



BIS™ Advance system

See beyond the index with cleaner EEG signal capture[†] and high-resolution DSA[†]

Every patient's brain responds differently to anesthesia. That's why patients depend on you to reliably gauge and personalize their anesthetic management to protect them from postoperative complications and drive faster recovery.

The BIS™ Advance monitor is designed to help you visualize anesthesia in action with the Density Spectral Array (DSA). DSA is a graphical interpretation of a patient's EEG data highlighting the spectral features of anesthetic-specific signatures in real time. Using DSA on the BIS™ Advance system gives you greater insight for a more personalized anesthetic approach.

Monitoring with BIS™ technology is associated with faster extubation, faster emergence, better orientation in the PACU, and faster discharge.¹⁻⁷

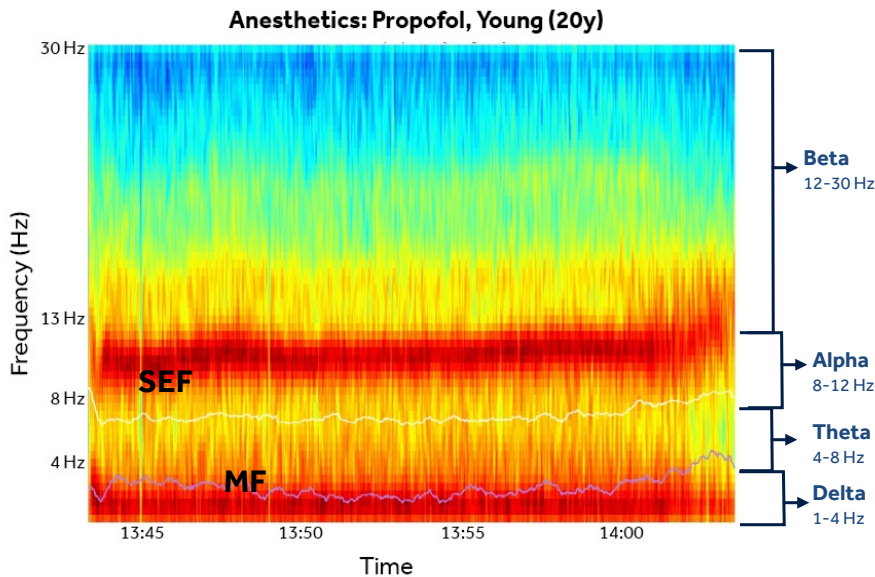


How the spectrogram works

The spectrogram is derived from raw EEG data that shows brain activity in real time. The spectrogram displays EEG signal power across frequencies over time using a graphical color display.^{1,3}

Spectrogram changes under anesthetics

DSA is a graphical display of changes in EEG spectral power, which shifts with administration of hypnotics or sedatives.^{1,3}



Color spectrum

Red indicates more power

Blue indicates less power³

Two horizontal lines⁴

Spectral Edge Frequency (SEF)

White horizontal line: represents the frequency below which 95% of the total power lies.

Median Frequency (MF)

Purple horizontal trend line: represents the frequency below which 50% of the total power lies.

Power spectral analysis of raw EEG with hypnotic agents differs based on the mechanism of the agent.¹

