

IEEE 802.11ax Compliant TRx Characteristics Evaluation

– Supporting 11ax, 6 GHz Band, 160 MHz Bandwidth, and WPA3 –

Wireless Connectivity Test Set MT8862A

The IEEE 802.11ax standard (hereinafter referred to as 11ax), which is the basic standard for Wi-Fi 6/6E, was standardized in February 2021. This application note introduces the evaluation of transmission and reception according to the IEEE 802.11ax standard when using the Wireless Connectivity Test Set MT8862A.

The IEEE 802.11ax standard has adopted technologies such as **OFDMA**, **Resource Unit (RU)**, and **Multi-User**, and also expanded to the **6 GHz band** in addition to the conventional frequency bands (2.4/5 GHz bands). Unlike the congested 2.4/5 GHz band, the 6 GHz band is expected to utilize **160 MHz bandwidth**.

According to the IEEE 802.11ax standard, this standard is known as "High-Efficiency Wireless LAN (WLAN)." In other words, unlike conventional WLAN, this method is designed to **improve the efficiency of frequency usage**. Utilizing the true value of 11ax in a real-world environment is important for the evaluation of the finished product.



IEEE 802.11ax Transmitter & Receiver Evaluation Items * From IEEE Std 802.11ax™ (February 2021)

The table below shows the IEEE 802.11ax transmit and receiver evaluation items and the corresponding MT8862A support. Examples of software operations are given in the corresponding figure number.

The evaluation content for IEEE 802.11ax has changed slightly compared to previous methods, but the MT8862A can handle this, as shown in the table below.

Chapter	Title	MT8862A Supported (✓)	MT8862A Operation Window Examples	
			Single-User	Multi-User
27.3.15.3	Pre-correction accuracy requirements			
	Transmit power and RSSI measurement accuracy	✓	*3	Figure 12
	Carrier frequency offset (CFO) error	✓	*3	Figure 14
	The arrival time of the HE TB PPDU at the AP	✓*1	*3	*4
27.3.19	Transmit specification			
27.3.19.1	Transmit spectral mask	✓	Figure 2	Figure 7
27.3.19.2	Spectral flatness	✓	Figure 3	Figure 8
27.3.19.3	Transmit center frequency and symbol clock frequency tolerance	✓	Figure 4	Figure 9*5
27.3.19.4.2	Transmit center frequency leakage	✓	Figure 5	Figure 10
27.3.19.4.3	Transmitter constellation error	✓	Figure 6	Figure 11
27.3.19.4.4	Transmitter modulation accuracy (EVM) test	✓	Figure 6	Figure 11*6
27.3.20	Receiver specification			
27.3.20.2	Receiver minimum input sensitivity	✓	*4	*7
27.3.20.3	Adjacent channel rejection	✓*2	*4	*7
27.3.20.4	Nonadjacent channel rejection	✓*2	*4	*7
27.3.20.5	Receiver maximum input level	✓	*4	*7

*1: Requires a spectrum analyzer.

*2: Requires a signal generator for jamming-signal

*3: For 27.3.15.3, MT8862A does not support Single-User, but supports STA and Multi-User (HE TB).

*4: Supported by MT8862A. Operation window examples are omitted from this application note.

*5: STA and Multi-User (HE TB) are described in 27.3.19.3 as follows.

"HE TB PPDU format is subject to additional requirements as defined in 27.3.15."

*6: Evaluation of Unused Tone Error is added depending on the Resource Unit setting.

*7: For 27.3.20, each item was evaluated as Single-User (HE SU).

Current Status and Risks of WLAN

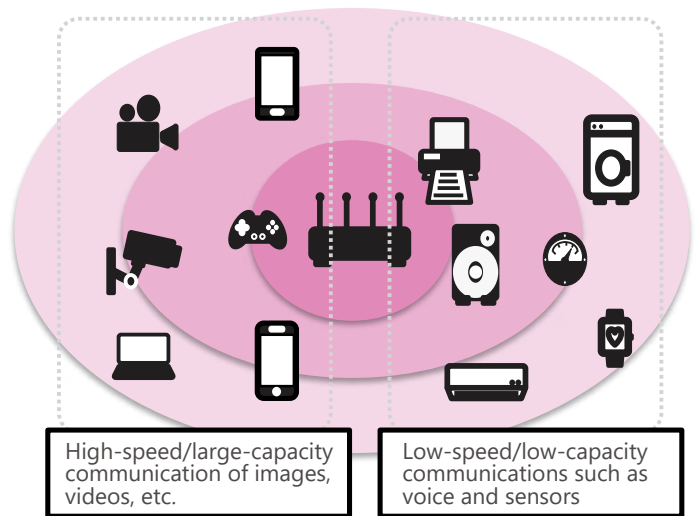
If the number of devices increases,
stable communication becomes impossible!?

Nowadays, not only smartphones and computers but a variety of other devices communicate via WLAN.

As the amount of WLAN communication around us increases, problems such as packet collisions and a decrease in free time/channels must occur.

As a result, problems such as low data rate, slow response, and frequent disconnections are increasing, making it difficult to provide a stable service.

To reduce such risks, the publication of "IEEE 802.11ax", which will feature the new technologies, is expected.



New Technologies of 11ax

[New technologies adopted in 11ax]

- OFDMA, Resource Unit (RU), Adoption of Multi-User mode
- Expected use of 6 GHz frequency band expansion and 160 MHz bandwidth
- Modulation method 1024QAM
- Subcarrier spacing: 1/4
- Number of subcarriers: Approximately 4 times
- Reduce the time rate of guard interval
- Added option to expand guard interval time ratio

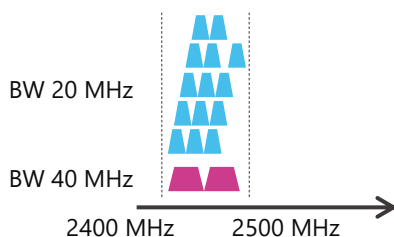
High Efficiency

IEEE Std 802.11ax™

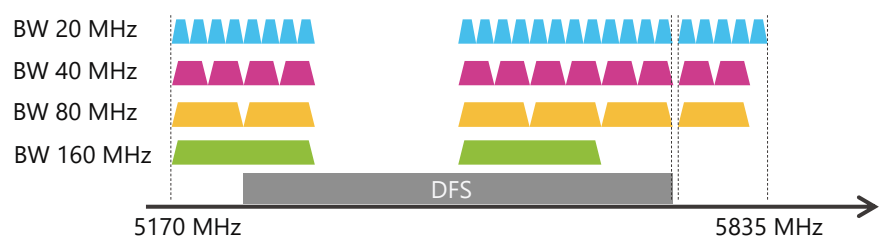
- Update of Transmit and Receiver specification
[27.3.19], [27.3.20]
- Addition of Evaluation for STA and Multi-User (HE TB)
[27.3.15.3]

Frequency Band 2.4/5/6 GHz and Channel Arrangement

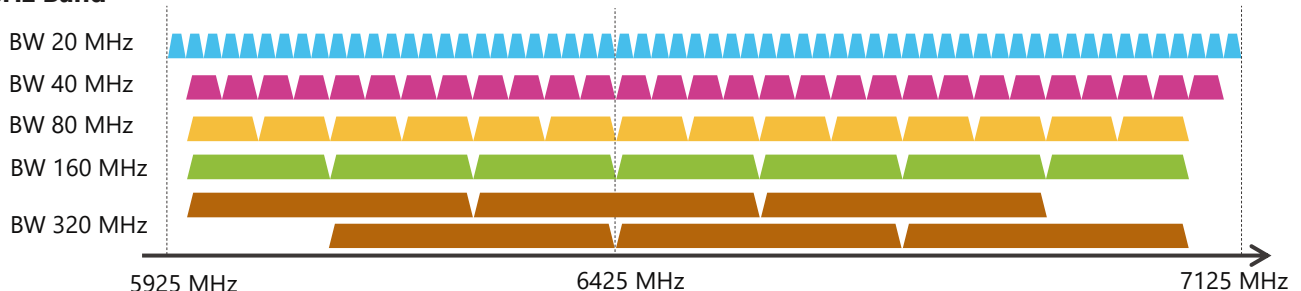
2.4 GHz Band



5 GHz Band



6 GHz Band



What Makes 11ax Different from Conventional WLAN?

