Table Tennis Review (TTR) – Technical requirements

Introduction

Table Tennis Review (TTR), first introduced by the International Table Tennis Federation (ITTF) at the 2019 ITTF World Tour Grand Finals, give players the right to review a decision made by an umpire, which they believe is incorrect.

A player can only request for TTR for decisions made by the umpire which directly affect the player with a fault or awarded against. *Eg, a player will not be able to request TTR in case an umpire has not called a fault service for the opponent*. With the help of highly accurate technology, it will be possible to have a point replayed instantly and reviewed by a match official, who will have the authority to overturn the original decision based on the evidence.

TTR will be available in selected events, and players are informed before the match starts whether TTR is available.

However, coaches do not have the ability to request for a review at the moment.

The following will serve as the guide for organisers on the support and technical requirements need for the installation of the TTR system.

Pre-event

Prior to the event, the LOC should be notified if the TTR system will be implemented. The cost of implementation of the TTR technology will be covered by ITTF, LOC should endeavour to support with the following

- Accommodation, Transportation, Meals
- Ensuring camera positions
- Workspace for TTR crew
- Liaising with host broadcasters & sport presentation team

Prior to the event, the relevant TTR equipment will be shipped to the event. ITTF will require the LOC to help receive and store the shipment prior to the start of the event.

Accommodation, Transportation, Meals

To fully set up, run and execute, ITTF's technical partner will dispatch at least 5 staff to the event. The TTR crew will arrive **4 days prior** to the start of the event. Travel details will be provided to the LOC for accreditation purposes and should have access to the Field of play, Technical desk, media centre and TV compound. LOC shall help to:

- Book the rooms according to the travel details provided

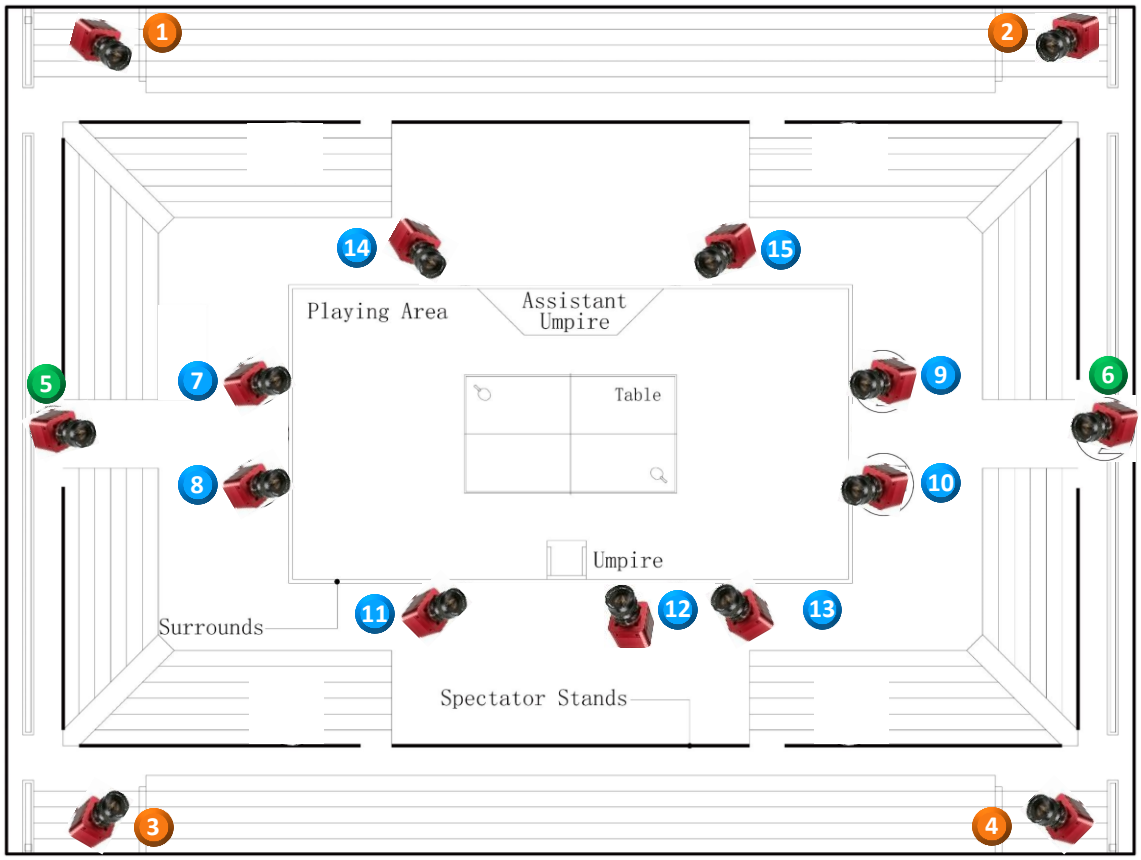
- TTR technical staff should be booked in double rooms
- Ensure that the technical staff have access to hospitality
  - Airport transfers
  - Transportation to and from venue
  - Meals