Beta (12-30 Hz) Decreases as anesthesia deepens^{1,5}

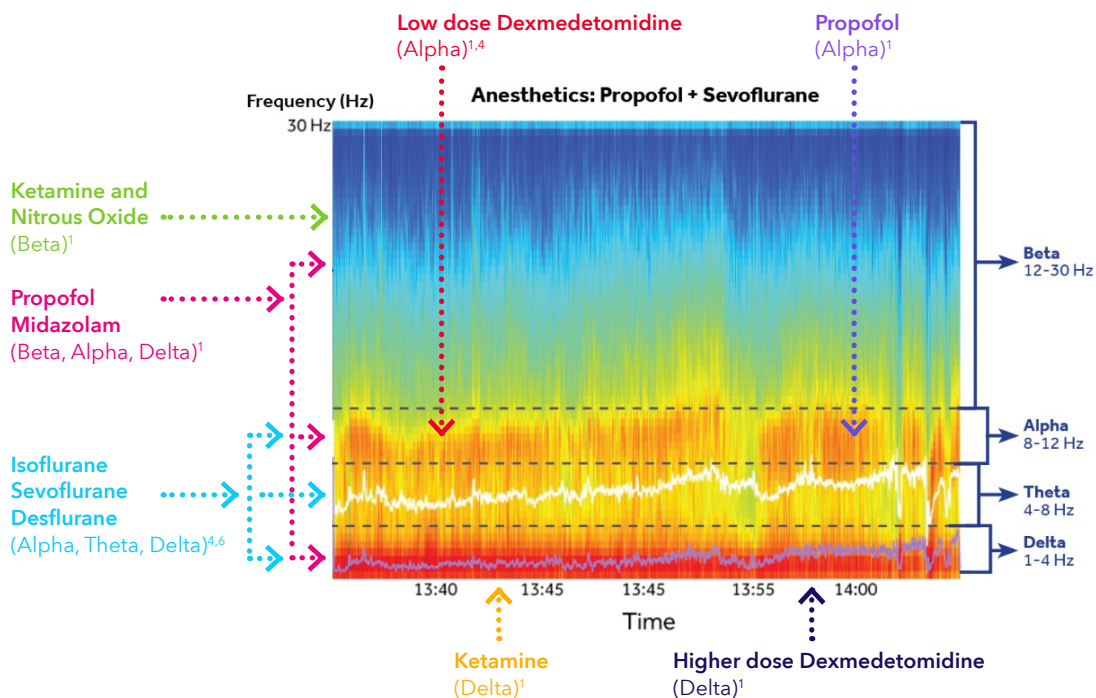
Alpha (8-12 Hz) Activity may increase during deeper anesthetic states^{1,5}

Theta (4-8 Hz) Seen during sleep or under anesthesia⁵

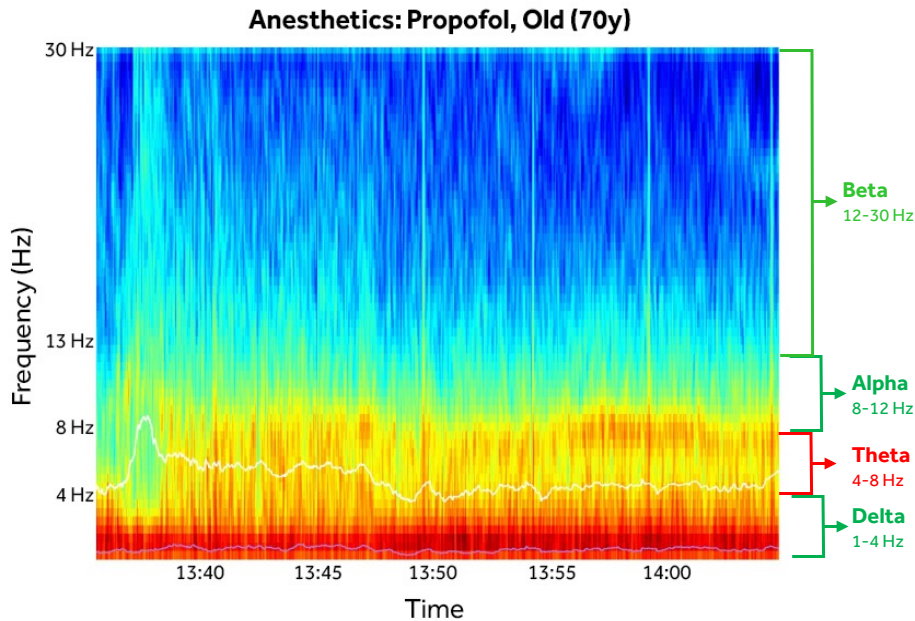
Delta (1-4 Hz) Seen during sleep or under anesthesia⁵