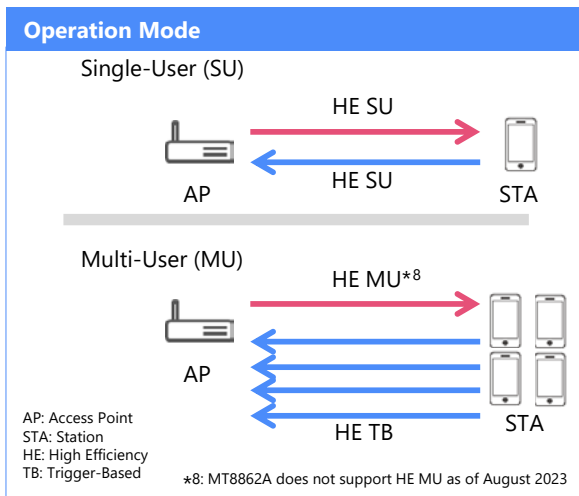
What is Multi-User mode?

Conventional WLAN uses Orthogonal Frequency-Division Multiplexing, "OFDM", but 11ax also uses Orthogonal Frequency-Division Multiple Access, "OFDMA". The OFDM operating mode is used for Single User (SU) but OFDMA allows Multi-User (MU) use.

In SU, both AP/STA send a frame called HE SU.

In MU, the AP sends a frame called HE MU and the STA sends a frame called HE TB.

In Single-User mode, only one AP and one STA can communicate at the same time. However, **Multi-User OFDMA allows one AP and multiple STAs to communicate simultaneously.**



What are OFDMA and Resource Unit (RU)?

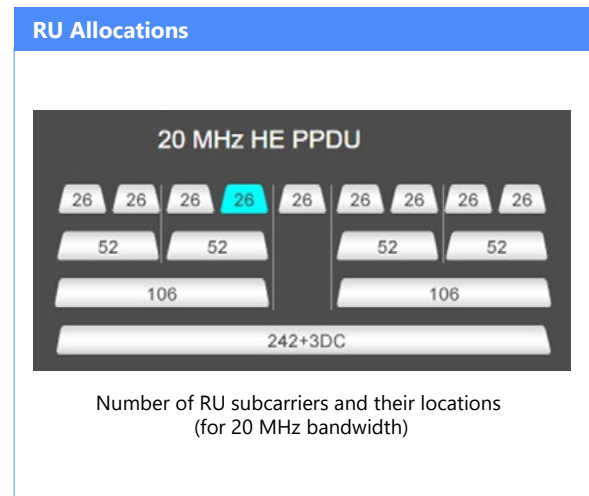
In conventional WLANs, when one AP and one STA are communicating, they occupy a channel (frequency) for that time. **OFDMA allows one AP and multiple STAs to communicate simultaneously because one channel can be divided on the frequency axis.**

The unit of division is called RU.

In 11ax, the number of subcarriers in the channel is increased by narrowing the subcarrier spacing.

In the 20 MHz channel width example, 26, 52, 106, or 242 RUs can be placed with a subcarrier.

(See the figure below)

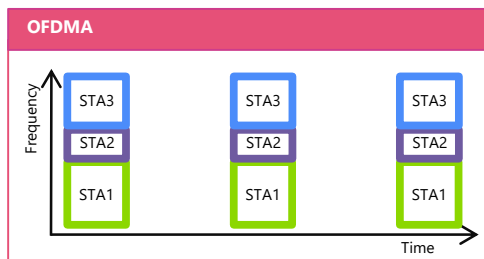
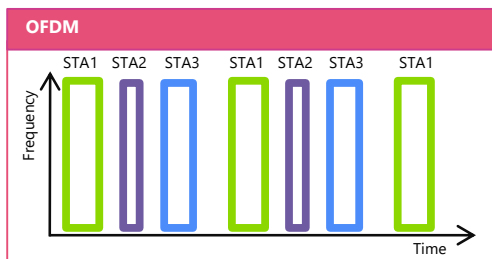


What is the Difference Between OFDM and OFDMA?

The diagrams below show the WLAN frequency allocation of each STA on the time axis.

In the case of OFDM, the channel (frequency) is occupied during communication even if the amount of data being communicated is small. Therefore, as more STAs communicate, the amount of free time decreases, forcing the users to wait until free time becomes available. **This can lead to problems such as difficulty connecting and slow data speeds.**

With OFDMA, multiple STAs can communicate at the same time by dividing the occupancy bandwidth on the frequency axis. It is also able to change the assigned RUs depending on the amount of data being communicated. As a result, even if the number of devices exchanging small amounts of data at low speeds increases, there will be fewer cases of frequencies being monopolized, **thus enabling stable communication.**



OFDMA allows multiple users to connect an AP at the same time.

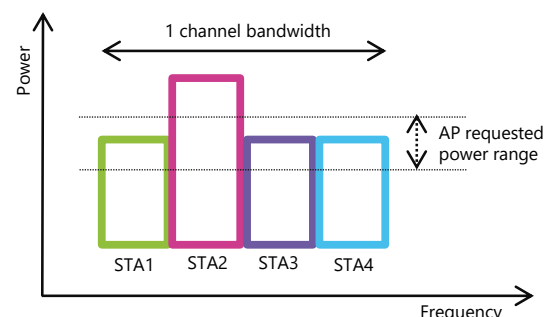
STA Power Control

Since an AP communicates with multiple STAs, the STAs must control their power based on the "power requested by the AP (RSSI)."

In the example on the right, STA2 is communicating at maximum power. STA2 may not be able to communicate with the AP because doing so would exceed the power range requested by the AP.

Furthermore, the signal will interfere with other STAs that are communicating at the same time, which may prevent them from communicating.

It is necessary to verify whether the STA can control the power effectively.



MT8862A: Setting and Required Option [11ax, Channels in 6 GHz Band, 160 MHz Bandwidth]

This section introduces the MT8862A setting window, the required options, and the operation overview.

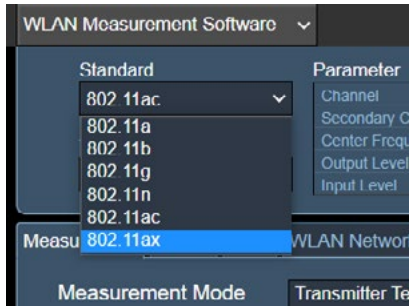


Figure 1-1: WLAN Measurement Software – Standard Selection

Choose **11ax**.

* The following options are required.

☐ MX886200A: WLAN Measurement Software (Required)

☐ MX886200A-002: WLAN 802.11ax Option

Software for IEEE 802.11ax measurement.

Supports evaluation of 11ax transmission power, modulation analysis, reception sensitivity, and other transmission and reception characteristics.

