V43H5655C	015/15:38:00 015/15:38:00	339:11:24:00 339:11:24:00

Table 4. STS-87 SAMS Sensor Head Orientations and Locations

Unit F TSH A Serial no.: 047-1 Location: Forward MPESS carrier (near AADSF)		Sample Rate: 50 samples/second Frequency: 10 Hz
ORIENTATION		**LOCATION**
Orbiter Structural Axis	**Sensor Axis**	**Structural Axis**
X_O	$-Y_H$	X_O = 987.69 in
Y_O	$+Z_H$	Y_O = 3.94 in
Z_O	$-X_H$	Z_O = 416.76 in

Unit F TSH B Serial no.: 047-3 Location: Forward MPESS carrier (near MEPHISTO)		Sample Rate: 125 samples/second Frequency: 25 Hz
ORIENTATION		**LOCATION**
Orbiter Structural Axis	**Sensor Axis**	**Structural Axis**
X_O	$-Y_H$	X_O = 987.69 in
Y_O	$+Z_H$	Y_O = -4.31 in
Z_O	$-X_H$	Z_O = 416.76 in

Unit G TSH A Serial no.: 821-46 Location: Rear MPESS carrier (inside IDGE)		Sample Rate: 50 samples/second Frequency: 5 Hz
ORIENTATION		**LOCATION**
Orbiter Structural Axis	**Sensor Axis**	**Structural Axis**
X_O	$+Z_H$	X_O = 1083.77 in
Y_O	$-.7071X_H + .7071Y_H$	Y_O = -37.08 in
Z_O	$-.7071X_H - .7071Y_H$	Z_O = 442.82 in

Unit G TSH B Serial no.: 821-45 Location: Rear carrier (inside CHeX)		Sample Rate: 250 samples/second Frequency: 100 Hz
ORIENTATION		**LOCATION**
Orbiter Structural Axis	**Sensor Axis**	**Structural Axis**
X_O	$+.5446X_H + .8387Z_H$	X_O = 1069.52 in
Y_O	$+Y_H$	Y_O = 29.52 in
Z_O	$-.8387X_H + .5446Z_H$	Z_O = 442.51 in

During post-mission analyses for MEPHISTO in which long series of SAMS Unit F, TSH A data were processed, it became evident that this TSH's acceleration data erroneously tracked the sensor temperature data. This problem is most evident in the lowest frequency regime of the data. Throughout the mission, the Orbiter was commanded to a number of different attitudes, which resulted in different temperature profiles. For those with large temperature variations (over the course of an orbit), the acceleration data manifests this problem most noticeably. For other periods of relatively small temperature swings, the problem is less obvious. The analyses performed for this report were done before this problem was noticed, but the analysis results were subsequently examined to assure that this problem was properly accounted for.

The OARE measures the quasi-steady acceleration environment of the Orbiter Columbia. The OARE was mounted to the floor of Columbia's cargo bay on a keel bridge, close to the Orbiter center of mass in the Orbiter X_0 - and Y_0 -axes. The location and orientation of the sensor with respect to the Orbiter structural coordinate system are given in Table 5. The quasi-steady microgravity environment is affected by aerodynamic drag on the Orbiter, gravity gradient effects, rotational motion of the Orbiter about its center of mass, maneuvering of the Orbiter, venting of water and air from the Orbiter, and crew activity. More information about OARE is available in references [8-11]. On STS-87, the OARE was configured such that data were recorded on-board the Orbiter and sent down to the ground periodically. The data are reported in terms of the Orbiter body coordinate system with a frame of reference fixed to the Orbiter, such that a forward thrust of the Orbiter (for example, during an Orbital Maneuvering System burn) is recorded as a negative X_b-axis acceleration because a free particle would appear to translate in the negative X_b-axis direction relative to the Orbiter.

The OARE was designed to measure quasi-steady accelerations from below 1×10^{-8} g up to 2.5×10^{-3} g. The OARE consists of an electrostatically suspended proof mass sensor, an in-flight calibration subsystem, and a microprocessor which is used for in-flight experiment control, processing, and storage of flight data. In support of USMP-4 experiments, the sensor output acceleration signal was filtered with a Bessel filter with a cutoff frequency of 1 Hz. The output signal was digitized at 10 samples per second and was processed and digitally filtered with an adaptive trimmean filter prior to electronic storage.

Table 5. STS-87 OARE Sensor Head Orientation and Location

OARE Sensor		Sample Rate: 10 samples/second
Location: Orbiter Cargo Bay Keel Bridge		Frequency: 0 to 1 Hz
ORIENTATION		**LOCATION**
Orbiter Structural Axis	**Sensor Axis**	**Structural Axis**
X_O	$-X_{OARE}$	X_O = 1153.3 in
Y_O	Z_{OARE}	Y_O = -1.3 in
Z_O	Y_{OARE}	Z_O = 317.8 in

OARE data are available from MET 00/00:11 through sensor saturation at MET 015/14:34 during Orbiter re-entry. Appendix A describes how these data can be accessed through the Internet.

3.2 Accelerometer Data Flow During STS-87

The PIMS team is tasked to characterize the microgravity environment of spacecraft and other carriers used by NASA Microgravity Research Program investigators. Prior to flight, PIMS talked to USMP-4 project scientists and principal investigators in an effort to understand the nature of acceleration data support required for real-time, near real-time, and post-mission analysis. These inquiries resulted in identification of the accelerometer systems, the frequency characteristics of the SAMS sensor heads, the real-time plot formats, and near real-time plot formats to be used in support of the USMP-4 experiments. A combination of each of these items would allow the best correlation between acceleration events and experiment science data.

Real-time support of the science teams was accomplished exclusively using SAMS data. Throughout the mission, PIMS received real-time downlink data from both SAMS units, converted the raw SAMS telemetry frame to engineering unit data, and generated data plots in the format requested pre-mission by the USMP-4 principal investigators. Periodic updates to the plotted images were made available approximately every two minutes through the PIMS USMP-4 World Wide Web (WWW) page.

The plot types developed by PIMS for Unit G, TSH B real-time data were driven specifically by the CHeX experiment team. Throughout the entire USMP-4 segment of the mission, the CHeX team requested plots of real-time acceleration versus time, interval maximum absolute value acceleration versus time, power spectral density, color spectrograms, and g_{RMS} versus time (for three frequency bands specified by CHeX). The plot types displayed using the Unit F, TSH A real-time data were acceleration versus time and color spectrograms. PIMS selected these plots as a compromise among varied plot type requests for the Unit F, TSH A data.

The unprocessed OARE data were recorded on the Orbiter payload tape recorder and telemetered to the ground approximately 8-10 hours after the measurement. Because the OARE data on USMP-4 were not available in real-time, payload recorder dumps containing the OARE data were processed by Marshall Space Flight Center's Data Reduction group for subsequent processing by PIMS computers located at the NASA Lewis Research Center's Telescience Support Center. The results of OARE data analysis were made available to the USMP-4 teams via the PIMS WWW page approximately ten to twelve hours after the actual measurement time had transpired. The plot types developed by PIMS using OARE data were limited to trimmean filtered acceleration versus time as measured at the OARE location and mathematically mapped to the following locations within the Orbiter: Orbiter center of mass, AADSF experiment location, and IDGE experiment location. See Table 6 for the structural coordinates used for these locations.

The AADSF experiment team requested processing of an additional set of data depicting the quasi-steady acceleration environment. This data set was from the Microgravity Analysis Workstation (MAWS). The MAWS model is used to predict the quasi-steady acceleration environment at any

point in the Orbiter. The AADSF experiment team requested comparison plots of the MAWS predictions of the quasi-steady acceleration environment at the AADSF experiment location with the OARE data mapped to the AADSF experiment location. These comparison plots were generated in support of the three AADSF experiment runs.

Table 6. Structural Coordinates of Experiment Locations

OARE Mapping Location	Orbiter Structural Coordinate (inches)		
	X_O -axis	Y_O -axis	Z_O -axis
AADSF	1008.00	0.00	439.25
IDGE	1078.62	-42.04	434.32
Orbiter Center of Mass	1091.85	-0.09	373.47

3.3 Roadmap to Accelerometer Data Plots

Several different types of data displays are provided in this report. The analysis techniques used to create the plots and generate data values provided in several tables are discussed at length in [12,13]. Because some readers may not be familiar with some of the plot types and also because there are some unusual features on some of the displays, we provide here some guidance for interpreting the plots in this report.

Line plots have clearly marked axis labels, typically time or frequency on the abscissa and acceleration levels in units of g (9.8 m/s^2), μg (1x10^{-6} g), g_{RMS} (root-mean-square of acceleration level), or g^2/Hz (power spectral density, PSD) on the ordinate. Spectrograms, presented in color throughout this report and in the appendices, represent a series of PSD calculations performed on successive sections of data and are arranged such that the PSD information is oriented vertically on the page with time increasing from left to right and frequency increasing from bottom to top. Each time-frequency bin is assigned a color corresponding to the base 10 logarithm of the PSD magnitude.

4. Microgravity Environment of Columbia on STS-87

In addition to the real-time accelerometer data displays that PIMS provided during the mission, the PIMS team also provided data analysis and interpretation during the mission in an “off-line” fashion. When experiment team members needed information about the STS-87 microgravity environment some time after a particular occurrence, the PIMS team used archived data to fulfill the request. During the mission, the PIMS team received close to 100 different requests. This section provides details on the effects that specific events had on the microgravity environment of Columbia. The data analysis in several examples (for instance Deadband Collapse and EVA Operations) was initiated by user requests during the mission.

4.1 Orbiter Systems

4.1.1 Ku-Band Antenna

The Ku-band antenna is located on the forward starboard sill of the Orbiter's cargo bay. On orbit, this antenna is used primarily for communications between the Orbiter and the ground via the Tracking and Data Relay Satellite System. In order to maintain line-of-sight, the Ku-band antenna must slew to compensate for motion of the Orbiter with respect to these communications satellites. The Ku-band antenna is mounted on gimbals, which allow for this tracking; however, the antenna must be dithered at 17 Hz to prevent stiction of the gimbal mechanism. Reaction torque forces at the base of this assembly introduce a strong 17 Hz oscillatory disturbance into the acceleration environment of the Orbiter, along with various contributions from its 2nd through at least its 6th harmonics. Focusing analysis on a narrow spectral region (0.2 Hz wide) centered on the dither frequency, we can track the root-mean-square (RMS) acceleration for the frequency band from 16.93 to 17.13 Hz. Figures 4 and 5 depict 56-hour periods for this type of analysis performed on SAMS Unit F, TSH B data for the USMP-3 and USMP-4 payloads, respectively. For both of these missions, SAMS Unit F, TSH B was mounted on the forward MPESS at the Orbiter structural coordinates shown in Table 7.

Table 7. SAMS Unit F, TSH B Sensor Locations for USMP-3 and USMP-4 With Respect to Orbiter Structural Coordinate System

Mission	Sensor Location (inches)		
	X_O	Y_O	Z_O
STS-75/USMP-3	1048.37	-4.37	418.13
STS-87/USMP-4	987.69	-4.31	416.76

The vertical dashed lines at the 47-hour mark in Figures 4 and 5 indicate the Ku-band antenna stowage time, which brings antenna dithering to an end. More details on the stowage operation are given later in this section. Table 8 aims to quantify the measured disparity between "dither on" and "dither off" periods. The values given represent the average RMS acceleration values for the times shown.

Table 8. Ku-Band Antenna Dither RMS Acceleration (16.93 < f < 17.13 Hz)

MET	Mission	Dither	RMS Acceleration (μg_{RMS})
012/00:00 - 013/00:00	STS-75/USMP-3	ON	143
014/00:00 - 014/08:00	STS-75/USMP-3	OFF	9
012/21:20 - 013/21:20	STS-87/USMP-4	ON	197
014/21:20 - 015/05:20	STS-87/USMP-4	OFF	8

While the ambient Orbiter environment for this small frequency range was measured to be under 10 μg_{RMS}, the antenna dithering added over 100 μg_{RMS} for both USMP-3 and USMP-4 missions. The Euclidean distance between the two Orbiter cargo bay positions enumerated in Table 7 is approximately 5 feet, but transmission of the dither frequency vibrations for the different structural paths to these locations is uncertain. Table 8 suggests a couple of possibilities: the USMP-3 location was less responsive to the 17 Hz disturbance than the USMP-4 location, and/or the dithering intensity was somewhat greater on the latter mission. Note that acceleration measurements recorded in the Spacelab module during STS-65/IML-2 averaged around 100 μg_{RMS} for this same 0.2 Hz wide frequency band. This would suggest, not surprisingly, that transmission of the Ku-band dither excitation is damped by the structure of the Spacelab module. Speculation that a Spacelab module structural mode exists around 17 Hz is not supported by these observations.

While the dither intensity does typically vary with time throughout most missions, there are certain times when the intensity decreases or the dither is turned off altogether. Expected off times take place during gimbal flips. When the Ku-band antenna is actively tracking a satellite and the line-of-sight causes one of its two gimbals to reach their physical limit, the system will do what is commonly called a gimbal flip. Further details on this are given in Section 5.4 of [2]. During the gimbal flip, the antenna will quickly slew (20 degrees per second) until the dish is again pointing in the correct direction on the other side of the physical stop. During fast slew operations, the 17 Hz dither is disabled. Figure 6 shows a Ku-band antenna gimbal flip. This overlay plot shows SAMS Unit F, TSH B Y_0-axis acceleration data (blue trace, left ordinate scale) and Johnson Space Center Mission Evaluation Workstation System (MEWS) data for the Ku-band antenna's alpha gimbal angle (red trace, right ordinate scale), both as a function of time. It is clear from this plot and Table 9, that when the antenna is slewing quickly (where the slope of the red trace is large), the dither disturbance is non-existent. Also, note that when the alpha gimbal angle stays relatively constant at about 0 degrees for several seconds just before the 3-minute mark in Figure 6, the dither intensity dips considerably (compare first two rows of Table 9).

Table 9. PSD Levels for Selected Times Relative to Figure 6

SAMS Unit F, TSH B	
Offset Time (minutes)	**PSD Level at 17 Hz (g^2/Hz)**
1.45 - 1.60	1.02×10^{-7}
2.82 - 3.02	2.80×10^{-8}
3.05 - 3.22	2.14×10^{-11}*
3.28 - 3.33	4.54×10^{-8}
4.20 - 4.35	1.36×10^{-7}

* ambient level, no distinct spectral peak observed on PSD

Prior to de-orbit, the Ku-band antenna must be moved into its stowed position so that the payload bay doors can be closed for re-entry. Table 10 details timing of the events for this stow procedure. The spectrogram of Figure 7 captures the antenna stow event for the USMP-4 mission. Note that this spectrogram is plotted out to the Nyquist frequency of the data, therefore the spectra are attenuated above 25 Hz, the cutoff frequency for this TSH. From this figure, we see the spectral peak at the dither frequency (the red horizontal streak at 17 Hz) cease just before the 8-minute mark. The same goes for its 2nd and 3rd harmonics, the spectral peaks at 34 and 51 Hz, respectively. These are the horizontal streaks labeled H2 and H3 in the figure. We attribute the other spectral components, that are labeled with an A, to aliasing. The three arrows near the lower left portion of this figure mark one final item of interest on this spectrogram. These are times when the antenna briefly stopped dithering for the purpose of fast slewing. This is evidenced by the large slope of the red trace on Figure 8 at these times. This plot is similar to Figure 6, except that the blue trace here (left ordinate scale) is acceleration magnitude, instead of the Y_0-axis acceleration, for SAMS Unit F, TSH B. The crew performs a cable repositioning procedure (gimbal flip) prior to stowing the antenna. This is seen around the 4-minute mark [14]. The dither stop time, as seen on this plot just before the 8-minute mark, occurred at MET 014/20:17:52. Mean acceleration magnitude for dither-on times in Figure 8 was 264 μg, compared to about 83 μg for the dither-off times. The highest acceleration magnitudes recorded in the time frame of Figure 8 were in excess of 1 milli-g, and occurred over a span of about 8 seconds just before dithering ceased. When the crew takes the “KU ANT” switch to the “STOW” position, the system moves to prescribed stow angles. Next, the system drives the locking pins, and then performs a “wiggle” test to verify that the pins are seated properly and that the antenna is in a locked position. This would account for the large accelerations observed just before the 8-minute mark of Figure 8 [15].

Table 10. Timeline for Ku-Band Antenna Stow Procedure

Time Relative to MET 014/20:10:00 (mm:ss)	Mission Event
00:00	Start of STOW event
02:36	Ku-Band in RADAR mode
02:55	Start slew to AZ = 0, EL = 0
03:15	At AZ = 0, EL = 0 (Alpha = 0, Beta = 0)
03:25	Slew up for 14 sec. (Cable positioning procedure)
03:39	Cable positioning complete
04:08	Slew to AZ = -123, EL = -27 (Alpha = 124.4, Beta = - 30.7)
04:35	At AZ = -123, EL = -27 (Alpha = 124.4, Beta = - 30.7)
07:22	Stow switch to STOW AZ = -125.1, EL = -29.6 (Alpha = 124.3, Beta = - 27.5)
07:43	Alpha and Beta gimbals are locked
07:58	Wiggle test complete - system ready for STOW
08:40	Antenna Deployed Assembly begins to move to its stowed position
09:02	Deployed Assembly is STOWED
09:20	Ku-Band system is powered OFF

4.1.2 Vehicle Structural Modes

Vehicle structural modes constitute some primary components of the Orbiter's vibratory environment in the oscillatory region of the acceleration spectrum. In the absence of substantial transient acceleration events or crew exercise, these resonant frequencies dominate the spectrum below about 10 Hz. They establish the ambient oscillatory acceleration environment in this spectral region in that they are always present with varying degrees of intensity. Crew exercise and Orbiter thruster firings tend to excite these resonances, causing heightened acceleration levels which persist for a short period of time before damping down toward some baseline.

As evidenced by the red vertical streaks in the spectrograms on Appendix pages C-12 and C-13, and as documented in the STS-87 As-Flown Attitude Timeline, Columbia's thrusters imparted numerous impulsive accelerations in an attempt to track the wayward Spartan satellite from about MET 002/01:20 to about MET 002/12:00. Like sporadic pinging of a tuning fork, these firings excited the Orbiter's natural frequencies and provided the opportunity for examining the heightened response of these vehicle structural modes. Toward that end, spectral averaging was performed on Hanning-windowed PSDs calculated with the parameters shown in Table 11 for the period from MET 002/02:30 to MET 002/07:30.

Table 11. PSD Parameters for Satellite-Tracking Period

SAMS Sensor Head					
Unit	**TSH**	**Sample Rate (samples per second)**	**Number of Points per PSD**	**Number of PSDs for Spectral Average**	**Effective Span (Hours)**
F	A	50	1024	660	3.75
F	B	125	4096	344	3.13
G	B	250	8192	346	3.15

Note that the last column shows the aggregate span of the spectral average. This does not total 5 hours, as suggested by the MET span, because any candidate PSD period containing a substantial impulsive transient (like would be the case for a thruster firing) was ignored. The intent here was to examine the resonant ringing after these impulsive accelerations. Figures 9, 10, and 11 show the resultant PSDs. Once these were computed, the RMS accelerations were then derived from them via Parseval's relation to yield the results shown in Table 12.

The resonance at 3.5 Hz represents an Orbiter fuselage torsion mode and expectedly imparts most energy in the $Y_0 Z_0$-plane. The strongest structural mode resides at about 4.7 Hz and aligns primarily with the Z_0-axis. Note that structural modes can be hard to identify on plots of short periods of time, but are readily apparent when examining a long-duration spectrogram.

Table 12. Structural Mode RMS Accelerations Resulting from Satellite-Tracking Maneuvers

Frequency (Hz)	RMS Acceleration (μg_{RMS})								
	Unit F, TSH A			Unit F, TSH B			Unit G, TSH B		
	X_O	Y_O	Z_O	X_O	Y_O	Z_O	X_O	Y_O	Z_O
3.2	4.6	11.4	7.3	1.4	7.1	3.5	6.7	3.5	3.6
3.5	2.9	25.6	5.5	2.0	25.7	7.0	3.7	19.5	3.3
4.7	6.4	18.3	39.1	3.9	13.4	35.6	1.7	4.0	24.2
6.3	3.3	5.0	7.2	1.4	2.2	5.0	1.5	1.2	3.0

The spectrogram of Figure 12 represents an arbitrary 6-hour time frame where the structural modes quantified in Table 12 are indicated by the long horizontal ticks shown on the frequency axis. Of these, the mode at 3.2 Hz is the most obscure, while again we see that the 4.7 Hz mode is the most intense. The RMS accelerations shown in Table 12 were computed from a time span of repeated impulsive battering. In order to investigate the nominal behavior of the 4.7 Hz mode measured over a longer time frame, the RMS acceleration contributed by this mode was computed every 81 seconds for SAMS Unit F, TSH A data, and every 66 seconds for TSH B data from both SAMS Units F and G. This RMS acceleration tracking was performed for the 24-hour period starting at MET 010/00:00. The results for SAMS Unit F, TSH B are shown in Figure 13. The salient features of this plot are as follows:

- the sample rate, f_s, shown in small text in the upper left portion of the figure represents how often the RMS acceleration value was computed (one sample every 66 seconds at 0.02 samples per second),

- the alignment of this structural mode is reinforced by comparing the Z_0-axis data (blue trace) to those of the other two axes (red trace is X_0-axis, green trace is Y_0-axis); essentially, the X_0-and Y_0-axes' data represent ambient or background accelerations in this spectral region,

- the transition to crew wake occurs just before the 4-hour mark as seen by heightening of the blue trace (see also Appendix page C-44) and the transition to crew sleep occurs just before the 22-hour mark as seen by quieting of the blue trace (see also Appendix page C-47); as expected, crew movement tends to excite this mode,

- crew exercise periods (at around hours 4 to 6 and again at around hour 18) result in the highest measured RMS accelerations for this mode in this 24-hour period; in fact, when the third harmonic of the shoulder-sway frequency approaches 4.7 Hz (as seen at about MET 010/05:20 on Appendix page C-44 and at about MET 010/17:30 on Appendix page C-46), the resonant RMS acceleration level contributed by this mode alone approaches that of Vernier Reaction Control System (VCRS) thruster firings.

Results from similar RMS acceleration versus time plots for SAMS Unit F, TSH A and Unit G, TSH B mimic those gleaned from Figure 13. Table 13 summarizes the results for all three plots.

Table 13. 4.7 Hz Structural Mode Mean RMS Accelerations for MET 010/00:00 - 011/00:00

	RMS Acceleration (μg_{RMS})								
	Unit F, TSH A			Unit F, TSH B			Unit G, TSH B		
Frequency (Hz)	X_o	Y_o	Z_o	X_o	Y_o	Z_o	X_o	Y_o	Z_o
4.7	2.8	8.2	29.3	2.6	7.2	26.4	1.9	5.7	21.9

Comparing the shaded cells in Tables 12 and 13, note that the 4.7 Hz mode was somewhat higher in amplitude in the aftermath of the repeated thruster firings required for satellite-tracking maneuvers. In contrast to the steady, albeit nebulous, mode at 4.7 Hz, the apparent structural mode at about 3.2 Hz has been observed to shift in frequency. Most notable are the spectral shifts seen on the spectrogram of Appendix page B-50 at about MET 011/12:35, 011/13:53, 011/14:39, and 011/16:43. The cause of these frequency shifts is unknown at this time.

4.1.3 Deadband Collapse

The Orbiter's attitude with respect to its orbital path plays an important role in a number of operational concerns. Maintaining suitable orientation for links with communications satellites, minimizing damage by space debris, and keeping proper alignment to account for the orbital mechanics that dictate quasi-steady acceleration levels are three motivating factors for defining an attitude. Deadband is a term used to specify the allowable deviations (number of degrees and rotational rate of the Orbiter) from a desired attitude. The Orbiter’s Reaction Control System is used to maintain a desired attitude, ensuring that the chosen deadband criteria are met. The Reaction Control System consists of the Primary Reaction Control System (PRCS) and the VRCS. The PRCS is typically used on orbit for pitch, roll, and yaw maneuvers, while the VRCS is used for fine adjustments of vehicle attitude. The Digital Auto Pilot (DAP) constantly monitors the Orbiter’s orientation and governs the VRCS (or PRCS), commanding the proper sequence and direction of thruster firings required to return to attitude when a specified deadband limit is exceeded.

On occasion, the deadband is changed as more (or less) stringent pointing needs arise or as vehicle health issues evolve. When the deadband is changed from a higher value to a lower one, the allowable deviation from the nominal attitude decreases. This is referred to as a deadband collapse. There were numerous deadband collapses during the STS-87 mission, many of them imposed for jet temperature maintenance [16]. Table 14 is a partial list of deadband collapse times from this mission as recorded in the PIMS logbook or as indicated by examination of the acceleration data. For these times, the DAP was changing between the A3 (0.07° deadband) and the A12 (1.0° deadband) settings. Note, as indicated in the center column of this table, that most of these collapsed deadbands lasted for just a few minutes. However, there were some that lasted for nearly 10 minutes.

Table 14. Deadband Collapse Times

Approximate MET Start	Approximate Duration (minutes)	Appendix D Page
006/08:20:14	1.8	D-29
007/06:01:29	0.5	D-33
008/07:29:48	9.3	D-37
008/11:47:48	1.6	D-37
008/14:14:04	3.2	D-38
008/20:06:03	9.9	D-39
009/21:53:58	1.1	D-43
009/22:55:03	1.4	D-43
009/23:30:52	1.9	D-43

Table 15 gives a rudimentary accounting of VRCS thruster firing activity during time frames before and during two of the longer deadband collapses. The values shown in the "Number of VRCS Firings" column were retrieved from the operational downlink database maintained as part of MEWS. The values shown in this column were tallied such that simultaneous firings were counted as a single firing and, because the database is incomplete, these numbers represent a minimum value. For example, during the period MET 008/07:00:00-008/07:29:00, there were no fewer than 22 VRCS thruster firings.

Note from the shaded rows in Table 15 that, during the two periods of deadband collapse, the VRCS firing rate was a couple of orders of magnitude greater than during nominal periods. Qualitative examination of the spectrogram pages from Appendix D referenced in Table 14 reveals that the increased firing frequency of the VRCS during deadband collapse tends to have broadband spectral effects. Most noticeably, it excites the vehicle structural modes below about 10 Hz, and somewhat heightens the spectrum around the Ku-band antenna dither frequency (17 Hz) and its harmonics. Figure 14 provides a quantitative measure of the effects of the deadband collapse that started at about MET 008/07:29:48. The data for each of the four subplots in this figure start at MET 008/07:00. The upper-left plot is SAMS Unit F, TSH A (10 Hz) data, the upper-right plot is SAMS Unit F, TSH B (25 Hz) data, the lower-left plot is SAMS Unit G, TSH A (5 Hz) data, and the lower-right plot is SAMS Unit G, TSH B (100 Hz) data. Note that the ordinate scales for the four plots shown in this figure are different. Table 16 summarizes the acceleration magnitude disparity between a portion of the deadband collapse period (MET 008/07:31 to 008/07:37) and a period preceding this (MET 008/07:00 to 008/07:29).

Table 15. Deadband Collapse VRCS Firing Comparisons

MET	Duration (minutes)	Number of VRCS Firings	VRCS Firing Rate (firings per minute)
008/07:00:00 - 008/07:29:00	29.0	22	0.8
008/07:29:48 - 008/07:39:08	9.3	953	102.1
008/19:30:00 - 008/20:00:55	30.9	25	0.8
008/20:06:03 - 008/20:15:57	9.9	1699	171.6

Table 16. Acceleration Magnitude Comparison for Deadband Collapse

SAMS Unit	TSH	Sensor Cutoff Frequency (Hz)	MET	Acceleration Magnitude (μg)
F	A	10	before deadband collapse 008/07:00-008/07:29	35
			during deadband collapse 008/07:31-008/07:37	201
F	B	25	before deadband collapse 008/07:00-008/07:29	156
			during deadband collapse 008/07:31-008/07:37	627
G	A	5	before deadband collapse 008/07:00-008/07:29	26
			during deadband collapse 008/07:31-008/07:37	133
G	B	100	before deadband collapse 008/07:00-008/07:29	781
			during deadband collapse 008/07:31-008/07:37	809

The values of acceleration magnitude shown in the rightmost column of Table 16 represent the average for the time frame indicated. As expected, for each sensor the acceleration magnitude was greater during the deadband collapse period. The difference was more extreme for the lower frequency sensors (TSH A for both SAMS Units F and G). This is because below 10 Hz the acceleration spectrum of the Orbiter is dominated by vehicle structural modes, which are highly excitable by impulsive events such as thruster firings. While this is still a factor for the higher frequency sensors, the effect of the firings is overshadowed by vehicle subsystems and experimental equipment vibrations above 10 Hz. For these sensors, the measured acceleration magnitude difference mentioned above is smaller because vibrations caused by experimental equipment and vehicle subsystems (except for RCS) are not driven by these firings.

4.1.4 Water Dump Operations

The Orbiter Food, Water, and Waste Management Subsystem provides storage and dumping capabilities for potable and waste water [17]. Supply and waste water dumps are performed using nozzles on the port side of the Orbiter. Water dumps from these nozzles are expected to cause a steady acceleration of about 5.0×10^{-7} g in the Y_b-axis [18]. Figures 15 and 16 show the effect of a simultaneous supply water and waste water dump and of a supply water dump on the quasi-steady acceleration environment, as represented by OARE data. These water dump plots show contributions to the Y_b-axis and to the Z_b-axis. While the anticipated effects on the acceleration environment from water dumps is exclusively in the Y_b-axis, effects have been routinely observed in the Z_b-axis since STS-73/USML-2.

4.1.5 Orbiter Attitudes

A summary plot of the OARE data for the entire STS-87 mission is provided in acceleration versus time format, Figure 17, and in Quasi-Steady Three-Dimensional Histogram (QTH) format, Figure 18 [12]. Each plot format illustrates some unique aspects of the USMP-4 mission. Figure 17 clearly illustrates the sleep cycles of the crew through the periodic quieting of the data on all three axes. Peak-to-peak variations are on the order of 1×10^{-6} g for crew active periods and 0.2×10^{-6} g for crew sleep periods. Figure 18 illustrates that multiple attitudes were flown in support of separate USMP-4 payloads and the non-microgravity payloads, including Spartan.

As a result of the multiple attitudes flown to support the STS-87 mission, many of the attitudes are not as clearly observed by examining a QTH plot of the entire mission. This is because the QTH plot displays data related to an Orbiter attitude as a “percentage of time spent” relative to the total amount of OARE data under examination. For the QTH plot for the entire mission, this can result in an attitude’s contribution being somewhat “washed out,” if the time spent at that attitude was relatively short when compared to the entire length of the mission. The various attitudes of the STS-87 mission are more clearly observed by separating Figure 18 into two QTH images, one for non-microgravity periods (Figure 19) and one for microgravity periods (Figure 20). Figure 19 examines the first 96 hours of the STS-87 mission while Figure 20 examines the remaining 280 hours of OARE data. The additional attitudes observed in these two plots are annotated in the plots themselves. Note the variable trace in Figure 20 introduced by the solar inertial attitude in days 14/15. The respective quasi-steady acceleration magnitudes for each of these attitudes can be extracted from the plots.

4.1.6 Radiator Deployment

Radiator panels attached to the forward payload doors are part of the Active Thermal Control System which provides Orbiter heat rejection during a mission. The port and starboard side radiators can be deployed independently to accommodate the heat rejection requirements for a particular Orbiter attitude or mission. An electromechanical actuation system on the door unlatches and deploys the radiators when open and latches and stows the radiators when closed [19]. In deploying each radiator, six motor driven latches are unlocked and the deploy motor

moves the radiator to the desired position.

The deployment or stowage of either the port or starboard side radiators results in a general excitation of the Orbiter structural modes. In particular, the 6.3 Hz structural mode and its 2nd and 3rd harmonics are excited. Figure 21 combines PSDs for periods just prior to (red), during (blue), and just after (green) deployment of the port side radiator. The excitation of the 6.3 Hz structural mode and its harmonics is readily apparent, as is a spectral component around 9.5 Hz. Figure 22 is an acceleration vector magnitude versus time plot during deployment of the port side radiator. The increased magnitude around the 150-second mark of this plot illustrates the impact of the radiator deployment on the environment.

4.2 On-board Activities

Numerous objectives slated for this mission kept the Orbiter crew busy for the duration of their work periods. Vehicle maintenance, Spartan satellite deployment/retrieval, spacewalks, and microgravity science were some of the key responsibilities that consumed crew time. Crew movement on-board and in the payload bay translates to vibrational disturbances being introduced to the Orbiter's microgravity environment. The extent and character of the disturbances attributable to crew activity can best be examined in differential fashion. That is, comparison of the acceleration environment during times when the crew is active versus times when they are not active is desired. Generally, single shift crew sleep and Public Affairs Office (PAO) events offer extended periods of crew inactivity. For this mission, both of these scenarios took place and serve as contrast to the impact of nominal crew activity. On the other extreme, crew exercise can have a severe impact on the microgravity environment. On STS-87, an exercise vibration isolation device was used to minimize the effects on the sensitive USMP-4 experiments.

4.2.1 Crew Sleep Cycle

Table 17 shows the MET start and stop times of crew sleep taken from the mission replanned timeline. This table shows that the nominal scheduled sleep duration was eight hours, and sleep start times shifted forward in time as the mission progressed as dictated by landing and Spartan deployment constraints. As human nature has it, the start time for sleep can be planned, but the transition is certainly not instantaneous. On the other hand, the sleep stop time can be enforced with an alarm, which in this case was a daily wake-up song that was broadcast up to the crew. These facts are evidenced by examining the sleep start/stop times in the Appendix plot pages referenced in Table 17. For example, compare the transition of spectral levels (most evident below about 13 Hz) that occurs around MET 003/14:40 on page B-18 to the transition that occurs at around MET 003/22:00 on page B-19. These typify the effects seen when the crew transitions to sleep and to wake, respectively.

The spectrograms cited in Table 17 show an obvious quieting below about 13 Hz when the crew transitions from wake to sleep, however, they do not indicate with much precision how much quieter the acceleration environment becomes. In order to obtain an accounting of this detail, the RMS acceleration level contributed by the spectrum below 13 Hz was calculated approximately

every 66 seconds for a 96-hour span (MET 009/12:00 to 013/12:00) for SAMS TSH B on both Units F and G. Figure 23 shows the results of these calculations for Unit F. The four pairs of consecutive dashed/solid red lines indicate scheduled crew sleep start/stop times, respectively, for this 4-day time frame. Note again that actual reduction in acceleration levels typically lags scheduled sleep start times by at least several minutes, while increased excitation of the environment is coincident with the scheduled wake times owing to the daily wake-up song. For the plot shown in Figure 23, the mean RMS acceleration during the non-sleep times was 62 μg_{RMS}, while the mean RMS acceleration during the four sleep periods was 23 μg_{RMS}. Calculations for Unit G yield a mean RMS acceleration during non-sleep times of 55 μg_{RMS}, and a mean RMS acceleration during sleep periods of 29 μg_{RMS}.

Table 17. USMP-4 Replanned Timeline Crew Sleep Times

Start Sleep Period		End Sleep Period	
MET	**Appendix Page**	**MET**	**Appendix Page**
000/11:00	B-5	000/19:00	B-7
001/12:00	B-9,10	001/20:00	B-11
002/12:00	B-13,14	002/20:00	B-15
003/14:00	B-18	003/22:00	B-19
004/15:00	B-22	004/23:00	B-23
005/16:00	B-26	006/00:00	B-27,28
006/17:00	B-30	007/01:00	B-32
007/18:00	B-34,35	008/02:00	B-36
008/19:00	B-39	009/03:00	B-40
009/20:00	B-43	010/04:00	B-44
010/21:00	B-47	011/05:00	B-48
011/22:00	B-51	012/06:00	B-52,53
012/22:00	B-55	013/06:00	B-56,57
013/22:00	B-59	014/06:00	B-60,61
014/22:00	B-63	015/07:00	B-65

As might be expected, the crew may have to wake during a sleep period for one reason or another. It is quite possible that this is what happened at around MET 003/17:20, see spectrogram on Appendix page D-18. Note in this plot that there are 5 to 10 minutes of heightened spectral response, particularly below 10 Hz, starting just before MET 003/17:20. This period coincides with an entry in the PIMS mission logbook, which notes that the IDGE science team observed “their crystal rotate and move” at that time. The correlation implied here is not a definitive cause-and-effect identification, it is merely conjecture. The IDGE team's

concern about their crystal motion prompted an unsuccessful search (by Marshall Space Flight Center and Johnson Space Center controllers) for specific disturbance sources.

While the whole mission OARE acceleration versus time plot shown in Figure 17 clearly demonstrates the sleep cycles of the crew, QTH plots can be employed to examine the relative excursions in the OARE data during crew sleep versus crew active periods. Figure 24 is a QTH plot created using a concatenation of OARE data from all the USMP-4 crew sleep periods from MET 004/00:00:00 to the end of the mission. Similarly, Figure 25 is a QTH plot created using a concatenation of OARE data from all the crew active periods for the same period of time. A comparison of the figures clearly shows the effect of crew activity on the OARE data. Figure 24 indicates a tight clustering of the recorded OARE data during crew sleep, which permits a more straightforward extraction of the quasi-steady acceleration vector from the OARE data. The increased scatter observable in the data of Figure 25 demonstrates the impact of the crew and equipment on the quasi-steady acceleration environment. Note, the circular/oval shaped signature in Figure 24 is the result of the Orbiter being in a solar inertial attitude during one of the crew sleep periods.

4.2.2 PAO Events

While crew sleep clearly provides a certain measure of quieting as detailed earlier, there are other non-sleep times during a mission that afford similar effects on the acceleration environment. Most notably, PAO events offer at least a brief respite for the crew. During a typical PAO event, the crew is relatively motionless and gathered in front of a camera for audio and video communications with interested parties on the ground. This period of minimal movement mimics that of sleep from an acceleration disturbance perspective, albeit for a much shorter time span. PAO events normally last around 15 to 20 minutes, compared to the 8-hour sleep periods. For this mission, the crew participated in more than a half dozen PAO events; Table 18 lists six of these that show up prominently on the spectrograms on the Appendix plot pages listed in the table.

Table 18. PAO Events

Approximate MET Start	Duration (minutes)	Appendix Pages
003/07:44	19	B-, C-, D-, E-17
006/13:03	8	B-, C-, D-, E-30
007/14:53	15	B-, C-, D-, E-34
011/08:32	19	B-, C-, D-, E-49
012/14:49	34	B-, C-, D-, E-54
014/17:15	15	B-, C-, D-, E-62

The longer-than-normal PAO event that takes place starting at about MET 012/14:49 (see Appendix page B-54) exemplifies the quietude, especially below about 13 Hz or so, which can be achieved by minimizing crew movement. For person-intensive tasks, this restriction might be impractical or unfeasible, but situational awareness and planning may facilitate maximum usage of desirable acceleration environmental conditions at some time in the future of microgravity research.

The quasi-steady environment measured by OARE also exhibits a noticeable quieting during PAO events. Figure 26 shows the effect of the fifth PAO event listed in Table 18 on the quasi-steady acceleration environment. With the reduced crew activity, the quasi-steady acceleration environment variations are more pronounced, much like the effects observed for crew sleep periods. The variations in the OARE data during PAO events is typically 0.2×10^{-6} g peak-to-peak. Non-PAO time intervals demonstrate a peak-to-peak variation of 1×10^{-6} g.

4.2.3 Bicycle Ergometer Isolation

While crew sleep periods and PAO events provide quiet microgravity conditions, other crew activity is routinely observed to have a negative effect on the microgravity environment. Crew members are expected to exercise to maintain physical conditioning. On STS-87, aerobic exercise was achieved using a bicycle ergometer. During the first few days of the mission, the ergometer was mounted to the Orbiter with each of three configurations of an ergometer vibration isolation system called the Passive Cycle Isolation System (PCIS). During mission planning, the mission management team requested that the PIMS team provide analysis of the SAMS Unit F, TSH A data collected during these initial days of crew exercise to assist them in assessing the vibration isolation performance of the PCIS. Two types of analysis were employed to quantify the differences measured by the SAMS among the three PCIS configurations and a hardmount configuration: (1) Δg_{RMS} derived from interval RMS acceleration versus time, and (2) cumulative RMS acceleration versus frequency.

The Δg_{RMS} derived from interval RMS acceleration versus time analysis was aimed at quantifying the change in the RMS acceleration level for two distinct periods: a non-exercise baseline period and the exercise period of interest. Care was taken to ensure that no strong, non-exercise related disturbances below 10 Hz were present for one period and not for the other. A spectrogram plot spanning both the baseline and the exercise periods served as the basis for this check. From this spectrogram, periods were identified as baseline and as exercise. Once these periods were selected, a 0.5-second interval RMS acceleration versus time curve was plotted for the same time span covered by the spectrogram. Based on this plot, the difference in the median of the RMS acceleration values between the baseline and exercise periods was calculated. This was done for the three (XYZ) orthogonal Orbiter structural axes and for the overall RMS acceleration calculated from the root-sum-of-squares (RSS) of the XYZ RMS acceleration values. The results were compiled in near real-time in tabular form on a PIMS WWW page.

After the Δg_{RMS} values were calculated, the cumulative RMS acceleration versus frequency curves for both the baseline and exercise periods were plotted. These served to quantify the contributions of spectral components at and below a given frequency to the overall RMS acceleration level for the periods of interest.

Commander Kevin Kregel was the only crew member to exercise in all of the ergometer configurations. Configuration #1 used stiff PCIS mounts on the front of the ergometer and stiff mounts at the seat connection; #2 used soft front and stiff seat connections; and #3 used stiff front and soft seat mounts. Based on analyses of Kregel's early exercise (see Table 19 below), several observations were made. Overall, the PCIS configuration #3 was better than either of the first two configurations. For the X_0-axis only, the PCIS configuration #2 was the best. For the Y_0-axis only, the PCIS configuration #1 was the best. For the Z_0-axis, the hardmount was the best. The differences among the three PCIS configurations were marginal in all cases.

Table 19. Δg_{RMS} Comparison of Commander's Exercise

Ergometer Configuration	Axis	Δg_{RMS}
PCIS Configuration #1 Stiff Front/Stiff Seat	RSS	9.206×10^{-5}
	X_O	2.227×10^{-5}
	Y_O	5.293×10^{-5}
	Z_O	7.010×10^{-5}
PCIS Configuration #2 Soft Front/Stiff Seat	RSS	1.245×10^{-4}
	X_O	1.027×10^{-5}
	Y_O	7.006×10^{-5}
	Z_O	1.053×10^{-4}
PCIS Configuration #3 Stiff Front/Soft Seat	RSS	8.410×10^{-5}
	X_O	2.405×10^{-5}
	Y_O	5.619×10^{-5}
	Z_O	5.093×10^{-5}
Hardmount	RSS	2.401×10^{-4}
	X_O	1.478×10^{-5}
	Y_O	2.495×10^{-4}
	Z_O	4.096×10^{-5}

Based on the analysis provided by PIMS, the PCIS configuration to be used for the USMP-4 timeframe was uplinked to the crew as part of the Flight Day 5 Payload Summary,

> RECOMMENDED PCIS CONFIGURATION: It appears that the differences among the three configurations are marginal. However, after analyzing the Δg_{RMS} (g_{RMS} exercise - g_{RMS} background) values for the three configurations, the final configuration was found to have the overall lowest value. Therefore, the Mission Scientist recommends the final configuration #3 as the optimum PCIS configuration for [Flight Days] 5-14.

The real-time PCIS data analysis relied exclusively on the SAMS Unit F, TSH A data which had the temperature/acceleration data problem mentioned earlier. This analysis, however, was done in a differential fashion, whereby the Δg_{RMS} between baseline and exercise periods was the decisive quantity. Assuming that the anomalous low-frequency component varied only slightly over the span of the baseline and exercise periods, then this analysis should not have been significantly affected.

4.3 Payload Operations

4.3.1 IDGE-Related Disturbances

Early in the mission, following activation of the USMP-4 experiments, a set of acceleration disturbances clustered around 56 Hz was noticed in the real-time spectrogram displays of SAMS Unit G, TSH B. See, for example, the pronounced red horizontal streaks at this frequency in the spectrograms of Appendix D. The CHeX team expressed concern about these disturbances because of their experiment susceptibility to vibrations around 55 Hz. During the first few days of the mission, an investigation was conducted by consulting with the various experiment teams, Spacelab-MPESS support staff, and Orbiter subsystem personnel to ascertain the source of these disturbances. In discussions with IDGE personnel, it was discovered that there were seven cooling fans within the IDGE apparatus. One of the fans had its speed controlled according to a measured internal IDGE temperature.

The spectrogram on Appendix page D-65 shows the SAMS Unit G, TSH B data during the IDGE experiment deactivation time on MET day 015. In addition to the 56 Hz traces, the variable trace between 35 and 40 Hz and a 74 Hz disturbance cease at the time of the IDGE power-off at about MET 015/09:45. When the IDGE and SAMS units were returned to NASA Lewis Research Center after de-integration from the Orbiter, a vibration assessment was performed with the IDGE flight apparatus and SAMS Unit G, TSH B. The data acquired by SAMS for this test are shown in Figure 27. This test confirmed that the variable 35 to 40 Hz trace, the traces around 56 Hz, and the 74 Hz disturbance were all related to IDGE fans.

During the ground testing of the IDGE hardware, another as-yet-unidentified disturbance evident in the SAMS data was potentially assigned to IDGE. This disturbance was manifested as a persistent spectral peak at 21 Hz (1260 rpm if a rotational source) and can be seen to start and stop in the bench test SAMS data shown in Figure 27. A similar disturbance was seen in the mission data. It was tightly controlled in frequency and spanned the time frame from approximately MET 000/20:39 (see Appendix page B-7) to MET 014/15:30 (see Appendix page

B-62) with only two brief pauses. The first intermission started at about MET 001/05:19 and lasted just under 7 minutes (see Appendix page B-8). The second started at about MET 013/09:58 and lasted just over 15 minutes (see Appendix page B-57). To quantify this disturbance, its RMS acceleration was computed every 33 seconds for the 24-hour period starting at MET 004/00:00 for TSH B on both SAMS Units F and G. The physical separation of these two heads and their cutoff frequencies enabled a comparison of the measured impact of this disturbance at two different locations in the Orbiter's payload bay. Figure 28 shows the RMS acceleration versus time for the frequency range from 20.8 to 21.1 Hz for SAMS Unit F, TSH B measurements. As seen, the intensity of this disturbance is somewhat variable; similar analyses of SAMS Unit G, TSH B data lead to the results summarized in Table 20. The RMS values indicate that this disturbance is relatively close in intensity at the two different sensor locations.

Table 20. RMS Accelerations from 21 Hz Disturbance for MET 004/00:00 - 005/00:00

	RMS Acceleration (μg_{RMS})	
	Unit F, TSH B	**Unit G, TSH B**
Minimum	3.1	3.9
Mean	12.4	14.6
Maximum	48.8	68.2

4.3.2 SAMS Hard Drive Disturbance

The spectrograms most often referred to in this report are those included in the appendices; these plots display data up to the filter cutoff frequency for the SAMS data. When characterizing the microgravity environment of the Orbiter, it is useful to also examine spectrograms that show data out to the Nyquist frequency, even though the acceleration energy represented by the plot between the cutoff and Nyquist frequencies is suppressed by filtering [12]. Such spectrograms are included on the report CD-ROM. While studying the SAMS Unit G, TSH B Nyquist frequency spectrograms, a strong, persistent 120 Hz disturbance was noticed. Subsequent discussions with the SAMS engineering team and evaluation of groundtest data led to the determination that the 120 Hz disturbance was caused by the 7200 rpm rotation of the SAMS computer hard disk drives used to record data on orbit.

4.3.3 Orbiter Cabin and Airlock Depressurization

In preparation for the two EVAs conducted during the STS-87 mission, the crew cabin and the airlock had to be depressurized to various degrees. In preparation for both EVAs, the cabin was depressurized from a nominal 14.7 psi to 10.2 psi. Prior to egress, the airlock was depressurized from 10.2 psi to the vacuum of space. This airlock depressurization was performed in two steps, from 10.2 psi to 5.5 psi and from 5.5 psi to vacuum. The air removed from the Orbiter during depressurization was vented through a relief valve located on the port side of the Orbiter. This relief valve is located very near the valves used for conducting supply water and waste water

dumps. This was the first mission where the effects of cabin depressurization and airlock depressurization on the microgravity acceleration environment were measured and recorded.

The effects of cabin depressurization and airlock depressurization are most evident in the quasi-steady acceleration environment. The OARE Y_b-axis and the OARE Z_b-axis data shown in Figures 29 and 30 indicate that the magnitude of the cabin depressurization can be as large as 10 μg. The OARE Y_b-axis and the OARE Z_b-axis data shown in Figures 31 and 32 indicate the magnitude of the airlock depressurization can be as large as 5 μg.

Figure 33 illustrates the two step process involved in performing the airlock depressurization. The red trace in Figure 33 is the differential pressure between the airlock and the payload bay as indicated by data retrieved from the MEWS system. The change in the differential pressure approximately 23 minutes into the plot causes a corresponding change in the quasi-steady acceleration environment of about 5 μg. When 5.5 psi is reached, the venting is stopped for about 5 minutes. The next change in pressure results in further venting that also affects the quasi-steady acceleration environment.

4.3.4 EVA Operations

As NASA prepares to build the International Space Station in collaboration with its international partners, successful completion of EVA missions becomes critical. Designers and mission planners are developing the equipment and procedures for constructing the space station and, while a good deal of testing can be done on the ground, certain tests must be performed on orbit. Lessons learned from a series of EVA tests will serve to increase the experience base of hardware developers, flight controllers, and the astronauts doing the spacewalks [20]. During the STS-87 mission, astronauts Winston Scott and Takao Doi performed two EVAs. Grappling and berthing of the wayward Spartan satellite consumed much of the time on the first of these. The second was focused on evaluation of equipment and procedures that will be used during construction and maintenance of the International Space Station. This spacewalk was intended to accomplish all of the primary objectives originally planned as part of the STS-80 mission in November 1996 that were not achieved due to a stuck airlock hatch [21].

For convenience, the first EVA, which took place from about MET 005/04:30 to 005/11:50 will be referred to as EVA #1, and the one that took place from about MET 013/13:20 to 013/18:15 will be referred to as EVA #2 in the remainder of this report. A cursory examination of the SAMS data collected during these times shows that these EVAs tended to excite the acceleration spectrum below about 50 Hz. This increased excitation can be seen in a relative manner by comparing Appendix D Figures 22 (during EVA #1) to 23 (after EVA #1) for SAMS Unit G, TSH B on pages D-25 and D-26. In order to quantify this comparison and to gain a better understanding of the effects that an EVA activity has on the Orbiter's acceleration environment, the RMS accelerations for a number of frequency bands were calculated as a function of time.

The RMS acceleration for each of the frequency bands shown in Table 21 was computed every 32.768 seconds from the SAMS Unit G, TSH B data for the period MET 005/06:30 to 005/15:30,

which spans most of EVA #1 and a few hours thereafter; and for the period MET 013/13:00 to 013/22:00, which spans most of EVA #2 and a few hours following. The RMS levels shown in the "During EVA" columns represent the median values during part of the EVA (MET 005/07:30 to 005/10:30 for EVA #1, and MET 013/13:20 to 013/16:20 for EVA #2), while the "After EVA" columns show the median values after the EVA (MET 005/12:30 to 005/15:30 for EVA #1, and MET 013/19:00 to 013/22:00 for EVA #2). Note that for each band the levels during the EVAs were higher, although only marginally so above about 50 Hz. The RMS acceleration levels for the 0-10, 10-20, and 30-40 Hz bands for this sensor are appreciably lower after the EVAs. For example, a plot of the RMS acceleration versus time for the first band (0 to 10 Hz) is shown in Figure 34. The red segment of the trace indicates the "During EVA #1" time frame considered for Table 21, while the blue segment indicates the "After EVA #1" span. Note from the figure the obvious disparity in RMS levels for this frequency band.

Table 21. EVA RMS Acceleration Comparison (SAMS Unit G, TSH B)

Frequency Range (Hz)	RMS Acceleration (μg_{RMS})			
	During EVA #1	After EVA #1	During EVA #2	After EVA #2
0 - 10	110	45	98	41
10 - 20	259	156	295	163
20 - 30	110	68	138	58
30 - 40	202	122	197	98
40 - 50	108	69	97	62
50 - 60	138	137	213	195
60 - 70	91	89	99	95
70 - 80	84	83	90	87
80 - 90	102	98	88	81
90 - 100	77	71	90	85

Table 22. EVA #1 RMS Acceleration Comparison (SAMS Unit F, TSH A and B)

Frequency Range (Hz)	RMS Acceleration (μg_{RMS})			
	Unit F, TSH A		Unit F, TSH B	
	During EVA	After EVA	During EVA	After EVA
0 - 10	116	48	121	51
10 - 20			267	105

Table 23. EVA #2 RMS Acceleration Comparison (SAMS Unit F, TSH A and B)

Frequency Range(Hz)	RMS Acceleration (μg_{RMS})			
	Unit F, TSH A		Unit F, TSH B	
	During EVA	After EVA	During EVA	After EVA
0 - 10	116	52	121	55
10 - 20			318	185

SAMS Unit F, TSH A and B data were analyzed as described above, with the exception that the analysis was limited by the lowpass filter cutoff frequencies of these heads (10 Hz for TSH A, and 25 Hz for TSH B). The results shown in Tables 22 and 23 for Unit F are similar to those obtained for Unit G.

To further investigate the sources of disturbance that may have contributed to the measured accelerations during the two EVAs, Orbiter thruster firing activity was analyzed. The MEWS software enabled access to a record, albeit incomplete, of Columbia's Reaction Control System thruster firing times. The firing count shown in the right-hand column of Table 24 gives the minimum number of times that the VRCS jets were fired. Simultaneous firings were counted as one. The PRCS thrusters were not fired during either EVA according to the MEWS data.

Table 24. Orbiter VRCS Thruster Firing Activity During EVAs

MET	VRCS Thruster Firing Count
005/08:00 - 005/11:00 (during EVA #1)	154
005/12:00 - 005/15:00 (after EVA #1)	640
013/13:40 - 013/16:40 (during EVA #2)	414
013/19:00 - 013/22:00 (after EVA #2)	66

For EVA #1, these data indicate that the increased excitation observed during the spacewalk is not attributable to thruster firings. The same implication cannot be gleaned from the firing count numbers for EVA #2 taken alone, however, when considered in conjunction with those of EVA #1, we infer that the thruster firings did not play a defining role in heightening the acceleration spectra in some preferential manner during the EVAs. The nature of the work being done during these spacewalks may help to explain the increased acceleration levels. It stands to reason that cumbersome space suits and "construction" work requires greater forces be exerted by the astronauts than nominal crew compartment activities. Also, during the EVAs the astronauts were closer to the SAMS sensors; spacewalk disturbances originated in the Orbiter's cargo bay, where the SAMS heads were mounted, instead of the middeck or flight deck, where the crew was the remainder of the mission.

4.4 Unknown Disturbance Sources

4.4.1 Twin Disturbances at 12 to 15 Hz

An unidentified pair of disturbances shows up as two closely spaced spectral peaks, most clearly seen in the spectrograms of Appendix B. These twin disturbances tend to track each other in the frequency domain, and gradually increase in frequency from around 12 Hz early in the mission to over 15 Hz on MET day 11. They exhibit sharp spectral transitions on occasion. For example, see Appendix pages B-31 and B-32 until about MET 007/01:30, Appendix pages B-35 and B-36 until about MET 008/01:40, and Appendix page B-47 at about MET 010/22:50. These disturbances are hard to discern from about MET 008/06:30 (Appendix page B-37) to about MET 008/18:00 (Appendix page B-38), and apparently cease sometime around MET 011/04:30 (Appendix page B-48).

4.4.2 Unknown 11.35 Hz Disturbance

An unidentified disturbance at 11.35 Hz, along with its 2nd harmonic at 22.70 Hz, is visible occasionally in the Appendix B spectrograms. The first occurrence of this disturbance was at approximately MET 009/14:30:00 and the last occurrence was at approximately MET 010/09:00:00. There exist eleven occurrences of this disturbance, the maximum duration being about 15 minutes. Typical durations seem to be approximately 5 minutes in length.

Figure 35 is a plot of RMS acceleration versus time for the narrow frequency band 11.25 Hz to 11.45 Hz. The intent of this analysis was to compare the signal in this frequency band when the 11.35 Hz signal was active versus when it was inactive. The elevated levels from the 0 to 10 minute mark and from the 90 to 100 minute mark represent intervals when the 11.35 Hz signal was present and clearly illustrate the change in signal. Appendix page B-43 shows the spectrogram representation of this condition from MET 009/22:00 to 010/00:00.

5. Summary

The OARE and two SAMS units were used to measure and record the microgravity environment of the Orbiter Columbia during the STS-87 mission in November-December 1997. Data from the two SAMS units were telemetered to the ground during the mission and data plots were displayed for USMP-4 investigators in near real-time using the World Wide Web. During SAMS data processing after the mission, it was determined that there was a problem with temperature / acceleration signals on SAMS Unit F, TSH A. The effects of this problem can be removed from the data in some types of analyses. Plots generated using OARE data telemetered to the ground were provided to the investigators approximately twelve hours after data recording using the World Wide Web.

Disturbances in the microgravity environment as recorded by these instruments are grouped by source type in this report: Orbiter systems, on-board activities, payload operations, and unknown sources. The environment related to the Ku-band antenna dither, Orbiter structural modes, attitude deadband

collapses, water dump operations, crew sleep, and crew exercise was comparable to the effects of these sources on previous Orbiter missions. RMS acceleration levels for the Ku-band dither disturbance (16.93 to 17.13 Hz) were about 1.9×10^{-4} g_{RMS} during USMP-4. Average RMS acceleration levels for the 4.7 Hz Orbiter structural mode ranged from 2×10^{-6} g_{RMS} for the least affected X_0-axis to 3×10^{-5} g_{RMS} for the most affected Z_0-axis. Attitude deadband collapses necessitated by VRCS jet conditions tended to increase the VRCS jet firing rate from approximately one firing per minute for the standard deadband (1.0°) to greater than 100 firings per minute for the collapsed deadband (0.07°). Disturbances related to operations of the IDGE fans and SAMS hard drives that were not observed on previous missions are detailed in the text.

The effects of EVAs and related Orbiter cabin depressurization on the microgravity environment are reported. The exact cause of heightened SAMS-recorded acceleration spectral levels during EVAs is not known, although the nature and location of the work being done during the STS-87 spacewalks may help to explain the increased levels. The effects of the cabin depressurizations performed to prepare the spacewalking astronauts for their EVAs were best seen in the OARE data as excursions from the background acceleration levels of as much as 1×10^{-5} g.

The attached CD-ROM version of this report contains the text and figures of this hard-copy along with Appendix plots and supplementary plots representing the entire mission. These spectrograms are for each of the four SAMS sensor heads that recorded data during the mission. The plots are useful in identifying relative acceleration levels and the approximate start and stop times of disturbances.

6. References

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[14] Personal communication with Martin O'Hare, Ku-Band Subsystem Engineer, Boeing North American, Johnson Space Center.

[15] Personal communication with Richard LaBrode, Instrumentation and Communication Officer (INCO), United Space Alliance, Johnson Space Center.

[16] STS-87 Space Shuttle Mission Report, NSTS-37418, Johnson Space Center, Houston, TX, February 1998.

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[19] http://shuttle.nasa.gov/reference/shutref/structure/baydoors.html

[20] http://shuttle.nasa.gov/sts-80/orbit/eva/edftov.html

[21] http://shuttle.nasa.gov/sts-87/orbit/payloads/#EVA

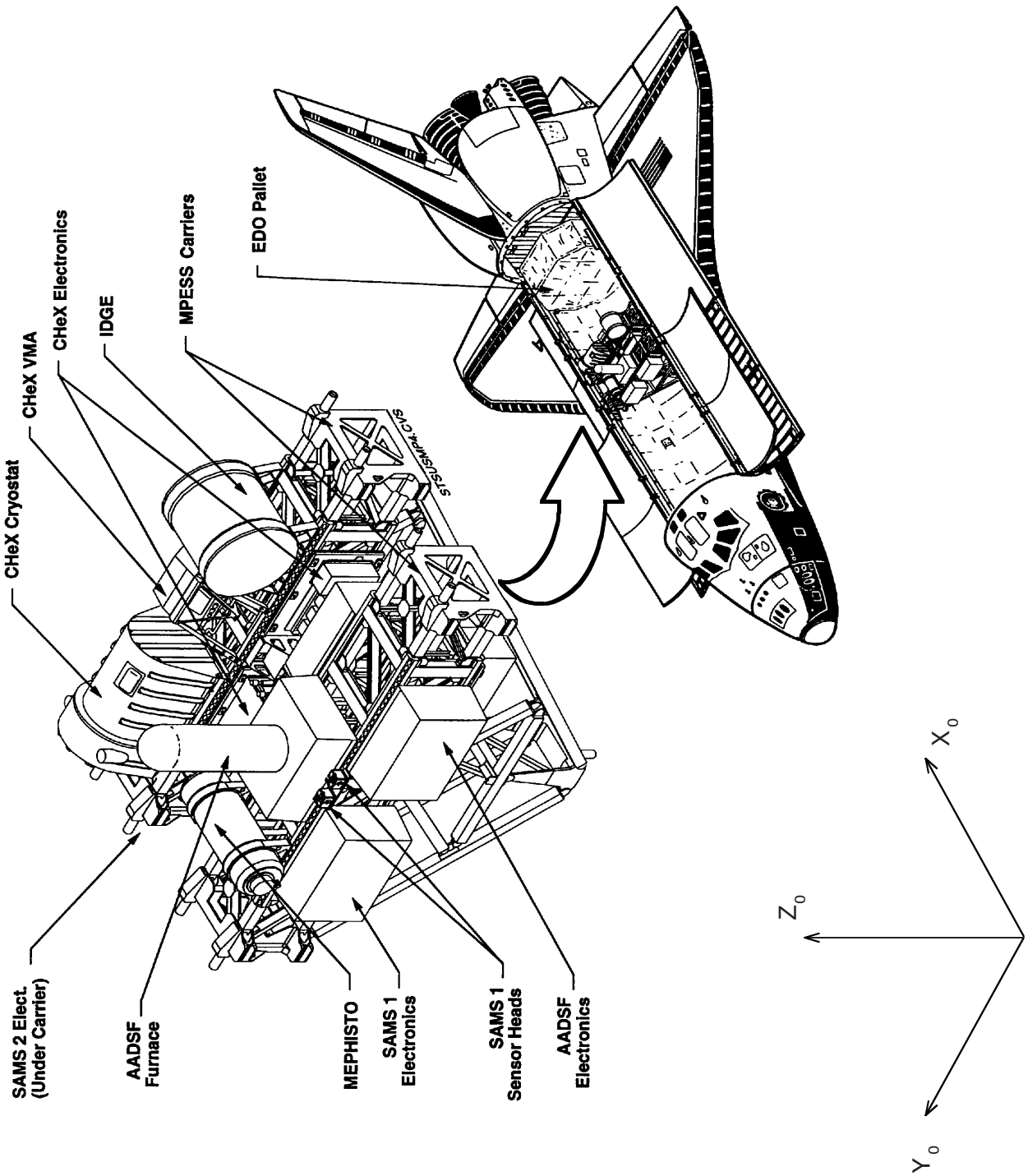


Figure 1. MPESS Layout and Approximate Payload Bay Location of USMP-4.

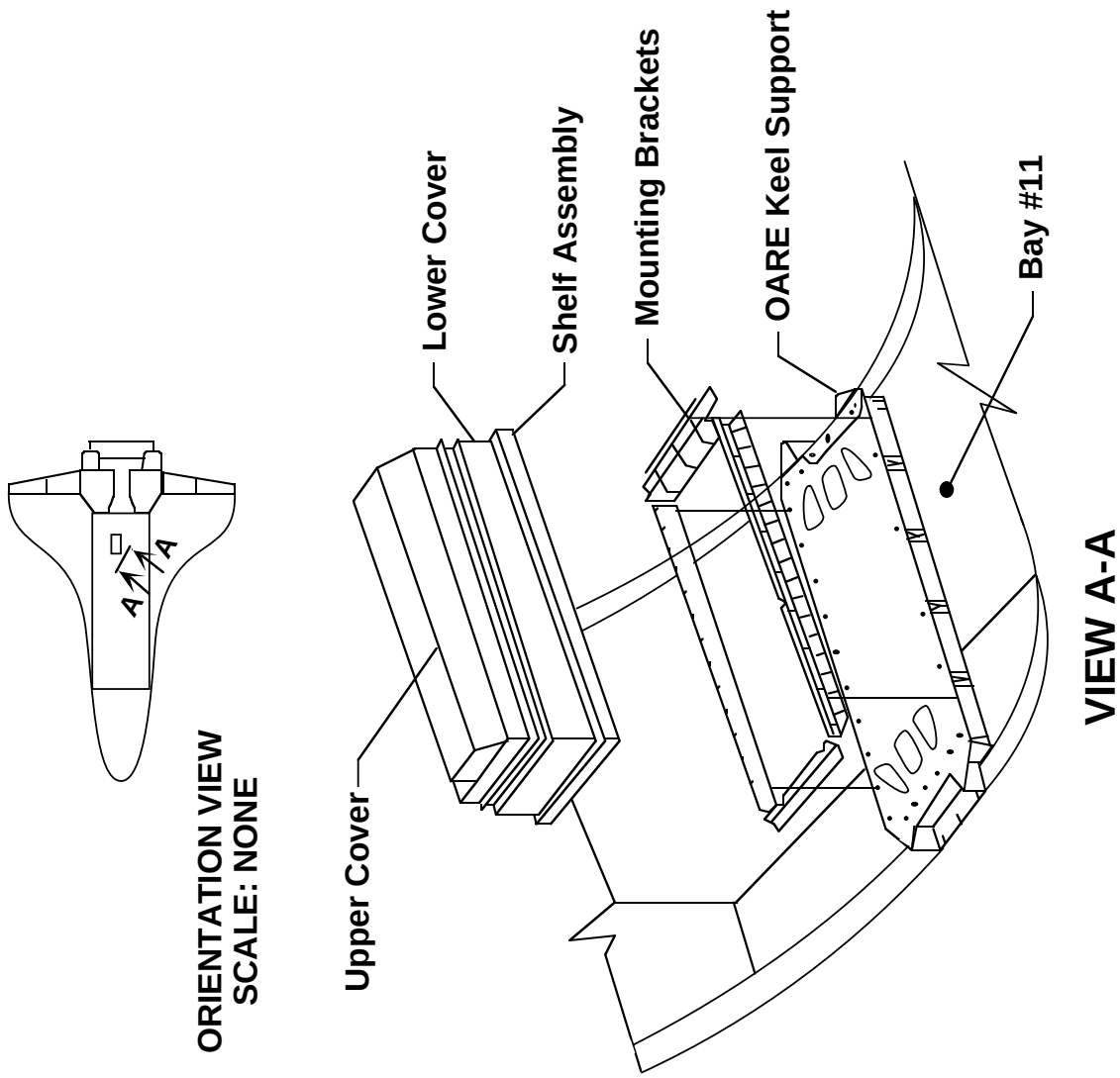


Figure 2. OARE Instrument Location for USMP-4.

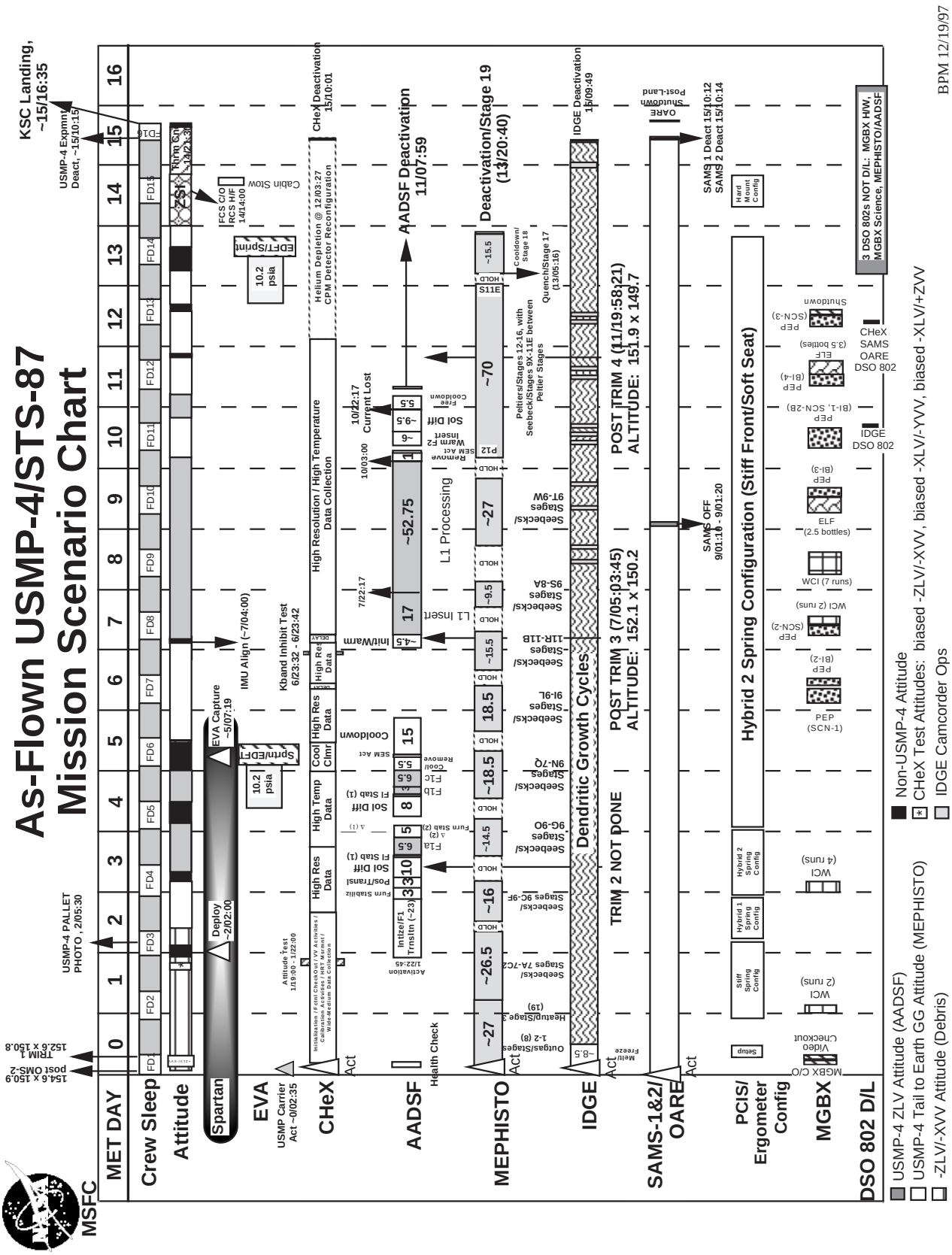


Figure 3. As-Flown Scenario.

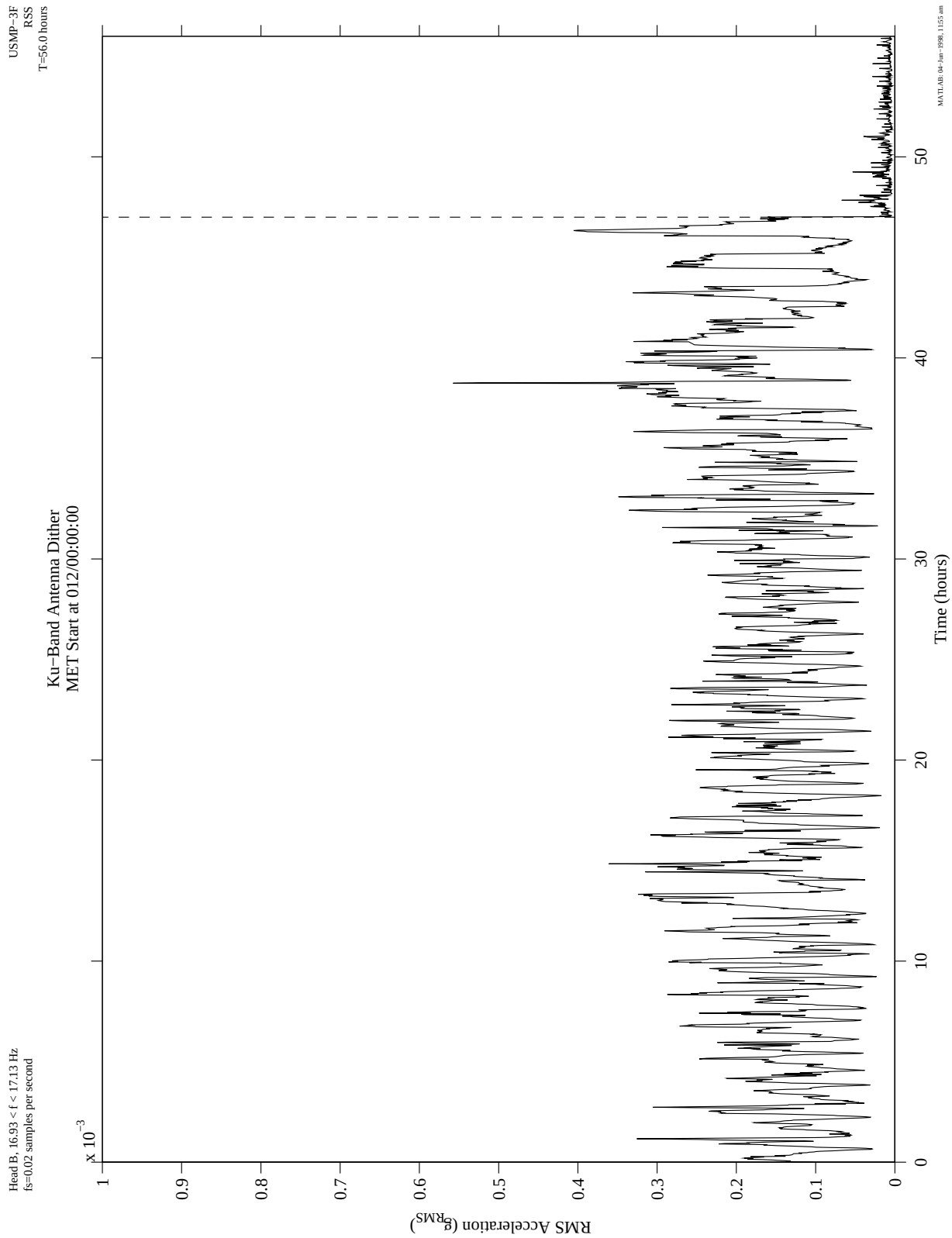


Figure 4. Ku-Band Antenna Dither Cessation (USMP-3).

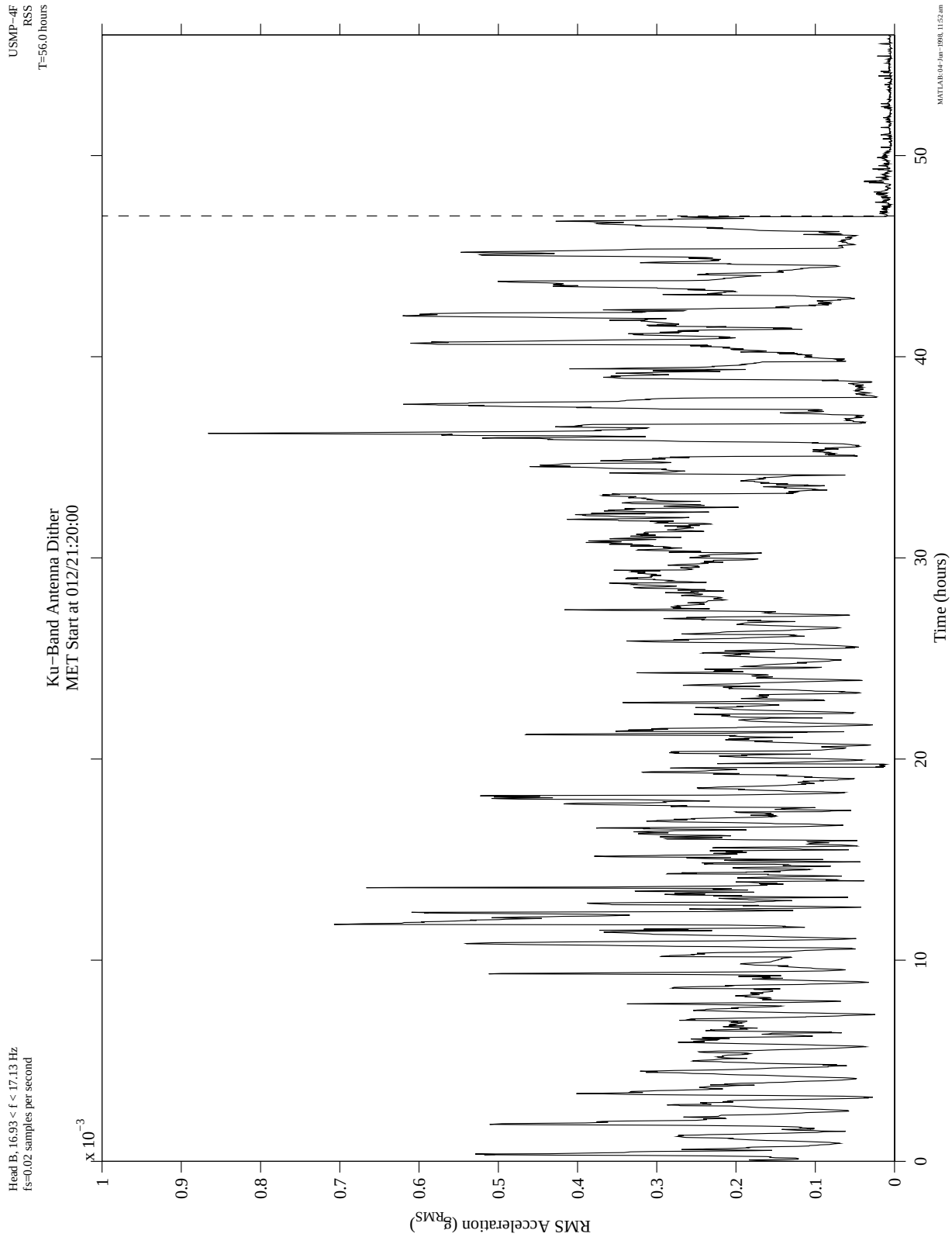


Figure 5. Ku-Band Antenna Dither Cessation (USMP-4).

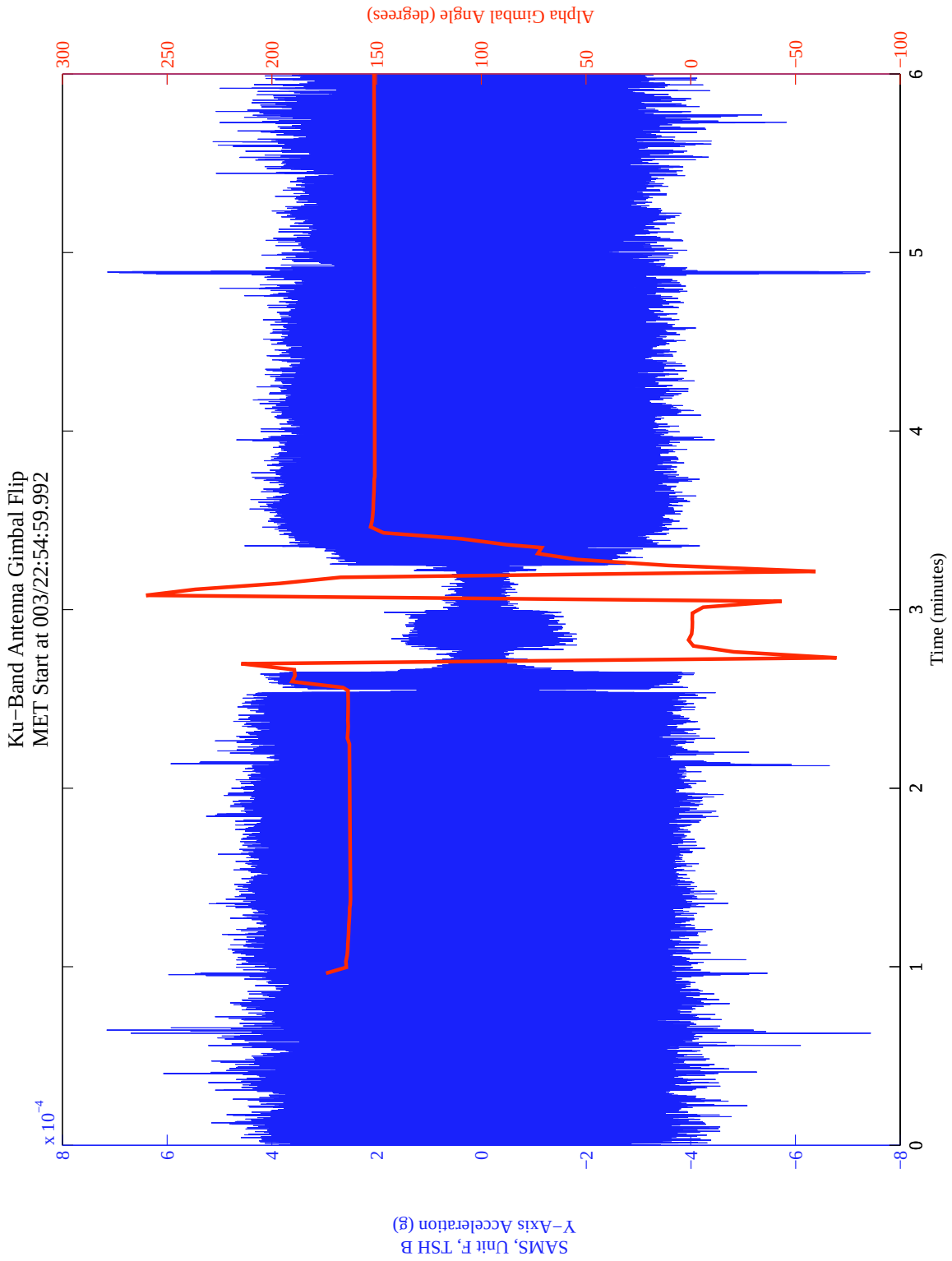


Figure 6. Ku-Band Antenna Gimbal Flip, Acceleration/Alpha Gimbal Angle Overlay.

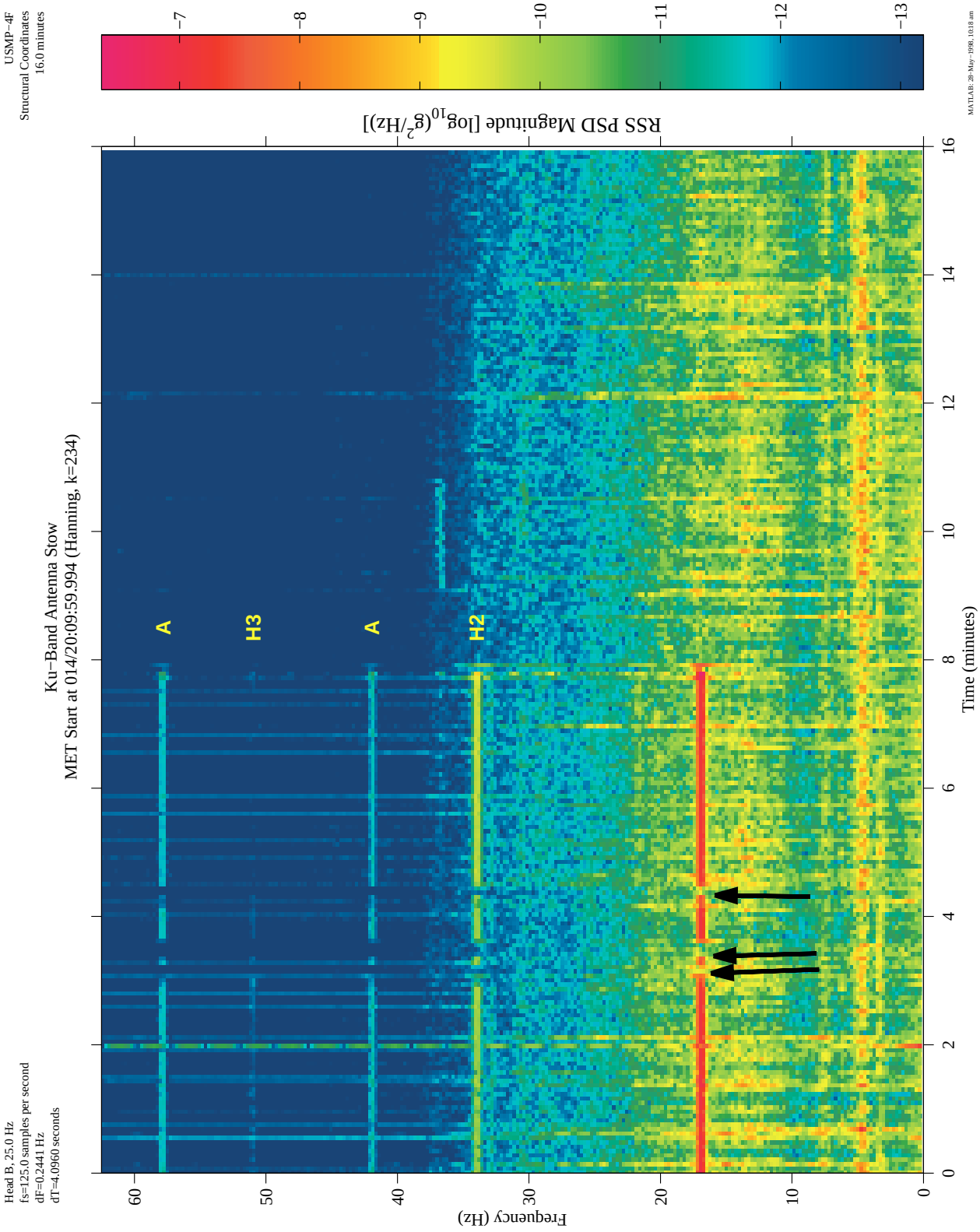


Figure 7. Ku-Band Antenna Stow Spectrogram.

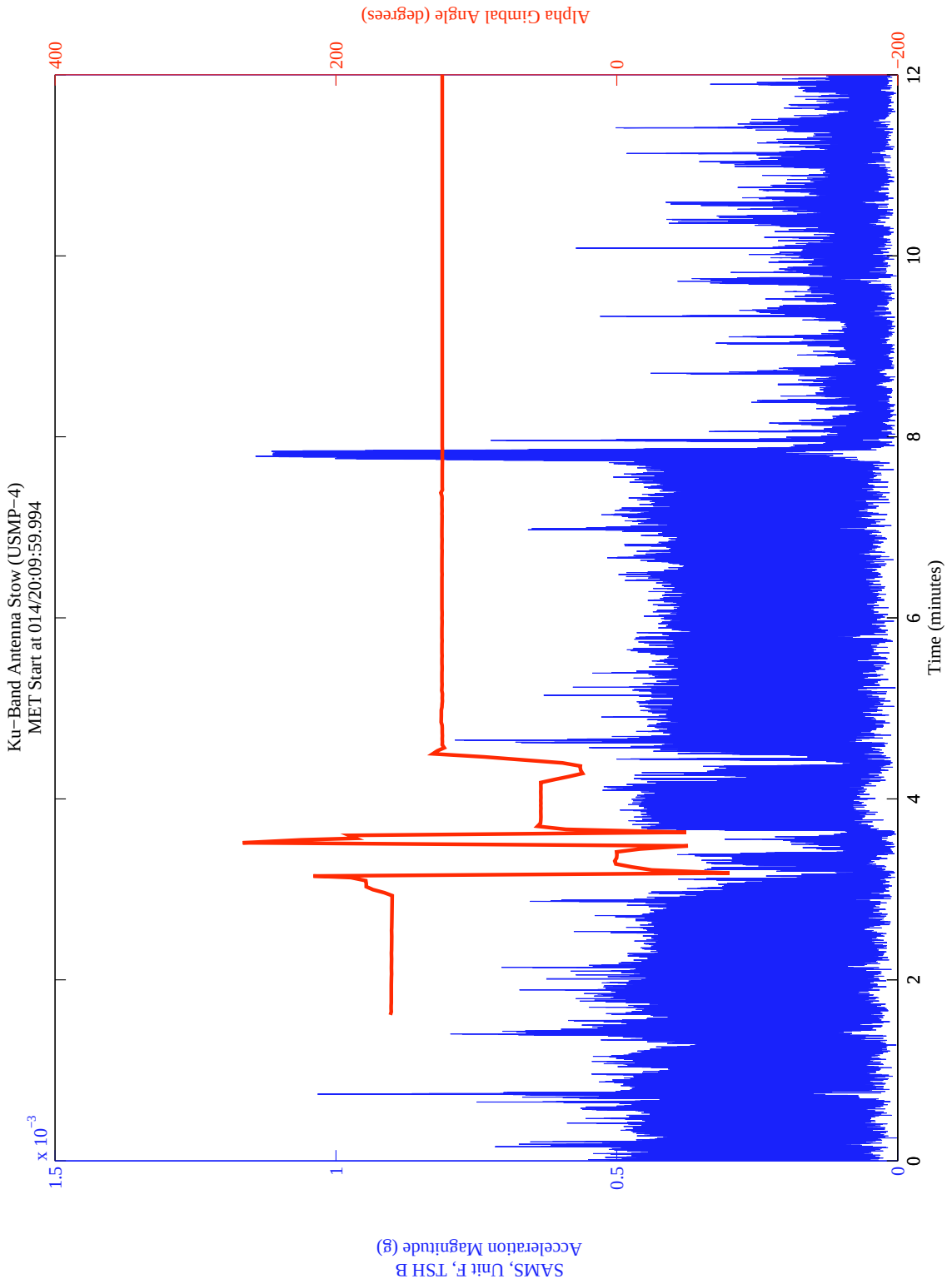


Figure 8. Ku-Band Antenna Stow, Acceleration/Alpha Gimbal Angle Overlay.

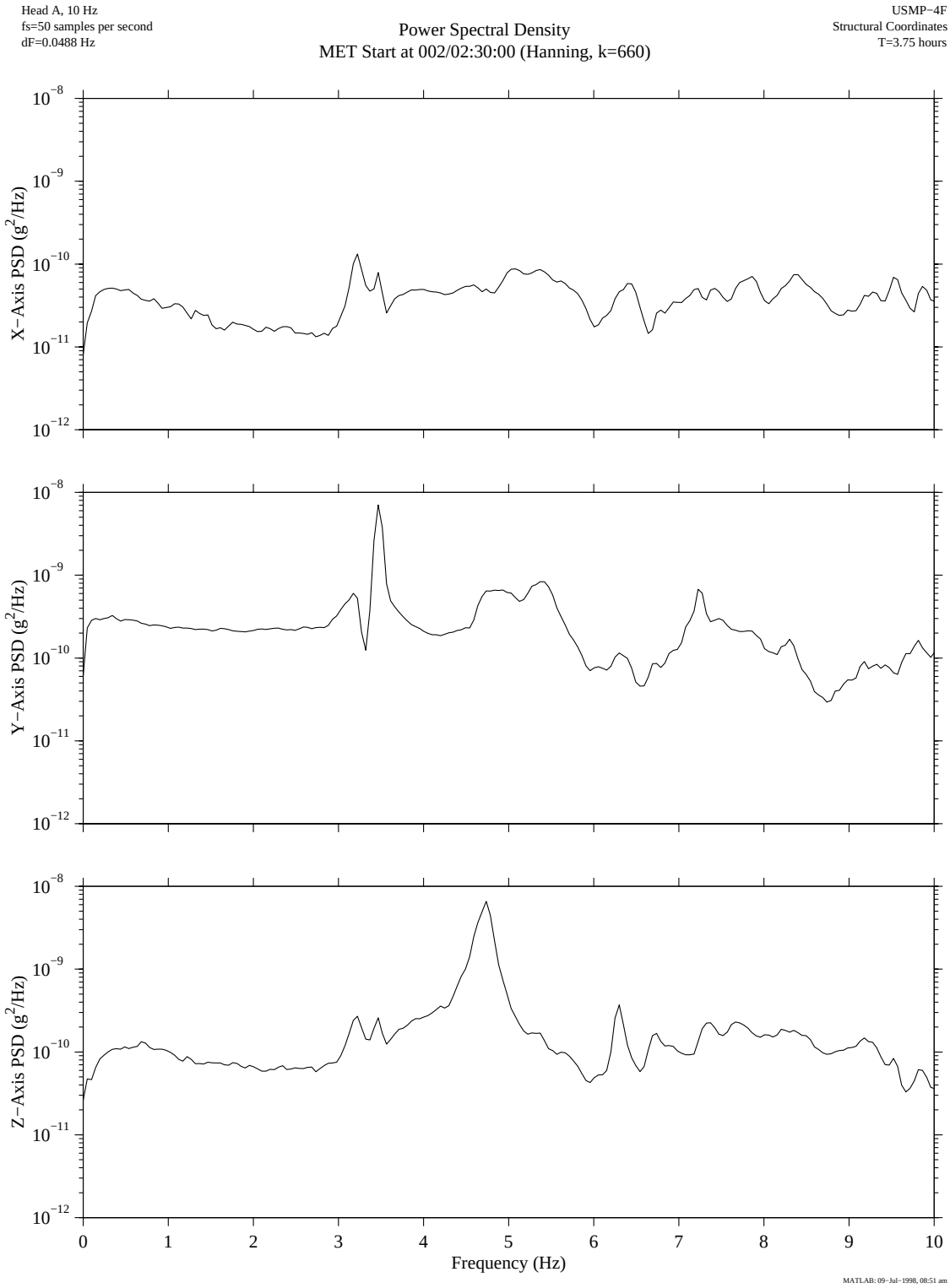


Figure 9. Structural Response to Satellite-Tracking Maneuvers (SAMS Unit F, TSH A).

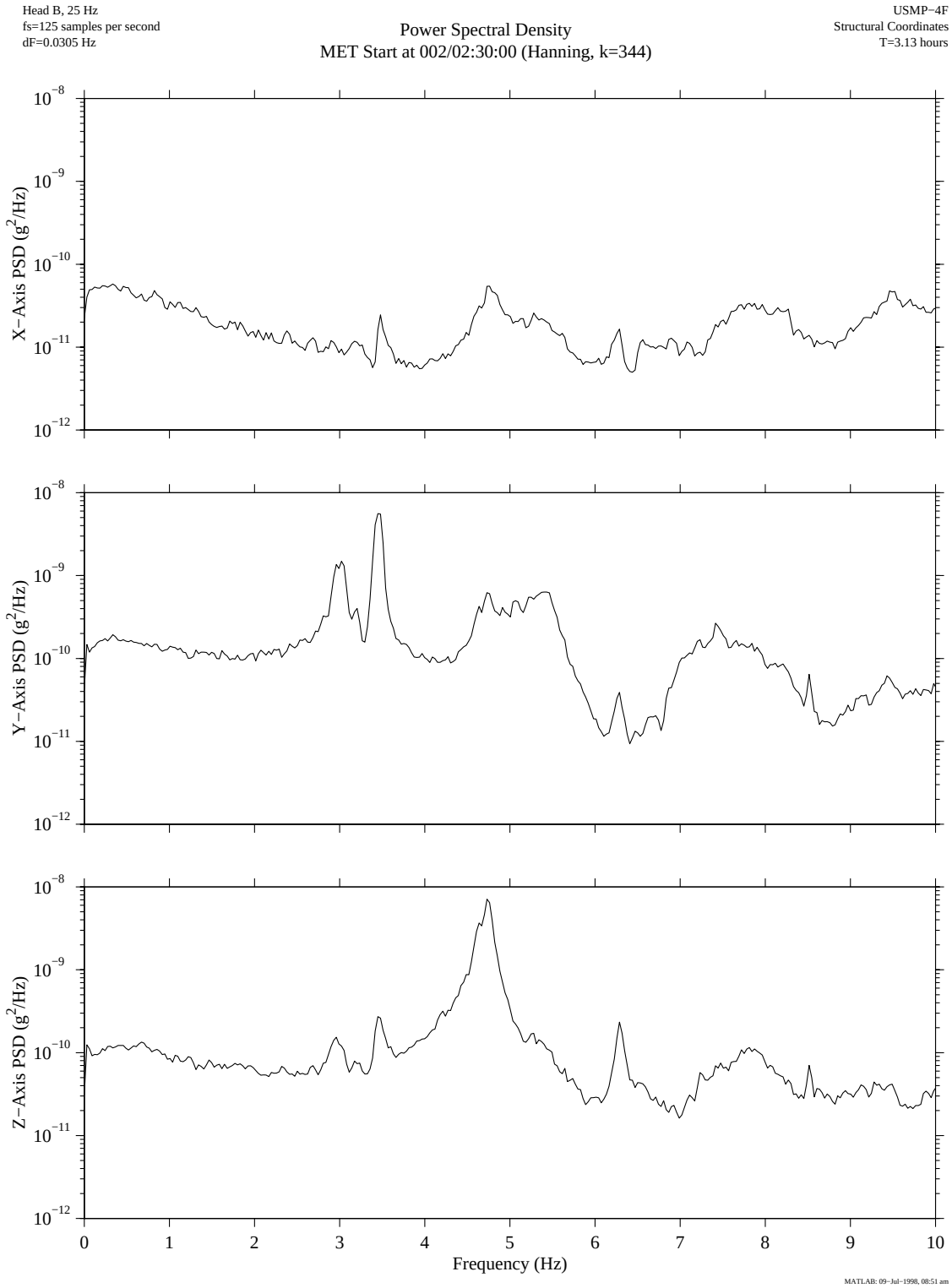


Figure 10. Structural Response to Satellite-Tracking Maneuvers (SAMS Unit F, TSH B).

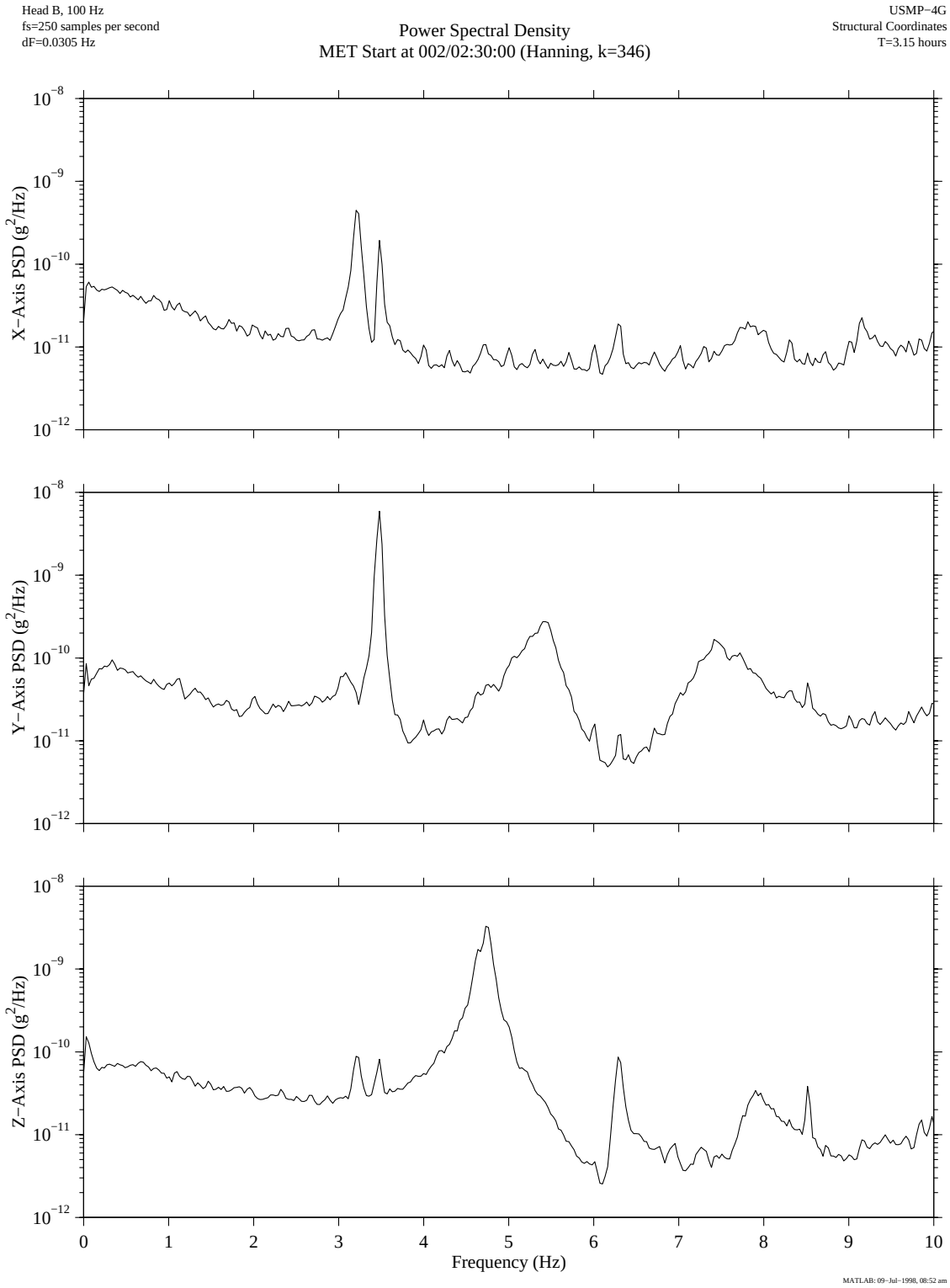


Figure 11. Structural Response to Satellite-Tracking Maneuvers (SAMS Unit G, TSH B).

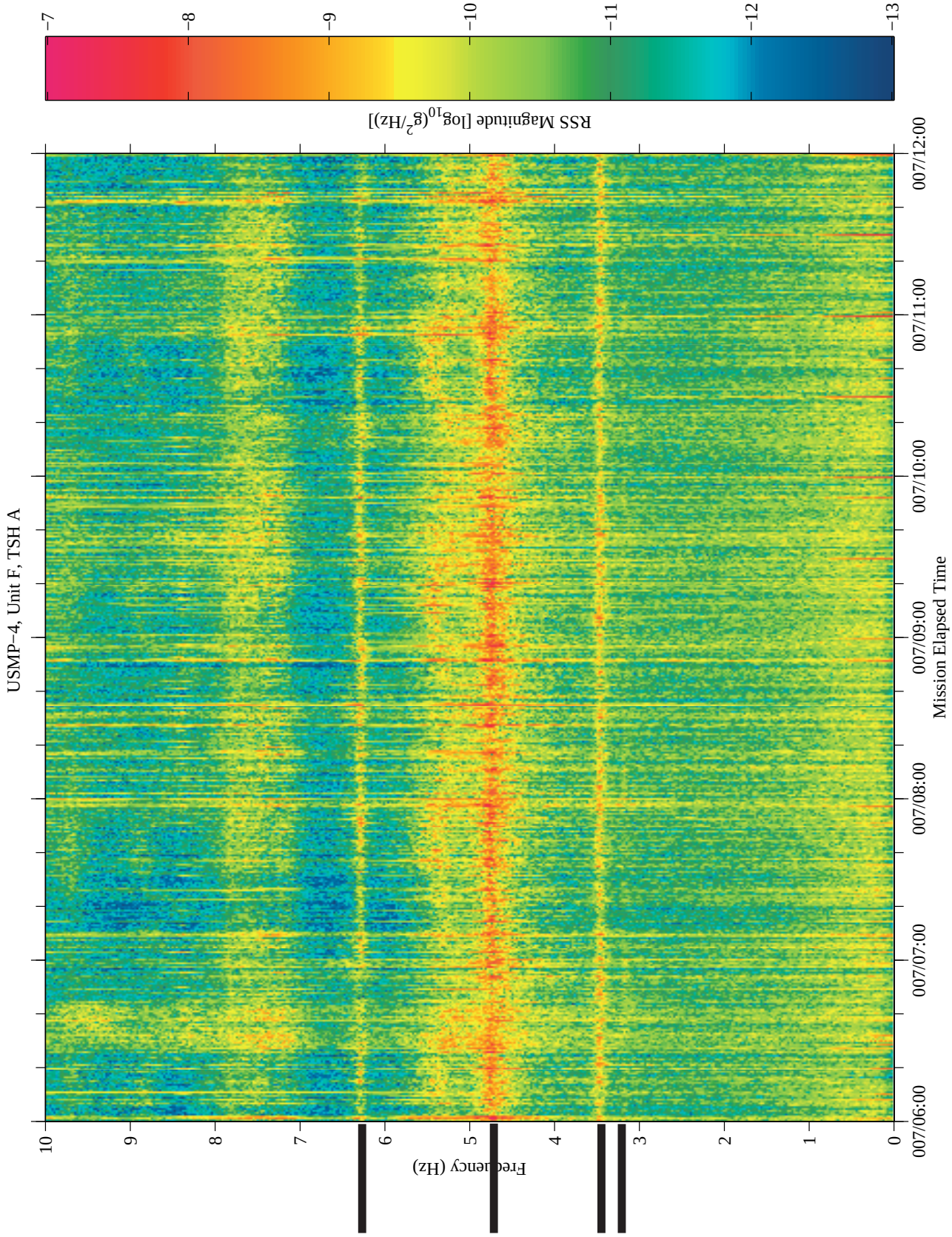


Figure 12. Structural Modes Spectrogram.

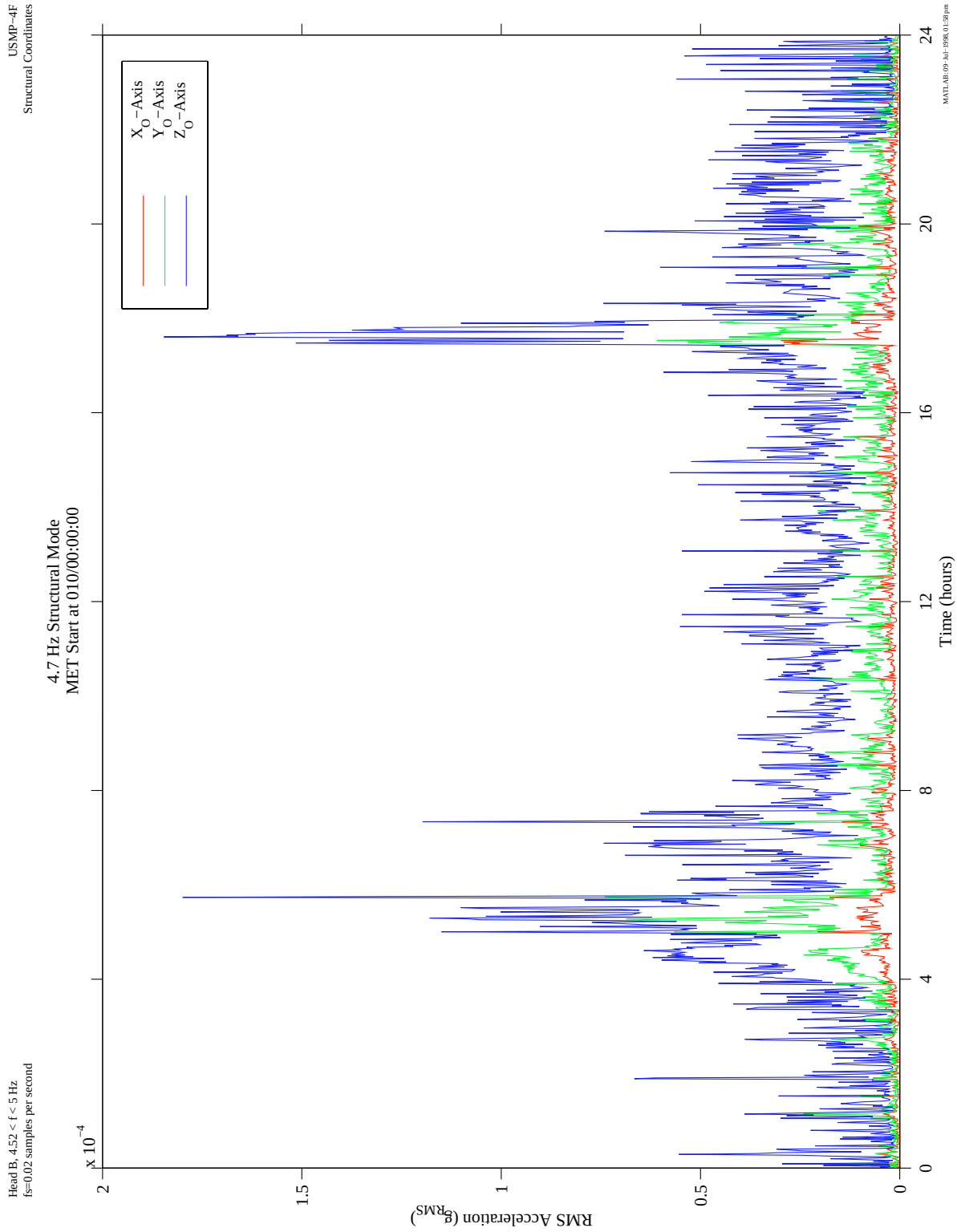


Figure 13. Structural Mode (4.7 Hz) XYZ RMS Acceleration Versus Time.

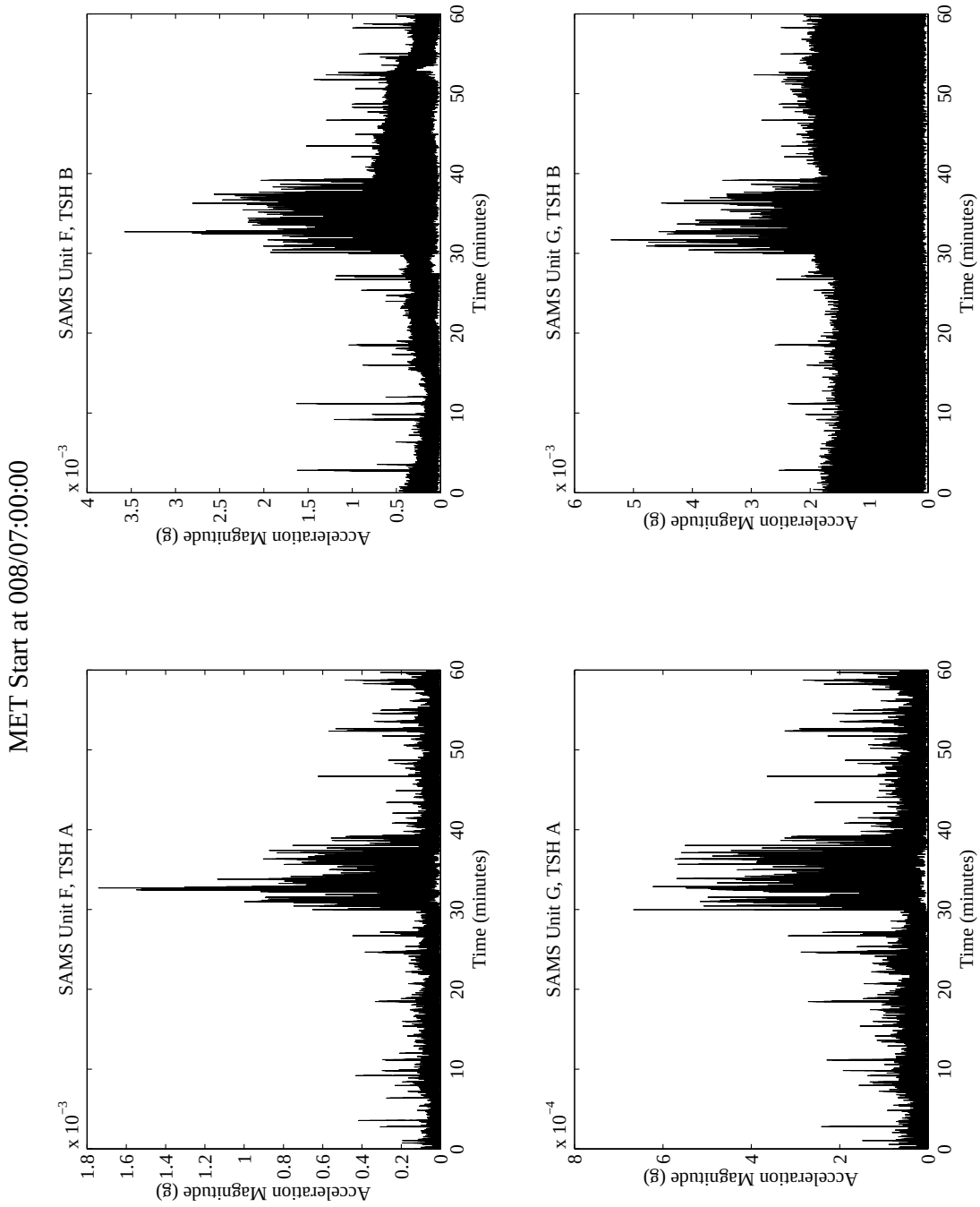


Figure 14. Heightened Acceleration Magnitude During Deadband Collapse.

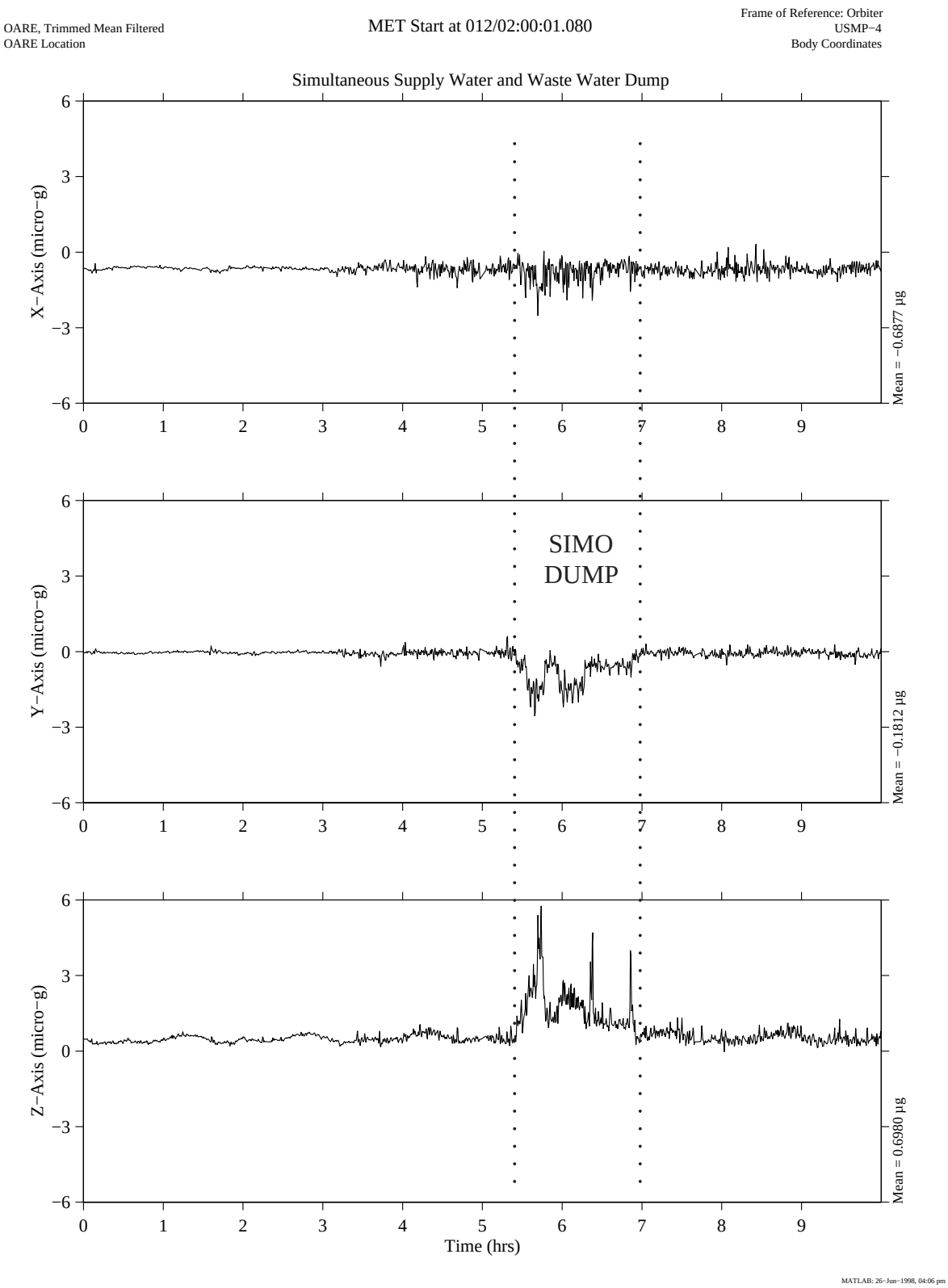


Figure 15. OARE Data Collected During a Simultaneous Supply and Waste Water Dump. MET Start at 012/02:00.

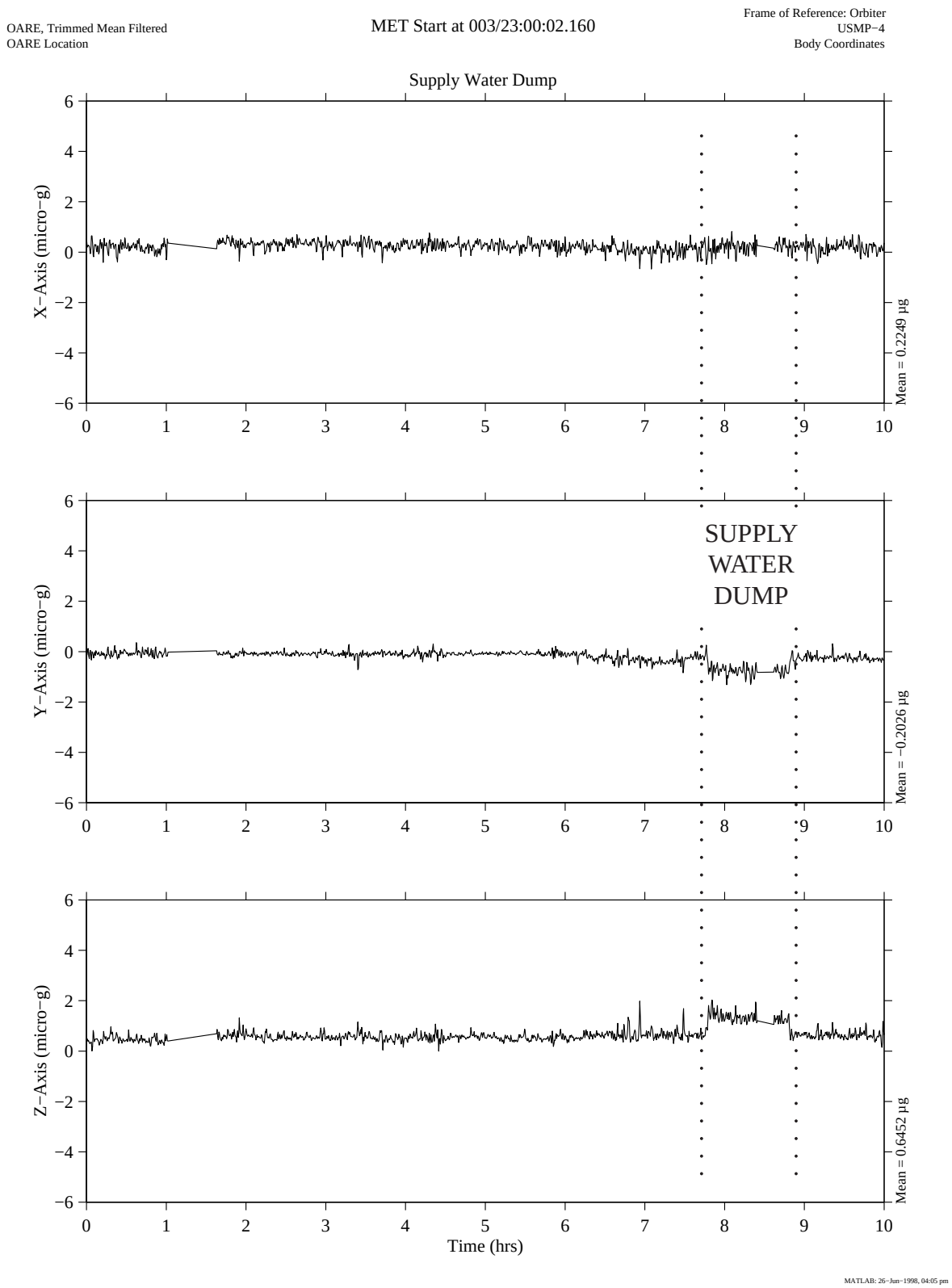


Figure 16. OARE Data Collected During a Supply Water Dump Starting at Approximately MET 004/07:00.

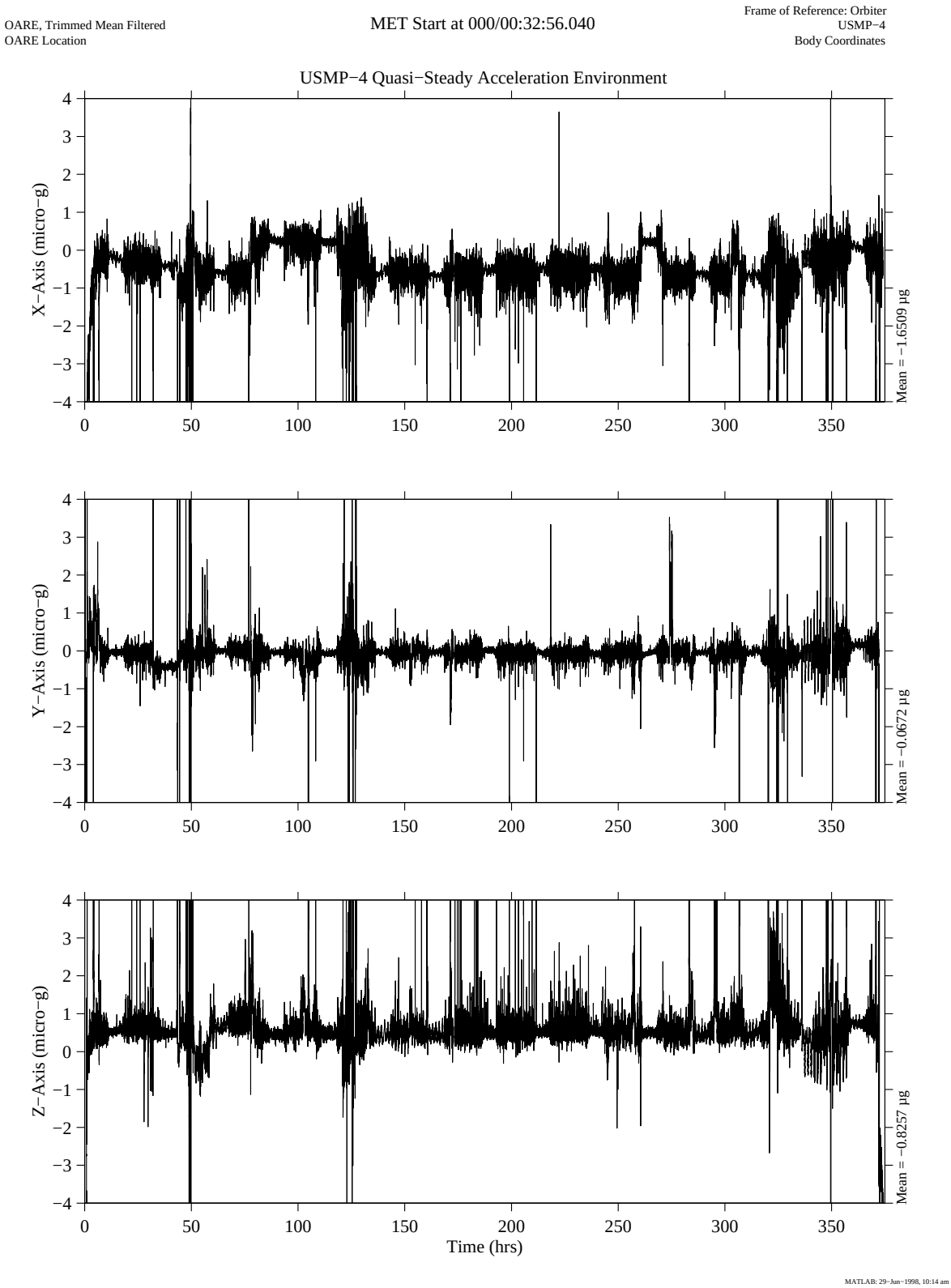


Figure 17. Trimmean Filtered OARE Data Versus Time for the STS-87 Mission.

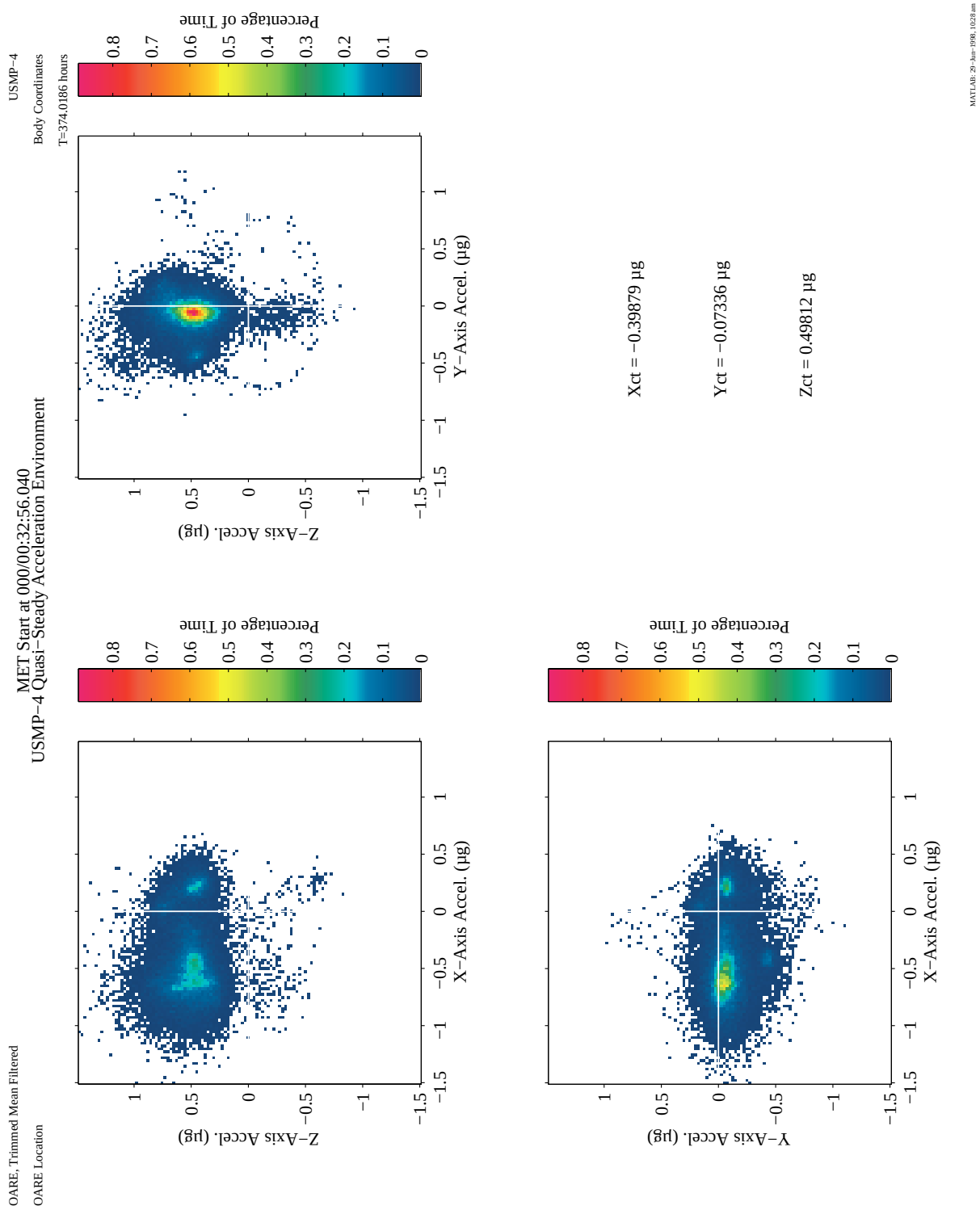


Figure 18. Quasi-Steady Three-Dimensional Histogram of Trimmean Filtered OARE Data for the STS-87 Mission.

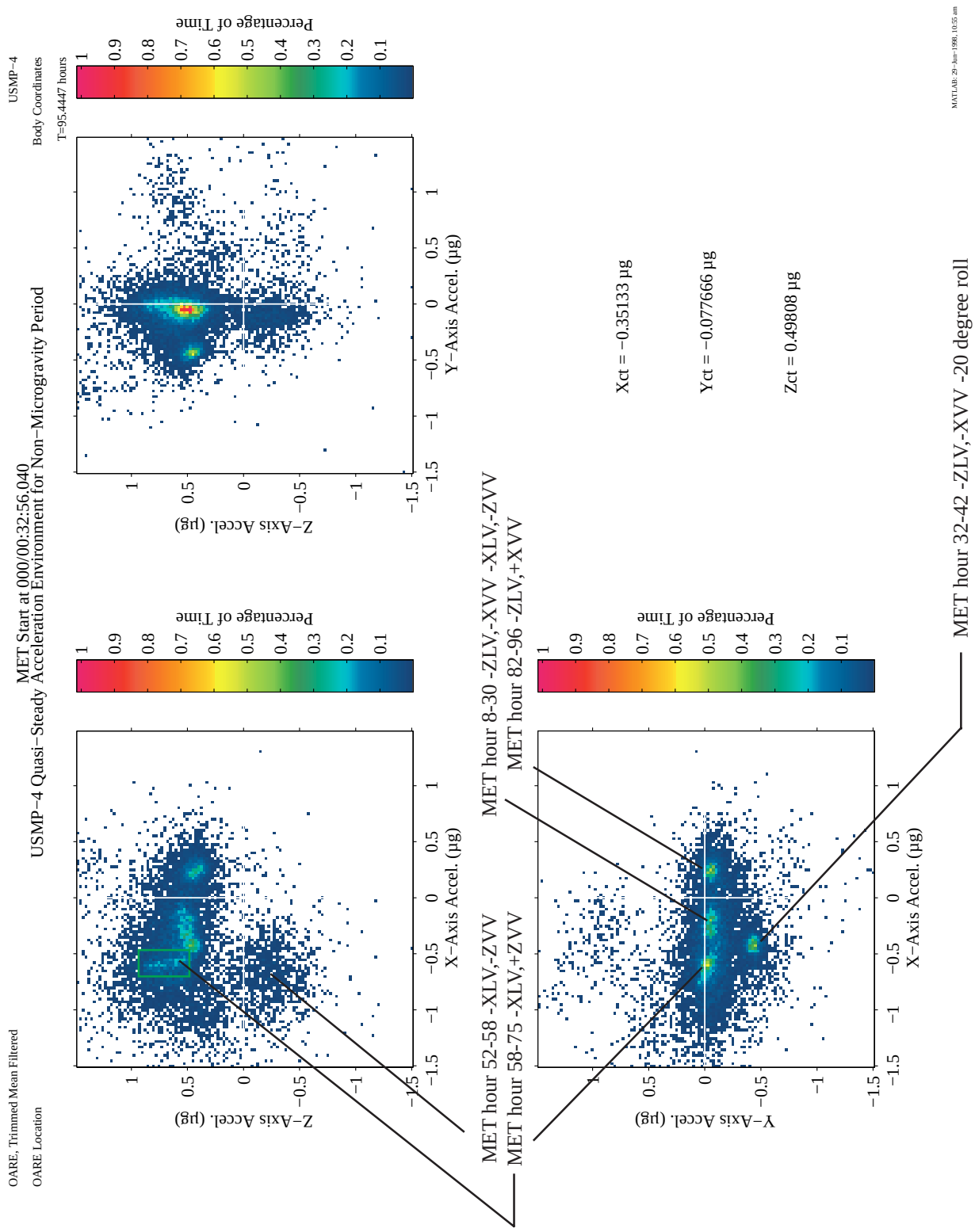


Figure 19. Quasi-Steady Three-Dimensional Histogram of the Non-Microgravity Period for the STS-87 Mission.

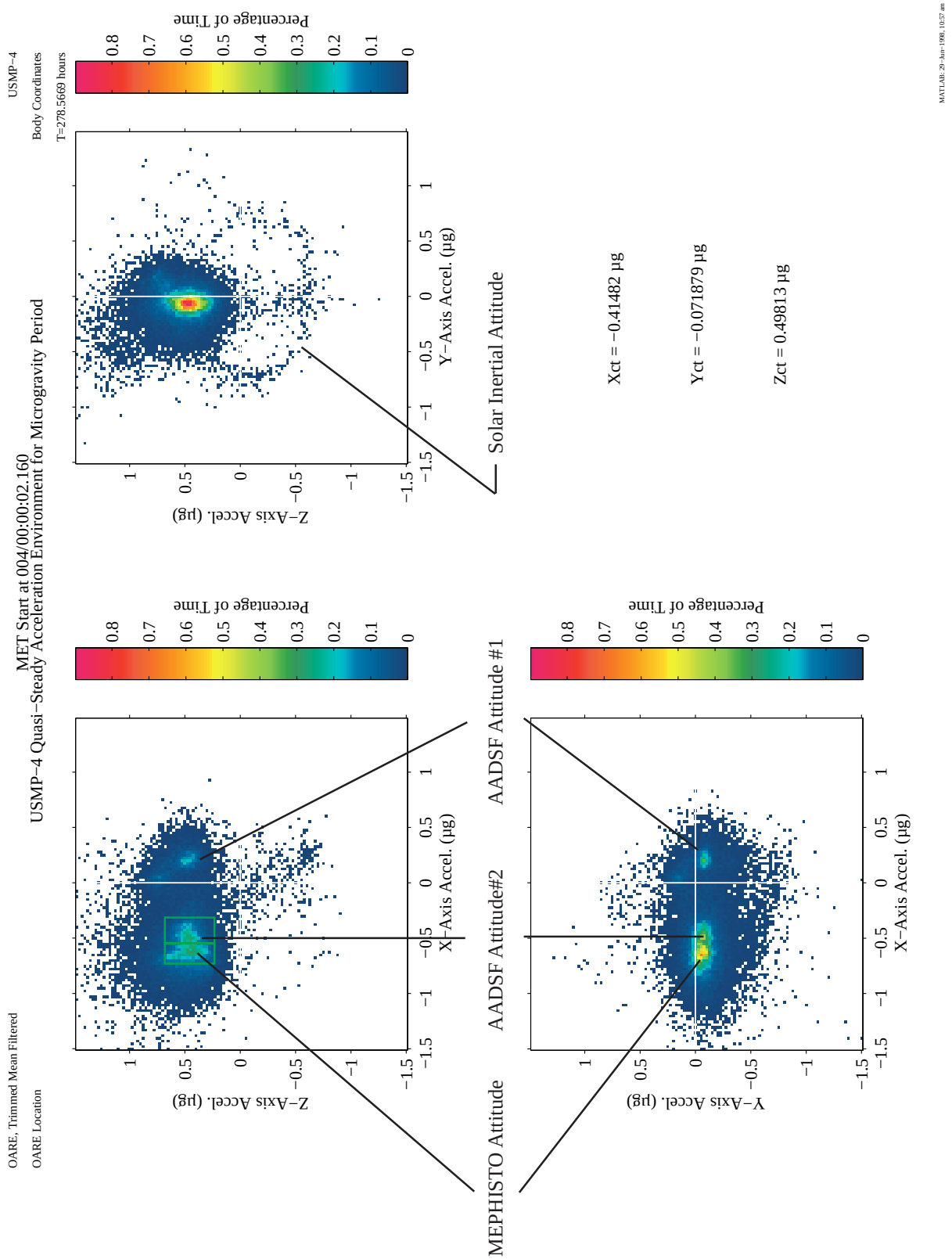


Figure 20. Quasi-Steady Three-Dimensional Histogram of the Microgravity Period for the STS-87 Mission.

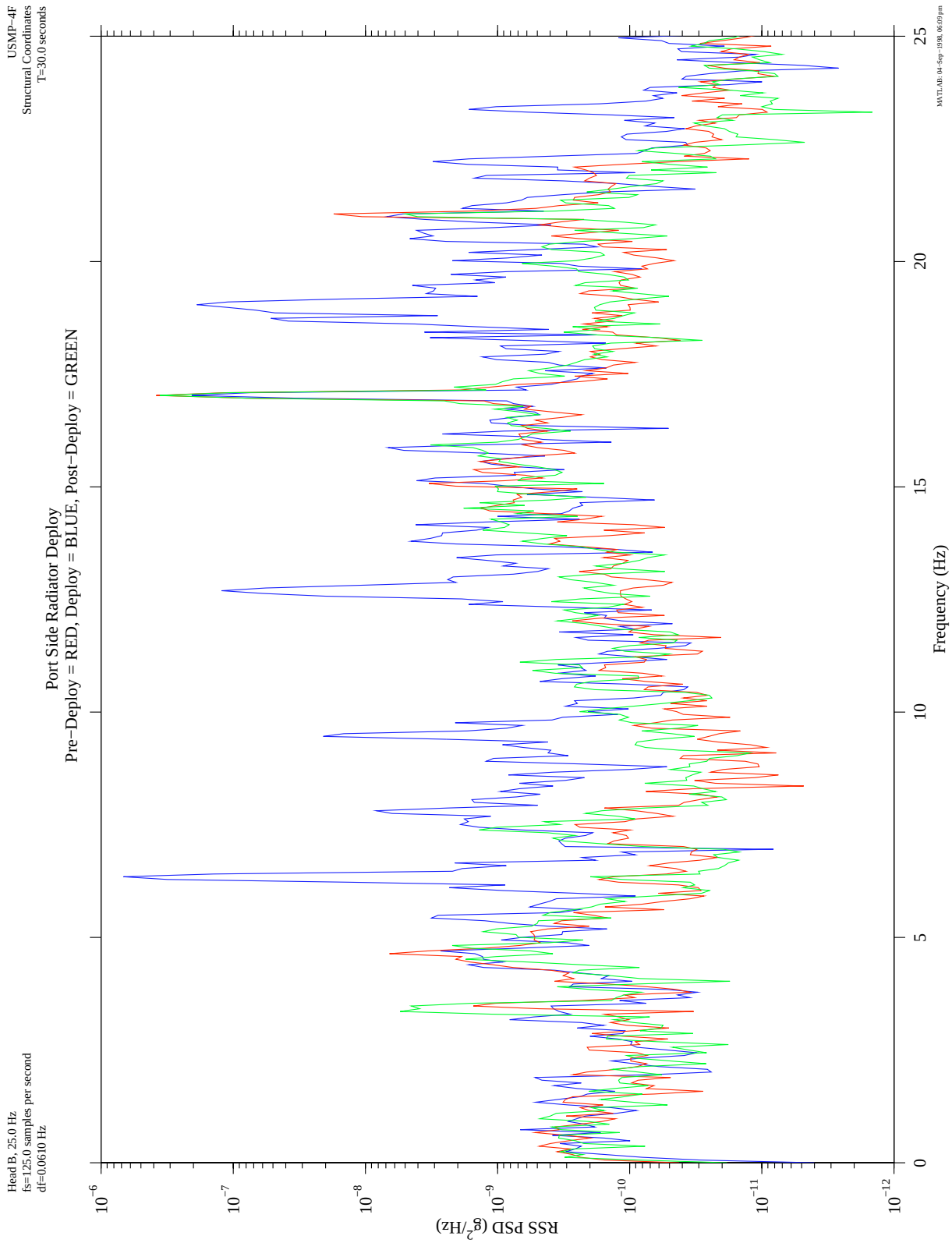


Figure 21. Port Side Radiator Deploy PSD.

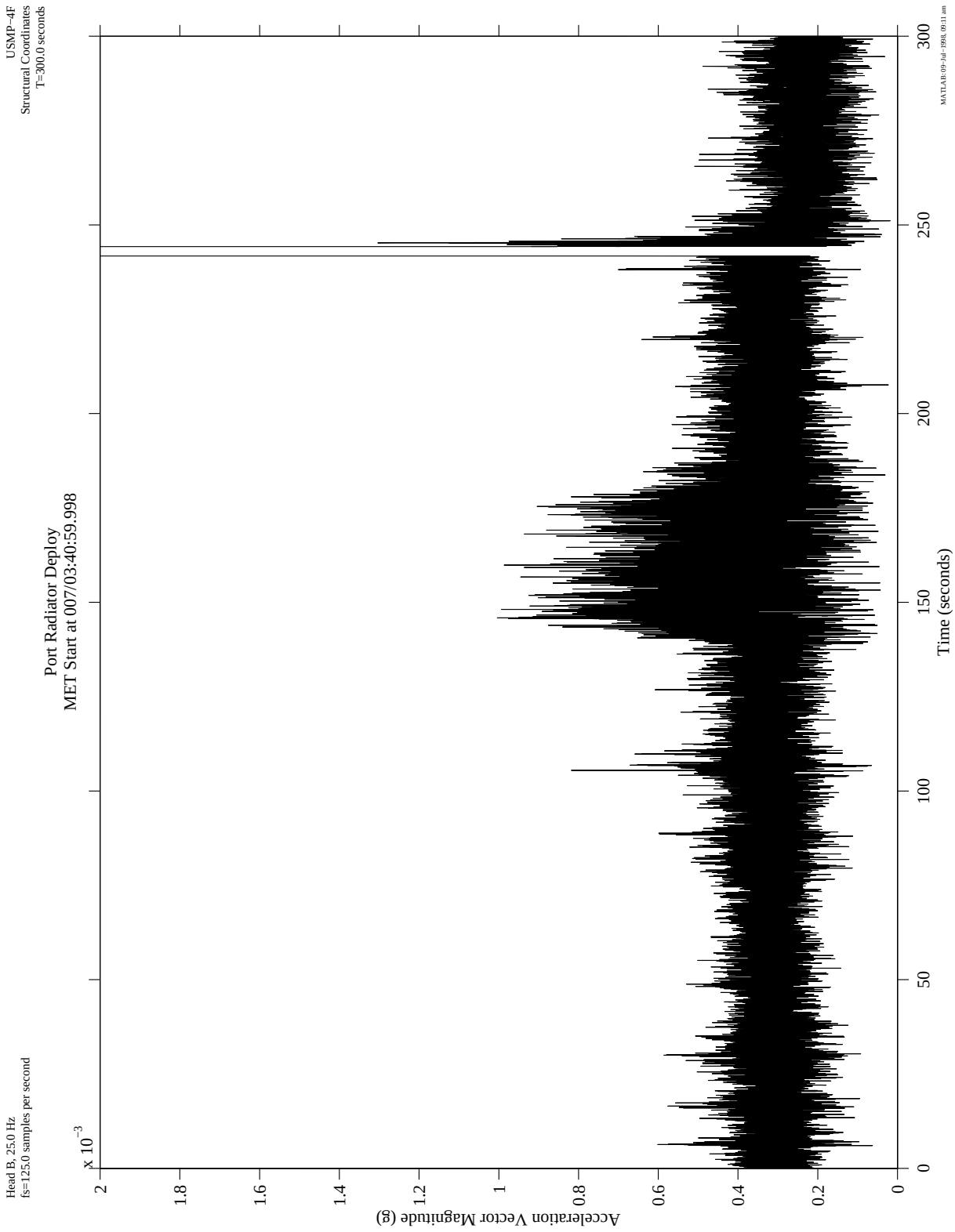


Figure 22. Port Radiator Deploy.

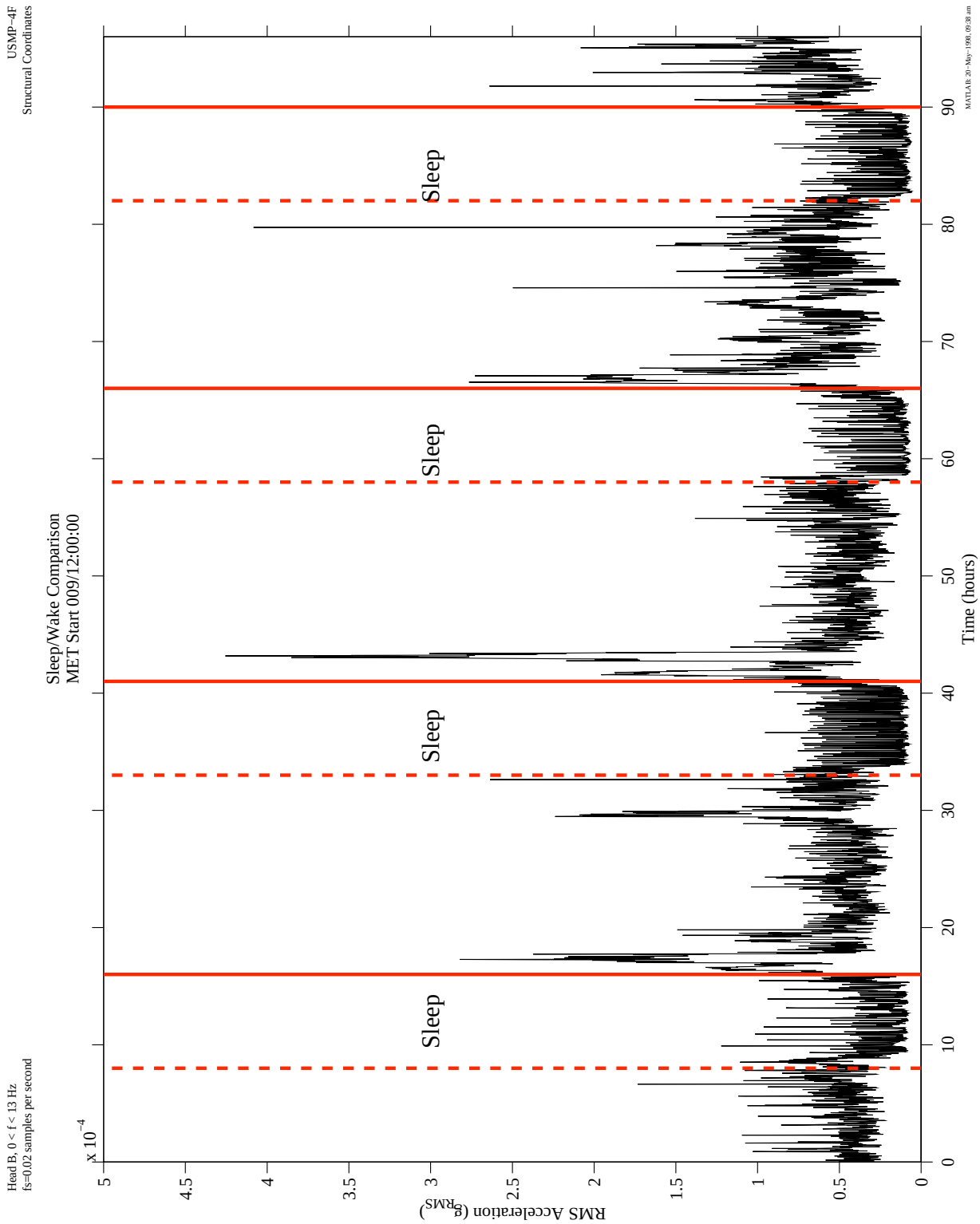


Figure 23. Sleep/Wake RMS Acceleration Comparison.

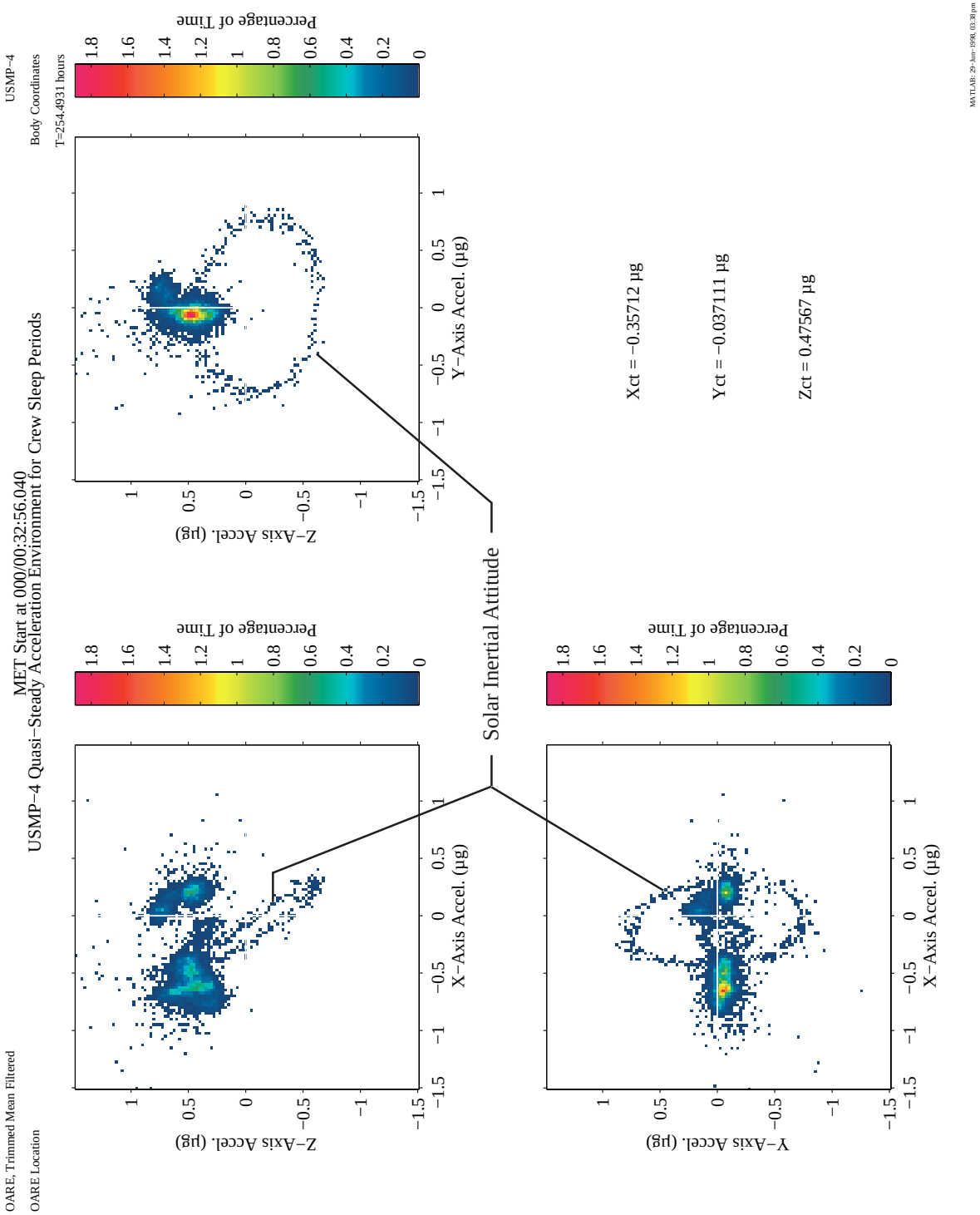


Figure 24. Quasi-Steady Three-Dimensional Histogram for Crew Sleep Periods During the STS-87 Mission.

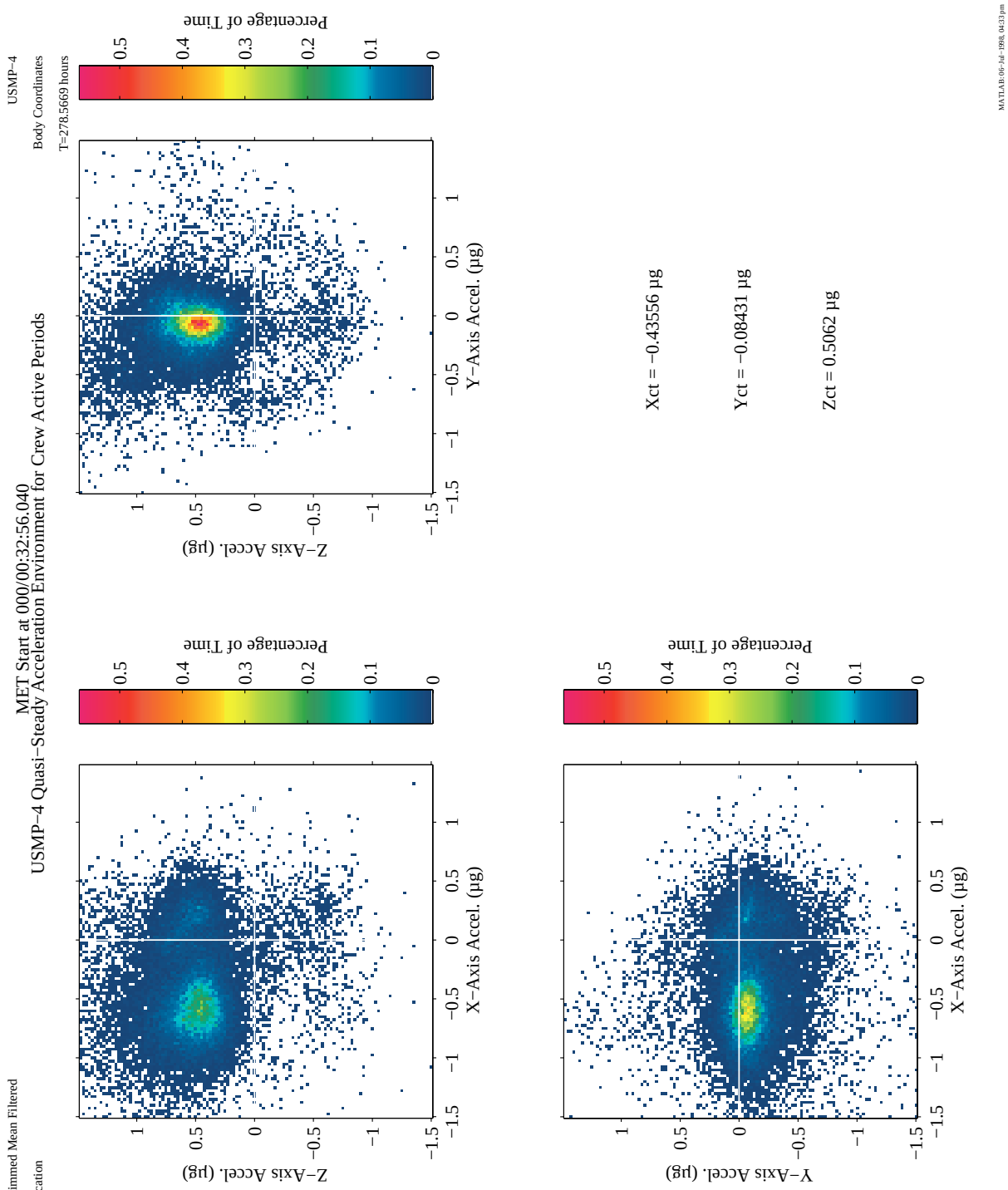


Figure 25. Quasi-Steady Three-Dimensional Histogram for Crew Active Periods During the STS-87 Mission.

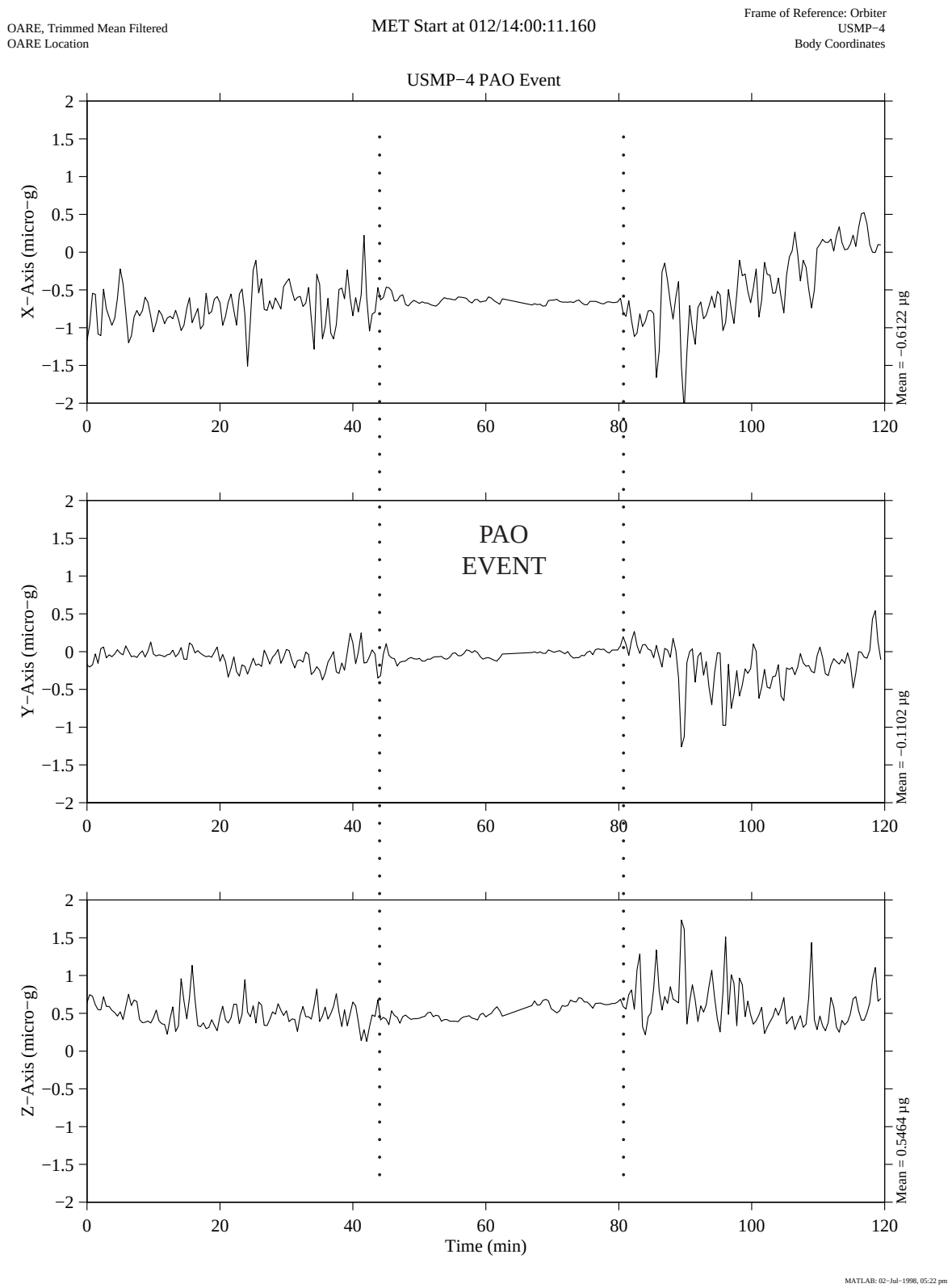


Figure 26. Trimmean Filter OARE Data During an STS-87 PAO Event.

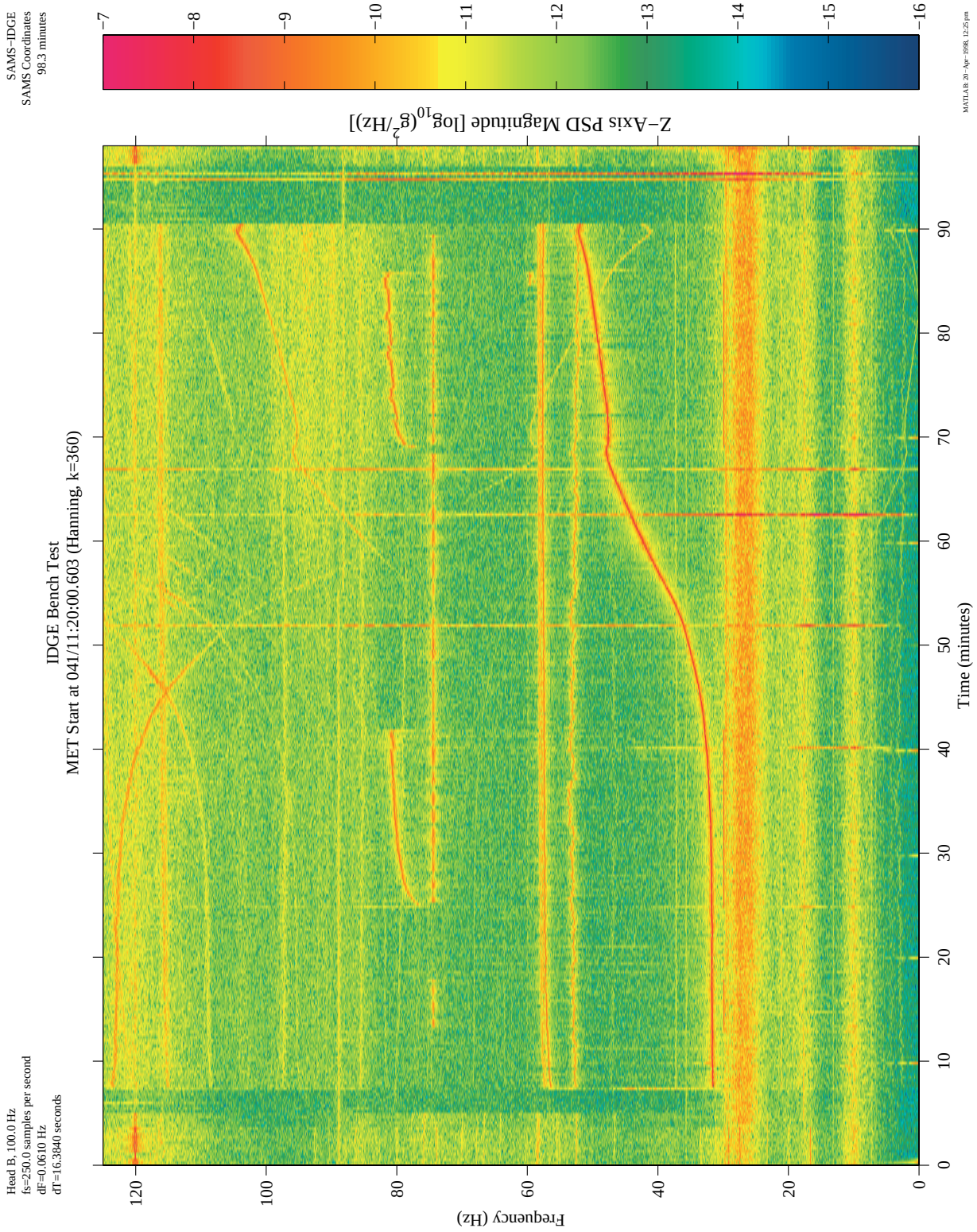


Figure 27. Spectrogram for SAMS/IDGE Bench Test.

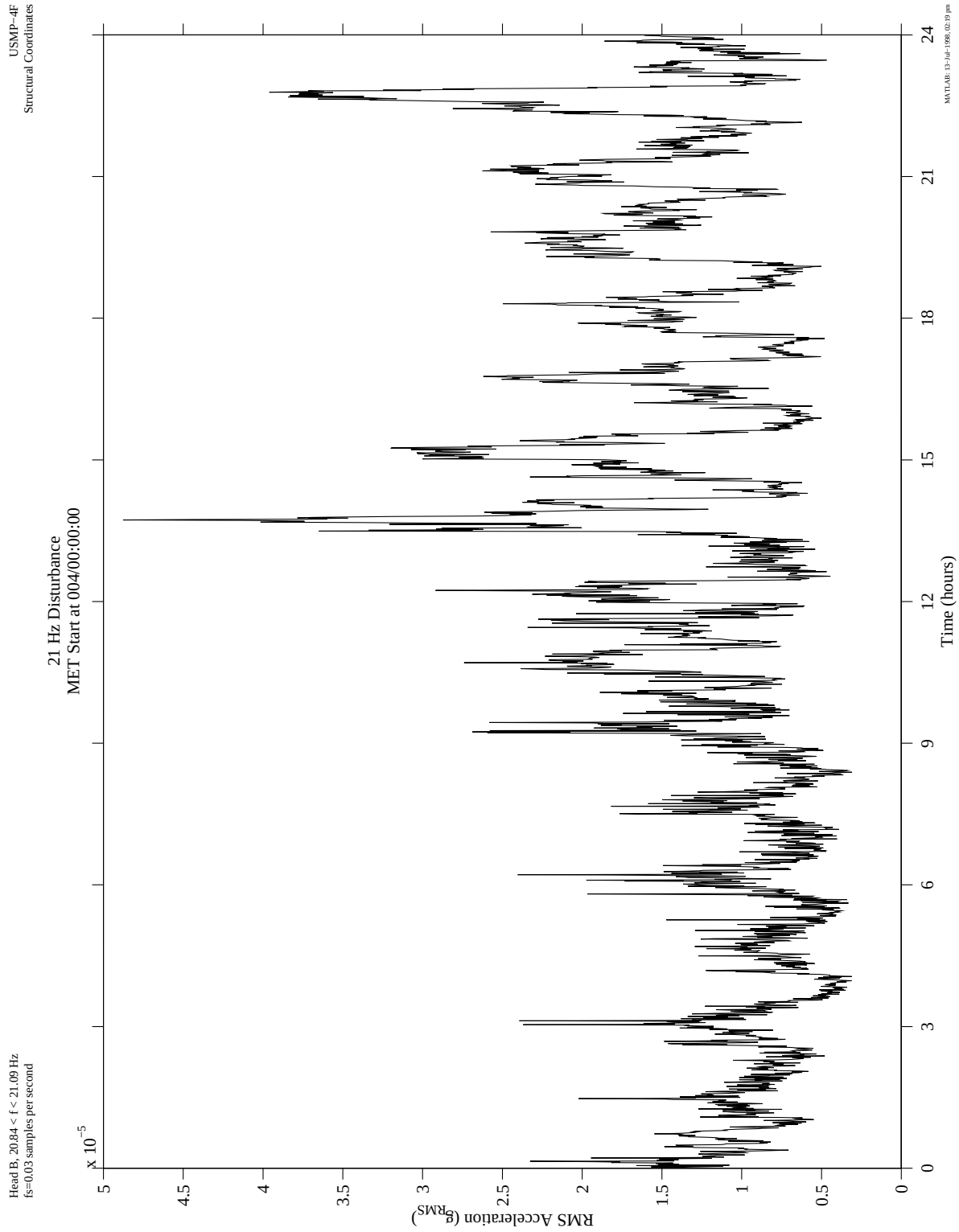


Figure 28. RMS Acceleration Versus Time for 21 Hz Disturbance.

