

# **TBTT Information Field Type (TIFT) Clarification for P802.11REVmd**

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## Abstract

This contribution, intended for presentation to IEEE 802.11 TGM, identifies ambiguity in the TBTT Information Field Type (TIFT) subfield in the Reduced Neighbor Report. It proposes clarification, using the TIFT to specify additional properties of the reported neighbor.

## TBTT Information Field Type (TIFT) Status

References to TBTT Information Field Type in IEEE Std 802.11:

- (a) 802.11-2016 §9.4.2.171.1 Neighbor AP Information field

*The TBTT Information Field Type subfield is 2 bits in length and defines the structure of the TBTT Information field. Its value is 0. Values 1, 2, and 3 are reserved.*

Figure 9-582—TBTT Information Header subfield

- (b) 802.11ai-2016 §9.4.2.171.1 Neighbor AP Information field

***Change 9.4.2.171.1 as follows:***

*The TBTT Information Field Type subfield is 2 bits in length and defines the structure of the TBTT Information field. ~~Its value is 0.~~ Values ~~1, 2~~ and 3 are reserved.*

## TIFT Issues

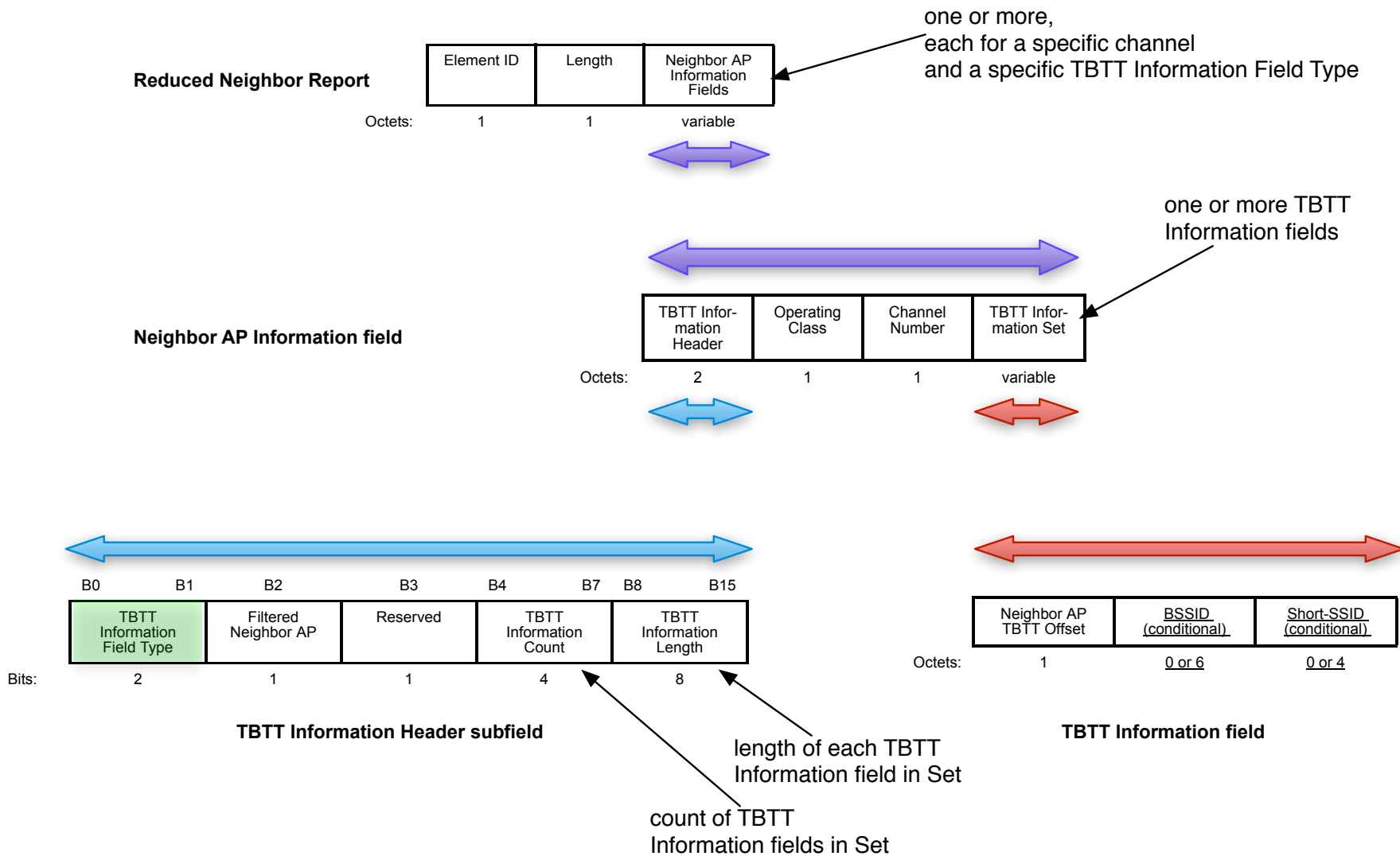
(1) The standard incorrectly states that the TBTT Information Field Type “defines the structure of the TBTT Information field”

