IEEE P802.11
Wireless LANs

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| Proposed Draft Text for TB Sensing Meausrement Instance |
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Abstract

This document includes proposed draft text for the “TB sensing measurement instance” sub-clause as defined in TGbf’s SFD.

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Added “covering the full bandwidth” after “The Sensing Sounding Trigger frame shall allocate uplink resources for one or more STA’s R2I NDP transmission”.
* Rev 2: Added several co-authors.
* Rev 3: Revised based on comments received at the TGbf call on Feb. 10th.
* Rev 4: Updated author list, made a few editorial revision and corrected descriptions of updated Figure 1.
* Rev 5: Updated the descriptions of the polling phase based on received comments and added a few notes to clarify a few points.

## Current SFD text related to this topic:

**7.1.4.2 TB sensing measurement instance**

(Motion 25c, 21/0990r2) A TB sensing measurement instance includes a polling phase, an NDPA sounding phase, and a TF sounding phase. The order of the NDPA sounding phase and of the TF sounding phase is TBD.

* Note: This is for HE and/or EHT STAs. Methods to support other STAs are TBD.

(Motion 29, 21/1543r1) Examples of possible TB sensing measurement instances are shown in Figure 3. In this figure,

* How to define the sounding order, as in example 3 or as in example 4, is TBD.
* The reporting phase in example 5 may be separated from the sounding phases (TBD).
* The polling in the reporting phase in example 5 could be addressed to responders other than those involved in the sounding (TBD).
* LTF security update is TBD.

 

**Figure 1: TB sensing measurement instance (examples). (Motion 29, 21/1543r1)**

*7.1.4.2.1 Polling phase*

In the polling phase, an AP sends a Trigger frame to check the availability of STAs. If a STA is available, it responds with a CTS-to-self (Motion 25c, 21/0990r2).

*7.1.4.2.2 NDPA sounding phase*

The NDPA sounding phase shall be present in a TB sensing measurement instance if at least one STA that is a sensing receiver responds in the polling phase (Motion 25c, 21/0990r2).

(Motion 25c, 21/0990r2; Motion 26c, 21/1015r2) The NDPA sounding phase consists of

* The transmission of a Sensing NDP Announcement (NDPA) frame by an AP; and
* The transmission of an NDP by an AP SIFS after the transmission of the Sensing NDPA frame.
* Note: NDPA sounding may be used by pre-HE STAs (i.e., its use is not limited to HE and/or EHT STAs).

NDP can be used for the channel measurement (e.g. CSI) between sensing transmitter and sensing receiver(s) in sub-7 GHz bands. NDP format for sensing is TBD (Motion 22, 21/1015r1; Motion 29, 21/1543r1).

*7.1.4.2.3 Trigger frame (TF) sounding phase*

The TF sounding phase shall be present in a TB sensing measurement instance if at least one STA that is a sensing transmitter responds in the polling phase (Motion 25c, 21/0990r2).

(Motion 25c, 21/0990r2; Motion 27, 21/1015r2) The TF sounding phase consists of

* The transmission of a Trigger frame by an AP to solicit NDP transmission(s) from STA(s); and
* The transmission of an NDP by STA(s) SIFS after receiving the Trigger frame.
* Note: TF sounding is defined for HE and/or EHT STAs. Supporting other STAs is TBD.

NDP can be used for the channel measurement (e.g. CSI) between sensing transmitter(s) and sensing receiver in sub-7 GHz bands. NDP format for sensing is TBD (Motion 22, 21/1015r1; Motion 29, 21/1543r1).

## Proposed Spec Text Contribution

*Editor: Include the text below in Clause 11 of TGbf D0.1*

**11.1.4.2 Trigger-based (TB) sensing measurement instance**

TB sensing measurement instance is the trigger-based variant of a sensing measurement instance. It is applicable to scenarios where an AP is the sensing initiator, and one or more non-AP STAs are the sensing responders. It includes one or more of the following phases: polling phase, NDPA sounding phase, Trigger frame (TF) sounding phase, and reporting phase.

* Note: This is for HE and/or EHT STAs. Methods to support other STAs are TBD.