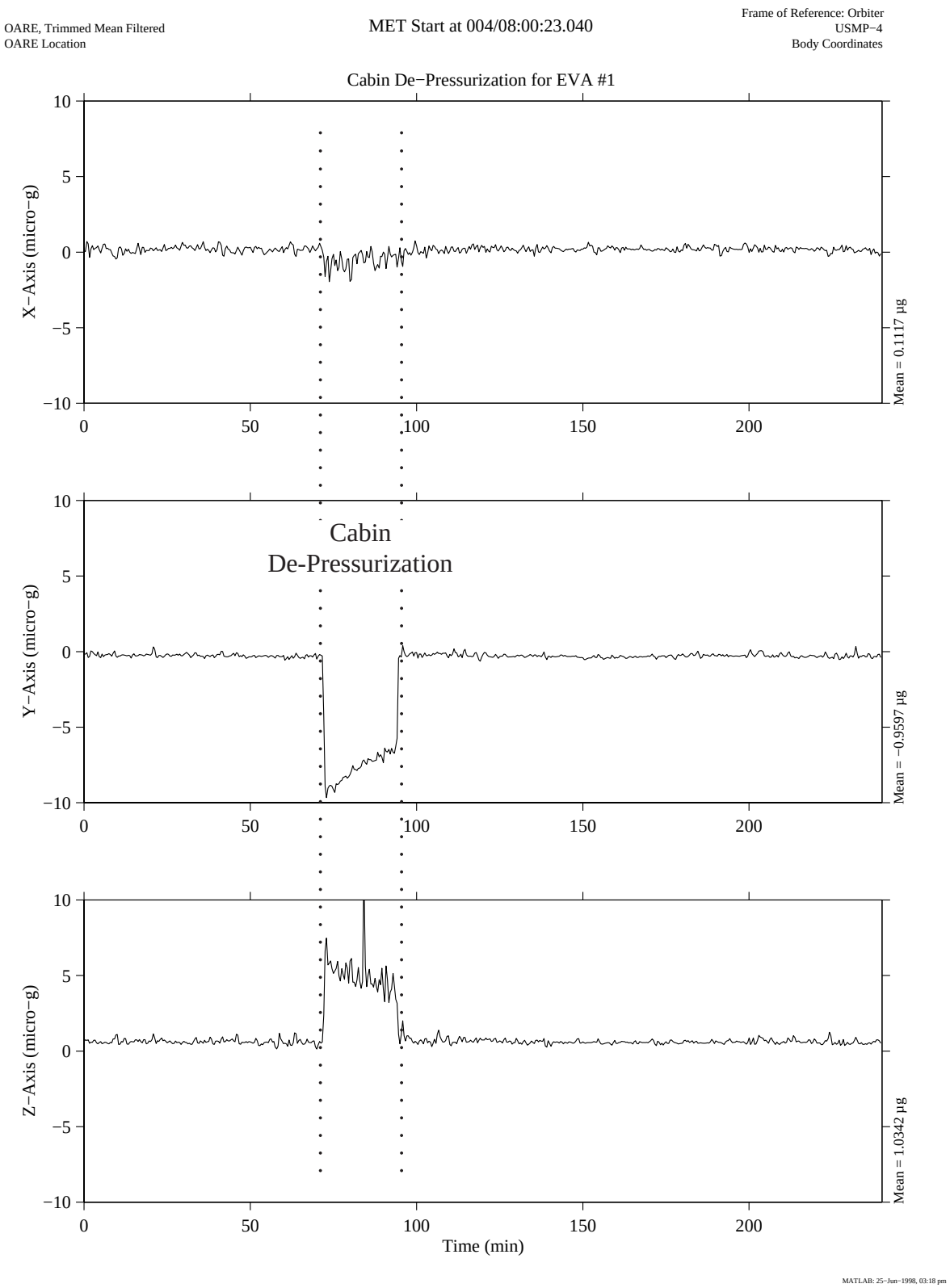


Figure 29. Cabin De-Pressurization in Preparation for EVA #1.

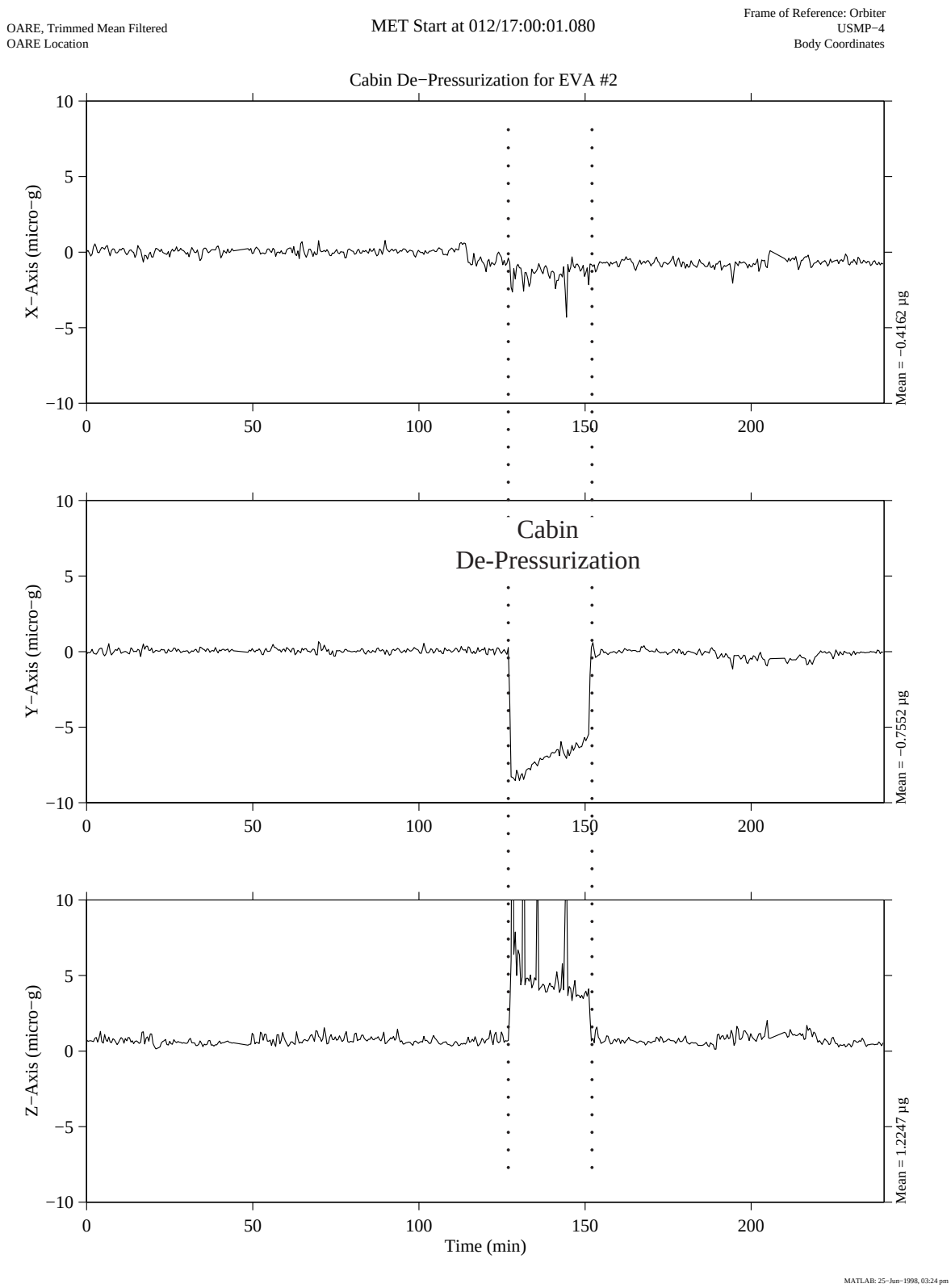


Figure 30. Cabin De-Pressurization in Preparation for EVA #2.

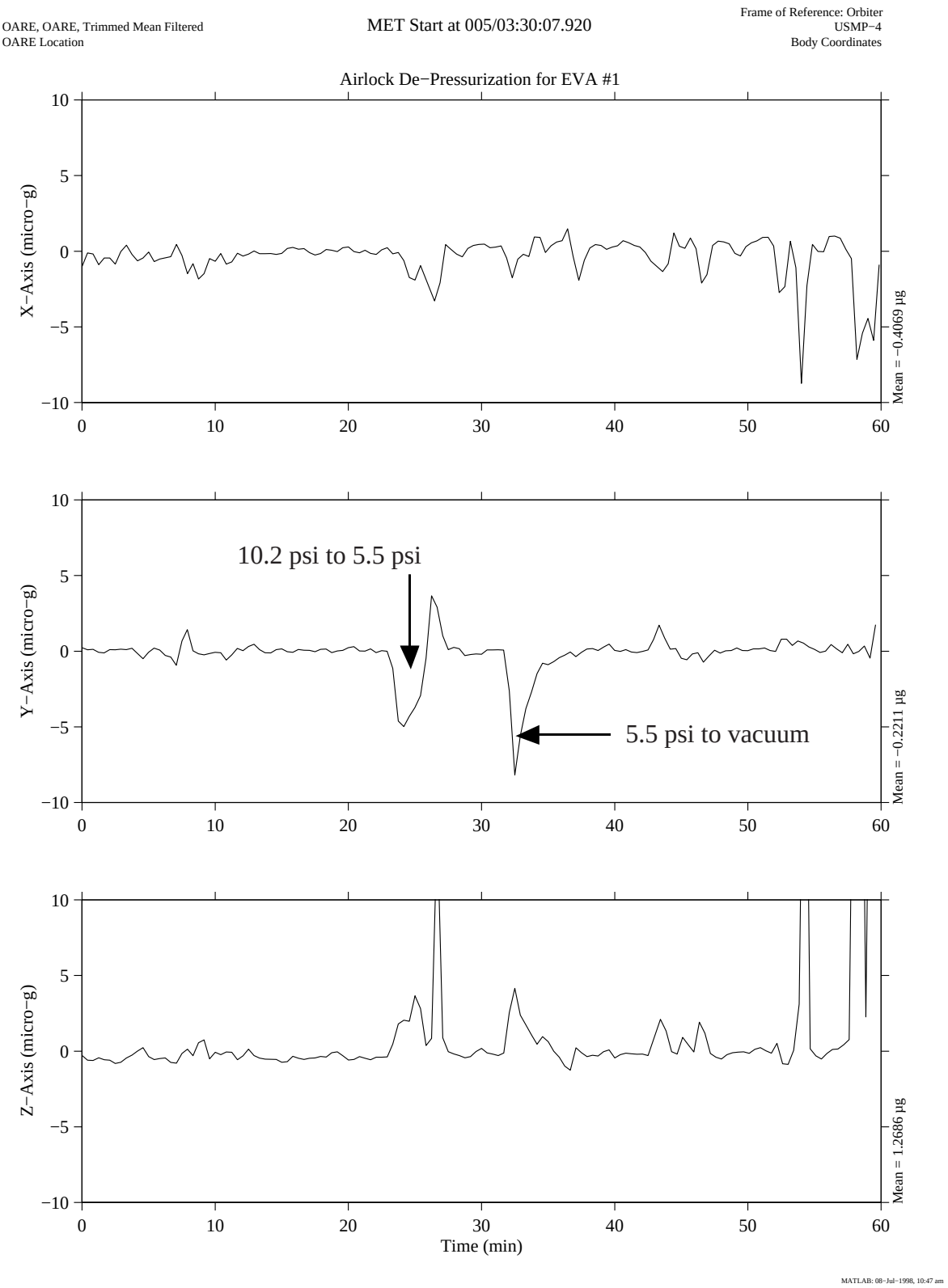


Figure 31. Airlock De-Pressurization in Preparation for EVA #1.

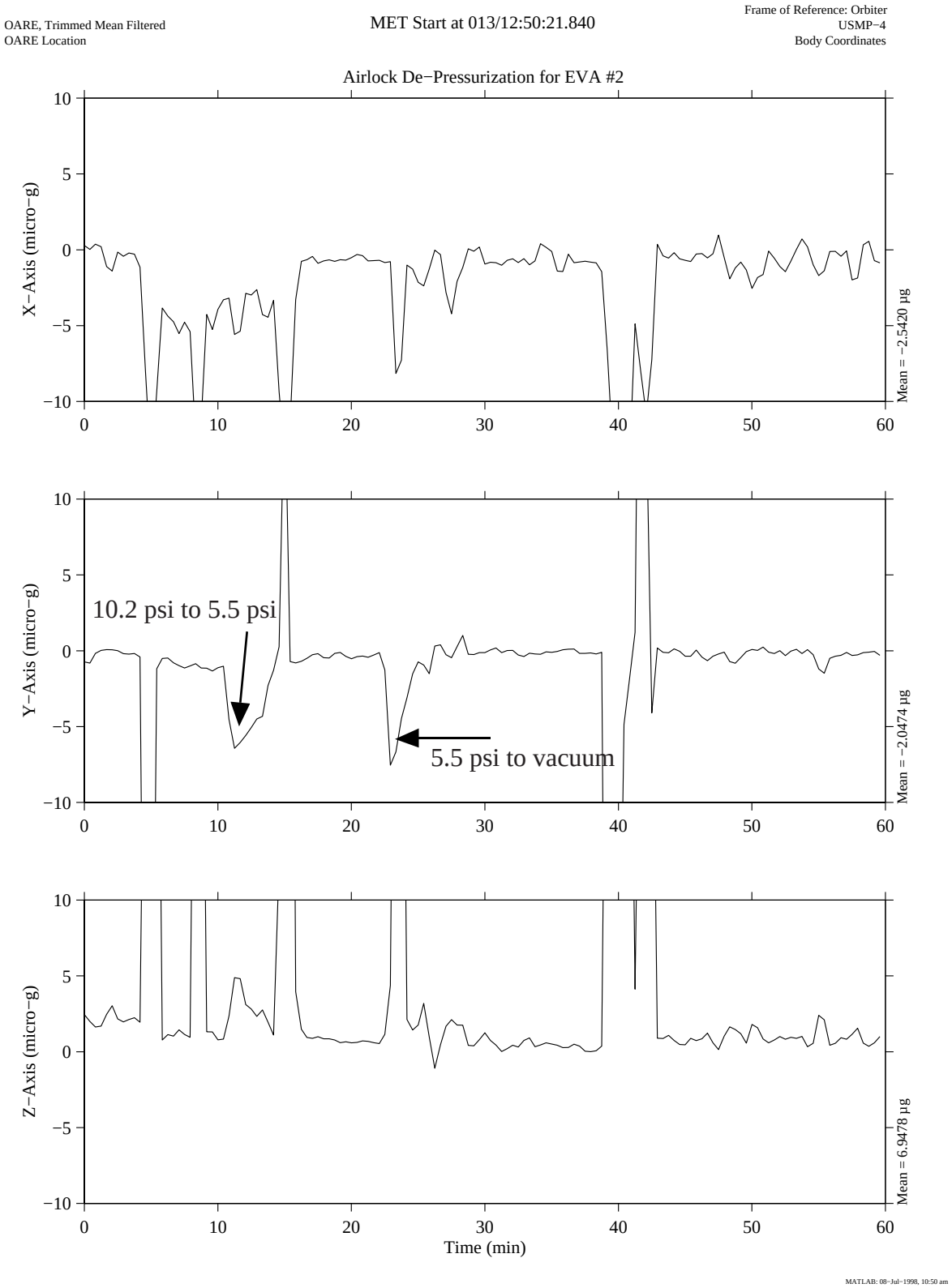


Figure 32. Airlock De-Pressurization in Preparation for EVA #2.

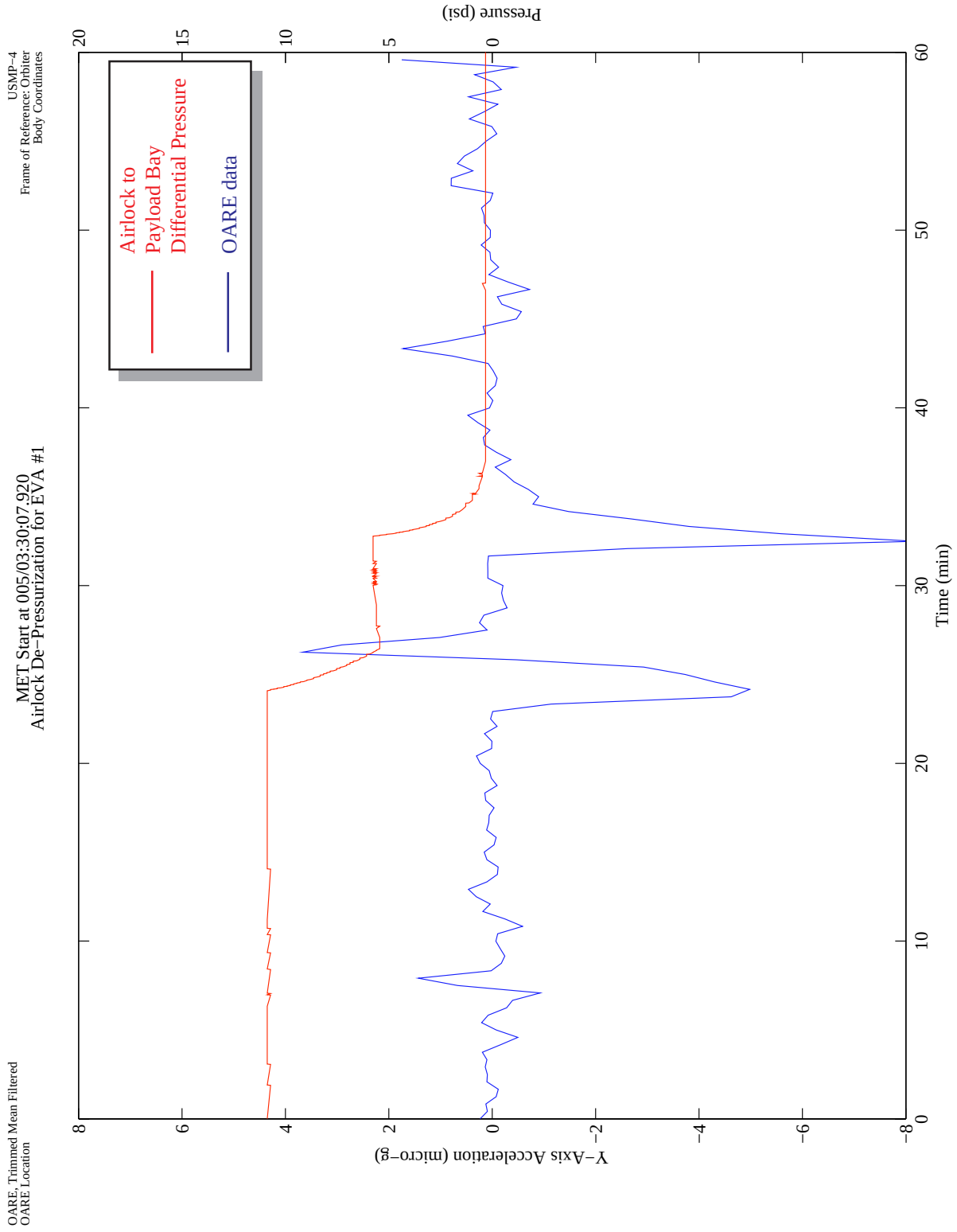


Figure 33. Airlock De-Pressurization for EVA #1 from STS-87.

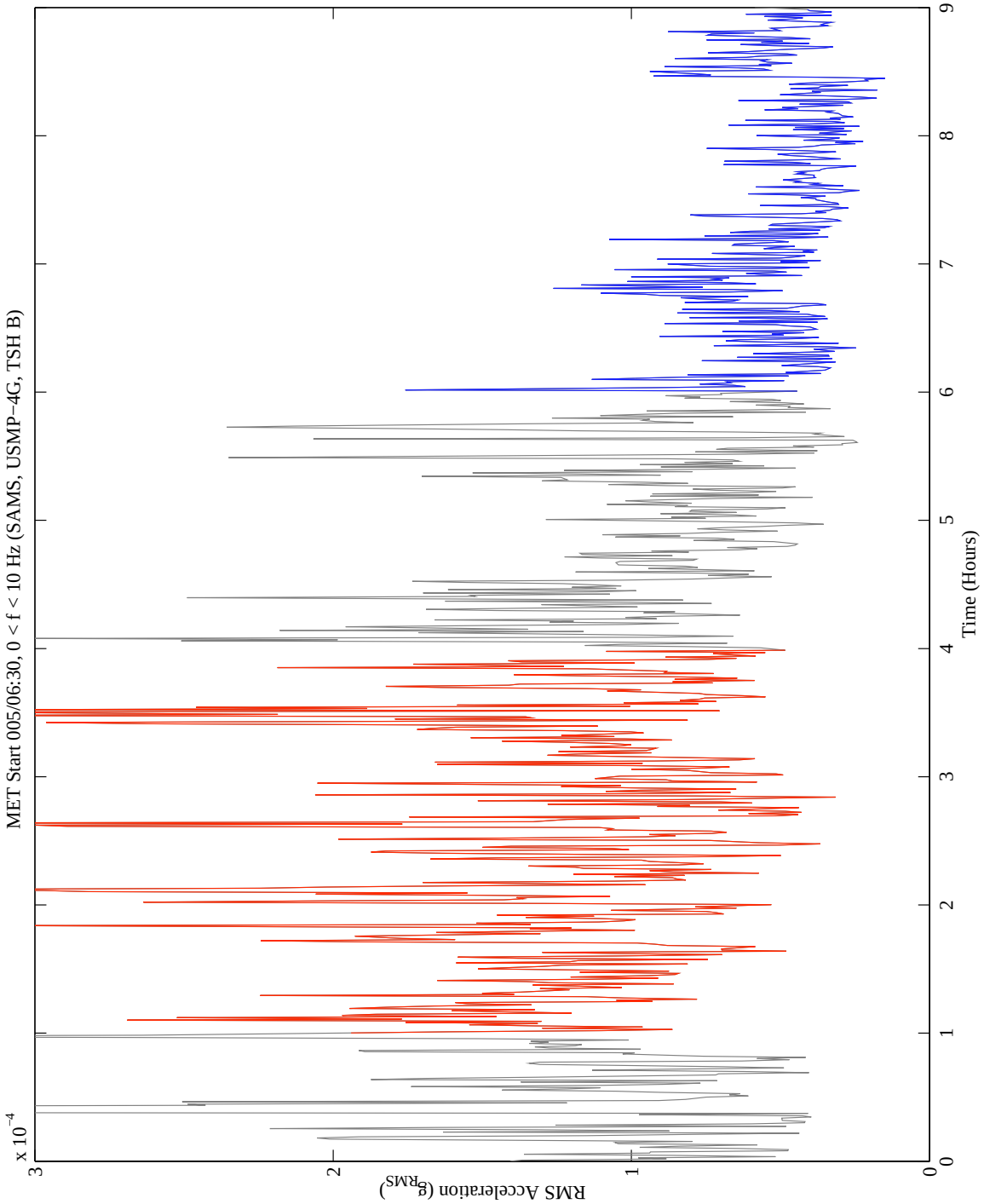


Figure 34. RMS Acceleration Versus Time During /After EVA #1.

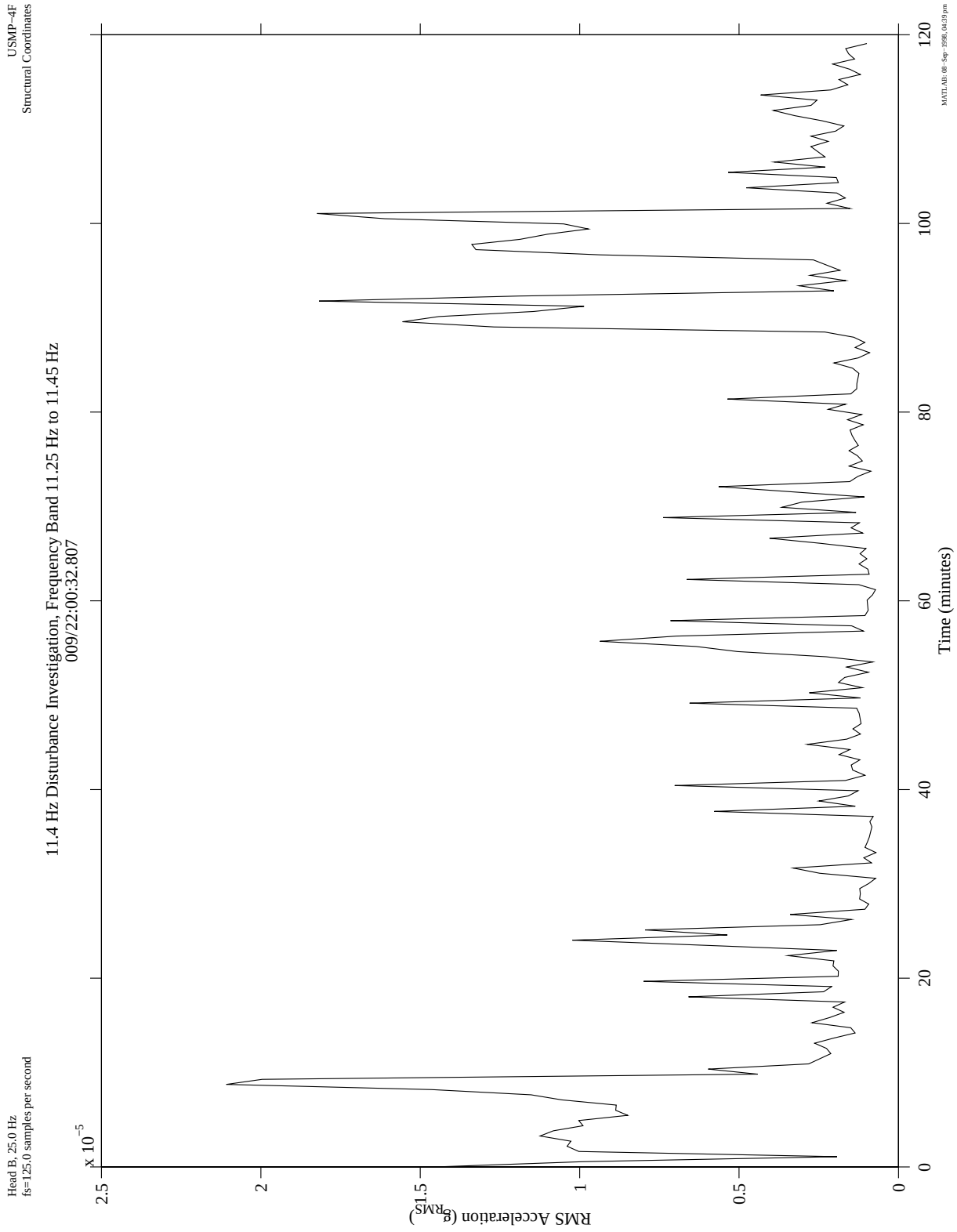
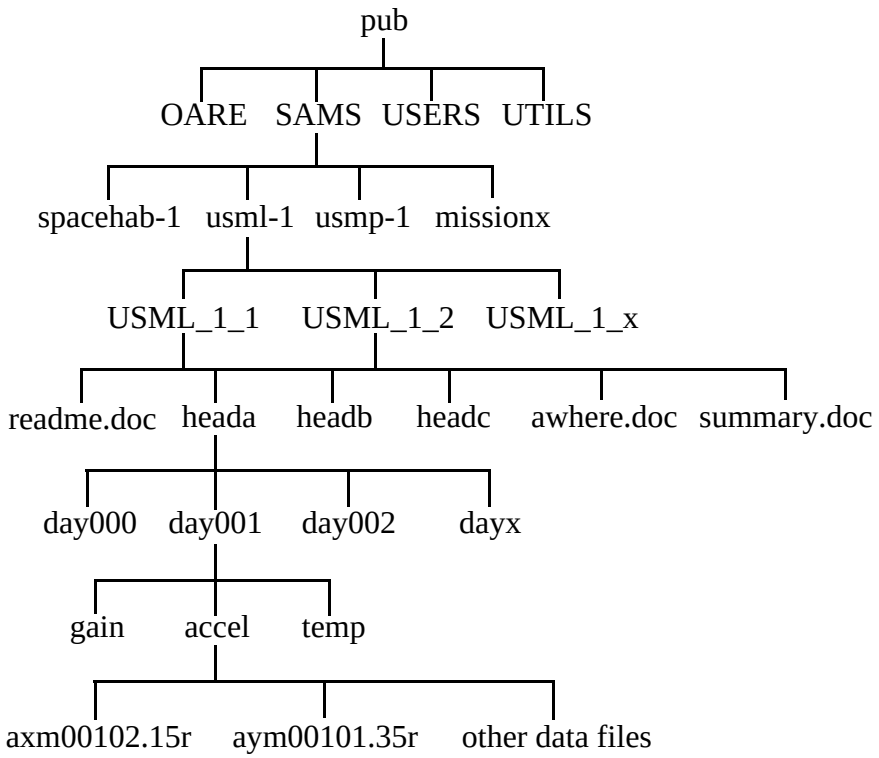


Figure 35. 11.35 Hz Disturbance Investigation, Frequency Band 11.25 Hz to 11.45 Hz.

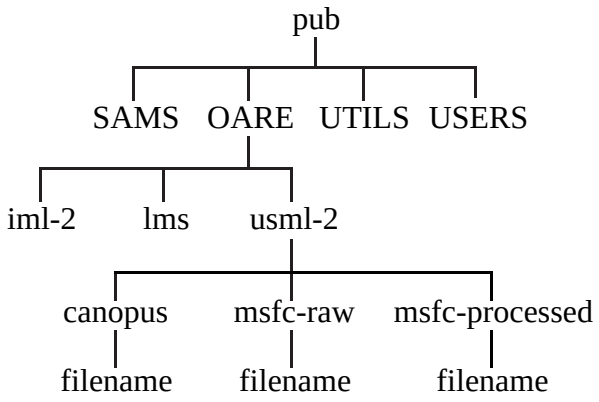
Appendix A: Accessing Acceleration Data Via the Internet

SAMS and OARE data are available over the Internet from the NASA Lewis Research Center file server "beech.lerc.nasa.gov". Acceleration data files are arranged in a tree-like structure. Data are first separated based upon accelerometer and then by mission. For SAMS data files, the data are further subdivided based upon some portion of the mission, sensor head, year (for Mir data), day, and finally type of data file (acceleration, temperature, or gain). The following figure illustrates this structure.



The SAMS data files (located at the bottom of the tree structure) are named based upon the contents of the file. For example, a file named "axm00102.15r" would contain TSH A data for the X-axis for day 001, hour 02, file 1 of 5. The readme.doc file gives a complete explanation of the file naming convention.

OARE data files also follow a tree-like structure, but with different branches. The data are first divided based upon mission, and then are divided by type of data. The OARE tree structure looks like this:



Files under the canopus directory are trimmean filter data, computed by Canopus Systems, Inc. Files under the msfc-raw directory contain the telemetry data files provided to PIMS by the Marshall Space Flight Center Payload Operations Control Center data reduction group. Files under the msfc-processed directory are raw files containing binary floating point values, listing the MET (in hours), and the x, y, and z axis acceleration in micro-g's. See the readme files under the canopus directory for complete data descriptions.

Data access tools for different computer platforms (MS-DOS, Macintosh, SunOS, and MS-Windows) are available in the /pub/UTILS directory.

The beech file server can be accessed via anonymous File Transfer Protocol (ftp), as follows:

1) Open a connection to "beech.lerc.nasa.gov"
2) Login as userid "anonymous"
3) Enter your e-mail address as the password
4) Change directory to pub
5) List the files and directories in the /pub directory
6) Change directory to the accelerometer of interest
7) Change directory to the mission of interest
8) Use the data file structures (described above) to locate the desired files
9) Enable binary file transfers
10) Transfer the desired files

If you encounter difficulty in accessing the data using the file server, send an electronic mail message to "pims@lerc.nasa.gov". Please describe the nature of the difficulty and also give a description of the hardware and software you are using to access the file server.

Appendix B: SAMS Color Spectrograms for Unit F, TSH B

The PIMS group has processed SAMS data from STS-87, Unit F, TSH B to produce the plots shown here. These data were collected at 125 samples per second, and a 25 Hz low pass filter was applied to the data by the SAMS unit prior to digitization. Prior to plot production, the raw SAMS data were compensated for gain changes, and then demeaned. Demeaning was accomplished by analyzing individual sections with a nominal length of 30 minutes. Users who are interested in further details for either of these operations are encouraged to contact the PIMS group.

Color spectrograms are used to show how the microgravity environment varies in intensity with respect to both the time and frequency domains. These spectrograms are provided as an overview of the frequency characteristics of the SAMS data during the mission. Each spectrogram is a composite of six hour's worth of data. The time resolution used to compute the spectrograms seen here is 16.4 seconds. This corresponds to a frequency resolution of 0.06 Hz.

In order to produce the spectrogram image, PSDs were computed for successive time intervals (the length of the interval is equal to the time resolution). For the PSD computation, a Hanning window was applied. In order to combine all three axes into a single plot to show an overall level, a vector magnitude (VM) operation was performed. Stated mathematically:

$$VM_k = \sqrt{PSD_{x_k}^2 + PSD_{y_k}^2 + PSD_{z_k}^2} \; .$$

By imaging the base 10 logarithm ($\log_{10}$) magnitude as a color and stacking successive PSDs from left to right, variations of PSD magnitude and frequency are shown as a function of time. Colors are assigned to discrete magnitude ranges, so that there are 207 colors assigned to the entire range of magnitudes shown.

The colorbar limits are chosen in order to minimize saturation in a given set of spectrogram plots. Data which fall outside of these limits will be imaged as either the highest or lowest magnitude, depending on which side they have saturated. If an area of interest seems to be saturated, care should be taken because the actual values may lie above or below the color mapping shown on the plot.

Due to the nature of spectrograms, care should be taken to not merely read a color's numeric value as being the "amount" of acceleration that is present at a given frequency. In order to get this type of information, the PSDs must be integrated between two frequencies. These frequencies (lower and upper) form the band of interest. The result of this integration is the g_{RMS} acceleration level in the $\left[f_{lower}, f_{upper}\right]$ band. The PIMS group is able to provide this type of analysis on a per-request basis.

Plot gaps (if any exist) are shown by either white or dark blue areas on the page. If a plot gap exists for an entire plot (or series of successive plots), a comment is placed on the page to let the user know there is a gap in the data. These "no data available" comments will not show exact times for which the data are not available, but will only indicate missing plots.

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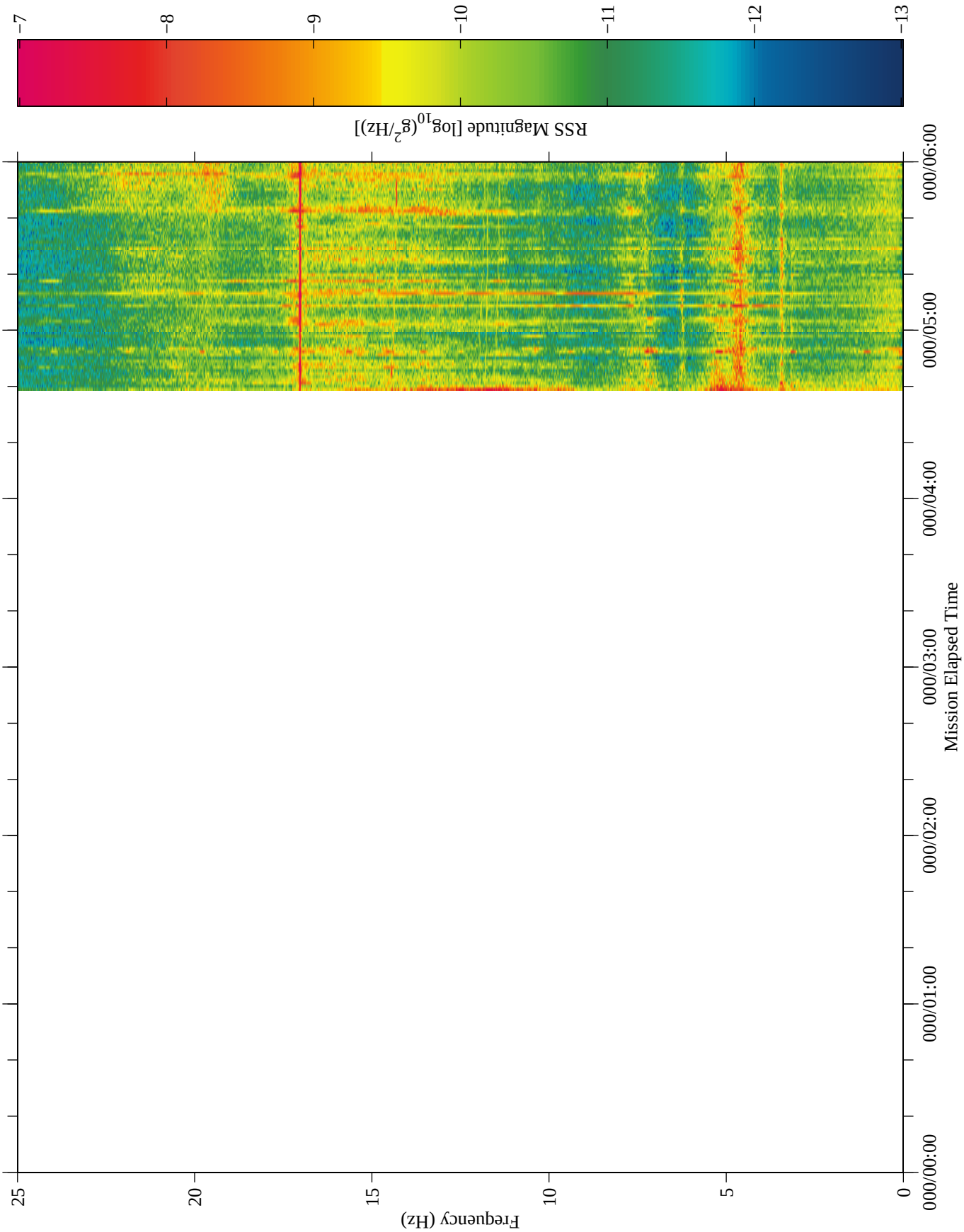
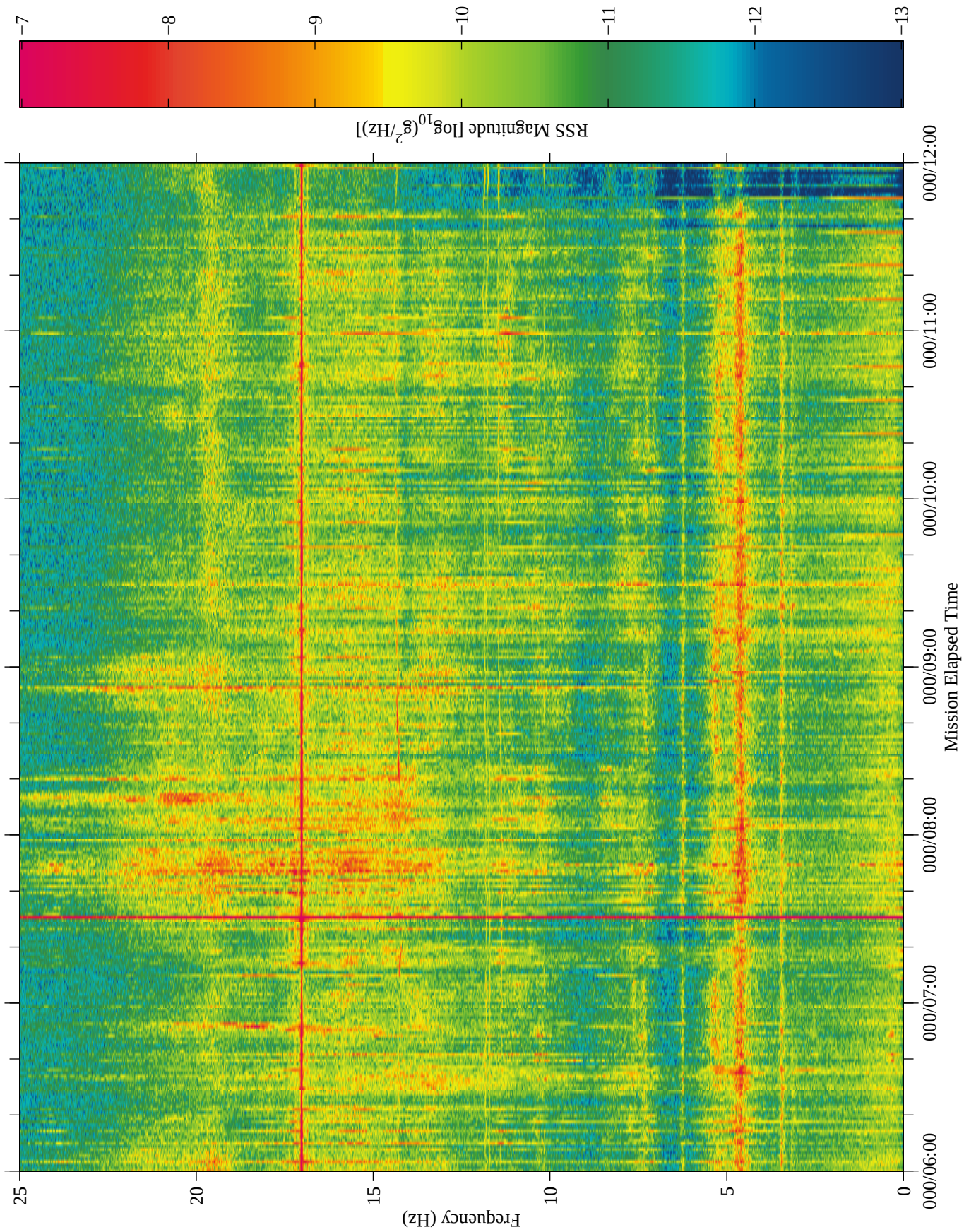


Figure 1: USMP−4, Unit F, TSH B



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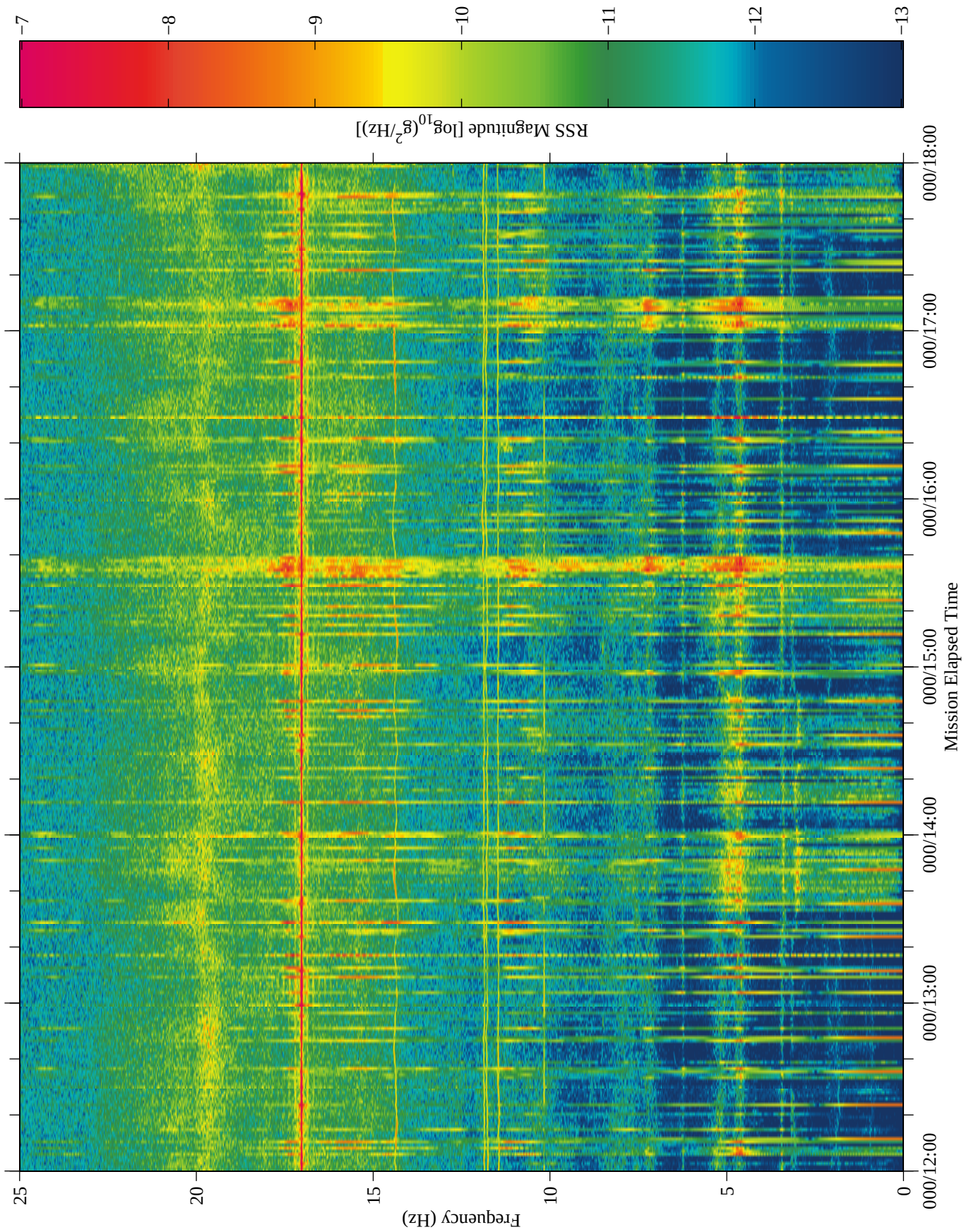

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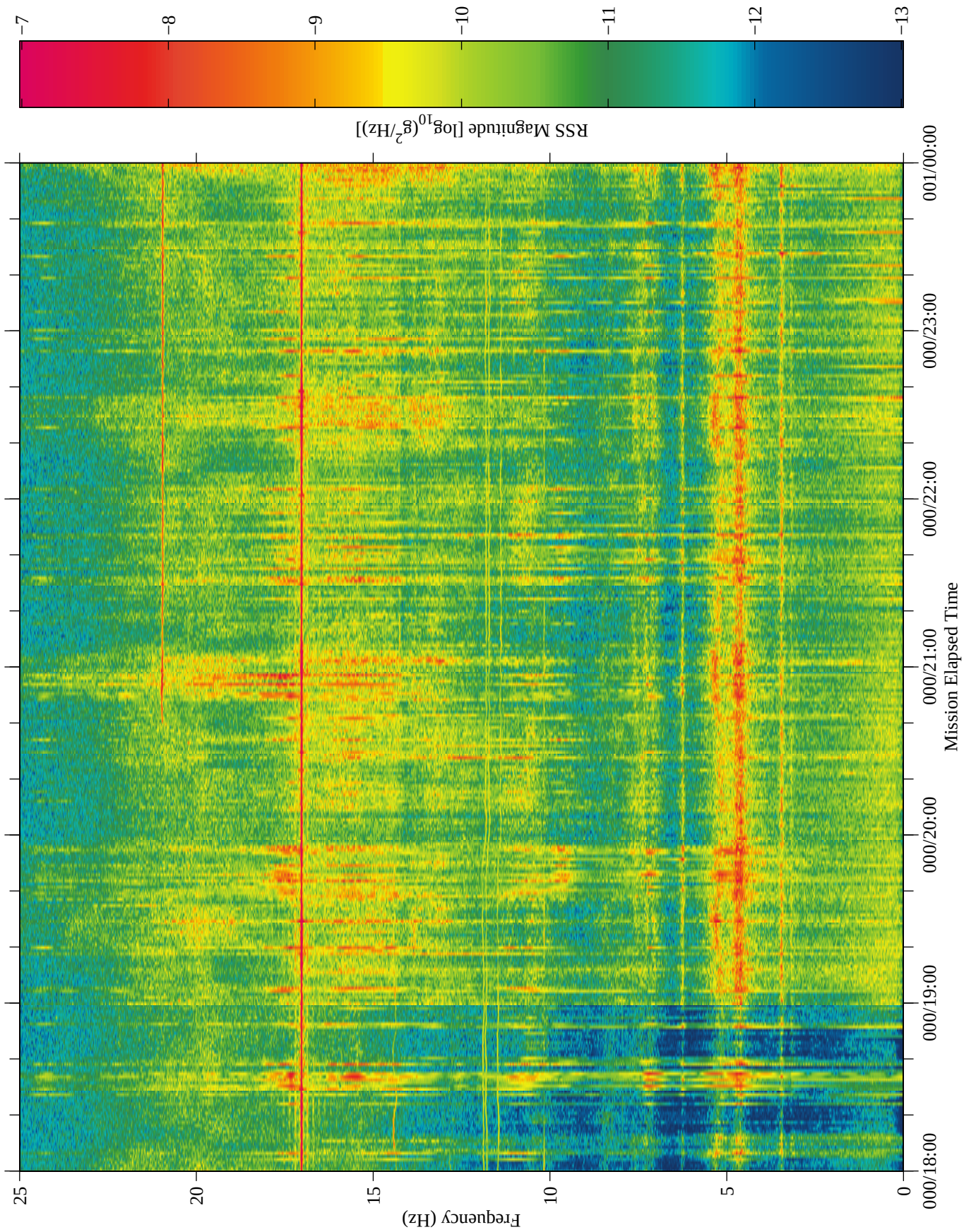

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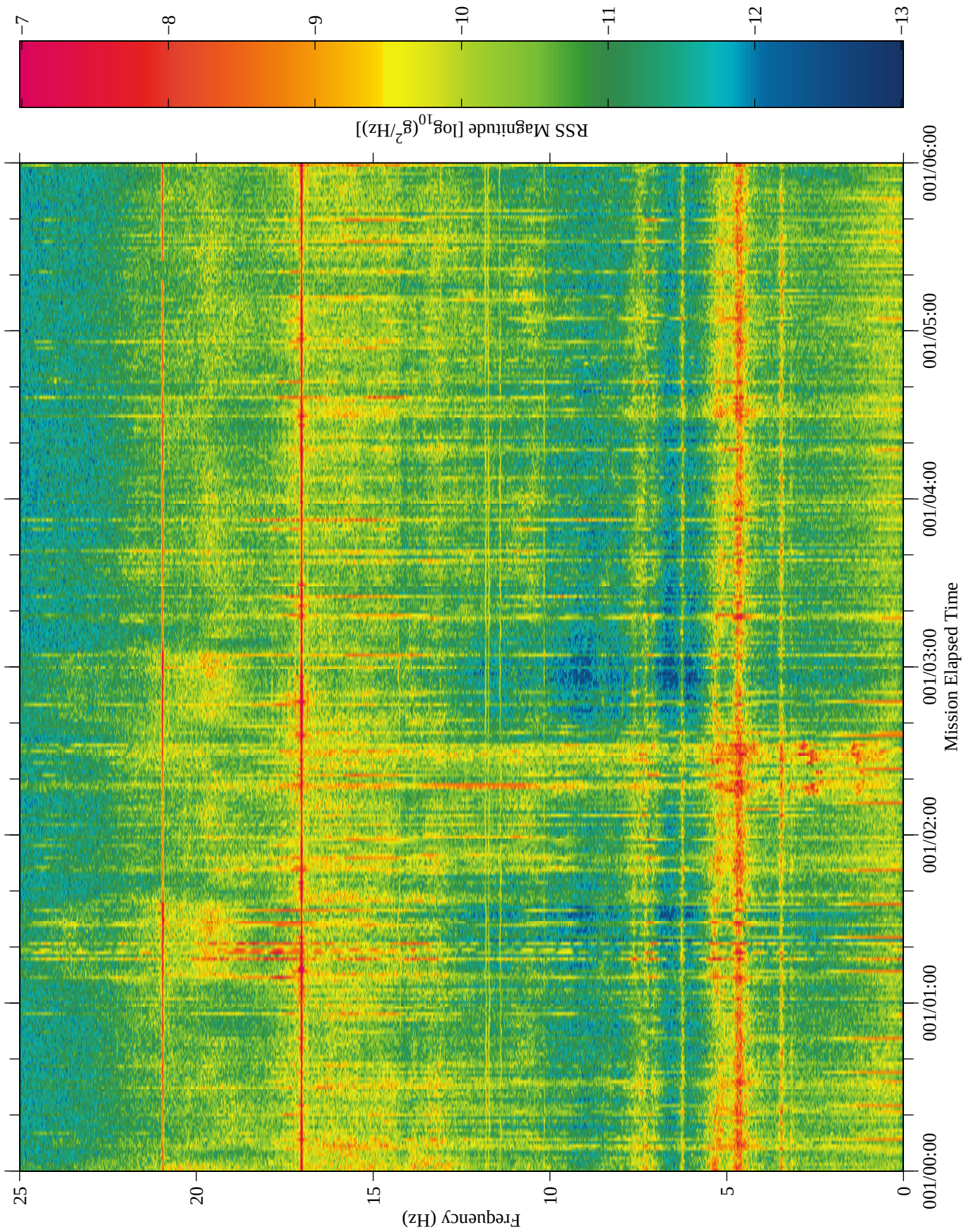

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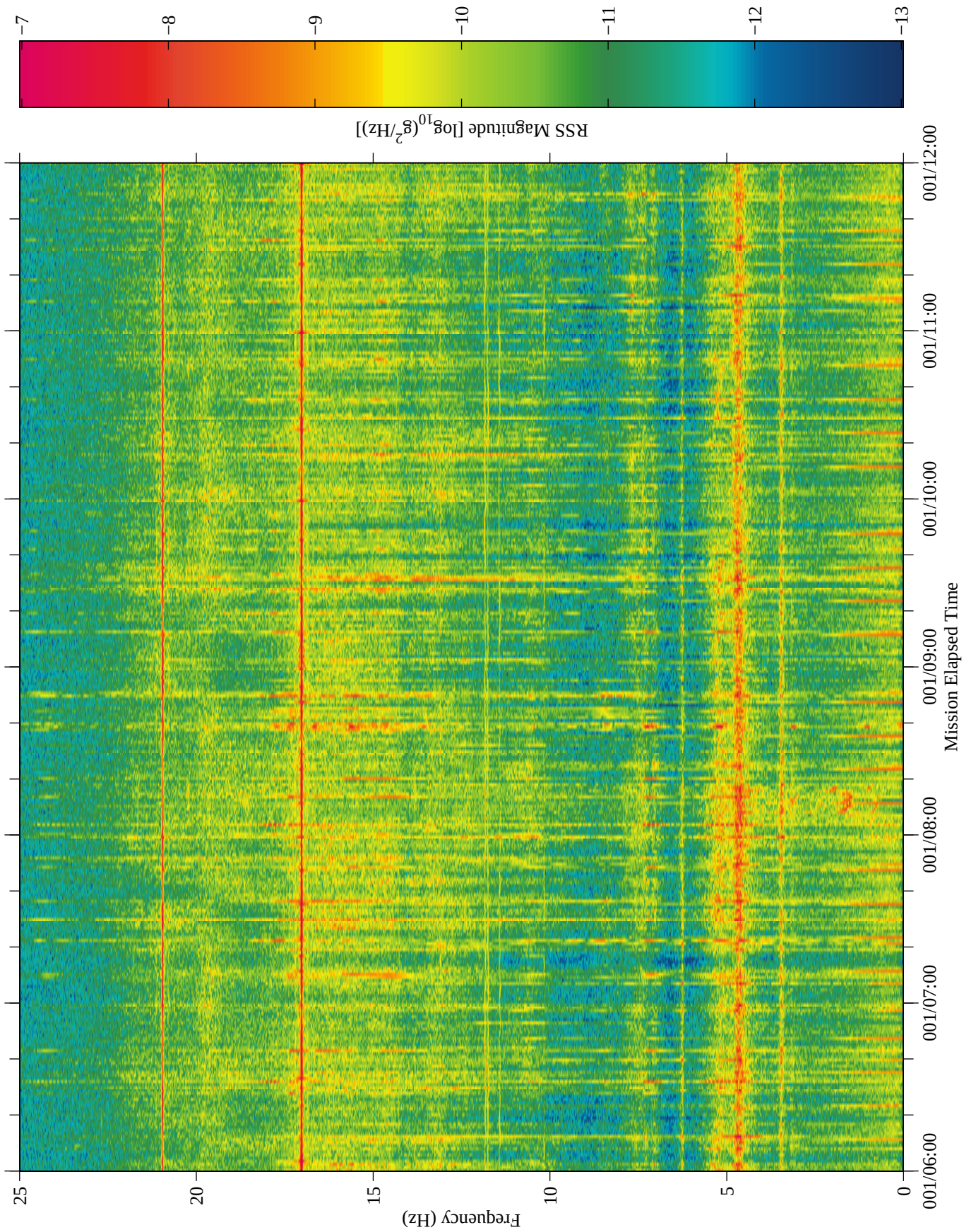

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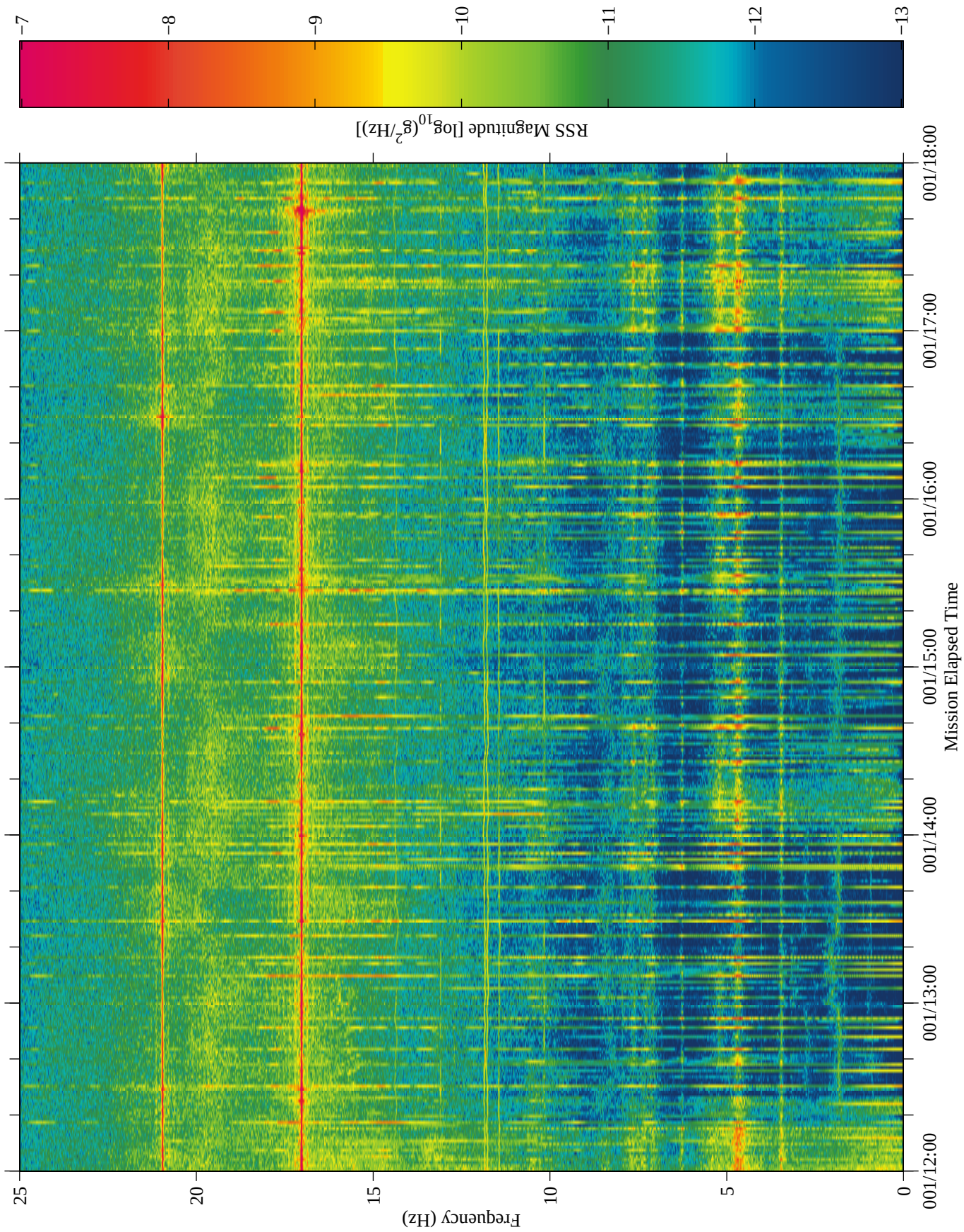

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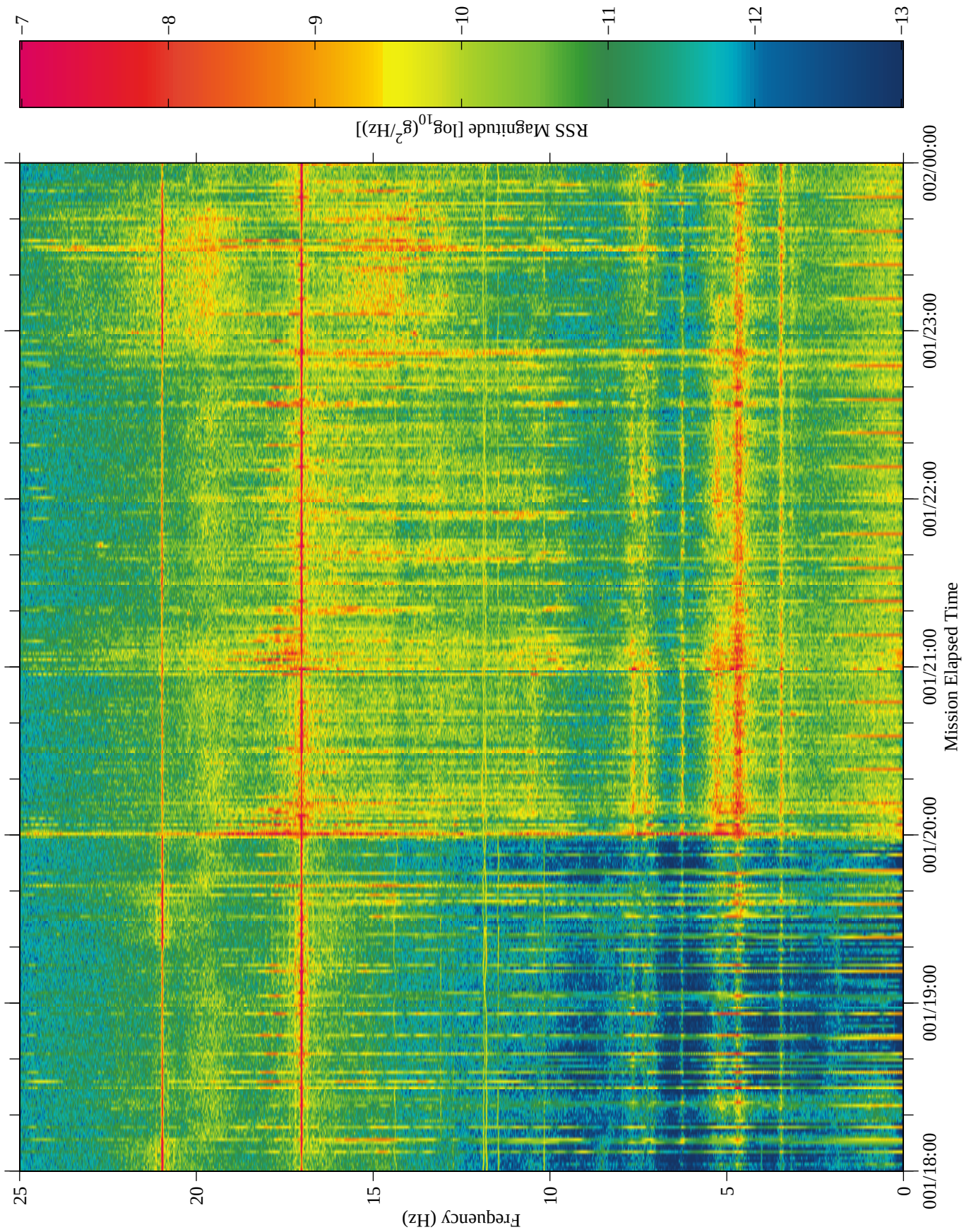

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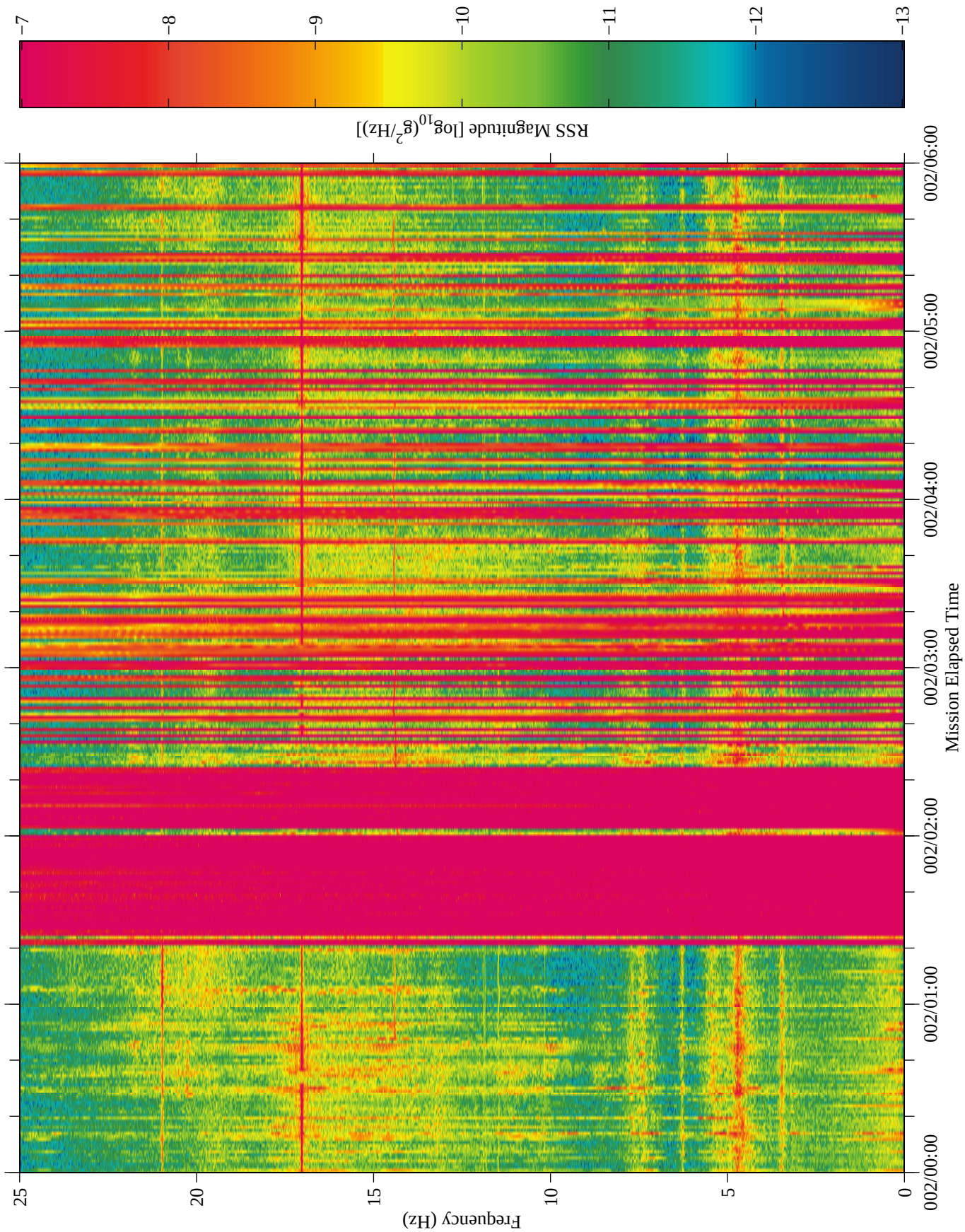

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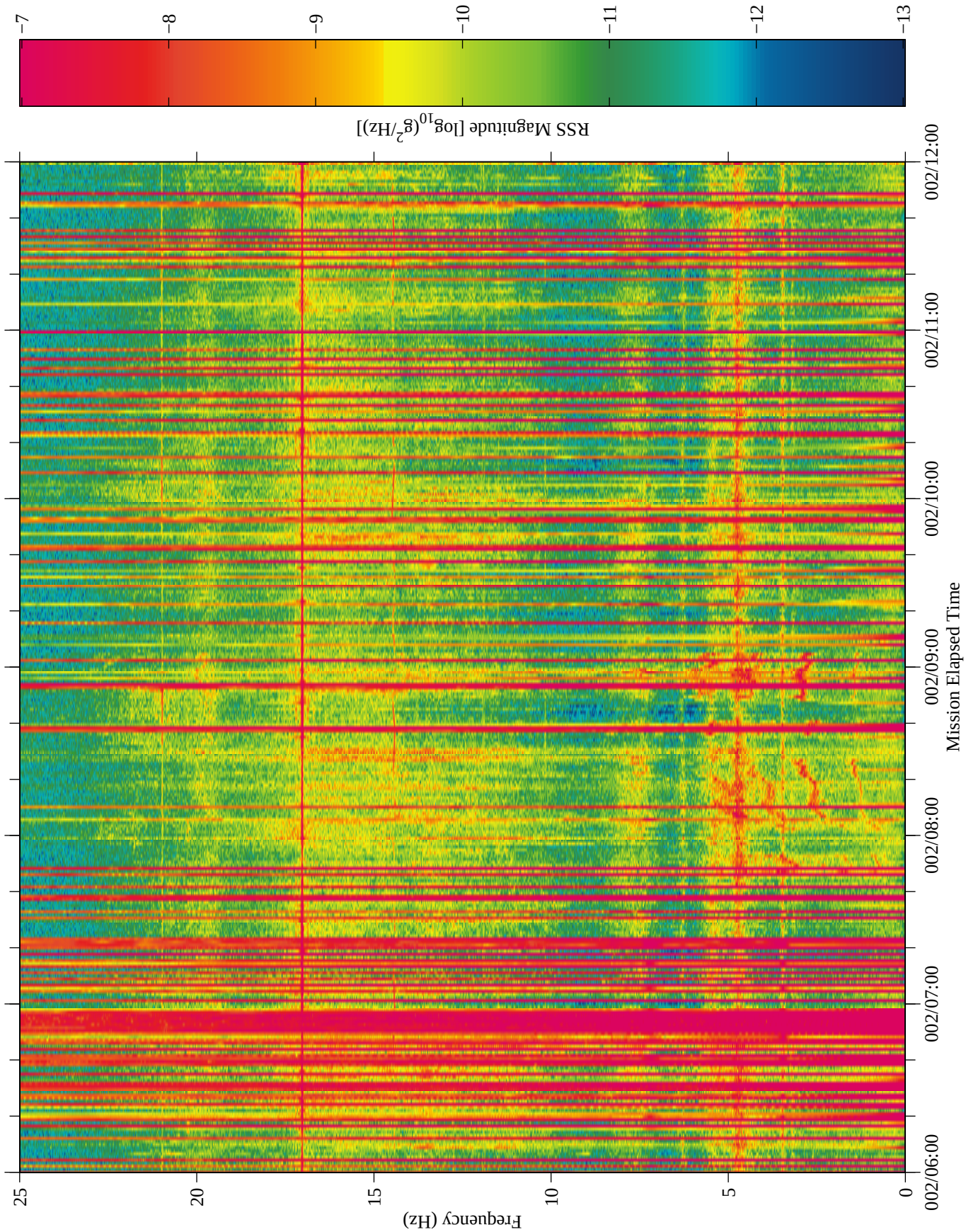

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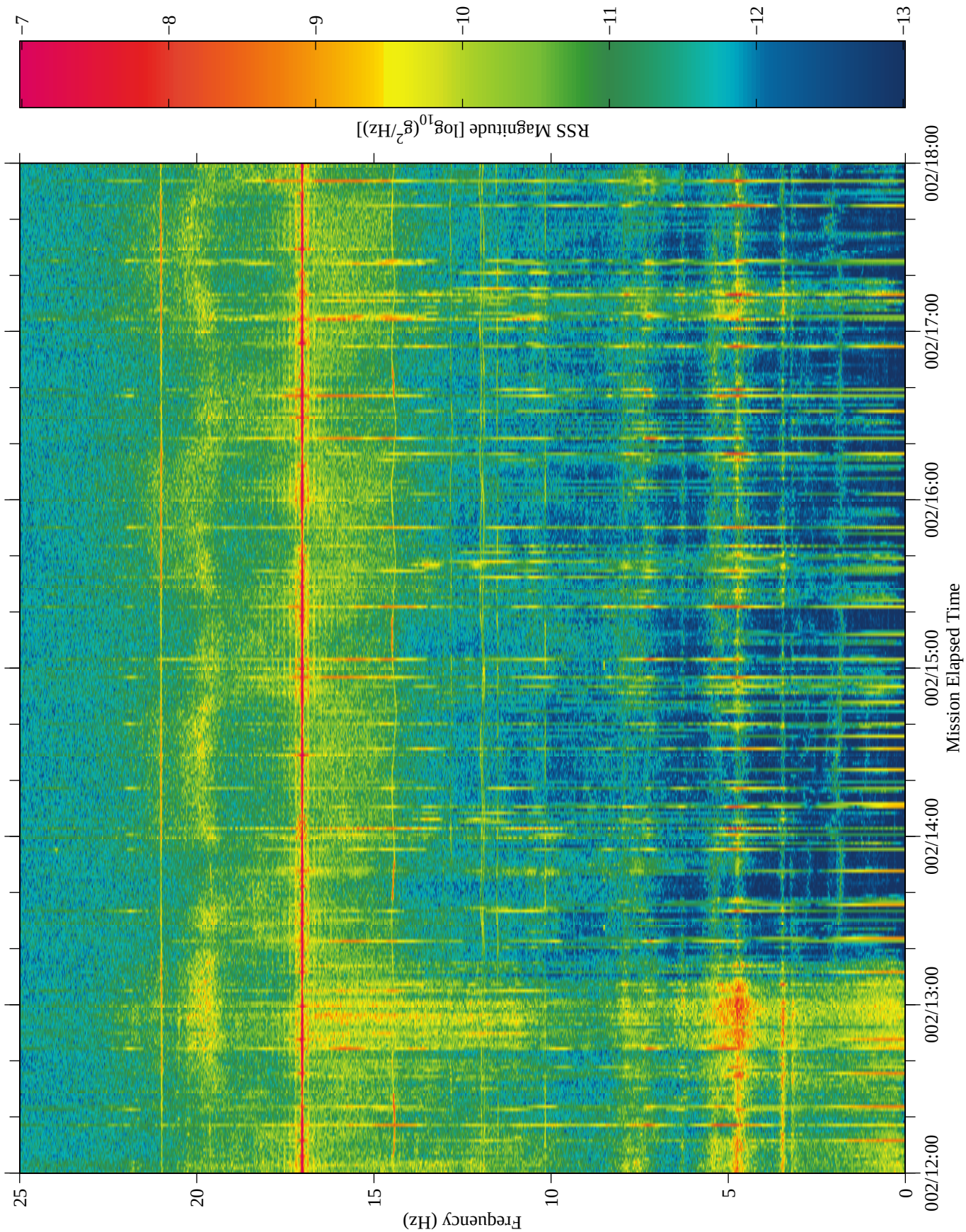

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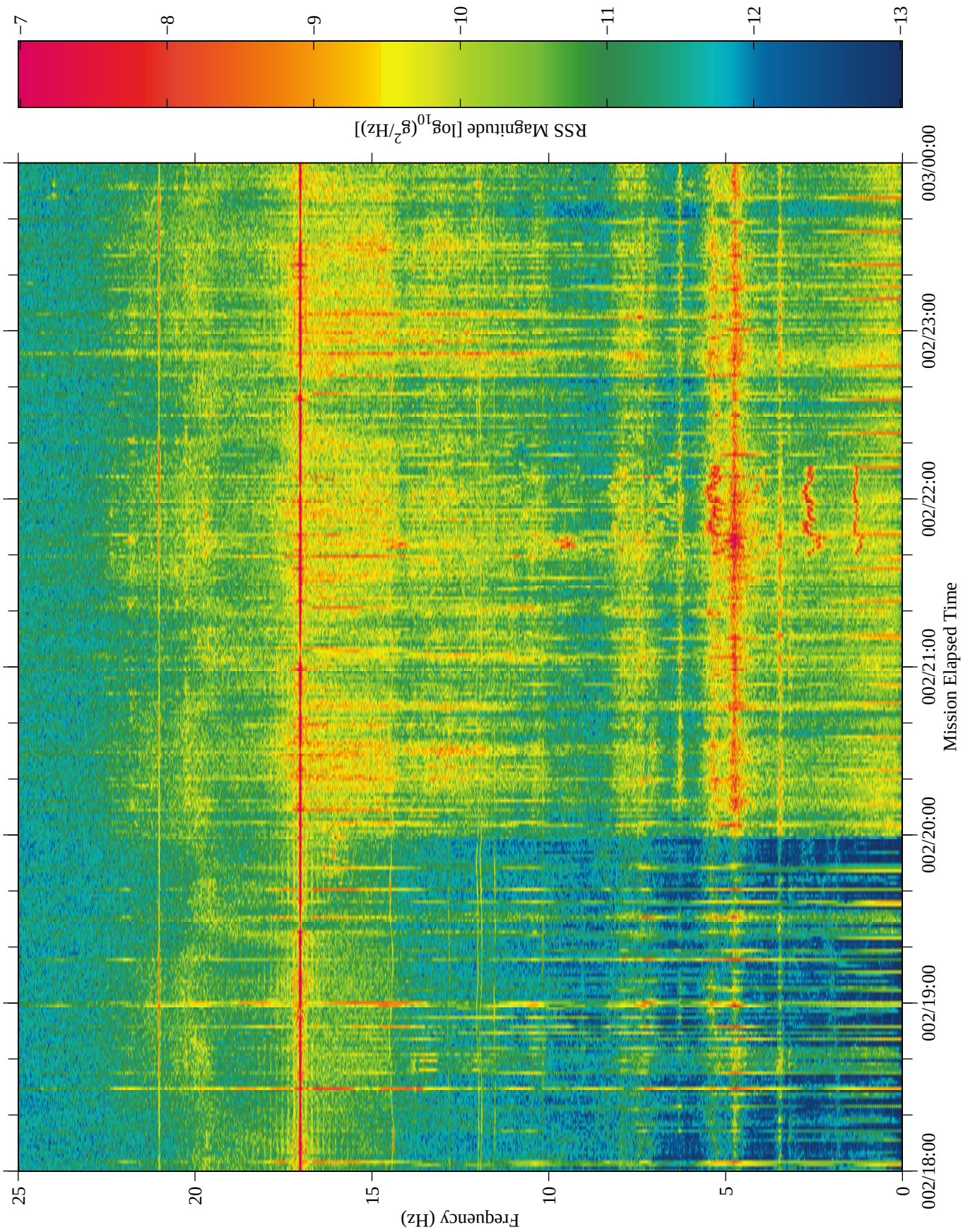

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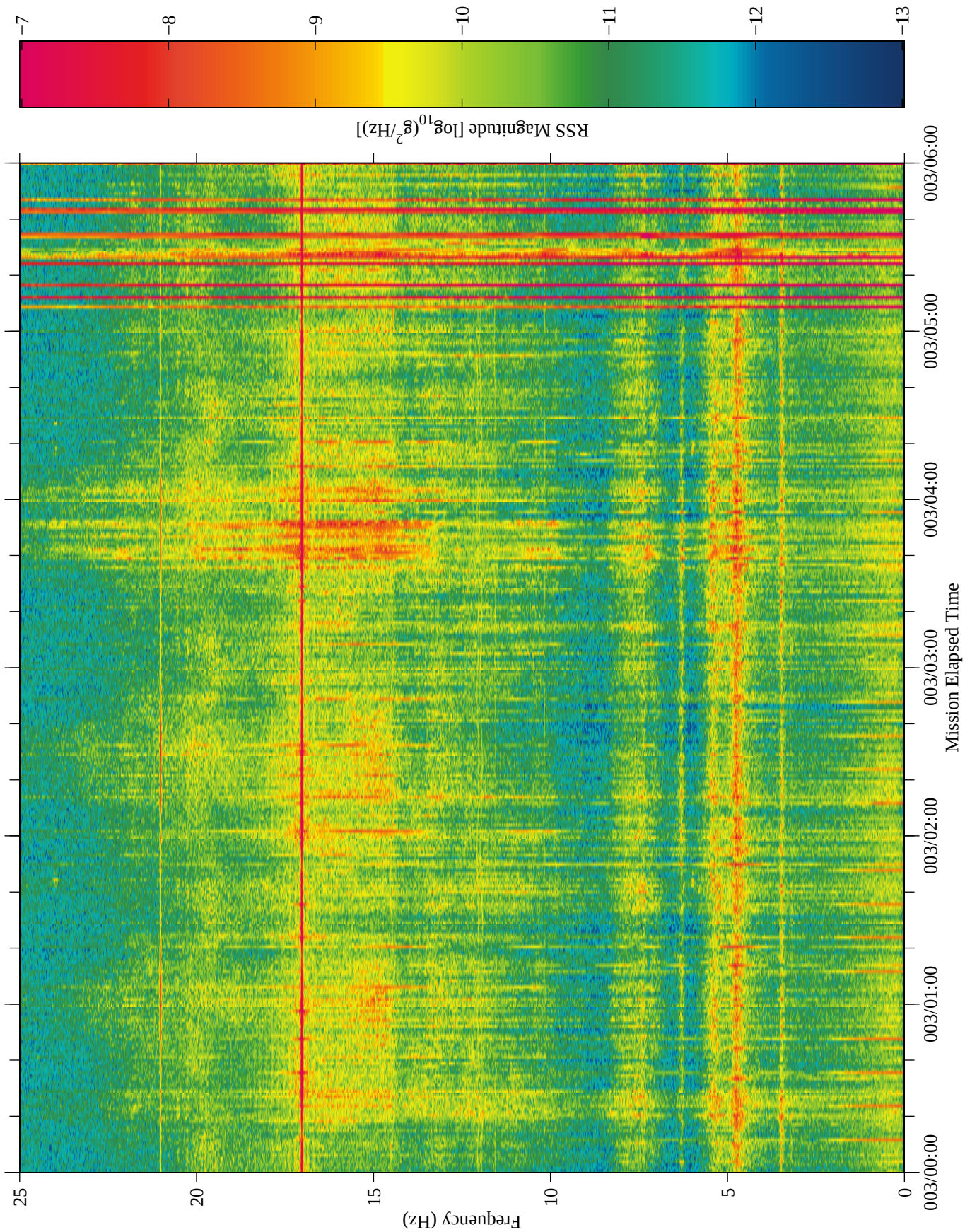

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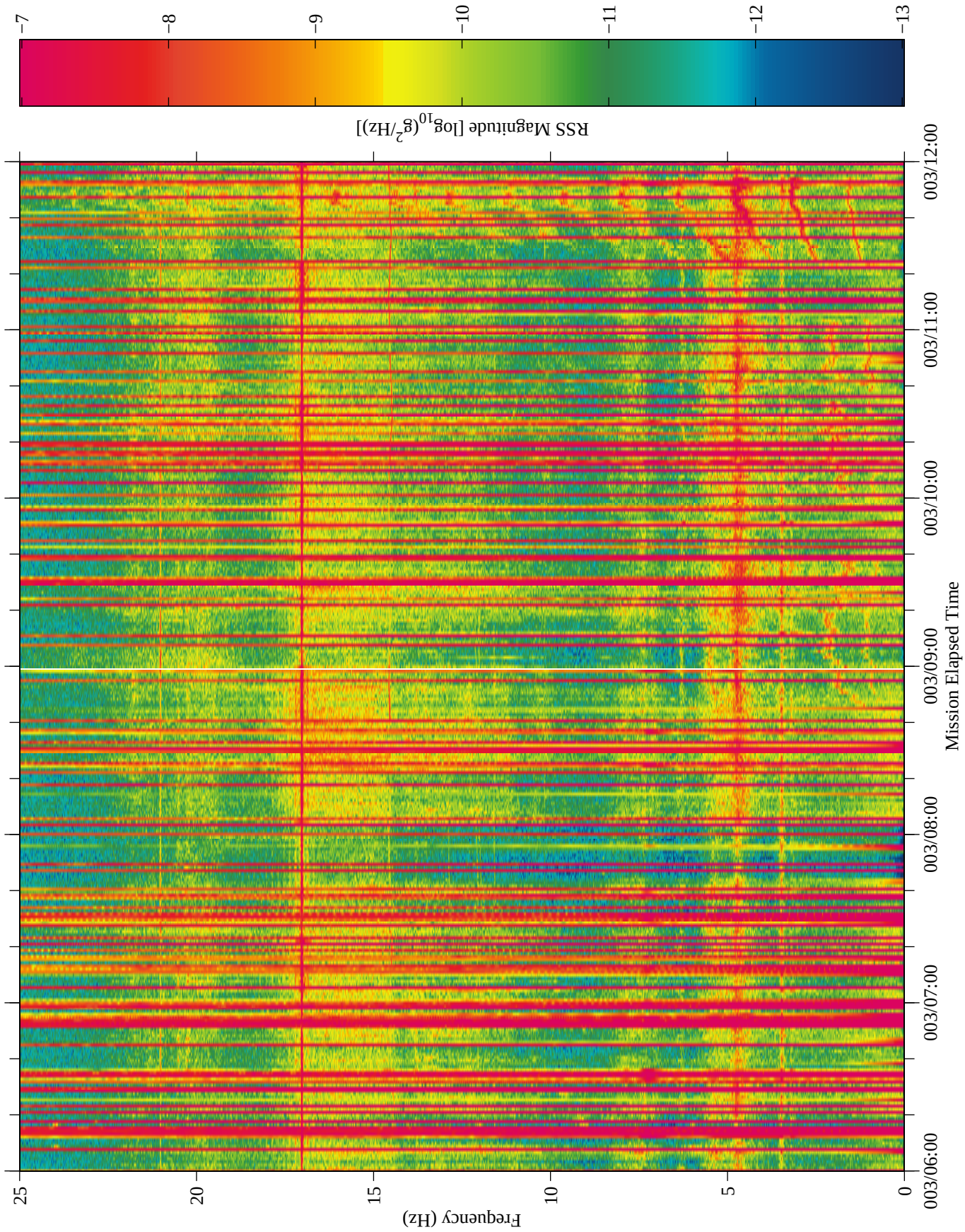

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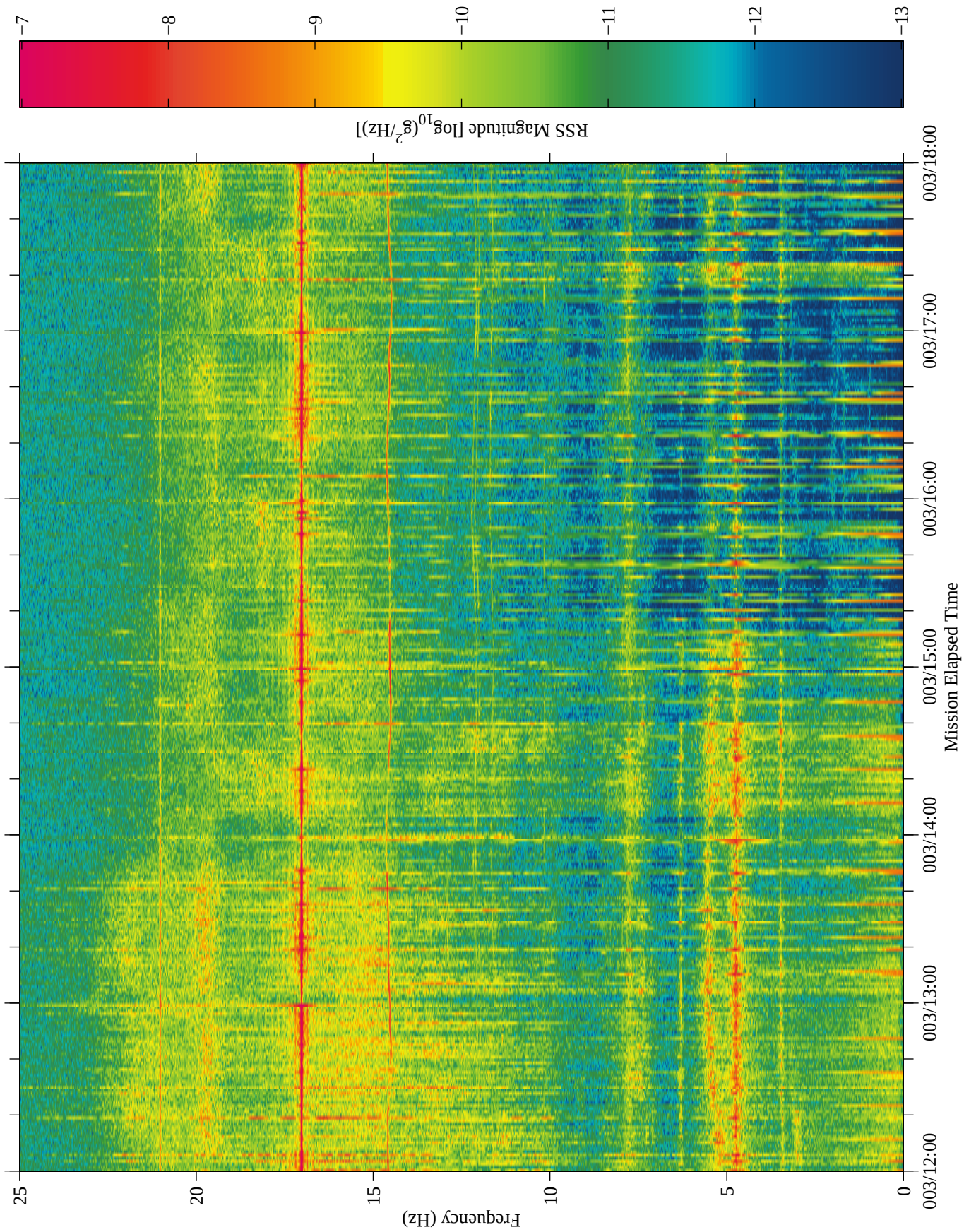

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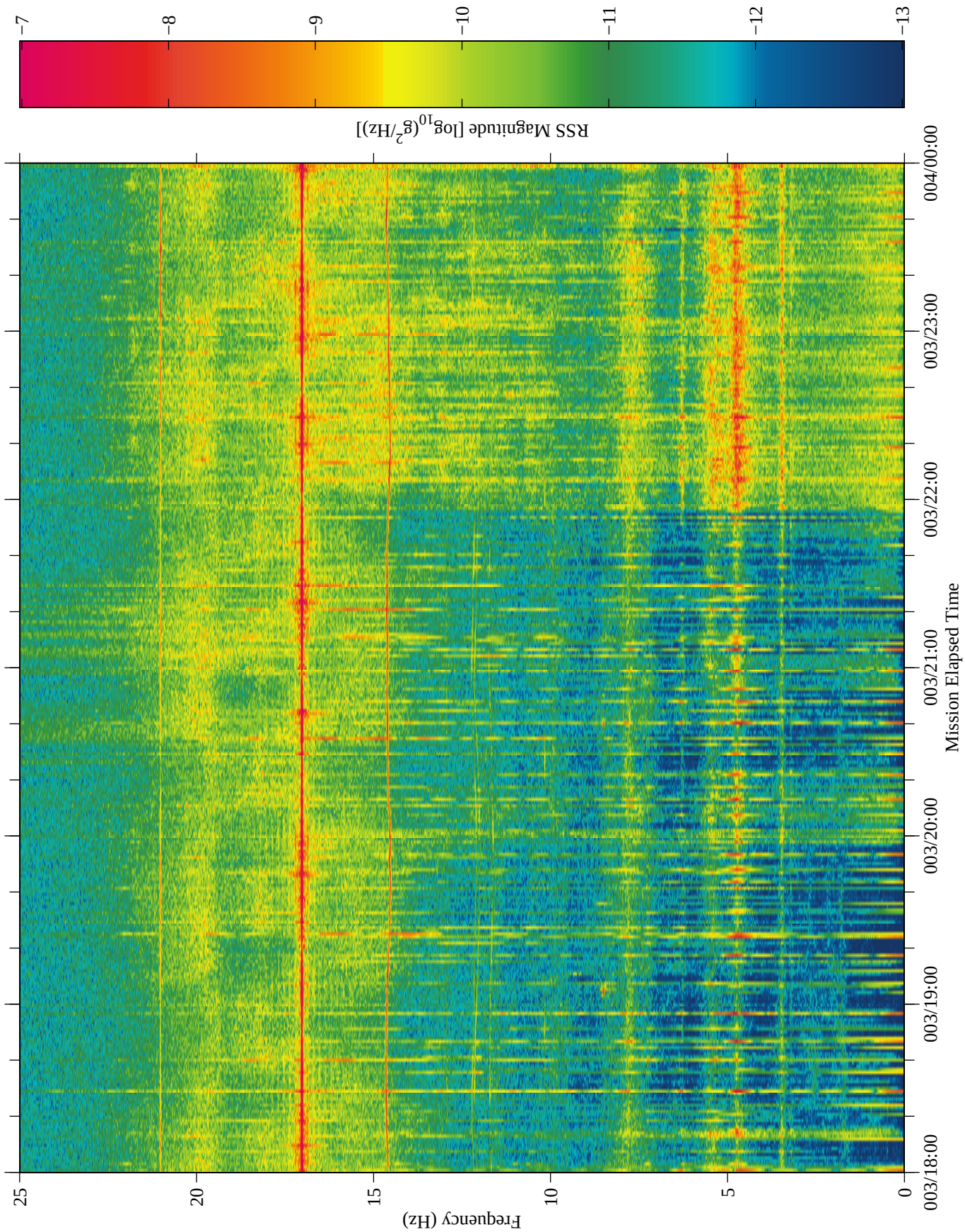

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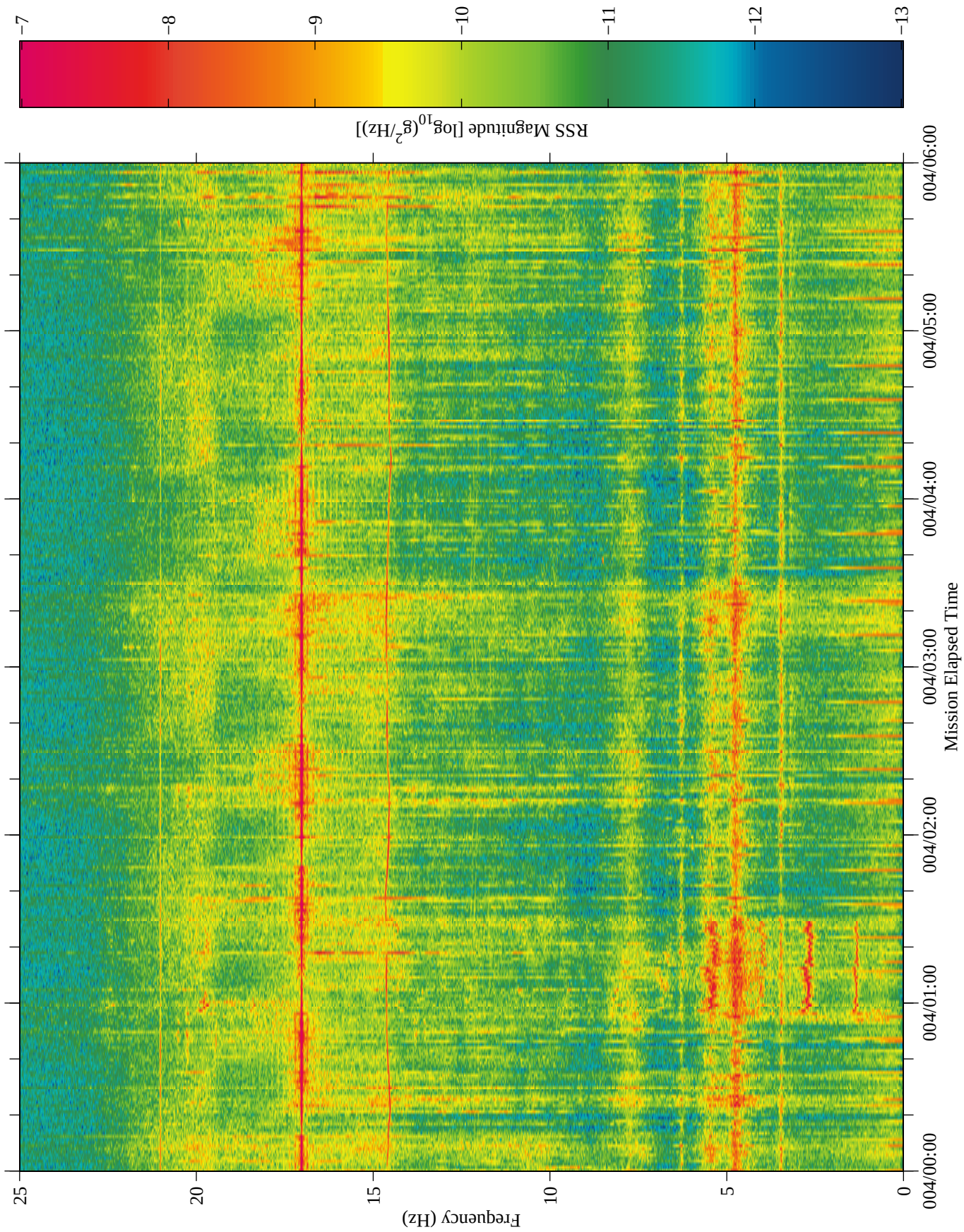

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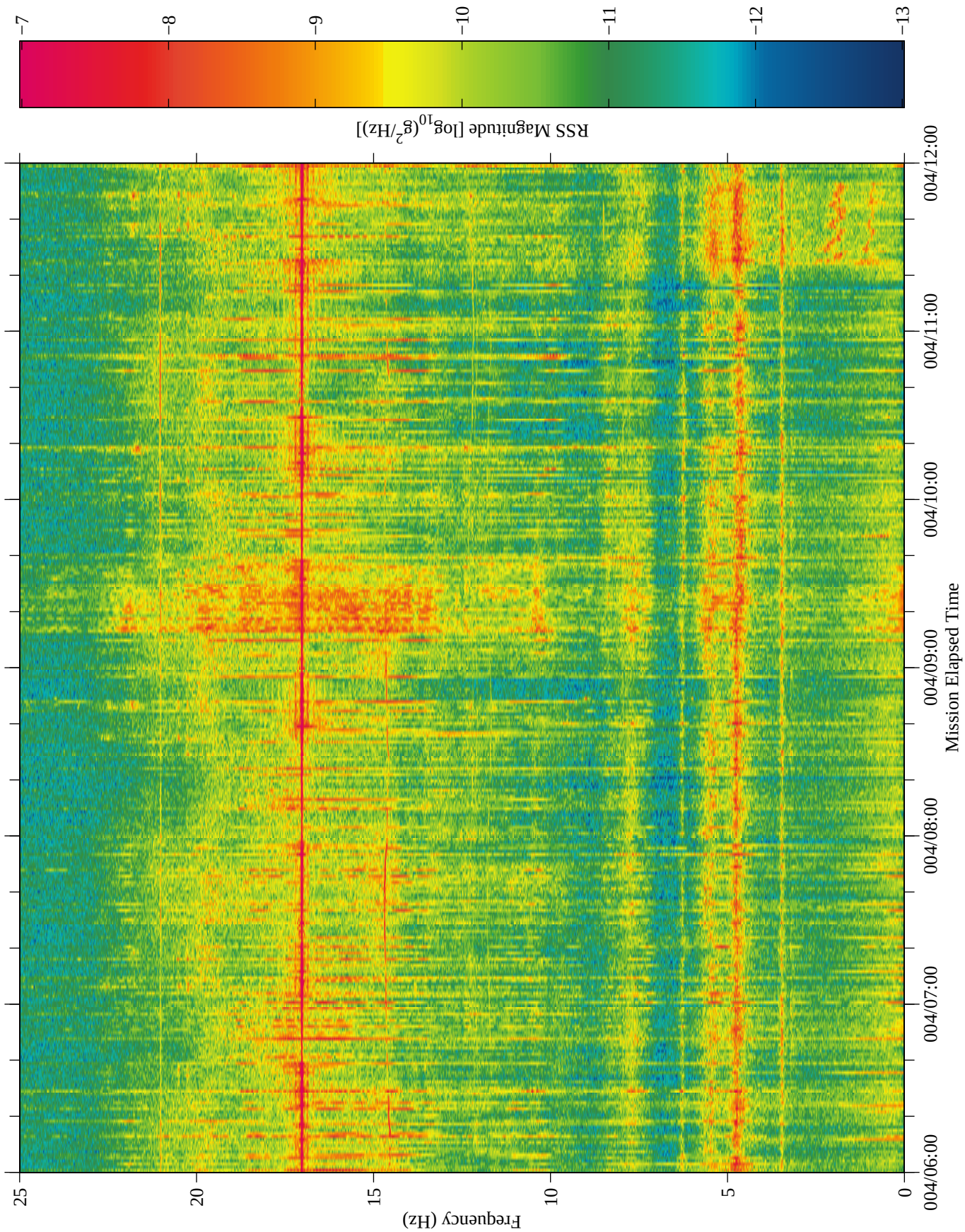

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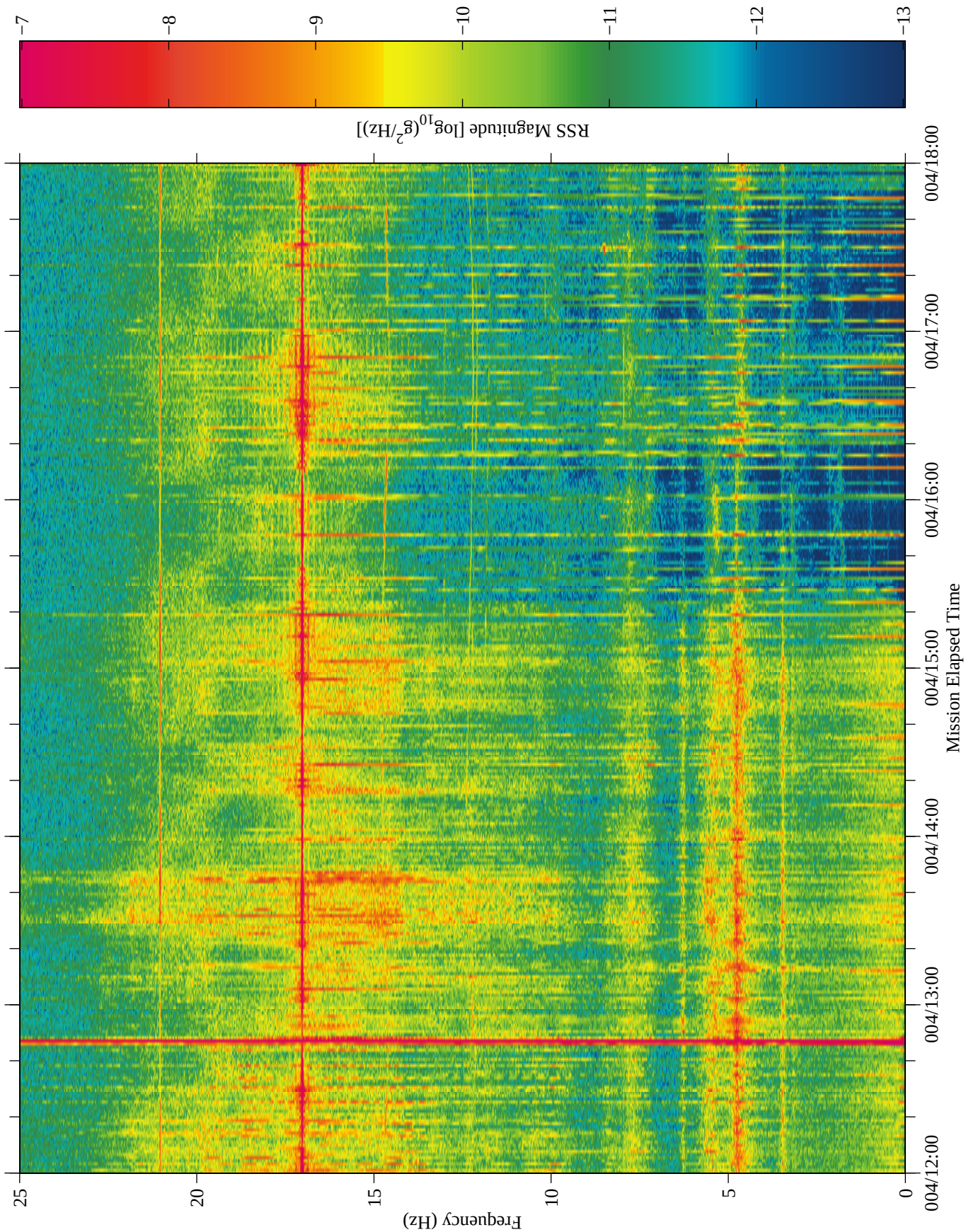

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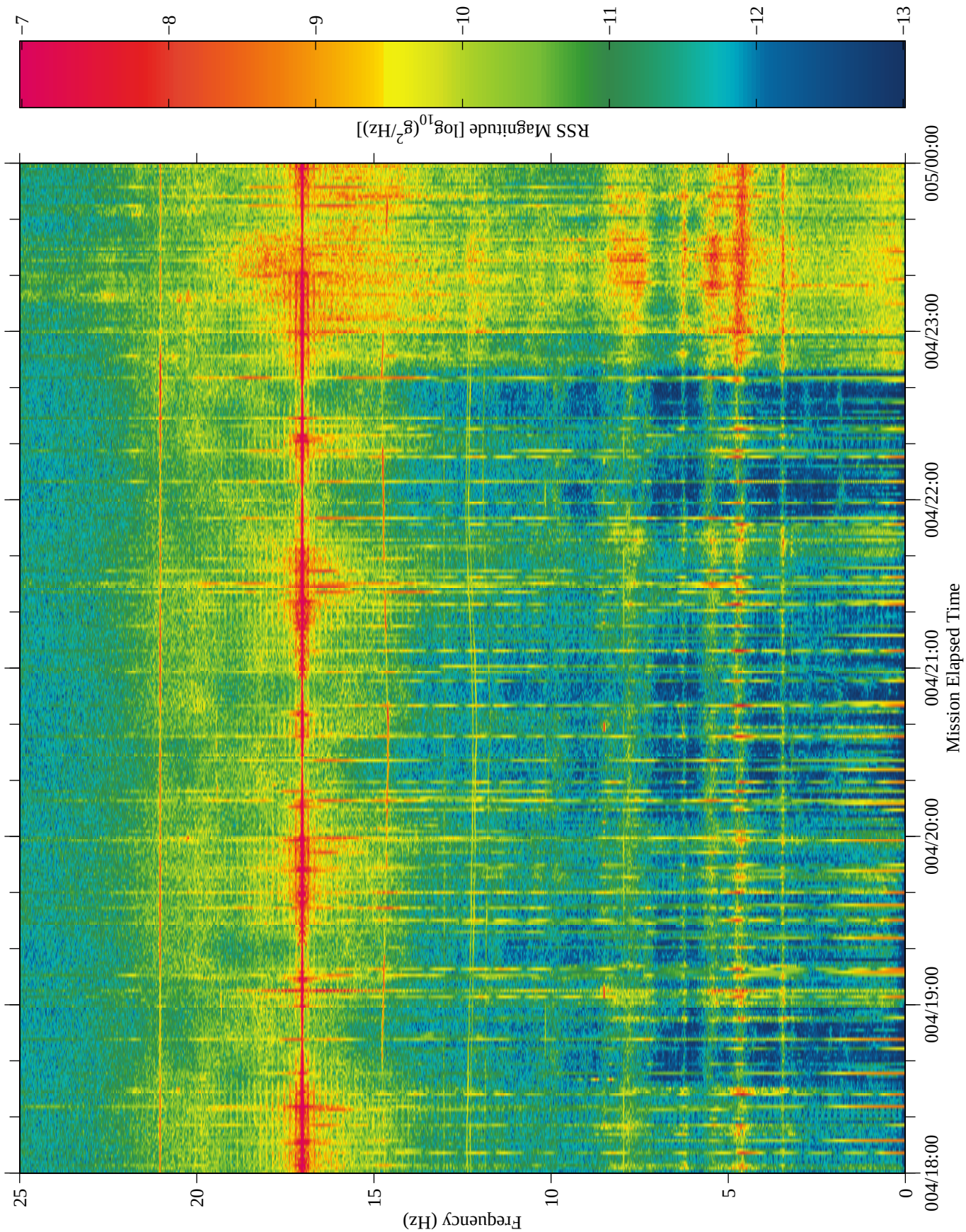

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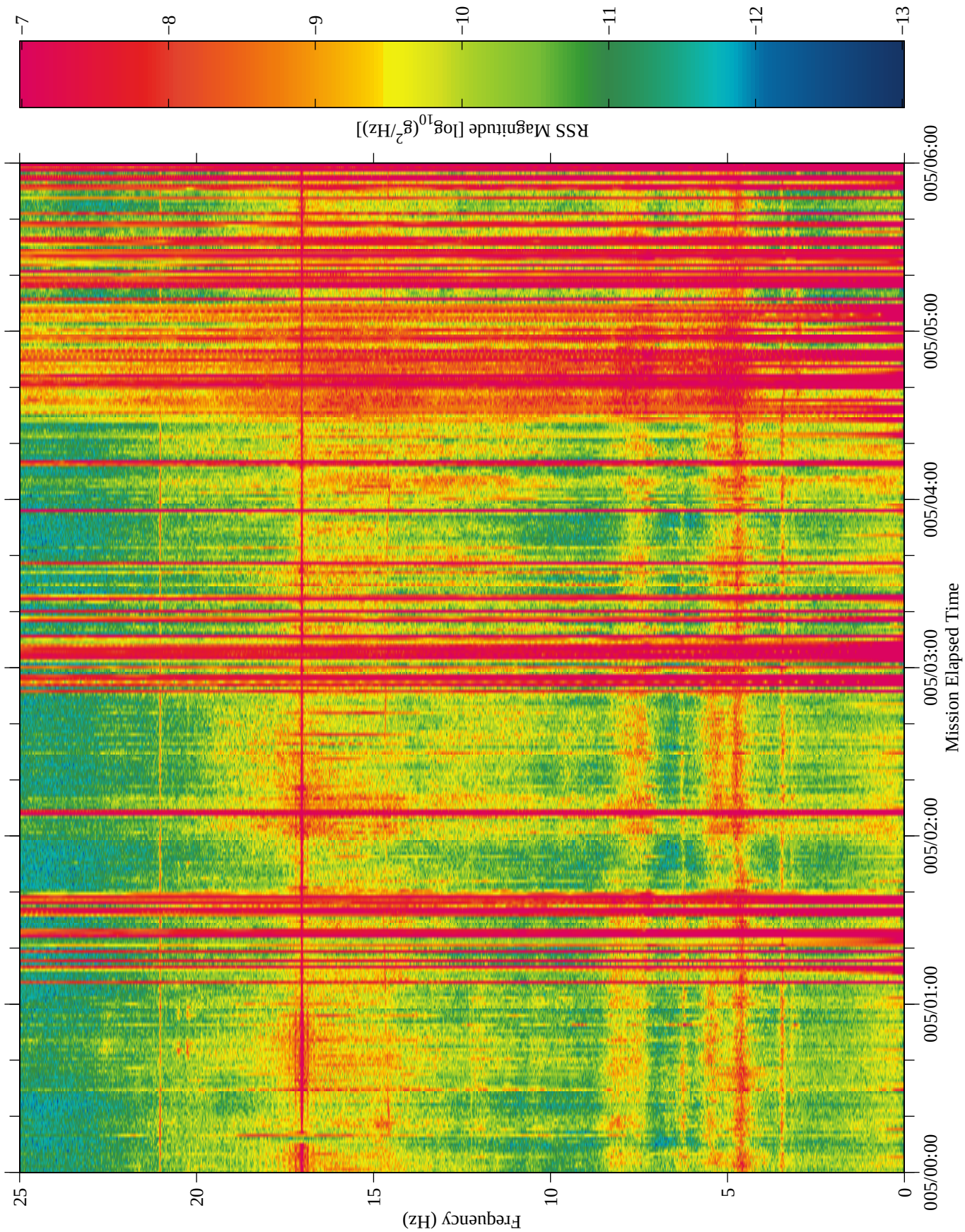

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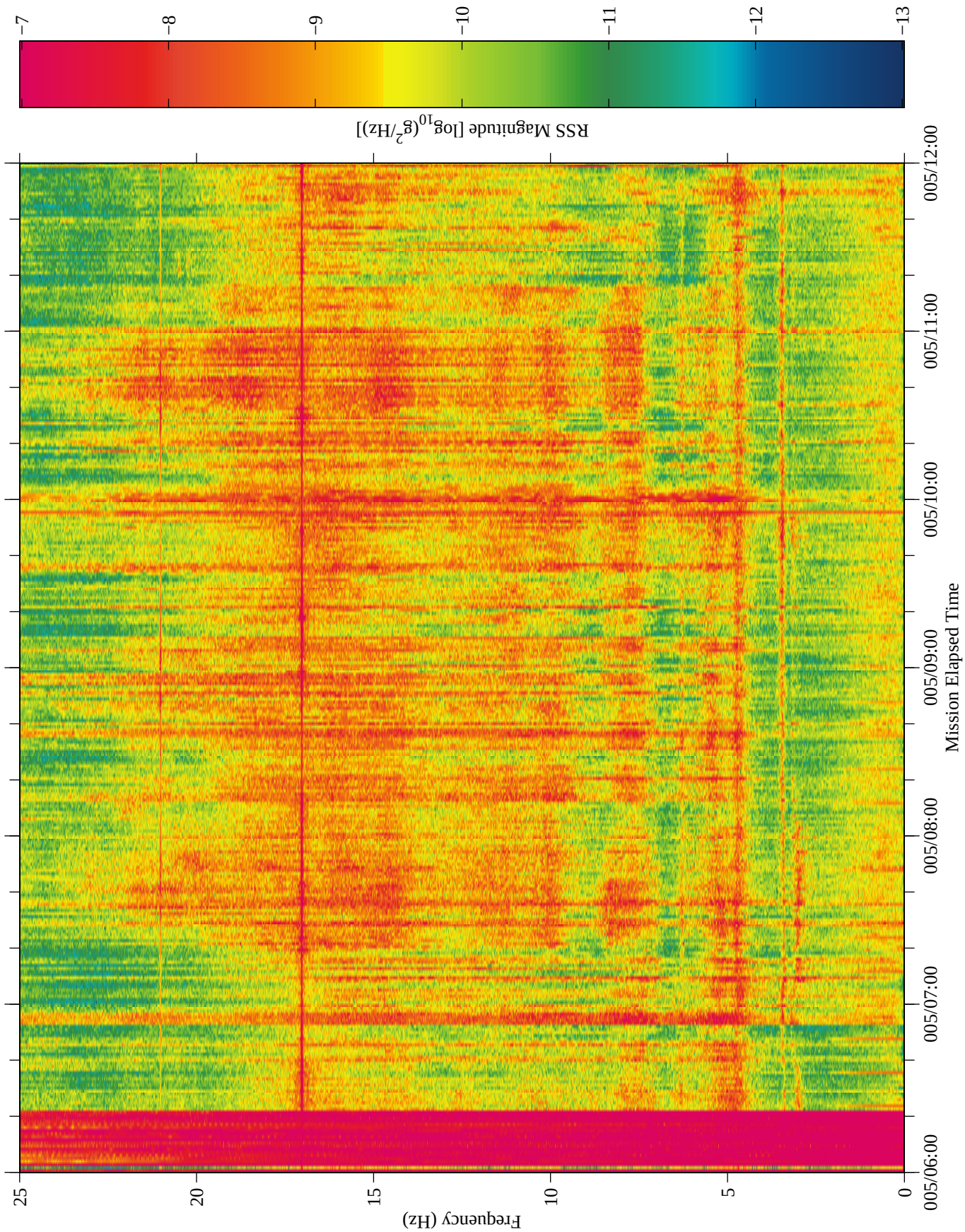

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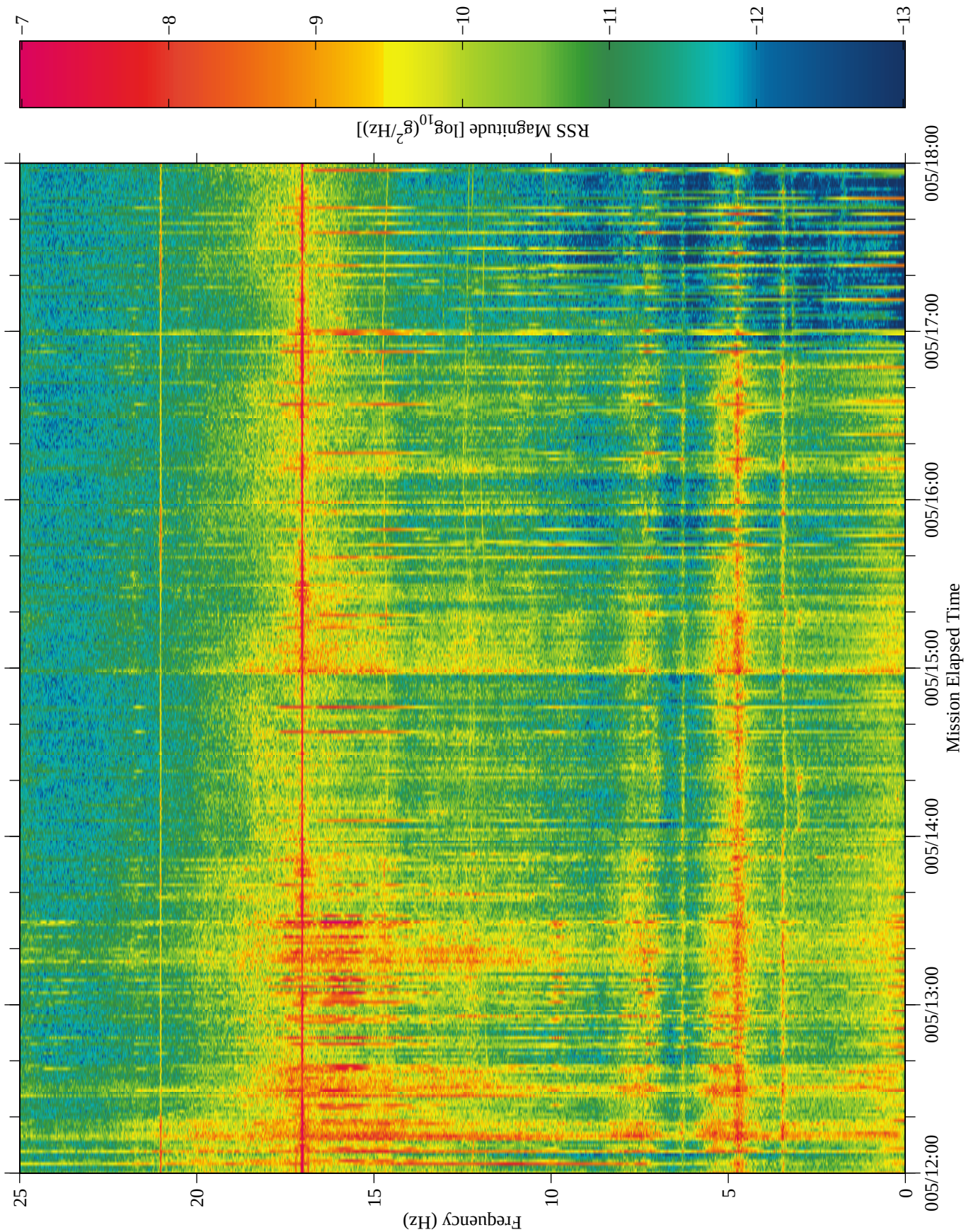

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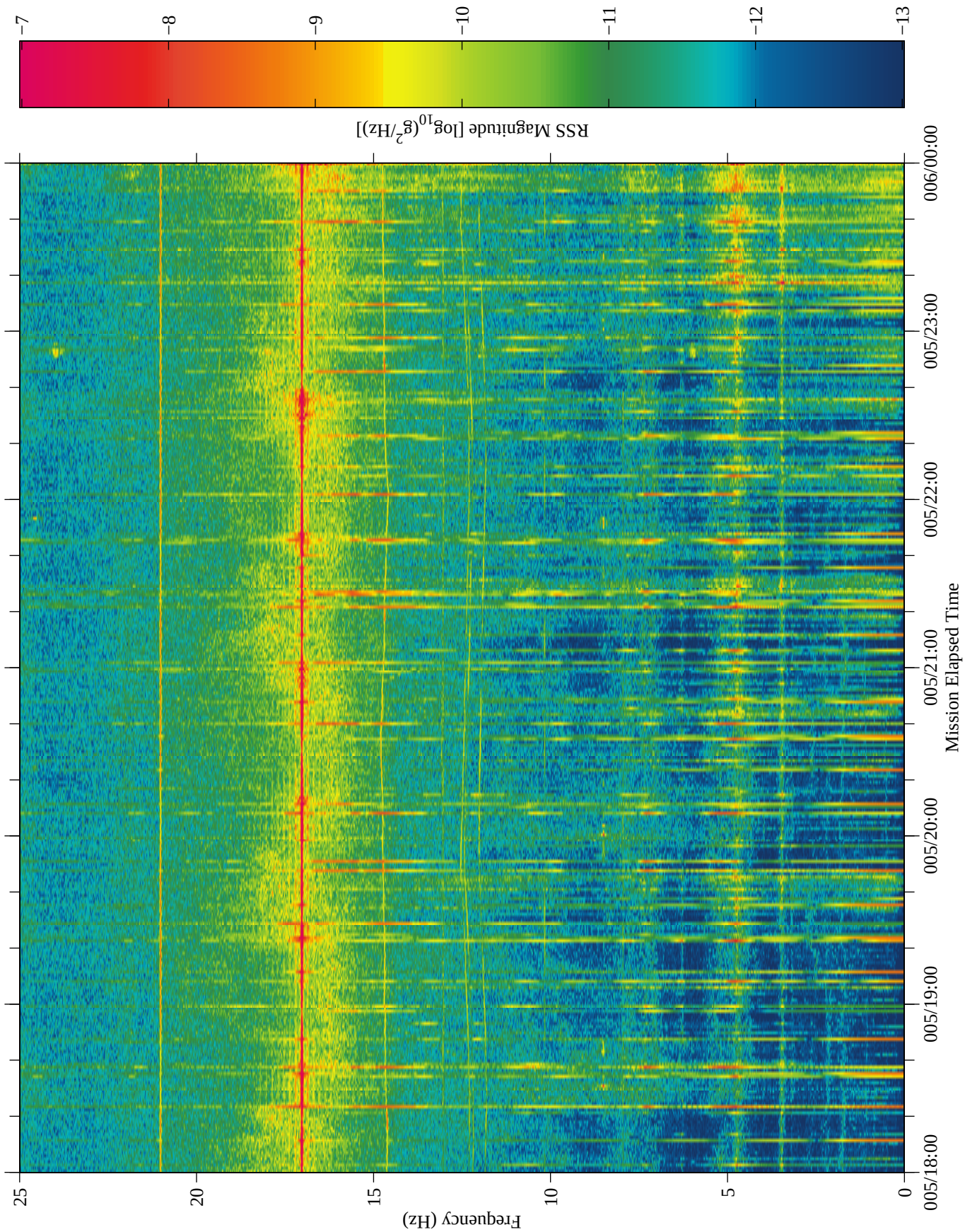

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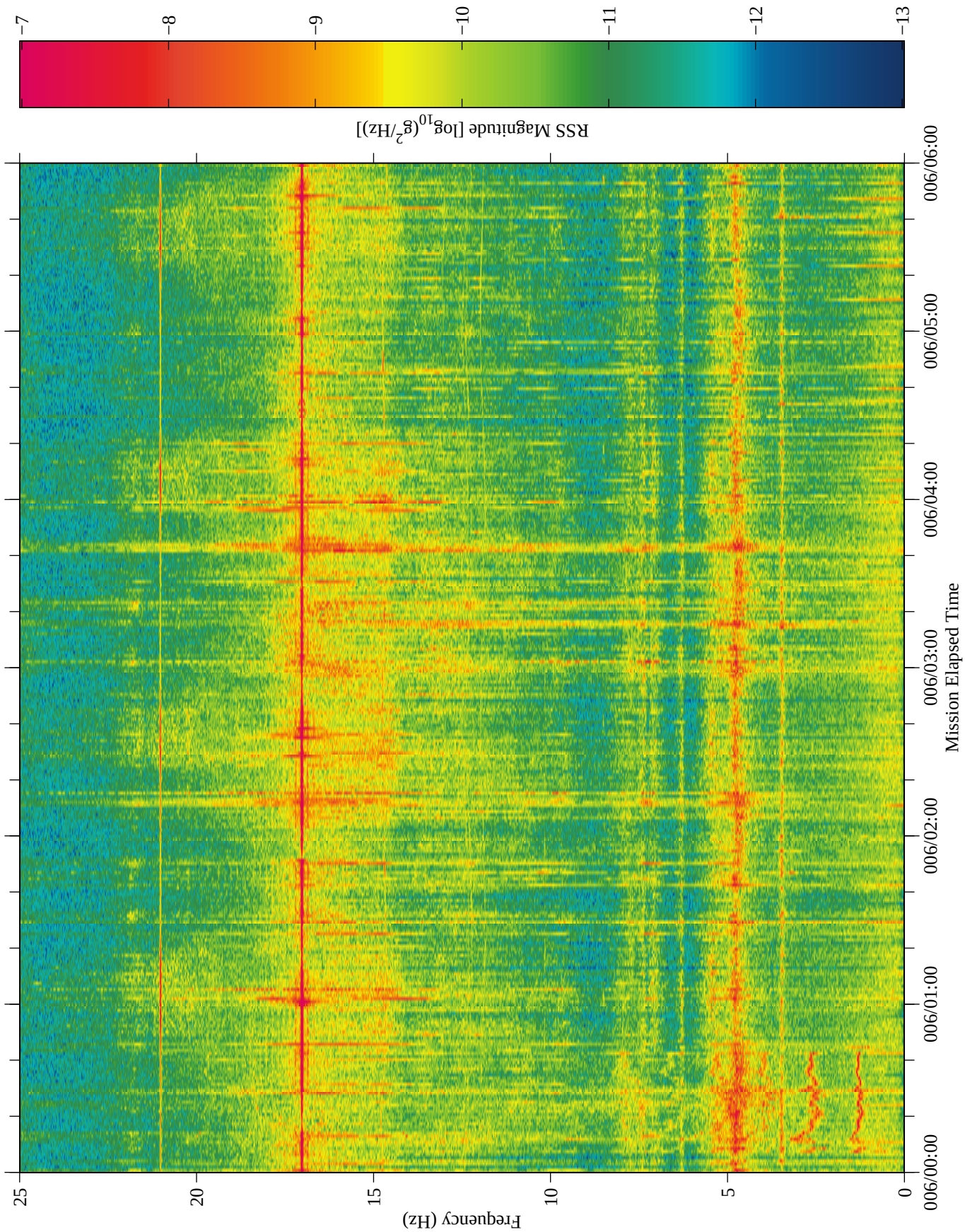

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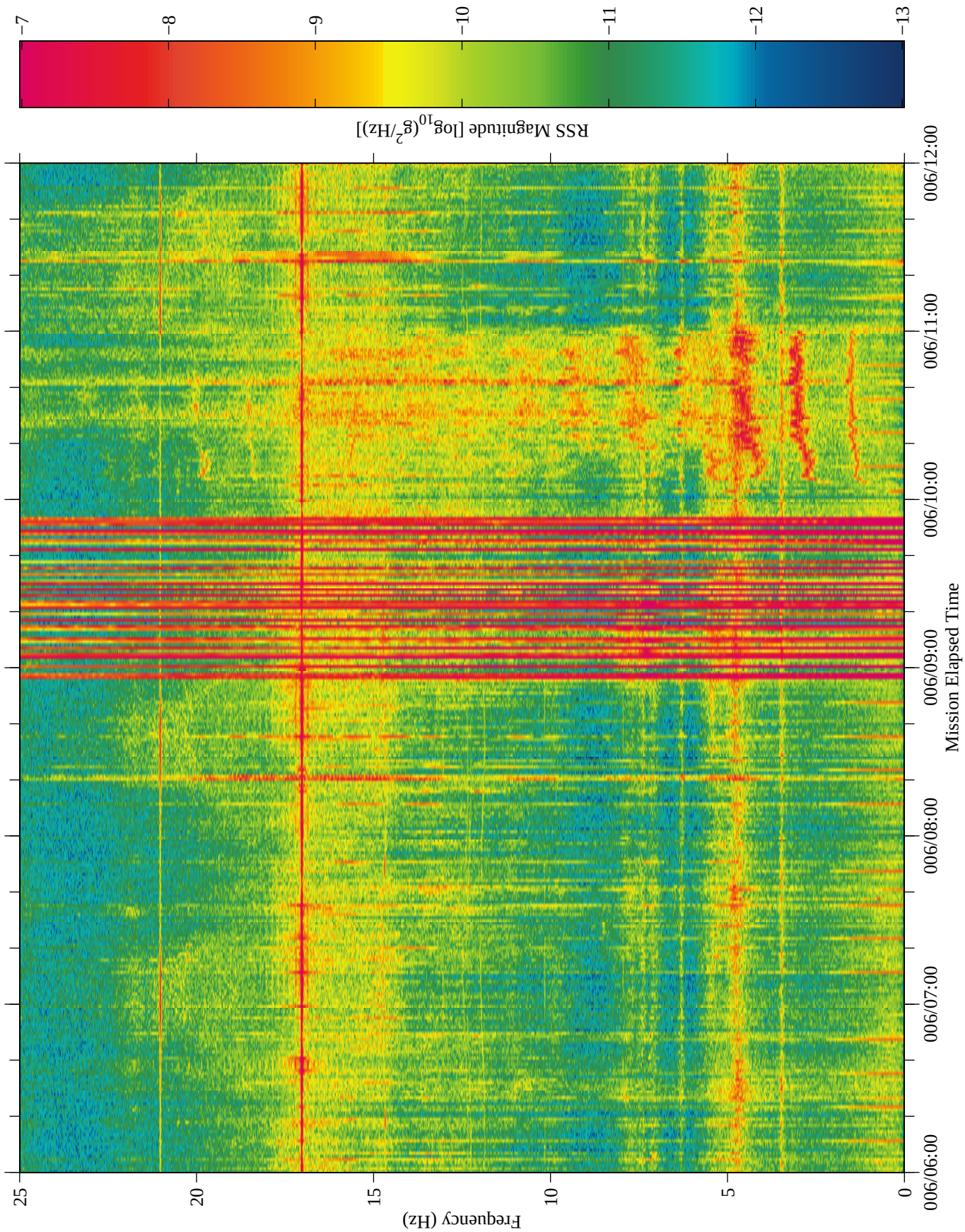

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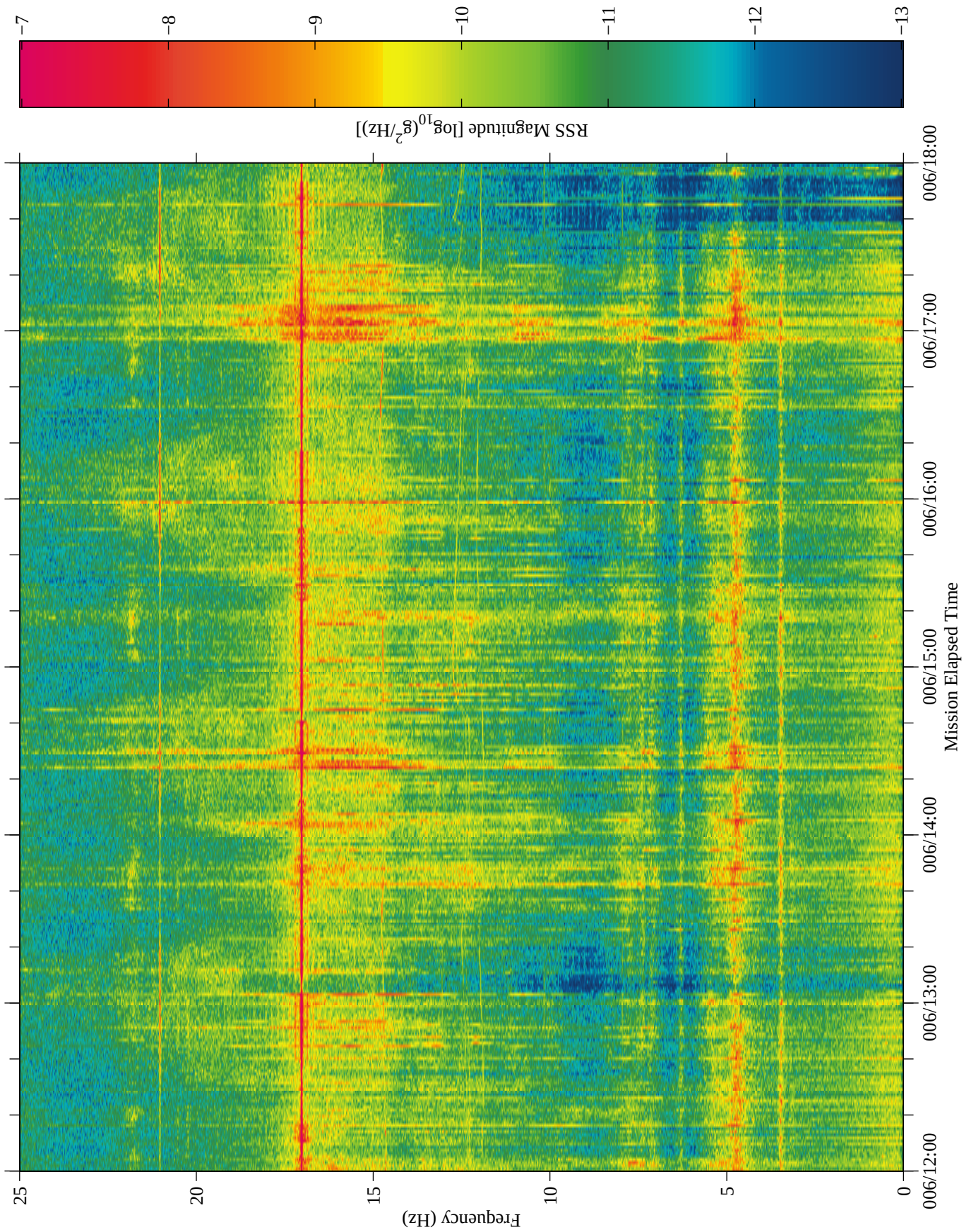

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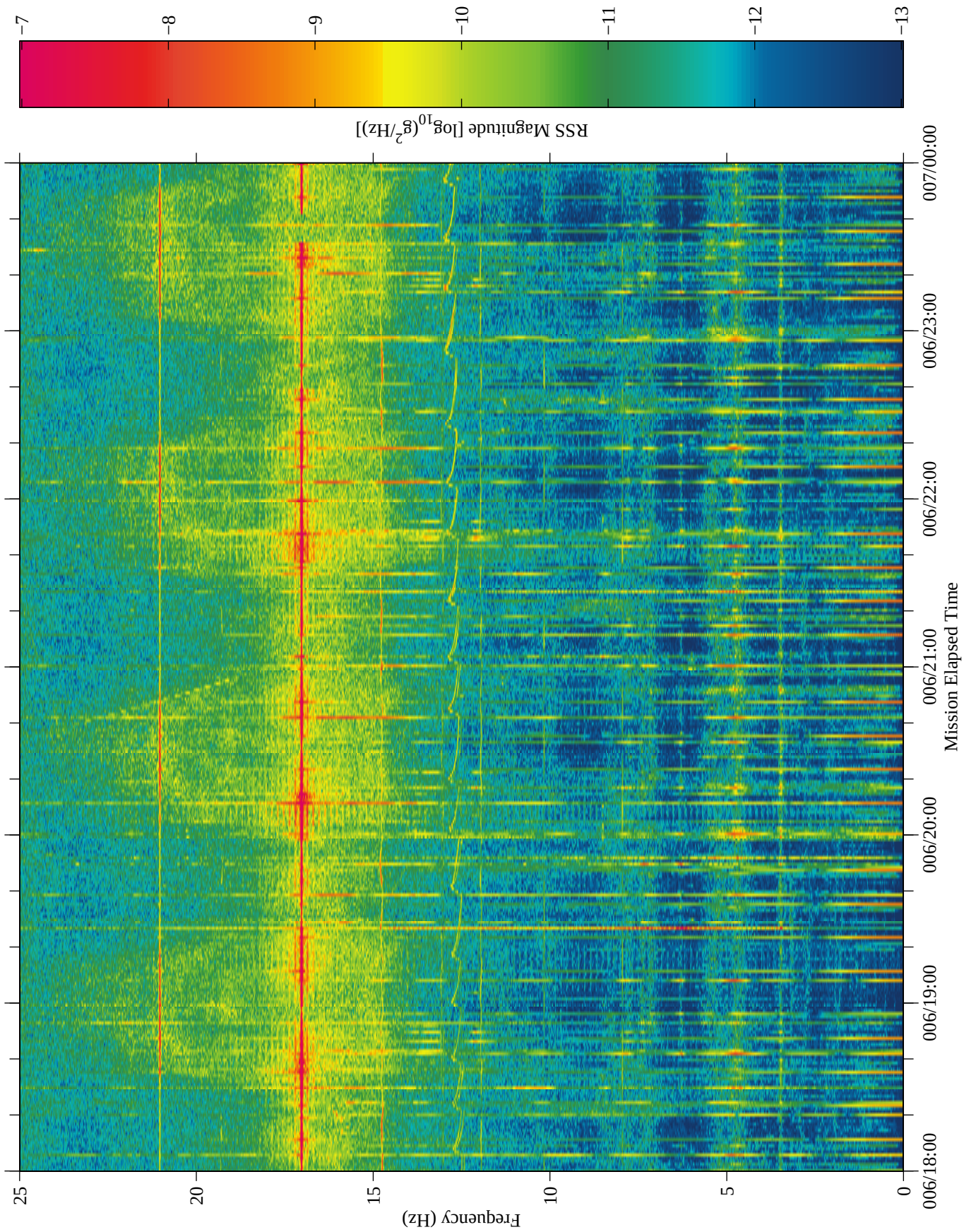

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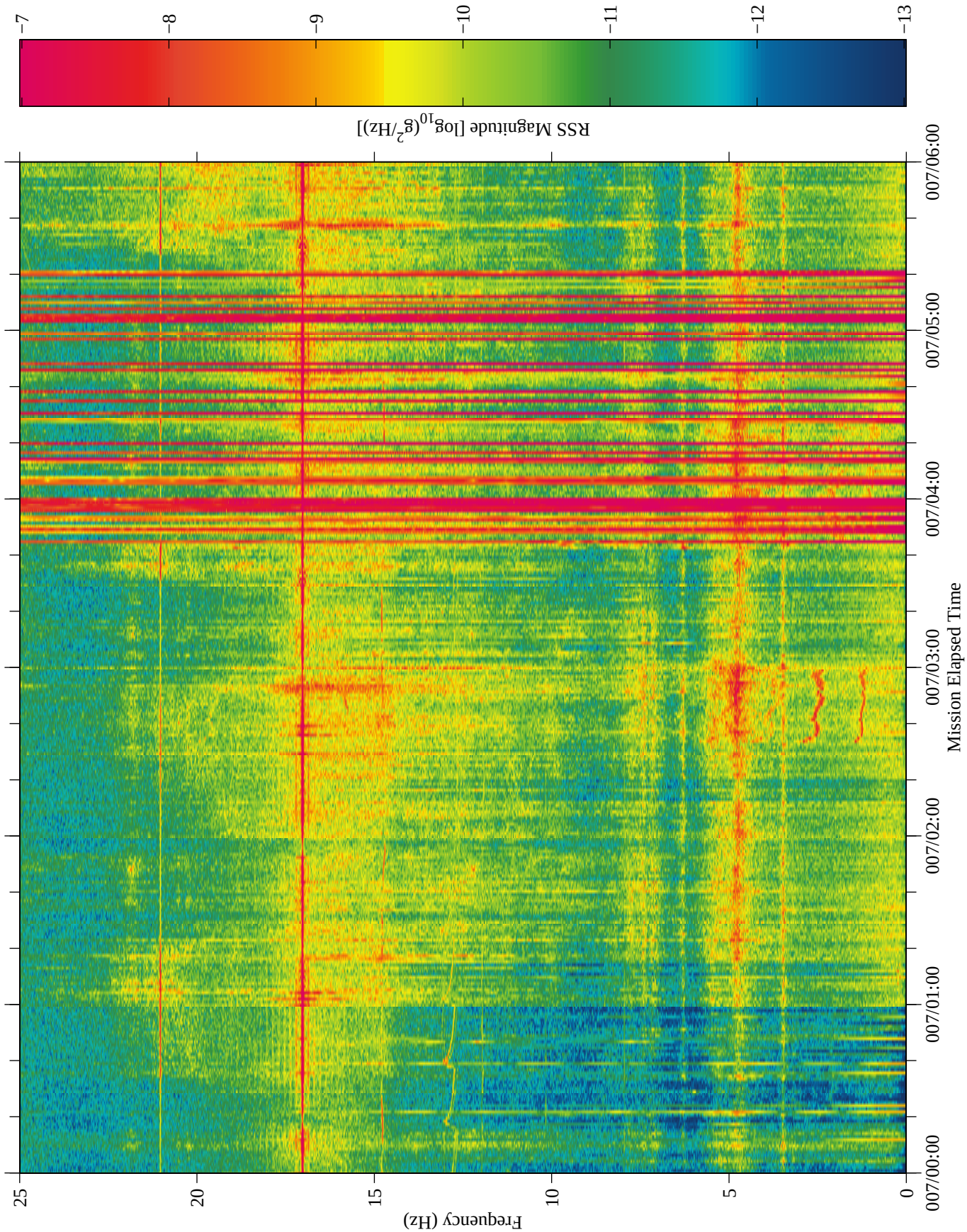

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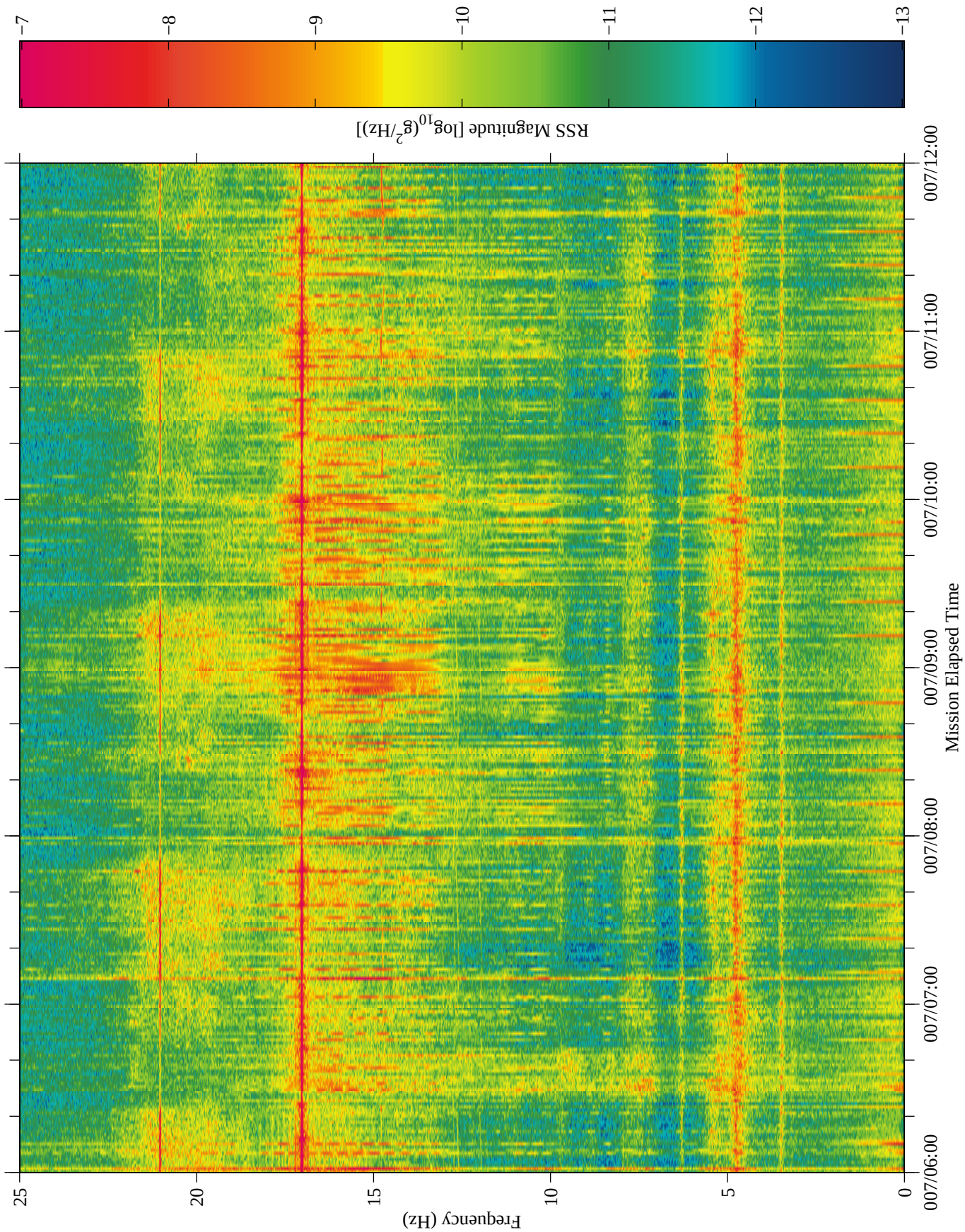

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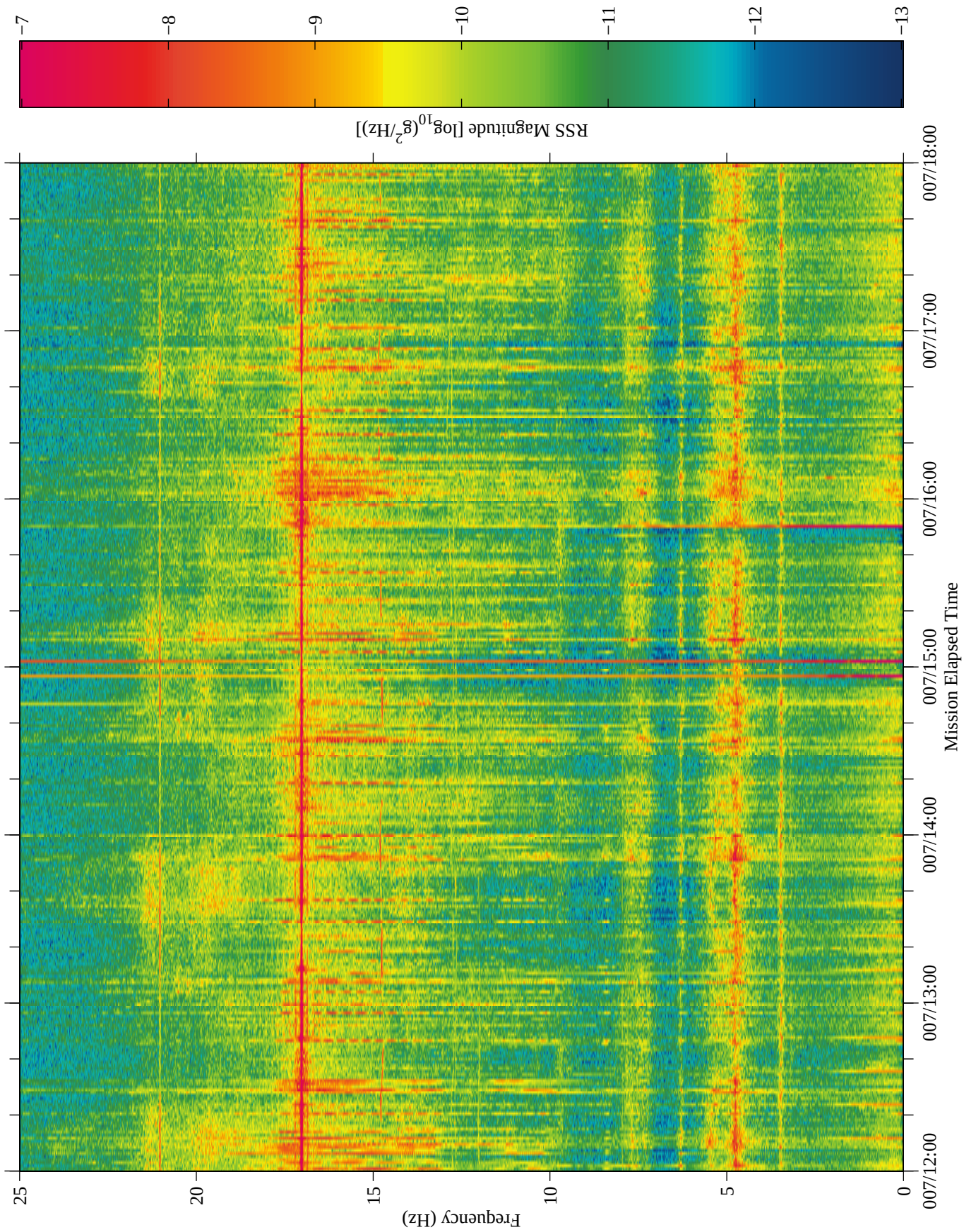

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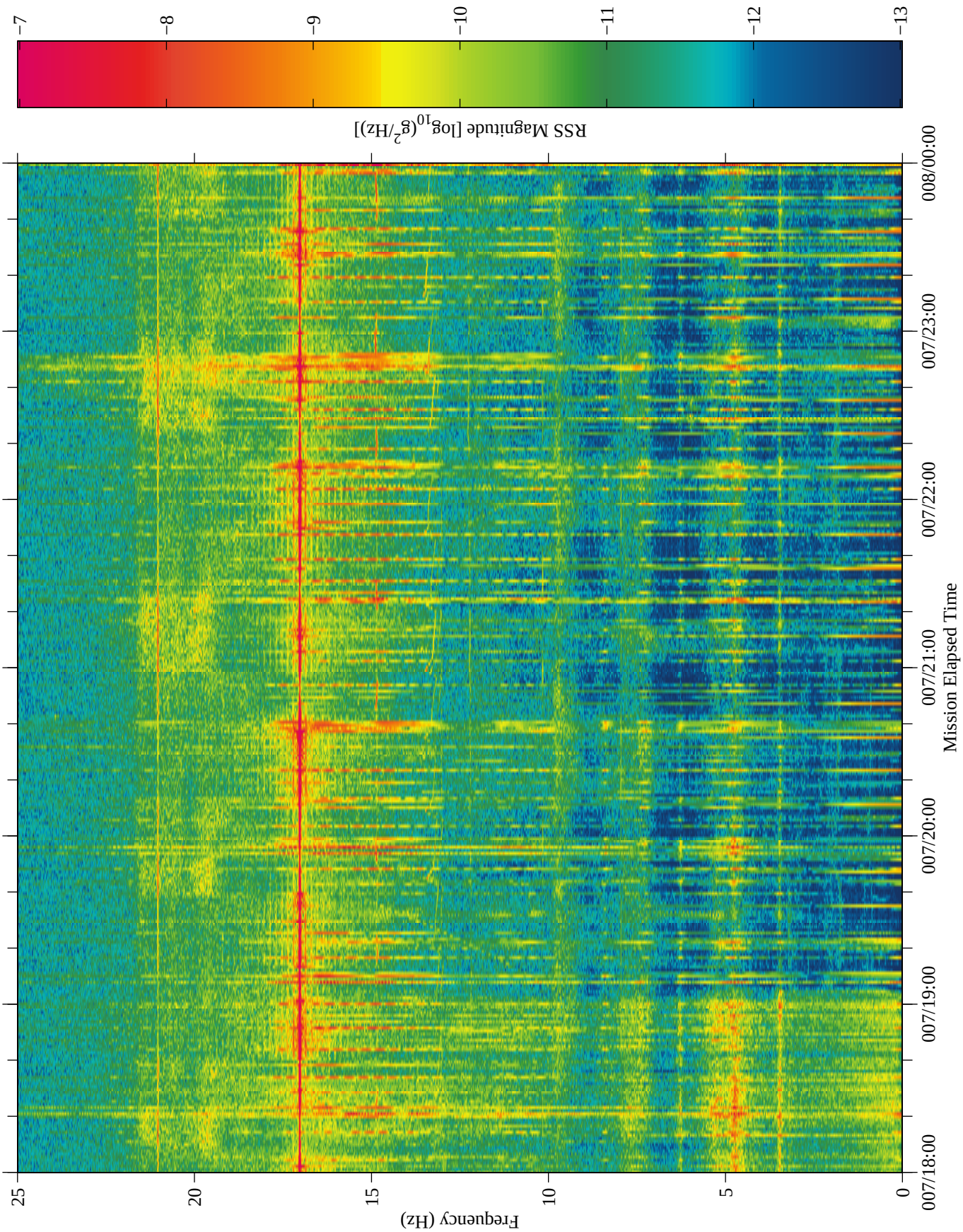

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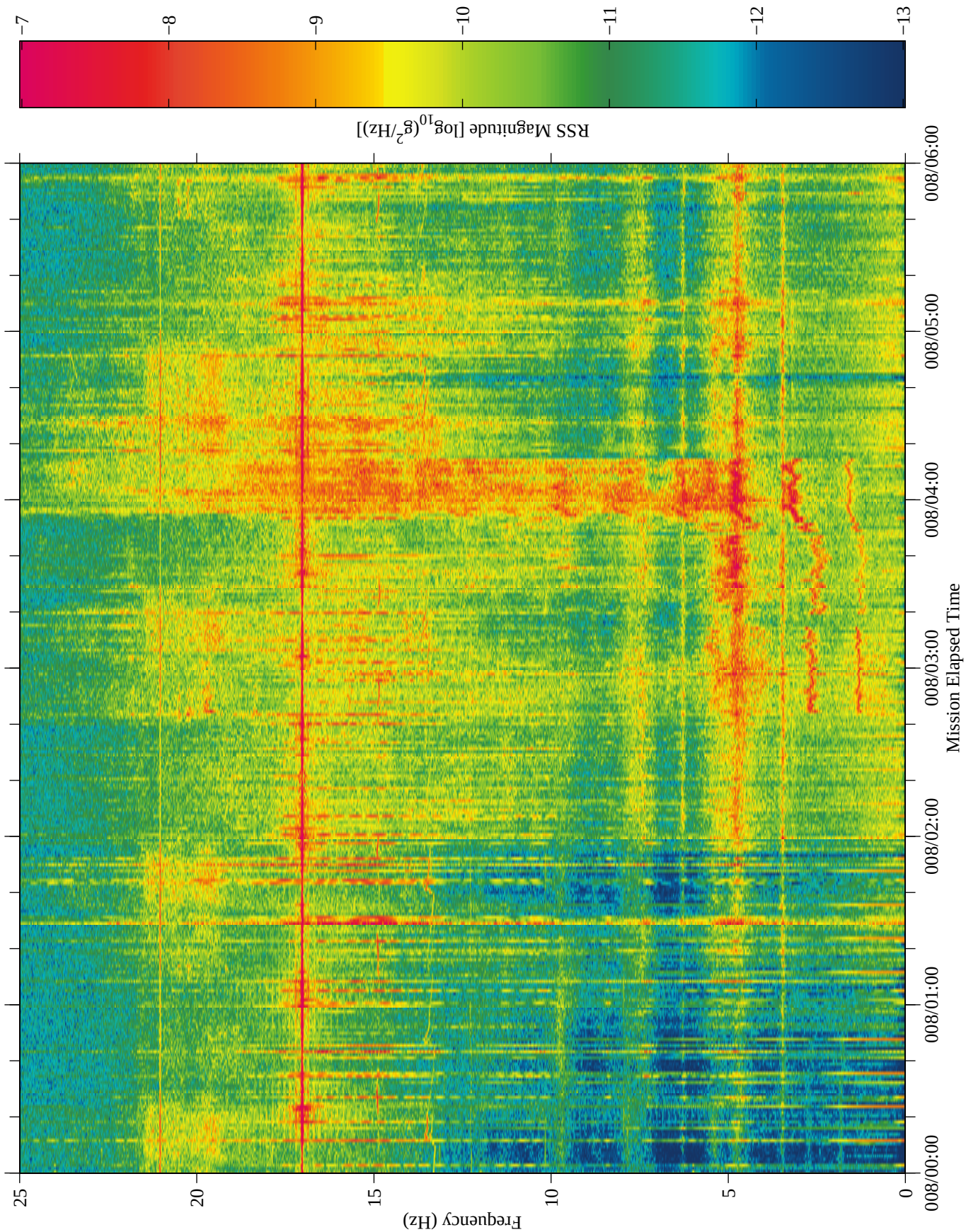

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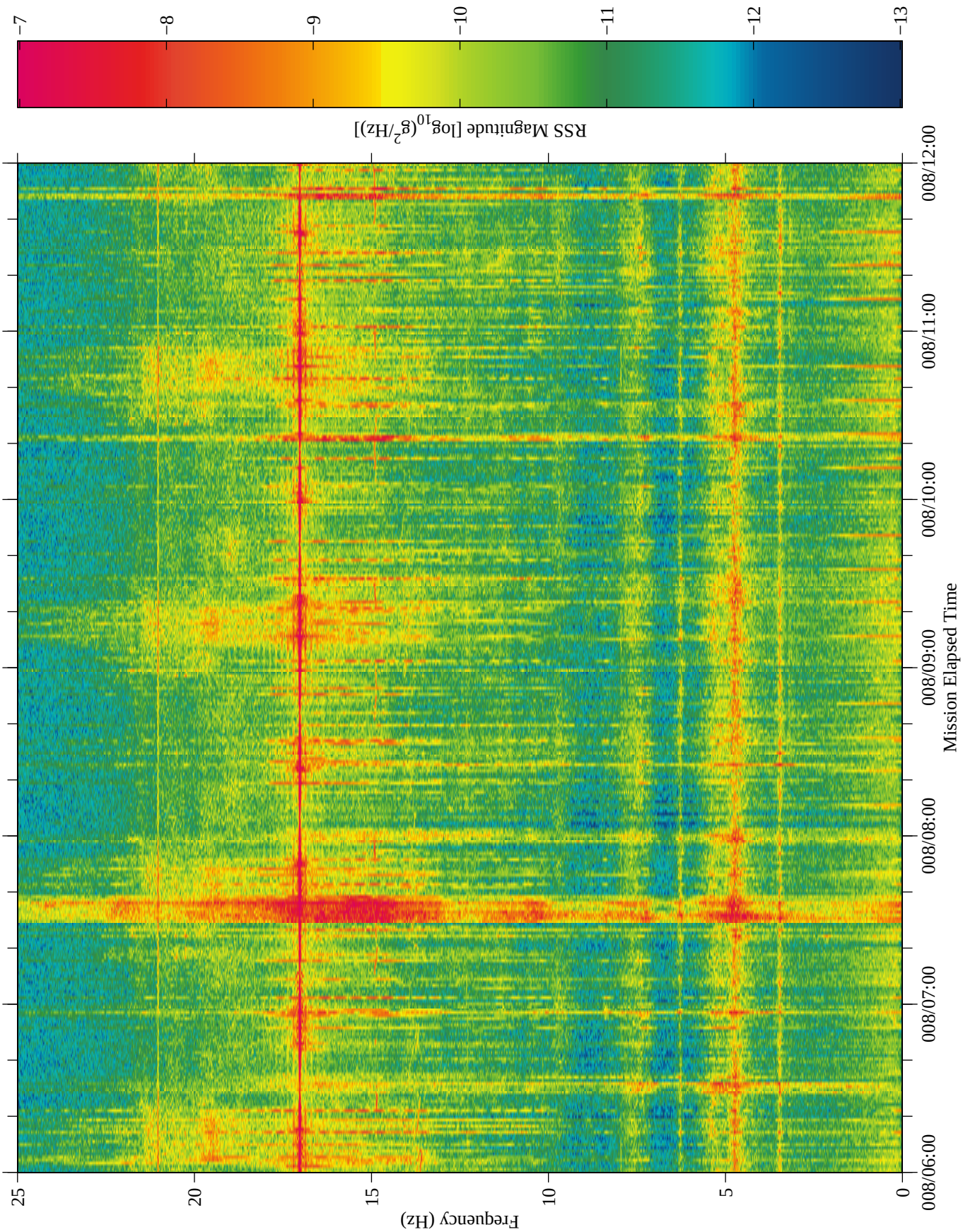

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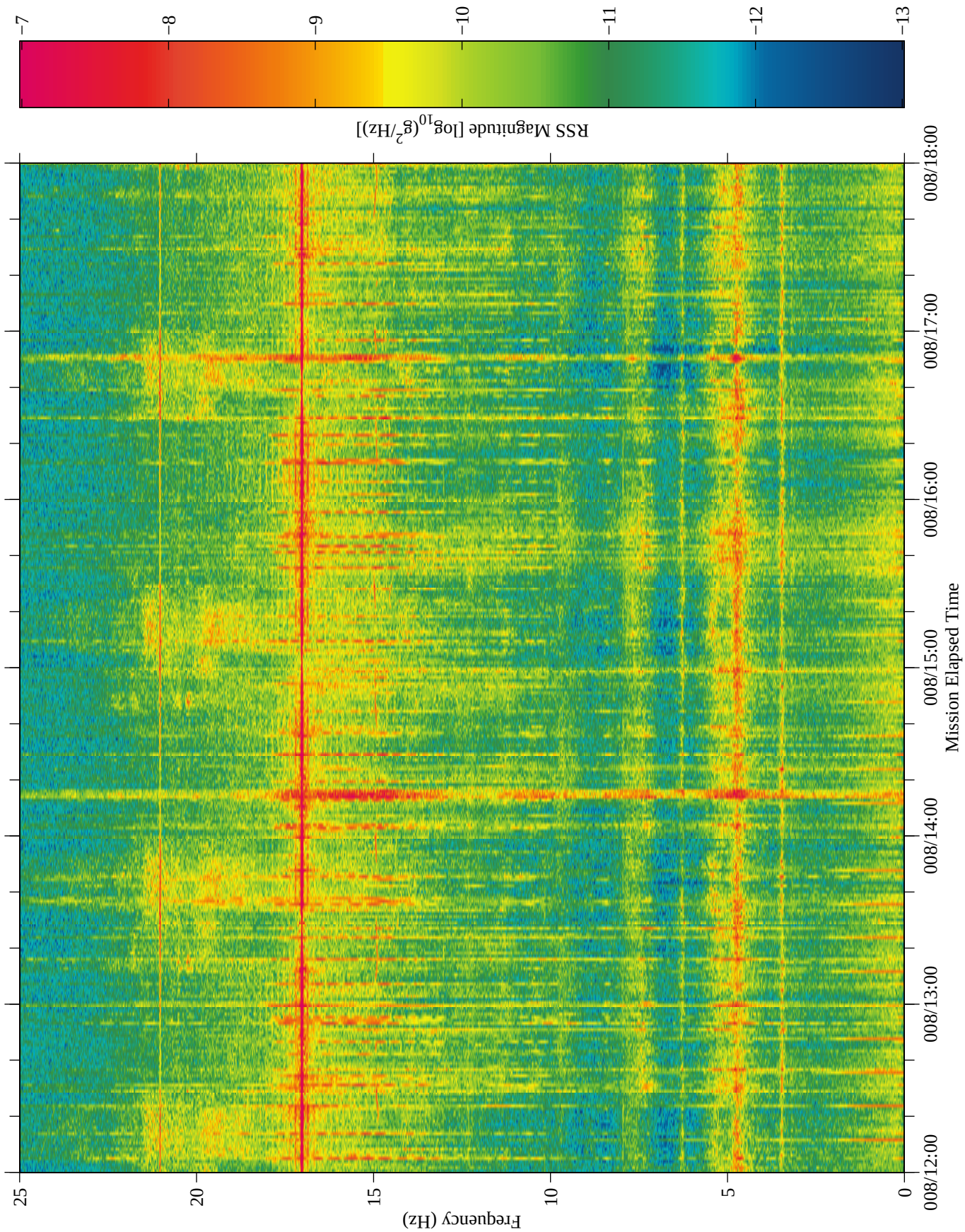

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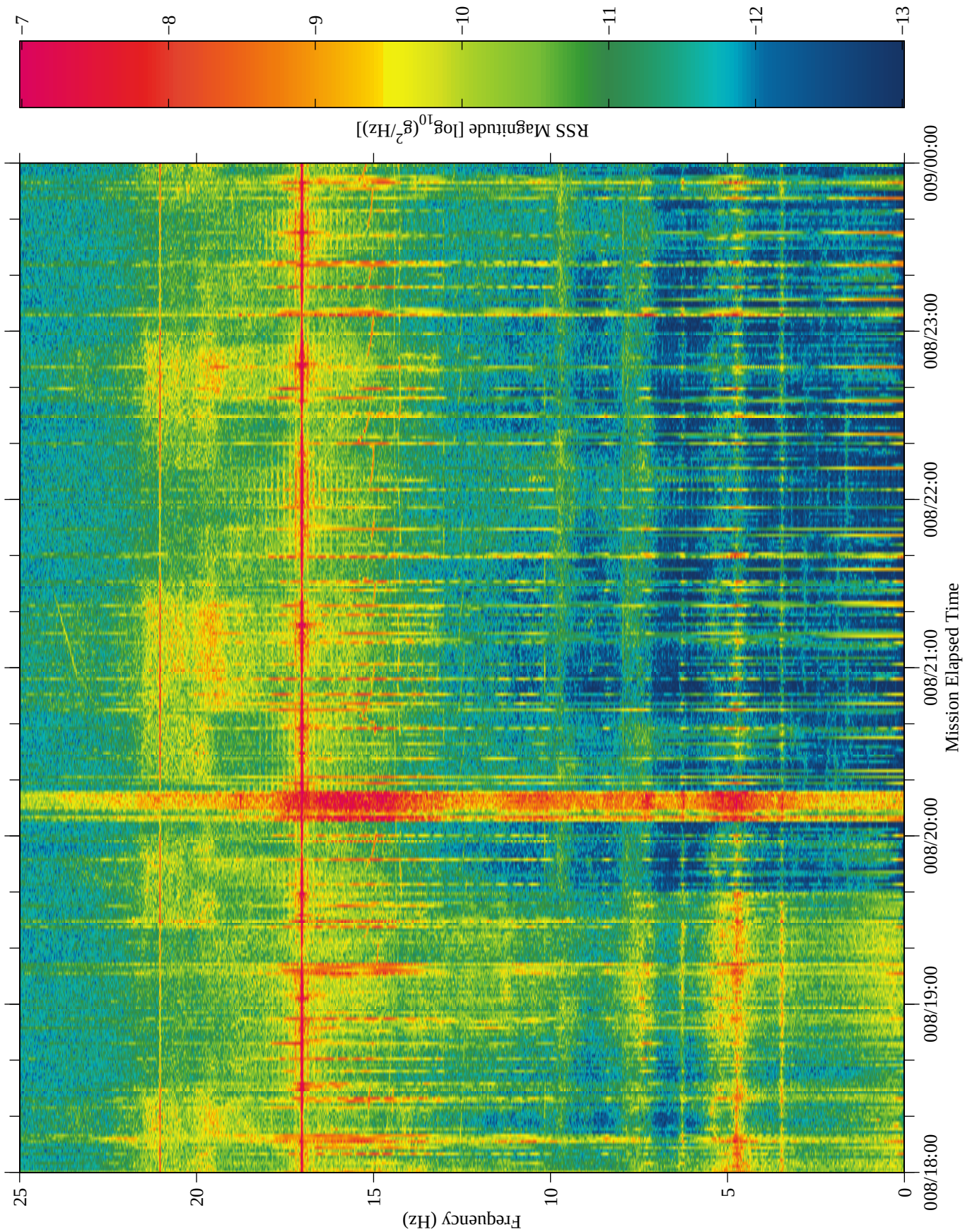

