IEEE P802.11
Wireless LANs

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| 11bp PDT PHY UL Modulation And Coding |
| Date: July 17, 2025 |
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Abstract

This document contains Proposed Draft Text (PDT) for UL modulation and coding of the proposed TGbp (AMP, Ambient Power) amendment to the 802.11 standard.

**Revision information**

The following is a summary of the important changes that occurred within each revision of this document:

|  |  |
| --- | --- |
| **Revision** | **Major changes** |
| 0 | Initial revision including motions up to 7/17/2025 |
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**Introduction**

Interpretation of a Motion to Adopt.

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGbp Draft. The abstract, revision information, introduction, explanation of the proposed changes and references sections are not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGbp Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

**Explanation of the proposed changes:**

The proposed changes to the 802.11 TGbp draft within this document are based on the following motions adopted by the TGbp task group:

# Relevant passing motions:

All the passing motions up to July 17, 2025 (see [1]) are as follows.

[Motion #19, [1] and [11]]

* 11bp defines Manchester encoding for the data portion of UL transmission in 2.4 GHz, including both backscattering and active transmission.

[Motion #21, [1], [14] and [15]]

* 11bp will define On-Off Keying (OOK) modulation for AMP-Sync field and the AMP-Data field in an AMP Uplink PPDU for Active Transmission.

[Motion #31, [1], [28] and [29]]

* 11bp defines the following data rates for AMP uplink transmissions at 2.4GHz
	+ 250kbps and 1Mbps for both backscatter and non-backscatter uplink transmission;
	+ 4Mbps for non-backscatter uplink transmission only.
		- Mandatory or optional is TBD

[Motion #38, [1], [40]]

* The AMP-Sync field and the AMP-Data field of AMP UL PPDU for backscatter communication use OOK modulation.

[Motion #40, [1], [40], [41], [42] and [43]]

* For DL PPDU and UL PPDU for backscattering:
	+ For AMP Manchester encoded OOK of rate 250kbps, each data bit is encoded based on the chip duration of 2us.
	+ For AMP Manchester encoded OOK of rate 1Mbps, each data bit is encoded based on the chip duration of 0.5us.

[Motion #41 and #79, [1], [40], [41], [42] and [43]]

* For DL PPDU and UL PPDU:
	+ For AMP Manchester encoded OOK, data bit 1 is encoded as chip bits “01” and data bit 0 is encoded as chip bits“10”
	+ Note: same definition as WUR HDR definition.

[Motion #43, [1], [44]]

* The PHY parameters (at least data rate) for AMP UL transmission are indicated by the AMP AP.
	+ Other PHY parameters TBD.

[Motion #78, [1], [44] and [76]]

* For UL PPDU for non backscattering case, for AMP Manchester encoded OOK the chip duration of data portion is different for different data rates. The exact chip duration is TBD.
	+ 4Mbps is TBD.

**Text to be adopted begins here.**

***TGbp editor: Please add the following text to the respective subclauses in 802.11bp draft D0.1:***

## 40.3 AMP PHY

### 40.3.5 AMP modulation and coding schemes (AMP-MCSs)

The AMP modulation and coding scheme (MCS) represents the modulation and coding scheme used in the AMP-Data field of the AMP PPDUs.

There are two MCSs, corresponding to 250 kb/s and 1 Mb/s data rates, in UL backscattering transmissions. There are three data rates, 250 kb/s, 1 Mb/s and 4 Mb/s, in UL active transmissions. The UL data rate or MCS in UL backscattering transmissions or UL active transmissions is indicated by the AMP AP in the preceding AMP Trigger frame. The rate-dependent parameters for UL backscattering transmissions and UL active transmissions are given in Table 40-B (MCS for UL AMP PPDU in Backscattering Transmission) and Table 40-C (MCS for UL AMP PPDU in Active Transmission), respectively.

### 40.3.9 Data field

#### 40.3.9.1 Modulation

On-off keying (OOK) modulation is used for the AMP-Data field in DL transmissions, UL backscattering transmissions and UL active transmissions. The AMP OOK modulation in DL transmissions and UL backscattering transmissions shall be generated by using the multicarrier on-off keying (MC-OOK) modulation technique with a signal constructed from multiple subcarriers. The AMP OOK modulation in UL active transmissions is generated by TBD.

In UL backscattering transmissions, the duration of the AMP OOK symbol corresponding to each encoded bit is dependent on the AMP data rate: 2 μs for 250 kb/s and 0.5 μs for 1 Mb/s. For 250 kb/s, 2 μs duration AMP OOK Off and On symbols are denoted as SymMcOokMcs0Off and SymMcOokMcs0On, respectively. For 1 Mb/s, 0.5 μs duration AMP OOK Off and On symbols are denoted as SymMcOokMcs1Off and SymMcOokMcs1On, respectively.