A special hospitality rate (maximum 75% of the official charge) should be offered to the TTR crew and invoice for the above mentioned should be sent to ITTF at the end of the event.

Camera Positions

The TTR system will be set up for one table unless informed by ITTF. Each table will include a total of 15 cameras. As these cameras will be calibrated to track the ball and provide accurate feedback, it is essential that the designated positions are reserved, and they should not be at any time moved. It is also essential that the area should be vibration free as it will affect the accuracy of the system.

The camera set up for the table should look like this:



Camera#	Installation position	Fixation Method
#1, #2, #3, #4	3rd Floor (or higher) of the Venue Spectator Stands	To be fixed on the fence by clamps.
#5, #6	2nd Floor of the Venue Spectator Stands	To be fixed on the fence by clamps.
#7, #8, #9, #10, #11, #12, #13, #14, #15	Around surrounds of Playing Area	Tripods
- TTR Tech Team will install the cameras and run the cables between cameras and TTR workspace. - The Fences that **Camera#1, #2, #3, #4** are clammed on must be very robust and stable without vibration. It is recommended that there should be a reasonable "no spectator" zone near these cameras		

The venue should be ready and available **3 days prior** to the start of the event for the TTR crew to setup their equipment.

Workspace for TTR crew

A workspace should be set aside for the TTR crew that must be able to accommodate:

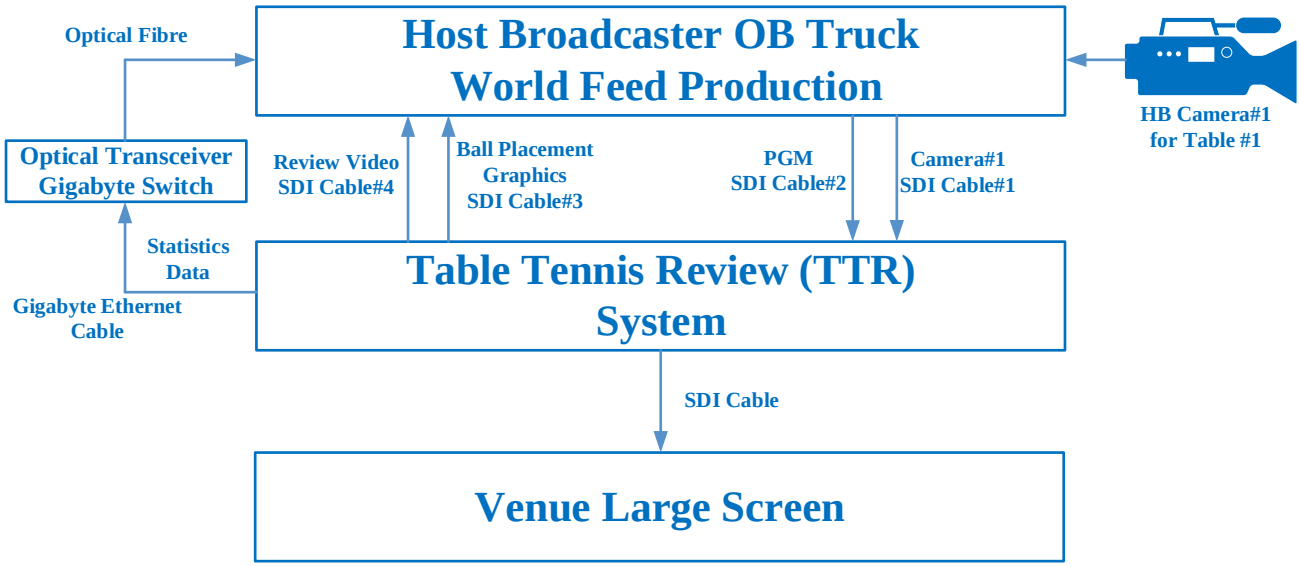
- 6 Servers
- 6 Monitors
- 1 TTR Match Official
- 5 TTR Tech crew