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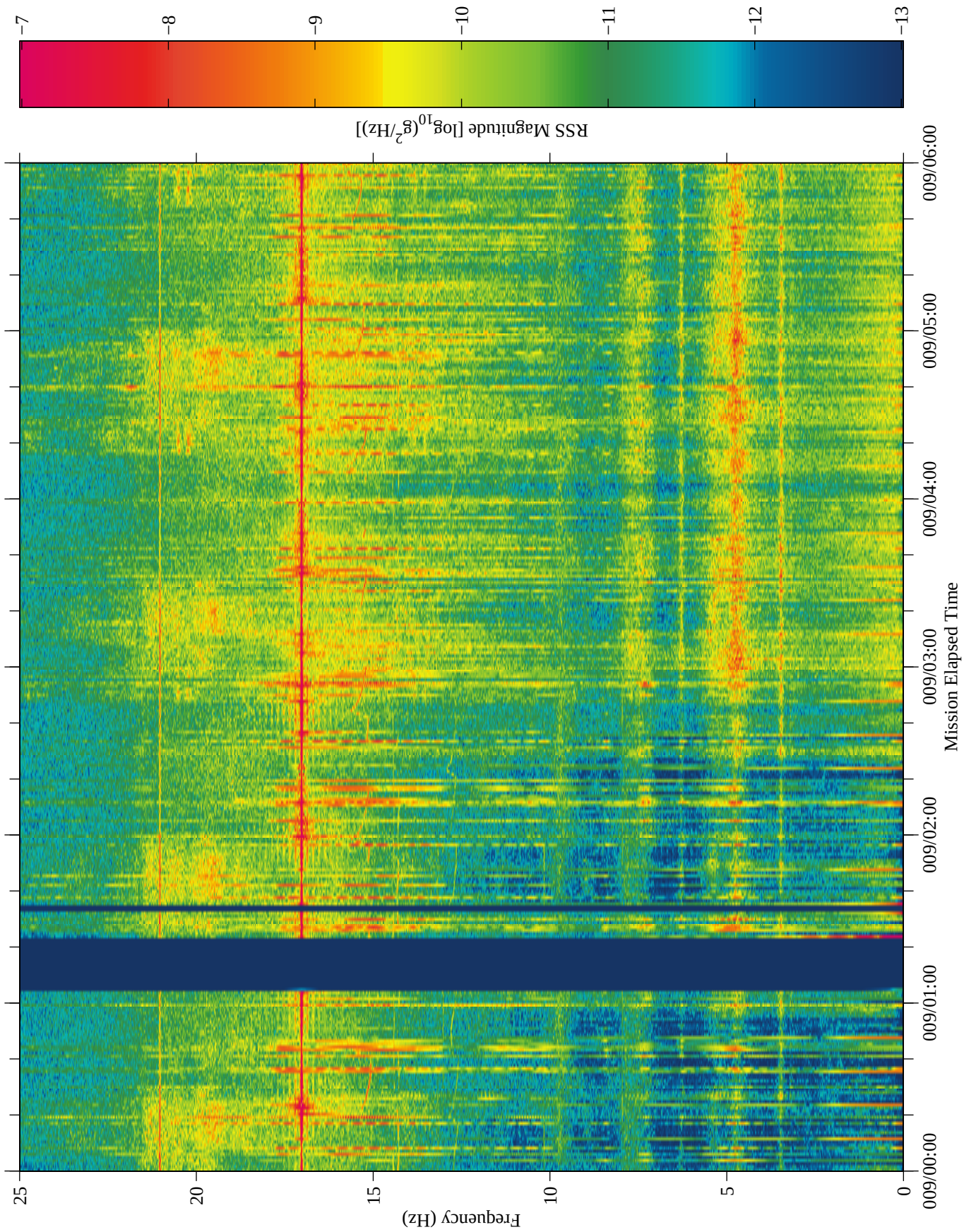

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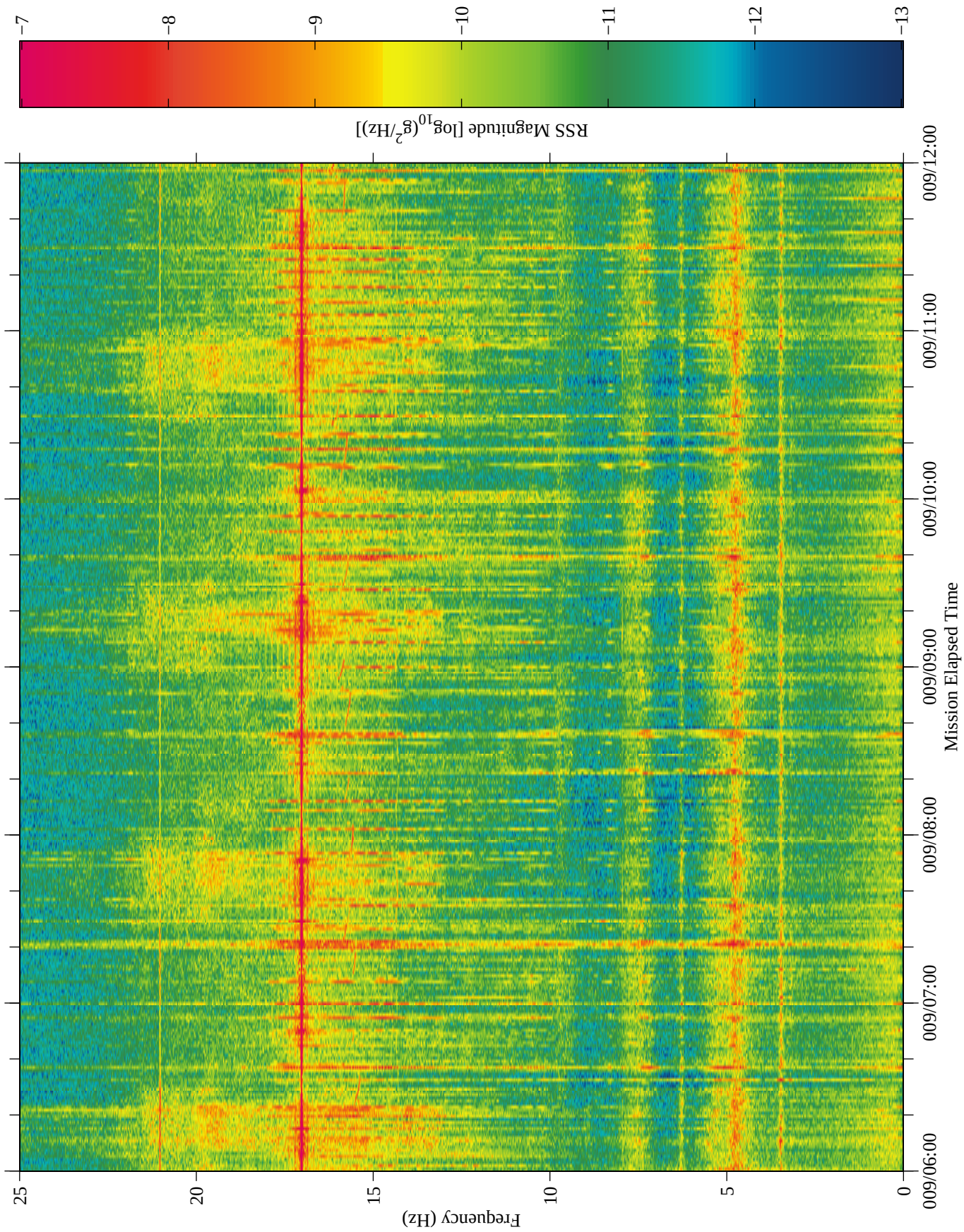

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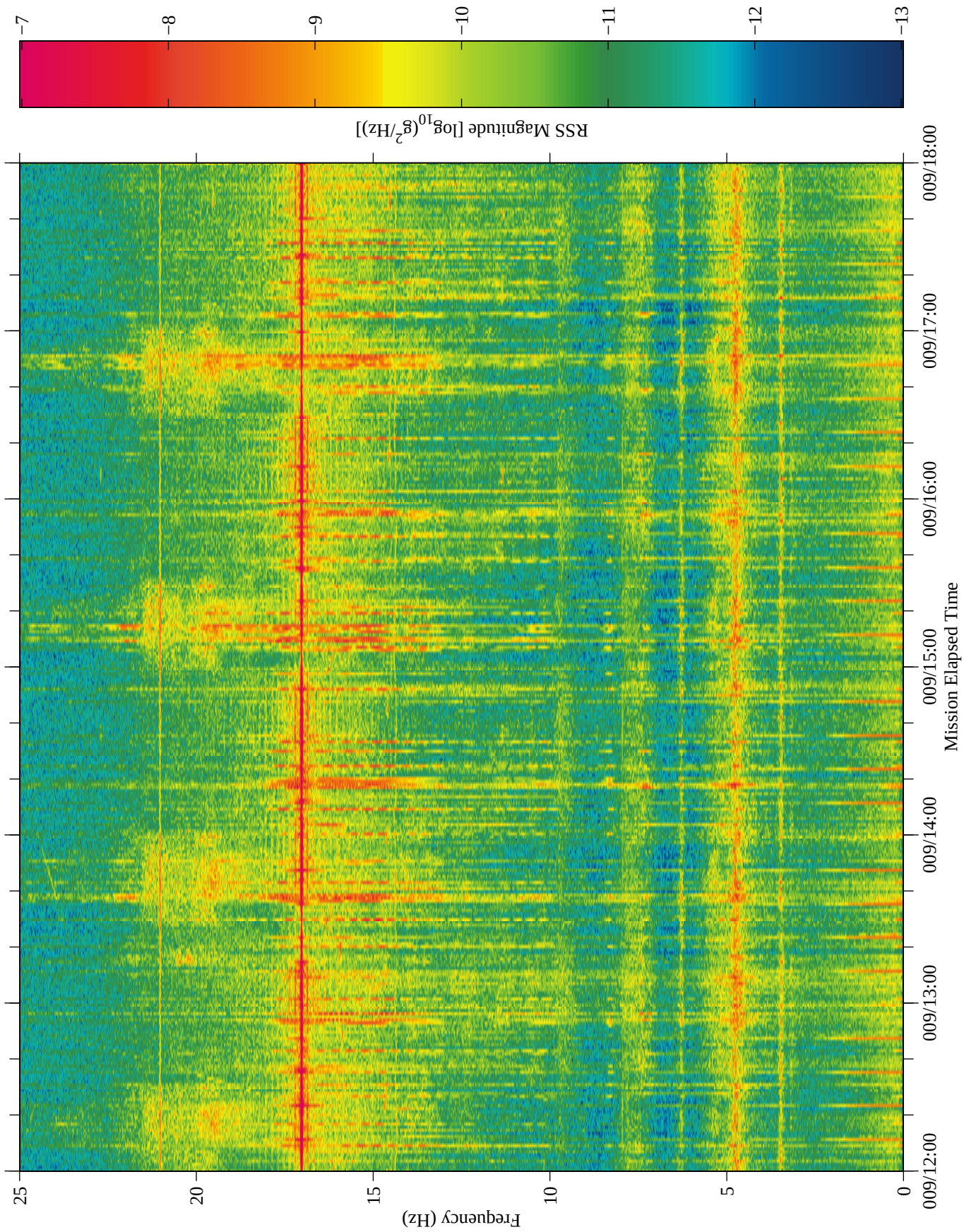

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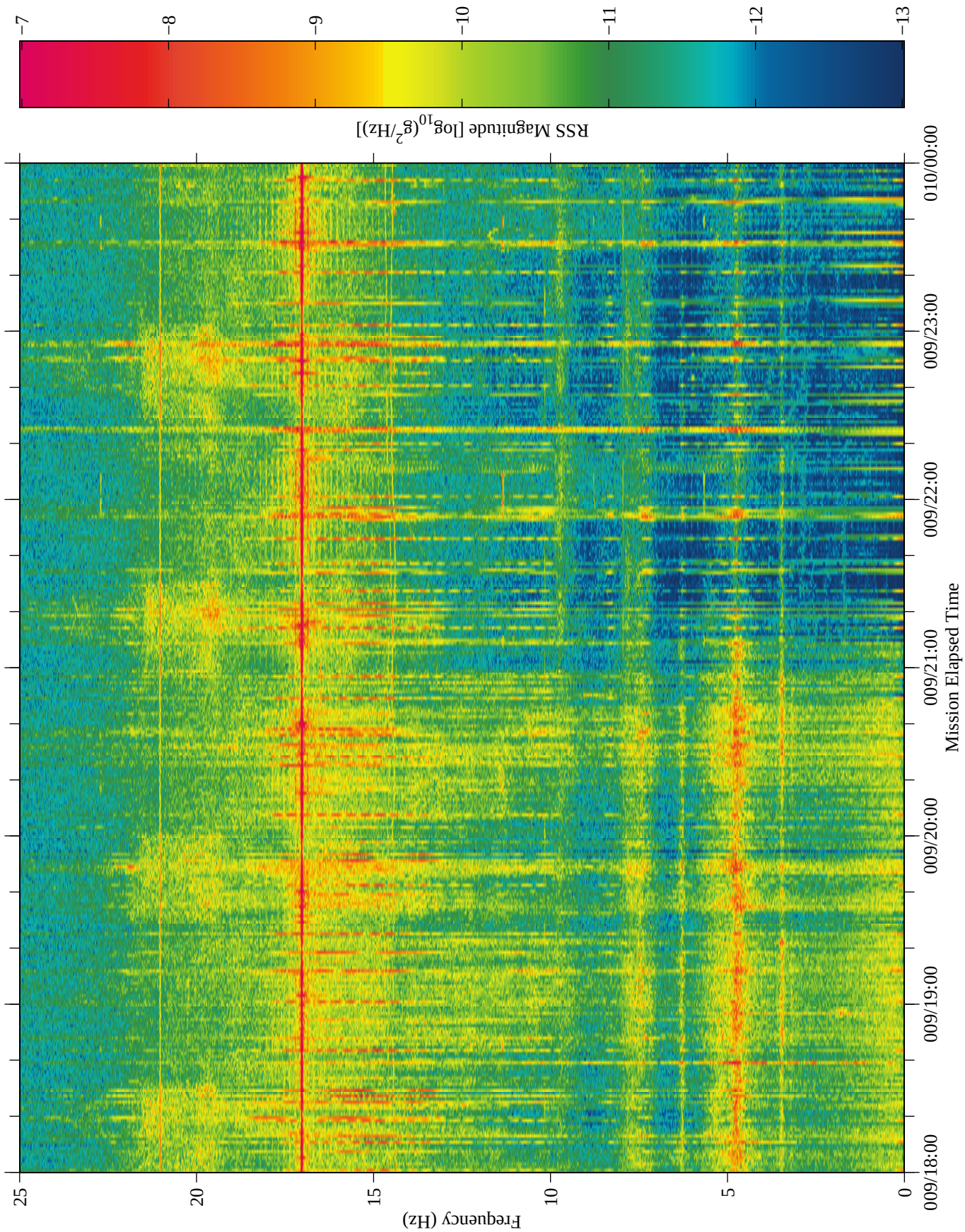

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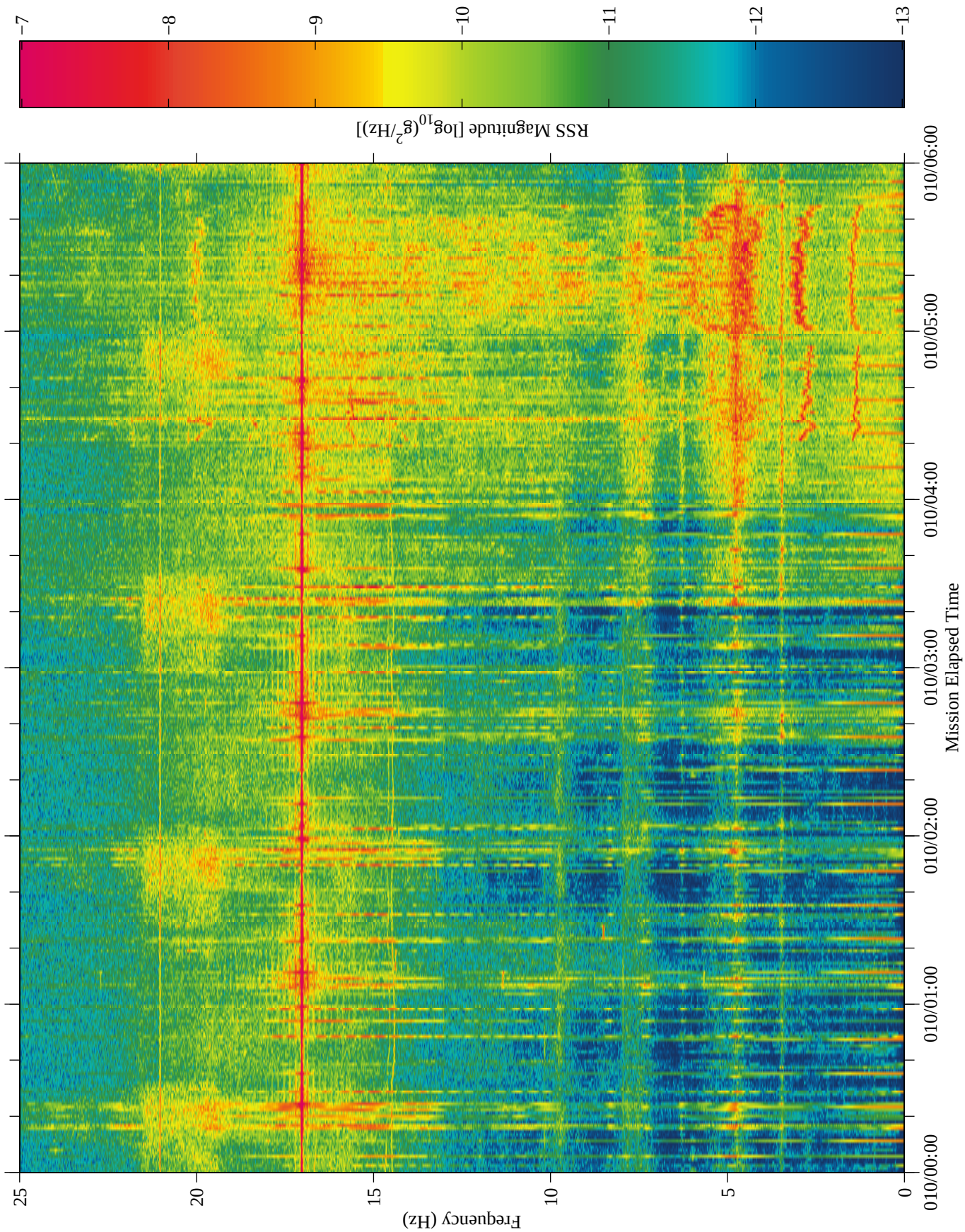

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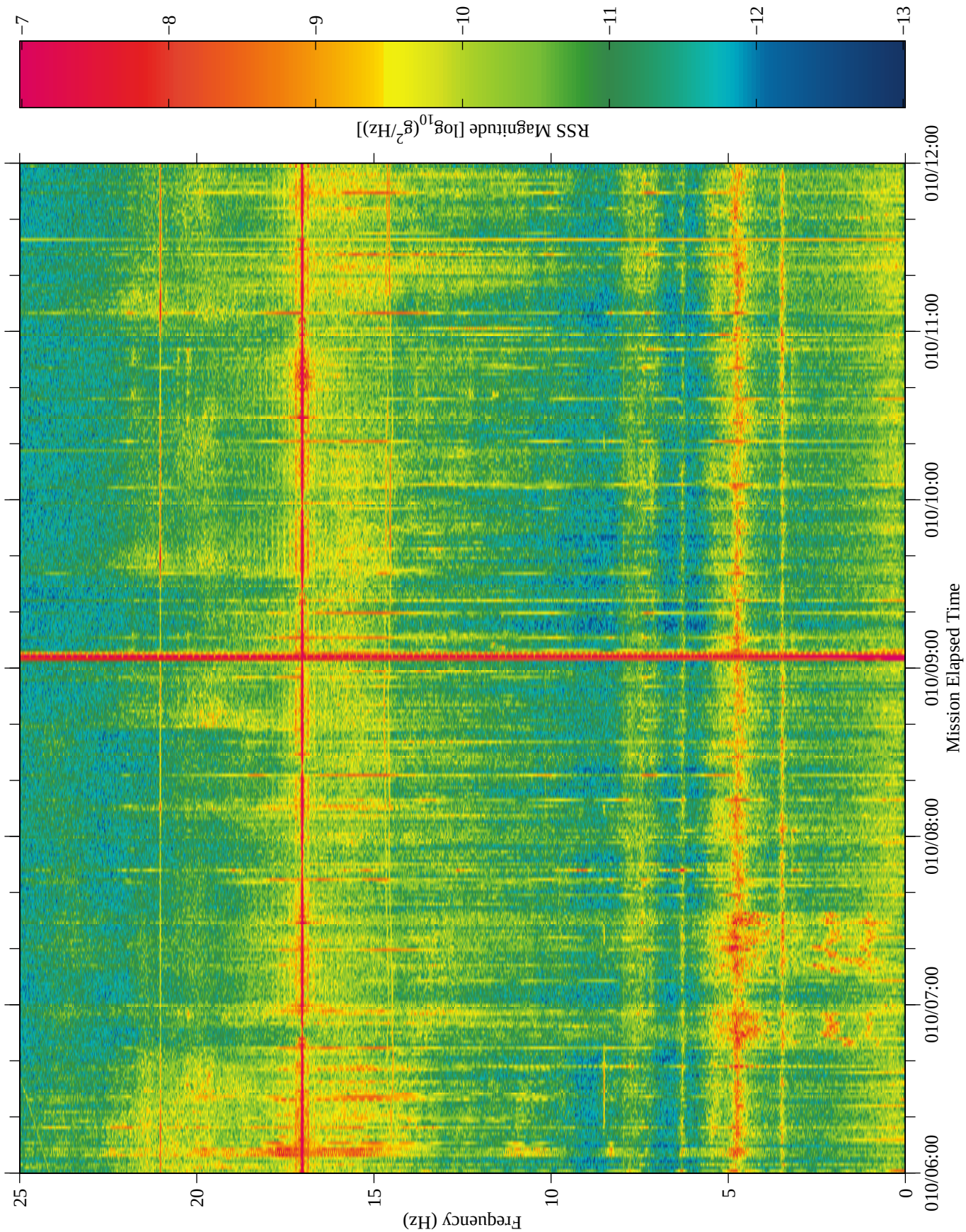

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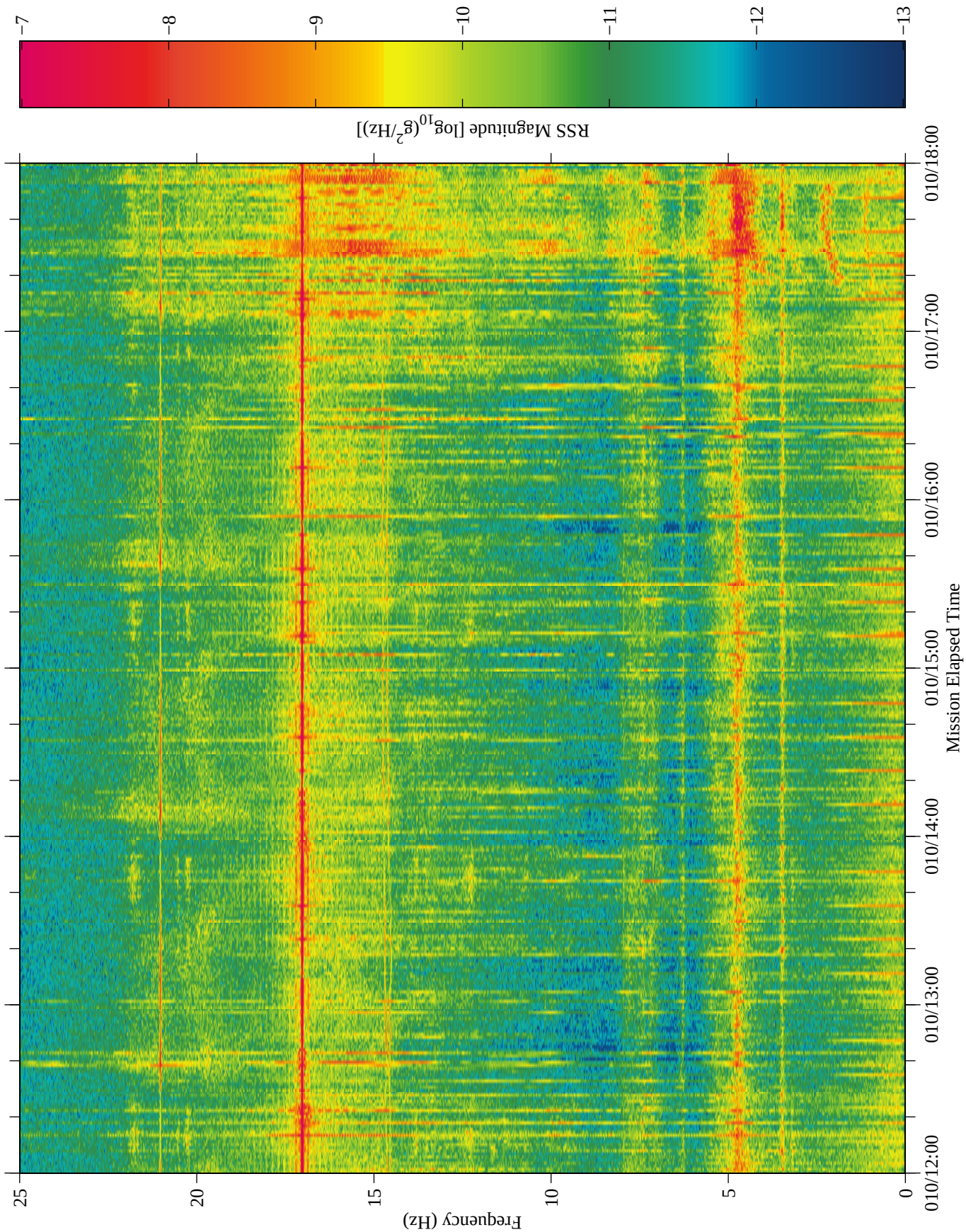

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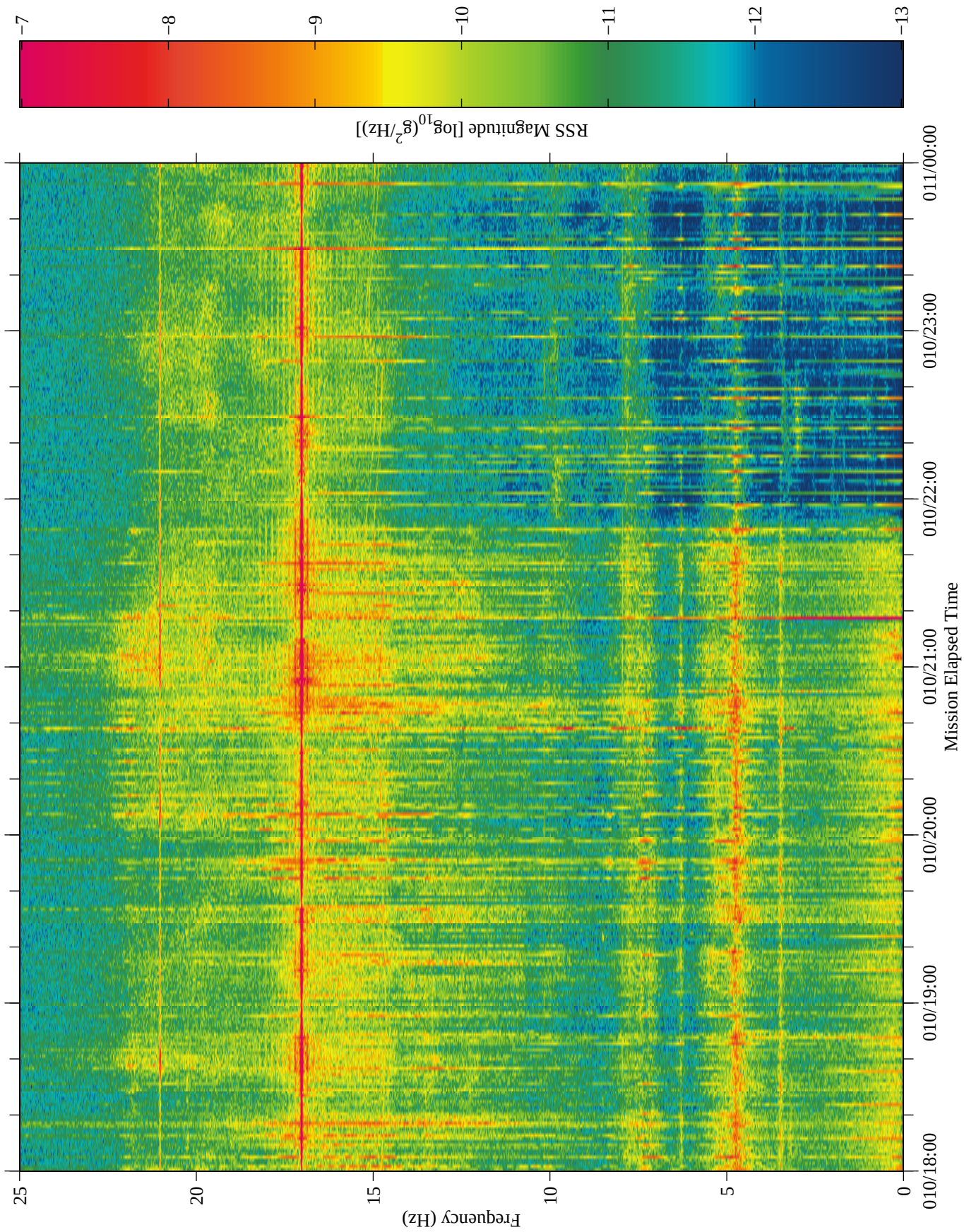

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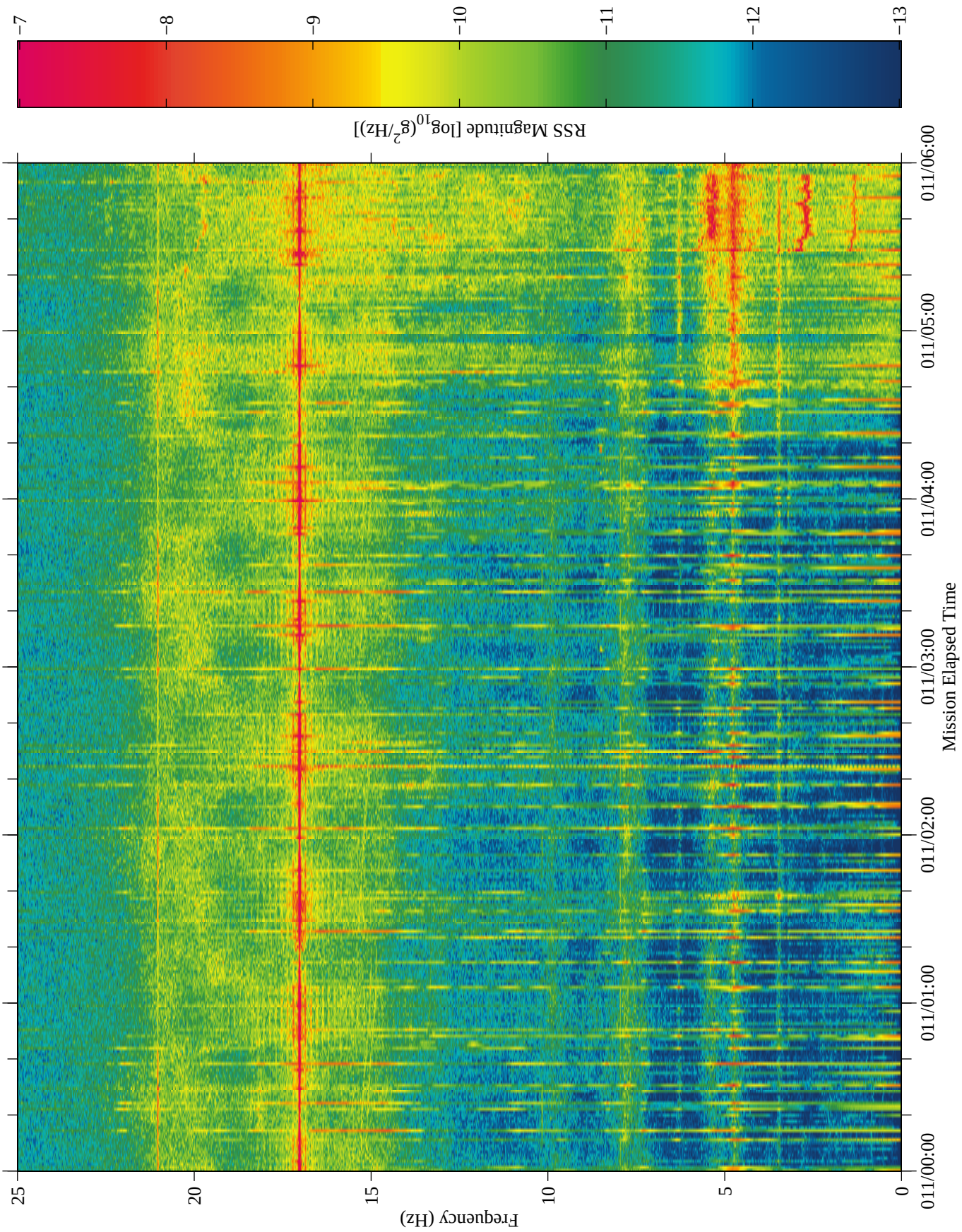
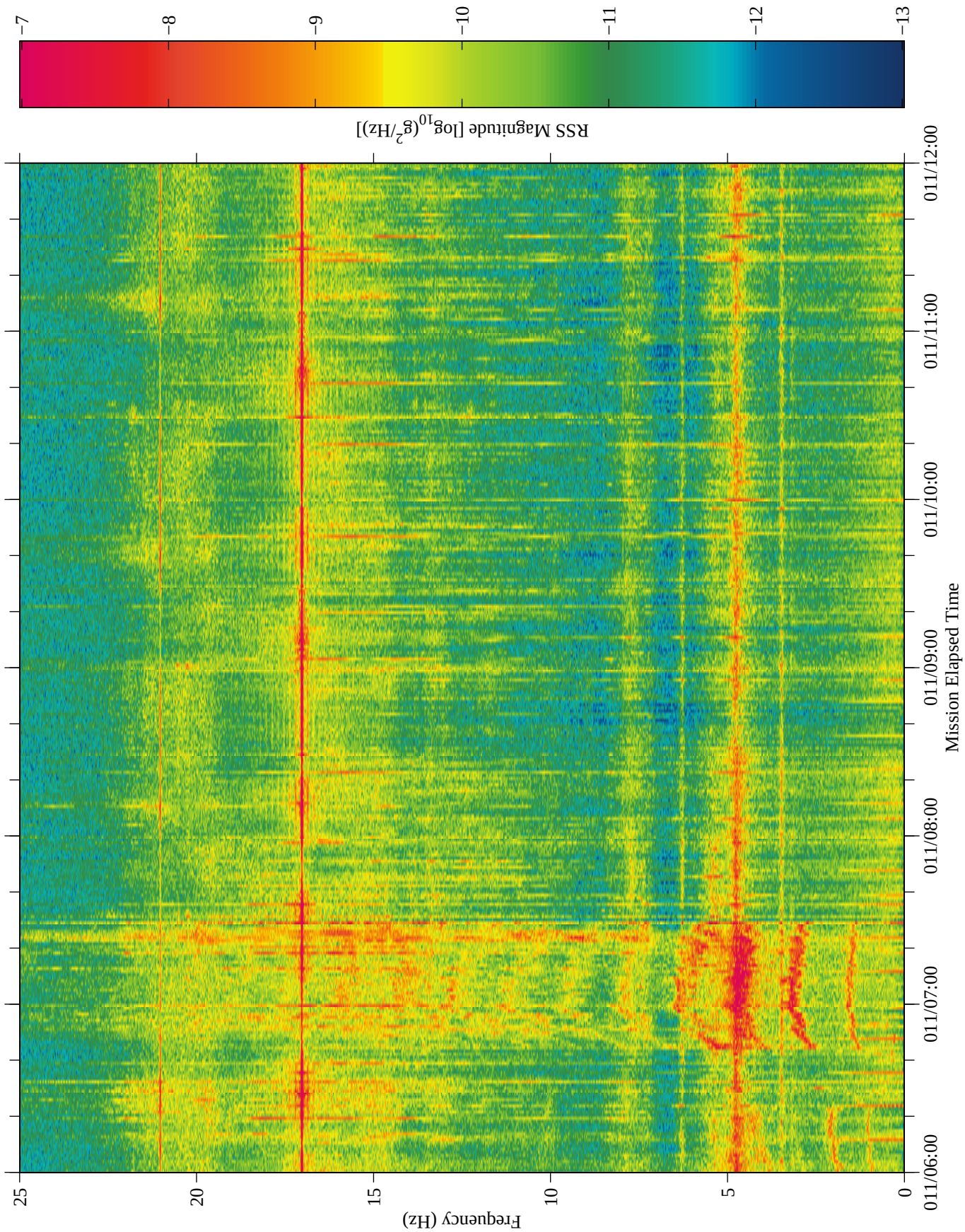


Figure 45: USMP−4, Unit F, TSH B



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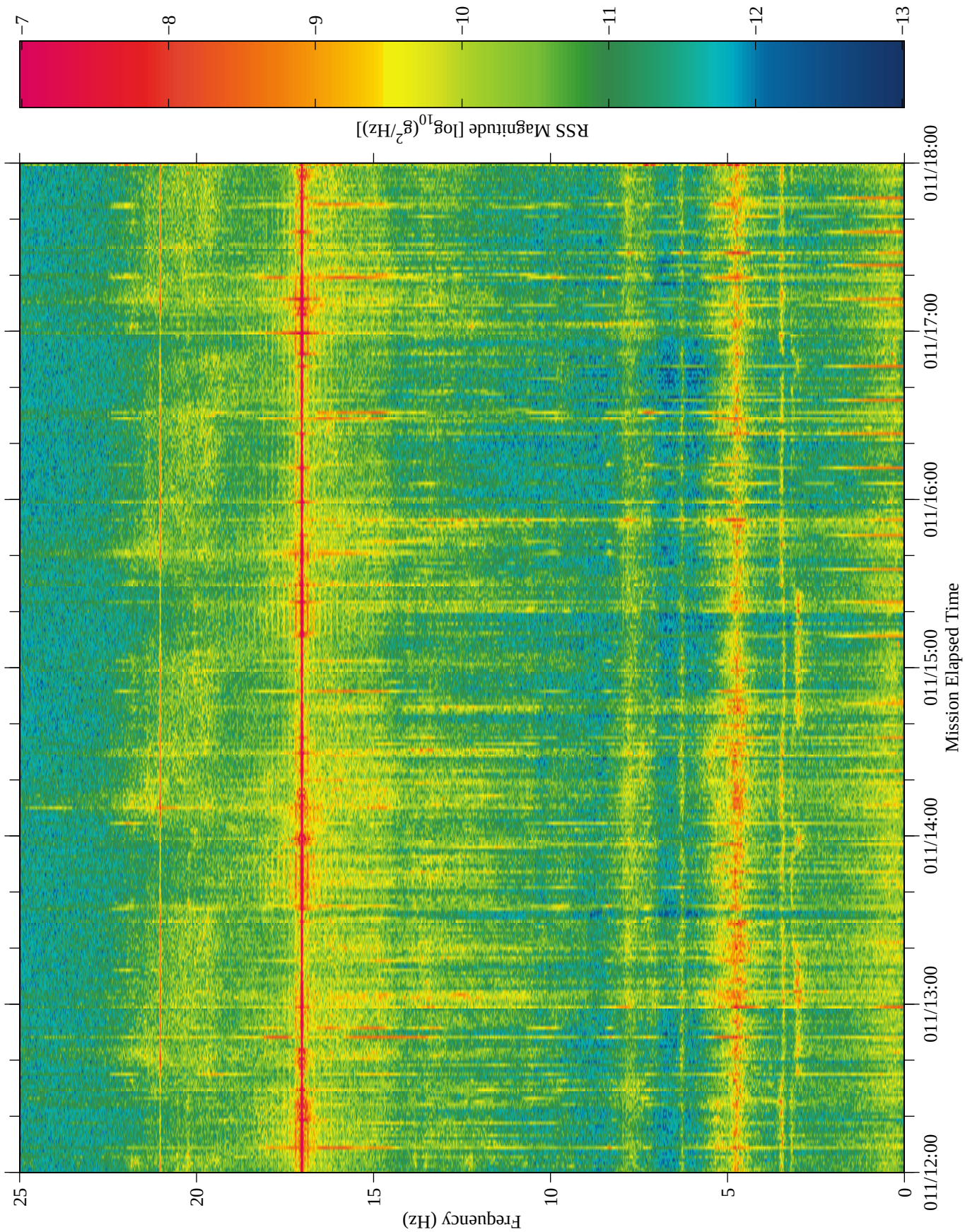

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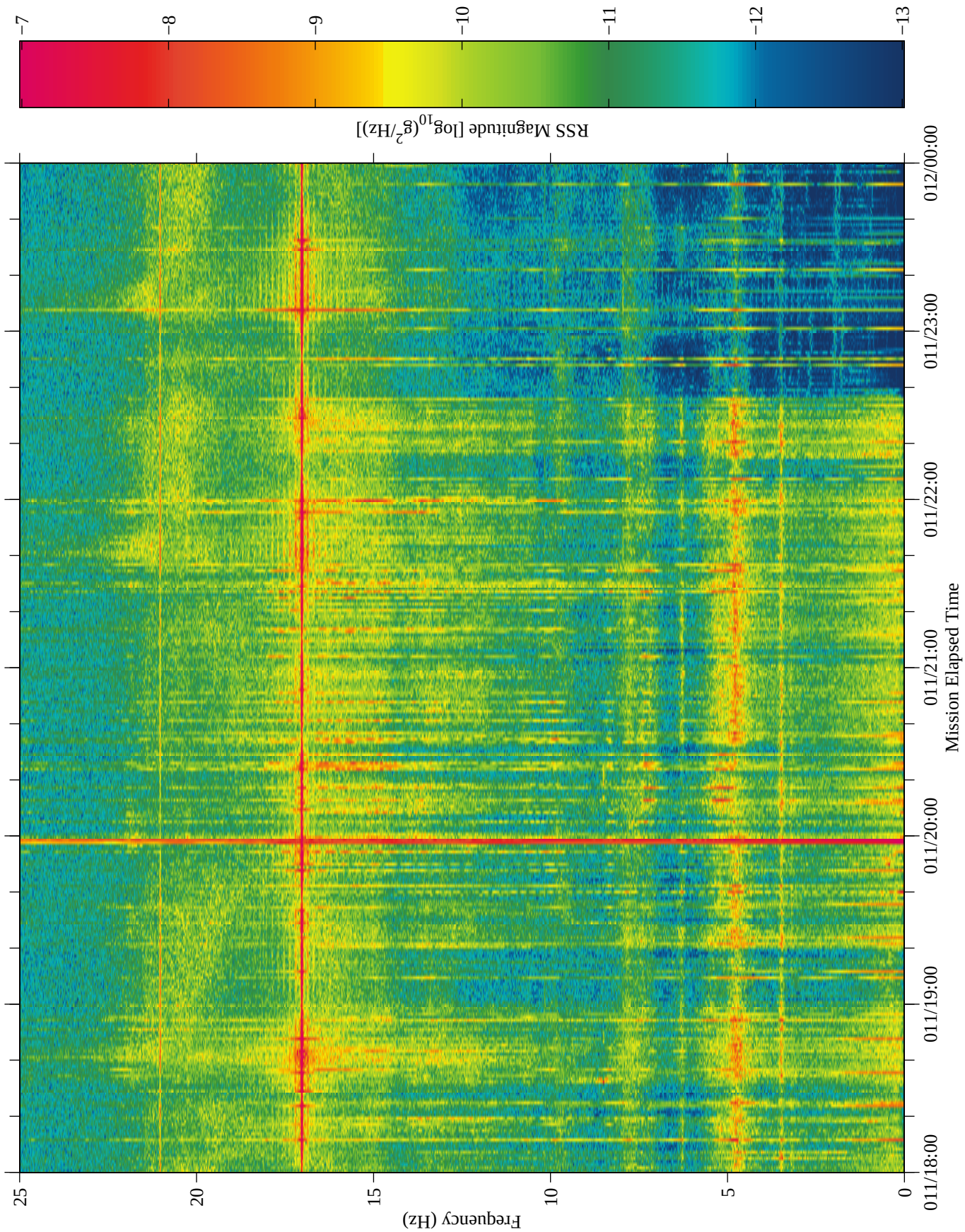

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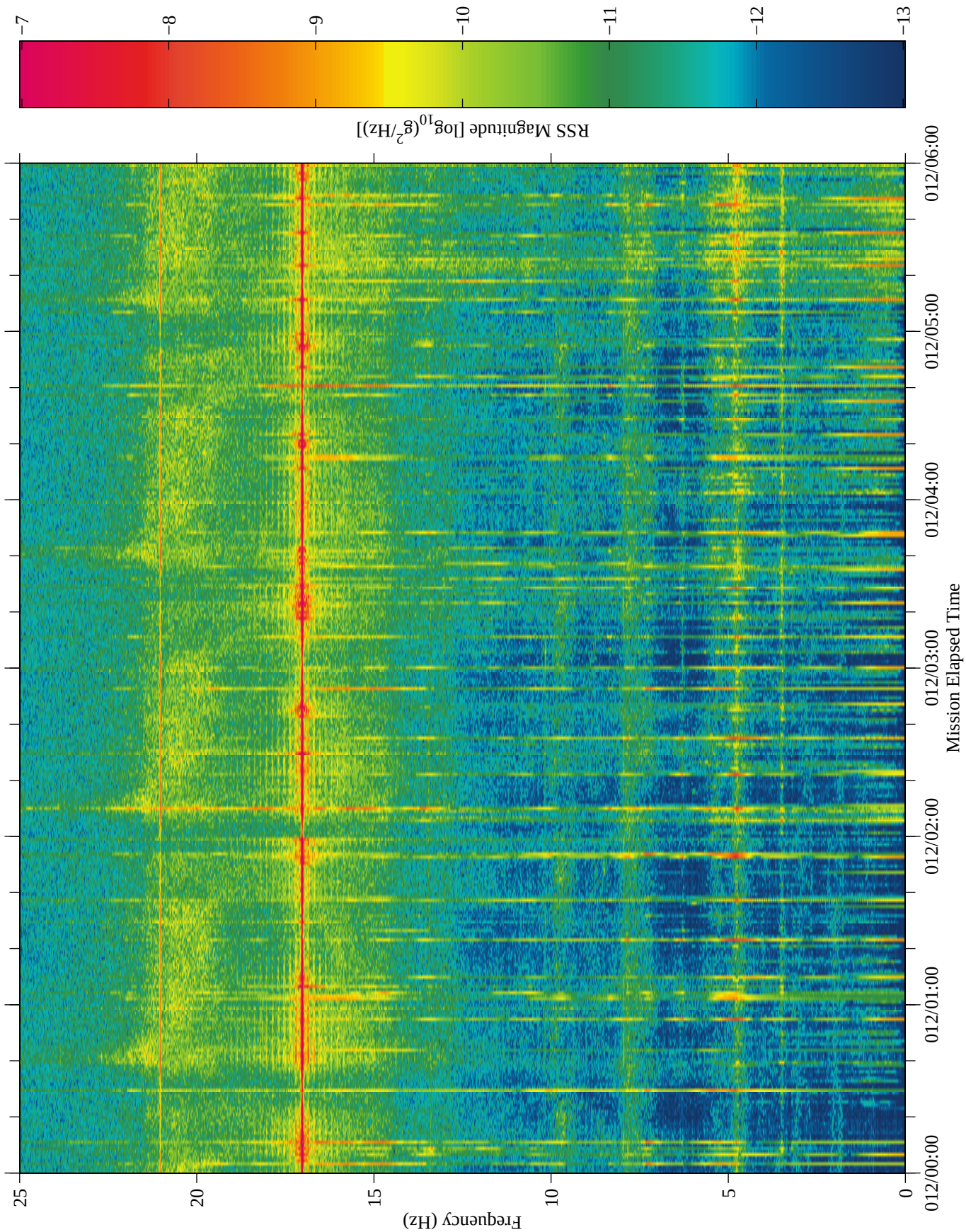

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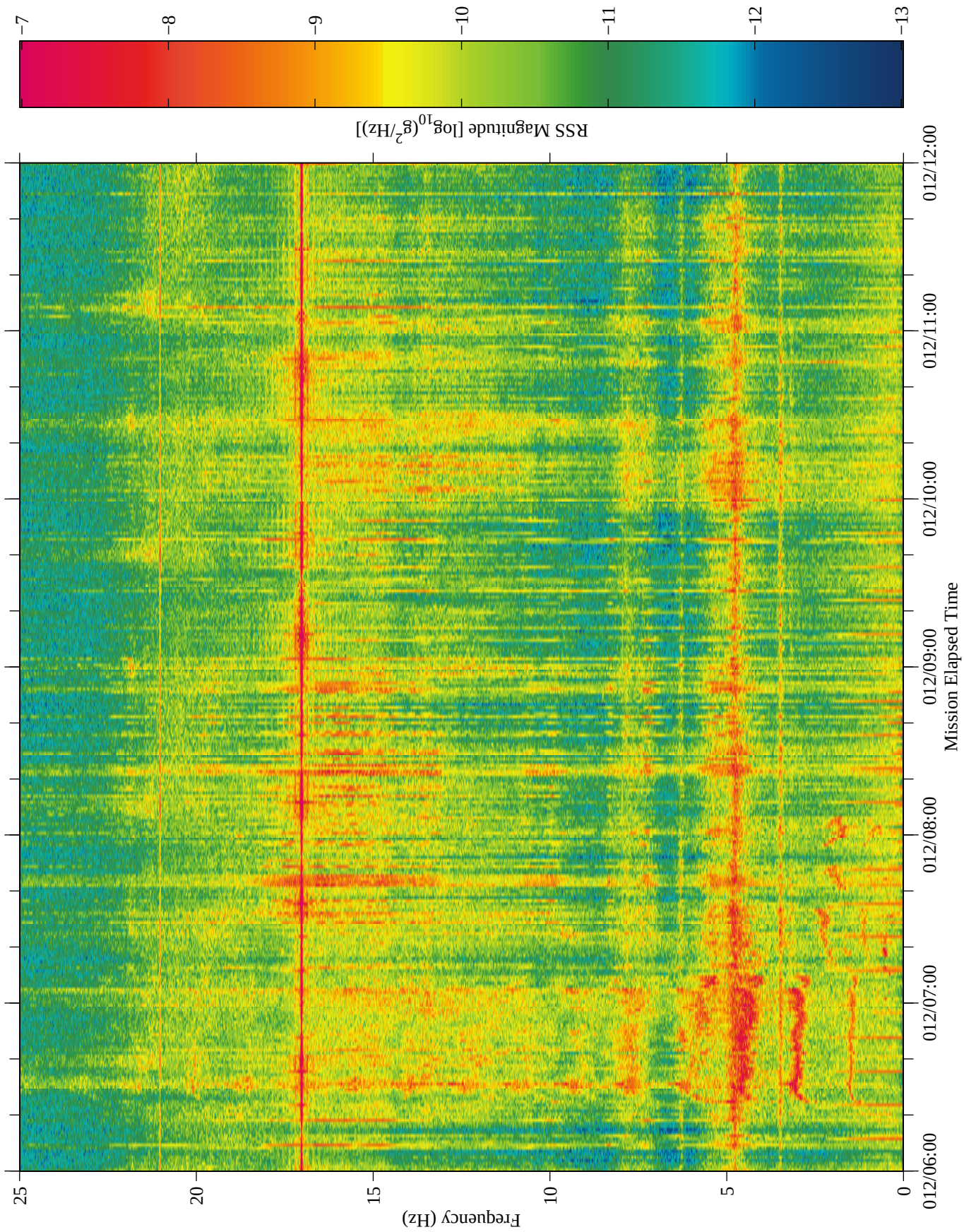

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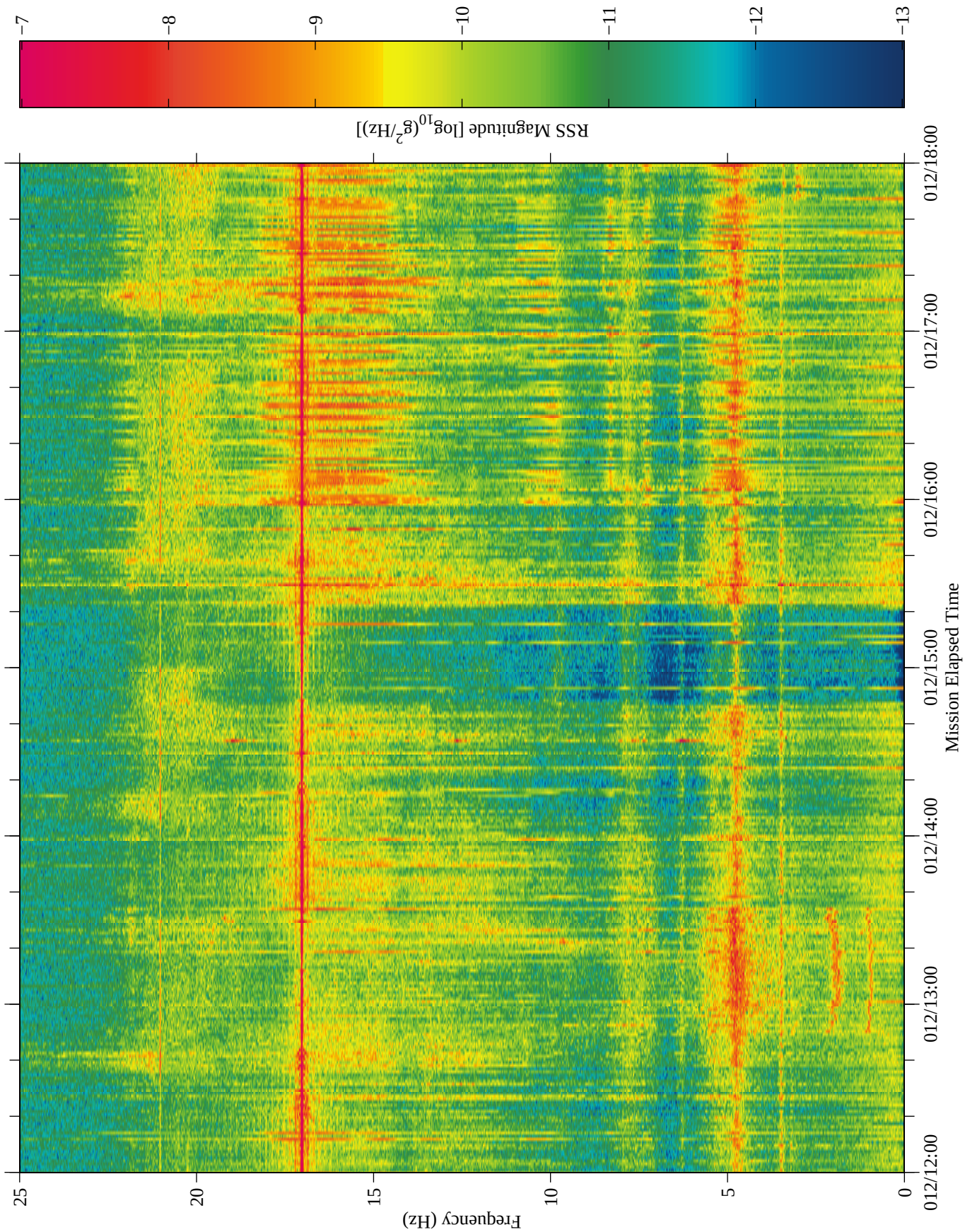

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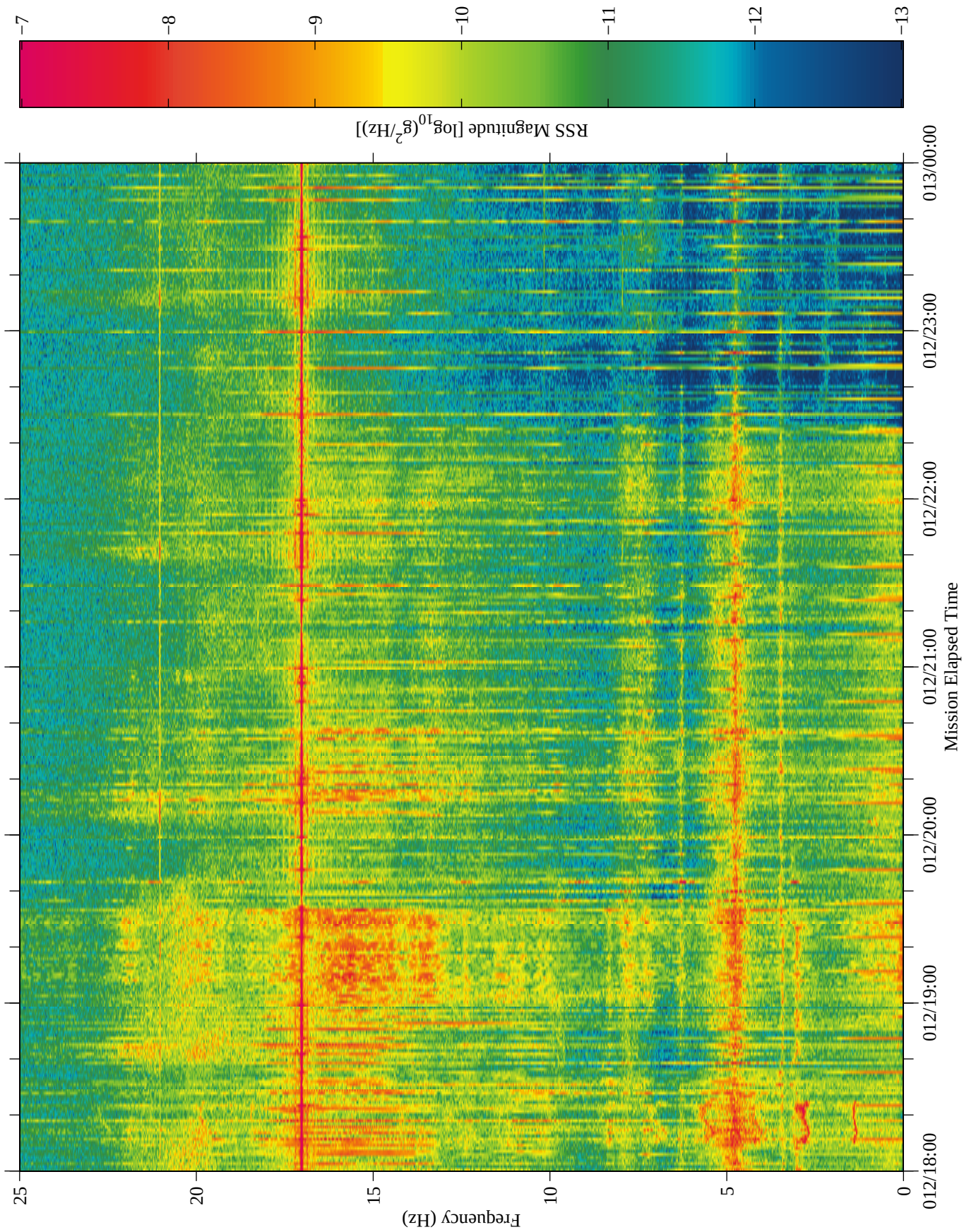

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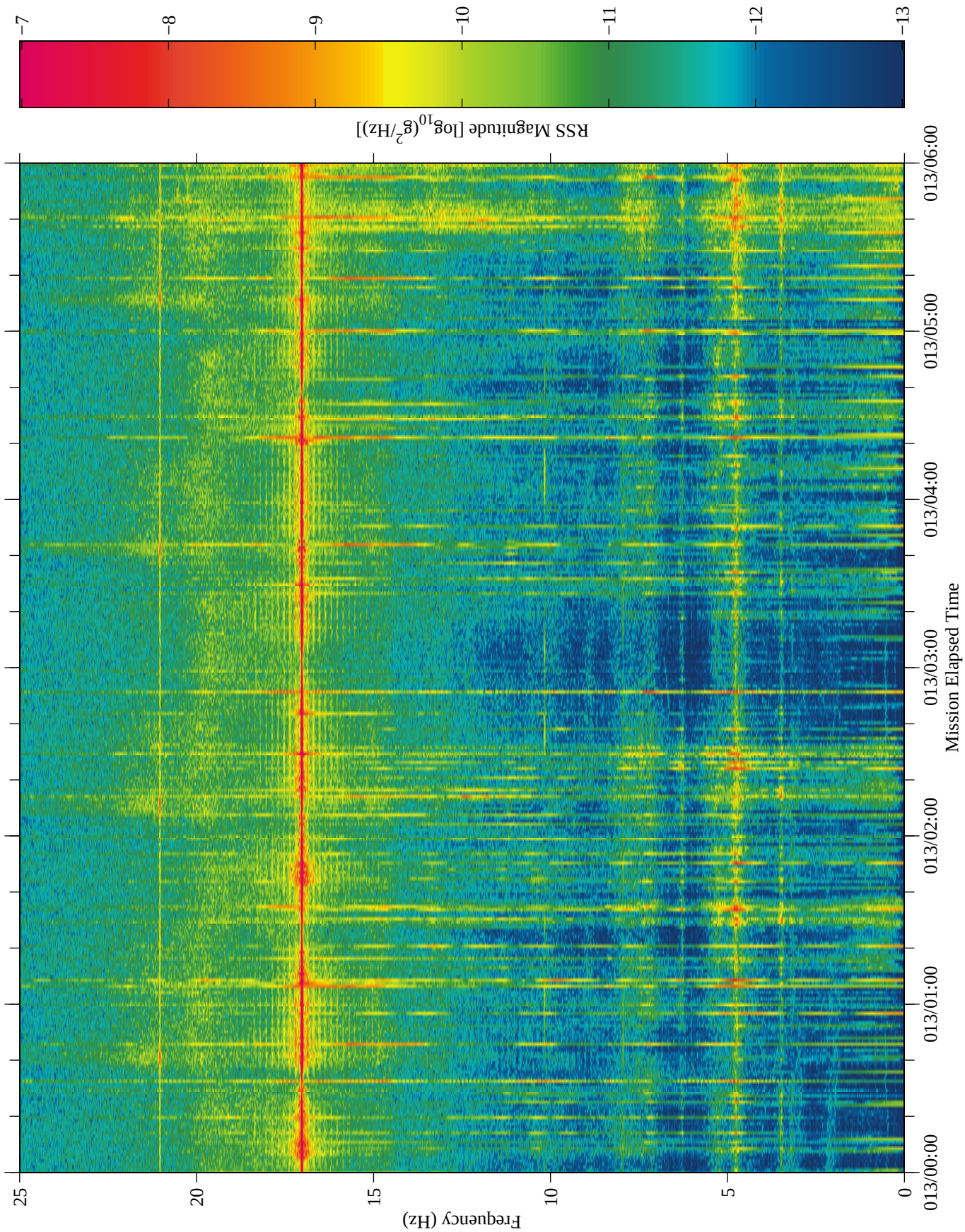

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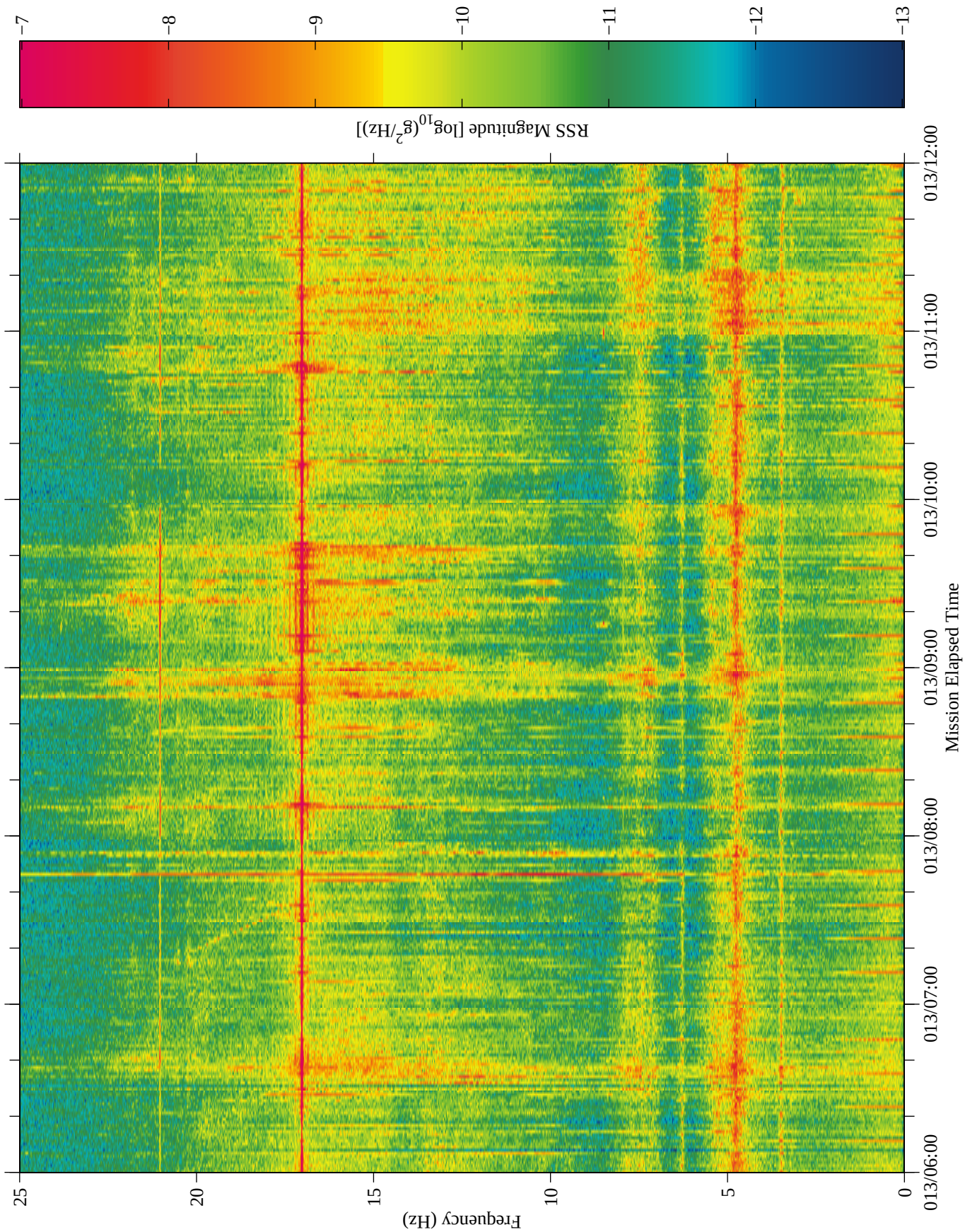

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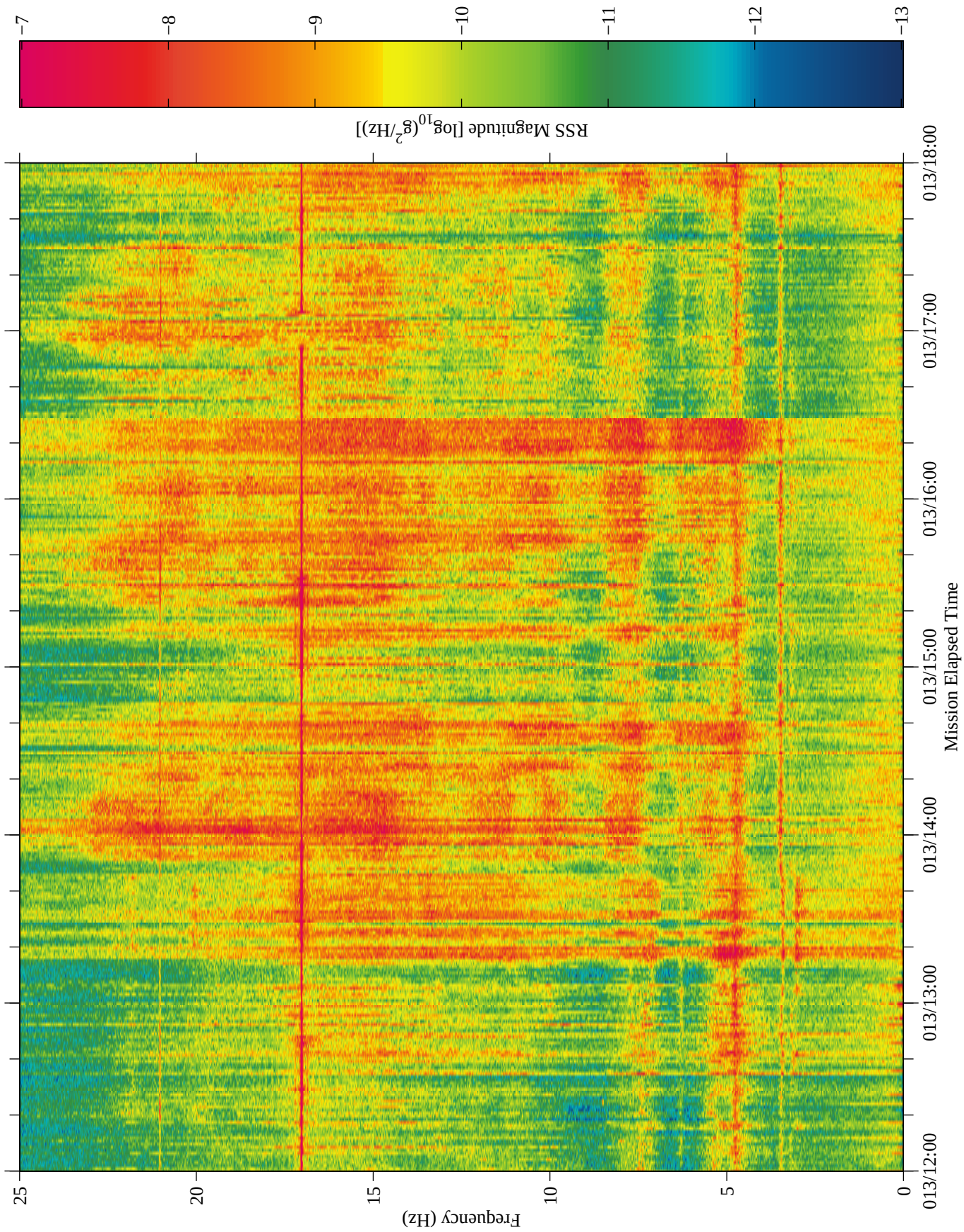

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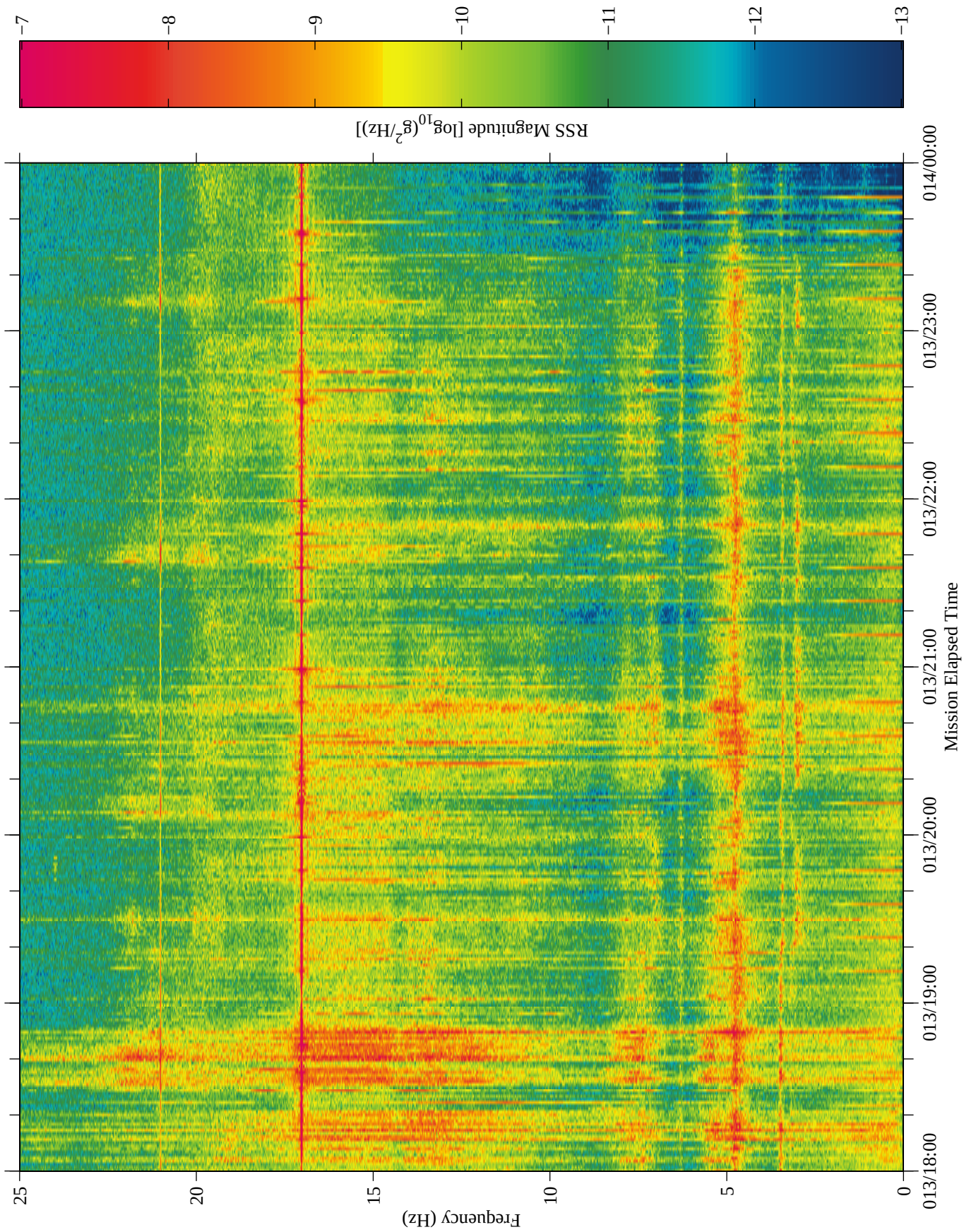

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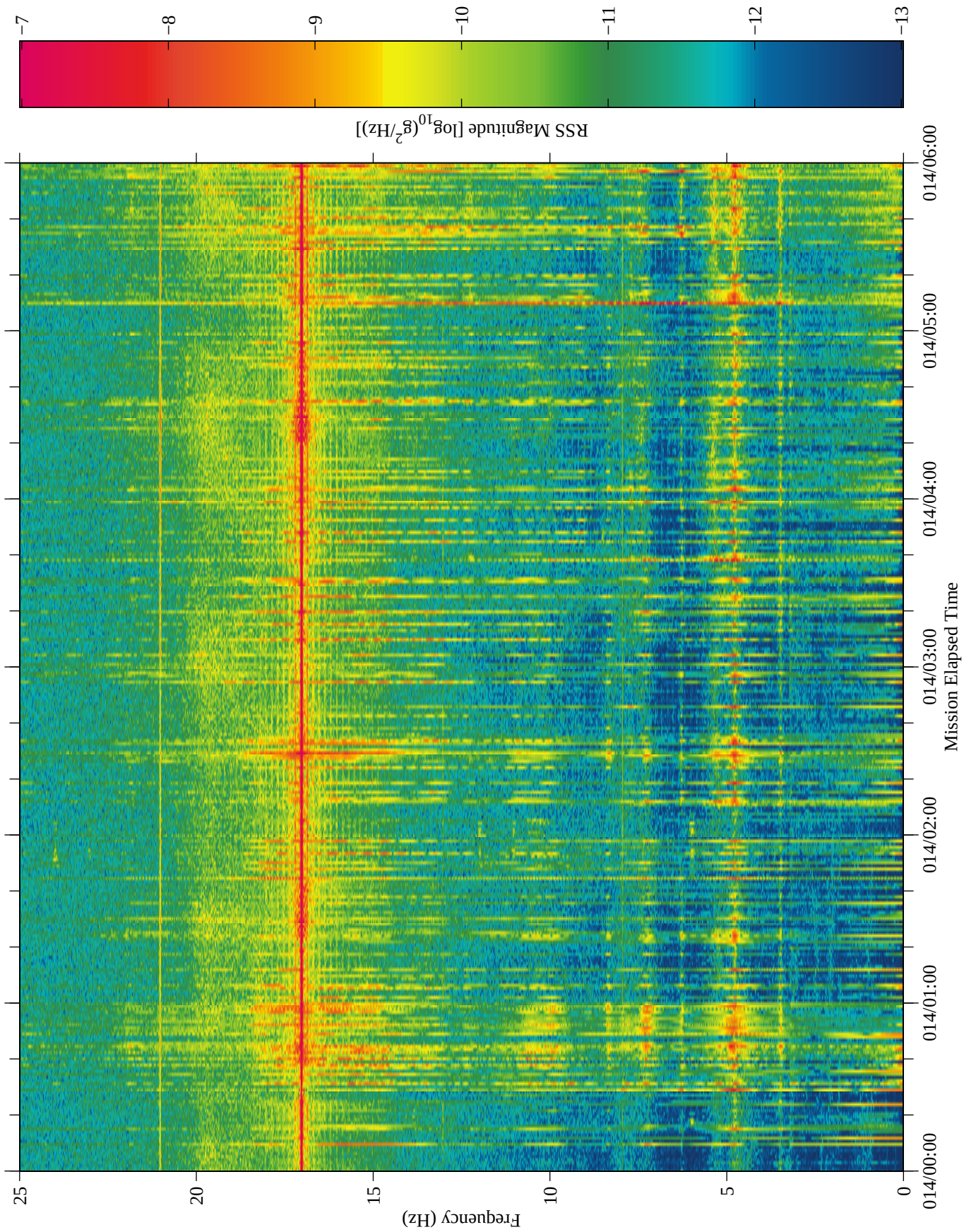

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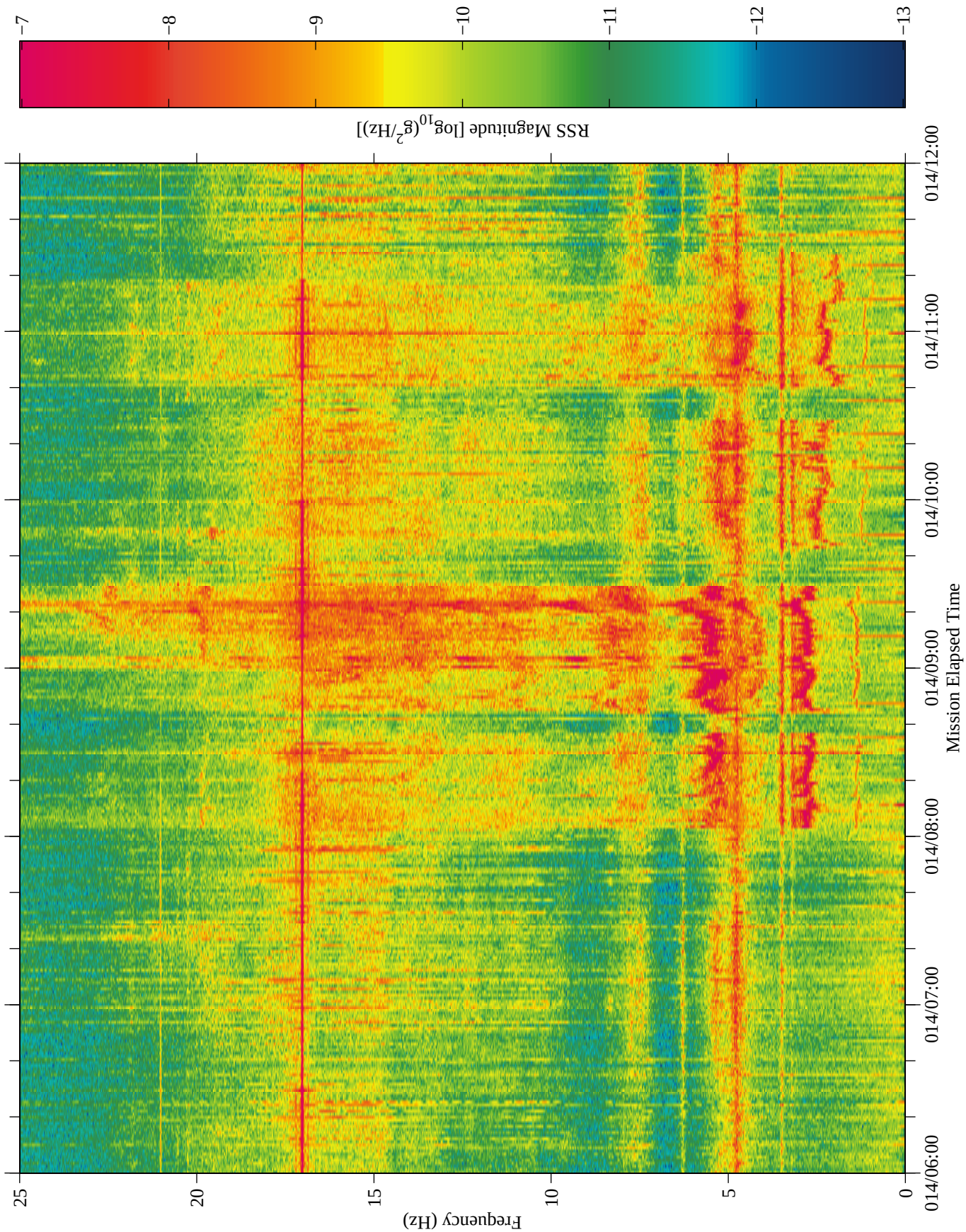

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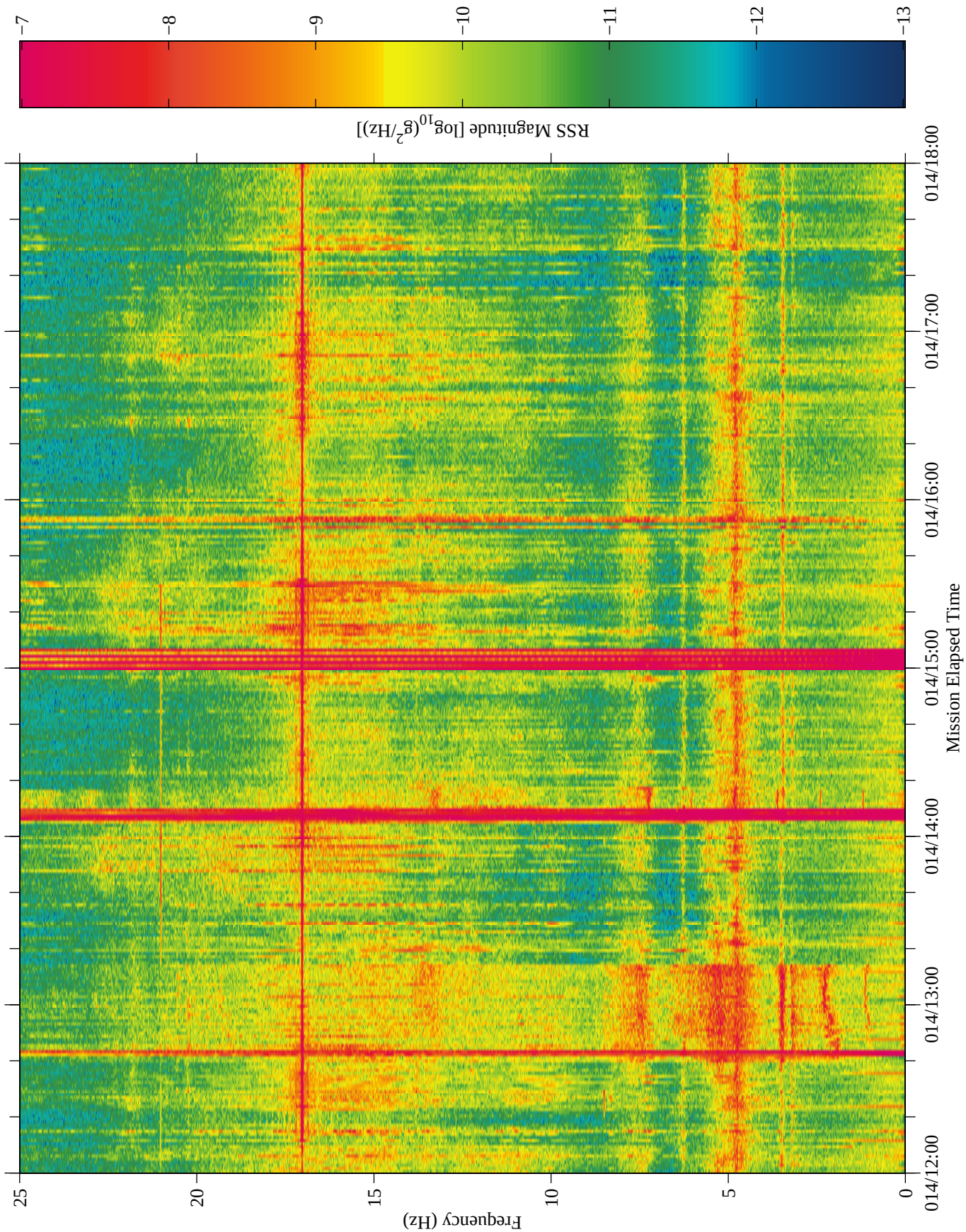

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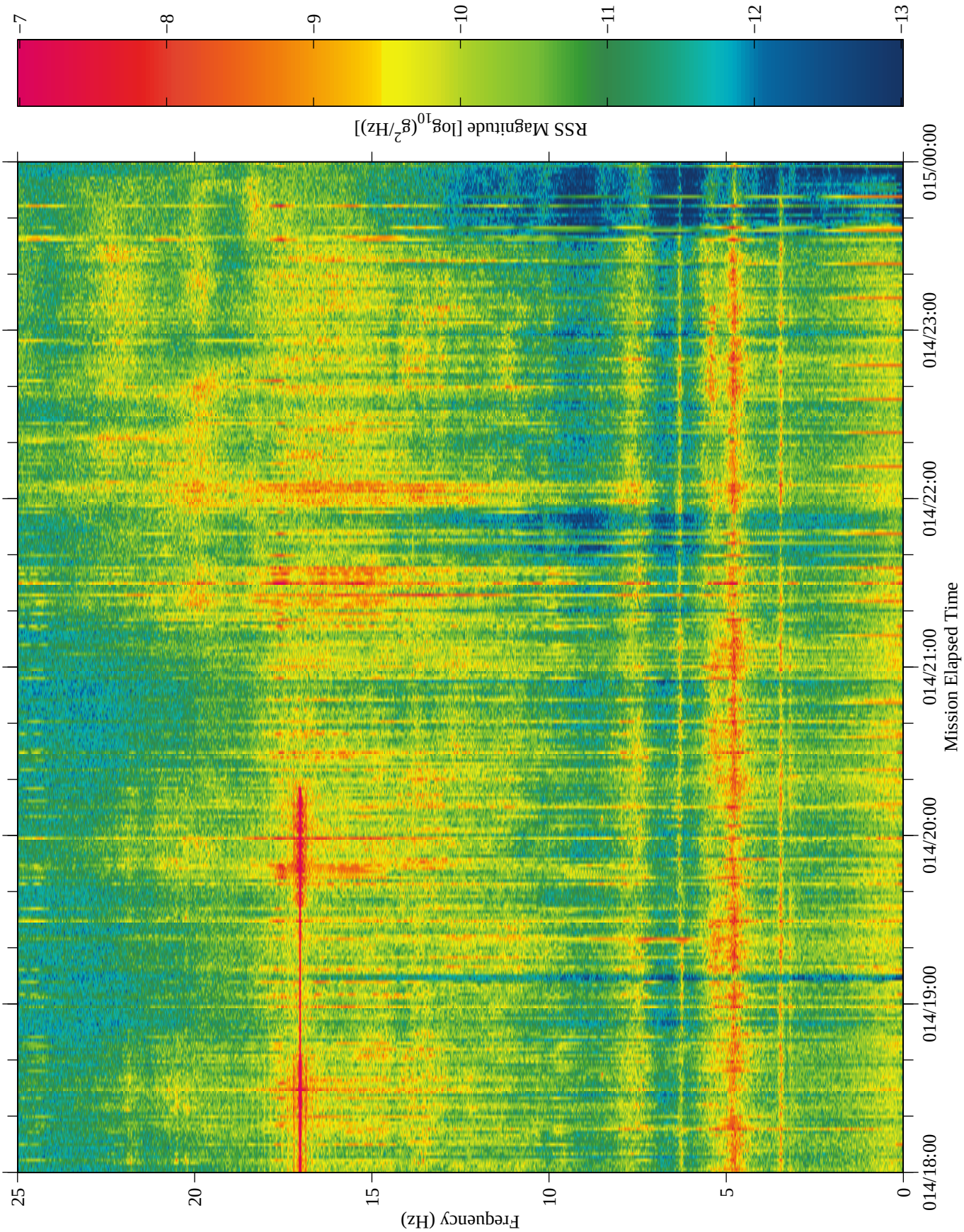

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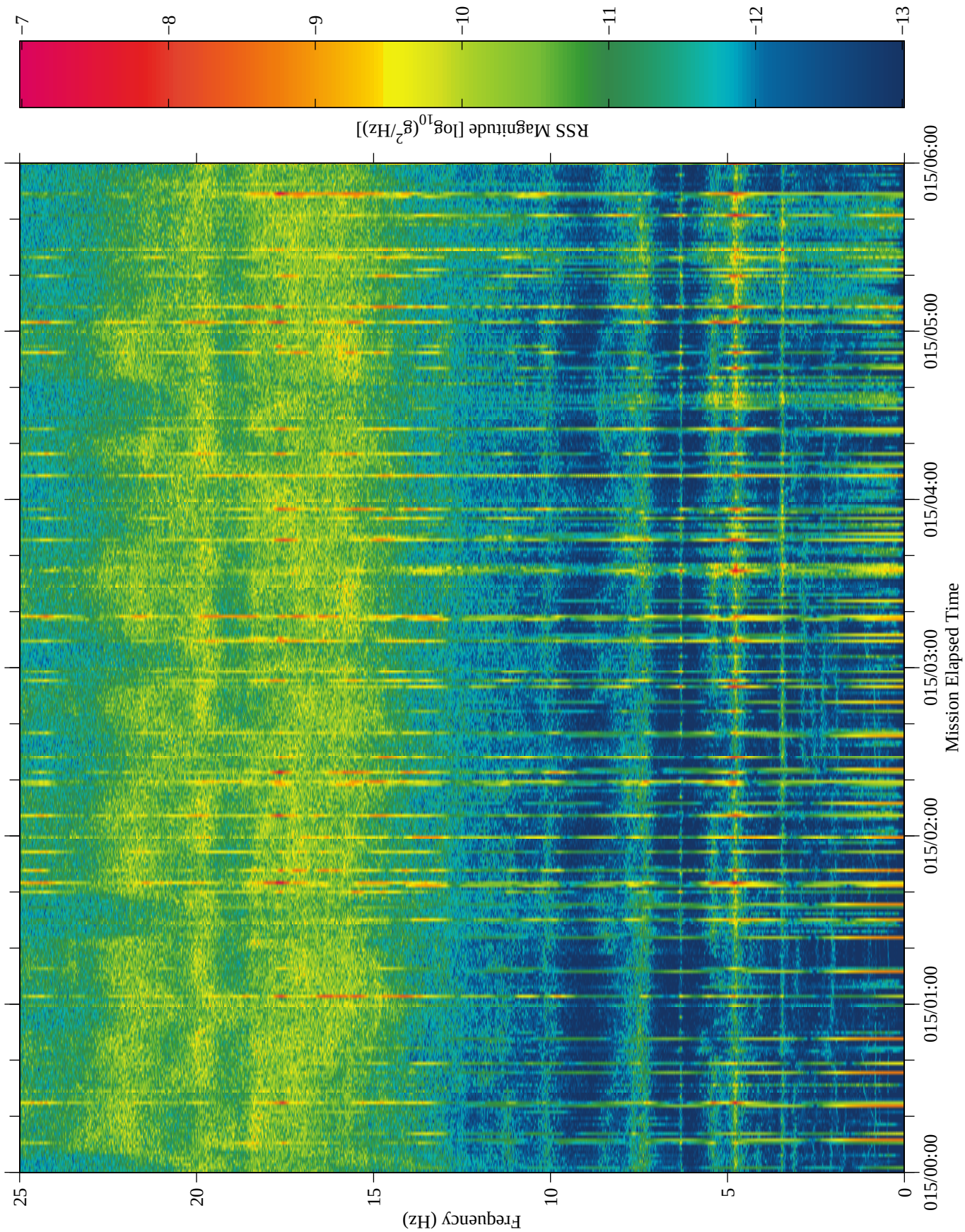

Figure 61: USMP−4, Unit F, TSH B

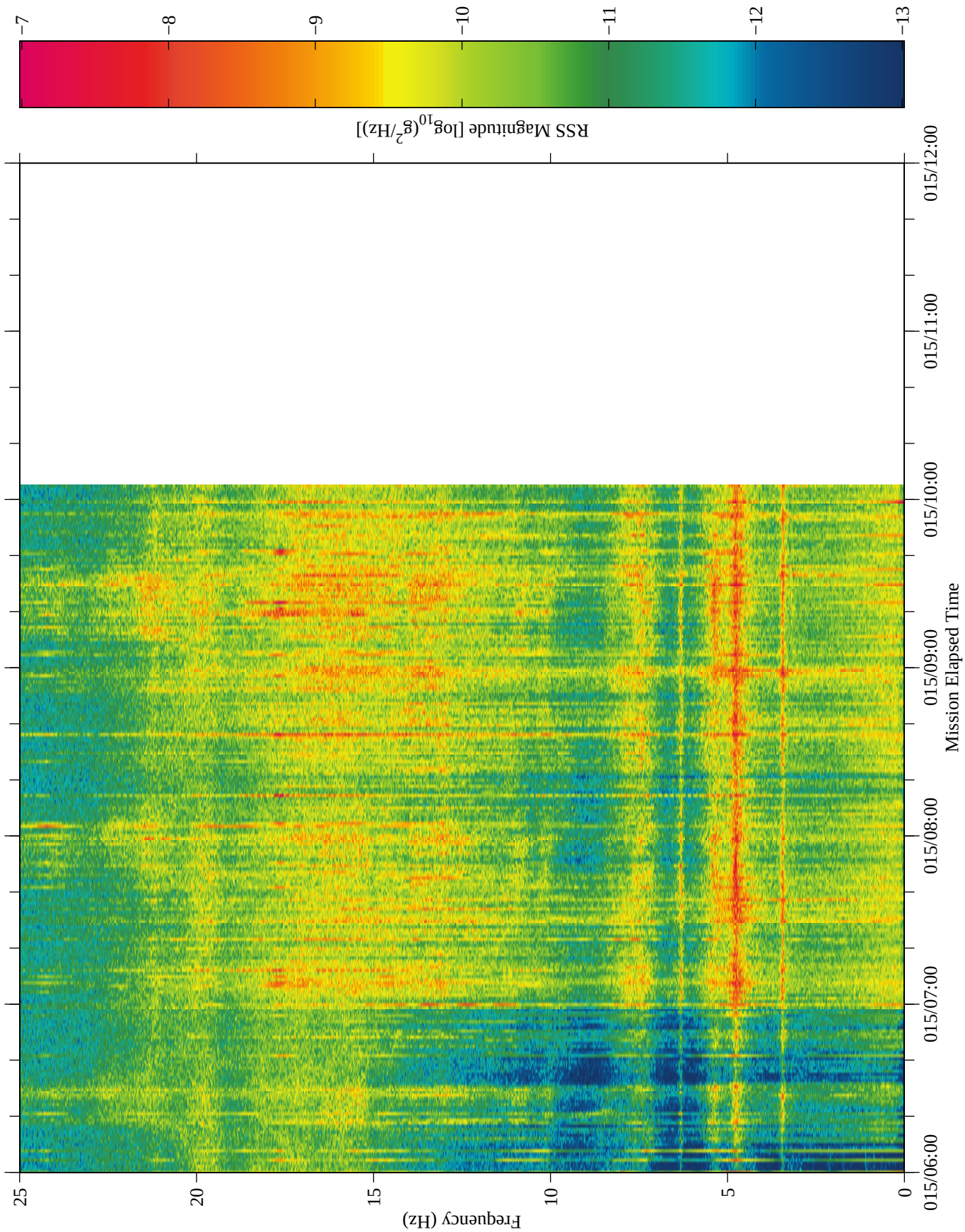

Figure 62: USMP−4, Unit F, TSH B

Appendix C: SAMS Color Spectrograms for Unit F, TSH A

The PIMS group has processed SAMS data from STS-87, Unit F, TSH A to produce the plots shown here. These data were collected at 50 samples per second, and a 10 Hz low pass filter was applied to the data by the SAMS unit prior to digitization. Prior to plot production, the raw SAMS data were compensated for gain changes, and then demeaned. Demeaning was accomplished by analyzing individual sections with a nominal length of 30 minutes. Users who are interested in further details for either of these operations are encouraged to contact the PIMS group.

Color spectrograms are used to show how the microgravity environment varies in intensity with respect to both the time and frequency domains. These spectrograms are provided as an overview of the frequency characteristics of the SAMS data during the mission. Each spectrogram is a composite of six hour's worth of data. The time resolution used to compute the spectrograms seen here is 40.96 seconds. This corresponds to a frequency resolution of 0.02 Hz.

In order to produce the spectrogram image, PSDs were computed for successive time intervals (the length of the interval is equal to the time resolution). For the PSD computation, a Hanning window was applied. In order to combine all three axes into a single plot to show an overall level, a vector magnitude (VM) operation was performed. Stated mathematically:

$$VM_k = \sqrt{PSD_{x_k}^2 + PSD_{y_k}^2 + PSD_{z_k}^2} \; .$$

By imaging the base 10 logarithm ($\log_{10}$) magnitude as a color and stacking successive PSDs from left to right, variations of PSD magnitude and frequency are shown as a function of time. Colors are assigned to discrete magnitude ranges, so that there are 207 colors assigned to the entire range of magnitudes shown.

The colorbar limits are chosen in order to minimize saturation in a given set of spectrogram plots. Data which fall outside of these limits will be imaged as either the highest or lowest magnitude, depending on which side they have saturated. If an area of interest seems to be saturated, care should be taken because the actual values may lie above or below the color mapping shown on the plot.

Due to the nature of spectrograms, care should be taken to not merely read a color's numeric value as being the "amount" of acceleration that is present at a given frequency. In order to get this type of information, the PSDs must be integrated between two frequencies. These frequencies (lower and upper) form the band of interest. The result of this integration is the g_{RMS} acceleration level in the $\left[f_{lower}, f_{upper}\right]$ band. The PIMS group is able to provide this type of analysis on a per-request basis.

Plot gaps (if any exist) are shown by either white or dark blue areas on the page. If a plot gap exists for an entire plot (or series of successive plots), a comment is placed on the page to let the user know there is a gap in the data. These "no data available" comments will not show exact times for which the data are not available, but will only indicate missing plots.

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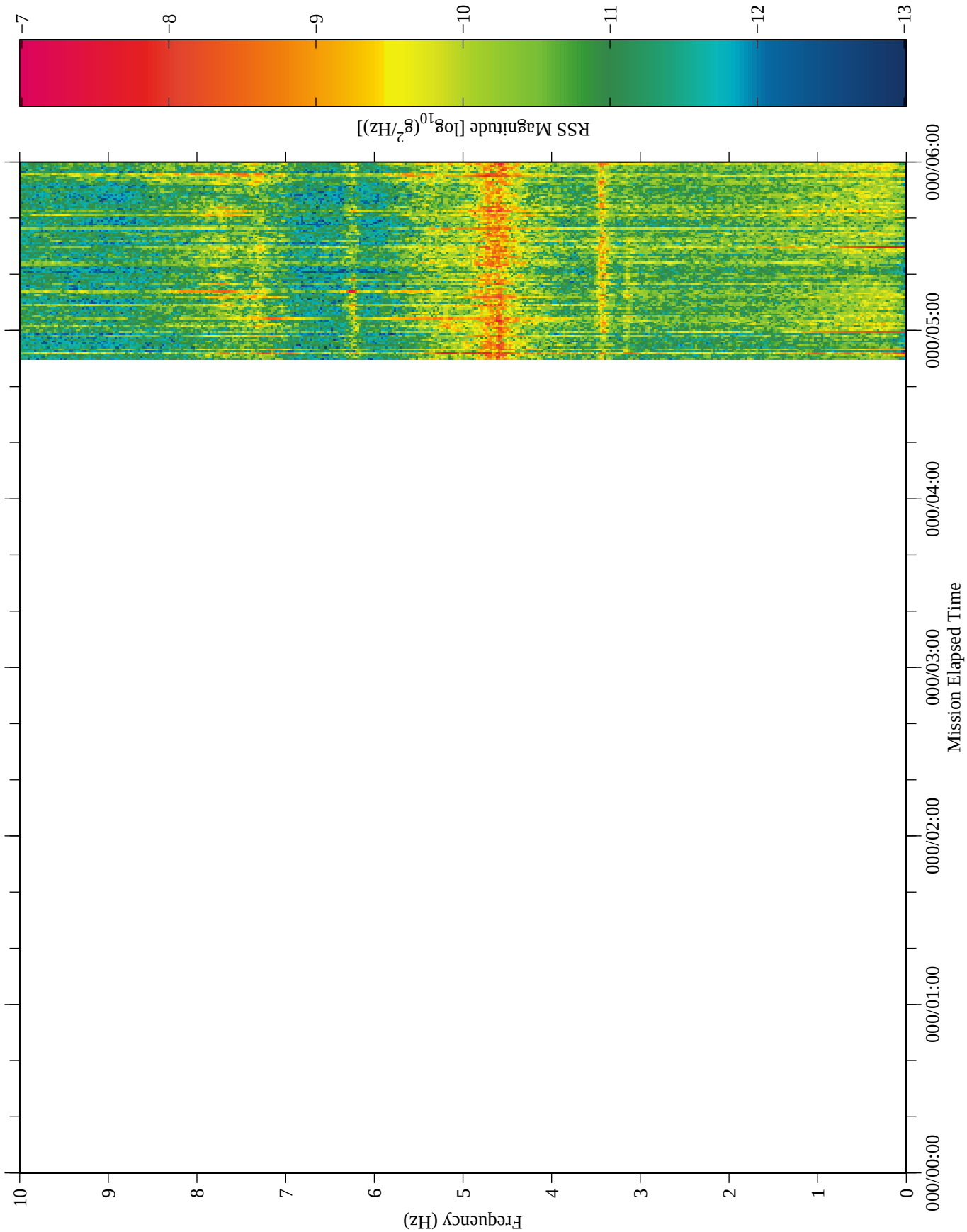
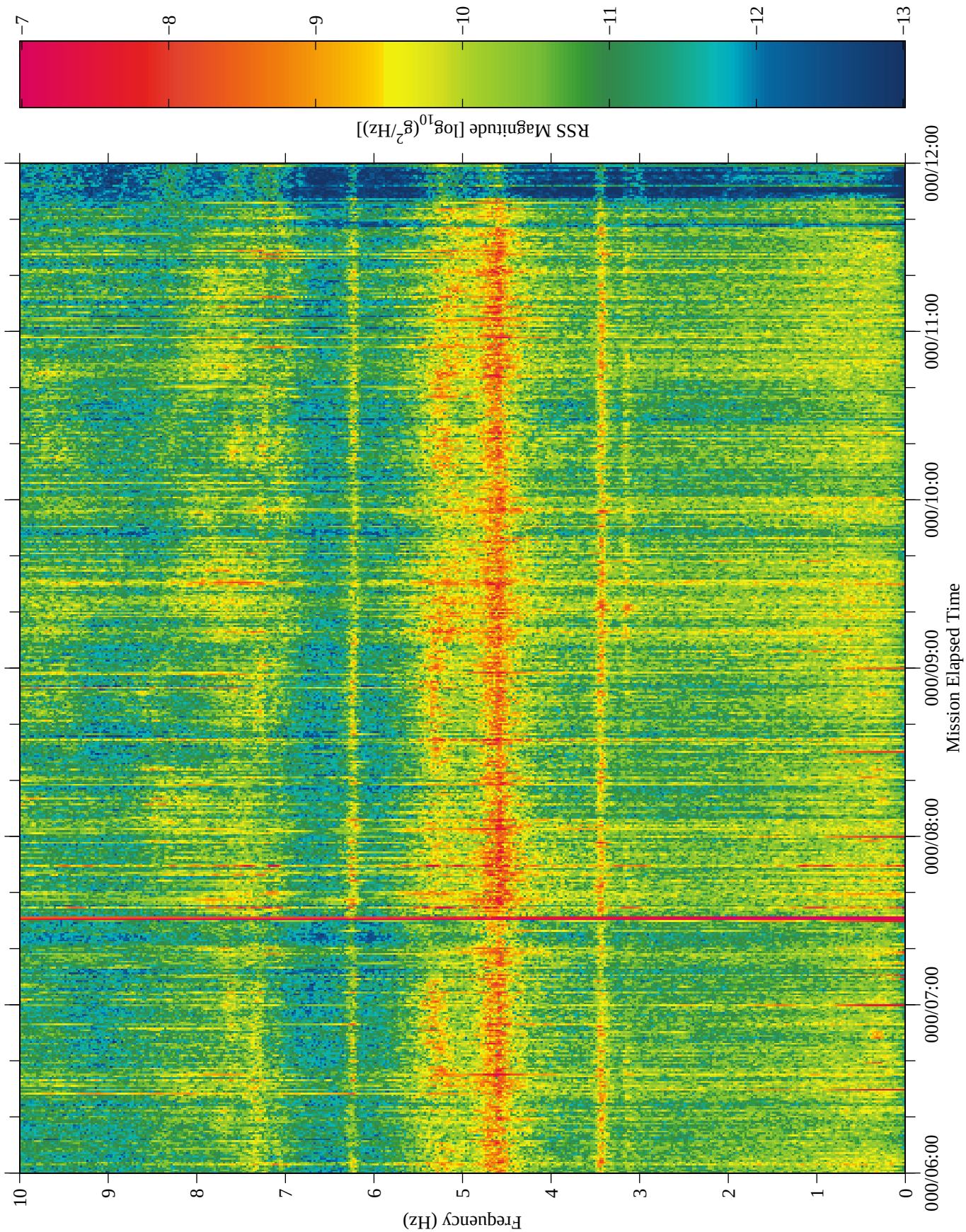


Figure 1: USMP−4, Unit F, TSH A



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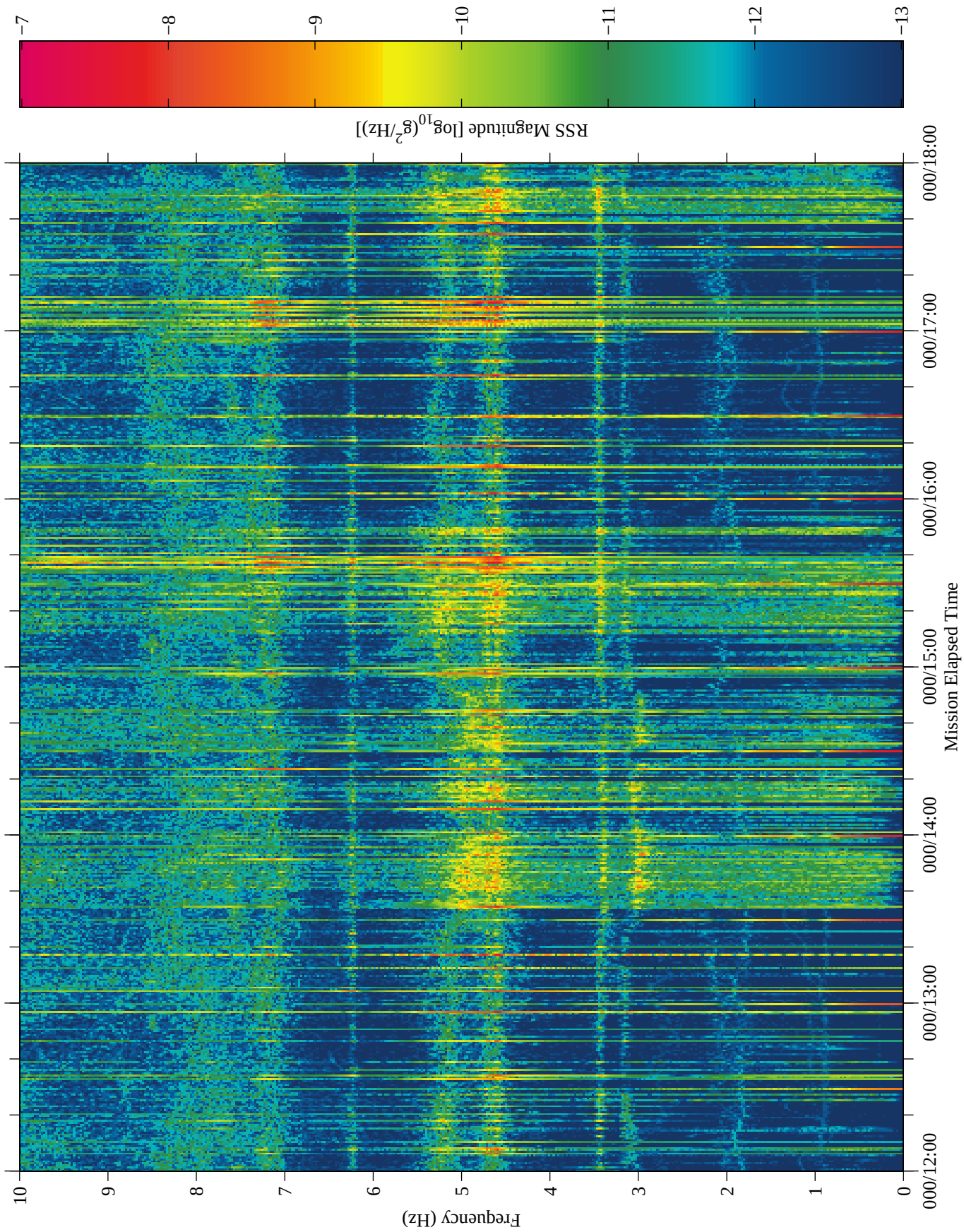

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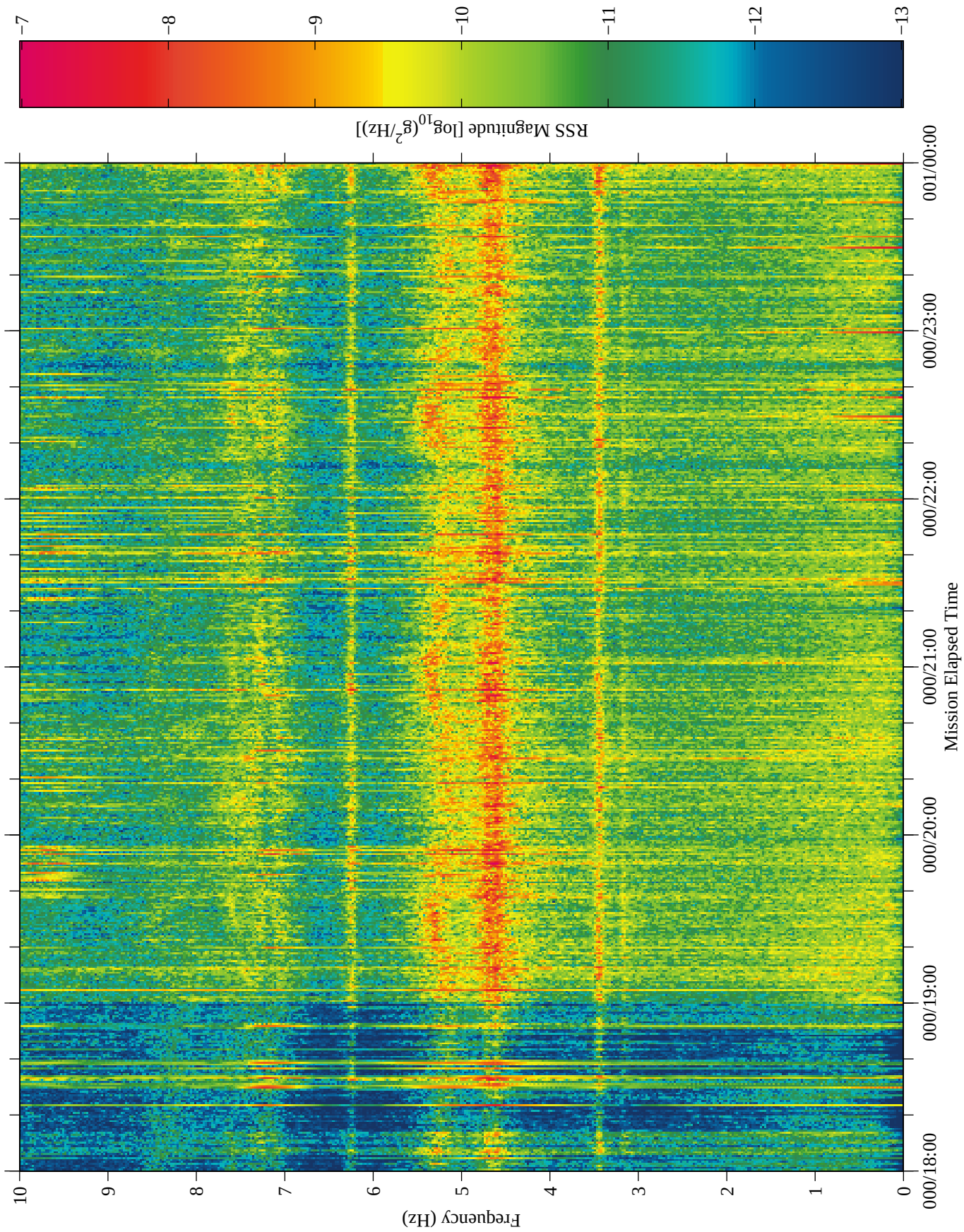

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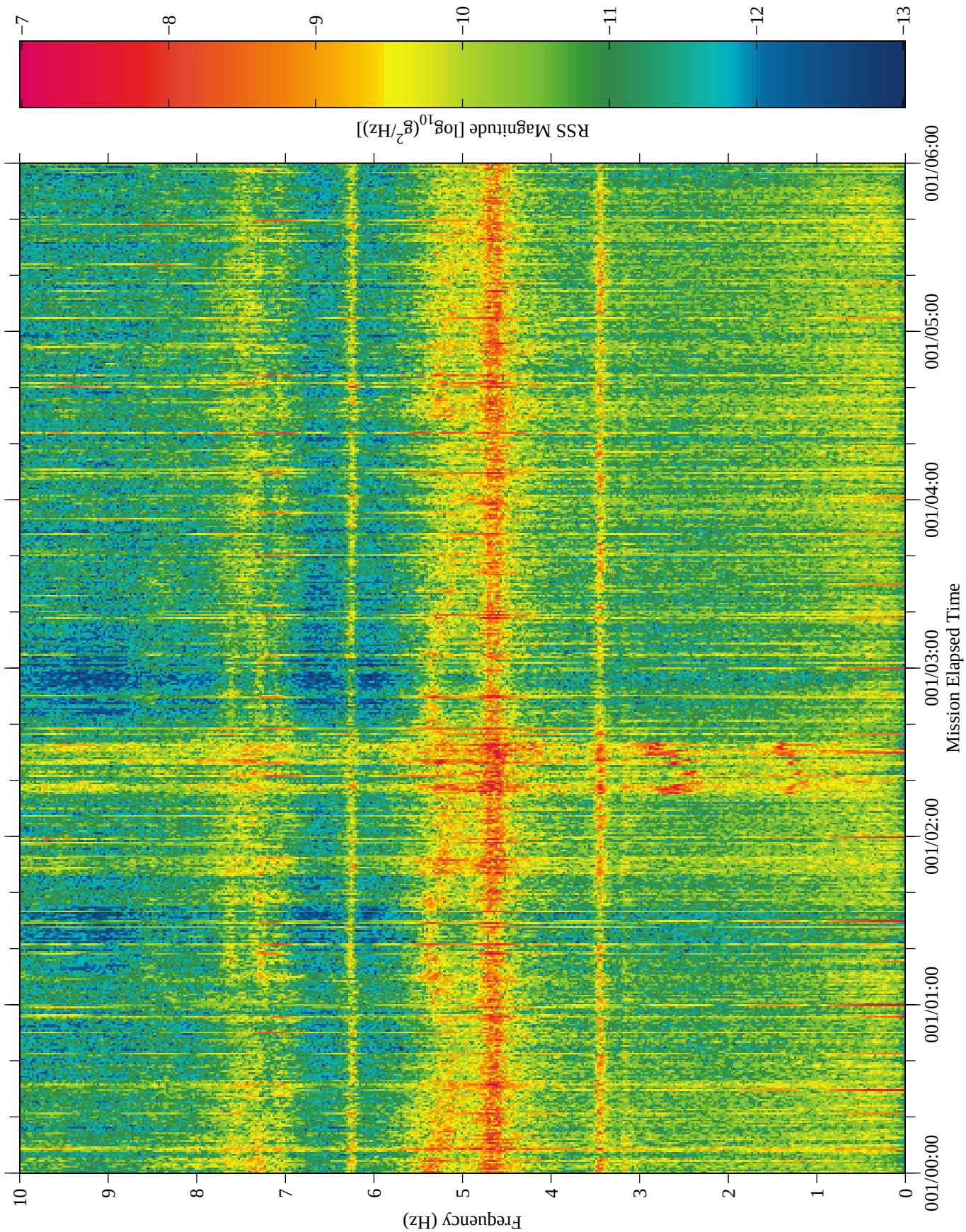

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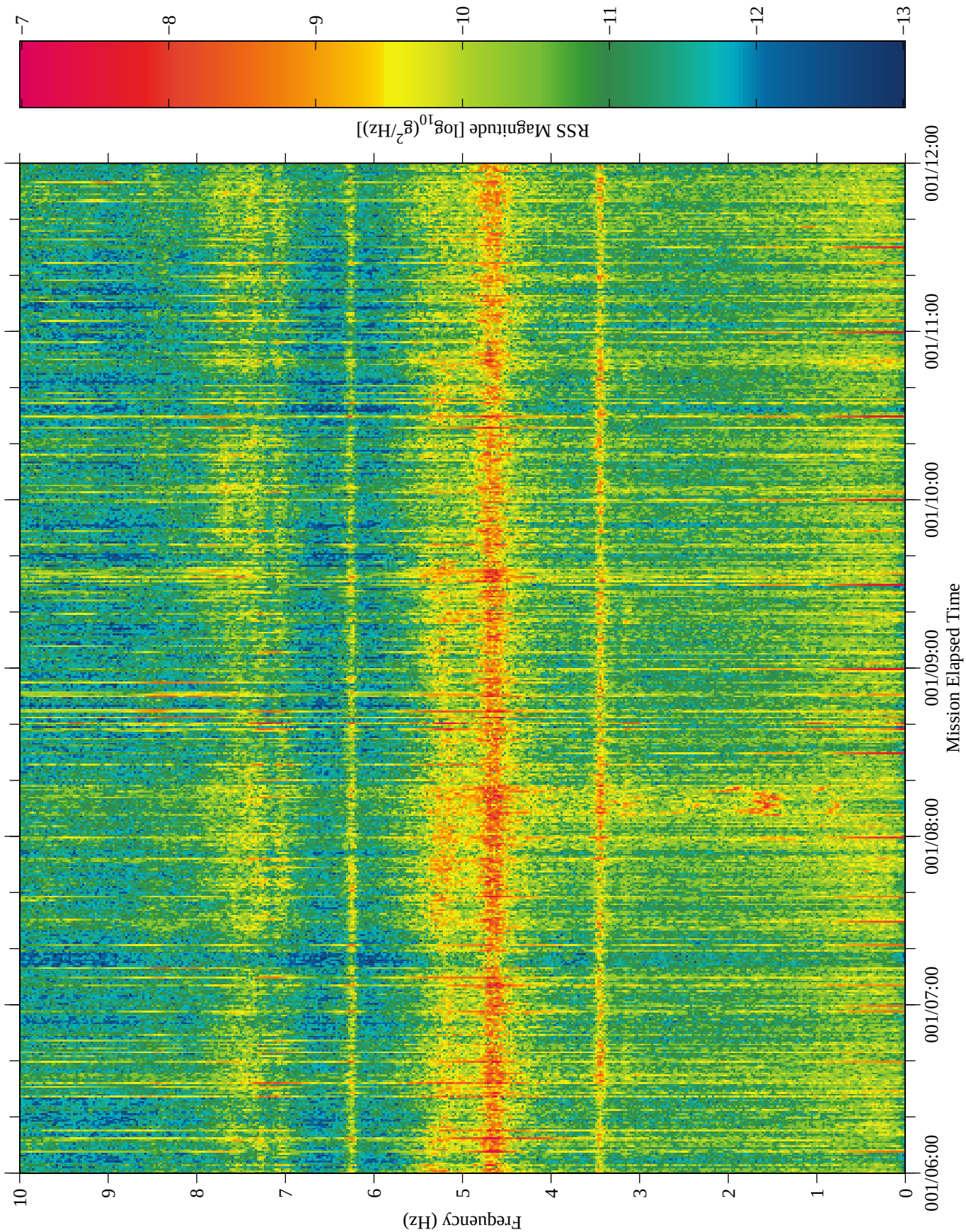

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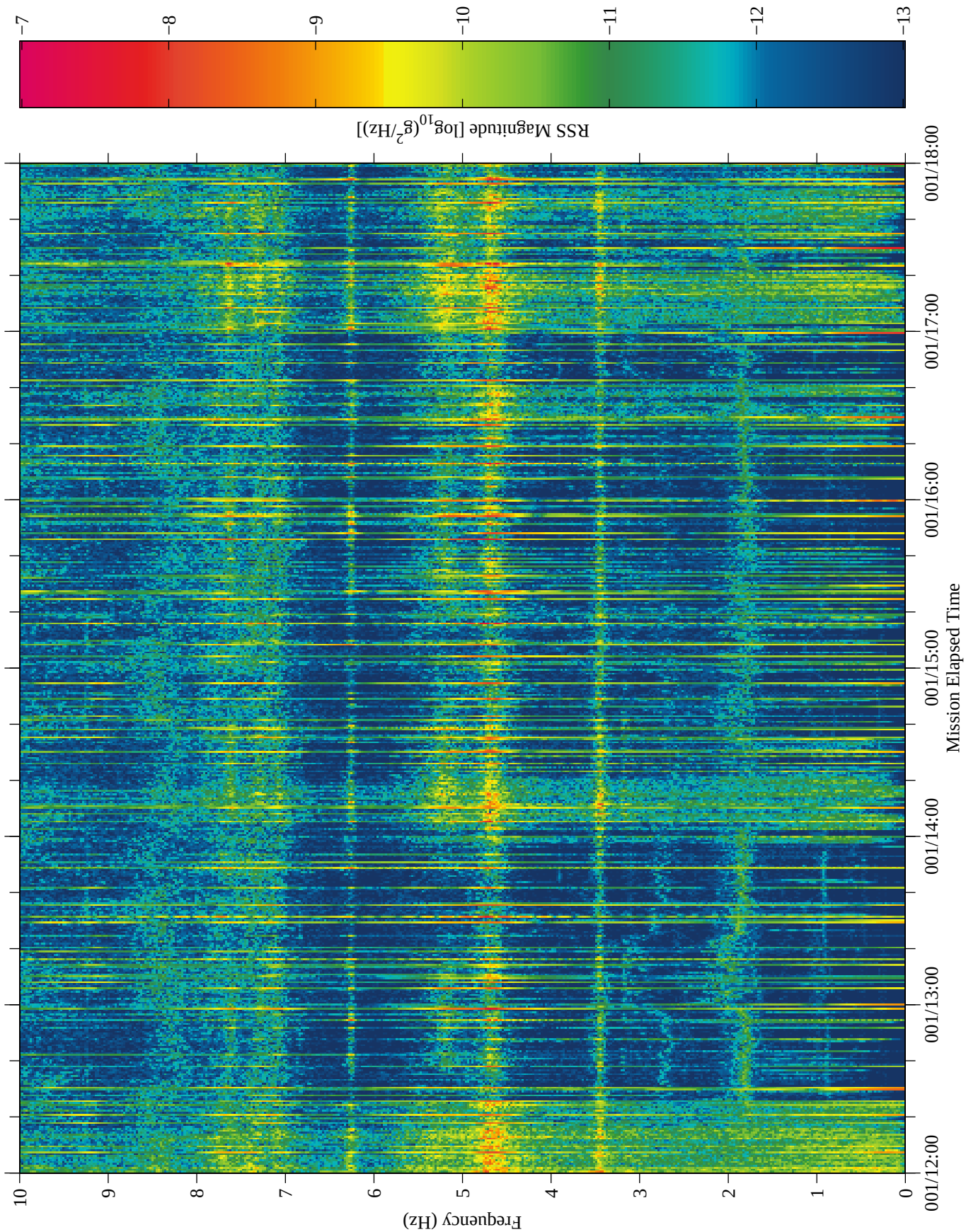

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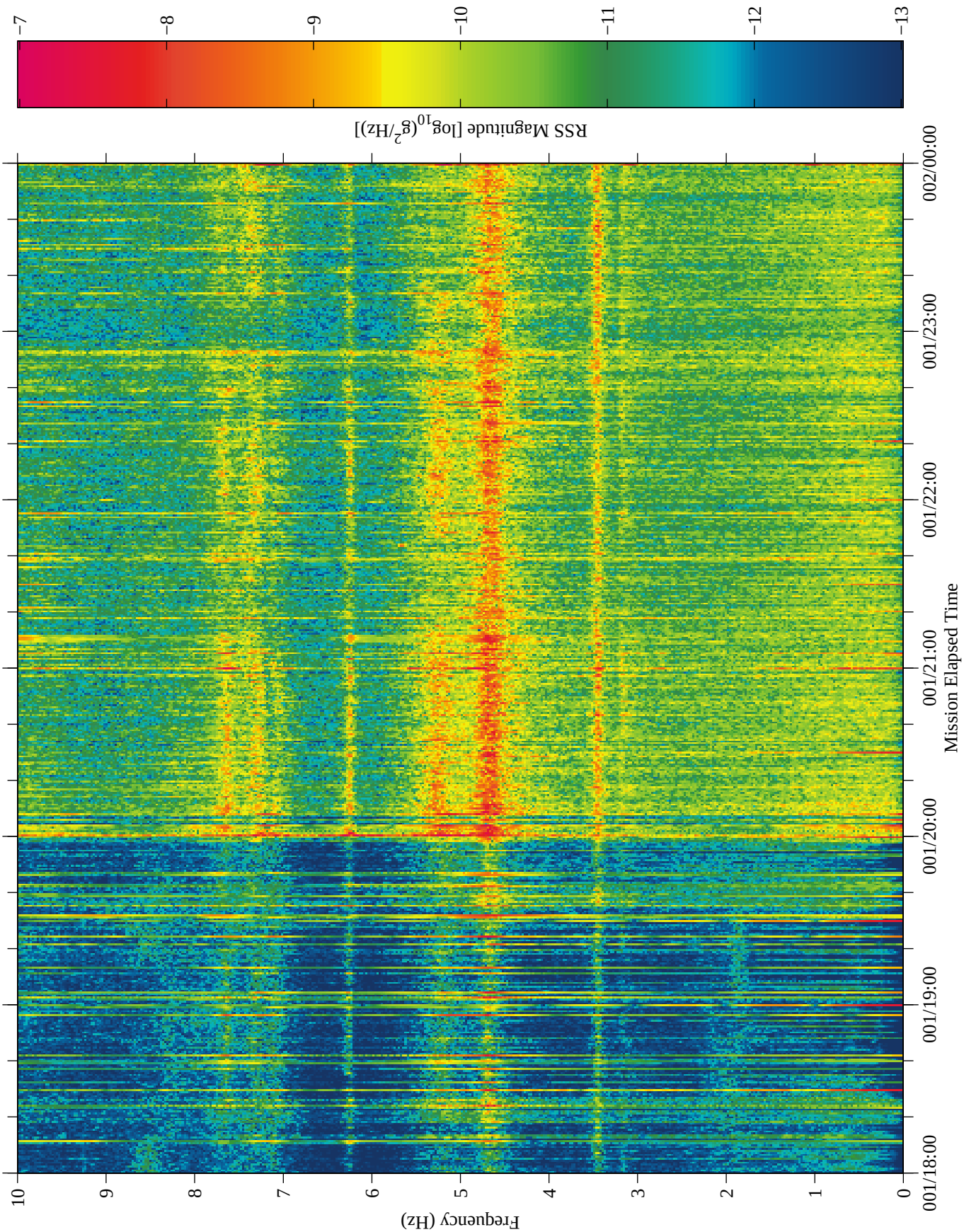

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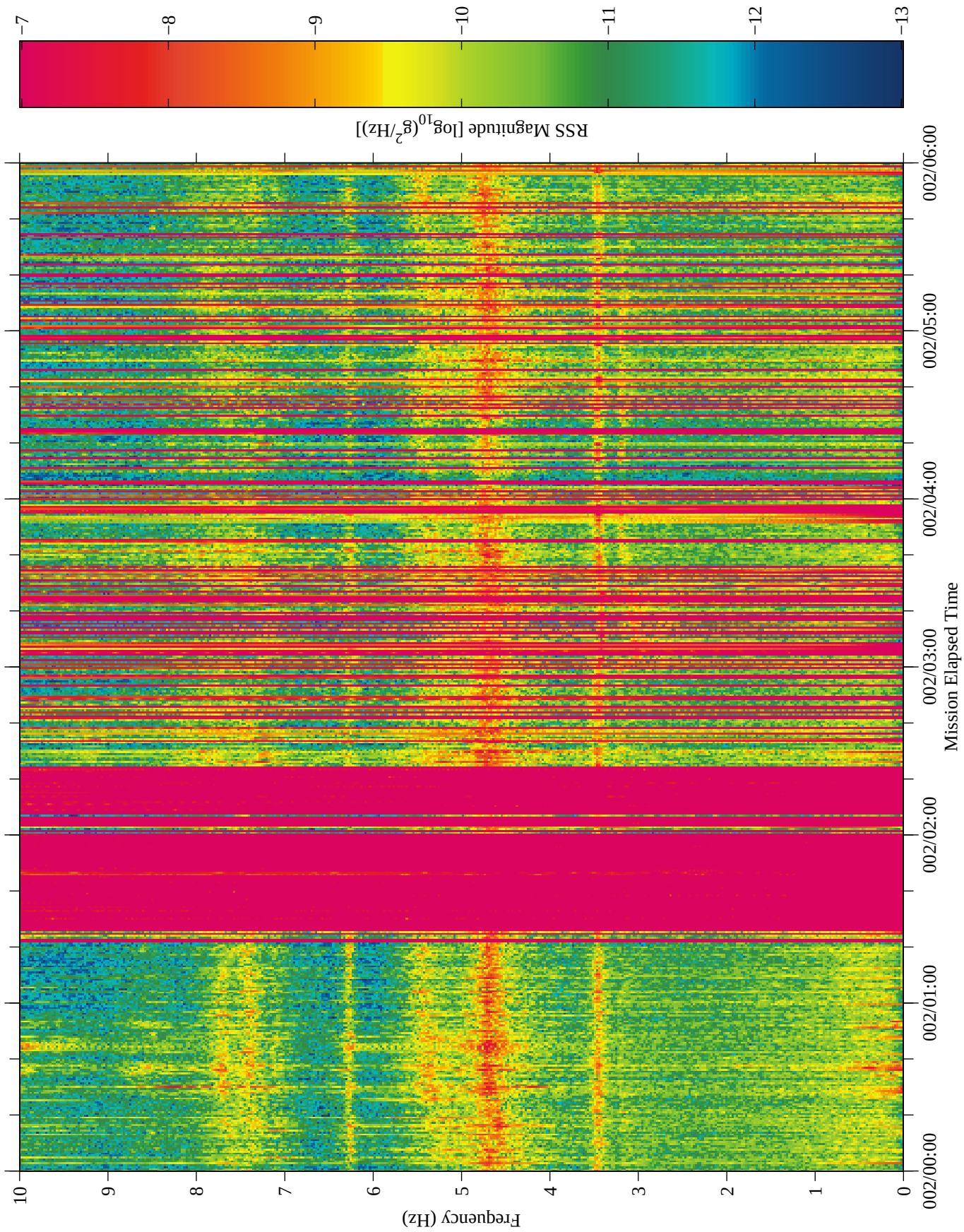

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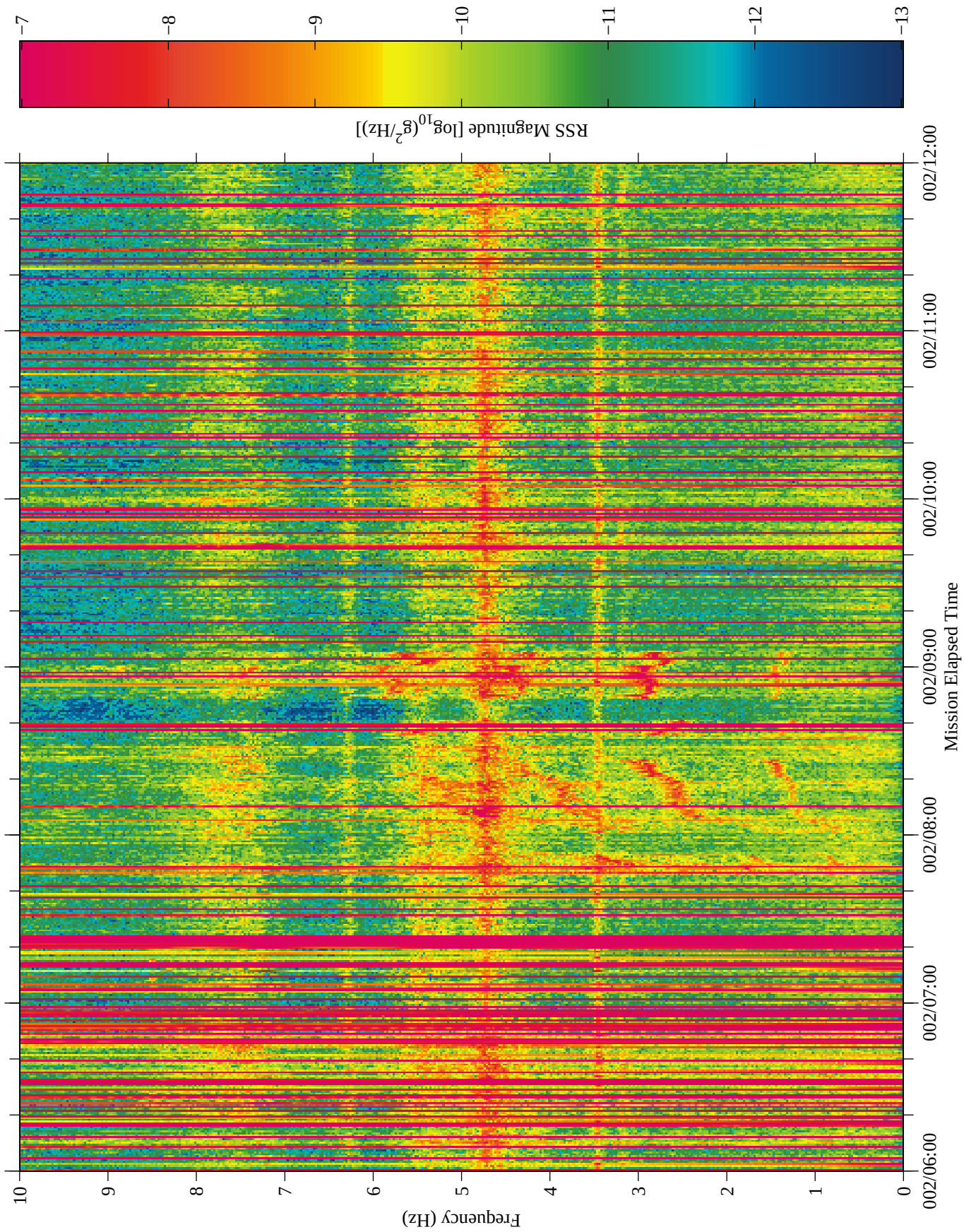

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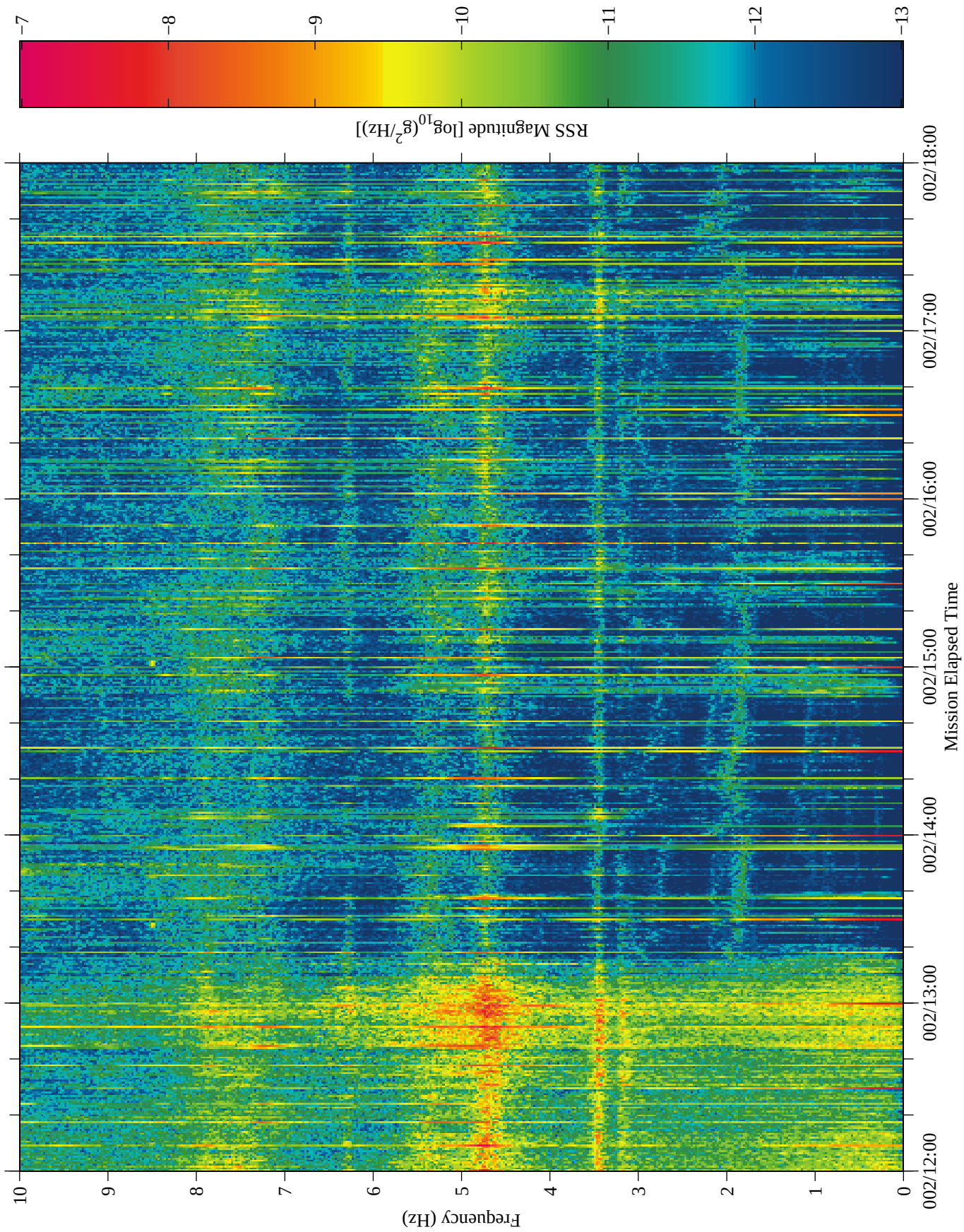

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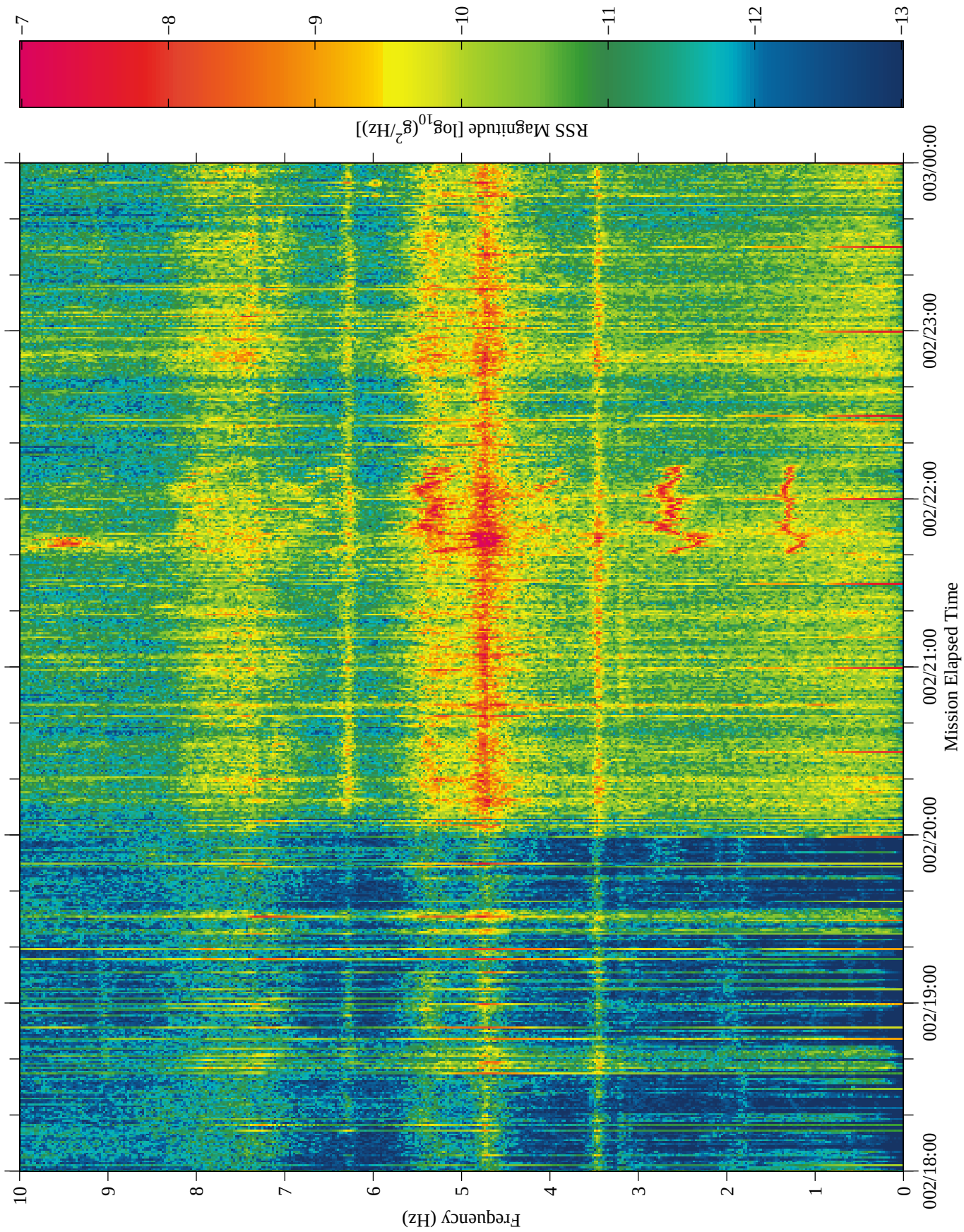

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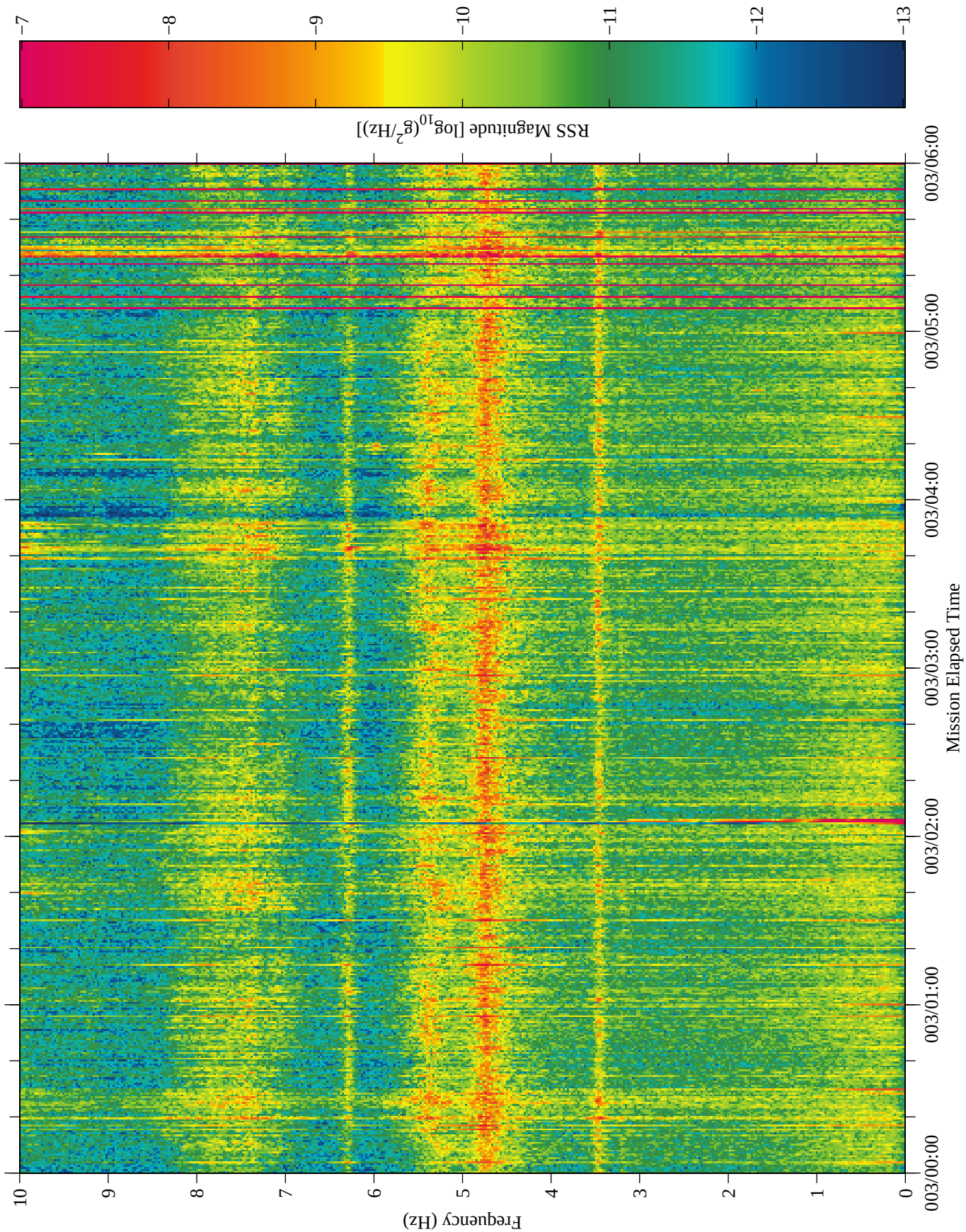

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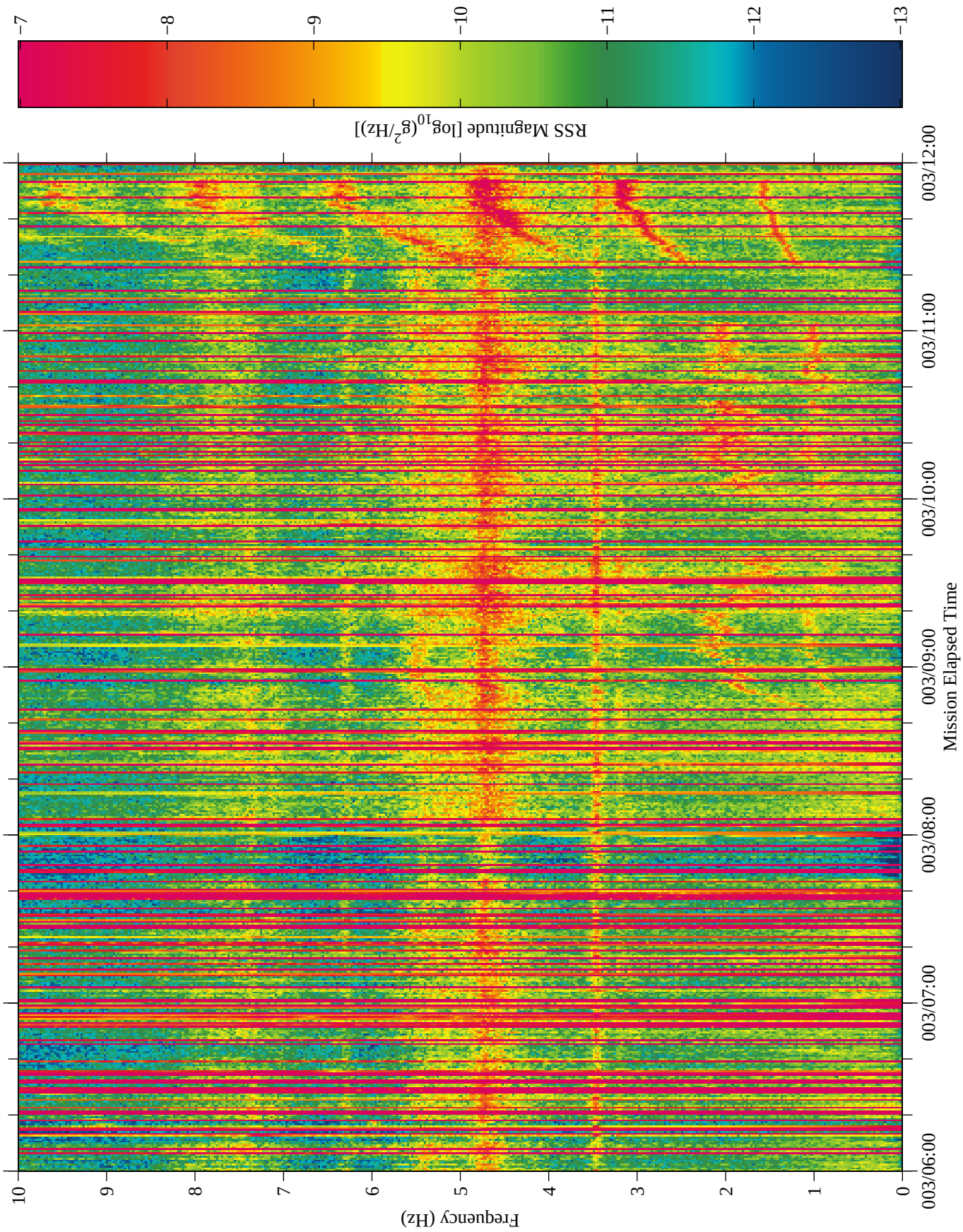

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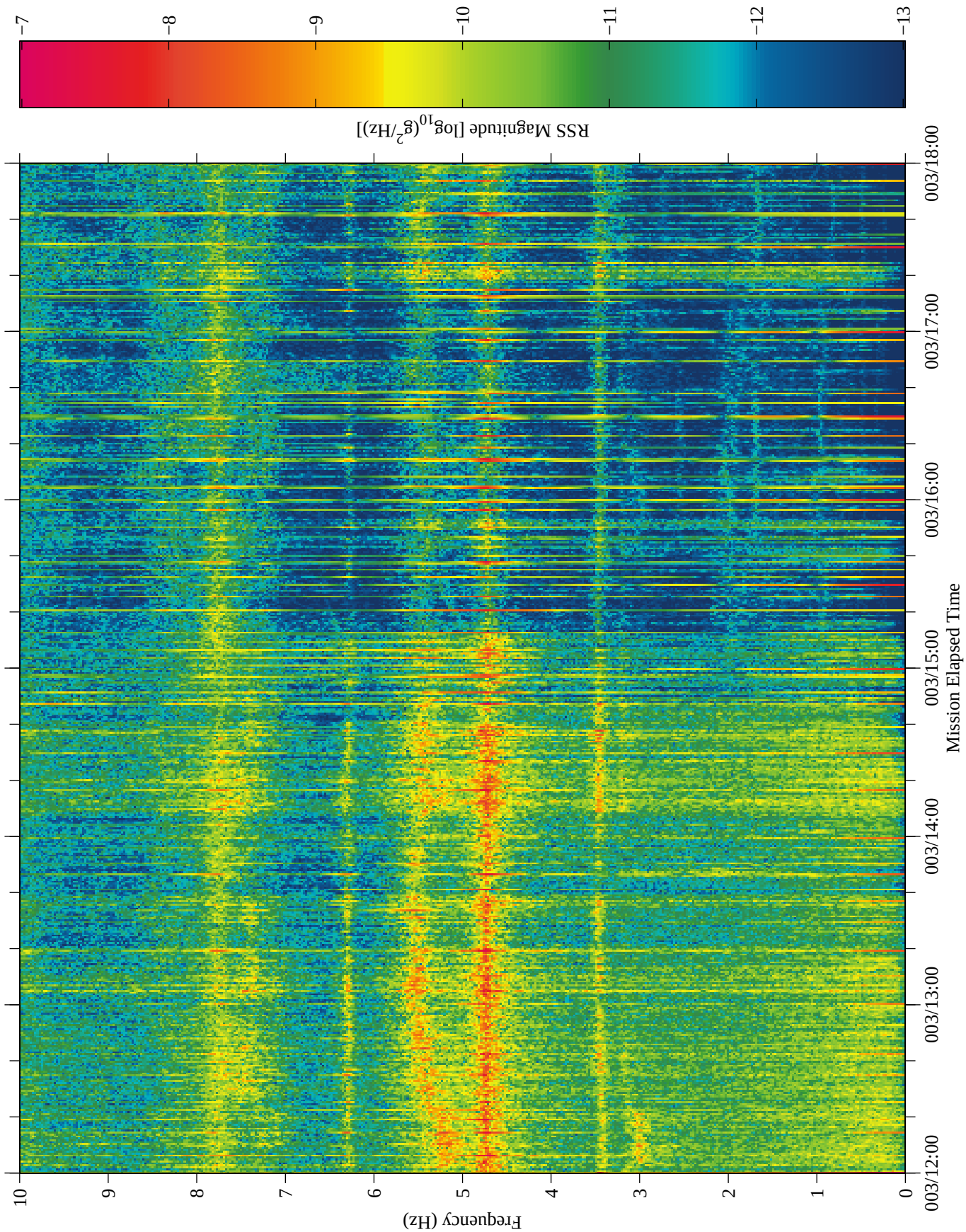

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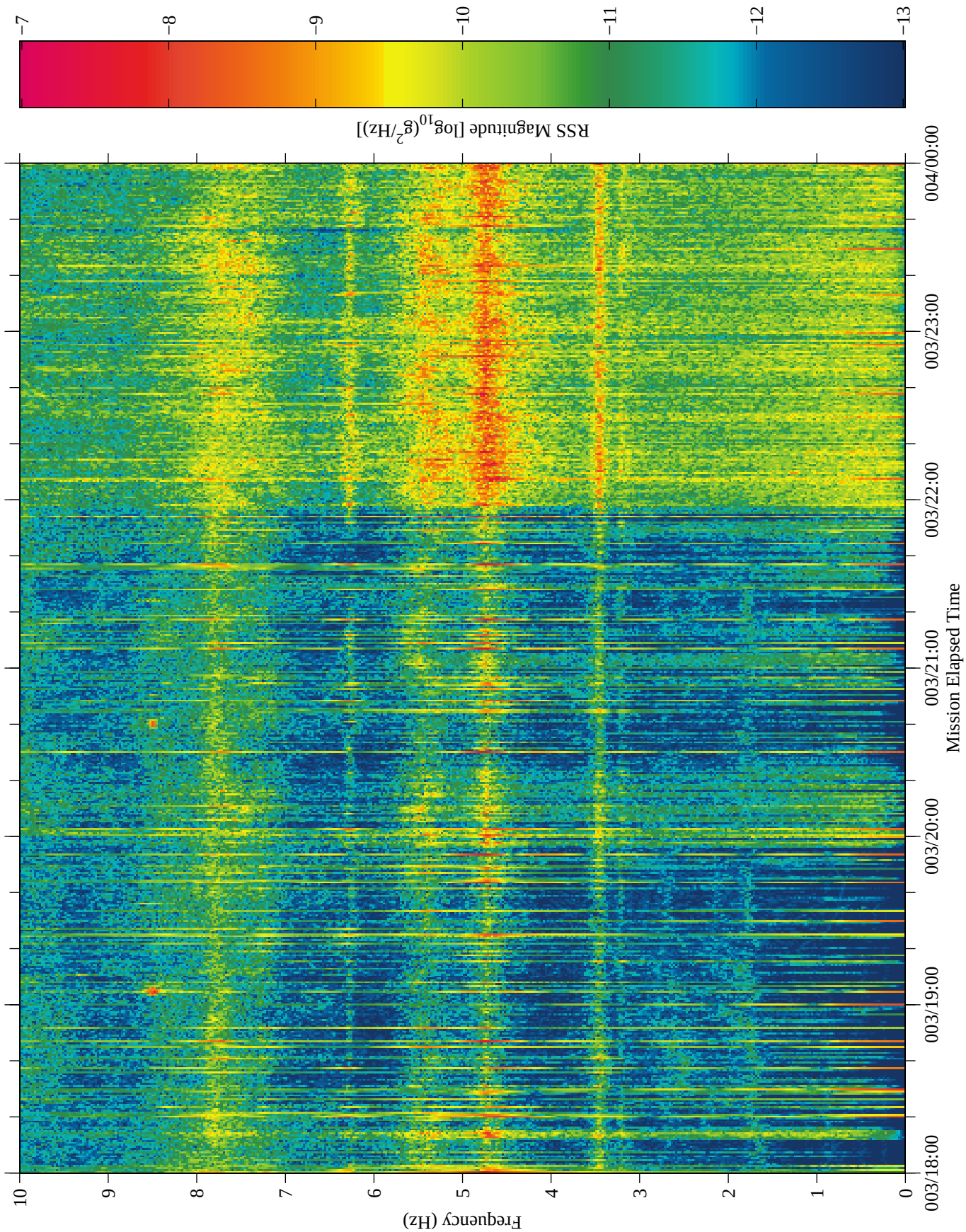

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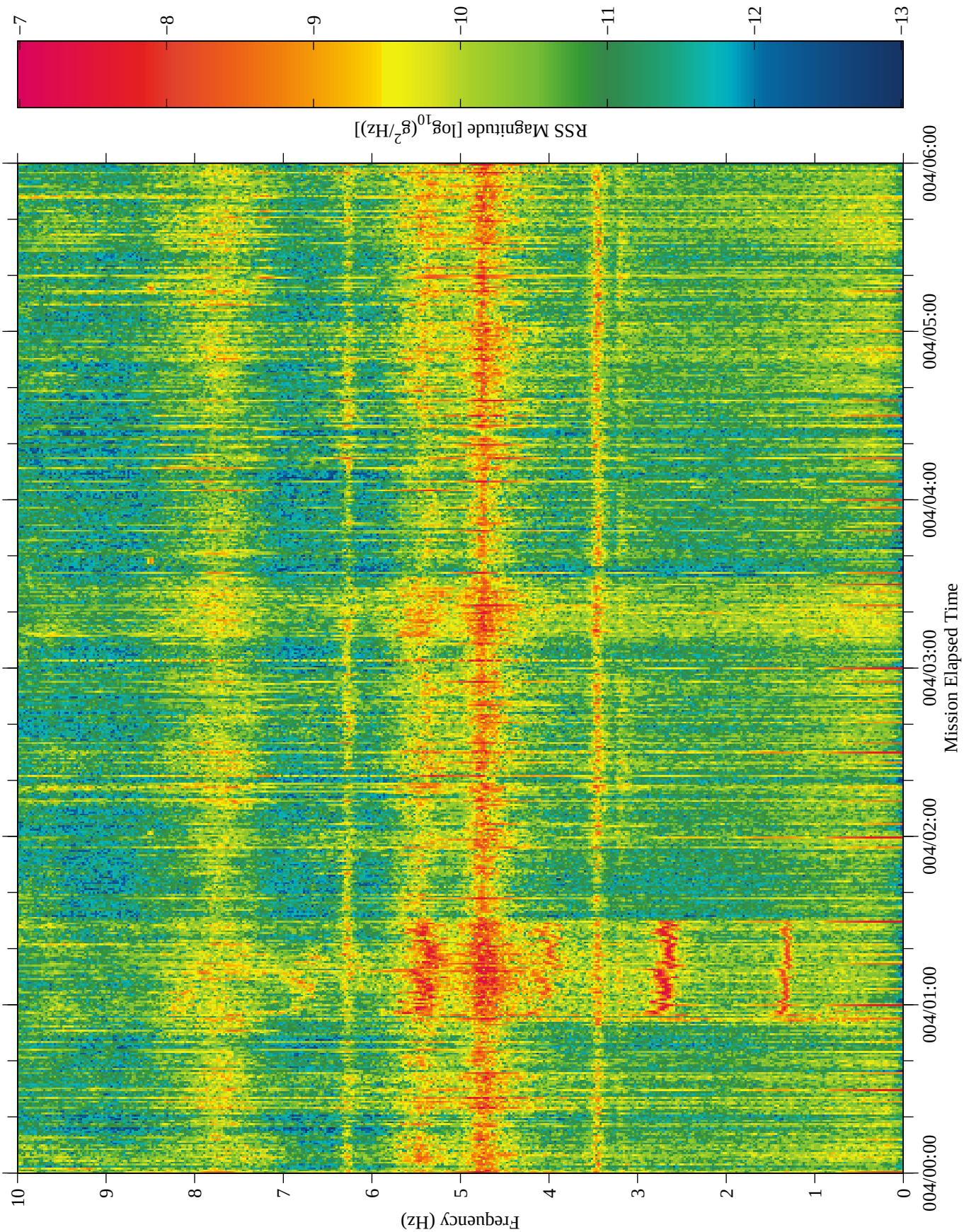

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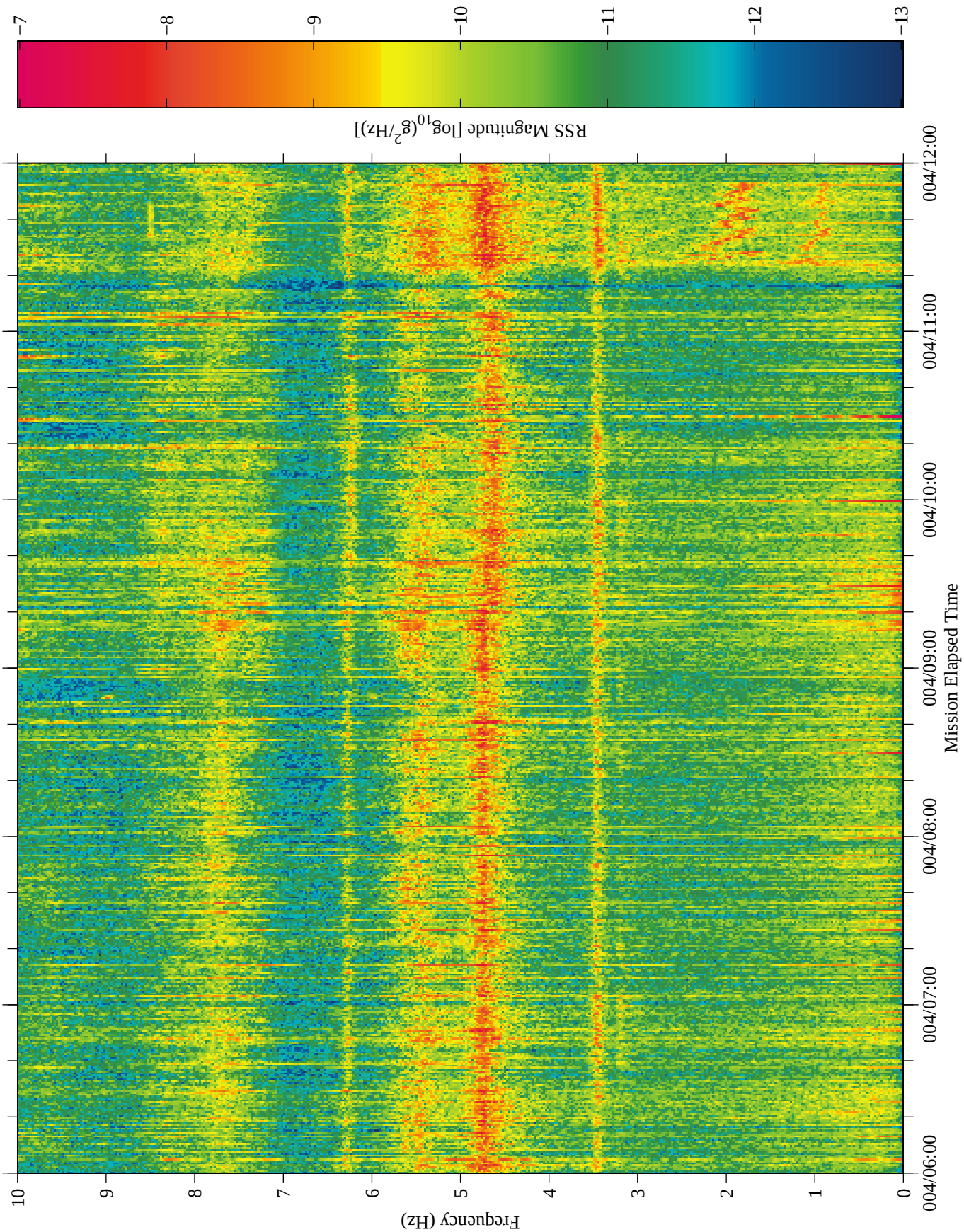

