ＭＳＥ、または何らかの他の技法に従って行われる。ＲＸデータプロセッサ２７０は、そのユーザ端末のための復号されたデータを取得するために、復元されたダウンリンクデータシンボルストリームを処理（例えば、復調、デインターリーブ、復号）する。

【００４１】

[0049] 各ユーザ端末１２０において、チャネル推定器２７８は、ダウンリンクチャネル応答を推定し、ダウンリンクチャネル推定値を提供し、それは、チャネル利得推定値、ＳＮＲ推定値、ノイズ分散などを含み得る。同様に、アクセスポイント１１０において、チャネル推定器２２８は、アップリンクチャネル応答を推定し、アップリンクチャネル推定値を提供する。各ユーザ端末のためのコントローラ２８０は通常、ユーザ端末のための空間フィルタマトリクスを、そのユーザ端末のためのダウンリンクチャネル応答マトリクス$H_{dn,m}$に基づいて導出する。コントローラ２３０は、効率的なアップリンクチャネル応答マトリクス$H_{up,eff}$に基づいて、アクセスポイントのための空間フィルタマトリクスを導出する。各ユーザ端末のためのコントローラ２８０は、フィードバック情報（例えば、ダウンリンクおよび／またはアップリンク固有ベクトル、固有値、ＳＮＲ推定値など）をアクセスポイントに送り得る。コントローラ２３０および２８０はまた、それぞれ、アクセスポイント１１０およびユーザ端末１２０において、様々な処理ユニットの動作を制御する。

【００４２】

[0050] 図３は、ＭＩＭＯシステム１００内で用いられ得るワイヤレスデバイス３０２において利用され得る様々なコンポーネントを図示する。ワイヤレスデバイス３０２は、本明細書で説明される様々な方法を実施するように構成され得るデバイスの一例である。例えば、ワイヤレスデバイスは、それぞれ、図１０および１１で図示される動作１０００および１１００を実施し得る。ワイヤレスデバイス３０２は、アクセスポイント１１０またはユーザ端末１２０であり得る。

【００４３】

[0051] ワイヤレスデバイス３０２は、ワイヤレスデバイス３０２の動作を制御するプロセッサ３０４を含み得る。プロセッサ３０４はまた、中央処理装置（ＣＰＵ）とも呼ばれ得る。メモリ３０６は、読み取り専用メモリ（ＲＯＭ）とランダムアクセスメモリ（ＲＡＭ）との両方を含み得、プロセッサ３０４に命令およびデータを提供する。メモリ３０６の一部はまた、不揮発性ランダムアクセスメモリ（ＮＶＲＡＭ）も含み得る。プロセッサ３０４は通常、メモリ３０６内に記憶されたプログラム命令に基づいて、論理および算術演算を行う。メモリ３０６内の命令は、本明細書で説明される方法を実施するように実行可能であり得る。

【００４４】

[0052] ワイヤレスデバイス３０２はまた、ワイヤレスデバイス３０２と遠隔ノードとの間でデータの送受信を可能にする、送信機３１０および受信機３１２を含み得る、ハウジング３０８を含み得る。送信機３１０および受信機３１２は、トランシーバ３１４に統合され得る。単一のまたは複数の送信アンテナ３１６は、ハウジング３０８に取り付けられ、トランシーバ３１４に電気的に結合され得る。ワイヤレスデバイス３０２はまた、複数の送信機、複数の受信機、および複数のトランシーバ（図示されない）を含み得る。

【００４５】

[0053] ワイヤレスデバイス３０２はまた、トランシーバ３１４によって受信された信号のレベルを検出し、定量化しようとするのに使用され得る信号検出器３１８を含み得る。信号検出器３１８は、そのような信号を、総エネルギー、シンボルあたりのサブキャリアごとのエネルギー、電力スペクトル密度および他の信号として検出し得る。ワイヤレスデバイス３０２はまた、信号を処理する際に使用するための、デジタルシグナルプロセッサ（ＤＳＰ）３２０も含み得る。

【００４６】

[0054] ワイヤレスデバイス３０２の様々なコンポーネントは、バスシステム３２２によって連結され得、それは、データバスに加えて、電力バス、制御信号バス、およびステ

ータス信号バスを含み得る。

【００４７】

[0055] 本明細書で使用されるような複数ユーザ（ＭＵ）送信という用語は、一般に、アクセスポイントから複数ユーザへの送信（送信機会内に同時パケットとして送られようと、順次パケットとして送られようと）、または複数ユーザからアクセスポイントへの送信（送信機会内に同時パケットとして送られようと、順次パケットとして送られようと）を指し、一方シングルユーザ（ＳＵ）送信という用語は、一般に、アクセスポイントからシングルユーザへの送信、またはシングルユーザからアクセスポイントへの送信を指す。

【００４８】

［アップリンク複数ユーザプロトコルにおけるＳＴＡ競合挙動の例］

[0056] 複数ユーザ（ＭＵ）通信では、アップリンク（ＵＬ）信号が複数の局（ＳＴＡ）からアクセスポイントへ送信され得るか、または代替的に、ダウンリンク（ＤＬ）信号がＡＰから複数のＳＴＡへ送信され得る。

【００４９】

[0057] 通常、ＳＴＡは、ＡＰからのトリガフレーム（ＴＦ）を受信した後に、ＵＬＭＵフレームを送る。本開示は、ＡＰがいつトリガフレームを送るか、およびＭＵモードで動作するＳＴＡが、受信したＴＦへの応答時以外にいつ媒体にアクセスすることができるかなどのような、ＭＵ通信に関する様々な問題に対処する。本開示の態様は、ＭＵモードで動作しているときでさえ、ＳＴＡによる競合ベースの媒体アクセス（contention-based medium access）のために使用され得るメカニズムを提供する。

【００５０】

[0058] 言い換えると、本開示の態様は、ＭＵおよびＳＵ通信の両方について競合ベースのアクセスを使用して通信するためのデバイス（例えば、ＡＰおよび非ＡＰ局）のための技法を提供する。このような技法は、例えば、スケジューリングされたＭＵ送信機会（ＴＸＯＰ）を待つ必要なく、緊急データを送るために局がアクセスを求めて競合することを可能にし得る。いくつかの場合には、このような技法は、例えば、ＭＵ動作が適切に動作しない場合に、ＳＵ送信を優先するために、デバイスが競合ベースのアクセスを変更することを可能にし得る。

【００５１】

[0059] ある特定の態様に従って、ＵＬ信号またはＤＬ信号は、例えば、ＭＵ他入力多出力（ＭＵ－ＭＩＭＯ）、ＭＵ（直交）周波数分割多元接続（ＭＵ－（Ｏ）ＦＤＭＡ）を使用して送信され得る。具体的には、図４－８は、アップリンクＭＵ－ＭＩＭＯ（ＵＬ－ＭＵ－ＭＩＭＯ）送信を図示しており、さらにＵＬ－（Ｏ）ＦＤＭＡに等しく適用できるだろう。これらの実施形態では、ＵＬ－ＭＵ－ＭＩＭＯまたはＵＬ（Ｏ）ＦＤＭＡ送信は、複数のＳＴＡからＡＰに同時に送られ得、ワイヤレス通信における効率をもたらし得る。

【００５２】

[0060] 図４は、本開示のある特定の態様に従った、ＭＵ通信のためのＵＬ／ＤＬフレーム交換４００の例である。図４で示されるように、ＡＰ（例えば、ＡＰ １１０）は、ＵＬ ＭＵ送信を開始することを特定のＳＴＡが知るように、どの局がＭＵ通信に参加し得るかを示す、複数のＳＴＡ１、ＳＴＡ２、およびＳＴＡ３へのトリガフレーム４１０（例えば、送信可（ＣＴＸ：clear-to-transmit）フレーム）を送信し得る。

【００５３】

[0061] ある特定の態様に従って、トリガフレームは、物理レイヤコンバージェンスプロトコル（ＰＬＣＰ）プロトコルデータユニット（ＰＰＤＵ）のペイロード部分で送信され得る。局ＳＴＡ １、ＳＴＡ ２、およびＳＴＡ ３がＡＰからのトリガフレームを受信すること、ここで、これらＳＴＡはフレーム内に示される、に応答して、これらＳＴＡは、ＵＬ ＭＵ送信（例えば、送信準備完了（ＲＴＸ：ready-to-transmit）フレーム）をＡＰに送信し得る。ある特定の態様に従って、ＳＴＡは、ＡＰからのトリガフレームを受信してから、ショートフレーム間隔（ＳＩＦＳ：short interframe space）時間の後に、Ｕ

ＵＬ ＭＵフレーム４２０を送り得る。

【００５４】

[0062] ある特定の態様に従って、ＡＰがトリガフレームを送る時間または時間期間を定義することが望ましいだろう。加えて、上述されるように、ＭＵ通信に参加しているＳＴＡが、例えば受信したトリガフレームに応答して送信しているとき以外にいつ媒体にアクセスすることができるかを定義することが望ましい。

【００５５】

[0063] 本開示のある特定の態様に従って、技法および装置は、ＵＬ ＭＵ通信において行われるときに、ＳＴＡの競合およびバックオフ挙動のために提供される。

【００５６】

[0064] 一般に、ＳＴＡは、それらの能力に基づいて分類され得る。例えば、ＳＴＡは、ＳＵ動作する（例えば、ＵＬ ＭＵで動作可能ではないＳＴＡ、またはＵＬ ＭＵで動作することを要求されないＵＬ ＭＵ使用可能なＳＴＡ）ものとして、またはＭＵ動作する（例えば、ＳＴＡがＵＬ ＭＵ使用可能であり、ＵＬ ＭＵで動作することを要求される場合）ものとして分類され得る。一般に、ＳＵ動作するＳＴＡ（SU-operating STAs）は、ＳＵ ＰＰＤＵのみを送ることが予期され得る。一方、ＭＵ動作するＳＴＡ（MU-operating STAs）は、（ＳＵ ＰＰＤＵの代わりに、またはＳＵ ＰＰＤＵに加えて）ＵＬ ＭＵ ＰＰＤＵを送信することをＡＰによって要求され得る。ＵＬ ＭＵ動作に含まれる（参加する）ための要求は、ＡＰに送られる管理フレーム内でＳＴＡによって示されるか、またはＭＵ ＴＸＯＰのための要求を示すことによって示されるか、あるいは、ＳＴＡの能力としてＵＬ ＭＵを示すことによって暗黙的に示され得る。

【００５７】

［ＳＵ送信を送るためのアクセスを求めるＭＵ動作するＳＴＡの競合の例］

[0065] ＭＵ動作に参加している（または参加することが可能な）ＳＴＡは、比較的緊急の事柄についてのＳＵ送信を送ることを望み得る。例えば、ＭＵ動作するＳＴＡは、ＭＵフレーム内で時間依存のデータ（time sensitive data）または管理情報を送るために次のトリガフレームを待つよりも早く、このようなデータについてのＳＵ送信を送ることを望み得る。

【００５８】

[0066] いくつかの場合、ＭＵ動作するＳＴＡは、媒体へのアクセスを求めて競合することが可能ではない可能性がある。このような場合、ＭＵ動作するＳＴＡは、送信時間をスケジューリングすることによって、またはトリガフレームの送信を用いてＡＰによって許可されたＴＸＯＰへの応答としてのみ送信し得る。

【００５９】

[0067] 別の場合には、ＭＵ動作するＳＴＡは、要請されていないＳＵフレームを送信するために、媒体へのアクセスを求めて競合することが可能であり得る。いくつかの場合には、ＳＴＡは、拡張分散チャネルアクセス（ＥＤＣＡ）パラメータの第１のセットに従って、アクセスを求めて競合し得る。

【００６０】

[0068] 図５は、本開示のある特定の態様に従った、ワイヤレス通信のための動作の例５００を図示する。動作５００は、装置によって、例えば（ユーザ端末／ＳＴＡ １２０のような）ＳＴＡによって、行われ得る。

【００６１】

[0069] 動作５００は、５０２において、装置がＭＵ通信を介してＡＰと通信するように構成される間、ＡＰへの送信のためにＳＵフレーム（例えば、要請されていないＳＵフレーム）を生成することによって開始する。５０２において、ＳＴＡは、送信のためにＳＵフレームを出力し得る。

【００６２】

[0070] 上述されるように、ＳＴＡは、例えば、ＡＰから送信機会（ＴＸＯＰ）を許可されなくとも、要請されていないシングルユーザ（ＳＵ）フレームを送るために拡張分散

チャネルアクセス（ＥＤＣＡ）ベースのプロトコルを使用して、媒体へのアクセスを求めて競合することが可能であり得る。ある特定の態様に従って、ＵＬ ＭＵ動作に参加している（例えば、それのためにネゴシエートおよびアドバタイズされた能力を有している）ＳＴＡでさえ、ＥＤＣＡを使用してアクセスを求めて競合することが可能であり得る。

【００６３】

[0071] いくつかの場合には、ＭＵ動作するおよびＳＵ動作するＳＴＡは、同じまたは類似するＥＤＣＡパラメータを使用し得、同じ媒体アクセスプロシージャを行い得る。この動作モードにおいて、ＭＵ動作するＳＴＡは、ＳＵ送信を行うための媒体を獲得し得る。この動作モードは、レイテンシに敏感なトラフィック（latency sensitive traffic）に、またはバースト的なトラフィック（bursty traffic）に適し得る。しかしながら、ＳＵ ＰＰＤＵの送信は、ＭＵ ＰＰＤＵの送信よりも効率的ではない可能性がある。従って、ＭＵ動作するＳＴＡからのこれらの要請されていないＳＵ送信は、例えば、ＳＵ送信よりもＭＵ送信を優遇するためにＡＰによって抑制される（discouraged）（例えば、異なるＥＤＣＡパラメータの対象となる）可能性がある。

【００６４】

[0072] ＭＵ動作するＳＴＡのためのＳＵ送信の優先度を下げること（Deprioritization）は、それがＳＵ送信のための媒体の使用を制限し得るため、ＭＵ送信のためにより多くの時間を残し、それにより、ネットワーク効率を強化する点で、有用であり得る。

【００６５】

[0073] ある実装の例では、ＡＰはこれらのＳＵ送信のために「アドホック」ＥＤＣＡアクセスパラメータを設定し得る。例えば、ＳＴＡによって使用されるＥＤＣＡパラメータの第１のセットは、ＳＴＡがＭＵ送信を介してＡＰと通信するように構成されないときにＳＴＡによって使用される通常のＥＤＣＡパラメータとは異なり得る。ＡＰは、ＭＵ動作するＳＴＡのために、ＳＵ動作するＳＴＡのためのものとは異なるＥＤＣＡアクセスパラメータを設定し得る。例として、ＡＰは、要請されていないＳＵフレームのために、より短いＴＸＯＰ制限、より大きい最小コンテンションウィンドウ（ＣＷ）、より大きい最大ＣＷ、またはより長い調停フレーム間隔数（ＡＩＦＳＮ：arbitration interframe space numbers）を設定し得る。

【００６６】

[0074] ある特定の態様に従って、ＭＵ動作するＳＴＡは、第１の時間間隔中にＥＤＣＡアクセスパラメータの第１の値を、第２の時間間隔中にＥＤＣＡアクセスパラメータの第２の値を使用し得る。例えば、第１の時間間隔は、ＳＴＡがＡＰにＵＬ ＴＸＯＰのための要求を送った後の持続時間Ｔの時間であり得る。その要求は、ＲＸＴフレームを使用して送られるか、またはＳＴＡからのＵＬデータＰＰＤＵにおいて示され得る。代替的に、第１の時間間隔は、ＵＬ送信のためのＳＴＡを示すＣＴＸをＡＰが送った後の持続時間Ｔの時間であり得る。第２の時間間隔は、第１の間隔の満了後の時間であり得る。

【００６７】

[0075] ある実装の例では、ＭＵ動作するＳＴＡは、第１の時間間隔中に、媒体にアクセスすることが可能ではない可能性がある。別の実装の例では、ＳＴＡが第１の時間間隔中に使用し得るＥＤＣＡパラメータの第１の値は、ＳＴＡが第２の時間間隔中に使用し得るＥＤＣＡパラメータの第２の値とは異なり得る。第１の値は、第２の値と比べて、より短いＴＸＯＰ制限、より長いＣＷｍｉｎ、より長いＣＷｍａｘ、および、より長いＡＩＦＳＮを含み得る。

【００６８】

[0076] ある特定の態様に従って、ＳＵおよびＭＵ動作のために使用され得るパラメータは、ＡＰによってＳＴＡの各々へと示され得る。例えば、ＡＰは、ＭＵ動作モードの設定で使用される管理フレームのような、各ＳＴＡに送られる管理フレーム（例えば、プローブまたはアソシエーション応答）内でインジケーションを送り得る。代替的に、インジケーションは、ビーコン内でＳＴＡに送られ得る。

【００６９】

[0077] ＥＤＣＡ値の第１および第２のセットの値は、管理フレームを使用することによって、ＡＰによってＳＴＡへと示され得る。時間Ｔは、ＡＰとＳＴＡとの間でネゴシエートされ得る。例えば、ＳＴＡは、ＳＴＡのトラフィック遅延要件に適合し得る望ましいＴを示し得る。ＡＰは、要求を受け入れ得るか、またはＳＴＡによって許可または拒否され得る代替の値を示し得る。

【００７０】

[0078] 別の実装の例では、ＡＰは、ＭＵ動作するＳＴＡが通常のＥＤＣＡパラメータを用いて媒体へのアクセスを求めて競合することを可能にすることによって、要請されていないＳＵ送信を抑制し得るが、ＡＰは、例えば、ＴＸＯＰを要求するある特定のパケットタイプの送信のみを可能にし得る。

【００７１】

[0079] ある特定の態様に従って、競合およびＳＵ ＰＰＤＵを送信することが可能なＭＵ動作するＳＴＡは、ＥＤＣＡアクセスの制限（例えば、ＴＸＯＰ制限）に従って、制御、データ、および／または管理を含む、ＳＵ ＰＰＤＵを送ることが可能であり得る。例えば、競合およびＳＵ ＰＰＤＵを送信することが可能なＭＵ動作するＳＴＡは、ＵＬ ＴＸＯＰを要求するフレーム（例えば、ＲＸＴフレームまたはＴＸＯＰインジケーションを有するサービス品質（ＱｏＳ：quality of service）ヌルフレーム）のみのような、フレームの特定のタイプのみを送ることが可能であり得る。

【００７２】

[0080] ある特定の態様に従って、ＭＵ動作するＳＴＡは、ＡＰにデータの新たなバーストを知らせ得る。一例では、ＳＴＡは、データフレーム、ＴＸＯＰ要求を有するショートデータフレーム、待ち行列ステータスフィードバック情報を有するフレームを、および／またはＴＸＯＰ要求を示す制御フレームを送ることによって、送り得る。ある特定の態様に従って、ＳＴＡは、ＳＴＡがＳＵ動作するＳＴＡであろうと、ＭＵ動作するＳＴＡであろうと、通常のコンテンションパラメータ（例えば、ＥＤＣＡパラメータ）を有するＴＸＯＰ要求フレームを送り得る。ある特定の態様に従って、ＳＴＡは、明確な要求を送るよりも、データフレーム内にＴＸＯＰ要求／待ち行列フィードバックをピギーバック（piggyback）し得る。

【００７３】

[0081] 図６の交換６００の例で示されるように、第１の局（ＳＴＡ １）は、６１０において（例えば、ＳＵ ＴＸＯＰまたはＭＵ ＴＸＯＰのための）要求を送り得る。示されるように、ＡＰは、ＡＫＣ ６２０（要求の受信の肯定応答）を用いて応答し得、ＳＵ送信６３０のためにＴＸＯＰを即時に許可し得る。同様に、ＳＴＡ ２は、６４０においてＳＵ ＴＸＯＰのための要求を送り得、ＡＰは、ＳＵ送信６６０のためのＴＸＯＰを許可するＡＣＫ ６５０を用いて応答し得る。ＳＵ ＴＸＯＰを可能にすることは、後に続くＴＦを待つよりも、ＳＴＡがデータをより早く送ることを可能にし得る。

【００７４】

[0082] 代替として、ＡＰは、即時ＭＵトリガフレーム（immediate MU trigger frame）を用いて、または次に続くＭＵトリガフレームの時間を示すＡＣＫを用いて、ＳＴＡ要求に応答し得る。例えば、ＳＴＡ ２は、それがバッファされたデータを有していることを既に示しており、従ってＡＰは、ＳＴＡ １に即時ＳＵ ＴＸＯＰを許可するよりもむしろＳＴＡ １およびＳＴＡ２がデータを送り得るため、ＭＵトリガフレームまで待つことを決定し得る。

【００７５】

[0083] さらに別の実装の例では、ＡＰは、例えば、ある特定のパケットタイプのみの送信を可能にすることによって、また送信のために「アドホック」ＥＤＣＡパラメータを設定することによって、要請されていないＳＵ送信を抑制し得る。

【００７６】

[0084] いくつかの場合には、制限された（または優先度を下げられた）ＳＵ送信は、ＡＰが、ＭＵ動作するＳＴＡの全てにサービスするためにＭＵデータのＴＸＯＰを割り当

てた場合に、容認可能であり得る。しかしながら、ある特定の態様に従って、ある特定の「エスケープ（escape）」条件下で、ＳＴＡは、ＭＵ動作が十分に挙動しない場合、上記の制限を無視し得る。

【００７７】

[0085] いくつかの場合には、ＳＴＡは、（例えば、望ましい結果を得るために、様々なパラメータの調整を用いて）ＭＵ動作に関連した１つまたは複数の条件を検出することに応答して、ＥＤＣＡパラメータの第１のセットを調整し得る。例えば、妥当な時間内に、ＡＰが、ＭＵ動作するＳＴＡへとＭＵトリガを成功裏に送らない場合（例えば、トリガが衝突した場合、ＡＰがトリガを送るために媒体にアクセスすることができないエクスポーズドノード（exposed node）である場合、またはＡＰがうまく実装されない場合）、ＳＴＡデータ遅延は影響を受け得る。ある特定の態様に従って、最後のＴＸＯＰ要求に続くある特定の時間の後に、ＳＴＡがＡＰによってＴＸＯＰを許可されない場合、このようなＭＵ動作するＳＴＡは、通常のＳＵ動作に（およびＳＵ ＥＤＣＡアクセスパラメータの使用に）戻り得る。このような場合、ＳＴＡはまた、ＳＵにおいて送信され得るフレームのタイプにおける制限を無視し得る。このようなエスケープ技法は、ＭＵ動作が適切に行われていないときに、枯渇（starvation）および／または遅延をＳＴＡが回避することを手助けし得る。別の例では、ＳＴＡは、取得されたスループットまたは遅延がＡＰと事前にネゴシエートされたレベル（pre-negotiated level）に到達しない場合、ＳＵ動作に戻り得る。

【００７８】

［トリガ受信後のＳＴＡバックオフの例］

[0086] ある特定の態様に従って、媒体へのアクセスを求めて競合することが可能なＭＵ動作するＳＴＡは、ＳＴＡがＳＵ ＰＰＤＵを送信するためにバックオフプロシージャを行っている間、ＵＬ ＭＵ ＴＸＯＰを許可するＡＰからのトリガ（例えば、ＣＴＸ）を受信し得る。このような場合、バックオフカウントダウンを継続しているＳＴＡは、ＵＬ ＴＸＯＰを許可するＣＴＸの受信によって影響され得る。

【００７９】

[0087] ある特定の態様に従って、ＳＴＡは、ポーリングされ得るか、またはトラフィック識別子（ＴＩＤ）を有するＡＰからのトリガを受信し得る。例えば、継続中のバックオフプロシージャ（ongoing backoff procedure）を有するＭＵ動作するＳＴＡは、ＴＸＯＰを許可するＡＰからのＣＴＸを受信し得る。

ある特定の態様に従って、トリガは、媒体へのコンテンションベースのアクセスのための１つまたは複数のバックオフパラメータを示し得る。ＳＴＡは、バックオフカウントダウンタイマを開始し得る。ある実装の例では、ＡＰは、決定性バックオフ（deterministic backoff）を示し得る。

【００８０】

[0088] どのＳＴＡがポーリングされ、媒体へのアクセスを求めて競合し得るかをＡＰは知っているため、ポーリング／トリガリングフレーム内でＡＰによって強いられる(enforced)決定性バックオフインジケーションは、競合を低減するために使用され得る。ある特定の態様に従って、ＡＰは、ＳＴＡごとのバックオフカウンタを示すか、またはバックオフカウンタは、トリガ情報から暗黙的に導出されるか、またはバックオフカウンタは、またはバックオフカウンタは、ＳＴＡアソシエーション識別子（ＡＩＤ）にリンクされ得る。

【００８１】

[0089] ある特定の態様に従って、ＳＴＡは、現在のバックオフプロシージャを停止し得、ＳＴＡ ＩＤの関数（function）である値にバックオフカウントダウンカウンタを初期化して新しいバックオフプロシージャを再開する。その値は、ＣＴＸ自体においてまたはＵＬ ＭＵ ＰＰＤＵに応答してＡＣＫ／ＢＡにおいてＳＴＡへと通信され得るか、あるいはＳＴＡ ＡＩＤの関数であり得るか、あるいは管理フレームを介してＭＵ動作の設定においてまたはアソシエーションにおいてＳＴＡへと通信されている可能性がある。

【００８２】
[0090] 優先度ベースの競合（priority-based contention）では、ＡＰは、優先度の異なるレベルを有するコンテンションパラメータのいくつかのセットを予め決定し得る。このような場合には、ＡＰは、各ポーリングされたＳＴＡのためのコンテンションパラメータセットを、その優先度に基づいて、指定し得、それは、ある特定のポーリング基準に従って決定され得る。競合のないアプローチ（contention-free approach）では、ＡＰは、各ポーリングされたＳＴＡのためのユニークタイムスロットを指定し得る。
【００８３】
[0091] 別の実装の例では、ＳＴＡは、送信の結果に関係なく、それがトリガを受信する前に行っていたバックオフを再開し得る。例えば、ＳＴＡは、トリガフレームを取得することまたはそのトリガフレームによってトリガされたＭＵ送信の成功とは関係なく、バックオフカウントダウンタイマを維持し得る。言い換えると、ポーリングされた送信は、ポーリングされていない送信に如何なる影響も与えない可能性がある。
【００８４】
[0092] さらに別の実装の例では、継続中のバックオフプロシージャを有するＭＵ動作するＳＴＡは、ＴＸＯＰを許可するＡＰからのトリガの受信の際に、現在のバックオフプロシージャを停止し、許可されたＴＸＯＰ内のＵＬ ＭＵ ＰＰＤＵの送信の後に、その送信の結果に依存して、新しいバックオフプロシージャを開始し得る。
【００８５】
[0093] ある特定の態様に従って、ＳＴＡは、トリガフレームによってトリガされたＭＵ送信の失敗成功に少なくとも部分的に基づいて、バックオフカウントダウンを調整し得る。一例では、バックオフプロシージャは、ＥＤＣＡルールに従って、ＵＬ ＭＵ ＰＰＤＵ送信が以前の継続中のバックオフプロシージャの完了の結果であるかのように再スタートされ得る。
【００８６】
[0094] 例えば、ＵＬ ＭＵ ＰＰＤＵ送信が成功する場合、ＳＴＡは、許可されたＴＸＯＰまたは送信されたＰＰＤＵのＴＩＤに対応するコンテンションウィンドウ値をリセットし得、ＳＴＡは、コンテンションウィンドウおよび他のＥＤＣＡパラメータに従って、別のバックオフカウントダウンを再スタートし得る。代替的に、ＵＬ ＭＵ ＰＰＤＵ送信が成功しない場合、ＳＴＡは、送信されたＰＰＤＵのＴＩＤについてのコンテンションウィンドウ値を増加し得、コンテンションウィンドウおよび他のＥＤＣＡパラメータに従って、別のカウントダウンタイマを再スタートし得る。
【００８７】
[0095] さらに別の実装の例では、ＳＴＡは、トリガに応答した後に、バックオフを再スタートし得る。言い換えると、ポーリングされた送信は、それがポーリングされていない送信であるかのように扱われ得る。送信が成功した場合、ＣＷｍｉｎは、送信されたＴＩＤのためにリセットされ得る。送信がエラーだった場合、コンテンションウィンドウは、送信されたＴＩＤについて２倍され得る。
【００８８】
[0096] さらに別の実装の例では、バックオフは、阻害要因（disincentive）となり得る。送信が成功した場合、コンテンションウィンドウは、送信されたＴＩＤについて増加され（例えば、２倍され）得、それは、ＳＵ送信のためにより長いバックオフ時間を提供し得るため、ＭＵ送信にとって好都合である。送信がエラーだった場合、コンテンションウィンドウは、送信されたＴＩＤについて２倍となり得、以前のバックオフが再開され得るか、またはＳＴＡは、ある特定の時間の間、チャネルにアクセスすることを停止し得る。
【００８９】
[0097] いくつかの実装では、ＳＴＡは、トリガを受信した後に、ある特定の時間の期間の間、媒体にアクセスすることを禁止され得る。
【００９０】

[0098] ある特定の態様に従って、ＡＰは、ＵＬ ＭＵ ＴＸＯＰを受信した後にバックオフを初期化するために使用される異なるＥＤＣＡパラメータを示し得る。一例では、ＳＴＡは、そのデータバッファのサイズがある特定の閾値よりも低いか、または遅延がある特定の閾値を下回るまで、ＳＵ ＰＰＤＵを送るためにＥＤＣＡパラメータの第１のセットを使用し得る。データバッファのサイズまたは遅延が閾値を超える場合、ＳＴＡは、ＳＵ ＰＰＤＵを送信するためにより高い優先度のＥＤＣＡパラメータを使用し得る。より高い優先度のアクセスは、コンテンションウィンドウをリセットすること、ＣＷｍｉｎを減少させること、ＣＷｍａｘを減少させること、ＡＩＦＳＮを減少させること、またはＴＸＯＰ制限を増加させることによって達成される。

【００９１】

[0099] ある特定の態様に従って、ＭＵ ＴＸＯＰを要求するためにＲＴＸを送る間、ＳＴＡは、ＡＰによって示される通常のＥＤＣＡアクセスパラメータを使用し得る。代替的に、ＳＴＡは、ペンディングのデータサイズの関数としてＥＤＣＡバックオフを調整し得る。例えば、バッファ内により多くのデータを有するＳＴＡは、チャネルにアクセスするより多くの機会を有するべきである。一旦ＳＴＡがバッファ内にデータを有すると、そのＳＴＡは、ＥＤＣＡを開始し得る。競合中に、バッファサイズが、Ｘバイトのある特定のレベルを超える場合、ＳＴＡは、コンテンションウィンドウサイズをリセットすることによって、コンテンションウィンドウサイズを減少させることによって、または、タイムアウト後でさえも現在のコンテンションウィンドウサイズを維持することによって、競合を早めることを選択し得る。ＳＴＡがチャネルアクセスを得ることなく、またはバッファされたデータを低減することなく、ある特定の時間の間に早められたコンテンションモードにある場合、ＳＴＡは、ＥＤＣＡを再スタートし得る。別の代替では、ＳＴＡは、受信したトリガの頻度(frequency)の関数として、バックオフを調整し得る。例えば、より長いコンテンションウィンドウは、より多くの受信したトリガのために使用され得る。さらに別の代替では、ＳＴＡは、送信されるフレームの長さの関数であるバックオフを調整し得る。

【００９２】

[0100] ある特定の態様に従って、競合のためにＳＴＡによって使用されるＥＤＣＡパラメータは、許可されるＵＬ ＭＵ ＴＸＯＰの頻度および持続時間の関数であり得る。ＳＴＡは、レイテンシおよびスループットに関して、要求されたトラフィック要件をＡＰに示し得る。ＳＴＡトラフィック要件を満たすために十分ではない可能性のある、１つのＭＵ ＴＸＯＰまたは複数のＭＵ ＴＸＯＰをめったに受信しないＳＴＡは、より高い優先度アクセスを取得するために、それらのＥＤＣＡパラメータを設定し得る。例えば、要求される遅延またはスループットを受信するＳＴＡは、それほど積極的ではない（less aggressive）ＥＤＣＡパラメータを使用し得る。受信されたサービスおよびＥＤＣＡパラメータに関連している関数は、ワイヤレス規格で示され得るか、またはＡＰによって定義され得る。

【００９３】

［ＡＰのコンテンションおよびバックオフの例］

[0101] ある特定の態様に従って、ＡＰはまた、トリガ（例えば、ＣＴＸ）フレーム（ＡＰがより高い優先度を使用し得る）を送るために、ＥＤＣＡを使用し得る。図７は、本開示のある特定の態様に従った、ワイヤレス通信のための動作７００を図示する。動作７００は、例えば、局（例えば、アクセスポイント１１０）によって行われ得る。動作７００は、７０２において、複数の装置からのＭＵ送信をトリガするために、第１のフレームを生成することによって媒体へのアクセスを求めて競合することによって開始し得る。７０２において、ＡＰは、送信のために第１のフレームを出力し得る。

【００９４】

[0102] ある特定の態様に従って、ＡＰは、１つ以上のＳＴＡが送るためのバッファされたデータの存在を示した後に、トリガフレームを送るためにアクセスを求めて競合し得る。例えば、ＳＴＡは、データフレーム、ＴＸＯＰ要求を有するデータフレーム、待ち行

列ステータス情報を有するフレーム、またはＴＸＯＰ要求を示す制御フレームであり得るＳＵフレーム内にバッファされたデータを示し得る。代替的に、ＡＰは、通常の間隔で（例えば、周期的に）トリガフレームを送信するためにアクセスを求めて競合し得る。

【００９５】

[0103] ＡＰが通常、それ自体のためにおよび基本サービスセット（ＢＳＳ）内の全てのＳＴＡのためにＥＤＣＡパラメータを制御しているため、トリガフレームを送るためにＡＰが媒体にアクセスする際に十分に高い優先度を有するように、ＡＰは、ＥＤＣＡパラメータを最適化し得る。ＡＰの競合のためのＥＤＣＡパラメータは、ＳＴＡから受信した要求の関数であり得る。例えば、競合は、より多くの要求またはより緊急度の高い要求がＳＴＡから受信される場合に、優先され得る。代替的に、競合は、より少ない要求がＳＴＡから受信される場合に優先度を下げられる可能性があり得る。

【００９６】

[0104] 一例では、一旦媒体がＰＩＦＳ持続時間（または、何らかの他の類似するショートフレーム間隔）の間にアイドルになっていると、ＡＰは、媒体にアクセスし得る。他のＢＳＳ ＳＴＡがより長い時間の間待つように構成され得るため、ＡＰは、媒体がアイドルになるとすぐに媒体にアクセスする際の絶対的な優先度（strict priority）を有する。これは、クライアントＳＴＡが媒体を解放した直後に、ＡＰが媒体にアクセスすることを可能にし得る。

【００９７】

[0105] １つ以上の隣接するＡＰが媒体にアクセスするための同じ待機時間を使用する場合、ＡＰ送信は、媒体がアイドルになるとすぐに衝突し得る。別の例では、衝突は、媒体が、媒体がそのＢＳＳ ＳＴＡのうちの１つによってビジー状態に維持される場合にのみ、ＡＰが媒体アクセスのためのショートフレーム間時間（short interframe time）（例えば、ＰＩＦＳ）を使用する場合に、回避され得る。媒体がＯＢＳＳ ＡＰ／ＳＴＡによってビジー状態に維持される場合、ＡＰは、アクセスのためにショートフレーム間隔を使用しない可能性があり、代わりに、ＯＢＳＳの衝突を回避するためにランダムバックオフを行い得る。ＡＰは、媒体を占有していたまたはＮＡＶを予約したフレームの、アドレス情報を有し得る、プリアンブルまたはＭＡＣヘッダを検出することによって、そのＢＳＳ内のデバイスによってまたはＯＢＳＳ内のデバイスによって媒体がビジー状態に維持されていたかどうかを識別し得る。プリアンブル／ｍａｃヘッダ

【００９８】

[0106] 一例では、ＡＰは、（例えば、装置においてバッファされたデータの量に基づいて）少なくとも１つの要請されていないＳＵフレームを送るために媒体にアクセスするのに使用するためのＥＤＣＡパラメータの第１のセットを、他の全ての装置に示すために、１つまたは複数のフレームを生成し得る。ある特定の態様に従って、ＡＰはまた、装置がＭＵ送信を介して装置と通信するように構成されないときに媒体にアクセスするのに使用するためのＥＤＣＡパラメータの第２のセットを、他の全ての装置に示すために、１つまたは複数のフレームを生成し得る。ある特定の態様に従って、ＥＤＣＡパラメータの第１のセットは、ＥＤＣＡパラメータの第２のセットよりも短いＴＸＯＰ制限、ＥＤＣＡパラメータの第２のセットよりも長い最小または最大コンテンションウィンドウ、あるいはＥＤＣＡパラメータの第２のセットよりも長いＡＩＦＳＮを有し得る。

【００９９】

[0107] ある特定の態様に従って、要請されていないＳＵフレームを受信することに応答して、ＡＰは、ＳＵ ＴＸＯＰ許可、ＭＵ ＴＸＯＰ許可、またはＡＣＫフレームを送り得る。ＡＣＫフレームは、第１のフレーム（例えば、トリガフレーム）の送信のタイミングを示し得る。トリガフレームはまた、検出ＳＴＡによる媒体への競合ベースのアクセスのための１つまたは複数のバックオフパラメータを含み得る。

【０１００】

[0108] ある特定の態様に従って、（例えば、ハイブリッドモードにおいて）遅延したトリガフレームを送るときに、ＡＰは、バックオフのために調整されたＥＤＣＡを使用す

る。例えば、ＡＰは、応答フレーム（例えば、ＲＴＸフレーム）を受信した後、およびＡＣＫを送信した後に、バックオフカウントダウンタイマを開始し得る。ＡＰは、バックオフカウントダウンタイマに基づいて、トリガフレームの送信を遅らせ得る。

【０１０１】

[0109] 競合中に、ＳＴＡがより大きいバッファされたデータを用いてＲＴＸフレームを繰り返し送るとき、他のＳＴＡからの新しいＲＴＸフレームが受信されるとき、および／またはＳＴＡ効率がカットオフ（cutoff）を超えるとき、ＡＰは競合を早め得る。代替的に、ＳＴＡは、その残りのバックオフをＡＰに通信し得、ＡＰは、アクセスを求めて競合する（例えば、いつトリガフレームを送信するかを決定する）ために、またはどのＳＴＡを含むか（例えば、トリガフレームを用いてどのＳＴＡをターゲットとするか）を選択するために、その残りのバックオフを使用し得る。

【０１０２】

[0110] 本明細書で開示される方法は、説明される方法を達成するための１つまたは複数のステップまたは動作を備える。方法のステップおよび／または動作は、特許請求の範囲から逸脱することなく互いに置き換えられ得る。言い換えると、ステップまたは動作の特定の順序が指定されない限り、特定のステップおよび／または動作の順序および／または使用は、特許請求の範囲から逸脱することなく修正され得る。

【０１０３】

[0111] 本明細書で使用される場合、項目のリスト「のうちの少なくとも１つ」を指すフレーズは、単一の要素を含む、それらの項目の任意の組み合わせを指す。例として、「ａ、ｂ、またはｃのうちの少なくとも１つ」は、ａ、ｂ、ｃ、ａ－ｂ、ａ－ｃ、ｂ－ｃ、およびａ－ｂ－ｃ、並びに、同じ要素の複数との任意の組み合わせ（例えば、ａ－ａ、ａ－ａ－ａ、ａ－ａ－ｂ、ａ－ａ－ｃ、ａ－ｂ－ｂ、ａ－ｃ－ｃ、ｂ－ｂ、ｂ－ｂ－ｂ、ｂ－ｂ－ｃ、ｃ－ｃ、およびｃ－ｃ－ｃ、あるいは、ａ、ｂ、およびｃの任意の他の順番）をカバーすることを意図する。

【０１０４】

[0112] 本明細書で使用される場合、「決定すること」という用語は、幅広い動作を含む。例えば、「決定すること」は、算出すること、計算すること、処理すること、導出すること、調査すること、ルックアップすること（例えば、表、データベース、または別のデータ構造内でルックアップすること）、確認することなどを含み得る。また、「決定すること」は、受信すること（例えば、情報を受信すること）、アクセスすること（例えば、メモリ内のデータにアクセスすること）などを含み得る。また、「決定すること」は、解決すること、選択すること、選ぶこと、確立することなどを含み得る。

【０１０５】

[0113] いくつかの場合には、フレームを実際に送信するよりもむしろ、デバイスは、送信のためのフレームを出力するためのインターフェースを有し得る。例えば、プロセッサは、送信のためにＲＦフロントエンドに、バスインターフェースを介してフレームを出力し得る。同様に、フレームを実際に送信するよりもむしろ、デバイスは、別のデバイスから受信したフレームを取得するためのインターフェースを有し得る。例えば、プロセッサは、送信のためにＲＦフロントエンドから、バスインターフェースを介してフレームを取得（または受信）し得る。

【０１０６】

[0114] 上述される方法の様々な動作は、対応する機能を行うことが可能な任意の適切な手段によって行われ得る。手段は、回路、特定用途向け集積回路（ＡＳＩＣ）、またはプロセッサを含むがそれらに制限されない、様々なハードウェアおよび／またはソフトウェアコンポーネントおよび／またはモジュールを含み得る。一般に、動作が図中に図示されている場合、それらの動作は、同様の参照番号を付した、対応する対照のミーンズプラスファンクションコンポーネントを有し得る。例えば、図５で図示される動作５００および図７で図示される動作７００は、それぞれ、図５Ａで図示される手段５００Ａおよび図７Ａで図示される手段７００Ａに対応する。

【０１０７】
[0115] 例えば、取得するための手段および受信するための手段は、図２で図示される受信機（例えば、トランシーバ２５４の受信機ユニット）および／またはユーザ端末１２０のアンテナ２５２、または図２で図示される受信機（例えば、トランシーバ２２２の受信機ユニット）、および／またはアクセスポイント１１０のアンテナ２２４であり得る。出力するための手段および送信するための手段は、図２で図示される送信機（例えば、トランシーバ２５４の送信機ユニット）および／またはユーザ端末１２０のアンテナ２５２、または図２で図示される送信機（例えば、トランシーバ２２２の送信機ユニット）および／またはアクセスポイント１１０のアンテナ２２４であり得る。

【０１０８】
[0116] 処理するための手段、決定するための手段、生成するための手段、含むための手段、競合するための手段、調整するための手段、開始するための手段、（アクセスを求めて競合することを控えるための）控えるための手段、および増加させるための手段は、処理システムを備え得、それらは、図２で図示されるＲＸデータプロセッサ２７０、ＴＸデータプロセッサ２８８、および／またはユーザ端末１２０のコントローラ２８０、または図２で図示されるＴＸデータプロセッサ２１０、ＲＸデータプロセッサ２４２、および／またはアクセスポイント１１０のコントローラ２３０のような、１つまたは複数のプロセッサを含み得る。

【０１０９】
[0117] ある特定の態様に従って、このような手段は、（例えば、ハードウェア命令において、またはソフトウェア命令を実行することによって）ＰＨＹヘッダ内の即時応答インジケーションを提供するために上述される様々なアルゴリズムを実装することによって、対応する機能を行うように構成された処理システムによって実施され得る。例えば、装置がＭＵ通信を介してＡＰと通信するように構成される間、ＡＰへの送信のために要請されていないＳＵフレームを生成するためのアルゴリズムと、送信のために要請されていないＳＵフレームを出力するためのアルゴリズム。別の例では、複数の装置からのＭＵ送信をトリガするために、第１のフレームを生成することによって、媒体へのアクセスを求めて競合するためのアルゴリズムと、送信のために第１のフレームを出力するためのアルゴリズム。

【０１１０】
[0118] 本開示に関連して説明された、様々な例示的な論理ブロック、モジュール、および回路は、本明細書で説明される機能を行うように設計された、汎用プロセッサ、デジタルシグナルプロセッサ（ＤＳＰ）、特定用途向け集積回路（ＡＳＩＣ）、フィールドプログラマブルゲートアレイ（ＦＰＧＡ）または他のプログラマブル論理デバイス（ＰＬＤ）、離散ゲートまたはトランジスタ論理、離散ハードウェアコンポーネント、または任意のそれらの組み合わせを用いて、実装または実行され得る。汎用プロセッサは、マイクロプロセッサであり得るが、代替では、このプロセッサは、任意の商業的に利用可能なプロセッサ、コントローラ、マイクロコントローラ、またはステートマシンであり得る。プロセッサはまた、コンピューティングデバイスの組み合わせ、例えば、ＤＳＰとマイクロプロセッサの組み合わせ、複数のマイクロプロセッサ、ＤＳＰコアを備えた１つまたは複数のマイクロプロセッサ、あるいは任意の他のこのような構成として実装され得る。

【０１１１】
[0119] ハードウェアで実装される場合、ハードウェア構成の例は、ワイヤレスノード内に処理システムを備え得る。処理システムは、バスアーキテクチャを用いて実装され得る。バスは、処理システムの特定のアプリケーションと全体的な設計制約に依存して、任意の数の相互接続バスおよびブリッジを含み得る。バスは、プロセッサ、機械可読媒体、およびバスインターフェースを含む様々な回路を共にリンクさせ得る。バスインターフェースは、特に、バスを介して処理システムにネットワークアダプタを接続するために使用され得る。このネットワークアダプタは、ＰＨＹレイヤの信号処理機能を実施するために使用され得る。ユーザ端末１２０（図１を参照）の場合、ユーザインターフェース（例え

ば、キーパッド、ディスプレイ、マウス、ジョイスティックなど）もまた、バスに接続され得る。バスはまた、タイミングソース、周辺機器、電圧レギュレータ、電力管理回路などのような様々な他の回路をリンクさせ得、それらは、当該技術において周知であるため、これ以上説明されない。プロセッサは、１つまたは複数の汎用および／または特殊用途プロセッサを用いて実施され得る。例は、ソフトウェアを実行することができるマイクロプロセッサ、マイクロコントローラ、ＤＳＰプロセッサ、および他の回路を含む。当業者は、システム全体に課された特定のアプリケーションおよび全体的な設計の制約に依存して、処理システムについて説明される機能をどのように実施することが最善かを認識するだろう。

【０１１２】

[0120] ソフトウェアで実装される場合、これら機能は、コンピュータ可読媒体上で、１つまたは複数の命令またはコードとして記憶または送信され得る。ソフトウェアは、ソフトウェア、ファームウェア、ミドルウェア、マイクロコード、ハードウェア記述言語と呼ばれる場合も、その他の名称で呼ばれる場合も、命令、データ、またはそれらの任意の組み合わせを意味するものとして広く解釈されるべきである。コンピュータ可読媒体は、コンピュータ記憶媒体と、１つの場所から別の場所へのコンピュータプログラムの転送を容易にする任意の媒体を含む通信媒体との両方を含む。プロセッサは、バスの管理と、機械可読記憶媒体に記憶されたソフトウェアモジュールの実行を含む汎用処理とを担い得る。コンピュータ可読記憶媒体は、プロセッサが記憶媒体から情報を読み取り、記憶媒体に情報を書き込むことができるように、プロセッサに結合され得る。代替では、記憶媒体は、プロセッサに不可欠であり得る。例として、機械可読媒体は、送信線、データによって変調された搬送波、および／またはワイヤレスノードとは別個の、命令を記憶したコンピュータ可読記憶媒体を含み得、それらは全てバスインターフェースを通じてプロセッサによりアクセスされ得る。代替的に、または追加的に、機械可読媒体、またはそれらの任意の部分は、キャッシュおよび／または汎用レジスタファイルを用い得るような場合、プロセッサに組み込まれ得る。機械可読記憶媒体の例は、例として、ＲＡＭ（ランダムアクセスメモリ）、フラッシュメモリ、ＲＯＭ（読取専用メモリ）、ＰＲＯＭ（プログラマブル読取専用メモリ）、ＥＰＲＯＭ（消去可能なプログラマブル読取専用メモリ）、ＥＥＰＲＯＭ（登録商標）（電気的に消去可能なプログラマブル読取専用メモリ）、レジスタ、磁気ディスク、光ディスク、ハードドライブ、または任意の他の適切な記憶媒体、またはそれらの任意の組み合わせを含み得る。機械可読媒体は、コンピュータプログラム製品内で具現化され得る。

【０１１３】

[0121] ソフトウェアモジュールは、単一の命令または多数の命令を備え得、いくつかの異なるコードセグメントにわたって、異なるプログラム間で、および複数の記憶媒体にわたって、分散され得る。コンピュータ可読媒体は、いくつかのソフトウェアモジュールを備え得る。ソフトウェアモジュールは、プロセッサのような装置によって実行されると、処理システムに様々な機能を実行させる命令を含む。ソフトウェアモジュールは、送信モジュールと受信モジュールとを含み得る。各ソフトウェアモジュールは、単一の記憶デバイス内に存在し得るか、または複数の記憶デバイスにわたって分散され得る。例として、ソフトウェアモジュールは、トリガイベントが生じる場合にハードドライブからＲＡＭにロードされ得る。ソフトウェアモジュールの実行中、プロセッサは、アクセススピードを上げるために、命令のうちのいくつかをキャッシュにロードし得る。１つまたは複数のキャッシュラインは次に、プロセッサによる実行のために、汎用レジスタファイルにロードされ得る。下記でソフトウェアモジュールの機能について言及する場合、そのような機能は、ソフトウェアモジュールから命令を実行するとき、プロセッサによって実施されることが理解されるだろう。

【０１１４】

[0122] また、任意の接続は、正確にはコンピュータ可読媒体と呼ばれ得る。例えば、ソフトウェアがウェブサイト、サーバ、または他の遠隔ソースから、同軸ケーブル、光フ

ファイバーケーブル、ツイストペア、デジタル加入者回線（ＤＳＬ）、あるいは赤外線（ＩＲ）、無線、およびマイクロ波のようなワイヤレス技法を使用して送信される場合、同軸ケーブル、光ファイバーケーブル、ツイストペア、ＤＳＬ、あるいは赤外線、無線、およびマイクロ波のようなワイヤレス技法は、媒体の定義に含まれる。本明細書で使用されるような、ディスク（disk）およびディスク（disc）は、コンパクトディスク（ＣＤ）、レーザーディスク（登録商標）、光ディスク、デジタル多目的ディスク（ＤＶＤ）、フロッピー（登録商標）ディスク、およびＢｌｕ－ｒａｙ（登録商標）ディスクを含み、ここで、ディスク（disks）が通常磁気的にデータを再生する一方、ディスク（discs）は、レーザーを用いて光学的にデータを再生する。よって、いくつかの態様において、コンピュータ可読媒体は、非一時的なコンピュータ可読媒体（例えば、有形的媒体）を備え得る。加えて、他の態様では、コンピュータ可読媒体は、一時的なコンピュータ可読媒体（例えば、信号）を備え得る。上記の組み合わせもまた、コンピュータ可読媒体の範囲内に含まれるべきである。

【０１１５】

[0123] このように、ある特定の態様は、本明細書に表される動作を行うためのコンピュータプログラム製品を備え得る。例えば、このようなコンピュータプログラム製品は、命令を記憶した（および／または符号化された）コンピュータ可読媒体を備え得、その命令は、本明細書で説明される動作を行うために１つまたは複数のプロセッサによって実行可能である。例えば、装置がＭＵ通信を介してＡＰと通信するように構成される間、ＡＰへの送信のために要請されていないＳＵフレームを生成するための命令と、送信のために要請されていないＳＵフレームを出力するための命令。別の例では、複数の装置からのＭＵ送信をトリガするために、第１のフレームを生成することによって、媒体へのアクセスを求めて競合するための命令と、送信のために第１のフレームを出力するための命令。

【０１１６】

[0124] さらに、本明細書で説明される方法および技法を行うためのモジュールおよび／または他の適切な手段がダウンロードされ得る、および／または、そうでなければユーザ端末および／または基地局によって適宜取得され得ることが理解されるべきである。例えば、このようなデバイスは、本明細書で説明される方法を行うための手段の転送を容易にするためにサーバに結合され得る。代替的に、本明細書で説明される様々な方法は、ユーザ端末および／または基地局が、デバイスに記憶手段を結合または提供する際に様々な方法を取得し得るように、記憶手段（例えば、ＲＡＭ、ＲＯＭ、コンパクトディスク（ＣＤ）またはフロッピーディスクのような物理記憶媒体など）を介して提供され得る。さらに、本明細書で説明される方法および技法をデバイスに提供するために、他の任意の適切な技法が利用され得る。

【０１１７】

[0125] 本願請求項は、上に例示されたまさにその構成およびコンポーネントに限定されないことが理解されるだろう。様々な修正、変更、およびバリエーションが、上述される方法および装置の配置、動作、および詳細において、本願の特許請求の範囲から逸脱することなく行われ得る。

【図１】

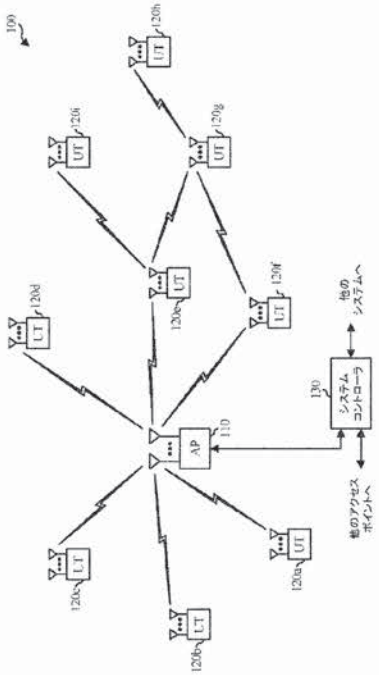


FIG. 1

【図２】

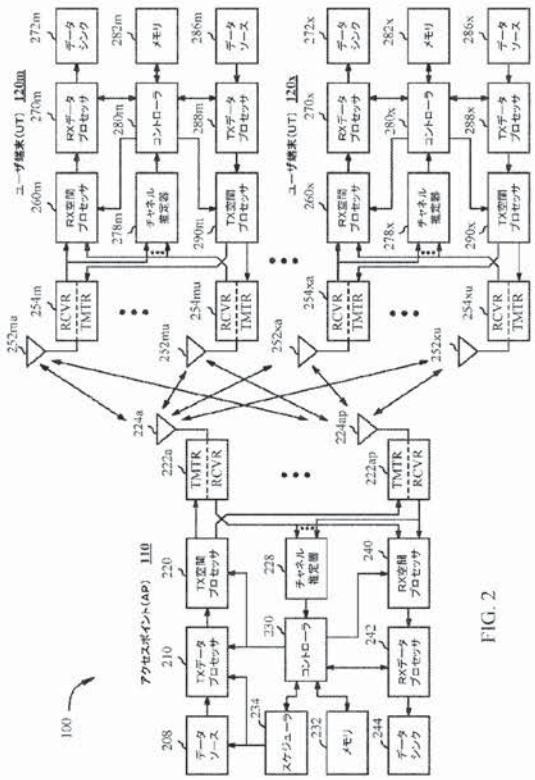


FIG. 2

【図３】

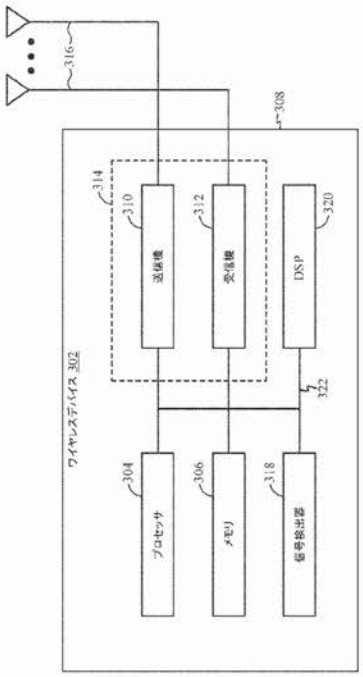


FIG. 3

【図４】

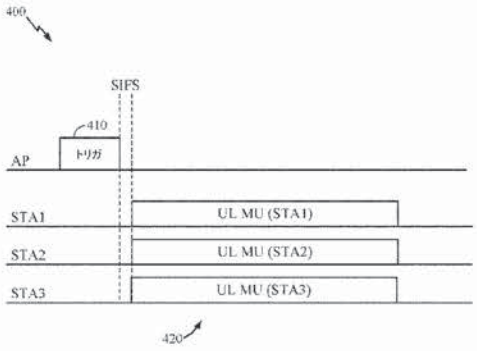


FIG. 4

【図５】



FIG. 5

【図５Ａ】

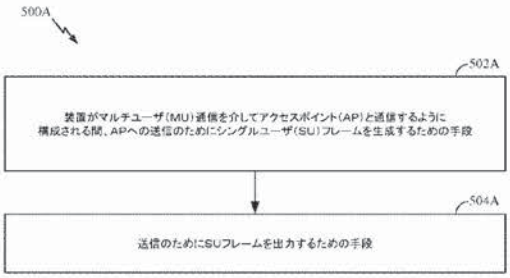


FIG. 5A

【図６】

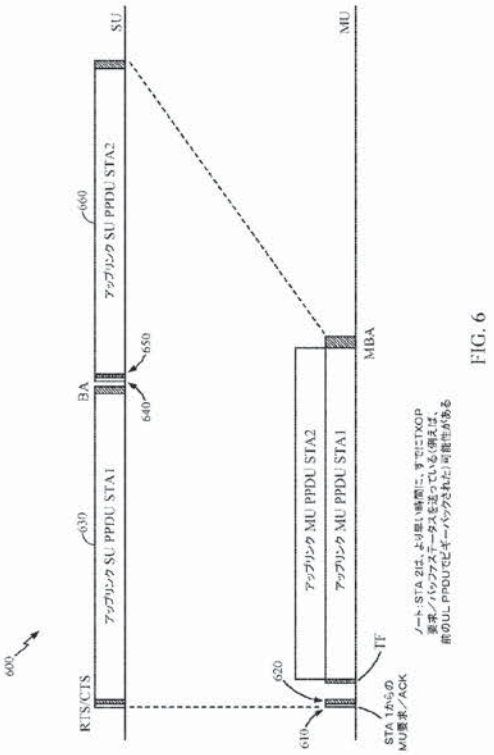


FIG. 6

【図７】

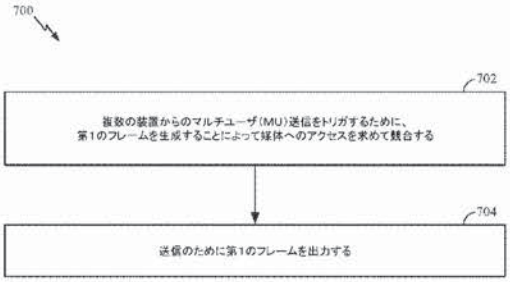


FIG. 7

【図７Ａ】

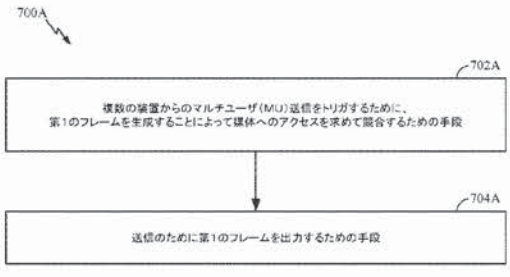


FIG. 7A

【国際調査報告】

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/012407

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W74/08
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04W

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2014/301383 A1 (SOHN ILL SOO [KR] ET AL) 9 October 2014 (2014-10-09)	1,7-10, 19,25, 29, 35-38, 47,53, 57, 63-66, 75,81, 85-88
Y	paragraphs [0009], [0010], [0049], [0051], [0052] paragraphs [0068] - [0070], [0073], [0074], [0077], [0081]	2-5, 11-15, 21-24, 26-28, 30-33, 39-43, 49-52, 54-56, 58-61, 67-71,
	-/--	

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 March 2016	30/03/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Konstantopoulou, P

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/012407

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
		77-80, 82-84
A		6,16-18, 20,34, 44-46, 48,62, 72-74,76

X	US 2011/150004 A1 (DENTENEER THEODORUS JACOBUS JOHANNES [NL] ET AL) 23 June 2011 (2011-06-23)	1,10,19, 20,22, 29,38, 47,48, 50,57, 66,75, 76,78, 85-88
A	paragraphs [0058], [0062], [0118], [0121], [0124], [0131], [0141]	2-9, 11-18, 21, 23-28, 30-37, 39-46, 49, 51-56, 58-65, 67-74, 77,79-84

Y	US 2012/140615 A1 (GONG MICHELLE X [US]) 7 June 2012 (2012-06-07)	2-5, 11-14, 24,26, 27, 30-33, 39-42, 52,54, 55, 58-61, 67-70, 80,82,83
A	paragraphs [0024] - [0026], [0033]	1,6-10, 15-23, 25,28, 29, 34-38, 43-51, 53,56, 57, 62-66, 71-79, 81,84-88

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/012407

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2011/255618 A1 (ZHU CHUNHUI [US] ET AL) 20 October 2011 (2011-10-20)	2-4,15, 21-24, 28, 30-32, 43, 49-52, 56, 58-60, 71, 77-80,84
A	paragraphs [0034], [0038], [0041], [0047] - [0052], [0055], [0056], [0075]	1,5-14, 16-20, 25-27, 29, 33-42, 44-48, 53-55, 57, 61-70, 72-76, 81-83, 85-88

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		US 2014301383 A1	09-10-2014
		WO 2013058512 A1	25-04-2013
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		EP 2561625 A1	27-02-2013
		JP 5695183 B2	01-04-2015
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		KR 20110116978 A	26-10-2011
		US 2011255618 A1	20-10-2011
		WO 2011132847 A1	27-10-2011

Form PCT/ISA/210 (patent family annex) (April 2005)

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14/794,702 8 July 2015 (08.07.2015) US

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(74) Agent: **ABUMERI, Mark M.**; Knobbe Martens Olson & Bear LLP, 2040 Main Street, Fourteenth Floor, Irvine, California 92614 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

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(54) **Title**: METHODS AND APPARATUS FOR MULTIPLE USER UPLINK CONTROL AND SCHEDULING VIA AGGREGATED FRAMES

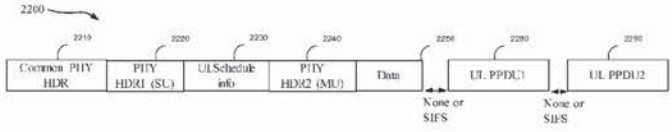


FIG. 22

(57) **Abstract**: Methods and apparatus for multiple user uplink are provided. In one aspect, a method includes generating, at an access point, an aggregated message. The aggregated message includes a single-user broadcast message and at least one other message. The method further includes transmitting the aggregated message to one or more stations.