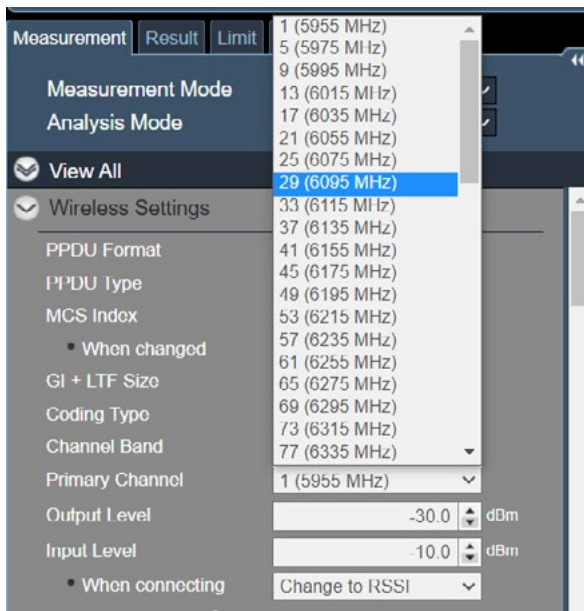


Figure 1-2: Wireless Settings, Primary Channel (frequency) Selection

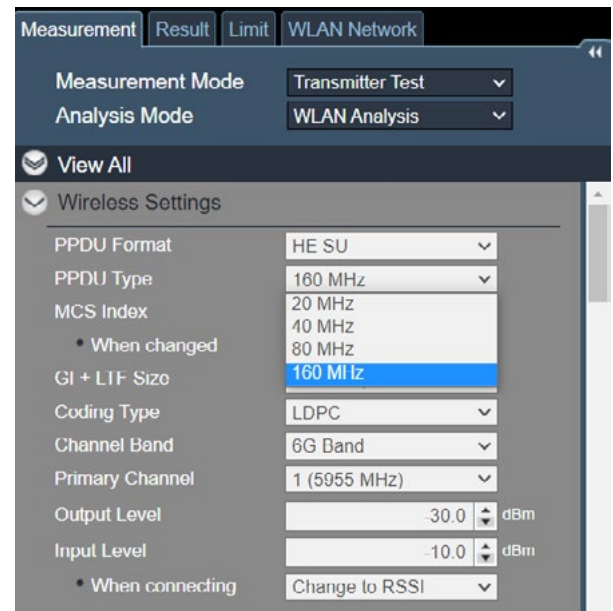


Figure 1-3: Wireless Settings, Bandwidth Selection

You can select a channel in the **6 GHz band**.

The following options are required.

☐ MT8862A-001: RF Frequency 2.4 GHz, 5 GHz (Required)

☐ MT8862A-002: RF Frequency 6 GHz

MX886200A WLAN Measurement Software which supports the 6 GHz WLAN frequency band (5995 to 7115 MHz)

☐ MT8862A-010: Extended RF Hardware

Extends MT8862A upper frequency limit to 7.3 GHz.

The upper-frequency limit without this option is 6 GHz

160 MHz bandwidth is available.

The following options are required.

☐ MT8862A-001, 002, 010: See left column.

☐ MX886200A-030: 160 MHz Bandwidth ^{Note}

Extends the maximum analysis bandwidth to 160 MHz.

Without this option, the maximum analysis bandwidth is 80 MHz.

(In network mode measurement)

Note: MX886200A-030 requires MT8862A-001, 002, 010.

For Product Configuration, Visit Anritsu Website



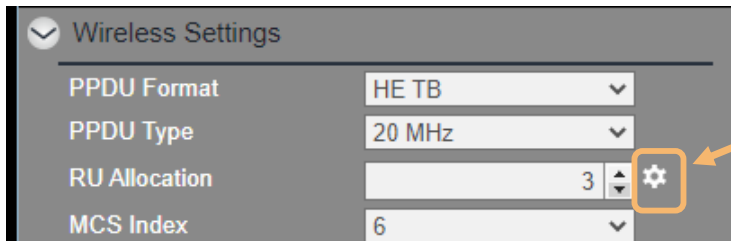
[Wireless Connectivity Test Set \(WLAN Tester\) MT8862A](#)

MT8862A: Setting Window [RU Allocation]

For the evaluation item (27.3.15) for STA and Multi-User (HE TB), it is necessary to specify and evaluate the RU* size/placement of the STA to be measured.

In this evaluation, the MT8862A (AP side) requests the target STA to set an arbitrary RU size/placement, and the MT8862A analyzes the header information sent from the STA to confirm that the STA's RU size/placement, etc. are set correctly.

* RU: Resource Unit



Clicking the gear button to the right of RU Allocation opens the RU Allocation Setting window (see below).
Click on the RU in the window - the allocated RU is displayed against a light-blue background.

Figure 1-4: Wireless Settings – RU Allocation selection

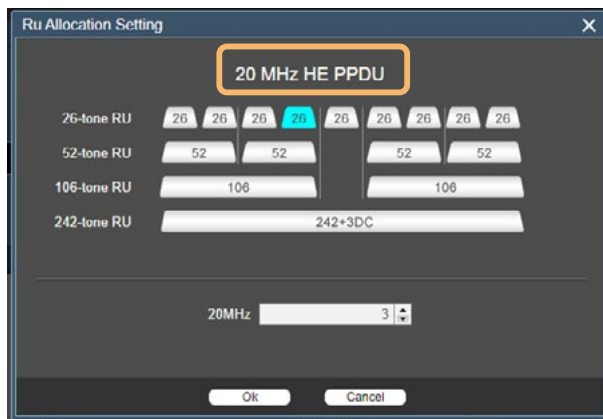


Figure 1-5: Wireless Settings
– RU Allocation Setting Dialog Box (20 MHz)

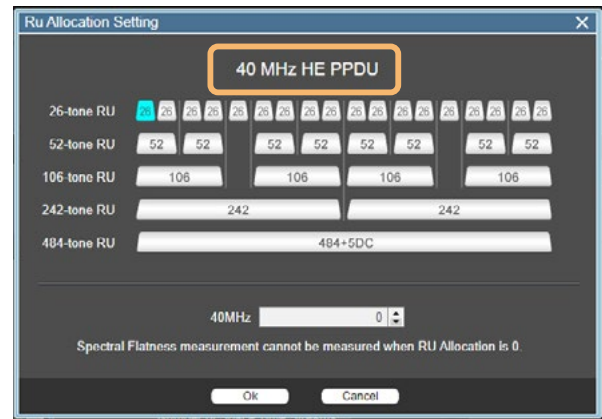


Figure 1-6: Wireless Settings
– RU Allocation Setting Dialog Box (40 MHz)

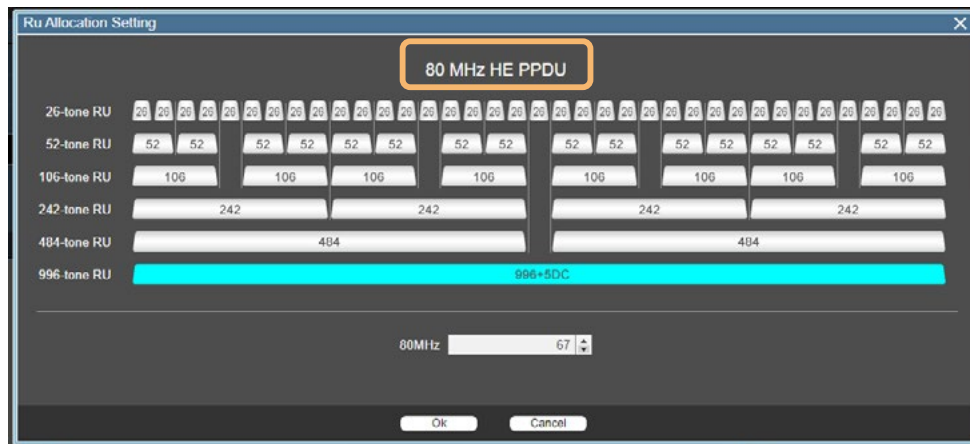


Figure 1-7: Wireless Settings – RU Allocation Setting Dialog Box (80 MHz)

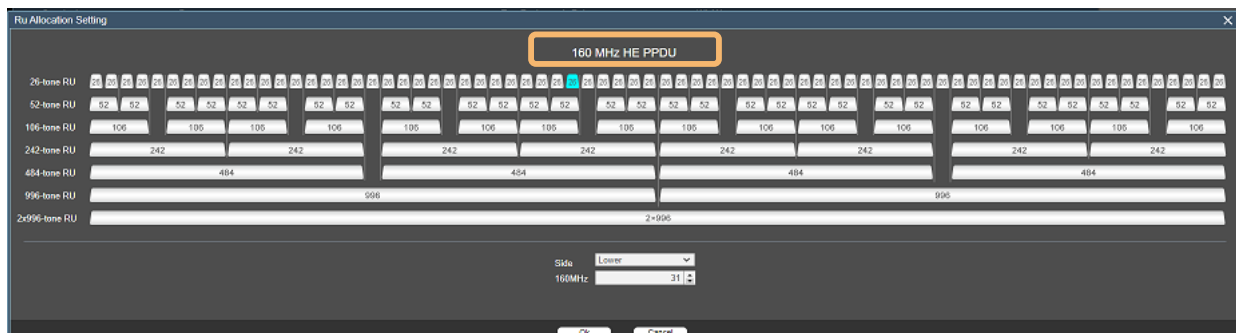


Figure 1-8: Wireless Settings – RU Allocation Setting Dialog Box (160 MHz)

MT8862A: 11ax Analysis Window [Single-User]

This section introduces the transmission evaluation for Single-User (HE SU) according to the 11ax standard when using the MT8862A.