Spectrogram summary

How different anesthetics affect various EEG bands



Spectrogram changes with propofol



Mechanism of action

Enhances GABA-A inhibition in the cortex, thalamus, and brainstem^{1,4,7}

Induction

When propofol is first administered, beta oscillations occur.^{1,4}

Delta oscillations will start to appear around the time of the loss of consciousness.^{1,4}

Maintenance

As anesthetic depth increases, activity in the alpha and delta band increases.^{1,4}

Delta band activity increases after loss of consciousness.¹

Theta power is fairly low regardless of concentration.⁶

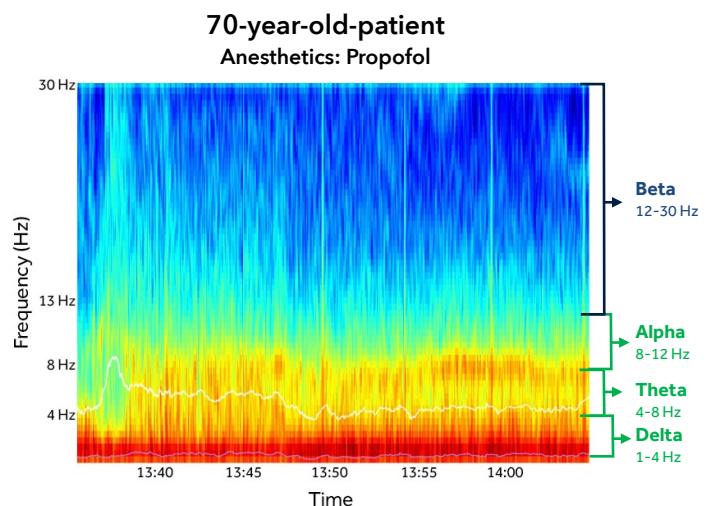
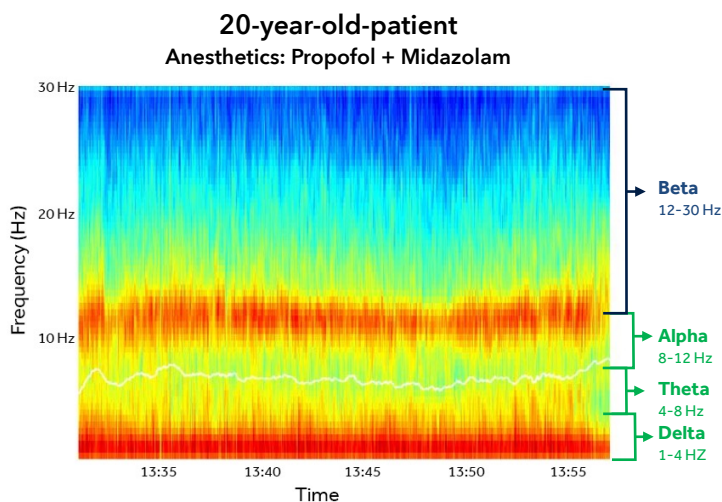
Emergence

During emergence, beta and gamma oscillations begin to appear as delta, theta and alpha activity dissipates.⁴