WO 2016/007770 A1

METHODS AND APPARATUS FOR MULTIPLE USER UPLINK CONTROL AND SCHEDULING VIA AGGREGATED FRAMES

FIELD

[0001] Certain aspects of the present disclosure generally relate to wireless communications, and more particularly, to methods and apparatus for multiple user uplink communication in a wireless network.

BACKGROUND

[0002] In many telecommunication systems, communications networks are used to exchange messages among several interacting spatially-separated devices. Networks can be classified according to geographic scope, which could be, for example, a metropolitan area, a local area, or a personal area. Such networks can be designated respectively as a wide area network (WAN), metropolitan area network (MAN), local area network (LAN), or personal area network (PAN). Networks also differ according to the switching/routing technique used to interconnect the various network nodes and devices (e.g., circuit switching vs. packet switching), the type of physical media employed for transmission (e.g., wired vs. wireless), and the set of communication protocols used (e.g., Internet protocol suite, SONET (Synchronous Optical Networking), Ethernet, etc.).

[0003] Wireless networks are often preferred when the network elements are mobile and thus have dynamic connectivity needs, or if the network architecture is formed in an ad hoc, rather than fixed, topology. Wireless networks employ intangible physical media in an unguided propagation mode using electromagnetic waves in the radio, microwave, infra-red, optical, etc. frequency bands. Wireless networks advantageously facilitate user mobility and rapid field deployment when compared to fixed wired networks.

[0004] In order to address the issue of increasing bandwidth requirements that are demanded for wireless communications systems, different schemes are being developed to allow multiple stations (STAs) to communicate with a single access point by sharing the channel resources while achieving high data throughputs. With limited communication resources, it is desirable to reduce the amount of traffic passing between the access point and the multiple STAs. For example, when multiple STAs send uplink communications to the access point, it is desirable to minimize the amount of traffic to

complete the uplink of all transmissions. Thus, there is a need for an improved protocol for uplink transmissions from multiple STAs.

SUMMARY

[0005] Various implementations of systems, methods and devices within the scope of the appended claims each have several aspects, no single one of which is solely responsible for the desirable attributes described herein. Without limiting the scope of the appended claims, some prominent features are described herein.

[0006] Details of one or more implementations of the subject matter described in this specification are set forth in the accompanying drawings and the description below. Other features, aspects, and advantages will become apparent from the description, the drawings, and the claims. Note that the relative dimensions of the following figures may not be drawn to scale.

[0007] One aspect of the present disclosure provides a method for wireless communication. The method includes generating, at an access point, an aggregated message. The aggregated message includes a single-user broadcast message and at least one other message. The method further includes transmitting the aggregated message to one or more stations.

[0008] In various embodiments, each sub-message of the aggregated message can include at least a physical layer data unit (PPDU) comprising a physical layer (PHY) control field and a media access control (MAC) payload. In various embodiments, the at least one other message can include at least one multi-user physical layer data unit (PPDU). In various embodiments, the at least one other message can include at least one single-user physical layer data unit (PPDU) excluding control or scheduling information.

[0009] In various embodiments, the aggregated message can include the single-user broadcast message and one or more multi-user messages. In various embodiments, the aggregated message can include a common physical layer header indicating whether the at least one other message includes at least message that all of the one or more stations are instructed to decode. In various embodiments, each message can include a physical layer header indicating whether the at least one other message includes at least message that all of the one or more stations are instructed to decode.

[0010] In various embodiments, the single-user broadcast message includes control information instructing the one or more stations to transmit a plurality of uplink data at a specified time. In various embodiments, the method can further include receiving transmission of the plurality of uplink data at the specified time, each transmission of the plurality of uplink data having the same duration. In various embodiments, the method can further include transmitting an acknowledgment message to the one or more stations.

[0011] In various embodiments, each message can include an uplink scheduling message. In various embodiments, the uplink scheduling message can include a physical layer data unit (PPDU) duration field indicating a duration of transmission of uplink data. In various embodiments, the uplink scheduling message can include a station access information field including an indication of allowed transmission modes.

[0012] In various embodiments, the station access information field can include a tone allocation field indicating tones/frequencies for uplink data using a frequency division multiple access (FDMA) system. In various embodiments, the uplink scheduling message can include a group identifier (GID) field indicating the stations that can participate in uplink communications. In various embodiments, the uplink scheduling message can include a receiver address (RA) field indicating a multicast address which identifies the one or more stations that can participate in uplink communications. In various embodiments, the uplink scheduling message can include a field indicating rate information for the one or more stations.

[0013] In various embodiments, the method can further include transmitting an uplink scheduling message to the one or more stations. The uplink scheduling message can instruct the one or more stations to transmit a station access information message in response to the uplink scheduling message. The method can further include receiving a plurality of station access information messages. The station access information messages can indicate station access information. In various embodiments, the single-user broadcast message can include data, control, or management information for one or more stations.

[0014] Another aspect provides an apparatus configured for wireless communication. The apparatus includes a processor configured to generate for transmission an aggregated message. The aggregated message includes a single-user

broadcast message and at least one other message. The apparatus further includes a transmitter configured to transmit the aggregated message to one or more stations.

[0015] In various embodiments, each sub-message of the aggregated message can include at least a physical layer data unit (PPDU) comprising a physical layer (PHY) control field and a media access control (MAC) payload. In various embodiments, the at least one other message can include at least one multi-user physical layer data unit (PPDU). In various embodiments, the at least one other message can include at least one single-user physical layer data unit (PPDU) excluding control or scheduling information.

[0016] In various embodiments, the aggregated message can include the single-user broadcast message and one or more multi-user messages. In various embodiments, the aggregated message can include a common physical layer header indicating whether the at least one other message includes at least message that all of the one or more stations are instructed to decode. In various embodiments, each message can include a physical layer header indicating whether the at least one other message includes at least message that all of the one or more stations are instructed to decode.

[0017] In various embodiments, the single-user broadcast message includes control information instructing the one or more stations to transmit a plurality of uplink data at a specified time. In various embodiments, the apparatus can further include a receiver configured to receive transmission of the plurality of uplink data at the specified time, each transmission of the plurality of uplink data having the same duration. In various embodiments, the transmitter can be further configured to transmit an acknowledgment message to the one or more stations.

[0018] In various embodiments, each message can include an uplink scheduling message. In various embodiments, the uplink scheduling message can include a physical layer data unit (PPDU) duration field indicating a duration of transmission of uplink data. In various embodiments, the uplink scheduling message can include a station access information field including an indication of allowed transmission modes.

[0019] In various embodiments, the station access information field can include a tone allocation field indicating tones/frequencies for uplink data using a frequency division multiple access (FDMA) system. In various embodiments, the

uplink scheduling message can include a group identifier (GID) field indicating the stations that can participate in uplink communications. In various embodiments, the uplink scheduling message can include a receiver address (RA) field indicating a multicast address which identifies the one or more stations that can participate in uplink communications. In various embodiments, the uplink scheduling message can include a field indicating rate information for the one or more stations.

[0020] In various embodiments, the apparatus can further include a transmitter configured to transmit an uplink scheduling message to the one or more stations. The uplink scheduling message can instruct the one or more stations to transmit a station access information message in response to the uplink scheduling message. The receiver can be further configured to receive a plurality of station access information messages, the station access information messages indicating station access information. In various embodiments, the single-user broadcast message can include data, control, or management information for one or more stations.

[0021] Another aspect provides an apparatus for wireless communication. The apparatus includes means for transmitting an aggregated message. The aggregated message includes a single-user broadcast message and at least one other message. The apparatus further includes means for transmitting the aggregated message to one or more stations.

[0022] In various embodiments, each sub-message of the aggregated message can include at least a physical layer data unit (PPDU) comprising a physical layer (PHY) control field and a media access control (MAC) payload. In various embodiments, the at least one other message can include at least one multi-user physical layer data unit (PPDU). In various embodiments, the at least one other message can include at least one single-user physical layer data unit (PPDU) excluding control or scheduling information.

[0023] In various embodiments, the aggregated message can include the single-user broadcast message and one or more multi-user messages. In various embodiments, the aggregated message can include a common physical layer header indicating whether the at least one other message includes at least message that all of the one or more stations are instructed to decode. In various embodiments, each message can include a physical layer header indicating whether the at least one other

message includes at least message that all of the one or more stations are instructed to decode.

[0024] In various embodiments, the single-user broadcast message includes control information instructing the one or more stations to transmit a plurality of uplink data at a specified time. In various embodiments, the apparatus can further include means for receiving transmission of the plurality of uplink data at the specified time, each transmission of the plurality of uplink data having the same duration. In various embodiments, the apparatus can further include means for transmitting an acknowledgment message to the one or more stations.

[0025] In various embodiments, each message can include an uplink scheduling message. In various embodiments, the uplink scheduling message can include a physical layer data unit (PPDU) duration field indicating a duration of transmission of uplink data. In various embodiments, the uplink scheduling message can include a station access information field including an indication of allowed transmission modes.

[0026] In various embodiments, the station access information field can include a tone allocation field indicating tones/frequencies for uplink data using a frequency division multiple access (FDMA) system. In various embodiments, the uplink scheduling message can include a group identifier (GID) field indicating the stations that can participate in uplink communications. In various embodiments, the uplink scheduling message can include a receiver address (RA) field indicating a multicast address which identifies the one or more stations that can participate in uplink communications. In various embodiments, the uplink scheduling message can include a field indicating rate information for the one or more stations.

[0027] In various embodiments, the apparatus can further include means for transmitting an uplink scheduling message to the one or more stations. The uplink scheduling message can instruct the one or more stations to transmit a station access information message in response to the uplink scheduling message. The apparatus can further include means for receiving a plurality of station access information messages, the station access information messages indicating station access information. In various embodiments, the single-user broadcast message can include data, control, or management information for one or more stations.

[0028] Another aspect provides a non-transitory computer-readable medium. The medium includes code that, when executed, causes an apparatus to transmit an aggregated message. The aggregated message includes a single-user broadcast message and at least one other message. The medium further includes code that, when executed, causes the apparatus to transmit the aggregated message to one or more stations.

[0029] In various embodiments, each sub-message of the aggregated message can include at least a physical layer data unit (PPDU) comprising a physical layer (PHY) control field and a media access control (MAC) payload. In various embodiments, the at least one other message can include at least one multi-user physical layer data unit (PPDU). In various embodiments, the at least one other message can include at least one single-user physical layer data unit (PPDU) excluding control or scheduling information.

[0030] In various embodiments, the aggregated message can include the single-user broadcast message and one or more multi-user messages. In various embodiments, the aggregated message can include a common physical layer header indicating whether the at least one other message includes at least message that all of the one or more stations are instructed to decode. In various embodiments, each message can include a physical layer header indicating whether the at least one other message includes at least message that all of the one or more stations are instructed to decode.

[0031] In various embodiments, the single-user broadcast message includes control information instructing the one or more stations to transmit a plurality of uplink data at a specified time. In various embodiments, the medium can further include code that, when executed, causes the apparatus to receive transmission of the plurality of uplink data at the specified time, each transmission of the plurality of uplink data having the same duration. In various embodiments, the medium can further include code that, when executed, causes the apparatus to transmit an acknowledgment message to the one or more stations.

[0032] In various embodiments, each message can include an uplink scheduling message. In various embodiments, the uplink scheduling message can include a physical layer data unit (PPDU) duration field indicating a duration of transmission of uplink data. In various embodiments, the uplink scheduling message can include a station access information field including an indication of allowed

transmission modes. In various embodiments, the station access information field can include a tone allocation field indicating tones/frequencies for uplink data using a frequency division multiple access (FDMA) system.

[0033] In various embodiments, the uplink scheduling message can include a group identifier (GID) field indicating the stations that can participate in uplink communications. In various embodiments, the uplink scheduling message can include a receiver address (RA) field indicating a multicast address which identifies the one or more stations that can participate in uplink communications. In various embodiments, the uplink scheduling message can include a field indicating rate information for the one or more stations.

[0034] In various embodiments, the medium can further include code that, when executed, causes the apparatus to transmit an uplink scheduling message to the one or more stations. The uplink scheduling message can instruct the one or more stations to transmit a station access information message in response to the uplink scheduling message. The medium can further include code that, when executed, causes the apparatus to receive a plurality of station access information messages, the station access information messages indicating station access information. In various embodiments, the single-user broadcast message can include data, control, or management information for one or more stations.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035] FIG. 1 illustrates a multiple-access multiple-input multiple-output (MIMO) system with access points and STAs.

[0036] FIG. 2 illustrates a block diagram of the AP 110 and two STAs 120m and 120x in a MIMO system.

[0037] FIG. 3 illustrates various components that can be utilized in a wireless device (such as an access point or a station) that can be employed within the wireless communication system of FIG. 1.

[0038] FIG. 4 shows a transmission and reception time diagram of an example of a frame exchange including an uplink (UL) MU-MIMO communication.

[0039] FIG. 5 shows a transmission and reception time diagram of another example of a frame exchange of an UL-MU-MIMO communication.

[0040] FIG. 6 shows a transmission and reception time diagram of another example of a frame exchange of an UL-MU-MIMO communication.

[0041] FIG. 7 shows a transmission and reception time diagram of another example of a frame exchange of an UL-MU-MIMO communication.

[0042] FIG. 8 shows a diagram of one embodiment of a request to transmit (RTX) frame.

[0043] FIG. 9 shows a diagram of another embodiment of a RTX frame.

[0044] FIG. 10 shows a transmission and reception time diagram of an example of a frame exchange including a station scheduling frame (SSF) and a station access information frame (SIF).

[0045] FIG. 11 shows a transmission and reception time diagram of another example of a frame exchange including a station scheduling frame (SSF) and a station access information frame (SIF).

[0046] FIG. 12 shows a diagram of one embodiment of a clear to transmit (CTX) frame.

[0047] FIG. 13 shows a diagram of another embodiment of a CTX frame.

[0048] FIG. 14 shows a diagram of another embodiment of a CTX frame.

[0049] FIG. 15 shows a diagram of another embodiment of a CTX frame.

[0050] FIG. 16 shows a transmission and reception time diagram of another example of a frame exchange of an UL-MU-MIMO communication.

[0051] FIG. 17 shows another example of a frame exchange of an UL-MU-MIMO communication.

[0052] FIG. 18 shows an example of a frame exchange including a trigger frame.

[0053] FIG. 19 shows another example of a frame exchange including a trigger frame.

[0054] FIG. 20 shows another example of a frame exchange including a trigger frame.

[0055] FIG. 21 is a diagram that illustrates one embodiment of an aggregated PPDU (A-PPDU).

[0056] FIG. 22 is a transmission and reception time diagram that illustrates one embodiment of an A-PPDU trigger exchange.

[0057] FIGS. 23A–23D show time sequence diagrams that illustrate various embodiments of A-PPDU trigger exchanges.

[0058] FIG. 24 shows a flowchart for an exemplary method of wireless communication that can be employed within the wireless communication system of FIG. 1.

DETAILED DESCRIPTION

[0059] Various aspects of the novel systems, apparatuses, and methods are described more fully hereinafter with reference to the accompanying drawings. The teachings disclosure can, however, be embodied in many different forms and should not be construed as limited to any specific structure or function presented throughout this disclosure. Rather, these aspects are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the disclosure to those skilled in the art. Based on the teachings herein one skilled in the art should appreciate that the scope of the disclosure is intended to cover any aspect of the novel systems, apparatuses, and methods disclosed herein, whether implemented independently of or combined with any other aspect of the invention. For example, an apparatus can be implemented or a method can be practiced using any number of the aspects set forth herein. In addition, the scope of the invention is intended to cover such an apparatus or method which is practiced using other structure, functionality, or structure and functionality in addition to or other than the various aspects of the invention set forth herein. It should be understood that any aspect disclosed herein can be embodied by one or more elements of a claim.

[0060] Although particular aspects are described herein, many variations and permutations of these aspects fall within the scope of the disclosure. Although some benefits and advantages of the preferred aspects are mentioned, the scope of the disclosure is not intended to be limited to particular benefits, uses, or objectives. Rather, aspects of the disclosure are intended to be broadly applicable to different wireless technologies, system configurations, networks, and transmission protocols, some of which are illustrated by way of example in the figures and in the following description of the preferred aspects. The detailed description and drawings are merely illustrative of the disclosure rather than limiting, the scope of the disclosure being defined by the appended claims and equivalents thereof.

[0061] Wireless network technologies can include various types of wireless local area networks (WLANs). A WLAN can be used to interconnect nearby devices together, employing widely used networking protocols. The various aspects described herein can apply to any communication standard, such as Wi-Fi or, more generally, any member of the IEEE 802.11 family of wireless protocols.

[0062] In some aspects, wireless signals can be transmitted according to a high-efficiency 802.11 protocol using orthogonal frequency-division multiplexing (OFDM), direct–sequence spread spectrum (DSSS) communications, a combination of OFDM and DSSS communications, or other schemes. Implementations of the high-efficiency 802.11 protocol can be used for Internet access, sensors, metering, smart grid networks, or other wireless applications. Advantageously, aspects of certain devices implementing this particular wireless protocol can consume less power than devices implementing other wireless protocols, can be used to transmit wireless signals across short distances, and/or can be able to transmit signals less likely to be blocked by objects, such as humans.

[0063] In some implementations, a WLAN includes various devices which are the components that access the wireless network. For example, there can be two types of devices: access points ("APs") and clients (also referred to as stations, or "STAs"). In general, an AP serves as a hub or base station for the WLAN and a STA serves as a user of the WLAN. For example, a STA can be a laptop computer, a personal digital assistant (PDA), a mobile phone, etc. In an example, a STA connects to an AP via a Wi-Fi (e.g., IEEE 802.11 protocol such as 802.11ah) compliant wireless link to obtain general connectivity to the Internet or to other wide area networks. In some implementations a STA can also be used as an AP.

[0064] The techniques described herein can be used for various broadband wireless communication systems, including communication systems that are based on an orthogonal multiplexing scheme. Examples of such communication systems include Spatial Division Multiple Access (SDMA), Time Division Multiple Access (TDMA), Orthogonal Frequency Division Multiple Access (OFDMA) systems, Single-Carrier Frequency Division Multiple Access (SC-FDMA) systems, and so forth. An SDMA system can utilize sufficiently different directions to simultaneously transmit data belonging to multiple STAs. A TDMA system can allow multiple STAs to share the same frequency channel by dividing the transmission signal into different time slots,

each time slot being assigned to different STA. A TDMA system can implement GSM or some other standards known in the art. An OFDMA system utilizes orthogonal frequency division multiplexing (OFDM), which is a modulation technique that partitions the overall system bandwidth into multiple orthogonal sub-carriers. These sub-carriers can also be called tones, bins, etc. With OFDM, each sub-carrier can be independently modulated with data. An OFDM system can implement IEEE 802.11 or some other standards known in the art. An SC-FDMA system can utilize interleaved FDMA (IFDMA) to transmit on sub-carriers that are distributed across the system bandwidth, localized FDMA (LFDMA) to transmit on a block of adjacent sub-carriers, or enhanced FDMA (EFDMA) to transmit on multiple blocks of adjacent sub-carriers. In general, modulation symbols are sent in the frequency domain with OFDM and in the time domain with SC-FDMA. A SC-FDMA system can implement 3GPP-LTE (3rd Generation Partnership Project Long Term Evolution) or other standards.

[0065] The teachings herein can be incorporated into (e.g., implemented within or performed by) a variety of wired or wireless apparatuses (e.g., nodes). In some aspects, a wireless node implemented in accordance with the teachings herein can comprise an access point or an access terminal.

[0066] An access point ("AP") can comprise, be implemented as, or known as a NodeB, Radio Network Controller ("RNC"), eNodeB, Base Station Controller ("BSC"), Base Transceiver Station ("BTS"), Base Station ("BS"), Transceiver Function ("TF"), Radio Router, Radio Transceiver, Basic Service Set ("BSS"), Extended Service Set ("ESS"), Radio Base Station ("RBS"), or some other terminology.

[0067] A station "STA" can also comprise, be implemented as, or known as a STA, an access terminal ("AT"), a subscriber station, a subscriber unit, a mobile station, a remote station, a remote terminal, a user agent, a user device, user equipment, user terminal, or some other terminology. In some implementations an access terminal can comprise a cellular telephone, a cordless telephone, a Session Initiation Protocol ("SIP") phone, a wireless local loop ("WLL") station, a personal digital assistant ("PDA"), a handheld device having wireless connection capability, or some other suitable processing device connected to a wireless modem. Accordingly, one or more aspects taught herein can be incorporated into a phone (e.g., a cellular phone or smartphone), a computer (e.g., a laptop), a portable communication device, a headset, a portable computing device (e.g., a personal data assistant), an entertainment device

(e.g., a music or video device, or a satellite radio), a gaming device or system, a global positioning system device, or any other suitable device that is configured to communicate via a wireless medium.

[0068] FIG. 1 is a diagram that illustrates wireless communication system 100, configured for multiple-access multiple-input multiple-output (MIMO), with access points and STAs. For simplicity, only one AP 110 is shown in FIG. 1. An access point generally communicates with the STAs and can also be referred to as a base station or other terminology. A STA can be fixed or mobile and can also be referred to as a mobile station or a wireless device, or using some other terminology. The AP 110 can communicate with one or more STAs 120 at any given moment on a downlink and/or uplink. The downlink (i.e., forward link) is the communication link from the access point to the STAs, and the uplink (i.e., reverse link) is the communication link from the STAs to the access point. A STA can also communicate peer-to-peer with another STA. A system controller 130 couples to and provides coordination and control for the access points.

[0069] While portions of the following disclosure will describe STAs 120 capable of communicating via Spatial Division Multiple Access (SDMA), for certain aspects, the STAs 120 can also include some STAs that do not support SDMA. Thus, for such aspects, the AP 110 can be configured to communicate with both SDMA and non-SDMA STAs. This approach can conveniently allow older versions of STAs ("legacy" stations) that do not support SDMA to remain deployed in an enterprise, extending their useful lifetime, while allowing newer SDMA STAs to be introduced as deemed appropriate.

[0070] The wireless communication system 100 employs multiple transmit and multiple receive antennas for data transmission on the downlink and uplink. The AP 110 is equipped with N_{ap} number of antennas and represents the multiple-input (MI) for downlink transmissions and the multiple-output (MO) for uplink transmissions. A set of K number of selected STAs 120 collectively represents the multiple-output for downlink transmissions and the multiple-input for uplink transmissions. For pure SDMA, it is desired to have $N_{ap} \leq K \leq 1$ if the data symbol streams for the K number of STAs are not multiplexed in code, frequency or time. The value of K can be greater than the value of N_{ap} if the data symbol streams can be multiplexed using TDMA technique, different code channels with CDMA, disjoint sets of sub-bands with OFDM,

and so on. Each selected STA can transmit user-specific data to and/or receive user-specific data from the access point. In general, each selected STA can be equipped with one or multiple antennas. The *K* number of selected STAs can have the same number of antennas, or one or more STAs can have a different number of antennas.

[0071] The wireless communication system 100, when configured for SDMA, can be a time division duplex (TDD) system or a frequency division duplex (FDD) system. For a TDD system, the downlink and uplink share the same frequency band. For an FDD system, the downlink and uplink use different frequency bands. The wireless communication system 100 can also utilize a single carrier or multiple carriers for transmission. Each STA can be equipped with a single antenna or multiple antennas. The wireless communication system 100 can also be a TDMA system if the STAs 120 share the same frequency channel by dividing transmission/reception into different time slots, where each time slot can be assigned to a different STA 120.

[0072] FIG. 2 illustrates a block diagram of the AP 110 and two STAs 120m and 120x in wireless communication system 100. The AP 110 is equipped with N_t number of antennas 224a through 224ap. The STA 120m is equipped with $N_{ut,m}$ number of antennas 252_{ma} through 252_{mu}, and the STA 120x is equipped with $N_{ut,x}$ number of antennas 252_{xa} through 252_{xu}. The AP 110 is a transmitting entity for the downlink and a receiving entity for the uplink. The STA 120 is a transmitting entity for the uplink and a receiving entity for the downlink. As used herein, a "transmitting entity" is an independently operated apparatus or device capable of transmitting data via a wireless channel, and a "receiving entity" is an independently operated apparatus or device capable of receiving data via a wireless channel. In the following description, the subscript "dn" denotes the downlink, the subscript "up" denotes the uplink. N_{up} number of STAs are selected for simultaneous transmission on the uplink, and N_{dn} STAs are selected for simultaneous transmission on the downlink. The value of N_{up} may or may not be equal to the value of N_{dn}, and the value of N_{up} and the value of N_{dn} can be static values or can change for each scheduled communication interval. Beam-steering or some other spatial processing technique can be used at the AP 110 and/or the STA 120.

[0073] On the uplink, at each STA 120 selected for uplink transmission, a TX data processor 288 receives traffic data from a data source 286 and control data from a controller 280. The TX data processor 288 processes (e.g., encodes, interleaves, and modulates) the traffic data for the STA based on the coding and modulation

schemes associated with the rate selected for the STA and provides a data symbol stream. A TX spatial processor 290 performs spatial processing on the data symbol stream and provides $N_{ut,m}$ number of transmit symbol streams for the $N_{ut,m}$ number of antennas. Each transmitter unit (TMTR) 254 receives and processes (e.g., converts to analog, amplifies, filters, and frequency upconverts) a respective transmit symbol stream to generate an uplink signal. $N_{ut,m}$ number of transmitter units 254 provide $N_{ut,m}$ number of uplink signals for transmission from $N_{ut,m}$ number of antennas 252, for example to transmit to the AP 110.

[0074] N_{up} number of STAs can be scheduled for simultaneous transmission on the uplink. Each of these STAs can perform spatial processing on its respective data symbol stream and transmit its respective set of transmit symbol streams on the uplink to the AP 110.

[0075] At the AP 110, N_{up} number of antennas 224a through 224_{ap} receive the uplink signals from all N_{up} number of STAs transmitting on the uplink. Each antenna 224 provides a received signal to a respective receiver unit (RCVR) 222. Each receiver unit 222 performs processing complementary to that performed by transmitter unit 254 and provides a received symbol stream. An RX spatial processor 240 performs receiver spatial processing on the N_{up} number of received symbol streams from N_{up} number of receiver units 222 and provides N_{up} number of recovered uplink data symbol streams. The receiver spatial processing can be performed in accordance with the channel correlation matrix inversion (CCMI), minimum mean square error (MMSE), soft interference cancellation (SIC), or some other technique. Each recovered uplink data symbol stream is an estimate of a data symbol stream transmitted by a respective STA. An RX data processor 242 processes (e.g., demodulates, deinterleaves, and decodes) each recovered uplink data symbol stream in accordance with the rate used for that stream to obtain decoded data. The decoded data for each STA can be provided to a data sink 244 for storage and/or a controller 230 for further processing.

[0076] On the downlink, at the AP 110, a TX data processor 210 receives traffic data from a data source 208 for N_{dn} number of STAs scheduled for downlink transmission, control data from a controller 230, and possibly other data from a scheduler 234. The various types of data can be sent on different transport channels. TX data processor 210 processes (e.g., encodes, interleaves, and modulates) the traffic data for each STA based on the rate selected for that STA. The TX data processor 210

provides N_{dn} number of downlink data symbol streams for the N_{dn} number of STAs. A TX spatial processor 220 performs spatial processing (such as a precoding or beamforming) on the N_{dn} number of downlink data symbol streams, and provides N_{up} number of transmit symbol streams for the N_{up} number of antennas. Each transmitter unit 222 receives and processes a respective transmit symbol stream to generate a downlink signal. N_{up} number of transmitter units 222 can provide N_{up} number of downlink signals for transmission from N_{up} number of antennas 224, for example to transmit to the STAs 120.

[0077] At each STA 120, $N_{ut,m}$ number of antennas 252 receive the N_{up} number of downlink signals from the AP 110. Each receiver unit 254 processes a received signal from an associated antenna 252 and provides a received symbol stream. An RX spatial processor 260 performs receiver spatial processing on $N_{ut,m}$ number of received symbol streams from $N_{ut,m}$ number of receiver units 254 and provides a recovered downlink data symbol stream for the STA 120. The receiver spatial processing can be performed in accordance with the CCMI, MMSE, or some other technique. An RX data processor 270 processes (e.g., demodulates, deinterleaves and decodes) the recovered downlink data symbol stream to obtain decoded data for the STA.

[0078] At each STA 120, a channel estimator 278 estimates the downlink channel response and provides downlink channel estimates, which can include channel gain estimates, SNR estimates, noise variance and so on. Similarly, a channel estimator 228 estimates the uplink channel response and provides uplink channel estimates. Controller 280 for each STA typically derives the spatial filter matrix for the STA based on the downlink channel response matrix $H_{dn,m}$ for that STA. Controller 230 derives the spatial filter matrix for the access point based on the effective uplink channel response matrix $H_{up,eff}$. The controller 280 for each STA can send feedback information (e.g., the downlink and/or uplink eigenvectors, eigenvalues, SNR estimates, and so on) to the AP 110. The controllers 230 and 280 can also control the operation of various processing units at the AP 110 and STA 120, respectively.

[0079] FIG. 3 illustrates various components that can be utilized in a wireless device 302 (such as an access point or a station) that can be employed within the wireless communication system 100 of FIG. 1. The wireless device 302 is an

example of a device that can be configured to implement the various methods described herein. The wireless device 302 can implement the AP 110 or a STA 120.

[0080] The wireless device 302 can include a processor 304 which controls operation of the wireless device 302. The processor 304 can also be referred to as a central processing unit (CPU). Memory 306, which can include both read-only memory (ROM) and random access memory (RAM), provides instructions and data to the processor 304. A portion of the memory 306 can also include non-volatile random access memory (NVRAM). The processor 304 can perform logical and arithmetic operations based on program instructions stored within the memory 306. The instructions in the memory 306 can be executable to implement the methods described herein.

[0081] The processor 304 can comprise or be a component of a processing system implemented with one or more processors. The one or more processors can be implemented with any combination of general-purpose microprocessors, microcontrollers, digital signal processors (DSPs), field programmable gate array (FPGAs), programmable logic devices (PLDs), controllers, state machines, gated logic, discrete hardware components, dedicated hardware finite state machines, or any other suitable entities that can perform calculations or other manipulations of information.

[0082] The processing system can also include machine-readable media for storing software. Software shall be construed broadly to mean any type of instructions, whether referred to as software, firmware, middleware, microcode, hardware description language, or otherwise. Instructions can include code (e.g., in source code format, binary code format, executable code format, or any other suitable format of code). The instructions, when executed by the one or more processors, cause the processing system to perform the various functions described herein.

[0083] The wireless device 302 can also include a housing 308 that can include a transmitter 310 and a receiver 312 to allow transmission and reception of data between the wireless device 302 and a remote location. The transmitter 310 and receiver 312 can be combined into a transceiver 314. A single or a plurality of transceiver antennas 316 can be attached to the housing 308 and electrically coupled to the transceiver 314. The wireless device 302 can also include multiple transmitters, multiple receivers, and multiple transceivers.

[0084] The wireless device 302 can also include a signal detector 318 that can be used in an effort to detect and quantify the level of signals received by the transceiver 314. The signal detector 318 can detect such signals as total energy, energy per subcarrier per symbol, power spectral density and other signals. The wireless device 302 can also include a digital signal processor (DSP) 320 for use in processing signals.

[0085] The various components of the wireless device 302 can be coupled together by a bus system 322, which can include a power bus, a control signal bus, and a status signal bus in addition to a data bus.

[0086] Certain aspects of the present disclosure support transmitting an uplink (UL) signal from multiple STAs to an AP. In some embodiments, the UL signal can be transmitted in a multi-user MIMO (MU-MIMO) system. Alternatively, the UL signal can be transmitted in a multi-user FDMA (MU-FDMA) or similar FDMA system. Specifically, FIGS. 4–7, 10–11, and 16–20 illustrate UL-MU-MIMO transmissions 410A, 410B, 1050A, and 1050B that would apply equally to UL-FDMA transmissions. In these embodiments, UL-MU-MIMO or UL-FDMA transmissions can be sent simultaneously from multiple STAs to an AP and can create efficiencies in wireless communication.

[0087] FIG. 4 is a transmission and reception time diagram illustrating an example of an UL-MU-MIMO protocol 400 that can be used for UL communications. As shown in FIG. 4 and in conjunction with FIG. 1, the AP 110 can transmit a clear to transmit (CTX) message 402 to the STAs 120 indicating which STAs can participate in the UL-MU-MIMO scheme, such that a particular STA knows to start an UL-MU-MIMO. An example of a CTX frame structure is described more fully below with reference to FIGS. 12–15.

[0088] Once a STA 120 receives a CTX message 402 from the AP 110 where the STA is listed, the STA can transmit the UL-MU-MIMO transmission 410. In FIG. 4, STA 120A and STA 120B transmit UL-MU-MIMO transmission 410A and 410B containing physical layer convergence protocol (PLCP) protocol data units (PPDUs). Upon receiving the UL-MU-MIMO transmission 410, the AP 110 can transmit block acknowledgments (BAs) 470 to the STAs 120.

[0089] Not all APs or STAs 120 can support UL-MU-MIMO or UL-FDMA operation. A capability indication from a STA 120 can be indicated in a high efficiency

wireless (HEW) capability element that is included in an association request or probe request and can include a bit indicating capability, the maximum number of spatial streams a STA 120 can use in a UL-MU- MIMO transmission, the frequencies a STA 120 can use in a UL-FDMA transmission, the minimum and maximum power and granularity in the power backoff, and the minimum and maximum time adjustment a STA 120 can perform.

[0090] A capability indication from an AP can be indicated in a HEW capability element that is included in an association response, beacon or probe response and can include a bit indicating capability, the maximum number of spatial streams a single STA 120 can use in a UL-MU- MIMO transmission, the frequencies a single STA 120 can use in a UL-FDMA transmission, the required power control granularity, and the required minimum and maximum time adjustment a STA 120 should be able to perform.

[0091] In one embodiment, capable STAs 120 can request to a capable AP to be part of the UL-MU-MIMO (or UL-FDMA) protocol by sending a management frame to AP indicating request for enablement of the use of UL-MU-MIMO feature. In one aspect, the AP 110 can respond by granting the use of the UL-MU-MIMO feature or denying it. Once the use of the UL-MU-MIMO is granted, the STA 120 can expect a CTX message 402 at a variety of times. Additionally, once a STA 120 is enabled to operate the UL-MU-MIMO feature, the STA 120 can be subject to follow a certain operation mode. If multiple operation modes are possible, an AP can indicate to the STA 120 which mode to use in a HEW capability element or in an operation element. In one aspect the STAs 120 can change the operation modes and parameters dynamically during operation by sending a different operating element to the AP 110. In another aspect the AP 110 can switch operation modes dynamically during operation by sending an updated operating element to a STA 120 or in a beacon. In another aspect, the operation modes can be indicated in the setup phase and can be setup per STA 120 or for a group of STAs 120. In another aspect the operation mode can be specified per traffic identifier (TID).

[0092] FIG. 5 is a transmission and reception time diagram that, in conjunction with FIG. 1, illustrates an example of an operation mode of a UL-MU-MIMO transmission. In this embodiment, a STA 120 receives a CTX message 402 from the AP 110 and sends an immediate response to the AP 110. The response can be

in the form of a clear to send (CTS) 408 or another similar signal. In one aspect, requirement to send a CTS can be indicated in the CTX message 402 or can be indicated in the setup phase of the communication. As shown in FIG. 5, STA 120A and STA 120B can transmit a CTS 1 408A and CTS 2 408B message in response to receiving the CTX message 402. The modulation and coding scheme (MCS) of the CTS 1 408A and CTS 2 408B can be based on the MCS of the CTX message 402. In this embodiment, CTS 1 408A and CTS 2 408B contain the same bits and the same scrambling sequence so that they can be transmitted to the AP 110 at the same time. The duration field of the CTS 408 signals can be based on the duration field in the CTX by removing the time for the CTX PPDU. The UL-MU-MIMO transmission 410A and 410B are then sent by the STAs 120A and 120B as listed in the CTX 402 signals. The AP 110 can then send acknowledgment (ACK) signals the STAs 120A and 120B. In some aspects, the ACK signals can be serial ACK signals to each station or BAs. In some aspects the ACKs can be polled. This embodiment creates efficiencies by simultaneously transmitting CTS 408 signals from multiple STAs to the AP 110 instead of sequentially, which saves time and reduces the possibility of interference.

[0093] FIG. 6 is a transmission and reception time diagram that, in conjunction with FIG. 1, illustrates another example of an operation mode of a UL-MU-MIMO transmission. In this embodiment, STAs 120A and 120B receive a CTX message 402 from the AP 110 and are allowed to start and UL-MU-MIMO transmission a time (T) 406 after the end of the PPDU carrying the CTX message 402. The time T 406 can be a short interframe space (SIFS), point interframe space (PIFS), or another time potentially adjusted with additional offsets as indicated by the AP 110 in the CTX message 402 or via a management frame. The SIFS and PIFS time can be fixed in a standard or indicated by the AP 110 in the CTX message 402 or in a management frame. One advantage of specifying the time T 406 can be to improve synchronization or to allow a STAs 120A and 120B time to process the CTX message 402 or other messages before transmission.

[0094] Referring to FIGS. 4–6, in conjunction with FIG. 1, the UL-MU-MIMO transmission 410 can have the same duration as other UL-MU-MIMO transmissions. The duration of the UL-MU-MIMO transmission 410 for STAs utilizing the UL-MU-MIMO feature can be indicated in the CTX message 402 or during the setup phase. To generate a PPDU of the required duration, a STA 120 can build a

PLCP service data unit (PSDU) so that the length of the PPDU matches the length indicated in the CTX message 402. In another aspect, a STA 120 can adjust the level of data aggregation in a media access control (MAC) protocol data unit (A-MPDU) or the level of data aggregation in a MAC service data units (A-MSDU) to approach the target length. In another aspect, a STA 120 can add end of file (EOF) padding delimiters to reach the target length. In another approach the padding or the EOF pad fields are added at the beginning of the A-MPDU. One of the benefits of having all the UL-MU-MIMO transmissions the same length is that the power level of the transmission will remain constant.

[0095] In some embodiments, a STA 120 can have data to upload to the AP but the STA 120 has not received a CTX message 402 or other signal indicating that the STA 120 can start a UL-MU-MIMO transmission.

[0096] In one operation mode, the STAs 120 are not allowed to transmit outside an UL-MU-MIMO transmission opportunity (TXOP) (e.g., after CTX message 402). In another operation mode STAs 120 can transmit frames to initialize a UL-MU-MIMO transmission, and then can transmit during the UL-MU-MIMO TXOP, if for example, they are instructed to do so in a CTX message 402. In one embodiment, the frame to initialize a UL-MU-MIMO transmission can be a request to transmit (RTX), a frame specifically designed for this purpose (an example of a RTX frame structure is described more fully below with reference to FIGS. 8 and 9). The RTX frames can be the only frames a STA 120 is allowed to use to initiate a UL MU MIMO TXOP. In one embodiment, the STA may not transmit outside an UL-MU-MIMO TXOP other than by sending an RTX. In another embodiment, a frame to initialize an UL MU MIMO transmission can be any frame which indicates to the AP 110 that a STA 120 has data to send. It can be pre-negotiated that these frames indicate a UL MU MIMO TXOP request. For example, the following can be used to indicate that a STA 120 has data to send and is requesting an UL MU MIMO TXOP: an RTS, a data frame or QoS Null frame with bits 8–15 of the QoS control frame set to indicate more data, or a PS poll. In one embodiment, the STA may not transmit outside an UL MU MIMO TXOP other than by sending frames to trigger this TXOP, where this frame can be an RTS, PS poll, or QOS null. In another embodiment, the STA can send single user uplink data as usual, and can indicate a request for a UL MU MIMO TXOP by setting bits in the QoS control frame of its data packet. FIG. 7 is a transmission and reception time diagram

illustrating, in conjunction with FIG. 1, an example where the frame to initialize a UL-MU-MIMO is a RTX 701. In this embodiment the STA 120 sends to the AP 110 a RTX 701 that includes information regarding the UL-MU-MIMO transmission. As shown in FIG. 7, the AP 110 can respond to the RTX 701 with a CTX message 402 granting an UL-MU-MIMO TXOP to send the UL-MU-MIMO transmission 410 immediately following the CTX message 402. In another aspect, the AP 110 can respond with a CTS that grants a single-user (SU) UL TXOP. In another aspect, the AP 110 can respond with a frame (e.g., ACK or CTX with a special indication) that acknowledges the reception of the RTX 701 but does not grant an immediate UL-MU-MIMO TXOP. In another aspect, the AP 110 can respond with a frame that acknowledges the reception of the RTX 701, does not grant an immediate UL-MU-MIMO TXOP, but grants a delayed UL-MU-MIMO TXOP and can identify the time of the TXOP is granted. In this embodiment, the AP 110 can send a CTX message 402 to start the UL-MU-MIMO at the granted time.

[0097] In another aspect, the AP 110 can respond to the RTX 701 with an ACK or other response signal which does not grant the STA 120 an UL-MU-MIMO transmission but indicates that the STA 120 shall wait for a time (T) before attempting another transmission (e.g., sending another RTX). In this aspect the time (T) can be indicated by the AP 110 in the setup phase or in the response signal. In another aspect the AP 110 and a STA 120 can agree on a time which the STA 120 can transmit a RTX 701, RTS, PS-poll, or any other request for a UL-MU-MIMO TXOP.

[0098] In another operation mode, STAs 120 can transmit requests for UL-MU-MIMO transmissions 410 in accordance with regular contention protocol. In another aspect, the contention parameters for STAs 120 using UL-MU-MIMO are set to a different value than for other STAs that are not using the UL-MU-MIMO feature. In this embodiment, the AP 110 can indicate the value of the contention parameters in a beacon, association response or through a management frame. In another aspect, the AP 110 can provide a delay timer that prevents a STA 120 from transmitting for a certain amount of time after each successful UL-MU-MIMO TXOP or after each RTX, RTS, PS-poll, or QoS null frame. The timer can be restarted after each successful UL-MU-MIMO TXOP. In one aspect, the AP 110 can indicate the delay timer to STAs 120 in the setup phase or the delay timer can be different for each STA 120. In another aspect, the AP 110 can indicate the delay timer in the CTX message 402 or the delay timer can

be dependent on the order of the STAs 120 in the CTX message 402, and can be different for each terminal.

[0099] In another operational mode, the AP 110 can indicate a time interval during which the STAs 120 are allowed to transmit a UL-MU-MIMO transmission. In one aspect, the AP 110 indicates a time interval to the STAs 120 during which the STAs are allowed to send a RTX or RTS or other request to the AP 110 to ask for an UL-MU-MIMO transmission. In this aspect, the STAs 120 can use regular contention protocol. In another aspect, the STAs may not initiate a UL-MU-MIMO transmission during the time interval but the AP 110 can send a CTX or other message to the STAs to initiate the UL-MU-MIMO transmission.

[0100] In certain embodiments, a STA 120 enabled for UL-MU-MIMO can indicate to the AP 110 that it requests an UL-MU-MIMO TXOP because it has data pending for UL. In one aspect, the STA 120 can send a RTS or a PS-poll to request a UL-MU-MIMO TXOP. In another embodiment, the STA 120 can send any data frame, including a quality of service (QoS) null data frame, where the bits 8–15 of the QoS control field indicate a non-empty queue. In this embodiment the STA 120 can determine during the setup phase which data frames (e.g., RTS, PS-poll, QoS null, etc.) will trigger a UL-MU-MIMO transmission when the bits 8–15 of the QoS control field indicate a non-empty queue. In one embodiment, the RTS, PS-poll, or QoS null frames can include a 1 bit indication allowing or disallowing the AP 110 to respond with a CTX message 402. In another embodiment, the QoS null frame can include TX power information and a per TID queue information. The TX power information and per TID queue information can be inserted in the two bytes of the sequence control and QoS controls fields in a QoS null frame and the modified QoS null frame can be sent to the AP 110 to request a UL-MU-MIMO TXOP. In another embodiment, referring to FIGS. 1 and 7, the STA 120 can send a RTX 701 to request a UL-MU-MIMO TXOP.

[0101] In response to receiving an RTS, RTX, PS-poll or QoS null frame, or other trigger frame as described above, the AP 110 can send a CTX message 402. In one embodiment, referring to FIG. 7, after the transmission of the CTX message 402 and the completion of the UL-MU-MIMO transmissions 410A and 410B, the TXOP returns to the STAs 120A and 120B which can decide on how to use the remaining TXOP. In another embodiment, referring to FIG. 7, after the transmission of the CTX message 402 and the completion of the UL-MU-MIMO transmissions 410A and 410B,

TXOP remains with the AP 110 and the AP110 can use the remaining TXOP for additional UL-MU-MIMO transmissions by sending another CTX message 402 to either STAs 120A and 120B or to other STAs.

[0102] FIG. 8 is a diagram of one embodiment of a RTX frame 800. The RTX frame 800 includes a frame control (FC) field 810, a duration field 815 (optional), a transmitter address (TA)/allocation identifier (AID) field 820, a receiver address (RA)/basic service set identifier (BSSID) field 825, a TID field 830, an estimated transmission (TX) time field 850, and a TX power field 870. The FC field 810 indicates a control subtype or an extension subtype. The duration field 815 indicates to any receiver of the RTX frame 800 to set the network allocation vector (NAV). In one aspect, the RTX frame 800 may not have a duration field 815. The TA/AID field 820 indicates the source address which can be an AID or a full MAC address. The RA/BSSID field 825 indicates the RA or BSSID. In one aspect the RTX frame may not contain a RA/BSSID field 825. The TID field 830 indicates the access category (AC) for which the user has data.. The Estimated TX time field 850 indicates the time requested for the UL-TXOP and can be the time required for a STA 120 to send all the data in its buffer at the current planned MCS. The TX power field 870 indicates the power at which the frame is being transmitted and can be used by the AP to estimate the link quality and adapt the power backoff indication in a CTX frame.

[0103] FIG. 9 is a diagram of another embodiment of a RTX frame 801. In this embodiment, the RTX frame 801 contains a TID field and an Estimated TX time field for each access class listed in the RTX 801 frame (TID fields 831 and 840 and Estimated TX time fields 851, 860).

[0104] Before an UL-MU-MIMO communication is allowed to take place, the AP 110 can collect information from the STAs 120 that can participate in the UL-MU-MIMO communication. The AP 110 can optimize the collection of information from the STAs 120 by scheduling the transmissions from the STAs 120.

[0105] In one embodiment, the AP 110 can use a station scheduling frame (SSF) to schedule the transmission of multiple station access information frames (SIFs) from STAs 120. The SSF frame can be a short frame to allow for faster communication to trigger a response from the STAs. The SSF can be a CTX message 402 or another message indicating the STAs 120 send a SIF. In general, station access information can include any information regarding a STA, for example information on how, when, or if

the STA should access the AP. For example, the SIF can contain information indicating that the STAs 120 have data, how much data they have, and what type of data (i.e. what access class). It can also include the transmit power that is being used to send that SIF. In one embodiment, the SIF is a null data packet (NDP).

[0106] The SIF/SSF exchange can be optimized by using a TDMA, FDMA, SDMA, OFDMA, UL-MU-MIMO, or any other communication system that is based on an orthogonal multiplexing scheme. FIG. 10 is a transmission and reception time diagram illustrating an example of a SSF/SIF exchange in a FDMA system. In this embodiment, the SSF 1005 contains a list of STAs 120 to send SIFs 1010 to the AP 110. The SSF 1005 can also contain power adjustment information to control the power of the FDMA transmission 1010 signals. The SIFs 1010A and 1010B as well as the maximum number of TID information blocks allowed in a SIF 1010 can be prenegotiated so that the SIF response is always a fixed time duration. Alternatively the amount of time for the SIF 1010 response can be prenegotiated. The amount of time for the SIF 1010 response can also be included in the SSF 1005. When the response time is known, the STAs 120 would be allowed to send at higher MCSs and therefore send more TIDs. The frequency allocation based on the STA 120 order in the SSF can also be prenegotiated to determine which STA 120 gets which 20 MHz block for communication.

[0107] FIG. 11 is a transmission and reception time diagram illustrating an example of a SSF/SIF exchange in a TDMA system. In this embodiment, the SSF 1005 contains a list of STAs 120 to send SIFs 1010 to the AP 110. In this embodiment, SIFs 1010A and 1010B are sent sequentially by the STAs 120A and 120B, respectively. The MCS of the SIFs 1010A and 1010B , as well as the maximum number of TIDs allowed in a SIF 1010 can be prenegotiated to determine the time of each SIF 1010. For example, if a STA 120 has less than the maximum number of TIDs to fill out, the STA 120 can fill the remaining TIDs with padding so that all the SIFs are the same length. Alternatively the amount of time for the SIF 1010 response can be prenegotiated. The amount of time for the SIF 1010 response can also be included in the SSF 1005. When the response time is known, the STAs 120 would be allowed to send at higher MCSs and therefore send more TID information blocks.

[0108] In another embodiment, the SSF/SIF exchange can take place in OFDMA system. In this embodiment, the SSF 1005 contains the total number of STAs

120 being asked to send SIFs 1010 and a list of STAs 120 to send SIFs 1010 to the AP 110. The SSF 1005 can also contain power adjustment information to control the power of the SIF transmission 1010 signals. In this embodiment, the MCS of the SIFs 1010 , and number of TID information blocks in the SIF 1010 can be prenegotiated. Alternatively, the amount of time for the SIF 1010 response can also be included in the SSF 1005 or prenegotiated. When the response time is known by the STAs 120, the STAs 120 would be allowed to send at higher MCSs and therefore send more TIDs. In one aspect, the mapping of the STAs 120 order to subcarriers can be prenegotiated and would be a function of the number of STAs 120 being asked to send a SIF 1010.

[0109] In another embodiment, the SSF/SIF exchange can take place in a UL-MU-MIMO system. In this embodiment, the SSF 1005 contains a list of STAs 120 to send SIFs 1010 to the AP 110. The SSF 1005 can also contain power adjustment information to control the power of the SIF transmission 1010 signals. In this embodiment, the MCS of the SIFs 1010 can be prenegotiated. In one aspect, the mapping of the STAs 120 order to spatial streams can be prenegotiated and would be a function of the number of STAs 120 being asked to send a SIF 1010. Additionally, the maximum number of TIDs allowed in a SIF 1010 and the amount of time for the SIF 1010 response can be prenegotiated. Alternatively, the amount of time for the SIF 1010 response can also be included in the SIF 1010, or prenegogiated. When the response time is known by the STAs 120, the STAs 120 would be allowed to send at higher MCSs and therefore send more TIDs.

[0110] As discussed above, the CTX message 402 can be used in a variety of communications. FIG. 12 is a diagram of an example of a CTX frame 1200 structure. In this embodiment, the CTX frame 1200 is a control frame that includes a frame control (FC) field 1205, a duration field 1210, a transmitter address (TA) field 1215, a control (CTRL) field 1220, a PPDU duration field 1225, a STA info field 1230, and a frame check sequence (FCS) field 1280. The FC field 1205 indicates a control subtype or an extension subtype. The duration field 1210 indicates to any receiver of the CTX frame 1200 to set the network allocation vector (NAV). The TA field 1215 indicates the transmitter address or a BSSID. The CTRL field 1220 is, in general, a field that can include information regarding the format of the remaining portion of the frame (e.g., the number of STA info fields and the presence or absence of any subfields within a STA info field), indications for rate adaptation for the STAs 120, indication of allowed TID,

and indication that a CTS must be sent immediately following the CTX frame 1200. The CTRL field 1220 can also indicate if the CTX frame 1200 is being used for UL MU MIMO or for UL FDMA or both, indicating whether a Nss or Tone allocation field is present in the STA Info field 1230. Alternatively, the indication of whether the CTX is for UL MU MIMO or for UL FDMA can be based on the value of the subtype. Note that UL MU MIMO and UL FDMA operations can be jointly performed by specifying to a STA both the spatial streams to be used and the channel to be used, in which case both fields are present in the CTX; in this case, the Nss indication is referred to a specific tone allocation. The PPDU duration 1225 field indicates the duration of the following UL-MU-MIMO PPDU that the STAs 120 are allowed to send. The STA Info 1230 field contains information regarding a particular STA and can include a per-STA (per STA 120) set of information (see STA Info 1 1230 and STA Info N 1275). The STA Info 1230 field can include an AID or MAC address field 1232 which identifies a STA, a number of spatial streams field (Nss) 1234 field which indicates the number of spatial streams a STA can use (in an UL-MU-MIMO system), a Time Adjustment 1236 field which indicates a time that a STA should adjust its transmission compared to the reception of a trigger frame (the CTX in this case), a Power Adjustment 1238 field which indicates a power backoff a STA should take from a declared transmit power, a Tone Allocation 1240 field which indicates the tones or frequencies a STA can use (in a UL-FDMA system), an Allowed TID 1242 field which indicates the allowable TID, an Allowed TX Mode 1244 field which indicates the allowed TX modes, and a MCS 1246 field which indicates the MCS the STA should use. A STA 120 receiving a CTX with an AllowedTID 1242 indication can be allowed to transmit data only of that TID, data of the same or higher TID, data of the same or lower TID, any data, or only data of that TID first, then if no data is available, data of other TIDs. The FCS 1280 field indicates the carries an FCS value used for error detection of the CTX frame 1200.

[0111] FIG. 13 is a diagram of another example of a CTX frame 1200 structure. In this embodiment and in conjunction with FIG. 12, the STA Info 1230 field does not contain the AID or MAC Address 1232 field and instead the CTX frame 1200 includes a group identifier (GID) 1226 field which identifies the one or more stations by a group identifier rather than an individual identifier. FIG. 14 is a diagram of another example of a CTX frame 1200 structure. In this embodiment and in conjunction with

FIG. 13, the GID 1226 field is replaced with a RA 1214 field which identifies a group of STAs through a multicast MAC address.

[0112] FIG. 15 is a diagram of an example of a CTX 1500 frame structure. In this embodiment, the CTX 1500 frame is a management frame that includes a Management MAC Header 1505 field, a Body 1510 field, and a FCS 1580 field. The Body 1510 field includes an IE ID 1515 field which identifies an information element (IE), a LEN 1520 field which indicates the length of the CTX 1500 frame, a CTRL 1525 field which includes the same information as the CTRL 1220 field, a PPDU Duration 1530 field which indicates the duration of the following UL-MU-MIMO PPDU that the STAs 120 are allowed to send., a STA Info 1 1535 field and a MCS 1575 field which can indicate the MCS for all the STAs to use in the following UL-MU-MIMO transmission, or an MCS backoff for all the STAs to use in the following UL-MU-MIMO transmission. The STA Info 1 1535 (along with STA Info N 1570) field represent a per STA field that includes AID 1540 field which identifies a STA, a number of spatial streams field (Nss) 1542 field which indicates the number of spatial streams a STA can use (in an UL-MU-MIMO system), a Time Adjustment 1544 field which indicates a time that a STA should adjust its transmission compared to the reception of a trigger frame (the CTX in this case), a Power Adjustment 1546 field which indicates a power backoff a STA should take from a declared transmit power, a Tone Allocation 1548 field which indicates the tones or frequencies a STA can use (in a UL-FDMA system), and an Allowed TID 1550 field which indicates the allowable TID.

[0113] In one embodiment, the CTX frame 1200 or the CTX 1500 frame can be aggregated in an A-MPDU to provide time to a STA 120 for processing before transmitting the UL signals. In this embodiment, padding or data can be added after the CTX to allow a STA 120 additional time to process the forthcoming packet. One benefit to padding a CTX frame can be to avoid possible contention issues for the UL signals from other STAs 120. In one aspect, if the CTX is a management frame, additional padding IEs can be sent. In another aspect the STAs 120 can request to the AP 110 a minimum duration or padding for the CTX frame.

[0114] In some embodiments, the AP 110 can initiate a CTX transmission. In one embodiment, the AP 110 can send a CTX message 402 in accordance with regular enhanced distribution channel access (EDCA) contention protocol. In another embodiment, the AP 110 can send a CTX message 402 at scheduled times. In this

embodiment, the scheduled times can be indicated by the AP 110 to the STAs 120 by using a restricted access window (RAW) indication in a beacon which indicates a time reserved for a group of STAs 120 to access the medium, a target wake time (TWT) agreement with each STA 120 which indicates to multiple STAs 120 to be awake at the same time to take part in a UL-MU-MIMO transmission, or information in other fields. Outside the RAW and TWT a STA 102 can be allowed to transmit any frame, or only a subset of frames (e.g., non-data frames). It can also be forbidden to transmit certain frames (e.g., it can be forbidden to transmit data frames). The STA 120 can also indicate that it is in sleep state. One advantage to scheduling a CTX is that multiple STAs 120 can be indicated for the same TWT or RAW time and can receive a transmission from the AP 110.

[0115] In one embodiment, a CTX message 402 can include information for a single STA 120. In this embodiment, the AP 110 can send multiple CTX messages 402 that include information for one STA 120 at the same time to multiple STAs 120, creating a schedule for the following UL-MU-MIMO transmission 410. FIG 16 is a transmission and reception time diagram illustrating an example of sending multiple CTX messages 402A and 402B at the same time. As shown, the CTX messages 402A and 402B can be sent simultaneously using DL-MU-MIMO or DL-FDMA transmissions to one station each (STA 120A and 120B, respectively). The STAs 120A and 120B receive the CTX messages 402A and 402B and then begin the UL-MU-MIMO (or UL-FDMA) transmissions 410A and 410B. FIG. 17 is a transmission and reception time diagram and illustrates an example of sending the CTX messages within A-MPDU messages 407A and 407B. As in FIG. 16, the CTX portion of the A-MPDU messages 407A and 407B contain information for one STA (STA 120A and 120B, respectively) and the STAs 120A and 120B receive the messages 407A and 407B and begin the UL-MU-MIMO (or UL-FDMA) transmissions 410A and 410B.