- it does not, though it did in pre-standard drafts
- the name could therefore be improved, but that’s not proposed here

(2) How to resolve the ambiguity of the TBTT Information Field Type (TIFT)?

- What’s the purpose of adding a new value (1) of TIFT?
- How to specify the use of TIFT = 0 and 1?
- How to make use of TIFT 2 & 3?

# What is TBTT Information Field Type (TIFT)?



## 802.11ai Draft History

D5-D11: TIFT specification is same as published standard

D5: Revised, based on editorial comment resolution, to final form, with TIFT values 0 and 1 unspecified

D2-D4: TIFT (0/1) differentiates format of TBTT Information field

earlier drafts:

- *“A STA that receives a Reduced Neighbor Report element in which the TBTT Information Field Type field is 1 and in which the BSSID field is not present may switch to another channel or to another band as specified in the received Operating Class field and Channel Number field. However, if the TBTT Information Field Type is 1 and BSSID field is included in the TBTT Information, the STA may switch to a neighbor AP as specified in the received Operating Class field, Channel Number field, and BSSID field.”*
- *“Value 0 indicates the presence of the informative Neighbor AP Information that is used to help the STA in AP discovery. Value 1 indicates the presence of the Neighbor AP Information that is used to recommend the STA to switch to the channel, the band, or the neighbor AP as specified in the Neighbor AP Information field. Values 2, and 3 are reserved.”*
- *“If the AP considers its operating channel too congested to accommodate STAs, the AP should include one (or more) Neighbor AP Information element with TBTT Information Field Type indicating value 1 to the TBTT Information Header of the Neighbor AP Information field of the Reduced Neighbor AP Report element in the Beacon or FILS Discovery frame or Probe Response frame to redirect the STA conducting initial link setup from current band to other band or to redirect the STA conducting initial link setup to other AP of the current channel.”*

## TGai Proposals for dedicated RNR channel

- IEEE 802.11-11/1510r0 (Marc Emmelmann)

*Non-AP STA conducts active scanning in 2.4GHz band –  
receives valid 5GHz channel list*

*Option a) verify this information via passive scanning on specific 5GHz channel*

*Option b) directly start link set-up on 5GHz channel*

[pointed out numerous challenges]

- IEEE 802.11-12/0546r1 (Dapeng Liu)

*802.11ai can use a pre-configured/dedicated channel for passive scan... STA monitoring that particular channel instead of scanning all the channels... Scanning time is reduced since not necessary to change channels and wait... 11ai can specify a default channel for passive scan*

[pointed out problems to be solved]

## Two proposed uses of TIFT

TIFT can provide additional properties of the reported neighbor, indicating whether it:

- (1) is an AP that belongs to the same ESS as that of the AP sending this RNR and is suitable for BSS transition and reassociation.
  - This informs the STA of which neighbors are handover targets (independent of the SSID, which is unreliable).
- (2) is a “rendezvous neighbor”, meaning that it identifies, in its own rendezvous RNR, only APs that belong to the same ESS as that of the AP sending this RNR and are suitable for BSS transition and reassociation.
  - STA can quickly read the rendezvous RNR and learn the right AP with which to associate, instead of having to scan all neighbor APs (which might be large number).
    - Note that “rendezvous neighbor” does not need to be an AP; it could be just a provider of RNR information.



