IEEE P802.11
Wireless LANs

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| 802.11[802.11az PHY Spec Text for Under 7GHz](relative to REVmd D0.5) |
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**Abstract**

This submission proposes P802.11az draft amendment text for the P802.11az Negotiation Protocol. The baseline documents that this proposal depends on are:

1. D0.05 of REVmd
2. D8.0 of PIEEE802.11aj
3. D5.0 of PIEEE802.11ak
4. D13.0 of PIEEE802.11aq

History:

R2: The revised parts are highlighted in yellow colour.

***TGaz Editor: Insert the following subclauses after 28.3.17 (HE TB NDP feedback PPDU):***

**28.3.17a HEz SU sounding NDP PPDU**

When the TXVECTOR parameter LTF\_SEQUENCE is not present, the format of an HEz SU sounding NDP PPDU is shown in Figure 28-44 (HE NDP PPDU format). It is mandatory to support 2x HE-LTF with *TGI1,Data*and 2x HE-LTF with *TGI2,Data*. The other combinations of HE-LTF modes and GI durations are disallowed.

When the TXVECTOR parameter LTF\_SEQUENCE is present, the HEz-LTF field and the Packet Extension (PE) field shall have a zero power guard interval and the length of the zero power guard interval of PE is equal to the length of the zero power guard interval of the HEz-LTF symbols. The format of an HEz SU sounding NDP PPDU with zero power guard interval is shown in Figure 28-aa.

 

Figure 28-aa HEz SU sounding NDP PPDU format with zero power GI

When the TXVECTOR parameter LTF\_SEQUENCE is present, the HEz-LTF sequence is generated as the following:

— In a 20 MHz transmission, the HEz-LTF sequence transmitted on subcarriers [-122:122] of an HEz SU sounding NDP is given by:

 TBD

— In a 40 MHz transmission, the HEz-LTF sequence transmitted on subcarriers [-244:244] of an HEz SU sounding NDP is given by:

 TBD

— In a 80 MHz transmission, the HEz-LTF sequence transmitted on subcarriers [-500:500] of an HEz SU sounding NDP is given by:

 TBD

— In a 160/80+80 MHz transmission, the HEz-LTF sequence transmitted on subcarriers [-500:500] of each 80 MHz frequency segment of an HEz SU sounding NDP is given by:

 TBD

When the TXVECTOR parameter LTF\_SEQUENCE is present, the time domain representation of the waveform of the HEz-LTF is described in Equation (28-58) with replacing the *TGI1,Data, TGI2,Data* with zero power guard interval and replacing the HE-LTF sequence with HEz-LTF sequence on each subcarrier.

When the TXVECTOR parameter LTF\_SEQUENCE is present and LTF\_SEQUENCE parameter has multiple LTF sequence generation information, the format for the HEz SU sounding NDP with multiple HEz-LTF fields is shown in Fig. 28-bb. In each HEz-LTF field, there is a zero power GI preceding each HEz-LTF symbol, and each HEz-LTF field has the same structure as the HEz-LTF field shown in Figure 28-aa. The length of the zero power GI of PE is equal to the length of the zero power GI of the HEz-LTF symbols. The HEz SU sounding NDP with multiple HEz-LTF fields is used for the secured downlink channel sounding between RSTA and one or more ISTAs. Different HEz-LTF fields can be allocated to different ISTAs for channel sounding. Each ISTA can be allocated one or more HEz-LTF fields and each ISTA’s allocation information of HEz-LTF field (for example, number of HEz-LTF symbols offset $N\_{OFS}$, number of space-time streams $N\_{STS}$ and number of repetition of the HEz-LTF fields $N\_{REP}$) are indicated in the STA info subfield of the NDP announcement frame preceding the HEz SU sounding NDP. See xxxx for details. Each HEz-LTF field is generated using a different random HEz-LTF sequence, and each HEz-LTF symbol is generated with zero power guard interval. P-matrix encode is used for each HEz-LTF field for the multiple Tx antenna case.. Multiple HEz-LTF fields may be used by a single ISTA to obtain independent channel estimates based on each HEz-LTF field. The PHY shall issue the error condition PHY-RXEND.indication(Integrity Check Error) primitive if the PHY detects the integrity check error.



Fig. 28-bb HEz SU sounding NDP PPDU with *NLTF* HEz-LTF fields

At the receiver the mechanism (e.g. DFT size) by which the time domain signal is transformed to frequency domain signal based on an HEz-LTF field with zero power guard interval is implementation specific.

**28.3.17a.1 HEz TB sounding NDP PPDU**

When the TXVECTOR parameter LTF\_SEQUENCE is not present, the format of an HEz TB sounding NDP PPDU is shown in Figure 28-cc (HEz TB sounding NDP PPDU format).

 

Figure 28-cc HEz TB sounding NDP PPDU format

The HEz TB sounding NDP PPDU has the following properties:

— Uses the HE TB PPDU format but without the Data field.

