

PLAYER ANALYSIS TECHNOLOGY OVERVIEW

What is Player Analysis Technology?

Technological advances have facilitated the development of a new class of equipment that allows detailed information about players' performances to be gathered and displayed in real time. This equipment is collectively known as 'Player Analysis Technology' ('PAT'). PAT includes items that the player wears (such as heart-rate monitors) or carries onto court (the racket), as well as devices located remotely around the court (player tracking systems).

PAT includes any equipment that has the potential to record, store, transmit, analyse or communicate player performance information in real time during a match, and is sub-divided into three groups:

1. **Integrated Equipment.** Equipment which is carried or worn by players on court. This includes clothing – commonly referred to as 'wearables' (items that would otherwise be classed as clothing, e.g. Google Glass); tennis-specific equipment (e.g. rackets); and non-tennis-specific equipment (e.g. heart rate monitors, activity monitors).
2. **Remote Equipment.** Any device that is not carried or worn by the player (e.g. camera-based player tracking systems).
3. **Auxiliary Equipment.** Equipment which does not record player performance information, but may perform any of the other functions of PAT, such as tablets and mobile telephones and software operating on those devices. PAT products typically use sensors such as accelerometers, gyroscopes, cameras and electrodes, which measure force, movement and physiological information. These allow a broad range of information to be gathered relating to the player, the stroke and the ball.

PAT has the capacity to measure, and cross-reference, a wide range of performance-related, time-based variables. These include:

In relation to...	Primary variables	Secondary variables	Tertiary variables
Player	Position and acceleration Step length and frequency Heart rate, sweat rate	Total and average distance travelled Work rate, energy consumption	Fatigue
Stroke	Racket position and orientation	Ball/racket impact location Shot type (serve, volley, forehand, backhand) Spin (topspin, backspin) (Racket) power	
Ball/shot	Position	Speed Trajectory Outcome (in/out)	Score Match time Match simulation

What are the rules?

In order to ensure that only products that do not threaten the nature of the game can be used during competition, and that all types of PAT are subject to the same regulations, the ITF Rules of Tennis state that:

1. PAT devices will be permitted for use during competition played under the Rules of Tennis, subject to prior approval by the ITF.
2. There shall be no access to the information that PAT devices generate during a match by a player, except when play is suspended and when coaching is permitted. The information generated by PAT (and access to that information) will be treated in the same way as any other coaching information, so that the prohibition of coaching during a match is protected.

The rule changes comprise three core parts:

1. **Rule 31.** This permits the use of PAT during competition, and requires that all PAT is Approved by the ITF prior to such use. Only Approved PAT may be used during competition, even if it is not activated while being used.
2. **Appendix III.** This defines PAT and restricts its use to that in accordance with Rule 30 (Coaching): that the information generated by PAT during a match cannot be accessed by a player until the match is completed, except when play is suspended and when coaching is permitted.
3. Associated changes to **Appendix II (The Racket)** and **Rule 30 (Coaching)**.

Who is affected by the rule changes?

Permission to use PAT during competition will affect several groups, who will need to know the following information:

- **Players.** Which PAT devices have been ITF Approved and so are permitted for use. What information is generated by PAT and when they can access it.
- **Coaches.** What information will be accessible to them and when can it be communicated to the player.
- **Officials.** Which PAT devices are approved and how the new rule will be enforced.
- **Equipment manufacturers.** What the restrictions are on what PAT can do in order to be Approved and used during competition.
- **Fans and the media.** What information could be made available to them (and how). Which players will be using PAT.

Note: Players, coaches and officials should refer to the list of ITF-Approved products together with the Rules of Tennis.