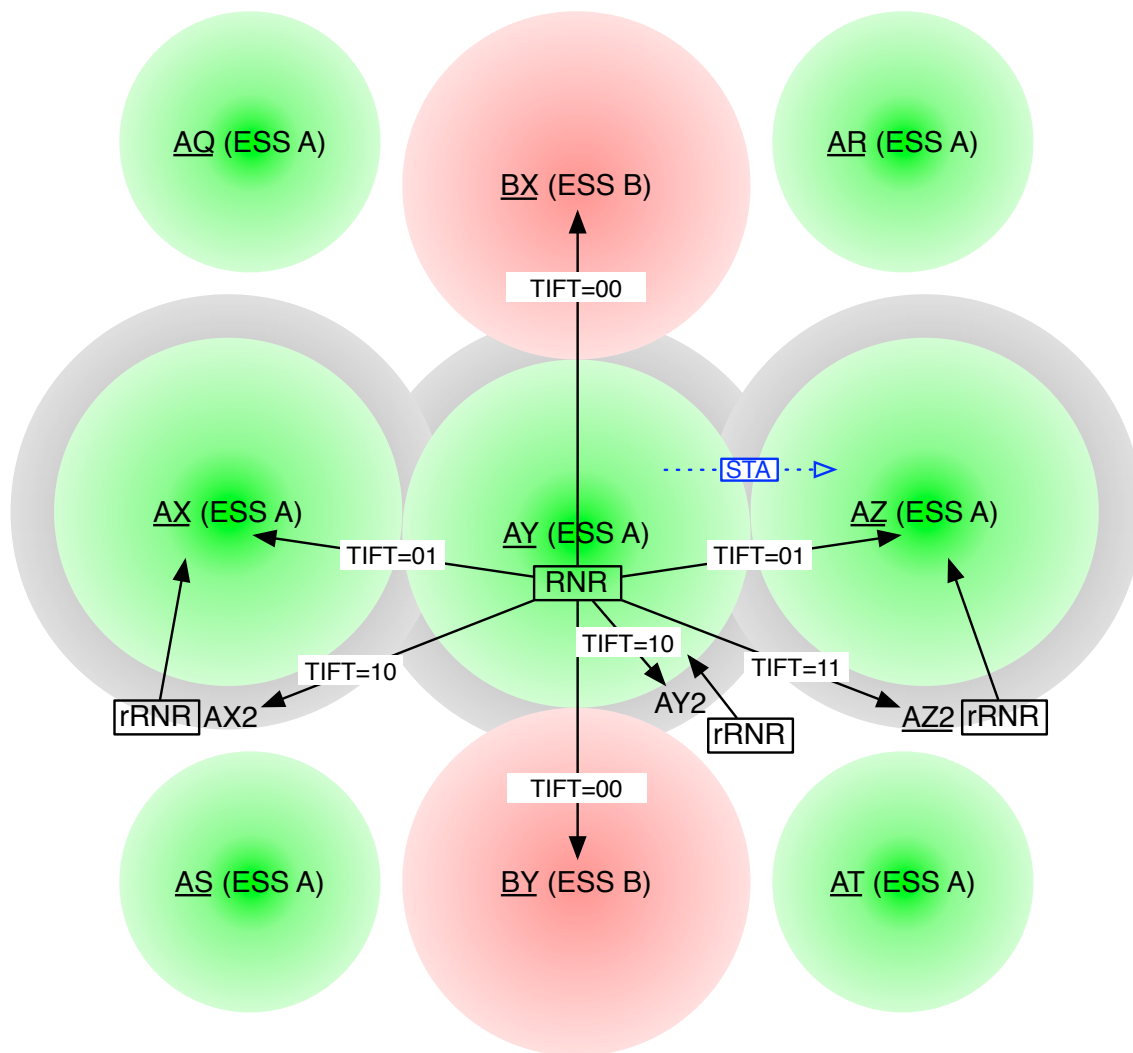
## Proposal

*The TBTT Information Field Type subfield is 2 bits in length ~~and defines the structure of the TBTT Information field. Values 2 and 3 are reserved~~ and set in accordance with Table 9-258aa.*