— Has Packet Extension field that is 4us in duration.

It is mandatory to support 2x HE-LTF with *TGI2,Data*. The other combinations of HE-LTF modes and GI durations are disallowed.

When the TXVECTOR parameter LTF\_SEQUENCE is not present, the time domain representation of the waveform of the HEz-LTF is described in Equation (28-59).

When the TXVECTOR parameter LTF\_SEQUENCE is present, the HEz-LTF field and PE field shall have a zero power guard interval and the length of the zero power guard interval of PE is equal to the length of the zero power guard interval of the HEz-LTF symbols. The format of an HEz TB sounding NDP PPDU with zero power guard interval is shown in Figure 28-dd.



Figure 28-dd HEz TB sounding NDP PPDU format with zero power GI

When the TXVECTOR parameter LTF\_SEQUENCE is present, the HEz-LTF sequence is generated as the following:

— In a 20 MHz transmission, the HEz-LTF sequence transmitted on subcarriers [-122:122] of an HEz TB sounding NDP is given by:

 TBD

— In a 40 MHz transmission, the HEz-LTF sequence transmitted on subcarriers [-244:244] of an HEz TB sounding NDP is given by:

 TBD

— In an 80 MHz transmission, the HEz-LTF sequence transmitted on subcarriers [-500:500] of an HEz TB sounding NDP is given by:

 TBD

— In a 160/80+80 MHz transmission, the HEz-LTF sequence transmitted on subcarriers [-500:500] of each 80 MHz frequency segment of an HEz TB sounding NDP is given by:

 TBD

When the TXVECTOR parameter LTF\_SEQUENCE is present, the time domain representation of the waveform of the HEz-LTF is described in Equation (28-59) with replacing the *TGI2,Data* with zero power guard interval and replacing the HE-LTF sequence with HEz-LTF sequence on each subcarrier.

When the TXVECTOR parameter LTF\_SEQUENCE is present and LTF\_SEQUENCE parameter has multiple LTF sequence generation information, the format of an HEz TB sounding NDP PPDU is shown in Figure 28-ee. Each HEz-LTF field is generated using a different random HEz-LTF sequence, and each HEz-LTF symbol is generated with zero power guard interval. P-matrix encode is used for each HEz-LTF field for the multiple Tx antenna case. An NDP with multiple HEz-LTF fields may be used by a single STA to obtain independent channel estimates based on each HEz-LTF field. The PHY shall issue the error condition PHY-RXEND.indication(Integrity Check Error) primitive if the PHY detects the integrity check error.

  Figure 28-ee HEz TB sounding NDP PPDU with *NLTF* HEz-LTF fields

At the receiver the mechanism (e.g. DFT size) by which the time domain signal is transformed to frequency domain signal based on an HEz-LTF field with zero power guard interval is implementation specific.

***TGaz Editor: Delete the following subclause after 21.3.12a (VHTz sounding NDP PPDU) in 11az\_D0.3\_r1:***

**~~21.3.12a VHTz sounding NDP PPDU~~**

~~When the TXVECTOR parameter LTF\_SEQUENCE is not present, the format of a VHTz sounding NDP PPDU is shown in Figure 21-28 (VHT NDP format).~~

~~When the TXVECTOR parameter LTF\_SEQUENCE is present, the format of a VHTz sounding NDP PPDU is TBD.~~

~~When the TXVECTOR parameter LTF\_SEQUENCE is present, the VHTz-LTF sequence is generated as the following:~~

~~— In a 20 MHz transmission, the VHTz-LTF sequence transmitted on subcarriers [-28:28] of a VHTz SU sounding NDP is given by:~~

 ~~TBD~~

~~— In a 40 MHz transmission, the VHTz-LTF sequence transmitted on subcarriers [-58:58] of a VHTz SU sounding NDP is given by:~~

 ~~TBD~~

~~— In an 80 MHz transmission, the VHTz-LTF sequence transmitted on subcarriers [-122:122] of a VHTz SU sounding NDP is given by:~~

 ~~TBD~~

~~— In a 160 MHz transmission, the VHTz-LTF sequence transmitted on subcarriers [-250:250] of a VHTz SU sounding NDP is given by:~~

 ~~TBD~~

~~— In an 80+80 MHz transmission, the VHTz-LTF sequence transmitted on each 80 MHz frequency segment is TBD~~

~~When the TXVECTOR parameter LTF\_SEQUENCE is present and LTF\_SEQUENCE parameter has multiple LTF sequence generation information, the format of a VHTz sounding NDP PPDU is TBD.~~

*TGaz Editor: Delete the following subclause in section 21 Very high throughput (VHT) PHY specification in 11az\_D0.3\_r1:*