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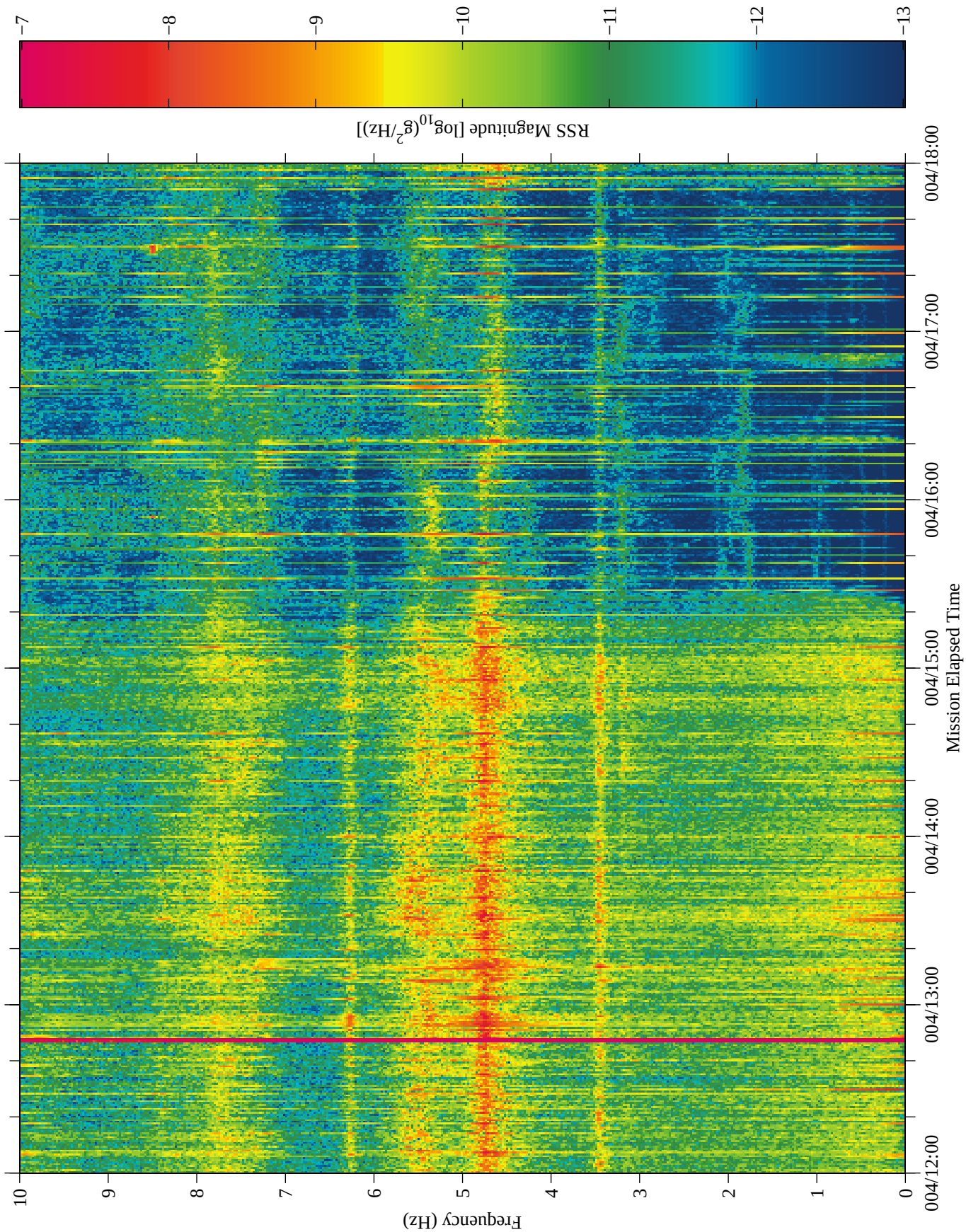

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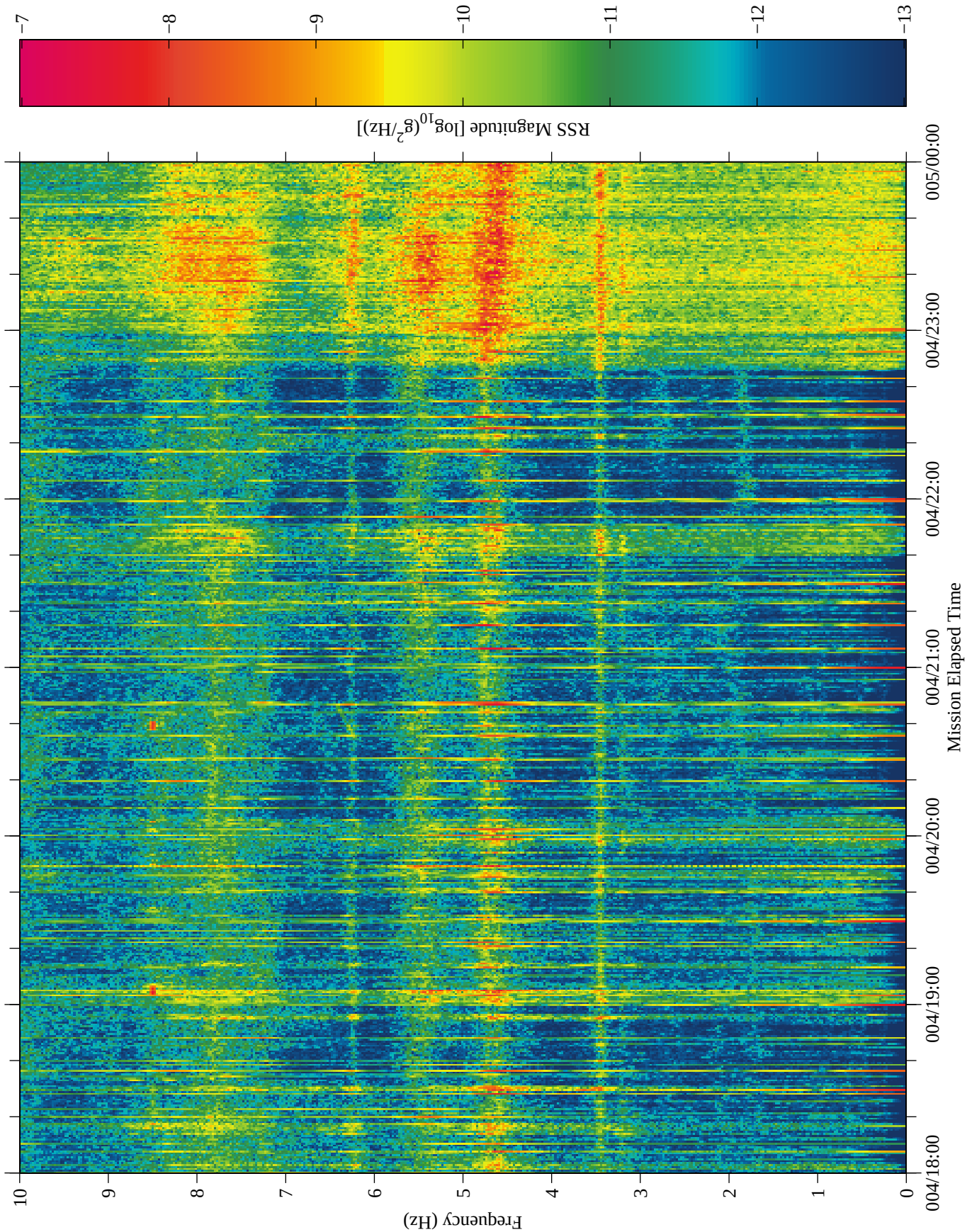

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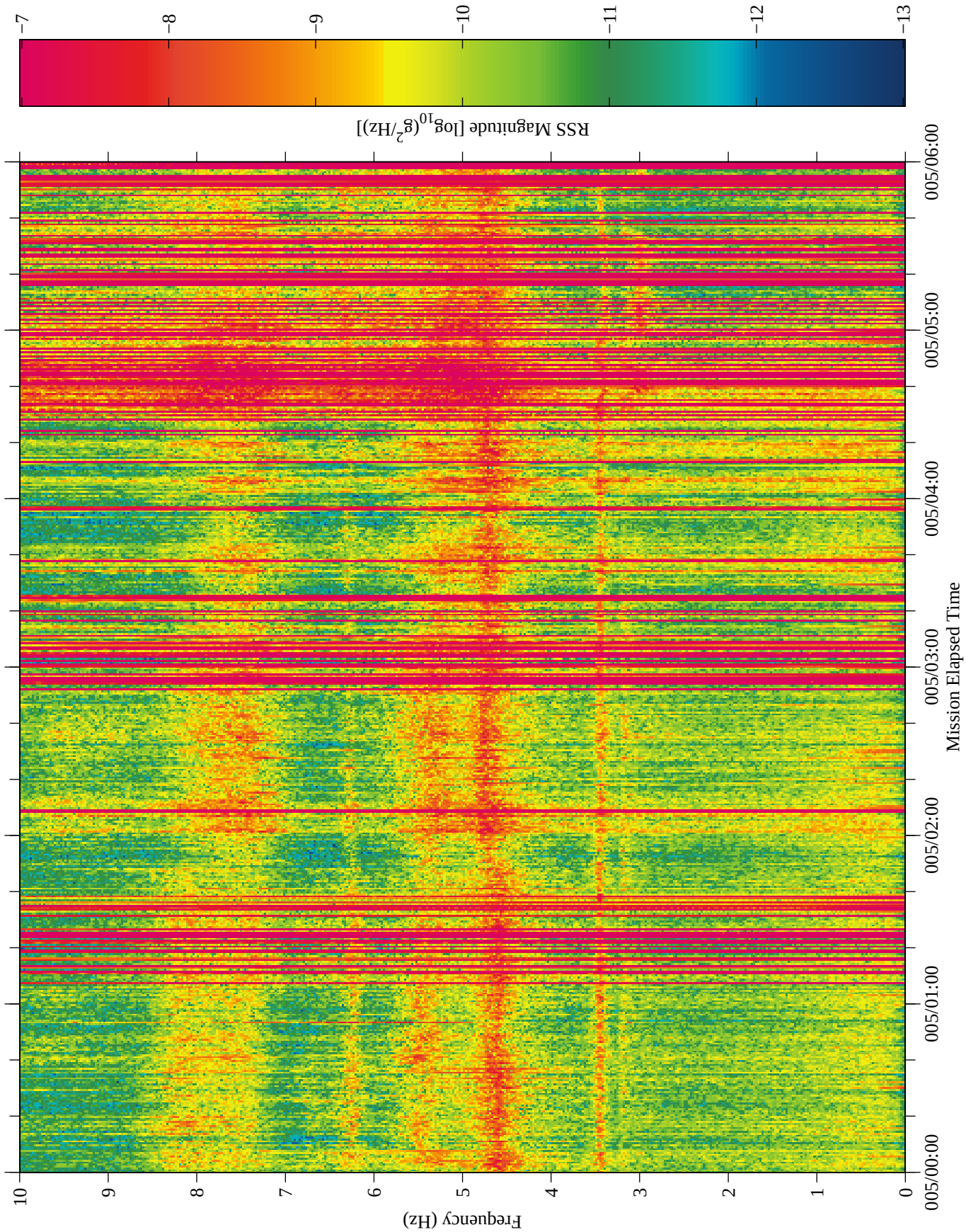

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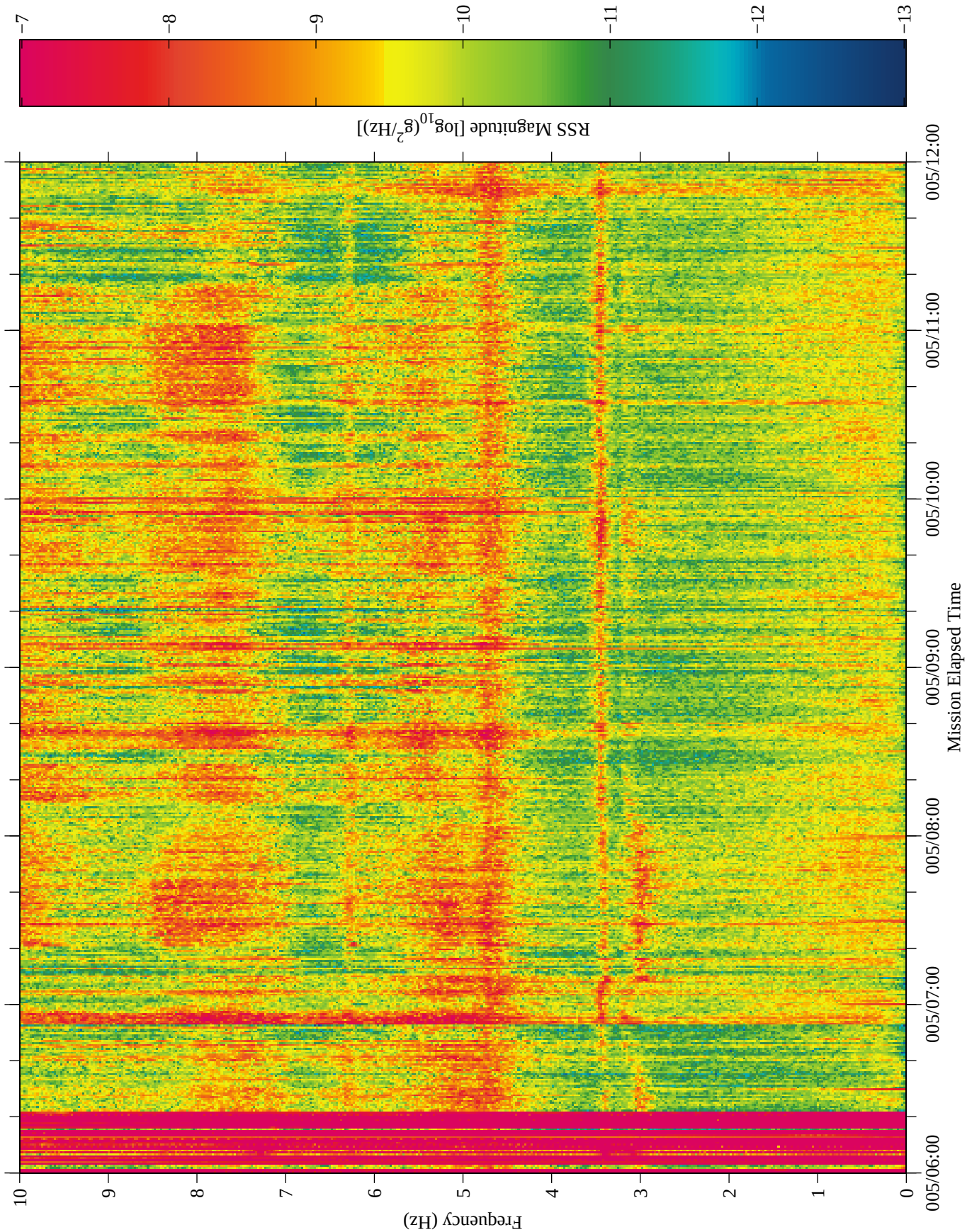

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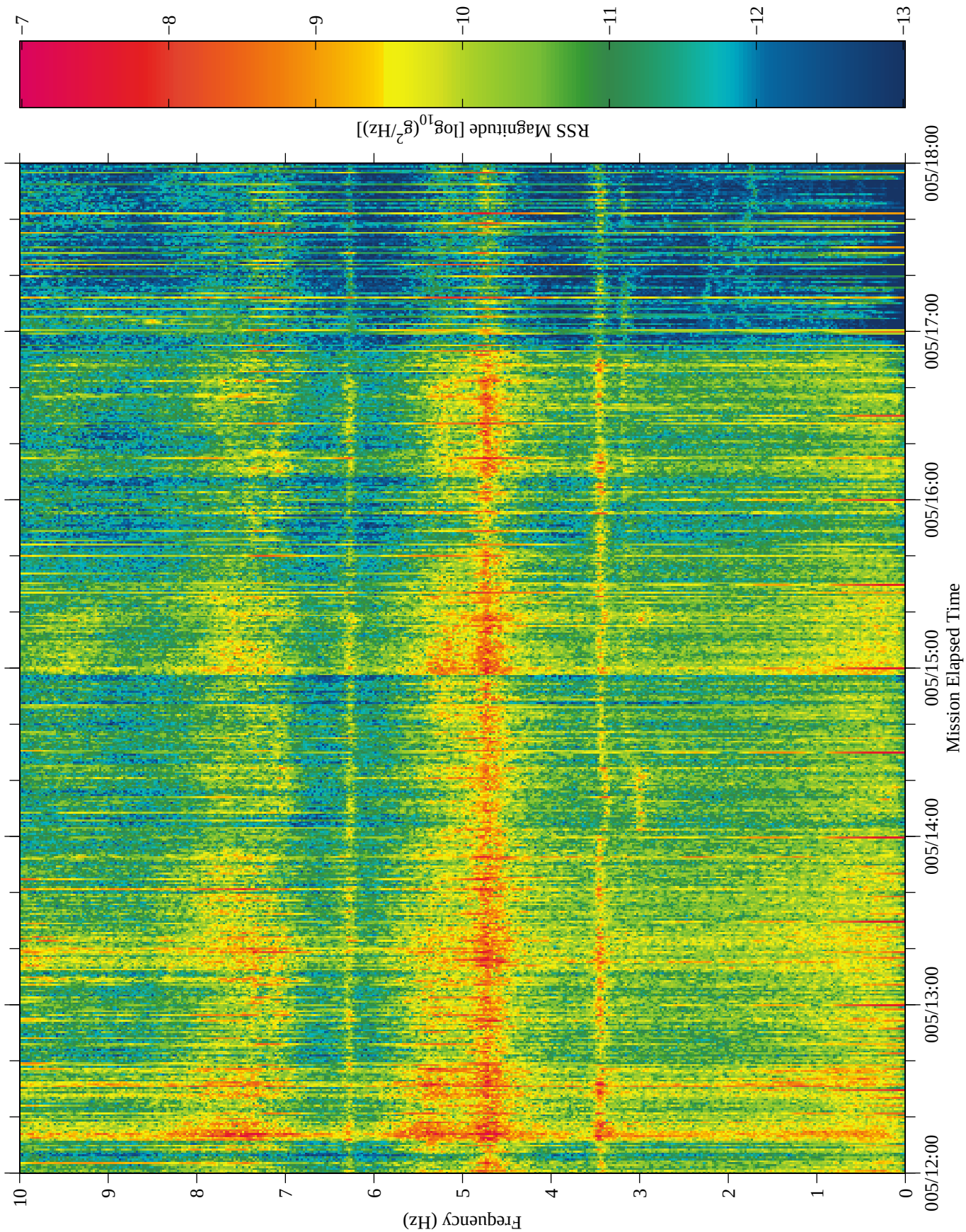

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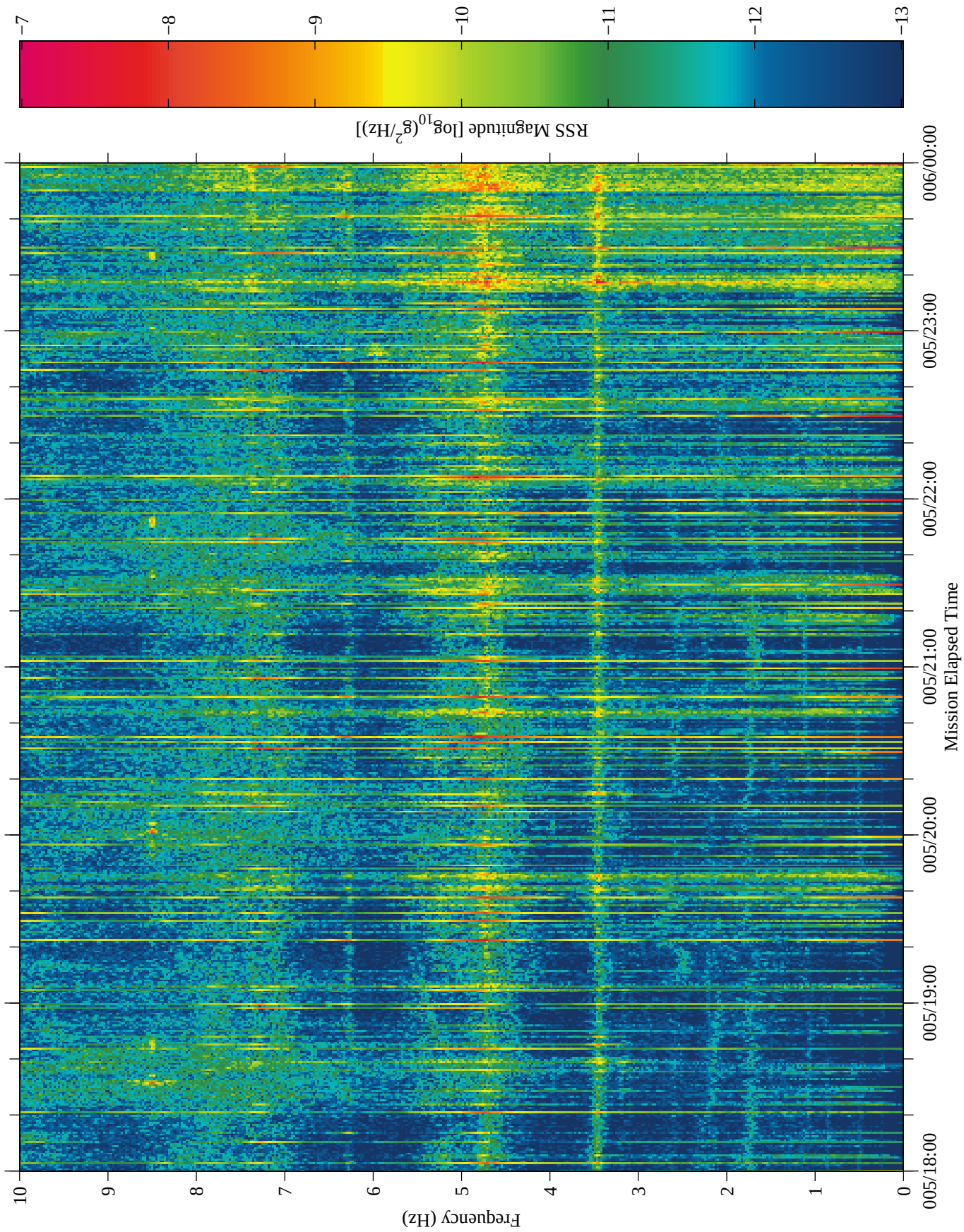

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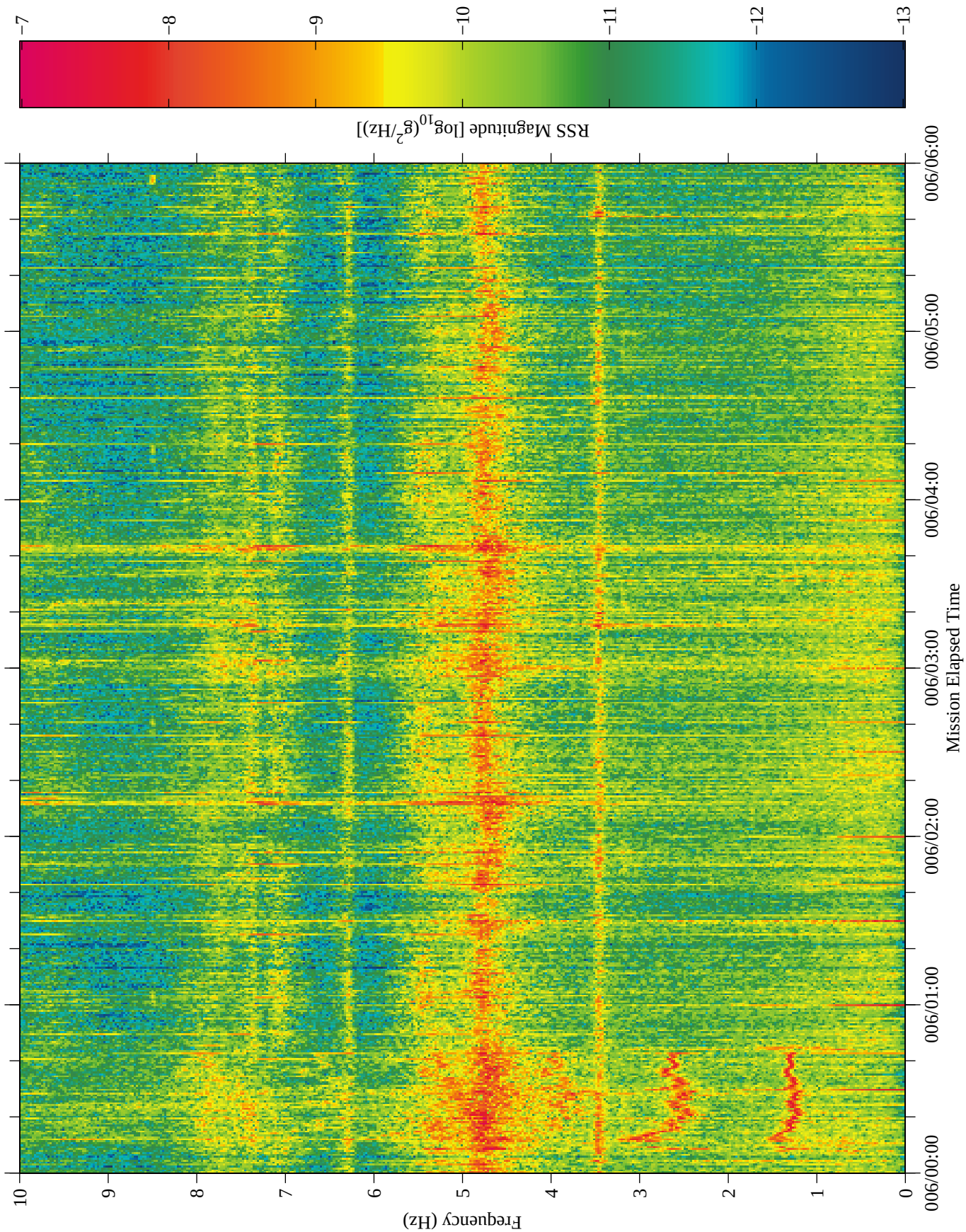

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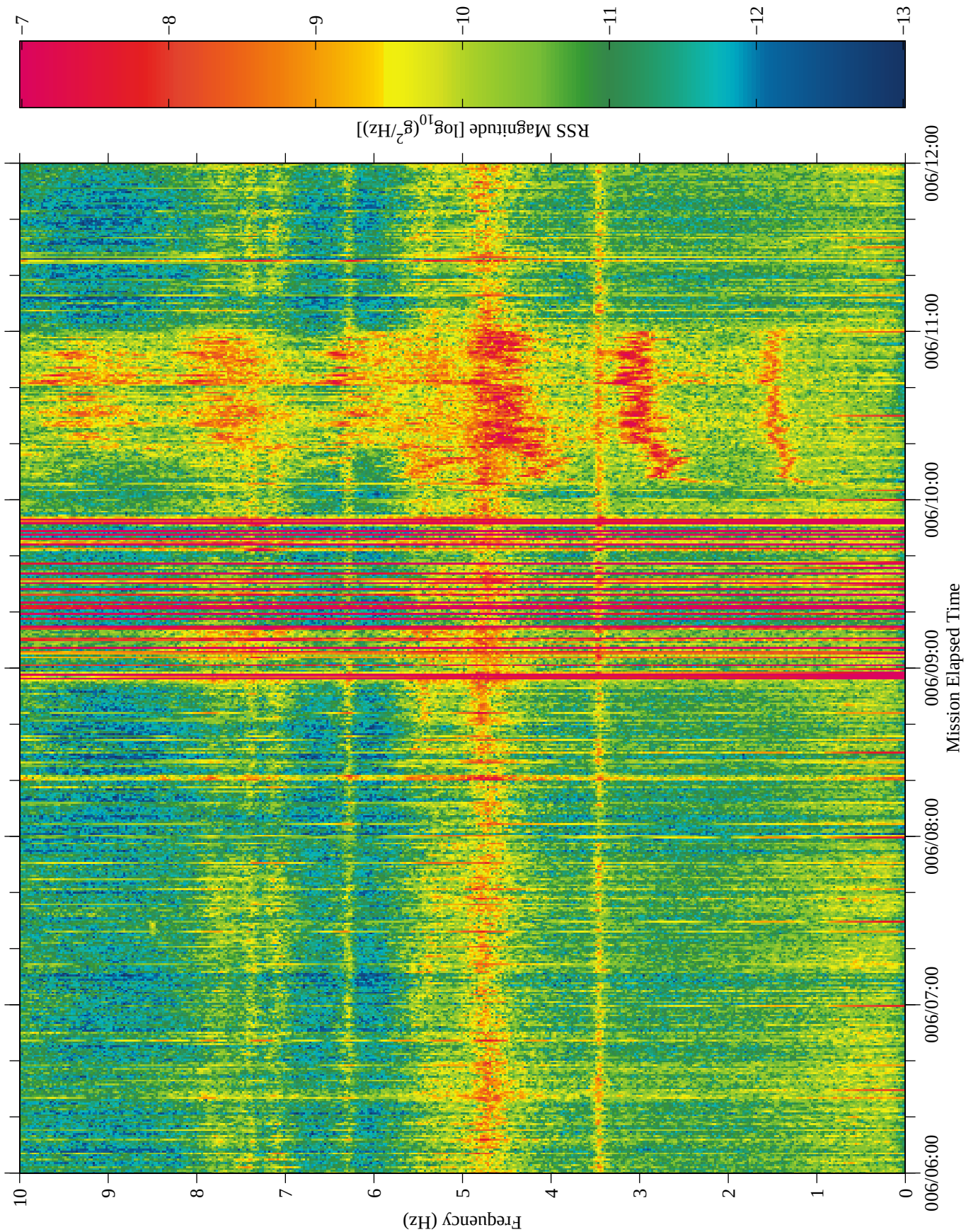

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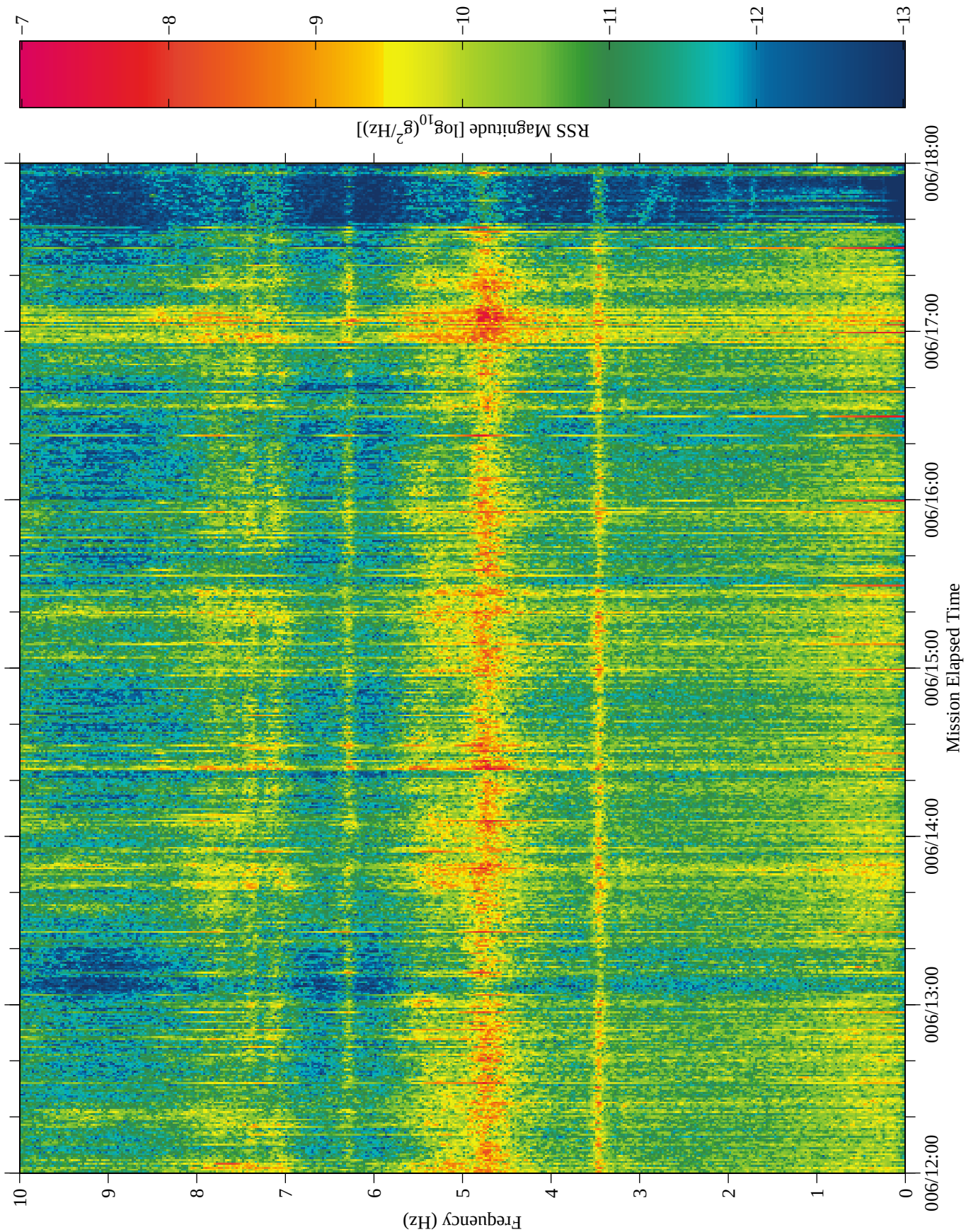

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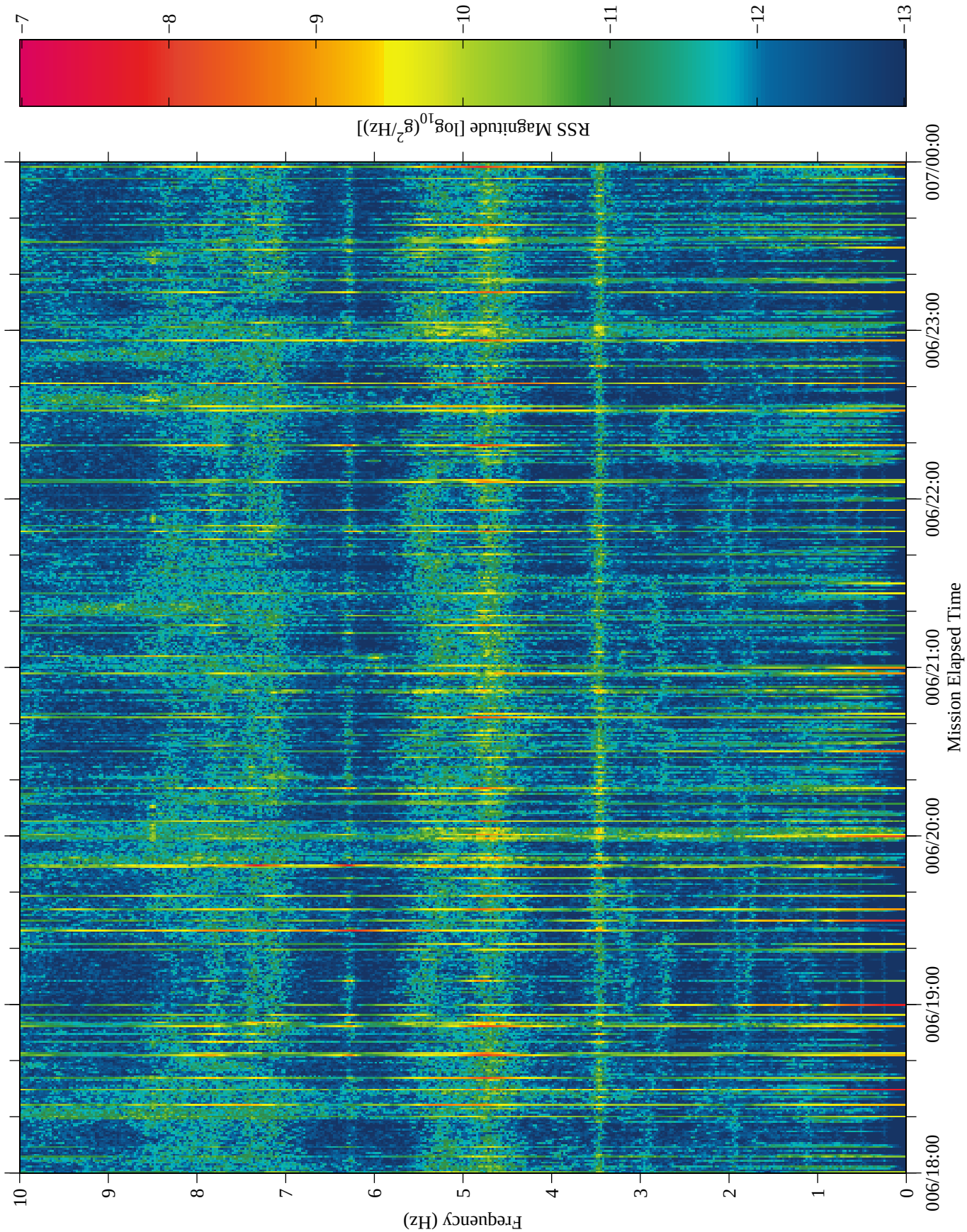

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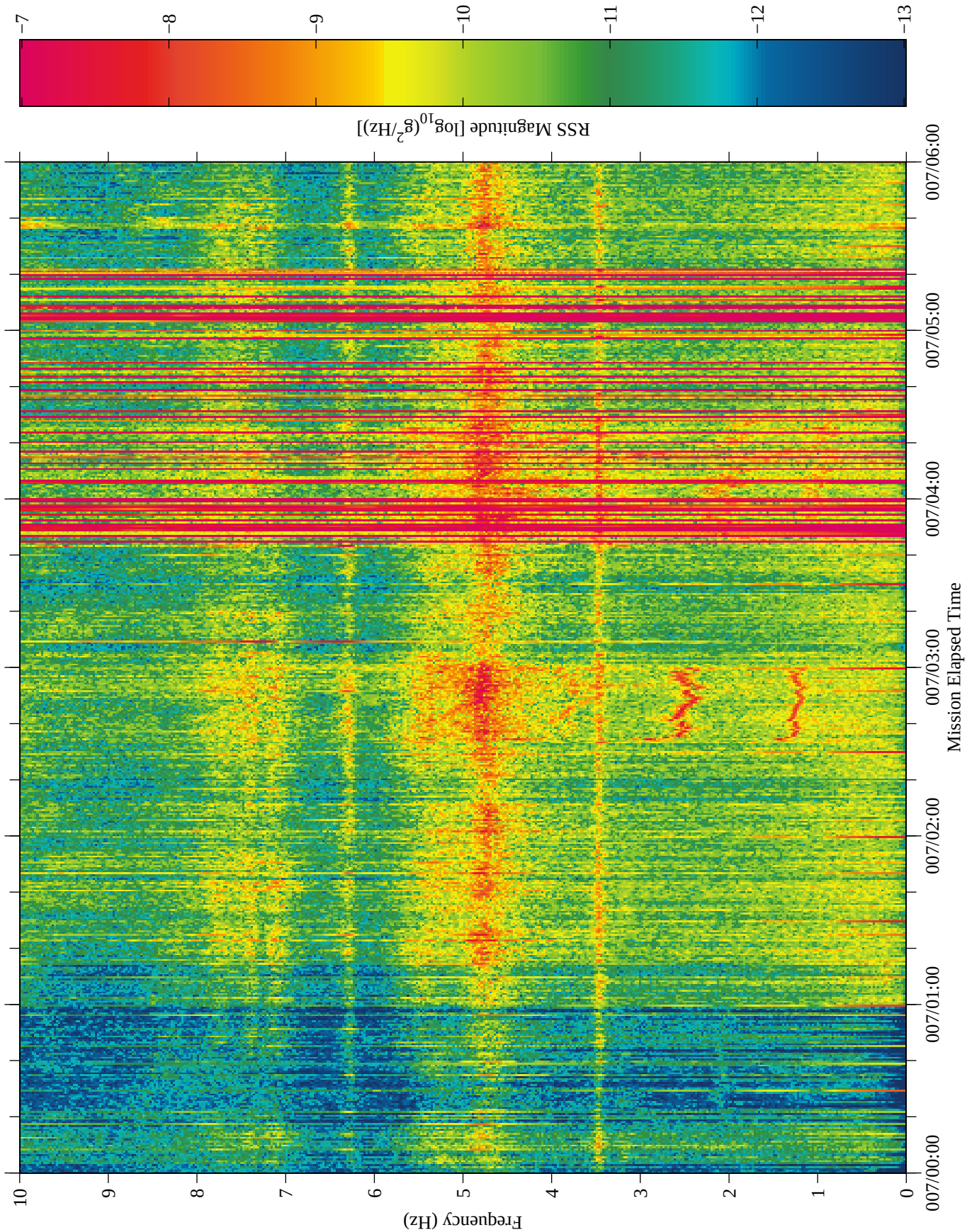

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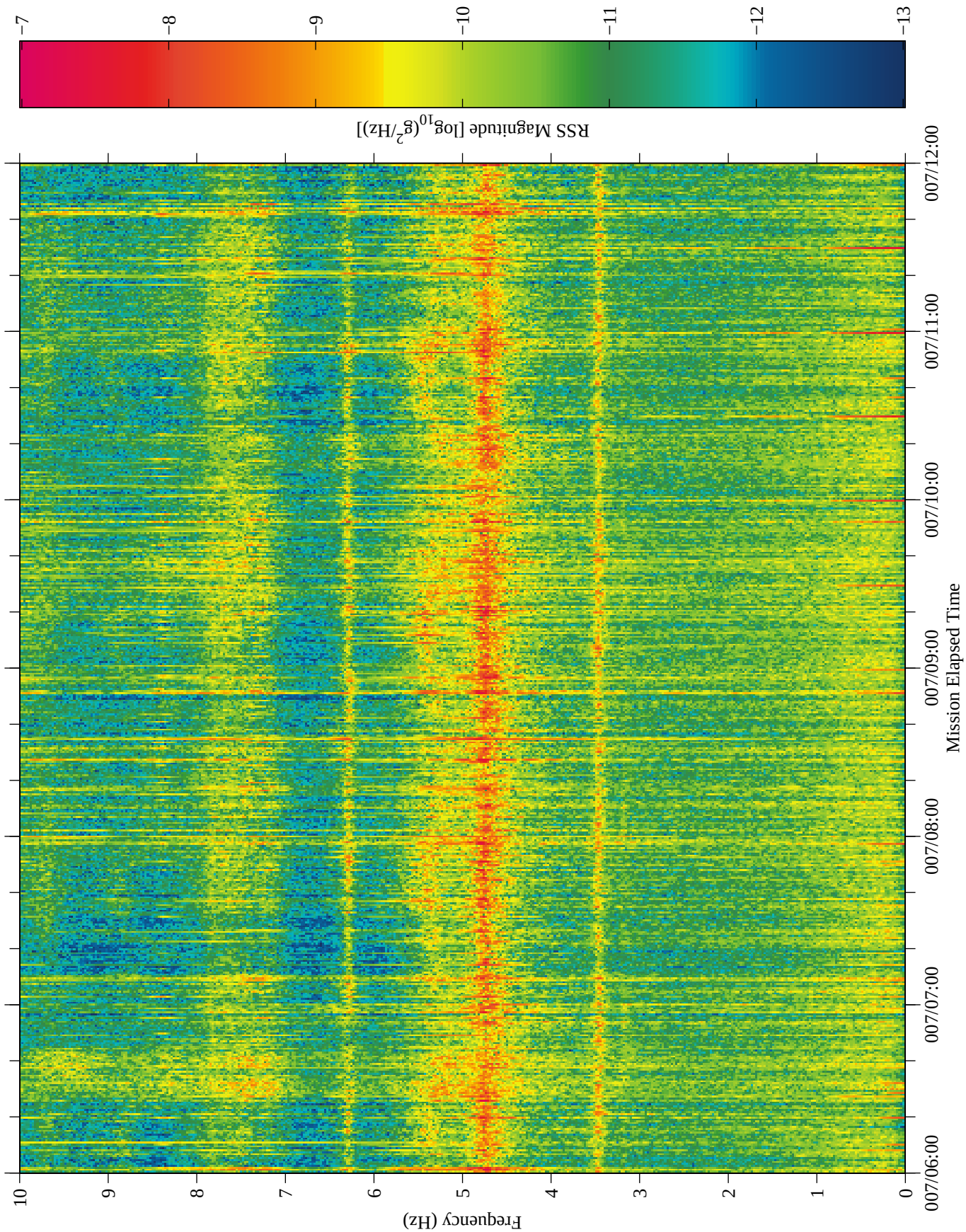

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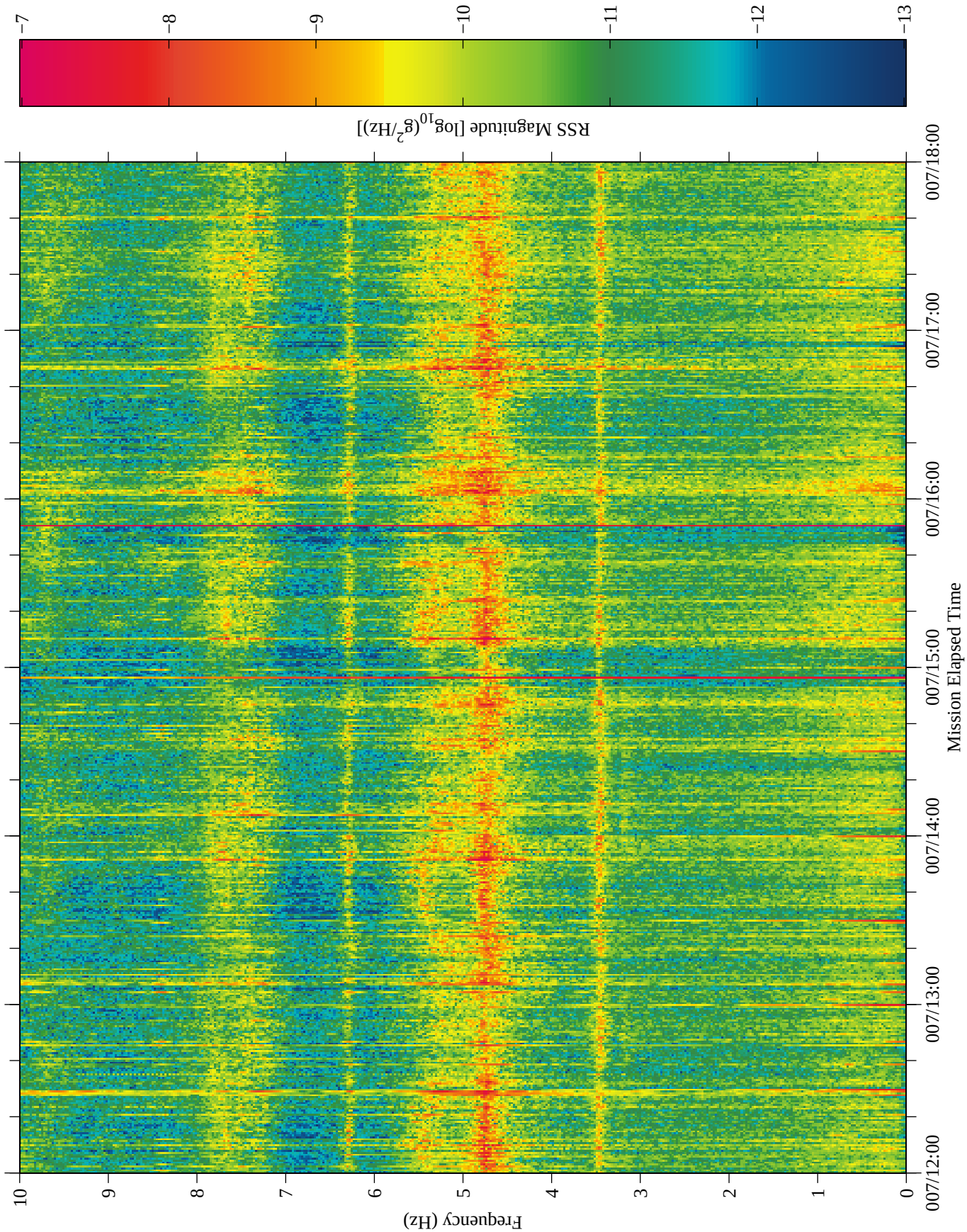

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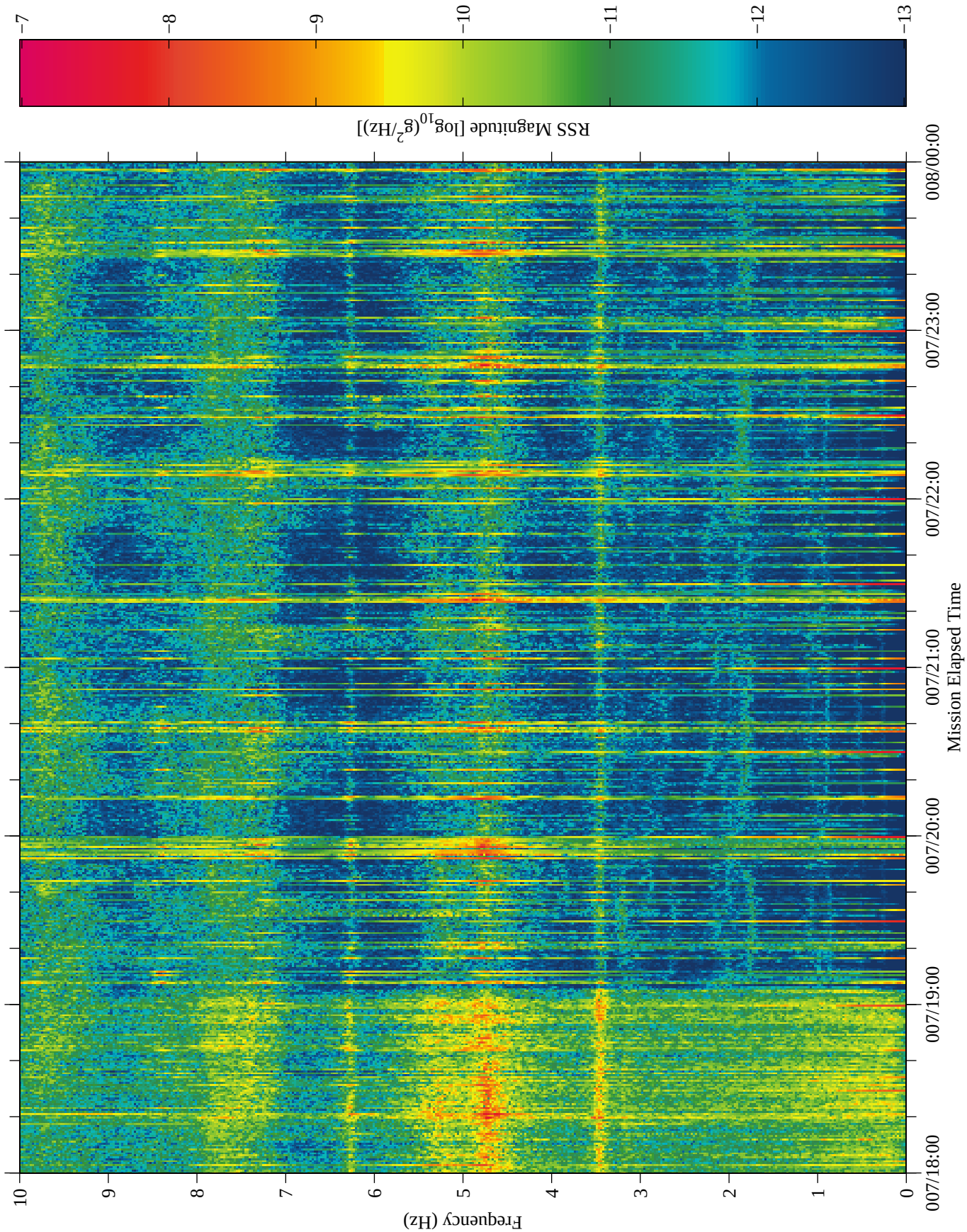

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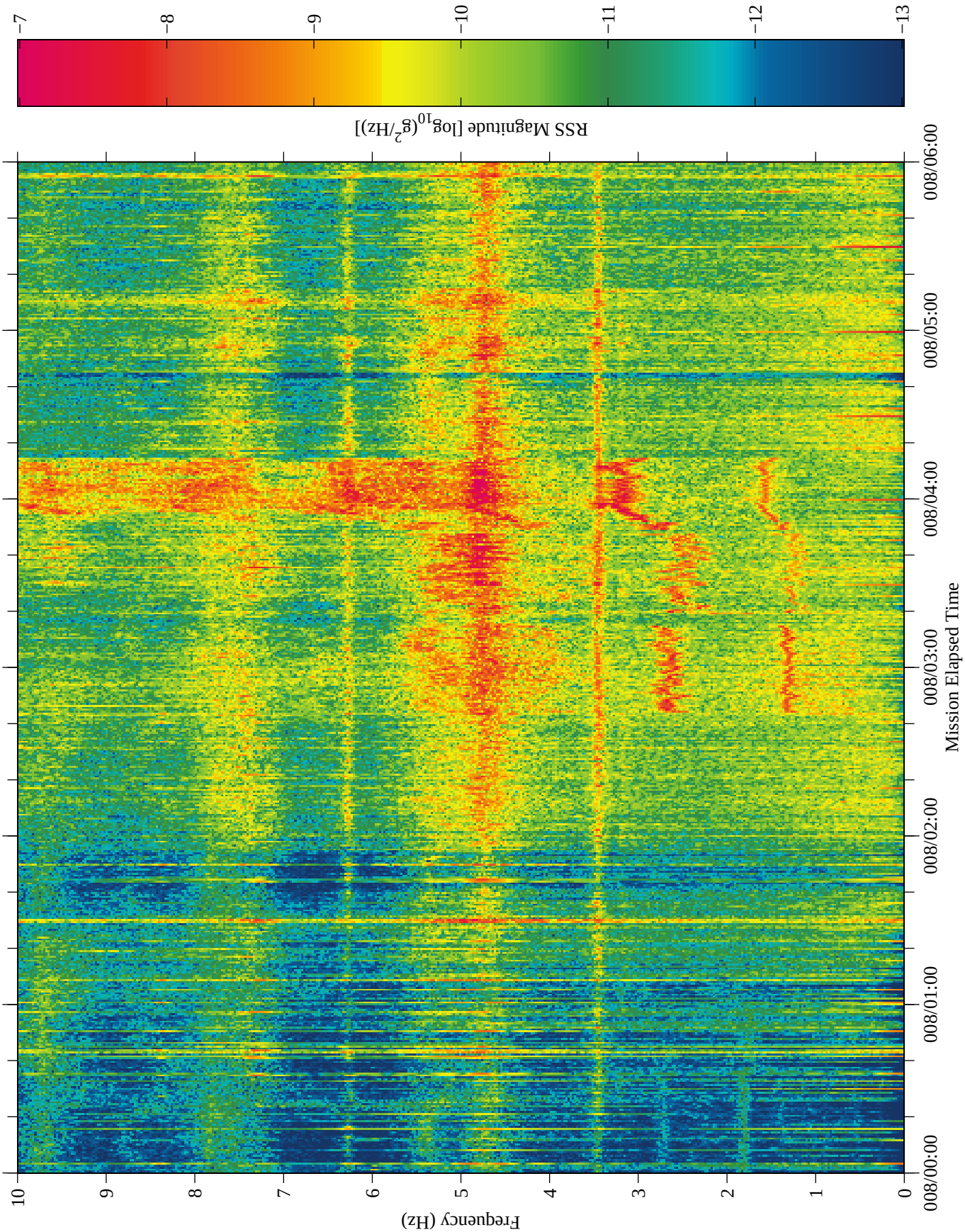

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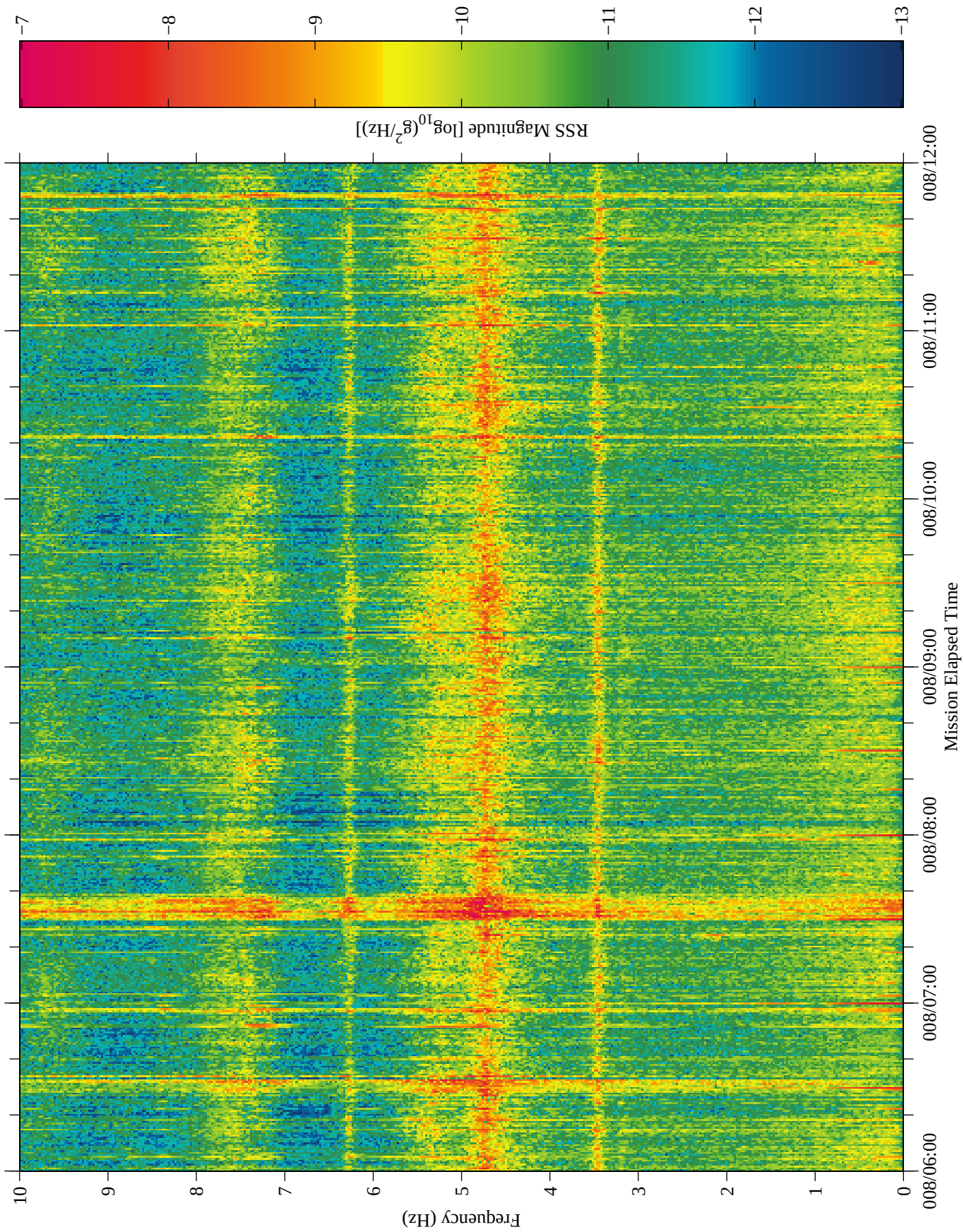

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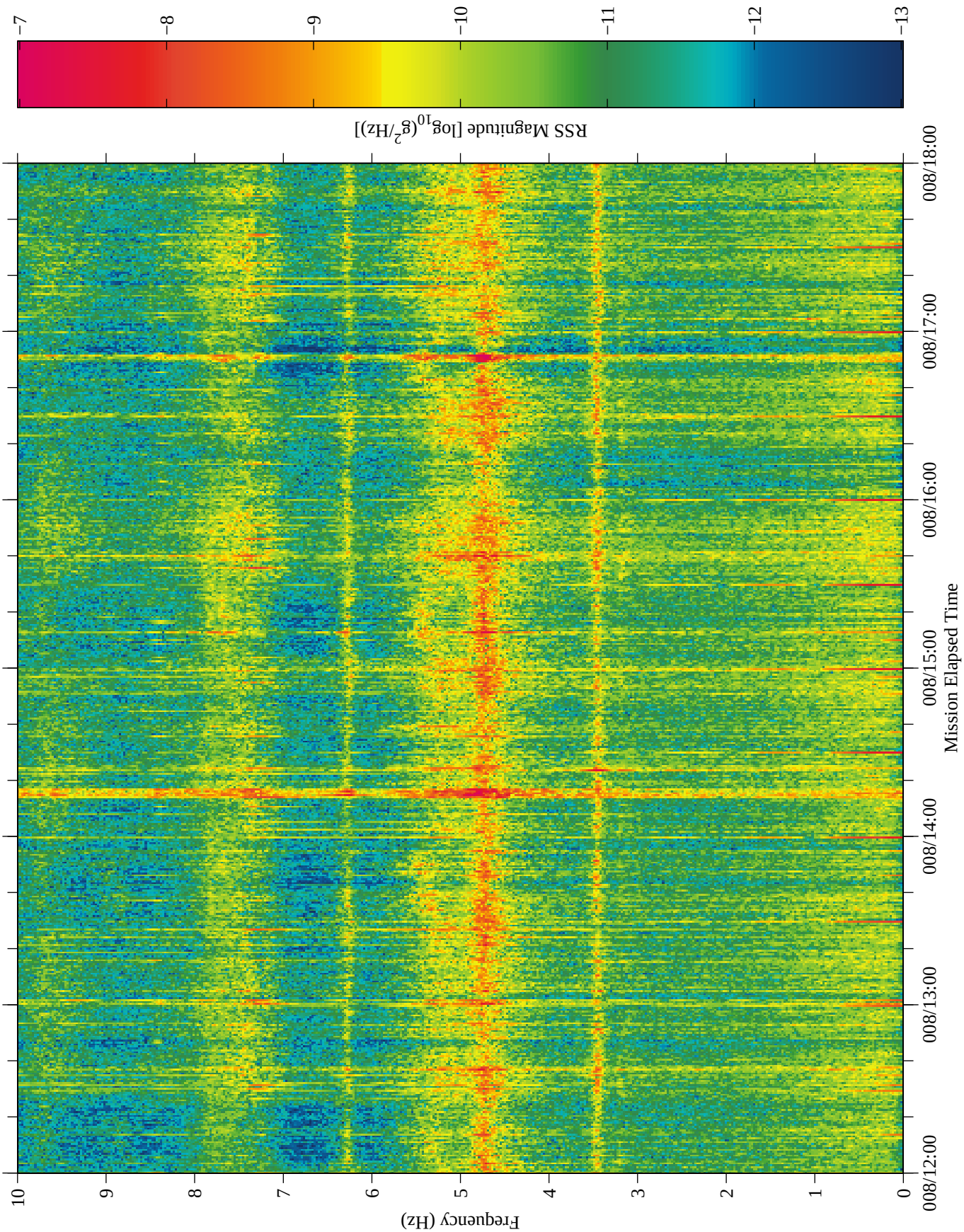

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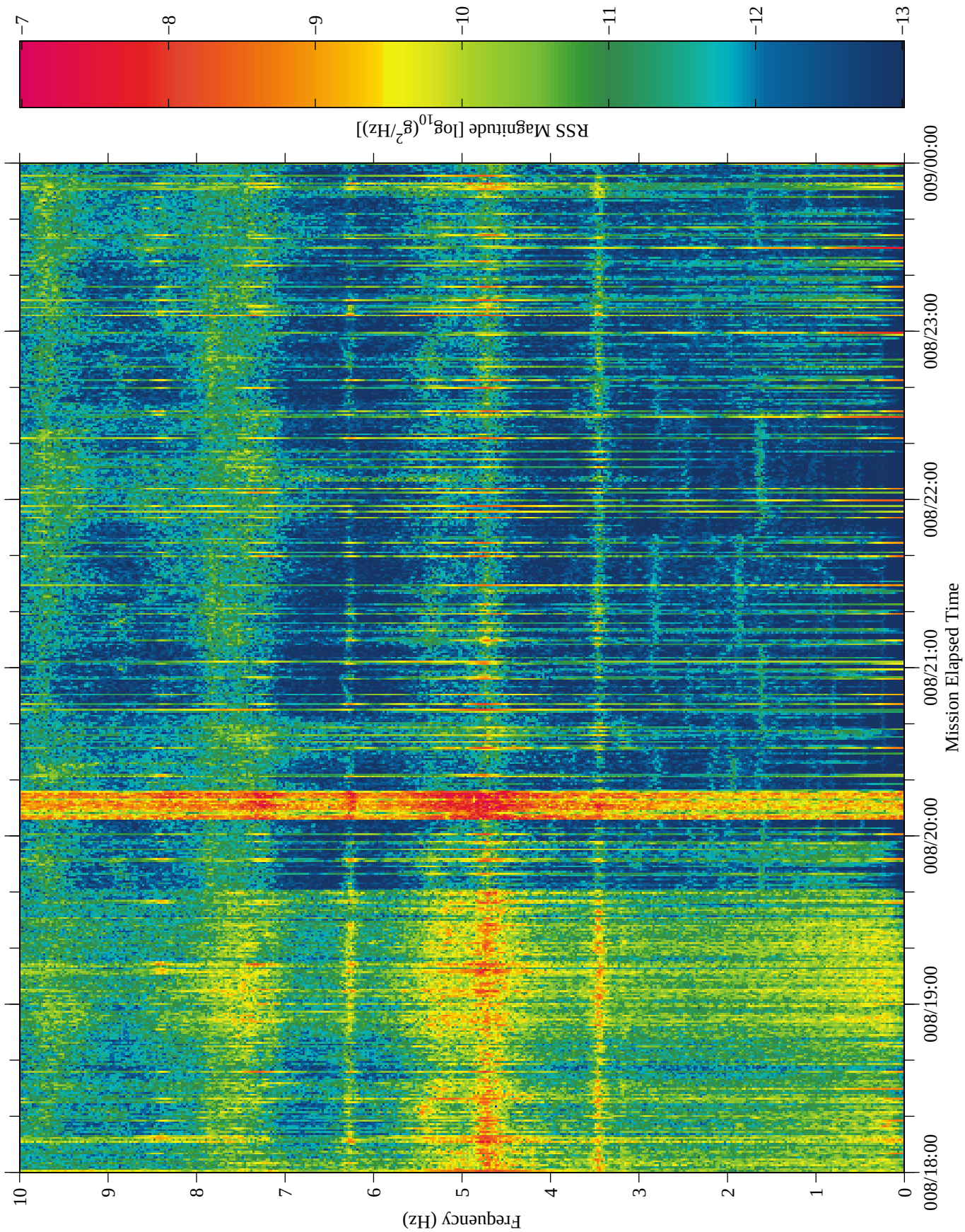

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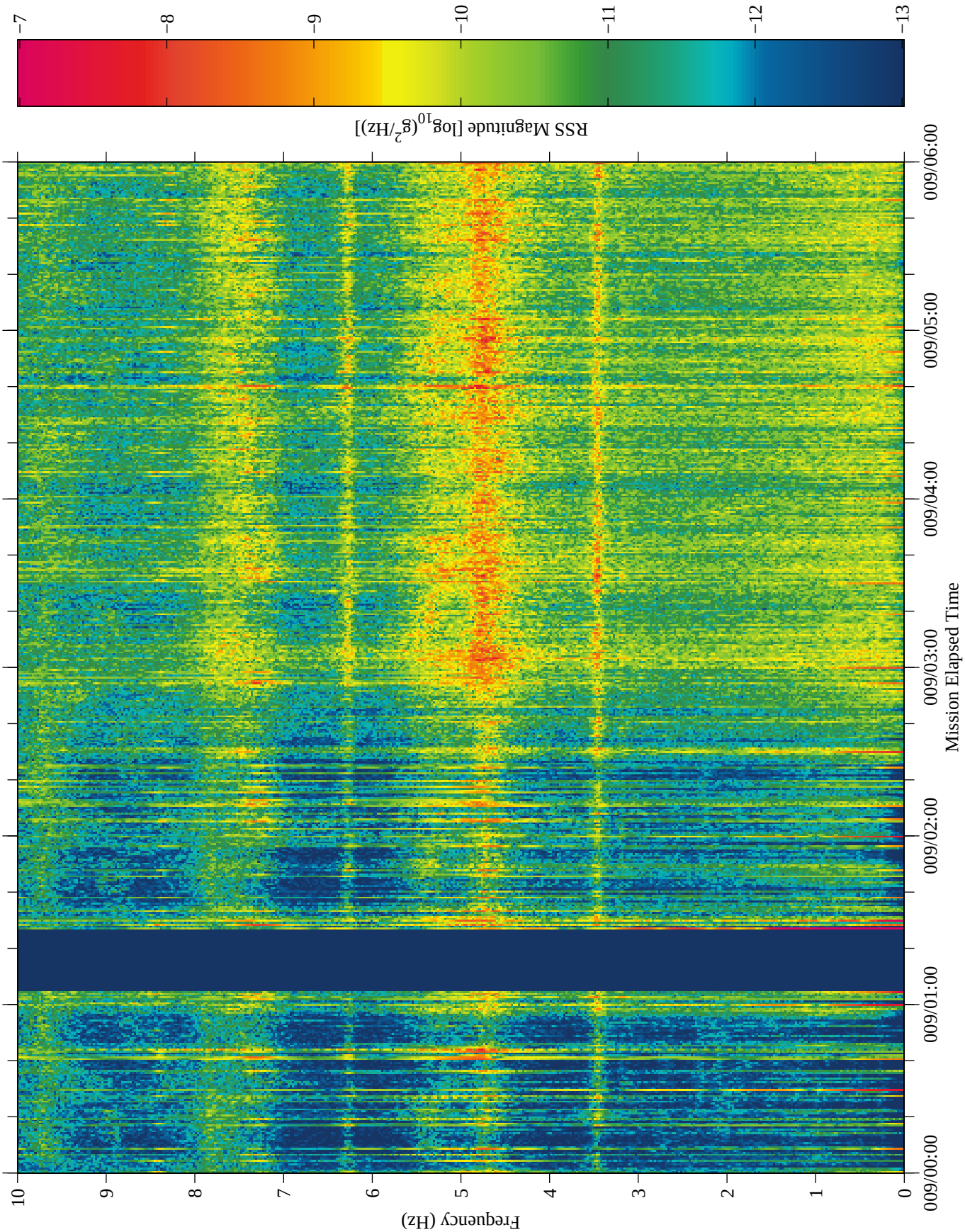

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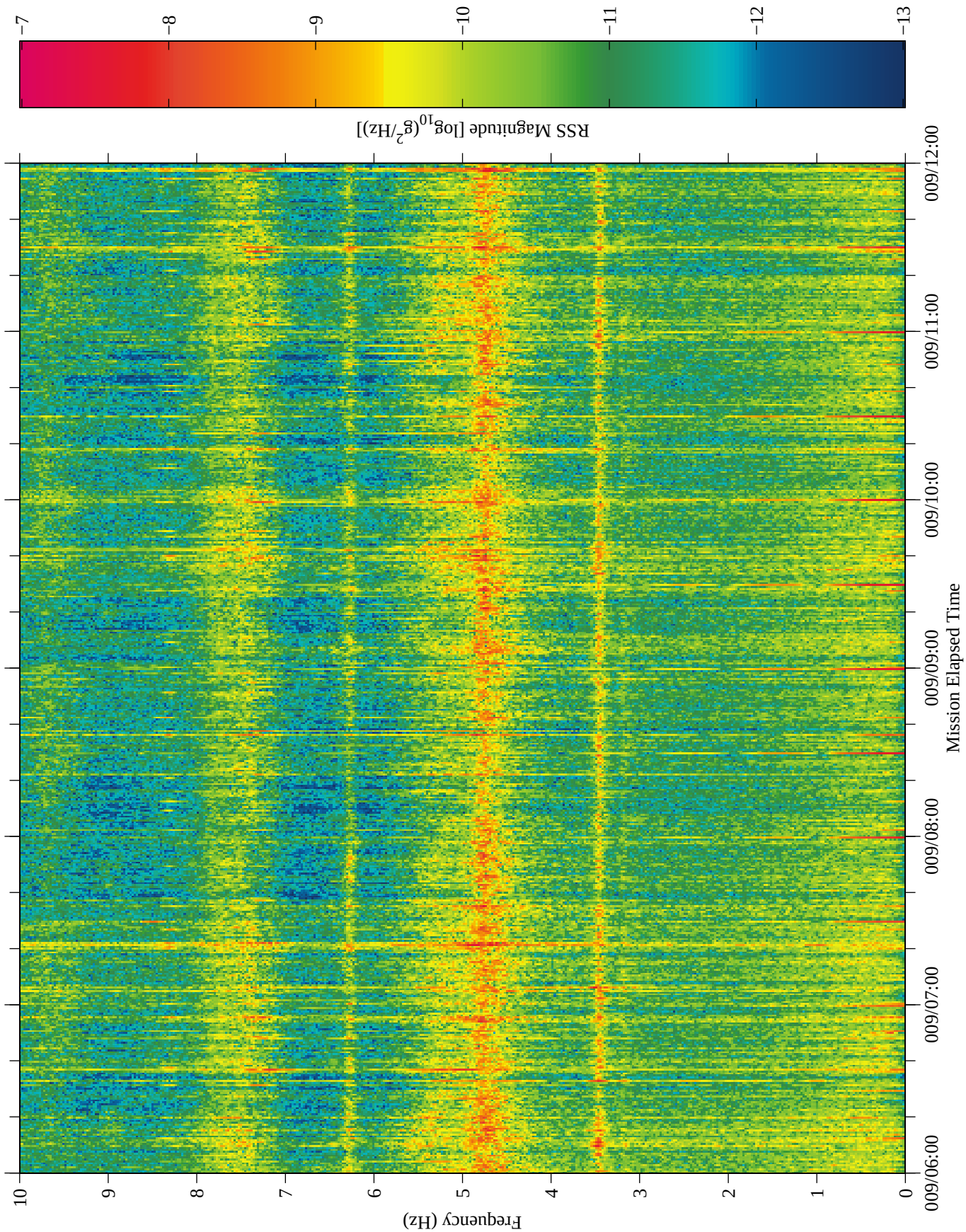

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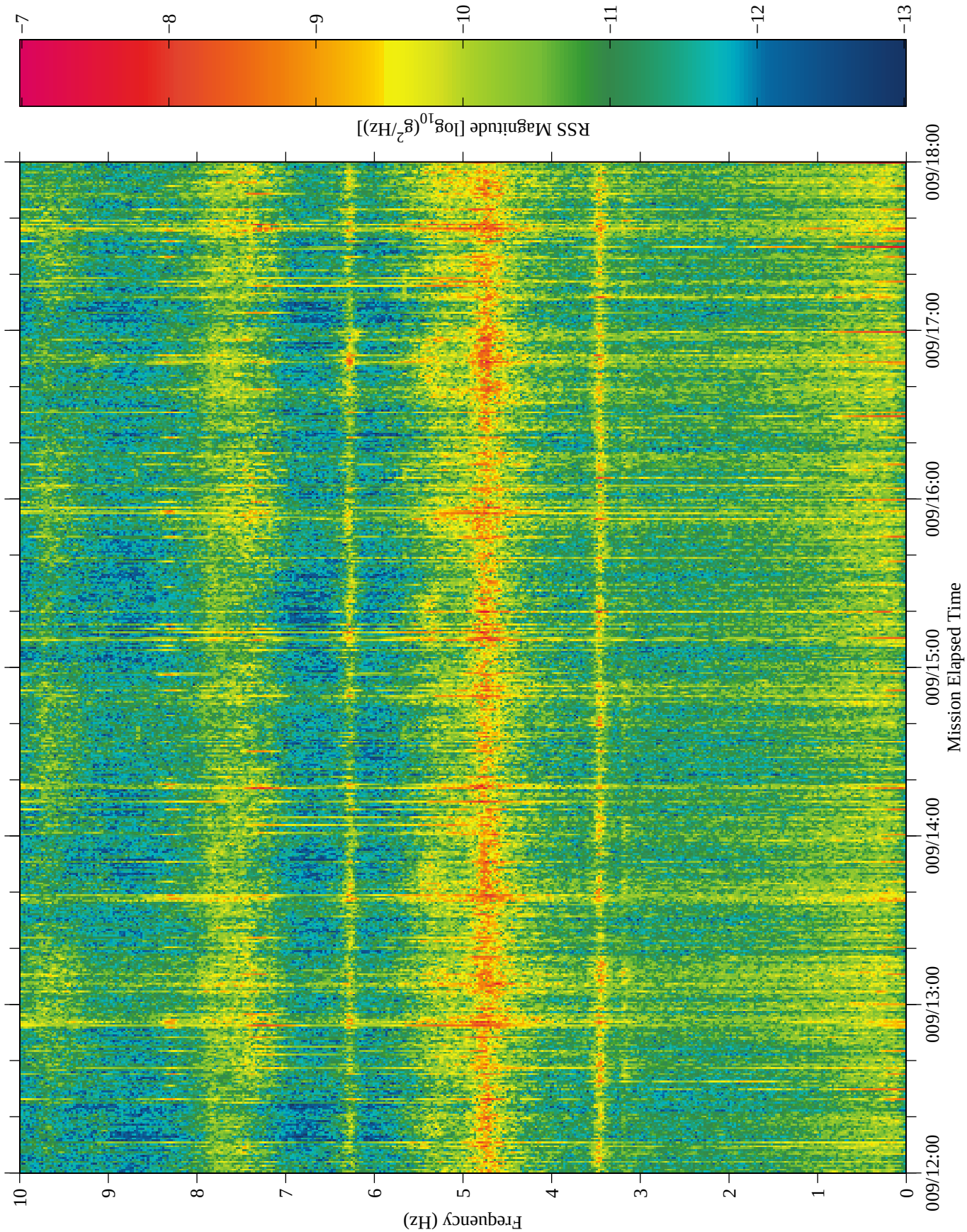

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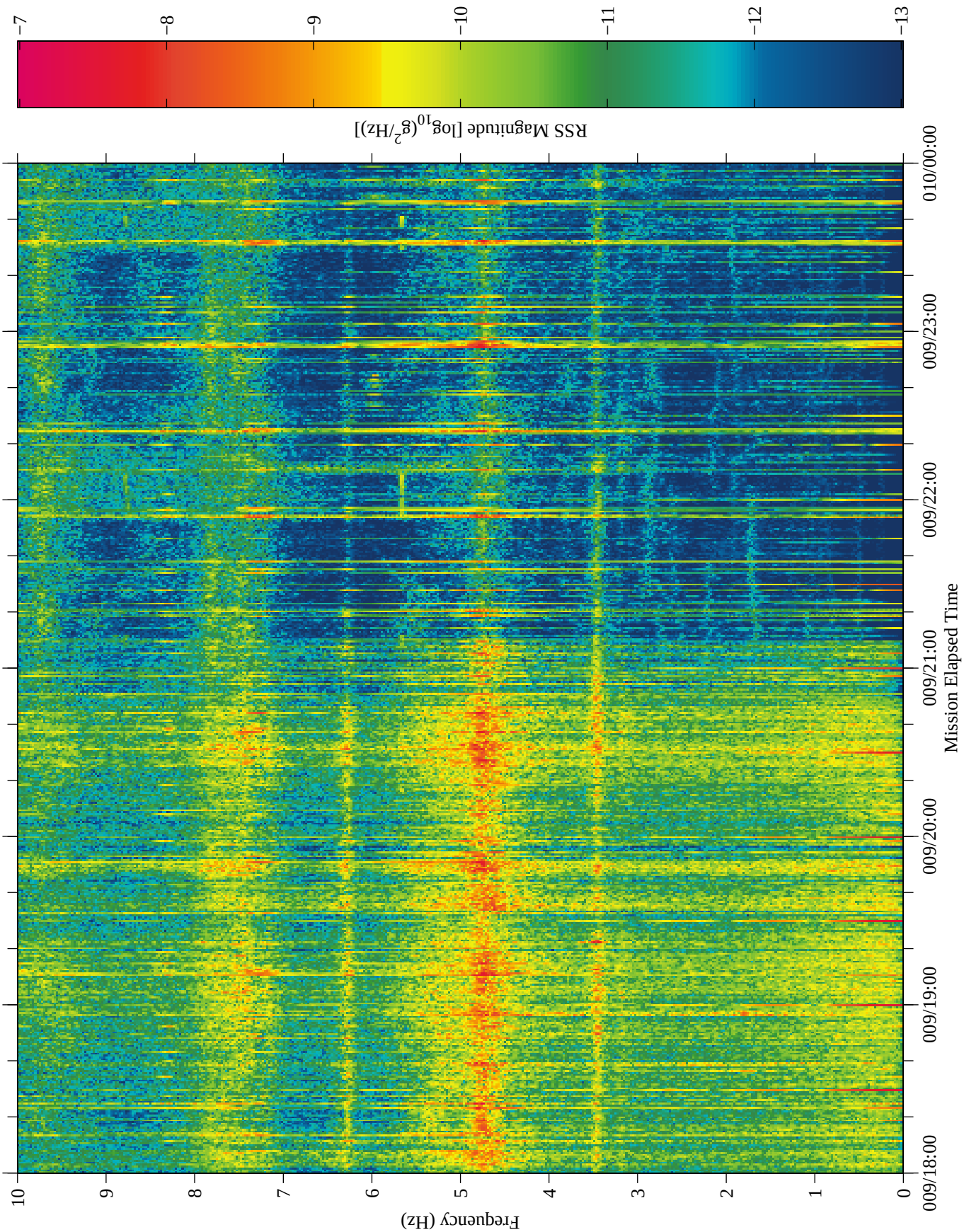

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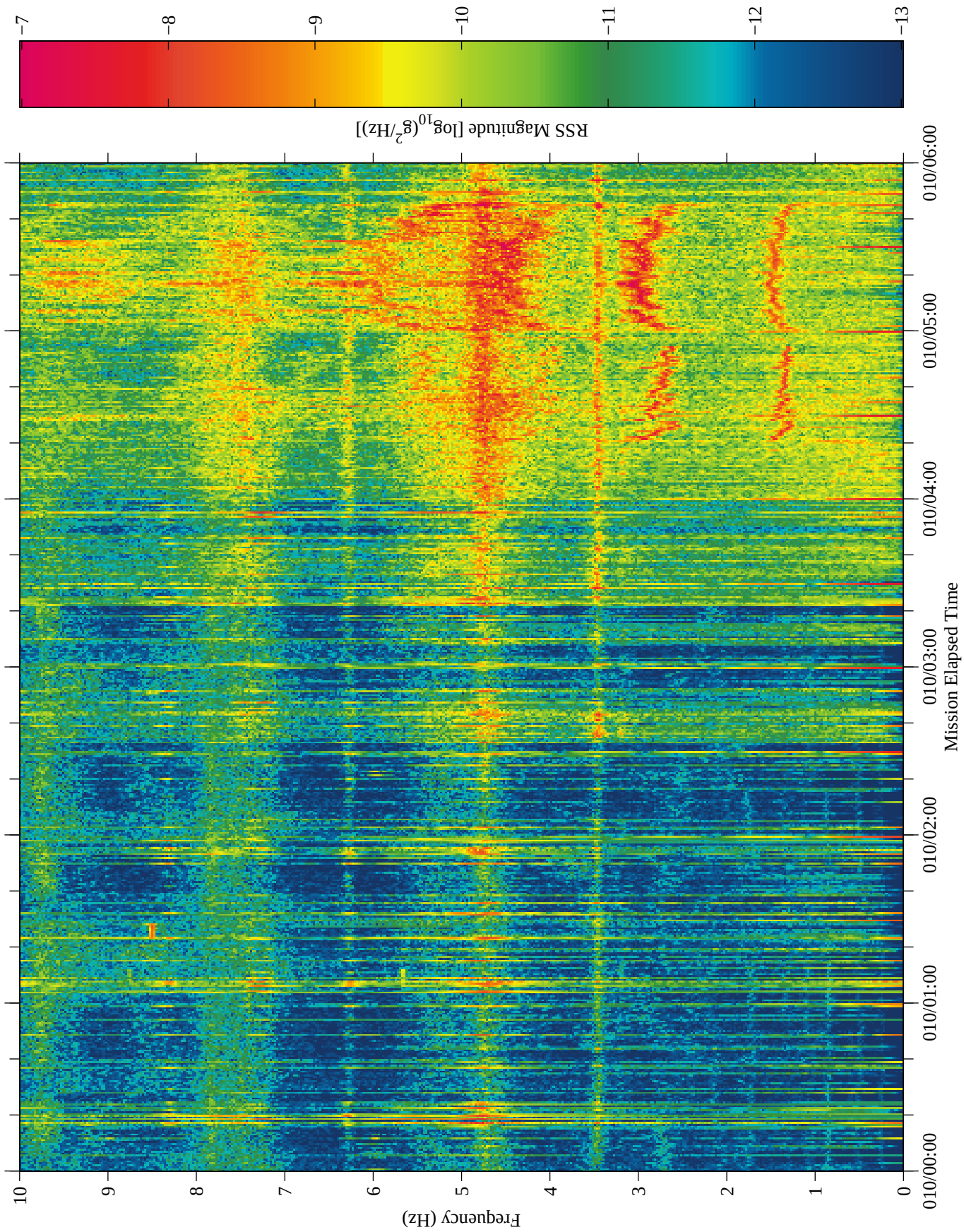

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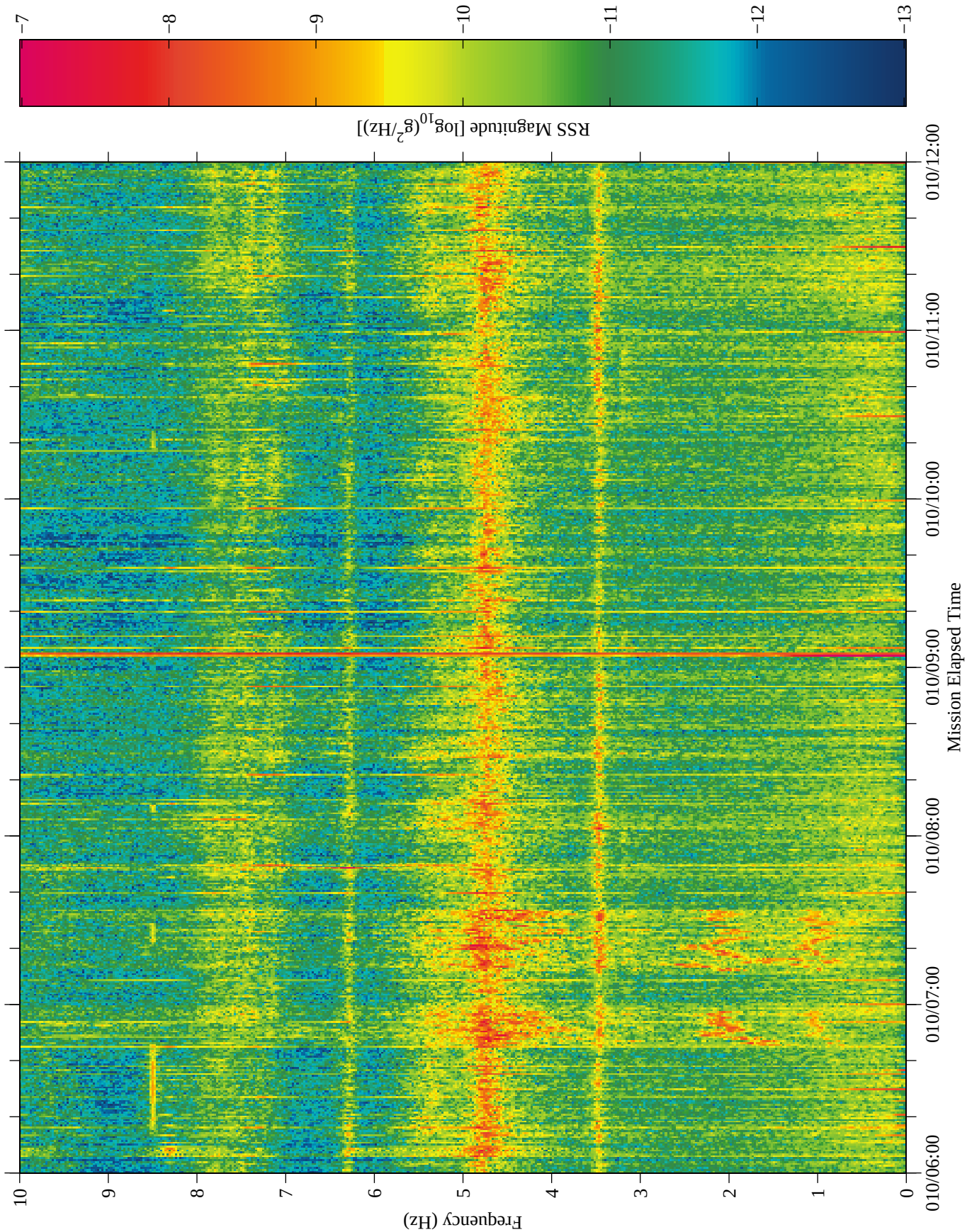

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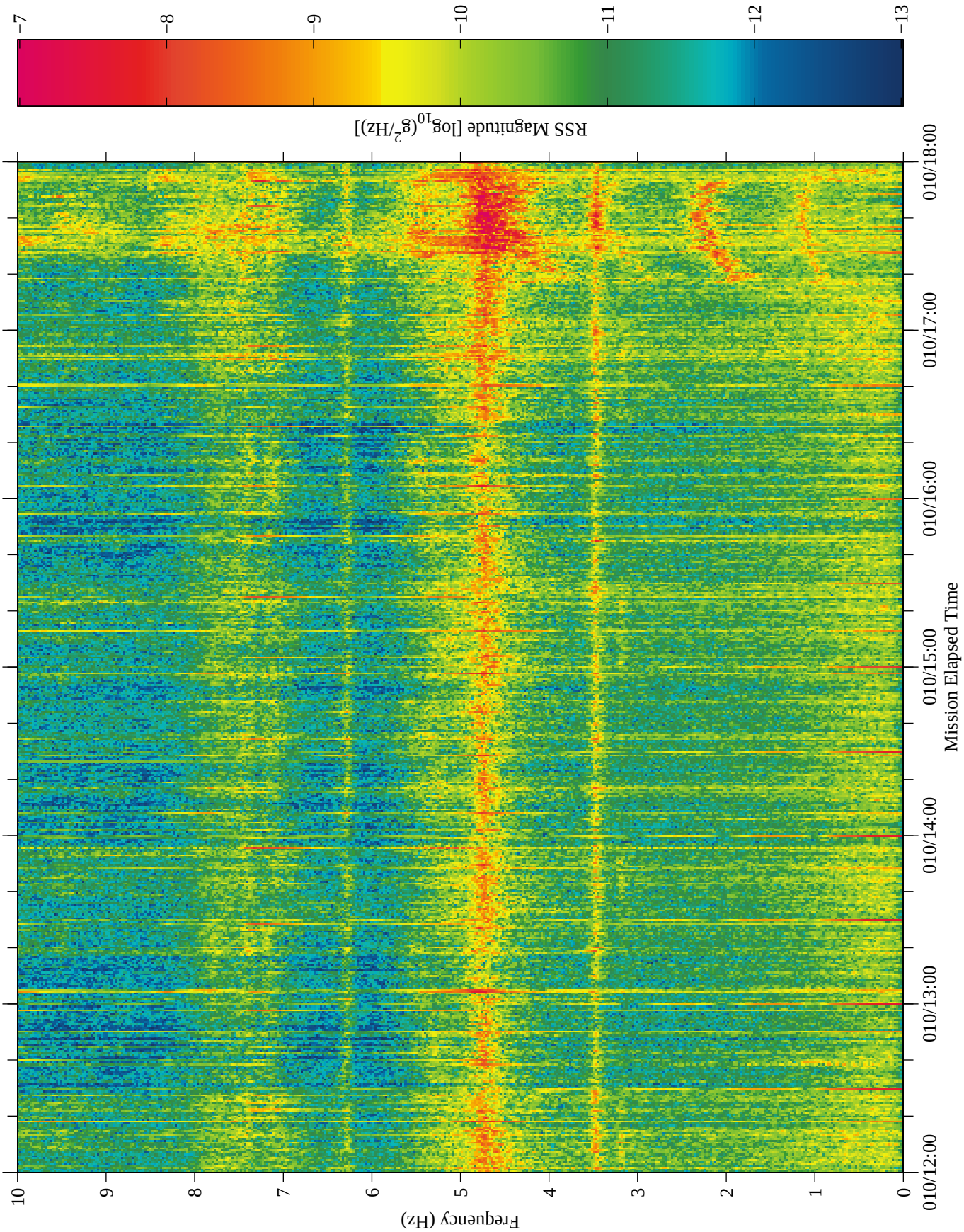

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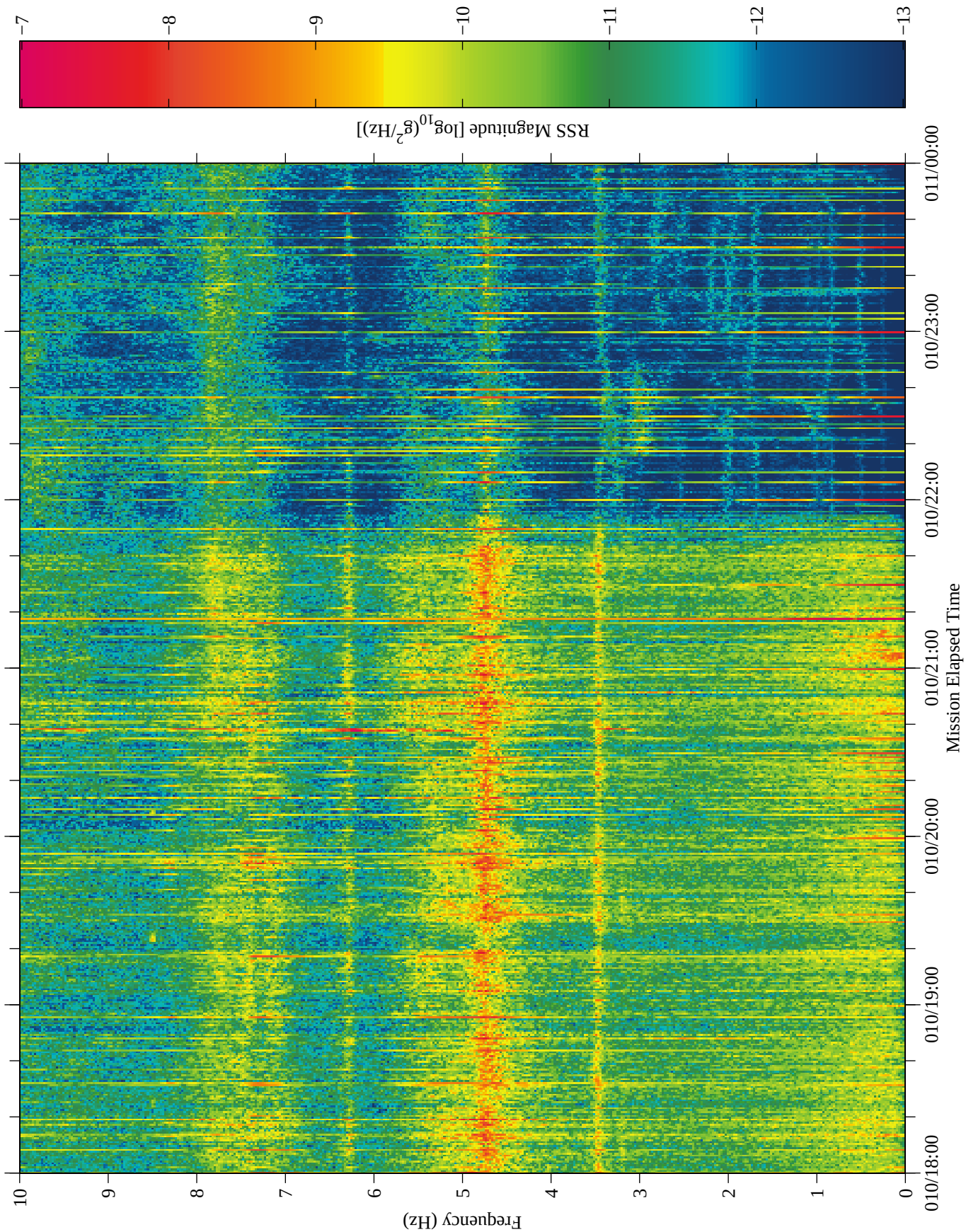

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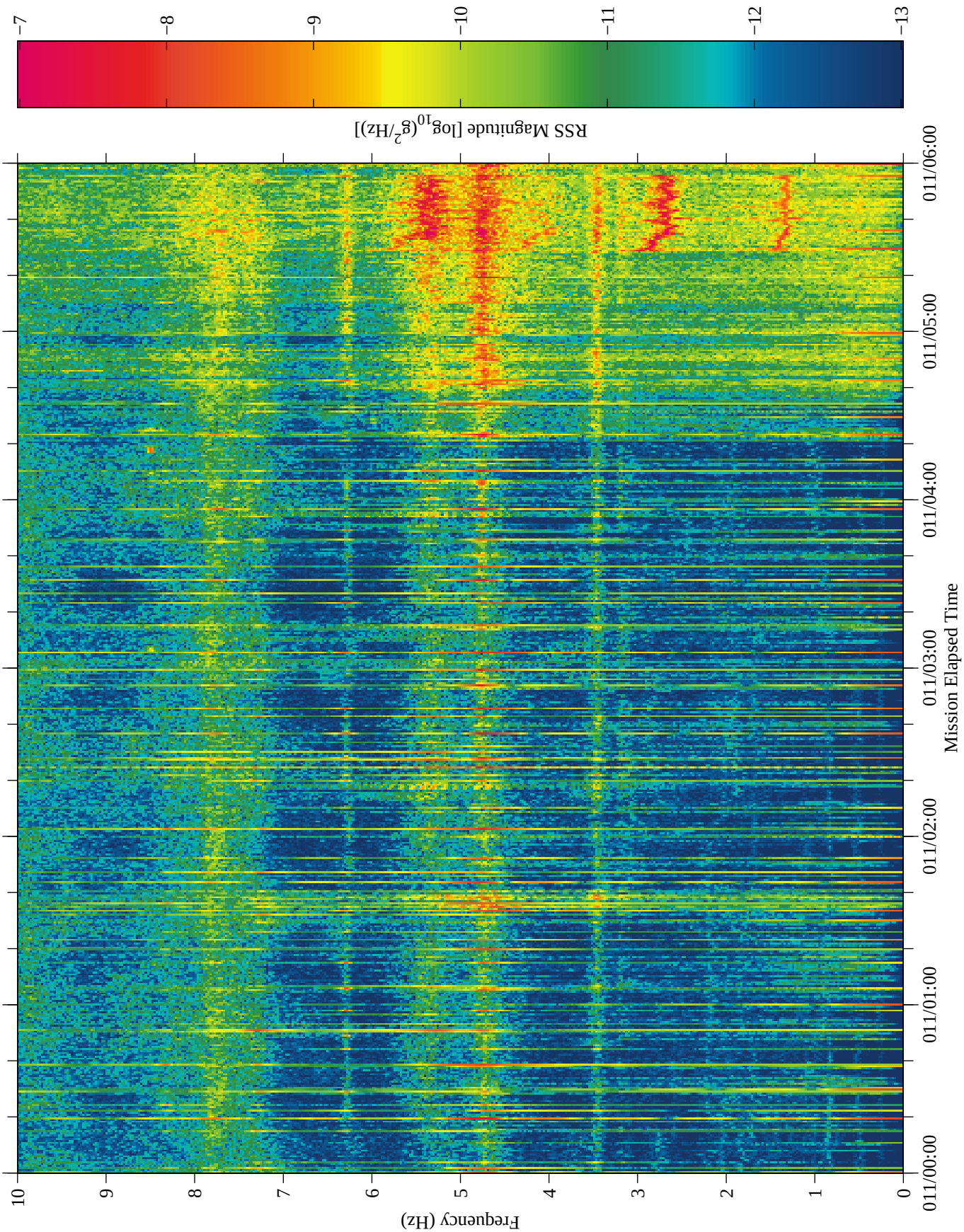

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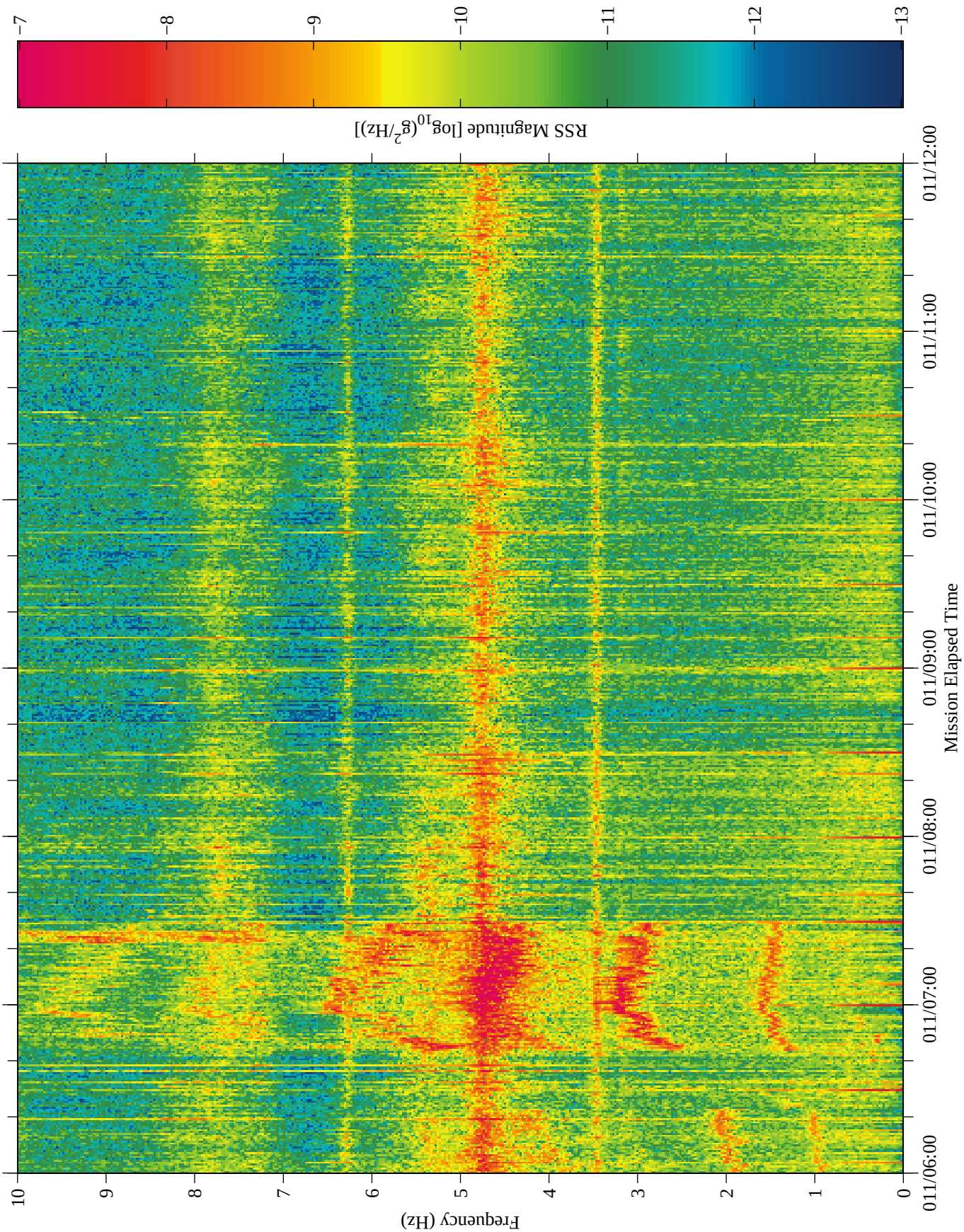

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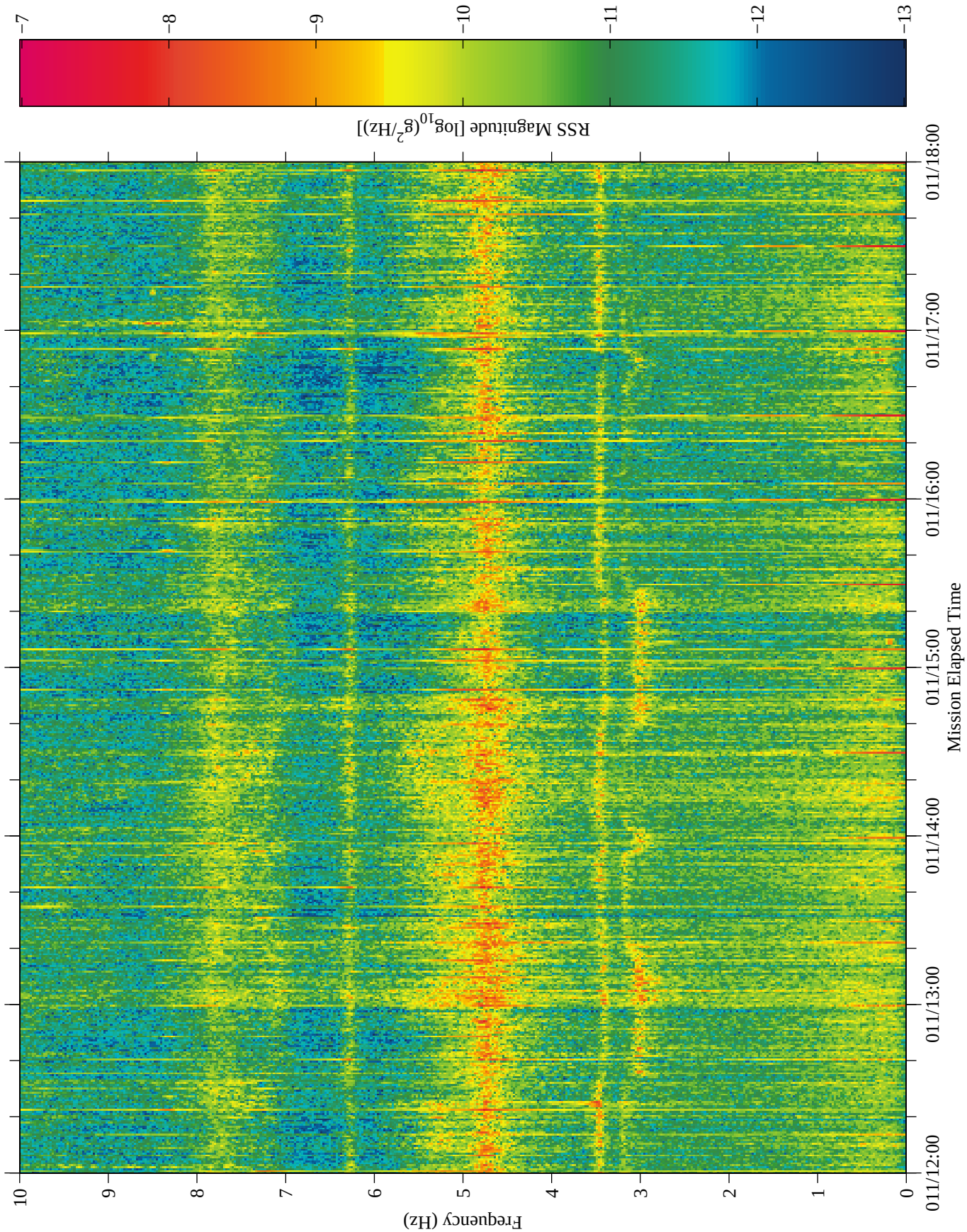

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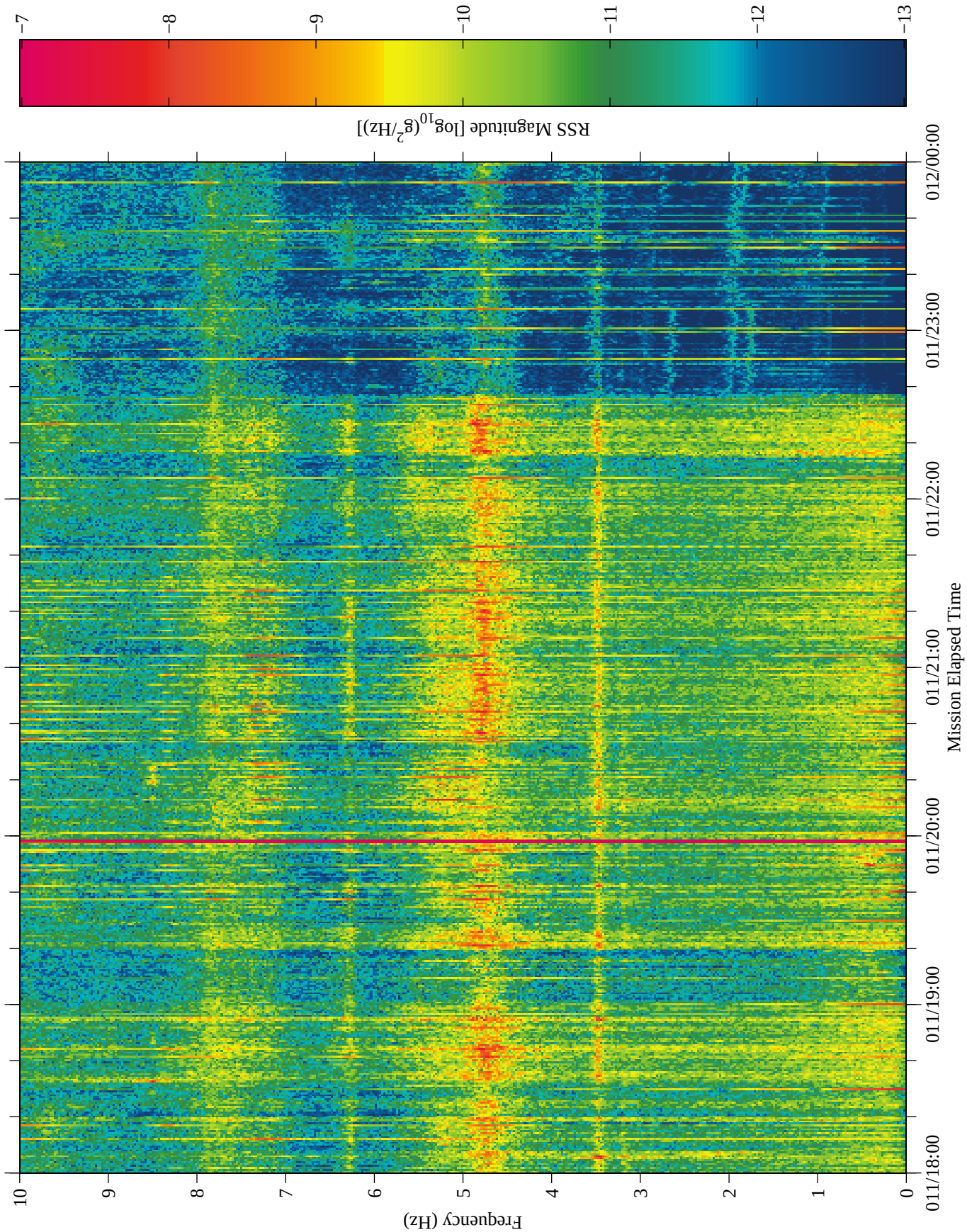

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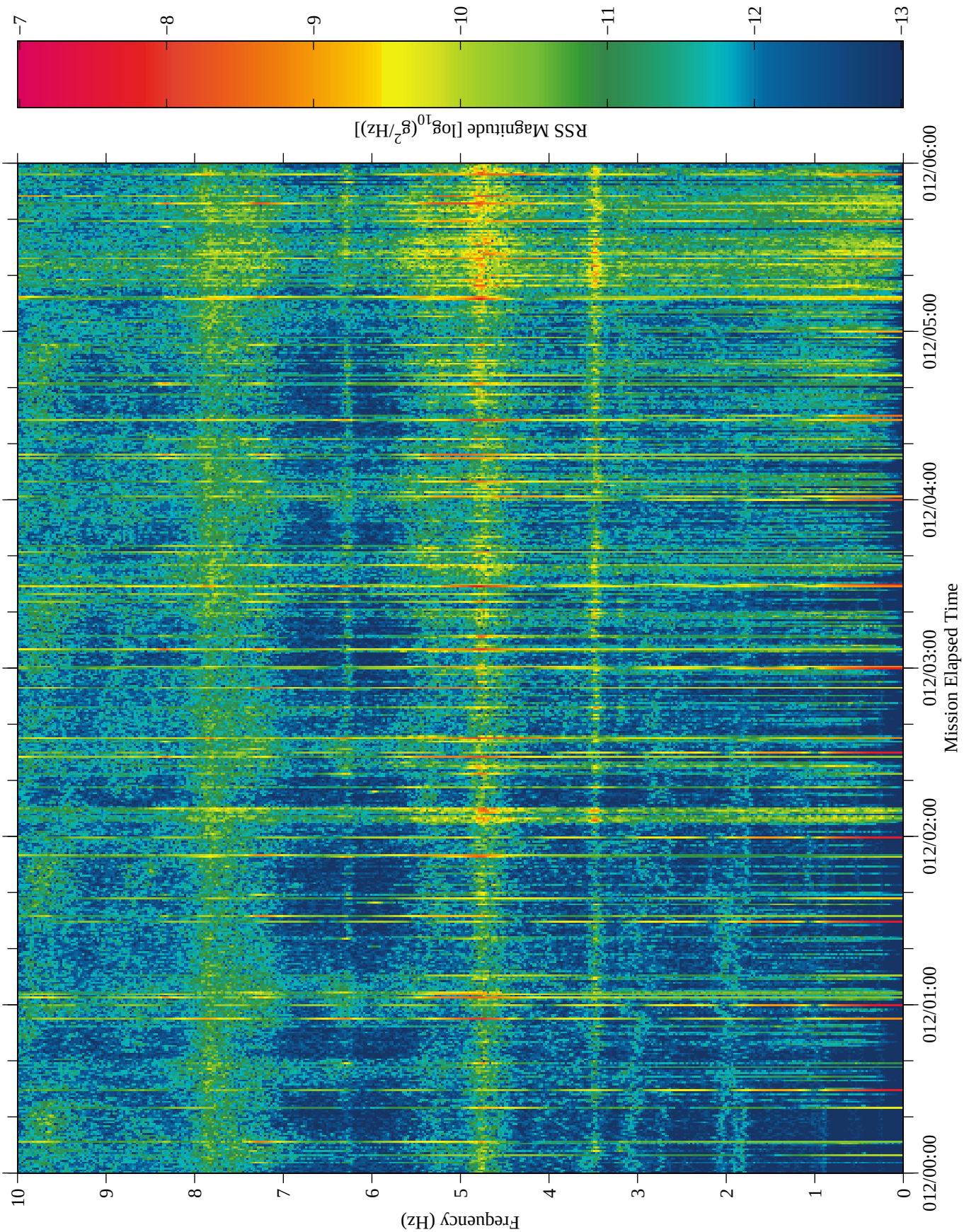

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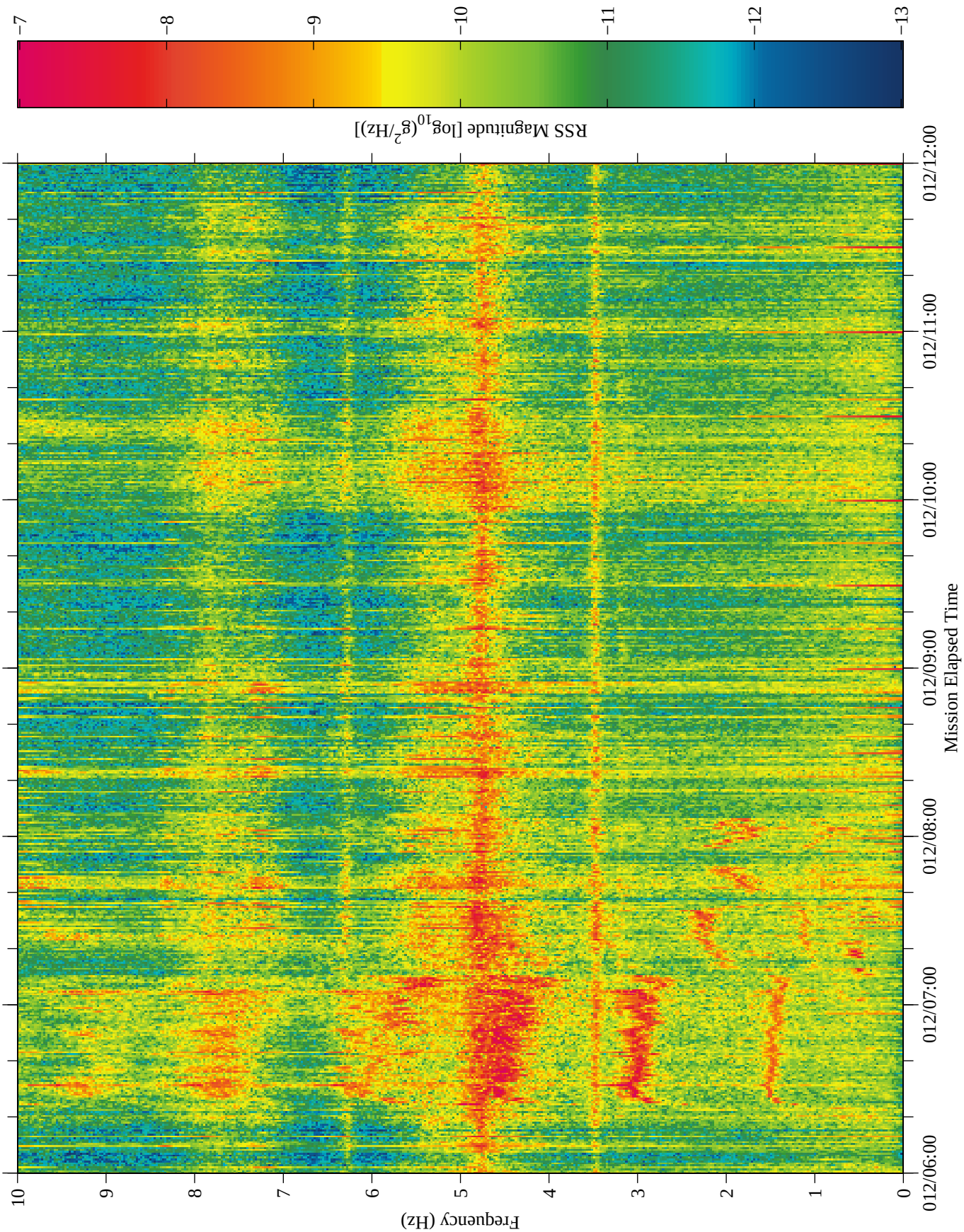

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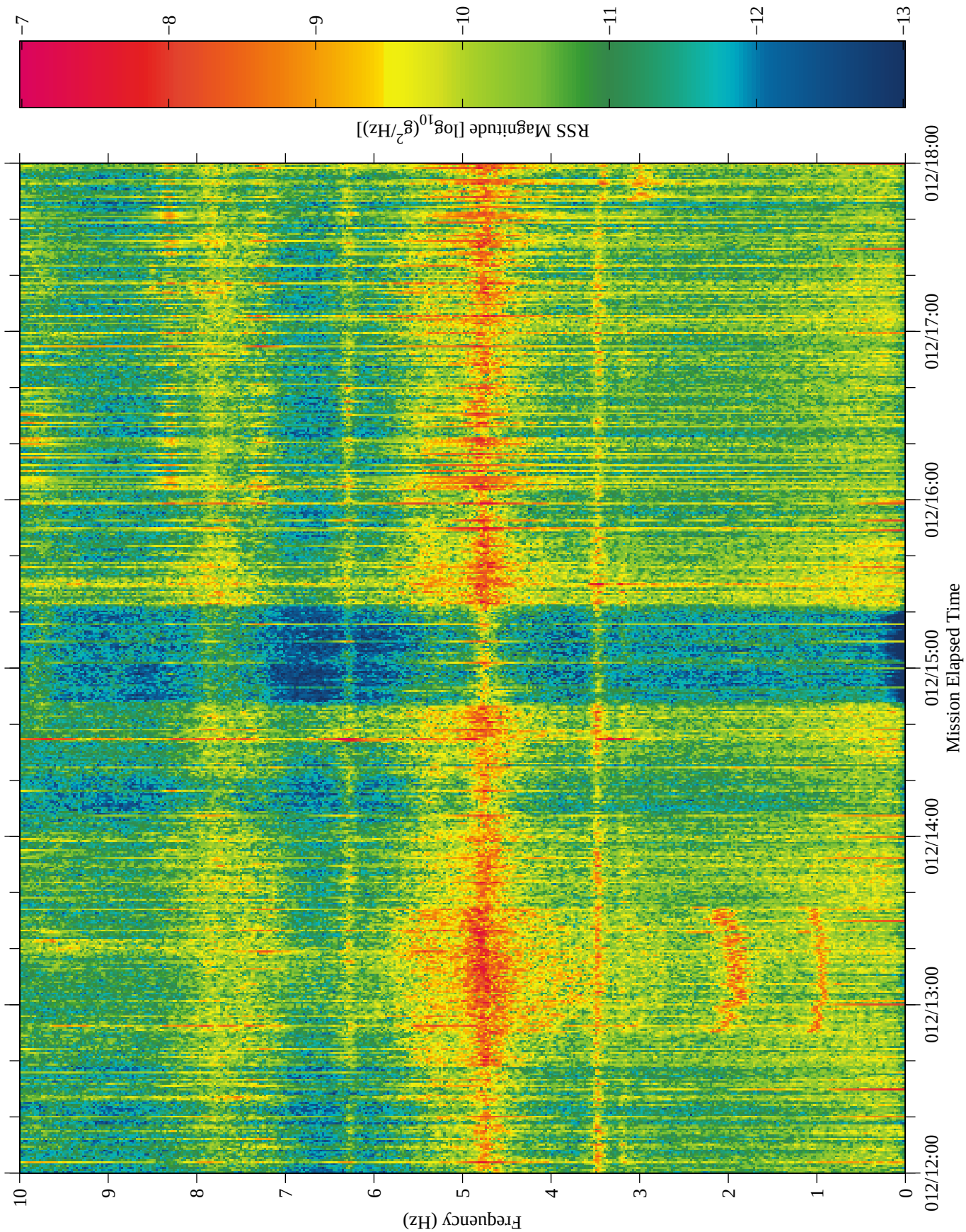

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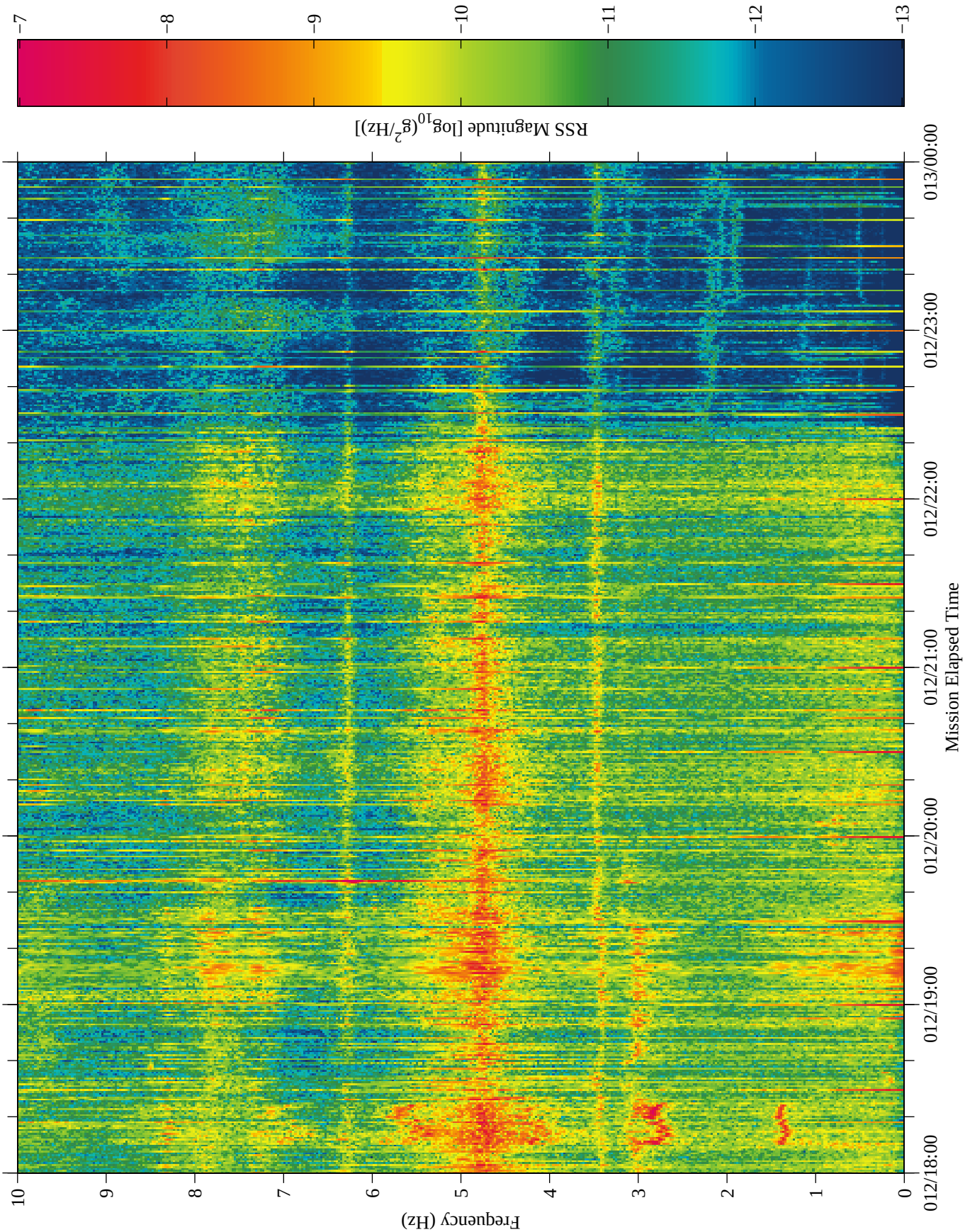

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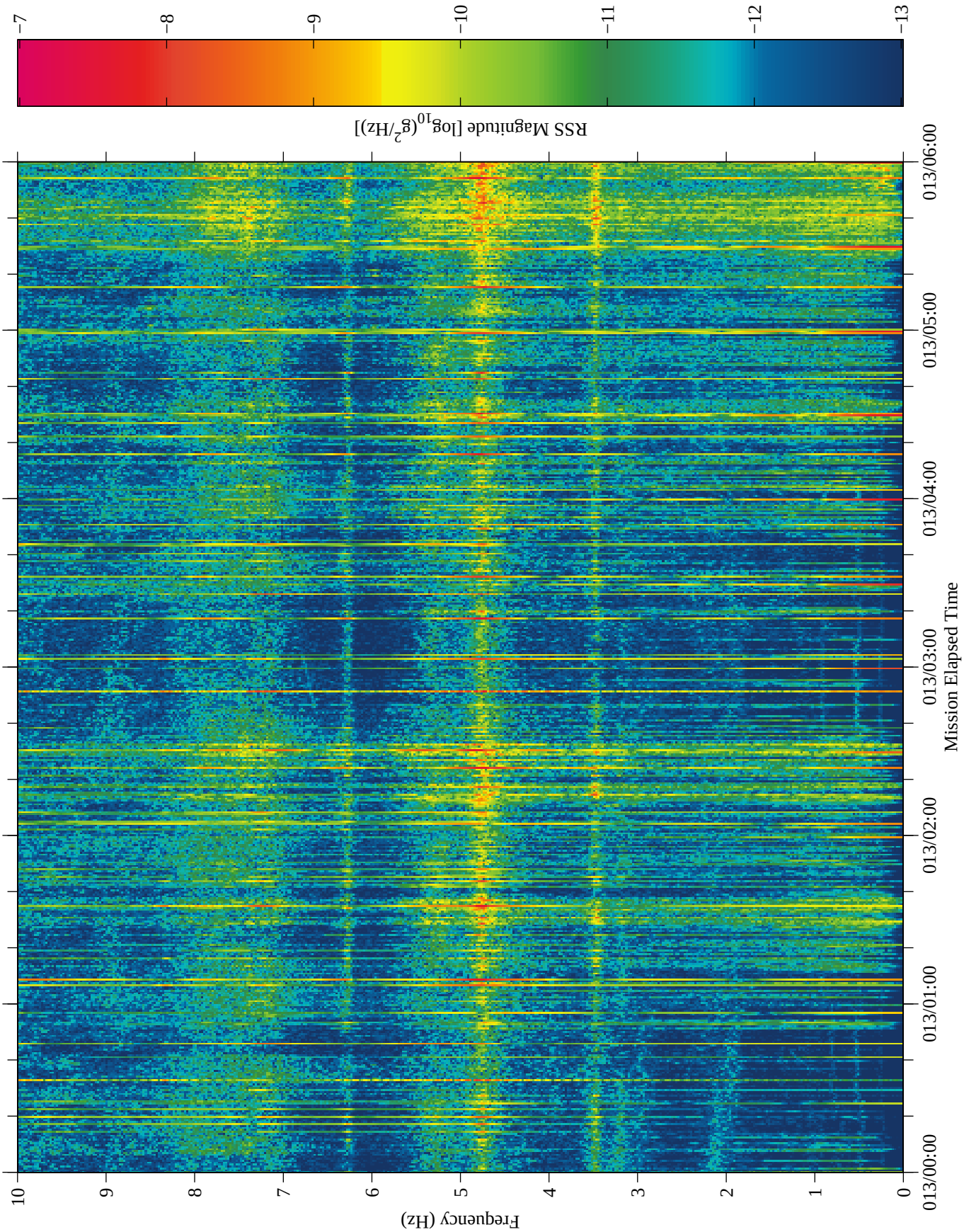

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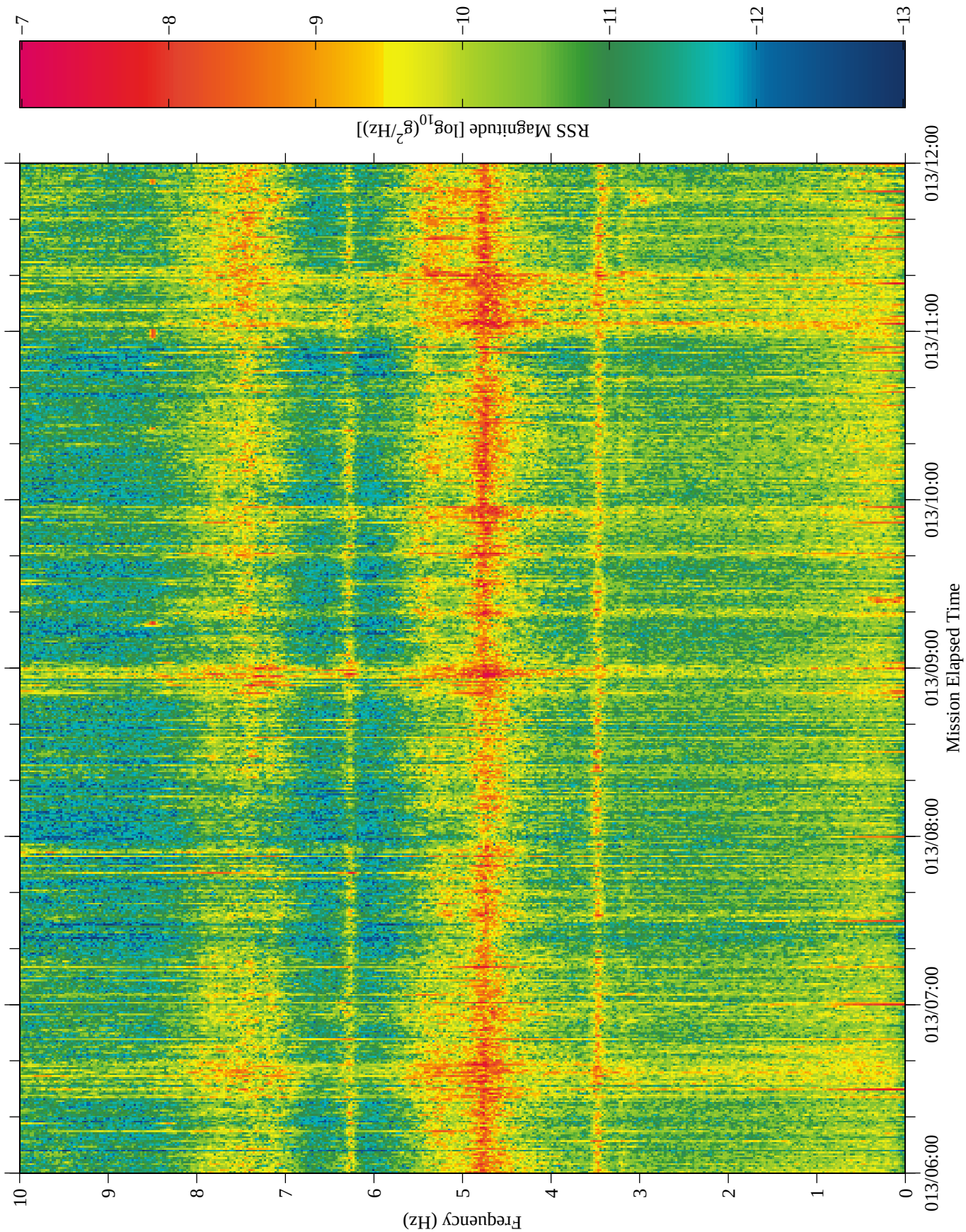

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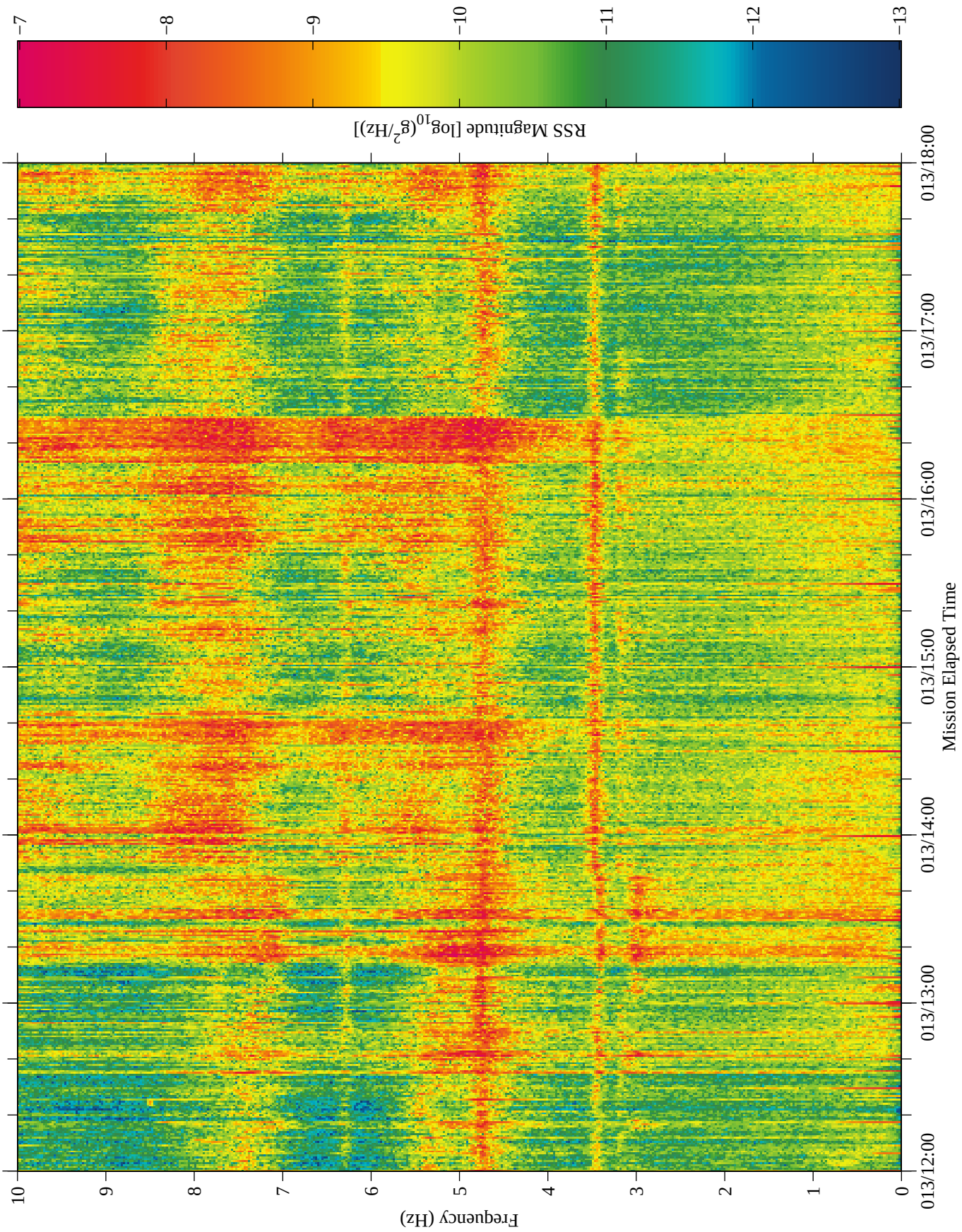

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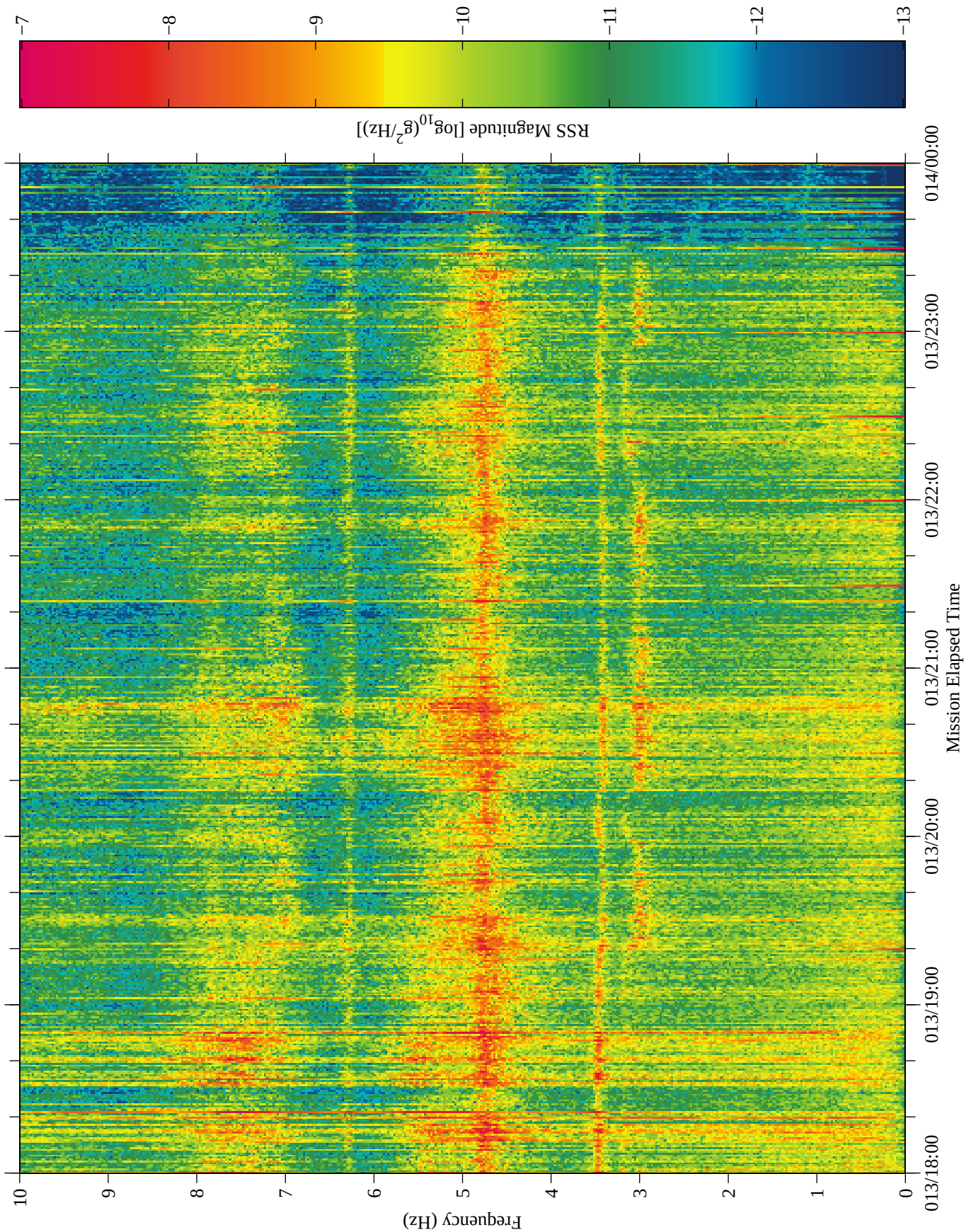

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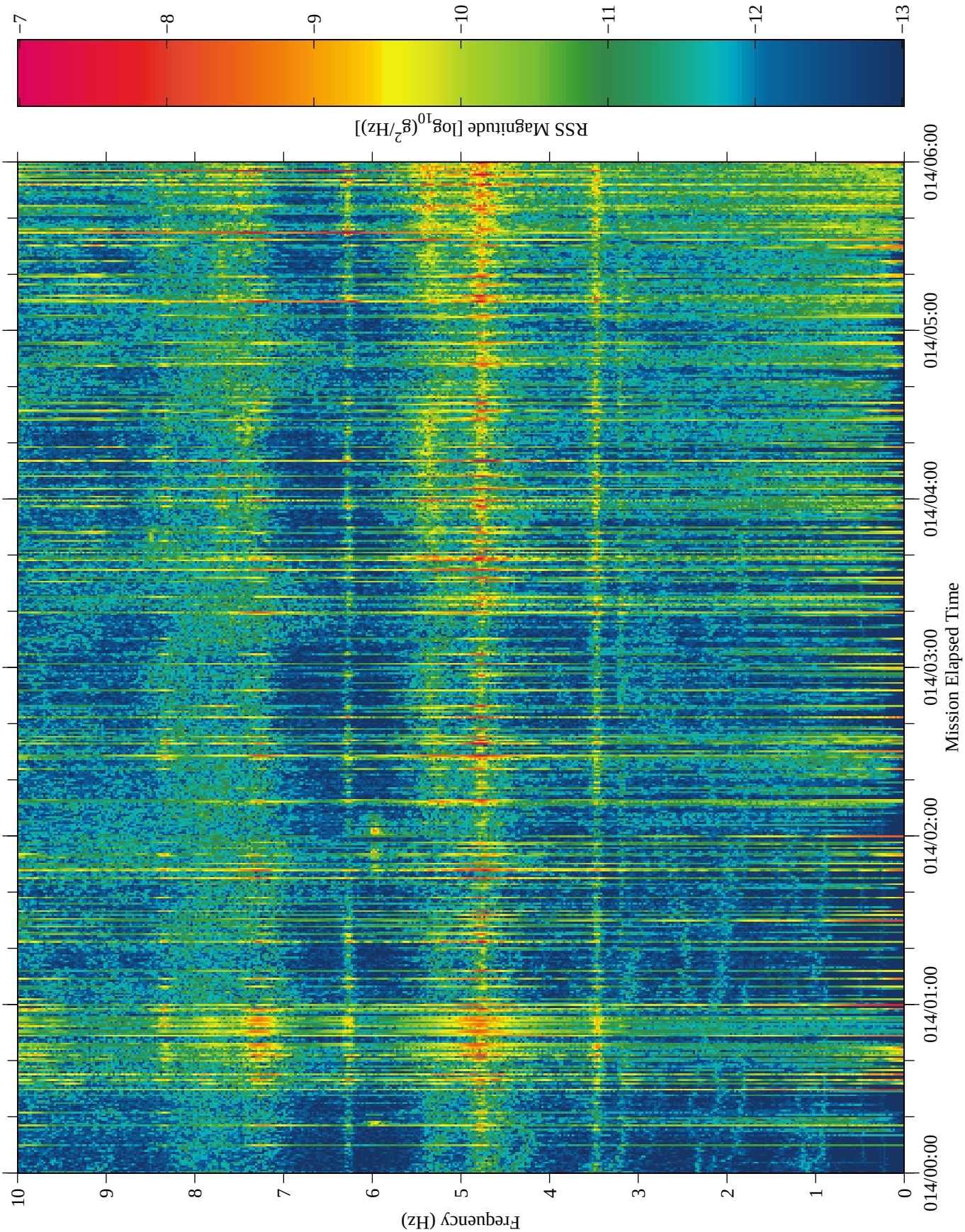

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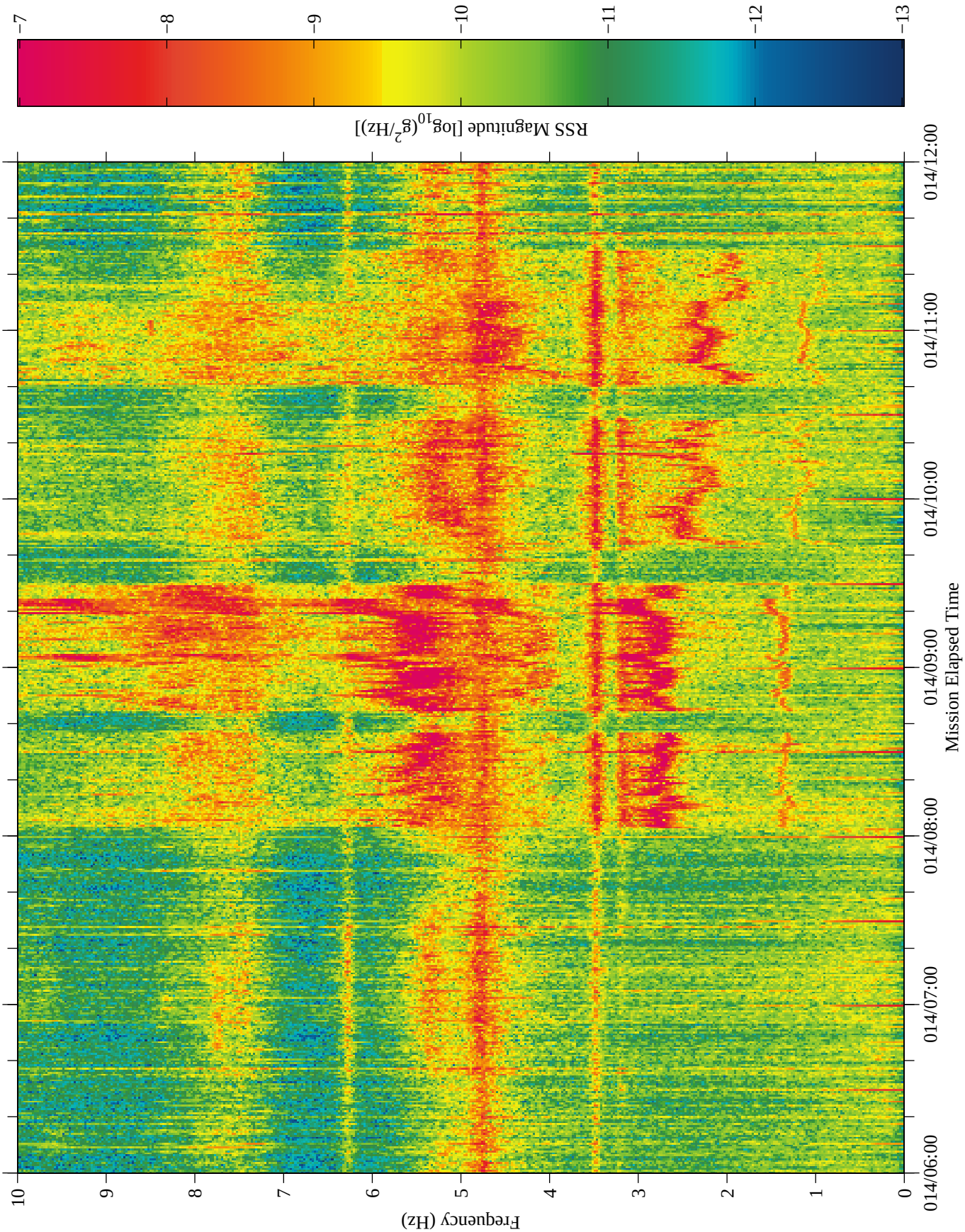

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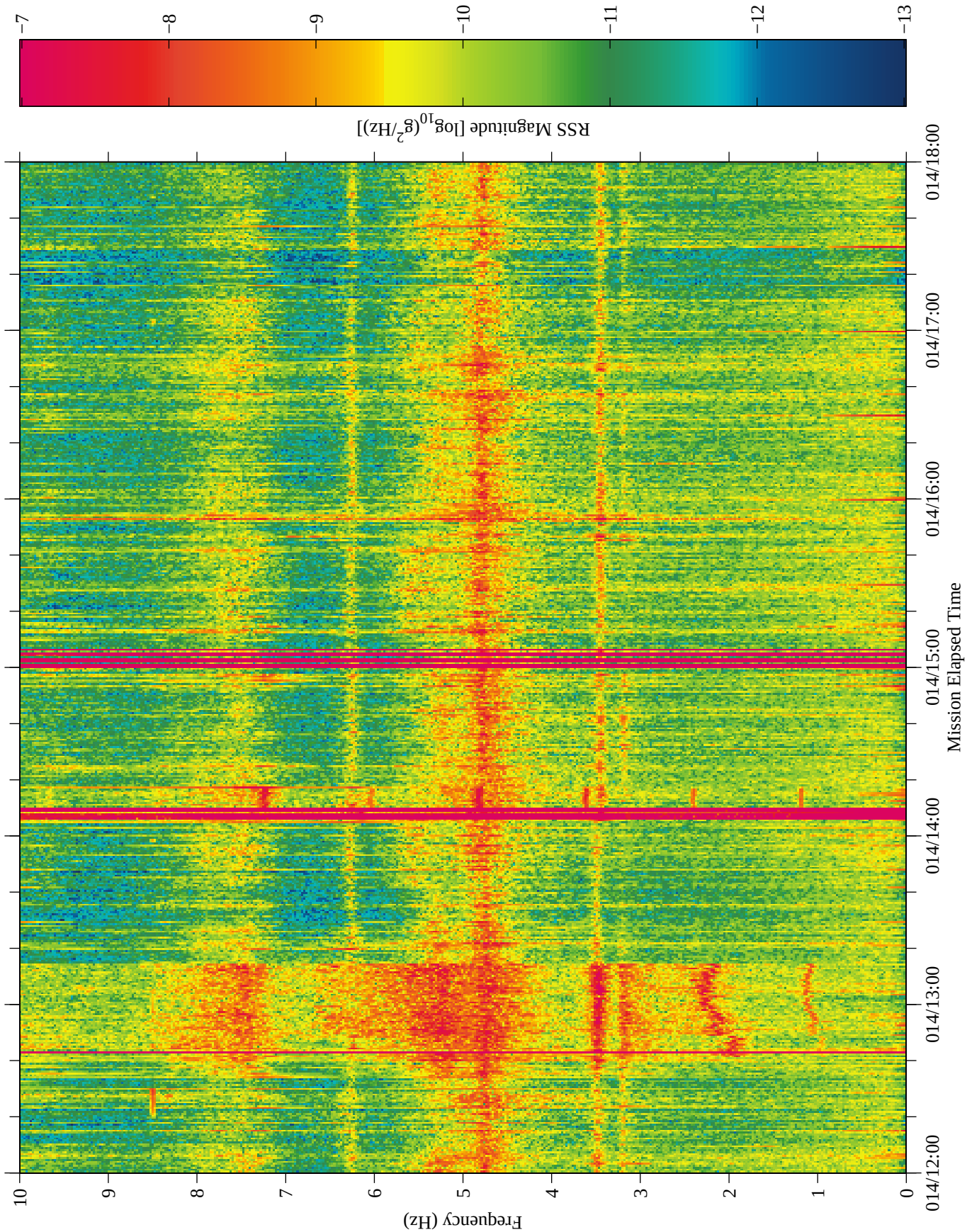

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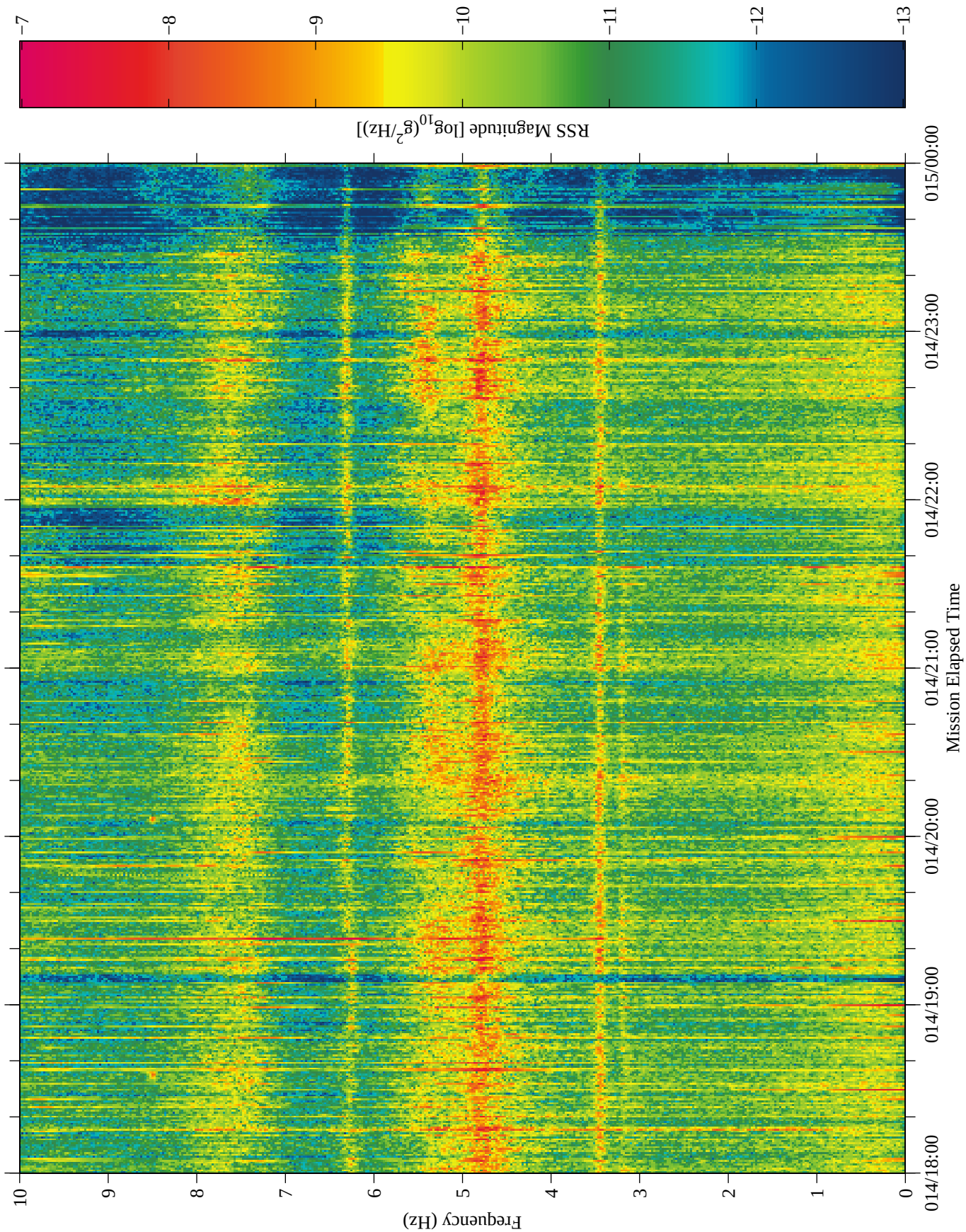

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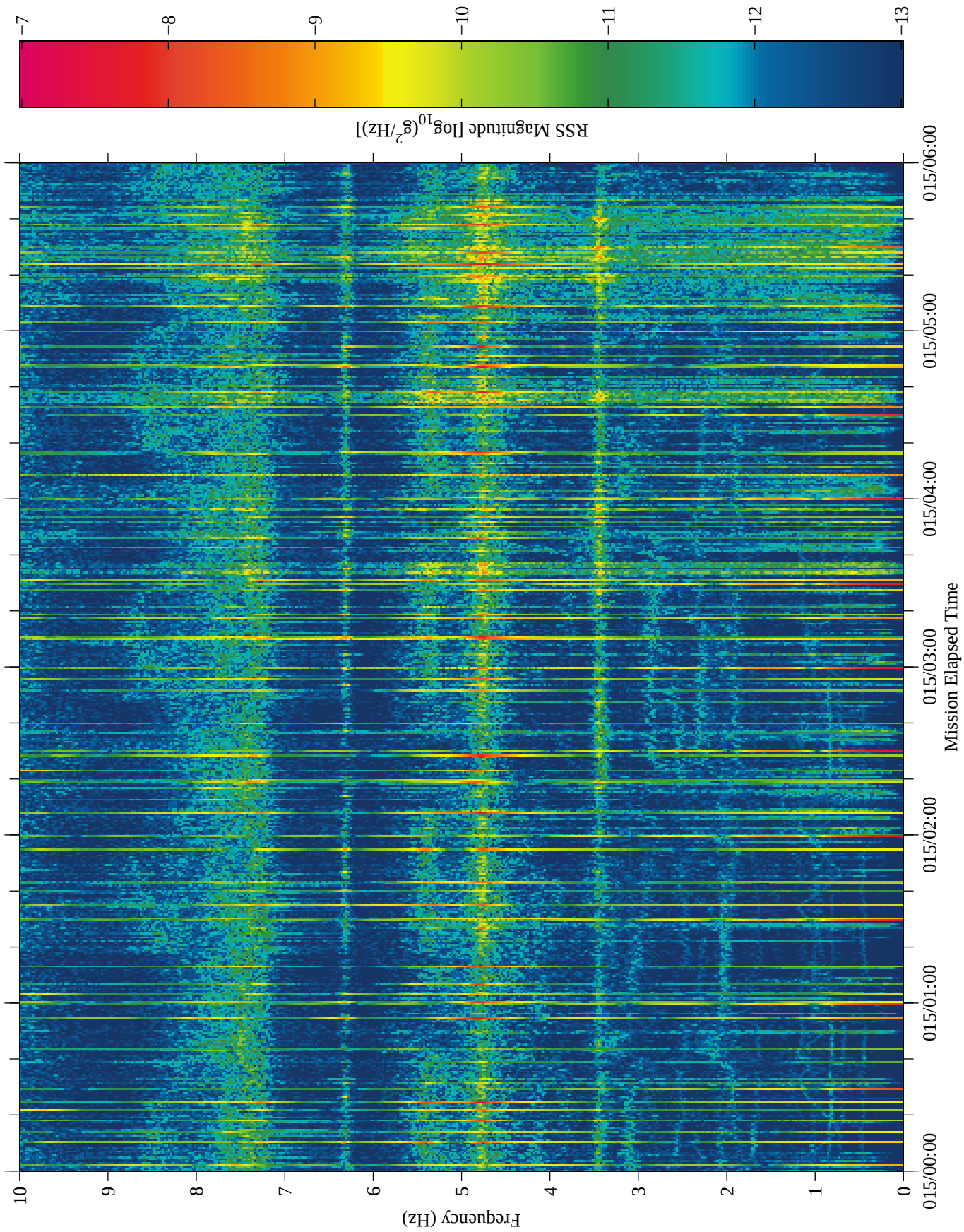

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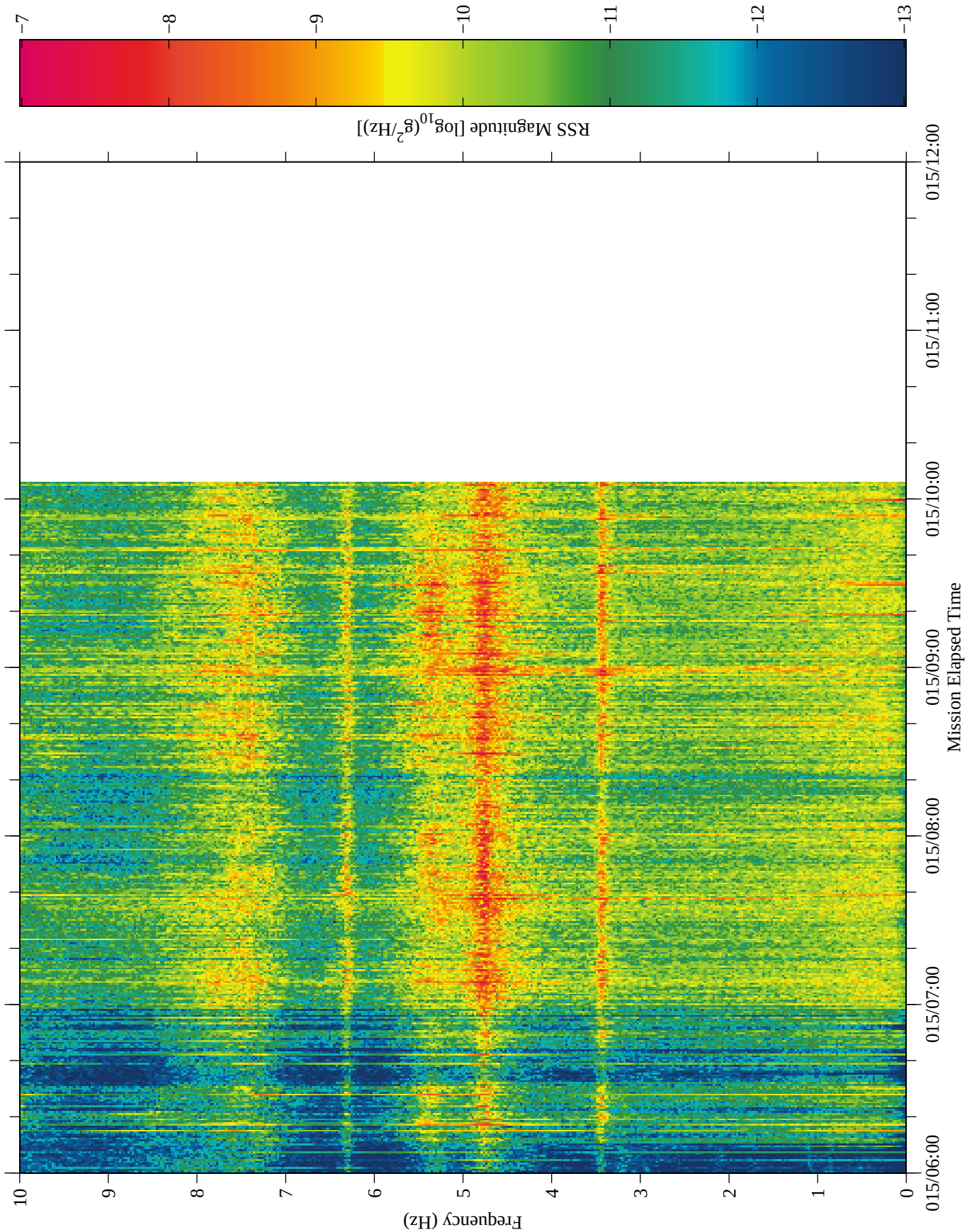

Figure 62: USMP−4, Unit F, TSH A

Appendix D: SAMS Color Spectrograms for Unit G, TSH B

The PIMS group has processed SAMS data from STS-87, Unit G, TSH B to produce the plots shown here. These data were collected at 250 samples per second, and a 100 Hz low pass filter was applied to the data by the SAMS unit prior to digitization. Prior to plot production, the raw SAMS data were compensated for gain changes, and then demeaned. Demeaning was accomplished by analyzing individual sections with a nominal length of 30 minutes. Users who are interested in further details for either of these operations are encouraged to contact the PIMS group.

Color spectrograms are used to show how the microgravity environment varies in intensity with respect to both the time and frequency domains. These spectrograms are provided as an overview of the frequency characteristics of the SAMS data during the mission. Each spectrogram is a composite of six hour's worth of data. The time resolution used to compute the spectrograms seen here is 16.4 seconds. This corresponds to a frequency resolution of 0.06 Hz.

In order to produce the spectrogram image, PSDs were computed for successive time intervals (the length of the interval is equal to the time resolution). For the PSD computation, a Hanning window was applied. In order to combine all three axes into a single plot to show an overall level, a vector magnitude (VM) operation was performed. Stated mathematically:

$$VM_k = \sqrt{PSD_{x_k}^2 + PSD_{y_k}^2 + PSD_{z_k}^2} \; .$$

By imaging the base 10 logarithm ($\log_{10}$) magnitude as a color and stacking successive PSDs from left to right, variations of PSD magnitude and frequency are shown as a function of time. Colors are assigned to discrete magnitude ranges, so that there are 207 colors assigned to the entire range of magnitudes shown.

The colorbar limits are chosen in order to minimize saturation in a given set of spectrogram plots. Data which fall outside of these limits will be imaged as either the highest or lowest magnitude, depending on which side they have saturated. If an area of interest seems to be saturated, care should be taken because the actual values may lie above or below the color mapping shown on the plot.

Due to the nature of spectrograms, care should be taken to not merely read a color's numeric value as being the "amount" of acceleration that is present at a given frequency. In order to get this type of information, the PSDs must be integrated between two frequencies. These frequencies (lower and upper) form the band of interest. The result of this integration is the g_{RMS} acceleration level in the $\left[f_{lower}, f_{upper}\right]$ band. The PIMS group is able to provide this type of analysis on a per-request basis.

Plot gaps (if any exist) are shown by either white or dark blue areas on the page. If a plot gap exists for an entire plot (or series of successive plots), a comment is placed on the page to let the user know there is a gap in the data. These "no data available" comments will not show exact times for which the data are not available, but will only indicate missing plots.