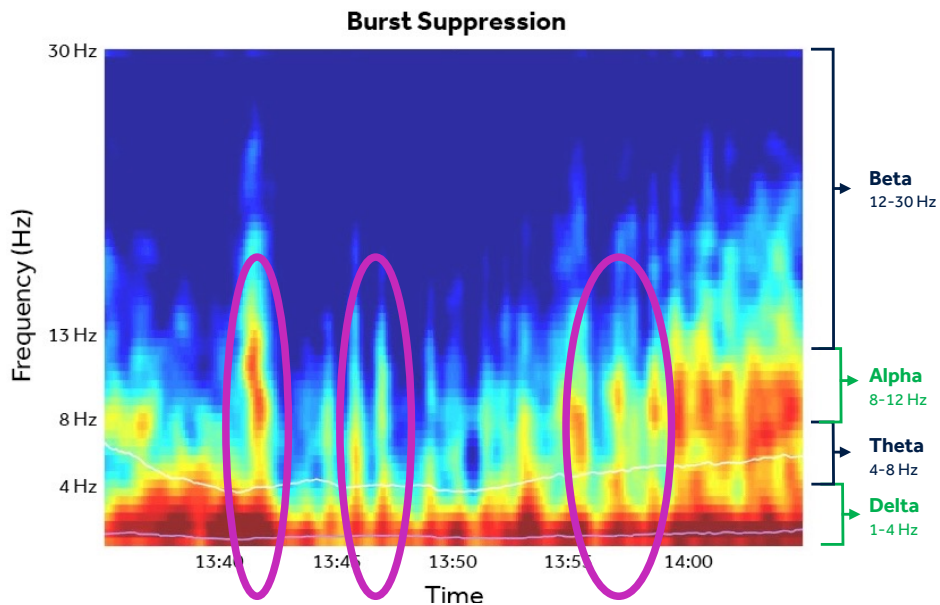
Age-related changes in the spectrogram

Age-related changes in brain structure and function may influence EEG patterns observed during anesthesia.⁸

While propofol should cause activity in the delta, alpha, and theta bands,¹ power will decrease significantly in the alpha band when propofol or sevoflurane are given to older adult patients.^{4,7,8}



Spectrogram changes with burst suppression



Mechanism of action

May be caused by a high dose of an anesthetic including propofol, barbiturates, and volatile anesthetics.

As anesthetic dose increases, the duration of suppression periods between bursts may increase.⁴

Induction

An induction bolus may produce burst suppression, particularly in older adult patients.⁴

Burst suppression has the appearance of vertical lines in the spectrogram.⁴

Maintenance

As the effect of the bolus decreases, the spectrogram should evolve into delta and alpha bands.⁴



Features and functionality

- Two- and four-channel capabilities
- High-resolution Density Spectral Array (DSA)
- EEG with adjustable amplitude scale and sweep speed
- Easy to use and configure based on clinical preference
- Color-coordinated data to quickly review readings
- Easy output to EMRs

† Compared to legacy BIS™ modules

1. Choi B. Characteristics of electroencephalogram signatures in sedated patients induced by various anesthetic agents. *J Dent Anesth Pain Med.* 2017;17(4):241-251.
2. Hajat Z, Ahmad N, Andrzejowski J. The role and limitations of EEG-based depth of anaesthesia monitoring in theatres and intensive care. *Anaesthesia.* 2017;72 (1):38-47.
3. BIS™ Advance Monitor [operator's manual]. Mansfield, MA: Medtronic; 2023.
4. Purdon P, Sampson A, Pavone K, Brown E. Clinical Electroencephalography for Anesthesiologists. *Anesthesiology.* 2015;123(4):937-960.
5. Jameson L, Sloan T. Using EEG to monitor anesthesia drug effects during surgery. *Journal of Clinical Monitoring and Computing.* 2006;20:445-472.
6. Hagihira S. Changes in the electroencephalogram during anaesthesia and their physiological basis. *British Journal of Anaesthesia* vol. 115 Suppl 1 (2015): i27-i31. 2015;27-31.
7. Mashour GA, Avidan MS. Black swans: challenging the relationship of anaesthetic-induced unconsciousness and electroencephalographic oscillations in the frontal cortex. *Brit Journal Anaesthesia.* 2017;119(4):563-565.
8. Purdon P, Pavone K, Akeju O, et al. The Ageing Brain: Age-dependent changes in the electroencephalogram during propofol and sevoflurane general anaesthesia. *British Journal of Anaesthesia.* 2015;46-57.

The BIS™ brain monitoring system should not be used as the sole basis for diagnosis or therapy and is intended only as an adjunct in patient assessment. Reliance on the BIS™ brain monitoring system alone for intraoperative anesthetic management is not recommended.

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