



# Player Analysis Technology Approval report

## Billie Jean King Cup Match Insights App

Test code: PAT-21-026

Serial no:  
N/A

Software version:  
1.51.1.0 (Windows)

Firmware version:  
N/A

Issue date: 31 October 2021



**Objective:** To test and evaluate Billie Jean King Cup Match Insights App Player Analysis Technology according to Rule 31 of the 2021 Rules of Tennis.

**Result:** Approved

### SUMMARY

The Billie Jean King Cup Match Insights App combines live scoring and ball/player tracking data feeds to provide near real-time coaching information on a Surface device (tablet).

The scoring data are generated on a tablet by the Chair Umpire and additional match statistics are generated by an operator on a Surface device at the side of the court. The ball/player tracking data are generated by multiple cameras located around the court, connected to personal computers, and controlled by a team of operators. These data are transmitted via wired Ethernet connection. The combined data feed is transmitted via the internet to a Microsoft Azure cloud platform service, processed and then sent to a Surface device running the Billie Jean King Match Insights App.

Coaching information, such as shot types, shot placement and court coverage by players, are available on the Surface device with the Billie Jean King Cup Match Insights App.

Restrictions on the access by a player to Billie Jean King Cup Match Insights App components during periods when coaching is and is not allowed are as follows:

COMPONENT	NO COACHING	COACHING
Tablet (live scoring by the Chair Umpire)	Permitted	Permitted
Video cameras (ball/player tracking)	Permitted	Permitted
Surface device (Billie Jean King Match Insights App)	Not permitted	Permitted

## MAIN COMPONENTS

The main components of the system are described in table 1 and depicted in figure 1.

COMPONENT	FUNCTION(S)
Tablet (with live scoring software)	Generate live score feed
Surface device (with match statistics software)	Generate additional match statistics
Video cameras	Capture images of play
Personal computers (PCs)	Start/stop ball/player tracking, store, process, transmit and display data
Computer vision software	Reconstruct the ball and player trajectories from camera images
Data analysis and modelling software	Generate tracking data
Microsoft Azure cloud platform	Store, process and transmit data
Billie Jean King Cup Match Insights App	Communicate data
Surface device (with App)	Communicate data

Table 1. Description of the components of the Billie Jean King Cup Match Insights App system.



Figure 1. Components of the Billie Jean King Cup Match Insights App system (from left to right): Tablet (for live scoring), video camera, Surface device (with Billie Jean King Cup Match Insights App). Images are not to scale.

## DATA CAPTURE AND TRANSMISSION

The Billie Jean King Cup Match Insights App combines data generated from multiple sources.

A tablet mounted in the umpire's chair, with live scoring software installed, is used by the Chair Umpire to keep score of the match. A Surface device is used by an operator watching the match at the side of the court to generate match statistics (e.g. identify winning shots). These two devices are connected via Ethernet to a personal computer (PC).

Multiple (typically 12) high frame rate (typically 75 Hz) cameras are mounted at fixed locations around the court. Each camera is connected via Ethernet cable to a dedicated PC, which performs image processing on the raw image data. The PCs are connected on an isolated network, which includes an additional 'control' PC.

The control PC is used to start and stop data capture and process the data provided by each camera PC. Proprietary software on the control PC reconstructs the trajectories (in three dimensions) of the ball and the players relative to the court. Additional proprietary software is used to create a virtual replay of the ball and player trajectories on the court and match statistics (derived from the trajectory data). Typically, the two software packages are run by designated operators on separate PCs.

The data from the live scoring device and match statistics device are integrated with the ball/player trajectory data from the tracking systems. The combined data feed is transmitted via the internet to a Microsoft Azure cloud platform service. The data are processed and stored in Microsoft Azure and then can be sent via the internet to a Surface device running the Billie Jean King Cup Match Insights App.

## COMMENTS

The system functions independently of the players (does not require any player input). It is typically run by 4-6 operators (including the Chair Umpire).

Transmission of data between data capture and processing components is on wired, isolated network, limiting its susceptibility to hacking. Transmission of the data to the Microsoft Azure services and to the Surface device with the Billie Jean King Cup Match Insights App is encrypted.

## DATA PROCESSING AND COMMUNICATION

Data are ingested, stored and computed using the Microsoft Azure cloud platform and Azure advanced analytics solutions.

Coaching information is available on the Surface device running the Billie Jean King Cup Match Insights App.

Information available in the Billie Jean King Cup Match Insights App includes:

1. Match statistics, e.g. aces, double faults, serves 'in', serves won
2. Placement of serve and returns, and identification of forehands and backhands
3. Serve and return ball speed
4. Player position on court, e.g. 'heat' map (indicating time spent in a given location), distance covered (per point and total)
5. Filtering by event and location, e.g. return points won for second serves into the deuce court in the first set
6. 'Inking' functionality – digital annotation of screenshots using touchscreen

Users need to login in to the Billie Jean King Cup Match Insights App with Microsoft account credentials. This protects the data from unauthorised access.

Because the match statistics and performance metrics are presented for both players, players automatically share data with their opponent (if both players have access to the Billie Jean King Cup Match Insights App).

## COMMENTS

Coaching information is available through the Billie Jean King Cup Match Insights App. Therefore, players must not have access to the Surface device, or other devices running the Billie Jean King Cup Match Insights App, when coaching is prohibited.

## ADDITIONAL INFORMATION

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**Date received:** 25 October 2021

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**Please note:**

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