[0116] In other embodiments, a STA 120 may not start an UL transmission after receiving a CTX message 402. In one embodiment the AP 110 defines a new frame that triggers a UL transmission. The new frame can be any frame indicated by the AP 110 and can comprise a NDP frame. In this embodiment, the new frame can include a sequence or token number that links the frame to the CTX so that the STA knows that the frame is the same trigger frame as indicated in the CTX and can begin an UL transmission. The frame can also include a duration so that other STAs 120 hearing

the transmission can set their NAV. The STA 120 can acknowledge receipt of the CTX by sending an ACK or similar frame. In another embodiment a STA 120 can request the use of a trigger frame. The request can indicate that the trigger be immediate or delayed. One benefit of having a separate trigger frame can be that the trigger frame can give a STA more time to process the CTX before an UL transmission. Another benefit can be that the trigger frame can be a shorter frame than the CTX and can be sent at multiple times without subsequent CTX messages to allow for faster UL time. The trigger frame could follow the CTX immediately, or at a pre-specified offset or set of offsets from the CTX.

[0117] FIG. 18 is a transmission and reception time diagram that illustrates one embodiment of a CTX/Trigger exchange. In this embodiment, the AP 110 sends a CTX message 402 to the STAs 120 and then later sends the trigger frame 405. Once the STAs 120A and 120B receive the trigger frame 405, they begin the UL-MU-MIMO transmissions 410A and 410B. FIG. 19 is a transmission and reception time diagram that illustrates an example where the time between the CTX message 402 and the trigger frame 405 is greater than that shown in FIG. 18. FIG. 20 is a transmission and reception time diagram that illustrates an example of sending multiple trigger frames 405 over time to initiate multiple UL-MU-MIMO 410 transmissions. In this embodiment, the second trigger frame 405 does not need to be preceded by the CTX 402 to initiate the second UL-MU-MIMO transmissions 410A and 410B because the STAs 120A and 120B can just confirm the trigger frame has the same sequence or token number as indicated in the CTX and begin transmission.

[0118] In some embodiments, if the AP 110 cannot multiplex ACKs or BAs to STAs 120 (i.e. the AP 110 is not using any DL-MU-MIMO or DL-FDMA to send ACKs to multiple STAs at the same time), then only one STA 120 can be allowed to set the BA policy to an immediate BA or a normal ACK and the AP 110 can be allowed to indicate which STA 120 in the CTX list can set the BA policy. The indication can be based on the position of the STA info field for that STA 120 in the CTX, such as the first position.

[0119] In another embodiment, if the AP 110 can multiplex ACKs or BAs to STAs 120, then more than one STA 120 can set the BA policy to immediate BA or normal ACK. In this embodiment, the AP 110 will use DL-MU-MIMO or DL-FDMA to send immediate ACKs to the multiple STAs 120 that indicated immediate BA or

normal ACK at the same time. In a different embodiment, if a STA sets the BA policy to Delayed BA, then the AP 110 can send the BAs in a time sequence to the STAs 120. The time sequence can be separated by SIFS. In another embodiment, if a STA 120 sets the BA policy to BA, the AP 110 will wait for a poll from each STA 120 before sending a BA. In another embodiment, a broadcast BA frame can be defined, which includes block acknowledgments for multiple STAs 120. In case such a frame is used, multiple STAs 120 are allowed to set the ACK policy to immediate BA; the STAs 120 that set the ACK policy to immediate BA are acknowledged by the inclusion of the corresponding block acknowledgment in the broadcast BA frame sent immediately after the UL transmissions. The broadcast BA can also be used to acknowledge multiple STAs 120 that set a delayed BA policy; in this case the broadcast BA frame is sent with contention at a later time.

[0120] As discussed above, for example with respect to FIG. 17, in various embodiments, control information and/or trigger information can be encapsulated in an A-MPDU. For example, in FIG. 17 the A-MPDU 407 includes CTX scheduling, control, and/or trigger information as described above with respect to FIGS. 4–20. Similarly, in various embodiments, such scheduling, control, and/or trigger information can be included in an aggregated PPDU (A-PPDU) instead of, or in addition to a CTX. In other words, in some embodiments, one or more fields or indicators discussed above with respect to the CTX can be included in an A-PPDU, which can replace the CTX in one or more of the time sequence diagrams shown in FIGS. 4–20.

[0121] FIG. 21 is a diagram that illustrates one embodiment of an aggregated PPDU (A-PPDU) 2100. As shown in FIG. 21, the A-PPDU 2100 includes a common PHY header 2110, one or more per-PPDU headers 2120, 2140, and 2160, and one or more per-PPDU payloads 2130, 2150, and 2170. Although the illustrated A-PPDU 2100 includes an SU PPDU header 2120 and payload 2130, and N-1 MU PPDU headers and payloads 2140–2170, a person having ordinary skill in the art will appreciate that the illustrated A-PPDU 2100 can include additional fields, fields can be rearranged, removed, and/or resized, and the contents of the fields varied. For example, in various embodiments, the SU PPDU header 2120 and payload 2130 can be in a different location, there can be more than one SU PPDU, there can be any number of MU PPDUs, etc.

[0122] The common PHY header 2110 serves to provide PHY layer information common to each PPDU in the A-PPDU 2100, such as acquisition and/or synchronization information. In various embodiments, the common PHY header 2110 can indicate (for example, via one or more bits or flags) whether the A-PPDU 2100 includes at least one PPDU with broadcast/multicast information that all STAs are instructed to decode. In an embodiment, when the indication is set, one or more STAs 120 can be configured to decode subsequent PPDUs in order to obtain the broadcast/multicast information (for example, in the SU payload 2130).

[0123] The SU PHY header 2120 serves to provide PHY layer information specific to the SU payload 2130. In various embodiments, the SU PHY header 2120 can indicate (for example, via one or more bits or flags) whether the A-PPDU 2100 includes at least one PPDU with broadcast/multicast information that all STAs are instructed to decode. In an embodiments, when the indication is set, one or more STAs 120 can be configured to decode subsequent PPDUs in order to obtain the broadcast/multicast information (for example, in the SU payload 2130).

[0124] In the illustrated embodiment, the SU payload 2130 includes control information, for example broadcast data, multicast data, control information, and/or management information that can be decoded by both SU and MU STAs. In various embodiments, the SU PHY header 2120 and the SU payload 2130 can be broadcast or unicast. In various embodiments, the SU PHY header 2120 and the SU payload 2130 can be in a position other than first in the A-PPDU 2100.

[0125] The MU PHY header 2140 serves to provide PHY layer information specific to the MU payload 2150. In various embodiments, the MU PHY header 2140 can indicate (for example, via one or more bits or flags) whether the A-PPDU 2100 includes at least one PPDU with broadcast/multicast information that all STAs are instructed to decode. In an embodiments, when the indication is set, one or more STAs 120 can be configured to decode subsequent PPDUs in order to obtain the broadcast/multicast information (for example, in the SU payload 2130).

[0126] As shown, the A-PPDU 2100 can include a total of N PPDUs. In various embodiments, the PHY header 2160 can be similar to one of the SU PHY header 2120 and the MU PHY header 2140. In various embodiments, the payload 2170 can be similar to one of the SU payload 2130 and the MU payload 2150. In various embodiments, the MU PPDUs can be omitted entirely.

[0127] In various embodiments, the A-PPDU 2100 of FIG. 21 can be used in conjunction with an UL MU MIMO/OFDMA protocol, such as for example 802.11ax. For example, the A-PPDU 2100 can include scheduling and/or trigger information discussed above with respect to the CTX and exchanges of FIGS. 4–20. Thus, in various embodiments, the AP 110 can transmit the A-PPDU 2100 to schedule UL PPDUs from one or more STAs 120. In various embodiments, such exchange can be referred to herein as an A-PPDU trigger exchange.

[0128] FIG. 22 is a transmission and reception time diagram that illustrates one embodiment of an A-PPDU 2200 trigger exchange. As shown in FIG. 22, the A-PPDU 2200 includes a common PHY header 2210, one or more per-PPDU headers 2220 and 2240, one or more per-PPDU payloads 2230 and 2250. The exchange further includes an one or more scheduled UL PPDUs 2280 and 2290. Although the illustrated A-PPDU 2200 trigger exchange includes one SU PPDU header 2220 and payload 2230, and one MU PPDU header 2240 and payload 2250, a person having ordinary skill in the art will appreciate that the illustrated A-PPDU 2200 trigger exchange can include additional fields, fields can be rearranged, removed, and/or resized, and the contents of the fields varied. For example, in various embodiments, the SU PPDU header 2220 and payload 2230 can be in a different location, there can be more than one SU PPDU, there can be any number of MU PPDUs, a different number of scheduled UL PPDUs, etc.

[0129] The common PHY header 2210 serves to provide PHY layer information common to each PPDU in the A-PPDU 2200, such as acquisition and/or synchronization information. In various embodiments, the common PHY header can indicate (for example, via one or more bits or flags) whether the A-PPDU 2200 includes at least one PPDU with broadcast/multicast information that all STAs are instructed to decode. In an embodiments, when the indication is set, one or more STAs 120 can be configured to decode subsequent PPDUs in order to obtain the broadcast/multicast information (for example, in the SU payload 2230).

[0130] The SU PHY header 2220 serves to provide PHY layer information specific to the SU payload 2230. In various embodiments, the SU PHY header 2220 can indicate (for example, via one or more bits or flags) whether the A-PPDU 2200 includes at least one PPDU with broadcast/multicast information that all STAs are instructed to decode. In an embodiments, when the indication is set, one or more STAs

120 can be configured to decode subsequent PPDUs in order to obtain the broadcast/multicast information (for example, in the SU payload 2230).

[0131] In the illustrated embodiment, the SU payload 2230 includes UL scheduling information 2230 for scheduling one or more UL PPDUs such as the UL PPDUs 2280 and 2290. In various embodiments, the UL scheduling information 2230 can include one or more fields or indicators discussed above with respect to one or more of: the CTX 402, 1035, 1200, and 1500, the CTS 408, the SSF 1005, the A-MPDU 407, the BAs 470, and the trigger frame 405, variously discussed above with respect to FIGS. 5–20. For example, in various embodiments, the UL scheduling information 2230 can include one or more of: identification of the STAs permitted or instructed to transmit one or more UL PPDUs, identification of resources allocated to STAs such as spatial streams, tones, etc., scheduling times and/or durations of UL transmissions, type and or content of scheduled UL transmissions, etc. In various embodiments, information included in the UL scheduling information 2230 can be omitted from the common PHY header 2210. In various embodiments, the SU PHY header 2220 and the SU payload 2230 can be broadcast or unicast. In various embodiments, the SU PHY header 2220 and the SU payload 2230 can be in a position other than first in the A-PPDU 2200.

[0132] The MU PHY header 2240 serves to provide PHY layer information specific to the MU payload 2250. In various embodiments, the MU PHY header 2240 can indicate (for example, via one or more bits or flags) whether the A-PPDU 2200 includes at least one PPDU with broadcast/multicast information that all STAs are instructed to decode. In an embodiments, when the indication is set, one or more STAs 120 can be configured to decode subsequent PPDUs in order to obtain the broadcast/multicast information (for example, in the SU payload 2230).

[0133] In an embodiment, the AP 110 can transmit the A-PPDU 2200, with UL scheduling information 2230, to one or more STAs 120. The STAs 120 can decode the UL scheduling information and can determine a time that they are instructed to transmit an UL PPDU. In various embodiments, UL PPDUs can be spaced according to a short interframe space (SIFS), can be spaced according to another spacing, or can be unspaced. In the illustrated embodiment, the STAs 120 transmit the UL PPDU1 2280 and the UL PPDU2 2290 according to the UL scheduling information 2230.

[0134] FIGS. 23A–23D show time sequence diagrams 2300A–2300D that illustrate various embodiments of A-PPDU trigger exchanges. A person having

ordinary skill in the art will appreciate that the illustrated A-PPDU trigger exchanges can include additional transmissions and/or fields, transmissions and/or fields can be rearranged, removed, and/or resized, and the contents of the transmissions and/or fields varied. For example, in various embodiments, the A-PPDU trigger exchange can optionally include a CTS 2310, which can precede an A-PPDU 2320A in embodiments where the A-PPDU 2320A is not legacy compatible. The CTS 2310 can set the NAV to protect the A-PPDU trigger exchange. In various embodiments, the A-PPDU trigger exchange can include another frame protecting the exchange, in addition to, or instead of, the CTS 2310.

[0135] As shown in FIG. 23A, the AP 110 can transmit the A-PPDU 2320A, including trigger information and one or more DL MU PPDUs, to one or more STAs 120. The STAs 120 can receive the DL MU PPDUs and can transmit one or more BAs 2330 based at least in part on the trigger information of the A-PPDU 2320A.

[0136] As shown in FIG. 23B, the AP 110 can transmit the A-PPDU 2320B, including trigger information and one or more DL MU PPDUs, to one or more STAs 120. The STAs 120 can receive the DL MU PPDUs and can transmit one or more BAs 2330 based at least in part on the trigger information of the A-PPDU 2320B. The STAs 120 can further transmit one or more MU-PPDUs 2340 based at least in part on the trigger information of the A-PPDU 2320B.

[0137] As shown in FIG. 23C, the AP 110 can transmit the A-PPDU 2320C, including trigger information, to one or more STAs 120. The STAs 120 can receive the DL MU PPDUs and can transmit one or more MU-PPDUs 2340 based at least in part on the trigger information of the A-PPDU 2320C. The AP 110 can transmit a A-PPDU 2350, including trigger information and BAs for the MU-PPDUs 2340, to one or more STAs 120. The STAs 120 can receive the BAs and can transmit one or more additional MU-PPDUs 2340 based at least in part on the trigger information of the A-PPDU 2350.

[0138] As shown in FIG. 23D, the AP 110 can transmit the A-PPDU 2320D, including trigger information and one or more DL MU PPDUs, to one or more STAs 120. The STAs 120 can receive the DL MU PPDUs and can transmit one or more BAs 2330 based at least in part on the trigger information of the A-PPDU 2320D. The STAs 120 can further transmit information about traffic ability to the AP 110 based at least in part on the trigger information of the A-PPDU 2320D. For example, in various

embodiments traffic information can include one or more SIFs, such as the SIFs 1010 discussed above with respect to FIGS. 10–11.

[0139] FIG. 24 shows a flowchart 2400 for an exemplary method of wireless communication that can be employed within the wireless communication system 100 of FIG. 1. The method can be implemented in whole or in part by the devices described herein, such as the AP 110 (FIG. 1), any of the STAs 120 (FIG. 1), and the wireless device 302 shown in FIG. 3. Although the illustrated method is described herein with reference to the wireless communication system 100 discussed above with respect to FIG. 1, the wireless device 302 discussed above with respect to FIG. 3, and the frames and frame exchanges of FIGS. 4–20, a person having ordinary skill in the art will appreciate that the illustrated method can be implemented by another device described herein, or any other suitable device. Although the illustrated method is described herein with reference to a particular order, in various embodiments, blocks herein can be performed in a different order, or omitted, and additional blocks can be added.

[0140] **[00141]** First, at block 2410, an access point generates an aggregated message. The aggregated message includes a single-user broadcast message and at least one other message. For example, the AP 110 can generate the A-PPDU 2200 for transmission to one or more STAs 120. The A-PPDU 2200 can include the SU payload 2230 including UL scheduling information instructing the STAs 120 to transmit the UL PPDUs 2280–2290 at particular times. In various embodiments, the single-user broadcast message and the at least one other message can be referred to as "sub-messages" of the aggregated message.

[0141] In various embodiments, the aggregated message can include the single-user broadcast message and one or more multi-user messages. For example, the A-PPDU 2200 can include the SU PHY header 2220 and payload 2230, and the MU PHY header 2240 and payload 2250.

[0142] In various embodiments, each sub-message of the aggregated message can include at least a physical layer data unit (PPDU) comprising a physical layer (PHY) control field and a media access control (MAC) payload. In various embodiments, the at least one other message can include at least one multi-user physical layer data unit (PPDU). In various embodiments, the at least one other message can include at least one single-user physical layer data unit (PPDU) excluding control or scheduling information.

[0143] In various embodiments, the aggregated message can include a common physical layer header indicating whether the at least one other message includes at least message that all of the one or more stations are instructed to decode. For example, the A-PPDU 2200 can include the common PHY header 2210, which can indicate that the SU payload 2250 includes the UL scheduling information.

[0144] In various embodiments, each message can include a physical layer header indicating whether the at least one other message includes at least message that all of the one or more stations are instructed to decode. For example, the SU PHY header 2220 can indicate that the SU payload 2250 includes the UL scheduling information.

[0145] In various embodiments, the single-user broadcast message includes control information instructing the one or more stations to transmit uplink data at a specific time, and the uplink data can be received from the one or more stations. For example, the UL scheduling information 2230 can instruct the STAs 120 to transmit the UL PPDUs 2280–2290 beginning a SIFS after the MU payload 2250.

[0146] In various embodiments, each message can include an uplink scheduling message. For example, the SU payload 2230 can include the UL scheduling information. In various embodiments, the uplink scheduling message can include a physical layer data unit (PPDU) duration field indicating a duration of transmission of uplink data. In various embodiments, the uplink scheduling message can include a station (STA) info field including an indication of allowed transmission modes. For example, the UL scheduling information 2230 can include any of the fields of the CTX discussed above with respect to FIGS. 4–20.

[0147] In various embodiments, the station (STA) info field can include a tone allocation field indicating tones/frequencies for uplink data using a frequency division multiple access (FDMA) system. In various embodiments, the uplink scheduling message can include a group identifier (GID) field indicating the STAs that can participate in uplink communications. In various embodiments, the uplink scheduling message can include a receiver address (RA) field indicating a multicast address which identifies the one or more stations that can participate in uplink communications. In various embodiments, the uplink scheduling message can include a field indicating rate information for the one or more stations. For example, the UL

scheduling information 2230 can include any of the fields of the CTX discussed above with respect to FIGS. 4–20.

[0148] In various embodiments, the method can further include transmitting an uplink scheduling message to the one or more stations. The uplink scheduling message can instruct the one or more stations to transmit a station access information message in response to the uplink scheduling message. The method can further include receiving a plurality of station access information messages. The station access information messages can indicate station access information. For example, the UL scheduling information 2230 can instruct the STAs 120 to provide the traffic information 2360. In various embodiments, the single-user broadcast message can include data, control, or management information for one or more stations.

[0149] Next, at block 2420, the access point transmits the aggregated message to one or more stations. For example, the AP 110 can transmit the A-PPDU 2200 to the STAs 120. The AP 110 can receive one or more of the UL PPDUs 2280–2290 from the one or more STAs 120. In various embodiments, receiving a plurality of uplink data can include receiving a plurality of uplink data having the same duration. For example, the UL PPDU 2280 and the UL PPDU 2290 can have the same duration as each other. Each of the UL PPDUs 2280 and 2290 can include multiple UL PPDUs simultaneously transmitted by one or more STAs 120 according to MU-MIMO and/or OFDMA. In various embodiments, the method can further include transmitting an acknowledgment message to the one or more stations. For example, the AP 110 can transmit the BAs 2350, in some embodiments with additional trigger information.

[0150] In an embodiment, the method shown in FIG. 24 can be implemented in a wireless device that can include a providing circuit, a transmitting circuit, and a receiving circuit. Those skilled in the art will appreciate that a wireless device can have more components than the simplified wireless device described herein. The wireless device described herein includes only those components useful for describing some prominent features of implementations within the scope of the claims.

[0151] The providing circuit can be configured to provide the aggregated message for transmission. In an embodiment, the providing circuit can be configured to implement block 2410 of the flowchart 2400 (FIG. 24). The providing circuit can include one or more of the transmitter 310 (FIG. 3), the transceiver 314 (FIG. 3), the

processor 304 (FIG. 3), the DSP 320 (FIG. 3), and the memory 306 (FIG. 3). In some implementations, means for providing can include the providing circuit.

[0152] The transmitting circuit can be configured to transmit the aggregated message. In an embodiment, the transmitting circuit can be configured to implement block 2410 of the flowchart 2400 (FIG. 24). The transmitting circuit can include one or more of the transmitter 310 (FIG. 3), the transceiver 314 (FIG. 3), the processor 304 (FIG. 3), the DSP 320 (FIG. 3), and the memory 306 (FIG. 3). In some implementations, means for transmitting can include the transmitting circuit.

[0153] The receiving circuit can be configured to receive the uplink messages. In an embodiment, the receiving circuit can be configured to implement block 2420 of the flowchart 2400 (FIG. 24). The receiving circuit can include one or more of the receiver 312 (FIG. 3), the transceiver 314 (FIG. 3), the processor 304 (FIG. 3), the DSP 320 (FIG. 3), the signal detector 318 (FIG. 3), and the memory 306 (FIG. 3). In some implementations, means for receiving can include the receiving circuit.

[0154] A person/one having ordinary skill in the art would understand that information and signals can be represented using any of a variety of different technologies and techniques. For example, data, instructions, commands, information, signals, bits, symbols, and chips that can be referenced throughout the above description can be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

[0155] Various modifications to the implementations described in this disclosure can be readily apparent to those skilled in the art, and the generic principles defined herein can be applied to other implementations without departing from the spirit or scope of this disclosure. Thus, the disclosure is not intended to be limited to the implementations shown herein, but is to be accorded the widest scope consistent with the claims, the principles and the novel features disclosed herein. The word "exemplary" is used exclusively herein to mean "serving as an example, instance, or illustration." Any implementation described herein as "exemplary" is not necessarily to be construed as preferred or advantageous over other implementations.

[0156] Certain features that are described in this specification in the context of separate implementations also can be implemented in combination in a single implementation. Conversely, various features that are described in the context of a single implementation also can be implemented in multiple implementations separately

or in any suitable sub-combination. Moreover, although features can be described above as acting in certain combinations and even initially claimed as such, one or more features from a claimed combination can in some cases be excised from the combination, and the claimed combination can be directed to a sub-combination or variation of a sub-combination.

[0157] The various operations of methods described above can be performed by any suitable means capable of performing the operations, such as various hardware and/or software component(s), circuits, and/or module(s). Generally, any operations illustrated in the Figures can be performed by corresponding functional means capable of performing the operations.

[0158] The various illustrative logical blocks, modules and circuits described in connection with the present disclosure can be implemented or performed with a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array signal (FPGA) or other programmable logic device (PLD), discrete gate or transistor logic, discrete hardware components or any combination thereof designed to perform the functions described herein. A general purpose processor can be a microprocessor, but in the alternative, the processor can be any commercially available processor, controller, microcontroller or state machine. A processor can also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

[0159] In one or more aspects, the functions described can be implemented in hardware, software, firmware, or any combination thereof. If implemented in software, the functions can be stored on or transmitted over as one or more instructions or code on a computer-readable medium. Computer-readable media includes both computer storage media and communication media including any medium that facilitates transfer of a computer program from one place to another. A storage media can be any available media that can be accessed by a computer. By way of example, and not limitation, such computer-readable media can comprise RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to carry or store desired program code in the form of instructions or data structures and that can be accessed by a

computer. Also, any connection is properly termed a computer-readable medium. For example, if the software is transmitted from a website, server, or other remote source using a coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave, then the coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave are included in the definition of medium. Disk and disc, as used herein, includes compact disc (CD), laser disc, optical disc, digital versatile disc (DVD), floppy disk and Blu-ray disc where disks usually reproduce data magnetically, while discs reproduce data optically with lasers. Thus, in some aspects computer readable medium can comprise non-transitory computer readable medium (e.g., tangible media). In addition, in some aspects computer readable medium can comprise transitory computer readable medium (e.g., a signal). Combinations of the above should also be included within the scope of computer-readable media.

[0160] The methods disclosed herein comprise one or more steps or actions for achieving the described method. The method steps and/or actions can be interchanged with one another without departing from the scope of the claims. In other words, unless a specific order of steps or actions is specified, the order and/or use of specific steps and/or actions can be modified without departing from the scope of the claims.

[0161] Further, it should be appreciated that modules and/or other appropriate means for performing the methods and techniques described herein can be downloaded and/or otherwise obtained by a STA and/or base station as applicable. For example, such a device can be coupled to a server to facilitate the transfer of means for performing the methods described herein. Alternatively, various methods described herein can be provided via storage means (e.g., RAM, ROM, a physical storage medium such as a compact disc (CD) or floppy disk, etc.), such that a STA and/or base station can obtain the various methods upon coupling or providing the storage means to the device. Moreover, any other suitable technique for providing the methods and techniques described herein to a device can be utilized.

[0162] While the foregoing is directed to aspects of the present disclosure, other and further aspects of the disclosure can be devised without departing from the basic scope thereof, and the scope thereof is determined by the claims that follow.

WHAT IS CLAIMED IS:

1. A method for wireless communication, comprising:

transmitting, at an access point, an aggregated message comprising a single-user broadcast message and at least one other message; and

transmitting the aggregated message to one or more stations.

2. The method of Claim 1, wherein the at least one other message comprises at least one multi-user physical layer data unit (PPDU).

3. The method of Claim 1, wherein the at least one other message comprises at least one single-user physical layer data unit (PPDU) excluding control or scheduling information.

4. The method of Claim 1, wherein the aggregated message comprises a common physical layer header indicating whether the at least one other message includes at least a message that all of the one or more stations are instructed to decode.

5. The method of Claim 1, wherein the single-user broadcast message and the at least one other message each comprise a physical layer header indicating whether the at least one other message includes at least a message that all of the one or more stations are instructed to decode.

6. The method of Claim 1, wherein the single-user broadcast message includes control information instructing the one or more stations to transmit a plurality of uplink data at a specified time.

7. The method of Claim 6, further comprising receiving transmission of the plurality of uplink data at the specified time, each transmission of the plurality of uplink data having the same duration.

8. The method of Claim 7, further comprising transmitting an acknowledgment message to the one or more stations.

9. The method of Claim 1, wherein each of the single-user broadcast message and at least one other message comprises an uplink scheduling message.

10. The method of Claim 9, wherein the uplink scheduling message comprises a station (STA) info field comprising an indication of allowed transmission modes.

11. The method of Claim 10, wherein the station (STA) info field comprises a tone allocation field indicating frequency tones for uplink data using a frequency division multiple access (FDMA) system.

12. The method of Claim 9, wherein the uplink scheduling message comprises a receiver address (RA) field indicating a multicast address which identifies the one or more stations allowed to participate in uplink communications.

13. The method of Claim 9, wherein the uplink scheduling message comprises a field indicating rate information for the one or more stations.

14. The method of Claim 1, further comprising:

transmitting an uplink scheduling message to the one or more stations, the uplink scheduling message instructing the one or more stations to transmit a station access information message in response to the uplink scheduling message; and

receiving a plurality of station access information messages, each of the plurality of station access information messages indicating station access information.

15. An apparatus configured for wireless communication, comprising:

a processor configured to generate for transmission an aggregated message comprising a single-user broadcast message and at least one other message; and

a transmitter configured to transmit the aggregated message to one or more stations.

16. The apparatus of Claim 15, wherein the at least one other message comprises at least one single-user physical layer data unit (PPDU) excluding control or scheduling information.

17. The apparatus of Claim 15, wherein the aggregated message comprises the single-user broadcast message and one or more multi-user messages.

18. The apparatus of Claim 15, wherein the aggregated message comprises a common physical layer header indicating whether the at least one other message includes at least a message that all of the one or more stations are instructed to decode.

19. The apparatus of Claim 15, wherein the single-user broadcast message and the at least one other message each comprise a physical layer header indicating

whether the at least one other message includes at least a message that all of the one or more stations are instructed to decode.

20. The apparatus of Claim 15, wherein the single-user broadcast message includes control information instructing the one or more stations to transmit a plurality of uplink data at a specified time.

21. The apparatus of Claim 20, further comprising a receiver configured to receive transmission of the plurality of uplink data at the specified time, each transmission of the plurality of uplink data having the same duration.

22. The apparatus of Claim 15, wherein each of the single-user broadcast message and the at least one other message comprises an uplink scheduling message.

23. The apparatus of Claim 22, wherein the uplink scheduling message comprises a physical layer data unit (PPDU) duration field indicating a duration of transmission of uplink data.

24. The apparatus of Claim 22, wherein the uplink scheduling message comprises a station (STA) info field comprising an indication of allowed transmission modes.

25. The apparatus of Claim 24, wherein the station (STA) info field comprises a tone allocation field indicating tones/frequencies for uplink data using a frequency division multiple access (FDMA) system.

26. The apparatus of Claim 22, wherein the uplink scheduling message comprises a receiver address (RA) field indicating a multicast address which identifies the one or more stations that can participate in uplink communications.

27. The apparatus of Claim 15, wherein the single-user broadcast message comprises data, control, or management information for the one or more stations.

28. The apparatus of Claim 15, further comprising:

a transmitter configured to transmit an uplink scheduling message to the one or more stations, the uplink scheduling message instructing the one or more stations to transmit a station access information message in response to the uplink scheduling message,

wherein a receiver of the apparatus is configured to receive a plurality of station access information messages, the station access information messages indicating station access information.

29. An apparatus for wireless communication, comprising:

means for generating an aggregated message comprising a single-user broadcast message and at least one other message; and

means for transmitting the aggregated message to one or more stations.

30. A non-transitory computer-readable medium comprising code that, when executed, causes an apparatus to:

generate an aggregated message comprising a single-user broadcast message and at least one other message; and

transmit the aggregated message to one or more stations.

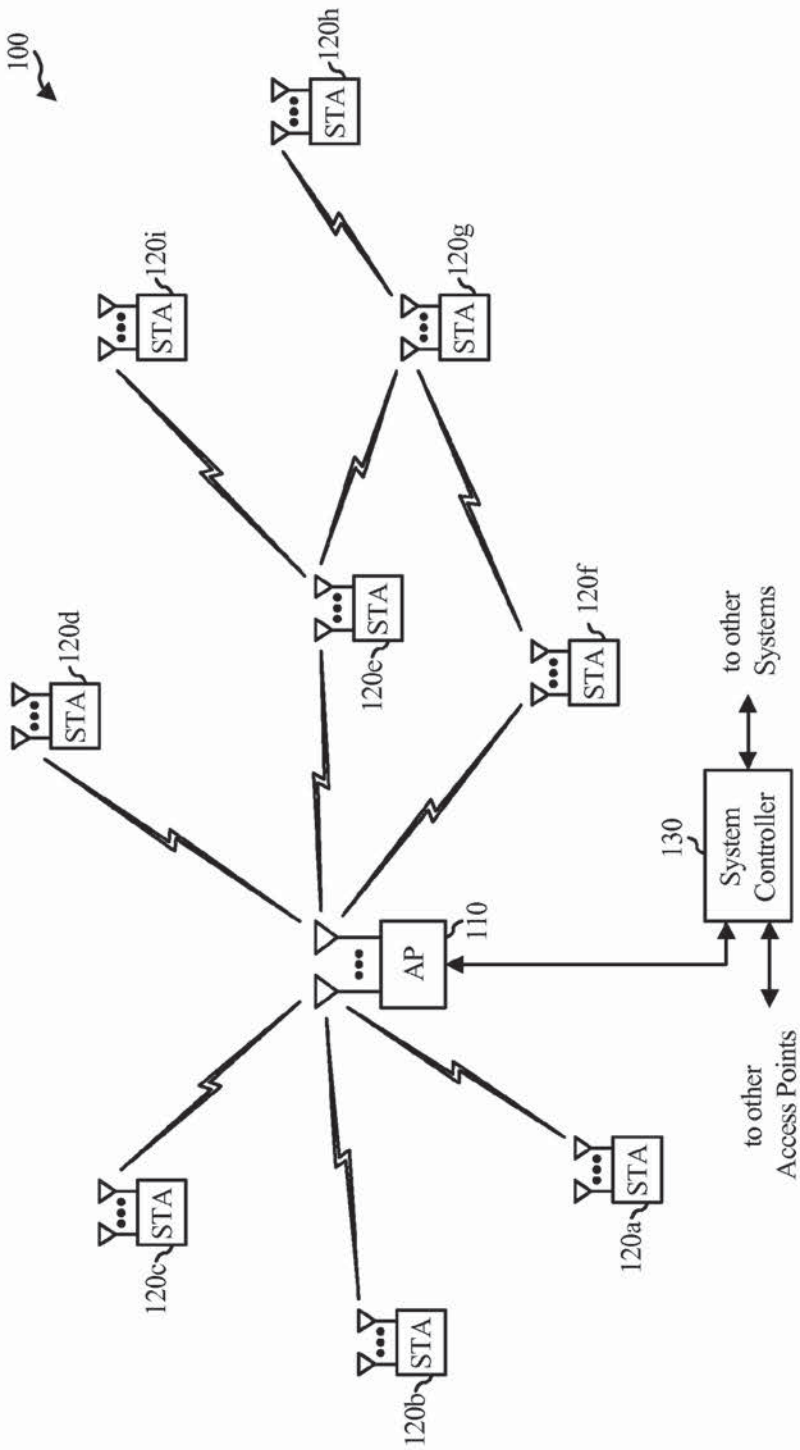

100
120h
STA
120i
STA
120g
STA
120d
STA
120e
STA
120f
STA
AP
110
130
System Controller
to other Systems
to other Access Points
120c
STA
120b
STA
120a
STA

FIG. 1

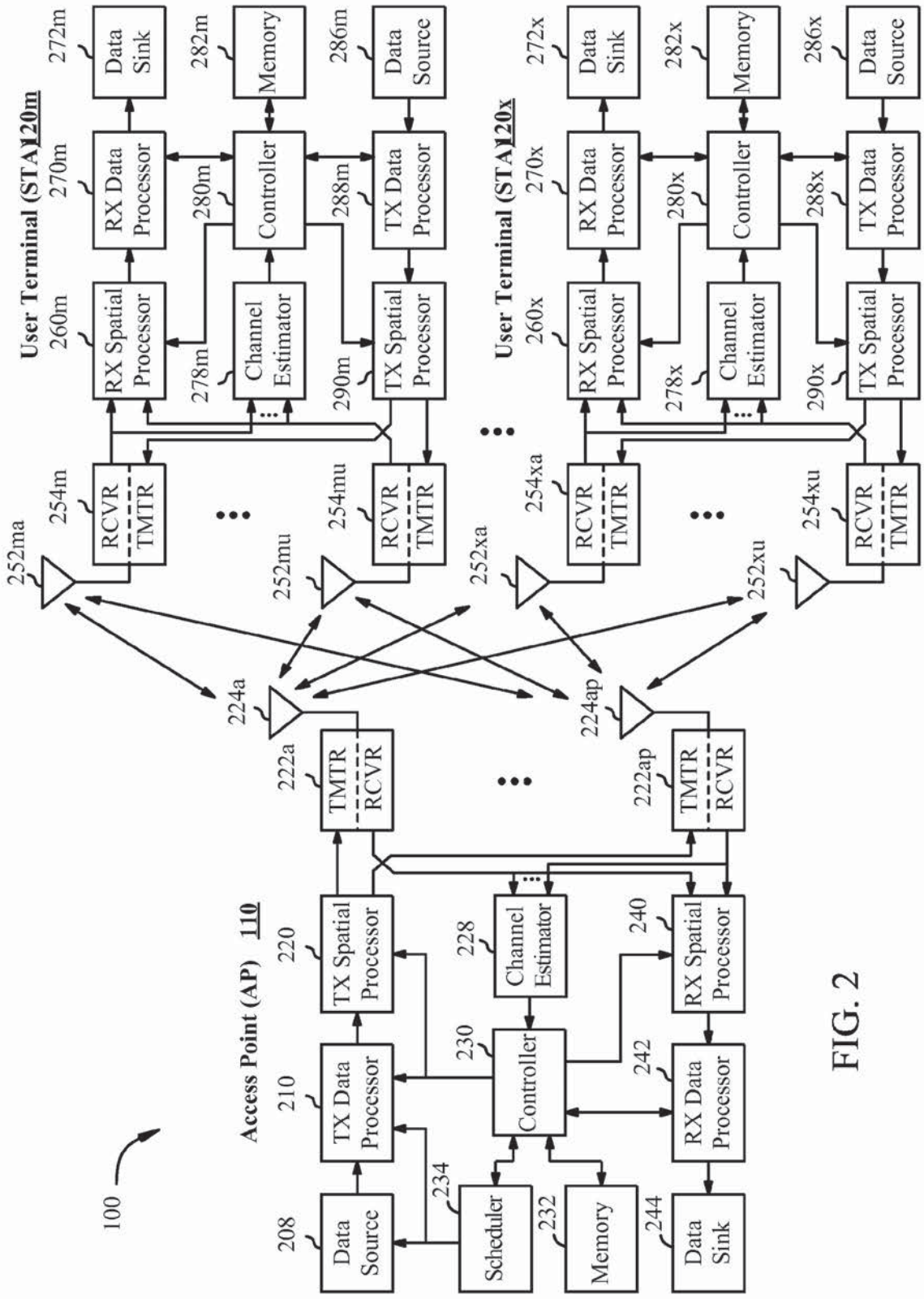

100
Access Point (AP) 110
208 Data Source
210 TX Data Processor
220 TX Spatial Processor
222a TMTR RCVR
222ap TMTR RCVR
224a
224ap
228 Channel Estimator
230 Controller
232 Memory
234 Scheduler
240 RX Spatial Processor
242 RX Data Processor
244 Data Sink
252ma
252mu
252xa
252xu
254m RCVR TMTR
254mu RCVR TMTR
254xa RCVR TMTR
254xu RCVR TMTR
User Terminal (STA) 120m
260m RX Spatial Processor
270m RX Data Processor
272m Data Sink
278m Channel Estimator
280m Controller
282m Memory
286m Data Source
288m TX Data Processor
290m TX Spatial Processor
User Terminal (STA) 120x
260x RX Spatial Processor
270x RX Data Processor
272x Data Sink
278x Channel Estimator
280x Controller
282x Memory
286x Data Source
288x TX Data Processor
290x TX Spatial Processor

FIG. 2

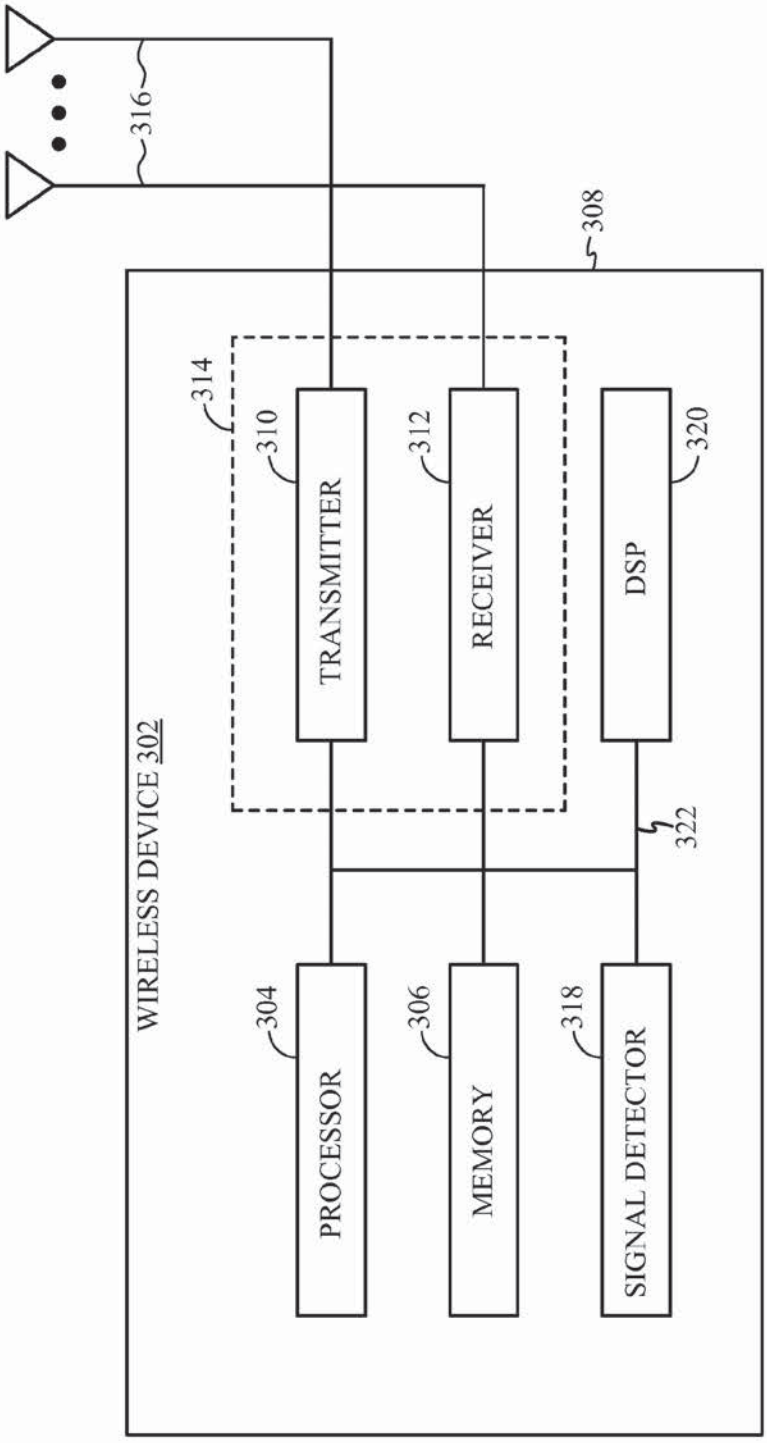

316
308
314
310
TRANSMITTER
312
RECEIVER
320
DSP
WIRELESS DEVICE 302
322
304
PROCESSOR
306
MEMORY
318
SIGNAL DETECTOR

FIG. 3

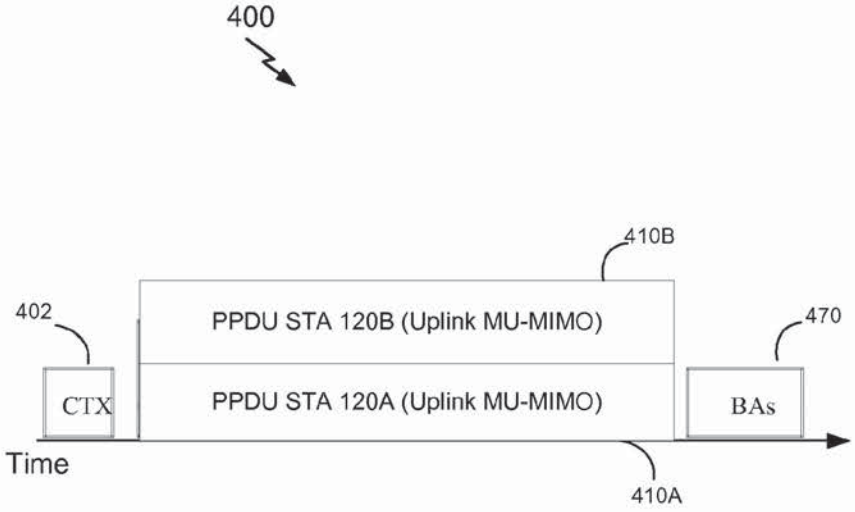

400
410B
402
PPDU STA 120B (Uplink MU-MIMO)
470
CTX
PPDU STA 120A (Uplink MU-MIMO)
BAs
Time
410A

FIG. 4

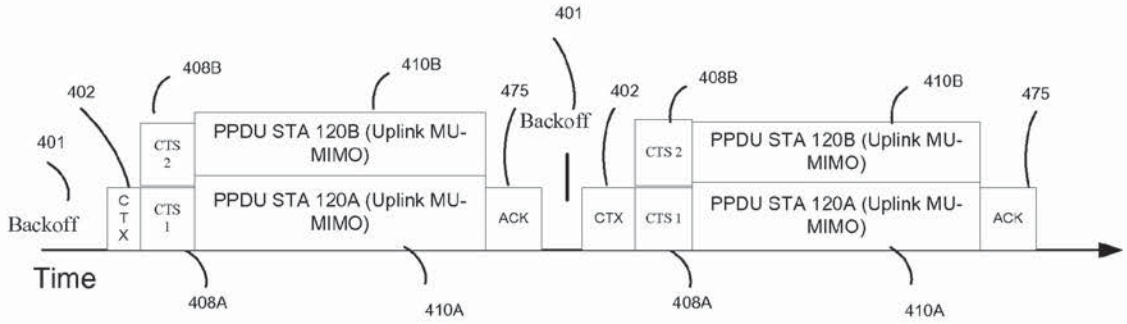

401
408B
410B
402
475
Backoff
402
408B
410B
475
CTS 2
PPDU STA 120B (Uplink MU-MIMO)
CTS 2
PPDU STA 120B (Uplink MU-MIMO)
401
C T X
CTS 1
PPDU STA 120A (Uplink MU-MIMO)
ACK
CTX
CTS 1
PPDU STA 120A (Uplink MU-MIMO)
ACK
Backoff
Time
408A
410A
408A
410A

FIG. 5

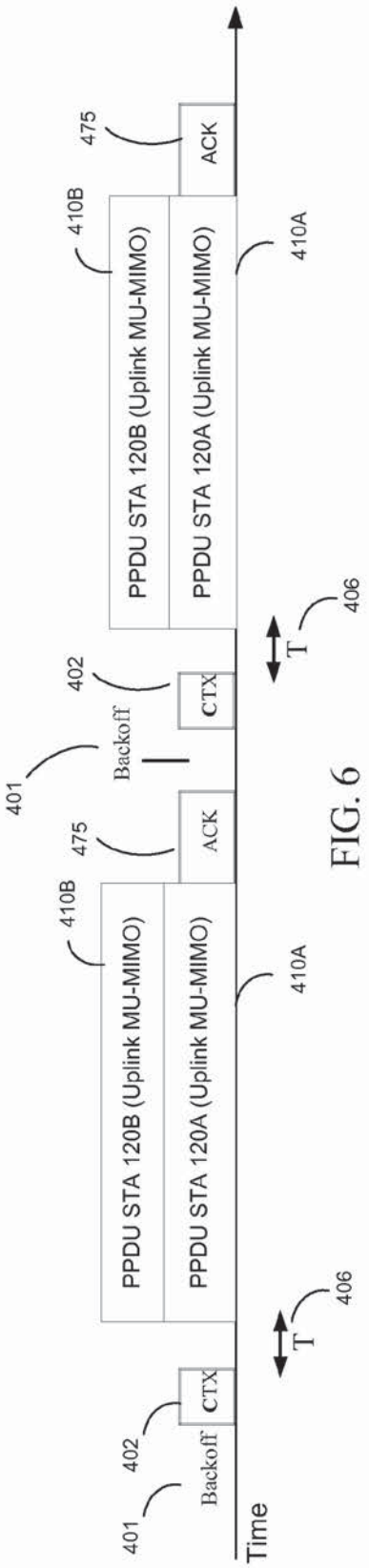

401
Backoff
402
CTX
T
406
410B
PPDU STA 120B (Uplink MU-MIMO)
410A
PPDU STA 120A (Uplink MU-MIMO)
475
ACK
Time

FIG. 6


701
RTX
402
CTX
410B
PPDU STA 120B (Uplink MU-MIMO)
410A
PPDU STA 120A (Uplink MU-MIMO)
475
ACK
Time

FIG. 7

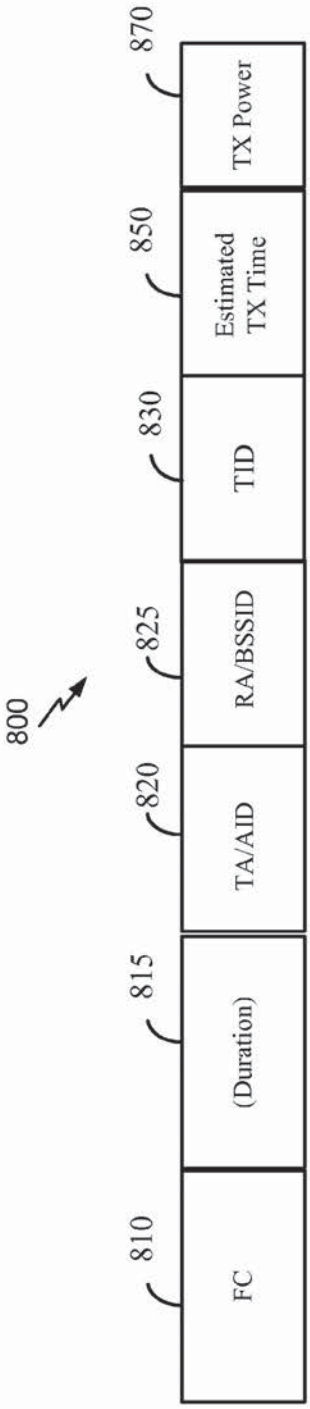

800
810
FC
815
(Duration)
820
TA/AID
825
RA/BSSID
830
TID
850
Estimated TX Time
870
TX Power

FIG. 8

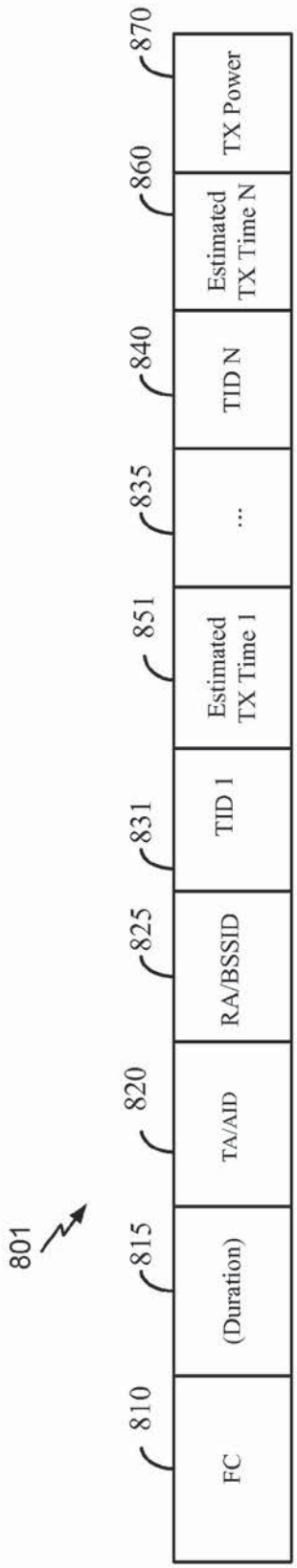

801
810
FC
815
(Duration)
820
TA/AID
825
RA/BSSID
831
TID 1
851
Estimated TX Time 1
835
...
840
TID N
860
Estimated TX Time N
870
TX Power

FIG. 9

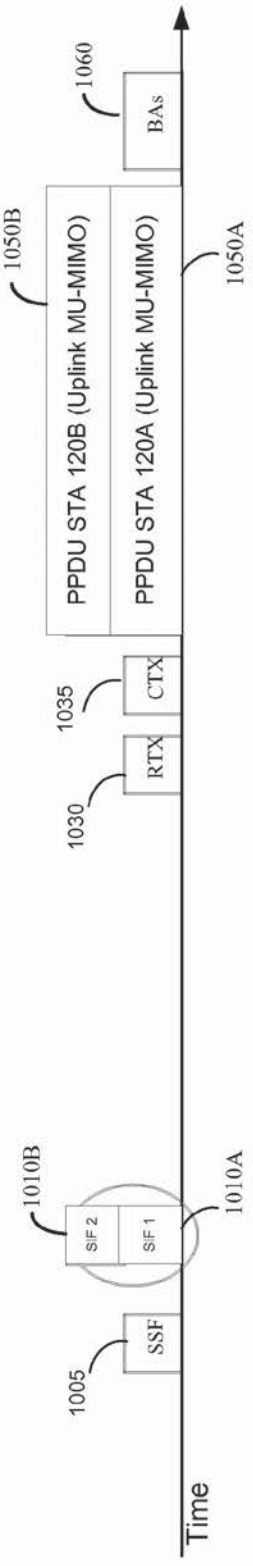

1060
BAs
1050B
PPDU STA 120B (Uplink MU-MIMO)
PPDU STA 120A (Uplink MU-MIMO)
1050A
1035
CTX
1030
RTX
1010B
SIF 2
SIF 1
1010A
1005
SSF
Time

FIG. 10

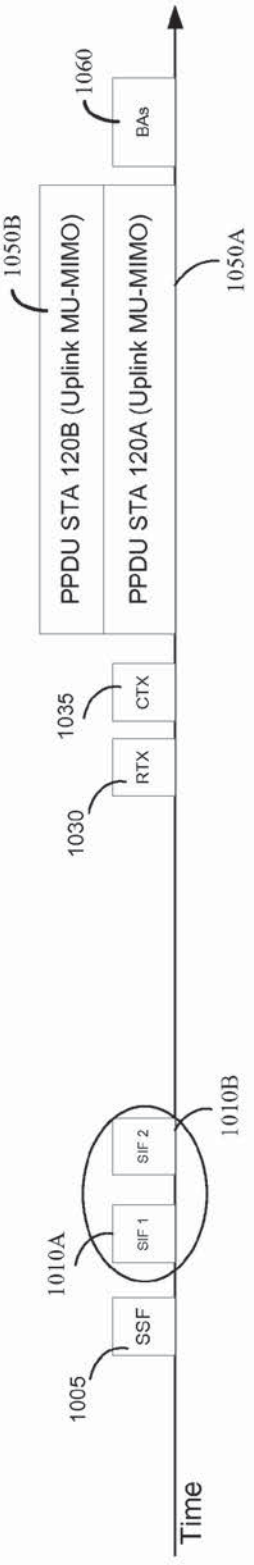

1060
BAs
1050B
PPDU STA 120B (Uplink MU-MIMO)
PPDU STA 120A (Uplink MU-MIMO)
1050A
1035
CTX
1030
RTX
1010B
SIF 2
SIF 1
1010A
1005
SSF
Time

FIG. 11

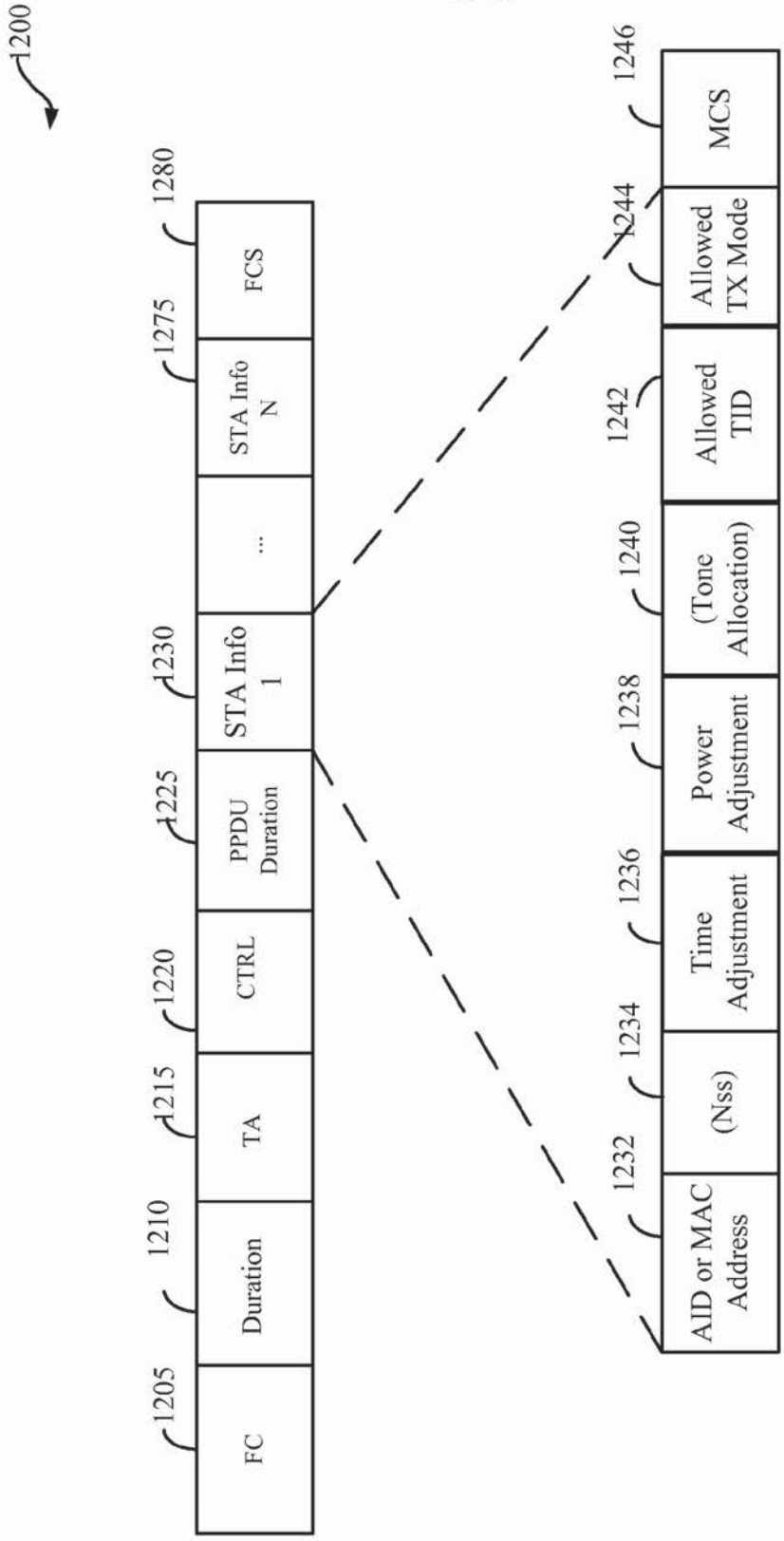

1200
1205
FC
1210
Duration
1215
TA
1220
CTRL
1225
PPDU Duration
1230
STA Info 1
...
1275
STA Info N
1280
FCS
1232
AID or MAC Address
1234
(Nss)
1236
Time Adjustment
1238
Power Adjustment
1240
(Tone Allocation)
1242
Allowed TID
1244
Allowed TX Mode
1246
MCS

FIG. 12

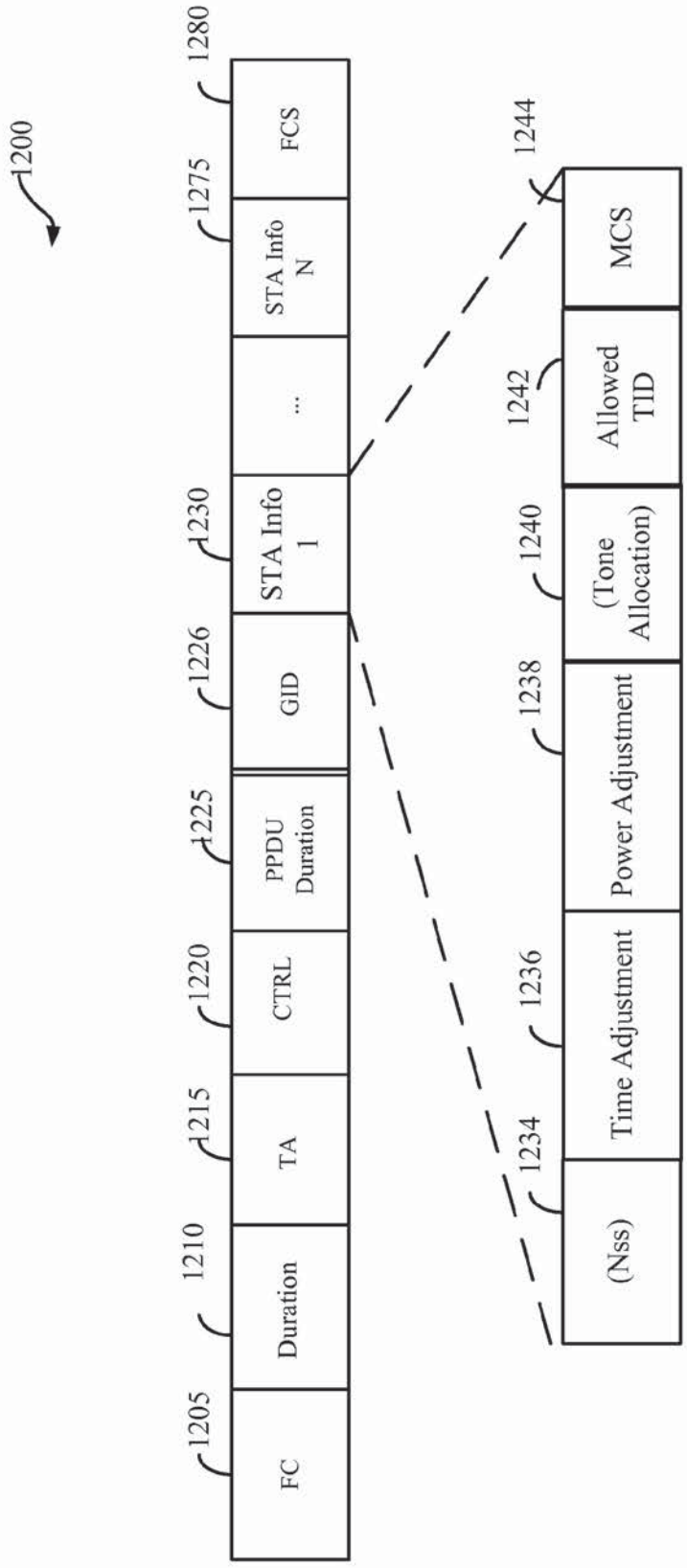

1200
1205
FC
1210
Duration
1215
TA
1220
CTRL
1225
PPDU Duration
1226
GID
1230
STA Info 1
...
1275
STA Info N
1280
FCS
1234
(Nss)
1236
Time Adjustment
1238
Power Adjustment
1240
(Tone Allocation)
1242
Allowed TID
1244
MCS