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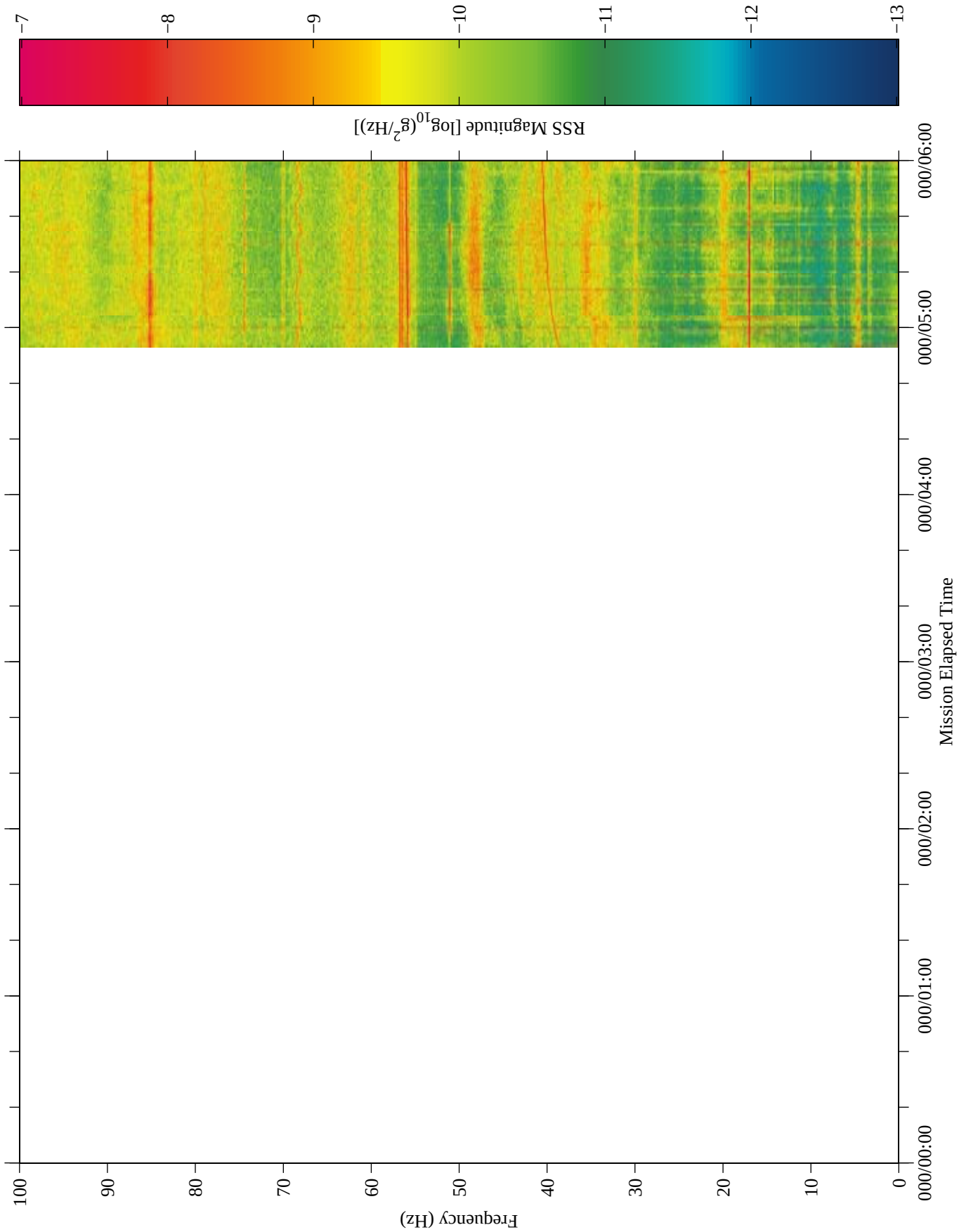
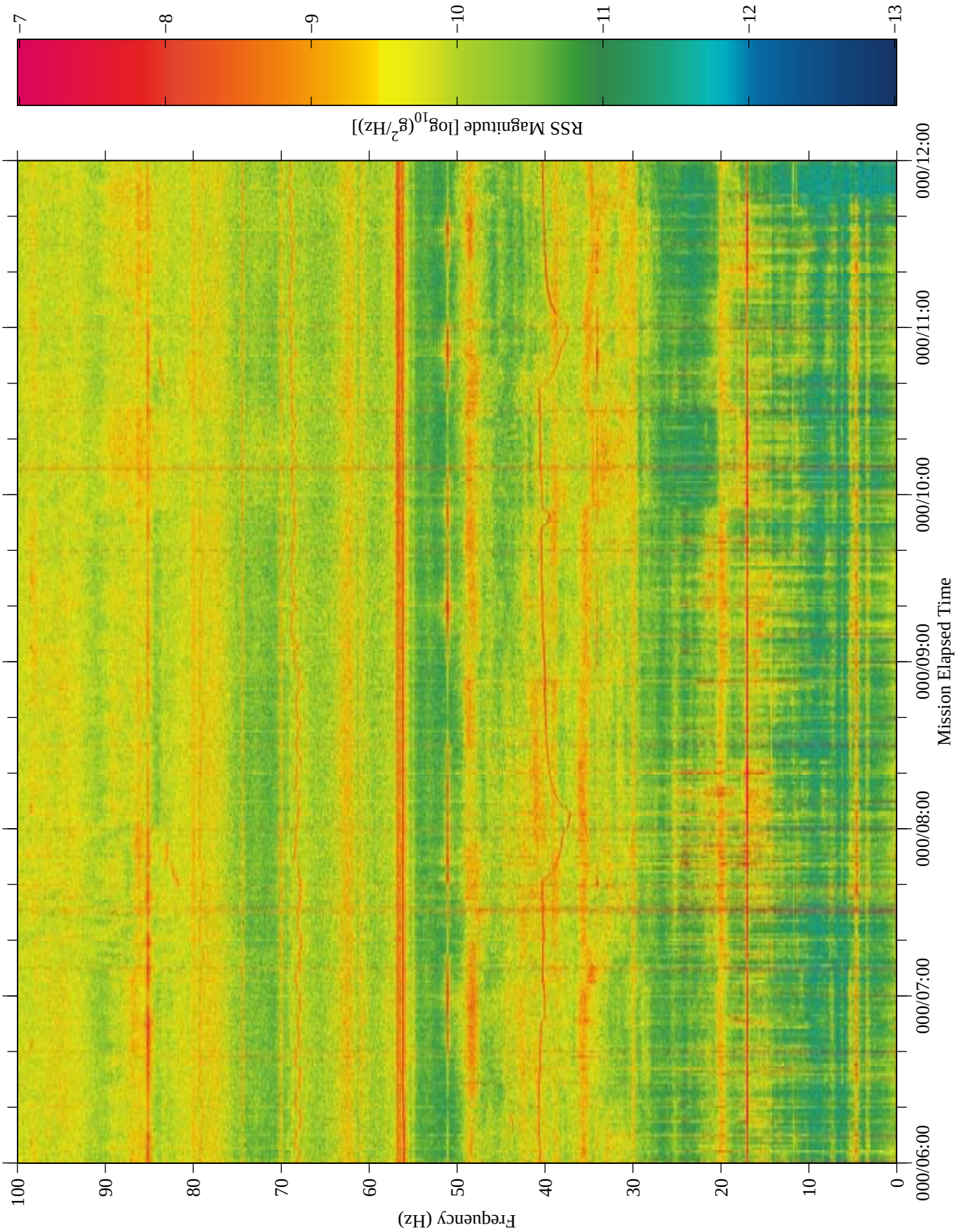


Figure 1: USMP−4, Unit G, TSH B



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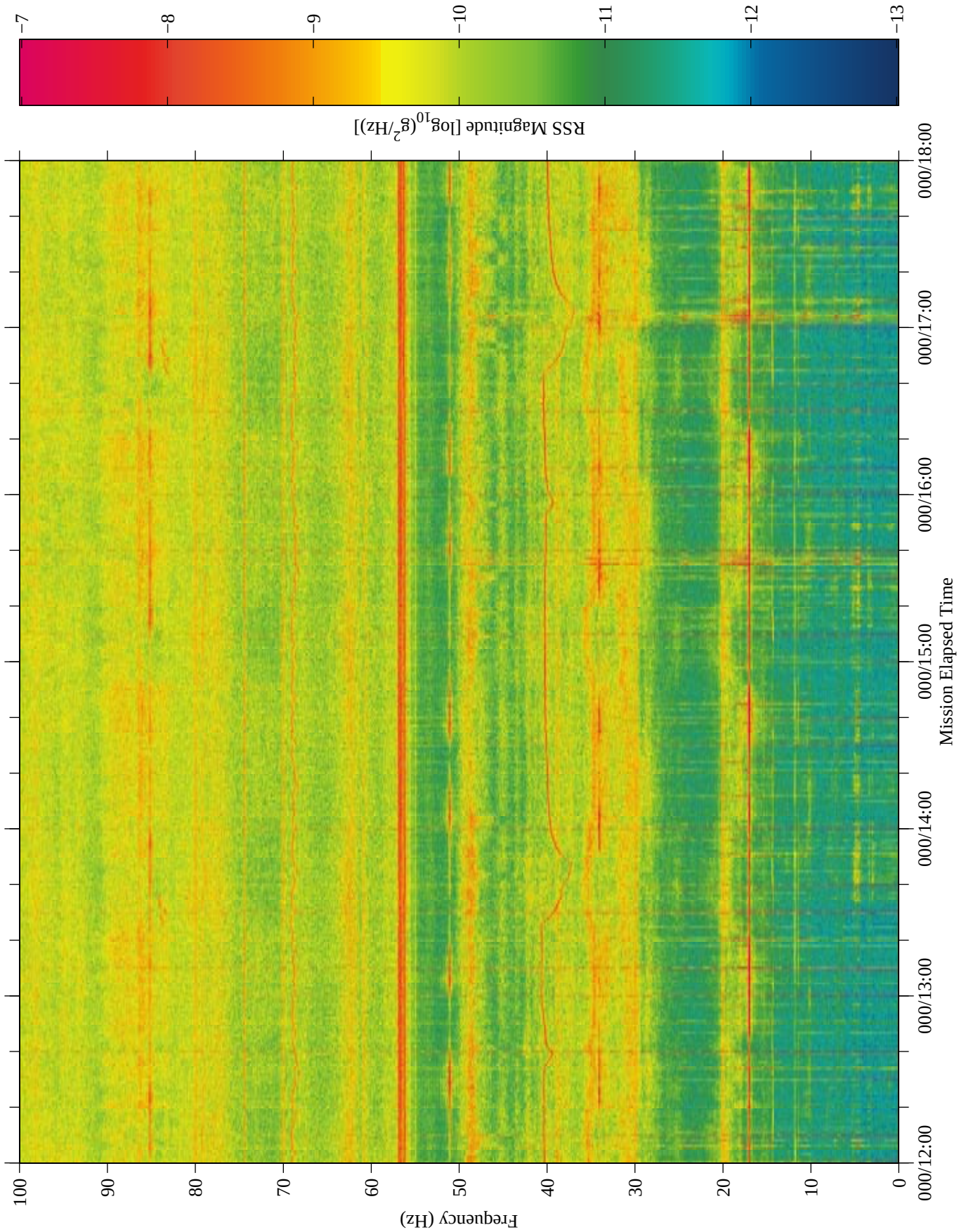

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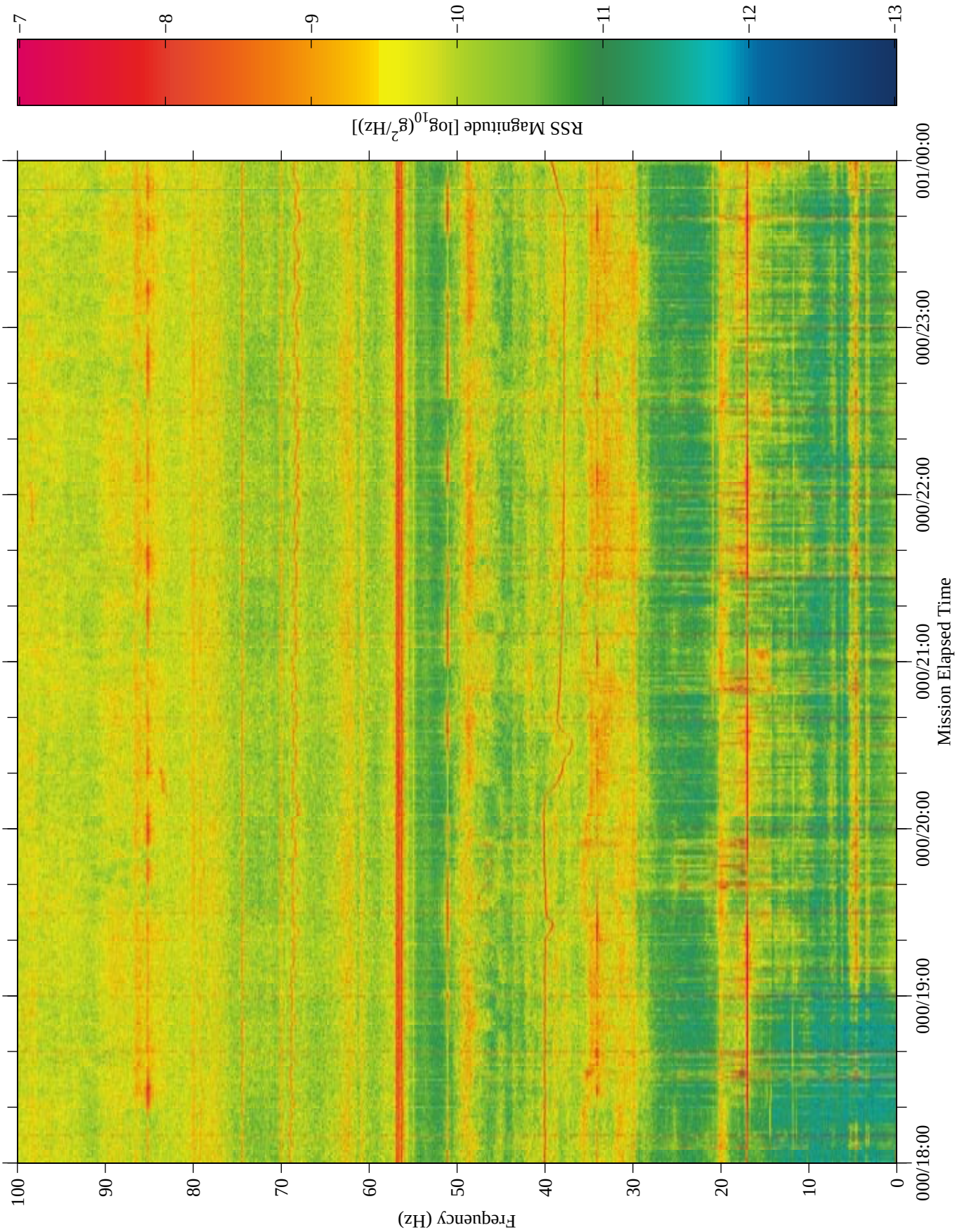

