Player Analysis Technology Approval report

HEAD Tennis Sensor

Test code: PAT-18-017

Serial no: ZTH1

Software versions:
Android: V0.3.6
iOS: V0.2.0

Firmware version: 4C.17.11.01

Issue date: 12 January 2018

Objective: To test and evaluate the HEAD Tennis Sensor Player Analysis Technology according to Rule 31 of the 2018 Rules of Tennis.

Result: Approved

SUMMARY

The HEAD Tennis Sensor (mass 7 g) containing electronic sensors is inserted into the butt of a compatible racket (in place of the traditional butt cap) to record the orientation, acceleration and vibration of the racket. Data collected by the sensor can be sent to an auxiliary device, e.g. smartphone, via a wireless (Bluetooth®) connection.

The sensor can be paired with multiple auxiliary devices, though not simultaneously, with no authorisation required. Real-time data can only be transmitted from the sensor to a single auxiliary device and data stored on the sensor can only be downloaded once. There is no notification to the user of the sensor as to which auxiliary device the sensor is connected.

Coaching information, including shot type, ball impact location on the stringbed, average and maximum ball speeds and spin rates, is available on the auxiliary device.

Restrictions on the access by a player to the HEAD Tennis Sensor components during periods when coaching is and is not allowed are as follows:

COMPONENT	NO COACHING	COACHING
Sensor	Permitted	Permitted
Auxiliary device (e.g. smartphone)	Not permitted	Permitted

MAIN COMPONENTS

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

COMPONENT	FUNCTION(S)
Sensor	Record orientation, motion and vibration of the racket, store and transmit data
Compatible racket	Accommodate sensor (in butt of the racket)
HEAD Tennis Sensor App	Communicate and transmit data
HEAD server	Store and synchronise data across devices
Auxiliary device (e.g. smartphone)	Communicate, store and transmit data

Table 1. Description of the components of the HEAD Tennis Sensor system.

Figure 1. Components of the HEAD Tennis Sensor system: HEAD Tennis Sensor (left); auxiliary device (smartphone).

DATA CAPTURE AND TRANSMISSION

A sensor containing electronic sensors (6-axis MEMS device) is inserted into the butt of a compatible racket in place of a traditional butt cap (see figure 2). The sensor measures the orientation and acceleration of the racket, and vibration of the frame (on impact with a ball). The mass of the sensor is 7 g.

Figure 2. HEAD Tennis Sensor attached to the butt of a racket.

Data capture is started when the sensor detects racket motion. When the head of the racket is orientated downwards, a flashing light indicates that the sensor is active and the status of battery charge. Data capture pauses after a 10 minute period of inactivity, with the sensor entering sleep mode. Data capture resumes upon movement of the sensor.

To transmit the data, the sensor must be connected to a Bluetooth® enabled auxiliary device, e.g. smartphone or tablet. The sensor must be initially paired with the auxiliary device. The sensor can be paired with an auxiliary device running the HEAD Tennis Sensor App at any time while the sensor is active (and not already wirelessly connected to another device). There is no authorisation process, e.g. password protection, to pair the sensor with the auxiliary device. Once the sensor has been paired with an auxiliary device, the sensor automatically re-connects to the device when the HEAD Tennis Sensor App is active. If the sensor has been paired with more than one auxiliary device, it will connect to the first available device.

The sensor has three modes of operation:
1. Offline: data are stored on the sensor and can be transmitted later.
2. Online: data are streamed, i.e. collected and transmitted, by the sensor to a connected device in real-time.
3. Online Tournament: the sensor is connected to an auxiliary device, with data stored on the sensor and transmitted when a session (match) ends.

The sensor cannot be connected to multiple auxiliary devices simultaneously. Therefore, real-time data are only available on a single device when operating in Online Mode. Similarly, once data are imported (downloaded) to an auxiliary device they are removed from the sensor, i.e. data cannot be imported to multiple auxiliary devices.

However, the sensor can be paired (and connected sequentially) with multiple/different auxiliary devices, hence data collected in either Online modes or the Offline mode can be transmitted to any device (that has been paired with the sensor). For example, the sensor could be connected to an initial auxiliary device which moves out of range of the Bluetooth® radio signal allowing a second device (within range) to take over the connection (with no notification to the user of the sensor).

In addition, the HEAD Smart Tennis Sensor App has an Online Mode video, which combines video capture on the auxiliary device with the sensor's Online Mode (real time data).

COMMENTS

The sensor automatically records data when racket motion is detected. When the head of the racket is orientated downwards, a flashing light indicates the sensor is active and battery charge level.

The sensor can be paired with multiple auxiliary devices, though not simultaneously, with no authorisation required. Real-time data can only be transmitted from the sensor to a single auxiliary device and data stored on the sensor can only be downloaded once. There is no notification to the user of the sensor as to which auxiliary device the sensor is connected.

DATA PROCESSING AND COMMUNICATION

Access to processed data is via the HEAD Tennis Sensor App installed on an auxiliary device. The HEAD server is used to backup (store) data (excluding video) and synchronise data across devices that are logged on to the same user account. If the user logs out of the account, or if the HEAD Tennis Sensor App is uninstalled, all data stored on the auxiliary device is removed.

Information available on the auxiliary device includes: date/time and classification of shots (i.e. forehand/backhand/smash/serve/volley); average and maximum ball speed and ball spin rate; average and maximum stoke 'heaviness' and ball impact location on the stringbed.

When Online Mode video is used, videos are automatically trimmed to identified 'moments of interest', e.g. longest rally, fastest forehand.

COMMENTS

The sensor does not have a means to communicate data collected directly to the user. An auxiliary device with Bluetooth® connectivity is required to receive the data from the sensor, and subsequently display the data.

Coaching information is available on the auxiliary device. Therefore, players must not have access to auxiliary devices, e.g. smartphone, tablet, when coaching is prohibited.

ADDITIONAL INFORMATION

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Date received: 7th September 2017

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