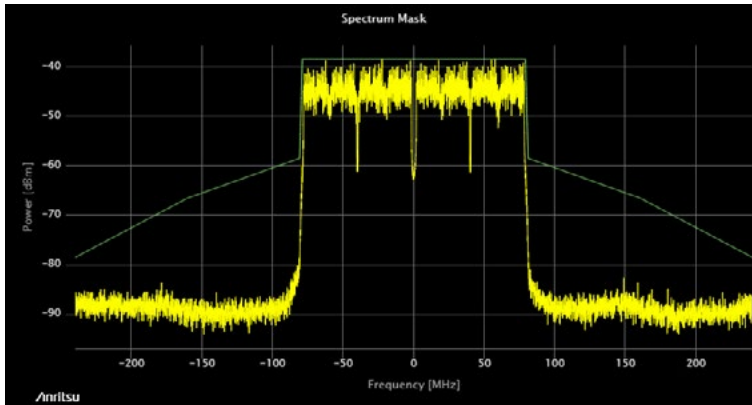


Figure 2-1: MT8862A Analysis Window – Spectrum Mask (Graph)

Spectrum Mask		Averaged Spectrum		Per Packet Spectrum	
Gate1 Pass/Fail		PASS		PASS	
Spectrum Mask Margin					
	L4	L3	L2	L1	
Gate1 Average [dB]	-	-10.35	-20.90	-19.38	
Gate1 Maximum [dB]	-	-7.00	-17.97	-18.74	
Gate1 Minimum [dB]	-	-9.48	-21.04	-19.86	
	U1	U2	U3	U4	
Gate1 Average [dB]	-17.48	-19.22	-9.70	-	
Gate1 Maximum [dB]	-17.21	-16.75	-6.29	-	
Gate1 Minimum [dB]	-17.70	-19.67	-9.30	-	

Figure 2-2: MT8862A Analysis Window – Spectrum Mask (Numeric Data)

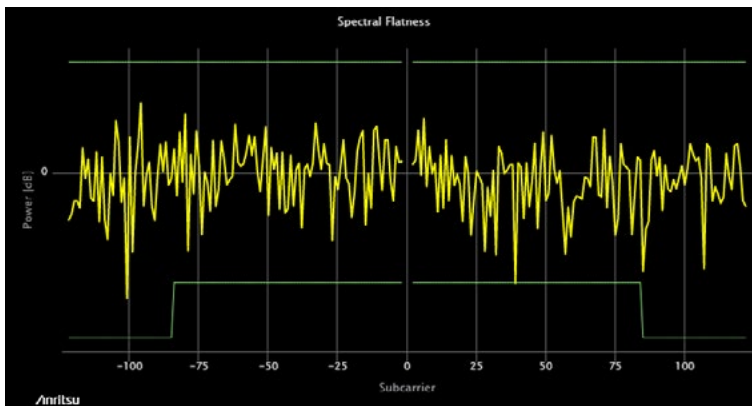


Figure 3-1: MT8862A Analysis Window – Spectral Flatness (Graph)

Spectral Flatness		Averaged Spectrum		Per Packet Spectrum	
Pass/Fail		PASS			

Figure 3-2: MT8862A Analysis Window – Spectral Flatness (Numeric Data)

Center Frequency Tolerance			
	Average	Maximum	Minimum
Center Frequency Tolerance [ppm]	3.6	3.7	3.5
Center Frequency Tolerance [Hz]	20042	20552	19643
Symbol Clock Frequency Tolerance			
	Average	Maximum	Minimum
Symbol Clock Frequency Tolerance [ppm]	9.89	9.71	10.08
Symbol Clock Frequency Tolerance [Hz]	2	2	3

Figure 4: MT8862A Analysis Window – Center Frequency Tolerance, Symbol Clock Frequency Tolerance (Numeric Data)

27.3.19.1 Transmit spectral mask

11ax specifies masks for each of the 20, 40, 80, and 160 MHz bandwidths.

The 11ax mask has a different offset frequency compared to a conventional WLAN.

The MT8862A automatically performs measurement using a mask that complies with the standard based on the set conditions. The results are displayed as a graph. The numerical results show the margin and the judgment result (PASS/FAIL).

27.3.19.2 Spectral flatness

11ax specifies allowable values for each of the 20, 40, 80, and 160 MHz bandwidths.

Compared to conventional WLAN, **11ax has a different subcarrier spacing and number of subcarriers, such that the flatness conditions are also different.**

The MT8862A automatically changes the flatness conditions based on the settings and displays the results as a graph. It also displays the result of the judgment (PASS/FAIL).

27.3.19.3 Transmit center frequency and symbol clock frequency tolerance

For 11ax, tolerance values are specified for each frequency band: 2.4, 5, and 6 GHz.

The MT8862A displays the numerical results in [ppm] and [Hz].

Tolerance 2.4 GHz band: ± 25 ppm
 5/6 GHz band: ± 20 ppm

MT8862A: 11ax Analysis Window [Single-User] (Continued)



Figure 5: MT8862A Analysis Window
– Center Frequency Leakage (Numeric Data)

27.3.19.4.2 Transmit center frequency leakage

Compared to a conventional WLAN, 11ax has a different subcarrier spacing.

The MT8862A displays the results numerically.
Tolerance < -32 dB

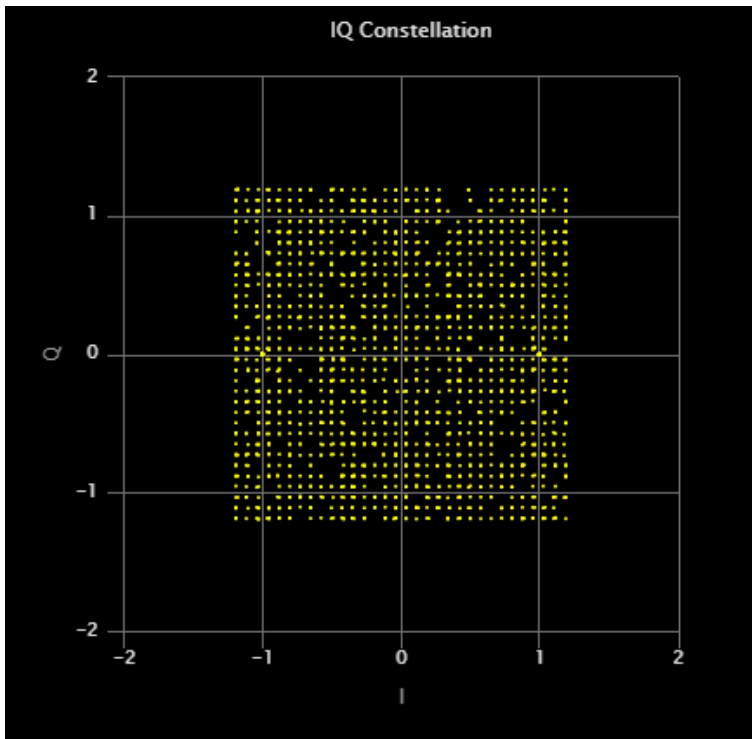


Figure 6-1: MT8862A Analysis Window – IQ Constellation (Graph)



Figure 6-2: MT8862A Analysis Window
– Error Vector Magnitude (EVM) (Numeric Data)

27.3.19.4.3 Transmitter constellation error

27.3.19.4.4 Transmitter modulation accuracy (EVM) test

11ax adds the modulation format 1024QAM as MCS10 and MCS11.