Figure 4: USMP−4, Unit G, TSH B

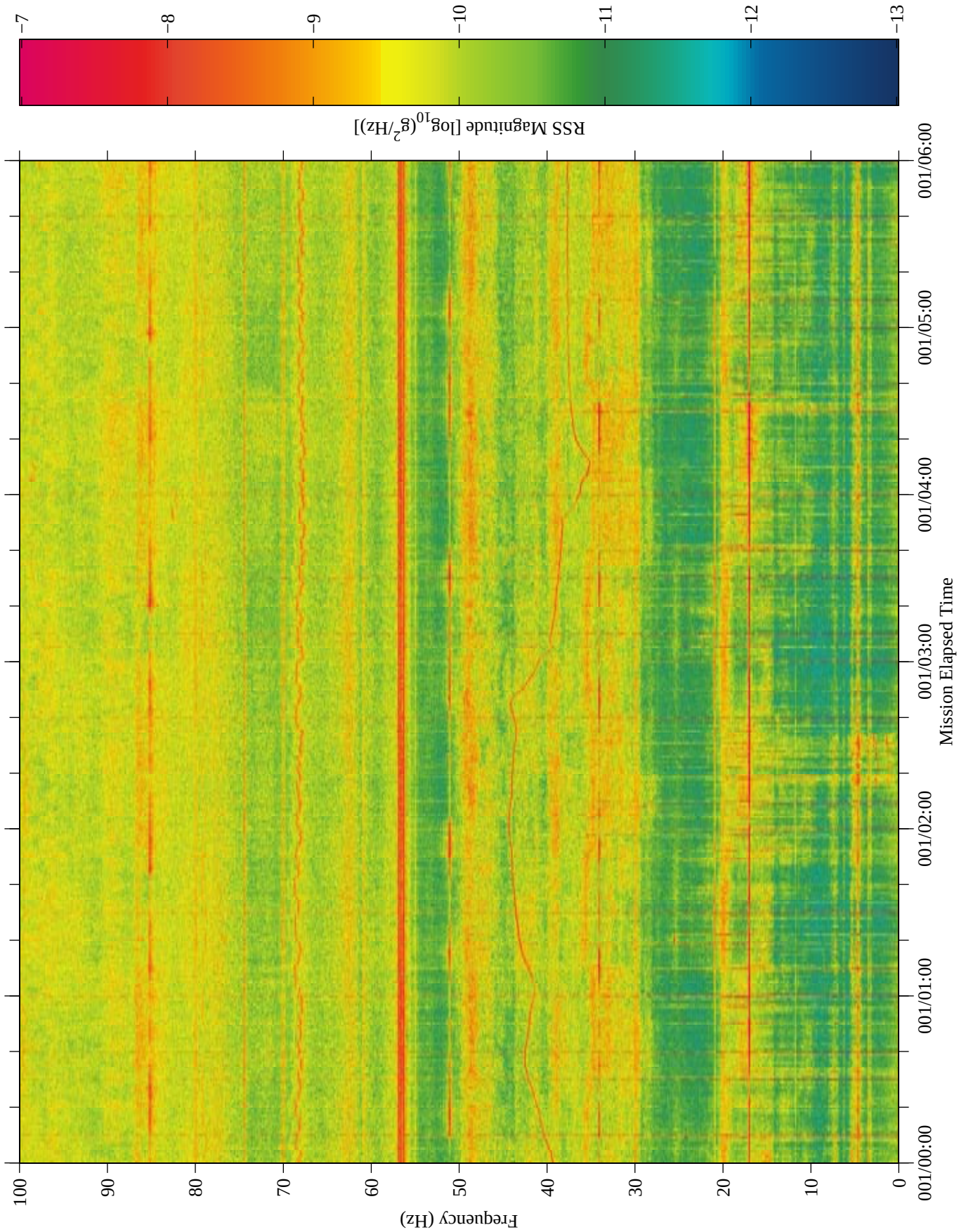

Figure 5: USMP−4, Unit G, TSH B

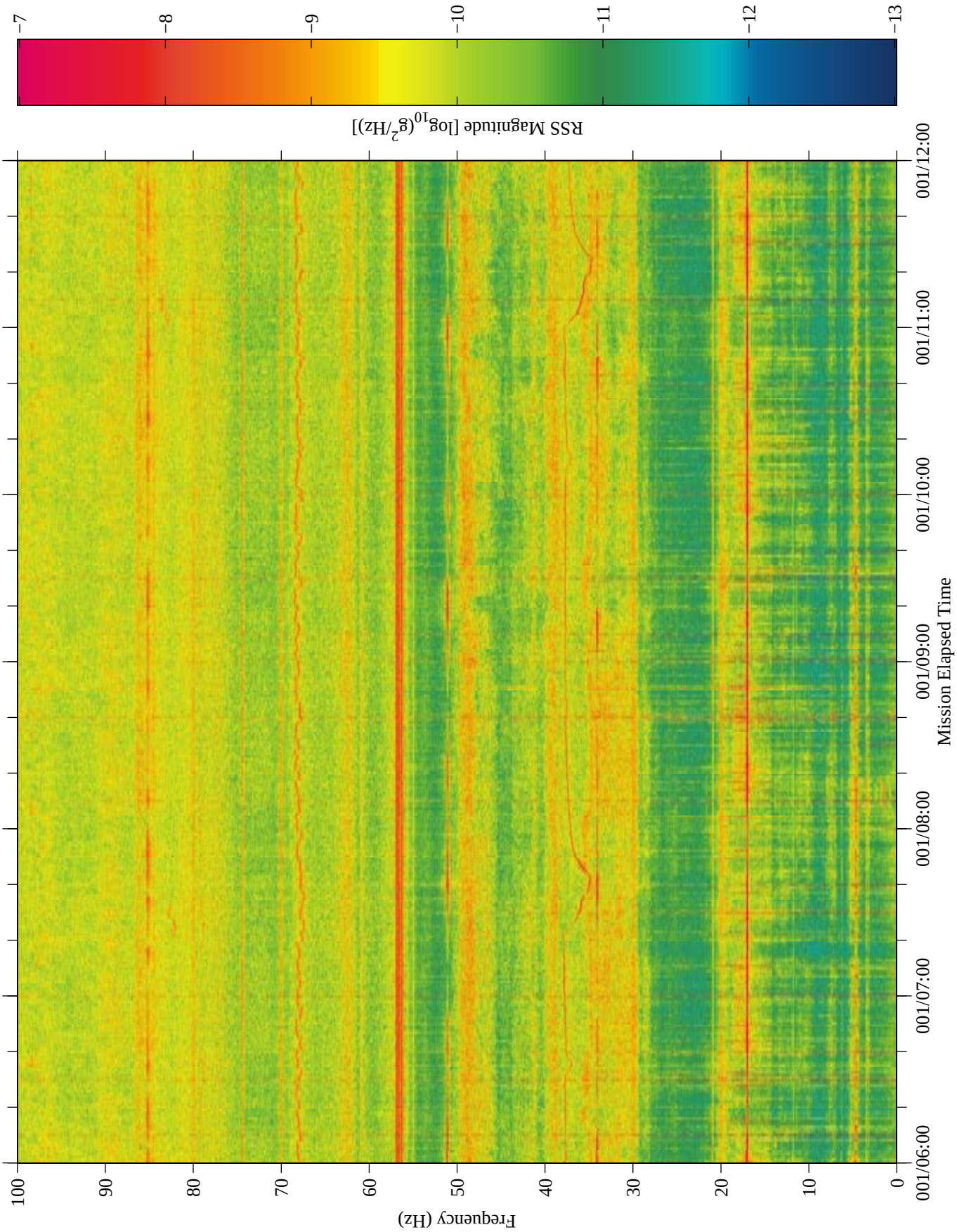

Figure 6: USMP−4, Unit G, TSH B

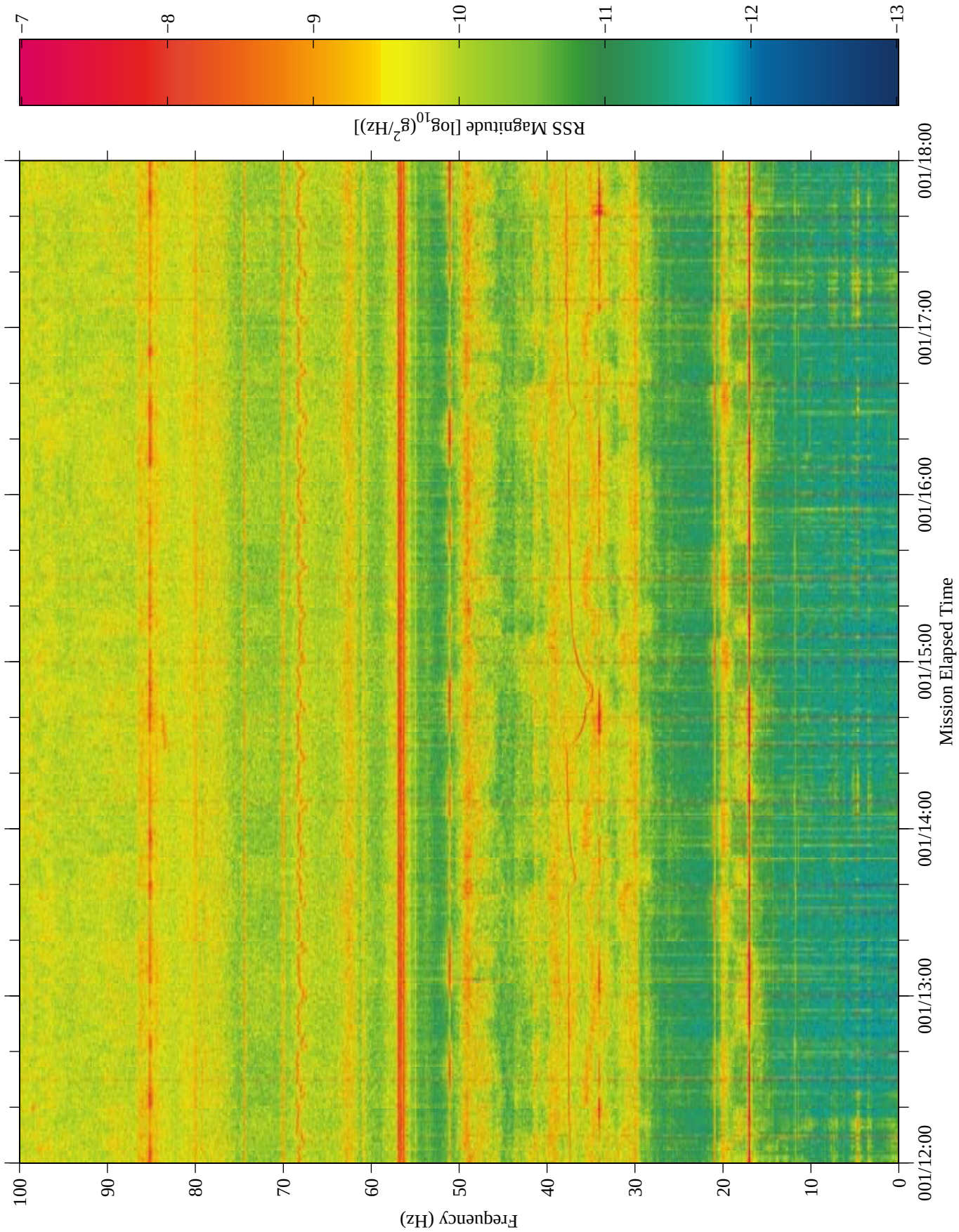

Figure 7: USMP−4, Unit G, TSH B

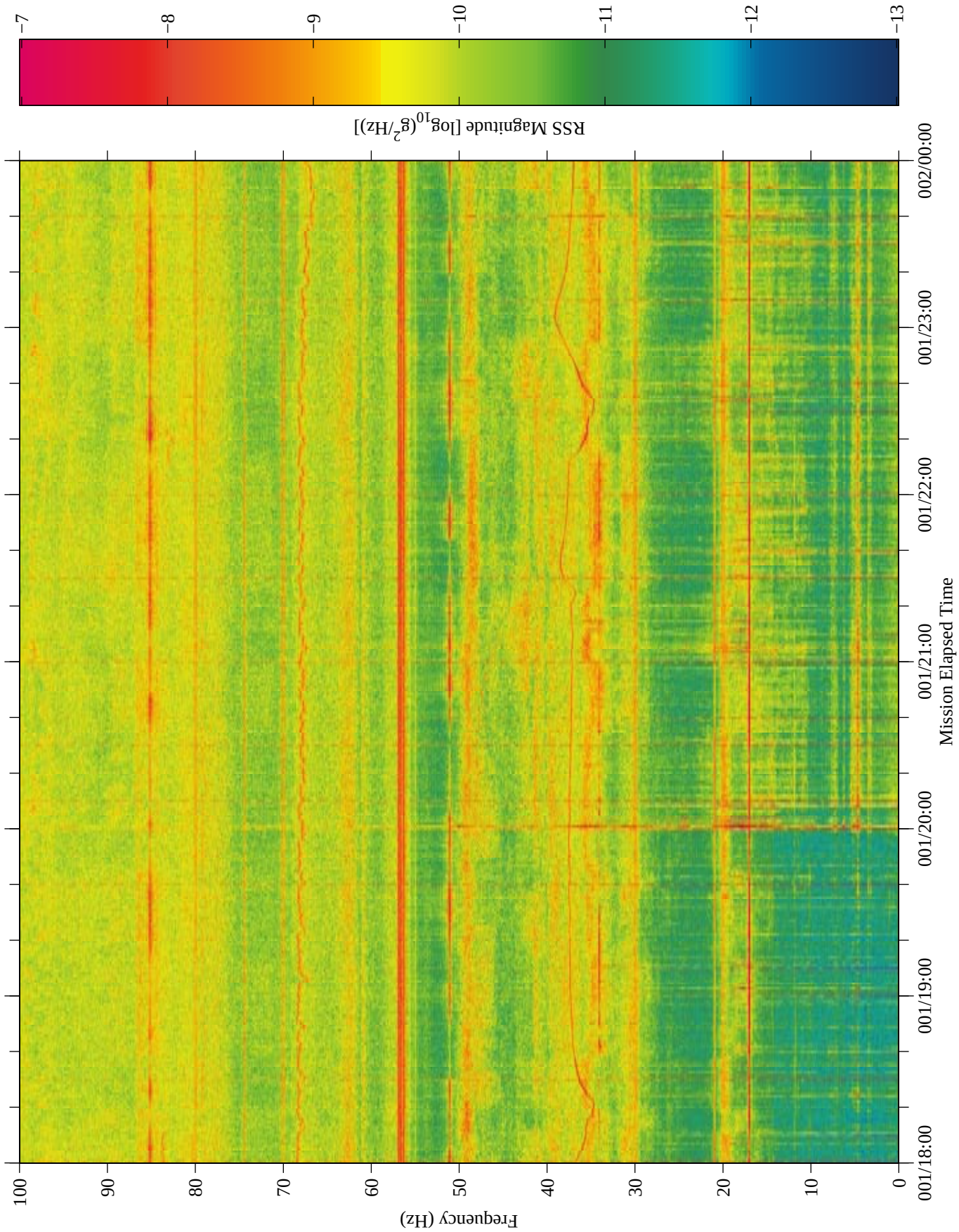

Figure 8: USMP−4, Unit G, TSH B

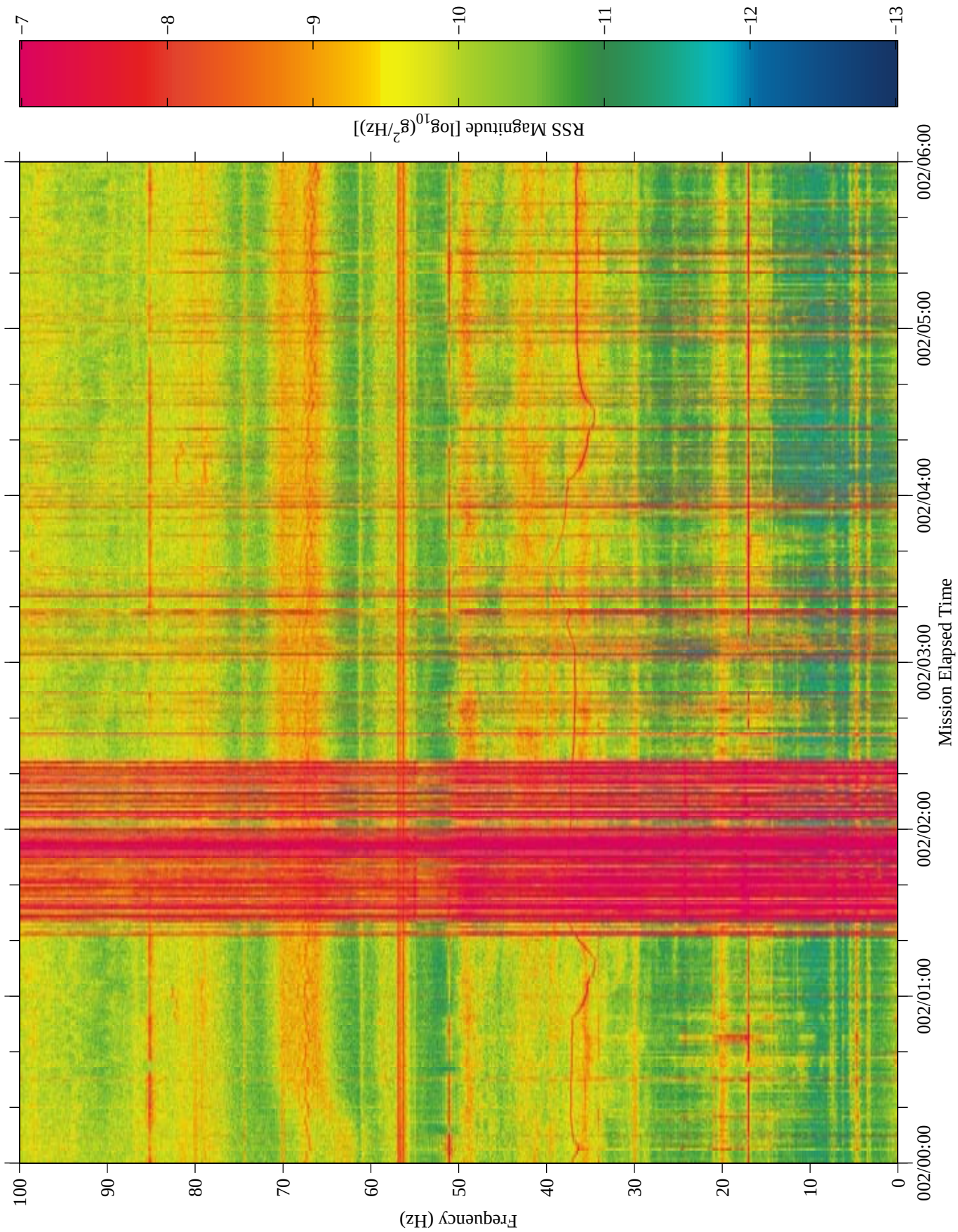

Figure 9: USMP−4, Unit G, TSH B

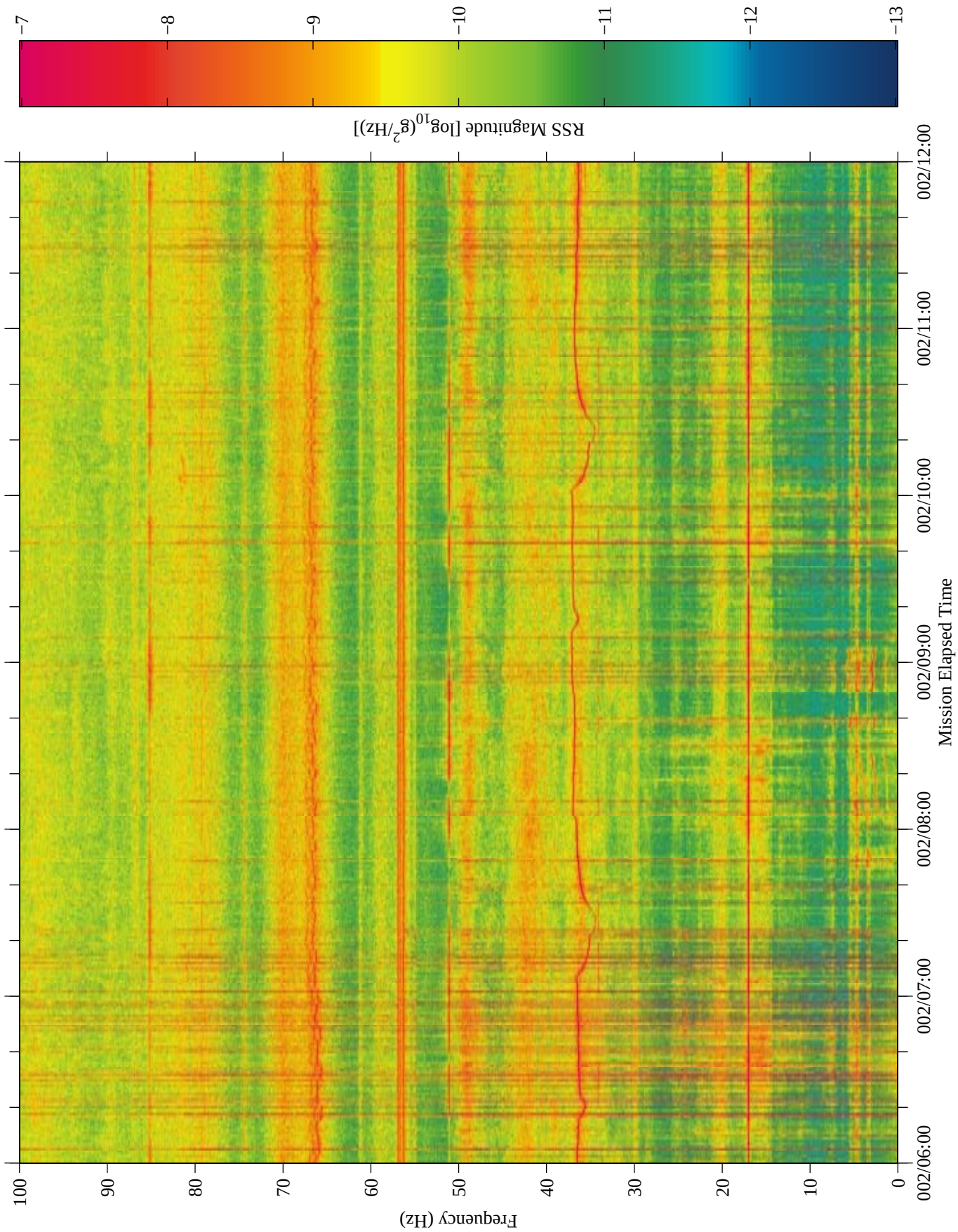

Figure 10: USMP−4, Unit G, TSH B

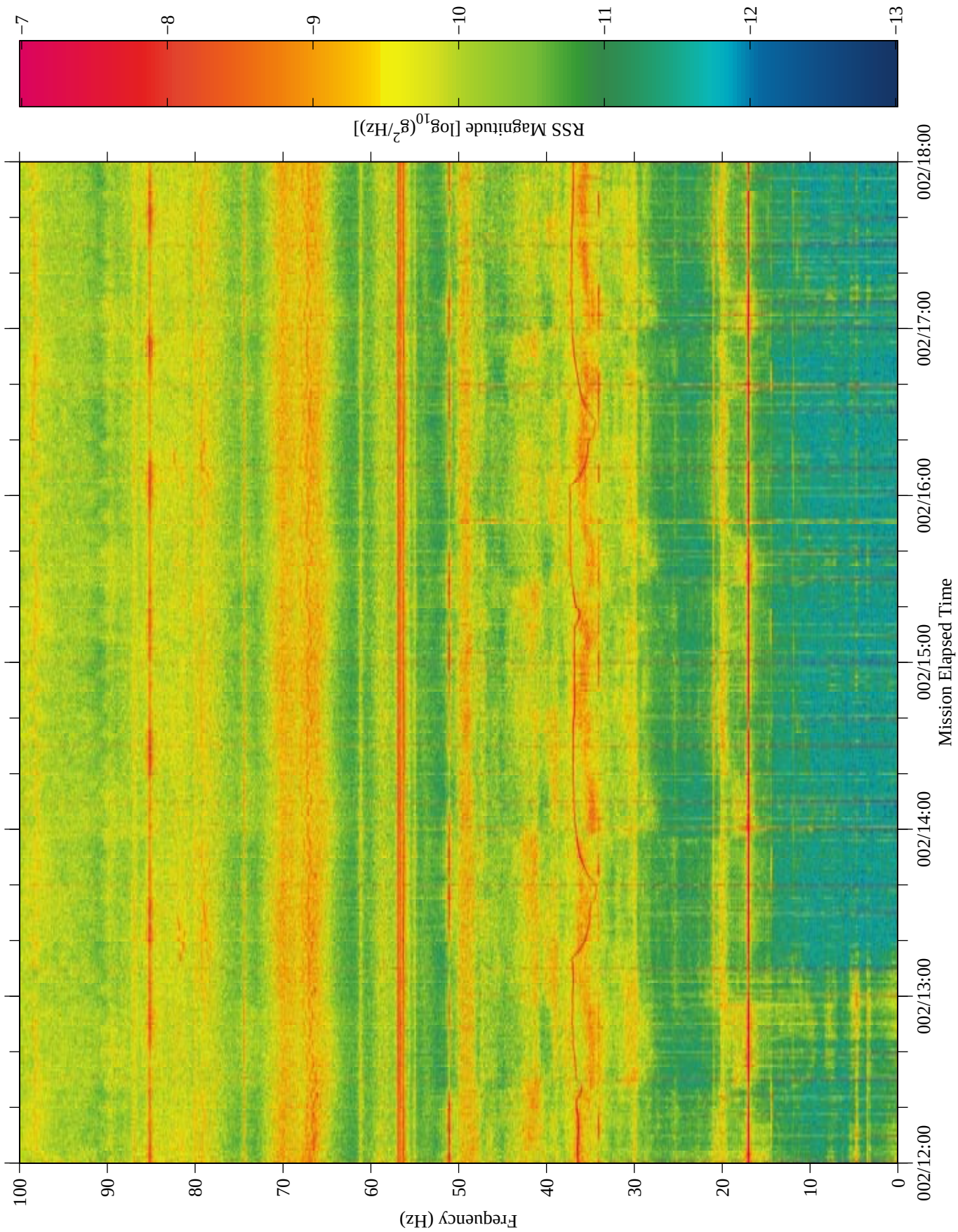

Figure 11: USMP−4, Unit G, TSH B

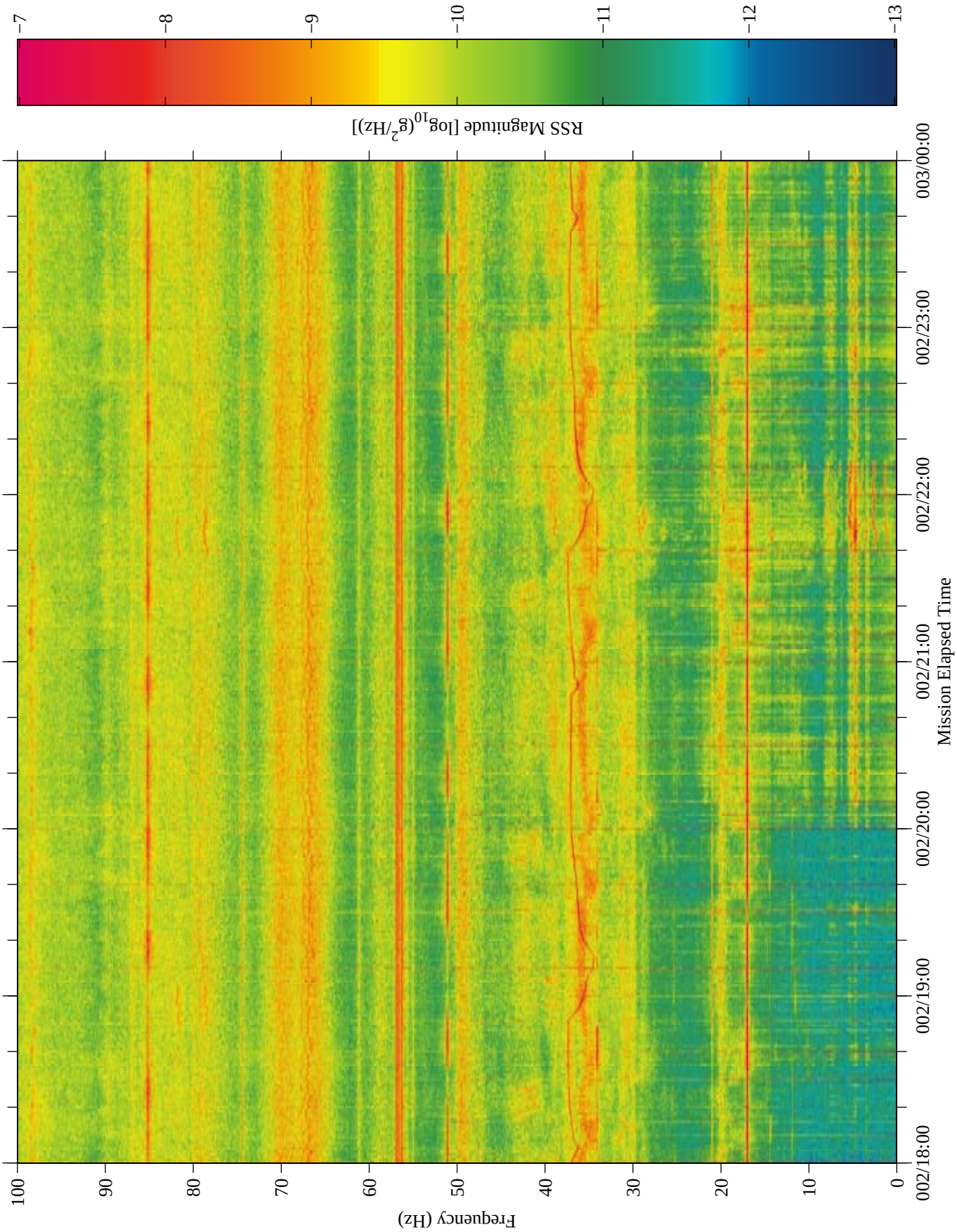

Figure 12: USMP−4, Unit G, TSH B

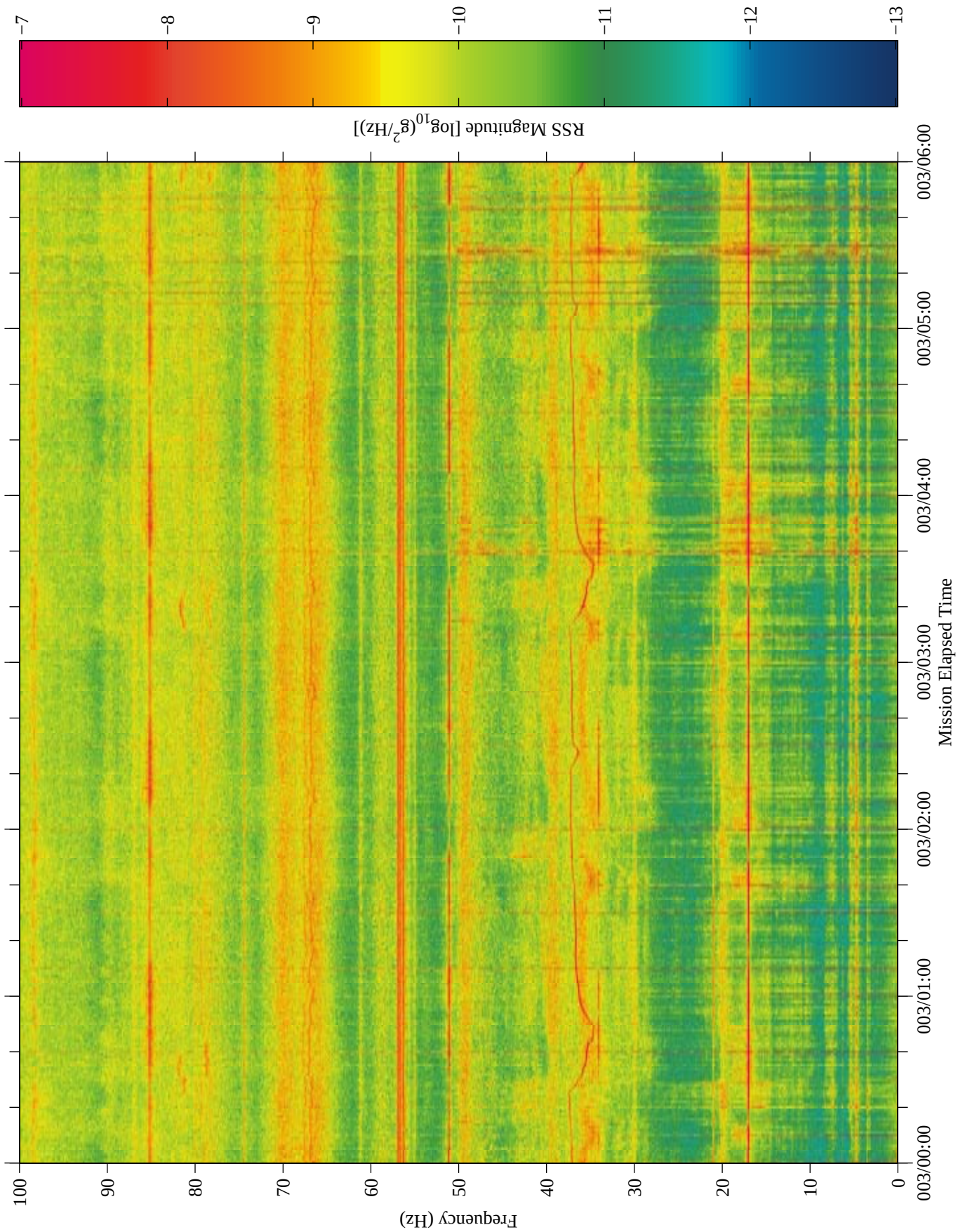

Figure 13: USMP−4, Unit G, TSH B

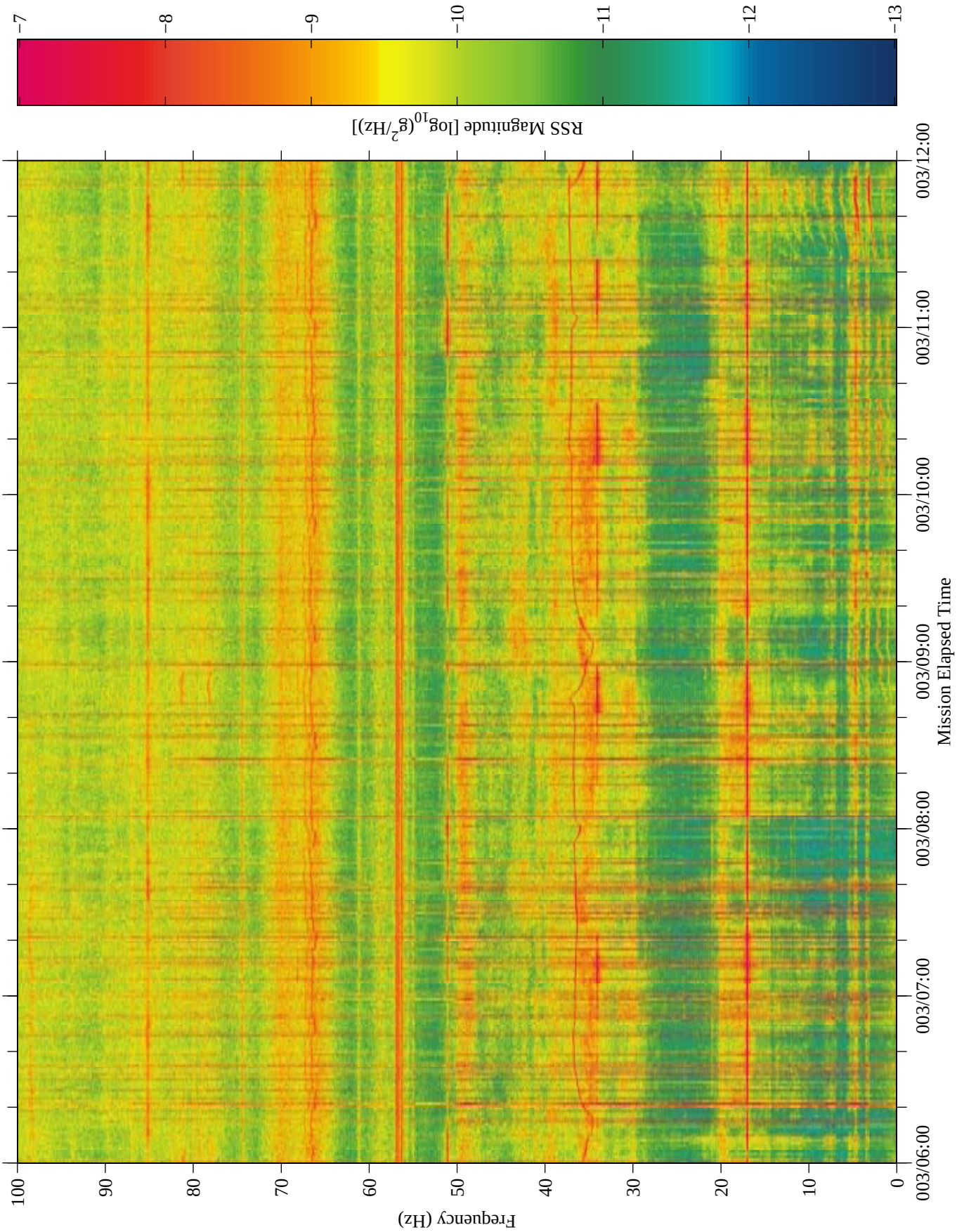

Figure 14: USMP−4, Unit G, TSH B

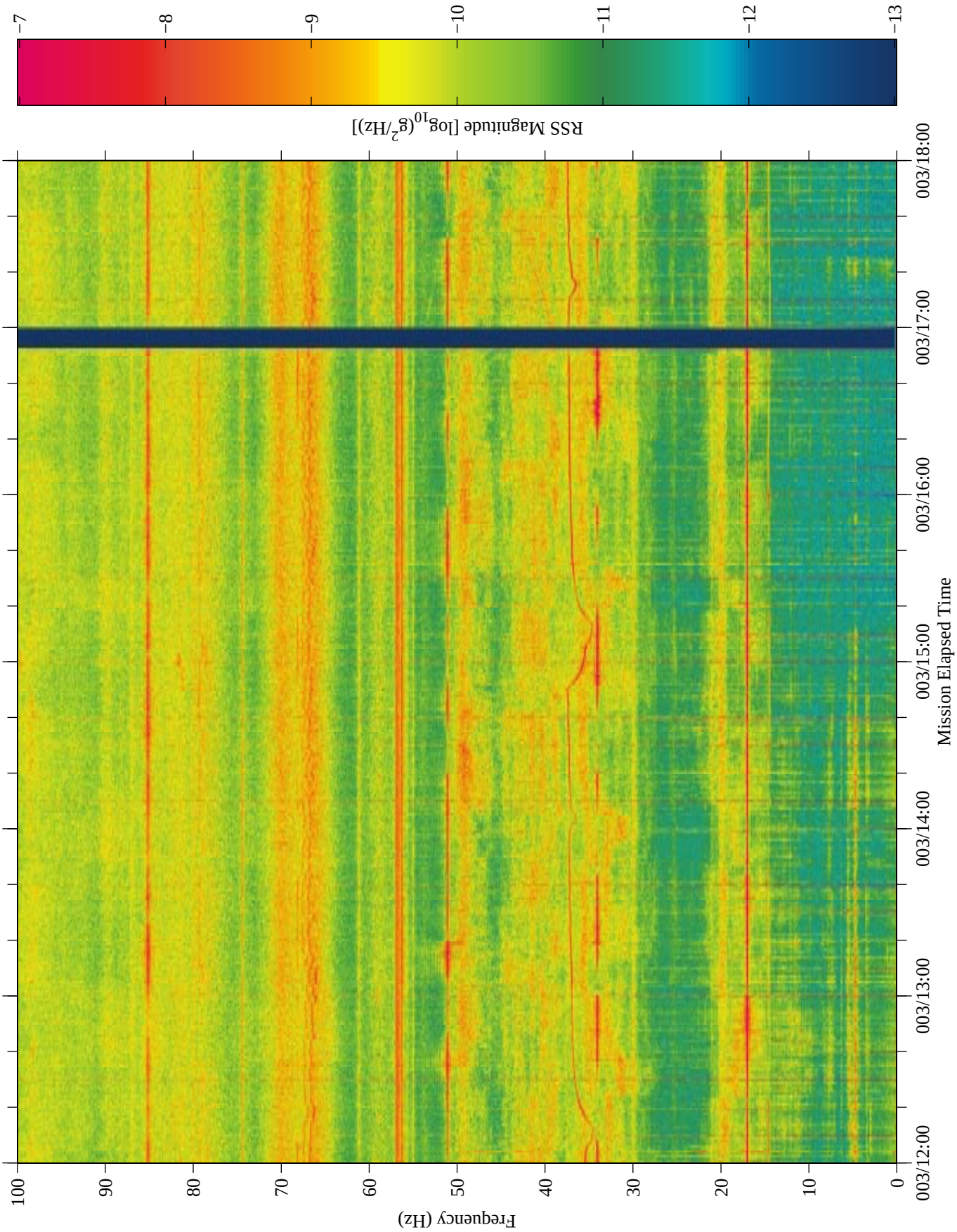

Figure 15: USMP−4, Unit G, TSH B

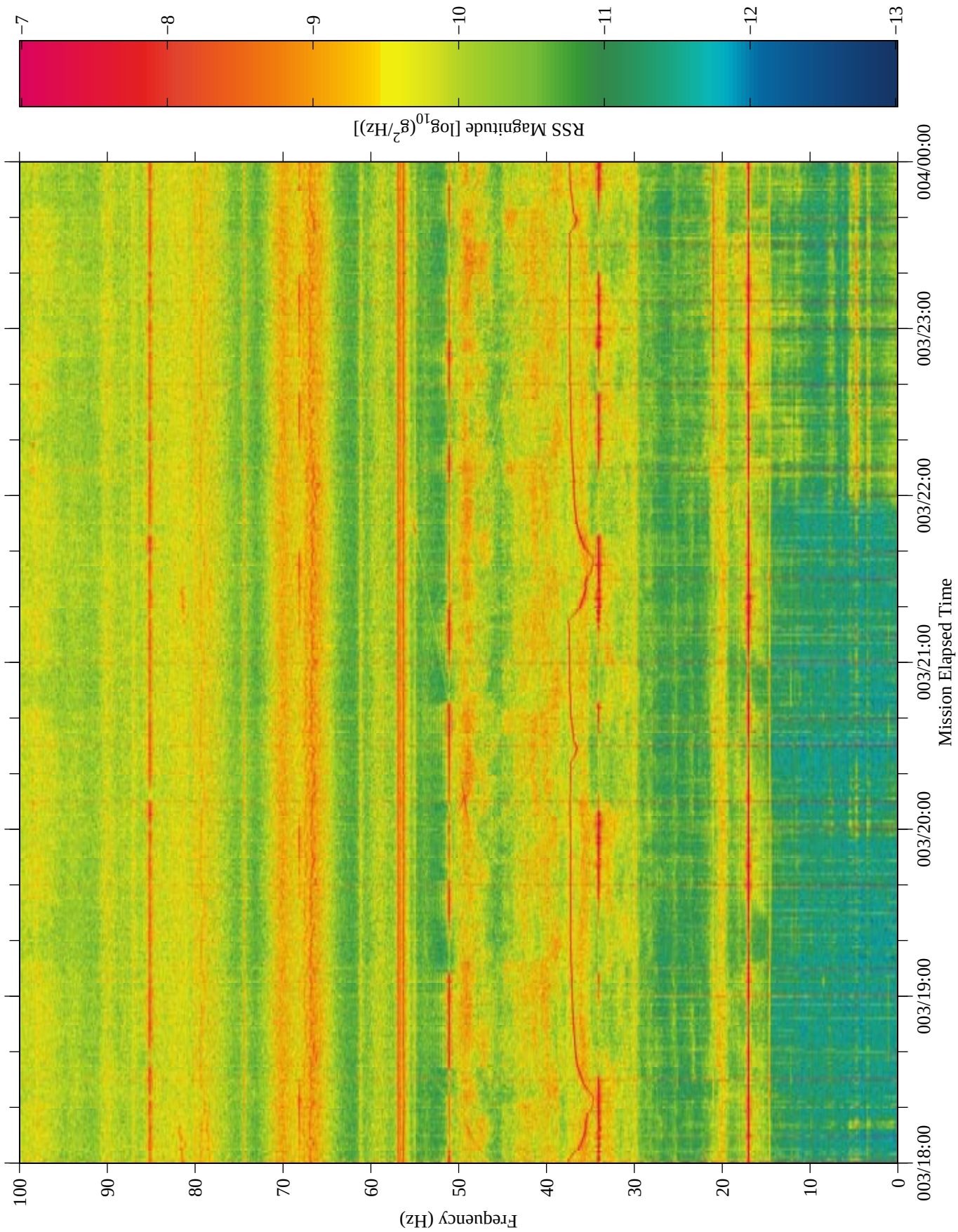

Figure 16: USMP−4, Unit G, TSH B

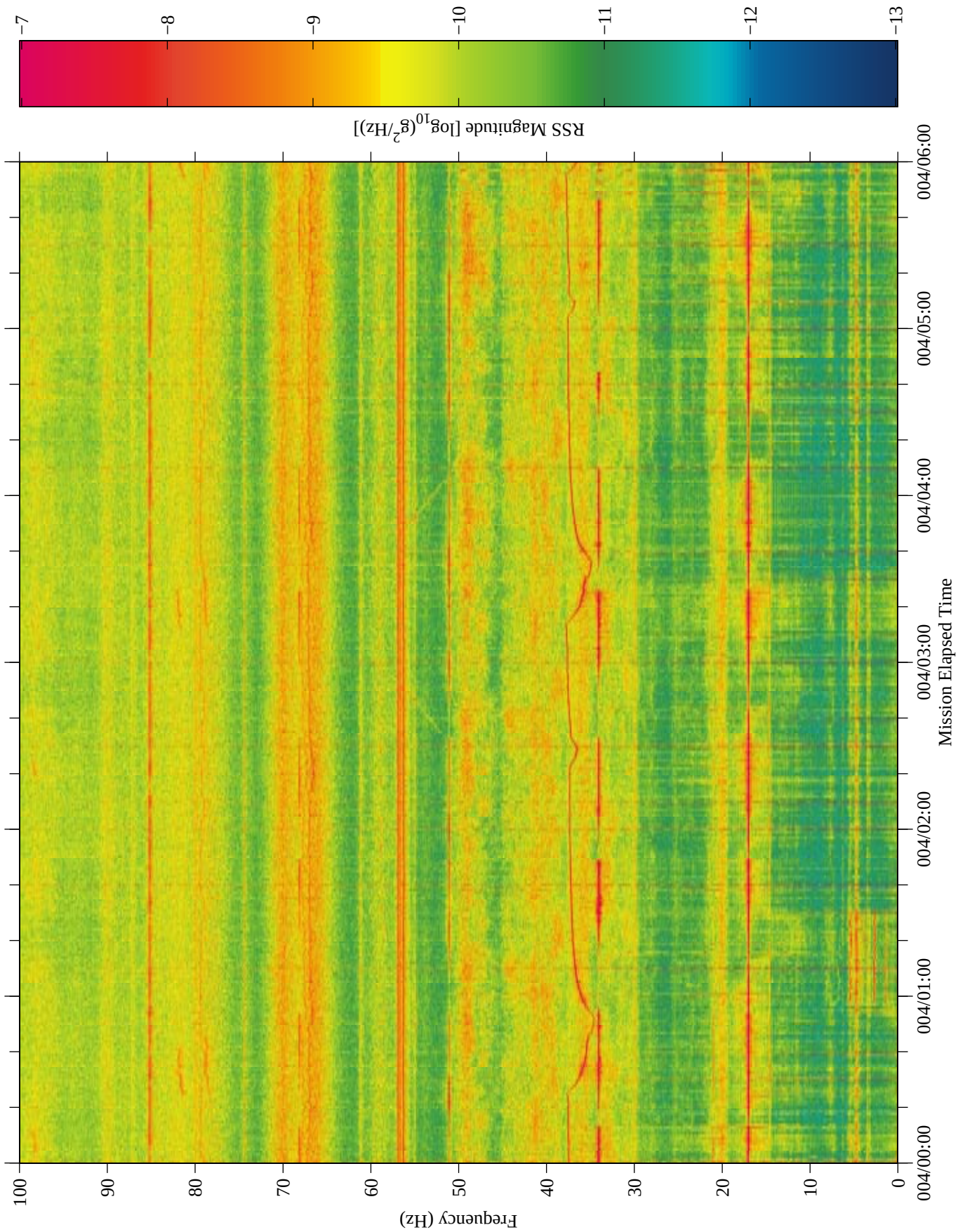

Figure 17: USMP−4, Unit G, TSH B

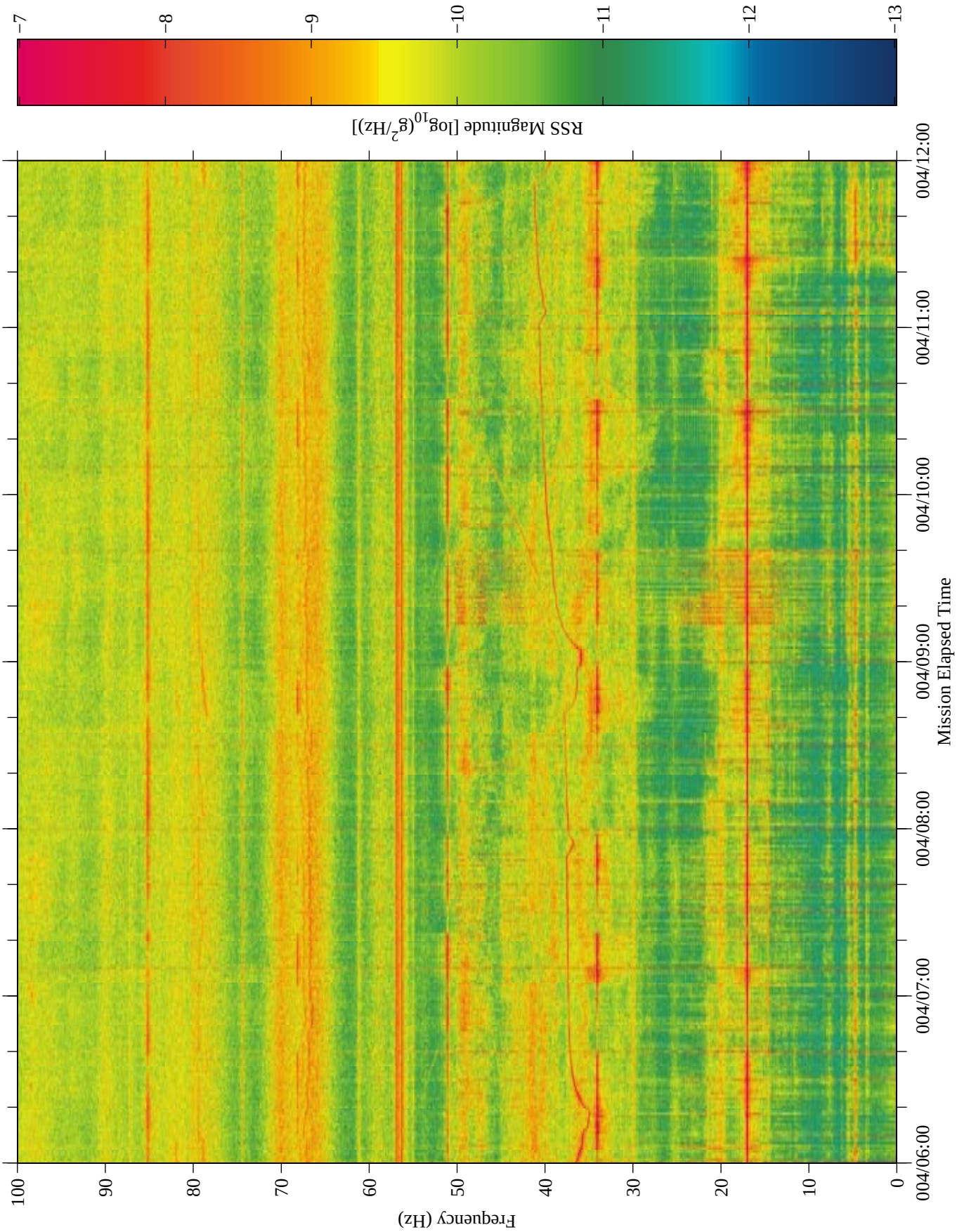

Figure 18: USMP−4, Unit G, TSH B

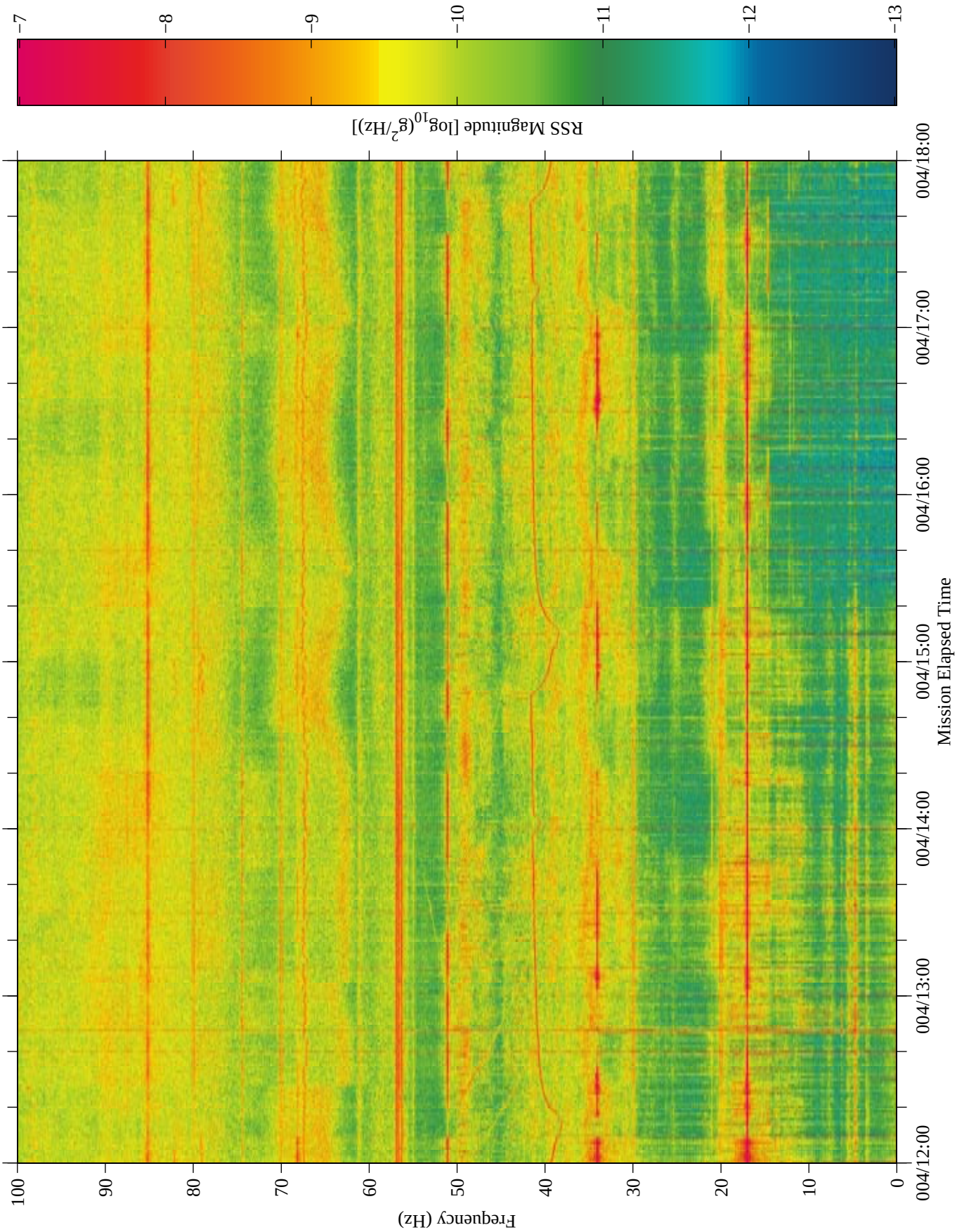

Figure 19: USMP−4, Unit G, TSH B

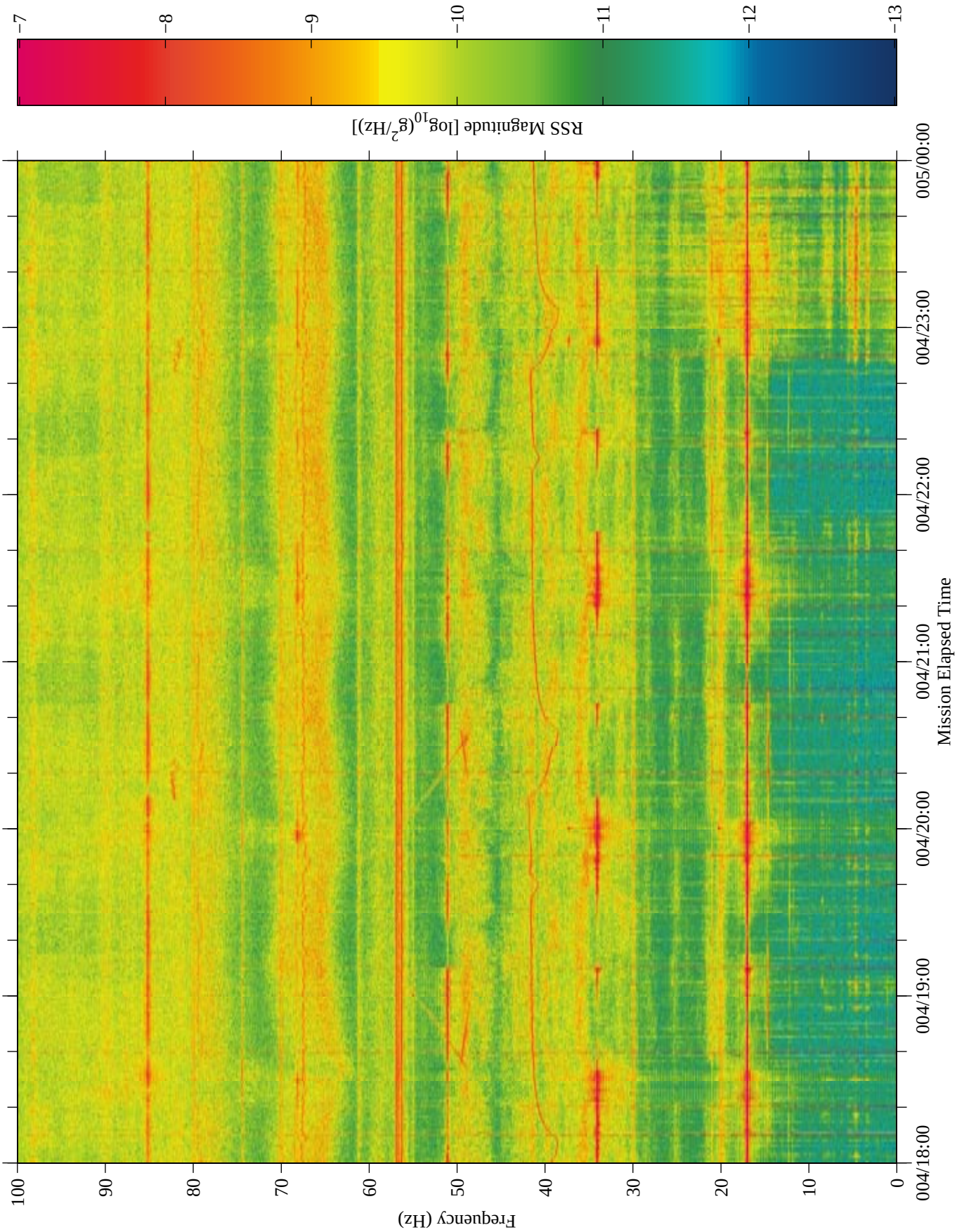

Figure 20: USMP−4, Unit G, TSH B

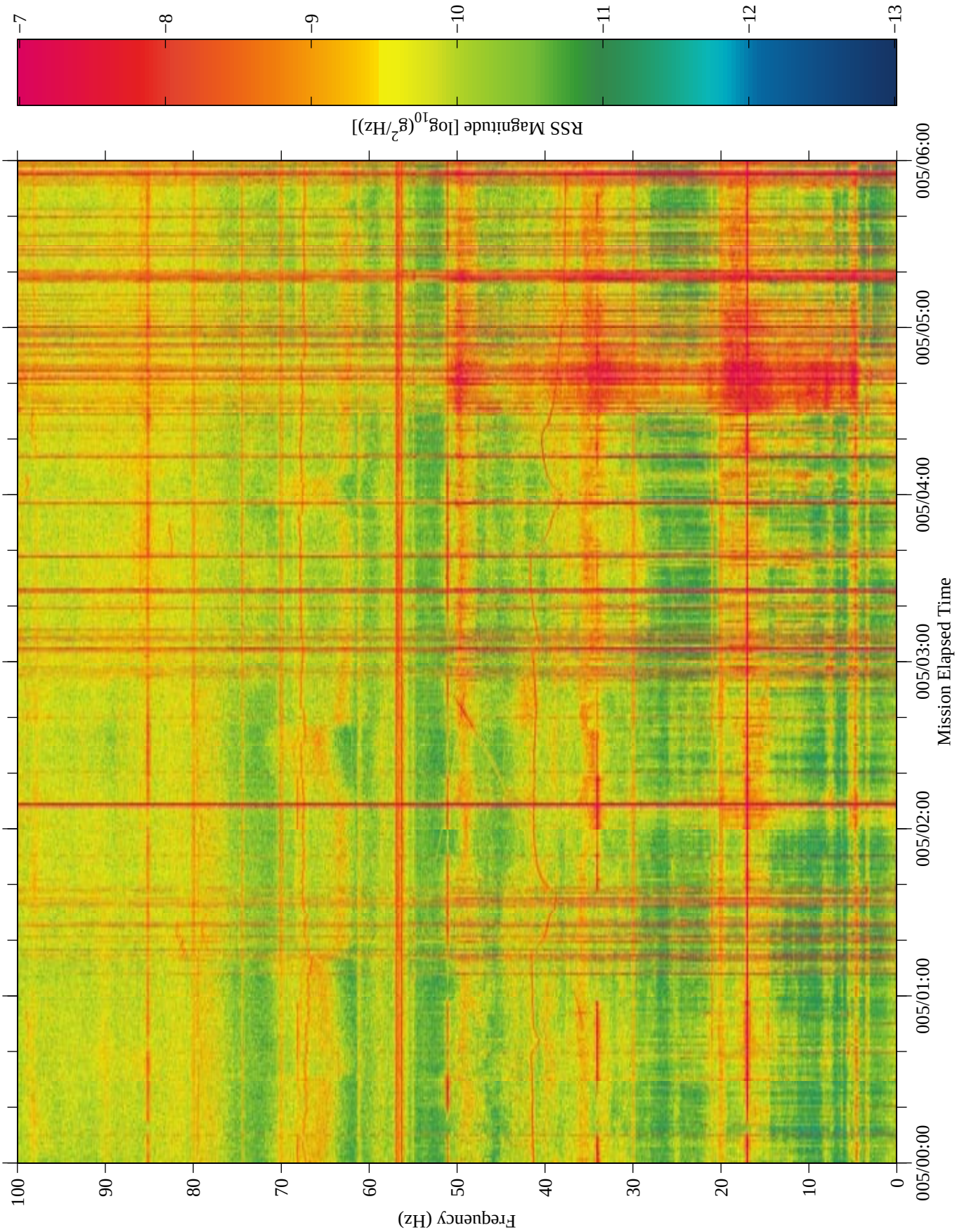

Figure 21: USMP−4, Unit G, TSH B

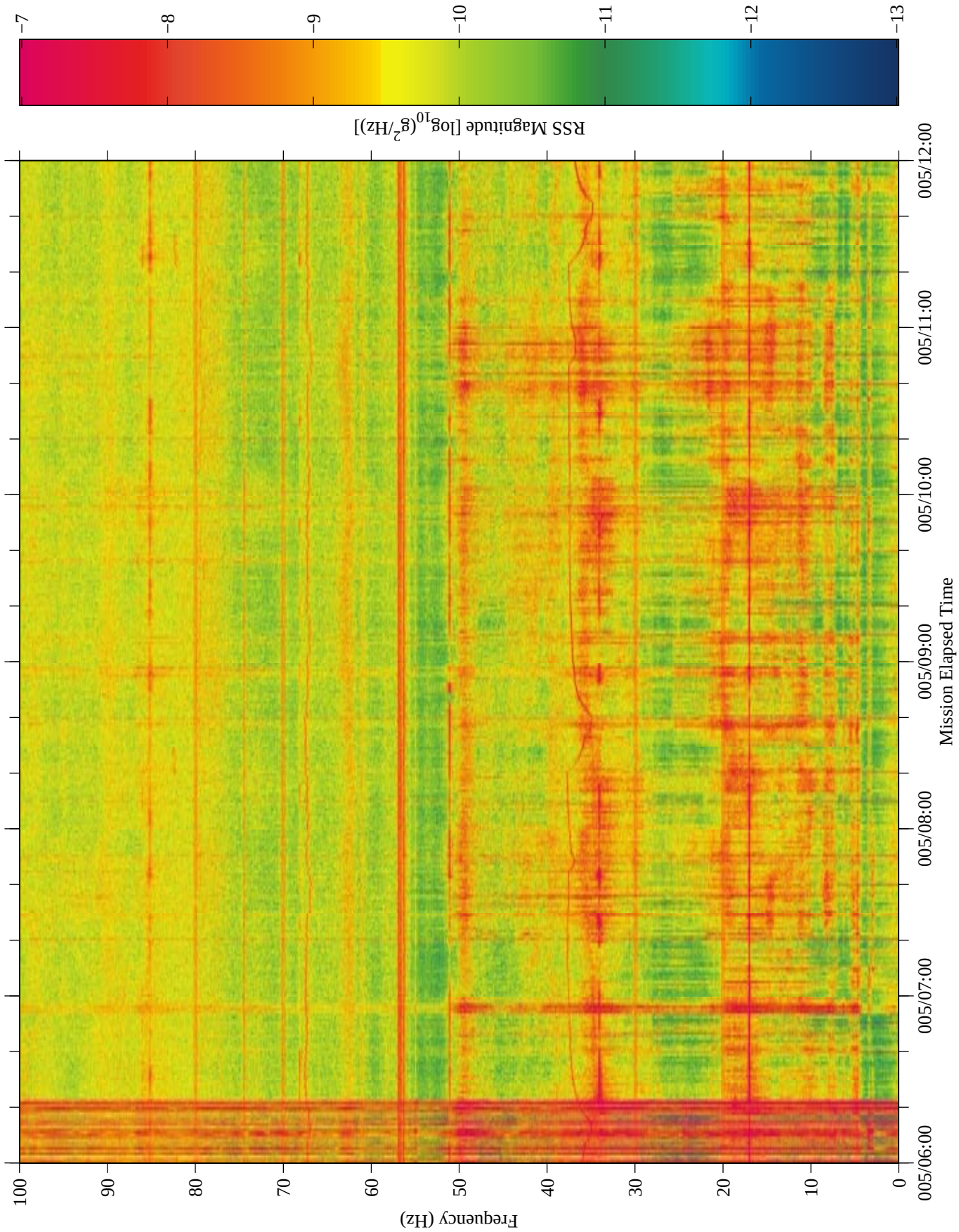

Figure 22: USMP−4, Unit G, TSH B

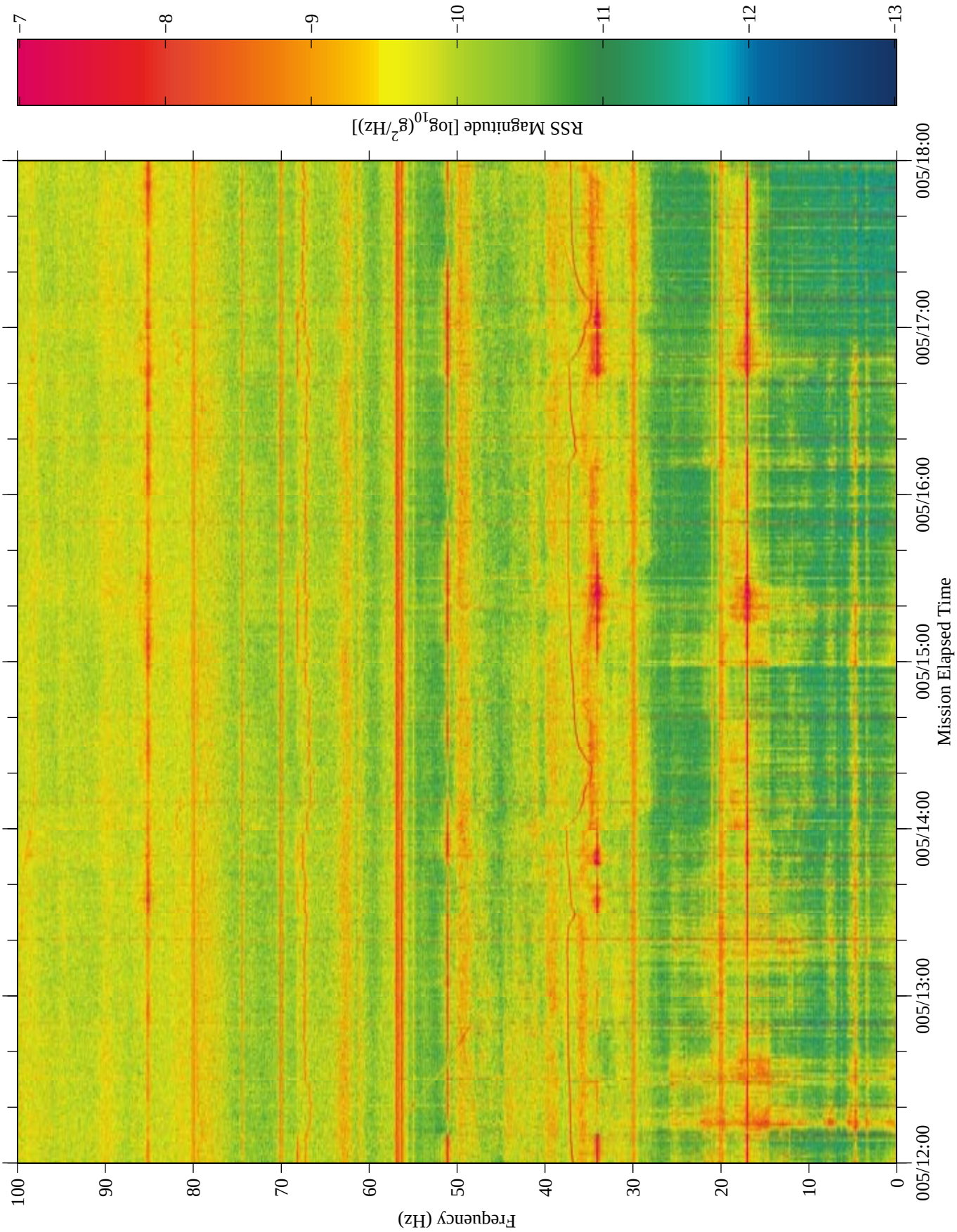

Figure 23: USMP−4, Unit G, TSH B

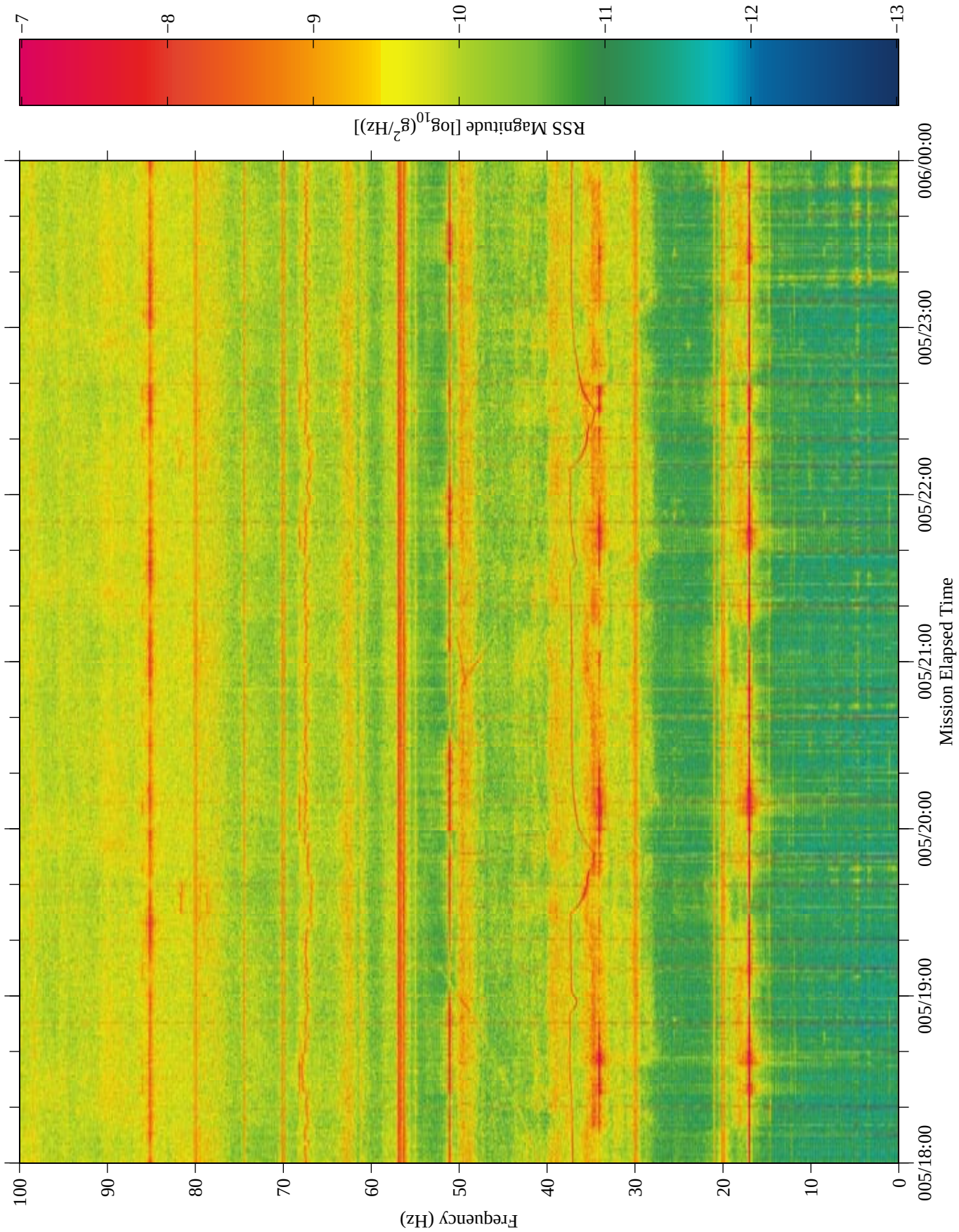

Figure 24: USMP−4, Unit G, TSH B

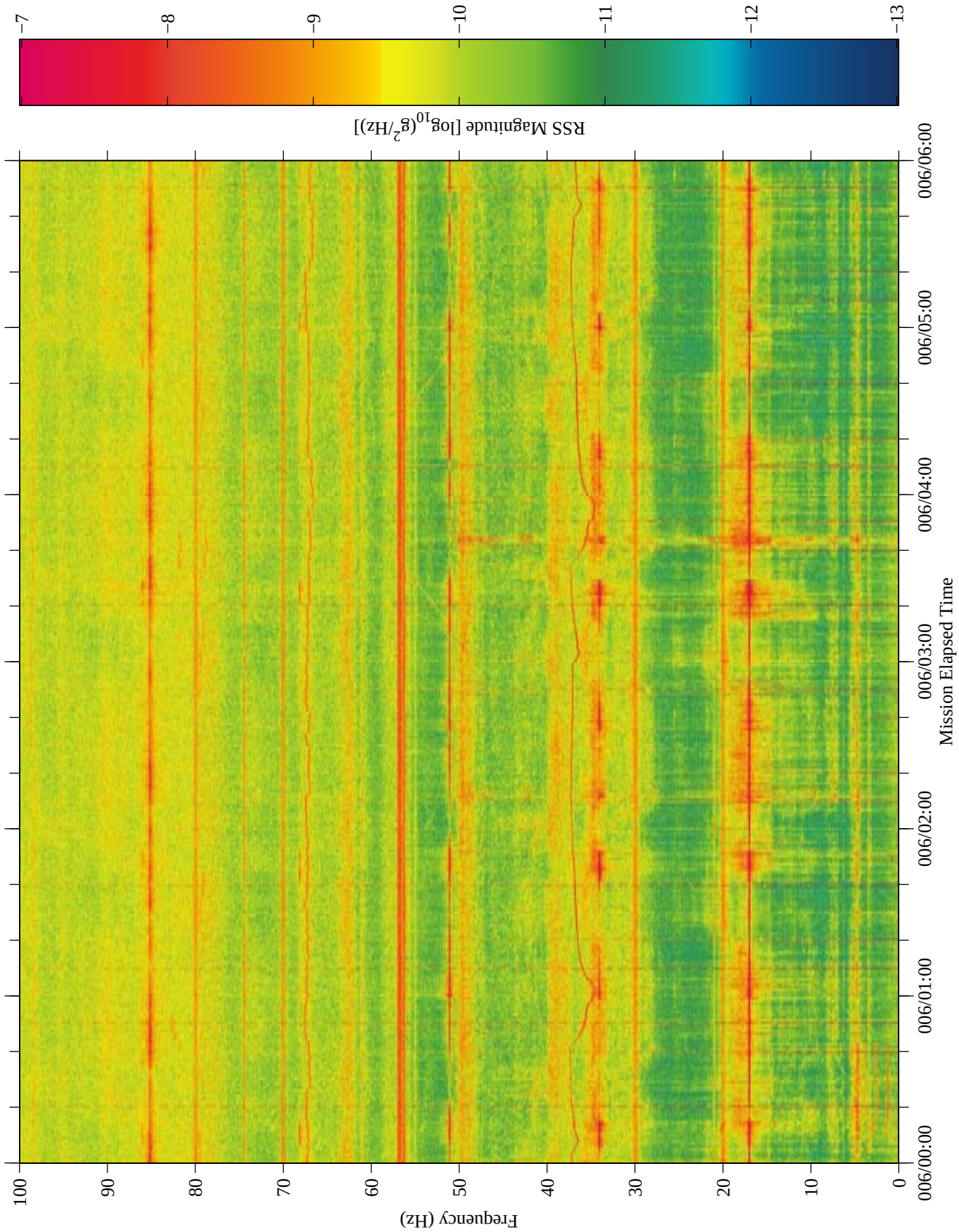

Figure 25: USMP−4, Unit G, TSH B

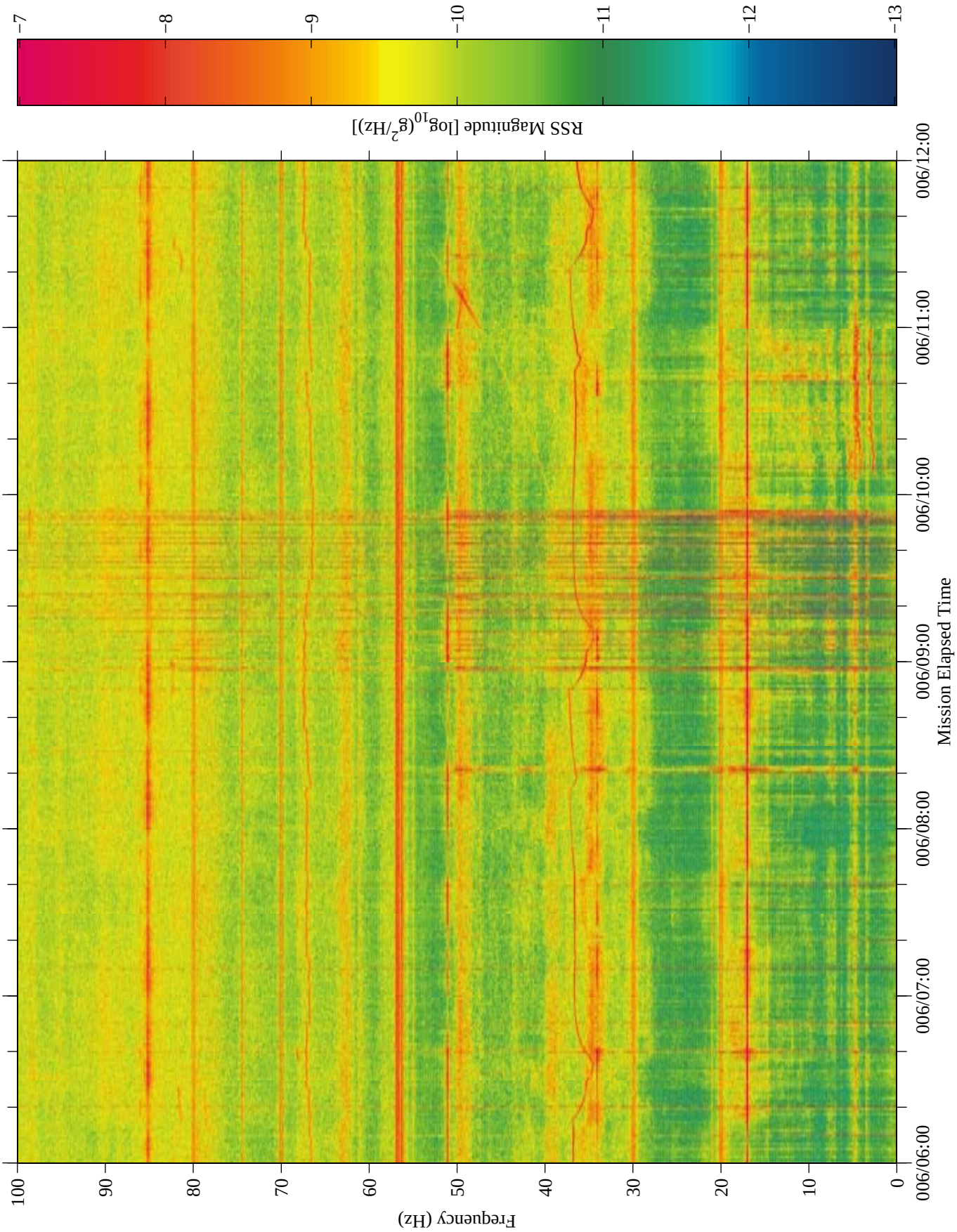

Figure 26: USMP−4, Unit G, TSH B

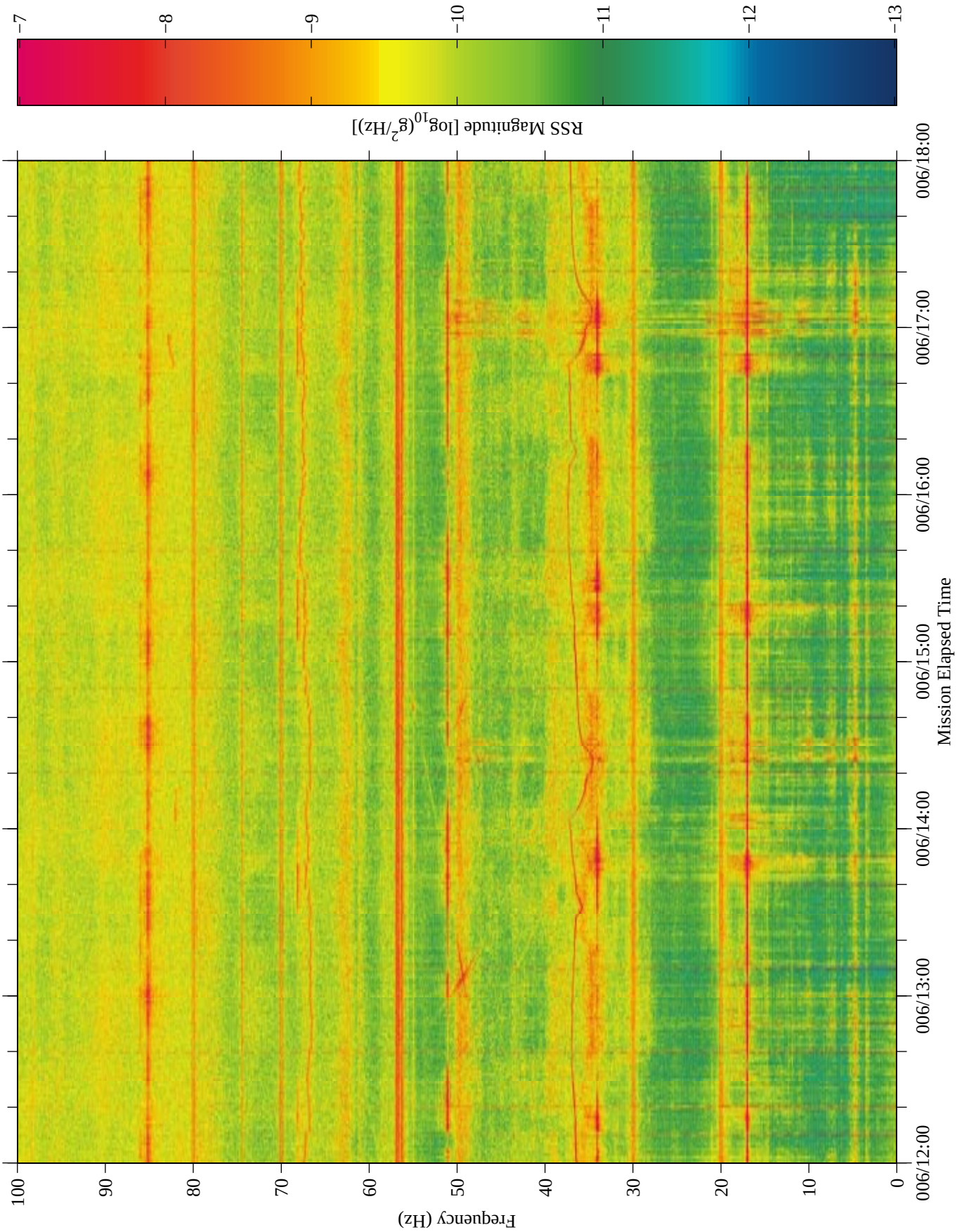

Figure 27: USMP−4, Unit G, TSH B

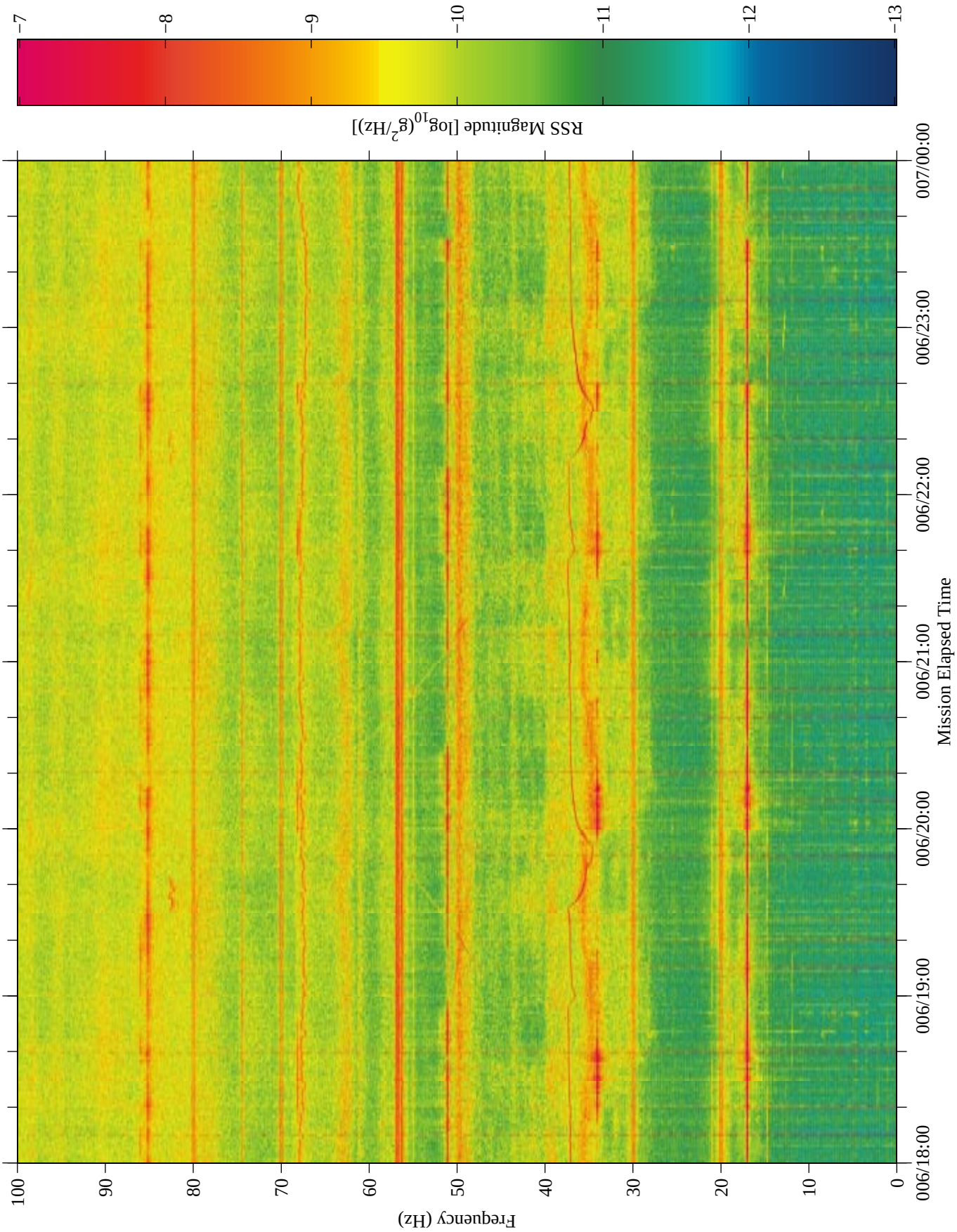

Figure 28: USMP−4, Unit G, TSH B

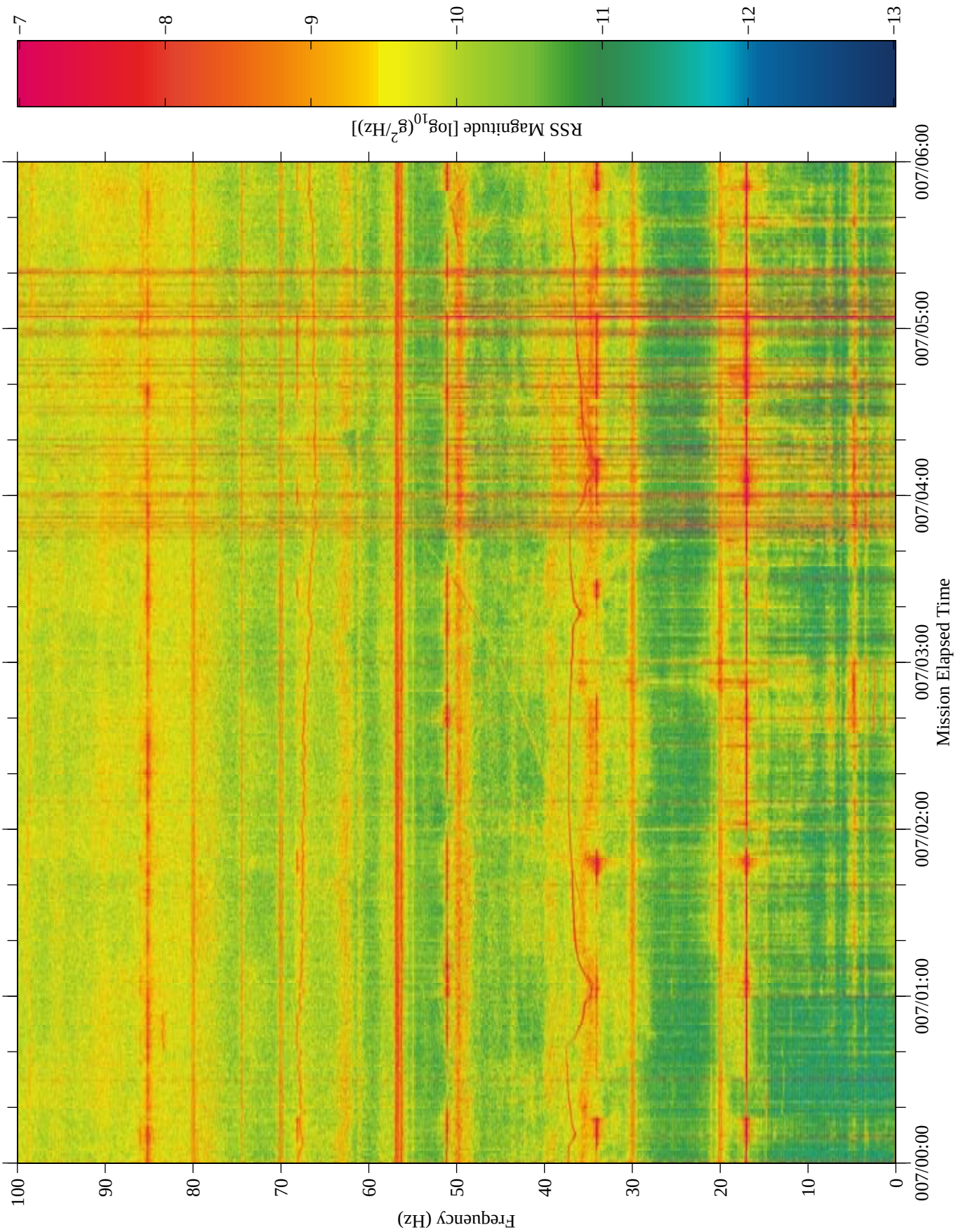

Figure 29: USMP−4, Unit G, TSH B

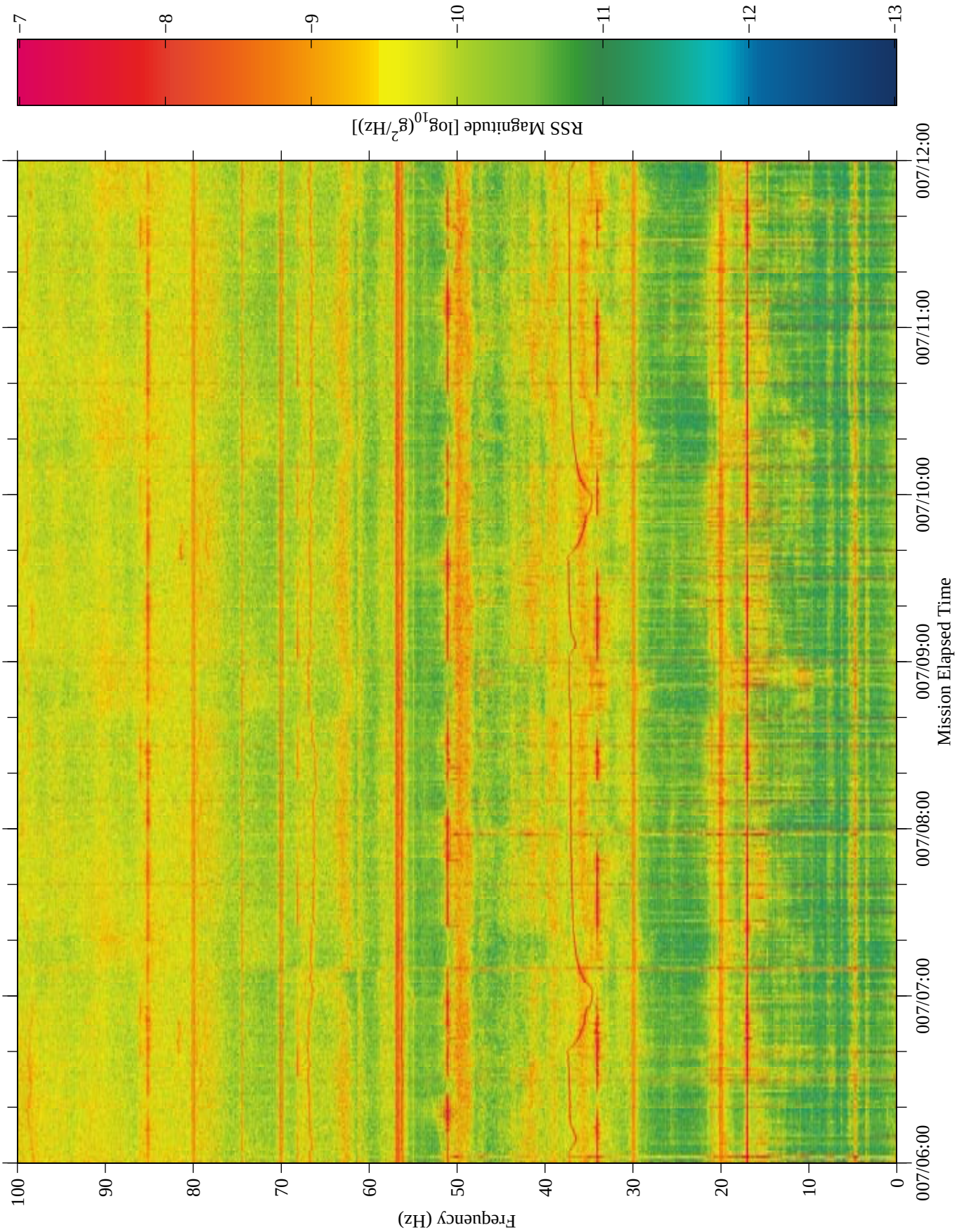

Figure 30: USMP−4, Unit G, TSH B

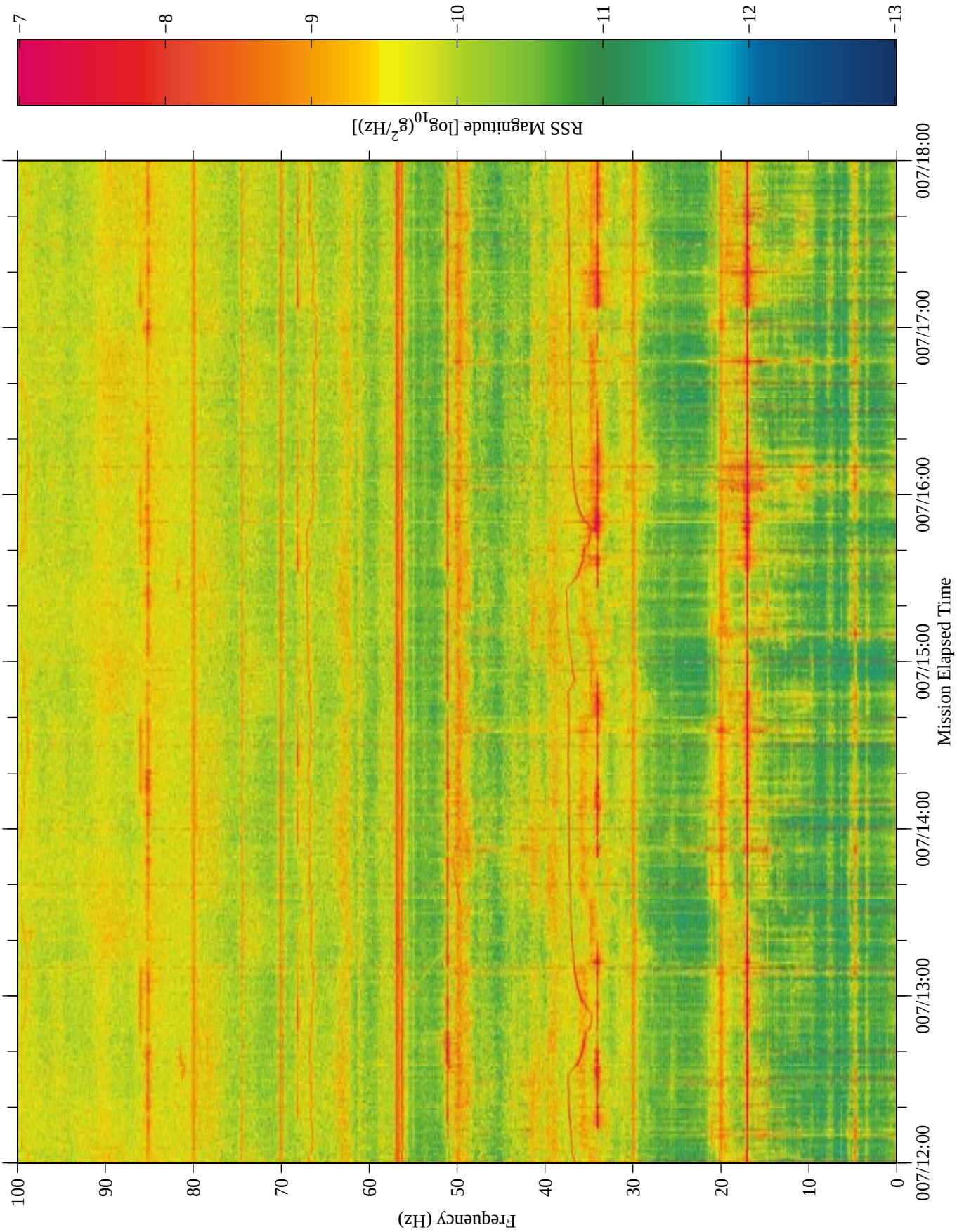

Figure 31: USMP−4, Unit G, TSH B

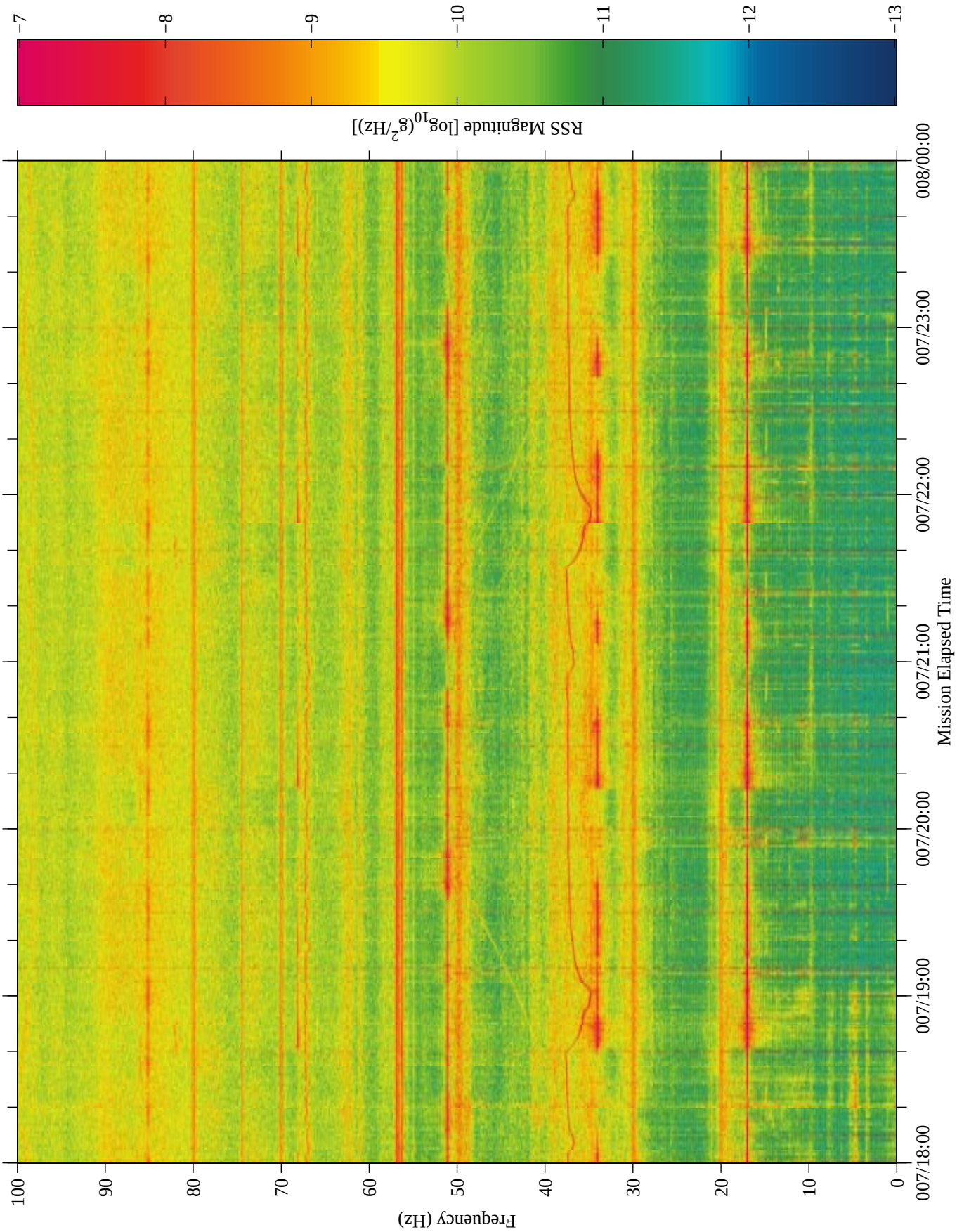

Figure 32: USMP−4, Unit G, TSH B

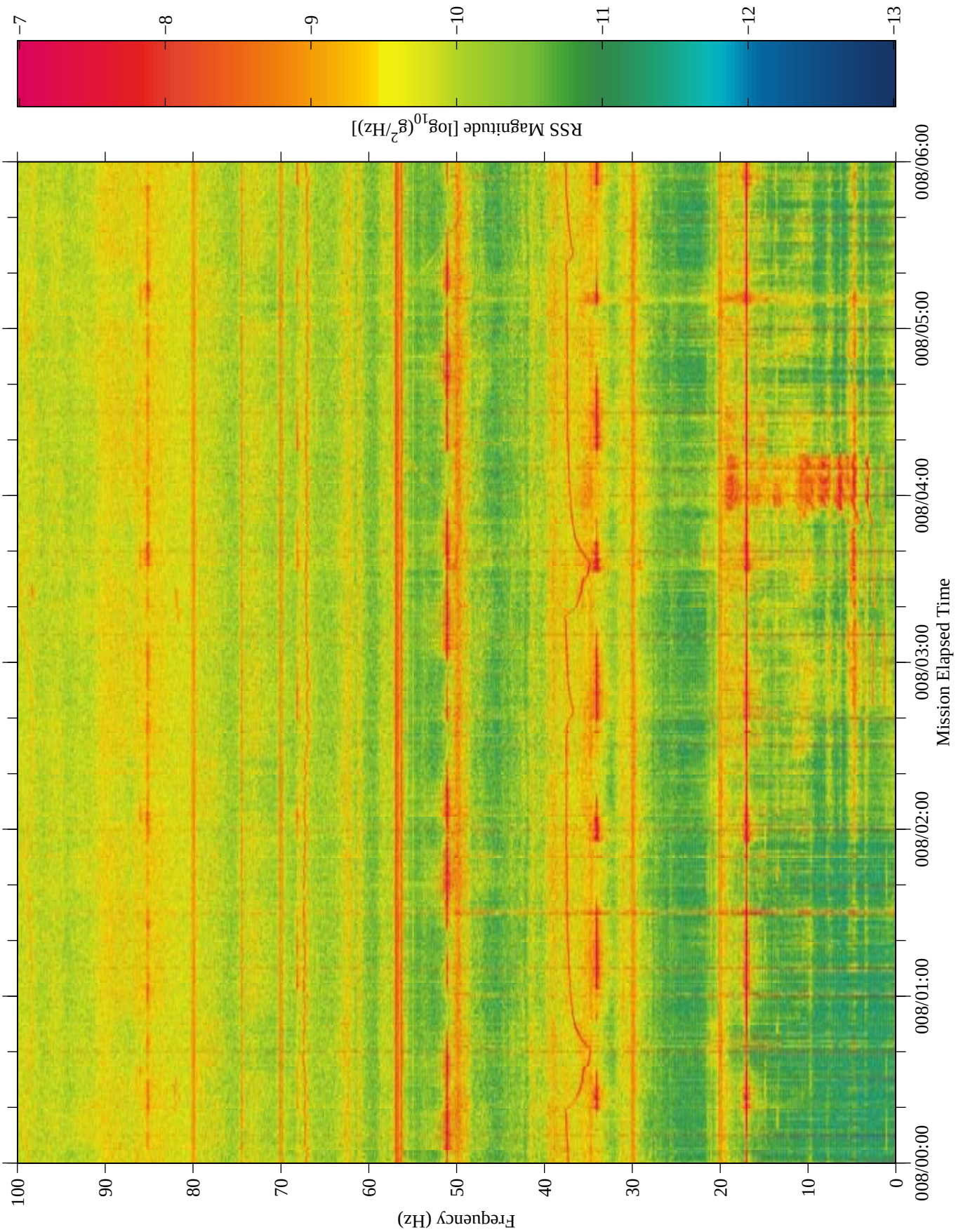

Figure 33: USMP−4, Unit G, TSH B

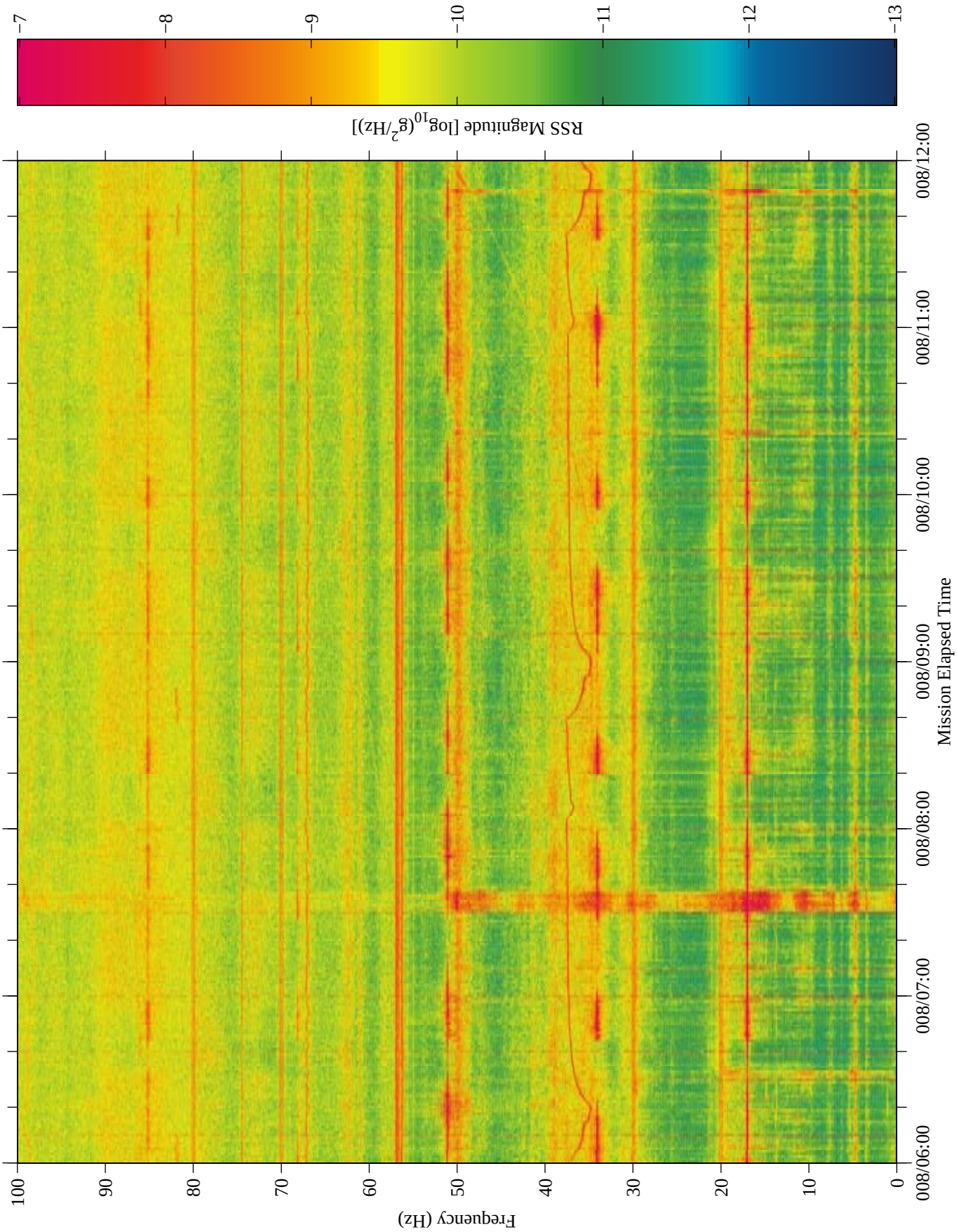

Figure 34: USMP−4, Unit G, TSH B

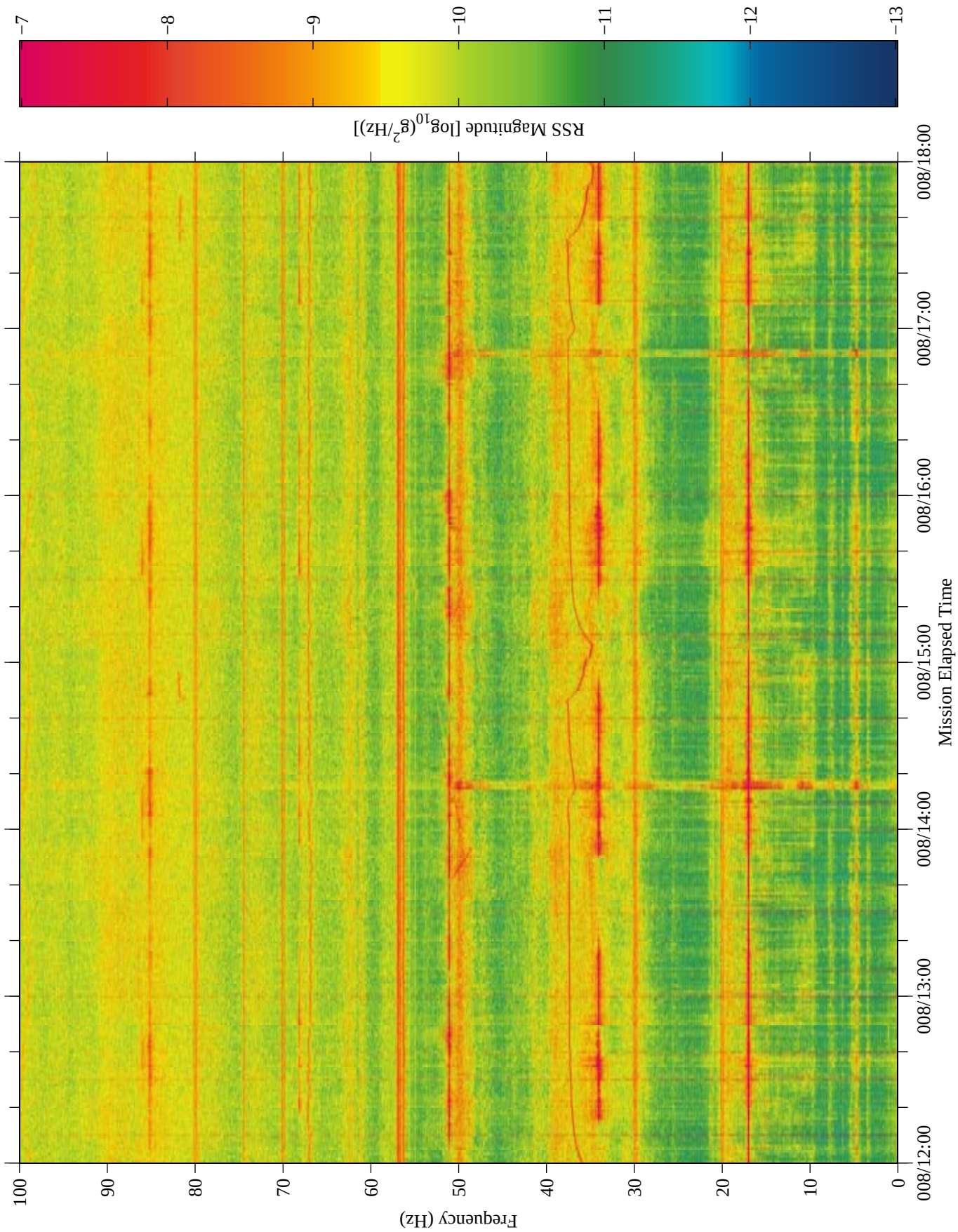

Figure 35: USMP−4, Unit G, TSH B

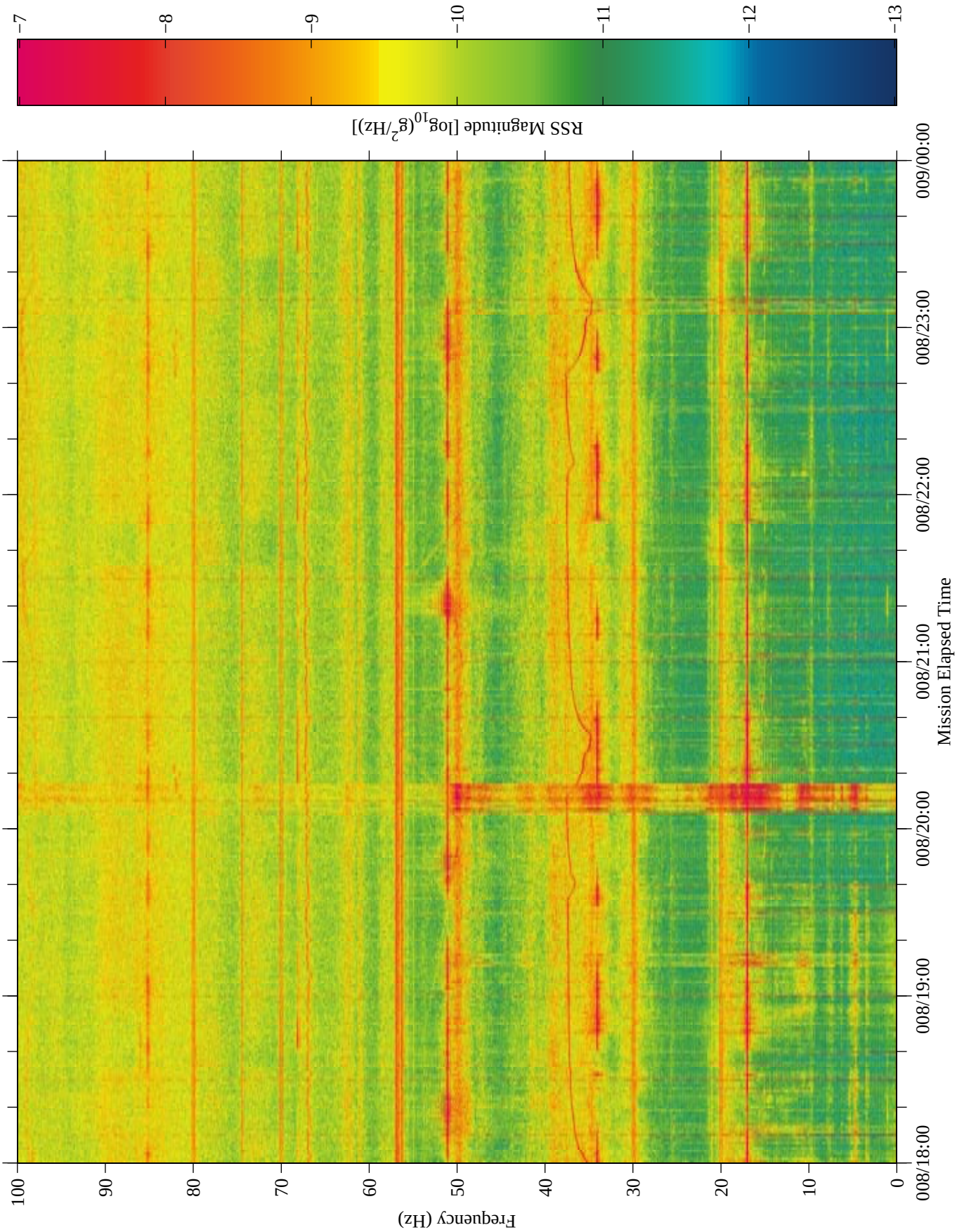

Figure 36: USMP−4, Unit G, TSH B

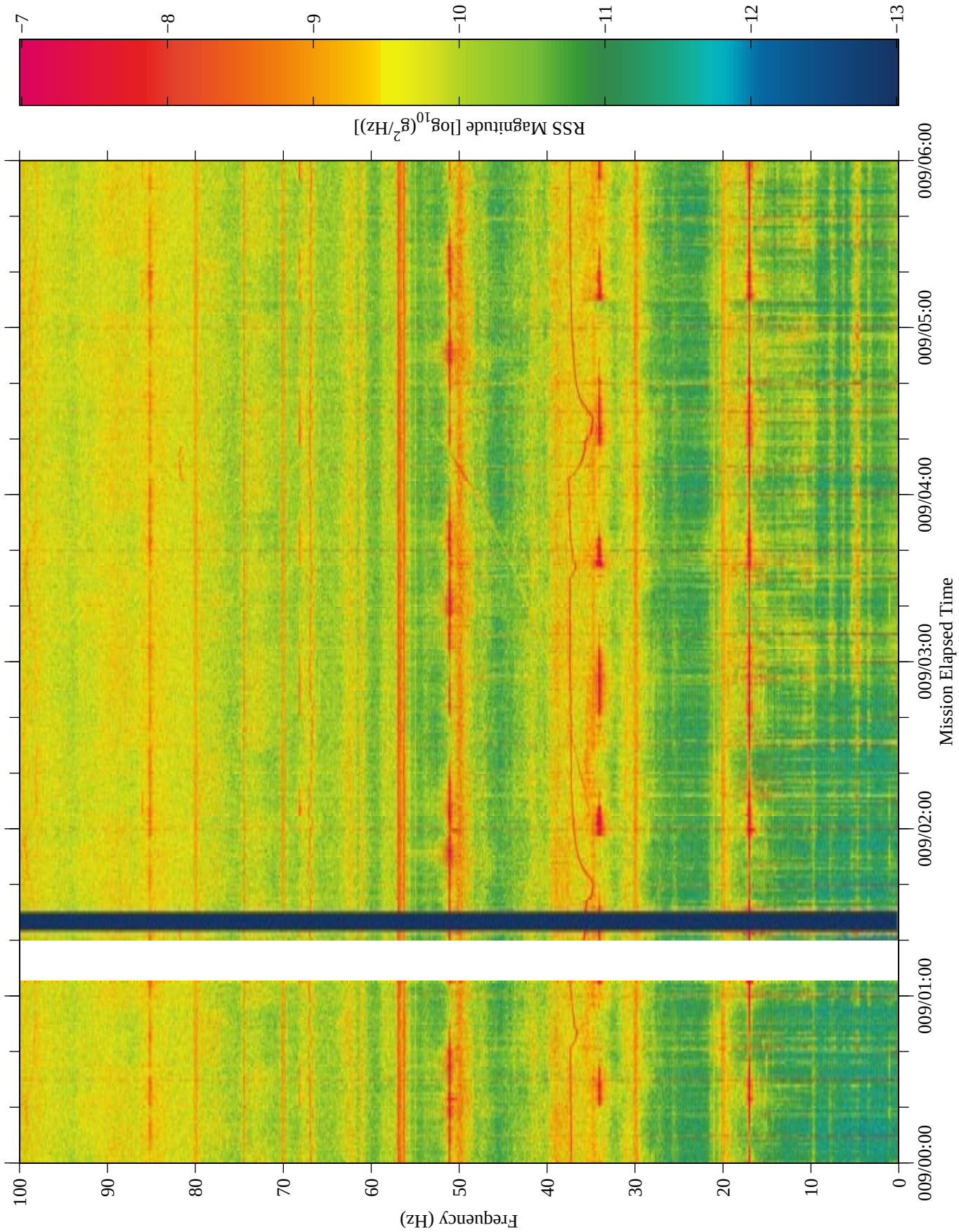

Figure 37: USMP−4, Unit G, TSH B

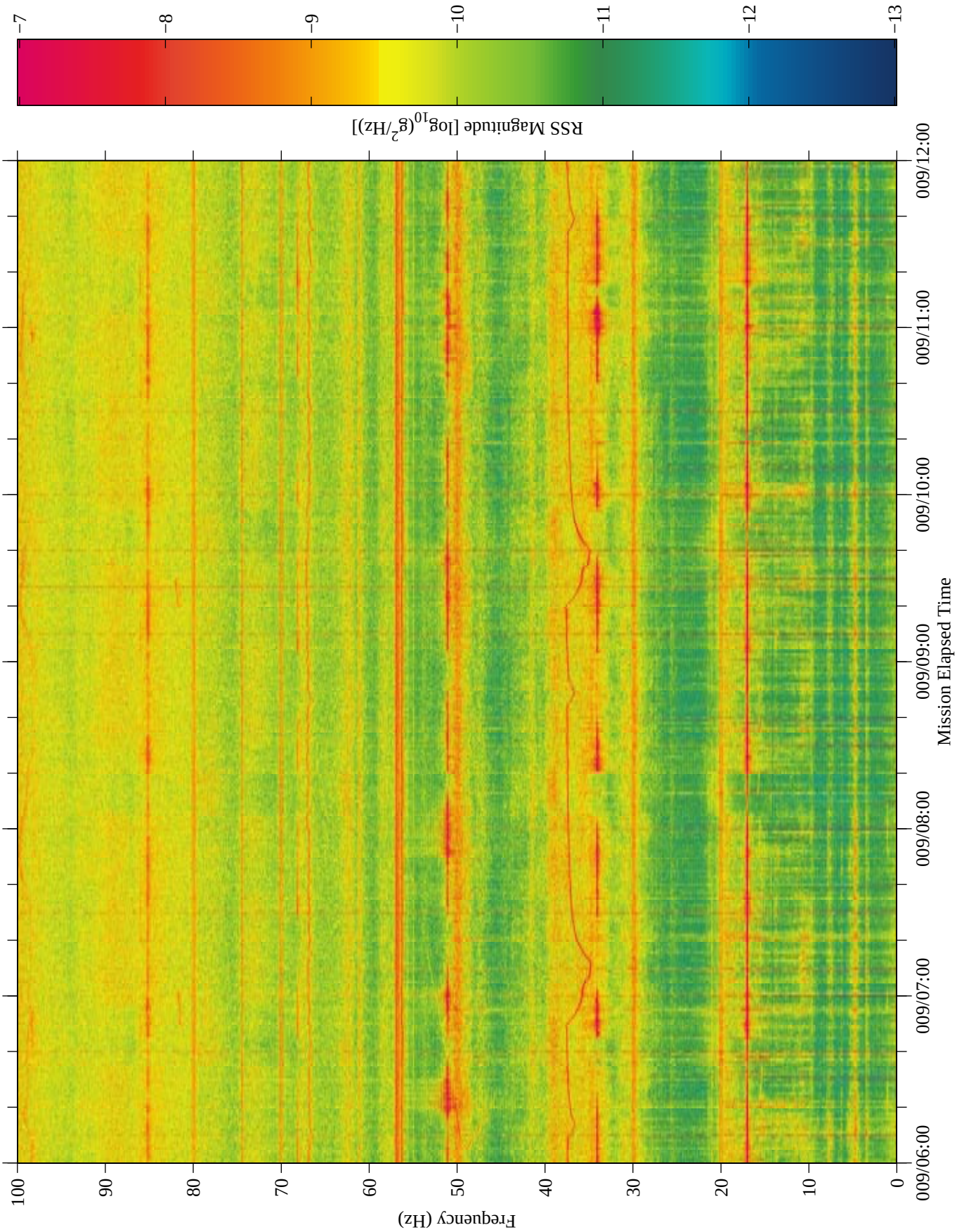

Figure 38: USMP−4, Unit G, TSH B

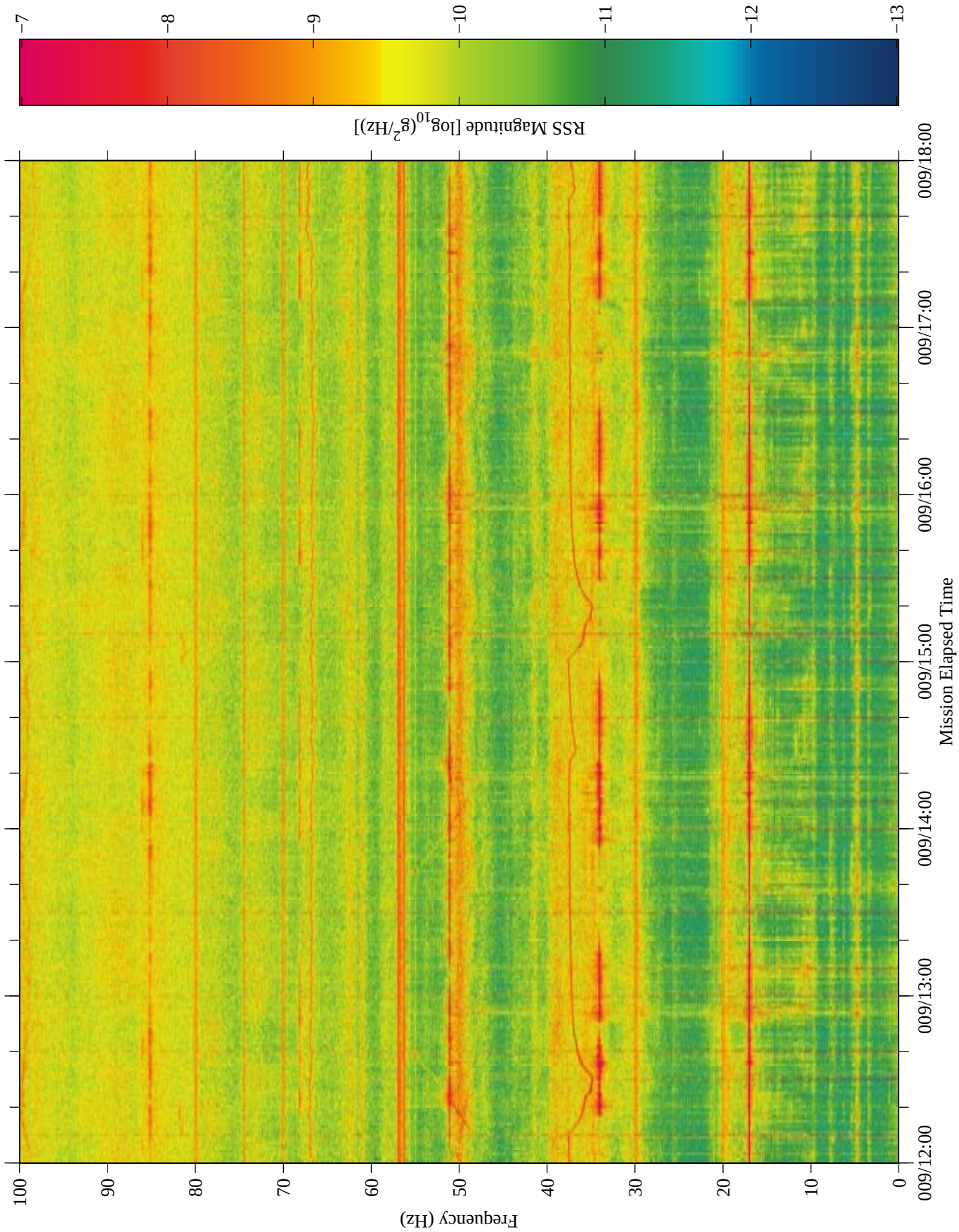

Figure 39: USMP−4, Unit G, TSH B

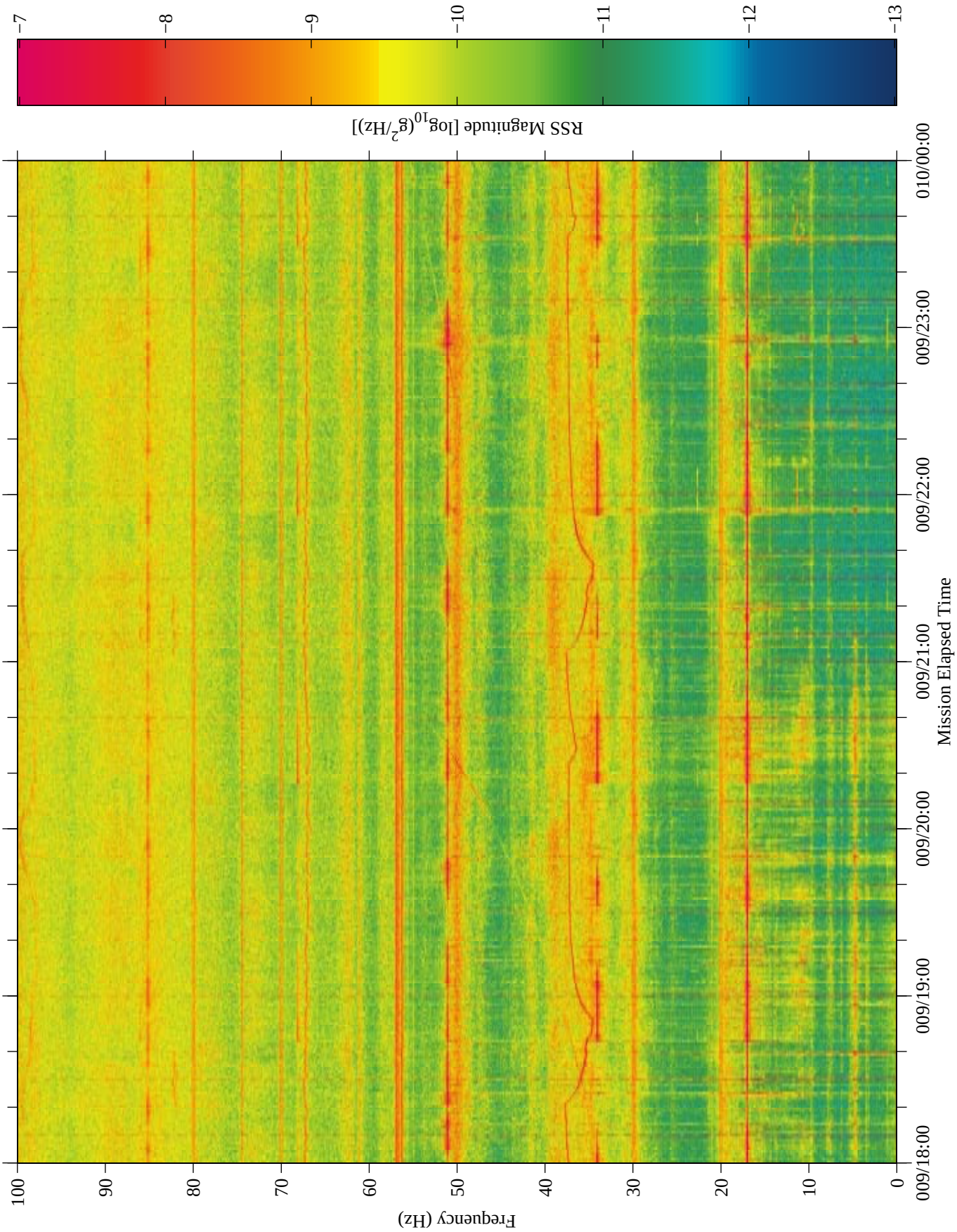

Figure 40: USMP−4, Unit G, TSH B

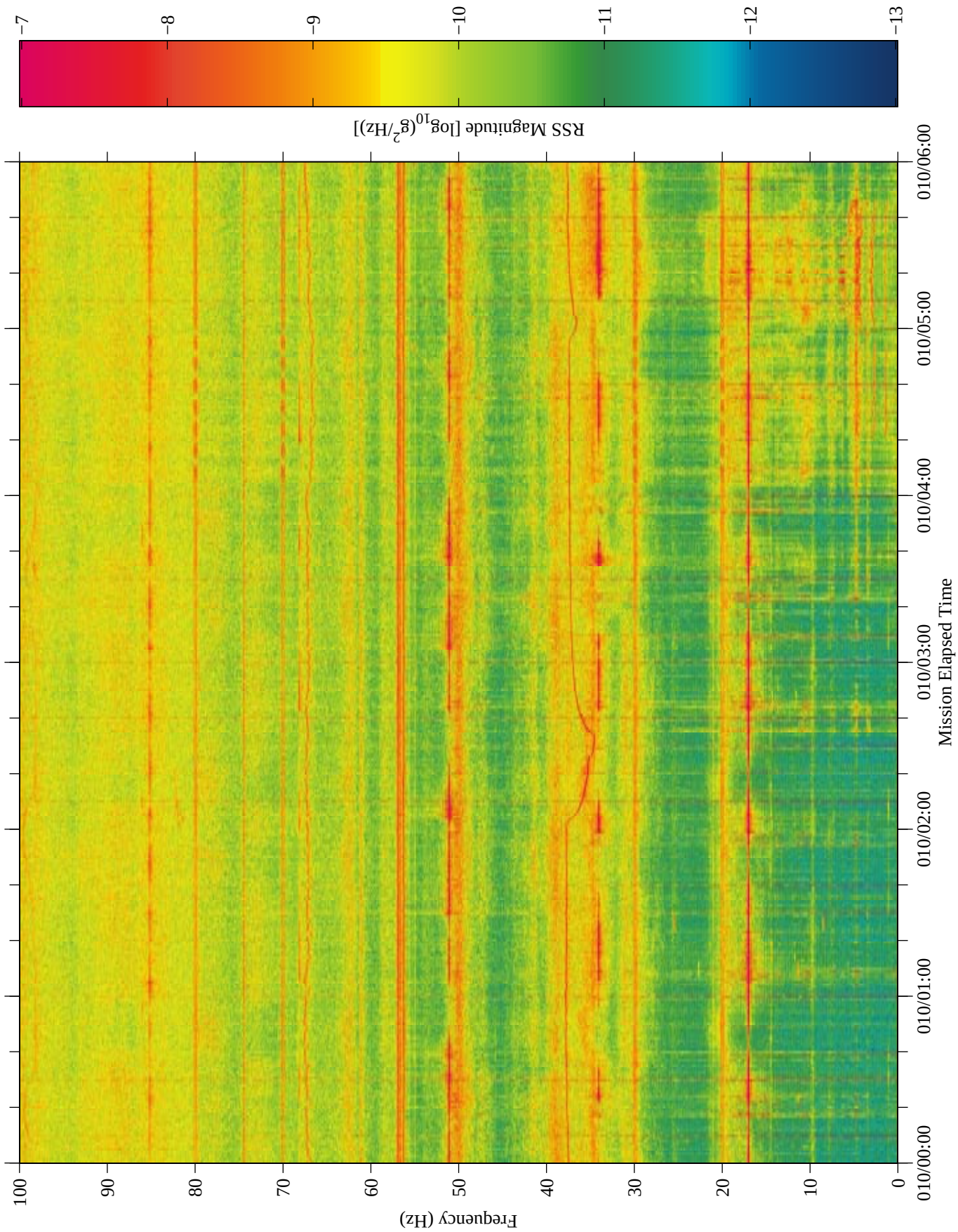

Figure 41: USMP−4, Unit G, TSH B

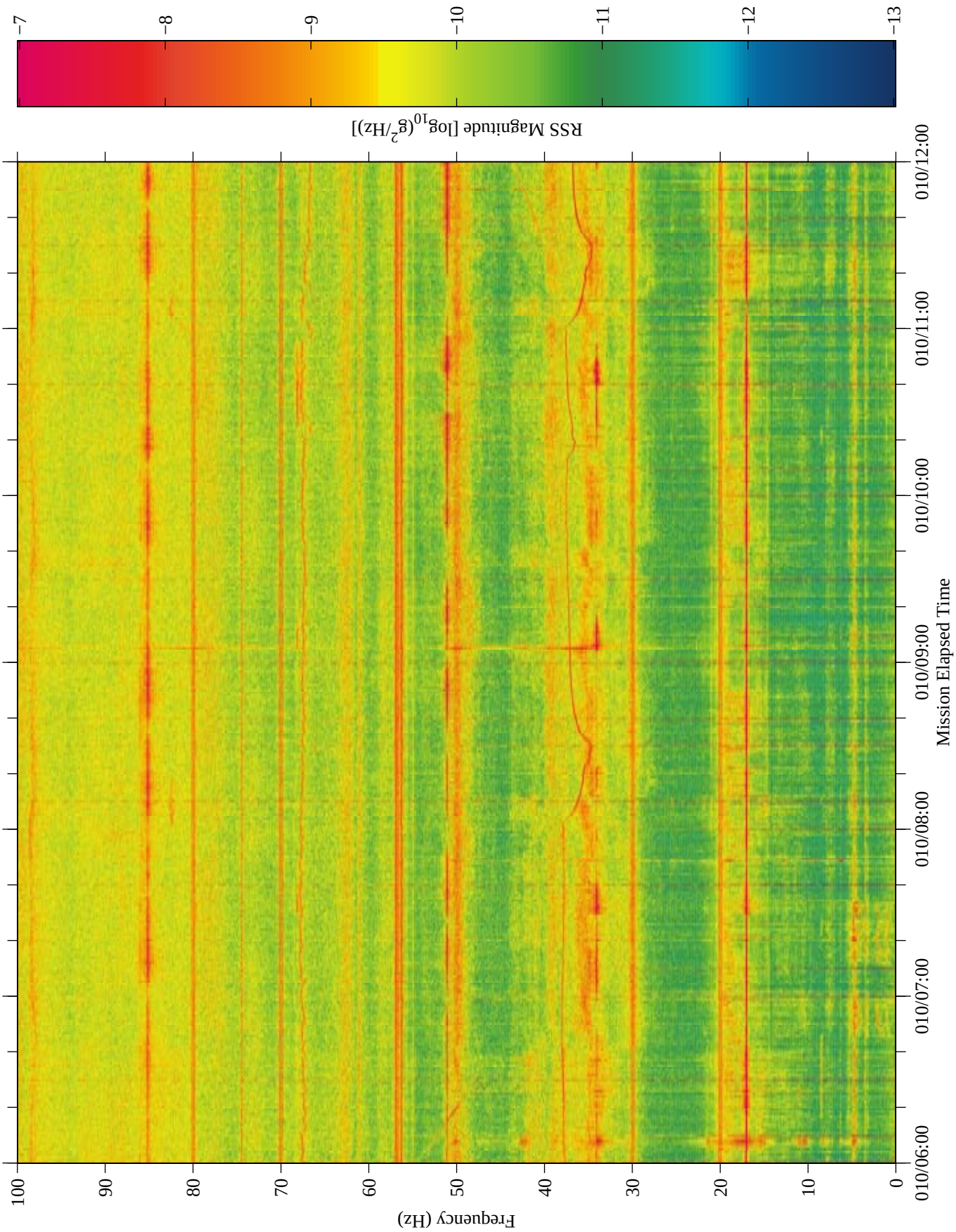

Figure 42: USMP−4, Unit G, TSH B

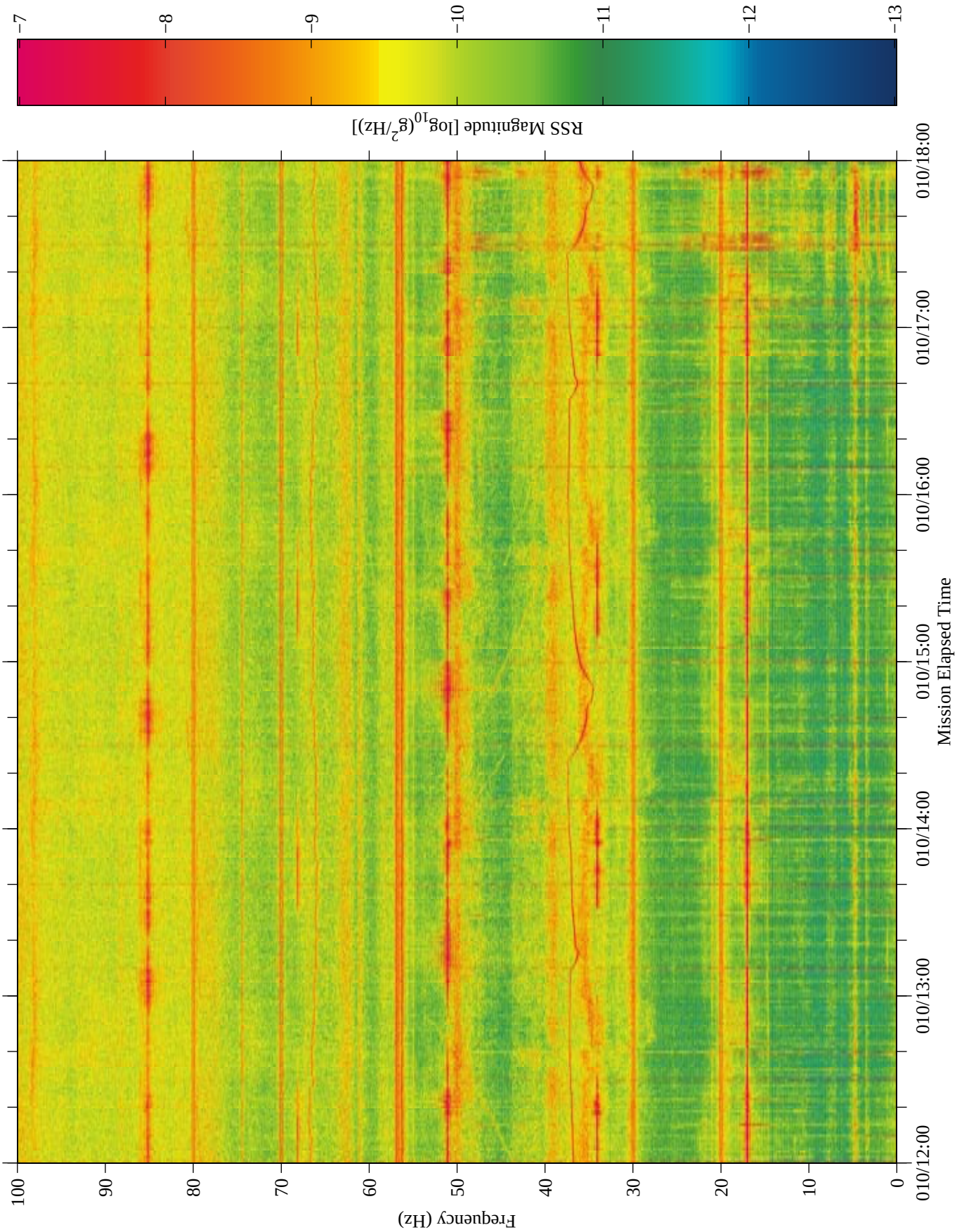

Figure 43: USMP−4, Unit G, TSH B

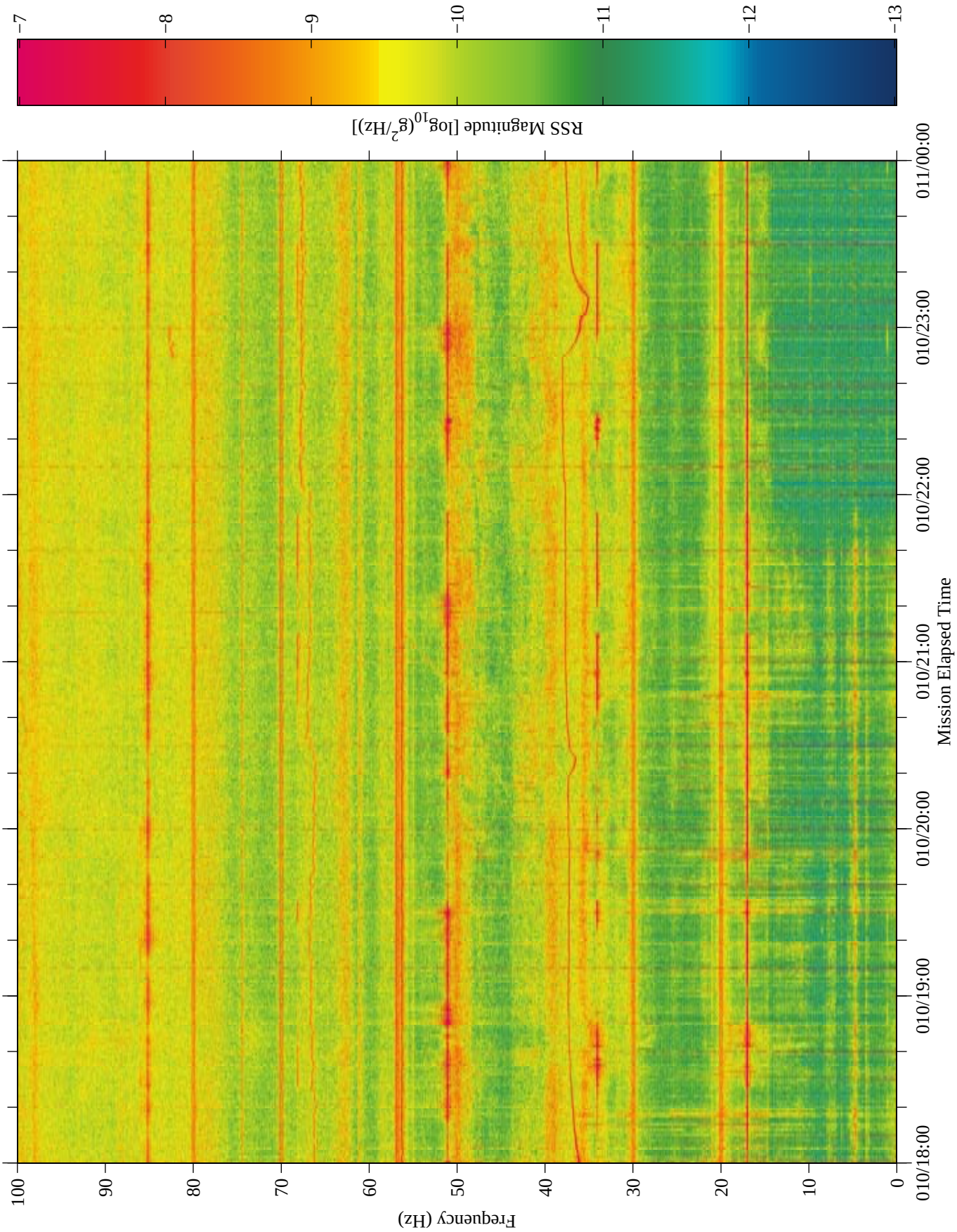

Figure 44: USMP−4, Unit G, TSH B

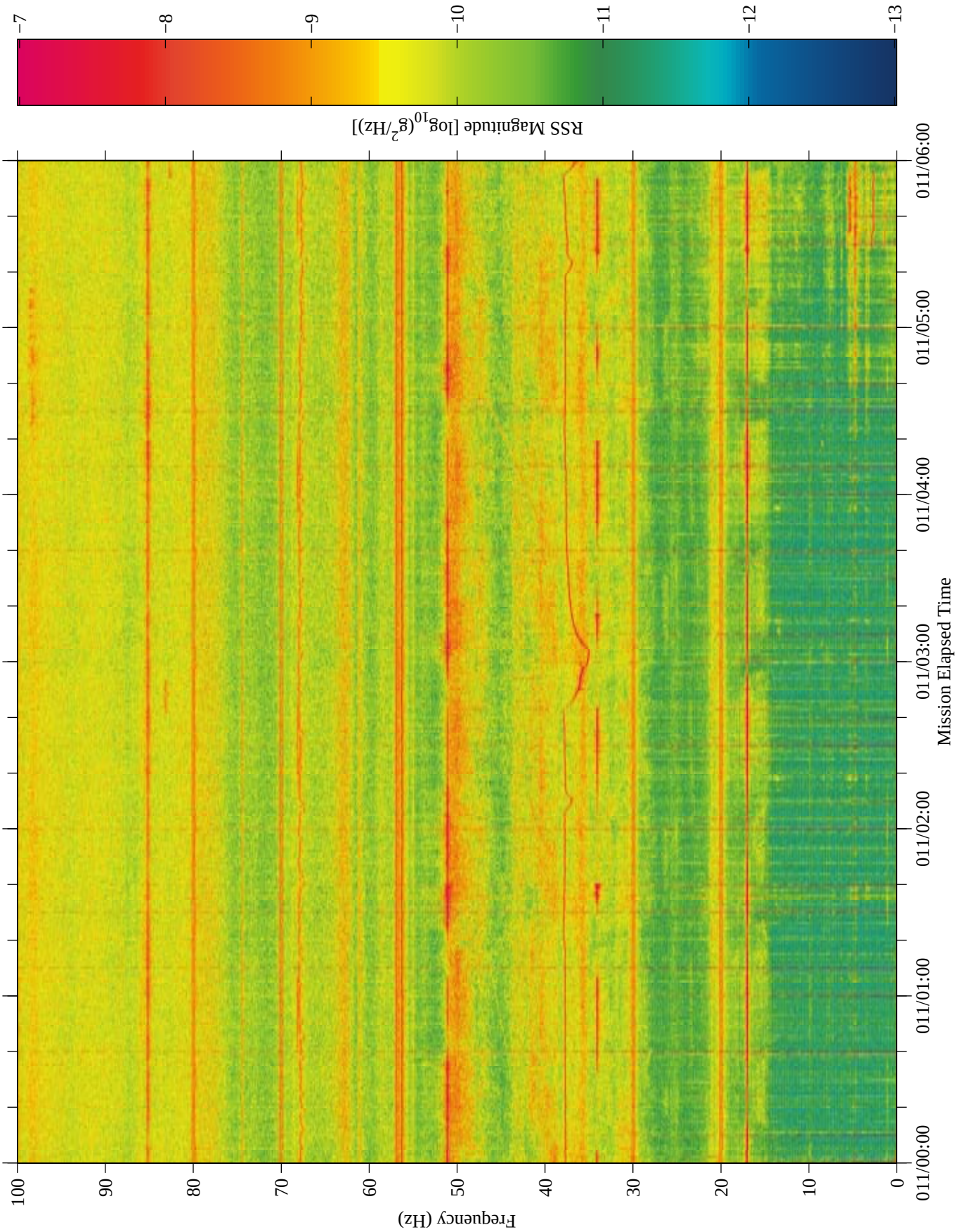

Figure 45: USMP−4, Unit G, TSH B

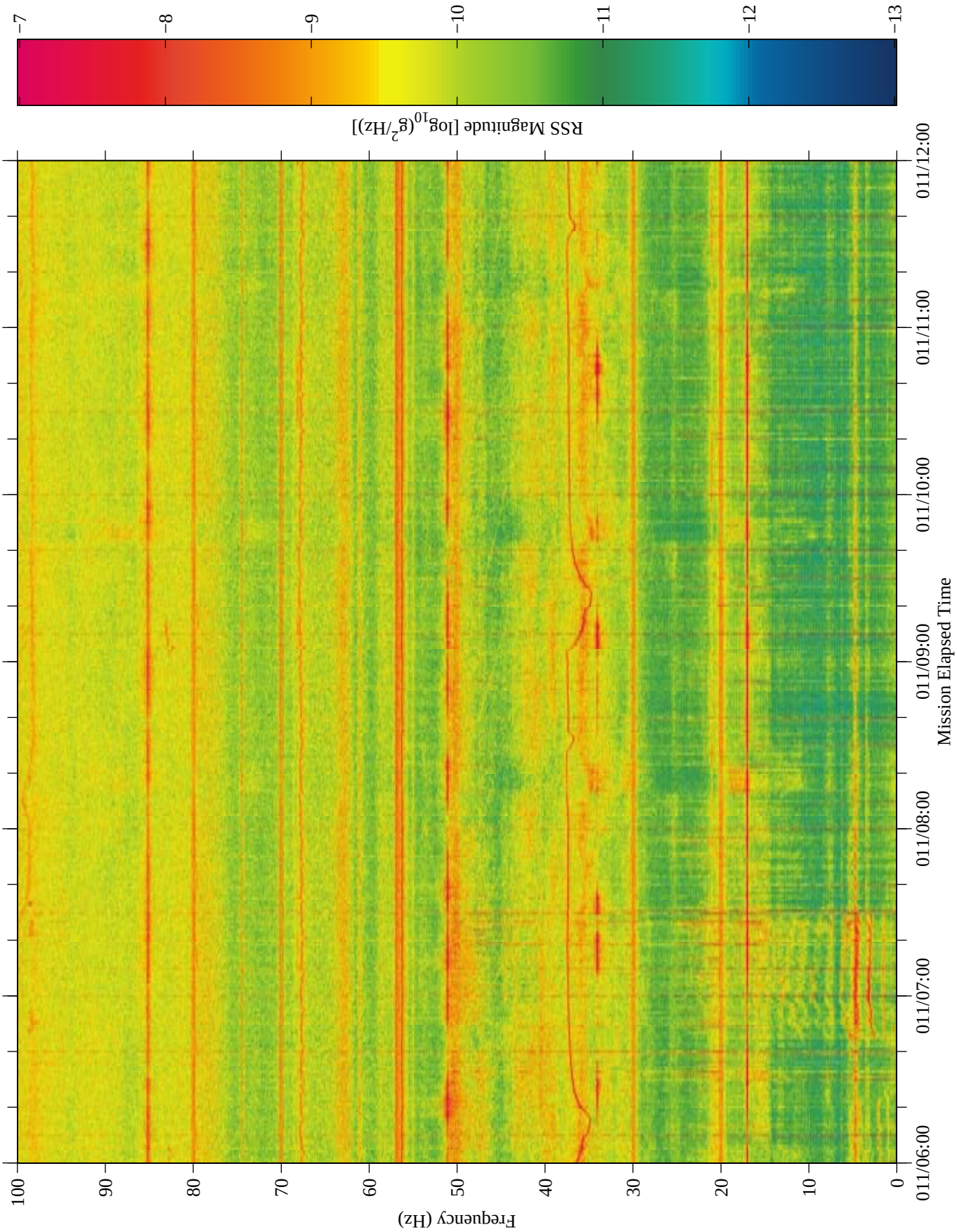

Figure 46: USMP−4, Unit G, TSH B

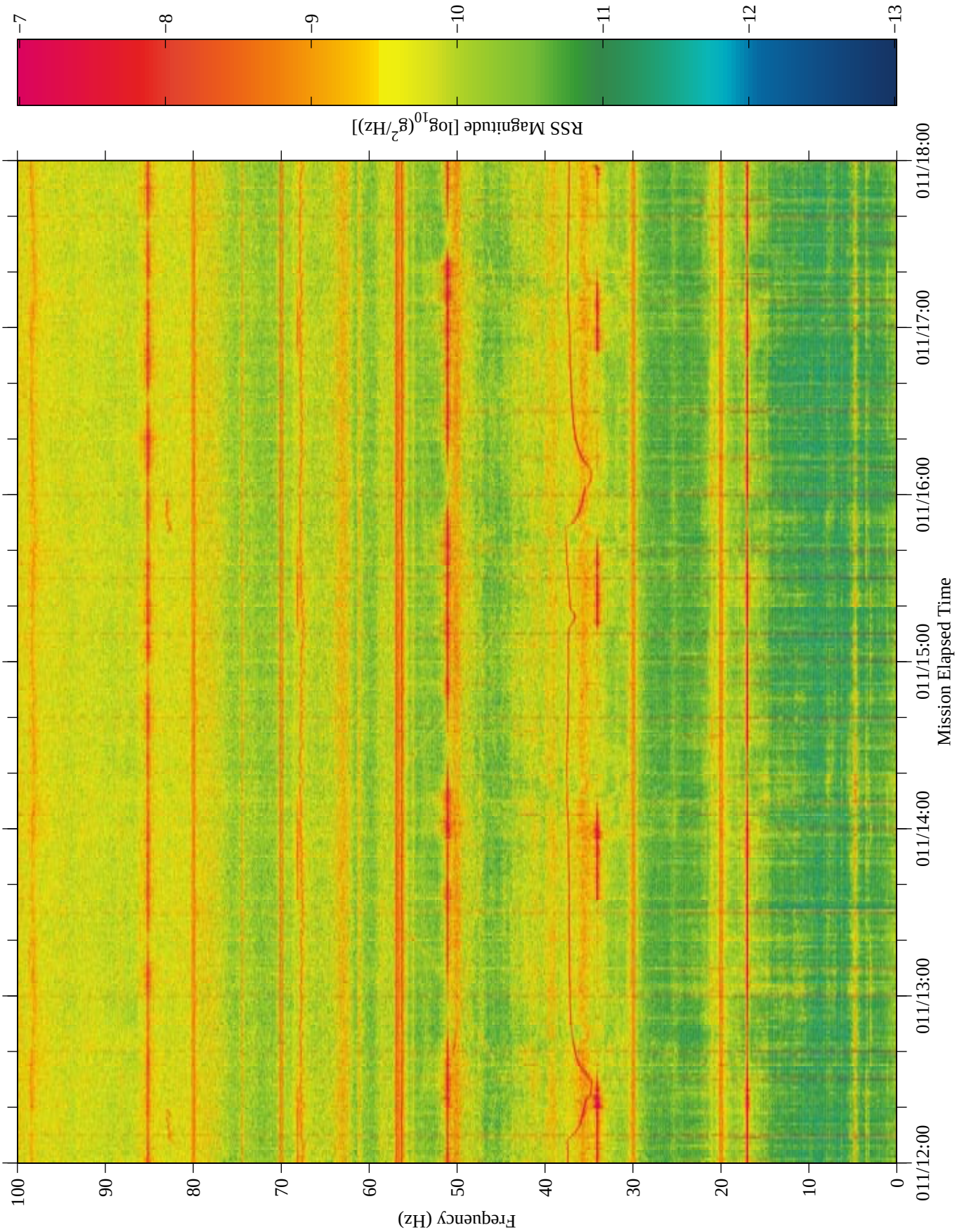

Figure 47: USMP−4, Unit G, TSH B

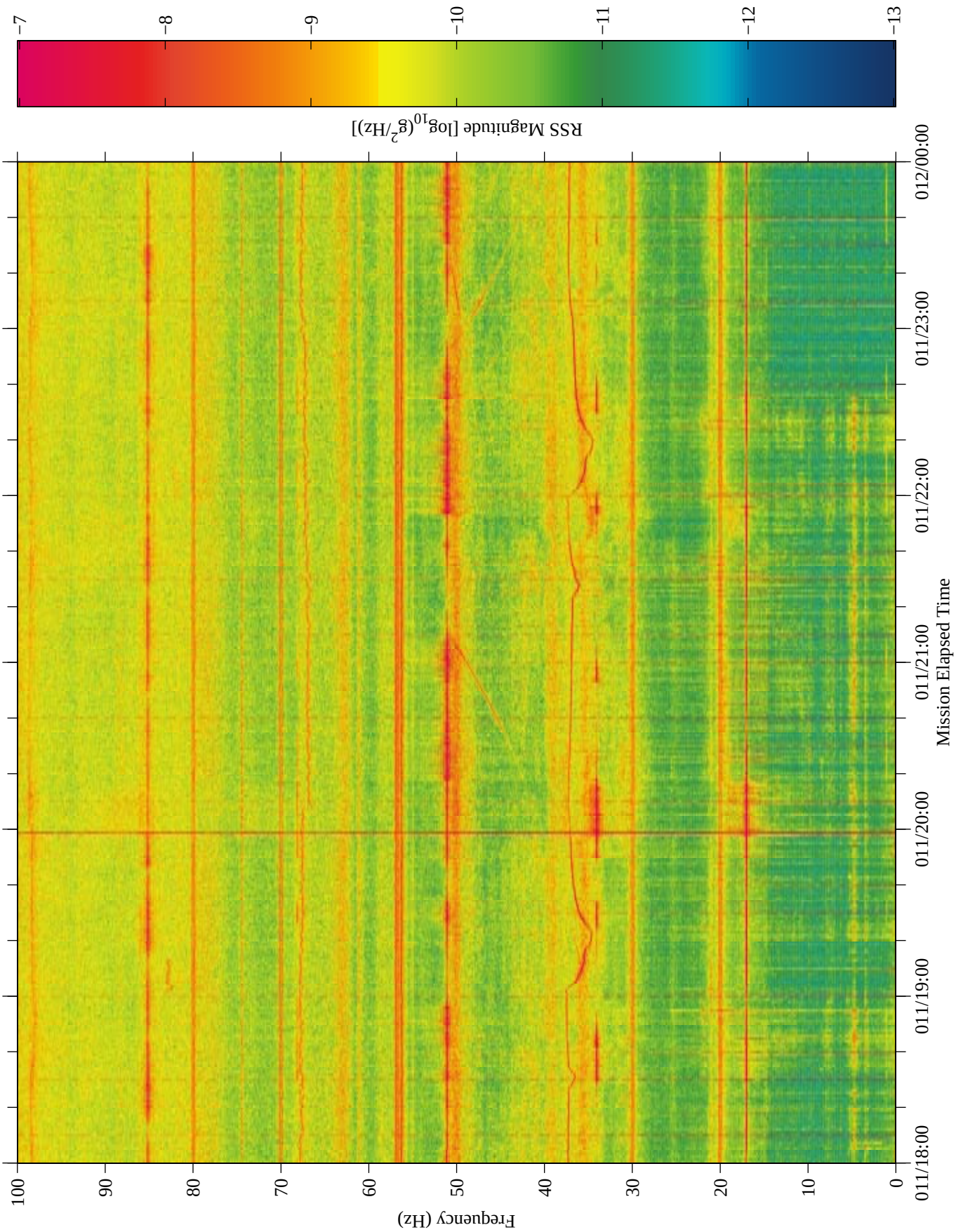

Figure 48: USMP−4, Unit G, TSH B

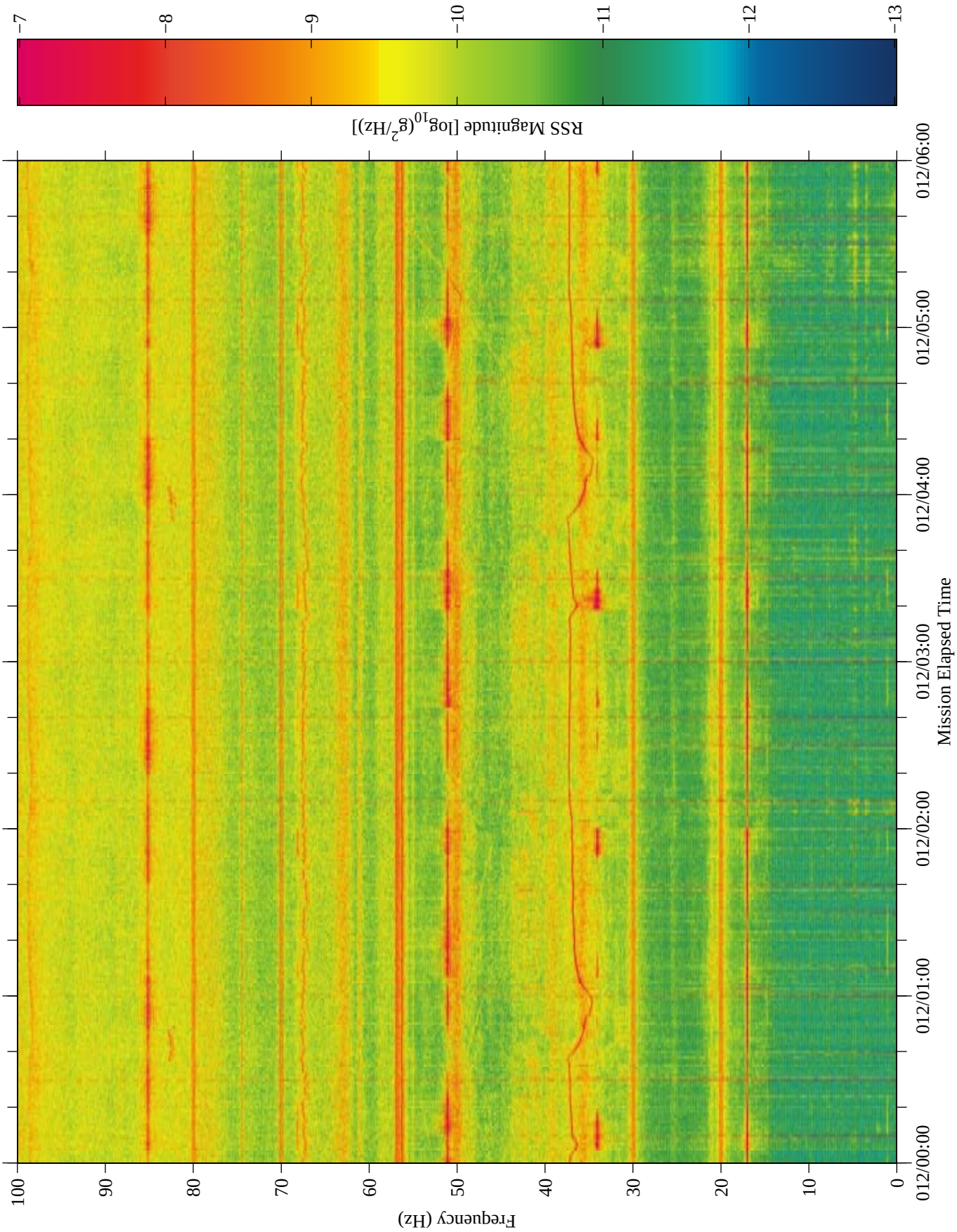

Figure 49: USMP−4, Unit G, TSH B

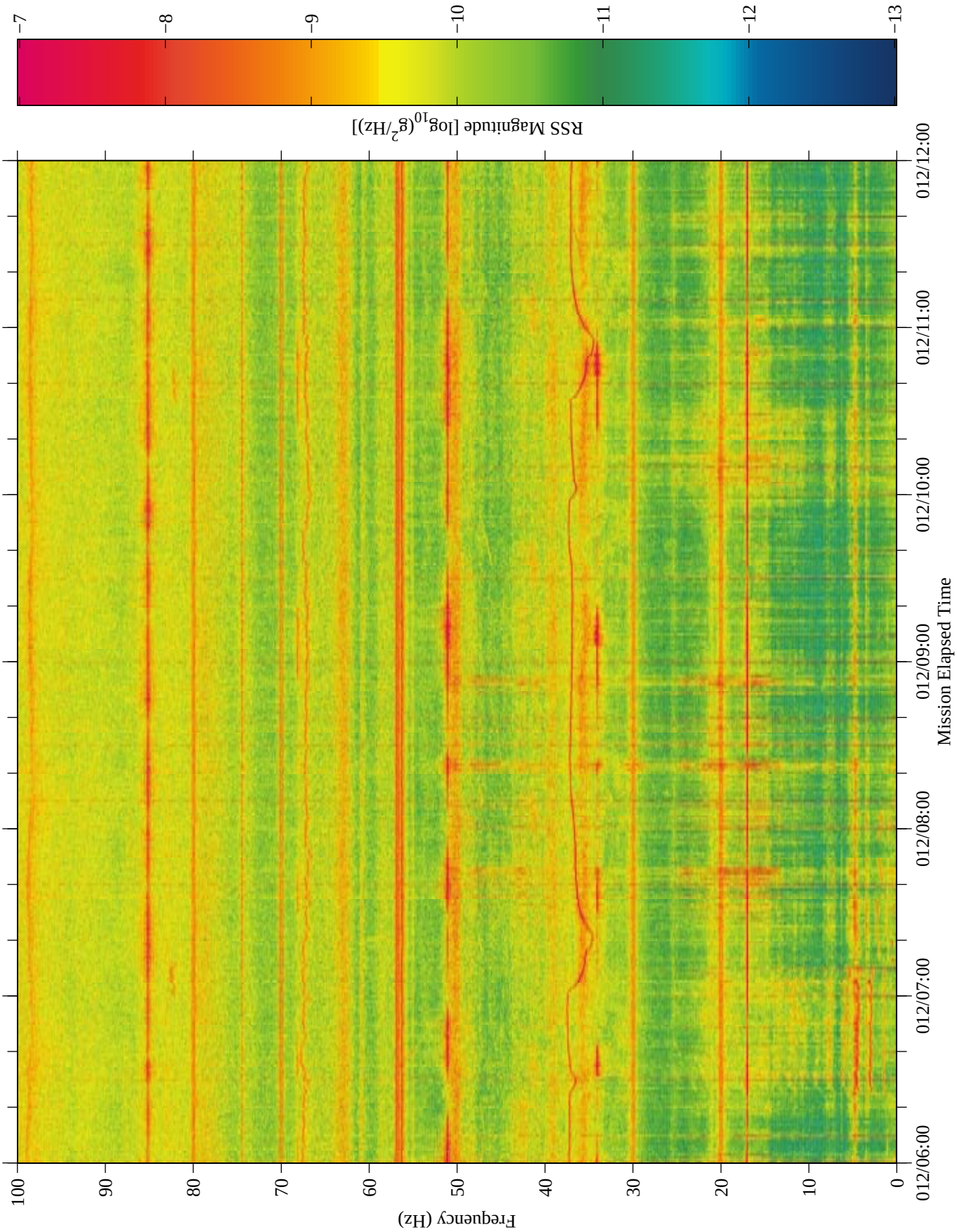

Figure 50: USMP−4, Unit G, TSH B

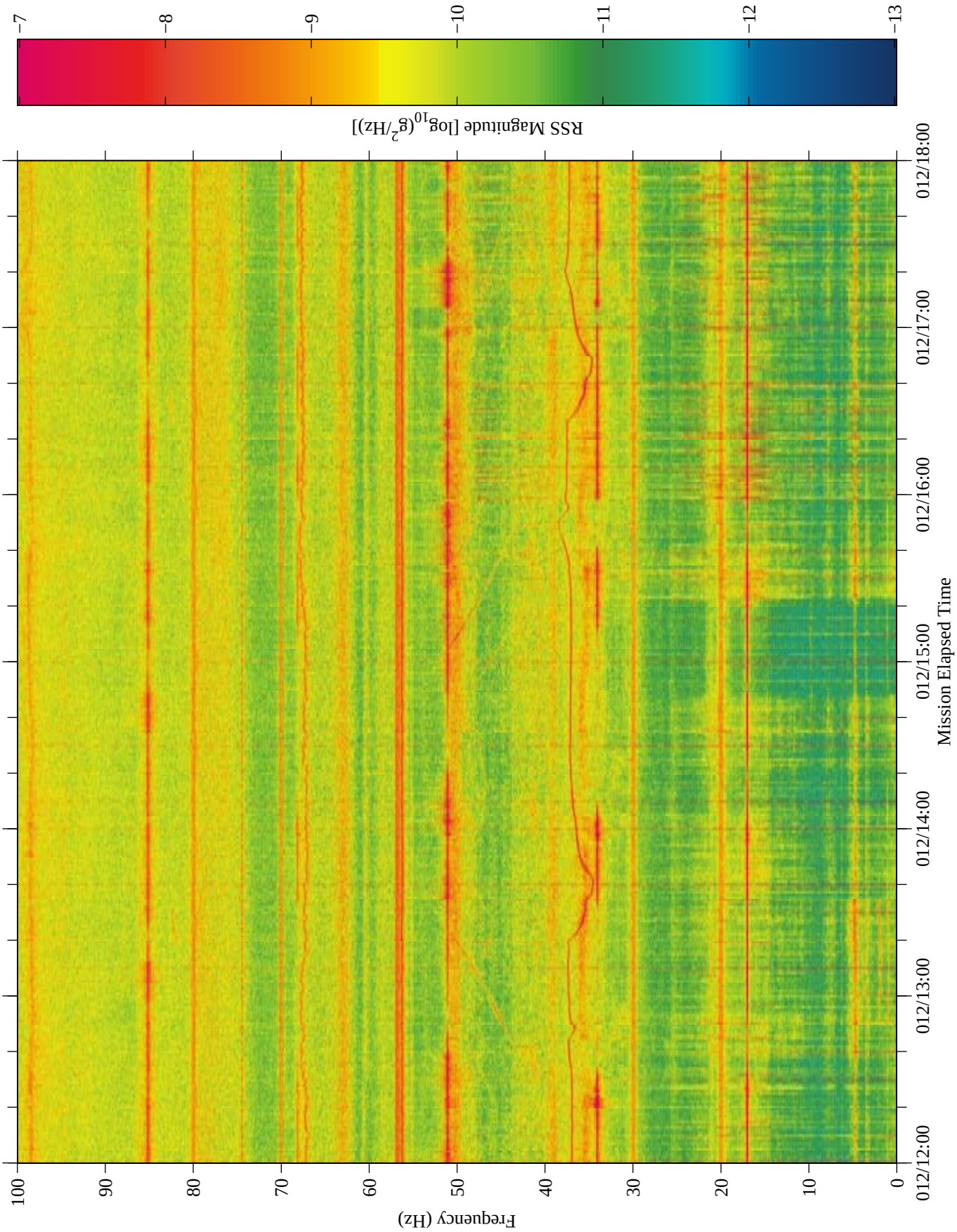

Figure 51: USMP−4, Unit G, TSH B

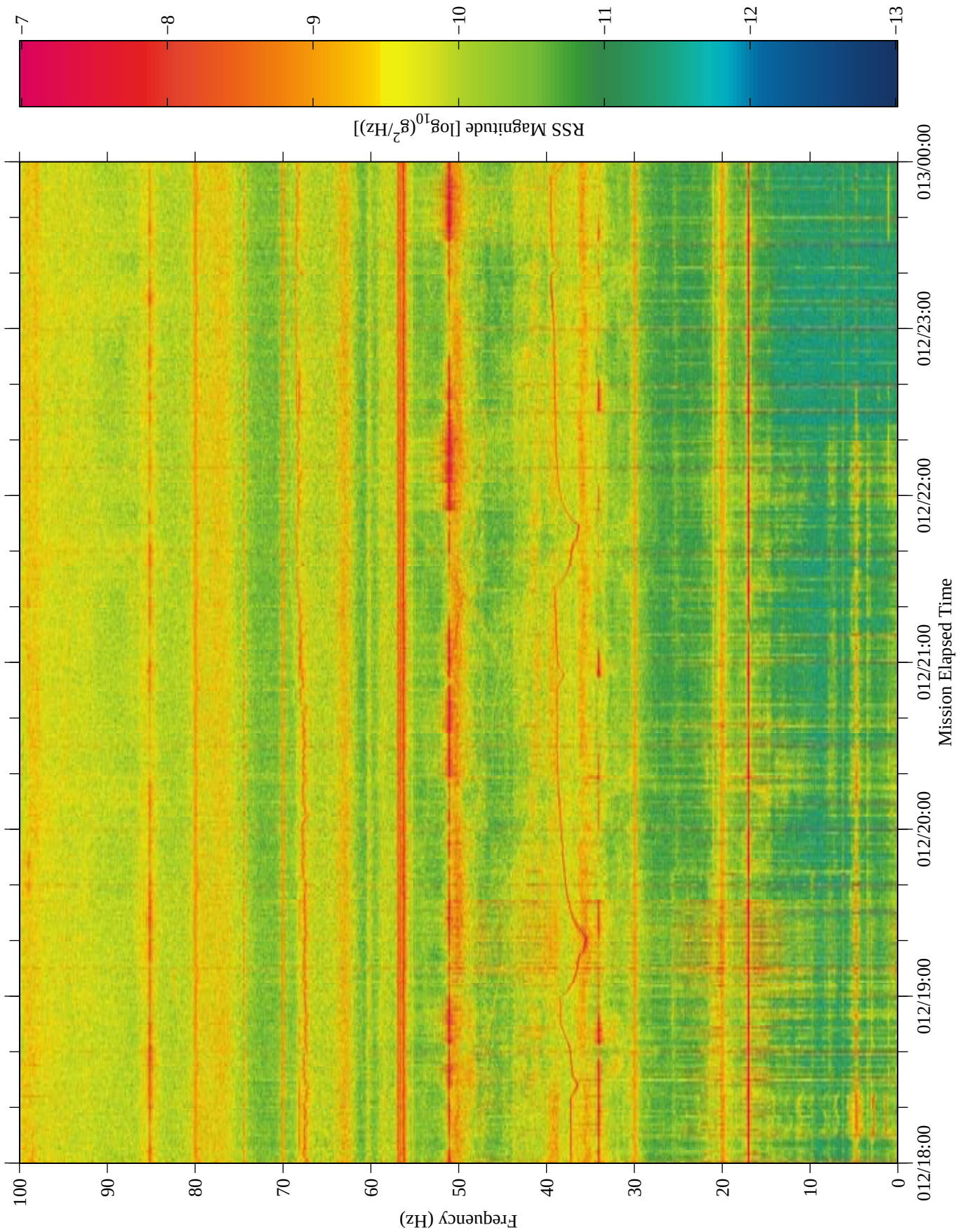

Figure 52: USMP−4, Unit G, TSH B

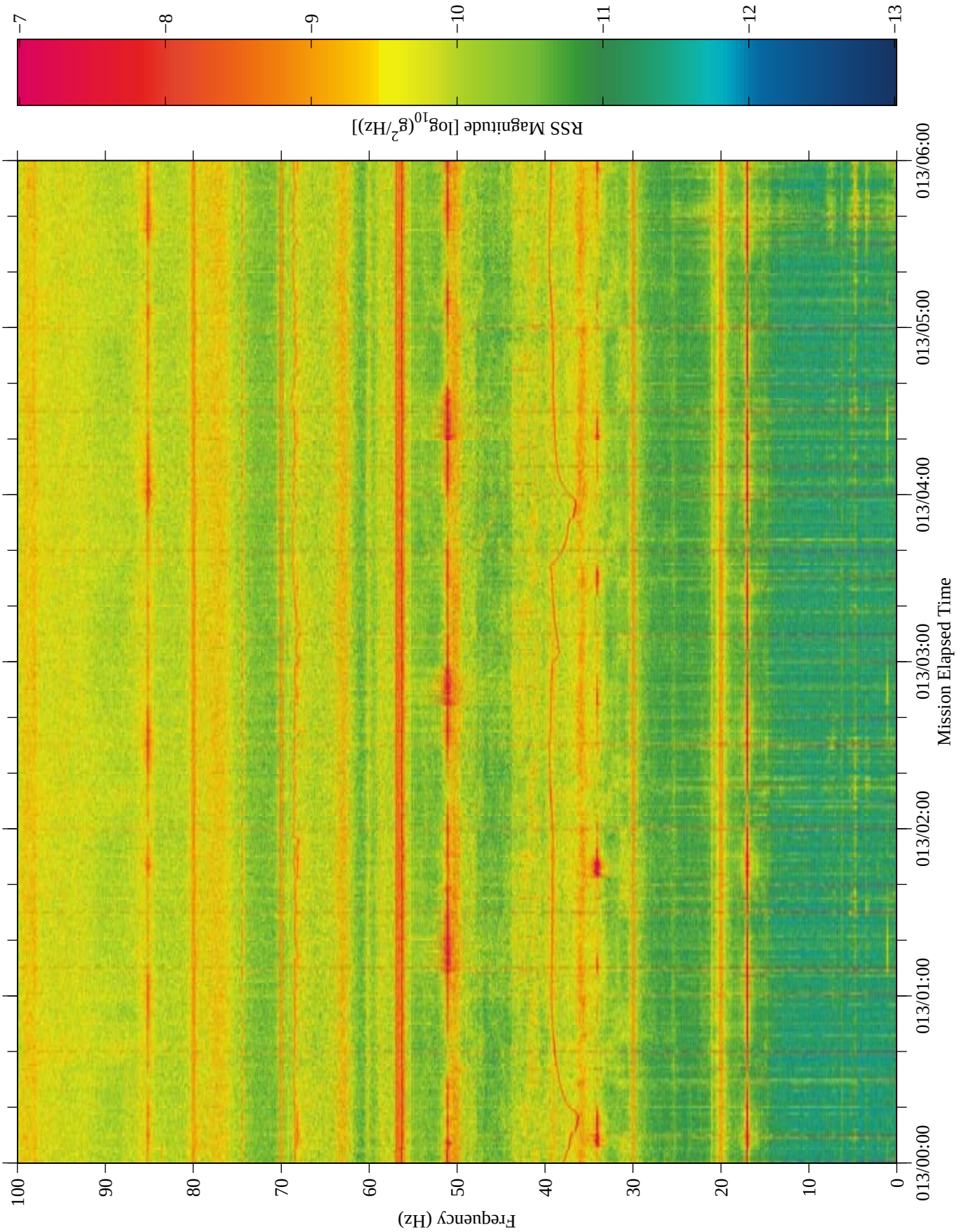

Figure 53: USMP−4, Unit G, TSH B

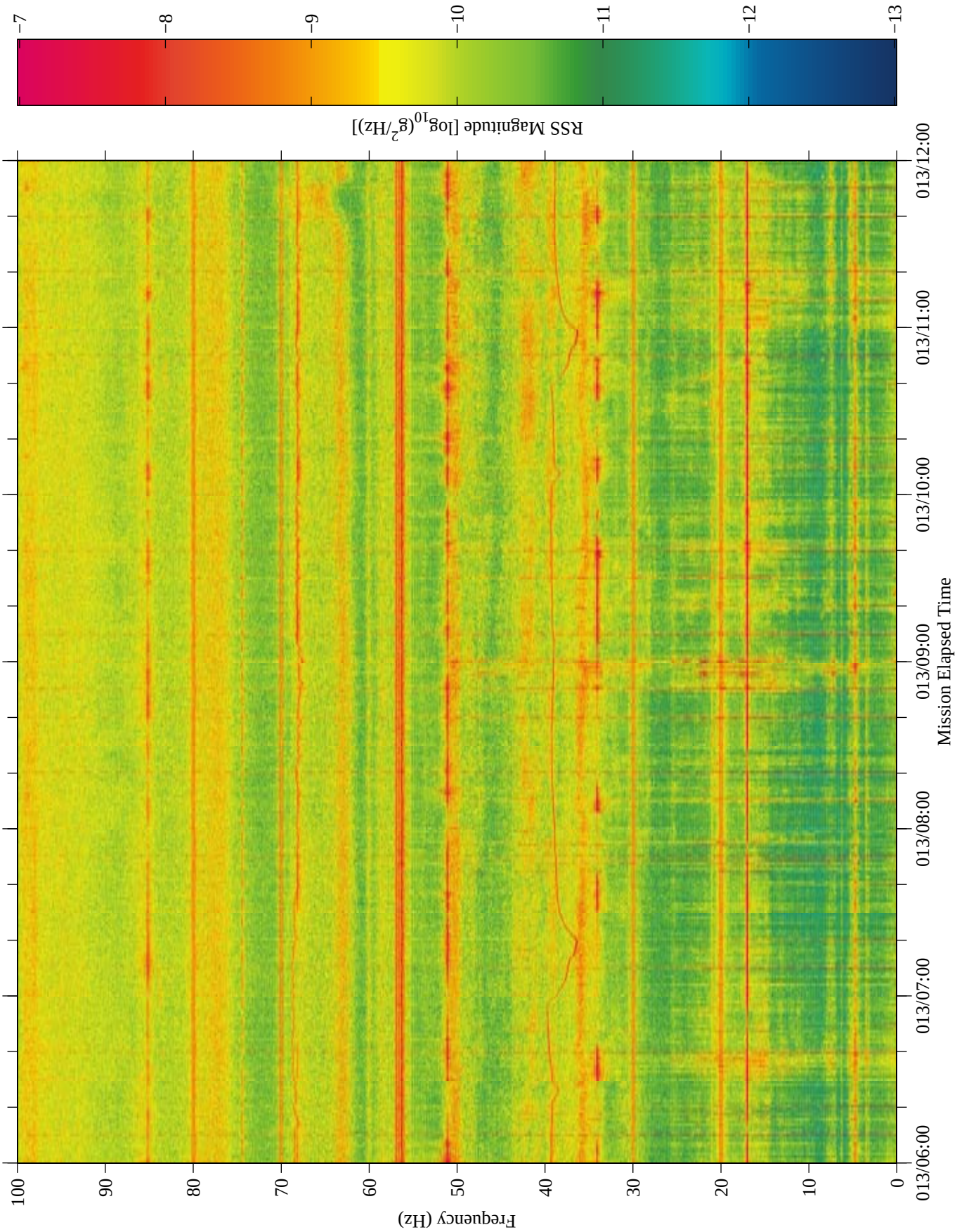

Figure 54: USMP−4, Unit G, TSH B

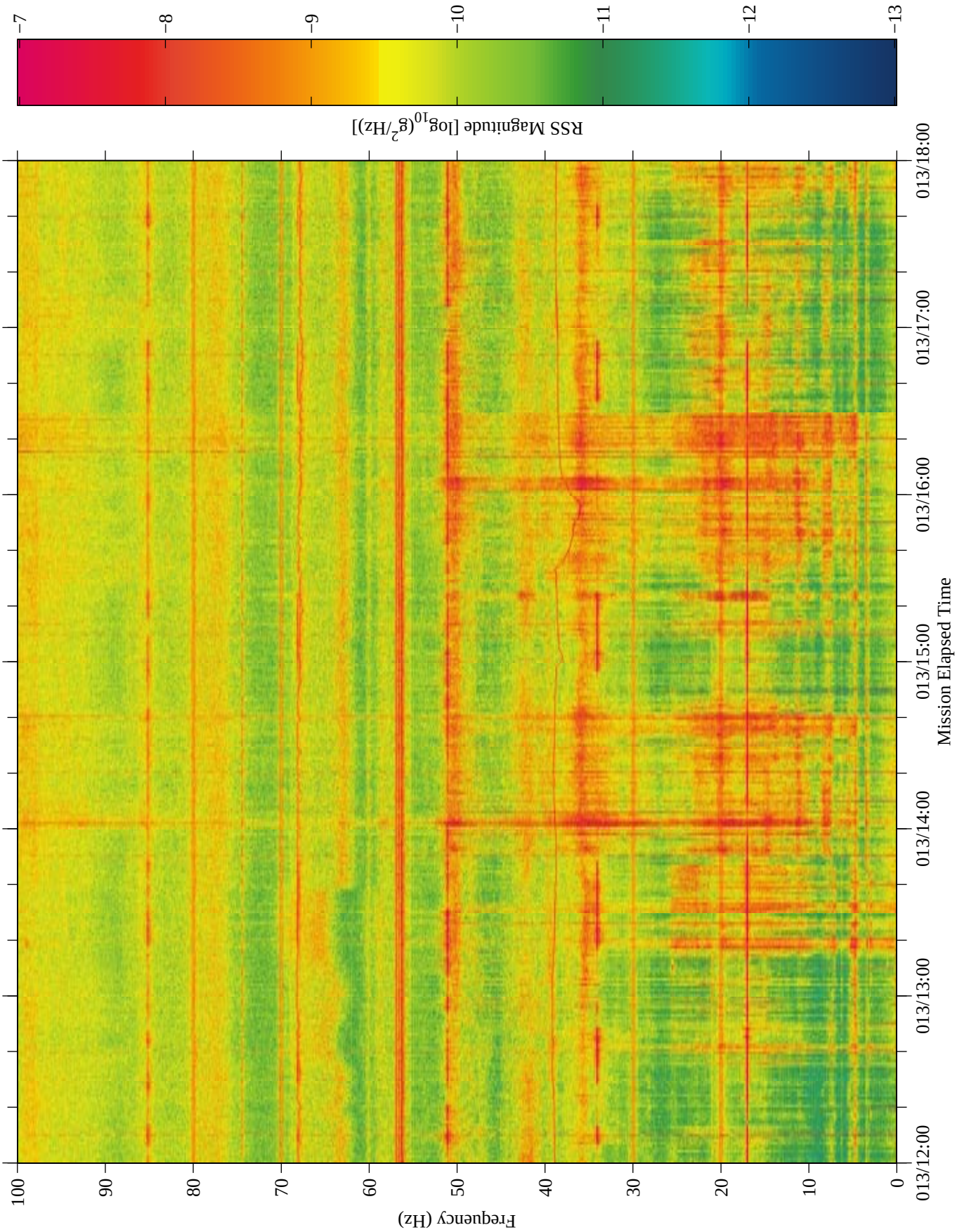

Figure 55: USMP−4, Unit G, TSH B

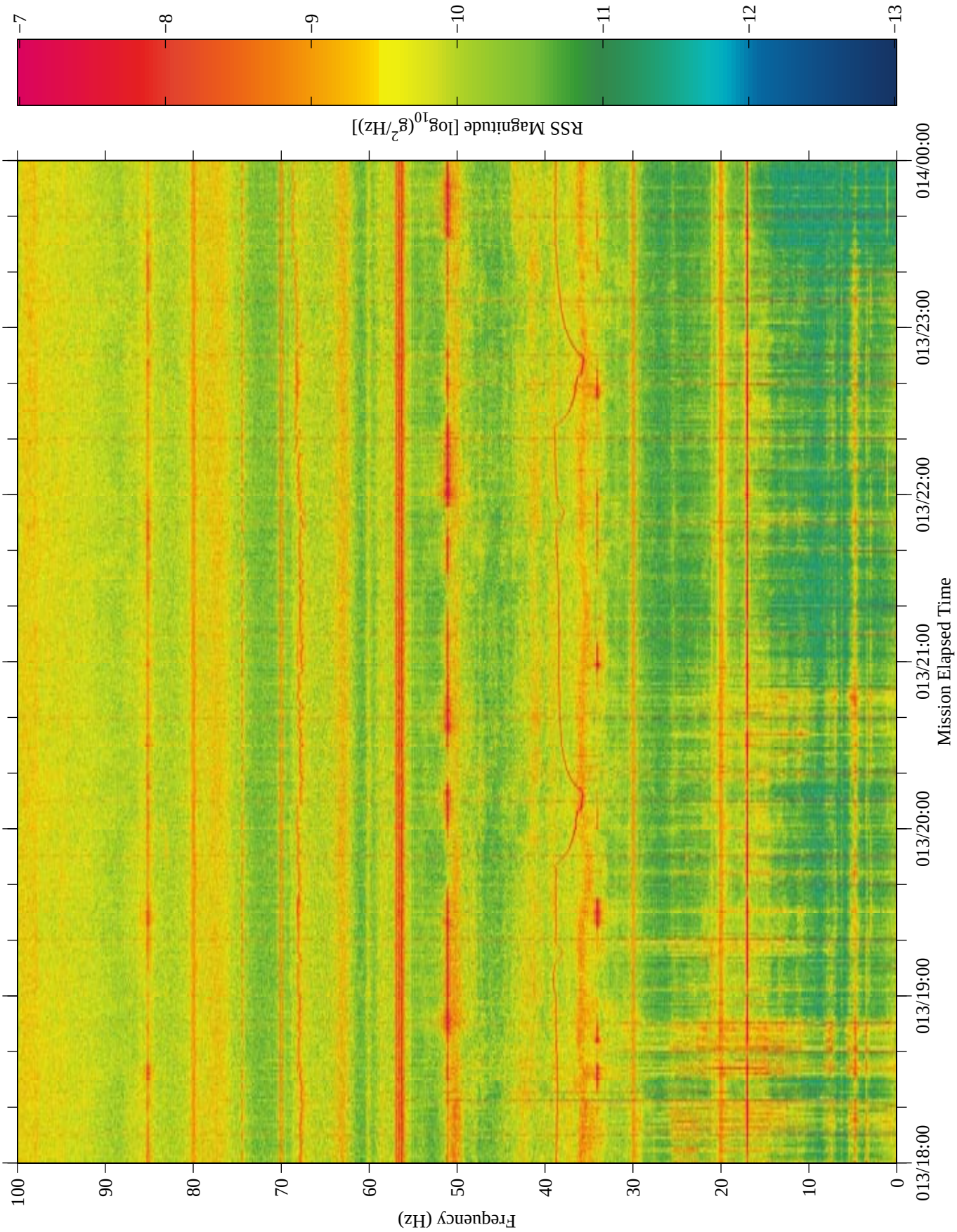

Figure 56: USMP−4, Unit G, TSH B

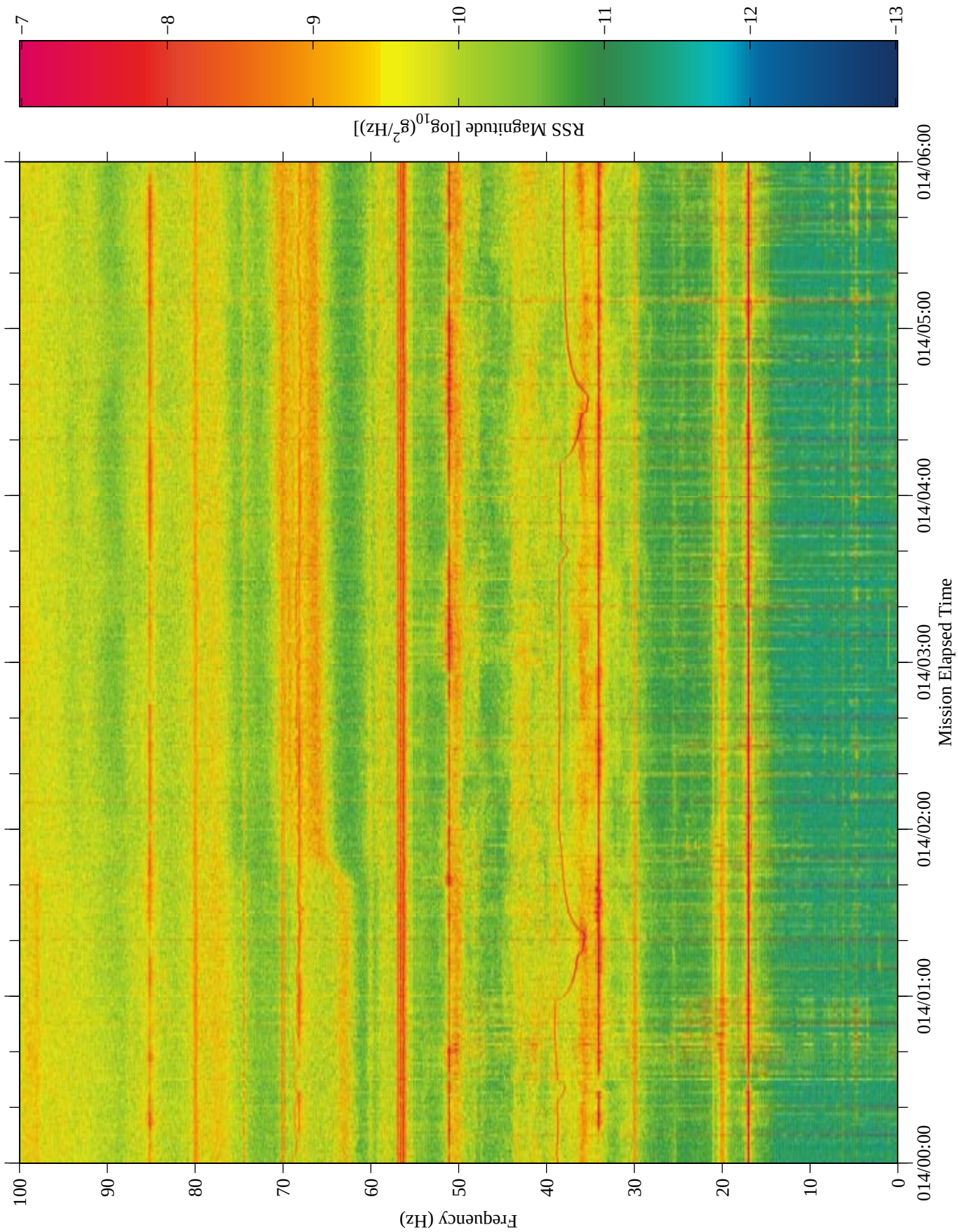

Figure 57: USMP−4, Unit G, TSH B

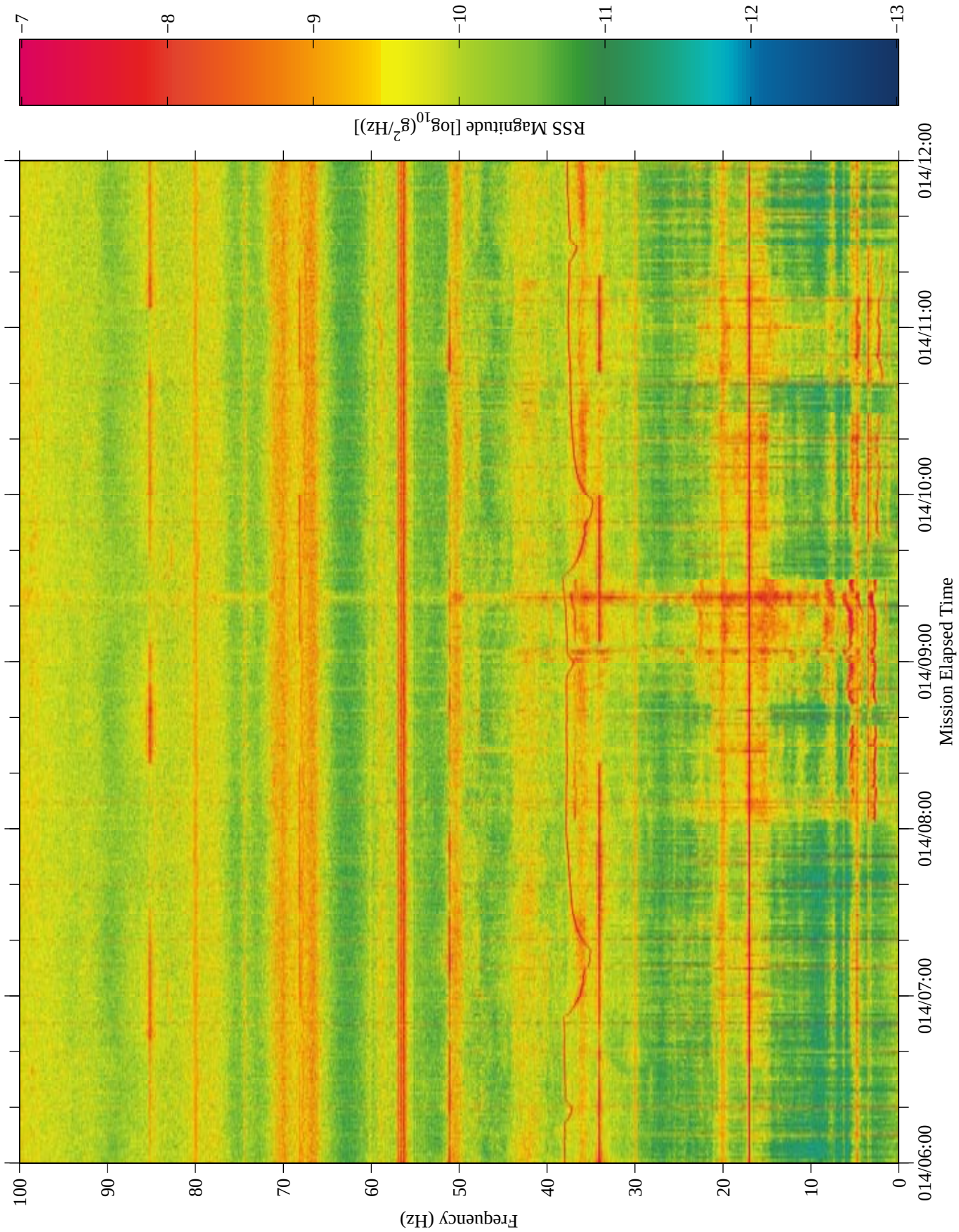

Figure 58: USMP−4, Unit G, TSH B

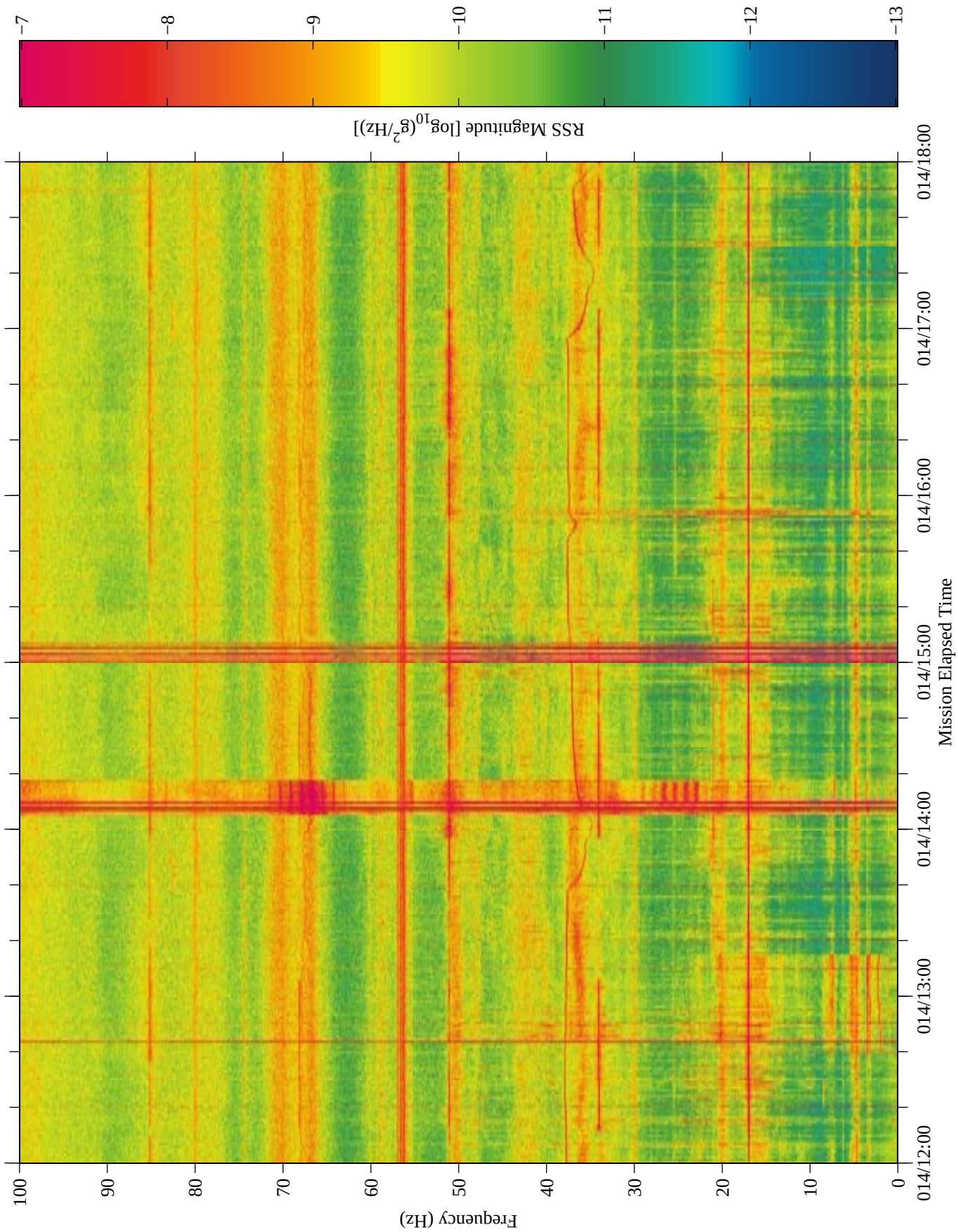

Figure 59: USMP−4, Unit G, TSH B

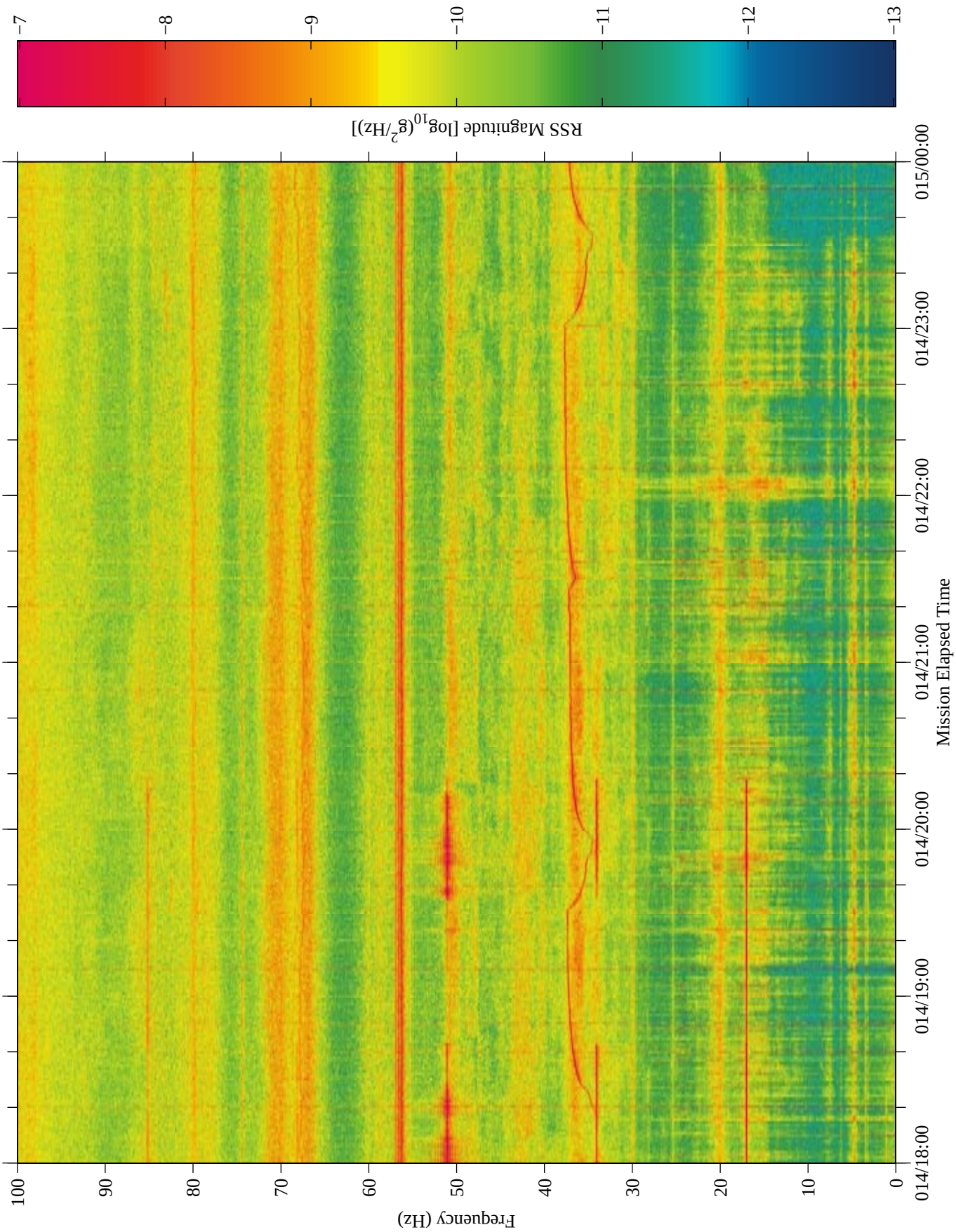

Figure 60: USMP−4, Unit G, TSH B

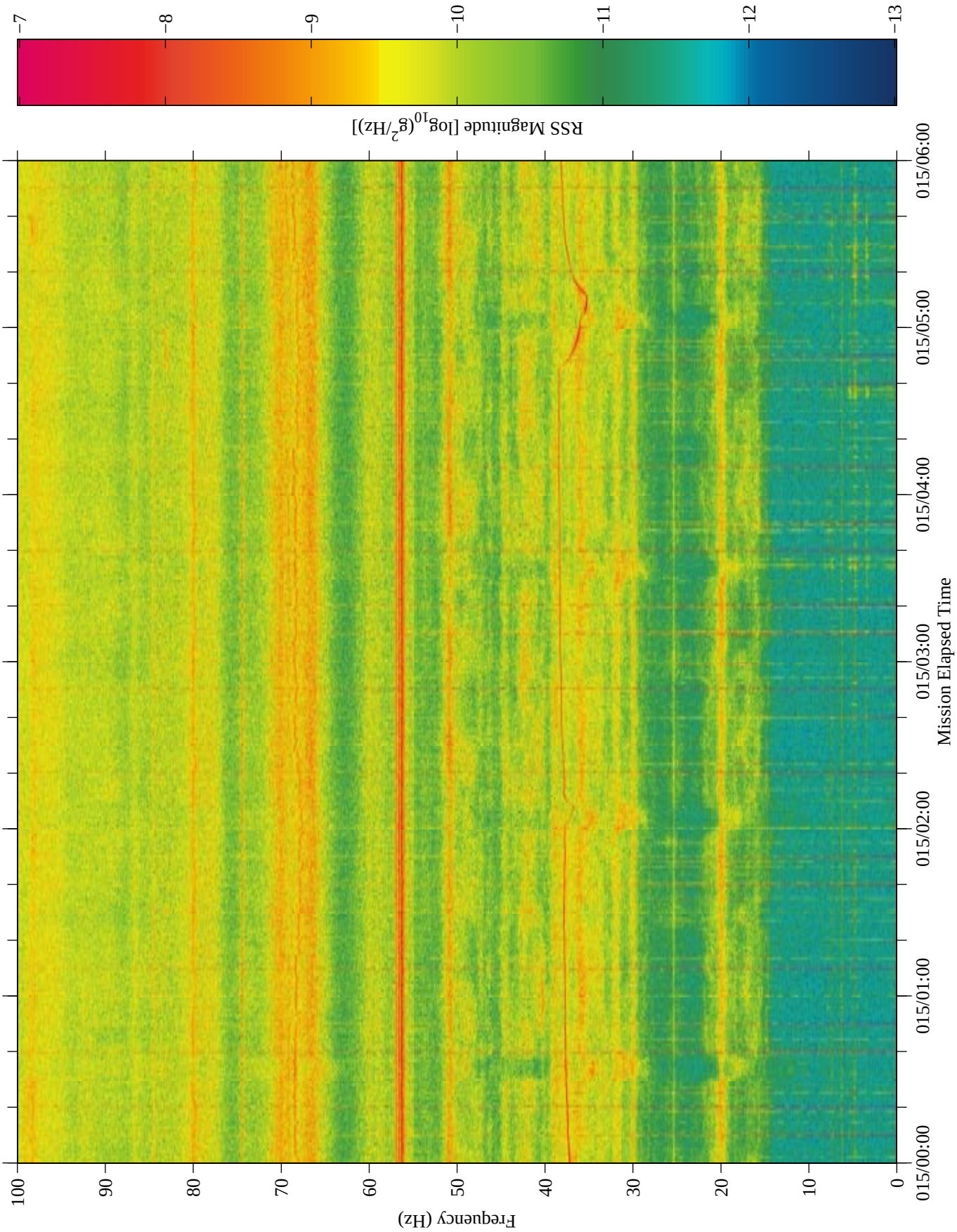

Figure 61: USMP−4, Unit G, TSH B

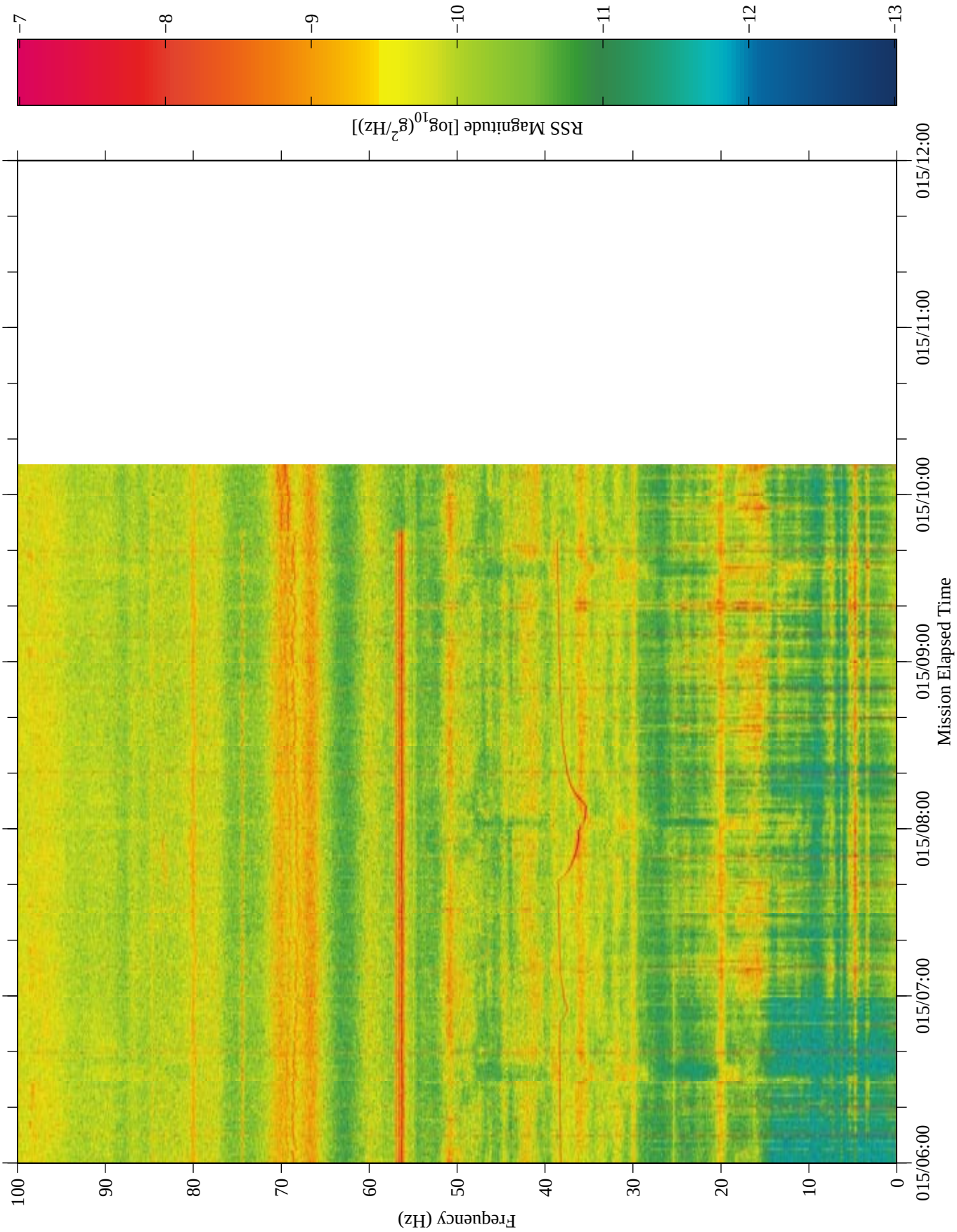

Figure 62: USMP−4, Unit G, TSH B

Appendix E: SAMS Color Spectrograms for Unit G, TSH A

The PIMS group has processed SAMS data from STS-87, Unit G, TSH A to produce the plots shown here. These data were collected at 50 samples per second, and a 5 Hz low pass filter was applied to the data by the SAMS unit prior to digitization. Prior to plot production, the raw SAMS data were compensated for gain changes, and then demeaned. Demeaning was accomplished by analyzing individual sections with a nominal length of 30 minutes. Users who are interested in further details for either of these operations are encouraged to contact the PIMS group.

Color spectrograms are used to show how the microgravity environment varies in intensity with respect to both the time and frequency domains. These spectrograms are provided as an overview of the frequency characteristics of the SAMS data during the mission. Each spectrogram is a composite of six hour's worth of data. The time resolution used to compute the spectrograms seen here is 40.96 seconds. This corresponds to a frequency resolution of 0.02 Hz.

In order to produce the spectrogram image, PSDs were computed for successive time intervals (the length of the interval is equal to the time resolution). For the PSD computation, a Hanning window was applied. In order to combine all three axes into a single plot to show an overall level, a vector magnitude (VM) operation was performed. Stated mathematically:

$$VM_k = \sqrt{PSD_{x_k}^2 + PSD_{y_k}^2 + PSD_{z_k}^2} \; .$$

By imaging the base 10 logarithm ($\log_{10}$) magnitude as a color and stacking successive PSDs from left to right, variations of PSD magnitude and frequency are shown as a function of time. Colors are assigned to discrete magnitude ranges, so that there are 207 colors assigned to the entire range of magnitudes shown.

The colorbar limits are chosen in order to minimize saturation in a given set of spectrogram plots. Data which fall outside of these limits will be imaged as either the highest or lowest magnitude, depending on which side they have saturated. If an area of interest seems to be saturated, care should be taken because the actual values may lie above or below the color mapping shown on the plot.

Due to the nature of spectrograms, care should be taken to not merely read a color's numeric value as being the "amount" of acceleration that is present at a given frequency. In order to get this type of information, the PSDs must be integrated between two frequencies. These frequencies (lower and upper) form the band of interest. The result of this integration is the g_{RMS} acceleration level in the $\left[f_{lower}, f_{upper}\right]$ band. The PIMS group is able to provide this type of analysis on a per-request basis.

Plot gaps (if any exist) are shown by either white or dark blue areas on the page. If a plot gap exists for an entire plot (or series of successive plots), a comment is placed on the page to let the user know there is a gap in the data. These "no data available" comments will not show exact times for which the data are not available, but will only indicate missing plots.

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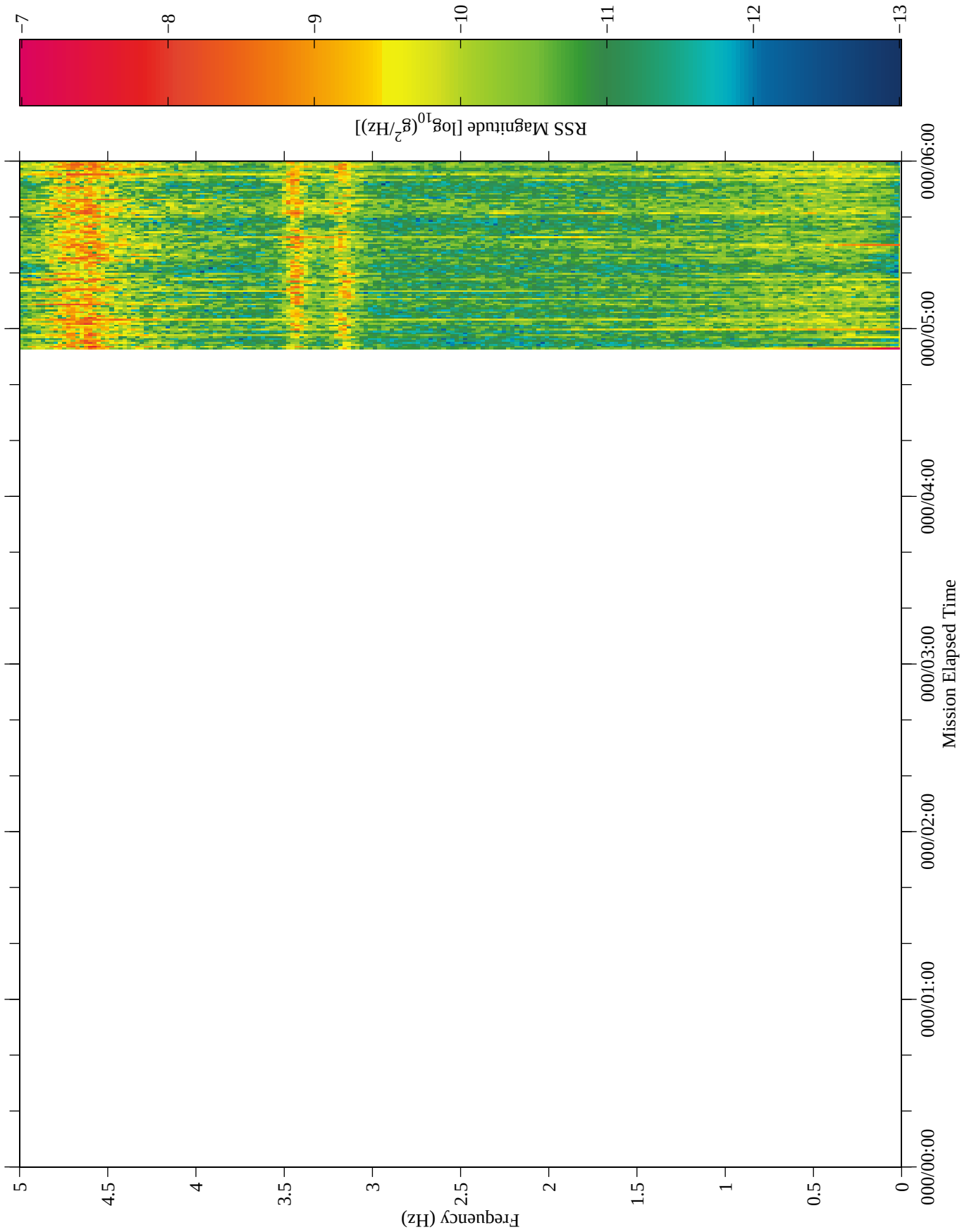
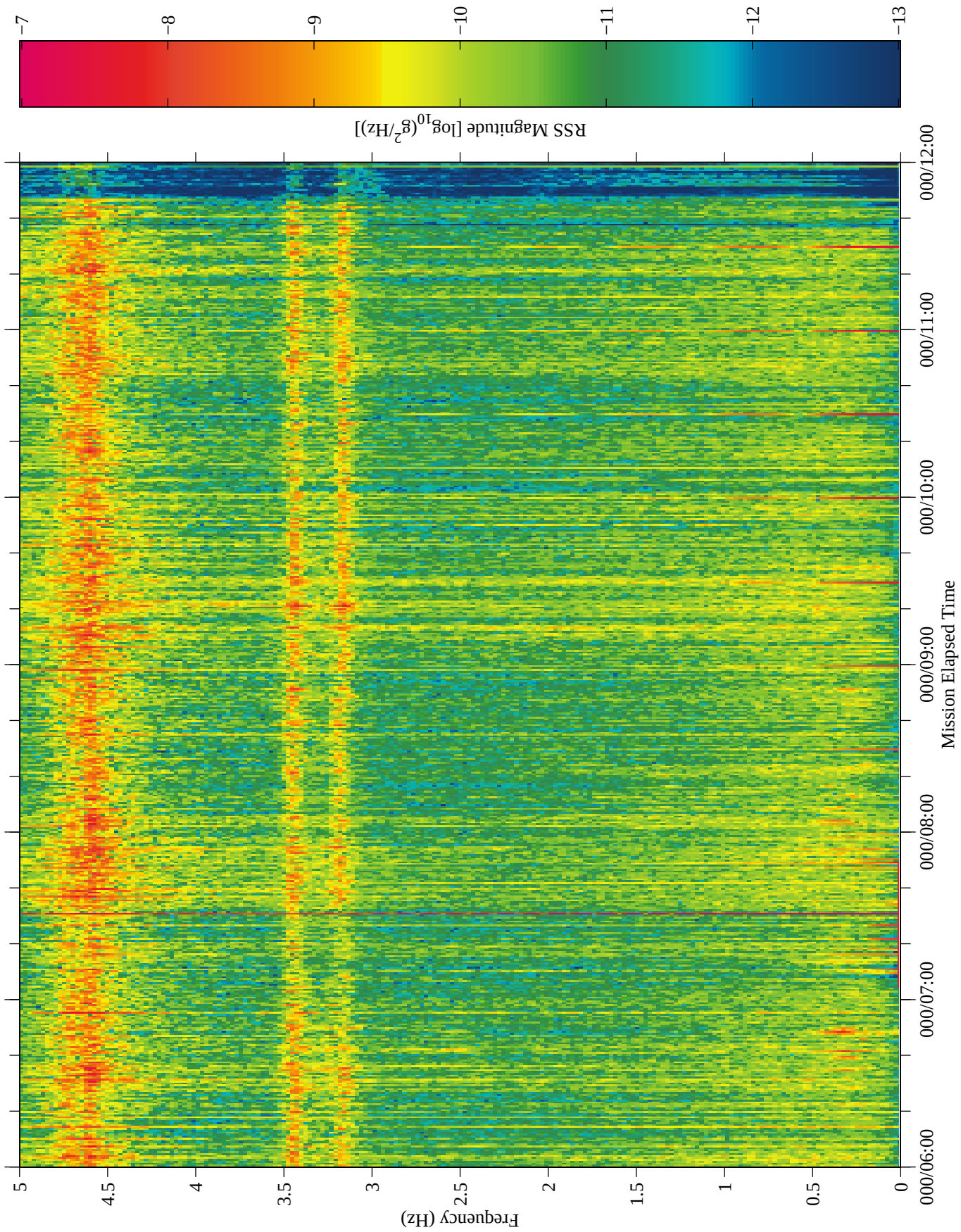


Figure 1: USMP−4, Unit G, TSH A



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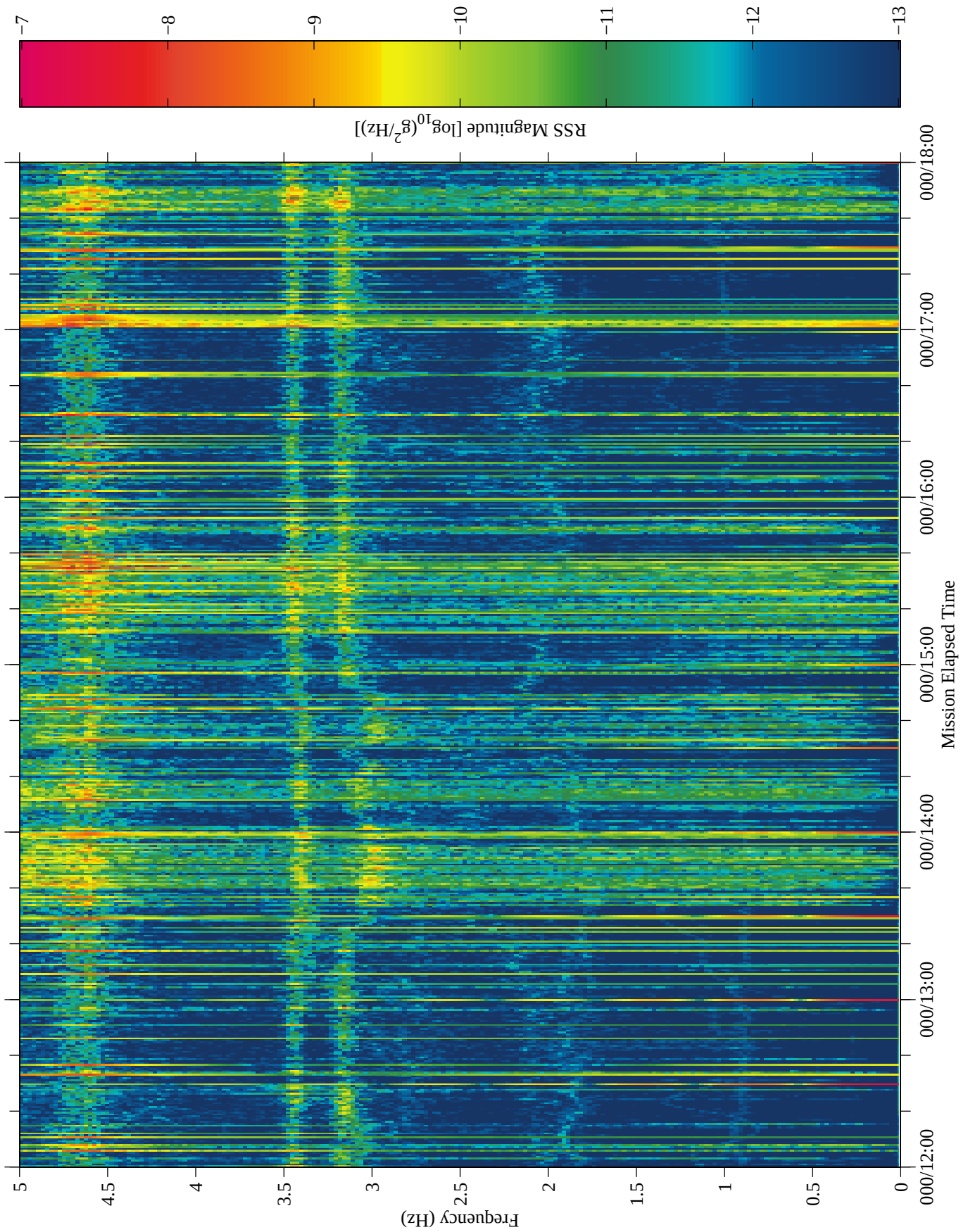

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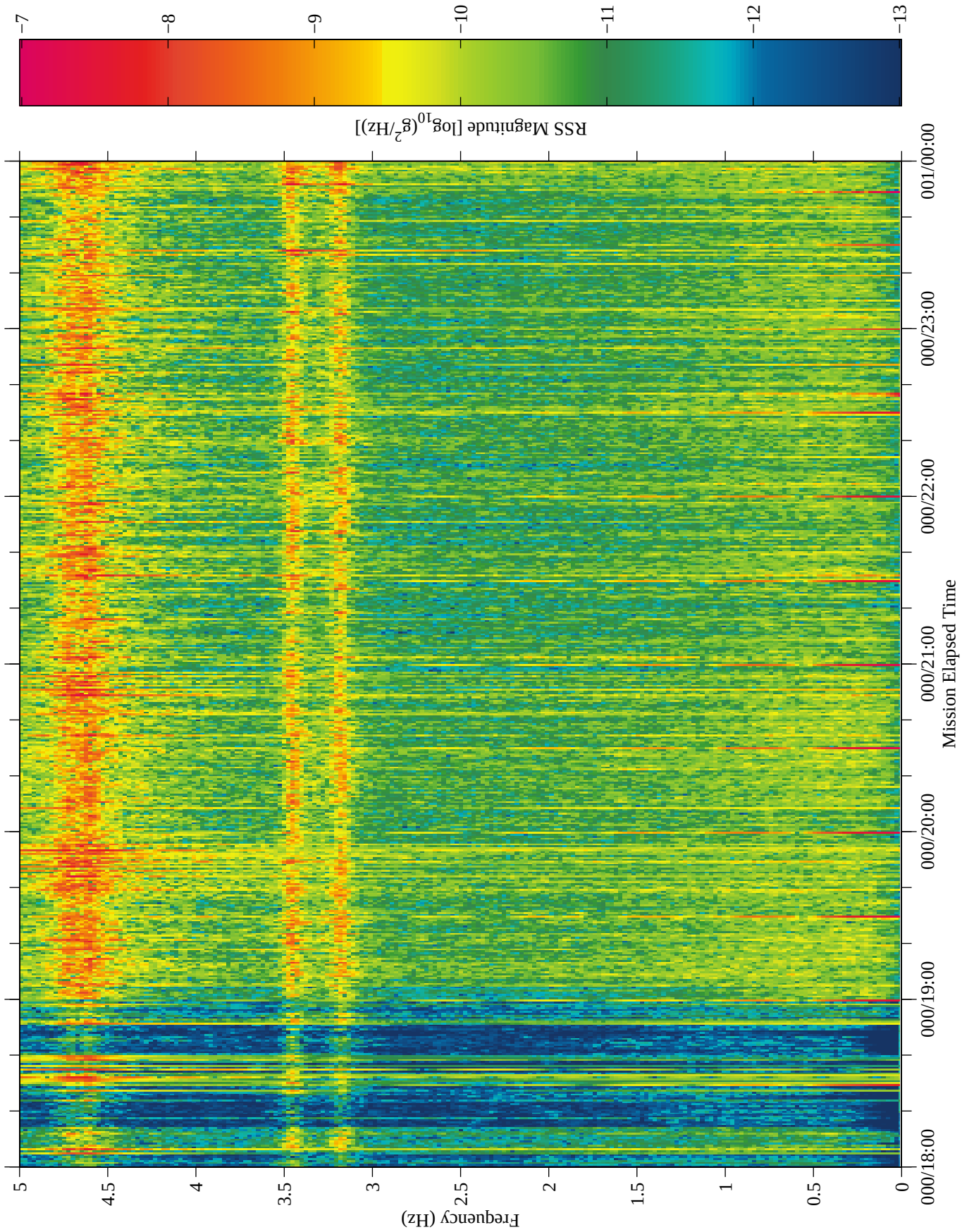

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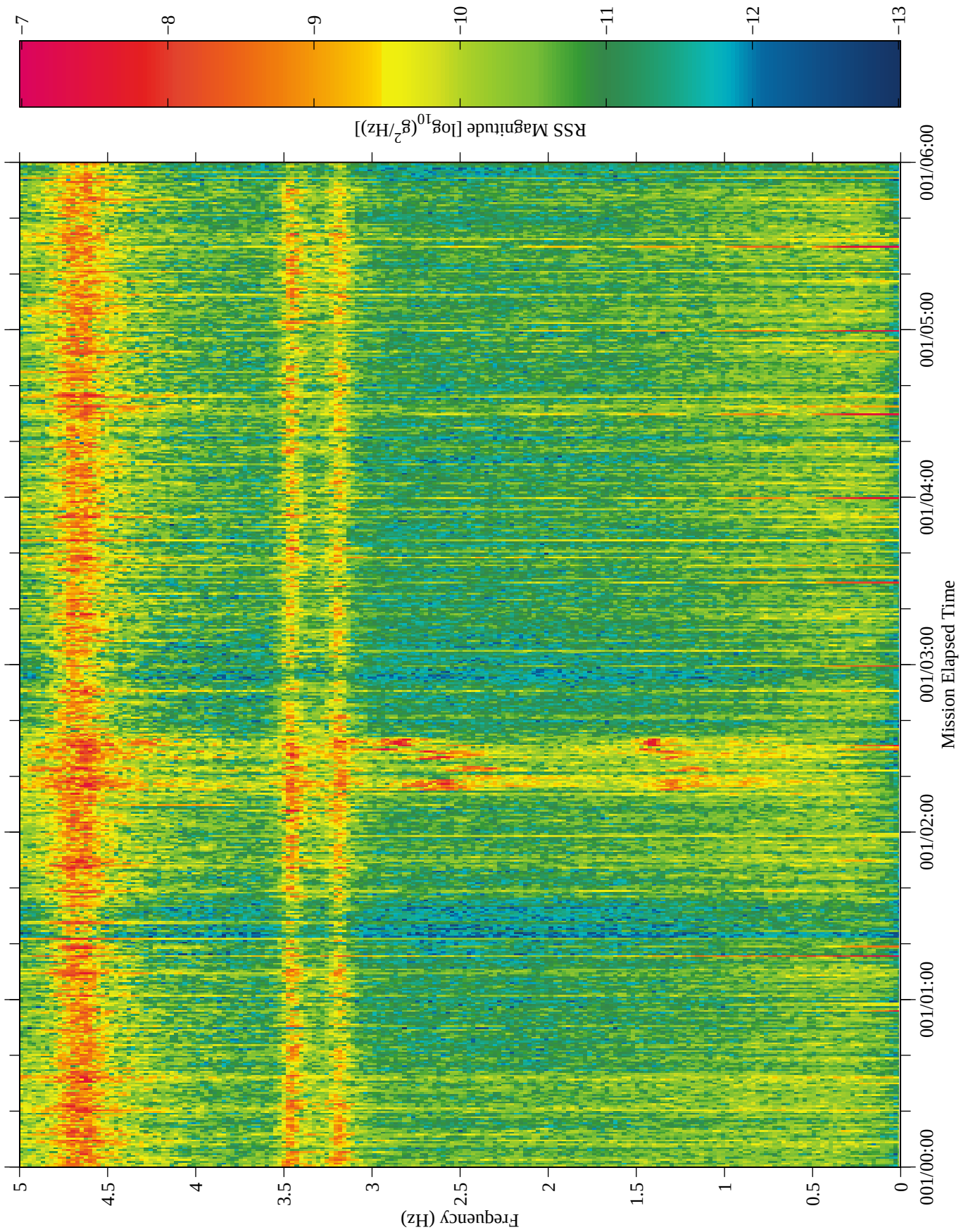

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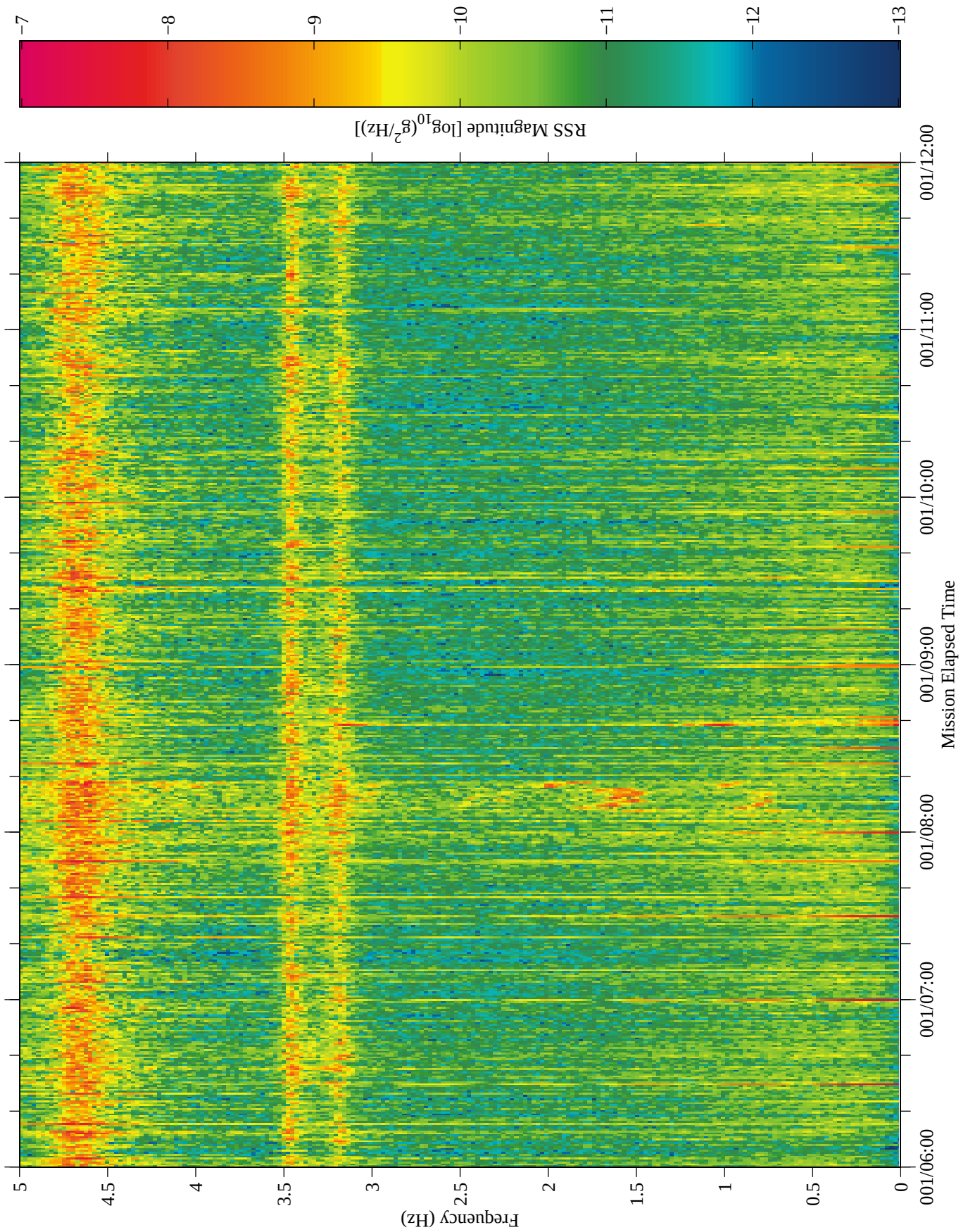

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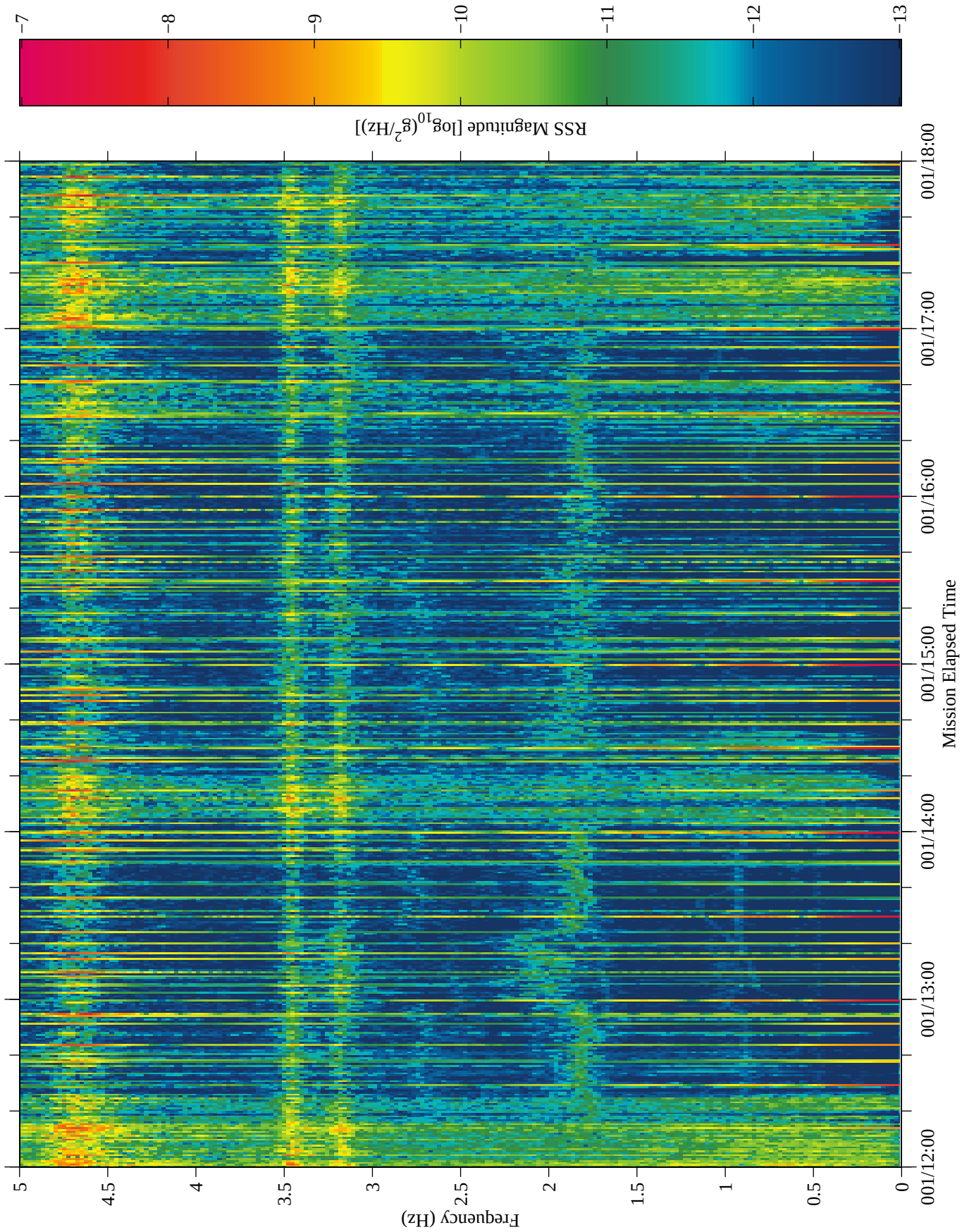

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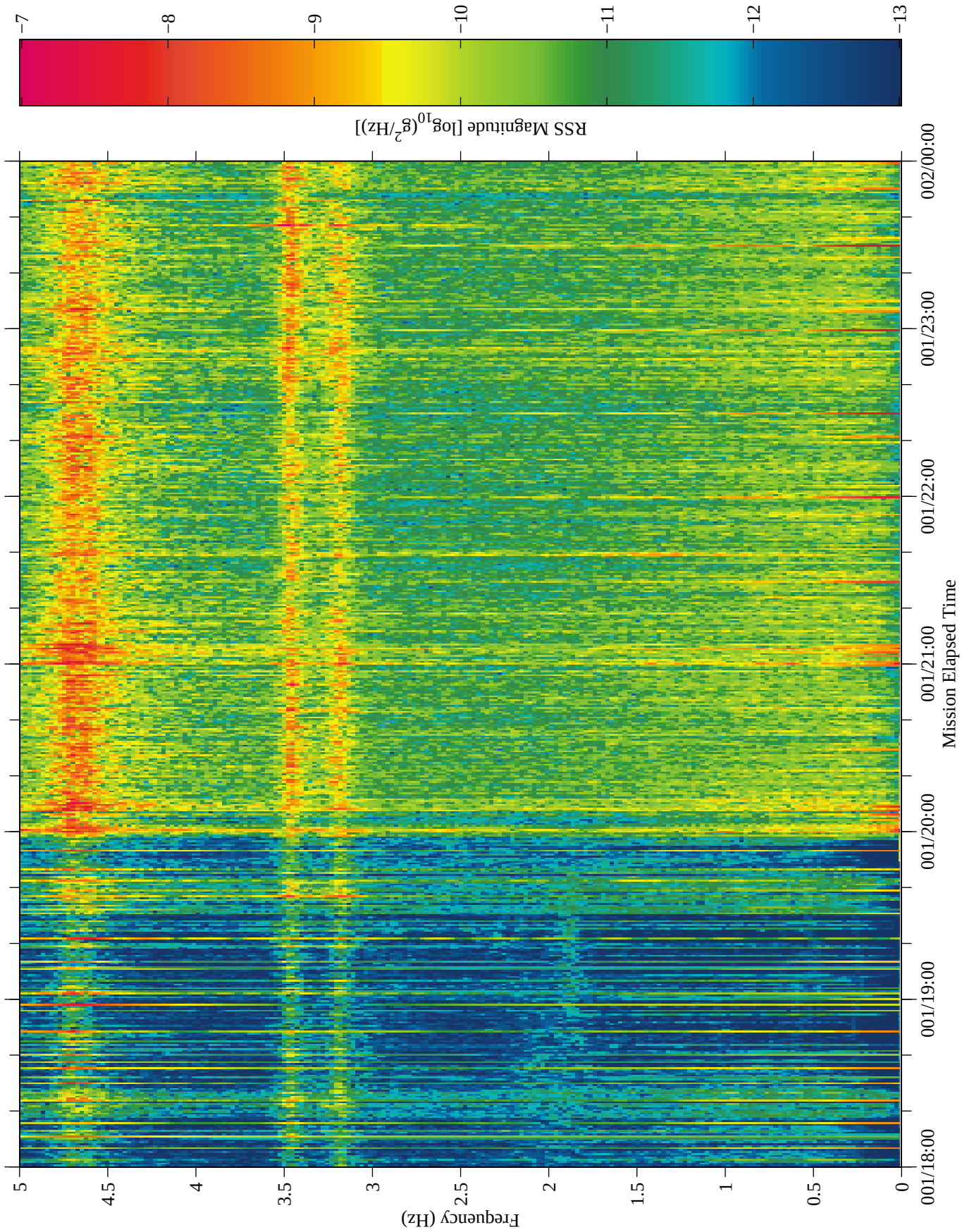

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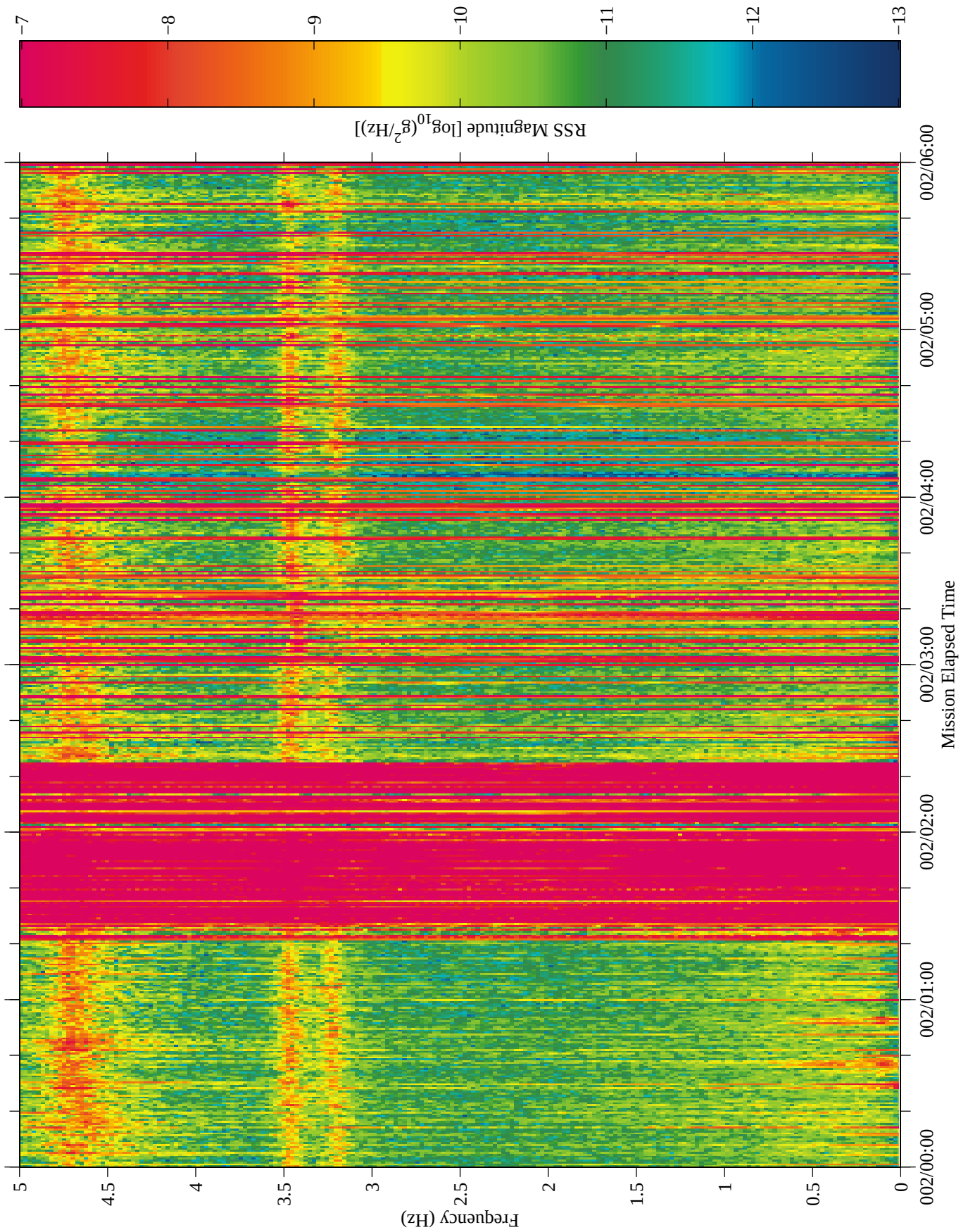

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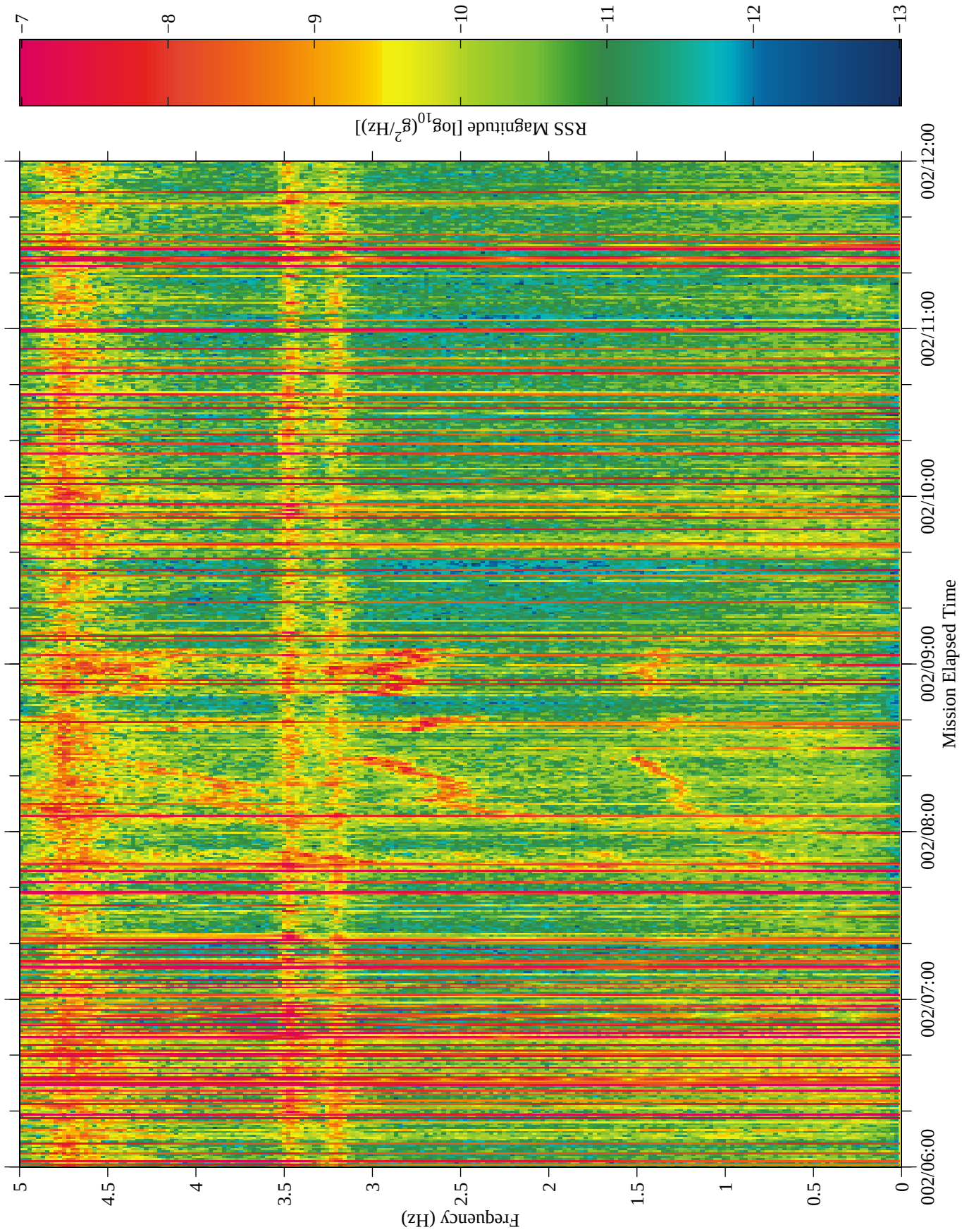

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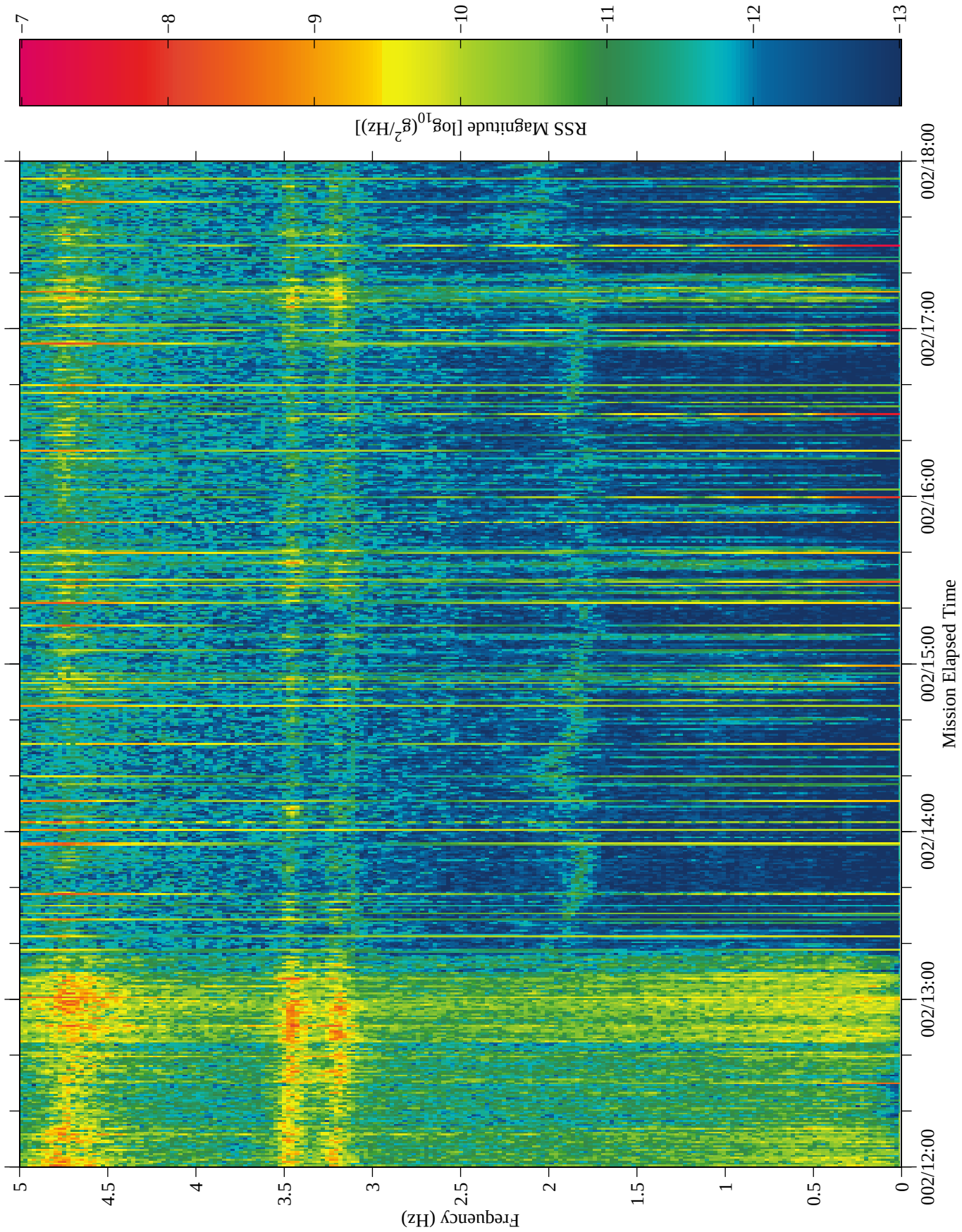

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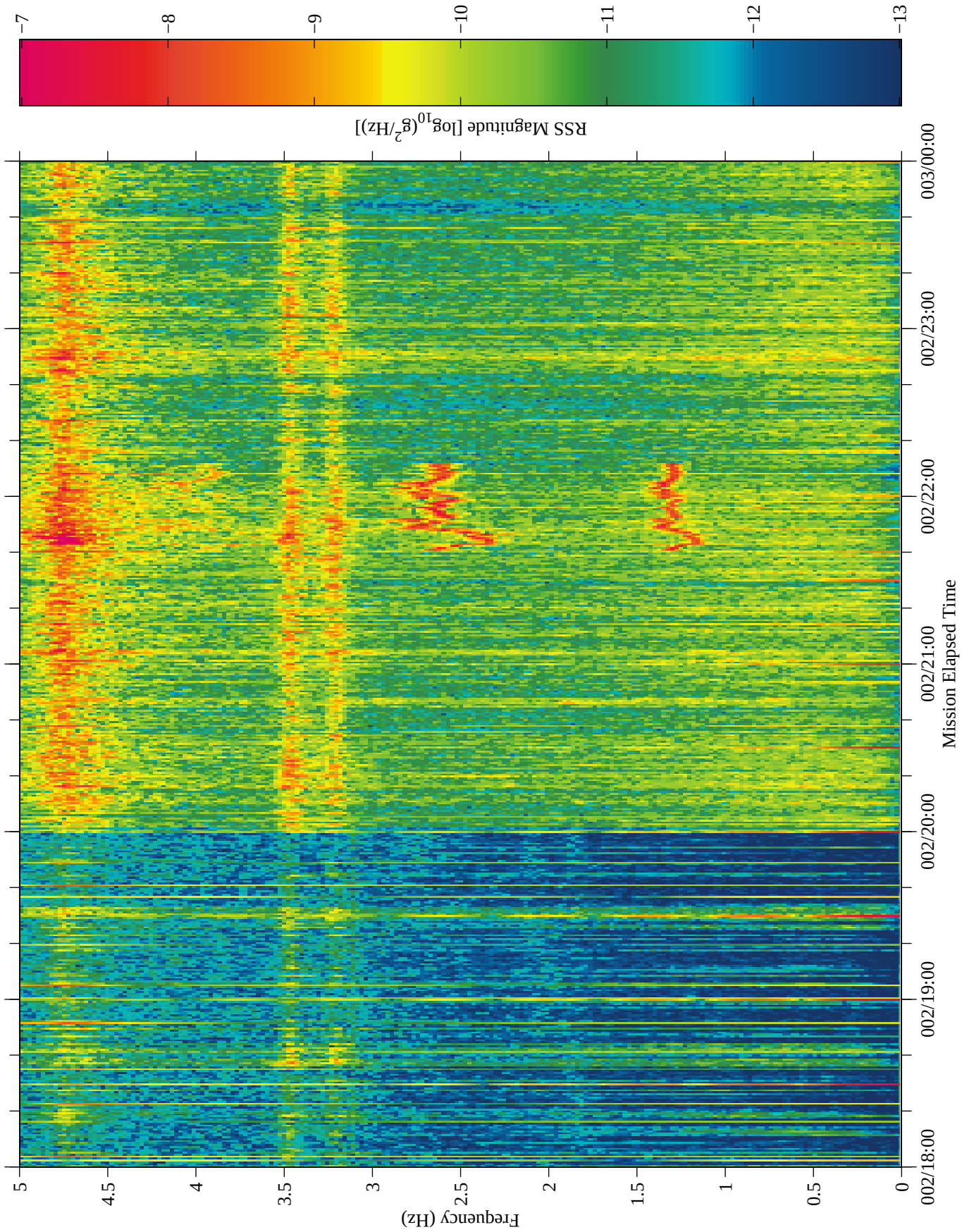

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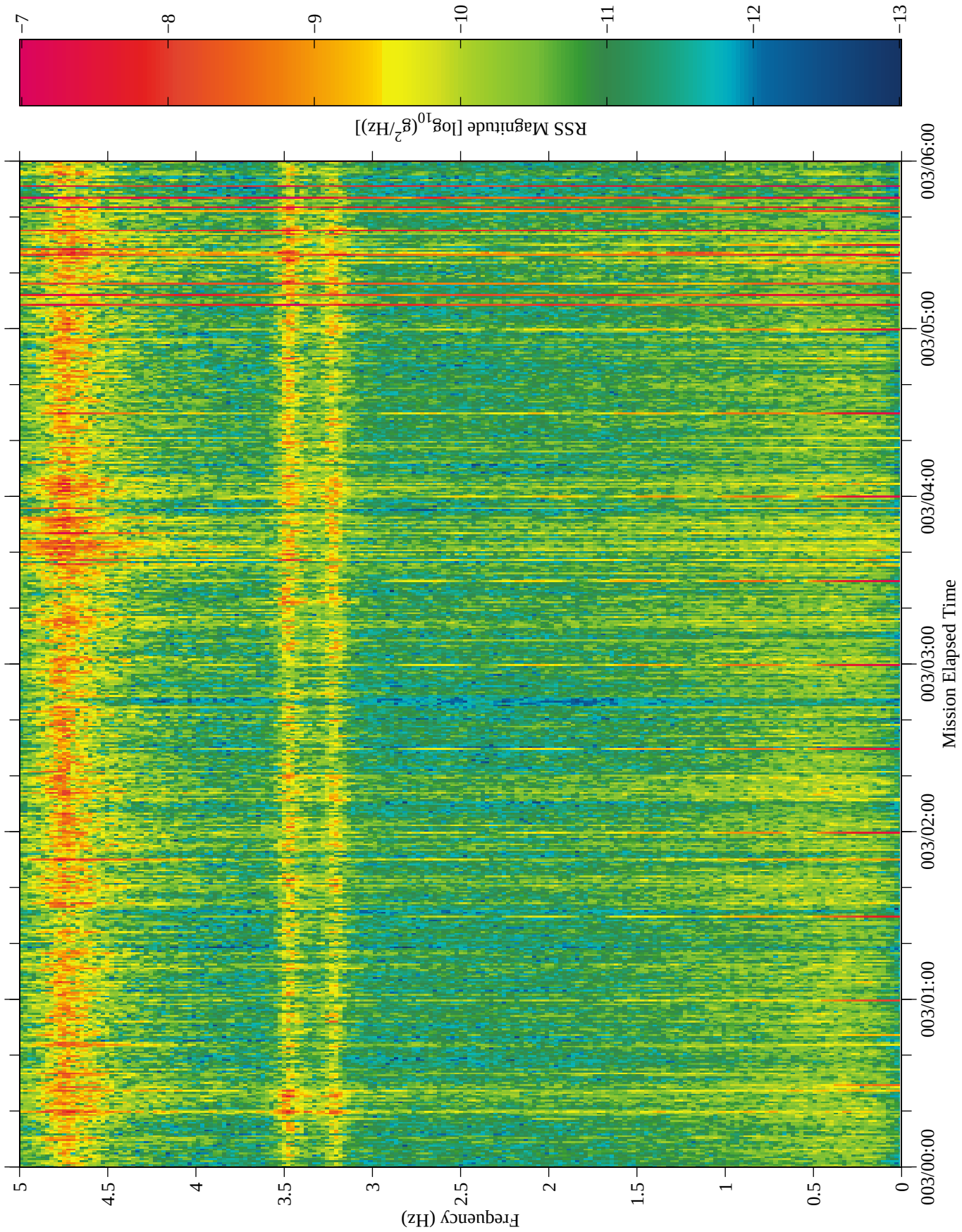

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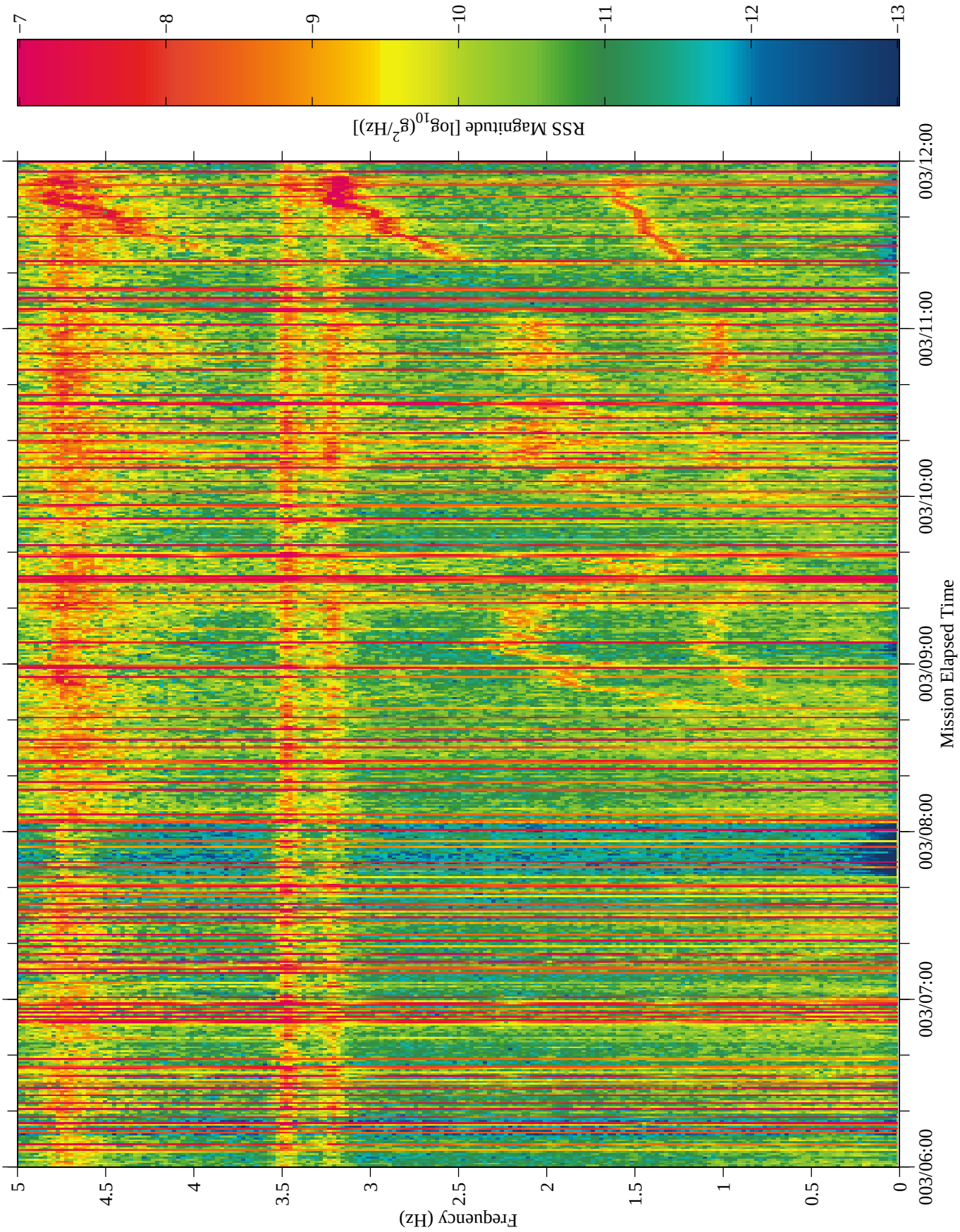

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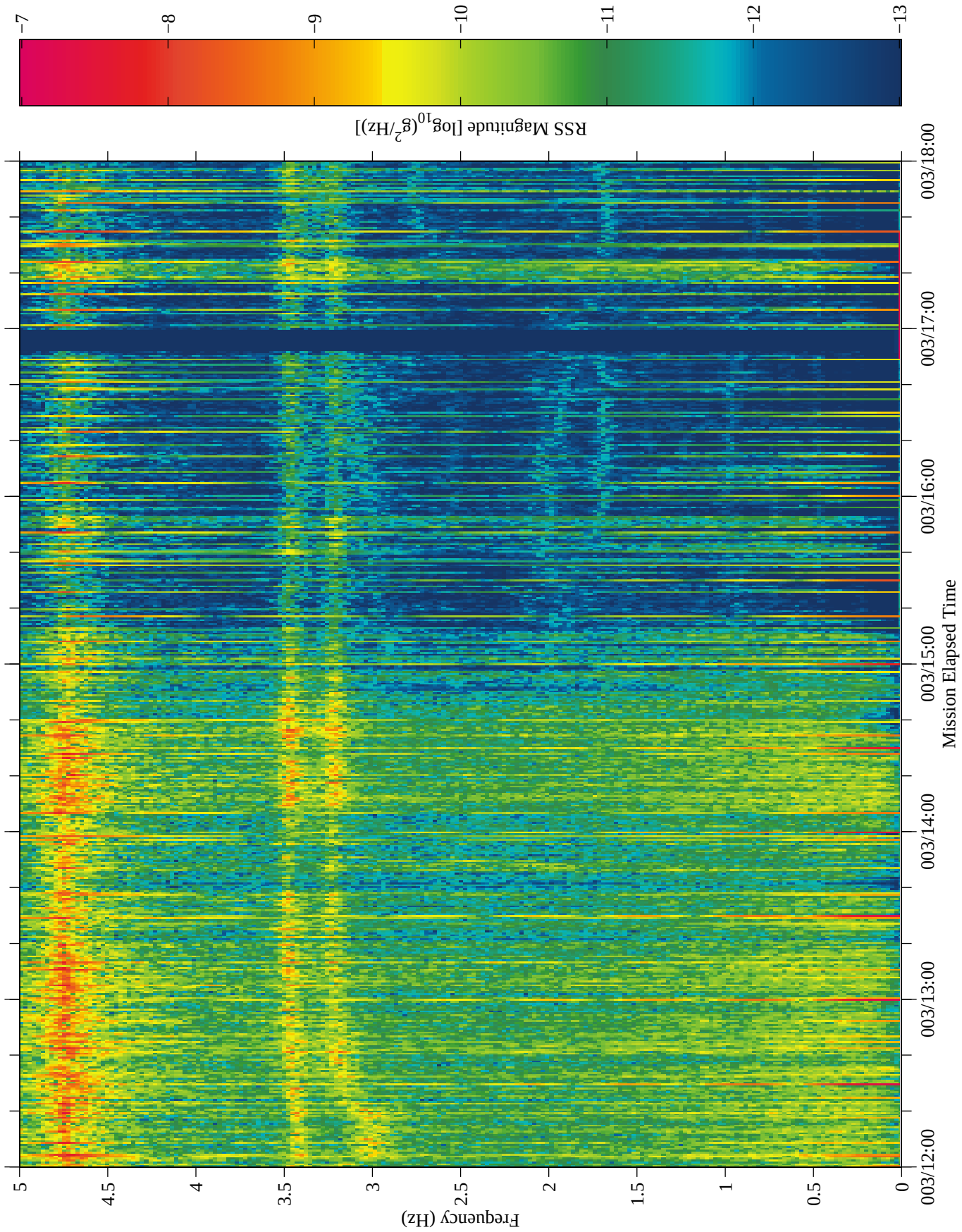

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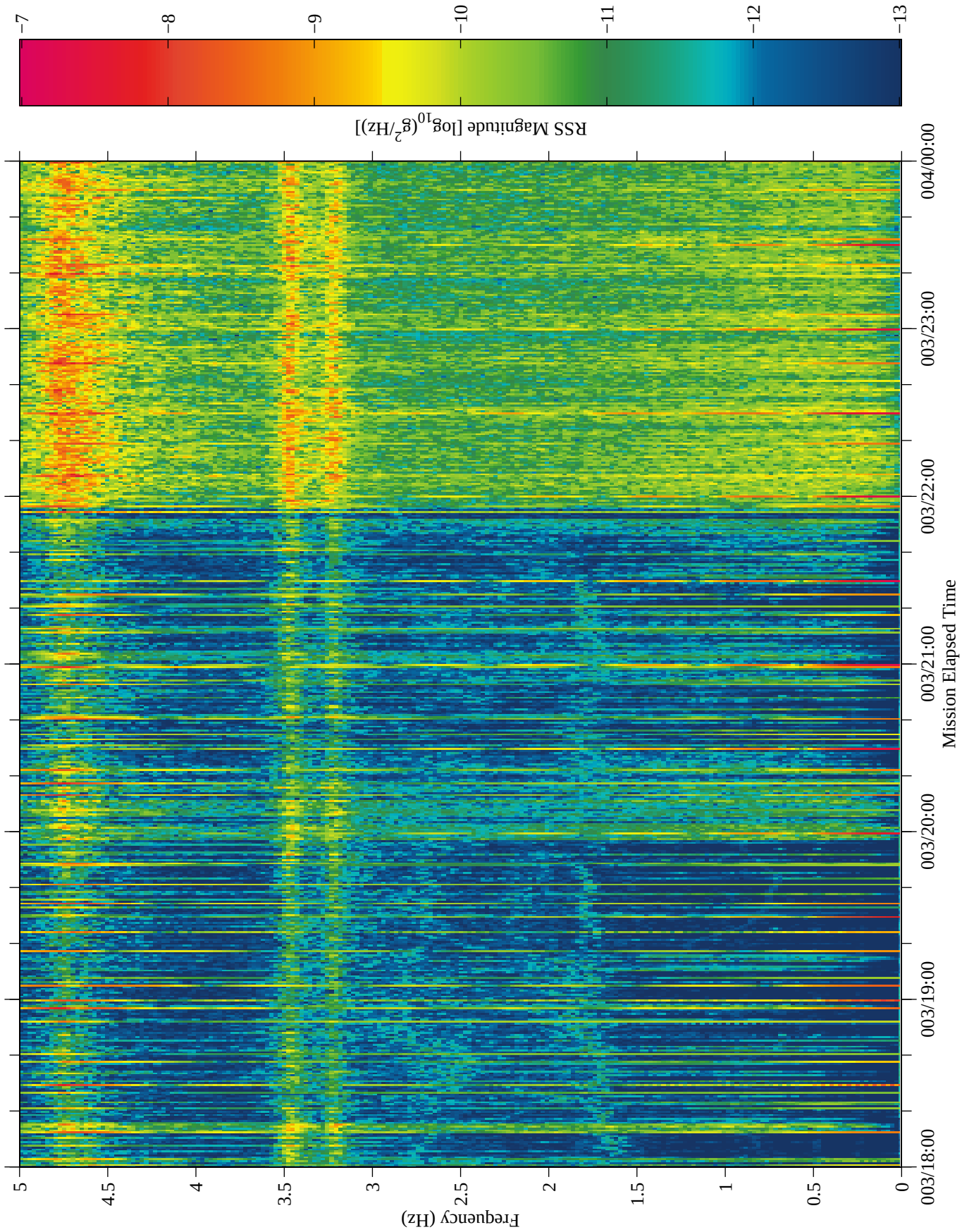

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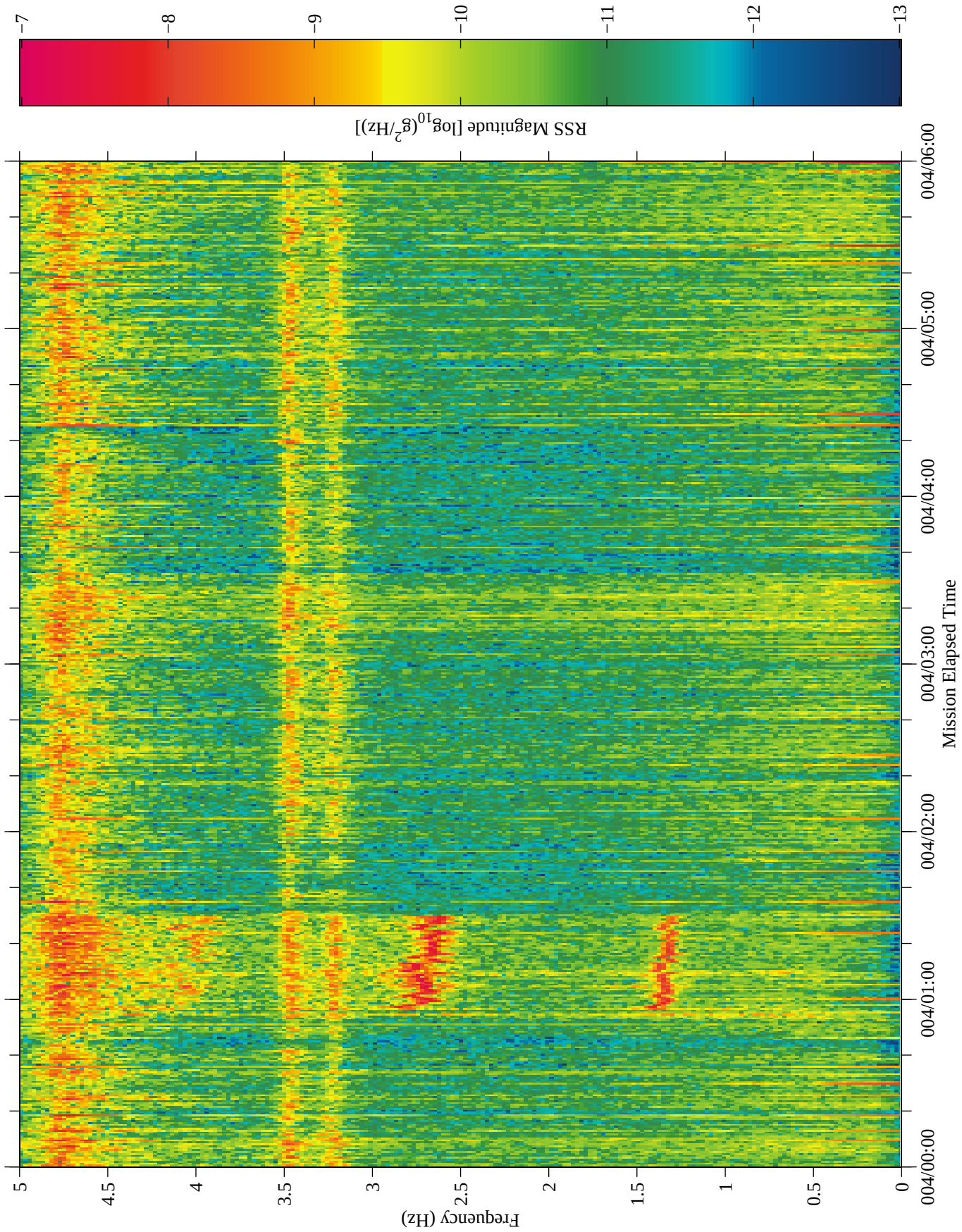

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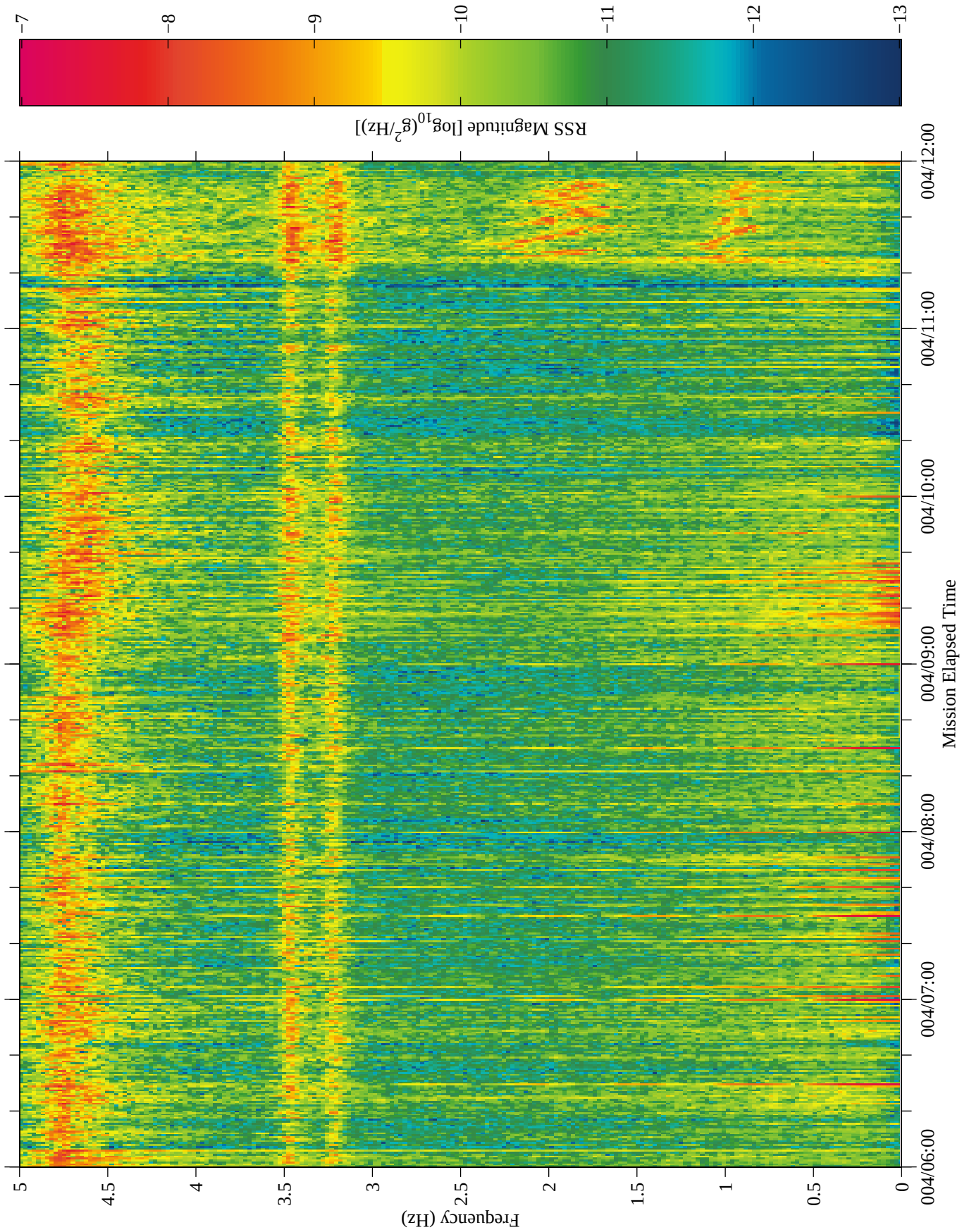

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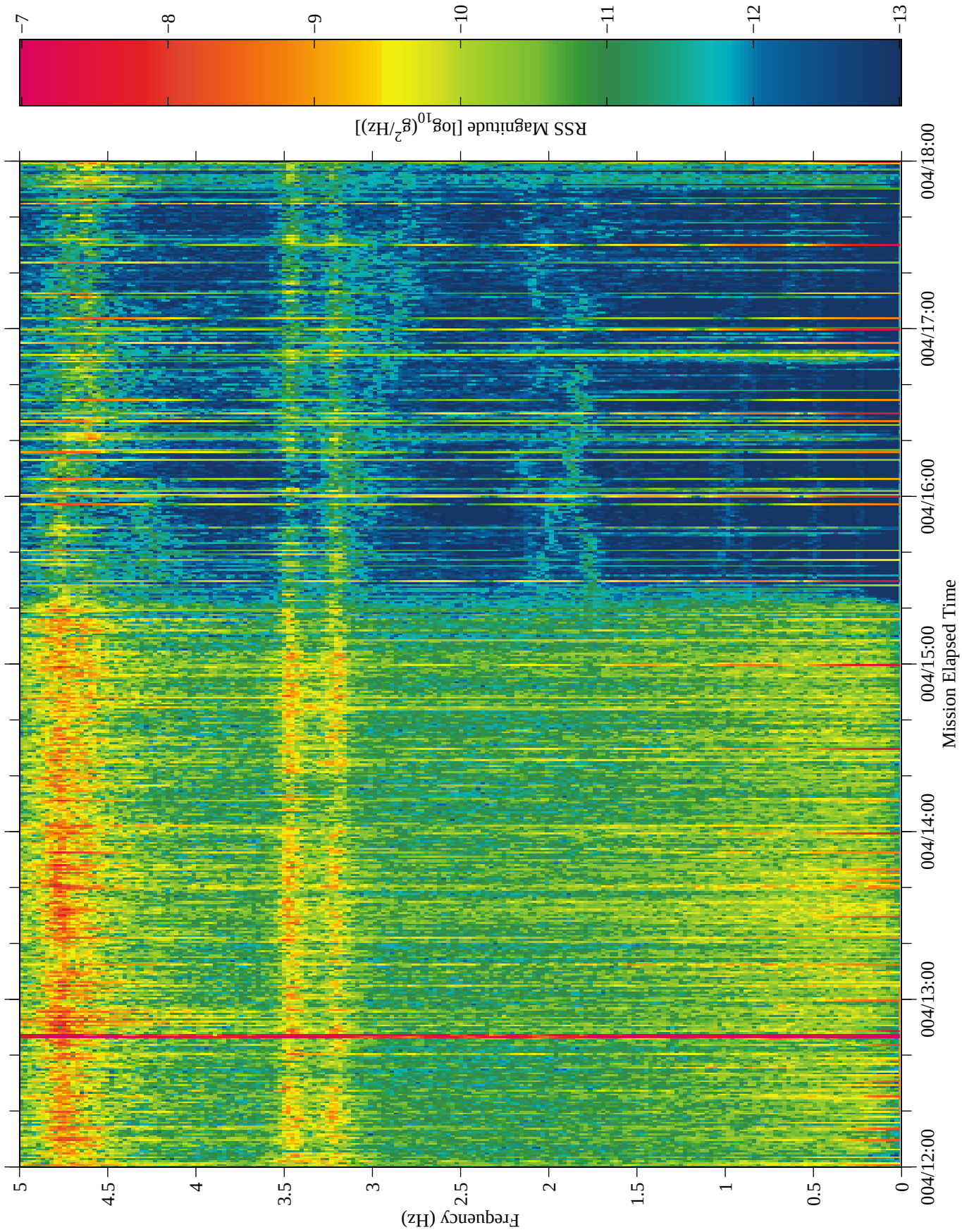

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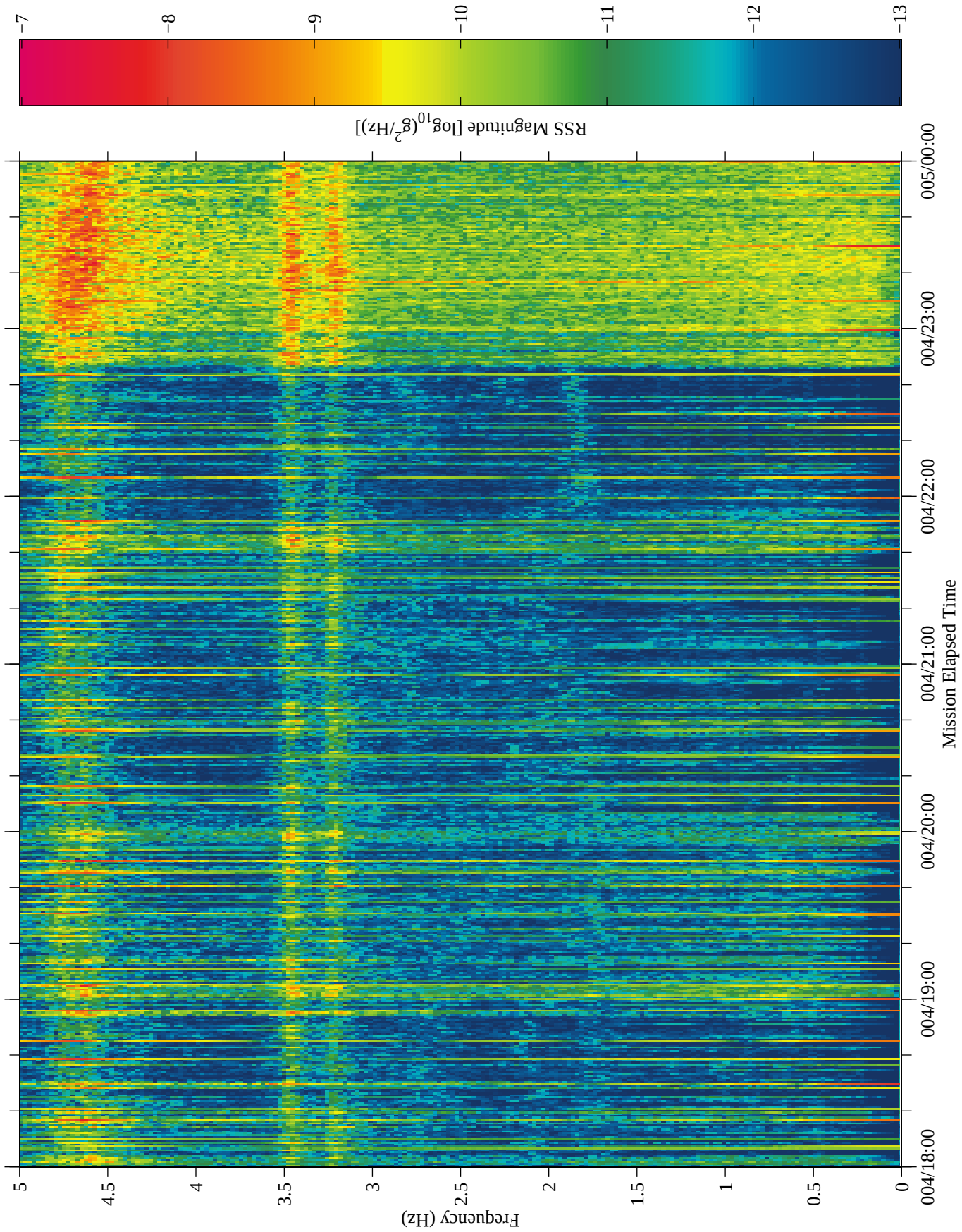

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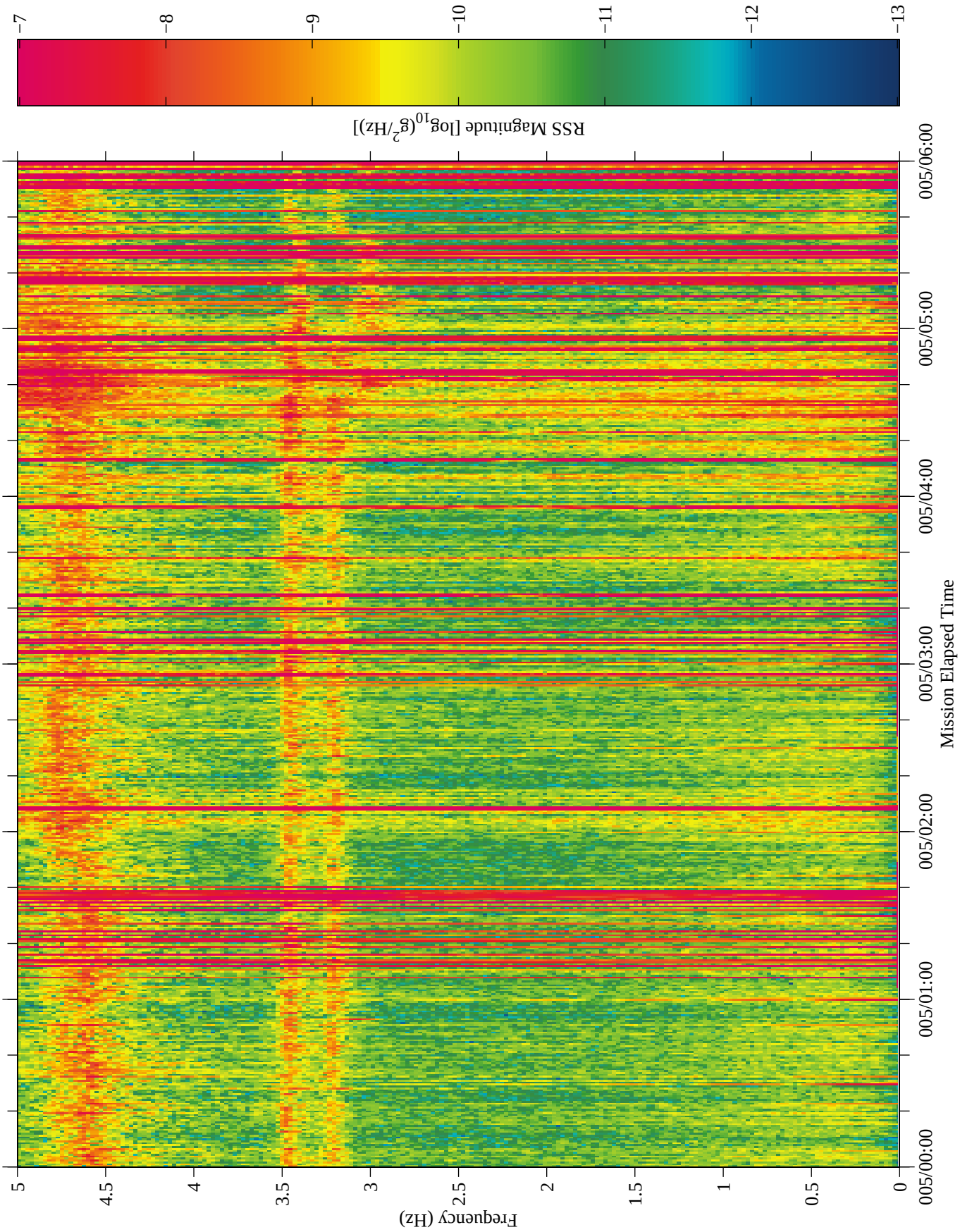

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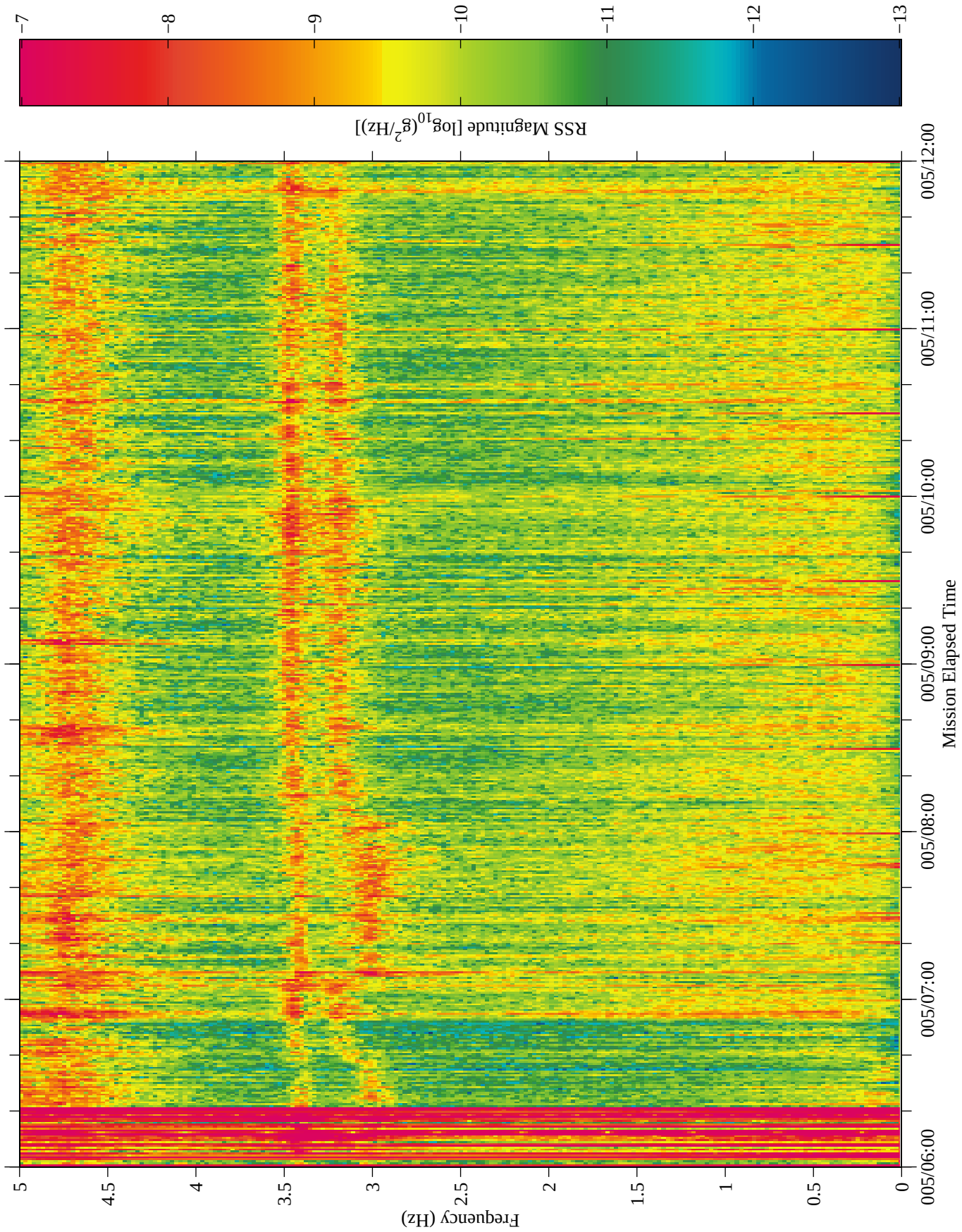

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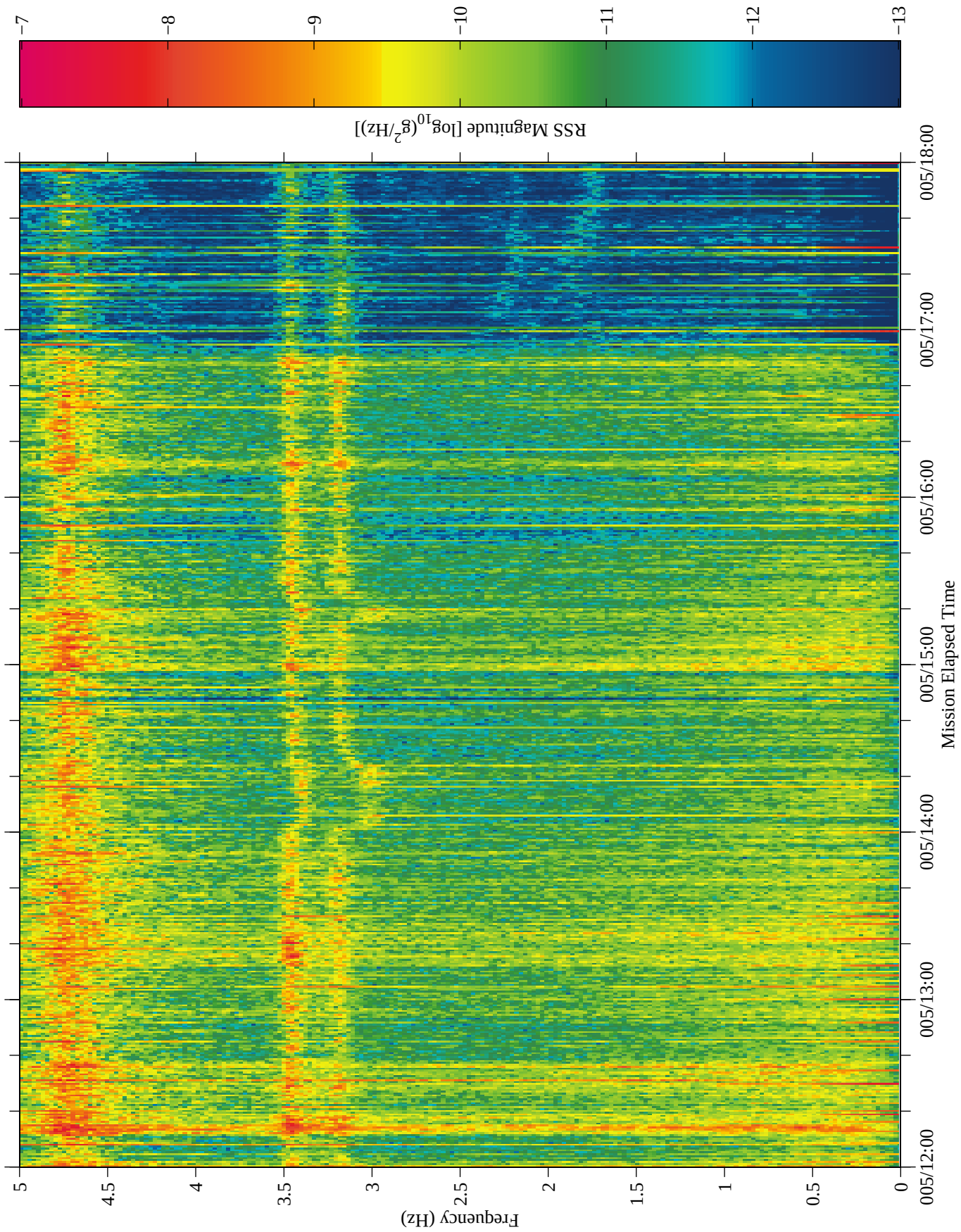

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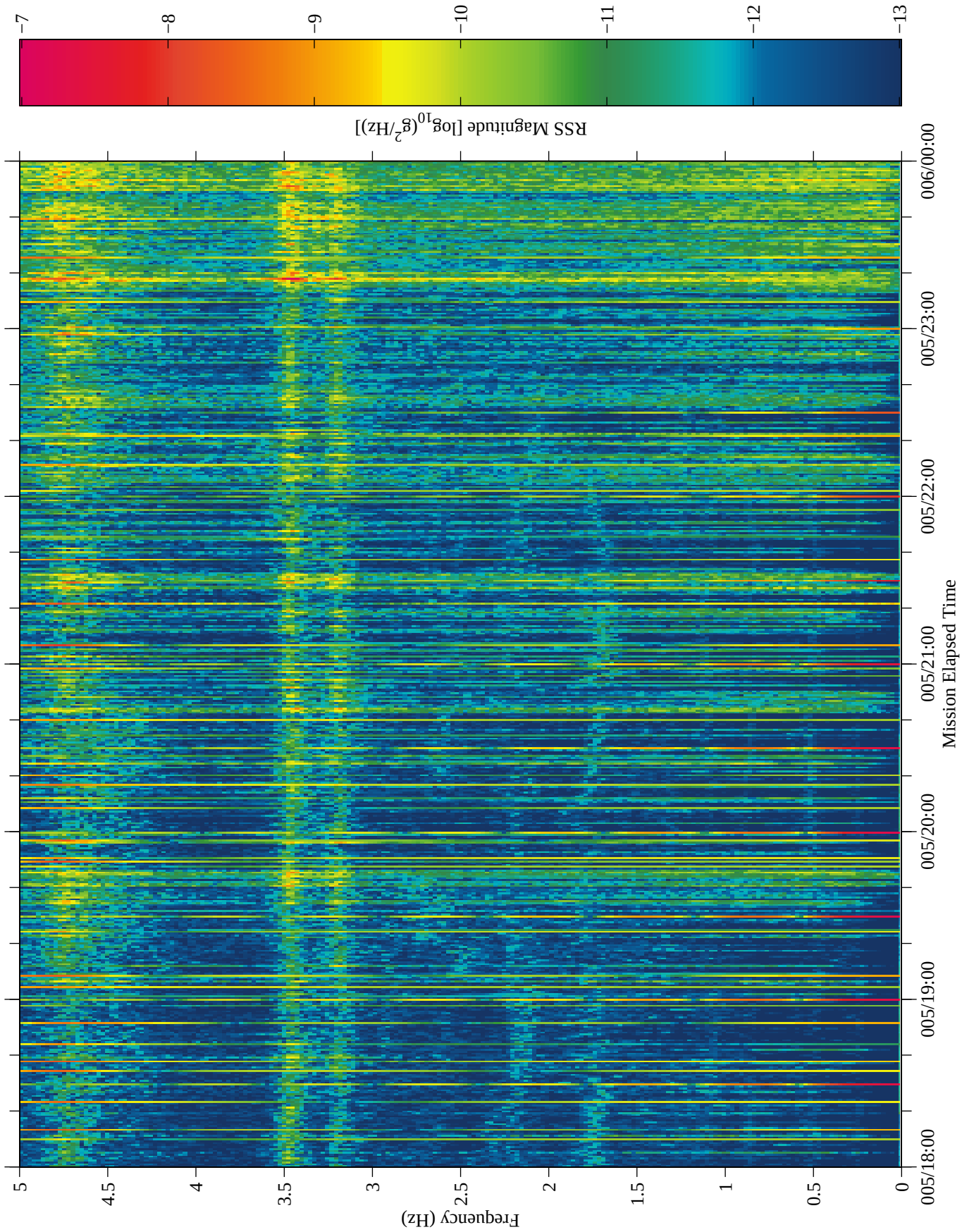

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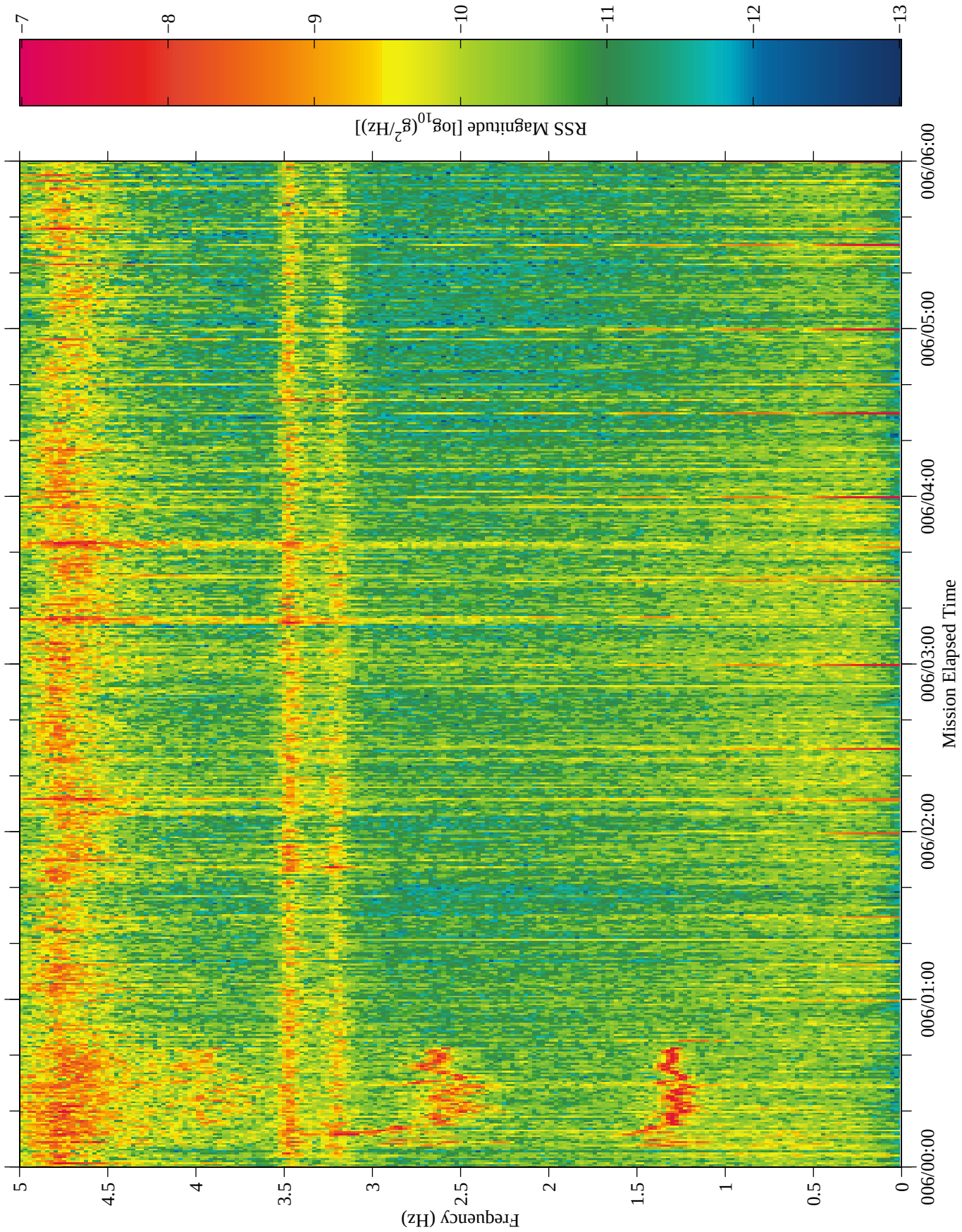

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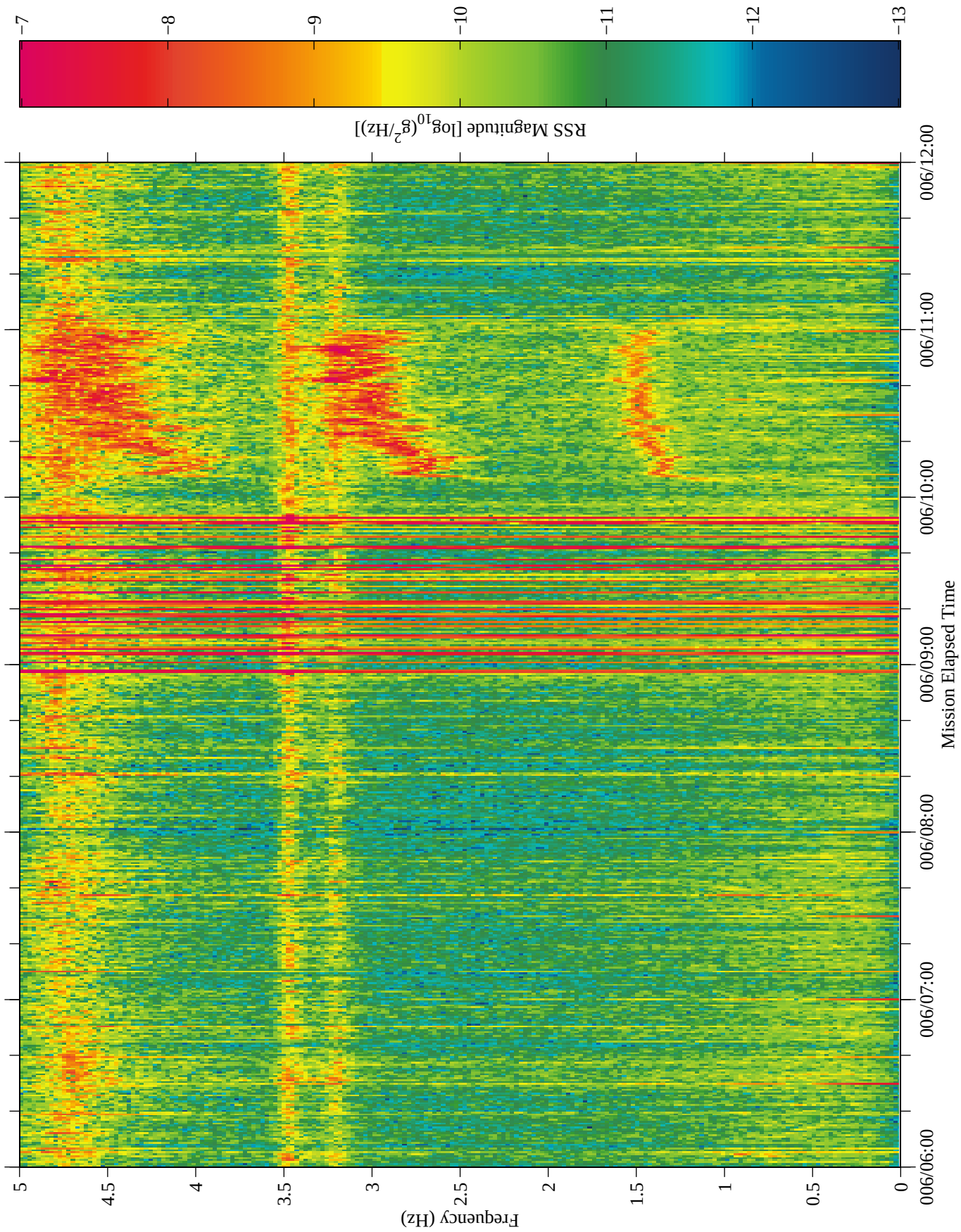

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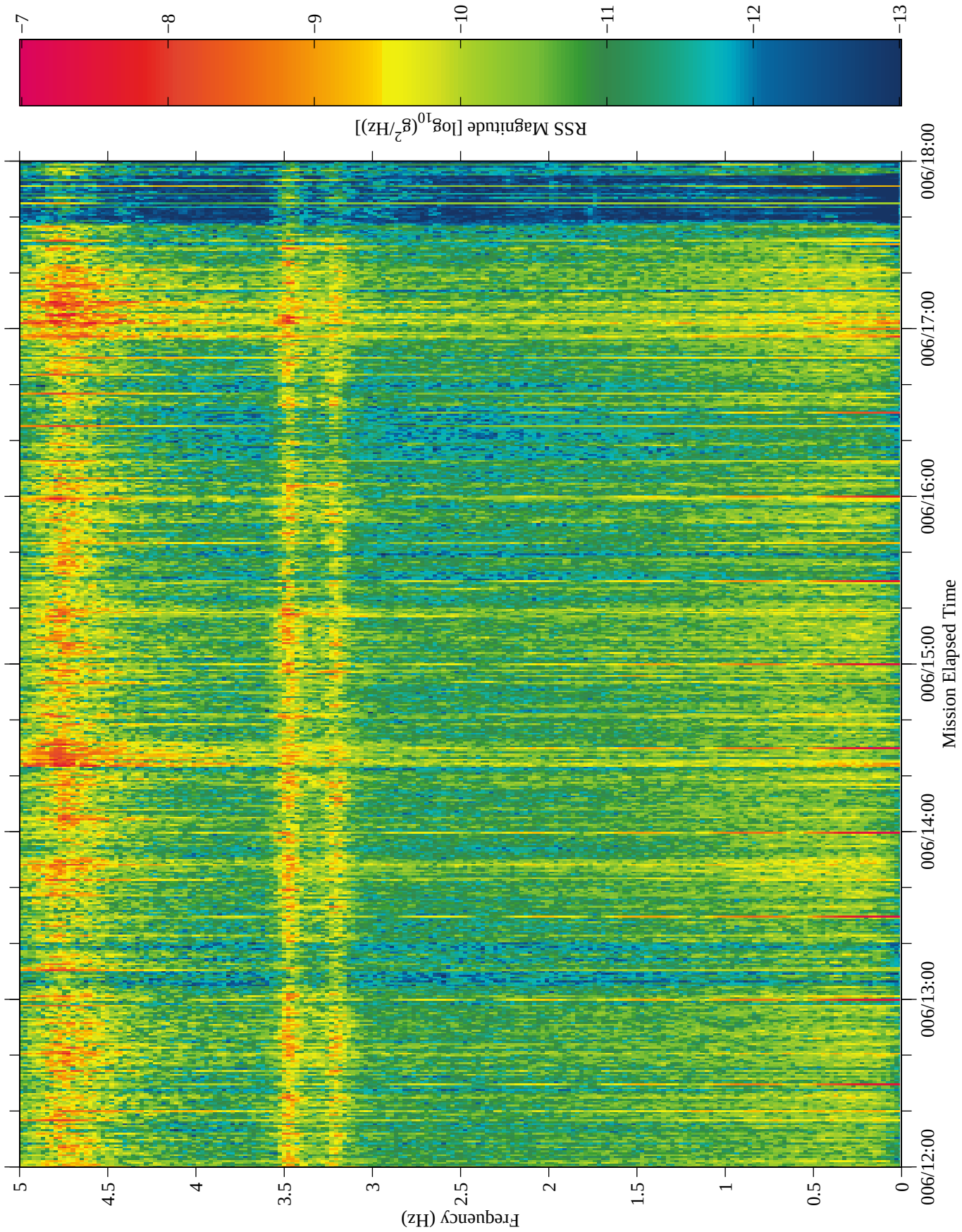