FIG. 13

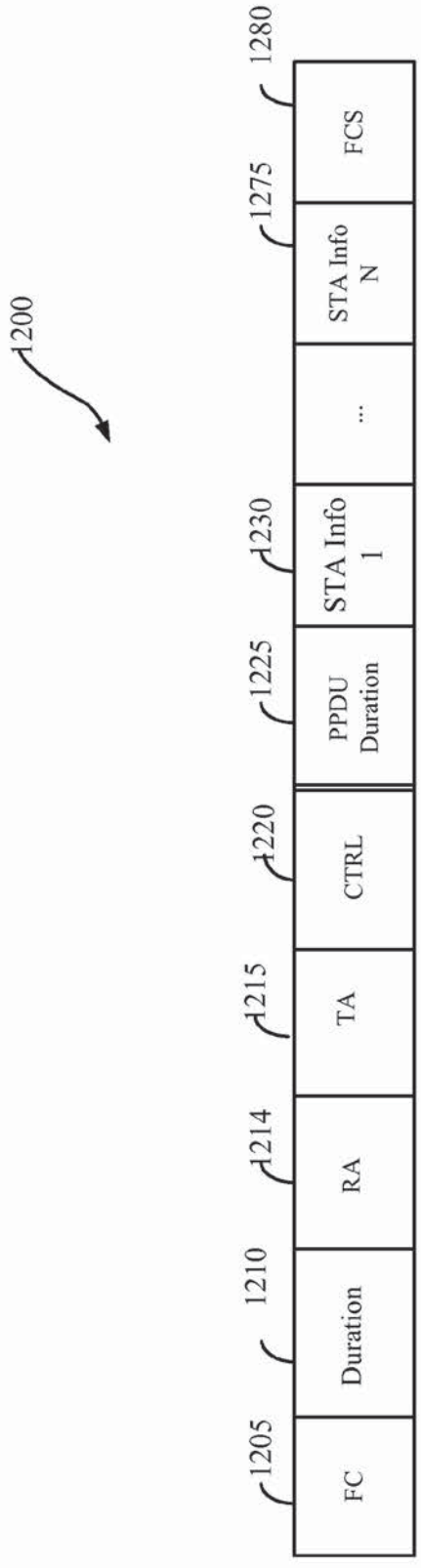

1200
1205
FC
1210
Duration
1214
RA
1215
TA
1220
CTRL
1225
PPDU Duration
1230
STA Info 1
...
1275
STA Info N
1280
FCS

FIG. 14

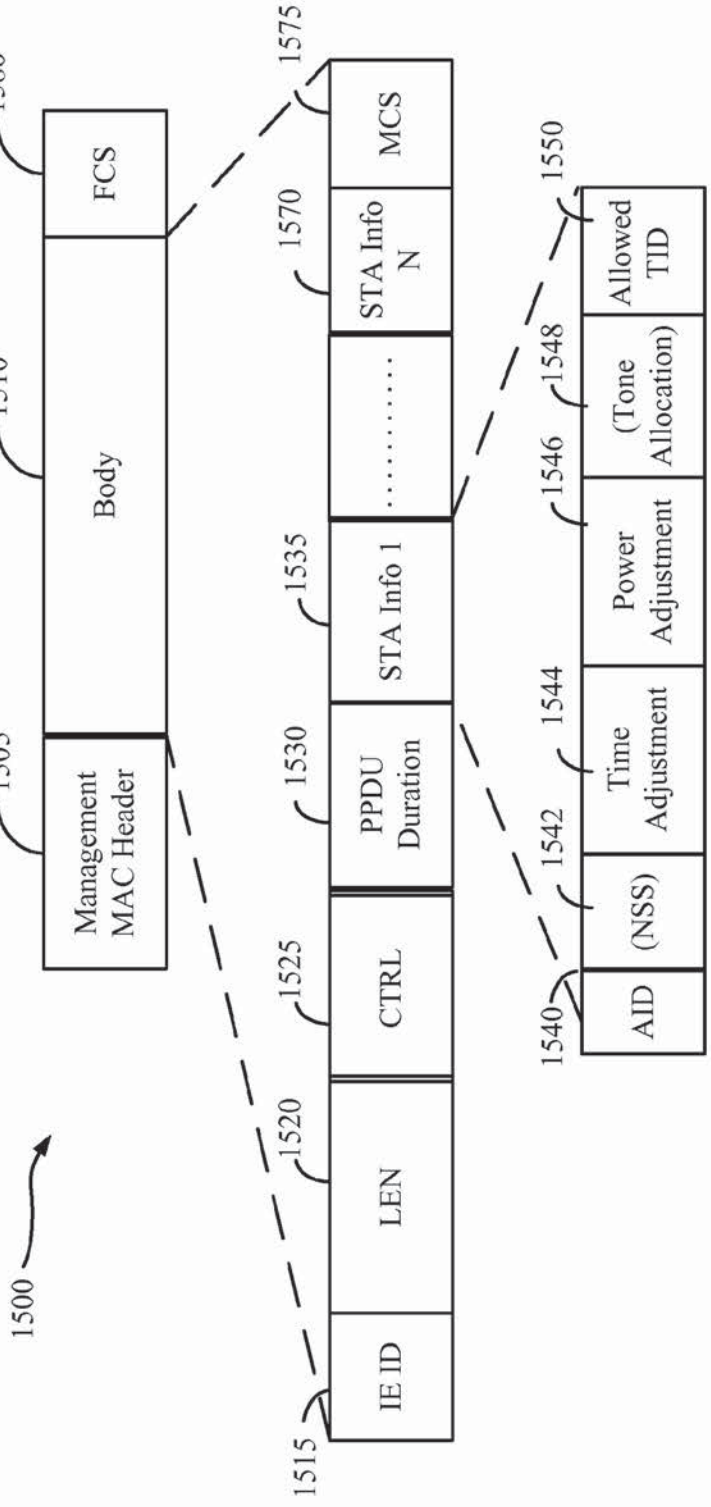

1500
1505
Management MAC Header
1510
Body
1580
FCS
1515
IE ID
1520
LEN
1525
CTRL
1530
PPDU Duration
1535
STA Info 1
.....
1570
STA Info N
1575
MCS
1540
AID
1542
(NSS)
1544
Time Adjustment
1546
Power Adjustment
1548
(Tone Allocation)
1550
Allowed TID

FIG. 15


402B
410B
CTX 2
PPDU STA 120B (Uplink MU-MIMO)
470
402A
CTX 1
PPDU STA 120A (Uplink MU-MIMO)
BAs
Time
410A

FIG. 16

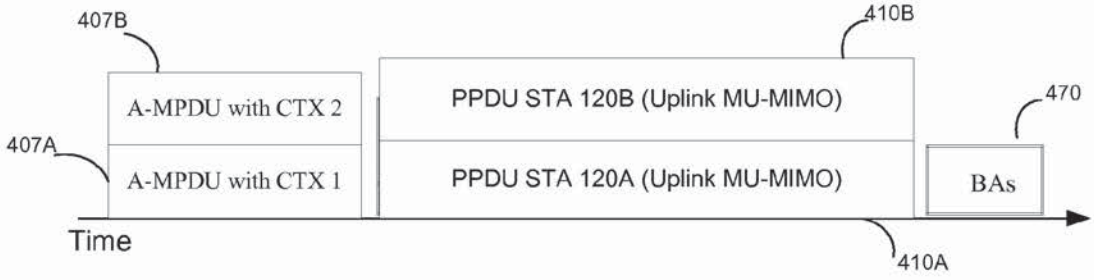

407B
410B
A-MPDU with CTX 2
PPDU STA 120B (Uplink MU-MIMO)
470
407A
A-MPDU with CTX 1
PPDU STA 120A (Uplink MU-MIMO)
BAs
Time
410A

FIG. 17

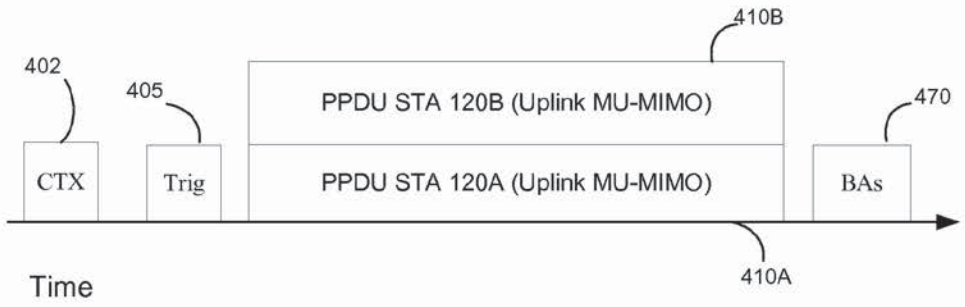


FIG. 18

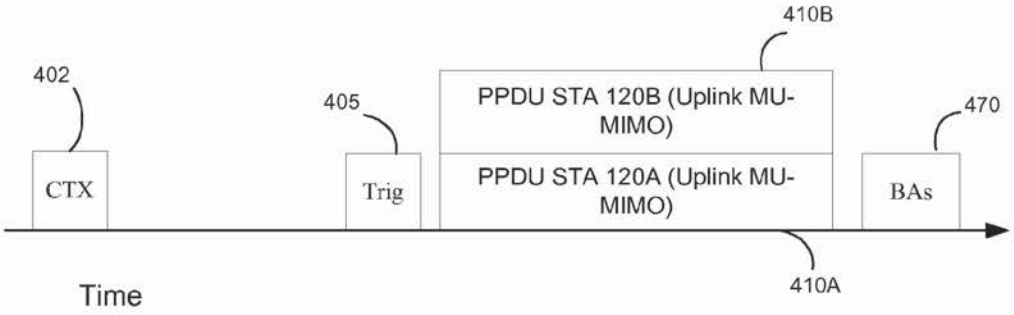


FIG. 19

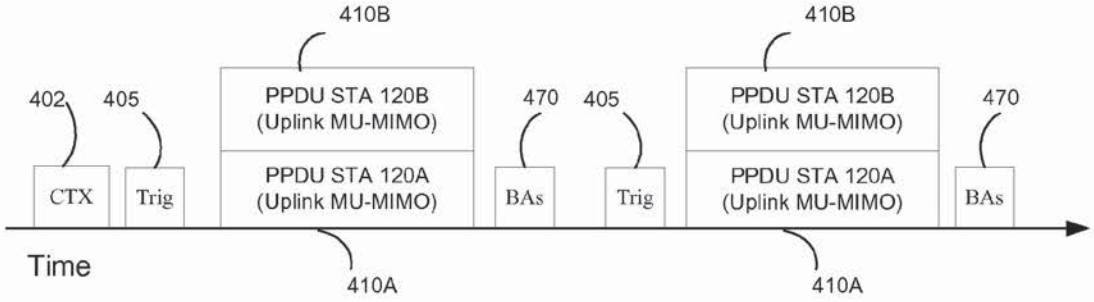


FIG. 20

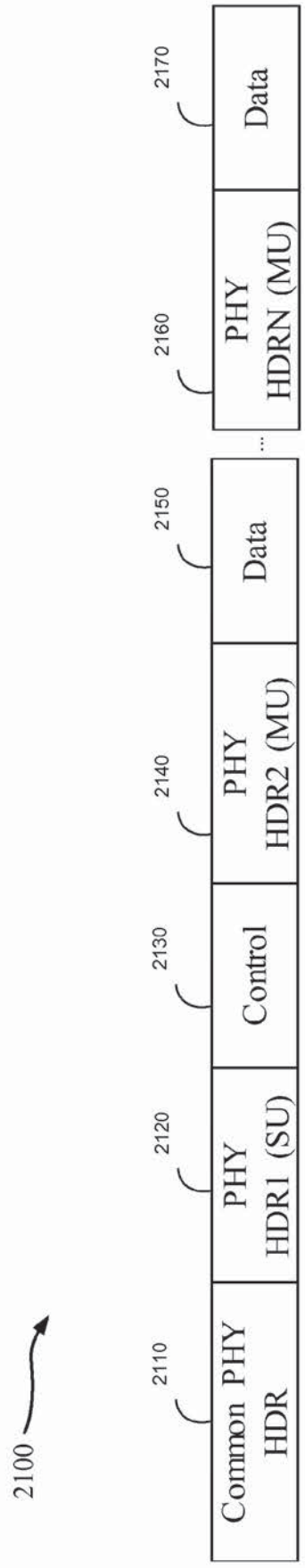

2100
2110
Common PHY HDR
2120
PHY HDR1 (SU)
2130
Control
2140
PHY HDR2 (MU)
2150
Data
2160
PHY HDRN (MU)
2170
Data

FIG. 21

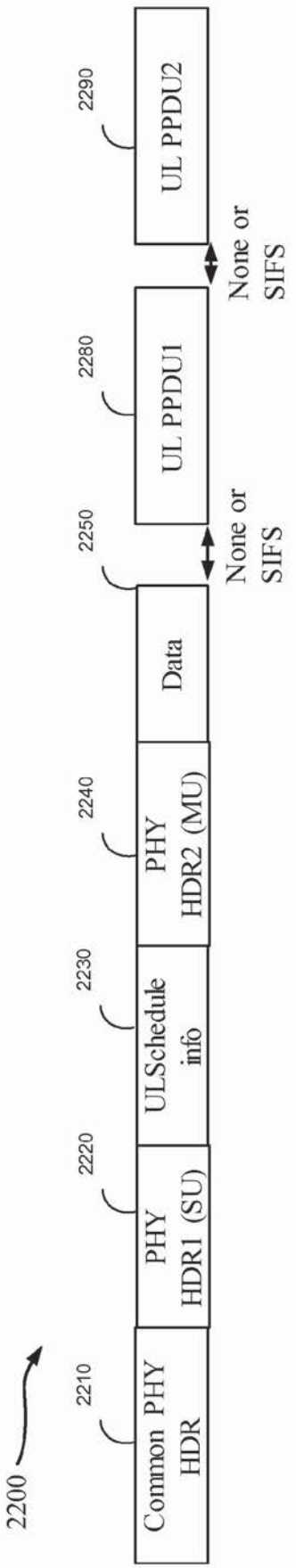

2200
2210
Common PHY HDR
2220
PHY HDR1 (SU)
2230
ULSchedule info
2240
PHY HDR2 (MU)
2250
Data
None or SIFS
2280
UL PPDU1
None or SIFS
2290
UL PPDU2

FIG. 22

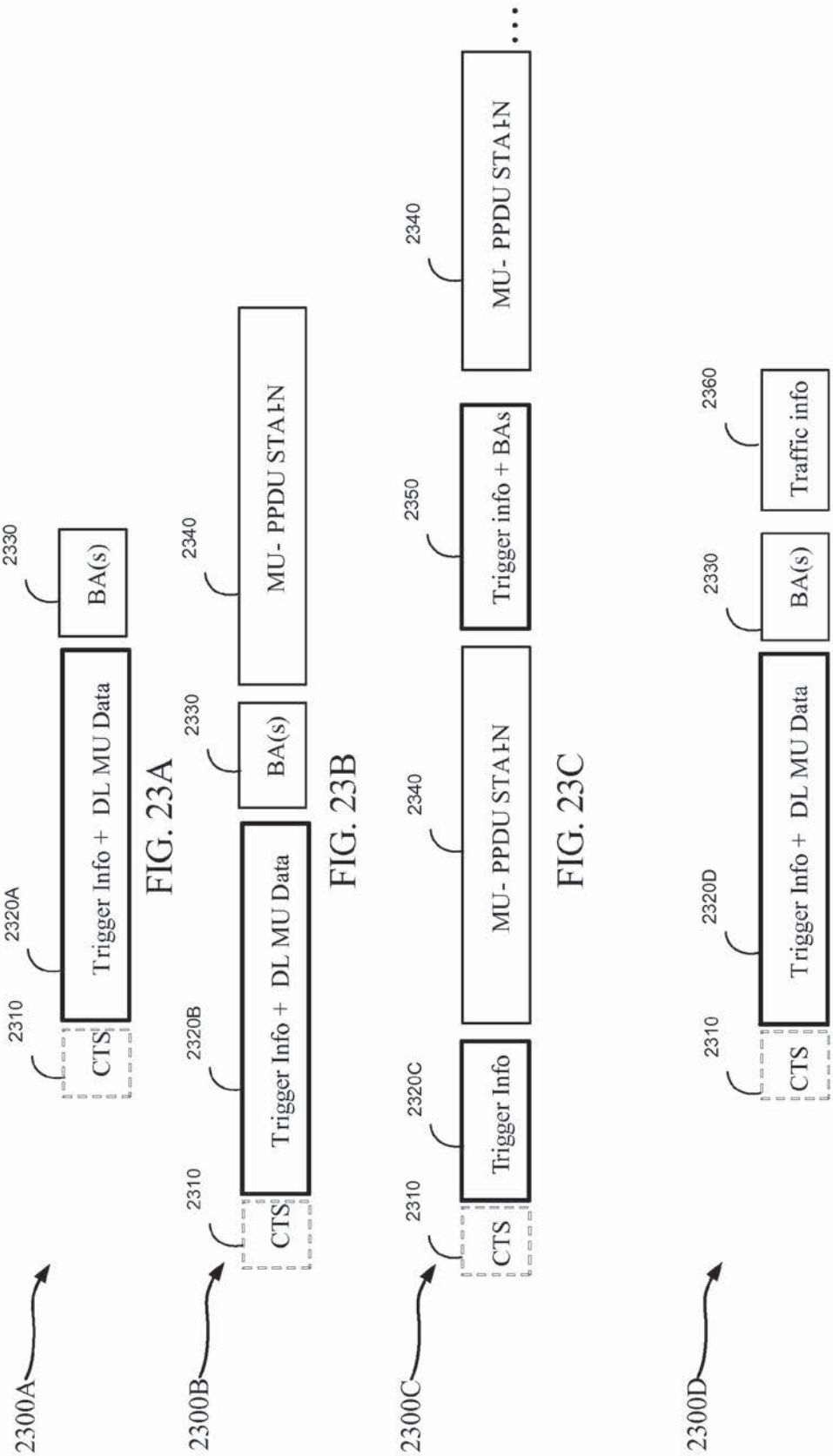


FIG. 23A

FIG. 23B

FIG. 23C

FIG. 23D

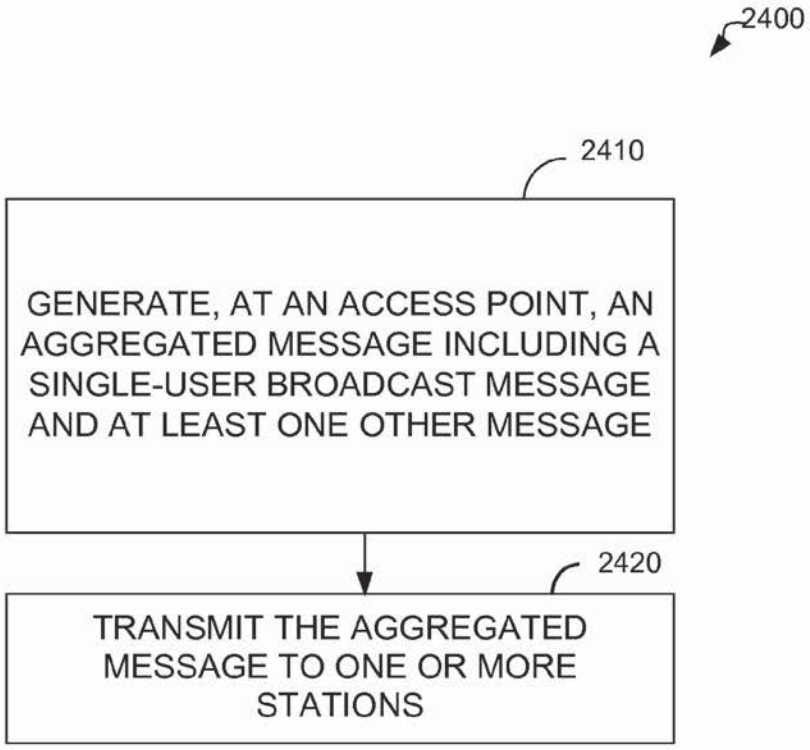

2400
2410
GENERATE, AT AN ACCESS POINT, AN AGGREGATED MESSAGE INCLUDING A SINGLE-USER BROADCAST MESSAGE AND AT LEAST ONE OTHER MESSAGE
2420
TRANSMIT THE AGGREGATED MESSAGE TO ONE OR MORE STATIONS

FIG. 24

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/039783

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W28/06 H04B7/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04W H04B H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011/150004 A1 (DENTENEER THEODORUS JACOBUS JOHANNES [NL] ET AL) 23 June 2011 (2011-06-23) paragraph [0107]; figure 14 paragraph [0109] - paragraph [0110] paragraph [0120] - paragraph [0124]; figure 11 paragraph [0127] - paragraph [0131] -----	1-30
X	US 2010/220678 A1 (WENTINK MAARTEN MENZO [NL]) 2 September 2010 (2010-09-02) paragraph [0051] paragraph [0075]; figure 11 paragraph [0086] - paragraph [0088] paragraph [0092] paragraph [0095] paragraph [0098] ----- -/--	1-30

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 September 2015	02/10/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Cortés Gómez, F

1

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 8 665 906 B1 (LIU YONG [US] ET AL) 4 March 2014 (2014-03-04) column 11, line 38 - line 52; figure 6 column 12, line 15 - line 30 column 19, line 6 - line 15 column 19, line 60 - line 65 column 20, line 27 - line 33	1-30
X,P	US 2015/124690 A1 (MERLIN SIMONE [US] ET AL) 7 May 2015 (2015-05-07) paragraph [0176]; figure 21	1,15,29,30

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2015/039783

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011150004 A1	23-06-2011	CN 101796880 A	04-08-2010
		EP 2198664 A2	23-06-2010
		ES 2395180 T3	08-02-2013
		JP 5639470 B2	10-12-2014
		JP 2010538514 A	09-12-2010
		KR 20100080520 A	08-07-2010
		TW 200929944 A	01-07-2009
		US 2011150004 A1	23-06-2011
		WO 2009027931 A2	05-03-2009
US 2010220678 A1	02-09-2010	CN 102318428 A	11-01-2012
		EP 2401887 A1	04-01-2012
		JP 5318974 B2	16-10-2013
		JP 2012519426 A	23-08-2012
		KR 20110120973 A	04-11-2011
		TW 201127159 A	01-08-2011
		US 2010220678 A1	02-09-2010
		WO 2010099496 A1	02-09-2010
US 8665906 B1	04-03-2014	US 8665906 B1	04-03-2014
		US 8681815 B1	25-03-2014
		US 8885495 B1	11-11-2014
US 2015124690 A1	07-05-2015	US 2015124690 A1	07-05-2015
		WO 2015066449 A1	07-05-2015

Form PCT/ISA/210 (patent family annex) (April 2005)

Espacenet

Bibliographic data: WO2016068572 (A1) — 2016-05-06

METHOD FOR TRANSMITTING AND RECEIVING MULTIPLE USER BLOCK ACKNOWLEDGEMENT FRAME IN WIRELESS LAN SYSTEM, AND APPARATUS THEREFOR

Inventor(s): KIM JEONGKI [KR]; RYU KISEON [KR]; CHO HANGYU [KR] ± (김정기, ; 류기선, ; 조한규)

Applicant(s): LG ELECTRONICS INC [KR] ± (엘지전자 주식회사)

Classification: - international: *H04L1/00; H04L1/16*
- cooperative: **H04B7/0452 (CN); H04L1/00 (EP, US); H04L1/16 (EP, US); H04L1/1614 (EP, CN, US); H04L5/0055 (US); H04W72/042 (US);** H04L1/1635 (EP, US); H04L1/1685 (EP, US); H04L2001/0093 (EP, US); H04W72/121 (US); H04W84/12 (US)

Application number: WO2015KR11367 20151027 Global Dossier

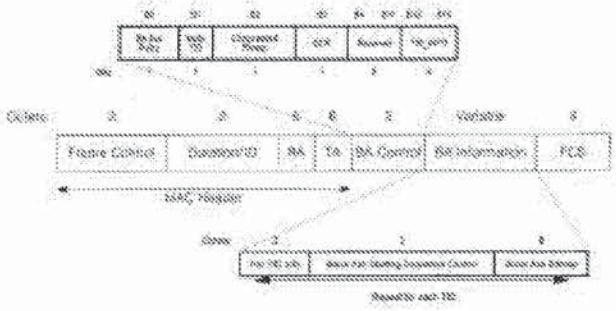
Priority number(s): US201462068771P 20141027 ; US201562100915P 20150108 ; US201562109623P 20150130 ; US201562110611P 20150202 ; US201562111021P 20150202 ; US201562112600P 20150205 ; US201562185741P 20150629

Also published as: AU2015340292 (A1) AU2015340292 (B2) CA2965807 (A1) CA2965807 (C) CN107078858 (A) more

Abstract of WO2016068572 (A1)

The present specification relates to a method of an access point (AP) transmitting a block acknowledgement (ACK) signal with respect to transmission data of a plurality of stations (STA) in a wireless LAN (WLAN) system, and an apparatus therefor. To this end, an AP transmits a multi-STA BA frame with respect to data received from the plurality

FIG. 13



of STA, wherein the multi-STA BA frame includes a MAC header field, a BA control field and a BA information field. In this regard, the BA information field may include: AID information with respect to one or more STA to which ACK/NACK is transmitted from the plurality of STA; and an individual information field including BA indicator information that indicates whether the BA information field includes one or more of a block ACK bitmap sub-field and a starting sequence control sub-field.

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CLAIMS WO2016068572

Claims [1] The method of claim 1, wherein an AP transmits a block acknowledgment signal for transmission data of a plurality of stations in a WLAN system. Receives data from a plurality of STAs, and transmits a multi STA BA frame for data received from the plurality of STAs, wherein the multi STA BA frame includes a MAC header field, a BA control field, and a multi-STA BA frame. And a BA information field, wherein the BA information field includes AID information for one or more STAs to which ACK / NACK is transmitted among the plurality of STAs, and the BA information field includes a B lock ACK bitmap subfield and a start sequence control. Start ing Sequence Control) A method of transmitting an acknowledgment signal comprising individual information fields including BA indicator information indicating whether one or more of the subfields are included. 2. The method according to claim 1, wherein when the BA indicator information of the individual information field indicates a first value, the BA information field does not include the Block ACK bitmap subfield and the start sequence control subfield. How to send an acknowledgment signal. 3. The method according to claim 2, wherein when the BA indicator information of the individual information field indicates the first value, the BA information field includes all MPDUs in the PPDU received from an STA having an AID included in the AID information. A method for transmitting an acknowledgment signal indicating an ACK for the. 4. The method according to claim 1, wherein when the BA indicator information of the individual information field indicates a second value, the BA information field includes the start sequence control subfield and includes the Bock ACK bitmap subfield. Method of transmitting acknowledgment signal, not included. [Claim 5] The method according to claim <4>, wherein when the BA indicator information of the individual information field indicates the thin value 2, the BA information field is provided in a plurality of PPDUs received from an STA having an AID included in the AID information. Increasing the MPDUs, indicating an ACK for all MPDUs after the MPDU based on the start sequence control subfield value.

[Claim 6] The method according to claim 1, wherein when the BA indicator information of the individual information field indicates a third value, the BA information field includes both the Block ACK bitmap subfield and the start sequence control subfield. How to send an acknowledgment signal. 7. The method of claim 1, wherein the multiple STA BA frame is a multiple TID BlockAck frame including multiple TID subfolds in the BA control field. 8. The method of claim 1, wherein the BA information field is repeated a plurality of times, and each of the BA information fields may indicate an acknowledgment for a different STA. 9. The method according to claim 1, wherein the individual information field has a length of 12 bits, first bits B0 through 11th bit B10 indicate the AID information, and 12th bit B11 indicates the BA indicator. A method of transmitting an acknowledgment signal, representing information. 10. The method of claim 1, wherein the individual information field is a per TID information field. 11. The method of claim 1, wherein the data received from the plurality of STAs has an UL multi-user PPDU (UL MU PPDU) format. The PPDU received from a particular STA includes a single MPDU or a plurality of MPDUs. 12. The method of claim 11, wherein the UL MU PPDU received from the plurality of STAs is received in response to the AP transmitting a trigger frame to the plurality of STAs. 13. A method in which a station (STA) receives a block ACK signal from an access point (AP) in a wireless LAN (WLAN) and a system, and transmits data to the AP, and transmits data from the AP. Receive an acknowledgment signal for the data through a multi-STA BA frame, the multi-STA BA frame includes a MAC header field, a BA control field and a BA information field, the BA The information field may include AID information about one or more STAs through which a plurality of STA authentication ACK / NACKs are transmitted, and the BA information field may include one or more of a Block ACK bitmap subfield and a Starting Sequence Control subfield. A method of receiving an acknowledgment signal comprising a separate information field comprising a BA indicator information indicating whether it is included.

14. An AP (Access Point) transmitting a Block Acknowledgment (Bl ock ACK) signal for transmission data of a plurality of stations (STA) in a WLAN 0VLAN) system, receiving data from the plurality of STAs, A transceiver configured to transmit a multiple STA BA frame (nml ti -STA BA frame) for data received from the plurality of STAs; And a processor coupled to the transceiver, the processor configured to process the data and configure the multiple STA BA frame, wherein the multi STA BA frame includes a MAC header field, a BA control field, and a BA information field. Wherein the BA information field includes: AID information about one or more STAs to which ACK / NACK is transmitted among the plurality of STAs; and the BA information field includes a Block ACK bitmap subfield and a starting sequence control. Sub-field increments to include individual information fields containing BA indicator information indicating whether one or more are included. 15. A station (STA) device that receives a Block ACK signal from an access point (AP) in a WLAN system, and transmits data to the AP, and transmits data to the AP. A transceiver configured to receive an acknowledgment signal through a multiple i-STA BA frame; and a processor coupled to the transceiver to configure the data and to process the multiple STA BA frame. Wherein the multi-STA BA frame includes a MAC header field, a BA control field, and a BA definition field, wherein the BA information field includes: AID information for one or more STAs in which ACK / NACK is transmitted among a plurality of STAs; and The BA information field includes BA indicator information indicating whether one or more of a Block AC bitmap subfield and a Starting Sequence Control subfield are included. , The station device comprising a separate information field.

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DESCRIPTION WO2016068572

[Specification]

[Name of invention]

Method for transmitting / receiving multi-user block acknowledgment frame in wireless LAN system and apparatus therefor

Technical Field

[1]

The following description relates to a method and apparatus for transmitting and receiving a multi-user or multi-station block (STA) block acknowledgment frame in a WLAN system. Background Art

[2]

The standard for WLAN technology is being developed as an Institute of Electrical and Electronics Engineers (IEEE) 802.11 standard. IEEE 802.11a and b are described in 2.4. Using unlicensed band at GHz or 5 GHz, IEEE 802.11b provides a transmission rate of 11 Mbps, and IEEE 802.11a provides a transmission rate of 54 Mbps. IEEE 802.11g orthogonal frequency-division multiplexing (OFDM) at 2.4 GHz. In application, it provides a transmission rate of 54 Mbps. IEEE 802.11 η applies a multiple input multiple out put (OFDM, MIM0-0FDM) to provide a transmission rate of 300 Mbps for four spatial streams. IEEE 802.11n supports channel bandwidths up to 40 MHz, in this case 600 Mbps.

[3]

The WLAN standard uses a maximum bandwidth of 160MHz, supports eight spatial streams, and supports IEEE 802.11ax standard that supports up to lGbit / s speed. [Detailed Description of the invention]

[Technical problem]

[4]

In the IEEE 802.11ax standardization, an uplink OFDMA (UL 0FDMA) transmission scheme and an uplink multiple user (UL MU) transmission scheme will be used. Accordingly, for the same transmission, the AP may receive the UL MU frame from the plurality of STAs, and it is necessary to transmit an acknowledgment frame.

[5]

In this case, it may be considered to efficiently transmit an acknowledgment signal to a plurality of STAs through a block

acknowledgment frame (Bl ock Ack Frame), but the MU BA frame for the plurality of STAs is increased in size and is overhead. May be a problem.

[6]

In the following description, a method and apparatus for efficiently transmitting a BA frame by minimizing overhead in a UL MU transmission situation will be described.

Technical Solution

In an aspect of the present invention for solving the above problems, a block acknowledgment (Block ACK) to an AP (Access Po int) for transmission data of a plurality of stations (WLAN) in a WLAN system A method for transmitting a signal, the method comprising: receiving data from the plurality of STAs and transmitting a multi STA BA frame for data received from the plurality of STAs, wherein the multi STA The BA frame includes a MAC header field, a BA control field and a BA information field, and the BA information field includes AID information for one or more STAs to which ACK / NACK is transmitted among the plurality of STAs, and the BA information field. An acknowledgment signal comprising an individual information field containing BA indicator information indicating whether one or more of the Block ACK bitmap subfield and the Starting Sequence Control subfield are included. Propose a transmission method.

[8]

In another aspect of the present invention, in a WLAN system, a station (STA) receives a block ACK signal from an access point (AP), and transmits data to the AP, Receive an acknowledgment signal for the data from the multiple STA BA frame (mul ti—STA BA frame), wherein the multi-STA BA frame includes a MAC header field, a BA control field and a BA information field, the BA information Field, AID information for one or more STAs in which ACK / NACK is transmitted among a plurality of STAs, and the BA information field includes one or more of a Bock ACK bitmap subfield and a starting sequence control subfield. We propose a method for receiving an acknowledgment signal that includes an individual information field including BA indicator information indicating inclusion.

[9]

In still another aspect of the present invention, there is provided an AP (Access Point) that transmits a block acknowledgment (Bl ock ACK) signal for transmission data of a plurality of stations (WLANs) in a WLAN system. A transceiver configured to receive data scatter and to transmit a multi STA BA frame for data received from the plurality of STAs; And a processor coupled to the transceiver, the processor configured to process the data and to configure the multi-STA BA frame, wherein the processor includes the MAC STA field, the BA control field, and the BA information field. Wherein the BA information field comprises: AID information about one or more STAs to which ACK / NACK is transmitted among the plurality of STAs; and wherein the BA information field is a B lock ACK bitmap subfield and starts 3/4. The present invention proposes an AP device configured to include individual information fields including BA indicator information indicating whether one or more of the starting sequence control subfields are included.

Another aspect of the present invention is a station (STA) device that receives a block acknowledgment (block ACK) signal from an access point (AP) in a WLAN system, and transmits data to the AP. A transceiver configured to receive a confirmation acknowledgment signal for the data from the AP through a mult i-STA BA frame; And a processor, connected to the transceiver, to configure the data and to process the multi-STA BA frame, wherein the multi-STA BA frame includes a MAC header field, a BA control field, and a BA information field. The BA information field includes AID information for one or more STAs that are ACK / NACK transmitted among a plurality of STAs, and the BA information field includes a Block ACK bitmap subfield and a Starting Sequence Control subfield. A station apparatus is proposed, which includes an individual information field containing BA indicator information indicating one or more inclusions.

In this case, the individual information field may be an information field for each TID or an information field for each AID.

[12] When the BA indicator information of the individual information field indicates the first value, the BA information field may not include the Block ACK bitmap subfield and the start sequence control subfield, and the BA information field may include the it can indicate ACK for all MPDUs in the PPDU received from the STA having the AID included in the AID information.

[13] When the BA indicator information of the individual information field indicates a second value, the BA information field includes a 3/4 source control subfield at the start,

Block ACK bitmap subfield may not include, the BA information field after the MPDU to the start sequence control subfield value of the plurality of MPDUs in the PPDU received from the STA having the AID included in the AID information it can indicate the ACK for all MPDU of.

When the BA indicator information of the individual information field indicates a third value, the BA information field may include both the Block ACK bitmap subfield and the 3/4 source control subfield at the start.

The multiple STA BA frame may be a multiple TID BlockAck frame including multiple TID subfields in the BA control field.

The BA information field may be repeatedly included a plurality of times, and each of the BA information fields may indicate an acknowledgment answer for a different STA.

The individual information field may have a length of 12 bits, the first bits B0 to 11th bit B10 may indicate the AID information, and the twelfth bit B11 may indicate the BA indicator information. have.

[18] Data received from the plurality of STAs is uplink multi-user

it may have a UL MU PPDU (PPDU) format, and the PPDU received from a specific STA may include a single MPDU or a plurality of MPDUs.

The UL MU PPDU received from the plurality of STAs may be received in response to the AP transmitting a trigger frame to the plurality of STAs.

Advantageous Effects According to the present invention as described above, in the UL MU transmission situation, the AP can efficiently transmit an acknowledgment signal to a plurality of STAs by minimizing the overhead.

[Brief Description of Drawings]

[21] 1 is a diagram illustrating an example of a configuration of a WLAN system.

[22] 2 is a diagram illustrating another example of a configuration of a WLAN system.

[23] 3 is a view for explaining a block Ack mechanism utilized in the WLAN system.

[24] 4 is a diagram illustrating a basic configuration of a block acknowledgment frame.

[25] FIG. 5 is a diagram illustrating a specific configuration of a BA control field shown in FIG. 4.

[26] FIG. 6 is a diagram illustrating a specific configuration of a BA information field shown in FIG. 4.

[27] 7 is a diagram illustrating a configuration of a Bock Ack start sequence control subfield.

[28] 8 is a diagram illustrating a BA information field configuration of a compressed Block Ack frame.

[29]

9 illustrates a BA information field of a Mul t-TID Block Ack frame.

<>

[30] 10 and 11 illustrate a case in which the Bock Ack mechanism is applied to the downlink MU-MIM0 scheme.

[31] 12 is a view for explaining an uplink multi-user transmission situation to which the present invention is applied.

[32] FIG. 13 is a diagram illustrating a frame structure to be used for a downlink multi-user Block Ack mechanism according to an embodiment of the present invention.

[33] FIG. 14 illustrates an example of changing a BA control field configuration in FIG. 13.

[34] FIG. 15 illustrates an example of using a BA information field of FIG. 13 when a BA frame is used as a Mul i-STA BA frame.

[35] FIG. 16 is a diagram illustrating a configuration of a Per AID info field in FIG. 15.

[36] FIG. 17 is a diagram illustrating a case where BA indicator information is added after the AID information and the reserved field.

[37] 18 and 19 illustrate Block ACK Start ing according to one embodiment of the present invention.

Figure showing the sequence control field and / or the Block ACK bitmap field omitted.

[38] 20 to 22 are diagrams for explaining a Mul t-STA Block Ack mechanism utilizing the BA indicator as described above.

[39] FIG. 23 is a diagram illustrating a mul t-STA BA frame format according to another embodiment of the present invention. FIG.

[40]

24 is a diagram for explaining an apparatus for implementing the method according to the present invention. [Form for implementation of invention]

[41] Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings. The detailed description, which will be given below with reference to the accompanying drawings, is intended to describe exemplary embodiments of the present invention, rather than to represent the only embodiments in which the invention may be practiced.

[42] The following detailed description includes specific details in order to provide a thorough understanding of the present invention. However, one of ordinary skill in the art appreciates that the present invention may be practiced without these specific details. In some instances, well-known structures and devices are omitted or shown in block diagram form, centering on the core functions of each structure and device, in order to avoid obscuring the concepts of the present invention.

[43] As described above, the following description relates to a method and an apparatus therefor for efficiently utilizing a channel having a wide band in a WLAN system. To this end, first, a WLAN system to which the present invention is applied will be described in detail.

[44] 1 is a diagram illustrating an example of a configuration of a WLAN system.

[45] As shown in FIG. 1, the WLAN system includes one or more basic service sets (BSSs). A BSS is a set of stations (STAs) that can successfully synchronize and communicate with each other.

[46] A STA is a logical entity that includes Medium Access Control (MAC) and a Physical Layer interface to a wireless medium. The STA is an access point (AP) and a non-AP STA (Non-AP Stat). ion). The portable terminal operated by the user among the STAs is a non-AP STA, and when referred to simply as an STA, it may also refer to a non-AP STA. Non-AP STA includes a terminal, a wireless transmit / receive unit (WTRU), a user equipment (UE), a mobile station (Mobi le Stat ion, MS), and a mobile terminal (Mobi le). It may also be called other names such as Terminal, or Mobile Subscriber Unit.

[47] The AP is an entity that provides access to a Distribution System (DS) through an associated Station WI wireless medium coupled to the AP. The AP may be called an aggregation controller, a base station (BS), a Node-B, a base transceiver system (BTS), or a site controller.

[48] BSS can be divided into infrastructure BSS and independent BSS (IBSS).

[49] The BBS shown in FIG. 1 is an IBSS. IBSS means BSS not including AP, and does not include AP, so that access to DS is not allowed, thus forming a self-contained network.

[50] 2 is a diagram illustrating another example of a configuration of a WLAN system. .

[51] The BSS shown in FIG. 2 is an infrastructure BSS. Infrastructure BSS includes one or more STAs and APs. In the infrastructure BSS, communication between non-APSTAs is performed via an AP. However, when a direct link is established between non-AP STAs, non-AP STAs may directly communicate with each other.

[52] As shown in FIG. 2, a plurality of infrastructure BSSs may be interconnected through a DS. A plurality of BSSs connected through a DS is called an extended service set (ESS). STAs included in the ESS may communicate with each other, and a non-APSTA may move from one BSS to another BSS while communicating seamlessly within the same ESS.

[53] The DS is a mechanism for connecting a plurality of APs. The DS does not necessarily need to be a network, and there is no limitation on its form as long as it can provide a predetermined distribution service. For example, the DS may be a wireless network such as a mesh network, or may be a physical structure that connects APs to each other.

[54] Based on the above description, a block acknowledgment method in a WLAN system will be described.

[55] The Block Ack mechanism increases the channel efficiency by transmitting multiple acknowledgments in one frame. There are two types of block Ack mechanisms: instant answering and delayed answering. The immediate response method is advantageous for wide bandwidth and low delay traffic transmission, while the delay response method may be suitable for applications that are not sensitive to delay. Unless otherwise specified in the following description, an STA that sends data using

a block Ack mechanism is referred to as an originator and an STA that receives such data as a recipient.

[56] 3 is a view for explaining a block Ack mechanism utilized in the WLAN system.

[57] The block Ack mechanism may be initiated by the exchange of an add block acknowledgment (ADDBA) request / answer frame as shown in FIG. 3 ((a) Setup step). After this disclosure, QoS data frame blocks may be sent from the sender to the receiver. Such blocks may be initiated in a polled TX0P or by winning an EDCA race. The sphere of the frame in the block can be limited. The MPDUs in such a frame block may be acknowledged by the BlockAck frame received according to the request by the BlockAckReq frame ((b) Data & Block Ack step).

[58] When the sender no longer has data to send and the final block acknowledgment is completed, the sender can terminate the Block Ack mechanism by sending a Delete Block Acknowledgment (DELBA) frame to the receiver. Recipients receiving this DELBA frame can release all resources allocated for Block Ack transmission (c) Tear Down.

[59] 4 is a diagram illustrating a basic configuration of a block acknowledgment frame.

[60] The block acknowledgment frame may include a MAC header field, a BA control field, and a BA informat ion field as shown in FIG. 4. In addition, the MAC header field may include a frame control field, a Durat ion / ID field, an RA field, and a TA field. Here, the RA field indicates the address of the receiving STA, and the TA field indicates the address of the calling STA.

[61] FIG. 5 is a diagram illustrating a specific configuration of a BA control field shown in FIG. 4.

[62] The value of the BA Ack policy subfield in the BA control field can convey the meaning as shown in Table 1 below.

[63] Table 1 Value Meaning

0 Normal Acbio ledgment.

The BA Ack Policy subtle ld is set to this value when the sender requires immediate acknowledgment. The addressee returns an Ack frame.

The vniue 0 is not used for data seat under HT-delayed Block Ack during a PSMP sequence.

The value 0 is not used in frames transmitted by DMG STAs.

i No AckKowiedgmeut.

The addressee sends no iminediate response xipon receipt of the frame.

The BA Ack Policy is set to this value when the sender does not require iminediate ackiiowiedgmeui.

The value 1 is not used in a Basic BlockAck frame outside n PSMP sequence.

The value I is not used in an Multi-TID BlockAck frame. On the other hand, Mull i-TID, Compressed Bitmap and GCR sub-blockable BlockAck frame modification in the BA control field may be determined according to the following rules.

[65] Table 2

[66] FIG. 6 is a diagram illustrating a specific configuration of a BA information field illustrated in FIG. 4, and FIG. 7 is a diagram illustrating a configuration of a Block Ack start sequence control subfield.

[67] As illustrated in FIG. 6, the BA information field may include a Block Ack Start Sequence Control (SSC) subfield and a Block Ack bitmap subfield.

[68] As shown in FIG. 6, the Block Ack bitmap subfield has a length of 128 octets, and thus may indicate a reception state of 64 MSDUs. Bit position n in the Block Ack bitmap field, if set to 1, can indicate the successful reception of an MPDU with an MPDU sequence control value corresponding to (SSC + n), where SSC is the starting block Ack sequence. Indicates the value of the control subfield. On the contrary, when bit position n of the Block Ack bitmap field is set to 0, this may indicate that an MPDU having an MPDU sequence control value corresponding to (SSC + n) has not been received. MPDU sequence control field and Block Ack start sequence control subfield values may be treated as 16-bit unsigned integers, respectively. For unused fragment numbers of the MSDU, the corresponding bit in the bitmap may be set to zero.

[69] 8 is a diagram illustrating a BA information field configuration of a compressed Block Ack frame.

[70] The Block Ack bitmap of the BS information field of the compressed Block Ack frame may have an length of 8 octagon 3/4

as shown in FIG. 8, and may indicate reception states of 64 MSDUs and A-MSDUs. The first bit of the bitmap refers to the MSDU or A-MSDU that corresponds to the value of the start sequence number subfield, and each bit can be sequentially referenced to the MSDU or A-MSDU following the MSDU or A-MSDU. .

[71] FIG. 9 illustrates a BA information field of a Mu-tID Block Ack frame.

[72] The TID_INF0 subfield of the BA control field of the Mul t i-TiD BockAck frame indicates how many TIDs are transmitted in the BA information field. In more detail, the value of the TiD_INF0 subfield indicates the number of TiDs -1 corresponding to the information of the BA information field. For example, when the TID_INF0 value is 2, it may represent that the BA information field includes information on three TIDs.

[73] Meanwhile, in the case of the Mul t-TID BlockAck frame, a Per TiD info subfield may be additionally included in the Block Ack start sequence control subfield and the Block Ack bitmap subfield as shown in FIG. 9. First Per

TID Info, block Ack start sequence control, Block Ack bitmap subfields may be transmitted corresponding to the lowest TID value, and subsequent repeated subfields may correspond to the next TiD. Tr iplet of these subfields may be repeated for each TiD.

[74] 10 and 11 illustrate a case in which the Block Ack mechanism is applied to the downlink MU-MIM0 scheme.

[75] As shown in FIG. 10 and FIG. 11, the AP may transmit MU-MIM0 data frames to a plurality of STAs (STAs 1 to 3).

[76] 10 assumes that frame exchange is performed after SIFS after MU PPDU transmission. In FIG. 10, it is assumed that an implicit Block Ack request is set to an Ack policy for STA 1, and a Block ACK is set to Ack policy for STA 2 and STA 3. Accordingly, the STA 1 can transmit the BA frame immediately after receiving the downlink MU PPDU without requesting the BA. in contrast, the AP may perform polling by transmitting a BAR (BA Request) frame to STA 2 and STA 3, and STA 2 and STA 3 may transmit a BA frame.

[77] Meanwhile, FIG. 11 is an example in which frame exchange is performed without SIFS after MU PPDLT, and assumes that an Ack policy is set to Block Ack for all STAs. Accordingly, the AP can poll by transmitting a BAR frame to all STAs.

[78] 12 is a view for explaining an uplink multi-user transmission situation to which the present invention is applied.

[79] As described above, in the 802.11ax system, a UL MU transmission scheme may be used. In this case, as illustrated in FIG. 12, an AP may trigger a trigger frame to a plurality of STAs (for example, STA 1 to STA 4). Can be started by sending. The trigger frame may include UL MU allocation information (eg, resource location and size, STA IDs, MCS U type (MIMO, 0FDMA, etc.)). In more detail, an example of information that may be transmitted in a trigger frame may be as follows.

[80] Table 3

i-... durat ion <'> .... for UL MU frame ◙ ^ ....

[81] Meanwhile, as shown in FIG. 12, the AP may acquire TX0P to transmit the trigger frame through a contention process to access the medium. In this regard, STAs may transmit a UL data frame in a format indicated by the AP after SIFS of a trigger frame. In this regard, it is assumed that the AP according to the present invention performs an acknowledgment on the UL MU data frame through a block (BA) frame.

[82] However, since the BA frame for the UL MU frame as described above is significantly larger in size compared to the BA frame for the UL MU frame, the overhead may be a serious problem. For example, in FIG. 10 and FIG. 11, the BA frame transmitted by STA 1 includes BA information on data transmitted by the AP to STA 1, whereas the BA frame transmitted by the AP in FIG. 12 is ULMU data transmitted by STA1 to STA4. It will contain the BA information for the frame. In addition, the overhead of the MAC frame size may correspond to 32 bytes when the compressed BlockAck is used and 150 bytes for the general BlockAck.

[83] Accordingly, preferred embodiments of the present invention propose a method of efficiently transmitting a BA frame in a UL MU situation by using the Multi-TID Block Ack frame format among the above-described BA frames.

[84] FIG. 13 is a diagram illustrating a frame structure to be used for a downlink multi-user Block Ack mechanism according to an embodiment of the present invention.

[85] The Multi-STABA frame to be used according to the present embodiment may basically have the form of a Multi-TID BA frame as shown in FIG. 13, and preferably, the BA frame is not a simple Multi-TID BA frame but a multi- It may include an

indicator indicating that the STA BA frame. Accordingly, the BA information field may include BA information for different STAs, unlike the existing one.

[86] FIG. 14 illustrates an example of changing a BA control field configuration in FIG. 13. [87] In the BA control field illustrated in FIG. 14, a Mul t i-AID field is added as compared to FIG. 13. As described above, the Mul t i-AID field may serve as an indicator indicating that the Mtil ti-TID BA frame is a BA frame for a plurality of STAs, and may include other additional information for a plurality of AIDs.

[88] As such, when configuring a BA frame for multiple users, it is preferable to include (partial) AID information for each STA, which may use a Per TID Info field or a corresponding field.

[89] FIG. 15 illustrates an example of using a BA information field of FIG. 13 when a BA frame is used as a Mul i-STA BA frame.

[90] In FIG. 15, the Block Ack start sequence control subfield and the Block Ack bitmap subfield may be similar to the above-described functions. However, in FIG. 15, the Block Ack start is performed for each AID by using the Per TID Info field as the Per AID Info field. A configuration including a Sumus subfield and a Block Ack bitmap subfield is shown.

[91] This may be used when the Mul t i—AID field is set to a specific value (for example, 1) in FIG. 14 to indicate that this BA frame is a Mul t i-STA BA frame.

[92] FIG. 16 is a diagram illustrating the configuration of a Per AID Info field in FIG. 15.

[93] As shown in FIG. 16, the Per AID Info field may use a small length to indicate AIDs of a plurality of STAs. In FIG. 16, the size of AID information is illustrated as 12 bits. However, when an abbreviated AID such as PAID is used, the size of the AID field may be defined to be smaller than 12 bits.

[94] Meanwhile, in a preferred embodiment of the present invention, in order to efficiently solve the overhead problem that may occur in utilizing the Mul t-STA BA frame as described above, the Per TID Info field of the Mul t-TID BA frame. (Or the Per AID Info field as illustrated in FIGS. 15 and 16), it is proposed to further include BA indicator information indicating whether the Block Ack start source control subfield and / or the Block Ack bitmap subfield can be omitted. do.

[95] For example, when the AP receives all the MPDUs / A-MPDUs transmitted through the UL MU PPDU received from a specific STA, the Block Ack start sequence Zea field and the Block Ack bitmap field may not be needed. As another example, when the AP successfully receives all MPDUs / A-MPDUs from a specific MPDU / A-MPDU among a plurality of MPDUs / A-MPDUs transmitted through a UL MU PPPDU received from a specific STA. In this case, Block Ack start sequence information is required, but Block Ack bitmap information may not be required. Therefore, in such a situation, when the 'BA indicator information' is additionally included after the AID information of the Per TID Info field (or Per AID Info field) and transmitted, the block Ack start sequence control subfield and / or Block in the above-described case is transmitted. In a situation where the Ack bitmap subfield is unnecessary, overhead caused by them can be reduced.

[96] FIG. 17 illustrates a case in which such BA indicator information is added after the AID information and the reserved field. However, it is obvious that such BA indicator information may be located immediately after the AID information.

[97] In a specific embodiment of the present invention, it is proposed that such BA indicator information is composed of two bits and indicates the following information.

[98] (1) 00 : Normal BA informat ion. This is done by Block Ack Start ing.

Indicates that both the Sequence Control field and the Block Ack bitmap field are included.

[99] (2) 01 : Part ial BA informat ion. The Block Ack Start Sequence Control field indicates that the MSDU / A-MSDU (or MPDU / A-MPDU) to the remaining MSDU / A-MSDIK or MPDU / A—MPDU are all well received. In this case, as shown in FIG. 18, only the Block ACK Starting Sequence Control field together with Per AID Info (Per TID Info) may be included in the BA Informat ion field and transmitted.

(3) 10: If the received PPDU is a single MPDU, it indicates that the MPDU is well received and indicates ACK. In addition, when the received PPDU includes a plurality of MPDUs, it may indicate that all MPDUs included in the PPDU have been successfully received. In this case, as shown in 19, only the Block ACK Starting, Sequence Control field, and the Per AID Info field (Per TID Info field under another name) may be included in the BA Informat ion field without the Block ACK bitmap.

[101] (4) 11: Reservations

In the above description, the BA indicator value is merely an example, and it is obvious that the specific value may be differently

set.

20 to 22 illustrate Mul t i-STA utilizing the BA indicator as described above.

it is a figure for demonstrating the Block Ack mechanism.

[104] In FIG. 20, an AP may transmit a trigger frame for UL MU transmission to a plurality of STAs (eg, STA 1 and STA 2). In response, the STA 1 and the STA 2 may include the pluralilty of MPDUs in the PPDU and transmit the same.

[105] If the AP has successfully received all MPDUs after the MPDU corresponding to Sequence Number 3 among the plurality of MPDUs received from STA 1, the AP skips the Block Ack bitmap for STA 1, and the SSC A BA information field can be configured and transmitted, including the start sequence subfield and AID information as shown in = 3. In this case, according to the above-described BA indicator rule, the BA indicator may indicate a value of 01.

On the other hand, if the MPDU successfully received even before the failed MPDU as shown in FIG. 20 among the plurality of MPDUs received from STA 2, the Block Ack bitmap cannot be omitted as in STA 1. For STA 2, AID, Block Ack start sequence control field, and Block Ack bitmap are included and transmitted. In this case, according to the above-described BA indicator rule, the BA indicator may indicate a value of 00.

Meanwhile, unlike FIG. 20, FIG. 21 illustrates a case in which an MPDU successfully received before transmission of a trigger frame from STA 1 exists.

[108] Even if all MPDUs transmitted after a specific MPDU are well received, including the previous PPDU as well as the current PPDU, only the SSC may be transmitted. This indicates that the MPDU indicated by the sequence number of the SSC received all the remaining MPDUs well. That is, FIG. 21 illustrates that MPDUs corresponding to SSC = 3 of STA 1 to subsequent MPDUs can be shown as shown in FIG. 21.

In the case of FIG. 22, all MPDUs received from STA 1 are successfully received. In this case, according to the above-described BA indicator rule, the BA indicator value is set to 10, and the SSC and bitmap module may be omitted and transmitted in the BA information field.

FIG. 23 illustrates a Mul t---STA BA frame format according to another embodiment of the present invention. FIG.

[111] 23 illustrates the transmission of the AID information and the above-described BA indicator information using the reserved 12 bits of the BA information field enhancement Per TID Info field. In the example of Fig. 23, however, BA indicator information is represented by one bit to indicate ACK / BA. Specifically, the first bit (BO) to the eleventh bit (B10) of the Per TID Info field indicates AID information, and the twelfth bit (B11) starts Block Ack in the BA information field <:> for the corresponding TID (AID). It illustrates that ACK / BA information indicating whether the sequence control subfield and the Block Ack bitmap subfield are omitted is included.

If B11 of the Per TID Info field is set, the Block Ack bitmap and the SC subfield may be omitted in the BA information field. In this case, the BA information field may be received from the STA of the corresponding AID. This may indicate that all MPDUs received through the PPDU (or a single MPDU, in the case of a single MPDU) have been successfully received.

That is, the embodiment of FIG. 23 shows a case where only Al l Ack Indicat ions are represented as 1-bit information among BA indicator values. However, the indicator for the case of including only the SSC may be defined in a separate field, and various combinations may be applied according to the structure of the corresponding frame.

[114] An indi cat ion for receiving all the rest from the MPDU corresponding to a specific sequence number is indicated in the Block ACK Starting Sequence Contr field, or a specific bit or specific value in the TID Value field indicates that there is no Block Ack Bitmap. Can be. In this case, the ACK / BA Indi cat ion bit of the Per TID Info field may indicate BA.

[115] Meanwhile, a specific bit / field of a Block ACK Starting Sequence Control field or a specific value of a specific field may indicate the presence or absence of a Block ACK (BA) bitmap. For example, in the Block ACK Starting Sequence Control field, a specific value of the Fragment Number field or a specific ratio of the Fragment Number field (LSB M bits, M = 2 or 3) indicates the Block ACK Bitmap length, For example, all 1 or all 0) can indicate that there is no BA bitmap.

[116] 24 is a diagram for explaining an apparatus for implementing the method as described above.

[117] The wireless device 800 of FIG. 24 may correspond to a specific STA of the above description, and the wireless device 850 may correspond to the AP of the above-described description.

[118] The STA 800 may include a processor 810, a memory 820, and a transceiver 830, and the AP 850 may include a

processor 860, a memory 870, and a transceiver 880. have. The transceivers 830 and 880 may transmit / receive radio signals and may be executed in a physical layer such as IEEE 802.il/3GPP. The processors 810 and 860 are executed at the physical layer and / or MAC layer, and are connected to the transceivers 830 and 880. Processors 810 and 860 may perform the UL MU scheduling procedure mentioned above.