From MCS0 to MCS11, each has a different modulation method and code rate, and the EVM tolerance also differs. (see Table 1)

In addition, common tolerances apply to the 20, 40, 80, and 160 MHz bandwidths.

Table 1: EVM Tolerance Reference: IEEE Std 802.11ax 27.3.19.4.3 (Feb 2021)

MCS	Modulation	Coding Rate	EVM [dB]	EVMrms [%]
0	BPSK	1/2	≤ -5	≤ 56.2
1	QPSK	1/2	≤ -11	≤ 31.6
2	QPSK	3/4	≤ -13	≤ 22.4
3	16QAM	1/2	≤ -16	≤ 15.8
4	16QAM	3/4	≤ -19	≤ 11.2
5	64QAM	2/3	≤ -22	≤ 7.9
6	64QAM	3/4	≤ -25	≤ 5.6
7	64QAM	5/6	≤ -27	≤ 4.5
8	256QAM	3/4	≤ -30	≤ 3.2
9	256QAM	5/6	≤ -32	≤ 2.5
10	1024QAM	3/4	$\leq -35^{*9}/-32$	$\leq 1.8^{*9}/2.5$
11	1024QAM	5/6	$\leq -35^{*9}/-32$	$\leq 1.8^{*9}/2.5$

*9: With amplitude correction

Note: For detailed information about the standard, please refer to the latest revision of IEEE Std 802.11ax.

MT8862A: 11ax Analysis Window [Multi-User]

This section introduces the transmission evaluation for Multi-User (HE TB) according to the 11ax standard when using the MT8862A.

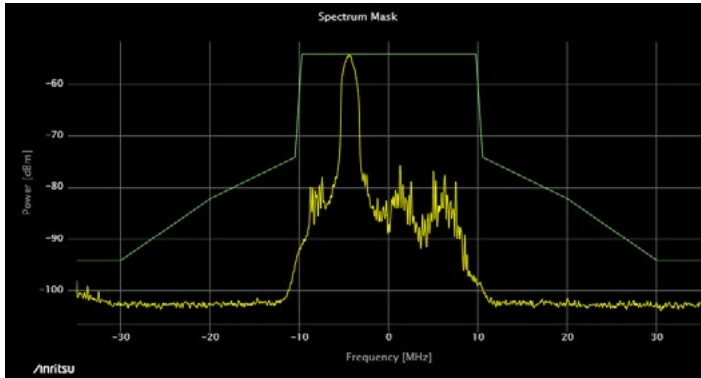


Figure 7-1: MT8862A Analysis Window – Spectrum Mask (Graph)



Figure 7-2: MT8862A Analysis Window – Spectrum Mask (Numeric Data)

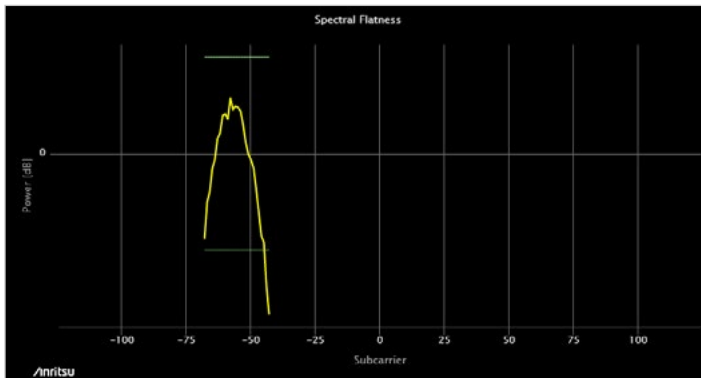


Figure 8-1: MT8862A Analysis Window – Spectral Flatness (Graph)



Figure 8-2: MT8862A Analysis Window – Spectral Flatness (Numeric Data)

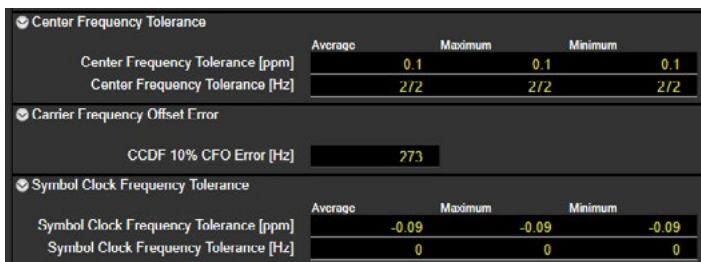


Figure 9: MT8862A Analysis Window – Center Frequency Tolerance, Symbol Clock Frequency Tolerance (Numeric Data)

27.3.19.1 Transmit spectral mask

The same tolerances (masks) as those used for Single-User are also applied to Multi-User.

11ax specifies masks for each of the 20, 40, 80, and 160 MHz bandwidths.

The 11ax mask has a different offset frequency compared to a conventional WLAN.

The MT8862A automatically performs measurement using a mask that complies with the standard based on the set conditions. The results are displayed as a graph.

The numerical results show the margin and the judgment result (PASS/FAIL).

27.3.19.2 Spectral flatness

In Multi-User, measurement is performed to only the specified RU portion.

The MT8862A automatically changes the flatness conditions based on the settings and displays the results as a graph. It also displays the result of the judgment (PASS/FAIL).

27.3.19.3 Transmit center frequency and symbol clock frequency tolerance

The same allowances as those used for Single-User are also applied to Multi-User.

For 11ax, tolerance values are specified for each frequency band: 2.4, 5, and 6 GHz.

The MT8862A displays the numerical results in [ppm] and [Hz].

Tolerance 2.4 GHz band: ± 25 ppm
5/6 GHz band: ± 20 ppm

* Please also see Figure 15 on p.11 for CFO Error.

TA and Multi-User (HETB) are described in 27.3.19.3 as follows:
"HETB PDU format is subject to additional requirements as defined in 27.3.15."

Note: For detailed information about the standard, please refer to the latest revision of IEEE Std 802.11ax.

MT8862A: 11ax Analysis Window [Multi-User] (Continued)



Figure 10: MT8862A Analysis Window
– Center Frequency Leakage (Numeric Data)

27.3.19.4.2 Transmit center frequency leakage

The same allowances as those used for Single-User are also applied to Multi-User.

Compared to a conventional WLAN, 11ax has a different subcarrier spacing.

The MT8862A displays the results numerically.

Tolerance < -32 dB

27.3.19.4.3 Transmitter constellation error

27.3.19.4.4 Transmitter modulation accuracy (EVM) test

In Multi-User mode, the measurement is performed on the RU that is outputting a signal to the channel, and the same tolerances as those applied to Single-User apply.

11ax adds the modulation format 1024QAM as MCS10 and MCS11.

From MCS0 to MCS11, each has a different modulation method and code rate, and the EVM tolerance also differs. (see Table 1)

In addition, common tolerances apply to the 20, 40, 80, and 160 MHz bandwidths.