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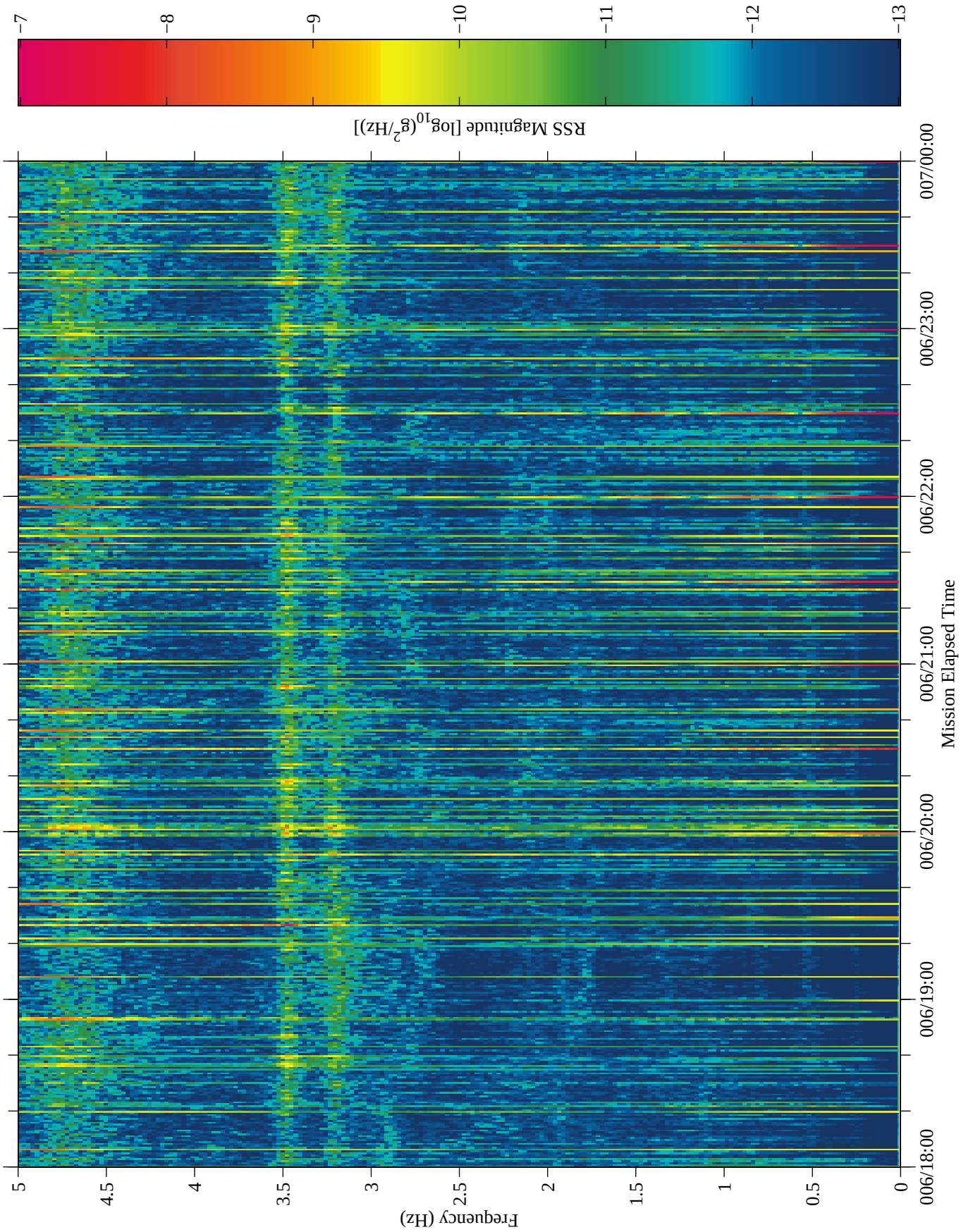

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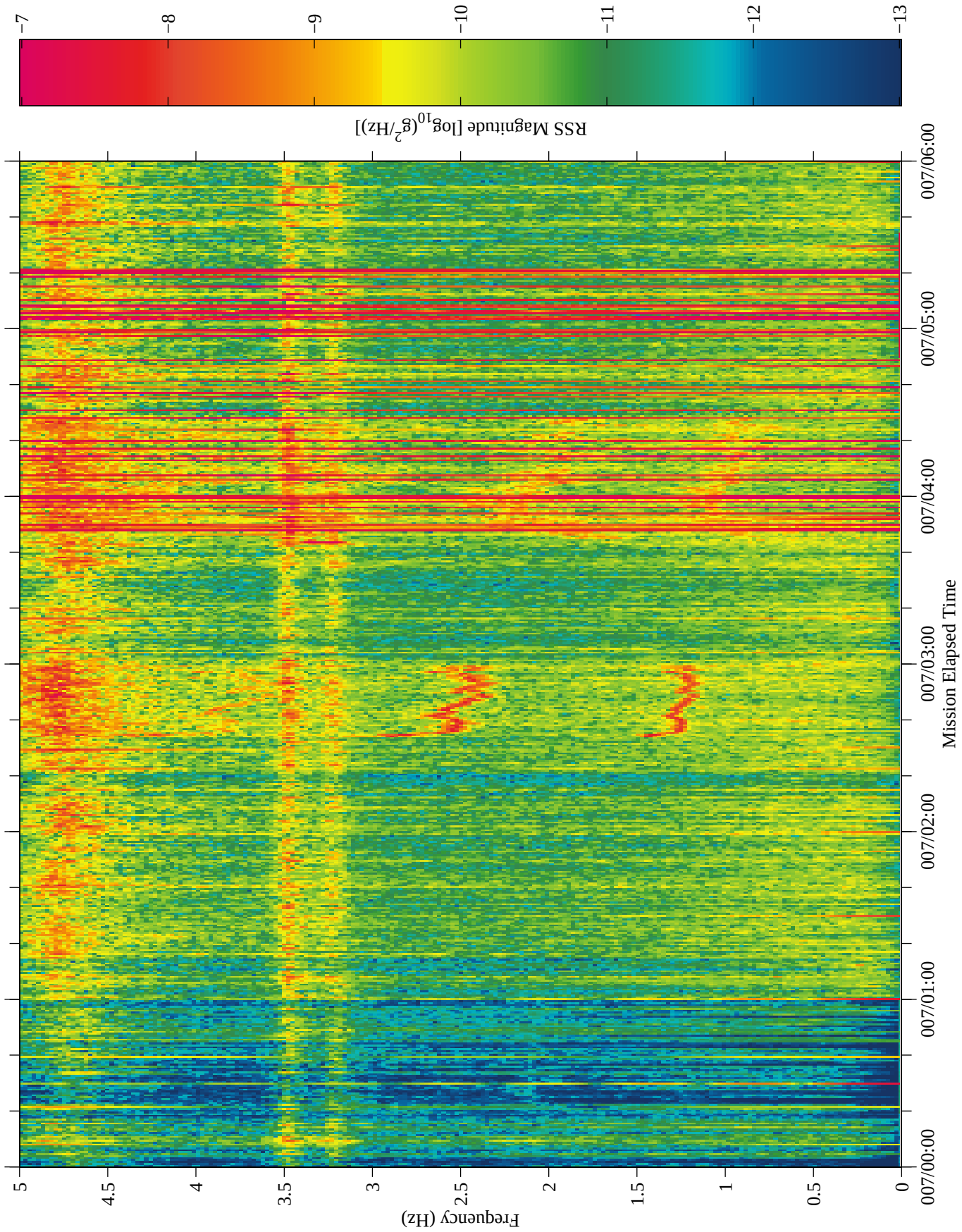

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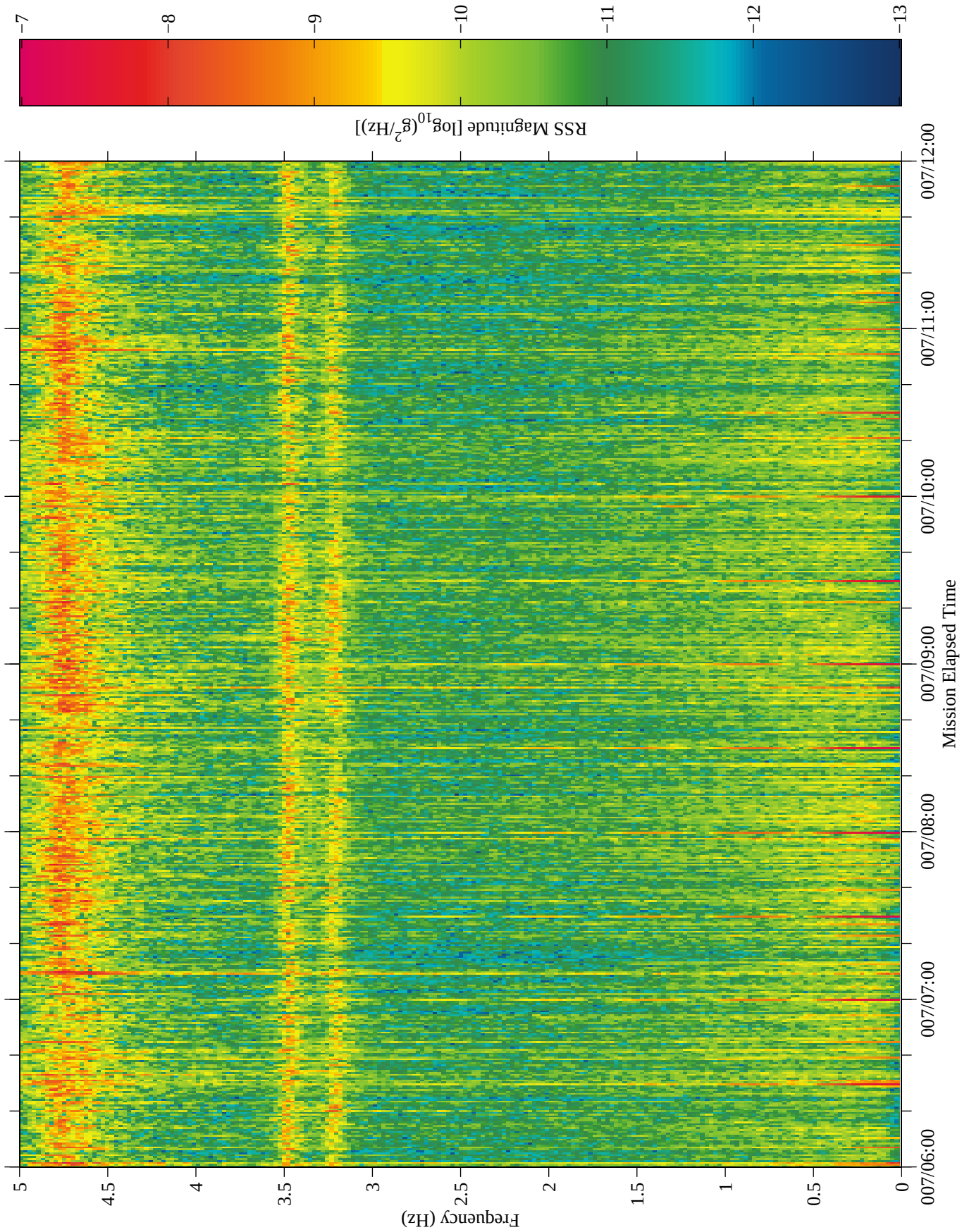

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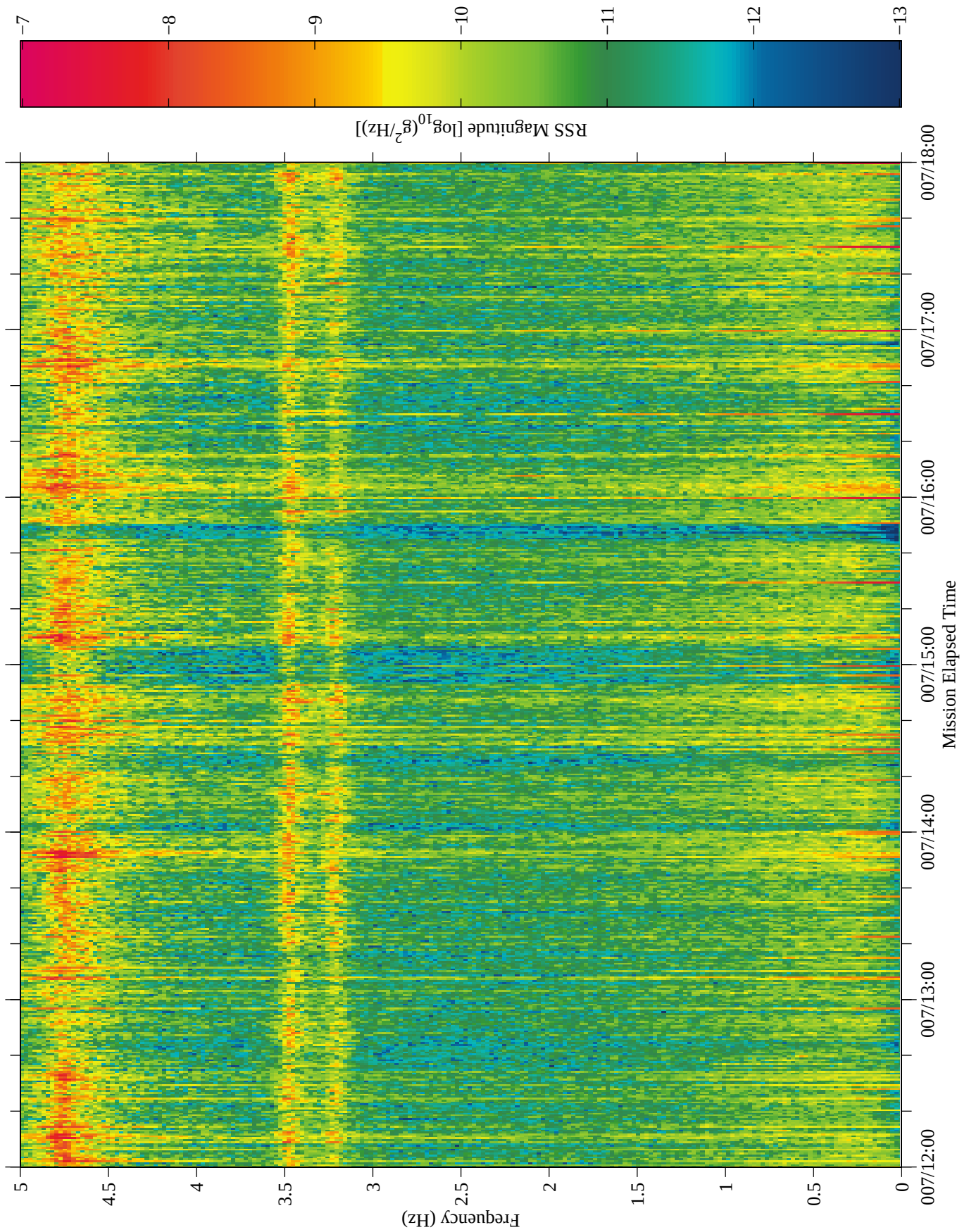

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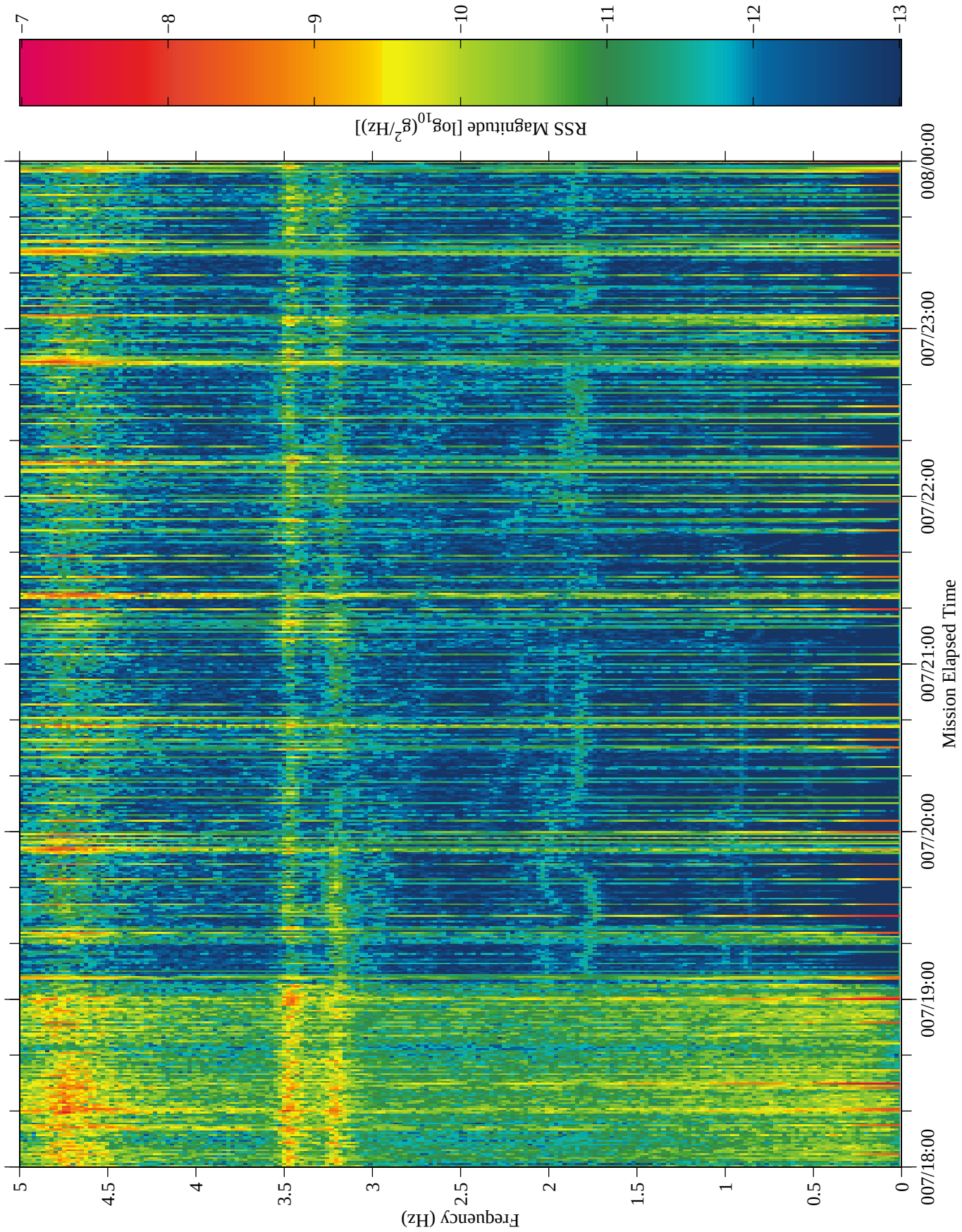

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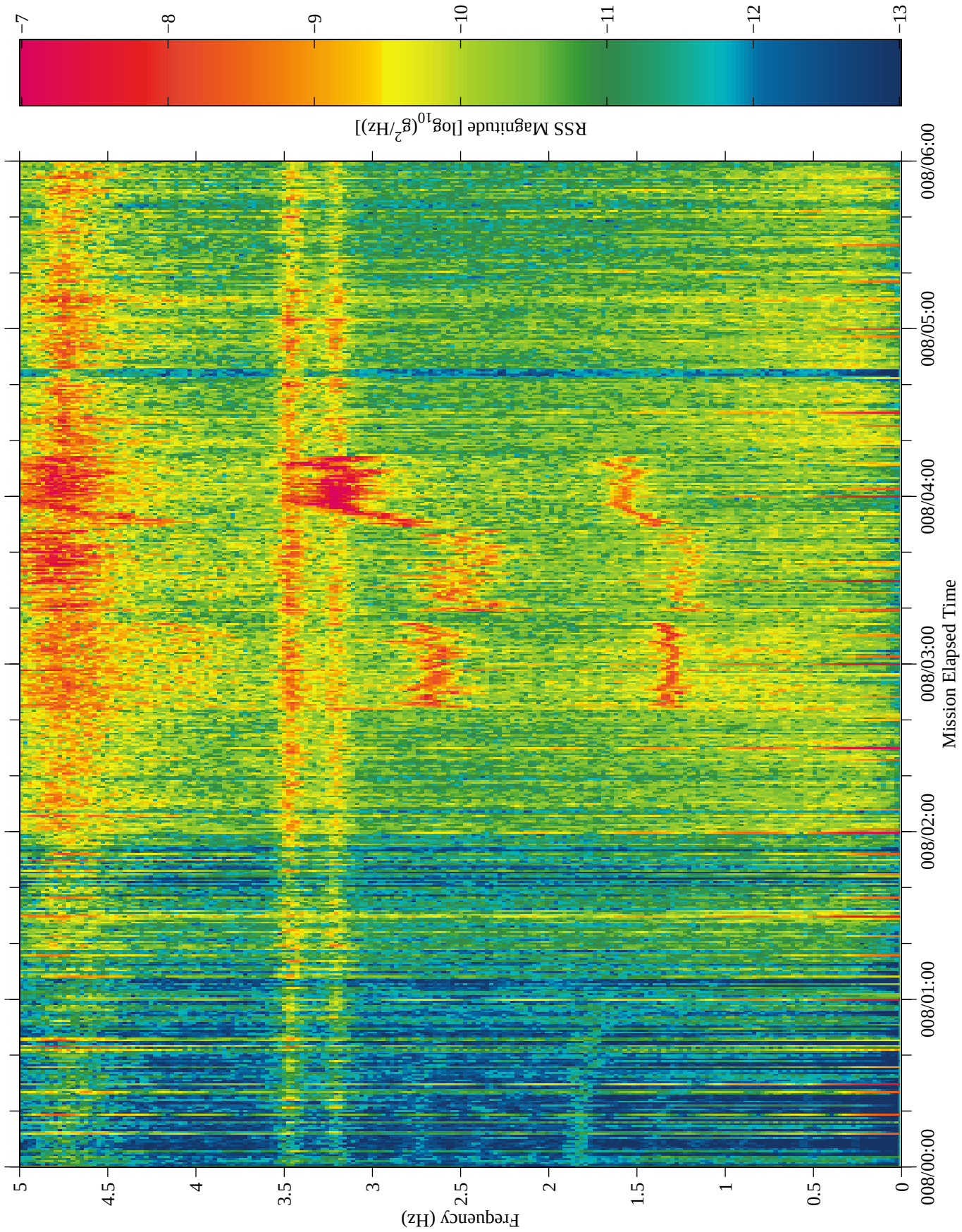

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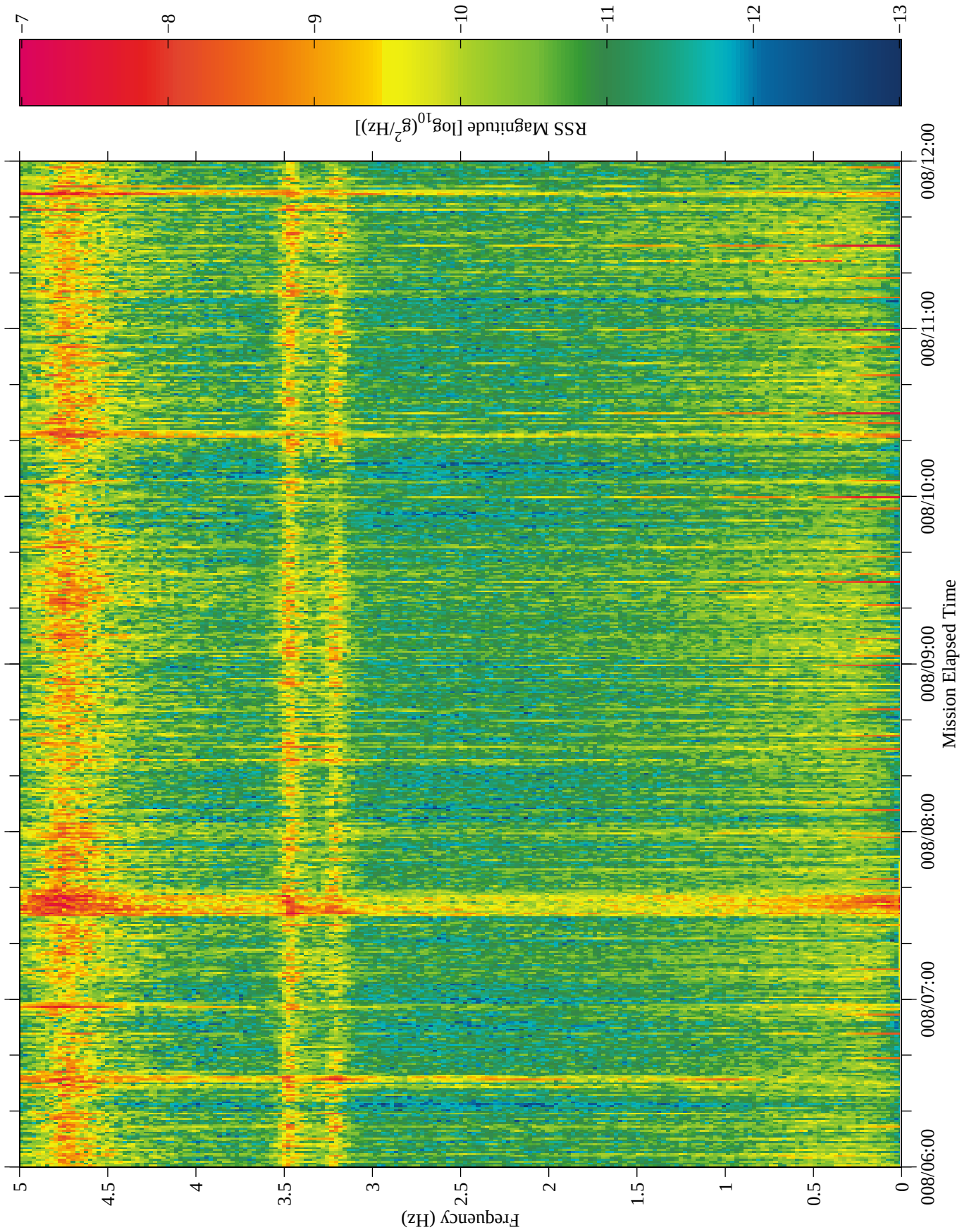

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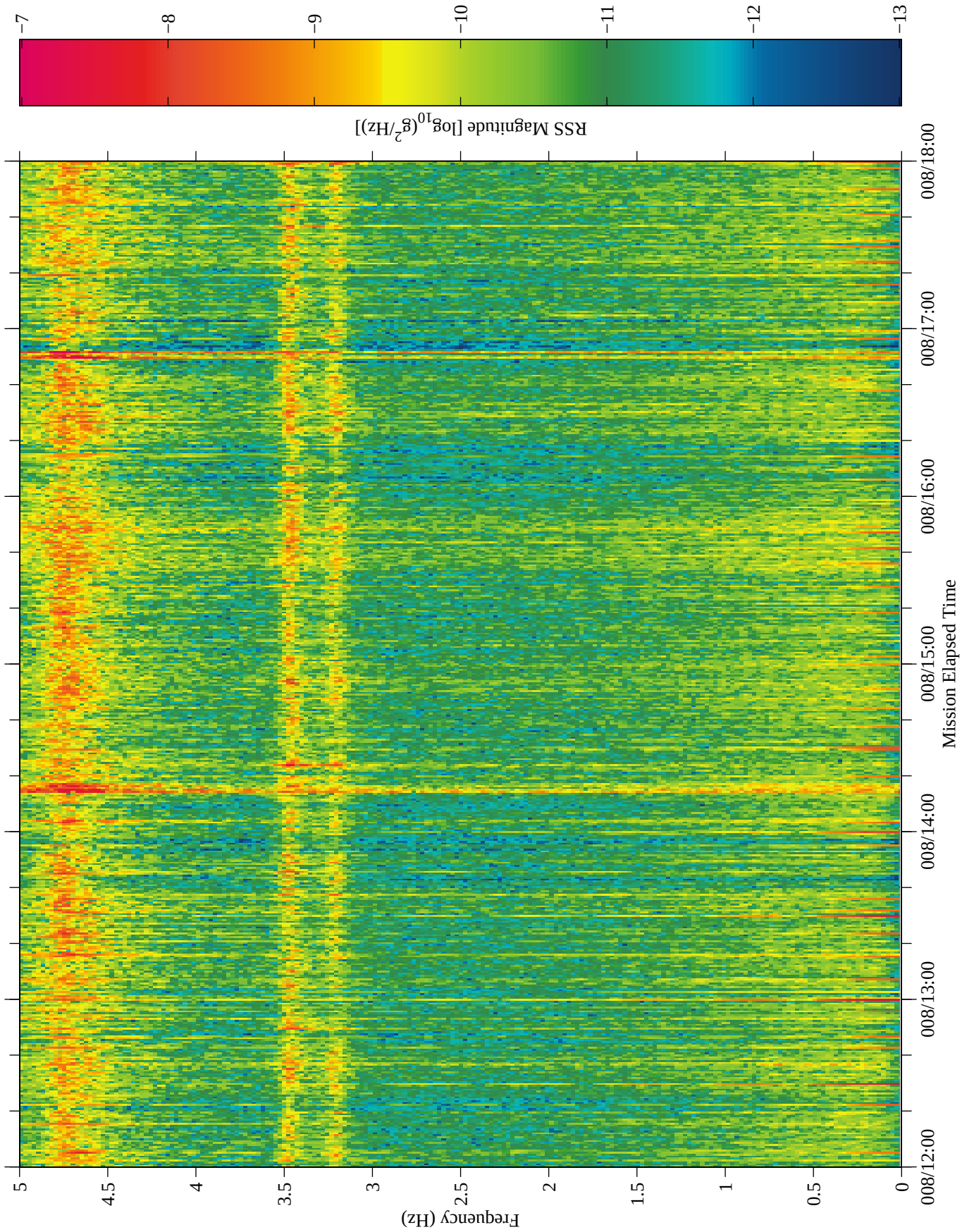

Figure 35: USMP−4, Unit G, TSH A

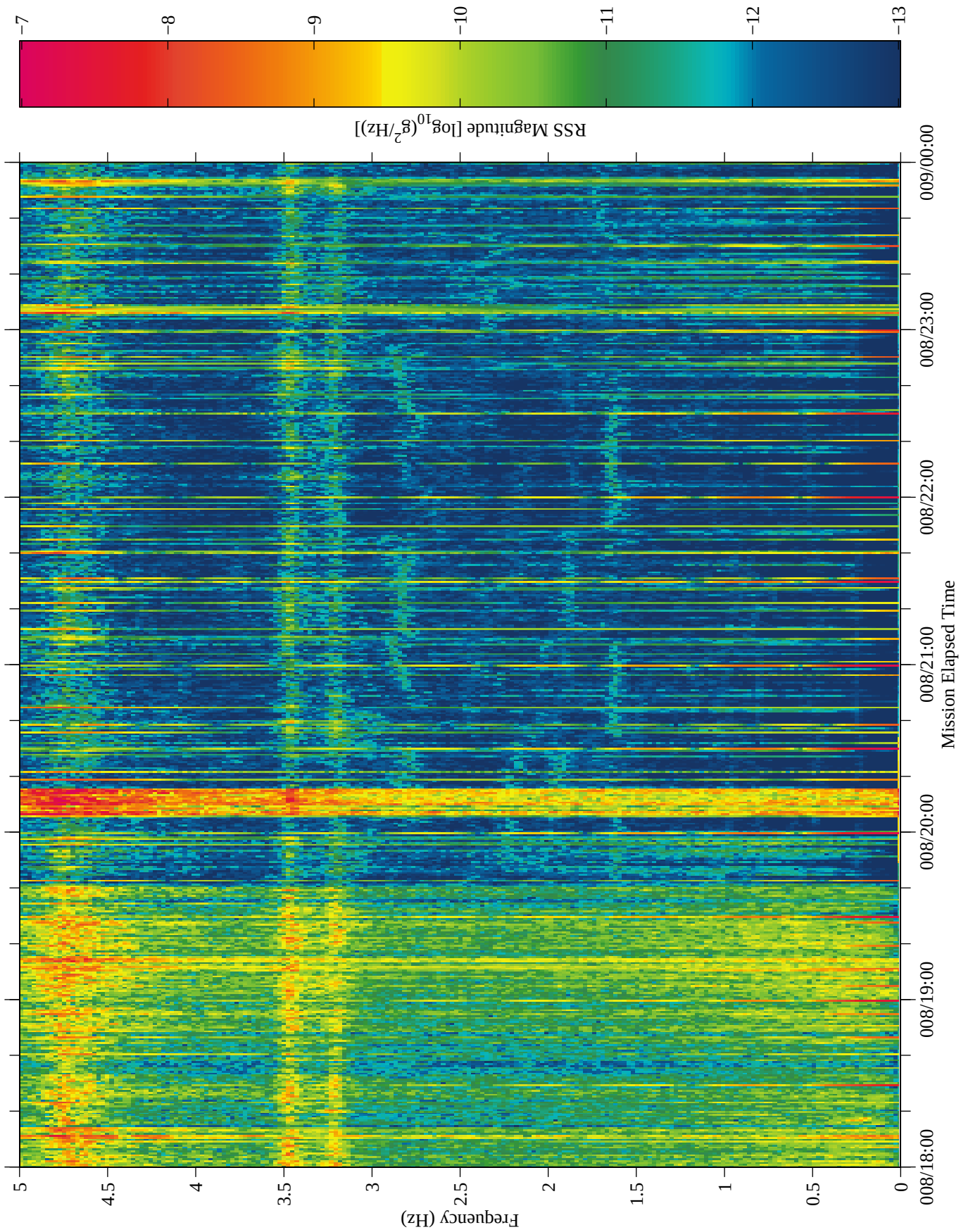

Figure 36: USMP−4, Unit G, TSH A

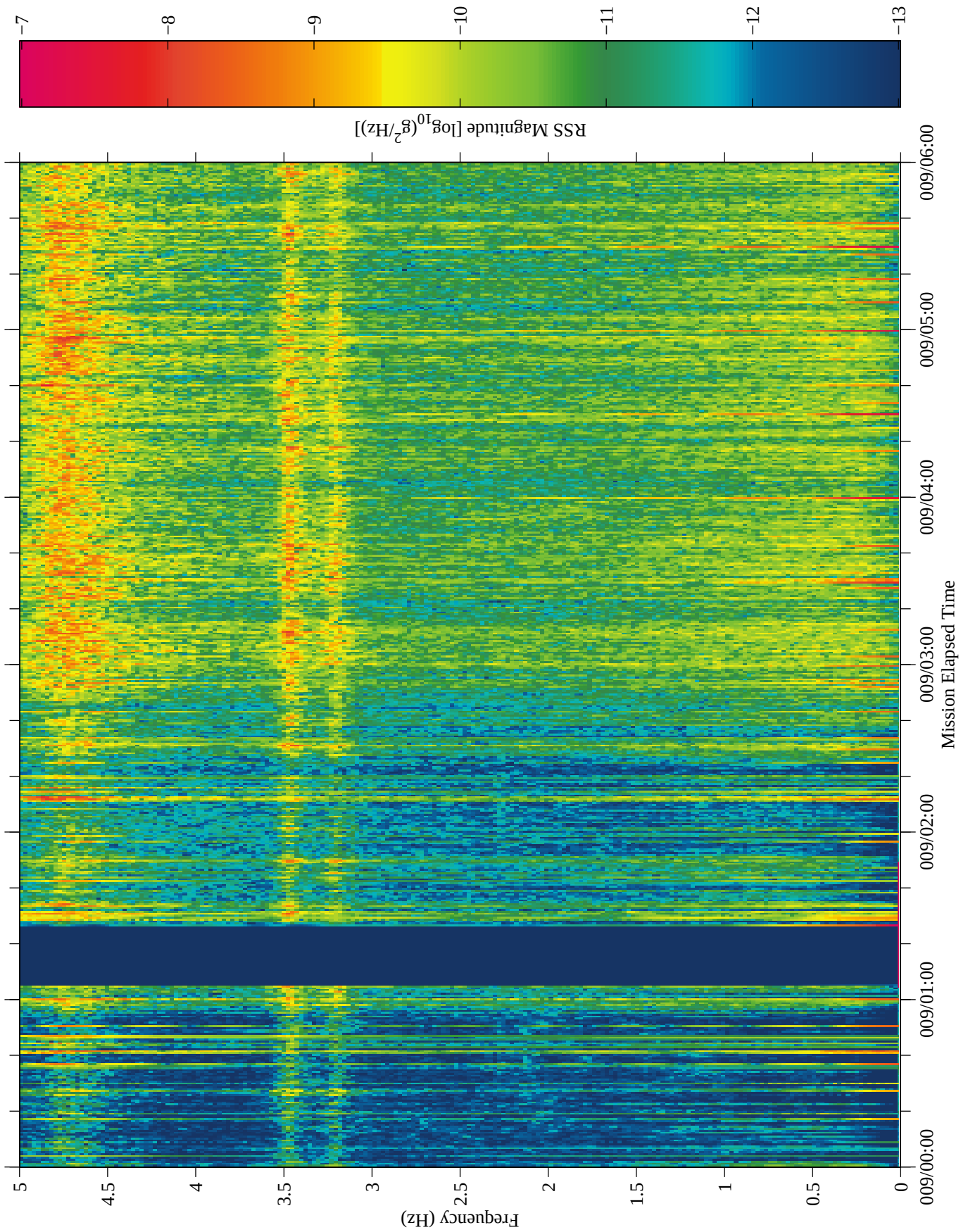

Figure 37: USMP−4, Unit G, TSH A

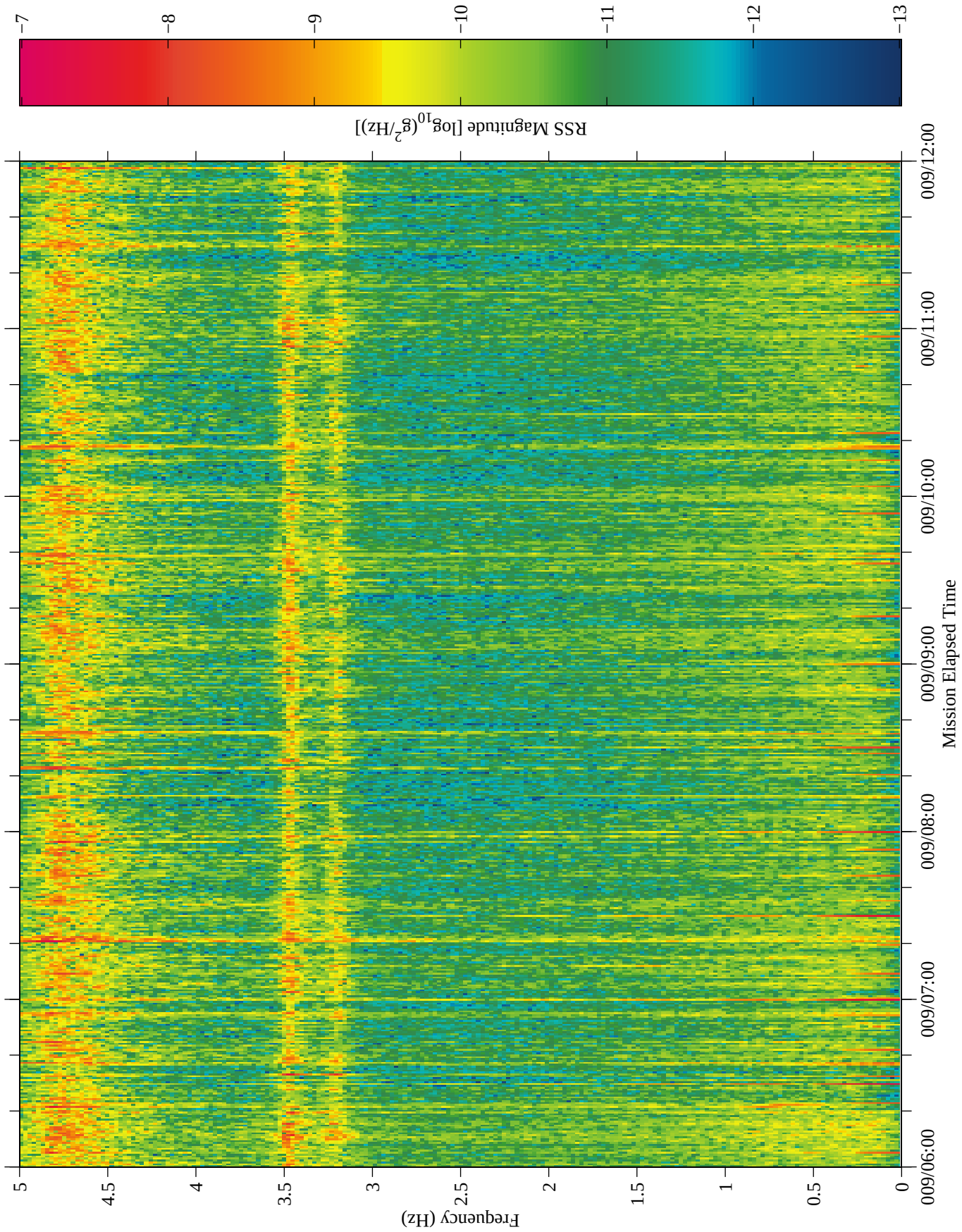

Figure 38: USMP−4, Unit G, TSH A

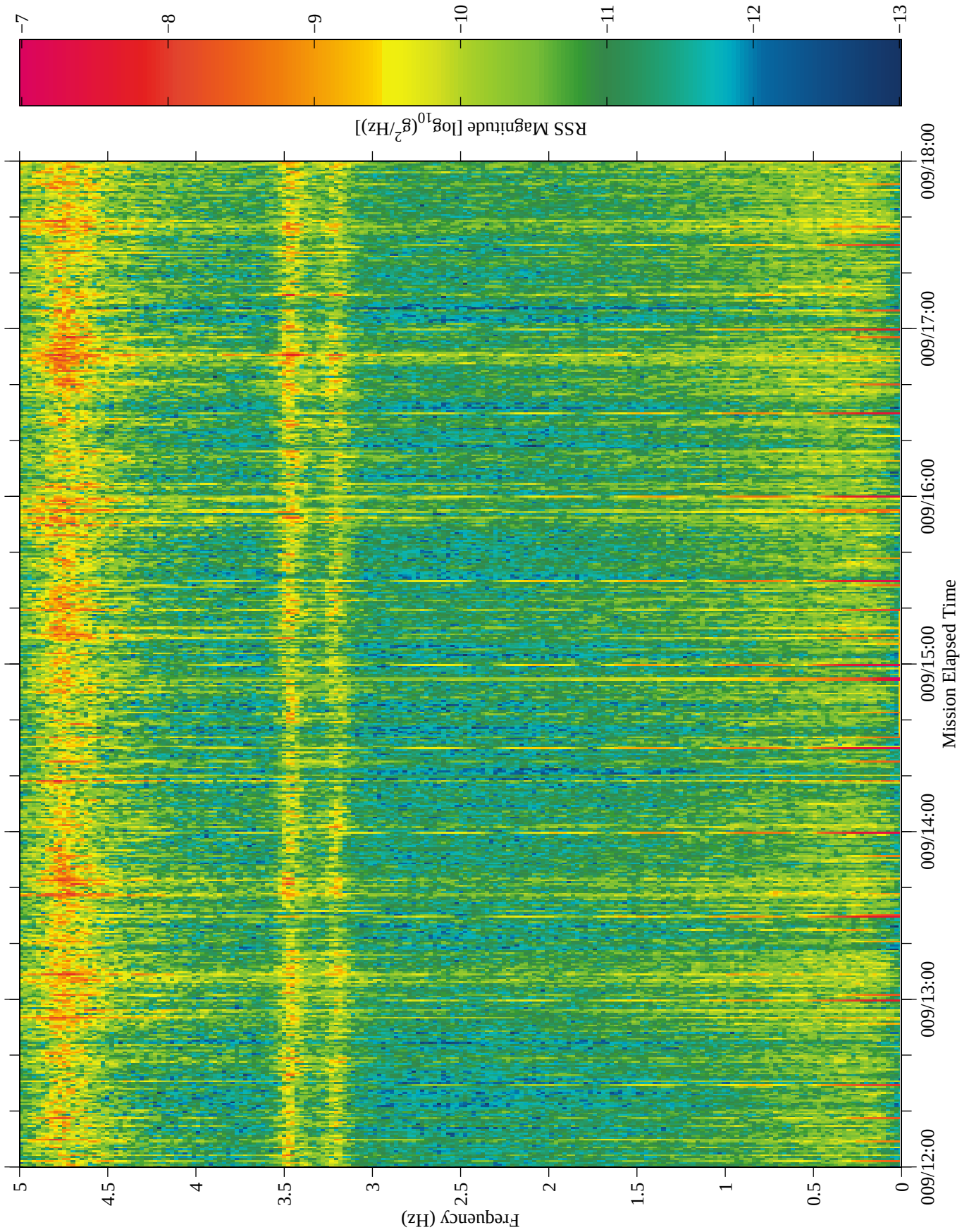

Figure 39: USMP−4, Unit G, TSH A

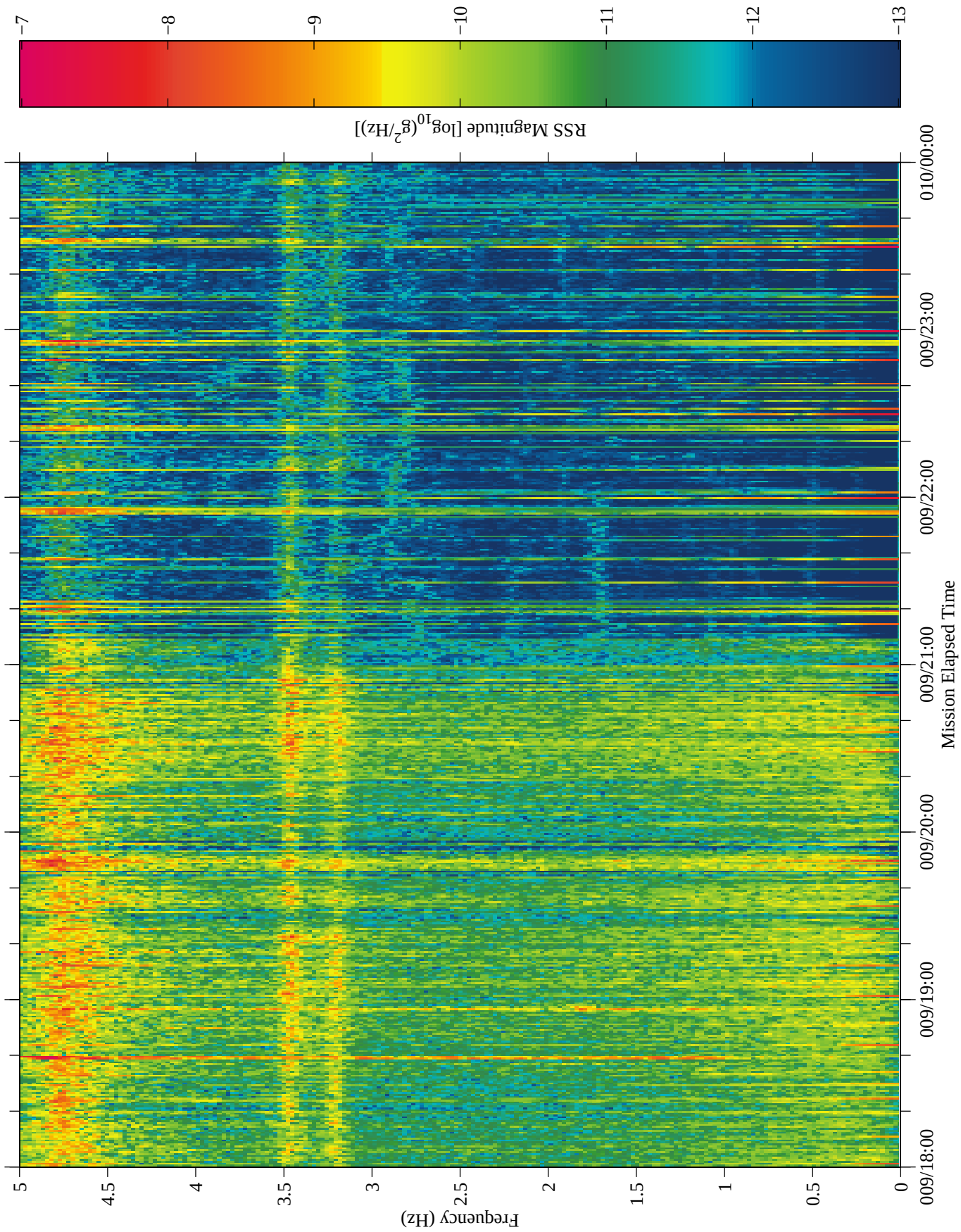

Figure 40: USMP−4, Unit G, TSH A

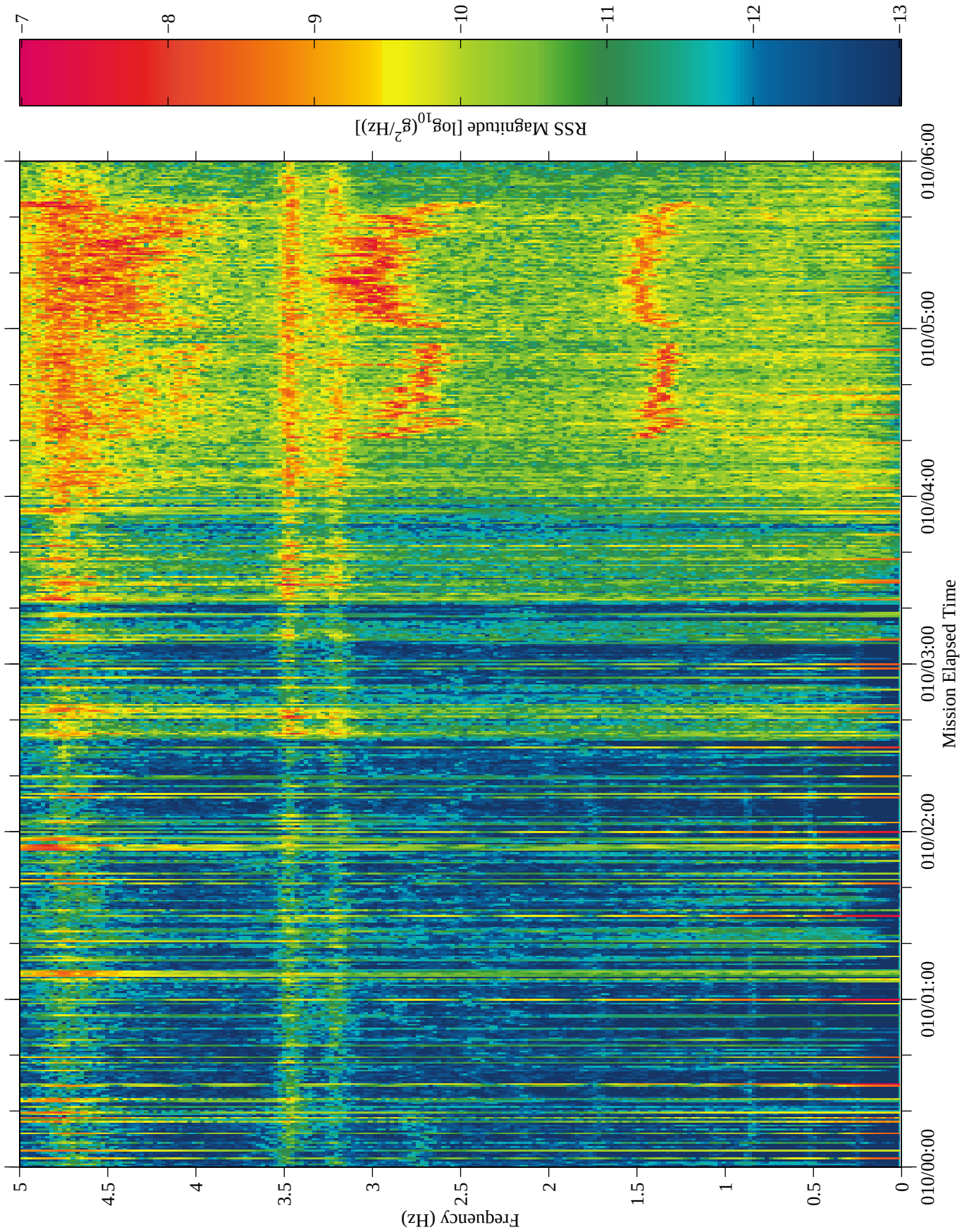

Figure 41: USMP−4, Unit G, TSH A

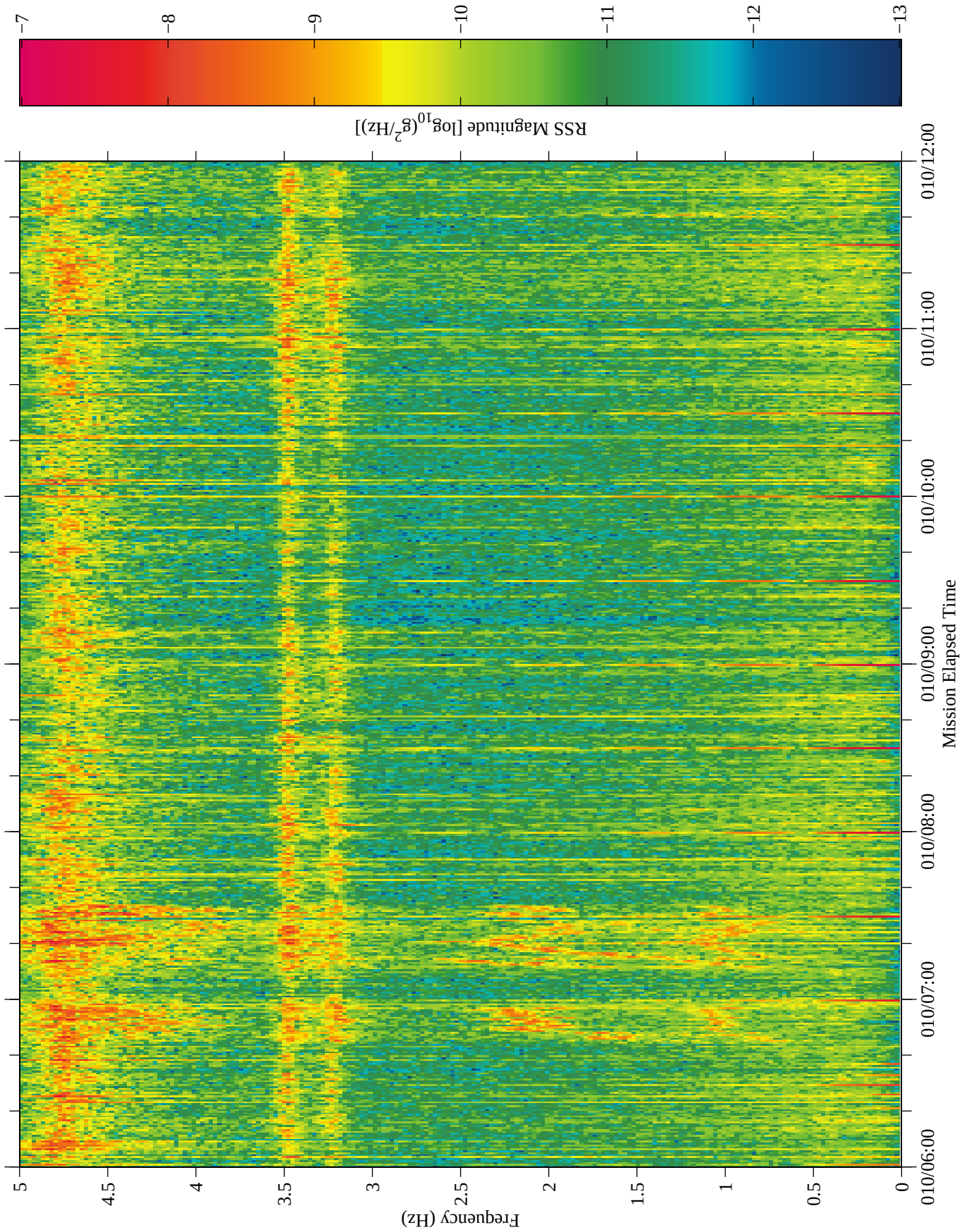

Figure 42: USMP−4, Unit G, TSH A

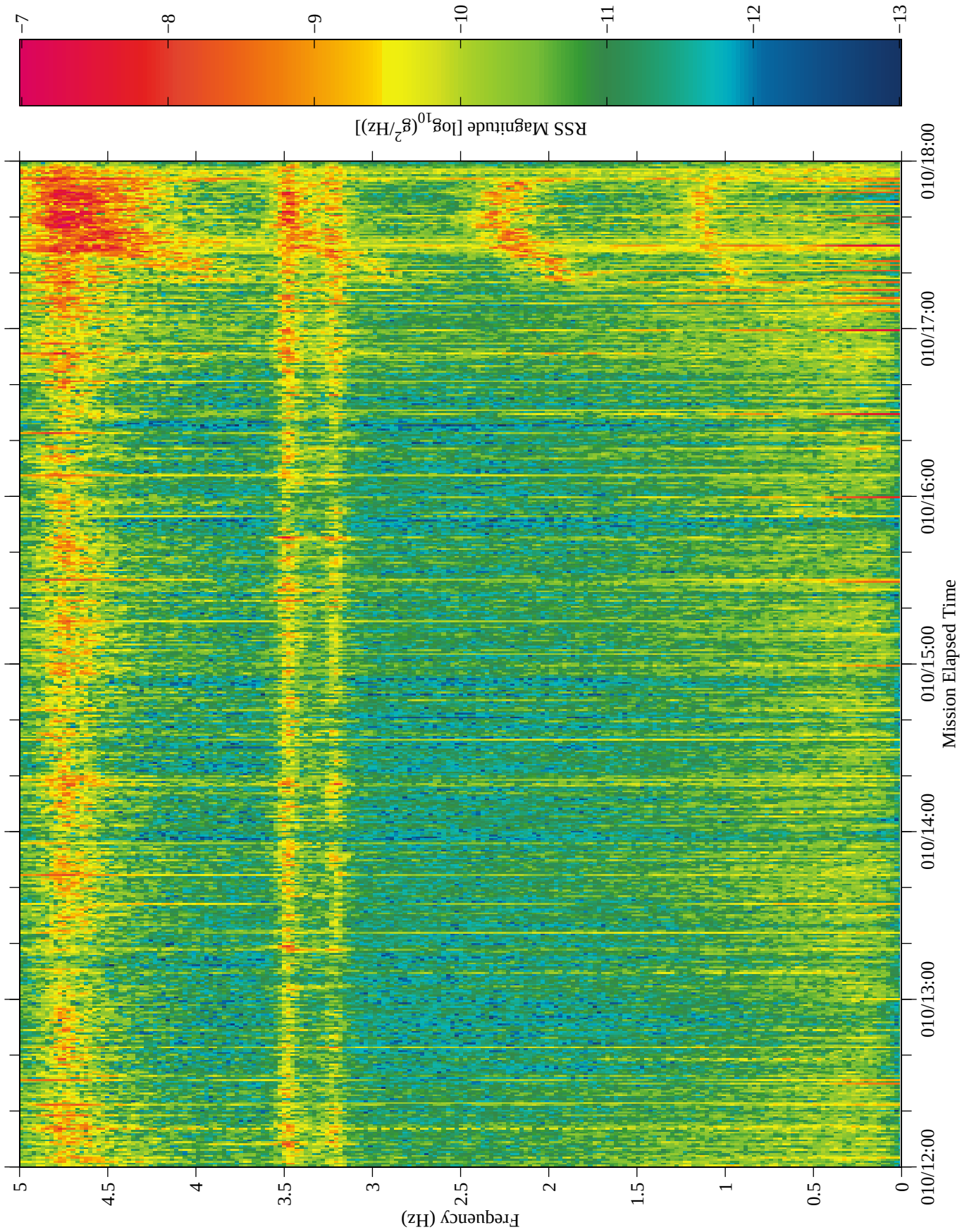

Figure 43: USMP−4, Unit G, TSH A

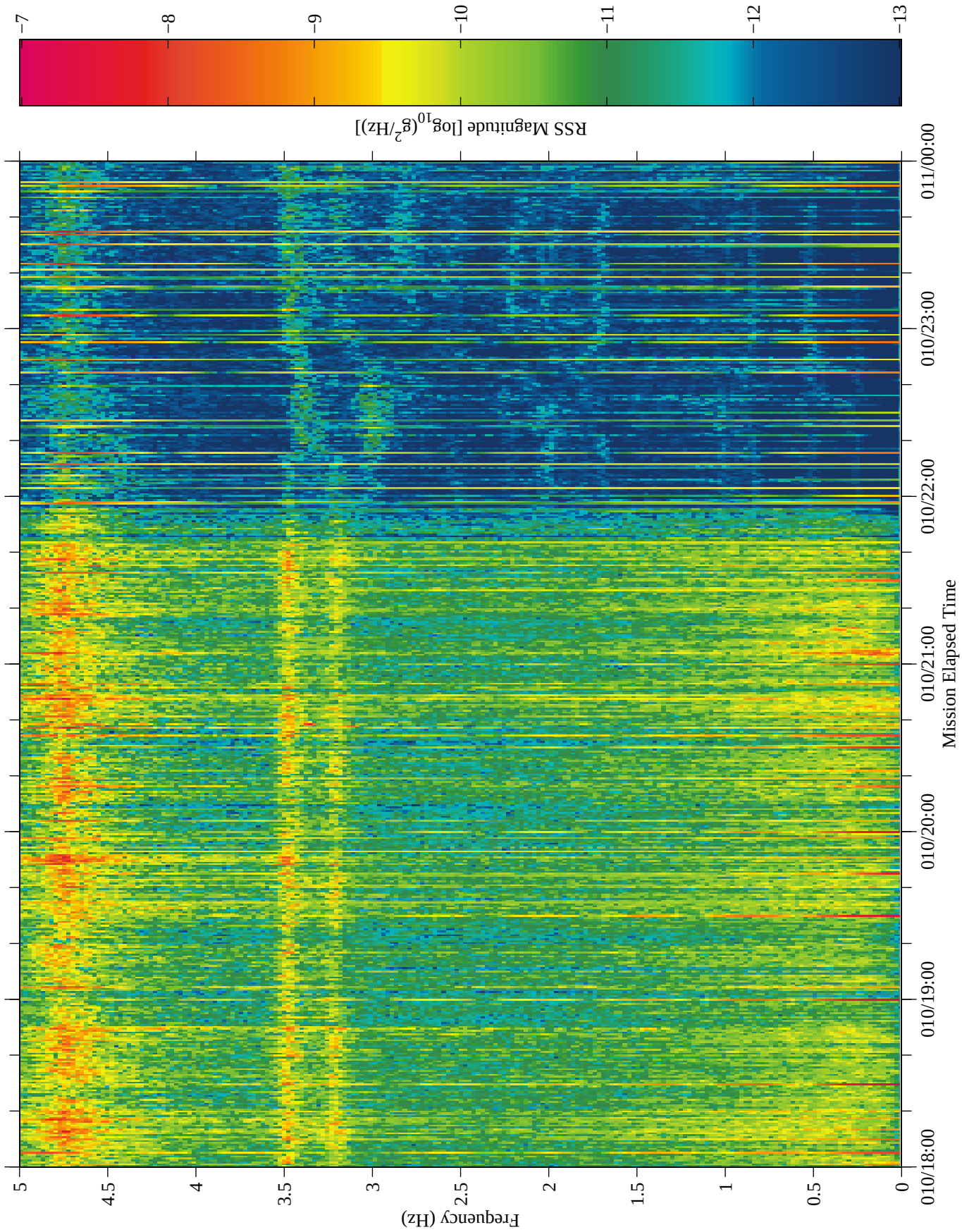

Figure 44: USMP−4, Unit G, TSH A

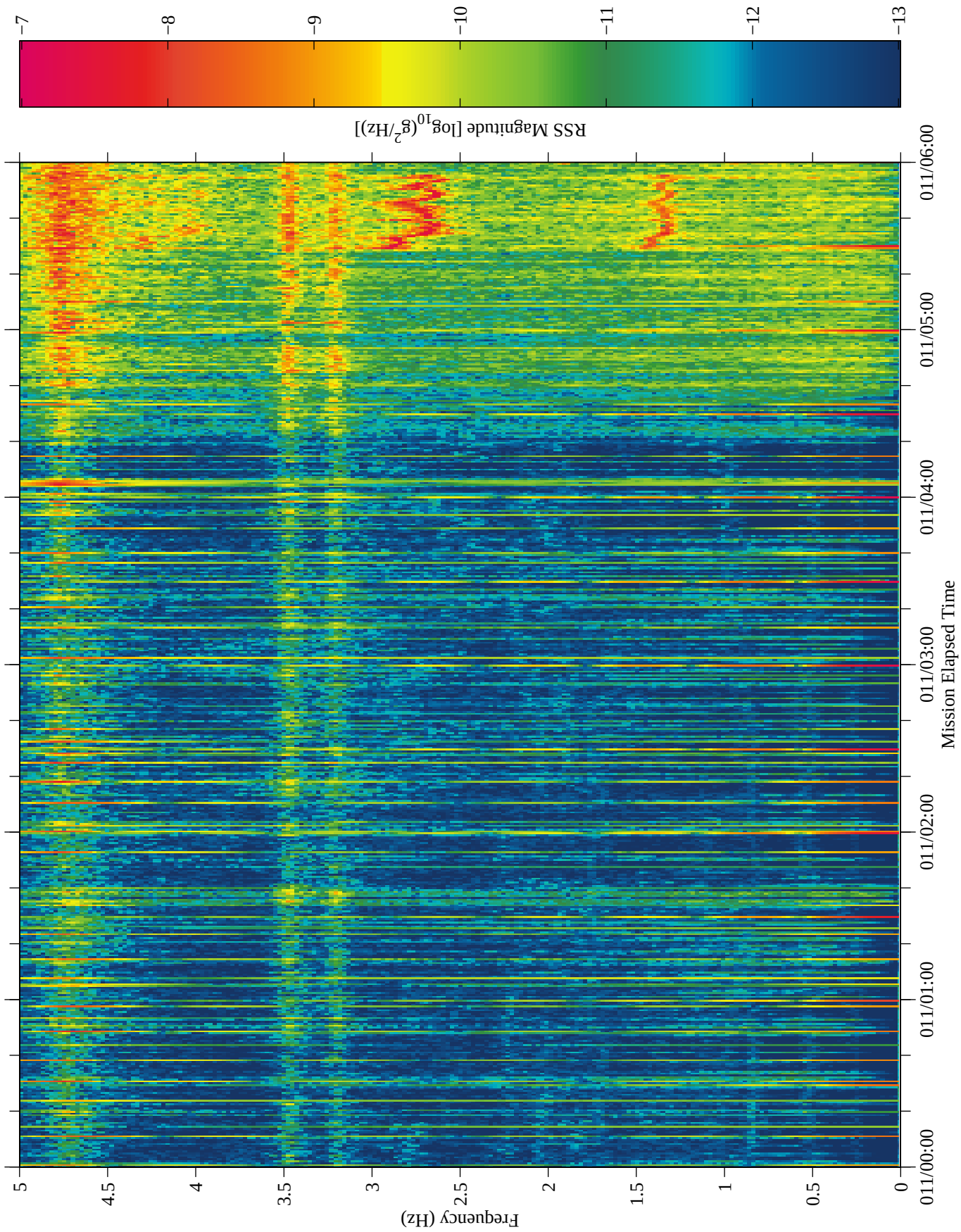

Figure 45: USMP−4, Unit G, TSH A

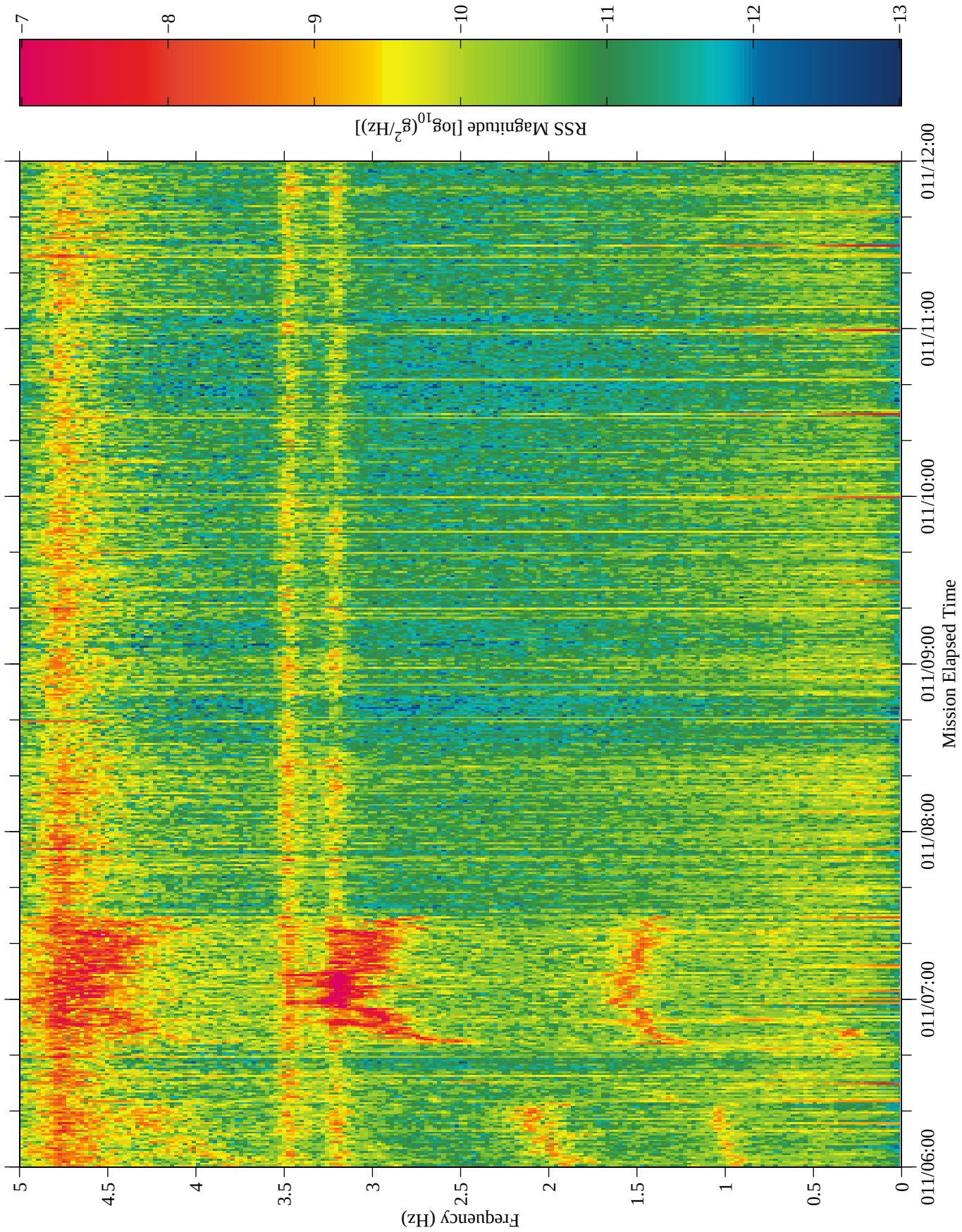

Figure 46: USMP−4, Unit G, TSH A

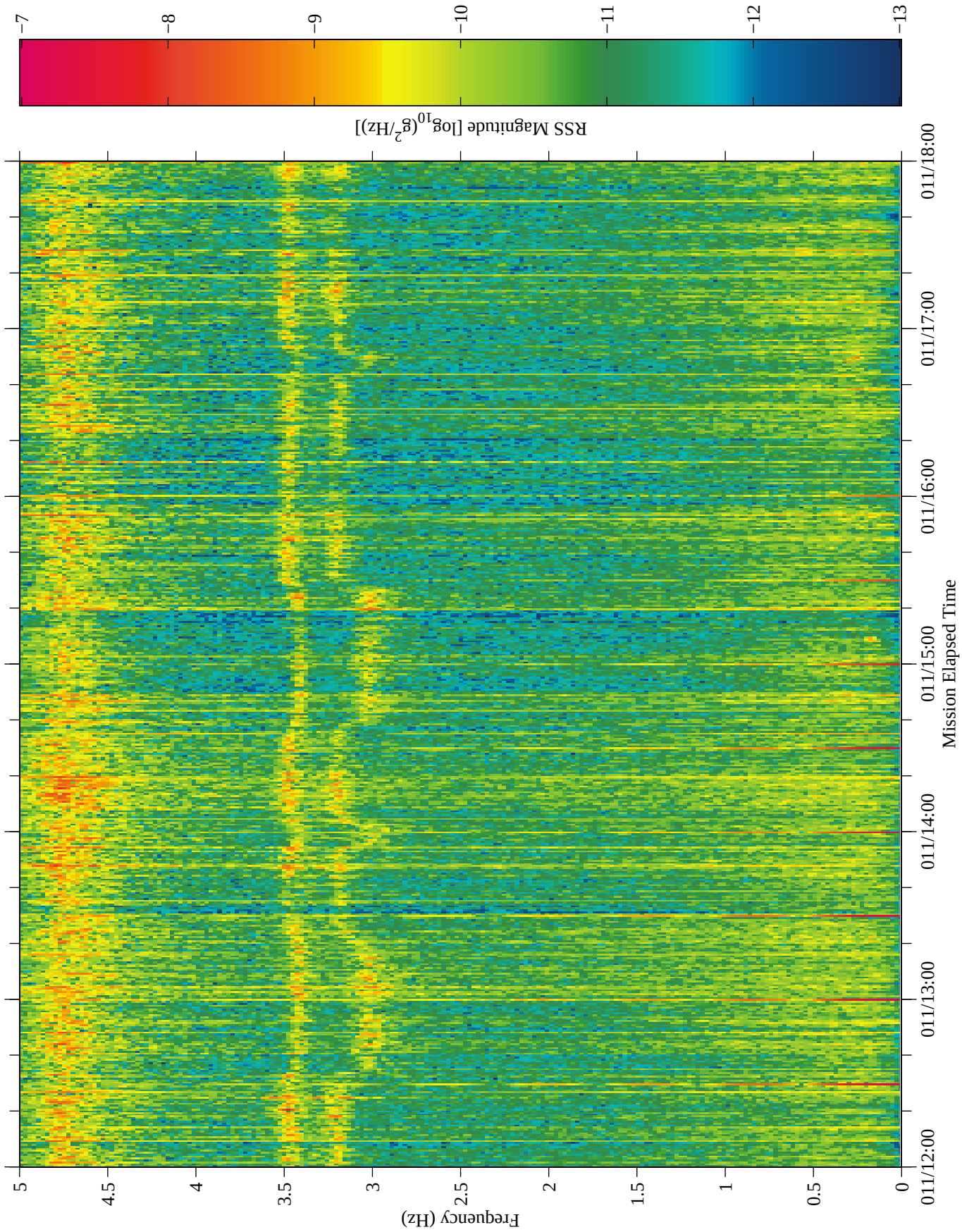

Figure 47: USMP−4, Unit G, TSH A

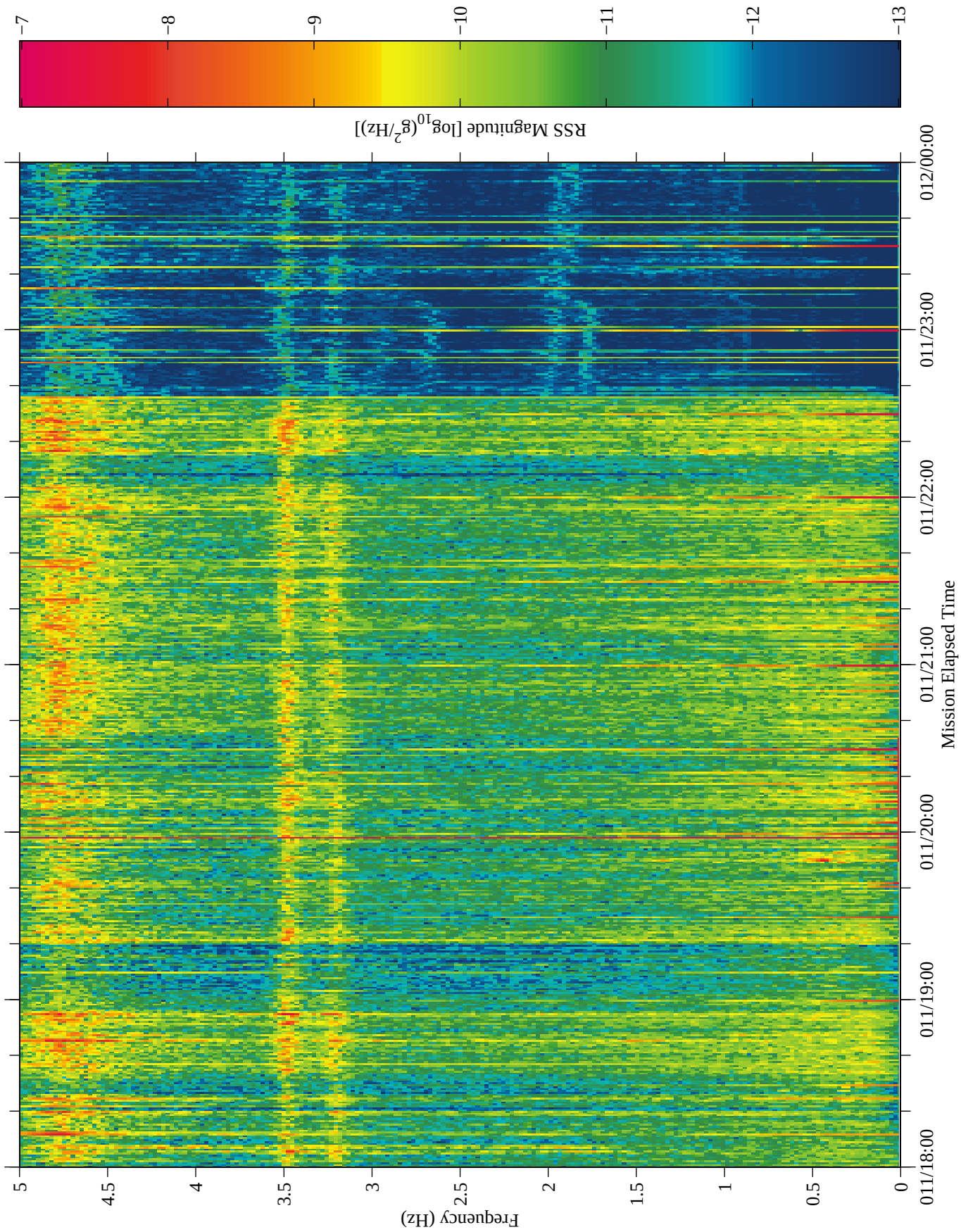

Figure 48: USMP−4, Unit G, TSH A

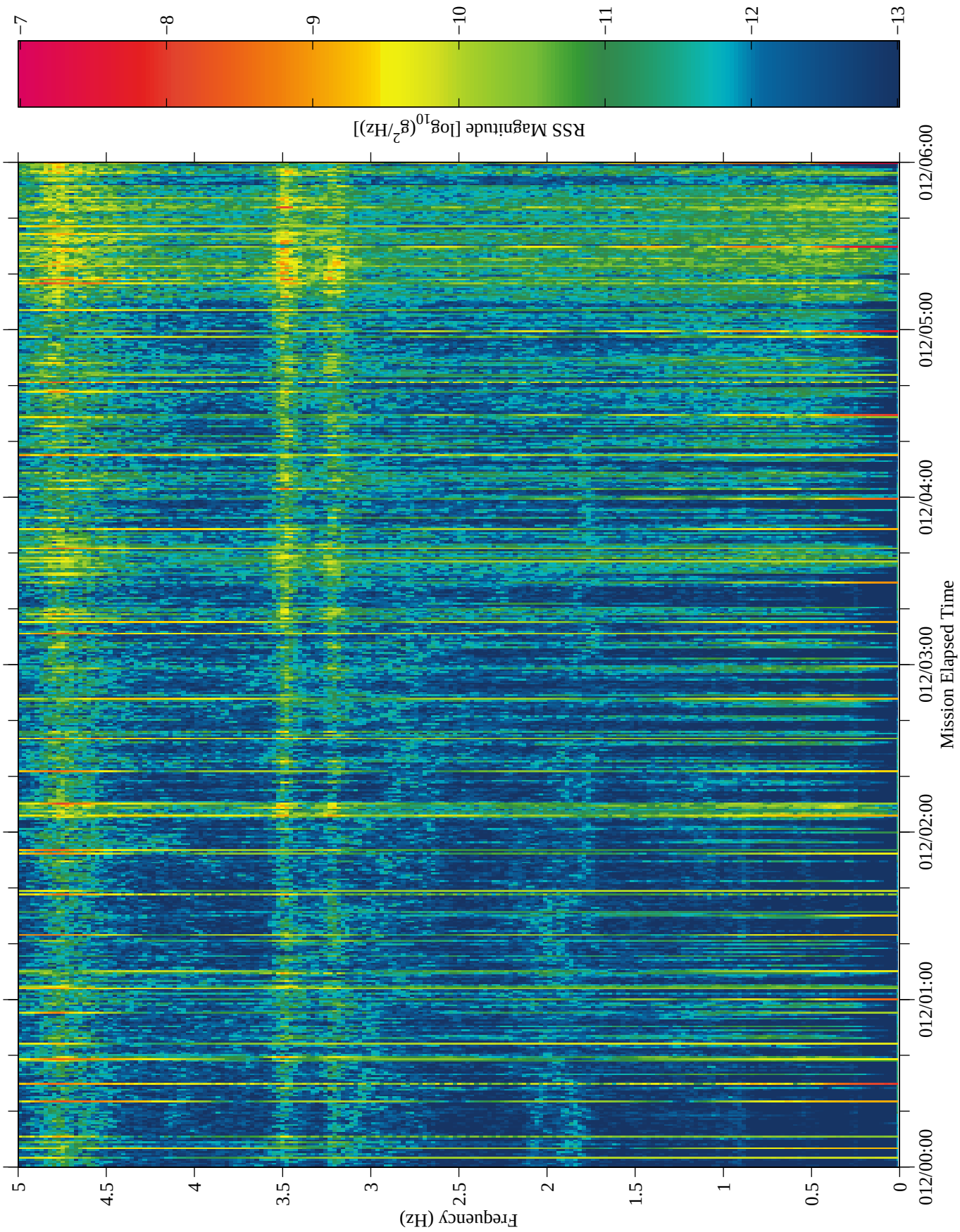

Figure 49: USMP−4, Unit G, TSH A

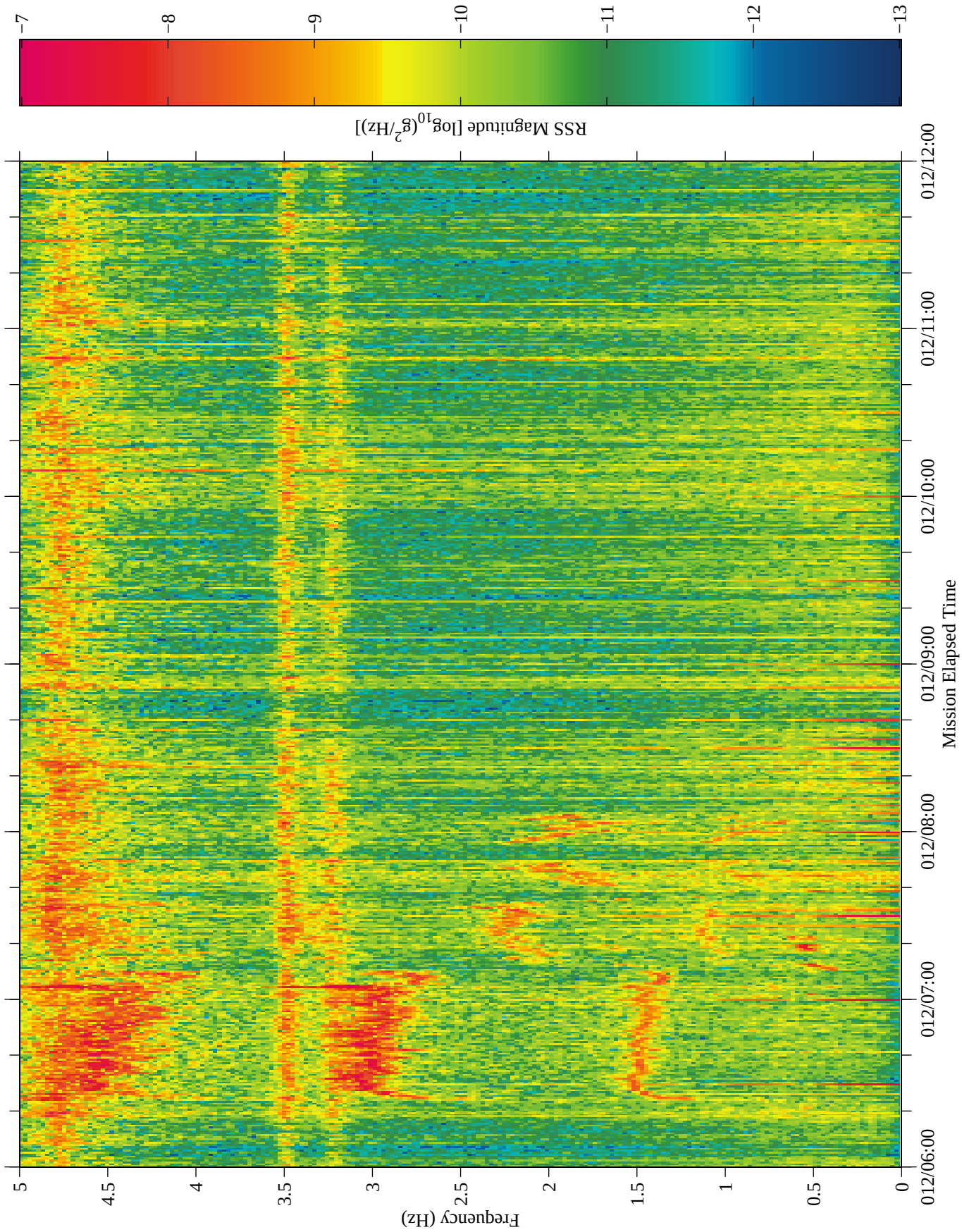

Figure 50: USMP−4, Unit G, TSH A

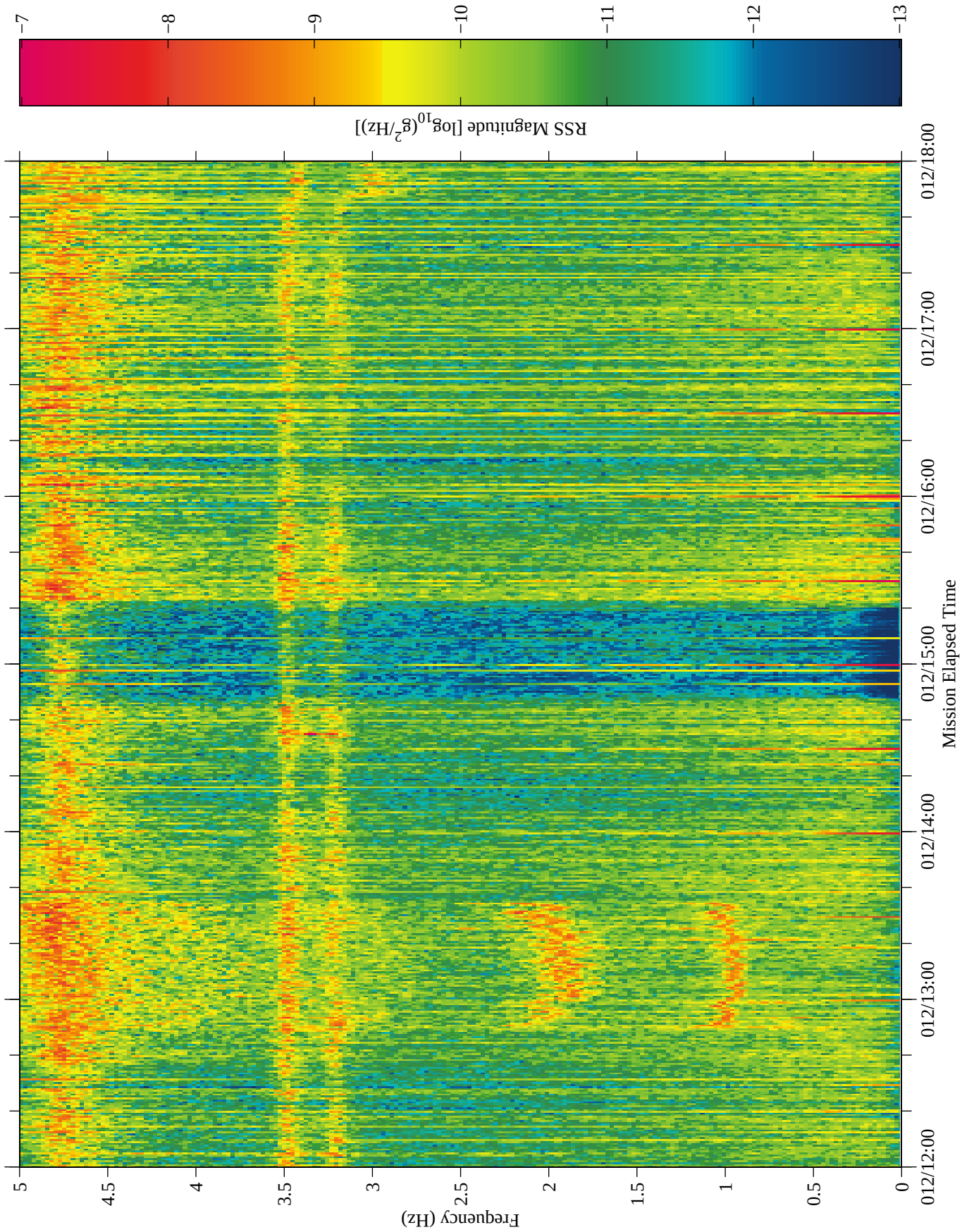

Figure 51: USMP−4, Unit G, TSH A

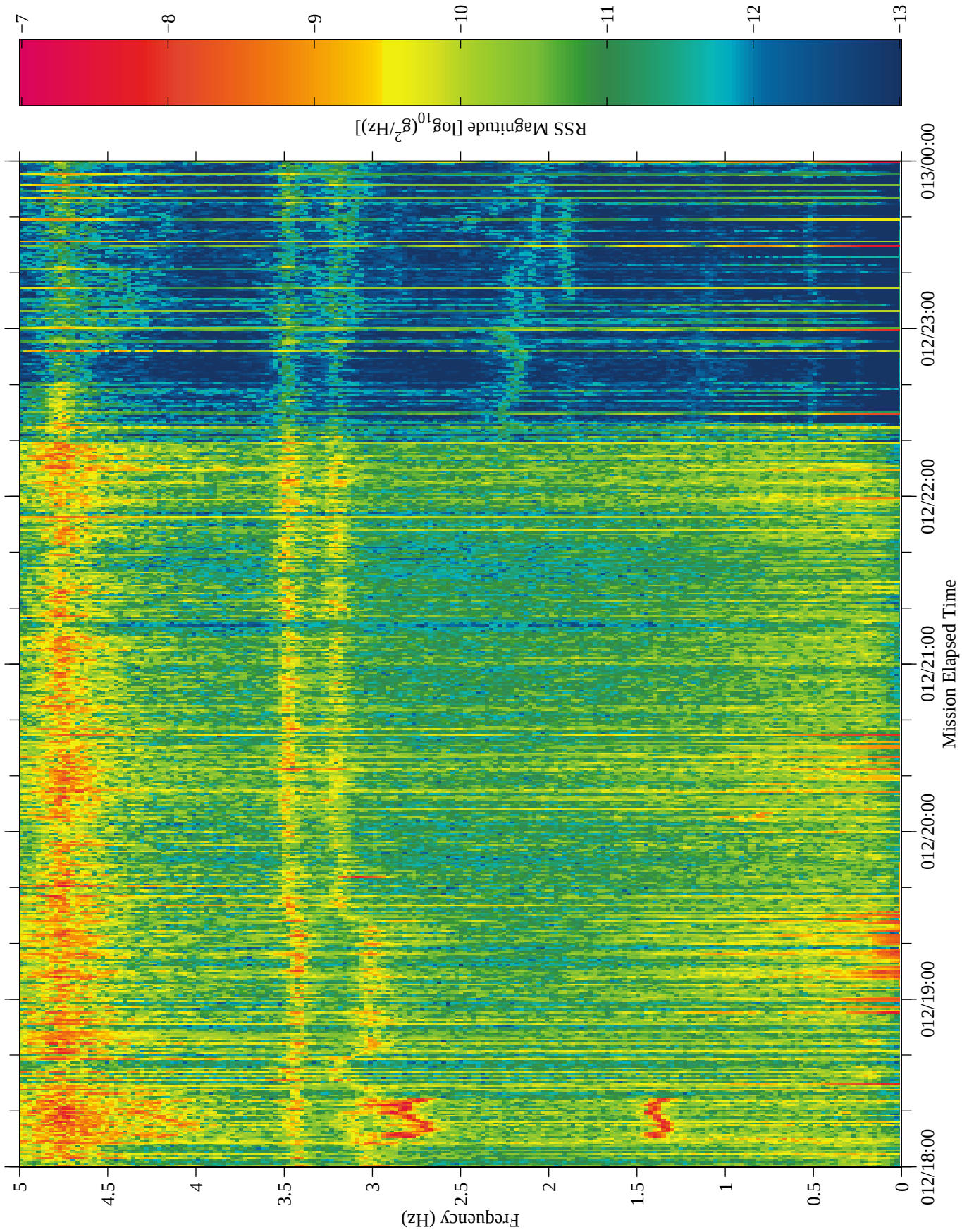

Figure 52: USMP−4, Unit G, TSH A

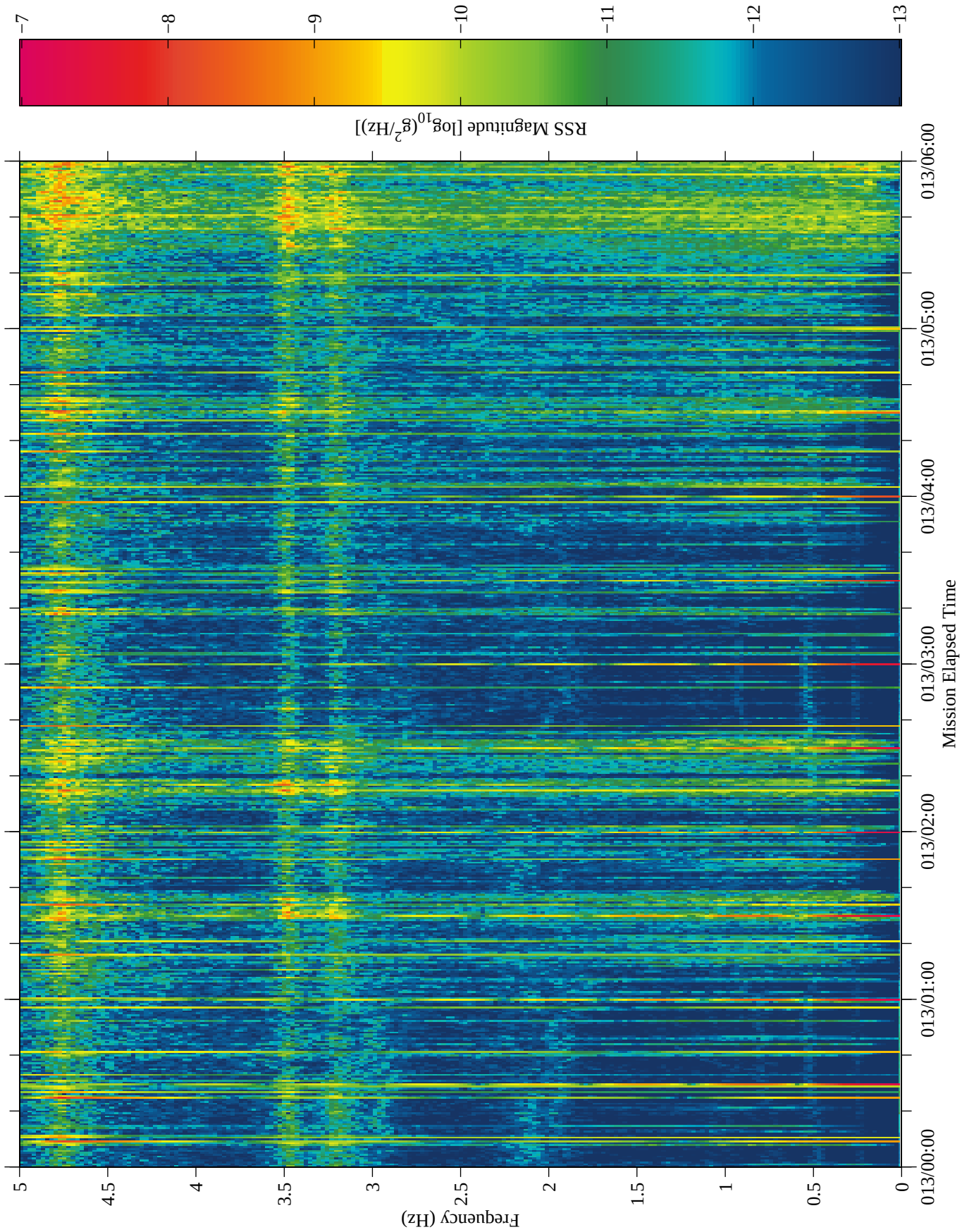

Figure 53: USMP−4, Unit G, TSH A

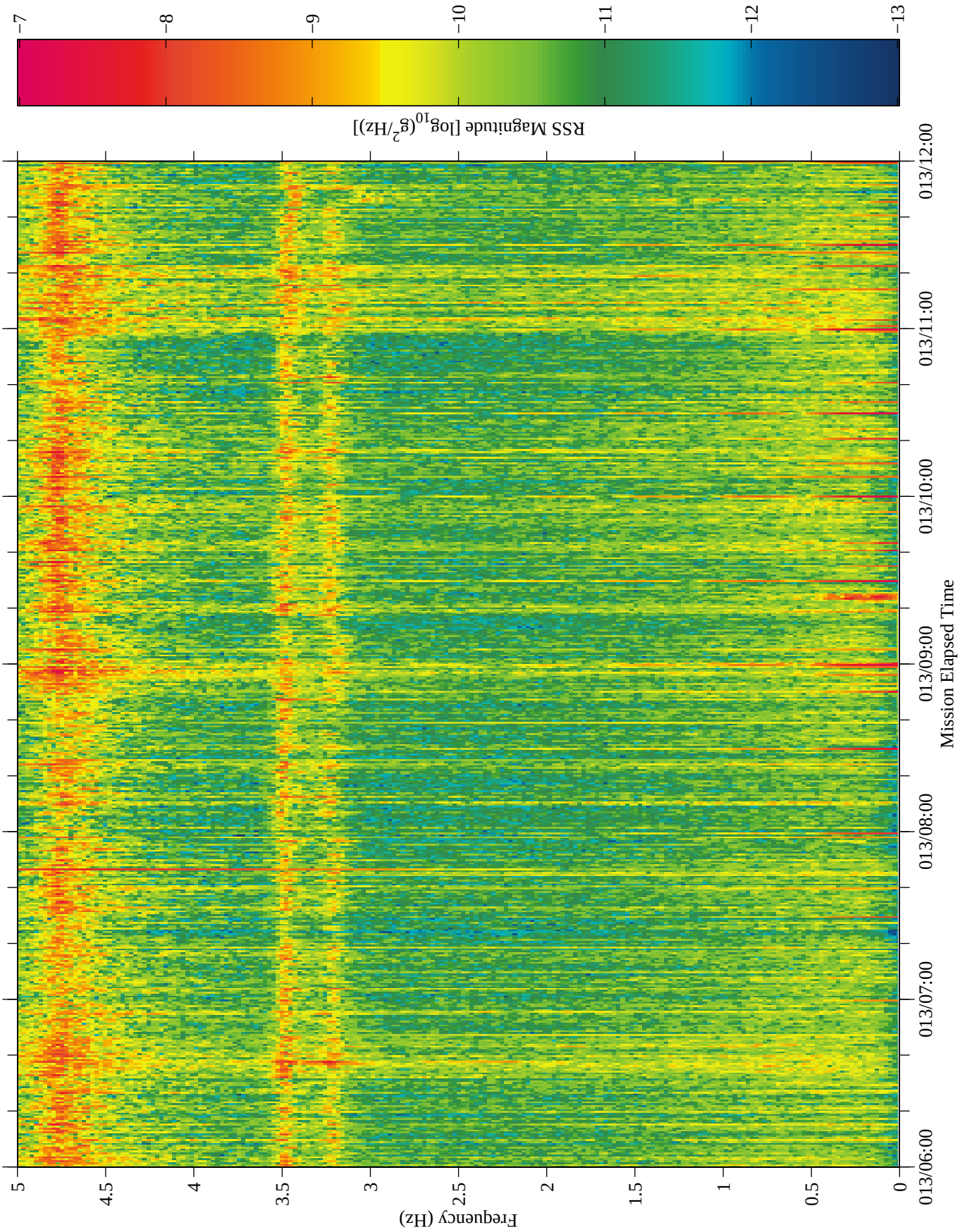

Figure 54: USMP−4, Unit G, TSH A

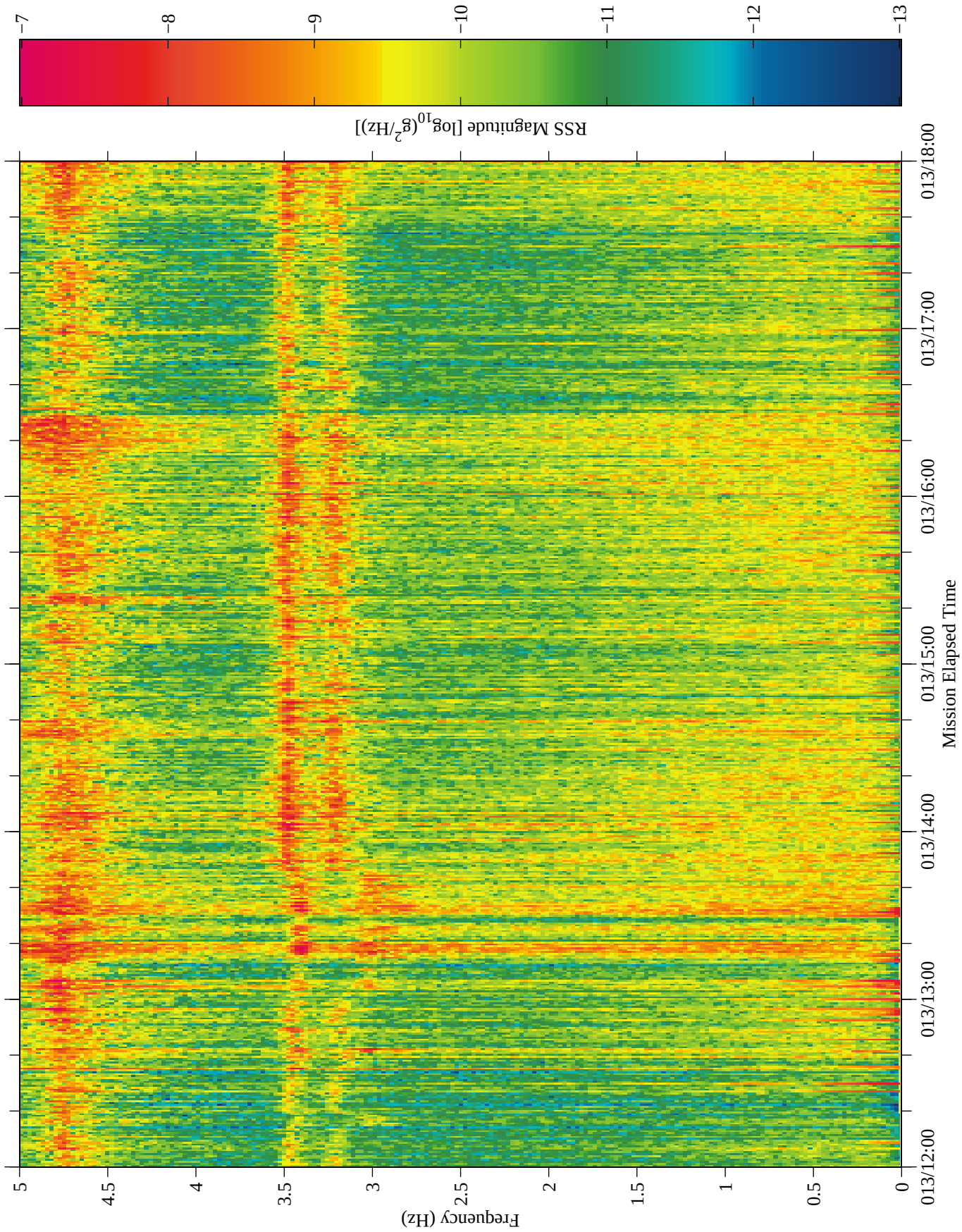

Figure 55: USMP−4, Unit G, TSH A

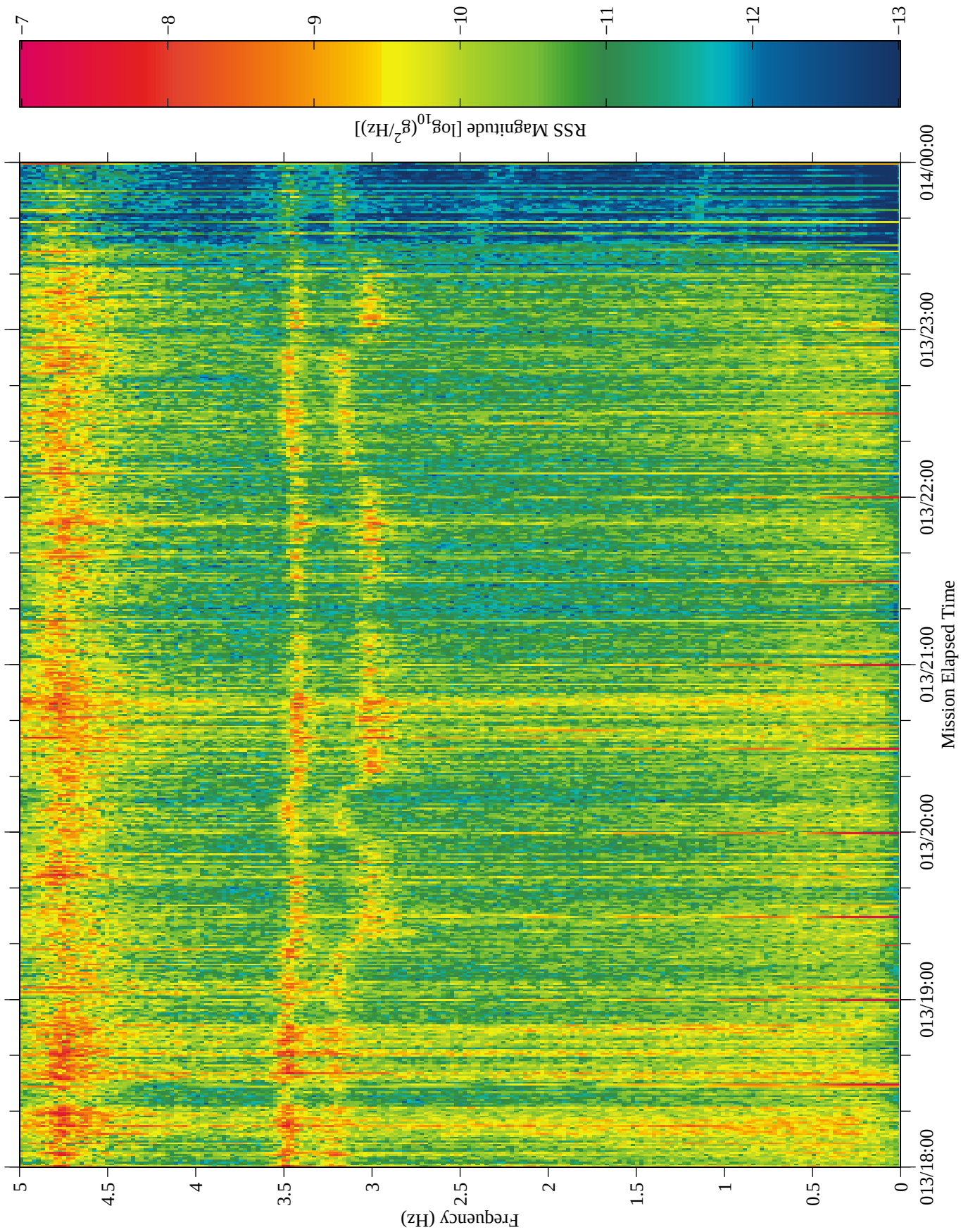

Figure 56: USMP−4, Unit G, TSH A

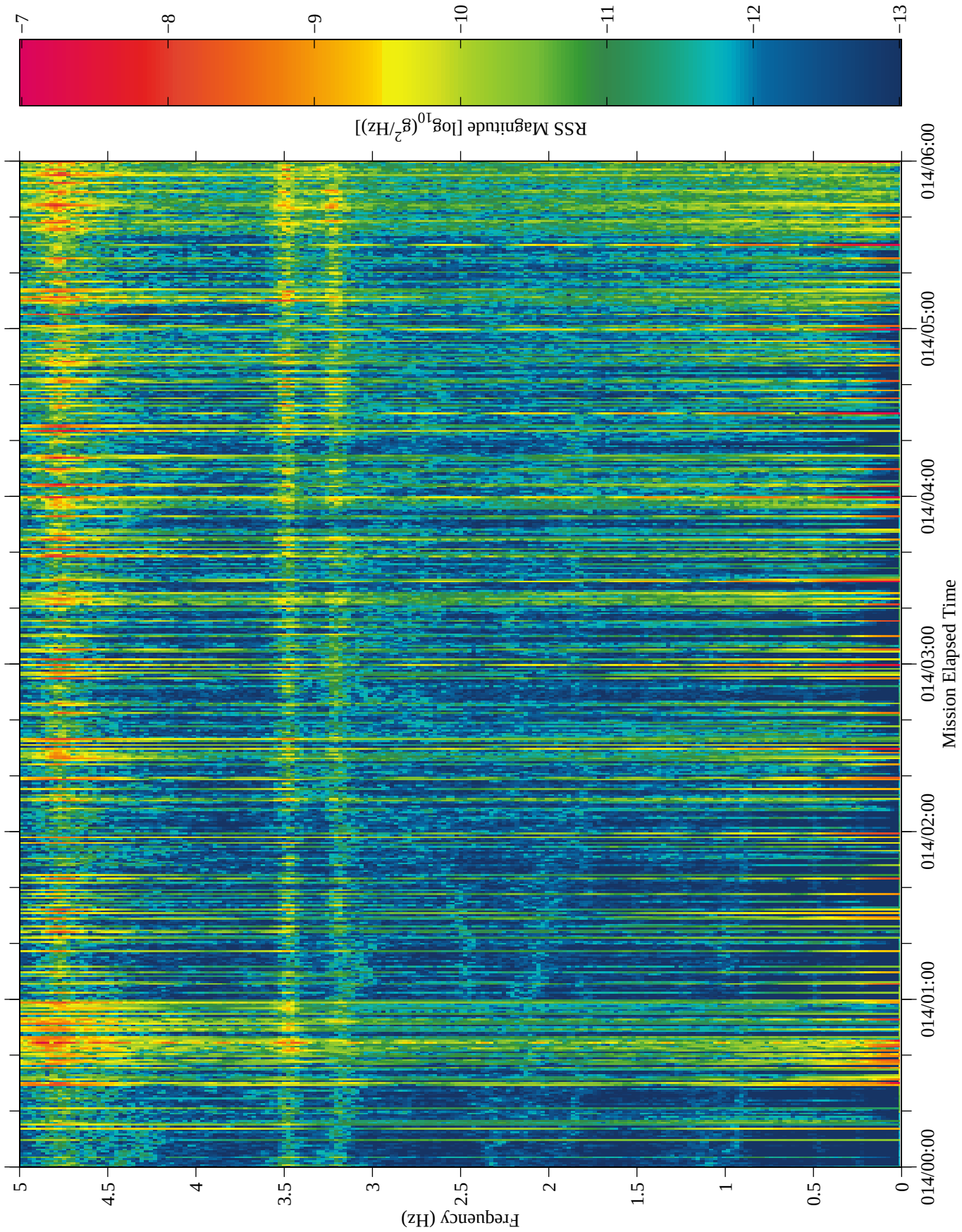

Figure 57: USMP−4, Unit G, TSH A

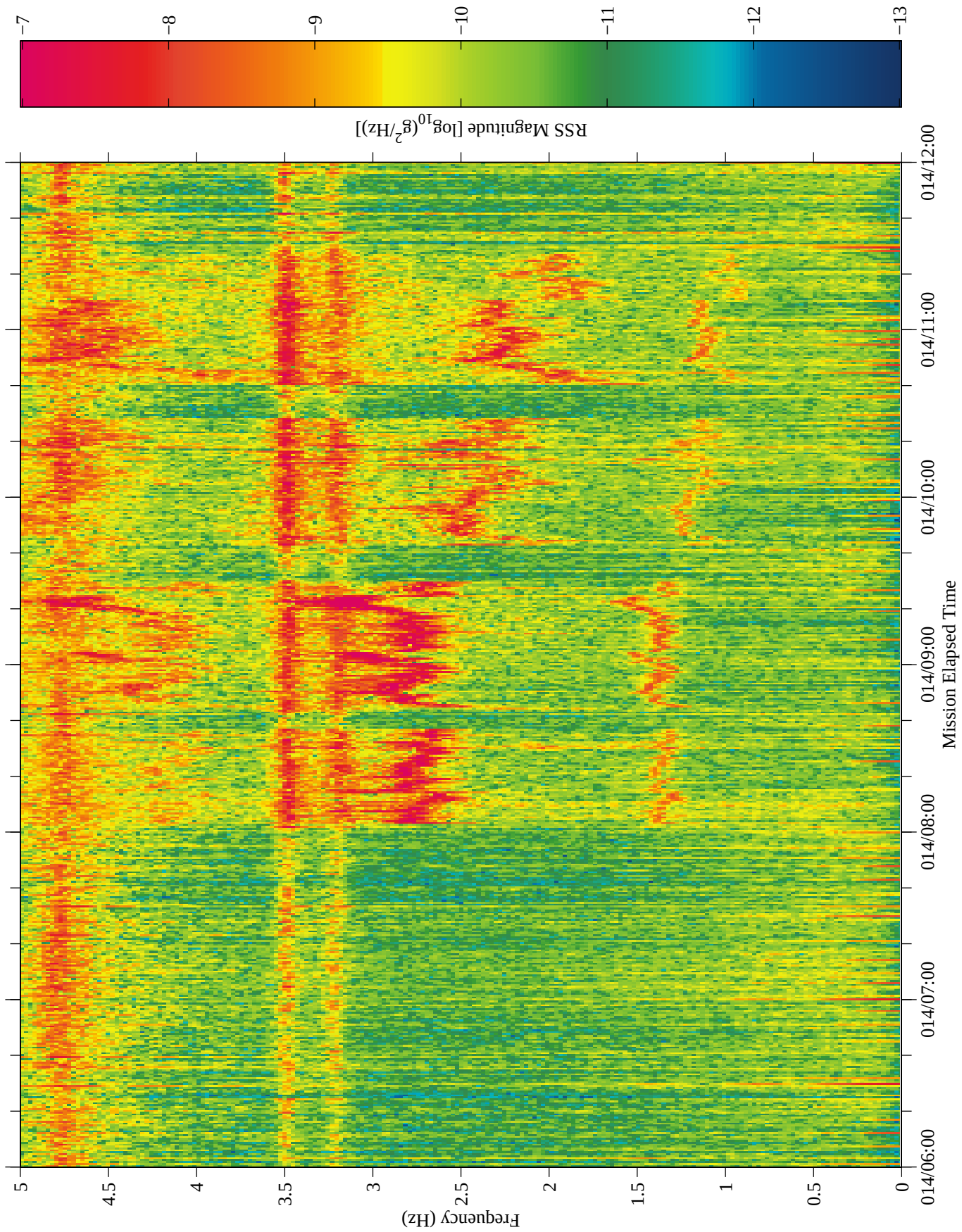

Figure 58: USMP−4, Unit G, TSH A

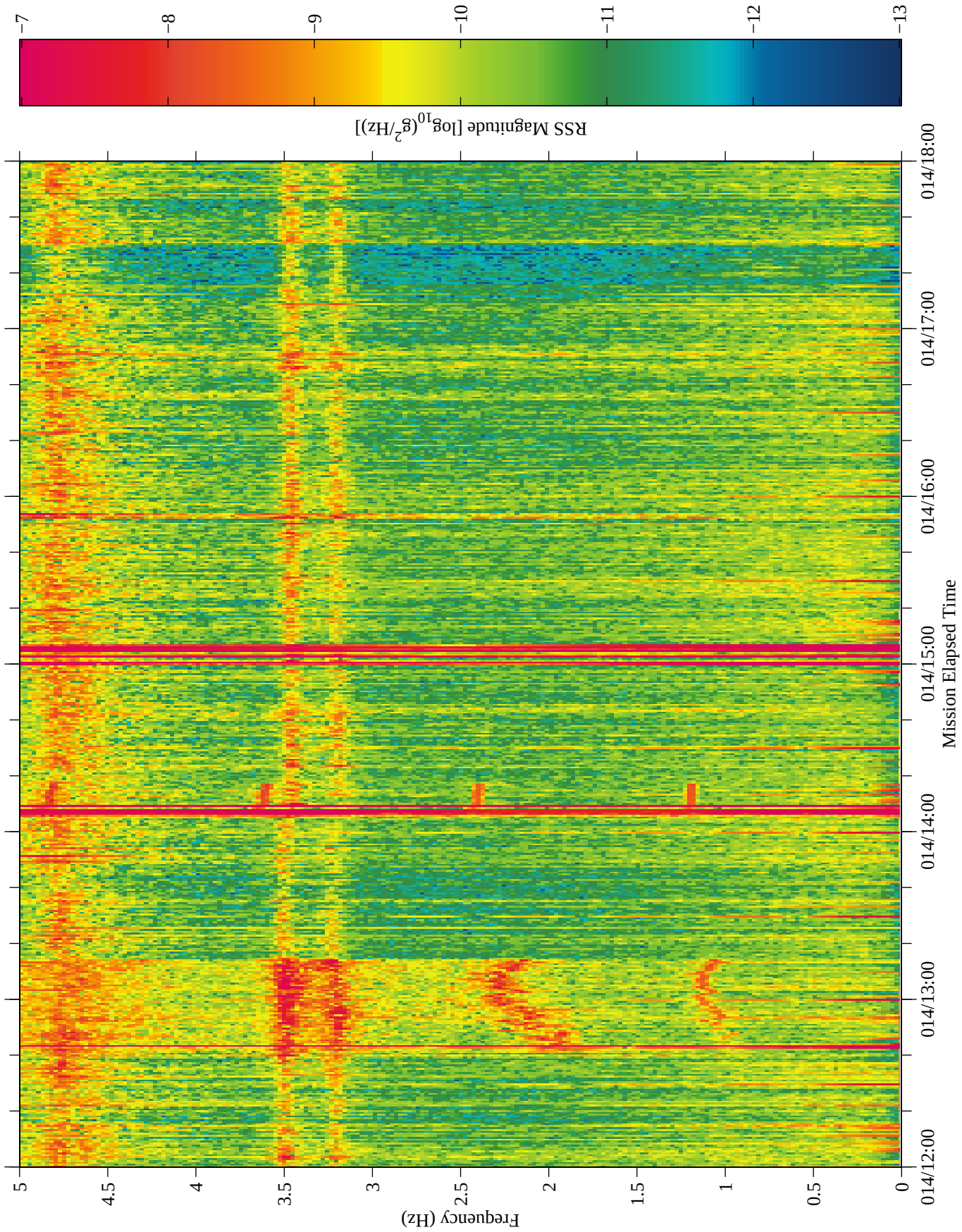

Figure 59: USMP−4, Unit G, TSH A

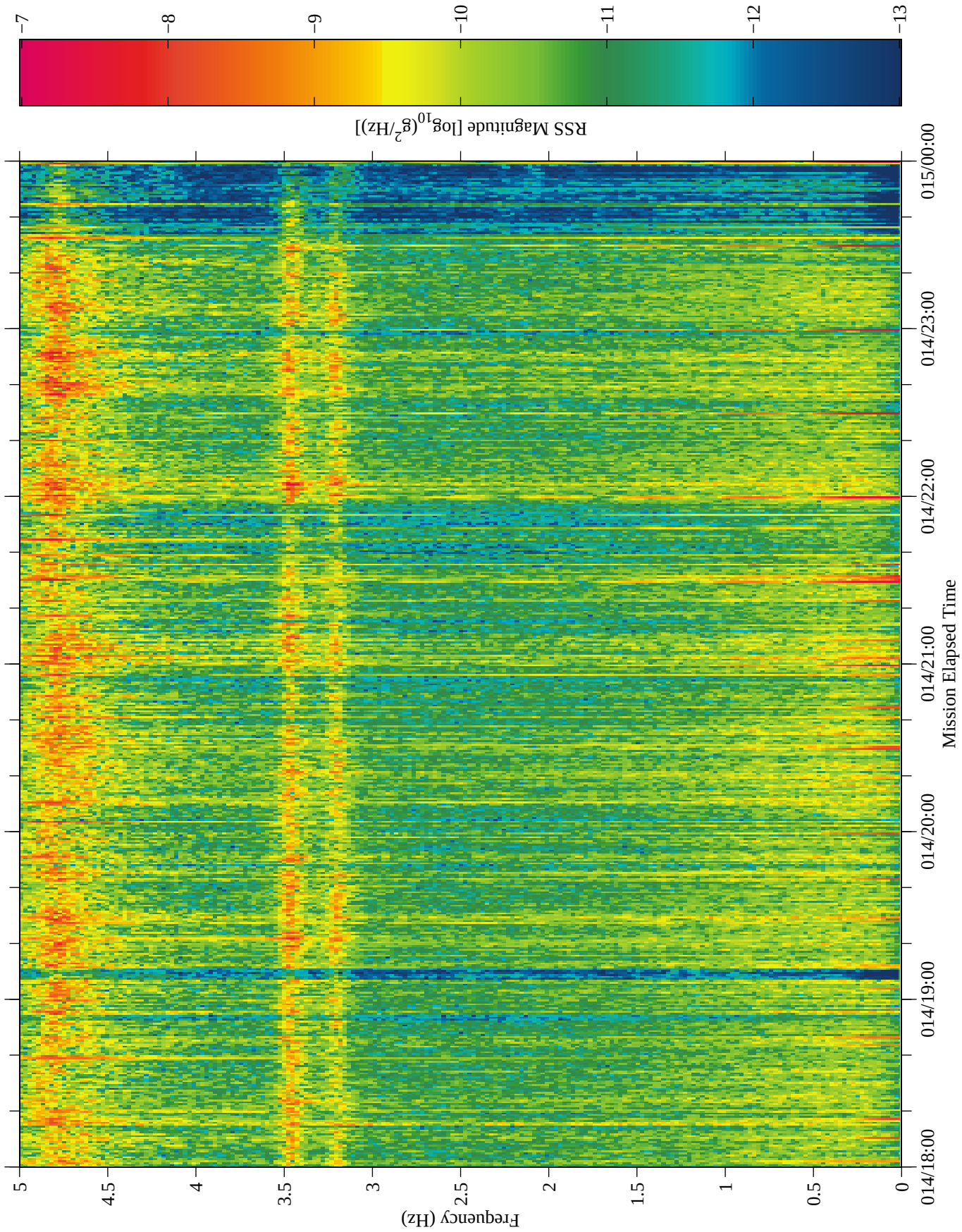

Figure 60: USMP−4, Unit G, TSH A

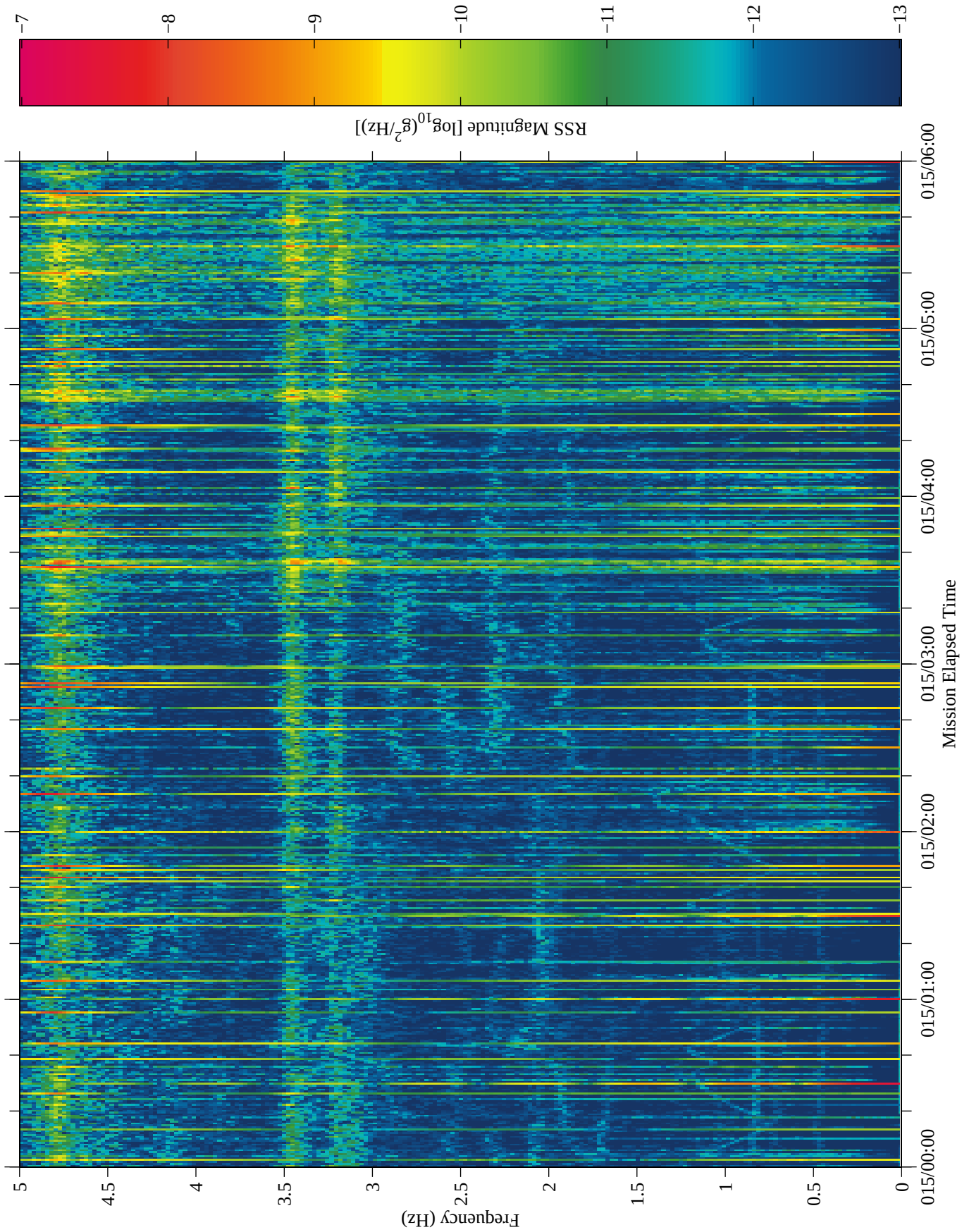

Figure 61: USMP−4, Unit G, TSH A

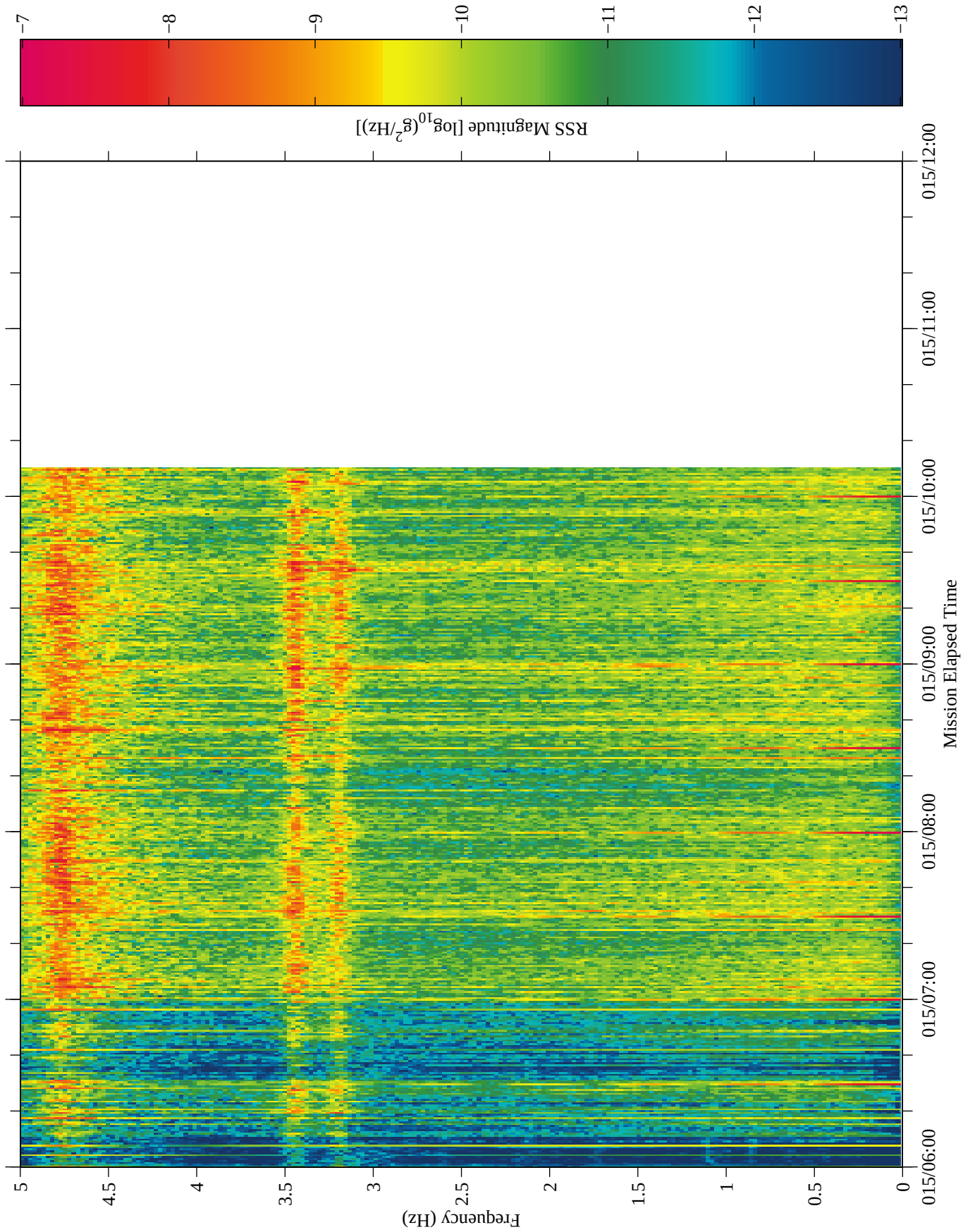

Figure 62: USMP−4, Unit G, TSH A

Appendix F: PIMS USMP-4 Logbook

During the STS-87 mission, members of the PIMS team monitored mission events using voice communication loops and video downlink. Items that were of interest because of the potential impact on the microgravity environment were recorded in the PIMS logbook. An electronic copy of the logbook is included in the CD-ROM version of this report.

ddd	hh	mm	ss	Category	Notes
000	00	00	00	Unclassified/Other	Rogers on Console
000	00	00	00	SPARTAN Operations	there has been some discussion of the spartan deploy being delayed by a day due to comm problems. This would delay prime ug time by a day
000	00	00	00	Attitude/Maneuver	launch at 323/19:46:00 launch time (will confirm when official call is made)
000	00	09	00	Attitude/Maneuver	OMS-1 not required
000	00	46	00	Ku/TDRSS/Communication	no comm from the crew, but telemetry confirmation that the crew can hear JSC; Australia can hear the crew
000	00	50	00	Ku/TDRSS/Communication	they got them on the switch to TDRSS-W
000	00	54	00	Orbiter Systems	starting block one of posst-insertion checklist
000	01	20	18	Attitude/Maneuver	maneuvring to PLB door opening attitude
000	01	20	20	Orbiter Systems	go for radiator activation
000	01	21	23	Orbiter Systems	radiator activation in works
000	01	21	42	Attitude/Maneuver	in attitude for PLB door opening
000	01	22	55	Orbiter Systems	go for opening, trying to look at real-time video of it
000	01	25	26	Orbiter Systems	starting opening procedure
000	01	28	10	Orbiter Systems	crew call down that they are starting the opening (don't know who made the previous call I noted, perhaps telemetry that they had issued some command); video timing didn't synch up
000	01	30	00	Orbiter Systems	PLB doors open (missed call, busy talking to CHeX)
000	01	37	00	Unclassified/Other	overheard conversation on PAC loop; for now, assume that Spartan deploy change will follow flight rules (deploy on orbit 34 with one rev late opportunity on 35); PAC needs to talk to CHeX about Ku, attitude and RCS test because deploy change will impact t
000	01	41	00	Thruster Activity	go for vernier mode
000	01	42	00	Thruster Activity	verniers on
000	01	57	00	Experiment/Facility	CHeX says that the Ku, attitude, and RCS tests are critical for their science; so that they need to be rescheduled, not just pre-empted by the Spartan move
000	02	00	00	Unclassified/Other	Truong logbook. SAMS 1 and SAM2 chekout is complete. Chex request for the analysis of the 56 hz. PIMS submmitted the flight notes to the POCC and AASDF did receved too. Also PIMS confirm to POL do not need to sent the flight notes to the SAMS team at TSC
000	02	19	00	Experiment/Facility	PSE polling USMP-4 teams for go for activation
000	02	39	00	Orbiter Systems	pump 1 on (perhaps freon loops, but I'm not sure, check with PAC when activation is done and things quiet down)
000	03	03	00	SAMS/OARE Issues	both SAMS units on
000	03	04	00	SAMS/OARE Issues	PSE waiting for call from SAMS to say that all is well
000	03	17	00	SAMS/OARE Issues	our SAMS-2 displays look good; Gene working on SAMS-1display
000	03	30	00	SAMS/OARE Issues	appears that SAMS is going through the checkout
000	03	44	00	SPARTAN Operations	if no respons from SOHO, possible plan for spartan delay: fd 3 deploy, fd 5 retrieve, emu checkout added to tomorrow, pick nominal operations of fd 6 with EDFT (if SOHO is nominal, no delay in spartan)
000	03	45	00	SAMS/OARE Issues	SAMS-1 time not updating for several seconds
000	03	49	00	Data Observation	check with PAC and PSE for 55 Hz disturbance starting about 000/03:28 (gRMS levels at about 100 ugRMS for 54-56 Hz range)

000	03	50	00	Data Observation	also something unidentified at just under 70 Hz
000	04	08	00	Attitude/Maneuver	SOPG: CHeX antincipating 14 days of He; MGBX activation should be going on now; PIMS reported on 55 and 70 Hz disturbances; discussion of spartan ops; discussion of need for altitude change because currently at 151x155; concensus to use 000/07:30 trim bu
000	04	27	00	SAMS/OARE Issues	SAMS checkout continues. Observing SAMS2 stream changing downlinked axes
000	05	24	51	Attitude/Maneuver	IMU align at crews' convenience
000	05	30	00	Unclassified/Other	request from CHeX to identify center frequency and spread of 55 Hz disturbance; asked them to submit request on form; we will let them know when we can do this analysis
000	05	30	00	Unclassified/Other	problems with PIMS2
000	05	30	00	SPARTAN Operations	info on the spartan plan is in the flight notes received folder
000	05	56	19	Orbiter Systems	steam vent heater deactivation in about an hour
000	05	59	00	MGBX Operations	called MGBX (Craig) about fans; they do not have any good time mark information for their activation and checkout; they do know that NOW their air circ fan is OFF and their interface frame fan (the more quiet fan) is ON; this call was in response to my se
000	06	18	30	EDFT Operations	starting RMS checkout
000	06	27	00	Attitude/Maneuver	TIG for burn: 000/07:30:50.000, will b +X burn
000	06	33	30	Orbiter Systems	steam vent heater deact
000	06	38	15	EDFT Operations	RMS power up complete, starting check out
000	07	15	55	Attitude/Maneuver	maneuvering to burn attitude
000	09	17	00	SAMS/OARE Issues	we received the first dump of OARE data and processed it
000	09	30	00	Experiment/Facility	IDGE try to save the image by manual
000	09	34	00	Unclassified/Other	very quiet right now
000	09	47	00	SAMS/OARE Issues	All SAMS PB/RT lines experienced dropout.
000	09	48	00	SAMS/OARE Issues	All machines from SAMS data were drop from real time and play back.
000	10	00	00	Unclassified/Other	Truong off console
000	10	11	00	SPARTAN Operations	Thought I heard SPARTAN deploy delayed by about [one day?].
000	10	16	00	Ku/TDRSS/Communication	Talk by PAC of plan for Ku-band antenna [dither?] inhibit at MET 001/07.
000	10	17	00	Attitude/Maneuver	Talk of maneuver from -ZLV/-XVV to -ZLV/+YVV at ?
000	10	18	00	Experiment/Facility	CHeX to MSCI: Four of the GRT (Germanium Resistance Thermometer) bridges are presently not working. No impact for now.
000	10	24	00	SPARTAN Operations	SPARTAN deploy to occur on flight day 3.
000	10	28	00	SPARTAN Operations	Rendezvous on flight day 5 [for retrieve?].
000	10	29	00	Unclassified/Other	EMU checkout on flight day 4 and EVA on flight day 6.
000	10	29	00	Orbiter Systems	Slow accumulator leak noted on right OMS engine. Talk of actions to suppress alarms during sleep regarding OMS.
000	10	53	00	Experiment/Facility	Talk of cycling power to CHeX with [relay ?] to correct temperature monitoring problem.
000	10	59	00	Ku/TDRSS/Communication	Call to ? that it sounds like JSC is going to entertain the Ku-band antenna inhibit around MET 001/07.
000	11	07	00	Data Observation	At around 000/10:40 [or so], noticed on SAMS-2 display's spectrogram that whatever the 40 Hz disturbance was went from being tightly controlled in frequency to slowly drifting down a few Hertz and then back to nearly its original value at around 000/11:05

000	11	08	29	Experiment/Facility	K6 relay cycled off for CHeX troubleshooting.
000	11	09	05	Experiment/Facility	K6 relay cycled on for CHeX troubleshooting.
000	11	37	00	Experiment/Facility	CHeX call that GRT bridges are back up and running.
000	12	14	00	Unclassified/Other	Current SAMS mean values: SAMS-2, TSH B: -1.94608e-03 g (-6,238.38/3,205,620) SAMS-1, TSH A, X: (4.56/4,002) g Y: (-70.41/4,002) g Z: (-57.93/4,002) g
000	12	50	00	Unclassified/Other	Submitted Science Shift Report for MET 000/00 - 000/12 via the internet.
000	14	24	00	Thruster Activity	VRCS F5L “getting chilly” so probable deadband collapse down to about 0.1 degrees fairly soon [in next 30-40 min.?] to get back up to temperature.
000	14	37	00	Thruster Activity	Deadband collapse in about an hour (down to about 0.1 degrees).
000	15	33	00	Thruster Activity	Collapsing deadband for about 5 minutes.
000	15	40	00	Thruster Activity	“Got good 30 to 40 firings” [deadband collapse results?]
000	15	52	00	SAMS/OARE Issues	SAMS 1 Archiver machine (pims1) displayed an error dialog box with message about “permission denied” [disk access?]. Appeared to be trying to access /export/disk1/data/000_15_37_53 and large MET display was reading 000_15_42_51 (record count = 45299)
000	16	20	00	Thruster Activity	PAC to MSCI and POL: talk of trim burn at about MET 001/09.
000	16	47	00	Thruster Activity	Next AOS, go back to 0.1 degree deadband to warm up jets.
000	16	48	00	Thruster Activity	MSCI called to ask us for analysis of deadband collapse to be presented at next SOPG meeting (001/04).
000	17	02	00	Thruster Activity	Call that they’re seeing tight deadband now.
000	18	28	00	Unclassified/Other	Hrovat off console.
000	18	28	00	Unclassified/Other	Finkelstein on console
000	19	39	00	Thruster Activity	Collapse deadbands again - VRCS F5L getting cold
000	19	55	30	Ku/TDRSS/Communication	Start LOS for about 19 minutes
000	20	23	00	SAMS/OARE Issues	Pava called from U of F (Ranga’s Team) asked for location of picture file created by Kevin Get back to Pava ASAP
000	20	30	00	Unclassified/Other	Reza A. / MEPH PI was asking POL about some past microgravity accel data for satelite deployment and retrieval. POL suggested that Reza call PIMS. I called MEPH back and told him that we had data from EURECA deployment and retrieval from SH-1 and LAGEOS s
000	20	32	00	SAMS/OARE Issues	Processed two OARE data files Do not have identification for first file, but second file was 00090001.oare. Time covered by files are: 000/7:56:09 - 000/8:59:38 and 000/9:00:30 - 000/11:59:3
000	20	48	00	Thruster Activity	Configure for DAP A3 to fire F5L - getting chilly
000	20	52	00	Unclassified/Other	Discussion on Flight Direcctor’s loop aobut the need for TV coverage by cmdr during his exercise and was the crew aware of this?
000	20	59	30	Thruster Activity	Ready to go back to DAP A6
000	21	00	00		Call to crew for deadband change. Crew: “Put that into work.”
000	21	11	00	Unclassified/Other	Curreri and Laurent (MSCI w/Peter) stopped by to ask for add’l deadband plots for the SOPG at 001/04:00. The SOPG will be at 04:00 for 001 and 002. The electronic logbook software looked so good to Curreri that he asked for a copy of it. I let hiim use th
000	21	17	00	Unclassified/Other	Melissa on console
000	21	22	20	Experiment/Facility	CHeX starting FO2.1, on nominal timeline
000	21	26	00	Thruster Activity	Prop. wants to go to DAP A3 to fire F5L before next LOS

000	21	30	00	Attitude/Maneuver	grd asking the crew for deadband change again (A-3), and an antenna re-positioning during this LOS.
000	21	30	00	Thruster Activity	LOS in about 2 _ minutes. Do DAP A3 before LOS
000	21	33	32	MGBX Operations	completed ELF set up, asking for permission to continue with step C
000	21	41	00	Unknown Signal	Mel pursue with the PAC or pse a trace around 39 Hz and 55 and 56 Hz and some higher ones in flight note does PSE know what the 55 / 56 region is ; they are noisy and in the cargo bay??? Call pse / pac about what has strarted about he time they showed
000	21	44	00	Unclassified/Other	Mel suggested a flight note about our home page link for the catalog of interesting events. We have two items on that page now and will be putting interesting items on there during the mission.
000	21	48	00	Unclassified/Other	flt note submmited by someone detailing update to the crew exercise inhibits
000	21	50	00	Attitude/Maneuver	talking about biasing the attitude to fix the cold jets problem. They are also going to look to see why their preflight predicts for the jet temps is so off.
000	21	53	00	Attitude/Maneuver	discussion on POL loop about attitude bias, etc. at 12 hours, we will be running MEPH; perhaps go to the MEPH attitude now; adding a 5 deg pitch to keep the sun out of the bay;
000	22	00	00	Exercise: Unknown	15 min cooling of wci periods met 000/23:50 to 001./02:35; chex thruster test 001/03:00 for 2 hours ; chex ku inhibit test 001/07:30 to 08:00; crew: are these requirements or desirements? Grd: requirements!
000	22	01	00	Attitude/Maneuver	any attitude is ok with chex now; considering going to tail down attitude; pac checking with all science for this; aadsf no problems;
000	22	06	00	Attitude/Maneuver	POL has ok'd the 5 deg pitch chnage and sent on the suggestion about the MEPH attitude
000	22	08	00	Unknown Signal	I asked PSE if they can find out what turned on in the cargo bay at around 000/03:25 that has a vibration about 55 Hz that could be a problem for CHEX.
000	22	16	00		Why wont' the thruster test in the flight plan not work for CHEX now? Question from pol to chex.
000	22	19	45	Flight Note/OMIS	prepared flight note PIMS-005
000	22	30	00	Unknown Signal	Talked with PSE at console about how to read spectrograms and the start of the 55 Hz disturbance at 000/03:25. He will look into records and see if they can determine what turned on at that time.
000	22	33	00	Thruster Activity	F5L getting cold - will bias Orbiter pitch by about 5 deg. Trying to get F5L to fire more often
000	22	36	00	Attitude/Maneuver	grd to crew to reselect the verniers and see if new attitude (must have gone to the 5 deg? Bias) will keep the verniers warm so that the tight deadband is not necessary
000	22	56	00	Unclassified/Other	Melissa off console for a non-mission related meeting
000	23	07	00	Ku/TDRSS/Communication	New Orbiter State Vector sent up. About two minutes to LOS, which will last for about 28 minutes.
000	23	20	00	Unknown Signal	PSE said that chex turned on at 000/03:22 and idge turned on at 000/03:25
000	23	38	00		PSE talking with POL about the 55 Hz unidentified trace.
000	23	39	00	Unknown Signal	POL reconfirms times given by PSE according to his notations about the relay telemetry
000	23	45	00	Unknown Signal	Late in day, 000/11:08 the chex K6 relay was cycled at this time.
000	23	48	00	Exercise: MS-2 (W. Scott)	jsc talking about moving CHEX sensitivity items [thruster firings (001/07) and the Ku sensitivity both to day 4
000	23	51	00	Exercise: Unknown	grd to crew about -above- and that those times are now open for exercise instead of being inhibited
001	00	12	00	Experiment/Facility	submitted flight note PIMS-006 to pass on the EURECA and LAGEOS satellite data plots on beech which Milton produced.
001	00	25	00	Unclassified/Other	it seems that flight notes, etc are not being sent up to PIMS at the TSC
001	00	30	00	Unknown Signal	Talked with mission manager about his need for an assessment of the 56 Hz disturbance relative to the Ku band antenna for example. He has a press briefing at 4:30 pm local time and wants some words in case there are questions.

001	00	35	00		the attitude is the 5 deg bias (rather than the MEPH attitude which had been considered early) THIS IS JUST CONFIRMATION
001	00	42	00	Unclassified/Other	Melissa on console, asked Tim to check the SAMS-2 WWW display there seems to be a problem (they have modified the display)
001	00	54	00		call down about upcoming door opening on the hitchhiker/ gas can in cargo bay - on downlink video - don't see any motion on any of the gas can items though - not sure which of these was supposed to be opening
001	00	56	00	Attitude/Maneuver	maneuver by orbiter ????? or just flood lights on in the cargo bay??? (maybe the latter)
001	00	58	25	Experiment/Facility	notice motion on the right hand hitchhiker just before the LOS period. The lid of the can opened
001	01	12	33	MGBX Operations	ELF has completed their runs (not right now, just some traffic on MSCI discussing the fact that they are done)
001	01	30	00		Mission scientist needs a shift report over due from PIMS/SAMS - Bob F and Gene L are handling it.
001	01	40	00	Unclassified/Other	Truong on console, PIMS POCC received flight note from PIMS/TSC
001	01	53	00	Exercise: Unknown	PAC reported hearing on AG2 that exercise might be starting.
001	02	03	44	Unclassified/Other	PIMS confirm to POL whenever exercises occur
001	02	08	00	Exercise: Unknown	checked 10 Hz TSH, no exercise going on now; PAC said that once WCI is finished in the middeck, someone will exercise.
001	02	11	00	Unclassified/Other	Finkelstein off console
001	02	15	00	MGBX Operations	started about 45 minutes late on PEP (was scheduled to start at 001/00:15)
001	02	17	00	Exercise: CDR (K. Kregel)	EXERCISES going on right now
001	02	30	00	Exercise: CDR (K. Kregel)	exercise by crew on downlink video - asked TSC to record video , crew member paused to talk on radio and then commmenced exercise
001	02	30	00	Unclassified/Other	PIMS/TSC ask for video recorded exercise from K. Kregel
001	02	31	00	Exercise: CDR (K. Kregel)	Kevin was also 'goofing around' when exercising - throwing abook back and forth to someone else, etc - lost video to LOS
001	02	40	00	SAMS/OARE Issues	Talked over time delay of OARE data with Marcus Vlasse / AADSF. He said that they were expecting to receive OARE data with only about 2 hours of delay. Now it looks about like 14 hours delay with the data that is on the WWW.
001	02	41	00	Unclassified/Other	TSC will recorded all the exercisse for us, but we need to let them know.
001	02	42	42	Unclassified/Other	PIMS/POCC ask: how often we received the OARE
001	02	48	42	SAMS/OARE Issues	ALL SAMS unit data lost right now(SAMS 2 Real-time and SAMS 1 real-time and playback), IDGE data was also lost too.
001	02	50	25	Unclassified/Other	PIMS received Chex request for SAMS 2
001	03	00	00	SAMS/OARE Issues	SAMS back again
001	03	00	00	SAMS/OARE Issues	PIMS/POCC ask a one minute plot PSD to support the SOPG for the next 40 minutes the SAMS 120hz
001	03	06	00	SAMS/OARE Issues	Loaded two OARE files
001	03	07	00	Unclassified/Other	JSC ask for manual fuel disposal
001	03	12	00	SAMS/OARE Issues	I earlier mentioned to Tim & Melissa that we have a separate WWW page for the 100 Hz TSH to that it is easier to broadcast over the POCC video system.
001	03	38	00	Orbiter Systems	waste water dump cancelled for tonight; and cancel supply dump; plan for a FES dump tomorrow after deploy if needed; then nozzle dump FD4 evening
001	03	39	00	Water Dumps	cancel water dump for tonight, only 23% in tank, only 10 minutes and will put off couple dump. Also the supply dump tonight will be deleted
001	03	39	00	Water Dumps	cancelled waste water and supply water dumps for tonight. Will be put off for a couple of days

001	03	44	00	SAMS/OARE Issues	AADSF want to verify OARE data dump from 8 to 10 hr
001	03	51	00	Unclassified/Other	Melissa's going to the SOPG.
001	03	55	00	Attitude/Maneuver	CHEX asked PAC if there had been recent attitude changes; PAC replied slight tweek at day 1, hour 2:30
001	04	00	00		SOPG meeting
001	04	00	00	Unclassified/Other	mcpherson on console
001	04	01	20	Unclassified/Other	faX 56 Hz DISTURBANCE TO pims/pocc to support the SOPG going on right now
001	04	03	00	Data Observation	processed 2 PSD for Dick regarding the 56 Hz disturbance. The 56 Hz shows up around 000/03:26. First PSD is listed from 000/03:20-03:25 and the second is from 000/03:26-03:25. The 56 Hz is evident on the second plot and not present on the first.
001	04	13	00	Unclassified/Other	Everything is normal right now. PIS start to process the user request
001	04	31	00	Unclassified/Other	Melissa off console
001	05	00	34	Unclassified/Other	PIMS/POCC back from SOPG and ask for more psd plot to understand the 56 hz. Call IDGE to verify the fans speed and some disturbance may help us understand about the 56 hz.
001	05	05	00	Unknown Signal	Kevin McPherson found that the 56 Hz signal started at 000 / 03:26 plus or minus 30 seconds or so.
001	05	26	00	Unknown Signal	I talked with the MGBX staff and they said that the MGBX was not on at 000 / 03:26 when the 56 Hz signal started.
001	05	30	00	Unclassified/Other	DeLombard off console at the POCC.
001	05	49	00	Experiment/Facility	Hickhiker open/close lactch in progress
001	05	49	00	Experiment/Facility	hitchhiker latch opening/closing in progress
001	05	51	00	Unclassified/Other	IDGE call to ask the 56 hz
001	06	00	00	Experiment/Facility	Chex team send the command holt to the JSC
001	06	04	00	Experiment/Facility	Chex team sent another command to JSC
001	06	06	00	Experiment/Facility	Checkout the hithicker is complete
001	06	14	50	Attitude/Maneuver	ECOM have a problem accumulate water, ask for change attitude to help the water level tonight
001	06	15	30	Unclassified/Other	Columbia change daylight to darkness
001	06	17	10	Orbiter Systems	Mission Scientist call to notify about the level of water and tonight during the crew sleep, but the two kits #1 in the ground and two kit# 2 in the cargo. The sample here in the ground , and will have less experiment running to avoid excess heat. Positiv
001	06	18	00	Attitude/Maneuver	20 degree roll bias needed to improve the production of water. This will be done during crew pre-sleep 1/9:00 - 1/20:00. Point payload bay further away from earth.
001	06	23	46	Experiment/Facility	IDGE conduct the experiment right now and we can see from the video replay.
001	06	32	50	Attitude/Maneuver	they will change the maneuver of 20 degree to save the water for the experience.
001	06	36	00	SPARTAN Operations	Saprtan wiil deploy tomorrow and retrieve on Sunday because of on day delay.
001	06	47	34	Crew Disturbances	space wark will be on schedule on Monday and will be 6 to 7 hours.
001	07	02	15	Ku/TDRSS/Communication	LOS start five minutes frm now
001	07	06	00	Ku/TDRSS/Communication	LOS start
001	07	07	00	SAMS/OARE Issues	Completed problem resolution for SAMS offline processor. Verified proper processing of 10 minute slice of MSFC data reduction SAMS data for both SAMS1 and SAMS2
001	07	10	00	SAMS/OARE Issues	AADSF verify the low magnitude can not pick it up from SAMS
001	07	20	14	Exercise: Unknown	Pcis activation updated to the JSC

001	07	24	56	SPARTAN Operations	spartan will display tomorrow, and crew going to sleep.
001	07	34	50	Unclassified/Other	It is so quiet right now. We still have 14 more days to go
001	07	47	29	Exercise: PS-1 (L. Kadeny)	crew exercise will be in about five minutes
001	07	50	00	Exercise: PS-1 (L. Kadeny)	someone beginning exercise. PS-1
001	07	55	57	SAMS/OARE Issues	OARE data dump to our file and we need to input the mass properties
001	08	02	00	Experiment/Facility	chex sent command to JSC and was received it.
001	08	03	00	SAMS/OARE Issues	exercise did not shown in the display
001	08	05	00	SAMS/OARE Issues	Chex call and ask for 10 second analog for the next ten minutes from sams
001	08	09	00	Exercise: PS-1 (L. Kadeny)	exercise begin from PS-1, but MS-1 and MS-3 did not exercise today
001	08	10	00	Exercise: PS-1 (L. Kadeny)	finally evidence of the exercise
001	08	12	00	Exercise: Unknown	heard commander and ps-1 have exercised. No one else will or did exercise today
001	08	14	00	Exercise: PS-1 (L. Kadeny)	exercise was done now.WE CAN SEE TWO DIFFERENT FREQUENCIES DURING THE EXERCISE PERIOD
001	08	22	00	Exercise: PS-1 (L. Kadeny)	exercise appears complete. Rather short duration. Somewhat erratic
001	08	24	27	Attitude/Maneuver	They continue running the water below the level, and not significant impact with IDGE and Chex. The orbital degree may get worse,
001	08	35	00	Attitude/Maneuver	the maneuver need to change as soon as possible to help us water reduction. Yaw 20, pitch 19, and will be effected in the flight plan at 11:00 met
001	08	38	00	Attitude/Maneuver	MISSION SCIENTIST call and ask all the payloads to monotor the maneuver right now and load the feature correctly
001	08	40	00	Attitude/Maneuver	manuevering to new attitude now. The 20 degree roll bias
001	08	56	00	Exercise: PS-1 (L. Kadeny)	call down that PS-1 exercise concluded at 001/08:28
001	09	22	00	Unclassified/Other	LOS start right now, Truong off console
001	09	27	00	SAMS/OARE Issues	call from SAMS. They are experiencing dropouts on SAMS2 stream. Asked if we were observing the same. Front panel display does show periodic drops, but the are pretty infrequent. SAMS asked that we track this for them.
001	09	30	00	Unclassified/Other	Nissim on consle
001	09	45	00	Unclassified/Other	McPherson out
001	09	55	00	Exercise: Unknown	MSCI called to ask for PCIS analysis for exercise done just recently and for PLT exercise on STS-78. E-mail postscript files to webcon (webcon@mole.msfc.nasa.gov).
001	09	57	05	Experiment/Facility	chex : we’re done and crew can proceed with deact of chex
001	10	36	00	Ku/TDRSS/Communication	MSCI call to all teams-Telemetery Format change (TIFFL) will take place in about 20 min for 15 second ,so we will be lossing real-time data (SAMS/OD)during that time. Also, right after the format change we will be getting OARE data dump.
001	14	39	00	Data Observation	Noticed on SAMS-2 display’s spectrogram that about 10 to 15 minutes ago, the slowly wavering disturbance at around 37 - 38 Hz (seen yesterday closer to 40 Hz) took a slow ramp down to just above 35 Hz or so.
001	14	56	00	Data Observation	Slowly wavering disturbance above 35 Hz or so starting ramping back up a few minutes ago.
001	16	31	00	Thruster Activity	Talk of doing thruster test now (or sooner than planned?).
001	16	44	00	Exercise: Unknown	MSCI requested that we look at some LMS data ask mentioned by CDR. We were unable to determine which LMS exercise was his. See the “PCIS Evaluation” folder in filing cabinet for plots/numbers that MSCI said we should have in our “back pocket”.
001	17	20	00	SPARTAN Operations	SPARTAN activities to start at around 001/22?, deploy to happen at around 002/00 - 002/02?