[119] Processors 810 and 860 and / or transceivers 830 and 880 may include application-specific integrated circuits (ASICs), other chipsets, logic ', circuits and / or data processors. The memories 820 and 870 may include read-on ly memory (ROM), random access memory (RAM), flash memory, memory cards, storage media and / or other storage units. When an embodiment is executed by software, the method described above can be implemented as modules (eg, processes, functions) that perform the functions described above. The modules may be stored in memory 820, 870 and executed by processor 810, 860. The memories 820 and 870 may be disposed inside or outside the processes 810 and 860 and may be connected to the processes 810 and 860 by well-known means.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS [00120] The detailed description of the preferred embodiments of the invention disclosed as described above is provided to enable any person skilled in the art to make and practice the invention. Although the above has been described with reference to a preferred embodiment of the present invention, those skilled in the art will understand that the present invention can be variously modified and changed from the above description. Thus, the present invention is not intended to be limited to the embodiments shown herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

Industrial Applicability

[121] The present invention as described above is IEEE 802.

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Although it has been described assuming that it is applied to the base wireless LAN system, it need not be limited thereto. The present invention can be applied in the same manner to various wireless systems in which the AP can operate the Block Ack mechanism for a plurality of STAs.

(12) 특허협력조약에 의하여 공개된 국제출원

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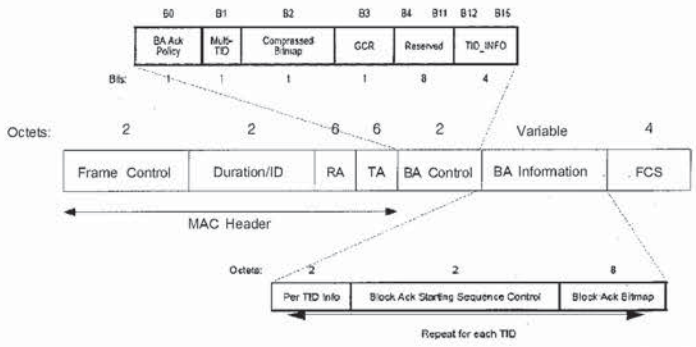
공개:

— 국제조사보고서와 함께 (조약 제 21 조(3))

(54) Title: METHOD FOR TRANSMITTING AND RECEIVING MULTIPLE USER BLOCK ACKNOWLEDGEMENT FRAME IN WIRELESS LAN SYSTEM, AND APPARATUS THEREFOR

(54) 발명의 명칭 : 무선랜 시스템에서 다중 사용자 블록 확인응답 프레임 송수신 방법 및 이를 위한 장치

FIG. 13



(57) Abstract: The present specification relates to a method of an access point (AP) transmitting a block acknowledgement (ACK) signal with respect to transmission data of a plurality of stations (STA) in a wireless LAN (WLAN) system, and an apparatus therefor. To this end, an AP transmits a multi-STA BA frame with respect to data received fiOm the plurality of STA, wherein the multi-STA BA frame includes a MAC header field, a BA control field and a BA information field. In this regard, the BA information field may include: AID information with respect to one or more STA to which ACK/NACK is transmitted from the plurality of STA; and an individual information field including BA indicator information that indicates whether the BA information field includes one or more of a block ACK bitmap sub-field and a starting sequence control sub-field.

(57) 요약서:

[다음 쪽 계속]

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본 문서는 무선랜 (WLAN) 시스템에서 AP (Access Point)가 복수의 스테이션 (STA) 의 전송 데이터에 대해 블록 확인응답 (Block ACK) 신호를 전송하는 방법 및 이를 위한 장치에 대한 것이다. 이를 위해 AP는 복수의 STA으로부터 수신한 데이터에 대한 다중 STA BA 프레임 (mul t i-STA BA frame) 을 전송하되, 이때 다중 STA BA 프레임은 MAC 헤더 필드, BA 제어 필드 및 BA 정보 필드를 포함한다. 여기서, BA 정보 필드는, 복수의 STA 중 ACK/NACK 이 전송되는 하나 이상의 STA 에 대한 AID 정보, 및 상기 BA 정보 필드가 BI ock ACK 비트맵 서브필드 및 시작 시퀀스 제어 (Starting Sequence Control) 서브필드 중 하나 이상의 포함여부를 나타내는 BA 지시자 정보를 포함하는 개별 정보 필드를 포함할 수 있다.

[명 세 서]

[발 명 의 명 칭]

무 선 랜 시 스 템 에 서 다 중 사 용 자 블 록 확 인 응 답 프 레 임 송 수 신 방 법 및 이 를 위 한 장 치

[기 술 분 야]

[1] 이 하 의 설 명 은 무 선 랜 시 스 템 에 서 다 중 사 용 자 또 는 다 중 스 테 이 션 (STA) 블 록 확 인 응 답 프 레 임 을 송 수 신 하 는 방 법 및 이 를 위 한 장 치 에 대 한 것 이 다 .

[배 경 기 술]

[2] 무 선 랜 기 술 에 대 한 표 준 은 IEEE(Inst i tute of Electr ical and Electronics Engineers) 802 . 11 표 준 으 로 서 개 발 되 고 있 다 . IEEE 802 . 11a 및 b 는 2 .4. GHz 또 는 5 GHz 에 서 비 면 허 대 역 (unl icensed band) 을 이 용 하 고 , IEEE 802. 11b 는 11 Mbps 의 전 송 속 도 를 제 공 하 고 , IEEE 802. 11a 는 54 Mbps 의 전 송 속 도 를 제 공 한 다 . IEEE 802 . llg 는 2 .4 GHz 에 서 직 교 주 파 수 분 할 다 중 화 (Orthogonal frequency-division mul t iplexing, OFDM) 를 적 용 하 여 , 54 Mbps 의 전 송 속 도 를 제 공 한 다 . IEEE 802 . 11η 은 다 중 입 출 력 0FDM(mul t iple input mul t iple out put -OFDM, MIM0-0FDM) 을 적 용 하 여 , 4 개 의 공 간 적 인 스 트 림 (spat ial stream) 에 대 해 서 300 Mbps 의 전 송 속 도 를 제 공 함 다 . IEEE 802 . lln 에 서 는 채 널 대 역 폭 (channel bandwidth) 을 40 MHz 까 지 지 원 하 며 , 이 경 우 에 는 600 Mbps 의 전 송 속 도 를 제 공 한 다 .

[3] 상 술 한 무 선 랜 표 준 은 최 대 160MHz 대 역 폭 을 사 용 하 고 , 8 개 의 공 간 스 트 림 을 지 원 하 여 최 대 IGbi t/s 의 속 도 를 지 원 하 는 IEEE 802 . llac 표 준 을 거 쳐 , IEEE 802 . 11ax 표 준 화 에 대 한 논 의 가 이 루 어 지 고 있 다 .

【발명의 상세한 설명】

【기술적 과제】

[4] IEEE 802.11ax 표준화 에서는 상향링크 OFDMA (UL OFDMA) 전송 방식 및 상향링크 다중 사용자 (UL MU) 전송 방식이 이용될 예정이다. 이에 따라 동일한 전송 기회에 AP는 복수의 STA으로부터 UL MU 프레임을 수신할 수 있으며, 이에 대해 확인응답 프레임을 전송하는 것이 필요하다.

[5] 이때, 복수의 STA 들에게 블록 확인응답 프레임(Block Ack Frame)을 통해 효율적으로 확인응답 신호를 전송하는 것이 고려될 수 있으나, 복수의 STA 에 대한 MU BA 프레임은 크기가 커지게 되어 오버헤드가 문제될 수 있다.

[6] 이하의 설명에서는 UL MU 전송 상황에서 오버헤드를 최소화하여 효율적으로 BA 프레임을 전송하기 위한 방법 및 장치에 대해 살펴본다.

【기술적 해결방법】

[기상술한 바와 같은 과제를 해결하기 위한 본 발명의 일 측면에서는 무선랜 (WLAN) 시스템에서 AP (Access Point)가 복수의 스테이션 (STA)의 전송 데이터에 대해 블록 확인응답 (Block ACK) 신호를 전송하는 방법에 있어서, 상기 복수의 STA 으로부터 데이터를 수신하고, 상기 복수의 STA 으로부터 수신한 데이터에 대한 다중 STA BA 프레임(multi-STA BA frame)을 전송하되, 상기 다중 STA BA 프레임은 MAC 헤더 필드, BA 제어 필드 및 BA 정보 필드를 포함하며, 상기 BA 정보 필드는, 상기 복수의 STA 중 ACK/NACK 이 전송되는 하나 이상의 STA 에 대한 AID 정보, 및 상기 BA 정보 필드가 Block ACK 비트맵 서브필드 및 시작 시퀀스 제어 (Starting Sequence Control) 서브필드 중 하나 이

상의 포함여부를 나타내는 BA 지시자 정보를 포함하는 개별 정보 필드를 포함하는, 확인응답 신호 전송 방법을 제안한다.

[8] 본 발명의 다른 일 측면에서는 무선랜(WLAN) 시스템에서 스테이션 (STA) 이 AP (Access Point)로부터 블록 확인응답 (Block ACK) 신호를 수신하는 방법에 있어서, 상기 AP 에 데이터를 전송하고, 상기 AP 로부터 상기 데이터에 대한 확인응답 신호를 다중 STA BA 프레임(multi—STA BA frame) 을 통해 수신하되, 상기 다중 STA BA 프레임은 MAC 헤더 필드, BA 제어 필드 및 BA 정보 필드를 포함하며, 상기 BA 정보 필드는, 복수의 STA 중 ACK/NACK 이 전송되는 하나 이상의 STA 에 대한 AID 정보, 및 상기 BA 정보 필드가 Block ACK 비트맵 서브필드 및 시작 시퀀스 제어 (Starting Sequence Control) 서브필드 중 하나 이상의 포함여부를 나타내는 BA 지시자 정보를 포함하는 개별 정보 필드를 포함하는, 확인응답 신호 수신 방법을 제안한다.

[9] 본 발명의 또 다른 일 측면에서는 무선랜(WLAN) 시스템에서 복수의 스테이션 (STA) 의 전송 데이터에 대해 블록 확인응답 (Block ACK) 신호를 전송하는 AP (Access Point) 로서, 상기 복수의 STA 으로부터 데이터를 수신하고, 상기 복수의 STA 으로부터 수신한 데이터에 대한 다중 STA BA 프레임(multi—STA BA frame) 을 전송하도록 구성되는 송수신기; 및 상기 송수신기와 연결되어, 상기 데이터를 처리하고, 상기 다중 STA BA 프레임을 구성하도록 구성되는 프로세서를 포함하되, 상기 프로세서는 상기 다중 STA BA 프레임이 MAC 헤더 필드, BA 제어 필드 및 BA 정보 필드를 포함하도록 구성하며, 상기 BA 정보 필드는, 상기 복수의 STA 중 ACK/NACK 이 전송되는 하나 이상의 STA 에 대한 AID 정보, 및 상기 BA 정보 필드가 Block ACK 비트맵 서브필드 및 시작 시퀀

스 제어 (Start ing Sequence Control) 서브필드 중 하나 이상의 포함여부를 나타내는 BA 지시자 정보를 포함하는 개별 정보 필드를 포함하도록 구성하는, AP 장치를 제안한다.

[10] 본 발명의 또 다른 일 측면에서는 무선랜(WLAN) 시스템에서 AP (Access Point)로부터 블록 확인응답 (Block ACK) 신호를 수신하는 스테이션 (STA) 장치로서, 상기 AP 에 데이터를 전송하고, 상기 AP 로부터 상기 데이터에 대한 확인응답 신호를 다중 STA BA 프레임(mul t i-STA BA frame) 을 통해 수신하도록 구성되는 송수신기; 및 상기 송수신기와 연결되어, 상기 데이터를 구성하고, 상기 다중 STA BA 프레임을 처리하도록 구성되는 프로세서를 포함하되, 상기 다중 STA BA 프레임은 MAC 헤더 필드, BA 제어 필드 및 BA 정보 필드를 포함하며, 상기 BA 정보 필드는, 복수의 STA 중 ACK/NACK 아 전송되는 하나 이상의 STA 에 대한 AID 정보, 및 상기 BA 정보 필드가 Block ACK 비트맵 서브필드 및 시작 시퀀스 제어 (Start ing Sequence Control) 서브필드 중 하나 이상의 포함여부를 나타내는 BA 지시자 정보를 포함하는 개별 정보 필드를 포함하는, 스테이션 장치를 제안한다 —

[11] 여기서 개별 정보 필드는 TID 별 정보 필드 또는 AID 별 정보 필드일 수 있다.

[12] 상기 개별 정보 필드의 BA 지시자 정보가 제 1 값을 나타내는 경우, 상기 BA 정보 필드는 상기 Block ACK 비트맵 서브필드 및 상기 시작 시퀀스 제어 서브필드를 포함하지 않을 수 있으며, 상기 BA 정보 필드는 상기 AID 정보에 포함된 AID 를 가진 STA 으로부터 수신한 PPDU 내의 모든 MPDU 들에 대한 ACK 을 나타낼 수 있다.

[13] 상기 개별 정보 필드의 BA 지시자 정보가 제 2 값을 나타내는 경우, 상기 BA 정보 필드는 상기 시작 시퀀스 제어 서브필드는 포함하되, 상기 Block ACK 비트맵 서브필드를 포함하지 않을 수 있으며, 상기 BA 정보 필드는 상기 AID 정보에 포함된 AID 를 가진 STA 으로부터 수신한 PPDU 내의 복수의 MPDU 들 중 상기 시작 시퀀스 제어 서브필드 값에 대응하는 MPDU 이후의 모든 MPDU 에 대한 ACK 을 나타낼 수 있다.

[14] 상기 개별 정보 필드의 BA 지시자 정보가 제 3 값을 나타내는 경우, 상기 BA 정보 필드는 상기 Block ACK 비트맵 서브필드 및 상기 시작 시퀀스 제어 서브필드를 모두 포함할 수 있다.

[15] 상기 다중 STA BA 프레임은 상기 BA 제어 필드 내 다중 TID 서브 필드를 포함하는 다중 TID BlockAck 프레임일 수 있다.

[16] 상기 BA 정보 필드는 복수 회 반복되어 포함될 수 있으며, 상기 복수의 BA 정보 필드 각각은 서로 다른 STA 에 대한 확인응답을 나타낼 수 있다.

[17] 상기 개별 정보 필드는 12 비트 길이를 가질 수 있으며, 제 1 비트(B0) 내지 제 11 비트(B10) 은 상기 AID 정보를, 제 12 비트(B11) 는 상기 BA 지시자 정보를 나타낼 수 있다.

[18] 상기 복수의 STA 으로부터 수신하는 데이터는 상향링크 다중 사용자 PPDU (UL MU PPDU) 형식을 가질 수 있으며, 특정 STA 으로부터 수신한 PPDU 는 단일 MPDU 또는 복수의 MPDU 를 포함할 수 있다.

[19] 상기 복수의 STA 으로부터 수신하는 UL MU PPDU 는 상기 AP 가 상기 복수의 STA 에 트리거 프레임을 전송함에 대응하여 수신될 수 있다.

【유리한 효과】

[20] 상술한 바와 같은 본 발명에 따르면, UL MU 전송 상황에서 AP 가 오버헤드를 최소화하여 복수의 STA 에 효율적으로 확인응답 신호를 전송할 수 있다.

【도면의 간단한 설명】

[21] 도 1 은 무선랜 시스템의 구성의 일례를 나타낸 도면이다.

[22] 도 2 는 무선랜 시스템의 구성의 다른 예를 나타낸 도면이다.

[23] 도 3 은 무선랜 시스템에서 활용되는 블록 Ack 메커니즘을 설명하기 위한 도면이다.

[24] 도 4 는 블록 확인응답 프레임의 기본 구성을 나타낸 도면아다.

[25] 도 5 는 도 4 에 도시된 BA 제어 필드의 구체적 구성을 도시한 도면이다.

[26] 도 6 은 도 4 에 도시된 BA 정보 필드의 구체적 구성을 도시한 도면이다.

[27] 도 7 은 Block Ack 시작 시퀀스 제어 서브필드의 구성을 도시한 도면이다.

[28] 도 8 은 압축된 Block Ack 프레임의 BA 정보 필드 구성을 도시한 도면이다.

[29] 도 9 는 Multi-TID Block Ack 프레임의 BA 정보 필드를 도시한 도면이다.

[30] 도 10 및 도 11 은 Block Ack 메커니즘이 하향링크 MU-MIMO 방식에 적용되는 경우를 설명하기 위한 도면이다.

[31] 도 12 는 본 발명이 적용될 상향링크 다중 사용자 전송 상황을 설명하

기 위한 도면이다.

[32] 도 13 은 본 발명의 바람직한 일 실시형태에 따라 하향링크 다중 사용자 Block Ack 메커니즘에 활용될 프레임 구조를 도시한 도면이다.

[33] 도 14 는 도 13 에서 BA 제어 필드 구성을 변경한 일례이다.

[34] 도 15 는 BA 프레임이 Multi-STA BA 프레임으로 활용되는 경우에 도 13 의 BA 정보 필드를 활용하는 일례를 도시한 도면이다.

[35] 도 16 은 도 15 에서 Per AID Info 필드의 구성을 도시한 도면이다.

[36] 도 17 은 BA 지시자 정보를 AID 정보와 유보 필드 이후에 추가하는 경우를 도시하는 도면이다.

[37] 도 18 및 도 19 는 본 발명의 일 실시형태에 따라 Block ACK Starting Sequence Control 필드 및/또는 Block ACK bitmap 필드가 생략되는 형태를 도시한 도면이다—

[38] 도 20 내지 22 는 상술한 바와 같은 BA 지시자를 활용한 Multi-STA Block Ack 메커니즘을 설명하기 위한 도면이다.

[39] 도 23 은 본 발명의 다른 일 실시형태에 따른 Multi-STA BA 프레임 포멧을 도시한 도면이다.

[40] 도 24 는 본 발명에 따른 방법을 구현하기 위한 장치를 설명하기 위한 도면이다.

【발명의 실시를 위한 형태】

[41] 이하, 본 발명에 따른 바람직한 실시 형태를 첨부된 도면을 참조하여 상세하게 설명한다. 첨부된 도면과 함께 이하에 개시될 상세한 설명은 본 발

명의 예시적인 실시형태를 설명하고자 하는 것이며, 본 발명이 실시될 수 있는 유일한 실시형태를 나타내고자 하는 것이 아니다.

[42] 이하의 상세한 설명은 본 발명의 완전한 이해를 제공하기 위해서 구체적 세부사항을 포함한다. 그러나, 당업자는 본 발명이 이러한 구체적 세부사항 없이도 실시될 수 있음을 안다. 몇몇 경우, 본 발명의 개념이 모호해지는 것을 피하기 위하여 공지의 구조 및 장치는 생략되거나, 각 구조 및 장치의 핵심기능을 중심으로 한 블록도 형식으로 도시된다.

[43] 상술한 바와 같이 이하의 설명은 무선랜 시스템에서 넓은 대역을 가지는 채널을 효율적으로 활용하기 위한 방법 및 이를 위한 장치에 대한 것이다. 이를 위해 먼저 본 발명이 적용되는 무선랜 시스템에 대해 구체적으로 설명한다.

[44] 도 1은 무선랜 시스템의 구성의 일례를 나타낸 도면이다.

[45] 도 1에 도시된 바와 같이, 무선랜 시스템은 하나 이상의 기본 서비스 세트(Basic Service Set, BSS)를 포함한다. BSS는 성공적으로 동기화를 이루어서 서로 통신할 수 있는 스테이션(Station, STA)의 집합이다.

[46] STA는 매체 접속 제어(Medium Access Control, MAC)와 무선 매체에 대한 물리계층(Physical Layer) 인터페이스를 포함하는 논리 개체로서, 액세스 포인트(access point, AP)와 비 AP STA(Non-AP Station)을 포함한다. STA 중에서 사용자가 조작하는 휴대용 단말은 Non-AP STA로써, 단순히 STA이라고 할 때는 Non-AP STA을 가리키기도 한다. Non-AP STA은 단말(terminal), 무선 송수신 유닛(Wireless Transmit/Receive Unit, WTRU), 사용자 장비(User Equipment, UE), 이동국(Mobile Station, MS), 휴대용 단말(Mobile Terminal),

또는 이동 가입자 유닛(Mobile Subscriber Unit) 등의 다른 명칭으로도 불릴 수 있다.

[47] 그리고, AP는 자신에게 결합된 STA(Associated Station)에게 무선 매체를 통해 분배 시스템(Distribution System, DS)으로의 접속을 제공하는 개체이다. AP는 집중 제어기, 기지국(Base Station, BS), Node-B, BTS(Base Transceiver System), 또는 사이트 제어기 등으로 불릴 수도 있다.

[48] BSS는 인프라스트럭처(infrastructure) BSS와 독립적인(Independent) BSS(IBSS)로 구분할 수 있다.

[49] 도 1에 도시된 BBS는 IBSS이다. IBSS는 AP를 포함하지 않는 BSS를 의미하고, AP를 포함하지 않으므로, DS로의 접속이 허용되지 않아서 자기 완비적 네트워크(self-contained network)를 이룬다.

[50] 도 2는 무선랜 시스템의 구성의 다른 예를 나타낸 도면이다.

[51] 도 2에 도시된 BSS는 인프라스트럭처 BSS이다. 인프라스트럭처 BSS는 하나 이상의 STA 및 AP를 포함한다. 인프라스트럭처 BSS에서 비AP STA들 사이의 통신은 AP를 경유하여 이루어지는 것이 원칙이나, 비AP STA 간에 직접 링크(link)가 설정된 경우에는 비AP STA들 사이에서 직접 통신도 가능하다.

[52] 도 2에 도시된 바와 같이, 복수의 인프라스트럭처 BSS는 DS를 통해 상호 연결될 수 있다. DS를 통하여 연결된 복수의 BSS를 확장 서비스 세트(Extended Service Set, ESS)라 한다. ESS에 포함되는 STA들은 서로 통신할 수 있으며, 동일한 ESS 내에서 비AP STA은 끊김 없이 통신하면서 하나와 BSS에서 다른 BSS로 이동할 수 있다.

[53] DS는 복수의 AP들을 연결하는 메커니즘(mechanism)으로서, 반드시 네

트워크일 필요는 없으며, 소정의 분배 서비스를 제공할 수 있다면 그 형태에 대해서는 아무런 제한이 없다. 예컨대, DS는 메쉬(mesh) 네트워크와 같은 무선 네트워크일 수도 있고, AP들을 서로 연결시켜 주는 물리적인 구조물일 수도 있다.

[54] 이상을 바탕으로 무선랜 시스템에서 블록 확인응답 (Block Ack) 방식에 대해 설명한다.

[55] 블록 Ack 메커니즘은 하나의 프레임에 복수의 확인응답을 포함시켜 전송함으로써 채널 효율성을 증대시키는 방식이다. 블록 Ack 메커니즘에는 즉시 응답 방식 및 지연 응답 방식과 같은 2 가지 방식이 존재한다. 즉시 응답 방식은 넓은 대역폭과 낮은 지연 트래픽 전송에 유리한 반면, 지연 응답 방식은 지연에 민감하지 않은 어플리케이션에 적합할 수 있다. 이하의 설명에서 특별히 다른 규정이 없는 한, 블록 Ack 메커니즘을 이용하여 데이터를 보내는 STA을 발신자 (or iginator) 로, 이러한 데이터를 수신하는 STA을 수산자 (recipient)로 나타낸다.

[56] 도 3 은 무선랜 시스템에서 활용되는 블록 Ack 메커니즘을 설명하기 위한 도면이다.

[57] 블록 Ack 메커니즘을 도 3 에 도시된 바와 같이 ADDBA (add Block Acknowledgment) 요청/응답 프레임의 교환에 의해 개시될 수 있다 ((a) Setup 단계). 이와 같이 개시된 이후, QoS 데이터 프레임 블록들은 발신자 로부터 수신자에게 전송될 수 있다. 이와 같은 블록들은 폴링된 TX0P 내 또는 EDCA 경쟁에서 이김으로써 개시될 수 있다. 상기 블록 내 프레임의 구는 제한될

수 있다. 이와 같은 프레임 블록 내 MPDU들은 BlockAckReq 프레임에 의한 요청에 따라 수신되는 BlockAck 프레임에 의해 수신 확인될 수 있다 ((b) Data & Block Ack 단계),

[58] 발신자가 더 이상 전송할 데이터가 없고 최종 블록 Ack 교환이 완료되는 경우, 발신자는 수신자에게 DELBA (delete Block Acknowledgment) 프레임을 전송하여 Block Ack 메커니즘을 종료할 수 있다. 이와 같은 DELBA 프레임을 수신한 수신자는 Block Ack 전송을 위해 할당된 모든 자원을 해제할 수 있다 ((c) Tear Down 단계).

[59] 도 4는 블록 확인응답 프레임의 기본 구성을 나타낸 도면이다.

[60] 블록 확인응답 프레임은 도 4에 도시된 바와 같이 MAC 헤더 필드, BA 제어(BA Control) 필드 및 BA 정보(BA information) 필드를 포함할 수 있다. 또한, MAC 헤더 필드는 프레임 제어 필드, Duration/ID 필드, RA 필드 및 TA 필드를 포함할 수 있다. 여기서 RA 필드는 수신 STA의 주소를, TA 필드는 발신 STA의 주소를 나타낸다.

[61] 도 5는 도 4에 도시된 BA 제어 필드의 구체적 구성을 도시한 도면이다.

[62] BA 제어 필드 내 BA Ack 정책 서브필드의 값은 아래 표 1과 같은 의미를 전달할 수 있다.

[63] 【표 1】

Value	Meaning
0	Normal Acknowledgment. The BA Ack Policy subfield is set to this value when the sender requires immediate acknowledgment. The addressee returns an Ack frame. The value 0 is not used for data sent under HT-delayed Block Ack during a PSMP sequence. The value 0 is not used in frames transmitted by DMG STAs.
1	No Acknowledgment. The addressee sends no immediate response upon receipt of the frame. The BA Ack Policy subfield is set to this value when the sender does not require immediate acknowledgment. The value 1 is not used in a Basic BlockAck frame sent in a PSMP sequence. The value 1 is not used in an Multi-TID BlockAck frame.

[64] 한편, BA 제어 필드 내 Multi-TID, Compressed Bitmap 그리고 GCR 서브 필드들은 가능한 BlockAck 프레임 변형을 다음과 같은 규정에 따라 결정할 수 있다.

[65] [표 2]

Multi-TID subfield value	Compressed Bitmap subfield value	GCR subfield value	BlockAck frame variant
0	0	0	Basic BlockAck
0	1	0	Compressed BlockAck
1	0	0	Extended Compressed BlockAck
1	1	0	Multi-TID BlockAck
0	0	1	Reserved
0	1	1	GCR BlockAck
1	0	1	Reserved
1	1	1	Reserved

[66] 도 6은 도 4에 도시된 BA 정보 필드의 구체적 구성을 도시한 도면이며, 도 7은 Block Ack 시작 시퀀스 제어 서브필드의 구성을 도시한 도면이다.

[67] 도 6에 도시된 바와 같이 BA 정보 필드는 Block Ack 시작 시퀀스 제어 (SSC) 서브필드 및 Block Ack 비트맵 서브필드를 포함할 수 있다.

[68] 도 6에 도시된 바와 같이 Block Ack 비트맵 서브필드는 128 옥텟 길이

를 가지며, 이에 따라 64 개의 MSDU 의 수신 상태를 나타낼 수 있다. Block Ack 비트맵 필드의 비트 위치 n 은, 만일 1 로 설정되는 경우, (SSC + n) 에 대응하는 MPDU 시퀀스 제어 값을 가지는 MPDU 의 수신 성공을 나타낼 수 있으며, 여기서 SSC 는 Block Ack 시작 시퀀스 제어 서브필드의 값을 나타낸다. 이와 달리, Block Ack 비트맵 필드의 비트 위치 n 이 0 으로 설정되는 경우, (SSC + n) 에 대응하는 MPDU 시퀀스 제어 값을 가지는 MPDU 가 수신되지 않았음을 나타낼 수 있다. MPDU 시퀀스 제어 필드 및 Block Ack 시작 시퀀스 제어 서브필드 값들은 각각 16 비트 unsigned integer 로 취급될 수 있다. MSDU 의 미사용 fragment number 들에 대해서, 비트맵 내 대응하는 비트는 0 으로 설정될 수 있다.

[69] 도 8 은 압축된 Block Ack 프레임의 BA 정보 필드 구성을 도시한 도면이다.

[70] 압축된 Block Ack 프레임의 BS 정보 필드의 Block Ack 비트맵은 도 8 에 도시된 바와 같이 8 옥¾ 길이를 가질 수 있으며, 64 개의 MSDU 및 A-MSDU 의 수신 상태는 나타낼 수 있다. 비트맵의 첫번째 비트는 시작 시퀀스 번호 서브필드의 값에 대응하는 MSDU 또는 A-MSDU 에 대응하며, 각 비트는 상기 MSDU 또는 A-MSDU 이후의 MSDU 또는 A-MSDU 에 순차적으로 대응할 수 있다.

[71] 도 9 는 Multi-TID Block Ack 프레임의 BA 정보 필드를 도시한 도면이다.

[72] Multi-TID BlockAck 프레임의 BA 제어 필드의 TID_INF0 서브필드는 BA 정보 필드에서 몇 개의 TID 에 대한 정보를 전달하는지를 나타낸다. 구체적으로 TID_INF0 서브필드의 값은 BA 정보 필드의 정보에 대응하는 TID 의 수 - 1

을 나타낸다. 예를 들어 ,TID_INF0 값이 2 인 경우 BA 정보 필드는 3 개의 TID 에 대한 정보를 포함함을 나타낼 수 있다.

[73] 한편 , Mul t i-TID BlockAck 프레임의 경우 도 9 에 도시된 바와 같이 Block Ack 시작 시퀀스 제어 서브필드 및 Block Ack 비트맵 서브필드에 추가적으로 Per TID Info 서브필드를 포함할 수 있다. 가장 처음에 등장하는 Per TID Info, block Ack 시작 시퀀스 제어 , Block Ack 비트맵 서브필드들은 가장 낮은 TID 값에 대응하여 전송될 수 있으며 , 이후의 반복되는 서브필드들은 다음 TID 에 대응할 수 있다. 이들 서브필 드들의 Tr iplet 은 TID 마 다 반복될 수 있다.

[74] 도 10 및 도 11 은 Block Ack 메커니즘이 하향링크 MU—MIM0 방식에 적용되는 경우를 설명하기 위한 도면이다.

[75] 도 10 및 도 11 에 도시된 바와 같이 AP 는 복수의 STA (STA 1 내지 3) 에세 MU-MIM0 데이터 프레임을 전송할 수 있다.

[76] 도 10 은 MU PPDU 전송 후 SIFS 이후 프레임 교환이 이루어지는 것을 가정하였다. 도 10 의 경우 STA 1 에 대해서는 묵시적 Block Ack 요청이 Ack 정책으로 설정되고 , STA 2 및 STA 3 에 대해서는 Block ACK 이 Ack 정책으로 설정된 것을 가정하였다. 이에 따라 STA 1 의 경우 BA 에 대한 요청 없이도 즉시 하향링크 MU PPDU 수신 후 BA 프레임을 전송할 수 있다. 이에 반해 STA 2 및 STA 3 에게는 AP 가 BAR (BA Request) 프레임을 전송하여 폴링을 수행할 수 있으며, 이에 대해 STA 2 및 STA 3 은 BA 프레임을 전송할 수 있다.

[77] 한편, 도 11 은 MU PPDLT 후 SIFS 없이 프레임 교환이 이루어지는 예로서, 모든 STA 들에게 Ack 정책이 Block Ack 으로 설정된 경우를 가정한다. 이에 따

라 AP는 모든 STA에게 BAR 프레임을 전송하여 폴링할 수 있다.

[78] 도 12는 본 발명이 적용될 상향링크 다중 사용자 전송 상황을 설명하기 위한 도면이다.

[79] 상술한 바와 같이 802.11ax 시스템에서는 UL MU 전송 방식이 사용될 수 있으며, 이는 도 12에 도시된 바와 같이 AP가 복수의 STA (예를 들어, STA 1 내지 STA 4)에게 트리거 프레임(Trigger Frame)을 전송함으로써 시작될 수 있다. 트리거 프레임은 UL MU 할당 정보(예를 들어, 자원 위치 및 크기, STA ID들, MCS, MU 타입 (MIMO, OFDMA 등)) 를 포함할 수 있다. 구체적으로 트리거 프레임에 포함되어 전송될 수 있는 정보의 일례는 다음과 같을 수 있다.

[80] 【표 3】

-— UL MU frame 에 대한 durat ion
- Number of allocation (N)
- Each allocation's Information
■ SU/MU
■ AID (MU일 경우, STA수만큼 추가로 포함된다.)
■ Power adjustment
■ Tone(/Resource) allocation information (e.g., bitmap)
■ MCS
■ Nsts
■ STBC
■ Coding
■ Beamformed
■ Etc.

[81] 한편, 도 12에 도시된 바와 같이 AP는 매체에 접속하기 위해 경쟁 과정을 거쳐 트리거 프레임을 전송할 TXOP를 획득할 수 있다. 이에 대해 STA들은 트리거 프레임의 SIFS 이후 AP에 의해 지시된 포맷으로 UL 데이터 프레

임을 전송할 수 있다. 이에 대응하여 본 발명에 따른 AP는 BA (Block ACK) 프레임을 통해 UL MU 데이터 프레임에 대해 확인 응답을 수행하는 것을 가정한다.

[82] 다만, 상술한 바와 같은 UL MU 프레임에 대한 BA 프레임은 UL MU 프레임에 대한 BA 프레임과 비교하여 크기가 상당히 커지기 때문에 오버헤드가 심각하게 문제될 수 있다. 예를 들어 도 10 및 도 11 에서 STA 1 이 전송하는 BA 프레임은 AP 가 STA 1 에 전송한 데이터에 대한 BA 정보를 포함하지만, 도 12 에서 AP가 전송할 BA 프레임은 STA 1 내지 STA 4 가 전송한 UL MU 데이터 프레임에 대한 BA 정보를 포함하게 된다. 또한, MAC 프레임의 크기는 압축 Block Ack 을 사용하는 경우 32 바이트, 일반 Block Ack 의 경우 150 바이트에 상응하여 오버헤드가 문제될 수 있다.

[83] 이에 따라 본 발명의 바람직한 실시형태들에서는 상술한 BA 프레임들 중 Mult i-TID Block Ack 프레임 포맷을 활용하여 UL MU 상황에서 효율적으로 BA 프레임을 전송하는 방법을 제안한다.

[84] 도 13 은 본 발명의 바람직한 일 실시형태에 따라 하향링크 다중 사용자 Block Ack 메커니즘에 활용될 프레임 구조를 도시한 도면이다.

[85] 본 실시형태에 따라 사용될 Mult i-STA BA 프레임을 기본적으로 도 13 에 도시된 바와 같이 Mul t i-TID BA 프레임의 형태를 가질 수 있으며, 바람직하게는 해당 BA 프레임이 단순한 Mult i-TID BA 프레임이 아니라 mul t i-STA BA 프레임임을 나타내는 지시자를 포함할 수 있다. 이에 따라 BA 정보 필드는 기존과 달리 서로 다른 STA 에 대한 BA 정보를 포함할 수 있다.

[86] 도 14 는 도 13 에서 BA 제어 필드 구성을 변경한 일례이다.

[87] 도 14 에 도시된 BA 제어 필드는 도 13 과 대비하여 Multi-AID 필드를 추가하 였다. 여기서 Multi-AID 필드는 상술한 바와 같이 본 Mtilti-TID BA 프레임이 복수의 STA 에 대한 BA 프레임임을 나타내는 지시자 역할을 수행할 수 있으며, 복수의 AID 에 대한 기타 부가 정보를 포함할 수 있다.

[88] 이와 같이 다중 사용자에 대한 BA 프레임을 구성하는 경우 각 STA 에 대한 (부분) AID 정보를 포함하는 것이 바람직하며, 이는 Per TID Info 필드 또는 이에 상응하는 필드를 사용할 수 있다.

[89] 도 15 는 BA 프레임이 Multi-STA BA 프레임으로 활용되는 경우에 도 13 의 BA 정보 필드를 활용하는 일례를 도시한 도면이다.

[90] 도 15 에서 Block Ack 시작 시퀀스 제어 서브 필드 및 Block Ack 비트맵 서브필드는 상술한 기능과 유사할 수 있다, 다만, 도 15 에서는 Per TID Info 필드를 Per AID Info 필드로 활용하여 각 AID 당 Block Ack 시작 서뭔스 서브 필드 및 Block Ack 비트맵 서브필드를 포함하는 구성을 도시하고 있다.

[91] 이는 도 14 에서 Multi-AID 필드가 특정 값(예를 들어 1)으로 설정되어 본 BA 프레임이 Multi-STA BA 프레임임을 나타내는 경우에 활용될 수 있다.

[92] 도 16 은 도 15 에서 Per AID Info 필드의 구성올 도시한 도면이다.

[93] Per AID Info 필드는 도 16 에 도시된 바와 같이 소장 길이를 복수의 STA 의 AID 를 나타내는데 사용할 수 있다. 도 16 에서 AID 정보의 크기는 12 비트로 예시하고 있으나, PAID 와 같이 축약된 AID 를 사용할 경우, AID 필드의 크기는 12 비트보다 작게 정의될 수 있음은 당업자에게 자명할 것이다.

[94] 한편, 본 발명의 바람직한 일 실시형태에서는 상술한 바와 같이 Multi-STA BA 프레임올 활용함에 있어서 발생할 수 있는 오버헤드 문제를 효

율적으로 해결하기 위해 Multi-TID BA 프레임의 Per TID Info 필드 (또는 도 15 및 도 16 에 예시된 바와 같이 Per AID Info 필드) 에 Block Ack 시작 시퀀스 제어 서브필드 및/또는 Block Ack 비트맵 서브필드의 생략 가능 여부를 나타내는 BA 지시자 정보를 추가적으로 포함시키는 것을 제안한다.

[95] 예를 들어, AP 가 특정 STA 으로부터 수신한 UL MU PPDU 를 통해 전송된 모든 MPDU/A-MPDU 들을 모두 잘 받은 경우, Block Ack 시작 시퀀스 제아 필드 및 Block Ack 비트맵 필드는 필요하지 않을 수 있다. 다른 예로서, AP 가 특정 STA 으로부터 수신한 UL MU PPPDU 를 통해 전송된 복수의 MPDU/A-MPDU 들 중 특정 MPDU/A-MPDU 부터 이후의 모든 MPDU/A-MPDU 들에 대해 수신을 성공한 경우, Block Ack 시작 시퀀스 정보는 필요하지만, Block Ack 비트맵 정보는 필요하지 않을 수 있다. 따라서, 이러한 상황들에서 'BA 지시자 정보' 를 Per TID Info 필드 (또는 Per AID Info 필드) 의 AID 정보 이후에 추가적으로 포함시켜 전송하는 경우, 상술한 경우에 Block Ack 시작 시퀀스 제어 서브필드 및/또는 Block Ack 비트맵 서브필드가 불필요한 상황에서 이들로 인한 오버헤드를 저감시킬 수 있다.

[96] 도 17 은 이와 같은 BA 지시자 정보를 AID 정보와 유보 필드 이후에 추가하는 경우를 도시하고 있으나, 이와 같은 BA 지시자 정보는 AID 정보 이후에 바로 위치할 수도 있음은 자명하다.

[97] 본 발명의 구체적인 일 실시형태에서는 이와 같은 BA 지시자 정보를 2 비트로 구성하고 다음과 같은 정보를 나타내는 것을 제안한다.

[98] (1) 00: Normal BA information. 이는 도 15 와 같이 Block Ack Starting Sequence Control 필드와 Block Ack 비트맵 필드가 모두 포함되는 경우를 나

타 낸다.

[99] (2) 01 : Partial BA information. Block Ack 시작 시퀀스 제어 필드가 가리키는 MSDU/A-MSDU (또는 MPDU/A-MPDU) 부터 나머지 MSDU/A-MSDIK 또는 MPDU/A—MPDU) 들이 모두 잘 수신되 었다는 것을 나타낸다. 이 경우, 도 18 과 같이 Per AID Info(Per TID Info) 와 함께 Block ACK Starting Sequence Control 필드만 BA Information 필드에 포함되어 전송될 수 있다.

[100] (3) 10 : 수신된 PPDU 가 Single MPDU 인 경우, 해당 MPDU 가 잘 수신되었다는 것을 가리키고 ACK 을 나타낸다. 또한, 수신된 PPDU 가 복수의 MPDU 를 포함하는 경우, PPDU 에 포함된 모든 MPDU 들이 성공적으로 수신된 것을 나타낼 수 있다. 이 경우 모두도 19 에 도시된 바와 같이 Block ACK Starting Sequence Control 필드와 Block ACK bitmap 없이 Per AID Info 필드 (다른 이름으로 Per TID Info 필드) 만 BA Information field 에 포함될 수 있다.

[101] (4) 11 : 유보

[102] 상술한 설명에서 BA 지시자 값은 예시에 불과하며, 구체적인 값은 이와 달리 설정될 수 있음은 자명하다.

[103] 도 20 내지 22 는 상술한 바와 같은 BA 지시자를 활용한 Multi-STA Block Ack 메커니즘을 설명하기 위한 도면이다.

[104] 도 20 에서 AP 는 복수의 STA (예를 들어, STA 1 및 STA 2) 에게 UL MU 전송을 위한 트리거 프레임을 전송할 수 있다. 이에 응답하여 STA 1 및 STA 2 는 복수의 MPDU 를 PPDU 에 포함시켜 전송할 수 있다.

[105] 만일 AP 가 STA 1 로부터 수신한 복수의 MPDU 중 Sequence Number 3 에 대응하는 MPDU 이후의 모든 MPDU 를 성공적으로 수신한 경우, AP 는 STA 1 에 대

해 Block Ack 비트맵을 생략하고 , SSC =3 에 대응하는 시작 시퀀스 서브필드 및 AID 정보를 포함하여 BA 정보 필드를 구성하여 전송할 수 있다. 이 경우 상술한 BA 지시자 규정에 따르면 BA 지시자는 01 값을 나타낼 수 있다.

[106] 한편 , STA 2 로부터 수신한 복수의 MPDU 중 도 20 에 도시된 바와 같이 수신에 실패한 MPDU 이전에도 성공적으로 수신한 MPDU 가 존재하는 경우 , STA 1 과 같이 Block Ack 비트맵을 생략할 수 없으며 , STA 2 에 대해서는 AID, Block Ack 시작 시퀀스 제어 필드 , Block Ack 비트맵을 모두 포함시켜 전송하게 된다. 이 경우 , 상술한 BA 지시자 규정에 따르면 BA 지시자는 00 값을 나타낼 수 있다.

[107] 한편 , 도 21 의 경우 도 20 과 달리 STA 1 로부터 트리거 프레임 전송 전에 성공적으로 수신한 MPDU 가 존재하는 경우를 도시한 도면이다 .

[108] 현재 PPDU 뿐 아니라 이전 PPDU 를 포함하여 , 특정 MPDU 이후에 전송된 모든 MPDU 들이 잘 수신되었을 경우에도 , SSC 만 포함시켜 전송할 수 있다. 이는 SSC 의 Sequence Number 가 가리키는 MPDU 부터 나머지 MPDU 를 모두 잘 받았다는 것을 가리킨다. 즉 , 도 21 에서 STA 1 의 SSC =3 에 대응하는 MPDU 부터 이후의 MPDU 는 수신에 성공하였음을 도시된 바와 같이 나타낼 수 있음을 도시하고 있다.

[109] 도 22 의 경우 STA 1 으로부터 수신한 MPDU 들이 모두 성공적으로 수신된 경우를 나타내고 있다. 이러한 경우 상술한 BA 지시자 규정에 따르면 BA 지시자 값이 10 으로 설정되고 , BA 정보 필드에는 SSC 및 비트맵 모부 생략하여 전송할 수 있다.

[110] 도 23 은 본 발명의 다른 일 실시형태에 따른 Mult i—STA BA 프레임 포맷

을 도시한 도면이다.

[111] 도 23 의 경우 BA 정보 필드 중 Per TID Info 필드의 유보된 12 비트를 이용하여 AID 정보와 상술한 BA 지시자 정보를 전송하는 것을 도시하고 있다. 다만, 도 23 의 예에서는 BA 지시자 정보를 1 비트로서 ACK/BA 를 나타내는 것을 도시하고 있다. 구체적으로 Per TID Info 필드의 제 1 비트 (BO) 내지 제 11 비트(B10) 는 AID 정보를 나타내고, 제 12 비트 (B11) 은 해당 TID (AID) 에 대한 BA 정보 필드에 Block Ack 시작 시퀀스 제어 서브 필드 및 Block Ack 비트맵 서브필드가 생략되었는지 여부를 나타내는 ACK/BA 정보가 포함되는 것을 예시하고 있다.

[112] 만일, Per TID Info 필드의 B11 이 설정된 경우, BA 정보 필드에 Block Ack 비트맵 및 SC 서브필드는 생략된 것을 나타낼 수 있으며, 이 경우의 BA 정보 필드는 대응하는 AID 의 STA 으로부터 수신한 PPDU 를 통해 수신한 모든 MPDU 들(단일 MPDU 인 경우, 해당 단일 MPDU) 이 성공적으로 수신되었음을 나타낼 수 있다.

[113] 즉, 도 23 의 실시형태에서는 BA 지시자 값 중 All Ack Indicat ion 만을 1 비트 정보로 나타내어 주는 경우를 도시하고 있다. 다만, SSC 만을 포함하는 경우에 대한 지시자도 별도의 필드에서 규정될 수 있으며, 그 밖에도 다양한 조합이 해당 프레임의 구조에 따라 적용될 수 있다.

[114] 특정 Sequence number 에 해당하는 MPDU 부터 나머지 모두 수신했다는 것에 대한 indicat ion 이 Block ACK Start ing Sequence Contr 이 필드에서 가리켜 지거나 TID Value 필드에서 특정 비트나 특정 값이 Block Ack Bitmap 이 없다는 것을 가리킬 수 있다. 이 경우, Per TID Info 필드의 ACK/BA Indicat ion

bit 는 BA 를 가리킬 수 있다.

[115] 한편, Block ACK Starting Sequence Control 필드의 특정 비트/필드나 특정 필드의 특정 값이 Block ACK (BA) Bitmap 의 존재 유무를 나타낼 수 있다. 예를 들어, Block ACK Starting Sequence Control 필드에서, Fragment Number field 의 특정 값이나, Fragment Number field 의 특정 비트 (LSB Mbits, M=2 or 3)가 Block ACK Bitmap length 를 나타내고, 특정 값(예를 들어, all 1 or all 0)은 BA Bitmap 이 없다는 것을 가리킬 수 있다

[116] 도 24 는 상술한 바와 같은 방법을 구현하기 위한 장치를 설명하기 위한 도면이다.

[117] 도 24 의 무선 장치(800) 은 상술한 설명의 특정 STA, 그리고 무선 장치(850) 은 상술한 설명의 AP 에 대응할 수 있다.

[118] STA (800) 은 프로세서 (810), 메모리 (820), 송수신부 (830) 를 포함할 수 있고, AP (850) 는 프로세서 (860), 메모리 (870) 및 송수신부 (880) 를 포함할 수 있다. 송수신부 (830 및 880) 은 무선 신호를 송신/수신하고, IEEE 802.11/3GPP 등의 물리적 계층에서 실행될 수 있다. 프로세서 (810 및 860) 은 물리 계층 및/또는 MAC 계층에서 실행되고, 송수신부 (830 및 880) 와 연결되어 있다. 프로세서 (810 및 860) 는 상기 언급된 UL MU 스케줄링 절차를 수행할 수 있다.

[119] 프로세서 (810 및 860) 및/또는 송수신부 (830 및 880) 는 특정 집적 회로 (application-specific integrated circuit, ASIC), 다른 칩셋, 논리 회로 및/또는 데이터 프로세서를 포함할 수 있다. 메모리 (820 및 870) 은

ROM(read-only memory), RAM(random access memory), 플래시 메모리, 메모리 카드, 저장 매체 및/또는 다른 저장 유닛을 포함할 수 있다. 일 실시 예가 소프트 웨어에 의해 실행될 때, 상기 기술한 방법은 상기 기술된 기능을 수행하는 모듈(예를 들어, 프로세스, 기능)로서 실¾될 수 있다. 상기 모듈은 메모리(820, 870)에 저장될 수 있고, 프로세서(810, 860)에 의해 실행될 수 있다. 상기 메모리(820, 870)는 상기 프로세스(810, 860)의 내부 또는 외부에 배치될 수 있고, 잘 알려진 수단으로 상기 프로세스(810, 860)와 연결될 수 있다.

[120] 상술한 바와 같이 개시된 본 발명의 바람직한 실시형태에 대한 상세한 설명은 당업자가 본 발명을 구현하고 실시할 수 있도록 제공되었다. 상기에서는 본 발명의 바람직한 실시 형태를 참조하여 설명하였지만, 해당 기술 분야의 숙련된 당업자는 상술한 설명으로부터 본 발명을 다양하게 주정 및 변경시킬 수 있음을 이해할 수 있을 것이다. 따라서, 본 발명은 여기에 나타난 실시형태들에 제한되려는 것이 아니라, 여기서 개시된 원리들 및 신규한 특징들과 일치하는 최광의 범위를 부여하려는 것이다.

【산 업상 이용가능성】

[121] 상술한 바와 같은 본 발명은 IEEE 802.11 기반 무선랜 시스템에 적용되는 것을 가정하여 설명하였으나, 이에 한정될 필요는 없다. 본 발명은 AP가 복수의 STA에 대해 Block Ack 메커니즘을 운용할 수 있는 다양한 무선 시스템에 동일한 방식으로 적용될 수 있다.

[청구의 범위]

[청구항 1]

무선랜(WLAN) 시스템에서 AP (Access Point)가 복수의 스테이션 (STA) 의 전송 데이터에 대해 블록 확인응답 (Block ACK) 신호를 전송하는 방법에 있어서 ,

상기 복수의 STA으로부터 데이터를 수신하고 ,

상기 복수의 STA으로부터 수신한 데이터에 대한 다중 STA BA 프레임(mul t i-STA BA frame) 을 전송하되 ,

상기 다중 STA BA 프레임은 MAC 헤더 필드 , BA 제어 필드 및 BA 정보 필드를 포함하며 ,

상기 BA 정보 필드는 ,

상기 복수의 STA 중 ACK/NACK이 전송되는 하나 이상의 STA에 대한 AID 정보 , 및

상기 BA 정보 필드가 Block ACK 비트맵 서브필드 및 시작 시퀀스 제어 (Start ing Sequence Control) 서브필드 중 하나 이상의 포함여부를 나타내는 BA 지시자 정보

를 포함하는 개별 정보 필드를 포함하는 , 확인응답 신호 전송 방법.

[청구항 2]

제 1 항에 있어서 ,

상기 개별 정보 필드의 BA 지시자 정보가 제 1 값을 나타내는 경우 , 상기 BA 정보 필드는 상기 Block ACK 비트맵 서브필드 및 상기 시작 시퀀스 제어 서브필드를 포함하지 않는 , 확인응답 신호 전송 방법.

[청구항 3]

제 2 항에 있어서,

상기 개별 정보 필드의 BA 지시자 정보가 상기 제 1 값을 나타내는 경우, 상기 BA 정보 필드는 상기 AID 정보에 포함된 AID 를 가진 STA으로부터 수신한 PPDU 내의 모든 MPDU들에 대한 ACK을 나타내는, 확인응답 신호 전송 방법.

【청구항 4】

제 1 항에 있어서,

상기 개별 정보 필드의 BA 지시자 정보가 제 2 값을 나타내는 경우, 상기 BA 정보 필드는 상기 시작 시퀀스 제어 서브필드는 포함하되, 상기 Block ACK 비트맵 서브필드를 포함하지 않는, 확인응답 신호 전송 방법.

【청구항 5】

제 4 항에 있어서,

상기 개별 정보 필드의 BA 지시자 정보가 상기 쎄 2 값을 나타내는 경우, 상기 BA 정보 필드는 상기 AID 정보에 포함된 AID 를 가진 STA으로부터 수신한 PPDU 내의 복수의 MPDU들 중 상기 시작 시퀀스 제어 서브필드 값에 대응하는 MPDU 이후의 모든 MPDU에 대한 ACK을 나타내는, 확인응답 신호 전송 방법.

【청구항 6】

제 1 항에 있어서,

상기 개별 정보 필드의 BA 지시자 정보가 제 3 값을 나타내는 경우, 상기 BA 정보 필드는 상기 Block ACK 비트맵 서브필드 및 상기 시작 시퀀스 제어 서브필드를 모두 포함하는, 확인응답 신호 전송 방법.

【청구항 7】

제 1 항에 있어서,

상기 다중 STA BA 프레임은 상기 BA 제어 필드 내 다중 TID 서브 팔드를 포함하는 다중 TID BlockAck 프레임인, 확인응답 신호 전송 방법.

[청구항 8]

제 1 항에 있어서,

상기 BA 정보 필드는 복수 회 반복되어 포함되며,

상기 복수의 BA 정보 필드 각각은 서로 다른 STA에 대한 확인응답을 나타낼 수 있는, 확인응답 신호 전송 방법.

[청구항 9]

제 1 항에 있어서,

상기 개별 정보 필드는 12비트 길이를 가지며,

제 1 비트(B0) 내지 제 11 비트(B10) 은 상기 AID 정보를, 제 12 비트(B11) 는 상기 BA 지시자 정보를 나타내는, 확인응답 신호 전송 방법.

[청구항 10]

제 1 항에 있어서,

상기 개별 정보 필드는 per TID 정보 필드인, 확인응답 신호 전송 방법.

[청구항 11]

제 1 항에 있어서,

상기 복수의 STA으로부터 수신하는 데이터는 상향링크 다중 사용자 PPDU (UL MU PPDU) 형식을 가지며,

특정 STA으로부터 수신한 PPDU는 단일 MPDU 또는 복수의 MPDU를 포함하는, 확인응답 신호 전송 방법.

[청구항 12]

제 11 항에 있어서,

상기 복수의 STA으로부터 수신하는 UL MU PPDU는 상기 AP가 상기 복수의 STA에 트리거 프레임을 전송함에 대응하여 수신되는, 확인응답 신호 전송 방법.

【청구항 13】

무선랜(WLAN) 시스템에서 스테이션 (STA) 이 AP (Access Point)로부터 블록 확인응답 (Block ACK) 신호를 수신하는 방법에 있어서,

상기 AP에 데이터를 전송하고,

상기 AP로부터 상기 데이터에 대한 확인응답 신호를 다중 STA BA 프레임(multi-STA BA frame) 을 통해 수신하되,

상기 다중 STA BA 프레임은 MAC 헤더 필드, BA 제어 필드 및 BA 정보 필드를 포함하며,

상기 BA 정보 필드는,

복수의 STA 중 ACK/NACK 이 전송되는 하나 이상의 STA에 대한 AID 정보, 및

상기 BA 정보 필드가 Block ACK 비트맵 서브필드 및 시작 시퀀스 제어 (Starting Sequence Control) 서브필드 중 하나 이상의 포함여부를 나타내는 BA 지시자 정보

를 포함하는 개별 정보 필드를 포함하는, 확인응답 신호 수신 방법.

【청구항 14】

무선랜0VLAN) 시스템에서 복수의 스테이션(STA) 의 전송 데이터에 대해 블록 확인응답 (Block ACK) 신호를 전송하는 AP (Access Point) 로서,

상기 복수의 $_{STA}$으로부터 데이터를 수신하고, 상기 복수의 STA으로부터 수신한 데이터에 대한 다중 STA BA 프레임(multi-STA BA frame) 을 전송하도록

구성되는 송수신기; 및

상기 송수신기와 연결되어, 상기 데이터를 처리하고, 상기 다중 STA BA 프레임을 구성하도록 구성되는 프로세서를 포함하되,

상기 프로세서는 상기 다중 STA BA 프레임이 MAC 헤더 필드, BA 제어 필드 및 BA 정보 필드를 포함하도록 구성하며,

상기 BA 정보 필드는,

상기 복수의 STA 중 ACK/NACK이 전송되는 하나 이상의 STA에 대한 AID 정보, 및

상기 BA 정보 필드가 Block ACK 비트맵 서브필드 및 시작 시퀀스 제어 (Starting Sequence Control) 서브필드 중 하나 이상의 포함여부를 나타내는 BA 지시자 정보

를 포함하는 개별 정보 필드를 포함하도록 구성하는, AP 장치.

【청구항 15】

무선랜(WLAN) 시스템에서 AP (Access Point)로부터 블록 확인응답 (Block ACK) 신호를 수신하는 스테이션 (STA) 장치로서,

상기 AP에 데이터를 전송하고, 상기 AP로부터 상기 데이터에 대한 확인응답 신호를 다중 STA BA 프레임(multi-STA BA frame)을 통해 수신하도록 구성되는 송수신기; 및

상기 송수신기와 연결되어, 상기 데이터를 구성하고, 상기 다중 STA BA 프레임을 처리하도록 구성되는 프로세서를 포함하되,

상기 다중 STA BA 프레임은 MAC 헤더 필드, BA 제어 필드 및 BA 정보 필드를 포함하며,

상기 BA 정보 필드는 ,

복수의 STA 중 ACK/NACK이 전송되는 하나 이상의 STA에 대한 AID 정보 , 및

상기 BA 정보 필드가 Block ACK 비트맵 서브필드 및 시작 시원스 제어 (Start ing Sequence Control) 서브필드 중 하나 이상의 포함여 부를 나타내는 BA 지시자 정보

를 포함하는 개별 정보 필드를 포함하는 , 스테이션 장치 .