Figure 1 shows five examples of TB sensing measurement instances. Example 1 shows a TB measurement instance consisting of a polling phase, an NDPA sounding phase, and a reporting phase. Example 2 shows a TB sensing measurement instance consisting of a polling phase and a TF sounding phase. Example 3 and example 4 show two TB sensing measurement instances consisting of a polling phase, an NDPA sounding phase, a TF sounding phase, and a reporting phase. Example 5 shows two TB sensing measurement instances. The first one consists of a polling phase, an NDPA sounding phase, and a TF sounding phase. The second one consists of a polling phase and a reporting phase.

* Note: The order of TF sounding and NDPA sounding as shown in example 3, example 4, and exampler 5 is TBD. The reporting phase in example 4 may be separated from the sounding phases (TBD). The polling in the reporting phase in example 5 could be addressed to responders other than those involved in the sounding (TBD). LTF security update shown in all examples is TBD.

 

**Figure 1: Examples of TB sensing measurement instance.**

*11.1.4.2.1 Polling phase*

In the polling phase, an AP sends a Sensing Polling Trigger frame to one or more STAs that are assigned to be polled in the TB sensing measurement instance and expected to participate during the availability period, and the polling phase shall be the first exchange in all TB sensing measurement instances for the measurement setup.

* Note: How the AP assigns the polling based on STA’s capabilities is TBD.

The AP shall send a Sensing Polling Trigger frame to one or more STAs and shall allocate each RU in the Polling Trigger frame to only one STA. Any STA addressed by a User Info field in a Sensing Polling Trigger frame can request to participate in the TB sensing measurement instance by responding with a CTS-to-self frame in its designated RU allocation as identified in the Sensing Polling Trigger frame.

* Note: The format of Sensing Polling Trigger frame is TBD.

*11.1.4.2.2 NDPA sounding phase*

In the NDPA sounding phase, the AP, which is a sensing transmitter, sends NDP to one or more STAs to perform sensing measurement. The NDPA sounding phase shall be present in a TB sensing measurement instance if at least one STA that is a sensing receiver has responded in the polling phase of the TB sensing measurement instance.

The AP shall transmit a Sensing NDP Announcement frame to one or more STAs that are sensing receivers and that have responded in the polling phase of the TB sensing measurement instance, followed by Initiator-to-Responder (I2R) NDP transmission after a SIFS. The STA Info fields within the Sensing NDP Announcement frame specify all the STAs that will use the NDP sent by the AP.

* Note: The formats of Sensing NDP Announcement frame and I2R NDP are TBD.

*11.1.4.2.3 Trigger frame (TF) sounding phase*

In the TF sounding phase, the AP, which is a sensing receiver, solicits NDP transmissions from one or more STAs to perform sensing measurement. The TF sounding phase shall be present in a TB sensing measurement instance if at least one STA that is a sensing transmitter has responded in the polling phase of the TB sensing measurement instance.

The AP shall transmit a Sensing Sounding Trigger frame to one ore more STAs that are sensing transmitters and that have responded in the polling phase of the TB sensing measurement instance to solicit Responder-to-Initiator (R2I) NDP transmission(s). The Sensing Sounding Trigger frame shall allocate uplink resources for one or more STA’s R2I NDP transmission covering the full bandwidth. Any STA addressed by a User Info field in a Sensing Sounding Trigger frame shall transmit NDP SIFS after receiving the Sensing Sounding Trigger frame.

* NOTE: If the number of available sensing transmitters exceeds the available uplink resources, multiple sequential trigger frames can be transmitted within the acquired TXOP.
* Note: The formats of Sensing Sounding Trigger frame and R2I NDP are TBD.

Figure 2 shows an example of a TB sensing measurement instance consisting of a polling phase, an NDPA sounding phase, and a TF sounding phase. In the polling phase, the AP polls five STAs, where STA1-2 are sensing transmitters and STA3-5 are sensing receivers. STA1-4 respond to the AP with CTS-to-self, so both TF sounding phase and NDPA sounding phase are present. In the TF sounding phase, the AP sends a Sensing Sounding Trigger frame to STA1-2 to solicit R2I NDP transmissions. In the NDPA sounding phase, the AP sends a Sensing NDP Announcement frame followed by I2R NDP to STA3-4.



**Figure 2: An example of TB sensing measurement instance including both TF sounding and NDPA sounding phase.**