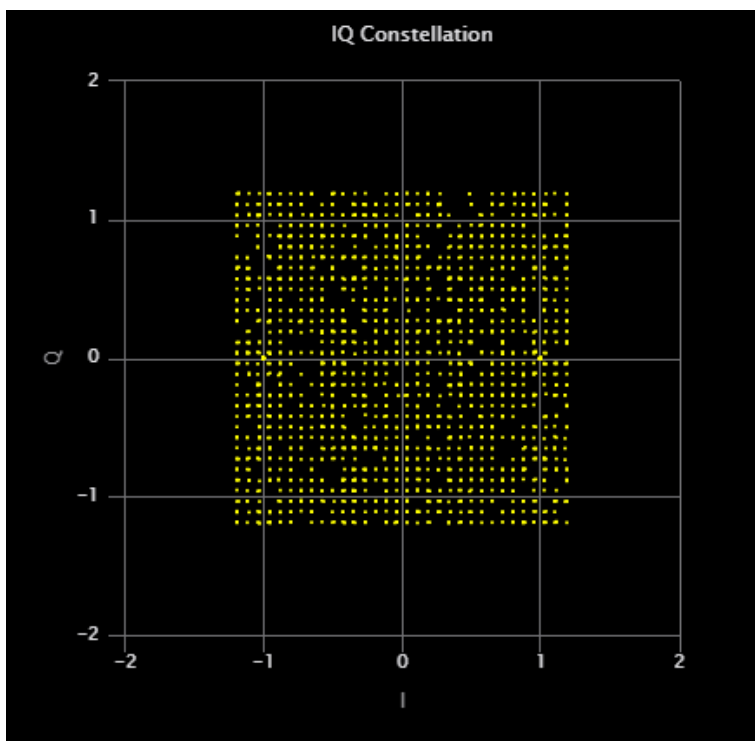


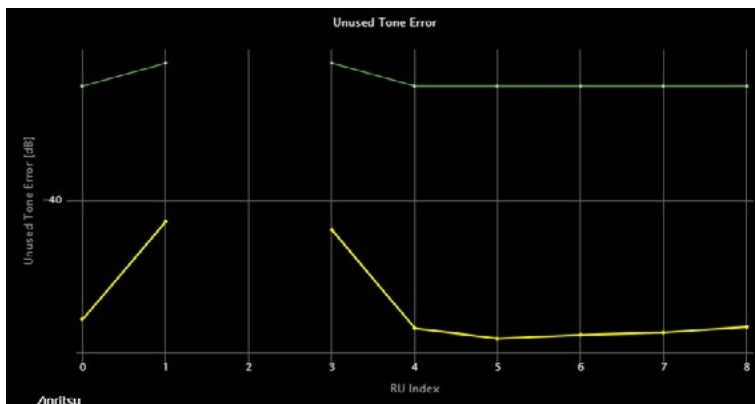
Figure 11-1: MT8862A Analysis Window – IQ Constellation (Graph)



Figure 11-2: MT8862A Analysis Window – EVM (Numeric Data)

* Figures 11-1 and 11-2 are examples of the Single-User measurement display.

The MT8862A also supports Multi-User measurements.



[New Evaluation] Unused Tone Error

Measured in the case of STA and Multi-User (HETB).

Unused Tone Error displays the ratio of the average power of the subcarriers in each unoccupied 26-tone RU to the average power of the subcarriers in the occupied RU. The measurement results are judged against the average value of the Summary to determine whether they exceed the Mask line.

If the device under test (DUT) does not support HE TB, the MT8862A will not perform measurement and judgment.

* Please also see Figure 14 on page 11.

Figure 11-3: MT8862A Analysis Window – Unused Tone Error (Graph)

Note: For detailed information about the standard, please refer to the latest revision of IEEE Std 802.11ax.

MT8862A: Setting/Analysis Window [STA and Multi-User (HE TB)]

Installing the 11ax option (MX886200A-002) on the MT8862A allows you to evaluate the following.

1. The MT8862A (AP side) requests the RU size/placement arbitrarily and checks the size/placement of the STA transmission

Set PPDU Format to [HE TB].

Clicking  to the right of the RU Allocation edit box opens the RU Allocation Setting dialog box.

Set the size and placement of the RU.

The MT8862A analyzes the header information sent from the STA.

Check whether Standard (11ax), PPDU Format (HE TB), and RU Allocation are controlled as required.

Request (MT8862A → STA)

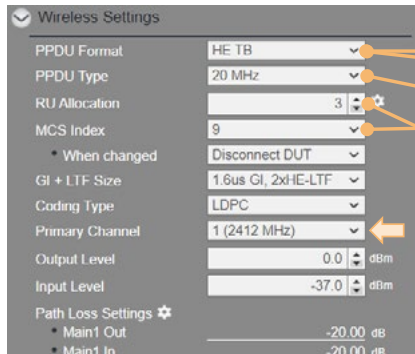


Figure 12-1: Wireless Settings

Checking Results (STA → MT8862A)

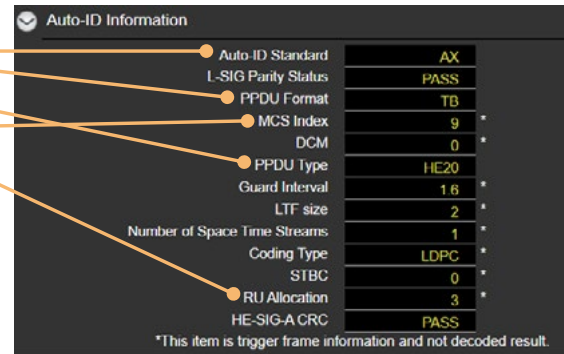


Figure 12-2: MT8862A Analysis Window (Numeric Data)

2. Request the power target value (RSSI) from the MT8862A (AP side) and check the STA transmission power and RSSI measurement

27.3.15.3 Pre-correction accuracy requirements

□ Transmit power and RSSI measurement accuracy

Absolute transmit power accuracy: $\pm 3 \text{ dB}^{*10}$

RSSI measurement accuracy: $\pm 3 \text{ dB}^{*10}$

*10: Example for Class A

Set the target value for the received power on the MT8862A (AP side) to "RSSI".

Request (MT8862A → STA)

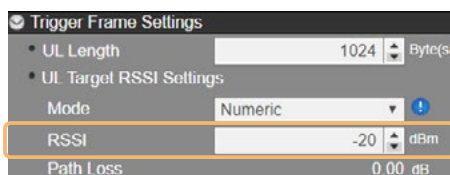
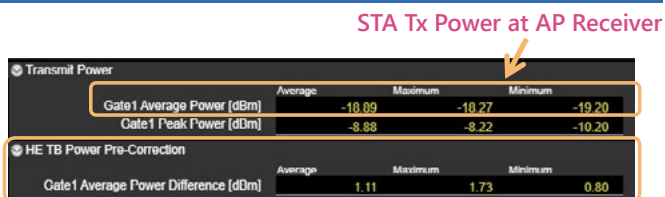


Figure 13-1: Trigger Frame Settings

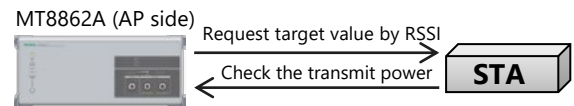
The power transmitted from the STA and received by the MT8862A (AP side) is measured. This checks whether the STA's power control is operating correctly and whether it can perform transmission while taking spatial attenuation into account.

Checking Results (STA → MT8862A)



Measured RSSI Power: Power difference between Target RSSI and the measured power at AP (MT8862A)

Figure 13-2: MT8862A Analysis Window (Numeric Data)



RSSI Measurement Power Transaction

HE TB Power Pre-Correction:

Power Pre-Correction is measured for 11ax HE TB format. Power Pre-Correction is the measurement of the difference between the average power of the signal within the Gate section and the Target RSSI.

Power Pre-Correction is a measurement of the function where the STA calculates the path loss based on the trigger frame sent by the MT8862A (AP side) and adjusts the transmission power on the STA side so that the target RSSI is achieved at the receiving end of the MT8862A (AP side).

For 11ax HE TB, it is necessary to evaluate whether the STA controls the RU size/placement and power in response to requests from the AP. The MT8862A acts as the AP and can communicate with the STA for evaluation.

3. Check the subcarrier power for each unoccupied 26-tone

27.3.19.4.4 Transmitter modulation accuracy (EVM) test

Unused Tone Error:

Unused Tone Error is measured for 11ax HE TB format.

Unused Tone Error is a measurement of the ratio of the average power of the subcarriers in each unoccupied 26-tone RU to the average power of the subcarriers in the occupied RU.