FIG. 1

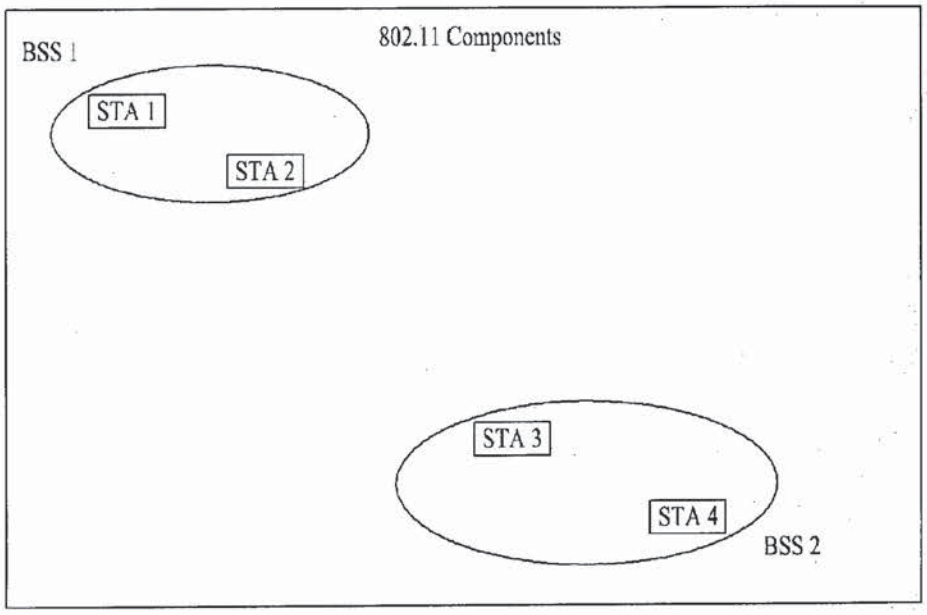


FIG. 2

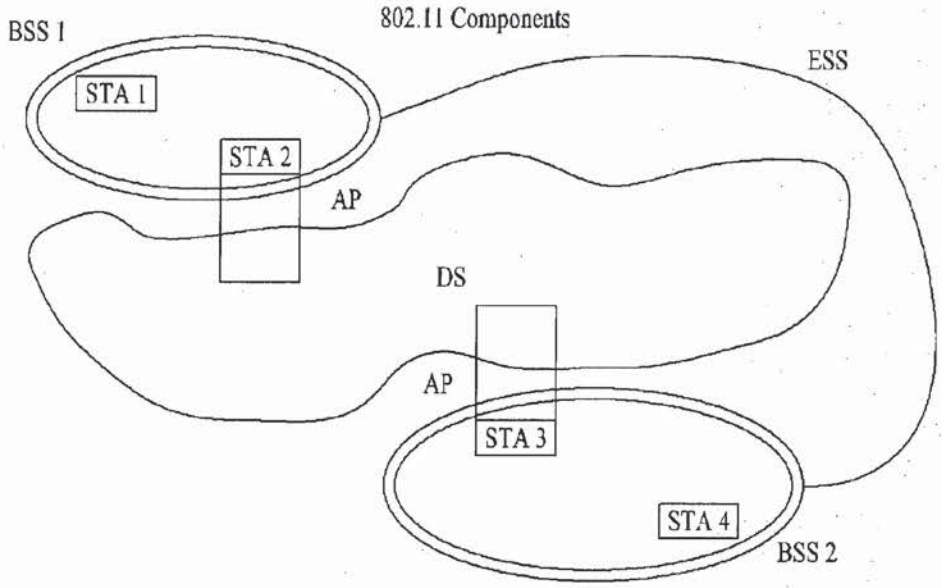


FIG. 3

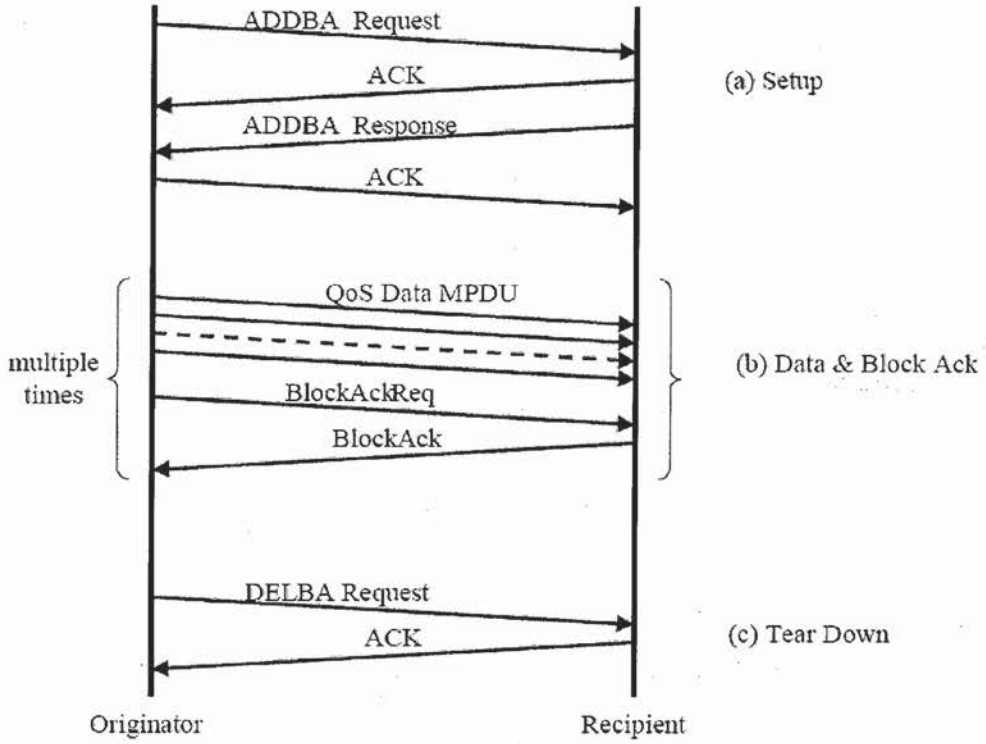

ADDBA Request
ACK
ADDBA Response
ACK
(a) Setup
QoS Data MPDU
multiple times
BlockAckReq
BlockAck
(b) Data & Block Ack
DELBA Request
ACK
(c) Tear Down
Originator
Recipient

FIG. 4

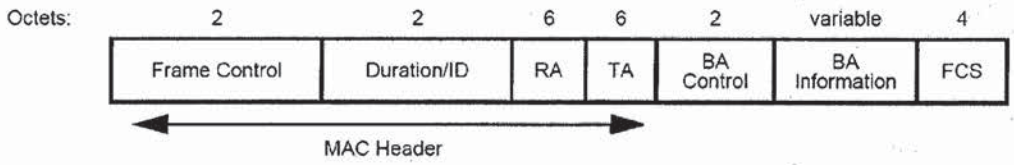

Octets:
2
2
6
6
2
variable
4
Frame Control
Duration/ID
RA
TA
BA Control
BA Information
FCS
MAC Header

FIG. 5

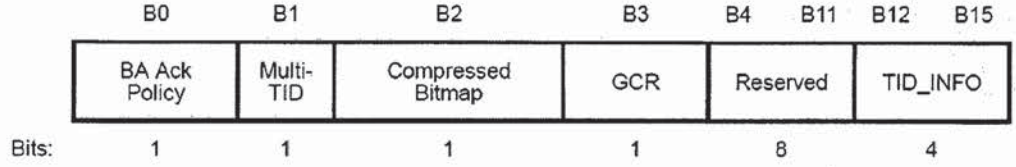


FIG. 6

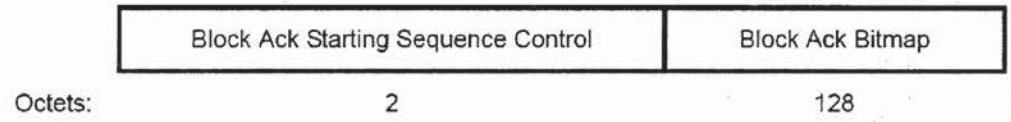


FIG. 7

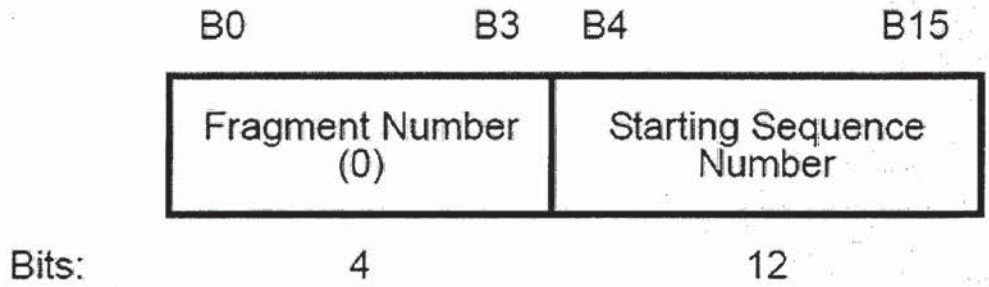


FIG. 8

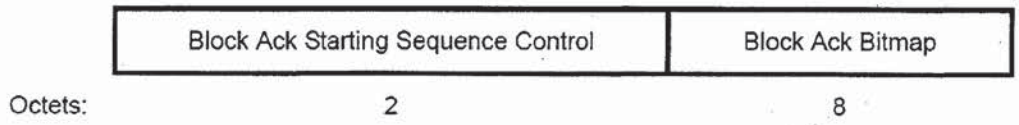

Block Ack Starting Sequence Control
Block Ack Bitmap
Octets:
2
8

FIG. 9

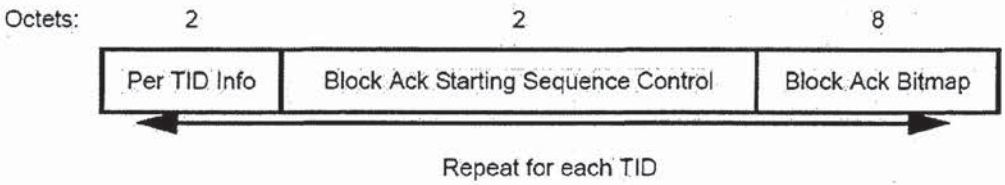

Octets:
2
2
8
Per TID Info
Block Ack Starting Sequence Control
Block Ack Bitmap
Repeat for each TID

FIG. 10

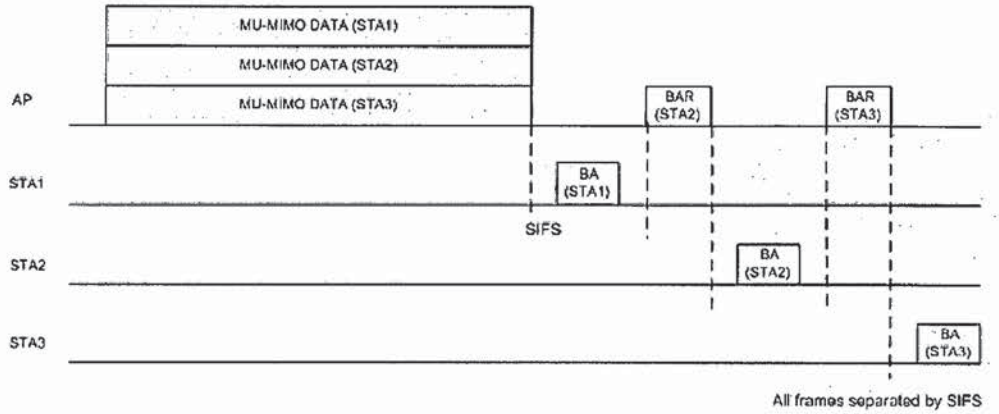

MU-MIMO DATA (STA1)
MU-MIMO DATA (STA2)
MU-MIMO DATA (STA3)
AP
BAR (STA2)
BAR (STA3)
STA1
BA (STA1)
SIFS
STA2
BA (STA2)
STA3
BA (STA3)
All frames separated by SIFS

FIG. 11

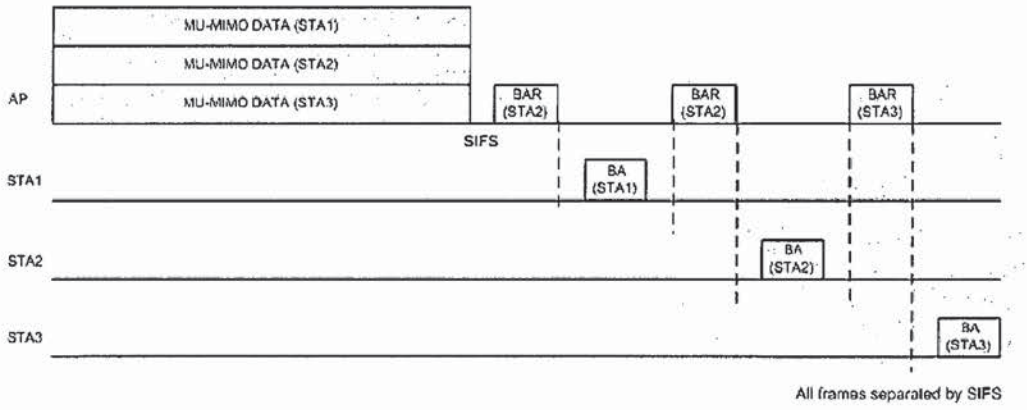

MU-MIMO DATA (STA1)
MU-MIMO DATA (STA2)
MU-MIMO DATA (STA3)
AP
BAR (STA2)
BAR (STA2)
BAR (STA3)
SIFS
STA1
BA (STA1)
STA2
BA (STA2)
STA3
BA (STA3)
All frames separated by SIFS

FIG. 12

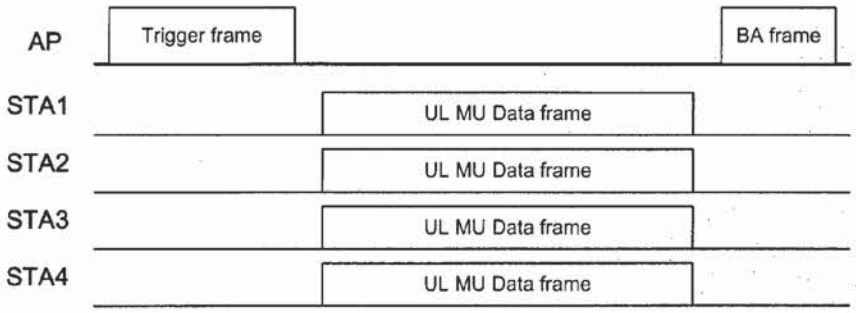

AP
Trigger frame
BA frame
STA1
UL MU Data frame
STA2
UL MU Data frame
STA3
UL MU Data frame
STA4
UL MU Data frame

FIG. 13

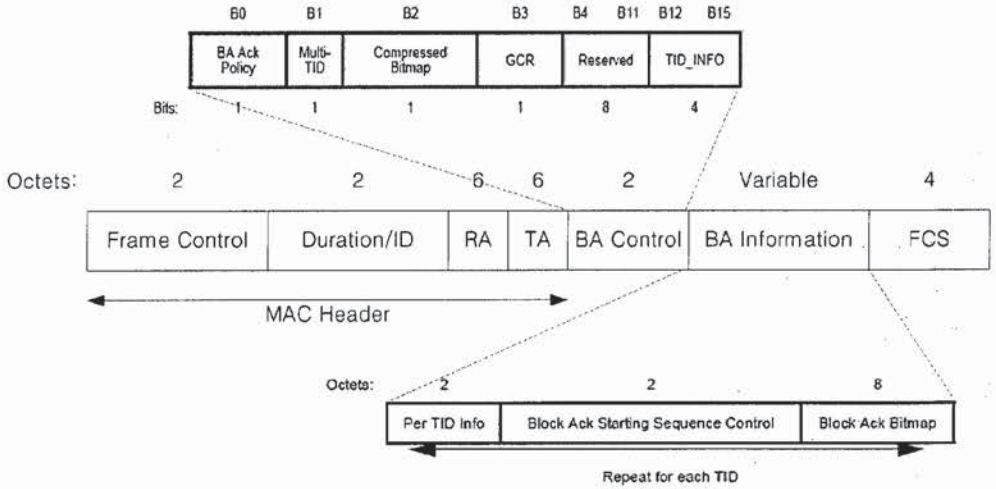

B0 B1 B2 B3 B4 B11 B12 B15
BA Ack Policy
Multi-TID
Compressed Bitmap
GCR
Reserved
TID_INFO
Bits: 1 1 1 1 8 4
Octets: 2 2 6 6 2 Variable 4
Frame Control
Duration/ID
RA
TA
BA Control
BA Information
FCS
MAC Header
Octets: 2 2 8
Per TID Info
Block Ack Starting Sequence Control
Block Ack Bitmap
Repeat for each TID

FIG. 14

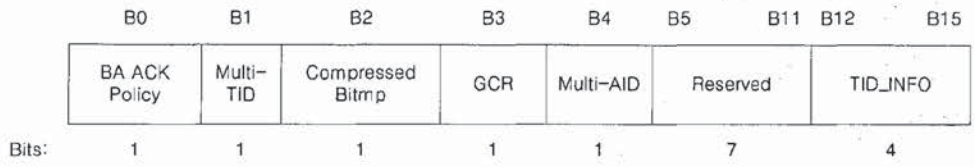


FIG. 15

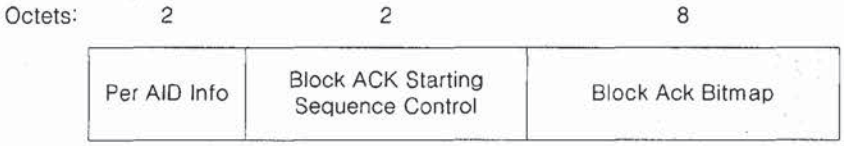


FIG. 16

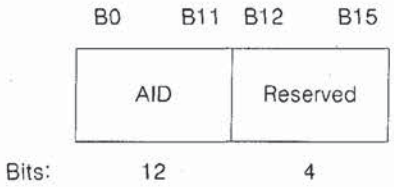


FIG. 17

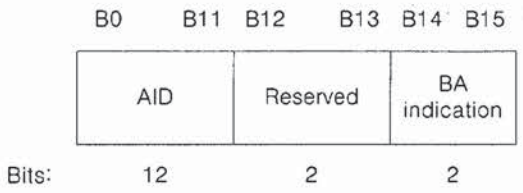


FIG. 18

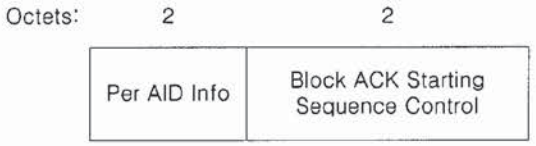


FIG. 19

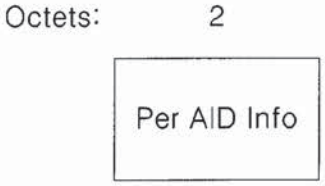


FIG. 20

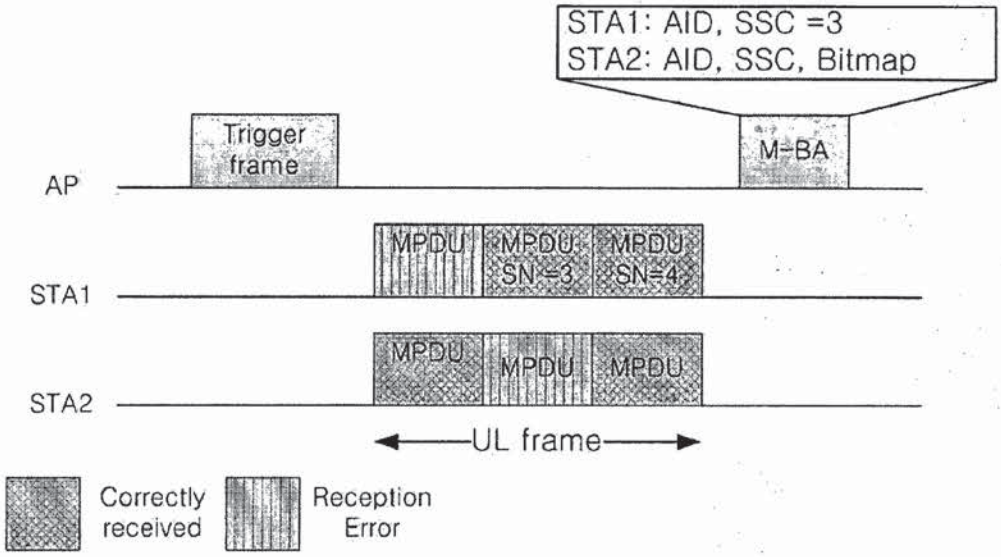

STA1: AID, SSC =3
STA2: AID, SSC, Bitmap
Trigger frame
M-BA
AP
MPDU
MPDU SN=3
MPDU SN=4
STA1
MPDU
MPDU
MPDU
STA2
UL frame
Correctly received
Reception Error

FIG. 21

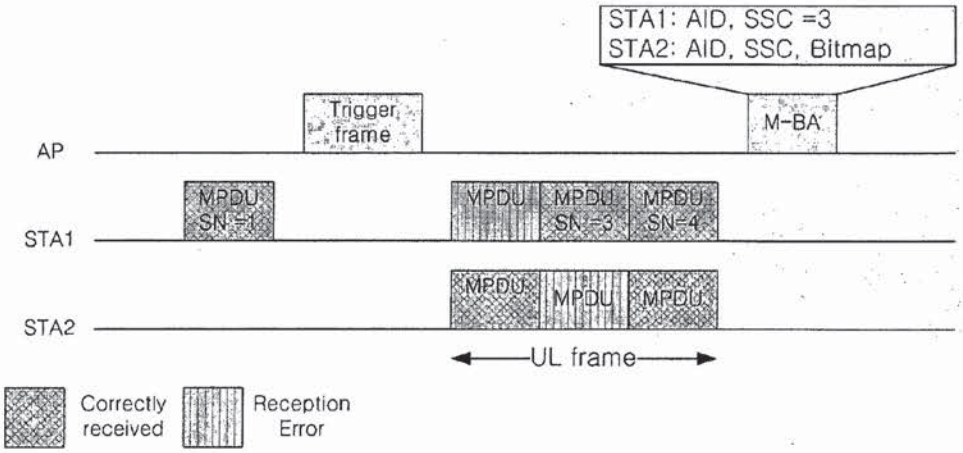

STA1: AID, SSC =3
STA2: AID, SSC, Bitmap
Trigger frame
M-BA
AP
MPDU SN=1
MPDU
MPDU SN=3
MPDU SN=4
STA1
MPDU
MPDU
MPDU
STA2
UL frame
Correctly received
Reception Error

FIG. 22

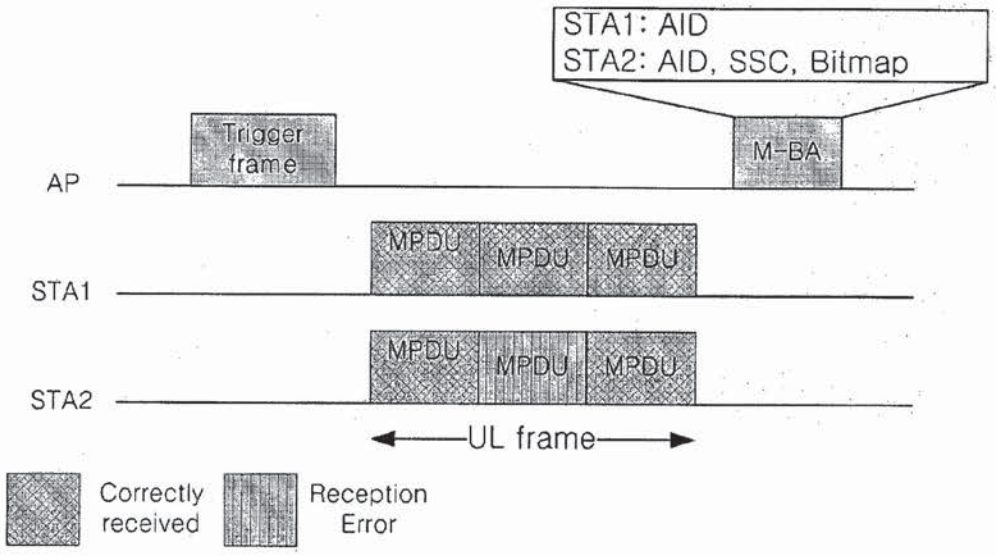

STA1: AID
STA2: AID, SSC, Bitmap
Trigger frame
M-BA
AP
MPDU
MPDU
MPDU
STA1
MPDU
MPDU
MPDU
STA2
UL frame
Correctly received
Reception Error

FIG. 23

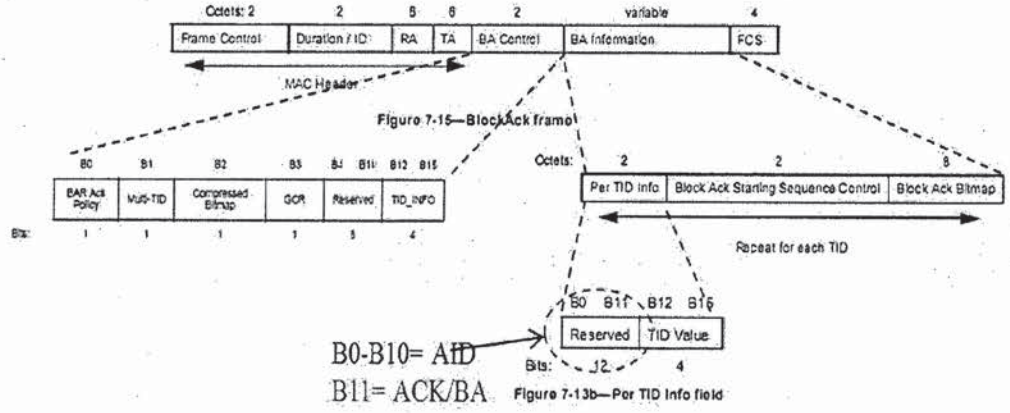
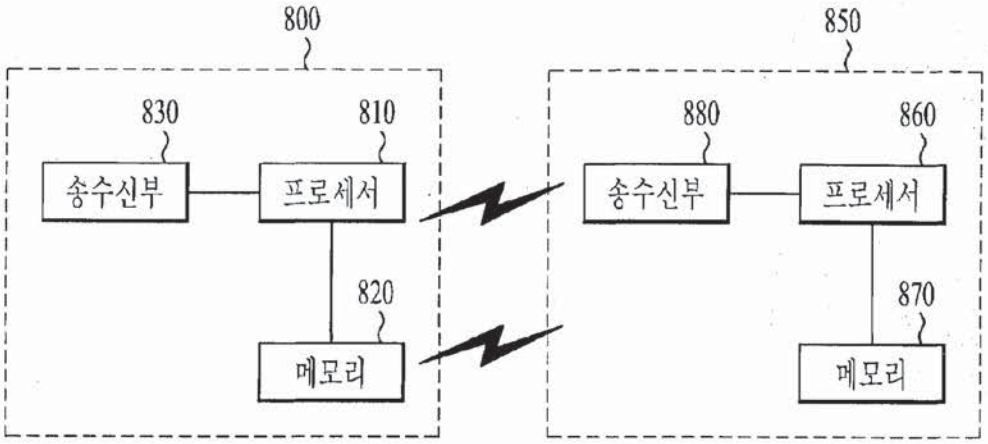

Octets: 2
2
6
6
2
variable
4
Frame Control
Duration / ID
RA
TA
BA Control
BA Information
FCS
MAC Header
Figure 7-15—BlockAck frame
B0
B1
B2
B3
B11
B12
B15
BAR Ack Policy
Multi-TID
Compressed Bitmap
GCR
Reserved
TID_INFO
Bits:
1
1
1
1
5
4
Octets:
2
2
8
Per TID Info
Block Ack Starting Sequence Control
Block Ack Bitmap
Repeat for each TID
B0
B11
B12
B15
Reserved
TID Value
Bits:
12
4
B0-B10= AID
B11= ACK/BA
Figure 7-13b—Per TID Info field

FIG. 24



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2015/011367

A. CLASSIFICATION OF SUBJECT MATTER

H04L 1/16 (2006.01)i, H04L 1/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04L 1/16; H04W 24/02; H04H 20/71; H04W 8/00; H04W 84/12; H04L 1/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applications for Utility models: IPC as above
Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS (KIPO internal) & Keywords: WLAN (Wireless LAN), multi-user, block check response, separate information field

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 10-2011-0095098 A (LG ELECTRONICS INC.) 24 August 2011 See paragraphs [0052]-[0079], [0096], [0097] and figures 4, 11	1-15
Y	US 2014-0254424 A1 (QUALCOM INCORPORATED) 11 September 2014 See paragraphs [0047], [0071] and figure 4.	1-15
A	US 2011-0235593 A1 (GONG, Michelle X. et al.) 29 September 2011 See paragraphs [0016]-[0020] and figures 1-5.	1-15
A	US 2011-0096710 A1 (LIU, Hang et al.) 28 April 2011 See paragraphs [0037]-[0042] and figures 3-5C.	1-15
A	US 2009-0147719 A1 (KANG, Joo Rak) 11 June 2009 See paragraphs [0031]-[0049] and figures 3-5B	1-15

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
32 FEBRUARY 2016 (12.02.2016)	12 FEBRUARY 2016 (12,02,2016)

Name and mailing address of the ISA/KR	Authorized officer
Korean Intellectual Property Office Government Complex-Daejeon, 189 Seonsa-ro, Daejeon 302-701, Republic of Korea	
Facsimile No. 82-42-472-7140	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2015/011367

Patent document cited in search report	Publication date	Patent family meffiber	Publication date
KR 10—2011—0095098 A	24/08/2011	EP 2538599 A1	26/12/2012
		US 2012-0314697 A1	13/12/2012
		WO 2011-102575 A1	25/08/2011
US 2014-0254424 AI	11/09/2014	NONE	
US 2011-0235593 A1	29/09/2011	CN 102412944 A	11/04/2012
		EP 2553853 A2	06/02/2013
		JP 2011-211703 A	20/10/2011
		US 8982758 B2	17/03/2015
		WO 2011-126851 A2	13/10/2011
		WO 2011-126851 A3	19/01/2012
US 2011—0096710 A1	28/04/2011	AU 2008-358409 A1	30/12/2009
		BR PI0822834 A2	23/06/2015
		CA 2727473 A1	30/12/2009
		CN 102057608 A	11/05/2011
		EP 2304890 A1	06/04/2011
		JP 05637988 B2	10/12/2014
		JP 2011-526455 A	06/10/2011
		KR 10-1482087 B1	13/01/2015
		KR 10-2011-0025657 A	10/03/2011
		MX 2010014072 A	11/04/2011
		RU 2011102757 A	10/08/2012
		RU 2478259 C2	27/03/2013
		US 8514763 B2	20/08/2013
		WO 2009-157901 A1	30/12/2009
US 2009-0147719 A1	11/06/2009	KR 10-0935976 B1	08/01/2010
		KR 10—2009—0059786 A	11/06/2009
		US 8588122 B2	19/11/2013

Form PCT/ISA/210 (patent family annex) (January 2015)

국제조사보고서

국제출원번호
PCT/KR2015/011367

A. 발명이 속하는 기술분류 (국제특허분류(IPC))

H04L 1/16(2006.01)i, H04L 1/00(2006.01)i

B. 조사된 분야

조사된 최소문헌 (국제 특허분류를 기재)

H04L 1/16 ; H04W 24/02 ; H04H 20/71 ; H04W 8/00 ; H04W 84/12 ; H04L 1/00

조사된 기술분야에 속하는 최소문헌 이외의 문헌

한국등록 실용신안공보 및 한국공개실용신안공보 : 조사된 최소문헌란에 기재된 IPC

일본등록 실용신안공보 및 일본공개실용신안공보 : 조사된 최소문헌란에 기재된 IPC

국제조사에 이용된 전산 데이터베이스(데이터베이스의 명칭 및 검색어(해당하는 경우))

eKOMPASS (특허청 내부 검색시스템) & 키워드 : WLAN (Wireless LAN), 다중 사용자, 블록 확인응답, 개별 정보 필드

C. 관련 문헌

카테고리*	인용문헌명 및 관련 구절(해당하는 경우)의 기재	관련 청구항
Y	KR 10-2011-0095098 A (엘지전자 주식회사) 2011.08.24 단락 [0052]— [0079], [0096], [0097] 및 도면 4, 11 참조	1—15
Y	US 2014-0254424 A1 (QUALCOMM INCORPORATED) 2014.09.11 단락 [0047], [0071] 및 도면 4 참조.	1—15
A	US 2011-0235593 A1 (MICHELLE X. GONG 등) 2011.09.29 단락 [0016]- [0020] 및 도면 1-5 참조.	1—15
A	US 2011-0096710 A1 (HANG LIU 등) 2011.04.28 단락 [0037]- [0042] 및 도면 3-5C 참조.	1—15
A	US 2009-0147719 A1 (JOO RAK KANG) 2009.06.11 단락 [0031]- [0049] 및 도면 3-5B 참조	1—15

☐ 추가 문헌이 C(계속)에 기재되어 있습니다.

¾ 대응특허에 관한 별지를 참조하십시오.

* 인용된 문헌의 특별 카테고리:

"A" 특별히 관련이 없는 것으로 보이는 일반적인 기술수준을 정의한 문헌

"E" 국제출원일보다 빠른 출원일 또는 우선일을 가지나 국제출원일 이후에 공개된 선출원 또는 특허문헌

"L" 우선권 주장에 의문을 제기하는 문헌 또는 다른 인용문헌의 공개일 또는 다른 특별한 이유(이유를 명시)를 밝히기 위하여 인용된 문헌

"O" 구두 개시, 사용, 전시 또는 기타 수단을 언급하고 있는 문헌

"P" 우선일 이후에 공개되었으나 국제출원일 이전에 공개된 문헌

"T" 국제출원일 또는 우선일 후에 공개된 문헌으로, 출원과 상충하지 않으며 발명의 기초가 되는 원리나 이론을 이해하기 위해 인용된 문헌

"X" 특별한 관련이 있는 문헌. 해당 문헌 하나만으로 청구된 발명의 신규성 또는 진보성이 없는 것으로 본다.

"Y" 특별한 관련이 있는 문헌. 해당 문헌이 하나 이상의 다른 문헌과 조합하는 경우로 그 조합이 당업자에게 자명한 경우 청구된 발명은 진보성이 없는 것으로 본다.

"&" 동일한 대응특허 문헌에 속하는 문헌

국제조사의 실제 완료일	국제조사보고서 발송일
2016 년 02월 12일 (12.02.2016)	2016년 02월 12일 (12.02.2016)

SA/KR 칭 우편
1 의 대한민국 특허청
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전화번호 +82-42-48 1-5560

서식 PCT/ISA/210 (두 번째 용지) (2015 년 1월)

국제조사보고서
대응 특허에 관한 정보

국제출원번호
PCT/KR2015/011367

국제조사보고 서에서 인용된 특허문헌	공개일	대응특허문헌	공개일
KR 10-2011-0095098 A	2011/08/24	EP 2538599 AI	2012/12/26
		US 2012-0314697 AI	2012/12/13
		WO 2011-102575 AI	2011/08/25
US 2014-0254424 AI	2014/09/11	없음	
US 2011-0235593 AI	2011/09/29	CN 102412944 A	2012/04/11
		EP 2553853 A2	2013/02/06
		JP 2011-211703 A	2011/10/20
		US 8982758 B2	2015/03/17
		WO 2011-126851 A2	2011/10/13
		WO 2011-126851 A3	2012/01/19
US 2011-0096710 AI	2011/04/28	AU 2008-358409 AI	2009/12/30
		BR PI 0822834 A2	2015/06/23
		CA 2727473 AI	2009/12/30
		CN 102057608 A	2011/05/11
		EP 2304890 AI	2011/04/06
		JP 05637988 B2	2014/12/10
		JP 2011-526455 A	2011/10/06
		KR 10-1482087 BI	2015/01/13
		KR 10-2011-0025657 A	2011/03/10
		MX 2010014072 A	2011/04/11
		RU 2011102757 A	2012/08/10
		RU 2478259 C2	2013/03/27
		US 8514763 B2	2013/08/20
		WO 2009-157901 AI	2009/12/30
US 2009-0147719 AI	2009/06/11	KR 10-0935976 BI	2010/01/08
		KR 10-2009-0059786 A	2009/06/11
		US 8588122 B2	2013/11/19

서식 PCT/ISA/210 (대응특허 추가용지) (2015년 1월)

Electronic Acknowledgement Receipt

EFS ID:	38773846
Application Number:	16294883
International Application Number:	
Confirmation Number:	6210
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME
First Named Inventor/Applicant Name:	Woojin Ahn
Customer Number:	158747
Filer:	Young Seok Koo
Filer Authorized By:	
Attorney Docket Number:	B-9905CON 631950-4
Receipt Date:	04-MAR-2020
Filing Date:	06-MAR-2019
Time Stamp:	23:11:25
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2020-03-04_631950_IDS.pdf	164530 9ffb7b2207b9d5856dce33c9c2aeddd16e5ea2f6	yes	5

	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Transmittal Letter		1	3	
	Information Disclosure Statement (IDS) Form (SB08)		4	5	
Warnings:					
Information:					
2	Foreign Reference	Ref4_JP2018-509024.pdf	888383 e8d14a0174063739 2a07d68de6fb6722ca4 6fe66	no	46
Warnings:					
Information:					
3	Foreign Reference	Ref6_WO2016-007770.pdf	5625277 ca989144545825da67e6e0f0f6ba50d31c32 1b66	no	65
Warnings:					
Information:					
4	Foreign Reference	Ref8_WO2016-068572.pdf	1768745 01df775433ed95c1bd211ad0dc61773b158 8cf50	no	60
Warnings:					
Information:					
5	Other Reference-Patent/App/Search documents	Ref1_JP2019-534619_1stOA.pdf	322495 0b2bf48ed1c504788808142e3ca208ce60d 4c27d	no	11
Warnings:					
Information:					
6	Other Reference-Patent/App/Search documents	Ref5_JP2019-500497_1stOA.pdf	267160 1cd18297ae5f48f96e5dc93ffcf30b7d2ac68 557	no	6
Warnings:					
Information:					
7	Other Reference-Patent/App/Search documents	Ref13_EP178245684_EESR.pdf	1038557 96dbadd1d872fd2e38027f2470db577d04e f73f7	no	10
Warnings:					

Information:					
8	Non Patent Literature	Ref2_IEEE802-11-16_0998r0.pdf	1256567 ae6072078fef15363d7eecf7d035a92df5ce56b6	no	21
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
9	Non Patent Literature	Ref7_IEEE802-11-15_0132r17.pdf	2131661 4af6d24b066fccd5b3f906f5d465ae0324bade8d	no	61
Warnings:					
Information:					
10	Non Patent Literature	Ref14_IEEE802-11-16_0667r0.pdf	2114601 a08921487b7c15a5ad5e4434d690b43d805b488a	no	16
Warnings:					
Information:					
11	Non Patent Literature	Ref15_IEEE802-11-16_0362r1.pdf	3410003 62af62fb78d3d510eda32caf71650c404f6f0c08	no	26
Warnings:					
Information:					
12	Non Patent Literature	Ref16_IEEEP802-11axTM_D02.pdf	22998749 a1d19f8c266fc72e2b2dd3d2e544d9fd92484db6	no	227
Warnings:					
Information:					
		Total Files Size (in bytes):	41986728		

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.	Examiner: BANDHAWA, MANDISH K
Serial No.: 16/294,883	Art Unit: 2477
Filing or 371 (c) Date: March 6, 2019	Conf. No.: 6210
For: "WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME"	Our Ref: B-9905CON 631950-4
Date: March 4, 2020	Re: ***Information Disclosure Statement***

INFORMATION DISCLOSURE STATEMENT

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir/Madam:

This information disclosure statement is filed in accordance with 37 C.F.R. §§ 1.56, 1.97 and 1.98 to disclose information that may be relevant to the above-identified patent application. The Applicant requests the Examiner consider the documents listed on the enclosed form PTO-1449 (modified) in the examination of this application.

The filing of this Information Disclosure Statement (IDS) shall not be construed as a representation that a search has been made (37 C.F.R. 1.97(g)), an admission that the information cited is, or is considered to be, material to patentability, or that no other material information exists.

The filing of this Information Disclosure Statement shall not be construed as an admission against interest in any manner (37 C.F.R § 1.97(h)).

If any additional fee is required for this filing, the Applicant requests the Examiner contact a practitioner associated with the Customer Number listed below for authorization.

This information disclosure statement also includes the statements marked below. Failure to mark a statement should not be construed as a negative assertion.

Timing and Fees

This IDS is being filed:

[ ] Concurrently with the application, and no fee is due.

[ ] Within three months of the filing of the national application, other than a continued prosecution application under § 1.53(d), and no fee is due.

[ ] Within three months of the date of entry of the national stage as set forth in § 1.491 in an international application, and no fee is due.

[x] Before the mailing of a first Office Action on the merits, and no fee is due.

[ ] Before the mailing of a first Office Action after the filing of a request for continued examination under§ 1.114, and no fee is due.

[ ] After the periods described above, and before a final Office Action under § 1.113, a Notice of Allowance under § 1.311, or an action that otherwise closes prosecution in the application, and is

- [ ] accompanied by the fee set forth in § 1.17(p), or
- [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(1): That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement; or
- [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(2): That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of the information disclosure statement.

[ ] After the periods described above, and is accompanied by the fee set forth in § 1.17(p), and is

- [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(1), that each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement; or

- [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(2), that no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of the information disclosure statement.

[ ] Concurrently with a Request for Continued Examination, and no additional fee is due for this IDS.

Items Disclosed

At least one item listed on the enclosed form PTO-1449 (modified) was

[x] Cited in an Office Action for a related application, the application number of the related application and the issue date of the Office Action are provided below and the Office Action is enclosed.

Please see the enclosed form PTO-1449 (modified) for related application number(s) and issue date(s).

[ ] Cited in an International Search Report (ISR) or an International Preliminary Report on Patentability (IPRP) or a Written Opinion (WO) of the International Searching Authority (ISA) for the related PCT Application, the PCT application number and the issue date of the ISR/IPRP/WO are provided below and the ISR/IPRP/WO is enclosed.

Additional Information

[x] Translations of the foreign-language documents are also enclosed as machine-translations, human-translations, or counterpart applications as noted. Machine translations were provided by the Japanese Patent Office, ESPACENET, Google Documents, Patent Fetcher® /ESPACENET, Google Translate or Google Translator Toolkit as noted and with OCR by Adobe Acrobat 9 or ABBYY PDF Transformer 3 if needed.

[x] English-language abstracts of foreign-language documents are provided.

[x] Documents listed on the enclosed ISR/IPRP/WO or the Office Action have relevance at least as described therein.

[ ] The documents with the following reference numbers were described in the specification of the present application; omission of a reference from this list does not indicate that it was not discussed in the specification of the present application.

[ ] At least one of the references cited in the Office Action listed on the attached PTO-1449 (modified) were previously submitted in an IDS or cited by the Examiner for the present application on _____ and therefore are not submitted in this IDS.

[ ] Other:

I hereby certify that this document is being transmitted to the Patent and Trademark Office via electronic filing.

March 4, 2020
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

/ Young Seok Koo 76,255 /

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE *Patent*

Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. and SK TELECOM CO., LTD.	)	***Re.: Preliminary Amendment***
USSN: 16/294,883	)	Group: 2464
Filing Date: March 6, 2019	)	Examiner: NGO, RICKY QUOC
For: "WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME"	)	Our Ref.: B-9905CON 631950-4
	)	Date: September 30, 2019

PRELIMINARY AMENDMENT

Sir:

Prior to examination of the above-identified U.S. patent application, please enter the following amendments and remarks into the prosecution history of the above-identified U.S. patent application without prejudice or disclaimer.

Amendments to the Claims begin on page 2 of this paper

Remarks begin on page 7 of this paper.

AMENDMENTS TO THE CLAIMS

Please amend the claims to read as indicated in the following list of claims:

Listing of claims

1-20. (Canceled).

21. (New) A wireless communication terminal that wirelessly communicates with a base wireless communication terminal, the wireless communication terminal comprising:

a transceiver; and

a processor,

wherein the processor is configured to:

transmit, to the base wireless communication terminal, a trigger-based physical layer protocol data unit (PPDU) using the transceiver,

switch a parameter set, which is a set of parameters used for the channel access, from a first parameter set to a second parameter set based on whether the base wireless communication terminal triggers a multi-user uplink transmission participation of the wireless communication terminal,

set a second parameter set timer based on whether a response to a MAC protocol data unit (MPDU) included in the trigger-based PPDU is received,

when the second parameter set timer expires, terminate an application of the second parameter set, and

access a channel according to a priority of data to be transmitted to the base communication terminal by the wireless communication terminal and the parameter set.

22. (New) The wireless communication terminal of claim 21, wherein the processor is configured to set the second parameter set timer when the response reception ends.

23. (New) The wireless communication terminal of claim 21, wherein the processor is configured to set the second parameter set timer for an access category of an MPDU for which the response is received.

24. (New) The wireless communication terminal of claim 21, wherein the processor is configured to determine when to set the second parameter set timer based on a type of responding requested by the MPDU included in the trigger-based PPDU.

25. (New) The wireless communication terminal of claim 24, wherein when the MPDU included in the trigger-based PPDU does not request an ACK, the processor is configured to set the second parameter set timer when the transmission of the trigger-based PPDU ends.

26. (New) The wireless communication terminal of claim 21, wherein the MPDU included in the trigger-based PPDU is a QoS data frame.

27. (New) The wireless communication terminal of claim 21, wherein the processor is configured to receive a beacon frame from the base wireless communication terminal and obtain information indicating a period of the second parameter set timer from the beacon frame.

28. (New) The wireless communication terminal of claim 21, wherein when switching the parameter set from the first parameter set to the second parameter set, the processor is configured to set the second parameter set timer.

29. (New) The wireless communication terminal of claim 21, wherein the processor is configured to calculate a random integer value within a contention window (CW),

set a backoff timer based on the random integer value, and

access the channel based on the back off timer and a predetermined slot time,

wherein the parameter set comprises a minimum value (CWmin) of the CW and a maximum value (CWmax) of the CW.

30. (New) The wireless communication terminal of claim 21, wherein the processor is configured to calculate a random integer value in a contention window (CW),

set a backoff timer based on the random integer value,

access the channel based on the back off timer and a predetermined slot time, and

if a value of the CW is greater than the maximum value (CWmax) of the CW according to a priority of the data to be transmitted, sets the value of the CW to the CWmax.

31. (New) The wireless communication terminal of claim 21, wherein the processor is configured to operate a plurality of queues that are classified according to an access category of data stored in a queue and performs backoff procedure of accessing a channel based on a time corresponding to a backoff timer in each of the plurality of queues, and

when there is no data stored in the queue and the backoff timer corresponding to the queue is 0, perform no operation at a slot boundary of the backoff timer,

wherein the backoff timer is set based on a random integer value calculated in a contention window (CW), and is reduced when the channel is idle for a predetermined slot time.

32. (New) The wireless communication terminal of claim 31, wherein when there is no data stored in the queue and the backoff timer corresponding to the queue is 0, the processor is configured to maintain the backoff timer to be 0.

33. (New) An operation method of a wireless communication terminal that wirelessly communicates with a base wireless communication terminal, the method comprising:

transmitting a trigger-based physical layer protocol data unit (PPDU) to the base wireless communication terminal using the transceiver;

switching a parameter set, which is a set of parameters used for the channel access, from a first parameter set to a second parameter set based on whether the base wireless communication terminal triggers a multi-user uplink transmission participation of the wireless communication terminal;

setting a second parameter set timer based on whether the response to the MPDU included in the trigger-based PPDU is received;

when the second parameter set timer expires, terminating an application of the second parameter set;

accessing a channel according to a priority of data to be transmitted to the base wireless communication terminal and the parameter set; and

transmitting the data through the channel.

34. (New) The method of claim 33, wherein the setting of the second parameter set timer comprises setting the second parameter set timer when the response reception ends.

35. (New) The method of claim 33, wherein the setting of the second parameter set timer comprises setting the second parameter set timer for an access category of an MPDU for which the response is received.

36. (New) The method of claim 33, wherein the setting the second parameter set timer comprises determining when to set the second parameter set timer based on a type of responding requested by the MPDU included in the trigger-based PPDU.

37. (New) The method of claim 36, wherein the determining when to set the second parameter set timer comprises setting the second parameter set timer when the transmission of the trigger-based PPDU ends when the MPDU included in the trigger-based PPDU does not request an ACK.

38. (New) The method of claim 33, wherein the MPDU included in the trigger-based PPDU is a QoS data frame.

39. (New) The method of claim 33, the method further comprising:

receiving a beacon frame from the base wireless communication terminal; and

obtaining information indicating a period of the second parameter set timer from the beacon frame.

40. (New) The method of claim 33, wherein the switching the parameter set from the first parameter set to the second parameter set comprises

setting the second parameter set timer when the switching the parameter set from the first parameter set to the second parameter set.

REMARKS

In this Preliminary Amendment, claims 1-20 are cancelled and new claims 21-40 are added. No new matter is presented as a result of these amendments.

Amendment of the subject application is respectfully requested.

* * *

No Disclaimers or Disavowals

Although the present communication may include alterations to the application or claims, or may contain characterizations of claim scope or referenced art, the Applicant is not conceding that any previously pending claims are unpatentable in view of the cited reference(s). Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of this application. The Applicant reserves the right to pursue at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure, including subject matter found to be specifically disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent child or related prosecution history shall not reasonably infer that the Applicant has made any disclaimers or disavowals of any subject matter supported by the present application.

I hereby certify that this document is being transmitted to the Patent and Trademark Office via electronic filing.

September 30, 2019
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

/ Young Seok Koo 76,255 /

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Electronic Acknowledgement Receipt

EFS ID:	37326335
Application Number:	16294883
International Application Number:	
Confirmation Number:	6210
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME
First Named Inventor/Applicant Name:	Woojin Ahn
Customer Number:	158747
Filer:	Young Seok Koo/Azatuhi Chinaryan
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-9905CON 631950-4
Receipt Date:	30-SEP-2019
Filing Date:	06-MAR-2019
Time Stamp:	22:35:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2019-09-30_631950_Preliminary_Amendments.pdf	109437 7acb3d6d98fcaf99d7d10dda4ff857bdd2bfb5ab	yes	7

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Preliminary Amendment	1	1
	Claims	2	6
	Applicant Arguments/Remarks Made in an Amendment	7	7
Warnings:			
Information:			
	Total Files Size (in bytes):	109437	

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/294,883	Filing Date 03/06/2019	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	09/30/2019	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0		x $460 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	SLIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/SHARON M WEST/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-9905CON 631950-4	U.S. SERIAL NO. 16/294,883
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. and SK TELECOM CO., LTD.	FILING DATE OR 371 (C) DATE March 6, 2019
		GROUP NO. 2464

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	ISSUE/PUBL. DATE	NAME	CLASS	SUB-CLASS	REMARKS
	1.	2017/0257196	Sept. 7, 2017	Ghosh et al.			
	2.	2017/0310446	Oct. 26, 2017	ASTERJADHI et al.			
	3.	2016/0080115	Mar. 17, 2016	Joshiam et al.			
	4.	2015/0124690	May 7, 2015	MERLIN et al.			
	5.	2017/0272138	Sep. 21, 2017	CHUN et al.			
	6.	2017/0303280	Oct. 19, 2017	CHUN et al.			
	7.	2017/0289911	Oct. 5, 2017	KIM et al.			

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	PUBLICATION DATE	COUNTRY	CLASS	SUB-CLASS	TRANSLATION

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT
	8.	International Preliminary Report on Patentability (Chapter I) issued on March 12, 2019 for PCT/KR2017/009841 and its English translation from WIPO
	9.	Notice of Allowance dated July 10, 2019 for U.S. Patent Application No. 16/233,078
	10.	Non-Final Office Action dated March 18, 2019 for U.S. Patent Application No. 16/233,078

EXAMINER	*DATE CONSIDERED*

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

Applicant's or agent's file reference WILP170086WO	**FOR FURTHER ACTION**	See item 4 below
International application No. PCT/KR2017/009841	International filing date *(day/month/year)* 07 September 2017 (07.09.2017)	Priority date *(day/month/year)* 07 September 2016 (07.09.2016)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.		

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 12 sheets, including this cover sheet.

   In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☒	Box No. VIII	Certain observations on the international application

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44*bis*.3(c) and 93*bis*.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44*bis* .2).

	Date of issuance of this report 12 March 2019 (12.03.2019)
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Authorized officer Kihwan Moon e-mail: pct.team1@wipo.int

Form PCT/IB/373 (January 2004)

PATENT COOPERATION TREATY

TRANSLATION

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	09.01.2018
Applicant's or agent's file reference WILP170086WO	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/KR2017/009841	07.09.2017	07.09.2016

International Patent Classification (IPC) or both national classification and IPC
H04W74/08(2009.01)i, H04W84/12(2009.01)i, H04W74/00(2009.01)i

Applicant
WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I — Basis of the opinion
- ☐ Box No. II — Priority
- ☐ Box No. III — Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV — Lack of unity of invention
- ☒ Box No. V — Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI — Certain documents cited
- ☐ Box No. VII — Certain defects in the international application
- ☒ Box No. VIII — Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/KR	Date of completion of this opinion	Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/237 (cover sheet) (January 2015)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/KR2017/009841

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

☒ the international application in the language in which it was filed

☐ a translation of the international application into _____ , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

a. ☐ forming part of the international application as filed:

☐ in the form of an Annex C/ST.25 text file.

☐ on paper or in the form of an image file.

b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/KR2017/009841

Box No. V **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-20	YES
	Claims	None	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-20	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	None	NO

2. Citations and explanations:

Reference is made to the following documents:

D1: KR 10-2015-0073165 A (LG ELECTRONICS INC.) 30 June 2015

D2: WO 2016-112146 A1 (QUALCOMM INCORPORATED) 14 July 2016

D3: KR 10-2016-0045023 A (NEWRACOM, INC.) 26 April 2016

D4: US 2016-0057657 A1 (NEWRACOM, INC.) 25 February 2016

D5: US 2010-0150116 A1 (JI, Lusheng et al.) 17 June 2010

2.1 Novelty and Inventive Step

2.1.1 Claims 1-14

Document D1, which is the most relevant prior art to the invention as set forth in claim 1, discloses a wireless communication terminal including the feature wherein a wireless device (1900) comprises a processor (1920), a memory (1940), and a radio frequency (RF) unit (1960), and the RF unit (1960) is connected to the processor (1920) to transmit/receive a wireless signal (see D1, paragraphs [0205] and [0206] and figure 19).

Claim 1 only differs from document D1 in that document D1 does not clearly disclose the feature, in claim 1, of

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

"accessing a channel according to the priority of data that a wireless communication terminal will transmit to a base communication terminal", but said difference could be readily derived by a person skilled in the art from the technical feature, in document D1, of defining traffic categories which are transmission priorities and accessing a channel on the basis of the defined traffic categories (see D1, paragraph [0110]). Therefore, the invention as set forth in claim 1 lacks an inventive step in light of document D1 (PCT Article 33(3)).

The additional technical feature in claim 2 is not disclosed in document D1 but could be readily derived from the feature, in document D2, wherein, when a device is not configured to communicate with an AP through multi-user (MU) communication, a first set of EDCA parameters is adjusted, and the first set of EDCA parameters is different from a second set of EDCA parameters to be used for an access to a medium (see D2, claims 3 and 6). Therefore, it would be obvious to a person skilled in the art to combine the invention disclosed in document D1 and the feature disclosed in document D2, and thus the invention as set forth in claim 2 lacks an inventive step (PCT Article 33(3)).

The additional technical features in claims 3-6 are not disclosed in documents D1 and D2 but could be readily derived from the features, in document D3, wherein: when an AP receives a data unit (for example, MPDU) from at least one STA indicated by polling for UL MU transmission (or UL MU triggering), the AP considers that a frame exchange starting by the UL MU polling (or UL MU

Box No. V **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

triggering) is successful (see D3, paragraph [0184]); when a terminal (STA3) receives a CTS frame, the terminal (STA3) sets a NAV timer for a frame transmission period (for example, SIFS + data frame + SIFS + ACK frame) for continuous transmission thereafter, by using duration information included in the CTS frame (see D3, paragraph [0058]); response frames transmitted in a UL MU random access scheme by random STAs which have received a frame which triggers a UL MU random access include a buffer state of a responding STA, an attribute (for example, access category) of UL data, the UL data, or the like (see D3, paragraph [0221]); and an access category-based UL MU random access is performed (see D3, paragraphs [0232] to [0236]). Therefore, it would be obvious to a person skilled in the art to combine the inventions disclosed in documents D1 and D2 and the features disclosed in document D3, and thus the invention as set forth in claims 3-6 lacks an inventive step (PCT Article 33(3)).

The additional technical feature in claim 7 is not disclosed in the cited documents, but "setting a second parameter set timer when transmission of a trigger-based PPDU ends if an MPDU included in the trigger-based PPDU does not request ACK" is merely a simple application of the well-known and commonly used feature, and thus the invention as set forth in claim 7 lacks an inventive step from the combination of documents D1, D2, and D3 (PCT Article 33(3)).

The additional technical feature in claim 8 could be readily derived from the features, in document D3,

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

wherein: an AP receives a data unit (for example, MPDU) from at least one STA indicated by polling for UL MU transmission (or UL MU triggering) (see D3, paragraph [0184]); and a quality of service (QoS) STA performs backoff after an arbitration IFS (AIFS) for an access category (AC) to which a frame belongs elapses, and then transmits the frame (see D3, paragraph [0052]). Therefore, the invention as set forth in claim 8 lacks an inventive step from the combination of documents D1, D2, and D3 (PCT Article 33(3)).

The additional technical feature in claim 9 could be readily derived from the feature, in document D3, wherein, to support a UL MU random access of a TIM STA, an AP broadcasts, to TIM STAs, a frame (for example, UL MU poll request frame) which triggers a UL MU random access (see D3, paragraph [0224]). Therefore, the invention as set forth in claim 9 lacks an inventive step from the combination of documents D1, D2, and D3 (PCT Article 33(3)).

The additional technical feature in claim 10 could be readily derived from the feature, in document D2, wherein a first set of EDCA parameters is different from a second set of EDCA parameters to be used for an access to a medium when a device is not configured to communicate with an AP through MU communication, and the first set of EDCA parameters is adjusted (see D2, claims 3 and 6) and the feature, in document D3, wherein, when the terminal (STA3) receives a CTS frame, the terminal (STA3) sets a NAV timer for a frame transmission period for continuous transmission thereafter, by using duration information

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

included in the CTS frame (see D3, paragraph [0058]). Therefore, the invention as set forth in claim 10 lacks an inventive step from the combination of documents D1, D2, and D3 (PCT Article 33(3)).

The additional technical feature in claim 11 could be readily derived from the features, in document D1, wherein: an STA determines a contention window (CW) size by using a random backoff algorithm and performs a backoff procedure (see D1, paragraph [0095]); and the STA can calculate a backoff time for performing the backoff procedure, on the basis of following mathematical formula 6, and with reference to mathematical formula 6, the CW is a value selected between the minimum value of a passive scanning-specific CW and aCWMax (see D1, paragraphs [0160] to [0162]). Therefore, the invention as set forth in claim 11 lacks an inventive step from the combination of documents D1 and D2 (PCT Article 33(3)).

The additional technical feature in claim 12 could be readily derived from the features, in document D1, wherein: an STA determines a CW size by using a random backoff algorithm and performs a backoff procedure (see D1, paragraph [0095]); and the STA can calculate a backoff time for performing the backoff procedure on the basis of the following mathematical formula 6, and with reference to mathematical formula 6, the CW is a value selected between the minimum value of a passive scanning-specific CW and aCWMax (see D1, paragraphs [0160] to [0162]). Therefore, the invention as set forth in claim 12 lacks an inventive step in light of document D1 (PCT Article 33(3)).

Box No. V **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

The additional technical feature in claim 13 could be readily derived from the feature, in document D1, wherein a four ACs-based transmission queue defined in 802.11e MAC can act as an individual EDCA contention entity for a wireless medium access in one STA, and one AC maintains an independent backoff counter with an own AIFS value (see D1, paragraph [0124] and figure 11). Therefore, the invention as set forth in claim 13 lacks an inventive step in light of document D1 (PCT Article 33(3)).

The additional technical feature in claim 14 is not disclosed in the cited documents, but "maintaining a backoff timer corresponding to a queue as 0 when no data is stored in the queue and the backoff timer is 0" is merely a simple application of the well-known and commonly used feature, and thus the invention as set forth in claim 14 lacks an inventive step in light of document D1 (PCT Article 33(3)).

2.1.2 Claims 15-20

Document D1, which is the most relevant prior art to the invention as set forth in claim 15, discloses a method comprising a step of transmitting traffic data through a channel access (see D1, paragraphs [0006] and [0110]). Claim 15 only differs from document D1 in that document D1 does not clearly disclose the feature, in claim 15, of "accessing a channel according to the priority of data to be transmitted to a base wireless communication terminal", but said difference could be readily derived by a person skilled in the art from the technical feature, in document D1, of defining traffic categories

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

which are transmission priorities and accessing a channel on the basis of the defined traffic categories (see D1, paragraph [0110]). Therefore, the invention as set forth in claim 15 lacks an inventive step in the light of document D1 (PCT Article 33(3)).

The additional technical feature in claim 16 is not disclosed in document D1 but could be readily derived from the feature, in document D1, of defining traffic categories which are transmission priorities to determine the priority for accessing a channel on the basis of the defined traffic categories and transmitting traffic data (see D1, paragraph [0110]) and the feature, in document D2, wherein, when a device is not configured to communicate with an AP through MU communication, a first set of EDCA parameters is adjusted, and the first set of EDCA parameters is different from a second set of EDCA parameters to be used for an access to a medium (see D2, claims 3 and 6). Therefore, it would be obvious to a person skilled in the art to combine the invention disclosed in document D1 and the feature disclosed in document D2, and thus the invention as set forth in claim 16 lacks an inventive step (PCT Article 33(3)).