In DL AMP transmissions or UL backscattering transmissions, SymMcOokMcs0On and SymMcOokMcs1On are described in 40.3.7 (Mathematical description of signals). The generation of SymMcOokMcs0On and SymMcOokMcs1On is described in 40.3.3.1 (AMP DL carrier wave generation).

In UL active transmissions, the duration of the AMP OOK symbol corresponding to each encoded bit is dependent on the AMP data rate: TBD μs for 250 kb/s, TBD μs for 1 Mb/s, and TBD μs for 4 Mb/s. For 250 kb/s, TBD μs duration AMP OOK Off and On symbols are denoted as SymAtMcs0Off and SymAtMcs0On, respectively. For 1 Mb/s, TBD μs duration AMP OOK Off and On symbols are denoted as SymAtMcs1Off and SymAtMcs1On, respectively. For 4 Mb/s, TBD μs duration AMP OOK Off and On symbols are denoted as SymAtMcs2Off and SymAtMcs2On, respectively.

In UL active transmissions, SymAtMcs0On, SymAtMcs1On and SymAtMcs2On are described in 40.3.7 (Mathematical description of signals). The generation of SymAtMcs0On, SymAtMcs1On and SymAtMcs2On is described in 40.3.3.1a (AMP UL active transmission carrier wave generation).

#### 40.3.9.2 Coding

##### 40.3.9.2.1 General

In UL backscattering transmissions, the AMP OOK symbols are Manchester encoded for both data rates of 250 kb/s and 1 Mb/s. In UL active transmissions, the AMP OOK symbols are Manchester encoded for both data rates of 250 kb/s and 1 Mb/s, and are TBD for 4 Mb/s.

##### 40.3.9.2.2 Manchester coding

Manchester encoded bits corresponding to each input bit are shown in Table 40-A (AMP Manchester encoded bits). The encoded binary data shall be modulated so that encoded bits 0 and 1 shall be represented by Off and On symbols, respectively.

###### Table 40-A AMP Manchester encoded bits

|  |  |
| --- | --- |
| **Input bit** | **Encoded bits** |
| 0 | 10 |
| 1 | 01 |

## 40.5 Parameters for AMP-MCSs

The rate-dependent parameters for UL backscattering transmissions are given in Table 40-B (MCS for UL AMP PPDU in Backscattering Transmission). Manchester encoding and OOK modulation shall be used for all MCS in the AMP-Data field of an UL AMP PPDU in backscattering transmission.

###### Table 40-B MCS for UL AMP PPDU in Backscattering Transmission

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **AMP-UL-BS-MCS index** | **Modulation** | **Symbol Structure** | **Equivalent information bit duration** | **NSPDB** | **Data rate (kb/s)** |
| 0 | AMP MC-OOK | Information 0 | [SymMcOokMcs0On, SymMcOokMcs0Off] | 4 μs | 2 | 250 |
| Information 1 | [SymMcOokMcs0Off, SymMcOokMcs0On] |
| 1 | AMP MC-OOK | Information 0 | [SymMcOokMcs1On, SymMcOokMcs1Off] | 1μs | 2 | 1000 |
| Information 1 | [SymMcOokMcs1Off, SymMcOokMcs1On] |

The rate-dependent parameters for UL active transmissions are given in Table 40-C (MCS for UL AMP PPDU in Active Transmission). Manchester encoding and OOK modulation shall be used for 250 kb/s and 1 Mb/s in the AMP-Data field of an UL AMP PPDU in active transmission. 4 Mb/s is TBD. In UL active transmissions, the duration of the AMP OOK symbol corresponding to each encoded bit is different for different data rates. The duration of the AMP OOK symbol corresponding to each encoded bit for each data rate is TBD.

###### Table 40-C MCS for UL AMP PPDU in Active Transmission

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **AMP-UL-AT-MCS index** | **Modulation** | **TBD** | **TBD** | **TBD** | **TBD** | **Data rate (kb/s)** |
| 0 | AMP OOK | TBD | TBD | TBD | TBD | 250 |
| TBD | TBD | TBD | TBD |
| 1 | AMP OOK | TBD | TBD | TBD | TBD | 1000 |
| TBD | TBD | TBD | TBD |
| 2 | AMP OOK | TBD | TBD | TBD | TBD | 4000 |
| TBD | TBD | TBD | TBD |

**Text to be adopted ends here.**

**References:**

1. [11-24-1613r10](https://mentor.ieee.org/802.11/dcn/24/11-24-1613-10-00bp-specification-framework-for-tgbp.docx): Specification Framework for TGbp, Yinan Qi (OPPO)