### ~~21.2.2 TXVECTOR and RXVECTOR parameters~~

***~~TGaz Editor: Insert the following row into Table 21-1:~~***

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| --- |
| ~~Table 21-1— TXVECTOR and RXVECTOR parameters~~ |
| ~~Parameter~~ | ~~Condition~~ | ~~Value~~ | ~~TXVECTOR~~ | ~~RXVECTOR~~ |
| ~~LTF\_SEQUENCE~~ | ~~FORMAT is VHT and APEP\_LENGTH is 0~~ | ~~Indicates the LTF sequence generation information to make the randomized LTF sequence used in the VHTz sounding NDP PPDU.~~ ~~The LTF sequence generation information is defined in 9.4.2.251 (Secure LTF Parameters).~~ | ~~O~~ | ~~N~~ |
| ~~Otherwise~~  | ~~Not present~~ | ~~N~~ | ~~N~~ |

***~~TGaz Editor: Insert the following subclause at the end of the 21.2.2:~~***

### ~~21.2.2a LTFVECTOR parameters~~

~~The LTFVECTOR is carried in a PHY-RXLTFSEQUENCE.request for PHY of AP to receive the secure VHTz sounding NDP PPDU. The parameters in Table 21-1a (LTFVECTOR parameters) are defined as part of the LTFVECTOR parameter list in the PHY-RXLTFSEQUENCE.request primitive.~~

|  |
| --- |
| ~~Table 21-1a—LTFVECTOR parameters~~ |
| ~~Parameter~~ | ~~Value~~ |
| ~~LTF\_SEQUENCE~~ | ~~Indicates the LTF sequence generation information to make the randomized LTF sequence used in the VHTz sounding NDP PPDU.~~ ~~The LTF sequence generation information is defined in 9.4.2.251 (Secure LTF Parameters).~~ |

***TGaz Editor: Modify the following subclause in 11az\_D0.3\_r1 as follows:***

***Change Figure 9-51e as follows:***



Figure 9-51e STA Info subfield format in a Ranging NDP Announcement frame

***Insert the following after the paragraph (“The RID11/AID11 subfield contains the 11 least significant bits ”):***

The HEz-LTF field offset subfield, Number of space-time streams subfield and repetition of HEz-LTF field subfield are used to indicate the HEz-LTF field allocation for the ISTAs in the DL sounding NDP of secured HEz ranging.

The HEz-LTF field offset subfield is set to the number of HEz-LTF symbols, *N*OFS, that precede the HEz-LTF field allocated to the ISTA. The HEz-LTF field allocated to the ISTA starts after *N*OFS HEz-LTF symbols following the HE-STF field. The HEz-LTF field offset is calculated by the RSTA based on the allocation of HEz-LTF fields to the ISTAs.

Number of space-time streams subfield carries the number of space-time streams, *NSTS,* associated with the HEz-LTF field(s) allocated to the ISTA. The number of HEz-LTF symbols in each HEz-LTF field, *N*HEz-LTF, is a function of the total number of space-time streams *NSTS* as shown in Table 21-13 (Number of VHT-LTFs required for different numbers of space-time streams) in 21.3.8.3.5 (VHT-LTF definition), replacing *NVHT-LTF* by *NHEz-LTF* and replacing *NSTS,total* by *NSTS*.The *NSTS* is determined by the ISTA and RSTA in the negotiation phase.

The Repetition of HEz-LTF field is set to the number of repetitions of the HEz-LTF fields allocated to the ISTA. The number of repetitions is determined by the ISTA and RSTA in the negotiation phase.

***TGaz Editor: Modify the first paragraph of subclause 11.22.6.4.3.1 General in 11az\_D0.3\_r1 as follows:***

In VHTz mode, the measurement exchange phase of the ranging protocol shall ~~be based on IEEE 802.11 VHT sounding protocol and~~ operate~~s~~ in an ISTA centric scheduling FTM operation (#Ed);

***TGaz Editor: Insert the following paragraph before the last paragraph of subclause11.22.6.4.3.2 Measurement Exchange Sequence in 11az\_D0.3\_r1:***

For VHTz mode operating at 2.4GHz and 5GHz bands, when the TXVECTOR parameter LTF\_SEQUENCE is not present, the DL NDP and UL NDP use HEz SU sounding NDP PPDU with GI=0.8us (shown in Figure 28-44 HE NDP PPDU format) for non-secured channel sounding; when the TXVECTOR parameter LTF\_SEQUENCE is present, the UL NDP and DL NDP use HEz SU sounding NDP PPDU format with zero power GI (shown in Figure 28-aa HEz SU sounding NDP PPDU format with zero power GI) for secured channel sounding and the length of zero power GI for HEz-LTF symbols and PE is 0.8us, and when the TXVECTOR parameter LTF\_SEQUENCE is present and LTF\_SEQUENCE parameter has multiple LTF sequence generation information, the UL NDP and DL NDP use HEz SU sounding NDP PPDU with multiple HEz-LTF fields (Fig. 28-bb HEz SU sounding NDP PPDU with NLTF HEz-LTF fields) for secured channel sounding with integrity check and the length of zero power GI for each HEz-LTF symbol and the PE is 0.8us.