001	18	12	00	Water Dumps	Two FES dumps coming up at 002/03:30 and 002/08.
001	18	20	00		Hrovat out.
001	18	30	00	Unclassified/Other	Finkelstein on console
001	19	50	00	SAMS/OARE Issues	Completed analysis that CHEX requested to plot SAMS data between 000/11:09:05 to 000/11:09:19. Provided Chex with a PSD plot (only X-axis available) between 000/11:09:00 to 000/11:09:30. Informed CHEX and put plot on WEB
001	20	50	00	Unclassified/Other	Finished with interview.
001	20	50	00	SAMS/OARE Issues	Chex has requested that PIMS plot SAMS data for the same times as above for the 54-58 Hz range.
001	21	08	00	SAMS/OARE Issues	Completed the plot that CHEX requested (0001/20:50:00) and placed the plot on the WEB. Informed CHEX.
001	21	17	00	Attitude/Maneuver	PAC to POL: They did start the maneuver on time. By the timeline it looks like two attitude changes were done recently. At 001 / 20:00, from -ZLV/-XVV to a biased -XLV / -YVV. And then at 001 / 21:15 (or so), to -XLV / +ZVV
001	21	19	40	Orbiter Systems	grd to Kevin: turn FES controller to OFF; Kevin: done
001	21	21	22		CHEX to PIMS: the plot you made for us looks good, but can you make the delta F to be 0.1 Hz; can you average more to reduce the noise; interested in 54 to 58 Hz with resolution of 0.1 Hz;
001	21	28	00	Orbiter Systems	acrtivities to be done at these times: 21:35 21:50 22:10
001	21	32	30	Orbiter Systems	grd to crew: LOS coming; we would like to do the antenna re-positioning during the upcoming ZOE
001	21	33	00	Unclassified/Other	off console to talk with POCC staff about distribution lists, etc.
001	21	33	00	Orbiter Systems	LOS about now. Back up (AOS) at approximately 001/21:44:00. Some door on the Orbiter scheduled to be opened at 001/21:35:00.
001	21	40	00	SAMS/OARE Issues	CHEX wants to improve resolution of 54-58 Hz SAMS data plot. CHEX would like a resolution of 0.01 and would like to average several time slices to improve resolution. Will check to see what can be done.
001	21	50	00	Unclassified/Other	back on console
001	21	50	00	SAMS/OARE Issues	Henry DeGroh of MEPHISTO called Gene to ask for SAMS 1 and OARE data plots. For MET 001/23:15:00 to 002/02:15:00 he wants to see g vs t plots for all three axes for the SAMS 1, 10 Hz head and OARE.
001	21	53	00	Unknown Signal	mel reports that 56 Hz may possibly be seen on USMP-1 also as well as on USMP-3.
001	22	00	00	Experiment/Facility	call from gene L. about request by meph/deGroh about some ‘future’ plots
001	22	02	50	Experiment/Facility	pol to aadsf: are you ready for your activation at 22:30? Response: yes
001	22	04	30	Experiment/Facility	call by me to mephisto/degroh: he wants the low frequency environment during the deployment activities of SPARTAN; He would like a the raw data (I said too much for 2 or 3 hours) - he then said one second averages; I told him I would look at the request a
001	22	17	20	Orbiter Systems	Kevin to grd: you may have just seen an inadvertant indication of flight controller power; (I don’t know what this was but thought I’d put it in here in case it ‘shook’ the Orbiter)
001	22	21	20	Unclassified/Other	Kevin told the ground to watch for something; grd said we’re watching, downlink video showed cargo bay with earth but nothing happened before it cut away
001	23	21	00	Orbiter Systems	RMS power up in work
001	23	25	00	Orbiter Systems	msci annoucnemet about a water dump to be conducted from 003 / 06:30 until 003 / 07:30
001	23	36	00	SPARTAN Operations	preparing for spartan deploy currently
001	23	39	00	Data Observation	noticed on the 100 Hz spectrogram that the 51 Hz trace seemed to be increased at around 001 / 23:10: it was quieter before and then quieted down again later;
001	23	42	40		grd to crew: ready for FCMS

001	23	43	23	SPARTAN Operations	at pre-grapple position; various video views of cargo bay
001	23	44	44		cricuit breaker mark from crew
001	23	44	00	SPARTAN Operations	getting reading to grapple spartan
001	23	45	17	SPARTAN Operations	motion of arm toward grappling
001	23	45	37	SPARTAN Operations	looked like grapple contacted
001	23	45	00	Unclassified/Other	Finkelstein of console. Liberman will log until Truong arrives.
001	23	46	45	SPARTAN Operations	someone to MM: “grapple”;
001	23	47	47	SPARTAN Operations	take video back to IDGE from grapple
001	23	53	00	SPARTAN Operations	per delombard grapple at 1/23:46:46. There was not a definitive call down that I heard. Dick to check with POL
001	23	57	19	Attitude/Maneuver	grd to crew: ok for kicking off the maneuver now to get to the deploy attitude; you can do it when you want; a 15 minute maneuver
002	00	00	00	Attitude/Maneuver	someone on PRIME OPS or FLT DIR loop: “on our way to deploy attitude”
002	00	00	21	Attitude/Maneuver	proceeding to spartan deploy attitude
002	00	07	25	Unclassified/Other	crew: VGS activation is complete
002	00	07	00	Experiment/Facility	VGS activation complete
002	00	08	51	SPARTAN Operations	grd to crew: ok for spartan unberth when in attitude
002	00	08	00	SPARTAN Operations	all related teams polled. Spartan is good for deploy
002	00	11	00	Attitude/Maneuver	the attitude appears to be tail forward, tail downward a bit and cargo bay up.
002	00	14	38	Attitude/Maneuver	arrived at attitude
002	00	14	00	Attitude/Maneuver	just arrived at the deploy attitude
002	00	15	00	Orbiter Systems	switching to TFL 184 now
002	00	19	25	Attitude/Maneuver	some mention of free drift for the unberth
002	00	19	47	SPARTAN Operations	unbertthing of spartan from carrier
002	00	26	00	SPARTAN Operations	spartan starting to be lifted out of the cargo bay. Very cool stuff. Spartan hanging out over the cargo bay now
002	00	28	35	SPARTAN Operations	spartan moved way out of cargo bay
002	00	34	40	Attitude/Maneuver	attitude is an inertial attitude for deployment; not pointing at the sun, but not moving relative to the sun
002	00	37	06	Orbiter Systems	they are going to use Ku antenna for radar; not sure when though;
002	00	45	00	SPARTAN Operations	grd to crew: hold this position for 5 min then can go to the deploy position; zoe coming up
002	00	53	30	SPARTAN Operations	going to be polling the mission room for ok to deploy
002	00	54	00	SPARTAN Operations	maneuvering to release position
002	00	57	00	SPARTAN Operations	someone on loop: “we are at release” (position I think)
002	00	57	00	SPARTAN Operations	at release position
002	00	58	10	SPARTAN Operations	mission polling flight to go for spartan release
002	00	58	37	SPARTAN Operations	grd to crew: go for spartan release on-time (according to flight plan release is 01:18)
002	00	59	00	SPARTAN Operations	someone on loop:according to flight plan release is 002 / 01:18
002	00	59	00	Flight Note/OMIS	submitted shift report for 1/12:00 - 2/00:00
002	01	00	00		end of logbook file - new one started
002	01	14	00	Attitude/Maneuver	comment on loop: go for free drift on time

002	01	17	25	Attitude/Maneuver	free drift for release
002	01	18	43	SPARTAN Operations	spartan release
002	01	18	00	SPARTAN Operations	“clean release”; end-effector nominal
002	01	21	40	SPARTAN Operations	crew: we do not see spartan do a ‘piroette’ so we will re-grapple
002	01	24	41	SPARTAN Operations	contact by arm to spartan but tipped it and spun it; waiting to re-grapple;
002	01	26	00	SPARTAN Operations	spartan deploy completed and now trying for re-capture. A planned activity. In trying for re-capture, it appears the RMS bumped the spartan, causing a tip off rate on the spartan. It is slowly spinning. Orbiter currently trying to match the spin rate
002	01	30	00	Unclassified/Other	Truong on console
002	01	32	00	Attitude/Maneuver	looks like the orbiter is maneuvering around the spinning SPARTAN satellite to re-grapple it;
002	01	33	00	Attitude/Maneuver	to spartan mission manager: orbit is matching rates to re-grapple
002	01	43	00	SPARTAN Operations	no major problem with a re-deploy except wait for a window; (except for being able to grapple it first!)
002	01	43	00	Thruster Activity	a lot of thruster activity, “stick control” to keep the orbiter spinning with spartan. Result is a lot off scale SAMS data for the last half hour on the real time system
002	01	46	00	SAMS/OARE Issues	brief interrupt in OD data. Call msfc data, said rug was okay, but shortly after the call the data was being received properly again
002	01	48	35	Attitude/Maneuver	on loops: the orbiter has gone free in all three axes to match rates with spartan; nothing we can do to help, he’s got the best seat in the house; the rate is outside anything they’ve trained to; nothing that spartan can do to stabilize the satellite;
002	01	49	00	SPARTAN Operations	-.75 yaw rate, .5 pitch rate currently being experienced by the orbiter to try to align with the grapple fixture. The rate of rotation of spartan is apparently higher than any of the training they have experienced
002	01	51	31	SPARTAN Operations	on loops: looking at data, there was an open command to end effector one second after capture; she may have done this to get a hold better (my words from what was said)
002	01	52	00	Unclassified/Other	PIMS/TSC call PIMS/POCC for the IDEG requested
002	01	56	00	SPARTAN Operations	They tried to another attemp to grap the Spartan. They can catching with the unsual attitude and wrape it up for the day
002	01	58	00	SPARTAN Operations	sounds like they may have to give up on re-capturing spartan. Flight engineers and FIDO not happy with the attitude the orbiter is in right now. Seems that a lot of fuel has been consumed trying to chase the spartan around
002	02	00	00	Orbiter Systems	grd to crew to do the intial radar acquisition as part of the rendevous procedure
002	02	00	00	SAMS/OARE Issues	OD rates data is pretty erratic as a result of all the maneuvering that is occuring
002	02	05	00	Unclassified/Other	The attitude right now may be able to do some exercise before their change the attitude
002	02	10	00	SPARTAN Operations	5% margin to attemp another before separated or get it back,
002	02	12	00	SAMS/OARE Issues	submitted PIMS request #12 on behalf of the mission scientist. Asked for g vs t plots of SAMS 1 and SAMS 2 data during the recent SPARTAN activity. Wants the data in time for the SOPG
002	02	23	00	Unclassified/Other	back to console after talking with chex about 56 hz signal plots; also talked with IDGE about when idge was turned off on usmp-3 to correlate with the data plots which we prepared looking for the 56 hz signal on that mission
002	02	24	00	Attitude/Maneuver	grd telling crew to maneuver away from spartan ???? maneuver to nose down with +Z into VV
002	02	24	00	SPARTAN Operations	giving up on retrieving spartan now. Considering EVA retrieval. Have consumed a lot of fuel in this chase
002	02	27	00	Attitude/Maneuver	grd to crew: do the SEP 1 maneuver when in attitude
002	02	33	45	Attitude/Maneuver	crew: SEP 1 burn at this time;
002	02	35	05	Attitude/Maneuver	grd to crew: we like inertial (in response to Kevin asking if he should put DAP in auto);

002	02	36	15	Attitude/Maneuver	go to ALT DAP
002	02	47	00	Attitude/Maneuver	maneuvering to recover from spartan ops continues. Alt dap, much activity/discussion on how best to proceed
002	02	55	50	Experiment/Facility	chex said that the power off cycling on day 000 started at 000 / 11:09 and lasted for ten minutes;
002	02	58	00	Experiment/Facility	call from Dick. CHeX power of cycle was started at 0/11:09 and lasted for approximately 10 minutes
002	03	01	00	Attitude/Maneuver	grd to crew: do a pitch maneuver to line up on spartan and switch Ku to high power and get a radar lock on spartan
002	03	02	00	Orbiter Systems	supply water dump to happen as scheduled in Kevin's column at 3:30; the FES will not be done; {I"m not sure of the details of this note - fast talking]
002	03	10	00	Unclassified/Other	PIMS/TSC closed out the requested from Dsquare(DD)
002	03	22	00	Thruster Activity	RCS will burn in the next three minutes, and thier confi, had a good burn.
002	03	23	00	Orbiter Systems	grd to crew: b urn within 3 minutes or don't burn; crew said that they were prepared to burn; this should be the Multi-axis RCS burns in the timeline;
002	03	24	20	Attitude/Maneuver	"he's burning" on loop to FAO
002	03	24	00	Attitude/Maneuver	RCS burn in progress to further separation from spartan
002	03	25	07	Attitude/Maneuver	looks like burn is complete
002	03	25	58	Attitude/Maneuver	on loops: next we go to the phasing burn; we'll go to that when we know where we are;
002	03	31	00	Water Dumps	FES dump starting per the time line
002	03	42	00	SPARTAN Operations	lots of talk on flight loops about the crew and Ku trying to find the spartan satellite
002	03	43	00	Orbiter Systems	grd to crew: try another auto search after re-zeroing the Ku antenna
002	03	46	24	Orbiter Systems	crew: we are tracking the spartan satellite;
002	03	48	00	Unclassified/Other	sent request to DD at PIMS/POCC for SOPG meeting
002	03	49	48	Attitude/Maneuver	from the pictorial attitude picture, it looks like the attitude is nose high, pitched forward a bit, cargo bay into the wind,
002	04	02	00	Unclassified/Other	AADSF ask MSCI about the attitude change of the orbiter had cause problem to their experiment
002	04	10	00	Experiment/Facility	Chex had a very bad data right now due to the attitude change early.
002	04	16	00	SAMS/OARE Issues	completed data request for mission scientist regarding thruster activity for SPARTAN retrieval attempt
002	04	18	00	Ku/TDRSS/Communication	we had a KU band data back now and the exercise will be perfom two hours from now.
002	04	23	00	SPARTAN Operations	discussion about eva and spartan retrieval possibly tomorrow, but the talk seems to indicate that that scenario is somewhat unlikely
002	04	41	00	SPARTAN Operations	discussions on going regarding whether EVA or RMS retrieval are the best options. Looking into end-effector checkout. Not sure the RMS end-effector worked properly during the retrieval attempt. Discussing what day is the best day for performing the EVA
002	04	42	00	Unclassified/Other	AADSF requeted data and PIS?PIMS take care it, and sent the plot to PIMS?POCC to support the SPOG meeting
002	04	44	00	SPARTAN Operations	trying to minimize the impact on the USMP activities but retrieval of the spartan is a priority also
002	05	26	00	Unclassified/Other	PIS has been work on PI request from AADSF. The SOPG over and Dick back to console
002	05	26	00	SAMS/OARE Issues	completed PIMS request #7 for hitchhiker can opening spectrograms. Called dick delombard and told him his request was ready
002	05	28	00		back on console after SOPG and discussions with Fripp
002	06	12	00	Thruster Activity	going to return to vernier control soon. Leaving alt dap control
002	06	19	00	SAMS/OARE Issues	3 OARE data files received from MSFC. A lot of disturbances due to the attitude change early
002	06	54	00	SPARTAN Operations	rendezvous with spartan looks like its headed for flight day 6, but still in negotiations

002	07	19	00	Thruster Activity	discussion of return to vernier control at 2/11:00 - 3/01:00, but return to alt dap (alternate digital autopilot). This impacts usmp teams greatly. Investigation on-going for magnitude of the impacts. IDGE stated it should not be a problem for them to o
002	07	20	00	Thruster Activity	MSCI said orbit will be vernier day 2 :11 until day 3 :01
002	07	26	00		back from talking with MSCI about exercise and SPARTAN rcs firing. MSCI will include SAMS plot with science summary which is sent to crew.
002	07	27	00	Thruster Activity	RETURN ALT DAPT again instead of vernier to save fuel has been discuss with the science team, Chex could easy lost eight hour to recovery for the laminar point burn.
002	07	34	00	SPARTAN Operations	Spartan customer concerned about this attitude may to cold for their experiment and request for the heat turn it on.
002	07	36	00	Experiment/Facility	IDGE said they can work around it, glovebox (3) might be able get by except chex will be disaster for chex if we on alt dapt..
002	07	42	00	Exercise: MS-3 (T. Doi)	Exercise is going on right now and look quiet than we expected in the display. We called mSCI and PAP to confirm the exercise going on.
002	07	59	00	Exercise: Unknown	exercise has stopped for the moment. See screen dump 002_07_58_02 and 002_08_02_47
002	08	07	00	Exercise: PLT (S. Lindsey)	more exercise in work, but still no call down as to who has exercised. The trace appears “more faint”. Is the isolation system that good??
002	08	14	00	Exercise: MS-3 (T. Doi)	They set up the manual mode for exercise and start about 5 to 10 minutes ago.
002	08	14	00	Unclassified/Other	Hrovat now logging.
002	08	15	00	Exercise: PLT (S. Lindsey)	call down that pilot started exercising again about 5-10 minutes ago. Also from the commander, the ergometer is being used in manual mode. In electronic mode appears to be “stuck” at one setting.
002	08	29	00	Exercise: CDR (K. Kregel)	pilot complete with exercise. CDR starting exercise now
002	08	36	25	Exercise: Unknown	The exercise start at 2:7:45 to 2:7:59 and 2:8:14 to 2:8:29
002	08	42	00	Thruster Activity	talk of opening deadband to reduce thruster firings
002	09	07	00	SPARTAN Operations	MSCI looking for the input for the Rendezvous with spartan in day five or six
002	09	08	00	Exercise: Unknown	Exercise finished.
002	09	08	30	Exercise: CDR (K. Kregel)	CDR called down that he just finished exercising.
002	09	14	40	Thruster Activity	Multi-axis RCS burn scheduled coming up has been deleted.
002	09	18	00	Thruster Activity	Do upcoming maneuver on ALT DAP [0.1 degrees per second?] (maneuver takes 30 minutes). Go back to VRCS attitude control at about [2/11:30?]
002	10	00	00	Unclassified/Other	TRUONG OFF CONSOLE
002	10	33	00	Thruster Activity	Do maneuver in A AUTO ALT, kickoff at 002/11; sometime after that go back to vern’s [VRCS?]
002	10	50	00	SAMS/OARE Issues	Problems accessing SAMS-1 data for PCIS analysis. Called Kevin, he is working problem with Nissim. I will call MSFC Data Reduction (x2957) to request Payload Recorder Dump Files for SAMS-1 files ASAP for GMT 326/03 through 326/05 to span CDR and PLT exe
002	11	00	30	Attitude/Maneuver	Maneuvering to attitude (bias -XLV/+ZVV).
002	11	20	00	SAMS/OARE Issues	Talked to MSCI regarding the fact that we will miss the 002/11:30 deadline for PCIS analysis. I told him that we will get MSFC DR data and process that as soon as possible. He said that tomorrow we will be working with a “real short fuse” deadline-wise.
002	11	29	30	Attitude/Maneuver	Call to FLT DIR, “we are in attitude”.

002	11	33	00	SAMS/OARE Issues	Called MSFC DR to request SAMS GMT 326/03 - 05 as soon as possible.
002	11	51	50	Thruster Activity	Reselect F5R and then VRCS for attitude control.
002	12	38	00	Attitude/Maneuver	Trim burn to happen at 003/10.
002	14	40	00	Data Observation	About 20 minutes ago, the sub 2 Hz [structural mode?] disturbance was on starting at ? till present.
002	16	00	00	Unclassified/Other	no activities to report
002	16	20	00	Unclassified/Other	Faxed PCIS Config. #2 plots to MSCI (finally got MSFC DR data).
002	16	33	00	Unclassified/Other	Gave webcon filenames for today's PCIS analysis.
002	16	53	00	Attitude/Maneuver	Maneuver for water dump in about 6 hours so we don't get SPARTAN wet.
002	17	07	00	Unclassified/Other	Moskowitz Started new logbook.
002	17	11	00	Unclassified/Other	Hrovat out
002	17	11	16	Water Dumps	Dump is supposed to be at 003/06:30. Maneuver before dump would be around 003/06:00.
002	17	12	30	Attitude/Maneuver	Sounds like they're planning to use the Primaries to do the attitude maneuver at 003/06:00. The MSCI (?) is now checking with AADSF to be sure that PRCS activity won't cause problems with their processing.
002	17	13	00	Unclassified/Other	Gene Liberman in
002	17	30	00	Unclassified/Other	Nissim off console
002	17	37	00	Attitude/Maneuver	Talk on the loop: to conserve propellant, they're going to make these water-dump related maneuvers take 30 minutes. There's also concern that there's a PAO event after the maneuver/dump/maneuver, so they have to be back in attitude for the PAO event.
002	17	40	00	Attitude/Maneuver	They're now discussing starting the maneuver at 003/05:45, and asking AA if they can delay their translation until AFTER the whole maneuver series.
002	18	11	00	Flight Note/OMIS	Submitted Flight Note PIMS-008, detailing VRCS and PRCS firings (copies from Microgravity Handbook)
002	18	39	25	Unclassified/Other	Finished the CHeX request which was handed-off by Ken (for better PSD resolution for the period 000/11:07-11:12). Placed the plot on the web, and called the CHeX representative (I didn't get his name), but who's the Roger Williamson for the morning shift
002	18	49	00	Attitude/Maneuver	The PAC is now asking AADSF if they'd be okay with the maneuvers if they were in VRCS mode. (They're thinking about asking JSC if they can delay the ALT-DAP start). AA said they didn't have a problem with VRCS use for the maneuver, but they're still try
002	19	01	00	Data Observation	On the SAMS-2 Display, Gene just pointed-out to me that there was a disturbance that was constant around 37 Hz, that has now drifted-down to a bit under 35 Hz. The time where the drift started was someplace around 002/18:50 or so.
002	19	06	33	Experiment/Facility	Gene just asked the IDGE team about that 55-56 Hz disturbance, and they said they thought it was them causing this.
002	19	24	06	Unclassified/Other	MEPHISTO was just asking PAC about the effects of ALT-DAP on g-jitter. PAC referred them over to us, and I suggested to Henry that the PIMS-008 flight note (which I submitted specifically so that people could evaluate ALT-DAP) had the g-levels of VRCS an
002	20	07	31	Thruster Activity	They're going to ALT-DAP at 003/05:00 (traffic from PAC to MSCI)
002	20	30	00		DeLombard on console
002	20	30	00	Orbiter Systems	discussions on the loops PAC, MAWS, PIMS about the number of thruster firings for the ALTDAP configuration.
002	20	50	00	SAMS/OARE Issues	talked with Jeff Clancy and he said that the SAMS unit now has fans in the data storgage unit; I confimred this with Jenn on the SAMS loop;
002	20	50	00	Unclassified/Other	Sent a FAX to MEPHISTO in response to their request (given to me over the loops, and entered into the data request form

					by Gene). The plot was a 1-second interval RMS of the period 002/03 - 002/04. Per MEPHISTO's request, this was an ALT-DAP period, and
002	20	56	55	Orbiter Systems	deselecting certain thrusters to get others to fire to warm them up;
002	20	56	52	Thruster Activity	A/G Call-up: F5L is getting cold. Deselect L5L and R5R.
002	20	59	15	Unclassified/Other	Word from MAWS. For an ALT-DAP time he was working on, they were averaging about 20 firings per hour.
002	21	33	00		JSC: do a Ku band cable reposition during the upcoming ZOE period
002	21	33	48	Exercise: CDR (K. Kregel)	A/G: Call – CDR is about to start exercise early, to "get ahead of the game".
002	21	34	00	Experiment/Facility	crew: exercise will be done to get ahead - aware of the exercise inhibit; tell us when to stop exercise and we will
002	21	35	00	Exercise: Unknown	JSC reminded the crew to do the PCIS reconfiguration; cre repllied that the configuration YESTERDAY was this: yellow on front, red on aft; they will reverse that for today to have red on front and yellow on aft for TODAY;
002	21	38	00	Exercise: Unknown	Today's exercise: yellow in the aft, red in the front. Yesterday's was the reverse. It sounds like they may have goofed on the configuration yesterday.
002	21	46	00	Exercise: CDR (K. Kregel)	CDR is setting up the exercise
002	22	05	00	Exercise: CDR (K. Kregel)	The SAMS TSH 1 plot is showing that the CDR (probably) is exercising. He started durin the ZOE.
002	22	14	00	Exercise: CDR (K. Kregel)	Jeff Clancy said that he heard (& I didn't) that the crew called down to say that the CDR (probably) finished exercise. The exact time is not known.
002	22	17	00	Exercise: CDR (K. Kregel)	CDR exercise ended a few minutes ago. Andy's system correctly showed the end of the period.
002	22	22	22	Data Observation	I noticed on the exercise that was just completed, the 10 Hz spectcrogram shows a good trace of the 3rd harmonic of the 1.3 (?) Hz signal. I don't recall seeing it that prominent before.
002	22	25	00	Orbiter Systems	Earlier, I checked with PAC about the water dump scheduled for MET 003 / 06:30. She said that it is now scheduled for 003 / 06:15 until 07:15.
002	22	28	00	Orbiter Systems	MSCI asking for input now for the justification for not going to the ALTDAP mode.
002	22	28	00	Unclassified/Other	PIMS/POCC fax the shift report and give the information to IDEG for their requested.
002	22	28	30	Unclassified/Other	MSCI loop talk: The mission manager is stepping-up the pace for the justification for not doing ALT-DAP. He said that if there's more input, now's the time to get it in.
002	22	30	00	Unknown Signal	conversation with Diane Malarik / IDGE about when IDGE turned off on USMP-3. She recalls that it was late at night about 9:30 or 10:00 pm Central time. She also said that Dick Abramcyzk had not passed on that I had requested this time and that someone sho
002	22	36	00	Orbiter Systems	I asked PAC if the CHEX VRCS test was still on - she said that it has been cancelled and the new EXECUTE package is on its way.
002	22	50	00	Unclassified/Other	Processed another request from Henry deGroh (MEPHISTO) for a 2-hour period from the ALT-DAP attitude, for which they had their experiment running. FAXed it to him.
002	22	55	00	Unclassified/Other	Entered Mass Properties into OARE system
002	23	02	00	SPARTAN Operations	grd to crew: plans for EVAs; similar to as-published nonRMS grab of satellite; two person grab is OPTION 1;;; eva optinon 2 is one person grab spartan with grapple fixture;
002	23	52	00	Unclassified/Other	MSCI calling for an emergency SOPG for the new plan for the mission.
002	23	52	36	Unclassified/Other	There's going to be an emergency SOPG within the next 20 minutes or so. This is to finalize the plan they're going to send to the mission manager.
002	23	56	00	Unclassified/Other	Emergency SOPG at 003 / 00:00

002	23	56	12	Unclassified/Other	There's going to be an SOPG at 003/00:00 (about 4 minutes)
002	23	58	00	Exercise: Unknown	grd to crew about ergometer trouble shooting; cdr reported wproblem with ergometer in powered mode yeseterday; a new procedure for trouble shooting will be sent up when someone is ready to exercise;
002	23	59	01	Exercise: Unknown	Something about ergometer troubleshooting. Apparently Kevin reported a problem in 'powered mode' yesterday. The ground has a procedure to walk-through with the crew when they're ready to use the ergometer. The crew just asked for it to be sent in a m
002	31	38	00	SPARTAN Operations	MSCI call asked for spartan retrieve analysis
002	52	40	00	Attitude/Maneuver	JSC still try to maneuver the orbital to improve the chance attemp the spartan
003	00	00	00		emergency SOPG
003	01	58	45	Unclassified/Other	And here's Kevin! Moskowitz signing-off of the logbook to print.
003	02	00	00	Unclassified/Other	McPherson on console
003	02	03	00	SAMS/OARE Issues	SAMS is going to do some gain commanding. They're planning to set a gain of 10, and then in one minute, unlocking the gain again.
003	02	05	00	SAMS/OARE Issues	approx time that SAMS switched gains to check to see if the SAMS 1 head was in a MSL-1 error mode. The data appears to have reset back to it regular value. Milton coordinated this with SAMS.
003	02	06	05	SAMS/OARE Issues	SAMS has sent the original command already.
003	02	06	53	SAMS/OARE Issues	And SAMS is done commanding – per SAMS the command sequence was a gain of 1000, then 10, then auto.
003	02	13	00	Attitude/Maneuver	on loops: may have to bias the attitude to keep a jet from being too cold; other: can we do a slow maneuver to get to the biased attitude rather than a 'fast' maneuver?
003	02	37	00	Exercise: CDR (K. Kregel)	I wrote up flight note PIMS-009 to document to the MSCI the configuration of the PCIS that the CDR had called down earlier in my shift.
003	02	38	00	Unclassified/Other	received email from dick stating he has sent flight note #9 to the mission scientist
003	02	50	00	Data Observation	I noticed that the PIMS WWW display of the three frequency bands for CHEX has some periodic elements in it with periods of about 2 minutes in the 74 Hz region, 1 minute in the 54 and 117 Hz regions.
003	02	57	00	Unclassified/Other	call from mickie nagy. Have not received a data dump since 02/12:00 which is approximately the last time we had any OARE data sent to us from MSFC data reduction
003	03	16	00	Unclassified/Other	call from ranga narayanan about the upcoming/current AADSF activity. He will need plots from day 3 hour 4-6 plus his request period filed pre-mission
003	03	18	50	Attitude/Maneuver	PAC: water dump will be needed at 004 / 06:50 with an attitude change and ALT DAP
003	03	25	00	Unclassified/Other	mickie talked to JSC about trying to improve the payload recorder dump turnarounds for our OARE and SAMS data
003	03	35	00	Unclassified/Other	talked to wayne at the MAWS console to discuss the time periods for AADSF request. Informed him the time periods of interest
003	03	39	00	Unclassified/Other	Rogers on console
003	03	39	38	Free Drift	may have just gone free drift and out, or they were talking about an earlier time on the loops
003	03	51	00	Orbiter Systems	grd to crew: going to DAP 12 with a modified rotation rate
003	03	51	50	Thruster Activity	in good shape to return to DAP A12, with modified rotation rate of 0.016
003	03	52	00	Attitude/Maneuver	PAC: burn will not be at 004/10:00 but a phasing burn will now be at 004/13:00
003	04	00	00	Water Dumps	water dump scheduled for day 3 hour 6:30. Alt dap scheduled for 3/5:00 and 3/12:00, ie off verniers at that time
003	04	25	00	Experiment/Facility	done with WCI

003	04	27	00	Attitude/Maneuver	MSCI is asking if going to ALTDAP right now instead of 003 / 05:00
003	04	30	00	Unclassified/Other	DeLombard closing up the POCC for today.
003	05	00	00	Thruster Activity	go to A auto alt dap, AADSF done
003	05	01	52	Thruster Activity	just went alt dap, first firing at about 05:02
003	05	01	00	Experiment/Facility	finished with AADSF work, first re-freeze
003	05	05	00	Water Dumps	plan for phasing burn and supply dump on flight day 5: 1 hour supply dump between 004/06 and 004/08 and maneuver to burn attitude, do 5 second PRCS phasing burn, and maneuver back to attitude during 004/12:30 and 004/13:30
003	05	20	00	Thruster Activity	F5L is giving an indication that it may be leaking (the crew collapsed the deadband, which is the appropriate course of action, but not really for alt dap, so they are now (003/05:30:36) telling the crew to go back to A Auto Alt); they will let it fail of
003	05	30	00	Thruster Activity	f5l fail leak. Back to a auto alt. Some type of trouble with the F5L jet
003	05	59	00	Water Dumps	supply water dump schedule for 1 hour. Believe waste water dump will be a 20 minute dump
003	06	00	48	Attitude/Maneuver	maneuvering to dump attitude; estimate 16 minutes to get there
003	06	01	00	Water Dumps	the dump will be 1 hour supply and 20 minute waste
003	06	11	00	SAMS/OARE Issues	close request #20 for IDGE. Plots available on beech and hand carried a copy of the plot to IDGE team at TSC
003	06	20	00	Attitude/Maneuver	ground thinks that the crew went to the wrong attitude (omicron is wrong); asking crew to check and correct, if needed
003	06	21	55	Attitude/Maneuver	maneuvering to correct attitude now
003	06	35	32	Attitude/Maneuver	in dump attitude
003	06	38	44	Water Dumps	begin supply dump
003	06	39	00	Unclassified/Other	pre-RIP sopg will be on sci-conf loop at 003/07
003	06	49	00	Water Dumps	supply water dump in progress. Waiting for waste water equipment to warm up before starting
003	06	54	00	Water Dumps	dumping waste now also
003	07	20	00	Unclassified/Other	finished giving input to Peter Colburn (?) for the next PAO report
003	07	28	00	Water Dumps	terminate the supply water dump at 07:30 due to a PAO event, trying to avoid any alarms during PAO event. Will remove the rest of the water with a FES. CDR was in process of terminating the waste water dump anyway, will terminate both dumps now
003	07	30	00	Water Dumps	terminate both supply and water dumps (this is being done a little early to avoid alarms during the upcoming PAO event; so a FES dump will be required later tonight)
003	07	42	00	PAO	getting ready for a PAO event in about 3 minutes
003	07	44	40	PAO	they are all “sitting” quietly in the crew compartment (not sure if it is middeck or flight deck)
003	08	04	53	PAO	PAO event over
003	08	22	00	Water Dumps	want to start FES dump (of 2 hour duration) before 003/09
003	08	45	00	Exercise: MS-1 (K. Chawl)	exercise starting for KC
003	08	45	00	Unclassified/Other	Start working on PCIS Config. #3 CDR exercise analysis.
003	08	48	00		Rogers off console
003	08	50	00	SAMS/OARE Issues	called data reduction about lack of new OARE data. Need this data to satisfy the OARE data request that starts in the next 6 hours or so. DR said they were having trouble ftp’ing the data to us
003	08	55	00	Thruster Activity	vrcs 3/12:00 - 4/6:00, off vrcs 4/6:00-4/8:00 for a water dump, then back to vrcs control. Phasing burn between 4/12:30 and 4/13:30. Back to vrcs through 5/00:00

003	09	14	00	Unclassified/Other	mcpherson off console
003	09	30	00	Thruster Activity	Talk of phasing burn (1 to 2 seconds) at 004/01:20 (short burn) for Spartan rendezvous; CHeX is concerned.
003	09	34	00	Unclassified/Other	Kevin processing OARE data 02150003.oare, 02180003.oare, and 02210003.oare.
003	09	38	00	Orbiter Systems	Starboard radiator deploy now instead of around time of burn at 004/01:20?
003	09	40	00	Exercise: MS-1 (K. Chawl)	KC [MS-1?] finished exercise.
003	09	41	30	Orbiter Systems	Starboard radiator deploy starting in the works.
003	09	54	00	Orbiter Systems	Starboard radiator has been deployed.
003	10	10	00	Exercise: MS-3 (T. Doi)	MS-3 started exercise about 10 minutes ago.
003	10	36	00	Exercise: MS-3 (T. Doi)	MS-3 finished exercise (PCIS config. #3).
003	10	37	00	Exercise: PS-1 (L. Kadeny)	PS-1 called down exercise start, but don't see it yet on SAMS displays.
003	11	00	00	Orbiter Systems	Opened door. Call up/down for crew to leave [PGC?] door open all night to inhibit humidity build-up.
003	11	05	00	Exercise: PS-1 (L. Kadeny)	PS-1 called down that he finished exercising.
003	11	23	00	Exercise: PLT (S. Lindsey)	PLT called down that he is starting exercise.
003	12	10	00	Flight Note/OMIS	Submitted PIMS-010 flight note regarding PCIS Config. #3 and overall analysis.
003	13	04	00	Water Dumps	Talk of water dump – happening now?
003	15	22	00	SAMS/OARE Issues	Processed OARE data ore00309.00
003	17	15	00	Unclassified/Other	Hrovat off console.
003	17	17	00	Unclassified/Other	Logbook file opened by Moskowitz.
003	17	32	50	Data Observation	Diane from IDGE was just in to ask about what we're seeing on our Unit 1 display... Sometime centered around 003/17:22 or so. MEPHISTO called PAC (they were looking at our display), and PAC didn't know what it was, but he was going to try to talk to som
003	19	05	40	Unknown Signal	The SAMS-F display is showing a VERY pronounced 8.5 Hz (or so) peak in the spectrogram... The Yo-Axis g versus t shows the envelope has opened-up considerably.
003	19	07	34	Unknown Signal	And the signal has stopped, while I was in the middle of talking to MSCI about it. Per MSCI: the timeline showed MEPHISTO just did "9H", and I'll give MEPHISTO a call about it, but I'd like to get more accurate times, using the offline system.
003	19	30	45	Unknown Signal	Working on the period from MET 003/19:00 - 003/19:10, to try to exactly determine the 8.5 Hz frequency, and start and stop times explicitly, so I can talk to MEPHISTO and MSCI about the specifics of it.
003	19	50	00	Unknown Signal	Talked to MEPHISTO about this disturbance. They said that if we didn't see it all the time, then it wasn't from them, because their experiment runs with the same stuff each time.
003	19	59	00	Flight Note/OMIS	Submitting flight note PIMS-013 to document this 8.5 Hz disturbance.
003	20	15	00	Unclassified/Other	DeLombard on console.
003	20	40	00	Unknown Signal	approx time - Milton mentioned that the 8.5 Hz signal appeared again
003	20	41	10	Unknown Signal	And there's another 8.5 Hz disturbance! This one looks more Z-axis than Y-axis, but there's definate Y and Z components in the g versus t. The X-axis looks fairly benign, though.
003	20	43	30	Unknown Signal	And the signal has ended (or roughly around here). MSCI was alerted, and he's going to get with the PAC to try to figure it out. Dick asked about 8.5 Hz disturbances on a past mission (IML-2), and suggested that we not discount this as being an orbiter
003	20	59	00	Unknown Signal	The MSCI asked for exact start and stop times for the signal. When the system has cleared-through the file (20 minutes), I'll

					run the analysis from MET 003/20:35 - 003/20:45.
003	21	00	00	Data Observation	Data observation from the SAMS-2 display – during a data dropout period, the 34 and 51 Hz Ku-harmonics seemed to turn-off. I submitted a data request to ourselves to look at a spectrogram for when the period is completely in as the MSFC data.
003	21	08	00	Attitude/Maneuver	USMP-4 does not have attitude requirements between 003 / 22 and 004 / 14. But we do have a requirement to be on VRCS control.
003	21	17	00	Unclassified/Other	Processing the 8.5 Hz period to find start and stop times, and to send a flight note out with this period.
003	21	36	00	Data Observation	Notice a frequency drop on SAMS 2 from ~37Hz to ~35Hz
003	21	45	00	Flight Note/OMIS	Submitting PIMS-014, discussing the 8.5 Hz disturbance.
003	22	00	00	Unclassified/Other	Crew wakeup song.
003	22	00	00	Crew Disturbances	And the wake-up song: Wild Blue Yonder. This note is dedicated to Kevin's wake-up song fund.
003	22	11	00	Orbiter Systems	POL giving AADSF options about cold jets; maneuver to an attitude, fire a jet; then go to the AADSF atitude which is cold for the jet; JSC feels that the jet will get very cold and then a hot fire of that primary jet will need to be done;
003	22	13	00	Experiment/Facility	Fripp replied that they are more interested in the direction of the accel to the sample as opposed to the exact attitude. There may be a backup attitude which gives the required accel but yet may allow the jet to warm up.
003	22	18	00	SAMS/OARE Issues	submitted request to re-plot OARE data for time MET 003 / 04:07 for 1.9 hours. For Ranga's concern mentioned above.
003	22	20	45	Orbiter Systems	grd to crew: fuel cell purge complete
003	22	45	00	Exercise: Unknown	crew to grd: any restrictions on exercise for the next hour?
003	22	46	00	Exercise: Unknown	The crew is asking if there are exercise restrictions within the next hour or so. The answer: MEPHISTO requested no exercise be performed for the next hour.
003	22	49	00	Exercise: Unknown	MEPHISTO replied to say NO exercise in the next hour,
003	22	53	00	Ku/TDRSS/Communication	grd to crew: ZOE coming up; can do a Ku band antenna cable re-positioning anytime from now through the end of the ZOE.
003	22	53	00	Exercise: Unknown	MEPHISTO: Crew exercise after 003/23 won't be a problem for them. The PAC said that since they voiced-up 1 hour, they won't bother telling them otherwise.
003	22	53	00	Ku/TDRSS/Communication	Just voiced-up that they can Ku-cable reposition anytime between now and end of the ZOE
003	23	22	00	Attitude/Maneuver	AADSF is exploring other alternate attitudes
003	23	30	00	Unclassified/Other	Joel Kearns stopped by on his tour of the POCC/SOA. I talked with him until about 004 / 00:15. I showed him our WWW displays, the OARE data I had plotted out, our reference documents, etc. He seemed happy with what we were doing. He also said that he pl
003	23	46	41	Thruster Activity	The PRCS burn at 004/01:35 is deleted.
004	00	30	00	Unknown Signal	Talked with MSCI and POL and PSE about the 8.5 Hz disturbances. PSE will talk with the JSC back room folks. The MSCI also menionted to me that at 003 / 17:22 there was a disturbance which seriously bothered IDGE, and also affected MEPHISTO and CHeX. The
004	00	58	40	Unclassified/Other	Moskowitz logging-out
004	01	00	00	Exercise: CDR (K. Kregel)	McPherson's logbook. commander is still exercising
004	01	23	00	Exercise: CDR (K. Kregel)	cdr exercise for the last 30 min or so
004	01	30	00	Exercise: CDR (K. Kregel)	CDR called down to say that his exercise was complete.
004	01	30	00	Unknown Signal	talk with CHeX and IDGE about the effect on them at 003 / 17:22 ; no real concrete info as to the effect; the dendrite apparently slid off the stinger at around that time when the IDGE chamber was being re-melted - this sliding off has not been the usua

004	01	30	00	Exercise: CDR (K. Kregel)	CDR exercise complete now
004	01	45	00	Experiment/Facility	SOLSE power on (step 4) and power off (step 6) times. Power on time was MET 004/01:05 and power off was MET 004/01:41
004	02	00	00	Unknown Signal	SOPG meeting. MM & MS asked about the risks of turning IDGE off to see the effects or lack of effects on CHEX; they are considering whether to power-off IDGE to see if CHEX effects would go away; turning off SAMS (temporarily) was also discussed due to
004	02	06	00	Experiment/Facility	SOLSE appears to be behaving nominally
004	03	52	00	Attitude/Maneuver	The crew messages with thecurrent execute package indicates an altitude of the current orbit is 152 X 150 nm.
004	04	06	00	Unclassified/Other	processed PIMS requests #34 and #35 for IDGE. Sent email to RPI informing them how to get the data
004	04	47	00	Data Observation	PAC question about a fuel cell purge, Brian said that the fuel cell purge should be non-propulsive since it a balanced O2 and H2 venting on opposite sides of the vehicle.
004	04	58	00	Unclassified/Other	processed request #29. Can see the 34 and 51 Hz signals disappear for a period of 15 minutes then re-appear. 17, 68, and 85 Hz signals present throughout
004	04	59	00	Orbiter Systems	discussion with Dick and PAC about fuel cell purge. Two minutes in duration generally. Call down for completion of one at 3/22:20:45 Will check g vs. T and spectrogram type plots. CHeX concerned about these for some reason
004	05	10	00	Thruster Activity	re-select jets L5L and R5R for use
004	05	24	00	Data Observation	I discused with PAC the fuel cell purge which ended at 003 / 22:20 and the 003 / 17:22 disturbance. I realized when talking with him that the latter item was probably someone getting up in the middle of the night. I called the MSCI position and told th
004	05	43	00	Unclassified/Other	processed AADSF PIMS requests #26,#27 for the special AADSF format. Data moved to USMP4_requests/AADSF_Narayanan. Email sent
004	05	49	00	Orbiter Systems	In the middle of a long, slow maneuver to an attitude for a water dump. The supply dump is scheduled for 06:30 start.
004	06	17	00	Unknown Signal	PAC is telling CHEX ? that we don't do fuel cell purges while the crew was asleep. He said that the 003 / 17 disturbance was not a fuel cell purge.
004	06	28	00	Attitude/Maneuver	in water dump attitude. Dump duration will be one hour
004	06	29	40	Orbiter Systems	grd to crew: ready for waste water dump; duration should be one hour;
004	07	00	00	Attitude/Maneuver	during water dump, the LVLH now is: PYR = (358, 290, 180 deg) [just in case someone is curious later - and I'm a bit bored]
004	07	05	00	Data Observation	I noticed on the SAMS 2 spectrogram that the level of the 17 Hz trace was significantly reduced after the recent LOS period compared with a long time leading up to the LOS. This would be interesting to see how it changed once we have the interleaved data.
004	07	08	00	Water Dumps	water dump indicator panel on attitude data page just went active. Supply dump
004	07	10	00	Orbiter Systems	PSE: Houston will be diverting some freon cooling at 004 / 08:40 for about 16 hours. The temperatures will likely increase over this time.The redline is 18 deg C but USMP has been running colder than predicted.
004	07	20	00	SAMS/OARE Issues	My checks with SAMS: there are two fans (identical) in the data storage unit; they come on when primary 28 volt power is applied to the unit; the drives may be spun up individually, but the fans are ON;
004	07	31	00	SAMS/OARE Issues	processed AADSF PIMS request #25 for the OARE/MAWS data. OARE and MAWS data appear in reasonable agreement
004	07	32	00	Orbiter Systems	checked with PAC: we are dumping supply water and have FES on also
004	07	36	00	SAMS/OARE Issues	processed oare files 03210003.oare and 04000003.oare using nissim's processor

004	07	42	00	Unclassified/Other	RIP SOPG on the loops to discuss the IDGE RR about video downlink.
004	07	43	00	Unclassified/Other	flight day 6 is the EVA day
004	07	46	00	Unknown Signal	sams on at 000/03:03
004	07	51	00	Orbiter Systems	I noticed that the supply water dump is OFF now but the FES indicator is still ON. It probably turned off just a few minutes ago since I've been watching it on the OAE comp screen.
004	08	01	00	Orbiter Systems	PAC to AADSF: Orbiter will hot fire as scheduled to make sure that the cold jet will work going into AADSF processign time and hopefully can stay warm enough to get through without needing another firing.
004	08	05	00	Water Dumps	water dump completed
004	08	17	00	Orbiter Systems	FES indicator still ON on the OAE comp screen
004	08	23	00	Orbiter Systems	FES indicator is now OFF; not sure of the time when it turned off;
004	08	29	00	Unclassified/Other	closed IDGE requests #32,#33. All files moved to beech USMP4_requests/IDGE directory
004	08	58	00	Data Observation	Hrovat logbook. Noticed on SAMS-2 display that <40Hz disturbance (the slowly wavering one) slowly dipped down about 15 - 20 minutes ago.
004	09	00	00	Unclassified/Other	DeLombard off console (whew)
004	09	23	00	Attitude/Maneuver	maneuver to AADSF attitude to about 4/12:51 to get to attitude by 4/13:44. This maneuver will be done using verniers.
004	09	29	00	Data Observation	Noticed on SAMS-2 display that the slowly wavering disturbance took a somewhat sharp turn up in ~ 35 - 37 Hz range (printscreen: 004_09_29_29.jpg)
004	10	00	00	Unclassified/Other	Nissim on console
004	11	14	00	Thruster Activity	R2D Jet Hot Fire and attitude burn coming up at [04/12:50ish?].
004	11	26	00	Experiment/Facility	Heard MEPHISTO (Henry de Groh) call that ALT DAP firings did not show any effects on their science?
004	11	27	00	Exercise: PS-1 (L. Kadeny)	PS-1 started exercise recently.
004	11	32	00	Ku/TDRSS/Communication	Ku-band antenna dither intensity went from quite loud to not-so-loud (see URL at: ftp://beech.lerc.nasa.gov/pub/USMP4_requests/screenprint/004_11_29_19.jpg)
004	11	35	00	SAMS/OARE Issues	MSCI requested we bring up the Ku-band activities seen on the SAM2 data on the next SOPG(Ku-band activities started at 004/11/11 and ended at 004/11/20)
004	11	38	00	Ku/TDRSS/Communication	MSCI requested that we get SAMS 2, TSH B, X-axis data analysis for Ku-band antenna dither and 2nd harmonic heating up (see URL: ftp://beech.lerc.nasa.gov/pub/USMP4_requests/screenprint/004_11_41_12.jpg) ready for next SOPG since it had an effect on IDGE
004	11	47	00	Attitude/Maneuver	Maneuver in short time to position for [MT4?] burn, followed by MT4 burn.
004	11	52	00	Ku/TDRSS/Communication	Ku intensity and 2nd harmonic heating up again (started flaring up a few minutes ago or so).
004	11	57	00	Exercise: PS-1 (L. Kadeny)	Looks like PS-1 exercise ended (or paused).
004	11	58	00	Attitude/Maneuver	Crew loading data for maneuver (slow maneuver rate?).
004	12	17	00	Thruster Activity	Jet burn for about 2 seconds at ? (coming up soon?).
004	12	27	00	Attitude/Maneuver	possible new attitude is planed(multi-axis rotation change) and then will go back to the AADSF attitude.
004	12	35	00	Attitude/Maneuver	Post burn will occure in about 12 min.
004	12	40	00	Thruster Activity	R2D is heating up in time for attitude burn.
004	12	45	00	Attitude/Maneuver	burn started
004	12	47	40	Attitude/Maneuver	FIDO to Flight: "looks like good burn".
004	12	49	00	Unclassified/Other	Submitted Science Shift Report for 4/00 - 4/12.

004	12	51	00	Attitude/Maneuver	Now maneuvering to AADSF attitude.
004	13	08	00	Orbiter Systems	Cryo manifold valve to close [before pre-sleep?].
004	13	29	00	Attitude/Maneuver	still in maneuver
004	14	44	00	Crew Disturbances	Crew went to sleep
004	15	58	00	Data Observation	Noticed on SAMS 1 display the slightly less than 2 Hz strutural-mode-type disturbance that I've seen on occassion. It may be that this is only evident during sleep periods, when ambient is quieter. Check sleep periods for this trace.
004	16	15	00	Unclassified/Other	Submitted flight note PIMS-016.
004	16	28	00	Thruster Activity	Talk of burn at 05/01:33 (part of rendezvous).
004	17	27	00	Experiment/Facility	IDGE melt moved at 04/17:17, wanted to know if we saw anything. Noted couple of VRCS firings in last 4 or 5 minutes.
004	18	35	00	Thruster Activity	worrying about a maneuver and a jet problem; talking about going A7 and B7 dap, modified to tail only; maybe go to free first then auto then maneuver so that the jet of interest fires; don't know what time they are talking about; oh now they are going to
004	18	41	00	Unclassified/Other	Nissim off console
004	18	43	00	Unclassified/Other	Finkelstein on console
004	18	57	00	SAMS/OARE Issues	CHEX called. Want a SAMS 2 PSD plot of 54.5-57.5 Hz range once an hour on WEB for a 12 hour period. After that want same plot twice a day. CHEX asked PIMS (Melissa) to recommend a time slice for the plot; M. suggested about 10 minutes. CHEX will submit
004	20	41	55	Data Observation	8.5 Hz disturbance seems to have started up about 004/20:38, noticed it first as increase of levels on SAMS-1 Y-axis; it lasted for about 4 minutes
004	20	48	00	Ku/TDRSS/Communication	got a call from Ken: he just noticed at home that there was anothr example of the 17 Hz getting very noisy; This was just before a LOS period.
004	21	00	00	Experiment/Facility	Mission Scientist confirmed for IDGE that at 005/01:00 "good" microgravity would end while the Orbiter initiated a number of burns.
004	21	22	00	Unclassified/Other	just sent IDGE e-mail about two data requests fulfilled and filed (42 and 43)
004	21	24	00	Unclassified/Other	DeLombard on console.
004	21	25	00	Data Observation	I noticed when checking the SAMS 1 data this morning that there was an 8.5 Hz occurrence at about 004 / 20:40 for just a few minutes again.
004	21	33	00	Unknown Signal	Looking at some of the 56 Hz plots that Ken prepared last night.
004	21	35	00	Orbiter Systems	on prime ops loop: ther will be a radiator stow about day 005, hour 01
004	21	39	00	Ku/TDRSS/Communication	Currently LOS; regain signal in about 7 minutes.
004	23	00	00	Unclassified/Other	Eslk of ligr Zeskru donp og yhr fsy (gifurd yhid onr ouy) Per melissa, this had SOMETHING to do with a wake-up song.
004	23	01	00	Attitude/Maneuver	first burn will b NC 5 at 005:01
005	00	04	00	Ku/TDRSS/Communication	ratty comm upcoming with next 5 minutes off the tail (let's see if the 17 Hz blooms)
005	00	05	00	Ku/TDRSS/Communication	more musing about the increased excitation of the 17 Hz signal: our data come down S-band, so why would there be any correlation between the 17 Hz increased excitation and our SAMS-2 data LOS periods? Sorry Ken, but I think I have to vote against both o
005	00	15	00	Unclassified/Other	Andy Hitton (? Worked with Matisak before) with VGF ? upstairs in POCC. He wanted to know about SAMSdata to correlate with some RMS arm movement data. I suggested he make a WWW PIMS request to lay out what he wants.
005	00	30	00	Data Observation	discussed with PSE about the PIMS-016 flight note about 17 hz levels.

005	00	48	00	Thruster Activity	Hot firing scheduled to start at MET 005/01:05.
005	01	00	00	Unclassified/Other	mcpherson on console
005	01	07	00	Unclassified/Other	rogers off console
005	01	14	00	Attitude/Maneuver	MSCI: we missed the note that the orbiter went into free drift for a few seconds and then a thruster firing
005	01	17	20	Experiment/Facility	AADSF has stopped translation and are in a controlled cooldown
005	01	34	00	Orbiter Systems	call down “we see a good burn”
005	01	45	20	Orbiter Systems	I just noticed that the FES indicator is flashing on the OAE comp screen.
005	01	45	00	Unclassified/Other	46 requests received, 2 post mission, 5 open, 40 closed
005	01	47	00	Unknown Signal	Some more info on the CHEX ICT heating rate plot given to Mike W. and I (& faxed to PIMS TSC): this heating rate is ok with CHEX if it is constnat, but bad if there are fluctuations; notice that the heating reate changed when sams and then idge turned off
005	01	48	00	SAMS/OARE Issues	Jeff / SAMS called to tell me that his tests with SAMS E.U. had these results for the fan speeds: with a TSH on top of DSU center post: 24 volts input - 56 Hz 28 volts input - 65 Hz 32 volts input - 72 Hz I then called the PSE and asked w
005	01	55	00	Unclassified/Other	SOPG in five minutes.
005	02	05	00	Ku/TDRSS/Communication	call from PSE regarding checking Ku Band antenna dither times. JSC too busy today with the EVA so PSE will ask them for the information tomorrow. This was related to PIMS flight note 16
005	02	33	00	Unclassified/Other	Finkelstein off console
005	02	36	00	Unclassified/Other	Black on console. Replaced Finkelstein.
005	02	36	00	Unclassified/Other	at step 59, just saw fans come on. Air to ground call down
005	02	46	00	Orbiter Systems	EMU purge in progress
005	03	03	00		talk with kevin and jeff about the action item from the SOPG to address the risk of turning off the SAMS unit to inviestigate the effecton CHEX. Jeff will write up something about the hardware risk and Kevin will look at some MSL-1 data to see if there w
005	03	05	00		crew: got a good burn
005	03	06	00	Thruster Activity	Crew called down that they did a burn
005	03	15	00	SAMS/OARE Issues	Dick DeLombard attended the SOPG and calls SAMS and PIMS TSC on the loops. CHeX requested a risk assessment from SAMS & PIMS regarding turning off the SAMS unit for a period of time. CHeX is looking at the 56 hz disturbance as it relates to the SAMS uni
005	03	34	00	SAMS/OARE Issues	discussion with Dick, Jeff regarding potential power off of SAMS to identify isolate the 56 hz disturbance. Will use CHeX heat index to see if SAMS turn off had any effect. Jeff to assemble a risk assessment for SAMS turn off and provide to Dick.
005	03	38	00	SAMS/OARE Issues	Ranga, of AADSF, called and requested OARE data analysis for day 003 from Kevin. Kevin supported the request and discussed it with Ranga.
005	03	50	00	SPARTAN Operations	Crew preparing for the EVA. Scott and Doi will conduct a space walk to retrieve the SPARTAN satellite.
005	03	57	00	Thruster Activity	MC2 Burn looked good.
005	04	00	00	SAMS/OARE Issues	moved SAMS2 PIMS RT data from /home/liberman/usmp4/rt to PIMS1 machine at /export/disk1/usmp4/sams2/rt. The data moved was from MET 000-003. This is done to make sure PIMS2 has disk capacity for the data it is receiving
005	04	01	28	Ku/TDRSS/Communication	Handing over to TDRS E for commanding.

005	04	05	00	Data Observation	41 hz signal dipping to 39 hz signal present on the sams 2 spectrogram. Screen image snapped to the file name 005_04_07_48.jpg
005	04	11	00	SAMS/OARE Issues	changed the 1st frequency range for grms plots to 54.5 through 57.5 hz
005	04	12	35	Ku/TDRSS/Communication	Handing over to TDRS W for commanding.
005	04	14	28	Thruster Activity	See a good MC burn
005	04	26	45	SPARTAN Operations	Crew members Scott and Doi are getting ready to egress and head out of the shuttle.
005	04	28	00	SPARTAN Operations	scott and doi ready to egress. Checkout of suits, equipment complete. Sounds like they are in the cargo bay
005	04	29	16	SPARTAN Operations	There is alot of communications static and it is difficult to hear the SPARTAN activity.
005	04	30	00	Thruster Activity	L1 Alpha jet is getting a bit hot.
005	04	31	00	Thruster Activity	L1A, R1A jets getting too hot. put them last on the list for use
005	04	33	00	SPARTAN Operations	SPARTAN is within view of the crew who say it looks stable.
005	04	35	00	SPARTAN Operations	spartan 700 feet away
005	04	42	00	SPARTAN Operations	EVA in progress.
005	04	47	00	SPARTAN Operations	in place for spartan retrieval. Spartan currently about 250 feet above the orbiter. “looks very stable”. Grappling fixture is pointed straight aft
005	04	48	00	SPARTAN Operations	SPARTAN is about 250 feet above the heads of Scott and Doi. Spartan looks very stable. Spartan has a slight rotation. Spartan Z axis is perpendicular. Arm on Orbiter is extended. Crew cannot yet see if the telescope door is closed.
005	05	00	00	Orbiter Systems	The RMS arm is deployed now while they are getting close to the SPARTAN satellite.
005	05	05	00	SPARTAN Operations	Per Winston, the INGRES aid is deployed about a foot on the starboard side and about 6 inches on the port side, above the MPES.
005	05	22	00	Attitude/Maneuver	getting close to capturing the SPARTAN; video has shown two crew members out in the cargo bay;
005	05	22	38	SPARTAN Operations	Per Winston, looking good. SPARTAN is coming down nicely. It is about a six feet away from them.
005	05	24	48	SPARTAN Operations	Per Winston. OK, Stop right there. Position looks good. Telescope is right between them.
005	05	27	00	SPARTAN Operations	spartan is about 6 feet above winston scott. Small rotation rate still
005	05	28	50	SPARTAN Operations	Commander, Kevin, tells the crew that the telescope is closed on both sides. Crew will need to rotate it another 45 degrees. Kevin asks them to let him know when he can go into a free drift command.
005	05	29	00	SPARTAN Operations	telescopes were both closed per crew observation of spartan
005	05	31	00	SPARTAN Operations	as expected, a lot of thruster activity during theses operations. Continual maneuvering to keep the satellite centered over the cargo bay and in the proper position
005	05	37	15	Attitude/Maneuver	pilot to EVA: make your call and I’ll go free drift
005	05	37	00	SPARTAN Operations	waiting for spartan to rotate around another 25 degrees or so to put it in the orientation to place back in the cargo bay
005	05	39	12	Orbiter Systems	on loops: Prop, where are we in terms of forward prop? Response from Prop: We are about where we expected
005	05	49	00	SPARTAN Operations	pretty cool video of the spartan over the payload bay. Looks like a picture everything is so still.
005	05	55	22	SPARTAN Operations	Per Winston, SPARTAN is about 2 feet aft.
005	05	57	33	SPARTAN Operations	Per Winston, SPARTAN is about 6 inches aft.
005	05	58	34	SPARTAN Operations	Commander said they are going to pitch the tail down.
005	06	06	00	Unclassified/Other	PAC distributed a plan for the microgravity time frame and a consultation is being held on the MSCI loop to discuss the plan. PAC: assumption after EVA we are at margins of PROP and we wil have 216 hours of VRCS. We have used some already. Brian went t

005	06	15	00	Free Drift	Now in FREE DRIFT, per commander.
005	06	22	10	SPARTAN Operations	Height is good. Winston cannot yet reach SPARTAN.
005	06	23	38	SPARTAN Operations	the EVA crew members grabbed the satellite
005	06	23	04	SPARTAN Operations	Now they can reach the scope. Stand bye. CAPTURE. Winston tells Doi to roll the SPARTAN right, very slowly. Winstons says to Doi, we are going to pitch the SPARTAN down, very slowly. Looking good. MS1, Chawla, begins assisting the crew. She says the
005	06	23	33	SPARTAN Operations	spartan captured by scott and doi. Maneuvering the satellite into position to be put back in the cargo bay
005	06	24	00	SPARTAN Operations	we should probably try to get the video for the capture to correlate our accels with the activities.
005	06	30	20	SPARTAN Operations	It sounds like they are trying to push it down into the structure in the cargo bay. It sounds like they are having trouble getting it to latch into the carrier.
005	06	35	00	SPARTAN Operations	very close to getting the spartan back in the guides and in place
005	06	37	32	SPARTAN Operations	Winston talks with the commander about strategies for completing the docking. He then directs Doi in manuvering SPARTAN into the bay.
005	06	38	00	SPARTAN Operations	they are going to use the RMS arm to push the SPARTAN back into its fixture;
005	06	43	20	SPARTAN Operations	MS1, Chawla, continues to talk with Winston and Doi about how to lock SPARTAN down into guides. Ground support also provide recommendations.
005	06	43	50	Data Observation	SAMS 1 data has exhibited much fluctuations in the data stream during the SPARTAN EVA. This might be attributed to the Orbiter manuvering to line up and dock the SPARTAN.
005	06	45	00	SPARTAN Operations	they are continuing to push the SPARTAN down into the cradle and back and forth trying to latch it.
005	06	47	23	Orbiter Systems	on loops: we see the arm in motion (grd to crew earlier: use the RMS to grapple and force the SPARTAN to berth)
005	06	48	35	SPARTAN Operations	they are going to rigidize on SPARTAN to grapple and berth; crew: we'll grapple, lift a bit, let someone get something out of the way, get the guys out of the way, and then berth it;
005	06	50	00	SPARTAN Operations	spartan grappled with the RMS while the astronauts get the spartan into its guides
005	06	52	15	Orbiter Systems	"five feet away from grapple fixture"
005	06	52	35	Orbiter Systems	"over the pin"
005	06	53	15	SPARTAN Operations	"captured and rigidizing - you guys can let go now"
005	06	55	27	SPARTAN Operations	"ok we've got it"
005	06	56	28	SPARTAN Operations	"it has been stowed"
005	06	56	33	SPARTAN Operations	Winston says the SPARTAN has been stowed!
005	06	56	00	SPARTAN Operations	spartan may be stowed now. Ingress aid would not stow properly. That is finally in. Proceeding through the spartan re-birthing procedure
005	06	57	31	SPARTAN Operations	grd: "we will now berth according to regular procedure; EVA crew can return to airlock so we can continue with EVA timeline."
005	06	57	28	SPARTAN Operations	Mission control congratulates Winston and Doi and tells them they may return to the Orbiter. The crew continues attempts at latching SPARTAN into its locked position. They experience some difficulties and make several attempts. The crew physically he
005	07	01	00	SAMS/OARE Issues	processed oare files 04180000.oare and 042100.oare. processed oare data now available through MET 004
005	07	04	05	Attitude/Maneuver	I just noticed that the orbtier is in free drift. May have been in free drift all this time. I don't know when free drift was started.

005	07	08	00	Unclassified/Other	They are considering extending the EVA by one hour - probably to recover the extra time taken to wrestle the SPARTAN into the berth position;
005	07	08	53	Orbiter Systems	FES indicator is on OAE comp screen; Free drift still indicated;
005	07	18	00	SPARTAN Operations	still not berthed yet. Having problems with this part of the procedure
005	07	25	00	Attitude/Maneuver	free drift is over (may have been over for a little while - looks like at 07:20 according to OAE comp screen)
005	07	29	29	Orbiter Systems	FES is still on the OAE comp screen
005	07	30	00	Unclassified/Other	new logbook for DeLombard's shift
005	07	30	00		end of logbook
005	07	33	00	Free Drift	go for free drift during the re-birthing process
005	07	35	00	Unclassified/Other	on loops: no problem with extending the EVA one hour based on crew activity; we have enough prop to support an extra hour for EVA;
005	07	36	00	Unclassified/Other	go to extend the EVA by one hour
005	07	37	20	SPARTAN Operations	I see three go ready for latches now -
005	07	37	35	SPARTAN Operations	Flight-Payloads: we are latched
005	07	37	00	SPARTAN Operations	SPARTAN IS LATCHED!
005	07	37	00	SPARTAN Operations	spartan is latched
005	07	43	00	Unknown Signal	phone w/Kevin: what is CHEX going to do if there is an impact from SAMS ?
005	07	51	15	Orbiter Systems	FES is back on
005	07	51	09	Experiment/Facility	EVA work continues on other operations.
005	07	53	00	Unclassified/Other	MSCI conference on MSCI loop: with the successful capture of SPARTAN, we are back to the nominal timeline; we are in vernier control;
005	07	55	07	Experiment/Facility	Mission Scientist announces to the Science Teams that they will proceed with the baseline time line, since the SPARTAN exercise is completed. The next SOPG will be held around 005/09, in about an hour. A Replan timeline will be discussed at the SOPG. P
005	07	55	00	Experiment/Facility	with successful capture of SPARTAN, we will return to the nominal timeline. Discussion will take place at the replan SOPG scheduled for 05/09:00
005	08	00	00	Unclassified/Other	DeLombard off console
005	08	02	07	Unclassified/Other	Dick DeLombard says he is leaving console for the night.
005	08	05	00	EDFT Operations	3 hz signal apparent during the EVA. Crane operations?? Also something at 10 hz during this EVA operations
005	09	26	30	EDFT Operations	EVA bang with crane (pivot about XY plane, bang-stop in +X-axis structural).
005	09	26	30	EDFT Operations	Hrovat logbook. EVA bang with crane (pivot about XY plane, bang-stop in +X-axis? structural).
005	09	55	00	Unclassified/Other	Black off console. Handover to Lugasy.
005	10	00	00	Unclassified/Other	Nissim on console
005	10	46	00	Ku/TDRSS/Communication	Roughly ten minutes ago, noticed the Ku-band antenna dither intensity increase, then [LOS/Ku reposition], then much quieter. This may be that cable binding, then repositioning thing (see ftp://beech.lerc.nasa.gov/pub/USMP4_requests/screenprint/005_10_45
005	11	00	05	EDFT Operations	Two EVAers closing latches and stuff on the port side of cargo bay, noticed at least a couple of good tugs in the structural Y direction.
005	11	22	00	Attitude/Maneuver	MEPHISTO maneuver on A1 verns at 05/11:45.

005	11	23	00	Unclassified/Other	Submitted Science Shift Report for 05/00 - 05/12.
005	11	24	00	EDFT Operations	EVAer tugging on FWD bulkhead of cargo bay (+/- X direction).
005	11	25	28	EDFT Operations	RMS arm moving toward FWD bulkhead of cargo bay.
005	11	26	00	Unclassified/Other	Arm oscillating in +/-X and Z directions.
005	11	28	00	SAMS/OARE Issues	Processed OARE file ore00503.00.
005	11	37	00	EDFT Operations	Arm moving up away from FWD bulkhead of the bay.
005	11	41	00	EDFT Operations	Winston (EVA-1?) closing PSA compartment on [starboard?] side of cargo bay [primarily Y direction].
005	11	46	30	EDFT Operations	Winston ingressing now.
005	11	48	45	EDFT Operations	Outer cover of ingress hatch closing now, and closing hatch?
005	11	50	52	EDFT Operations	Ingress hatch is closed and locked.
005	11	56	10	Unclassified/Other	Arm moving close to stowage stanchions.
005	11	57	09	Unclassified/Other	Arm locking into first (elbow?) stanchion (Z direction).
005	11	57	58	Unclassified/Other	Arm locking into end stanchion (Z direction).
005	12	02	00	EDFT Operations	Winston was out for 14 hours and 15 minutes [a record?]. (Winston the astronaut, not the cigarette).
005	12	15	00	Attitude/Maneuver	They started slow attituded adjust at 05/11:45
005	12	50	00	Data Observation	Noted slowly ramping down trace on spectrogram for SAMS 2, Head B, X-axis. Is this the chevron source that we've seen on previous USMP missions? See URL: ftp://beech.lerc.nasa.gov/pub/USMP4_requests/screenprint/005_12_44_38.jpg
005	12	52	00	SAMS/OARE Issues	Processed OARE file ore00506.00.
005	12	56	00	Water Dumps	Starting a half hour supply water dump now.
005	13	00	00	SAMS/OARE Issues	Had problems processing CHeX request for PSDs from MET 04/18 to 05/06. Message from MATLAB that 2 seconds of switched head were detected and 1 second of switched axis was detected.
005	13	31	00	Water Dumps	Terminate of supply water dump.
005	13	58	00	Ku/TDRSS/Communication	Ku-band antenna was repositioned in the last ZOE.
005	15	33	00	Data Observation	Snapped interesting SAMS 2, TSH B, X-axis display, see: ftp://beech.lerc.nasa.gov/pub/USMP4_requests/screenprint/005_15_32_51.jpg
005	17	27	00	Unknown Signal	ken is gone; I'm printing his logbook
005	17	32	00	Unclassified/Other	Rogers logbook. printed out Ken's logbook and starting a new one
005	17	35	00	Unclassified/Other	Finkelstein on console
005	17	41	00	Flight Note/OMIS	submitting PIMS-020 to default list: QS levels before/during/after Spartan capture
005	17	59	00	Unclassified/Other	starting CHeX 004/23-005/00 PSD
005	18	00	00	Attitude/Maneuver	discussion on FDIR about attitudes: it sounds like they are unhappy with the AA attitude because of jet problems and want to find a different attitude for AA run that starts on 007
005	18	27	00	Ku/TDRSS/Communication	LOS
005	18	32	00	Unclassified/Other	starting CHeX 005/00-005/01
005	18	41	00	SAMS/OARE Issues	switched over to MOCZ body rate from older computed body rates to improve jaggedness of mapped data plots (older computed body rates tended to add more spikes into mapped data, MOCZ seems smoother)
005	19	06	00	Ku/TDRSS/Communication	About one minute to LOS - Didn't hear announcement about AOS after LOS at 005/18:27.
005	20	00	00	Unclassified/Other	Nissim off console
005	20	16	00	Unclassified/Other	starting CHeX 005/01-005/02

005	20	20	00	Data Observation	noticed increased (not big-time) levels on all three axes of SAMS-1 at about 005/20:42 for about 5 minutes then LOS
005	21	30	00	Water Dumps	Per Mission Scientist: Trying to conserve nozzle fuel in case of a redeployment of SPARTAN later in the mission. Looking at changing water dump as a way to conserve fuel. Combined supply and waste water dump at 006/15:00 - 006/16:30 or FES dump at 006/
005	21	40	00	Water Dumps	to save nozzle fuel for a possible redeploy, they want to do 006/15 water dump to 006/16:30 with alt-dap tail only mode; or all night fes (6/17 through to wake up) on VRCS. CHeX had a good idea (this impacts CHeX and EPHISTO): POL will go to JSC to see
005	21	45	00	Unclassified/Other	DeLombard back on console
005	21	46	00	Orbiter Systems	discussion on the loops about water dumps, etc.
005	21	51	00	Orbiter Systems	POL telling PAC that USMP-4 would prefer to have the water dump on top of the exercise period next day.
005	22	03	00	Water Dumps	006/11:30 to 006/13:30 is plan for supply dump on alt-dap tail only, end of it to coincide with exercise end
005	22	15	00	Orbiter Systems	considering doing the supply water dump at 006 / 08:45 during exercise period until 10:15; this would be a tail-only PRCS control; CHEX concurs; AADSF concurs;
005	22	18	00	Water Dumps	okay, now the plan is supply nozzle dump on alt-dap tail only from 006/08:45 to 006/10:15, during exercise
005	22	40	00	Orbiter Systems	talk about a data dropout from the cargo bay for 10 seconds;
005	22	42	00	SPARTAN Operations	JSC is satying that the prospects for re-deployment of SPARTAN is looking slim
005	22	44	00	Unclassified/Other	something about an attitude needed now;
005	22	44	00	Data Observation	I noticed a variable trace just above 35 Hz for the period starting about 005/21:46 and continuing for about 30 minutes.
005	22	48	00	Attitude/Maneuver	PAC is telling MSCI that flight needs an attitude definition right now, asking for tail forward, bay to earth;
005	22	49	30	SAMS/OARE Issues	NICE VIDEO OF CARGO BAY SILL WITH EARTH AND SPACE OUT SIDE AND SAMS MLI COVER AND SENSOR HEAD CABLES WITH HITCHHIKER CANS, ETC. turned off of SAMS at 22:51:30 or so
005	23	03	00	Data Observation	I noticed another 8.5 Hz occurrence at about 005 / 21:51 for about five minutes
005	23	05	00	Data Observation	I called up to TSC an obervation that there was a variable trace a bit above 35 Hz on the curent 100 hz spectrogram. It looks like it has been going on since 22:45 for about 15 minutes
005	23	15	00	Data Observation	notice that the 17 Hz has an increasing magnitidue (according to the specttrogram) starting at about 005 / 22:40; there is NOT an LOS at this time (as opposed to some of the other items like this we've seen);
005	23	37	00	Unclassified/Other	off console to talk with PSE and MSCI
006	00	00	00	Unclassified/Other	crew wakeup call
006	00	00	00	Unclassified/Other	somene had asked about ku activity 006/00:00 to 006/00:20; the response from JSC is: Ku normal tracking
006	00	01	00	Crew Disturbances	crew wake-up song: something for KC
006	00	02	00	Exercise: CDR (K. Kregel)	CDR wants to exercise within the next 45 minutes; checking to see if that is OK with USMP;
006	00	03	44	Exercise: CDR (K. Kregel)	POL to Houston: Go for exercise now til 01:00
006	00	04	21	Exercise: CDR (K. Kregel)	crew to grd: CDR is getting on the ergometer now
006	00	04	00	Exercise: CDR (K. Kregel)	CDR is free to exercise up to 006/01:00; he says he will start now
006	00	05	00	Exercise: CDR (K. Kregel)	per the SAMS-1 display he's starting to pedal about now. Now, I planned to pin it down really close, but they did a 10 second TFL change and I missed the start. But this is really close.
006	00	06	00	Data Observation	it appears there was a weak 8.5 Hz signal at about 005 / 23:27
006	00	10	00	Attitude/Maneuver	giving them stars of opportunity for a star align for all three IMUs at the crew's convenience
006	00	12	00	Exercise: CDR (K. Kregel)	Kevin is doing little bits of pedalling, either he's still warming up or he's just messing around, getting set up.

006	00	12	00	Attitude/Maneuver	IMU alignment done
006	00	14	00	Ku/TDRSS/Communication	just saw that the 17 Hz has gone white again on the SAMS-2 display. New thought: any connection to the IMU align? There appears to be a transient (thruster) just at the beginning of the increase magnitude. Of course, the signal was a very intense red
006	00	22	00	Unclassified/Other	I'm going to call PSE and ask if they can find out about any Ku antenna activity (wraparound, whatever) occurring between 006/00:00 and 006/00:20
006	00	28	00	Unclassified/Other	PSE is checking with JSC for us
006	00	28	00	Ku/TDRSS/Communication	per JSC, normal Ku tracking during the time of interest
006	00	43	25	Exercise: CDR (K. Kregel)	CDR exercise complete
006	00	43	25	Exercise: CDR (K. Kregel)	CDR exercise complete
006	00	55	00	Unclassified/Other	GI Stocker asked about the Ku 1 mg discussion at the SOPG; I also illlustrated our dat displays that he might use during his ELF experimenet ops
006	00	59	00	Unclassified/Other	Submitted Science Shift Report for 5/12-6/00 to Mission Scientist.
006	01	06	00	Unclassified/Other	preparing PIMS-022 flight note about annotated OARE whole mission plot;
006	01	13	00	Unclassified/Other	rogers off console
006	01	30	00		mcpherson on console
006	01	38	00	Data Observation	I earlier asked PSE / Pete Paceley what was going on at day 004 / 09:15 for about 20 or 30 minutes that would cause a disturbance in two axes of OARE of about 5 - 10 uG. I think this may have been venting of air from the crew cabin during the EVA depress
006	02	39	00	Ku/TDRSS/Communication	rather noisy ku band trace over the last 30 plus minutes
006	02	40	00	Unclassified/Other	Black on console. Replaced Finkelstein.
006	03	12	00	SAMS/OARE Issues	processed data files 05180001.oare and 05210001.oare
006	03	15	00	SAMS/OARE Issues	Processed two OARE files noted in Kevin McPherson's PIS logbook entry.
006	03	19	00	Crew Disturbances	Crew coming out of post-sleep
006	03	23	00	Orbiter Systems	no joy on recovering the "quantity transducer". Re-cycle a circuit breaker. Water system??
006	03	32	23	Orbiter Systems	Noted the CO2 levels are high.
006	03	35	00	Unclassified/Other	checked back with TSC after SOPG; we discussed the request that Mike Wargo made for the high resolution PSDs for the 56 Hz puzzle.
006	03	50	00	Data Observation	checked with PSE about the possible identification of the (my guess) depressurization event. Pete said that he faxed the OARE plot down to JSC at 006/01.
006	03	51	00	Orbiter Systems	note from dick about cabin de-pressurization at 004/09:00. On the 3 hour OARE plot, this depressurization looks very obvious. About a half hour in duration with disturbance in the y and z axes
006	04	10	00	Orbiter Systems	PAC talking with MEPHISTO about closing down thedead band. Over the next four hours MEPH will not be too sensitive.
006	04	11	00	Orbiter Systems	call from PSE . time slice for the depressurization valve openings will be provided by JSC. This should coincide with the OARE disturbances observed in the note above
006	04	12	00	Orbiter Systems	PSE said that JSC confirms that there is a vent valve that is opened to de-pressurize the cabin. They are still checking on time hacks for the opening & closing.
006	04	13	00	Orbiter Systems	I asked POL for when the dead band was closed down. She replied with the last one was at 6/03:43 for 5 min or so .
006	04	24	00	Orbiter Systems	grd to crew: requesting a jet de-selection

006	04	25	00	MGBX Operations	PEP operations begin. Glovebox work.
006	04	25	00	Experiment/Facility	PEP operations in work. Glovebox operations
006	04	26	00	Thruster Activity	deselect L5L and R5R. Trying to get other verniers to fire
006	04	27	00	Experiment/Facility	ready to actually start the PEP run
006	05	00	55	Exercise: Unknown	In looking at some one hour 10 Hz spectrograms recently and making notes on the time line, there were no exercise periods done in the time from 006 / 02:20 through 05:00. There was an exercise period identified in the time line, but apparently wasn't use
006	05	04	00	Ku/TDRSS/Communication	KuBand antenna dropout is planned for 006/05:05 to 006/05:15. They will turn the recorder on.
006	05	16	00	Orbiter Systems	PSE said that the JSC PSE will be putting out a flight note down there to ask across the board for what was going on during the de-press time.
006	05	18	00	Data Observation	Payload Systems will look at systems going on at the time of the OARE data disturbance on 004/09 (noted above). The Mission Scientist said they will send a flight note when they have completed their evaluation.
006	05	26	00	Orbiter Systems	from PSE: JSC said that the OARE disturbance lined up perfectly with the de-press actions. JSC said that there are two vents on lower port side in payload bay.
006	05	29	00	Unclassified/Other	preparing PIMS-023 flight note for the above de-press
006	05	54	00	Orbiter Systems	call from PSE. The depressurization valve openings coincide exactly with the OARE data. Prepared a plot for dick for flight note 23 showing the effects of the depressurization and a water dump on the same plot. Filed the plots in the faxes sent folder
006	06	00	00	Data Observation	noticed ~22 Hz trace present for the past 5-7 minutes. Very visible yellow trace. Appear to come on shortly after a brief LOS period
006	06	01	00	MGBX Operations	Glovebox work continues.
006	06	20	00	Data Observation	22 Hz has faded to light green. Can still see a trace, but not nearly as obvious as the yellow trace cited above
006	06	27	00	Experiment/Facility	PEP operations continue
006	06	45	15	MGBX Operations	They are scheduling an additional 2 hour glovebox run following the scheduled run.
006	06	46	00	Data Observation	8.5 hz light trace observed about 45 minutes ago on the SAMS1 display 5-8 minutes in duration
006	06	49	00	Data Observation	Dick and Kevin discussed a 8.5 hz SAMS 1 disturbance around 006/05/50.
006	06	49	00	Data Observation	ku antenna has period of white, followed by LOS back to nominal read display after. Snapped an image of this screen into file name 006_06_47_31.jpg under the screen print subdirectory
006	06	57	00	Unclassified/Other	Dick is leaving console for the night at MSFC.
006	06	60	00	MGBX Operations	Glovebox work continues.
006	07	13	05	Ku/TDRSS/Communication	Two minutes to ZOE. Pick-up again at 006/07:29
006	07	23	00	SAMS/OARE Issues	moved all of MET day 004 sams2 rt files from PIMS2 to PIMS1 with command mv /home/liberman/usmp4/rt/004* /net/pims1/export/disk1/usmp4/sams2/rt
006	07	34	50	SAMS/OARE Issues	Processed a new OARE file 006000001 noted in Kevin's PIS logbook.
006	07	36	00	SAMS/OARE Issues	processed file 06000001.oare
006	07	45	04	Unclassified/Other	Duc Truong stopped in to see how things are going...fine.
006	08	07	00	Unclassified/Other	terminate charge on EMU 2, continue charging EMU 1
006	08	13	00	MGBX Operations	problem with glovebox shutdown a while ago. Apparently the glovebox got to warm causing a relay to open up shutting things down. Restart successful once the system was allowed to cool down some. Just completed initial steps of restart

					procedure
006	08	18	00	MGBX Operations	turn air circ from 5 to 4 set work area temperature to -3. Re-booting the PGSE now
006	08	20	00	Thruster Activity	F5L getting cold again. Columbia instructed to select DAP-B. Deadband collapse
006	08	23	00	Orbiter Systems	some force pushing the orbiter to the negative deadband per the flt-dir loop. See above about deadband collapse. Apparently never getting to the positive deadband, resulting in F5L not getting used and therefore getting cold. Collapse the deadband to m
006	08	27	00	MGBX Operations	looks like the glovebox start up procedure may have caused somewhat noisier conditions initially. Can observe a 3-4 minute period on SAMS 2 plot with structural modes excited, new frequency around 42-43 hz. Snapped this image and saved under name 006_08
006	08	30	00	Thruster Activity	for those interested alt-dap is primary RCS and dap is vernier mode vernier RCS
006	08	40	00	Thruster Activity	L2L and L1U in low priority for this alt-dap period. R4R and R4U in last priority. This makes good RCS configuration. Will maintain attitude for the supply water dump. Alt dap scheduled to start at 8:45
006	08	42	00	Water Dumps	water dump preps on-going. Dump duration will be one hour.
006	08	47	08	Water Dumps	Go ahead to prepare for the water dump.
006	08	51	15	Ku/TDRSS/Communication	Going into ZOE. Back in 9 hours.
006	09	00	00	Unclassified/Other	hrovat on
006	09	07	00	Unclassified/Other	mcpherson off
006	09	12	00	Water Dumps	water dump is in progress
006	09	13	36	Unclassified/Other	There will be an SOPG at 006/10:00. It will be broadcast on the Science loop.
006	09	15	00	Thruster Activity	Series of thruster firings (at least 6 or more) through about 06/09:25 [ALT DAP tail only and R2D hot fire?].
006	09	19	00	Thruster Activity	See a series of thruster firings around 006/09:19 in SAMS data.
006	09	21	25	Water Dumps	Supply dump will be terminated around 006/10:30.
006	09	24	00	Exercise: Unknown	Exercise might begin late, around 006/10:45
006	09	35	00	Thruster Activity	L5L is about to [fail leak – getting cold?].
006	09	54	00	Thruster Activity	Go to VRCS coming up [after water dump?], [with deadband collapse?]
006	09	56	00	Water Dumps	Go for termination of water dump.
006	10	00	00	Unclassified/Other	Black off console. Replaced by Lugasy.
006	10	00	00	Unclassified/Other	Nissim on console
006	10	00	00	Unclassified/Other	Participating in RIP SOPG on SCI CONF loop as requested by MSCI.
006	10	03	00	Thruster Activity	Call up to select verns [no more ALT DAP for now?]
006	10	05	43	Thruster Activity	Jet firing for warm-up
006	10	10	00	Exercise: Unknown	Exercise started
006	10	10	00	Exercise: Unknown	SAMS 1 display shows that exercise has started. No indication of who yet.
006	10	24	00	Experiment/Facility	Stop/restart PEP in GBX (any fan effects? – SAMS 2 display says no).
006	10	41	00	MGBX Operations	Call down by crew that all GBX indications, including fans, are ready to go.
006	11	00	00	Exercise: Unknown	Exercise stopped
006	11	09	00	Exercise: Unknown	Noticed that exercise finished about 10 minutes ago. This must have been more than one session.
006	11	24	00	Thruster Activity	Firing F5L now, then auto to free drift?
006	11	25	00	Free Drift	Going into free drift

006	11	28	00	Thruster Activity	Jet F5L fired
006	12	00	31	Attitude/Maneuver	We are in the MEPHISTO Attitude
006	12	07	00	SAMS/OARE Issues	Processed OARE data files ore00606.00 and
006	12	35	00	MGBX Operations	Having problems with GBX overheating.
006	12	40	00	Unclassified/Other	Submitted Science Shift Report for 06/00 - 06/12.
006	12	45	00	PAO	PAO [with Tokyo and Al Gore] event coming up [in about 20 minutes?]
006	12	49	00	Exercise: Unknown	Move exercise to 06/14:35.
006	13	03	50	PAO	Start PAO Event in a minute and a half.
006	13	20	40	PAO	PAO Event complete.
006	15	13	44	Ku/TDRSS/Communication	Ku-band antenna cable reposition during upcoming ZOE.
006	15	41	00	Orbiter Systems	WCS vacuum vent valve close coming up.
006	15	42	00	Crew Disturbances	Going to sleep now (not me, the crew).
006	16	06	00	Water Dumps	Fuel cell purge is complete.
006	16	20	00	Unclassified/Other	Submitted PIMS-024 flight note of OARE QTH at AADSF.
006	17	06	00	Data Observation	And we're back from LOS, and the SAMS-1 display is showing significantly louder structural modes than from before we were LOS.
006	17	14	10	Thruster Activity	There's talk on PRIME-OPS about adding more yaw to warm-up some jets.
006	17	15	00		Hrovat out.
006	17	27	22	Thruster Activity	Further talk on PRIME-OPS: they can't add yaw to the attitude. I guess they'll have to warm-up the jets in some other way.
006	17	44	27	Thruster Activity	Talking about overnight deadband collapses to keep things warm, but they're planning these for VRCS jets. They're also trying to save propellant for the forward RCS systems.
006	17	44	53	Data Observation	The SAMS-1 display spectrogram got generally quieter again. The structural modes are back to where they were before my previous comment. I made a screen print. We should do a more detailed analysis of this after the MSFC data gets in.
006	18	00	00	Unclassified/Other	Nissim off console
006	18	13	00	Thruster Activity	Talk on MSCI loop while I was working on the systems – the maneuver to the AADSF attitude will be done with ALT-DAP.
006	18	20	00	Unclassified/Other	Black on console. Replaced Lugasy.
006	18	20	00	Flight Note/OMIS	Received a flight note showing some cabin switches and vent positions. I think this was Dick's request for the venting operation. Incase it wasn't sent to Dick originally, I FAXed a copy down to him at the POCC, so it'll be waiting for him when he gets
006	18	21	00	Thruster Activity	thruster activity noticed on SAMS
006	18	24	00	Data Observation	Just noticed on the SAMS-2 display that the Ku-antenna had a very abrupt jump to a louder signal. Looks like the time is somewhere around MET 006/18:20 or so. When the data clears through the system, do a plot from MET 006/18:15 to 006/18:25. This peri
006	18	35	00	Data Observation	And the SAMS-2 display is showing a signal which seems to have forked upwards from the 85 Hz line, someplace between 006/17:30 and 006/18:30. The plot's hard to figure-out times from, so run a plot of this hour period to help try to localize.
006	18	50	00	SPARTAN Operations	Considering a SPARTAN deploy for later in the mission. Do not want it to impact planned science/payload operations. FAO is building time lines and Payload Operations is working on requirements. They will keep us informed.
006	18	58	00	Thruster Activity	They're going to have to do some trim burn (to stay within USMP-4 altitude requirements), then go into ALT-DAP to get

					into AADSF attitude, and then go back to VRCS control. This is sometime around MET 007/05.
006	19	02	53	Data Observation	Now the SAMS-2 display shows there to be a signal around 36-38 Hz (it's hard to read frequencies on these spectrograms), that took a dip down to maybe 35 Hz or so, and is now headed back up. So, another period to look at: MET 006/18:40 - 006/19:00 or mor
006	19	16	00	Data Observation	And got the plot of the Ku-antenna jump in intensity. Looks like there was a short LOS period immediately before the jump. In fact, it's possible that the jump may have occurred during the LOS period, but I think the jump is outside the LOS by a split s
006	19	32	00	Orbiter Systems	There's a plan to put-out the port radiator during the AADSF run.
006	19	37	05	Data Observation	The signal around 36 Hz or so is now taking a linear dip downward. The start of this event was sometime after MET 006/19:30 (my best guess).
006	19	40	00	Thruster Activity	Talk of maneuvering to the trim burn attitude using ALT-DAP. Also sounds like Payloads is going to be talking about a SIMO dump on ALT-DAP.
006	19	45	18	Thruster Activity	Proposal: 007/03:35 – go to ALT-DAP mode to perform a waste water SIMO dump. This dump is planned for a few hours later in the mission – so we'd move it up. The dump is for 1 hour or so. So they're looking to be in ALT-DAP from 007/03:35 - 007/05:30.
006	19	59	00	Data Observation	And got that 85 Hz fork period plotted. This is weird in that it looks like a fork when you plot from 0-100 Hz, but when you zoom-in to the 80-90 Hz region, there doesn't appear to be a fork, and the 85 Hz signal looks like a triangular wave with respect
006	20	03	00	Data Observation	Just noticed that that 37 Hz signal, which ended-up around 35 Hz, is now going back upwards, and appears to be almost back where it started.
006	20	29	30	Unclassified/Other	Just reset the running mean again on the SAMS-1 display, since there seemed to be a dc-component showing on the spectrograms. I'm guessing that a few bad points got into the system, and that threw-off the mean.
006	20	43	25	SAMS/OARE Issues	Chex requested KuBand data from the PAC for analysis. They will be in contact with PIMS later to further analyze their data.
006	20	46	09	Data Observation	And I got the 37 Hz dip and revive plot printed, and all I can say to the zoom-in spectrogram is WOW! Since this isn't a turn-on or turn-off, I don't think that asking experiment teams about this will produce much fruit, but I'll send-out a flight note a
006	21	00	00	Crew Disturbances	Crew is sleeping.
006	21	00	00	Attitude/Maneuver	The trim burn maneuver will occur around MET 007/03:35. The AADSF maneuver will be around 007/05:05. FIDO predicts this will be a pitch-up. They're planning to be in attitude, in VRCS at 007/05:25.
006	21	09	00	SPARTAN Operations	Discussed options and tentative plans for further SPARTAN activity. Might do the SPARTAN VGS on flight day 15. Might do SPARTAN EVA on day 10 in the morning and move ELF to the afternoon. Plans to be further decided.
006	21	53	38	Data Observation	Dick just called the CHeX group to let them know there were "increased accelerations" on the SAMS-1 display a little while back. Prior to the AOS, Dick called me to ask what I thought of these. There was some definate g versus t increase, but the full-s
006	22	18	00	Data Observation	And the 37 Hz signal is on a ramp-down again.
006	23	10	00	Ku/TDRSS/Communication	There is a Ku-band inhibit for CHeX coming up at MET 006/23:32 - 007/00:00
006	23	15	41	Ku/TDRSS/Communication	PAC called PIMS to confirm the KuBand will be out from 006/23:32 to 007/00:00. Note that SAMS data is coming on S band (not Kband) for this mission.
006	23	32	00	Ku/TDRSS/Communication	And the Ku is off!

006	23	46	36	Ku/TDRSS/Communication	And there's about 5 minutes of Ku-buildup in the data. I talked to Dick, and he said that the CHeX team was planning that they might ask for it to be turned-back on before the MET 007/00 point.
006	23	48	38	Ku/TDRSS/Communication	Per CHeX: turned back on at 006/23:42.
007	00	12	00	Experiment/Facility	Results of the Ku- turn-off test: the CHeX stage 5 calorimeter does see the turn-off. It adds about 0.5-1 nano-Watt into the calorimeter.
007	00	36	15	Ku/TDRSS/Communication	The Science Teams were notified that there will be a data outage for about ten seconds between 3:30 and 3:40.
007	00	36	50	Ku/TDRSS/Communication	JSC will do a TIFL swap between 03:30 and 03:40 (10 seconds).
007	01	00	00	Unclassified/Other	mcpherson on console
007	01	15	00	Crew Disturbances	Crew wake up call.
007	01	15	00	Crew Disturbances	Crew Wake-up call. Sounds like a muscial something or other. From the wake-up call, it was supposed to remind Leonid of home.
007	01	18	00	Unclassified/Other	Moskowitz logging out
007	01	44	00	SAMS/OARE Issues	processed oare data file 06180001.oare
007	01	59	00	Unclassified/Other	re-submitted maws screen capture request. Machine name is beech 139.88.62.56, account name is maws, password is mawspims. Submitted request for 999 snapshots, 10 minutes apart. This request should take us through the end of the mission or close to it.
007	02	00	00	Unclassified/Other	Black off console. Replaced by Truong.
007	02	00	00	Unclassified/Other	PIMS/POCC atttended SPOG and ask for some PSD pot support for the 56 Hz, and mews group call for help.
007	02	05	00	Exercise: CDR (K. Kregel)	cdr cleared for exercise. They will start exercise in 5-10 minutes
007	02	13	00	Exercise: CDR (K. Kregel)	exercise is going on right now
007	02	30	00	Unclassified/Other	Truong on console
007	02	45	00	SPARTAN Operations	PAC called and asked about the disturbances (EVA) while they deployed the spartan
007	03	12	00	Unclassified/Other	just got finished re-starting neural net software. System is back up and running nominally now
007	03	13	00	Exercise: CDR (K. Kregel)	cdr exercise apparently started about 40 minutes ago
007	03	15	00	Exercise: Unknown	exercise was stop about 15 minutes ago
007	03	15	00	SAMS/OARE Issues	entered CG numbers for oare processor. x,y,z = 1092.96,0.09,373.76
007	03	21	00	Water Dumps	water dump about 8 hrs to let AADSF and Chex know to prepare for the effect , maneuver, burn, dick will be off console and will go back early tomorrow.
007	03	21	00	Water Dumps	supply/waste water dump for 30 minutes for supply dump, and waste dump should take 20 minutes
007	03	23	00	Thruster Activity	move to aadsf in alt-dap, return to verniers when aadsf attitude achieve. Aadsf processing to start at 05:30
007	03	29	00	Water Dumps	They loook at the water dump about an hour or so now, the sooner the better for the AADSF and Chex experiences
007	03	30	00	Unclassified/Other	impromptu SOPG meeting
007	03	33	00	Exercise: MS-1 (K. Chawl)	ms-1 to start exercising in about 5 minutes
007	03	34	00	Exercise: Unknown	The exercise will start next couple minutes
007	03	36	00	Water Dumps	setting up to do supply/waste water dump
007	03	41	00	Orbiter Systems	getting ready to deploy radiator (port side)
007	03	46	00	Water Dumps	water dump is in progress currently per the orbiter attitude and pointing page
007	03	59	00	Water Dumps	noticed on sams 1 display that KC started her exercise about 15 minutes ago
007	04	13	00	Unclassified/Other	MSCI ask PIMS support the depressure, low frequency, spike or hight frequency for the PAC.

007	04	19	00	Exercise: Unknown	AADSF asked for the water dump in flight note # 19, and the exercise still going on right now.
007	04	23	00	Thruster Activity	putting thruster L3L and R1U in low priority
007	04	24	00	Water Dumps	terminate waste water dump
007	04	39	00	Exercise: MS-1 (K. Chawl)	ms-1 exercise complete about 10 minutes ago
007	04	41	00	Exercise: Unknown	exercised end an dthe PEP processing will start soon and run 3 hours (glovebox experienc)
007	04	47	00	MGBX Operations	JSC CALLED AND CONFIRM THE BURN LOOK REAL GOOD
007	05	00	00	Thruster Activity	RCS trim burn occurred
007	05	01	22	Attitude/Maneuver	start maneuver OK'd by ground to crew
007	05	04	00	Thruster Activity	columbia houston - good burn
007	05	05	00	Ku/TDRSS/Communication	We will loose the KU band from 5:05 to 5:45, the last burn of the trim RCS was confirm very good.
007	05	21	00	Thruster Activity	back on venier now
007	05	21	00	Thruster Activity	re-select verniers for attitude control
007	05	25	31	Orbiter Systems	possible freon problem from JSC
007	05	25	00	Thruster Activity	IDGE ask may have a bad microgravity environ next two hours, PAC responded we were back to venier now.
007	05	37	00		MEPHISTO wants some g-jitter introduced into the mission (asking MSCI for some disturbances)
007	05	38	51		AADSF has completed the warmup and less than one half hour will go ahead with FO1
007	05	40	00	Data Observation	8.5 hz signal just scrolling off the sams1 one hour chart. Duration 5-10 minutes
007	05	43	00	Thruster Activity	problem already with some jets getting too cold in this attitude. Considering a deadband collapse again. Asking AADSF for implications to science if a maneuver is required. They have not started processing yet, but are getting close to starting, could
007	05	50	00	Attitude/Maneuver	POL ask if we pass the point for maneuver , AADSF can hold for another run after the manneuver done that way will not effect their run.
007	05	55	00	Ku/TDRSS/Communication	AOS AGAIN AND WE HAD A Ku band back now, and look like the one degree on ku band is not working, nd ku band will fully work again at 6:17
007	05	55	00	Thruster Activity	apparently just barely missing firing jets before the orbiter forces push the vehicle back to the center of the deadband
007	06	01	00	Experiment/Facility	MEPHISTO withdrew their request to operate their valve to cause a g-jitter marker in their sample. They were trying to work it in before AADSF sample insertion and while PEP was working.
007	06	01	00	Thruster Activity	collasped deadband, Los
007	06	01	00	Thruster Activity	collapsed the deadband to 0.3
007	06	10	00	Experiment/Facility	AADSF is translating sample now and is g-sensitive now.prefer to stay in attitude for the next 60 hours or so
007	06	45	00	Data Observation	AADSF asked about the jitter around 6:00 to 6:50, we do not see anything different compare with the previous plot
007	06	59	00	Thruster Activity	seems to be staying pretty much on one side of the deadband. Still having a lot of problems with keeping the thrusters warm enough
007	07	02	00	SPARTAN Operations	send EVA disturbances during the spartan deployed to pac
007	07	14	00	MGBX Operations	PEP glovebox activity continues
007	07	40	00	MGBX Operations	PEP processing right now, AADSF call pac to ask for the attitude less than 10 degree from the original plan to help their experience (?)
007	07	46	00	Thruster Activity	collapsing the dead band to 0.2 now. Really trying hard to save AADSF experiment time.
007	07	54	00	Thruster Activity	even at 0.2 the thruster is not firing enough

007	07	58	00	Thruster Activity	dap b selected. Collapsing the deadband to 0.1. back to dap a. 0.2 deadband not working
007	08	00	00	MGBX Operations	pol ask the glovebox to move slowly their video that way when they get back to the ground, the science team easy to see and indentified the particles.
007	08	15		Attitude/Maneuver	.AADSF ask for the same attitude right now but slighly change .25 degree and + 3 in yaw and pitch why you tell me
007	08	22	00	Unclassified/Other	PEP last run until 8:30, they should have an exercise start right now but I do not see anything on the displayed from sams1 yet, may be they wrap up the PEP run and will do the exercise.
007	08	27	00	Thruster Activity	changing the deadband to 0.8 now
007	08	29	00	MGBX Operations	sounds like PEP is complete. Stowing equipment once this experiment wraps up in the next several minutes
007	08	59	00	SAMS/OARE Issues	PAC asked for the AADSF location, like the transfer the OARE location to the AADSF location.
007	09	00	00		reckart on
007	09	10	00	Unclassified/Other	ended unsuccessful attempt to get the network situation corrected on the PIMS POCC computer over the phone with Kevin.
007	09	13	00	Attitude/Maneuver	PAC said that there will be an IMU align maneuver to be accomplished within one hour before WPI begins processing
007	09	19	00	Unclassified/Other	Truong off console, Gene Liberman take over
007	09	22	00	Unclassified/Other	mcpherson out
007	09	28	00	Unclassified/Other	Liberman on
007	09	29	00	Attitude/Maneuver	PAC reported that we were in free drift even though that was not called for at this time
007	09	30	00	Attitude/Maneuver	after a call from the ground, the crew changed back from free to auto in the attitude control
007	09	32	00	Unclassified/Other	MAWS can not get to the USMP4_requests/MAWS directory
007	09	36	00	Attitude/Maneuver	new attitude called up to crew: roll 152 pitch 224 yaw 16; get to that attitude as soon as possible; attitude in B1ALT; need primary drivers (does that mean PRCS?);
007	09	59	00	Attitude/Maneuver	PROBLEMS with the IMU resolver (???)
007	09	59	00	Thruster Activity	ground suspects a slow leak in a forward RCS - slow leak - they will secure the forward RCS
007	10	00	00	Experiment/Facility	checked with PAC - paylaods (AADSF, etc) are holding their ops for the thruster leaks - orbiter in ALTDAP control now
007	10	19	00	SAMS/OARE Issues	Processed OARE data file 07030001.oare
007	10	30	00	Orbiter Systems	PAC is requesting Circ pump activity, called Ken and was refered to the Hydraulic System of the MEDH and in turn passed this information on to PAC
007	10	40	00	SAMS/OARE Issues	Informed PAC that their grms vs. Frequency plots are now available
007	11	00	00	Experiment/Facility	delivered an ADAPT report to the CHeX team.
007	11	05	00	Attitude/Maneuver	POL: orbiter back on vernier control now
007	11	13	00	Unclassified/Other	Listened to SOPG on loops
007	11	22	00	Orbiter Systems	talk about opening all the forward the RCS
007	11	25	00	Unclassified/Other	SOPG (late getting there)
007	11	39	58	Thruster Activity	start deadband collapse
007	11	50	00	SAMS/OARE Issues	plotted user request #53 for CHeX
007	12	00	00	Attitude/Maneuver	PAC wants to bump up the maneuver rate (the speed from one attitude to another) from .008 to .016
007	14	52	00	PAO	CNN PAO event begins
007	16	28	00	SAMS/OARE Issues	processed OARE data files 07060001.oare and 07090001.oare
007	17	00	00	Unclassified/Other	Nissim on console
007	17	00	00		Reckart off console

007	17	00	00	Unclassified/Other	Moskowitz starting new logbook.
007	17	26	45	Ku/TDRSS/Communication	They're going to do a Ku-reposition shortly.
007	17	30	00	Unclassified/Other	liberman off console
007	17	40	40	Attitude/Maneuver	They're mentioning that they can go up to 0.02 (degrees/sec) for rotation rates for burns. I don't think they ARE doing this now, but they're saying that they COULD.
007	18	15	00	Data Observation	And that 37 Hz signal has been dipping again. I think I'm going to try to pull a 6-hour spectrogram from sometime yesterday (using MSFC data), and perhaps submit a flight note, or at least look closely at this thing.
007	18	18	30	Attitude/Maneuver	They're going to do a deadband collapse in like 4-5 mins.
007	18	19	40	Attitude/Maneuver	GO for deadband collapse at this time.
007	18	38	00	Unclassified/Other	Heading over to SOPG
007	18	45	00	Unclassified/Other	DeLombard at POCC
007	18	45	00	Unclassified/Other	SOPG special time for Thanksgiving; points raised during SOPG: continued concern of Lipa about 17 Hz; good attitude for AADSF/Alex concurred by L. French/MAWS; PIMS has been asked for past mission
007	19	06	00	Thruster Activity	Ready for deadband collaps
007	19	08	03	Thruster Activity	Deadband collapsed
007	19	09	01	Ku/TDRSS/Communication	5min to hand over.
007	19	10	00	SAMS/OARE Issues	Processed OARE data file ore00712.00 (007/12-007/15)
007	19	25	00	Attitude/Maneuver	Roll firing now
007	20	42	00	Ku/TDRSS/Communication	I noticed a strong variation in the 17 Hz signal after an LOS; MET: ~007/20:20
007	20	43	00	Data Observation	Dick called to ask I note that the SAMS-2 display showed a very loud Ku-antenna a little bit ago. I made a screen print.
007	21	04	00	Attitude/Maneuver	Roll firing in few min.
007	22	14	38	Water Dumps	No water dump is planed while in the AADSF attitude
007	22	14	00	Water Dumps	Talk on PRIME-OPS: no water dumps planned at this time for this attitude.
007	22	40	00	Unclassified/Other	DeLombard on console.
007	23	00	00	Unclassified/Other	Nissim off console
007	23	44	00	Thruster Activity	TALKING about changing jet selection to help with cold jets
007	23	45	00	Unclassified/Other	Melissa came on shift at aboutd MET 007/23:15
007	23	56	40	Attitude/Maneuver	Deadband collapse command sent.
008	00	00	00	Thruster Activity	talk that they are collapsing the deadband (maybe not right now though)
008	00	00	00	Unclassified/Other	Black on Console. No hand-off. Liberman went home sick last night and did not work full DAS shift. Reckart handled shift alone.
008	00	15	00	Unclassified/Other	DeLombard off console to return home.
008	00	41	00	Orbiter Systems	A little bit ago, the PSE came-up with some times for Circ pump operations on this mission. The times he gave:
008	00	43	00	SAMS/OARE Issues	Working on producing plots from these above periods. For the second period, there seems to be some oddity with the data we're getting back from LabVIEW's processing of both the MSFC and PIMS merged data for Unit F. I'm asking for 15 minutes of data from
008	00	59	00	Orbiter Systems	circulation pump operation times for three intervals: GMT times start stop 330 / 15:12:53 15:35:50 330 / 22:55:39 23:01:28 331 / 09:53:24 10:27:52
008	01	29	00	Thruster Activity	collapse deadband

008	01	29	00	Crew Disturbances	post sleep in about 30 minutes (okay, I haven't written anything, so I figured it was about time) and this was a really cheap excuse to use the crew disturbance selection in the classification section
008	01	33	00		rogers off console
008	01	44	00	Attitude/Maneuver	Truong on console, we just had a yaw and roll fire same time
008	01	52	50	Unclassified/Other	Moskowitz logging-out
008	02	00	00		mcpherson on
008	02	41	00	PAO	Set up the Presidential call to congratulation the crew at 4: 30
008	03	04	00	Exercise: Unknown	exercise started about 20 minutes ago. Most likely the CDR
008	03	15	00	Exercise: Unknown	exercise is complete
008	03	18	16	Exercise: Unknown	Exercises end right now .
008	03	20	00	Exercise: Unknown	exercise has started again
008	03	24	40	Exercise: Unknown	Exercise start back again now
008	03	35	00	Thruster Activity	talking about the first deadband collapse of the evening. L5L getting cold again
008	03	51	00	Exercise: Unknown	EXERCISE stop and another crew member jump right back again, look like their are boring up there too.
008	03	52	00	Exercise: Unknown	possible exercise end with another period starting immediately afterward (within a couple of minutes)
008	04	19	00	Exercise: Unknown	MSCI and PAC called to requested the exercises impact and on the 3 circe pumps(?), the exercises is end
008	04	34	00	Orbiter Systems	discussion of elevon float issue. Circulation pumps will come on to drive the elevons to a stable position. They do not actually float but go to a "stable position"
008	05	05	00	MGBX Operations	problem with WCI initialization. Software crashed on start up. Restarting the system. Re-booting the entire PGSE
008	06	09	00	SPARTAN Operations	discussions with SPARTAN. Possibly considering a second SPARTAN deploy. Talks at this time considering the use of propellant during whatever operations are performed
008	06	21	00	Orbiter Systems	the action to pursue the elevon issue looks like it is dead. Discussion over the flight director loop sounds like this will not be done. Small venting events flushing the WCO's, fuel cell purge. Sounds like the plan will be to continue the deadband col
008	06	42	00	MGBX Operations	very quiet on the loops. Some WCI activity in the glovebox area but that's about it
008	06	51	00	Ku/TDRSS/Communication	ku band intensification period following a short LOS period
008	06	59	00	SAMS/OARE Issues	finished circ pump analysis. All results on the web. Just in time for them to say they don't need the analysis
008	07	00	00	SPARTAN Operations	Debate on whether to deploy the spartan again on Monday next week for 6 hours operation, 1000feet, infront and behind the orbital if the orbital still has enough fuel..
008	07	10	00	Unclassified/Other	Exercise period still same as plan eventhough glovebox try to squeeze another run for the WCI
008	07	10	00	SPARTAN Operations	spartan re-deploy being considered on flight day 15
008	07	12	00	MGBX Operations	WCI operations continue. Starting to process a new sample at 008/07:33
008	07	13	00	Unclassified/Other	Chex microgravity environment will be same for the next four days
008	07	13	00	Experiment/Facility	CHeX hyper-sensitive period has begun and will last for the next 4 days
008	07	39	00	Thruster Activity	last deadband collapse about 5 minutes ago resulting in a lot thruster firings and therefore a lot of propellant
008	08	00	00	Unclassified/Other	PI happy with all the run for their glovebox experiments.
008	08	11	00	MGBX Operations	WCI operations continue. Not much else going on
008	08	34	00	Experiment/Facility	trouble during SOLSE activity. Cannot power up?? Power cycle PGSE with SOLSE
008	08	40	00	Unclassified/Other	Look over the PI requested (64), most o fthem from chex and AADSF

008	09	00	00	Unclassified/Other	mcpherson off
008	15	00	00	Crew Disturbances	Crew is in pre-sleep.
008	15	10	00	Experiment/Facility	MSCI called about a possible disturbance at 008/14:45:43 which CHeX was asking about. I did not see anything in the data and tryed to call MSCI with no success
008	15	25	00	Experiment/Facility	the disturbance in CHeX data seems to have been due to a heater shut off. They will try to confirm this the during the next scheduled shut off
008	16	03	00	PAO	PAO event from middeck of Columbia
008	16	50	00	SAMS/OARE Issues	processed OARE data files 08090002.oare and 08060002.oare
008	17	00	00	Unclassified/Other	Moskowitz in -- New logbook started.
008	18	00	50	Exercise: Unknown	They just voiced-up to the crew to please avoid exercise during the MEPHISTO runs. The crew thanked the ground for letting them know, and then mentioned something about trying to get in exercise early, when they can.
008	19	00	00	Crew Disturbances	Crew is in sleep period.
008	19	26	00	SAMS/OARE Issues	AADSF called to get help in seeing SAMS 1 data. Milton instructed them to re-load the file and the problem was corrected.
008	22	53	00	SAMS/OARE Issues	MSCI calling on their loop to tell the science teams that they are looking for a time in the next 4 hours to shut down SAMS-2 for about 10 minutes. 009/01:08-009/01:18; 009/02:45-009/02:55 are two windows provided by CHeX as good for them. CHeX wants s
008	22	53	00	SAMS/OARE Issues	MSCI giving everyone a heads-up: they're looking for a time in the next 4 hours or so to try to cycle SAMS off. They want to test for the possibility of energy being input to the CHeX unit due to fans, etc on the MPESS. This is to help CHeX identify a h
008	23	00	00	SAMS/OARE Issues	MSCI, POL and Chex held a discussion. Chex is interested in turning off SAMs for a ten minute period during day 9, hour 01:08 or 02:45 to see the impact on their science.
008	23	38	52	SAMS/OARE Issues	Discussed turning off SAMS 1 & 2 units. Explained this is a characterization exercise and not intended to point fingers.
008	23	38	12	SAMS/OARE Issues	AADSF called to ask why we haven't gotten OARE data files in a bit... Have to call to check on this.
008	23	42	02	SAMS/OARE Issues	SAMS contacted MSCI to inform them that it would take twenty minutes to receive SAMS data, after it is turned back on again.
008	23	49	15	SAMS/OARE Issues	SAMS said they would send the stop data record command ahead of other turn-off commands.
009	00	07	40	SAMS/OARE Issues	Just asked SAMS for a definate time about power-off. The plan is:
009	00	08	30	SAMS/OARE Issues	SAMS 1 & 2 is scheduled to turn off at 009/01:05. Stop data record command will be given at 009/01:03. Power On at 009/01:15 and recording will resume at 009/01:35.
009	00	40	00	Thruster Activity	go for deadband collapse; looking at the SAMS-1 display following this call, there appears to be an increase in thruster activity (surprise, surprise, surprise)
009	01	05	00	SAMS/OARE Issues	SAMS told they may proceed with turning record off then the units. They go ahead.
009	01	07	20	SAMS/OARE Issues	SAMS done with turning off recorders and will proceed with power off.
009	01	07	19	SAMS/OARE Issues	GO to turn off power
009	01	08	00	SAMS/OARE Issues	and I think we're off
009	01	12	19	SAMS/OARE Issues	McPherson logbook. Per loops from SAMS: 009/01:07:xx was when they turned-off recording (Jeff didn't get the seconds)
009	01	18	02	SAMS/OARE Issues	CHeX gave POL okay to turn SAMS back on at 009/01:19
009	01	20	55	SAMS/OARE Issues	POL/PSE calls that SAMS is back on; SAMS needs to reconfigure/command various setting
009	01	20	00	SAMS/OARE Issues	POL wants to turn SAMS on

009	01	21	00	SAMS/OARE Issues	K2 & K3 are back on. SAMS is given instructions to power-up.
009	01	21	00	SAMS/OARE Issues	SAMS powered back on. Cleared by PSE to send any necessary configuration commands
009	01	22	00	SAMS/OARE Issues	Lipa came by to say that they didn't see any change when SAMS was off
009	01	23	00	SAMS/OARE Issues	SAMS doesn't expect solid data for at least 5 minutes while they initialize
009	01	23	35	SAMS/OARE Issues	SAMS is going through configuration/testing. Data is not stable yet. SAMS said it will take at least five minutes to stablize.
009	01	23	10	SAMS/OARE Issues	SAMS 1 time information appears to be updating correctly
009	01	23	40	SAMS/OARE Issues	SAMS 2 time information appears to be updating correctly
009	01	24	40	SAMS/OARE Issues	data is somewhat intermittent for both units. SAMS told PSE this is expected for about the first 5 minutes of operation
009	01	27	13	SAMS/OARE Issues	SAMS 2 is back up and nominal, per SAMS.
009	01	28	00	SAMS/OARE Issues	SAMS 1 is back up and nominal, per SAMS.
009	01	28	00	SAMS/OARE Issues	SAMS 1 time is not updating at all. SAMS 2 time information is okay
009	01	29	22	SAMS/OARE Issues	both are updating again, but neither is displaying the correct MET time information yet
009	01	30	00	SAMS/OARE Issues	PIMS notices a bit of a MET time lag on both SAMS 1 & 2. SAMS says there will be a lag until the unit gets fully up.
009	01	30	00	SAMS/OARE Issues	Truong on console, PIMS/POCC called to inform us no effect on chex when SAMS Unit turn it off for 10 minutes.
009	01	30	17	SAMS/OARE Issues	SAMS call to PSE. Back up and nominal. Recording back on for SAMS 2 at 009/01:27:13 and SAMS 1 and 009/01:28
009	01	31	00	SAMS/OARE Issues	SAMS-2 record on 009/01:27:13 SAMS-1 record on 009/01:28
009	01	34	00	SAMS/OARE Issues	SAMS1 and SAMS2 display times are still lagging. Call to SAMS this is expected and will take a little while to catch up. SAMS2 about 15 seconds behind, SAMS1 display about 65 seconds behind
009	02	10	00	Thruster Activity	deadband collapse
009	02	59	00	Unclassified/Other	back from the SOPG meeting
009	03	18	00	Data Observation	crew activity apparent on the SAMS 1 display. Activity started about 30 minutes ago. Generally 'noisier' plot after the crew activity started
009	03	25	17	Unclassified/Other	Process request for Chex up to 8/18:00:00
009	03	29	49	Thruster Activity	go for deadband collapse; increase firings on SAMS-1
009	04	09	00	Unclassified/Other	Rogers off console
009	04	31	00	Experiment/Facility	update from melissa. Actually the chex affect from sams turn off was 1/3 of the effect from the ICT conducted on the ground and was about 4 times the effect observed when the Ku band was turned off
009	04	32	00	Unclassified/Other	PIMS/POCC called and off console for the day
009	04	41	00	Thruster Activity	collapsed dead band, jet warm again, open deadband again
009	04	42	00	Unclassified/Other	JSC discussed about the exercise with MSFC
009	05	00	00	Unclassified/Other	Pac called pims to asked about the limit 10e-3 to 10-e-4, PiS will be going to generate the time line will given from PAC to verify it (6/4:00 to 6/4:30:00
009	05	00	00	Exercise: Unknown	discussion about exercise implications vs nominal glovebox operations. CDR stated he thought exercise was less than the nominal banging around during glovebox operations. MPAC requested comparison plot for this mission, exercise vs nominal glovebox. Wi
009	05	11	00	Water Dumps	Plan to move the water twice a day to minize the level of water, see 10 hz display on the SAMS 2 but was not shown in the SAMS 1
009	05	37	00	Data Observation	broad disturbance at around 10 Hz for the past 15 minutes. Currently conducting preps in the glovebox for ELF. Does not

					seem to be present on the SAMS1 display
009	05	42	00	Exercise: Unknown	Called down for exercise
009	06	01	00	Flight Note/OMIS	submitted flight note 33 regarding the comparison of glovebox and exercise operations
009	06	15	00	PAO	PAO event. Several interviews with various news stations across the country
009	06	40	00	Ku/TDRSS/Communication	Next 45 minutes will not have any com
009	06	51	00	Ku/TDRSS/Communication	potential for 45 minute LOS period coming up (actually LOS plus poor com). Concern with deadband collapse, ability to keep jets warm while in the LOS period
009	06	55	00	Thruster Activity	dapt will start at 7:20, needed deadband collapsed
009	07	15	00	Unclassified/Other	Chex experience will last until met 13
009	07	20	00	Thruster Activity	currently LOS but prior to entering LOS deadband collapse requested at this time for 3 minutes duration
009	07	54	00	Ku/TDRSS/Communication	back AOS with good data again. Outage was about 50 minutes
009	07	55	00	MGBX Operations	all steps of scenario a being executed. ELF operations ongoing
009	08	05	00	SAMS/OARE Issues	processed oare data files 08180002.oare,08210002.oare, and 09000538.oare
009	13	30	00	Exercise: Unknown	exercise will not occur as scheduled in MEPHISTO OCR #20, it will revert back to the origional timelines schedule
009	17	21	00	Orbiter Systems	Fuel cell purge coming up ?
009	17	35	30	Thruster Activity	Deadband collapse.
009	17	37	55	Orbiter Systems	Fuel cell purge complete.
009	17	50	00	Unclassified/Other	Black on console. Replaced Liberman.
009	18	12	00	Data Observation	MSCI called PIMS to confirm that during exercise (referencing flight note 33), we are getting two to three times the root, mean, square (RMS) level. Ken confirmed.
009	18	14	00	Exercise: Unknown	MSCI called to confirm that difference between RMS acceleration levels for with and without exercise was ballpark 2 to 3 times (see flight note PIMS-033).
009	18	24	00	Thruster Activity	Deadband collapse.
009	19	11	00	Ku/TDRSS/Communication	Ku-antenna reposition coming up at ??
009	19	15	00	Crew Disturbances	Crew is sleeping. They did not exercise as shown in the time-line.
009	19	20	00	Orbiter Systems	FCS checkout tentatively on flight day 16
009	19	48	00	Thruster Activity	Deadband collapse.
009	19	54	00	Experiment/Facility	IDGE called POL that they may have survived the deadband collapse.
009	20	08	00	Crew Disturbances	Crew is into sleep, no exercise seen on my shift so far.
009	20	36	30	SPARTAN Operations	There may be a re-deploy of the SPARTAN satellite. Plans will be announced no sooner than Monday 12/1/97, following meeting discussing the matter.
009	20	36	15	Thruster Activity	Deadband collapse.
009	20	40	00	Unclassified/Other	Completed AADSF request #69.
009	20	44	20	Thruster Activity	Expand deadband.
009	20	50	00	Unclassified/Other	Rogers on console
009	21	18	00	Thruster Activity	go for deadband collapse
009	21	18	00	Thruster Activity	Deadband collapse.
009	21	23	00	Unclassified/Other	MEPHISTO rep (Gil) came by asking about acceleration levels during ALT-DAP. I pulled two flight notes for him which he went to look for in their files. I also explained to him the going to ALT-DAP meant a change to the DAP which meant

					that PRCS would be
009	21	24	00	Thruster Activity	Expand deadband.
009	21	46	00	Thruster Activity	No ALT DAP before 12/12:00?
009	21	48	00	Data Observation	A significant 12 hz disturbance started on SAMS 2 around 009/21:54. It starts at 5 _ hz and rises to 12 hz. According to the FD10 Replanned Time line, NaSBE was just beginning Phase IV of their experiment. Ken contacted PSE for further time line activi
009	21	50	00	Data Observation	Thruster firings noted on SAMS 1.
009	21	53	49	Thruster Activity	go for another deadband collapse (to A3), and look at all that activity on SAMS-1
009	21	53	44	Thruster Activity	Deadband collapse.
009	21	58	29	Thruster Activity	go to open up the deadband
009	21	58	33	Thruster Activity	Expand deadband.
009	22	02	00	Unknown Signal	Noticed a strong ~5.5 Hz signal starting about 10 minutes ago on SAMS 2 spectrogram. SAMS 1 Nyquist spectrogram shows tail-end of this disturbance ending at about 09/21:12 or so.
009	22	24	30	Thruster Activity	back to A12
009	22	24	00	Thruster Activity	Deadband collapse.
009	22	28	20	Thruster Activity	Expand deadband.
009	22	40	35	SAMS/OARE Issues	MAWS called and requested an OARE plot for the last couple days, any time slice is fine. Ken will produce a comparison plot for them.
009	22	40	00	SAMS/OARE Issues	MAWS called looking for MAWS/OARE comparison plot.
009	22	46	00	Unclassified/Other	just finished talking to Dave Dooling about OARE and PIMS
009	22	54	20	Thruster Activity	deadband collapse
009	22	54	20	Thruster Activity	Deadband collapse.
009	22	58	45	Thruster Activity	expand deadband
009	22	58	45	Thruster Activity	Expand deadband.
009	23	03	00	Unknown Signal	Called PSE to see if they showed any experiment or Orbiter systems startup at about MET 09/21:54 or so for tracking down unknown 12 Hz disturbance (with significant harmonics). He did not show anything, but said he'd call JSC to check with them. See ht
009	23	30	00	Thruster Activity	Deadband collapse. [I think someone is trying to set a deadband collapse/expand record].
009	23	33	37	Thruster Activity	Expand deadband.
010	00	01	00	Unknown Signal	Saw unknown 12 Hz disturbance pop up again. See http://max.lerc.nasa.gov/USMP4_requests/screenprint/009_23_53_12.jpg. It appears that ~12 Hz is fundamental and 5.5 Hz is alias.
010	00	15	00	Thruster Activity	Deadband collapse.
010	00	24	00	Thruster Activity	Expand deadband.
010	00	41	00	Unknown Signal	PSE called to say JSC only had deadband collapse in their logs for MET 09/21:54 onset time of ~ 12 Hz disturbance we had inquired about.
010	00	54	00	Unclassified/Other	Completed CHeX request #71.
010	00	59	46	Unclassified/Other	Submitted science shift report with about 14 seconds to spare.
010	01	05	00	Unclassified/Other	McPherson on console

010	01	15	00	Unclassified/Other	Hrovat out
010	01	40	00	Data Observation	8.5 hz disturbance present on both displays. Started about 15 minutes ago lasting about 5 minutes
010	01	49	20	SAMS/OARE Issues	AADSF called and talked with Kevin about MAWS/OARE data.
010	01	53	36	Thruster Activity	go for another deadband collapse (I didn't log the last few of these)
010	01	53	54	Unclassified/Other	Melissa called to say she is going to the SOPG and will be off console until after the meeting.
010	02	48	00	Thruster Activity	open the deadband
010	04	13	00	Experiment/Facility	AADSF attitude is -ZLV/+XVV, MEPHISTO -XLV/+ZVV
010	04	26	00	Experiment/Facility	big conference on prime ops loop regarding spartan redeploy, effect on AADSF science and usmp science. In order to do redeploy, need to save propellant. Given the prop situation, extending the mission by a day is NOT an option. In order to do the re-de
010	04	42	00	Exercise: CDR (K. Kregel)	exercise is currently in progress, approaching 40 minutes of exercise. This crew does not seem to follow at all the timelines for when exercise is scheduled. Possibly CDR exercising
010	04	45	00	Thruster Activity	13 deadband collapses during the past crew sleep period
010	04	53	00	Experiment/Facility	decided to move AADSF operations up by one day. Need to be in AADSF attitude by 10/21:00. Need to start commanding the furnace by 10/07:30. May need a trim burn to get to the proper altitude
010	04	55	00	Exercise: CDR (K. Kregel)	CDR exercise complete
010	04	57	00	Attitude/Maneuver	preparing for maneuver to MEPHISTO attitude in about 10 minutes
010	05	03	00	Exercise: PLT (S. Lindsey)	another exercise period just started 3-5 minutes ago
010	05	07	00	Orbiter Systems	will need starboard radiator deployed for the AADSF attitude scheduled to start at 010/21:00
010	05	08	20	Attitude/Maneuver	maneuvering to MEPHISTO attitude
010	05	15	00	Experiment/Facility	potential problem with hot fire of jet during the middle of AADSF activities, specifically the 16 hour run for F2B. AADSF stated hot fire could be done during solutal diffusion. The critical time is during the beginning of the sample processing period
010	05	22	00	Attitude/Maneuver	MEPHISTO maneuver will conclude at 010/06:37
010	05	29	00	SAMS/OARE Issues	problem with MAWS files 08-20.oar and 08-20.aad. 2 records in this file had **** data instead of numeric data. This caused the offline processor to stop. Deleted these lines and re-saved the data. No problem. Also, reprogrammed maws/oare plots to use
010	05	53	00	Exercise: PLT (S. Lindsey)	back from LOS and PLT exercise has stopped
010	06	10	00	Data Observation	another 8.5 hz disturbance in the data. Noticed that the 8.5 hz disturbance really makes the period noisier, excites structural modes, etc.
010	06	33	00	MGBX Operations	preparing for glovebox turn on and PEP preparations. Need to monitor glovebox temperatures during operations, 45 C is the temperature threshold
010	06	39	00	Attitude/Maneuver	achieved MEPHISTO attitude
010	06	46	00	Data Observation	fairly constant 8.5 hz signal for the last half hour. Not as intense as the short duration 8.5 occurences but on for about 30 minutes.
010	06	47	00	Exercise: MS-1 (K. Chawl)	exercise started for ms-1
010	06	56	00	Data Observation	that 8.5 hz long duration disturbance ended about 8 minutes ago
010	06	56	00	Unclassified/Other	go for IMU alignment
010	07	03	00	Exercise: MS-1 (K. Chawl)	exercise complete. Short. Erratic. MS-1

010	07	15	00	Exercise: Unknown	looks like a another exercise period starting
010	07	43	00	Exercise: Unknown	exercise ended about 10 minutes ago
010	07	48	00	MGBX Operations	glovebox operations continue
010	07	50	00	SPARTAN Operations	latest in the spartan re-deploy saga. Current plan being discussed usmp through day 13, deploy day 14, retrieve day 15, land day 16. Also considering usmp through day 12, deploy 13, retrieve day 14, usmp day 15, land day 16
010	08	10	00	Data Observation	looks like another less intense 8.5 hz disturbance is starting on sams 1 display
010	08	13	00	Data Observation	just noticed a 25 hz or so disturbance lasting about 3-4 minutes ending about 3 minutes ago
010	08	45	00		mcpherson out
010	09	00	00	Unclassified/Other	Moskowitz starting new logbook.
010	09	40	00	Experiment/Facility	Call on the loop from AADSF to the MSCI: they're furnace stopped translating, and they're looking into the problem. Perhaps we'll see some stop/start effect from the translation? (Probably not, but...)
010	10	08	08	Experiment/Facility	AADSF call to MSCI: cycling the power worked, and the furnace is now translating again.
010	12	25	00	Unclassified/Other	Shift report submitted for MET 010/00 - 010/12.
010	14	04	00	Unclassified/Other	Now having the RIP SOPG on the Sci-Conf loop.
010	14	52	00	Orbiter Systems	They voiced-up a Starboard Radiator Deploy, to be done at MET 010/21:00
010	14	53	30	Attitude/Maneuver	Maneuver for AADSF planned for MET 010/19:45
010	15	15	00	MGBX Operations	They just told K.C. to keep an eye on the temperature (in the MGBX?), and if it gets too high, to turn on ACC-1 (one of the MGBX fans?). So, there could be MGBX fan activity in the near future... maybe.
010	16	05	00	MGBX Operations	Talk on the loop - they never had to turn the fan on, because the temperature never got above their threshold.
010	17	21	20	Exercise: Unknown	Hrovat logbook. Exercise started about 5 minutes ago or so. Called ELF at x9576 to tell them this (from yesterday's handover), but no answer.
010	17	24	55	Thruster Activity	Go to DAP B so that F5L jet will fire.
010	17	27	00	Thruster Activity	Want DAP B5, not B11 – going to B11.
010	17	33	53	Thruster Activity	Expand deadband (back to DAP A).
010	17	53	00	Thruster Activity	DAP B5 for deadband collapse.
010	17	56	00	Exercise: Unknown	Exercise ended [for now?], still no answer at ELF phone.
010	17	58	00	Thruster Activity	Expand deadband (back to DAP A).
010	18	00	00	Unclassified/Other	Black on console. No DAS on prior night shift. Milton Moskowitz worked the PIS shift alone.
010	18	05	00	Exercise: Unknown	It appears that the crew has finished exercise. SAMS 1 data disturbance flowing in the 1 hz to 2 hz levels has stopped.
010	18	10	00	SAMS/OARE Issues	Received OARE Mass Properties Update and entered the new center of gravity data into the OARE system.
010	18	14	45	Water Dumps	Go to terminate supply dump at 10/18:15
010	18	15	50	Water Dumps	JSC sees supply dump terminated.
010	18	23	30	SAMS/OARE Issues	Entered new Orbiter CG location on map2exp.vi
010	18	29	00	Ku/TDRSS/Communication	Abrupt Ku-band antenna dither intensification a few minutes ago.
010	18	40	00	Crew Disturbances	Crew did not exercise further. SAMS data is quiet. The crew is in a pre-sleep period.
010	18	44	00	Attitude/Maneuver	Maneuver at 10/19:45?
010	19	46	00	Attitude/Maneuver	Maneuvering for AADSF attitude, will be there in about an hour.
010	19	47	00	Experiment/Facility	Attempted doing IDGE request #74, but offline data [not available?]. Suggested to IDGE that alternative is MEWS for thruster firing times. Will wait for e-mail reply.

010	20	00	00	Unclassified/Other	Rogers on console
010	20	09	00	Ku/TDRSS/Communication	“Upcoming is good ZOE for cable repositioning.”
010	20	18	00	Ku/TDRSS/Communication	Out of ZOE, so assume cable reposition is complete?
010	20	26	25	Orbiter Systems	Waiting for starboard radiator deploy [when?]
010	20	30	40	Exercise: Unknown	MSCI asked the crew to not do exercise during the first hour of post-sleep, until AADSF is complete with their experiment.
010	20	41	00	Unclassified/Other	current orbit: 151.9 x 147.9; FIDO predicts as of 10/05 close (151.9 x 148.1); based on that, FIDOs predicts at end of AA processing will be at 151.5 x 146.6 (below USMP window but within eccentricity
010	22	08	00	Attitude/Maneuver	people keep asking about this on the loops, so I’ll put in here just in case it didn’t get in the other logbooks: maneuver to AA attitude began at 010/19:45 and Columbia was in attitude at 010/20:45
010	23	40	41	SPARTAN Operations	POL: “No SPARTAN deploy for rest of mission.”
010	23	44	00	Experiment/Facility	JSC FLT director traffic: “AADSF has lost furnace control (thermocouple problem). They will configure for reentry upon cool-down. AADSF has effectively terminated science operations for remainder of mission.”
010	23	53	00	Unknown Signal	8.5 Hz start
010	28	00	00	Unknown Signal	8.5 Hz end (times estimates from SAMS-1 displays)
011	00	15	00	Unclassified/Other	MSCI called to ask for PIMS plan for remainder of mission now that AADSF has terminated science ops. Not sure what this means, Melissa said she’d call with details.
011	00	16	00	Unclassified/Other	Mission Scientist said AADSF has completed operations. He requested PIMS submit a replan for the rest of the mission and bring it to the SOPG. Melissa will do this and attend the SOPG.
011	00	25	20	Exercise: Unknown	The next crew exercise is: Day 011/07:00
011	03	15	00	Data Observation	noticed 37-38 hz disturbance dipped in frequency to about 35-36 hz then returned to original level. Happened about 15 minutes ago
011	03	17	00	Data Observation	2 minute duration disturbance on sams 2 display at about 15 hz.
011	06	45	00	Exercise: Unknown	Excercise started
011	07	24	00	Experiment/Facility	AADSF is ready for deactivation
011	08	38	00	PAO	Moskowitz in. Three people (Kregel, Scott, Leonid) are having a PAO event.
011	08	56	44	Attitude/Maneuver	Talk on PRIME-OPS, that on Flight day 12, they will NOT go to the “cold” attitude. Don’t know what this attitude is, but we’re not going to it! But there is a time in the future (MET day 013 I think I heard), that they’ll be going out of the MEPHISTO at
011	09	26	50	Unknown Signal	The SAMS-2 color spectrogram shows the turn-off of a 34 and 84 Hz (frequencies are approximate, as they’re hard to read-off) lone that was constant-frequency earlier in the spectrogram plot. The signal turn-off time looks kind-of like MET 011/09:15 or so
011	09	31	32	Unknown Signal	Sometime during the LOS around MET 011/09:00, there appears to be a 103-105 Hz signal which started-up in the SAMS-2 Nyquist color spectrogram. I say it “appears to have started” during the LOS because it didn’t exist before, but DID exist after. If we
011	09	37	38	Unknown Signal	And another unknown signal! This time, the SAMS-1 display. There is a 21 Hz signal which was on, then went away, and then came back between MET 011/08:30 - 011/09:30. It may have gone away either very close to the LOS period, or during the LOS period.
011	09	41	00	Unclassified/Other	Gene Liberman off console
011	09	50	00		Reckart on console

011	09	55	00	MGBX Operations	PEP just called to ask to see if we've seen any unusual jitters during their run (the past _ hour or so). I didn't see anything unusual in either SAMS-1 or SAMS-2.
011	10	08	30	Unclassified/Other	PEP just called again to ask if we could get more recent OARE data (like the last hour or so), and then asked about which SAMS unit was better for them to use. I explained that OARE data isn't real-time, and the SAMS units are probably not very indicativ
011	11	23	00	MGBX Operations	PSE called and said the glovebox disturbance in the OARE data was also apparent at 010/08/40
011	11	23	39	MGBX Operations	PSE called again. He said that the MGBX folks noticed a similar disturbance to the one they're currently seeing around MET 010/08:40. Working on a plot to FAX to the MGBX folks. Putting the plot with request #78. PEP called back and let us know that t
011	11	27	00	MGBX Operations	PSE was informed that the glovebox disturbance was only a momentary disturbance which could have been a thruster firing
011	12	10	00	Attitude/Maneuver	According to PAC, there was a maneuver around MET 011/06:30, and I guess this is the cause for the shift in OARE levels in our most recent plot.
011	12	49	52	Unclassified/Other	Submitted shift report.
011	14	31	50	Attitude/Maneuver	The trim burn will be at MET 011/19:53. They'll maneuver to the burn, and then back to the GG attitude.
011	14	49	18	PAO	Doing a PAO from the middeck (with Leonid)
011	18	11	00	Attitude/Maneuver	"MET 11/19:53 trim burn is still on."
011	18	19	00	Attitude/Maneuver	Maneuver to MEPHISTO attitude after upcoming trim burn.
011	18	34	00	Experiment/Facility	ELF science ops complete. Beginning ELF stow now.
011	18	50	00	PAO	Ukranian Education PAO event coming up from MET 11/18:55 to 11/19:25.
011	18	55	49	PAO	PAO event starting now.
011	19	32	00	Attitude/Maneuver	Upcoming maneuver should take 15 minutes.
011	19	41	00	Water Dumps	Upcoming supply water dump duration 1 hour 40 minutes starting at MET 11/20:00
011	19	42	00	Data Observation	At about MET 11/19:40 or so on SAMS 2 display, noticed a DC shift (downward on CheX X-axis) for a couple [few?] minutes.
011	19	58	00	Attitude/Maneuver	Noticed DC shift a few minutes ago on SAMS 1 display on Orbiter structural X- and Z-axes (pitch maneuver).
011	19	58	35	Attitude/Maneuver	"Flight, Prop, we're burning".
011	20	00	00	Attitude/Maneuver	Burn to go from -XLV/+ZVV to MEPHISTO attitude at about 11/19:00 clearly seen on both SAMS1 and SAMS2 data. Gene printed the screen on both and filed the data. We will do a flight note on these as soon as the off-line data becomes available.
011	20	03	44	Water Dumps	JSC sees crew initiating water dump.
011	20	07	33	Ku/TDRSS/Communication	Go to do Ku-band antenna cable reposition during upcoming ZOE.
011	20	20	00	Unknown Signal	8.5 Hz unknown visible on SAMS 1 display.
011	21	34	25	Water Dumps	Venting from water dump resulting in F5L getting cool, go to terminate water dump now so as to avoid LOS delay of call up to terminate water dump.
011	21	34	00	Water Dumps	Houston gave Columbia a "go" to terminate supply water dump at this time.
011	21	35	12	Water Dumps	"Vent valve is closed."
011	21	52	00	Unclassified/Other	Processed CHeX request 54-26 PSD plot.
011	21	54	36	Crew Disturbances	Crew going to sleep after answering one internet question.
011	23	15	00	Unclassified/Other	Called MEPHISTO to see what their request was for SAMS data. Henry had a little trouble earlier with web page submittal

					of request. All that we received was one ASCII character in the e-mail (a square – the ASCII character, not Henry). Henry was not in
012	00	25	00	Experiment/Facility	Completed MEPHISTO Request 81, with K. Hrovat's help. Ken faxed the data plots to MEPHISTO.
012	00	47	00	Attitude/Maneuver	Stay in MEPHISTO attitude until [12/14:30? and go to LHP attitude].
012	04	40	00	Experiment/Facility	talked to PAC about RR for turnoff sequence. She thought most experiments would already be powered off, only IDGE requires switch throw. Normally no call down by crew, but we can ask for call down in the RR. AADSF is already powered off, MEPHISTO will
012	04	45	00	Experiment/Facility	discussed with CHeX their power off sequence. They are out of helium at this point, will continue to run however as long as they can. John Lipa said they do require astronaut support for turn off
012	05	20	00	Crew Disturbances	quiet, crew sleep submit the replan request to MSFC from PIMS
012	05	30	00	Ku/TDRSS/Communication	they are handling the tdrss very good right now.
012	05	30	00	Experiment/Facility	submitted replan request PIMS-001 asking that the turn off sequence for the various experiments be modified so that SAMS is turned off last and IDGE is turned off first. Asked for 5 minutes between each experiment turn off
012	06	07	00	Exercise: Unknown	crew has been okayed to exercise at any time during this current post sleep period
012	06	08	00	MGBX Operations	note about discussion with glovebox PI Sen regarding movement of particles during their 2nd run. For first run, any sudden movement was associated with VRCS activity. During their second run, there seemed to be "constant" disturbance to their particles
012	06	20	00	Exercise: CDR (K. Kregel)	Exercise is begin, see some excited frequency around 5, 6, and 8 hzs.
012	06	25	00	Exercise: Unknown	exercise started about 10 minutes ago. Seems to be strong exercise period. Harmonics are evident in sams1 plot. Exciting the 4.8 hz mode?? Per the time line, should be the commander but did not hear that specifically
012	07	07	00	MGBX Operations	Exercise continue, glovebox has been running
012	07	10	00	Exercise: Unknown	exercise complete
012	07	13	00	Exercise: CDR (K. Kregel)	exercise stop, water dump will take 1 hr 35 minutes
012	07	15	00	Water Dumps	SIMO dump to start in 15 minutes, right at the beginning of an LOS periods. Limits being uplinked now. Supply dump should take 1 hour 35 minutes, waste dump should take 25 minutes (dumping to 5% on the waste dump)
012	07	19	00	Exercise: PLT (S. Lindsey)	Exercise start again,
012	07	19	00	Exercise: Unknown	next exercise starting. Not very vigorous in the early stages of this exercise
012	07	31	00	Exercise: PLT (S. Lindsey)	los right now, and start to see a dispaly for exercise again
012	07	37	21	Exercise: PLT (S. Lindsey)	Exercise stop right now, PC work on the time-line now
012	07	40	00	Thruster Activity	deadband collapse is required. Load dap b-5
012	07	41	00	Thruster Activity	deadband collasped and fire cold jet, simo dump int
012	07	45	00	Thruster Activity	re-load dap b-11. Deadband collapse required because of the force imparted on the orbiter by the water dump activity
012	07	47	00	Thruster Activity	a lot of thruster activity evident because of the last deadband collapse
012	07	48	00	Exercise: PLT (S. Lindsey)	pac confirmed the schedule will be one hour ahead than planned, and exercise start again.
012	07	50	00	Exercise: Unknown	exercise started again
012	08	00	00	Exercise: PLT (S. Lindsey)	Exercise stop
012	08	14	00	Exercise: Unknown	exercise stopped about 10 minutes ago
012	08	20	00	Thruster Activity	another deadband collapse
012	08	24	00	Unclassified/Other	Setup video conference to help chex data

012	08	25	00	Thruster Activity	back to dap b-11
012	08	42	00	PAO	They're doing PAOs now...
012	08	43	40	Unclassified/Other	crew talk about the material properties
012	08	45	00		mcpherson out
012	08	45	00	Unclassified/Other	moskowitz on
012	08	50	00	Unclassified/Other	crew talk about the SAMS data could help the crew do the job much easier and better
012	08	50	44	PAO	PAO is over.
012	09	56	00	Unclassified/Other	Truong off console
012	10	00	00	Unclassified/Other	Reckart on console
012	12	09	00	Orbiter Systems	MISSION CONTROL: crew is preparing the robotic camera (AERCam) for upcoming spacewalk, spacewalk tool configuration, middeck glovebox experiments continue
012	12	27	40	Exercise: Unknown	The crew just asked if they could start some exercise when the MGBX experiment is done.
012	12	30	30	Exercise: Unknown	Houston just gave Kevin a GO for exercise. I don't think this is necessarilly Kevin that's going to be exercising, but it's very possible that it is. They're also checking to see when the next constraints are.
012	12	32	42	Exercise: Unknown	Voice-up: there are no more exercise constraints for the rest of today.
012	12	50	00	Exercise: Unknown	Looks like there's exercise now.
012	12	55	00	Crew Disturbances	PEP stowage activity should happen shortly, crew will be having lunch shortly.
012	13	00	00	SAMS/OARE Issues	Now receiving OARE files (at least 2).
012	13	22	22	MGBX Operations	Call on MSCI loop: MGBX science has been completed, and MGBX is being stowed.
012	13	40	00	Exercise: Unknown	Exercise stopped a few minutes ago.
012	13	43	52	Orbiter Systems	They're going to change the port radiator deploy to MET 012/14:30, and then FES immediately thereafter.
012	14	30	00	Crew Disturbances	Shift Change is currently uder way and should take about 45 minutes
012	14	49	00	PAO	Columbia, this is Houston, we can bring down live pictures when your ready. Columbia, this is Houston. Are you ready to begin.....The PAO event begins.
012	14	50	30	PAO	PAO going-on from flight deck – all six people are there.
012	15	18	50	PAO	Looking at the SAMS data from this PAO time, we can see a very clear quieting behavior.
012	15	20	00	Unclassified/Other	went to Building 500 to fill an outreach request foe D. Truong
012	15	20	50	PAO	PAO Event concluded.
012	16	07	33	Data Observation	Within the past 30 minutes (MET 012/15:37-012/16:07), the 36 Hz signal has made some interesting up and down variations. Also, the 34 Hz signal (quite strong) seems to have shown an abrupt turn-on and turn-off during this period.
012	18	13	00	Exercise: Unknown	Exercise started a few minutes ago seen on SAMS' displays. Don't know who it is. Entered info on neural network system.
012	18	13	30	Exercise: Unknown	Exercise started a few minutes ago. This is not called out in the timeline.
012	18	23	00	Exercise: Unknown	Exercise stopped.
012	18	28	00	Exercise: Unknown	Exercise ended about 5 minutes ago or so. Entered this info on neural network system.
012	18	55	00	Attitude/Maneuver	Go to start maneuver to MEPHISTO attitude now.
012	18	55	35	Attitude/Maneuver	"Flight, FAO, they're maneuvering."
012	19	06	00	Orbiter Systems	Go for [10.2 depress?].
012	19	14	00	Unclassified/Other	Just back from reboot of PC next to OMIS terminal.
012	19	34	00	Ku/TDRSS/Communication	Fuel cell purge before sleep and standard Ku reposition at ZOE.

012	19	42	00	Orbiter Systems	Go to stow radiators.
012	20	02	00	Water Dumps	Half hour supply water dump coming up.
012	20	02	30	Water Dumps	They are talking about a water dump. Apparantly they produced more water than they anticipated.
012	20	07	30	Orbiter Systems	Fuel cell purge after upcoming ZOE.
012	20	38	00	Orbiter Systems	Go for fuel cell purge.
012	20	39	44	Water Dumps	Go to terminate supply water dump.
012	20	52	00	Orbiter Systems	Fuel cell purge is complete.
012	21	11	00	Unclassified/Other	Finkelstein on console
012	21	45	00	Crew Disturbances	Columbia's crew is going "beddy-bye", and Houston bid them good night.
012	21	59	00	Water Dumps	They're going to delay the FES until they get the other radiator out
013	03	06	00	Data Observation	things are pretty quiet. Crew sleeping. Other than occasional thruster firing, very quiet environment. 56 hz and ~38 hz still present
013	04	10	00	Experiment/Facility	Mephisto experience sucessful finished and wait for cool down
013	05	20	00	Experiment/Facility	MEPHISTO quenched their last sample and they are waiting for the furnace to cool down. Translation: MEPHISTO operations are complete for USMP-4
013	06	03	00	Crew Disturbances	Good morning, time to go to work in space now
013	07	03	00	Attitude/Maneuver	Power up and continue to maneuver
013	09	05	03	Orbiter Systems	Talk with PSE: The Radiators (both of them) were stowed at MET 012/19:57
013	09	07	32	SPARTAN Operations	GO for Spartan unberth
013	09	25	16	SPARTAN Operations	They're now showing a picture of the SPARTAN, and it appears to be on the end of the arm, someplace outside of the payload bay (the Earth is is the background of the picture). This means there must've been some arm motion between the MERT 013/09:07 GO fo
013	10	20	00	Unclassified/Other	Reckart on console
013	11	01	45	Crew Disturbances	A/G call-down: the EVA people seem to be working on suiting-up. Actually, I'd imagine everyone's working on it
013	11	08	03	Unknown Signal	A few minutes ago, the SAMS-1 display showed that unknown 8.5 Hz disturbance.
013	11	27	10	Experiment/Facility	Talk with PAC/PSE: MEPHISTO may want to deactivate early on Flight Day 15 (MET day 014).
013	11	52	30	Orbiter Systems	The crew said they were ready for the EMU Purge pre-breathe. The ground said the purge was 8 minutes, the pre-breathe was 1 hour, and they have a GO to start that.
013	11	53	00	Orbiter Systems	Start EMU purge, which will last 8 minutes
013	13	17	00	Data Observation	The SAMS-1 display is showing some really weird behavior... There were some dc-offsets, and then it's gotten pretty loud recently. Made a screen print. The spectrogram looks mostly like structural increases.
013	13	20	00	Crew Disturbances	And they're almost out the hatch – I saw a white suit wiggling-around from the PLB camera.
013	13	21	57	SPARTAN Operations	And now there's a picture of the SPARTAN, I'm guessing being lowered into place. You can see the pin line-ups.
013	13	24	35	Data Observation	And the loudness of the data has subsided somewhat on SAMS-1. Post-Mission, check this verus RMS Arm Motion.
013	13	25	35	SPARTAN Operations	The pins looked like they were slammed against the orbiter. The SAMS-1 display showed a higher-magnitude spike in the Y and Z axes for this time (yes, I accounted for the NEAR-real-time nature of the system, and looked for the coincident time, and not ju
013	13	27	00	SPARTAN Operations	SPARTAN in place ready to be secured
013	13	32	27	Thruster Activity	They're in DAP-A1.

013	13	33	23	Crew Disturbances	And here comes the 1st astronaut – head first. When we saw him popping-out before (see above note), he was feet-first. So, I guess he decided to flip-over within the airlock (to prevent a "breach birth"?)
013	13	34	00	Crew Disturbances	astronauts Winston Scott and Takao Doi are exiting the airlock now
013	14	02	58	Data Observation	Noticed that within the last hour, the 3 Hz structural mode has disappeared... Also, about the same time this signal disappeared, the 7 and 7.5 Hz "structural-looking" modes shifted to 7.5 and 8 Hz. Check this post-mission.
013	14	03	24	Crew Disturbances	A minute or so ago, they were doing some tugging (and they still are now, but not to as great of an extent). Looks like they're trying to un-stow the crane?
013	14	05	03	Crew Disturbances	Looks like they've gotten the crane unstowed, and they're now setting it up on one side of the Orbiter. Both people are working on it.
013	14	05	55	Crew Disturbances	Now they're pushing the post into its support in the -Zo-axis direction.
013	14	33	18	Water Dumps	At MET 013/16:00, they're going to do a supply water dump using FES, for 4 hours.
013	14	35	55	Crew Disturbances	Looks like they've got the crane stretched from one sill to the other, and they're working on securing it on the second sill. Actually it's just one person on the second sill.
013	14	39	58	Crew Disturbances	One of the astronauts has his feet on some restraint, and is pushing (it looks like a hard push) against the foot restraint. Actually, the pole the restraint is on seems to be bending under his shoves. Unless I'm mistaken, I think he's pushing in the Xo
013	14	43	45	SPARTAN Operations	crane extending
013	14	44	15	SPARTAN Operations	retract crane
013	14	44	45	SPARTAN Operations	successful softdock
013	14	45	30	Crew Disturbances	Winston is working on "docking" something with the end of the crane. It looks like the end that I thought he was securing (the second end) isn't "secured", but free-floating. It looks like his docking pushing is in the -Zo direction.
013	14	46	50	SPARTAN Operations	release and re-softdock
013	14	59	00	Data Observation	The SAMS-1 display g versus t is quieter now than it was.
013	15	02	50	Data Observation	Just noticed in the SAMS-2 display from MET 013/14:30 - 013/14:45 that there are a series of disturbances from about 5-20 Hz or so...
013	15	03	35	Water Dumps	A/G call to Kevin: they want to leave the FES on. (I thought they weren't going to FES until 013/16). Maybe I only caught part of the question/answer, with the A/G-1 traffic (the EVA) being too heavy.
013	15	38	29	Crew Disturbances	Looks like they're retracting the crane.
013	15	39	30	Crew Disturbances	And now they're re-extending the crane.
013	15	47	30	Data Observation	And the SAMS-1 data has gotten louder again, all 3 axes.
013	15	57	50	Crew Disturbances	They're trying to "re-seat" the crane. Winston said to Takoi "Don't twist it – just try to work it in."
013	16	29	43	Thruster Activity	Winston just said something that he can "feel" the thruster firings.
013	16	30	00	EDFT Operations	the astronauts have been in the cargo bay since 013/13:34:00 test a crane and a roving, robotic eye
013	16	35	22	Experiment/Facility	Looks like they're doing Sprint now...
013	17	47	25	EDFT Operations	EVAer tugging on something on starboard sill [+/- Y direction?].
013	17	47	25	EDFT Operations	EVAer tugging on something on starboard sill [+/- Y direction?].
013	17	51	30	EDFT Operations	EVAer banging something on starboard still again. About to do maneuver so EVAer's get a handhold somewhere.
013	17	51	30	EDFT Operations	EVAer banging something on starboard still again. About to do maneuver so EVAer's get a handhold somewhere.
013	17	58	00	EDFT Operations	EVAer translating along starboard sill in -X structural direction.

013	17	58	00	EDFT Operations	EVAer translating along starboard sill in -X structural direction.
013	18	00	00	Unclassified/Other	Reckart out
013	18	00	07	EDFT Operations	Winston just pulled AERCam's tether and it banged into PLB camera on starboard sill.
013	18	00	07	EDFT Operations	Winston just pulled AERCam's tether and it banged into cargo bay camera on starboard sill.
013	18	06	00	EDFT Operations	Ready to start EVA ingress.
013	18	08	45	EDFT Operations	Winston moving into hatch at front of cargo bay [this looks like it's going to take a while].
013	18	08	55	Orbiter Systems	RMS arm being moved to precradle before power down.
013	18	12	00	EDFT Operations	Winston tugging on top of hatch just as he is going in.
013	18	15	33	EDFT Operations	Hatch is closed and locked.
013	18	15	00	EDFT Operations	Hatch was closed. End of EVA activity.
013	18	17	44	Orbiter Systems	RMS arm moving [quickly] toward stowage stanchions.
013	18	20	27	Orbiter Systems	RMS appears to be latched now at [aftmost?] stanchion.
013	18	26	00	EDFT Operations	Steve called down that he got AERCam about 40 feet above the sill of the cargo bay. The plan was for 160 feet, but lighting conditions made it tough to get higher than 40 feet.
013	18	28	11	Orbiter Systems	Good hatch seal [I didn't know they had animals on this flight], go to continue with repressurization.
013	18	28	50	Orbiter Systems	Repressurization in progress.
013	18	30	44	Orbiter Systems	RMS arm is powered down.
013	18	31	45	Orbiter Systems	Airlock is at cabin pressure.
013	18	57	07	Water Dumps	Go to terminate supply dump; FES is required.
013	19	04	00	Flight Note/OMIS	Submitted a PDRF (PIMS 001) for EVA video from MET 013/13:20 to 013/18:15. This will be used post-mission to correlate acceleration data with EVA activity.
013	19	20	00	Unclassified/Other	PIMS 001 PDRF was approved by DFA.
013	20	34	30	Experiment/Facility	PAC called to say MEPHISTO will be shutting down soon
013	20	34	00	Experiment/Facility	MEPHISTO doing their final shutdown.
013	20	41	00	Attitude/Maneuver	Maneuver to LHP attitude (+ZSI) [happening now/soon?]
013	21	06	00	Experiment/Facility	56 Hz still present, so MEPHISTO not culprit.
013	21	22	00	Unclassified/Other	Finkelstein on console
013	21	46	07	Unclassified/Other	Sounds like Kregel is going to propose or something from low Earth orbit tomorrow. This is a hunch based on a cryptic presleep call-up about staffing at JSC tomorrow in response to question he sent down to JSC earlier.
013	21	51	00	Unclassified/Other	SAMS 2 CHeX display of 3 frequency bands' RMS acceleration versus time made it on NASA TV.
013	21	52	00	Unclassified/Other	IDGE is only experiment left.
014	00	30	00	Attitude/Maneuver	Maneuver-ish DC offset noted on SAMS 1 display.
014	00	42	06	Attitude/Maneuver	Started maneuver to +Zsi about 11 minutes ago.
014	00	46	00	Attitude/Maneuver	Flight, GNC, we're in attitude.
014	00	51	00	SAMS/OARE Issues	Processed OARE file: 13150003.oare.
014	00	51	00	Attitude/Maneuver	Orbiter in +ZFI attitude (not in planning document)
014	01	09	00	SAMS/OARE Issues	SAMS 1 Mean values: X: -450.0451/17378379=-2.5896e-05 Y: 954.7081/17378379=0.000054936 Z: 26.2735/17378379=0.000001512
014	01	30	00	Unclassified/Other	Truong on console

014	01	30	00	Unclassified/Other	Truong on console
014	02	18	00	Ku/TDRSS/Communication	Talk of Ku-band stow a day before landing as contingency in case it won't go, then it would require an EVA to stow it.
014	02	25	00	Unclassified/Other	Finkelstein off console
014	03	45	00	Crew Disturbances	Crew still slept, see some 8.5 hz about 10 minutes
014	03	45	00	Crew Disturbances	Crew still sleep, nothing happen, see 8.5 hz
014	04	19	00	Ku/TDRSS/Communication	los,
014	04	21	00	Unknown Signal	At about 14/03:45 or so, the unknown 8.5 Hz was evident on the SAMS 1 spectrogram (duration was about 6 minutes or so).
014	04	48	00		Hrovat out.
014	04	49	00	Unclassified/Other	Replan for another day of the mission
014	04	49	00	Unclassified/Other	truong off console
014	05	00	00	Unclassified/Other	mcpherson on console
014	05	48	00	Attitude/Maneuver	noticed from nissim's OD data processor that we are in a solar inertial attitude. Belly to the sun, 270 degree roll. Warm those tires
014	05	50	00	Attitude/Maneuver	Solar inertia attitude
014	05	53	00	SAMS/OARE Issues	processed files 13211543.oare, 14000003.oare, and 13180003.oare
014	06	00	00	SAMS/OARE Issues	process three(3) oare
014	06	01	00	Crew Disturbances	Music on (Bumble Bee song),good morning Columbia keep it up, one more day
014	06	03	00	Exercise: Unknown	replan input package states exercise hardmount will be done around 14/08:00 for day 15 exercise periods
014	07	08	00	Unclassified/Other	truong off console
014	07	12	00	Experiment/Facility	for lack of nothing better to do, read the entire execute package and found the following line interesting, "The PI has expressed concerns that the packets placed in the middle of the freezer will be damaged by the SOYMET canister during re-entry". Anybo
014	08	03	00	Exercise: CDR (K. Kregel)	CDR starting exercise. Exercise being downlinked. Seems pretty steady in his exercise, not much upper body movement, steady rate on the pedaling
014	08	40	00	Exercise: CDR (K. Kregel)	CDR finished exercise about 5 minutes ago
014	08	44	00	Unclassified/Other	mcpherson off
014	08	45	00	Unclassified/Other	moskowitz on
014	08	48	00	Exercise: PLT (S. Lindsey)	next exercise period has started couple minutes ago.
014	09	30	38	Exercise: PLT (S. Lindsey)	Call-down: PLT completed exercise.
014	09	43	16	Exercise: MS-1 (K. Chawl)	A/G Call-dow: MS-1 starting exercise now.
014	09	45	00		Reckart on console
014	10	05	12	Unclassified/Other	A/G just told them that landing-day weather is looking pretty good for Friday morning.
014	10	22	20	Water Dumps	GO to do the supply water dump when it's convenient for them. Details: dump for 40 minutes.
014	10	26	00	Exercise: MS-1 (K. Chawl)	MS-1 has been exercising since 014/09:45:00
014	10	29	00	Exercise: MS-1 (K. Chawl)	MS-1 has finished exercising
014	10	29	19	Exercise: MS-1 (K. Chawl)	A/G calldown: MS-1 done exercising.
014	10	40	00	Exercise: MS-2 (W. Scott)	Exercise for MS-2 started around now. This was during an LOS period, so my time is approximate.
014	10	52	00	Exercise: MS-2 (W. Scott)	MS-2 began exercising sometime during an LOS

014	11	11	00	Water Dumps	Supply Water Dump
014	11	11	24	Water Dumps	GO to terminate supply water dump.
014	11	29	00	Exercise: MS-2 (W. Scott)	MS-2 has completed exercise
014	11	29	00	Exercise: MS-2 (W. Scott)	MS-2 exercise complete.
014	12	04	05	Attitude/Maneuver	A/G call: they're going to maneuver to a new attitude anytime in the next 16 minutes (to get to MET 014/12:20). Kevin said he'd start the maneuver now.
014	12	40	00	PAO	pao event with the Prime Minister of India
014	12	45	36	Data Observation	A little bit ago, during the LOS period, an 8.5 Hz disturbance started-up, and then stopped. The signal's duration is longer than we've seen before, figure someplace between MET 014/12:10 and 014/12:30. Also, a minute ago or so, there was some HUGE spik
014	12	46	32	PAO	They're doing an LOS with some Indian TV something.
014	12	50	54	Exercise: Unknown	Talked to POL to find-out who's exercising now, and she said she didn't think anyone was exercising now (although it REALLY looks like exercise). Brian Matisak (PAC) called to let us know that he showed exercise for CDR, PLT, MS-1, and MS-2 today. Thus,
014	13	00	00	Unclassified/Other	Science shift report submitted via the web, and FAXed to MSCI (per his request).
014	13	05	00	Crew Disturbances	Per the timeline (and a recent A/G call-up), the crew is scheduled to be eating now, but there's still exercise showing in the spectrograms, so at least one person isn't eating. Also, the timeline shows the FCS checkout and RCS hotfire tests as being sch
014	13	17	30	Exercise: Unknown	Exercise stopped just recently.
014	13	58	19	Orbiter Systems	Starting FCS checkout – using APU #3.
014	14	05	03	Orbiter Systems	A/G call-down: ready for APU start. Ground concurs.
014	14	10	34	Orbiter Systems	A/G asked for a GO for APU shutdown, but Houston said no – they had to wait for it to warm-up enough for "water spray boiler check."
014	14	14	00	Orbiter Systems	Call-up: "the test it going well. They showed that it just started 'spraying' within the last couple seconds, and they're planning to test only for another minute or so."
014	14	17	08	Orbiter Systems	GO for APU shut-down.
014	14	39	00	SAMS/OARE Issues	processed OARE data files 14060003.oare and 14090003.oare
014	14	55	00	Unclassified/Other	Just talked to Brian (PAC) to ask if we could get a detailed list which has times for hydraulic system ops, elevon/aileron park, etc. – the kinds of things we were discussing earlier in the mission, but didn't have data for. Brian suggested that he try t
014	14	56	30	Thruster Activity	A/G calldown: ready for RCS hotfire test. Houston gave them a GO, and they said there's enough prop to run the sequence twice.
014	15	03	40	Thruster Activity	And the SAMS displays show evidence of the RCS hotfire tests.
014	18	45	00	Unclassified/Other	Completed PCIS-type analysis for CDR hardmount ergometer exercise; faxed plots and table to MSCI and WEBCON.
014	19	09	00	Unclassified/Other	It turns out that Kregel's speculated proposal was actually just a tribute to Jim Harrington's last duty as shuttle launch director at KSC.
014	19	35	44	Ku/TDRSS/Communication	Go for Ku-band stow as shown in flight plan [just before 14/19:45 or so?].
014	19	40	19	Ku/TDRSS/Communication	Ku-band antenna stow is in work.
014	19	40	00	Ku/TDRSS/Communication	They are in the process of stowing the Kuband antenna.

014	19	56	00	SAMS/OARE Issues	Processed Orbiter Telemetry (real-time) VI beeped for a while, then got happy again (by itself).
014	19	59	00	Ku/TDRSS/Communication	MSCI called to say he did not receive a science shift report for 14/00:00 - 14/12:00. Submitted via e-mail.
014	20	21	30	Ku/TDRSS/Communication	Ku-band antenna stowed a few minutes ago (actually, during LOS, between 14/20:09 and 14/20:19). After LOS, no dither signature (as expected).
014	20	50	54	Thruster Activity	Also, the POL said that there was some type of burn a few minutes ago. This would be those large data spikes I saw. Per POL, the burn was approximately 10 seconds in duration.
014	21	12	00	Unclassified/Other	Finkelstein on console
014	21	17	00	Unclassified/Other	Weather looks favorable for landing tomorrow at KSC. Two opportunities at KSC: first is a touchdown at about 6:20 am CST; second is a touchdown at about 7:55 am CST.
014	23	21	00	Unknown Signal	~83 Hz unknown started up about 15 - 20 minutes ago as seen on SAMS 2 display spectrogram.
014	23	21	01	Experiment/Facility	Talked to Diane Malarik of IDGE. Asked her when IDGE turn-off is going to be. She said “around midnight”. Pass on word so that we can see if ~56 Hz unknowns belong to IDGE.
014	28	02	00	Attitude/Maneuver	Attitude change
015	00	14	00	Unclassified/Other	Submitted science shift report for 14/12:00 - 15/00:00 via the web and e-mail.
015	01	30	00	Unclassified/Other	mcpherson on console
015	01	40	00	Unclassified/Other	Black on console. Replaced Finkelstein.
015	01	40	00	Crew Disturbances	Crew is sleeping. There are no experiments going on. Data is quiet, except for thruster firings.
015	01	43	00	Unclassified/Other	Hrovat out.
015	01	48	00	Unclassified/Other	Finkelstein off console
015	02	49	00	Thruster Activity	one jet still a little cool. Talk about changing the attitude slightly to warm the jet
015	04	40	00	Unclassified/Other	Black off console. DeLombard and McPherson will cover deactivation and shut-down, on behalf of PIMS.
015	05	04	00	Unclassified/Other	no weather constraints for landing. No fog anticipated for landing
015	06	06	00	Attitude/Maneuver	-ZLV/-YVV attitude to be moved to after crew wake up to warm the R2D jet
015	06	51	00	Orbiter Systems	fuel cell purge scheduled for about 1 hour
015	07	00	00	Unclassified/Other	the final crew wakeup song, The Clash, “Should I Stay or Should I Go?”
015	07	45	00	Unclassified/Other	DeLombard on console for deact activities.
015	07	55	00	Orbiter Systems	Noticed on the OARE display for 014/14:14 that there were some large disturbances. This was during the FCS checkout.
015	08	15	00	Experiment/Facility	I called the PAC and asked about the deactivation sequencing. She said the following was the timeline for that period. 015 / 09:55 idge turn off thru 015 / 10:00 015 / 10:05 chex grd command for 5 min until 015 / 10:10 then crew ops for 15 min for ch
015	08	18	00	Experiment/Facility	I asked the PAC to ask JSC for the time of SOLSE activation. She would check on the time for SOLSE act.
015	08	30	00	Experiment/Facility	From PAC: Time for SOLSE activation: 000 / 04:28:35. This was about an hour after the 56 Hz stuff showed up.
015	08	40	00	Data Observation	At about 015 / 08:10 there was a short turn off / turn on event of a few minutes. This was noticed in the 20 and 40 Hz region of SAMS 2.
015	08	50	00	Experiment/Facility	call from PAC regarding SOLSE turn on. Happened at 000/04:28:35
015	09	12	00	Orbiter Systems	Going through the execution packge for flight day 15, I noticed on page 4 there was a mod to the FCS C/O procedure.
015	09	30	00	Data Observation	Kevin is exploring the time of SOLSE turn on based on PAC’s times. It looks like the 38 Hz maybe started at that time.
015	09	43	00	Data Observation	there was a nother of the short turn off turn on for a few minutes about 09:33 - freq range in 20+ and 40+ Hz like the other one earlier.

015	09	45	00	Experiment/Facility	IDGE de-activation call downed from crew. Can see both 56 hz and 38 Hz signatures disappear clearly with the IDGE power off. Also signature around 74 hz seems to have stopped as well
015	09	45	00	Experiment/Facility	call down from crew about being ready for IDGE deact (time is approx)
015	09	47	00	Experiment/Facility	call down that it is already done and idge is off (time is approx when it was actually off); turns out that the crew started the idge deact when they called down a couple of minutes ago.
015	09	48	00	Data Observation	we see in the sams 2 display that the 56 Hz and 38 Hz appear to have gone off with teh idge deact
015	09	50	47	Experiment/Facility	IDGE de-activation complete. Crew call down
015	09	50	47	Experiment/Facility	crew: “idge deact complete”
015	09	55	00	Experiment/Facility	crew standing by for de-activation of CHeX system
015	09	55	05	Experiment/Facility	grd to crew: stdby for chex deact ; crew: ‘haven’t started yet’
015	09	55	40	Experiment/Facility	chex: we’re not done sending commands
015	09	57	50	Experiment/Facility	crew has go ahead for CHeX deactivation
015	09	57	45	Experiment/Facility	grd to crew: go for chex deact
015	10	01	30	Experiment/Facility	call down CHeX deactivation complete
015	10	01	00	Experiment/Facility	POL & crew: chex deact complete; after a bit we don’t see any changes in the sams data;
015	10	04	00	SAMS/OARE Issues	delombard to pol: go for sams; can we have sams1 then sams2 off a few minutes later? “we’ll check”
015	10	05	00	SAMS/OARE Issues	grd to crew: go for sams deact and do sams1 wait one minute for sams2 deacct
015	10	07	00	SAMS/OARE Issues	record is now off for SAMS1. Proceeding with SAMS 2 record off
015	10	09	00	SAMS/OARE Issues	doing the ssams 1 and 2
015	10	11	50	SAMS/OARE Issues	sms to pol: record is off on both units now
015	10	11	45	SAMS/OARE Issues	sams 1 off
015	10	12	00	SAMS/OARE Issues	SAMS 2 record off. SAMS 1 now off (power off)
015	10	13	00	SAMS/OARE Issues	SAMS 1 is off
015	10	14	00	SAMS/OARE Issues	SAMS 2 is off
015	10	14	15	SAMS/OARE Issues	we see sams2 off
015	10	15	00	Unclassified/Other	delombard and mcpherson cleaning up files, etc.
015	10	19	00	SAMS/OARE Issues	final note actually about SAMS activation process and switching through the various heads: MET 000/04:23:08 - 04:24:51 head B, y axis MET 000/04:24:53 - 04:27:25 head B, z axis MET 000/04:27:26 - 04:28:49 head B, x axis MET 000/04:28:50 - 04:45:24 hea
015	10	21	30	SAMS/OARE Issues	POL: sams2 relay was off at 015 / 10:14

Appendix G: User Comments Sheet

We would like you to give us some feedback so that we may improve the Mission Summary Reports. Please answer the following questions and give us your comments.

1. Do the Mission Summary Reports fulfill your requirements for acceleration and mission information?
_____Yes _____No If not why not?

Comments:

_____

_____

2. Is there additional information which you feel should be included in the Mission Summary Reports?
_____Yes _____No If so what is it?

Comments:

_____

_____

3. Is there information in these reports which you feel is not necessary or useful?

_____Yes _____No If so, what is it?

Comments:

_____

_____

4. Do you have internet access via: (____)ftp (____)WWW (____)gopher (____)other? Have you already accessed SAMS data or information electronically?

_____Yes _____No

Comments:

_____

_____

Completed by: Name:_____ Telephone_____

Address:_____ Facsimile_____

_____ E-mail addr_____

Return this sheet to:
PIMS Project Manager
NASA Lewis Research Center
21000 Brookpark Road MS 500-216
Cleveland, OH 44135

or
FAX to PIMS Project: 216-433-8660
e-mail to: pims@lerc.nasa.gov.

Appendix H: Contents of CD-ROM

Format

Summary Report of Mission Acceleration Measurements for STS-87 (incl. App. A, G, & H) ..... PDF
Appendix A Accessing Acceleration Data Via the Internet
Appendix B SAMS Color Spectrograms for Unit F, Head B ..... PDF
Appendix C SAMS Color Spectrograms for Unit F, Head A ..... PDF
Appendix D SAMS Color Spectrograms for Unit G, Head B ..... PDF
Appendix E SAMS Color Spectrograms for Unit G, Head A ..... PDF
Appendix F PIMS USMP-4 Logbook ..... PDF
Appendix G User Commets Sheet
Appendix H Contents of CD-ROM

Supplementary Spectrogram Folder
SAMS Nyquist Color Spectrograms for Unit F, Head B ..... PDF
SAMS Nyquist Color Spectrograms for Unit F, Head A ..... PDF
SAMS Nyquist Color Spectrograms for Unit G, Head B ..... PDF
SAMS Nyquist Color Spectrograms for Unit G, Head A ..... PDF

Summary Report of Mission Acceleration Measurements for STS-75 (USMP-3) ..... PDF
Summary Report of Mission Acceleration Measurements for STS-62 (USMP-2) ..... PDF

Adobe Acrobat Reader Files
Macintosh 3.01 Installer
Windows 3.0 / 3.1.exe
Sun Solaris 3.0 / 3.1.tar.gz
Silicon Graphics 3.0.tar.gz

README.DOC
Release Notes ..... TXT

REPORT DOCUMENTATION PAGE

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13. ABSTRACT ***(Maximum 200 words)***
Two accelerometer systems, the Orbital Acceleration Research Experiment and the Space Acceleration Measurement System, were used to measure and record the microgravity environment of the Orbiter Columbia during the STS-87 mission in November-December 1997. Data from two separate Space Acceleration Measurement System units were telemetered to the ground during the mission and data plots were displayed for investigators of the Fourth United States Microgravity Payload experiments in near real-time using the World Wide Web. Plots generated using Orbital Acceleration Research Experiment data (telemetered to the ground using a tape delay) were provided to the investigators using the World Wide Web approximately twelve hours after data recording. Disturbances in the microgravity environment as recorded by these instruments are grouped by source type: Orbiter systems, on-board activities, payload operations, and unknown sources. The environment related to the Ku-band antenna dither, Orbiter structural modes, attitude deadband collapses, water dump operations, crew sleep, and crew exercise was comparable to the effects of these sources on previous Orbiter missions. Disturbances related to operations of the Isothermal Dendritic Growth Experiment and Space Acceleration Measurement Systems that were not observed on previous missions are detailed. The effects of Orbiter cabin and airlock depressurization and extravehicular activities are also reported for the first time. A set of data plots representing the entire mission is included in the CD-ROM version of this report.

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