It is recommended that the workspace have at least 2 extension plugs to power the equipment and is located directly behind the playing area. There should be an estimated 1m of workspace per TTR Tech crew. If possible, the workspace should be located at the same technical desk as ITTF officials and the sports presentation crew.

Liaising with host broadcaster & sports presentation team

In order to be as transparent and fair as possible, the entire process of the review must be shown to fans worldwide as well as in venue. As such, it is the responsibility to inform and liaise the requirements needed for HB and sports presentation team to receive the feed from the TTR crew.

The following is the workflow and requirements:



OB Truck needs to provide the following link cables for connecting TTR system to TV production system:

- SDI cable #1: OB Truck outputs Table #1's camera video to TTR system
- SDI cable #2: OB Truck outputs PGM signal to TTR system
- SDI cable #3: TTR system outputs ball placement graphics to OB truck
- SDI cable #4: TTR system outputs review videos to OB truck
- Statistics Data Link: Because the distance between OB trunk and TTR system usually exceeds 100 meters, in this case, OB trunk needs to run an optical fibre into the venue and then convert the optical fibre link to gigabyte ethernet link via a gigabyte ethernet switch with optical transceiver (provided by the HB).

The venue needs to provide one SDI link cable to connect large screen to each TTR system.

**Please refer to the Match Official Guide for step-by-step instructions on what will happen when a challenge is called.*
*** HB and Sports Presentation team must be clear on the TTR protocol to avoid any delay when a call is made.*

Additional statistics for enhanced broadcast

TTR system can deliver additional statistics to the HB to enhance quality of production and additional information for viewers. They include:

- Ball Speed
- Spin Rate and Spin Direction
- Height of Net Clearance
- Ball Placement
- Player's Reaction Time
- Rally Length
- Ball Placement
- Two Player's comparison data after each game and each match
    - Max ball speed
    - Max ball spin rate
    - Average Height of net clearance during serve
    - Minimum serving net clearance
    - Average reaction time
    - Minimum reaction time
- Top 5 Leaderboard
    - The highest ball speed;
    - The highest spin rate;
    - The lowest height of net clearance during serve;

- Players' shortest reaction time.

For statistics data protocol, please refer to the following sections.

Protocol Description

The data sent is in UDP, the port number is 3456 (variable), the message is encoded in utf8 format. The start identifier of the message is ASCII character 1, and the end identifier is ASCII character 4. As shown in the table below, the message is encapsulated as

<SOH> Message type| Action issuer| Message content <EOT> (divided by vertical line)

The definition of message type is in section 3.2.2. The action issuer is 1 or 2 (singles competition)/ 1, 2, 3 or 4(doubles competition, 1 and 3 as a team, 2 and 4 as a team). The message content is defined as text, when the content is the distribution of ball placement: Each area is divided by '#', the content in first angle bracket is the location of the placement, the content in second angle bracket is the percentage, and the rest are the coordinates of the ball placement:

<x1,y1,x2,y2>;<33>;<x,y>;<x,y>#<x1,y1,x2,y2>;<33>;<x,y>;<x,y>#<x1,y1,x2,y2>;<33>;<x,y>;<x,y>

Decimal	Hex	Abbreviation/Character
0	0x00	NUL (null)
1	0x01	SOH (start of headline)
2	0x02	STX (start of text)

3	0x03	ETX (end of text)
4	0x04	EOT (end of transmission)

Message Type

Type	Description	Notes
SERVESPEED	Serve speed	Unit: Km/h, in real-time
REACTIONTIME	Reaction time of receive	Unit: Second
WINNERPLACE	Winning shot placement in one Game	Unit: Millimetre
TRACK	Trajectory	
WINNERSPEED	Speed of winning shot	Unit: Km/h
WINNERROTATION	Spin rate of winning shot	Unit: RPS (Revolutions Per Second)
SHOTS	Shot count	
SERVEPLACE	Serve placement in one Game	Unit: Millimetre
GAMETIME	Duration of one Game	Unit: Second
MATCHTIME	Duration of one Match	Unit: Second
SHOTSPLACE	Shot placement in one Game	Unit: Millimetre
SERVEROTATION	Service spin rate	Unit: RPS, in real time
SERVEROTATION2	Service spin rate and spin direction	Vector format, comma separated: spinx, spiny
WINNERROTATION2	Winning shot spin rate and spin direction	Vector format, comma separated: spinx, spiny
SERV_OVER_NET	Height of net clearance during serve	
BALL_HIGHEST	Highest height of ball during lobs in one Rally	Unit: Meter
TECH_STAT_GAME	Technical data comparison of two players in one Game	Refer to *(1) below
TECH_STAT_MATCH	Technical data comparison of two players in one Match	Refer to *(1) below
LEADERBOARD_MAX_SPEED	Ranking of max ball speed	Refer to *(2) below
LEADERBOARD_MAX_SPIN	Ranking of max ball spin rate	Refer to *(2) below
LEADERBOARD_MIN_OVER_NET	Ranking of lowest height of net clearance during serve	Refer to *(2) below
LEADERBOARD_MIN_REACTIONTIME	Ranking of the shortest reaction time of players	Refer to *(2) below

*(1) Item 17-18: Format of Message Content

Data of different players is divided by '#', the first group of data is for player A, the second group of data is for player B. The comparison data description is shown in the following table.

MAX_SPEED	Max ball speed
MAX_SPIN	Max ball spin rate
AVG_NET	Average Height of net clearance during serve
MIN_NET	Minimum serving net clearance
AVG_REACTION	Average reaction time
MIN_REACTION	Minimum reaction time

Separate each name and data with a colon and separate each data with a comma. For example:

MAX_SPEED:80,MAX_SPIN:20,AVG_NET:5,MIN_NET:3,AVG_REACTION:0.2,MIN_REACTION:0.1#MAX_SPEED:80,MAX_SPIN:20,AVG_NET:5,MIN_NET:3,AVG_REACTION:0.2,MIN_REACTION:0.1

*(2) Item 19-22: Leaderboard (Top5)

The leaderboard shows the ranking of four indicators:

- The highest ball speed;
- The highest spin rate;
- The lowest height of net clearance during serve;
- Players' shortest reaction time.

The data format is:

Player1's name, Player1's nationality, data; Player2'name, player2's nationality, data; player3's name, player3's nationality, data; player4's name, player4's nationality, data; player5's name, player5's nationality, data;

Separate each person's data with a semicolon and separate each person's data field with a comma.

Example for highest ball speed:

PLAYER1,CHN,100KM/H;PLAYER2,CHN,99KM/H;PLAYER3,KOR,98KM/H;PLAYER4,JPN,97KM/H;PLAYER5,JPN,96KM/H