The measurement results are judged against the average value of the Summary to determine whether they exceed the mask line.

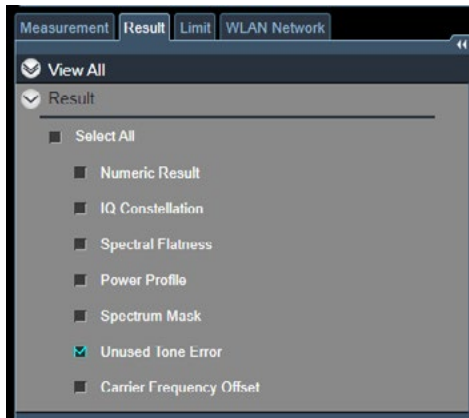


Figure 14-1: Result Tab – Result Selection

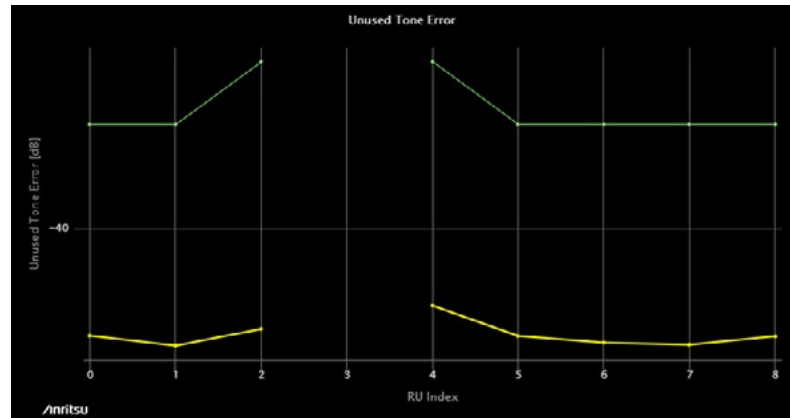


Figure 14-2: MT8862A Analysis Window – Unused Tone Error (Graph)

4. Check the carrier frequency offset of the STA side relative to the AP side trigger frame

27.3.15.3 Pre-correction accuracy requirements

Carrier frequency offset error

10% of CCDF of CFO: ≤ 350 Hz

Carrier Frequency Offset Error:

Carrier Frequency Offset (CFO) Error is measured for the 11ax HE TB format.

Measure the frequency at which the complementary cumulative distribution function (CCDF) of the CFO is 10%. Numeric results are given in Hz. The complementary cumulative distribution function (CCDF) can also be viewed graphically.

The frequency offset on the horizontal axis can be scaled.

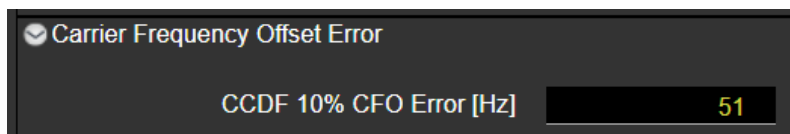


Figure 15-1: MT8862A Analysis Window – CFO (Numeric Data)

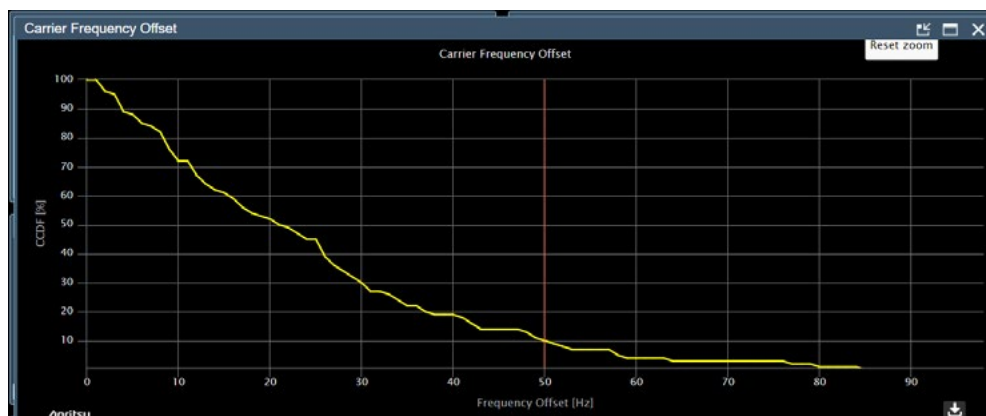


Figure 15-2: MT8862A Analysis Window – CFO (CCDF Graph)

**Verification
Example 1**

Using the MT8862A (AP side), confirm the operation of the Multi-User (MU) mode function for the STA side 11ax devices (Model A and B).

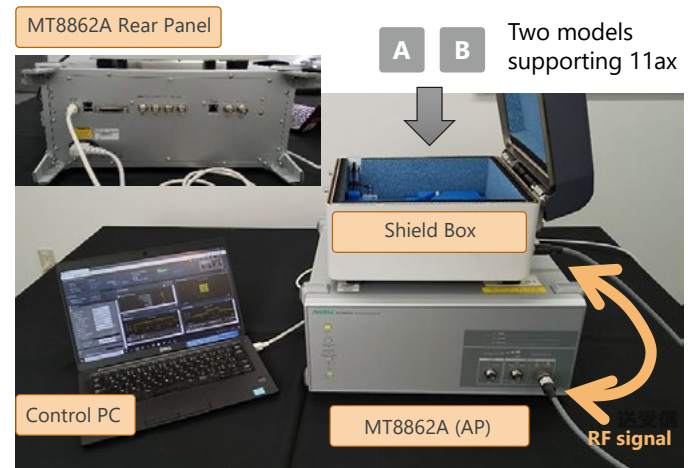
This section introduces a case study where the operation of the Multi-User and RU settings for 11ax devices (two models) on the STA side is evaluated, with the MT8862A acting as the AP side.

Device under test: Model A, Model B

Two models which support 11ax

Object:

Operation check of Multi-User mode and RU setting.

**Evaluation Conditions and Results**

Standard		11ac	11ax SU	11ax MU
Evaluation Conditions	Channel	36, 52, 100, 116		
	Bandwidth	20, 40, 80 MHz		
	MCS	1, 6	1, 6, 9	1, 6, 9
	RU	–	–	3, 38, 53, 61
Result	A	OK	OK	OK
	B	OK	OK	NG

- A**
- Confirmed that the 11ac/11ax SU can be connected to the MT8862A and evaluated normally.
 - The 11ax MU was also connected properly and it was confirmed that the STA was outputting as requested by the MT8862A (AP side).
- B**
- Confirmed that the 11ac/11ax SU can be connected to the MT8862A and evaluated normally.
 - The 11ax MU did not respond to the request from the MT8862A (AP side).
Model B does not support Multi-User.

Analysis example using MT8862A: Normal condition "A" (Example: 11ax HE-TB, 20 MHz, RU = 3)

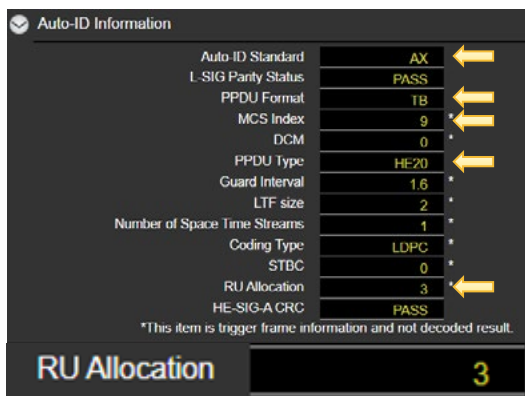


Figure 16-1: MT8862A Analysis Window
– Auto-ID Information

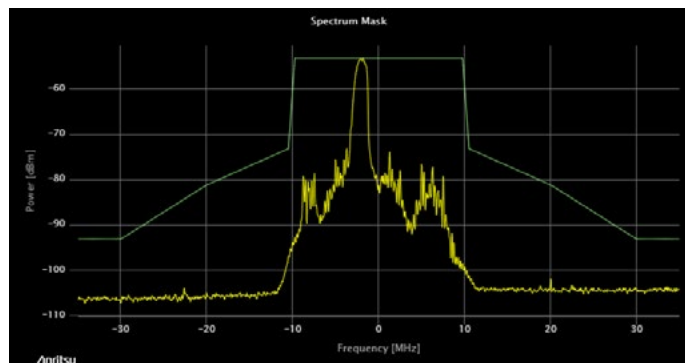


Figure 16-2: MT8862A Analysis Window
– Spectrum Mask (Graph)

Based on the numerical results and spectrum obtained by analyzing the header information of transmissions from "A" (STA side), it was confirmed under multiple conditions that control was being performed as requested by the AP.

