

EMFISIS Burst Summary

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RBSP SWG

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EMFISIS Measurements

- Vector magnetic fields: 64 vectors/s all the time (frequency range up to 30 Hz)
- 6-channel (3-E and 3-B) ~10 Hz to 12 kHz
 - Survey acquires spectral matrices based on 0.5 second waveform capture every 6 seconds
- Single E-channel 10 – 400 kHz
 - Survey acquires spectrum once every 6 seconds

Goals of EMFISIS Burst Modes

- Chorus
- Shock-induced events
- ULF waves

Chorus Burst

- Primary burst mode is brief recordings of ‘continuous’ 6-channel waveforms
 - Provides 5+ seconds of continuous waveforms
 - Usually compressed (losslessly)
 - Can ‘afford’ of order 10 minutes in this mode per day
 - This mode can be
 - Triggered by highest intensity events (n m-second bins)
 - Scheduled by absolute time based on ephemeris
 - Applied in ‘picket fence’ mode, e.g. 6 seconds every 5 minutes

Chorus Burst, continued

- Other burst modes are less likely to be used early in the mission, other than for evaluation
 - 30 msec spectral matrices
 - Onboard wave parameter determination
 - ‘discontinuous waveforms’ (468 msec every half-second)

ULF Waves

- Not originally planned to have a burst mode for low frequency waves, but the continuous waveforms allow for very high resolution spectra at low frequencies, not the 2 Hz limitation in the original 'discontinuous' waveform mode – this one's 'for free'.

Shock-induced events

- Will record continuous waveforms into a circular buffer of length several minutes
- An 'event' as per a TBD algorithm based on MAG data will cause the buffer to be saved with $\sim 25\%$ of the buffer length prior to the 'event'.
- We expect a handful of true shock-induced events over the life of the mission, so the trick is to develop an algorithm which finds these and does not have a high false-detection rate

Other Burst Modes

- We have also defined a small number of additional burst modes that basically accelerate our standard survey cadence to e.g. 1 per second or allow HFR waveforms.

EMFISIS Components and Performance

- **Triaxial Magnetometer (MAG):**
 - vector B, DC-30 Hz;
 - 3 ranges: ± 256 nT, $\pm 4,096$ nT and $\pm 65,536$ nT with corresponding resolutions: ± 0.008 nT, ± 0.125 nT ± 2 nT
- **Waves:**
 - *Magnetic field:*
 - vector B.
 - 10 Hz-12 kHz and sensitivity: 3×10^{-11} nT²Hz⁻¹ @1 kHz.
 - *Electric field:*
 - vector E from double probe experiment.
 - 10 Hz-12 kHz (vector), 10-400 kHz (single channel)
 - sensitivity: 3×10^{-17} V²m⁻²Hz⁻¹ @ 1 kHz,
- **EMFISIS data rate: 31.6 kbits/s.**

Data Taking Modes

- **MAG – 64 vectors per second, always.**
- **Survey: ~0.5 s wave snapshot every six seconds: spectral matrix and 10-400 kHz spectrum**
 - Fast survey samples HFR data every second
- **Burst waveform: steady, 3-E, 3-B waveforms. Storage up to 40 m of data, BUT, it takes 3 days to dump**
- **30 ms mode: 30 ms resolution, somewhat limited spectral range, full spectral matrices. Total capacity: ~1.5 hours, BUT, 3 days to dump**
- **Burst triggers:**
 - Deterministic, location driven
 - Event driven: wave power, B change