The additional technical features in claims 17-20 are not disclosed in documents D1 and D2 but could be readily derived from the features, in document D3, wherein: when an AP receives a data unit (for example, MPDU) from at least one STA indicated by polling for UL MU transmission (or UL MU triggering), the AP considers that a frame exchange starting by the UL MU polling (or UL MU triggering) is successful (see D3, paragraph [0184]);

Box No. V **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

when the terminal (STA3) receives a CTS frame, the terminal (STA3) sets a NAV timer for a frame transmission period (for example, SIFS + data frame + SIFS + ACK frame) for continuous transmission thereafter, by using duration information included in the CTS frame (see D3, paragraph [0058]); response frames transmitted in a UL MU random access scheme by random STAs which have received a frame which triggers a UL MU random access include a buffer state of a responding STA, an attribute (for example, access category) of UL data, the UL data, or the like (see D3, paragraph [0221]); and an access category-based UL MU random access is performed (see D3, paragraphs [0232] to [0236]). Therefore, it would be obvious to a person skilled in the art to combine the inventions disclosed in documents D1 and D2 and the features disclosed in document D3, and thus the invention as set forth in claims 17-20 lacks an inventive step (PCT Article 33(3)).

2.2 Industrial Applicability

The invention as set forth in claims 1-20 is industrially applicable (PCT Article 33(4)).

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/KR2017/009841

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

1. The wording "the base communication terminal" in claims 1 and 16 is unclear since said wording is not previously defined, and thus claims 1 and 16 do not meet the requirement of PCT Article 6.
(Note: The present international search report and written opinion have been established on the basis of the assumption that "the base communication terminal" is "the base wireless communication terminal".)

2. The wording "the traffic priority" in claim 12 is unclear since said wording is not previously defined, and thus claim 12 does not meet the requirement of PCT Article 6.

3. The wording "the transmission and reception unit" in claim 17 is unclear since said wording is not previously defined, and thus claim 17 does not meet the requirement of PCT Article 6.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

Applicant's or agent's file reference WILP170086WO	**FOR FURTHER ACTION**	See item 4 below
International application No. PCT/KR2017/009841	International filing date *(day/month/year)* 07 September 2017 (07.09.2017)	Priority date *(day/month/year)* 07 September 2016 (07.09.2016)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.		

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 9 sheets, including this cover sheet.

   In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☒	Box No. VIII	Certain observations on the international application

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44*bis*.3(c) and 93*bis*.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44*bis* .2).

	Date of issuance of this report 12 March 2019 (12.03.2019)
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Authorized officer Kihwan Moon e-mail: pct.team1@wipo.int

Form PCT/IB/373 (January 2004)

특허협력조약

발신: 국제조사기관

수신:
임국일

대한민국 06776 서울시 서초구 마방로 48, 2층

PCT

국제조사기관의 견해서

(PCT규칙 43의2.1)

발송일 *(일/월/년)*	2018년 01월 09일 (09.01.2018)
출원인 또는 대리인의 서류참조기호 WILP170086WO	**추가적인 조치** 아래 2를 참조

국제출원번호	국제출원일 *(일/월/년)*	우선일 *(일/월/년)*
PCT/KR2017/009841	2017년 09월 07일 (07.09.2017)	2016년 09월 07일 (07.09.2016)

국제특허분류(IPC)
H04W 74/08(2009.01)i, H04W 84/12(2009.01)i, H04W 74/00(2009.01)i

출원인
주식회사 윌러스표준기술연구소

1. 본 견해서는 다음 기재란에 관한 내용을 포함합니다.

- [x] 제1기재란 견해서의 기초
- [ ] 제2기재란 우선권
- [ ] 제3기재란 신규성, 진보성 및 산업상이용가능성에 관한 견해 부작성
- [ ] 제4기재란 발명의 단일성 결여
- [x] 제5기재란 신규성, 진보성 또는 산업상이용가능성에 관한 견해(PCT규칙 43의2.1(a)(i)), 이를 뒷받침하는 인용문헌 및 설명
- [ ] 제6기재란 특이 인용문헌
- [ ] 제7기재란 국제출원의 흠결
- [x] 제8기재란 국제출원에 관한 의견

2. **추가적인 조치**

국제예비심사가 청구되면, 본 견해서는 국제예비심사기관("IPEA")의 견해서로 간주될 것입니다. 다만, 출원인이 본 기관 이외의 기관을 IPEA로 선택하고, 그 선택된 IPEA가 PCT규칙 66.1의2(b)에 따라 본 국제조사기관의 견해서가 위와 같이 간주되지 않을 것임을 국제사무국에 통보한 경우에는 그러하지 않습니다.

본 견해서가 상기와 같이 IPEA의 견해서로 간주되는 경우, 출원인은 서식 PCT/ISA/220의 발송일로부터 3월 또는 우선일부터 22월 중 늦게 만료되는 날 이전에 의견서 및 보정서(해당하는 경우)를 IPEA에 제출할 수 있습니다.

다른 선택사항에 대하여는 서식 PCT/ISA/220에 대한 안내문을 참조하십시오.

ISA/KR의 명칭 및 우편주소	본 견해서의 완료일	심사관
대한민국 특허청 (35208) 대전광역시 서구 청사로 189, 4동 (둔산동, 정부대전청사) 팩스번호 +82-42-481-8578	2018년 01월 09일 (09.01.2018)	진상범 전화번호 +82-42-481-8398

서식 PCT/ISA/237 (표지) (2015년 1월)

국제조사기관의 견해서

국제출원번호
PCT/KR2017/009841

제1기재란 본 견해서의 기초

1. **언어**와 관련하여, 본 견해서는 아래에 기초하여 작성되었습니다.

☒ 출원시의 언어로 된 국제출원

☐ 국제조사를 위하여 _____ 로 번역되어 제출된 국제출원의 번역문
(PCT규칙 12.3(a) 및 23.1(b))

2. ☐ 본 견해서는 PCT규칙 91에 따라 당해 기관이 허가하였거나 당해 기관에 통보된 **명백한 잘못의 정정**을 고려하여 작성되었습니다(PCT규칙 43의2.1(a)).

3. ☐ 국제출원에 개시된 핵산염기 및/또는 아미노산 서열과 관련하여, 본 견해서는 아래에 기초하여 작성되었습니다.

a. ☐ 아래의 형태로 출원시 국제출원의 일부를 구성하는 서열목록

☐ 부록 C/ST.25 텍스트 파일

☐ 서면 혹은 이미지 파일

b. ☐ PCT 규칙 13의3.1(a)에 따라 국제출원과 함께 국제조사만을 목적으로 부록 C/ST.25 텍스트 파일의 형태로 제출된 서열목록

c. ☐ 국제조사만을 목적으로 국제출원일 이후에 아래 형태로 제출된 서열목록

☐ 부록 C/ST.25 텍스트 파일 (규칙 13의3.1(a))

☐ 서면 혹은 이미지 파일 (규칙 13의3.1(b) 및 시행세칙 713)

4. ☐ 추가로 서열목록에 대하여 하나 이상의 버전이나 사본이 제출된 경우, 후속 버전 또는 추가된 사본에 기재되어 있는 정보가 출원시 출원의 일부를 구성하는 정보와 동일하거나 또는 출원시의 개시범위를 벗어나지 않는다는 진술서가 제출되었습니다.

5. 추가 의견:

국제조사기관의 견해서

국제출원번호
PCT/KR2017/009841

제5기재란 신규성, 진보성 또는 산업상이용가능성에 관한 견해(PCT규칙 43의2.1(a)(i)), 이를 뒷받침하는 인용문헌 및 설명

1. 견해

신규성 (N)	청구항	1-20	있음
	청구항	없음	없음
진보성 (IS)	청구항	없음	있음
	청구항	1-20	없음
산업상 이용가능성 (IA)	청구항	1-20	있음
	청구항	없음	없음

2. 인용문헌 및 설명:

참고한 인용문헌은 다음과 같습니다.

D1: KR 10-2015-0073165 A (엘지전자 주식회사) 2015.06.30
D2: WO 2016-112146 A1 (QUALCOMM INCORPORATED) 2016.07.14
D3: KR 10-2016-0045023 A (뉴라컴 인코포레이티드) 2016.04.26
D4: US 2016-0057657 A1 (NEWRACOM, INC.) 2016.02.25
D5: US 2010-0150116 A1 (LUSHENG JI 등) 2010.06.17

2.1 신규성 및 진보성
2.1.1 청구항 제1항-제14항
청구항 제1항에 기재된 발명과 가장 근접한 인용문헌 D1에는 무선장치(1900)가 프로세서(1920), 메모리(1940) 및 RF부(radio frequency unit, 1960)를 포함하고, 상기 RF부(1960)는 프로세서(1920)와 연결하여 무선신호를 송신/수신하는 것(D1: 단락 [0205]-[0206]; 및 도면 19 참조)을 포함하는 무선 통신 단말이 제시되어 있습니다.
다만, 청구항 제1항의 특징인 '무선 통신 단말이 베이스 통신 단말에게 전송할 데이터의 우선도에 따라 채널에 액세스하는 것'이 상기 인용문헌 D1에 명시적으로 기재되어 있지 않다는 점에서 차이가 있으나, 이러한 차이는 통상의 지식을 가진 자에게 상기 인용문헌 D1의 전송 우선 순위인 트래픽 카테고리(traffic categories)를 정의하여 이를 기반으로 채널에 액세스를 수행하는 것(D1: 단락 [0110] 참조)의 기술적 특징으로부터 용이하게 도출 가능합니다. 따라서 청구항 제1항에 기재된 발명은 인용문헌 D1에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제2항에 추가된 기술적 특징은 인용문헌 D1에는 제시되어 있지 않으나, 인용문헌 D2의 장치가 MU(다중 사용자) 통신을 통해 AP와 통신하도록 구성되지 않은 경우 제1세트의 EDCA 파라미터로 조정하고, 이는 매체에 대한 액세스를 위해 사용되는 EDCA 파라미터의 제2세트와는 다른 것(D2: 청구항 3, 6 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 인용문헌 D1에 기재된 발명과 인용문헌 D2에 기재된 상기 특징을 결합하는 것은

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제8기재란 국제출원에 관한 의견

청구범위, 발명의설명 및 도면의 명료성에 관하여 또는 청구범위가 발명의설명에 의하여 충분히 뒷받침되고 있는지에 관하여 다음과 같은 의견을 제시합니다.

1. 청구항 제1항 및 제16항의 '상기 베이스 통신 단말'은 이전에 정의되어 있지 않아 불명확하므로, 청구항 제1항 및 제16항은 PCT 제6조의 요건을 충족시키지 않습니다.
(Note: 본 국제조사 보고서 및 견해서에서는 '상기 베이스 통신 단말'이 '상기 베이스 무선 통신 단말'인 것으로 가정하여 작성되었습니다.)

2. 청구항 제12항의 '상기 트래픽의 우선도'는 이전에 정의되어 있지 않아 불명확하므로, 청구항 제12항은 PCT 제6조의 요건을 충족시키지 않습니다.

3. 청구항 제17항의 '상기 송수신부'는 이전에 정의되어 있지 않아 불명확하므로, 청구항 제17항은 PCT 제6조의 요건을 충족시키지 않습니다.

추가 기재란

이전 기재란의 공간이 충분하지 아니한 경우.
제5 기재란의 연속

통상의 지식을 가진자에게 자명하므로, 청구항 제2항에 기재된 발명은 진보성이 없습니다(PCT 제33조(3)).

청구항 제3항-제6항에 추가된 기술적 특징은 인용문헌 D1 및 D2에는 제시되어 있지 않으나, 인용문헌 D3의 AP가 UL MU 전송을 위한 폴링(또는 UL MU 트리거링)에 의해서 지시되는 적어도 하나의 STA으로부터 데이터 유닛(예를 들어, MPDU)을 수신한 경우, AP는 UL MU 폴링(또는 UL MU 트리거링)에 의해서 개시되는 프레임 교환이 성공적인 것으로 간주하는 것(D3: 단락 [0184] 참조), 단말(STA3)은 CTS 프레임을 수신한 경우 CTS 프레임에 포함된 듀레이션 정보를 사용하여 이후에 연속적으로 전송되는 프레임 전송 기간(예를 들어, SIFS + 데이터 프레임 + SIFS + ACK 프레임)에 대한 NAV 타이머를 설정하는 것(D3: 단락 [0058] 참조), UL MU 랜덤 액세스를 트리거하는 프레임을 수신한 임의의 STA들이 UL MU 랜덤 액세스 방식으로 전송하는 응답 프레임에는, 응답하는 STA의 버퍼 상태, UL 데이터의 속성(예를 들어, 액세스 카테고리), 또는 UL 데이터 등이 포함되는 것(D3: 단락 [0221] 참조), 액세스 카테고리 기반 UL MU 랜덤 액세스를 수행하는 것(D3: 단락 [0232]-[0236] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 인용문헌 D1 및 D2에 기재된 발명과 인용문헌 D3에 기재된 상기 특징을 결합하는 것은 통상의 지식을 가진자에게 자명하므로, 청구항 제3항-제6항에 기재된 발명은 진보성이 없습니다(PCT 제33조(3)).

청구항 제7항에 추가된 기술적 특징은 상기 인용문헌들에는 기재되어 있지 않으나, '트리거 기반 PPDU가 포함하는 MPDU가 ACK을 요청하지 않는 경우, 트리거 기반 PPDU의 전송을 종료한 때 제2 파라미터 셋 타이머를 설정하는 것'은 널리 알려진 관용 기술의 단순한 적용에 지나지 않으므로 청구항 제7항에 기재된 발명은 인용문헌 D1, D2 및 D3의 결합에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제8항에 추가된 기술적 특징은 인용문헌 D3의 AP가 UL MU 전송을 위한 폴링(또는 UL MU 트리거링)에 의해서 지시되는 적어도 하나의 STA으로부터 데이터 유닛(예를 들어, MPDU)을 수신하는 것(D3: 단락 [0184] 참조)과 QoS(Quality of Service) STA은 프레임이 속하는 액세스 카테고리(access category, AC)를 위한 AIFS(arbitration IFS) 경과 후 백오프를 수행한 다음 프레임을 전송하는 것(D3: 단락 [0052] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제8항에 기재된 발명은 인용문헌 D1, D2 및 D3의 결합에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제9항에 추가된 기술적 특징은 인용문헌 D3의 TIM STA의 UL MU 랜덤 액세스를

다음 페이지에 계속

추가 기재란

이전 기재란의 공간이 충분하지 아니한 경우.
이전 기재란의 연속

지원하기 위해서, AP는 TIM STA들을 대상으로 UL MU 랜덤 액세스를 트리거하는 프레임(예를 들어, UL MU 폴 요청 프레임)을 브로드캐스트하는 것(D3: 단락 [0224] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제9항에 기재된 발명은 인용문헌 D1, D2 및 D3의 결합에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제10항에 추가된 기술적 특징은 인용문헌 D2의 제 1 세트의 EDCA 파라미터는 장치가 MU(다중 사용자) 통신을 통해 AP와 통신하도록 구성되지 않은 경우 매체에 대한 액세스를 위해 사용되는 EDCA 파라미터의 제 2 세트와 다르며, 상기 제1 세트의 EDCA 파라미터로 조정하는 것(D2: 청구항 3, 6 참조)과, 인용문헌 D3의 단말(STA3)은 CTS 프레임을 수신한 경우 CTS 프레임에 포함된 듀레이션 정보를 사용하여 이후에 연속적으로 전송되는 프레임 전송 기간에 대한 NAV 타이머를 설정하는 것(D3: 단락 [0058] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제10항에 기재된 발명은 인용문헌 D1, D2 및 D3의 결합에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제11항에 추가된 기술적 특징은 인용문헌 D1의 STA은 랜덤 백오프 알고리즘(random backoff algorithm)에 의해서 CW(contention window)의 사이즈를 결정하고 백오프 절차를 수행하는 것(D1: 단락 [0095] 참조)과, STA이 백오프 절차를 수행하기 위한 백오프 타임을 아래의 수학식 6을 기반으로 산출할 수 있으며, 수학식 6을 참조하면, CW는 패시브 스캐닝 특정 경쟁 윈도우의 최소값 및 aCWMax 사이에서 선택되는 값인 것(D1: 단락 [0160]-[0162] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제11항에 기재된 발명은 인용문헌 D1 및 D2의 결합에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제12항에 추가된 기술적 특징은 인용문헌 D1의 STA은 랜덤 백오프 알고리즘(random backoff algorithm)에 의해서 CW(contention window)의 사이즈를 결정하고 백오프 절차를 수행하는 것(D1: 단락 [0095] 참조)과, STA이 백오프 절차를 수행하기 위한 백오프 타임을 아래의 수학식 6을 기반으로 산출할 수 있고으며, 수학식 6을 참조하면, CW는 패시브 스캐닝 특정 경쟁 윈도우의 최소값 및 aCWMax 사이에서 선택되는 값인 것(D1: 단락 [0160]-[0162] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 청구항 제12항에 기재된 발명은 인용문헌 D1에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제13항에 추가된 기술적 특징은 인용문헌 D1의 802.11e MAC에 정의된 4개의 AC 별 전송 큐는 하나의 STA 내에서 무선 매체 액세스를 위해 개별적인 EDCA 경쟁 개체로서 역할을 수행할 수 있고, 하나의 AC는 자신의 AIFS 값을 가지고 독립된 백오프 카운터를 유지하는 것(D1: 단락 [0124]; 및 도면 11 참조)으로부터 용이하게 도출할 수 있습니다.

다음 페이지에 계속

추가 기재란

이전 기재란의 공간이 충분하지 아니한 경우.
이전 기재란의 연속

따라서 청구항 제13항에 기재된 발명은 인용문헌 D1에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제14항에 추가된 기술적 특징은 상기 인용문헌들에는 기재되어 있지 않으나, '큐에 저장된 데이터가 없고, 상기 큐에 해당하는 백오프 타이머가 0인 경우, 상기 백오프 타이머를 0으로 유지하는 것'은 널리 알려진 관용 기술의 단순한 적용에 지나지 않으므로 청구항 제14항에 기재된 발명은 인용문헌 D1에 의해서 진보성이 없습니다(PCT 제33조(3)).

2.1.2 청구항 제15항-제20항
청구항 제15항에 기재된 발명과 가장 근접한 인용문헌 D1에는 채널 액세스를 통해 트래픽 테이터를 전송하는 단계(D1: 단락 [0006], [0110] 참조)를 포함하는 방법이 제시되어 있습니다.
다만, 청구항 제15항의 특징인 '베이스 무선 통신 단말에게 전송할 데이터의 우선도에 따라 채널에 액세스하는 것'이 상기 인용문헌 D1에 명시적으로 기재되어 있지 않다는 점에서 차이가 있으나, 이러한 차이는 통상의 지식을 가진 자에게 상기 인용문헌 D1의 전송 우선 순위인 트래픽 카테고리(traffic categories)를 정의하여 이를 기반으로 채널에 액세스를 수행하는 것(D1: 단락 [0110] 참조)의 기술적 특징으로부터 용이하게 도출 가능합니다. 따라서 청구항 제15항에 기재된 발명은 인용문헌 D1에 의해서 진보성이 없습니다(PCT 제33조(3)).

청구항 제16항에 추가된 기술적 특징은 인용문헌 D1에는 제시되어 있지 않으나, 인용문헌 D1의 전송 우선 순위인 트래픽 카테고리(traffic categories)를 정의하여 이를 기반으로 채널에 액세스를 수행하는 우선 순위를 결정하고, 트래픽 데이터를 전송하는 것(D1: 단락 [0110] 참조)과 인용문헌 D2의 장치가 MU(다중 사용자) 통신을 통해 AP와 통신하도록 구성되지 않은 경우 제1세트의 EDCA 파라미터로 조정하고, 이는 매체에 대한 액세스를 위해 사용되는 EDCA 파라미터의 제2세트와 다른 것(D2: 청구항 3, 6 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 인용문헌 D1에 기재된 발명과 인용문헌 D2에 기재된 상기 특징을 결합하는 것은 통상의 지식을 가진자에게 자명하므로, 청구항 제16항에 기재된 발명은 진보성이 없습니다(PCT 제33조(3)).

청구항 제17항-제20항에 추가된 기술적 특징은 인용문헌 D1 및 D2에는 제시되어 있지 않으나, 인용문헌 D3의 AP가 UL MU 전송을 위한 폴링(또는 UL MU 트리거링)에 의해서 지시되는 적어도 하나의 STA으로부터 데이터 유닛(예를 들어, MPDU)을 수신한 경우, AP는 UL MU 폴링(또는 UL MU 트리거링)에 의해서 개시되는 프레임 교환이 성공적인 것으로

다음 페이지에 계속

추가 기재란

이전 기재란의 공간이 충분하지 아니한 경우.
이전 기재란의 연속

간주하는 것(D3: 단락 [0184] 참조), 단말(STA3)은 CTS 프레임을 수신한 경우 CTS 프레임에 포함된 듀레이션 정보를 사용하여 이후에 연속적으로 전송되는 프레임 전송 기간(예를 들어, SIFS + 데이터 프레임 + SIFS + ACK 프레임)에 대한 NAV 타이머를 설정하는 것(D3: 단락 [0058] 참조), UL MU 랜덤 액세스를 트리거하는 프레임을 수신한 임의의 STA들이 UL MU 랜덤 액세스 방식으로 전송하는 응답 프레임에는, 응답하는 STA의 버퍼 상태, UL 데이터의 속성(예를 들어, 액세스 카테고리), 또는 UL 데이터 등이 포함되는 것(D3: 단락 [0221] 참조), 액세스 카테고리 기반 UL MU 랜덤 액세스를 수행하는 것(D3: 단락 [0232]-[0236] 참조)으로부터 용이하게 도출할 수 있습니다. 따라서 인용문헌 D1 및 D2에 기재된 발명과 인용문헌 D3에 기재된 상기 특징을 결합하는 것은 통상의 지식을 가진 자에게 자명하므로, 청구항 제17항-제20항에 기재된 발명은 진보성이 없습니다(PCT 제33조(3)).

2.2 산업상 이용가능성
청구항 제1항-제20항에 기재된 발명은 산업상 이용가능합니다(PCT 제33조(4)).

Electronic Acknowledgement Receipt

EFS ID:	37125470
Application Number:	16294883
International Application Number:	
Confirmation Number:	6210
Title of Invention:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME
First Named Inventor/Applicant Name:	Woojin Ahn
Customer Number:	158747
Filer:	Young Seok Koo/Azatuhi Chinaryan
Filer Authorized By:	Young Seok Koo
Attorney Docket Number:	B-9905CON 631950-4
Receipt Date:	10-SEP-2019
Filing Date:	06-MAR-2019
Time Stamp:	22:06:06
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2019-09-10_631950_IDS.pdf	151459 04fba930ad82781b5a2471b3d9053dbb8b5dcc82	yes	4

	Multipart Description/PDF files in .zip description			
	Document Description	**Start**	**End**	
	Transmittal Letter	1	3	
	Information Disclosure Statement (IDS) Form (SB08)	4	4	
Warnings:				
Information:				
2	Other Reference-Patent/App/Search documents	Ref1_US16233078_1stOA_3-18-19.pdf	564087 e537362eb06e3d47cd58a1ba9e0c24fe82684c93	no 15
Warnings:				
Information:				
3	Other Reference-Patent/App/Search documents	Ref7_US16233078_NOA_7-10-19.pdf	597064 4022943628829bbb3c01332ed6ab6b5b3af1faee	no 13
Warnings:				
Information:				
4	Other Reference-Patent/App/Search documents	Ref10_PCTKR2017009841_IPRP.pdf	804907 10307c77252bf75ddc28d04d0729e1e773b535ff	no 21
Warnings:				
Information:				
		Total Files Size (in bytes):	2117517	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. and SK TELECOM CO., LTD.	Examiner: NGO, RICKY QUOC
Serial No.: 16/294,883	Art Unit: 2464
Filing or 371 (c) Date: March 6, 2019	Conf. No.: 6210
For: "WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME"	Our Ref: B-9905CON 631950-4
Date: September 10, 2019	Re: ***Information Disclosure Statement***

INFORMATION DISCLOSURE STATEMENT

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir/Madam:

This information disclosure statement is filed in accordance with 37 C.F.R. §§ 1.56, 1.97 and 1.98 to disclose information that may be relevant to the above-identified patent application. The Applicant requests the Examiner consider the documents listed on the enclosed form PTO-1449 (modified) in the examination of this application.

The filing of this Information Disclosure Statement (IDS) shall not be construed as a representation that a search has been made (37 C.F.R. 1.97(g)), an admission that the information cited is, or is considered to be, material to patentability, or that no other material information exists.

The filing of this Information Disclosure Statement shall not be construed as an admission against interest in any manner (37 C.F.R § 1.97(h)).

If any additional fee is required for this filing, the Applicant requests the Examiner contact a practitioner associated with the Customer Number listed below for authorization.

This information disclosure statement also includes the statements marked below. Failure to mark a statement should not be construed as a negative assertion.

Timing and Fees

This IDS is being filed:

[ ] Concurrently with the application, and no fee is due.

[ ] Within three months of the filing of the national application, other than a continued prosecution application under § 1.53(d), and no fee is due.

[ ] Within three months of the date of entry of the national stage as set forth in § 1.491 in an international application, and no fee is due.

[x] Before the mailing of a first Office Action on the merits, and no fee is due.

[ ] Before the mailing of a first Office Action after the filing of a request for continued examination under§ 1.114, and no fee is due.

[ ] After the periods described above, and before a final Office Action under § 1.113, a Notice of Allowance under § 1.311, or an action that otherwise closes prosecution in the application, and is

- [ ] accompanied by the fee set forth in § 1.17(p), or
- [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(1): That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement; or
- [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(2): That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of the information disclosure statement.

[ ] After the periods described above, and is accompanied by the fee set forth in § 1.17(p), and is

- [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(1), that each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement; or

- [ ] filed with the statement set forth in 37 C.F.R. 1.97(e)(2), that no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of the information disclosure statement.

[ ] Concurrently with a Request for Continued Examination, and no additional fee is due for this IDS.

Items Disclosed

At least one item listed on the enclosed form PTO-1449 (modified) was

[x] Cited in an Office Action for a related application, the application number of the related application and the issue date of the Office Action are provided below and the Office Action is enclosed.

Notice of Allowance dated July 10, 2019 and Non-Final Office Action dated March 18, 2019 for U.S. Patent Application No. 16/233,078

[x] Cited in an International Search Report (ISR) or an International Preliminary Report on Patentability (IPRP) or a Written Opinion (WO) of the International Searching Authority (ISA) for the related PCT Application, the PCT application number and the issue date of the ISR/IPRP/WO are provided below and the ISR/IPRP/WO is enclosed.

International Preliminary Report on Patentability (Chapter I) issued on March 12, 2019 for PCT/KR2017/009841

Additional Information

[x] Translations of the foreign-language documents are also enclosed as machine-translations, human-translations, or counterpart applications as noted. Machine translations were provided by the Japanese Patent Office, ESPACENET, Google Documents, Patent Fetcher® /ESPACENET, Google Translate or Google Translator Toolkit as noted and with OCR by Adobe Acrobat 9 or ABBYY PDF Transformer 3 if needed.

[ ] English-language abstracts of foreign-language documents are provided.

[x] Documents listed on the enclosed ISR/IPRP/WO or the Office Action have relevance at least as described therein.

[ ] The documents with the following reference numbers were described in the specification of the present application; omission of a reference from this list does not indicate that it was not discussed in the specification of the present application.

[x] At least one of the references cited in the Office Action listed on the attached PTO-1449 (modified) were previously submitted in an IDS or cited by the Examiner for the present application on March 6, 2019 and therefore are not submitted in this IDS.

[ ] Other:

I hereby certify that this document is being transmitted to the Patent and Trademark Office via electronic filing.

September 10, 2019
(Date of Transmission)

Azatuhi Chinaryan
(Name of Person Transmitting)

/ Azatuhi Chinaryan /
(Signature)

Respectfully submitted,

/ Young Seok Koo 76,255 /

Young Seok Koo
Attorney for Applicant
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4525 Wilshire Blvd., Suite 240
Los Angeles, CA 90010
(323) 934-2300 voice

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/294,883	03/06/2019	Woojin Ahn	B-9905CON 631950-4

CONFIRMATION NO. 6210

158747
LADAS & PARRY
E-MAIL
4525 Wilshire Boulevard
Suite 240
LOS ANGELES, CA 90010

PUBLICATION NOTICE



Title:WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME

Publication No.US-2019-0208571-A1
Publication Date:07/04/2019

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/294,883

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*			OR	x 100 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*				x 460 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1720

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/294,883	03/06/2019	2642	1720	B-9905CON 631950-4	20	2

CONFIRMATION NO. 6210

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LOS ANGELES, CA 90036-5679

FILING RECEIPT

OC000000106786571

Date Mailed: 03/25/2019

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Woojin Ahn, Gyeonggi-do, KOREA, REPUBLIC OF;
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SK TELECOM CO., LTD., Seoul, KOREA, REPUBLIC OF;

Power of Attorney: The patent practitioners associated with Customer Number 158747

Domestic Priority data as claimed by applicant

This application is a CON of PCT/KR2017/009841 09/07/2017

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
REPUBLIC OF KOREA 10-2016-0114822 09/07/2016 No Access Code Provided
REPUBLIC OF KOREA 10-2016-0116877 09/10/2016 No Access Code Provided
REPUBLIC OF KOREA 10-2016-0116965 09/12/2016 No Access Code Provided
REPUBLIC OF KOREA 10-2016-0117898 09/13/2016 No Access Code Provided
REPUBLIC OF KOREA 10-2016-0122488 09/23/2016 No Access Code Provided
REPUBLIC OF KOREA 10-2016-0147189 11/06/2016 No Access Code Provided
REPUBLIC OF KOREA 10-2017-0022227 02/20/2017 No Access Code Provided

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 03/21/2019
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/294,883**
Projected Publication Date: 07/04/2019
Non-Publication Request: No
Early Publication Request: Yes
Title

WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME

Preliminary Class

455

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative,

this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop

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PTO/SB/80 (11-08)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 158747

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☑ The address associated with Customer Number: 158747

OR

☐ Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address:

WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.
5F 216 Hwangsaeul-ro Bundang-gu
Seongnam-si, Gyeonggi-do, 13595 Republic of Korea

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	Nov. 22. 2018
Name	JIN SAM KWAK	Telephone	82-10-8623
Title	CEO		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2

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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 158747

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☑ The address associated with Customer Number: 158747

OR

☐ Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address:

SK TELECOM CO., LTD.
65, Eulji-ro, Jung-gu
Seoul 04539 Republic of Korea

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature	B S Shin	Date	Nov. 21, 2019.
Name	Bum Soo SHIN	Telephone	82-2-6100-3465
Title	Director of IPR		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.

Application No./Patent No.: _____ Filed/Issue Date: _____

Titled: WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME

WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC., a INSTITUTE

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☐ The assignee of the entire right, title, and interest.

2. ☑ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☑ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   SK TELECOM CO., LTD.

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____

   The document was recorded in the United States Patent and Trademark Office at

   Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____

   The document was recorded in the United States Patent and Trademark Office at

   Reel _____, Frame _____, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

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Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

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5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Young Seok Koo 76,255/	March 6, 2019
Signature	Date
YOUNG SEOK KOO	76,255
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. & SK TELECOM CO., LTD.

Application No./Patent No.: _____ Filed/Issue Date: _____

Titled: WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME

SK TELECOM CO., LTD., a CORPORATION

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☐ The assignee of the entire right, title, and interest.

2. ☑ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☑ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

   1. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached.

   2. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Young Seok Koo 76,255/	March 6, 2019
Signature	Date
YOUNG SEOK KOO	76,255
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Client Ref: WILP-170086-US
Wilus Ref: FNHEWW-170023-US
Our Ref: B-9905CON 631950-4

ASSIGNMENT

WHEREAS, I/we, Woojin AHN of Gyeonggi-do, Republic of Korea, Juhyung SON of Gyeonggi-do, Republic of Korea, Geonjung KO of Gyeonggi-do, Republic of Korea, and Jinsam KWAK of Gyeonggi-do, Republic of Korea ("Assignor"), am/are the inventor(s) of an invention entitled "WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME" that is the subject matter of: (check all that apply)

[x] an application for Letters Patent which claims the priority to Korean Patent Application No. 10-2016-0114822 filed on September 7, 2016,

[x] an application for Letters Patent which claims the priority to Korean Patent Application No. 10-2016-0116877 filed on September 10, 2016,

[x] an application for Letters Patent which claims the priority to Korean Patent Application No. 10-2016-0116965 filed on September 12, 2016,

[x] an application for Letters Patent which claims the priority to Korean Patent Application No. 10-2016-0117898 filed on September 13, 2016,

[x] an application for Letters Patent which claims the priority to Korean Patent Application No. 10-2016-0122488 filed on September 23, 2016,

[x] an application for Letters Patent which claims the priority to Korean Patent Application No. 10-2016-0147189 filed on November 6, 2016,

[x] an application for Letters Patent which claims the priority to Korean Patent Application No. 10-2017-0022227 filed on February 20, 2017,

[x] an application made under the Patent Cooperation Treaty which is identifiable at WIPO by or claiming the benefit of or priority to Application No. PCT/KR2017/009841 filed on September 7, 2017,

[x] an application for Letters Patent which is identifiable in the Patent Office of _____ by Application No. _____ filed on _____;

WHEREAS, (1) WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC., an institute organized and existing under the laws of Republic of Korea ("Assignee"), and having offices at 5F 216 Hwangsaeul-ro Bundang-gu Seongnam-si Gyeonggi-do 13595 Republic of Korea and (2) SK TELECOM CO., LTD., a corporation organized and existing under the laws of Republic of Korea ("Assignee"), and having offices at 65, Eulji-ro Jung-gu Seoul 04539, Republic of Korea, are desirous of acquiring the entire right, title and interest in and to the invention, the applications, and any and all Letters Patent or similar foreign or domestic legal protection

[x] in the United States
[ ] in all other countries or jurisdictions;

"NOW THEREFORE, for good and valuable consideration, the receipt and adequacy of which is hereby acknowledged,

a) Assignors agree to transfer, and
b) Assignors do hereby transfer,

to Assignee, its successors and assigns, effective as of September 7, 2016, *nunc pro tunc*, Assignors' entire right, title and interest in the above-named countries and jurisdictions in and to the following including the right to sue for past infringement: the invention, the above-identified applications, all applications from which any of the above-identified applications claim priority, corresponding U.S. and non-U.S. applications, any continuation, continuation-in-part, division, renewal, or substitute for the applications, all Letters Patent for the applications, any reissue, re-examination, or similar legal protection issuing related to the Letters Patent, and all rights and benefits under any applicable treaty or convention, and Assignors authorize the Director of the United States Patent and Trademark Office or foreign equivalent to issue the Letters Patent or similar legal protection to the Assignee.

Assignors authorize the U.S. attorneys handling the above application(s) or patent(s) for the invention and the Assignee, its successors and assigns, to insert in this instrument the filing date(s), and application and patent number(s) when ascertained, for the above applications and patents and to insert any necessary missing titles. Assignors further authorize the Assignee, its successors and assigns, or anyone it may properly designate, to apply for Letters Patent or similar legal protection in its own name if desired, in the above-named countries and jurisdictions and appoint Assignee the common representative in the above-identified international application and any international application for the invention.

Assignors represent to the Assignee, its successors and assigns, that Assignors shall not execute any writing or do any act whatsoever conflicting with this Assignment. Assignors, its executors or administrators, will at any time upon request, without additional consideration, but at the reasonable expense of the Assignee, its successors and assigns, execute and deliver to Assignee or its legal representatives such additional writings and do such additional acts as the Assignee, its successors and assigns, may deem desirable to perfect its enjoyment of this grant, and render all assistance in making application for and obtaining, maintaining, and enforcing the Letters Patent or similar legal protection on the invention in any and all countries and jurisdictions, including without limitation providing testimony in any related interference, litigation or proceeding. To the extent that Assignors, its executors or administrators are unable or unavailable to execute and deliver to Assignee or its legal representatives such additional writings and do such additional acts as Assignee, its successors and assigns may deem desirable to perfect its enjoyment of this grant, and render all assistance in making application for and obtaining, maintaining, and enforcing the Letters Patent or similar legal protection on the invention in any and all countries and jurisdictions, Assignors, our executors or administrators hereby authorize Assignee, its successors and assigns to act on Assignors' behalf.

If any provision of this Assignment is held unenforceable or in conflict with the law of any jurisdiction, the validity of the remaining provisions will not be affected by such holding and the part held unenforceable in or in conflict with the law of one jurisdiction will remain in effect for other jurisdictions until held unenforceable or in conflict with the law of that jurisdiction.

Assignors and Assignee hereby irrevocably waive and agree not to assert in any suit, action, or proceeding, any claim that it is not personally subject to the jurisdiction of any such court, that such suit, action, or proceeding is brought in an inconvenient forum or that the venue of such suit, action or proceeding is improper. Each party hereby irrevocably waives personal service of process and consents to process being served in any such suit, action or proceeding by mailing a copy thereof (certified or registered mail, return receipt requested, or any foreign equivalent of such mail service if the address in effect for notices is in a foreign country or territory) to such party at the address in effect for notices to it under this assignment and agrees that such service shall constitute good and sufficient service of process and notice thereof. Nothing contained herein shall be deemed to limit in any way any right to serve process in any manner permitted by law.

Assignors agree not to take any action, or to assist or request any third party in challenging or opposing Assignee's rights granted hereunder. Assignors further acknowledge that Assignee's patent counsel does not represent Assignors personally and acknowledge that Assignors have the right to seek independent counsel.

Woojin AHN

(Inventor / Assignor)

Feb. 20. 2019

Date

Juhyung SON

(Inventor / Assignor)

Feb 20 2019

Date

Geonjung KO

(Inventor / Assignor)

Feb 20, 2019

Date

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Feb. 20. 2019

Date

Form PTO-1449 (Modified) Page 1 of 1	ATTY DOCKET NO. B-9905CON 631950-4	U.S. SERIAL NO. N/A
LIST OF PATENTS AND PUBLICATIONS STATEMENT	APPLICANT WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC. et al.	FILING DATE Concurrently Herewith
		GROUP NO. N/A

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	ISSUE/PUBL. DATE	NAME	CLASS	SUB-CLASS	REMARKS
	1.	2016/0057657	Feb. 25, 2016	SEOK			
	2.	2010/0150116	Jun. 17, 2010	Ji et al.			

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT NUMBER	PUBLICATION DATE	COUNTRY	CLASS	SUB-CLASS	TRANSLATION
	3.	10-2015-0073165	Jun. 30, 2015	KR			KIPRIS
	4.	2016/112146	Jul. 14, 2016	WO			
	5.	10-2016-0045023	Apr. 26, 2016	KR			KIPRIS
	6.	2018/048229	Mar. 15, 2018	WO			Espacenet

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

EXAMINER INITIAL	REFERENCE NUMBER	DOCUMENT
	7.	International Search Report for PCT/KR2017/009841 mailed on January 9, 2018 and its English translation from WIPO (now published as WO 2018/048229)
	8.	Written Opinion of the International Searching Authority for PCT/KR2017/009841 mailed on January 9, 2018 and its English translation by Google Translate (now published as WO 2018/048229)
	9.	Laurent Cariou et al., "Motivation: Improving HE STAs UL performance", IEEE 802.11-16/0998r0, July 2016, Slides 1-21 created on created on July 25, 2016
	10.	Laurent Cariou et al., "Motivation: Improving HE STAs UL performance", IEEE 802.11-16/0998r1, July 2016, Slides 1-33 created on July 25, 2016
	11.	Laurent Cariou et al., "Motivation: Improving HE STAs UL performance", IEEE 802.11-16/0998r2, July 2016, Slides 1-32 created on September 12, 2016
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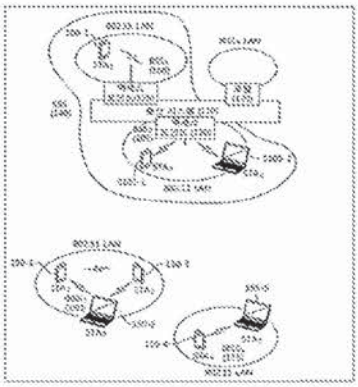
EXAMINER	*DATE CONSIDERED*

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

무선랜에서 채널 엑세스 방법 및 장치

METHOD AND APPARATUS FOR ACCESSING CHANNEL IN WIRELESS LAN

(51) Int. CL	H04W 74/08(2019.01.01) H04W 48/14(2009.01.01) H04W 84/12 (2009.01.01) H04W 72/04(2009.01.01) H04W 74/00(2009.01.01)
(52) CPC	H04W 74/0808(2013.01) H04W 48/14(2013.01) H04W 84/12(2013.01) H04W 72/0406(2013.01) H04W 74/008(2013.01)
(21) Application No.(Date)	1020157007891 (2013.10.16)
(71) Applicant	LG Electronics Inc.
Translation submission Date	(2015.03.27)
(11) Registration No.(Date)	
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(11) Publication No.(Date)	
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Legal Status	Withdrawn
Examination Status	Withdrawal (No request for examination)
Trial Info	
Kind	International Application / New Application
Right of Org. Application No.(Date)	
Related Application No.	
Request for an examination(Date)	N
Number of examination claims	16



Abstract in Korean (Translation) In the wireless LAN, channel access method and apparatus are disclosed. The channel access method of the STA (station) comprises the step that STA receives the access distribution element through the passive scanning frame, the step that STA selects the access random variable out based on the access distribution element, and the step that STA determines the minimum value of the passive scanning specific contention window based on the access random variable and the step of performing the channel access based on the backoff time which STA determines based on the minimum value of the passive scanning specific contention window.

Bibliographic Data

Int.Cl.	H04W 74/08 | H04W 48/14 | H04W 72/04 | H04W 74/00 | H04W 84/12
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Application Date	20131016
Unexamined Publication No.	1020150073165
Unexamined Publication Date	20150630
Priority Claims	61/714,231 | 20121016 | US
Agent.	Envision Patent & Law Firm
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Applicant	LG Electronics Inc.

발명의 명칭

무선랜에서 채널 액세스 방법 및 장치

Title of Invention

METHOD AND APPARATUS FOR ACCESSING CHANNEL IN WIRELESS LAN

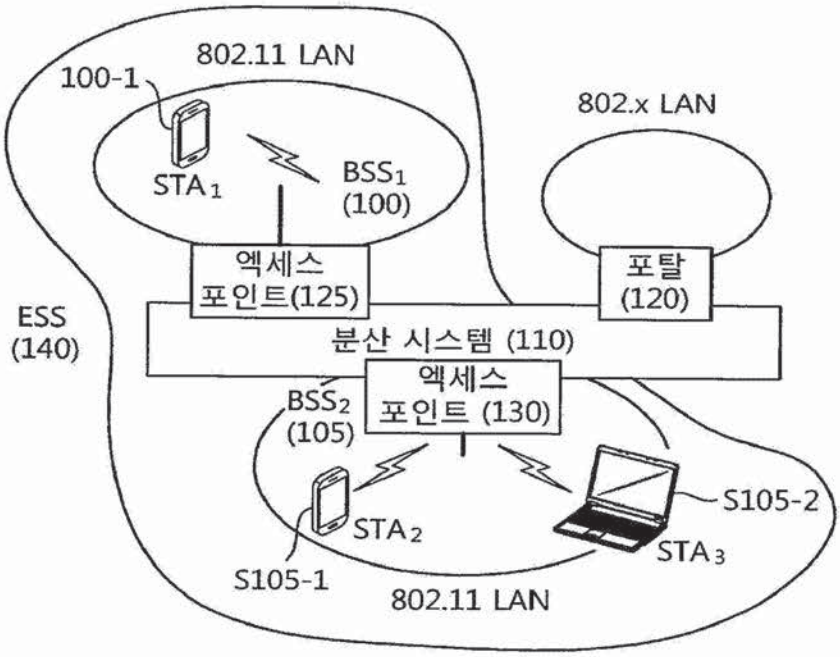
요약

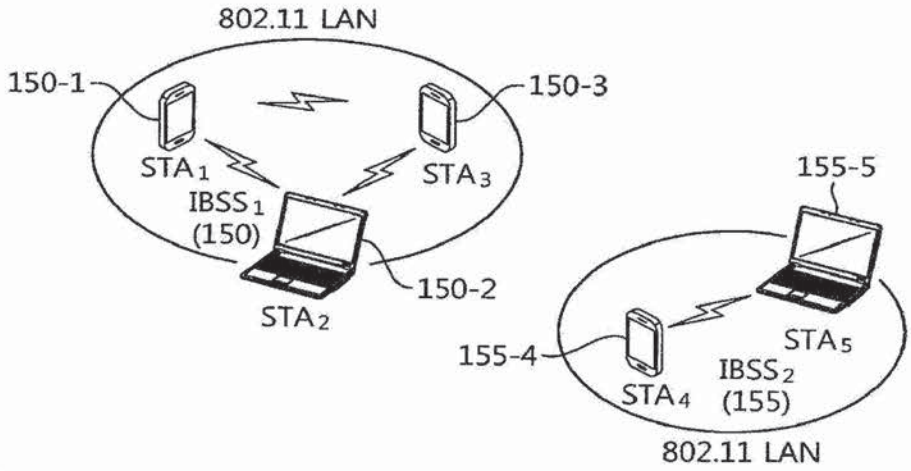
무선랜에서 채널 액세스 방법 및 장치가 개시되어 있다. STA (station)의 채널 액세스 방법은 STA이 패시브 스캐닝 프레임을 통해 액세스 분배 요소를 수신하는 단계, STA이 액세스 분배 요소를 기반으로 액세스 랜덤 변수를 선택하는 단계, STA이 액세스 랜덤 변수를 기반으로 패시브 스캐닝 특정 경쟁 윈도우의 최소값를 결정하는 단계와 STA이 패시브 스캐닝 특정 경쟁 윈도우의 최소값을 기반으로 결정한 백오프 타임을 기반으로 채널 액세스를 수행하는 단계를 포함할 수 있다.

Abstract

In the wireless LAN, channel access method and apparatus are disclosed. The channel access method of the STA (station) comprises the step that STA receives the access distribution element through the passive scanning frame, the step that STA selects the access random variable out based on the access distribution element, and the step that STA determines the minimum value of the passive scanning specific contention window based on the access random variable and the step of performing the channel access based on the backoff time which STA determines based on the minimum value of the passive scanning specific contention window.

대표도면(Representative drawing)





청구의 범위

청구 **1**항**:**

STA(station)의 채널 액세스 방법에 있어서,

상기 STA이 패시브 스캐닝 프레임을 통해 액세스 분배 요소를 수신하는 단계;

상기 STA이 상기 액세스 분배 요소를 기반으로 액세스 랜덤 변수를 선택하는 단계;

상기 STA이 상기 액세스 랜덤 변수를 기반으로 패시브 스캐닝 특정 경쟁 윈도우의 최소값을 결정하는 단계; 및

Scope of Claims

Claim 1:

The channel access method of the STA (station), wherein the channel access method including the step of performing the channel access based on the backoff time which the step :

that the step :

STA in which the step :

STA in which

상기 STA이 상기 패시브 스캐닝 특정 경쟁 윈도우의 최소값을 기반으로 결정한 백오프 타임을 기반으로 채널 액세스를 수행하는 단계를 포함하는 채널 액세스 방법.

STA receives the access distribution element through t he passive scanning frame selects the access random variable out based on the access distribution element d etermines the minimum value of the passive scanning s pecific contention window based on the access random variable and STA determine based on the minimum valu e of the passive scanning specific contention window.

청구 **2**항:

제1항에 있어서,

상기 패시브 스캐닝 특정 경쟁 윈도우의 최소값은 상기 액세스 랜덤 변수에 미리 결정된 기본 경쟁 윈도우 최소값을 곱한 값이고

상기 백오프 타임은 랜덤 변수를 기반으로 산출되고,

상기 랜덤 변수는 상기 패시브 스캐닝 특정 경쟁 윈도우의 최소값을 최소 범위로 설정한 구간에서 결정되는 값인 채널 액세스 방법.

Claim 2:

As for claim 1, the channel access method which is the value in which the minimum value of

passive scanning specific contention window multiplies the access random variable by the predetermined basis contention window minimum value and the backoff time is calculated based on the random variable ; and is the value
determined on section in which

random variable sets up the minimum value of the passi ve scanning specific contention window as the minimu m range.

청구 **3**항:

제2항에 있어서,

상기 백오프 타임은 아래와 같이 결정되고,

Claim 3:

As for claim 2, the channel access method which

backoff time is determined like the lower part ;

상기 aSlotTime은 단위 시간이고, 상기 Random은 랜덤 함수이고, 상기 aCWMax는 상기 aSlotTime 단위의 상기 CW의 최대값이고 상기 패시브 스캐닝 특정 경쟁 윈도우 최소값은 상기 aSlotTime 단위의 상기 CW의 최소값이고, 상기 CW는 상기 패시브 스캐닝 특정 경쟁 윈도우의 최소값 및 상기 aCWMax 사이에서 선택되는 값인 채널 액세스 방법.

aSlotTime is the unit time ; the Random is the random f unction ; the aCWMax is the maximum value of CW of t he aSlotTime unit and the passive scanning specific co ntention window minimum value is the minimum value of CW of the aSlotTime unit ; and is the value in which C W is selected between the minimum value and aCWMax of the passive scanning specific contention window.

청구 **4**항:

제1항에 있어서,

상기 STA이 상기 액세스 랜덤 변수를 기반으로 채널 접속을 위한 인터 프레임 심볼수를 결정하는 단계를 더 포함하고,

상기 백오프 타임은 상기 결정된 인터 프레임 심볼수에 해당하는 기간 동안 채널이 아이들한 경우 감소되는 채널 액세스 방법.

Claim 4:

As for claim 1, the channel access method it further includes the step that

STA determines the P-frame number of symbols for the channel connection based on the access random variab le ; and for being reduced for the period when

backoff time corresponds to the above-mentioned dete rmined P-frame number of symbols in case the channel is idle.

청구 **5**항:

제**4**항에 있어서,

상기 인터 프레임 심볼수는 상기 액세스 랜덤 변수에 미리 결정된 AIFSN(arbitration inter-frame space number)을 곱한 값인 채널 액세스 방법.

Claim 5:

As for claim 4, the channel access method which is the value in which

P-frame number of symbols multiplies the access rando m variable by the predetermined AIFSN (arbitration inte r-frame space number).

청구 **6**항:

제1항에 있어서,

Claim 6:

As for claim 1,

상기 패시브 스캐닝 프레임은 비콘 프레임, FILS(fast initial link setup) 탐색 프레임 또는 측정 파일롯 프레임 중 하나인 채널 액세스 방법.

passive scanning frame is the beacon frame, and the FILS (fast initial link setup) search frame or the channel access method which is one among the measurement pilot frame.

청구 **7**항:

Claim 7:

제1항에 있어서,

상기 액세스 랜덤 변수는 상기 액세스 분배 요소보다 작은 값으로 선택되는 값인 채널 액세스 방법.

As for claim 1, the channel access method which is the value in which

access random variable is selected as the value smaller than the access distribution element.

청구 **8**항:

Claim 8:

제1항에 있어서,

상기 액세스 분배 요소는 N(여기서, N은 정수값)을 지시하고,

상기 N은 상기 패시브 스캐닝 프레임을 전송하는 AP(access point)의 부하를 기반으로 결정되는 값인 채널 액세스 방법.

As for claim 1, the channel access method which

access distribution element indicates N (here, N is the integer value) ; and is the value determined based on the load of the AP (access point) in which

N transmits the passive scanning frame.

청구 **9**항:

Claim 9:

무선랜에서 동작하는 STA(station)에 있어서, 상기 STA은

무선 신호를 송신 및 수신하는 RF(radio frequency)부; 및

상기 RF부와 선택적으로 연결되는 프로세서를 포함하되,

상기 프로세서는 패시브 스캐닝 프레임을 통해 액세스 분배 요소를 수신하고, 상기 액세스 분배 요소를 기반으로 액세스 랜덤 변수를 선택하고, 상기 액세스 랜덤 변수를 기반으로 패시브 스캐닝 특정 경쟁 윈도우의 최소값를 결정하고, 상기 패시브 스캐닝 특정 경쟁 윈도우의 최소값을 기반으로 결정한 백오프 타임을 기반으로 채널 액세스를 수행하도록 구현되는 STA.

STA which *** includes the processor selectively connected to the RF (radio frequency) part :

and RF part the STA

radio signal as to the STA (station) operating in the wireless LAN ;

processor receives the access distribution element through the passive scanning frame ; it selects the access random variable out based on the access distribution element ; it determines the minimum value of the passive scanning specific contention window based on the access random variable ; and is implemented in order to perform the channel access based on the backoff time which determines based on the minimum value of the passive scanning specific contention window.

청구 **10**항:

Claim 10:

제9항에 있어서,

상기 패시브 스캐닝 특정 경쟁 윈도우의 최소값은 상기 액세스 랜덤 변수에 미리 결정된 기본 경쟁 윈도우 최소값을 곱한 값이고

상기 백오프 타임은 랜덤 변수를 기반으로 산출되고,

상기 랜덤 변수는 상기 패시브 스캐닝 특정 경쟁 윈도우의 최소값을 최소 범위로 설정한 구간에서 결정되는 값인 STA.

As for claim 9, STA which is the value in which the minimum value of

passive scanning specific contention window multiplies the access random variable by the predetermined basis contention window minimum value and the backoff time is calculated based on the random variable ; and is the value
determined on section in which

random variable sets up the minimum value of the passive scanning specific contention window as the minimum range.

청구 **11**항:

Claim 11:

제10항에 있어서,

상기 백오프 타임은 아래와 같이 결정되고,

As for claim 10, STA which

backoff time is determined like the lower part ;

상기 aSlotTime은 단위 시간이고, 상기 Random은 랜덤 함수이고, 상기 aCWMax는 상기 aSlotTime 단위의 상기 CW의 최대값이고 상기 패시브 스캐닝 특정 경쟁 윈도우 최소값은 상기 aSlotTime 단위의 상기 CW의 최소값이고, 상기 CW는 상기 패시브 스캐닝 특정 경쟁 윈도우의 최소값 및 상기 aCWMax 사이에서 선택되는 값인 STA.

aSlotTime is the unit time ; the Random is the random function ; the aCWMax is the maximum value of CW of the aSlotTime unit and the passive scanning specific contention window minimum value is the minimum value of CW of the aSlotTime unit ; and is the value in which CW is selected between the minimum value and aCWMax of the passive scanning specific contention window.

청구 **12**항:

제9항에 있어서, 상기 프로세서는,

상기 STA이 상기 액세스 랜덤 변수를 기반으로 채널 접속을 위한 인터 프레임 심볼수를 결정하도록 구현되고,

상기 백오프 타임은 상기 결정된 인터 프레임 심볼수에 해당하는 기간 동안 채널이 아이들한 경우 감소되는 STA.

Claim 12:

As for claim 9, STA which the processor is implemented so that

STA determines the P-frame number of symbols for the channel connection based on the access random variable ; and is reduced for the period when

backoff time corresponds to the above-mentioned determined P-frame number of symbols in case the channel is idle.

청구 **13**항:

제12항에 있어서,

상기 인터 프레임 심볼수는 상기 액세스 랜덤 변수에 미리 결정된 AIFSN(arbitration inter-frame space number)을 곱한 값인 STA.

Claim 13:

As for claim 12, STA which is the value in which

P-frame number of symbols multiplies the access random variable by the predetermined AIFSN (arbitration inter-frame space number).

청구 **14**항:

제9항에 있어서,

상기 패시브 스캐닝 프레임은 비콘 프레임, FILS(fast initial link setup) 탐색 프레임 또는 측정 파일롯 프레임 중 하나인 STA.

Claim 14:

As for claim 9,

passive scanning frame is the beacon frame, and the FILS (fast initial link setup) search frame or STA which is one among the measurement pilot frame.

청구 **15**항:

제9항에 있어서,

상기 액세스 랜덤 변수는 상기 액세스 분배 요소보다 작은 값으로 선택되는 값인 STA.

Claim 15:

As for claim 9, STA which is the value in which

access random variable is selected as the value smaller than the access distribution element.

청구 **16**항:

제9항에 있어서,

상기 액세스 분배 요소는 N(여기서, N은 정수값)을 지시하고,

상기 N은 상기 패시브 스캐닝 프레임을 전송하는 AP(access point)의 부하를 기반으로 결정되는 값인 채널 액세스 방법.

Claim 16:

As for claim 9, the channel access method which

access distribution element indicates N (here, N is the integer value) ; and is the value determined based on the load of the AP (access point) in which

N transmits the passive scanning frame.

기술분야

본 발명은 무선랜에 관한 것으로 보다 상세하게는 무선랜에서 매체에 액세스를 수행하는 방법 및 장치에 관한 것이다.

Technical Field

The invention relates to the wireless LAN, more specifically to a method and apparatus for in the wireless LAN, the access is performed in the media.

배경기술

최근의 무선랜(wireless LAN) 기술의 진화 방향은 크게 3가지 방향으로 진행되고 있다. 기존 무선랜 진화 방향의 연장 선상에서 전송 속도를 더욱 높이기 위한 노력으로 IEEE(institute of electrical and electronic engineers) 802.11ac와 IEEE 802.11ad가 있다. IEEE 802.11ad는 60GHz 밴드를 사용하는 무선랜 기술이다. 또한, 기존의 무선랜보다 거리적으로 광역 전송을 가능하게 하기 위해 1GHz 미만의 주파수 밴드를 활용하는 광역 무선랜이 최근에 대두되고 있는데, 이에는 TVWS(TV white space) 대역을 활용하는 IEEE 802.11af와 900MHz 대역을 활용하는 IEEE 802.11ah가 있다. 이들은 스마트 그리드(smart grid), 광역 센서 네트워크뿐만 아니라, 확장 범위 Wi-Fi(extended range Wi-Fi) 서비스의 확장을 주목적으로 한다. 또한 기존의 무선랜 MAC(medium access control) 기술은 초기 링크 셋 업 시간이 경우에 따라 매우 길어지는 문제점을 가지고 있었다. 이러한 문제점을 해결하여 STA이 AP로 신속한 접속이 수행 가능하도록 하기 위하여 IEEE 802.11ai 표준화 활동이 최근에 활발하게 이루어지고 있다.

Background Art

The evolution direction of the recent wireless LAN technology is progressed 3 kinds. In the extension cord of the existing wireless LAN evolution direction, it has IEEE (institute of electrical and electronic engineers) 802.11ac and IEEE 802.11ad to the effort of more enhancing the transfer rate. It is the wireless LAN technology in which the IEEE 802.11ad uses 60GHz band. Moreover, recently the wide area wireless LAN which utilizes the frequency band less than 1GHz than the existing wireless LAN in order to make the broad area transmission possible to the distance, emerges. It has the IEEE 802.11af utilizing the TVWS (TV white space) band and the IEEE 802.11ah utilizing 900MHz band in this. These expand the smart grid, and the expansion of the extent Wi-Fi (extended range Wi-Fi) service not only the broad area sensor network, to the main purpose. Moreover, it had the problem in some cases, that the initial link set-up time the existing wireless LAN media access controller (medium access control) technology very got longer. Such problem is solved and in order to the connection in which STA is quick to AP makes be executable the IEEE 802.11ai standardization activity is comprised of the recent.

IEEE 802.11ai는 무선랜의 초기 셋-업(set-up) 및 결합(association) 시간을 획기적으로 절감하기 위하여 신속한 인증 절차를 다루는 MAC 기술로서, 2011년 1월에 정식 태스크 그룹으로 표준화 활동이 시작되었다. 신속 접속 절차를 가능하게 하기 위하여 IEEE 802.11ai는 AP 탐색(AP discovery), 네트워크 탐색(network discovery), TSF 동기화(time synchronization function synchronization), 인증 & 결합(Authentication & Association,) 상위 계층(higher layer)과의 절차 병합 등의 영역에서 절차 간소화에 대한 논의를 진행하고 있다. 그 중에서, DHCP(dynamic host configuration protocol)의 피기백(piggyback)을 활용한 절차 병합, 병행 IP(concurrent IP)를 이용한 전체 EAP(full EAP(extensible authentication protocol))의 최적화, 효율적인 선별적 AP(access point) 스캐닝 등의 아이디어가 활발하게 논의 중이다.