Analysis example using MT8862A: "B" is abnormal



MT8862A Connection error (timeout)

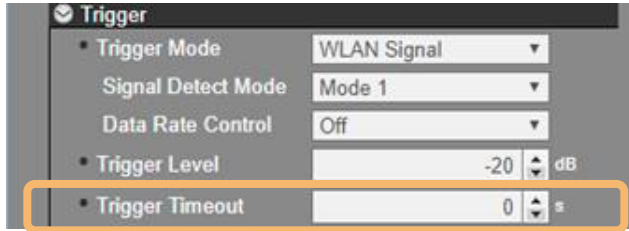


Figure 17-1: Trigger Setting – Trigger Timeout
Range: 0 to 60 s

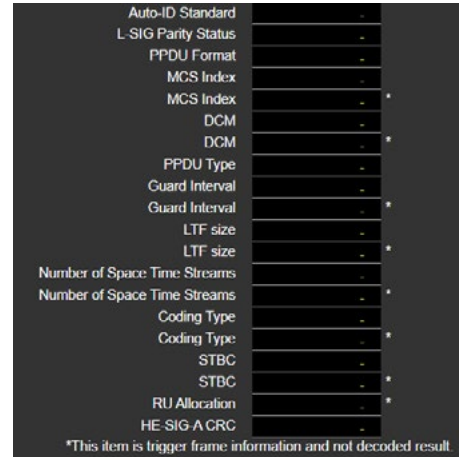


Figure 17-2: MT8862A Analysis Window (Numeric Data)
Display an example when an STA does not support RU

Even if "B" requests it from the MT8862A (AP side), it is not sent, resulting in a "Trigger Timeout," and nothing is displayed on the analysis screen (numerical results). Furthermore, there was no response even when "B" changed the channel, bandwidth, or MCS. From these evaluations, we can determine that "B" does not support MU. The "Trigger Timeout" can be set to any value between 0s and 60 s.

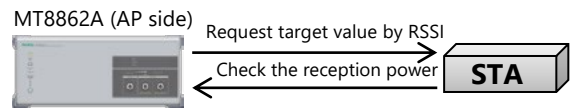
Verification
Example 2

Evaluating the power control function of the 11ax device (Model A) using the MT8862A.

Next, we will evaluate the power control function of "A", which supports 11ax MU.

(Model B cannot be rated because it does not support MU)

The power control tolerances are defined by the IEEE 802.11ax standard as mentioned above.



Power Control Transaction

Device under test: Product which supports 11ax, "Product A"
Object: Checking the transmitter power control of STA
Evaluation criteria: Channel number: 1ch, 36ch, RU: 3, 38, 53, 61
Tolerance: ± 3 dB * Class A

Results

1ch (2412 MHz)		
RU	Power Difference	Judge
RU3	0.72 dB	OK
RU38	0.34 dB	OK
RU53	0.45 dB	OK
RU61	1.02 dB	OK

36ch (5180 MHz)		
RU	Power Difference	Judge
RU3	-7.99 dB	NG
RU38	-7.25 dB	NG
RU53	-7.27 dB	NG
RU61	-6.15 dB	NG

A

- Confirmed that power differences of 1ch satisfy the MT8862A (AP side) RSSI required power of ± 3 dB.
- Confirmed that power differences of 36ch exceeded the tolerance value and did not satisfy the performance requirements.

Request (MT8862A → STA)

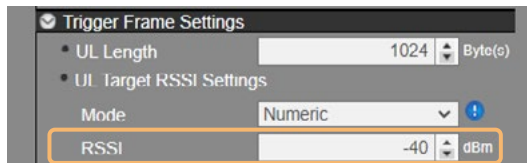


Figure 18-1: Trigger Frame Settings - RSSI

For normal conditions, we can confirm, from power difference results, that the STA controls the power within RSSI ± 3 dB.

However, where conditions are abnormal, the power differences exceed tolerance.

The cause may be, for instance, assumed to be that power control is not working in some frequency bands.

Checking Results (STA → MT8862A)

Normal condition

Transmit Power		Average	Maximum	Minimum
Gate1 Average Power [dBm]		-39.28	-39.28	-39.28
Gate1 Peak Power [dBm]		-30.36	-30.36	-30.36

HE TB Power Pre-Correction		Average	Maximum	Minimum
Gate1 Average Power Difference [dBm]		0.72	0.72	0.72

STA average power
(At AP receiver end)

Error between target value (RSSI)
and STA average power

Abnormal condition

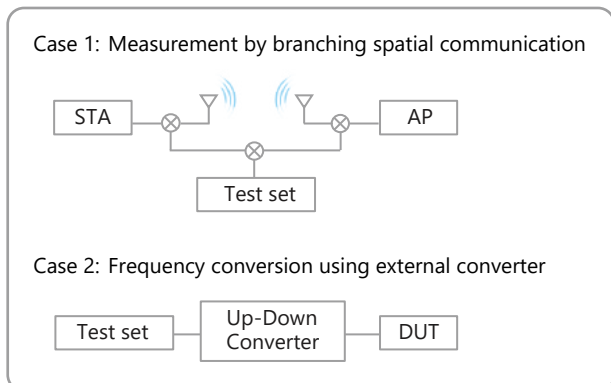
Transmit Power		Average	Maximum	Minimum
Gate1 Average Power [dBm]		-47.99	-47.99	-47.99
Gate1 Peak Power [dBm]		-38.68	-38.68	-38.68

HE TB Power Pre-Correction		Average	Maximum	Minimum
Gate1 Average Power Difference [dBm]		-7.99	-7.99	-7.99

Figure 18-2: MT8862A Analysis Window (Numeric Data)

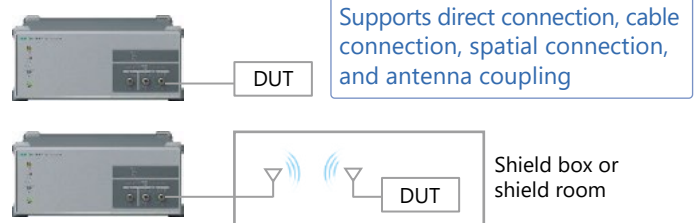
MT8862A: Measurement System Outline of 6 GHz Band Evaluation

When using ordinary measurement instrument



When using Wireless Connectivity Test Set MT8862A

Evaluation by connecting one-to-one with DUT is available.



- Standard: 11a/b/g/n/ac/ax
- Frequency bands: 2.4 GHz, 5 GHz, 6 GHz
- Bandwidth: 20/40/80/160 MHz
- Security: WEP, WPA/WPA2/WPA3-personal
- TCP/IP Stack: IPv4, IPv6
- Test Mode: Network Mode, Direct Mode

MX886200A-020 WLAN Security Function

Options to connect using WEP/WPA-Personal/WPA2-Personal/WPA3-Personal

For finished products with security enabled, this option enables measurement by establishing a connection between the finished product and the MT8862A. * This is not a security functionality verification option.

The 11ax standard also stipulates that "WPA3-Personal compatibility is mandatory for the 6 GHz band."

Consider this option when evaluating the 6 GHz band.

- When evaluating AP: Specify the security type from the AP, and establish a connection with the MT8862A.
- When evaluating STA: Specify the security type from the MT8862A (AP side), and establish a connection with the STA.