**Table 9-258aa—TBTT Information Field Type**

TBTT Information Field Type bit	Meaning
Bit 0	Each neighbor designated in the Neighbor AP Information field is an AP that belongs to the same ESS as that of the AP sending this Reduced Neighbor Report and is suitable for BSS transition and reassociation.
Bit 1	Each neighbor designated in the Neighbor AP Information field is a rendezvous neighbor, which identifies, in its own rendezvous Reduced Neighbor Report, only APs that belong to the same ESS as that of the AP sending this Reduced Neighbor Report and are suitable for BSS transition and reassociation.

# How TIFT might be used



TIFT

Bit 1	Bit 0
rendezvous neighbor	available for reassociation

- underlined labels represent APs
- AX2, AY2, AZ2 are rendezvous neighbors
- AZ2 is also an AP

(1) STA, associated with AY, receives RNR from AY  
 -learns of APs in ESS B  
 -learns of APs in ESS A, available for reassociation (AX, AY, AZ, AQ, AR, AS, AT)  
 -learns of rendezvous neighbors

(2) STA moves toward AZ and disassociates  
 -seeks to reassociate with an ESS A AP, but which one of the other six?  
 -consults known rendezvous neighbor (beacon, probe, FILS Disc. Frame)  
 -reads AZ2 rendezvous RNR (rRNR), which points to AZ  
 -STA does not associate with AZ2  
 -STA finds AZ without scanning  
 -STA attempts to associate with AZ  
 • if that fails, STA associates with AZ2

## Many possible implementations

- In managed high-density enterprise network, STA learns reassociation AP directly without scanning all the neighbor APs.
- Many possible rendezvous neighbor designs
  - could use 2.4 GHz band
  - rendezvous neighbor could be APs, or not
- Rendezvous neighbor ranges could be distinct
  - rRNR might specify the TBTT, for efficient scanning
- Rendezvous neighbor ranges could overlap
  - might coordinate to avoid simultaneous TBTT, avoiding collision
  - rRNR might specify the TBTT, for efficient scanning
  - rRNR might not specify the TBTT, and the STA (knowing the correct channel) would scan for beacon or FILS Discovery Frame, or actively probe
  - STA detecting multiple rRNRs could choose the strongest

## Other Improvements to §9.4.2.171.1 (1)

In IEEE Std 802.11ai-2016, §9.4.2.171.1 (“Neighbor AP Information field”) begins:

***Change 9.4.2.171.1 as follows:***

The TBTT Information Field...

However, the intention is not to change the content through Figure 9-582. Therefore, in the preparation of P802.11REVmd, the editing instruction should be interpreted as:

***Change 9.4.2.171.1, below Figure 9-582, as follows:***

The TBTT Information Field...

## Other Improvements to §9.4.2.171.1 (2)

In IEEE Std 802.11ai-2016, §9.4.2.171.1 (“Neighbor AP Information field”), this sentence should be revised for clarity:

The TBTT Information Length subfield is 1 octet in length and contains the length in octets of each TBTT Information field that is included in the TBTT Information set of the Neighbor AP Information field.

## Other Improvements to §9.4.2.171.1 (3)

In IEEE Std 802.11-2016, as amended by 802.11ai-2016, §9.4.2.171.1 (“Neighbor AP Information field”), these two sentences should be revised for clarity:

The Filtered Neighbor AP subfield is 1 bit in length. When included in the Probe Response frame, it is set to 1 if the SSID of each APs in this Neighbor AP Information field matches the specific SSID in the corresponding Probe Request frame. When included in the Beacon frame, it is set to 1 if the SSID of each APs in this Neighbor AP Information field matches the specific SSID in the containing Beacon frame. It is set to 0 otherwise.

## Summary of Proposed Changes

The proposed changes to to §9.4.2.171.1 are incorporated in a separate contribution:

Document IEEE 802.11-17/0667r0

## Comments and Discussion

**Comments and discussion are welcome.**

**No Straw Poll requested at this time.**