It was the MAC technology handling the authentication process which was quick so that the IEEE 802.11ai conspicuously reduce the initial set-up and combination (association) time of the wireless LAN and the standardization activity was initiated in 2011 year January with the formal task group. The IEEE 802.11ai progresses the discussion about the procedure simplification in the domain including the procedure merge of the AP search (AP discovery), the network search (network discovery), the TSF synchronization (time synchronization function synchronization), with the authentication & combination (Authentication & Association,) higher layer etc. in order to make the rapid connection procedure possible. Among them, the procedure merge, utilizing the piggyback of the DHCP (dynamic host configuration protocol) the optimization of the whole EAP (full EAP(extensible authentication protocol)) using the concurrent IP, and the idea of the efficient selective AP (access point) scanning etc are active it is in the discussion.

발명의 내용

Summary of Invention

해결하고자 하는 과제

Problem to be solved

본 발명의 목적은 초기 액세스 방법을 제공하는 것이다.

The object of the present invention provides the primary access method.

본 발명의 또 다른 목적은 초기 액세스 방법을 수행하는 장치를 제공하는 것이다.

Another object of the present invention is to provide the apparatus for performing the primary access method.

과제해결 수단

Means to solve the problem

상술한 본 발명의 목적을 달성하기 위한 본 발명의 일 측면에 따른 STA(station)의 채널 액세스 방법은 상기 STA이 패시브 스캐닝 프레임을 통해 액세스 분배 요소를 수신하는 단계, 상기 STA이 상기 액세스 분배 요소를 기반으로 액세스 랜덤 변수를 선택하는 단계, 상기 STA이 상기 액세스 랜덤 변수를 기반으

The channel access method of the STA (station) according to one side of the invention for achieving the object of the invention comprises the step that STA receives the access distribution element through the passive scanning frame, the step that STA selects the

로 패시브 스캐닝 특정 경쟁 윈도우의 최소값를 결정하는 단계와 상기 STA이 상기 패시브 스캐닝 특정 경쟁 윈도우의 최소값을 기반으로 결정한 백오프 타임을 기반으로 채널 액세스를 수행하는 단계를 포함할 수 있다.

access random variable out based on the access distribution element, and the step that STA determines the minimum value of the passive scanning specific contention window based on the access random variable and the step of performing the channel access based on the backoff time which STA determines based on the minimum value of the passive scanning specific contention window.

상술한 본 발명의 목적을 달성하기 위한 본 발명의 다른 측면에 따른 무선랜에서 동작하는 STA(station) 은 무선 신호를 송신 및 수신하는 RF(radio frequency)부와 상기 RF부와 선택적으로 연결되는 프로세서를 포함하되, 상기 프로세서는 패시브 스캐닝 프레임을 통해 액세스 분배 요소를 수신하고, 상기 액세스 분배 요소를 기반으로 액세스 랜덤 변수를 선택하고, 상기 액세스 랜덤 변수를 기반으로 패시브 스캐닝 특정 경쟁 윈도우의 최소값를 결정하고, 상기 패시브 스캐닝 특정 경쟁 윈도우의 최소값을 기반으로 결정한 백오프 타임을 기반으로 채널 액세스를 수행하도록 구현될 수 있다.

The STA (station) operating in the wireless LAN according to the dissimilar side of the invention for achieving the object of invention *** includes the RF (radio frequency) part and the processor selectively connected to the RF part the radio signal. The processor receives the access distribution element through the passive scanning frame and the access random variable is selected out based on the access distribution element and the minimum value of the passive scanning specific contention window is determined based on the access random variable and in order to perform the channel access based on the backoff time determined based on the minimum value of the passive scanning specific contention window the processor can be implemented.

발명의 효과

Effects of the Invention

복수의 STA이 서로 다른 파라메터를 기반으로 채널에 액세스를 수행하도록 함으로서 동일한 채널에서 복수의 STA이 초기 액세스를 수행시 STA의 초기 액세스를 분산시킬 수 있다.

In the channel multiple STAs perform the access based on the different parameter in the channel similar, multiple STAs can disperse the primary access of STA the primary access in the performance.

발명을 실시하기 위한 구체적인 내용

Description of Embodiments

도 1의 상단은 IEEE(institute of electrical and electronic engineers) 802.11의 인프라스트럭쳐 네트워크(infrastructure network)의 구조를 나타낸다.

The upper end of fig. 1 shows the structure of the infrastructure network of IEEE (institute of electrical and electronic engineers) 802.11.

도 1의 상단을 참조하면, 무선랜 시스템은 하나 또는 그 이상의 기본 서비스 세트(Basic Service Set, BSS, 100, 105)를 포함할 수 있다. BSS(100, 105)는 성공적으로 동기화를 이루어서 서로 통신할 수 있는 AP(access point, 125) 및 STA1(Station, 100-1)과 같은 AP와 STA의 집합으로서, 특정 영역을 가리키는 개념은 아니다. BSS(105)는 하나의 AP(130)에 하나 이상의 결합 가능한 STA(105-1, 105-2)을 포함할 수도 있다.

The wireless LAN-system may include one or more the basic service set (Basic Service Set, BSS, 100, 105) with reference to the upper end of fig. 1. It is the gathering of AP like APs (access point, 125) in which BSSs (100, 105) are successfully comprised the synchronization and communicating and STA 1s (Station, 100-1) and STA and it is not concept indicating the given area. The BSS (105) can include possibly combine STAs (105-1, 105-2) in one AP (130).

인프라스트럭쳐 BSS는 적어도 하나의 STA, 분산 서비스(Distribution Service)를 제공하는 AP(125, 130) 및 다수의 AP를 연결시키는 분산 시스템(Distribution System, DS, 110)을 포함할 수 있다.

The infrastructure BSS comprises APs (125, 130) providing at least one STA, and the distribution service and the distributed system (Distribution System, DS, 110) connecting multiple APs.

분산 시스템(110)는 여러 BSS(100, 105)를 연결하여 확장된 서비스 셋인 ESS(extended service set, 140)를 구현할 수 있다. ESS(140)는 하나 또는 여러 개의 AP(125, 130)가 분산 시스템(110)을 통해 연결되어 이루어진 하나의 네트워크를 지시하는 용어로 사용될 수 있다. 하나의 ESS(140)에 포함되는 AP는 동일한 SSID(service set identification)를 가질 수 있다.

ESSs (extended service set, 140) which are the service set in which the distributed system (110) connects some BSSs (100, 105) and which is expanded can be implemented. It can be used as the term indicating one network in which one or the several APs (125, 130) is connected through the distributed system (110) and the ESS (140) is made. It can have the SSID (service set identification) in which AP included in one ESS (140) is identical.

포털(portal, 120)은 무선랜 네트워크(IEEE 802.11)와 다른 네트워크(예를 들어, 802.X)와의 연결을 수행하는 브리지 역할을 수행할 수 있다.

The bridge role that portals (portal, 120) perform the connection with the network (for example, 802 X) different from the wireless lan network (IEEE 802.11) can be performed.

도 1의 상단과 같은 인프라스트럭쳐 네트워크에서는 AP(125, 130) 사이의 네트워크 및 AP(125, 130)와 STA(100-1, 105-1, 105-2) 사이의 네트워크가 구현될 수 있다. 하지만, AP(125, 130)가 없이 STA 사이에서도 네트워크를 설정하여 통신을 수행하는 것도 가능할 수 있다. AP(125, 130)가 없이 STA 사이에서도 네트워크를 설정하여 통신을 수행하는 네트워크를 애드-혹 네트워크(Ad-Hoc network) 또는 독립 BSS(independent basic service set)라고 정의한다.

In the infrastructure network like the upper end of fig. 1, the network between the network between APs (125, 130) and APs (125, 130) and STAs (100-1, 105-1, 105-2) can be implemented. However, the communication can be possible to set up the network without APs (125, 130) between STA and perform the communication. The network setting up the network without APs (125, 130) between STA and performs the communication is defined as the ad-hoc network or the independent BSS (independent basic service set).

도 1의 하단은 독립 BSS를 나타낸 개념도이다.

It is the conceptual diagram in which the lower part of fig. 1 shows the independent BSS.

도 1의 하단을 참조하면, 독립 BSS(independent BSS, IBSS)는 애드-혹 모드로 동작하는 BSS이다. IBSS는 AP를 포함하지 않기 때문에 중앙에서 관리 기능을 수행하는 개체(centralized management entity)가 없다. 즉, IBSS에서는 STA(150-1, 150-2, 150-3, 155-4, 155-5)들이 분산된 방식(distributed manner)으로 관리된다. IBSS에서는 모든 STA(150-1, 150-2, 150-3, 155-4, 155-5)이 이동 STA으로 이루어질 수 있으며, 분산 시스템으로의 접속이 허용되지 않아서 자기 완비적 네트워크(self-contained network)를 이룬다.

Referring to the lower part of fig. 1, the independent BSS (independent BSS, IBSS) is BSS operating to the ad-hoc mode. There is no entity (centralized management entity) which performs the function manager in the center because IBSS does not include AP. That is, in IBSS, it is managed to the mode (distributed manner) in which STAs (150-1, 150-2, 150-3, 155-4, 155-5) are dispersed. In IBSS, all STAs (150-1, 150-2, 150-3, 155-4, 155-5) can be made of the movement STA and the connection to the distributed system is not tolerated and it is comprised the magnetism totality network (self-contained network).

STA은 IEEE(Institute of Electrical and Electronics Engineers) 802.11 표준의 규정을 따르는 매체 접속 제어(Medium Access Control, MAC)와 무선 매체에 대한 물리계층(Physical Layer) 인터페이스를 포함하는 임의의 기능 매체로서, 광의로는 AP와 비-AP STA(Non-AP Station)을 모두 포함하는 의미로 사용될 수 있다.

STA may be used with AP and the meaning including the non-A P STA (Non-AP Station) with the broad sense it is the media access control (Medium Access Control, MAC) following the rules of IEEE (Institute of Electrical and Electronics Engineers) 802.11 standard and the arbitrary function media including the physical layer interface about the wireless medium.

STA은 이동 단말(mobile terminal), 무선 기기(wireless device), 무선 송수신 유닛(Wireless Transmit/Receive Unit; WTRU), 사용자 장비(User Equipment; UE), 이동국(Mobile Station; MS), 이동 가입자 유닛(Mobile Subscriber Unit) 또는 단순히 유저(user) 등의 다양한 명칭으로도 불릴 수 있다.

STA can be just called as the mobile terminal, the wireless device, the wireless transmit-receive unit (Wireless Transmit/Receive Unit: WTRU), the user equipment (User Equipment: UE), the mobile station (Mobile Station: MS), the mobile subscriber unit through the various name including the user etc.

도 2는 IEEE 802.11에 의해 지원되는 무선랜 시스템의 계층 아키텍처를 나타낸 도면이다.

Figure 2 is a drawing showing the layer architecture of the wireless LAN-system supported by the IEEE 802.11.

도 2에서는 무선랜 시스템의 계층 아키텍처(PHY architecture)를 개념적으로 도시하였다.

In fig. 2, the layer architecture (PHY architecture) of the wireless LAN-system was conceptually shown.

무선랜 시스템의 계층 아키텍처는 MAC(medium access control) 부계층(sublayer)(220)과 PLCP(Physical Layer Convergence Procedure) 부계층(210) 및 PMD(Physical Medium Dependent) 부계층(200)을 포함할 수 있다. PLCP 부계층(210)은 MAC 부계층(220)이 PMD 부계층(200)에 최소한의 종속성을 가지고 동작할 수 있도록 구현된다. PMD 부계층(200)은 복수의 STA 사이에서 데이터를 송수신하기 위한 전송 인터페이스 역할을 수행할 수 있다.

The layer architecture of the wireless LAN-system comprises the MAC (medium access control) sublayer (sublayer) (220) and the PLCP (Physical Layer Convergence Procedure) sublayer (210) and PMD (Physical Medium Dependent) sublayer (200). It is implemented so that the MAC sub-layer (220) has the minimum dependency on the PMD sublayer (200) and the PLCP sublayer (210) operates. The PMD sublayer (200) can perform the transmission interface role for transmitting and receive data between multiple STAs.

MAC 부계층(220)과 PLCP 부계층(210) 및 PMD 부계층(200)은 개념적으로 관리부(management entity)를 포함할 수 있다.

The MAC sub-layer (220), the PLCP sublayer (210) and PMD sublayer (200) conceptually may include the administration unit (management entity).

MAC 부계층(220)의 관리부는 MLME(MAC Layer Management Entity, 225), 물리 계층의 관리부는 PLME(PHY Layer Management Entity, 215)라고 한다. 이러한 관리부들은 계층 관리 동작이 수행되는 인터페이스를 제공할 수 있다. PLME(215)는 MLME(225)와 연결되어 PLCP 부계층(210) 및 PMD 부계층(200)의 관리 동작(management operation)을 수행할 수 있고 MLME(225)도 PLME(215)와 연결되어 MAC 부계층(220)의 관리 동작(management operation)을 수행할 수 있다.

The administration unit of the MAC sub-layer (220) MLMEs (MAC Layer Management Entity, 225) , and the administration unit of the physical layer are called PLMEs (PHY Layer Management Entity, 215). The interface in which such administration units the layer management operation is performed can be provided. The PLME (215) is connected to the MLME (225) and the management operation of the PMD sublayer (200) and PLCP sublayer (210) can be performed and the MLME (225) is connected to the PLME (215) and the management operation of the MAC sub-layer (220) be performed.

올바른 MAC 계층 동작이 수행되기 위해서 SME(STA management entity, 250)가 존재할 수 있다. SME(250)는 계층에 독립적인 구성부로 운용될 수 있다. MLME, PLME 및 SME는 프리미티브(primitive)를 기반으로 상호 구성부 간에 정보를 송신 및 수신할 수 있다.

So that the right MAC layer operation be performed SMEs (STA management entity, 250) can exist. The SME (250) can be used to the configuration part independent in the layer. MLME , and PLME and SME are the information for *** number based on the primitive between the reciprocity configuration part.

각 부계층에서의 동작을 간략하게 설명하면 아래와 같다. PLCP 부계층(110)은 MAC 부계층(220)과 PMD 부계층(200) 사이에서 MAC 계층의 지시에 따라 MAC 부계층(220)으로부터 받은 MPDU(MAC Protocol Data Unit)를 PMD 부계층(200)에 전달하거나, PMD 부계층(200)으로부터 오는 프레임을 MAC 부계층(220)에 전달한다. PMD 부계층(200)은 PLCP 하위 계층으로서 무선 매체를 통한 복수의 STA 사이에서의 데이터 송신 및 수신을 수행할 수 있다. MAC 부계층(220)이 전달한 MPDU(MAC protocol data unit)는 PLCP 부계층(210)에서 PSDU(Physical Service Data Unit)이라 칭한다. MPDU는 PSDU와 유사하나 복수의 MPDU를 어그리게이션(aggregation)한 A-MPDU(aggregated MPDU)가 전달된 경우 개개의 MPDU와 PSDU는 서로 상이할 수 있다.

The operation at each sublayer is made to be equal to the lower part it briefly illustrates. According to the PLCP sublayer (110) is the indication of the MAC layer between the MAC sub-layer (220) and the PMD sublayer (200), the MPDU (MAC Protocol Data Unit) received from the MAC sub-layer (220) is delivered to the PMD sublayer (200) or the frame coming from the PMD sublayer (200) is delivered to the MAC sub-layer (220). The PMD sublayer (200) can perform the data transmission-reception at the multiple STA intervals through the wireless medium as the PLCP lower layer. Because the MPDU (MAC protocol data unit) which the MAC sub-layer (220) delivers is the PSDU (Physical Service Data Unit) in the PLCP sublayer (210) it calls. In case MPDU is similar to PSDU but the aggregation (aggregation) one A- MPDU (aggregated MPDU) is multiple MPDUs delivered each MPDU and PSDU can be different from each other.

PLCP 부계층(210)은 PSDU를 MAC 부계층(220)으로부터 받아 PMD 부계층(200)으로 전달하는 과정에서 물리 계층 송수신기에 의해 필요한 정보를 포함하는 부가필드를 덧붙인다. 이 때 부가되는 필드는 PSDU에 PLCP 프리앰블(preamble), PLCP 헤더(header), 컨볼루션 인코더를 영상태(zero state)로 되돌리는데 필요한 꼬리 비트(Tail Bits) 등이 될 수 있다. PLCP 프리앰블은 PSDU이 전송되기 전에 수신기로 하여금 동기화 기능과 안테나 다이버시티를 준비하도록 하는 역할을 할 수 있다. 데이터 필드는 PSDU에 패딩 비트들, 스크램블러를 초기화하기 위한 비트 시퀀스를 포함하는 서비스 필드 및 꼬리 비트들이 덧붙여진 비트 시퀀스가 인코딩된 코드화 시퀀스(coded sequence)를 포함할 수 있다. 이 때, 인코딩 방식은 PPDU를 수신하는 STA에서 지원되는 인코딩 방식에 따라 BCC(Binary Convolutional Coding) 인코딩 또는 LDPC(Low Density Parity Check) 인코딩 중 하나로 선택될 수 있다. PLCP 헤더에는 전송할 PPDU(PLCP Protocol Data Unit)에 대한 정보를 포함하는 필드가 포함될 수 있다.

The PLCP sublayer (210) receives PSDU from the MAC sub-layer (220) and the optional field including the necessary information with the physical layer transceiver is added in the process of delivering to the PMD sublayer (200). The added field returns the packet level control processor preamble, the PLCP header, and the convolutional encoder in the zero status (zero state) in PSDU but it can become then the tail bit (Tail Bits) etc. necessary. The packet level control processor preamble prepares for the synchronization and antenna diversity to the receiver before PSDU is transmitted. The data field comprises the service field including the padding bit in PSDU, and the bit sequence and the coded sequence in which the bit sequence in which tail bits add is encoded. The bit sequence is for the scrambler to do with initialization. Then, according to the encoding method supported in STA in which the encoding method receives PPDU, it can be selected as one of the BCC (Binary Convolutional Coding) encoding or the LDPC (Low Density Parity Check) encoding. The PLCP header includes the field including the information about the PPDU (PLCP Protocol Data Unit) transmitted.

PLCP 부계층(210)에서는 PSDU에 상술한 필드를 부가하여 PPDU(PLCP Protocol Data Unit)를 생성하여 PMD 부계층(200)을 거쳐 수신 스테이션으로 전송하고, 수신 스테이션은 PPDU를 수신하여 PLCP 프리앰블, PLCP 헤더로부터 데이터 복원에 필요한 정보를 얻어 복원한다.

In the PLCP sublayer (210), the field describing in detail in PSDU is added and the PPDU (PLCP Protocol Data Unit) is produced and it transmits after the PMD sublayer (200) with the receiving station and the receiving station receives PPDU and the necessary information is obtained from the packet level control processor preamble, and the PLCP header in reconstitution of data and it restores.

도 3은 무선랜에서 스캐닝 방법을 나타낸 개념도이다.

Figure 3 is a conceptual diagram showing the method for scanning in the wireless LAN.

도 3을 참조하면, 스캐닝 방법은 패시브 스캐닝(passive scanning, 300)과 액티브 스캐닝(active scanning, 350)으로 구분될 수 있다.

Referring to Figure 3, the method for scanning can be classified into passive scannings (passive scanning, 300) and active scannings (active scanning, 350).

도 3의 좌측을 참조하면, 패시브 스캐닝(300)은 AP(300)가 주기적으로 브로드캐스트하는 비콘 프레임(330)에 의해 수행될 수 있다. 무선랜의 AP(300)는 비콘 프레임(330)을 특정 주기(예를 들어, 100msec)마다 non-AP STA(340)으로 브로드캐스트 한다. 비콘 프레임(330)에는 현재의 네트워크에 대한 정보가 포함될 수 있다. non-AP STA(340)은 주기적으로 브로드캐스트되는 비콘 프레임(330)을 수신함으로서 네트워크 정보를 수신하여 인증/결합(authentication/association) 과정을 수행할 AP(310)와 채널에 대한 스캐닝을 수행할 수 있다.

The passive scanning (300) can be performed by the beacon frame (330) which the AP (300) periodically broadcasts with reference to the left side of fig. 3. The AP (300) of the wireless LAN broadcasts the beacon frame (330) from the specific cycle (for example, 100msec) to the non-AP STA (340). The beacon frame (330) includes the information about the current network. The scanning for the channel and the AP (310) receiving the beacon frame (330) in which the periodically the non-AP STA (340) is broadcasted receives the network information and performs the authentication / combination (authentication/association) process can be performed.

패시브 스캐닝 방법(300)은 non-AP STA(340)이 프레임을 전송할 필요가 없이 AP(310)에서 전송되는 비콘 프레임(330)을 수신만 하면 된다. 따라서, 패시브 스캐닝 (300)은 네트워크에서 데이터 송신/수신에 의해 발생되는 전체적인 오버헤드가 작다는 장점이 있다. 하지만, 비콘 프레임(330)의 주기에 비례하여 수동적으로 스캐닝을 수행할 수 밖에 없기 때문에 스캐닝을 수행하는데 걸리는 시간이 늘어난다는 단점이 있다. 비콘 프레임에 대한 구체적인 설명은 2011년 11월에 개시된 IEEE Draft P802.11-REVmb™/D12, November 2011 #39#IEEE Standard for Information Technology Telecommunications and information exchange between systems-Local and metropolitan area networks-Specific requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications(이하, IEEE 802.11)#39#의 8.3.3.2 beacon frame에 개시되어 있다. IEEE 802.11 ai에서는 추가적으로 다른 포맷의 비콘 프레임을 사용할 수도 있고 이러한 비콘 프레임을 FILS(fast initial link setup) 비콘 프레임이라고 할 수 있다. 또한, 측정 파일롯 프레임(measurement pilot frame)은 비콘 프레임의 일부 정보만을 포함하는 프레임으로 스캐닝 절차에서 사용할 수 있다. 측정 파일롯 프레임은 IEEE 802.11 8.5.8.3 measurement pilot format에 개시되어 있다.

The beacon frame (330) in which the passive method for scanning (300) is transmitted from the AP (310) without the need that the non-AP STA (340) transmits the frame is received. Therefore, the passive scanning (300) has the advantage that in the network, the whole overhead which is generated with data transmission / reception is small. However, it has the disadvantage that the time it performs the scanning because it manually cannot help performing the scanning proportionally to the cycle of the beacon frame (330) but to hang grows longer. The detailed description about the beacon frame is the disclosed IEEE Draft P802.11-REVmb™ / D12 in 2011 year November, and November 2011 'IEEE Standard for Information Technology Telecommunications and information exchange between systems-Local and metropolitan area networks- Specific requirements Part 11: it is disclosed in 8.3.3.2 beacon frame of Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications (hereinafter, the IEEE 802.11) '. In the IEEE 802.11 ai, the beacon frame which is additionally dissimilar of the format can be used and such beacon frame can be done as the FILS (fast initial link setup) beacon frame. Moreover, it can use in the scanning process as the frame in which the measurement pilot frame includes only the portion information of the beacon frame. The measurement pilot frame is disclosed in the IEEE 802.11 8.5.8.3 measurement pilot format.

또한, FILS 탐색 프레임(FILS discovery frame)이 정의될 수도 있다. FILS 탐색 프레임은 각 AP에서 비콘 프레임의 전송 주기 사이에서 전송되는 프레임으로 비콘 프레임보다 짧은 주기를 가지고 전송되는 프레임일 수 있다. 즉, FILS 탐색 프레임은 비콘 프레임의 전송 주기보다 작은 값의 주기를 가지고 전송되는 프레임이다. FILS 탐색 프레임은 탐지 프레임을 전송하

Moreover, the FILS search frame (FILS discovery frame) can be defined. In the FILS search frame is each AP, it can be the frame transmitted to the frame transmitted between the transfer period of the beacon frame with the cycle which is short than the beacon frame. That is, the frame in which the FILS search frame is

는 AP의 식별자 정보(SSID, BSSID)를 포함할 수 있다. FILS 탐색 프레임은 STA으로 비콘 프레임이 전송되기 전에 전송되어 해당 채널에 AP가 존재함을 STA이 미리 탐색하도록 할 수 있다. 하나의 AP에서 FILS 탐색 프레임이 전송되는 간격을 FILS 탐색 프레임 전송 간격이라고 한다. FILS 탐색 프레임에는 비콘 프레임에 포함되는 정보의 일부가 포함되어 전송될 수 있다.

transmitted with the cycle of the value smaller than the transfer period of the beacon frame. The identifier information (SSID, BSSID) of AP in which the FILS search frame transmits the detection frame is include might. STA searches in advance that it is transmitted and AP exists in the corresponding channel before the FILS search frame the beacon frame is transmitted to STA. In one AP, it can be said to be the gap in which the FILS search frame is transmitted the FILS search frame transfer interval. In the FILS search frame, the part of the information included in the beacon frame can be contained and transmitted.

도 3의 우측을 참조하면, 액티브 스캐닝(350)은 non-AP STA(390)에서 프로브 요청 프레임(370)을 AP(360)로 전송하여 주도적으로 스캐닝을 수행하는 방법을 말한다.

In the active scanning (350) with reference to the right side, of fig. 3 is the non-AP STA (390), the method for performing the scanning to the occasion transmitting the probe request frame (370) with the AP (360) is referred to.

AP(360)에서는 non-AP STA(390)으로부터 프로브 요청 프레임(370)을 수신한 후 프레임 충돌(frame collision)을 방지하기 위해 랜덤 시간 동안 기다린 후 프로브 응답 프레임(380)에 네트워크 정보를 포함하여 non-AP STA(390)으로 전송할 수 있다. non-AP STA(390)은 수신한 프로브 응답 프레임(380)을 기초로 네트워크 정보를 얻고 스캐닝 과정을 중지할 수 있다.

In the AP (360), after the probe request frame (370) is waited for from the non-AP STA (390) for the random time in order to prevent the frame collision after doing the reception , the network information is included in the probe response frame (380) and it can transmit with the non-AP STA (390). The network information can be obtained based on the probe response frame (380) which the non-AP STA (390) receives and the scanning process can be stopped.

액티브 스캐닝(350)의 경우 non-AP STA(390)이 주도적으로 스캐닝을 수행하므로 스캐닝에 사용되는 시간이 짧다는 장점이 있다. 하지만, non-AP STA(390)에서 프로브 요청 프레임(370)을 전송해야 하므로 프레임 송신 및 수신을 위한 네트워크 오버헤드가 증가한다는 단점이 있다. 프로브 요청 프레임(370)은 IEEE 802.11 8.3.3.9 절에 개시되어 있고 프로브 응답 프레임(380)은 IEEE 802.11 8.3.3.10에 개시되어 있다.

Time used for the scanning the non-AP STA (390) performs the scanning in case of the active scanning (350) has the advantage that is short. However, in the non-AP STA (390), it has the disadvantage that the network overhead for the frame *** increases since it has to transmit the probe request frame (370). The probe request frame (370) is disclosed in the IEEE 802.11 8.3.3.9 fold and the probe response frame (380) is disclosed in the IEEE 802.11 8.3.3.10.

스캐닝이 끝난 후 AP와 STA은 인증(authentication)과 결합(association) 과정을 수행할 수 있다.

AP and STA can perform the authentication and combination (association) process after the scanning is finished.

도 4는 AP와 STA의 스캐닝 후 인증 및 결합 과정을 나타낸 개념도이다.

Figure 4 is a conceptual diagram showing the authentication after the scanning of AP and STA and combining process.

도 4를 참조하면, 패시브/액티브 스캐닝을 수행한 후 스캐닝이 된 AP 중 하나의 AP와 인증 및 결합을 수행할 수 있다.

Referring to Figure 4, one AP, the authentication and combination can be performed among AP which is the passive / active scanning scanned after doing the performance.

인증(authentication) 및 결합(association) 과정은 예를 들어, 2-방향 핸드쉐이킹(2-way handshaking)을 통해 수행될 수 있다. 도 4의 좌측은 패시브 스캐닝 후 인증 및 결합 과정을 나타낸 개념도이고 도 4의 우측은 액티브 스캐닝 후 인증 및 결합 과정을 나타낸 개념도이다.

The authentication (authentication) and combination (association) process can be performed through for example, 2- direction handshaking (2-way handshaking). It is the conceptual diagram in which the left side of fig. 4 shows the authentication and combining process after the passive scanning and it is the conceptual diagram in which the right side of fig. 4 shows the authentication and combining process after the active scanning.

인증 및 결합 과정은 액티브 스캐닝 방법 또는 패시브 스캐닝을 사용하였는지 여부와 상관없이 인증 요청 프레임(authentication request frame, 410)/인증 응답 프레임(authentication

Authentication request frame (authentication request frame, 410) / authentication response frames (authentication response frame, 420) and association request fr

response frame, 420) 및 결합 요청 프레임(association request frame, 330)/결합 응답 프레임(association response frame, 440)을 AP(400, 450)와 non-AP STA(405, 455) 사이에서 교환함으로서 동일하게 수행될 수 있다.

ame (association request frame, 330) / association response frames (association response frame, 440) are irrespective exchanged acceptance and rejection and between APs (400, 450) and non-AP STAs (405, 455) whether the authentication and combining process used the active method for scanning or the passive scanning it can be identically performed.

인증 과정은 non-AP STA(405, 455)에서 인증 요청 프레임(410)을 AP(400, 450)로 전송하여 수행될 수 있다. 인증 요청 프레임(410)에 대한 응답으로 인증 응답 프레임(420)을 AP(400, 450)에서 non-AP STA(405, 455)으로 전송할 수 있다. 인증 프레임 포맷(authentication frame format)에 대해서는 IEEE 802.11 8.3.3.11에 개시되어 있다.

In the authentication procedure is non-AP STAs (405, 455), the authentication request frame (410) is transmitted with APs (400, 450) and it can be performed. In APs (400, 450) the response about the authentication request frame (410) the authentication response frame (420), it can transmit with non-AP STAs (405, 455). It is disclosed about the authentication frame format in the IEEE 802.11 8.3.3.11.

결합 과정(association)은 non-AP STA(405, 455)에서 결합 요청 프레임(association request frame, 430)을 AP(400, 405)로 전송하여 수행될 수 있다. 결합 요청 프레임(430)에 대한 응답으로 결합 응답 프레임(440)을 AP(405, 455)에서 non-AP STA(400, 450)으로 전송할 수 있다. 전송된 결합 요청 프레임(430)에는 non-AP STA(405, 455)의 성능(capability)에 관한 정보가 포함되어 있다. non-AP STA(405, 455)의 성능 정보를 기초로 AP(400, 350)는 non-AP STA(405, 355)에 대해 지원이 가능한지 여부를 판단할 수 있다. 지원이 가능한 경우 AP(300, 450)는 결합 응답 프레임(440)에 결합 요청 프레임(440)에 대한 수락 여부와 그 이유, 자신이 지원 가능한 성능 정보(capability information)을 담아서 non-AP STA(405, 455)에 전송할 수 있다. 결합 프레임 포맷(association frame format)에 대해서는 IEEE 802.11 8.3.3.5/8.3.3.6에 개시되어 있다.

In the combining process (association) is non-AP STAs (405, 455), association request frames (association request frame, 430) are transmitted with APs (400, 405) and it can be performed. In APs (405, 455) the response about the association request frame (430) the association response frame (440), it can transmit with non-AP STAs (400, 450). The transmitted association request frame (430) includes the information about the performance (capability) of non-AP STAs (405, 455). APs (400, 350) can determine based on the capability information of non-AP STAs (405, 455) whether it is possible for the support about non-AP STAs (405, 355) or not. In case it is possible for the support the capability information enabling to assist is put in and grant acceptance and rejection and reason for the about the association request frame (440), and oneself APs (300, 450) can transmit in the association response frame (440) in non-AP STAs (405, 455). It is disclosed about the combination frame format (association frame format) in the IEEE 802.11 8.3.3.5/8.3.3.6.

만약 결합 단계까지 수행된 경우 이후에 정상적인 데이터의 송신 및 수신이 수행되게 된다. 결합이 수행되지 않은 경우, 결합이 수행되지 않은 이유를 기반으로 다시 결합이 수행되거나 다른 AP로 결합이 수행될 수 있다.

Thereafter *** of normal data is performed in case of being performed to the binding step. In case the combination is not performed the combination is again performed based on the reason in which the combination is not performed or the combination can be performed to dissimilar AP.

도 5는 액티브 스캐닝 절차(active scanning procedure)에 대한 개념도이다.

Fig. 5 is the conceptual diagram about the active scanning process (active scanning procedure).

도 5를 참조하면, 액티브 스캐닝 절차는 아래와 같은 단계로 수행될 수 있다.

Referring to Figure 5, the active scanning process can be performed to the following step.

(1) STA(500)이 스캐닝 절차를 수행할 준비가 되었는지를 판단한다.

(1) It determines whether it became the preparation in which the STA (500) performed the scanning process or not.

STA(500)은 예를 들어, 프로브 딜레이 시간(probe delay time)이 만료(expire)되거나 특정한 시그널링 정보(예를 들어, PHY-RXSTART.indication primitive)가 수신될 때까지 기다려서 액티브 스캐닝을 수행할 수 있다.

Until for example, the probe delay time becomes the STA (500) with the expiration (expire) or the specific signaling information (for example, the PHY-RXSTART indication. primitive) is received it waits and the active scanning can be performed.

프로브 딜레이 시간은 STA(500)이 액티브 스캐닝을 수행 시 프로브 요청 프레임(510)을 전송하기 전에 발생되는 딜레이 다. PHY-RXSTART.indication primitive는 물리(PHY) 계층

The probe delay time is *** in which the STA (500) is the active scanning generated before transmitting the probe request frame (510) in the performance. PHY-RX

에서 로컬 MAC(medium access control) 계층으로 전송되는 신호이다. PHY-RXSTART.indication primitive는 PLCP (physical layer convergence protocol)에서 유효한 PLCP 헤더를 포함하는 PPDU(PLCP protocol data unit)를 수신하였다는 정보를 MAC 계층으로 시그널링할 수 있다.

START. In the indication primitive is the physical (PHY) layer, it is the signal transmitted to the local MAC (medium access control) layer. PHY-RXSTART. The information that the indication primitive received the PPDU (PLCP protocol data unit) including the effective PLCP header by the PLCP (physical layer convergence protocol) can be signaled to the MAC layer.

(2) 기본 접속(basic access)을 수행한다.

(2) The basic access is performed.

802.11 MAC 계층에서는 예를 들어, 경쟁 기반 함수인 분산 조정 함수(distributed coordination function, DCF)를 사용하여 여러 STA이 무선 매체를 공유할 수 있다. DCF는 접속 프로토콜로 (carrier sense multiple access/collision avoidance, CSMA/CA)를 사용하여 백-오프(back-off) 방식을 통해 STA 간의 출동을 방지할 수 있다. STA(500)은 기본 접속 방법을 사용하여 프로브 요청 프레임(510)을 AP(560, 570)로 전송할 수 있다.

In 802.11 MAC layer, the some STA can share the wireless medium using the distributed coordination function (distributed coordination function, DCF) which is the contention based function for example. DCF can prevent the going out between STA to the access protrocol using (carrier sense multiple access/collision avoidance, CSMA/CA) through the back-off mode. The STA (500) transmits the probe request frame (510) using the basic access method to APs (560, 570).

(3) MLME-SCAN.request primitive에 포함된 AP(560, 570)를 특정하기 위한 정보(예를 들어, SSID(service set identification) 및 BSSID(basic service set identification) 정보)를 프로브 요청 프레임(510)에 포함하여 전송할 수 있다.

(3) MLME-SCAN. Information (for example, the SSID (service set identification) and BSSID (basic service set identification) information) for specifying are included in the probe request frame (510) and APs (560, 570) included in the request primitive can be transmitted.

BSSID는 AP를 특정하기 위한 지시자로서 AP의 MAC 주소에 해당하는 값을 가질 수 있다. SSID(service set identification)는 STA을 운용하는 사람이 읽을 수 있는 AP를 특정하기 위한 네트워크 명칭이다. BSSID 및/또는 SSID는 AP를 특정하기 위해 사용될 수 있다.

BSSID can have the value corresponding to the MAC address of AP AP as the pointer for specifying. It is the network name for specifying AP which the human in which the SSID (service set identification) uses STA can read. BSSID and/or SSID can be AP used in order to specify.

STA(500)은 MLME-SCAN.request primitive에 의해 포함된 AP(560, 570)를 특정하기 위한 정보를 기초로 AP를 특정할 수 있다. 특정된 AP(560, 570)는 프로브 응답 프레임(550, 550)을 STA(500)으로 전송할 수 있다. STA(500)은 프로브 요청 프레임(510)에 SSID 및 BSSID 정보를 포함하여 전송함으로서 프로브 요청 프레임(510)을 유니캐스트, 멀티캐스트 또는 브로드캐스트할 수 있다. SSID 및 BSSID 정보를 사용하여 프로브 요청 프레임(510)을 유니캐스트, 멀티캐스트 또는 브로드캐스트하는 방법에 대해서는 도 5에서 추가적으로 상술한다.

AP can be specified based on the information for specifying APs (560, 570) in which the STA (500) is included with the MLME-SCAN request. primitive. Specified APs (560, 570) transmits probe response frames (550, 550) to the STA (500). SSID and BSSID information are contained and the STA (500) transmits in the probe request frame (510) the probe request frame (510) is unicastd and it multicasts or it can broadcast. The probe request frame (510) is unicastd using SSID and BSSID information and it additionally describes in detail in fig. 5 about the method for multicasting or broadcasting.

예를 들어, MLME-SCAN.request primitive에 SSID 리스트가 포함되는 경우, STA(500)은 프로브 요청 프레임(510)에 SSID 리스트를 포함하여 전송할 수 있다. AP(560, 570)는 프로브 요청 프레임(510)을 수신하고 수신된 프로브 요청 프레임(510)에 포함된 SSID 리스트에 포함된 SSID를 판단하여 STA(200)으로 프로브 응답 프레임(550, 550)을 전송할지 여부를 결정할 수 있다.

For example, the case where the SSID list is included in the MLME-SCAN request. primitive, and the STA (500) is the SSID list in the probe request frame (510) are included and it can transmit. It can determine if SSID included in the SSID list in which APs (560, 570) receive the probe request frame (510) and which is included in the received probe request frame (510) is determined and probe response frames (550, 550) are transmitted with the STA (200).

(4) 프로브 타이머를 0으로 초기화한 후 타이머를 동작시킨다.

(4) The timer is operated after the probe timer is initialized to 0.

프로브 타이머는 최소 채널 시간(MinChanneltime, 520) 및 최대 채널 시간(MaxChanneltime, 530)을 체크하기 위해 사용될 수 있다. 최소 채널 시간(520) 및 최대 채널 시간(530)은 STA(500)의 액티브 스캐닝 동작을 제어하기 위해 사용될 수 있다.

It can be used so that the probe timer check minimum channel times (MinChanneltime, 520) and maximum channel times (MaxChanneltime, 530). It can be used so that the minimum channel time (520) and maximum channel time (530) control the active scanning operation of the STA (500).

최소 채널 시간(520)은 STA(500)이 액티브 스캐닝을 수행하는 채널을 변경하기 위한 동작을 수행하기 위해 사용될 수 있다. 예를 들어, STA(500)은 프로브 타이머가 최소 채널 시간(520)에 도달할 때까지 다른 프레임(예를 들어, 프로브 응답 프레임(550, 550))의 전송을 탐지 하지 못한 경우, STA(500)은 스캐닝 채널을 옮겨서 다른 채널에서 스캐닝을 수행할 수 있다. STA(500)은 프로브 타이머가 최소 채널 시간(520)에 도달할 때까지 다른 프레임의 전송을 탐지한 경우, 프로브 타이머가 최대 채널 시간(530)에 도달할 때까지 채널을 모니터링할 수 있다. 프로브 타이머가 최대 채널 시간(530)에 도달하면 STA은 수신된 프로브 응답 프레임(540, 550)을 처리할 수 있다.

In order to perform the operation in which the minimum channel time (520) changes the channel in which the STA (500) performs the active scanning, the operation can be used. For example, in case the STA (500) is unable to detect the transmission of the dissimilar frame (for example, probe response frames (550, 550)) until the probe timer reaches the minimum channel time (520) the STA (500) moves the scanning channel and the scanning can be performed in the dissimilar channel. In case the STA (500) detects the transmission of the dissimilar frame until the probe timer reaches the minimum channel time (520) the channel can be monitored until the probe timer reaches the maximum channel time (530). When probe timer reaches maximum channel time (530), probe response frames (540, 550) in which STA is received can be processed.

STA(500)은 프로브 타이머가 최소 채널 시간(520)에 도달하기 전까지 PHY-CCA.지시 프리미티브(indication primitive)를 탐색하여 최소 채널 시간(520) 전까지 다른 프레임(예를 들어, 프로브 응답 프레임(540, 550))의 전송 여부를 탐지할 수 있다.

Until the probe timer reaches the minimum channel time (520) the STA (500) searches the PHY-CCA indication primitive and the transmission of the dissimilar frame (for example, probe response frames (540, 550)) can be detected before the minimum channel time (520).

PHY-CCA.지시 프리미티브는 물리 계층에서 MAC 계층으로 매체(medium)의 상태에 대한 정보를 전송할 수 있다. PHY-CCA.지시 프리미티브는 채널이 가용하지 않은 경우 비지(busy), 채널이 가용한 경우 아이들(idle) 이라는 채널 상태 파라메터를 사용하여 현재 채널의 상태를 STA(500)으로 알려줄 수 있다. STA(500)은 PHY-CCA.지시 프리미티브가 비지(busy)로 탐색되는 경우는 STA(500)으로 수신된 프로브 응답 프레임(550, 550)이 존재한다고 판단하고 PHY-CCA.지시 프리미티브가 아이들(idle)로 탐색되는 경우는 STA(500)으로 수신된 프로브 응답 프레임(550, 550)이 존재하지 않는다고 판단할 수 있다.

PHY-CCA. In the indication primitive is the physical layer, the information toward the state of the media (medium) can be transmitted with the MAC layer in case the bean-curd dregs (busy), and the channel are available in case the channel the PHY-CCA indication primitive is not available the state of the current channel can be informed of using the channel condition parameter that it is the idle by the STA (500). The case where the PHY-CCA indication primitive the STA (500) is searched in the bean-curd dregs (busy) determines that probe response frames (550, 550) received to the STA (500) exist and the case where the PHY-CCA indication primitive is searched in the idle can determine that probe response frames (550, 550) received to the STA (500) are nonexistent.

PHY-CCA.지시 프리미티브가 아이들(idle)로 탐색되는 경우, STA(500)은 NAV(net allocation vector)를 0으로 설정하고 다음 채널을 스캐닝할 수 있다. STA(500)은 PHY-CCA.지시 프리미티브가 비지(busy)로 탐색되는 경우는 프로브 타이머가 최대 채널 시간(530)에 도달한 후 수신된 프로브 응답 프레임(550, 550)에 대한 처리를 수행할 수 있다. 수신된 프로브 응답 프레임(550, 550)에 대한 처리 후 NAV(net allocation vector)를 0으로 설정하고 STA(500)은 다음 채널을 스캐닝할 수 있다.

PHY-CCA. The case , and the STA (500) where the indication primitive is searched in the idle can set up the NAV (net allocation vector) as 0 and the next channel can be scanned. As to the case, where the PHY-CCA indication primitive the STA (500) is searched in the bean-curd dregs (busy) the probe timer can perform the processing about probe response frames (550, 550) received in the maximum channel time (530) after doing the access. The NAV (net allocation vector) can be set up after the processing about received probe response frames (550, 550) as 0 and the STA (500) can scan the next channel.

이하, 본 발명의 실시예에서는 STA(500)으로 수신된 프로브 응답 프레임(550, 550)이 존재하는지 여부를 판단한다는 것은 PHY-CCA.지시 프리미티브를 사용하여 채널 상태를 판단한다는 의미를 포함할 수 있다.

Hereinafter, probe response frames (550, 550) which in an embodiment of the invention, are received to the STA (500) may include the meaning that it determines the channel condition using the PHY-CCA indication primitive that it determines whether it exists or not.

(5) 채널리스트(ChannelList)에 포함된 모든 채널이 스캐닝되는 경우 MLME는 MLME-SCAN.확인 프리미티브(confirm primitive)를 시그널링할 수 있다. MLME-SCAN.확인 프리미티브는 스캐닝 과정에서 획득한 모든 정보를 포함하는 BSSDescriptionSet를 포함할 수 있다.

(5) MLME in which all channels included in the channel list (ChannelList) are scanned can signal the MLME-SCAN confirm primitive. MLME-SCAN. The BSSDescriptionSet including all the information which the confirm primitive obtains in the scanning process is include might.

STA(500)이 액티브 스캐닝 방법을 사용하는 경우, 프로브 타이머가 최소 채널 시간에 도달할 때까지 PHY-CCA.지시 프리미티브의 파라메터가 비지(busy)인지 여부를 판단하는 모니터링을 수행해야 한다.

The case where the STA (500) uses the active method for scanning, and the monitoring which determines until the probe timer reaches even the minimum channel time whether the parameter of the PHY-CCA indication primitive. is the bean-curd dregs (busy) or not have to be performed.

전술한 MLME-SCAN.요청 프리미티브(request primitive)에 포함되는 구체적인 정보는 아래와 같다. STA이 스캐닝을 수행하기 위해서는 MLME에서 MLME-SCAN.요청 프리미티브를 수신할 수 있다. MLME-SCAN.요청 프리미티브는 SME에 의해 생성된 프리미티브이다. MLME-SCAN.요청 프리미티브는 STA이 결합할 다른 BSS가 존재하는지 여부를 판단하기 위해 사용될 수 있다.

The detailed information included in the above-described MLME-SCAN request primitive is as follows:. The MLME-SCAN request primitive can be received by MLME so that STA perform the scanning. MLME-SCAN. It is the primitive in which the request primitive is generated with SME. MLME-SCAN. So that the request primitive determine whether dissimilar BSS in which STA combines exists, or not it can be used.

MLME-SCAN.요청 프리미티브는 구체적으로 BSSType, BSSID, SSID, ScanType, ProbeDelay, ChannelList, MinChannelTime, MaxChannelTime, RequestInformation, SSID List, ChannelUsage, AccessNetworkType, HESSID, MeshID, VendorSpecificInfo와 같은 정보를 포함할 수 있다. MLME-SCAN.요청 프리미티브에 대한 구체적인 설명은 2011년 11월에 개시된 IEEE Draft P802.11-REVmb™/D12, November 2011 #39#IEEE Standard for Information Technology Telecommunications and information exchange between systems-Local and metropolitan area networks-Specific requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications#39#의 6.3.3.2 MLME-SCAN.request에 개시되어 있다.

MLME-SCAN. The request primitive specifically may include the information like the BSSType, BSSID, SSID, scanType, probeDelay, channelList, minChannelTime, maxChannelTime, requestInformation, SSID List, channelUsage, accessNetworkType, HESSID, meshID, vendorSpecificInfo. MLME-SCAN. the detailed description about the request primitive is the disclosed IEEE Draft P802.11-REVmb™ / D12 in 2011 year November, and November 2011 'IEEE Standard for Information Technology Telecommunications and information exchange between systems-Local and metropolitan area networks- Specific requirements Part 11: it is disclosed in 6.3.3.2 MLME-SCAN request of Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications'.

아래의 표 1은 MLME-SCAN.요청 프리미티브가 포함하는 정보를 예시적으로 대해 간략하게 나타낸다.

The following table 1 illustratively faces the information which the MLME-SCAN request primitive includes and it shows.

003c#표 1003e#

003c# table 1003e#.

MLME-SCAN.요청 프리미티브에 포함된 요청 파라메터(request parameter)는 응답 STA이 프로브 응답 프레임을 전송할지 여부를 결정하기 위해 사용될 수 있다. 요청 파라메터는 다른 BSS의 정보가 프로브 응답 프레임에 포함되기를 요청하기 위한 정보를 포함할 수 있다. 또한, 요청 파라메터는 리포트 요청 필드, 딜레이 기준 필드, 최대 딜레이 한계 필드를 포함할 수 있다.

MLME-SCAN. So that the request parameter included in the request primitive determine if the response STA transmits the probe response frame, it can be used. The information of BSS in which the request parameter is different may include the information for requesting to be included in the probe response frame. Moreover, the request parameter may include the report request field, the delay reference field, and the maximum delay limit field.

리포트 요청 필드는 다른 BSS의 정보가 프로브 응답 프레임에 포함되기를 요청하는 정보이고, 딜레이 기준 필드는 프로브 요청 프레임에 대한 응답으로 적용되는 딜레이 타입에 대한 정보를 포함하고, 최대 딜레이 한계 필드는 딜레이 기준 필드에 의해 지시된, 딜레이 타입에 대한 최대 접속 딜레이 정보를 포함할 수 있다.

The report request field may include the information in which it is the information which requests that the information of dissimilar BSS is included in the probe response frame and the delay reference field is applied to the response about the probe request frame. About the delay type, and the maximum delay limit field may include the maximum connection delay information indicated with the delay reference field about the delay type.

이외에도 요청 파라메터는 최소 데이터 레이트 필드 및/또는 수신된 신호 세기 한계 필드를 포함할 수 있다. 최소 데이터 레이트 필드는 MSDU 또는 A-MSDU를 전송함에 있어서 가장 낮은 전체 데이터 레이트에 대한 정보를 포함한다. 수신된 신호 세기

Besides, the request parameter may include the minimum data rate field and/or the received signal strength limit field. The minimum data rate field includes the information about the whole data rate that is most lo

한계 필드는 프로브 요청 프레임의 수신자가 응답을 하기 위해 필요한 신호의 한계값에 대한 정보를 더 포함할 수 있다.

w in transmitting MSDU or the A-MSDU. The received signal strength limit field is that the receiver of the probe request frame tells and the information toward the limit value of the necessary signal is further include migh t.

도 6은 프로브 요청 프레임 전송 방법을 나타낸 개념도이다.

Figure 6 is a conceptual diagram showing the probe request frame transmission method.

도 6에서는 STA이 프로브 요청 프레임(probe request frame)을 브로드캐스트, 멀티캐스트, 유니캐스트하는 방법에 대해 개시한다.

In fig. 6, STA discloses the probe request frame about the broadcast, the multicast, and the method for unicasting.

도 6의 상단은 STA(600)이 프로브 요청 프레임(610)을 브로드캐스트하는 방법이다.

The upper end of fig. 6 is the method in which the STA (600) broadcasts the probe request frame (610).

STA(600)은 프로브 요청 프레임(610)에 와일드카드 SSID (wildcard SSID) 및 와일드카드 BSSID(wildcard BSSID)를 포함하여 프로브 요청 프레임(610)을 브로드캐스트할 수 있다.

The wild card SSID (wildcard SSID) and wild card BSSID (wildcard BSSID) are included and the STA (600) can broadcast the probe request frame (610) to the probe request frame (610).

와일드 카드 SSID 및 와일드 카드 BSSID는 STA(600)의 전송 범위에 포함되는 AP(606-1, 606-2, 606-3, 606-4, 606-6)를 모두 지시하기 위한 식별자로 사용될 수 있다.

It can be used the identification of altogether indicating the wild card SSID and APs (606-1, 606-2, 606-3, 606-4, 606-6) in which the wild card BSSID is included in the transmission range of the STA (600).

STA(600)이 프로브 요청 프레임(610)에 와일드 카드 SSID 및 와일드 카드 BSSID를 포함하여 전송하는 경우, STA(600)이 전송하는 프로브 요청 프레임(610)을 수신한 AP(606-1, 606-2, 606-3, 606-4, 606-6)는 수신된 프로브 요청 프레임에 대한 응답으로 프로브 응답 프레임을 STA(600)으로 전송할 수 있다.

The STA (600) is the wild card SSID in the probe request frame (610) and APs (606-1, 606-2, 606-3, 606-4, 606-6) including the wild card BSSID and receive the probe request frame (610) which the STA (600) transmits in case the transmission transmit the response about the received probe request frame the probe response frame to the STA (600).

브로드캐스트된 프로브 요청 프레임(610)을 수신한 AP(606-1, 606-2, 606-3, 606-4, 606-6)들이 수신한 프로브 요청 프레임(610)에 대한 응답으로 프로브 응답 프레임을 STA(600)으로 일정 시간 안에 전송하는 경우, STA(600)은 한꺼번에 너무 많은 프로브 응답 프레임(probe response frame)을 수신하여 처리해야 하는 문제점이 발생할 수 있다.

The problem that the STA (600) has to receive and processes the at a timeso many probe response frame can be generated the probe response frame by the response about the probe request frame (610) which APs (606-1, 606-2, 606-3, 606-4, 606-6) receiving the broadcasted probe request frame (610) receive by the STA (600) in the preset time in case the transmission.

도 6의 중단은 STA(620)이 프로브 요청 프레임(630)을 유니캐스트하는 방법이다.

The abort of fig. 6 is the method in which the STA (620) unicasts the probe request frame (630).

도 6의 중단을 참조하면, STA(620)이 프로브 요청 프레임(630)을 유니캐스트(unicast)하는 경우에는 STA(620)은 AP의 특정한 SSID/BSSID 정보를 포함한 프로브 요청 프레임(630)을 전송할 수 있다. 프로브 요청 프레임(630)을 수신한 AP 중 STA(620)이 특정한 SSID/BSSID에 해당하는 AP(626)만이 STA(620)으로 프로브 응답 프레임을 전송할 수 있다.

In case the STA (620) the probe request frame (630) the unicast the probe request frame (630) in which the STA (620) includes the specific SSID / BSSID information of AP can be transmitted with reference to the abort of fig. 6. The probe response frame can be transmitted with the STA (620) only the AP (626) in which the STA (620) corresponds to the specific SSID / BSSID among AP receiving the probe request frame (630).

도 6의 하단은 STA(640)이 프로브 요청 프레임(660)을 멀티캐스트하는 방법이다.

The lower part of fig. 6 is the method in which the STA (640) multicasts the probe request frame (660).

도 6의 하단을 참조하면, STA(640)은 프로브 요청 프레임(660)에 SSID 리스트와 와일드카드 BSSID를 포함하여 전송할 수 있다. 프로브 요청 프레임(660)을 수신한 AP 중 프로브 요청 프레임에 포함된 SSID 리스트에 포함된 SSID에 해당하

The SSID list and wild card BSSID are included and the STA (640) can transmit with reference to the lower part of fig. 6 in the probe request frame (660). APs (660-1, 660-2) corresponding to SSID included in the SSID li

는 AP(660-1, 660-2)는 프로브 응답 프레임을 STA(640)으로 전송할 수 있다.

st included in the probe request frame among AP receiving the probe request frame (660) transmits the probe response frame to the STA (640).

전술한 바와 같이 기존의 STA은 MLME.SCAN-요청 프리미티브에 포함된 SSID와 BSSID를 기반으로 프로브 요청 프레임을 유니캐스트, 멀티캐스트 또는 브로트캐스트할지 여부를 결정할 수 있다. 프로브 요청 프레임의 유니캐스트, 멀티캐스트 또는 브로트캐스트는 아래와 같은 MLME.SCAN-요청 프리미티브의 설정을 기반으로 수행될 수 있다.

As described above, the probe request frame is unicastd based on SSID and BSSID in which the existing STA is included in the request primitive with the MLME SCAN and the multicast or broadcast paper acceptance and rejection can be decided. The unicast of the probe request frame , and the multicast or the broadcast can be performed based on the setting of the request primitive with the following MLME SCAN.

MLME.SCAN-요청 프리미티브가 특정 BSSID를 포함하고 있는 경우, STA은 특정 BSSID를 가지는 AP로 프로브 요청 프레임을 유니캐스트한다. 유니캐스트되는 프로브 요청 프레임의 MAC 헤더의 주소 필드(address field)에 AP의 특정 BSSID를 포함할 수 있다.

MLME. The probe request frame is unicastd to the case where the SCAN- request primitive includes the specific BSSID, and AP in which STA has the specific BSSID. The specific BSSID of AP is include might in the address field of the MAC header of the probe request frame unicasting.

MLME.SCAN-요청 프리미티브에 SSID 또는 SSID 리스트를 포함하고 와일드카드 BSSID를 포함하고 있는 경우, STA은 SSID 또는 SSID 리스트에 해당하는 AP에 프로브 요청 프레임을 멀티캐스트할 수 있다. 프로브 요청 프레임에 SSID 또는 SSID 리스트를 포함하고, 프로브 요청 프레임의 MAC 헤더의 주소 필드에 와일드카드 BSSID를 포함할 수 있다.

MLME. SSID or the case , and STA of containing the SSID list and including the wild card BSSID can multicast the probe request frame at SSID or AP corresponding to the SSID list in the SCAN- request primitive. SSID or the SSID list is included in the probe request frame and the wild card BSSID is include might in the address field of the MAC header of the probe request frame.

MLME.SCAN-요청 프리미티브에 와일드카드 SSID가 포함된 경우, STA은 프로브 요청 프레임을 브로드캐스트할 수 있다. 프로브 요청 프레임에 와일드카드 SSID를 포함하고, MAC 헤더의 주소 필드에 와일드카드 BSSID를 포함할 수 있다.

MLME. In case the wild card SSID is included in the SCAN- request primitive STA can broadcast the probe request frame. The wild card SSID is included in the probe request frame and the wild card BSSID is include might in the address field of the MAC header.

이하에서는 802.11에서 사용되는 무선 접속 방법에 대해 개시한다.

Hereinafter, it discloses about the radio connection method for being used in 802.11.

기본적으로 MAC 계층은 복수의 STA이 무선 매체를 공유하기 위한 방법으로 DCF(distributed coordination function)를 사용할 수 있다. DCF는 CSMA/CA(carrier sensing multiple access with collision avoidance)를 기본으로 한다. 선택적으로 MAC 계층은 RTS(request to send)/CTS(clear to send)를 기반으로 STA 간에 매체를 공유하기 위한 방법을 정의한다. DCF 구체적으로 아래와 같다.

Elementarily, the MAC layer can use the DCF (distributed coordination function) as the method in which multiple STAs share the wireless medium. DCF the CSMA / CA (carrier sensing multiple access with collision avoidance) to the basis. Selectively, the MAC layer defines the method for sharing the media based on the RTS (request to send) / CTS (clear to send) between STA. Specifically it is as follows: with DCF.

도 7은 DCF 접속 과정을 나타낸 개념도이다.

Figure 7 is a conceptual diagram showing the DCF login.

일반적으로 DCF 접속 환경에서 동작할 때는 DIFS 기간 이상으로 매체가 사용 중이지 않으면(즉, 아이들(idle)한 경우) STA은 전송이 임박한 MPDU(MAC protocol data unit)를 전송할 수 있다. 매체가 반송파 감지 메커니즘(carrier sensing mechanism)에 의해서 사용 중이라고 결정되었을 경우 STA은 랜덤 백오프 알고리즘(random backoff algorithm)에 의해서 CW(contention window)의 사이즈를 결정하고 백오프 절차를 수행할 수 있다. STA은 백오프 절차를 수행하기 위해 CW를 설정하게 되고 CW 내에서 임의의 타임 슬롯(timeslot)을 선택한다. 이를 백오프 타임이라고 부른다. 이 중에서 가장 짧은 백오프 타임을 가진 STA이 매체에 접속할 수 있고 나머지 STA들은 남은 백오프 타임을 중지하고 전송하는 단말이 전송 완료될 때까지 대기할 수 있다. STA의 프레임 전송이 완료된 후에는 나머지 STA은 다시 남은 백오프 타임을 가지고 경쟁을 수

Generally, when operating in the DCF connection environment, if the media is not the use over the DIFS period (it does with other words, the idle (idle)), STA can transmit the MPDU (MAC protocol data unit) in which the transmission is near at hand. In case the media was determined with the carrier detect mechanism (carrier sensing mechanism) as the use STA can determine the size of the CW (contention window) with the random backoff algorithm and the backoff procedure can be performed. So that STA perform the backoff procedure, CW is set up and the arbitrary time slot (timeslot) is chosen in CW. This is called a backoff time. Among these, STA having the shortest backoff time can connect to the media and until the terminal stopping the backoff time remaining and transmits is transfer completed rest